**E**UROPEAN
TELECOMMUNICATION
STANDARD**ETS 300 001**

August 1992

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Key words: PSTN, Access, TE

**Attachments to Public Switched Telephone Network (PSTN);
General technical requirements for equipment connected to
an analogue subscriber interface in the PSTN****(Candidate NET 4)****ETSI**

European Telecommunications Standards Institute

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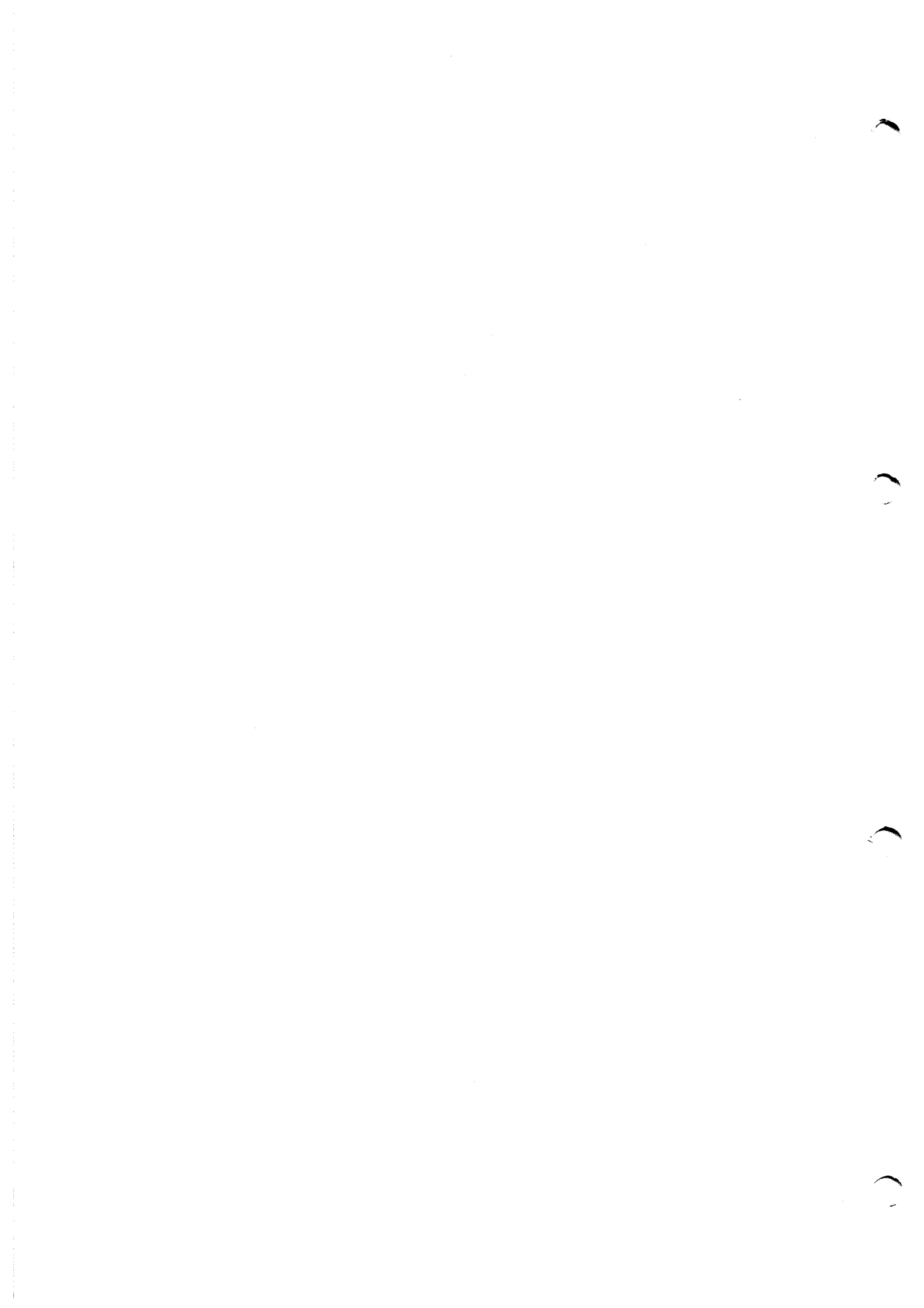
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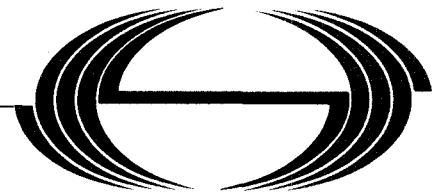
ETS 300 001

(Candidate NET 4)

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General technical requirements for equipment connected to
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Foreword

Chapter 1 of this European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI). The text of this ETS may be utilized, wholly or in part, for the establishment of NET 4.

For historical purposes, this ETS was drafted in the form of a NET. However, until a final decision to adopt this ETS as NET 4 has been agreed by the Technical Recommendations Application Committee (TRAC), the terms NET or NET 4 in this document should be read as ETS or ETS 300 001 respectively.

This ETS comprises ten chapters:

"Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

Chapter 1	-	General
Chapter 2	-	DC characteristics
Chapter 3	-	Ringing signal characteristics
Chapter 4	-	Transmission characteristics
Chapter 5	-	Calling functions
Chapter 6	-	Answering function
Chapter 7	-	Power failure
Chapter 8	-	Connection methods
Chapter 9	-	Special functions
Chapter 10	-	Additional unclassified requirements

This is the first chapter providing, among other information, the scope of this ETS, definitions, symbols and abbreviations, an explanation of the structure of the ETS and its method of use.

This ETS contains requirements and associated compliance tests. Each compliance test has been assigned a section number which is identical to that of the related requirement and has been given the prefix "A". The requirements and their associated compliance tests are grouped together in the main body of this ETS.

National variations to each requirement and test, which may be particular to an Administration, are given as additional text within the body of each requirement or test. The national designations used are given in section 1.9 of this chapter (page 60). Section 1.3 provides further details on the structure and how to use this ETS.

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1 General

1.1 Introduction

1.1.1 Foreword

It is recognised, in the field of telecommunications within Europe, that there is a need to create common European standards for telecommunication equipment.

Such harmonisation would, among other things, facilitate co-operation between telecommunication equipment manufacturers and public telecommunication network operators, create a marketplace which naturally transcends that of national frontiers, enhance the efficiency of business and other communications across Europe to bring economic benefits, and help translate the vision of a united Europe into a working reality.

In 1985, an initiative by the Conference of European Posts and Telecommunications Administrations (CEPT) resulted in the drafting of a Memorandum of Understanding (MoU) agreeing to the mutual recognition of results of tests of conformity to a technical specification which would be known as a Norme Européenne de Telecommunication (or NET). The signatories of the MOU represent the telecommunications administrations of most countries in Western Europe, including EEC and EFTA administrations.

In 1986, European Community Council Directive 86/361/EEC laid down the principles of the initial stage of the mutual recognition of type approval for telecommunications Terminal Equipment (TE). The Directive imposes the obligation on EC Member States to implement the recognition of tests to common conformity specifications.

1.1.2 NETs

The guiding principals under which a NET is written are the need to ensure that essential requirements are met.

These include:

- user safety, insofar as this requirement is not covered by other legal instruments (e.g. Directive 73/23/EEC);
- safety of employees of the public telecommunication network operators, insofar as this requirement is not covered by other legal instruments (e.g. Directive 73/23/EEC);
- protection of public telecommunication networks from harm;
- interworking of TE, in justified cases.

Each NET constitutes part of a series of NETs prepared in response to the MOU and the EC Directive 86/361.

A NET details the requirements, and a specification of interface tests for conformance to those requirements, which a defined type of telecommunication TE is required to satisfy in order to obtain authorisation for connection of the equipment to a defined European Telecommunications Network. The NET also includes, where appropriate, requirements made necessary in a given State by historical network peculiarities.

The existence of a NET will make it possible for an accredited laboratory in a country whose administration has signed the MOU, to carry out tests, specified in the NET, on TE submitted to it, and to issue a test report. On the basis of the report, a competent body may then issue a certificate of conformity to the NET. There may of course be cases where the laboratory itself is the competent authority. This certificate is then recognised as valid in all other signatory countries, avoiding the need for equipment to have to undergo the same tests, over and over again, each time approval is applied for in any of those countries.

The common reference point which a NET represents thus offers the opportunity of substantially reducing the complexity, length and cost of approval formalities. The operators of public networks are required to make reference to relevant NETs in public supply contracts. Manufacturers are thereby enabled to compete on a more equal technical basis in the supply of terminal equipment covered by NETs.

1.1.3 Types of NET

The majority of NETs fall into one of three categories; general NETs, access NETs, and terminal NETs as described below;

a) General NET

The objective of a general NET is to ensure the general requirements concerning the safety of people and the protection of both the network and the TE.

b) Access NET

The objective of an access NET is to ensure no disturbance occurs to the network and to ensure interworking between network and TE so that calls can be routed successfully through the network (but without any guarantee of terminal to terminal operation). Indeed, since an access NET may have to serve a number of terminal NETs and applications which have not even been envisaged at present, it is important for the content not to include anything which is particular to a specific terminal or otherwise inhibiting to new developments.

Details of the technical characteristics (electrical, mechanical and access control protocols), to be offered by TE at the interface to a specific public telecommunications network are covered in an access NET.

c) Terminal NET

The objective of a terminal NET is to ensure the end-to-end compatibility of a defined telecommunication service. The terminal NET should indicate any requirement which must be added to the corresponding access NET(s) to ensure end-to-end communication.

1.1.3 (N) 1 For requirements concerning safety and protection see Chapter 10.

1.1.4 NET 4

ETSI has adopted this approach in the generation of NETs, but labelled as follows:

- a) Aspect 1 - General requirements;
- b) Aspect 2 - Access requirements;
- c) Aspect 3 - TE requirements.

This document is a candidate for adoption as an access NET and is to be used for type approval according to the scope stated in section 1.2.

TE submitted for type approval is subject to Aspect 1 requirements in every case and, in addition to other relevant requirements e.g. NETs, international or national specifications. Such additional requirements are not contained in this document.

Aspect 3 NETs or other national standards which are relevant to a given type of TE meeting the requirements of this NET shall be in addition to, and refer to the requirements in this NET and shall not modify the requirements in this access NET.

1.1.4 (D) 1 In accordance with the three level approach of EG and ETSI, all TEs have to fulfil in addition to the requirements stated in this document the following Aspect 1 requirements:

- electrical safety;
- climatic environment;
- EMC.

As long as there are no European recommendations for electrical safety, climate and EMC, the relevant enclosures of the national specifications 1 TR 2, Part 1 are applicable.

1.2 Scope

This Access NET specifies the technical requirements (electrical, mechanical and method of signalling) and their associated compliance tests to be met by all TE at each of its ports provided for connection to the Public Switched Telephone Network (PSTN). This connection is effected at a standard analogue interface. This interface is characterised by a two-wire derived presentation using dc loop seizure and clear and low-frequency ac ringing signals below the speech passband.

These requirements and associated compliance tests form the definition of the standard analogue PSTN access (Aspect 2) in each of the participating Administrations.

It is recognised that for historical reasons requirements and their associated compliance tests may include values particular to each Administration's network. These requirements reflect existing standards.

This access NET does not necessarily contain all the requirements which a specific type of TE shall meet in order to gain type approval for attachment to the relevant PSTN attachment point.

1.2 (DK) 1 This document does not form the type approval requirements for those equipments that are part of PABX or other complex installations connected to the PSTN.

For these types of installations, including their associated (series- or parallel connected) equipment to the PSTN, DK national requirements apply.

In every case, reference shall be made to the DK Approval Authority in order to determine the totality of applicable requirements and associated tests.

1.2 (F) 1 The national values contained in the current issue of this NET are not applicable to the standard analogue interface used for the connection to the PSTN when connecting a complex installation. For these types of installation, connection to the PSTN is covered by:

- I-ETSS 300 003 and 300 004 for transmission characteristics of digital PABXs;
- national standards for other characteristics of digital PABXs and for other complex installations, until a new enhancement of this NET will be available.

Complex installations are hereby understood as equipment:

- including switching capability to interconnect at least one PSTN access with at least two other ports (e.g. PBXs);
- or
- able to interconnect PSTN accesses (e.g. call diverting devices);
- or
- able to broadcast the same information to several PSTN accesses at the same time.

1.2 (D) 1 This document basically applies to all TE intended for linking to customer accesses with analogue interconnection points. For PBXs, besides the interface requirements set out in this document, relevant provisions are contained in the:

- approval specifications for PABXs and telecommunications systems, KNr.: 651 500 800-0 (catalogue number).

1.2 (D) 2 This document is applicable for PABXs and telecommunications systems in which the a/b input wires are switched galvanically to the extension lines.

Technical equipment intended for connection to these PABXs via user accesses for permanent services are subject to other regulations. This document does not apply for TEs connected to public call offices.

1.2 (D) 3 This guideline does not apply to TE intended to be connected to:

- user access for broadcast services;
- radiopaging accesses;
- special telephone accesses;
 - a) mobile radiotelephone accesses;
 - b) accesses for maritime mobile communication;
 - c) Rhine radiotelephone accesses;
 - d) emergency telephone accesses for the police and fire brigade;
 - e) public emergency call boxes;
- telephone accesses with Impuls-kennzeichengabe (IKZ);
- telephone accesses with Gleichstrom-kennzeichengabe (GKZ);
- accesses for Group 1 fixed connections (leased lines);
- accesses for the warning and alarm service.

For these accesses special regulations apply.

1.2 (D) 4 In view of the reunification of the FRG and the GDR, the requirements imposed by the FRG in this document possibly have to be supplemented with the particularities of the GDR-specific network requirements. Pending corresponding amendment of this document, the document containing these particularities can be obtained from the approval authority and may be ordered from there.

1.2 (I) 1 This document does not form the type approval requirements for those TE that contain call routing or switching functions. In these cases Italian national requirements apply. In every case, reference must be made to the Italian Approval Authority in order to determine the totality of applicable requirements and associated tests.

1.2 (NL) 1 This document does not contain the type approval requirements for those TE that contain call routing and switching functions. In these cases Dutch national requirements apply and reference must be made to the Dutch Approval Authority in order to determine the totality of applicable requirements and associated tests.

1.2 (N) 1 This document does not contain the type approval requirements for those equipment that includes call routing and switching functions, and which provides local dc loop current on the extension side of the equipment. In these cases the Norwegian national requirements apply.

1.2 (S) 1 This standard shall not form the type approval requirements for user classes of equipment that are characterised as providing:

- multiple lines to the PSTN;
- multiple ports for separately identifiable terminal equipment;
- switching and routing functions; and
- the capability of providing additional telecommunication services at these ports not provided by the PSTN.

Accordingly, this document is not applicable for PBXs and other private telecommunication networks nodal components.

In these cases the Swedish national requirements apply.

1.2 (GB) 1

This document does not form the type approval requirements for equipment that contain certain call routing or certain switching functions, in these cases UK national requirements apply and reference must be made to the UK Approval Authority in order to determine the totality of applicable requirements and associated tests.

1.3 Method of use

1.3.1 Structure of the NET

This NET contains requirements and associated compliance tests. Each compliance test has been assigned a section number which is the same as the related requirement and has, in addition, a prefix "A". Thus the requirements and their associated compliance tests are grouped together in the main body of the document.

Where applicable, each requirement and associated compliance test have harmonised text which includes parameters to which each Administration may assign its own values. In these cases, parameter values are set out in accompanying tables.

National variations to each requirement and test which may be particular to a single Administration are set out as additional text within the body of each requirement or test. These are designated nationally according to the convention set out in section 1.9 and are referenced in the "remarks" column of relevant tables.

This NET includes a number of Chapters, arranged according to general technical content; Chapter 1 includes introductory information of a general nature, definitions and abbreviations. Chapter 10 includes technically unclassified additional requirements and tests particular to various Administrations. It may therefore be necessary, in order to determine the total requirement and compliance test in any given case, to refer to the harmonised text and its national variations as well as to the relevant contents in Chapter 10.

1.3.2 Use of requirements and tests

Each of the requirements in the common text of this document is a harmonised text. The use of each requirement by each Administration is determined by parameter values shown in the requirement table(s) and may be qualified further by remarks. These are set out in the requirement table(s).

It is common to find that certain requirements are to be met over ranges of parameter values; for example, return loss values might be required to be met over two independent ranges of frequency and of loop current. In such cases, compliance may be determined by testing at a limited number of parameter test values within these ranges. Such cases are clearly set out. TE which, on the basis of testing outlined in this document, appears to comply with a requirement but which subsequently is found to be non-compliant at an untested point within the range must be considered according to the relevant type approval procedures under which this document is used.

1.4 Definitions of terms used in this NET

The following terms are given particular meaning within this NET. Other technical terms not specifically mentioned are to be taken according to their normally accepted meaning.

1.4.1 Local subscriber line (analogue)

An analogue subscriber line is part of a local telephone network and is traditionally metallicly connected to the analogue interface of an exchange port by means of two wires (normally termed

the a-wire and the b-wire) and to which an unique telephone network address has been assigned (telephone number).

NOTE: This definition does not exclude standard analogue interfaces of the PSTN where a unique telephone network address is assigned to a number of such physical presentations.

1.4.2 Public switched telephone network (PSTN)

A generally used term for the nation-wide public telephone network comprising interconnected telephone exchanges capable of switching telephone calls between telephones connected to the network (exchanges).

1.4.3 PSTN connection point

The point where the local subscriber line (analogue) is terminated, the PSTN standard analogue interface is presented and the TE is connected. Reference is made to figure 1.4.4.3.

- a) Leads a_1 and b_1 are provided for connection to the PSTN.
- b) Leads a_2 and b_2 (if they are provided) are intended for the connection of this TE in series with other TEs.
- c) Additional leads for instance n_1 (if provided) are intended for auxiliary connections, to be defined by the National Administrations' Network Termination Schedules (Chapter 8).
- d) Additional leads for instance n_2 (if provided) are intended for optional connections, to other TEs, to be defined in Chapter 8.
- e) Lead "e" (if provided) is intended for connection to signal earth.
- f) Figure 1.4.4.3 does not indicate that TEs may have other interfaces. These interfaces are not described in this document.

1.4.3 (E) 1 Common reference terminal

The common reference terminal is defined as the terminal or lead provided for connection to a common reference potential, for the functional purpose of receiving longitudinal 50 Hz metering pulses. In the Spanish contribution (E) this terminal or lead is normally called "REF", and it may either be connected internally to the earth terminal or lead "e", when it exists, or not.

1.4.4 Terminal equipment

1.4.4.1 General definitions

Terminal equipment is defined as an equipment which is intended to be connected to a termination point of PSTN (PSTN connection point: PSTN CP).

One-port TE is defined as TE with wires or leads intended solely for connection to a PSTN CP (see figure 1.4.4.1.a).

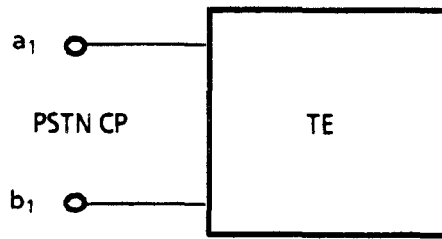


Figure 1.4.4.1.a: One-port TE

Series-connected TE is defined as TE intended to be attached to a PSTN CP and which in addition provides a second connection point to which a second TE may be attached so as to permit this second TE to be excited solely by loop current wholly derived from the PSTN connection (see figure 1.4.4.1.b).

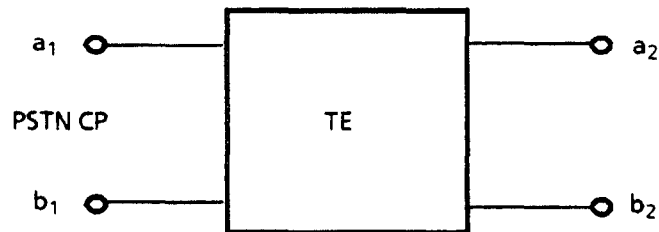


Figure 1.4.4.1.b: Series-connected TE

NOTE: Two or more TE can be connected to the PSTN CP in parallel (see figure 1.4.4.1.c).

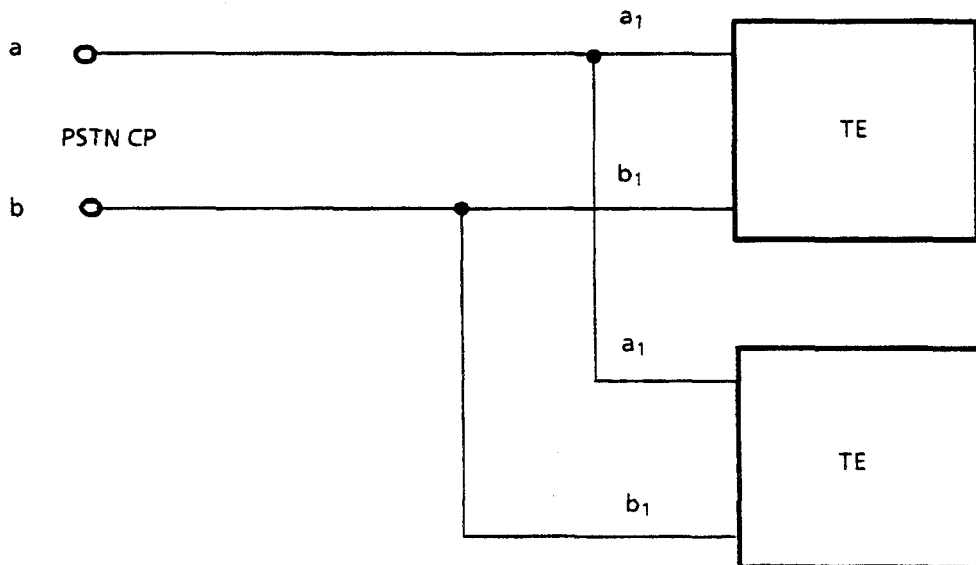


Figure 1.4.4.1.c: Parallel connected TE

1.4.4.1 (D) 1

For TEs with telephony functions in Germany direct parallel connection is not permitted. Reference is made to Chapter 8.

1.4.4.1 (D) 2 In the German contribution (D), in some places the term "additional equipment" which is a special group of series-connected TEs is used instead of "series-connected TE". Special reference is made to section 8.3 (D).

1.4.4.1 (E) 1 (This remark relates to series-connected TEs).

PROVISION: Network compatibility cannot be expected if several series TEs are simultaneously connected in series to the same line.

NOTE: In the Spanish contribution (E), the additional requirements for series TEs have the word "series" included in brackets in the requirement heading.

1.4.4.1 (E) 2 Associated TE

Associated TE is defined as a TE which is approved for connection to the network. This name is normally used, in the Spanish contribution (E), to designate a TE which is connected to the line output terminals of a series-connected TE.

1.4.4.1 (E) 3 Multiline TE

Multiline TE is defined as a TE which is able to be connected to either more than one PSTN connection point, or to a multiline PSTN CP.

NOTE: In the Spanish contribution (E), the additional requirements for multiline TEs have the word "multiline" included between brackets in the requirement heading.

1.4.4.1 (GB) 1 Series-connected TE

Series-connected TE can be of two types:

- i) those for which the electrical characteristics have in every case values that represent the maximum impairment that may be introduced between the main TE and the PSTN connection point (CP) of a complete system; consequently, if the whole of the allowance for one or more of the parameters is consumed by a series-connected TE then no other equipment or leads consuming the same characteristic will be permitted within a system containing such series-connected TE;
- ii) those for which the electrical characteristics have sufficient margin against the maximum allowable impairments such that more than one such series-connected TE can be connected within a system; the number of items of TE that may be series-connected is determined by the Series Equivalent Number (SEN), which may have a value between 0,3 and 1.

Thus SEN is a number that represents the portion of the maximum allowable impairment which is taken up by a series-connected TE and may be used to calculate the composition of a TE system connected to the PSTN; this number is determined by the larger of two quantities representing the dc resistance and the insertion loss (see 4.3 (GB) 1).

1.4.4.2 Types of TE

TE can generally be categorised into one or more of the following types:

Type 1: One-port TE capable of holding the loop condition by itself (e.g. telephone set), see figure 1.4.4.2.a.

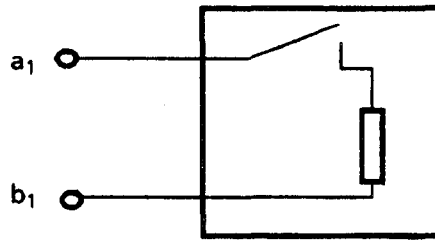


Figure 1.4.4.2.a: One-port TE (loop holding)

Type 2:

One-port TE not capable of holding the loop condition by itself (e.g. ringing detector) see figure 1.4.4.2.b.

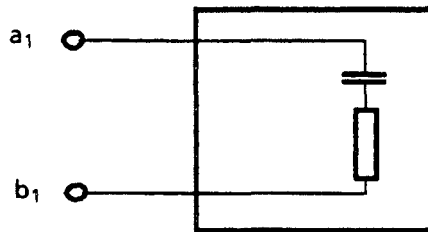


Figure 1.4.4.2.b: One-port TE (non-loop holding)

Type 3:

A series-connected TE through which the loop condition to another TE can be maintained, but is capable of holding the loop condition by itself. It is possible for this type to have two arrangements:

Type 3 (I):

The loop is held but the output port is disconnected (e.g. modem), see figure 1.4.4.2.c.

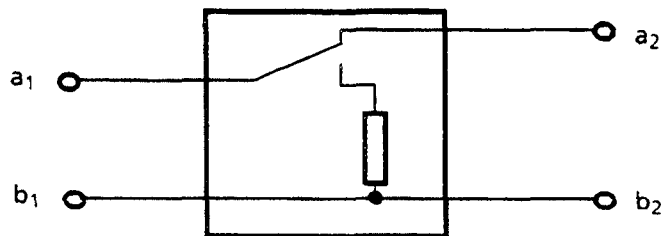


Figure 1.4.4.2.c: Series-connected TE (loop holding, output disconnected)

Type 3 (II):

The loop is held and the output port remains connected (e.g. answering machine), see figure 1.4.4.2.d.

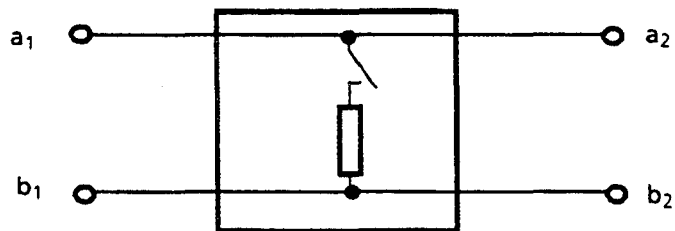


Figure 1.4.4.2.d: Series-connected TE (loop holding, output connected)

Type 4:

A series-connected TE through which the loop condition to another TE can be maintained, but is not capable of holding the loop condition by itself (e.g. monitoring device), see figure 1.4.4.2.e.

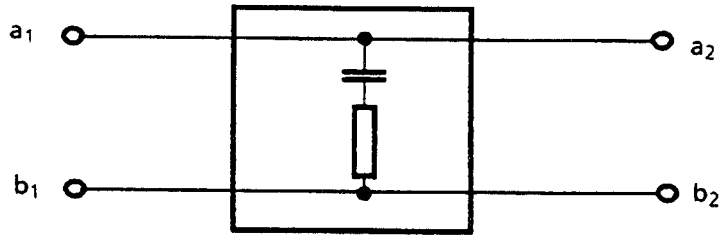


Figure 1.4.4.2.e: Series-connected TE (non-loop holding)

1.4.4.3 Reference model of a TE

A reference model of a TE is shown in figure 1.4.4.3.

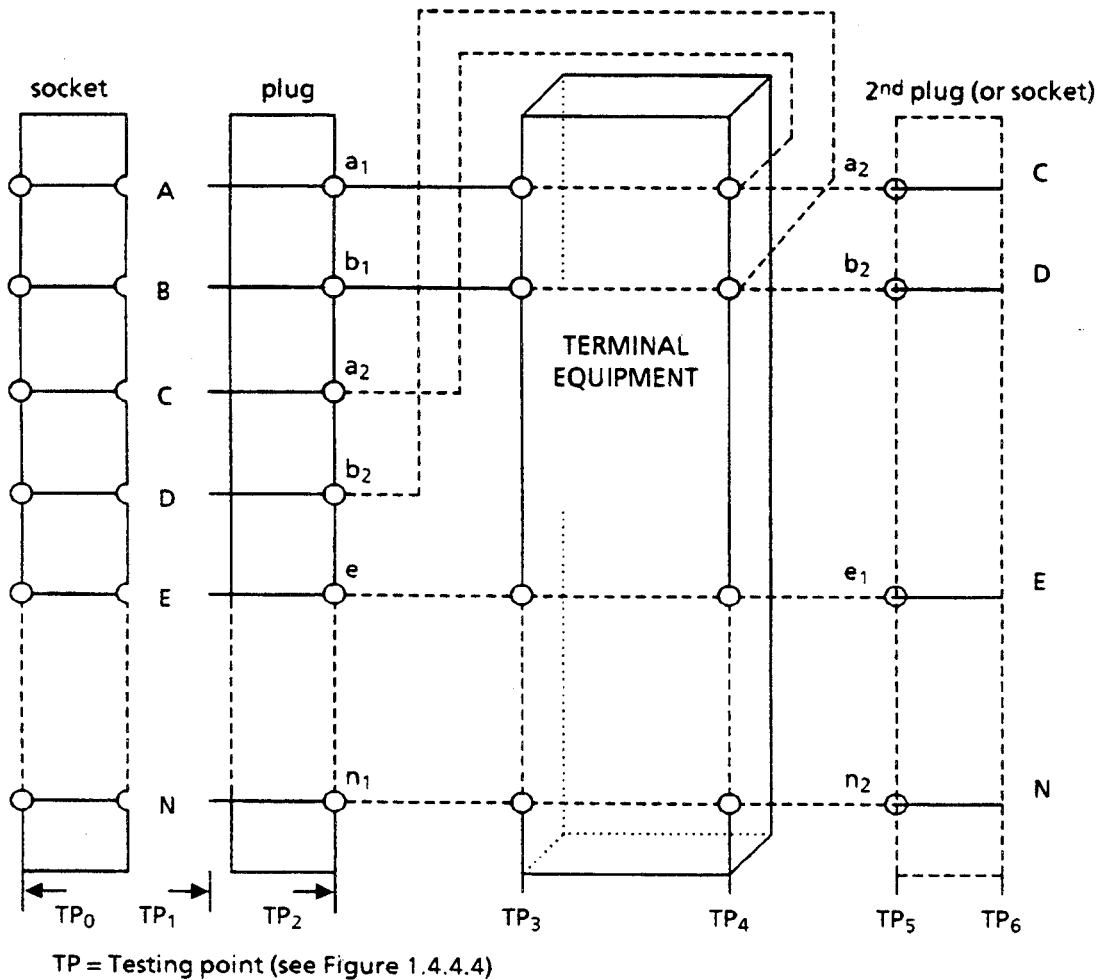


Figure 1.4.4.3: TE reference model

1.4.4.3 (B) 1

The second plug (or socket) shown in figure 1.4.4.3 may be combined with the first plug as a standard intermediate plug (see Chapter 8).

1.4.4.4 Testing point

Testing points are defined in table 1.4.4.4. in conjunction with figure 1.4.4.4 (see also figure 1.4.4.3).

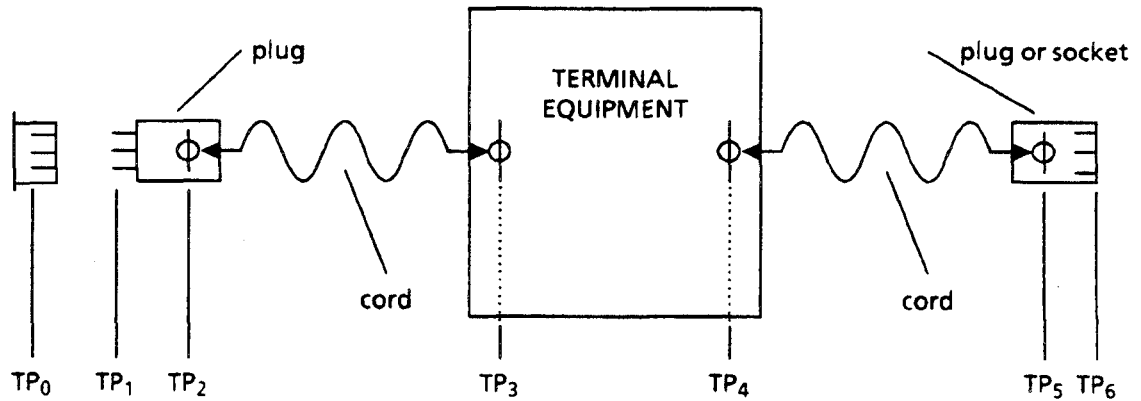


Figure 1.4.4.4: Definition of testing point

Table 1.4.4.4: Testing points

COUNTRY	TESTING POINT							Remarks
	TP ₀	TP ₁	TP ₂	TP ₃	TP ₄	TP ₅	TP ₆	
Austria		X		X				yes
Belgium		X					X	yes
Cyprus		X		X				yes
Denmark		X		X	X		X	yes
Finland		X		X	X		X	yes
France		X		X	X		X	
Germany		X		X				yes
Greece		X		X	X		X	yes
Iceland		X		X				
Ireland								yes
Italy		X		X	X		X	yes
Luxembourg		X		X				
Malta								
Netherlands		X				X		
Norway		X		X	X		X	yes
Portugal	X		X	X	X	X		yes
Spain		X					X	yes
Sweden		X		X	X		X	yes
Switzerland		X		X	X			yes
U. Kingdom		X	X	X	X	X	X	

- 1.4.4.4 (A) 1 Testing point TP₁ shall be used if cross-talk is possible to other circuits.
- 1.4.4.4 (B) 1 In case of multiline TE, the testing points may be TP₂ (or TP₃) and TP₅ (or TP₄).
- 1.4.4.4 (CY) 1 TP₃ shall only be used in case the cord is removable.
- 1.4.4.4 (DK) 1 If the TE is provided with a cord, the type approval shall include plug and cord. If the TE is provided with a permanent connection (e.g. screws), the testing shall be performed using TP₃ and TP₄, respectively.
- 1.4.4.4 (SF) 1 If the TE is provided with a cord, the type approval shall include the plug and cord (testing point TP₁). If the TE is provided with a permanent connection (e.g. screws), the testing shall be performed using TP₃.
- In case of a series-connected TE testing point TP₄ or TP₆ is used, depending on whether the series-connected TE has plug and cord or a permanent connection.
- 1.4.4.4 (D) 1 If the TE is provided with a cord, the type approval shall include the plug and cord. If the TE is provided with a permanent connection (e.g. screws), the testing shall be performed using TP₃.
- 1.4.4.4 (GR) 1 If the TE is provided with a cord, the type approval shall include the plug and cord. If the TE is provided with a permanent connection (e.g. screws), the testing shall be performed using TP₃ and TP₄ if it exists.
- 1.4.4.4 (IRL) 1 If the TE is provided with a cord, the type approval shall include the plug and cord. If the TE is provided with a permanent connection (e.g. screws), the testing shall be performed using TP₃. The test points for series-connected equipment where applicable on port a₂b₂ shall be the second plug or socket if supplied with the TE, or else TP₄.
- 1.4.4.4 (I) 1 If the TE is provided with a cord, the type approval shall include the plug and cord. If the TE is provided with a permanent connection (e.g. screws), the testing shall be performed using TP₃ and TP₄ if it exists.
- 1.4.4.4 (N) 1 If the TE is provided with a cord, the type approval shall include the plug and cord. If the TE is provided with a permanent connection (e.g. screws), the testing shall be performed using TP₃.
- 1.4.4.4 (N) 2 If the TE is provided with a cord, TP₆ is used. If the TE is provided with a permanent connection, the TP₄ is used.
- 1.4.4.4 (P) 1 TE provided with cord(s) and plug(s) shall be tested with the related socket(s). So, testing point TP₀ shall be used.
- 1.4.4.4 (P) 2 Testing point TP₂ shall be used for TE provided with a cord or a cord and a connection box.
- 1.4.4.4 (P) 3 Testing point TP₂ shall be used for TE provided with a cord, a cord and a connection box or a cord and a socket.
- 1.4.4.4 (P) 4 Testing points TP₃ and TP₄ shall be used for TE provided with no cords.
- 1.4.4.4 (E) 1 The cord which is shown in figure 1.4.4.4 cannot be a constitutive part of the TEUT, but the plug shall be.

NOTE: When the TEUT is provided with an earth (or earth protection) terminal or lead, then the testing point 3 (TP₃) (or testing point TP₄) is used in certain test arrangements together with the accessible parts.

1.4.4.4 (CH) 1 If the TE is provided with a cord, the type approval shall include the plug and cord. If the TE is provided with a permanent connection (e.g. screws), the testing shall be performed using TP₃.

1.4.5 States or conditions of TE

The states below are always states of TE.

1.4.5.1 Quiescent or idle state or condition

Quiescent or idle state or condition is defined as an electrical condition into which the TE, when connected to the network, is placed such that it draws minimum current and does not activate the exchange.

In this case some equipment connected in series to other TE may be operating (e.g. recording apparatus with a high ohmic resistance).

1.4.5.1 (E) 1 When the TE is in quiescent or idle state or condition, it shall not be capable of sending nor receiving speech-band information to and from the network. (See also the paragraph "a" in section 1.4.5.1 (E) 2, and the note in section 1.4.5.3 (E) 1).

1.4.5.1 (E) 2 High impedance state or condition

High impedance state or condition is defined as an electrical condition into which the TE, when connected to the network, is placed such that it is

- a) potentially capable of sending or receiving speech-band information or other classes of signals to or from the network;
- and
- b) supposed to be simultaneously when another TE, which is connected to the same termination point of the network, is in loop condition or dialling condition or register recall condition. It shall be noted that this condition may be exclusively invoked during the situation defined here.

1.4.5.2 Ringing state or condition

Ringing state or condition is defined as a quiescent or idle state or condition into which ringing signal is applied.

1.4.5.3 Loop state or condition

Loop state or condition is defined as an electrical condition into which, when connected to the network, TE is placed such that it draws enough dc current to be capable of activating the exchange.

1.4.5.3 (E) 1

PROVISION: In some Spanish requirements, when no specific mention to the high impedance condition is made, and the term loop condition is used just in the opposite meaning of the term quiescent condition, the term loop condition is also used simultaneously with the sense of high impedance condition (see section 1.4.5.1 (E) 2).

NOTE: Usually, the TE in loop condition is potentially capable of sending or receiving speech-band information to or from the network.

1.4.5.4 Dialling or signalling state or condition

Dialling or signalling state or condition of a TE is defined as a condition into which the TE, when connected to the network, is placed such that it passes to the network break pulses or MFPB signals.

1.4.5.5 Register recall state or condition

Register recall state or condition of a TE is defined as a condition into which the TE, when connected to the network, is placed such that it passes to the network a register recall signal.

1.4.6 Line terminals

The term "line terminals" is used throughout the NET as an abbreviated form of "terminals or leads provided for connection to the PSTN CP".

1.4.6 (E) 1 The term "line terminals" is also used instead of line input terminals in series TEs. They are normally called "a₁" and "b₁" ("a_{1,i}", "b_{1,i}", for multiline TEs).

1.4.6 (E) 2 Line input terminals

Line input terminals are defined as the two terminals of the port provided for connection to the network in series TEs. They are normally called "a₁" and "b₁" ("a_{1,i}", "b_{1,i}", for multiline TEs).

1.4.6 (E) 3 Line output terminals

Line output terminals are defined as the two terminals of the port which provides a termination point for the connection of one associated TE (see section 1.4.4.1 (E) 2) in series TEs. They are normally called "a₂" and "b₂" ("a_{2,i}", "b_{2,i}", for multiline TEs).

1.4.7 Speech band

The speech band is defined as the 300 - 3 400 Hz frequency band.

1.5 DC feeding arrangements

The dc feeding arrangements differ for each Administration but generally are of a similar nature to that given in the Idealised Feeding Bridge described in figure 1.5. The feeding resistance R_f includes the resistance of the inductor L_f .

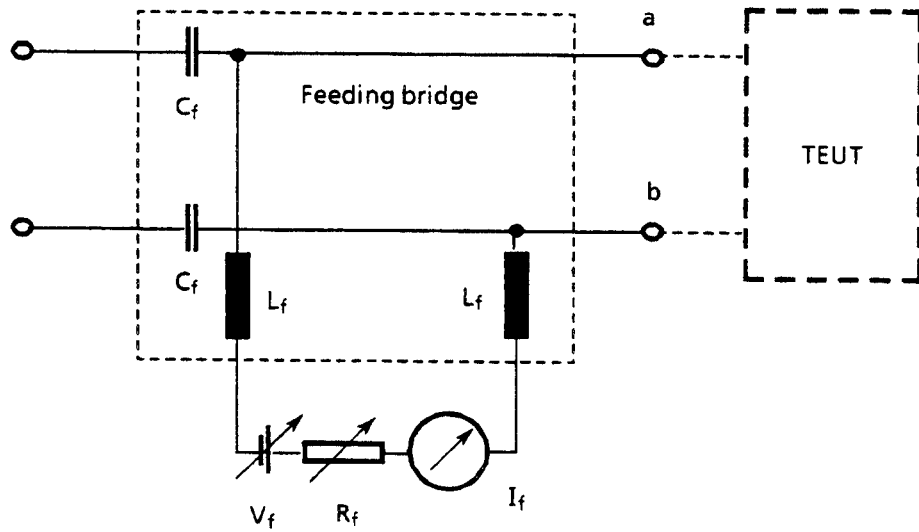


Figure 1.5: Idealised feeding bridge circuit

The standard values of inductors L_f and capacitors C_f for each Administration are included within this section (see table 1.5).

Table 1.5: Idealised feeding bridge values

COUNTRY	REQUIREMENT VALUES		Remarks
	C_f (μF)	L_f (H)	
Austria	≥ 47	≥ 5	
Belgium	20	5	
Cyprus	4	2	
Denmark	≥ 2	≥ 2	yes
Finland	$2 \pm 2\%$	≥ 2	
France	$100 \pm 5\%$	$5 \pm 10\%$	
Germany	≥ 47	≥ 5	
Greece	20	5	
Iceland	≥ 2	≥ 2	
Ireland	470	10	
Italy	2	≥ 1	yes
Luxembourg	≥ 47	≥ 5	
Malta			
Netherlands	20	2	
Norway	≥ 10	≥ 2	
Portugal	≥ 50	$\geq 2,5$	
Spain	≥ 20	≥ 5	yes
Sweden	$\geq 2,2$	≥ 2	
Switzerland	≥ 47	≥ 5	
U. Kingdom	≥ 400	≥ 10	

1.5 (DK) 1

Requirement values according to national test circuits.

1.5 (I)1

$C_f = 47 \mu F$; $L_f = 5 H$ to perform type approval tests in section A.4.1.2.

1.5 (E) 1

In some test procedures other feeding arrangements or other values may be used.

In all cases in which a feeding bridge is specified, the values of inductors (L_f) and capacitors (C_f) shall be met at all frequencies of measurement, and the circuit diagram of the feeding bridge used may have additional components to meet this requirement. For this reason the diagram shown in figure 1.5 is considered to be an idealised representation of the circuit at the frequency or frequencies of measurement.

In all cases in which a dc voltage source or an ac signal generator is specified, it is understood that the values of the external associated components absorb the values of the source/generator output resistance.

When a dc voltage source is connected in series with an ac signal generator, both they shall be coupled in such a manner that the magnitude of the dc voltage source impedance shall be near 0Ω , at the frequencies of testing.

1.5 (E) 2

Mains test power source

When the Terminal Equipment Under Test (TEUT) is intended to be connected to the mains, then

- a) the voltage of the mains test power source shall be within $\pm 5\%$ of any of the declared nominal mains voltages for which the TE is prepared;
and
- b) the frequency of the mains test power source shall be within ± 1 Hz of the nominal frequency of 50 Hz.

1.5 (E) 3

Other test power sources

When the TEUT is intended to be powered from power sources other than the network and/or the mains, the voltage of the test power sources shall be within $\pm 5\%$ of the declared nominal voltages.

1.5.1 Requirement values for feeding conditions

The range of ΔV_f , ΔR_f and ΔI_f (where applicable) which should be applied to the feeding bridge circuit in order to represent the local exchange network and subscribers line of each Administration are given in table 1.5.1.

All requirements should be fulfilled within all ranges specified in table 1.5.1, except otherwise specified.

Table 1.5.1: Requirement values for feeding conditions

COUNTRY	REQUIREMENT VALUES			Remarks
	ΔV_f (V)	ΔR_f (Ω)	ΔI_f (mA)	
Austria			19 - 60	yes
Belgium	44,5 - 53	360 - 1 725		
Cyprus	43 - 53	400 - 1 740	20 - 100	
Denmark	44 - 56	500 - 2 400	$\leq I_{max.}$	yes
Finland	48 \pm 10%	800 - 1 710	20 - 50	
France	46 - 54 89 - 104	300 - 1 400 1 400 - 2 960	25 - 60	yes
Germany	60	1 000 - 3 500		
Greece	44 - 66		20 - 80	
Iceland	43 - 56	800 - 2 400	14 - 70	
Ireland	48	0 - 5 000	20 - 100	
Italy	44 - 52	720 - 5 000		
Luxembourg	60		14 - 60	
Malta				
Netherlands	42 - 66	800 - 2 140	16 - 80	yes
Norway	24 60	460 - 1 000 (1 200) 460 - 3 100 (3 500)		yes
Portugal	45 - 55	300 - 5 500	not applicable	
Spain	48	500 - 2 200		yes
Sweden				yes
Switzerland	43 - 57	2 200 - 600		yes
U. Kingdom	50	\geq 400	0 - 125	

1.5.1 (A) 1

ΔV_f in idle condition of the PSTN line circuit: 15...64 V

ΔI_f in transient condition to go from the idle to the loop condition of PSTN line circuit: 1...60 mA.

ΔV_f in feeding condition of PSTN line circuit: 50...60 V

ΔI_f in feeding condition of PSTN line circuit: 19...60 mA. In the Austrian network a limitation of the feeding current to a value of "n" mA for new exchanges is under study.

Transient time of the PSTN line circuit to go from idle to loop condition: \leq 40 ms.

1.5.1 (DK) 1
$$I_{\max.} = \frac{56 \text{ V}}{500 \Omega + R_{\text{TEUT}}}$$

1.5.1 (F) 1 The values given in table 1.5.1 are related to the conversation state, case a) referring to normal feeding and case b) to overfeeding. The case c) is used for series-connected TE with normal feeding as well as with overfeeding. The feeding conditions in other states are as follows:

State		Normal feeding		Overfeeding	
		V_f (V)	R_f (Ω)	V_f (V)	R_f (Ω)
Quiescent		45 - 54	300 - 3 600	86 - 104	1 400 - 3 000
Ringing:	polarised	45 - 54	300 - 3 600	86 - 104	1 400 - 3 000
	non-polarised	42 - 54	360 - 1 740	90 - 106	1 360 - 2 900
Dialling:	decadic	45 - 54	300 - 1 845	86 - 104	1 400 - 3 350
	MFPB(DTMF)	46 - 54	300 - 1 450	89 - 104	1 400 - 2 960
	Howler	52 - 54	300 - 8 225	82 - 104	1 400 - 5 225

For each requirement, the ranges of feeding values V_f , R_f and I_f (where applicable) for which the requirement shall be met, are given in the relevant table.

NOTE: The maximum value of PSTN feeding voltage V_f can be 56 V instead of 54 V for at most 24 hours per month.

1.5.1 (NL) 1 At any place throughout NET 4 where feeding voltage and feeding resistance is stated as $\Delta V_f = 42 - 66 \text{ V}$ and $\Delta R_f = 800 - 2\,140 \Omega$ has to be read in a way that the highest voltage (66 V) belongs to the lowest resistance (800 Ω) and the lowest voltage (42 V) belongs to the highest resistance (2 140 Ω).

The nominal value of the voltage (48 V) belongs to a resistance of 1 130 Ω .

The loop current is not regulated but is depending on the feeding condition, the loop resistance and the dc resistance of the TE. The value of the loop current is between about 16 mA and about 80 mA.

1.5.1 (N) 1 The requirements given in the Norwegian regulations shall be complied with in loop condition for current values derived from a feeding voltage (V_f) of 60 V, a feeding resistance (R_f) between 460 and 3 100 Ω , and the dc resistance of the TE. In addition, the equipment shall function properly for R_f values up to 3 500 Ω . The maximum line current is defined as the current flowing through the TEUT when $R_f = 460 \Omega$.

For some characteristics, specific requirements are given for line current values between 15 and maximum line current.

1.5.1 (E) 1 In some requirements other values than those indicated in this section may be specified.

In general, six cases (I to VI) of specifying dc feeding excitations could happen, as it is indicated in table 1.5.1 (E) 1, with the following definitions:

Case I For situations where no feeding bridge is used and a dc feeding excitation is needed, but its concrete values do not affect results.

Case II For resistance in loop condition and make resistance during decadic dialling. No feeding bridge is used.

NOTE: The maximum loop current achieved during these situations may be lower than the higher values quoted in table 1.5.1 (E) 1 and 1.5.2 (E) 1 because of the current limitations imposed by the TE resistance.

Case III For other decadic dialling and recall situations. No feeding bridge is used.

Case IV For other dc situations. No feeding bridge is used.

Case V For dialling with DTMF signals and metering pulses reception. A feeding bridge is used (see sections 1.5 and 1.5 (E) 1).

Case VI For other ac situations. A feeding bridge is used (see sections 1.5 and 1.5 (E) 1).

Table 1.5.1 (E) 1: Requirement values for feeding conditions

Case	I_f (mA)	V_f (V)	R_f (Ω)
I	n.s.	n.i.	n.i.
II	18,5 - 100	43 - 56	300 - 2 300
III	n.s.	48	500 - 2 200
IV			500 - 1 700
V			500 - 2 200
VI			500 - 1 700
NOTES: n.s. = not specified n.i. = not indicated			

1.5.1 (S) 1 See remark 1.5.2 (S) 1.

1.5.1 (CH) 1 General comments on supply arrangements:

Exchange supply voltages V_f :

Nominal 48 V, limits: 43 and 57 V; 60 V for 5 minutes per month.

Nominal 60 V, limits: 56 and 66 V; 75 V for 5 minutes per month.

In the idle state certain lines or supplementary devices (e.g. line concentrators, alarm equipment) supply 24 V or 12 V dc.

dc resistance of the subscriber line:

$R_L = 0$ to $2 \times 350 \Omega$ (for PABXs: 0 to $2 \times 250 \Omega$)

Feeding characteristics of exchanges:

Table 1.5.1 (CH) 1

R_S (Ω)	$R_S < 275$	$275 < R_S < 1\ 400$	$1\ 600 < R_S < 1\ 400$	$R_S > 1\ 800$
I_{Smin} (mA)	22		22...18	$32,4/R_S$
I_{Smax} (mA)	120	$57/(200 + R_S)$		

I_S : Loop current

R_S : Resistance of subscriber loop (line + TE)

The upper limit will be discussed and later harmonised in Chapter 2, section 2.3 "Loop resistance".

Exceeding of dialling surveillance period:

With newer exchanges, only a reduced supply current of e.g. 8 mA (for the reception of the congestion tone) is available after a dialling surveillance period of e.g. 20 S without dialling.

Party lines:

With several party lines, there is a rectangular identification signal of 3 Hz/10 V in the idle state.

Specifications and tests:

For specifications and tests only the nominal 48 V Supply (43 - 57 V) is taken into account since this power supply is more critical for the TE (higher current range) than the 60 V supply.

1.5.2 Test values for feeding conditions

The actual values of V_f , R_f and I_f which should be applied to TE during testing are given in table 1.5.2 unless otherwise stated.

These values shall be met at all test frequencies.

Table 1.5.2: Test values for feeding conditions

COUNTRY	TEST VALUES			Remarks
	V _f (V)	R _f (Ω)	I _f (mA)	
Austria	60		19, 60	
Belgium	48	400, 1 600		
Cyprus	48	800	20 - 100	yes
Denmark			16, I _{max.}	yes
Finland	48	800, 1 710		
France				yes
Germany	60	1 000, 2 530		
Greece	60		20, 35, 55	
Iceland	48		14, I _{max.}	yes
Ireland	48	0, 5 000	20, 100	
Italy	44, 48, 52	1 880, 1 100, 720		
Luxembourg	60		14, 60	
Malta				
Netherlands	42, 48, 66	800, 1 130, 2 140		yes
Norway	60	460, 1 200, 3 100		
Portugal	45, 48, 55		not applicable	yes
Spain	48	500, 1 700, 2 200		yes
Sweden			I _{min.} , 25, I _{max.}	yes
Switzerland	43, 48, 57	2 200, 1 200, 600		yes
U. Kingdom	50	400 min.	0 - 125	yes

NOTE: In some cases, Administrations may elect to substitute a constant current generator for the series-connected dc voltage, V_f, and its associated total loop resistance, R_f. In these cases, the constant current generator shall have a rate of change current with respect to TE resistance of less than 1 μA per ohm over the entire range of TE resistance variation or of the various loop constant values encountered during the test.

1.5.2 (CY) 1 For compliance testing as specified in this document, test measurements will be made for values of I_f between 20 and 100 mA that are not greater than the current obtained when the TE line terminals are connected to a voltage source of 48 V dc in series with a 440 ohm resistor.

1.5.2 (DK) 1 In several tests other values of I are used.

1.5.2 (F) 1 The test values of feeding conditions depending on the test given in the relevant tables.

1.5.2 (IS) 1
$$I_{max.} = \frac{56}{800 + R_{TEUT}}$$

1.5.2 (NL) 1 In some tests a range of measurement values is used as shown in the appropriate tests.

The figures in table 1.5.2 have to be read as follows:

42 V belongs to $R_f = 2\ 140\ \Omega$
 48 V belongs to $R_f = 1\ 130\ \Omega$
 66 V belongs to $R_f = 800\ \Omega$

1.5.2 (P) 1

The values for R_f are related with the tests.

1.5.2 (E) 1

The corresponding testing values that are normally used for the six cases defined in section 1.5.1 (E) 1 are indicated in table 1.5.2 (E) 1.

Table 1.5.2 (E) 1: Testing values for feeding conditions

Case	I_f (mA)	V_f (V)	R_f (Ω)
I	n.s.	48	1 100
II	18,5, 25, 40, 65, 100	43 - 56	300 - 2 300
III	n.s.	48	500, 1 100, 2 200
IV			500, 1 100, 1 700
V			500, 1 100, 2 200
VI			500, 1 100, 1 700
NOTE: n.s. = not specified			

1.5.2 (S) 1

- The lower limit of I shall be 10 mA or the higher value determined by connecting $V_f = 36\ V$ and $R_f = 3\ 000\ \Omega$ (except in cases c) and d) below):
- The upper limit of I shall be determined by connecting $V_f = 60\ V$ and $R_f = 1\ 200\ \Omega$ (except in case d) below).
- When measuring electro-acoustic characteristics (except loudness ratings) the lower limit of I shall be determined by connecting $V_f = 38\ V$ and $R_f = 2\ 300\ \Omega$. The upper limit shall be as in b) above.
- When measuring loudness ratings the lower limit of I shall be determined by connecting $V_f = 50\ V$ and $R_f = 2\ 800\ \Omega$. The upper limit shall be determined by connecting $V_f = 50\ V$ and $R_f = 1\ 600\ \Omega$.

Static measurements: $C_f \geq 200\ \mu F$
 $L_f \geq 17,4\ H$
 Dynamic measurements: $C_f \geq 2,2\ \mu F$
 $L_f \geq 2\ H$

1.5.2 (CH) 1

For test purposes the following three settings of V_f/R_f can be used:

$V_f: 43\ V/R_f: 2\ 200\ \Omega$
 $V_f: 48\ V/R_f: 1\ 200\ \Omega$ and
 $V_f: 57\ V/R_f: 600\ \Omega$

Feeding for data transmission equipment:

Equipment for data transmission can be tested with a constant current power supply which may deviate slightly from these values. The supply from the telephone line is of subordinate importance since the equipment is normally fed by a local power supply during data transmission.

1.5.2 (GB) 1 For most compliance tests specified in this document, measurements are made at those values of I_f in the sequence 25, 32, 40, 50, 65, 75, 85 and 100 mA that are not greater than the current obtained when the TE line terminals are connected to a voltage source of 50 V dc in series with a 400 ohm resistor. In some cases, tests are carried out at other current values I_f ; the appropriate values are indicated in the appropriate compliance test.

1.6 Test parameters

Throughout the document the following test provisions are assumed unless otherwise stated in this document.

It is assumed that laboratories may use other test methods which can be considered electrically equivalent to those specified.

1.6 (N) 1 Power supply

For TE that is directly powered from the mains all tests shall be carried out with 230 V \pm 10% and frequency 50 Hz \pm 2%.

TE powered by dc, e.g. batteries, shall be tested within the tolerances declared by the supplier.

1.6 (E) 1

NOTE: In all cases, the tests are assumed to be conducted in an environment free of electromagnetic radiation capable of affecting any result arising from any test.

1.6.1 Environmental conditions

The following conditions shall apply for TEUT and the testing environment. For some TE, different requirements are applicable.

- a) Ambient temperature: 15°C to 35°C (inclusive);
- b) Relative humidity: 25% to 75%;
- c) Air pressure: 86 kPa to 106 kPa (860 mbar to 1 060 mbar).

1.6.1 (S) 1 In cases when the manufacturer specifies other values of the parameters in section 1.6.1 or specifies values of other environmental parameters, the values given by the manufacturer shall apply for the testing of the TE.

1.6.2 Tolerances of components used for testing

The values of components used for testing shall be within 1% of the indicated values.

1.6.2 (NL) 1 For capacitances and inductances the tolerance is \pm 5%.

1.6.3 Test equipment accuracy

The test equipment accuracy is assumed to be \pm 1% for all readings, dial settings, or other variable parameter settings specified in the various tests contained herein.

1.6.4 Test equipment resolution

The test equipment resolution is assumed to be at least one order of magnitude greater than the equipment accuracy required in section 1.6.3.

1.6.5 Measurement values

The measurement values are assumed to be within $\pm 1\%$ of those required by the various tests contained herein.

1.6.6 TE connection

1.6.6.1 Series-connected TEs

The TEUT normally shown in the test figures, in this document, is a one-port TE. It should be remembered that this is simply a representation of a TEUT which, in reality, may either be a one-port or a series-connected TE.

When testing series-connected TEs the second port (output) shall be left open circuit unless otherwise specified.

1.6.6.2 Additional wires

Additional wires (e.g. earth wire, ringer shunt wire, etc.) present at the port under test shall be left open circuit unless otherwise specified.

1.7 Summary of network tones and signals (informative)

1.7.1 Dial tone

The following frequencies and levels are presented at the PSTN CP for dial tone:

- f_1 - minimum frequency;
- f_2 - maximum frequency;
- p_1 - minimum level;
- p_2 - maximum level.

Levels are assumed to be measured over a load of 600 ohms.

Table 1.7.1: Frequencies and levels for dial tone

COUNTRY	VALUES				Remarks
	f ₁ (Hz)	f ₂ (Hz)	p ₁ (dBm)	p ₂ (dBm)	
Austria	400	500	-26,0	-6,5	yes
Belgium	420	455	-14	-4	
Cyprus	325 + 425	375 + 475	-22	-7	yes
Denmark	400	450	-26	-6,5	
Finland	325	525	-25	-6	
France	425	455	-25	-10	
Germany	380	490	-27	-4	
Greece	400	475	-25	-4	yes
Iceland	400	450	-30	-7	
Ireland	400, 450		-16	0	yes
Italy	410	440	-25	-6	yes
Luxembourg	380	490	-27	-4	
Malta					
Netherlands	100 340	200 550	-25,7 -25,7	+2,2 -3,8	
Norway	410	440	-30	-3 ± 2	yes
Portugal	300	450	-30	-5	
Spain	410	440	-20	-5	yes
Sweden	400	450	-30	-10	
Switzerland	400	450	-18	-6,5	yes
U. Kingdom	350	440	-27	0	yes

- 1.7.1 (A) 1** Cadence: Continuous tone or morse signal "a"
- | | | | |
|-------------|-----------|-----------|-----------|
| 1. Tone | 1. Pause | 2. Tone | 2. Pause |
| 1 200 ± 20% | 660 ± 20% | 300 ± 20% | 240 ± 20% |
- 1.7.1 (CY) 1** Combination of two frequencies: nominal 350 Hz + 450 Hz continuous.
- 1.7.1 (IRL) 1** Typical power level -12 dBm.
- 1.7.1 (I) 1** Cadence: pulse 0,2 ± 10% s, pulse 0,6 ± 10% s.
- 1.7.1 (NL) 1** In due time only the 425 Hz tone will be used as dial tone in the Dutch PSTN.
- 1.7.1 (N) 1** The normal nominal frequency is 425 Hz. Other nominal frequencies may be presented from old exchanges.
- 1.7.1 (N) 2** Cadence general dial tone: Continuous tone. Cadence Centrex dial tone: 600 ± 60 ms pulse, 15 ± 1,5 ms pause. Characteristics for special dial tone, please refer to section 1.7.7.

1.7.1 (E) 1

PROVISION 1: The nature of the contents of the sections 1.7 and 1.7.1 (E) 1 to 1.7.9 (E) 1 is considered to be informative.

The values indicated are rather typical than contractual absolute limits. However, it has been considered, at least in their more habitual position or state in the network, situations like short and long lines, locally and remotely exchange generated tones, and old and new exchanges. Therefore, because the values refer to the whole network, at a particular PSTN CP it is expected to have less dispersed values.

For the network tones, a general informative reference is made to the CCITT Recommendations, and in particular to the definitions contained in Annex A of CCITT Recommendation E. 182 (Blue Book).

PROVISION 2: The tolerances of the durations of signal (on) and pause (off) periods in all the cadences indicated are:

- ± 20% for the old exchanges;
- ± 5% for the new exchanges.

PROVISION 3: General or specific recorded announcements instead of tones are being introduced in some of the new parts of the network.

PROVISION 4: In the old exchanges the frequencies are either

- $f_1 = 320 \text{ Hz}, f_2 = 480 \text{ Hz};$
- or
- $f_1 = 360 \text{ Hz}, f_2 = 540 \text{ Hz}.$

In some of the old exchanges levels above or below the limits indicated in table 1.7.1 may be presented.

For the characteristics of the second dial tone (used for international outgoing calls) and the special dial tone see sections 1.7.7 (E) 1.1 and 1.7.7 (E) 1.2 respectively.

1.7.1 (CH) 1

A tone advising that the exchange is ready to receive call information and inviting the user to start sending call information, at the same time reminding the user that special conditions apply to the termination from which the call is being made.

Cadence (repeated):

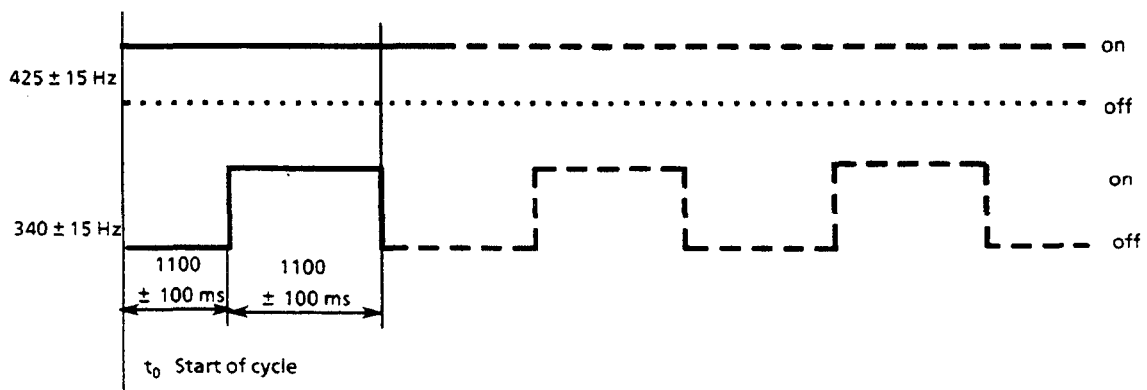


Figure 1.7.1 (CH) 1

- 1.7.1 (CH) 2 Dial tone frequency in older PABXs: 500 ± 25 Hz and exceptional 100 Hz.
- 1.7.1 (GB) 1 Continuous tones, present simultaneously. Frequency tolerance of each tone is $\pm 5\%$. Level of each tone separately, 3 dB lower.
- 1.7.1 (GB) 2 Special dial tone may be applied when certain supplementary services are invoked. This is the same as dial tone, but either f_1 , or both f_1 and f_2 are cadenced at 750 ms on, 750 off. Cadence tolerance is $\pm 25\%$.
- 1.7.1 (GB) 3 A second dial tone at a single frequency of $1\ 111$ Hz $\pm 20\%$ and with a power level in the range -27 dBm to 0 dBm is returned to indirectly connected calls accessing the Mercury Switched Network.
- 1.7.1 (GB) 4 "Old" dial tone will be received from certain types of exchange while they remain in service. It is a continuous tone with a fundamental frequency of 30 or 50 Hz, rich in harmonics, having a power level at the customer's premises of 0 to -27 dBm.

1.7.2 Ringing tone

The following frequencies and levels are presented at the PSTN CP for ringing tone:

- f_1 - minimum frequency;
- f_2 - maximum frequency;
- p_1 - minimum level;
- p_2 - maximum level;
- Cadence - on/off.

Levels are assumed to be measured over a load of 600 ohms.

Table 1.7.2: Frequencies and levels for ringing tone

COUNTRY	VALUES					Remarks
	f ₁ (Hz)	f ₂ (Hz)	p ₁ (dBm)	p ₂ (dBm)	cadence (s)	
Austria	400	500	-43,0	-6,5	1/5 ± 20%	
Belgium	420	455	-18	-8	1/3 ± 0,1	
Cyprus	400	450	-25	-10	1,5/3	yes
Denmark	400	450	-43	-6,5	0,75/7,5 ± 20% or 1/4 ± 10%	
Finland	325	525	-35,5	-11	1/4	
France	425	455	-38	-10	1,5/3,5 ± 10%	yes
Germany	380	490	-43	-4	1/4 ± 10%	yes
Greece	400	475	under study		1/4	
Iceland	400	450	-43	-7	1,2/4,7	
Ireland	400, 450		-16	0	0,4/0,2	yes
Italy	410	440	-43	-6	1/4 ± 10%	
Luxembourg	380	490	-43	-6,5	1/4	
Malta						
Netherlands	340	550	-25,7	-3,8	1 ± 25%/4 ± 10%	yes
Norway	410	440	-30	-8 ± 2	1/4 ± 10%	yes
Portugal	300	450	-30	-5	1 ± 20%/5 ± 20%	
Spain	410	440	-37	-5	1,5/3	yes
Sweden	400	450	-43	-10	1/5	
Switzerland	400	450	-33	-6,5	1 ± 0,25/4 + 2/-0,5	yes
U. Kingdom	400	450	-37	0	0,4/0,2, 0,4/2,0	yes

1.7.2 (CY) 1

The nominal frequency is 425 Hz.

1.7.2 (F) 1

The first ringing tone received by the calling party can occur up to 3,8 s after the first ringing pulse received by the called party.

1.7.2 (D) 1

If the calls are routed to special exchanges; such as exchanges in foreign countries or direct dialling-in PABXs, the tones and cadences may be different.

1.7.2 (IRL) 1

Cadence repeated.

1.7.2 (NL) 1

Before the normal cyclic ringing tone an "immediate ringing tone" with a length between 600 and 1 200 ms is given. The pause between this pre-ringing tone and the first ringing tone in the ringing tone cycle may be between 0 and 4 500 ms.

1.7.2 (N) 1

The normal nominal frequency is 425 Hz. Other nominal frequencies may be presented from old exchanges.

1.7.2 (E) 1

PROVISION 1: See the provisions 1 and 2 in section 1.7.1 (E) 1.

PROVISION 2: See the provision 4 in section 1.7.1 (E) 1.

In the old exchanges the cadences in seconds are 1,5/2,9 or 1,5/3 or 1,5/3,4.

1.7.2 (CH) 1 Cadence repeated.

The first ringing tone can be non-cyclic: First ringing tone: 250 - 500 ms and pause between first ringing tone and normal ringing tone: 0 - 4 s.

1.7.2 (CH) 2 Tone frequency in older PABXs: 500 ± 25 Hz and exceptional 100 Hz.

1.7.2 (CH) 3 Statements valid for CH-tones:

Tone detection under international aspects in Chapter 9 "PSTN tone detection".

1.7.2 (GB) 1 f_1 and f_2 may be modulated by 50 Hz, 25 Hz or 17 Hz, or the tone may consist of f_1 plus f_2 at approximately equal levels, in which case the cadence is 0,35/0,2 s, then start at any point in the normal cadence shown in table 1.7.2. Cadence tolerance is $\pm 25\%$.

1.7.3 Busy tone

The following frequencies and levels are presented at the PSTN CP for busy tone:

f_1 - minimum frequency;
 f_2 - maximum frequency;
 p_1 - minimum level;
 p_2 - maximum level;
Cadence - on/off.

Levels are assumed to be measured over a load of 600 ohms.

Table 1.7.3: Frequencies and levels for busy tone

COUNTRY	VALUES					Remarks
	f ₁ (Hz)	f ₂ (Hz)	p ₁ (dBm)	p ₂ (dBm)	cadence (ms)	
Austria	400	500	-43,0	-6,5		yes
Belgium	420	455	-18	-8	500/500 ± 50	
Cyprus	400	450	-25	-10	500/500	yes
Denmark	400	450	-43	-6,5	450/450 ± 20% or 250/250 ± 10%	
Finland	325	525	-20,5	-11	300/300	
France	425	455	-38	-10	500/500 ± 10%	
Germany	380	490	-43	-4	480/480 ± 10%	yes
Greece	400	475	under study		300/300	
Iceland	400	450	-43	-7	250/250	
Ireland	400 ± 5		-16	0	500/500 ± 250	yes
Italy	410	440	-43	-6	500/500 ± 10%	
Luxembourg	380	490	-43	-6,5	480/480 ± 10%	
Malta						
Netherlands	340	550	-25,7	-3,8	180 - 330/330 - 180 400 - 600/600 - 400	
Norway	410	440	-30	-8 ± 2	500/500 ± 10%	yes
Portugal	300	450	-30	-5	500/500 ± 20%	
Spain	410	440	-35	-5	200/200	yes
Sweden	400	450	-43	-10	250/250	
Switzerland	400	450	-33	-6,5	500/500 + 50 - 300	yes
U. Kingdom	400 ± 80		-37	0	375/375	yes

1.7.3 (A) 1 Tone: 300 ± 20% Pause 300 ± 20%
or
Tone: 400 ± 20% Pause 400 ± 20%

1.7.3 (CY) 1 The nominal frequency is 425 Hz.

1.7.3 (D) 1 If the calls are routed to special exchanges, such as exchanges in foreign countries or direct dialling in PABXs, the tones and cadences may be different.

1.7.3 (D) 2 In PABX and in some other cases this might be different.

1.7.3 (IRL) 1 Typical power level -12 dBm.

1.7.3 (N) 1 The normal nominal frequency is 425 Hz. Other nominal frequencies may be presented from old exchanges.

1.7.3 (E) 1

PROVISION 1: See the provisions 1 and 2 in section 1.7.1 (E) 1.

PROVISION 2: See the provision 4 in section 1.7.1 (E) 1.

In old exchanges the cadences in milliseconds are either 170/170 or 170/200.

1.7.3 (CH) 1 Cadence repeated, start of cycle arbitrary.

1.7.3 (CH) 2 Busy tone in older PABXs: 500 ± 25 and exceptional 100 Hz.

1.7.3 (CH) 3 Statements valid for CH-tones.

Tone detection under international aspects in Chapter 9 "PSTN tone detection".

1.7.3 (GB) 1 Cadence tolerance is $\pm 25\%$.

1.7.4 Congestion tone

The following frequencies and levels are presented at the PSTN CP for congestion tone:

- f_1 - minimum frequency;
 - f_2 - maximum frequency;
 - p_1 - minimum level;
 - p_2 - maximum level;
- Cadence - on/off.

Levels are assumed to be measured over a load of 600 ohms.

Table 1.7.4: Frequencies and levels for congestion tone

COUNTRY	VALUES					Remarks
	f ₁ (Hz)	f ₂ (Hz)	p ₁ (dBm)	p ₂ (dBm)	cadence (ms)	
Austria	400	450	-43,0	-16,0	200/200 ± 20%	
Belgium	420	455	-18	-8	167/167 ± 12	
Cyprus	400	450	-25	-10	250/250	yes
Denmark	400	450	-43	-6,5	450/450 ± 20% or 250/250 ± 10%	
Finland	325	525	-20,5	-11	200 - 250 200 - 250	
France	425	455	-38	-10	500/500 ± 10%	
Germany	380	490	-43	-4	240/240 ± 10%	yes
Greece	400	475	under study		300/300	
Iceland	400	450	-43	-7	250/250	
Ireland	not used					yes
Italy	410	440	-43	-6	200/200 ± 10%	
Luxembourg	380	490	-43	-6,5	240/240 ± 10%	
Malta						
Netherlands	340	550	-25,7	-3,8	180 - 330/ 330 - 180	
Norway	410	440	-30	-8 ± 2	200/200 ± 10%	yes
Portugal	300	450	-30	-5	200/200 ± 20%	
Spain	410	440	-35	-5	(3 x 200)/ (2 x 200 + 600)	yes
Sweden	400	450	-43	-10	250/750	
Switzerland	400	450	-33	-6,5	180 - 300 180 - 300	yes
U. Kingdom	400 ± 80		-43	0	400/350, 225/525	yes

1.7.4 (CY) 1

The nominal frequency is 425 Hz.

1.7.4 (D) 1

If calls are routed to special exchanges, such as exchanges in foreign countries or direct dialling-in PABXs, the tones and cadences may be different.

1.7.4 (D) 2

In international connections and in some other cases this might be different.

1.7.4 (N) 1

The normal nominal frequency is 425 Hz. Other nominal frequencies may be presented from old exchanges.

1.7.4 (E) 1

PROVISION 1: See the provisions 1,2 and 3 in section 1.7.1 (E) 1.

PROVISION 2: See the provision 4 in section 1.7.1 (E) 1.

In old exchanges the cadence in milliseconds is $(3 \times 170)/(2 \times 190 + 580)$.

1.7.4 (CH) 1 Cadence repeated, start of cycle arbitrary.

1.7.4 (CH) 2 Statements valid for CH-tones. Tone detection under international aspects in Chapter 9.5 "PSTN tone detection".

1.7.4 (GB) 1 The shorter tone (225 ms) is 6 dBm higher than the longer tone (400 ms), i.e. $p_1 = -37$ dBm, $p_2 = 0$ dBm for the shorter tone, $p_1 = -43$ dBm, $p_2 = -6$ dBm for the longer tone. Cadence tolerance is $\pm 25\%$.

1.7.5 Special information tone(s)

The following frequencies and levels are presented at the PSTN CP for special information tone(s):

- f_1 - minimum frequency;
- f_2 - maximum frequency;
- p_1 - minimum level;
- p_2 - maximum level.

Levels are assumed to be measured over a load of 600 ohms.

Table 1.7.5: Frequencies and levels for information tone(s)

COUNTRY	VALUES					Remarks
	f ₁ (Hz)	f ₂ (Hz)	p ₁ (dBm)	p ₂ (dBm)	cadence (s)	
Austria			-43,0	-9,5		yes
Belgium	900/1 380/1 860 ± 5		-24	-8		yes
Cyprus	not used					
Denmark						yes
Finland						yes
France						yes
Germany	not used					
Greece	not used					
Iceland						yes
Ireland						yes
Italy			-32	-15		yes
Luxembourg	not used					
Malta						
Netherlands						yes
Norway						yes
Portugal			-30	-5		yes
Spain						yes
Sweden						yes
Switzerland			-33	-6,5		yes
U. Kingdom	950, 1 400, 1 800		-37	0	0,33/0,03	yes

1.7.5 (A) 1

$f_1 = 950 \pm 50 / 1\ 400 \pm 50 / 1\ 800 \pm 50$ Hz

Cadence:

330 ms ± 70 ms for each tone;

1 000 ms ± 20% pause after the 3 tones.

1.7.5 (B) 1

The information tone is emitted in the following sequence:

900 Hz during 330 ± 70 ms followed by;

1 380 Hz during 330 ± 70 ms followed by;

1 860 Hz during 330 ± 70 ms followed by a pause of 1 ± 0,25 s.

1.7.5 (DK) 1

$f_1 = 950 \pm 50 / 1\ 400 \pm 50 / 1\ 800 \pm 50$ Hz;

$p_1 = -43$ dBm;

$p_2 = -9,5$ dBm.

Cadence:

330 ms ± 70 ms for each tone;

1 000 ms pause after the 3 tones.

1.7.5 (SF) 1

The following values apply:

$f_1 = 950 \pm 50$ Hz $t_1 = 330 \pm 70$ ms $p_1 = -25,5$ dBm

$$\begin{array}{lll} f_2 = 1\,400 \pm 50 \text{ Hz} & t_2 = 330 \pm 70 \text{ ms} & p_2 = -16 \text{ dBm} \\ f_3 = 1\,800 \pm 50 \text{ Hz} & t_3 = 330 \pm 70 \text{ ms} & \end{array}$$

pause between each set phase 30 ms
pause between each set of three signals $1\,000 \pm 250$ ms.

1.7.5 (F) 1

Three successive tones of frequencies 950 Hz, 1 400 Hz, 1 800 Hz, sent in that order, each lasting for 300 ± 70 ms, with a gap of up to 30 ms between these tones and with pause of $1\,000 \pm 250$ ms between each set of three tones.

$$\begin{array}{l} p_1 = -40 \text{ dBm (for the tone 950 Hz);} \\ p_2 = -10 \text{ dBm.} \end{array}$$

1.7.5 (IS) 1

$$\begin{array}{l} f_1 = 950 \pm 50 \text{ Hz;} \\ f_2 = 1\,400 \pm 50 \text{ Hz;} \\ f_3 = 1\,800 \pm 50 \text{ Hz;} \\ p_1 = -55 \text{ dBm, } p_2 = -20 \text{ dBm for 1 800 Hz.} \end{array}$$

1.7.5 (IRL) 1

Frequencies: 950 ± 5 Hz, $1\,400 \pm 5$ Hz, $1\,800 \pm 5$ Hz;
Level range: 0 dBm to -16 dBm;
Typical level: -12 dBm;
Cadence: Silent period of $1\,000 \pm 250$ ms, followed by 3 tones of increasing frequency each of 330 ± 70 ms, with gaps of up to 30 ms between tones, repeated.

1.7.5 (I) 1

The following values apply:

$$\begin{array}{ll} f_1 = 950 \pm 50 \text{ Hz} & t_1 = 330 \pm 30 \text{ ms} \\ f_2 = 1\,400 \pm 50 \text{ Hz} & t_2 = 330 \pm 30 \text{ ms} \\ f_3 = 1\,800 \pm 50 \text{ Hz} & t_3 = 330 \pm 30 \text{ ms} \end{array}$$

pause between each set phase 0 - 20 ms
pause between each set of three signals $1\,000 \pm 10\%$

1.7.5 (NL) 1

There are two different sets of tones:

1)
$$\begin{array}{ll} f_1 = 950 \pm 50 \text{ Hz} & t_1 = 330 \pm 70 \text{ ms} \\ f_2 = 1\,400 \pm 50 \text{ Hz} & t_2 = 330 \pm 70 \text{ ms} \\ f_3 = 1\,800 \pm 50 \text{ Hz} & t_3 = 330 \pm 70 \text{ ms} \end{array}$$

pause between each signal 0 - 30 ms;
pause between each set of three signals $1\,000 \pm 250$ ms.

level -12 to -23 dBm

2)
$$\begin{array}{ll} f_1 = 100 - 200 \text{ Hz} & t_1 = 500 \pm 50 \text{ ms} \\ f_2 = 340 - 550 \text{ Hz} & t_2 = 500 \pm 50 \text{ ms} \end{array}$$

level of $f_1 = -17$ dBm to 0 dBm;
level of $f_2 = -20$ dBm to -5 dBm;

1.7.5 (N) 2

The following values apply:

$$\begin{array}{ll} f_1 = 950 \pm 50 \text{ Hz} & t_1 = 330 \pm 10\% \\ f_2 = 1\,400 \pm 50 \text{ Hz} & t_2 = 330 \pm 10\% \\ f_3 = 1\,800 \pm 50 \text{ Hz} & t_3 = 330 \pm 10\% \end{array}$$

pause between each set phase 0 - 20 ms;
pause between each set of three signals $1\,000 \pm 10\%$.

$$p_1 = -30 \text{ dBm}$$
$$p_2 = -8 \pm 2 \text{ dBm}$$

1.7.5 (P) 1

Special information tone according to CCITT Recommendation E. 180:

$$f_1 \text{ (Hz)} = 900, 1\ 350, 1\ 750 \text{ (3 tones);}$$
$$f_2 \text{ (Hz)} = 1\ 000, 1\ 450, 1\ 850 \text{ (3 tones);}$$

Cadence(s) = $0,330 \pm 0,070$ for each tone, with a gap between tones of up to $30 \text{ ms}/1 \pm 0,25$ pause after 3 tones.

1.7.5 (P) 2

The special information tone is not yet provided. It will be used in the future.

1.7.5 (E) 1

PROVISION:

See the provisions 1, 2 and 3 in section 1.7.1 (E) 1.

This tone is considered to be the special information tone:

Frequencies (Hz): $f_a = 950 \pm 50;$
 $f_b = 1\ 400 \pm 50;$
 $f_c = 1\ 800 \pm 50.$

Cadences (ms): on (950 Hz) = 333;
on (1 400 Hz) = 333;
on (1 800 Hz) = 333;
off = 1 000;
cycle = 2 000.

Level (dBm): p_1 (950 Hz) = -32 p_2 (950 Hz) = -12
 p_1 (1 400 Hz) = -35,5 p_2 (1 400 Hz) = -13
 p_1 (1 800 Hz) = -39 p_2 (1 800 Hz) = -14

For the characteristics of the number unobtainable tone see section 1.7.7 (E) 1.3.

1.7.5 (S) 1

CCITT special information tone with

$$f_1 = 950 \pm 50, f_2 = 1\ 400 \pm 50;$$
$$f_3 = 1\ 800 \pm 50 \text{ is used;}$$
$$p_1 = -55, p_2 = -20.$$

1.7.5 (CH) 1

Special information tone

An audible indication to the caller advising that the called number cannot be reached for reasons other than subscriber busy or congestion. Normally used when a call is connected to a recorded voice machine; the tone is given during the silent intervals between the transmission of the announcement.

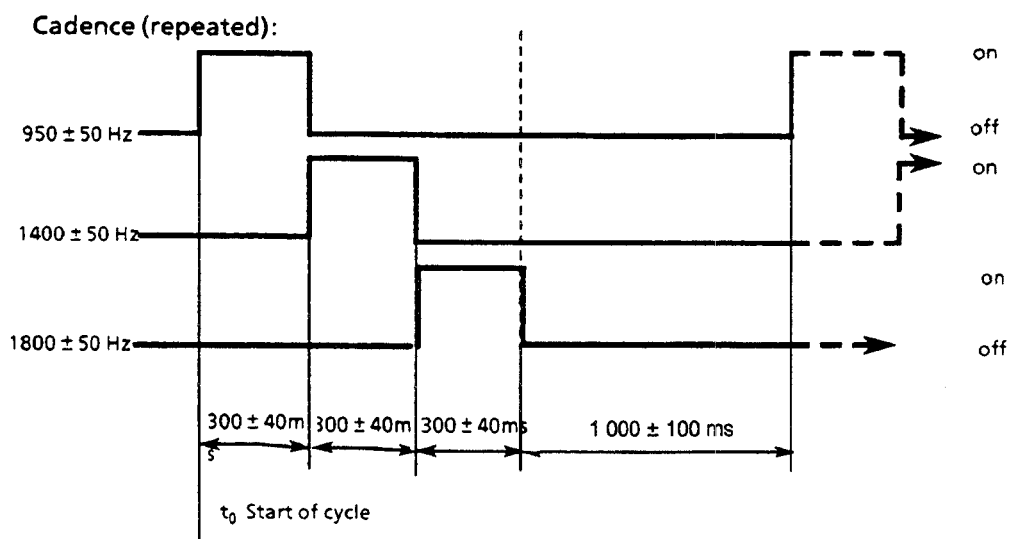


Figure 1.7.5 (CH) 1

1.7.5 (GB) 1

$$f_1 = 950 \pm 50 \text{ Hz};$$

$$f_2 = 1\,400 \pm 50 \text{ Hz};$$

$$f_3 = 1\,800 \pm 50 \text{ Hz}.$$

Cadence is 330 ± 70 ms "on" for each frequency in the order given, with up to 30 ms "off" between adjacent signals.

1.7.6 Call in progress tone

The following frequencies and levels are presented at the PSTN CP for call in progress tone:

- f_1 - minimum frequency;
- f_2 - maximum frequency;
- p_1 - minimum level;
- p_2 - maximum level;
- Cadence - on/off.

Levels are assumed to be measured over a load of 600 ohms.

Table 1.7.6: Frequencies and levels for call in progress tone

COUNTRY	VALUES				
	f ₁ (Hz)	f ₂ (Hz)	p ₁ (dBm)	p ₂ (dBm)	cadence (ms)
Austria	not used				
Belgium	not used				
Cyprus	not used				
Denmark	not used				
Finland	not used				
France	425	455	-38	-10	50/50 ± 10%
Germany	not used				
Greece	not used				
Iceland	not used				
Ireland	not used				
Italy	not used				
Luxembourg	not used				
Malta					
Netherlands	not used				
Norway	not used				
Portugal	not used				
Spain	not used				
Sweden	not used				
Switzerland	No special tone				
U. Kingdom	not used				

1.7.7 Tones for other purposes

The following frequencies and levels are presented at the PSTN CP for other purposes:

- f₁ - minimum frequency;
- f₂ - maximum frequency;
- p₁ - minimum level;
- p₂ - maximum level;
- Cadence - on/off.

Levels are assumed to be measured over a load of 600 ohms.

Table 1.7.7: Frequencies and levels for other purposes

COUNTRY	VALUES					Remarks
	f ₁ (Hz)	f ₂ (Hz)	p ₁ (dBm)	p ₂ (dBm)	cadence (s)	
Austria						yes
Belgium						yes
Cyprus						yes
Denmark						yes
Finland	not used					
France	425 + 315	455 + 345	-30	-10	continuous	yes
Germany	not used					
Greece	not used					
Iceland						
Ireland	not used					
Italy						yes
Luxembourg	not used					
Malta						
Netherlands						yes
Norway						yes
Portugal	400	450	-30	-5		yes
Spain						yes
Sweden						yes
Switzerland						yes
U. Kingdom	400 ± 80		-37	0	continuous	yes

1.7.7 (A) 1 Special dial tone

f₁ + f₂;
340 Hz ≤ f₁ ≤ 425 Hz continuous tone;
400 Hz ≤ f₂ ≤ 450 Hz continuous tone;
f₂ - f₁ > 25 Hz;
p₁ = -26,0 dBm;
p₂ = -16,0 dBm.

1.7.7 (A) 2 Acknowledgement tone

f₁ + f₂;
340 Hz ≤ f₁ ≤ 425 Hz;
400 Hz ≤ f₂ ≤ 450 Hz;
f₂ - f₁ > 25 Hz;
positive: Tone: 1 000 ms ± 20% Pause: 5 000 ms ± 20%;
negative: Tone: 400 ms ± 20% Pause: 400 ms ± 20%;
p₁ = -26,0 dBm;
p₂ = -16,0 dBm.

1.7.7 (A) 3

Intrusion tone

$400 \text{ Hz} \leq f_1 \leq 450 \text{ Hz};$
 $p_1 = -43,0 \text{ dBm};$
 $p_2 = -6,5 \text{ dBm}.$

Cadence:

1. Tone	1. Pause	2. Tone	2. Pause
$150 \pm 20\%$	$150 \pm 20\%$	$150 \pm 20\%$	$1\ 950 \pm 20\%$

1.7.7 (A) 4

Call waiting tone

$400 \text{ Hz} \leq f_1 \leq 450 \text{ Hz};$
 $p_1 = -36 \text{ dBm};$
 $p_2 = -10 \text{ dBm}.$

Cadence:

Tone	Pause
$40 \pm 10 \text{ ms}$	$1\ 950 \text{ ms} \pm 20\%$

1.7.7 (B) 1

International dial tone

$f_1 \text{ (Hz)} = (900/1\ 020/1\ 140) \pm 5 \text{ Hz};$
 $p_1 \text{ (dBm)} = -19;$
 $p_2 \text{ (dBm)} = -4;$
cadence = $330 \pm 70 \text{ ms}$ for each tone, without pause.

1.7.7 (B) 2

Special dial tone

$f_1 \text{ (Hz)} = 420;$
 $f_2 \text{ (Hz)} = 455;$
 $p_1 \text{ (dBm)} = -14;$
 $p_2 \text{ (dBm)} = -4;$
cadence (ms) = $(1\ 000/250) \pm 50.$

1.7.7 (B) 3

Special confirmation tone

$f_1 \text{ (Hz)} = 420;$
 $f_2 \text{ (Hz)} = 455;$
 $p_1 \text{ (dBm)} = -14;$
 $p_2 \text{ (dBm)} = -4;$
cadence (ms) = $(40/40) \pm 5.$

1.7.7 (CY) 1

Number unobtainable tone

$f_1 = 400 \text{ Hz}, f_2 = 450 \text{ Hz};$
 $p_1 = -25 \text{ dBm}, p_2 = -10 \text{ dBm};$
Nominal frequency $f = 425 \text{ Hz};$
Cadence (s) = $2,5/0,5.$

1.7.7 (CY) 2

Call waiting tone

$f_1 = 400 \text{ Hz}, f_2 = 450 \text{ Hz};$
 $p_1 = -33 \text{ dBm}, p_2 = -18 \text{ dBm};$
Nominal frequency $f = 425 \text{ Hz};$
Cadence (s) = $0,2/0,2/0,2/0,6.$

1.7.7 (CY) 3

Warning tone

$f_1 = 1\ 300\ \text{Hz}$, $f_2 = 1\ 500\ \text{Hz}$;
 $p_1 = -35\ \text{dBm}$, $p_2 = -20\ \text{dBm}$;
 Nominal frequency $f = 1\ 400\ \text{Hz}$;
 Cadence (s) = 0,5/14.

1.7.7 (DK) 1

Special dial tone

$f_1\ (\text{Hz}) = 425 \pm 10$, $p_1\ (\text{dBm}) = -21$, $p_2\ (\text{dBm}) = -6,5$;
 $f_2\ (\text{Hz}) = 375 \pm 10$, $p_1\ (\text{dBm}) = -23$, $p_2\ (\text{dBm}) = -8,5$.

Cadence:

f_1 : continuous;
 f_2 tone/pause (ms) = $120 \pm 12/1\ 000 \pm 100$.

1.7.7 (F) 1

Special dial tone

Used as second dial tone and as special dial tone, but with $p_1 = -25\ \text{dBm}$ for special dial tone.

The frequency component $330 \pm 15\ \text{Hz}$ is emitted from the public exchange with an accentuation of $3,5 \pm 1\ \text{dB}$ with respect to the frequency component $440 \pm 15\ \text{Hz}$.

1.7.7 (F) 2

Howler tone

$f_1 = 425\ \text{Hz}$;
 $f_2 = 455\ \text{Hz}$;
 $p_1 = -25\ \text{dBm}$;
 $p_2 = -10\ \text{dBm}$;
 cadence = 500/500 ms.

The howler tone is emitted by the public exchange to invite the subscriber to hang up, when, for example, the time limit to dialling is reached, the distant party has hung up, etc.

The duration of this tone can be limited to 30 s and the associated feeding condition can be $V_f = 46\ \text{V}$ and $R_f = 8\ 225\ \Omega$.

1.7.7 (I) 1

Special dial tone

$f_1 = 410\ \text{Hz}$; $f_2 = 440\ \text{Hz}$; $p_1 = -25\ \text{dBm}$; $p_2 = -6\ \text{dBm}$;
 cadence: continuous tone

1.7.7 (I) 2

Intrusion tone

$f_1 = 410\ \text{Hz}$; $f_2 = 440\ \text{Hz}$; $p_1 = -30\ \text{dBm}$; $p_2 = -11\ \text{dBm}$;
 cadence: pulse $200 \pm 10\%$ ms, pause $200 \pm 10\%$ ms;
 pulse $200 \pm 10\%$ ms, pause $1\ 400 \pm 10\%$ ms.

1.7.7 (I) 3

Waiting tone

$f_1 = 410\ \text{Hz}$; $f_2 = 440\ \text{Hz}$; $p_1 = -25\ \text{dBm}$; $p_2 = -10\ \text{dBm}$;
 single shot $1\ \text{s} \pm 10\%$ s.

1.7.7 (NL) 1	f_1 (Hz)	f_2 (Hz)	p_1 (dBm)	p_2 (dBm)	cadence on/off (ms)
Special dial tone	100	200	-25,7	-3,8	450-550/35-75
(NOTE) or	400	450	-25,7	-3,8	450-550/35-75
Positive indication tone	400	450	-25,7	-3,8	continuous
Negative indication tone	400	450	-25,7	-3,8	50-100/50-100
Call waiting tone	400	450	-31,7	-9,8	150-250/150-250/ 150-250/4 000-5 000
Paging acceptance tone	1 575	1 625	-25,7	-3,8	continuous

NOTE: In due time only the 425 Hz tone will be in use in the Dutch PSTN.

- 1.7.7 (N) 1** Special dial tone
- A continuous signal consisting of two alternating tones. The frequencies are 470 ± 15 Hz and 425 ± 15 Hz. The alternating intervals are $400 \text{ ms} \pm 10\%$.
- $p_1 = -30$ dBm;
 $p_2 = -8 \pm 2$ dBm.
- 1.7.7 (N) 2** Warning tone
- $f = 1\ 400 \text{ Hz} \pm 50 \text{ Hz}$, signal/pause = $400/15\ 000 \text{ ms} \pm 10\%$,
 $p_2 = -22 \pm 2$ dBmO.
- 1.7.7 (N) 3** Intrusion tone
- $f = 1\ 400 \text{ Hz} \pm 50 \text{ Hz}$, one tone burst $2\ 000 \text{ ms} \pm 10\%$,
 $p_2 = -22 \pm 2$ dBmO.
- 1.7.7 (N) 4** Call waiting call
- $f = 1\ 400 \text{ Hz} \pm 50 \text{ Hz}$, signal/pause/signal/pause/signal/pause = $200/2\ 000/200/90\ 000/200/90\ 000 \text{ ms} \pm 10\%$, $p_2 = -22 \pm 2$ dBmO.
- 1.7.7 (N) 5** Howler tone
- $f = 950$ Hz with the following format:
- $p_2 = 18,5$ dBm in 4 sec., $13,5$ dBm in 4 sec., 9 dBm in 4 sec., $4,5$ dBm in 4 sec. and 0 dBm in 4 sec. The tone format is sent to parked subscribers 3 times.
- 1.7.7 (P) 1** Special dial tone as defined in CCITT Recommendation E. 182.
Cadence(s) = $1 \pm 20\%$ / $0,2 \pm 20\%$.
- 1.7.7 (P) 2** Positive indication tone as defined in CCITT Recommendation E. 182.
Cadence(s) = $1 \pm 20\%$ / $0,2 \pm 20\%$.
- 1.7.7 (P) 3** Negative indication tone as specified in CCITT Recommendation E. 182.
Same characteristics as for special information tone.
- 1.7.7 (P) 4** The tones specified in section 1.7.7 are not yet provided. They will be used in the future.
- 1.7.7 (E) 1**
- PROVISION: See the provisions 1, 2 and 3 in section 1.7.1 (E) 1.

1.7.7 (E) 1.1 Second dial tone

The characteristics presented for the second dial tone that is sent continuously are:

$$f_1 = 570 \text{ Hz}, \quad f_2 = 630 \text{ Hz};$$
$$p_1 = -21 \text{ dBm}, \quad p_2 = -5 \text{ dBm}.$$

1.7.7 (E) 1.2 Special dial tone

The characteristics presented for the special dial tone are:

$$f_1 = 410 \text{ Hz}, \quad f_2 = 440 \text{ Hz};$$
$$p_1 = -20 \text{ dBm}, \quad p_2 = -5 \text{ dBm}.$$

The cadence in milliseconds is either 1 000/100 or 320/20.

1.7.7 (E) 1.3 Number unobtainable tone

The characteristics presented for the number unobtainable tone are either

$$f_1 = 410 \text{ Hz}, \quad f_2 = 440 \text{ Hz};$$
$$p_1 = -35 \text{ dBm}, \quad p_2 = -6 \text{ dBm};$$
$$\text{cadence (ms)} = (2 \times 200) / (200 + 600);$$

or

$$f_1 - f_2 \equiv 320 \text{ Hz} - 480 \text{ Hz} \text{ or } 360 \text{ Hz} - 540 \text{ Hz};$$
$$p_1 = -35 \text{ dBm}, \quad p_2 = -5 \text{ dBm};$$
$$\text{cadence (ms)} = (2 \times 235) / (190 + 490) \text{ or } (2 \times 235) / (150 + 500).$$

1.7.7 (E) 1.4 Call waiting tone

The characteristics presented for the call waiting tone are:

$$f_1 = 410 \text{ Hz}, \quad f_2 = 440 \text{ Hz};$$
$$p_1 = -15 \text{ dBm}, \quad p_2 = -6 \text{ dBm}.$$
$$\text{cadence (ms)} = (2 \times 600) / (200 + 1\,000).$$

1.7.7 (E) 1.5 Warning tone

The characteristics presented for the warning tone are:

$$f_1 = 1\,350 \text{ Hz}, \quad f_2 = 1\,450 \text{ Hz};$$
$$p_1 = -60 \text{ dBm}, \quad p_2 = -33 \text{ dBm}.$$
$$\text{cadence (s)} = 0,4/5.$$

This tone is also used as general intrusion tone.

1.7.7 (S) 1 Special dial tone

$$f_1 = 400, \quad f_2 = 450, \quad p_1 = -25, \quad p_2 = -10. \quad \text{Cadence: } 320/40.$$

Warning tone

$$f_1 = 1\,379, \quad f_2 = 1\,421, \quad p_1 = -40, \quad p_2 = -25. \quad \text{Cadence: } 100/1\,500.$$

Call waiting tone

$$f_1 = 400, \quad f_2 = 450, \quad p_1 = -25, \quad p_2 = -10. \quad \text{Cadence: } 200/500/200 \text{ (two tone bursts once only)}.$$

1.7.7 (CH) 1

If the relevant meanings are needed, it is advisable to use the following tones:

1.7.7 (CH) 1.1 Warning tone

An audible indication to a caller to warn that privacy of a conversation cannot be ensured, e.g. where a recording machine is being used, or to both parties during a call to warn that privacy of the conversation has been interrupted.

Cadence (repeated):

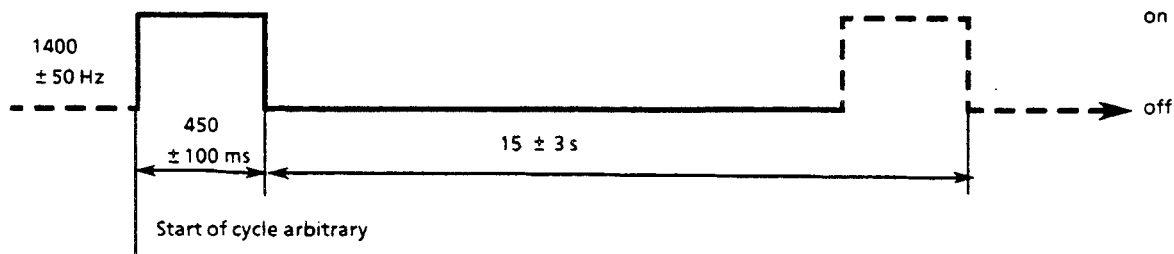


Figure 1.7.7 (CH) 1.1

1.7.7 (CH) 1.2 Call waiting tone

An audible indication to the call waiting supplementary service user who is engaged on a call that someone is attempting to that termination.

Cadence (repeated):

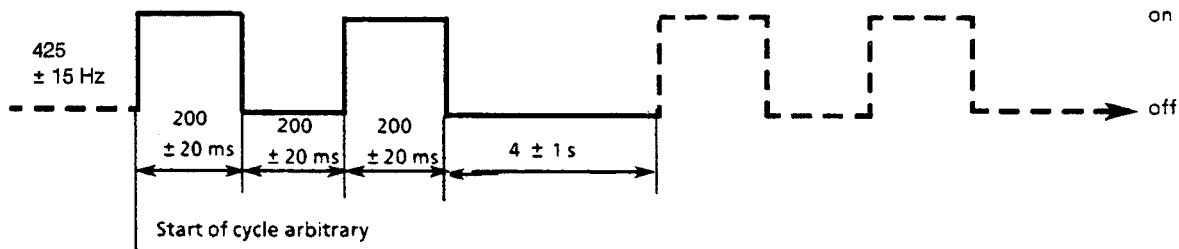


Figure 1.7.7 (CH) 1.2

1.7.7 (CH) 1.3 Intrusion tone

An audible indication to persons on a telephone call that some third person, e.g. an operator or a user of PABX executive intrusion service, is intruding or has intruded on the conversation.

Cadence (repeated):

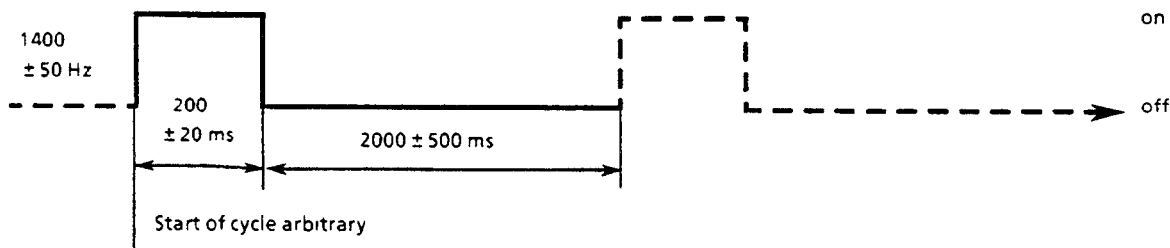


Figure 1.7.7 (CH) 1.3

1.7.7 (CH) 1.4 Confirmation tone

An audible indication to persons on a telephone call that a phase of programming or activation of a telephone service is terminated.

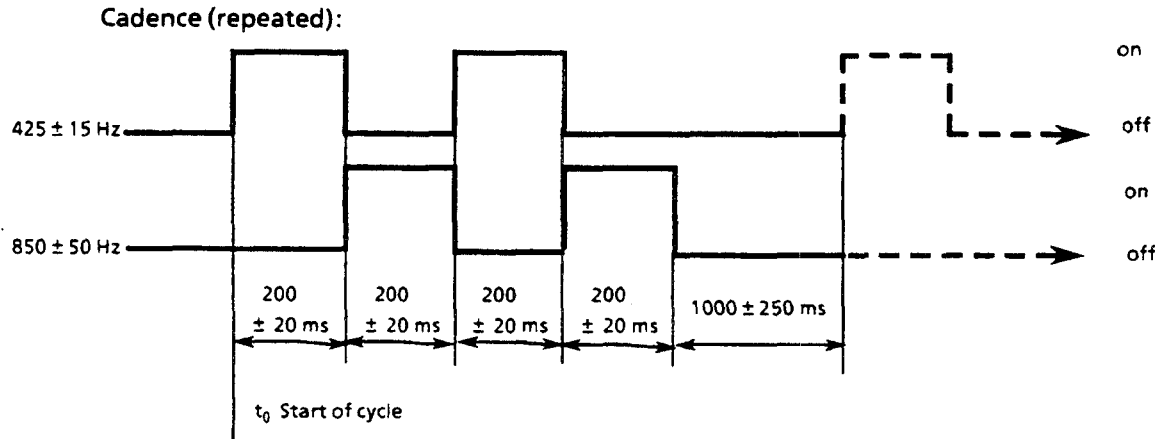


Figure 1.7.7 (CH) 1.4

1.7.7 (GB) 1 A variety of tones and verbal announcements can occur within the UK network. The most important tone, which TE may need to recognise, is Number Unobtainable Tone, specified as follows:

- frequency = $400 \pm 20\%$;
- min. level = -37 dBm;
- max. level = 0 dBm;
- cadence = continuous tone.

1.7.8 Frequencies for pulse metering

The following frequencies and levels are presented at the PSTN CP for pulse metering:

- f_1 - minimum frequency;
- f_2 - maximum frequency;
- p_1 - minimum level;
- p_2 - maximum level;
- Cadence - ? pause, ? pause.

Levels are assumed to be measured over a load of Z_1 ohms.

Table 1.7.8: Frequencies and levels for pulse metering

COUNTRY	VALUES						Remarks
	f ₁ (Hz)	f ₂ (Hz)	p ₁ (dBm)	p ₂ (dBm)	cadence (ms)	Z ₁ (Ω)	
Austria	11 928	12 072	-27	+10		200	yes
Belgium	15 840	16 160	-18	+17	80 min. on/ 220 min. pause	200	
Cyprus	15 840	16 160	100 mV	4 V	80 - 300 on/ 400 min. pause	200	yes
Denmark	11 916	12 084	-27	+15		200	yes
Finland	15 950	16 050	240 mV	8,0 V	150 ± 50/≥ 350	200	
France	11 880	12 120	-19	+13	125 ± 25/>160	200	yes
Germany	15 920	16 080	-22	+22		200	yes
Greece	15 250	16 750	-18	+18	50/90	200	yes
Iceland	11 940	11 960	-20	+13	140/140 ± 10	200	
Ireland	11 880	12 100	45 mV	2,6 V	120 ± 20	200	
Italy	11 880	12 120	65 mV	2 400 mV	125 ± 25 on / ≥ 150	200	
Luxembourg	15 920 (48)	16 080 (52)	3,75 V	8,7 V	90 - 170	200	
Malta							
Netherlands	48	52			70 - 200		yes
Norway	15 840	16 160	-25	+7		200	yes
Portugal	11 880	12 120	-19	15	120 - 250	200	
Spain							yes
Sweden	11 940	12 060	5,5 mV	447 mV		200	
Switzerland	11 880	12 120	110 mV	10 V	>50/>90	200	
U. Kingdom	50						yes

1.7.8 (A) 1 Pulse ≥ 50 ms, pause ≥ 50 ms, not cadenced.

1.7.8 (CY) 1 For long distances, a pulsed frequency is used with the following characteristics:

f₁ = 48 Hz;

f₂ = 52 Hz;

nominal frequency f = 50 Hz;

cadence (ms) = 80 - 300 on / 400 min. pause;

nominal duration = 200 ms;

maximum voltage = 80 V_{rms};

minimum voltage = 30 V_{rms}.

1.7.8 (DK) 1 Pulse: 75 - 200 ms, pause: 50 ms...infinite

1.7.8 (F) 1 In case of long subscriber's line, the meter pulses consist of longitudinal signals between the line terminals and a common signal earth terminal, with the following characteristics at the PSTN CP:

f_1 (Hz)	f_2 (Hz)	U_1 (V)	U_2 (V)	t_{on} (ms)	t_{off} (ms)	Z_L (k Ω)
48	52	36	70	125 ± 25	>160	10

1.7.8 (D) 1 Pulse: 80...365 ms; pause: 135 ms...infinite. The levels p_1 and p_2 are related to dB (775 mV).

1.7.8 (GR) 1 Pulse: 50 ms; pause: 90 ms.

1.7.8 (NL) 1 Pulses are common mode.

Voltages of the pulses is 65 - 100 mV measured on a load resistance of 5 - 100 k Ω .

1.7.8 (N) 1 Pulse 150 ± 30 ms, pause ≥ 120 ms.

1.7.8 (N) 2 For equipment which requires authorised installation personnel a p_1 value of -20 dBm is allowed.

1.7.8 (E) 1

PROVISION: See the provisions 1 and 2 in section 1.7.1 (E) 1.

1.7.8 (E) 1.1 12 kHz metering pulses

The request for the presence of 12 kHz metering pulses over a line shall be addressed to the network operator.

The 12 kHz signal is applied in transverse mode between the two wires of the line, simultaneously in parallel with the dc feeding system (feeding bridge and battery).

The tolerance of the frequency is $\pm 1\%$.

The open circuit ac_{rms} output voltage is $(4 \pm 0,8)$ V. The signal is presented through an output equivalent resistance of $200 \Omega \pm 10\%$. In these values the influence of the external wiring (typically from 0 to 1 200 equivalent ohms, 273 Ω / km, and 49 nF / km) shall be added.

The minimum durations of the signal and pause periods are 50 ms.

1.7.8 (E) 1.2 50 Hz metering pulses

The request for the presence of 50 Hz metering pulses over a line shall be addressed to the network operator.

The 50 Hz signal is applied in longitudinal mode between the two wires of the line and earth. The dc feeding system (feeding bridge and battery) is simultaneously in parallel between the two wires of the line.

The tolerance of the frequency is ± 1 Hz.

The open circuit ac_{rms} output voltage is (95 ± 5) V. The signal is presented to each wire through an output equivalent resistance of 500 Ω . In these values the influence of the external wiring (see section 1.7.8 (E) 1.1), and the earth resistance at the subscriber's premises shall be added.

The minimum duration of the signal and pause periods conforms to a cadence in milliseconds of either 50/90 or 70/70.

1.7.8 (GB) 1

Low frequency meter pulse

A low frequency meter pulse is a 50 Hz signal applied longitudinally, that is, to the A and B wires in parallel as a single conductor. The usual method of detection at the TE is a capacitor in series with a centre-tapped coil, in series with a second capacitor, this combination being connected across the A and B wires. The signal at the centre-tap is detected with respect to earth.

The voltage of the pulse at the exchange is in the range 40 V to 45 V_{rms} and the current available at the TE is approximately 1 mA rms. The signal is likely to be rich in harmonics. The duration of the pulse at the exchange is in the range 200 ms to 595 ms, but regenerative distortion can elongate pulses to durations in excess of 1 s at the customer's terminal.

1.7.8 (GB) 2

High frequency meter pulse

High frequency private meter pulse is currently under development by the PTOs and information on its proposed characteristics should be obtained from the relevant PTO.

1.7.9 Ringing signal

The following frequencies and levels are presented at the PSTN CP for ringing signal:

- f_1 - minimum frequency;
- f_2 - maximum frequency;
- V_1 - minimum voltage;
- V_2 - maximum voltage;
- Cadence - on/off.

Table 1.7.9: Frequencies and voltages for ringing signal

COUNTRY	VALUES					Remarks
	f ₁ (Hz)	f ₂ (Hz)	V ₁ (V)	V ₂ (V)	cadence (s)	
Austria	40	60	under study	66	1/5 ± 20%	yes
Belgium	23	27	75	90	1/3	yes
Cyprus	23,5	26,5	25	85	1,5/3	yes
Denmark	22,5	27,5	40	120	0,75/7,5 ± 20%	yes
Finland	25		35	90	1/4	
France	48	52	25 V/2 kΩ	90	1,5/3,5 ± 10%	
Germany	23	54	45	75	1/4 or 5 ± 10%	yes
Greece	16	50	25	90	1/4	
Iceland	22	28	30	90	1,2/4,7	
Ireland	17 or 25		40	75	0,4/0,2/0,4/2	yes
Italy	20	50	26	80	1/4 ± 10%	
Luxembourg	25		55	75	1/4 or 5 ± 10%	
Malta						
Netherlands	23	27	35	90	0,75 - 1,25/3,5 - 4,5	yes
Norway	22	28	28	90	1/4	yes
Portugal	15	30	30	120	1 ± 20%/5 ± 20%	
Spain	20	30	65	90	1,5/3	yes
Sweden	25 ± 3	50 ± 1	64	100	1/5	yes
Switzerland	25 ± 3	50 ± 5	25	90	1 ± 0,2/4 + 2 -0,5	yes
U. Kingdom	16 ² / ₃ + 5% -13%	25 + 5% -13%	63	100	0,4/0,2, 0,4/2,0	yes

- 1.7.9 (A) 1** During the ringing condition (ringing + pause) the dc-voltage superimposed to the ac is between 20...64 V.
- 1.7.9 (B) 1** The values given in the table are related to the generator in the public exchange office.
- 1.7.9 (CY) 1** The nominal frequency is 25 Hz.
- 1.7.9 (DK) 1** Also call back ringing signal with the following cadences may apply.

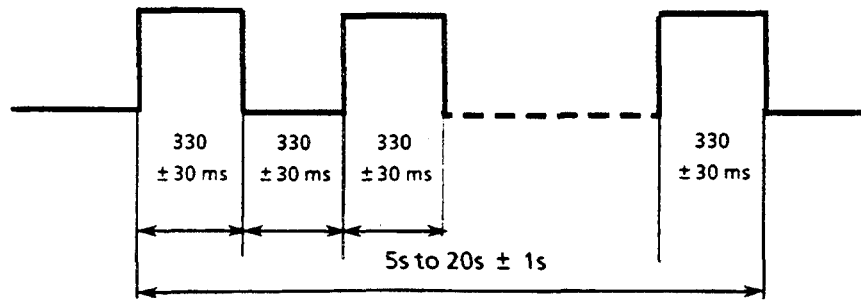


Figure 1.7.9 (DK) 1

1.7.9 (D) 1

The minimum voltage (45 V) is applied by connecting a four-terminal network between the voltage source ($R_i = 0$ ohm) and the TEUT:

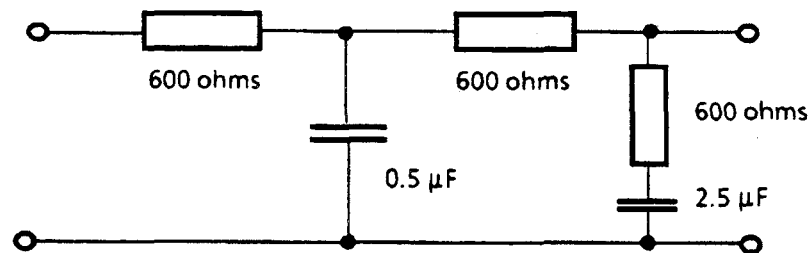


Figure 1.7.9 (D) 1: Voltage divider

1.7.9 (IRL) 1

Cadence as shown repeated.

1.7.9 (NL) 1

Also a ringing signal with the following cadence may apply:

tone	pause	tone	pause	tone	pause
400	200	400	4 000		

tone tolerance: 400 ± 50 ms

pause tolerances: 200 ± 50 ms and 4 000 ± 200 ms.

1.7.9 (NL) 2

Before the normal cyclic ringing signal an "immediate ringing signal" with a length between 600 and 1 200 ms is given. The pause between this pre-ringing signal and the first ringing signal in the ringing cycle may be between 0 and 4 500 ms.

1.7.9 (N) 1

Also signals with the following characteristics may apply:

- 1) 40 - 60 V_{rms} sine wave signal, 22 - 28 Hz, 70 - 90 V dc component voltage.
- 2) 155 V_{p-p} square wave signal, 22 - 28 Hz, 80 V dc component voltage.
- 3) 30 - 90 V_{rms} sine wave, 45 - 55 Hz, 24 - 60 V dc component (from PABXs).

1.7.9 (E) 1

PROVISION:

See the provisions 1 and 2 in section 1.7.1 (E) 1.

The voltage values indicated are open circuit ac_{rms} voltages.

In old exchanges the cadences in seconds are 1,5/2,9 or 1,5/3,4.

The ringing signal is presented through an output equivalent resistance of 0 + 200 ohms or 0 + 700 ohms or 350 + 350 ohms or 400 +

400 ohms; in these values a tolerance of $\pm 10\%$ shall be considered and the influence of the external wiring (from 0 to 1 200 equivalent ohms) shall be added.

The ringing signal is presented simultaneously superimposed to the dc voltage of the battery of the exchange.

1.7.9 (S) 1 The voltage values indicated are open circuit ac_{rms} voltages.

1.7.9 (CH) 1 The first call can be non-cyclic:
 Call on 250 - 500 ms, pause between first call and normal call: 0 - 4,4 s.

1.7.9 (CH) 2 Timing for an exchange call through a PABX.

Cadence (repeated):

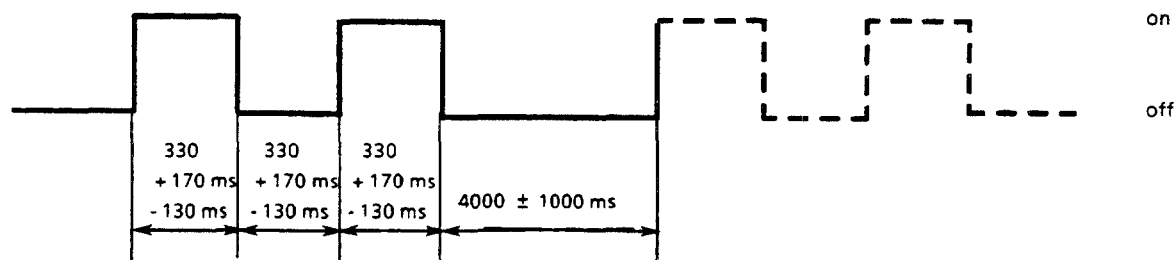


Figure 1.7.9 (CH) 2

1.7.9 (CH) 3 Alarm call: continuous call.

TE with automatic answering function (ringing current detection) shall in any case not seize the line.

1.7.9 (GB) 1 An alternative ringing signal that may be applied has a frequency of 25 Hz + 1 Hz - 5 Hz, with an initial cycle of 0,35/0,22 s, thereafter starting at any point in the normal cycle shown in table 1.7.9.

1.7.9 (GB) 2 Some exchanges provide a facility known as "immediate ring", whereby an initial burst of ringing, 20 ms to 1 s in length, immediately precedes switching to any point in the normal ringing cycle.

1.7.9 (GB) 3 Other ringing signals used to indicate calls arriving from particular supplementary services may be available.

1.7.9 (GB) 4 DC bias may be present during the whole cadence or may be confined to the "off" periods. Cadence tolerance is $\pm 25\%$.

1.7.9 (GB) 5 The cadence of all ringing signals has a tolerance of +10 % -20 %. Ringing signal cadence does not necessarily coincide with ringing tone cadence.


1.8 Abbreviations

The following abbreviations are used throughout this document:

α	return loss
α_i	insertion loss
α_q	longitudinal conversion loss (LCL)
α_l	longitudinal conversion transfer loss (LCTL)
a	a-wire of the two wire PSTN line
a_1	a-wire connection at the TE input port
a_2	a-wire connection at the output port of a series-connected TE
a_n	power level
A	Ampere
ac	alternating current
b	b-wire of the two wire PSTN line
b_1	b-wire connection at the TE input port
b_2	b-wire connection at the output port of a series-connected TE
B	bandwidth
$^{\circ}\text{C}$	degree Celsius
C	Capacitor, Capacitance
CEPT	Conférence Européenne des Administrations des Postes et des Télécommunications (European Conference of Posts and Telecommunications Administrations)
CCITT	Comité Consultatif International Télégraphique et Téléphonique (International Consultative Committee for Telegraphy and Telecommunications)
C_f	feeding Capacitor
CH	Channel
CP	Connection Point
dB	decibel
dB (775 mV)	decibel relative to 775
dBm	decibel relative to 1 mW
dBm0(p)	decibel relative to 0 (psophometrically weighted)
dBmp	decibel psophometrically weighted
dB _r	decibel, relative level
dBV	decibel relative to 1 V
dc	direct current
Δ	prefix to indicate a range of the following item
DTMF	Dual Tone Multi-Frequency Dialling
e	emf (when used in conjunction with a signal generator)
e	earth wire
emf	electromotive force
ETSI	European Telecommunications Standards Institute
F	Farad
FFT	Fast Fourier Transform
H	Henry
Hz	Hertz (cycles per second)
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardisation
L	Inductance
I_f	feeding current
log	logarithm to the base 10
k	kilo (10^3)
L_f	feeding inductor
m	milli (10^{-3})
ms	millisecond
M	Mega (10^6)
MFPB	Multi-Frequency Push Button Dialling
n	nano (10^{-9})

Abbreviations continued:

N/A	Not Applicable
NET	Norme Européenne de Télécommunications
Ω	ohm
Pa	Pascal
PABX	Private Automatic Branch Exchange
P_s	sending power level
PSTN	Public Switched Telephone Network
Rec	Recommendation
REN	Ringer Equivalence Number
R	Resistor, Resistance
R_f	feeding Resistor
R_L	load Resistance
rms	root mean square
s	second
S	Switch
t	time
TE	Terminal Equipment
TEUT	Terminal Equipment Under Test
TP	Testing Point
μ	micro (10^{-6})
V	Voltage, Volts
V_f	feeding Voltage
Z	impedance
Z_L	load impedance

1.8 (B) 1 In this document the symbol  near a parameter means that there is no value applicable for this parameter.






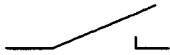









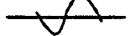
1.9 National designators

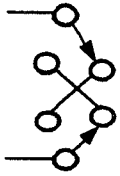
The following country designators are used within the numbering system employed in this document:

Country	National Designation
Austria	A
Belgium	B
Cyprus	CY
Denmark	DK
Finland	SF
France	F
Germany	D
Greece	GR
Iceland	IS
Ireland	IRL
Italy	I
Luxembourg	L
Malta	M
The Netherlands	NL
Norway	N
Portugal	P
Spain	E
Sweden	S
Switzerland	CH
United Kingdom	GB

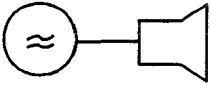
1.10 Symbols

The following symbols are used throughout this document:

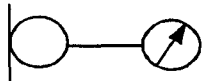
	Resistor
	Capacitance
	Inductance
	Diode
	Ground
	Switch
	AC Generator
	Alternating voltage meter
	Alternating current meter
	Receiver
	Loudspeaker
	Microphone
	Indicating Instrument. General Symbol
	Telephone Set. General Symbol
	Continuously variable
	AC General Symbol



Pole inverter

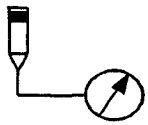


Artificial mouth with low frequency generator

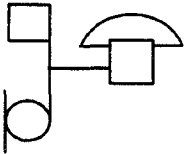


Artificial ear with sound pressure meter

IEC 318



Measuring microphone with sound pressure meter



Telephone set in off-hook state acoustic coupled to earphone and/or microphone



Direct voltage source



Direct voltage source, adjustable



Direct voltage meter



Direct current meter



Alternating current meter, selective



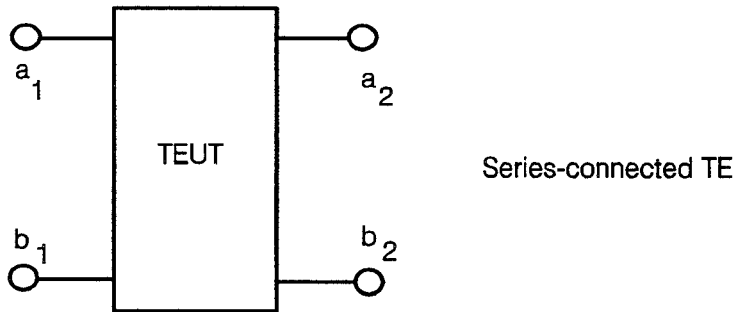
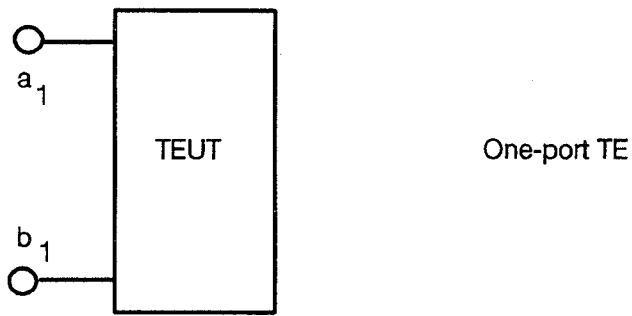
Alternating voltage meter, selective



Frequency meter, possibly selective



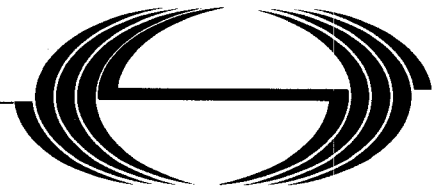
Oscilloscope



1.11 Summary of references

Section	Reference
1.1.1	M.O.U. Directive 86/361/EEC
1.1.2	Directive 73/23/EEC (Directive 86/361)
1.10	IEC 318
A.4	CCITT Blue Book Rec. P.76 CCITT Blue Book Rec. P.34
Figure A.4.2.a	CCITT Rec. O.121
A.4.4.2.1	CCITT Rec. P.56
4.5.1	CCITT Rec. O.41
A.4.5.1	CCITT Rec. O.41
A.9.6.1.2	NOTE on page 121 CCITT Rec. Y.25
1.11 (E) 1	The references that are made in the Spanish contribution (E) to CCITT Recommendations as published in Blue Book, they are in: CCITT Blue Book, UIT, Geneva, 1989.

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**Attachments to Public Switched Telephone Network (PSTN);
General technical requirements for equipment connected to
an analogue subscriber interface in the PSTN**

Chapter 2: DC characteristics

(Candidate NET 4)

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Foreword

Chapter 2 of this European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI). The text of this ETS may be utilized, wholly or in part, for the establishment of NET 4.

For historical purposes, this ETS was drafted in the form of a NET. However, until a final decision to adopt this ETS as NET 4 has been agreed by the Technical Recommendations Application Committee (TRAC), the terms NET or NET 4 in this document should be read as ETS or ETS 300 001 respectively.

This ETS comprises ten chapters:

"Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

- Chapter 1 - General
- Chapter 2 - DC characteristics**
- Chapter 3 - Ringing signal characteristics
- Chapter 4 - Transmission characteristics
- Chapter 5 - Calling functions
- Chapter 6 - Answering function
- Chapter 7 - Power failure
- Chapter 8 - Connection methods
- Chapter 9 - Special functions
- Chapter 10 - Additional unclassified requirements

Refer to Chapter 1 (General) of this ETS for information on the structure and details of how to use this ETS. The national designations used to identify national variations to requirements and tests within this ETS are given in section 1.9 of Chapter 1 (page 60).

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2 DC characteristics

2.1 Polarity

All requirements in this document shall be met independently of the polarity of the dc voltage applied to the line terminals of the Terminal Equipment Under Test (TEUT) which are intended for connection to the PSTN. In addition, for series-connected TE, the additional terminals intended for connection to other TE shall not of themselves extend to, nor require from that other TE any polarity-dependent requirements.

Compliance shall be checked using the tests outlined in section A.2.1.

Table 2.1: Polarity requirements

COUNTRY	REQUIREMENT	Remarks
	mandatory	
Austria	X	
Belgium	X	
Cyprus	X	
Denmark	X	
Finland	X	
France	X	
Germany	X	yes
Greece	X	
Iceland	X	
Ireland	X	yes
Italy	X	
Luxembourg	X	
Malta		
Netherlands	X	yes
Norway	X	yes
Portugal	X	
Spain	X	
Sweden	X	
Switzerland	X	
U. Kingdom	X	

2.1 (D) 1 Polarity independence is also required for the W-wire.

2.1 (IRL) 1 All equipment which is sensitive to the polarity of the telephone line shall be fitted with its own polarity protection equipment.

2.1 (NL) 1 The PSTN, when changing of feeding bridge with the same or with reversed polarity and also during tests, can cause feeding interruptions of up to 80 ms. It is not mandatory to test the behaviour of TE with respect to such feeding interruptions.

2.1 (N) 1 For TE with a call barring function based on polarity test from the public exchange. Please refer to section 2.3 (N) 1.

A.2 DC characteristics

A.2.1 Polarity

Tests to determine polarity independence of requirements shall be made by reversal of the dc voltage applied to the line terminals of the TEUT which are intended for connection to the PSTN, from test to test or between changes of test configuration.

In certain tests, two groups of tests are to be made, one group with each polarity of applied dc voltage. In these cases, this additional testing will be specified.

In other cases when two groups of tests are not specified, the testing laboratory can establish the compliance methods and shall describe them in the test report.

Table A.2.1: Polarity tests

COUNTRY	TEST	Remarks
	mandatory	
Austria	X	
Belgium	X	
Cyprus	X	
Denmark	X	
Finland	X	
France	X	
Germany	X	yes
Greece	X	
Iceland	X	
Ireland	X	
Italy	X	
Luxembourg	X	
Malta		
Netherlands	X	
Norway	X	
Portugal	X	
Spain	X	
Sweden	X	
Switzerland	X	
U. Kingdom	X	

A.2.1 (D) 1

During the polarity independence test it has to be checked whether the W-wire is functioning independently of the polarity.

2.2 Insulation resistance

It is a requirement in this section that TEUT shall not be modified in any way.

2.2.1 TE in quiescent condition

The requirements of this section shall be met when the TEUT is in the quiescent condition and after the TEUT has had each test voltage, up to the declared value of $V_{tmax.}$, applied for a time sufficient to allow transient effects arising from the application of that test voltage to be absent.

Table 2.2.1: Insulation resistance for TE in quiescent condition

COUNTRY	REQUIREMENT VALUES				Remarks
	R_1 (M Ω)	R_2 (M Ω)	R_3 (M Ω)	$V_{tmax.}$ (V)	
Austria	5	not mandatory	not mandatory	100	yes
Belgium	5	100	100	200	yes
Cyprus	5	10	10	100	
Denmark	3	100	100	250	yes
Finland	1	not mandatory	5	100	yes
France	5	5	not mandatory	100	yes
Germany	5	5	not mandatory	≤ 100	yes
Greece	5	100	100	100	
Iceland	1	10	10	100	
Ireland	5	10	not mandatory	100	
Italy	5	100	100	100	
Luxembourg	5	100	100	100	
Malta					
Netherlands	1	10	not mandatory	100	yes
Norway	3	10	10	100	
Portugal	1	5	5	100	
Spain	5			100	yes
Sweden	1	10	10	250	yes
Switzerland	5	10	100	100	yes
U. Kingdom	see remark	5	see remark	100	yes

- R_1 Resistance between the two line terminals to be connected to the PSTN,
 R_2 Resistance between the line terminals when shorted together and any signal earth terminals,
 R_3 Resistance between the two line terminals when shorted together and all user accessible parts of the TE, other than earth or signal earth terminals.

NOTE: For R_1 (M Ω), R_2 (M Ω), R_3 (M Ω), see sections 2.2.1.1, 2.2.1.2, and 2.2.1.3.

- 2.2.1 (A) 1** With telephone sets (or equivalent TEs) which are designed as two-pole and pulse metering equipment, the insulation resistance R_1 in quiescent condition between the connecting terminals a and b shall be greater than 1 Mohm at a voltage up to 100 V.

- 2.2.1 (B) 1 The value of V_{tmax} (V) is 500 in section 2.2.1.3 ("line terminals to user accessible part").
- 2.2.1 (DK) 1 For a telephone set in quiescent condition the insulation resistance R_1 between the connecting terminals a and b shall be greater than 1 Mohm at a voltage of up to 250 V.
- 2.2.1 (F) 1 For TE which tests the continuity of the line, the insulation resistance value R_1 may be less than 5 M Ω but not less than 0,5 M Ω , during maximal periods of 10 ms with a repetition rate of at least 10 s. The requirement relevant R_3 is considered as covered by the safety tests.
- 2.2.1 (F) 2 In addition to table 2.2.1, it is required:
- $R_1 \geq 1 \text{ M}\Omega$ at $V_t = 180 \text{ V}$;
- $R_2 \geq 1 \text{ M}\Omega$ at $V_t = 130 \text{ V}$.
- 2.2.1 (D) 1 The insulation resistance between the connecting terminals a and b as well as between a and earth wire (e) and between b and the earth wire of the TE shall in all operational states, except the loop state, the dialling state and the active states of signalling (earth, flash), be $\geq 5 \text{ M}\Omega$ at a voltage of up to 100 V and $\geq 100 \text{ k}\Omega$ at a voltage of 150 V. The measurement values are read 30 s after the application of the test voltage.
- 2.2.1 (D) 2 The a- and b-wires of the TE shall not have, in any case, a galvanic connection inside the TE with potential against earth, except for signal earth "E" in the signalling state where signal earth-signalling is used.
- It is not allowed to supply any additional current from the TE to the line.
- 2.2.1 (NL) 1 The following is related to sections 2.2.1.1, 3.1 and 4.1:
- Connection factor
- The connection factor is a measure of the maximum number of terminals connected in a parallel and is determined by the properties of the TE in the quiescent condition and in the situation of an incoming call.
- 2.2.1 (NL) 1.1 DC properties in quiescent condition (section 2.2.1.1)
- DC resistance in M Ω : Connection factor (A-type)
- | | |
|------------|-----|
| 1,0 to 2,0 | 1,5 |
| 2,0 to 4,0 | 1,0 |
| > 4,0 | 0,5 |

2.2.1 (NL) 1.2

Impedance at 25 Hz (section 3.1)

Table 2.2.1 (NL) 1.2: Connection factor (B-type)

C (μF) is the capacity of the TE in quiescent condition.

Connection factor (B - type)			
C (μF) \n ZI ($\text{k}\Omega$) at 25 Hz	$\leq 0,2$	$\leq 0,5$	$\leq 1,1$
3,5 - 6	2,5	2,5	2,5
6 - 9	2,0	2,0	2,0
9 - 13	1,5	1,5	2,0
13 - 20	1,0	1,0	1,5
>20	0,5	1,0	1,5

2.2.1 (NL) 1.3

Minimum impedance in the range 300 - 3 400 Hz (section 4.1)

Impedance ($\text{k}\Omega$)	Connection factor (C-type)
15 - 18	2,5
18 - 24	2,0
24 - 36	1,5
36 - 50	1,0
> 50	0,5

2.2.1 (NL) 1.4

Final connection factor

The final connection factor of a terminal is based on the tables for A-type, B-type and C-type in such a way that the highest value is decisive. This factor shall be indicated on the approved equipment. The sum of the connection factors of the terminals connected in parallel shall be limited to a maximum of 5 for the PSTN.

2.2.1 (S) 1

A TE in idle state shall have a voltage/current characteristic (equivalent R_1 resistance) that falls within area I in figure 2.2.1 (S) 1. However, it is desirable that the resistance value is higher than the indicated limit value.

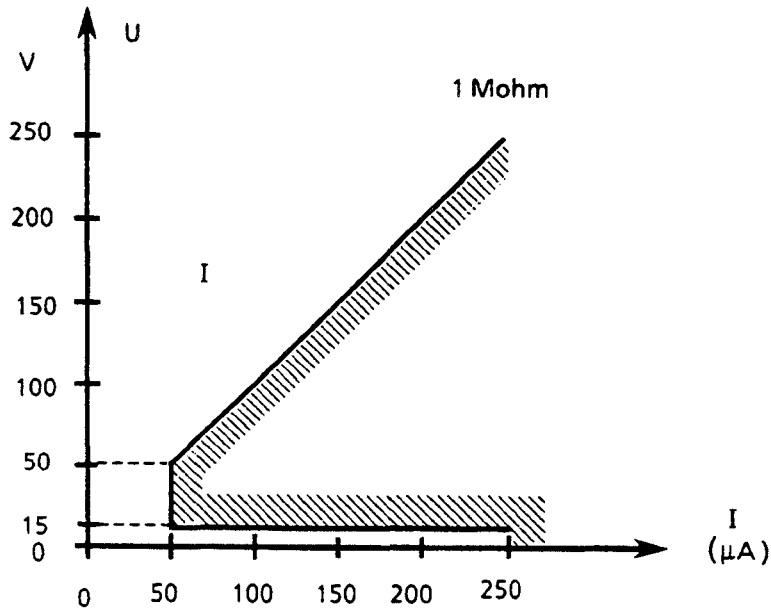


Figure 2.2.1 (S) 1

2.2.1 (CH) 1

5 M Ω for specific TEs, e.g. subscriber sets, automatic answering machines, alarm devices, facsimile equipment, data terminals and other customer's premises equipment.

REMARK: The resistance of at least 5 M Ω (for apparatus on the PSTN), basically allows a certain current to be drawn by the connected apparatus, depending on the particular supply voltage. However, this option may only be used for the implementation of auxiliary subordinate applications, such as memory holding for number repetition. There is no guarantee for the supply voltage to be available without interruption. Under no circumstances shall basic functions or facilities that have to be available over a long period of time be realised using this power supply.

Insulation measured 60 s after application at 100 V.

2.2.1 (GB) 1

For section 2.2.1.1, the insulation resistance between line terminals or leads is not specified, hence no value for R_1 is defined. Instead loop insulation resistance as a function of bleed current, defined in terms of the ringer equivalence number (REN) of the TEUT, is specified. The current drawn by the TEUT shall be not greater than $(30 * REN) \mu A$ or, where the $REN = 0$, not greater than $5 \mu A$.

Insulation resistance between line terminals of TE when in the quiescent state, and input voltage-current characteristics at ringing frequencies, are not specified.

Instead, these parameters are defined in terms of the concept of the "ringer equivalent number" or REN of the TE; this is a measure of the numbers of items of equipment that can be connected in parallel, the reference for a $REN = 1$ being a simulated ringing detector circuit consisting of an inductor of 55 H in series with a resistor of 7 kohms.

The maximum REN of a single PSTN line installation is 4; that is, the individual RENs of all items of TE connected to a single line, when added together, must not exceed 4.

Thus, the higher the REN of an item of TE, the lower its impedance at ringing frequencies, the lower its insulation resistance between the line terminals, and the greater the permissible leakage current drawn in the quiescent state.

A supplier may declare the REN of an item of TE to be greater than its measured value in order to prevent other items of equipment from being connected in parallel with it, or to be allowed to draw a greater off-line current from the PSTN than would be otherwise permitted.

Determination of REN is fully explained in Chapter 3.

2.2.1 (GB) 2 For section 2.2.1.2, R_2 is the value of the resistance between all earth terminals or leads shorted together, and each of the terminals and leads intended for connection to the PSTN.

2.2.1 (GB) 3 For section 2.2.1.3, this requirement is a safety requirement and thus outside the scope of this document.

2.2.1.1 Line terminal to line terminal

The insulation resistance between the two line terminals intended for connection to the PSTN shall not be less than the value R_1 given in table 2.2.1.

Compliance shall be checked using the tests outlined in section A.2.2.1.1.

2.2.1.1 (SF) 1 For TE where power consumption in the quiescent condition is permitted, the dc loop current across the line terminals, tested at dc voltage of 48 V and with the feeding resistor of 800 Ω , shall not be greater than 1 mA.

2.2.1.1 (E) 1 (Remark with alternative requirement to section 2.2.1.1)

However, for TEs where power consumption in the quiescent condition is permitted (exclusively TEs with dc line voltage detectors, and/or with volatile memory for dialling), the dc loop current across the line terminals, tested at a dc voltage of 48 V, shall not be greater than:

- i) 50 μA for mains powered TE;
- or
- ii) 0.5 mA for TE that is not mains powered.

NOTE 1: A specific external identification mark should be mandatory for each TE of this kind.

NOTE 2: Network compatibility cannot be expected if several TEs of this kind are simultaneously connected to the same line.

Compliance shall be checked using the tests outlined in section A.2.2.1.1 (E) 1.

A.2.2 Insulation resistance

A.2.2.1 TE in quiescent condition

A.2.2.1.1 Line terminal to line terminal

The TEUT is connected as shown in figure A.2.2.1.1.

For the dc voltage, V_t given in table A.2.2.1.1, the corresponding value of current I is measured. The values of the insulation resistance are then calculated using formula A.2.2.1.1:

$$R_1 = \frac{V_t}{I}$$

Formula A.2.2.1.1

where R_1 is the insulation resistance value, V_t is the test voltage value given in table A.2.2.1.1, expressed in volts, and I is the value of the current expressed in amperes, resulting from the application of the given test voltage.

Tests are undertaken for both polarities of dc voltage applied to the line terminals of the TEUT.

Table A.2.2.1.1: Line terminal to line terminal

COUNTRY	TEST VALUES	Remarks
	V_t (V)	
Austria	100	yes
Belgium	200	
Cyprus	100	
Denmark	45 and 250	
Finland	100	
France	180	
Germany	25, 50, 75, 100, 150	
Greece	100	
Iceland	100	
Ireland	100	
Italy	100	
Luxembourg	100	
Malta		
Netherlands	100	
Norway	100	yes
Portugal	100	yes
Spain	100	yes
Sweden	250	
Switzerland	100	yes
U. Kingdom	50	yes

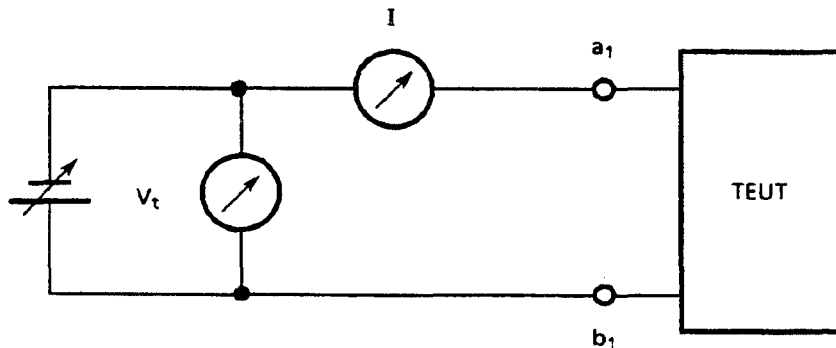


Figure A.2.2.1.1: Line terminal to line terminal

- A.2.2.1.1 (A) 1** The value of current I shall be measured 30 s after the voltage has been applied.
- A.2.2.1.1 (N) 1** The dc voltage V_t shall be applied for a time of 5 minutes for each polarity.

A.2.2.1.1 (P) 1 The dc voltage V_t shall be applied for a time of 1 minute.

A.2.2.1.1 (E) 1 (This test method is used when the alternative requirement in section 2.2.1.1 (E) 1 is applied).

The procedure of test in section A.2.2.1.1 is followed, where the dc voltage V_t takes the value of 48 V.

The current I resulting from the application of the test voltage, shall not be greater than the values stipulated in the requirement in section 2.2.1.1 (E) 1.

A.2.2.1.1 (CH) 1 Insulation measured 60 s after application at 100 V.

A.2.2.1.1 (GB) 1 Compliance is checked by measurement of the current flowing between the two terminals or leads intended for connection to the PSTN, with a 50 V dc source applied in series with a 1 500 Ω resistor. Any special signalling conditions must be disabled.

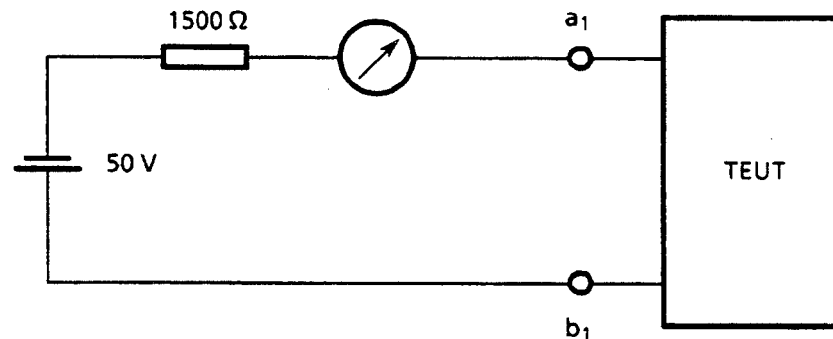


Figure A.2.2.1.1 (GB) 1: Line terminal to line terminal

2.2.1.2 Line terminals to signal earth

For TE with signal earth terminals, the resistance between the line terminals when shorted together and any signal earth terminals shall not be less than the value R_2 given in table 2.2.1.

Compliance shall be checked using the tests outlined in section A.2.2.1.2.

2.2.1.2 (E) 1 Insulation resistance between line terminals and accessible parts (and earth) in quiescent condition.
(Requirement to be applied instead of sections 2.2.1.2 and/or 2.2.1.3)

With TE in the quiescent condition, the insulation resistance between the line terminals, when shorted together, and any accessible part, connected to the earth terminal if it is provided, shall not be lower than 100 M Ω , tested at dc voltages of up to 100 V.

Compliance shall be checked using the tests outlined in section A.2.2.A.2 (E) 1.

2.2.1.2 (GB) 1 The resistance between any point provided for connection to a signal earth (as described in 1.4.3 e) and any other earth connection shall be not less than 5 Mohms.

Compliance shall be checked using the test outlined in A.2.2.1.2.

A.2.2.1.2 Line terminals to signal earth

The TEUT is connected as shown in figure A.2.2.1.2. For the dc voltage V_t given in table A.2.2.1.2, the corresponding value of current I is measured.

The value of the insulation resistance is then calculated using formula A.2.2.1.2:

$$R_2 = \frac{V_t}{I} \qquad \text{Formula 2.2.1.2}$$

where R_2 is the insulation resistance value in ohms, V_t is the test voltage value given in table A.2.2.1.2, expressed in volts, and I is the value of the current expressed in amperes, resulting from the application of the given test voltage.

Tests are undertaken for both polarities of dc voltage applied between the shorted line terminals of the TEUT and all signal earth terminals shorted together.

Table A.2.2.1.2: Line terminals to signal earth

COUNTRY	TEST VALUES	Remarks
	V_t (V)	
Austria	not mandatory	
Belgium	200	
Cyprus	100	
Denmark	45 and 250	
Finland	not mandatory	
France	130	
Germany	25, 50, 75, 100	yes
Greece	100	
Iceland	100	
Ireland	100	
Italy	100	
Luxembourg	100	
Malta		
Netherlands	100	
Norway	100	
Portugal	100	yes
Spain	100	yes
Sweden	250	
Switzerland	100	
U. Kingdom	100	yes

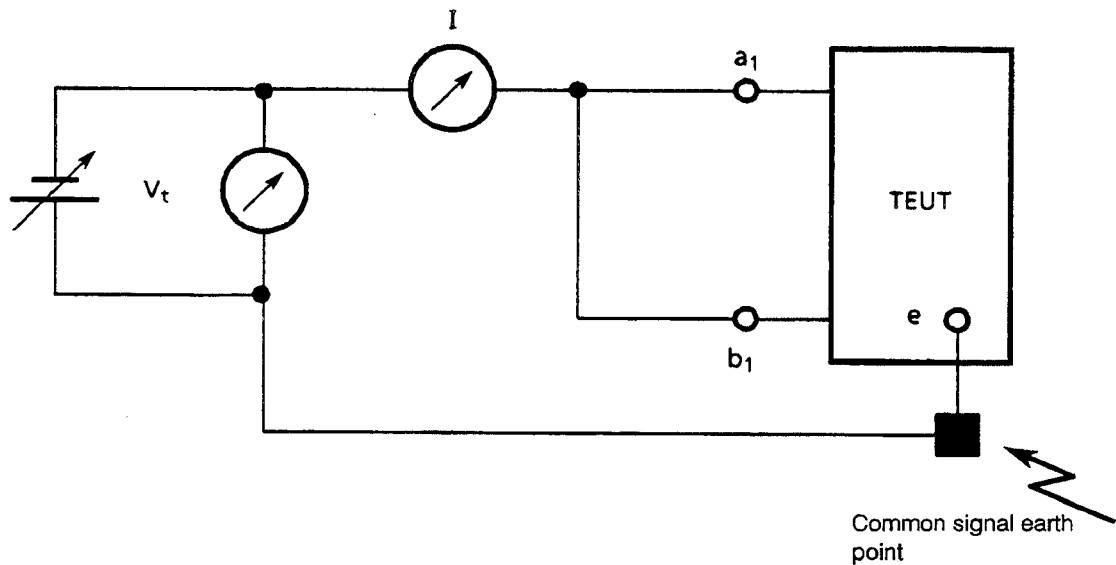


Figure A.2.2.1.2: Line terminals to signal earth

- A.2.2.1.2 (D) 1 The test is carried out not with line terminals or leads shorted together but with each line terminal or lead to signal earth.
- A.2.2.1.2 (P) 1 The dc voltage V_t shall be applied for a time of 1 minute.
- A.2.2.1.2 (E) 1 Insulation resistance between line terminals and accessible parts (and earth) in quiescent condition.

The procedure of test in section A.2.2.1.2 is followed using the circuit shown in figure A.2.2.1.2 (E) 1, where the dc test voltage V_t takes the value of 100 V.

The testing laboratory shall use a suitable earth plate related with the TEUT.

NOTE: The testing laboratory shall take into account the requirement in section 2.2.1.2 (E) 1 which refers to all accessible parts.

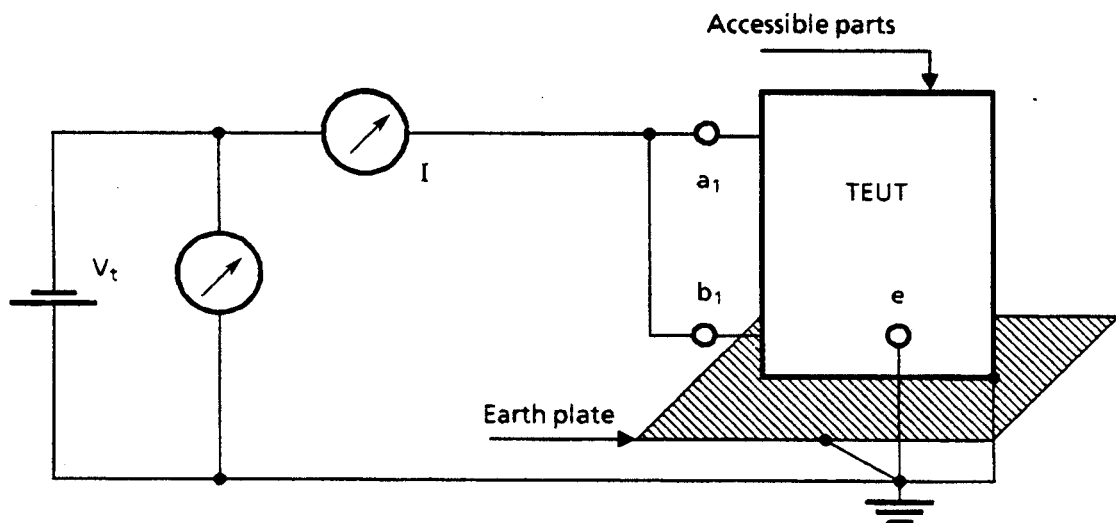


Figure A.2.2.1.2 (E) 1: Insulation resistance between line terminals and accessible parts (and earth) in quiescent condition

A.2.2.1.2 (GB) 1 The measurement of R_2 is made between each lead or terminal intended for connection to the PSTN and all earth terminals or leads shorted together.

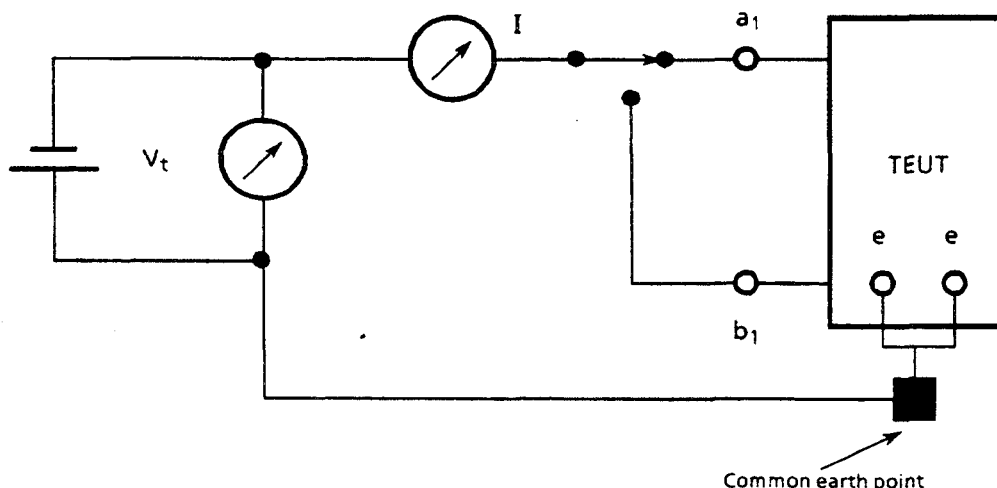


Figure A.2.2.1.2 (GB) 1: Line terminals to signal earth

2.2.1.3 Line terminals to user accessible parts

The insulation resistance between the two line terminals when shorted together and all user accessible parts of the TE, other than earth or signal earth terminals, shall not be less than the value R_3 given in table 2.2.1.

Compliance shall be checked using the tests outlined in section A.2.2.1.3.

2.2.1.3 (E) 1 Requirement 2.2.1.2 (E) 1 shall be applied.

A.2.2.1.3 Line terminals to user accessible parts

The TEUT is connected as shown in figure A.2.2.1.3. All earth terminals are electrically isolated from any part of the test circuit. For the dc voltage V_t given in table A.2.2.1.3, the corresponding value of current I is measured.

The value of the insulation resistance is then calculated using formula A.2.2.1.3:

$$R_3 = \frac{V_t}{I} \quad \text{Formula A.2.2.1.3}$$

Where R_3 is the insulation resistance value, V_t is the test voltage value given in table A.2.2.1.3 expressed in volts, and I is the value of the current expressed in amperes, resulting from the application of the given test voltage.

Tests are undertaken for both polarities of dc voltage applied between the shorted line terminals of the TEUT and the TE accessible surface.

Table A.2.2.1.3: Line terminals to user accessible parts

COUNTRY	TEST VALUES	Remarks
	V_t (V)	
Austria	not mandatory	
Belgium	500	
Cyprus	100	
Denmark	45 and 250	
Finland	100	
France	not mandatory	
Germany	not mandatory	
Greece	100	
Iceland		
Ireland	not mandatory	
Italy	100	
Luxembourg	not mandatory	
Malta		
Netherlands	not mandatory	
Norway	100	
Portugal	100	yes
Spain		yes
Sweden	250	yes
Switzerland	100	
U. Kingdom	not mandatory	

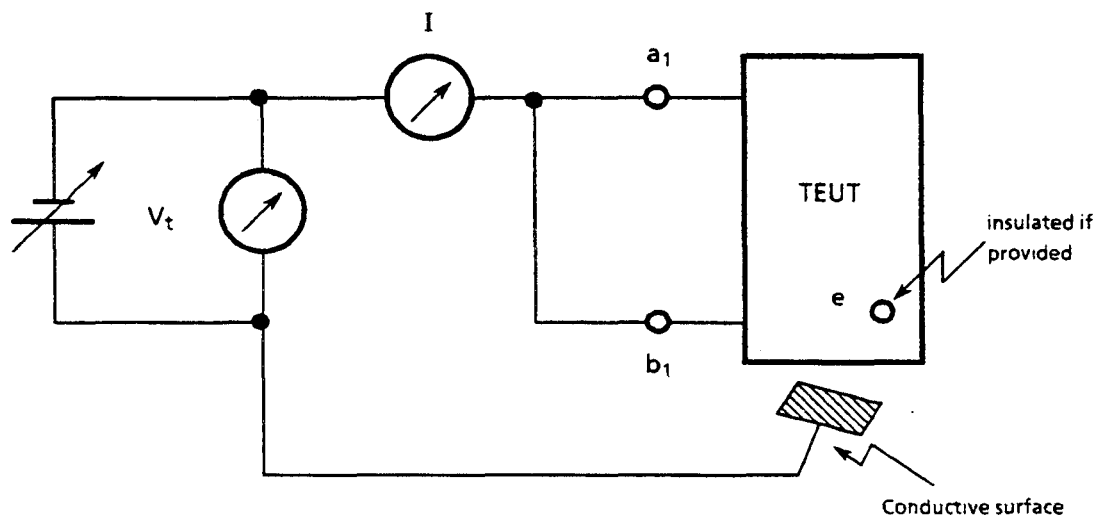


Figure A.2.2.1.3: Line terminals to user accessible parts

A.2.2.1.3 (P) 1

The dc voltage V_t shall be applied for a time of 1 minute.

A.2.2.1.3 (E) 1 See the requirement in section 2.2.1.2 (E) 1 and its compliance test method in section A.1.2.2.1 (E) 1.

A.2.2.1.3 (S) 1 These requirements shall be fulfilled when an electrically conducting casing is earthed and also when equipment with an insulation casing is placed on an earthed metal sheet.

2.2.2 TE in loop condition

The requirements of this section shall be met after the TEUT has been placed in a loop condition and after the TEUT has had each test voltage up to the declared value of V_{tmax} applied for a time sufficient to allow transient effects arising from the application of that test voltage to be absent.

Table 2.2.2: Insulation resistance for TE in loop condition

COUNTRY	REQUIREMENT VALUES			Remarks
	R_4 (M Ω)	R_5 (M Ω)	V_{tmax} (V)	
Austria	not mandatory	not mandatory	not mandatory	
Belgium	not mandatory	not mandatory	not mandatory	
Cyprus	not mandatory	not mandatory	not mandatory	
Denmark	100	100	250	
Finland	not mandatory	5	100	
France	not mandatory	not mandatory	not mandatory	
Germany	not mandatory	not mandatory	not mandatory	
Greece	100	100	100	
Iceland	10	10	100	
Ireland	10	not mandatory	100	
Italy	100	100	100	
Luxembourg	not mandatory			
Malta				
Netherlands	10	not mandatory	100	
Norway	10	10	100	
Portugal	5	5	100	
Spain			100	yes
Sweden	10	10	250	
Switzerland	10	100	100	
U. Kingdom	not mandatory	not mandatory	not mandatory	yes

R_4 Resistance between each of the line terminals and the signal earth terminals,

R_5 Resistance between each of the line terminals and all user accessible parts of the TE, other than any earth terminals.

NOTE: For R_4 (M Ω), see sections 2.2.2.1 and 2.2.2.2.

2.2.2.1 Line terminals to signal earth

For TE with signal earth terminals, the resistance between each of the line terminals and the signal earth terminals shall not be less than the value of R_4 , given in table 2.2.2.

Compliance shall be checked using the tests outlined in section A.2.2.2.1.

2.2.2.1 (E) 1 Insulation resistance between line terminals and accessible parts (and earth) in loop condition.
(Requirement to be applied instead of sections 2.2.2.1 and 2.2.2.2).

With TE in the loop condition, the insulation resistance between each one of the two line terminals, and any accessible part, connected to the earth terminal if it is provided, shall not be lower than 100 M Ω , tested at dc voltages of up to 100 V.

Compliance shall be checked using the test outlined in section A.2.2.2.1 (E) 1.

2.2.2.1 (GB) 1 This UK requirement is considered in the UK as a safety requirement and hence is outside the scope of this document.

A.2.2.2 TE in loop condition

A.2.2.2.1 Line terminals to signal earth

The TEUT is connected as shown in figure A.2.2.2.1. A feeding voltage of V_f is applied via a series resistor of a value R_f . The values are given in table A.2.2.2.1. For the dc voltage V_t given in table A.2.2.2.1, the corresponding value I is measured.

The value of the insulation resistance is then calculated using formula A.2.2.2.1:

$$R_4 = \frac{V_t}{I} \qquad \text{Formula A.2.2.2.1}$$

Where R_4 is the insulation resistance value, V_t is the test voltage given in table A.2.2.2.1, expressed in volts, and I is the value of the current, expressed in amperes, resulting from the application of the given test voltage.

Tests are undertaken for both polarities of dc insulation resistance test voltage of value V_t .

Table A.2.2.2.1: Insulation resistance for TE in loop condition, line terminals to signal earth

COUNTRY	TEST VALUES			Remarks
	V_t (V)	V_f (V)	R_f (Ω)	
Austria	not mandatory	not mandatory	not mandatory	
Belgium	not mandatory	not mandatory	not mandatory	
Cyprus	not mandatory	not mandatory	not mandatory	
Denmark	45 and 250	48	1 000	
Finland	not mandatory			
France	not mandatory	not mandatory	not mandatory	
Germany	not mandatory	not mandatory	not mandatory	
Greece	100	60	600	
Iceland	100	48	800	
Ireland	100	48	5 000	
Italy	100	48	800	
Luxembourg	100			
Malta				
Netherlands	100	48	800	
Norway	100	60	1 200	
Portugal	100	48	400	yes
Spain	100	48	1 100	yes
Sweden	250	38	1 000	
Switzerland	100	48	1 200	yes
U. Kingdom	not mandatory	not mandatory	not mandatory	

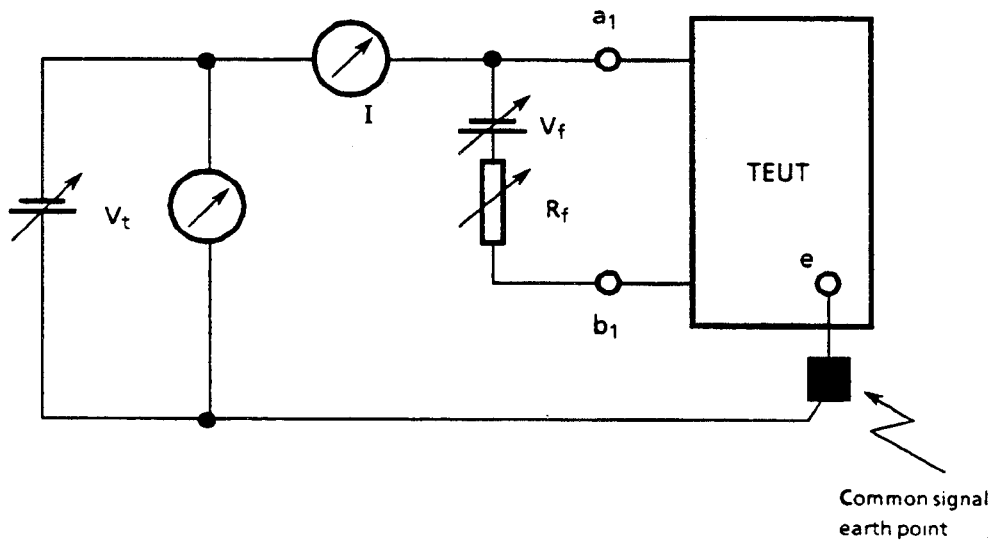


Figure A.2.2.2.1: Insulation resistance for TE in loop condition, line terminals to signal earth

A.2.2.2.1 (P) 1

For series-connected TE, through which the loop state to another TE is maintained, the TEUT is connected as shown in figure A.2.2.2.1 (P) 1.

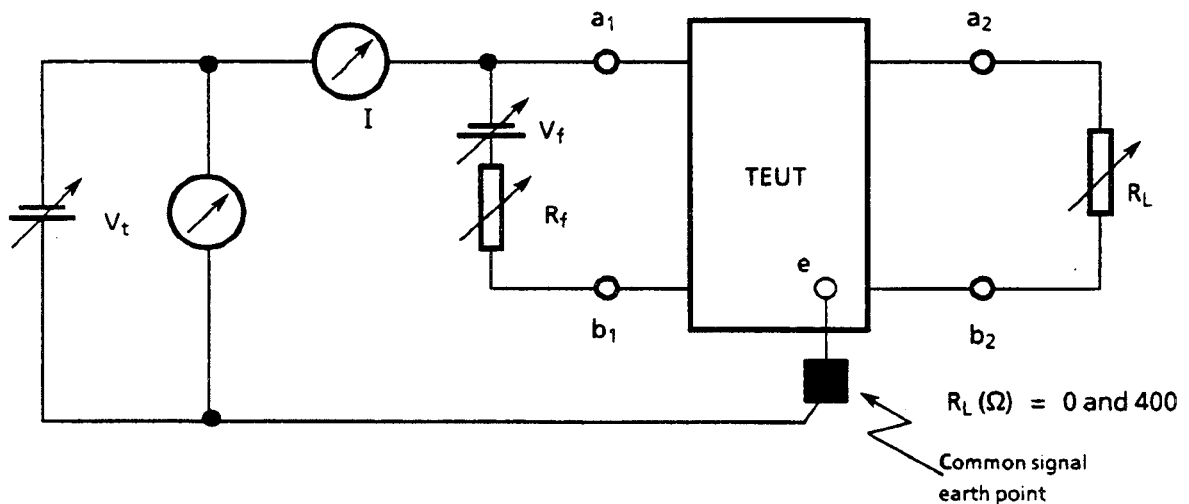


Figure A.2.2.2.1 (P) 1: Insulation resistance for TE in loop condition, line terminals to signal earth - Series-connected TE

A.2.2.2.1 (P) 2 The dc voltage V_t shall be applied for a time of 1 minute.

A.2.2.2.1 (E) 1 Insulation resistance between line terminals and accessible parts (and earth) in loop condition.

The procedure of test in section A.2.2.2.1 is followed using the circuit shown in figure A.2.2.2.1 (E) 1, where the dc test voltage V_t takes the value of 100 V, the dc feeding voltage V_f takes the value of 48 V and the feeding resistor R_f takes the value of 1 100 Ω .

The testing laboratory shall use a suitable earth plate related with the TEUT.

NOTE: The testing laboratory shall take into account that requirement in section 2.2.2.1 (E) 1 which refers to all accessible parts.

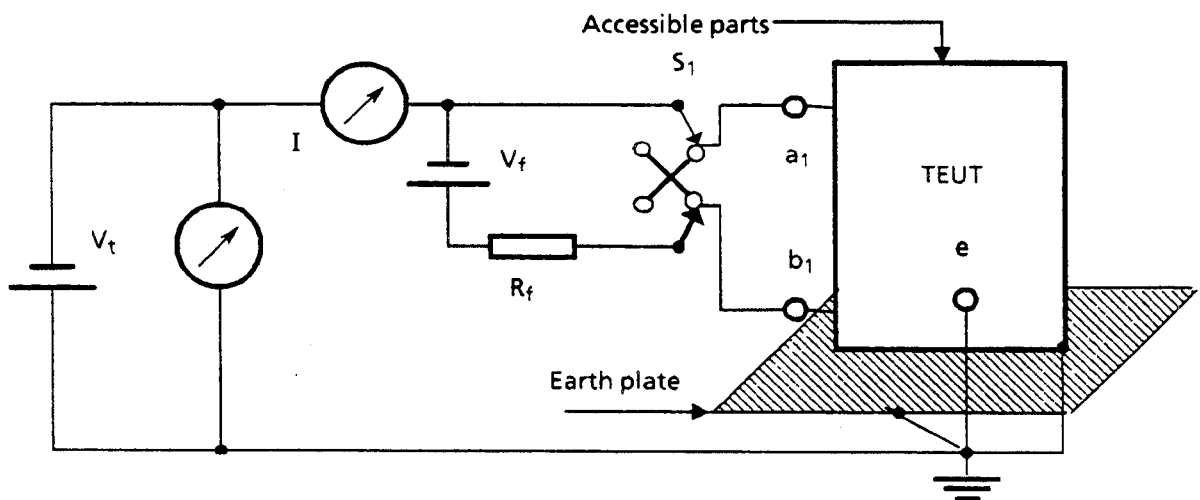


Figure A.2.2.2.1 (E) 1: Insulation resistance between line terminals and accessible parts (and earth) in loop condition

A.2.2.2.1 (CH) 1 For those TE in which the a-b-loop resistance is established metallicly or by passive components, the determination of insulation resistance between a/b and e (or user accessible parts) may be made with the values $V_t = 0$ V and $R_f = 0 \Omega$.

2.2.2.2 Line terminals to user accessible parts

The insulation resistance between each of the line terminals and all user accessible parts of the TE other than any earth terminals shall not be less than the value of R_5 , given in table 2.2.2.

Compliance shall be checked using the tests outlined in section A.2.2.2.2.

2.2.2.2 (E) 1 The requirement in section 2.2.2.1 (E) 1 shall be applied.

2.2.2.2 (GB) 1 For section 2.2.2.2 this requirement is a safety requirement so it is outside the scope of this document.

A.2.2.2.2 Line terminals to user accessible parts

The TEUT is connected as shown in figure A.2.2.2.2. A feeding voltage of value V_f is applied via a series resistor of a value R_f . These values are given in table A.2.2.2.2. All earth terminals are electrically insulated from the feeding and testing circuits. For the dc voltage V_t , given in table A.2.2.2.2, the corresponding value of current I is measured.

The value of the insulation resistance is then calculated using formula A.2.2.2.2:

$$R_5 = \frac{V_t}{I} \qquad \text{Formula A.2.2.2.2}$$

where R_5 is an insulation resistance value, V_t is the test voltage value given in table A.2.2.2.2, expressed in volts, and I is the value of the current, expressed in amperes, resulting from the application of the given test voltage.

Tests are undertaken for both polarities of dc insulation resistance test voltage.

Table A.2.2.2.2: Insulation resistance for TE in loop condition, line terminals to user accessible parts

COUNTRY	TEST VALUES			Remarks
	V_t (V)	V_f (V)	R_f (Ω)	
Austria	not mandatory	not mandatory	not mandatory	
Belgium	not mandatory	not mandatory	not mandatory	
Cyprus	not mandatory	not mandatory	not mandatory	
Denmark	45 and 250	48	1 000	
Finland	100	48	800	
France	not mandatory			
Germany	not mandatory			
Greece	100	60	600	
Iceland	100	48	800	
Ireland	not mandatory			
Italy	100	48	800	
Luxembourg	100			
Malta				
Netherlands	not mandatory			
Norway	100	60	1 200	
Portugal	100	48	400	yes
Spain				yes
Sweden	250	38	1 000	
Switzerland	100	48	1 200	yes
U. Kingdom	not mandatory	not mandatory	not mandatory	

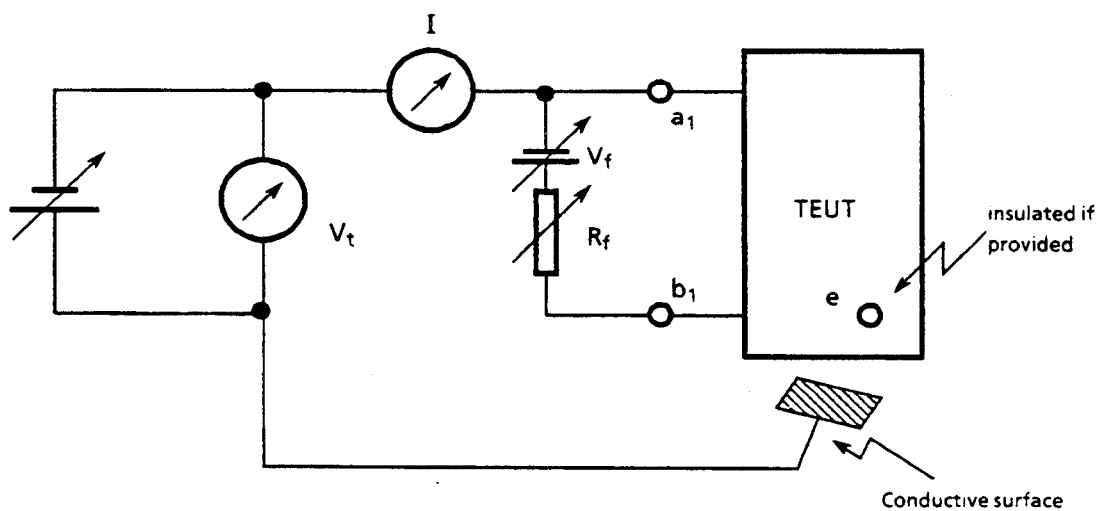


Figure A.2.2.2.2: Insulation resistance for TE in loop condition, line terminals to user accessible parts

A.2.2.2.2 (P) 1 For series-connected TE, through which the loop state to another TE is maintained, the TEUT is connected as shown in figure A.2.2.2.2 (P) 1.

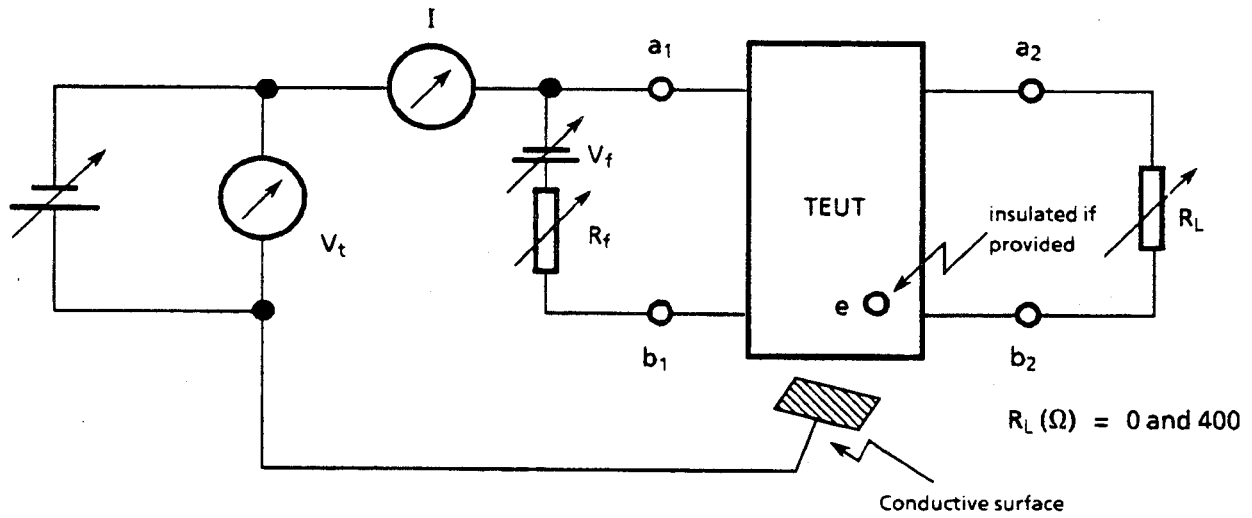


Figure A.2.2.2.2 (P) 1: Insulation resistance for TE in loop condition, line terminals to user accessible parts - Series-connected TE

- A.2.2.2.2 (P) 2 The dc voltage V_t shall be applied for a time of 1 minute.
- A.2.2.2.2 (E) 1 See the requirement in section 2.2.2.1 (E) 1 and its compliance test method in section A.2.2.2.1 (E) 1.
- A.2.2.2.2 (CH) 1 For those TE in which the a-b-loop resistance is established metallicly or by passive components, the determination of insulation resistance between a/b and e (or user accessible parts) may be made with the values $V_f = 0 \text{ V}$ and $R_t = 0 \Omega$.

2.3 DC current and loop resistance

The TE, when placed in the loop condition, shall comply with the requirements specified by the relevant Administration. The detailed requirements for each country, including dc masks where applicable, are specified in the sections referred to in table 2.3.

Compliance shall be checked using the tests outlined in section A.2.3. A summary of the loop resistance and current is given in table 2.3.

Table 2.3: DC current and loop resistance

COUNTRY	Loop resistance (Ω)	Loop current (mA)	Section
Austria	100 - 500	19 .. 60	2.3 (A) 1
Belgium	█	█	2.3 (B) 1
Cyprus	400	20 .. 100	2.3 (CY) 1
Denmark			2.3 (DK) 1
Finland	≤ 400	20 .. 50	
France			2.3 (F) 1
Germany	≤ 480	20 .. 60	2.3 (D) 1
Greece	≤ 400	20 .. 80	2.3 (GR) 1
Iceland	≤ 400	14 .. 70	
Ireland		20 .. 100	2.3 (IRL) 1
Italy			2.3 (I) 1
Luxembourg	≤ 400	14 .. 60	
Malta			
Netherlands	≤ 560	15,5.. 82,5	2.3 (NL) 1 and 2.3 (NL)
Norway			2.3 (N) 1
Portugal			2.3 (P) 1
Spain	≤ 400	18,5.. 100	2.3 (E) 1 and 2.3 (E) 2
Sweden			2.3 (S) 1
Switzerland			2.3 (CH) 1
U. Kingdom		0 .. 125	2.3 (GB) 1

- 2.3 (A) 1** Additionally, the loop resistance must be ≤ 4 kohms at a dc-voltage of 5 V applied on the line terminals a_1 , b_1 .
- 2.3 (B) 1** The loop current shall be higher than 25 mA when connected to a feeding source of 48 V dc with a series resistance R_f from 400 ohms up to 1 600 ohms.
- 2.3 (CY) 1** Loop mark $U = f(I)$

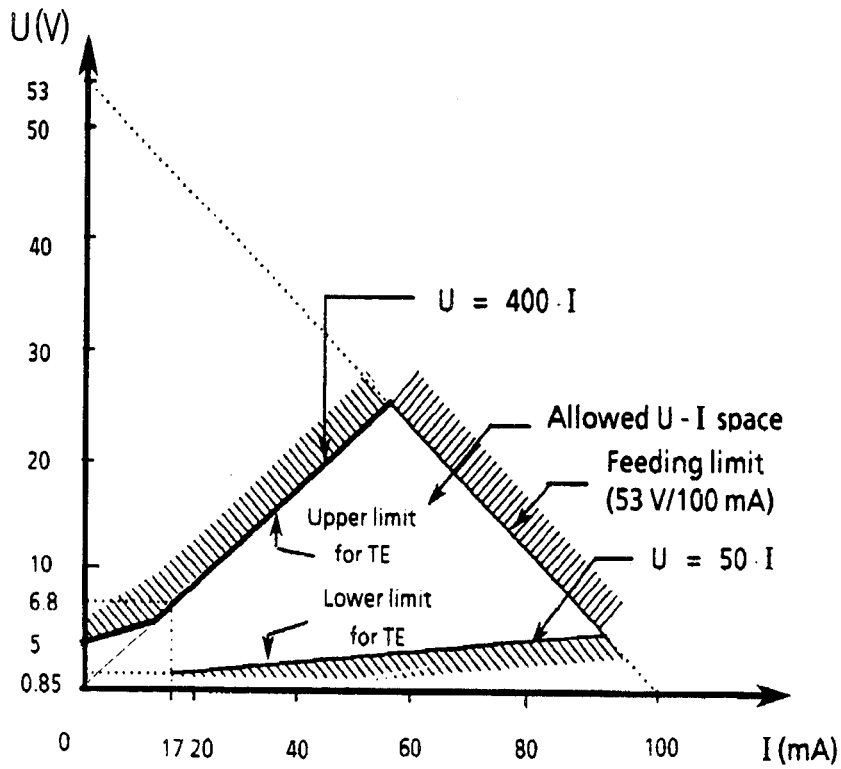


Figure 2.3 (CY) 1

In loop condition, requirements are set for the dc characteristic of the TEUT according to the limits shown in figure 2.3 (CY) 1.

2.3 (DK) 1

In loop condition there shall be a dc loop between the line terminals of the equipment with a current-voltage characteristic increasing from 0 to 112 mA within the limits shown in the following figure:

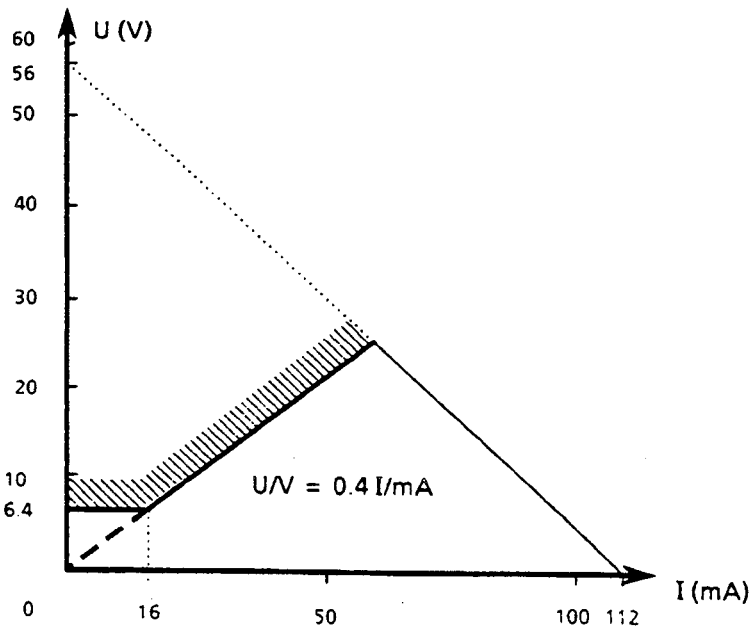


Figure 2.3 (DK) 1: dc current and loop resistance

2.3 (DK) 2

For a telephone set in loop condition there shall be a dc loop between the line terminals with a current-voltage characteristic increasing from 0 to 112 mA within the limits shown in the following figure:

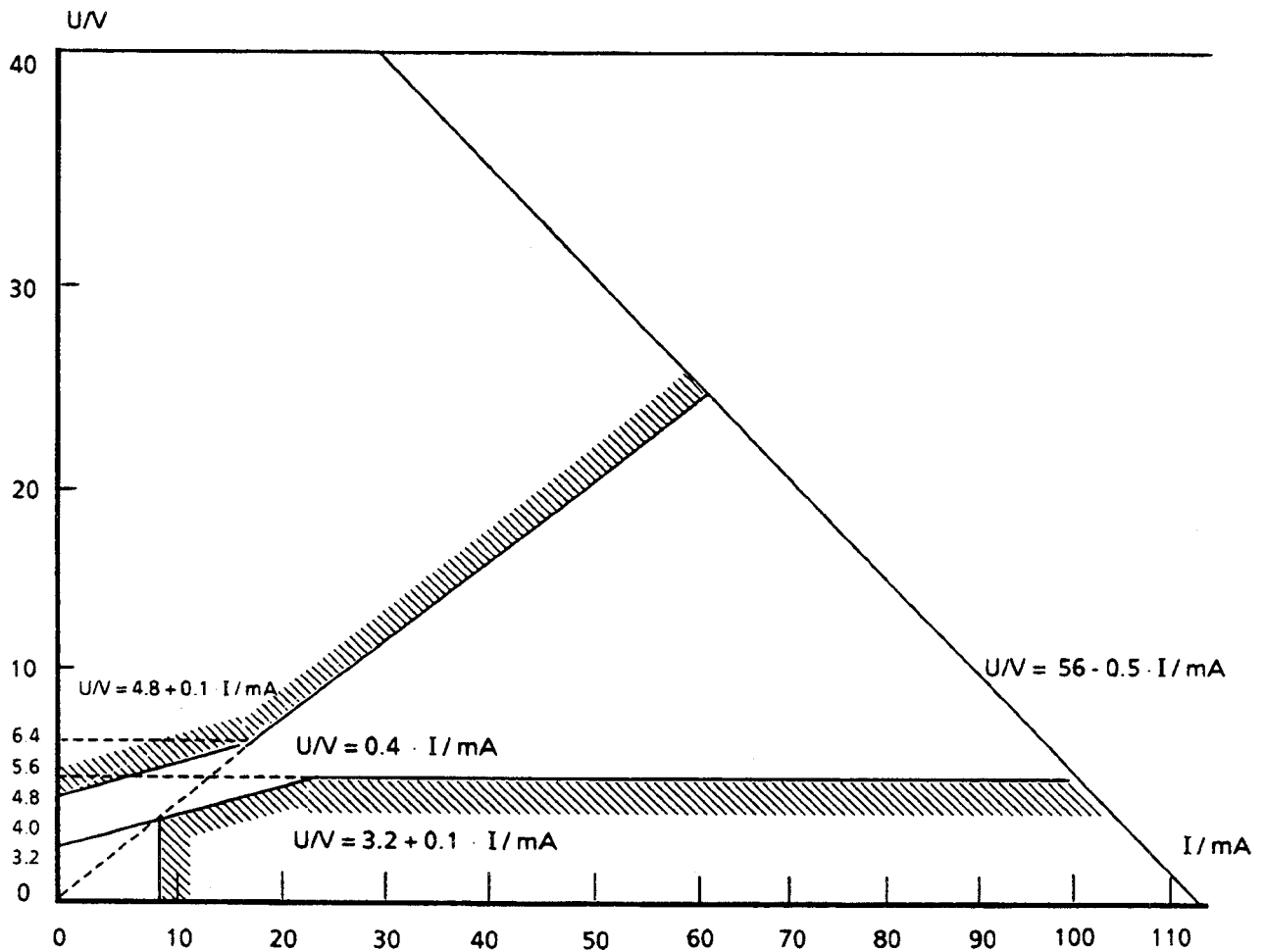


Figure 2.3 (DK) 2: Limits for the current-voltage characteristic of the dc loop in a telephone set

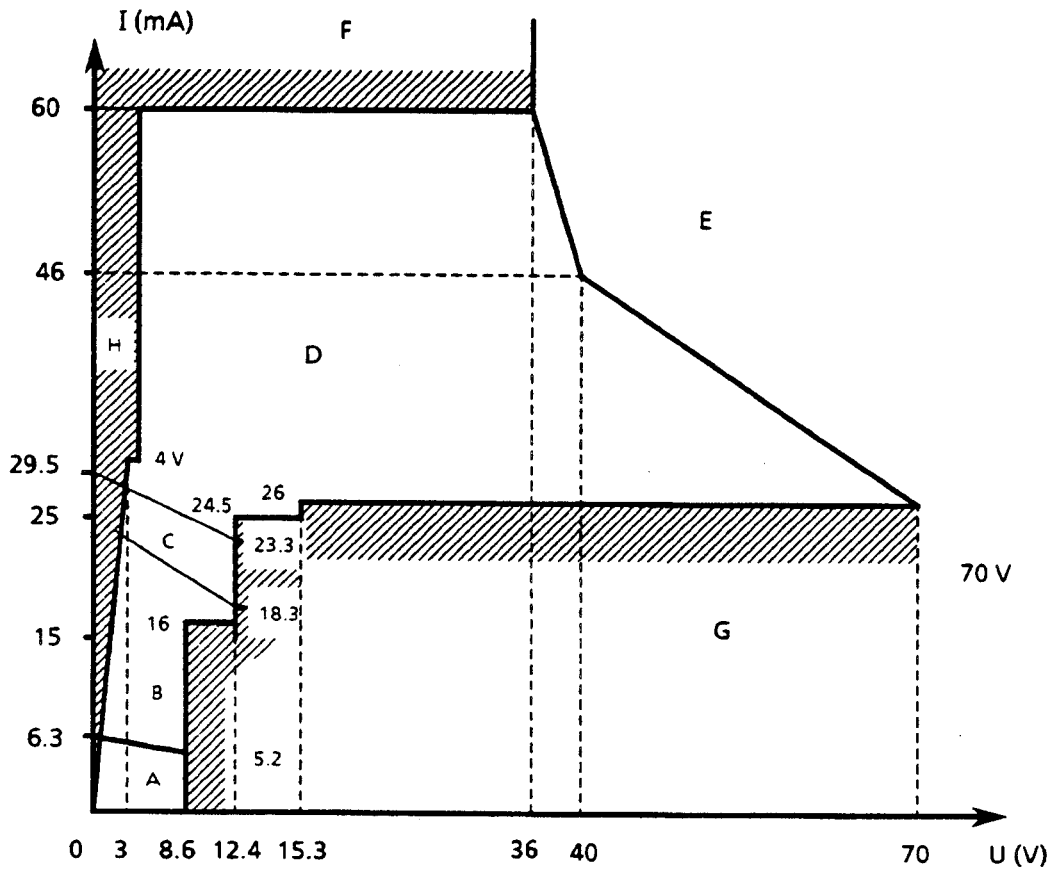
2.3 (F) 1

Loop mask $I = f(U)$

Outside the periods of transmission of decimal dialling pulses, and under the polarisation conditions specified below, the loop current measured by means of the set-up shown in figure A.2.3 shall satisfy the loop mask $I = f(U)$ shown in figure 2.3 (F) 1.a or 2.3 (F) 1.b.

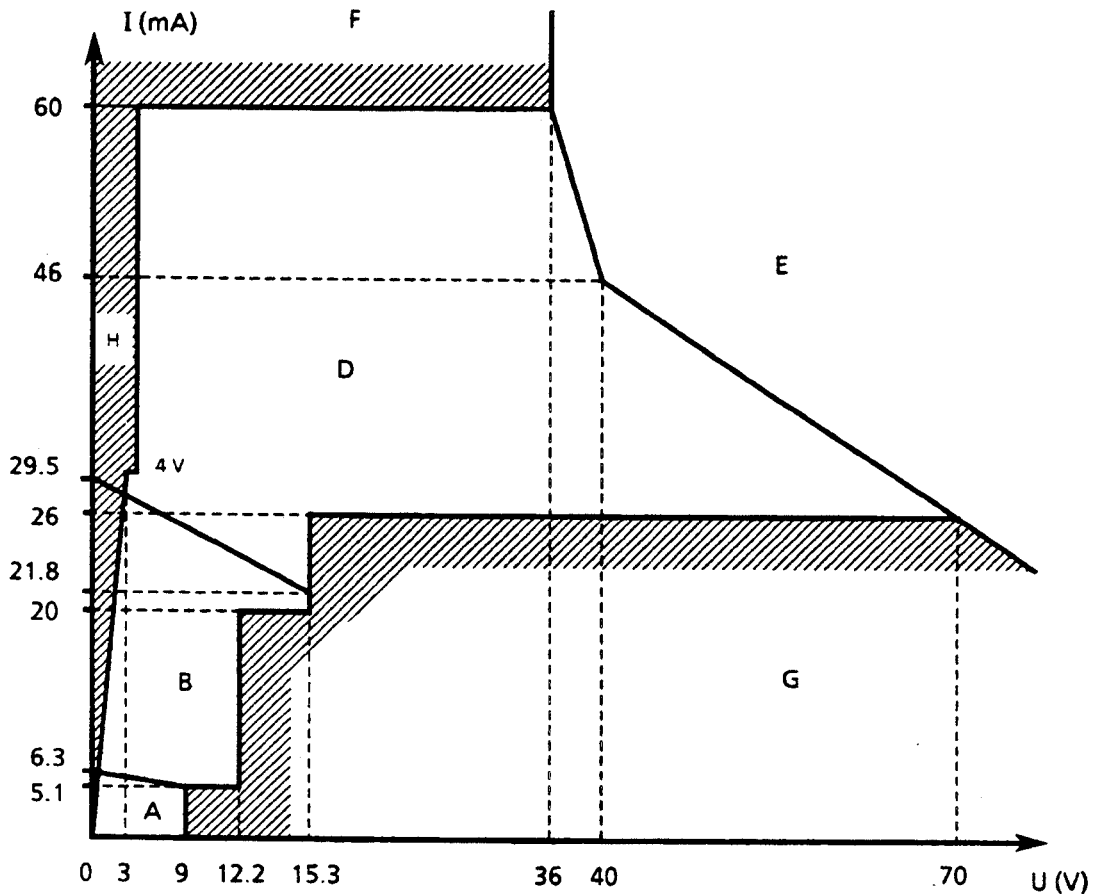
The loop mask of figure 2.3 (F) 1.a is to apply to the general type of TE.

The loop mask of figure 2.3 (F) 1.b is to apply to TEs which can be used only in conversation state. However, in this last case, a TE with equivalent loop resistance between 530 and 610 ohms is allowed.



I, U: see figure 2.3 (F) 2.
 The hatched areas (F,G,H) are forbidden in stable state.
 The dc characteristics must be stable in the areas B, C and D.

Figure 2.3 (F) 1.a: Loop mask $I = f(U)$ (general case)



The hatched areas (F,G,H) are forbidden in stable state.
The dc characteristics must be stable in the areas B and D.

Figure 2.3 (F) 1.b: Loop mask $I = f (U)$ (conversion state)

2.3 (D) 1

Loop resistance R:

- 1) $V_f = 60 \text{ V}$, $R_f \leq 2\,530$ $R \leq 480$, with a voltage drop at the TE of $\geq 6 \text{ V}$;
- 2) $V_f = 60 \text{ V}$, $R_f \leq 28\,700$ $R \leq 2\,250$;
- 3) $V_f = 60 \text{ V}$, $R_f \leq 219 \text{ k}$ $R \leq 22\,000$.

2.3 (GR) 1

$V_f = 44$ up to 66 V inclusive

$R_f =$ adjustable

$I_t =$ takes values from 20 up to 80 mA inclusive

The loop resistance is calculated using formula 2.3 (GR) 1:

$$R = \frac{V_t}{I_t} \quad \text{Formula 2.3 (GR) 1}$$

2.3 (IRL) 1

DC loop resistance

In the holding loop stage there shall be a dc loop between the line terminals with a maximum equivalent dc loop resistance within the envelope of the attached graph (test part), at line currents from 20 to 100 mA .

2.3 (I) 1

Loop resistance

The steady-state voltage at the device leads or terminals shall be greater than or equal to zero and less than the maximum values indicated in figure 2.3 (I) 1 when the apparatus under test is placed in the "loop" condition and is not in signalling state. The TE must work perfectly from 18 mA to 80 mA.

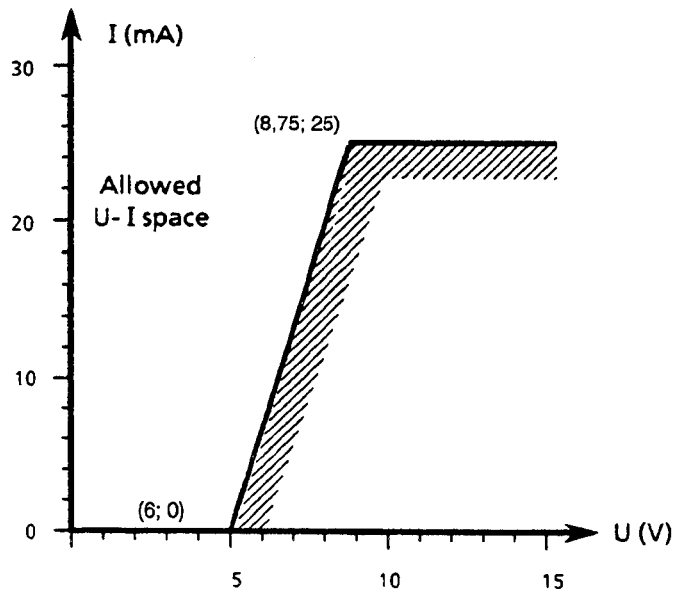


Figure 2.3 (I) 1: DC conditions : allowed U - I space

2.3 (NL) 1

DC mask

In the loop closure state the dc-properties of the terminal shall comply with the dc mask in figure 2.3 (NL) 1.

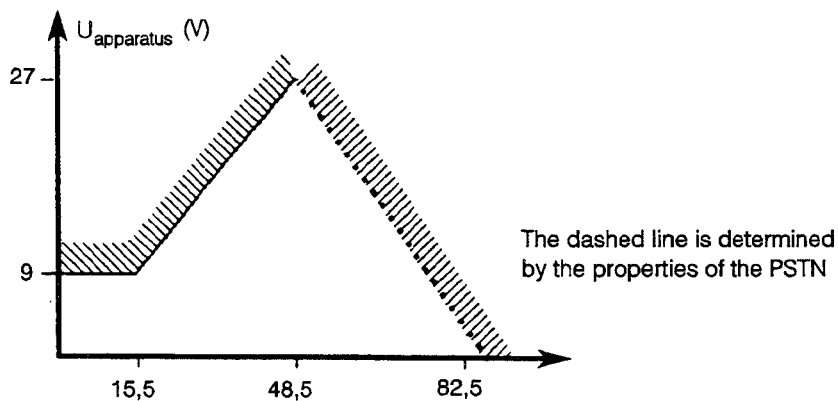


Figure 2.3 (NL) 1: DC current and loop resistance

2.3 (NL) 2

In the case of a TE with the possibility of dialling with loop pulsing the dc-properties of that terminal shall comply with the dc-mask of figure 2.3 (NL) 2 during at least 300 ms after the change from the quiescent to the loop condition. After this point in time the TE shall comply with the DC-mask of figure 2.3 (NL) 1.

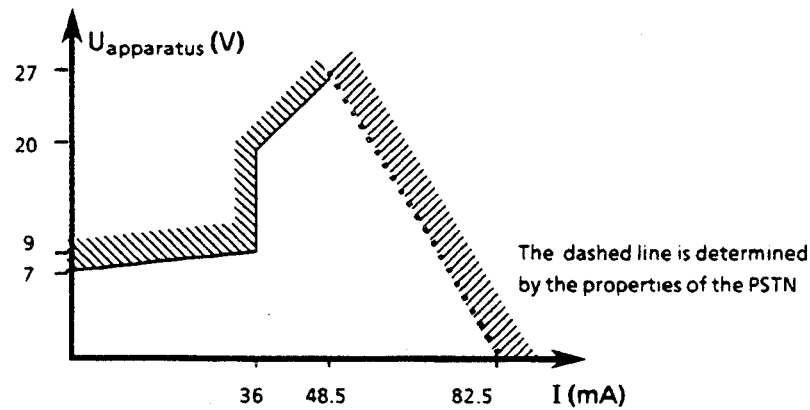


Figure 2.3 (NL) 2: DC current and loop resistance

2.3 (NL) 3

The TE shall comply with the DC-masks of figure 2.3 (NL) 1 or figure 2.3 (NL) 2 from 10 ms after the change from the quiescent to the loop condition. As point in time of change from the quiescent to the loop condition is to be used the point in time that $U_{\text{apparatus}}$ drops below 27 V.

2.3 (N) 1

In loop condition, requirements are set for the dc characteristics of the TEUT according to the limits shown in figure 2.3 (N) 1.

The coefficient $\Delta U/\Delta I$ shall always be greater than zero.

Comprehensive user installation is defined as TE which normally do not have additional equipment connected in series (e.g. PABX and multifunction TE as telephone sets with automatic answering and/or recording function).

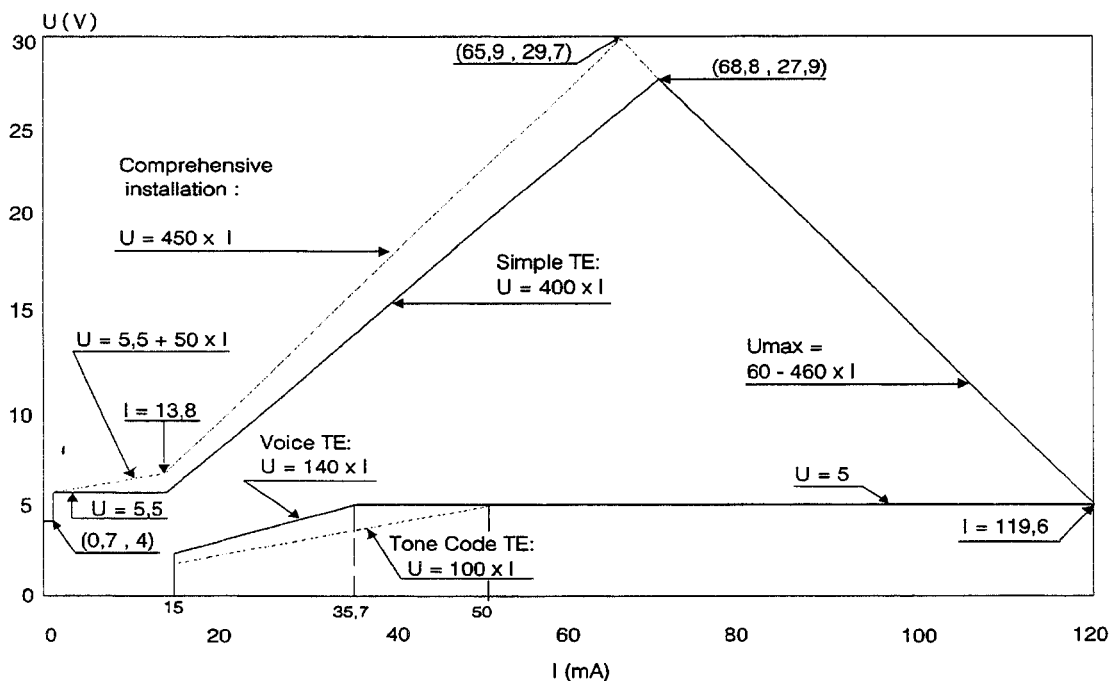


Figure 2.3 (N) 1

2.3 (N) 2

TEs with a call barring function based on polarity test (performed by dc polarity reversal from the public exchange) shall have a dc resistance of at least 3 M Ω for the reverse polarity. Maximum test voltage is 60 V.

2.3 (P) 1

For TE capable of holding the loop state by itself, the loop current shall comply with the limits specified in figure 2.3 (P) 1 when dc voltages from 45 V to 55 V are applied to its line terminals through resistances from 300 Ω to 5 500 Ω .

However, it is permitted for the TE not to comply with the limits specified in figure 2.3 (P) 1 for resistances from 4 500 Ω to 5 500 Ω if the TE returns to the quiescent condition within a maximum period of 100 ms after the application of feeding voltages from 45 V to 55 V to its line terminals.

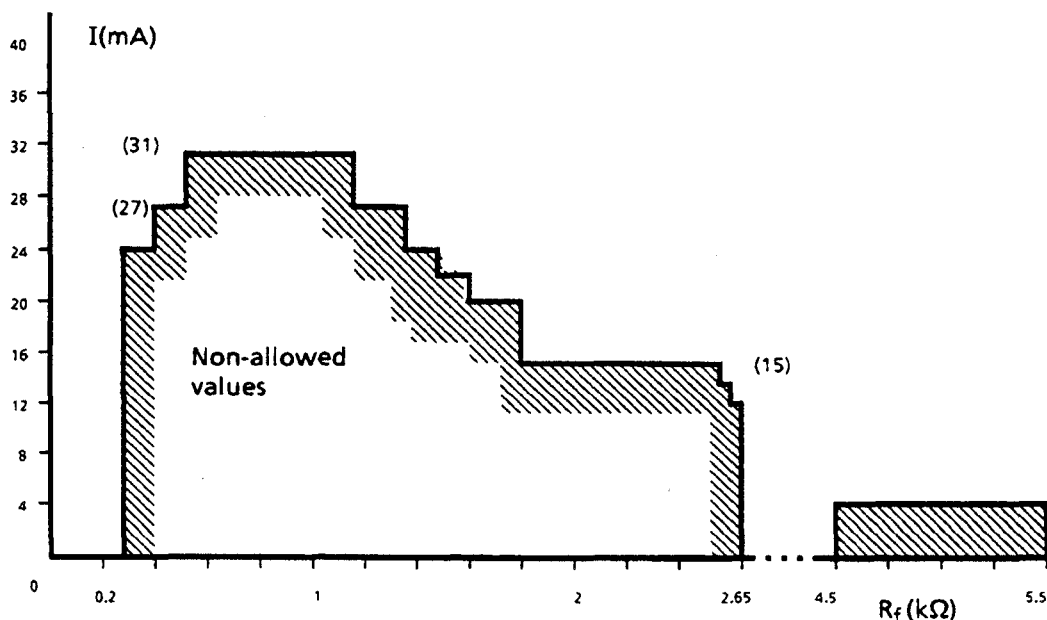


Figure 2.3 (P) 1: DC current and loop resistance

2.3 (E) 1

Resistance in loop condition

With TE in the loop condition, the equivalent between the two line terminals shall not be greater than 400 Ω tested at dc loop currents between 18,5 mA and 100 mA.

Compliance shall be checked using the tests outlined in section A.2.3 (E) 1.

2.3 (E) 2

Resistance in high impedance condition

With TE in the high impedance condition, the equivalent loop resistance between the two line terminals shall not be lower than 50 k Ω tested at dc voltages of up to 66 V.

Compliance shall be checked using the tests outlined in section A.2.3 (E) 2.

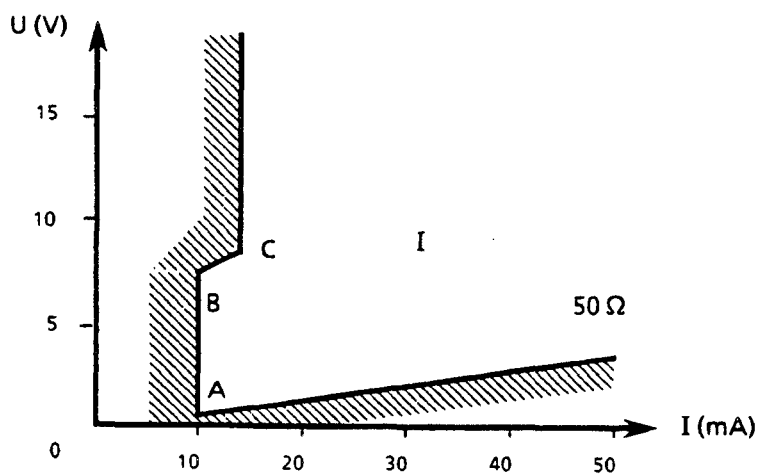
2.3 (S) 1

Terminating equipment

Equipment which terminates a line on which a call is established shall have a voltage/current characteristic (equivalent resistance) that falls within area I in figure 2.3 (S) 1. However, it is desirable that the characteristic (equivalent resistance) takes values between 150 and 500 Ω since this will provide more reliable functioning in the PSTN under certain marginal conditions and for certain combinations of equipment.

Connected equipment shall function and for dc currents between two limits comply with all requirements of this specification:

- a lower limit, 10 mA, or the higher value determined by a current feed case with a battery voltage of 36 V in series with 3 000 ohms and the terminating equipment; and
- an upper limit, determined by a current feed case with a battery voltage of 60 V in series with 1 200 ohms and the terminating equipment.

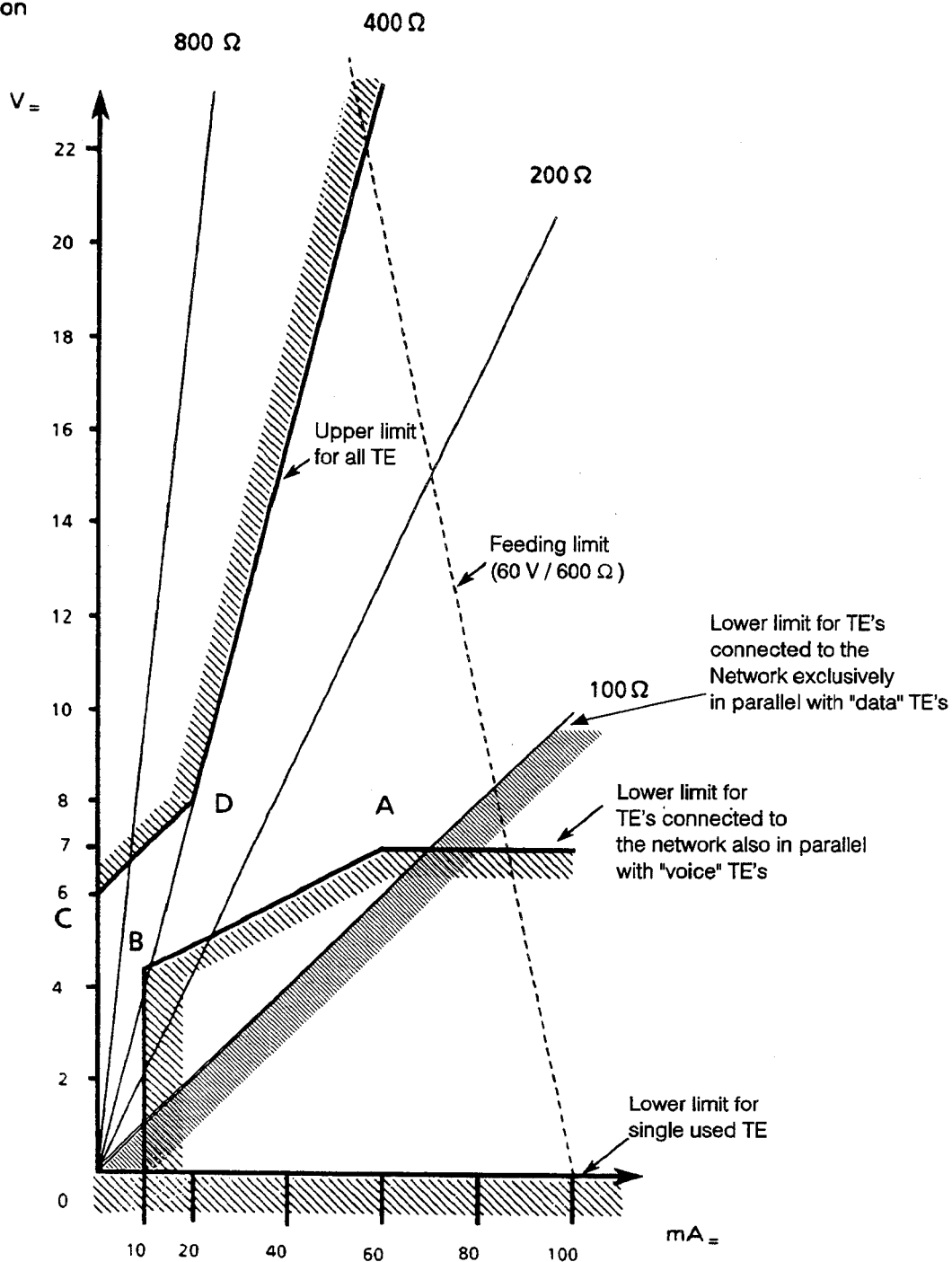


Point	I (mA)	U (V)
A	10	0,5
B	10	7,5
C	14	8,4

Figure 2.3 (S) 1: DC current and loop resistance

2.3 (CH) 1

U/I mask for loop condition



Point	I (mA)	U (V)
A	60	7
B	10	4,5
C	0	6
D	20	8

Figure 2.3 (CH) 1: DC current and loop resistance

2.3 (GB) 1

Loop resistance (dc mask)

When the two terminals or leads intended for connection to the PSTN are connected to a voltage source of 50 V dc in series with a 400 ohm resistor and a variable resistor, the steady-state voltage measured at the terminals of the TEUT for values of current in the range 0 - 125 mA shall be less than the upper limit A shown in figure 2.3 (GB) 1, and not less than zero.

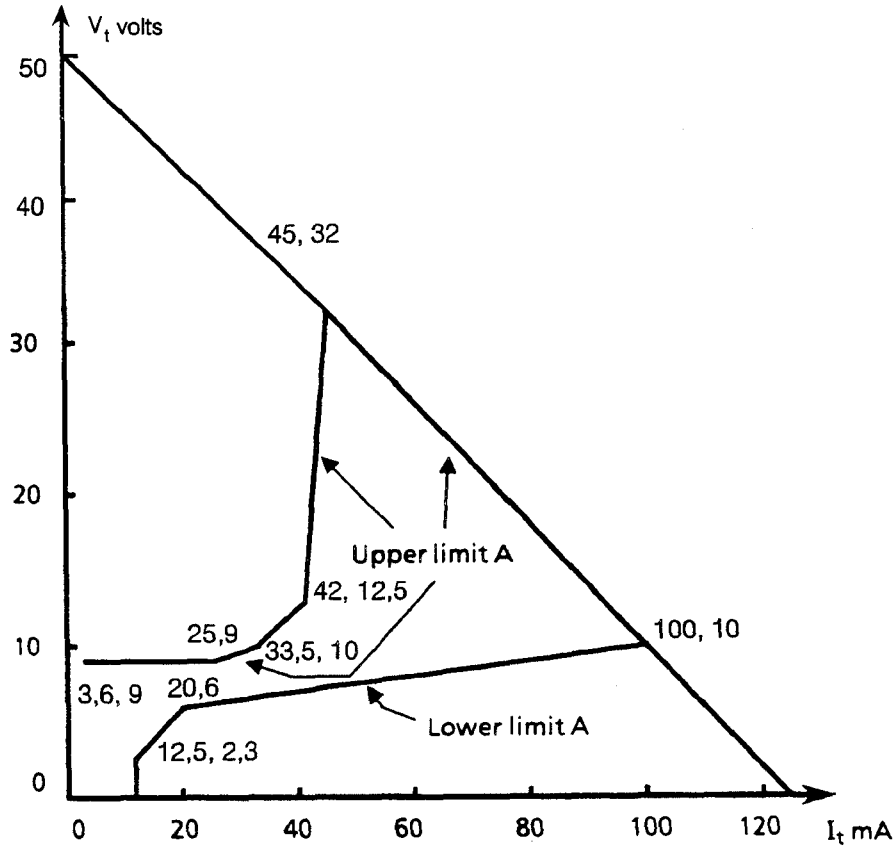


Figure 2.3 (GB) 1: Loop resistance (dc mask)

In addition, for telephones, the steady state voltage measured at the terminals of the TEUT when plotted against the corresponding values of current shown shall not be less than the lower limit A shown in figure 2.3 (GB) 1.

A.2.3 DC current and loop resistance

The TEUT is connected as shown in figure A.2.3.

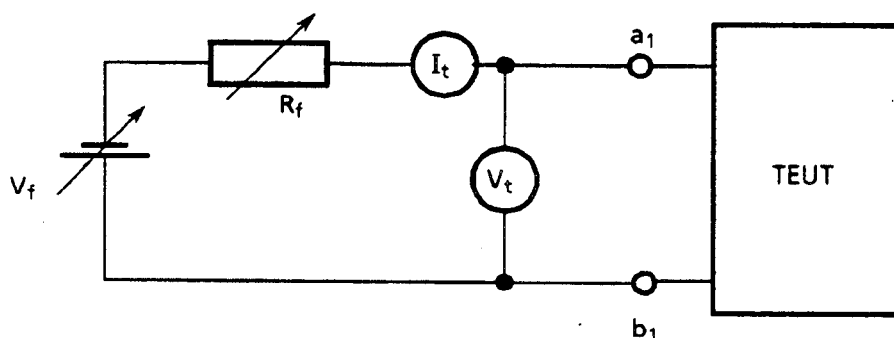


Figure A.2.3: DC current and loop resistance

A feeding voltage, V_f , is applied via series resistors R_f . The values are given in table A.2.3. Tests are undertaken for both polarities of dc applied to the line terminals of the TE.

Table A.2.3: DC current and loop resistance

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_f (Ω)	V_t (V)	I_t (mA)	
Austria	60			19 - 60	
Belgium	48	400, 800 1 200, 1 600			
Cyprus	48	800	measured values	100 max.	
Denmark					yes
Finland	48	800, 1 710			
France	45 - 54	300 - 8 225			yes
Germany	60				yes
Greece	44 - 66	20 - 80			yes
Iceland	43 - 56	800 min.		14 - 60	
Ireland					yes
Italy	48	800 - 5 000			yes
Luxembourg	60			14 - 60	
Malta					
Netherlands	42 - 66	800 - 2 140		dc-charact.	yes
Norway	60	adjustable	measured values	0,6, 13,5, 16, 20, 40, 60, 80, I_{max} .	
Portugal	45 - 55	300 - 5 500	not applicable		yes
Spain	43 - 56	300 - 2 300	measured values	18,5 - 100	yes
Sweden	33 - 60	variable	measured values	10 - 50	
Switzerland	0 - 57	600	measured values	measured values	yes
U. Kingdom	50	400 min.	32 max.	125 max.	yes

A.2.3 (DK) 1

The loop resistance is measured at $I = 8, 16, 24$ and 50 mA as well as I_{max} , with both polarities of the dc voltage at these currents.

The test principle is shown in figure A.2.3 (DK) 1.

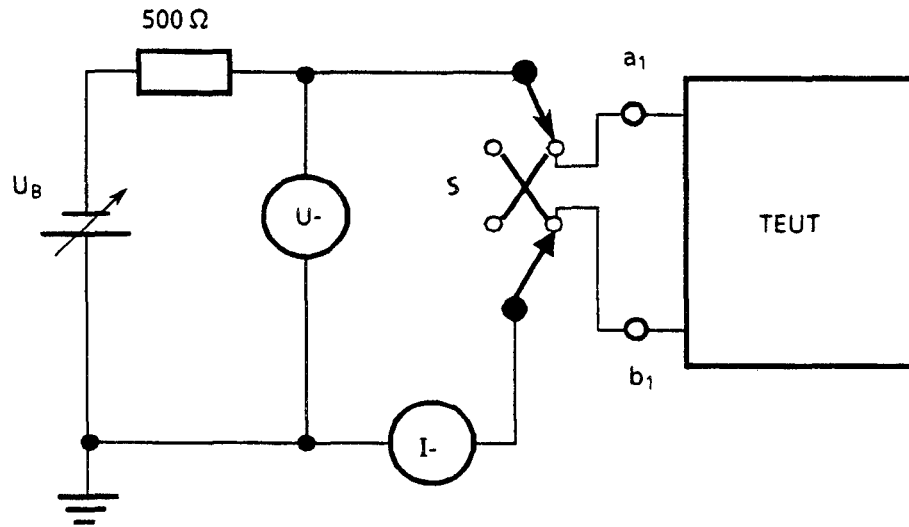


Figure A.2.3 (DK) 1

A.2.3 (F) 1

In the case of overfeeding:

$$V_f \text{ (V)} = 82 - 104 \text{ and } R_f \text{ (\Omega)} = 1\,400 - 5\,225$$

A.2.3 (D) 1

Feeding resistance R_f :

- 1) 2 530 Ω
- 2) 28 700 Ω
- 3) 219 k Ω

A.2.3 (GR) 1

The measuring set up is given in figure A.2.3 (GR) 1.

$V_f = 44$ up to 66 V in steps of 4 V, starting from 44 V.

I_t = takes values from 20 up to 80 mA, in steps of 10 mA, starting from 20 mA.

The loop resistance is calculated using formula A.2.3 (GR) 1:

$$R = \frac{V_t}{I_t}$$

Formula A.2.3 (GR) 1

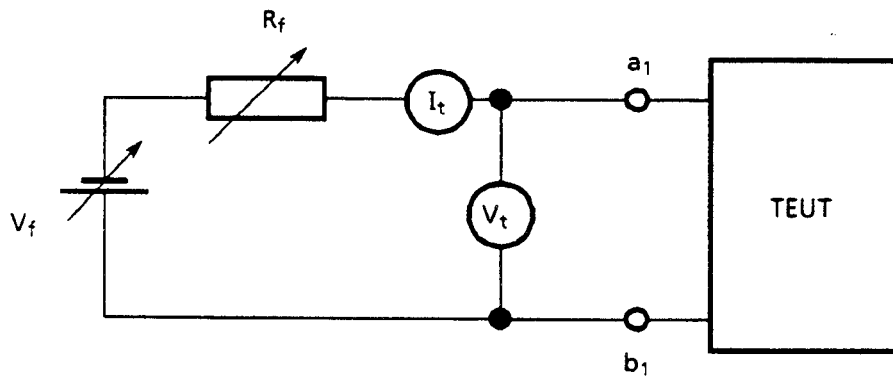


Figure A.2.3 (GR) 1

A.2.3 (IRL) 1

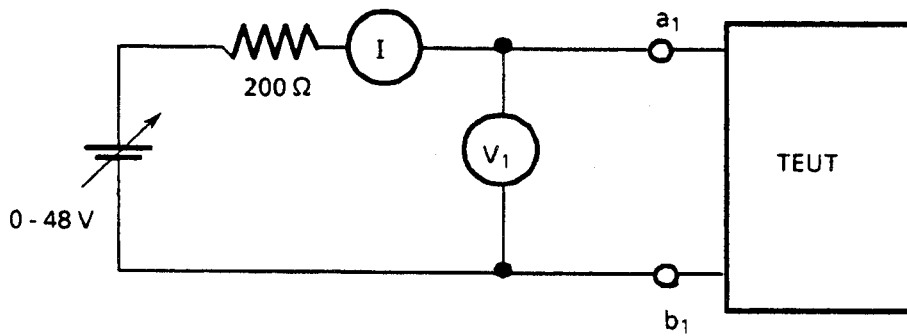


Figure A.2.3 (IRL) 1

- 1) Adjust V_f to give currents of $I = 20 - 100 \text{ mA}$ (or I_{max}) in steps of 10 mA, noting V_1 at each step.
- 2) Reverse a,b connections and repeat for 20 mA, 50 mA, 100 mA.
- 3) Compare result with mask.

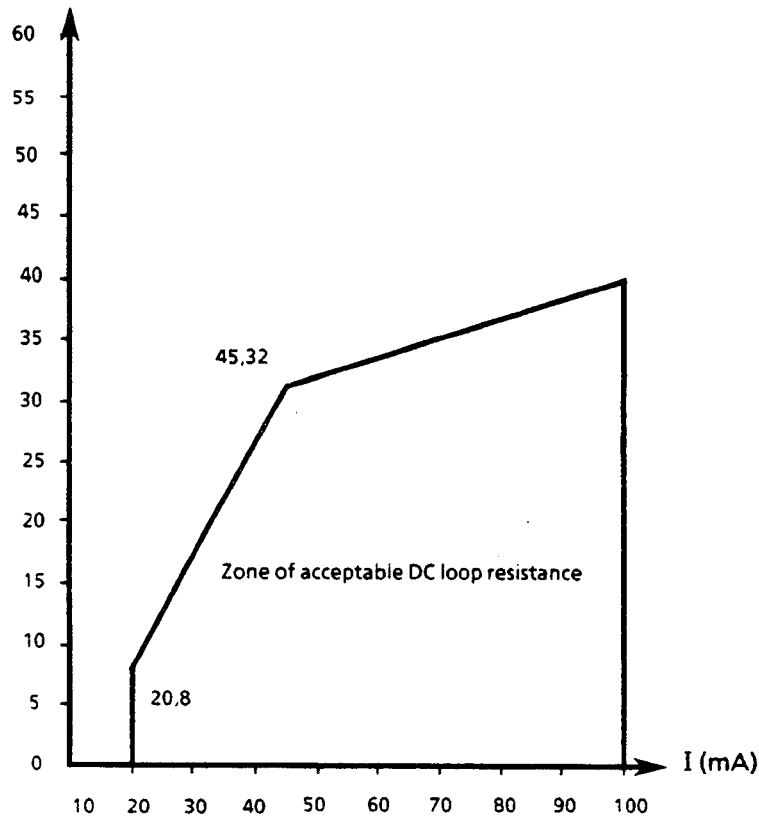


Figure A.2.3 (IRL) 2: DC current and loop resistance; dc mask

A.2.3 (I) 1

The two leads or terminals of the apparatus designed for connection to the basic network loop are connected to a dc voltage source of 48 V in series with a variable resistor. The steady state voltage at the device leads or terminals shall be greater than or equal to zero and less than the maximum value indicated in figure 2.3 (I) 1 for values of current in the range 0 to 50 mA, in case of apparatus without devices that limit the current; otherwise the test will be carried out on the linearity range of the limitators.

A.2.3 (NL) 1

The dc-characteristic is measured and plotted with the following values of V_f and R_f :

V_f	R_f
42	2 140
48	1 130
66	800

The feeding bridge with the inductors (L_f) of 2 times 2 H is to be used.

A.2.3 (P) 1

If the TE has a handset, the line current shall be measured with the handset in the REF position after the conditioning described in CCITT Recommendation P.75.

A.2.3 (E) 1

Resistance in loop condition

The TEUT is connected as shown in figure A.2.3.

The variable feeding voltage V_f takes values between 43 V and 56 V; the tests are undertaken for each polarity of the voltage source. The variable feeding resistor R_f takes values between 300 ohms and 2 300 ohms.

The test shall be made at the following loop currents (mA): 18,5, 25, 40, 65, and 100.

The equivalent loop resistance R_e is calculated using formula A.2.3 (E) 1, where I_t is the loop current ammeter value in milliamperes and V_t is the resulting voltmeter reading in volts.

$$R_e = \frac{V_t (V)}{I_t (mA)} \times 1\,000 \qquad \text{Formula A.2.3 (E) 1}$$

NOTE: The maximum current achieved during this test may be lower than the higher values quoted above because of the currents limitations imposed by the TE resistance

A.2.3 (E) 2 Resistance in high impedance condition

The procedure of the test in section A.2.3 (E) 1 is followed, where the variable feeding voltage V_f is fixed to a value of 66 V and the variable feeding resistor R_f is fixed to a value of 500 Ω .

The equivalent loop resistance R_e is calculated using formula A.2.3 (E) 1, where V_t is the voltmeter reading in volts and I_t is the resulting loop current ammeter reading milliamperes.

A.2.3 (CH) 1 Measured with increasing and decreasing voltage V_f .

A.2.3 (GB) 1 The duration of an undesigned interruption or random break in the dc path caused by the TEUT should not exceed 10 ms.

Under the conditions specified, the value of voltage and current obtained are limited in practice by the 400 Ω load line.

Current I_t is increased incrementally from zero to the maximum value obtainable. V_t is measured at each value of current.

2.4 Transient response of loop current

2.4.1 Quiescent to loop state

When the TE is caused to change from a quiescent state to a "loop" state, the accompanying change in loop current should be such that the current measured t_c ms after the commencement of the change is within the specified deviation (d) from the steady-state value.

Compliance shall be checked using the tests outlined in section A.2.4.1.

Table 2.4.1: Transient response - Quiescent to loop state

COUNTRY	REQUIREMENT VALUES		Remarks
	t_c (ms)	d	
Austria	under study		
Belgium	not mandatory		
Cyprus	100	1 mA	
Denmark	105	1 mA	
Finland	not mandatory		
France			yes
Germany	150		yes
Greece	not mandatory		
Iceland	not mandatory		
Ireland	not mandatory		
Italy			yes
Luxembourg	100	1 mA	
Malta			
Netherlands	See section 2.3		
Norway			yes
Portugal	100	not applicable	yes
Spain			yes
Sweden	not mandatory		
Switzerland	10	+/-10%	yes
U. Kingdom	not mandatory	not mandatory	

2.4.1 (F) 1

General

2.4.1 (F) 1.1

The loop current value shall be higher than the lower limit (area G) of the mask described in figure 2.3 (F) 1.a or b, within 400 ms from the loop seizure.

The feeding conditions are described in table 2.4.1 (F) 1.1.

The compliance test is outlined in section A.2.4.1 (F) 1.

Table 2.4.1 (F) 1.1

V_f (V)	R_L (Ω)
45 to 54	200 to 8 125
82 to 104	1 300 to 5 125

2.4.1 (F) 1.2

The loop current value shall be lower than 60 mA within 2 s(*) from the loop seizure, in the following feeding conditions:

$$V_f = 45 \text{ to } 54 \text{ V and } R_L = 200 \text{ to } 800 \text{ ohms (without overfeeding)}$$

$$V_f = 82 \text{ to } 104 \text{ V and } R_L = 1\,300 \text{ to } 1\,630 \text{ ohms} \\ \text{(with overfeeding)}$$

The compliance test is outlined in section A.2.4.1 (F) 1.

* 0,4 s will be required from 1st January 1992

2.4.1 (F) 2

Outgoing call

During the transient state, the loop current I (mA), measured t_c (s) after the loop seizure, shall conform to the following mask:

$$I \leq 150 \text{ mA for } t_c \leq 0,3 \text{ s,} \\ I \text{ limit regularly decreases from (0,3 s, 150 mA) to (0,327 s, 125 mA),} \\ I \leq 125 \text{ mA for } 0,327 \text{ s} \leq t_c \leq 2 \text{ s,} \\ I \leq 60 \text{ mA for } t_c \geq 2 \text{ s.}$$

The requirement shall be met in the following feeding conditions:

$$V_f = 54 \text{ V and } R_L = 200 \text{ ohms} \\ \text{(without overfeeding)}$$

$$V_f = 104 \text{ V and } R_L = 1\,300 \text{ ohms} \\ \text{(with overfeeding)}$$

The compliance test is outlined in section A.2.4.1 (F) 2.

NOTE: In order to introduce as soon as possible new electronic subscriber interfaces in the PSTN, this mask will be replaced from 1st January 1992 by the following:

$$I \leq 150 \text{ mA for } t_c \leq 0,3 \text{ s,} \\ I \text{ limit regularly decreases from (0,3 s, 150 mA) to (0,4 s, 60 mA),} \\ I \leq 60 \text{ mA for } t_c \geq 0,4 \text{ s.}$$

Furthermore, to make possible the use of economical automatic loop current regulation devices it is allowed from the 1st January 1990 that:

- a) the loop current reaches a value lower than 80 mA (instead of 75 mA), with overflows no longer than 5 ms, during the make pulse and interpulsing periods for decadic dialling.
- b) the loop current average value t reaches 24,5 mA (the tests at 28 mA will not be required anymore), with $V_f = 46 \text{ V}$ and $R = 1\,340/200 \, \Omega$ in the polarised incoming call conditions defined in 2.4.1 (F) 3.

2.4.1 (F) 3

Polarised incoming call

Under the polarisation conditions defined in table 2.4.1 (F) 3, the average value of the loop current measured by means of the set-up described in figure A.2.4.1 (F) 3 shall, not later than 250 ms after the seizure of the line, reach a value higher than the value I_m specified in table 2.4.1 (F) 3 and remain higher than this limit for at least 150 ms.

Table 2.4.1 (F) 3

V_f (V)	e (V)	R_L (Ω)	I_m (mA)
30	90 and 0	1 900	10,5
46	90 and 0	1 340	24,5
46	90 and 0	960	28
54	90 and 0	200	28

Remarks:

- 1) The test e (V) = 90 V is not applicable to the automatic answering TEs which are designed to seize the line during the break period of the ringing signal.
- 2) For the maximum limit I_m , the value 75 mA is under study.

2.4.1 (F) 4

Non-polarised incoming call

Under the polarisation conditions defined in table 2.4.1 (F) 4, the loop current value measured by means of the test set-up described in figure A.2.4.1 (F) 4 shall conform to the following requirements corresponding to the five cases shown in figure 2.4.1 (F) 4:

V_f (V)	e (V)	R (Ω)	r (Ω)	I_m (mA)
46	90	1 100	1 100	15
46 to 54	90	260 to 1 340	0 to 1 080	18 (1)
90 to 106	90	1 320 to 2 795	1 320 to 2 795	18 (1)

(1) These cases are under study.

Case 1

If the off hook appears during the first pulse of "e", more than 150 ms before the change from "e" to V_f , the loop current shall be greater than I_m not later than 30 ms after the change from "e" to V_f .

Case 2

If the off hook appears:

- during the first pulse less than 150 ms before the change from "e" to V_f ;
- during the break ringing (64 ms);
- during the second pulse more than 150 ms before the change from "e" to V_f ;

the loop current shall be greater than I_m not later than 30 ms after the following change from "e" to V_f .

Case 3

If the off hook appears during the second pulse less than 150 ms before the change from "e" to V_f , the loop current shall be greater than I_m not later than 180 ms after the change from "e" to V_f .

Case 4 If the off hook appears during the period V_f , more than 214 ms before the end of V_f , the loop current shall be greater than I_m not later than 180 ms after the seizure of the line.

Case 5 If the off hook appears during the period V_f , less than 214 ms before the end of V_f , the loop current shall be greater than I_m not later than 30 ms after the following change from "e" to V_f .

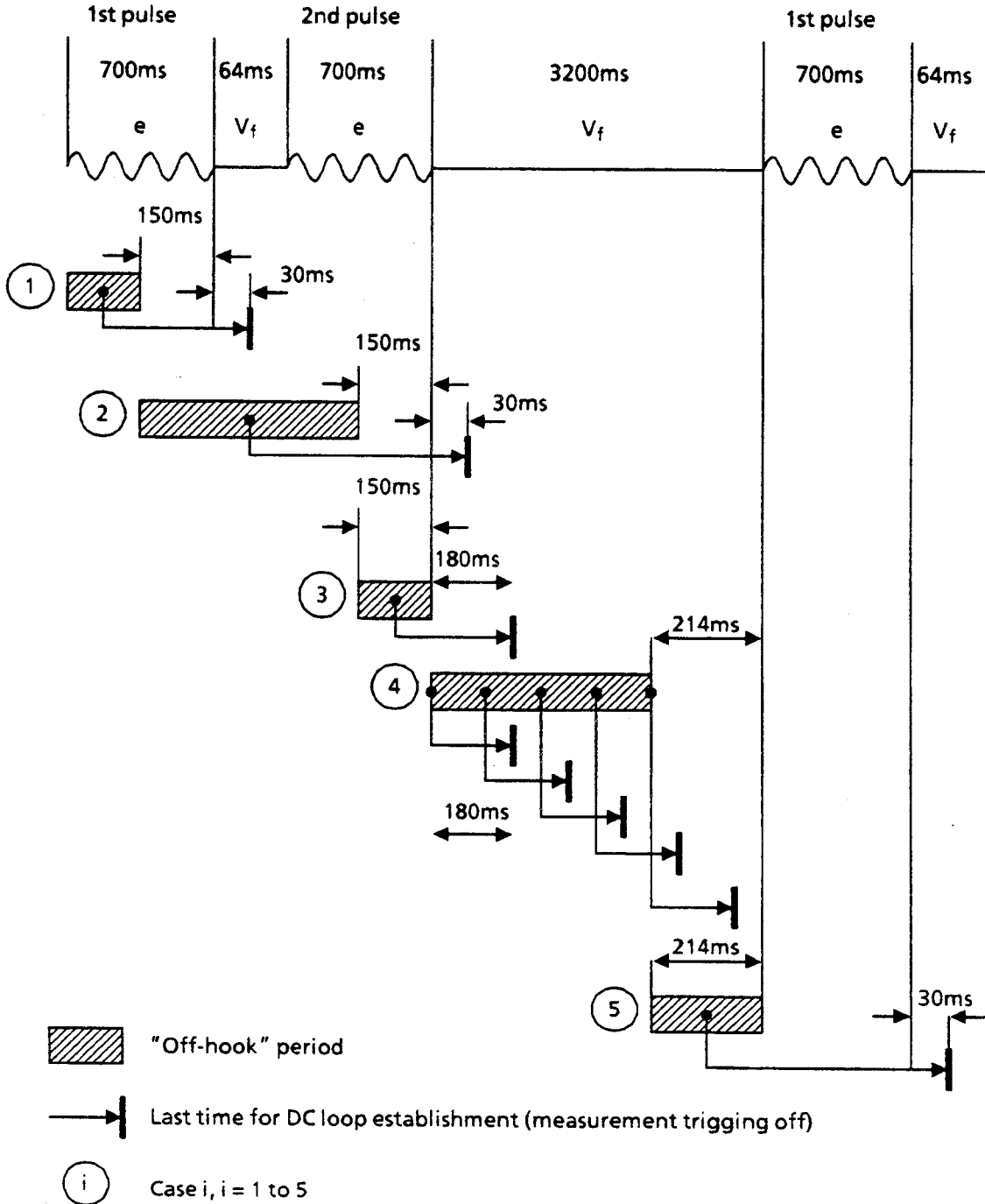


Figure 2.4.1 (F) 4

2.4.1 (D) 1 The transient response may be such as shown in figure 2.4.1 (D) 1. After line seizure, a maximum of two peak pulses, each with a duration of ≤ 3 ms, may occur in addition to the transient. The test conditions are set out in the test description.

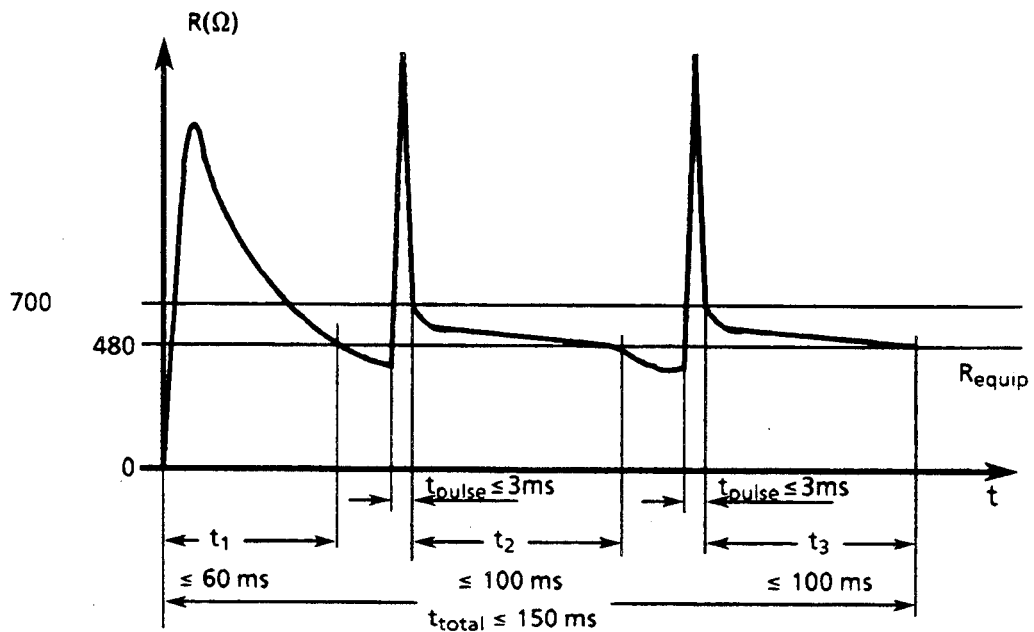


Figure 2.4.1 (D) 1: Transient response

The loop resistance of $\leq 480 \Omega$ shall, in the case of a feeding resistance $R_V = 2\,530 \Omega$ (see figure A.2.4.1 (D) 1) be reached for the first time within 60 ms after activation of the line.

Following the peak pulses, the permissible dc resistance of ≤ 480 ohms may be exceeded by 220 ohms. Within $t_{2\max} = t_{3\max} = 100$ ms the permissible dc resistance of ≤ 480 ohms has to be reached (see figure 2.4.1 (D) 1).

After $t_{\text{total}} = 150$ ms, the dc loop resistance shall not exceed 480 ohms.

2.4.1 (I) 1

When the TE is caused to change from a quiescent state to a loop state, under the polarisation condition specified in A.2.4, the current measured 15 ms after the commencement of the change shall not be less than 15 mA.

2.4.1 (N) 1

When the TE changes from quiescent to loop condition, the loop current shall, 30 ms after the loop seizure, not be lower than 13,5 mA. The same requirement applies when feeding voltage is connected to a TE that is already in loop condition. In this case the measurement starts simultaneously with the connection of the feeding voltage.

2.4.1 (P) 1

For TE capable of holding the loop state by itself, the loop current measured from 100 ms after the commencement of the change shall comply with that specified in section 2.3.

Compliance shall be checked using the tests outlined in sections A.2.4.1 and A.2.1 (P) 1.

2.4.1 (P) 2

Series-connected TE, through which the loop state to another TE is maintained, shall comply with the values specified in section 2.5, from 100 ms after the commencement of the change from quiescent state to loop state.

Compliance shall be checked using the tests outlined in sections A.2.4.1 and A.2.4.1 (P) 2.

2.4.1 (E) 1

Change from quiescent condition to loop condition
(Requirement to be applied instead of section 2.4.1).

When the TE is prepared for change from quiescent condition to loop condition, this last state shall be established in such a manner that the loop current shall comply with the limits according to the mask of figure 2.4.1 (E) 1, where

- t_1 = Instant in that the loop current exceeds I_1 mA;
- $t_2 = t_1 + 25$ ms;
- $t_3 = t_1 + 100$ ms;
- $I_1 = 5$ mA;
- $I_2 = 18$ mA;
- I_3 = Stationary value of the loop current;
- $I_4 = I_3 - 1$ mA;
- $I_5 = I_3 + 1$ mA.

Compliance shall be checked using the tests outlined in section A.2.4.1 (E) 1.

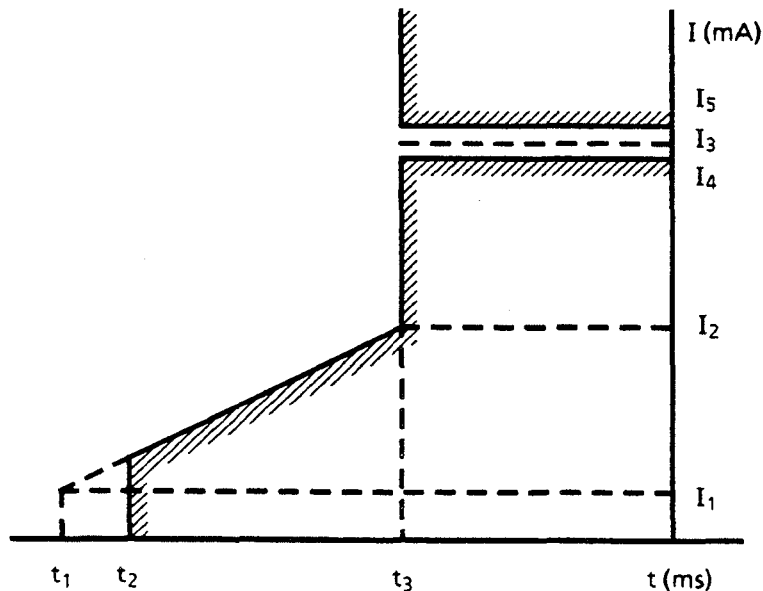


Figure 2.4.1 (E) 1: Change from quiescent condition to loop condition

2.4.1 (E) 2

Change from quiescent condition to loop condition of an associated TE (series)
(Remark with additional requirement to section 2.4.1 (E) 1 for series TE)

With series TE in the quiescent condition, when an associated TE connected to the line output terminals changes from quiescent condition to loop condition, the series TE shall allow the loop current to be greater than 19 mA after 5 ms from the change.

For this requirement, the associated TE is supposed equivalent to an ideal circuit of a resistor of 300 Ω in series with a switch.

This requirement shall, however, not be applied to series TE which is prepared for disconnecting the associated TE from the line while this associated TE is disconnected from the line.

Compliance shall be checked using the tests outlined in section A.2.4.1 (E) 2.

2.4.1 (CH) 1 The minimum limit of the current (loop state) has to be > 15 mA.

2.4.1 (CH) 2 When the TE is caused to change from loop state to quiescent state, the transient period for changing from 15 mA to < 5mA has to be ≤ 15 ms.

A.2.4 Transient response of loop current

A.2.4.1 Quiescent to loop state

The TEUT is connected as shown in figure A.2.4.1 and placed units quiescent state. DC excitation is provided as stipulated by the relevant Administration.

A suitable instrument is used to document the loop current during TE change of state as indicated.

Table A.2.4.1: Transient response - Quiescent to loop state

COUNTRY	TEST VALUES		Remarks
	V _f (V)	R _f (Ω)	
Austria	under study		
Belgium	not mandatory		
Cyprus	48	220	
Denmark	48	400	
Finland	not mandatory		
France			yes
Germany			yes
Greece	not mandatory		
Iceland	not mandatory		
Ireland	not mandatory		
Italy	48	900	
Luxembourg	not mandatory		
Malta			
Netherlands	See section 2.3		
Norway	40, 60	1 000, 1 550	yes
Portugal	45, 55	575, 1 250	yes
Spain	48	250, 1 100	yes
Sweden	not mandatory		
Switzerland	43	2 200	
U. Kingdom	not mandatory		

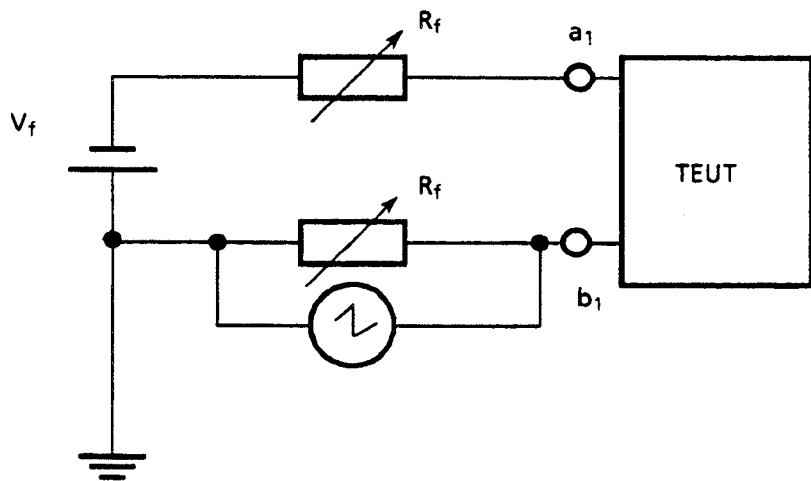


Figure A.2.4.1: Transient response

A.2.4.1 (F) 1

General

The tests are carried out using figure A.2.4.1 (F) 1 with relevant values of V_f and R_L defined in section 2.4.1 (F) 1.1 and 2.4.1 (F) 1.2.

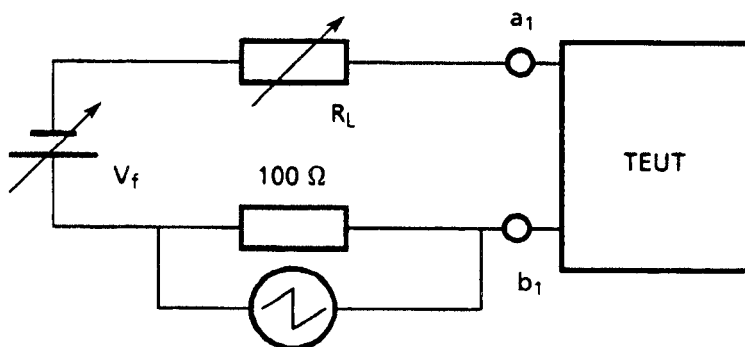


Figure A.2.4.1 (F) 1

A.2.4.1 (F) 2

Outgoing call

The tests are carried out using figure A.2.4.1 (F) 2 with values of V_f and R_L defined in section 2.4.1 (F) 2.

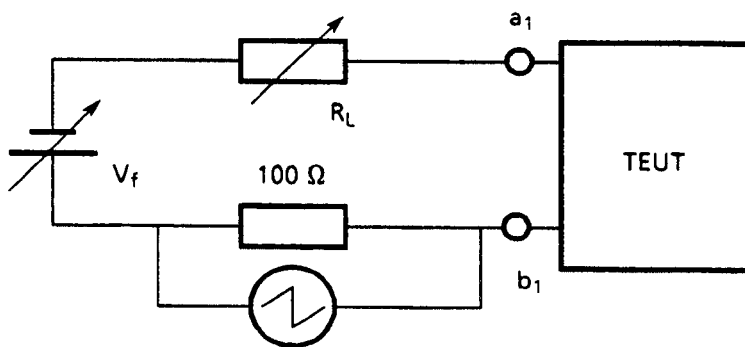


Figure A.2.4.1 (F) 2

A.2.4.1 (F) 3

Polarised incoming call

The TEUT is connected as shown in figure A.2.4.1 (F) 3.

The tests are carried out with the values of V_f and R_L defined in section 2.4.1 (F) 3.

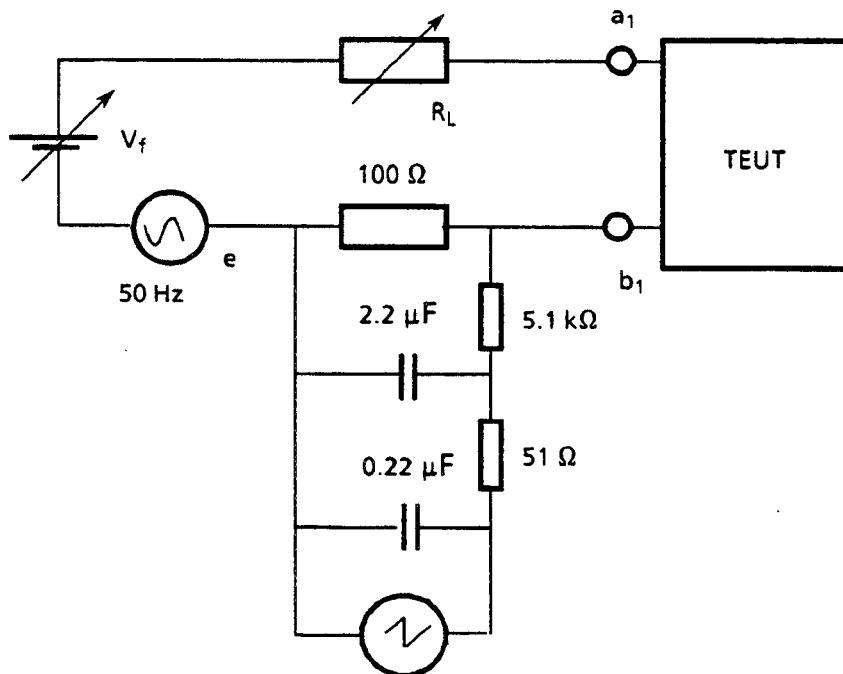


Figure A.2.4.1 (F) 3

A.2.4.1 (F) 4

Non-polarised incoming call

The TEUT is connected as shown in figure A.2.4.1 (F) 4.

The test is carried out with the values of V_f , e , R and r defined in section 2.4.1 (F) 4.

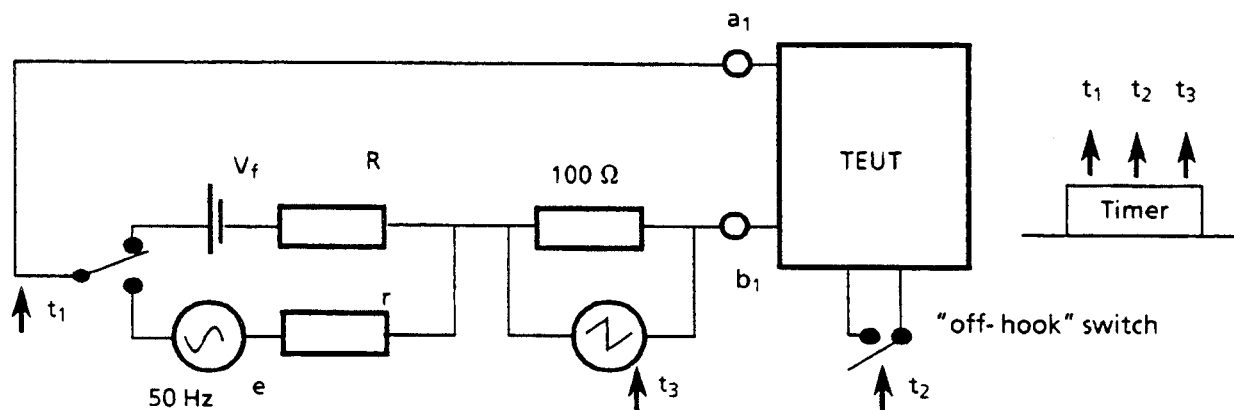


Figure A.2.4.1 (F) 4

The timer is used for connecting alternately sources e and V_f (t_1) bringing about the "off-hook" of the TEUT (t_2) and triggering off the measurement (t_3) of the loop current as described in figure 2.4.1 (F) 4.

A.2.4.1 (D) 1 The transient response is tested using the set-up shown in figure A.2.4.1 (D) 1.

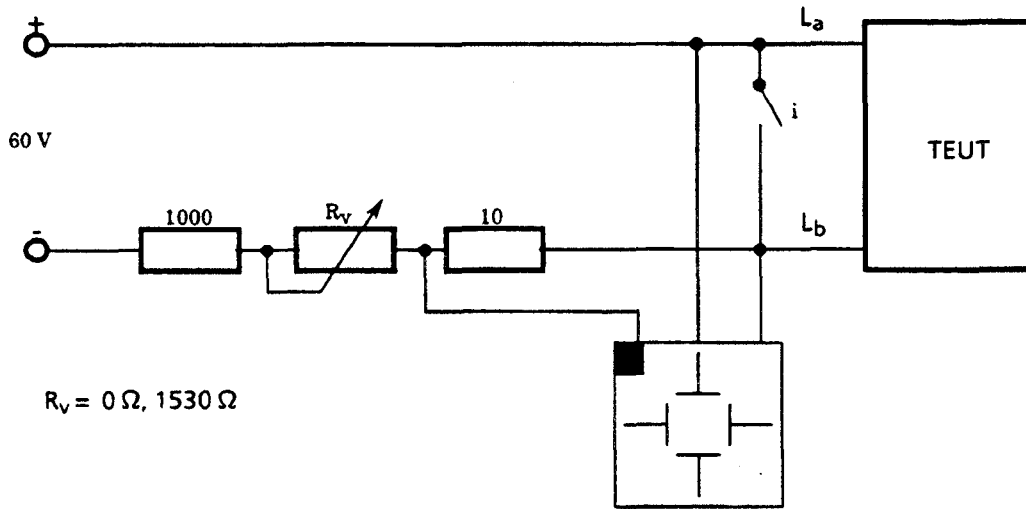


Figure A.2.4.1 (D) 1: Transient response

The transient response ends when the current-voltage ratio corresponds to the required dc resistance of the TEUT. The measurement is performed by means of a switch "i" simulating a pulsed supply voltage, on R_v of 0Ω and on R_v of $1\,530 \Omega$ (= 20 mA) Pause duration 1 200 ms; pulse duration 600 ms.

A.2.4.1 (N) 1 R_f id divided into R_{f1} and R_{f2} .

The part of R_f which is in parallel with the test instrument (R_{f1}) is 100 ohm.

Two tests with the following feeding requirements shall be carried out:

$$40 V_{dc} - R_{f2} = 1\,900 \text{ ohm};$$

$$60 V_{dc} - R_{f2} = 3\,000 \text{ ohm}.$$

A.2.4.1 (P) 1 TE capable of holding the loop state by itself.

The TEUT is connected as shown in figure A.2.4.1.

A.2.4.1 (P) 2 Series-connected TE through which the loop state to another TE is maintained

The TEUT is connected as shown in figure A.2.4.1 (P) 2.

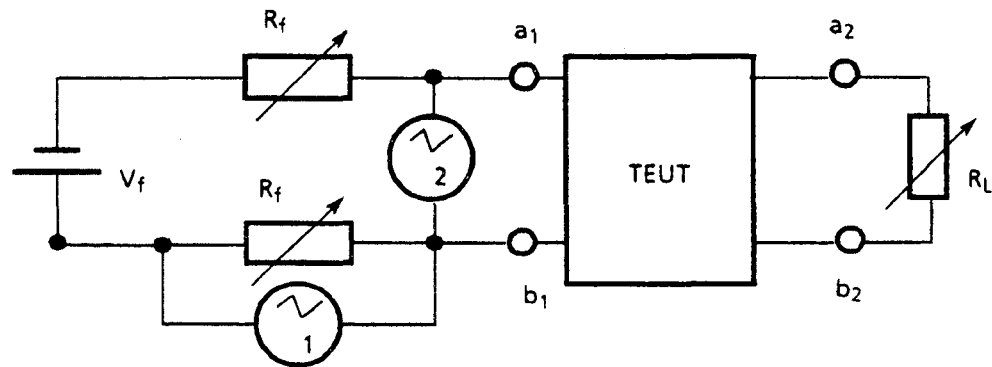


Figure A.2.4.1 (P) 2: Transient response, quiescent to loop state - Series-connected TE

V_f (V) = 45, 55
 R (Ω) = 575, 1 250
 R (Ω) = 400

Oscilloscope 1 measures the voltage across one of the feeding resistors R_f .

The ratio (voltage across R_f/R_f) is checked 100 ms after starting the change in the loop current.

The value of the series resistance is obtained with the ratio V/I , with V being the voltage measured by oscilloscope 2.

A.2.4.1 (E) 1

Change from quiescent condition to loop condition
 (Remark to section A.2.4.1)

The two feeding resistors R_f take the value of 250 Ω the test shall also be made when these resistors take the value of 1 100 Ω .

A.2.4.1 (E) 2

Change from quiescent condition to loop condition of an associated TE (series)

The series TEUT is connected as shown in figure A.2.4.1 (E) 2 and placed in its quiescent condition. The switch S_1 is in its open position.

The feeding excitation is provided as stipulated in test sections A.2.4.1 and A.2.4.1 (E) 1. The resistor R_L connected to the line output terminals through switch S_1 takes the value of 300 Ω .

A suitable instrument is used to document the loop current just after switch S_1 has been changed to its closed position.

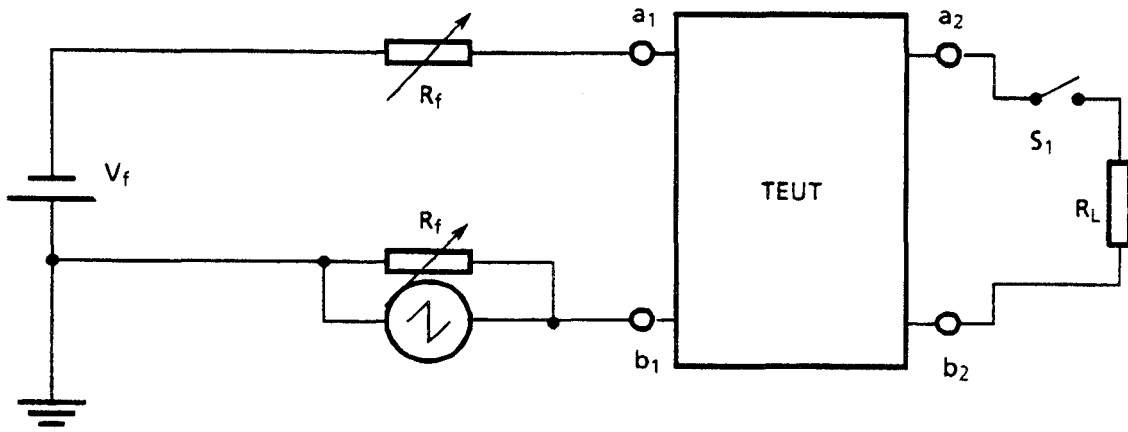


Figure A.2.4.1 (E) 2: Change from quiescent condition to loop condition of an associated TE (series)

A.2.4.1 (CH) 1 $V_f = 57 \text{ V}$, $R_f = 300 \Omega$ for the test described in 2.4.1 (CH) 1.

2.4.2 Loop current transfer

For TE capable of transferring its loop condition to or from another TE, or capable of transferring its loop condition to or from another circuit in the same TE. The value of the loop current shall reach a value of not less than I_t no later than t_t after the commencement of the transfer.

This requirement does not apply in those cases when loop transfer is effected during the period in which the TE has assumed any state relating to "loop disconnect" or any dialling or signalling function.

The values of I_t and t_t are given in table 2.4.2.

Compliance shall be checked using the tests outlined in section A.2.4.2.

Table 2.4.2: Loop current transfer

COUNTRY	REQUIREMENT VALUES		Remarks
	I_t (mA)	t_t (ms)	
Austria			yes
Belgium	20	5	
Cyprus	15	5	
Denmark	15	5	
Finland	15	5	
France	20	10	
Germany	20	5	
Greece	not mandatory		
Iceland	15	5	
Ireland	not mandatory		
Italy	18	15	
Luxembourg	15	5	
Malta			
Netherlands	15,5	10	
Norway			yes
Portugal	20	10	
Spain	15	5	yes
Sweden		10	yes
Switzerland	15	5	
U. Kingdom	not mandatory		

2.4.2 (A) 1

In this case the current interruption shall be less than 5 ms.

2.4.2 (N) 1

The loop current shall not be lower than 13,5 mA for more than 5 ms as a consequence of a loop current transfer to another circuit inside the TE, or to an associated TE, or when external power is switched on or off.

2.4.2 (E) 1

Transient during loop condition
(Requirement to be applied instead of section 2.4.2)

With TE in the loop condition, this condition shall be maintained in such a manner that the loop current shall not be lower than 15 mA for a period greater than 5 ms, as a consequence of a transfer to or from another circuit inside the TE.

Compliance shall be checked using the tests outlined in section A.2.4.2 (E) 1.

- 2.4.2 (E) 2** Loop condition transfer to an associated TE (series)
(Requirement to be applied, for series TE, in addition to section 2.4.2 (E) 1 instead of section 2.4.2)

When the series TE in the loop condition is prepared for changing automatically to quiescent condition when an associated TE connected to the line a output terminals change from quiescent condition o loop condition, the change of series TE shall be done in such manner that the loop current shall not be lower than 15 mA for a period greater than 5 ms.

For this requirement, the associated TE is supposed as being equivalent to an ideal circuit of a resistor of 300 Ω in series with a switch.

Compliance shall be checked using the tests outlined in section A.2.4.2 (E) 2.

- 2.4.2 (E) 3** Loop condition transfer from an associated TE (series)
(Requirement to be applied, for series TE, in addition to section 2.4.2 (E) 1 instead of section 2.4.2)

When the series TE in the quiescent condition is allowed for taking over the loop condition when an associated TE connected to the line output terminals is previously in loop condition, the change of the series TE shall be done in such a manner that the loop current shall not be lower than 15 mA for a period greater than 5 ms.

For this requirement, the associated TE in loop condition is supposed equivalent to an ideal resistor of 300 Ω . If the series TE is prepared for taking automatically the loop condition when the associated TE changes to quiescent condition, a switch shall be connected in series with the resistor of 300 Ω .

Compliance shall be checked using the tests outlined in section A.2.4.2 (E) 3.

- 2.4.2 (S) 1** Requirements in section 2.3 shall be fulfilled within 10 ms.

A.2.4.2 Loop current transfer

The TEUT is connected as shown in figure A.2.4.2. A feeding voltage of value V_f is applied via series resistors R_{f1} and R_{f2} ; for TE capable of loop transfer to an external circuit, a load impedance of value R_L is connected. Values are given in table A.2.4.2. An instrument capable of documenting the loop current is connected as shown in figure A.2.4.2.

The TEUT is caused to effect loop transfer and the associated loop current is documented.

Table A.2.4.2: Loop current transfer

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_{f1} (Ω)	R_{f2} (Ω)	R_L (Ω)	
Austria	60		100	500	yes
Belgium	48	600	1 000	300	
Cyprus	48	800	800	400	
Denmark	48	1 200	1 200	400	
Finland	48	400	400	400	
France	48	800	100	600	
Germany	60	1 530	1 000	300	
Greece	not mandatory				
Iceland	48	1 200	1 200	400	
Ireland	not mandatory				
Italy	48	900	900	200	
Luxembourg	60				
Malta					
Netherlands	42	1 020	1 020	560	
Norway	24 60	900 3 000	100 100	400	
Portugal	48	900	900	400	
Spain	48	250, 1 100	250, 1 100	300	yes
Sweden	38	900	100	600	
Switzerland	43	1 100	1 100	400	
U. Kingdom	not mandatory	not mandatory	not mandatory	not mandatory	

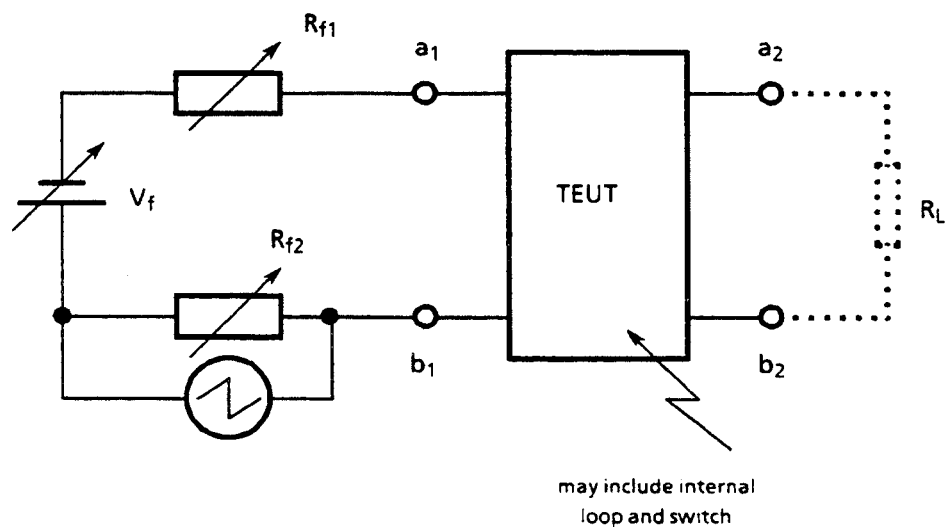


Figure A.2.4.2: Loop current transfer

A.2.4.2 (A) 1 $I = 19...60$ mA, adjusted by R_{f1} .

A.2.4.2 (E) 1 Transient during loop condition

The procedure for test in section A.2.4.2 is followed, with the TE placed in its loop condition.

The two feeding resistors R_{f1} and R_{f2} take the value of 250Ω ; the test shall also be made when these resistors take the value of $1\ 100 \Omega$. For series TE the output line terminals shall be left in open circuit.

A suitable instrument is used to document the loop current during the switching between circuits inside the TE.

A.2.4.2 (E) 2 Loop condition transfer to an associated TE (series)

The series TEUT is connected as shown in figure A.2.4.1 (E) 2 and placed in its loop condition. The switch S_1 , is in its open position.

The feeding excitation is provided as stipulated in test sections A.2.4.2 and A.2.4.2 (E) 1. The resistor R_L connected to the line output terminals through switch S_1 , takes the value of 300Ω .

A suitable instrument is used to document the loop current just after switch S_1 has been changed to its close position.

A.2.4.2 (E) 3 Loop condition transfer from an associated TE (series)

The procedure of test in section A.2.4.2 (E) 2 is followed, with switch S_1 placed in closed position at the beginning of the test.

Switch S_1 , when necessary, shall be changed to its open position.

A suitable instrument is used to document the loop current during series TE change to loop condition.

2.5 Series resistance

Series-connected TE shall not, when connected in series with the PSTN and other TE, introduce additional loop resistance greater than R_s , nor cause a voltage drop greater than V_s to be interposed between the PSTN and the other TE to which it is connected. The values of R_s and V_s are given in table 2.5.

Compliance shall be checked using the tests outlined in section A.2.5.

Table 2.5: Series resistance

COUNTRY	REQUIREMENT VALUES		Remarks
	R_s (Ω)	V_s (V)	
Austria	10	not mandatory	yes
Belgium	20		yes
Cyprus	20	not mandatory	
Denmark	36	not applicable	
Finland	200	not mandatory	
France			yes
Germany	25		yes
Greece	110		
Iceland	20	not mandatory	
Ireland	20	not mandatory	yes
Italy		5	
Luxembourg	20		
Malta			
Netherlands	100		
Norway	20	not mandatory	yes
Portugal	100	not applicable	
Spain	50	not applied	yes
Sweden	75	not mandatory	
Switzerland	20	not mandatory	yes
U. Kingdom	10		yes

2.5 (A) 1 For pulse metering equipment $R_s = 150 \Omega$.

2.5 (A) 2 R_s for line currents ≤ 19 mA under study.

2.5 (B) 1 The value of R_s is related to each wire.

2.5 (DK) 1 The existing text of section 2.5 is replaced with section 2.5 (DK) 1 as follows:

Any device which is connected in series between a terminal and the line shall after 5 ms not make up a voltage drop in excess of the characteristic shown in figure 2.5 (DK) 1. Confer, however, to section 4.

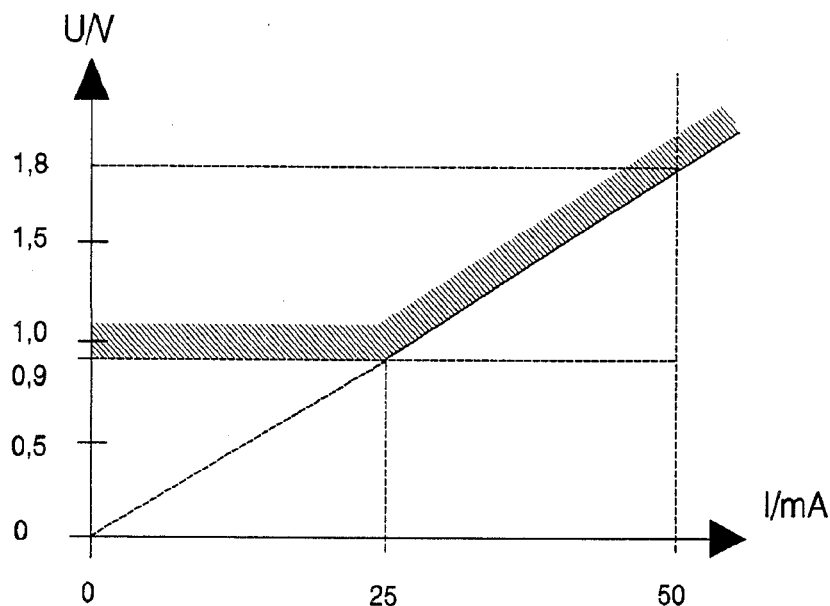


Figure 2.5 (DK) 1: DC current - voltage characteristics for serial device

2.5 (F) 1

Insertion mask

Under the measuring and polarisation conditions specified in the test description, the insertion voltage V_s of the equipment shall satisfy mask 1) in figure 2.5 (F) 1 in the general case, and mask 2) of the same figure in the case of metering pulse detector fed remotely by the PSTN.

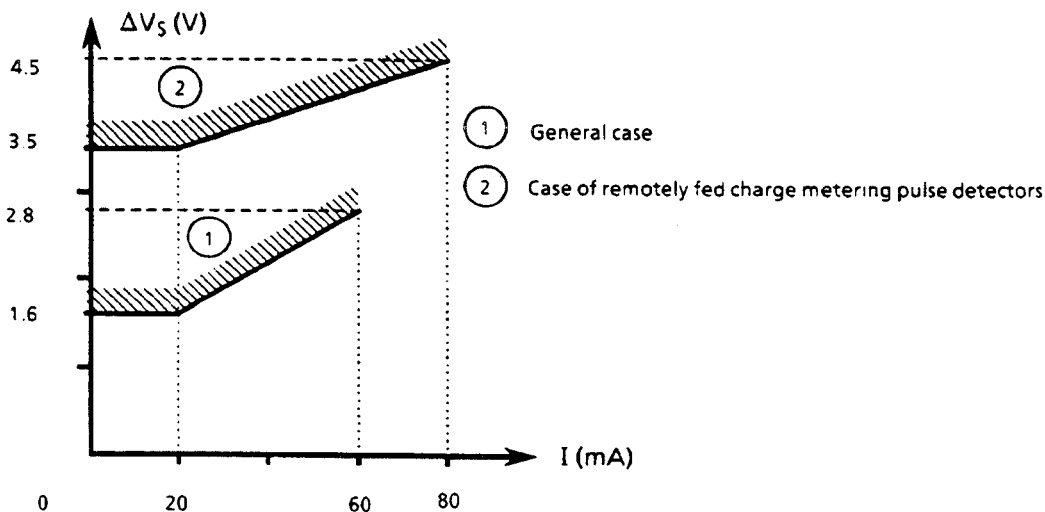


Figure 2.5 (F) 1: Insertion mask $V_s = f(I)$

2.5 (D) 1

Series-connected TEs with extended wires a_2 , b_2 , which are not intended for fixed installations shall in the idle state not cause a series resistance greater than 25Ω with connecting cord; for TEs used for evaluating the 16 kHz charge meter pulses a series resistance of up to 40Ω is allowed. TEs intended only for fixed installations (no connecting cord provided) shall not cause a maximum series resistance greater than 25Ω .

2.5 (IRL) 1

Requirement applies for all loop currents between 20 to 100 mA.

2.5 (N) 1 The requirement is not applicable for comprehensive user installation (see 2.3 (N) 1).

2.5 (E) 1 Insertion loop resistance (series)
(Requirement to be applied instead of section 2.5)

With series TE in both quiescent condition and high impedance condition, the equivalent loop resistance of the associated TE shall not be increased by more than 50 Ω , tested at dc loop currents between 19 mA and 100 mA.

For this requirement, the associated TE in loop condition is supposed equivalent to an ideal resistor of 100 Ω .

This requirement shall, however, not be applied to series TE which is prepared for disconnecting the associated TE from the line while this associated TE is disconnected from the line.

Compliance shall be checked using the tests outlined in section A.2.5 (E) 1.

2.5 (CH) 1 R_s as small as possible, up to 20 Ω in an established loop.

2.5 (GB) 1

1) Where the series-connected TE is intended to be the only apparatus introduced between the PSTN and the other TE it shall meet either of the following limiting values (I) or (II) of voltage drop:

- (I) a) 400 mV for line currents up to and including 40 mA;
b) a voltage equivalent to the potential difference across 10 ohms for line currents greater than 40 mA.
- (II) a) 400 mV for line currents up to and including 5 mA;
b) 2 V for line currents up to and including 40 mA;
c) a voltage equivalent to the potential difference across 50 ohms for line currents greater than 40 mA.

NOTE: Requirement (I) is primarily intended to apply to series apparatus which does not involve series current-sensing elements but may include fuses, tinsel cords or switch contacts.

Requirement (II) is primarily intended to apply to series apparatus which has series elements such as opto-couplers or relay coils.

The series-connected TE shall be supplied with instructions for use containing the following:

- a statement of the voltage drop introduced by the series TE into the loop connection between the PSTN and other TE at a current of 40 mA. The stated voltage drop shall be equal to or greater than the voltage drop actually measured at a current of 40 mA in accordance with (I) or (II) above;
- advice to the user on permissible limits of resistance of cable or wiring used to connect the series TE to the PSTN and other terminal apparatus;

- advice to the user that difficulties may occasionally be experienced when making calls from other TE connected to the PSTN via series TE. Such difficulties may include difficulty in making calls or problems in telephone conversation being experienced by both parties to the call;
 - where 1 (II) a) is not complied with, a warning that, while operation may be possible initially, changes to or modernisation of the network taking place in the normal course of events may result in the TE being connected to a network service with which it was not designed to be compatible. Failure of the TE to work under these circumstances may not be the fault of the network operator;
 - advice to the user to consult the supplier or maintainer of the series TE, not the network operator, if such difficulties are experienced.
- 2) Where the series TE is intended to be one of two or more series apparatus introduced between the PSTN and the other TE, requirement 1 (I) or 1 (II) above applies and, in addition, the following requirements apply:
- (I) the series TE shall be supplied with instructions for use in which a value for the Series Equivalent Number (SEN) is stated;
 - where 1(I) applies, the value of SEN shall be 0,3;
 - where 1(II) applies and the voltage drop at a line current of 40 mA is U, a value of SEN of $U/2$ shall apply. The value of SEN may additionally depend on insertion loss.
 - (II) The series TE shall be supplied with instructions for user explaining how the value of SEN is to be used in determining permissible numbers of series TE and lengths of cable or wiring which may be concatenated between the PSTN and other TE.

A.2.5 Series resistance

The TEUT is connected as shown in figure A.2.5. A feeding voltage of value V_f is applied via a series resistor of value R_f , and a load resistance of value R_L is connected. These values are given in table A.2.5.

The series resistance is then calculated using formula A.2.5.a:

$$R_s = \frac{V_1 + V_2}{I} \quad \text{Formula A.2.5.a}$$

and the voltage drop is calculated using formula A.2.5.b:

$$V_s = V_1 + V_2 \quad \text{Formula A.2.5.b}$$

Tests are undertaken for both polarities of dc applied to the line terminals of the TEUT.

Table A.2.5: Series resistance

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	R_L (Ω)	
Austria	60		500	yes
Belgium	48	800	300	yes
Cyprus	48	800	400	yes
Denmark				yes
Finland	48	800, 1 710	400	yes
France				yes
Germany	60	1 000, 2 530	300	
Greece	60	600 - 2 600	400	
Iceland	48	800, 2 400	400	
Ireland				yes
Italy	44	1 880	200	
Luxembourg	60		500	
Malta				
Netherlands	See section 2.4.2			
Norway	60	460, 3 500	400	yes
Portugal	45, 55	1 150, 2 500	0 and 400	
Spain	43 - 56	300 - 2300	100	yes
Sweden	33 - 60	variable	0	yes
Switzerland	43	2 200	400	
U. Kingdom	50	400 min.	600	yes

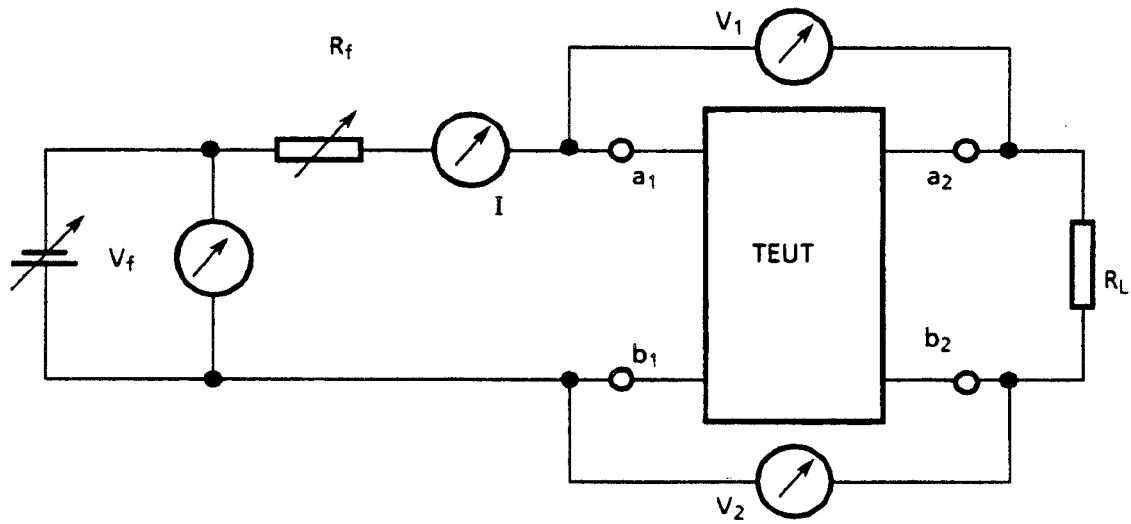


Figure A.2.5: Series resistance

A.2.5 (A) 1

$I = 19 \text{ mA} - 60 \text{ mA}$, adjustable by R_f

A.2.5 (B) 1

The series resistances are calculated using formulas A.2.5 (B) 1.a and A.2.5 (B) 1.b:

$$R_{s1} = \frac{V_1}{I}$$

Formula A.2.5 (B) 1.a

$$R_{s1} \leq 20 \Omega$$

$$R_{s2} = \frac{V_2}{I}$$

Formula A.2.5 (B) 1.b

$$R_{s2} \leq 20 \Omega$$

A.2.5 (CY) 1

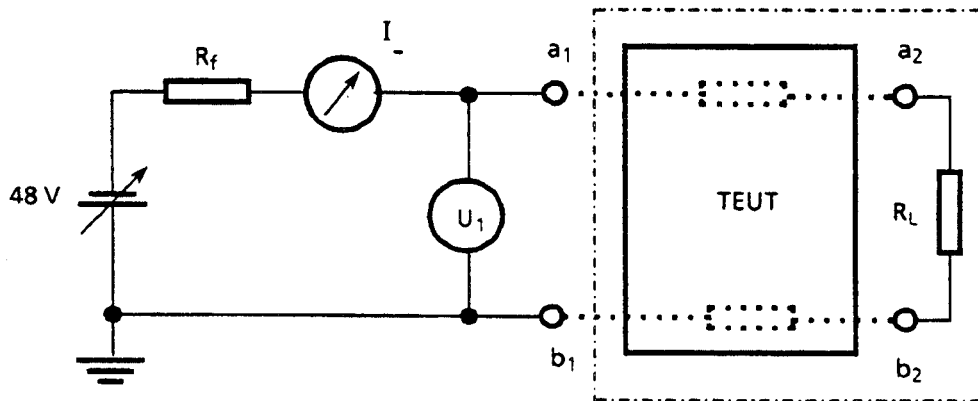


Figure A.2.5 (CY) 1

$R_f = 800 \text{ ohms}$

$R_L = 400 \text{ ohms}$

The series resistance is calculated using the formula:

$$R_s = \frac{U_f}{I} - R_L$$

A.2.5 (DK) 1

The principle of the test is shown in figure A.2.5 (DK) 1. The test shall be made at the following currents:

8, 16, 24, 50 and 100 mA

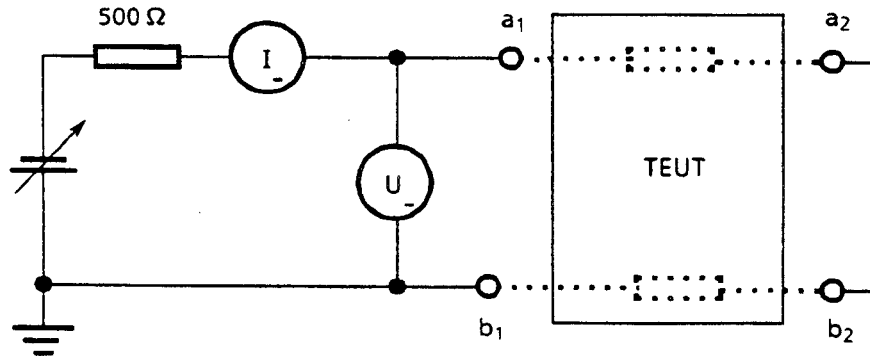


Figure A.2.5 (DK) 1: Series resistance

A.2.5 (SF) 1

The measuring set-up is given in figure A.2.5 (SF) 1.

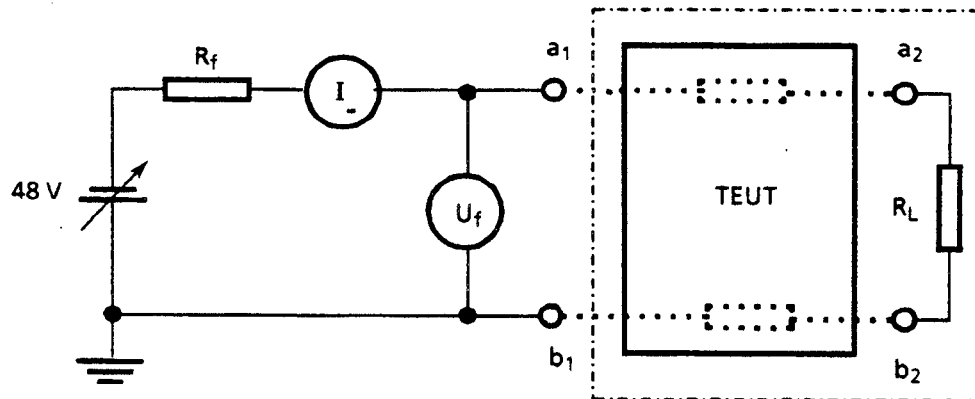


Figure A.2.5 (SF) 1: Series resistance

$$R_f = 800, 1\ 710 \text{ ohms}$$

$$R_L = 400 \text{ ohms}$$

The series resistance is calculated using formula A.2.5 (SF) 1:

$$R_s = \frac{U_f}{I} - R_L$$

Formula A.2.5 (SF) 1

A.2.5 (F) 1

The TEUT is connected as shown in figure A.2.5 (F) 1. The feeding conditions are given in table A.2.5 (F) 1.

Tests are undertaken for both polarities of dc applied to the line terminals or leads of the TEUT.

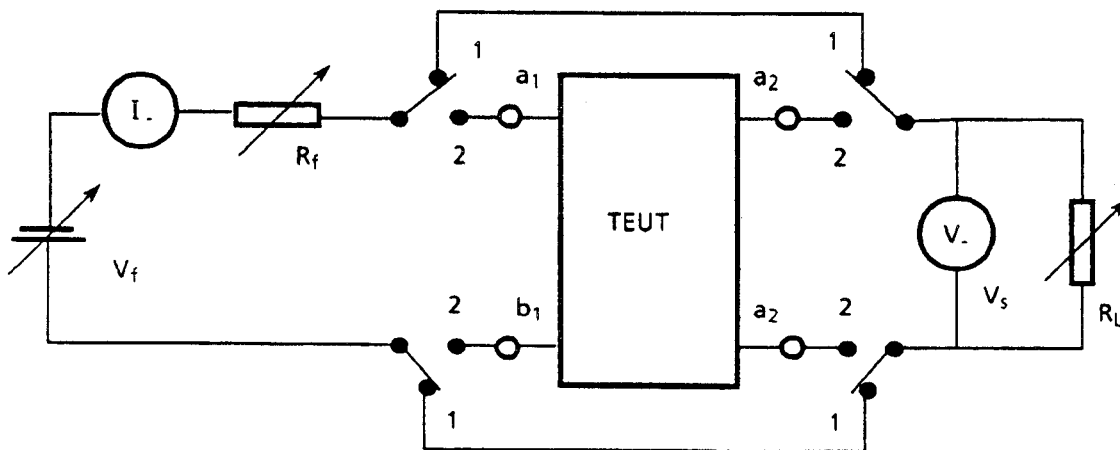


Figure A.2.5 (F) 1

Table A.2.5 (F) 1

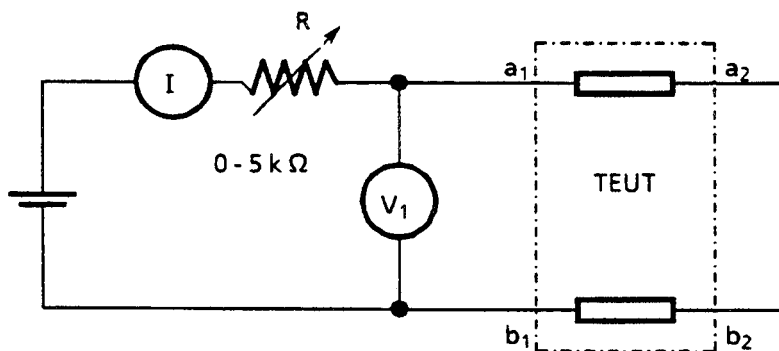
V_f (V)	R_f (Ω)	I_f (mA)
45	1 400	25
54	300	60

The voltage drop is calculated using formula A.2.5 (F) 1:

$$\Delta V_s = |V_{s1}| - |V_{s2}|, \quad \text{Formula A.2.5 (F) 1}$$

where V_{s1} and V_{s2} are the values measured when the switches are in position 1 and 2, respectively.

A.2.5 (IRL) 1



Adjust R for loop currents of 20 to 100 mA.

Figure A.2.5 (IRL) 1: Series resistance

A.2.5 (N) 1

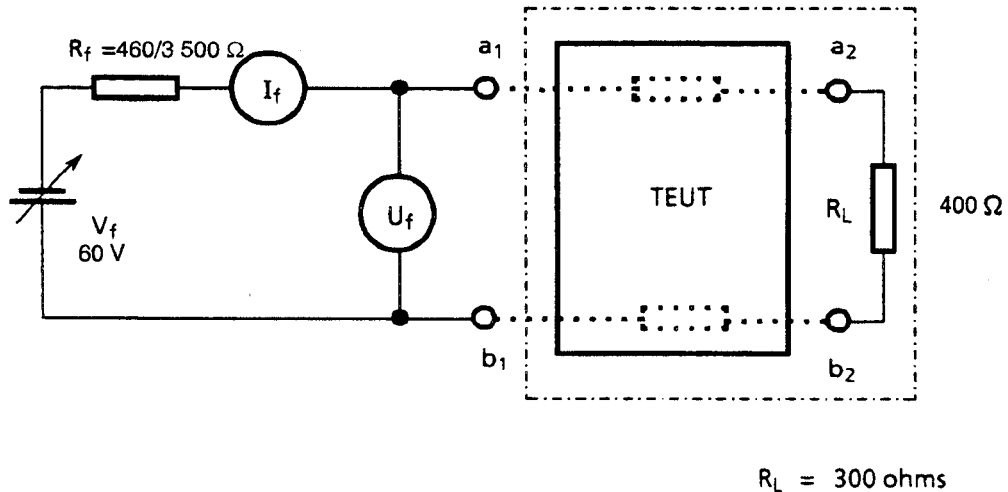


Figure A.2.5 (N) 1: Series resistance

The series resistance is calculated using formula A.2.5 (N) 1:

$$R_s = \frac{U_f}{I_f} - R_L \quad \text{Formula A.2.5 (N) 1}$$

A.2.5 (E) 1

Insertion loop resistance (series)

The series TEUT is connected as shown in figure A.2.5 (E) 1.

The variable feeding voltage V_f takes values between 43 V and 56 V; the tests are undertaken for each polarity of the voltage source. The variable feeding resistor R_f takes values between 300 Ω and 2 300 Ω . The load resistor R_L takes the value of 100 Ω .

The test shall be made at the following current values of I_{t2} (mA): 18,5, 25, 40, 65, and 100 mA.

The resistance increase ($R+$) is calculated using formula A.2.5 (E) 1, where V_{t1} and V_{t2} are the voltmeter readings in volts, and I_{t1} and I_{t2} are the ammeter readings in milliamperes when switch S_1 is in positions 1 and 2, respectively.

$$R+ = \left[\frac{V_{t2} \text{ (V)}}{I_{t2} \text{ (mA)}} - \frac{V_{t1} \text{ (V)}}{I_{t1} \text{ (mA)}} \right] \times 1\,000 \quad \text{Formula A.2.5 (E) 1.}$$

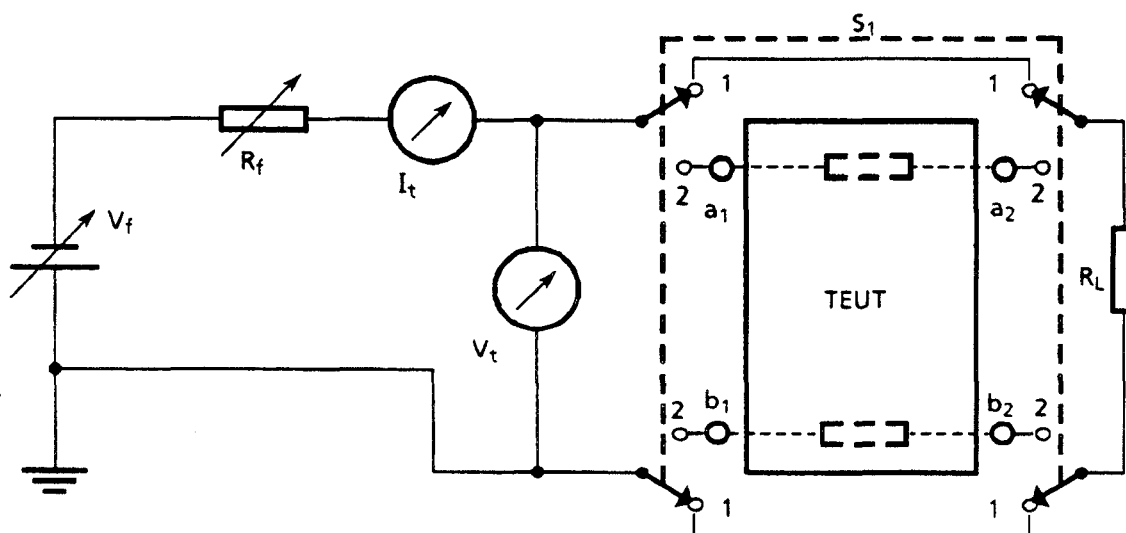


Figure A.2.5 (E) 1: Insertion loop resistance (series)

A.2.5 (S) 1

Test shall be undertaken in the range $I = 10 - 50 \text{ mA}$.

A.2.5 (GB) 1

A fixed feeding voltage of 50 V dc is used, the line current being varied by means of a variable resistor in series with a fixed resistor of 400Ω (R_f).

V_1 and V_2 are measured at three values of line current chosen by the test house, one lying in each of the three ranges 1 mA to 5 mA, 5 mA to 40 mA, 40 mA to 50 mA.

2.6 DC overload susceptibility

TE in loop condition shall withstand the application of a dc feeding voltage of increased value V_f via a series resistor of reduced value R_f or a current I_o for a given time t_o .

For series-connected TE, this requirement shall be met with a load impedance of value R_{Lo} connected.

TE shall still comply with all requirements in this document. Values are given in table 2.6.

Compliance shall be checked using the tests outlined in section A.2.6.

Table 2.6: DC overload susceptibility

COUNTRY	REQUIREMENT VALUES					Remarks
	V_f (V)	R_f (Ω)	I_o (mA)	t_o (min)	R_{Lo} (Ω)	
Austria	not mandatory					
Belgium	53	400		5	0	
Cyprus	66	300	125	5	300 resistive	yes
Denmark	56	220		30	0	yes
Finland	not mandatory					
France	54	300		5	600 resistive	
Germany	120	500		10s	300 resistive	
Greece	66		100	5	400 resistive	
Iceland	56	400	125	30		
Ireland	not mandatory					
Italy	48	400	not mandatory	5	200	
Luxembourg	66	300		5		
Malta						
Netherlands						yes
Norway	60	200		30	100	yes
Portugal	not mandatory					
Spain	66	300	125	5	100	yes
Sweden	not mandatory					
Switzerland	not mandatory					yes
U. Kingdom	not mandatory	not mandatory	not mandatory	not mandatory	not mandatory	yes

2.6 (CY) 1

For dc loop current that may exceed 125 mA the feeding dc voltage shall be adjusted to limit the current to the above value.

2.6 (DK) 1

A TE set in the off-hook state shall be able without causing secondary damage to continuously withstand the power from a dc voltage of 56 V applied to the line terminals through a resistance of 220 ohms.

2.6 (NL) 1

In the Netherlands a related safety requirement applies and is outside the scope of NET 4.

2.6 (N) 1

The polarity is reversed after 15 minutes.

2.6 (E) 1

Direct current overload susceptibility
(requirement to be applied instead of section 2.6)

With TE in loop condition, it shall be capable of withstanding without damage the application of a dc voltage of 66 V between the line terminals through a resistor of 300 Ω for a period of 5 minutes.

If the value of the dc loop current exceeds 125 mA, the dc voltage shall be decreased until the current takes that value.

However, for TE which is prepared for automatically limiting the duration of the loop condition to a period of value lower than 5 minutes, the requirement shall only be applied during that period.

Compliance shall be checked using the tests outlined in section A.2.6 (E) 1.

2.6 (E) 2

Direct current overload susceptibility (series)

(Requirement to be applied, for series TE, in addition to section 2.6 (E) 1, instead of section 2.6)

With series TE in both quiescent condition and high impedance condition, it shall be capable of withstanding without damage the application of a dc voltage of 66 V between the line input terminals through a resistor of 300 Ω for a period of 5 minutes, when a resistor of 100 Ω is connected to the line output terminals.

If the value of the dc loop current exceeds 125 mA, the dc voltage shall be decreased until the current takes that value.

However, for TE which is prepared for automatically limiting the duration of the high impedance condition to a period of value lower than 5 minutes, the requirement shall only be applied during that period for that condition.

Compliance shall be checked using the tests outlined in section A.2.6 (E) 2.

2.6 (CH) 1

The requirement for the overload susceptibility shall be met according to section 3.2 (dc mixed with 25 Hz ac instead of pure dc) on TE with and without ringing detection.

2.6 (GB) 1

In UK a related safety requirement applies and is outside the scope of this NET.

A.2.6 DC overload susceptibility

The TEUT is connected as shown in figure A.2.6. Switch S is closed at the commencement of the test and opened at a time t_0 later.

During the time switch S is closed, current I is monitored. If, during the time that switch S is closed, the current increases to a value I_0 , the value of the feeding voltage is reduced so as to maintain the current at a value I_0 for the duration of the test.

NOTE: The testing authority may wish to carry out this test before certain other tests are made.

Table A.2.6: DC overload susceptibility

COUNTRY	TEST VALUES	Remarks
Austria		
Belgium		
Cyprus	As per section 2.6	yes
Denmark		
Finland	not mandatory	
France		
Germany		
Greece		yes
Iceland		
Ireland	not mandatory	
Italy		
Luxembourg		
Malta		
Netherlands		
Norway		
Portugal		
Spain		yes
Sweden	not mandatory	
Switzerland		
U. Kingdom	not mandatory	

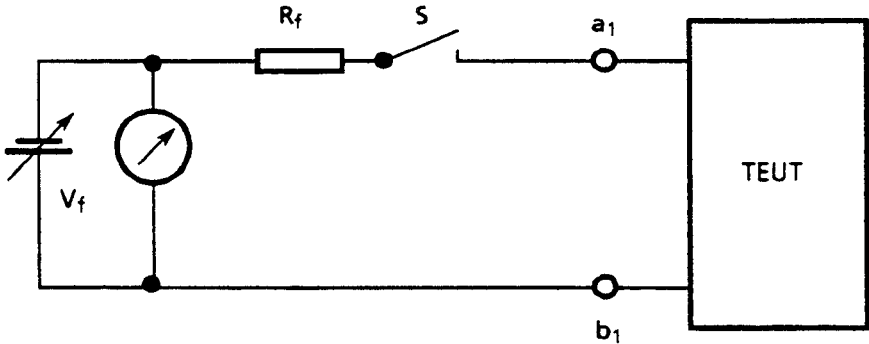


Figure A.2.6: DC overload susceptibility

A.2.6 (B) 1

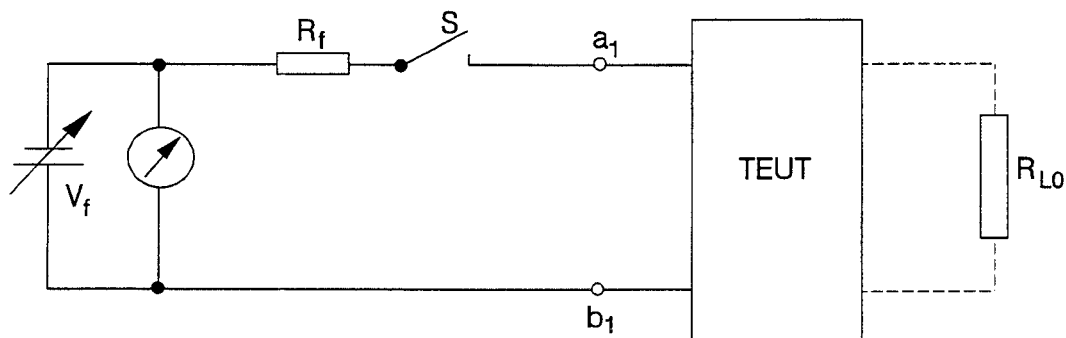


Figure A.2.6 (B) 1: DC Overload susceptibility

A.2.6 (CY) 1

The test values are those given in section 2.6.

A.2.6 (GR) 1

For testing the series-connected TE, figure A.2.5 is used.

A.2.6 (E) 1

Direct current overload susceptibility
 (Remark to section A.2.6)

The feeding voltage V_f takes the value of 66 V. The feeding resistor R_f takes the value of 300 Ω . For series TE the output line terminals shall be left in open circuit.

This test shall be carried out before certain other tests (see section 10.1 (E) 1).

A.2.6 (E) 2

Direct current overload susceptibility (series)

The series TEUT is connected as shown in figure A.2.6 (E) 2.

The procedure of test in section A.2.6 with the remark in section A.2.6 (E) 1 is followed, where the load resistor R_L takes the value of 100 Ω .

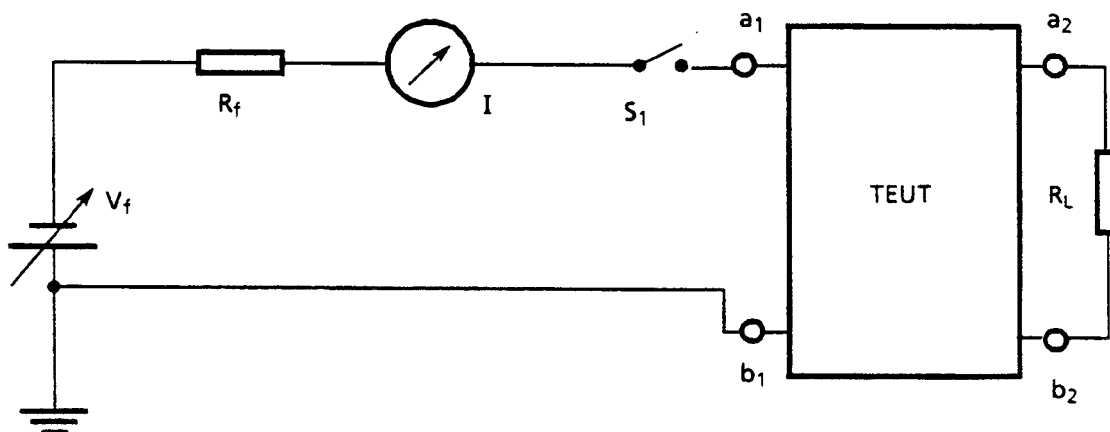
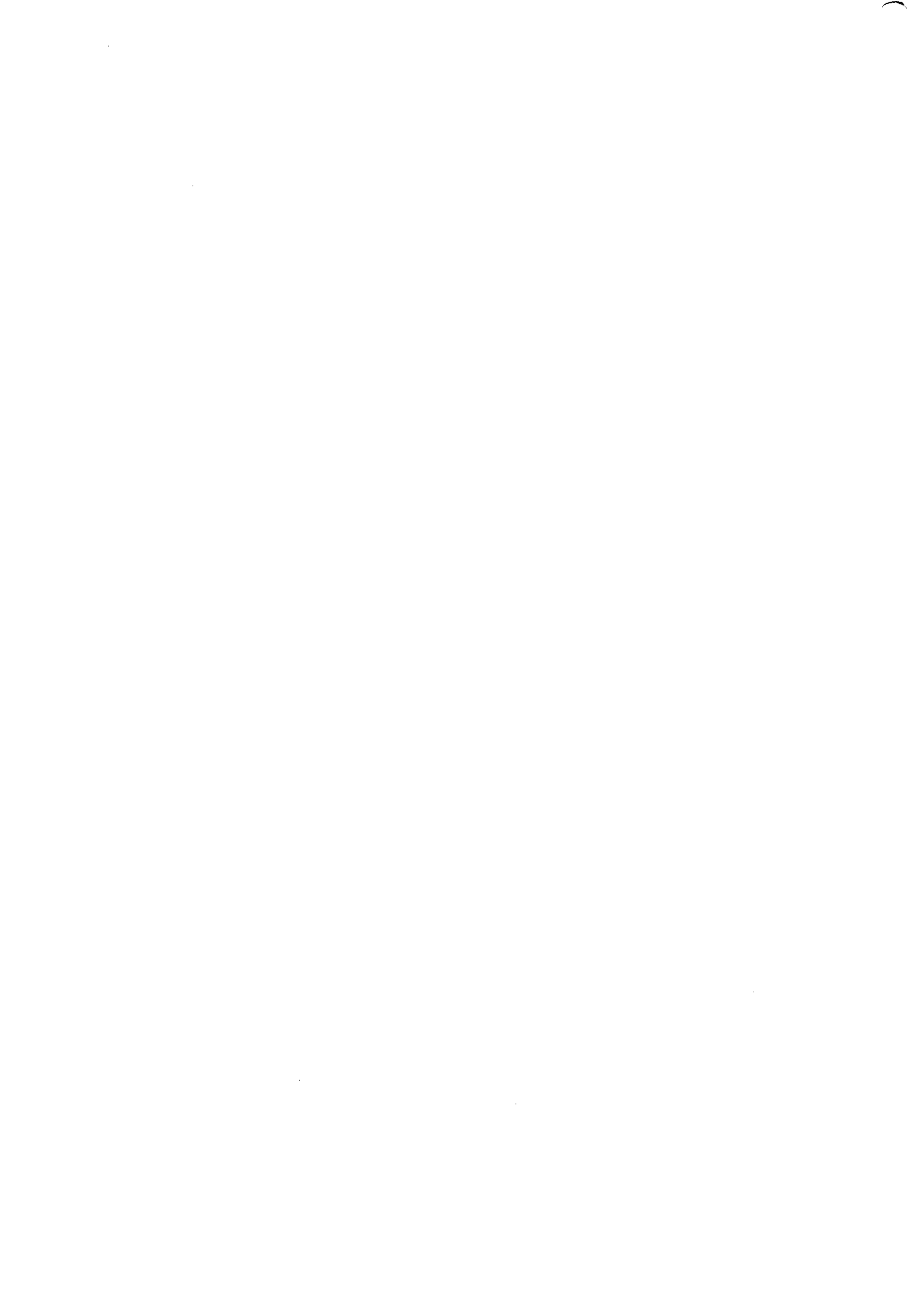
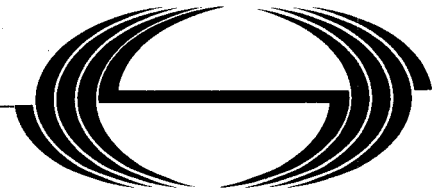


Figure A.2.6 (E) 2: DC overload susceptibility (series)

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**Attachments to Public Switched Telephone Network (PSTN);
General technical requirements for equipment connected to
an analogue subscriber interface in the PSTN**

Chapter 3: Ringing signal characteristics

(Candidate NET 4)

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Foreword

Chapter 3 of this European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI). The text of this ETS may be utilized, wholly or in part, for the establishment of NET 4.

For historical purposes, this ETS was drafted in the form of a NET. However, until a final decision to adopt this ETS as NET 4 has been agreed by the Technical Recommendations Application Committee (TRAC), the terms NET or NET 4 in this document should be read as ETS or ETS 300 001 respectively.

This ETS comprises ten chapters:

"Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

- Chapter 1 - General
- Chapter 2 - DC characteristics
- Chapter 3 - Ringing signal characteristics**
- Chapter 4 - Transmission characteristics
- Chapter 5 - Calling functions
- Chapter 6 - Answering function
- Chapter 7 - Power failure
- Chapter 8 - Connection methods
- Chapter 9 - Special functions
- Chapter 10 - Additional unclassified requirements

Refer to Chapter 1 (General) of this ETS for information on the structure and details of how to use this ETS. The national designations, used to identify national variations to requirements and tests within this ETS, are given in section 1.9 of Chapter 1 (page 60).

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3 Ringing signal characteristics

3.1 Input voltage-current characteristics

The TE shall be placed in the quiescent condition with its ringing detector (if provided) able to function. The ac voltage-current characteristics of the equipment, when measured at the line terminals shall be determined over a frequency range of from f_1 to f_2 , over an ac voltage range from V_{t1} to V_{t2} .

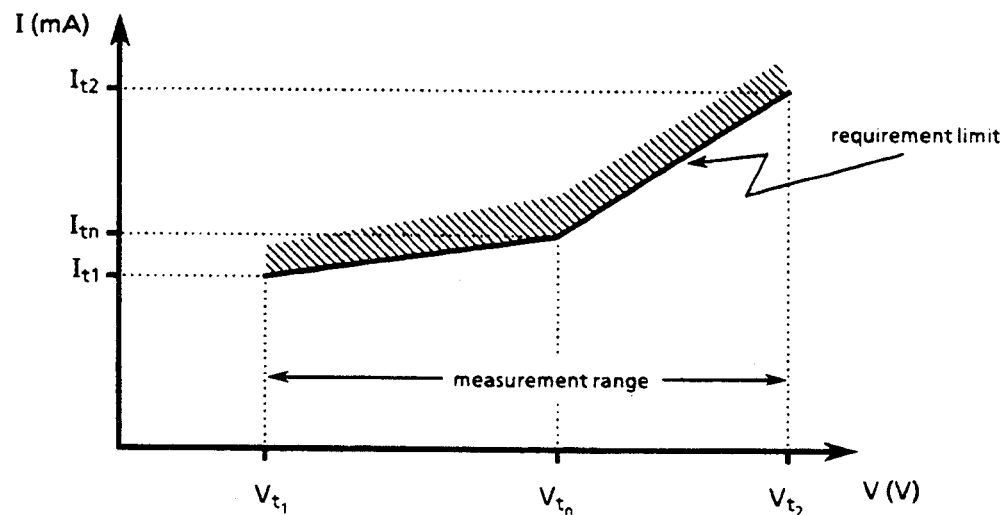


Figure 3.1: Voltage-current limits

The co-ordinates of the requirement limit for each of the requirements 3.1.1, 3.1.2. and 3.1.3 and their related frequency ranges are shown in tables 3.1.1, 3.1.2 and 3.1.3.

3.1 (GB) 1

Ringing signal input voltage-current characteristics.

Input voltage-current characteristics at ringing frequencies for TE in the quiescent state are not specified. Instead, this parameter is defined in terms of the concept of the "ringer equivalence number" (REN) of the TE; This is an approximate measure of the number of items of equipment that can be connected in parallel to the PSTN, the reference for a REN = 1 being a simulated ringing detector circuit consisting of an inductor of 55 H in series with a resistor of 7 kohms.

The maximum REN that can be assigned to a single PSTN line installation is 4; that is, the individual RENs of all items of TE connected to a single line, when added together, should not exceed 4.

The REN assigned to the TE when tested as described in A.3.1 (GB) 1 shall be not greater than the value marked on the TE. It is permissible for the REN marked on the TE to be a higher number than that determined for the TE in A.3.1 (GB) 1.

Where the TE is marked with a REN of 0 (zero), the test of A.3.1 (GB) 1 is not performed.

3.1 (GB) 2 For TE in the quiescent state, the additional capacitance between the "b wire" and the "shunt wire" (see 8.2 (GB) 1) shall be not greater than $(25 + \text{REN})$ nF where the value of REN is as marked on the TE. For the TE with a REN of 0 (zero), the capacitance between the "a wire" and "b wire" shall be less than 5 nF (see also 2.2.1 (GB) 1).

Compliance shall be checked by measurement of the capacitance over the frequency range 300 Hz to 3 400 Hz.

3.1 (GB) 3 For TE with an automatic answering function, the REN shall be equal to or less than 3.

3.1 (GB) 4 Where TE has a means of disabling the ringing detector, the REN assigned shall be the higher of the two values determined when the ringing detector is fully operational and when it is fully disabled.

A.3 Ringing signal characteristics

A.3.1 Input voltage-current characteristics

The TEUT is placed in the quiescent condition and is connected as shown in figure A.3.1. DC excitation from a source of value V_f via a series resistor of value R_f and ac excitation from a series-connected ac generator with an output rms voltage of value "e" are applied as shown in figure A.3.1 and V_t , I_t are measured. The ac generator shall be adjusted to produce an output at frequencies f_n or over a frequency range of from f_1 to f_2 .

Ammeter I_t and voltmeter V_t are true rms- indicating devices able to accept waveforms with a crest factor of at least 3:1 over a frequency range of at least f_a to f_b with a response of within 1 dB of the absolute value.

The test values for each of the tests A.3.1.1, A.3.1.2 and A.3.1.3 are as shown in the respective tables included in this paragraph.

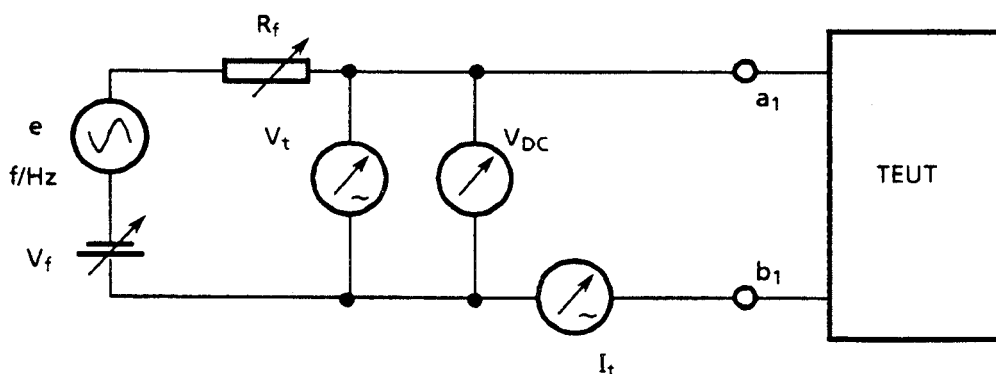


Figure A.3.1 - Input voltage-current characteristics

A.3.1 (GB) 1

- i) Determination of REN is based upon the characteristics of a dynamic impedance equivalent to the BT bell No 59D.

The TEUT is connected to the circuit shown in figure A.3.1 (GB) 1a. Two-wire connected TEs have no connection to the "shunt wire" terminal. For TE marked with a REN of 4, switch S is left open; for TE marked with a REN other than 4, switch S is closed.

The procedure given in figure A.3.1 (GB) 1b is followed. For TE with an audible ringing detector, the ringing detector shall be regarded as failing to comply with the relevant terminal requirements when the SPL measured as described in ii) below, falls below 65 dBA. For a non-audible ringing detector, it shall be regarded as failing to comply with the relevant terminal requirements when it no longer operates in the manner described in those terminal requirements.

- ii) A non-resonant hardwood surface of dimensions at least 1 m by 1 m is placed in an anechoic chamber or a suitable room in such a position that the TEUT, when placed on the surface, will be orientated as in normal use. Where a room other than an anechoic chamber is used, free field measurement conditions are established.

The TEUT is placed centrally on the surface.

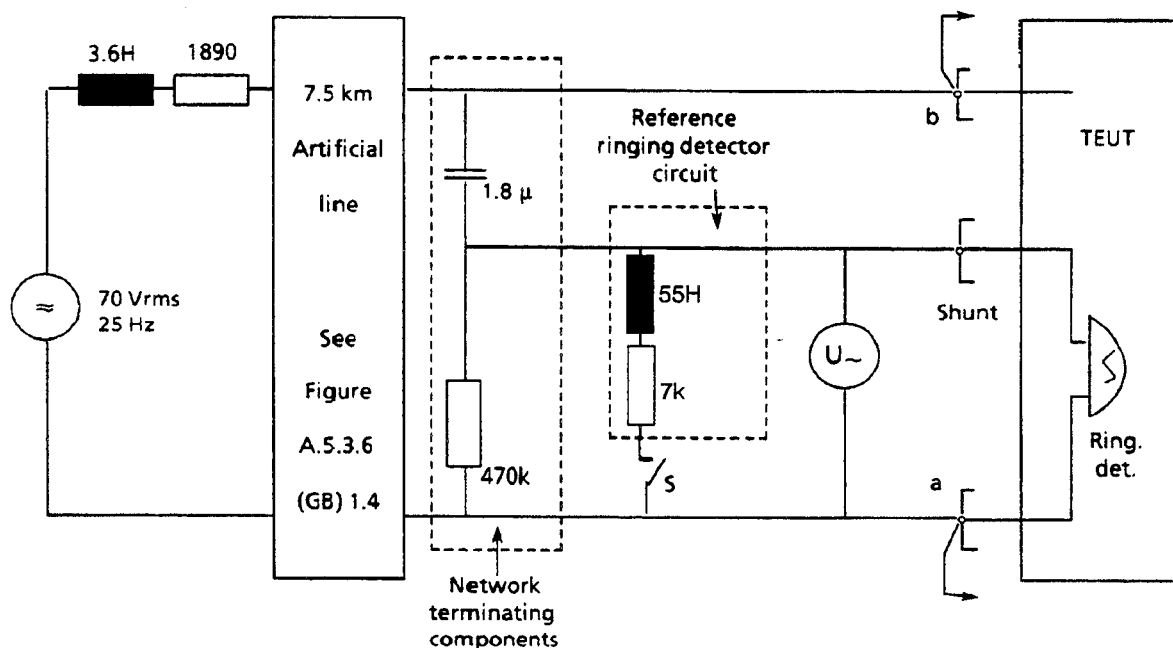
The TEUT is connected to the test circuit shown in Figure A.3.1 (GB) 1a.

The Sound Pressure Level (SPL) is measured at an elevation of 10° above the hardwood surface and at a distance of 1m from the centre of the TEUT at 10 equi-spaced measurement points.

The average A-weighted sound pressure level p (in dB relative to 20 μPa) is calculated using formula A.3.1 (GB) 1.

$$p = 10 \times \log_{10} \sum_{i=1}^{10} 10^{SPL_i / 10} \quad \text{Formula A.3.1 (GB) 1}$$

where SPL_i is the A-weighted sound pressure level of the i th measurement (in dB).

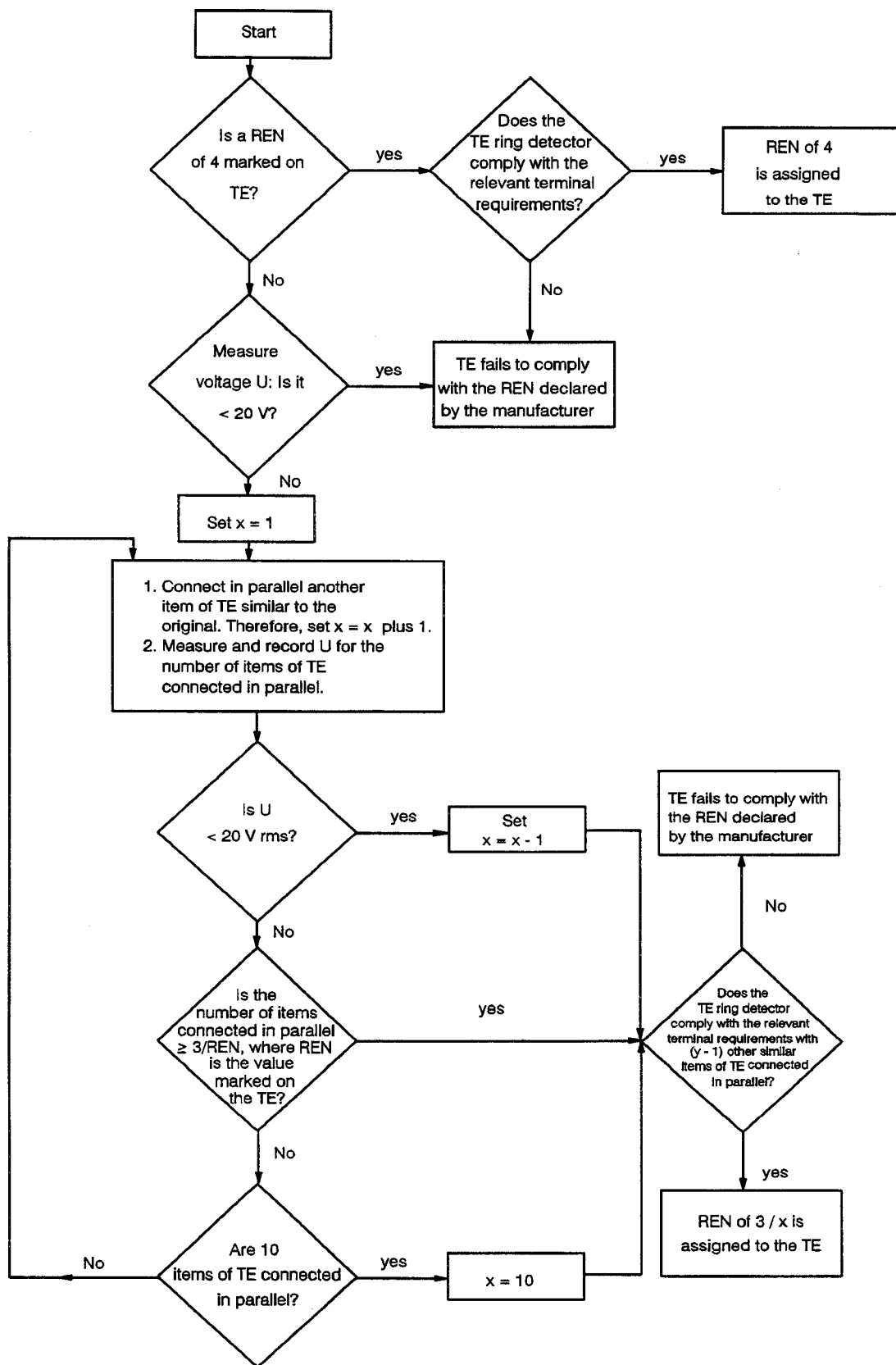


NOTE: See 8.2 (GB) 1.

Figure A.3.1 (GB) 1a: REN test circuit

The output of the generator is set to deliver a sine wave frequency of 25 Hz at 70 Vrms and a ringing sequence cadence of

- 0,4s ON
- 0,2s OFF
- 0,4s ON
- 2,0s OFF



NOTE: x is the number of items of TE under test.
y is the number of items under test at which U is measured to be a minimum, but ≥ 20 V rms.

Figure A.3.1 (GB) 1b: Procedure for assignment of REN

3.1.1 Ringing detectors producing electrical signals

For TE with ringing signal detection circuitry which generates electrical signals which indicate the presence of ringing signal, the location of any voltage-current point determined at any frequency of measurement shall lie below the limit shown in figure 3.1. Requirement values are shown in table 3.1.1.

Compliance shall be checked using the tests outlined in section A.3.1.1.

Table 3.1.1: Ringing detectors producing electrical signals (see figure 3.1)

COUNTRY	REQUIREMENT VALUES								Remarks
	f ₁ (Hz)	f ₂ (Hz)	V _{t1} (V)	V _{t2} (V)	V _{tn} (V)	I _{t1} (mA)	I _{t2} (mA)	I _{tn} (mA)	
Austria	50		60			3			yes
Belgium	23	27	20	90		2	9		yes
Cyprus	25		25	80		2	24		
Denmark									yes
Finland	25		35	75		5	10,7		
France	50		10	90		1	9		yes
Germany									yes
Greece	16	50	25	90		2,5	9		yes
Iceland	22	28	30	90		4	12		
Ireland									yes
Italy	20	50	20	80		5	20		yes
Luxembourg	25		25	120					
Malta									
Netherlands	23	27	25	90	(90 - 800 * I _{tn})				yes
Norway	25 ± 3	50 ± 5	28	90					yes
Portugal	15	55	30	120	80	not applic.	not applic.	not applic.	yes
Spain	20	30							yes
Sweden									yes
Switzerland	25 ± 3	50 ± 3	20	40	30				yes
U. Kingdom									not applicable yes

3.1.1 (A) 1

The values are for TE, where the ringing circuit is connected to the line in quiescent as well as in loop condition. The ringing circuit of the TE has to include a capacitance $\leq 0,47 \mu\text{F}$.

When the ringing circuit is connected only in quiescent condition to the line, the relevant values of section 3.1.2 must be fulfilled.

3.1.1 (B) 1

In the quiescent condition, the voltage to current ratio of the ringing detection device shall include in series capacitance of value C comprised between 0,3 microfarad and 1 microfarad. In case of PABX, this capacitance shall be comprised between 1 and 3 microfarads.

- | | | | |
|---------------------|-----------------------|--------------------------|--|
| 3.1.1 (DK) 1 | Frequency range | Voltage range | Limit points |
| | $f_1 = 20 \text{ Hz}$ | $V_{t1} = 0 \text{ V}$ | $V_{t1} = 0 \text{ V}$ $V_{tm} = 45 \text{ V}$ |
| | $f_2 = 30 \text{ Hz}$ | $V_{t2} = 120 \text{ V}$ | $I_1 = 0 \text{ mA}$ $I_m = 1,5 \text{ mA}$ |
| | $f_3 = 45 \text{ Hz}$ | | $V_{t2} = 120 \text{ V}$ |
| | $f_4 = 55 \text{ Hz}$ | | $I_2 = 12 \text{ mA}$ |
- 3.1.1 (F) 1** Applicable only to TE with ringing signal detection facilities which never takes energy from the ringing signal for internal purpose.
- 3.1.1 (F) 2** The equivalent capacitance across a_1 and b_1 shall be less than $1,2 \mu\text{F}$.
- 3.1.1 (D) 1** The impedance of the ringing detection circuitry or ringer, measured at 25 Hz, shall be within the limits of tolerance which are described by the following parameters:
- $C \geq 0,35 \mu\text{F}$ and $\leq 0,85 \mu\text{F}$
- $Z_{25 \text{ Hz}} \geq 8 \text{ k}\Omega$ and $\leq 25 \text{ k}\Omega$, real part $\geq 1,8 \text{ k}\Omega$
- $\tau = R \times C \leq 10 \text{ ms}$.
- 3.1.1 (GR) 1** The equivalent capacitance across a_1 and b_1 shall be: $C = 1 \pm 10\% \mu\text{F}$
- 3.1.1 (IRL) 1** In the quiescent state TE shall have an input impedance equivalent to either
- a) resistor of value between $1 \text{ k}\Omega$ and $60 \text{ k}\Omega$ in series with a capacitance of value $1,8 \mu\text{F} \pm 50\%$;
 - or
 - b) resistance of value between 900Ω and $20 \text{ k}\Omega$ in series with a positive inductance when tested with any voltage between 25 V and $75 V_{\text{rms}}$ at frequencies between 17 Hz and 25 Hz .
- 3.1.1 (I) 1** See Chapter (10.3) "Additional unclassified requirements".
- 3.1.1 (NL) 1** The magnitude of the voltage to current ratio V_{tn}/I_{tn} at 25 Hz shall be $\geq 3,5 \text{ k}\Omega$. The capacitive reactance component of the voltage to current ratio shall be $\leq 1,1 \mu\text{F}$. The actual values of the voltage to current ratio and the capacitive reactance component are used to determine the connection factor of the TE. For requirements and determination of the final connection factor, see the (NL) notes to section 2.2.1.
- 3.1.1 (N) 1** The impedance shall be $\leq 16 \text{ kohms}$. The capacitive part shall be $\leq 0,5 \mu\text{F}$.
- 3.1.1 (P) 1** TE shall have an input voltage to current ratio with a minimum real component (equivalent series resistance) and a maximum absolute value as specified in the table below.

Table 3.1.1 (P) 1a: Real component

	Voltages (rms)	$30 \text{ V} \leq V \leq 80 \text{ V}$	$80 \text{ V} < V \leq 120 \text{ V}$
Frequencies			
$15 \text{ Hz} \leq f \leq 30 \text{ Hz}$		$5 \text{ k}\Omega$	$4 \text{ k}\Omega$
$30 \text{ Hz} < f \leq 55 \text{ Hz}$		$4 \text{ k}\Omega$	$3 \text{ k}\Omega$

Table 3.1.1 (P) 1b: Absolute value

Frequencies	Voltages (rms)	$30\text{ V} \leq V \leq 80\text{ V}$	$80\text{ V} < V \leq 120\text{ V}$
	$15\text{ Hz} \leq f \leq 30\text{ Hz}$	8 k Ω	6 k Ω
	$30\text{ Hz} < f \leq 55\text{ Hz}$	6 k Ω	5 k Ω

3.1.1 (E) 1 (Requirement to be applied instead of section 3.1.1)

With TE in the quiescent condition, the value of the ratio between the applied voltage (in V) and the measured current (in mA) shall not be lower than

- a) 5 for TE in which the received ringing signal is directly converted to an acoustic signal;
- or
- b) 10 for TE with a ringing signal receiver-detector other than a direct converter;

tested with a ringing signal with open circuit $a_{c,rms}$ voltages from 35 V to 75 V and frequencies from 20 Hz to 30 Hz, simultaneously superimposed to a dc voltage of 48 V, applied between the line terminals through a resistor of 200 Ω .

Compliance shall be checked using the tests outlined in section A.3.1.1 (E) 1.

3.1.1 (S) 1 Voltage to current ratio in the idle state

The equipments voltage to current ratio in the idle state shall exceed the values in the table. The measuring voltage shall be superimposed on a dc voltage of up to 60 V.

The requirements shall be fulfilled when the TEUT line terminals are connected to a test system where the plus pole of the dc source is earthed and the ringing signal generator is connected to the minus pole of the dc source. The requirements shall be met independently of the dc polarity applied to the line terminals.

Table 3.1.1 (S) 1

Frequency (Hz)	Impedance kohm	Measuring voltage V_{rms}
25 ± 3	12 ¹⁾	30 - 50
25 ± 3	8 ¹⁾	50 - 90
50 ± 1	12 ¹⁾	30 - 50
50 ± 1	8 ¹⁾	50 - 90

¹⁾ Desired value 15 k Ω

3.1.1 (S) 2 For equivalent (lines) to which other TEs are not intended to be connected in parallel, the value shall be ≥ 8 kohms.

3.1.1 (CH) 1 In the quiescent state the impedance (calculated as a voltage, V_t , to current, I_t , ratio) of the TE, together with its ringing signal detection circuit

shall exceed the values given in table 3.1.1 (CH) 1. The applied test voltage is superimposed on a dc voltage of up to 57 V.

Table 3.1.1. (CH) 1

Test voltage V_t (rms)	20 - 40 V
Frequency	$\geq 8 \text{ k}\Omega$
25 \pm 3 Hz	
50 \pm 3 Hz	$\geq 8 \text{ k}\Omega$

It is desirable to have impedance values higher than 10 k Ω .

3.1.1 (GB) 1 See remarks 3.1 (GB) 1 to 4.

A.3.1.1 Ringing detectors producing electrical signals

The TEUT is connected as shown in figure A.3.1. Measurements are carried out at a limited number of values of ac and dc parameters shown in table A.3.1.1. Values of V_t and the corresponding values of I_t are noted and located within the figure 3.1 to determine compliance.

Table A.3.1.1: Ringing detectors producing electrical signals

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_f (Ω)	e (V)	V_t (Vrms)	
Austria	60	500	adjustable	60	
Belgium	48	1 000	75		
Cyprus	48	800	adjustable	25, 80	
Denmark					yes
Finland	48	800	not defined	35, 75	
France	54	300		10 to 90 (step: 10 V)	
Germany			adjustable	45	yes
Greece	60	500		25, 55, 75	
Iceland	48	800		30, 60, 90	
Ireland					yes
Italy	44, 48, 52	1 880, 1 100, 720	80		yes
Luxembourg	60	500	adjustable		
Malta					
Netherlands	66	800	90		yes
Norway	24, 60	1 200	adjustable	28, 90	yes
Portugal	48	500	30, 80, 120	not applicable	yes
Spain	48	200	35, 75		yes
Sweden				30, 50, 90	yes
Switzerland	57	600	adjustable	30	yes
U. Kingdom			not applicable		yes

A.3.1.1 (DK) 1 Feeding values cadence

$f = 25$ and 50 Hz $t_{on} < \infty$
 $V_f = 48$ V $t_{off} = 0$
 $R_f = 150 \Omega$
 $V_t = 45$ V and 120 V

A.3.1.1 (D) 1

Due to the partly considerable distortion of current in ringing signal detection facilities, the measurement of the impedance shall be based on a method which, per definition of impedance, evaluates the rms value for all measurement parameters.

The amount of impedance Z and phase angle Φ is calculated using the values of

- I = rms current
- P = effective power
- R = internal resistance of voltage path
- U = rms voltage
- Φ = phase angle

$$Z = \frac{U}{\sqrt{\left|\frac{U}{R}\right|^2 - 2\frac{P}{R} + I^2}} \quad \text{Formula A.3.1.1 (D) 1.a}$$

$$\Phi = \arctan \frac{\sqrt{I^2 - \left|\frac{P}{U}\right|^2}}{\frac{P}{U} - \frac{U}{R}} \quad \text{Formula A.3.1.1 (D) 1.b}$$

The TEUT is connected as shown in figure A.3.1.1 (D) 1

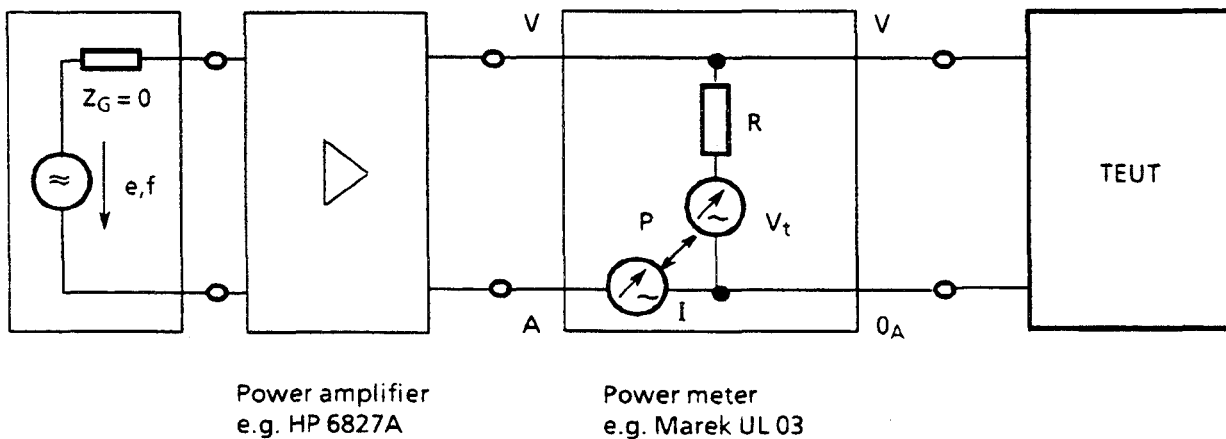


Figure A.3.1.1 (D) 1

A.3.1.1 (IRL) 1

Ringing frequency impedance

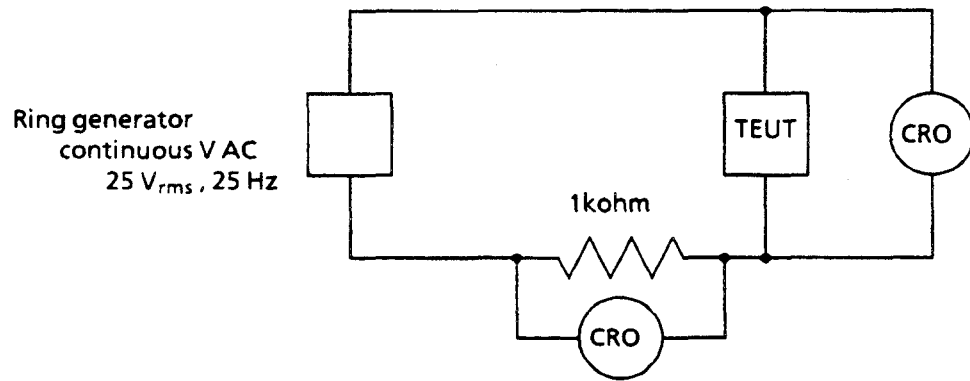


Figure A.3.1.1. (IRL) 1a

- a) Check visually where possible otherwise measure V, I and θ on scope at 25 Hz, with $V = 25 V_{rms}$
- b) X - Y Display Method

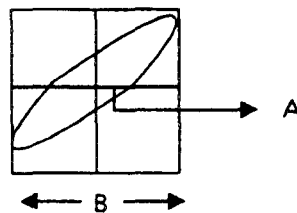


Figure A.3.1.1 (IRL) 1.b

$$|Z| = \frac{|V|}{|I|} \quad \theta = \sin^{-1} \frac{|A|}{|B|} \quad \text{Formula A.3.1.1 (IRL) 1.a}$$

From inspection, θ is normally positive, i.e., I leading V.

If, from inspection, circuit is simple R in series with C, calculate $|Z|$ and θ as a check at 25 Hz.

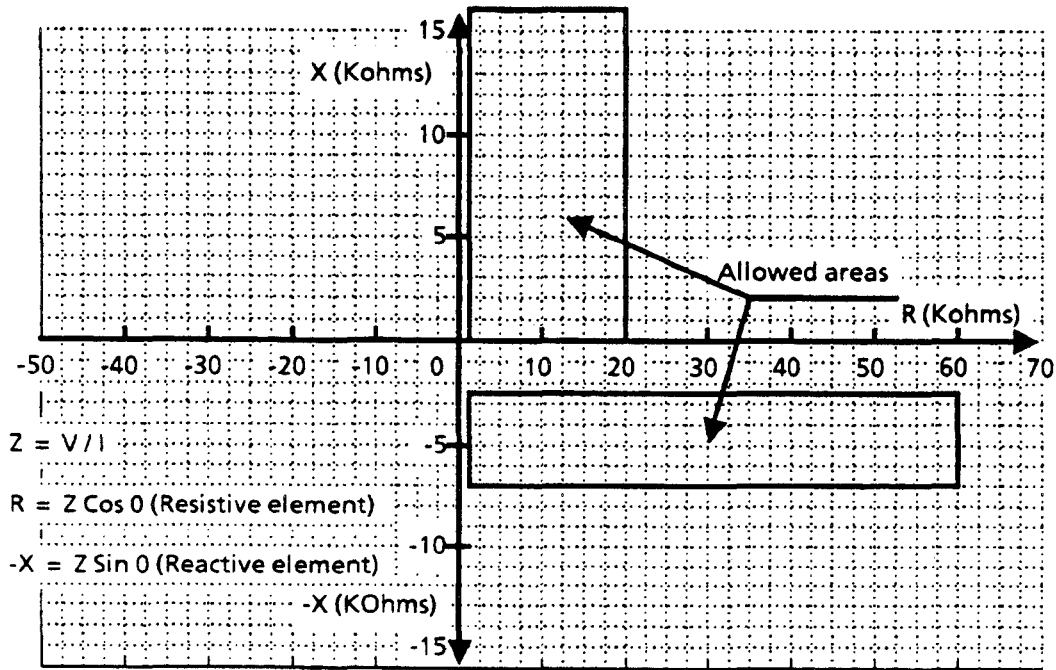
$$Z = \sqrt{R^2 + X_c^2} \quad \theta = \tan^{-1} \frac{|X_c|}{|R|} \quad \text{Formula A.3.1.1 (IRL) 1.b}$$

Plot $(|Z|, \theta)$ points on a graph of allowed area. Check its points lie in allowed area.

- c) Alternative Method

Display voltage and current waveforms simultaneously on scope and measure phase difference θ directly.

Tests to be carried out in both the power up and power down modes of the TEUT.



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Figure A.3.1.1 (IRL) 1c: Ringing impedance.

- A.3.1.1 (I) 1 See Chapter 10.3 "Additional unclassified requirements".
- A.3.1.1 (I) 2 The test is carried out with an on-off cadence timing of the ac generator e stated as follows:
 $t_{on} = 1 \text{ s}$ $t_{off} = 4 \text{ s}$
- A.3.1.1 (NL) 1 The value of V_t and the corresponding value of I_t at 25 Hz are noted. The magnitude of the voltage to current ratio is calculated to determine compliance and the connection factor.

The capacitive reactance component of the impedance is measured with an instrument for measuring capacities. The test voltage shall be between 25 V and 90 V.
- A.3.1.1 (N) 1 Four measurements are carried out with the following corresponding values:
 $90 V_{rms} / 60 \text{ V dc}$ with $f = 25$ and 50 Hz ;
 $V_{rms} / 24 \text{ V dc}$ with $f = 25$ and 50 Hz .
- A.3.1.1 (N) 2 The input impedance $|z|$ is determined as shown in figure A.3.1. The phase angle is measured with a single analyser connected as shown in figure A.3.1.1 (N) 1. The capacitance is then calculated from the formula $C = 1 / (2\pi f |z| \sin \alpha)$.

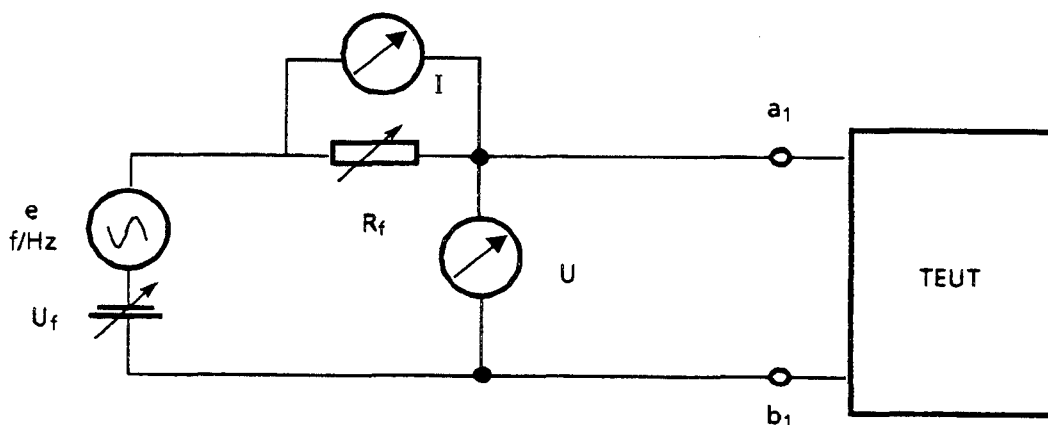


Figure A.3.1.1 (N) 1

A.3.1.1 (P) 1

The TEUT is connected as shown in figure A.3.1.1 (P) 1.

Measurements are carried out within the frequency band 15 Hz - 55 Hz. The input voltage to current ratio, in absolute value and real component, is checked with a FFT analyser with 800 lines and 2 channels.

The ac generator shall be adjusted to obtain in the voltmeter V_1 the values of 30 V, 80 V and 120 V_{rms} with the TEUT disconnected.

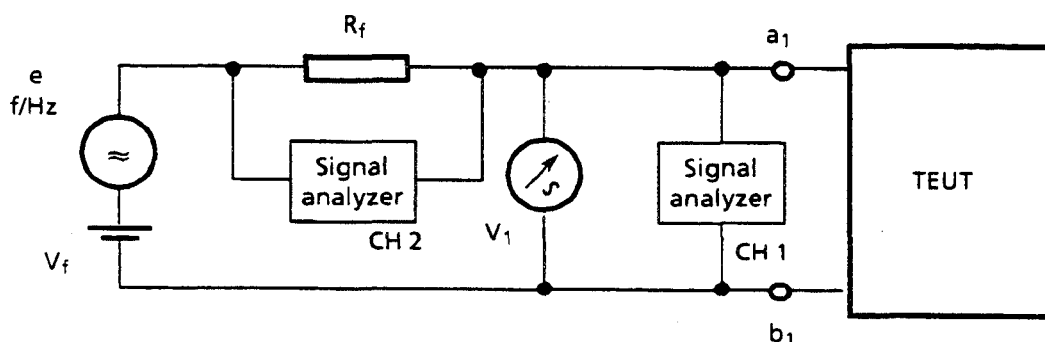


Figure A.3.1.1.(P) 1: Input voltage-current characteristics - Ringing detectors producing electrical signals

A.3.1.1 (E) 1

The procedure of test in sections A.3.1 (see also the provision in this section) and A.3.1.1 is followed, where the ac generator open circuits rms voltages (e) and frequencies (f) are indicated in table A.3.1.1 (E) 1.

The voltage current ratio (R, in thousands) is calculated using formula A.3.1.1.(E) 1, where V_t is the voltmeter (V_t) reading in volts and I_t is the ammeter (I_t) reading in milliamperes.

$$R (k) = \frac{V_t (V)}{I_t (mA)} \quad \text{Formula A.3.1.1 (E) 1}$$

PROVISION:

The ac voltmeters and the ac ammeters used in ringing signal characteristics testing, are true rms-indicating devices able to accept waveforms with a crest factor of at least 3:1 and with a reading accuracy over the required frequency range of at least three per cent or 0,5 dB for the readings in decibels.

Table A.3.1.1 (E) 1: Testing voltages and frequencies

e (V)	f (Hz)
35	20
35	25
35	30
75	20
75	25
75	30

A.3.1.1 (S) 1 Feeding conditions, see Swedish remark in Chapter 1, section 1.5.2.

A.3.1.1 (CH) 1 Test signal:

$$V_t = 30 \text{ V (applied continuously)}$$

$$f_1 = 25 \text{ Hz}$$

$$f_2 = 50 \text{ Hz}$$

In critical cases selective voltage and current measurements are taken.

The test can be carried out with $V_f = 0 \text{ V}$ and $R_f = 0 \Omega$ provided the absence of the dc power supply has a negligible influence on the voltage to current ratio.

A.3.1.1 (GB) 1 See remarks 3.1 (GB) 1 to 4.

3.1.2 Ringing detectors producing discernible signals.

For TE with ringers or with ring detection circuitry which produces directly a discernible signal (e.g. acoustical or visual signal) to indicate the presence of ringing signal, the location of any voltage-current point determined at any frequency of measurement shall lie below the limit shown in figure 3.1. Requirement values are shown in table 3.1.2.

Compliance shall be checked using the tests outlined in section A.3.1.2.

Table 3.1.2: Ringing detectors producing discernible signals

COUNTRY	REQUIREMENT VALUES									Remarks	
	f ₁ (Hz)	f ₂ (Hz)	V _{t1} (V)	V _{t2} (V)	V _{tn} (V)	I _{t1} (mA)	I _{t2} (mA)	I _{tn} (mA)			
Austria	50		18	60						yes	
Belgium	23	27	20	90		4	18			yes	
Cyprus	25		25	80		2	24				
Denmark										yes	
Finland	25		35	75		5	10,7				
France	50		10	90	30	2	30	6		yes	
Germany										yes	
Greece	16	50	25	90		2,5	9			yes	
Iceland	22	28	30	90		4	12				
Ireland										yes	
Italy	20	50	20	80		5	20			yes	
Luxembourg	25		25	120							
Malta											
Netherlands	23	27	25	90	(90 - 800 * I _{tn})					yes	
Norway	25 ± 3	50 ± 5	28	90						yes	
Portugal	15	55	30	120	80	not applic.	not applic.	not applic.		yes	
Spain	20	30								yes	
Sweden										yes	
Switzerland	25 ± 3	50 ± 3	20	40	30					yes	
U. Kingdom										not applicable	yes

3.1.2 (A) 1 Values for electronic sounders: I_{t1} = 2,5 - 3,6 mA, I_{t2} = 12 - 14 mA

Values for electromechanical sounders: V_{t1} = 60V, I_{t1} = 20 - 24 mA

3.1.2 (A) 2 The ringing circuit of the TE has to include a capacitor 1 μF 20%.

3.1.2 (B) 1 The remark in 3.1.1 is also applicable here in 3.1.2.

3.1.2 (DK) 1

Frequency range	Voltage range	Limit points
f ₁ = 20 Hz	V _{t1} = 0 V	V _{t1} = 0 V V _{tm} = 45 V
f ₂ = 30 Hz	V _{t2} = 120 V	I ₁ = 0 mA I _n = 5,625 mA
f ₃ = 45 Hz		V _{t2} = 120 V
f ₄ = 55 Hz		I ₂ = 24,375 mA

3.1.2 (DK) 2 In addition to the requirement in 3.1.2, the equipment must between the line terminals have an input impedance of which the real component at a 50 Hz ac voltage of 45 V, is not less than 4 kΩ.

3.1.2 (F) 1 Applicable only to TE with ringing signal detection facilities which take from the ringing signal the energy necessary to the working of the ringing device.

3.1.2 (F) 2 The ringing detector shall include in series a capacitor with a value less than $1,2 \mu\text{F}$.

3.1.2 (D) 1 The impedance of the ringing detection circuitry or ringer, measured at 25 Hz, shall be within the limits of tolerance which are described by the following parameters:

$$C \geq 0,35 \mu\text{F} \text{ and } \leq 0,85 \mu\text{F}$$

$$Z_{25\text{Hz}} \geq 8 \text{ k}\Omega \text{ and } \leq 25 \text{ k}\Omega, \text{ real part } \geq 1,8 \text{ k}\Omega$$

$$\tau = R \times C \leq 10 \text{ ms}$$

3.1.2 (GR) 1

a) For electromechanical systems only the values are:

f_1 (Hz)	f_2 (Hz)	V_{t1} (Vrms)	V_{t2} (Vrms)	I_{t1} (mA)	I_{t2} (mA)
16	50	25	90	7,1	25,7

b) The equivalent capacitance across a_1 and b_1 shall be $C = 1 \pm 10\% \mu\text{F}$.

3.1.2 (IRL) 1 In the quiescent state TE shall have an impedance equivalent to

a) a resistor of value between $1 \text{ k}\Omega$ and $60 \text{ k}\Omega$ in series with a capacitor of value $1,8 \mu\text{F} \pm 50\%$;

or

b) a resistance of value between 900Ω and $20 \text{ k}\Omega$ in series with a positive inductance;

when tested with any voltage between 25 V and $75 V_{\text{rms}}$ at frequencies between 17 Hz and 25 Hz.

3.1.2 (I) 1 See Chapter (10.3) "Additional unclassified requirements".

3.1.2 (NL) 1 The magnitude of the voltage to current ratio $V_{\text{tn}}/I_{\text{tn}}$ at 25 Hz shall be $\geq 3,5 \text{ k}\Omega$. The capacitive reactance component of the voltage to current ratio shall be $\leq 1,1 \mu\text{F}$. The actual values of the voltage to current ratio and the capacitive reactance component are used to determine the connection factor of the TE. For requirements and determination of the final connection factor, see the (NL) notes to section 2.2.1.

3.1.2 (N) 1 The impedance shall be $\geq 8 \text{ kohms}$. The capacitive part shall be $\leq 1,0 \mu\text{F}$.

3.1.2 (P) 1 TE shall have an input voltage to current ratio with a minimum real component (equivalent series resistance) and a minimum absolute value as specified in the table below.

Table 3.1.2 (P) 1.a: Real component

Frequencies \ Voltages (rms)	$30 \text{ V} \leq V \leq 80 \text{ V}$	$80 \text{ V} < V \leq 120 \text{ V}$
	$15 \text{ Hz} \leq f \leq 30 \text{ Hz}$	5 k Ω
$30 \text{ Hz} < f \leq 55 \text{ Hz}$	4 k Ω	3 k Ω

Table 3.1.2 (P) 1.b: Absolute value

Frequencies	Voltages (rms)	$30 \text{ V} \leq V \leq 80 \text{ V}$	$80 \text{ V} < V \leq 120 \text{ V}$
	$15 \text{ Hz} \leq f \leq 30 \text{ Hz}$	8 k Ω	6 k Ω
	$30 \text{ Hz} < f \leq 55 \text{ Hz}$	6 k Ω	5 k Ω

3.1.2 (P) 2 Single telephone sets with "low impedance ringers" shall have an input voltage to current ratio with a minimum real component (equivalent series resistance) of 1 k Ω and a minimum absolute value of 2 k Ω .

3.1.2 (E) 1 Requirement in section 3.1.1 (E) 1 shall be applied.

3.1.2 (S) 1 Voltage to current ratio in the idle state.

The equipments voltage to current ratio in the idle state shall exceed the values in the table. The measuring voltage shall be superimposed on a dc voltage of up to 60 V.

The requirements shall be fulfilled when the TEUT line terminals are connected to a test system where the plus pole of the dc source is earthed and the ringing signal generator is connected to the minus pole of the dc source. The requirements shall be met independently of the dc polarity applied to the line terminals.

Table 3.1.2 (S) 1

Frequency Hz	Voltage to current ratio k Ω	Measuring voltage V _{rms}
25 \pm 3	12 ¹⁾	30 - 50
25 \pm 3	8 ¹⁾	50 - 90
50 \pm 1	12 ¹⁾	30 - 50
50 \pm 1	8 ¹⁾	50 - 90

¹⁾ Desired value 15 k Ω

3.1.2 (S) 2 For equipment (lines) to which other TEs are not intended to be connected in parallel, the value shall be $\geq 8 \text{ k}\Omega$.

3.1.2 (CH) 1 In the quiescent state the impedance (calculated as a voltage; V_t , to current, I_t , ratio) of the TE, together with its ringing detection circuit, shall exceed the values given in table 3.1.2 (CH) 1. The applied test voltage is superimposed on a dc voltage of up to 57 V.

Table 3.1.2 (CH) 1

Ringer type	Tone ringer	Mechanical ringer
Test voltage V_t (rms)		20 - 40 V
Frequency		
25 ± 3 Hz	$\geq 8 \text{ k}\Omega$	$\geq 4 \text{ k}\Omega$
50 ± 3 Hz	$\geq 8 \text{ k}\Omega$	$\geq 4 \text{ k}\Omega$

In the frequency range 25 ± 3 Hz, impedance values higher than 10 k Ω are desirable for tone ringers.

3.1.2 (GB) 1 See remarks 3.1 (GB) 1 to 4.

A.3.1.2 Ringing detectors producing discernible signals.

The TEUT is connected as shown in figure A.3.1. Measurements are carried out at a limited number of values of ac and dc parameters shown in table A.3.1.2. Values of V_t and the corresponding values of I are noted and located within the figure 3.1 to determine compliance.

Table A.3.1.2: Ringing signal producing discernible signals

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_f (Ω)	e (V)	V_t (Vrms)	
Austria	60	500	adjustable	18, 60	yes
Belgium	48	1 000	75		
Cyprus	48	800	adjustable	25, 80	
Denmark					
Finland	48	800	not defined	35, 75	
France	54	300		10 to 90 (step: 10 V)	
Germany			adjustable	45	yes
Greece	60	500		25, 55, 75	
Iceland	48	800		30, 60, 90	
Ireland					yes
Italy	44, 48, 52	1 880, 1 100, 720	80		yes
Luxembourg	60	500	adjustable		
Malta					
Netherlands	66	800	90		yes
Norway	24, 60	1 200	adjustable	28, 90	yes
Portugal	48	500	30, 80, 120	not applicable	yes
Spain	48	200	35, 75		yes
Sweden				30, 50, 90	yes
Switzerland	57	600	adjustable	30	yes
U. Kingdom			not applicable		yes

A.3.1.2 (A) 1

For electromechanical sounders $V_t = 60 \text{ V}$

A.3.1.2 (DK) 1

Feeding values

Cadence

$f = 25 \text{ and } 50 \text{ Hz}$

$t_{\text{on}} < \infty$

$V_f = 48 \text{ V}$

$t_{\text{off}} = 0$

$R_f = 500 \Omega$

$V_t = 45 \text{ V and } 120 \text{ V}$

The TEUT is connected as shown in figure A.3.1.2 (DK) 1 and placed in the quiescent condition. voltmeter U_f is a selective voltmeter.

The real component of the input voltage to current ratio is determined from:

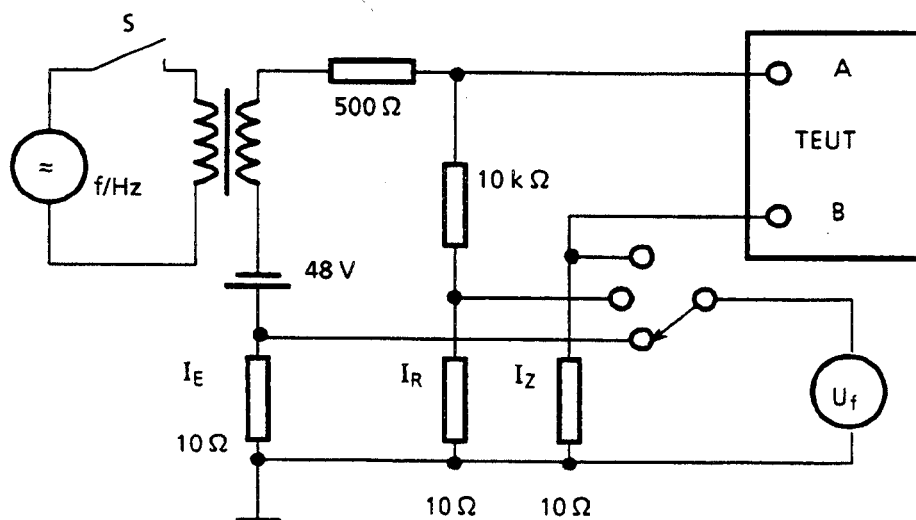


Figure A.3.1.2 (DK) 1

A.3.1.2 (D) 1

Due to the partly considerable distortion of current in ringing signal detection facilities, the measurement of the impedance shall be based on a method which, per definition of impedance, evaluates the rms value for all measurement parameters.

The amount of impedance Z and phase angle Φ is calculated using values of

I = rms current

P = effective power

R = internal resistance of voltage path

U = rms voltage

Φ = phase angle

$$Z = \frac{U}{\sqrt{\left|\frac{U}{R}\right|^2 - 2 \frac{P}{R} + I^2}} \quad \text{Formula A.3.1.2 (D) 1.a}$$

$$\Phi = \arctan \frac{\sqrt{\left|I^2 - \frac{P}{U}\right|^2}}{\frac{P}{U} - \frac{U}{R}} \quad \text{Formula A.3.1.2 (D) 1.b}$$

The TEUT is connected as shown in figure A.3.1.2 (D) 1.

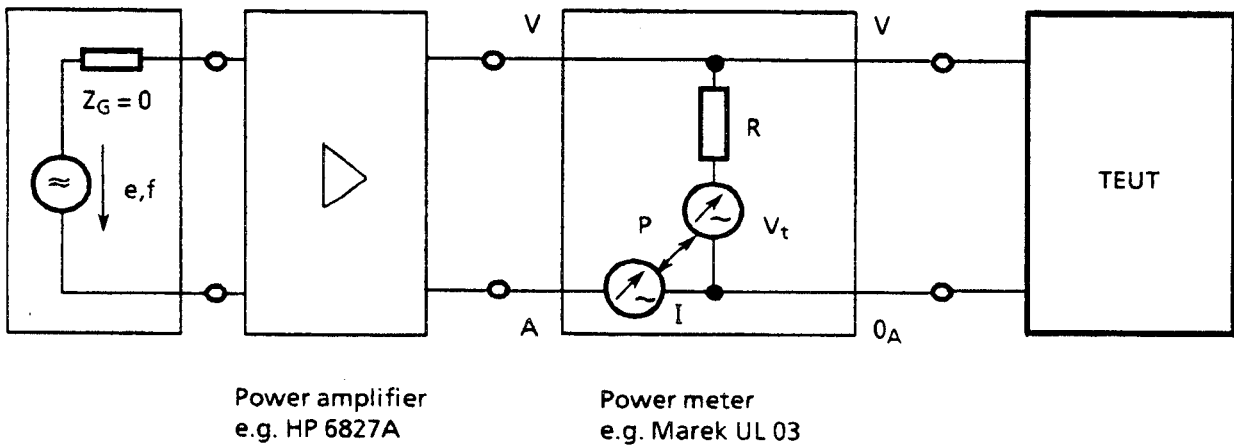


Figure A.3.1.2 (D) 1

A.3.1.2 (IRL) 1 Ringing frequency impedance

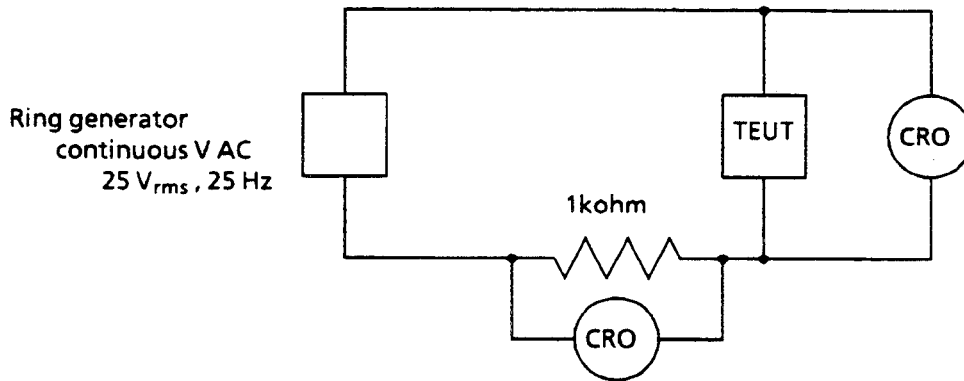
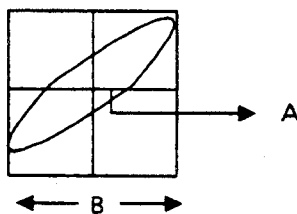


Figure A.3.1.2 (IRL) 1.a

- a) Check visually where possible otherwise measure V, I, and θ on scope at 25 Hz, with $V = 25 V_{rms}$
- b) X - Y Display Method



$$|Z| = \frac{|V|}{|I|} \quad \theta = \sin^{-1} \frac{|A|}{|B|} \quad \text{Formula A.3.1.2 (IRL) 1.a}$$

From inspection, θ is normally positive, i.e., I leading V.

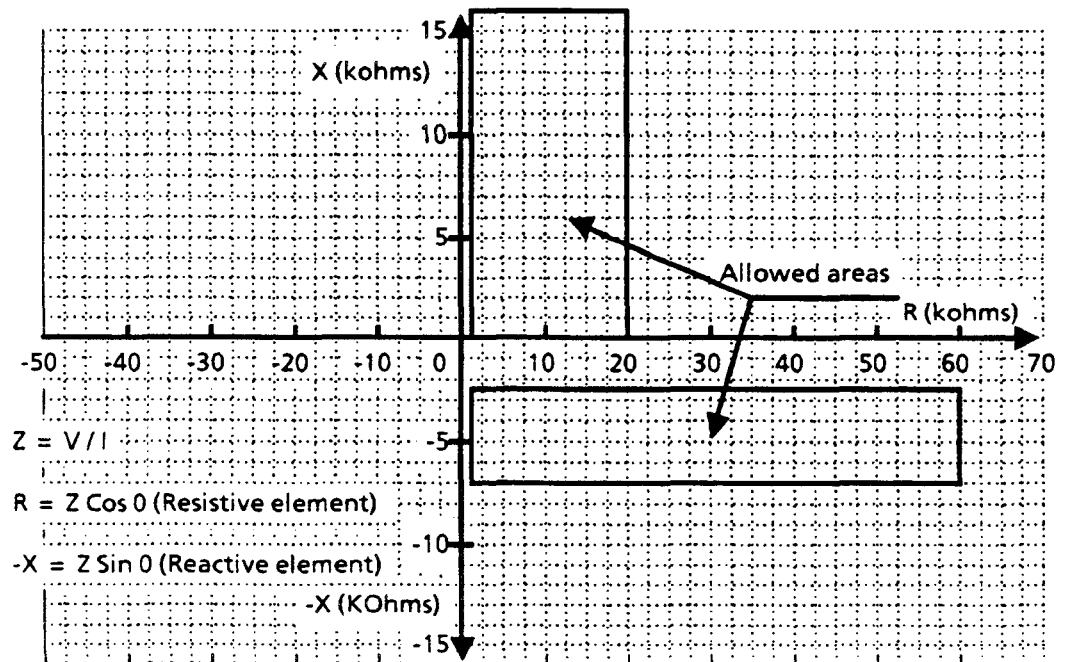
If, from inspection, circuit is simple R in series with C, calculate $|Z|$ and θ as a check at 25Hz.

$$Z = \sqrt{R^2 + X_c^2} \quad \theta = \tan^{-1} \frac{|X_c|}{|R|} \quad \text{Formula A.3.1.2 (IRL) 1.b}$$

c) Alternative Method

Display voltage and current waveforms simultaneously on scope and measure phase difference θ directly.

Tests to be carried out in both the power up and power down modes of the TEUT.



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Figure A.3.1.2 (IRL) 1c: Ringing impedance

- A.3.1.2 (I) 1 See chapter 10.3 "Additional unclassified requirements."
- A.3.1.2 (I) 2 The test is carried out with an on-off cadence timing of the ac generator "e" stated as follows:
 $t_{on} = 1 \text{ s} \quad t_{off} = 4 \text{ s}.$
- A.3.1.2 (NL) 1 The value of V_t and the corresponding value of I_t at 25 Hz are noted. The magnitude of the voltage ratio is calculated to determine compliance and the connection factor.

The capacitive reactance component of the impedance is measured with an instrument for measuring capacities. The test voltage is from 25 to 90 V.
- A.3.1.2 (N) 1 For measuring please refer to A.3.1.1 (N) 1 and 2.
- A.3.1.2 (P) 1 The TEUT is connected as shown in figure A.3.1.2 (P) 1.

Measurements are carried out within the frequency band 15 Hz - 55 Hz. The input voltage to current ratio, in absolute value and real component, is checked with a FFT analyser with 800 lines and 2 channels.

The ac generator shall be adjusted to obtain in the voltmeter V_1 the values of 30 V, 80 V and 120 V_{rms} with the TEUT disconnected.

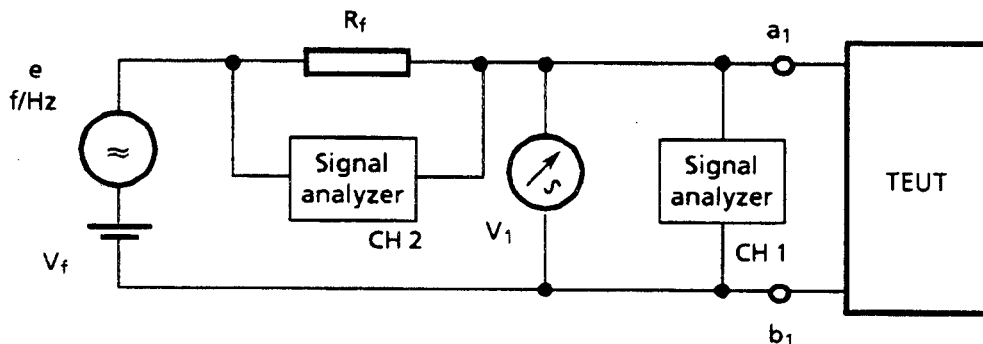


Figure A.3.1.2 (P) 1: Input voltage-current characteristics - Ringing detectors producing discernible signals

A.3.1.2 (E) 1 See the requirement in section 3.1.1 (E) 1 and its compliance test method in section A.3.1.1 (E) 1.

A.3.1.2 (S) 1 Feeding conditions, see Swedish remark in Chapter 1, section 1.5.2.

A.3.1.2 (CH) 1 Test signal

$$V_t = 30V \text{ (applied continuously)}$$

$$f_1 = 25 \text{ Hz}$$

$$f_2 = 50 \text{ Hz}$$

In critical cases selective voltage and current measurements are taken.

The test can be carried out with $V_f = 0 \text{ V}$ and $R_f = 0 \Omega$ provided the absence of the dc power supply has a negligible influence on the voltage to current ratio.

A.3.1.2 (GB) 1 See remarks 3.1 (GB) 1 to 4.

3.1.3 TE without ringing signal detection facilities

The location of any voltage-current point determined at any frequency of measurement shall lie below the limit shown in figure 3.1. Requirement values are shown in table 3.1.3.

Compliance shall be checked using the tests outlined in section A.3.1.3.

Table 3.1.3: TE without ringing signal detection facilities

COUNTRY	REQUIREMENT VALUES								Remarks
	f ₁ (Hz)	f ₂ (Hz)	V _{t1} (V)	V _{t2} (V)	V _{tn} (V)	I _{t1} (mA)	I _{t2} (mA)	I _{tn} (mA)	
Austria	50		60			3			
Belgium	23	27	20	90		2	9		yes
Cyprus	25		25	80		2	24		
Denmark									yes
Finland	25	35	75			5	10,7		
France	50		10	90		0,1	0,9		
Germany	not mandatory								
Greece	16	50	25	90		2,5	9		yes
Iceland	22	28	30	90		4	12		
Ireland									yes
Italy	not mandatory								
Luxembourg	25		25	120					
Malta									
Netherlands	23	27	25	90	(90 - 800 * I _{tn})				yes
Norway	25 ± 3	50 ± 5	28	90					yes
Portugal	15	55	30	120	80	not applic.	not applic.	not applic.	yes
Spain	20	30							yes
Sweden									yes
Switzerland	25 ± 3	50 ± 3	20	40	30				yes
U. Kingdom	not applicable								yes

3.1.3 (B) 1 The remark in 3.1.1 is also applicable here in 3.1.3.

3.1.3 (DK) 1 Frequency range Voltage range Limit points

f ₁ = 20 Hz	V _{t1} = 0 V	V _{t1} = 0 V	V _{tn} = 45 V
f ₂ = 30 Hz	V _{t2} = 120 V	I ₁ = 0 mA	I _n = 1,5mA
f ₃ = 45 Hz		V _{t2} = 120 V	
f ₄ = 55 Hz		I ₂ = 12mA	

3.1.3 (GR) 1 The equivalent capacitance across a₁ and b₁ shall be: C = 1 ± 10%µF.

3.1.3 (IRL) 1 In the quiescent state TE shall have an input impedance equivalent either to

- a) a resistor of value between 1 kΩ and 60 kΩ in series with a capacitor of value 1,8 µF ± 50%;
- or
- b) a resistance of value between 900 Ω and 20 kΩ in series with a positive inductance;

when tested with any voltage between 25 V and 75 Vrms at frequencies between 17 Hz and 25 Hz.

3.1.3 (NL) 1 The magnitude of the voltage to current ratio V_{tn}/I_{tn} at 25 Hz shall be $\geq 3,5 \text{ k}\Omega$. The capacitive reactance component of the voltage to current ratio shall be $\leq 1,1 \mu\text{F}$. The actual values of the voltage to current ratio and the capacitive reactance component are used to determine the connection factor of the TE. For requirements and determination of the final connection factor, see the (NL) notes to section 2.2.1.

3.1.3 (N) 1 The impedance shall be $\geq 16 \text{ kohms}$. The capacitive part shall be $\leq 0,5 \mu\text{F}$.

3.1.3 (P) 1 TE shall have an input voltage to current ratio with a minimum real component (equivalent series resistance) and a minimum absolute value as specified in the table below.

Table 3.1.3 (P) 1a: Real component

Frequencies	Voltages (rms)	
	$30 \text{ V} \leq V \leq 80 \text{ V}$	$80 \text{ V} < V \leq 120 \text{ V}$
$15 \text{ Hz} \leq f \leq 30 \text{ Hz}$	5 k Ω	4 k Ω
$30 \text{ Hz} < f \leq 55 \text{ Hz}$	4 k Ω	3 k Ω

Table 3.1.3 (P) 1b: Absolute value

Frequencies	Voltages (rms)	
	$30 \text{ V} \leq V \leq 80 \text{ V}$	$80 \text{ V} < V \leq 120 \text{ V}$
$15 \text{ Hz} \leq f \leq 30 \text{ Hz}$	8 k Ω	6 k Ω
$30 \text{ Hz} < f \leq 55 \text{ Hz}$	6 k Ω	5 k Ω

3.1.3 (E) 1 (Requirement to be applied instead of section 3.1.3)

When the TE without any kind of ringing signal receiver-detector is in the quiescent condition, the value of the ratio between the applied voltage (in V) and the measured current (in mA) shall not be lower than 30, tested with a ringing signal with open circuit $a_{c_{rms}}$ voltages from 35 V to 75 V and frequencies from 20 Hz to 30 Hz, simultaneously superimposed to a dc voltage of 48 V, applied between the line terminals through a resistor of 200 Ω .

Compliance shall be checked using the tests outlined in section A.3.1.3 (E) 1.

3.1.3 (S) 1 Voltage to current ratio in the idle state.

The equipments voltage to current ratio in the idle state shall exceed the values in the table. The measuring voltage shall be superimposed on a dc voltage of up to 60 V.

The requirements shall be fulfilled when the TEUT line terminals are connected to a test system where the plus pole of the dc source is earthed and the ringing signal generator is connected to the minus pole of the dc source. The requirements shall be met independently of the dc polarity applied to the line terminals.

Table 3.1.3 (S) 1

Frequency (Hz)	Voltage to current ratio k Ω	Measuring voltage V _{rms}
25 \pm 3	12 ¹⁾	30 - 50
25 \pm 3	8 ¹⁾	50 - 90
50 \pm 1	12 ¹⁾	30 - 50
50 \pm 1	8 ¹⁾	50 - 90

¹⁾ Desired value 15 kohms.

3.1.3 (S) 2 For equipment (lines) to which other TEs are not intended to be connected in parallel, the value shall be ≥ 8 k Ω .

3.1.3 (CH) 1 In the quiescent state, the TE without a ringing signal detector shall have a voltage to current ratio of ≥ 20 k Ω in the frequency range 21 - 55 Hz for an ac voltage of up to 40 V, superimposed on a dc voltage of up to 57 V.

3.1.3 (GB) 1 See remarks 3.1 (GB) 1 to 4.

A.3.1.3 TE without ringing signal detection facilities

TEUT is connected as shown in figure A.3.1. Measurements are carried out at a limited number of values of ac and dc parameters shown in table A.3.1.3. Values of V_t and the corresponding values of I are noted and located within the figure 3.1 to determine compliance.

Table A.3.1.3: TE without ringing signal detection facilities.

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_f (Ω)	e (V)	V_t (Vrms)	
Austria	60	500	adjustable	60	
Belgium	48	1 000	75		
Cyprus	48	800	adjustable	25, 80	
Denmark					yes
Finland	48	800	not defined	35, 75	
France	54	300		90	
Germany	not mandatory				
Greece	60	500		25, 55, 75	
Iceland	48	800		30, 60, 90	
Ireland					yes
Italy	not mandatory				yes
Luxembourg	60	500	adjustable		
Malta					
Netherlands	66	800	90		yes
Norway	24, 60	1 200	adjustable	28, 90	yes
Portugal	48	500	30, 80, 120	not applicable	yes
Spain	48	200	35, 75		yes
Sweden				30, 50, 90	yes
Switzerland	57	600	adjustable	30	yes
U. Kingdom	not applicable				yes

A.3.1.3 (DK) 1 Feeding values cadence

$$\begin{aligned}
 f &= 25 \text{ and } 50 \text{ Hz} & t_{\text{on}} &< \infty \\
 V_f &= 48 \text{ V} & t_{\text{off}} &= 0 \\
 R_f &= 150 \Omega \\
 V_t &= 45 \text{ V and } 120 \text{ V}
 \end{aligned}$$

A.3.1.3 (IRL) 1 Ringing frequency impedance

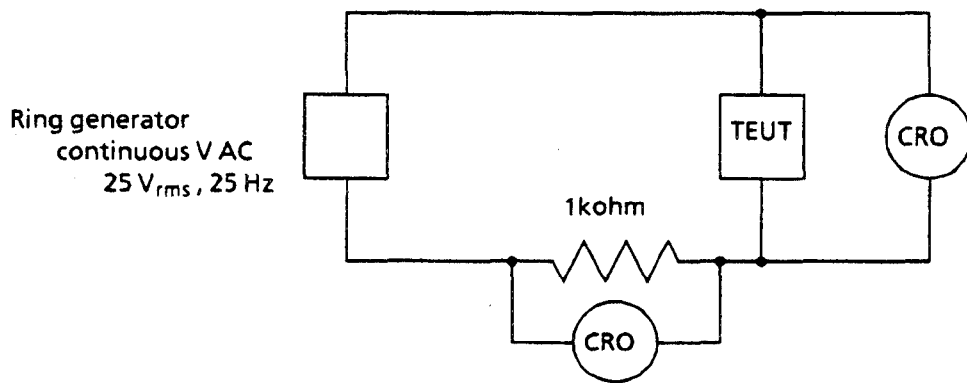


Figure A.3.1.3 (IRL) 1a

- a) Check visually where possible otherwise measure V, I and θ on scope at 25 Hz, with $V = 25 V_{rms}$
- b) X-Y Display Method

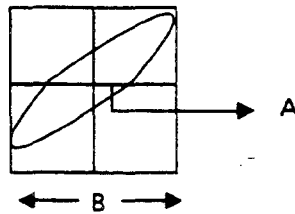


Figure A.3.1.3 (IRL) 1.b

$$|Z| = \frac{|V|}{|I|} \quad \theta = \sin^{-1} \frac{|A|}{|B|} \quad \text{Formula A.3.1.3 (IRL) 1.a}$$

From inspection, θ is normally positive, i.e., I leading V.

If, from inspection, circuit is simple R in series with C, calculate $|Z|$ and θ as a check at 25 Hz.

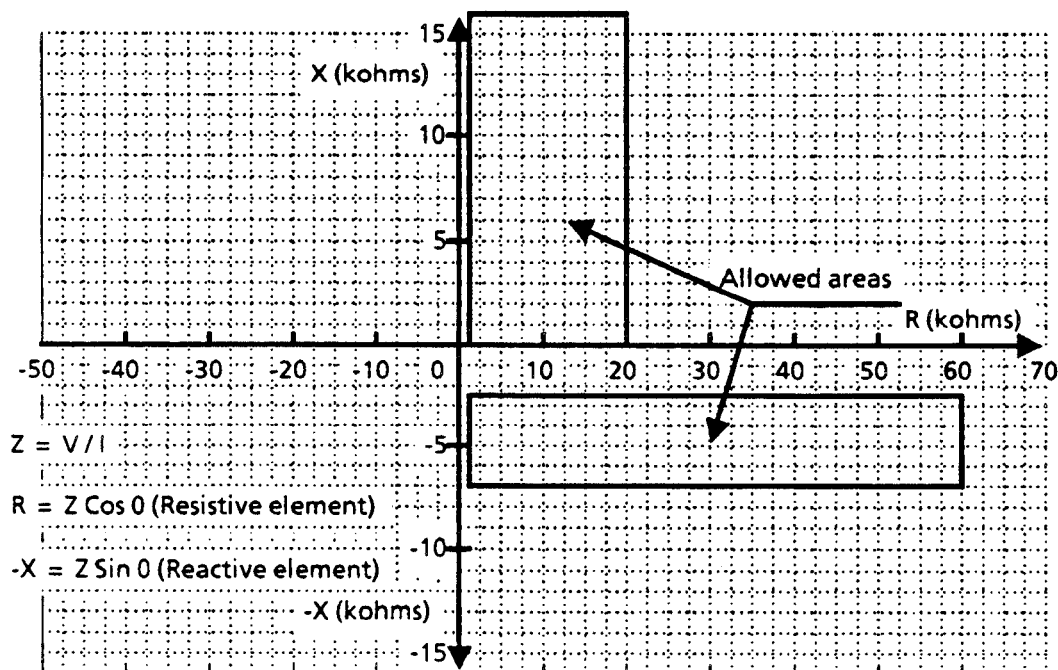
$$Z = \sqrt{R^2 + X_c^2} \quad \theta = \tan^{-1} \frac{|X_c|}{|R|} \quad \text{Formula A.3.1.3 (IRL) 1.b}$$

Plot $(|Z|, \theta)$ points on a graph of allowed area. Check it points lie in allowed area.

- c) Alternative method

Display voltage and current waveforms simultaneously on scope and measure phase difference θ directly.

Tests to be carried out in both the power up and power down modes of the TEUT.



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Figure A.3.1.3 (IRL) 1.c: Ringing impedance

- A.3.1.3 (I) 1** See Chapter 10.3 "Additional unclassified requirements".
- A.3.1.3 (I) 2** The test is carried out with an on-off cadence timing of the generator e stated as follows:
- $t_{on} = 1 \text{ s}$ $t_{off} = 4 \text{ s}$
- A.3.1.3 (NL) 1** The value of V_t and the corresponding value of I_t at 25 Hz are noted. The magnitude of the voltage to current ratio is calculated to determine compliance and the connection factor.
- The capacitive reactance component of the impedance is measured with an instrument for measuring capacities. The test voltage is from 25 to 90 V.
- A.3.1.3 (N) 1** For measuring please refer to A.3.1.1 (N) 1 and 2.
- A.3.1.3 (P) 1** The TEUT is connected as shown in figure A.3.1.2 (P) 1.
- Measurements are carried out within the frequency band 15 Hz - 55 Hz. The input voltage to current ratio, in absolute value and real component, is checked with a FFT analyser with 800 lines and 2 channels.
- The ac generator shall be adjusted to obtain in the voltmeter V_1 the values of 30 V, 80 V and 120 V_{rms} with the TEUT disconnected.

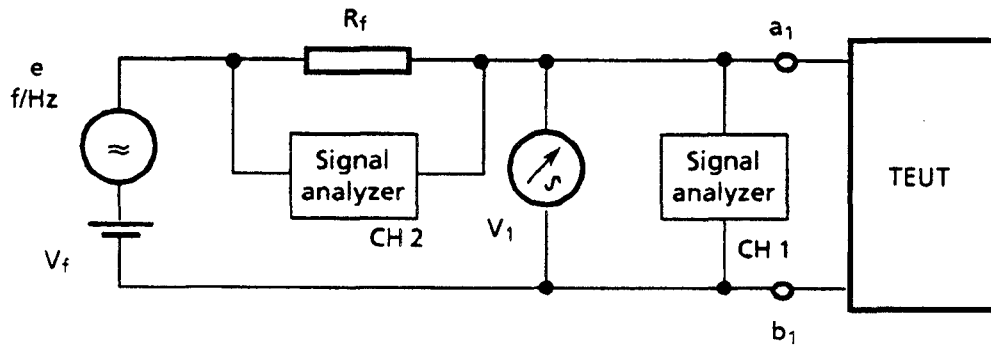


Figure A.3.1.3 (P) 1: Input voltage- current characteristics - TE without ringing signal detection facilities

A.3.1.3 (E) 1 The procedure of test in section A.3.1.1 (E) 1 is followed.

A.3.1.3 (S) 1 Feeding conditions, see Swedish remark in Chapter 1, section 1.5.2.

A.3.1.3 (CH) 1 Test signal:

$V_t = 30 \text{ V}$ (applied continuously)
 $f_1 = 25 \text{ Hz}$
 $f_2 = 50 \text{ Hz}$

In critical cases selective voltage and current measurements are taken.

The test can be carried out with $V_f = 0 \text{ V}$ and $R_f = 0 \Omega$ provided the absence of the dc power supply has a negligible influence on the voltage to current ratio.

A.3.1.3 (GB) 1 See remarks 3.1 (GB) 1 to 4.

3.2 Overload susceptibility

The TEUT shall be capable of withstanding a simultaneous continuous application at its line terminals of a dc feeding voltage V_f and ringing excitation "e" via a series-connected resistor R_f during a period in which the equipment is initially in a quiescent condition, is then caused to assume a loop condition, and is subsequently maintained in that loop condition as shown in figure 3.2.

This requirement shall be met at a number of ringing excitation frequencies, f_n , with a ringing cadence t_{on}/t_{off} .

Following these tests, the TEUT shall comply with all other requirements in this document.

Requirement parameter values are shown in table 3.2.

Compliance shall be checked using the test outlined in section A.3.2.

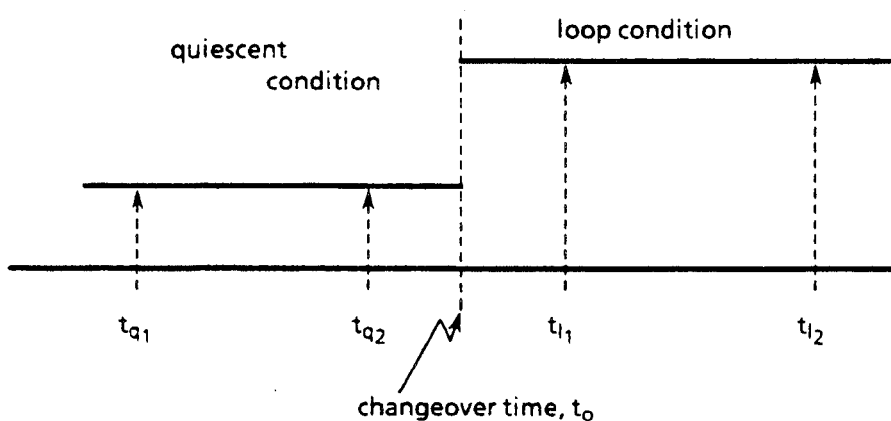


Figure 3.2: Overload susceptibility

Table 3.2.a: Overload susceptibility

COUNTRY	REQUIREMENT VALUES						
	e (V)	V _f (V)	R _f (Ω)	f ₁ (Hz)	f ₂ (Hz)	t _{on} (s)	t _{off} (s)
Austria	not mandatory						
Belgium	130	60	400	25	-	∞	0
Cyprus	not mandatory						
Denmark	130	56	150	25	50	1,3	60
Finland	not mandatory						
France	not mandatory						
Germany	110	0	0	50	0	∞	0
Greece	135	66	500	25	50	∞	0
Iceland	not mandatory						
Ireland		48	1 200	17	25	2	0
Italy	80	48	400	25		∞	0
Luxembourg	not mandatory						
Malta	not mandatory						
Netherlands	90	66	800	25		60	∞
Norway	not mandatory						
Portugal	120	55	500	15	30	∞	0
Spain	90	56	300	25	N/A	∞	0
Sweden	not mandatory						
Switzerland		57	600	25			
U. Kingdom	not mandatory						

Table 3.2.b: Overload periods

COUNTRY	REQUIREMENT VALUES				Remarks
	$t_{q1} - t_{q1}$	$t_0 - t_{q2}$	$t_{11} - t_0$	$t_{12} - t_{11}$	
Austria					
Belgium	60 s	not applicable	not applicable	1 s	
Cyprus			not mandatory		
Denmark			not mandatory		yes
Finland			not mandatory		
France			not mandatory		
Germany	15 s	not applicable	not applicable	not applicable	yes
Greece	1 min.	1 s \geq	1 s \geq	2 s	
Iceland			not mandatory		
Ireland			25		
Italy	60 s	0,1 s	0,1 s	1 s	
Luxembourg					
Malta					
Netherlands	60 s				
Norway			not mandatory		
Portugal	not applicable	not applicable	1 300 ms	not applicable	
Spain	0 s	8,5 s	1,5 s	0 s	yes
Sweden			not mandatory		
Switzerland					yes
U. Kingdom			not mandatory		

3.2 (DK) 1

A TE shall be able, without causing any secondary damage, to withstand the energy supplied to it.

3.2 (D) 1

During this test the ringing detection circuitry or ringer shall operate reliably.

3.2 (E) 1

The dc and ac voltage values are considered in open circuit.

Compliance shall be checked using the tests outlined in section A.3.2 (E) 1.

3.2 (E) 2

Ringling signal overload susceptibility (series)

(Requirement to be applied in addition to sections 3.2 and 3.2 (E) 1, for series TEs).

With series TE in the quiescent condition, it shall be capable of withstanding, without damage, a ringing signal with an open circuit ac rms voltage of 90 V and frequency of 25 Hz, simultaneously superimposed to a dc voltage of 56 V, applied between the line input terminals through a resistor of 300 Ω for a period of 10 seconds, when a resistor of 1 k Ω in series with a capacitor of 4 μ F are always connected to the line output terminals and a resistor of 200 Ω is also connected to the line output terminals just before the last 1,5 seconds.

Compliance shall be checked using the tests outlined in section A.3.2 (E) 1.

3.2 (CH) 1

Ringing applied to a TE in the loop state:

The TE (excluding telephone sets) shall withstand the superposition of the 25 Hz*) ringing current with the maximum supply current (power supply: 57 V dc, 600 Ω) without damage. The same applies for a tone signal of 3 V_{eff} intended for producing a howling effect at the TE.

*) The 25 Hz ringing current generator shall supply a constant current of 80 mA whereby the terminal voltage should not exceed 90 V.

The combined dc and ac signals are applied for 300 s.

For telephone sets, the dc power supply is applied continuously and the ringing signal is repeated 20 times (1 s ring, 4 s pause).

3.2 (CH) 2

Ringing applied to a series connection of other equipment with a TE:

In this case, the TE is replaced with a 300 Ω resistor and the requirements of paragraph 3.2 (CH) 1 apply for the equipment connected in series.

3.2 (CH) 3

The overload susceptibility requirements have to be co-ordinated with all the relevant safety and protection standards.

A.3.2 Overload susceptibility

The TEUT is connected as shown in figure A.3.2.

The ac generator and dc source are adjusted so that the values specified in table 3.2 to be reached. The TEUT is caused to assume the state or states specified in table 3.2 and switch S is closed for the periods relevant to the states to be tested with the duration or durations specified in table A.3.2 (see figure A.3.2).

NOTE: This test may be carried out before other tests in this document are undertaken!

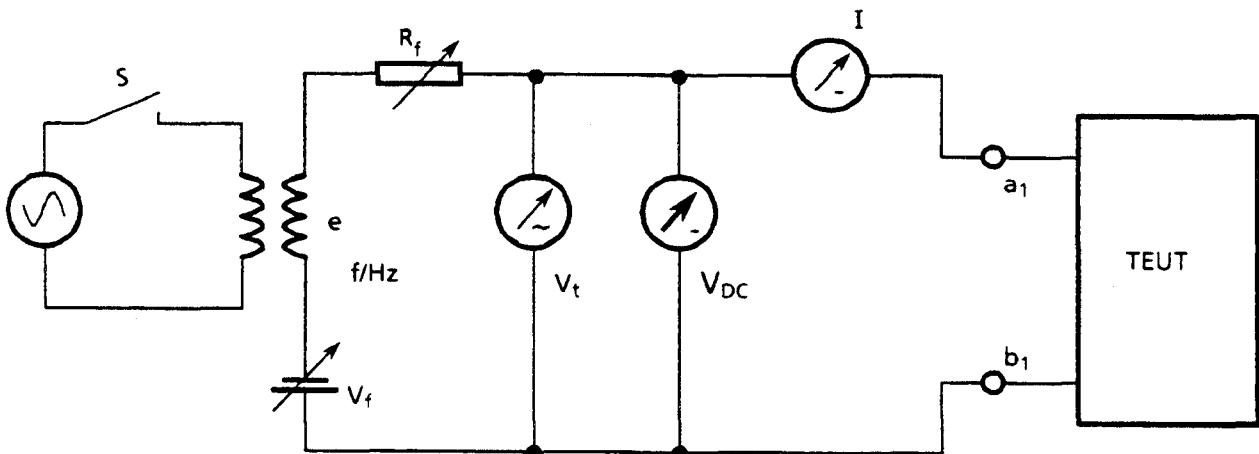


Figure A.3.2: Overload susceptibility

Table A.3.2: Overload susceptibility (see figure A.3.2)

COUNTRY	TEST VALUES					Remarks
	V_f (V)	R_f (Ω)	e (V)	S_{closed} (s)	S_{open} (s)	
Austria	not mandatory					
Belgium	60	400	130			yes
Cyprus	not mandatory					
Denmark	56	150	130	1,3	60	yes
Finland	not mandatory					
France	not mandatory					
Germany	0	0	110	15	0	
Greece	66	500	135			
Iceland	not mandatory					
Ireland	48	1 200	75	2	0	
Italy	48	400	80	1	60	yes
Luxembourg	not mandatory					
Malta						
Netherlands	66	800	90	60	∞	yes
Norway	not mandatory					
Portugal	55	500	120	1,3		
Spain	56	300	90			yes
Sweden	not mandatory					
Switzerland	57	600			1 x 300 on	yes
U. Kingdom	not mandatory					

A.3.2 (B) 1

The switch S is closed only during the periods ($t_{q2} - t_{q1}$) and ($t_{i2} - t_{i1}$) as specified in table 3.2.

A.3.2 (DK) 1

Test principle. The test principle is shown in figure A.3.2 (DK) 1.

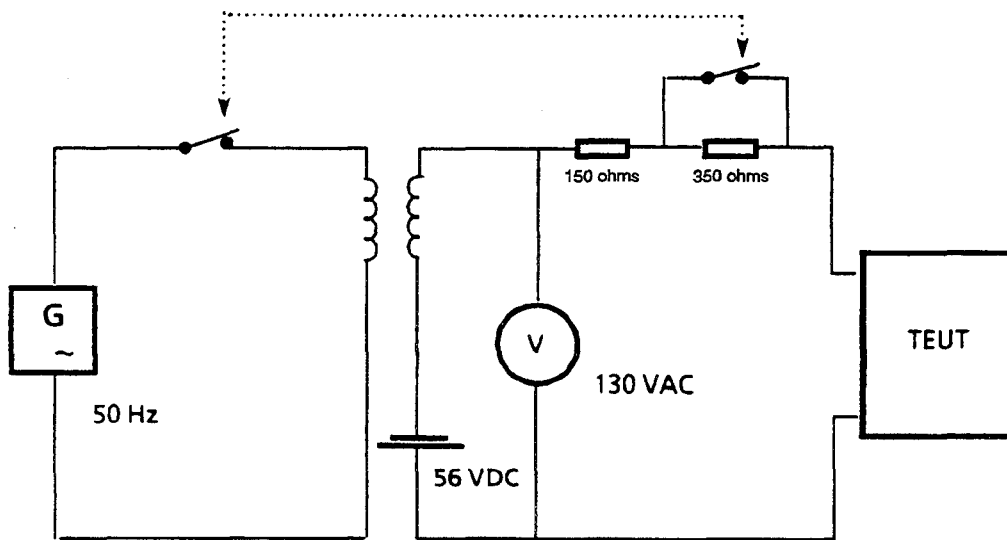


Figure A.3.2 (DK) 1

A.3.2 (I) 1 Twice, with 1 minute pause and reverse polarity voltage.

A.3.2 (NL) 1 Measurement with $f = 25$ Hz.

A.3.2 (E) 1 The TEUT is connected as shown in figure A.3.2 (E) 1 and placed in its quiescent condition, where the switch (S_1) is closed for 10 seconds and the feeling values (V_f , R_f , and e) are indicated in table A.3.2.

The test procedure is followed as stipulated in the requirements in sections 3.2 and 3.2 (E) 1.

PROVISION 1: See the provision in section A.3.1.1 (E) 1.

PROVISION 2: This test shall be carried out before certain other tests (see section 10.1 (E) 1)

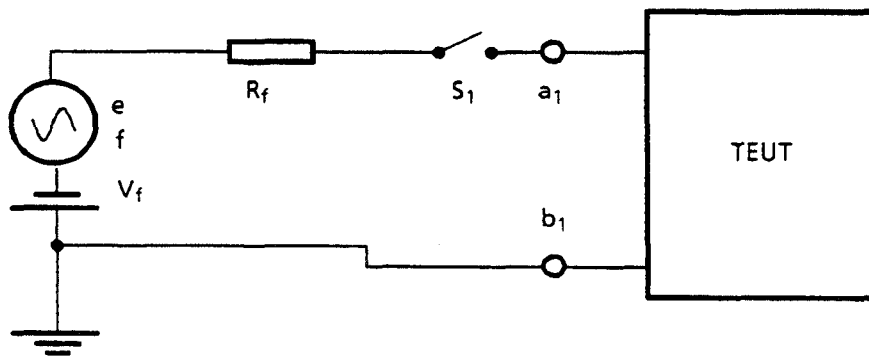


Figure A.3.2 (E) 1: Overload susceptibility

A.3.2 (E) 2 Ringing signal overload susceptibility (series)

The series TEUT is connected as shown in figure A.3.2 (E) 2, where the switch (S_1) is closed for 10 seconds and the switch (S_2) is closed during the last 1,5 seconds.

The feeding values, the load component values (R_t , C_t , and R_L), and the test procedure to follow are stipulated in the requirement in section 3.2 (E) 2.

PROVISION : See the provisions 1 and 2 in test A.3.2 (E) 1.

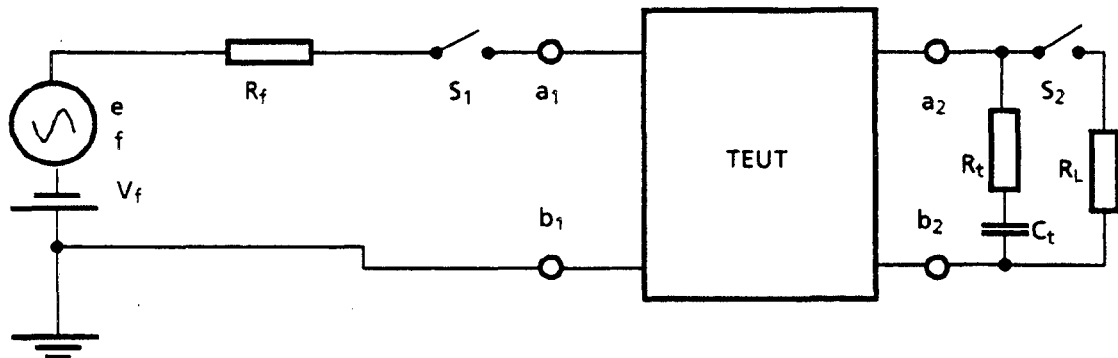


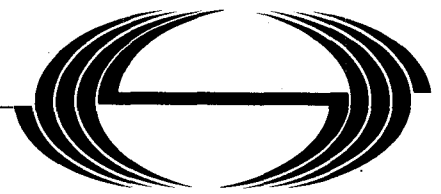
Figure A.3.2 (E) 2: Overload susceptibility (series)

A.3.2 (CH) 1

The 25 Hz ringing current generator shall supply a constant current of 80 mA, whereby the terminal voltage V_{t1} should not exceed 90 V.

In the case of equipment connected in series, a terminating resistor of 300 Ω should be used.

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**Attachments to Public Switched Telephone Network (PSTN);
General technical requirements for equipment connected to
an analogue subscriber interface in the PSTN****Chapter 4: Transmission characteristics**

(Candidate NET 4)

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Foreword

Chapter 4 of this European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI). The text of this ETS may be utilized, wholly or in part, for the establishment of NET 4.

For historical purposes, this ETS was drafted in the form of a NET. However, until a final decision to adopt this ETS as NET 4 has been agreed by the Technical Recommendations Application Committee (TRAC), the terms NET or NET 4 in this document should be read as ETS or ETS 300 001 respectively.

This ETS comprises ten chapters:

"Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

- Chapter 1 - General
- Chapter 2 - DC characteristics
- Chapter 3 - Ringing signal characteristics
- Chapter 4 - Transmission characteristics**
- Chapter 5 - Calling functions
- Chapter 6 - Answering function
- Chapter 7 - Power failure
- Chapter 8 - Connection methods
- Chapter 9 - Special functions
- Chapter 10 - Additional unclassified requirements

Refer to Chapter 1 (General) of this ETS for information on the structure and details of how to use this ETS. The national designations, used to identify national variations to requirements and tests within this ETS, are given in section 1.9 of Chapter 1 (page 60).

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4 Transmission characteristics

4.1 Input impedance

4.1.1 Input impedance of TE in quiescent condition

The value of modulus of the input impedance between the line terminals shall exceed the values shown in table 4.1.1.a for ac rms voltages of either up to V_{t1} or up to V_{t2} at dc voltages of up to V_f (see figure A.4.1.1). The values of V_{t1} or V_{t2} and V_f are shown in table 4.1.1.b.

The requirement shall be met for each sense of dc polarity.

Compliance shall be checked using the tests outlined in section A.4.1.1

Table 4.1.1.a: Frequency range

Frequency range (Hz)	Modulus of impedance (k Ω)
Δf_1 200 \leq f_1 < 2 000	Z_1
Δf_2 2 000 \leq f_2 < 4 000	Z_2
Δf_3 4 000 \leq f_3 < 10 000	Z_3
Δf_4 10 000 \leq f_4 < 18 000	Z_4 (see NOTE)

NOTE: Not applicable to TE equipped with 12 or 16 kHz meter pulse detector, to which 9.2.1 applies.

Table 4.1.1.b: Input impedance of TE in quiescent condition

COUNTRY	REQUIREMENT VALUES							Remarks
	Z_1 (k Ω)	Z_2 (k Ω)	Z_3 (k Ω)	Z_4 (k Ω)	V_{t1} (V _{rms})	V_{t2} (V _{rms})	V_f (V)	
Austria	6	6		6		0,775	60	yes
Belgium	20	20				1	48	
Cyprus	30	20	10	5		1,5	48	
Denmark						1,5	56	yes
Finland	10	10				0,5	48	yes
France					0,775		3 - 70	yes
Germany	not mandatory							
Greece	10	10	8	5		0,775	44 - 66	
Iceland	30	30		5		1	48	
Ireland	50	25	10		1			
Italy	10	10				0,775	44 - 52	yes
Luxembourg								
Malta								
Netherlands			not mandatory		1,5		66	yes
Norway	50	25	10	5	measured value	0,775	60	
Portugal	15	15	6	6	not applicable	1,5	55	yes
Spain								yes
Sweden						1	60	yes
Switzerland								yes
U. Kingdom	10	10	N/A	N/A	N/A	1,0	50	yes

- 4.1.1 (A) 1 Frequency range Δf_4 : 11 928 Hz - 12 072 Hz.
- 4.1.1 (DK) 1 In the on-hook state a TE shall have an impedance between the line terminals, whose magnitude is at least 30 kohms at ac voltages up to 1,5 V in the frequency range from 55 Hz to 4 000 Hz. At higher frequencies the magnitude shall not decrease by more than 6 dB/octave.
- 4.1.1 (SF) 1 The considered frequency range is 200....3 400 Hz.
- 4.1.1 (F) 1 The input impedance is defined as the parallel insertion loss a dB. The value of a dB shall be less than 0,2 dB in the frequency range 300 - 3 400 Hz, for ac rms voltage V_{t1} of value up to 0,775 V and for dc voltage V_f of value in the range 3 - 70 V.
- Compliance shall be checked using the test described in section A.4.1.1 (F) 1.
- 4.1.1 (I) 1 The considered frequency range is 300 - 3 400 Hz.
- 4.1.1 (NL) 1 The input impedance of the TE in quiescent condition in the frequency range 300 - 3 400 Hz is used to determine the connection factor of the TE. For requirements and determination of the final connection factor, see the (NL) notes to section 2.2.1.
- 4.1.1 (P) 1 $z_1(k\Omega) = 15$ in the frequency range Δf_1 (Hz): $300 \leq f_1 < 2\ 000$.
 $z_4(k\Omega) = 6$ in the frequency range Δf_4 (Hz): $10\ 000 \leq f_4 \leq 15\ 000$.
- 4.1.1 (E) 1 (Requirement to be applied instead of section 4.1.1).
- PROVISION 1: All the voice frequency characteristics shall be met with the dc feeding excitation stated in the associated testing methods. This provision shall be applied to all Spanish sections (E) in this Chapter 4 and also in section 10.4 (E) of Chapter 10.
- With TE in the quiescent condition, the value of the modulus of the complex impedance between the two line terminals shall not be lower than:
- a) the values stipulated in table 4.1.1 (E) 1.a over the frequency ranges indicated, for TE in which the received ringing signal is directly converted to an acoustic signal;
 - or
 - b) the values stipulated in table 4.1.1 (E) 1.b over the frequency ranges indicated, for TE without a direct converter of ringing signal;
- tested with a signal with an open circuit ac rms voltage of 3 V and frequencies from 300 Hz to 12 kHz, applied between the line terminals through a resistor of 600 Ω .
- PROVISION 2: This requirement shall not be applied in the frequency band from 11,8 kHz to 12,2 kHz for TE with a 12 kHz metering pulses receiver.
- Compliance shall be checked using the tests outlined in section A.4.1.1 (E) 1.

Table 4.1.1 (E) 1.a: Input impedance of TE in the quiescent condition, case a

Modulus limit	Frequency range
12 kΩ	300 Hz ≤ f ≤ 3,4 kHz
5 kΩ	f = 12 kHz

Table 4.1.1 (E) 1.b: Input impedance of TE in the quiescent condition, case b

Modulus limit	Frequency range
30 kΩ	300 Hz ≤ f ≤ 3,4 kHz
5 kΩ	f = 12 kHz

4.1.1 (S) 1

Δf (Hz)	z(kΩ)
11 940 - 12 060	1
200 - 3 800	8

For meter pulse receivers the requirements in the 200 - 3 800 Hz frequency band shall be replaced by the following:

The return loss measured against a circuit according to the figure below, shall fulfil the following requirements when the other interface is connected to a circuit also according to the same figure.

Frequency Hz	Return loss dB
200 - 300	16
300 - 600	18
600 - 2 000	20
2 000 - 3 400	15
3 400 - 3 800	12

$$\text{Return loss} = 20 \log_{10} \left| \frac{Z + Z_{\text{Ref}}}{Z - Z_{\text{Ref}}} \right| \text{ dB}$$

where Z_{Ref} = reference impedance

Z = input impedance when the equipment is terminated with Z_{Ref}

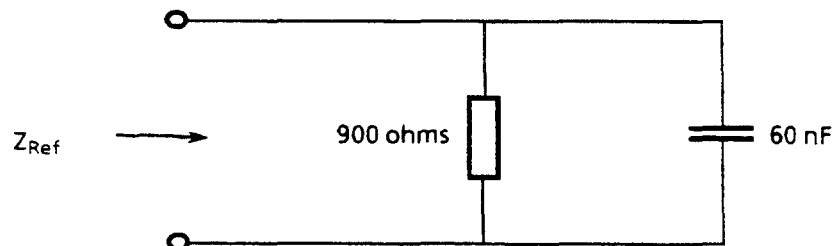


Figure 4.1.1 (S) 1: Circuit for return loss measurement

4.1.1 (S) 2 For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.

4.1.1 (CH) 1 Current method:

The insertion loss on a parallel connection shall be $\leq 0,2$ dB (300 - 3 400 Hz, as residual attenuation measured between a purely resistive 600 Ω generator and 600 Ω load with a level of + 3 dBm). TE without a call charge meter shall maintain an insertion loss of ≤ 1 dB at $12 \pm 0,12$ kHz with a level of up to + 20 dBm (600/600 Ω). For TE with an incorporated charge meter, the corresponding impedance values apply (see section 9.2).

4.1.1 (GB) 1 Input impedance is specified in the frequency range 300 - 3 400 Hz only. For TE with earth terminals or leads, the impedance between these terminals or leads when connected together, and each lead of the TE provided for connection to the PSTN, shall not be less than 30 kohms.

4.1.1 (GB) 2 The input impedance for two-port TE which is connected in series with the main TE shall not be less than 30 kohms in the frequency range 300 to 3 400 Hz.

The input impedance of TE that is connected in parallel with the main TE shall not be less than 30 kohms in the frequency range 25 to 3 400 Hz.

4.1.1 (GB) 3 For single port TE, tests are made with $V = \text{zero}$.

A.4 Transmission characteristics

Throughout this section, a number of tests are made with TE placed in a loop condition. In these cases, the TE intended for speech using hand-held parts containing an earphone or similar assembly or containing a microphone or similar assembly shall have acoustic terminations applied throughout the tests.

In addition hand-held parts shall be mounted in an artificial head assembly as described in CCITT Recommendation P.76.

For equipment intended for hands-free speech operation, all parts containing acoustic traducers shall be placed in an anechoic chamber with properties as described in CCITT Recommendation P.34.

A.4.1 Input impedance

A.4.1.1 Input impedance of TE in quiescent condition

The TEUT is connected as shown in figure A.4.1.1 and placed in its quiescent condition.

Measurements are made in the frequency range specified by the relevant administration and each frequency of measurement shall not be spaced more than one octave from the subsequent frequency of measurement and the lowest frequency of measurement equal to f_1 .

The values of the modulus of impedance are calculated using formula A.4.1.1.

$$Z_n = \frac{V_{t2}}{I}$$

Formula A.4.1.1

where V_{t2} is either the rms value set in table A.4.1.1 or rms value measured during the test after setting V_{t1} , and I is the rms value of current expressed in amperes, resulting from the application of the given test voltage.

Measurements are carried out at a limited number of dc excitation values V_f , R_f using both polarities.

Table A.4.1.1: Input impedance of TE in quiescent condition

COUNTRY	TEST VALUES					Remarks
	f_l (Hz)	V_{t1} (V_{rms})	V_{t2} (V_{rms})	R_f (Ω)	V_f (V)	
Austria	200		0,775		60	
Belgium	300		1	400	48	
Cyprus	200		1,5	440	48	
Denmark	50		1,5	500	48	
Finland	200		0,5	800	48	
France	300	0,775		300	3 - 70	yes
Germany	not mandatory					
Greece	200		0,775	600	48,60	
Iceland	200		1	800	48	
Ireland	200	1		5k	48	
Italy	300		0,775	800	48	
Luxembourg	200		0,775		60	
Malta						
Netherlands	300	1,5		600	66	
Norway	200	measured value	0,775	10k	60	yes
Portugal	200	not applicable	1,5	300 - 1 800	55	
Spain				600	48	yes
Sweden	200		1			yes
Switzerland				600	57	yes
U. Kingdom	300		1,0			yes

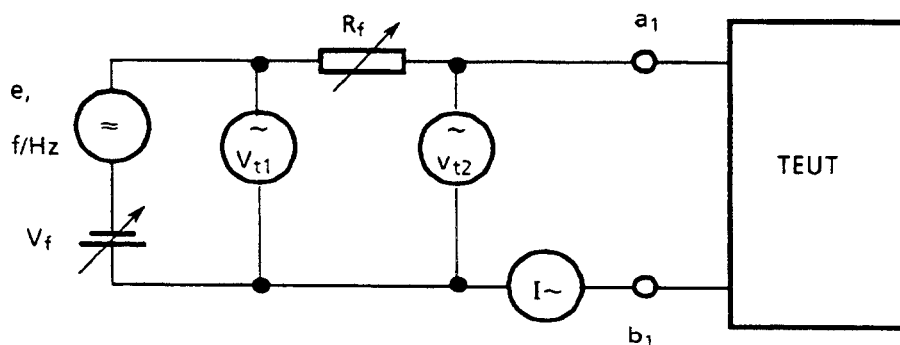


Figure A.4.1.1: Input impedance of TE in quiescent condition

A.4.1.1 (F) 1

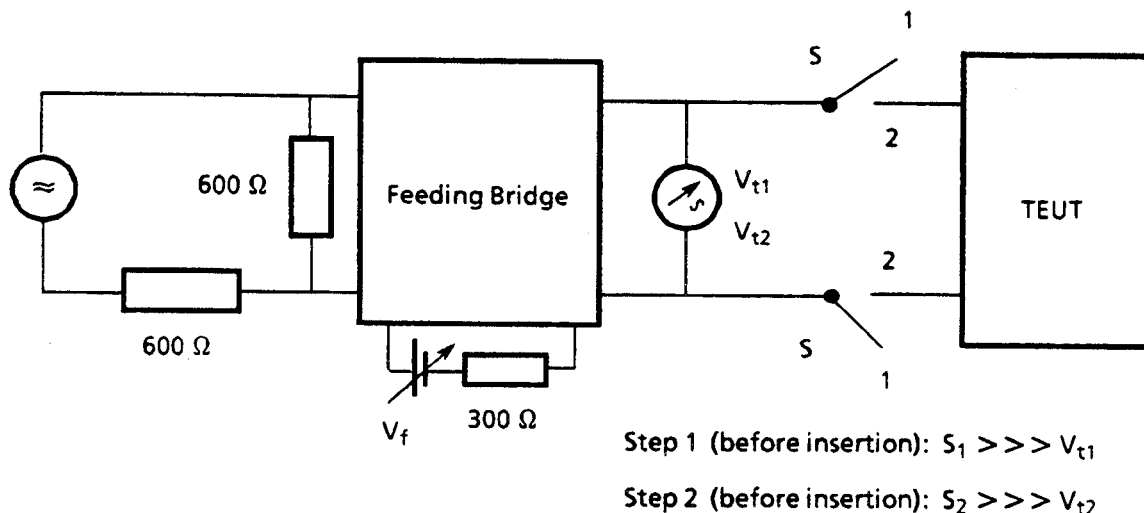


Figure A.4.1.1 (F) 1: Parallel insertion loss

$$a \text{ dB} = 20 \log (V_{t1} / V_{t2})$$

$$V_f = 3\text{V up to } 70\text{V}$$

A.4.1.1 (N) 1

The values of the impedances are calculated using formula A.4.1.1 (N) 1:

$$Z_n = \frac{V_{t2} \times 10^4}{V_{t1} - V_{t2}} \quad \text{Formula A.4.1.1 (N) 1}$$

A.4.1.1 (E) 1

PROVISION 1:

The provisions 2 to 5 shall be applied to all testing methods for Spain (E) in this Chapter 4 and also in section 10.4 (E) of Chapter 10.

PROVISION 2:

A number of tests are made with the TEUT placed in its loop condition or in its high impedance condition; in some cases the TE uses hand-held parts containing an earphone or similar assembly or containing a microphone or similar assembly; in these cases, acoustic terminations shall be applied throughout the tests; these acoustic terminations shall be according with CCITT Recommendation P.51 (Blue Book).

PROVISION 3:

When the TE uses a handset, it shall be mounted in an artificial head, where the relative position mouth to ear shall be according with the OREM-A method of testing.

PROVISION 4:

When the TE uses a microphone or similar assembly, all parts containing acoustic to electric transducers shall be placed in an environment with a room noise level lower than 35 dB (A), which is considered low enough to ensure that the test procedures are not disturbed.

PROVISION 5:

Selective voltmeters (V_f) and selective ammeters (I_f) are normally used. The reading accuracy is at least one percent, over the required frequency range, unless another indication is made.

The procedure of test in section A.4.1.1 is followed, where it is not explicitly necessary to use both polarities.

The tests shall be made at the ac generator open circuit rms voltage (e) stipulated in the requirement in section 4.1.1 (E) 1. The generator frequency (f) takes at least the values of the centre frequencies of one-third of an octave in preferred series from 315 Hz to 3,15 kHz, and at 300 Hz, 3 kHz, 3,4 kHz, and 12 kHz.

The modulus of the complex impedance ($\|Z_n\|$) is calculated using formula A.4.1.1, where V_{tn} is the voltmeter (V_{t2}) reading in volts and I is the ammeter reading in milliamperes at each testing frequency value.

A.4.1.1 (S) 1 Feeding conditions, see Swedish remark Chapter 1, section 1.5.2.

A.4.1.1 (S) 2 For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.

A.4.1.1 (CH) 1 Δf_1 : 300 - 3 400 Hz, V_{t2} : + 3 dBm (rel. 775 V).

$\Delta f'_1$: $12 \pm 0,12$ kHz, V'_{t2} : + 20 dBm (rel. 775 mV).

A.4.1.1 (GB) 1 Measurement is made at frequency intervals of 1/3 of an octave as specified in ISO 3-1973-R10 across the frequency range 300 - 3 400 Hz, with a 1,0 V ac rms source applied.

For series-connected TE, V_f is equal to 50 volts and R_f is equal to 400 ohms. For one-port TE, V_f has a value of zero volts and the value of R_f is not specified.

4.1.2 Input impedance of TE in loop condition

The input impedance between the TE line terminals shall, in the frequency range Δf , and in the current range ΔI_f have a return loss, in relation to the reference impedance(s) Z_r , which is not less than α dB at a voltage V_{t1} or a voltage V_{t2} (see figure A.4.1.2) in accordance with table 4.1.2.

The return loss of the input impedance Z_i in relation to the reference impedance is

$$\alpha = 20 \times \log_{10} \left| \frac{Z_i + Z_r}{Z_i - Z_r} \right| \text{ (dB) } \text{ Formula 4.1.2}$$

where both impedances, in principle, are complex values.

Compliance shall be checked using the tests outlined in section A.4.1.2.

Table 4.1.2: Input impedance of TE in loop condition

COUNTRY	REQUIREMENT VALUES						Remarks
	Δf (Hz)	ΔI_f (mA)	Z_r (Ω)	V_{t1} (V_{rms})	V_{t2} (V_{rms})	α dB	
Austria	300 - 3 400	19 - 60	600	0,245		14	
Belgium	300 - 3 400	20 - I_{max}	600		0,775	14	yes
Cyprus	300 - 3 400	100	600			14	
Denmark	300 - 3 400	8 - I_{max}	600		1,5	10	yes
Finland	300 - 3 400	20 - 50	600	0,5		10	
France	300 - 3 400		600	0,115 - 1,55		14	yes
Germany	300 - 3 400	20 - 60	(220 + 820//115 nF)		0,245, 0,775	14	yes
Greece	300 - 3 400	20 - 80			0,775	14	yes
Iceland	300 - 3 400	14 - I_{max}	600	1,5		10	
Ireland	300 - 3 400	20 - 100	600			14	yes
Italy	300 - 3 400		600		0,775	14	
Luxembourg	300 - 3 400	60	600			14	
Malta							
Netherlands	300 - 3 400		600 resistive	1,5		14	yes
Norway	300 - 3 400	17 - I_{max}	(120 + 820//115 nF)	1,55	measured value	9	yes
Portugal	300 - 3 400		600	1,55	not applicable	10	yes
Spain			600				yes
Sweden	300 - 3 400		(275 + 850//150 nF)		0,5		yes
Switzerland	300 - 3 400		(220 + 820//115 nF)		0,0775 - 0,775	14	yes
U. Kingdom	200 - 4 000	25 - 100	See remarks	0,632		14	yes

4.1.2 (B) 1

Requirements for digital PABXs with analogue interface:

The reference impedance used is the network described in figure 4.1.2 (B) 1.a.

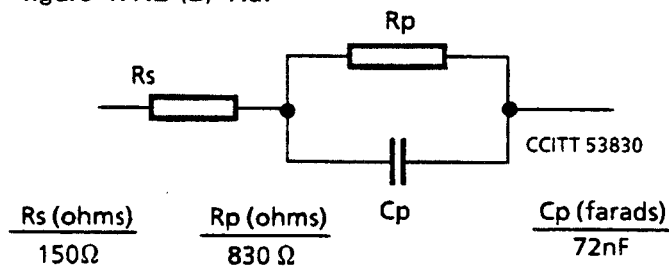


Figure 4.1.2 (B) 1.a: Complex impedance Z_c

The return loss of the impedance of the two wires analogue access in relation to this reference impedance shall comply with the mask defined in figure 4.1.2 (B) 1.b:

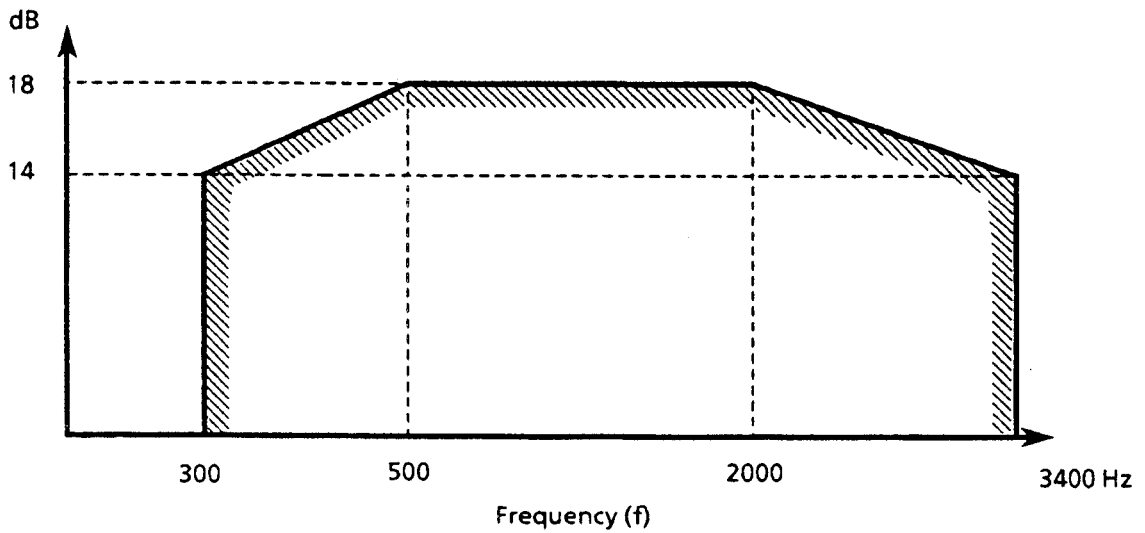


Figure 4.1.2 (B) 1.b: Minimum values of the return loss

4.1.2 (DK) 1

For a telephone set, the reference impedance is shown in figure 4.1.2 (DK) 1.a.

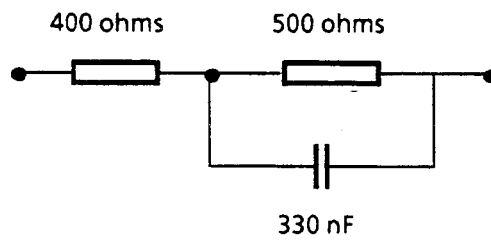


Figure 4.1.2 (DK) 1.a

The return loss of the impedance in the frequency range Δf shall comply with the mask defined in figure 4.1.2 (DK) 1.b.

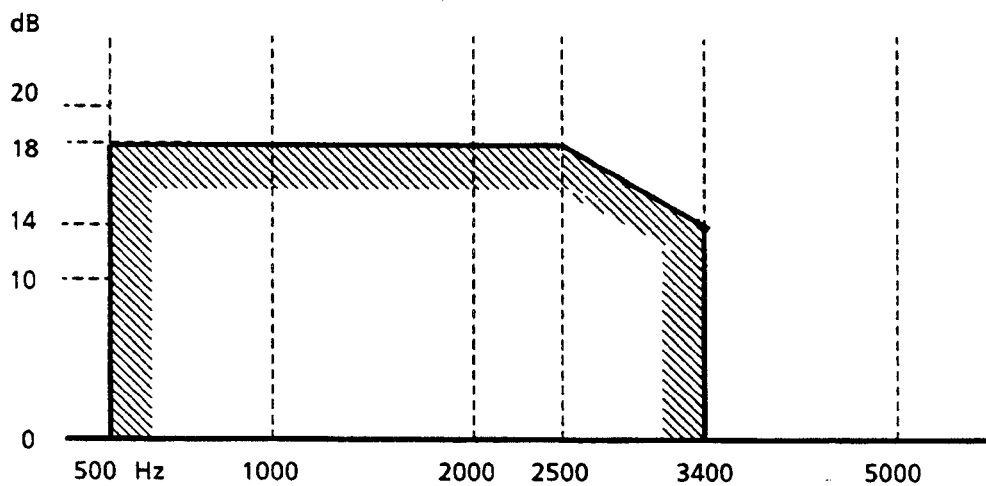


Figure 4.1.2 (DK) 1.b

4.1.2 (DK) 2

For loop currents between 8 mA and 16 mA the requirement shall be met only at voltages V_{t2} up to 0,775 V.

4.1.2 (F) 1 For telephone sets, the input impedance shall have a return loss higher than 9 dB.

4.1.2 (F) 2 The requirement described in section 4.1.2 does not apply to TE in DTMF dialling condition. However, in this case, the modulus of impedance shall be between 400 ohms and 900 ohms.

Compliance shall be checked using the test outlined in section A.4.1.2 (F) 2.

4.1.2 (F) 3 The feeding conditions are:

$$V_f = 45 \text{ V up to } 54 \text{ V}$$

$$R_f = 300 \text{ ohms up to } 1\,400 \text{ ohms}$$

4.1.2 (F) 4 In the event of distortion for $V_{t1} = 1,55 \text{ V}$, the requirement applies up to $V_{t1} = 0,92 \text{ V}$.

4.1.2 (D) 1

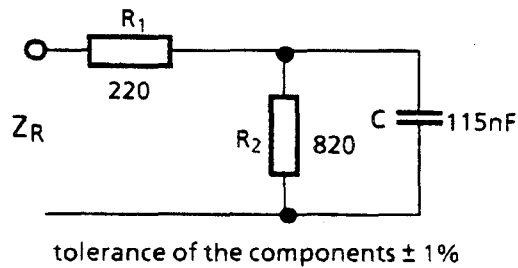


Figure 4.1.2 (D) 1.a

The return loss of the impedance in the frequency range Δf shall comply with the mask defined in figure 4.1.2 (D) 1.b:

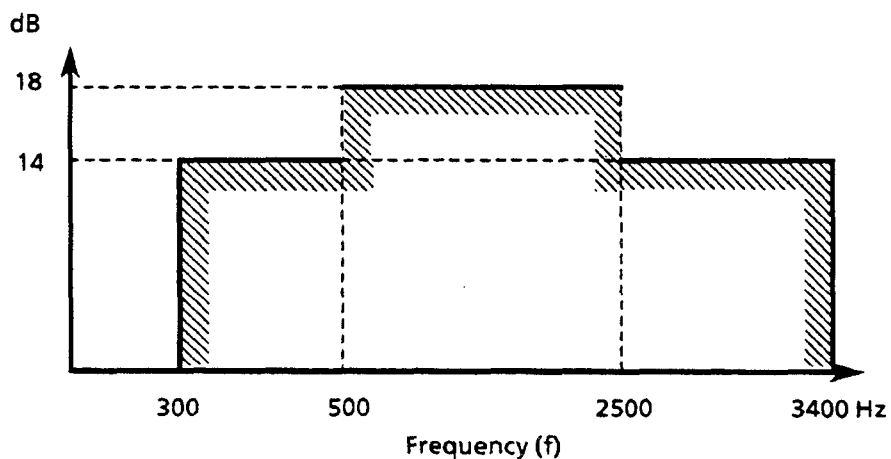


Figure 4.1.2 (D) 1.b: Minimum values of the return loss

The value of the modulus of impedance in the frequency range 15 920 Hz to 16 080 Hz shall be $\geq 220 \Omega$.

4.1.2 (GR) 1

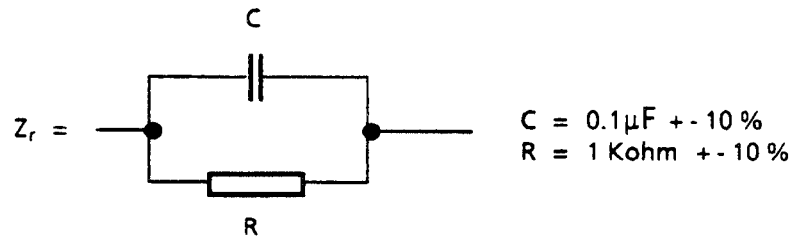


Figure 4.1.2 (GR) 1

4.1.2 (IRL) 1

Loop state voice frequency band impedance. This requirement shall be met over the current levels 20 - 100 mA.

4.1.2 (NL) 1

Voltage and resistance ranges instead of ΔI_f are applicable, respectively ΔV_f and ΔR_f .

$$\Delta V_f(\text{V}) = 42 - 66$$

$$\Delta R_f(\Omega) = 800 - 2140$$

4.1.2 (N) 1

The reference impedance Z_r in the Norwegian requirements is the network described in figure 4.1.2 (N) 1:

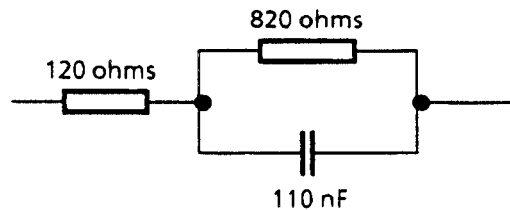


Figure 4.1.2 (N) 1

4.1.2 (N) 2

Data terminals (i.e., any tone code generating TE, e.g. modems) may alternatively have a return loss > 14 dB in relation to $Z_r = 600 \Omega$.

4.1.2 (N) 3

I_{max} is defined in 1.5.1 (N) 1.

4.1.2 (N) 4

Return loss in the frequency range 15,5 - 16,5 kHz., see section 9.2.1.4.

4.1.2 (N) 5

Series-connected TE shall have a return loss equal to or greater than 12 dB measured from the PSTN CP and a2/b2 terminated with the reference impedance (see figure 1.4.4.1.b). It shall also have a return loss equal to or greater than 12 dB measured from connection points a2/b2 and the PSTN CP terminated with the reference impedance. The TEUT shall be in quiescent mode during the test.

The complex impedance is specified in figure 4.1.2 (N) 1.

4.1.2 (P) 1

Voltage and resistance ranges, respectively ΔV_f and ΔR_f , are applicable instead of ΔI_f .

$$\Delta V_f(\text{V}) = 45 - 55$$

$$\Delta R_f(\Omega) = 300 - 1800$$

4.1.2 (P) 2

α dB = 14, for data TE

4.1.2 (P) 3 A complex impedance Z_r will be specified in the future.

4.1.2 (E) 1 Input impedance in loop condition.
(Requirement to be applied instead of section 4.1.2).

PROVISION 1: The TE, when either in the loop condition or in the high impedance condition, is supposed not sending useful signals (nor signals for which it is intended to transmit) to the line.

The TE with loop condition, the value of the complex impedance between the two line terminals shall be such that the Transverse Return Loss (TRL) in relation to a resistor of 600 ohms (+/- 1%) shall not be lower than the values stipulated in table 4.1.2 (E) 1 over the frequency ranges indicated, tested with a signal with an open circuit ac rms voltage of 1,5 V and frequencies from 300 Hz to 3,4 kHz, applied between the line terminals through the reference resistor of 600 ohms.

PROVISION 2: This requirement shall, however, not be applied during the first two seconds after the establishment of loop condition.

PROVISION 3: This requirement shall also be applied for series TE when, in the quiescent condition, a resistor of 600 ohms is connected to its line output terminals.

PROVISION 4: See the provision 3 in section 4.2.2.1 (E) 1, when the provision 3 in this section is applied.

NOTE: The meaning given in this requirement for the term TRL is according with the CCITT Recommendation G.117 (Blue Book).

Compliance shall be checked using the tests outlined in section A.4.1.2 (E) 1.

Table 4.1.2 (E) 1: Input impedance in loop condition

<u>TRL limit</u>	<u>Frequency range</u>
10 dB	$300 \text{ Hz} \leq f_1 \leq 500 \text{ Hz}$
12 dB	$500 \text{ Hz} < f_1 \leq 800 \text{ Hz}$
14 dB	$800 \text{ Hz} < f_1 < 3\ 000 \text{ Hz}$
10 dB	$3\ 000 \text{ Hz} \leq f_1 \leq 3,4 \text{ kHz}$

4.1.2 (E) 2 Input impedance in high impedance condition.
(Requirement to be applied instead of section 4.1.2).

PROVISION 1: See the provision 1 in section 4.1.2 (E) 1.

With TE in high impedance condition, the value of the modulus of the complex impedance between the two line terminals shall not be lower than 30 kΩ, tested with a signal with an open circuit ac rms voltage of 3 V and frequencies from 300 Hz to 12 kHz, applied between the line terminals through a resistor of 600 ohms.

PROVISION 2: See the provision 2 in section 4.1.1 (E) 1.

Compliance shall be checked using the tests outlined in section A.4.1.2 (E) 2.

4.1.2 (S) 1 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.1.2 (S) 2 For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.

4.1.2 (S) 3 The return loss of the impedance in the frequency range Δ_f shall comply with the mask defined in figure 4.1.2 (S) 3

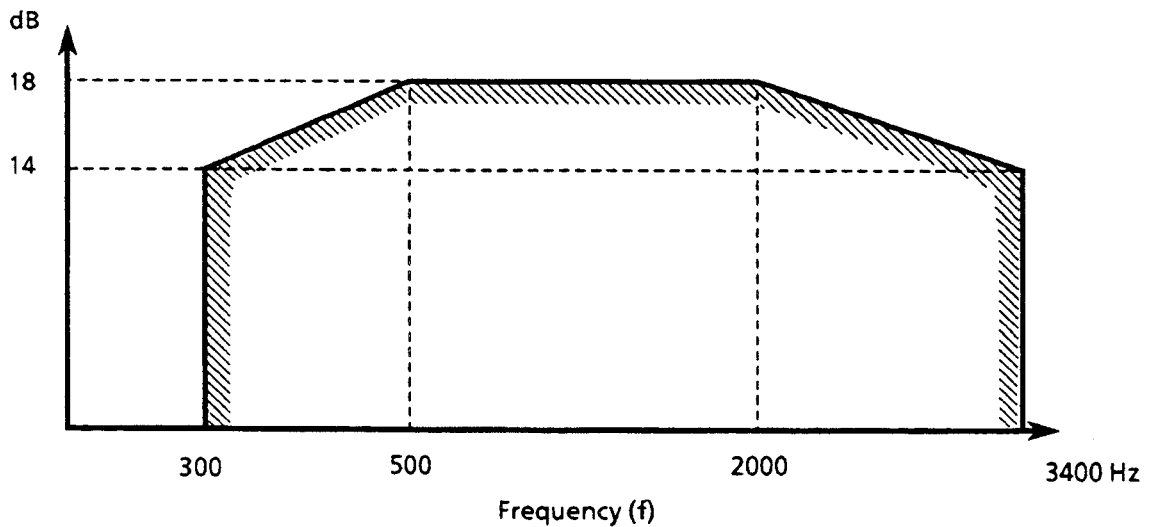


Figure 4.1.2 (S) 3: Minimum values of the return loss

4.1.2 (CH) 1

Feeding range:

V_f : 43 - 57 V
 R_f : 2 200 - 600 Ω

The input impedance Z is specified for Δ_f 300 - 3 400 Hz as a return loss with respect to the following network:

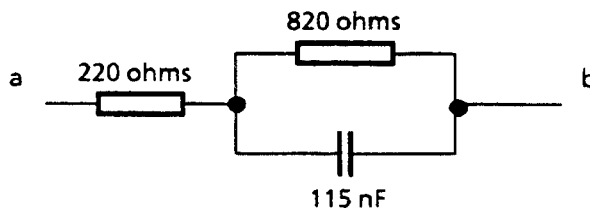


Figure 4.1.2 (CH) 1

If the TE is not equipped with a call charge meter, the insertion loss shall be ≤ 2 dB in the frequency range Δf_4 (11 880 - 12 120 Hz) for levels up to +20 dBm (rel. 775 mV), measured between a 600 Ω generator and a 600 Ω level meter.

See also remarks on sections 4.3, A.4.3 (CH) 1.

4.1.2 (GB) 1

The return loss is specified with respect to the network shown in figure 4.1.2 (GB) 1 for both speech TE and non-speech TE in impedance class (a).

The echo return loss for speech TE shall not be less than 16 dB with respect to the network shown in figure 4.1.2 (GB) 1.

For non-speech TE in impedance class (b), the return loss shall not be less than 14 dB with respect to a 600 ohm resistive load; the impedance shall have a reactive component not greater than + 50 ohms.

NOTE 1: Selection of the appropriate impedance class (a) or (b) for non-speech TE and the application of the corresponding compliance check is dependant upon the impedance classification declared by the supplier.

For speech or non-speech apparatus that incorporates a special impedance facility where the apparatus is capable of being placed in an on-line state such that it has a nominal input impedance of 270 Ω , when this facility is invoked both of the following shall apply:

- (a) the impedance presented by the apparatus shall be $(270 \pm 30) \Omega \pm j30 \Omega$ in the frequency range 200 Hz to 4 000 Hz over the current range described in the test of A.4.1.2
- (b) transmission to and from the PSTN shall be suppressed by at least 30 dB.

Compliance shall be checked by measurement of the impedance as described in A.4.1.2. The suppression of the transmission by 30 dB shall be checked by an appropriate functional test.

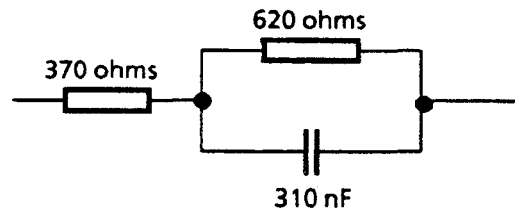


Figure 4.1.2 (GB) 1

4.1.2 (GB) 2 The voltage V_{t1} is 0,1 volts for TE with loudspeaking facilities.

4.1.2 (GB) 3 Input impedance of series-connected TE with main TE in loop condition.

The impedance presented by the series-connected TE shall be such that the return loss, as defined in section 4.1.2, shall not be less than 28 dB when the terminals A_2 and B_2 of the TEUT are connected to either:

- a) a resistance of 600 ohms $\pm 0,1\%$;
- or
- b) the network shown in figure 4.1.2 (GB) 1;

the choice of which is stated by the supplier.

Compliance shall be checked using the test of section A.4.1.2 at currents (I_f) of 25 mA and 40 mA dc only.

A.4.1.2 Input impedance of TE in loop condition

The TEUT is connected as shown in figure A.4.1.2 and placed in loop condition.

Measurements are made in the frequency range specified by the relevant administrations, and each frequency of measurement shall not be spaced more than one third of an octave from the subsequent frequency of measurement, and the lowest frequency of measurement equal to f_1 (see ISO 3-1973-/R10). The ac and dc parameter values are shown in table A.4.1.2.

The return loss is determined by figure A.4.1.2 using formula A.4.1.2.

$$\alpha = 20 \log_{10} \frac{V_{t1}}{2 \times U} \quad (\text{dB}) \quad \text{Formula A.4.1.2}$$

Measurements are carried out at a limited number of dc excitation values V_f , R_f or I_f .

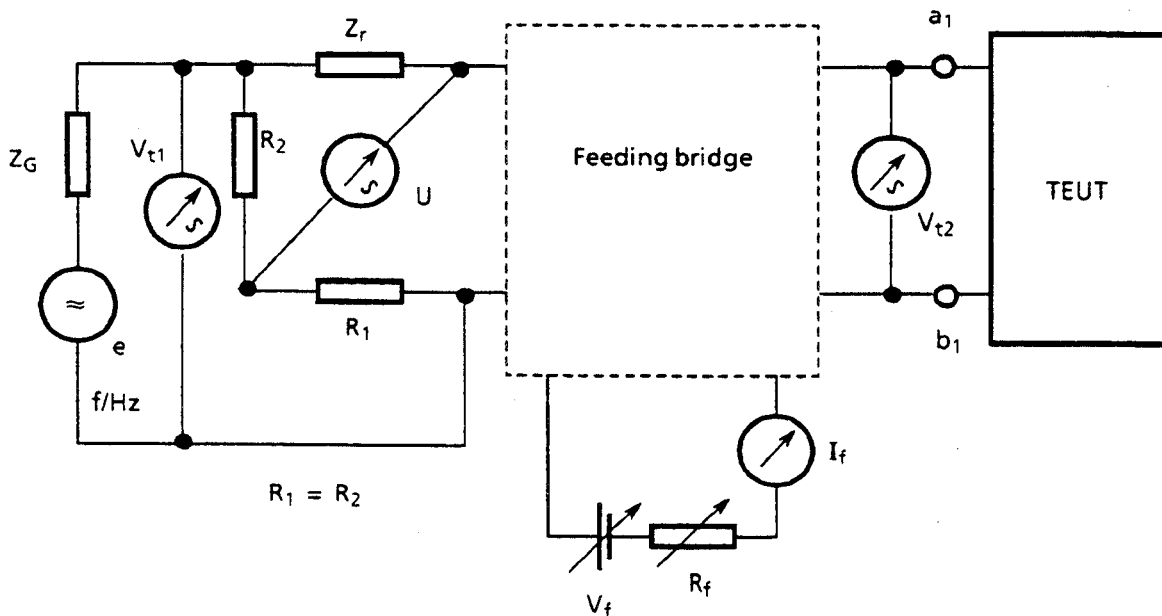


Figure A.4.1.2: Input impedance of TE in loop condition
 The feeding bridge is specified in section 1.5.

Table A.4.1.2: Input impedance of TE in loop condition

COUNTRY	TEST VALUES									Remarks
	f_i (Hz)	Z_G (Ω)	I_f (mA)	R_f (Ω)	V_f (V)	V_{t1} (V_{rms})	V_{t2} (V_{rms})	$R_1 = R_2$ (Ω)		
Austria	300	0	19, 60		60	0,245				
Belgium	300	0		400, 1 600	48		0,775	600		
Cyprus	300	0	20 - 100	800	48	1,5		600		
Denmark									yes	
Finland	300	< 600		800, 1 710	48	0,5		600	yes	
France	300	0		300, 1 400	54, 45	1,55			yes	
Germany	300	0		1 000, 2 530	60		0,245, 0,775		yes	
Greece	300	0	20, 35, 55		60		0,775	600		
Iceland	300	0	$14 - I_{max}$		48	1,5		600		
Ireland	200		20 - 100		48	1				
Italy	300	≤ 50		800 - 1 800	48		0,775		yes	
Luxembourg	300		14, 60		60					
Malta										
Netherlands	300	0		800 - 2 140	42 - 66	1,5		600		
Norway	250	50	17, 40, I_{max}	adjustable	60	1,55		600	yes	
Portugal	300	0	N/A	300 - 1 800	48	1,5	N/A	600	yes	
Spain		≤ 50		500, 1 100, 1 700	48			10k	yes	
Sweden	200	0					0,5		yes	
Switzerland	300 - 3 400	0				0,775		600	yes	
U. Kingdom	200	Fig. 4.1.2 (GB) 1	25 - 100	400 min.	50	0,632			yes	

A.4.1.2 (DK) 1

The return loss is determined as $20 \log_{10} (U_1/U_2)$ dB. Measurement shall be made at loop currents of 16 and 32 mA, $E = 1,5$ V and $f = 0,3, 0,5, 1,0, 2,5$ and $3,4$ kHz.

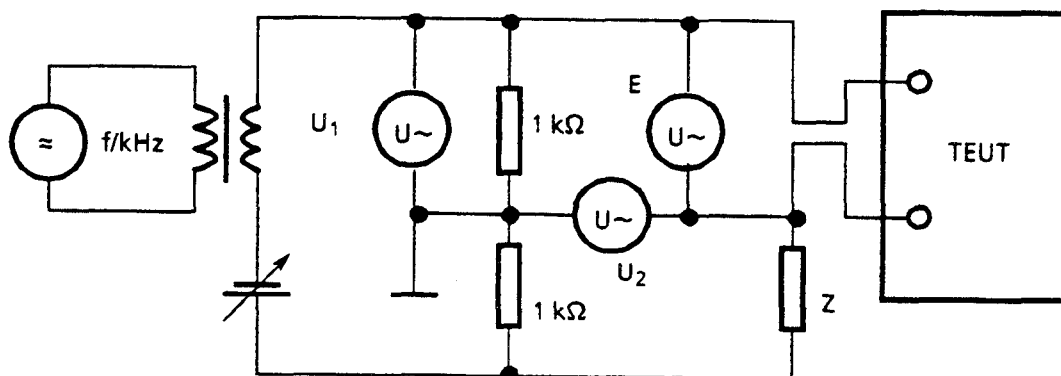


Figure A.4.1.2 (DK) 1

$Z = 600$ ohms for normal TE. For telephone sets, Z is the reference impedance shown in figure 4.1.2 (DK) 1.a.

A.4.1.2 (SF) 1 Capacitors in feeding bridge are $\geq 100\mu\text{F}$.

A.4.1.2 (F) 1 For telephone sets, the test is carried out either by putting the microphone in a silent ($< 40 \text{ dBA}$) and anechoic area or by replacing the microphone with its equivalent resistance.

A.4.1.2 (F) 2 The modulus of impedance $|Z|$ is calculated by formula A.4.1.2 (F) 2:

$$|Z| = \frac{V_1 - V_2}{\frac{V_2}{600} - \frac{V_1}{400}} \quad \text{Formula A.4.1.2 (F) 2}$$

referring to figure A.4.1.2 (F) 2:

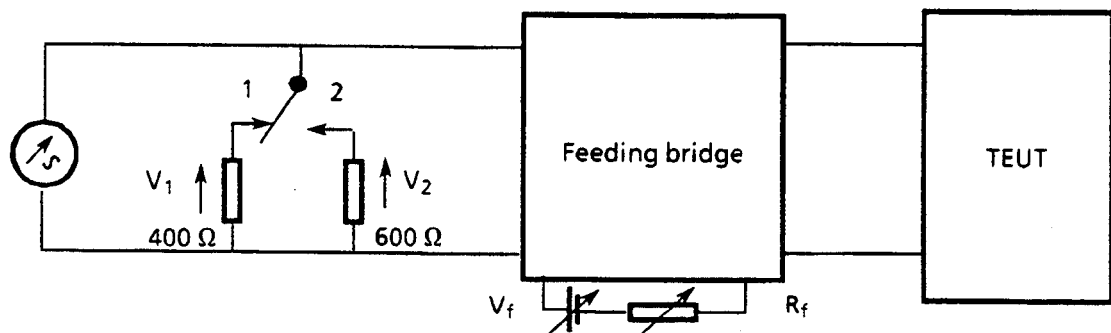


Figure A.4.1.2 (F) 2: Modulus of impedance by DTMF dialling

$(V_f, R_f) = (54\text{V}, 300 \text{ ohms})$ and $(45\text{V}, 1\ 400 \text{ ohms})$

A.4.1.2 (F) 3 In the event of distortion for $V_{t1} = 1,55\text{V}$, the test is carried out with $V_{t1} = 0,92\text{V}$.

A.4.1.2 (D) 1 For telephone sets, the test is carried out either by putting the microphone in a silent and anechoic area or by replacing the microphone with its equivalent circuitry. The receiver will be coupled to an artificial ear according to IEC 318.

A.4.1.2 (D) 2 The input impedance of the TE forming the electrical termination of the line shall, in the frequency range 15,92 kHz to 16,08 kHz, be $\geq 220 \text{ ohms}$. The test is carried out using the test arrangement outlined in section A.4.1.2, with sending levels V_{t2} of + 20 dB (775 mV) and 0 dB (775 mV).

A.4.1.2 (I) 1 For telephone sets, the test is carried out either by putting the microphone in a silent area ($< 40 \text{ dB (A)}$) or by replacing the microphone with an equivalent circuit.

The receiver will be coupled to an artificial ear according to IEC 318.

A.4.1.2 (N) 1 The measurements are carried out in two steps:

Firstly the reference value U_2 is measured without the TEUT connected. Then the value U_1 is measured with the TEUT connected. The return loss is determined using formula A.4.1.2 (N) 1:

$$\alpha = 20 \times \log \frac{U_1}{U_2} \quad \text{Formula 4.1.2 (N) 1}$$

A.4.1.2 (P) 1

TE provided with one port intended to be attached to the PSTN and a second port to which another TE, which itself is approved for connection to the PSTN, is connected.

The TEUT is connected as shown in figure A.4.1.2 (P) 1:

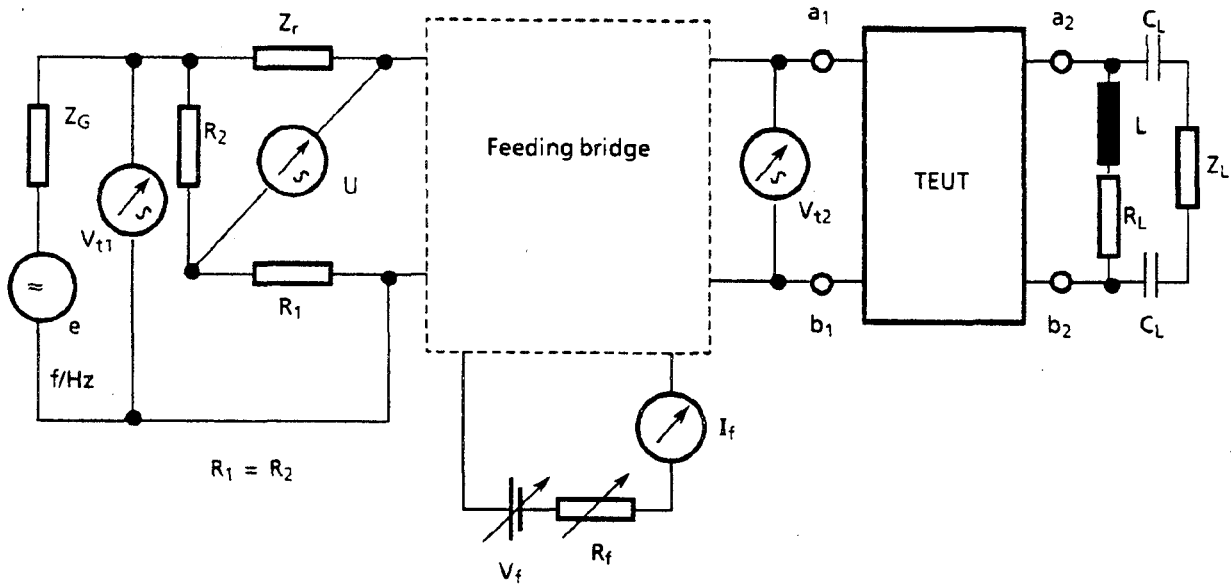


Figure A.4.1.2 (P) 1: Input impedance of TE in loop condition - TE provided with one port intended to be attached to the PSTN and a second port to which another TE, which itself is approved for connection to the PSTN, is connected

- $L (H) \geq 5$
- $R_L (\Omega) = 400$
- $C_L (\mu F) \geq 50$
- $Z_L (\Omega) = 600$

A.4.1.2 (E) 1

Input impedance in loop condition.

The procedure of test in section A.4.1.2 is followed.

The impedance (Z_r) is the reference resistor stipulated in the requirement in section 4.1.2 (E) 1.

The tests shall be made at the ac generator open circuit rms voltage "e" stipulated in the requirement in section 4.1.2 (E) 1. The generator frequency (f) takes at least the values of the centre frequencies of one third of an octave in preferred series from 315 Hz to 3,15 kHz, and at 300 Hz, 3 kHz, and 3,4 kHz.

The value of the Transverse Return Loss (TRL) (α , in dB) is calculated using formula A.4.1.2, where V_{t1} and U are the voltmeters (V_{t1}) and (U) readings in volts at each testing frequency value.

PROVISION: In order to validate the test results, it shall be necessary to check that when a resistor of 600 ohms (+/-1%) is connected instead of the TEUT, the resultant TRL values are not lower than 34 dB.

A.4.1.2 (E) 2 Input impedance in high impedance condition.

The procedure of test in section A.4.1.1 (E) 1 is followed.

A.4.1.2 (S) 1 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

A.4.1.2 (S) 2 For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.

A.4.1.2 (CH) 1 Feeding settings:

$V_{f1} : 43 \text{ V}, R_{f1} : 2\ 200 \ \Omega$

$V_{f2} : 48 \text{ V}, R_{f2} : 1\ 200 \ \Omega$

$V_{f3} : 57 \text{ V}, R_{f3} : 600 \ \Omega$

$\Delta f_4 : 11\ 880 - 12\ 120 \text{ Hz} : + 20 \text{ dBm (rel. 775 mV), Z generator and level meter: } 600 \ \Omega \text{ for insertion loss measurement.}$

A.4.1.2 (GB) 1 Measurements are made at frequencies spaced not greater than 1/12 of an octave as specified in ISO 3-1973 R40 (with tolerance of $\pm 2\%$ to embrace the end limits of the range) across the frequency range 200 - 4 000 Hz, at those values of current in the sequence 25, 32, 40, 50, 65, 75, 85, and 100 mA dc that are not greater than the current obtained when the leads designated for connection to the PSTN are connected to a voltage source of 50 V dc in series with a 400 ohm resistor.

Echo return loss is calculated according to CCITT Recommendation G. 122 using formula A.4.1.2 (GB) 1.

$$\text{ERL} = 3,24 - 10 \log_{10} \sum_{i=1}^n (A_i + A_{i-1}) \times (\log_{10} f_i - \log_{10} f_{i-1}) \text{ dB}$$

Formula A.4.1.2 (GB) 1

where:

A_i is the return loss power ratio at frequency f_i expressed as $A_i = 10^{-(\text{decibel return loss at } f_i)/10}$;
 A_o is the ratio at $f_o = 300 \text{ Hz}$;
 A_n is the ratio at $f_n = 3\ 400 \text{ Hz}$.

4.2 Degree of unbalance about earth

The requirements in this section shall be met by one-port TE and by certain series-connected TE at dc excitation conditions ΔV_f , ΔR_f and ΔI_f , if required, which are specified in tables 4.2.1.1, 4.2.1.2, 4.2.2.1, 4.2.2.2.a, 4.2.2.2.b.

These requirements are set out in both quiescent and loop conditions.

4.2 (GB) 1 TE in loop condition: Signal balance about earth.

For TE with an earth connection:

The signal balance about earth shall not be less than 46 dB. Compliance shall be checked by the test of A.4.2 (GB) 2.

A.4.2 Degree of unbalance about earth

The TE is connected to the appropriate test circuit (see figure A.4.2.a or A.4.2.b as appropriate). dc feeding conditions are established and ac excitation is applied. The value of the voltage V_t is determined for the relevant condition.

The longitudinal conversion loss, respectively longitudinal conversion transfer loss, α , is then determined as:

$$\alpha = 20 \log_{10} \frac{e}{V_t} \quad \text{Formula A.4.2}$$

where "e" is the value of the ac excitation voltage.

Equipment with a signal earth terminal or lead provided shall be connected to the appropriate test circuit (see figure A.4.2.a or A.4.2.b, as appropriate) and/or an eventual earth return path realised using the method stated in table A.4.2.a.

Requirements for the measuring arrangements:

The inherent longitudinal conversion loss of the measuring arrangements should be 20 dB greater than the limit set for the item under test. This balance should also be obtained when the connections at "a" and "b" are reversed.

Table A.4.2.a: Test conditions

COUNTRY	TEST VALUES	
	earth plane	foil
Austria	not mandatory	
Belgium	not mandatory	
Cyprus	X	
Denmark	X	X
Finland	X	
France	X	
Germany	X	
Greece		X
Iceland	X	
Ireland		
Italy	X	X
Luxembourg	not mandatory	
Malta		
Netherlands	X	
Norway	X	
Portugal	X	
Spain	X	
Sweden	X	
Switzerland	X	
U. Kingdom	not applicable	

Table A.4.2.b: Degree of unbalance about earth - Values of test figures

COUNTRY	TEST VALUES						Remarks
	C_L (μF)	R_L (Ω)	L (H)	Z_1 (Ω)	Z_2 (Ω)	Z_3 (Ω)	
Austria							
Belgium	20	300	5	600	600	600	yes
Cyprus	50	300	5	600	600	600	yes
Denmark							yes
Finland	≥ 16	400	≥ 6	600	600	600	yes
France	100	300	10	600		600	yes
Germany	47	300	15	600		600	yes
Greece	20	400	5	600			
Iceland	≥ 2	400	≥ 4	600		600	
Ireland							yes
Italy	≥ 200	200	≥ 2	600		600	yes
Luxembourg							
Malta							
Netherlands	20	300	4	600	600	600	yes
Norway	≥ 20	400 or ∞	≥ 10	600		600	yes
Portugal	≥ 50	400	≥ 5	600	600	600	
Spain	≥ 20	300	≥ 10		600		yes
Sweden	2	600	> 4	600			yes
Switzerland	≥ 47	300	5	600	600	600	yes
U. Kingdom		600		600			yes

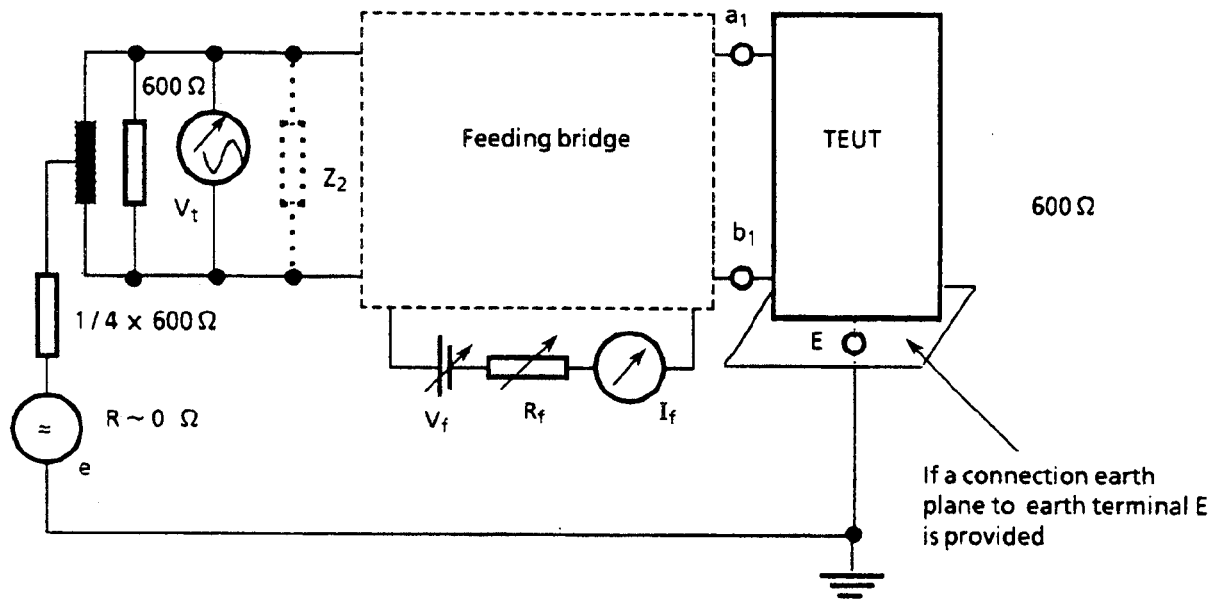


Figure A.4.2.a: Degree of unbalance about earth - one-port TE Feeding bridge as specified in Chapter 1

NOTE: The dotted impedance-component Z_2 in figure A.4.2.a is needed for a TE, which, when in use, only bridges the transmission circuits as stated in CCITT Recommendation 0.121, Paragraph 3.2.

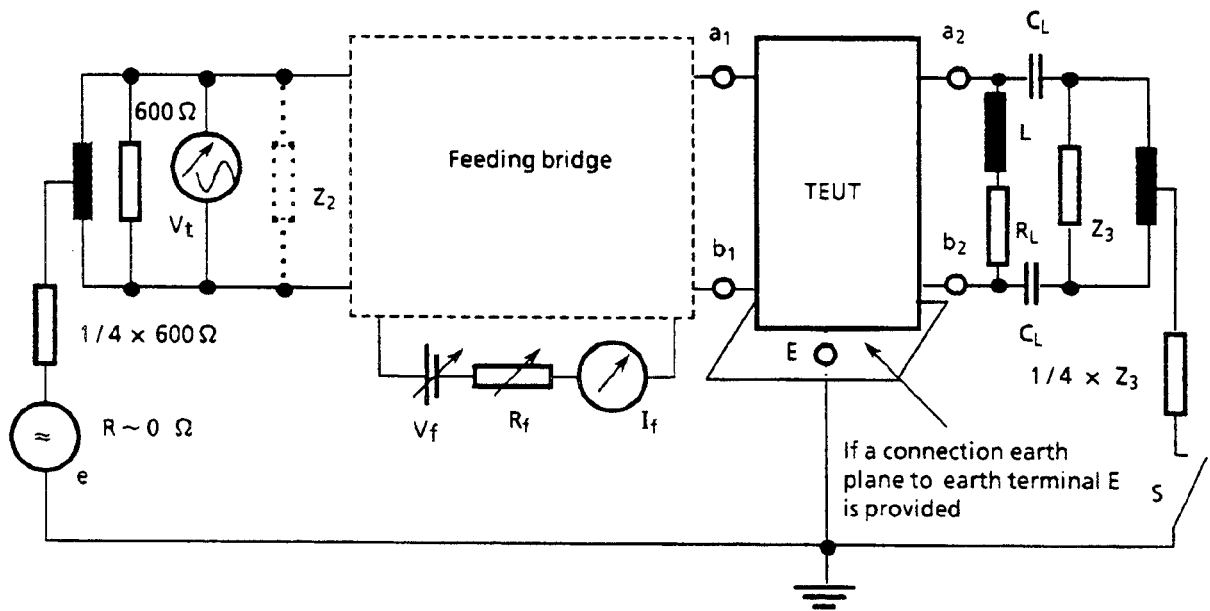


Figure A.4.2.b: Degree of unbalance about earth - Series-connected TE Feeding bridge as specified in Chapter 1

NOTE: The dotted impedance-component Z_2 in figure A.4.2.b is needed for a series-connected equipment, which, when in use, only bridges the transmission circuit (Z_2 very high value).

Switch S open: Measurement of longitudinal conversion loss.

Switch S closed: Measurement of longitudinal conversion transfer loss.

A.4.2 (B) 1

Test method:

Belgium makes use of the test circuits shown in figures A.4.2.a and A.4.2.b but in which the following changes are made:

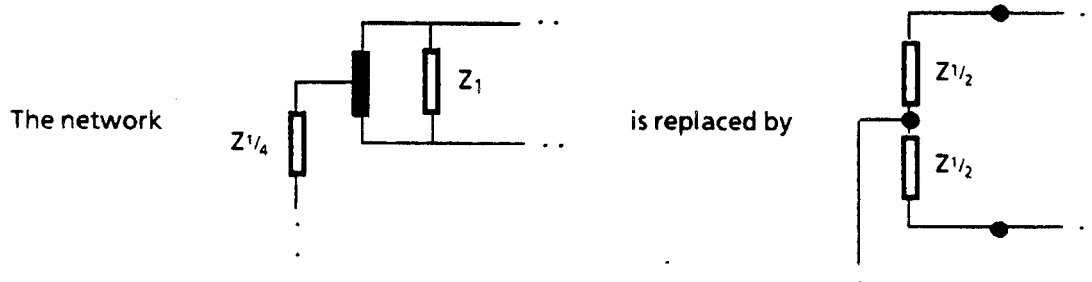


Figure A.4.2 (B) 1

A.4.2 (CY) 1

Test method:

Test circuits as shown in figures A.4.2.a and A.4.2.b with the following changes:

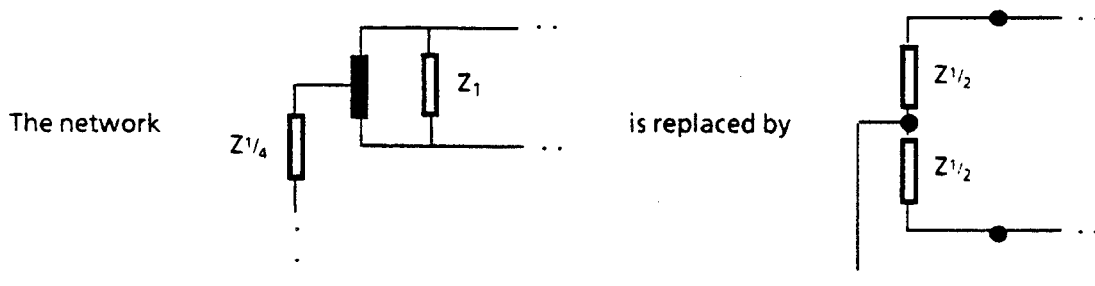


Figure A.4.2 (CY) 1

A.4.2 (DK) 1

Impedance of unbalance to earth:

The principle of the earth balance test is shown in figure A.4.2.a (DK) 1.

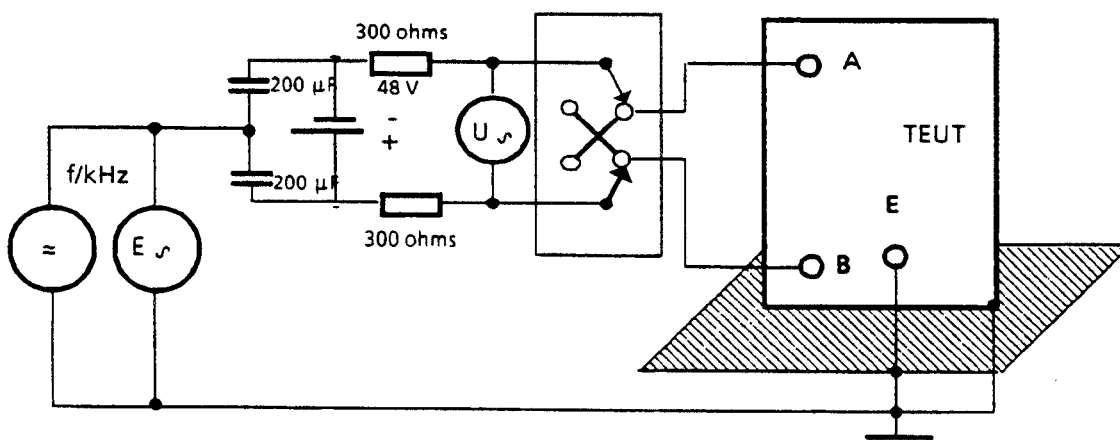


Figure A.4.2 (DK) 1

Here, the balance ratio to earth is determined as $20 \times \log_{10} (E/U)$ dB. U is measured with the switch in both positions. The balance ratio to earth is measured with the TE placed in normal position on a 10 cm thick, electrically insulating support with a relative dielectric constant of 1, placed on a metal plate at least 5 cm larger than the equipment on all sides. Measurement is made in relation to the metal plate connected with an artificial hand laid around (over) the control panel. Connection shall also be made with any accessible metal parts of the equipment and with any equipment point intended for connection to external earth/rack. The design of the artificial hand is shown in figure A.4.2.b (DK) 1.

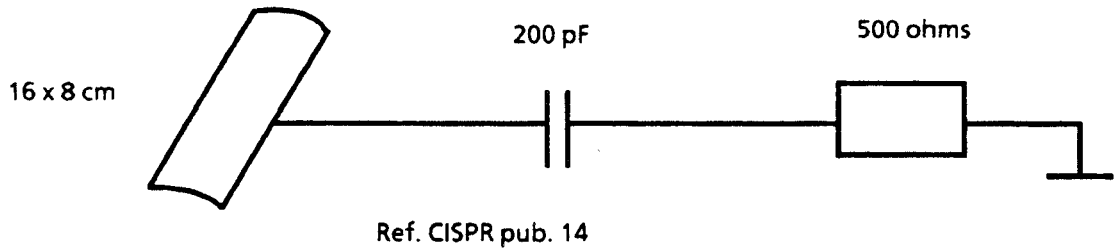


Figure A.4.2.b (DK) 1

The balance ratio to earth shall be measured at the following frequencies and voltages:

f/kHz	0,05	0,1	0,6	1,0	3,4	6,8	13,6
U/V	10	5	0,83	0,5	0,5	0,5	0,5

A.4.2 (SF) 1

Instead of the centre-tapped inductor and two separate resistors any of the configurations given in CCITT Recommendation 0.121, figure 8 can be used in the measuring set-up. Capacitors in feeding bridge are 47 μ F.

A.4.2 (F) 1

Figures A.4.2.a and A.4.2.b are used by

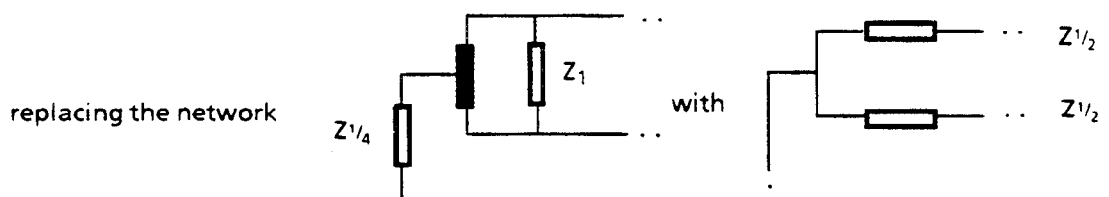


Figure A.4.2 (F) 1

A.4.2 (D) 1

The TEUT shall be mounted not higher than 3 mm above earth plane.

Germany uses a test bridge in the test circuit shown in figures A.4.2.a and A.4.2.b but in which the following changes are made:

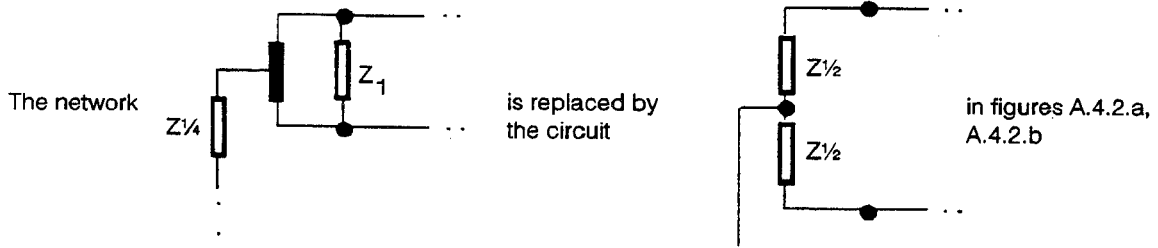


Figure A.4.2 (D) 1

A.4.2 (IRL) 1

The earth terminal of the TE is connected to the earth reference point. This requirement is only mandatory for TE with an earth terminal.

A.4.2 (I) 1

In the test circuits shown in figures A.4.2.a and A.4.2.b, the following changes are made:

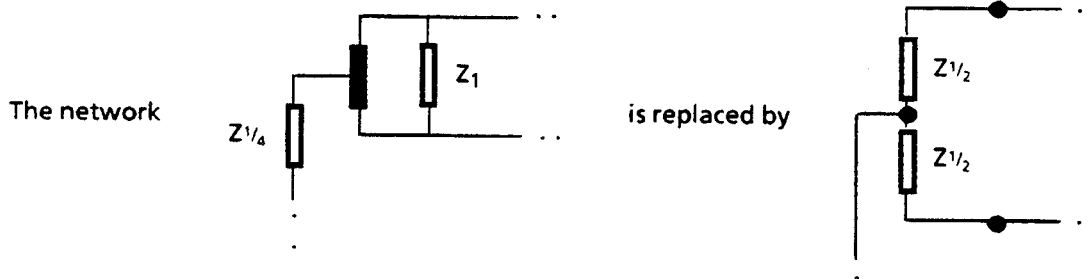


Figure A.4.2 (I) 1

A.4.2 (NL) 1

In the test circuits shown in figures A.4.2.a and A.4.2.b the following changes are made:

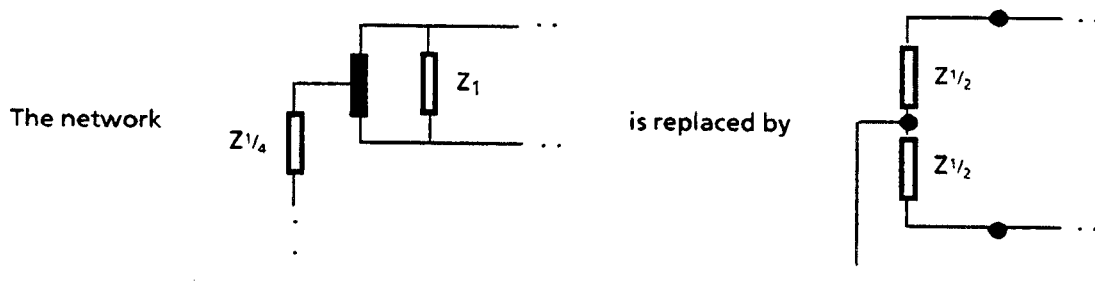


Figure A.4.2 (NL) 1

A.4.2 (N) 1

The TE earth lead or terminal is hardwired to the earth reference point of the test circuit.

A.4.2 (N) 2

Norway makes use of the test circuits shown in figures A.4.2.a and A.4.2.b but in which the following changes are made:

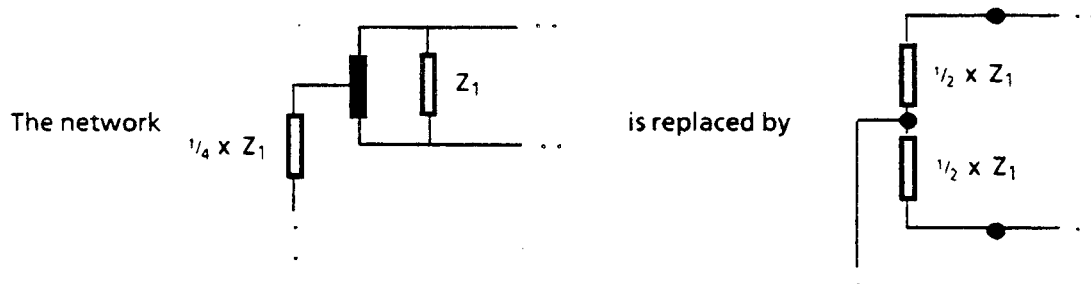


Figure A.4.2 (N) 1

- A.4.2 (N) 3** $R_L = 400$ ohms, $Z_3 = 600$ ohms in loop condition. $R_L = \infty$ in quiescent condition.
- A.4.2 (E) 1** See tests in sections A.4.2.1.1 (E) 1 and A.4.2.2.1 (E) 1.
- A.4.2 (S) 1** Electrically conducting casing shall be earthed and equipment having an insulation casing shall be placed on an earthed metal sheet.
- A.4.2 (S) 2** For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.
- A.4.2 (CH) 1** In the case of a subscriber's set, an artificial hand (metal foil connected to earth) shall be used around the whole handset.
- A.4.2 (GB) 1** The TE earth lead or terminal is hardwired to the earth reference point of the test circuit.
- For testing, the circuits in figures A.4.2.a and A.4.2.b shall be modified as shown in figure A.4.2 (GB) 1 below.

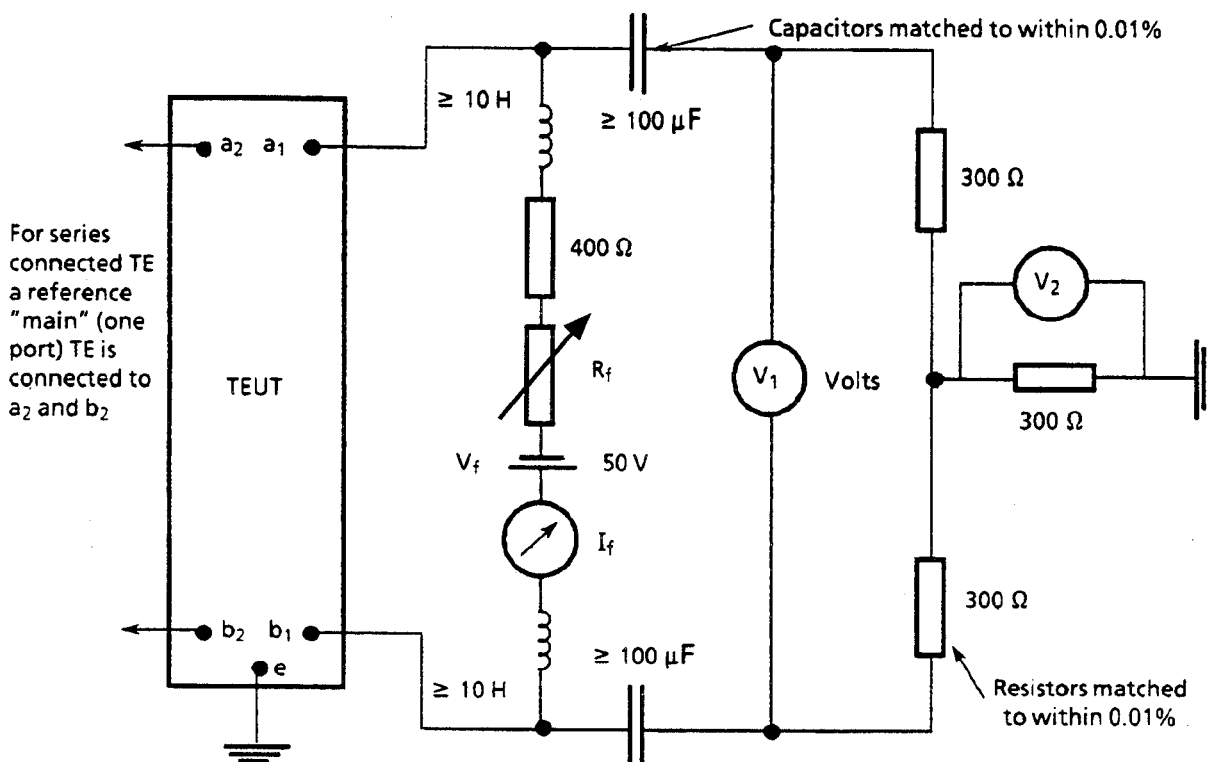


Figure A.4.2 (GB) 1.a: Signal balance about earth test circuit

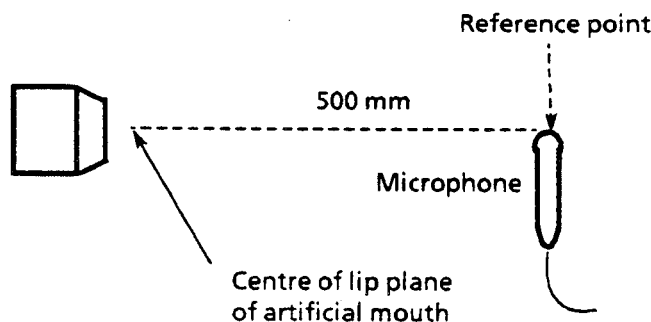


Figure A.4.2 (GB) 1.b : Microphone reference point

A.4.2 (GB) 2

- i) The TEUT is connected to the figure shown in figure A.4.2 (GB) 1a. The TEUT is energised as appropriate (see ii) below) and voltages V_1 and V_2 are measured, the values obtained are used to calculate the signal balance using formula A.4.2 (GB) 1:

$$\text{Signal balance} = 20 \times \log_{10} \left(\frac{V_1}{V_2} \right) \text{ dB} \quad \text{Formula A.4.2 (GB) 1}$$

Measurements are made at those values of I_f in the sequence 25, 32, 40, 50, 65, 75, 85, and 100 mA dc which are not greater than the current obtained when the line terminals are connected to a feed voltage of 50V dc in series with a 400 ohm resistor.

- ii) For TE that sends signals to line as a result of any live acoustic stimulus:

TE incorporating a telephone handset shall be energised by means of an artificial mouth applying a sinusoidal signal of 1 kHz at +5 dBPa to the mouth reference point. TE without a telephone handset (e.g. loudspeaking telephones) shall be energised by a sinusoidal signal of 1 kHz and a free field sound pressure level of -20 dBPa at the microphone reference point as shown in figure A.4.2 (GB) 1b.

4.2.1 Longitudinal conversion loss of a one-port TE

4.2.1.1 Quiescent condition

The longitudinal conversion loss of TE in the quiescent condition shall be greater than each value of α_q over its corresponding frequency range, Δf , as shown in table 4.2.1.1.

Compliance shall be checked according to the test outlined in section A.4.2.1.1 using figure A.4.2.a.

Table 4.2.1.1: Longitudinal conversion loss value for one-port TE, quiescent condition

COUNTRY	REQUIREMENT VALUES	
	ΔV_f (V)	ΔR_f (Ω)
Austria	60	
Belgium	48	400
Cyprus	48	800
Denmark	56	600
Finland	48	800
France	3 - 70	300
Germany	60	1 000 - 2 530
Greece	44 - 66	600
Iceland	48	800
Ireland	48	5 000
Italy	44 - 52	720 - 1 880
Luxembourg	60	1 000
Malta		
Netherlands	42 - 66	800 - 2 140
Norway	60	1 200
Portugal	45 - 55	300 - 1 800
Spain	48	1 100
Sweden		
Switzerland	48	1 200
U. Kingdom	not mandatory	

Table 4.2.1.1 cont: Longitudinal conversion loss value for one-port TE, quiescent condition

COUNTRY	REQUIREMENT VALUES								Remarks
	α_{q1} (dB)	Δf_1 (Hz)	α_{q2} (dB)	Δf_2 (Hz)	α_{q3} (dB)	Δf_3 (Hz)	α_{q4} (dB)	Δf_4 (Hz)	
Austria	52	300 - 3 400							
Belgium	48	300 - 3 400							yes
Cyprus	50	40 - 3 400	50	15 000 - 17 000					
Denmark	50	40 - 600	55	600 - 3 400		(> 3 400 -6 dB/octave)			
Finland	≥ 40	40 - 300	≥ 50	300 - 600	≥ 55	600 - 3 400			
France	40	50 - 300	50	300 - 3 400					
Germany	30	50 - 300	52	300 - 4 000					
Greece	40	40 - 300	40	300 - 3 400	52 - 6 dB/oct.	3 400 - 18 000			
Iceland	40	40 - 600	46	600 - 3 400					
Ireland	40	40 - 300	50	300 - 600	52	600 - 3 400			yes
Italy	40	300 - 3 400							
Luxembourg									
Malta									
Netherlands	46	48 - 52	46	300 - 3 400					yes
Norway	40	16 - 300	46	300 - 600	52	600 - 3 400			
Portugal	40	40 - 300	50	300 - 600	55	600 - 3400	N/A	N/A	
Spain									yes
Sweden	40	15 - 50	46	50 - 600	52	600 - 3 400	50	10 000 - 17 0000	yes
Switzerland	57	40 - 3 400		(> 3 400 Hz: -6 dB/octave)					yes
U. Kingdom									not mandatory

4.2.1.1 (B) 1

The requirement values for digital PABXs with analogue interface are:

$$\begin{aligned}\alpha_{q1} \text{ (dB)} &= 40 \\ \Delta f_1 \text{ (Hz)} &= 300 - 600 \\ \alpha_{q2} \text{ (dB)} &= 46 \\ \Delta f_2 \text{ (Hz)} &= 600 - 3 400\end{aligned}$$

4.2.1.1 (IRL) 1

This requirement is only mandatory for TE with an earth terminal.

4.2.1.1 (NL) 1

Additional requirements:

- a) The longitudinal input impedance at 50 Hz must be at least 1 M Ω when a TE without meter pulse reception is tested.
- b) The longitudinal input impedance at 50 Hz must be at least 6,7 k Ω when a TE with meter pulse reception is tested.

The requirements and tests are specified in 9.2.2.1 and A.9.2.2.1.

4.2.1.1 (E) 1 Impedance unbalance about earth, longitudinal conversion loss.
(Requirement to be applied instead of section 4.2.1.1).

PROVISION 1: See provision 1 in section 4.1.2 (E) 1

With TE in three following conditions, quiescent condition, loop condition, or high impedance condition, the degree of the impedance unbalance between the two line terminals with respect to any accessible part, connected to the earth terminal if it is provided, shall be such that the Longitudinal Conversion Loss (LCL) shall not be lower than the values stipulated in table 4.2.1.1 (E) 1.a over the frequency ranges indicated, tested with a longitudinal signal with the open circuit ac rms voltage values stipulated in table 4.2.1.1 (E) 1.b over the frequency ranges indicated, applied through two resistors of 300 ohms.

PROVISION 2: With TE in the quiescent condition and high impedance condition, an additional resistor of 600 ohms shall be connected (uncoupled from the dc feeding excitation) between the line terminals.

NOTE: The meaning given in this requirement for the term LCL is according with the CCITT Recommendations G.117 (Blue Book) and 0.9 (Blue Book) (formerly 0.121).

Compliance shall be checked using the tests outlined in section A.4.2.1.1 (E) 1.

Table 4.2.1.1 (E) 1.a: Impedance unbalance about earth, LCL limits

<u>LCL limit</u>	<u>Frequency range</u>
52 dB	$f = 50 \text{ Hz}$
40 dB	$50 \text{ Hz} < f < 300 \text{ Hz}$
50 dB	$300 \text{ Hz} \leq f \leq 600 \text{ Hz}$
55 dB	$600 \text{ Hz} < f \leq 3,4 \text{ kHz}$
44 dB	$f = 12 \text{ kHz}$

Table 4.2.1.1 (E) 1.b: Impedance unbalance about earth, voltage values

<u>Testing voltage (e)</u>	<u>Frequency range</u>
$e = 10 \text{ V}$	$f = 50 \text{ Hz}$
$e = 5 \text{ V}$	$50 \text{ Hz} < f < 300 \text{ Hz}$
$e = 3 \text{ V}$	$300 \text{ Hz} < f \leq 12 \text{ kHz}$

4.2.1.1 (S) 1 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.2.1.1 (S) 2 For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.

4.2.1.1 (CH) 1 Impedance unbalance with respect to earth: $\geq 57 \text{ dB}$ in the frequency range 40 to 3 400 Hz and decrease above 3 400 Hz $\leq 6 \text{ dB/octave}$.

A.4.2.1 Longitudinal conversion loss of a one-port TE

A.4.2.1.1 Quiescent condition

A resistor of value Z_2 (shown dotted in the test circuit figure A.4.2.a) is connected parallel with the circuit.

DC feeding conditions are established using the relevant values of V_f and R_f , and for each frequency, f_r , or frequency range, Δ_f , an ac excitation voltage of value "e" is applied. The corresponding values of V_t are measured and the values of α are determined using formula A.4.2.

The test parameter values are given in table A.4.2.1.1.

Table A.4.2.1.1 : Longitudinal conversion loss of a TE in quiescent condition

COUNTRY	TEST VALUES		
	V_f (V)	R_f (Ω)	Z_2 (Ω)
Austria	60		600
Belgium	48	400	600
Cyprus	48	440	600
Denmark	48	600	600
Finland	48	800	600
France	48	300	600
Germany	60	1 000	600
Greece	60	600	600
Iceland	48	800	600
Ireland	48	5 000	600
Italy	44, 48, 52	1 880, 1 100, 720	600
Luxembourg	60	1 000	600
Malta			
Netherlands	42 - 66	800 - 2 140	600
Norway	60	1 200	600
Portugal	48	300 - 1 800	600
Spain	48	1 100	
Sweden			600
Switzerland			600
U. Kingdom	not mandatory	not mandatory	not mandatory

Table A.4.2.1.1 cont. : Longitudinal conversion loss of a TE in quiescent condition

COUNTRY	TEST VALUES								Remarks
	e ₁ (mV)	Δf ₁ (Hz)	e ₂ (mV)	Δf ₂ (Hz)	e ₃ (mV)	Δf ₃ (Hz)	e ₄ (mV)	Δf ₄ (Hz)	
Austria	775	300 - 3 400							
Belgium	775	300 - 3 400							
Cyprus	1500	40 - 3 400	1 500	15 000 - 17 000					
Denmark	10 ⁴	50	5 000	100	830	600	500	1000 - 13600	
Finland	775	40 - 3 400							
France	775	50 - 300	775	300 - 3 400					
Germany	775	50 - 300	775	300 - 4 000					
Greece	775	40 - 18 000							yes
Iceland	775	40 - 600	775	600 - 3 400					
Ireland	1000	40 - 300	1 000	300 - 600	1000	600 - 3 400			
Italy	775	300 - 3 400							
Luxembourg	775	300 - 3 400							
Malta									
Netherlands	100 V	48 - 52	775	300 - 3 400					
Norway	775	16 - 300	775	300 - 600	775	600 - 3 400			
Portugal	3 000	40 - 3 400	N/A	N/A	N/A	N/A	N/A	N/A	
Spain									yes
Sweden	775	15 - 50	775	50 - 600	775	600 - 3 400	775	10000 - 17000	yes
Switzerland	775	40... > 5 000							yes
U. Kingdom									

A.4.2.1.1 (GR) 1 In the frequency range 40 - 18 000 Hz measurement frequencies shall be spaced 1 octave, beginning from $f_1 = 40$ Hz.

A.4.2.1.1 (E) 1 Impedance unbalance about earth, longitudinal conversion loss.

The TEUT is connected as shown in figure A.4.2.1.1 (E) 1.

PROVISION: The testing laboratory shall use a suitable earth plate related with the TEUT.

The dc voltage source (V_f), the inductors (L_1) and (L_2), and the capacitors (C_1) and (C_2), take the values stipulated in test A.4.1.2 (E) 1. The resistor (R_f) takes the value of 1 100 ohms; when the TE is in loop condition, the tests shall also be made when this resistor takes the value of 500 ohms and 1 700 ohms.

The resistors (R_1) and (R_2) take the value of 300 ohms.

The generator output resistance (R_G) shall not be greater than 50 ohms.

The resistor (R_3) is the additional resistor stipulated in the provision 2 of the requirement in section 4.2.1.1 (E) 1.

The tests shall be made at the ac generator open circuit rms voltages (e) stipulated in the requirement in section 4.2.1.1 (E) 1. The generator frequency (f) takes at least the values of the centre frequencies of one-third of one octave in preferred series from 50 Hz to 3,15 kHz, and at 50 Hz, 150 Hz, 250 Hz, 300 Hz, 600 Hz, 3,4 kHz, and 12 kHz.

The Longitudinal Conversion Loss (LCL) is calculated using formula A.4.2.1.1 (E) 1, where V_1 is voltmeter (V_1) reading in volts and V_2 is voltmeter (V_2) reading in volts, at each testing frequency value.

$$\text{LCL (dB)} = 20 \times \log_{10} \frac{V_1 \text{ (V)}}{V_2 \text{ (V)}} \quad \text{Formula A.4.2.1.1 (E) 1}$$

In order to validate the test results, it shall be necessary to check that when the resistor (R_3) is connected, the TEUT is disconnected, and the earth connection is in open circuit, the resultant LCL values are at least 20 dB greater than the limits stipulated in the requirement in section 4.2.1.1 (E) 1.

NOTE: The testing laboratory shall take into account the requirement in section 4.2.1.1 (E) 1 which refers to all accessible parts.

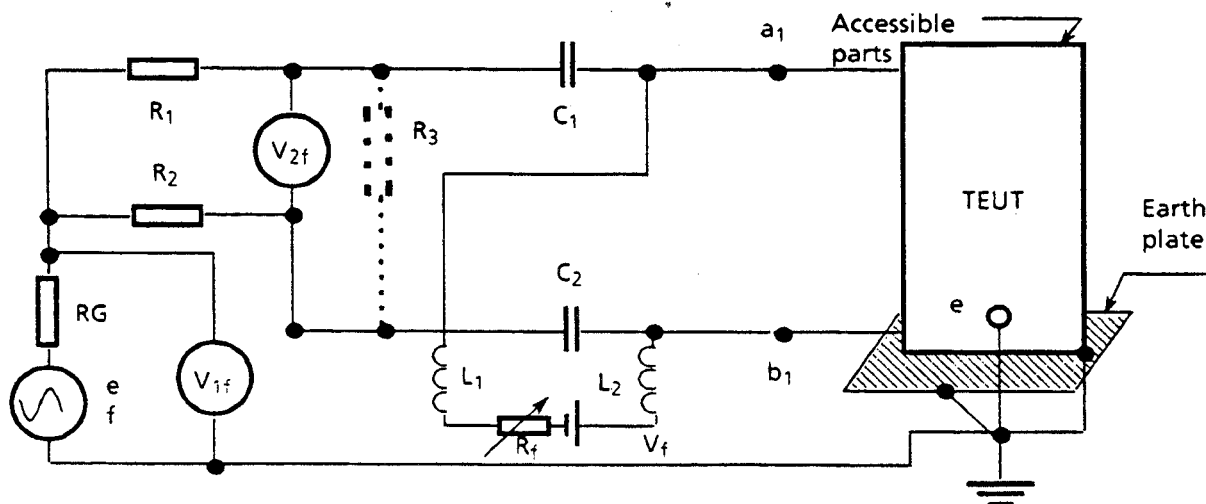


Figure A.4.2.1.1 (E) 1: Impedance unbalance about earth, longitudinal conversion loss

A.4.2.1.1 (S) 1 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

A.4.2.1.1 (CH) 1 Feeding settings:

$V_{f1} : 43 \text{ V}, R_{f1} : 2\ 200 \ \Omega$

$V_{f2} : 48 \text{ V}, R_{f2} : 1\ 200 \ \Omega$

$V_{f3} : 57 \text{ V}, R_{f3} : 600 \ \Omega$

4.2.1.2 Loop condition

The longitudinal conversion loss of TE in the loop condition shall be greater than each value of α_l over its corresponding frequency range Δf as shown in table 4.2.1.2.

Compliance shall be checked according to the test outlined in section A.4.2.1.2 using figure A.4.2.a.

Table 4.2.1.2: Longitudinal conversion loss values for one-port TE, loop condition

COUNTRY	REQUIREMENT VALUES		
	ΔV_f (V)	ΔR_f (Ω)	ΔI_f (mA)
Austria	60		19 - 60
Belgium	48		20 - $I_{max.}$
Cyprus	48	800	20 - 100
Denmark			8 - $I_{max.}$
Finland	48	800 - 1 710	
France	45 - 54	300 - 1 400	
Germany	60	1 000 - 2 530	
Greece	44 - 66		20 - 80
Iceland	48		14 - $I_{max.}$
Ireland	48		20 - 100
Italy	44 - 52	720 - 1 880	
Luxembourg	60		14 - 60
Malta			
Netherlands	42 - 66	800 - 2 140	
Norway	60	460 - 3 500	
Portugal	45 - 55	300 - 1 800	not applicable
Spain	48	500 - 1 700	
Sweden			
Switzerland	43 - 57	2 200 - 600	
U. Kingdom	50	400 min.	25 - 100

Table 4.2.1.2 cont: Longitudinal conversion loss values for one-port TE, loop condition

COUNTRY	REQUIREMENT VALUES								Remarks
	α_{11} (dB)	Δf_1 (Hz)	α_{11} (dB)	Δf_2 (Hz)	α_{13} (dB)	Δf_3 (Hz)	α_{14} (dB)	Δf_4 (Hz)	
Austria	52	300 - 3 400							
Belgium	48	300 - 3 400							yes
Cyprus	50	40 - 3 400	50	15 000 - 17 000					
Denmark	50	40 - 60	55	600 - 3 400		(> 3400 -6 dB/octave)			
Finland	≥ 40	40 - 300	≥ 50	300 - 600	≥ 55	600 - 3 400			
France	40	50 - 300	50	300 - 3 400					
Germany	30	50 - 300	52	300 - 4 000					
Greece	40	40 - 300	40	300 - 3 400	52-6 dB/oct.	3 400 - 18 000			
Iceland	40	40 - 600	46	600 - 3 400					
Ireland	40	40 - 300	50	300 - 600	52	600 - 3 400			yes
Italy	40	300 - 3 400							
Luxembourg	52	300 - 3 400							
Malta									
Netherlands	46	48 - 52	46	300 - 3 400					yes
Norway	40	16 - 300	46	300 - 600	52	600 - 3 400			
Portugal	40	40 - 300	50	300 - 600	55	600 - 3 400	N/A	N/A	
Spain									yes
Sweden	40	15 - 50	46	50 - 600	52	600 - 3 400	50	10000 - 17000	yes
Switzerland	57	40 - 3 400		(> 3 400 Hz:-6 dB/octave)					
U. Kingdom	46	300 - 3 400							yes

4.2.1.2 (B) 1 The requirement values for digital PABXs with analogue interface are:

$$\begin{aligned} \alpha_{q1} \text{ (dB)} &= 40 \\ \Delta f_1 \text{ (HZ)} &= 300 - 600 \\ \alpha_{q2} \text{ (dB)} &= 46 \\ \Delta f_2 \text{ (HZ)} &= 600 - 3 400 \end{aligned}$$

4.2.1.2 (IRL) 1 This requirement is mandatory only for TE with an earth terminal.

4.2.1.2 (NL) 1 Additional requirements:

- a) The longitudinal input impedance at 50 Hz must be at least 1 M Ω when a TE without meter pulse reception is tested.
- b) The longitudinal input impedance at 50 Hz must be at least 6,7 k Ω when a TE with meter pulse reception is tested.

The requirements and tests are specified in 9.2.2.1 and A.9.2.2.1.

4.2.1.2 (E) 1 Requirement in section 4.2.1.1 (E) 1 shall be applied.

4.2.1.2 (S) 1 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.2.1.2 (S) 2 For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.

4.2.1.2 (GB) 1 This requirement is mandatory only for TE with an earth connection.

A.4.2.1.2 Loop condition

A given dc feeding condition is established using the relevant values V_f , R_f or I_f and for that condition a given ac excitation voltage value, "e", is chosen; using that value, "e", the values of α are determined at a number of frequencies, f_r , or over a range of frequencies, Δf .

The values of the dc feeding parameters V_f , R_f , and I_f are shown in table A.4.2.1.2.a. The values of the excitation parameters, "e", f_r , Δf are shown in table A.4.2.1.2.b; $Z_1 = 600 \Omega$.

Table A.4.2.1.2.a : Values of the dc feeding parameters V_{fi} , R_{fi} , and I_i for testing longitudinal conversion loss of a TE in loop condition

COUNTRY	TEST VALUES		
	V_f (V)	R_f (Ω)	I_f (mA)
Austria	60		19, 60
Belgium	48	400, 1 600	
Cyprus	48	800	
Denmark	48	600	not stated
Finland	48	800, 1 710	
France	48	300	
Germany	60	1 000, 2 530	
Greece	60		20, 35, 55
Iceland	48		14, I_{max} .
Ireland	48	5 000	20, 50, 100
Italy	44, 48, 52	1 880, 1 100, 720	
Luxembourg	60		14, 60
Malta			
Netherlands	42 - 66	800 - 2 140	
Norway	60	1 200	
Portugal	48	300 - 1 800	not applicable
Spain	48	500, 1 100, 1 700	
Sweden			
Switzerland	43, 48, 57	2 200, 1 200, 600	
U. Kingdom	50	400 min.	25, 32, 40, 50, 65, 75, 85, 100

Table A.4.2.1.2.b : Values of the ac excitation parameters "e", f_t , Δf for testing longitudinal conversion loss of a TE in loop condition

COUNTRY	TEST VALUES								Remarks
	e_1 (mV)	$\Delta f_1/f_{t1}$ (Hz)/(Hz)	e_2 (mV)	$\Delta f_2/f_{t2}$ (Hz)/(Hz)	e_3 (mV)	$\Delta f_3/f_{t3}$ (Hz)/(Hz)	e_4 (mV)	$\Delta f_4/f_{t4}$ (Hz)/(Hz)	
Austria	775	300, 1 000, 3 400							
Belgium	775	300 - 3 400							
Cyprus	1 500	40 - 3 400	1 500	15 000 - 17 000					
Denmark	10 ⁴	50	5 000	100	830	600	500	1 000 - 13 600	
Finland	775	40 - 3 400							
France	775	50 - 300	775	300 - 3 400					
Germany	775	50 - 300	775	300 - 4 000					
Greece	775	40 - 18 000							yes
Iceland	775	40 - 600	775	600 - 3 400					
Ireland	1 000	40, 200	1 000	400	1 000	1 200, 3 400			
Italy	775	300 - 3 400							
Luxembourg	775	300 - 3 400							
Malta									
Netherlands	100 V	48 - 52	775	300 - 3 400					
Norway	775	16, 40, 160	775	320	775	630, 1 500, 3 400			
Portugal	3 000	40 - 3 400	N/A	N/A	N/A	N/A	N/A	N/A	
Spain									yes
Sweden	775	over the ranges 15 - 3 400 and 10 000 - 17 000 Hz							yes
Switzerland	775	40... > 5 000							
U. Kingdom	1 000 ± 10%	300 - 3 400							yes

A.4.2.1.2 (GR) 1 In the frequency range 40 - 18 000 Hz measurement frequencies shall be spaced 1 octave, beginning from $f_1 = 40$ Hz.

A.4.2.1.2 (E) 1 See the requirement in section 4.2.1.1 (E) 1 and its compliance test method in section in section A.4.2.1.1 (E) 1.

A.4.2.1.2 (S) 1 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

A.4.2.1.2 (GB) 1 The test circuit is as shown in figure A.4.2.1.2 (GB) 1.

$$\alpha = 20 \log \left(\frac{e}{V_t} \right)$$

where "e" = voltage across generator G, with a value of:
1 V ± 10% ac rms;
 V_t = voltage across two sides of test circuit.

Measurements are made at those values of TE current in the sequence 25, 32, 40, 50, 65, 75, 85, and 100 mA dc which are not greater than the current obtained when the two leads designated for connection to the PSTN are connected to a voltage source of 50 V dc in series with a 400 ohm resistor.

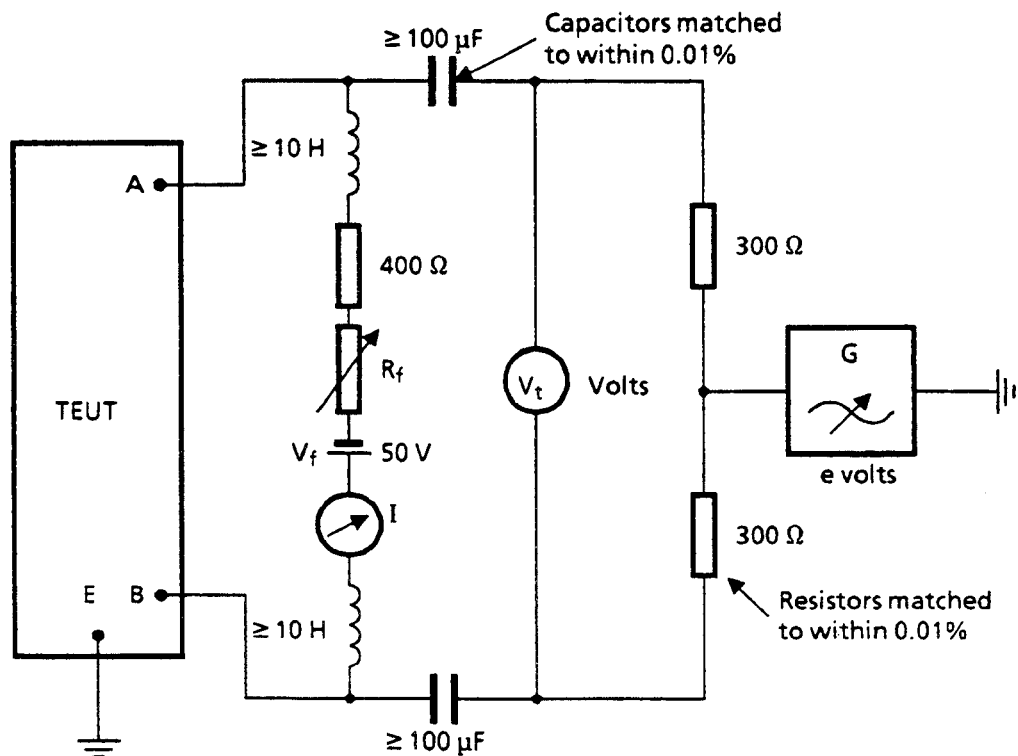


Figure A.4.2.1.2 (GB) 1: Impedance balance test circuit

NOTE 1: The variable resistor, series resistor and battery may be replaced by a constant current source. If the impedance of the constant current source is greater than 25 kohms over the frequency range 160 Hz to 8 000 Hz the inductors may also be omitted.

NOTE 2: For speech apparatus, acoustical terminations are required.

NOTE 3: The value of 400 ohms for the resistor includes the resistance value of the coils.

4.2.2 Longitudinal conversion loss and longitudinal conversion transfer loss of a series-connected TE.

For the purpose of this section, series-connected TE is defined as equipment which is provided with one port intended to be attached to the PSTN and a second port to which TE, which itself is approved for connection to the PSTN may alternatively be connected.

Requirements in this section are to be met when this series-connected TE is in a condition such that no loop current flows (second port attached TE or termination in quiescent condition), defined as quiescent condition; and when series-connected TE is in a condition such that loop current flows (second port attached TE or termination in loop condition), defined as loop condition.

4.2.2.1 Quiescent condition

The longitudinal conversion loss and respectively the longitudinal conversion transfer loss of a TE in the quiescent condition shall be greater than each value of α_q over its corresponding frequency range, Δf , as shown in tables 4.2.2.1.a and 4.2.2.1.b, respectively.

Compliance shall be checked according to the test outlined in section A.4.2.2.1 using figure A.4.2.b.

Table 4.2.2.1.a: Longitudinal conversion loss values for series-connected TE, quiescent condition

COUNTRY	REQUIREMENT VALUES	
	ΔV_f (V)	ΔR_f (Ω)
Austria	not mandatory	
Belgium	48	400
Cyprus	48	800
Denmark	not mandatory	
Finland	48	800
France	3 - 70	300
Germany	60	1 000 - 2 530
Greece	44 - 66	600
Iceland	48	800
Ireland	48	5 000
Italy	44 - 52	720 - 1 880
Luxembourg	60	1 000
Malta		
Netherlands	42 - 66	800 - 2 140
Norway	60	460 - 3 500
Portugal	45 - 55	300 - 1 800
Spain	48	1 100
Sweden		
Switzerland	48	1 200
U. Kingdom	not mandatory	

Table 4.2.2.1.a cont.: Longitudinal conversion loss values for series-connected TE, quiescent condition

COUNTRY	REQUIREMENT VALUES							
	α_{q1} (dB)	Δ_{f1} (Hz)	α_{q2} (dB)	Δ_{f2} (Hz)	α_{q3} (dB)	Δ_{f3} (Hz)	α_{q4} (dB)	Δ_{f4} (Hz)
Austria	not mandatory							
Belgium	48	300 - 3 400						
Cyprus	50	40 - 3 400	50	15 000 - 17 000				
Denmark	not mandatory							
Finland	≥ 40	40 - 300	≥ 50	300 - 600	≥ 55	600 - 3 400		
France	40	50 - 300	50	300 - 3 400				
Germany	30	50 - 300	52	300 - 4 000				
Greece	40	40 - 300	40	300 - 3 400	52 -6 dB/oct.	3 400 - 18 000		
Iceland	40	40 - 600	46	600 - 3 400				
Ireland	40	40 - 300	50	300 - 600	52	600 - 3 400		
Italy	40	300 - 3 400						
Luxembourg	52	300 - 3 400						
Malta								
Netherlands	46	48 - 52	46	300 - 3 400				
Norway	40	16 - 300	46	300 - 600	52	600 - 3 400		
Portugal	40	40 - 300	50	300 - 600	55	600 - 3 400	N/A	N/A
Spain								
Sweden	40	15 - 50	46	50 - 600	52	600 - 3400	50	10000 - 17000
Switzerland	57	40 - 3 400	(>3 400 Hz: -6 dB/octave)					
U. Kingdom								

Table 4.2.2.1.b: Longitudinal conversion transfer loss values for series-connected TE, quiescent condition

COUNTRY	REQUIREMENT VALUES	
	ΔV_f (V)	ΔR_f (Ω)
Austria	not mandatory	
Belgium	not mandatory	
Cyprus	not mandatory	
Denmark	not mandatory	
Finland	not mandatory	
France	not mandatory	
Germany	not mandatory	
Greece	not mandatory	
Iceland	not mandatory	
Ireland	48	5 000
Italy	not mandatory	
Luxembourg	not mandatory	
Malta		
Netherlands	42 - 66	800 - 2 140
Norway	not mandatory	
Portugal	not mandatory	
Spain	48	1 100
Sweden		
Switzerland	48	1 200
U. Kingdom	not mandatory	

Table 4.2.2.1.b cont.: Longitudinal conversion transfer loss values for series-connected TE, quiescent condition

COUNTRY	REQUIREMENT VALUES								Remarks	
	α_{q1} (dB)	Δf_1 (Hz)	α_{q2} (dB)	Δf_2 (Hz)	α_{q3} (dB)	Δf_3 (Hz)	α_{q4} (dB)	Δf_4 (Hz)		
Austria									not mandatory	
Belgium									not mandatory	
Cyprus									not mandatory	
Denmark									not mandatory	
Finland									not mandatory	
France									not mandatory	
Germany									not mandatory	
Greece									not mandatory	yes
Iceland									not mandatory	
Ireland	40	40 - 300	50	300 - 600	52	600 - 3 400			yes	
Italy									not mandatory	
Luxembourg									not mandatory	
Malta										
Netherlands	46	48 - 52	46	300 - 3 400					yes	
Norway									not mandatory	
Portugal									not mandatory	
Spain										yes
Sweden	40	15 - 50	46	50 - 600	52	60 - 3 400	50	10 000 - 17 000	yes	
Switzerland	57	40 - 3 400		(> 3400 Hz: -6 dB/octave)						
U. Kingdom										

4.2.2.1 (GR) 1 The requirement of all subsections shall be met at either ports of the TE.

4.2.2.1 (IRL) 1 This requirement is mandatory only for TE with an earth terminal.

4.2.2.1 (NL) 1 Additional requirements:

- a) The longitudinal input impedance at 50 Hz must be at least 1 M Ω when a TE without meter pulse reception is tested.
- b) The longitudinal input impedance at 50 Hz must be at least 6,7 k Ω when a TE with meter pulse reception is tested.

The requirements and tests are specified in 9.2.2.1 and A.9.2.2.1.

4.2.2.1 (E) 1 Impedance unbalance about earth, longitudinal conversion transfer loss (Series).
(Requirement to be applied instead of section 4.2.2.1).

PROVISION 1: See provision 1 in section 4.1.2 (E) 1.

With series TE in the three following conditions, quiescent condition, loop condition, or high impedance condition, the degree of the impedance unbalance between the two line input terminals and between the two line output terminals with respect to any accessible part, connected to the earth terminal if it is provided, shall be such that the Longitudinal Conversion Transfer Loss (LCTL) shall not be lower than the values stipulated in table 4.2.2.1 (E) 1 over the frequency ranges indicated, tested with the signals stipulated in the requirement in section 4.2.1.1 (E) 1, when two resistors of 300 ohms are connected to the line output terminals.

PROVISION 2: See the provision 1 in section 4.2.1.1 (E) 1.

PROVISION 3: This requirement shall, however, not be applied for series TEs which are prepared for disconnecting the associated TE from the line, while this associated TE is disconnected from the line.

NOTE 1: The meaning given in this requirement for the term LCTL is according with the CCITT Recommendations G.117 (Blue Book) and 0.9 (Blue Book) (formerly 0.121).

NOTE 2: See section 4.2.1.1 (E) 1 for Longitudinal Conversion Loss (LCL) at input port.

Compliance shall be checked using the tests outlined in section A.4.2.2.1 (E) 1.

Table 4.2.2.1 (E) 1 : Impedance unbalance about earth, LCTL limits

<u>LCTL limit</u>	<u>Frequency range</u>
52 dB	$f = 50 \text{ Hz}$
40 dB	$50 \text{ Hz} < f < 300 \text{ Hz}$
50 dB	$300 \text{ Hz} \leq f \leq 600 \text{ Hz}$
55 dB	$600 \text{ Hz} < f \leq 3,4 \text{ kHz}$
44 dB	$f = 12 \text{ kHz}$

4.2.2.1 (S) 1 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.2.2.1 (S) 2 For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.

A.4.2.2 Longitudinal conversion loss and longitudinal conversion transfer loss of a series-connected TE

A.4.2.2.1 Quiescent condition

An impedance of value Z_2 (shown dotted in the test circuit figure A.4.2.b) is connected in parallel with the circuit.

DC feeding conditions are established using the relevant values of V_f and R_f , and for that condition a given ac excitation voltage value "e" is chosen; using that value "e" the values of α are determined at a number of frequencies f_t or in the frequency ranges Δf declared.

The test parameter values are given in table A.4.2.2.1.

Table A.4.2.2.1: Longitudinal conversion loss of a TE in quiescent condition.

COUNTRY	TEST VALUES				
	V_f (V)	R_f (Ω)	R_L (Ω)	Z_1 (Ω)	Z_2 (Ω)
Austria	not mandatory				
Belgium	48	400	$\geq 5 \text{ M}\Omega$	600	$\geq 20 \text{ 000}$
Cyprus	48	800	300	600	600
Denmark	not mandatory				
Finland	48	800, 1 710	400	600	600
France	48	300	∞	600	
Germany	60	1 000, 2 530	300	600	
Greece	60	600	400	600	600
Iceland	48	800	400	600	600
Ireland	48	5 000		600	
Italy	44, 48, 52	1 880, 1 100, 720	∞	600	10k
Luxembourg	60	1 000	300	600	600
Malta					
Netherlands	42, 48, 66	800, 1 130, 2 140	∞	600	600
Norway	60	1 200	∞	600	
Portugal	48	300 - 1 800	400	600	600
Spain	48	1 100	300		600
Sweden				600	600
Switzerland	48	1 200	300	600	600
U. Kingdom	not mandatory				

Table A.4.2.2.1 cont.: Longitudinal conversion loss of a TE in quiescent condition.

COUNTRY	TEST VALUES								Remarks
	e_1 (mV)	$\Delta f_1/f_1$ (Hz)/(Hz)	e_2 (mV)	$\Delta f_2/f_2$ (Hz)/(Hz)	e_3 (mV)	$\Delta f_3/f_3$ (Hz)/(Hz)	e_4 (mV)	$\Delta f_4/f_4$ (Hz)/(Hz)	
Austria	not mandatory								
Belgium	775	300 - 3 400							
Cyprus	1 500	40 - 3 400	1 500	15 000 - 17 000					
Denmark	not mandatory								
Finland	775	40 - 3 400							
France	775	50 - 300	775	300 - 3 400					
Germany	775	50 - 300	775	300 - 4 000					
Greece	775	40 - 18 000							yes
Iceland	775	40 - 600	775	600 - 3 400					
Ireland	1 000	40, 200	1 000	400	1000	1 200, 3 400			
Italy	775	300 - 3 400							
Luxembourg	775	300 - 3 400							
Malta									
Netherlands	100 V	48 - 52	775	300 - 3 400					
Norway	775	16, 40, 160	775	320	775	630, 1 500, 3 400			
Portugal	3 000	40 - 3 400	N/A	N/A	N/A	N/A	N/A	N/A	
Spain									yes
Sweden	775	15 - 50	775	50 - 600	775	600 - 3 400	775	10 000 - 17 000	yes
Switzerland	775	40... >5 000							
U. Kingdom									

A.4.2.2.1 (GR) 1

- a) In the frequency range 40 - 18 000 Hz measurement frequencies shall be spaced 1 octave, beginning from $f_1 = 40$ Hz.
- b) In the case of a tax meter, in the frequency range 15 250 - 16 750 Hz an additional measurement is made at $f = 16 000$ Hz with $Z_1 = Z_2 = 200$ ohms.

A.4.2.2.1 (E) 1

Impedance unbalance about earth, longitudinal conversion transfer loss (Series).

The series TEUT is connected as shown in figure A.4.2.2.1 (E) 1.

PROVISION:

See the provision in section A.4.2.1.1 (E) 1.

The dc voltage (V_f), the inductors (L_1) and (L_2), and the capacitors (C_1) and (C_2), take the values stipulated in test A.4.1.2 (E) 1. The resistor (R_f) takes the values stipulated in test A.4.2.1.1 (E) 1.

The resistors (R_1) and (R_2), and the output resistance (R_G) take the values stipulated in test A.4.2.1.1 (E) 1. The resistor (R_3) is the additional resistor stipulated in the provision 2 of the requirement in section A.4.2.1.1 (E) 1.

The value of the inductor (L_3) shall not be lower than 10 H. The resistor (R_4) takes the value of 300 ohms. The value of the capacitors (C_3) and (C_4) shall not be lower than 20 μF . The resistors (R_5) and (R_6) take the value of 300 ohms.

The switch (S_1) shall be in its closed state when the series TEUT is in quiescent condition or in high impedance condition, and it shall be in its open state when the series TEUT is in loop condition. The tests shall be made for each position of the switch (S_2).

The test shall be made at the ac generator open circuit rms voltage (e) and frequency (f) values stipulated in test A.4.2.1.1 (E) 1.

The Longitudinal Conversion Transfer Loss (LCTL) is calculated using formula A.4.2.2.1 (E) 1, where V_1 is the voltmeter (V_1) reading in volts and V_3 is the voltmeter (V_3) reading in volts, at each testing frequency value.

$$\text{LCTL (dB)} = 20 \times \log_{10} \frac{V_1 \text{ (V)}}{V_3 \text{ (V)}} \quad \text{Formula A.4.2.2.1 (E) 1}$$

In order to validate the test results, it shall be necessary to check that when the series TEUT is disconnected, the leads (a_1) and (a_2) are shorted together, the leads (b_1) and (b_2) are shorted together, and the earth connection (e) is in open circuit, the resultant LCTL values are at least 20 dB greater than the limits stipulated in the requirement in section 4.2.2.1 (E) 1. The check shall also be made when the leads (a_1) and (b_2) are shorted together, and the leads (b_1) and (a_2) are shorted together.

NOTE: The testing laboratory shall take into account the requirement in section 4.2.2.1 (E) 1 which refers to all accessible parts.

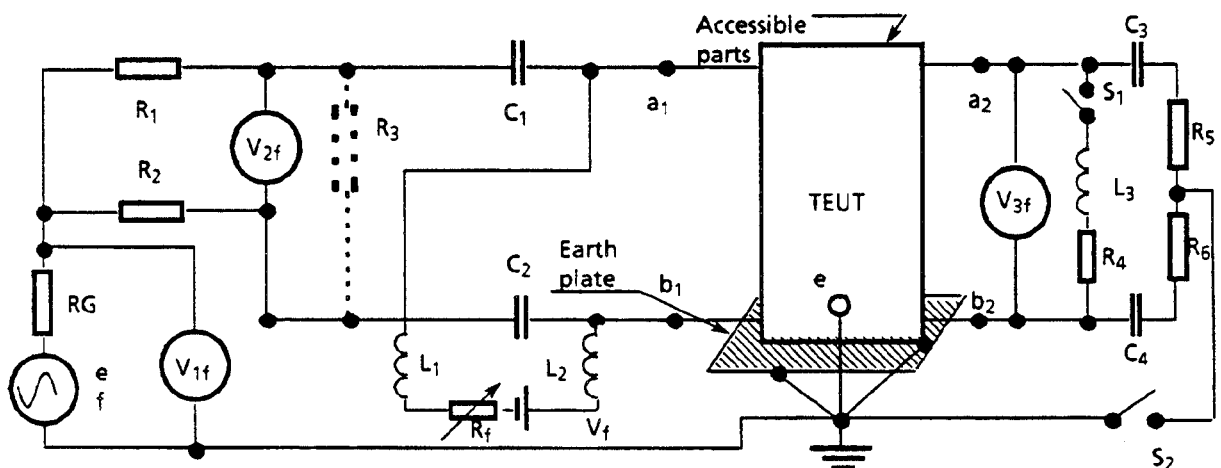


Figure A.4.2.2.1 (E) 1: Impedance unbalance about earth, longitudinal conversion transfer loss (Series)

A.4.2.2.1 (S) 1

Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.2.2.2 Loop condition

The longitudinal conversion loss and respectively the longitudinal conversion transfer loss of a TE in the loop condition shall be greater than each value of α_1 over its corresponding frequency range, Δf , as shown in tables 4.2.2.2.a and 4.2.2.2.b, respectively.

Compliance shall be checked according to the test outlined in section A.4.2.2.2, using figure A.4.2.b.

Table 4.2.2.2.a: Longitudinal conversion loss values for series-connected TE, loop condition

COUNTRY	REQUIREMENT VALUES		
	ΔV_f (V)	ΔR_f (Ω)	ΔI_f (mA)
Austria	not mandatory		
Belgium	48		20 - $I_{max.}$
Cyprus	48	440 - 1 740	20 - 100
Denmark	not mandatory		
Finland	48	800 - 1 710	
France	48		25 - 60
Germany	60	1 000 - 2 530	
Greece	44 - 66		20 - 80
Iceland	48		14 - $I_{max.}$
Ireland	48	5 000	20 - 100
Italy	44 - 52	720 - 1 880	
Luxembourg	60	1 000	
Malta			
Netherlands	42 - 66	800 - 2140	
Norway	60	460 - 3 500	
Portugal	45 - 55	300 - 1 800	not applicable
Spain	48	500 - 1 700	
Sweden			
Switzerland	43 - 57	2 200 - 600	
U. Kingdom	50	400 min.	25, 40

Table 4.2.2.2.a cont.: Longitudinal conversion loss values for series-connected TE, loop condition

COUNTRY	REQUIREMENT VALUES							
	α_{11} (dB)	Δ_{f1} (Hz)	α_{12} (dB)	Δ_{f2} (Hz)	α_{13} (dB)	Δ_{f3} (Hz)	α_{14} (dB)	Δ_{f4} (Hz)
Austria	not mandatory							
Belgium	48	300 - 3 400						
Cyprus	50	40 - 3 400	50	15 000 - 17 000				
Denmark	not mandatory							
Finland	≥ 40	40 - 300	≥ 50	300 - 600	≥ 55	600 - 3 400		
France	40	50 - 300	50	300 - 3 400				
Germany	30	50 - 300	52	300 - 4 000				
Greece	40	40 - 300	40	300 - 3 400	52 -6dB/oct.	3 400 - 18 000		
Iceland	40	40 - 600	46	600 - 3 400				
Ireland	40	40 - 300	50	300 - 600	52	600 - 3 400		
Italy	40	300 - 3 400						
Luxembourg	52	300 - 3 400						
Malta								
Netherlands	46	48 - 52	46	300 - 3400				
Norway	40	16 - 300	46	300 - 600	52	600 - 3400		
Portugal	40	40 - 300	50	300 - 600	55	600 - 3400	N/A	N/A
Spain								
Sweden	40	15 - 50	46	50 - 600	52	600 - 3400	50	10 000 - 17 000
Switzerland	57	40 - 3 400	(> 3 400 Hz: -6 dB/octave)					
U. Kingdom	46	300 - 3 400	N/A	N/A	N/A	N/A	N/A	N/A

Table 4.2.2.2.b: Longitudinal conversion transfer loss values for series-connected TE, loop condition

COUNTRY	REQUIREMENT VALUES		
	ΔV_f (V)	ΔR_f (Ω)	ΔI_f (mA)
Austria		not mandatory	
Belgium		not mandatory	
Cyprus		not mandatory	
Denmark		not mandatory	
Finland		not mandatory	
France		not mandatory	
Germany		not mandatory	
Greece		not mandatory	
Iceland		not mandatory	
Ireland	48	5 000	
Italy		not mandatory	
Luxembourg		not mandatory	
Malta			
Netherlands	42 - 66	800 - 2 140	
Norway		not mandatory	
Portugal		not mandatory	
Spain	48	500 - 1 700	
Sweden			
Switzerland	43 - 57	2 200 - 600	
U. Kingdom		not mandatory	

Table 4.2.2.2.b cont.: Longitudinal conversion transfer loss values for series-connected TE, loop condition

COUNTRY	REQUIREMENT VALUES								Remarks
	α_{11} (dB)	Δf_1 (Hz)	α_{11} (dB)	Δf_1 (Hz)	α_{11} (dB)	Δf_1 (Hz)	α_{11} (dB)	Δf_1 (Hz)	
Austria	not mandatory								
Belgium	not mandatory								
Cyprus	not mandatory								
Denmark	not mandatory								
Finland	not mandatory								
France	not mandatory								
Germany	not mandatory								
Greece	not mandatory								
Iceland	not mandatory								
Ireland	40	40 - 300	50	300 - 600	52	600 - 3 400			yes
Italy	not mandatory								
Luxembourg	not mandatory								
Malta									
Netherlands	46	48 - 52	46	300 - 3 400					yes
Norway	not mandatory								
Portugal	not mandatory								
Spain									yes
Sweden	40	15 - 50	46	50 - 600	52	60 - 3 400	50	10 000 - 17 000	yes
Switzerland	57	40 - 3 400	(> 3 400 Hz: -6dB/octave)						
U. Kingdom	not mandatory								yes

4.2.2.2 (IRL) 1 This requirement is mandatory only for TE with an earth terminal.

4.2.2.2 (NL) 1 Additional requirements:

- a) The longitudinal input impedance at 50 Hz must be at least 1 M Ω when a TE without meter pulse reception is tested.
- b) The longitudinal input impedance at 50 Hz must be at least 6,7 k Ω when a TE with meter pulse reception is tested.

The requirements and tests are specified in 9.2.2.1 and A.9.2.2.1.

In this case switch S must be open.

4.2.2.2 (E) 1 Requirement in section 4.2.2.1 (E) 1 shall be applied.

4.2.2.2 (S) 1 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.2.2.2 (S) 2 For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.

4.2.2.2 (GB) 1 The requirement for longitudinal conversion loss is mandatory only for equipment with an earth connection. There is no mandatory requirement for longitudinal conversion transfer loss.

A.4.2.2.2 Loop condition

A given dc feeding condition is established using the relevant values V_f , R_f , R_L or I_f and for that condition a given ac excitation voltage value "e" is chosen; using that value "e", the values of α are determined at a number of frequencies, f_{ti} , for each frequency range Δf_i declared.

The values of the dc feeding parameters V_f , R_f , and I_f and the values R_L , C_L and L are shown in table A.4.2.2.2.a. The values of the ac excitation parameters e , f_{t1} , Δf_1 and of the impedances Z_1 and Z_2 are shown in table A.4.2.2.2.b.

Table A.4.2.2.2.a: Values of the dc feeding parameters V_f , R_f , I_f and the value R_L for testing longitudinal conversion loss and longitudinal conversion transfer loss of a TE in loop condition

COUNTRY	TEST VALUES					
	V_f (V)	R_f (Ω)	R_L (Ω)	C_L (μF)	L (H)	I_f (mA)
Austria	not mandatory					
Belgium	48	400, 1 600	300	20	5	
Cyprus	48	800	300	50	5	20, 100
Denmark	not mandatory					
Finland	48	800, 1 710	400	≥ 16	≥ 6	
France	48		300	100	10	25, 60
Germany	60	1 000, 2530	300	47	15	
Greece	60		400	20	5	20, 35, 55
Iceland	48	800	400	≥ 2	≥ 4	
Ireland	48	5000	800			20, 50, 100
Italy	44, 48, 52	1 880, 1 100, 720	200	≥ 200	≥ 2	
Luxembourg	60	1 000	300			
Malta						
Netherlands	42, 48, 66	800, 1 130, 2 140				
Norway	60	1200	400	≥ 20	≥ 10	
Portugal	48	300 - 1 800	400	≥ 50	≥ 5	N/A
Spain	48	500, 1 100, 1 700	300	≥ 20	≥ 10	
Sweden				> 100	> 17	
Switzerland			300	47	5	
U. Kingdom	50	400 min.				25, 40

Table A.4.2.2.2.b: Values of the impedances Z_1 and Z_2 for testing longitudinal conversion loss and longitudinal conversion transfer loss of a TE in loop condition

COUNTRY	TEST VALUES	
	Z_1 (Ω)	Z_2 (Ω)
Austria	not mandatory	
Belgium	600	600
Cyprus	600	600
Denmark	not mandatory	
Finland	600	600
France	600	
Germany	600	600
Greece	600, 200	600, 200
Iceland	600	600
Ireland	600	600
Italy	600	10 k
Luxembourg	600	600
Malta		
Netherlands	600	600
Norway	600	
Portugal	600	600
Spain		
Sweden	600	600
Switzerland	600	600
U. Kingdom	600	

Table A.4.2.2.2.b cont.: Values of the excitation parameters "e", f_{ti} , Δf_i for testing longitudinal conversion loss and longitudinal conversion transfer loss of a TE in loop condition

COUNTRY	TEST VALUES								Remarks
	e_1 (mV)	$\Delta f_1/f_{t1}$ (Hz)/(Hz)	e_2 (mV)	$\Delta f_2/f_{t2}$ (Hz)/(Hz)	e_3 (mV)	$\Delta f_3/f_{t3}$ (Hz)/(Hz)	e_4 (mV)	$\Delta f_4/f_{t4}$ (Hz)/(Hz)	
Austria	not mandatory								
Belgium	775	300 - 3 400							
Cyprus	1 500	40 - 3 400	1 500	15 000 - 17 000					
Denmark	not mandatory								
Finland	775	40 - 3 400							
France	775	50 - 300	775	300 - 3 400					
Germany	775	50 - 300	775	300 - 4 000					
Greece	775	40 - 18 000							yes
Iceland	775	40 - 600	775	600 - 3 000					
Ireland	1 000	40, 200	1 000	400	1 000	1 200, 3 400			
Italy	775	300 - 3 400							
Luxembourg	775	300 - 3 400							
Malta									
Netherlands	100 V	48 - 52	775	300 - 3 400					
Norway	775	16, 40, 160	775	320	775	630, 1 500, 3 400			
Portugal	3 000	40 - 3 400	N/A	N/A	N/A	N/A	N/A	N/A	
Spain									yes
Sweden	775	40, 3400	775	10 000, 17 000					yes
Switzerland	775	40... > 5 000							yes
U. Kingdom	1 000 ± 10%	300 - 3 400 Hz							

A.4.2.2.2 (GR) 1

- a) In the frequency range 40 - 18 000 Hz measurement frequencies shall be spaced 1 octave, beginning from $f_1 = 40$ Hz.
- b) In the case of a tax meter, in the frequency range 15 250 - 16 750 Hz an additional measurement is made at $f = 16 000$ Hz with $Z_1 = Z_2 = 200$ ohms.

A.4.2.2.2 (E) 1 See requirement in section 4.2.2.1 (E) 1 and its compliance test method in section A.4.2.2.1 (E) 1.

A.4.2.2.2 (S) 1 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

A.4.2.2.2 (CH) 1 Feeding settings:

$V_{f1} : 43$ V, $R_{f1} : 2\ 200$ Ω
 $V_{f2} : 48$ V, $R_{f2} : 1\ 200$ Ω
 $V_{f3} : 57$ V, $R_{f3} : 600$ Ω

Table A.4.2.2.2.c: Test conditions for longitudinal conversion transfer loss

COUNTRY	TEST	Remarks
	carried out (yes/no)	
Austria	no	
Belgium	no	
Cyprus	no	
Denmark	no	
Finland	no	
France	no	
Germany	no	
Greece	no	
Iceland	no	
Ireland		
Italy	no	
Luxembourg	no	
Malta		
Netherlands	no	
Norway	no	
Portugal	no	
Spain	yes	yes
Sweden	yes	
Switzerland	yes	yes
U. Kingdom	no	

A.4.2.2.2.c (E) 1 See requirement in section 4.2.2.1 (E) 1 and its compliance test method in section A.4.2.2.1 (E) 1.

A.4.2.2.2.c (CH) 1 The same specifications and test parameters are used as declared in 4.2.2 and A.4.2.2 for longitudinal conversion loss matters.

4.3 Series-connected TE insertion loss

The series-connected TE, at those frequencies at which it is intended to be transparent to signals, shall exhibit an insertion loss for the frequency ranges Δf_1 and Δf_2 and between impedances Z_0 and Z_L less than the values shown in the table 4.3.b. The requirement shall be met at various dc excitation conditions, ΔI_f , ΔV_f , ΔR_f , which are specified in table A.4.3.b.

Compliance shall be checked using the test outlined in section A.4.3.

Table 4.3.a: Frequency range

Frequency range (Hz)	Minimum value (dB)
Δf_1 300 \leq f_1 < 3 400	$a_{1max.}$
Δf_2 3 400 \leq f_2 \leq 18 000	$a_{2max.}$

Table 4.3.b: Insertion loss of series-connected TE

COUNTRY	REQUIREMENT VALUES					Remarks
	a_{1max} (dB)	a_{2max} (dB)	ΔI_f (mA)	ΔV_f (V)	ΔR_f (Ω)	
Austria	0,2	0,2	19 - 60	60		yes
Belgium	0,2	not mandatory	20 - I_{max}	48		
Cyprus	0,25	0,5	20 - 100	48	440 - 1 740	
Denmark	0,25	0,5	8 - 112			
Finland		not mandatory		48	800 - 1 710	yes
France	0,3		25 - 60	48	300	
Germany	0,5	not mandatory		60	1 000, 2 530	yes
Greece	0,35	0,5	20 - 80	0 - 60		
Iceland	0,5	0,5	14 - I_{max}	48		
Ireland	0,2	not mandatory	20 - 100	48		yes
Italy	0,25	not mandatory		44 - 52	720 - 1 880	
Luxembourg	0,5	not mandatory				
Malta						
Netherlands	0,5	not mandatory		42 - 66	800 - 2 140	
Norway	0,2	not mandatory		60	460 - 3 500	
Portugal	1	not mandatory	N/A	45 - 55	300 - 1 800	yes
Spain	0,5			48	500 - 1 700	yes
Sweden	0,5	0,5				yes
Switzerland	0,2	1		43, 48, 57	2 200, 1 200, 600	yes
U. Kingdom	0,5	not mandatory	25, 40	50	400 min	yes

4.3 (A) 1 Frequency range: $\Delta f_2 = 11\ 928 - 12\ 072$ Hz.

4.3 (SF) 1 TE which is connected in series with the PSTN network TP and with other TE approved for direct connection to the PSTN network TP shall exhibit an insertion loss less than 1 dB at the frequency of 800 Hz and the loss distortion shall not exceed values given in table 4.3 (SF) 1.

Table 4.3 (SF) 1: Loss distortion

Frequency / Hz	Distortion / dB
300 .. 400	-1,3 ... +5,2
400 .. 600	-1,3 ... +2,6
600 .. 2 400	-1,3 ... +1,3
2 400 .. 3 000	-1,3 ... +2,6
3 000 .. 3 400	-1,3 ... +5,2

4.3 (D) 1 Frequency range: $\Delta f_2 = 15\ 920 - 16\ 080$ Hz $a_{2max} \leq 0,5$ dB

The insertion loss of a pre-connected TE has to meet the requirements in table 4.3 and in this paragraph if this TE does not use this frequency range

for its operation. If the terminal allows functions to be switched off, the measurement is performed with these functions switched on.

4.3 (D) 2 In the frequency range 23 Hz to 54 Hz, the insertion loss is measured as the difference of rms voltages.

$$U_G = 45 \text{ V to } 75 \text{ V}$$

$$R_1 = 0 \text{ ohm}$$

$$U_1 - U_2 \leq 1,0 \text{ V at } U_G = 45 \text{ V}$$

$$U_1 - U_2 \leq 1,5 \text{ V at } U_G = 75 \text{ V}$$

The test is carried out using the test outlined in section A.4.3 (D) 2.

4.3 (IRL) 1 In addition a further requirement is to be satisfied, a_3 to be less than or equal to 1 dB in the frequency range 17 to 25 Hz.

4.3 (P) 1 Frequency range Δf_1 (Hz): $300 \leq f_1 \leq 3\,400$.

4.3 (E) 1 (Requirement to be applied instead of section 4.3).

With series TE in both quiescent condition and high impedance condition, the insertion loss exhibited shall not be greater than the values stipulated in table 4.3 (E) 1 over the frequency ranges indicated, tested with a signal with open circuit ac rms voltage values stipulated in table 4.3 (E) 1 over the frequency ranges indicated, applied between the line input terminals through a resistor equal to the load resistor, when a load resistor as stipulated in table 4.3 (E) 1 is connected to the line output terminals.

PROVISION 1: See the provision 2 in section 4.1.1 (E) 1.

PROVISION 2: See the provision 3 in section 4.2.2.1 (E) 1.

PROVISION 3: The TE, when in the high impedance condition, is supposed not sending useful signals (nor signals for which it is intended to transmit) to the line.

Compliance shall be checked using the tests outlined in section A.4.3 (E) 1.

Table 4.3 (E) 1: Series-connected TE insertion loss

Ins. loss limit	Frequency range	Volt. (e)	Load res.
0,5 dB	$300 \text{ Hz} \leq f_1 \leq 3,4 \text{ kHz}$	3 V	600 Ω
1,0 dB	$f_1 = 12 \text{ kHz}$	3 V	200 Ω

4.3 (S) 1 DC feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.3 (S) 2 $f_2 = 11\,940 - 12\,060 \text{ Hz}$

4.3 (S) 3 For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is connected to the PSTN standard analogue interface, reference is made to the Swedish national specifications.

4.3 (CH) 1 Frequency range Δf_2 : 11 880 - 12 120 Hz.

Remark concerning lower frequencies : $a_3 \leq 1 \text{ dB}$ for Δf 21 - 55 Hz and "e": 10 - 100 V.

4.3 (GB) 1 The insertion loss shall not be less than 0 dB in the frequency range 300 - 3 400 Hz.

4.3 (GB) 2 Series-connected TE insertion loss.

For series-connected TE having less than the maximum allowable impairments (see 1.4.4.1 (GB) 1 sub paragraph ii)), the value of SEN attributable to insertion loss and numerically equal to twice the value determined from A.4.3 shall not be greater than the value stated in the instructions for use (see 2.5 (GB) 1).

4.3 (GB) 3 Series-connected TE distortion.

The total second and third harmonic distortion generated by the series-connected TE each shall be not greater than 2% for pure input signal of $0,1 V_{rms}$ at the fundamental frequencies of 315 Hz, 500 Hz and 1 000 Hz.

Compliance shall be checked using the circuit of figure A.4.3 with the switch in position S2. A high impedance selective level measuring set is used to measure voltage U_1 .

A.4.3 Series-connected TE insertion loss

The TEUT is connected as shown in figure A.4.3, with the switch in position S_1 .

The ac generator impedance Z is adjusted to a value equal to Z_L , and its voltage is adjusted to a value so as to produce a voltage U_1 across Z_L .

The TE is switched in by changing the switch in its position S_2 , and the voltage U_2 across Z_L is determined.

The rms value of voltage U_i is determined over a number of values of loop currents in conjunction with declared values of V_f and R_f specified in table A.4.3. The values of C_L , R_L , L , Z , Z_L , I_f and f_t are also shown in table A.4.3.

Measurement frequencies, f_t , shall extend over the bandwidth 300 Hz to 18 000 Hz and shall be spaced at intervals and values as defined by the relevant Administration.

The insertion loss is then determined for each set of measurements according to formula A.4.3:

$$\alpha_i = 20 \log_{10} \left(\frac{U_1}{U_2} \right) \quad \text{Formula A.4.3}$$

Table A.4.3: Series-connected TE insertion loss

COUNTRY	TEST VALUES			
	C_L (μF)	R_L (Ω)	L (H)	Z (Ω)
Austria	≥ 10		≥ 5	
Belgium	20	300	5	600
Cyprus	50	300	5	600
Denmark				600
Finland	≥ 16	400	≥ 6	600
France	100	300	10	600
Germany	47	300	15	(220 + 820 // 115 nF)
Greece	20	400	5	600
Iceland	∞	∞	∞	600
Ireland	470	5 000	2,5	600
Italy	≥ 200	200	≥ 2	600
Luxembourg	47	300	5	600
Malta				
Netherlands	20	300	4	600
Norway	≥ 20	400	≥ 10	see fig. 4.1.2 (N) 1
Portugal	≥ 50	400	≥ 5	600
Spain	≥ 20	300	≥ 10	
Sweden	≥ 2	600	≥ 4	
Switzerland	≥ 47	300	≥ 5	600
U. Kingdom	≥ 400	0	≥ 20	see fig. 4.1.2 (GB) 1

Table A.4.3 cont.: Series-connected TE insertion loss

COUNTRY	TEST VALUES						Remarks
	I_f (mA)	e (V)	f_t (Hz)	Z_L (Ω)	R_f (Ω)	V_f (V)	
Austria	19, 60	0,775		600		60	yes
Belgium		1,55	300 - 3 400	600	400, 1 600	48	
Cyprus	20, 100	1,5	40 - 17 000	600	800	48	
Denmark	16, 32, 80	3	300 - 18 000	600			yes
Finland		1,5		600	800, 1 710	48	yes
France	25, 60	0,488	300 - 3 400	600		48	
Germany				(220 + 820 // 115 nF)	1 000, 2 530	60	yes
Greece	20, 35, 55	0,775		600		60	yes
Iceland	14, I_{max}	0,775	300 - 3 400	600		48	
Ireland	20, 50, 100	0,1, 1	300, 600, 1 200, 3 400	600		48	yes
Italy		0,775	300, 3 400	600	1 880, 1 100, 720	44, 48, 52	
Luxembourg	14, 60	0,775	300 - 3 400	600		60	
Malta							
Netherlands		0,5	300 - 3 400	600	1 130	48	
Norway		1,55	300 - 3 400	see fig. 4.1.2 (N) 1	460, 1 200, 3 500	60	
Portugal	not applicable	1,5		600	300 - 1 800	48	yes
Spain					500, 1 100, 1 700	48	yes
Sweden		0,5		600			yes
Switzerland				600			yes
U. Kingdom	25, 40	0,1	300 - 3 400	see fig. 4.1.2 (GB) 1	400	50	yes

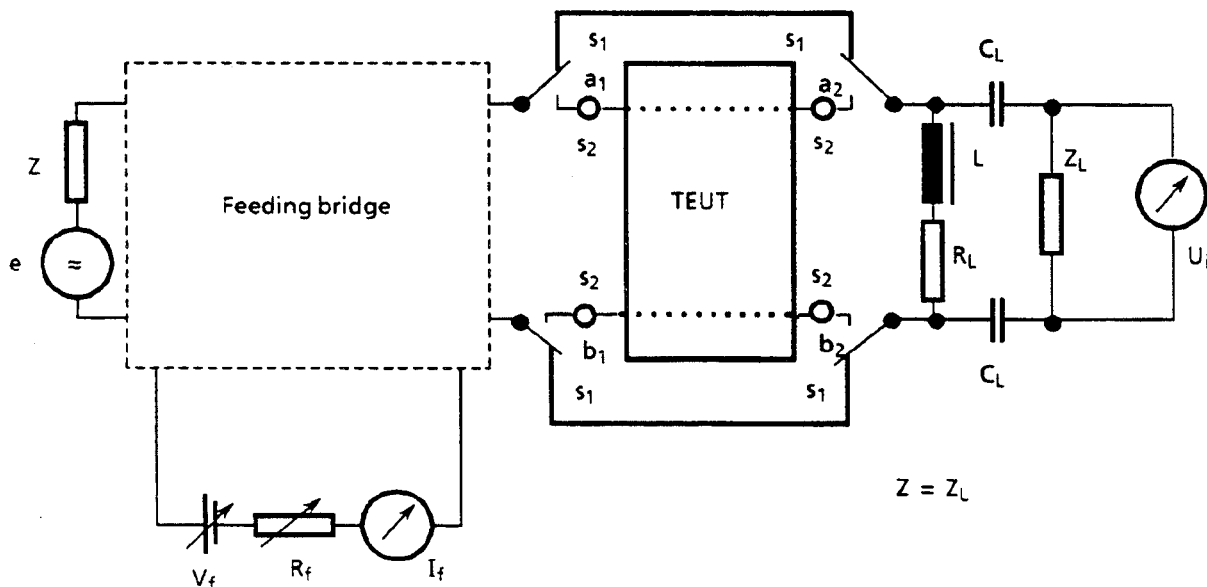


Figure A.4.3: Series-connected TE insertion loss
 Feeding bridge as specified in Chapter 1

A.4.3 (A) 1

The measurement frequencies f_t shall be spaced less than one third of an octave.

The impedance $Z = Z_L = 600 \Omega$ for 300 - 3 400 Hz

$Z = Z_L = 200 \Omega$ for 11 928 - 12 072 Hz

A.4.3 (DK) 1

The principle of test is shown in figure A.4.3 (DK) 1.

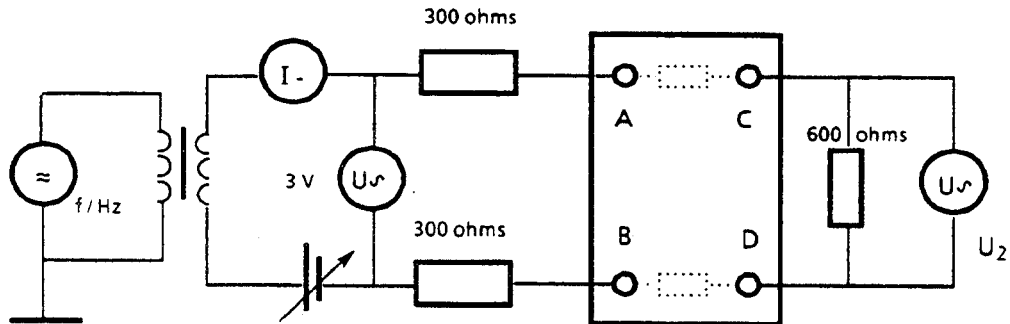


Figure A.4.3 (DK) 1

The voltage U_2 is measured and the insertion loss is then calculated according to formula A.4.3 (DK) 1.

$$A = 20 \times \log_{10} \left(\frac{1,5}{U_2} \right) \text{ dB} \quad \text{Formula A.4.3 (DK) 1}$$

Measurement shall be made in the frequency range 300 Hz to 18 000 Hz at frequencies not spaced greater than 1/3 of an octave from each other, and at loop currents of 16, 32 and 80 mA.

A.4.3 (SF) 1

The TEUT is connected as shown in figure A.4.3 (SF) 1. The test is made at the frequency of 800 Hz and over a frequency range 300 to 3 400 Hz. The measurement frequencies, f_t , shall be spaced less than one third of an octave. The load impedance Z_L is ohm resistive.

The attenuation is calculated by:

$$A = 20 \times \log_{10} \left(\frac{U_1}{U} \right) \text{ dB,}$$

where U_1 = voltage over the load resistor Z_L when there is not a series-connected equipment. In figure A.4.3 (SF) 1 the voltage is e/2 V.

U = voltage over the load resistor Z_L when there is the series connected equipment in the circuit.

Capacitors in feeding bridge are 27 μ F.

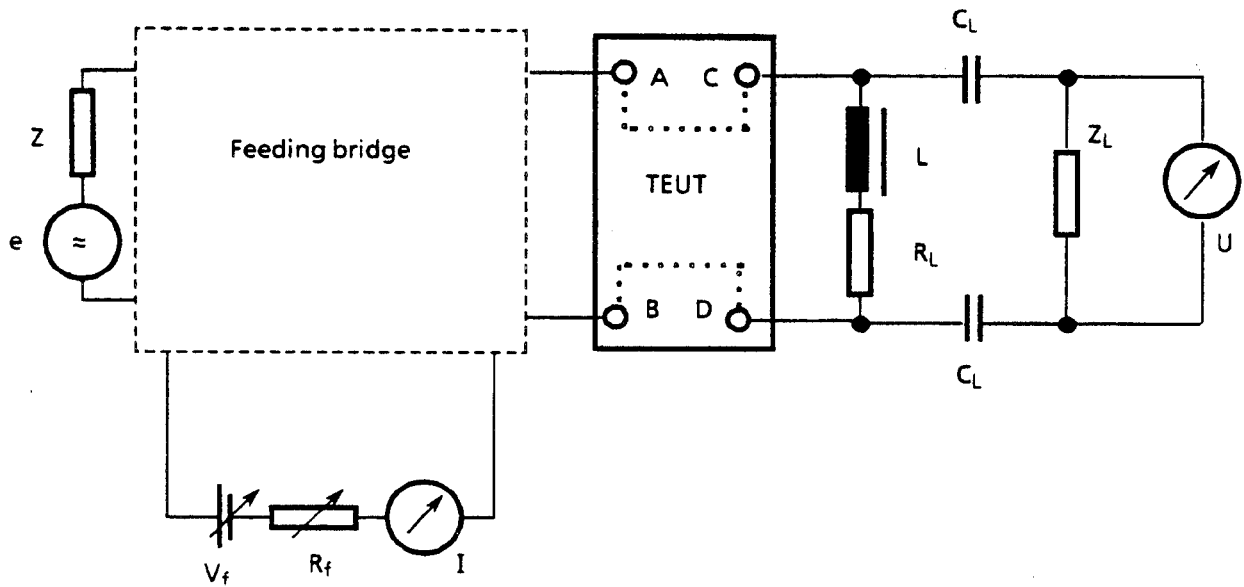


Figure A.4.3 (SF) 1

A.4.3 (D) 1 In the frequency range 300 Hz to 3 400 Hz, the sending level "e" shall be +12 dB (775 mV). In the frequency range 15,92 kHz to 16,08 kHz, the sending level shall be +44 dB (775 mV). In both cases the internal impedance of the generator shall be $= Z_L$.

A.4.3 (D) 2 In the frequency range 23 Hz to 54 Hz, the insertion loss is measured as the difference of rms voltages by connecting the TEUT as shown in figure A.4.3 (D) 2. A dc feeding voltage of 60 V is applied via a feeding resistor of 2 530 ohms. The test is carried out at 23 Hz and 54 Hz.

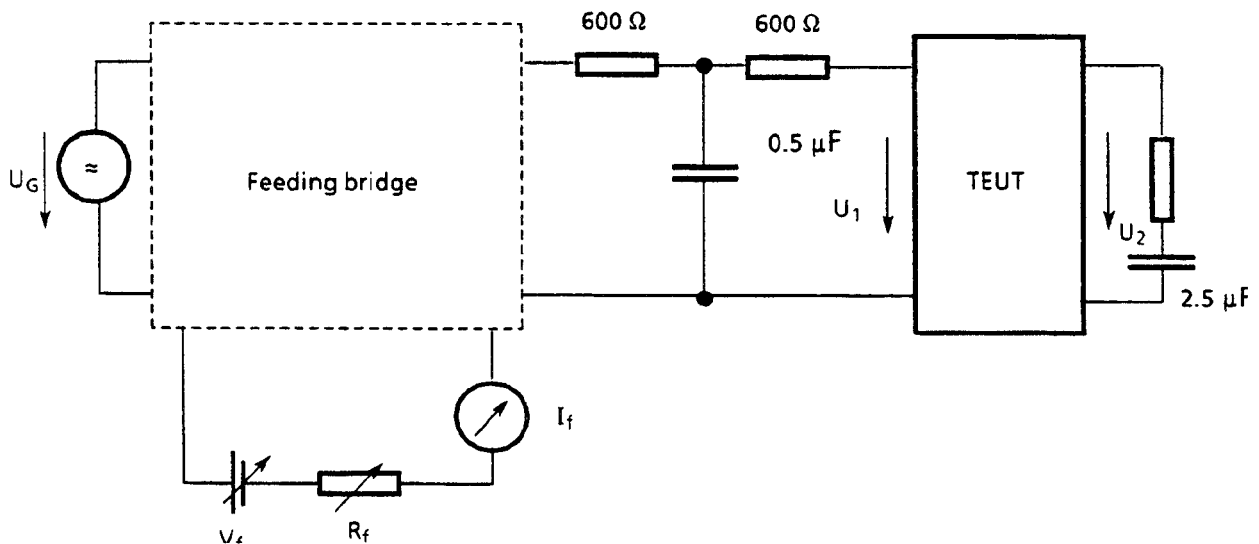


Figure A.4.3 (D) 2

A.4.3 (GR) 1

- a) Measurements are carried out at frequencies spaced 1 octave, beginning from $f_1 = 300$ Hz.
- b) In the case of a tax meter, in the frequency range 15 250 - 16 750 Hz an additional measurement is made at $f = 16\ 000$ Hz with $Z_1 = Z_2 = 200$ ohms.

A.4.3 (IRL) 1

To measure a_3 as specified in 4.3 (IRL) 1, Z_L is replaced by a resistor of value $8\ k\Omega$, Z replaced by a resistor of value $5\ k\Omega$, $e = 75\ V_{rms}$, $L = 0$, $R_L = \infty$, $C_L = 0$ and f_t in the range 17 to 25 Hz.

A.4.3 (P) 1

Measurement frequencies, f_t , shall extend over the bandwidth 300 Hz to 3 400 Hz and shall not be spaced more than one third of an octave from the subsequent frequency of measurement.

The lowest frequency of measurement is equal to 300 Hz.

A.4.3 (E) 1

The series TEUT is connected as shown in figure A.4.3.

The dc voltage source (V_f) takes the value of 48 V. The resistor (R_f) takes the value of 500 ohms; the tests shall also be made when the resistor takes the values of 1 100 and 1 700 ohms.

The value of the inductor (L) shall not be lower than 10 H. The value of the two capacitors (C_L) shall not be lower than $20\ \mu F$. The resistor (R_L) takes the value of 300 ohms.

The output impedance (Z) and the load impedance (Z_L) are two equal resistors and take the value stipulated in the requirement in section 4.3 (E) 1.

The test shall be made at the ac generator open circuit rms voltages (e) stipulated in the requirement in section 4.3 (E) 1. The generator frequency (f) takes at least the values of the centre frequencies of one-third of one octave in preferred series from 315 Hz to 3,15 kHz, and at 300 Hz, 3,4 kHz, and 12 kHz.

The insertion loss (α) is calculated using formula A.4.3 (E) 1, where V_1 and V_2 are the voltmeter readings in volts at each testing frequency value, when the switch is respectively in the positions (S_1) and (S_2).

$$\alpha\ (\text{dB}) = 20 \times \log_{10} \frac{V_1\ (\text{V})}{V_2\ (\text{V})} \quad \text{Formula A.4.3 (E) 1}$$

A.4.3 (S) 1

$Z = Z_L = 600\ \Omega$ for 300 - 3 400 Hz.

$Z = Z_L = 200\ \Omega$ for 11 940 - 12 060 Hz.

A.4.3 (S) 2

Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

A.4.3 (S) 3

For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.

A.4.3 (CH) 1

Feeding settings:

$V_{f1} : 43 \text{ V}, R_{f1} : 2\ 200 \ \Omega$

$V_{f2} : 48 \text{ V}, R_{f2} : 1\ 200 \ \Omega$

$V_{f3} : 57 \text{ V}, R_{f3} : 600 \ \Omega$

e for Δ_{f1} (300 - 3 400 Hz): + 9 dBm (rel. 775 mV)

e for Δ_{f2} (11 880 - 12 120 Hz): + 26 dBm (rel. 775 mV)

e for Δ_{f3} (21 - 55 Hz): 100 V

For Δ_{f2} the insertion loss has to be met with and without loop current.

A.4.3 (GB) 1

Measurements are made at frequencies spaced not greater than 1/3 of an octave apart across the frequency range 300 to 3 400 Hz. Insertion loss is measured in each direction of transmission, that is, first with the configuration shown in figure A.4.3, then with the generator and power-measuring termination interchanged.

Impedance Z is the network shown in figure 4.1.2 (GB) 1.

4.4 Transmission levels

4.4.1 Maximum transmission levels

The TE, whilst in loop condition, shall not emit signals with a peak value greater than V_{tmax} measured across the load Z_L . The requirement shall be met over a loop current range ΔI_f or at various dc excitation conditions ($\Delta R_f, \Delta V_f$). V_{tmax}, Z_L are shown in table 4.4.1.

The requirement does not apply to TE in the dialling state.

Compliance shall be checked using the tests outlined in section A.4.4.1.

Table 4.4.1: Maximum transmission levels.

COUNTRY	REQUIREMENT VALUES					Remarks
	V_{tmax} (V)	Z_L (Ω)	ΔI_f (mA)	ΔR_f (Ω)	ΔV_f (V)	
Austria	2	600	19 - 60		60	yes
Belgium	3,5	600	20 - I_{max}		48	
Cyprus	1,5	600		440 - 1 740	48	
Denmark	3,5	600	0 - I_{max}			
Finland	not mandatory					
France	1,5	600		300 - 1 400	46 - 54	yes
Germany		(220 + 820 // 115 nF)		1 000 - 2 530	60	yes
Greece	1,5	600	20 - 80		44 - 66	yes
Iceland	3,5	600	14 - I_{max}		48	
Ireland	1,5	600	20 - 100		48	yes
Italy	1,1	600		720 - 1 880	44 - 52	yes
Luxembourg	1,1	600	14 - 60		60	
Malta						
Netherlands	3,5	600		800 - 2 140	42 - 66	
Norway	3,5	600		460 - 3 100	60	yes
Portugal	1,5	600	not applicable	300 - 1 800	45 - 55	
Spain				500 - 1 700	48	yes
Sweden	1,1	600				yes
Switzerland	+ 3 dBm	600		2 200 - 600	43 - 57	
U. Kingdom	1,74	600	25 - 100	400 min.	50	yes

4.4.1 (A) 1

For live speech $V_{tmax} = 2$ V.
For all other signals $V_{tmax} = 0,55$ V.

4.4.1 (F) 1

Not applicable to live speech TE to which telephony requirements apply.

4.4.1 (F) 2

$V_{tmax} = 3$ V for modems.

4.4.1 (D) 1

Sending level for TEs with electro-acoustic coupling:

Additional equipment with electro-acoustic coupling to a telephone handset shall have a sound pressure level which produces in the telephone a sending level at a line impedance Z_L of -13,5 dB (775 mV) up to -7,5 dB (775 mV).

4.4.1 (D) 2

Sending level of non-voice TEs (e.g. modem, fax)

The sending level is measured as a sum voltage level at Z_L in the frequency range of 300 Hz to 3 400 Hz and shall be adjustable in steps of ≤ 3 dB over the range of -10,5 dB (775 mV) to -4,5 dB (775 mV). The adjustable range may be up to +1,5 dB (775 mV). The feeding conditions are given in table 4.4.1.

- 4.4.1 (D) 3** Sending level of TEs not participating in any regulated service:
- The sending level is measured as a sum voltage level at Z_L over the frequency range of 300 Hz to 3 400 Hz and may not exceed -10,5 dB (775 mV). The feeding conditions are given in table 4.4.1.
- 4.4.1 (D) 4** Sending level of directly connected DTMF generators:
- The sending level of directly connected DTMF generators is measured on Z_L as a sum voltage level and shall not exceed -4,5 dB (775 mV) \pm 2,5 dB. The generated signal duration shall be at least 40 ms and shall not exceed 100 ms. The feeding conditions are given in table 4.4.1.
- The pre-emphasis between upper and lower frequency groups shall be +2 dB \pm 1,5 dB.
- 4.4.1 (GR) 1** Not applicable for live speech TE to which telephony requirements apply.
- 4.4.1 (IRL) 1** This requirement only applies to non-live sources such as synthetic voice or music on hold.
- 4.4.1 (I) 1** For code signals only.
- 4.4.1 (N) 1** Not applicable to live speech TE to which telephony requirements apply.
- 4.4.1 (E) 1** (Requirement to be applied instead of section 4.4.1).
- PROVISION 1:** The following provisions 1 and 2 shall be applied to all Spanish sections (E) in 4.4 and also in sections 10.4 (E) 3 of Chapter 10.
- PROVISION 2:** The TEs are supposed sending useful signals (or signals for which they are intended to transmit) to the line in the frequency band from 300 Hz to 3,4 kHz.
- PROVISION 3:** The acoustic excitation, when necessary, is stipulated in the associated testing method.
- With TE in both loop condition and high impedance condition, the output signal shall be controlled in such a manner that the maximum peak value of its instantaneous voltage shall not be in any moment greater than
- a) 3,5 V for TE with a microphone while an acoustic signal is applied to such transducer;
 - or
 - b) 1,5 V for TE without a microphone and for TE with a microphone while it is not active;
- when the output voltage is measured over a load resistor of 600 ohms connected to the line terminals.
- No manufacturing tolerance is allowed which would permit this voltage level to be exceeded by any TE.
- PROVISION 4:** With TE in the high impedance condition, the output voltage shall be measured over a load resistor of 300 ohms instead of 600 ohms.
- Compliance shall be checked using the tests outlined in section A.4.4.1 (E) 1.

- 4.4.1 (S) 1** 1,1 V for code signals
 3,0 V for speech signals
- 4.4.1 (S) 2** Feeding conditions see Swedish remark Chapter 1, section 1.5.2.
- 4.4.1 (GB) 1** For TE where the power level is adjustable, the requirement for instantaneous power level shall be determined with the mean power level set to an indicated one minute mean power level of -9 dBm, or the nearest lower value for which a setting is practicable. (See 4.4.2.2 (GB) 1).
- The maximum instantaneous power level shall not be greater than a level corresponding to that of a sine wave of $1,23 V_{rms}$ (+4 dBm). Exceptionally, signals which exceed the limit of $1,23 V_{rms}$ (+4 dBm) shall be permitted, provided that all other relevant requirements of 4.4 are met and the signals which exceed the limit account for no more than 0,001% (1 in 10^5) of samples during a 5 minute measurement period.
- This requirement applies only to TE that sends to line recorded or synthetic speech, music, data, or code signals.
- The requirement for TE that sends signals to line as a result of any live acoustic stimulus (e.g. telephones, loudspeaking telephones, headsets) is outside the scope of this NET; the appropriate national standard or terminal NET shall be referred to.

A.4.4 Transmission levels

A.4.4.1 Maximum transmission levels

The TEUT shall be placed in loop condition whilst connected as shown in figure A.4.4.1. Resistor R_f and voltage V_f or current I_f shall be adjusted according to table A.4.4.1. The test shall be undertaken at each polarity of dc excitation applied.

The equipment shall then be caused to send to line its highest speech-band output level. If the TE emits signals arising from recordings or other non-live sources, these signals are to be produced by the TE as outlined in its associated instructions for use.

Voltage V_f measured across load Z_L is then determined using a device which indicates the peak value of measured voltage and which has a rise time no greater than $50 \mu s$ and a detection bandwidth from 200 Hz to 4 000 Hz at least.

Table A.4.4.1: Maximum transmission levels.

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	60		19, 60	
Belgium	48	400, 1 600		
Cyprus	48	800		
Denmark			16, I_{max}	yes
Finland		not mandatory		
France	46, 54	1 400 resp. 300		
Germany	60	1 000, 2 530		
Greece	60		20, 35, 55	
Iceland	48		14, I_{max}	
Ireland			100	
Italy	44, 48, 52	1 880, 1 100, 720		
Luxembourg	60		14, 60	
Malta				
Netherlands	48	1 130		
Norway	60	460		
Portugal	55	300	not applicable	
Spain	48	500, 1 100, 1 700		yes
Sweden				yes
Switzerland	43, 48, 57	2 200, 1 200, 600		
U. Kingdom	50	400 min.	25 - 100	yes

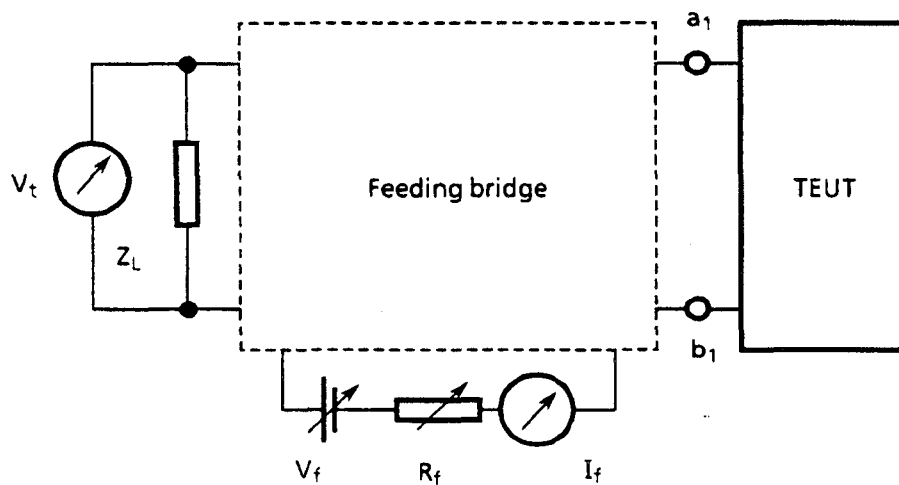


Figure A.4.4.1: Maximum transmission levels
Feeding bridge as specified in Chapter 1

A.4.4.1 (DK) 1

The principle of test is shown in figure A.4.4.1 (DK) 1.

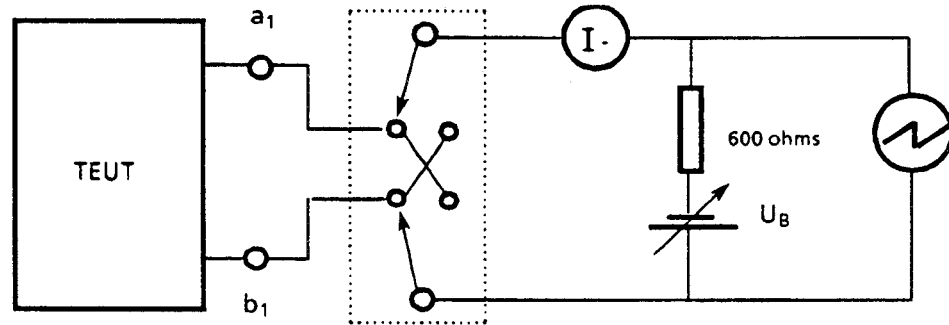


Figure A.4.4.1 (DK) 1

The maximum transmission voltage shall be measured at loop currents of 16 mA and I_{max} for both polarities of the dc current.

A.4.4.1 (E) 1

The procedure of test in section A.4.4.1 is followed.

For the resistor (R_L) the provision 4 in the requirement in section 4.4.1 (E) 1 shall be applied.

PROVISION 1:

The TEUT is caused to generate their absolute maximum output voltage level according with the user's manual.

PROVISION 2:

When live speech excitation is necessary, the acoustic artificial voice pressure level shall be either 104 dB SPL (at mouth reference point) with the handset over the artificial head, or 80 dB SPL (near the microphone input) with the artificial mouth at 10 centimetres from the handsfree microphone, where the artificial voice is of the type used in the method OREM-A.

PROVISION 3:

The handsets with a carbon microphone shall be conditioning according with the CCITT Recommendation P.75 (Blue Book).

A.4.4.1 (S) 1

Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

A.4.4.1 (GB) 1

The maximum instantaneous power level shall be determined as $V^2/600$ using a quality digital encoder meeting the requirements of CCITT Recommendation 0.133 section 4 to the A-Law format. The input to digital encoder shall be calibrated by applying a $1,23 V_{rms}$ sinusoidal signal to the analogue input, via an adjustable attenuator, such that the digital output registers a character bit sequence of *1111110. The signal delivered by the apparatus under test is then applied to the calibrated encoder when no more than 240 samples ($1 \text{ in } 10^5$) shall register the next higher character bit sequence of *1111111 in any 5 minute period.

NOTE 1:

In the character bit sequence given above the "*" indicates the polarity bit, the value of which is irrelevant, and the change in the value of the sequence from *1111110 to *1111111 is in the least significant bit.

NOTE 2:

The total of 240 samples is derived by considering 8 000 samples per second during a period of 5 minutes (300 seconds) making a total of 2,4 M samples. $1 \text{ in } 10^5$ samples therefore equates to 240 in 2,4M samples.

4.4.2 Speech band power levels of signals sent to line

4.4.2.1 Levels of recorded, synthetic or live, speech or music

When the TE is in loop condition the average active power level delivered by the TE to a load Z_L during any period of 10 seconds shall not exceed P_s . The requirement shall be met over a loop current range ΔI or at various dc excitation conditions ($\Delta R_f, \Delta R_f$). ac and dc parameter values are shown in table 4.4.2.

Compliance shall be checked using the test outlined in sections A.4.4.2 and A.4.4.2.1.

This requirement does not apply to TE in the dialling state.

Table 4.4.2: Speech band power levels of signals sent to line

COUNTRY	REQUIREMENT VALUES							Remarks
	P_s (dBm)	P_{d1} (dBm)	P_{d2} (dBm)	Z_L (Ω)	ΔI_f (mA)	ΔV_f (V)	ΔR_f (Ω)	
Austria	-6,0	-6,0	-6,0	600	19 - 60	60		
Belgium	-6	-6	-6	600	20 - I_{max}	48		
Cyprus	-10	-10	-10	600		48	440 - 1 740	
Denmark	-10	-10	-10	600	0 - I_{max}			
Finland	-10	-10	-10	600		48	800, 1 710	
France	-10	0	0	600		46 - 54	300 - 1 400	yes
Germany								yes
Greece	-10	-10	-10	600	20 - 80	44 - 66		
Iceland	-10	-10	-10	600	14 - I_{max}	48		
Ireland	-10	-10		600	20 - 100	48		
Italy		-3	-3	600		44 - 52	720 - 1 880	yes
Luxembourg	-6	-6	-6	600	14 - 60	60		
Malta								
Netherlands	-6	-6	-6	600		42 - 66	800 - 2 140	
Norway	-10	-10	-10	600		60	460 - 3 100	yes
Portugal	-10	-10	-6	600	not applicable	45 - 55	300 - 1 800	
Spain	-10					48	500 - 1 700	yes
Sweden	-10	-10	-13	600				yes
Switzerland	-13	-6	-9	600		43 - 57	2 200 - 600	
U. Kingdom	-9	-9	-9	600	25 - 100	50	400 min.	yes

NOTE: For P_{d1} and P_{d2} see 4.4.2.2.

- 4.4.2 (F) 1 Not applicable to live speech TE to which telephony requirements apply.
- 4.4.2 (D) 1 The levels of recorded, synthetic or live, speech or music are given in the terminal requirements.
- 4.4.2 (I) 1 The levels of recorded, synthetic or live, speech or music are given in the terminal requirements.

- 4.4.2 (N) 1 No level adjustment to be user accessible.
- 4.4.2 (N) 2 Data terminals (e.g. modems) shall have a carrier level of -14 to -10 dBm.
- 4.4.2 (E) 1 The requirement in section 4.4.2.1 shall also be applied with the TE in high impedance condition.
- The output power is measured in the frequency band from 300 Hz to 3,4 kHz.
- PROVISION 1: The access requirement about ac signals originated exclusively from live speech shall, however, not be applied for TEs in which this function shall meet other terminal requirements (e.g. Send Loudness Rating, etc.) included in another mandatory specification that shall be applied simultaneously to the TE.
- PROVISION 2: The maximum mean power level(s) may be exceeded by as much as 1,0 dBm by a TE, provided that the power averaged over all TEs of production meets with the specified limit(s).
- PROVISION 3: With TE in the high impedance condition, the output power shall be measured over a load resistor of 300 ohms instead of 600 ohms.
- Compliance shall be checked by the tests outlined in section A.4.4.2.1 (E) 1.
- 4.4.2.1 (S) 1 Speech and music transmission
- The average speech band power level for any period of speech exceeding 1s shall not exceed -6 dBm corresponding to 0,25 mW. Live speech and music are excluded from the requirements in table 4.4.2.
- 4.4.2.1 (S) 2 Simultaneous signals and speech
- When signals and speech are transmitted simultaneously, the requirements for speech transmission in 4.4.2.1 shall be applied and shall refer to the total level.
- 4.4.2.1 (S) 3 Feeding conditions see Swedish remark, Chapter 1, section 1.5.2.
- 4.4.2.1 (GB) 1 All mean power levels P_s , are averaged over a period of the active signal, or one minute, whichever is the shorter.
- For TE incorporating facilities for sending to line recorded or synthetic speech, and/or music signals, the following shall apply:
- 1) speech signals shall have a mean power level whilst active not exceeding -9 dBm;
 - 2) music signals, or simultaneous speech and music signals, shall have a mean power level whilst active not exceeding -12 dBm;
- It is recommended that, in each case, the minimum signal levels should not be more than 6 dB below the levels specified in 1) and 2) respectively.
- Requirements for average power levels for TE that sends signals to line as a result of any live acoustic stimulus are outside the scope of this NET; the appropriate national standard or terminal NET should be referred to.

A.4.4.2 Speech band power levels of signals sent to line

The TEUT shall then be placed in loop condition whilst connected as shown in figure A.4.4.2.

The equipment shall then be caused to send to line its highest speech-band output level. If the TE emits signals arising from recordings or other non-live sources, these signals are to be produced by the TE as outlined in its associated instructions for use.

The measurements are carried out at dc excitation values V_f , R_f or I_f as shown in table A.4.4.2. The requirement shall be met at each polarity of dc excitation applied.

Table A.4.4.2: Speech band power levels of signals sent to line

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	60		19, 60	
Belgium	48	400, 1 600		
Cyprus	48	800		
Denmark			35	yes
Finland	48	800, 1 710		
France	46, 54	1 400 resp. 300		
Germany				
Greece	60		20, 35, 55	
Iceland	48		14, I_{max}	
Ireland	48	5000	100	
Italy	44, 48, 52	1 880, 1 100, 720		yes
Luxembourg	60		14, 60	
Malta				
Netherlands	48	1 130		
Norway	60	460		yes
Portugal	55	300	not applicable	
Spain	48	500, 1 100, 1 700		yes
Sweden				yes
Switzerland	43, 48, 57	2 200, 1 200, 600		
U. Kingdom	50	400 min.	25 - 100	yes

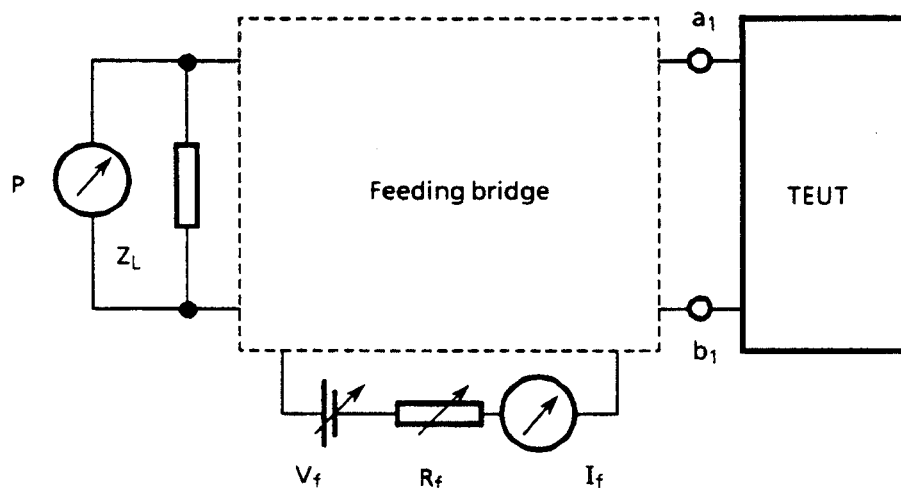


Figure A.4.4.2: Speech band power levels of signals sent to line
Feeding bridge as specified in Chapter 1

- A.4.4.2 (DK) 1 Test as in A.4.4.1 (DK) 1. The TE is adjusted for sending max. level.
- A.4.4.2 (I) 1 Output power level adjustment shall not be user accessible.
- A.4.4.2 (N) 1 No level adjustment to be user accessible. Check by inspection.
- A.4.4.2 (S) 1 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.
- A.4.4.2 (GB) 1 See remark 4.4.2.1 (GB) 1.

A.4.4.2.1 Levels of recorded, synthetic or live, speech or music

Power P_s is measured by an instrument meeting the requirements of CCITT Recommendation P.56 and capable of indicating average active power delivered to a load Z_L over a 10 second measurement period.

The instrument shall have a measurement bandwidth from 200 Hz to 4 000 Hz.

- A.4.4.2.1 (N) 1 When live speech excitation is necessary the sound pressure level during measurement shall be set to -4,7 dBpa.

A.4.4.2.1 (E) 1

PROVISION 1: The following provisions 2,3,4 and 5 shall be taken into account when tests in sections A.4.4.2.1 (E) 1 to A.4.4.3.1 (E) 4 are carried out.

PROVISION 2: The TEUT are caused to generate their maximum output mean power level according with the user's manual.

PROVISION 3: When live speech excitation is necessary, the acoustic artificial voice pressure level shall be either 94,6 dB SPL (at mouth reference point) with the handset mounted on the artificial head, or 75 dB SPL (near the microphone input) with the artificial mouth at 10 centimetres from the handsfree microphone, where the artificial voice is of the type used in the method OREM-A.

PROVISION 4: See the provision 3 in section A.4.4.1 (E) 1.

PROVISION 5: Unless another indication is made, the ac rms voltmeter with its previous filter give mean power values during the periods stipulated in the associated requirements, in the associated requirements, in the detection bandwidths indicated with a reading accuracy of $\pm 0,5$ dB. The considerations in CCITT Recommendation P.52 (Blue Book), in CCITT Recommendation P.56 (Blue Book), and in CCITT supplement no.18 of Volume V (Blue Book) can be taken into account.

The TEUT is connected as shown in figure A.4.4.2.1 (E) 1.

The dc voltage source (V_f), the resistor (R_f), the inductors (L_1) and (L_2), and the capacitors (C_1) and (C_2), take the values stipulated in test in section A.4.4.1.

The load resistor (R_L) takes the values stipulated in the requirement in section 4.4.2.1 (E) 1.

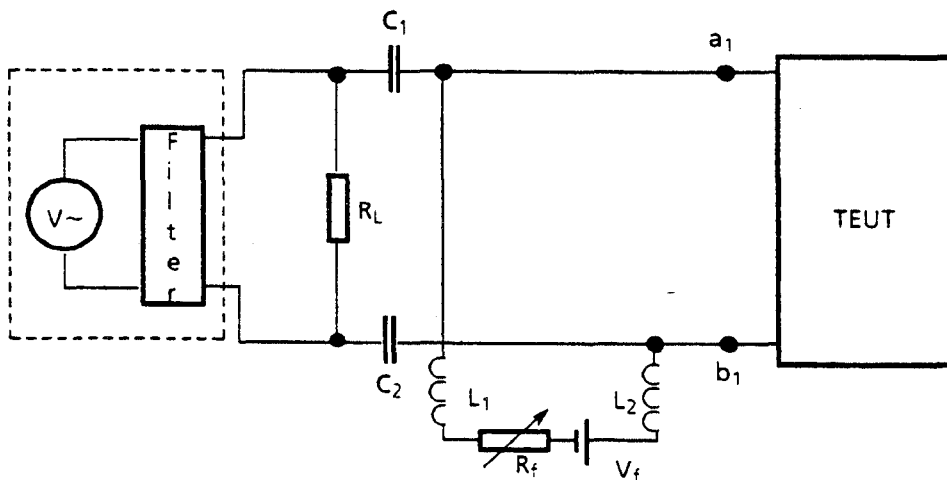


Figure A.4.4.2.1 (E) 1: Levels of recorded, synthetic or live, speech or music

A.4.4.2.1 (GB) 1 The dependant threshold technique identified in method B of supplement 8 to CCITT Recommendation P.52 (1985 Red Book) is used. A reasonable approximation to this can be obtained by using the test method described in A.4.4.2.2 (GB) 1, and manually suspending the averaging process when the signal is absent.

4.4.2.2 Levels of data or code signals

When the TE is in loop condition the average power level to a load Z_L delivered by the TE when sending signals arising from any form of data or code excitation shall not at any 200 ms period exceed P_{d1} if signals are transmitted in one direction, or P_{d2} if signals are transmitted in both directions at the same time. The requirement shall be met over a loop current range ΔI_f or at various dc excitation conditions ($\Delta R_f, \Delta V_f$). ac and dc parameter values are shown in table 4.4.2.

Compliance shall be checked using the test outlined in sections A.4.4.2 and A.4.4.2.2.

This requirement does not apply to TE in the dialling state.

4.4.2.2 (F) 1 For modems, the average power level shall be adjustable from 0 dBm up to a value not higher than -15 dBm, with space between steps not higher than 4 dB, and with nominal value (adjusted in factory) equal to -10 dBm.

4.4.2.2 (F) 2 $P_{d1} = P_{d2} = -6$ dBm for code signals.

- 4.4.2.2 (D) 1 See paragraph 4.4.1 (D) 2.
- 4.4.2.2 (I) 1 Data or code signals average power level is measured over the frequency range of 300 - 3 400 Hz and shall be adjustable in the step ≤ 2 dBm over the range of $(-3 \pm 0,5)$ dBm up to (-15 ± 1) dBm.
- 4.4.2.2 (I) 2 Data or code signal with electro-acoustics coupling to a telephone handset shall have a pressure which produces, at the telephone leads, a sending level that shall not exceed -9 dBm.
- 4.4.2.2 (I) 3 Portable TEs may have a fixed output power level which shall not exceed -10 dBm.
- 4.4.2.2 (E) 1 Data or code signals output power level.
(Requirement to be applied instead of section 4.4.2.2).

When the TE in either loop condition or high impedance condition is prepared to transmit ac data or code signals, the output signal shall be controlled in such a manner that the maximum mean power level shall not be during any period of 200 milliseconds greater than the values stipulated below, when the output power is measured as stipulated in the requirement in sections 4.4.2.1 and 4.4.2.1 (E) 1.

- a) Fixed output power level
For TEs with fixed output power level, the maximum mean power level shall not be greater than -10 dBm.
- b) Variable output power level
When the TE is prepared to vary its output level, it shall comply at least with one of the following requirements:

Either

b1) it is not possible for the mean power level to exceed -10 dBm;

or

b2) it is possible for the mean power level to exceed -10 dBm, then

i) the method of alteration of the output power level shall not be available to the user on the exterior of the TE;

and

ii) the maximum mean power level shall not be greater than -3 dBm;

and

iii) it shall be possible to achieve the maximum mean output power level values of -10 dBm and -13 dBm;

and

iv) in the cases that the selection of the maximum mean power level gets out of order unintentionally (e.g. transient software fail, programming bridge out of any position, etc.) the output power level shall go down to its lowest position;

and

v) the user's manual shall include inside a square the following sentence:

"Para la conexión de este equipo a la red deben seguirse las instrucciones de instalación y ajuste del nivel de salida establecidas por el operador de la red"

NOTE: The English sentence is: "For the connection of this equipment to the network it shall be followed the instructions for the installation and adjustment of the output level established by the network operator".

PROVISION 1: This requirement shall be complied with whether a code signal contains one or more frequencies and whether it is sent continuously or intermittently, with constant or varying amplitude and/or frequency. (See also the provisions 5 and 6).

PROVISION 2: This requirement shall, however, not be applied when the TE is transmitting DTMF signals (see requirement 5.4.4).

PROVISION 3: This requirement shall, however, not be applied when the TE is transmitting an echo disabling tone (see requirements in section 9.3 and the associated Spanish (E) sections).

PROVISION 4: See the provisions 2 and 3 in section 4.4.2.1 (E) 1.

PROVISION 5: Nevertheless the contents of the provision 1, if the data or code signal consists of one frequency, it shall be outside the following frequency intervals:

5a) 2 280 Hz \pm 25 Hz;

5b) 2 500 Hz \pm 25 Hz;

5c) 2 600 Hz \pm 50 Hz.

PROVISION 6: Nevertheless the contents of the provision 1, if the data or code signal consists of two or more than two frequencies, either

6a) all of them shall be outside the following frequency intervals:

6a.i) 2 040 Hz \pm 25 Hz;

6a.ii) 2 280 Hz \pm 25 Hz;

6a.iii) 2 400 Hz \pm 50 Hz;

6a.iv) 2 500 Hz \pm 25 Hz;

6a.v) 2 600 Hz \pm 25 Hz;

or

6b) the energy density in the 1 800 Hz \pm 20 Hz interval shall not be lower than 7 dB with respect to the maximum energy density in another 40 Hz interval between 300 Hz and 3 400 Hz.

Compliance shall be checked using the tests outlined in section A.4.4.2.2 (E) 1.

4.4.2.2 (E) 2

Data or code signals mixed with any music or speech output power level (Requirement to be applied in addition to section 4.4.2.2 (E) 1, instead of section 4.4.2.2).

When the TE in either loop condition or high impedance condition is prepared to transmit ac data or code signals mixed with any music or speech signals, the output signal shall meet the requirement in sections 4.4.2.1 and 4.4.2.1 (E) 1.

Compliance shall be checked using the tests outlined in section A.4.4.2.2 (E) 2.

4.4.2.2 (S) 1

Tone level signals:

If the equipment is designed so that a signal can be sent during a maximum of 10 s throughout any 60 s time interval or so that a signal is sent only during the time interval throughout which a switch, pushbutton or the like is actuated manually, the total power level is permitted to reach a maximum of -6 dBm, corresponding to 0,25 mW.

For equipment which simultaneously sends and receives signals throughout more than 10% of the time during any 60 s time interval, the limit values are reduced by 3 dB, i.e. from -10 to -13 dBm and from -6 to -9 dBm respectively.

4.4.2.2 (GB) 1

Average power levels P_{d1} , P_{d2} are one minute mean power levels.

- a) For fixed power level TE in adjustment class (0), the one minute mean power level shall not be greater than -9 dBm.
- b) For TE where the power level is adjustable, the one minute mean power level shall not be greater than 0 dBm. The range of adjustment shall include the value -13 dBm. The means of adjustment shall meet one of the following requirements:

NOTE: For TE where the power level is adjustable, the level is set at the time of installation according to a procedure arranged with the PTO.

- 1. For adjustable power level TE in adjustment class (1), the means of adjustment, whereby levels could be set above those set at the time of installation, shall be inaccessible without the use of a tool.
 - 2. For adjustable power level TE in adjustment class (2), the means of adjustment, whereby levels could be set above those set at the time of installation, shall be capable of being rendered inaccessible or inoperative by physical guards that are able to be released only by the use of a tool.
 - 3. For adjustable power level TE in adjustment class (3), the means of adjustment, whereby levels could be set above those set at the time of installation, shall be capable of being operated only after release of software locks, the operation of which requires skill and detailed knowledge not available to the user of the apparatus by means of information provided by the supplier.
- c) The total power level in a 10 Hz bandwidth contained wholly within the frequency range 0 Hz to 3 400 Hz shall not be greater than the upper limit given in table 4.4.2.2 (GB) 1 and shown by the full line in figure 4.4.2.2 (GB) 1, except for signals in area A as given in table 4.4.2.2 (GB) 1 for which the following requirements apply.

Where a signal occurs in area A, it shall be accompanied by a signal or signals in area B, as given in table 4.4.2.2 (GB) 1 and shown by additional dotted lines in figure 4.4.2.2 (GB) 1, at a total power level not less than a level that is 12 dB below the power level of the signal in area A.

For TE where the power level is adjustable, the foregoing requirements for the total power level shall be determined with the power level adjusted for one minute mean power level of -9 dBm, or the nearest lower value for which a setting is practicable.

Where there is no signal in area B, the total power in the frequency range 2 220 Hz to 2 340 Hz shall not be greater than -33 dBm.

Table 4.4.2.2 (GB) 1: Co-ordinates of limit curves for power level in a 10 Hz bandwidth

Limit curve	Frequency	Power level in a 10 Hz bandwidth	Limit curve	Frequency	Power level in a 10 Hz bandwidth	
Upper limit	Hz	dBm	Area A	2 130	-6	
	30	-33		2 220	-33	
	100	-33		2 340	-33	
	100	-23		2 430	-6	
	200	-23		2 130	-6	
	200	-6		Area B	900	-6
	2 130	-6			1 000	-23
	2 220	-33			1 000	-45
	2 340	-33	2 000		-45	
	2 430	-6	2 000		-23	
	3 200	-6	2 130		-6	
	3 200	-23	900		-6	
	3 400	-23				
	3 400	-33				

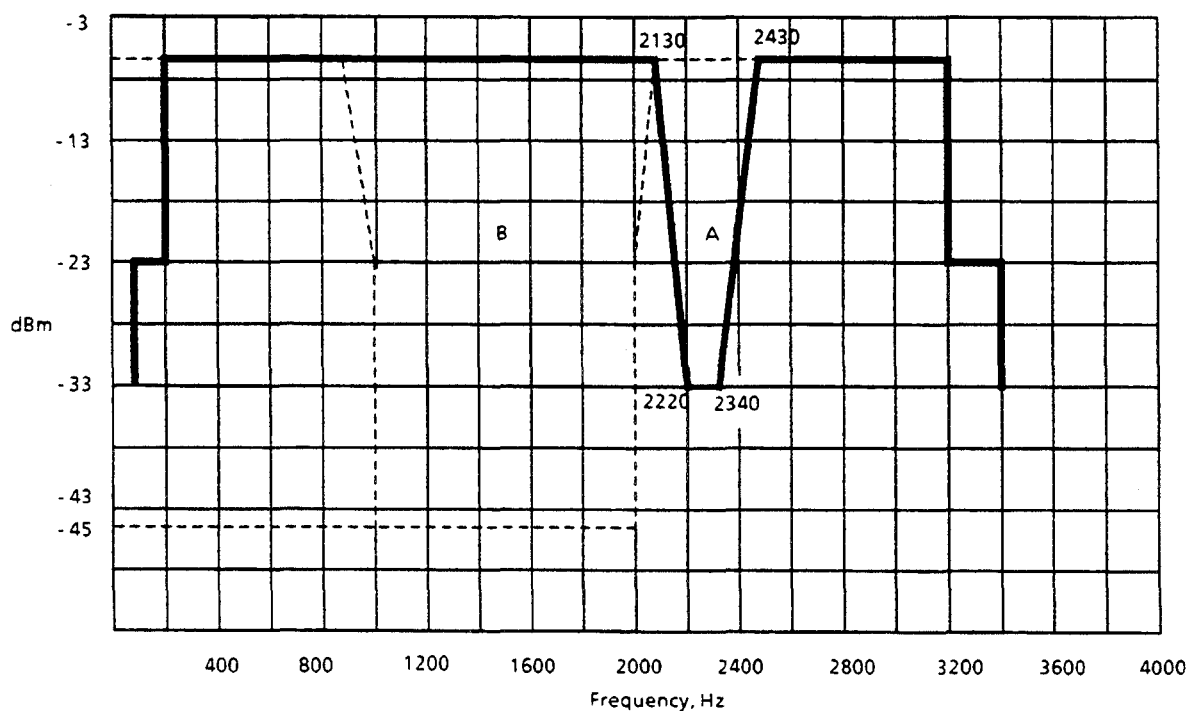


Figure 4.4.2.2 (GB) 1: Limits of power level in a 10 Hz bandwidth of the output signal from the TE

A.4.4.2.2 Levels of data or code signals

The TE is excited in such a way as to send maximum power to the line. Power P_{d1} and P_{d2} are measured across the load Z_L with an instrument capable of indicating average power over a 200 ms measurement period.

The instrument shall have a measurement bandwidth from 200 Hz to 4 000 Hz.

A.4.4.2.2 (E) 1 Data or code signals output power level

The procedure of test in section A.4.4.2.1 (E) 1 is followed.

PROVISION:

When tests over the sections b.2.i, b.2.iv and b.v of the requirement in section 4.4.2.2 (E) 1 are carried out, the installation instructions and the user's manual shall be taken into account.

A.4.4.2.2 (E) 2 Data or code signals mixed with any music or speech output power level

The procedure of test in section A.4.4.2.1 (E) 1 is followed.

A.4.4.2.2 (CH) 1

For inband signalisation reasons in the PSTN, discrete signals of frequencies > 1 900 Hz (such as carriers, tones for control purposes, etc.) are generally not allowed. This applies to TEs which do not comply with international standards (e.g. series V-Recommendations).

A.4.4.2.2 (GB) 1

The test circuit shown in figure A.4.4.2 is used, except that the measuring instrument P and load resistor Z_L are replaced by a voltmeter presenting a terminating impedance of 600 ohms resistive.

Measurements are made at those values of TE current in the sequence 25, 32, 40, 50, 65, 75, 85 and 100 mA dc which are not greater than the current obtained when the two leads designated for connection to the basic network loop are connected to a voltage source of 50 V dc in series with a 400 ohm resistor.

When power levels are determined with TE in the quiescent state, a single measurement is made with the TE current at its quiescent value.

The power levels mentioned herein are to be determined by the measurement of a voltage V, with a measuring instrument presenting a termination impedance of 600 ohms resistive. The measuring instrument has the following additional characteristics:

- (a) For the one minute power level measurements required by 4.4.2.1 (GB) 1 and 4.4.2.2 (GB) 1, the voltmeter has the following elements:
 - (1) an input band-selection filter;
 - (2) a square law detector having a time constant of approximately 100 ms;
 - (3) an averaging circuit that performs a continuing averaging process over a period of 1 minute, i.e. that computes the value of

$$\left(\frac{1}{60}\right) \int_{t=T_n}^{t=T_n+60} (V^2) dt$$

where t and T_n are times in seconds and V is the rms voltage indicated by the square law detector, expressed in volts.

The measurement is carried out for a sufficient time for the averaging circuit to record a steady value, and the power is then determined as $V^2/600$.

The measurement bandwidth shall extend from 200 Hz to 3 200 Hz.

The time constant of the detector specified in (2) above is chosen to be compatible with the duration of speech syllables. It is that duration of a

pulse of 1 kHz sinusoidal signal which causes the detector to indicate 63% of the ultimate value attained by the detector when the same signal is applied for an indefinitely long period of time.

- (b) For the total power level required by 4.4.2.2 (GB) 1 measured within a 10 Hz bandwidth, and determined as $V^2/600$ a selective measuring set or its equivalent is used to explore the frequency band at centre frequencies extending from 35 Hz to 3 395 Hz. The measuring instrument shall be calibrated to measure the rms voltage V of any signal within that band and shall have an effective measurement bandwidth of 10 Hz.

4.4.3 Unwanted outband signal levels sent to line

The requirements of this section shall be met with TE placed in loop condition.

Reference is made to figure A.4.4.3.

The power level of any individual frequency component, found in a bandwidth of 125 Hz, delivered to a load Z_L and arising from any form of excitation of the TE shall not exceed the limits shown in table 4.4.3.1.b for the frequency ranges shown in table 4.4.3.1.a.

The requirement shall be met at various dc excitations ΔV_f , ΔR_f or ΔI .

ac and dc parameters are shown in table 4.4.3.1.b.

Compliance shall be determined by measurement as outlined in section A.4.4.3.

This requirement is not applicable during dialling state.

4.4.3.1 Levels of recorded, synthetic or live, speech or music

Table 4.4.3.1.a: Frequency range

Frequency range (Hz)	Maximum level (dB)
Δf_1 3 400 \leq f_1 < 4 300	a_1
Δf_2 4 300 \leq f_2 < 28 000	a_2
Δf_3 28 000 \leq f_3 < 150 000	a_3

Table 4.4.3.1.b: Levels of recorded, synthetic or live, speech or music

COUNTRY	REQUIREMENT VALUES							Remarks
	a ₁ (dBm)	a ₂ (dBm)	a ₃ (dBm)	Z _L (Ω)	ΔV _f (V)	ΔR _f (Ω)	ΔI _f (mA)	
Austria		-37...-70	-70	600	60		19 - 60	yes
Belgium	-33	-37...-70	-70	600	48		20 - I _{max.}	yes
Cyprus	-33	-37	-70	600	48	40 - 1 740		yes
Denmark	-33	-37...-70	-70	600			0 - I _{max.}	yes
Finland	not mandatory							
France				600	46 - 54	300 - 1 400		yes
Germany								yes
Greece	-33...-37	-37...-70	-70					yes
Iceland	-33	-37	-70	600	48		14 - I _{max.}	
Ireland	not mandatory							
Italy				600	44 - 52	720 - 1 880		yes
Luxembourg		-37...-70	-70	600	60		14 - 60	
Malta								
Netherlands				600	42 - 66	800 - 2 140		yes
Norway	-33			600	60	460 - 3 100		yes
Portugal	-33		-60	600	45 - 55	300 - 1 800	N/A	yes
Spain					48	500 - 1 700		yes
Sweden				600				yes
Switzerland								yes
U. Kingdom	-33...-38	-38...-60	-60...-70	600	50	400 min.	25 - 100	yes

4.4.3.1 (A) 1 The transmission frequency response shall drop 12 dB/octave above 4 300 Hz beginning with -37 dB.

4.4.3.1 (B) 1 In the frequency band 3 400 - 4 300 Hz: -33 dBm.
In the frequency band 4 300 - 28 000 Hz: -37 dBm at 4 300 Hz, then falling at 12 dB per octave to 28 kHz.
In the frequency band 28 - 150 kHz: -70 dBm.

4.4.3.1 (CY) 1 In the frequency band 4,3 to 28 kHz falling at 12 dB per octave.

4.4.3.1 (DK) 1 The transmission frequency response shall drop at least 12 dB/octave above 4 300 Hz beginning from -37 dBm.

4.4.3.1 (F) 1 Applicable in loop condition only, with the limits below:

- 3,4 kHz : -6 dBm
- 3,4 - 6,8 kHz : -6 dBm per octave
- 6,8 - 64 kHz : -15 dB per octave
- 64 - 150 kHz : -60 dBm

4.4.3.1 (F) 2 Not applicable to live speech TE.

4.4.3.1 (D) 1 The power level of unwanted frequencies, which is sent from the TE in all conditions, including the quiescent condition, to the line terminals shall be within the following limits, measured with a bandwidth of ≤ 80 Hz:

- in the range of 50 Hz...300 Hz: -43 dBm;
- in the range of 4,3 kHz...28 kHz: -37 dBm at 4,3 kHz dropping by 12 dB/octave up to 28 kHz;
- in the range of 28 kHz...200 kHz: -70 dBm;
- in the quiescent condition (4,3 kHz...200 kHz): -72 dBm.

During this test, the microphone has to be disconnected.

4.4.3.1 (GR) 1 In the frequency ranges Δ_{f1} and Δ_{f2} , a_1 and a_2 decrease 12 dB/octave.

In the range 0 - 300 Hz, $a_0 = -15$ dB.

4.4.3.1 (I) 1 In the frequency band 3 400 - 4 300 Hz:
 -33 dBm

In the frequency band 4 300 - 28 000 Hz:
 -37 dBm at 4 300 Hz, then falling at 12 dB per octave to 28 kHz

In the frequency band 28 - 150 kHz:
 -70 dBm.

4.4.3.1 (NL) 1

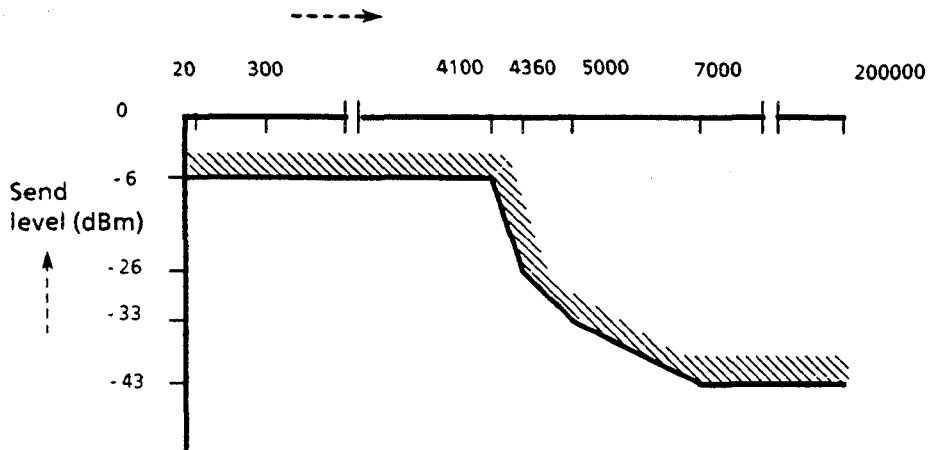


Figure 4.4.3.1 (NL) 1

4.4.3.1 (N) 1 -37 dBm at 4,3 kHz falling off 12 dB/octave to 16 kHz.
 -60 dBm in the frequency range $16 \text{ kHz} < f_3 < 100 \text{ kHz}$.

4.4.3.1 (N) 2 Not applicable to live speech TE. Telephone sets shall comply with national regulations.

4.4.3.1 (P) 1 $a_2(\text{dBm}) = -37$ for 4,3 kHz, decreasing by 12 dB/octave in the frequency range $4,3 \text{ kHz} \leq f_2 < 16 \text{ kHz}$.

$a_2(\text{dBm}) = -60$ in the frequency range $16 \text{ kHz} \leq f_2 < 28 \text{ kHz}$.

4.4.3.1 (E) 1

All TE total outband output power level:

With TE in both loop condition and high impedance condition, the output signal shall be controlled in such a manner that the total maximum mean power level of all unwanted frequency components shall not be during any period of 10 seconds greater than -30 dBm, when the output power is measured over a load resistor of 600 ohms connected to the line terminals, in the frequency band up to 1 MHz, excluding the frequency band up to 3,4 kHz.

PROVISION 1:

This requirement shall, however, not be applied when the TE is transmitting DTMF signals (see requirement 5.4.5 (E) 1).

PROVISION 2:

See the provisions 2 and 3 in section 4.4.2.1 (E) 1.

Compliance shall be checked using the tests outlined in section A.4.4.3 (E) 1.

4.4.3.1 (E) 2

All TE low frequency outband output power level:

With TE in both loop condition and high impedance condition, the output signal shall be controlled in such a manner that the maximum mean power level shall not be during any period of 1 second greater than the values stipulated in table 4.4.3.1 (E) 2 over the frequency ranges indicated, when the output power is measured over a load resistor of 600 ohms connected to the line terminals, in any 10 Hz bandwidth in the frequency band from 0 Hz to 300 Hz.

PROVISION:

See the provisions 2 and 3 in section 4.4.2.1 (E) 1.

Compliance shall be checked using the tests outlined in section A.4.4.3 (E) 2.

Table 4.4.3.1 (E) 2: All TE low frequency outband output power level

<u>Power level limit</u>	<u>Frequency range</u>
-33 dBm	0 Hz < f < 100 Hz
-23 dBm	100 Hz ≤ f < 300 Hz

4.4.3.1 (E) 3

All TE medium frequency outband output power level:

With TE in both loop condition and high impedance condition, the output signal shall be controlled in such a manner that the maximum mean power level shall not be during any period of 100 milliseconds greater than the values stipulated in table 4.4.3.1 (E) 3 over the frequency ranges indicated, when the output power is measured over a load resistor as stipulated in table 4.4.3.1 (E) 3 connected to the line terminals, in each one of the bandwidths indicated in table 4.4.3.1 (E) 3, in the frequency band from 3,4 kHz to 200 KHz, where (fc) is the centre frequency (in kHz) of each 4 kHz bandwidth between 8 kHz and 28 kHz.

PROVISION 1:

See the provision 2 in section 4.4.2.1 (E) 1.

PROVISION 2:

With TE in the high impedance condition, the output power shall be measured over a load resistor with a value of a half of the values stipulated in table 4.4.2.1 (E) 1.

Compliance shall be checked using the tests outlined in section A.4.4.3 (E) 3.

Table 4.4.3.1 (E) 3: All TE medium frequency outband output power level

Power level limit (dBm)	Frequency range (kHz)	Bandwidth	Load resistor (Ω)
-30	$3,4 < f \leq 4$	600 Hz	600
-33	$4 < f \leq 8$	4 kHz	600
$3,7 - 40,6 \cdot \log_{10} f_c$	$8 < f \leq 28$	4 kHz	300
-55	$28 < f < 200$	4 kHz	150

4.4.3.1 (E) 4 All TE high frequency outband output power level

With TE in both loop condition and high impedance condition, the output signal shall be controlled in such a manner that the maximum mean power level shall not be during any period of 100 milliseconds greater than -55 dBm, when the output power is measured over a load resistor of 75 ohms connected to the line terminals, in each 4 kHz bandwidth in the frequency band from 200 kHz to 1 MHz.

PROVISION 1: See provision 2 in section 4.4.2.1 (E) 1.

PROVISION 2: With TE in the high impedance condition, the output power shall be measured over a load resistor of 35,7 ohms instead of 75 ohms.

Compliance shall be checked using the tests outlined in section A.4.4.3 (E) 4.

4.4.3.1 (S) 1 These requirements apply to the loop condition.

Individual frequency components in the 3,4 - 150 kHz band shall not exceed the values shown on the curve in figure 4.4.3.1 (S) 1.

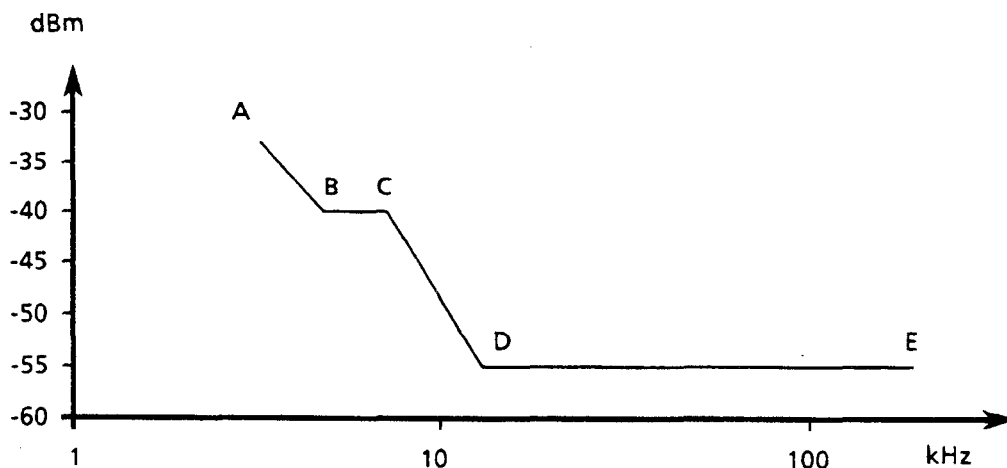


Figure 4.4.3.1 (S) 1

Table 4.4.3.1 (S) 1

Point	Frequency (kHz)	Level (dBm)
A	3,4	-33
B	5,0	-40
C	7,5	-40
D	12	-55
E	150	-55

Equipment which sends or receives speech and equipment connected in parallel or in series (cascade) with speech transmitting or speech receiving equipment shall not transmit individual frequencies of a level which exceeds -20 dBm in the 0 - 75 Hz band or exceeds -30 dBm in the 75 - 300 Hz band while speech is being transmitted.

The transmission frequency response shall drop at least 12 dB/octave above 4 000 Hz.

4.4.3.1 (S) 2

Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.4.3.1 (CH) 1

See Switzerland's remarks section 4.4.3.

4.4.3.1 (GB) 1

The total power level in any 3 kHz bandwidth wholly above 3,4 kHz shall not be greater than the limit given in table 4.4.3.1 (GB) 1 and shown in figure 4.4.3.1 (GB) 1, for the centre frequency of the band. Exceptionally, individual signals with frequencies of $(24 + 8n)$ kHz with a tolerance of $\pm(1,2 + 0,4n)$ Hz (where $n = 0$ or any positive integer between 1 and 396) may have a power level which exceeds the limit but shall not exceed -50 dBm.

NOTE: The tolerance above is equal to ± 50 parts per million.

Requirements for TE that send signals to line as a result of any live acoustic stimulus are outside the scope of this NET; the appropriate National Standard or terminal NET should be referred to.

Table 4.4.3.1 (GB) 1: Co-ordinates of power level limit curve

Frequency (kHz)	Power level (dBm)
3,4	-33
5,1	-40
8,9	-40
50	-70
1000	-70
2000	-58
4000	-46
8000	-34

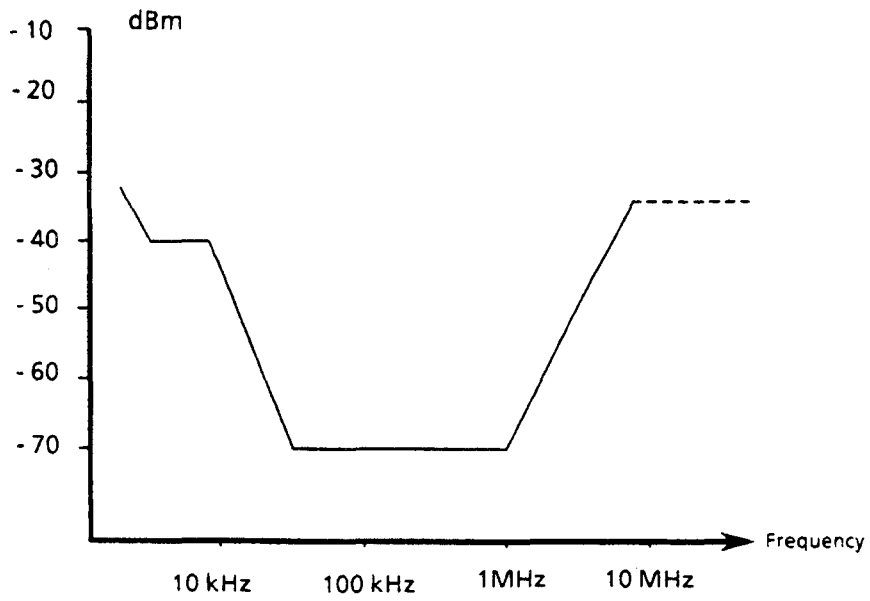


Figure 4.4.3.1 (GB) 1: Power level limit of the output power from the TE

4.4.3.2 Levels of data or code signals

Table 4.4.3.2.a: Maximum level

Frequency range (Hz)	Maximum level (dB)
Δf_1 3 400 $\leq f_1 <$ 4 300	a_4
Δf_2 4 300 $\leq f_2 <$ 28 000	a_5
Δf_3 28 000 $\leq f_3 \leq$ 150 000	a_6

Table 4.4.3.2.b: Maximum outband signal power level

COUNTRY	REQUIREMENT VALUES							Remarks
	a ₄ (dBm)	a ₅ (dBm)	a ₆ (dBm)	Z _L (Ω)	ΔV _f (V)	ΔR _f (Ω)	ΔI (mA)	
Austria		-37...-70	-70	600	60		19 - 60	yes
Belgium	-33	-37 ... -70	-70	600	48		20 - I _{max.}	yes
Cyprus	-33	-37	-70	600	48	440 - 1 740		yes
Denmark	-33	-37...-70	-70	600			0 - I _{max.}	yes
Finland	not mandatory							
France				600	46 - 54	300 - 1 400		yes
Germany								yes
Greece	-33...-37	-37...-70	-70	600	0 - 60		20 - 80	yes
Iceland	-33	-37	-70	600	48		14 - I _{max.}	
Ireland				600				yes
Italy					44 - 52	720 - 1 880		yes
Luxembourg		-37...-70	-70	600	60		14 - 60	
Malta								
Netherlands				600	42 - 66	800 - 2 140		yes
Norway	-33			600	60	460 - 3 100		yes
Portugal	-33		-60	600	45 - 55	300 - 1 800	N/A	yes
Spain								yes
Sweden				600				yes
Switzerland				600, 150	43 - 57	2 200 - 600		yes
U. Kingdom	-33...-38	-38...-60	-60...-70		50	400 min.	25 - 100	yes

- 4.4.3.2 (A) 1** The transmission frequency response shall drop 12 dB/octave above 4 300 Hz beginning from -37 dB.
- 4.4.3.2 (B) 1** The Belgian remark in 4.4.3.1 is also applicable to this requirement 4.4.3.2.
- 4.4.3.2 (CY) 1** In the frequency band 4,3 to 28 kHz falling at 12 dB per octave.
- 4.4.3.2 (DK) 1** The transmission frequency response shall drop at least 12 dB/octave above 4 300 Hz beginning from -37 dB.
- 4.4.3.2 (F) 1** Applicable in loop condition only, with the requirements below:
- a) for code signals the level of any individual frequency component shall not exceed the limits shown in figure A.4.4.3.2 (F) 1.a;

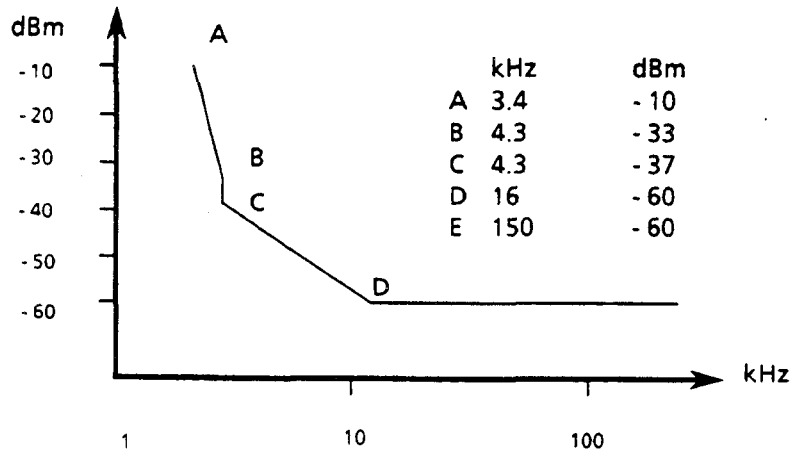


Figure 4.4.3.2 (F) 1.a: Code signals

- b) for data signals the level of any individual frequency component compared to the level of the total power shall not exceed the limits shown in figure A.4.4.3.2 (F) 1.b, with maximal level of the total power.

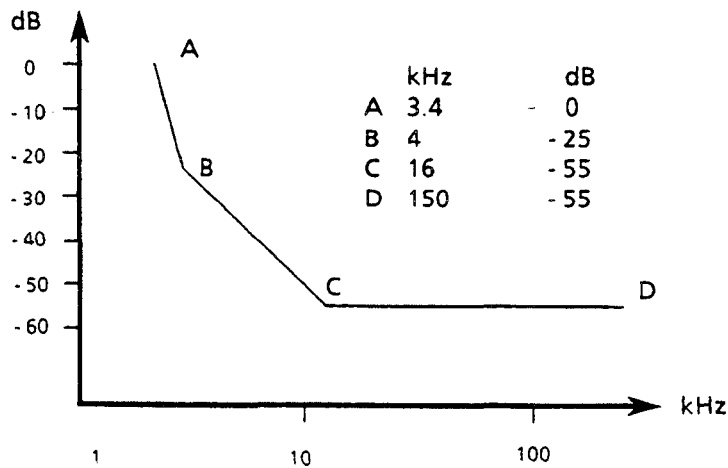


Figure 4.4.3.2 (F) 1.b: Data signals

4.4.3.2 (D) 1

The power level of unwanted frequencies, which is sent from the TE in all conditions, including the quiescent condition, to the line terminals shall be within the following limits, measured with a bandwidth of ≤ 80 Hz:

- in the range of 50 Hz...300 Hz: -43 dBm;
- in the range of 4,3 kHz...28 kHz: -37 dBm at 4,3 kHz dropping by 12 dB/octave up to 28 kHz;
- in the range of 28 kHz...200 kHz: -70 dBm;
- in quiescent condition (4,3 kHz...200 kHz): -72 dBm.

4.4.3.2 (GR) 1

In the frequency ranges Δ_{f1} and Δ_{f2} , a_4 and a_5 decrease 12 dB/octave.

In the range 0 - 300 Hz $a_0 = -15$ dB.

4.4.3.2 (IRL) 1

Values are as follows:

- 33 dBm for 3,4 kHz to 4,3 kHz;
- 37 dBm for $f = 4,3$ kHz and then falling 12 dB/octave up to 16 kHz;
- 60 dBm for frequencies above 16 kHz.

4.4.3.2 (I) 1

The power level of unwanted frequencies sent from the TE is measured with a bandwidth of 100 Hz and shall be within the following limits:

Frequency range (Hz)	Maximum level (dBm)
20 - 250	-25
3 750 - 4 000	-25
4 000 - 12 000	-35
12 000 - 163 k	-55
163 k - 358 k	-65

4.4.3.2 (NL) 1

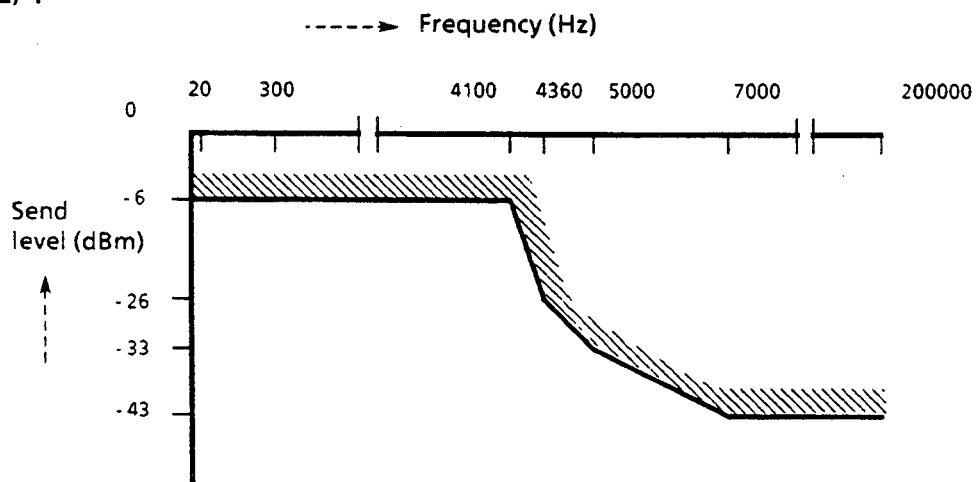


Figure 4.4.3.2 (NL) 1

4.4.3.2 (N) 1

- 37 dBm at 4,3 kHz falling off 12 dB/octave to 16 kHz.
- 60 dBm in the frequency range $16 \text{ kHz} < f_3 < 100 \text{ kHz}$.

4.4.3.2 (P) 1

$a_5(\text{dBm}) = -37$ for 4,3 kHz, decreasing by 12 dB/octave in the frequency range

$$4,3 \text{ kHz} \leq f_2 < 16 \text{ kHz}$$

$$a_5(\text{dBm}) = -60, \text{ in the frequency range } 16 \text{ kHz} \leq f_2 < 28 \text{ kHz}$$

4.4.3.2 (E) 1

The requirements in sections 4.4.3.1 (E) 1 to 4.4.3.1 (E) 4 shall be applied.

4.4.3.2 (S) 1

The requirements apply to the loop condition.

Individual frequency components in the 3,4 - 150 kHz band shall not exceed the values shown on the curve in figure 4.4.3.2 (S) 1.

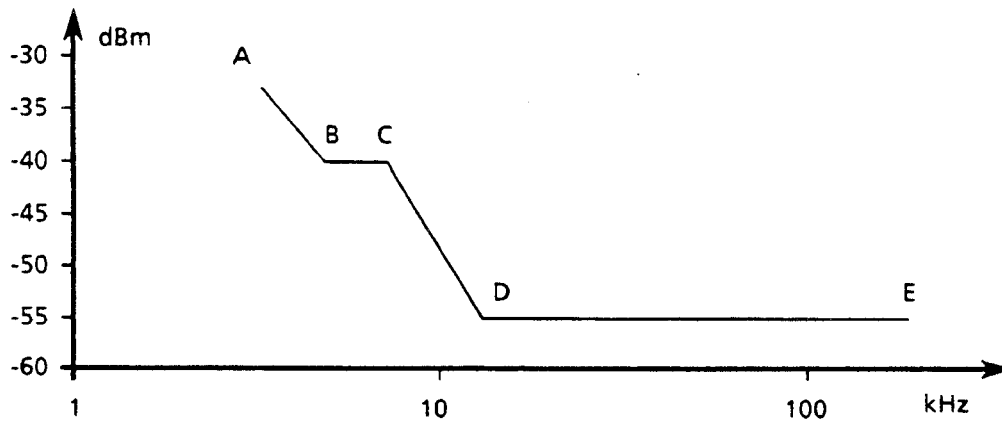


Figure 4.4.3.2 (S) 1

Table 4.4.3.2 (S) 1

Point	Frequency (kHz)	Level (dBm)
A	3,4	-33
B	5,0	-40
C	7,5	-40
D	12	-55
E	150	-55

Equipment which sends or receives speech and equipment connected in parallel or in series (cascade) with speech transmitting or speech receiving equipment shall not transmit individual frequencies of a level which exceeds -20 dBm in the 0 - 75 Hz band or exceeds -30 dBm in the 75 - 300 Hz band while speech is being transmitted.

4.4.3.2 (S) 2

Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.4.3.2 (CH) 1

Symmetric interference level (peak assessment)

The TE shall not exceed the following limits:

Table 4.4.3.2 (CH) 1

Frequency range	Maximum level	Measuring bandwidth	Z_L
4 - 12 kHz	-38 dBm	300 Hz	600 Ω
12 - 150 kHz	-58 dBm	300 Hz	150 Ω

4.4.3.2 (GB) 1

For TE where the power level is adjustable, the following requirements for the total power level in any 3 kHz bandwidth shall be determined with the mean power level set to an indicated one minute mean power level of -9 dBm, or the nearest lower value for which a setting is practicable.

The total power level in any 3 kHz bandwidth wholly above 3,4 kHz shall not be greater than the limit given in table 4.4.3.2 (GB) 1 and shown in figure 4.4.3.2 (GB) 1, for the centre frequency of the band. Exceptionally, individual signals with frequencies of $(24 + 8n)$ kHz with a tolerance of $\pm(1,2 + 0,4n)$ Hz (where $n = 0$ or any positive integer between 1 and 396) may have a power level which exceeds the limit but shall not exceed -50 dBm.

NOTE: The tolerance above is equal to ± 50 parts per million.

Table 4.4.3.2 (GB) 1: Co-ordinates of power level limit curve

Frequency (kHz)	Power level (dBm)
3,4	-33
5,1	-40
8,9	-40
50	-70
1000	-70
2000	-58
4000	-46
8000	-34

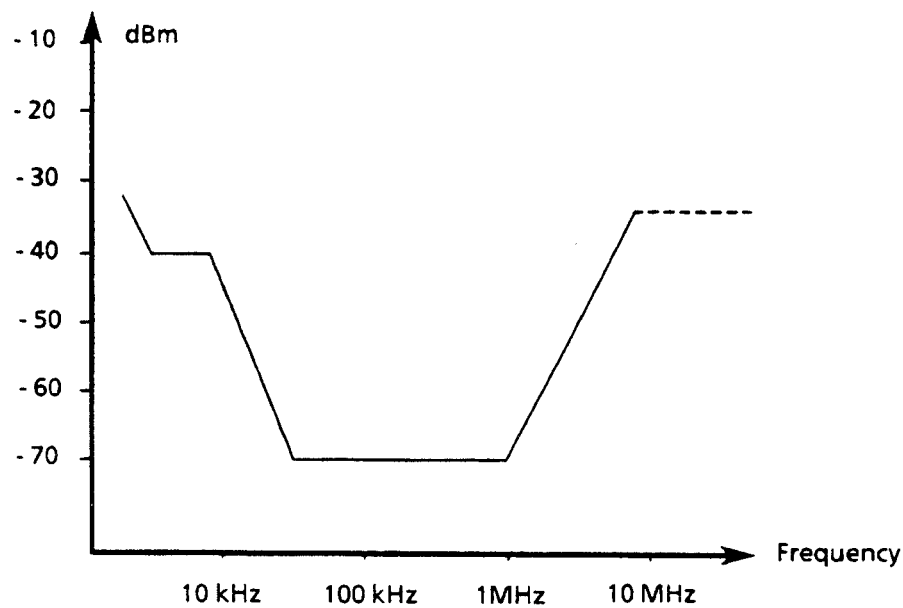


Figure 4.4.3.2 (GB) 1: Power level limit of the output power level from the TE

A.4.4.3 Unwanted outband signal levels sent to line

The TE will be tested in loop condition as shown in figure A.4.4.3.

The TEUT shall be caused to emit a code or data-signals of a random or pseudo-random kind by choosing an appropriate exciting function, or live speech signals.

Measurements shall be made at all frequency bandwidths specified.

Measurements are carried out at a limited number of values of dc excitation V_f , R_f , or I_f as shown in table A.4.4.3.

Table A.4.4.3: Unwanted outband signal levels sent to line

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	60		19, 60	
Belgium	48	400, 1 600		
Cyprus	48	800		
Denmark			35	yes
Finland		not mandatory		
France	46, 54	1 400, 300		
Germany	60	1 000, 2 530		
Greece	60		20, 35, 55	
Iceland	48		14, I_{max} .	
Ireland				
Italy	44, 48, 52	1 880, 1 100, 720		
Luxembourg	60		14, 60	
Malta				
Netherlands	48	1130		
Norway	60	460		
Portugal	55	300	not applicable	
Spain	48	500, 1 100, 1 700		yes
Sweden				yes
Switzerland				yes
U. Kingdom	50	400 min.	25 - 100	yes

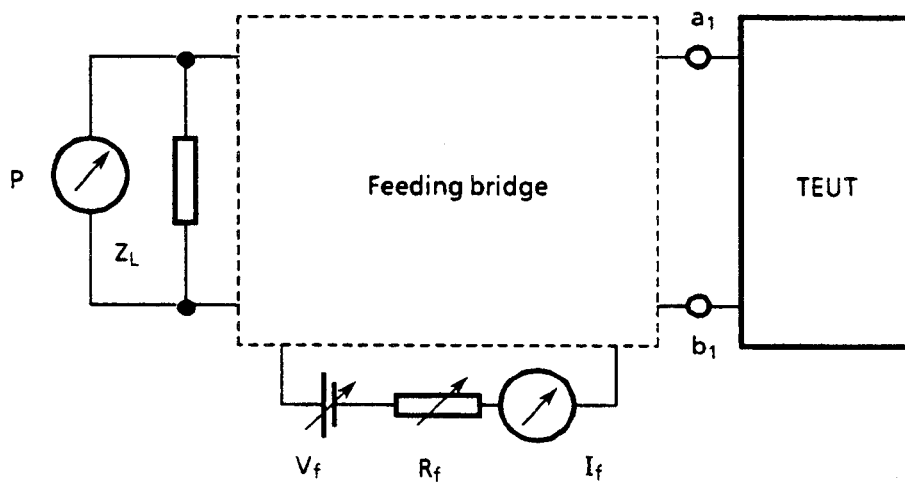


Figure A.4.4.3: Unwanted outband signal sent to line
 Feeding bridge as specified in Chapter 1

A.4.4.3 (DK) 1 The test principle is shown in figure A.4.4.3 (DK) 1.

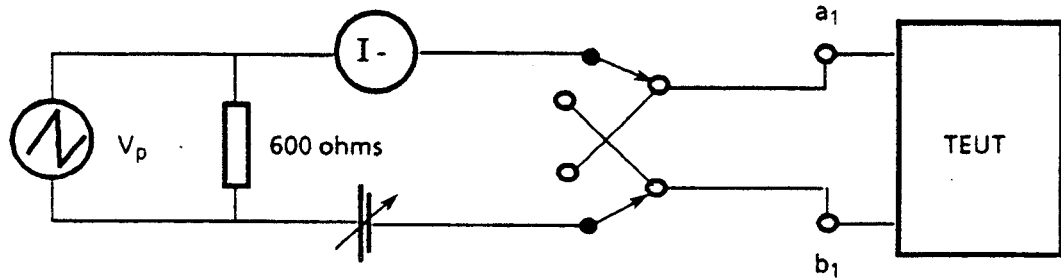


Figure A.4.4.3 (DK) 1

A.4.4.3 (E) 1 All TE outband output power level:

The procedure of test in section A.4.4.2.1 (E) 1 is followed. The test procedure shall be carried out at least three times, and the result with the intermediate value shall be chosen.

A.4.4.3 (E) 2 All TE low frequency outband output power level:

The procedure of test in section A.4.4.2.1 (E) 1 is followed, where an FFT instrument is used.

The test procedure shall be carried out over at least three samples, each one of them with the duration stipulated in the associated requirement. The result of averaging the measured values in each bandwidth shall be chosen.

A.4.4.3 (E) 3 All TE medium frequency outband output power level:

The procedure of test in section A.4.4.3 (E) 2 is followed.

A.4.4.3 (E) 4 All TE high frequency outband output power level:

The procedure of test in section A.4.4.3 (E) 2 is followed.

A.4.4.3 (S) 1 Feeding conditions see Swedish remark, Chapter 1, section 1.5.2.

A.4.4.3 (CH) 1 Feeding setting for quiescent condition:

V_f : 48 V, R_f : 1 200 Ω

Feeding condition for loop condition:

V_{f1} : 43 V, R_{f1} : 2 200 Ω

V_{f2} : 48 V, R_{f2} : 1 200 Ω

V_{f3} : 57 V, R_{f3} : 600 Ω

A.4.4.3 (GB) 1 See A.4.4.2.2 (GB) 1 for details of the test method.

1. For the total power level required by 4.4.3 in the loop state, measured as that power contained within a 3 kHz bandwidth wholly above 3,4 kHz and determined as $V^2/600$ a selective measuring set or its equivalent having effective measurement bandwidth of 3 kHz is used to explore the frequency band at centre frequencies extending from 4,9 kHz to 7 998,5 kHz.

For power level of any exceptional individual signal frequencies required by 4.4.3 and determined as $V^2/600$ a selective measuring set or its equivalent having effective measurement bandwidth of 30 Hz is used to explore the band of individual signal frequencies specified in 4.4.3 at centre frequencies bounded by that same specified band of individual signal frequencies and to measure the power contained within the 30 Hz band. The rms voltage V is then determined either by means of internal calibration or by matching against a sinusoidal signal of known rms voltage V at a frequency equal to the centre frequency of the measurement bandwidth.

2. For the total power level required in the quiescent state, measured as that power contained within a 3 kHz bandwidth wholly above 5,1 kHz and determined as $V^2/600$ a selective measuring set or its equivalent having effective measurement bandwidth of 3 kHz is used to explore the frequency band at centre frequencies extending from 6,6 kHz to 7 998,5 kHz. The rms voltage V is then determined either by means of internal calibration or by matching against a sinusoidal signal of known rms voltage V at a frequency equal to the centre frequency of the measurement bandwidth.
3. The measurement method to be used for 1 and 2 above shall be as follows:
 - 3.1 With the TE arranged for testing with power applied so as to place the TE in a working state, a series of 10 sweep measurements shall be made to determine the increase in level of signals normally present but enhanced by the TE. A signal enhancement of less than 10 dB may be ignored.
 - 3.2 With the TE arranged for testing as in 3.1 above but without power applied, a further series of up to 10 sweep measurements shall be made to determine the levels and frequencies of those signals normally present within the testing environment.

NOTE: It is assumed that the measurements undertaken in clauses 1 and 2 are made after typical TE deployment and operational parameters have been mutually agreed by the relevant parties and the TE has been configured accordingly.

4.5 Noise level

The noise level requirement shall be met when either quiescent or loop condition at various dc excitation conditions ΔI , ΔV_f , ΔR_f , specified as shown in tables 4.5.1 and 4.5.2.

A.4.5 Noise level

The TE will be tested in both conditions, quiescent as well as loop condition as shown in figure A.4.5.

Resistors R_f and voltage V_f or current I_f shall be adjusted as described by the relevant administration with each polarity of dc excitation applied.

The TE shall be set with all sending and receiving transducers acoustically terminated and all electrical telecommunication signal input terminals terminated by the nominal input impedance Z_L , and all other electrical input terminals terminated according to normal operating conditions.

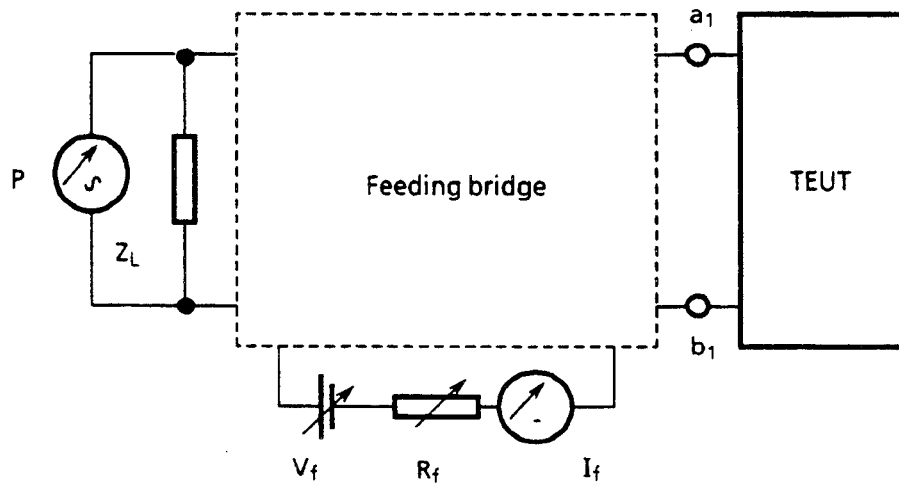


Figure A.4.5: Noise level
Feeding bridge as specified in Chapter 1

Table A.4.5: Noise level

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	f (Hz)	
Austria	60		19, 60		
Belgium	48	400, 1 600			yes
Cyprus	48	800			
Denmark	48		35		yes
Finland	not mandatory				
France	46, 54	1 400, 300			yes
Germany	60	1 000, 2 530			
Greece	60		20, 35, 55		yes
Iceland	48		14, I_{max} .		
Ireland	not mandatory				
Italy	48	800 - 1 100			
Luxembourg	60		14, 60		
Malta					
Netherlands	48	1 130			
Norway	60	460			
Portugal	55	300	not applicable	3 000	
Spain	48	500, 1 100, 1 700			
Sweden					yes
Switzerland					yes
U. Kingdom	50	400 min.	25 - 100	3 000	yes

A.4.5 (B) 1

- 1) In quiescent condition, $R_f = 400 \Omega$

A.4.5 (DK) 1

The test principle is shown in figure A.4.5 (DK) 1.

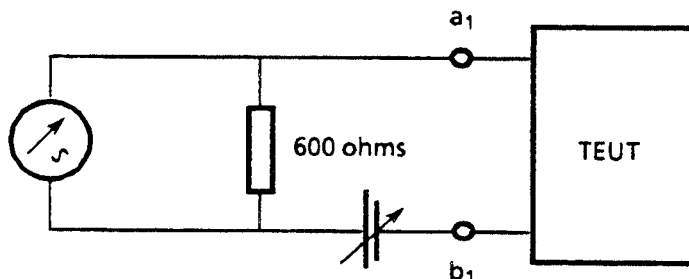


Figure A.4.5 (DK) 1

A.4.5 (F) 1

$V_f = 48 \text{ V}$ and $R_f = 300 \Omega$ in quiescent condition.

A.4.5 (F) 2

For telephone sets, the tests carried out either by putting the microphone in a silent ($< 40 \text{ dB(A)}/20\mu\text{Pa}$) and anechoic area or by replacing the microphone with its equivalent resistance.

A.4.5 (GR) 1

In the frequency ranges $0 \leq f < 300$ and $3\,400 \leq f < 18\,000$ measurement frequencies shall be spaced 1 octave.

Starting frequencies: $f_1 = 20 \text{ Hz}$ and $f_2 = 3\,400 \text{ Hz}$, respectively.

A.4.5 (S) 1

Feeding conditions, see Swedish remark Chapter 1, section 1.5.2.

A.4.5 (CH) 1

Feeding setting for quiescent condition:

$V_f: 48 \text{ V}, R_f: 1\,200 \Omega$

Feeding condition for loop condition:

$V_{f1}: 43 \text{ V}, R_{f1}: 2\,200 \Omega$

$V_{f2}: 48 \text{ V}, R_{f2}: 1\,200 \Omega$

$V_{f3}: 57 \text{ V}, R_{f3}: 600 \Omega$

A.4.5 (GB) 1

The test method and requirements for the measurement of inband and outband noise levels are given in A.4.4.2.2 (GB) 1 and A.4.4.3 (GB) 1.

4.5.1 Inband noise (Psophometrically weighted)

The TE, when in either quiescent or loop condition, is placed in a state such as it does not send to the line any signal. It shall not deliver a psophometric weighted noise power level greater than P_{Nq} and P_{NL} respectively onto a load impedance Z_L , according to CCITT Recommendation 0.41.

The ac parameter values are shown in table 4.5.1.

Compliance shall be checked using the test outlined in section A.4.5.1.

Table 4.5.1: Inband noise (Psophometrically weighted)

COUNTRY	REQUIREMENT VALUES						Remarks
	P_{Nq} (dBmp)	P_{NL} (dBmp)	Z_L (Ω)	ΔI_f (mA)	ΔV_f (V)	ΔR_f (Ω)	
Austria		-72	600	19 - 60	60		
Belgium	-65	-65	600	20 - $I_{max.}$	48		yes
Cyprus	-64	-64	600		48	440 - 1 740	
Denmark	not mandatory						
Finland	not mandatory						
France	-64	-64	600		46 - 54	300 - 1 400	
Germany	-72	-72	600		60	1 000 - 2 530	yes
Greece	-64	-64	600	20 - 80	44 - 66		
Iceland	-64	-64	600	14 - $I_{max.}$	48		
Ireland	not mandatory						
Italy	-64	-64	600		48	800 - 1 100	
Luxembourg	-72	-72	600	14 - 60	60		
Malta							
Netherlands							yes
Norway	-65	-65	600		60	460 - 3 500	
Portugal	-64	-64	600	not applicable	45 - 55	300 - 1 800	
Spain	-68				48	500 - 1 700	yes
Sweden	-73	-60	600				yes
Switzerland	-78	-64	600		43 - 57	2 200 - 600	yes
U. Kingdom	-65		600	25 - 100	50	400 min.	yes

4.5.1 (B) 1 In quiescent condition, $R_f = 400 \Omega$.

4.5.1 (D) 1 The mean psophometrically weighted noise power level ($\tau = 200$ ms) which is sent from the TE in all conditions, including the quiescent condition, to the line terminals shall be less than -75 dBmp. Single values shall not exceed -72 dBmp.

4.5.1 (NL) 1 The total noise requirements are covered by 4.5.2.

4.5.1 (E) 1 (Requirements to be applied instead of section 4.5.1).

PROVISION: See the provision 1 in section 4.1.2 (E) 1.

4.5.1 (E) 1.1 Quiescent condition inband noise power level:

With TE in the quiescent condition, the unwanted output signals shall be controlled in such a manner that the maximum mean psophometric power level shall not be greater than -68 dBmp, when the output power is measured over a load resistor of 300 ohms with an instrument that complies with CCITT Recommendation 0.41 (Blue Book).

PROVISION 1: The suffix (p) is used as psophometric according with the weighting coefficients indicated in CCITT Recommendation 0.41 (Blue Book).

PROVISION 2: The maximum psophometric mean power level may be exceeded by as much as 1,0 dBmp by a TE, provided that the power averaged over all TE of production meets with the specified limit.

Compliance shall be checked using the tests outlined in section A.4.5.1 (E) 1.1.

4.5.1 (E) 1.2 Loop condition inband noise power level:

PROVISION 1: This is not a mandatory access requirement in order to limit the maximum mean power level of the unwanted inband noise signals, however, it is possible to be required, when necessary, for certain TEs, in their respective specification.

With TE in both loop condition and high impedance condition, the unwanted output signals shall be controlled in such a manner that the maximum psophometric mean power level shall not be greater than -60 dBmp, when the output power is measured over a load resistor of 600 ohms with an instrument that complies with CCITT Recommendation 0.41 (Blue Book).

PROVISION 2: See the provisions 1 and 2 in sections 4.5.1 (E) 1.1.

PROVISION 3: With TE in the high impedance condition, the output power shall be measured over a load resistor of 300 ohms instead of 600 ohms.

Compliance shall be checked using the tests outlined in section A.4.5.1 (E) 1.2.

4.5.1 (S) 1 The P_{NL} requirement is only applicable for equipment with speech transmission capability.

4.5.1 (S) 2 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.5.1 (S) 3 For such equipment - other than simple terminals - which comprises switching system(s) and connected terminals, constituting its own network e.g. PABX and which is to be connected to the PSTN standard analogue interface, reference is made to Swedish national specifications.

4.5.1 (CH) 1 Feeding setting for loop condition:

V_{f1} : 43 V, R_{f1} : 2 200 Ω

V_{f2} : 48 V, R_{f2} : 1 200 Ω

V_{f3} : 57 V, R_{f3} : 600 Ω

4.5.1 (GB) 1 Series-connected TE inband noise (psophometrically weighted):

The noise level developed across a 600 ohm resistor connected across the line terminals of the series-connected TEUT shall not be greater than -75 dBmp when measured in accordance with CCITT Recommendation P.53.

4.5.1 (GB) 2 For TE in the quiescent condition, and when the ringing detector is active, the total psophometrically-weighted voltage measured at line terminals shall not be greater than -10 dBV. Compliance shall be checked by the test of A.4.5 (GB) 2.

A.4.5.1 Inband noise (Psophometrically weighted)

The test shall be carried out with a psophometer that conforms to CCITT Recommendation 0.41.

A.4.5.1 (E) 1.1 Quiescent condition inband noise power level

The TEUT is connected as shown in figure A.4.4.2.1 (E) 1.

The dc voltage source (V_f) takes the value of 48 V; the tests are undertaken for each polarity of the voltage source. The resistor (R_f) takes the value of 1 100 ohms.

The value of the inductors (L_1) and (L_2) shall not be lower than 5 H. The value of the capacitors (C_1) and (C_2) shall not be lower than 20 μ F.

The load resistor (R_L) takes the values stipulated in the requirement in section 4.5.1 (E) 1.1.

The test procedure is followed as stipulated in the requirement in section 4.5.1 (E) 1.1. The test shall be carried out at least three times and the result with the intermediate value shall be chosen.

A.4.5.1 (E) 1.2 Loop condition inband noise power level:

When the requirement becomes necessary, the procedure of test in section A.4.5.1 (E) 1.1 is followed, where the tests shall also be made when the resistor (R_f) takes the values of 500 ohms and 1 700 ohms.

A.4.5.1 (GB) 1 Compliance shall be checked using the circuit of figure A.4.5, with a resistor of 600 ohms \pm 0,1% connected across terminals a_2 and b_2 of the TEUT.

A.4.5.1 (GB) 1 For TE in the quiescent condition and with the ringing detector activated, the test circuit in figure A.4.5.1 (GB) 1 shall be used.

The generator G is set to deliver a sine wave with a frequency of 25 Hz and a rms voltage of 70 volts. Voltage V is measured across terminals A and B with an instrument presenting an impedance modulus of value 10 kohms \pm 5% at 1 000 Hz and which gives an indication in voltage or in dBV over a passband in accordance with CCITT Recommendation P.53 and with the instrument set to be insensitive to signals with a fundamental frequency of 25 Hz.

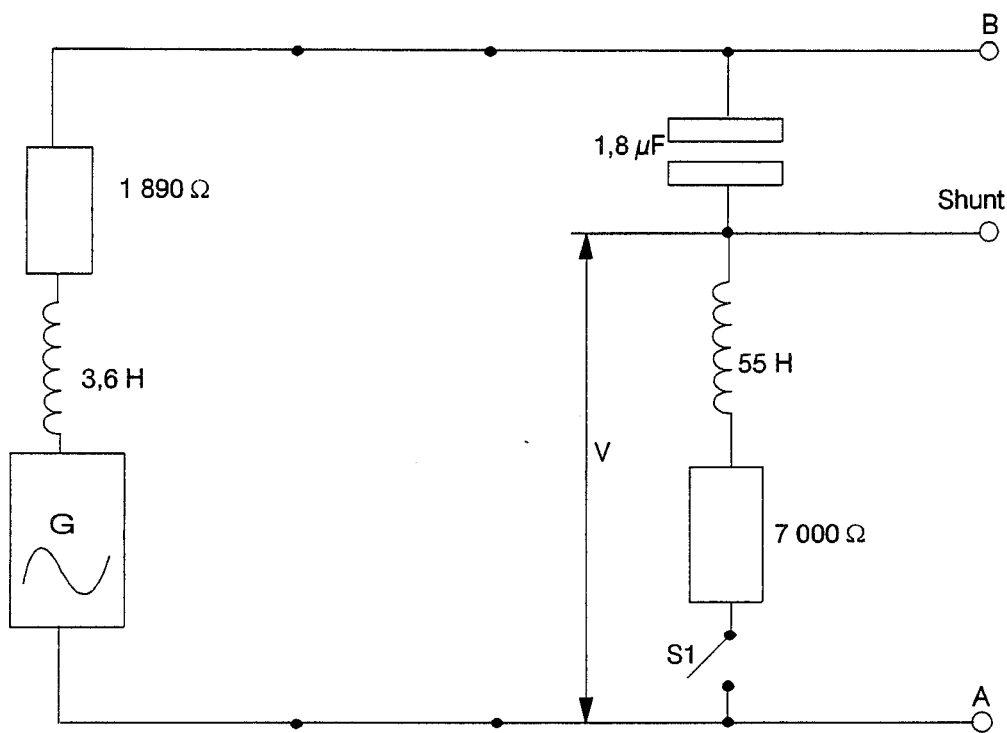


Figure A.4.5.1 (GB) 1: Unwanted signals test circuit

4.5.2 Outband noise (Unweighted)

The TE, when either quiescent or loop condition, is placed in a state such that it does not send to the line any signal. It shall not send to the line any noise with an unweighted (power) level greater than P_{Nq1} , P_{Nq2} , P_{NL1} , P_{NL2} , respectively over a bandwidth of Δf_1 and Δf_2 when terminated with a load impedance Z_L .

Requirement ac and dc parameters are shown in table 4.5.2.

Compliance shall be checked using the test outlined in section A.4.5.2.

Table 4.5.2: Outband noise (Unweighted)

COUNTRY	REQUIREMENT VALUES			
	P_{Nq1} (dBm)	P_{Nq2} (dBm)	P_{NL1} (dBm)	P_{NL2} (dBm)
Austria	not mandatory			
Belgium	█	█	█	█
Cyprus	not mandatory			
Denmark		-50		-50
Finland	not mandatory			
France				
Germany				
Greece	10	1	10	1
Iceland	not mandatory			
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory	0,775	not mandatory	0,775
Spain				
Sweden	not mandatory			
Switzerland	under study			
U. Kingdom	7,75 to 0,245		17,3 to 0,245	

Table 4.5.2 cont.: Outband noise (Unweighted)

COUNTRY	REQUIREMENT VALUES						Remarks
	Z _L (Ω)	Δf ₁ (Hz)	Δf ₂ (kHz)	ΔI _f (mA)	ΔR _f (Ω)	ΔV _f (V)	
Austria	not mandatory						
Belgium	600			20 - I _{max}		48	yes
Cyprus	not mandatory						
Denmark	600		0,02 - 150	0 - I _{max}			
Finland	not mandatory						
France	600	20 Hz - 20 kHz			300 - 1 400	46 - 54	yes
Germany	(220 + 820 // 115 nF)				1 000, 2530	60	yes
Greece	600	0 - 300	3,4 - 18	20 - 80		44 - 66	
Iceland	not mandatory						
Ireland	not mandatory						
Italy	not mandatory						
Luxembourg	not mandatory						
Malta	not mandatory						
Netherlands	600				800 - 2 140	42 - 66	yes
Norway	not mandatory						
Portugal	600	not mandatory	3,4 - 150	N/A	300 - 1 800	45 - 55	
Spain					500 - 1 700	48	yes
Sweden	not mandatory						
Switzerland	under study						
U. Kingdom	600	5,1 kHz- 89 kHz (quies.)	3,4- 8 (loop)	25 - 100	400 min.	50	yes

4.5.2 (B) 1 The requirements of sections 4.4.3.1 and 4.4.3.2 shall be applied in this section.

4.5.2 (F) 1 $P_{Nq1} = P_{Nq2} = -50$ dBm, as total power in the range 20 Hz - 20 kHz.

4.5.2 (D) 1 See paragraphs 4.4.3.1 (D) 1 and 4.4.3.2 (D) 1.

4.5.2 (NL) 1 The power level of individual frequency components between 20 Hz and 28 kHz shall be below -50 dBm.

The power level of individual frequency components between 28 Hz and 150 kHz shall be below -60 dBm.

The measurements are made with a bandwidth of 125 Hz.

4.5.2 (E) 1 (Requirements to be applied instead of section 4.5.2).

PROVISION: See the provision 1 in section 4.1.2 (E) 1.

4.5.2 (E) 1.1

Quiescent condition outband noise power level:

With TE in the quiescent condition, the unwanted output signal shall be controlled in such a manner that the maximum mean power level shall not be:

- a) during any period of 10 seconds greater than -58 dBm, when the output power is measured over a load resistor of 600 ohms connected to the line terminals, in the frequency band up to 1 MHz, excluding the frequency band up to 3,4 kHz;
- and
- b) during any period of 100 milliseconds greater than the values stipulated in table 4.5.2 (E) 1.1 over the frequency ranges indicated, when the output power is measured over a load resistor as stipulated in table 4.5.2 (E) 1.1 connected to the line terminals, in each one of the bandwidths indicated in table 4.5.2 (E) 1.1, in the frequency band from 3.4 kHz to 1 MHz.

PROVISION:

The maximum mean power level may be exceeded by as much as 1,0 dBm by a TE, provided that the power averaged over all TE of production meets with the specified limits.

Compliance shall be checked using the tests outlined in section A.4.5.2 (E) 1.1.

Table 4.5.2 (E) 1.1: Quiescent condition outband noise power level

Power level limit (dBm)	Frequency range	Bandwidth	Load resistor (Ω)
-78	3,4 kHz < f ≤ 4 kHz	600 Hz	300 Ω
-78	4 kHz < f ≤ 8 kHz	4 kHz	300 Ω
-78	8 kHz < f ≤ 28 kHz	4 Hz	150 Ω
-78	28 kHz < f ≤ 200 kHz	4 kHz	75 Ω
-78	200 kHz < f ≤ 1 MHz	4 kHz	37,5 Ω

4.5.2 (E) 1.2

Loop condition outband noise power level

With TE in both loop condition and high impedance condition, the unwanted output signals shall be controlled in such a manner that the maximum mean power level shall not be

- a) during any period of 10 seconds greater than -50 dBm when the output power is measured over a load resistor of 600 ohms connected to the line terminals, in the frequency band up to 1 MHz, excluding the frequency the frequency band up to 3,4 kHz;
- and
- b) during any period of 100 milliseconds greater than the values stipulated in table 4.5.2 (E) 1.2 over the frequency ranges indicated. when the output power is measured over a load resistor as stipulated in table 4.5.2 (E) 1.2 connected to the line terminals, in each one of the bandwidths indicated in table 4.5.2 (E) 1.2, in the frequency band from 3,4 kHz to 1 MHz.

PROVISION 1:

See the provision in section 4.5.2 (E) 1.1.

PROVISION 2:

With TE in the high impedance condition, the output power shall be measured over a load resistor with a value of a half of the values stipulated in table 4.5.2 (E) 1.2.

Compliance shall be checked using the tests outlined in section A.4.5.2 (E) 1.2.

Table 4.5.2 (E) 1.2: Loop condition outband noise power level

Power level limit (dBm)	Frequency range	Bandwidth	Load resistor (Ω)
-70	3,4 kHz < f \leq 4 kHz	600 Hz	600 Ω
-70	4 kHz < f \leq 8 kHz	4 kHz	600 Ω
-70	8 kHz < f \leq 28 kHz	4 Hz	300 Ω
-70	28 kHz < f \leq 200 kHz	4 kHz	150 Ω
-70	200 kHz < f \leq 1 MHz	4 kHz	75 Ω

4.5.2 (GB) 1 The requirements for outband noise (unweighted) in any 3 kHz bandwidth above

1. 3,4 kHz with TE in the loop state;
2. 5,1 kHz with TE in the quiescent state;

are given in 4.4.3.1 (GB) 1.

A.4.5.2 Outband noise (Unweighted)

The test shall be carried out using a frequency selective instrument with a bandwidth of "f" Hz capable of measuring peak voltage levels within this bandwidth.

A.4.5.2 (F) 1 The test is carried out using a rms voltmeter with a bandwidth higher than 20 kHz.

A.4.5.2 (E) 1.1 Quiescent condition outband noise power level.

A.4.5.2 (E) 1.1.a The procedure of test in section A.4.5.1 (E) 1.1 is followed.

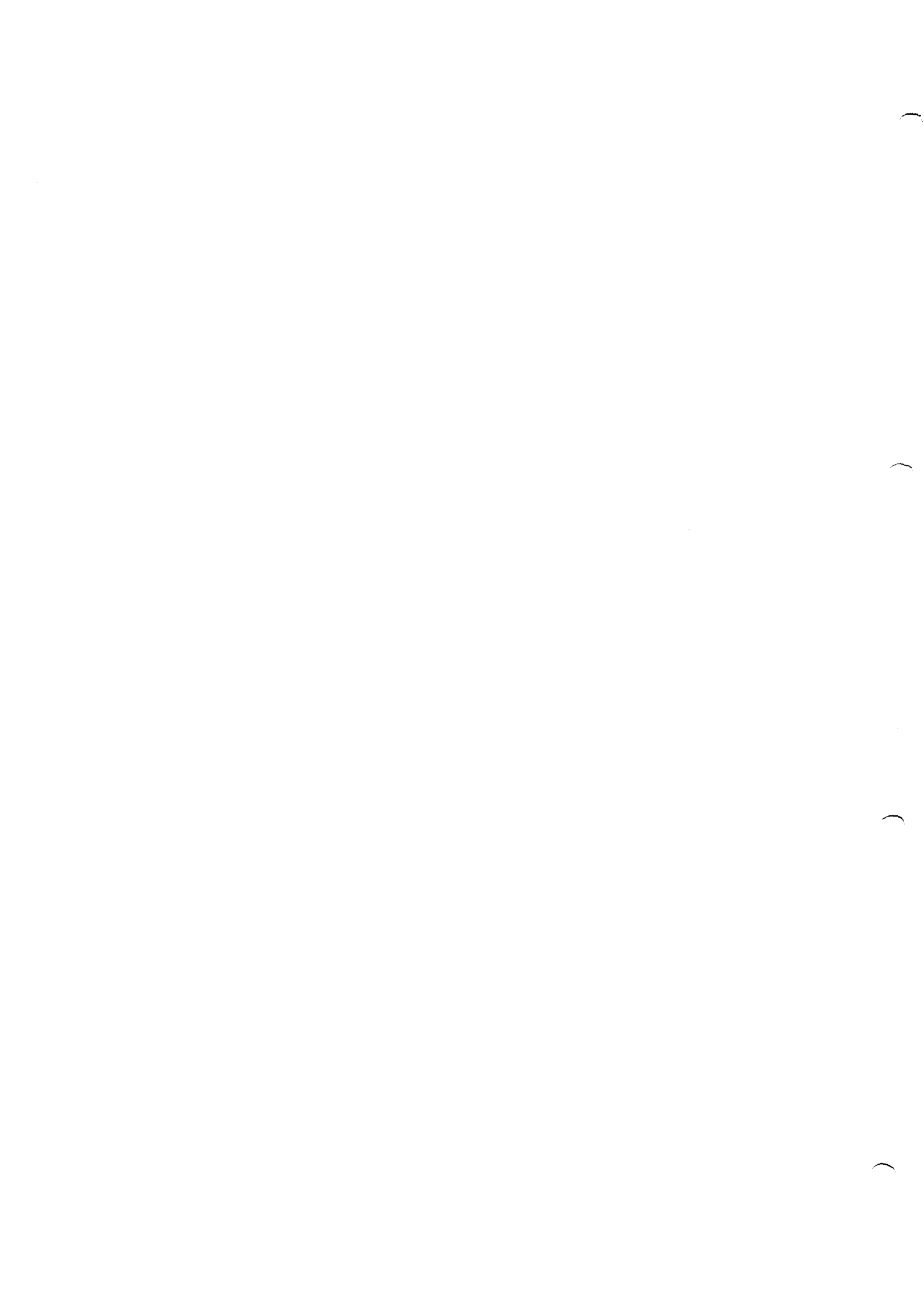
NOTE: The ac rms voltmeter with its previous filter give mean power values during the periods stipulated in the associated requirement, in the detection bandwidths indicated. The reading accuracy is +/- 1,0 dB.

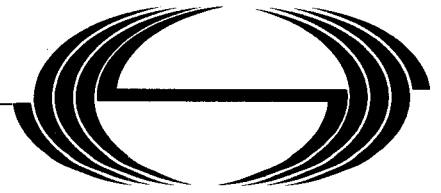
A.4.5.2 (E) 1.1.b The procedure of test in section A.4.4.3 (E) 2 is followed.

A.4.5.2 (E) 1.2 Loop condition outband noise power level:

The procedure of test in section A.4.5.2 (E) 1.1 are followed, where the tests shall also be made when the resistor (R_p) takes the values of 500 ohms and 1 700 ohms.

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**Attachments to Public Switched Telephone Network (PSTN);
General technical requirements for equipment connected to
an analogue subscriber interface in the PSTN**

Chapter 5: Calling function

(Candidate NET 4)

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Foreword

Chapter 5 of this European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI). The text of this ETS may be utilized, wholly or in part, for the establishment of NET 4.

For historical purposes, this ETS was drafted in the form of a NET. However, until a final decision to adopt this ETS as NET 4 has been agreed by the Technical Recommendations Application Committee (TRAC), the terms NET or NET 4 in this document should be read as ETS or ETS 300 001 respectively.

This ETS comprises ten chapters:

"Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

- Chapter 1 - General
- Chapter 2 - DC characteristics
- Chapter 3 - Ringing signal characteristics
- Chapter 4 - Transmission characteristics
- Chapter 5 - Calling functions**
- Chapter 6 - Answering function
- Chapter 7 - Power failure
- Chapter 8 - Connection methods
- Chapter 9 - Special functions
- Chapter 10 - Additional unclassified requirements

Refer to Chapter 1 (General) of this ETS for information on the structure and details of how to use this ETS. The national designations, used to identify national variations to requirements and tests within this ETS, are given in section 1.9 of Chapter 1 (page 60).

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5 Calling function

5.1 General

TE may be configured such that after either a manual or automatic start procedure has been initiated, one or more of the following functions may be performed. This includes:

- establishment of the loop condition;
- dial tone reception/detection, manually or automatically;
- dialling;
- determination of repeat call attempts;
- enabling of transmission;
- transfer of established connection to other TE;
- reversion of the quiescent condition.

5.2 Dial tone detector

5.2.1 Dial tone detector sensitivity

For TE capable of detecting a dial tone, the relevant detector shall be activated, when a signal in the frequency range from f_1 (Hz) up to f_2 (Hz), with a level between p_1 (dBm) and p_2 (dBm) measured on a load impedance Z_L (Ω), is applied through an impedance Z_G (Ω) to the line terminals for a period of at least t_d (s).

The requirement values f_1 , f_2 , p_1 , p_2 , Z_G , Z_L and t_d are shown in table 5.2.1.

The requirements shall be met with dc feeding values V_f , R_f , I_f in the ranges specified in table 5.2.1.

Compliance shall be checked using the tests outlined in section A.5.2.1.

Table 5.2.1: Dial tone detector sensitivity

COUNTRY	REQUIREMENT VALUES										Remarks
	f ₁ (Hz)	f ₂ (Hz)	p ₁ (dBm)	p ₂ (dBm)	Z _G (Ω)	Z _L (Ω)	t _d (s)	V _f (V)	R _f (Ω)	I _f (mA)	
Austria	380	520	-26	-6,5	600	600	0,85	60		19 - 60	
Belgium	415	460	-18	0	600	600	0,85	48		20 - I _{max.}	yes
Cyprus	325 and 425	375 and 425	-22	-7	600	600	3	48	440 - 1 740		
Denmark	350	500	-35	0	600	600	4			16 - I _{max.}	
Finland	325	525	-25	-6	600	600	4	48	800 - 1 710		
France	425	455	-27	-10	600	600	2	45 - 54	300 - 1 845		yes
Germany	380	490	-27	-4	600	600	0,8				yes
Greece	400	475		0	600	600	2	44 - 66		20 - 80	
Iceland	400	450	-30	0	600	600	4	48		14 - I _{max.}	
Ireland	not mandatory										
Italy	410	440	-25	-6	600	600	4	44 - 52	720 - 1 880		yes
Luxembourg	380	490	-26	-6,5	600	600	2	60		19 - 60	
Malta											
Netherlands	100 and 340	200 resp. 550	-25,7	+2,2	600	600	> 1 < 2	42 - 66	800 - 2 140		yes
Norway	350	500	-30	0	600	600	4	60	460 - 3 100		
Portugal	300	450	-30	-5	600	600		45 - 55	300 - 1 800	N/A	yes
Spain			-35	0	600	600	3	48	500 - 2 200		yes
Sweden	375	475	-25	0	600	600	0,8				yes
Switzerland	375	550	-23	0	600	600	0,9	43 - 57	2 200 - 600		yes
U. Kingdom	not mandatory										

5.2.1 (B) 1

- 1) The values in the table are related to the National Dial Tone (NDT).
- 2) A second dial tone (International Dial Tone - IDT) is provided by electromechanical public exchanges for use of the international network. The IDT is composed of 3 successive frequencies, i.e. 900 Hz, 1 020 Hz and 1 140 Hz, each emitted during 330 ms ± 70 ms.

Two options are allowed for the IDT detector sensitivity:

- a) individual detection of the 3 characteristic frequencies, which means that the detector will possess 3 selective networks reacting respectively to the frequencies 900 Hz, 1 020 Hz and 1 140 Hz; for each selective network the selectivity will be so that they will react under a level between -24 dBm and -1 dBm (measured on 600 ohms) to frequencies deviating no more than 10 Hz from the nominal frequency; the detection of the presence of the three frequencies only is necessary; it is required to verify their succession.

- b) detection of the frequency $1\ 140 \pm 10$ Hz within the same voltage limits as above. The IDT shall be recognised when the frequency is received twice during 330 ± 70 ms with a pause of 660 ± 140 ms.
- 3) One broadband detector for both NDT and IDT is also allowed. In this case, the TE shall recognise signals with a frequency between 420 Hz and 1 150 Hz, a level between -24 dBm and -1 dBm and a duration of more than 1 200 ms for IDT. The levels are measured as described in the requirements 5.2.1.
- 4) For digital PABXs, the impedances Z_G and Z_L are equal to Z_c (Belgian complex impedance defined in section 4.1.2).

5.2.1 (F) 1 The requirement values shown in table 5.2.1 are defined for the first dial tone.

5.2.1 (F) 2 The relevant detector shall also be activated when the second dial tone consisting of a continuous signal composed of the superposition of two frequencies in a range from f_{a1} (Hz) up to f_{a2} (Hz) and from f_{b1} (Hz) up to f_{b2} (Hz), with a total power level between p_{t1} (dBm) and p_{t2} (dBm) measured on a load impedance Z_1 (Ω) is applied through an impedance Z_G (Ω) to the line terminals for a period of at least t_d (s).

The requirement shall be met with the following values:

- $f_{a1} = 425$ Hz, $f_{a2} = 455$ Hz, $f_{b1} = 315$ Hz, $f_{b2} = 345$ Hz,
- $p_{t1} = -10$ dBm, $p_{t2} = -32$ dBm,
- accentuation of f_b with respect to f_a : $3,5$ dB \pm 1 dB.

The requirement values Z_G , Z_L and t_d are shown in table 5.2.1.

The requirement shall be met with dc feeding values V_f and R_f in the range specified in table 5.2.1.

Compliance shall be checked using the tests outlined in section A.5.2.1.

5.2.1 (F) 3 The detection of the first or second dial tone shall not be disturbed by interruption of the signal of duration no more than 30 ms.

5.2.1 (F) 4 The dial tone detector shall also detect the special dial tone as described in 9.5.2.

5.2.1 (D) 1 The dial tone detector shall not be activated during incoming calls.

5.2.1 (D) 2 If the dial tone detector does not detect the PSTN dial tone within 40 s of the application of the dial tone, the TE shall not start the dialling procedure.

5.2.1 (D) 3 If the TE includes a dial tone detector, the dialling procedure shall start within $t \geq 800$ ms and ≤ 5 s after the application of the PSTN dial tone.

5.2.1 (D) 4 If during dialling a pre-pulsing condition of ≥ 650 ms to $\leq 1\ 300$ ms is realised within the TE, the TE shall start dialling directly after the detection of the dial tone.

5.2.1 (I) 1 Cadenced signal as follows: 2 successive pulses respectively,

- $t_{onA} = (200 \pm 10\%)$ ms;
- $t_{onB} = (600 \pm 10\%)$ ms separated by a pause;
- $t_{offA} = (200 \pm 10\%)$ ms and repeated after a pause;
- $t_{offB} = (1\ 000 \pm 10\%)$ ms.

In the future the dial tone will be a continuous tone.

5.2.1 (NL) 1 The values of p_1 and p_2 are calculated from the requirements of $e_1 = 80$ mV and $e_2 = 2$ V.

5.2.1 (NL) 2 The special dial tone is the same as the normal dial tone with tone interruptions of 35 - 75 ms every 450 - 550 ms. Testing of the dial detector on the sensitivity for special dial tone is not mandatory.

5.2.1 (P) 1 In the beginning of a call attempt, after the establishment of the loop condition,

$t_d(s) = 3$, for the calling TE.

TE shall start dialling not later than 3 s after the beginning of application of the PSTN dial tone (see section 5.6.3).

5.2.1 (P) 2 During a successful call (see definition of a successful call in section 5.6.7.2) if the dial tone is present then,

$t_d(s) = 20$, for TE having transmission duration automatically controlled by monitoring the flow of information (information-related control of loop condition), except for TE using the backward channel according to CCITT Recommendations V.23, V.26 bis or V.27 ter.

TE shall never revert to the idle state within a subsequent time period of 10 s.

5.2.1 (E) 1 (Requirement to be applied instead of section 5.2.1).

PROVISION 1: The provisions 2 to 4 shall be applied to all Spanish sections (E) in this Chapter 5 and also in section 10.5 (E) of Chapter 10.

PROVISION 2: All the requirements related with the calling facility shall be met with the dc feeding excitation stipulated in the associated testing methods, when it is not indicated in the requirement.

PROVISION 3: It should be noted that the mandatory requirements for Spain cover basic and minimum interworking functional characteristics, but quite apart from fulfilling such requirements, it is necessary in addition to provide the TE with appropriate timings during the appropriate periods, in order to avoid non mandatory and unwanted call releases, or unnecessarily long call attempts.

PROVISION 4: As an amplification of the content of the provision 3, it should be noted that in some requirements the expression "no later than a certain period" is deliberately used instead of "within a certain period". That is to say one limit instead of two limits.

With TE in the loop condition, which has a dial tone receiver that, because of the requirements in sections 10.5 (E) 3.1.a.ii, is intended for automatic start and/or restart of the dialling sequence, it shall:

- a) start the dialling sequence not later than 3 seconds after a signal with open circuit AC rms voltages from 27,5 mV to 1 550 mV (-35 dBm, over a load resistor of 600 ohms), frequencies from 320 Hz to 480 Hz, and with the cadences stipulated in table 5.2.1 (E) 1, is applied between the line terminals through a resistor of 600 ohms;

and/or

- b) restart the dialling sequence not later than 3 seconds after the application of a signal as stipulated in paragraph a), but continuous, and with frequencies from 570 Hz to 630 Hz.

Compliance shall be checked using tests outlined in section A.5.2.1 (E) 1.

Table 5.2.1 (E) 1: Dial tone receiver sensitivity

Signal type	Duration (ms)	
	Signal	Pause
i	Continuous	0
ii	1 000	100
iii	320	20

5.2.1 (S) 1 After a signal has been approved as a dial tone, signalling shall start as soon as possible, at the latest 2 s after the start of the dial tone.

5.2.1 (S) 2 Feeding conditions, see Chapter 1, section 1.5.2.

5.2.1 (CH) 1 Dial tone and special dial tone detector sensitivity.

Dial tone: Permanent signal (f: 375 - 550 Hz),

Special dial tone (also to detect): Dial tone plus a pulsed signal (f: 325 - 355 Hz, t_{on} and t_{off} : $1\ 100 \pm 100$ ms)

Dialling shall not start later than 2 s after receiving dialling tone.

See also section 1.7 (summary of network tones and signals).

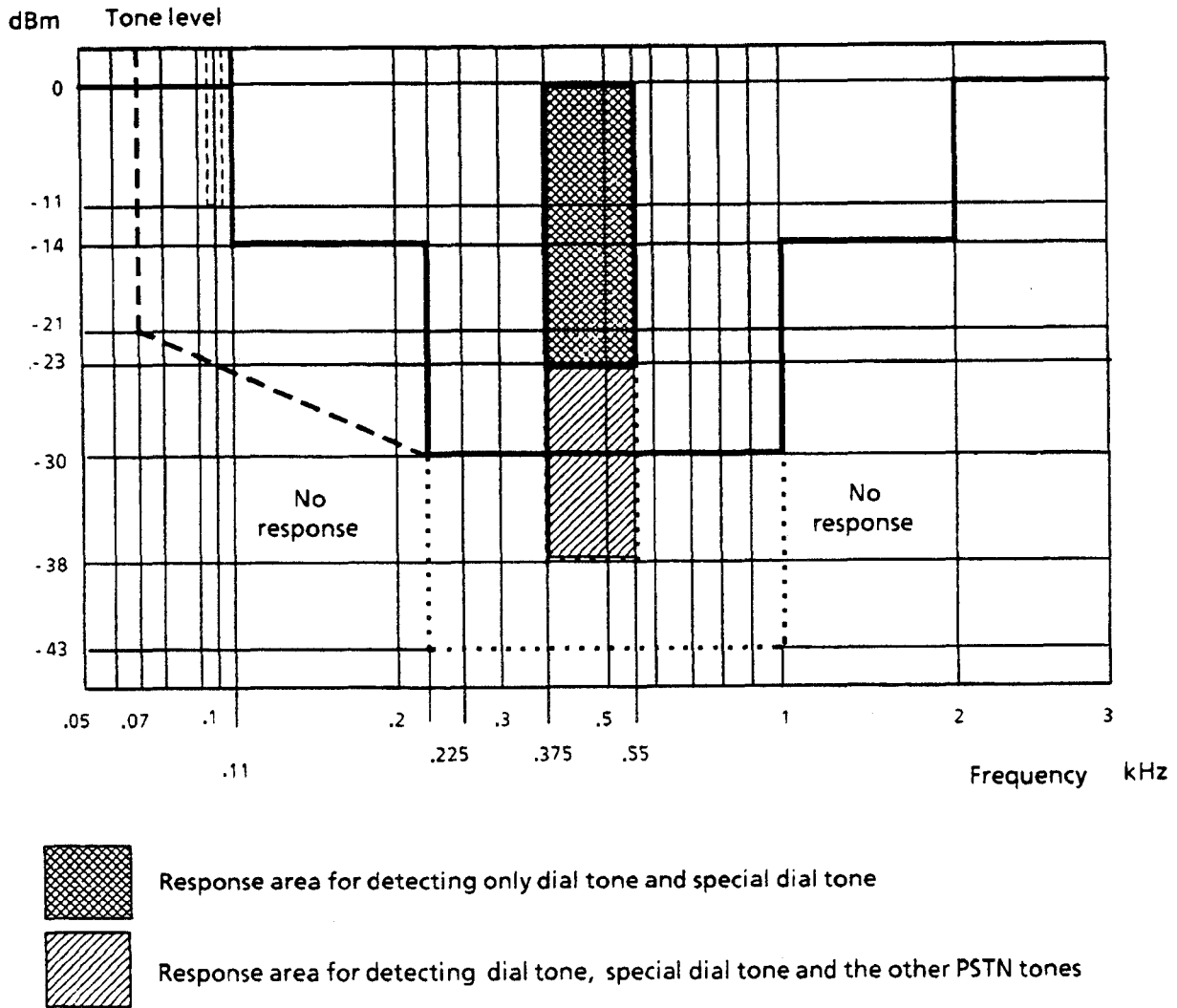


Figure 5.2.1 (CH) 1

Some older PABX still use a tone frequency of 100 Hz. Recognition of the 100 Hz tone is generally not required. However, if a TE is connected to such a PABX, then the following condition is to be met for automatic dialling: Response (conversion of the tone recognition within the PABX area): $f = 100 \pm 5$ Hz, -11 to 0 dBm.

A.5.2.1 Dial tone detector sensitivity

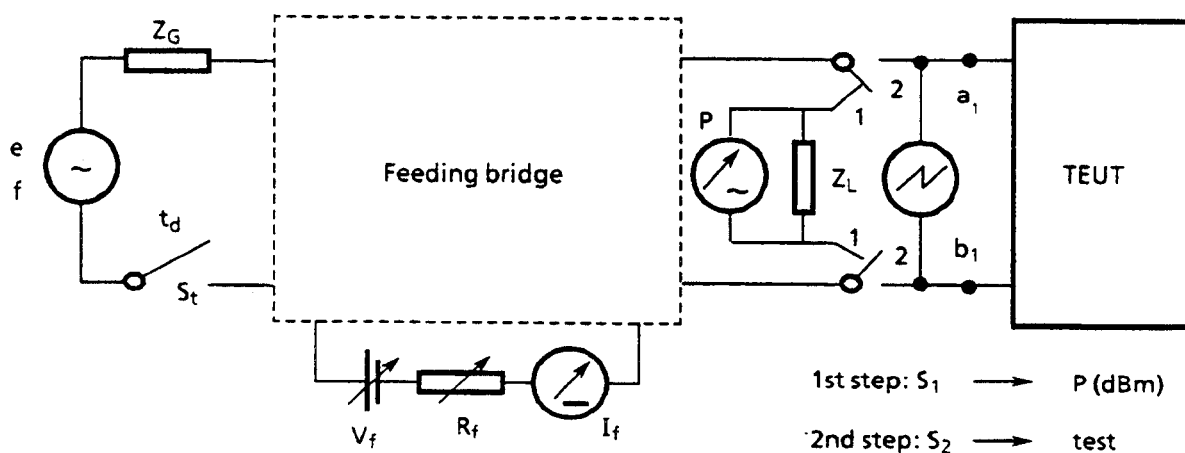
The TEUT is connected as shown in figure A.5.2.1.

The dc feeding conditions V_f , R_f , I_f are adjusted as specified in table A.5.2.1.

For each of the feeding conditions established and for each set of parameter values given in table A.5.2.1, a check must be performed to ensure that the detector indicates presence of the dial tone during the time that S_t is closed.

Table A.5.2.1: Dial tone detector sensitivity

COUNTRY	TEST VALUES					Remarks
	f (Hz)	p (dBm)	V _f (V)	R _f (Ω)	I _f (mA)	
Austria	380, 520	-26, -6,5	60		19, 60	
Belgium	415, 460	-18	48	400, 1 600		yes
Cyprus	350 + 450	-22, -7	48	800		
Denmark	400, 425, 450	0, -35			16, I _{max.}	
Finland	325, 425, 525	-25	48	800, 1 710		
France	440	-27	48	600		yes
Germany	425	-27	60	1 000, 2 530		
Greece	425, 450	-0, -27	60		20, 35	
Iceland	400, 425, 450	-30	48		14, I _{max.}	
Ireland	not mandatory					
Italy	410, 425, 440	-25, -12, -6	44, 48, 52	1 880, 1 100, 720		
Luxembourg	425, 450	-26, -6,5	60		19, 60	
Malta						
Netherlands	100, 150, 200, 340, 425, 550	-25,7, -3,8	48	1 130		yes
Norway	350, 500	0, -30	60	3 100		
Portugal	300, 450	-30	48	300, 1 800	not applicable	
Spain				48	500, 1 100, 2 200	yes
Sweden	425, 375, 475	0, -25				yes
Switzerland	375, 550	-23, 0				yes
U. Kingdom	not mandatory					



Feeding bridge as specified in Chapter 1.
Figure A.5.2.1: Dial tone detector sensitivity

A.5.2.1 (B) 1

- 1) The values in the table are related to the NDT detector.
- 2) For the IDT detector see Belgian remark 5.2.1 (B) 2. For option a), the parameter values are:

f_a (Hz)	f_b (Hz)	f_c (Hz)	p (dBm)	t_d (s)	V_f (V)	R_f (Ω)
890	1 010	1 130	-24	0,260	48	400, 1 600
910	1 030	1 150	-24	0,4	48	400, 1 600

For the option b), the parameter values f , p , t_d , V_f and I_f are:

f (Hz)	p (dBm)	t_{on} (s)	t_{off} (s)	V_f (V)	R_f (Ω)
1 130	-24	0,260	0,520	48	400, 1 600
1 150	-24	0,4	0,8	48	400, 1 600

- 3) For the broadband detector, the parameter values are:

Sequence	f (Hz)	p (dBm)	t_d (s)	V_f (V)	R_f (Ω)
first detection (NDT)	420, 1 150	-18	0,850	48	400, 1 600
second detection (IDT)	420, 1 150	-24	5	48	400, 1 600

A.5.2.1 (F) 1

Other sets of parameter values for the detection of the first dial tone:

Table A.5.2.1 (F) 1.a

f (Hz)	p (dBm)	t_d (s)	V_f (V)	R_f (Ω)
440	-10	2	54	300
425	-27	2	48	600
455	-27	2	48	600
440	-27	2	45	1 845
440	-27	2*	48	600

* The signal is transmitted with one interruption of value 30 ms in the middle of the sending period.

For the detection of the second dial tone, the parameter sets are as follows:

Table A.5.2.1 (F) 1.b

f_a (Hz)	f_b (Hz)	p_a (dBm)	p_b (dBm)	t_d (s)	V_f (V)	R_f (Ω)
440	330	-37	-33,5	2	48	600
440	330	-15	-11,5	2	54	300
425	315	-37	-33,5	2	48	600
455	345	-37	-33,5	2	48	600
440	330	-37	-33,5	2	45	1 845
440	330	-37	-33,5	2*	48	600

* The signal is transmitted with one interruption of value 30 ms in the middle of the sending period.

A.5.2.1 (NL) 1 The value of "p" is calculated from the requirement of $e = 80$ mV.

A.5.2.1 (E) 1 The procedure of test in section A.10.5 (E) 3.1 is followed, where the resistor (R_f) takes also the values of 500 ohms and 2 200 ohms. The generator open circuit AC rms voltages (e) and frequencies (f) take the values stipulated in table A.5.2.1 (E) 1, where also the sequences of the switch (St) are indicated.

After the switch (St) is closed for the first time, count the period until the start or restart of the dialling sequence occurs.

Table A.5.2.1 (E) 1: Dial tone detector sensitivity

Requirement	Signal type	Frequency (f) (Hz)	Voltage (e) (mV)	Switch (St)	
				Closed (ms)	Opened
5.2.1 (E) 1.a	i	320	27,5	Continuous	0
	i	320	1550	Continuous	0
	i	400	27,5	Continuous	0
	i	425	27,5	Continuous	0
	ii	425	27,5	1 000	100
	iii	425	27,5	320	20
	i	480	27,5	Continuous	0
	i	480	1550	Continuous	0
5.2.1 (E) 1.b	-	570	27,5	Continuous	0
	-	570	1550	Continuous	0
	-	600	27,5	Continuous	0
	-	630	27,5	Continuous	0
	-	630	1550	Continuous	0

A.5.2.1 (S) 1 The TEUT shall accept dial tone with the following frequencies and levels applied at its terminals for 800 ms or more.

f_1 (Hz)	p (dBm)
425, 375, 475	-25
425, 375, 475	0

An allowed alternative test arrangement is shown in figure A.5.2.1 (S) 1, which corresponds to figure A.5.2.1, but for the fact that the measurement is made in one step only. The measured value (U_1) shall be adjusted according to the formula p (dBm) = U_1 (dBm) - A.

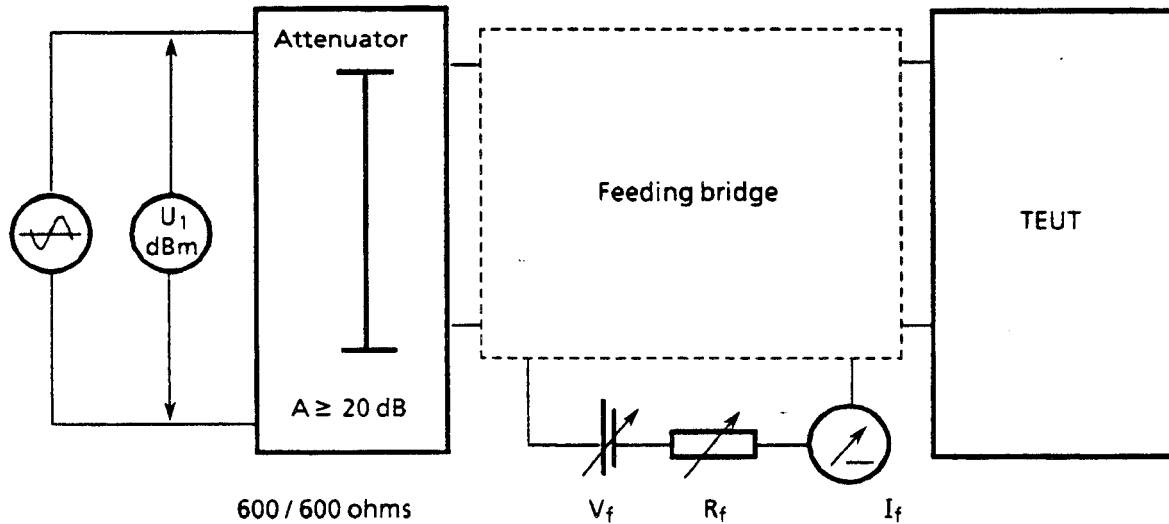


Figure A.5.2.1 (S) 1

A.5.2.1 (S) 2 Feeding conditions, see Chapter 1, section 1.5.2.

A.5.2.1 (CH) 1 Settings:

V_f (V)	R_f (Ω)
43	2 200
48	1 200
57	600

5.2.2 Dial tone detector insensitivity

For TE capable of detecting dial tone, the relevant detector shall not be activated, when in loop condition, if any of the following signals is applied through an impedance Z_G (Ω) to the line terminals:

a) "outband" signals with:

frequency of value lower than f_3 (Hz) or higher than f_4 (Hz) and:

- any level of value lower than P_3 (dBm), measured on a load impedance Z_L (Ω);
- any value of cadence t_{on}/t_{off} ;
- any value of duration.

b) "weak" signals with:

level of value lower than P_4 (dBm), measured on a load impedance Z_L (Ω) and:

- any value of frequency;
- any value of cadence t_{on}/t_{off} ;
- any value of duration.

c) "improperly cadence" signals with:

t_{on} of value lower than t_{on1} (ms) and any value of t_{off} , or t_{on} of value higher than t_{on2} (ms) and any value of t_{off} , or t_{off} of value lower than t_{off1} (ms) and any value of t_{on} or t_{off} of value higher than t_{off2} (ms) and any value of t_{on} and;

- any value of frequency;
- any value of level;
- any value of duration.

The requirement values are given in table 5.2.2.

The requirements shall be met with feeding values V_f , R_f , I_f in the ranges specified in table 5.2.2.

Compliance shall be checked using the test outlined in section A.5.2.2.

Table 5.2.2: Dial tone detector insensitivity

COUNTRY	REQUIREMENT VALUES							
	Z_G (Ω)	Z_L (Ω)	f_3 (Hz)	f_4 (Hz)	p_3 (dBm)	p_4 (dBm)	t_{on1} (ms)	t_{on2} (ms)
Austria	600	600					< 750	
Belgium	600	600	350	550	8	-28		
Cyprus	not mandatory							
Denmark	600	600	110	2 000	0	-45	1 200	
Finland	600	600				-52		
France	600	600	160	900	-10	-50		
Germany	not mandatory							
Greece	600	600	350	525	0	-45	200	
Iceland	600	600	50	4 000	2,2 (50 Hz) 0 (4 kHz)	-40		
Ireland	not mandatory							
Italy			350	550	-6	-48		
Luxembourg	not mandatory							
Malta	not mandatory							
Netherlands	600	600				-31,8		
Norway	600	600						
Portugal	600	600	160	not applic.	0	-45	600	not applic.
Spain	600	600	160	1 000		-45		
Sweden	600	600						
Switzerland	600	600						
U. Kingdom	not mandatory							

Table 5.2.2 cont.: Dial tone detector insensitivity

COUNTRY	REQUIREMENT VALUES					Remarks
	t_{off1} (ms)	t_{off2} (ms)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria			60		19, 60	yes
Belgium			48		20, I_{max} .	yes
Cyprus	not mandatory					
Denmark					16, I_{max} .	yes
Finland	not mandatory		48	800 - 1 710		
France			45 - 54	300 - 1 845		yes
Germany	not mandatory					
Greece			44 - 66		20 - 80	
Iceland	not mandatory		48		14, I_{max} .	yes
Ireland	not mandatory					
Italy						yes
Luxembourg	not mandatory					
Malta						
Netherlands			42 - 66	800 - 2 140		yes
Norway			60	460 - 3 100		yes
Portugal	not applicable	not applicable	45 - 55	300 - 1 800	not applicable	
Spain			48	500 - 2 200		yes
Sweden						yes
Switzerland			43 - 57	2 200 - 600		yes
U. Kingdom	not mandatory					

5.2.2 (A) 1 The values for f_3 , f_4 , p_3 , p_4 are under study.

5.2.2 (B) 1

- 1) For TE capable of detecting dial tone, the relevant detector shall not be activated, when in loop condition, if "short" signals with duration of value lower than $t_d(\text{ms}) = 550$ and:
 - any value of frequency;
 - any value of level;
 - any value of cadence t_{on}/t_{off} .
- 2) The values in the table are related to the NDT detector.
- 3) For TE with IDT detector, each selective network shall not be activated by a signal with a voltage less than 2 V and with a frequency deviating more than 50 Hz from the nominal frequency of the selective network. To avoid an inappropriate release under the influence of transient phenomena which are due to the switching, the detector or the associated circuit will have to show a functioning delay of circa 30 ms.

4) For TE with a broadband detector:

f_3 (Hz) = 350
 f_4 (Hz) = 1 250
 p_4 (dBm) = -32
 t_{on1} (ms) = 1 200 in the case of IDT

5) For digital PABXs see Belgian remark 5.3.2 (B) 4.

5.2.2 (DK) 1 For TE capable of detecting dial tone, the relevant detector shall not be activated, when in loop condition single stray, short noise pulses with peak voltages of up to 250 V are applied to the line terminals. Compliance shall be checked using the test outlined in section A.5.2.2.

5.2.2 (F) 1 The "improper cadence" signals for which the detector shall not be activated are busy tone and call progress tone.

In addition, the relevant detector shall not be activated by "short" signal as described in section A.5.2.2 (F) 1.

5.2.2 (IS) 1 Dial tone detector insensitivity: Refer to the curve in the Norwegian remark 5.2.2 (N) 1.

5.2.2 (I) 1 Improperly cadenced signals with one of the following eight cases:

Table 5.2.2 (I) 1

	t_{onA}	t_{offA}	t_{onB}	t_{offB}
1)	< 160	any	any	any
2)	> 240	any	any	any
3)	any	< 160	any	any
4)	any	> 240	any	any
5)	any	any	< 480	any
6)	any	any	> 720	any
7)	any	any	any	< 800
8)	any	any	any	> 1 200

and:

- any value of frequency;
- any value of level;
- any value of duration.

5.2.2 (NL) 1 The value of p_4 is calculated from the requirement of $e = 40$ mV

5.2.2 (NL) 2 The detector shall be insensitive for signals with the following cadences:

$t_{on1} = 180 - 330$ ms
 $t_{on2} = 400 - 600$ ms
 $t_{off1} = 330 - 180$ ms
 $t_{off2} = 600 - 400$ ms

This applies to frequencies between 340 and 550 Hz, received with levels between -25,7 dBm and -3,8 dBm.

5.2.2 (N) 1 Continuous signals having frequencies and levels as in area II in figure 5.2.2 (N) 1 shall not be recognised.

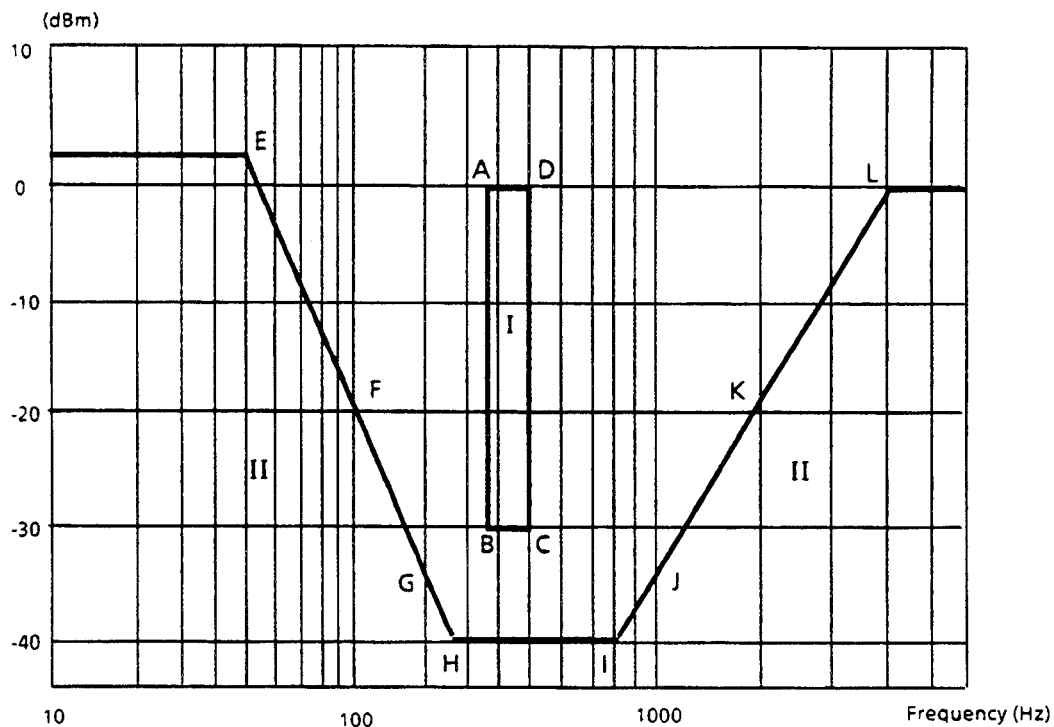


Figure 5.2.2 (N) 1

A = 300 Hz, +2,2 dBm	G = 200 Hz, -35 dBm
B = 350 Hz, -30 dBm	H = 250 Hz, -40 dBm
C = 500 Hz, -30 dBm	I = 800 Hz, -40 dBm
D = 500 Hz, 0 dBm	J = 1000 Hz, -35 dBm
E = 50 Hz, +2,2 dBm	K = 2000 Hz, -17 dBm
F = 100 Hz, -17 dBm	L = 4000 Hz, 0 dBm

5.2.2 (E) 1

(Requirement to be applied instead of section 5.2.2).

With TE in the loop condition, which has a dial tone receiver that, because of the requirements in section 10.5 (E) 3.1.a.ii and/or in section 10.5 (E) 3.1.b.ii, is intended for automatic start and/or restart of the dialling sequence, it shall:

neither

a) start the dialling sequence;

nor

b) restart the dialling sequence;

after the signals stipulated in table 5.2.2 (E) 1 are applied between the line terminals through a resistor of 600 ohms.

Compliance shall be checked by the tests outlined in section A.5.2.2 (E) 1.

Table 5.2.2 (E) 1: Dial tone detector insensitivity

Signal type	Open circuit. AC rms	dBm equ. (600 ohms)	Frequency range	Duration	
				Signal	Pause
i	$\leq 2\,000\text{ mV}$	$\leq +2,2\text{ dBm}$	$320\text{ Hz} \leq f_1 \leq 480\text{ Hz}$	$< 950\text{ ms}$	$\geq 250\text{ ms}$
ii	$\leq 2\,000\text{ mV}$	$\leq +2,2\text{ dBm}$	$570\text{ Hz} \leq f_1 \leq 630\text{ Hz}$	$< 950\text{ ms}$	$\geq 250\text{ ms}$
iii	$< 8,7\text{ mV}$	$< -45\text{ dBm}$	$300\text{ Hz} \leq f_1 \leq 3,4\text{ kHz}$	Continuous	
iv	$\leq 2\,000\text{ mV}$	$\leq +2,2\text{ dBm}$	$16\text{ Hz} \leq f_1 \leq 160\text{ kHz}$	Continuous	
v	$\leq 490\text{ mV}$	$\leq -10\text{ dBm}$	$1\,000\text{ Hz} \leq f_1 \leq 3,4\text{ kHz}$	Continuous	

5.2.2 (S) 1

Dial tone detectors are tested in accordance with one of the following two alternatives:

Alternative 1:

Signals having a power level below the values indicated by the diagram. ABCDEF in figure 5.2.2 (S) 1 shall not be approved as dial tone.

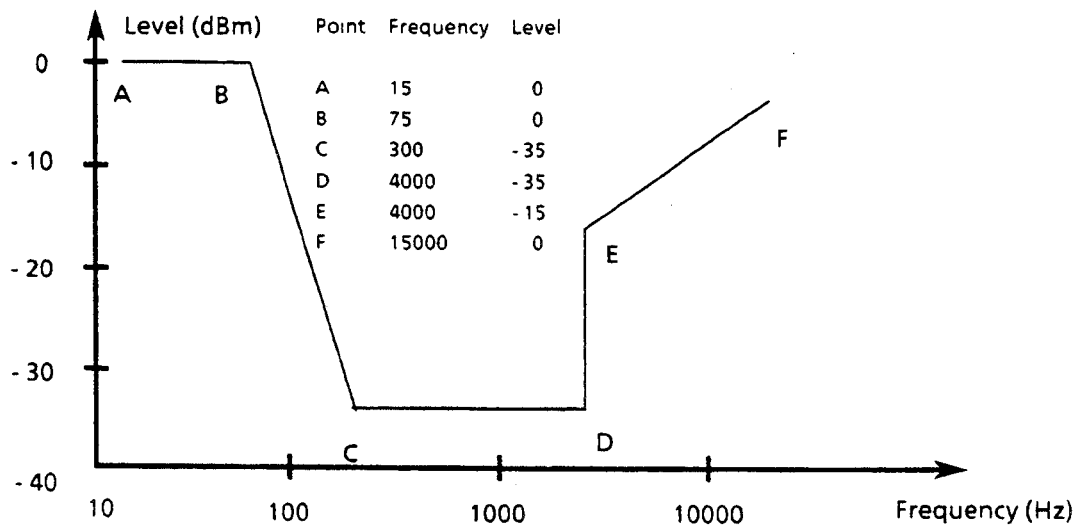


Figure 5.2.2 (S) 1

Alternative 2:

Signals having a power level below the values indicated in table 5.2.2 (S) 1 shall not be approved as dial tone.

Table 5.2.2 (S) 1

Frequency band (Hz)	Level (dBm)
15 - 300	+ 5
300 - 600	- 45
600 - 15 000	0

It shall be possible for the detector, in both alternatives, to accept an interruption in the dial tone of up to 50 ms. Interruptions longer than 100 ms shall not be accepted.

5.2.2 (S) 2 Feeding conditions, see Chapter 1, section 1.5.2.

5.2.2 (CH) 1 The values for f_3 , f_4 , p_3 , p_4 of table 5.2.2 deal with the upper limit of the "no response" area of figure 5.2.1 (CH) 1. Improperly cadence requirements for dial tone are under study. However, a tone detector susceptibility test is required:

- a) Distributing source: Any signal with frequency and level according to the "no response" area.
- b) Tone signal: Any signal with frequency and level according to the "response" area.
- c) Requirement: With a properly cadenced tone signal, the tone detector shall operate correctly.

Requirements before dialling:

If a loop current is unsuccessful, i.e. if the conditions for the dialling are not met (congestion tone before dialling), repetition is permitted provided the following requirements are fulfilled:

- a) Before another loop condition is attempted, the line must be released during a pause T_{p1} of at least 5 s.
- b) The maximum number of these pauses is 4; afterwards a pause T_{p2} of at least 5 min must be observed.
- c) If an incoming call leads to a connection, the cycle can be reset.

A.5.2.2 Dial tone detector insensitivity

The TEUT is connected as shown in figure A.5.2.1.

The dc feeding conditions V_f , R_f , I_f are adjusted as specified in table A.5.2.2.d.

For each of the feeding conditions established and for each set of parameter values given in tables A.5.2.2.a, b, and c, a check must be performed to ensure that the detector is not activated.

The tables A.5.2.2.a, b, and c refer, respectively, to cases a, b, and c mentioned in requirement section 5.2.2.

Table A.5.2.2.a: Dial tone detector insensitivity for case "a"

COUNTRY	TEST VALUES				
	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)
Austria	350, 550	-6,5			0,85
Belgium	345, 555	0	continuous	0	
Cyprus	not mandatory				
Denmark	100, 2 100	0			4
Finland	not mandatory				
France	160, 900	-10	continuous		6
Germany	not mandatory				
Greece	350, 525	0			
Iceland	50, 4 000	+ 2,2 (50 Hz) 0 (4 kHz)			5
Ireland	not mandatory				
Italy	350, 550	-6			
Luxembourg	not mandatory				
Malta					
Netherlands	not mandatory				
Norway					
Portugal	159	-1	∞	0	10
Spain					
			continuous	0	15
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.5.2.2.b: Dial tone detector insensitivity for case "b"

COUNTRY	TEST VALUES				
	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)
Austria					
Belgium	425, 450	-29	continuous	0	
Cyprus			not mandatory		
Denmark	425	-46			4
Finland	300 - 3 400	≤ -52			
France	440	-50	continuous		6
Germany			not mandatory		
Greece	425	-45			
Iceland	50, 4 000	+ 2,2 - -40			5
Ireland			not mandatory		
Italy		-48			
Luxembourg			not mandatory		
Malta					
Netherlands	150, 425	-31,8			10
Norway					
Portugal	400	-46	∞	0	10
Spain			continuous	0	15
Sweden					
Switzerland					
U. Kingdom			not mandatory		

Table A.5.2.2.c: Dial tone detector insensitivity for case "c"

COUNTRY	TEST VALUES				
	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)
Austria	380, 520	-6,5			0,7
Belgium	not mandatory				
Cyprus	not mandatory				
Denmark	425	0	1 200		1,1
Finland	not mandatory				
France	440	-10	50	50	6
Germany	not mandatory				
Greece	425	0	200	200	
Iceland	not mandatory				
Ireland	not mandatory				
Italy					
Luxembourg	not mandatory				
Malta					
Netherlands	425	-3,8	600 and 330	400 resp. 180	
Norway	5				
Portugal	400	0	590	250	10
Spain	925			250	15
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.5.2.2.d: Dial tone detector insensitivity, feeding conditions

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	60		19, 60	
Belgium	48	400, 1 600		yes
Cyprus	not mandatory			
Denmark			16, I_{max} .	yes
Finland	48	800, 1 710		
France	48	600		yes
Germany	not mandatory			
Greece	60		20, 35	
Iceland	48		14, I_{max} .	
Ireland	not mandatory			
Italy	48	800		yes
Luxembourg	not mandatory			
Malta				
Netherlands	48	1 130		yes
Norway	60	460		yes
Portugal	48	460	not applicable	
Spain	48	500, 1 100, 2 200		yes
Sweden				yes
Switzerland	48	1 200		yes
U. Kingdom	not mandatory			

A.5.2.2 (B) 1

- 1) For testing the case of "short" signals (see Belgian remark 5.2.2 (B) 1), the parameters of the test signal are:

$$f \text{ (Hz)} = 425, 450$$

$$p \text{ (dBm)} = -6$$

$$t_d \text{ (s)} = 0,500$$

- 2) The values in the tables a and b are related to the NDT detector.
- 3) For the IDT detector, the following tables apply:

IDT case a:

$i = 1 \text{ to } 6$	f_a (Hz)	f_b (Hz)	f_c (Hz)	p (dBm)
1	840	1 020	1 140	0
2	900	960	1 140	0
3	900	1 020	1 080	0
4	960	1 020	1 140	0
5	900	1 080	1 140	0
6	900	1 020	1 200	0

NOTE: Each successive frequency is emitted during 330 ms, and the signal has a total duration of 30 s.

IDT case b:

f_a (Hz)	f_b (Hz)	f_c (Hz)	p (dBm)
900	1 020	1 140	-35

NOTE: Each successive frequency is emitted during 330 ms, and the signal has a total duration of 30 s.

IDT case c:

$i = 1 \text{ to } 2$	f (Hz)	p (dBm)	t_{on} (ms)	t_{off} (ms)
1	1 140	0	180	360
2	1 140	0	480	960

NOTE: This is only valid for the IDT detector, option b.

- 4) For the broadband detector:
- in table A.5.2.2 a, f (Hz) = 345, 1 300
 - in table A.5.2.2.b, f (Hz) = 425, 1 140
(dBm) = -35
 - in the remark 1) above, f (Hz) = 425, 1 140
 $t_d = 1 150$

A.5.2.2 (DK) 1

Dial tone detector signal immunity:

Impulse measurements are made by replacing the AC generator in figure A.5.2.1 with the impulse generator shown in figure A.5.2.2 (DK) 1. Switch S_1 should be operated once per second.

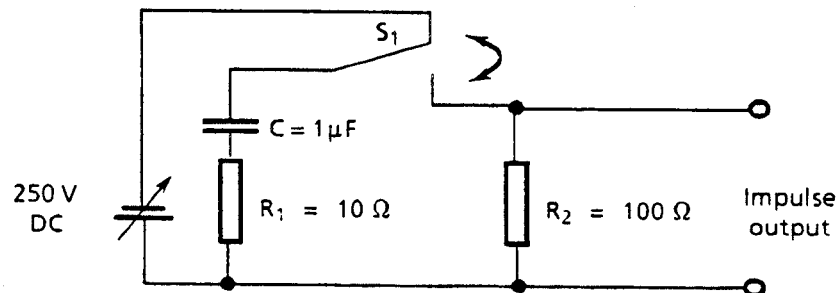


Figure A.5.2.2 (DK) 1: Impulse generator

A.5.2.2 (F) 1 Other "weak" signals:

Table A.5.2.2 (F) 1.a

f_a (Hz)	f_b (Hz)	p_a (dBm)	p_b (dBm)	t_d (s)
440	330	-55	-51,5	6

Other "improper cadence" signals:

Table A.5.2.2 (F) 1.b

f (Hz)	p (dBm)	t_{on} (ms)	t_{off} (ms)
440	-10	500	500

"short" signals:

Table A.5.2.2 (F) 1.c

f (Hz)	p (dBm)		t_d (s)	
440	-10		1	
f_a (Hz)	f_b (Hz)	p_a (dBm)	p_b (dBm)	t_d (s)
440	330	-15	-11,5	1

A.5.2.2.c (I) 1 See remark 5.2.2 (I) 1.

A.5.2.2.b (NL) 1 The value of "p" is calculated from the requirement of $e = 40$ mV.

A.5.2.2.c (NL) 1 The value of "p" is calculated from the requirement of $e = 1$ V.

A.5.2.2.a/b (N) 1 Continuous signals having frequencies and levels as in area II in figure 5.2.2 (N) 1/ table 5.2.2 (N) 1 shall not be recognised. For testing, the frequencies Z - L shall be used.

A.5.2.2.c (N) 1 Compliance shall be checked using the cadence outlined in table A.5.2.2.c (N) 1.

Table A.5.2.2.c (N) 1

t_{on} (ms)	t_{off} (ms)
100	100
250	100
500	100
600	100

A.5.2.2 (E) 1 The procedure of test in section A.5.2.1 (E) 1 is followed, where the switch (St) is operated, and the generator open circuit AC rms voltage (e) and frequency (f) take the values stipulated in table A.5.2.2 (E) 1.

NOTE: See also the test in section A.10.5 (E) 3.2.

Table A.5.2.2 (E) 1: Dial tone detector insensitivity

Signal type	Frequency	Voltage	Switch (St)		
	(f) (Hz)	(e) (mV)	Closed	(ms)	Opened
i	425	2000	925		250
ii	600	2000	925		250
iii	425	7,75	Continuous		0
	600	7,75	Continuous		0
	1 000	7,75	Continuous		0
iv	25	2000	Continuous		0
	50	2000	Continuous		0
	100	2000	Continuous		0
	150	2000	Continuous		0
v	1 000	490	Continuous		0
	2 200	490	Continuous		0
	3 400	490	Continuous		0

A.5.2.2 (S) 1

Case a)

f (Hz)	p (dBm)
16	0
75	0
15 000	0

Case b)

f (Hz)	p (dBm)
300	-35
425	-35
4 000	-35

Case c)

	f (Hz)	p (dBm)	t _{on}	t _{off}	t _d
1	425	-5	790	110	2
2	425	-5	150	150	2

A.5.2.2 (CH) 1

See also remark 5.2.2 (CH) 1.

5.3 Decadic dialling (loop pulsing)

Decadic dialling may consist of a number of events as shown in principle in figure 5.3.a and detailed in figures 5.3.b to 5.3.d.

These events occur as follows:

- a change of state from loop condition to dialling condition;
- a pre-pulsing period;
- one or more pulsing periods (separated by interpulsing periods, where appropriate);
- an interpulsing period (interdigital pause);
- a post-pulsing period;
- a change from dialling condition to the loop condition.

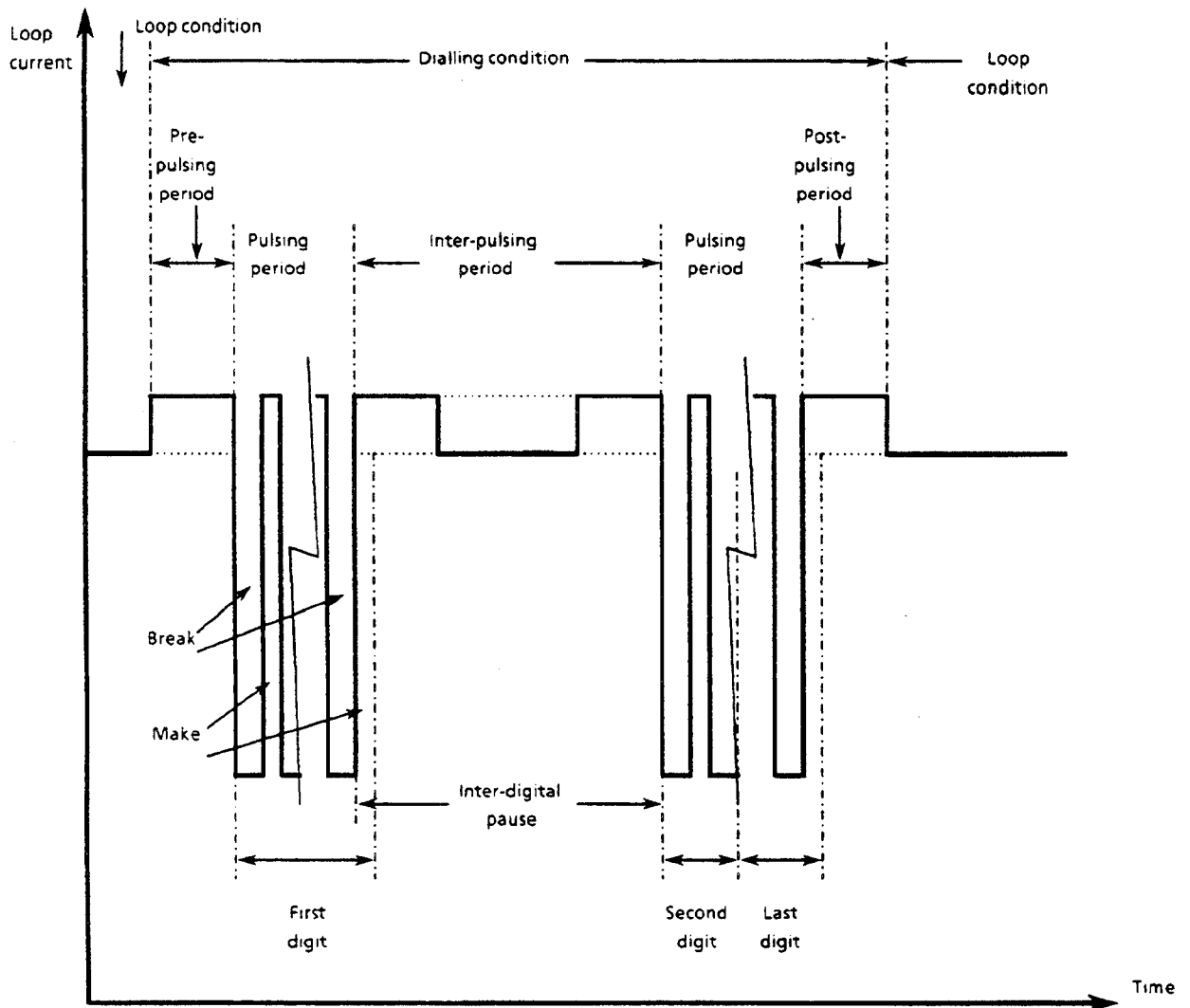
The requirements in this section relate to those values of time at which the value of the loop current is above or below the specified limits.

The requirements shall be met with dc feeding values V_f , R_f , I_f as specified in table 5.3.

Compliance shall be checked using the tests outlined in section A.5.3.

Table 5.3: Decadic dialling (loop pulsing) - feeding conditions

COUNTRY	REQUIREMENT VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	60		19 - 60	
Belgium	48		20 - I_{max} .	
Cyprus	48	440 - 1 740		
Denmark			17,5 - 70	yes
Finland	48	800 - 1 710		
France	45 - 54 86 - 104	300 - 1 745 1 300 - 3 250		
Germany	60	1 000, 2 530		yes
Greece	44 - 66		20 - 80	
Iceland	48		14, I_{max} .	
Ireland	48		20 - 100	
Italy	44 - 52	720 - 1 880		
Luxembourg	60		19 - 60	
Malta				
Netherlands	42 - 66	800 - 2 140		
Norway				yes
Portugal	45 - 55	300 - 1 800	not applicable	yes
Spain	48	250 + (250 - 1 950)		yes
Sweden				yes
Switzerland	43 - 57	2 200 - 600		
U. Kingdom	50	400	0 - 125	



NOTE: The actual current levels during the dialling condition are determined in the requirements.

Figure 5.3.a: Dialling condition periods - idealised plot

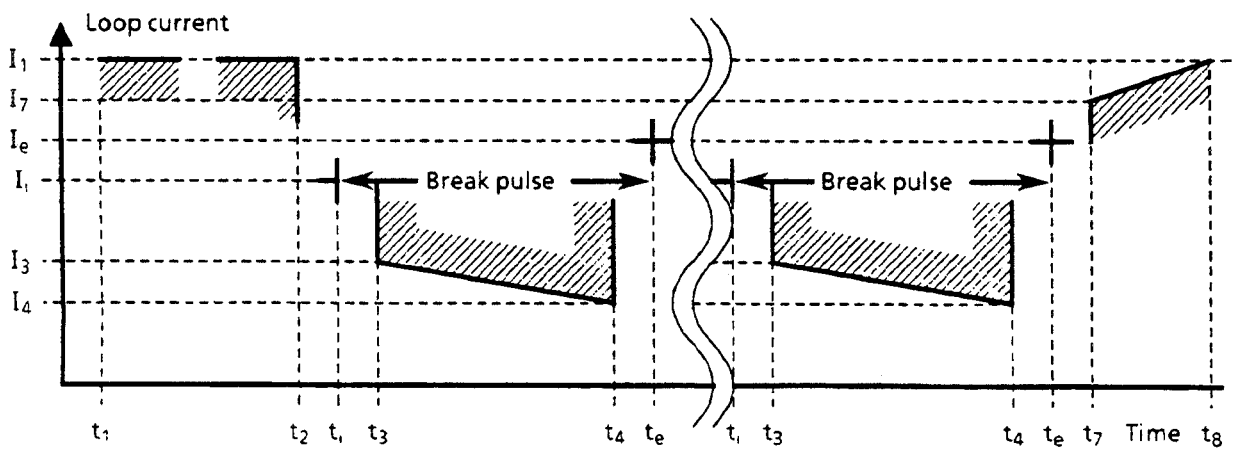


Figure 5.3.b: Loop current during pre-pulsing, first break pulse, last break pulse and post pulsing periods

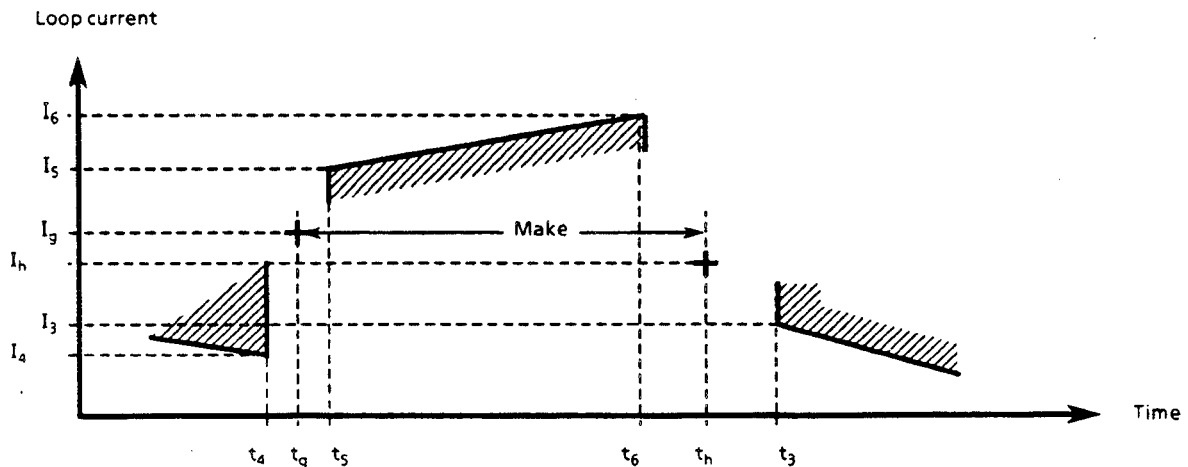


Figure 5.3.c: Loop current between two break pulses

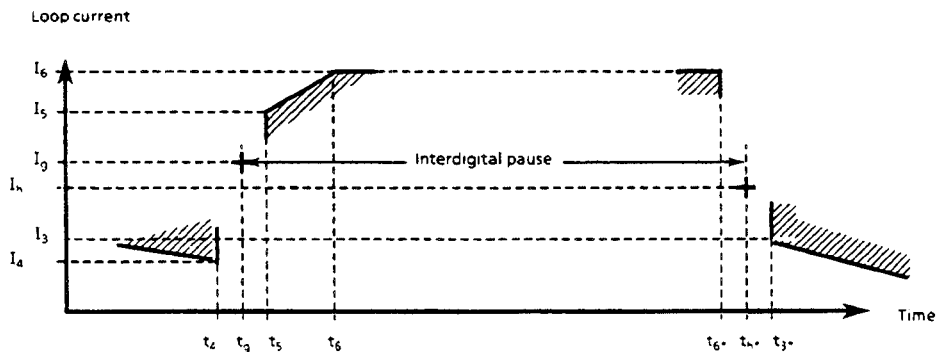


Figure 5.3.d: Loop current during interdigital pause

- 5.3 (DK) 1 A telephone set shall be provided with MFPB (DTMF).
- 5.3 (D) 1 Decadic dialling is caused by pulsing interruptions of the dc loop feeding the TE. The break is the interruption of the loop and the make is the time between two breaks, during which the loop is closed again.
- 5.3 (D) 2 The generation of the dialling pulses may be effected in other ways than by mechanical means.
- 5.3 (N) 1 Dialling shall be carried out by using MFPB bursts as described in Chapter 5.4. The possibility to use decadic dialling shall not be operator-accessible.
- 5.3 (P) 1 Feeding conditions for the requirement in section 5.3.3.1: V_f (V) = 48, R_f (Ω) = 400.
- 5.3 (E) 1 See also the general requirements in section 10.5 (E) 6.1.
- 5.3 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.
- 5.3 (S) 2 The requirements for decadic dialling (break pulses and make times) are given in two masks - one for 33 V and one for 45 V feeding voltage, indicating areas of approval values of the break pulse together with approved make time. The test arrangement is also shown.

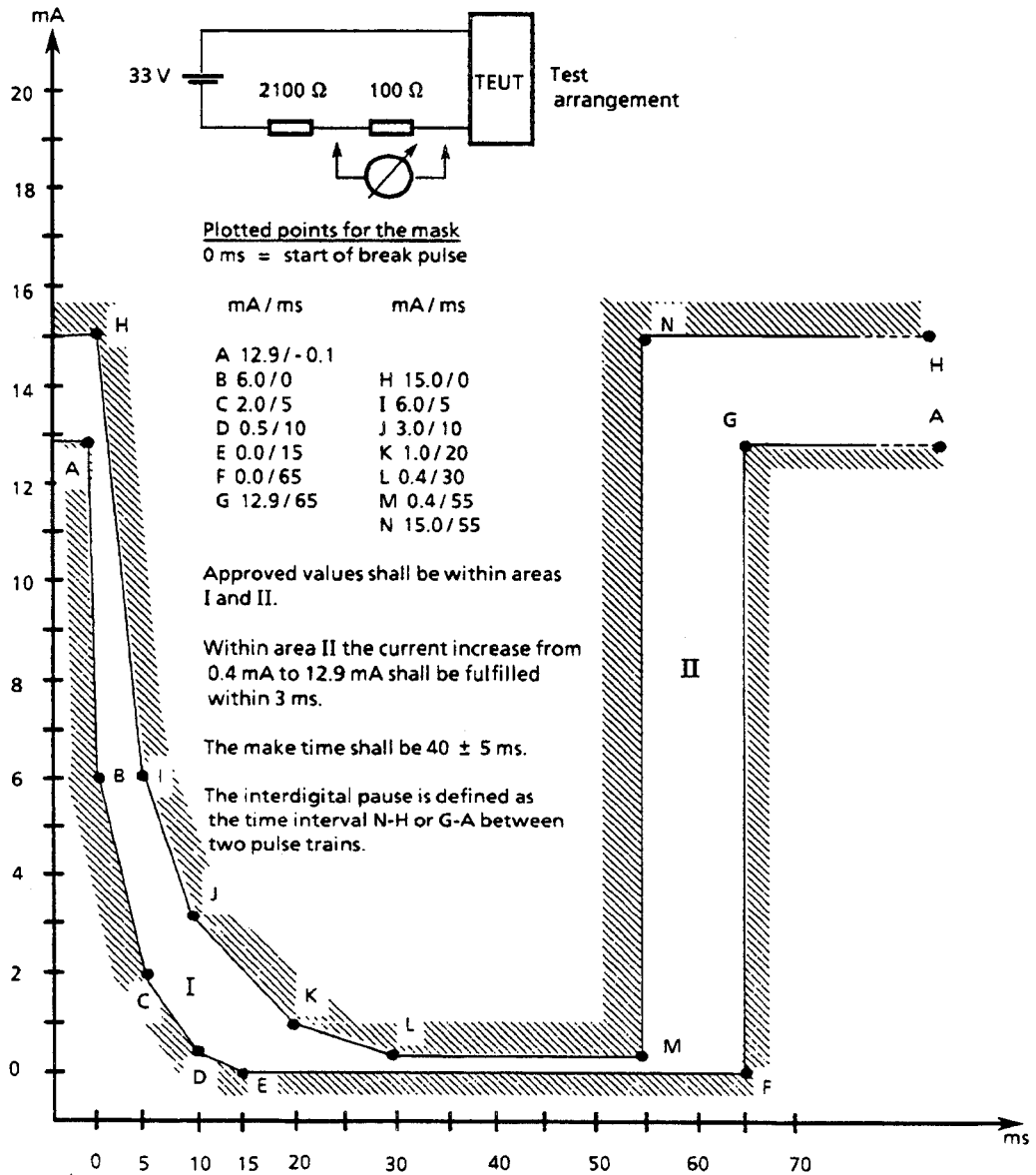


Figure 5.3 (S) 2.a: Mask for decadic pulsing, break, 33 V.

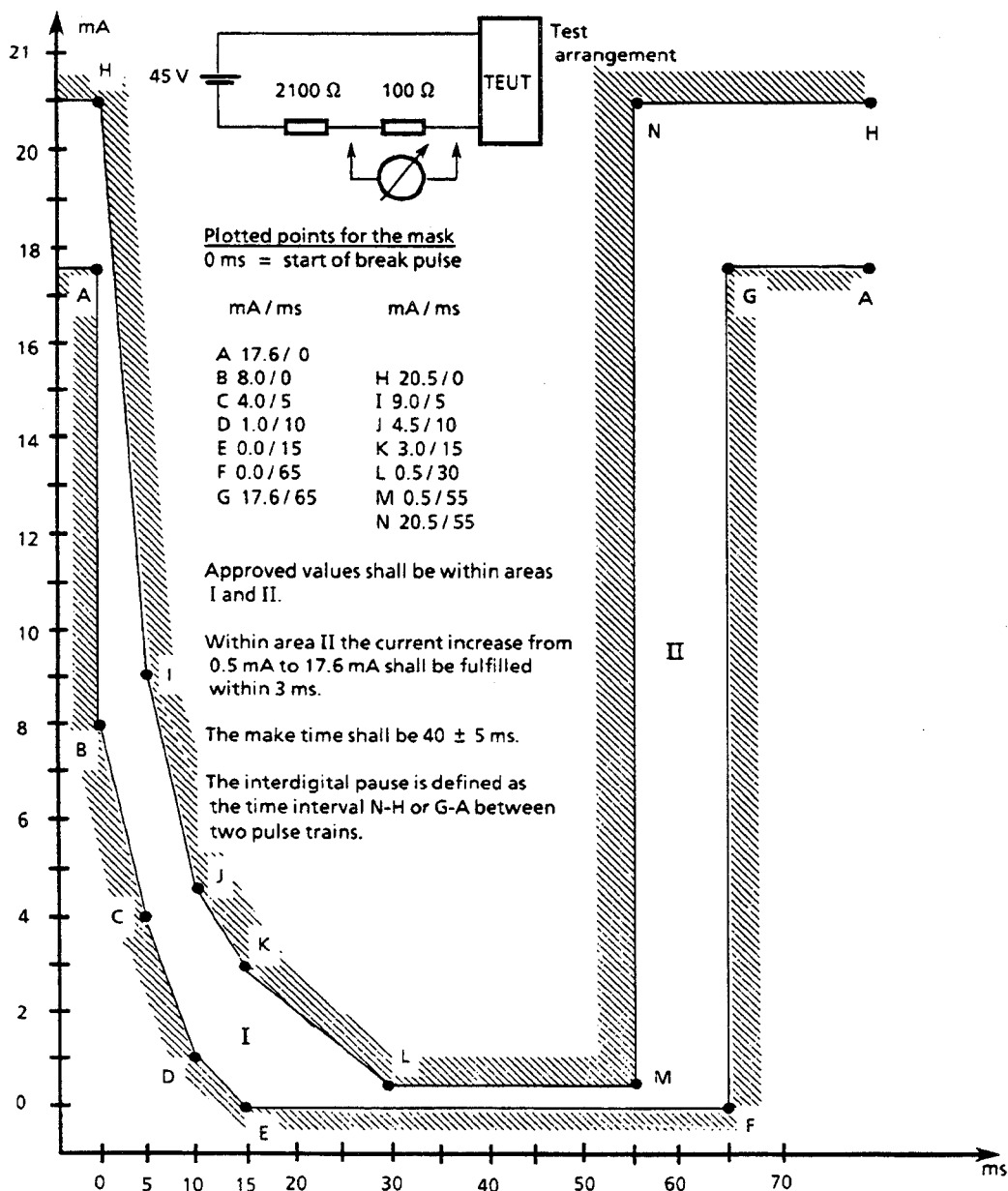


Figure 5.3 (S) 2.b: Mask for decadic pulsing, break, 45 V.

A.5.3 Decadic dialling (loop pulsing)

The TEUT is connected as shown in figure A.5.3 and placed in the loop condition. A feeding voltage of value V_f is applied via a series resistor of value R_f and a shunt resistor of value R_s . The dc feeding values and the value of R_s are specified in table A.5.3.

The basic dialling behaviour of the TEUT is related to graphs of loop current I_t and the voltage across the line terminals V_t with respect of time. The current and voltage values I_t and V_t shall be registered throughout the dialling condition which consists of as many digits as necessary.

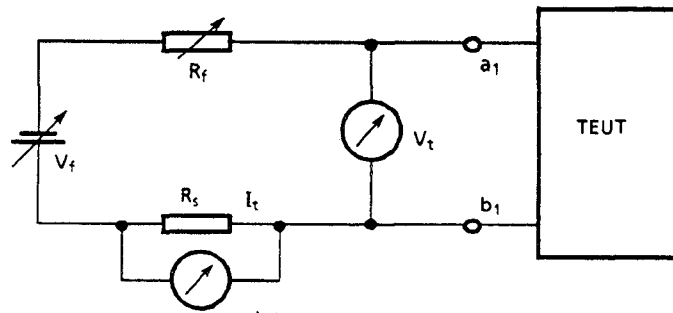


Figure A.5.3: Decadic dialling test circuit

Table A.5.3: Decadic dialling

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	R_s (Ω)	
Austria	60		19, 60	100	
Belgium	48	600		1 000	
Cyprus	48	800			
Denmark	56	0, 1 600		800	
Finland	48	0,910		800	
France	45, 54, 86, 104	1 745, 200, 3 250, 1 300		100	
Germany	60	1 000, 2 530			yes
Greece	60		20, 35, 55	100	
Iceland	48		14, I_{max}	not specified	
Ireland	48		20 - 100	not specified	
Italy	44, 48, 52	1 880, 1 100, 720			
Luxembourg	60		19, 60	100	
Malta					
Netherlands	42, 66	2 040, 700		100	yes
Norway					
Portugal	45, 55	100, 1 600	not applicable	200	yes
Spain	48	250, 850, 1 950		250	
Sweden	33, 45	2 100		100	yes
Switzerland	48	1 200		R_s included in R_f	
U. Kingdom	50	400	see remark	included in R_f	yes

A.5.3 (D) 1

For measuring the resistance during loop interruption, a shunt arrangement is used, which consists of a resistor of 1 000 ohms parallel with two Z-diodes which are connected in series but are opposite one another (see figure 10.2 (D) 1.b). For measuring the resistance during loop, a resistor of 10 ohms is used.

A.5.3 (NL) 1

An inductance of 4 H shall be placed in series with R_f .

A.5.3 (P) 1 Feeding conditions for the tests in section A.5.3.1, A.5.3.3.1 and A.5.3.4.1:

$$V_f (V) = 48$$

$$R_f (\Omega) = 200$$

$$R_s (\Omega) = 200$$

A.5.3 (S) 1 See remarks 5.3 (S) 2.

A.5.3 (GB) 1 All compliance tests shall be checked by measurement with the TEUT drawing current I_f equal to the current obtained when the TEUT is connected to a 50 V dc source in series with a 400 ohm resistor.

Break and make timings are measured between the start of the exponential fall and the start of the exponential rise of the current I_f .

5.3.1 Format and timing

5.3.1.1 Dial numbering

With TE in the dialling condition, the number of break pulses of each series transmitted shall correspond to the value of the digits 1 to 9 and 10 for the digit 0.

Compliance shall be checked using the test outlined in section A.5.3.1.1.

5.3.1.1 (D) 1 To ensure reliable connection set-up, loop-pulsed exchanges require minimum break periods, referred to as interdigital pauses, between each series of pulses (pulse train) transmitted.

The generation of more than 10 dial pulses (break pulses) shall be technically prevented.

5.3.1.1 (S) 1 The digit "n" shall correspond to $n + 1$ pulses.

5.3.1.2 Dialling pulse timing

Dialling pulses shall have the following characteristics:

- 1) Dialling frequency: 10 Hz \pm x HZ.
- 2) Break period: The time interval ($t_e - t_f$) as specified in table 5.3.1.2 (nominal value and tolerance).
- 3) Make period: The time interval ($t_h - t_g$) as specified in table 5.3.1.2 (nominal value and tolerance).

NOTE: The dialling frequency is also described as the rate of generated pulses per second. The break period and the make period are defined as differences of time values given at specified current values, as shown in figures 5.3.b and 5.3.c.

Compliance shall be checked by measurement using the test outlined in section A.5.3.1.2.

Table 5.3.1.2: Dialling pulse timing

COUNTRY	REQUIREMENT VALUES							Remarks
	Make			Break			Frequency	
	$(t_h - t_g)$ (ms)	I_h (mA)	I_g (mA)	$(t_e - t_i)$ (ms)	I_e (mA)	I_i (mA)	tol. x (Hz)	
Austria	40 ± 2	18	18	60 ± 3	18	18	0,5	
Belgium	34 ± 4	15	15	66 ± 7	15	15	1	
Cyprus	33 ± 3	15	15	67 ± 5	10	10	1	
Denmark	27 - 41	8	8	56 - 80	8	8		
Finland								yes
France	33 ± 4	17	17	66 ± 7	5	5	1	yes
Germany	40	20, 60		60		0,012	1	yes
Greece	38,5 ± 3	12	18	61,5 ± 3	18	12	1	
Iceland	40 ± 5	not spec.	not spec.	60 ± 5	not spec.	not spec.	1	
Ireland	33 ± 3	20	20	67 ± 3	20	20	1	
Italy	40	15	15	60	15	15	1	yes
Luxembourg	40 ± 2	18	18	60 ± 3	18	18	0,5	
Malta								
Netherlands	38,5 ± 7,5	8	8	61,5 ± 10	8	8	1	
Norway								
Portugal	33 1/3			66 2/3			1	yes
Spain		15	18		4	4	1	yes
Sweden	40 ± 5			60 ± 5			1	yes
Switzerland	40 ± 5	20	20	60 ± 5	4	4	not spec.	
U. Kingdom	33 + 4 -5	not spec.	not spec.	67 + 5 -4	not spec.	not spec.	1	yes

5.3.1.2 (SF) 1 The rate of pulsing shall be 10 ± 1 pulses per second and the break period shall be 56...64% of the total pulse period.

5.3.1.2 (F) 1 The loop current shall be strictly increasing or decreasing in the rising or falling transient zones between 5 mA and 17 mA.

5.3.1.2 (D) 1 For the generation of the makes and breaks, the following three options may be used:

- Option 1: The resistance of the TE during the make period shall be $R_m \leq 20$ ohms, and during the break period R_b shall be ≥ 5 Mohms
- make 32 - 46 ms
 - break 52 - 71 ms
 - ratio between break and make limit values 1,4 : 1 and 1,8 : 8.

Option 2: The resistance of the TE during the make period shall be $R_m \leq 220$ ohms, and during the break period R_b shall be ≥ 100 kohms

- make 36 - 44 ms
- break 54 - 66 ms
- ratio between break and make
limit values 1,45 : 1 and 1,55 : 1.

Option 3: The resistance of the TE during the make period shall be $R_m \leq 325$ ohms, and during the break period R_b shall be ≥ 100 kohms

- make 38 - 42 ms
- break 57 - 63 ms
- ratio between pulse and pause
limit values 1,45 : 1 and 1,55 : 1.

5.3.1.2 (D) 2 The break period is measured from the moment when R_b has been reached to the moment when R_m has been reached.

5.3.1.2 (D) 3 The total time of a pulse train generated by dialling 0 shall not exceed the tolerance of $1\ 000 \pm 100$ ms.

5.3.1.2 (I) 1 The relationship between the make time $T_m (=t_h - t_g)$ and the break time $T_b (=t_e - t_i)$ is:

$$T_b/T_m = 1,4 \text{ to } 1,7$$

$$1/(T_b + T_m) = (10 \pm 1) \text{ Hz.}$$

5.3.1.2 (P) 1 $t_i = t_h$ - time in the beginning of the falling edge of the current.
 $t_e = t_g$ - time in the beginning of the rising edge of the current.

5.3.1.2 (P) 2 $I_i = I_h$ - current level in the beginning of the falling edge of the current.
 $I_e = I_g$ - current level in the beginning of the rising edge of the current.

5.3.1.2 (P) 3 The break and make periods shall have nominal values of $66^{2/3}$ ms and $33^{1/3}$ ms, respectively, according to the limits specified in figure 5.3.1.2 (P) 3.

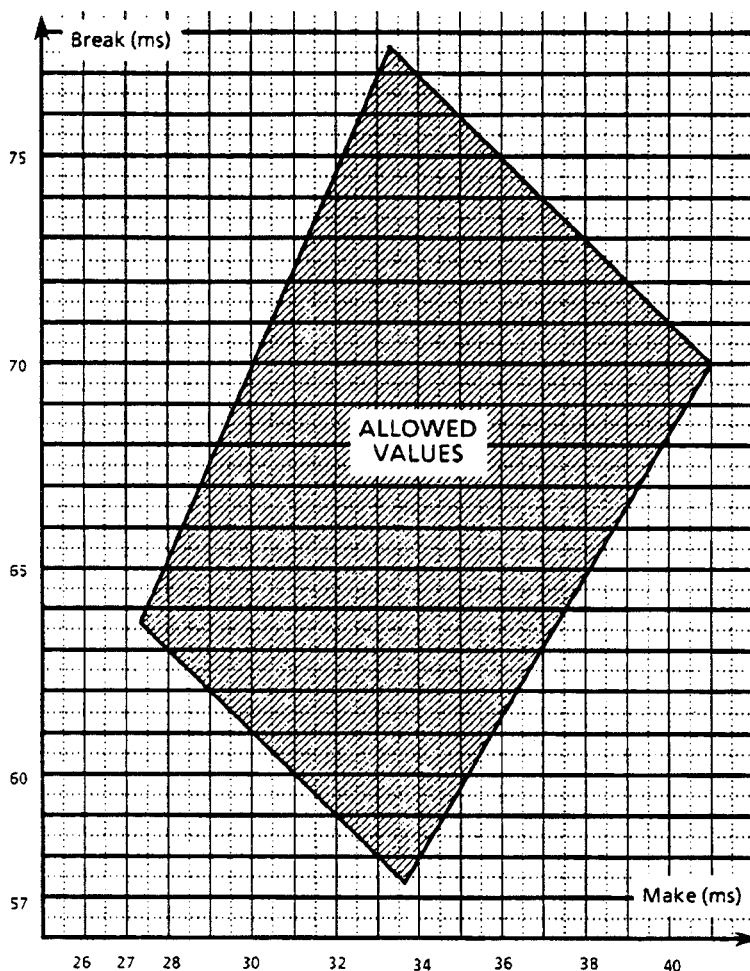


Figure 5.3.1.2 (P) 3: Dialling pulse timing

5.3.1.2 (E) 1

(Remark to paragraph 1 in section 5.3.1.2).

Compliance shall be checked by the tests outlined in section A.5.3.1.2 (E) 1.

5.3.1.2 (E) 2

Break period duration:

(Requirement to be applied instead of paragraphs 2 and 3 in section 5.3.1.2).

With TE in the dialling condition with loop pulsing, the mean net duration of the break periods of each series shall be within the range $(67 \pm 3)\%$ in relation with the mean net duration of an impulse (net break duration + net make duration).

NOTE:

The meaning given for the term "net" is to exclude the fall times and the rise times of the loop current (see requirements in sections 10.5 (E) 6.3.1.a and 10.5 (E) 6.3.2.b).

Compliance shall be checked by the tests outlined in section A.5.3.1.2 (E) 2.

5.3.1.2 (S) 1

See remark 5.3 (S) 2.

5.3.1.2 (GB) 1

The values of the break and make pulse periods given in table 5.3.1.2 are the nominal values at a dialling frequency of 10 Hz. The break pulse period is allowed to vary between 63% and 72% of the total make and break period at all permitted dialling frequencies. The current values I_h , I_g are not specified, except to say that the current drawn by the TE shall be either not less than the current drawn in the normal loop condition or not less than the current drawn in the dialling condition, whichever is the lower.

The current values I_j , I_e are not specified except to say that in the break period the current must fall below 0,5 mA.

A.5.3.1 Format and timing

The testing arrangement used is defined in A.5.3.

A.5.3.1.1 Dial numbering

The test consists of inspection according to good engineering practice. Every digit shall be checked.

A.5.3.1.2 Dialling pulse timing

The TEUT shall be caused to emit a pulse train consisting of 10 successive break pulses.

1) Dialling frequency Method 1 (figure 5.3.c):

For the feeding conditions specified in table A.5.3, each time interval "t" between two successive falling edges of the current is measured, at the current value I_j .

For the last break pulse, the time interval "t" is measured at the same current value but between the last rising edge of the current and the previous one.

The dialling frequency f_d is then calculated according to formula A.5.3.1.2.a:

$$f_d = \frac{1}{t} \quad \text{Formula A.5.3.1.2.a}$$

Each of the 10 measurements shall be within limits of the requirement in table 5.3.1.2.

Method 2 (figure 5.3.c):

For the feeding conditions specified in A.5.3, the time interval "t" between the beginning of the first break pulse and the end of the tenth break pulse is measured at the current value I_j .

The dialling frequency f_d is then calculated according to formula A.5.3.1.2.b:

$$f_d = \frac{10}{(t + t_m)} \quad \text{Formula A.5.3.1.2.b}$$

where t_m is the nominal value for the make period ($t_h - t_g$) as shown in table 5.3.1.2.

The measuring method to be applied is indicated in table A.5.3.1.2.

2) Break period For the feeding conditions specified in table A.5.3, the duration of each break pulse shall be measured, using the current levels I_i and I_e .

Each of the 10 measurements shall be within the limits of the requirement in table 5.3.1.2.

3) Make period For the feeding conditions specified in table A.5.3, the duration of each make pulse shall be measured, using the current levels I_g and I_h .

Each of the 9 measurements shall be within the limits of the requirement in table 5.3.2.1.

Table A.5.3.1.2: Dialling frequency test methods

COUNTRY	TEST VALUES		Remarks
	Method 1	Method 2	
Austria	yes	no	
Belgium	no	yes	
Cyprus	yes	no	
Denmark	not mandatory	not mandatory	
Finland	yes	no	
France	yes	no	
Germany	no	yes	yes
Greece	yes	no	
Iceland	yes	no	
Ireland	yes	no	yes
Italy	yes	no	
Luxembourg	not specified		
Malta			
Netherlands	yes	no	
Norway			
Portugal	yes	no	
Spain	no	no	yes
Sweden			yes
Switzerland	not specified		
U. Kingdom	yes	no	

A.5.3.1.2 (D) 1 In cases where after the last break pulse the make is not visible, the total time of the pulse train generated by dialling 0 is evaluated by adding the mathematical average value of a make of this pulse train to the measured time.

A.5.3.1.2 (IRL) 1 Rather than 10, only 5 such measurements are performed.

A.5.3.1.2 (E) 1 Dialling frequency

The procedure of test in section A.5.3 is followed, where the tests are undertaken for each polarity of the voltage source (V_f).

The digit 0 shall be emitted.

The frequency of dialling (f_d) is calculated using formula A.5.3.1.2 (E) 1, where T is the measured period duration in milliseconds from the front edge ($I_i = 4$ mA) of the first break pulse to the front edge ($I_i = 4$ mA) of the tenth break pulse.

$$f_d \text{ (Hz)} = \frac{9}{T \text{ (ms)}} \times 1\,000 \qquad \text{Formula A.5.3.1.2 (E) 1}$$

A.5.3.1.2 (E) 2 Break period duration

The procedure of test in section A.5.3.1.2 (E) 1 is followed.

The break period duration (B/M) is calculated using formula A.5.3.1.2 (E) 2, where "tbi" are the net duration ($t_e - t_i$) of each one of the first nine break periods, and "tmi" are the net duration ($t_h - t_g$) of each one of the nine make periods, all of them in milliseconds.

$$B / M \text{ (\%)} = \frac{\sum tbi \text{ (ms)}}{\sum tbi \text{ (ms)} + \sum tmi \text{ (ms)}} \times 100 \qquad \text{Formula A.5.3.1.2 (E) 2}$$

A.5.3.1.2 (S) 1 See remark 5.3 (S) 2.

5.3.2 Pre-pulsing period current and loop resistance

Reference is made to figure 5.3.b.

From the time t_1 that the TE assumes the dialling condition until the time t_2 that the first break pulse is generated, the loop current shall be greater than I_1 as shown in figure 5.3.b, or the resistance between the line terminals shall not be greater than R_{pr} .

The values of I_1 , R_{pr} and time interval ($t_2 - t_1$) are given in table 5.3.2.

Compliance shall be checked using the test outlined in section A.5.3.2.

Table 5.3.2: Pre-pulsing period current and loop resistance

COUNTRY	REQUIREMENT VALUES			Remarks
	$(t_2 - t_1)$ (ms)	I_1 (mA)	R_{pr} (Ω)	
Austria	40 - 1 000	not mandatory	350	yes
Belgium				yes
Cyprus		not mandatory		
Denmark		not mandatory		
Finland		not mandatory		
France		20		yes
Germany	650 - 1 300		480	
Greece	not specified	I_f		
Iceland				
Ireland	≥ 250	20	450	
Italy	1 000	18		
Luxembourg	650 - 1 300		480	
Malta				
Netherlands		not mandatory		
Norway				
Portugal				yes
Spain	$\leq 1 200$	not applicable	400	yes
Sweden				yes
Switzerland	not mandatory		see sec. 2.3	
U. Kingdom	≥ 240	not specified	not specified	yes

5.3.2 (A) 1 The time $t_2 - t_1$ may be for dials > 10 ms.

5.3.2 (B) 1

- 1) The time interval $(t_2 - t_1)$ is not specified (not mandatory).
- 2) The minimum value I_1 of the loop current during the pre-pulsing period shall be equal to or greater than the value of the loop current before this period.

5.3.2 (F) 1 The loop current shall be lower than 60 mA.

5.3.2 (P) 1 During the period $(t_2 - t_1)$ the loop current and the voltage at the line terminals of the TE shall comply with the limits of figure 5.3.2 (P) 1.

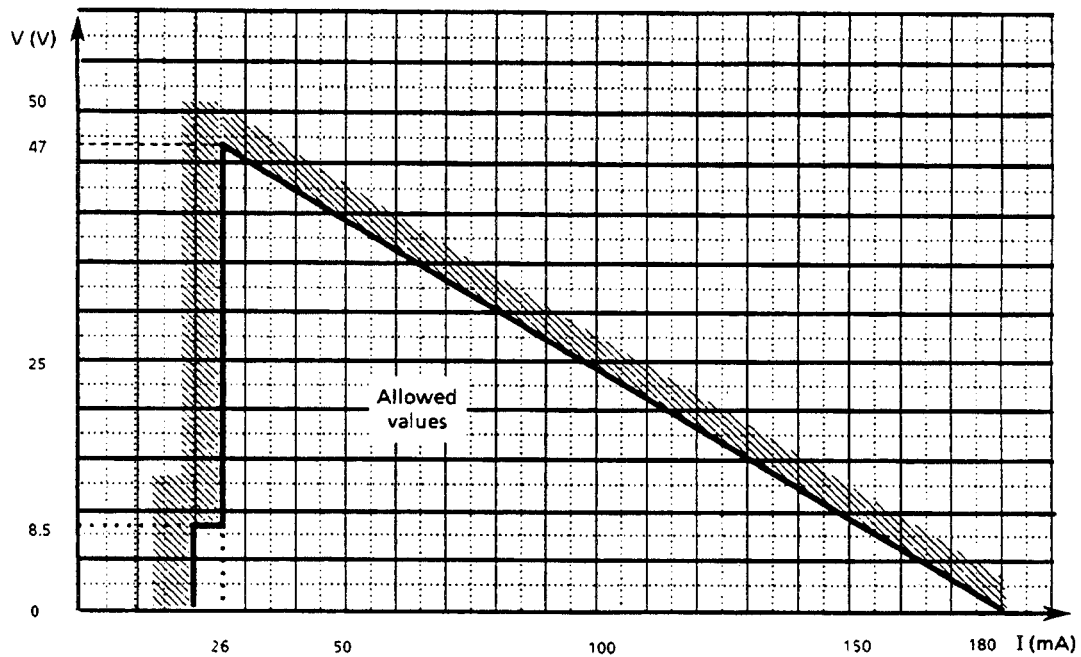


Figure 5.3.2 (P) 1: Pre-pulsing period current and loop resistance

5.3.2 (P) 2 t_2 - time in the beginning of the falling edge of the current.

$$t_2 = t_i, \text{ for the first break pulse.}$$

5.3.2 (E) 1 The resistance (R_{pr}) shall be tested at dc loop currents between 18,5 mA and 100 mA.

PROVISION: The limit for the duration of the period of time ($t_2 - t_1$) shall, however, not be applied for TE where the dialling sequence with loop pulsing is done manually with a rotary dial.

5.3.2 (S) 1 See remark 5.3 (S) 2.

5.3.2 (GB) 1 The loop current I_1 in the pre-pulsing period is not specified. For a period of not less than 240 ms before the first break pulse of a series, the current drawn by the TE shall be as stated in 5.3.1.2 (GB) 1.

A.5.3.2 Pre-pulsing period current and loop resistance

Reference is made to figures 5.3.b and A.5.3.

The TEUT shall be caused to emit a dialling pulse train including at least one break pulse. For the feeding conditions specified in table A.5.3, the values of the current I_t and, if needed, of the voltage V between the times t_1 and t_2 are registered.

Depending on the requirement, the loop current values I_t shall be greater than I_1
 or
 the resistance R_t between the line terminals is calculated according to formula A.5.3.2

$$R_t = \frac{V_t}{I_t} \qquad \text{Formula A.5.3.2}$$

and shall not be greater than the value R_{pr} specified in table 5.3.2.

Table A.5.3.2: Pre-pulsing period current and loop resistance

COUNTRY	TEST VALUES	Remarks
	I_f (mA)	
Austria	19, 60	
Belgium		
Cyprus	not mandatory	
Denmark	not mandatory	
Finland	not mandatory	
France		
Germany		
Greece		
Iceland	not mandatory	
Ireland	20 - 80	
Italy		
Luxembourg	not mandatory	
Malta		
Netherlands	not mandatory	
Norway		
Portugal		
Spain		yes
Sweden		yes
Switzerland		
U. Kingdom	not specified	

A.5.3.2 (E) 1 The tests are undertaken for each polarity of the voltage source (V_f).

The procedure of test in section A.5.3.3.2 (E) 1 is followed when the resistance (R_{pr}) is tested.

A.5.3.2 (S) 1 See remark 5.3 (S) 2.

5.3.3 Pulsing period current and loop resistance

5.3.3.1 Break pulse period current and loop resistance

Reference is made to figure 5.3.b.

During the break period there shall be a period ($t_4 - t_3$) during which the loop current shall be below the limits shown in figure 5.3.b, or the resistance between the line terminals shall be greater than R_b .

The values of I_3 , I_4 , R_b and time interval ($t_4 - t_3$) are given in table 5.3.3.1.

Compliance shall be checked using the test outlined in section A.5.3.3.1.

Table 5.3.3.1: Break period current and loop resistance

COUNTRY	REQUIREMENT VALUES				Remarks
	($t_4 - t_3$) (ms)	I_3 (mA)	I_4 (mA)	R_b (Ω)	
Austria	> 35	not mandatory	not mandatory	100 k	
Belgium	59	0,5	0,5		
Cyprus	50	0,5	0,5		
Denmark	56 - 80			100 000	
Finland	50 %	not specified	not specified	70 000	yes
France	40	1	1		
Germany					yes
Greece	($t_e - t_i$) - 6	0,5	0,5		
Iceland	55 - 65	0,5	0,5		
Ireland	not specified	0,5	not specified	not specified	
Italy	53 - 70			100 k	
Luxembourg	> 35	not specified	not specified	100 k	
Malta					
Netherlands	40	0,5	0,5		
Norway					
Portugal		2	0,5	not applicable	yes
Spain		480 μ A	480 μ A	not applicable	yes
Sweden					yes
Switzerland	52	not mandatory	not mandatory	> 80 k Ω	
U. Kingdom		not specified	not specified	not specified	yes

- 5.3.3.1 (SF) 1** The resistance between the two line terminals shall be ≥ 70 k Ω of the break period.
- 5.3.3.1 (D) 1** See section 5.3.1.2.
- 5.3.3.1 (P) 1** ($t_3 - t_i$)(ms) = 4 ms
($t_4 - t_i$)(ms) = 6 ms
- 5.3.3.1 (P) 2** From the time t_4 until the time t_e the current shall not exceed 0,5 mA.
- 5.3.3.1 (E) 1** See also the requirements in sections 5.3.1.2, 5.3.1.2 (E) 1, 5.3.1.2 (E) 2, and 10.5 (E) 6.3.
- 5.3.3.1 (S) 1** See remark 5.3 (S) 2.
- 5.3.3.1 (GB) 1** See remark 5.3.1.2 (GB) 1. The minimum break period permitted at a dialling frequency of 10 Hz shall be 63 ms. The break period is defined as the time between the start of the exponential fall and the start of the exponential rise of the current I_f . During this period I_f must fall to a value equal to or less than 0,5 mA.

A.5.3.3 Pulsing period current and loop resistance

The TEUT shall be caused to emit a dialling pulse train consisting of at least 2 successive break pulses.

A.5.3.3.1 Break pulse period current and loop resistance

The test arrangement is shown in figure A.5.3. For the feeding conditions specified in table A.5.3.3.1 the values of the current I_t and, if needed, the voltage V_t during each of the break pulse periods are registered.

Depending on the requirement and during a period $t_4 - t_3$, the loop current value I_t shall be below the current limits specified

or

the resistance R_t between the line terminals is calculated according to formula A.5.3.3.1:

$$R_t = \frac{V_t}{I_t} \quad \text{Formula A.5.3.3.1}$$

and shall be greater than the value R_p specified in section 5.3.3.1.

Table A.5.3.3.1: Break pulse period current and loop resistance

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_f (Ω)	R_s (Ω)	I_f (mA)	
Austria	60		1 000	19, 60	yes
Belgium	48	600	1 000		
Cyprus	48	800	not specified	not specified	
Denmark	150	0, 1 600	800		
Finland	48	0,910	800		
France	54, 104 45, 86	200, 1 300 1 745, 3 250	100		
Germany					
Greece	60		100	20, 35, 55	
Iceland	48		not specified	14, $I_{max.}$	
Ireland	48		not specified	20 - 80	
Italy	48	800	1 000		
Luxembourg	60		1 000	19, 60	
Malta					
Netherlands	42, 66	2 040	100		
Norway					
Portugal	48	200	200	not applicable	yes
Spain	48				yes
Sweden					yes
Switzerland	48	1 200	R_s incl. in R_t		
U. Kingdom	50	400	not specified		yes

A.5.3.3 (A) 1 Test is undertaken for both polarities of dc applied to the line terminals or leads of the TE.

A.5.3.3 (NL) 1 An inductance of 4 H shall be placed in series with R_f .

A.5.3.3.1 (P) 1 The period during which the loop current value I_t shall be below the current limits specified in the requirement is ($t_e - t_3$).

A.5.3.3.1 (E) 1 The tests are undertaken for each polarity of the voltage source (V_f).

The digit 0 shall be emitted.

A suitable instrument is used to measure the dc loop current (I_t) through the resistor (R_s) during the break periods, or at least for the first, sixth, and tenth break pulses.

A.5.3.3.1 (S) 1 See remark 5.3 (S) 2.

A.5.3.3.1 (GB) 1 See remark 5.3 3.1 (GB) 1

5.3.3.2 Make pulse period current and loop resistance

Reference is made to figure 5.3.c.

During the make period there shall be a period ($t_6 - t_5$) during which the loop current shall be above the limits shown in figure 5.3.c, or the resistance between the line terminals shall not be greater than R_m .

The values of I_5 , I_6 , R_m and the time interval ($t_6 - t_5$) are given in table 5.3.3.2.

Compliance shall be checked using the test outlined in section A.5.3.3.2.

Table 5.3.3.2: Make pulse period current and loop resistance

COUNTRY	REQUIREMENT VALUES				Remarks
	$(t_6 - t_5)$ (ms)	I_5 (mA)	I_6 (mA)	R_m (Ω)	
Austria	38	not mandatory	not mandatory	350	
Belgium	30	20	20		
Cyprus	25	20	20		
Denmark	27 - 41			200	
Finland	50 %	not specified	not specified	300	yes
France	29	17	17		yes
Germany					yes
Greece	$(t_h - t_g) - 4$	I_f	I_f		
Iceland	35 - 45	14	14	not specified	
Ireland	30 - 36	20	20	450	
Italy	33,7 - 46,3	15	15		yes
Luxembourg	37 - 42	not specified	not specified	180	
Malta					
Netherlands	25	15,5	15,5		
Norway					
Portugal					yes
Spain		not applicable	not applicable	400	yes
Sweden					yes
Switzerland	32	not specified	not specified	250 or ≤ 5 V	yes
U. Kingdom		not specified	not specified	not specified	yes

- 5.3.3.2 (SF) 1** The resistance between the line terminals shall be $\leq 300 \Omega$ during 50% of the make period.
- 5.3.3.2 (F) 1** The loop current shall be lower than 75 mA. However, the loop current may exceed 75 mA (80 mA from 1 st January 1992) for periods no longer than 5 ms.
- 5.3.3.2 (D) 1** See section 5.3.1.2.
- 5.3.3.2 (I) 1** During the period $T_6 - T_5$, the drop voltage between the line terminals of the TE shall be $\leq 5,5$ V with a loop current in the range of 18 and 25 mA.
- 5.3.3.2 (P) 1** $(t_5 - t_g)(ms) = 4$
 $t_6 = t_h$
- 5.3.3.2 (P) 2** During the period $(t_6 - t_5)$ the loop current and the voltage at the line terminals of the TE shall comply with the limits of figure 5.3.3.2 (P) 2.

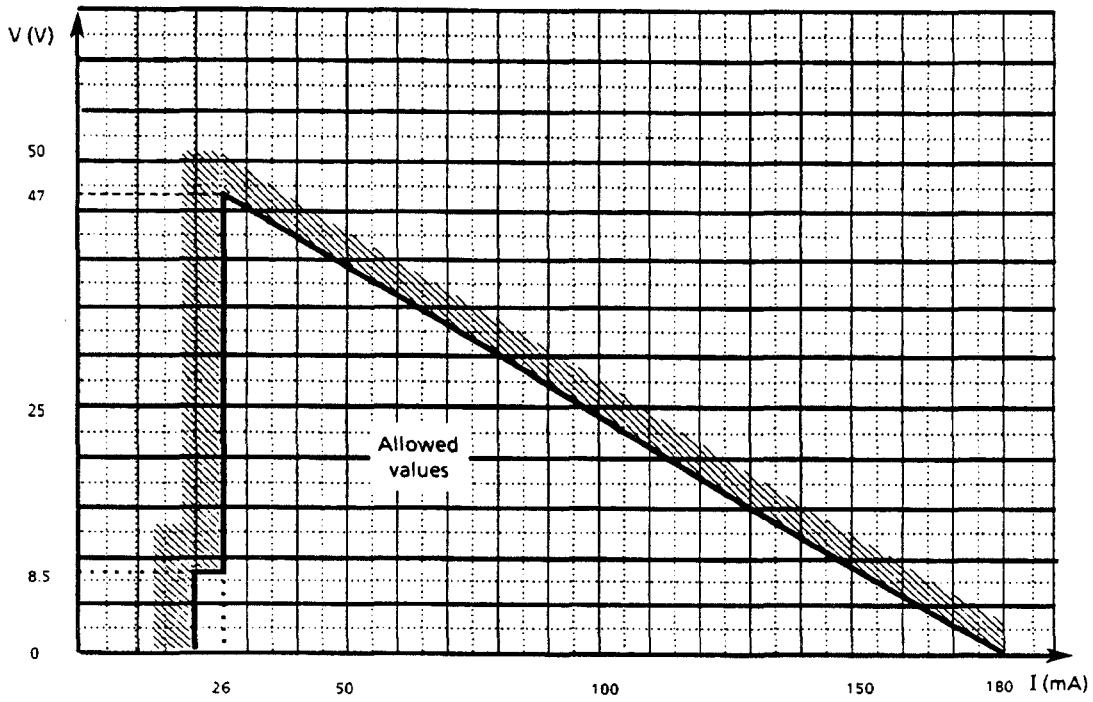


Figure 5.3.3.2 (P) 2: Make pulse period current and loop resistance

5.3.3.2 (E) 1

See also the requirements in sections 5.3.1.2, 5.3.1.2 (E) 1, 5.3.1.2 (E) 2, and 10.5 (E) 6.3.

The resistance (R_m) shall be tested at dc loop currents between 18,5 mA and 100 mA.

Compliance shall be checked by the tests outlined in section A.5.3.3.2 (E) 1.

5.3.3.2 (S) 1

See remark 5.3 (S) 2.

5.3.3.2 (CH) 1

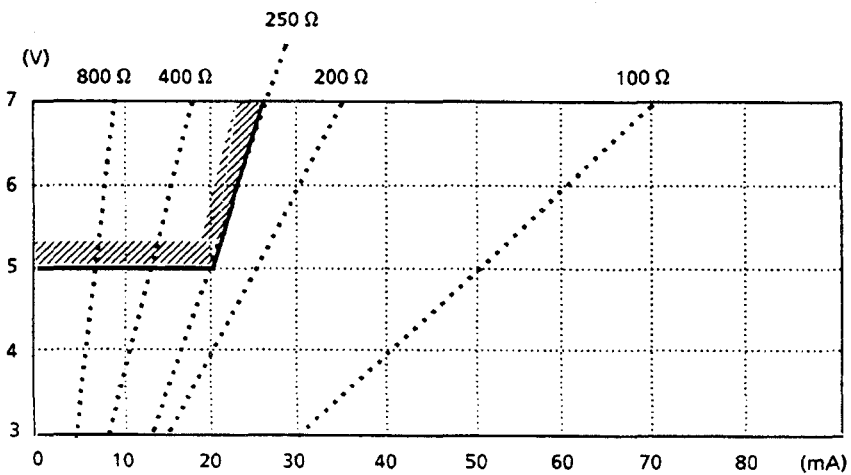


Figure 5.3.3.2 (CH) 1

5.3.3.2 (GB) 1

The minimum make period permitted at a dialling frequency of 10 Hz shall be 28 ms. The make period is defined as the time between the start of the exponential rise and the start of the exponential fall of the current I_f . The minimum loop current is not specified (see 5.3.1.2 (GB) 1).

A.5.3.3.2 Make pulse period current and loop resistance

Reference is made to figures 5.3.c and A.5.3.

For the feeding conditions specified in table A.5.3 the values of the current I_t and, if needed, the voltage V_t during each of the make periods are registered.

Depending on the requirements and during a period $t_6 - t_5$, the loop current values I_t shall be above the current limits, as specified

or

the resistance R_t between the line terminals is calculated according to formula A.5.3.3.2

$$R_t = \frac{V_t}{I_t} \qquad \text{Formula A.5.3.3.2}$$

and shall not be greater than the value R_m specified in table 5.3.3.2.

Table A.5.3.3.2: Make pulse period current and loop resistance

COUNTRY	TEST VALUES	Remarks
	I_f (mA)	
Austria	19, 60	yes
Belgium		
Cyprus	20, 80	
Denmark		
Finland		
France		
Germany		
Greece		
Iceland	14, I_{max} .	
Ireland	20 - 80	
Italy		
Luxembourg	19, 60	
Malta		
Netherlands		
Norway		
Portugal		
Spain		yes
Sweden		yes
Switzerland		
U. Kingdom	see earlier remark	yes

A.5.3.3.2 (A) 1 Tests are undertaken for both polarities of dc applied to the line terminals or leads of the TE.

A.5.3.3.2 (E) 1 The TEUT is connected as shown in figure A.5.3.

The variable voltage source (V_t) takes values between 43 V and 56 V; the tests are undertaken for each polarity of the voltage source. The resistor (R_s) takes the value of 250 ohms, and the variable resistor (R_t) takes values between 50 ohms and 2 050 ohms.

The tests shall be made at the following loop currents (I_t): 18,5 mA, 25 mA, 40 mA, 65 mA, and 100 mA.

The digit 0 shall be emitted.

A suitable instrument is used to document and to measure the dc loop current (I_t) through the resistor (R_s), and the dc voltage across the line terminals (V_t) during the make periods or at least for the make periods between the first and second break pulses, between the fifth and sixth break pulses, and between the ninth and the tenth break pulses.

The equivalent make resistance (R_m) is calculated using formula A.5.3.3.2 (E) 1, where (V_t) is the voltage in volts and (I_t) is the loop current in milliamperes.

NOTE: See the note in section A.2.3 (E) 1.

$$R_m (\Omega) = \frac{V_t (V) \times 1\,000}{I_t (mA)} \quad \text{Formula A.5.3.3.2 (E) 1}$$

A.5.3.3.2 (S) 1 See remark 5.3 (S) 2.

5.3.4 Interpulsing period

5.3.4.1 Interdigital pause

The interdigital pause is defined as a difference of time value ($t_h - t_g$) given at the current values I_g and I_h specified in table 5.3.1.2 and shown in the figure 5.3.d.

5.3.4.1.1 Automatic or stored-digit outputting

For decadic dialling using equipment capable of accepting and storing digits faster than the specified outputting rate, the interdigital pause ($t_h - t_g$) shall be as specified in table 5.3.4.1.

5.3.4.1.2 Real-time outputting

The decadic dialling using equipment which outputtes in real time, the interdigital pause shall be generated by a method incorporated in the dialling equipment which ensures a minimum interdigital pause t_r as specified in table 5.3.4.1.

Compliance for both the above subsections shall be checked using the test described in section A.5.3.4.1.

Table 5.3.4.1: Interdigital pause

COUNTRY	REQUIREMENT VALUES		Remarks
	$t_h - t_g$ (ms)	t_r (ms)	
Austria	850 + 150 - 50	not mandatory	
Belgium	750 ± 250	400	
Cyprus	450 - 1 000	not mandatory	
Denmark	450 - 900	450	
Finland	≥ 720	not mandatory	
France	900 ± 100		
Germany	650 - 1 300	not mandatory	yes
Greece	720 - 1 000	400	
Iceland	450 - 900	not mandatory	
Ireland	720 - 1 000	240	yes
Italy	880 + 120 - 130	190	
Luxembourg	800 - 1 000	not mandatory	
Malta			
Netherlands	700 - 3 000	700	
Norway			
Portugal	600 min., 1 000 max.	not applicable	yes
Spain	450 - 1 200	450	yes
Sweden	500 - 900	500	yes
Switzerland	620 - 1 000	620	
U. Kingdom	720 min.	240	yes

5.3.4.1 (D) 1

The interdigital pause is defined as the time interval between the moment when, for the first pulse train, the resistance of the TE has reached the value of R_m for the last time and the moment when, for the second pulse train, the resistance of the TE has reached R_b for the first time.

The interdigital pause has to be ≥ 650 ms and $\leq 1\ 300$ ms. The upper limit of 1 300 ms is only applicable for dialling storage. During the interdigital pause the TE may have a dc resistance of ≤ 480 ohms.

5.3.4.1 (IRL) 1

Rotary dials normally have a lost motion time of at least 240 ms inherent in their design. In addition, they have a "wind-up" time of at least 180 ms for digit 1 and correspondingly more for other digits. Together with user selection time, which is non controllable, a typical interdigital pause of approximately 800 ms may be expected

5.3.4.1 (P) 1

t_h^* - time in the beginning of the falling edge of the current.

5.3.4.1 (E) 1

PROVISION: This requirement is not applicable for TE where the dialling sequence with loop pulsing is done manually with a rotary dial, because this method is considered as several dialling sequences of a digit.

5.3.4.1 (S) 1 See remark 5.3 (S) 2.

5.3.4.1 (S) 2 The implemented interdigital pause time for real-time outpulsing shall not exceed 900 ms.

5.3.4.1 (GB) 1 For rotary dials, the combination of a minimal lost-motion period of 240 ms, plus the time taken to rotate the dial from rest to the desired digit, along with the user selection time, means that an average interdigital pause of approximately 800 ms may be expected.

5.3.4.1 (GB) 2 The interdigital pause should not exceed 920 ms.

A.5.3.4 Interpulsing period

A.5.3.4.1 Interdigital pause

Reference is made to figures 5.3.d and A.5.3.

The TEUT shall be caused to emit a dialling signal of two successive pulse trains.

The feeding conditions specified in table A.5.3 are used. The time interval between t_g (at I_g) in the last break pulse of the first pulse train and t_{h^*} (at I_h) in the first break pulse of the second pulse train as specified in table 5.3.4.1, is measured.

The outpulsing system of the TEUT is checked by inspection according to good engineering practice. Depending on the system, 5.3.4.1.1 or 5.3.4.1.2 applies.

A.5.3.4.1 (D) 1 Measurement is made of the time interval between the moment when, for the first pulse train, the resistance of the TE has reached the value of R_m for the last time and the moment when, for the second pulse train, the resistance of the TE has reached R_b for the first time.

A.5.3.4.1 (E) 1 The tests are undertaken for each polarity of the voltage source (V_f).

The digit 0 shall be emitted several times.

A.5.3.4.1 (S) 1 See remark 5.3 (S) 2.

5.3.4.2 Current and loop resistance

Reference is made to figure 5.3.d.

During the interdigital pause there shall be a period ($t_{6^*} - t_5$) during which the loop current shall be above the limits shown in figure 5.3.d or the resistance between the line terminals shall not be greater than R_m as shown in table 5.3.4.2.

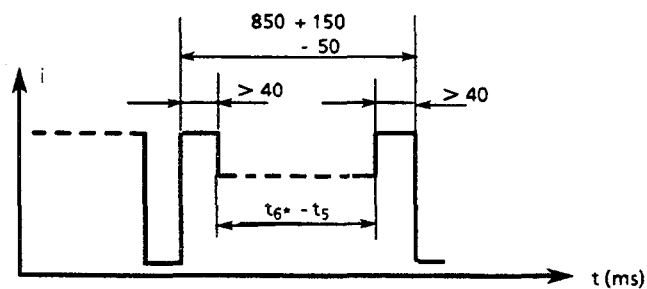
The values of current I_5 and I_6 and the resistance R_m are defined in table 5.3.3.2.

Compliance shall be checked using the test outlined in section A.5.3.4.2.

Table 5.3.4.2: Current and loop resistance

COUNTRY	REQUIREMENT VALUES		Remarks
	$(t_{6^*} - t_5)$ (ms)	R_m (Ω)	
Austria			yes
Belgium	400		
Cyprus	not mandatory		
Denmark		200	yes
Finland	not mandatory		
France	800		yes
Germany		480	
Greece	$(t_h - t_g) - 80$		
Iceland		not mandatory	
Ireland		not mandatory	
Italy	750 - 1 000		
Luxembourg		not mandatory	
Malta			
Netherlands	700		
Norway			
Portugal			yes
Spain			yes
Sweden			yes
Switzerland	auto. 620 - 1 000 real time \geq 620		
U. Kingdom			yes

5.3.4.2 (A) 1



For the values of resistance R , for the time $t_{6^*} - t_5$, see table 2.3

Figure 5.3.4.2 (A) 1: Current and loop resistance

5.3.4.2 (DK) 1

The value of the resistance between the line terminals shall not be greater than $R_m = 200$ ohms during a period of at least 5 ms after the last break pulse for each digit.

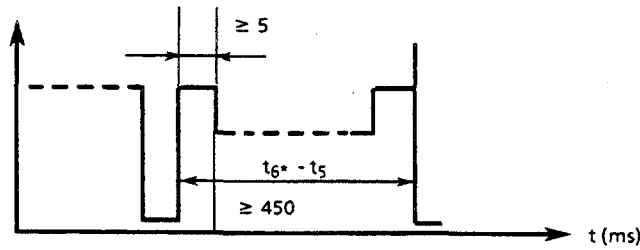


Figure 5.3.4.2 (DK) 1

5.3.4.2 (F) 1 The loop current shall be lower than 75 mA. However, the loop current may exceed 75 mA (80 mA from 1 st January 1992) for periods no longer than 5 ms.

5.3.4.2 (P) 1 $(t_5 - t_9)(ms) = 4$

$t_6^* = t_h^*$

5.3.4.2 (P) 2 During the period $(t_6^* - t_5)$ the loop current and the voltage at the line terminals of the TE shall comply with the limits of figure 5.3.4.2 (P) 2.

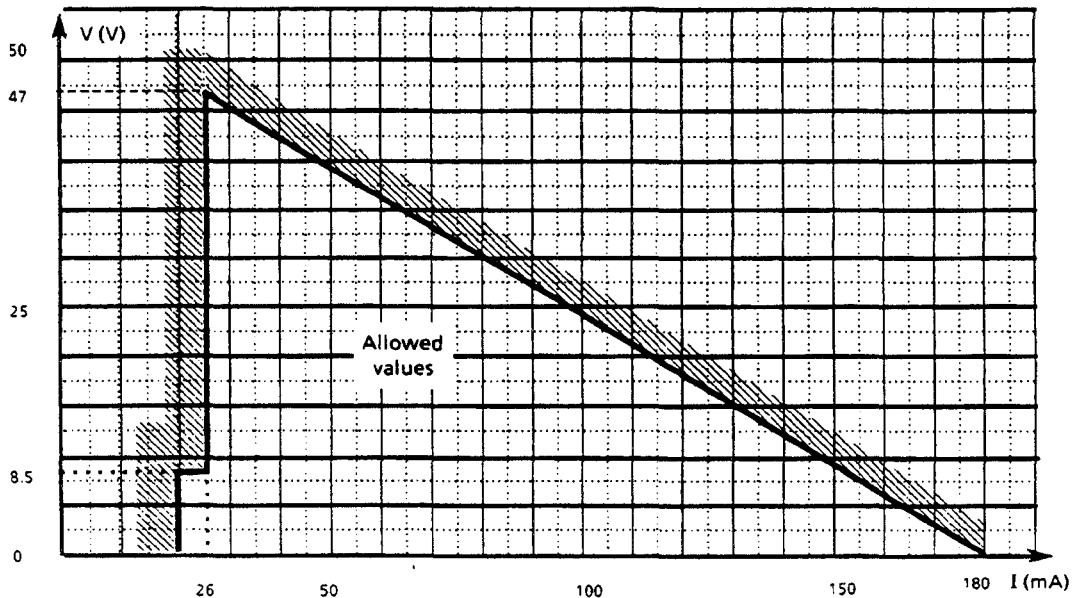


Figure 5.3.4.2 (P) 2: Interpulsing period current and loop resistance

5.3.4.2 (E) 1 See also the requirements in sections 5.3.1.2, 5.3.1.2 (E) 1, 5.3.1.2 (E) 2, and 10.5 (E) 6.3.

The resistance (R_m) shall be tested at dc loop currents between 18,5 mA and 100 mA.

Compliance shall be checked by the tests outlined in section A.5.3.4.2 (E) 1.

5.3.4.2 (S) 1 See remark 5.3 (S) 2.

5.3.4.2 (GB) 1 The loop current in the interdigital pause is not specified, as stated in 5.3.1.2 (GB) 1.

The TE shall be capable of accepting, storing and transmitting digits when interruptions in the loop current occur during the interdigital pause that

- a) have a duration of not greater than 110 ms;
- b) start not less than 90 ms, and finish not more than 620 ms after the preceding make transition.

See remark A.5.3.5 (GB) 1.

A.5.3.4.2 Current and loop resistance

Reference is made to figures 5.3.d and A.5.3.

The TEUT is caused to emit a dialling signal of two successive pulse trains.

For the feeding conditions specified in table A.5.3 the values of the current I_t and, if needed, the voltage V_t during the interdigital pause are registered.

Depending on the requirements and during a period ($t_6^* - t_5$), the loop current I_t shall be above the current limits specified,

or

the resistance R_t between the line terminals is calculated according to formula A.5.3.4.2:

$$R_t = \frac{V_t}{I_t} \qquad \text{Formula A.5.3.4.2}$$

and shall not be greater than the value R_m specified in table 5.3.3.2

Table A.5.3.4.2: Current and loop resistance

COUNTRY	TEST VALUES	Remarks
Austria		
Belgium		
Cyprus	not mandatory	
Denmark		
Finland	not mandatory	
France		
Germany		
Greece		
Iceland	not mandatory	
Ireland	not mandatory	
Italy		
Luxembourg	not mandatory	
Malta		
Netherlands		
Norway		
Portugal		
Spain		yes
Sweden		yes
Switzerland		
U. Kingdom	see earlier remark	yes

A.5.3.4.2 (E) 1 The procedure of test in section A.5.3.3.2 (E) 1 is followed.

A.5.3.4.2 (S) 1 See remark 5.3 (S) 2.

5.3.5 Post pulsing period

Reference is made to figure 5.3.b.

From the time t_7 that the TEUT completes the last break pulse in the last pulsing period until the time t_8 that the TE reverts to loop condition from the dialling state, the value of the loop current shall be above the limits shown in table 5.3.5.

The interval ($t_8 - t_7$) is defined in table 5.3.5. The current I_1 as defined in table 5.3.2.

Compliance shall be checked using the test outlined in section A.5.3.5.

Table 5.3.5: Post pulsing period

COUNTRY	REQUIREMENT VALUES			Remarks
	$t_8 - t_7$ (ms)	I_7 (mA)	R_{po} (Ω)	
Austria	40 - 400	not mandatory	350	yes
Belgium	≥ 30	20		
Cyprus		not mandatory		
Denmark	5 - 900		200	
Finland		not mandatory		
France	0 - 1 000	17		yes
Germany	650 - 1 300		480	
Greece	≤ 100	I_f		
Iceland		not mandatory		
Ireland		not mandatory		
Italy	1 000	18		
Luxembourg	650 - 1 300		480	
Malta				
Netherlands		not mandatory		
Norway				
Portugal				yes
Spain	$\leq 1 200$	not applicable	400	yes
Sweden				yes
Switzerland	40 - 1000		see sec. 5.3.3.2	
U. Kingdom	28	not specified	not specified	yes

5.3.5 (A) 1

The time $t_8 - t_7$ may be for dials 10 ms - 400 ms.

5.3.5 (A) 2

The time of the post pulsing period shall be in relation to the time t_s in section 5.5.

5.3.5 (F) 1

The loop current shall be lower than 75 mA. However, the loop current may exceed 75 mA for periods no longer than 5 ms.

5.3.5 (P) 1

During the period ($t_8 - t_7$) the loop current and the voltage at the line terminals of the TE shall comply with the limits of figure 5.3.5 (P) 1.

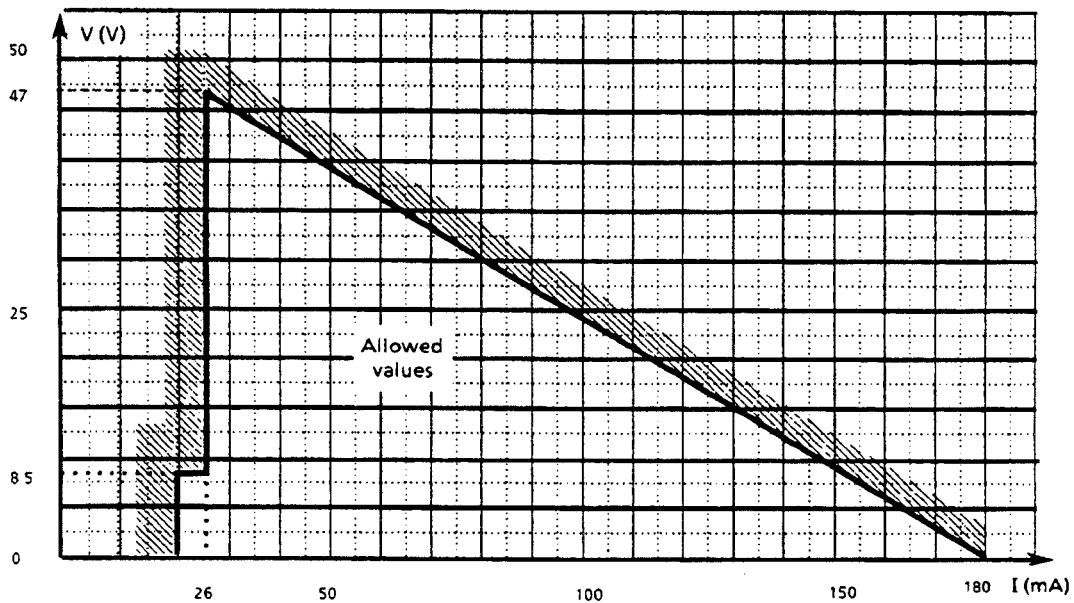


Figure 5.3.5 (P) 1: Post-pulsing period

5.3.5 (P) 2 $(t_7 - t_e)(ms) = 4$

5.3.5.(E) 1 The resistance (R_{p0}) shall be tested at dc loop currents between 18,5 mA and 100 mA.

PROVISION 1: For TE that, after the rear edge of the last break pulse for the last digit, activate acoustic transducers, that activation shall not be done before the first 25 ms are elapsed.

PROVISION 2: The provision 1 is not applied when only acoustic transducers involved are intended to be used for the purpose of listening and placed far from the ear.

5.3.5 (S) 1 See remark 5.3 (S) 2.

5.3.5 (S) 2 When a digit has been completely pulsed, the pulsing contact shall remain closed from the end of the last break period until the connection of the impedance of the equipment. This connection should take place at the earliest 25 ms and at the latest 100 ms after the end of the last break period. The impedance of the equipment shall be connected and the receiving part of the speech circuit shall be active at the latest 150 ms after the end of the last break period.

5.3.5 (GB) 1 The minimum current in the post pulsing period is not specified, as stated in 5.3.1.2 (GB) 1.

The TE shall be immune to interruptions in the loop current occurring during the post pulsing condition, as specified in 5.3.4.2 (GB) 1.

A.5.3.5 Post pulsing period

Reference is made to figures 5.3.b and A.5.3.

The TEUT shall be caused to emit a pulse train of at least 1 break pulse.

For the feeding conditions specified in table A.5.3, the values of the current I_t and, if needed, the voltage V_t after the last break pulse are registered, as specified in 5.3.5.

Depending on the requirement and during a period ($t_8 - t_7$), the loop current value I_t shall be above the current limits specified,
or
the resistance R_t between the line terminals is calculated according to formula A.5.3.5

$$R_t = \frac{V_t}{I_t} \quad \text{Formula A.5.3.5}$$

and shall not be greater than the value R_{po} specified in table 5.3.5.

Table A.5.3.5: Post pulsing period

COUNTRY	TEST VALUES	Remarks
	I_f (mA)	
Austria	19, 60	
Belgium		
Cyprus	not mandatory	
Denmark		
Finland		
France		
Germany		
Greece		
Iceland	not mandatory	
Ireland	not mandatory	
Italy		
Luxembourg	not mandatory	
Malta		
Netherlands	not mandatory	
Norway		
Portugal		
Spain		yes
Sweden		yes
Switzerland		
U. Kingdom		yes

A.5.3.5 (E) 1

The tests are undertaken for each polarity of the voltage source (V_f).

The procedure of test in section A.5.3.3.2 (E) 1 is followed when the resistance (R_{po}) is tested.

A.5.3.5 (S) 1

See remark 5.3 (S) 2.

A.5.3.5 (GB) 1

Compliance with the requirements for immunity to interruptions in the loop current specified in 5.3.4.2 (GB) 1 and 5.3.5 (GB) 1 shall be checked as follows:

An interruption of duration 110 ms starting 90 ms after the last make transition before the i.d.p. or post pulsing state is introduced. The TEUT shall continue to operate as specified in 5.3 in the presence of this interruption when connected, as shown in figure A.5.3. This test is repeated with an interruption of duration 110 ms starting 510 ms after the last make transition.

5.3.6 Spark quenching

Spark quench circuitry shall be incorporated into the TE. This circuitry shall be connected, or have the electrical effect of being connected, in parallel with the loop current interrupter. The circuitry should have the same electrical effect as a series circuit made up of a resistor with a value in the range R_1 to R_2 , and a capacitor with a value in the range C_1 to C_2 and which is placed in parallel with metallic contacts that open and close to cause the loop current to be interrupted.

The values of R_1 , R_2 , C_1 , C_2 are shown in table 5.3.6.

Compliance shall be checked using the test outlined in section A.5.3.6.

Table 5.3.6: Spark quenching

COUNTRY	REQUIREMENT VALUES				Remarks
	R_1 (Ω)	R_2 (Ω)	C_1 (μF)	C_2 (μF)	
Austria	200	240	0,9	1,1	yes
Belgium	100	> 100	0,1	1,5	
Cyprus	not mandatory				
Denmark	300	1 000	0,09	0,55	
Finland	not mandatory				
France					
Germany	not mandatory				
Greece	100	200		1,5	
Iceland	not mandatory				
Ireland	not mandatory				
Italy					yes
Luxembourg	not mandatory				
Malta					
Netherlands					yes
Norway					
Portugal	not mandatory				
Spain	not mandatory				yes
Sweden	540	660	1,8	2,2	yes
Switzerland					yes
U. Kingdom	not mandatory				yes

- 5.3.6 (A) 1** The same RC-combination shall be connected in parallel to equivalent electronic circuitries.
- 5.3.6 (I) 1** During the dialling function the pulse voltage across the apparatus terminals or leads provided for connection to the network should be in the range 120 - 300 V.
- 5.3.6 (NL) 1** V_t shall be limited to a peak value of between 95 and 140 volts.
- 5.3.6 (E) 1** NOTE: Reference is made to the requirement in section 10,5 (E) 6.2.d.
- 5.3.6 (S) 1** Compliance, see remark 5.3 (S) 2.
- 5.3.6 (CH) 1** Spark quenching is of aspect 1; together with other measurements it forms part of the EMC requirements: "Disturbances at the telecommunication signal ports".
- 5.3.6 (GB) 1** Distortion: The dialling performance of the TE shall be adequate for normal operation under extremes of conditions and configurations.
- 5.3.6 (GB) 2** Unless the supplier declares that the series-connected TE is intended for use only with TE that cannot generate decadic dialling, the dial distortion introduced by the series-connected TE shall be not greater than 2%. Compliance shall be checked by the test described in A.5.6.3 (GB) 2.

A.5.3.6 Spark quenching

The TE is connected as shown in figure A.5.3.6.

With the dc feeding parameters V_f and R_{f1} applied, the TE is caused to assume dialling state and to emit a pulse train to the PSTN.

The time constant T_1 due to an equipment capacitance C_x is determined by noting the time at which the voltage across the line terminals has reached 63% of its final value or when the line current has dropped to 63% of its peak value.

The measurement is repeated with a second set of feeding parameters V_f and R_{f2} , and time constant T_2 is determined. The values of R_x and C_x are calculated using formulas A.5.3.6.a and A.5.3.6.b:

$$R_x = \frac{(T_1 \times R_{f2}) - (T_2 \times R_{f1})}{T_2 - T_1} \quad \text{Formula A.5.3.6.a}$$

$$C_x = \frac{T_1}{R_{f1} + R_x} \quad \text{Formula A.5.3.6.b}$$

The values of V_f , R_{f1} , R_{f2} are shown in table A.5.3.6.

Table A.5.3.6: Spark quenching

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_{f1} (Ω)	R_{f2} (Ω)	
Austria	60	2 000	3 500	
Belgium	48	2 000	3 500	
Cyprus	not mandatory			
Denmark	56	1 000	3 000	
Finland	not mandatory			
France				
Germany				
Greece	60	1 500	2 400	
Iceland	not mandatory			
Ireland	not mandatory			
Italy	44, 48, 52	1 880, 1 100, 720		yes
Luxembourg	not mandatory			
Malta				
Netherlands	66	800		yes
Norway				
Portugal	not mandatory			
Spain	not mandatory			
Sweden				yes
Switzerland	not mandatory			
U. Kingdom	not mandatory			yes

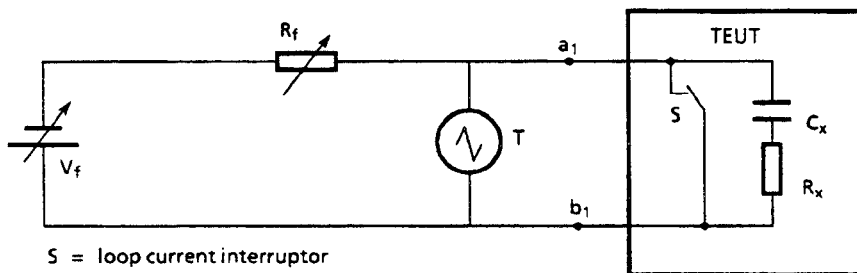


Figure A.5.3.6: Spark quenching

A.5.3.6 (I) 1 The TE is connected as shown in figure A.5.3.6 (I) 1.

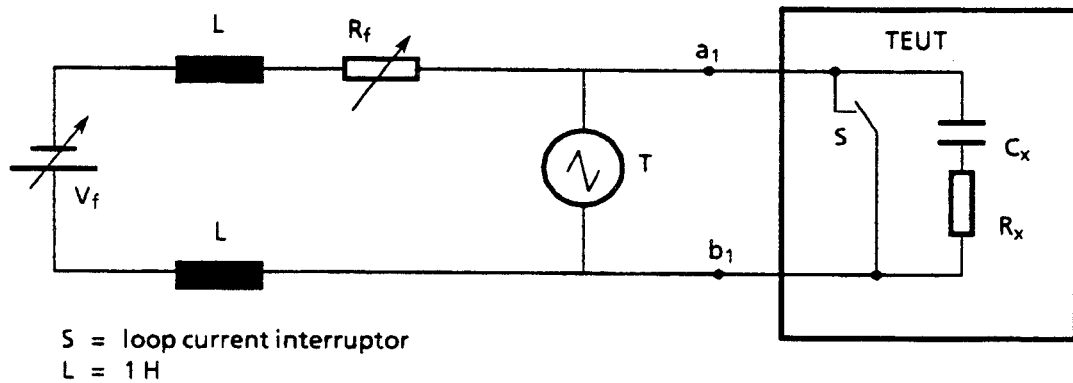


Figure A.5.3.6 (I) 1: Spark quenching

A.5.3.6 (NL) 1 Measurement according to figure A.5.3.6 (NL) 1. Inductance $L = 12 \text{ H}$.

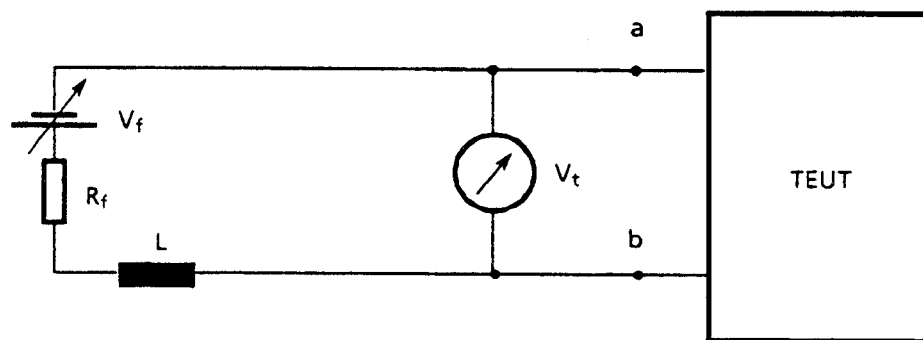


Figure A.5.3.6 (NL) 1: Spark quenching

A.5.3.6 (S) 1 See remark 5.3 (S) 2.

A.5.3.6 (GB) 1

- 1) The object of these tests is to compare the performance of the TE with the performance of two standard reference dialling sources, each operating at an extreme of the specified range of the characteristic being tested.

The TE to be tested is connected to a typical installation specified in Chapter 8 and $n-1$ similar items of apparatus are plugged into parallel sockets, where "n" has the value determined in Chapter 3 for calculation of the REN. A reference instrument is plugged into another socket.

Two tests are made. First, the performance of the reference instrument in dialling conditions with all other items of TE connected and in the quiescent condition, is evaluated. Second, the performance of the TEUT with all other items of TE including the reference instrument in the quiescent state is evaluated.

- 2) The two reference sources consist of pulsing contacts in parallel with a spark-quench circuit as shown in figure A.5.3.6 (GB) 1.1. The pulsing contacts are non-reactive passive components of resistance not exceeding 50 ohms. The spark-quench circuit consists of the connection of a $1,8\mu\text{F}$ capacitor and 100 ohm resistor in series, as shown. The electrical characteristics are:

Reference 1: 11 pulses per second, 63% break period.

Reference 2: 9 pulses per second, 72% break period.

- 3) The test procedure is carried out for each of the two detection elements shown in figure A.5.3.6 (GB) 1.2.
- 4) The test circuit is shown in figure A.5.3.6 (GB) 1.3. Terminals A' and B' are for connection of a reference source or the simulated installation as appropriate. The artificial line consists of the required number of the line segments shown in figure A.5.3.6 (GB) 1.4. The pulse detector is one of the two circuits shown in figure A.5.3.6 (GB) 1.2. Pulses are generated from the reference source or simulated installation, which connected to the test circuit, and the ninth or tenth pulse in a train of 10 successive pulses (that is, the digit "0") is examined at the output of the pulse detector. The break period is measured.

NOTE: The generation of pulses for each measurement should begin not less than 1 s after the reference instrument or TEUT, as appropriate, has been placed in the on-line state.

For each of the configurations described, measurements are repeated with artificial line lengths of:

- zero;
- 6 km.

Measurements are made with the two different detectors in the test circuit, that is:

- pulse detection circuit (a) of figure A.5.3.6 (GB) 1.2;
- pulse detection circuit (b) of figure A.5.3.6 (GB) 1.2.

The test is initiated by taking measurements with each of the two reference sources placed in turn at the input to the test circuit, that is:

- Reference 1;
- Reference 2.

The two values obtained for the two reference sources determine the upper and lower limits of the range of output pulse duration with which the values of output pulse duration of the installation under test are to be compared. Four such ranges are obtained for comparison under each of the four different conditions obtaining with different line lengths and pulse detectors.

Finally, the simulated installation is connected to the test circuit and measurements are made for each of the two configurations described in 1, that is:

- Reference instrument signalling;
- TEUT signalling.

The two values obtained are compared with the range determined under reference conditions, for each of the four combinations of the line length and pulse detector previously described.

For the purpose of this test, the reference instrument is a telephone that meets the dialling requirements of Chapter 5, but with a rate of pulsing of $10 \pm 0,2$ pulses per second and a break period of $67\% \pm 1\%$, when connected to the typical installation with no other TE connected in parallel.

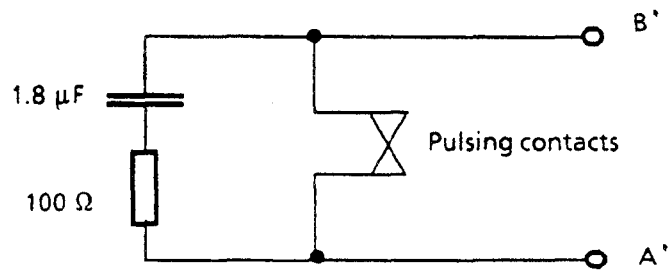
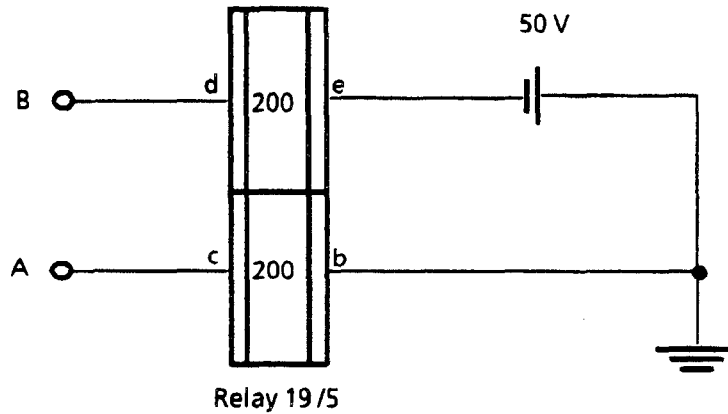


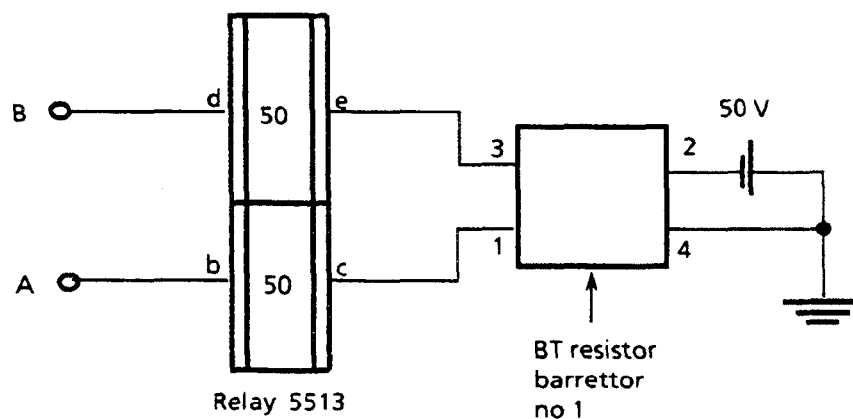
Figure A.5.3.6 (GB) 1.1: Reference source



- a) Resistance per coil: $200 \Omega \pm 10\%$
 $i_{\text{operate}} \leq 14 \text{ mA}$
 $i_{\text{release}} \geq 4,5 \text{ mA}$
 Armature travel: $0,64 \pm 0,05 \text{ mm}$
 Residual gap: $0,30 \pm 0,05 \text{ mm}$

Terminals A and B connect to circuit under test.

Figure A.5.3.6 (GB) 1.2.a: Pulse detection circuit



- b) Resistance per coil: $50 \Omega \pm 10\%$
 $i_{\text{operate}} \leq 24 \text{ mA}$
 $i_{\text{release}} \geq 10 \text{ mA}$
 Armature travel: $0,64 \pm 0,05 \text{ mm}$
 Residual gap: $0,28 \pm 0,05 \text{ mm}$

Figure A.5.3.6 (GB) 1.2.b: Pulse detection circuit

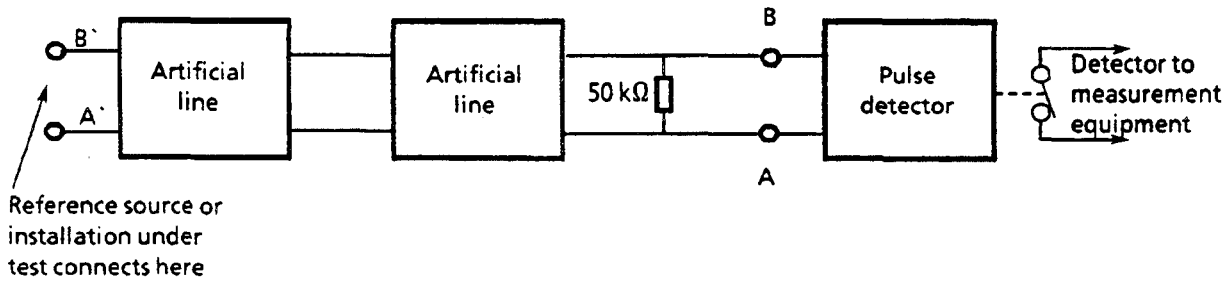


Figure A.5.3.6 (GB) 1.3: Scheme of measurement circuit

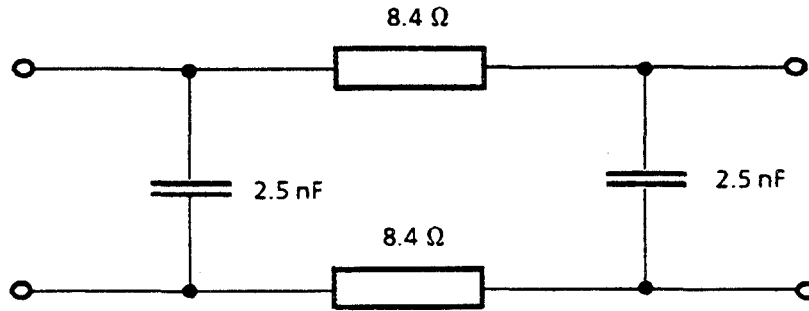


Figure A.5.3.6 (GB) 1.4: Artificial line segment, 0,1 km length

A.5.3.6 (GB) 2

The test circuit consists of the pulse detection circuits shown in figures A.5.3.6 (GB) 1.2 and an artificial line as described in figure A.5.3.6 (GB) 1.4 arranged as shown in figure A.5.3.6 (GB) 1.3.

A reference source, as shown in figure A.5.3.6 (GB) 1.1 with a dialling frequency of $10 \text{ Hz} \pm 0,2 \text{ Hz}$ and a break period of $67 \pm 1\%$ is connected to terminals A' and B'. The series-connected TEUT is connected between the reference source and terminals A' and B' of the test circuit. Trains of ten successive pulses are generated by the reference source and the break period of the ninth or tenth pulse is examined at the output of the pulse detection circuit for each pulse detector (a) and (b) and for the line lengths of 0 km (zero) and 6 km.

Two sets of measurements are made as shown in table A.5.3.6 (GB) 2.

For measurements 1, 3, 5 and 7, the reference source is connected directly to terminals A' and B'; for measurements 2, 4, 6 and 8, the series-connected TEUT is connected between the reference source and terminals A' and B'.

The measured break periods are expressed as percentages of the total test period, giving values T_1 to T_8 for the different test configurations as given in table A.5.3.6 (GB) 2.

The pulse distortion introduced by the series-connected TEUT in each of the four conditions is calculated as $T_2 - T_1$, $T_4 - T_3$, $T_6 - T_5$ and $T_8 - T_7$.

Table A.5.3.6 (GB) 2: Pulse distortion test conditions

Measurement number	Artificial line length (km)	Pulse detection circuit	Series-connected TEUT	Break period %
1	0	(a)	out	T ₁
2	0	(a)	in	T ₂
3	6	(a)	out	T ₃
4	6	(a)	in	T ₄
5	0	(b)	out	T ₅
6	0	(b)	in	T ₆
7	6	(b)	out	T ₇
8	6	(b)	in	T ₈

5.4 Dialling with MFPB (DTMF) tone bursts

5.4.1 General requirements

TE using MFPB (DTMF) signalling shall, whilst in the signalling state, meet requirements for loop condition outlined in sections 2.2.2, 2.3, 4.1.2, and 4.2 of this document.

Compliance shall be checked using the relevant tests.

Table 5.4.1: General requirements for MFPB dialling

COUNTRY	REQUIREMENT VALUES				Remarks
	2.2.2	2.3	4.1.2	4.2	
Austria	no	yes	yes	yes	
Belgium	yes	yes	yes	yes	yes
Cyprus	no	yes	yes	yes	
Denmark	yes	yes	yes	yes	yes
Finland	no	yes	no	no	
France	yes	yes	yes	yes	
Germany	no	yes	yes	no	yes
Greece	yes	yes	yes	yes	
Iceland	yes	yes	yes	yes	
Ireland	yes	yes	yes	yes	
Italy	yes	yes	yes	yes	
Luxembourg	yes	yes	yes	yes	
Malta					
Netherlands	yes	yes	yes	yes	
Norway	not mandatory				
Portugal	yes	no	yes	yes	yes
Spain					yes
Sweden	yes	yes	yes	yes	
Switzerland	yes	yes	yes	yes	
U. Kingdom	no	yes	yes	yes	yes

5.4.1 (B) 1

Specific requirement values for section 4.2.1.2 (LCL for one-port TE in loop condition) and for section 4.2.2.2 (LCL and LCTL of series-connected TE in loop condition). In tables 4.2.1.2 and 4.2.2.1, the following values are appreciable whilst in MFPB signalling state:

- V_f (V) = 48
- I_f (mA) = 20 - I_{max} .
- α_{q1} (dB) = 40
- Δ_{f1} (Hz) = 40 - 300
- α_{q2} (dB) = 50
- Δ_{f2} (Hz) = 300 - 600
- α_{q3} (dB) = 55
- Δ_{f3} (Hz) = 600 - 3 400

5.4.1 (DK) 1

A telephone set shall be provided with MFBP (DTMF).

5.4.1 (D) 1

In the dialling state, the source impedance (internal generator resistance) of the oscillator shall correspond to Z_R .

Frequency f = 600 - 1 700 Hz; transmitting level P_s = -10 dB (775 mV).
The return loss shall be ≥ 18 dB.

5.4.1 (P) 1 During the dialling state, the loop current shall be not lower than 20 mA, for feeding voltages from 45 V to 55 V applied to the line terminals of the TE through resistances from 400 ohms to 1 800 ohms.

Compliance shall be checked by the test outlined in section 2.3.

5.4.1 (E) 1 See general requirements in section 10.5 (E) 7.1.

5.4.1 (GB) 1 TE in impedance class (b) shall have a return loss of not less than 11 dB with respect to a 600 ohm resistive load in the frequency range 300 to 3 400 Hz, during MFPB signalling. See 4.1.2 (GB) 1 for definition of impedance class (b).

5.4.2 Signalling frequencies and format

For each digit or special signalling character provided on a TE, two frequencies shall be assigned, one from each of two groups of four frequencies as outlined in table 5.4.2.a.

The frequencies shall be generated simultaneously such that the resultant combination of signals appears across the line terminals.

These frequencies shall be maintained to within n% of the nominal values shown in table 5.4.2.a over the range of dc feeding conditions given in table 5.4.2.b.

Compliance shall be checked using the test outlined in section A.5.4.2.

Table 5.4.2.a: Signalling frequency groups

Signalling frequencies (Hz)	
Low frequency group	High frequency group
697	1 209
770	1 336
852	1 477
941	1 633

Table 5.4.2.b: MFPB frequency groups and format, feeding conditions

COUNTRY	REQUIREMENT VALUES				Remarks
	V _f (V)	R _f (Ω)	I _f (mA)	n (%)	
Austria	60		19 - 60	± 1,5	
Belgium	48		20 - I _{max.}	1,5	
Cyprus	48	440 - 1 740	20 - 100	1,5	
Denmark			16 - I _{max.}	1,5	
Finland	48	800 - 1 710		± 1,5	
France	46 - 54 89 - 104	300 - 1 400 1 400 - 2 960		1,5	
Germany	60	1 000 - 2 530		± 1,8	
Greece	44 - 66		20 - 80	± 1,6	
Iceland	48		14 - I _{max.}	± 1,5	
Ireland	48		20 - 100	± 1,5	
Italy	44 - 52	720 - 1 880		± 1,5	
Luxembourg	60		19 - 60	± 1,5	
Malta					
Netherlands	42 - 66	800 - 2 140		1,5	
Norway	60	adjustable	15 - I _{max.}	1,5	yes
Portugal	45 - 55	400 - 1 800	not applicable	1,5	
Spain	48	500 - 2 200		1,5	yes
Sweden				1,5	yes
Switzerland	43 - 57	2 200 - 600		± 1,5	
U. Kingdom	50	≥ 400	25 - 100	1,5	

5.4.2 (N) 1 Maximum line current, I_{max}, is defined in Chapter 1, section 1.5.1 (N) 1.

5.4.2 (E) 1 The frequency tolerance shall be maintained within the range stipulated, when the output signal is applied to a load resistor (Z_L) between 400 ohms and 900 ohms.

5.4.2 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.

A.5.4 Dialling with MFPB (DTMF) tone bursts

A.5.4.2 Signalling frequencies and format

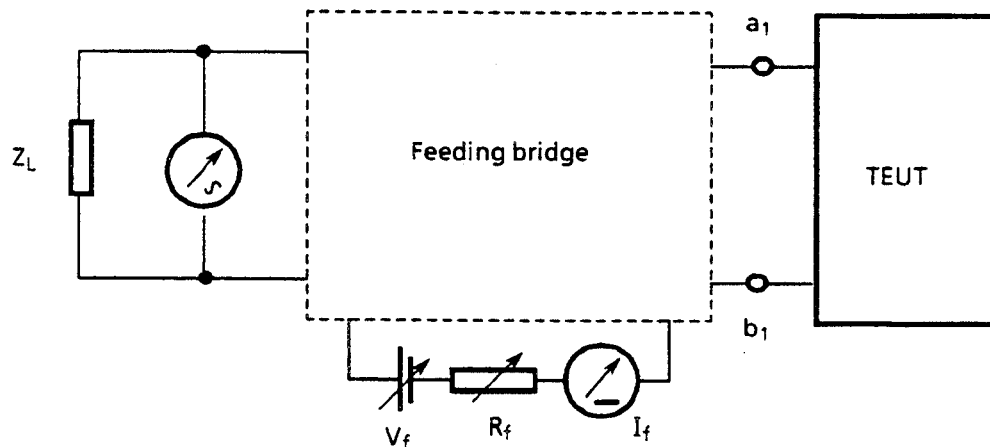
The TEUT is connected as shown in figure A.5.4.2 and placed in the signalling state. The MFPB sender is caused to output, in turn, all provided combinations of the signalling frequencies.

The frequency of each output signal is evaluated using an instrument capable of measuring each signal frequency with an accuracy better than ± 0,2%.

This accuracy requirement shall be met for continuous signals as well as for bursts of signal of 50 ms duration separated by 40 ms intervals of no signal output.

Measurements are carried out at various dc feeding condition values shown in table A.5.4.2.

The load impedance value Z_L is shown in Table A.5.4.2.



Feeding bridge as specified in Chapter 1
Figure A.5.4.2: Signalling frequencies and format

Table A.5.4.2: Signalling frequencies and format

COUNTRY	TEST VALUES				Remarks
	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	600	60		19, 60	
Belgium	600	48	400, 1 600		
Cyprus	600	48	800		
Denmark	600			16, $I_{max.}$	
Finland	600	48	800, 1 710		
France	600	46, 54	1 400 resp. 300		
Germany	220 + 820/115 nF	60	1 000, 2 530		
Greece	600	60		20, 35	
Iceland	600	48		14, $I_{max.}$	
Ireland	600	48		20, 100	
Italy	600	44, 48, 52	1 880, 1 100, 720		
Luxembourg	600	60		19, 60	
Malta					
Netherlands	600	42, 48, 66	800, 1 130, 2 140		
Norway	600	60	adjustable	15 - $I_{max.}$	
Portugal	600			not applicable	yes
Spain	600	48	500, 1 100, 2 200		yes
Sweden	600				yes
Switzerland	600	43, 48, 57	2 200, 1 200, 600		
U. Kingdom	600	50	400	40	yes

A.5.4.2 (P) 1	V_f (V)	R_f (Ω)
	45	1 800
	55	400

A.5.4.2 (E) 1 The input impedance of the instrument (or DTMF analyser) shall be greater than 50 k Ω .

When the frequency tolerance is tested, the tests are undertaken for each polarity of the voltage source (V_f), and the load resistor (Z_L) takes also the values of 400 ohms and 900 ohms.

A.5.4.2 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.

A.5.4.2 (GB) 1 Measurements are carried out with $I_f = 40$ mA, or the current obtained when the TEUT is connected to a 50 V dc source in series with a 400 ohm resistor, whichever is the less.

5.4.3 Signalling codes

The sixteen combinations assigned to digits or special signalling characters are shown in the matrix in Table 5.4.3.a.

Table 5.4.3.a: Signalling combinations

Low group (Hz)	High group (Hz)			
	1 209	1 336	1 477	1 633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

The TE may use only 10 signalling frequency combinations, in which case the frequencies assigned to characters *, #, A, B, C, and D are not used.

Alternatively, the TE may use 12 signalling frequency combinations, in which case the frequencies assigned to characters A, B, C, and D are not used.

Compliance shall be checked using the test outlined in section A.5.4.3.

Table 5.4.3.b: Signalling codes

COUNTRY	REQUIREMENT VALUES	Remarks
Austria		
Belgium		
Cyprus		yes
Denmark		yes
Finland		
France		
Germany		
Greece		
Iceland		
Ireland		
Italy		
Luxembourg		
Malta		
Netherlands		
Norway	Only ABCD not mandatory	
Portugal		
Spain		yes
Sweden		yes
Switzerland		
U. Kingdom	not specified	

- 5.4.3 (CY) 1 Signalling combinations used are as in table 5.4.3.a with A, B, C, D not mandatory.
- 5.4.3 (DK) 1 At least 12 signalling frequency combinations are required.
- 5.4.3 (F) 1 A, B, C, D are optional, but all other frequency combinations are required.
- 5.4.3 (F) 2 Symbols *, #, A, B, C and D are exclusively devoted to send the corresponding DTMF signals. However, for keyboards with both decimal and DTMF dialling, symbol * shall give the transfer to DTMF mode (symbol # may be an additional possibility for this transfer).
- 5.4.3 (E) 1 When the TE is not able to generate the signalling codes that correspond to the symbols * and #, then the user's manual shall include within a square the following sentence:

"Este equipo terminal no es capaz de generar los códigos de señalización multifrecuencia * y # (estrella y cuadrado), los cuáles pueden ser necesarios para el acceso a algunas de las facilidades suplementarias de la red".

NOTE: The equivalent English sentence is: "This TE is not able to generate the multifrequency signalling codes * and # (star and square), which may be needed for access to certain supplementary facilities in the network".

It shall be checked, when necessary, whether the user's manual includes the required sentence.

5.4.3 (S) 1 See remark 10.5 (S) 1.

A.5.4.3 Signalling codes

Correspondence between selected signalling characters and their related frequency pairs shall be checked using the data obtained in test A.5.4.2.

5.4.4 Sending levels

The sending levels across a load impedance Z_L for frequencies in each group shall differ and be defined by the values according to the option described in table 5.4.4.a. In either case, the value of the level of the higher frequency component of the compound signal shall be $2 \text{ dB} \pm 1 \text{ dB}$ greater than the value of the level of the lower frequency component.

The requirement shall be met in the presence of dial tone signals of level "b" and frequency "f".

Measurements are carried out at the various dc feeding condition values shown in table 5.4.2.b.

The TE should be submitted for test with a declaration of which option has been selected for evaluation.

The parameter values Z_L , "b", and "f" are shown in table 5.4.4.b.

Compliance shall be checked using the tests outlined in section 1.5.4.

Table 5.4.4.a: Sending levels options

	Sending level options	
	Option 1	Option 2
High group	$-9 \text{ dBm} \pm 2 \text{ dB}$	$-6 \text{ dBm} \pm 2 \text{ dB}$
Low group	$-11 \text{ dBm} \pm 2 \text{ dB}$	$-8 \text{ dBm} \pm 2 \text{ dB}$

Table 5.4.4.b: Sending levels

COUNTRY	REQUIREMENT VALUES					Remarks
	b (dBm)	Z _L (Ω)	f (Hz)	Option 1	Option 2	
Austria	-6,5	600	380 - 520	no	yes	
Belgium	-4	600	420 - 455	no	yes	yes
Cyprus	-7	600	350 + 450	no	yes	
Denmark	0	600	425	yes	no	
Finland	not mandatory	600	not mandatory	yes	yes	
France	-20	600	440	no	yes	yes
Germany	220 + 820 / 115 nF			no	no	yes
Greece	0	600	400 - 475	no	yes	
Iceland	0	600	425	yes	yes	
Ireland						
Italy	-6	600	350 - 550	no	yes	
Luxembourg	-6,5	600	380 - 490	no	yes	
Malta						
Netherlands	not mandatory	600	not mandatory	yes	no	
Norway	0	600	425	yes	no	
Portugal	-5	600	425	yes	no	
Spain		600		no	yes	yes
Sweden	-5	600	425	yes	no	
Switzerland	-6	600	375 - 550	no	yes	
U. Kingdom	not applicable	see remark	not applicable	see remark		yes

5.4.4. (B) 1

- 1) If current-regulated sending circuits are used, the CEPT Recommendation T/STI 46-04, section 2.3.2.2 applies.
- 2) For digital PABXs, one shall use the option 2 or the following levels: -4 ± 1 dBmO and -6 ± 1 dBmO for respectively the high group and the low group of the DTMF frequencies.

5.4.4 (F) 1

In addition, the maximum peak levels shall be lower than 3 V.

5.4.4 (D) 1

The transmitting level (sum level) of the frequencies shall be $P_{sn} = -4,5$ dB (775 mV) $\pm 2,5$ dB, referred to Z_R. The level shall be measured as rms value.

5.4.4 (D) 2

The pre-emphasis between the upper and lower frequency groups shall be $+2$ dB $\pm 1,5$ dB.

5.4.4 (E) 1

The requirement in section 10.5 (E) 7.3 shall be applied when dial tone is used.

5.4.4 (GB) 1

The level of the high and low signalling tones shall lie within the areas A and B respectively for different feed currents I_f as shown in figure 5.4.4 (GB) 1. The load impedance shall be either 600 ohms or the network shown in figure 4.1.2 (GB) 1 as appropriate to the impedance class used in 4.1.2 (GB) 1. Measurements are made at those values of I_f in the sequence specified in 1.5.2 (GB) 1.

This requirement and associated test are to be met by the TEUT in the absence of dial tone being applied.

The high group tone amplitude shall be between 1 and 4 dB greater than the low tone amplitude.

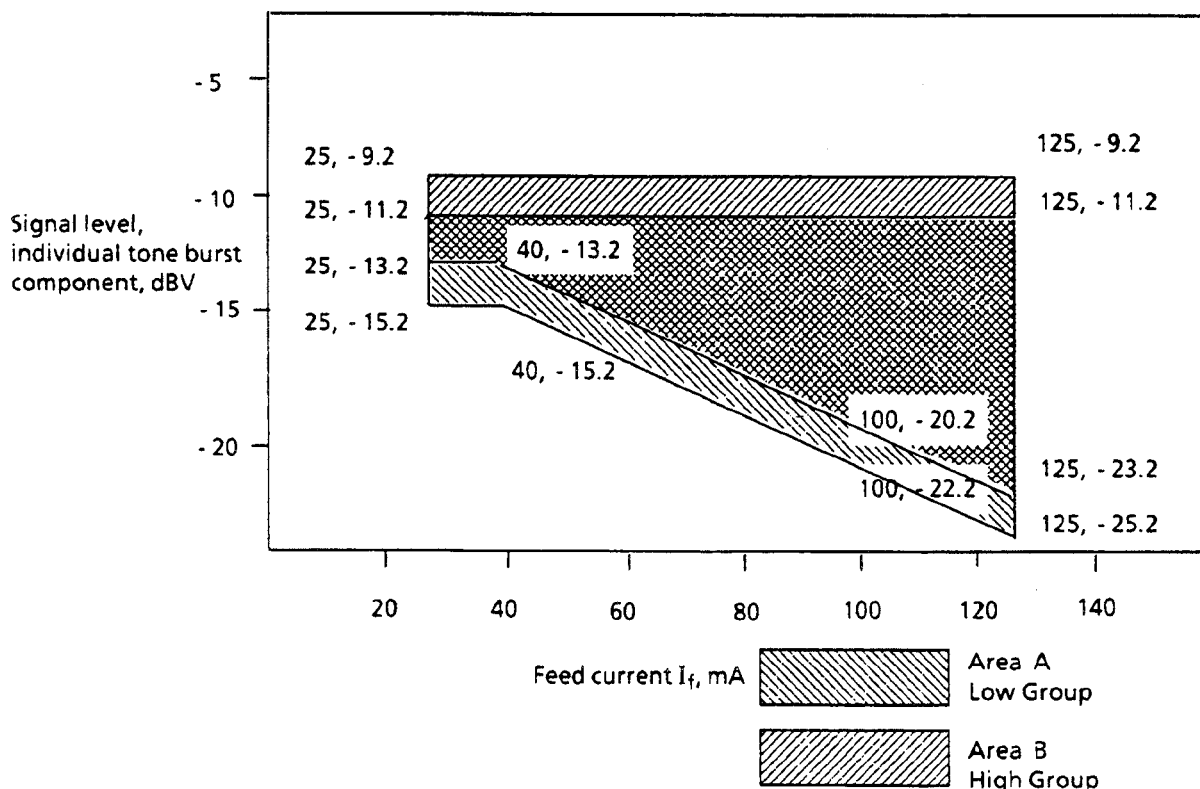


Figure 5.4.4 (GB) 1: Sending levels

A.5.4.4 Sending levels

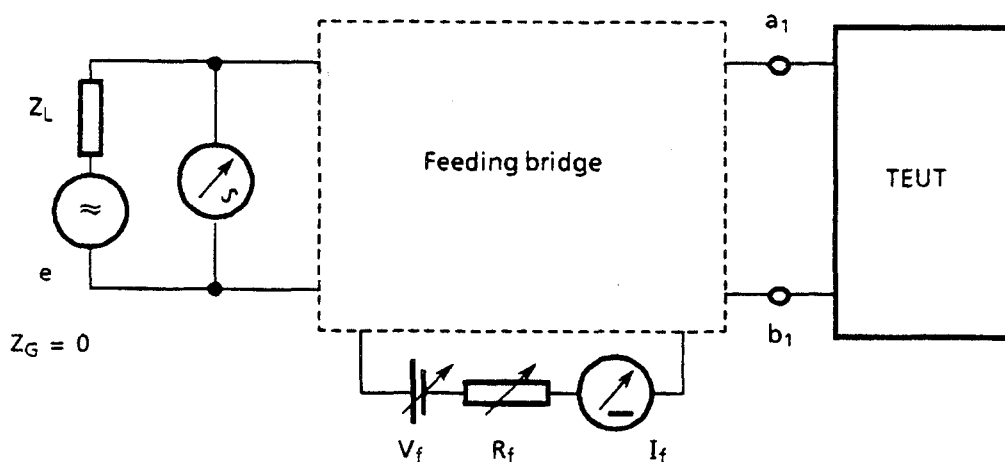
The TEUT is connected as shown in figure A.5.4.4 and placed in the signalling state. The MFPB sender is caused to output, in turn, all provided combinations of the signalling frequencies.

The level of each output signal is evaluated using an instrument capable of measuring each frequency component with an accuracy better than $\pm 0,2$ dB.

This accuracy requirement shall be met for continuous signals as well as for bursts of signal of 50 ms duration separated by 40 ms intervals of no signal output.

Dial tone is applied in accordance with table 5.4.4.b.

Measurements are carried out at various dc feeding condition values shown in table A.5.4.2.



Feeding bridge as specified in Chapter 1
Figure A.5.4.4: Sending levels

Table A.5.4.4: Sending levels

COUNTRY	TEST VALUES	Remarks
Austria	Dial: $f = 425 \text{ Hz}$, $p = -6,5 \text{ dBm}$, $Z_L = 600 \Omega$	
Belgium		
Cyprus	Dial tone: $350 + 450 \text{ Hz}$, $b = -7 \text{ dBm}$, $Z_L = 600 \Omega$	
Denmark		
Finland		
France		
Germany	mandatory	yes
Greece		
Iceland		
Ireland	mandatory	
Italy		
Luxembourg	mandatory	
Malta		
Netherlands	mandatory	
Norway	mandatory	
Portugal		yes
Spain		yes
Sweden		
Switzerland	Dial: $f: 425 \text{ Hz}$; $b: -6 \text{ dBm}$; $Z_L: 600 \Omega$	
U. Kingdom		yes

A.5.4.4 (D) 1

The test shall be performed for bursts of signal with 40 ms duration separated by 40 ms intervals of no signal output. No presence of dial tone is necessary.

- A.5.4.4 (P) 1 Same dc feeding condition values as in section A.5.4.2 (P) 1.
- A.5.4.4 (E) 1 The tests are undertaken for each polarity of the voltage source (V_f).
The AC signal generator (e) is changed for a short-circuit.
- A.5.4.4 (GB) 1 See 5.4.4 (GB) 1 for feeding conditions.

5.4.5 Unwanted frequency components

The TEUT shall be placed in the signalling state and caused to emit the frequencies corresponding to any given signalling character combination (see section 5.4.3). During the period in which the selected combination of frequencies causes a corresponding signal to appear across the load impedance Z_L :

- a) the total power level of all unwanted frequency components over the bandwidth 300 - 3 400 Hz shall be at least 20 dB below the level of the low-group frequency component of the signal;
- b) the level of any individual unwanted frequency component found in a bandwidth of 125 Hz shall not exceed the following limits:
- in the frequency band 300 - 4 300 Hz: -33 dBm;
 - in the frequency band 4 300 - 28 000 Hz: -37 dBm;
at 4 300 Hz falling 12 dB/octave to 28 kHz;
 - in the frequency band 28 - 150 kHz: -70 dBm.

The requirement shall be met at the dc feeding conditions specified in table 5.4.2.b.

The value of the load impedance Z_L and the use of the requirements "a" and "b" are shown in table 5.4.5.

Compliance shall be checked using the test outlined in section A.5.4.5.

Table 5.4.5: Unwanted frequency components

COUNTRY	REQUIREMENT VALUES			Remarks
	Requirement a	Requirement b	Z _L (Ω)	
Austria		X	600	
Belgium	X	X	600	yes
Cyprus	X		600	yes
Denmark	X	X	600	yes
Finland	not mandatory			
France	X		600	yes
Germany		X	220 + 820 / 115 nF	yes
Greece	X	X	600	
Iceland	X	X	600	
Ireland	X	X	600	
Italy	X	X	600	
Luxembourg		X	600	
Malta				
Netherlands	X	X	600	
Norway	X		600	
Portugal		X	600	yes
Spain				yes
Sweden			600	yes
Switzerland	X	X	600	
U. Kingdom	X	X	600	yes

5.4.5 (B) 1 When, in signalling state, no signal is output, the requirement in section 4.5 (noise level) is applicable.

5.4.5 (CY) 1 This requirement shall also be met during interdigital pauses.

5.4.5 (DK) 1 This requirement shall be met also during the interdigital pauses.

5.4.5 (DK) 2 For a telephone set the requirement "b" is:

- in the frequency band 300 - 4 300 Hz: -33 dBm;
- in the frequency band 4 300 - 16 200 Hz: - 37 dB at 4 300 Hz falling 12 dB/octave to 16 200 Hz;
- in the frequency band 16,2 - 150 kHz: -60 dBm.

5.4.5 (F) 1 The level of any individual unwanted frequency component found in a bandwidth of 100 Hz shall not exceed the following limits:

- in the frequency band 300 - 3 400 Hz: -33 dBm;
- in the frequency band 3 400 - 4 300 Hz: -37 dBm;
- in the frequency band 4,3 - 28 kHz: -37 dBm at 4,3 kHz falling 6 dB/octave to 28 kHz;
- in the frequency band 28 - 150 kHz: -53 dBm.

5.4.5 (F) 2 For the total power of all unwanted frequency components (Option a), the unwanted frequency components outside the bandwidth 300 - 3 400 Hz are also taken into account in the total.

5.4.5 (D) 1 The rms value of all occurring non signal associated frequencies from 4 kHz to 28 kHz, caused by nonlinearities, shall be at least 26 dB below the respective sum level.

5.4.5 (P) 1 In the frequency band 4 300 Hz - 16 kHz: -37 dBm at 4 300 Hz, falling 12 dB/octave to 16 kHz.
In the frequency band 16 kHz - 150 kHz: -60 dBm.

5.4.5 (E) 1 (Requirement to be applied instead of section 5.4.5).

With TE in the dialling condition with DTMF signals, the output signal shall be controlled in such a manner that:

a) the total mean power level of all unwanted frequency components (resulting from harmonics intermodulation, or other unwanted signals) shall be during the period of emission of each one of the DTMF signals at least 20 dB lower than the mean power level of the low group frequency, when the output power is measured over a load resistor of 600 ohms connected to the line terminals, in the frequency band from 300 Hz to 3,4 kHz, excluding the frequency bands that correspond to the two components of the useful signal;

and

b) the total maximum mean power level of all unwanted components shall meet with the requirement in section 4.4.3.1 (E) 1, where the provision 1 and the provision 3 of section 4.4.2.1 (E) 1 are not applicable.

PROVISION b: When it is not possible to generate a dialling sequence with a duration equal to or greater than 10 seconds, the requirement shall be applied to the longest possible dialling sequence.

and

c) during the period of emission of each one of the DTMF signals the low frequency outband output power level shall meet the requirement in section 4.4.3.1 (E) 2, where the provision 3 of section 4.4.2.1 (E) 1 is not applicable;

PROVISION c: When the maximum signal period is shorter than 1 second, the requirement shall be applied during the longest possible signal period.

and

d) during the period of emission of each one of the DTMF signals, the medium frequency outband output power level shall meet with the requirement in section 4.4.3.1 (E) 3, where the provision 2 is not applicable;

PROVISION d: When the maximum signal period is shorter than 100 milliseconds, the requirement shall be applied during the longest possible signal period.

and

e) during the period of emission of each one of the DTMF signals, the high frequency outband output power level shall meet with the requirement in section 4.4.3.1 (E) 4, where the provision 2 is not applicable;

PROVISION e: See provision d.

NOTE: It is not included in the dialling condition with DTMF signals any mandatory requirement about the Longitudinal Output Level (LOL) (see section 10.4 (E) 3.1), nor about Output Signal Balance loss (OSB) (see section 10.4 (E) 3.2).

and

f) during the pause periods, when they exist, the inband noise power level shall meet with the requirement in section 4.5.1 (E) 1.2, where the provision 1 shall not be taken into account, and the provision 3 is not applicable;

and

- g) during the pause periods, the outband noise power level shall meet with the requirement in section 4.5.2 (E) 1.2.b, where the provision 2 is not applicable.

PROVISION g: When the maximum pause period is shorter than 100 milliseconds, the requirement shall be applied during the longest possible pause period.

Compliance shall be checked by the tests outlined in section A.5.4.5 (E) 1.

5.4.5 (S) 1 When a multifrequency tone signal is sent:

- a) the total power level of all unwanted frequency components shall be at least 20 dB below the level of the low group frequency component of the signal;
- b) the level of any individual unwanted frequency component shall not exceed the following limits:
- within 300 - 4 300 Hz: -33 dBm;
 - within 4 300 - 12 000 Hz: -37 dBm at 4 300 Hz and then dropping at 12 dB per octave to 12 000 Hz;
 - 12 - 150 kHz: -55 dBm.

When no signal is sent, the level of any signal frequency emitted from the sender to the line shall not exceed -60 dBm in the 300 - 3 400 Hz frequency band nor exceed the values shown on the curve in figure 4.4.3.1 (S) 1 in the 3,4 - 150 kHz frequency band.

5.4.5 (GB) 1 When no DTMF signal is being sent to the network, the total power of all signals presented to the network shall be not greater than -60 dBmp.

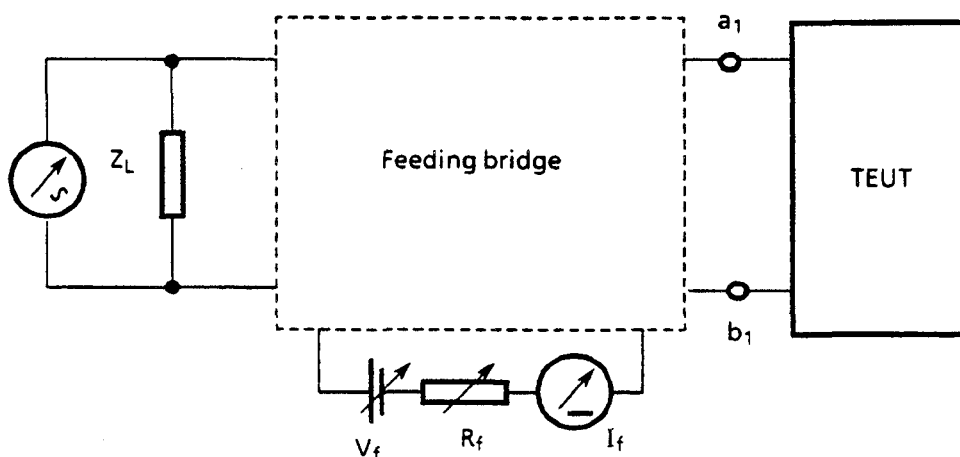
In addition during signalling, for any single unwanted frequency component in the frequency range 300 Hz to 3 400 Hz the power level shall be not greater than -33 dBm, and above 3 400 Hz the power level shall be not greater than the limit values shown in 4.4.3.1 (GB) 1. Compliance shall be checked by the test of A.5.4.5 (GB) 1.

A.5.4.5 Unwanted frequency components

The TEUT is connected as shown in figure A.5.4.5 and placed in signalling state. The MFBP sender is caused to output, in turn, all provided combinations of the signalling frequencies.

The frequency and level of each unwanted output signal are evaluated.

Measurements are carried out at various dc feeding condition values shown in table A.5.4.2.



Feeding bridge as specified in Chapter 1
Figure A.5.4.5: Unwanted frequency components

- A.5.4.5 (E) 1** The testing procedures, where at least the signals 1,5,9 and D (or, when it is not provided, the signal 0) shall be analysed, are as follows:
- A.5.4.5 (E) 1.a** The procedure of test in section A.5.4.2 is followed, where the tests are undertaken for each polarity of the dc voltage source (V_f). The signal power due to both frequency components shall be subtracted from the total power within the bandwidth required, and the result shall be compared with the power level of the low group frequency component.
- A.5.4.5 (E) 1.b** The procedure of test in section A.4.4.3.1 (E) 1 is followed, where the resistor (R_f) takes the values of 500, 1 100, and 2 200 ohms.
- PROVISION b:** The TEUT is caused to continuously generate every DTMF signal tested or, when that is not possible, to generate their highest signal to pause ratio according with the user's manual.
- A.5.4.5 (E) 1.c** The procedure of test in section A.4.4.3.1 (E) 2 is followed, where the resistor (R_f) takes the value of 500, 1 100, and 2 200 ohms.
- PROVISION c:** When the maximum signal period is shorter than 1 second, the TEUT is caused to generate their highest signal to pause ratio.
- A.5.4.5 (E) 1.d** The procedure of test in section A.4.4.3.1 (E) 3 is followed, where the resistor (R_f) takes the values of 500, 1 100, and 2 200 ohms.
- PROVISION d** When the maximum signal period is shorter than 100 milliseconds, the TEUT is caused to generate their highest signal to pause ratio.
- A.5.4.5 (E) 1.e** The procedure of test in section A.4.4.3.1 (E) 4 is followed, where the resistor (R_f) takes the values of 500, 1 100, and 2 200 ohms.
- PROVISION e:** See provision d.
- A.5.4.5 (E) 1.f** The procedure of test in section A.4.5.1 (E) 1.2 is followed, where the resistor (R_f) takes the values of 500, 1 100, and 2 200 ohms.
- A.5.4.5 (E) 1.g** The procedure of test in section A.4.5.2 (E) 1.2 is followed, where the resistor (R_f) takes the values of 500, 1 100, and 2 200 ohms.
- PROVISION g:** When the maximum pause period is shorter than 100 milliseconds, the TEUT is caused to generate their lowest signal to pause ratio.

A.5.4.5 (GB) 1 Measurements are carried out with $I_f = 25$ mA, and a current obtained when the TEUT is connected to a 50 V dc source in series with a 400 ohm resistor.

5.4.6 MFPB transient timing

Reference is made to figure 5.4.6.

The rise time t_r and the fall time t_f of MFPB (DTMF) signal envelopes will be defined using the maximum and minimum reference levels.

The maximum level is taken as the maximum peak voltage, U_p , which corresponds to the maximum value of the final signal level attained during excitation of the sending TE. A maximum reference peak value, U_u is then defined as in formula 5.4.6.a

$$U_u = 0,9 U_p \quad \text{Formula 5.4.6.a}$$

The minimum reference value U_l is defined as in formula 5.4.6.b

$$U_l = 0,1 U_p \quad \text{Formula 5.4.6.b}$$

The rise time of the output signal arising from a MFPB (DTMF) sender is defined as the first period between the time that the amplitude of the peak envelope of the output signal exceeds for the first time the lower reference value U_l , and the time that the amplitude peak envelope of the output signal exceeds for the last time the upper reference value, U_u .

The fall time of the output signal arising from an MFPB (DTMF) sender is defined as the period between the time that the amplitude of the peak envelope of the output signal is for the first time less than the upper reference value, U_u , and the time that the amplitude of the peak envelope of the output signal is for the last time less than the lower reference value, U_l .

The requirements shall be met at the dc feeding conditions specified in table 5.4.6.

Compliance shall be checked using tests outlined in section A.5.4.6

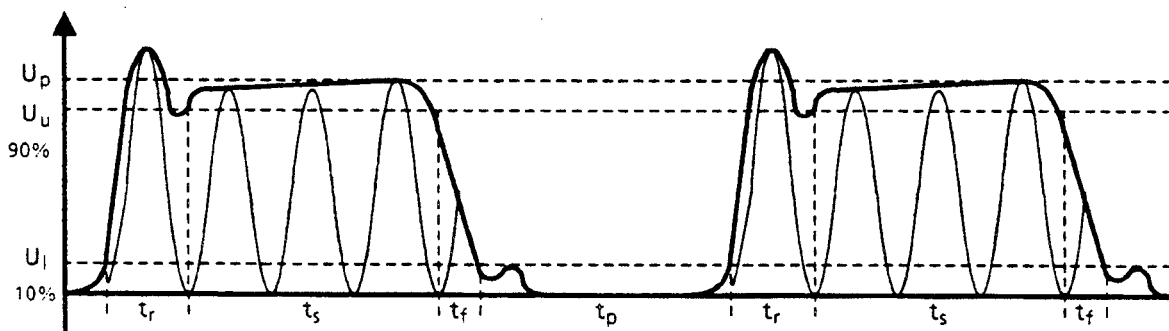


Figure 5.4.6: MFPB transient timing

Table 5.4.6: MFPB transient timing

COUNTRY	REQUIREMENT VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	60		19 - 60	
Belgium	48		20 - $I_{max.}$	
Cyprus	48	440 - 1 740	20 - 90	
Denmark			16 - $I_{max.}$	
Finland		not mandatory		
France	46 - 54 89 - 104	300 - 1 400 1 400 - 2 960		
Germany	60	1 000 - 2 530		
Greece		not mandatory		
Iceland	48		14, $I_{max.}$	
Ireland		not mandatory		
Italy	44 - 52	720 - 1 880		
Luxembourg	60		19 - 60	
Malta				
Netherlands	42 - 66	800 - 2 140		
Norway	60	460 - 3 100		
Portugal	45 - 55	400 - 1 800	not applicable	
Spain	48	500 - 2 200		yes
Sweden				yes
Switzerland	43 - 57	2 200 - 600		
U. Kingdom	50	≥ 400	25 - 100	yes

5.4.6 (E) 1 $U_u = 525$ mV
 $U_l = 11$ mV

5.4.6 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.

5.4.6 (GB) 1 The transient peak voltages associated with the rise and fall of the tone burst, that is, the maximum excursions associated with the rise and fall of the tone burst, shall be not greater than 5 V.

A.5.4.6 MFPB transient timing

Reference is made to the timing diagram, figure 5.4.6.

The TEUT is connected as shown in figure A.5.4.6. Voltage V_t is measured with an instrument capable of registering the instantaneous value of applied voltage.

The MFPB sending circuits is then actuated so as to provide records of the instantaneous values of output signal when at least the digits, 1, 5, 9, and D, or if not implemented, 0, are activated.

For MFPB senders with internal timing, either from digit to digit including the interdigital pause or pauses or within a given digit output, additional records to illustrate the performance of the internal timing circuitry shall be obtained.

Measurements are carried out at the various dc feeding condition values shown in table A.5.4.6.

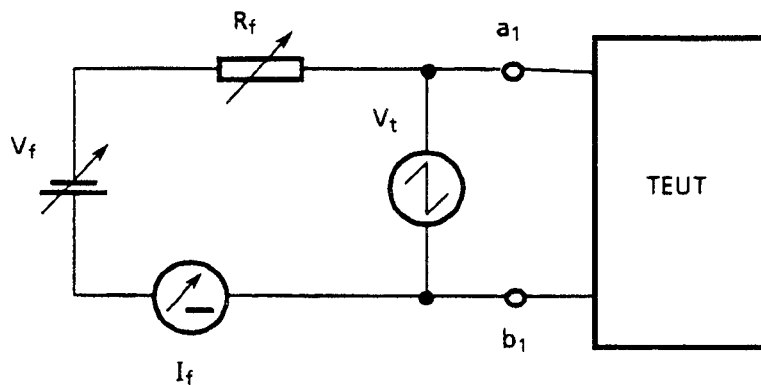


Figure A.5.4.6: MFPB transient timing

Table A.5.4.6: MFPB transient timing

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	60		19, 60	
Belgium	48	600		
Cyprus	48	800		
Denmark		600	16, I_{max}	
Finland	not mandatory			
France	48	600		
Germany			19 - 60	yes
Greece	not mandatory			
Iceland	48		14, I_{max}	
Ireland	not mandatory			
Italy	44, 48, 52	1 880, 1 100, 720		
Luxembourg	60		19, 60	
Malta				
Netherlands	48	1 130		
Norway	60	460, 3 100		yes
Portugal				yes
Spain	48	500, 1 100, 2 200		yes
Sweden				yes
Switzerland	43, 48, 57	2 200, 1 200, 600		
U. Kingdom	50	400	40	yes

A.5.4.6 (D) 1

The TEUT is connected as in figure A.5.4.6 (D) 1. Voltage V_f is measured with an instrument capable of registering the instantaneous value of applied voltage.

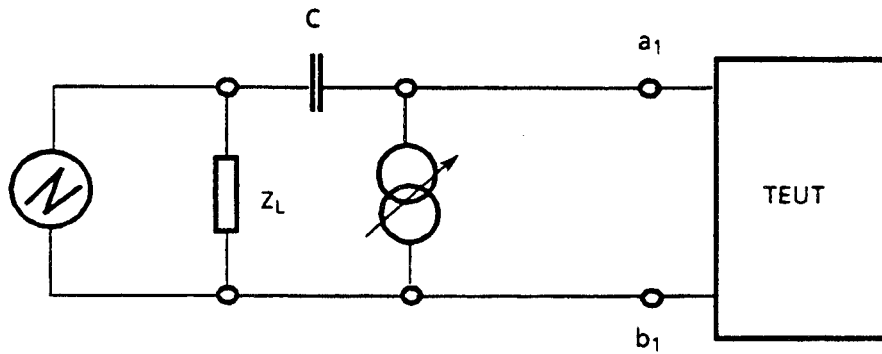


Figure A.5.4.6 (D) 1

A.5.4.6 (N) 1

The TEUT is connected as shown in figure 5.4.6 (N) 1. The signal level is measured 7 ms after the start of the signal, and then compared with the final value which is defined as the level measured 60 ms after the start of the signal.

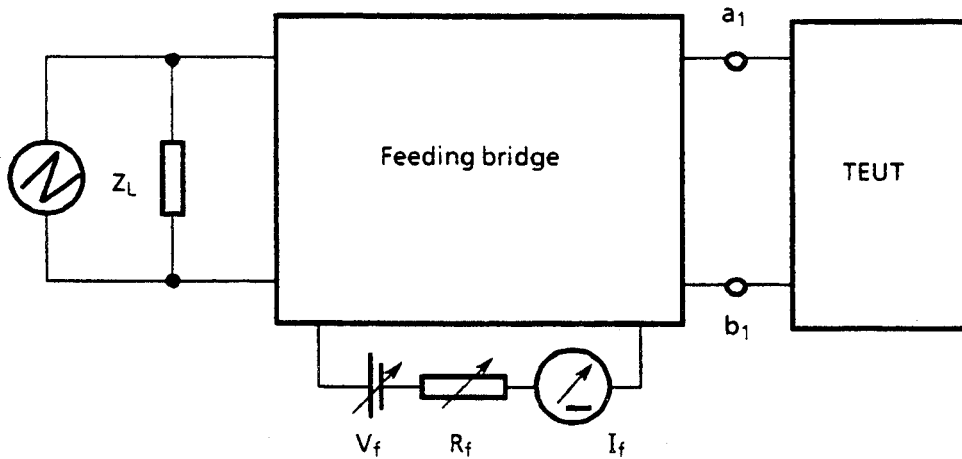


Figure A.5.4.6 (N) 1

A.5.4.6 (P) 1

Same dc feeding condition values as in section A.5.4.2 (P) 1.

A.5.4.6 (E) 1

The TEUT is connected as shown in figure A.5.4.2 instead of figure A.5.4.6.

The tests are undertaken for each polarity of the voltage source (V_f).

A.5.4.6 (S) 1

Feeding conditions, see Chapter 1, section 1.5.2.

A.5.4.6 (GB) 1

I_f is 40 mA, or the current obtained when the TEUT is connected to a 50 V dc source in series with a 400 ohm resistor, whichever is the less.

5.4.6.1 MFPB signal rise time

Reference is made to figure 5.4.6.

The rise time t_r shall not be greater than the value declared in table 5.4.6.1.

The requirements shall be met at the dc feeding conditions specified in table 5.4.6.

Compliance shall be checked by measurement using the tests outlined in section A.5.4.6.1.

Table 5.4.6.1: MFPB signal rise time

COUNTRY	REQUIREMENT VALUES	Remarks
	t_r (ms)	
Austria	10	
Belgium	7	
Cyprus	7	
Denmark	7	
Finland	not mandatory	
France	5	
Germany	7	
Greece	not mandatory	
Iceland	7	
Ireland	7	
Italy	7	
Luxembourg	7	
Malta		
Netherlands	7	
Norway	7	yes
Portugal	18	yes
Spain	5	
Sweden	7	
Switzerland	7	
U. Kingdom	15	

5.4.6.1 (N) 1

The level of the two frequency components of the multifrequency signal shall be within 1 dB of the final value within 7 ms from the start of the signal.

5.4.6.1 (P) 1

For TE with MFPB senders with manually-controlled output times which do not contain timing circuitry to determine the output duration independently of the time during which the push-button or other control is actuated, the maximum period of 18 ms specified in table 5.4.6.1 shall include the rise time and the period from the time that the TE assumes the dialling condition until the time that the TE assumes the dialling condition until the time that the MFPB signal is generated.

A.5.4.6.1 MFPB signal rise time

Reference is made to section A.5.4.5.

The same testing arrangements and test settings are used.

Records of the instantaneous value of output signal are analysed according to requirement 5.4.6 and the results are applied to the requirements of section 5.4.6.1.

Table A.5.4.6.1: MFPB signal rise time

COUNTRY	TEST VALUES	Remarks
Austria		
Belgium	mandatory	
Cyprus	mandatory	
Denmark		
Finland		
France		
Germany	mandatory	
Greece		
Iceland		
Ireland	mandatory	
Italy		
Luxembourg	mandatory	
Malta		
Netherlands	mandatory	
Norway	mandatory	
Portugal		
Spain		
Sweden		
Switzerland		
U. Kingdom	see earlier remark	

5.4.6.2 MFPB signal fall time

Reference is made to figure 5.4.6.

This fall time t_f shall not be greater than the time specified in table 5.4.6.2.

The requirement shall be met at the dc feeding conditions specified in table 5.4.6.

Compliance shall be checked by measurement using the tests outlined in section A.5.4.6.2.

Table 5.4.6.2: MFPB signal fall time

COUNTRY	REQUIREMENT VALUES	Remarks
	t_f (ms)	
Austria	10	
Belgium	7	
Cyprus	7	
Denmark	7	
Finland	not mandatory	
France	5	
Germany	not mandatory	
Greece	not mandatory	
Iceland	7	
Ireland	not mandatory	
Italy	not mandatory	
Luxembourg	not mandatory	
Malta		
Netherlands	7	
Norway	not mandatory	
Portugal	18	
Spain	5	
Sweden	not mandatory	
Switzerland	5	
U. Kingdom	10	

A.5.4.6.2 MFPB signal fall time

Reference is made to section A.5.4.6.

The same testing arrangements and test settings are used.

Records of the instantaneous value of output signal are analysed according to requirement 5.4.6 and the results are applied to the requirements of section 5.4.6.2.

Table A.5.4.6.2: MFPB signal fall time

COUNTRY	TEST VALUES	Remarks
Austria		
Belgium	mandatory	
Cyprus	mandatory	
Denmark		
Finland		
France		
Germany		
Greece		
Iceland		
Ireland	not mandatory	
Italy		
Luxembourg	not mandatory	
Malta		
Netherlands	mandatory	
Norway	not mandatory	
Portugal		
Spain		
Sweden		
Switzerland		
U. Kingdom	see earlier remark	

5.4.7 MFPB output signal duration

5.4.7.1 MFPB senders with manually-controlled output times

The output signal of an MFPB (DTMF) sender with manually-controlled output times shall relate directly in real time to the actuation of a push-button or other control which itself can select only one pair of signalling frequencies representing a single signalling character.

The actuation of any given control of this kind shall cause the appropriate signalling voltages to be generated and applied to the line terminals. These signalling voltages may continue to be generated and to be applied to the line terminals until the actuation of the pushbutton or other control is ceased.

Alternatively, if the manually-operated sender contains timing circuitry which determines the output signal duration independently of the time during which the push-button or other control is actuated, the minimum duration of the signal send time shall not be less than t_s ms. In addition, such senders must incorporate time-guard circuitry which ensures that the minimum pause time, regardless of how the push-buttons or other controls are operated manually is equal to t_p ms.

Signal send time t_s , and signal pause time t_p , are shown in figure 5.4.6 and the values are given in table 5.4.7.1. They do not contain rise time, t_r , and fall time, t_f .

The requirement shall be met at the dc feeding conditions specified in table 5.4.6.

Compliance shall be checked using the tests outlined in section A.5.4.7.1.

Table 5.4.7.1: MFPB senders with manually-controlled output times

COUNTRY	REQUIREMENT VALUES		Remarks
	t_s (ms)	t_p (ms)	
Austria	70	70	yes
Belgium	65	65	
Cyprus	70	70	
Denmark	65	$t_s - 10$	yes
Finland	65	65	
France	65	65	
Germany	40	not mandatory	
Greece	78		
Iceland	65	65	
Ireland	not mandatory		
Italy	65	65	
Luxembourg	65	65	
Malta			
Netherlands	65	65	
Norway	not mandatory		
Portugal	65	65	
Spain	65	135	yes
Sweden	65	65	yes
Switzerland	65	65	
U. Kingdom	not mandatory		yes

5.4.7.1 (A) 1 t_s includes the rise time
 t_p includes the fall time

5.4.7.1 (DK) 1 Maximum duration of signal < 130 ms.

5.4.7.1 (E) 1

PROVISION 1: For the purpose of this requirement it is permitted a pause duration (t_p) comprised between 65 ms and 135 ms, when the user's manual includes the sentence mentioned in the following provision 2.

PROVISION 2: The user's manual, under the conditions of provision 1 above, shall include within a frame the following sentence:

"La marcación manual de números internacionales con este equipo terminal puede llegar a ser infructuosa".

NOTE: The equivalent English sentence is: "The manual dialling international numbers with this TE can become unsuccessful".

5.4.7.1 (S) 1 If the interdigit pause is not supervised, the signal duration shall be a maximum of 120 ms. If the interdigit pause is supervised (this is not mandatory), the sum of the signal duration and the interdigit pause shall be a maximum of 240 ms.

5.4.7.1 (GB) 1 It is recommended that $t_s \geq 40$ ms.

A.5.4.7 MFPB output signal duration

A.5.4.7.1 MFPB senders with manually-controlled output times

Reference is made to section A.5.4.6. The same testing arrangements and test settings are used.

Records of the relevant instantaneous value of output signal are analysed according to requirement 5.4.6 and the results are applied to the requirements of section 5.4.7.1.

Table A.5.4.7.1: MFPB senders with manually-controlled output times

COUNTRY	TEST VALUES	Remarks
Austria		
Belgium	mandatory	
Cyprus	mandatory	
Denmark		
Finland		
France		
Germany	mandatory	
Greece		
Iceland		
Ireland	not mandatory	
Italy		
Luxembourg	mandatory	
Malta		
Netherlands	mandatory	
Norway	not mandatory	
Portugal		yes
Spain		yes
Sweden		
Switzerland		
U. Kingdom	not mandatory	yes

A.5.4.7.1 (P) 1 Same dc feeding condition values as in section A.5.4.2 (P) 1.

A.5.4.7.1 (E) 1 The remarks in section A.5.4.6 (E) 1 shall also be applied.

The feeding resistor (R_f) takes only the values of 500 ohms and 200 ohms.

Check, when necessary, that the user's manual includes the required sentence.

5.4.7.2 MFPB senders with automatic operation

MFPB (DTMF) senders are able to generate an output resulting from a sequence of signals corresponding to a given sequence of characters, and which cause the timing of such output sequences to be corresponding to a given sequence of characters, and which cause the timing of such output sequences to be independent of the times at which information regarding the given characters are input to the sender circuitry shall have a value of send time t_s , and pause time t_p which are within the ranges shown in table 5.4.7.2.

Signal send time t_s , and signal pause time t_p , are shown in figure 5.4.6 and the values are given in table 5.4.7.2. They do not contain rise time, t_r , and fall time, t_f .

The requirement shall be met at the dc feeding conditions specified in table 5.4.6.

Compliance shall be checked using the tests outlined in section A.5.4.7.2.

Table 5.4.7.2: MFBP senders with automatic operation

COUNTRY	REQUIREMENT VALUES		Remarks
	t_s (ms)	t_p (ms)	
Austria	70 - 90	70 - 90	yes
Belgium	65 min.	65 min.	
Cyprus	70 - 120	70 - 120	
Denmark	65 - 130	$t_s - 10$	
Finland	≥ 65	≥ 65	
France	65 - 130	65 - 130	
Germany	80 - 100	80 - 100	
Greece			
Iceland	≥ 65	≥ 65	
Ireland	65 - 120	65	
Italy	65 - 150	65 - 150	
Luxembourg	80 ± 10	80 ± 10	
Malta			
Netherlands	≥ 65	≥ 65	yes
Norway	65 - 130	65 - 130	
Portugal	65 - 150	65 - 150	
Spain	≥ 65	135 - 1 200	yes
Sweden	≥ 65	≥ 65	yes
Switzerland	65 - 110	65 - 110	
U. Kingdom	≥ 68	≥ 68	yes

5.4.7.2 (A) 1 t_s includes the rise time
 t_p includes the fall time

5.4.7.2 (NL) 1 $t_s + t_p \leq 250$ ms.

5.4.7.2 (E) 1

PROVISION 1: For the purpose of this requirement it is permitted a pause duration (t_p) comprised between 65 ms and 135 ms, when the user's manual includes the sentence mentioned in the following provision 2.

PROVISION 2: The user's manual, under the conditions of provision 1 above, shall include within a frame the following sentence:

"La marcación manual de números internacionales con este equipo terminal puede llegar a ser infructuosa".

NOTE: The equivalent English sentence is: "The manual dialling international numbers with this TE can become unsuccessful".

5.4.7.2 (S) 1 $t_s + t_p \leq 240$ ms.

5.4.7.2 (GB) 1 The ratio $t_s / (t_s + t_p)$ shall not be greater than 0,6.

A.5.4.7.2 MFPB senders with automatic operation

Reference is made to section A.5.4.6.

The same testing arrangements and test settings are used.

Records of the relevant instantaneous value of output signal are analysed according to requirement 5.4.6 and the results are applied to the requirements of section 5.4.7.2.

Table A.5.4.7.2: MFPB senders with automatic operation

COUNTRY	TEST VALUES	Remarks
Austria		
Belgium	mandatory	
Cyprus	mandatory	
Denmark		
Finland		
France		
Germany	mandatory	
Greece		
Iceland	mandatory	
Ireland	mandatory	
Italy		
Luxembourg	mandatory	
Malta		
Netherlands	mandatory	
Norway	mandatory	
Portugal		yes
Spain		yes
Sweden		
Switzerland		
U. Kingdom	see earlier remark	

A.5.4.7.2 (P) 1 Same dc feeding condition values as in section A.5.4.2 (P) 1.

A.5.4.7.2 (E) 1 The remarks in section A.5.4.7.1 (E) 1 shall also be applied.

5.4.8 Suppression of unassociated signals

During the signalling state, the actuation of MFPB (DTMF) senders shall have the effect of reducing to a lower value of level of those output signals appearing at the line terminals which arise from normal excitation of any transducers or signal input ports during the time the TE is in loop condition when the original excitation is sustained and the TE is placed in the signalling state.

This reduction in level shall exceed α dB as shown in table 5.4.8.

The requirement shall be met at the dc feeding conditions specified in table 5.4.2.

Compliance shall be checked by inspection using the tests outlined in section A.5.4.8.

Table 5.4.8: Suppression of unassociated signals

COUNTRY	REQUIREMENT VALUES	Remarks
	α (dB)	
Austria	not mandatory	
Belgium	50	
Cyprus	50	
Denmark	50	
Finland	not mandatory	
France	55	
Germany	not mandatory	
Greece		
Iceland	not mandatory	
Ireland	not mandatory	
Italy	50	
Luxembourg	not mandatory	
Malta		
Netherlands		yes
Norway	50	
Portugal	30	
Spain	50	yes
Sweden	60	
Switzerland	50	
U. Kingdom	50	yes

5.4.8 (NL) 1 Same requirements as in 5.4.5.

5.4.8 (E) 1

PROVISION:

All associated transmission circuitry inside the TE shall be inhibited in such a manner that the TE shall meet the requirements in section 5.4.5 (E) 1.

The acoustic excitation, when necessary, is stipulated in the associated testing method in section A.5.4.8 (E) 1.

The only signal input port taken into account are the line output terminals, for series TE.

5.4.8 (GB) 1

Suppression of any associated transmission process shall commence not later than 15 ms after the instant of the start of the first MFPB signal.

A.5.4.8 Suppression of unassociated signals

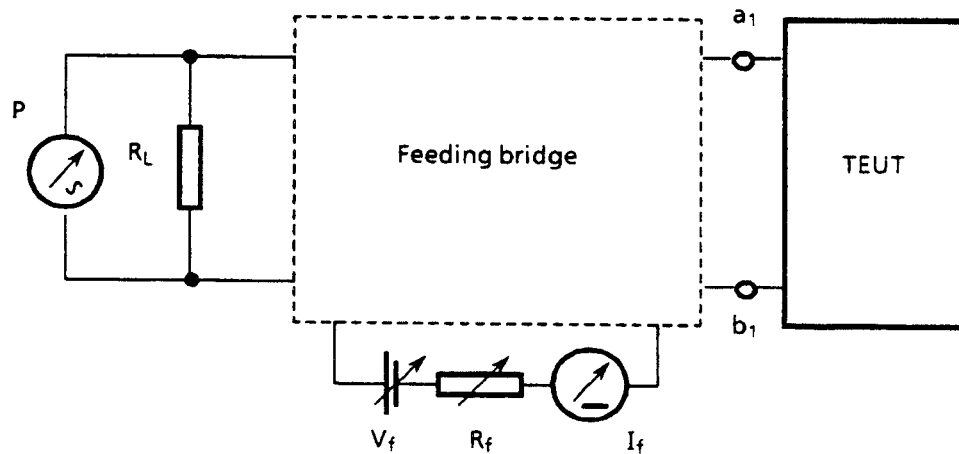
The TEUT is arranged as shown in figure A.5.4.8. It is caused to assume loop condition, and is caused to send continuously to line speech-band signals appropriate to its normal manner of use.

The level of signals is measured across the line termination impedance, R_L , over a bandwidth, Δ_f . Values R_L and Δ_f are specified in table 5.4.8.

The TE is then caused to enter the signalling state by the actuation of the MFPB sender circuitry. The level of signals sent to line, excluding those signals generated by the MFPB sender circuitry, is again measured.

The requirement shall be met at the dc feeding conditions specified in table 4.5.4.2.

The test method shall include MFPB (DTMF) signal filters with an attenuation of at least 60 dB and shall ensure that the speech-band signal level arising from the TE whilst in loop condition and excited is at least -13 dBm or another equivalent method.



Feeding bridge as specified in Chapter 1
Figure A.5.4.8: Suppression of unassociated signals

Table A.5.4.8: Suppression of unassociated signals

COUNTRY	TEST VALUES		Remarks
	Δf (Hz)	R_L (Ω)	
Austria	not mandatory		
Belgium	1 000	600	yes
Cyprus	30 - 3 400	600	
Denmark	1 000	600	
Finland	not mandatory		
France	1 100	600	
Germany	not mandatory		
Greece			
Iceland	not mandatory		
Ireland	not mandatory		
Italy	300 - 3 400	600	
Luxembourg	not mandatory		
Malta			
Netherlands			yes
Norway	1 100	600	yes
Portugal	300 - 3 400	600	yes
Spain	300 - 3 400	600	yes
Sweden	300 - 3 400	600	
Switzerland	300, 1 000, 3 400	600	
U. Kingdom	300 - 3 400	600	

A.5.4.8 (B) 1

The test is carried out for telephone sets. Instead of using MFPB signal filters as mentioned in A.5.4.8, the following method can be used:

A 1 000 Hz test signal is sent to line with a level of 0 dBm in the loop condition, using the artificial mouth.

The remaining level of frequency is measured in the signalling condition by use of a selective voltmeter.

A.5.4.8 (NL) 1

Same tests as in A.5.4.5.

A.5.4.8 (N) 1

The test is carried out using a spectrum analyser as a level meter.

A.5.4.8 (P) 1

Same dc feeding condition values as in section A.5.4.2 (P) 1.

A.5.4.8 (E) 1

The feeding resistor (R_f) takes only the value of 1 100 ohms.

For the acoustic excitation, the provisions 2 and 3 in section A.4.4.1 (E) 1 shall be applied.

The signal power due to both frequency components, when it is present, shall be subtracted from the total power within the bandwidth required, when the resulting power value shall meet with the requirement with respect to the power in loop condition with the acoustic excitation applied to the transducers.

When a series TE is tested, a signal with a generator open circuit AC rms voltage of 1 550 mV and frequency 1 kHz, is applied between the line output terminals through a resistor of 600 ohms.

5.5 Switching after dialling condition

TE capable of dialling shall at termination of the dialling condition revert to the loop condition and/or a condition such that it is capable of exchanging speech band frequency signals with the PSTN. This reversion shall take place within a given time t_s as shown in table 5.5.

The requirement shall be met at the dc feeding conditions as specified in table 5.5.

Compliance shall be checked by measurement using the test outlined in section A.5.5.

Table 5.5: Switching after dialling condition

COUNTRY	REQUIREMENT VALUES				Remarks
	t_s (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	0,4	60		19 - 60	yes
Belgium				not mandatory	
Cyprus				not mandatory	
Denmark	2			16 - I_{max} .	
Finland				not mandatory	
France	1	46 - 54 86 - 104	200 - 1 300 300 - 2 860		
Germany	0,5	60	2 530		yes
Greece	0,1	44 - 66		20 - 80	
Iceland				not mandatory	
Ireland	1	48		20, 100	
Italy	0,15	44 - 52	720 - 1 880		
Luxembourg	1	60		19 - 60	
Malta					
Netherlands	1	42 - 66	800 - 2 140		
Norway				not mandatory	
Portugal				not mandatory	yes
Spain					yes
Sweden	0,15				yes
Switzerland	0,065 ... 0,1143	57 2 200 - 600			
U. Kingdom				not specified	

- 5.5 (A) 1 For decadic dialling the time t_s includes the time of the post pulsing period.
- 5.5 (A) 2 The time t_s includes the transient time of the speech circuit.
- 5.5 (D) 1 See also sections 10.2 (D) 1.1 and 10.2 (D) 1.2.
- 5.5 (P) 1 It may be mandatory on terminal standards or NET.
- 5.5 (E) 1 The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to section 10.5 (E) 8.
- 5.5 (S) 1 If the TE is able to acoustically reproduce received speech signals, this shall be possible after t_g (ms).
- 5.5 (S) 2 Feeding conditions, see Chapter 1, section 1.5.2.

A.5.5 Switching after dialling condition

The TEUT is connected as shown in figure A.5.5 and shall be placed in the loop condition. After that it is caused to enter the dialling condition. The voltage V_t between the line terminals, and the loop current I_t shall be registered at least from the end of the dialling condition until the TEUT has reverted to the loop condition which permits the exchange of speech passband signals with the PSTN. Measurements are carried out at various dc feeding conditions.

The testing parameters V_f , R_f , I_f and R_s are shown in table A.5.5.

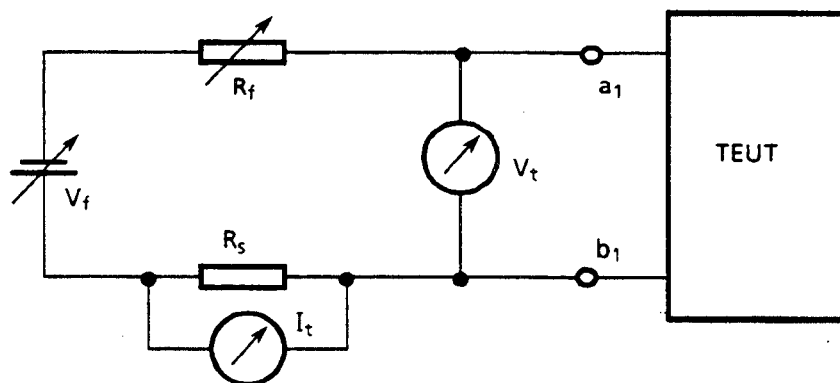


Figure A.5.5: Switching after dialling condition

Table A.5.5: Switching after dialling condition

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	R_S (Ω)	
Austria	60		19, 60	100	
Belgium	not mandatory				
Cyprus	not mandatory				
Denmark			16, $I_{max.}$	600	
Finland	not mandatory				
France	46, 54	1 300 resp. 200		100	
Germany	60	2 530		10	
Greece	60		20, 35	100	
Iceland	not mandatory				
Ireland	48	5 000		0	
Italy	44, 48, 52	1 780, 1 000, 620		100	
Luxembourg	60		19, 60	100	
Malta					
Netherlands	48	1 130		0	
Norway	not mandatory				
Portugal	not mandatory				yes
Spain					yes
Sweden					yes
Switzerland	48	1 200		R_S incl. in R_f	
U. Kingdom	not specified				

A.5.5 (P) 1 It may be mandatory on terminal standards or NET.

A.5.5 (E) 1 See remark in section 5.5 (E) 1.

A.5.5 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.

5.6 Automatic calling functions

This section specifies the requirements for

- dialling initiation;
- transmission initiation;
- transmission duration control;
- automatic repeat calls.

The initiation of a calling function may be made either manually or by some automatic means.

Manual initiation is normally made by the user operating a "start" button or by some other similar physical action. Automatic initiation is normally made by an instruction from a timer control, alarm system or similar automatic devices.

As a result of this initiation the TE commences the appropriate dialling procedure.

An informative overview of the various combinations of options within an automatic calling procedure is given in diagram 5.6, which is intended to show how the sub-sections which follow, fit together during a normal calling procedure.

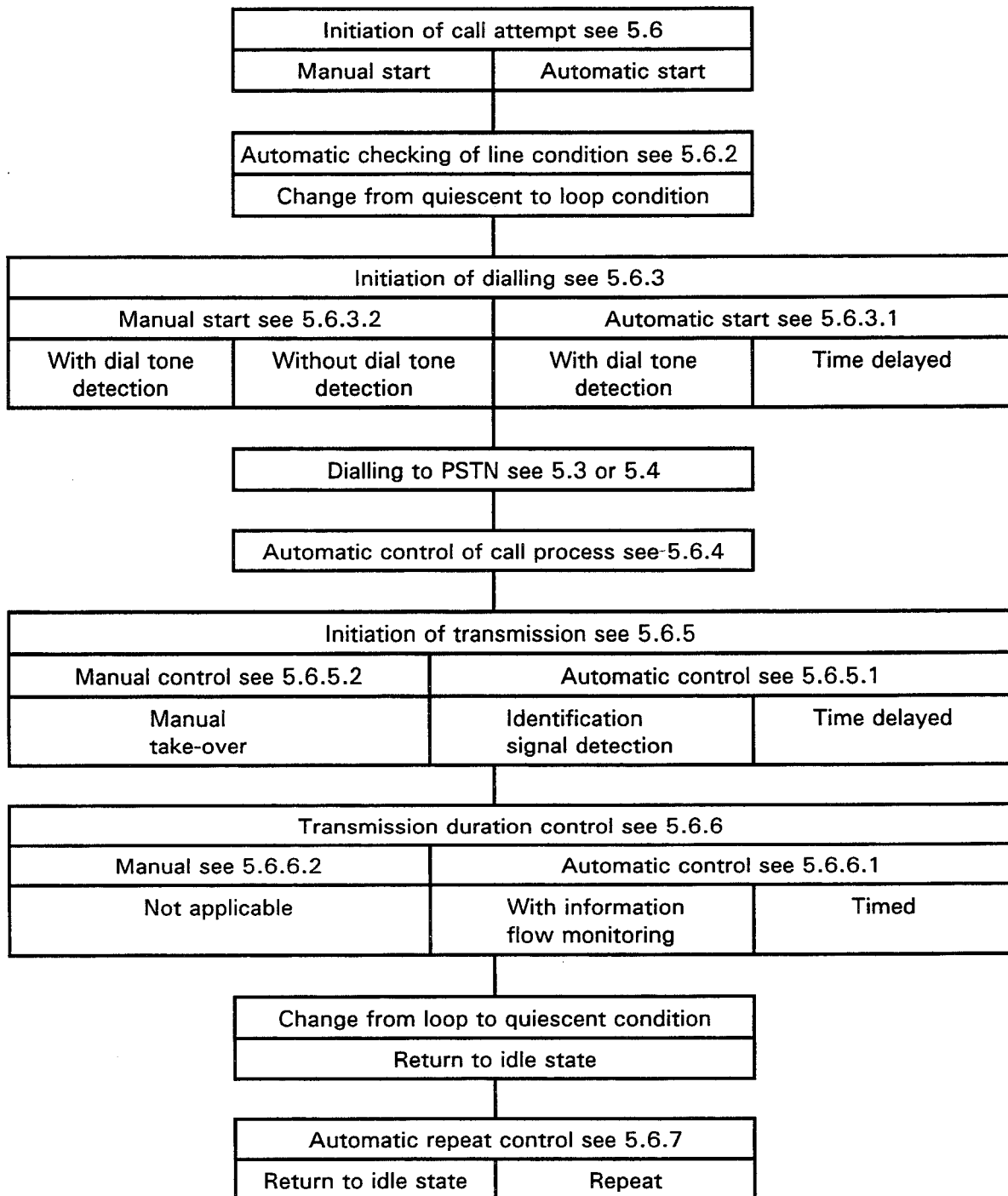


Diagram 5.6: Overview of automatic calling procedure

5.6 (D) 1

This section specifies the requirements for TE with automatic initiation of calling functions and automatic repeat call attempts to the same or different numbers only. The requirements for TE with manual initiation of calling functions and without automatic repeat call attempts are given in Chapter 10, section 5.6.

5.6.1 General requirements

5.6.1.1 Hardware/software realisation

The control of the automatic dialling calling functions described in the requirements in section 5.6 shall be contained within the associated hardware and/or software, which shall only operate within the TE in conjunction with each other, and shall not be alterable by external means.

It is a requirement that the supplier declares the means by which it is effected.

The inclusion of these functions may be mandatory, see table 5.6.1.1.

Compliance shall be checked by the evaluation of the declared information from the supplier.

Table 5.6.1.1: Hardware/software realisation

COUNTRY	HARDWARE/SOFTWARE REALISATION		Remarks
	mandatory yes/no		
Austria	yes		
Belgium	yes		
Cyprus	yes		
Denmark	yes		
Finland	yes		
France	yes		
Germany	yes		yes
Greece	yes		
Iceland	yes		
Ireland	no		
Italy	yes		
Luxembourg	yes		
Malta			
Netherlands	no		
Norway	no		yes
Portugal	yes		
Spain	no		yes
Sweden	no		
Switzerland	yes		yes
U. Kingdom	no		yes

5.6.1.1 (D) 1 Special reference is made to section 10.1 (D) 2.5.

5.6.1 (N) 1 The type approval is no longer valid if the requirement is modified (hardware and/or software), or if the hardware is associated with a non-approved software.

5.6.1.1 (E) 1

NOTE: The TE under approval is considered as a whole in its realisation, whichever is the hardware/software association.

It is not permitted the use of any other different association because it is outside the approval certificate and also outside the permission for connection to the network.

5.6.1.1 (CH) 1

For telematic TEs with fully automatic call establishment facilities, a tone detector (dial tone, busy tone and congestion tone) is mandatory.

5.6.1 (GB) 1

The supplier shall state which features (call initiation, determination of the outcome of a call attempt and repeat call attempts) are provided on the TE and which of the features, if any, require other means external to the TE or intervention by the user.

Where operation of the TE is dependant upon conditions generated externally to the TE, the supplier shall provide such information or means as is necessary to produce the operation needed for testing purposes.

The supplier shall state whether or not adjustments of the TE are available to the user that would allow the user to vary the characteristics of the TE in such a way that it would no longer comply with the requirements of section 5.6.

NOTE 1: Adjusts are not available to the user where either:

- a) the means of adjustment is inaccessible without the use of a tool,
- or
- b) the means of adjustment is capable of being rendered inaccessible or inoperative by physical guards that are able to be released only by use of a tool (e.g. a locked switch),
- or
- c) the means of adjustment is capable of being operated only after the release of software locks the operation of which requires skill and detailed knowledge not available to the user of the apparatus by means of information provided by the supplier.

NOTE 2: "Adjustment" is used in this section as a loose term describing the means of altering the operating characteristics.

The supplier shall state whether the TE is capable of sending in loop-disconnect form, or multi-frequency (MF) form, or both forms, and shall state how each form is invoked.

5.6.1.2 Call up from memory

TE with number storage facilities shall not initiate dialling when unoccupied or erased memory locations have been called up. In the case of TE with automatic initiation of dialling the line seizure shall not be performed when unoccupied or erased memory locations have been called up.

The inclusion of these functions may be mandatory, see table 5.6.1.2.

Compliance shall be checked by functional tests.

Table 5.6.1.2: Call up from memory

COUNTRY	NUMBER STORAGE	Remarks
	mandatory yes/no	
Austria	yes	
Belgium	yes	
Cyprus	yes	
Denmark	yes	
Finland	no	
France	yes	yes
Germany	yes	
Greece	yes	
Iceland	yes	
Ireland	no	
Italy	yes	
Luxembourg	yes	
Malta		
Netherlands	no	
Norway	no	
Portugal	yes	
Spain	no	
Sweden	yes	
Switzerland	yes	
U. Kingdom	no	

5.6.1.2 (F) 1 Number storage and consultation shall not require the seizure of the line, except for TE with storage capacity not more than 20 numbers and for remote number storage.

5.6.1.2 (F) 2 For TE with fully automatic calling facility and with storage capacity of more than four call numbers, number storage shall include a monitor in order to enable an auditory or visual control of the number before validation.

In case of remote number storage, the monitor shall repeat the received number to the calling party before validation.

5.6.1.2 (F) 3 The stored dialling characters (call number digits and dial tone waiting characters) shall be either alterable by the user (e.g. with keyboard) or replaceable with change support (e.g. PROM or EPROM). In particular, it shall be possible:

- to inhibit the detection or the timer function relevant to the second dial tone, when the PSTN will not send any more this second dial tone;
- to replace prefixes "16" and "19" by respectively "0" and "00", when these last prefixes will be in use in PSTN.

If the material necessary to the above modifications is not associated with the TE, the appropriate instructions shall be clearly indicated in the user's manual.

5.6.1.3 Call progress monitoring

TE with on-hook dialling facilities which can pass a call attempt to an associated handset or similar device shall include a call progress monitor in order to enable audible and/or visible monitoring of the progress of the call attempt.

The inclusion of these functions may be mandatory, see table 5.6.1.3.

Compliance shall be checked by inspection.

Table 5.6.1.3: Call progress monitoring

COUNTRY	CALL PROGRESS MONITORING	Remarks
	mandatory (yes/no)	
Austria	yes	
Belgium	yes	
Cyprus	yes	
Denmark	yes	
Finland	no	
France	yes	yes
Germany	yes	
Greece	no	
Iceland	yes	
Ireland	no	
Italy	yes	
Luxembourg	yes	
Malta		
Netherlands	no	
Norway	no	
Portugal	yes	yes
Spain	no	yes
Sweden	no	
Switzerland	no	
U. Kingdom	no	

5.6.1.3 (F) 1

This requirement is generalised to all TE with automatic seizure of the line which can pass a call attempt to an associated manual system.

Monitoring shall be operational from at the latest 1 s (2 s for handsfree systems) after the seizure of the line until passing to the associated manual system.

5.6.1.3 (F) 2

In case of audible monitoring, a minimum level of 55 dBA (with respect to 20 μ Pa) shall be provided, eventually by adjustment, at 50 cm in front of the TE for an input signal frequency 440 Hz with a level of -20 dBm between the line terminals.

Compliance shall be checked using figure 5.6.1.3 (F) 2.

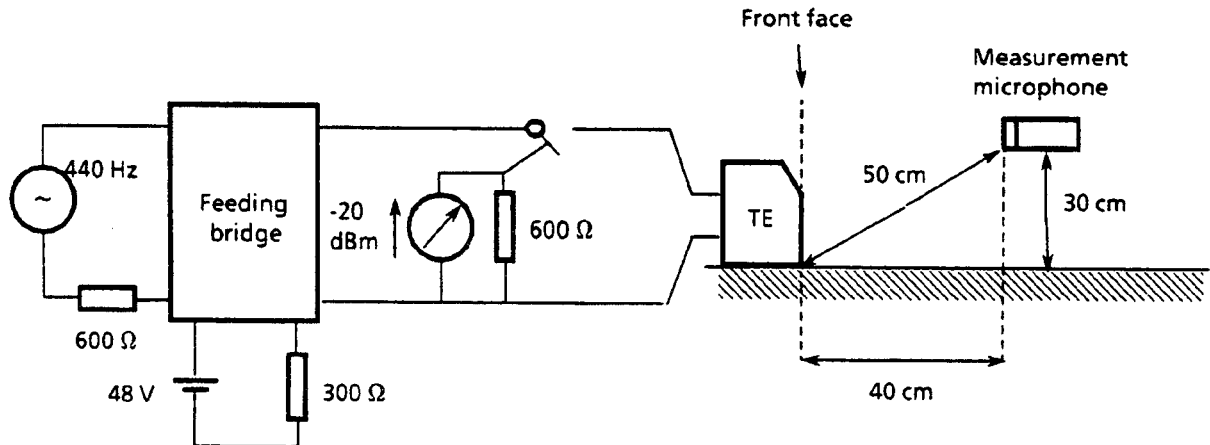


Figure 5.6.1.3 (F) 2: Audible monitoring

5.6.1.3 (P) 1

This requirement is not applicable to TE having dial tone and special dial tone detection (see section 5.6.3).

5.6.1.3 (E) 1

The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to sections 10.5 (E) 8 and 10.5 (E) 10.2.

5.6.2 Automatic checking of line condition

Prior to assuming the loop condition, the TE shall check the voltage across its line terminals or associated loop current according to Chapter 9.4, to ensure that the line through which it is connected is not already in loop condition.

If the line is determined as being already in loop condition then the TE shall not initiate a call attempt until the line becomes free.

The inclusion of these functions shall be mandatory, see table 5.6.2.

Compliance shall be checked by inspection.

Table 5.6.2: Automatic checking of line condition

COUNTRY	AUTOMATIC CHECKING OF LINE CONDITION		Remarks
	mandatory (yes/no)		
Austria	yes		yes
Belgium	no		yes
Cyprus	no		
Denmark	no		
Finland	no		
France	yes		yes
Germany	yes		yes
Greece			
Iceland	no		
Ireland	no		
Italy	no		
Luxembourg	no		
Malta			
Netherlands	no		
Norway	no		
Portugal	no		yes
Spain	no		
Sweden	no		
Switzerland	no		
U. Kingdom	no		

- 5.6.2 (A) 1** Not mandatory for TE with alarm functions.
- 5.6.2 (B) 1** The requirement is only applicable if the function is provided with the TE.
- 5.6.2 (F) 1** For TE with automatic calling and automatic answering facilities, incoming call shall be processed prior to outgoing call.
- 5.6.2 (F) 2** The following requirements contained in this section are not mandatory for alarm TE and for TE agreed to be connected only alone to the line.
- 5.6.2 (F) 2.a** TE with automatic seizure of the line shall not initiate a call attempt if an incoming call has been detected during a test period of 5 to 15 s before the call attempt.
- The ringing signal detection shall conform to section 6.2.1 with 500 ms as maximum detection time.
- 5.6.2 (F) 2.b** TE with automatic seizure of the line shall be connected in series at the head of the line, and shall not initiate a call attempt if a loop current is detected as described in section 9.4.1.1.

5.6.2 (D) 1 Prior to assuming the loop condition, the Group A additional equipment (see 8.3 (D) 3.1) must check the line condition (whether it is busy or not) and must react in accordance with its interworking mode.

5.6.2 (P) 1 It may be mandatory on terminal standards or NET.

5.6.3 Initiation of dialling

Initiation of dialling may be controlled manually, or automatically.

5.6.3.1 Automatic initiation of dialling

Automatic initiation of dialling shall be controlled either by a dial tone detector or by a timer function or by a combination of both, within the TE. The inclusion of a dial tone detector may be mandatory, see table 5.6.3.1.

Where the calling function has been manually initiated and the TE does not include a dial tone detector, audible monitoring of the presence of dial tone may be mandatory, see table 5.6.3.1.

If the TE includes a timer function, dialling shall not be initiated until a time period $t_{1min}(s)$ has elapsed, but shall be initiated before $t_{1max}(s)$ has elapsed, following the establishment of the dc loop condition.

If the TE includes a dial tone detector, then dialling shall start within $t_2(s)$ of the application of the PSTN dial tone.

If the TE includes a dial tone detector and it does not detect the PSTN dial tone within $t_3(s)$ of the establishment of loop condition, the TE shall revert to the idle state.

The values of t_1 , t_2 and t_3 are shown in table 5.6.3.1.

Compliance shall be checked using the tests outlined in section A.5.6.3.1.

Table 5.6.3.1: Automatic initiation of dialling

COUNTRY	REQUIREMENT VALUES						
	t _{1min} (s)	t _{1max} (s)	t ₂ (s)	t ₃ (s)	dial tone detector mandatory (yes/no)	audible monitoring mandatory (yes/no)	
Austria	2,5	6,5	2	6	yes	yes	yes
Belgium	2	5	1		yes	yes	yes
Cyprus	2	5	3	10	yes	yes	
Denmark	not applic.	not applic.	4	10	yes	yes	
Finland	2	not spec.	4	not spec.	no	no	
France	2	3	3	6 - 12			yes
Germany			2 - 5	20	yes	no	yes
Greece	2	5	4	20	no	yes	
Iceland	6	not spec.	4	10	yes	yes	
Ireland	3,5	4,5	1 ± 0,5	10	no	no	
Italy	1	10	4	20	yes	no	
Luxembourg			2 - 5	20	yes	yes	
Malta							
Netherlands			2	5 - 40	yes	no	yes
Norway	2	6	4	20	yes	yes	yes
Portugal	2,5	5	3	10	no	yes	yes
Spain							yes
Sweden			2	60	yes	no	
Switzerland	6	10	0,9 - 2		yes	yes	yes
U. Kingdom	3,5	8,0	4,5	25	no	no	yes

5.6.3.1 (A) 1 A timer function is only allowed for TE where the calling function is manually initiated.

5.6.3.1 (A) 2 For TE with manual call initiation and successive automatic call attempts a dial tone detector is mandatory.

5.6.3.1 (B) 1

- 1) Automatic initiation of dialling controlled by a timer function is only allowed in case of TE with manual initiation of transmission (e.g. the user has to pick-up the handset or switch-on a loudspeech function).
- 2) A call shall be considered failed and the TE be disconnected from the line if the dial tone is not received within:
 - 3 s min. and 20 s max. in the case of DTMF dialling.
 - 10 s min. and 20 s max. in the case of pulse dialling.

5.6.3.1 (F) 1 Dial tone detector is mandatory only in case of automatic seizure of the line and in case of manual seizure of the line followed by full automatic (e.g. alarm call initiated by pressure on a button for old people).

Audible or visual monitoring of the presence of the first dial tone is mandatory for TE with manual seizure of the line not followed by full automatic call. In case of audible monitoring by loudspeaker, a minimum audible control level shall be in accordance with 5.6.1.3 (F) 2.

- 5.6.3.1 (F) 2 For the case of second dial tone, time periods t_{1min} and t_{1max} start from the end of the last sent digit.
- 5.6.3.1 (F) 3 TE with facility to register the last manually sent number and to recall automatically this last number after manual initiating is not authorised to register automatically a calibrated pause (between 2 and 3 s) during the last manual dialling when an interruption of the manual dialling exceeds a determined time.
- 5.6.3.1 (F) 4 The dial tone detector shall also detect as first dial tone the special dial tone (see 9.5.2).
- 5.6.3.1 (D) 1 For TE with automatic initiation of dialling or automatic repeat call attempts a dial tone detector is mandatory. A timer is not allowed.
- 5.6.3.1 (NL) 1 When busy tone or congestion tone is received during the time that the TE is waiting for dial tone, the TE shall revert to the idle state. The detection of busy tone and congestion tone shall comply with the requirements of section 9.5.3 and section 9.5.4.
- 5.6.3.1 (N) 1 TE with automatic initiation of dialling and automatic call control shall have dial tone detector.
- TE with manually initiation of automatic calling function, and which after dialling transfer the call control by the user, may, if the TE has audible monitoring of dialtone, have a timer function.
- 5.6.3.1 (P) 1 The inclusion of a dial tone detector is mandatory for TE having automatic start of call attempt.
- 5.6.3.1 (P) 2 The dial tone detector mentioned in section 5.6.3 shall be a special dial tone detector as well.
- 5.6.3.1 (E) 1 The requirements in sections 10.5 (E) 3, 5.2.1 (E) 1, 5.2.2 (E) 1, and 10.5 (E) 4 shall be applied.
- 5.6.3.1 (CH) 1 t_3 for TE without busy/congestion tone detector: 6 - 9 s;
 t_3 for TE with busy/congestion tone detector: 6 - 21 s.
- For a "non speech TE" and in the case of fully automatic call establishment procedure, a dial tone detector is mandatory.
 - For a "speech TE", Switzerland requires (for the initiation of dialling) a "dial tone detector" or a "time-out" or "audible monitoring".
- 5.6.3.1 (GB) 1 Where dial tone is returned not more than 3,5 s after the instant loop condition has been established, the TE shall not initiate dialling before dial tone is returned.
- Where dial tone is returned not more than 3,5 s after the instant that the loop condition is established, either:
- a) the TE shall begin sending the first dialled digit not more than 8 s after the instant that the loop state is established;

- or
 b) the TE shall revert to the idle state not more than 25 s after the instant that the loop state is established.

Where dial tone is not returned after the loop condition is established, either:

- a) the TE shall begin sending the first dialled digit not more than 8 s after the instant that the loop state is established;
 or
 b) the TE shall revert to the idle state not more than 25 s after the instant that the loop state is established.

NOTE: The effect of these requirements is that TE that detects dial tone should initiate dialling not more than 4,5 s after dial tone has been detected; TE that pauses before dialling instead of responding to dial tone should pause for between 3,5 s and 8 s after the loop condition is established.

A.5.6 Automatic calling function

A.5.6.3 Initiation of dialling

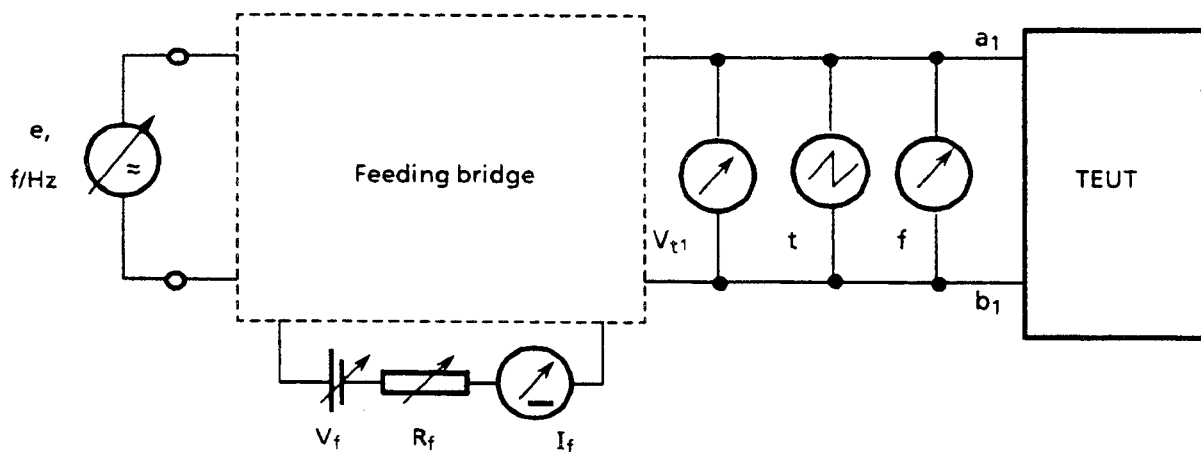
A.5.6.3.1 Automatic initiation of dialling

The TEUT is connected as shown in figure A.5.6.3.1 and the automatic calling function is initiated. The TEUT shall commence dialling either after $t_{1min}(s)$ but before $t_{1max}(s)$ or, where a dial tone detector is used, within $t_2(s)$ of the application of the appropriate nominal PSTN dial tone.

In the case where a dial tone detector is used, the test shall be repeated, without the application of the PSTN dial tone, and the TE shall revert to the idle state after $t_3(s)$.

The values of t_1 , t_2 and t_3 are shown in table 5.6.3.1.

Measurements are carried out at various dc feeding condition values shown in table A.5.6.3.1.



Feeding bridge as specified in Chapter 1
 Figure A.5.6.3.1: Automatic initiation of dialling

Table A.5.6.3.1: Automatic initiation of dialling

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria		60	19, 60	
Belgium	48	400, 1 600		
Cyprus	48	800		
Denmark			16, $I_{max.}$	
Finland	48	800, 1 710		
France	48	600		
Germany	60	2 530		
Greece	60		20, 35	
Iceland	48		14, $I_{max.}$	
Ireland	48	5 000		
Italy	44, 48, 52	1 880, 1 100, 720		
Luxembourg	60		19, 60	
Malta				
Netherlands	48	1 130		
Norway	60	3 100		
Portugal	48	300, 1 800	not applicable	
Spain				yes
Sweden				yes
Switzerland	48	1 200		
U. Kingdom	50	400	≥ 25	yes

A.5.6.3.1 (E) 1 See remark in section 5.6.3.1 (E) 1.

A.5.6.3.1 (S) 1 Feeding conditions see Chapter 1, section 1.5.2.

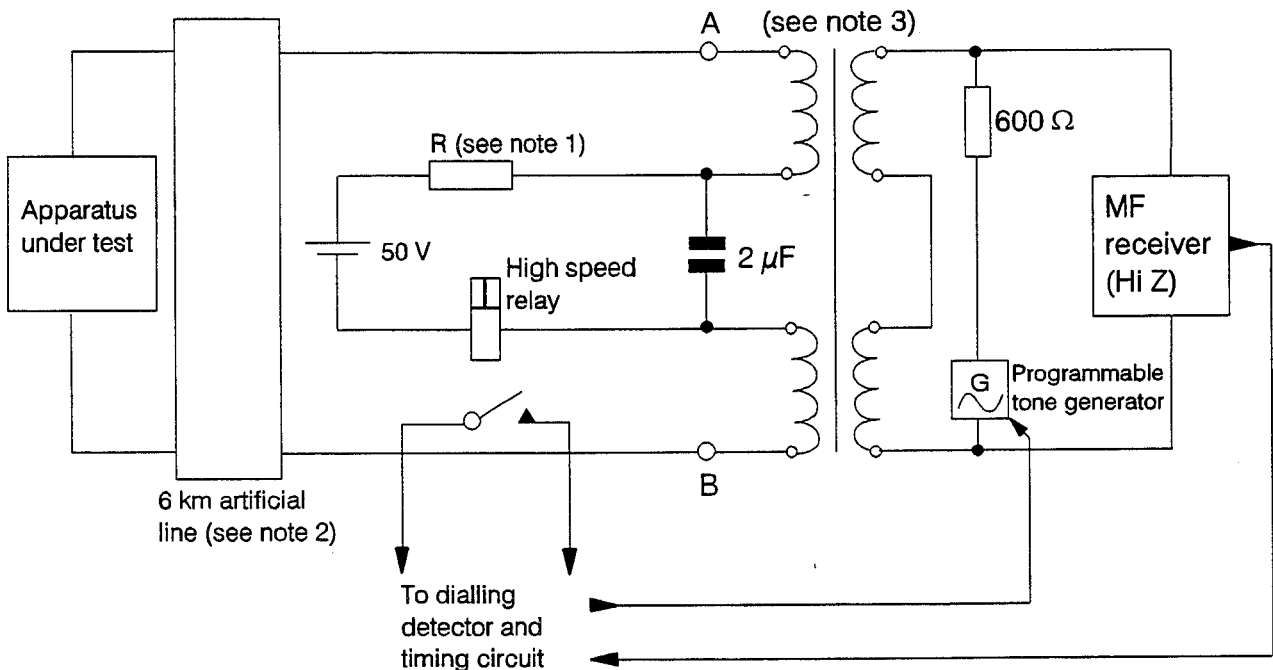
A.5.6.3.1 (GB) 1 The characteristics of the tones used for testing are given in table A.5.6.3.1 (GB) 1.

The test circuit is shown in figure A.5.6.3.1 (GB) 1. Compliance with the requirements when dial tone is returned not more than 3,5 s after the instant the loop state is established is checked, first when dial tone is returned not more than 0,5 s after the instant that the loop state is established, and again when dial tone is returned not less than 3 s and not more than 3,5 s after the instant that the loop state is established.

Compliance with the requirements when dial tone is not returned after the instant the loop state is established is checked, first when, representing no dial tone, special information tone is returned not more than 0,5 s after the instant the loop state is established, and again when, representing no dial tone, silence is returned after the loop state is established.

Table A.5.6.3.1 (GB) 1: Characteristics of tones for test purposes

Tone	Frequency Hz ± 0,5%	Cadence ± 1%	Level dBm ± 0,5 dBm	Application time
Dial tone	350 plus 440	Continuous	-10 dBm (each tone separately 3 dB lower)	10 s followed by silence
Special information tone	950 ± 50 1 400 ± 50 1 800 ± 50	Each frequency sent for 330 ± 70 ms in the order given and with silent periods of up to 30 ms between signals	-10 dBm	One triplet followed by silence
Silence			< -52 dBm	As required



- NOTE 1: R is a resistor with a value such that the total series resistance of R and the high speed relay coil is $400 \Omega \pm 10\%$.
- NOTE 2: The 6 km artificial line is that described in A.5.3.6 (GB) 2.
- NOTE 3: The transformer is BT type 3/216A. Details of this device may be obtained from BSI Customer Information, Linford Wood, Milton Keynes MK14 6LE.

Figure A.5.6.3.1 (GB) 1: Automatic initiation of dialling test circuit

5.6.3.2 Manual initiation of dialling

The supervision of manually initiated dialling may be controlled by either the user or an integral dial tone detector.

If the TE includes a dial tone detector then dialling shall not commence until the detection of the PSTN dial tone has taken place. The TE shall start dialling within t_2 (s) of detection.

If the TE includes a dial tone detector and it does not detect the PSTN dial tone within t_3 (s) of the establishment of the dc loop condition the TE shall revert to the idle state.

The values of t_2 and t_3 are shown in table 5.6.3.1.

Compliance shall be checked using the tests outlined in section A.5.6.3.2.

5.6.3.2 (F) 1 Sections 5.6.3.1 (F) 2 and 5.6.3.1 (F) 3 apply to TE including timer function for automatic dialling after second dial tone.

5.6.3.2 (GB) 1 The UK has no requirement.

A.5.6.3.2 Manual initiation of dialling

The TEUT is connected as shown in figure A.5.6.3.1 and the calling function is initiated manually.

If the TEUT does not include a dial tone detector then the initiation of dialling shall be checked by inspection.

If the TEUT includes a dial tone detector then dialling shall commence within t_2 (s) of the application of the appropriate nominal PSTN dial tone or within t_2 (s) of the manual initiation if the dial tone is already present.

In the case where a dial tone detector is used, the test shall be repeated, without the application of the PSTN dial tone, and the TE shall revert to the idle state after t_3 (s).

The values of t_2 (s) and t_3 (s) are shown in table 5.6.3.1.

Measurements are carried out at various dc feeding condition values shown in table A.5.6.3.1.

5.6.4 Automatic control of call progress

Prior to the initiation of transmission, the TE may monitor the line to check if the PSTN tones are present. Reference is made to Chapter 9.

If a tone, which indicates that the call connection has not been successful, is detected (e.g. busy tone, congestion tone, etc.) the TE shall revert to the idle state.

The inclusion of these functions may be mandatory, (see table 5.6.4).

Compliance shall be checked by inspection.

Table 5.6.4: Automatic control of call progress

COUNTRY	CALL PROGRESS CONTROL		Remarks
	mandatory (yes/no)		
Austria	no		
Belgium	no		yes
Cyprus	no		
Denmark	no		
Finland	no		
France	no		
Germany	no		
Greece	no		
Iceland	no		
Ireland	no		
Italy	no		
Luxembourg	no		
Malta			
Netherlands	no		yes
Norway	no		
Portugal	no		
Spain			yes
Sweden	no		
Switzerland	yes		
U. Kingdom	no		yes

5.6.4 (B) 1 The requirement is only applicable if the function is provided within the TE.

5.6.4 (NL) 1 Detection of busy tone and congestion tone in this stage of the call set-up is only mandatory for equipment with a dial tone detector according to section 5.6.3.1.

In the case that busy tone and congestion tone are detected, this must comply with the requirements of section 9.5.3 and section 9.5.4.

5.6.4 (E) 1 The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to section 10.5 (E) 10.6.

5.6.4 (GB) 1 It is not mandatory for tone detection to be provided. However, where a TE has a tone detection facility and that facility is used to control certain other functions then that facility shall be tested using the tones with the characteristics set out in Chapter 9.

5.6.5 Initiation of transmission

Initiation of transmission shall be controlled manually, or automatically by either identification signal or by a timer within the TE.

5.6.5.1 Automatic initiation of transmission

Automatic initiation of transmission shall be controlled either by an identification signal or by a timer within the TE which shall not initiate transmission until a time period t_4 (s) has elapsed.

If the TE is controlled by identification signals and it does not receive the identification signal within t_5 (s) of the change from dialling to transmission state, then the TE shall revert to the idle state.

If the TE is controlled by identification signals and it receives the identification signal, then transmission shall start within t_6 (s) of recognition.

The values t_4 , t_5 and t_6 are shown in table 5.6.5.1.

Compliance shall be checked using the tests outlined in section A.5.6.5.1.

Table 5.6.5.1: Automatic initiation of transmission

COUNTRY	REQUIREMENT VALUES			Remarks
	t_4 (s)	t_5 (s)	t_6 (s)	
Austria	not mandatory	60	not mandatory	
Belgium		80		yes
Cyprus	not mandatory	90	not mandatory	
Denmark	not mandatory			
Finland	not mandatory	60	not mandatory	
France	35 to 60/35 to 90			yes
Germany	not mandatory	100	not mandatory	yes
Greece	not mandatory			
Iceland	not mandatory			
Ireland	not mandatory			
Italy		60	not mandatory	
Luxembourg	not mandatory	100	not mandatory	
Malta				
Netherlands	not mandatory			
Norway	not mandatory	90	not mandatory	
Portugal	not applicable	90	not applicable	yes
Spain				yes
Sweden	not mandatory			
Switzerland	TE type dependent	60	TE type dependent	yes
U. Kingdom	not mandatory			

5.6.5 (B) 1 Time periods t_4 and t_6 may be specified on terminal standards.

5.6.5 (F) 1

- $t_5 = 35$ to 60 s for automatic calling towards TE with automatic answering;
- $t_5 = 35$ to 90 s for automatic calling towards TE with manual answering.

5.6.5 (F) 2 TE with automatic calling facility shall:

- initiate at the latest 3 s after the end of dialling a repetitive speech or code message, the distant party receiving the message with the current;

or

- initiate at the latest 1 s after the recognition of the answer of the distant party by detection of stop of ringing tone (see section 9.5.5), either a repetitive speech or code message or a transfer to manual position.

or

- a) emit at the latest 3 s after the end of dialling a calling tone of frequency 1 300 Hz \pm 5% or frequency related to data digit "1", with cadence t_{on}/t_{off} of 0,5 to 0,7 s / 1,5 to 2 s (1);

and

- b) detect answering tone as described in section 9.6.1;

and

- c) stop calling tone;

and

- d) recognise the end of the received tone by detection of an absence of answering tone greater than 55 ms before to initiate data transmission.

- (1) For fax machines the calling tone shall be 1 100 Hz or frequency related to data digit "1" with cadence t_{on}/t_{off} of 0,5 s / 3 s and for DTMF (MFPB) code transmission the calling tone can be the code corresponding to character "2" with cadence t_{on}/t_{off} of 0,5 to 0,7 s / 1,5 to 2 s.

5.6.5.1 (D) 1 If the initiation of transmission within the TE is not controlled by identification signals, the TE may start transmission immediately after dialling has finished. If the initiation of transmission does not take place, the TE shall revert to the idle state within 100 s.

5.6.5.1 (P) 1 Time periods t_4 and t_6 may be specified on terminal standards or NET.

5.6.5.1 (E) 1 The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to sections 10.5 (E) 8 and 10.5 (E) 9.2.

5.6.5 (CH) 1 See also remark 5.7.1 (CH) 1.

A.5.6.5.1 Automatic initiation of transmission

The TEUT is connected as shown in figure A.5.6.3.1 and the automatic calling function is initiated. After dialling has been completed the TEUT shall initiate transmission either after t_4 (s) or, where an identification signal is used, within t_6 (s) of the application of the appropriate nominal identification signal.

In the case where an identification signal is used, the test shall be repeated, without the application of the identification signal, and the TE shall revert to the idle state after t_5 (s).

The values of t_4 , t_5 and t_6 are shown in table 5.6.5.1.

Measurements are carried out at the various dc feeding condition values shown in table A.5.6.3.1.

5.6.5.2 Manual initiation of transmission

If the TE allows only manual initiation of transmission and the user does not manually initialise transmission (e.g. pick-up the handset or switch-on a handsfree function, etc.) within t_7 (s) of the change from dialling to transmission state the TE shall revert to the idle state.

The value of t_7 is shown in table 5.6.5.2.

Compliance shall be checked using the tests outlined in section A.5.6.5.2.

Table 5.6.5.2: Manual initiation of transmission

COUNTRY	REQUIREMENT VALUES	Remarks
	t_7 (s)	
Austria	60	
Belgium	80	
Cyprus	not mandatory	
Denmark	90	
Finland	60	
France		yes
Germany	100	
Greece	not mandatory	
Iceland	not mandatory	
Ireland	not mandatory	
Italy	60	
Luxembourg	100	
Malta		
Netherlands	not mandatory	
Norway	not mandatory	
Portugal	90	
Spain		yes
Sweden	not mandatory	
Switzerland	TE type dependent	
U. Kingdom	not mandatory	

5.6.5.2 (E) 1 The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to sections 10.5 (E) 8, and more specifically to section 10.5 (E) 8.c.

5.6.5.2 (F) 1 The timer t_7 is not mandatory, but a monitoring system is mandatory (see 5.6.1.3 (F) 1 and 2).

A.5.6.5.2 Manual initiation of transmission

The TEUT is connected as shown in figure A.5.6.3.1 and the automatic calling function is initiated. After dialling has been completed, the user shall initiate manually and the TEUT shall respond appropriately. This shall be checked by inspection.

In the case where the user does not initiate manually transmission within t_7 (s), the TEUT shall revert to the idle state.

The value of t_7 is shown in table 5.6.5.2.

Measurements are carried out at the various dc feeding condition values shown in table A.5.6.3.1.

5.6.6 Transmission duration control

Transmission duration control may be controlled automatically by either monitoring the flow of information or by a timer within the TE. When transmission has been completed under automatic duration control with information flow, it is possible for the TE to pass control to the user and the termination of the call to be performed manually.

5.6.6.1 Automatic transmission duration control

Transmission duration control shall be controlled automatically by either monitoring the flow of information or by a timer within the TE. The timer terminates the transmission and returns the TE to the idle state within a time period t_8 (s).

If the transmission duration is controlled by monitoring the flow of information and no information flow is identified for a continuous period of t_9 (s), the TE shall revert to the idle state or pass control of the call to the user as appropriate.

The values of t_8 and t_9 are shown in table 5.6.6.1.

Compliance shall be checked using the tests outlined in section A.5.6.6.1.

Table 5.6.6.1: Automatic transmission duration control

COUNTRY	REQUIREMENT VALUES		Remarks
	t_8 (s)	t_9 (s)	
Austria	60	60	yes
Belgium	300	60	
Cyprus	90	20	
Denmark	60	15	yes
Finland	90	90	
France	180	180	yes
Germany	100	60	
Greece	90	60	
Iceland	not mandatory		
Ireland	not mandatory		
Italy	90	20 - 40	yes
Luxembourg	100	60	
Malta			
Netherlands	not mandatory		
Norway	180		yes
Portugal	90		yes
Spain			yes
Sweden	not mandatory		
Switzerland	TE type dependent		
U. Kingdom	i) 60, ii) 180, iii) 240 - 300	not mandatory	yes

- 5.6.6.1 (A) 1 See also sections 6.4.1 and 6.4.2.
- 5.6.6.1 (DK) 1 As an exception from this rule it may, however, be permissible for the loop condition to be succeeded by quiescent condition at the latest 20 minutes after reception of a code signal with a piece of information, which unambiguously means continuation of loop condition and is perceived as such.
- 5.6.6.1 (F) 1 If the answer of the distant party is detected, the time period t_8 begins from this moment; if not, t_8 begins from the end of dialling.
- 5.6.6.1 (F) 3 Depending on the type of the controlled information, section 6.4.2 or 6.4.3 or 6.4.4 apply. For section 6.4.4, the polarity inversion which shall cause the return to quiescent conditions, the second polarity inversion detected after the last activation of the public exchange and the polarity inversion detection period shall start 1 s after the dialling period. To this end, it is recommended to "read" the polarity of origin just after the dial tone detection and before the dialling period.
- 5.6.6.1 (F) 4 Series-connected TE shall connect again its output with the PSTN, at the latest 2 s after its return to quiescent condition.
- 5.6.6.1 (I) 1 t_8 timer is requested only for autocalling TEs not using flow of control information.
- 5.6.6.1 (N) 1 If the duration of the call is controlled by monitoring the information flow, the loop condition shall be maintained for signal levels above -43 dBm, averaged over a period of 0,2 s. The line must be released within 10 s if the level is less than -54 dBm for more than 20 s.
- 5.6.6.1 (N) 2 If the busy/congestion tone is detected, the line must be released within 20 s.
- 5.6.6.1 (P) 1 If the transmission duration is controlled by monitoring the flow of information and no information flow is identified for a continuous period of t_9 (s), the TE shall revert to the idle state unless the user assumes control of the call.
- 5.6.6.1 (P) 2 If the TE has the initiation of transmission and the transmission duration automatically controlled by a timer within the TE, then it shall be t_4 (s) + t_8 (s) = 90 (i.e., 90 s after dialling).
- 5.6.6.1 (P) 3 If the TE has the initiation of transmission automatically controlled by a timer within the TE and the transmission duration automatically controlled by monitoring the flow of information, then the TE shall revert to the idle state within a time period of 90 s after dialling, unless the call is successful (see definition of a successful call in section 5.6.7.2) during this time period. That means:
- $$t_4(s) + t_9(s) = 90$$
- If the call is successful and no information flow is identified during the call for a continuous period of t_9 (s) (t_9 is specified in sections 5.6.6.1 (P) 4 and 5.6.6.1 (P) 5), the TE shall revert to the idle state unless the user assumes manual control of the call.
- 5.6.6.1 (P) 4 If the TE has the transmission duration automatically controlled by monitoring the flow of information, then during a successful call

$t_9(s) = 0,25$ for TE using the backward channel according to CCITT Recommendations V.23, V.26 bis or V.27 ter.

TE shall revert to the idle state within a subsequent time period of 10 s.

5.6.6.1 (P) 5

If the TE has the transmission duration automatically controlled by monitoring the flow of information, then during the successful call

$t_9(s) = 20$, for other TE (i.e., TE not covered by section 5.6.6.1 (P) 4)

TE shall revert to the idle state within a subsequent time period of 10 s.

5.6.6.1 (P) 6

If the TE has the transmission duration automatically controlled by monitoring the flow of information and if during a successful call the dial tone, busy tone or congestion tone occur, then the TE shall revert to the idle state. Reference is made to Chapter 9.

5.6.6.1 (E) 1

The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to sections in 10.5 (E) 10, and, more specifically to sections 10.5 (E) 10.3 to 10.5 (E) 10.5.

5.6.6.1 (GB) 1

The timer within the TE shall set the time-out period t_8 according to the mode of operation of the TE, mode 1, 2 or 3; these modes of operation are defined below.

The time-out is the duration of the period from the instant of termination of dialling by the TE to the instant when the TE reverts to the quiescent state. The time-out may be fixed, i.e. one that is not dependent on external control signals and not affected by call-outcome conditions.

- 1) Mode 1: A mode of operation of the TE in which the time-out is not more than 1 min when each of the ineffective call conditions given in table 5.6.6.1 (GB) 1 is received.

NOTE: Mode 1 may be used for all types of call, except voice alert calls to public emergency authorities and the BT emergency (999) service.

- 2) Mode 2: A mode of operation of the TE in which the time-out is not more than 3 min when each of the ineffective call conditions given in table 5.6.6.1 (GB) 1 is received.

NOTE: Mode 2 is for use only for voice alert calls other than voice alert calls to the BT emergency (999) service.

- 3) Mode 3: A mode of operation of the TE in which the time-out is not more than 5 min and, for effective calls, not less than 4 min.

NOTE: Mode 3 is for use only for voice alert calls to the BT emergency (999) service.

Table 5.6.6.1 (GB) 1: Tones indicative of ineffective calls*

Item	Description
1	Ring tone
2	Number unobtainable tone
3	Special information tone
4	Busy tone
5	Congestion tone

* Characteristics of tones used for testing are given in table A.5.6.6.1 (GB) 1.

A.5.6.6.1 Automatic transmission duration control

The TEUT is connected as shown in figure A.5.6.3.1 and the automatic calling function is initiated. After dialling has been completed and the transmission state initiated, the appropriate signals shall be applied to its line terminals.

If the transmission duration is controlled by a timer within the TEUT, then it shall terminate the transmission and return to idle state after t_g (s). This shall be checked by inspection.

If the transmission duration is controlled by monitoring the flow of information, the TEUT shall terminate the transmission and either return to the idle state or pass control to the user within t_g (s) after the test signal has been removed.

The values of t_g and t_9 are shown in table 5.6.6.1.

Measurements are carried out at various dc feeding condition values shown in table A.5.6.3.1.

A.5.6.6.1 (GB) 1 The characteristics of the tones used for testing are given in table A.5.6.6.1 (GB) 1. The test circuit is shown in figure A.5.6.3.1 (GB) 1.

Dial tone is returned and is removed not more than 600 ms after the instant of termination of the first dialled digit. When one of the tones given in table A.5.6.6.1 (GB) 1 is used, the test circuit begins to apply the tone not less than 5 s and not more than 10 s after the instant of termination of the last dialled digit.

Table A.5.6.6.1 (GB) 1: Characteristics of tones for test purposes

Tone	Frequency Hz ± 0,5%	Cadence ± 1%	Level dBm ± 0,5 dBm	Application time
Dial tone	350 plus 440	Continuous	-10 dBm (each tone separately 3 dB lower)	10 s followed by silence
Ring tone	400 plus 450	0,4 s on 0,2 s off 0,4 s on 2 s off	-10 dBm (each tone separately 3 dB lower)	180 s followed by silence
Number unobtainable tone	400	Continuous	-10 dBm	20 s followed by silence
Special information tone	950 ± 50 1 400 ± 50 1 800 ± 50	Each frequency sent for 330 ± 70 ms in the order given and with silent periods of up to 30 ms between signals	-10 dBm	One triplet followed by silence
Busy tone	400	0,375 s on 0,375 s off	-10 dBm	20 s followed by silence
Congestion tone	400	0,4 s on 0,35 s off 0,225 s on 0,525 s off	-16 dBm -10 dBm	20 s followed by silence
Silence			< -52 dBm	As required

5.6.6.2 Manual transmission duration control

If it has been indicated (by lifting the handset etc.) that control of the call duration should be passed to the user, after the automatic duration control with information flow has finished operating, then the TE may include an audible warning device to alert the user, see table 5.6.6.2.

Compliance shall be checked using the tests outlined in section A.5.6.6.2.

Table 5.6.6.2: Manual transmission duration control

COUNTRY	AUDIBLE WARNING DEVICE	Remarks
	mandatory (yes/no)	
Austria	no	
Belgium	yes	
Cyprus	yes	
Denmark	yes	
Finland	no	
France	yes	
Germany	yes	yes
Greece		
Iceland	not mandatory	
Ireland	no	
Italy	yes	
Luxembourg	no	
Malta		
Netherlands	not mandatory	
Norway	not mandatory	
Portugal	no	yes
Spain		yes
Sweden	not mandatory	
Switzerland	not mandatory	
U. Kingdom	no	

5.6.6.2 (D) 1 Whether this requirement is mandatory or not depends on the kind of TE. Details are given in section 8.3 (D).

5.6.6.2 (P) 1 See section 5.6.6.1 (P) 1.

5.6.6.2 (E) 1 The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to section 10.5 (E) 10.2.

A.5.6.6.2 Manual transmission duration control

The TEUT is connected as shown in figure A.5.6.3.1 and the automatic calling function is initiated. After dialling has been completed and transmission is in progress, it shall be indicated to the TEUT (by lifting the handset etc.) that control is to be passed to the user when the transmission has been terminated. The test signal is then removed and when the duration control (automatic timer)

operates, the TEUT shall pass control to the user. If the TEUT includes an audible warning device, then it shall be activated at this time. This shall be checked by inspection.

Measurements are carried out at various dc feeding condition values shown in table A.5.6.3.1.

5.6.7 Automatic repeat function

TE with automatic calling functions may be capable of performing repeat call attempts to the same or different numbers in an arbitrary order.

5.6.7.1 Repeat call attempts

TE capable of performing repeat call attempts to the same or different numbers shall not repeat a second call attempt until a time period of t_{10} (s) has elapsed, following the return to idle state at the end of the first call attempt. Subsequent call attempts shall not be repeated until a time period of t_{11} (min) has elapsed following the return to idle state at the end of the previous call attempt.

In the case where a subsequent call attempt is to a number which is different from the number used in the previous call attempt, the repeat time period t_{10} shall apply.

The values of t_{10} and t_{11} are shown in table 5.6.7.1.

Compliance shall be checked using the tests outlined in section A.5.6.7.1.

Table 5.6.7.1: Repeat call attempts

COUNTRY	REQUIREMENT VALUES		Remarks
	t_{10} (s)	t_{11} (min)	
Austria	5	1	
Belgium	5	1	
Cyprus	5	1	
Denmark	2	1/30	
Finland	5	1	
France			yes
Germany	5	1	yes
Greece	5	1	
Iceland	5	1	
Ireland	5	1	
Italy	5	1	
Luxembourg	5	1	
Malta			
Netherlands	5	1	
Norway			yes
Portugal	60	1	
Spain			yes
Sweden	3	1	yes
Switzerland	5	5 s / 30 s	yes
U. Kingdom	5	i) 1, ii) 2, iii) 3, iv) 10	yes

5.6.7.1 (F) 1

a) Case of alarm call:

- $t_{10} = t_{11} = 6$ s for call attempt
In addition, series-connected alarm TE shall disconnect the output port (and remains in quiescent condition) for a period between 6 and 12 s before each call attempt.

b) Other cases:

- b1) $t_{10} = t_{11} = 2$ s for call attempt following an outgoing call, except for case b3);
- b2) $t_{10} = t_{11} = 6$ s for call attempt following an incoming call;
- b3) $t_{10} = t_{11} = 1$ min for repeat call attempt to the same number when previous call attempt was not successful.

5.6.7.1 (D) 1

TEs are put into the following three categories:

- 1) TEs with manual initiation of calling function, which are capable of performing repeat call attempts to any one number, and which do not include answering tone detector (e.g. simple dialling equipment).

- 2) TEs with automatic initiation of calling function, capable of performing repeat call attempts to any one number, and which do not include answering tone detector (e.g. simple alarm systems).
- 3) TEs with manual or automatic initiation of calling function, which are capable of performing call attempts to any one number, and which include an acknowledgement signal detector (not speech or 16 kHz recognition), e.g. modems, fax, alarm systems.

The TEs shall comply with the following requirements:

- (1) Group 1: The TE shall not attempt more than 12 call attempts to any one number and shall then return to the idle state. The restart of the calling function shall only be possible by manual intervention (by manual reset) of the user (e.g. by pressing a key). Each commenced emission of dialling information shall be rated as a call attempt.
- (2) Group 2: The TE shall not perform more than 12 repeat call attempts from the same memory location. The maximum number of locations shall be 4. Following a series of 12 call attempts from each memory location, the TE shall return to idle state. The restart of the calling function may recommence by manual reset or by occurrence of a new event (e.g. a new alarm). Each commenced emission of dialling information shall be rated as a call attempt.
- (3) Group 3: The TE shall not perform more than 12 call attempts to any one number if no answering signal is recognised. The counter for unsuccessful call attempts may be reset upon the recognition of an answering signal. Following a series of 12 unsuccessful call attempts, the TE shall return to the idle state. The restart of the calling function may recommence by manual reset or by occurrence of a new event. Each commenced emission of dialling information shall be rated as a call attempt.
- (4) The delay times between the initial and the second and between the second and third call attempts to the same number (redialling) shall be at least 5 s.
- (5) The delay time between the third and all subsequent call attempts to the same number (redialling) shall be at least 60 s.
- (6) In case where call attempts are to different call numbers the delay time between two call attempts shall be at least 5 s.

5.6.7.1 (N) 1 TEs capable of using the repeat call attempt function shall have a dial tone detector.

5.6.7.1 (N) 2 TEs are allowed to use the repeat call attempt function when:

- Busy or congestion tone is detected . At least three pulses must be detected.
- No dial tone is detected.
- No activity except ringing tone is detected on the line within 60 s after the end of dialling.

5.6.7.1 (N) 3 The line shall be in quiescent condition for at least 5 s between each call attempt.

5.6.7.1 (E) 1 The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to sections in 10.5 (E) 11, and, more specifically to sections 10.5 (E) 11.1 to 10.5 (E) 11.2.

5.6.7.1 (S) 1 For alarm calls $t_{11} = 3$ s.

5.6.7.1 (CH) 1 **Requirements after dialling**

If a dial attempt is unsuccessful, a repetition is permitted within the following conditions:

- a) The maximum permissible number of repetitions per destination is 4. Every transmission of dialling information counts as a dial attempt.
- b) Before dialling the same subscriber number, a waiting period t_{11} of at least 30 s must be observed.
- c) Before dialling a new destination the line must be released for at least 5 s.

The following requirements apply for successful dial attempts (subscriber B connected, call answered):

- a) In the course of the same programmed dial routine, the calling equipment must not dial the respective number automatically again. This also applies when no or inadequate data transmission has taken place.
- b) Before selecting a new destination, the line must be released for a pause t_{11} of at least 5 s.

See also requirements before dialling; section 5.2.2 (CH) 1.

5.6.7.1 (GB) 1 Where seizure of a PSTN line is part of a repeat attempts sequence invoked by the intention to set up a connection in respect of the same PSTN directory number without direct user intervention between call attempts of that sequence, the number of repeat call attempts and the minimum durations between these repeat call attempts shall comply with the call pattern or patterns nominated by the supplier from those given in table 5.6.7.1 (GB) 1.

NOTE: No requirements are specified for the minimum duration between call attempts 1) where the seizure of a PSTN line is under the direct control of the user, or 2) where the call attempts are to different PSTN numbers.

5.6.7.1 (GB) 2 In any one repeat attempts sequence, the TE shall not be capable of operating in a combination of call patterns A, B, and C.

Where the TE intends automatically to repeat either of call patterns A or B, as given in table 5.6.7.1 (GB) 1, there shall be not more than one sequence of the nominated pattern to the same PSTN directory number within a period of 2 hours from the commencement of the initial call attempt.

Where a repeat attempts sequence is invoked under the direct control of a user while an existing repeat attempts sequence to the same PSTN directory number is in progress, the TE shall comply with one of the following:

- a) take no action in response to the invocation;
- or
- b) make a single attempt to the PSTN directory number in addition to the remainder of the existing repeat attempts sequence;

- or
- c) cancel the existing repeat attempts sequence and initiate a fresh repeat attempts sequence.

Call pattern D shall be nominated only where the TE is capable of recognising congestion tone.

The TE shall not be capable of operating in accordance with call pattern D unless it is receiving and recognising congestion tone.

If the call pattern D is entered on receipt and recognition of congestion tone via one of call patterns A, B or C.

- a) the 5 s minimum duration specified for call pattern D in table 5.6.7.1 (GB) 1 shall not be used;
- and
- b) the TE shall revert to the remainder of the originating call pattern on receipt and recognition of PSTN tones other than congestion tone.

Table 5.6.7.1 (GB) 1: Repeat attempts - number of attempts and durations between attempts

Call attempt	Minimum duration between call attempts for call pattern:			
	A	B	C	D
Initial attempt	5 s	5 s	5 s	5 s
1st repeat attempt	1 min	2 min	10 min	3 min
2nd repeat attempt	1 min	2 min	10 min	3 min
3rd repeat attempt	1 min	2 min	10 min	3 min
4th repeat attempt	End of sequence (see note 1)	2 min	10 min	3 min
5th repeat attempt		2 min	10 min	3 min
6th repeat attempt		End of sequence (see note 1)	10 min	3 min
7th repeat attempt			10 min	3 min
nth repeat attempt (see NOTE 2)			10 min	10 min

NOTE 1: The maximum number of calls for repeat attempt call pattern A is 5, and for call pattern B is 7.

NOTE 2: No limit is specified for the value of "n".

NOTE 3: The durations given in table 5.6.7.1 (GB) 1 are measured from clear-down to re-seizure.

A.5.6.7.1 Repeat call attempts

The TEUT is connected as shown in figure A.5.6.7.1 and the automatic calling function with repeat attempts is initiated. The appropriate tones and signal required to force the TE to make repeat attempts shall be applied and removed as necessary.

The delay times between the initial attempt and the first repeat attempt, and between subsequent attempts shall be measured.

Measurements are carried out at the various dc feeding condition values shown in table A.5.6.3.1.

A.5.6.7.1 (GB) 1 The test circuit is shown in figure A.5.6.3.1 (GB) 1.

Dial tone is returned not more than 0,5 s after the instant the loop state is established and is removed not more than 200 ms after the instant of termination of the first dialled digit. After the final dialled digit has been sent, one of the tones given in table A.5.6.6.1 (GB) 1 is applied, which indicates an ineffective call. The process is repeated as each fresh attempt is generated.

Where the TE makes use solely of the absence of an answering tone or other answer signal from the called station when a decision is being reached to make a repeat attempt, busy tone is returned for each attempt generated. The number of attempts generated in a period of 4 h and their spacings are determined.

Where the TE makes use of one or more of the tones given in table 5.6.6.1 (GB) 1 when a decision is being reached to make a repeat attempt, one of these tones (agreed with the supplier) is returned for each attempt generated. The number of attempts generated in a period of 4 h and their spacings are determined.

5.6.7.2 Number of repeat call attempts

TE capable of performing repeat call attempts shall not attempt more than n_1 call attempts to any one number within any one time period of t_{12} (hrs), except for alarm calls which shall not attempt more than n_2 calls within the same period if no call is successful. Following a successful call or a manual reset, the repeat call attempt cycle may recommence. For the purpose of this requirement a successful call is defined as one that:

- a) provides to the calling TE a data or code signal originating from the TE;
- b) delivers to the calling party a metering pulse or an answering signal.

The values of t_{12} , n_1 and n_2 are shown in table 5.6.7.2.

Compliance shall be checked using the tests outlined in section A.5.6.7.2.

Table 5.6.7.2: Number of repeated call attempts

COUNTRY	REQUIREMENT VALUES			Remarks
	t_{12} (hrs)	n_1	n_2	
Austria				yes
Belgium	1	4	15	yes
Cyprus	1	4	15	
Denmark	∞	10	10	
Finland	1	4	not specified	
France	1	6	16	yes
Germany				yes
Greece	1	4	not specified	
Iceland		10	10	
Ireland	1	4	15	
Italy	1	4	15	yes
Luxembourg	1	4	15	
Malta				
Netherlands	1	15		
Norway		10	15	yes
Portugal	not applicable	4	15	yes
Spain				yes
Sweden		10	15	
Switzerland	See type specific recommendations			yes
U. Kingdom	2	5 or 7	5 or 7	yes

- 5.6.7.2 (A) 1** For the purpose of repeat call attempts the TE shall be categorised into three groups:
- 1) TE with manual dial start and capable of performing repeat call attempts to any one number and without answering tone recognition (e.g. simple automatic dialler).
 - 2) TE with manual or automatic dial start and capable of performing repeat call attempts to any one number and with answering tone recognition (e.g. modem, fax, alarm systems).
 - 3) TE with automatic dial start and capable of performing repeat call attempts to any one number and without answering tone recognition (e.g. simple alarm devices).

The TE shall be in accordance with the following requirements:

Group 1: The TE shall not attempt more than 3 call attempts to any one number. After 3 call attempts the TE has to stop the dialling function.

Restart or stop of the dialling function is only possible by manual intervention of the user (e.g. by pressing a button, lift off the handset).

Group 2: The TE shall not attempt more than 6 attempts to any one number if no answering tone is recognised. The counter of unsuccessful call attempts is reset by recognition of the answering tone. After 6 unsuccessful attempts the TE has to stop the dialling function. In addition the TE shall not attempt more than 3 call attempts from the same memory location.

Restart of the dialling function is possible by manual intervention of the user automatically every 12 hours and by remote control via the subscriber line.

Group 3: The TE shall not attempt more than 3 call attempts from the same memory location. The total number of memory locations are four. After 3 call attempts from each used memory location the TE has to stop the dialling function.

Restart of the dialling function is possible by manual intervention on the TE or by occurrence of a new task (e.g. renewed fault report from alarm source).

5.6.7.2 (A) 2 Section 5.6.7.2.b is not applicable in the Austrian PSTN.

5.6.7.2 (B) 1 For TE transmitting alarm messages to one of the official emergency services, each call shall be followed by a speech message and the entire call process shall be repeated twice (3 successful calls in total).

For the same event, such a TE shall alert only one of the official emergency services.

5.6.7.2 (F) 1

a) Definition of terms used in this section:

- ineffective call: dialling not followed by a loop state in the distant party;
- erroneous call: dialling followed by a loop state in the distant party, but coming from a correspondent different of the addressee. This condition is recognised by detection of stop of ringing tone (see section 9.5.5.2) not followed by answering tone or code signal.

- b) Case of TE able to distinguish between erroneous call and ineffective call:
- series of maximum 6 call attempts may be repeated each hour. If a call is verified erroneous for a second time, the call attempts series shall be stopped and the relevant call number shall be invalidated until a next manual reset. After a first erroneous call, an effective non erroneous call to the same number can reset the erroneous call counter.
- c) Case of TE not able to distinguish between erroneous call and effective call:
- only one series of maximum 6 call attempts within the hour following the first attempt is authorised, and if no call is successful in the series, the relevant call number shall be invalidated until a next manual reset.

5.6.7.2 (F) 2 The time period t_{12} is not applicable to alarm TE.

Alarm TE without acknowledge process which allows the distant party to interrupt the call attempts series, shall limit the call attempts number to 6.

Alarm TE are authorised to initiate automatically again the call attempts series towards the same number, when a new alarm appears, even if the previous cycle was not successful.

5.6.7.2 (D) 1 See 5.6.7.1 (D) 1.

5.6.7.2 (I) 1 For the purpose to save life, there are no limit to the number of call attempts.

5.6.7.2 (N) 1 The total number of allowed call attempts to the same telephone number shall be spread over at least a 10 minutes period.

5.6.7.2 (N) 2 Additional calling sequences to the same number may be initiated manually or automatically. For automatic initiated calling sequences, the equipment shall be in quiescent condition for at least 30 minutes between each sequence.

5.6.7.2 (P) 1 For telemetry calls, $n_2 = 15$.

5.6.7.2 (E) 1 The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to sections in 10.5 (E) 11, and more specifically to section 10.5 (E) 11.3.

5.6.7.2 (CH) 1 The determination of the time period t_{12} needs further studies.

Concerning n_1 and n_2 , see remark 5.6.7.1 (CH) 1.

Following a manual reset, only the repeat call attempt cycle can be restarted.

5.6.7.2 (GB) 1 Refer to 5.6.7.1 (GB) 2.

A.5.6.7.2 Number of repeat call attempts

The TEUT is connected as shown in figure A.5.6.3.1 and the automatic calling function with repeat attempts to the same number is initiated. The appropriate tones and signals required to force the TE to make repeat attempts shall be applied and removed as necessary.

The maximum number and timing of repeat call attempts to the same number shall be checked by inspection or measurement.

Measurements are carried out at various dc feeding condition values as shown in table A.5.6.3.1.

5.7 Identification signals

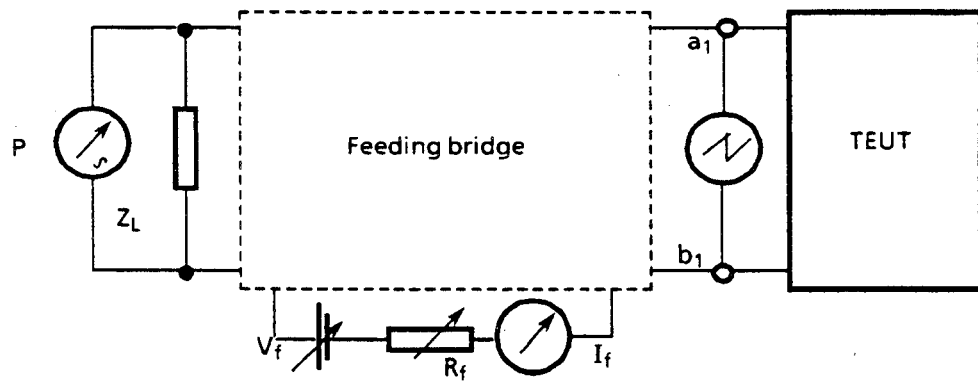
For TE capable of automatically establishing a call, an identification signal consisting of speech or data-related tones shall be sent by the TE no later than t_1 after the completion of the dialling function.

A.5.7 Identification signals

The TEUT is connected as shown in figure A.5.7.

The tests for sections 5.7.1 and 5.7.2 are to be effected by electrical, mechanical and operational inspection according to accepted engineering practice.

Measurements are performed at all the dc feeding conditions specified in table A.5.6.3.1.



Feeding bridge as specified in Chapter 1
Figure A.5.7: Identification signals

Table A.5.7: Identification signals

COUNTRY	TEST VALUES	Remarks
	mandatory	
Austria	yes	
Belgium	yes	
Cyprus	yes	
Denmark	yes	
Finland	no	
France		
Germany	no	
Greece		
Iceland	no	
Ireland	yes	
Italy	yes	
Luxembourg	yes	
Malta		
Netherlands	no	
Norway	yes	yes
Portugal	no	yes
Spain		yes
Sweden	no	
Switzerland	yes	
U. Kingdom	no	

A.5.7 (N) 1 The requirement is not valid for alarm equipment.

A.5.7 (P) 1 It may be mandatory on terminal standards or NET.

A.5.7 (E) 1 See remarks in sections 5.7.1 (E) 1 and 5.7.2 (E) 1.

5.7.1 Data-related tones

For data-related tones, the identification signal shall consist of one or more frequencies in a bandwidth B, and shall be emitted in such a way as to comply otherwise with all the relevant requirements in section 4.4 and to attempt to cause either a related action at the remote TE or the receipt of a signal which is subject to the requirements of section 6.4 from the called TE.

The bandwidth B and t_1 are shown in table 5.7.1.

Compliance shall be checked by inspection and measurement using the appropriate test arrangements outlined in section A.5.7.

Table 5.7.1: Identification signals - data related tones

COUNTRY	REQUIREMENT VALUES		Remarks
	T ₁ (s)	B (Hz)	
Austria			yes
Belgium	5	700 - 3 000	yes
Cyprus	5	800 - 2 200	
Denmark	5	300 - 2 200	yes
Finland	not mandatory		
France	3		yes
Germany	not mandatory		
Greece	5	800 - 2 200	
Iceland	not mandatory		
Ireland	5	800 - 2 200	
Italy	5	650 - 2 200	
Luxembourg	5	800 - 2 200	
Malta	not stated		
Netherlands			
Norway	5	800 - 1 900	yes
Portugal	not mandatory		yes
Spain			yes
Sweden	not mandatory		
Switzerland	0,1 ... 5	800 - 1 900	yes
U. Kingdom	not mandatory		

5.7.1 (A) 1

The identification signal is required for TE without speech transmission.

The signal shall be sent immediately after completion of the dialling function.

With TE for data transmission, the identification signal shall be a signal for 40 s to 60 s consisting of frequency 1 300 Hz ± 10 Hz, cadence (according to CCITT Recommendation V.25):

Tone: 0,5 s - 0,7 s
Pause: 1,5 s - 2 s

For facsimile equipment an intermittent signal tone is required for 35 s ± 5 s according to CCITT Recommendation T.30:
(frequency: 1 100 Hz ± 38 - Hz, tone duration: 0,5 s ± 15%, pause: 3 s ± 15%).

5.7.1 (B) 1

For modems, the identification tone may be 1 300 ± 10 Hz or another tone related to the binary "1" in the modem. It shall not have power in the band 2 100 ± 250 Hz. The identification signal is sent during periods from 0,5 to 0,7 s, followed by pauses from 1,5 to 2 s. The power level is the same as for the data signals.

For facsimile equipment an intermittent single tone is required for $35\text{ s} \pm 5\text{ s}$ according to CCITT Recommendation T.30 (frequency: $1\ 100\text{ Hz} \pm 38\text{ Hz}$, tone duration: $0,5\text{ s} \pm 15\%$, pause: $3\text{ s} \pm 15\%$).

- 5.7.1 (DK) 1** An identification signal in the form of a code signal shall consist of one or more frequencies in the frequency range 300 - 2 200 Hz and be emitted continuously or intermittently until a correct identification signal has been received from the called subscriber, or till the loop condition has been succeeded by the quiescent condition. Furthermore, it shall be permissible to use multifrequency pulses (MFT signals) as identification signal.
- 5.7.1 (F) 1** See section 5.6.5 (F) 2.
- 5.7.1 (N) 1** The signal shall be sent after completion of the dialling function with a power level of $-12 \pm 2\text{ dBm}$. Any related action at the remote TE is not required.
- 5.7.1 (N) 2** For facsimile equipment and data modems the identification signal (calling tone) shall be according to CCITT Recommendations T.30 and V.25 respectively.
- 5.7.1 (P) 1** It may be mandatory on terminal standards or NET.
- 5.7.1 (E) 1** The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to sections 10.5 (E) 8 and 10.5 (E) 9, and more specifically to section 10.5 (E) 9.3.
- 5.7.1 (CH) 1** Identification signals (e.g. calling tones) according to CCITT Recommendations T.30 (FAX) and V.25 (Modems) are mandatory for telematic TEs with automatic calling devices. In multifunctional terminals, identification signals may be used for subsequent actions.

5.7.2 Speech or other non-data related tones

For speech or speech-like or music signals, the identification signal shall be emitted in such a way as to comply with all the relevant requirements in section 4.4 and to attempt to cause either a related action at the remote TE or the receipt of a signal subject to the requirements of section 6.4 from the remote TE.

This requirement may be mandatory and this is shown in table 5.7.2.

Compliance shall be checked by inspection and measurement using the appropriate test arrangements outlined in section A.5.7.

Table 5.7.2: Identification signals - speech or other non data related tones

COUNTRY	REQUIREMENT VALUES	Remarks
	mandatory	
Austria	no	
Belgium	no	
Cyprus	no	
Denmark	no	
Finland	no	
France		yes
Germany	no	
Greece		
Iceland	no	
Ireland	no	
Italy	yes	
Luxembourg	no	
Malta		
Netherlands		
Norway	yes	yes
Portugal	no	yes
Spain		yes
Sweden	no	
Switzerland	no	yes
U. Kingdom	no	

5.7.2 (F) 1

See section 5.6.5 (F) 2.

5.7.2 (N) 1

The requirement is not valid for alarm equipment. Any related action at the remote TE is not required.

5.7.2 (P) 1

It may be mandatory on terminal standards or NET.

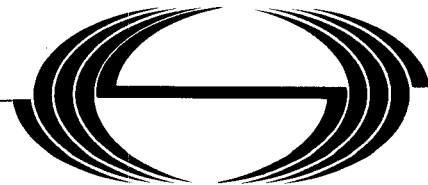
5.7.2 (E) 1

The requirements in sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to sections 10.5 (E) 8 and 10.5 (E) 9, and more specifically to section 10.5 (E) 9.4.

5.7.2 (CH) 1

This requirement is under reconsideration.

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**Attachments to Public Switched Telephone Network (PSTN);
General technical requirements for equipment connected to
an analogue subscriber interface in the PSTN**

Chapter 6: Answering function

(Candidate NET 4)

ETSI

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Foreword

Chapter 6 of this European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI). The text of this ETS may be utilized, wholly or in part, for the establishment of NET 4.

For historical purposes, this ETS was drafted in the form of a NET. However, until a final decision to adopt this ETS as NET 4 has been agreed by the Technical Recommendations Application Committee (TRAC), the terms NET or NET 4 in this document should be read as ETS or ETS 300 001 respectively.

This ETS comprises ten chapters:

"Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

- Chapter 1 - General
- Chapter 2 - DC characteristics
- Chapter 3 - Ringing signal characteristics
- Chapter 4 - Transmission characteristics
- Chapter 5 - Calling functions
- Chapter 6 - Answering function**
- Chapter 7 - Power failure
- Chapter 8 - Connection methods
- Chapter 9 - Special functions
- Chapter 10 - Additional unclassified requirements

Refer to Chapter 1 (General) of this ETS for information on the structure and details of how to use this ETS. The national designations, used to identify national variations to requirements and tests within this ETS, are given in section 1.9 of Chapter 1 (page 60).

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6 Answering function

6.1 General

TE capable of detecting a ringing signal, whilst in the quiescent state, shall subsequently alter its state to the loop condition or indicate to the user that such a change should be initiated.

Compliance shall be checked by inspection and measurement using the tests outlined in the relevant sections.

6.2 Ringing signal reception

6.2.1 Ringing signal detector sensitivity

The ringing detection circuitry or ringer of the TE shall be activated within the time t_r (ms) when ringing signals generated by an ac source "e" connected in series with a dc source (V_f) are applied to the line terminals (see figure A.6.2.1). The requirements shall be met in the specified voltage ranges ΔU (ac) and ΔV_f , in the specified frequency range Δf and with the series resistance ΔR_f . The requirement values ΔU , ΔV_f , Δf and ΔR_f are shown in table 6.2.1.

Compliance shall be checked using the test outlined in A.6.2.1.

Table 6.2.1: Ringing signal detector sensitivity

COUNTRY	REQUIREMENT VALUES					Remarks
	ΔU (V _{rms})	Δf (Hz)	ΔV_f (V)	ΔR_f (Ω)	t_r (ms)	
Austria	18 - 65	40 - 60	20,60	500	200	yes
Belgium	25 - 75	23 - 27	48	1 000	250	
Cyprus	30 - 85	23,5 - 26,5	48	440 - 1 740	200	
Denmark	40 - 120	25 \pm 2,5; 50 \pm 5	44 - 56	500 - 2 400	200	
Finland	35 - 75	25	48	800	not spec.	
France	28 - 90	50 \pm 10 %	0,45 - 54	300	200	yes
Germany	45 - 75	23 - 54	0	0	200	yes
Greece	25 - 90	16 - 50	44 - 66	500	200	
Iceland	30 - 90	22 - 28	48	800	200	
Ireland	25 - 75	17, 25	43 - 53	5 000	not spec.	
Italy	26 - 70	20 - 50	44 - 52	720 - 1 880	200	yes
Luxembourg	45 - 75	25 \pm 10%	60	500	200	
Malta						
Netherlands	25 - 90	23 - 27	66	800	200	
Norway	28 - 90	25 \pm 3	24 60	460 - 1 200 460 - 3 500	350	yes
Portugal	30 - 120	16 2/3 \pm 10 % 25 \pm 20 %	45 - 55	500 - 2 500	10 s	yes
Spain		20 - 30	48	200		yes
Sweden	30 - 90	25 \pm 3; 50 \pm 1	33 - 60	800 - 2 200	200	yes
Switzerland	20 - 90	21 - 55	43 - 57	2 200 - 600	200	yes
U. Kingdom			not specified			yes

- 6.2.1 (A) 1** For electromechanical sounders: $\Delta U = 15 - 65$ V.
- 6.2.1 (F) 1** Not applicable to TE with automatic answering function for which section 6.3.1 is used.
- 6.2.1 (F) 2** For ringing detectors producing luminous signals as flashlights, the time value t_r is not applicable, but it is required at least 1 flashlight for each ringing pulse.
- 6.2.1 (F) 3** Ringing devices producing discernible signals shall be deactivated within 200 ms after the end of each pulse, except for musical ringing devices which shall be deactivated within 5 s after the end of each ringing pulse.
- When the loop is established during a ringing pulse, a musical ringing device shall be deactivated within 200 ms after the establishment of the loop.
- 6.2.1 (F) 4** Not applicable to cordless telephones.
- 6.2.1 (D) 1** When ringing signals of voltage $U_G = 45$ V to 75 V ($R_{iG} = 0$ ohm), generated by an ac source, are applied in the frequency range $f = 23$ Hz to

54 Hz, call: 1 s, pause 4 s or 5 s and the interconnection of a four-terminal network to the ringing detector in the quiescent condition, the ringing detector shall respond, operate and switch off reliably. In practice, pause periods of up to 11 s may occur.

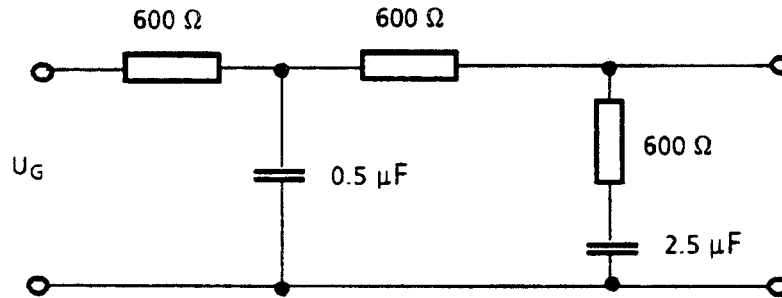


Figure 6.2.1 (D) 1: Four-terminal network "response"

- 6.2.1 (D) 2** When connecting an ac source $U_G = 75 \text{ V}$ ($R_{iG} = 0 \text{ ohm}$), in the frequency range $f \geq 23 \text{ Hz}$ and $f \leq 54 \text{ Hz}$, call: 1 s, pause 4 s or 5 s without interconnection of a four-terminal network, the ringing detector shall respond, operate and switch off reliably.
- 6.2.1 (D) 3** The response and switch-off delays of the incoming call signal shall not exceed 200 ms.
- 6.2.1 (D) 4** The indicated pulse and pause periods of the ringing signal may have a tolerance of $\pm 10\%$.
- 6.2.1 (I) 1** The ringing signal detector sensitivity shall be activated when a ringing signal of voltage $V = 70 \text{ V}_{\text{rms}}$ and frequency $f = 25 \text{ Hz}$ is applied to TE line terminal through a 10 kohm resistor.
- 6.2.1 (I) 2** The ringing signal detector sensitivity shall be activated when a ringing signal of voltage $V = 70 \text{ V}_{\text{rms}}$ and frequency $f = 25 \text{ Hz}$ is applied to TE line terminal with 2 kohm resistor across and through a 1 800 ohms resistor.
- 6.2.1 (N) 1** The TE shall also detect the following signals:
 $-\Delta U = 30 - 90, \Delta f = 50 \pm 5, \Delta V_f = 24 - 60, \Delta R_f = 1\ 200$
 $-\Delta U = 40 - 60, \Delta f = 25 \pm 3, \Delta V_f = 70 - 90, \Delta R_f = 1\ 200$
 The signal peak level is $V_f + \sqrt{2} \times U$.
 $-155 \text{ V}_{\text{p-p}}$ (square wave), $f = 25 \pm 3, V_f = 80, R_f = 1\ 200$
 The signal peak level is $V_f + 1/2 \times V_{\text{p-p}}$.
- 6.2.1 (P) 1** Cadence:
 $t_{\text{on}}(\text{s}) = 1 \pm 0,2$
 $t_{\text{off}}(\text{s}) = 5 \pm 1$
- 6.2.1 (P) 2** For TE with automatic answering function the requirement in section 6.3.1 shall apply.
- 6.2.1 (E) 1** (Requirement to be applied instead of section 6.2.1).
- PROVISION 1:** The provisions 2 to 4 shall be applied to all Spanish sections (E) in this Chapter 6 and also in section 10.6 (E) of Chapter 10.

PROVISION 2: All the requirements related with the answering facility shall be met with the dc feeding excitation stipulated in the associated testing methods, when it is not indicated in the requirement.

PROVISION 3: It should be noted that the mandatory requirements for Spain cover basic and minimum interworking functional characteristics, but quite apart from fulfilling such requirements, it is additionally necessary to provide the TE with appropriate timings during the appropriate periods, in order to avoid non mandatory and unwanted early call releases, or unnecessarily long call attempts.

PROVISION 4: As an amplification of the content of the provision 3 it should be noted that in some requirements the expression "no later than a certain period" is deliberately used instead of "within a certain period". That is to say one limit instead of two limits.

PROVISION 5: TE in the quiescent condition or in the ringing condition, which has a ringing signal receiver that is intended for automatically establishing the loop condition according with the conditions in section 10.6 (E) 2.3, it is expected that it meets with the relevant requirements of other sections and in particular the requirements in Chapter 3 and in section 10.3 (E) of Chapter 10.

With TE in the ringing condition, which has a ringing signal receiver that is intended for automatically establishing the loop condition according with the requirement in section 10.6 (E) 2.3, it shall establish this loop condition (see requirement in section 10.6 (E) 2.3.c) after a ringing signal with open circuit ac rms voltages from 35 V to 75 V and frequencies from 20 Hz to 30 Hz, in a sequence which is made up by a duration of the signal from 1 second to 1,5 seconds and 3 seconds of pause, simultaneously superimposed to a dc voltage of 48 V, is applied between the line terminals through a resistor of 200 ohms.

PROVISION 6: For certain TE, and in accordance with the modes of operation indicated in the user's manual, it may be necessary to insert periods of no ac signal in the interrupted ringing signal specified.

Compliance shall be checked by the tests outlined in section A.6.2.1 (E) 1.

6.2.1 (S) 1 The ringing detection shall not be activated for pulses having a duration of less than 100 ms.

6.2.1 (CH) 1 Sensitivity:

The ringing detector shall function normally with a ringing current source of 60 to 90 V emf in the entire source resistance range of 1,2 to 6 k Ω (purely resistive) and in the frequency range 21 to 55 Hz, and at least respond reliably to a ringing signal of 200 ms duration. Within the frequency range of 21 to 55 Hz, the ringing detector shall respond correctly at ≥ 20 V (source resistance 0 Ω).

The normal dc supply voltage is superimposed on the ringing current; the ringing signal receiver shall not draw any dc current. Ringing burst specifications vs. time:

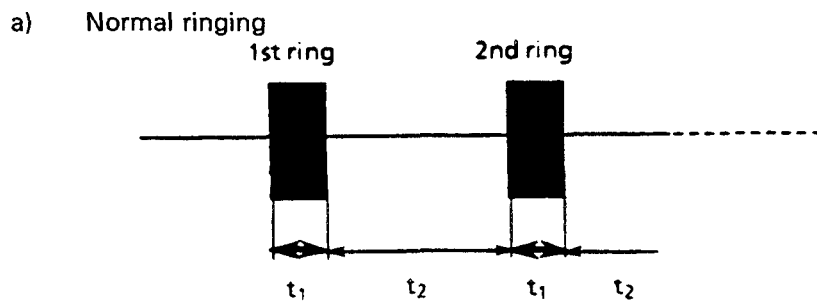


Figure 6.2.1 (CH) 1.a: Normal ringing

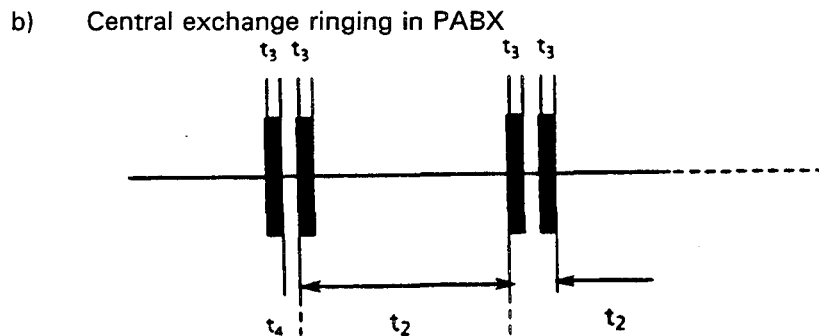


Figure 6.2.1 (CH) 1.b: Central exchange ringing in PABX

Ringling bursts and pauses correspond to the following general conditions:

- Ringing burst: 200 ms (t_3 : 330 ms²⁾) to 1 200 ms (t_1 : 1 000 ms²⁾);
- Pause: 200 ms (t_4 : 330 ms²⁾) to 5 000 ms (t_2 : 4 000 ms²⁾).

- 1) For normal ringing in particular, an acyclic first ringling burst has to be taken into account (duration: 0,25...0,5 s; pause: 0...4,75 s).
- 2) Nominal values; operational tolerances are not taken into consideration.

c) Continuous ringling (for alarm purposes):

For TE with the capability of detecting ringling signals and subsequently capable of automatically establishing a loop condition in itself as a related TE, the requirements are shown in section 6.3 (no seizure shall occur for continuous ringling or for only one ringling burst in the case of automatic establishment of the loop condition).

6.2.1 (GB) 1

Ringling signal detector sensitivity is defined in terms of ringling equivalence number (REN), the requirements and compliance tests for which are specified in Chapter 3.

NOTE: When ringling signal is applied from the PSTN, the voltage developed across the TE can be as low as 23 V. TE should be able to recognise ringling signals under these circumstances.

A.6.2.1 Ringing signal detector sensitivity

The TEUT is connected as shown in figure A.6.2.1 and the test signal is applied.

The ringing signal detector shall be activated within t_r (ms) of the application of the test signal. Compliance shall be checked by inspection or measurement, as appropriate, according to the response generated by the ringing detector. The test shall be performed at all combinations of the values given in table A.6.2.1.

TEs with automatic answering functions, which do not have available a separate indication of the activation of the ringing detector, shall be tested according to section 6.3.

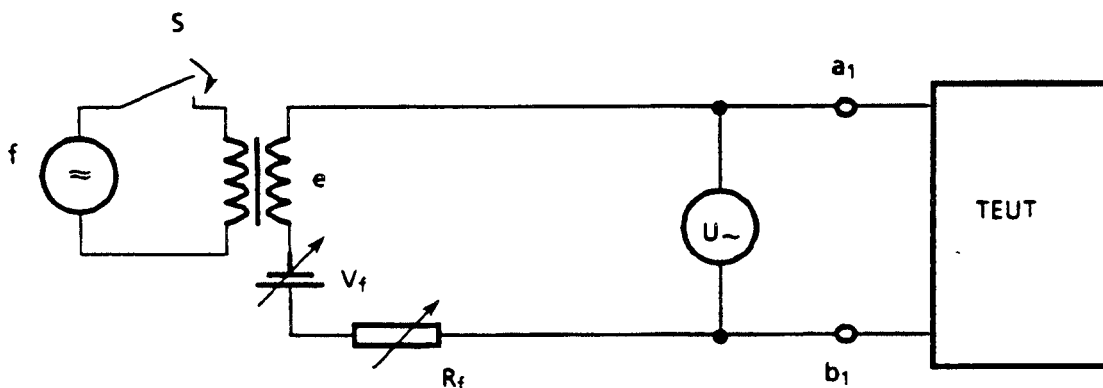


Figure A.6.2.1: Ringing signal detector sensitivity

The signal level is set using a true rms-indicating device able to accept waveforms with a crest factor of at least 3:1 and with a reading accuracy over the required frequency range of within 1 dB of the absolute value.

Table A.6.2.1: Ringing signal detector sensitivity

COUNTRY	TEST VALUES				Remarks
	U (V _{rms})	f (Hz)	V _f (V)	R _f (Ω)	
Austria	18, 60	40, 60	20, 60	500	yes
Belgium	25	25	48	1 000	
Cyprus	30, 85	25	48	800	
Denmark	40, 120	25, 50	48	500	
Finland	35	25	48	800	yes
France	28, 90	50	0, 48	300	
Germany	45, 75	23, 54	0	0	yes
Greece	25, 50, 75	25, 50	60	500	
Iceland	30, 90	25	48	800	
Ireland	25	25	48	5 000	
Italy	26, 70	20, 50	48	800	
Luxembourg	45, 75	25	60	500	
Malta					
Netherlands	25, 90	25	66	800	
Norway				1 200	yes
Portugal	30, 120	16 2/3 ± 10 % 25 ± 20 %	45, 55	500	yes
Spain		20, 25, 30	48	200	yes
Sweden	30, 90	22, 28, 50	38	1 000	yes
Switzerland	20, 90	25, 50	48	1 200	yes
U. Kingdom					yes

A.6.2.1 (A) 1 For electromechanical sounders: $U_1 = 15,60$ V.

A.6.2.1 (A) 2 The value R_{f1} for the test with $V_{f1} = 20$ V is under study.

A.6.2.1 (SF) 1 The test is made using a cadenced signal which has the timing:
 $t_{on} = 750$ ms
 $t_{off} = 5\,000$ ms.

A.6.2.1 (D) 1 The test is carried out using the test arrangement shown in figure A.6.2.1 (D) 1. U corresponds to U_G .

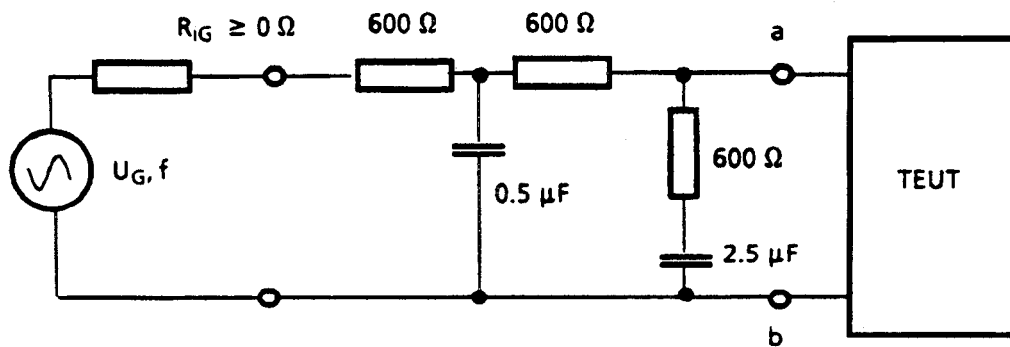


Figure A.6.2.1 (D) 1

A.6.2.1 (N) 1

The following signal combinations shall be tested:

- 28 V_{rms}, 22 Hz, 24 V dc;
 - 28 V_{rms}, 28 Hz, 24 V dc;
 - 30 V_{rms}, 55 Hz, 24 V dc;
 - 90 V_{rms}, 22 Hz, 60 V dc;
 - 40 V_{rms}, 22 Hz, 70 V dc;
 - 60 V_{rms}, 22 Hz, 90 V dc;
 - 155 v_{p-p} (square wave), 22 Hz, 80 V dc;
 - 155 v_{p-p} (square wave), 28 Hz, 80 V dc;
- The rise time is 3 ms (between 10% and 90% of the signal level);
 The cadence is 1 s on/4 s off.

A.6.2.1 (P) 1

Switch S closed, t_{on}(s) = 1,2
 Switch S open, t_{off}(s) = 6.

A.6.2.1 (E) 1

Check that the relevant tests, related with the content of the provision 5 in section 6.2.1 (E) 1, have been carried out.

The TEUT is connected as shown in figure A.6.2.1.

The dc voltage source (V_f) takes the value of 48 V.

The resistor (R_f) takes the value of 200 ohms.

The value of the open circuit ac rms voltage (e) when the switch (S) is closed, the generator frequency (f), and the sequence of the switch (S), are indicated in table A.6.2.1 (E) 1.

A suitable instrument for detecting when the TE changes to loop condition is connected to the line terminals.

PROVISION:

The switch (S) shall also remain opened during the intermediate periods of no A signal, when they become necessary.

Table A.6.2.1 (E) 1: Ringing signal detector sensitivity

Voltage (e) (V)	Frequency (f) (Hz)	Switch (S)	
		Closed	Opened
35	20	1	3
35	20	1,5	3
35	25	1	3
35	25	1,5	3
75	25	1,5	3
35	30	1	3
35	30	1,5	3

A.6.2.1 (S) 1 The time requirements for both activation (t_a) and non-activation shall be measured.

A.6.2.1 (CH) 1 Timing: Ringing bursts: 200 ms
Ringing pauses: 400 ms

The test can be carried out with $V_f = 0$ V and $R_f = 0$ Ω , provided the absence of the dc feeding has a negligible influence on the ringing signal detector sensitivity and the activation of the ringer detector is indicated.

A.6.2.1 (GB) 1 The relevant tests are given in Chapter 3.

6.2.2 Ringing signal detector insensitivity

The ringing detection circuitry or ringer of the TE shall not be activated when ringing signals of voltages less than U are applied at its terminals for 20 s in the frequency range Δf , generated by an ac source connected in series with a dc source (V_f) (see figure A.6.2.2). The requirement shall be met for various dc excitations (V_f , R_f).

The requirement values U , Δf , ΔV_f , ΔR_f are shown in table 6.2.2.

Compliance shall be checked using the test outlined in A.6.2.2.

Table 6.2.2: Ringing signal detector insensitivity

COUNTRY	REQUIREMENT VALUES				Remarks
	U (V)	Δf (Hz)	ΔV_f (V)	ΔR_f (Ω)	
Austria	10	40 - 60	60	500	
Belgium	10	23 - 27	48	1 000	
Cyprus	10	25	48	440 - 1 740	
Denmark	17	$25 \pm 2,5$; 50 ± 5	44 - 56	500 - 2 400	
Finland	not mandatory				
France	10	$50 \pm 10 \%$	45 - 54	300	yes
Germany	not mandatory				yes
Greece	15	16 - 50	44 - 66	500	
Iceland	10	22 - 28	48	800	
Ireland	not mandatory				
Italy	15	20 - 50	48	800	yes
Luxembourg	10	$25 \pm 10\%$	60	500	
Malta	not mandatory				
Netherlands	not mandatory				
Norway	17	50 ± 1	24 60	460 - 1 200 460 - 3 500	
Portugal	12	$16 \frac{2}{3} \pm 10 \%$ $25 \pm 20 \%$	45 - 55	500 - 2 500	yes
Spain	not mandatory		48	200	yes
Sweden	10	25 ± 3 ; 50 ± 1	60	1 200	yes
Switzerland	≤ 8	21 - 55	43 - 57	2 200 - 600	yes
U. Kingdom	not mandatory				

6.2.2 (F) 1 Not applicable to TE with automatic answering function, for which section 6.3.2 is used.

6.2.2 (D) 1 When connecting an ac source $U_G = 45 \text{ V}$ ($G_{iG} = 0 \text{ ohm}$), in the frequency range $f = 23 \text{ Hz}$ to 54 Hz , call: 1 s, pause 4 s or 5 s and interconnection of a four-terminal network, the ringing detector shall no longer respond and operate.

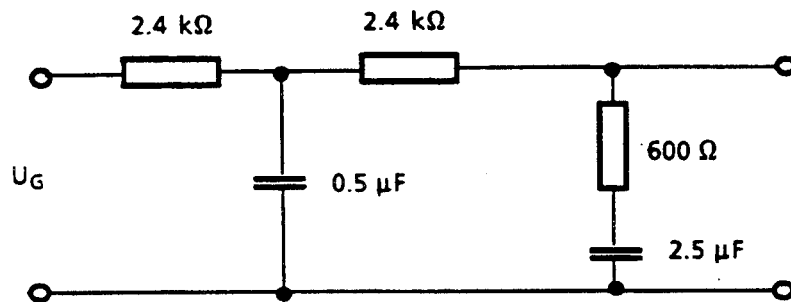


Figure 6.2.2 (D) 1: Four-terminal network "non-response"

6.2.2 (D) 2 When connecting to an ac source $U_G = 75 \text{ V}$ ($R_{iG} = 0 \text{ ohm}$), in the frequency range $f \leq 18 \text{ Hz}$ and $f \geq 5 \text{ kHz}$, call: 1 s, pause 4 s or 5 s, without interconnection of a four-terminal network, the ringing detector shall no longer respond and operate.

6.2.2 (D) 3 When ringing signals of voltage $U = 45 \text{ V}$, applied in the frequency range 23 Hz to 54 Hz and superimposed by square-wave, delta or sine-wave voltages with $U_{(eff)} = 6,0 \text{ V}$ in the frequency range from 0 Hz to 20 kHz, the ringing detector shall respond and switch off reliably. Not included are clock frequencies of the system and their harmonics, with the clock frequency of the ringing detector $\geq 5 \text{ kHz}$.

6.2.2 (D) 4 External voltages of $U_{(eff)} \leq 9 \text{ V}$ shall not be recognised.

6.2.2 (I) 1 In the range $\Delta_f = 35 \text{ to } 50 \text{ Hz}$, $U = 10 \text{ V}$.

6.2.2 (P) 1 This requirement is only applicable to TE with automatic answering function.

6.2.2 (E) 1 (Requirement to be applied instead of section 6.2.2).

With TE in the ringing condition, which has a ringing signal receiver that is intended for automatically establishing the loop condition according with the requirement in section 10.6 (E) 2.3, it shall not establish the loop condition after application of the signals stipulated in table 6.2.2 (E) 1, where:

- a) the ringing signal i to iv are simultaneously superimposed to a dc voltage of 48 V, and applied between the line terminals through a resistor of 200 ohms;

PROVISION a: However, when the signal type ii is applied, it is permitted to establish the loop condition, for TEs which are prepared to delay this change (see option c.ii in the requirement in section 10.6 (E) 2.3) more than one second after the application of the first whole signal interval.

- b) the ac signal type v is applied between line terminals through a resistor of 600 ohms.

Compliance shall be checked by the tests outlined in section A.6.2.2 (E) 1.

Table 6.2.2 (E) 1: Ringing signal detector insensitivity

Signal type	Open circuit ac rms	Frequency range	Duration	
			Signal	Pause
i	$35 \text{ V} \leq e_1 \leq 75 \text{ V}$	$20 \text{ Hz} \leq f_1 \leq 30 \text{ Hz}$	$\leq 190 \text{ ms}$	$\geq 1\ 000 \text{ ms}$
ii	$35 \text{ V} \leq e_1 \leq 75 \text{ V}$	$20 \text{ Hz} \leq f_1 \leq 30 \text{ Hz}$	$> 190 \text{ ms}$ $\leq 600 \text{ ms}$	$\geq 1\ 000 \text{ ms}$
iii	$e_1 = 25 \text{ V}$	$20 \text{ Hz} \leq f_1 \leq 30 \text{ Hz}$	Continuous	
iv	$e_1 = 25 \text{ V}$	$f_1 = 50 \text{ Hz}$	Continuous	
v	$e_1 \leq 775 \text{ m}$	$300 \text{ Hz} \leq f_1 \leq 3,4 \text{ kHz}$	Continuous	

6.2.2 (S) 1 See 6.2.1 (S) 1.

6.2.2 (CH) 1 The ringing detector shall not respond to a rectangular signal of 14 V/3 Hz applied to the equipment terminals (sampling signal for the underground party-line connection).

At 3 V (300 - 3 400 Hz) there should be no noticeable reaction of the ringing detector.

No seizure shall occur for continuous ringing or for only one ringing burst in the case of automatic establishment of the loop condition as shown in section 6.3.

A.6.2.2 Ringing signal detector insensitivity

The TEUT is connected as shown in figure A.6.2.2 and the test signal is applied for 20 seconds. The ringing detector shall not be activated during this period.

Compliance shall be checked by inspection or measurement, as appropriate, according to the response which would normally be generated by the ringing detector when it is activated, as in section 6.2.1.

The test shall be performed at all combinations of the values given in table A.6.2.2.

TEs with automatic answering functions, which do not have available a separate indication of the activation of the ringing detector, shall be tested according to section 6.3.

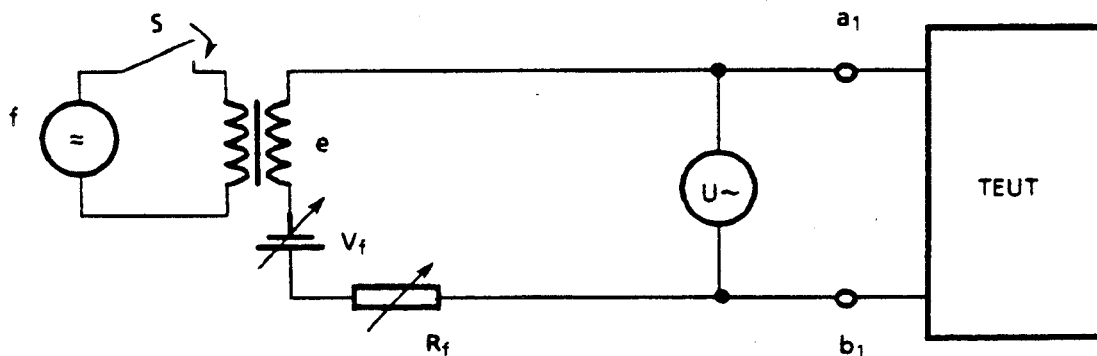


Figure A.6.2.2: Ringing signal detector insensitivity

The signal level is set using a true rms-indicating device able to accept waveforms with a crest factor of at least 3:1 and with a reading accuracy over the required frequency range of within 1 dB of the absolute value.

Table A.6.2.2: Ringing signal detector insensitivity

COUNTRY	TEST VALUES				Remarks
	U (V)	f_1 (Hz)	V_f (V)	R_f (Ω)	
Austria	10	40, 60	60	500	
Belgium	9	25	48	1 000	
Cyprus	10	25	48	800	
Denmark	17	25, 50	48	500	
Finland					
France	10	50	48	300	
Germany	45	23, 54	0	0	yes
Greece	5, 15	25, 50, 425	60	500	
Iceland	10	22, 25, 28	48	800	
Ireland	not mandatory				
Italy	15	20 - 50	48	800	
Luxembourg	10	25	60	500	
Malta					
Netherlands	not mandatory				
Norway	17	50	24, 60	460	yes
Portugal	12	$16 \frac{2}{3} \pm 10 \%$ $25 \pm 20 \%$	45, 55	500	
Spain			48	200	yes
Sweden	10	22, 28, 50	60	1 200	yes
Switzerland	8	25, 50	48	1 200	yes
U. Kingdom	not mandatory				

A.6.2.2 (D) 1 The test is carried out using the arrangement shown in figure A.6.2.2 (D) 1. U corresponds to U_G .

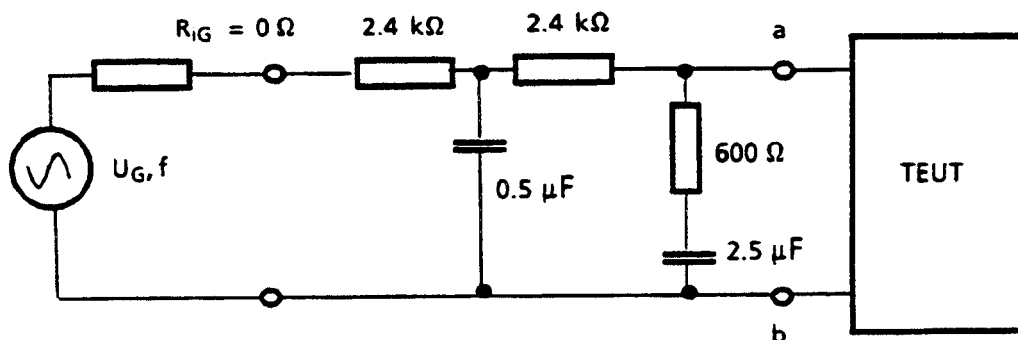
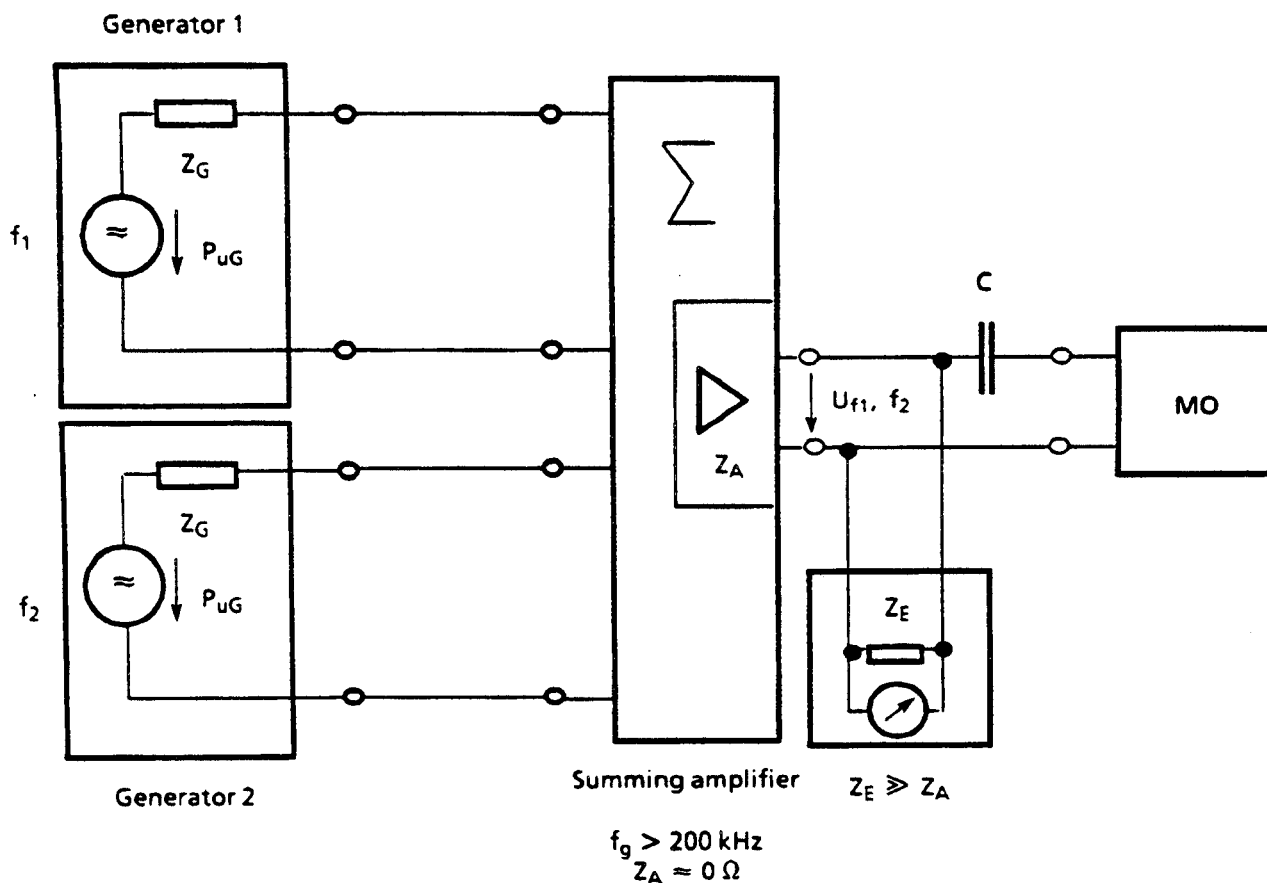


Figure A.6.2.2 (D) 1

A.6.2.2 (D) 2 The tests relating to 6.2.2 (D) 2 and 6.2.2 (D) 3 are carried out using the test arrangement shown in figure A.6.2.2 (D) 2.



Generator 1: Sine

Generator 2: Sine,)
 Rectangle,) Symmetry
 Triangle)

Figure A.6.2.2 (D) 2

A.6.2.2 (N) 1 U corresponds to open-circuit voltages.

A.6.2.2 (E) 1 The procedure of test in section A.6.2.1 (E) 1 is followed, with the values of table A.6.2.2 (E) 1, for the signals i to iv.

For the signal type v, the procedure of test in section A.10.5 (E) 3.1 is followed, where the switch (St) is normally closed.

PROVISION: When applying the signal type ii, see the provision in the associated requirement in section 6.2.2 (E) 1.

Table A.6.2.2 (E) 1: Ringing signal detector insensitivity

Signal type	Voltage (e) (V)	Frequency (f) (Hz)	Switch (S)	
			Closed	ms Opened
i	75	25	190	1 000
ii	75	25	600	1 000
iii	25	25	Continuous	0
iv	25	50	Continuous	0
v	0,775	1 000	Continuous	0
v	0,775	2 200	Continuous	0
v	0,775	3 400	Continuous	0

A.6.2.2 (S) 1 It is sufficient to apply the ringing signal for 5 s.

A.6.2.2 (CH) 1 The test signal is also applied periodic repeated for 1 s ringing and 4 s pause (no activation of ringing detectors shall occur).

The test can be carried out with $V_f = 0$ V and $R_f = 0$ Ω , provided the absence of the dc feeding has a negligible influence on the ringing signal detector sensitivity and the activation of the ringer detector is indicated.

6.2.3 Immunity to decadic dialling from parallel TE

The ringing detector of a TE shall not produce any indication of ringing detection caused by the decadic dialling (loop pulsing) function of frequency Δf of a parallel connected TE.

The requirements shall be met at variation of dc conditions ΔV_f , ΔR_f . The requirement values Δf , Δt_{break} , Δt_{make} , ΔV_f , ΔR_f are shown in table 6.2.3. Δt_{break} , Δt_{make} are the ranges of the break and the make respectively.

Compliance shall be checked using the test outlined in A.6.2.3.

Table 6.2.3: Immunity to decadic dialling from a parallel TE

COUNTRY	REQUIREMENT VALUES					Remarks
	Δf (Hz)	Δt_{break} (ms)	Δt_{make} (ms)	ΔV_f (V)	ΔR_f (Ω)	
Austria	8 - 12	50 - 70	30 - 50	60	1 000	
Belgium	9 - 11	59 - 73	30 - 38	48	400 - 1 600	
Cyprus	9 - 11	30 - 36	62 - 72	48	440 - 1 740	
Denmark	not mandatory					
Finland	not mandatory					
France		66 ± 7	33 ± 4	45 - 54	300 - 1 845	yes
Germany	not mandatory					
Greece	9 - 11	$61,5 \pm 3$	$38,5 \pm 3$	44 - 66	500	
Iceland	not mandatory					
Ireland	9 - 11	64 - 70	36 - 30	43 - 53	5 000	yes
Italy	9 - 11	70 - 53	46,3 - 33,7	48	800	
Luxembourg	9 - 11	60 ± 3	40 ± 3	60	1 000	
Malta						
Netherlands	not mandatory					
Norway	not mandatory					
Portugal	9 - 11			45 - 55	300 - 1 800	yes
Spain	10	67	33	48	500	yes
Sweden	9 - 11	55 - 65	35 - 45			yes
Switzerland	9 - 11	55 - 65	35 - 45	43 - 57	2 200 - 600	yes
U. Kingdom	not specified					yes

6.2.3 (F) 1

Not applicable to the ringing detectors producing discernible signals which use the shunt wire to avoid bell tinkling (see Chapter 8, section 8 (F) 2).

For other detectors, the requirements shall be met at the following values of L_f and R_f (see figure A.6.2.3 (F) 1):

$L_f = 3 \text{ H}$ (representative of the inductance of the feeding bridge)

R_f : representative of the equivalent resistance of a TE in accordance with the loop mask $I = f(U)$ defined in figure 2.3.1 (F) 1.a.

Compliance shall be checked using the test outlined in A.6.2.3 (F) 1.

6.2.3 (IRL) 1

Dialling from any equipment connected across the line terminals in parallel with answering equipment shall not initiate the answering function.

6.2.3 (P) 1

The values for t_{break} and t_{make} shall be in accordance with the limits specified in figure 6.2.3 (P) 1.

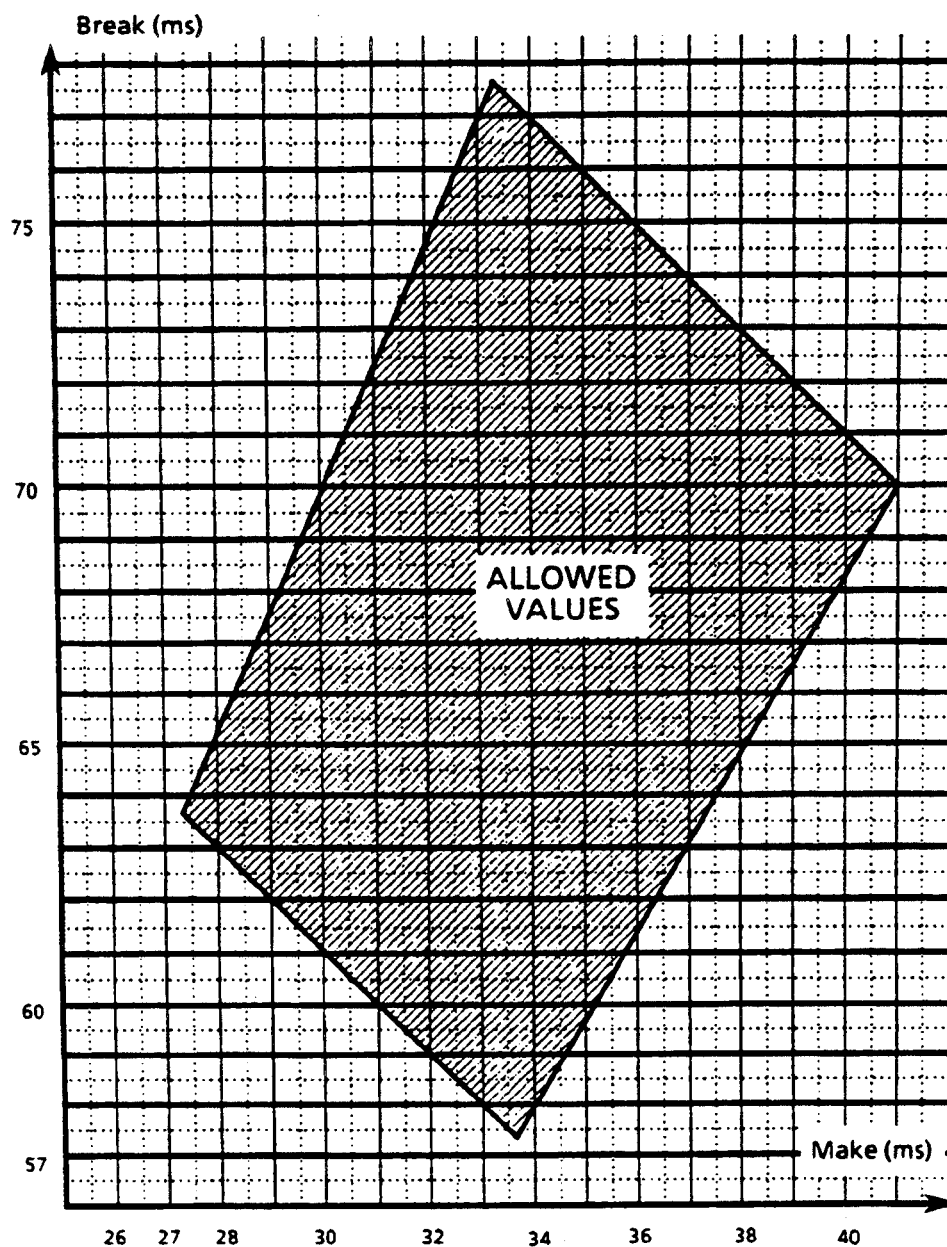


Figure 6.2.3 (P) 1: Immunity to decadic dialling from a parallel TE

6.2.3 (P) 2 This requirement is only applicable to TE with automatic answering function.

6.2.3 (E) 1 The requirement in section 6.2.3 shall be applied to the TE in the ringing condition, which has a ringing signal receiver that is intended for automatically establishing the loop condition according with the requirement in section 10.6 (E) 2.3.

The loop condition shall not be established after the application between the line terminals of ten series of dialling pulses as stipulated in the associated testing method.

PROVISION 1: For series TEs this requirement shall also be applied when the series of pulses are applied to the line output terminals.

PROVISION 2: This requirement shall, however, not be applied for TEs which are intended to be connected in parallel only with TEs that are prepared for carrying out the dialling sequence with loop pulsing.

Compliance shall be checked by the tests outlined in section 6.2.3, with the remarks in section A.6.2.3 (E) 1.

6.2.3 (S) 1 Feeding conditions, see Swedish remark in Chapter 1, section 1.5.2.

6.2.3 (S) 2 The requirements in section 6.2.3 are not mandatory for equipment which is two-wire connected to the plug.

6.2.3 (CH) 1 The immunity to decadic dialling from a parallel TE is mandatory for TE capable of automatically establishing a loop condition in itself and recommended for other TEs.

6.2.3 (GB) 1 The ringing detector shall not operate when tested in accordance with the test of A.6.2.3 (GB) 1.

In addition, for telephones, the ringing detector shall not respond to speech voltages. Compliance shall be checked using the test set out in A.6.2.3 (GB) 2.

A.6.2.3 Immunity to decadic dialling from a parallel TE

The TE to be tested is arranged for measurement according to figure A.6.2.3.

The switch S_1 is then caused to open and close ten times at the make and break times t_{make}/t_{break} shown in table A.6.2.3.

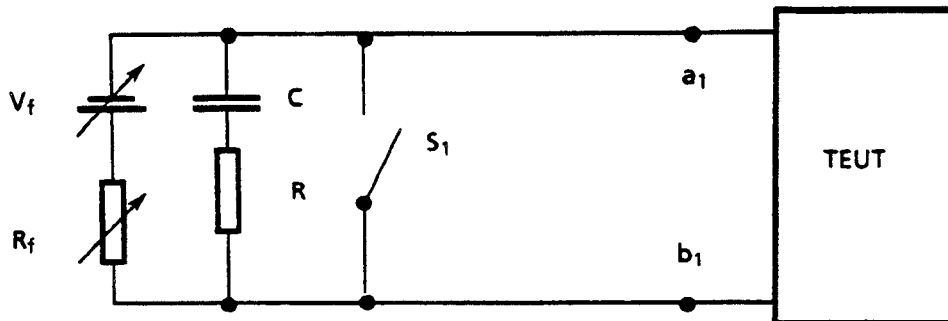


Figure A.6.2.3: Immunity to decadic dialling from a parallel TE

Table A.6.2.3: Immunity to decadic dialling from a parallel TE

COUNTRY	TEST VALUES							Remarks
	C (μ F)	R (Ω)	f (Hz)	t _{make} (ms)	t _{break} (ms)	V _f (V)	R _f (Ω)	
Austria	1	220	8, 12	30, 50	50, 70	60	1 000	yes
Belgium	1	220	10	34	66	48	1 000	
Cyprus	1	600	10	33	67	48	800	
Denmark	not mandatory							
Finland	not mandatory							
France	2,2	160		33	66	45, 54	1 845, 300	yes
Germany	not mandatory							
Greece	1 \pm 10 %	100 \pm 10 %	10	38,5	61,5	60	500	
Iceland	not mandatory							
Ireland	1	2 900	10	66,6	33,3	48	5 000	yes
Italy	1	600	10	40	60	48	800	yes
Luxembourg	1	220	10	40	60	60	1 000	
Malta	not mandatory							
Netherlands	not mandatory							
Norway	not mandatory							
Portugal	1,8	200	10	33 1/3	66 2/3	55	300	
Spain	1	600	10	33	67	48	500	yes
Sweden	2	600	10	40	60	60	1 600	yes
Switzerland	0	∞	10	40	60	57	600	
U. Kingdom			10	33	67	50	200 + 200 relay	yes

A.6.2.3 (A) 1

This test shall be done twice during a time of 7 seconds for TE with an automatic establishment of the loop condition.

A.6.2.3 (F) 1

The test is carried out using figure A.6.2.3 (F) 1, with:

$$L_f = 3 \text{ H}$$

$$R_f = 100, 1\ 840 \ \Omega$$

Other parameter values: see table A.6.2.3.

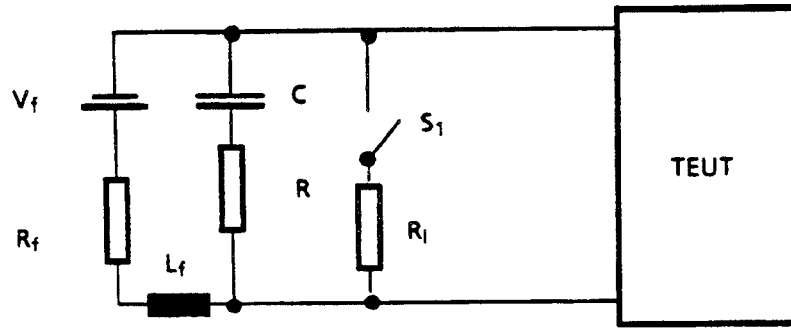


Figure A.6.2.3 (F) 1: Immunity to decadic dialling from a parallel TE

A.6.2.3 (IRL) 1

A mechanical dialling telephone is connected in parallel with TEUT, and is taken off hook and the number sequence 999 999 is dialled at normal dialling speed. This sequence is carried out three times at 30 s intervals. The TEUT must not enter the off hook mode on any of these attempts.

A.6.2.3 (I) 1

The test arrangement is as follows:

$L = 2 \text{ H}$

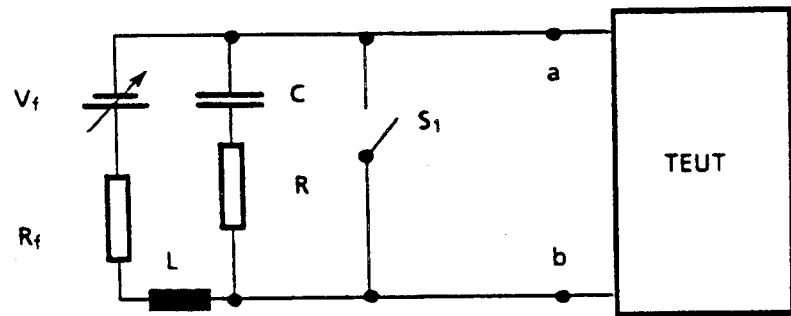


Figure A.6.2.3 (I) 1: Ringing detection in parallel connected equipment

A.6.2.3 (E) 1

The TEUT is connected as shown in figure A.6.2.3 (E) 1 instead of figure A.6.2.3.

The inductor (L) takes the value of 10 H.

The switch (S_1) is normally closed.

The interpulsing period between each two series is 450 ms.

PROVISION:

For series TEs the test shall also be made when switch (S_1), capacitor (C), and resistor (R) are connected to the line output terminals.

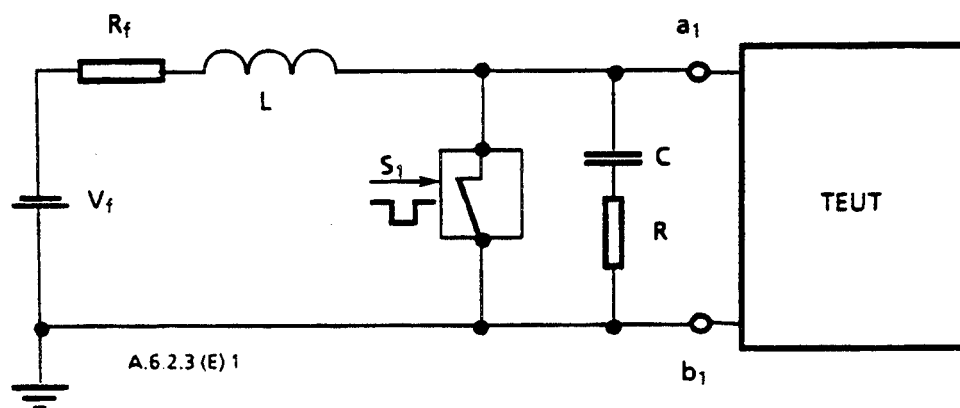


Figure A.6.2.3 (E) 1: Immunity to decadic dialling from a parallel TE

A.6.2.3 (S) 1

The test arrangement is as follows:

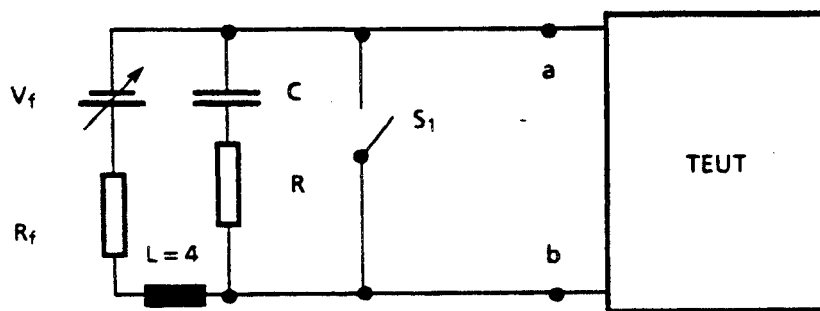


Figure A.6.2.3 (S) 1: Ringing detection in parallel connected equipment

A.6.2.3 (GB) 1

The test circuit is as shown in figure A.6.2.3 (GB) 1. The TEUT is plugged into one of the sockets of a typical installation described in Chapter 8, figure 8.2 (GB) 1.2.

A reference dialling source consisting of pulsing contacts (without a spark quench circuit) operating at 10 Hz, with a nominal break period of 67 ms is connected across the line terminals of the TEUT by means of contacts 2 and 5 of another socket in the installation. A 100 ohm resistor is connected between contacts 2 and 4 of the socket.

The ringing detector of the TEUT is considered immune to decadic dialling if, at any time when the pulsing contacts are active, it does not respond to the decadic dialling pulses thus generated.

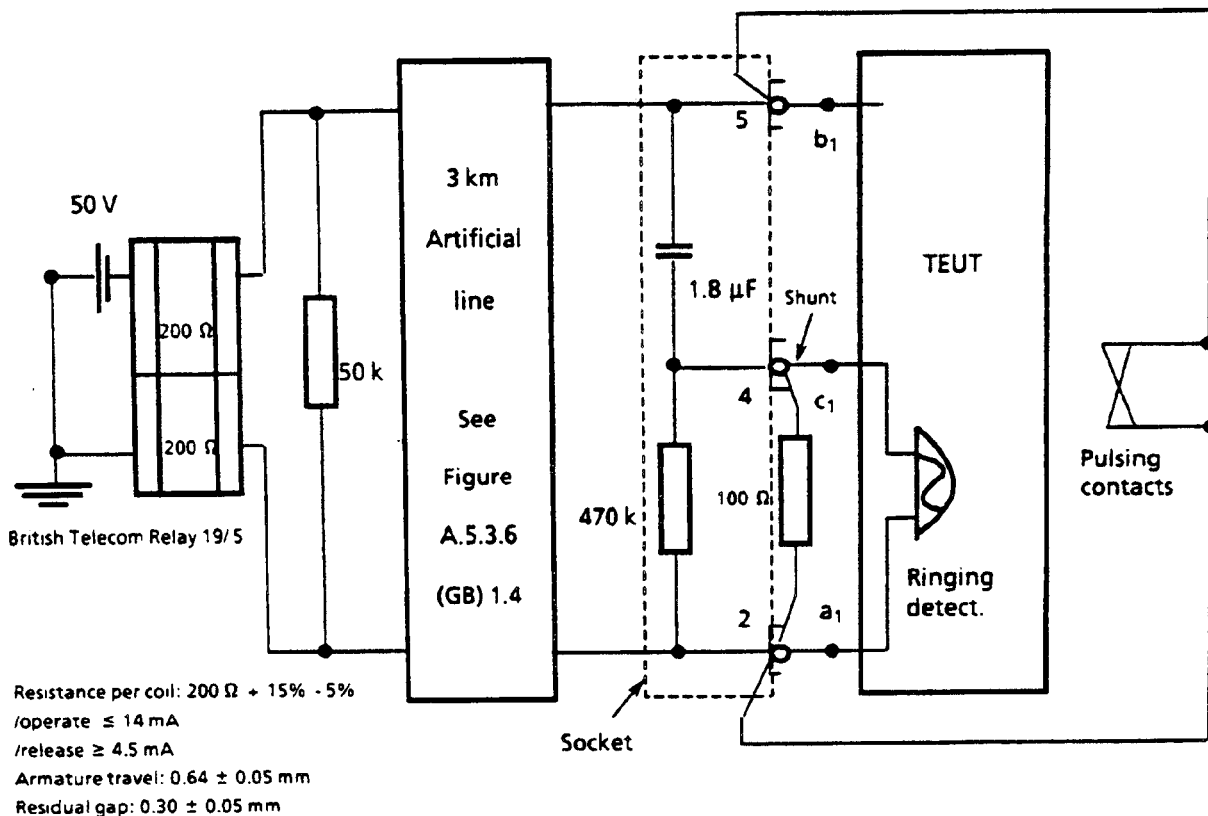


Figure A.6.2.3 (GB) 1: Immunity to decadic dialling

A.6.2.3 (GB) 2

For telephones, immunity to speech signals is tested using the test circuit shown in figure A.6.2.3 (GB) 2. A signal of frequency 1 kHz at + 10 dBV emf is applied to the TEUT, and its ringing detector should not respond.

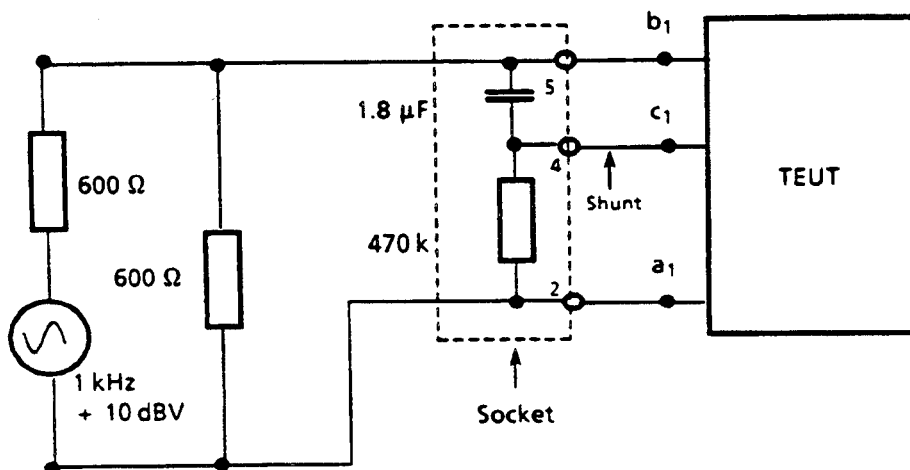


Figure A.6.2.3 (GB) 2: Immunity to speech signals

6.3 Automatic answering function

6.3.1 Automatic establishment of loop condition

For TE with the ability to detect ringing signals and subsequently capable of automatically establishing a loop condition in itself or a related TE, the time period between the application of the

ringing signal and the establishment of the loop condition shall be greater than t_1 (s) but less than t_2 (s).

The requirement shall be met in the specified voltage ranges ΔU (ac) and ΔV_f (dc) in the specified frequency range Δf and with the series resistance ΔR_f .

The requirement values t_1 , t_2 , ΔU , ΔV_f and ΔR_f are shown in table 6.3.1.

Compliance shall be checked using the test outlined in A.6.3.1.

Table 6.3.1: Automatic establishment of loop condition

COUNTRY	REQUIREMENT VALUES						Remarks
	ΔV_f (V)	ΔR_f (Ω)	t_1 (s)	t_2 (s)	ΔU (V_{rms})	Δf (Hz)	
Austria	20, 60	500		7	18 - 65	40 - 60	
Belgium	48	1 000	4	20	25 - 75	23 - 27	
Cyprus	48	440 - 1 740	6	20	30 - 85	23,5 - 26,5	
Denmark	44 - 56	500 - 2 400	0,5	not spec.	40 - 120	25 \pm 10 % 50 \pm 10 %	
Finland	48	800	1	not spec.	35 - 75	25	
France	45 - 54	300	5	15	25 - 90	50 \pm 10 %	yes
Germany	60	1 000 - 2 530			45 - 75	23 - 54	yes
Greece	44 - 66	500		20	25 - 90	16 - 50	
Iceland	not mandatory						
Ireland	43 - 53	5 000		9	25	17 - 25	
Italy	48	800	6	22	26 - 80	20 - 50	yes
Luxembourg	60	500	5	15	45 - 75	25 \pm 10%	
Malta							
Netherlands	66	800	1		25 - 90	25	
Norway	24 60	460 - 1 200 460 - 3 500		16	28 - 90	25 \pm 3	yes
Portugal	45 - 55	500 - 2 500	0,8		30 - 120	16 2/3 \pm 10 25 \pm 20 %	yes
Spain							yes
Sweden	not mandatory						yes
Switzerland	43 - 57	2 200 - 600			20 - 60	21 - 55	yes
U. Kingdom	not applicable						yes

6.3.1 (F) 1

a) Polarised call

The requirements shall be met in accordance with figure A.6.3.1 with the following sequence of the ringing signal:

1st pulse: 1 - 2 s

1st pause: 0 - 3,5 s

2nd and following pulses: 1,5 s \pm 10%

2nd and following pauses: $3,5 \pm 10\%$

b) Non-polarised call

The requirements shall be met in accordance with figure A.6.3.1 (F) 1, with the following sequence of the ringing signal:

	<u>1st case</u>	<u>2nd case</u>
1st pulse:	700 ms	800 ms
1st pause:	64 ms	100 ms
2nd pulse:	700 ms	800 ms
2nd pause:	3 200 ms	3 300 ms
3rd pulse:	700 ms	800 ms
etc.		

in the following conditions:

$$V_f = 42 - 54 \text{ V}$$

$$R_f = 300 \Omega$$

Other parameters: see table A.6.3.1.

6.3.1 (F) 2 The first ringing pulse of a polarised call, just as the two first ringing pulses of a non-polarised call, shall not be enough to trigger off automatic answer. In addition, the timer providing the answering delay between t_1 and t_2 shall be reset, when the ringing signal stops before the establishment of the loop (a ringing signal is considered as stopped when the pause is longer than 8 s).

Compliance shall be checked using the test outlined in A.6.3.1 (F) 2.

6.3.1 (F) 3 For automatic answering TE with remote controlled start or stop of domestical function as "house-heating", the following t_1 and t_2 values may also be used:

$$t_1 = 35 \text{ s}$$

$$t_2 = 45 \text{ s}$$

For answering machines which use the same cassette to send the welcome message and to register the message from distant party, the TE shall establish the loop condition 10 s at the latest after its return to call waiting state, when a call is coming during the rewinding of the cassette.

For non-integrated modems, answering delay shall not depend on the DTE. This means, for example for modems with V.24 interface, that only the mode 108,2 is allowed.

6.3.1 (D) 1 If the ringing detection circuitry or ringer initiates automatic linking to the access line, the TE may be linked to the line only if its operating state is reached within a period of 500 ms.

6.3.1 (D) 2 When linking is effected automatically, the TE must be connected to the access line at the end of the 5th ringing signal at the latest. Possible exceptions are contained in the terminal requirements.

6.3.1 (D) 3 For the "sensitivity" of the ringing detection circuitry of the TE, see paragraph 6.2.1 including the national annexes.

6.3.1 (I) 1 For facsimile and modem equipments, the following t_1 and t_2 values may be used:

$t_1 = 300 \text{ ms};$
 $t_2 = 60 \text{ ms}.$

6.3.1 (N) 1

The TE shall also detect the following signals:

- $\Delta U = 30 - 90, \Delta f = 50 \pm 5, \Delta V_f = 24 - 60, \Delta R_f = 1\ 200;$

- $\Delta U = 40 - 60, \Delta f = 25 \pm 3, \Delta V_f = 70 - 90, \Delta R_f = 1\ 200;$

The signal peak level is $V_f + \sqrt{2} \times U.$

- $155 \text{ Vp - p (square wave), } f = 25 \pm 3, V_f = 80, R_f = 1\ 200;$

The signal peak level is $V_f + 1/2 \times V_{p-p}.$

6.3.1 (P) 1

$t_2(s)$ = time corresponding to 10 presences (ON periods) of the ringing signal.

6.3.1 (E) 1

The requirement in section 6.2.1 (E) 1 shall be applied.

6.3.1 (S) 1

For detection of ringing signal the requirements in section 6.2.1 are valid.

6.3.1 (S) 2

A telephone answering machine shall, in its normal state, start no later than in response to the second ringing signal in the periodic cycle. However, other states in which starting takes place at the latest in response to the fourth ringing signal in the periodic cycle are permitted.

6.3.1 (CH) 1

Sensitivity:

The ringing signal detector shall function normally with a ringing current source of 60 to 90 V emf in the entire source resistance range of 1,2 to 6 k Ω (purely resistive) and in the frequency range 21 to 55 Hz, and at least respond reliably to a ringing signal of 200 ms duration. Within the frequency range of 21 to 55 Hz the ringing element shall respond correctly at $\geq 20 \text{ V}$ (source resistance 0 Ω).

The normal dc supply voltage is superimposed on the ringing current; the ringing signal receiver shall not draw any dc current.

Ringing burst specifications vs. time:

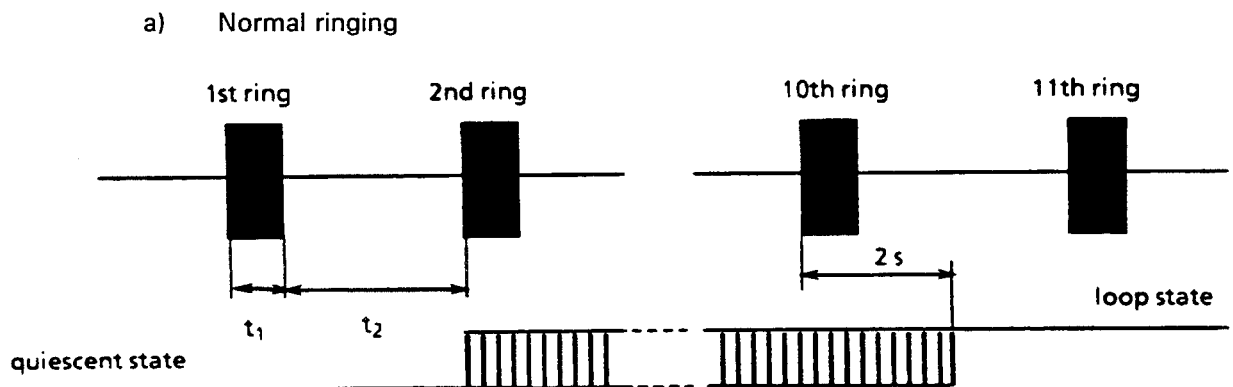


Figure 6.3.1 (CH) 1.a: Normal ringing

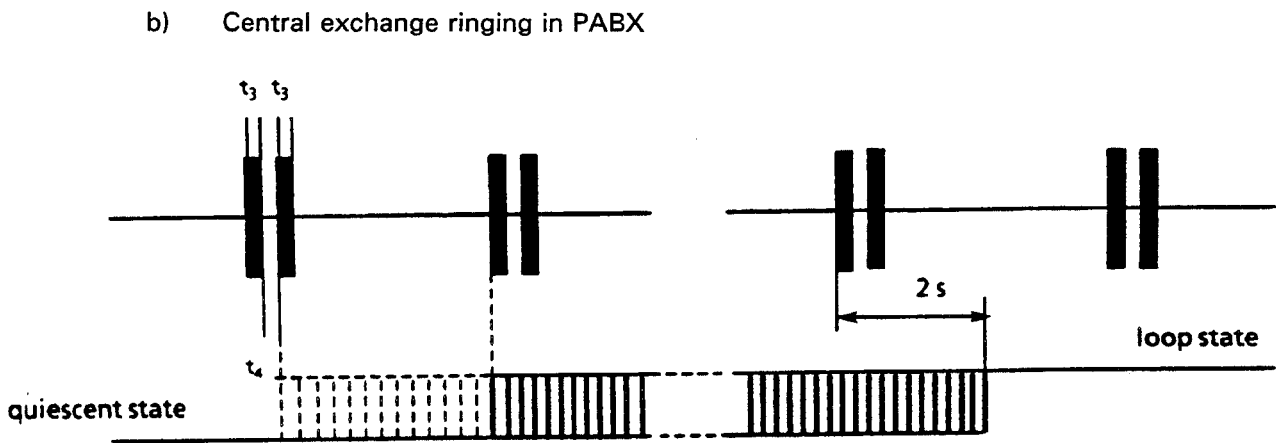


Figure 6.3.1 (CH) 1.b

Ringing bursts and pauses correspond to the following general conditions:

- Ringing burst: 200 ms ($t_3: 330 \text{ ms}^2$) to 1 200 ms ($t_1: 1 000 \text{ ms}^2$)
 - Pause: 200 ms ($t_4: 330 \text{ ms}^2$) to 5 000 ms ($t_2: 4 000 \text{ ms}^2$)
- 1) For normal ringing in particular, an acyclic first ringing burst has to be taken into account (duration: 0,25...0,5 s; pause: 0...4,75 s)
 - 2) Nominal values; operational tolerances are not taken into consideration.

Functional conditions:

The ringing detector shall not seize the line prior to the second ringing burst, but at the latest by the beginning of the 10th burst.

These requirements are valid for the entire tolerance range stated in the specifications as well as for ringing voltages $U = 20 \dots 60 \text{ V}$. A central exchange ringing in PABX (double ring; 2 separate bursts) is generally considered as one ring.

NOTE: In the case of a ringing signal with short ringing bursts (e.g. central exchange ringing in PABX) the ringing detection element may seize the line after a second ringing burst.

No seizure shall occur for continuous ringing or for only one ringing burst.

6.3.1 (GB) 1

TE, when in the automatic answering mode, which offers more than one answering delay shall permit the user to select a setting or range of settings, one or more of which causes the TE to answer within a maximum of $t_2 = 15 \text{ s}$.

Where the TE is not intended to be used for answering naive callers, no requirement is specified for the maximum time to answer t_2 . A naive caller is one with no special knowledge of the characteristics of the automatic answering system, or with no special equipment to assist the transfer of information across the established connection.

The supplier shall state whether the TE is intended to be used for answering calls from naive callers.

A.6.3.1 Automatic establishment of loop condition

The TEUT is connected as shown in figure A.6.3.1. The dc feeding conditions and ringing signals are specified in table A.6.3.1.

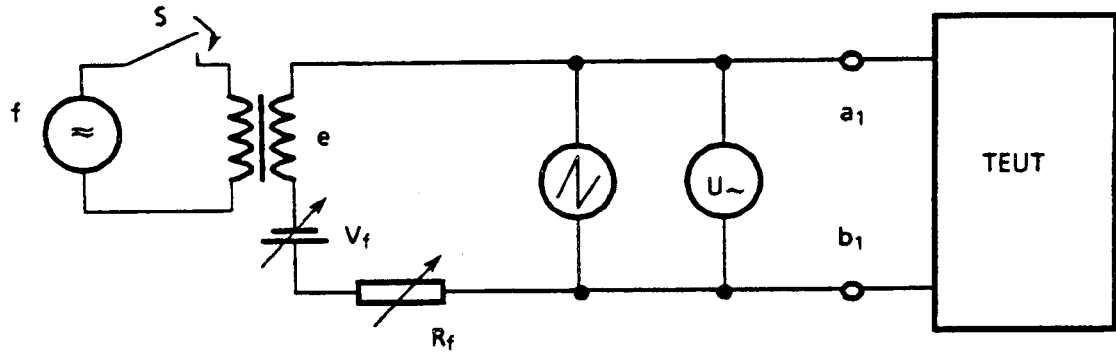


Figure A.6.3.1: Automatic establishment of loop condition

Table A.6.3.1: Automatic establishment of loop condition

COUNTRY	TEST VALUES						Remarks
	U (V _{rms})	V _f (V)	R _f (Ω)	f (Hz)	t _{on} (s)	t _{off} (s)	
Austria	18, 60	20, 60	500	40, 60	0,75	5,5	yes
Belgium	25	48	1 000	25	1	3	
Cyprus	30, 85	48	800	25	1,5	3	
Denmark	40	480	500	25, 50	0,5	not spec.	
Finland	35	48	800	25	0,75	5	
France	25, 90	48	300	50			yes
Germany	45, 75	60	2 530	23, 54	1	4	yes
Greece	25, 50, 75	60	500	25, 50	1	4	
Iceland	not mandatory						
Ireland	25	48	5 000	25	0,4	0,2	yes
Italy	26, 80	44, 48, 52	1 880, 1 100, 720	20, 50	1	4	
Luxembourg	45, 75	60	500	25	1	4	
Malta							
Netherlands	25, 90	66	800	25			yes
Norway			1 200		1	4	yes
Portugal	30, 120	45, 55	500	16 2/3 ± 10 % 25 ± 20 %	0,8 and 1,2	4 and 6	
Spain							yes
Sweden	not mandatory						yes
Switzerland	20, 60	48	1 200	25, 50	0,2 ... 1,2	0,2 ... 5	yes
U. Kingdom	not applicable						yes

A.6.3.1 (A) 1 The value R_f for the test with $V_f = 20$ V is under study.

A.6.3.1 (F) 1

a) Polarised call

The TEUT is connected as shown in figure A.6.3.1 with the following sequences:

Table A.6.3.1 (F) 1.a

Cases	1st t_{on} (ms)	1st t_{off} (ms)	2nd t_{on} (ms)	2nd t_{off} (ms)	3rd t_{on} (ms)	etc.
I	1 000	3 500	1 500	3 500	1 500	
II	3 500	3 500	1 500	3 500	1 500	
III	1 000	1 000	1 500	3 500	1 500	

b) Non-polarised call

The TEUT is connected as shown in figure A.6.3.1 in the following conditions:

$$V_f = 48 \text{ V}$$

$$R_f = 300 \Omega$$

Table A.6.3.1 (F) 1.b

Cases	1st t_{on} (ms)	1st t_{off} (ms)	2nd t_{on} (ms)	2nd t_{off} (ms)	3rd t_{on} (ms)	etc.
I	700	64	700	3 200	700	
II	800	100	800	3 300	800	

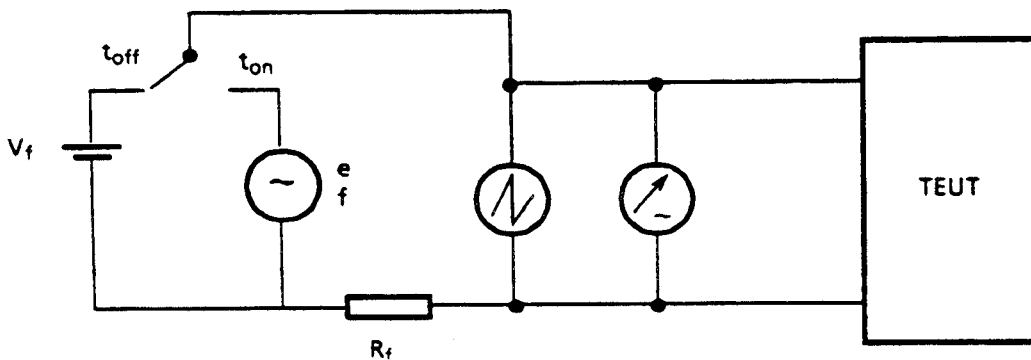


Figure A.6.3.1 (F) 1: Automatic establishment of loop condition (non-polarised call)

A.6.3.1 (F) 2

The TEUT is connected as shown in figure A.6.3.1 with $V_f = 48$ V and $R_f = 300 \Omega$ as feeding conditions. Five ringing sequences of frequency $f = 50$ Hz, voltage $U = 90 V_{rms}$, duration $t_{on} = 1,5$ s, pause $t_{off} = 8$ s are applied between the line terminals, and it is checked whether the TE does not establish the loop condition.

Then the TEUT is connected as shown in figure A.6.3.1 (F) 1, with $V_f = 48$ V and $R_f = 300 \Omega$ as feeding conditions. Five ringing sequences of frequency $f = 50$ Hz, voltage $U = 90 V_{rms}$, cadence $t_{on}/t_{off} = 800$ ms on / 100 ms off / 800 ms on / 8 000 ms off, are applied between its line terminals, and it is checked whether the TE does not establish the loop condition.

For TE with answering delay between 35 s and 45 s (see 6.3.1 (F) 3), the number of ringing sequences is increased from five to ten.

A.6.3.1 (D) 1

The TEUT is connected as shown in figure A.6.3.1 (D) 1. The dc feeding conditions and ringing signals are specified in table A.6.3.1.

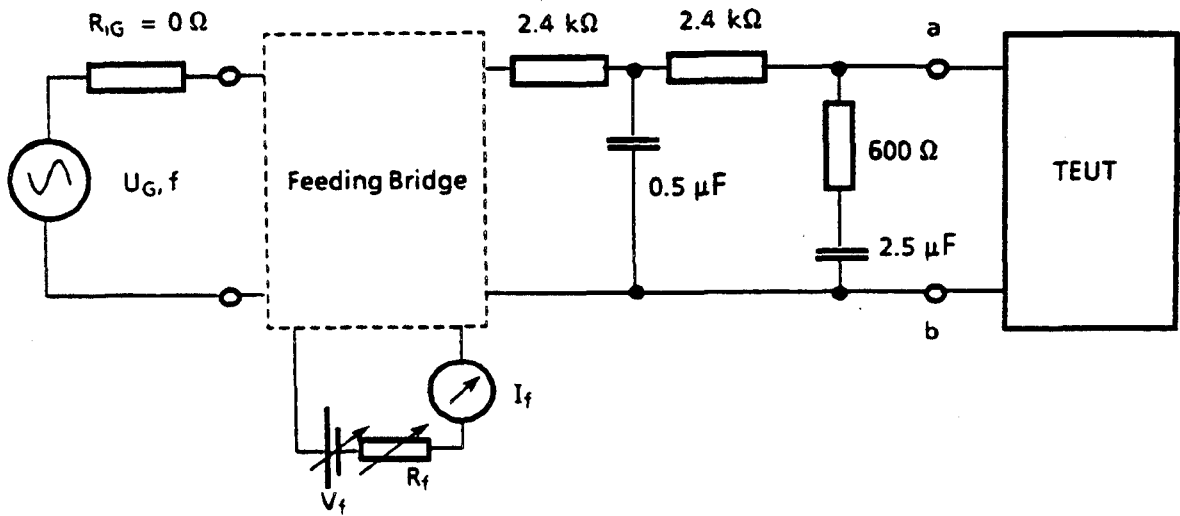


Figure A.6.3.1 (D) 1

A.6.3.1 (IRL) 1

The cadence of the ringing signal
0,4 s on
0,2 s off
0,4 s on
2,0 s off

A.6.3.1 (NL) 1

This test is performed with two different cadences with their tolerances. These cadences are described in sections 1.7.9 and 1.7.9 (NL) 1.

A.6.3.1 (N) 1

The following signal combinations shall be tested:

- 28 V_{rms}, 22 Hz, 24 V dc
- 28 V_{rms}, 28 Hz, 24 V dc
- 30 V_{rms}, 55 Hz, 24 V dc
- 90 V_{rms}, 22 Hz, 60 V dc
- 40 V_{rms}, 22 Hz, 70 V dc
- 60 V_{rms}, 22 Hz, 90 V dc

- 155 v_{p-p} (square wave), 22 Hz, 80 V dc
- 155 v_{p-p} (square wave), 28 Hz, 80 V dc

The rise time is 3 ms (between 10% and 90% of the signal level).

The square wave signals shall be tested with a half-pulsewidth relation of 50/50 and 60/40.

A.6.3.1 (E) 1

See remark in section 6.3.1 (E) 1.

A.6.3.1 (S) 1

Test of ringing detector sensitivity, see A.6.2.1.

A.6.3.1 (CH) 1

The test includes sensitivity and functional burst number examinations (seizure between 2nd ring and 2 s after 10th ring).

The test can be carried out with $V_f = 0 \text{ V}$ and $R_f = 0 \Omega$, provided the absence of the dc feeding has a negligible influence on the ringing signal detector sensitivity and the activation of the ringer detector is indicated.

A.6.3.1 (GB) 1 The test circuit is shown in figure A.6.3.1 (GB) 1.

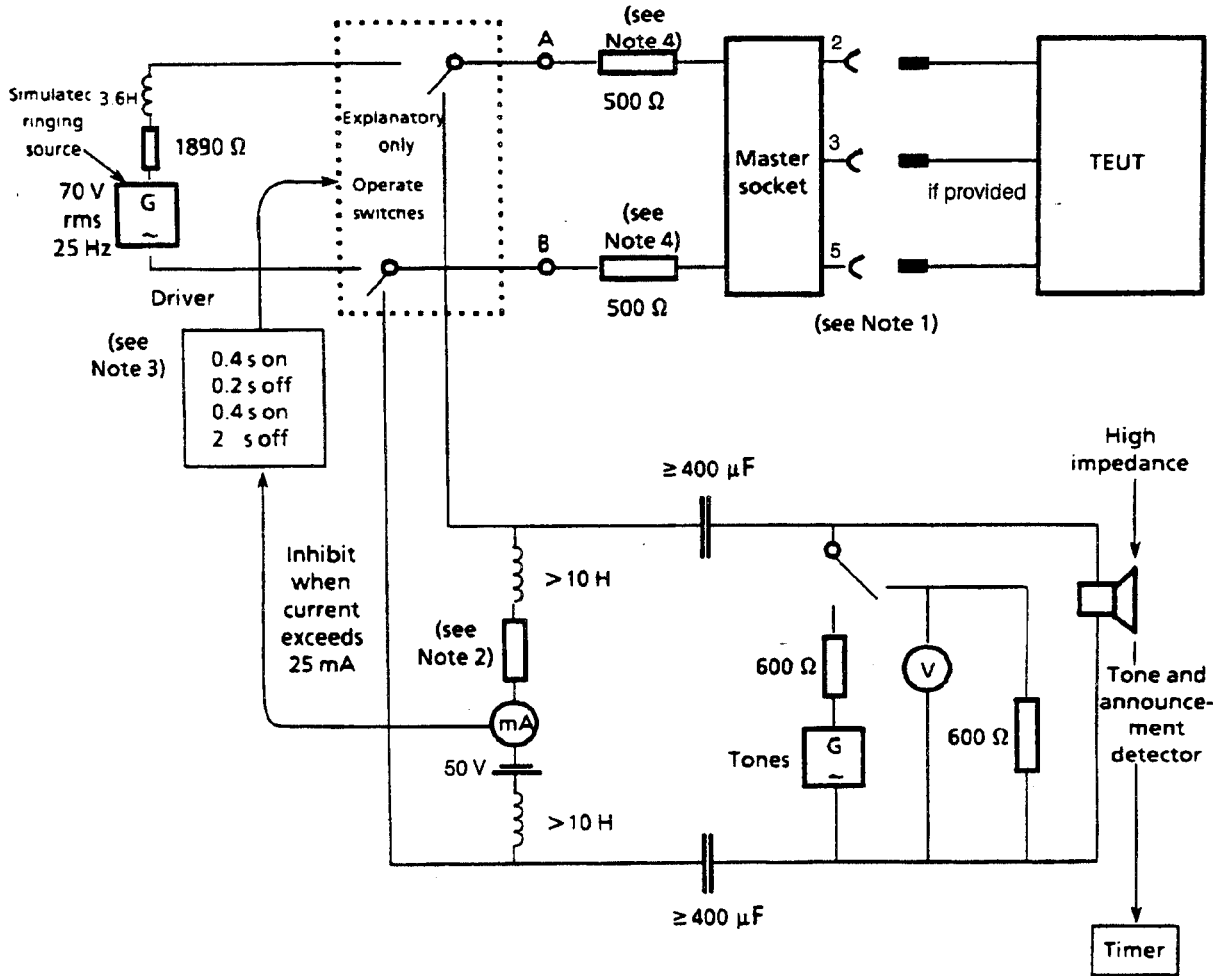


Figure A.6.3.1 (GB) 1: Auto-answer test circuit

- NOTE 1: Connections may be hardwired where appropriate.
- NOTE 2: The total resistance of the feeding circuit should be 400 ohms. This includes the resistance of the chokes, etc. The feed circuit may be realised in an unbalanced form.
- NOTE 3: The tolerance of the timing of the ringing cadence is $\pm 5\%$.
- NOTE 4: The two 500 ohm resistors represent an artificial line simplified for the purposes of this test.

A.6.3.1 (GB) 2 Time to answer test

The TEUT is connected to test circuit shown in figure A.6.3.1 (GB) 1. Cadenced ringing voltage is applied, commencing during the 2 s OFF period. The time to answer is measured from the start of the first 0.4 s ON period of ringing current. For apparatus offering adjustable answering delay, compliance is checked by selecting the answering delay at the "normal" setting or the higher end of the range "normal" settings available to the user.

The test circuit shown cannot sense on-line conditions during ON periods of ringing current. Where the change to the on-line state is detected within 100 ms of the start of an OFF period of ringing current, the change to the on-line state is deemed to have occurred at the start of the preceding ON period.

6.3.2 Insensitivity to ringing signal

For TE with the ability to detect ringing signals and subsequently capable of automatically establishing a loop condition in itself or a related TE, the loop condition shall not be established when ringing signals of voltage less than U are applied at its terminal for t_3 (s) in the frequency range Δf generated by an ac source connected in series with a dc source V_f .

The requirement shall be met for various dc excitations (V_f , R_f).

The requirement values U, Δf , ΔV_f , ΔR_f and t_3 are shown in table 6.3.2.

Compliance shall be checked using the test outlined in A.6.3.2.

Table 6.3.2: Insensitivity to ringing signal

COUNTRY	REQUIREMENT VALUES					Remarks
	U (V_{rms})	Δf (Hz)	ΔV_f (V)	ΔR_f (Ω)	t_3 (s)	
Austria	10	40 - 60	60	500	20	yes
Belgium	10	23 - 27	48	1 000	40	
Cyprus	10	25	48	440 - 1 740	25	
Denmark	120	$25 \pm 2,5$; 50 ± 5	44 - 56	500 - 2 400	$\leq 0,090$	yes
Finland	10	20 - 3 400	48	800	20	
France	10	$50 \pm 10 \%$	45 - 54	300	25	yes
Germany	45 - 75	23 - 54	60	1 000 - 2 500	not spec.	yes
Greece	15	0 - 50	44 - 66	500	20	
Iceland	not mandatory					
Ireland	3		43 - 53	5 000		yes
Italy	15	20 - 50	44 - 52	720 - 1 880	20	
Luxembourg	10	$25 \pm 10\%$	60	500	20	
Malta						
Netherlands	15	25	66	800	30	yes
Norway	17	25 ± 3 ; 50 ± 3	24 60	460 - 1 200 460 - 3 500	20	
Portugal	12	$16 \frac{2}{3} \pm 10 \%$ $25 \pm 20 \%$	45 - 55	500 - 2 500	20	
Spain						yes
Sweden	not mandatory					yes
Switzerland	≤ 8	21 - 55	43 - 57	2 200 - 600		yes
U. Kingdom	not mandatory					

6.3.2 (A) 1 The TE shall not react on ringing signals of $1\text{ s} \pm 20\%$ duration interrupted by a pause of $5\text{ s} \pm 20\%$.

6.3.2 (DK) 1 The TE shall not establish the loop condition when short pulses with peak values of up to 250 V are applied to its line terminals. Using the test principle shown in figure A.6.3.2 (DK) 1.

6.3.2 (F) 1 The requirements shall be met with the following cadence of the ringing signal:

$$t_{\text{on}}/t_{\text{off}} = 1\ 500\text{ ms}/3\ 500\text{ ms}$$

For TE with answering delay between 35 s and 45 s (see 6.3.1 (F) 3), t_3 is increased from 25 s to 60 s.

6.3.2 (F) 2 The TE shall not establish the loop condition when a signal of frequency $f = 50\text{ Hz}$ and a voltage $U = 90\text{ V}_{\text{rms}}$ is applied for 100 ms, with the feeding conditions $V_f = 48\text{ V}$ and $R_f = 300\ \Omega$.

Compliance shall be checked using the test outlined in A.6.3.2 (F) 2.

6.3.2 (F) 3 The TE shall not establish the loop condition when a discharge of a capacitor of value $4\ \mu\text{F}$, beforehand charged with 100 V, is applied to its line terminals.

Compliance shall be checked using the test outlined in A.6.3.2 (F) 3.

6.3.2 (D) 1 When connecting an ac source $U_G = 45\text{ V}$ ($R_{iG} = 0\text{ ohm}$), in the frequency range $f = 23\text{ Hz}$ to 54 Hz , call: 1 s, pause 4 s or 5 s and interconnection of a four-terminal network, the ringing detector shall no longer respond and operate.

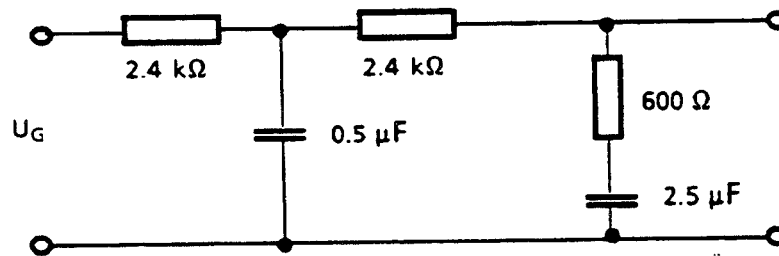


Figure 6.3.2 (D) 1: Four-terminal network "non-response"

6.3.2 (D) 2 When connecting an ac source $U_G = 75\text{ V}$ ($R_{iG} = 0\text{ ohm}$), in the frequency range $f \leq 18\text{ Hz}$ and $f \geq 64\text{ Hz}$ to $\leq 5\text{ kHz}$, call: 1 s, pause 4 s or 5 s, without interconnection of a four-terminal network, the ringing detector shall no longer respond and operate.

6.3.2 (D) 3 When ringing signals of voltage $U = 45\text{ V}$, applied in the frequency range 23 Hz to 54 Hz and superimposed by square-wave, delta or sine-wave voltages with $U_{(\text{eff})} = 6,0\text{ V}$ in the frequency range from 0 Hz to 20 kHz, the ringing detector shall respond and switch off reliably. Not included are clock frequencies of the system and their harmonics, with the clock frequency of the ringing detector $\geq 5\text{ kHz}$.

6.3.2 (D) 4 External voltages of $U_{(\text{eff})} \leq 9\text{ V}$ shall not be recognised.

6.3.2 (IRL) 1 The loop condition will not be established when the following are applied:

- (i) A continuous ringing signal of normal amplitude whose duration does not exceed 100 ms in any 1 s interval.
- (ii) Single, stray, short noise pulses with peak values of up to 100 V.
- (iii) In addition to the requirement values in table 6.3.2 it is strongly recommended that equipment should not respond to ac voltages of less than $17 V_{\text{rms}}$.

6.3.2 (NL) 1 The TE should also be insensitive to:

- signals < 100 ms
- polarity reversal
- decadic dialling from a parallel TE.

6.3.2 (E) 1 The requirements in sections 6.2.2 (E) 1, 10.6 (E) 3.1, 6.2.3 (plus 6.2.3 (E) 1), and 10.6 (E) 3.2 shall be applied.

6.3.2 (S) 1 Requirements of ringing signal detection insensitivity, see section 6.2.2.

6.3.2 (CH) 1 Timing:

No response shall occur for pulsed ringing corresponding to section 6.3.1 (for $U \leq 8 \text{ V}$).

Additional requirements:

No seizure shall occur for continuous ringing > 1,1 s or for only one ringing burst 0,2 - 1,1 s (e: 20 - 90 V).

The ringing detection circuit shall have a certain response delay in order to avoid dummy connections.

No response shall occur for pulses of any polarity and up to 50 ms duration, with a repetition frequency of 1 Hz and up to 90 V peak voltage.

The ringing detector shall not respond to a signal of 14 V/ 3 Hz applied to the equipment terminals (sampling signal for the underground party-line connection).

Supplementary remark:

The ringing detector shall not produce any indication of ringing by decadic dialling function of a parallel TE as it is stated in section 6.2.3.

A.6.3.2 Insensitivity to ringing signal

The TEUT is connected as shown in figure A.6.3.2 and the test signal is applied for t_3 seconds. The TEUT shall not be activated during this period. Compliance shall be checked by inspection or measurement of the loop current, as appropriate.

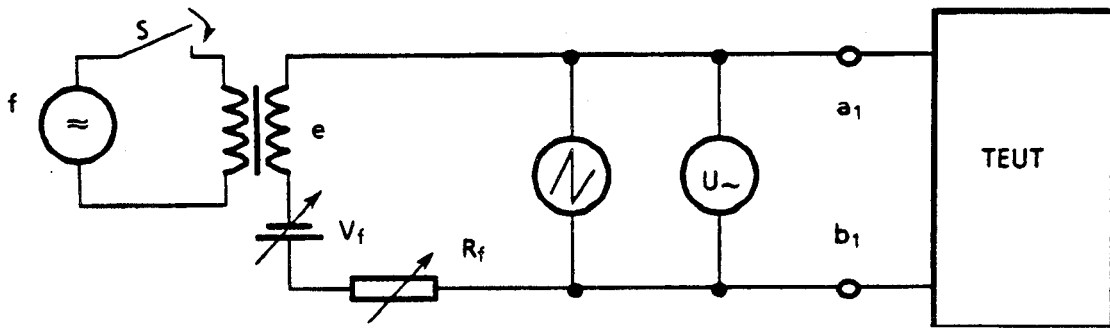


Figure A.6.3.2: Insensitivity to ringing signal

The test shall be performed at all combinations of the values given in table A.6.3.2.

NOTE: The signal is set using a true rms-indicating device able to accept waveforms with a crest factor of at least 3:1 and with a reading accuracy over the required frequency range of within 1 dB of the absolute value.

Table A.6.3.2: Insensitivity to ringing signal

COUNTRY	TEST VALUES					Remarks
	U (V _{rms})	V _f (V)	R _f (Ω)	Δf (Hz)	t ₃ (s)	
Austria	10	60	500	40, 60	20	yes
Belgium	9	48	1 000	25	40	
Cyprus	10	48	800	25	25	
Denmark	120	48	500	25, 50	0,090	yes
Finland	10	48	800	25	20	
France	10	48	300	50	25	yes
Germany	45, 75	60	2 530	23, 54	not spec.	yes
Greece	5, 15	60	500	25, 50	20	
Iceland	not mandatory					
Ireland	3	48	5 000	25	30	yes
Italy	15	44, 48, 52	1 880, 1 100, 720	20, 50	20	
Luxembourg	10	60	500	25	20	
Malta						
Netherlands	15, 90	66	800	25		yes
Norway	16	60, 24	460	50	20	
Portugal	12	45, 55	500	16 2/3 ± 10 % 25 ± 20 %	20	
Spain						yes
Sweden	not mandatory					yes
Switzerland	8	48	1 200	25, 50		yes
U. Kingdom	not mandatory					

A.6.3.2 (A) 1 The TE shall not react on ringing signals of 1 s duration interrupted by a pause of 5 s.

A.6.3.2 (DK) 1 For test according to 6.3.2 (DK) 1. Compliance shall be checked by inspection.

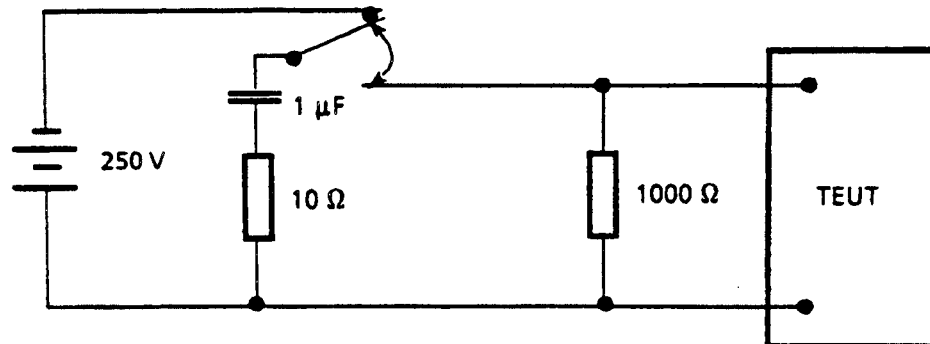


Figure A.6.3.2 (DK) 1

A.6.3.2 (F) 1 The following sequence is applied during 25 s:

- 1st pulse: 1,5 s
- 1st pause: 3,5 s
- 2nd pulse: 1,5 s
- etc. ...

For TE with answering delay between 35 s and 45 s (see 6.3.1 (F) 3), the duration of the ringing sequence is increased from 25 s to 60 s.

A.6.3.2 (F) 2 The TEUT is connected as shown in figure A.6.3.2 with the parameter values specified in section 6.3.2 (F) 2.

A.6.3.2 (F) 3 The TEUT is connected as shown in figure A.6.3.2 (F) 3.

Compliance shall be checked by inspection or by observing an abrupt drop in the discharge curve, as appropriate.

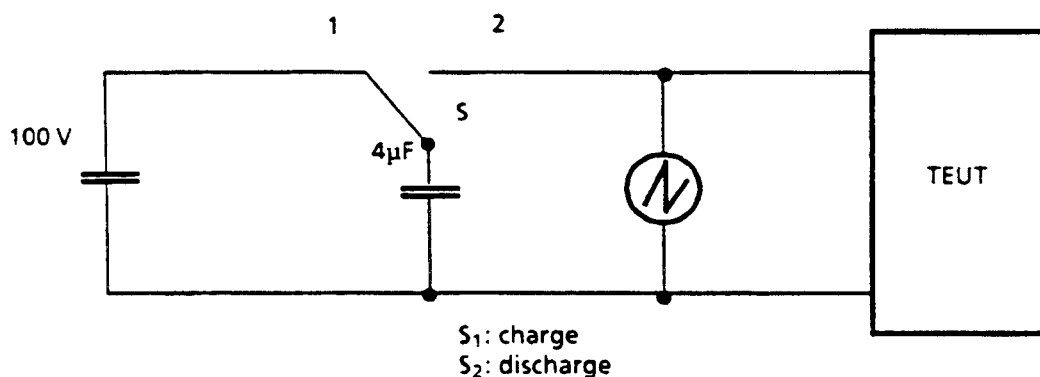


Figure A.6.3.2 (F) 3: Immunity to discharge of capacitor

A.6.3.2 (D) 1 The TEUT is connected as shown in figure A.6.3.2 (D) 1. The dc feeding conditions and ringing signals are specified in table A.6.3.2.

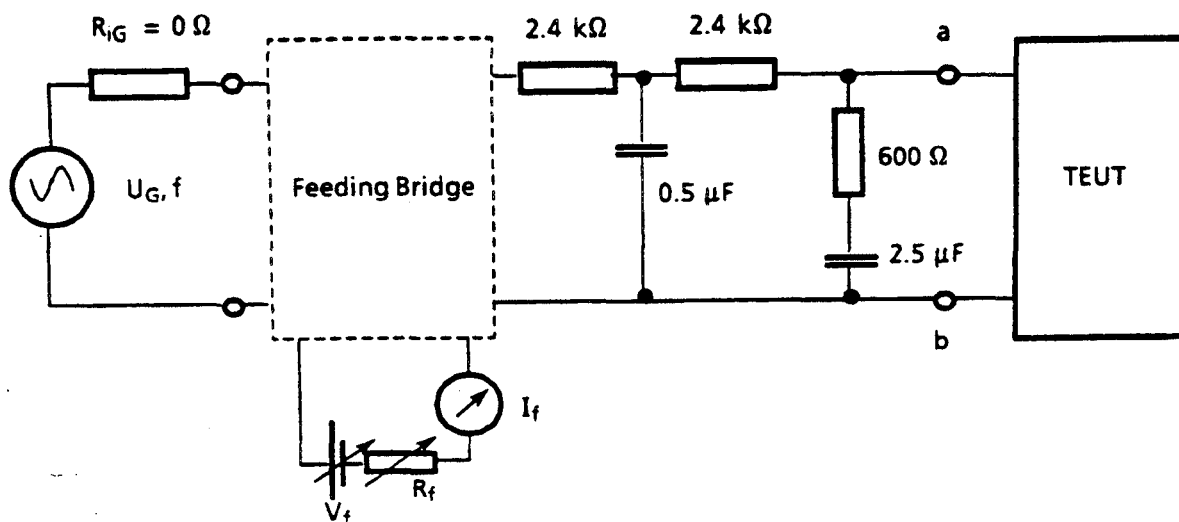


Figure A.6.3.2 (D) 1

- A.6.3.2 (IRL) 1** The cadence of the signal is 0,4 s on, 0,2 s off repeated.
- A.6.3.2 (IRL) 2** In addition to the test signal given in table A.6.3.2 two further signals are applied:
- (i) A 30 s sequence of ringing such that in any interval there is a burst at 75 V_{rms} and frequency 25 Hz.
 - (ii) A differentiated square wave period 2 s and amplitude 100 V applied for 30 s.

A.6.3.2 (NL) 1 Test with the following cadences of the ringing signal ($V_{rms} = 15$ V)

t_{on}	t_{off}	t_{on}	t_{off}
1	4	0,4	4
0,4	0,2	0,4	4

A.6.3.2 (NL) 2 The test with the following cadence is made with $V_{rms} = 90$ V.

t_{on}	t_{off}
0,1	1

A.6.3.2 (NL)3 Polarity reversal every 1 s with $V_{rms} = 90$ V.

A.6.3.2 (NL) 4 Test with decadic dialling from a parallel TE, with $V_{rms} = 90$ V.

See figure A.6.3.2 (NL) 1.

- $t_{make} = 38,5 \text{ ms} \pm 7,5 \text{ ms}$
- $t_{break} = 63,5 \text{ ms} \pm 10 \text{ ms}$
- $L = 12 \text{ H}$
- $C = 1 \mu\text{F}$
- $R = 560 \Omega$

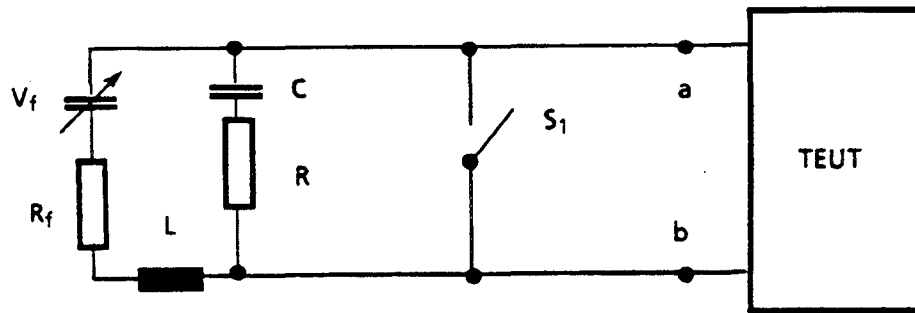


Figure A.6.2.3 (NL) 1: Decadic dialling from a parallel TE

- A.6.3.2 (E) 1** See the remark in section 6.3.2 (E) 1.
- A.6.3.2 (S) 1** Test of ringing signal detector insensitivity, see section A.6.2.2.
- A.6.3.2 (CH) 1** Timing:

No response for 10 times repeated 1 s ringing and 4 s pause.

The test regarding the immunity to continuous ringing is carried out with:
 $e = 90 \text{ V}$, $V_f = 48 \text{ V}$, $R_f = 1\ 200 \text{ ohms}$, $f = 25 \text{ and } 50 \text{ Hz}$, $t_3 = 20 \text{ s}$.

The tests can be carried out with $V_f = 0 \text{ V}$, provided the absence of the dc feeding has a negligible influence on the ringing signal detector sensitivity and the activation of the ringer detector is indicated.

The test regarding the immunity to decadic dialling from a parallel TE is described in section A.6.2.3.

6.3.3 Answering signal

For TE which has the capability of automatically altering its state from the quiescent condition to the loop condition an answering signal complying with all the requirements of section 4.4 and with a minimum level of a (dBm) and a minimum duration t_5 seconds shall be able to be applied to the network by the TE or related TE no later than t_4 seconds after the TE establishes the loop condition.

The answering signal shall either be a recorded message or a tone within a frequency band Δf (Hz).

The requirements shall be met for various dc excitations (V_f , R_f).

The requirement values t_4 , t_5 , Δf , a , ΔV_f , ΔR_f are shown in table 6.3.3.

Compliance shall be checked by inspection and measurement using the tests outlined in section A.6.3.3.

Table 6.3.3: Answering signal

COUNTRY	REQUIREMENT VALUES							Remarks
	t_4 (s)	t_5 (s)	Δf (Hz)	ΔV_f (V)	ΔR_f (Ω)	ΔI_f (mA)	a (dBm)	
Austria			2 085 - 2 115	60		19 - 60	-15	yes
Belgium	2,5	2,6	700 - 3 000	48		20 - I_{max}	-11	yes
Cyprus	2,5	2,6 - 4	2 100 \pm 15	48	440 - 1 740		-10	
Denmark	5	3	800 - 2 200	44 - 56	500 - 2 400		-13 \pm 3	yes
Finland	not mandatory							
France			2 100 \pm 15	46 - 54	300 - 1 400			yes
Germany	0,5 - 3	2,6	300 - 3 400	60	1 000 - 2 530		-13,3 (775 mV)	yes
Greece	not mandatory							
Iceland	not mandatory							
Ireland	3	not spec.	300 - 3 400	48	5 000	20 - 80		yes
Italy	2,5	2,6	300 - 3 400	44 - 52	720 - 1 880		-15	
Luxembourg	2,5		300 - 3 400	60		19 - 60	-15	
Malta								
Netherlands	2,5	2,5	800 - 2 200	42 - 66	800 - 2 140		-10	yes
Norway	3	2	800 - 2 200	60	460 - 3 100		-12 \pm 2	yes
Portugal	2,5	not applic.	not applic.	45 - 55	300 - 1 800		-15	
Spain								yes
Sweden	not mandatory							yes
Switzerland	2 - 3	10 - 50	speech	43 - 57	2 200 - 600		-13 \pm 3	yes
U. Kingdom	2,5	2,6	1 600 - 2 500				-25	yes

6.3.3 (A) 1

Speech signal: $t_4 = 3$ s; it shall not start earlier than 2 s
Tone signal: $t_4 = 2,5$ s; it shall not start earlier than 1,8 s
Speech signal: $t_5 = 10$ s
Tone signal: $t_5 = 2,6$ s; it shall not be longer than 4 s.

6.3.3 (B) 1

Facsimile equipment shall follow the recommendations specified in CCITT Recommendation T.30 (CED-signal).

Data modem shall follow the recommendations specified in CCITT Recommendation V.25 or V.25 bis. For modems, the send level of this calling tone is the same as the signal level or is fixed between -6 and -8 dBm.

6.3.3 (DK) 1

Also DTMF signals as specified in 5.4.

6.3.3 (F) 1

a) Speech signal:

$t_{4min} = 1$ s;
 $t_{4max} = 3$ s;
 $t_{5min} = 5$ s;

a (dBm) = -15 dBm.

b) Tone signal:

$t_{4min} = 1,8 \text{ s};$

$t_{4max} = 2,5 \text{ s};$

$t_{5min} = 2,6 \text{ s};$

$t_{5max} = 4 \text{ s};$

a (dBm) = -12 dBm except for modems for which the tone signal level shall be the same as the data level (see section 4.4.2 (F) 2).

6.3.3 (D) 1 For Germany, the requirement of section 6.3.3 is not an access requirement and is therefore not generally mandatory. The values in table 6.3.3 are only for information.

Terminal NETs may specify this requirement as mandatory. The approval requirements are then stated in the terminal NET.

6.3.3 (IRL) 1 The signal may be in the form of a code, verbal announcement or tone.

6.3.3 (NL) 1 No normal network tones are allowed.

6.3.3 (N) 1 Facsimile equipment shall follow the recommendations specified in CCITT Recommendation T.30 (CED-signal). Data modem shall follow the recommendations specified in CCITT Recommendation V.25. Phase reversals are not mandatory.

6.3.3 (E) 1 The requirements in sections 10.6 (E) 4 to 10.6 (E) 6 shall be applied. Particular reference is made to section 10.6 (E) 5.

6.3.3 (S) 1 If an answer signal is used, section 4.4 shall apply.

6.3.3 (CH) 1 Switzerland contents of table 6.3.3 deals with speech answering signals, e.g. from automatic answering machines.

For other purposes other signal types are used, e.g. disabling of echo control devices, described in Chapter 9, section 3.

The property of section 6.3.3 rather deals with equipment specific conditions for aspect 3 than being specific for the access to the PSTN.

In this paper stated conditions are valid only if no service related requirements exist for the equipment under consideration.

Other NETs, equipment specific requirements or Chapter 10 of NET 4 deal with such information.

For multifunctional terminals other values of t_4 and t_5 may be required (under study). Facsimile equipment shall follow the recommendations specified in CCITT V.25. For TEs dealing for instance with telemetry or alarm or other closed user group applications, other answering signals can be agreed upon (this matter is under study).

6.3.3 (GB) 1 The application of answering tone to the network is not mandatory for TE not intended to be used for answering naive callers. However, the instructions for use shall state that the TE may only be connected to lines not listed in directories published by Public Network Operators when used in the automatic answering mode, and that the telephone number should not be made public unless accompanied by suitable instructions concerning incoming calls.

6.3.3 (GB) 2 Where the answering signal consists of stored speech and/or music:

- a) speech signals shall have a mean power level whilst active not exceeding -9 dBm;
- b) music signals, or simultaneous speech and music signals, shall have a mean power level whilst active not exceeding -12 dBm.

See section 4.4.2.1.

6.3.3 (GB) 3 There is no UK requirement to answer with a speech and/or music signal within a specified time.

A.6.3.3 Answering signal

The TEUT is connected as shown in figure A.6.3.3.

The loop condition shall be established by using an appropriate method.

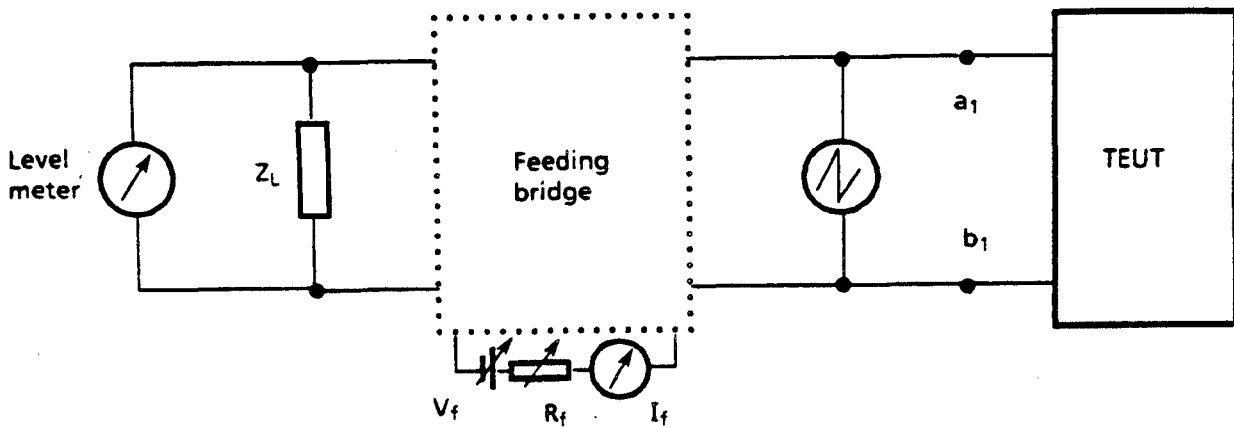


Figure A.6.3.3: Answering signal
The feeding bridge is as specified in Chapter 1

Table A.6.3.3: Answering signal

COUNTRY	TEST VALUES				Remarks
	Z _L (Ω)	V _f (V)	R _f (Ω)	I _f (mA)	
Austria	600	60		19, 60	
Belgium	600	48	400, 1 600		
Cyprus	600	48	800		
Denmark	600			50	
Finland					
France	600	46, 54	1 400, 300		
Germany	220 + 820//115 nF	60	1 000, 2 530		
Greece	600	60	500		
Iceland		not mandatory			
Ireland	600	48	5 000	20, 80	
Italy	600	44, 48, 52	1 880, 1 100, 720		
Luxembourg	600	60		19, 60	
Malta					
Netherlands	600	48	1 130		
Norway	600	60	3 100		
Portugal	600	48	300 - 1 800	not applic.	
Spain					yes
Sweden		not mandatory			
Switzerland	600	48	1 200		
U. Kingdom		not applicable			yes

A.6.3.3 (E) 1 See the remark in section 6.3.3 (E) 1.

A.6.3.3 (GB) 1 The loop condition is established by using the test circuit of figure A.6.3.1 (GB) 1.

A.6.3.3 (GB) 2 The test method to be used is that described in A.6.3.1 (GB) 2.

6.4 Automatic control of loop condition

The TE may have a manual control capable of interrupting the automatic control of the loop at any moment by the user.

6.4.1 TE without information-related control of loop condition

TE without information-related control of loop condition shall revert to the quiescent condition no longer than t_6 (s) after the loop condition was initially established.

The requirement shall be met for various dc excitations (V_f , R_f).

Compliance shall be checked using the tests outlined in A.6.4.1.

Table 6.4.1: TE without information-related control of loop condition

COUNTRY	REQUIREMENT VALUES				Remarks
	t_6 (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	60	60		19 - 60	
Belgium	300	48		20 - I_{max}	
Cyprus	90	48	440 - 1 740		
Denmark	60	44 - 56	500 - 2 400		yes
Finland	90	48	800 - 1 710		yes
France	180	46 - 54	300 - 1 400		yes
Germany	not mandatory				yes
Greece	90	44 - 66		20 - 80	
Iceland	90	48		14 - I_{max}	
Ireland	90	48	5 000	20 - 80	
Italy	90	44 - 52	720 - 1 880		
Luxembourg	100	60		19 - 60	
Malta					
Netherlands	120	48	1 130		yes
Norway	180	60	460 - 3 100		
Portugal	90	45 - 55	300 - 1 800	not applicable	yes
Spain					yes
Sweden	240				yes
Switzerland	TE dependent	43 - 57	2 200 - 600		yes
U. Kingdom	not mandatory				

6.4.1 (DK) 1 If the TE with an automatic answering function is capable to send a message to a calling party, it is allowed to send a message with a duration maximum of 5 minutes.

6.4.1 (SF) 1 If the TE with an automatic answering function is capable to send a message to a calling party, time t_6 starts when the message to be sent has ended.

6.4.1 (F) 1 It is authorised to extend the time t_6 to 6 minutes for certain particular applications, provided the user has always the possibility to change the time t_6 into a nominal value of 3 minutes.

6.4.1 (D) 1 For Germany, the requirement of section 6.4.1 is not an access requirement and is therefore not generally mandatory.

Terminal NETs may specify this requirement as mandatory. The approval requirements are then stated in the terminal NET.

6.4.1 (NL) 1 Information related control of loop condition is not mandatory. The meaning of the requirement in this section is that TE without network tone related control of loop condition or without control of loop condition on the basis of control by CCITT defined carrier waves, shall revert to the quiescent condition within 120 s.

- 6.4.1 (P) 1 TE with automatic answering function shall comply with this requirement unless it has information-related control of loop condition in which case it shall comply with the requirements in section 6.4.2, as appropriate.
- 6.4.1 (E) 1 The requirements in sections 10.6 (E) 4 to 10.6 (E) 6 shall be applied. Particular reference is made to section 10.6 (E) 6, and more specifically to section 10.6 (E) 6.3.
- 6.4.1 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.
- 6.4.1 (CH) 1 In telematic application (fax, modem, etc.) and in the case of unsuccessful negotiation (during pre- or post-message procedures), the connection must be released after maximum 60 s. This applies specifically to TEs which do not correspond to CCITT standards.

A.6.4 Automatic control of loop condition

A.6.4.1 TE without information-related control of loop condition

The test circuit shown below shall be used.

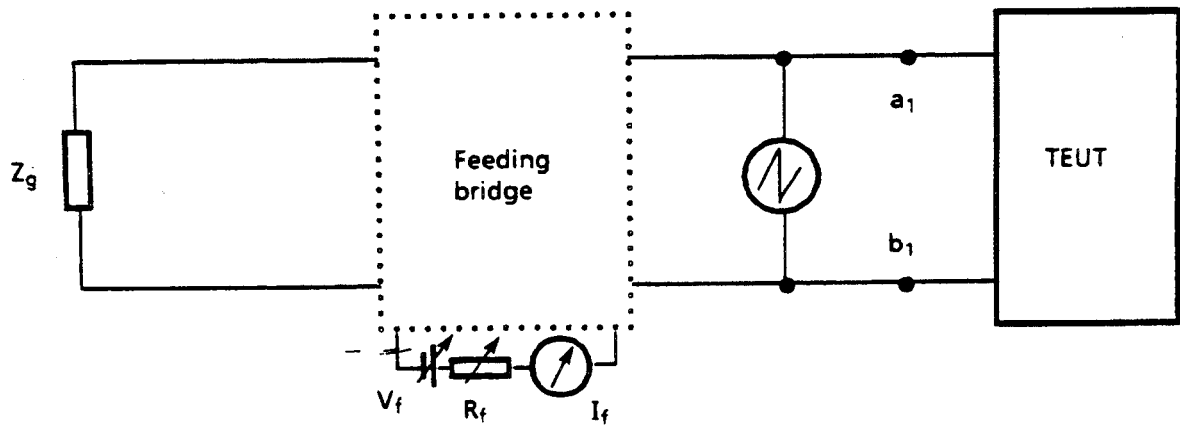


Figure A.6.4.1: TE without information related control of loop condition

Table A.6.4.1: TE without information related control of loop condition

COUNTRY	TEST VALUES				Remarks
	Z_g (Ω)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria		60		19, 60	
Belgium	600	48	400, 1 600		
Cyprus	600	48	800		
Denmark				50	
Finland	600	48	800, 1 710		
France	600	48	300		
Germany	not mandatory				
Greece	600	60		20, 35	
Iceland	600	48		14 - I_{max}	
Ireland	600	48	5 000	20, 80	yes
Italy	600	44, 48, 52	1 880, 1 100, 720		
Luxembourg	600	60		19, 60	
Malta					
Netherlands	600	48	1 130		
Norway	600	60	3 100		
Portugal	600	48	300 - 1 800	not applicable	
Spain					yes
Sweden		38	1 000		
Switzerland	600	43	1 200		
U. Kingdom	not applicable				

A.6.4.1 (IRL) 1 After automatic answering of a call the TEUT shall return to the on hook mode within 90 s unless the loop state is controlled by exchange of information over the line. The loop current is monitored and at the end of answering is observed on the oscilloscope to test for compliance.

A.6.4.1 (E) 1 See the remark in section 6.4.1 (E) 1.

6.4.2 TE with information-related control of loop condition

The requirements in this section apply to TEs with facilities which permit a loop condition to be sustained or controlled by the presence of speechband signals.

6.4.2.1 Data or code signal related control

The TE shall revert to the idle state if the level of the present signal falls below a value a_2 (dBm) for at least t_7 (s). If during this period the level should rise again to a value greater than a_3 (dBm), the timer controlling time t_7 (s) shall be reset (hysteresis).

The requirement shall be met for various dc excitations (V_f , R_f).

Compliance shall be checked using the tests outlined in section A.6.4.2.

Table 6.4.2.1: Data or code signal related control

COUNTRY	REQUIREMENT VALUES						Remarks
	a ₂ (dBm)	a ₃ (dBm)	t ₇ (s)	V _f (V)	R _f (Ω)	I _f (mA)	
Austria	-48	-43	40	60		19 - 60	yes
Belgium	-48	-43	5 - 60	48		20 - I _{max}	
Cyprus	-48	-43	20	48	440 - 1 740		
Denmark							yes
Finland	-48	-43	90	48	800 - 1 710		
France	-48			46 - 54	300 - 1 400		yes
Germany				not mandatory			yes
Greece	-43	-33	40	44 - 66		20 - 80	
Iceland	-48	-43	20	48		14 - I _{max}	
Ireland	-48	-43	20	48	20 - 100	5 000	
Italy	-48	-43	20 - 40	44 - 52	720 - 1 880		
Luxembourg	-48	-43	40	60		19 - 60	
Malta							
Netherlands				not mandatory			
Norway	-54	-43		60	460 - 3 100		yes
Portugal	-48			45 - 55	300 - 1 800	not applicable	yes
Spain							yes
Sweden				not mandatory			
Switzerland	-43 - -48	-43 - -48	0,1 - 3	48	1 200		yes
U. Kingdom				not mandatory			

6.4.2.1 (A) 1

For simplex and half duplex modems this requirement is mandatory only in the receiving mode.

6.4.2.1 (DK) 1

If loop condition is preserved for more than one minute in private equipment with automatic answering function and exchange of information via an established connection on the basis of information received, the loop condition shall be succeeded by quiescent condition at the latest 15 s after the latest information received which has been sufficient for the continuation of the loop condition.

As an exception from this rule it may, however, be permissible for the loop condition to be succeeded by quiescent condition at the latest 20 minutes after reception of the code signal with a piece of information which unambiguously means continuation of the loop condition and is perceived as such.

In private equipment in which the duration of the loop condition in excess of one minute is controlled solely by the effect of the information received, the loop condition shall always be succeeded by quiescent condition at the latest 20 minutes after establishment of a connection.

6.4.2.1 (F) 1

The TE shall revert to quiescent condition if the received data signal remains below -48 dBm for at most 3 minutes.

For half-duplex TEs which cannot detect the howler tone as described in 6.4.3 (F) 1, this requirement means that each sending period shall be limited to three minutes, except for fax machines for which nine minutes are recommended.

6.4.2.1 (F) 2

The TE shall sustain the loop condition for received data signal higher than -43 dBm, with a detection level of the received signal higher by at least 2 dB than the non-detection level (hysteresis).

However, the TE shall not recognise the PSTN howler tone of frequency = 440 Hz, level between -10 dBm and -25 dBm, cadence $t_{on}/t_{off} = 500$ ms, as data signal. Especially for full-duplex with return channel having energy in the howler tone band (440 ± 15 Hz), this requirement is considered as met if the TE reverts to quiescent condition for any drop of received data below -48 dBm for at least 350 ms.

6.4.2.1 (D) 1

For Germany, the requirement of section 6.4.2.1 is not an access requirement and is therefore not generally mandatory.

Terminal NETs may specify this requirement as mandatory. The approval requirements are then stated in the terminal NET.

6.4.2.1 (N) 1

The line shall be released within 10 s if the level of the information signal is less than -54 dBm for more than 20 s, the power level shall be averaged over a period of 0.2 s.

6.4.2.1 (P) 1

For TE using the backward channel according to CCITT Recommendation V.23, V.26 bis or V.27 ter.

$$a_3(\text{dBm}) = -43$$

$$t_7(\text{s}) = 0,25$$

TE shall revert to the quiescent condition within a subsequent time period of 10 s.

6.4.2.1 (P) 2

For other TE the second sentence in the requirement - "If during this period.....shall be reset (hysteresis)" - is not applicable. For these TE:

$$a_3(\text{dBm}) = \text{Not applicable}$$

$$t_7(\text{s}) = 20$$

TE shall revert to the quiescent condition within a subsequent time period of 10 s.

6.4.2.1 (E) 1

The requirements in sections 10.6 (E) 4 to 10.6 (E) 6 shall be applied. Particular reference is made to section 10.6 (E) 6, and more specifically to sections 10.6 (E) 6.4 and 10.6 (E) 6.5.

6.4.2.1 (CH) 1

The property of section 6.4.2.1. rather deals with the equipment specific conditions for aspect 3 than being specific for the access to the PSTN.

In this paper, stated conditions are valid only if no service-related requirements exist for the equipment under consideration.

Other NETs, CCITT Recommendations: for data transmission V and X series as well as Blue Book Vol. VII (VII.3, T.30), equipment specific requirements or Chapter 10 of NET 4 deal with such information.

The stated value of $t_7 = 0,1 - 3$ s is under reconsideration.

A.6.4.2 TE with information-related control of loop condition

Generator "e" is caused to emit information signals appropriate to the functionality of the TEUT.

A.6.4.2.1 Data or code signal related control

The test circuit shown below shall be used. All signal levels shall be measured with respect to 775 mV.

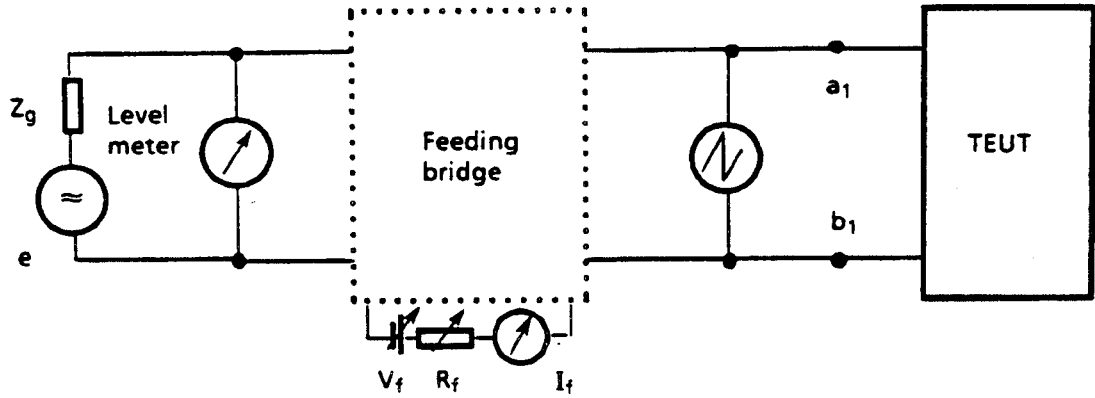


Figure A.6.4.2.1: Data or code signal related control

Table A.6.4.2.1: Data or code signal related control

COUNTRY	TEST VALUES								Remarks
	e (V)	Z _g (Ω)	V _f (V)	R _f (Ω)	I _f (mA)	a ₂ (dBm)	a ₃ (dBm)	t ₇ (s)	
Austria		600	60		19, 60	-49	-42	40	
Belgium		600	48	400, 1 600		-49	-42		yes
Cyprus		600	48	800		-48	-43	20	
Denmark									yes
Finland		600	48	800, 1 710		-48		90	yes
France									yes
Germany									not mandatory
Greece		600	60			-43, -45	-30, -35	20, 40	yes
Iceland		600	48		14, I _{max.}	-48	-43	20	
Ireland		600	48	5 000	20, 80	-48	-43	20	yes
Italy	not stated	600	44, 48, 52	1 880, 1 100, 720		-48	-43		
Luxembourg		600	60		19, 60	-48	-43		
Malta									
Netherlands									not mandatory
Norway	variable	600	60	3 100					yes
Portugal		600	48	300 - 1 800	N/A	N/A	N/A		yes
Spain									yes
Sweden									not mandatory
Switzerland		600	48	1 200		-48	-43	4	yes
U. Kingdom									not mandatory

A.6.4.2.1 (B) 1 For this test, the TE is caused to enter the loop condition. The generator "e" is adjusted to produce a rms voltage level of a₃ = -42 dB (775 mV) at the TE line terminals. The TE shall stay in the loop condition. Two tests are made:

- a) The level of the signal is decreased by 7 dB (a₂ = -49 dB (775 mV)) and the time needed by the TE for entering the quiescent condition is recorded.
- b) Starting again the loop condition (a₃), the level of the signal is decreased to a₂ = -49 dB (775 mV) only during t = 0,8 x t₇ and then increased to a₃: the TE shall stay in the loop condition.

A.6.4.2.1 (DK) 1 Compliance with 6.4.2.1 (DK) 1 shall be checked by inspection.

A.6.4.2.1 (SF) 1 The level of the test signal a₂(dBu) is the level of the signal across the terminals of the TE.

A.6.4.2.1 (F) 1

- a) For the half-duplex modems and the FSK modems the test is carried out by using figure A.6.4.2.1 (F) 1.a with the following parameter values:

$V_f = 48 \text{ V}$
 $R_f = 300 \Omega$
 $f =$ frequencies corresponding to the bits "0" and "1" in case of FSK modulation
or carried frequency in the other cases,
 $e = 1,55 \text{ V}$
A: increased to obtain the threshold t_{h1} at which the test frequency is not
detected any more, the A is decreased to obtain the threshold t_{h2} at which the
test frequency is detected again.

It is verified:

$-48 \text{ dBm} < t_{h1} < -45 \text{ dBm}$
 $-46 \text{ dBm} < t_{h2} < -43 \text{ dBm}$
 $t_{h2} - t_{h1} > 2 \text{ dB}$

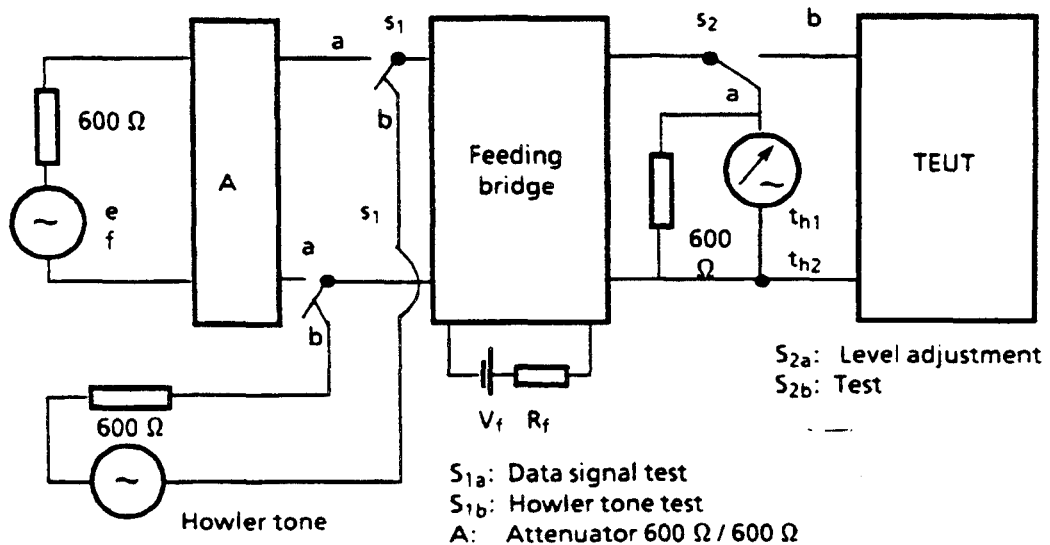


Figure A.6.4.2.1 (F) 1.a: Data signal control for half-duplex and FSK full-duplex modems

- b) For the full-duplex modems, except FSK modems, the test is carried out using figure A.6.4.2.1 (F) 1.b with a modem M identical to the TEUT, in the following conditions:

$V_f = 48 \text{ V}$
 $R_f = 300 \Omega$
sending level of modem M = -10 dBm
sending level of the TEUT: 0 dBm
A is increased to obtain the threshold t_{h1} at which the modulated signal of modem M is not detected any more, then A is decreased to obtain the threshold t_{h2} at which the modulated signal of modem M is detected again; the values of t_{h1} and t_{h2} are calculated by subtracting respectively the adjusted values of A from -10 dBm.

It is verified:

$-48 \text{ dBm} < t_{h1} < -45 \text{ dBm}$
 $-46 \text{ dBm} < t_{h2} < -43 \text{ dBm}$
 $t_{h2} - t_{h1} > 2 \text{ dB}$

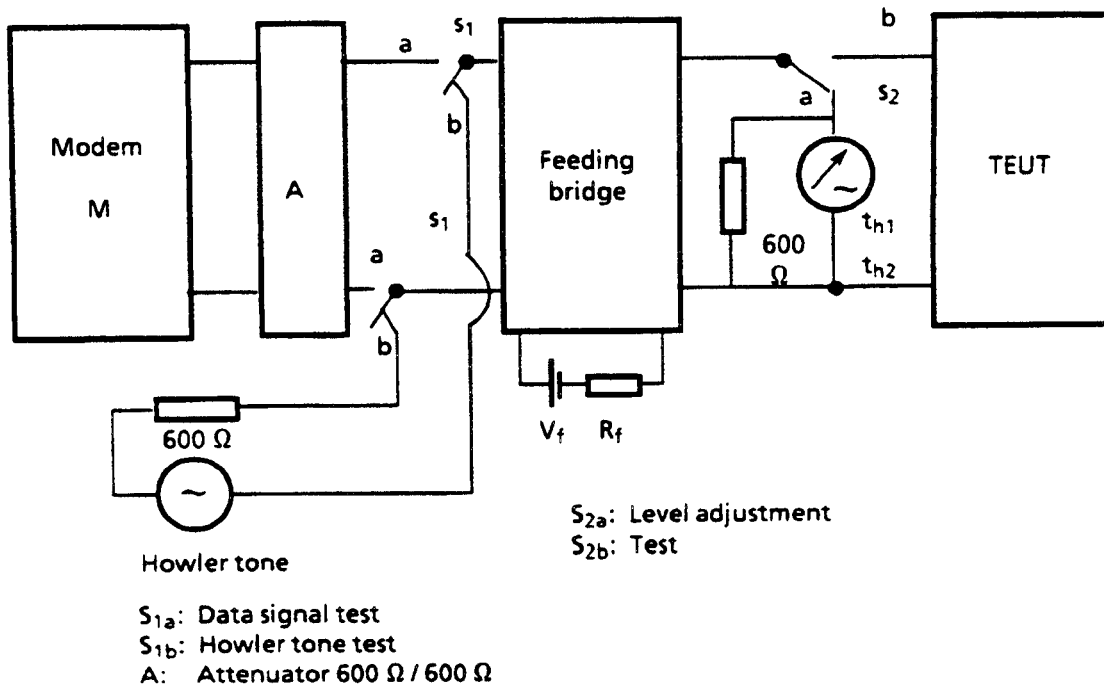


Figure A.6.4.2.1 (F) 1.b: Data signal control for full-duplex (except FSK) modems

A.6.4.2.1 (F) 2 In order to verify that the TE does not sustain the loop condition more than 3 minutes when a howler tone is present, a howler tone signal frequency = 440 Hz, level -10 dBm, cadence $t_{on}/t_{off} = 500 \text{ ms}/500 \text{ ms}$, is applied to the TE during at least 3 minutes at any time of the data exchange.

The test is carried out using figures A.6.4.2.1 (F) 1.a or b, as appropriate.

A.6.4.2.1 (GR) 1 $I_f = 20, 35, 55 \text{ mA}$.
TE is caused to assume loop condition. Generator "e" is capable to give levels in the range 0 - 60 dBm.

A.6.4.2.1 (IRL) 1 The loop state shall be maintained for 90 s by use of an external information simulator. On removal of information the loop state shall be succeeded by the quiescent state within 20 s.

A.6.4.2.1 (N) 1 Timer values see 6.4.2.1 (N) 1.

A.6.4.2.1 (N) 2 Signal levels shall be measured in dBm.

$$a_2 = -54 \text{ dBm and } a_3 = -43 \text{ dBm.}$$

A.6.4.2.1 (P) 1 $e(V) = 6 \times 10^{-3}$ to test the requirement concerning $a_2(\text{dBm})$.

A.6.4.2.1 (P) 2 $e(V) = 12 \times 10^{-3}$ to test the requirement concerning $a_3(\text{dBm})$ where applicable.

A.6.4.2.1 (P) 3 $t_7(\text{s}) =$ according to the sections 6.4.2.1 (P) 1 and 6.4.2.1 (P) 2.

A.6.4.2.1 (E) 1 See the remark in section 6.4.2.1 (E) 1.

A.6.4.2.1 (CH) 1 The stated value of t_7 is under reconsideration.

6.4.2.2 Incoming speech or other non-data signal related control

The TE shall sustain the loop condition when signals with an active average speech power level greater than or equal to a_4 (dBm) are received.

For received signals with an active average power level less than a_5 (dBm), for a continuous period of t_8 (s), the TE shall revert to quiescent condition within a subsequent time period of t_9 (s).

The requirement shall be met for various dc excitations (V_f , R_f).

Compliance shall be checked using the tests outlined in section A.6.4.2.2.

Table 6.4.2.2: Incoming speech or other non-data signal related control

COUNTRY	REQUIREMENT VALUES							Remarks	
	a_4 (dBm)	a_5 (dBm)	t_8 (s)	t_9 (s)	V_f (V)	R_f (Ω)	I_f (mA)		
Austria	-45	-52	8	9	60		19 - 60		
Belgium	-40	-48	10 - 30	5	48		20 - I_{max}		
Cyprus	-43	-48	20	10	48	440 - 1 740			
Denmark								yes	
Finland	not spec.	-52	not spec.	90	48	800 - 1 710			
France	-40	-50	12		46 - 54	300 - 1 400		yes	
Germany			not mandatory						yes
Greece	-43	-48	20	10	44 - 66		20 - 80		
Iceland	-48	-48	20	10	48	48	14, I_{max} .		
Ireland	-43	-48	20		48	5 000	20, 80		
Italy	-34	-40	6 - 10	10	48	800			
Luxembourg	-40	-50	8	10	60		19 - 60		
Malta									
Netherlands			not mandatory						
Norway	-43	-54	20	10	60	460 - 3 100		yes	
Portugal	-43	-48	20	10	45 - 55	300 - 1 800	N/A		
Spain								yes	
Sweden	-50	-60	20	10				yes	
Switzerland	-40 - -52	-40 - -52	8		43 - 57	2 200 - 600		yes	
U. Kingdom			not mandatory						

6.4.2.2 (DK) 1 As 6.4.2.1 (DK) 1.

6.4.2.2 (F) 1 The TE shall not revert to quiescent condition when the active average speech falls below -50 dBm for only 6 s.

6.4.2.2 (F) 2 The TE shall revert to quiescent condition 12 s at the latest after the beginning of the "silent" period specified in table 6.4.2.2.

6.4.2.2 (F) 3 The TE shall not recognise the PSTN howler tone of frequency 440 Hz, level between -10 dBm and -25 dBm, cadence $t_{on}/t_{off} = 500$ ms/500 ms, as speech signal.

- 6.4.2.2 (F) 4 TE without the possibility to detect in sending condition the howler tone as described in section 6.4.3, shall revert, at least every 3 minutes during at least the period necessary to detect a "silence", to receiving condition.
- 6.4.2.2 (D) 1 For Germany, the requirement of section 6.4.2.2 is not an access requirement and is therefore not generally mandatory.
- Terminal NETs may specify this requirement as mandatory. The approval requirements are then stated in the terminal NET.
- 6.4.2.2 (N) 1 The power level shall be measured over a period of 10 s.
- 6.4.2.2 (E) 1 The remark in section 6.4.2.1 (E) 1 shall be applied.
- 6.4.2.2 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.
- 6.4.2.2 (S) 2 The TE shall not be kept activated by signals lower than 0 dBm outside the 300 - 3 400 Hz frequency band.
- 6.4.2.2 (CH) 1 t_g : 4 s after the end of operation, e.g. the end of the closing phrase of an automatic answering machine.

The property of section 6.4.2.2 rather deals with equipment specific conditions for aspect 3 than being specific for the access to the PSTN.

In this paper, stated conditions are valid only if no service-related requirements exist for the equipment under consideration.

Other NETs, equipment specific requirements or Chapter 10 of NET 4 deal with such information.

In multifunctional TEs other values of t_g and t_g may be required (under study).

A.6.4.2.2 Incoming speech or other non-data related control

The test circuit shown below shall be used. All signal levels shall be measured with respect to 775 mV.

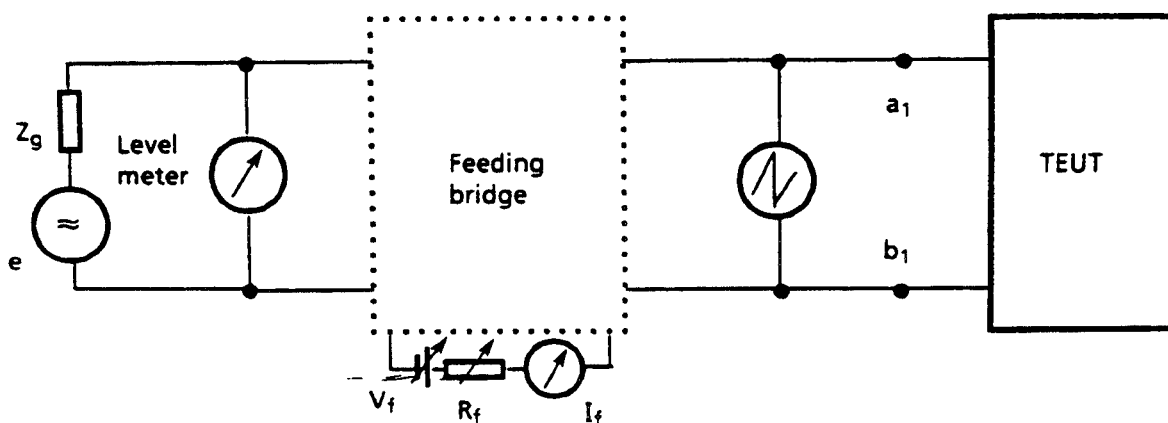


Figure A.6.4.2.2: Incoming speech or other non-data signal related control

Table A.6.4.2.2: Incoming speech or other non-data signal related control

COUNTRY	TEST VALUES				
	e (V)	Z _g (Ω)	V _f (V)	R _f (Ω)	I _f (mA)
Austria		600	60		19, 60
Belgium		600	48	400, 1 600	
Cyprus		600	48	800	
Denmark					
Finland		600	48	800, 1 710	
France					
Germany	not mandatory				
Greece		600	60		
Iceland		600	48		14, I _{max.}
Ireland		600	48	5 000	20, 80
Italy	not stated	600	48	800	
Luxembourg		600	60		19, 60
Malta					
Netherlands	not mandatory				
Norway	variable	600	60	3 100	
Portugal		600	48	300 - 1 800	not applic.
Spain					
Sweden	variable	600	38	1 000	
Switzerland		600	48	1 200	
U. Kingdom	not mandatory				

Table A.6.4.2.2 cont: Incoming speech or other non-data signal related control

COUNTRY	TEST VALUES				Remarks
	a ₄ (dBm)	a ₅ (dBm)	t ₈ (s)	t ₉ (s)	
Austria	-45	-52			yes
Belgium	-38	-50			yes
Cyprus	-43	-48	20	10	
Denmark					yes
Finland		-52		90	yes
France					yes
Germany	not mandatory				
Greece	-30, -25	-48, -55	20, 30		yes
Iceland	-48	-48	20	10	
Ireland	-43	-48	20		
Italy	-34	-40			
Luxembourg					
Malta					
Netherlands	not mandatory				
Norway			20	10	yes
Portugal	not applicable	not applicable	20	10	yes
Spain					yes
Sweden	-50	-60	20	10	yes
Switzerland	40	52	8	3 + t end	yes
U. Kingdom	not mandatory				

A.6.4.2.2 (A) 1 The generated signal shall be an interrupted white noise signal within a bandwidth of 355 Hz - 2 800 Hz.

The cadence shall be 100ms/100ms.

A.6.4.2.2 (B) 1 For the test, the generator "e" is adjusted to produce the rms voltage levels a₄ and a₅ at the TE line terminals.

The times t₈ and t₉ are results of the test and have to be within the limits specified in 6.4.2.2.

A.6.4.2.2 (DK) 1 As A.6.4.2.1 (DK) 1.

A.6.4.2.2 (SF) 1 The level of the test signal a₄(dBu) is the level of the signal across the terminals of the TE.

A.6.4.2.2 (F) 1 The test is carried out using figure A.6.4.2.2 (F) 1 with a generator of white noise (or a generator of speech signal if the TE is able to distinguish between white noise and speech signal) in the following dc conditions:

$$V_f = 48 \text{ V}$$

$$R_f = 300 \Omega$$

It is verified:

- a) the TE reverts to quiescent condition for any period of speech/noise signal of level -50 dBm during 12 s at any moment in receiving condition;
- b) the TE sustains the loop condition when periods of speech/noise signal of level -40 dBm and duration 2 s alternated with periods of speech/noise signal of level -50 dBm and duration 6 s are applied between the line terminals, when the TE is in receiving condition;
- c) the same check as in case b) but with a level of speech/noise of -10 dBm.

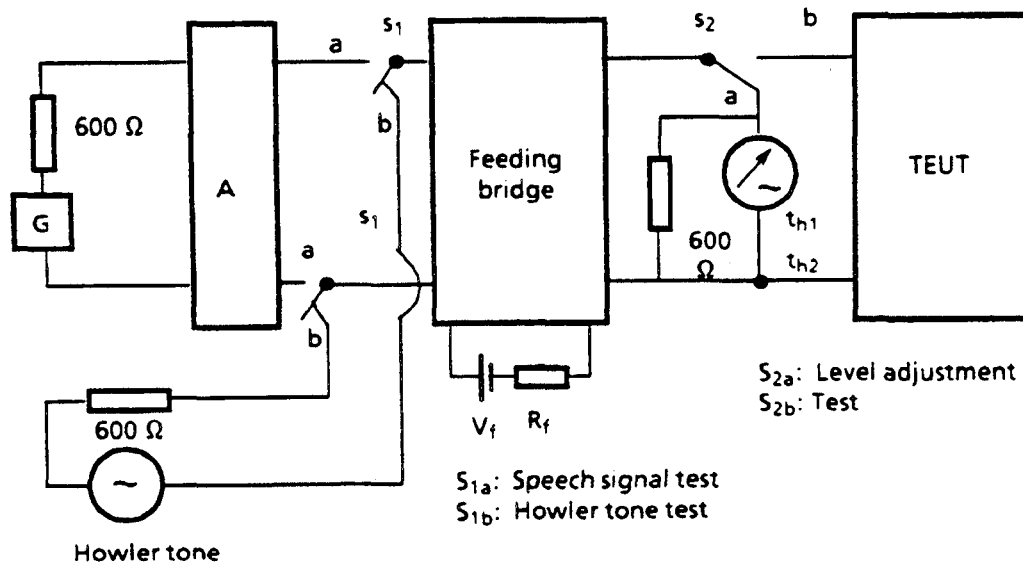


Figure A.6.4.2.2 (F) 1: Speech signal control

A.6.4.2.2 (F) 2

In order to verify that the TE does not sustain the loop condition when a howler tone is present:

- a) a howler tone signal of frequency = 440 Hz, level -10 dBm, cadence $t_{on}/t_{off} = 500 \text{ ms}/500 \text{ ms}$, is applied during 12 s to the TE in receiving condition;
- b) a howler tone signal of frequency = 440 Hz, level -10 dBm, cadence $t_{on}/t_{off} = 500 \text{ ms}/500 \text{ ms}$, is applied during 3 minutes 12 s to the TE in sending condition.

The test is carried out using figure A.6.4.2.2 (F) 1 with the following dc conditions:

$$V_f = 48 \text{ V}$$

$$R_f = 300 \Omega.$$

A.6.4.2.2 (GR) 1

$$I_f = 20, 35, 55 \text{ mA.}$$

TE is caused to assume loop condition. Generator "e" is capable to give levels in the range 0 - 60 dBm.

A.6.4.2.2 (N) 1

Signal levels shall be measured in dBm.

$$a_4 = -43 \text{ dBm and } a_5 = -54 \text{ dBm.}$$

A.6.4.2.2 (P) 1

$$e(V) = 12 \times 10^{-3} \text{ to test the requirement concerning } a_4(\text{dBm}).$$

- A.6.4.2.2 (P) 2** $e(V) = 6 \times 10^{-3}$ to test the requirement concerning a_5 (dBm).
- A.6.4.2.2 (E) 1** See the remark in section 6.4.2.2 (E) 1.
- A.6.4.2.2 (S) 1** For frequencies outside the speech band (300 -3 400 Hz) the level is varied between 0 dBm and -60 dBm.
- A.6.2.2 (CH) 1** See remark in section 6.4.2.2 (CH) 1.

6.4.2.3 Remotely transmitted control signals

For control signals (e.g. remote recall) with a level less than a_6 (dBm) or, in the absence of control signals, the TE shall revert to the quiescent condition within a period of t_{10} (s) following the last successful receipt of any control signal.

The requirement shall be met for various dc excitations (V_f , R_f).

Compliance shall be checked using the tests outlined in section A.6.4.2.3.

Table 6.4.2.3: Remotely transmitted control signals

COUNTRY	REQUIREMENT VALUES					Remarks
	a_6 (dBm)	t_{10} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	-45	60	60		19 - 60	
Belgium			not mandatory			yes
Cyprus			not mandatory			
Denmark						yes
Finland			not mandatory			
France	-48		46 - 54	300 - 1 400		yes
Germany			not mandatory			yes
Greece	-48	10	0 - 60			yes
Iceland			not mandatory			
Ireland			not mandatory			
Italy			not mandatory			
Luxembourg			not mandatory			
Malta						
Netherlands			not mandatory			
Norway			not mandatory			
Portugal	-48	30	45 - 55	300 - 1 800	not applicable	
Spain						yes
Sweden			not mandatory			
Switzerland			not mandatory			yes
U. Kingdom			not mandatory			

6.4.2.3 (B) 1 For control signals, the requirement 6.4.2.1 applies.

6.4.2.3 (DK) 1 As 6.4.2.1 (DK) 1.

6.4.2.3 (F) 1

The TE shall revert to quiescent condition when any control signal or a control signal with level less than a_6 dBm is received during control periods of duration t_c between 6 s and 40 s (three minutes for interactive data systems).

TE without the possibility to detect in sending condition the howler tone as described in section 6.4.3 shall revert, at least every 3 minutes* during at least t_c s, to control condition.

*6 minutes for automatic answering machines with the facility to send to the distant party the recorded messages.

6.4.2.3 (F) 2

The TE shall recognise control signal of level higher than -43 dBm.

However, the TE shall not recognise the PSTN howler tone frequency 440 Hz, level between -10 dBm and -25 dBm, cadence $t_{on}/t_{off} = 500$ ms/500 ms, as control signal.

6.4.2.3 (F) 3

For the case of use of DTMF tones as control signal, see the detection conditions and the non-detection conditions in section 10.9.

6.4.2.3 (D) 1

For Germany, the requirement of section 6.4.2.3 is not an access requirement and is therefore not generally mandatory.

Terminal NETs may specify this requirement as mandatory. The approval requirements are then stated in the terminal NET.

6.4.2.3 (GR) 1

$\Delta f = 0 - 60$ V dc $\Delta I_f = 20 - 80$ mA.

6.4.2.3 (E) 1

The remark in section 6.4.2.1 (E) 1 shall be applied.

6.4.2.3 (CH) 1

The property of section 6.4.2.3 rather deals with equipment specific conditions for aspect 3 than being specific for the access to the PSTN.

Other NETs, CCITT recommendations equipment specific requirements or Chapter 10 of NET 4 deal with such information.

A.6.4.2.3 Remotely transmitted control signals

Test circuit shown below shall be used. All signal levels shall be measured with respect to 775 mV.

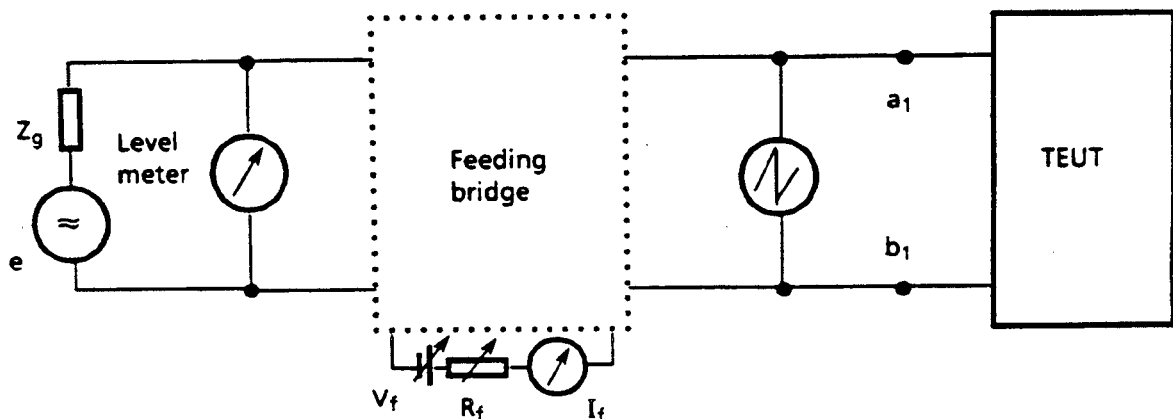


Figure A.6.4.2.3: Remotely transmitted control signals

Table A.6.4.2.3: Remotely transmitted control signals

COUNTRY	TEST VALUES						Remarks
	e (V)	Z _g (Ω)	V _f (V)	R _f (Ω)	I _f (mA)	a ₆ (dBm)	
Austria		600	60		19, 60	-46	
Belgium							not mandatory
Cyprus							not mandatory
Denmark							yes
Finland							
France							yes
Germany							not mandatory
Greece		600	60			-48, -55	yes
Iceland							not mandatory
Ireland							not mandatory
Italy							not mandatory
Luxembourg							not mandatory
Malta							
Netherlands							not mandatory
Norway							not mandatory
Portugal	6 × 10 ⁻³	600	48	300 - 1 800	not applic.	not applic.	
Spain							yes
Sweden							not mandatory
Switzerland							not mandatory
U. Kingdom							not mandatory

A.6.4.2.3 (DK) 1 As A.6.4.2.1 (DK) 1.

A.6.4.2.3 (F) 1 The test carried out using figure A.6.4.2.3 (F) 1 with the distant terminal equipment T providing the code signal, in the following conditions:

$$V_f = 48 \text{ V}$$

$$R_f = 300 \text{ } \Omega$$

A: increased to obtain a control signal level of -43 dBm and it is checked whether the TE recognises the code when this one is applied 6 s after the beginning of the control period; then A is decreased to obtain a control signal level of -48 dBm and it is checked the TE reverts to quiescent condition at the latest 40 s after the beginning of the control period when the code signal is applied at any time during this control period.

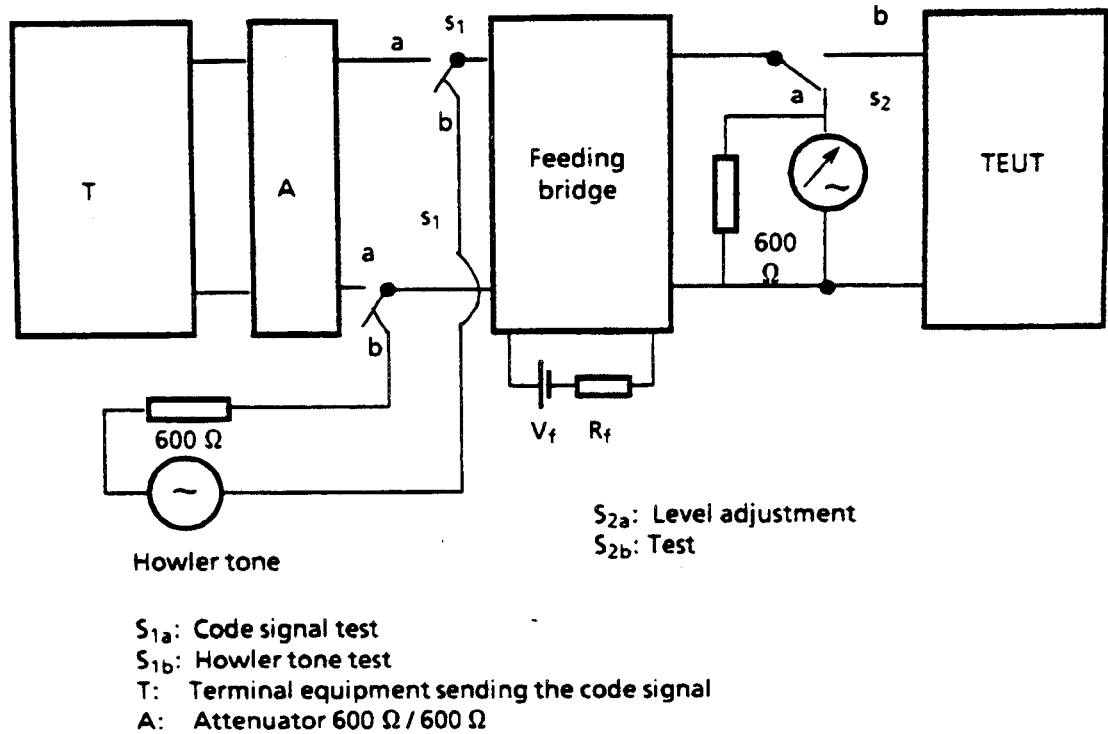


Figure A.6.4.2.3 (F) 1: Remote control

A.6.4.2.3 (F) 2

In order to verify that the TE does not sustain the loop condition when a howler tone is present:

- a) a howler tone signal of frequency = 440 Hz, level -10 dBm, cadence $t_{on}/t_{off} = 500 \text{ ms}/500 \text{ ms}$, is applied for 40 s to the TE in control period;
- b) a howler tone signal of frequency = 440 Hz, level -10 dBm, cadence $t_{on}/t_{off} = 500 \text{ ms}/500 \text{ ms}$, is for 3 minutes 40 s to the TE in sending condition.

The test is carried out using figure A.6.4.2.3 (F) 1 with the following dc conditions:

$$V_f = 48 \text{ V}$$

$$R_f = 300 \Omega.$$

A.6.4.2.3 (GR) 1

$$I_f = 20, 35, 55 \text{ mA.}$$

TE is caused to assume loop condition. Generator "e" is capable to give levels in the range 0 - 60 dBm.

A.6.4.2.3 (E) 1

See the remark in section 6.4.2.3 (E) 1.

6.4.3 TE with network tone related control of loop condition

TEs with the facility of network tone detection and the facility to terminate the loop condition upon the detection of network tones shall revert to the quiescent condition upon the receipt of the tones specified in table 6.4.3.a. The inclusion of these facilities may be mandatory (see table 6.4.3.a).

For the characteristics of the tones which activate the detection facility see Chapter 9.

Table 6.4.3.a: Network tone detection - mandatory (yes/no)

COUNTRY	REQUIREMENT VALUES			
	Dial tone detection	Busy tone detection	Congestion tone detection	Other tone detection
Austria	yes	no	yes	no
Belgium	no	no	no	no
Cyprus	no	yes	yes	no
Denmark	not mandatory			
Finland	no	yes	no	no
France	howler tone			
Germany	yes	no	no	no
Greece				
Iceland	not mandatory			
Ireland	yes	yes	no	no
Italy	yes	no	no	no
Luxembourg	yes	no	no	no
Malta				
Netherlands	yes	yes	yes	no
Norway	optional	optional	optional	not mandatory
Portugal	yes	yes	yes	no
Spain				
Sweden	not mandatory			
Switzerland	not mandatory	not mandatory	not mandatory	
U. Kingdom	see remark			

The TE shall revert to quiescent condition within a period t_{11} (s) after the application of the relevant tones.

The requirement shall be met for various dc excitations (V_f , R_f).

Compliance shall be checked using the test outlined in section A.6.4.3.

Table 6.4.3.b: TE with network tone related control of loop condition

COUNTRY	REQUIREMENT VALUES				Remarks
	t_{11} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	17	60		19 - 60	yes
Belgium	5	48		20 - I_{max}	yes
Cyprus	10	48	440 - 1 740		
Denmark	not mandatory				
Finland	90	48	800 - 1 710		
France		46 - 54	300 - 8 225		yes
Germany	not mandatory				yes
Greece	10	0 - 60			yes
Iceland	not mandatory				
Ireland	20	48	5 000	20 - 80	
Italy	10	44 - 52	720 - 1 880		yes
Luxembourg	not mandatory				
Malta					
Netherlands		48	1 130		yes
Norway	20	60	460 - 3 100		
Portugal	30	45 - 55	300 - 1 800	not applicable	yes
Spain					yes
Sweden	not mandatory				
Switzerland	not mandatory				yes
U. Kingdom	180				yes

6.4.3 (A) 1 For frequencies and cadences for dial tone, see section 5.2 and for congestion tone see section 9.5.4.

6.4.3 (B) 1 The requirement in sections 6.4.1 and/or 6.4.2 are also applicable to TE with network tone related control of loop condition: this section 6.4.3 is only additional to 6.4.1 and/or 6.4.2.

6.4.3 (F) 1 TEs which only use PSTN signals to revert to quiescent condition, shall detect the howler tone in sending condition as in receiving condition. However, it is authorised to detect the howler tone only during limited periods, provided the scrutiny cadence is at least every 20 s.

See the detection conditions in section A.6.4.3 (F) 1.

6.4.3 (D) 1 See also section 5.6.3.1.

6.4.3 (GR) 1 If the detectors of the relevant tones are present, then conformance of the TE with the requirements of this section is mandatory.

$\Delta f = 0 - 60$ V dc $I_f = 20 - 80$ mA.

6.4.3 (I) 1 The following requirement is mandatory only for answering machine: the answering machines in loop condition shall revert in the quiescent condition

within 10 s upon the reception of any sinusoidal signal with the frequency over the range 400 - 500 Hz, level over the range -6 up to -25 dBm and duration longer than 100 ms.

6.4.3 (NL) 1 The requirements for detection of the different tones are specified in the following sections:

- dial tone: 5.2
- busy tone: 9.5.3
- congestion tone: 9.5.4

6.4.3 (NL) 2 For automatic calling and/or answering TEs, automatic control of loop condition on the basis of network tone control is mandatory, except for TE with a time out according to section 6.4.1 or with control of loop condition on the basis of control by CCITT defined carrier waves.

6.4.3 (P) 1 The facility of network tone detection and the facility to terminate the loop condition upon the detection of network tones, as specified, are mandatory to all TE with information-related control of loop condition except for TE using the backward channel according to CCITT Recommendations V.23, V.26 bis or V.27 ter.

6.4.3 (E) 1 The requirements in sections 10.6 (E) 4 to 10.6 (E) 6 shall be applied. Particular reference is made to section 10.6 (E) 6, and more specifically to section 10.6 (E) 6.6.

6.4.3 (CH) 1 When a line is prematurely released by a caller, the called party can obtain a congestion tone or, in the case of some older exchanges, a busy tone. At present, this criterion is available for over 90% of all subscriber connections and its implementation will be further extended. In the remaining percentage, dial tone or no tone criteria will be available.

These facilities are, however, not mandatory. If nevertheless used, see Chapter 9, section 9.5 (tone detection).

6.4.3 (GB) 1 Where the facility is provided, the TE shall revert to the quiescent state when tested according to A.6.4.3 (GB) 1.

NOTE: Where there is no conflict with conditions occurring during normal operation of an established call, it is recommended that clearing shall be initiated within 5 s of receipt of dial tone, congestion tone or number unobtainable tone, irrespective of when they appear.

A.6.4.3 TE with network related control of loop condition

The test circuit shown below shall be used.

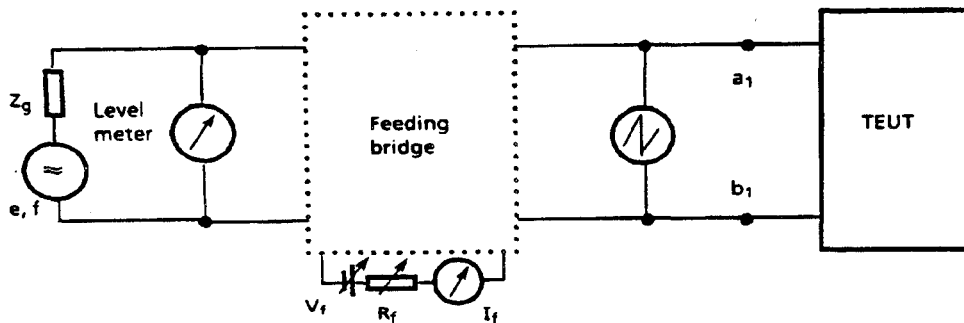


Figure A.6.4.3: TE with network tone related control of loop condition

Table A.6.4.3: TE with network tone related control of loop condition

COUNTRY	TEST VALUES					
	e_1 (V)	f_1 (Hz)	Z_g (Ω)	V_f (V)	R_f (Ω)	I_f (mA)
Austria			600	60		19, 60
Belgium	████	████	600	48	400, 1 600	████
Cyprus			600	48	800	
Denmark	not mandatory					
Finland			600	48	800, 1 710	
France						
Germany	not mandatory					
Greece	60					
Iceland	not mandatory					
Ireland			600	48	5 000	20, 80
Italy			600	44, 48, 52	1 880, 1 100, 720	
Luxembourg	not mandatory					
Malta						
Netherlands	80×10^{-3}	100 - 200	600	48	1 130	
Norway		425	600	60	3 100	
Portugal	not applic.	not applic.	600	48	300 - 1 800	
Spain						
Sweden	not mandatory					
Switzerland	not mandatory, if used, see Chapter 9					
U. Kingdom	not mandatory					

Table A.6.4.3 cont.: TE with network tone related control of loop condition

COUNTRY	TEST VALUES			Remarks
	e_2 (V)	f_2 (Hz)	t_{11} (s)	
Austria		380, 520		yes
Belgium	0,150	425, 450		yes
Cyprus		425	10	
Denmark		not mandatory		
Finland			90	
France				yes
Germany				
Greece				yes
Iceland		not mandatory		
Ireland				
Italy	0,040	400 - 500	10	yes
Luxembourg		not mandatory		
Malta				
Netherlands	80×10^{-3}	340 - 550		yes
Norway		425	20	yes
Portugal	55×10^{-3}	300 - 450	30	yes
Spain				yes
Sweden		not mandatory		
Switzerland		not mandatory, if used, see Chapter 9		
U. Kingdom				yes
NOTE:	e_1, f_1	ringing signal		
	e_2, f_2	network tone		

A.6.4.3 (A) 1 Application of dial tone: 850 ms (see section 5.2).

Application of congestion tone: 200 ms/200 ms cadenced (see section 9.5.4). Level -35 dBm.

A.6.4.3 (B) 1 Cadence for the signals:

dial tone: continue

busy tone: $t_{on} = 500 \text{ ms} / t_{off} = 500 \text{ ms}$

congestion tone: $t_{on} = 167 \text{ ms} / t_{off} = 167 \text{ ms}$.

A.6.4.3 (F) 1

1 The TEUT is set in receiving condition and the test is carried out figure A.6.4.3 (F) 1 with the following conditions:

a) Conditions of detection:

$V_f = 52 \text{ V}$

$R_f = 8\ 225 \ \Omega$

Table A.6.4.3 (F) 1.a

Cases	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)
I	440	-10	500	500	10
II	425	-25	500	500	10
III	455	-25	500	500	10
IV	440	-25	450	450	10
V	440	-25	550	550	10

t_d: sequence duration

b) Conditions of non-detection:

$$V_f = 54 \text{ V}$$

$$R_f = 300 \ \Omega$$

Table A.6.4.3 (F) 1.b

Cases	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)
I	250	-10	500	500	10
II	600	-10	500	500	10
III	440	-50	500	500	10
IV*	440	-10	500	500	3

* The cadenced signal is applied 5 times with intervals of 10 s.

t_d: cadenced signal duration.

- 2 Then the TEUT is set in sending condition. A howler tone signal frequency = 440 Hz, level -25 dBm, cadence t_{on}/t_{off} = 500 ms/500 ms, is applied for 30 s to the TE with the following dc conditions:

$$V_f = 52 \text{ V}$$

$$R_f = 8\ 225 \ \Omega$$

and it is checked whether the TE revert to quiescent condition.

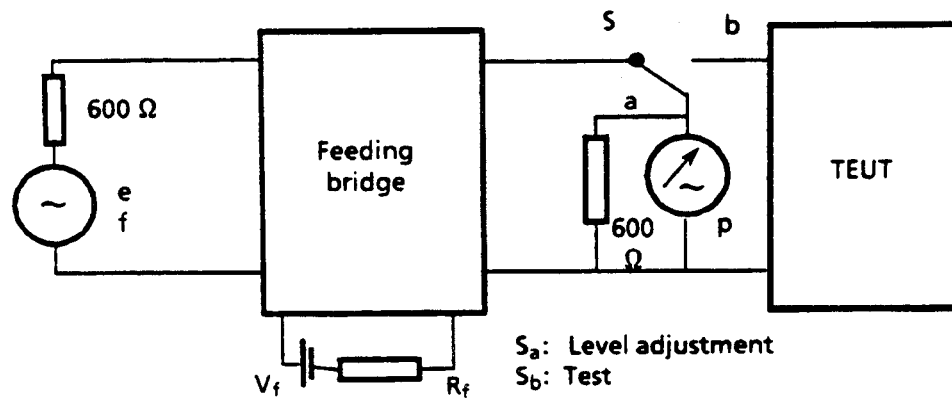


Figure A.6.4.3 (F) 1: Detection of howler tone

A.6.4.3 (GR) 1

$$I_f = 20, 35, 55 \text{ mA.}$$

For $Z_g = 0$, e_1 is adjusted to give across a_1, b_1 a voltage equal to $U = 25, 50, 75 \text{ V}_{\text{rms}}$ for frequencies $f_1 = 25, 50 \text{ Hz}$.

For $Z_g = 600 \Omega$, e_2 is adjusted to give across Z_g a voltage $U = 775 \text{ mV}$ at a frequency $f = 425 \text{ Hz}$.

t_{11} is just observed.

A.6.4.3 (I) 1 This test shall be carried out only for answering machines.

A.6.4.3 (I) 2 Continue application of following signals during loop condition:

busy tone
congestion tone.

The cadence can be found in sections 1.7.3 and 1.7.4.

A.6.4.3 (NL) 1 The test methods for detection of the different tones are specified in the following sections:

dial tone: A.5.2
busy tone: A.9.5.3
congestion tone: A.9.5.4.

A.6.4.3 (N) 1 e_1 and $e_2 = -10 \text{ dBm}$. The test signals have on/off (cadence) duration of 450/550 for busy tone and 180/220 for congestion tone.

A.6.4.3 (P) 1 Dial tone is a continuous signal.

A.6.4.3 (P) 2 Cadence for busy tone:

$t_{\text{on}}(\text{s}) = 0,5$
 $t_{\text{off}}(\text{s}) = 0,5$

A.6.4.3 (P) 3 Cadence for congestion tone:

$t_{\text{on}}(\text{s}) = 0,2$
 $t_{\text{off}}(\text{s}) = 0,2$

A.6.4.3 (E) 1 See the remark in section 6.4.3 (E) 1.

A.6.4.3 (GB) 1 The TE is connected to the test circuit shown in figure A.6.3.1 (GB) 1. The characteristics of the tones used for testing are given in table A.6.4.3 (GB) 1. Cadenced ringing voltage as specified in A.6.3.1 is applied to the TEUT until it assumes the loop condition. The conditions in table A.6.4.3 (GB) 1 are applied in turn, starting at a time between 9 s and 12 s from the time which the loop state is detected. The time to revert to the quiescent state is measured from the start of the application of the condition in the table.

Table A.6.4.3 (GB) 1: Characteristics of tones for test purposes

Tone	Frequency Hz ± 0,5%	Cadence ± 1%	Level dBm ± 0,5 dBm	Application time
Dial tone	350 plus 440	Continuous	-10 dBm (each tone separately 3 dB lower)	10 s followed by silence
Number unobtainable tone	400	Continuous	-10 dBm	20 s followed by silence
Congestion tone	400	0,4 s on 0,35 s off 0,225 s on 0,525 s off	-16 dBm -10 dBm	20 s followed by silence
Silence			< -52 dBm	As required

6.4.4 TE with control of the loop condition related to certain network dc conditions

TEs with the facility to detect certain network dc conditions and the facility to terminate the loop condition upon detection of these conditions shall revert to the quiescent condition upon the detection of the conditions specified in table 6.4.4.

These facilities may be mandatory.

The TE shall revert to the quiescent condition within a period of $t_{12}(s)$ after application of the relevant signal.

The requirement shall be met for various dc excitations (V_f , R_f , I_f).

Compliance shall be checked using the tests outlined in section A.6.4.4.

Table 6.4.4: TE with control of the loop condition related to certain network dc conditions

COUNTRY	REQUIREMENT VALUES						Remarks
	Condition 1	Condition 2	t_{12} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	loop disconnect	200 ms	60		19 - 60		yes
Belgium	R_f increased by at least 600 Ω	not mandatory	5	48		$20 - I_{max}$	yes
Cyprus		not mandatory					
Denmark		not mandatory					
Finland		not mandatory					
France	polarity inversion		1	46 - 54	300 - 8 225		yes
Germany		not mandatory					
Greece	not mandatory	not mandatory					
Iceland		not mandatory					
Ireland		not mandatory					
Italy		not mandatory					
Luxembourg		not mandatory					
Malta							
Netherlands	not mandatory	not mandatory					
Norway		not mandatory					
Portugal	not mandatory						
Spain							yes
Sweden		not mandatory					
Switzerland		not mandatory					yes
U. Kingdom		not mandatory					yes

6.4.4 (A) 1 This requirement is mandatory for all TEs with speech or other non-data signal related control of the loop condition.

6.4.4 (A) 2 This requirement shall be met by TE with answering function with a time related loop disconnect greater than 1 minute.

6.4.4 (A) 3 This requirement is optional and only applicable for TEs complying with the requirements in section 6.4.1.

6.4.4 (F) 1 TE may detect the polarity inversion produced by some public exchanges of the PSTN when the distant party reverts to quiescent condition in order to terminate itself the loop condition. But this facility shall be accompanied by at least one of the other facilities described in sections 6.4.1, 6.4.2.1, 6.4.2.2, 6.4.2.3, and 6.4.3.

If this facility is implemented in the TE, the following requirements shall be met:

- Any polarity inversion produced at least 2 s after establishment of the loop condition shall cause the return to quiescent condition. In order to avoid a false detection during the ringing stop period, it is recommended to "read" the polarity of origin in a period comprised between 1,5 and 2 s after the seizure of the line. However, if the seizure of the line can occur only between ringing pulses, this

polarity reading period can be comprised between 0,2 and 2 s after the seizure of the line.

- Each polarity state shall be confirmed during at least 200 ms before to be taken into account.
- The polarity inversion detector shall not be disturbed by any feeding interruption of at most 200 ms (see 10.2 (F) 1).

Compliance shall be checked using the test outlined in section A.6.4.4 (F) 1.

6.4.4 (E) 1 The requirements in sections 10.6 (E) 4 to 10. (E) 6 shall be applied. Particular reference is made to section 10.6 (E) 6, and more specifically to section 10.6 (E) 6.7.

6.4.4 (CH) 1 When a line is prematurely released by the caller, the loop current of the called party is interrupted for 120 ± 20 ms (an interruption ≥ 90 ms must be reliably recognised). Interruptions of up to 50 ms may occur, but these must on no account be recognised. The use of this criterion is not mandatory, as it is not available at all exchanges. The present availability and future extension of this criterion will be investigated and taken into account before the enforcement of NET 4.

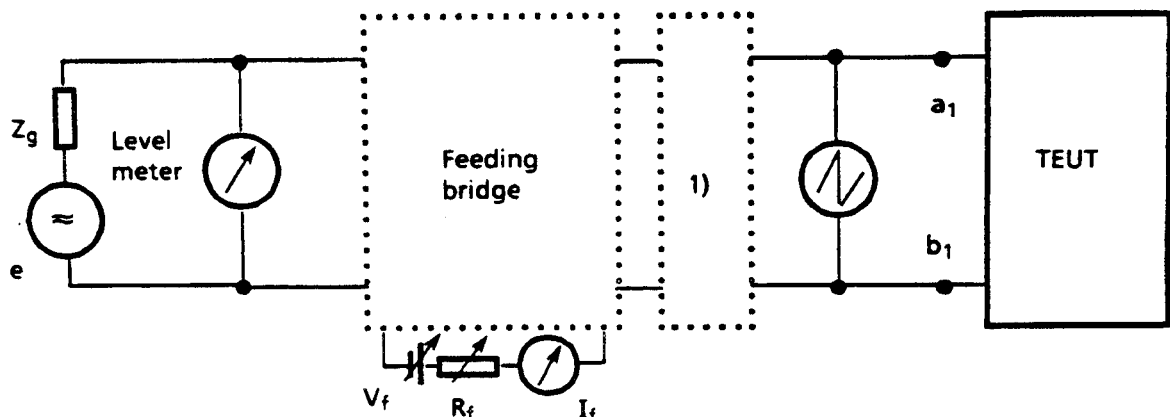
6.4.4 (GB) 1

NOTE 1: An "end of call" signal, sometimes known as the "K-break" signal, is a design feature of all but the earliest modern (digital) local exchanges and offers a positive way for automatic answering TE to determine when a calling TE has resumed the quiescent state. This signal consists of momentary disconnection or significant reduction in the loop current (to below 1 mA) lasting from between 90 and 130 ms. On older electromechanical exchanges this signal is sometimes available but it varies considerably in its timing and thus cannot always be reliably detected.

NOTE 2: On certain systems, for the first few seconds after a call is answered, there are line transients which can simulate an "end of call" signal, and it is advisable for TE not to seek an "end of call" signal until these disturbances have subsided.

A.6.4.4 TE with control of loop condition related to certain network conditions

The test circuit shown below shall be used.



1) Simulation of dc network signals.

Figure A.6.4.4: TE with control of loop condition related to certain network dc conditions

Table A.6.4.4: TE with control of loop condition related to certain network dc conditions

COUNTRY	TEST VALUES							Remarks
	e_1 (V)	Z_g (Ω)	V_f (V)	R_f (Ω)	I_f (mA)	Condition 1	Condition 2	
Austria			60		19, 60	loop disconnect		yes
Belgium	█	█	48	400, 1 600	█	see remark	█	yes
Cyprus						not mandatory		
Denmark						not mandatory		
Finland								
France	0	600	46	8 225		polarity inversion		yes
Germany						not mandatory		
Greece						not mandatory		
Iceland						not mandatory		
Ireland						not mandatory		
Italy						not mandatory		
Luxembourg						not mandatory		
Malta								
Netherlands						not mandatory		
Norway						not mandatory		
Portugal						not mandatory		
Spain								yes
Sweden						not mandatory		
Switzerland						not mandatory		yes
U. Kingdom						not mandatory		

A.6.4.4 (A) 1 Test values for loop current detector see section A.9.4.2.

A.6.4.4 (B) 1 The dc condition which can be tested for reverting the TE to the quiescent condition is the increase of the resistance R_f by 700 ohms.

A.6.4.4 (F) 1 The circuit used to simulate the polarity inversion (represented by box 1 in figure A.6.4.4) is the following:

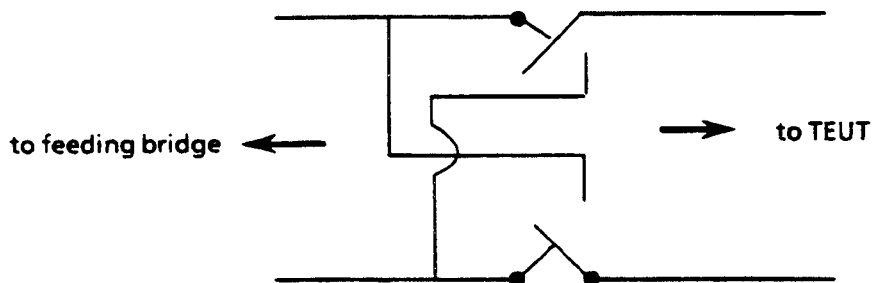


Figure A.6.4.4 (F) 1

A.6.4.4 (E) 1 See the remark in section 6.4.4 (E) 1.

A.6.4.4 (CH) 1

Test specification if criterion is used:

A line current reduction to 5 mA during 90 ms shall be recognised and the TE under consideration shall revert to the quiescent condition no longer than 4 s after the current reduction. A line current reduction to 5 mA during 50 ms shall not be recognised.

Feeding test values (V_f - R_f pairs)

Table A.6.4.4 (CH) 1

V_f (V)	43	48	57
R_f (Ω)	2 200	1 200	600

Test arrangement:

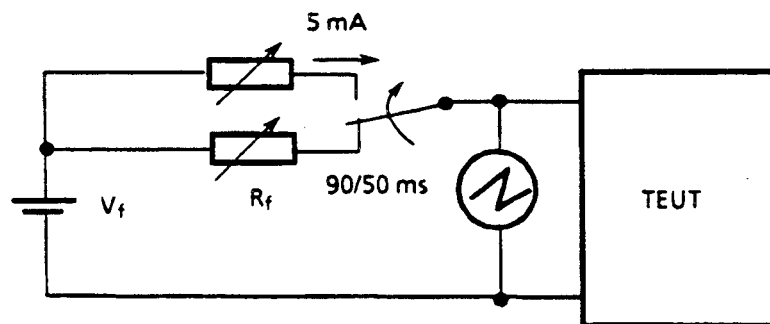
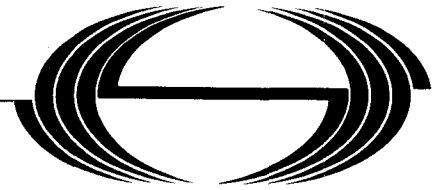


Figure A.6.4.4 (CH) 1

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General technical requirements for equipment connected to
an analogue subscriber interface in the PSTN****Chapter 7: Power failure**

(Candidate NET 4)

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Foreword

Chapter 7 of this European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI). The text of this ETS may be utilized, wholly or in part, for the establishment of NET 4.

For historical purposes, this ETS was drafted in the form of a NET. However, until a final decision to adopt this ETS as NET 4 has been agreed by the Technical Recommendations Application Committee (TRAC), the terms NET or NET 4 in this document should be read as ETS or ETS 300 001 respectively.

This ETS comprises ten chapters:

"Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

- Chapter 1 - General
- Chapter 2 - DC characteristics
- Chapter 3 - Ringing signal characteristics
- Chapter 4 - Transmission characteristics
- Chapter 5 - Calling functions
- Chapter 6 - Answering function
- Chapter 7 - Power failure**
- Chapter 8 - Connection methods
- Chapter 9 - Special functions
- Chapter 10 - Additional unclassified requirements

Refer to Chapter 1 (General) of this ETS for information on the structure and details of how to use this ETS. The national designations, used to identify national variations to requirements and tests within this ETS, are given in section 1.9 of Chapter 1 (page 60).

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7 Power failure

The requirements of this chapter refer to a TE whose functions covered by this document depend upon power derived from sources other than the PSTN to which it is attached.

7.1 Power failure with TE in the quiescent condition.

TE which, whilst in a quiescent condition, has its power source interrupted, shall not subsequently be able to initiate any function or sequence of functions which cannot be completed with its power source interrupted. Subsequent re-application of the power source to the TE shall not of itself cause the TE to change from the quiescent condition to any other condition.

NOTE: It is permitted for the TE to execute an intended reaction to the restoration of power (e.g. for a TE intentionally to make an automatic call for the purposes of indicating to a remote party that it is back in service).

Compliance shall be checked using the tests outlined in section A.7.1.

Table 7.1: Power failure with TE in the quiescent condition

COUNTRY	REQUIREMENT VALUES		Remarks
	Mandatory		
Austria	yes		yes
Belgium	yes		
Cyprus	yes		yes
Denmark	yes		
Finland	yes		
France	yes		yes
Germany	no		
Greece	yes		yes
Iceland	yes		yes
Ireland	yes		
Italy	yes		yes
Luxembourg	yes		
Malta			
Netherlands	no		
Norway	yes		
Portugal	yes		
Spain	yes		yes
Sweden	yes		yes
Switzerland	yes		yes
U. Kingdom	yes		yes

7.1 (A) 1

The requirements of this chapter are applicable for TEs which are powered by an external power source or battery, which is re-chargeable or chargeable by the user. If the TE is additionally powered by a buffer battery the requirements shall be fulfilled without the external power source and buffer battery.

- 7.1 (A) 2 The TE shall work regularly in a voltage range specified by the supplier for the power source. If the voltage goes below the minimum voltage of the specified voltage range, the requirements for power failure are relevant.
- 7.1 (A) 3 Values of requirements shall be maintained.
- 7.1 (A) 4 Stored call numbers shall either remain or be cleared.
- 7.1 (A) 5 With telephone sets (or TE with included telephone functions) the basic telephone functions, e.g. ringing, dialling and speech transmission, shall always be possible (not required for cordless telephones).
- 7.1 (A) 6 With series-connected TE (e.g. answering machines) the lines "a" and "b" through the TE shall not be interrupted.
- 7.1 (A) 7 With PABX, one line from the PSTN board shall be connected to a line terminated by a telephone set.
- 7.1 (CY) 1 Stored dial-up numbers shall remain unaltered or otherwise be cleared.
- 7.1 (CY) 2 For all TE which includes basic telephone functions and are powered by sources other than the PSTN line, shall maintain these functions irrespectively of the provision of local power supply.
- 7.1 (CY) 3 Restoration of the power provision to the TE, shall not cause the TE to revert to any state other than the quiescent condition.
- 7.1 (CY) 4 Defined numbers of call attempts, periodicity of call attempts and dialling parameters shall remain in accordance with section 5.6 after restoration of the power source, otherwise the automatic calling function shall remain de-activated.
- 7.1 (F) 1 Simple telephone set which does not carry out correctly the basic functions, (ringing, line seizure) in case of power failure, is authorised to be connected to the PSTN only as additional TE with a principal telephone set.*
- * Principal telephone set is a telephone set which carries out all basic functions (line seizure and disconnection, dialling, speech communication, ringing) without external power.
- 7.1 (F) 2 TE with automatic answering function shall work correctly when the mains power (220 V, 50 Hz) fails no longer than 50 ms with an occurrence of 1 minute minimum.
- 7.1 (F) 3 For TE with fully automatic calling functions, the call process parameters (limited call attempt number, time period between call attempts,) shall be in accordance with section 5.6, after re-application of the power source following a failure, or else de-activates the automatic calling function.
- For TE with automatic answering functions, the answering parameters, (answer time limit,....) shall be in accordance with section 6.3 after re-application of the power source following a failure, or else de-activates the automatic answering function.
- 7.1 (GR) 1 In case that the voltage of the external power source falls below 15% of the nominal value and remains there for more than 10 ms, this is taken also as an interruption.

- 7.1 (GR) 2** In case of power failure, TE shall not impair the use of other TEs connected to the same line.
- 7.1 (GR) 3** For all TE incorporating the functions of a telephone set and which are powered by sources other than the PSTN line, in case of power failure the functions of dialling, ringing and speech communication shall remain operable.
- 7.1 (IS) 1** In the event of disconnection or failure of an external power supply, the TE must not affect any other TE connected to the same line.
- 7.1 (I) 1** In case of power failure, the basic functions of a telephone shall still be operable (e.g. normal dialling). For digital PABXs this is mandatory only for emergency lines.
- 7.1 (E) 1**
- PROVISION 1:** The provisions 2 to 5 shall be applied to all sections and Spanish sections (E) in this Chapter 7.
- PROVISION 2:** The meaning given in this Chapter 7 for the term "power source interrupted" is assimilated to "power failure" in general, that is to say that at least one (or several) of the power sources other than the network has been disappeared or are out of their guaranteed limits.
- PROVISION 3:** It should be noted that the real mains rms voltage may be between +10% and -15% of its nominal values (125 V rms or 220 V rms.) and the real mains frequency may be within ± 1 Hz of its nominal value (50 Hz). Reference is made to sections 1.5 (E) 2 and 1.5 (E) 3 relating to test power sources.
- PROVISION 4:** The meaning given in this Chapter 7 for the term "improper action over the line" is:
- a) an action related with the inter-working (network-terminal) functions that the TE does automatically over the line which is not in accordance with the contents of the user's manual;
 - or
 - b) a blocking state, without any control by the TE in a condition other than quiescent condition.
- PROVISION 5:** For series TE the possible disconnection of the associated TE from the line shall never be made because of a blocking state without any control of the TE.
- The initiation that is not permitted is understood as automatic initiation.
- Compliance shall be checked using the tests outlined in section A.7.1 (E) 1.
- 7.1 (S) 1** In the event of a power failure, the telephone answering machine must not obstruct traffic to or from the telephone set that is connected to the same line. It shall assume an idle state (quiescent condition) within a maximum of 30 s after the power fails, or, alternatively, within a maximum of 90 s after the start of the announcement. When power is restored, the telephone answering machine should automatically start and return to the start of the announcement) tape without assuming the loop state (condition).
- 7.1 (CH) 1** All the TE requirements must be wholly satisfied and proper operation must be guaranteed for external power supplies having the following tolerances:

- external power supply voltage: 198 ... 253 V
- battery operation: 15% below the nominal voltage

Uncontrolled procedures which could interfere with proper operation of the PSTN and other TE must not be triggered during and after short or longer periods where the power supply conditions stated above are not satisfied (voltage breaks up to 100%). In particular, it is a requisite that no unintentional seizure, dialling or blocking occurs and that equipment connected in series must connect through the line if their proper functioning is no longer assured. After the problem is removed, the TE must return automatically to an error-free state, meaningful to the user. (Memory retention for subordinate functions, such as dialling registers, is not mandatory).

Because it is very important that telephone sets can be used in emergencies, at least the basic functions such as calling, line seizure and release, dialling and speech transmission must be satisfied, in addition to the conditions stated above. Additionally these basic functions may be met for the time being by a suitable separate telephone set. The users must be instructed appropriately how to operate their equipment under such conditions.

7.1 (GB) 1

For the purposes of this chapter, power derived from internal batteries is considered to be equivalent to power derived from the PSTN.

In the event of disconnection or failure of an external power supply, the TE shall comply with the quiescent conditions defined in Chapters 2 and 4 and shall continue to meet the REN as determined in accordance with remarks 3.1 (GB) 1 to 4.

A.7 Power failure

A.7.1 Power failure with TE in quiescent condition

Tests shall be effected by electrical and operational inspection according to accepted engineering practice.

Table A.7.1: Power failure with the TE in quiescent condition

COUNTRY	TEST VALUES	Remarks
	Mandatory	
Austria	yes	
Belgium	yes	
Cyprus	yes	
Denmark		
Finland	yes	
France		
Germany		
Greece	yes	
Iceland		
Ireland	yes	
Italy	yes	
Luxembourg	yes	
Malta		
Netherlands		
Norway	yes	
Portugal	yes	
Spain		yes
Sweden		
Switzerland	yes	yes
U. Kingdom	yes	

A.7.1 (E) 1

The test procedure to follow is to check by inspection and according with the user's manual and other technical documentation, which type of power sources are understood to be used for the TEUT, and what limits can be supposed as guaranteed for that power sources.

The procedure of tests in Chapters 5 and 6, and in other relevant tests, are used when the associated requirements in sections 7.1 and 7.1 (E) 1 is checked by inspection, while at least one power source is switched off.

The test procedure is repeated with the power source switched on, but when it is forced to be out of its guaranteed limits.

The tests are undertaken for every one of the power sources.

A.7.1 (CH) 1 It must be tested that the requirements in 7.1 and 7.1 (CH) 1 are satisfied for interruptions of the external power supply lasting 30, 100, 300, and 1 000 ms as well as 30 s.

Test values for feeding conditions: $V_f = 48 \text{ V}$, $R_f = 1\,200 \Omega$.

7.2 Power failure with TE in conditions other than the quiescent condition.

TE which, whilst in any condition other than quiescent condition, has its power source interrupted such that it is unable to continue normally the function in progress, shall revert to the quiescent condition no later than "t" seconds after the power source interruption occurs. Subsequent re-application of the power source to the TE shall not of itself cause the TE to change from the quiescent condition to any other condition.

NOTE: It is permitted for the TE to execute an intended reaction to the restoration of power (e.g. for a TE intentionally to make an automatic call for the purposes of indicating to a remote party that it is back in service.)

Compliance shall be checked using the tests outlined in section A.7.2.

Table 7.2: Power failure with TE in conditions other than the quiescent condition.

COUNTRY	TEST VALUES		Remarks
	Mandatory	t (s)	
Austria	yes	1	yes
Belgium	yes	15	
Cyprus	yes	10	yes
Denmark	yes	1	
Finland	yes	not specified	
France	yes	1	yes
Germany	no		
Greece	yes	3	yes
Iceland	yes		
Ireland	yes		
Italy	yes	1	yes
Luxembourg	yes	10	
Malta			
Netherlands	no		
Norway	yes	5	yes
Portugal	yes	1	
Spain		3	yes
Sweden	yes	10	yes
Switzerland	yes	10	yes
U. Kingdom	yes		yes

- 7.2 (A) 1 The requirements of this chapter are applicable for TEs which are powered by an external power source or battery, which is re-chargeable or chargeable by the user. If the TE is additionally powered by a buffer battery the requirements shall be fulfilled without the external power source and buffer battery.
- 7.2 (A) 2 The TE shall work regularly in a voltage range specified by the supplier for the power source. If the voltage goes below the minimum voltage of the specified voltage range, the requirements for power failure are relevant.
- 7.2 (A) 3 Values of requirements shall be maintained.
- 7.2 (A) 4 Stored call numbers shall either remain or be cleared.
- 7.2 (A) 5 With telephone sets (or TE with included telephone functions) the basic telephone functions, e.g. ringing, dialling and speech transmission, shall always be possible (not required for cordless telephones).
- If power failure occurs, a change from the loop condition to the quiescent condition is allowed.
- 7.2 (A) 6 With series-connected TE (e.g. answering machines) the lines "a" and "b" through the TE shall not be interrupted.
- 7.2 (A) 7 With PABX, one line from the PSTN board shall be connected to a line terminated by a telephone set.
- 7.2 (CY) 1 TE reverting to the quiescent condition after power failure must comply with the conditions stated in section 7.1.
- 7.2 (F) 1 Simple telephone set, which does not carry out correctly the basic functions, (dialling, speech communication) in case of power failure, is authorised to be connected to the PSTN only as additional TE with a principal telephone set.
- 7.2 (F) 2 TE with automatic answering function shall work correctly when the mains power (220 V, 50 Hz) fails no longer than 50 ms each minute.
- In addition, this TE shall maintain its answering parameters, (answer time limit,...) in accordance with section 6.3, after re-application of the power source following a failure, or else de-activates the automatic answering function.
- 7.2 (F) 3 TE with fully automatic calling functions, the call process parameters (limited call attempt number, time period between call attempts,) shall be in accordance with section 5.6, after re-application of the power source following a failure, or else de-activates the automatic calling function.
- 7.2 (GR) 1 In case that the voltage of the external power source falls below 15% of the nominal value and remains there for more than 10 ms, this is taken also as an interruption.
- 7.2 (GR) 2 In case of power failure, TE shall not impair the use of other TEs connected to the same line.
- 7.2 (GR) 3 For all TE incorporating the functions of a telephone set and which are powered by sources other than the PSTN line, in case of power failure the functions of dialling, ringing and speech communication shall remain operable.

7.2 (I) 1 In case of power failure, the basic functions of a telephone shall still be operable (e.g. normal dialling). For digital PABXs this is mandatory only for emergency lines.

2 (N) 1 Series-connected equipment and equipment with switching function shall have at least one emergency connection between the public network and the local line in case of power failure.

7.2 (E) 1 The TE shall neither do any improper action over the line after a power failure, nor after all power sources other than the network are restored within their guaranteed limits.

Compliance shall be checked by tests outlined in section 7.2 (E) 1.

7.2 (S) 1 In the event of a power failure, the telephone answering machine must not obstruct traffic to or from the telephone set that is connected to the same line. It shall assume an idle state (quiescent condition) within a maximum of 30 s after the power fails, or, alternatively, within a maximum of 90 s after the start of the announcement. When power is restored, the telephone answering machine should automatically start and return to the start of the (announcement) tape without assuming the loop state (condition).

7.2 (CH) 1 The remarks stated under 7.1 (CH) 1 apply.

7.2 (GB) 1 For the purposes of this chapter, power derived from internal batteries is considered to be equivalent to power derived from the PSTN.

In the event of disconnection or failure of an external power supply, the TE shall comply with the quiescent conditions defined in Chapters 2 and 4 and shall continue to meet the REN as determined in accordance with remarks 3.1 (GB) 1 to 4.

In addition, TE with live speech telephony facilities capable of accessing the UK emergency service shall continue to meet the on-line requirements of Chapters 2 and 4 for at least 1 hour during the 7 hour period after the external power source is disconnected.

A.7.2 Power failure with the TE in conditions other than the quiescent condition

Tests shall be effected by electrical and operational inspection according to accepted engineering practice.

A.7.2 (N) 1 The emergency connection shall be checked by inspection.

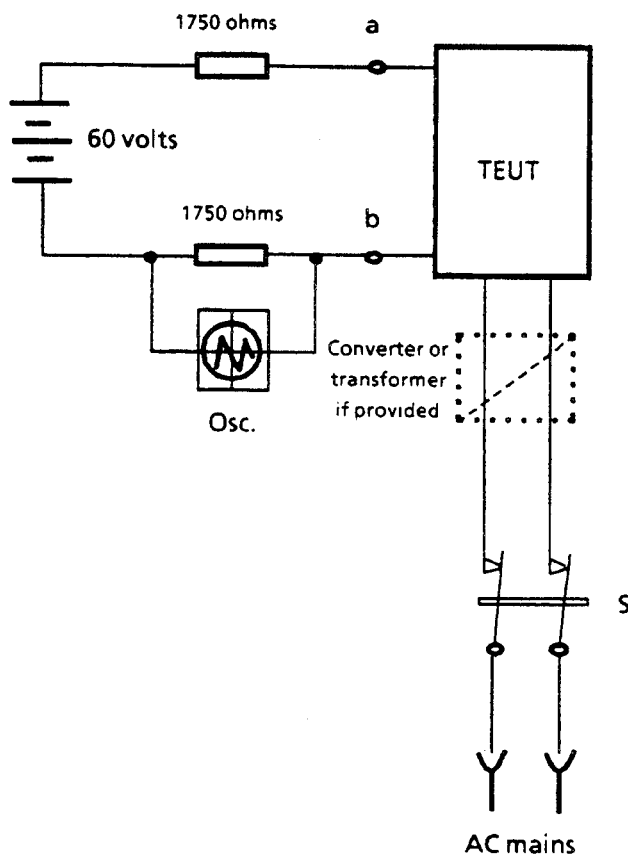


Figure A.7.2 (N) 1

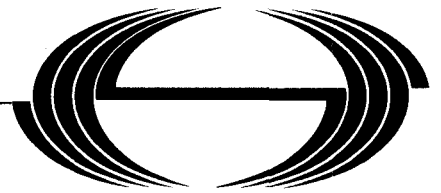
A.7.2 (E) 1

The procedure of test in A.7 (E) 1 is followed.

A.7.2 (CH) 1

The remarks stated in A.7.1 (CH) 1 apply.

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**Attachments to Public Switched Telephone Network (PSTN);
General technical requirements for equipment connected to
an analogue subscriber interface in the PSTN****Chapter 8: Connection methods**

(Candidate NET 4)

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8 Connection methods

Introduction to Chapter 8

This chapter sets out the mechanical and electrical methods used for connection of TE to the standard analogue PSTN interface.

It is grouped in three sections. The first section, 8.1, describes the network termination point or points of the PSTN and is for information. Sections 8.2 and 8.3 describe the connection methods, in detail, for signal terminal connections and multiple terminal connections, according to the type of TE.

Sections 8.2 and 8.3 contain information describing the mandatory method of connection of TE to the network, unless otherwise stated.

Where applicable, compliance shall be checked according to the tests outlined in the appropriate sections of this paragraph or according to the referenced National Standards or by inspection.

As the connection methods are different in each country, there is no common text for the different sections. Therefore, the numbering in the sections follows the system used for remark numbering throughout this document.

8.1 Network termination point for the PSTN

8.1 (A) 1

In Austria, the basic network termination is a special threefold socket, which includes three sockets connected in series and a tone ringer for the last socket. Each socket has 10 poles. When a plug of a telephone set is inserted into the telephone socket from the threefold socket, the tone ringer is disconnected from the line.

The subscriber's installation (sockets, permanently connected TEs such as ringers) is the monopoly of the PTT. The number of sockets is not limited. The last socket is always terminated by a (tone) ringer.

If more TEs are connected on one line in quiescent condition the ringer circuits of the TE are connected in parallel. A parallel connection of TE in loop condition is not allowed.

One telephone set and permanently connected TEs provided only by PTT. A private telephone set may be used on the telephone line instead of the PTT telephone set.

8.1 (B) 1

In Belgium, the basic termination is a four pole socket (shown in figure 8.1 (B) 1), provided and installed by the RTT-BELGACOM at the subscriber's premises. This socket also contains an electrical load (RC Network) which terminates the PSTN line (a and b wires). When the plug is inserted into the socket, the RC network is automatically disconnected from the line.

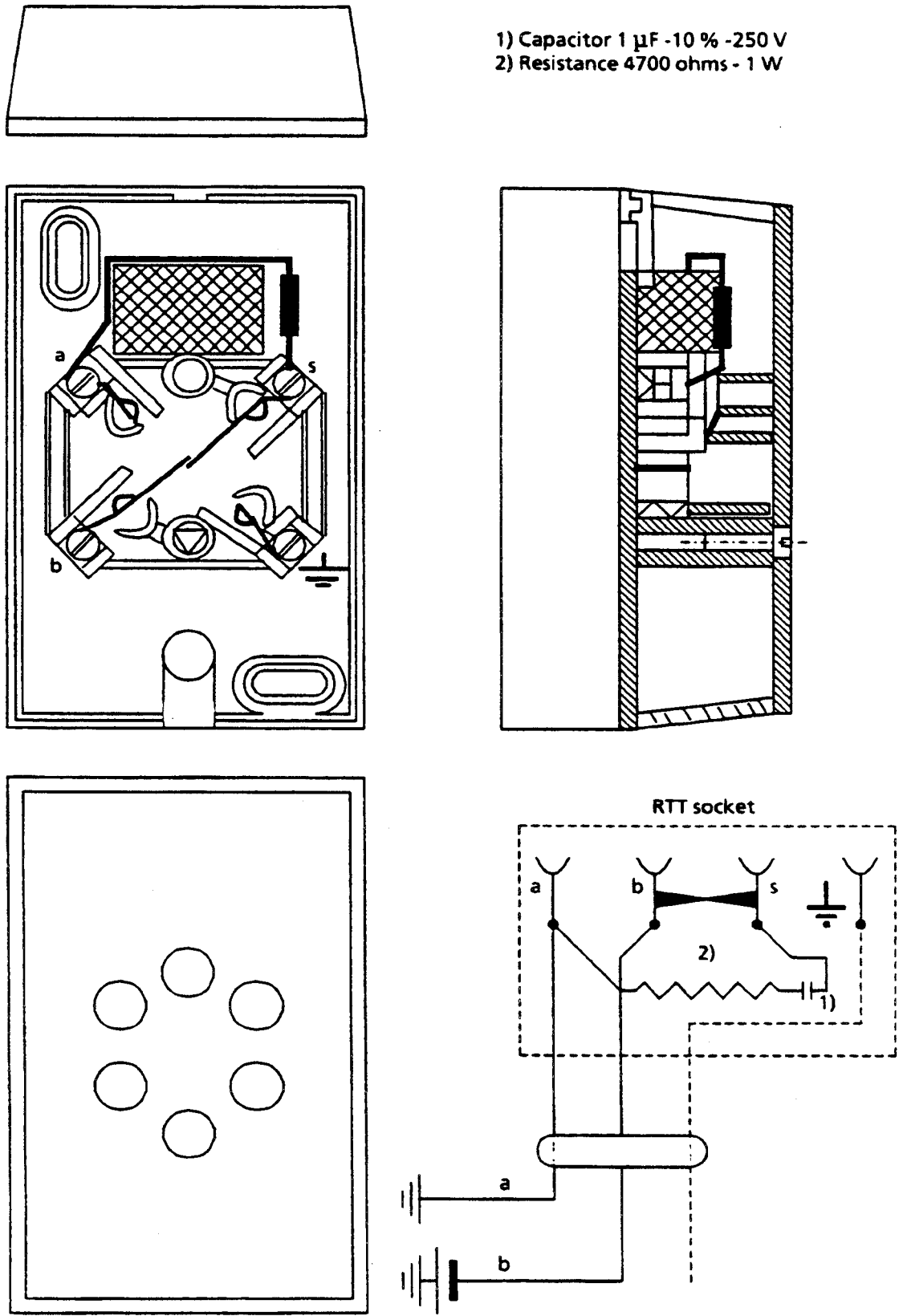


Figure 8.1 (B) 1: Belgian standard socket

8.1 (CY) 1

In Cyprus, the network termination is done by a "Primary Socket", which includes a RC-network and a voltage protection device. Other sockets (secondary sockets) can be installed in addition.

- 8.1 (DK) 1** Information not available at the moment.
- 8.1 (SF) 1** In Finland the basic telephone network termination is a nationally standardised three pole socket at the subscriber's premises. Also, a six-pole mini-connector is used, but the use is very limited. All the equipment that are meant to be connected to the PSTN have to be provided with a plug that fits the socket.
- The network provider supplies the network to the distribution frame in the building. The internal cabling, including sockets, can be installed by an authorised company.
- 8.1 (F) 1** In France, the basic network termination point is the first cut off point located at the subscriber's premises. This point is mainly materialised by a nationally standardised 8-pole socket which contains a RC network ($R = 20$ kohms, $C = 2,2 \mu F$) between the PSTN wires for testing the line. Also, a 6 pole socket and a 12 or 24 pole connecting strip are used, but only in old subscriber's installation in the first case and for some types of TE in the second case (e.g. meter pulse detector). The first socket (or connecting strip) is provided and installed by the Public Telecommunications Operator or by any authorised company. Other sockets may be wired in parallel by the subscriber himself. The number of ringer circuits is limited up to 3 for each subscriber's line.
- 8.1 (D) 1** In Germany, the basic network termination is a 6 pole socket, provided and installed by the Deutsche Bundespost (DBP) at the subscriber's premises. Only the first socket is provided by the DBP. Subscriber's may add additional sockets and installations. Direct parallel connecting is not allowed, this is done using manual or automatic switches (When TEs are in quiescent condition the ringer circuits are connected in parallel. Transmission circuits are individual switched, as required). The maximum number of ringer circuits is 4. The first socket has a terminating circuit ($R = 480$ kohms, diode) in it. When a plug is inserted into the socket the hard wired circuit behind this socket (a_2, b_2) is disconnected.
- The plugs and sockets are coded. For telephones, multi-service TEs with integrated telephones and integrated Group B equipment, the coding F as described in section 8.2 (D) 1 is used. For all other TEs, coding N described in section 8.3 (D) 1 applies.
- For TEs using more than six wires, a 16-pole connector described in section 8.3 (D) 2 is used.
- Depending on the type of the plug, the connection is either locked or arrested. Normally it is arrested.
- 8.1 (GR) 1** At the moment, the official physical connection method of the first telephone set is exclusively by a fixed way, namely by a small plastic termination box (rosette). All other connection points, are allowed to consist of a plug and socket system, the type of which is not yet specified.
- 8.1 (IS) 1** The PSTN is provided by the P & T at a main distribution frame and in the case of multi-subscriber premises to a distribution box to which each individual subscriber is connected. All terminal cabling, including sockets, for each individual subscriber may be installed by an authorised person. All plans for internal cabling must be approved by the P & T or its representative.

In Iceland the telephone network termination is a standard four pole socket. An eight pole socket is under study. Multiple PSTN networks (e.g. PABX) are normally terminated using cross connection blocks.

8.1 (IRL) 1

In Ireland, Telecom Eireann has the exclusive privilege of offering, providing and maintaining telecommunications services for transmitting, receiving, collecting and delivering of telecommunications messages within the State, up to (and including) a connection point in the subscriber's premises for any such service.

A PSTN signal line entering the subscriber's premises must be terminated on an appropriate Block Terminal. The Block Terminal is then connected to a Jack Modular 1M/1 by 4 (or 6) wire / 0,5 mm cable. The Jack Modular incorporates a Western Electric Modular Socket.

8.1 (I) 1

All PSTN line terminations for the ordinary telephone service consist of two kinds of socket. The first one is described in figures 8.1 (I) 1.1 to 1.5.

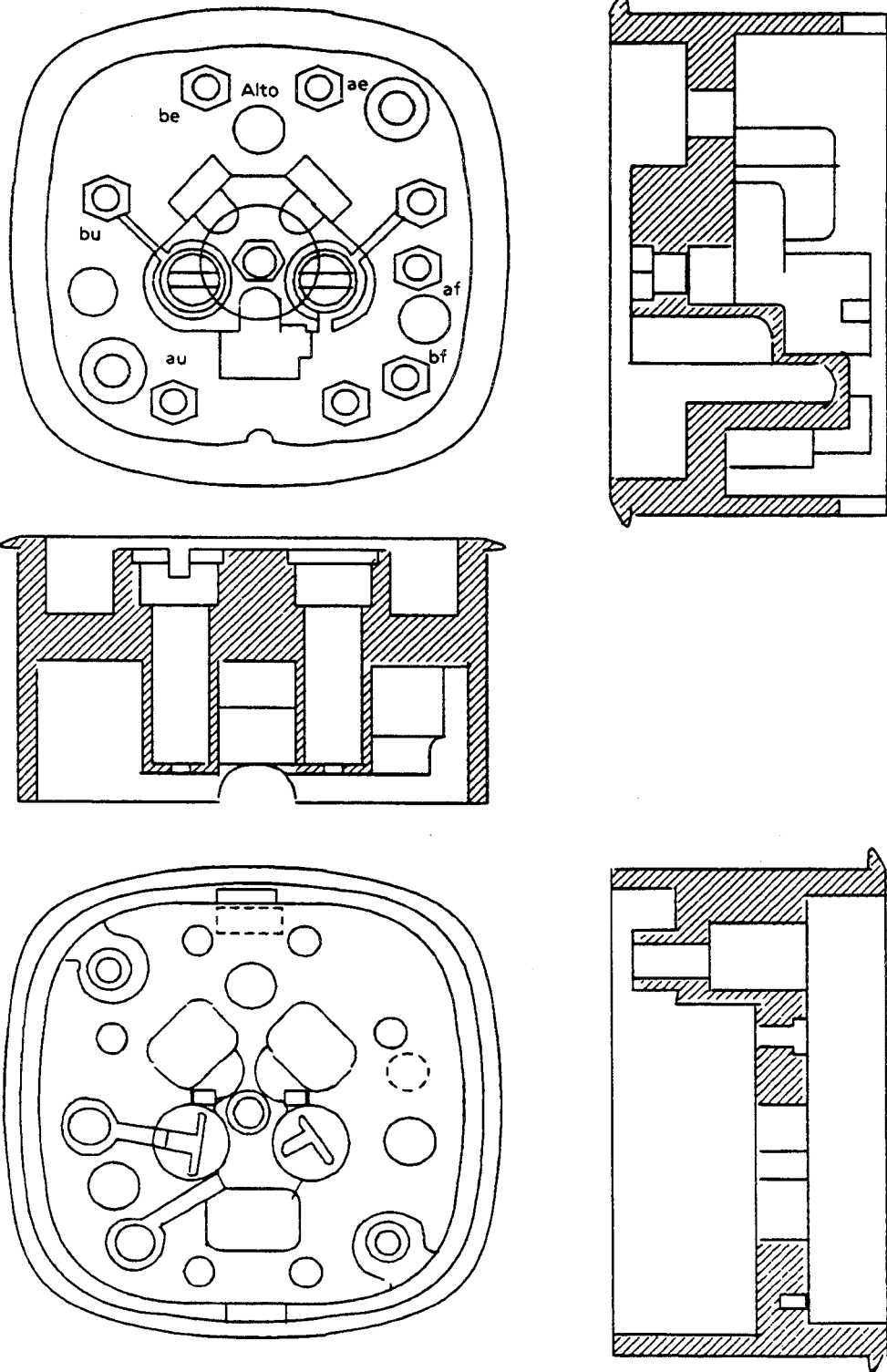


Figure 8.1 (I) 1.1

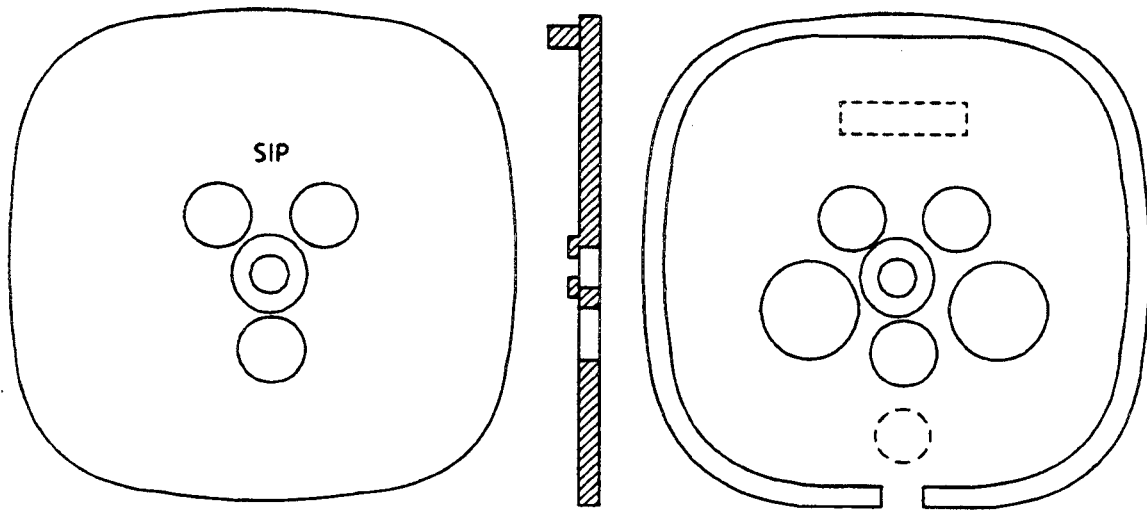


Figure 8.1 (I) 1.2

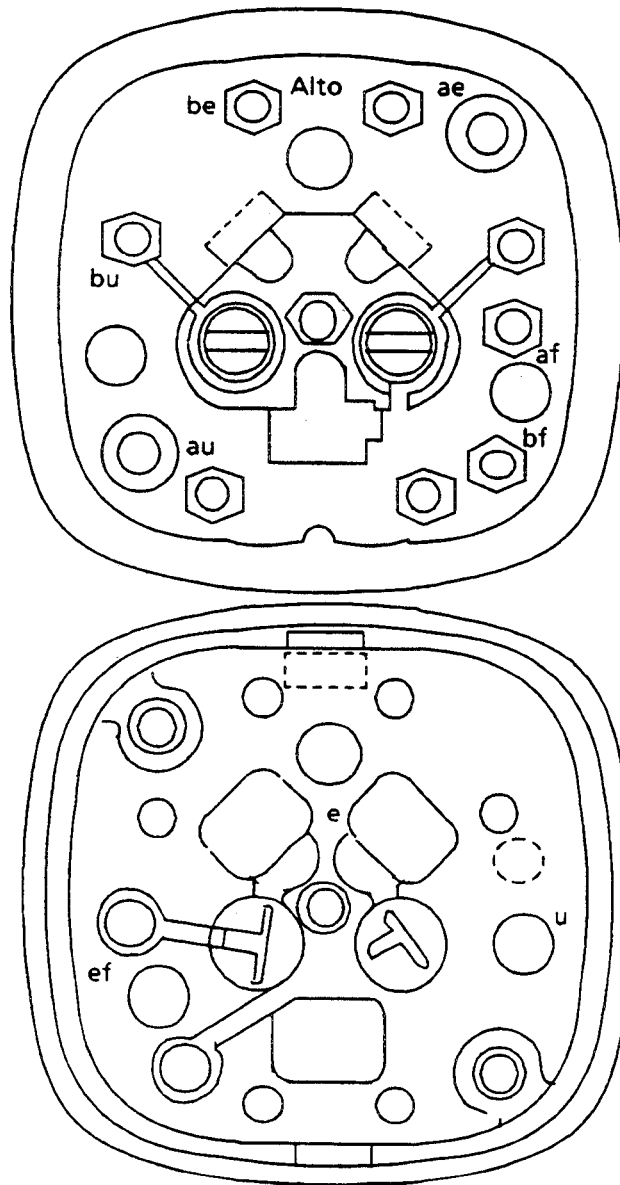
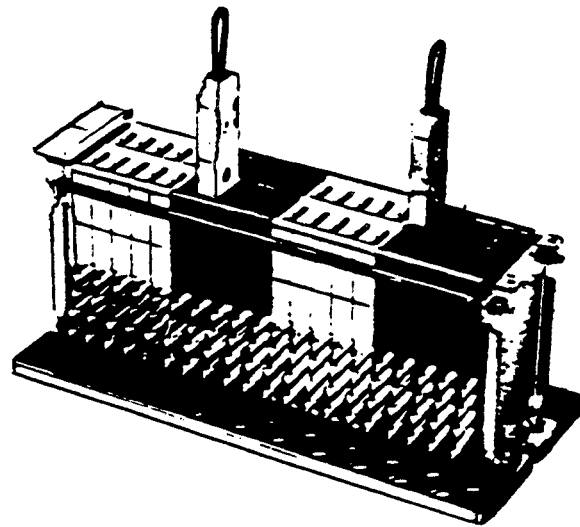


Figure 8.1 (I) 1.3

Multiple terminations (e.g. PABX) must be connected to PSTN using the device described in figure 8.1 (I) 1.4.



Dimensions in mm

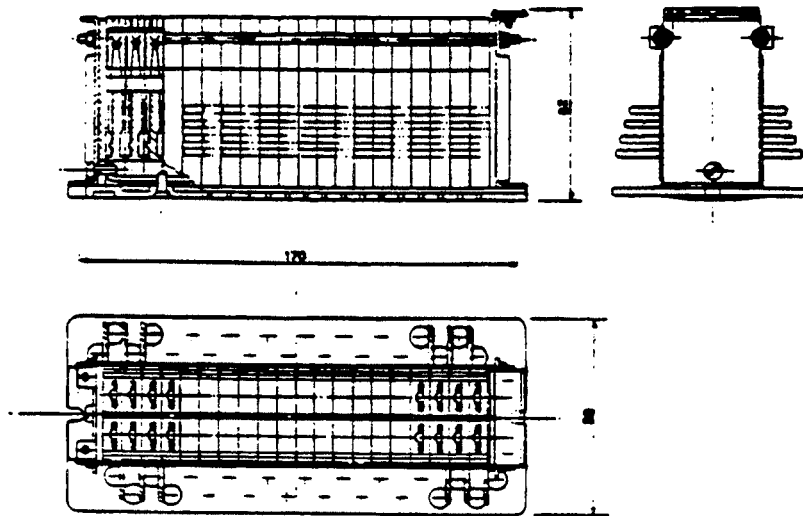


Figure 8.1 (I) 1.4

8.1 (L) 1

In Luxembourg, the basic network termination is a four pole socket (ADo 4), shown in figure 8.2 (L) 1.1. Normally the first socket is provided and installed by the Posts and Telecommunications Administration at the subscriber premises. Additional sockets and installations may be added. No termination (e.g. RC-Network) for testing the line is provided.

The installation for multiple terminal connection (standard socket ADo 8 as shown in figure 8.3 (L) 1.3) is only done by private authorised companies.

8.1 (M) 1

Information not available at the moment.

8.1 (NL) 1

Starting from 1989 in The Netherlands the network termination point will be a special distribution frame which is placed in the meter cupboard of the subscriber (figures 8.1 (NL) 1.1 and 1.2). It has two compartments. In the first compartment the connection to the PTT-line is made, some room for equipment is available. The second compartment is a strip with bolts and nuts, this is the connection point for the subscriber.

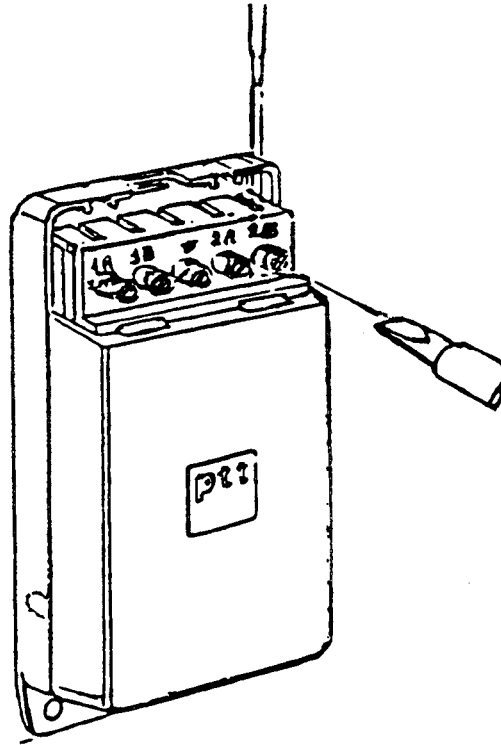


Figure 8.1 (NL) 1.1

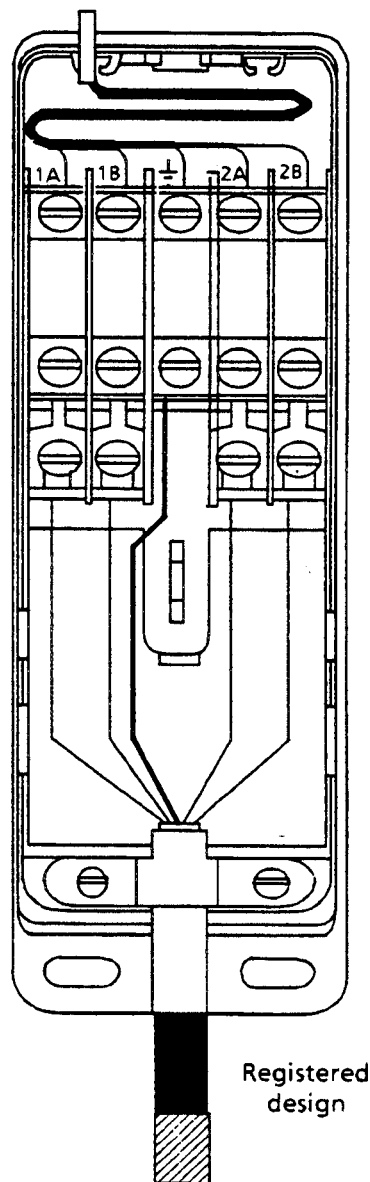


Figure 8.1 (NL) 1.2

The wiring in the house including plugs and sockets are owned by the subscriber.

8.1 (N) 1

Single PSTN lines in Norway are terminated by a standard socket provided by the public operator Norwegian Telecom (NT). The socket constitutes the boundary towards the public operator. The standard socket is an 8-pole modular socket (EN 28877). Earlier a 3-pole socket was used as the standard socket.

TE shall be provided with an 8-pole, and 3-pole, plug (EN 28877). Preferably TE should be made available with both the 8-pole and the 3-pole socket, or with an appropriate adaptor for connection to 3-pole sockets.

Both plug types shall comply with the Appropriate Type Approval Regulations.

Only the first, standardised socket is provided by the NT as part of the PSTN subscription. Additional sockets shall be installed by an installation company licensed by NTRA. Additional sockets may also be installed by the

subscriber, provided that a "do-it-yourself" installation material kit is used, including a plug-in connection into the first socket (which is NT property).

According to Norwegian regulations, multiple line PSTN terminations (normally provided to business subscriber's) are handled differently from the signal line terminations described above (and which are normally provided to households).

Multiple PSTN subscriber lines (e.g. to a PABX) are terminated onto a cross-connection-field (CCF) on the subscriber's premises, normally just inside the basement wall near the point where the cable(s) enters into the building.

The location of the CCF is decided by the subscriber.

When found most practical, out-door location of the CCF may be agreed upon.

All CCF wiring and distribution networking (including the sockets) are property of the subscriber, but the installation and maintenance shall be done by an installation company/person appropriately licensed by NTRA.

The CCF shall be provided with current fuses.

8.1 (P) 1

In Portugal, the network termination point for the PSTN may be a socket and, for permanently connected TE, either a connection box or a distribution frame.

The policy of network presentation has some differences in the areas of the two public telecommunications network operators - Telefones de Lisboa e Porto (TLP) and Correios e Telecomunicações de Portugal (CTT) - according to the types of TE.

In the area of TLP (Lisbon and Oporto) the socket for connection of single telephone sets is actually provided only by TLP; however, only telephone sets supplied by TLP are allowed to be connected to this socket. For other types of TE, TLP recommends a special socket (ADO 8) but the subscriber's may use any socket they want provided that it has been approved by TLP. For permanently connected TE (ALL types), connection boxes and distribution frames are allowed.

In the area of CTT (the rest of the country) a special socket (ADO 8) is always used to connect facsimile machines. For other types of TE any socket approved by CTT is allowed or, if the TEs are permanently connected, connection boxes and distribution frames may be used.

On the 1st of January 1988 a new regulation came into force introducing a nationally standardised 6-pin modular plug and socket system to be in full application in all new installations after a maximum transient period of 30 months. As a first step and after the transient period, this new connection system will be used only with single telephone sets but, in the future it is expected that it will be used with other types of TE as well. The new socket will be either provided by TLP and CTT or purchased in the market by the subscriber.

Meanwhile, non standardised sockets will be allowed to maintain the old installations or to connect TE not covered by the applicability of the new plug and socket system but, in both cases, they will have to be approved by CTT or TLP.

8.1 (E) 1

(the contents of this section are informative)

In Spain, the network termination point for the PSTN is implemented by an "equipment" called PCR (abbreviation of the Spanish term: "Punto de Conexión de Red"; in English: "Point of connection to the network"). The PCR constitutes the outer boundary of the plant owned and provided by the Public Network Operator (PNO). Now it is used it is used a Single Line PCR, and a Multi-line PCR will be introduced shortly. The conversion of the existing old network to include a PCR is at this moment voluntary; when the subscriber asks for connecting to the network a private owned terminal equipment, the installation of a PCR and the possible internal re-wiring is compulsory.

Both types of PCR's are provided, installed, and owned by the PNO by charging authorised rates; by now the actual location of the PCR, inside the subscriber premises, is decided by the involved subscriber. The possible additional private wiring in the subscriber premises, that includes wires and sockets (to which the approved terminal equipments are plugged), is installed under the responsibility of the subscriber, and it is owned by him.

The PCR's have two compartments. The first compartment is normally closed, and it is accessible only by the representatives of the PNO; it contains the point to which the wires of the outside plant are connected. Usually, the first compartment contains also a network termination dipole; the termination dipole is formed by a resistor of 22 k Ω in series with a capacitor of 1 μ F and, when provided, it is permanently connected across the two wires of the line, for telemetering and maintenance purposes. In the future it is planned to use, instead this passive termination circuit, an active remote operated circuit; this circuit is going now on a field trial. There are no access restrictions to the second compartment, and it contains a connecting point, a manually operated switch, and a socket. The private wiring (two wires are normally used) is connected to the connecting point in the second compartment. The switch allows the disconnection of the private wiring from the network wires, either for functional purposes or for safe (re-)wiring. The socket is connected before the switch and in parallel with the network wires, and has the purpose of checking, with the help of a simple telephone set or other type of terminal equipment, the availability of the line, with non-interference (while the switch is opened) from the private wiring and the possible terminal equipments plugged into its sockets; the testing socket used is of one of the types standardised for the private wiring, in order to match with the plugs or connectors stipulated for the terminal equipments.

At present, when a single line PCR is provided, the first telephone set is exclusively supplied by the PNO, and it may be either permanently wired in the interior of the first compartment or plugged into the testing socket. Usually, the single line PCR also provides an additional manually operated switch which allows the subscriber to inter-connect in a hierarchical mode the first telephone set with a series terminal equipment which is plugged into a socket in the private wiring; if this is the case, it is needed to use four wires for building the private wiring.

8.1 (S) 1

In Sweden the network termination point for PSTN line (for normal telephone sets) is a standard 4-pin socket provided by Televerket. Only the first socket is installed by PTT; other sockets within the subscriber's installation may be added and installed by the subscriber. No termination (e.g. RC-network) for testing the line is provided.

For connection of customer premises networks (e.g. PABX) to the PSTN, normally a terminal block is used for twin cable connection with the following mechanical requirements applying to the wire or cable being used:

- * the conductor shall be solid, not stranded;
- * the conductor shall have a diameter of 0,4 - 0,7 mm;
- * the conductor shall not be made of steel or similar material liable to damage the contact devices;
- * the conductor insulation shall have a diameter of 0,6 - 1,7 mm.

In certain cases a plug and socket arrangement may be used for twin cable connection.

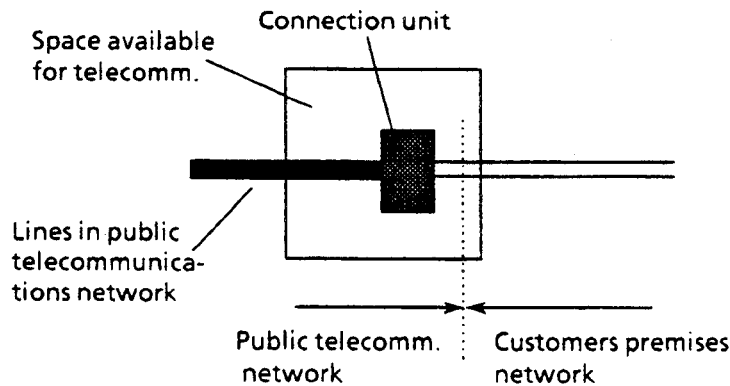


Figure 8.1 (S) 1

8.1 (CH) 1

The network termination point or delivery point for the PSTN line is a special distribution frame depending on the installation point and the kind of line (underground cable, overhead line). To this distribution frame the subscriber's installation is connected, normally terminated by a T + T 83 socket. The inhouse installation and the socket must be installed by the PTT or by authorised companies. Additional sockets may be installed in parallel. No termination (e.g. RC-network) for line testing is provided.

The present mandatory PTT connection system between the TE cord and the inhouse installation is called T + T 83.

The different methods of connection are specified in the Installation Requirements for Subscriber Equipment B 191. For externally controlled special functions (e.g. switch, LED, etc.) a contact bank must be provided in the TE. The TE is tested with the T + T 83/87 plug or for critical measurements at the connecting contacts of the TE.

8.1 (GB) 1

The normal method of presentation of the standard analogue interface of the PSTN is by means of a socket on the network termination and testing apparatus (NTTA), to which TE is connected by means of a multi-contact plug complying with British standard BS 6312 Part 1.

The NTTA contains network terminating circuitry; other sockets compatible with plugs conforming to BS 6312 Part 1 may be wired in parallel with the NTTA.

The PSTN can be presented in other forms for special applications. See remark 8.2 (GB) 2.

8.2 Single terminal connection for PSTN-access

8.2 (A) 1

For single and multiple terminal connection to the PSTN connection to the PSTN line the mechanical parameters of the principle plug and socket system are shown in figure 8.2 (A) 1.1 to figure 8.2 (A) 1.5.

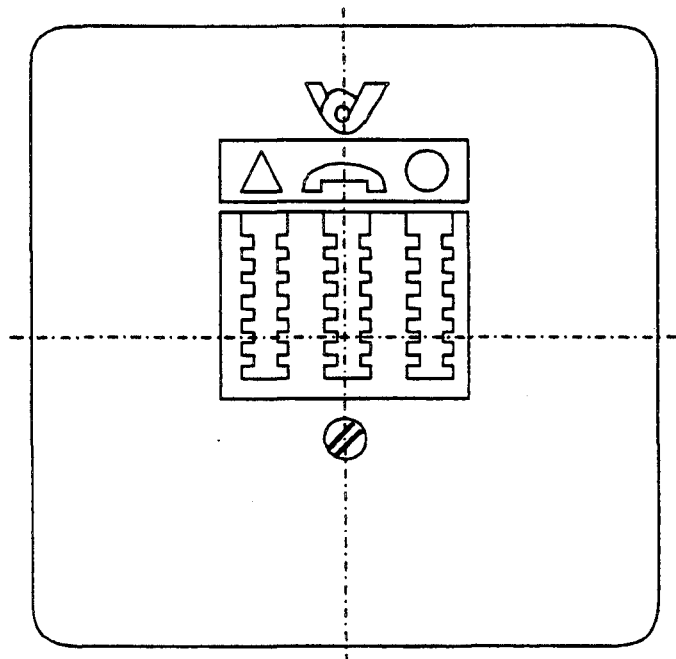


Figure 8.2 (A) 1.1: Threefold socket

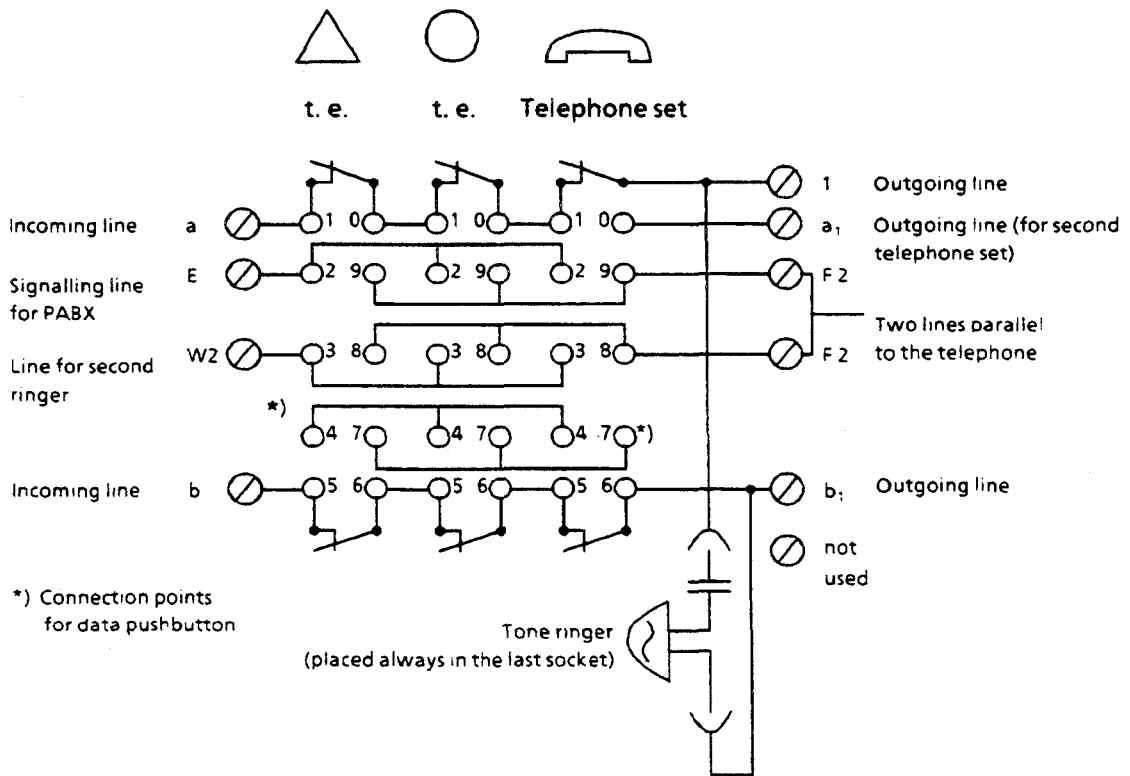


Figure 8.2 (A) 1.2: Circuit diagram of the threefold socket

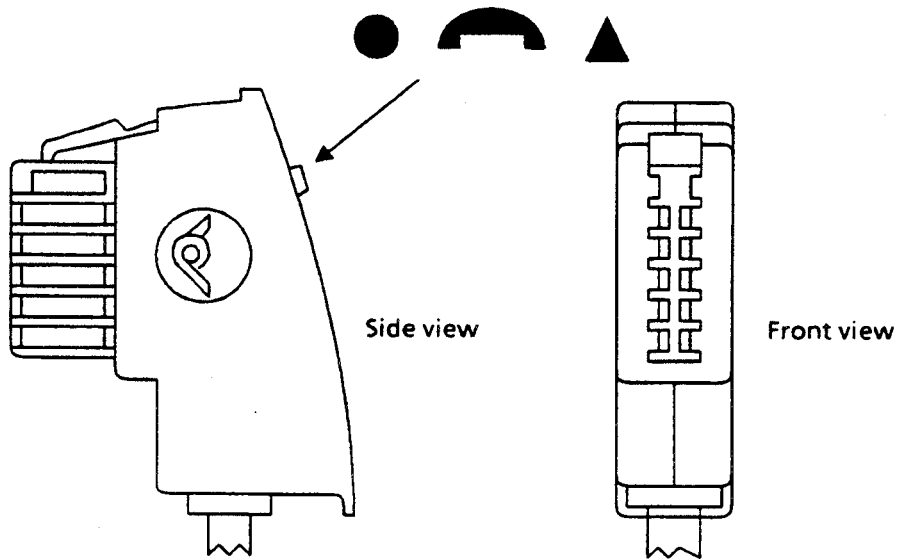


Figure 8.2 (A) 1.3: Plug

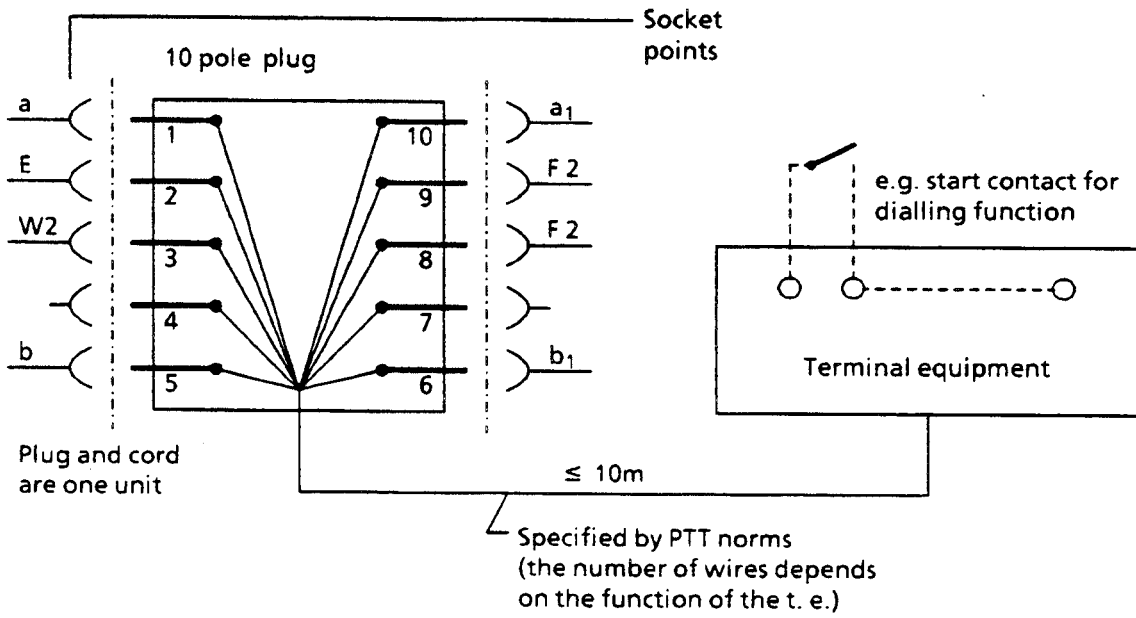


Figure 8.2 (A) 1.4: Plug and cord

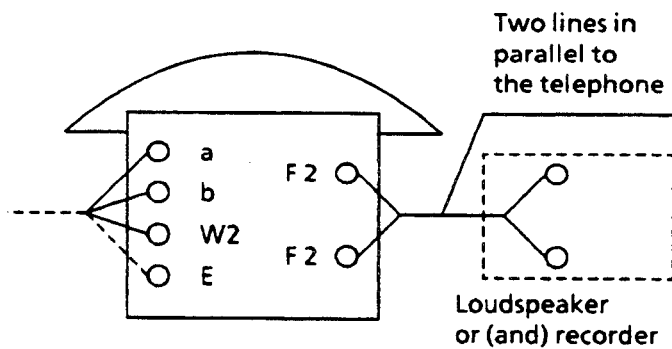


Figure 8.2 (A) 1.5: Direct connection for loudspeaker or (and) recorder to the telephone set

With the threefold socket a simple connection for one telephone set and two other TEs to the PSTN is possible.

The configuration of a single and multiple terminal connection is shown in figure 8.2 (A) 1.6.

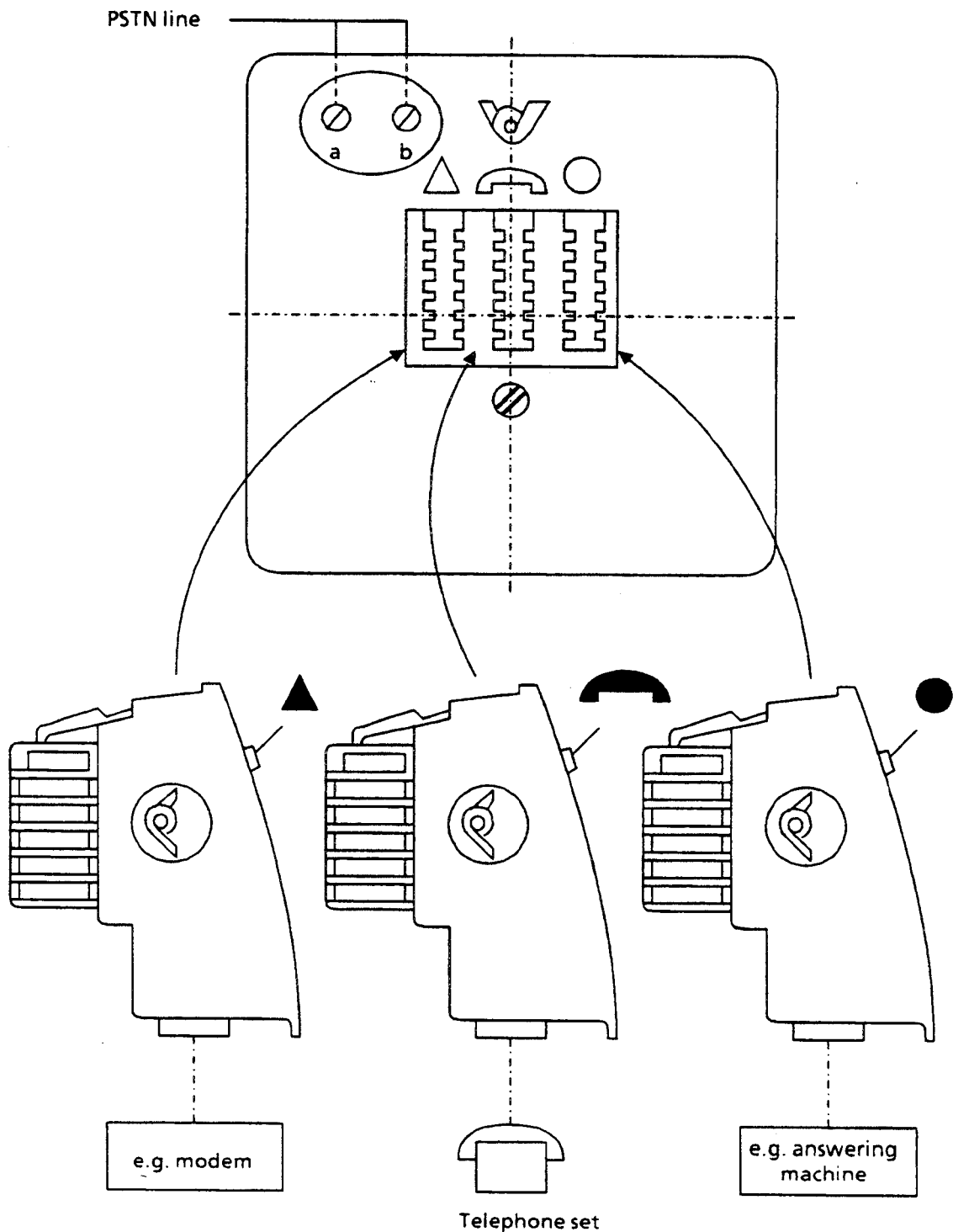


Figure 8.2 (A) 1.6: Plug and socket system for single and multiple connection

Cord, plug and plug symbol are laid down at the type approval. For tests the TE may be presented either with the proper cord and plug or without cord and plug.

8.2 (B) 1

One-port TE are fitted with a simple plug, mechanically and electrically equivalent to the standard plug which is shown in figure 8.2 (B) 1. This standard simple plug is compatible with the standard socket shown in figure 8.1 (B) 1.

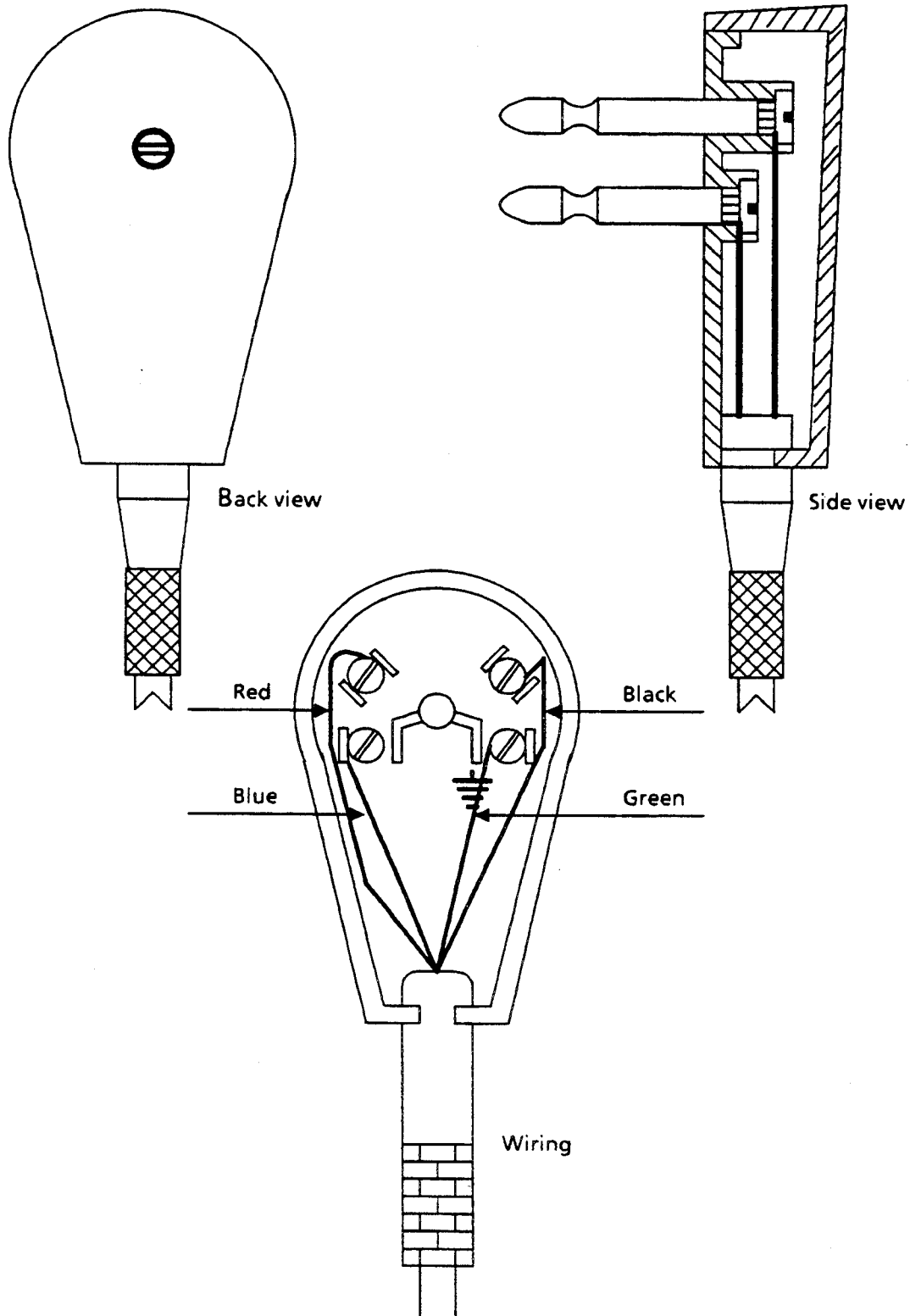


Figure 8.2 (B) 1: Belgian standard simple plug

8.2 (CY) 1

The TE plug to fit the socket which normally presents the interface of the PSTN is specified in BS 6312: 1985.

The sockets being employed must be such to ensure reliable electrical contact and mechanical compatibility with plugs complying with BS 6312: 1985.

8.2 (CY) 2

A typical internal wiring installation is indicated in figure 8.2 (CY) 2.1. As can be seen, the sockets being employed are of two types, namely primary and secondary sockets. These terms are explained below.

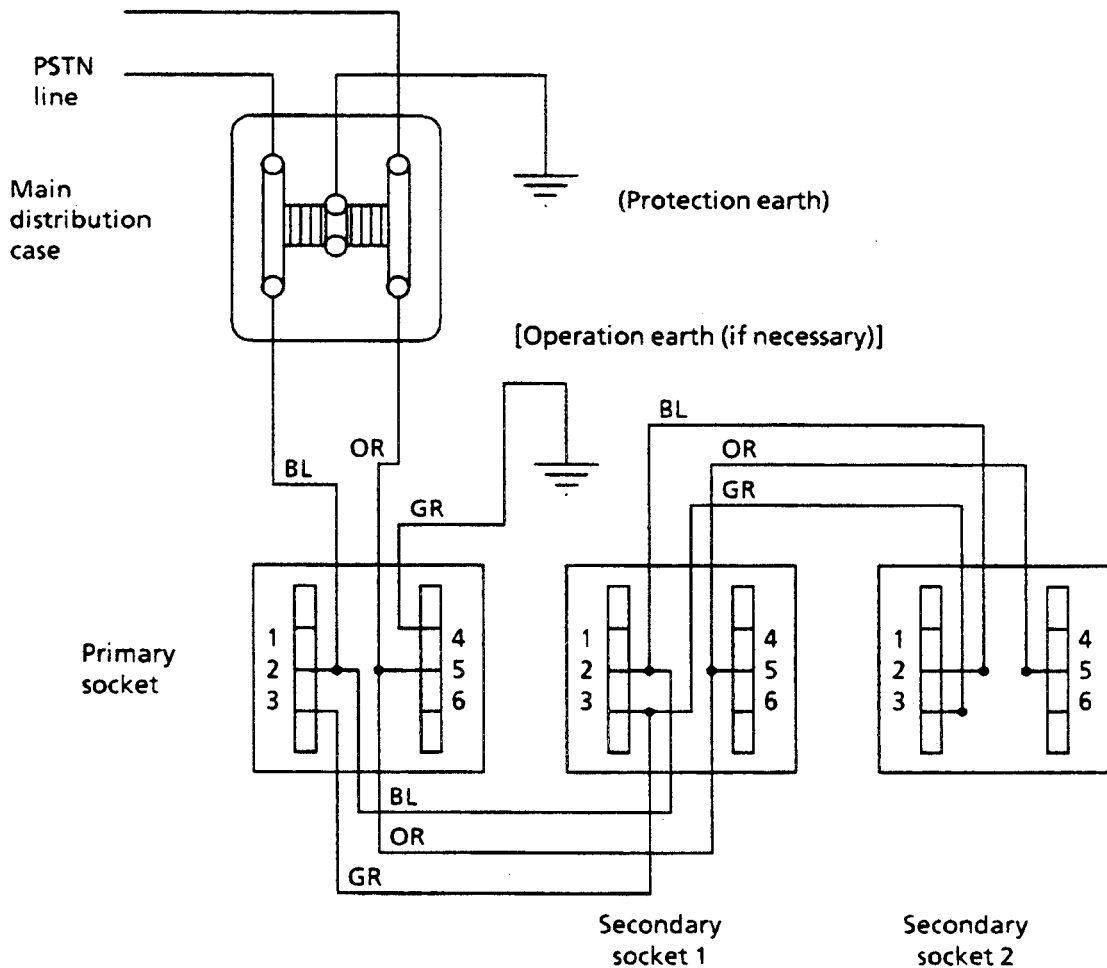


Figure 8.2 (CY) 2.1: Typical internal wiring installation

One primary socket is being employed for every Direct Exchange Line, just after the Main Distribution Case, whilst an indefinite number of secondary sockets may be employed:

The primary socket incorporates a capacitor (C_1), a resistor (R_1) and a voltage surge protection device (SP1), as shown in figure 8.2 (CY) 2.2. R_1 and C_1 are used for line testing. C_1 alone is also used for external bell connection.

The secondary socket is intended for connection to the telecommunications network in parallel with and always following the primary socket. Secondary sockets do not incorporate the electrical components mentioned before, but are otherwise identical with primary sockets.

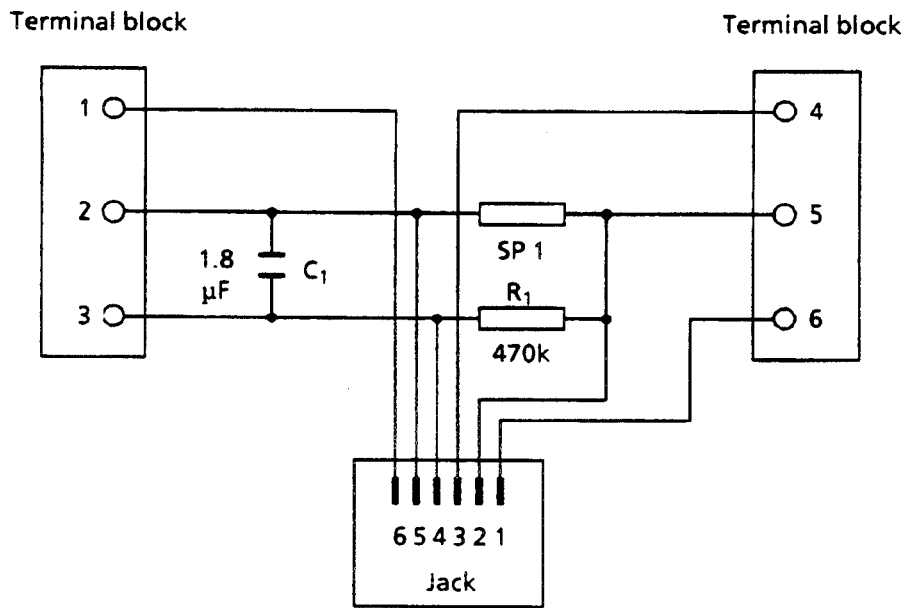


Figure 8.2 (CY) 2.2: Telecommunications line socket circuit schematic

A pictorial description of the plug being employed is shown in figure 8.2 (CY) 1.3.

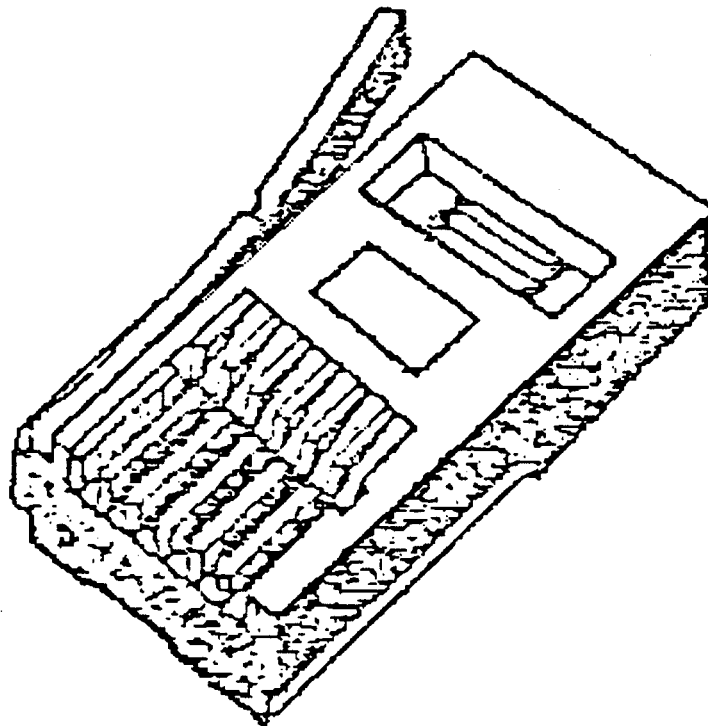


Figure 8.2 (CY) 1.3: Plug used to connect terminal equipment onto Cyprus Telecommunication Administrations PSTN

8.2 (DK) 1

General conditions:

A plug and socket connection consisting of a socket for line connections and a plug to plug cord.

Covers for sockets and plugs must be clearly and visibly marked to show that the equipment has been approved by the Danish Telecommunications Administration.

The name factory and the type number of the part must be stated on important parts.

The Danish specifications are under revision.

8.2 (DK) 2

3-pole plug and socket connections:

Both the socket and the plug must satisfy the requirements stated in the general section of the circular.

8.2 (DK) 2.1

Plug

The plug should be shaped like an angle plug. The pins should be dimensioned and positioned in accordance with the diagram. The contact faces must not be split, but shall form an unbroken surface. The pins may move up to 1 mm in all directions. The mechanical parameters of the plug are shown in figure 8.2 (DK) 2.1.

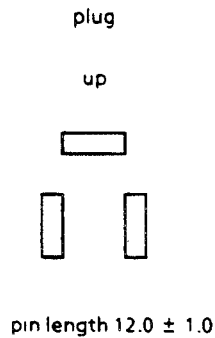


Figure 8.2 (DK) 2.1: Pin positions in 3-pole plug and socket connections

8.2 (DK) 3

5-pole plug and socket connections

Both the socket and the plug must satisfy the requirements stated in the general section of the circular.

8.2 (DK) 3.1

Plug

The plug should be shaped like an angle plug. The pins should be dimensioned and positioned in accordance with the dimensions stated in the diagram. Their contact faces must not be split, but shall form an unbroken surface. The pins may move up to 1 mm in all directions. The mechanical parameters of the plug are shown in figure 8.2 (DK) 3.1.

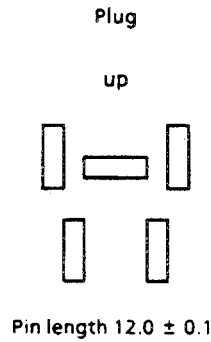


Figure 8.2 (DK) 3.1: Pin positions in 5-pole plug and socket connections

8.2 (DK) 4 6-pole plug and socket connections

Both the socket and the plug must satisfy the requirements stated in the general section of the circular.

8.2 (DK) 4.1 Plug

The plug should be shaped like an angle plug. The pins should be dimensioned and positioned in accordance with the dimensions stated in the diagram. Their contact faces must not be split, but shall form an unbroken surface. The pins may move up to 1 mm in all directions. The mechanical parameters of the plug are shown in figure 8.2 (DK) 4.1.

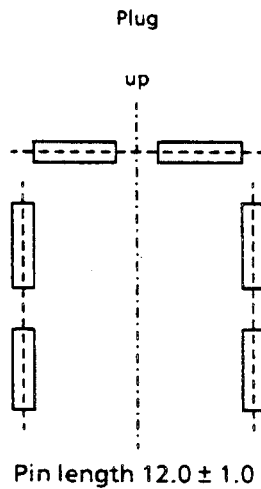


Figure 8.2 (DK) 4.1: Pin positions in 6-pole plug and socket connections

8.2 (DK) 5 Module plug and socket connections

Module plug and socket connections are specified by the American Federal Communications Commission (FCC) in Part 68: Connection of Terminal Equipment to the Telephone Network.

Both the plug and the socket must satisfy the requirements stated in the general section of the circular.

8.2 (DK) 5.1 Module plug and socket connections 6/4 and 6/6

Module plug and socket connections with room for 6 contact points may be used for normal installations. Only 4 contact pins (module plug and socket

connections 6/4) are used in simple installations, whereas all 6 contact pins (module plug and socket connection 6/6) may be used in other cases.

8.2 (DK) 5.1.1

Plug

The plug, like the socket, may have 4 or 6 contact points. Contacts 1 and 6 are omitted from the variants with 4 contact points. Both plugs have identical external dimensions. The plug cord is a flat cord with 4 or 6 conductors. A drawing of this plug is shown in figure 8.2 (DK) 5.1.1.

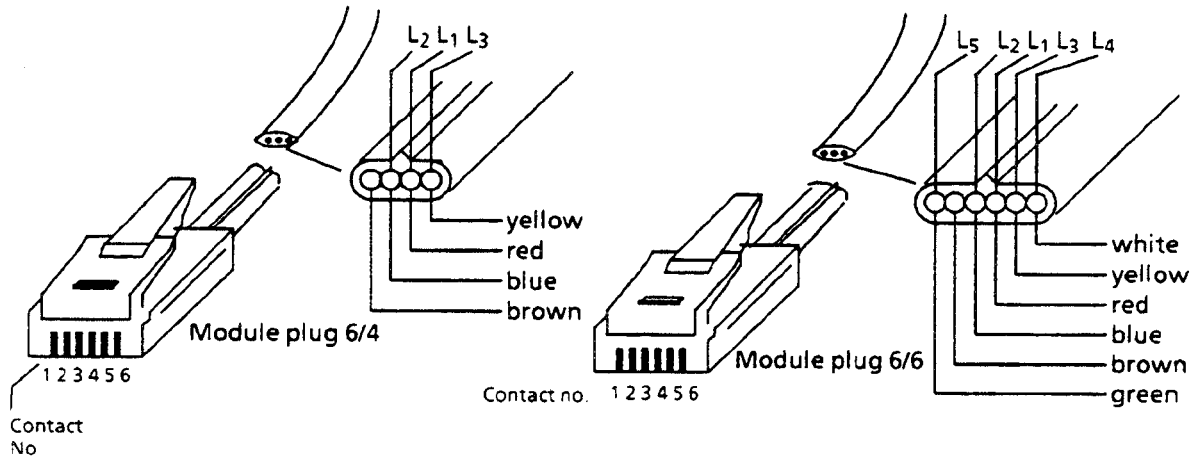


Figure 8.2 (DK) 5.1.1: Module plug and socket connections 6/4 and 6/6

8.2 (DK) 5.2

Module plug and socket connection 8/8

The module plug and socket connection 8/8, with 8 contact points, is available for special applications.

8.2 (DK) 5.2.1

Plug

The plug has 8 contact points. The plug cord is a flat cord with 8 conductors. A drawing of this plug is shown in figure 8.2 (DK) 5.2.1.

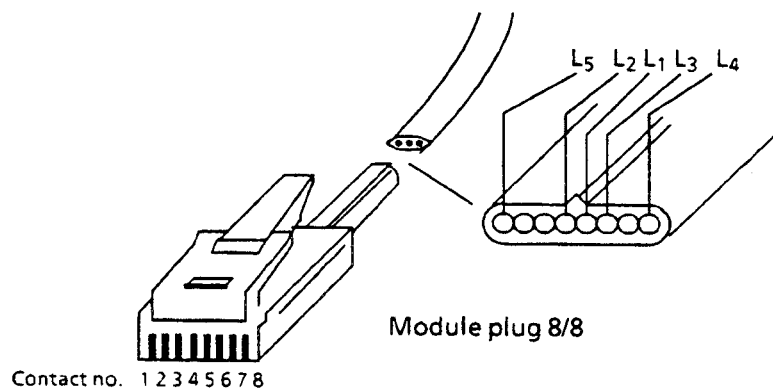


Figure 8.2 (DK) 5.2.1: Module plug and socket connections 8/8

8.2 (DK) 6 Termination configuration

8.2 (DK) 6.1 3-pole

8.2 (DK) 6.1.1 The marking of clamps

Clamps in the plug and socket connection should be as marked as in the diagram in figure 8.2 (DK) 6.1.1, which shows the socket as seen from the front.

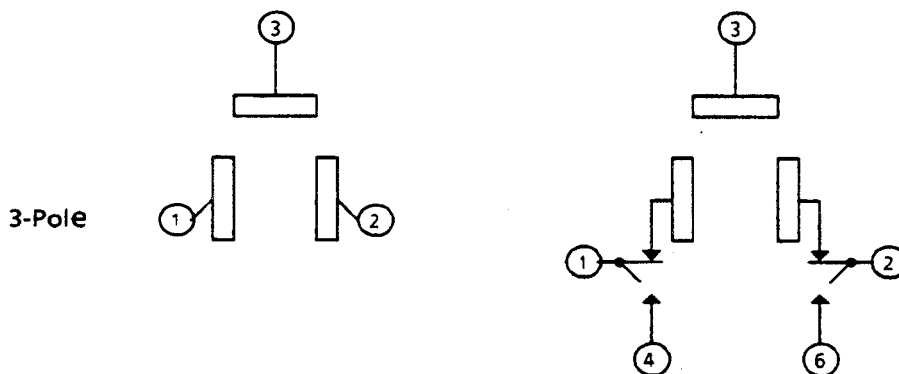


Figure 8.2 (DK) 6.1.1: Marking of clamps of 3-pole socket

8.2 (DK) 6.1.2 The use of contact/pin no

The plug and socket connections normally used are as follows:

- pin no. 1: L_1 - or a-wire
- pin no. 2: L_2 - or b-wire
- pin no. 3: L_3 - or gnd-wire

Plug and socket connections used for special applications may be created and must be coded as a matching pair.

6.2 (DK) 6.2 5-pole

8.2 (DK) 6.2.1 The marking of clamps

Clamps in the plug and socket connection should be marked as in the diagram in figure 8.2 (DK) 6.2.1, which shows the socket as seen from the front.

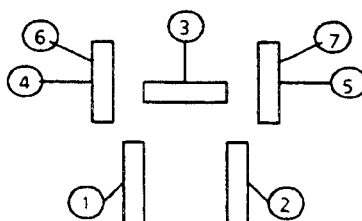


Figure 8.2 (DK) 6.2.1: Marking of the clamps of 5-pole socket

8.2 (DK) 6.2.2 The use of contact/pin no

The plug and socket connections normally used are as follows:

pin no. 1: L₁- or a-wire
 pin no. 2: L₂- or b-wire
 pin no. 3: L₃- or gnd-wire
 pin no. 4:
 pin no. 5:

The plug and socket connections used for special applications may be created and must be coded as a matching pair.

8.2 (DK) 6.3

6-pole

8.2 (DK) 6.3.1

The marking of clamps

Clamps in the plug and socket connection should be marked as in the diagram in figure 8.2 (DK) 6.3.1, which shows the socket as seen from the front.

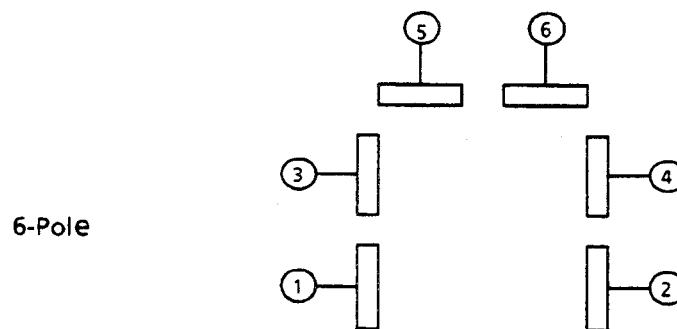


Figure 8.2 (DK) 6.3.1: Marking of clamps of 6-pole socket

8.2 (DK) 6.3.2

The use of contact/pin no

The plug and socket connections are normally used as follows:

pin no. 1:	L ₁ - or a-wire	line no. 1.
pin no. 2:	L ₂ - or b-wire	
pin no. 3:	L ₁ - or a-wire	line no. 2.
pin no. 4:	L ₂ - or b-wire	
pin no. 5:	Perhaps gnd-wire.	
pin no. 6:		

8.2 (DK) 6.4

Module plug and socket connections

8.2 (DK) 6.4.1

Module plug and socket connections 6/4 and 6/6

8.2 (DK) 6.4.1.1

The marking of clamps

Clamps in the plug and socket connection should be marked as in the diagram in figure 8.2 (DK) 6.4.1.1.

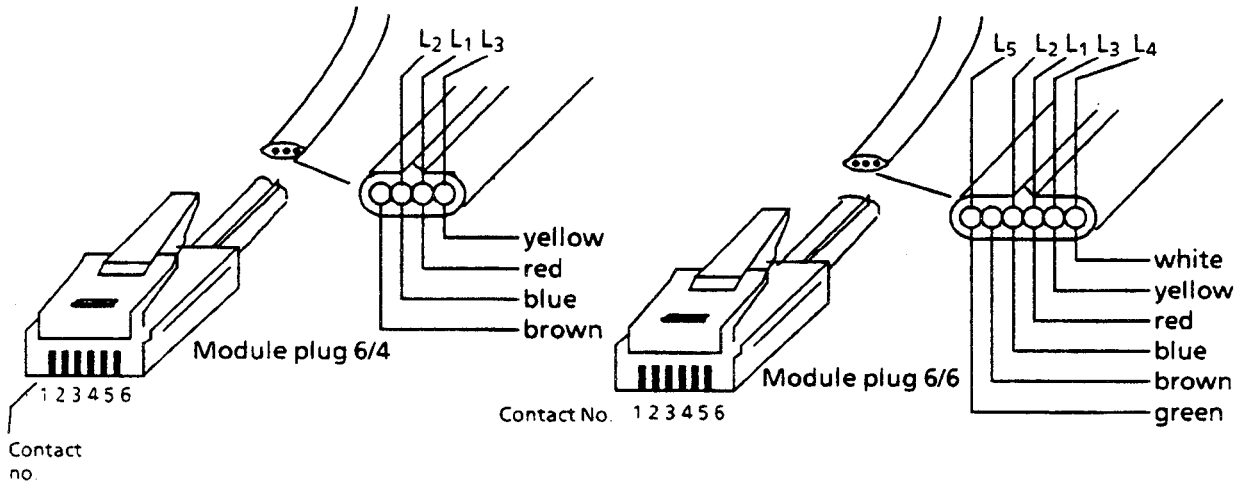


Figure 8.2 (DK) 6.4.1.1: Module and plug and socket connections 6/4 and 6/6

8.2 (DK) 6.4.1.2 The use of contact/pin no

The plug and socket connections normally used are as follows:

- pin no. 1:
- pin no. 2:
- pin no. 3: L₂- or b-wire
- pin no. 4: L₁- or a-wire
- pin no. 5: L₃- or gnd-wire
- pin no. 6:

8.2 (DK) 6.4.2 Module and plug socket connection 8/8

8.2 (DK) 6.4.2.1 The marking of clamps

Clamps in the plug and socket connections should be marked as shown in the diagram in figure 8.2 (DK) 6.4.2.1

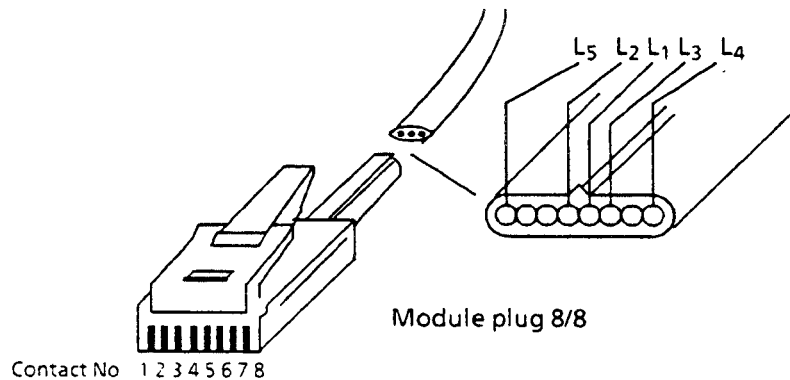


Figure 8.2 (DK) 6.4.2.1: Module plug and socket connections 8/8

8.2 (DK) 6.4.2.2 The use of contact/pin no

The plug and socket connections normally used are as follows:

- pin no. 1:
- pin no. 2:
- pin no. 3:

pin no. 4: L₂- or b-wire
 pin no. 5: L₁- or a-wire
 pin no. 6:
 pin no. 7:
 pin no. 8:

8.2 (DK) 7

Electrical parameters related to termination

The electrical parameters related to termination are given in table 8.2 (DK) 7.

Table 8.2 (DK) 7

Characteristics	Requirement	Deviation after environmental tests	Testing		Remarks
			Measurement method	Reference	
<u>Contact resistance</u> -wire-terminal (in socket)	≤ 10 Mohm	≤ 2 Mohm	Dry circuit	IEC 352 or DIN 41 640 part 5	Mounting / dismounting after 10 times
-pin -wire (in socket)	≤ 10 Mohm	≤ 2 Mohm	Dry circuit	IEC 352 or DIN 41 640 part 5	
-contact -pin double contact	≤ 10 Mohm	≤ 5 Mohm	Dry circuit	IEC 352 or DIN 41 640 part 5	After 200 times insertion/removal. Cycle time 5 secs.
-single contact	≤ 20 Mohm	≤ 10 Mohm	Dry circuit		
<u>Insulating resistance</u>	≥ 500 Mohm	none	500 V dc		Without wire.
<u>Flash-over voltage</u>	≥ 2 000 V _{rms}	none	50 Hz 1 minute	Circular 14 point 2.1	Between all terminals and to outside of cap

8.2 (SF) 1

In Finland all single line network terminations are provided with one of the sockets described in figure 8.2 (SF) 1.1 and figure 8.2 (SF) 1.2.

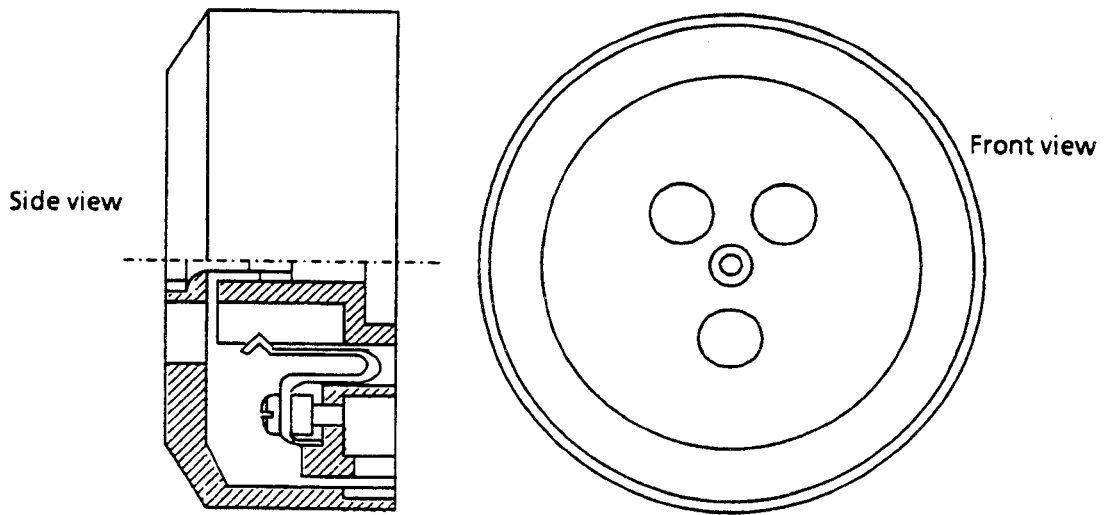


Figure 8.2 (SF) 1.1: Basic 3-pole socket (seen from front)

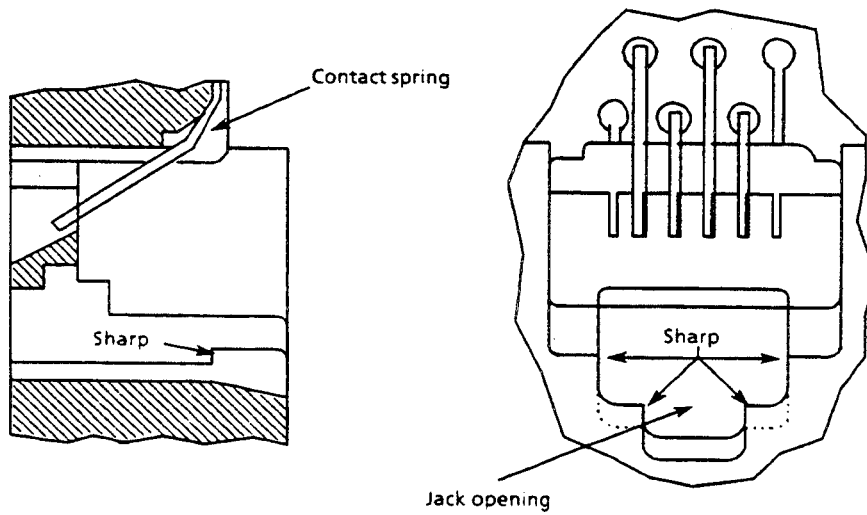


Figure 8.2 (SF) 1.2: Mini socket, very limited use (seen from front)

The wiring of the plug and socket is as shown in figure 8.2 (SF) 1.3, which shows the socket as seen from the front. Wiring of both possible sockets is described.

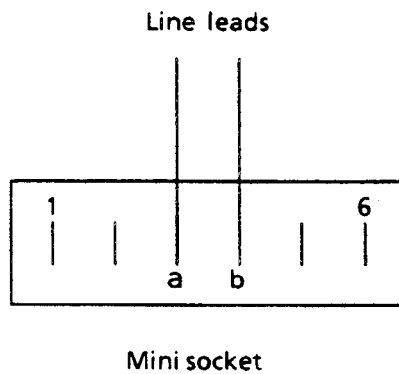
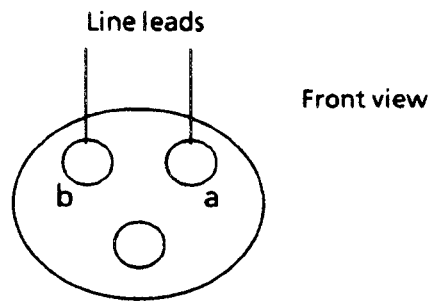


Figure 8.2 (SF) 1.3: Socket wiring for basic 3-pole socket

8.2 (F) 1

Except for the case of some types of TE (e.g. meter pulse detector), a single terminal connection shall be made using a standard 6-pole or 8-pole plug, which is compatible with the sockets and the associated wiring system as described in figures 8.2 (F) 1.1 and 8.2 (F) 1.2.

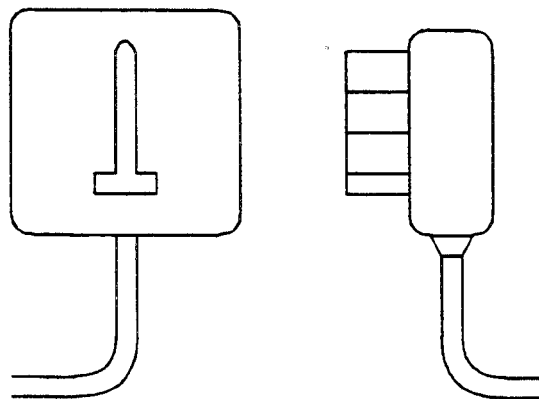


Figure 8.2 (F) 1.1: Plug and socket

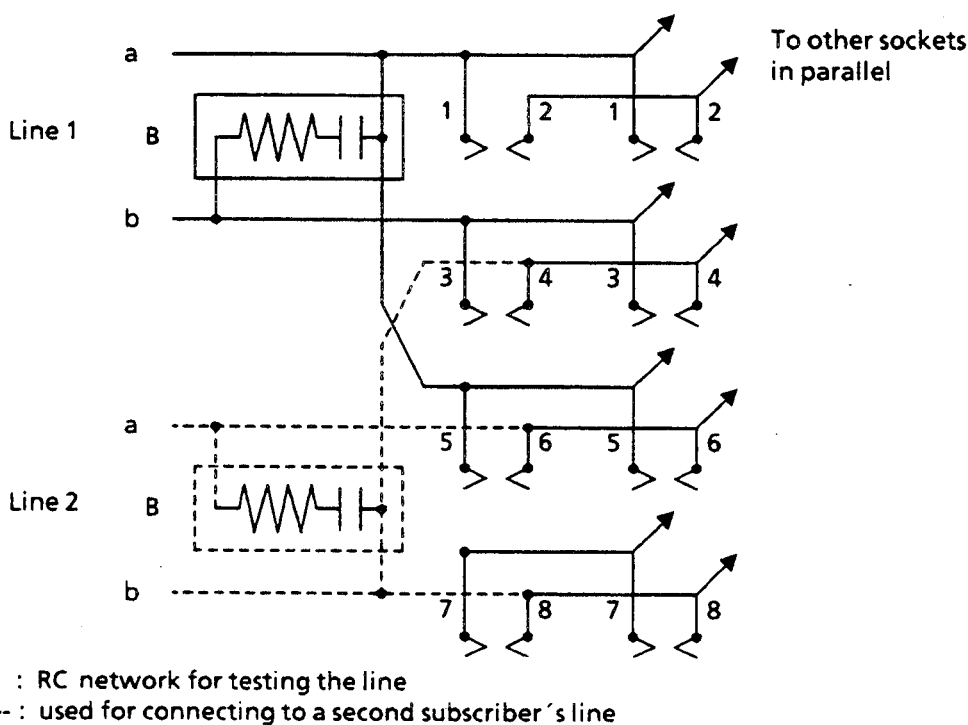


Figure 8.2 (F) 1.2: Wiring plan at subscriber's premises (new version)

The allocation of the pins of the plug is as follows:

Pin no	Allocation	
	6-pole plug	8-pole plug
1	"a" wire	"a" wire of line 1
2	shunt wire(*)	shunt wire(*) of line 1
3	"b" wire	"b" wire of line 1
4	not used	not used
5	not used	not used
6	not used	"a" wire of line 2
7	not used	shunt wire(*) of line 2
8	not used	"b" wire of line 2

(*) The purpose of the "shunt wire" is to provide means for preventing "bell tinkling" in a telephone set due to loop-disconnect dialling from a parallel TE. The necessity of a shunt wire depends on the type of the TE (see figure 8.2 (F) 1.3).

The transmission circuit shall be connected between the pins 1 and 3 which access to the line wires, through the switch hook or its equivalent, as described in figure 8.2 (F) 1.3.

The TE which use the loop-disconnect dialling shall have a shunt wire connected between the pins 1 and 2, through the switch hook or its equivalent, as described in figures 8.2 (F) 1.3B, 1.3D and 1.3E.

The incorporated or external ringing circuit shall be connected to the pin 1 of the ringing detector (e.g. bell) and to the pin 3 on the side of the capacitor, as described in figures 8.2 (F) 1.3C, 1.3D, 1.3E, 1.3F, 1.3G and 1.3H.

If the ringing detector is sensitive to the loop disconnect dialling of a parallel connected TE (e.g. bell tinkling), the point between the capacitor and the ringing detector shall be connected to the pin 2 as described in figures 8.2 (F) 1.3E, 1.3F and 1.3H.

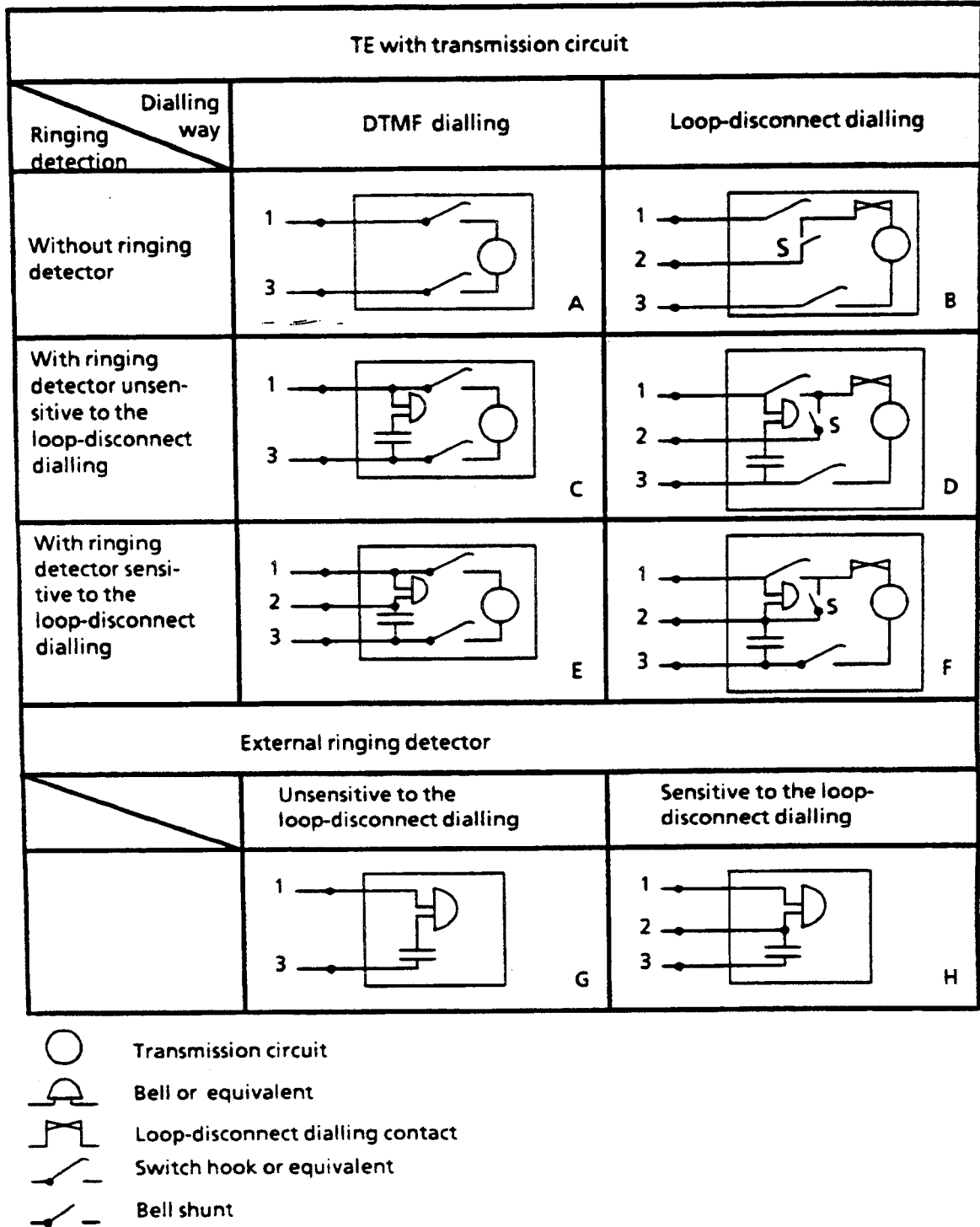
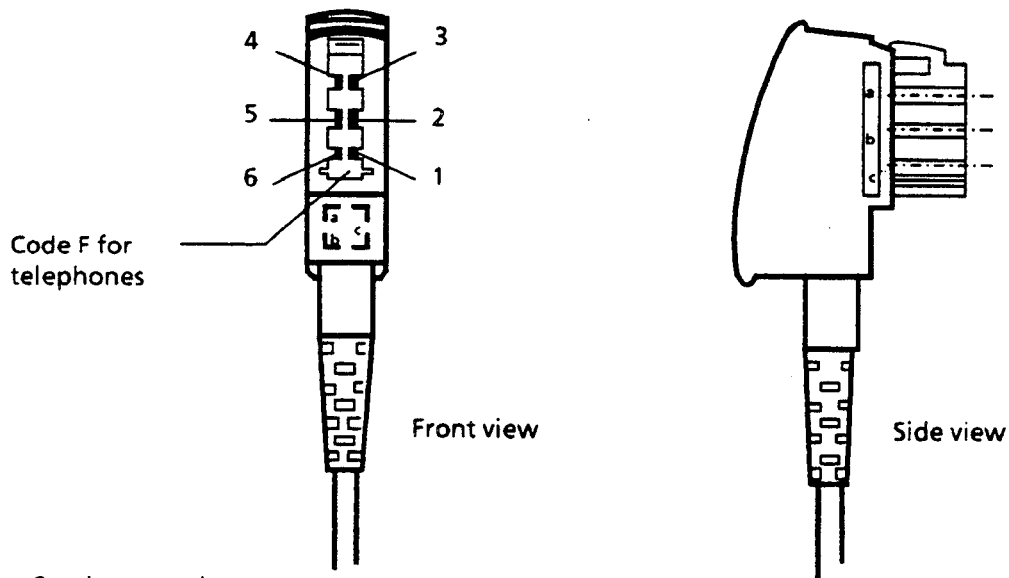


Figure 8.2 (F) 1.3: Single terminal connection

8.2 (D) 1

Single TE access to a PSTN line is done by using a simple wall socket with code F (figure 8.2 (D) 1.2) as an inter-connection device which is part of the local subscriber loop. TE (e.g. telephones, PABXs) can be connected to this inter-connection device either directly or indirectly by means of in-house cables.

As a rule, the Deutsche Bundespost uses sockets conforming to Deutsche Industrie Norm (DIN) 41 715 as the inter-connection device for normal TE without switching functions (telephone set). The key features of this connection method including the wiring are shown in figure 8.2 (D) 1.1 and figure 8.2 (D) 1.2.



Conductor codes :

- 1 --> a
- 2 --> b
- 3 --> W
- 4 --> E
- 5 --> b2
- 6 --> a2

6-way right angle plug type R 1 conforming to DIN Standard 41 715 Part 3

Figure 8.2 (D) 1.1: 6-way plug for 6-way line cord (TAE S 6 F)

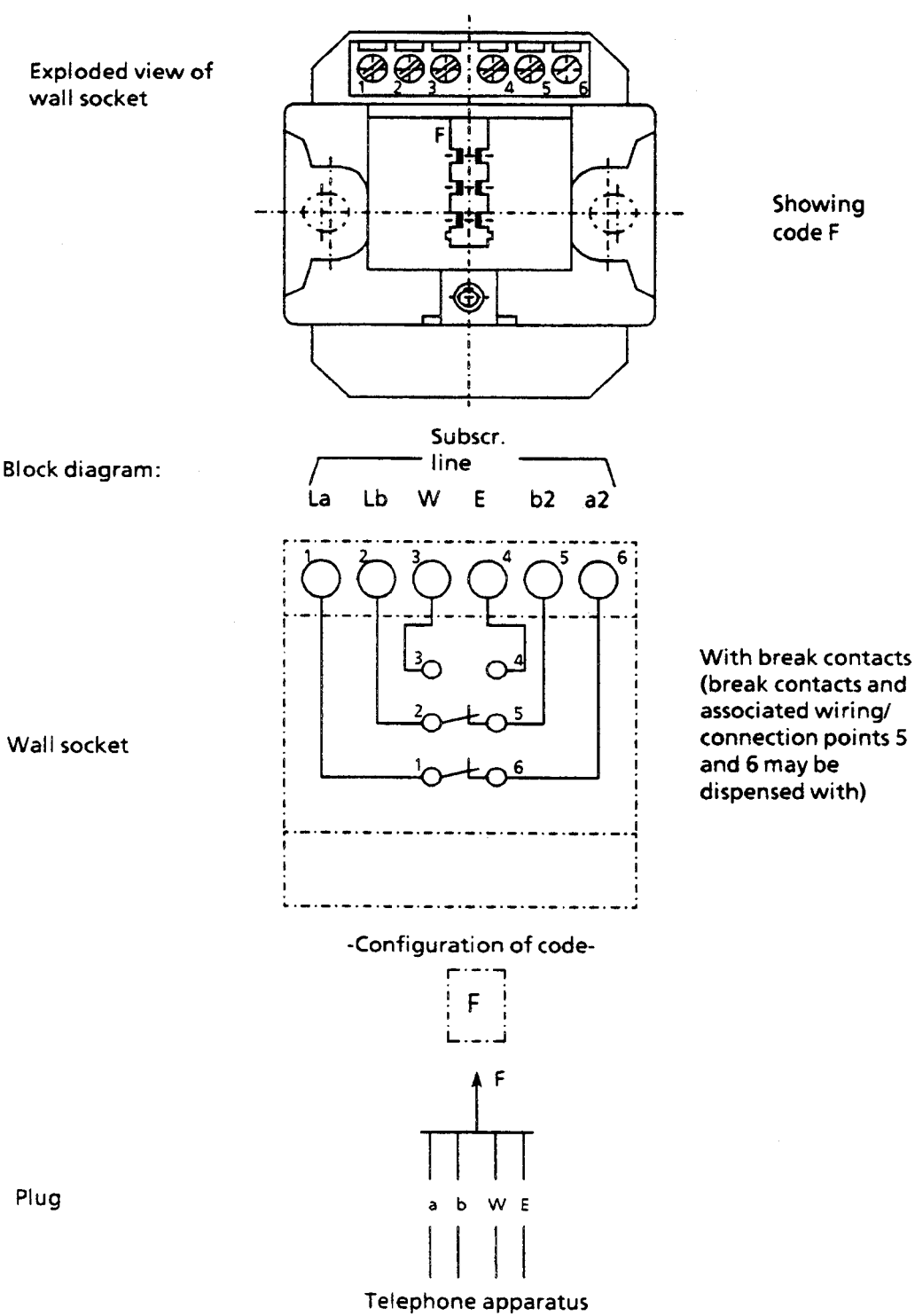


Figure 8.2 (D) 1.2: Simple wall socket with code F (inter-connection device)

8.2 (GR) 1

The physical connection of the first telephone set is done by using a small plastic termination box (rosette) with four screw-type terminals. The drawing of this box is shown in figure 8.2 (GR) 1. All other secondary (parallel) connection points, are allowed to consist of a plug and socket system, the type of which is not yet specified.

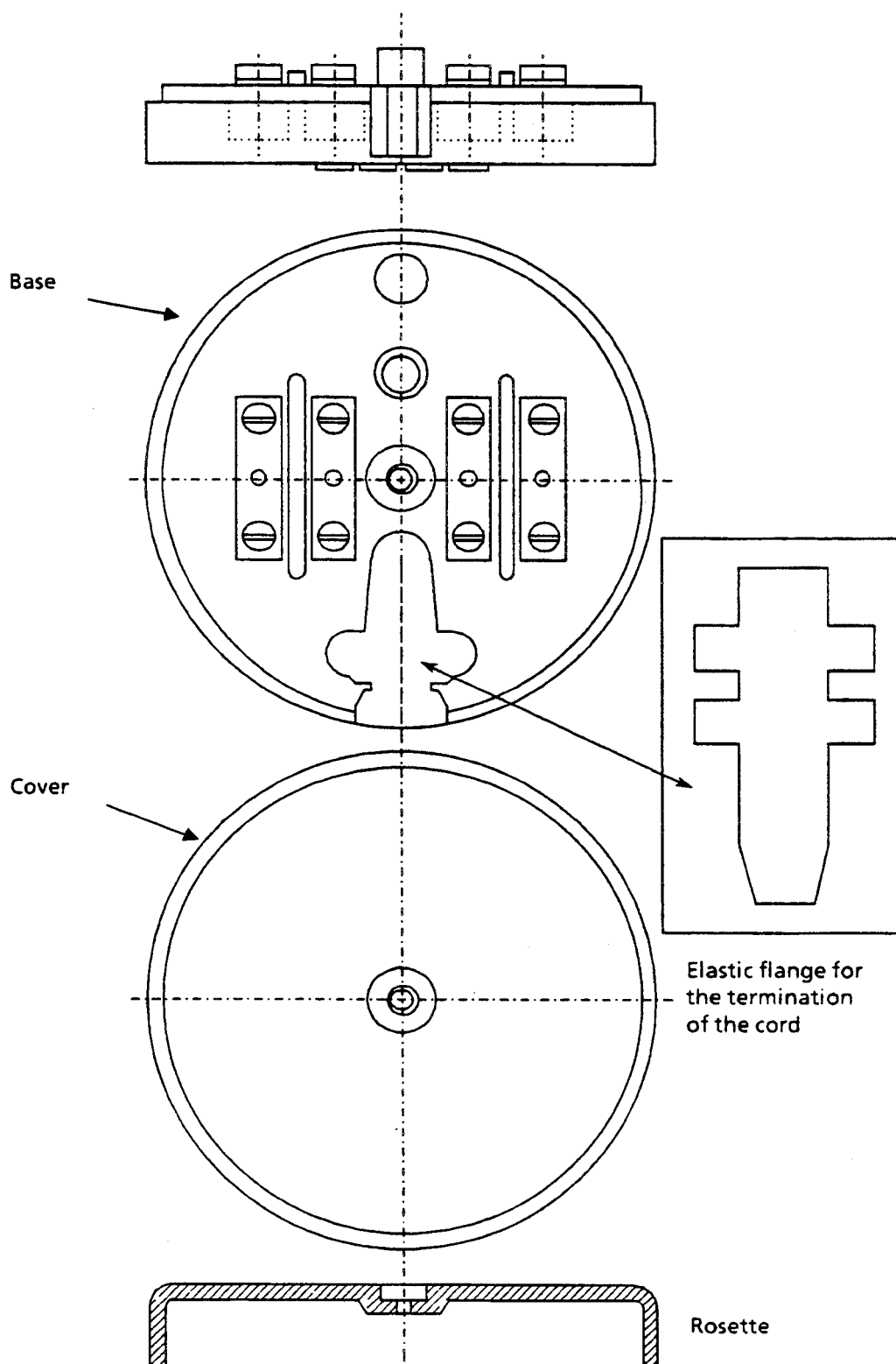


Figure 8.2 (GR) 1: Telephone set termination box

8.2 (IS) 1

All single and end terminal connections to the PSTN shall be through a plug/socket as described in figure 8.2 (IS) 1.

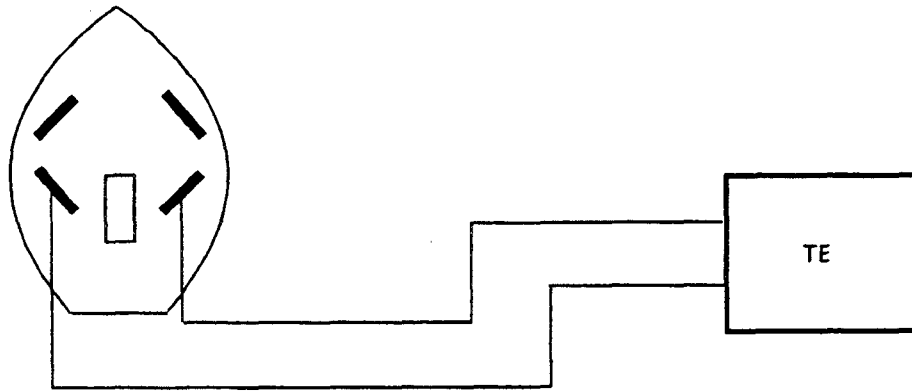
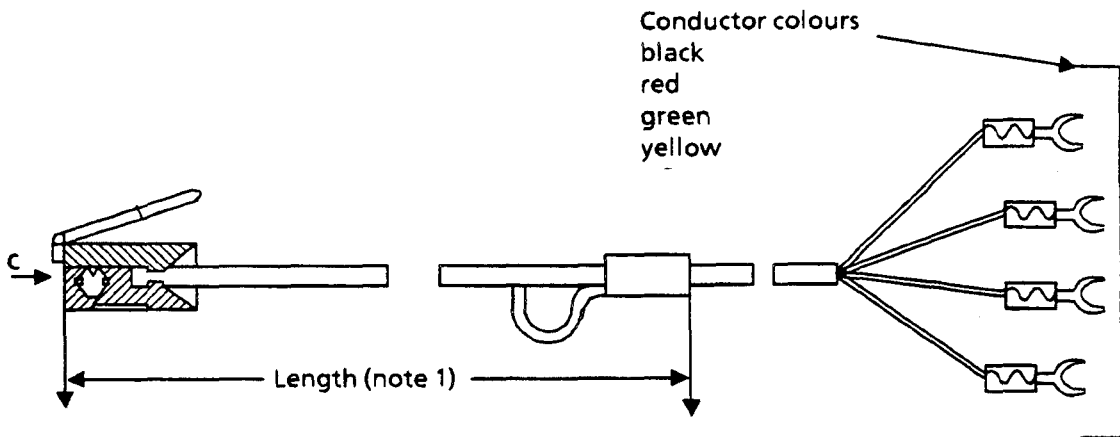


Figure 8.2 (IS) 1: Basic four pole socket

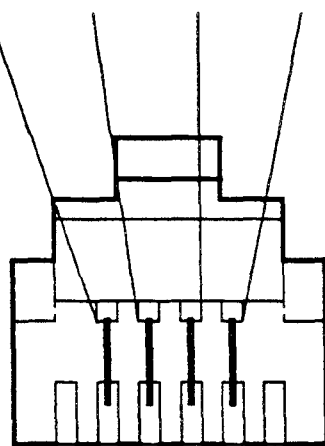
8.2 (IRL) 1

TE supplied by Telecom Eireann is fitted with a modular plug, as shown in figure 8.2 (IRL) 1, which is compatible with the socket shown in figure 8.2 (IRL) 2. The wiring of jacks Modular No. 1M/1 is shown in figure 8.2 (IRL) 3.



Note 1: standard lengths: 2.1 m and 4.2 m

black red green yellow



VIEW AT "C"

Figure 8.2 (IRL) 1: Modular plug

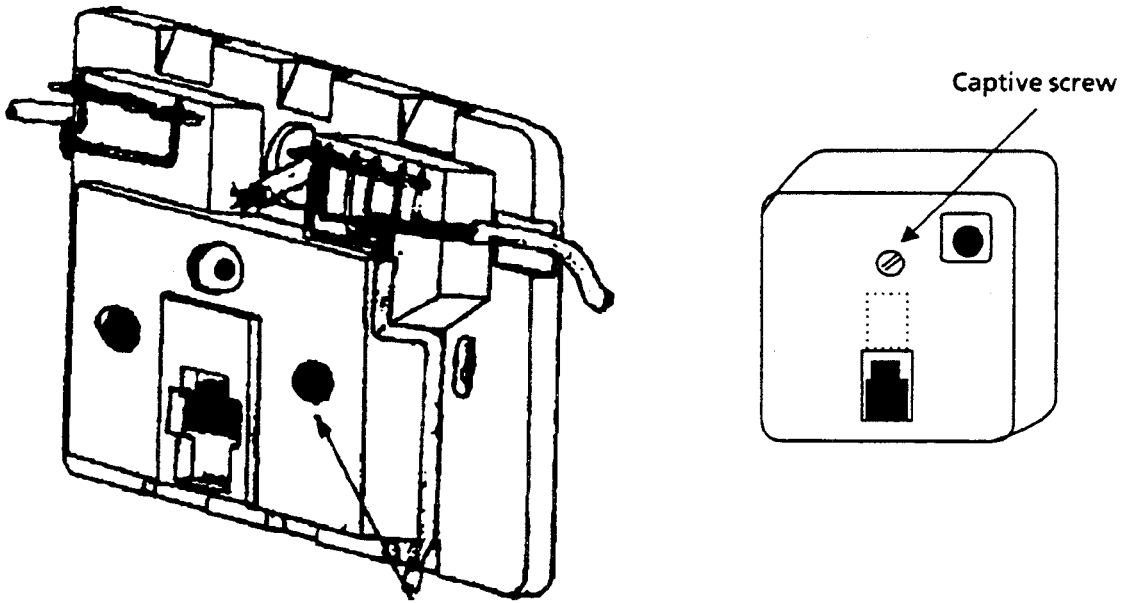


Figure 8.2 (IRL) 2: Jacks Modular 1M/1

Apertures allow for check that R.C. network is or is not present.

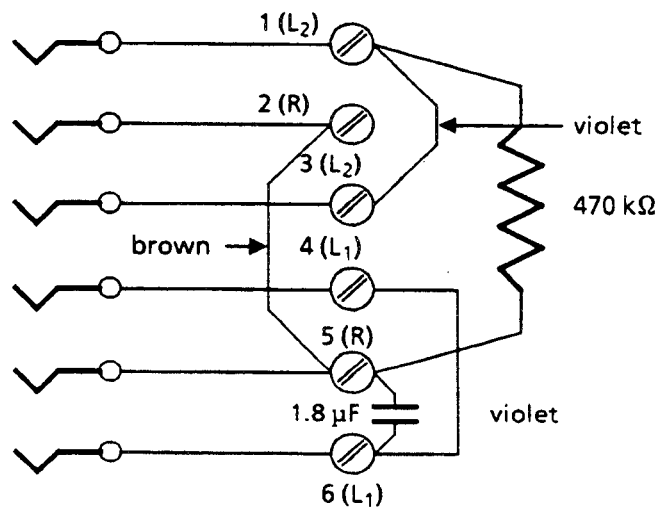


Figure 8.2 (IRL) 3: Wiring of Jacks Modular 1M/1

Customers must use suitable adaptors to connect other types of plug to the modular socket.

8.2 (I) 1

Mechanical parameters

All single terminal connections must be made by the standard 3-pins plug described in figure 8.2 (I) 1.

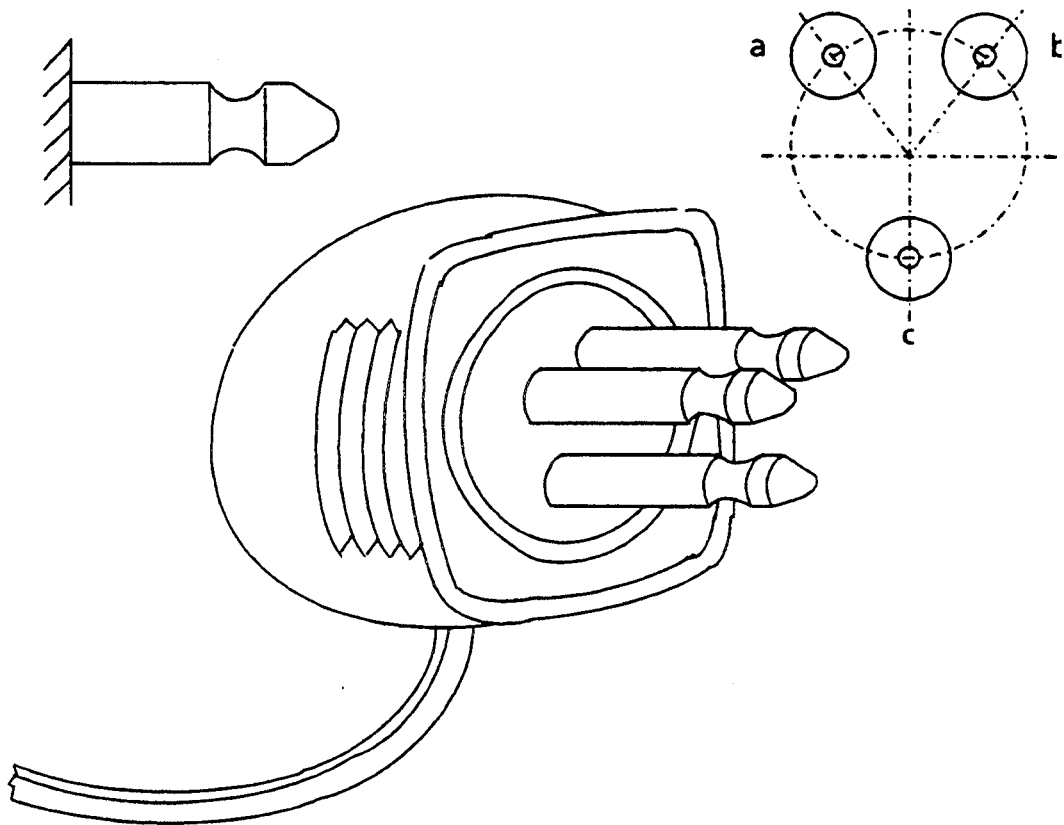


Figure 8.2 (I) 1: 3-pole plug

8.2 (I) 2

Termination configuration

The "a" and "b" poles are connected to line leads. The "c" pole is connected to extra leads (for telephone set 2 extra leads are used) that can be used:

- to connect the equipment to subscriber plant at subscriber's premises;
- for signalling scope using a ground button on equipment connected to some types of PABX.

One example is given in figure 8.2 (I) 2 to describe the Italian method to make a wiring plant at the subscriber's premises.

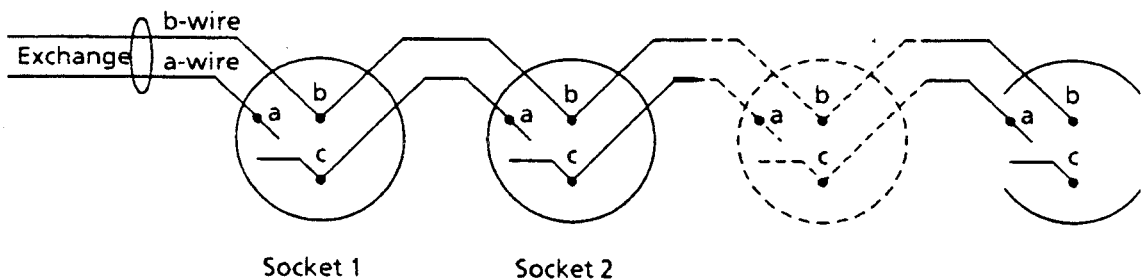


Figure 8.2 (I) 2: Wiring plant at subscriber's premises

The socket makes the contact between "b" and "c" poles only if no plug is in.

When an equipment is connected to the socket by its 3-pin plug the equipment internal circuit shall make the contact between:

- "a" and "c" socket poles when the equipment is in quiescent condition;
- "b" and "c" socket poles when the equipment is in loop condition.

After all connection Italian philosophy in subscriber's wiring plant aims at:

- making parallel equipment connection when all equipments are in quiescent condition (in that way all equipments can receive ringing signals);
- making sure that only one equipment at a time can receive speech band signals (secrecy of telephone call).

8.2 (I) 3

Electrical parameters related to termination

The insulation resistance between any two pins of the plug shall not be less than 5 000 Mohms.

The measure shall be made only after the plug under test voltage $V_t = 500 \text{ V}$ applied for a time $t = 30 \text{ s}$. Moreover an alternative voltage test between metallic parts electrically separated from each other shall be made; a rms voltage of value 1 000 V (frequency 50 Hz) shall be applied for a period of 30 s without discharges.

8.2 (L) 1

Single TE (e.g. telephone sets) should be delivered with a simple four pole plug (ADoS4), shown in figure 8.2 (L) 1.2. This standard plug is compatible with the standard four pole socket (shown in figure 8.2 (L) 1.1), provided and installed either by the Posts and Telecommunications Administration or a private authorised company. The wiring should be according to the plan shown in figure 8.2 (L) 1.3.

ADo 4

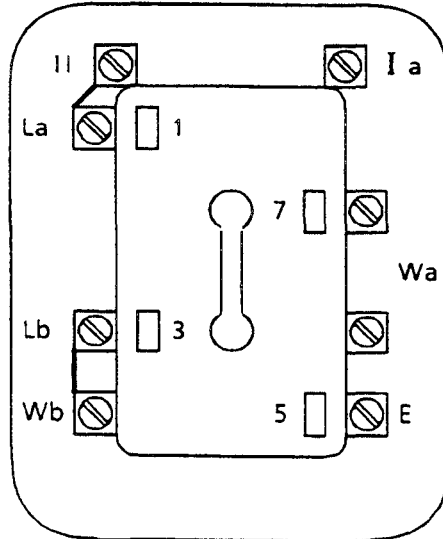


Figure 8.2 (L) 1.1: Standard socket

ADoS 4

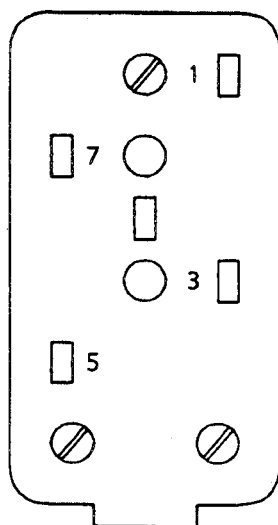


Figure 8.2 (L) 1.2: Standard plug

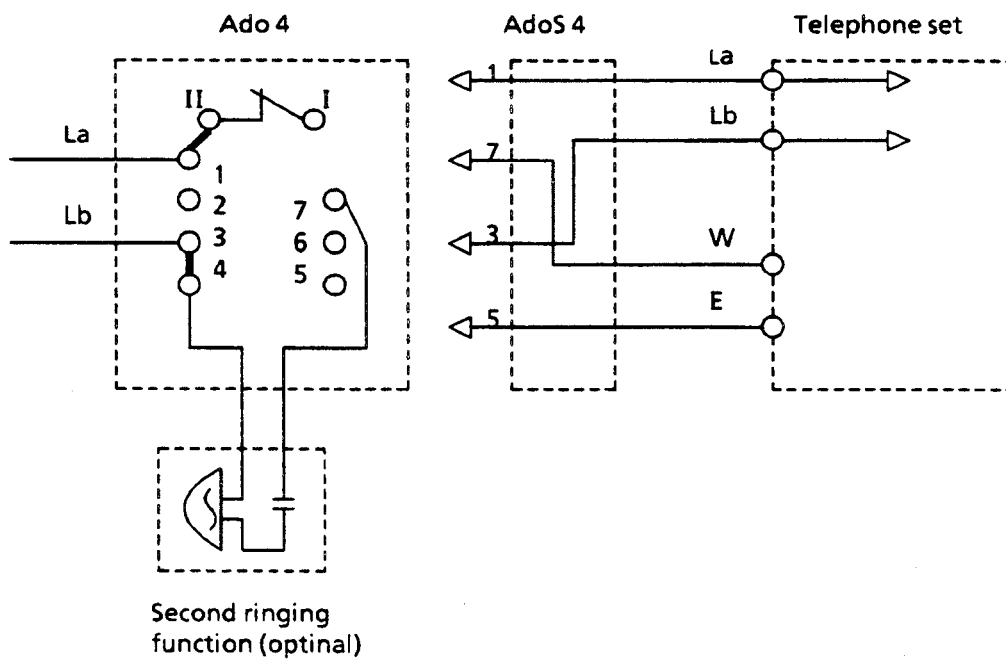


Figure 8.2 (L) 1.3: Wiring plan for single terminal connection for PSTN

8.2 (M) 1

Information not available at the moment.

8.2 (NL) 1

For signal terminal connection, PTT Telecom is providing a 4-pin socket. Drawings of this socket including the plug of the TE are shown in figure 8.2 (NL) 1.1 and figure 8.2 (NL) 1.2.

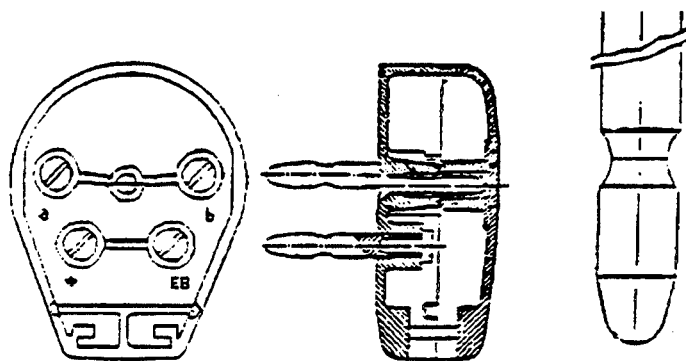


Figure 8.2 (NL) 1.1: 4-pin plug of PTT

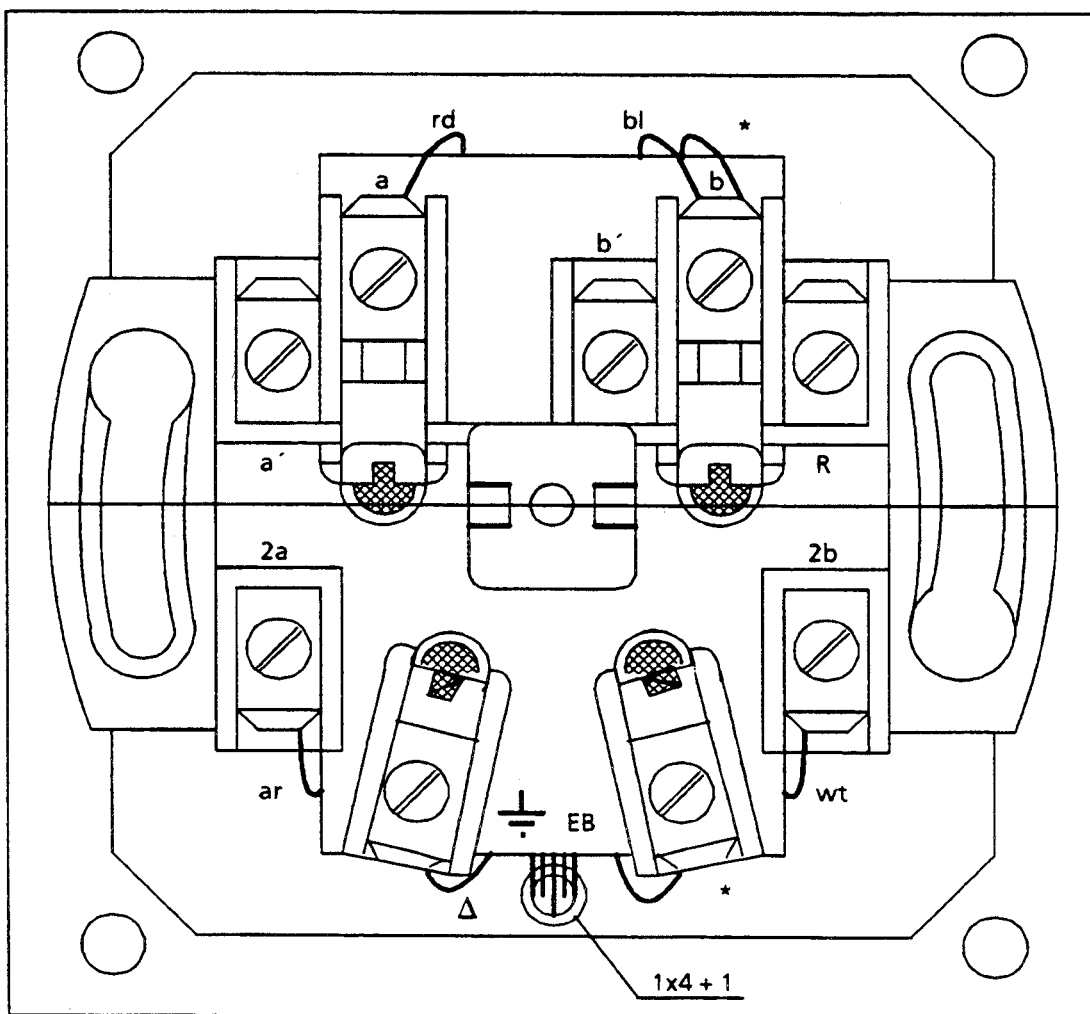


Figure 8.2 (NL) 1.2: Socket of PTT

This connection plug and socket is not mandatory. Other methods are allowed but not provided by PTT Telecom.

In normal cases PTT Telecom will supply the described standard connection box to the subscriber with the first installation.

8.2 (N) 1

Single line terminal connections at the PSTN CP shall use a standard plug attached to the TE, to be plugged into the socket provided by the NT.

This shall be an 8-pole (EN 28877) plug. A 3-pole plug or an appropriate adaptor should be available as an option.

The 3-pole plug is described in figure 8.2 (N) 1.1. Both of these are compatible with the NTA socket shown in figure 8.2 (N) 1.2. The terminals 2 and 1 are for the a- and b-wires respectively. The terminal 3 is reserved for an earth connection to the TE (if required for the PABX register recall function).

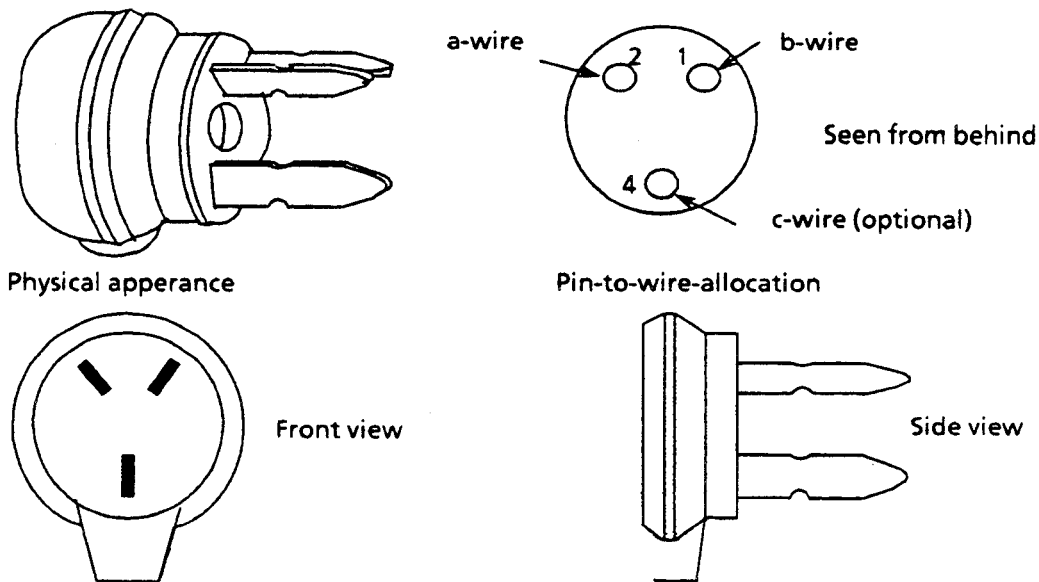


Figure 8.2 (N) 1.1: The 3-pole plug

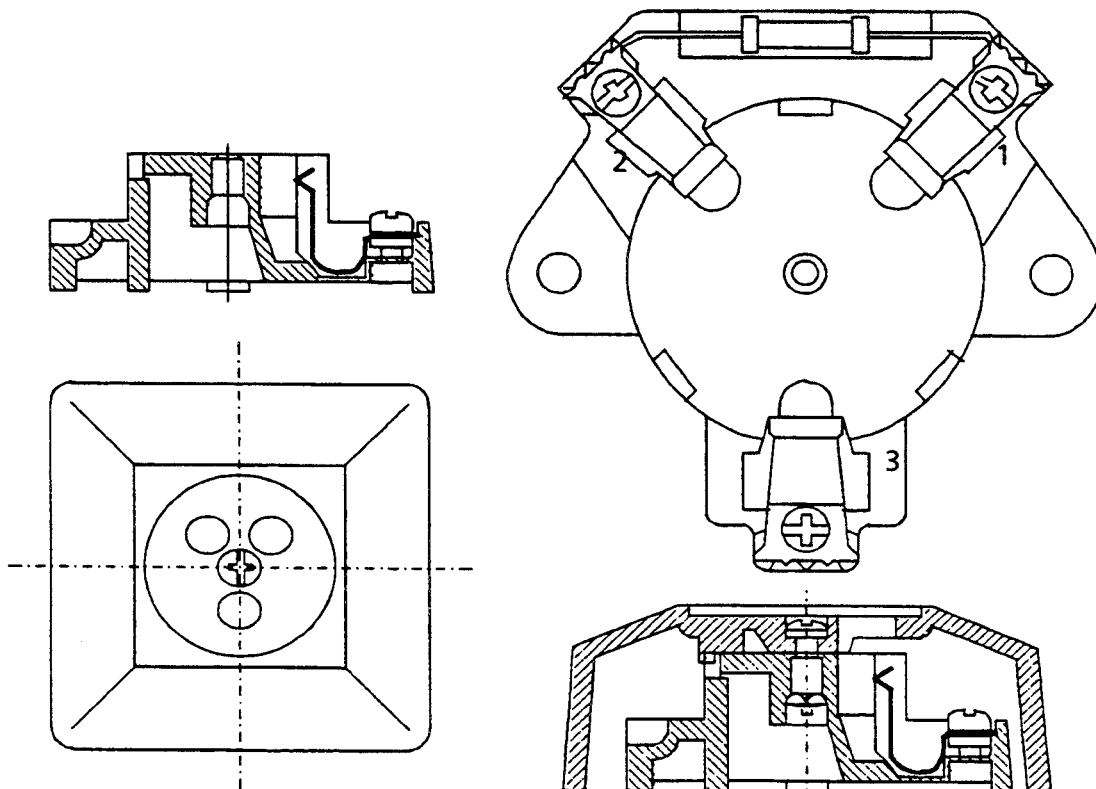


Figure 8.2 (N) 1.2: 3-pole PSTN single line socket

The alternative Norwegian 8-pole plug and socket system (see section 8.1) is based on the standardised ISDN plug, as specified by the ISO 8877 standard.

The modular plug and socket are described in figure 8.2 (N) 1.3. (As may be seen, this plug & socket system is in Norway used for several types of applications, including leased circuits, data networks, connections and of course ISDN).

Application	Pin no.							
	1	2	3	4	5	6	7	8
Analogue telephone				B	A			
Telex				B	A			
Leased CCTS 2-Wire				B	A			
Leased CCTS 4-Wire			U	I	I	U		
DATEX = CSPDN 2-Wire				B	A			
DATEX = CSPDN 4-Wire			U	I	I	U		
ISDN	Note		U	I	I	U	P2	P2

- A = a-wire
- B = b-wire
- I = incoming signal (from network)
- U = outgoing signal (from the TE)
- P2 = power supply to the TE

NOTE: The pin allocation for ISDN is defined by ISO 8877: 1987 (E) except that P3 (power from the TE) on pins 1 and 2 shall not be used in Norway.

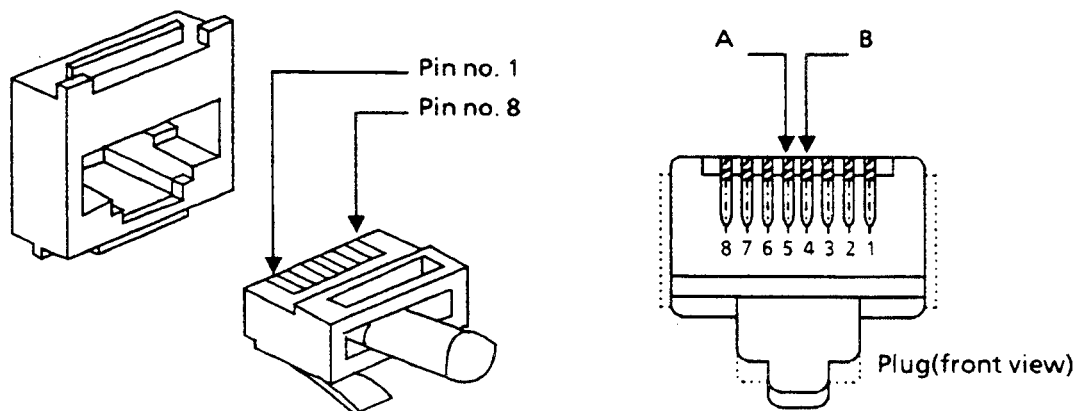


Figure 8.2 (N) 1.3: 8-pole modular socket and plug with wiring scheme

The two alternative plugs, 3-pole or 8-pole, as described above are the only connection components which have to comply with the Type Approval Regulations. This is required in order to ensure compatibility with the NT provided sockets which are the boundary towards the public network of NT. Compliance is checked by inspection.

8.2 (P) 1

Special socket and plug ADO 8 / ADOS 8

This connection method is:

- recommended by TLP for all types of TE which are not telephone sets;
- mandatory for facsimile machines, in the area of CTT.

When used for the connection of facsimile machines to the PSTN, the allocation of the pins of the plug is as follows:

Pin no.	Allocation
1	a ₁ -wire
2	not used
3	not used
4	b ₁ -wire
5	b ₂ -wire (for associated telephone set)
6	not used
7	not used
8	a ₂ -wire (for associated telephone set)

The plug and socket are shown in figure 8.2 (P) 1.

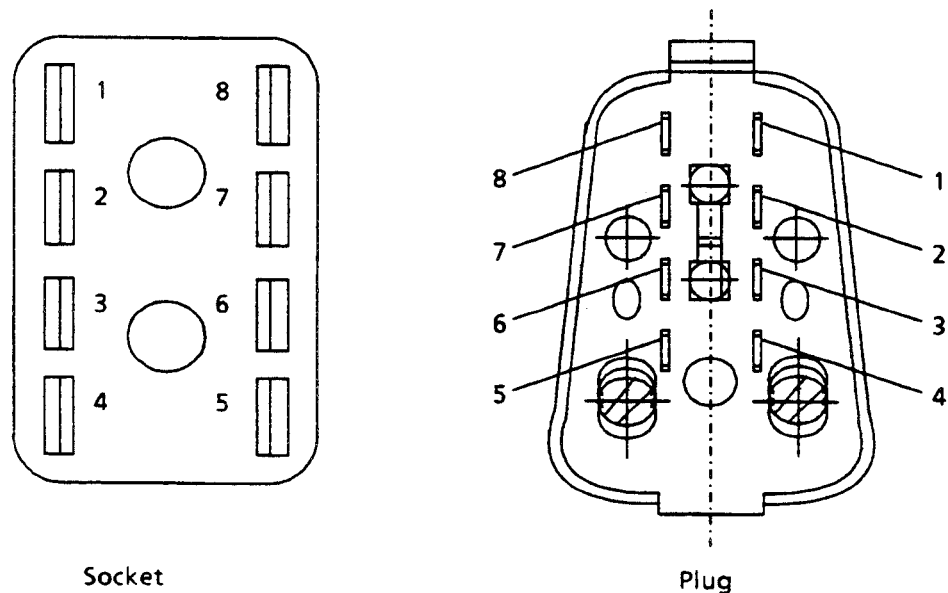


Figure 8.2 (P) 1: Special socket and plug ADO 8 / ADOS 8.

8.2 (P) 2

6-pin socket and plug

This connection method will be used in all new installations from the 1st of July 1990, at the latest, to connect to the PSTN:

- single telephone sets;
- other types of TE, depending on further decisions.

The socket shall comply with the CTT/TLP Technical Specification 226.19.003. The plug is specified in the US Federal Communications Commission (FCC), Part 68 (Connection of Terminal Equipment to the Telephone Network), Subpart F (Connectors), Section 68.500 (Specifications), Subsection (a) (Miniature 6-position plug) and should be equipped either with 4 contacts or with 6 contacts.

The allocation of the pins of the 4 contact plug is as follows:

Pin no.	Allocation
1	not used
2	shunt-wire
3	a-wire
4	b-wire
5	additional facility
6	not used

The allocation of the pins of the 6 contact plug is as follows:

Pin no.	Allocation
1	additional facility
2	shunt-wire
3	a-wire
4	b-wire
5	additional facility
6	special-wire for single telephone sets with "low impedance ringers".

When this connection method is used, a RC-network ($R = 100 \text{ kohms} \pm 10\%$; $C = 1.8 \mu\text{F} \pm 15\%$) to terminate the PSTN line (a and b wires) is provided in the installation, outside the sockets. The capacitor in the RC-network is common to all TE in the installation via the shunt wire. The ringing detector in the TE, when provided, is connected either across the shunt wire and the special wire.

The connection of single telephone sets to the socket is shown in figure 8.2 (P) 2.1 and 8.2 (P) 2.2.

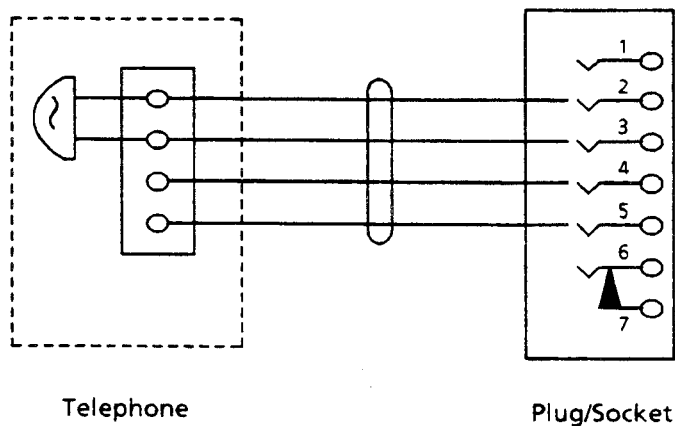


Figure 8.2 (P) 2.1: Connection of single telephone sets with "high impedance ringers"

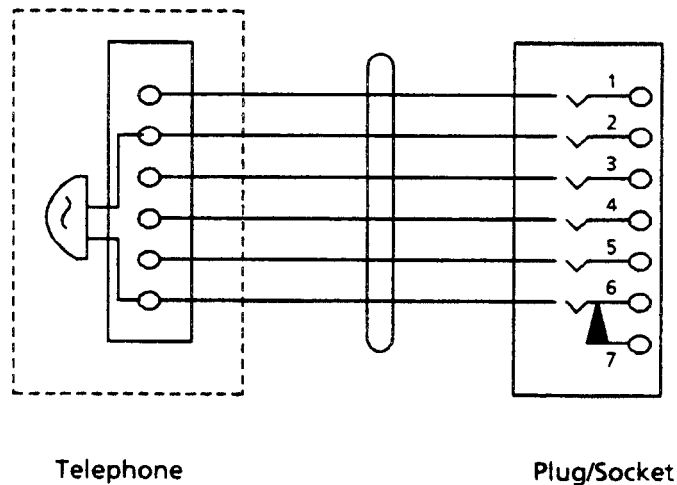


Figure 8.2 (P) 2.2: Connection of single telephone sets with "low impedance ringers"

8.2 (E) 1

General

- PROVISION 1: The contents of this section 8.2 (E) 1 shall be applied to all Spanish sections (E) in this Chapter 8.
- PROVISION 2: All terminal equipments shall use one or more than one of the connection methods stipulated in sections 8.2 (E) 2 and in 8.3 (E).
- PROVISION 3: A terminal equipment can (or shall) use other connection methods, different from those required in sections 8.2 (E) 2 and in 8.3 (E), when they became permitted (or required) in another mandatory specification that shall be simultaneously applied to that terminal equipment.
- PROVISION 4: Different physical connection methods shall be provided depending whether a terminal equipment is prepared for being connected in parallel mode, or a series terminal equipment is prepared for being connected (at least a part of its lines) in series mode.

A terminal equipment

- a) may use a parallel connection method, unless it becomes forbidden in another mandatory specification that shall be simultaneously applied to that terminal equipment;
- and
- b) cannot use a series connection method, unless it becomes literally permitted in another mandatory specification that shall be simultaneously applied to that terminal equipment.

PROVISION b:

However, for terminal equipments which are prepared for transmitting data or code signals, it is permitted to use a series connection method without any other additional permission.

- PROVISION 5: When the terminal equipment is provided with an earth protection terminal, it shall be placed separately from the contacts of the connectors required in sections 8.2 (E) 2 and in 8.3 (E).
- PROVISION 6: Compliance with the requirements in this section 8.2 (E) 1, and in sections 8.2 (E) 2 and in 8.3 (E), shall be checked by the tests outlined in the following provisions 7 and 8.

PROVISION 7: The general test procedure to follow is to check by inspection and according with the user's manual and other technical documentation, and other relevant specifications, which type of physical connection is provided by the terminal equipment under test.

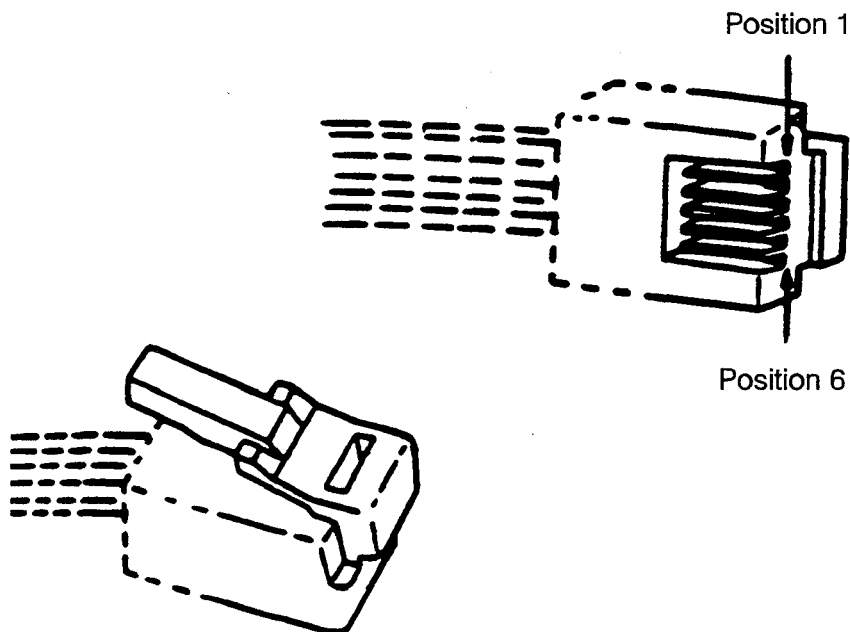
PROVISION 8: The specific test procedure to follow, is to check by inspection and using the user's manual and any other technical documentation that the stipulated connector(s) meet(s) the requirements, and that the layout of the connections (or wiring) is as stipulated in the relevant associated requirement(s).

8.2 (E) 2 Single line parallel connection method

PROVISION: The single line parallel connection method may be used, either in a terminal equipment which is prepared for being connected in parallel mode to only a line, or for every line connected in parallel mode in a multi-line terminal equipment.

Terminal equipments that use the single line parallel connection method shall be provided for every involved line with a miniature 6-position plug (see in figure 8.2 (E) 2 an illustrated representation of the plug and its contact numeration), where

- a) the line terminals ("a1", "b1") shall be respectively connected to contacts 3 and 4;
- and
- b) the contact 5, when provided and when necessary, is used as a common reference terminal for 50 Hz metering pulses reception (see section 1.4.3 (E) 1);
- and
- c) contacts 1, 2, and 6, may not be provided, and in any case shall be isolated between them and from any part of the terminal equipment.



NOTE: (Normative)
Plugs may be made longer than shown or adapted (see doted line) for direct use on terminal equipments without cord.

Figure 8.2 (E) 2: Miniature 6-position plug

8.2 (S) 1

Installation with sockets of the type used by Swedish Telecom

The permanent subscriber installation via which privately-owned equipment may be connected to the PSTN consists, in principle, of one or more connection sockets. See figure 8.2 (S) 1.1.

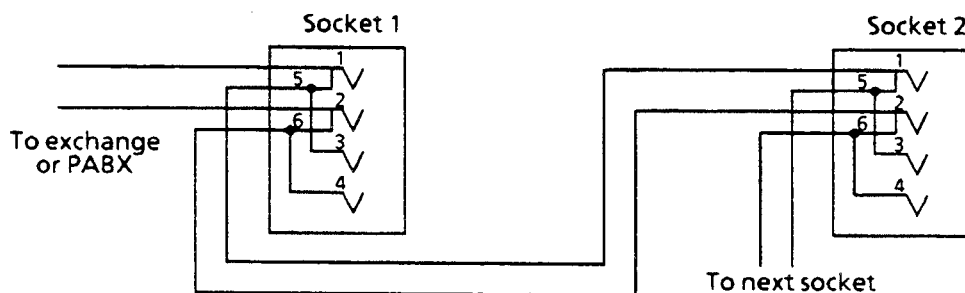


Figure 8.2 (S) 1.1: Wiring of used plug and sockets

Each socket incorporates a contact function arranged in such a way that equipment connected to the socket is connected into the line, in cascade, in accordance with the two-port principle, see figure 8.2 (S) 1.2.

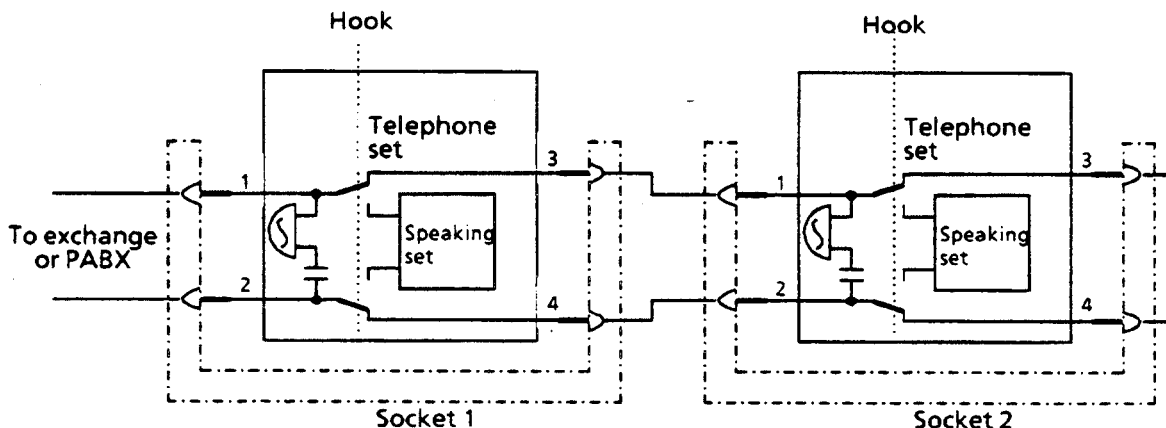


Figure 8.2 (S) 1.2: Wiring of used plug and sockets

Items of equipment that are to be connected to the PSTN by means of plugs are normally connected via a 4-wire system.

Before any circuit other than (perhaps) a ringing signal detector is connected to the line, the item of equipment in question shall open all branches behind the equipment. When such a circuit is disconnected, the branches behind the equipment shall be connected again. In situations where connection is accomplished by means of continuous make-and-break contacts that can be held at their intermediate position, the line shall be short-circuited during the changeover phase (because of privacy considerations).

A device designed for two-wire connection may also be accepted. Connection shall be restricted to pins 1 and 2 of the plug. When such a device is connected to a socket, the subsequent sockets are disconnected.

The connection of 2-wire devices which do not require disconnection of the line behind (ringing signal detectors for example) shall be carried out as shown in figures 8.2 (S) 1.3 and 1.4. The connection of 4-wire devices shall be carried out as shown in figure 8.2 (S) 1.5.

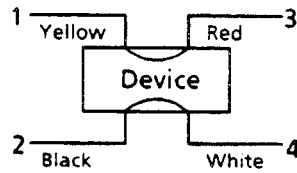


Figure 8.2 (S) 1.3: Wiring of used plug and sockets

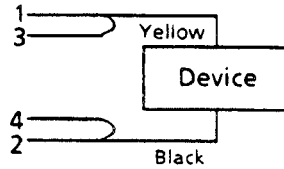


Figure 8.2 (S) 1.4: Wiring of used plug and sockets

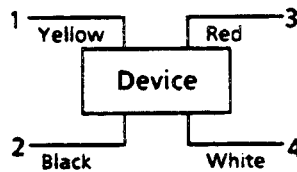


Figure 8.2 (S) 1.5: Wiring of used plug and sockets

The device cord shall be connected to the plug as shown in figure 8.2 (S) 1.6

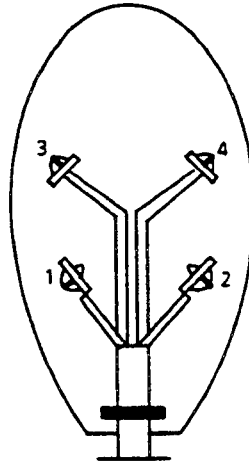


Figure 8.2 (S) 1.6: Wiring of the used plug and sockets

8.2 (S) 2

Installation with socket according to SS-ISO 8877.

The socket shall be designed according to SS-ISO 8877. With contact numbers assigned according to SS-ISO 8877 the contacts 4 and 5 shall be used for the connection of the subscriber line towards the telephone network and the contacts 3 and 6 may be used for the connection of a line to the next socket, if any. The contacts 1, 2, 7 and 8 are not used here.

8.2 (CH) 1

For all single terminal connections use of the T + T 83 or T + T 87 plug is mandatory. The T + T 87 plug is only for telephones. The T + T 83 connection system is shown in figure 8.2 (CH) 1.1. For TE connecting to an old socket (figure 8.2 (CH) 1.2), an adapter plug is used.

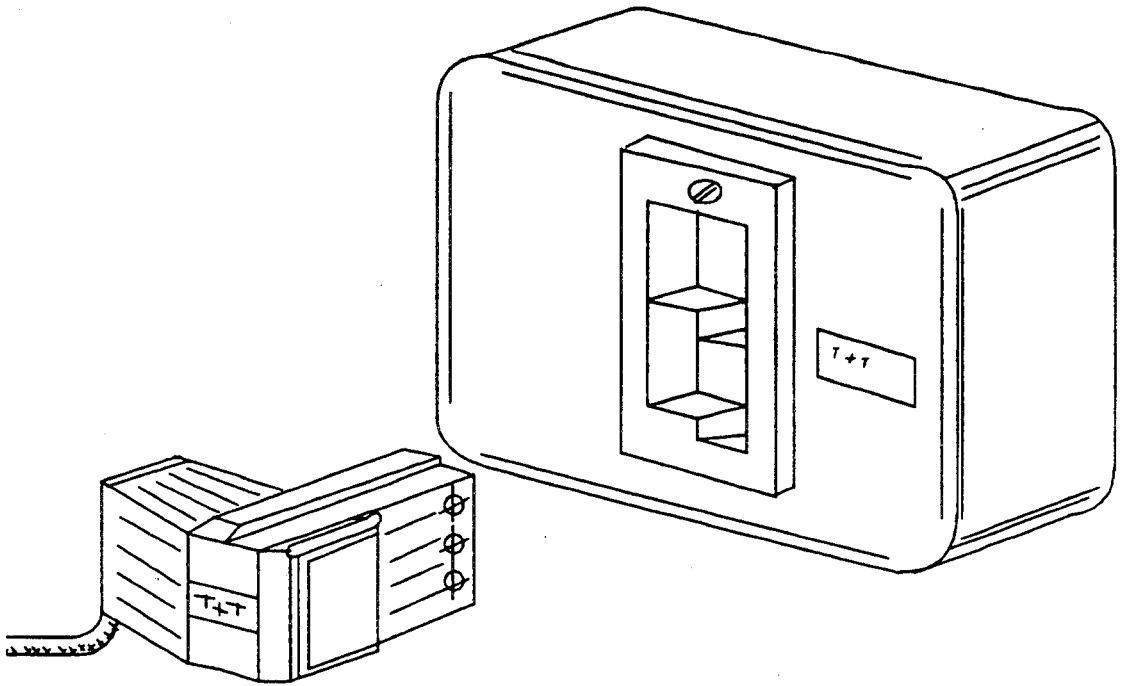


Figure 8.2 (CH) 1.1: Plug and plug socket T + T 83

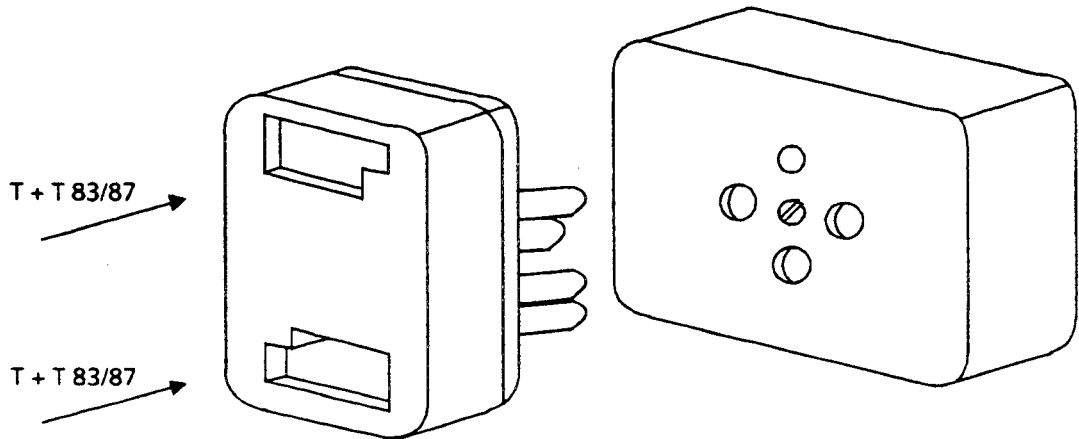


Figure 8.2 (CH) 1.2: Adapter plug and plug socket (old version)

The telephone cord can be fixed tightly (e.g. screwed) to the TE (screwed connections shall only be accessible by tools). Between telephone cord and TE a plug system can also be used. If a 6-pin FCC type is used, wires must be connected according to figure 8.2 (CH) 1.3 to figure 8.2 (CH) 1.5.

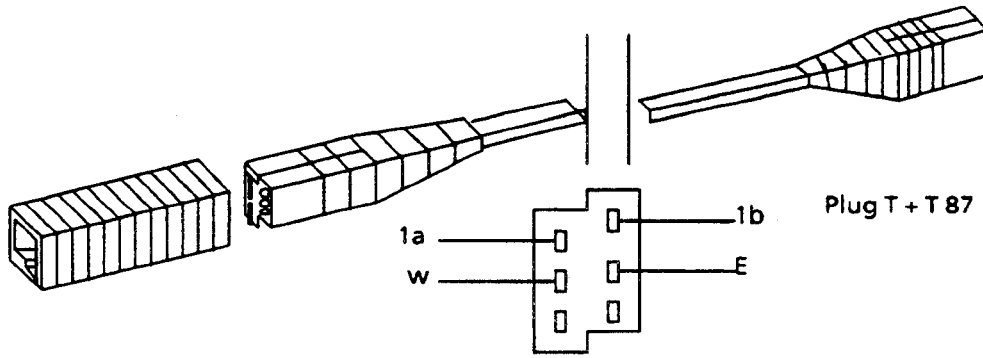


Figure 8.2 (CH) 1.3: FCC connection system

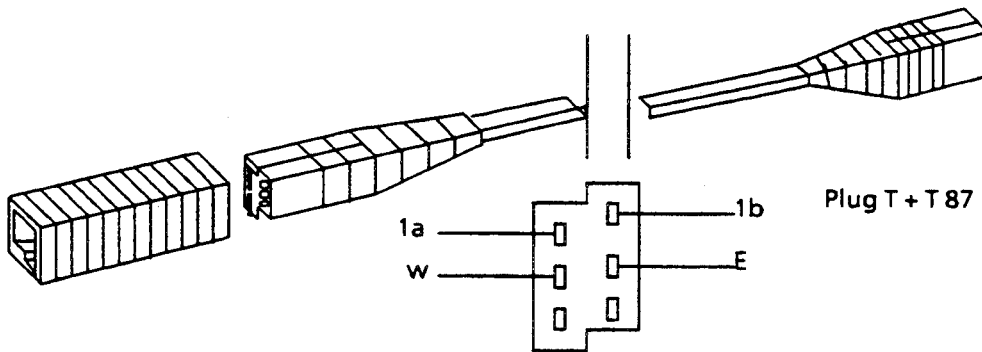


Figure 8.2 (CH) 1.4: Extension cable

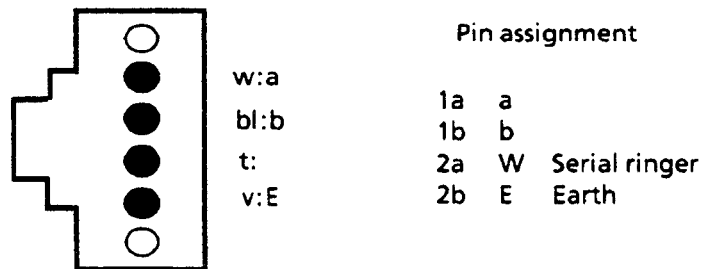


Figure 8.2 (CH) 1.5: Wire assignment if FCC plug on terminal side

The different methods of connection are specified in figure 8.2 (CH) 1.6 to figure 8.2 (CH) 1.9.

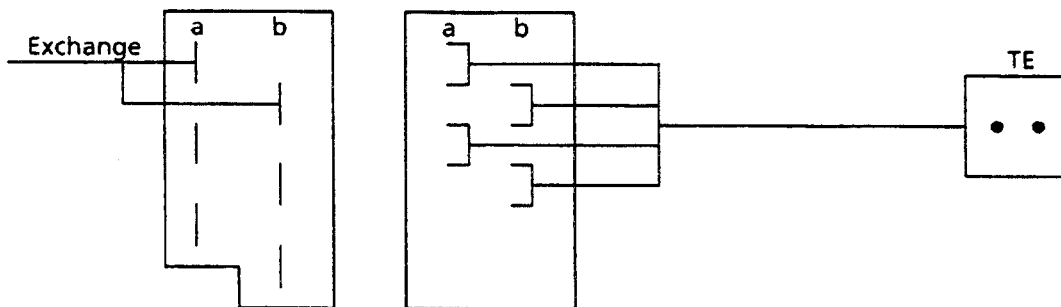


Figure 8.2 (CH) 1.6: T + T 83 connection system with single TE

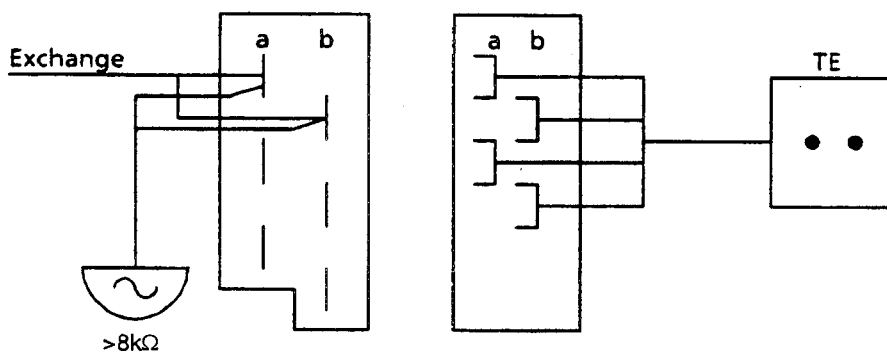


Figure 8.2 (CH) 1.7: T + T 83 connection system with single TE with parallel ringer

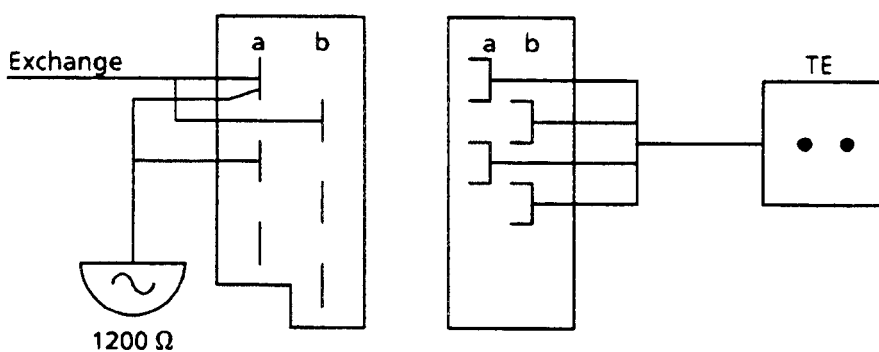
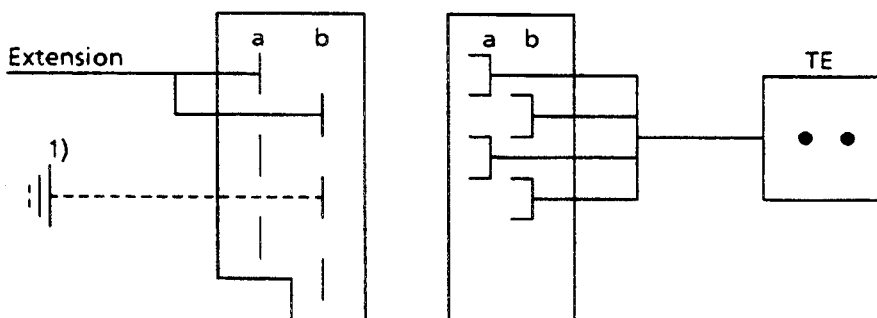


Figure 8.2 (CH) 1.8: T + T 83 connection with single TE with serial ringer



1) For decadic dialling (loop pulsing) needed

Figure 8.2 (CH) 1.9: T + T 83 connection system with single TE behind PABX

8.2 (GB) 1

Normal connection method

The TE plug to fit the socket which normally presents the interface of the PSTN is specified in BS6312 Part 1.

The allocation of the plug is as follows:

<u>Contact no.</u>	<u>Allocation</u>
1	Subject to additional national requirements
2	A wire
3	Connection to signalling earth (when required)
4	Shunt wire (when utilised)
5	B wire
6	Subject to additional national requirements

The latch is adjacent to contact no. 6.

The A and B wires within the PSTN may be subject to transposition.

The socket provides for two-wire connection between A and B wires of the PSTN and the TE, or three-wire connection where an additional shunt wire is derived by means of circuitry within the NTTA.

Contact 3 of the socket may be used to provide an earth connection.

A representative installation showing the PSTN terminating circuitry, derivation of the shunt wire, and parallel-connected sockets is shown in figure 8.2 (GB) 1.2.

Where a three-wire connection is to be used, the connections to the plug are as shown in figure 8.2 (GB) 1.3, where the transmission and MF or decadic dialling circuits are connected across the A and B wires, and the ringing detector circuit is connected between the A and shunt wires.

The shunt is typically a circuit of 100 ohm resistance between the A and shunt wires of the TE. This circuit must be connected at least in the decadic dialling condition but must be removed when the TE is in the quiescent condition.

The purpose of the shunt wire is to provide a means for preventing the ringing detector of TE (particularly telephones) from responding to decadic dialling pulses from parallel connected TE.

Where a two-wire connection is to be used, the connections to the plug are as shown in figure 8.2 (GB) 1.4, where the transmission and MF or decadic dialling circuits, and the ringing detector circuits are connected across the A and B wires. TE connected in this way cannot electrically suppress the ringing detectors of parallel-connected TE.

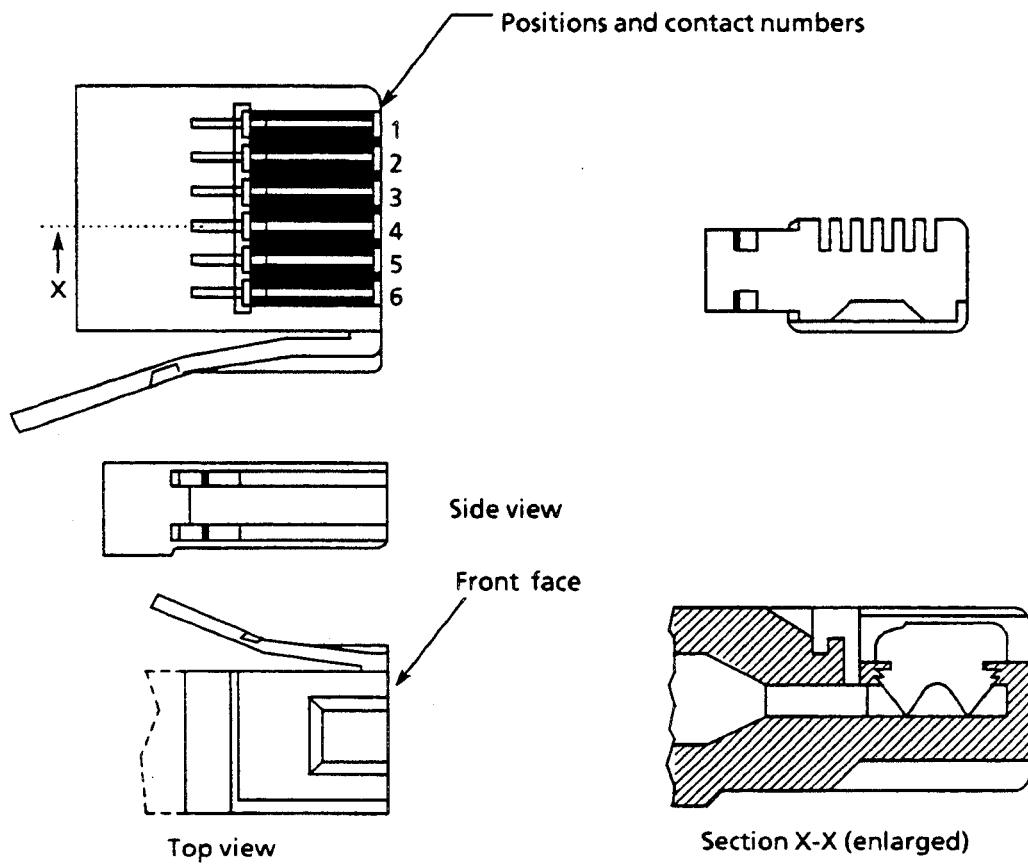
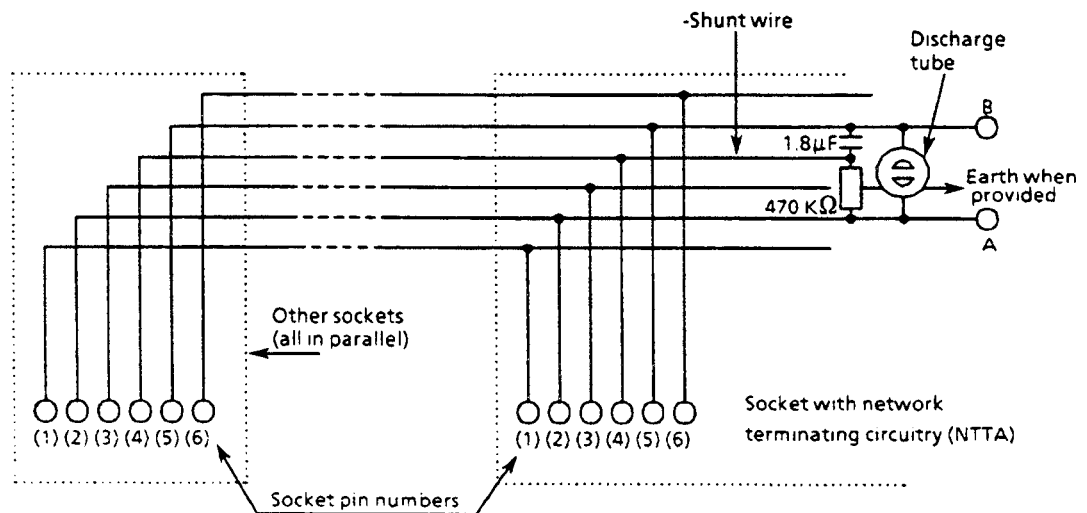


Figure 8.2 (GB) 1.1: Diagram of plug



NOTE 1: Wiring to socket pins (1) and (6) may not be provided, and such wiring when provided is not used by network attachments.

NOTE 2: Pin 6 is adjacent to the latch. See BS 6312: 1985.

Figure 8.2 (GB) 1.2: Typical network connection points, showing wiring and sockets

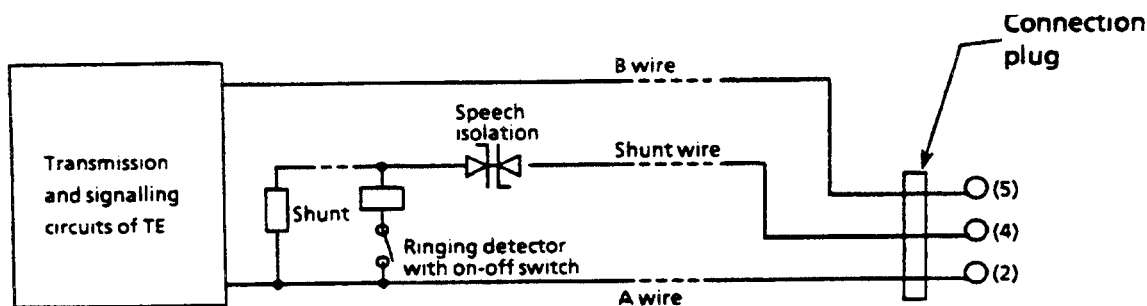


Figure 8.2 (GB) 1.3: Simplified circuit of TE suitable for 3-wire connection

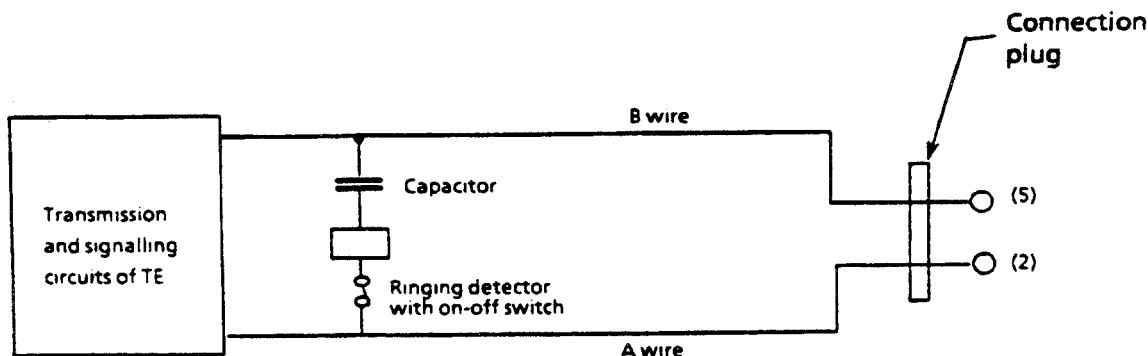


Figure 8.2 (GB) 1.4: Simplified circuit of TE suitable for 2-wire connection

8.2 (GB) 2 Alternative connection arrangements

Certain TE, e.g. modems, where national requirements permit, use one of the connection methods described as follows:

- a) solid copper conductors of size between 0,38 mm and 0,65 mm diameter;
- or
- b) a lead that is not detachable by the user and that is either fitted with a plug, BT no. 420, or suitable for connection to 2,8 mm screw terminals. The instructions for use shall state that this method will not be applicable for new connections to networks operated by certain PTO's.

8.2 (GB) 3 Connection leads

Approval of the TE includes the lead and the plug where provided. Where the TE is either:

- (a) not provided with a lead;
- or
- (b) is provided with a lead that is detachable by the user:
 - (i) no requirements are specified for the terminals of the TE, i.e., the point of connection between the TE and the detachable lead (Test point TP3 defined in Chapter 1, Section 1.4.4.4);
 - (ii) the means of direct connection to the PSTN listed in 8.2 (GB) 1 or 8.2 (GB) 2 will normally apply.

TE conforming to (a) or (b) above shall be supplied for test purposes with a $2,5 \pm 0,25$ metre length of cable terminated at the apparatus end with a suitable connector and terminated at the network end by one of the methods listed in 8.2 (GB) 1 or 8.2 (GB) 2.

8.3 Simple and multiple connection for PSTN-access

8.3 (A) 1 The multiple terminal connection to the PSTN line is described in paragraph 8.2.

8.3 (B) 1 The connection to a PSTN line, of series-connected TE has to be made with an intermediate plug, the pattern of which is described in figure 8.3 (B) 1.1.

This plug is compatible with the socket described in paragraph 8.1 (B) 1 and with the plug described in paragraph 8.2 (B) 1.

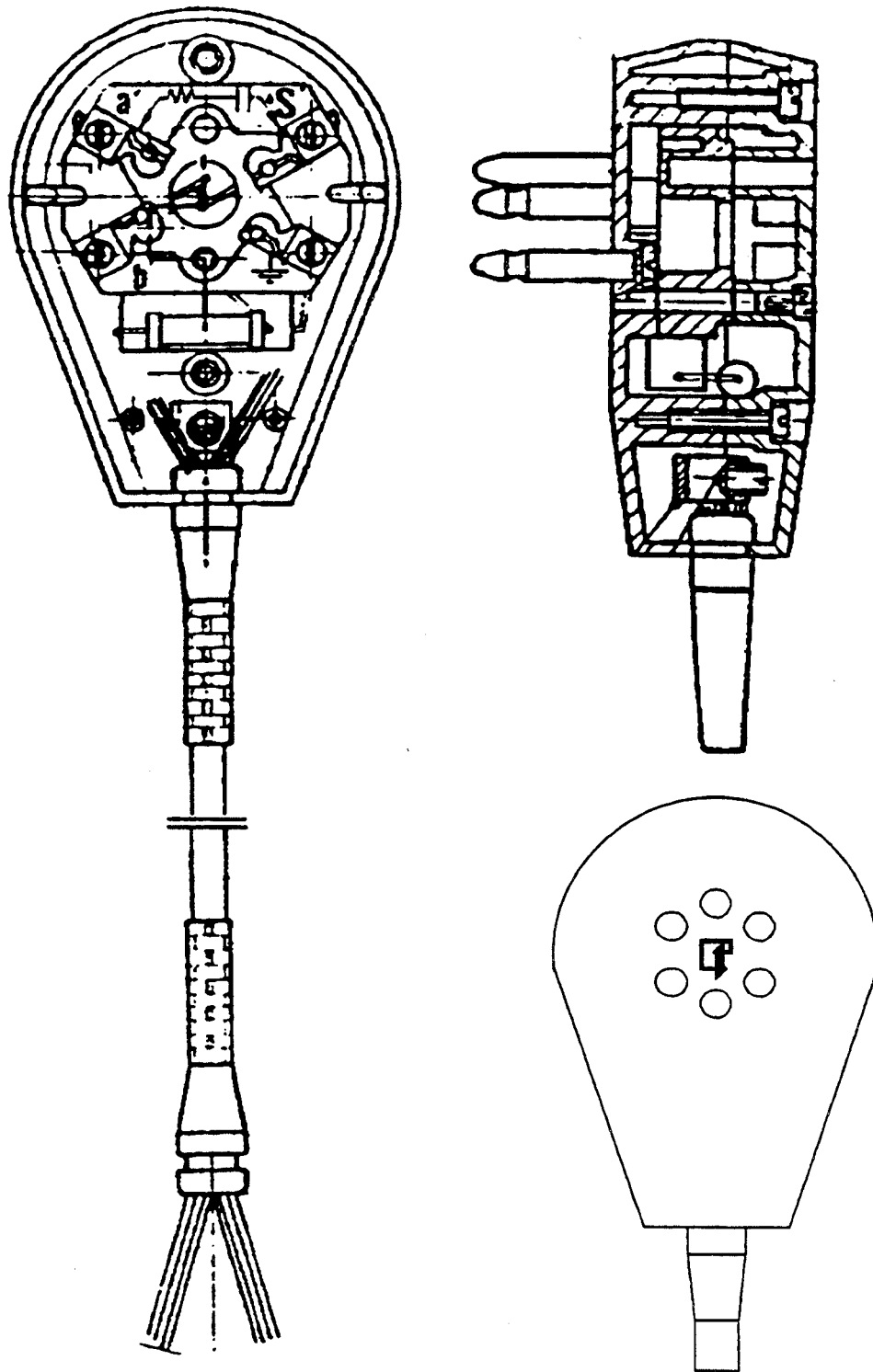


Figure 8.3 (B) 1.1: Belgian standard intermediate plug

The intermediate plug is used with an 8 wire extension cord or with a 4 wire extension cord. The model of extension cord and its wiring depend on the type of equipment and its operation mode with the telephone set connected to the (a', b') side of the intermediate plug.

The general wiring of an 8 wire cord is given in figure 8.3 (B) 1.2, and the one of a 4 wire cord is given in figure 8.3 (B) 1.3 but each particular wiring depends on the TE type. The RC network (the same as for the socket) is not always required; if it is used, it is also automatically disconnected from the line when a telephone set is plugged in this intermediate plug.

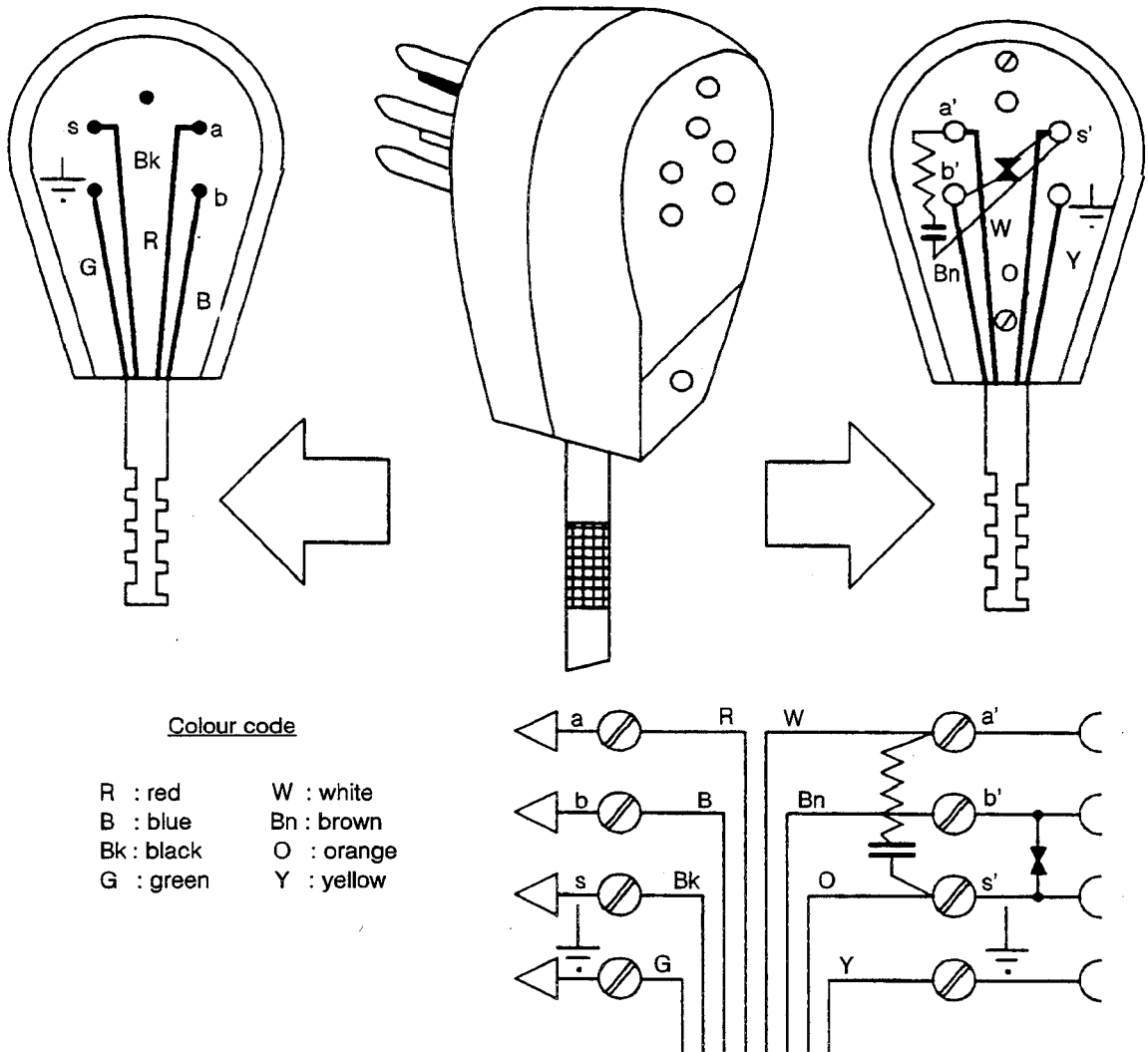


Figure 8.3 (B) 1.2: Wiring of intermediate plug (8 wires)

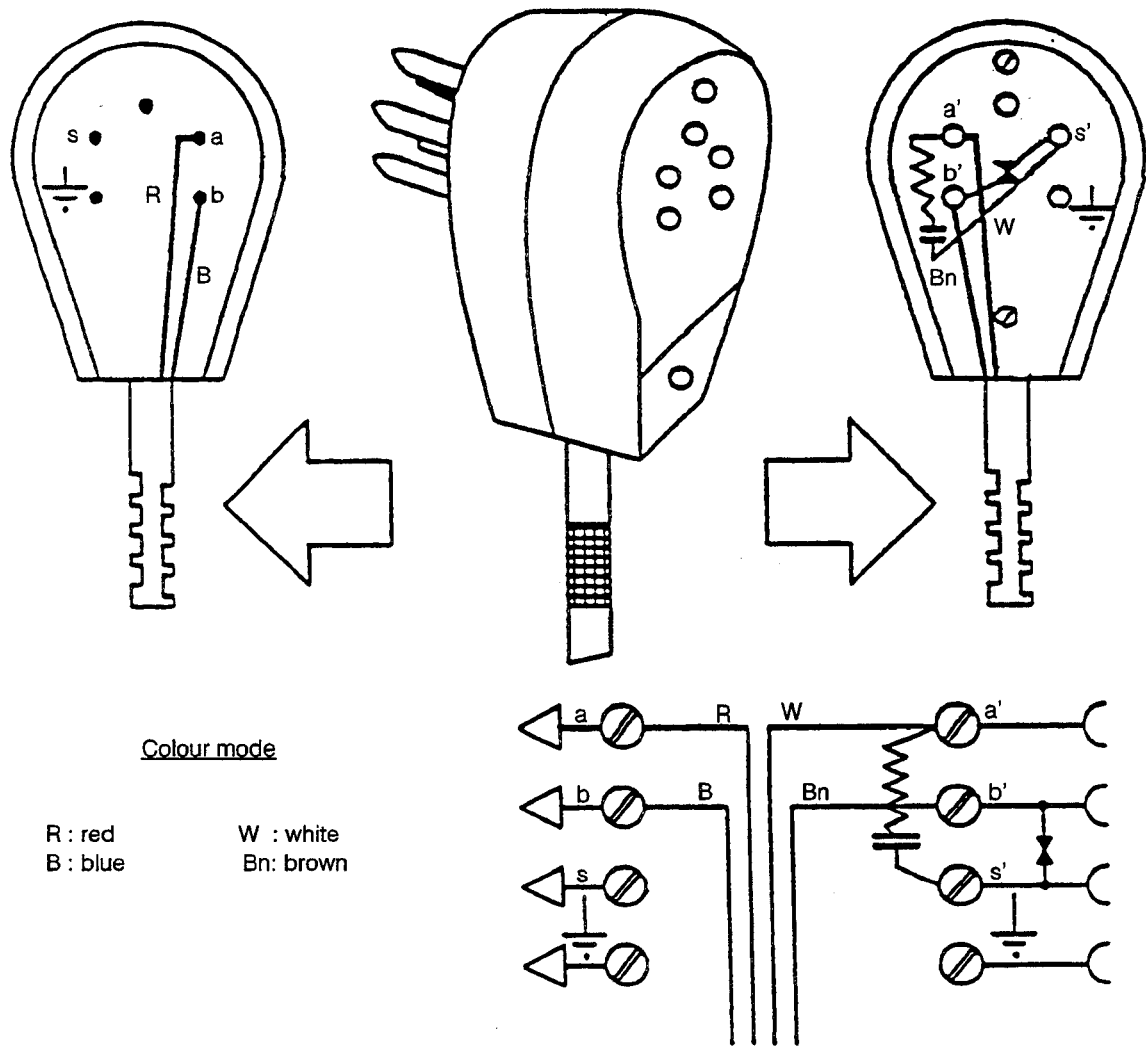


Figure 8.3 (B) 1.3: Wiring of intermediate plug (4 wires)

8.3 (CY) 1

For simple multiple connections dual outlet sockets and adaptors are available which are electrically connected in parallel. Also quad-outlet adaptors are available. The mechanical and electrical parameters are the same as the simple sockets and plugs described in paragraph 8.2.

8.3 (DK) 1

For simple multiple terminal connections a special 3-pole plug (hermaphrodite connection) is used. By insertion of the special plug between socket and telephone plug, the direct connection between subscriber line and telephone set is interrupted. In this case, a possible connection between subscriber line and telephone set must be established in the TE.

The plug should be shaped like an angle plug. The pins should be positioned in accordance with the diagram. Their contact face must not be split, but shall form an unbroken surface. The pins may move up to 1 mm in all directions. Figure 8.3 (DK) 1.1 shows a simple drawing of the special 3-pole plug and socket connection with the marking of the clamps. The use of the contact / pin numbers is shown in table 8.3 (DK) 1 and the pin positions are shown in figure 8.3 (DK) 1.2.

Clamps in the plug-and-socket connection should be marked as shown in the diagram below.

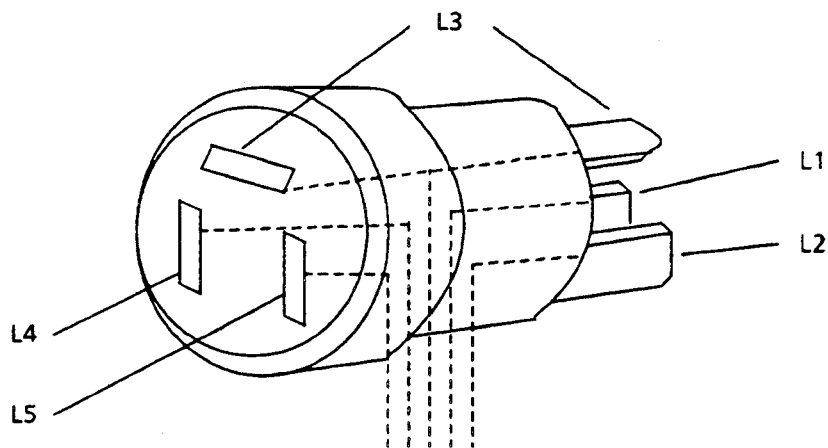


Figure 8.3 (DK) 1.1: Special 3-pole plug - the marking of clamps

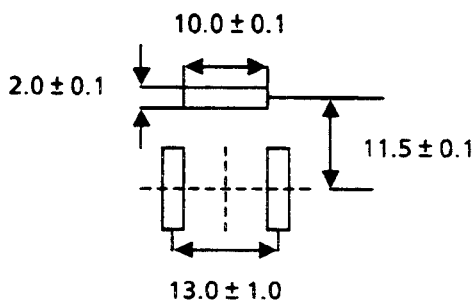
The plug connection is normally used as shown in the following table:

Table 8.3 (DK) 1: Special 3-pole plug the use of contact/pin no.

pin no. 1	L ₁ - or a-wire
pin no. 2	L ₂ - or b-wire
pin no. 3	L ₃ - or gnd-wire
pin no. 4	L ₁ '- or a'-wire
pin no. 5	L ₂ '- or b'-wire

plug

up



pin length 12.0 ± 1.0

Figure 8.3 (DK) 1.2: Pin positions

8.3 (SF) 1

The direct parallel connection is accepted. Normally single line PSTN termination have at least two parallel connected sockets. The parallel connection can also be made with the direct extension plug which has a wiring as described in figure 8.3 (SF) 1. The extension plug has to fit to the socket described in paragraph 8.2.

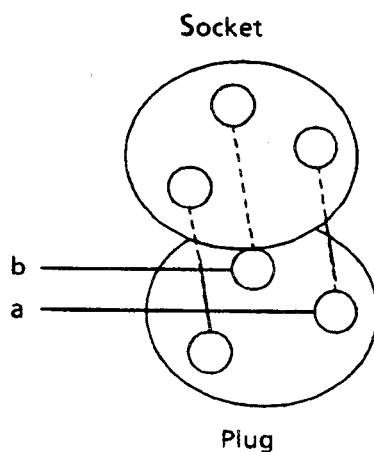
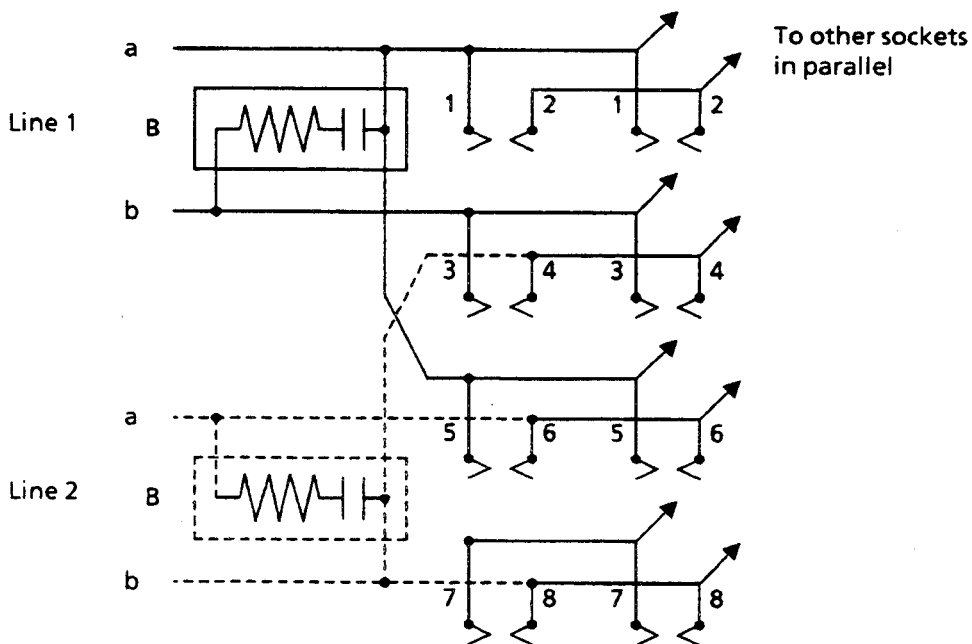


Figure 8.3 (SF) 1: Extension plug wiring

8.3 (F) 1

The connection to a PSTN line of an additional TE shall be made using one of the following ways:

- a) by using an additional parallel socket as described in figure 8.3 (F) 1.1;



B : RC network for testing the line
 ---- : used for connecting to a second subscriber's line

Figure 8.3 (F) 1.1: Wiring plan at subscriber's premises (new version)

- b) by using a "gigogne" plug (plug with incorporated socket) as described in figure 8.3 (F) 1.2;
- c) by using an incorporated socket as described in figure 8.3 (F) 1.2;

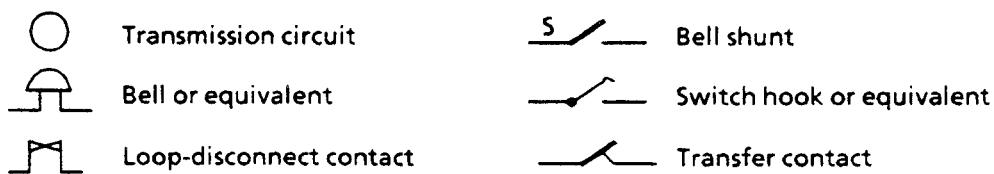
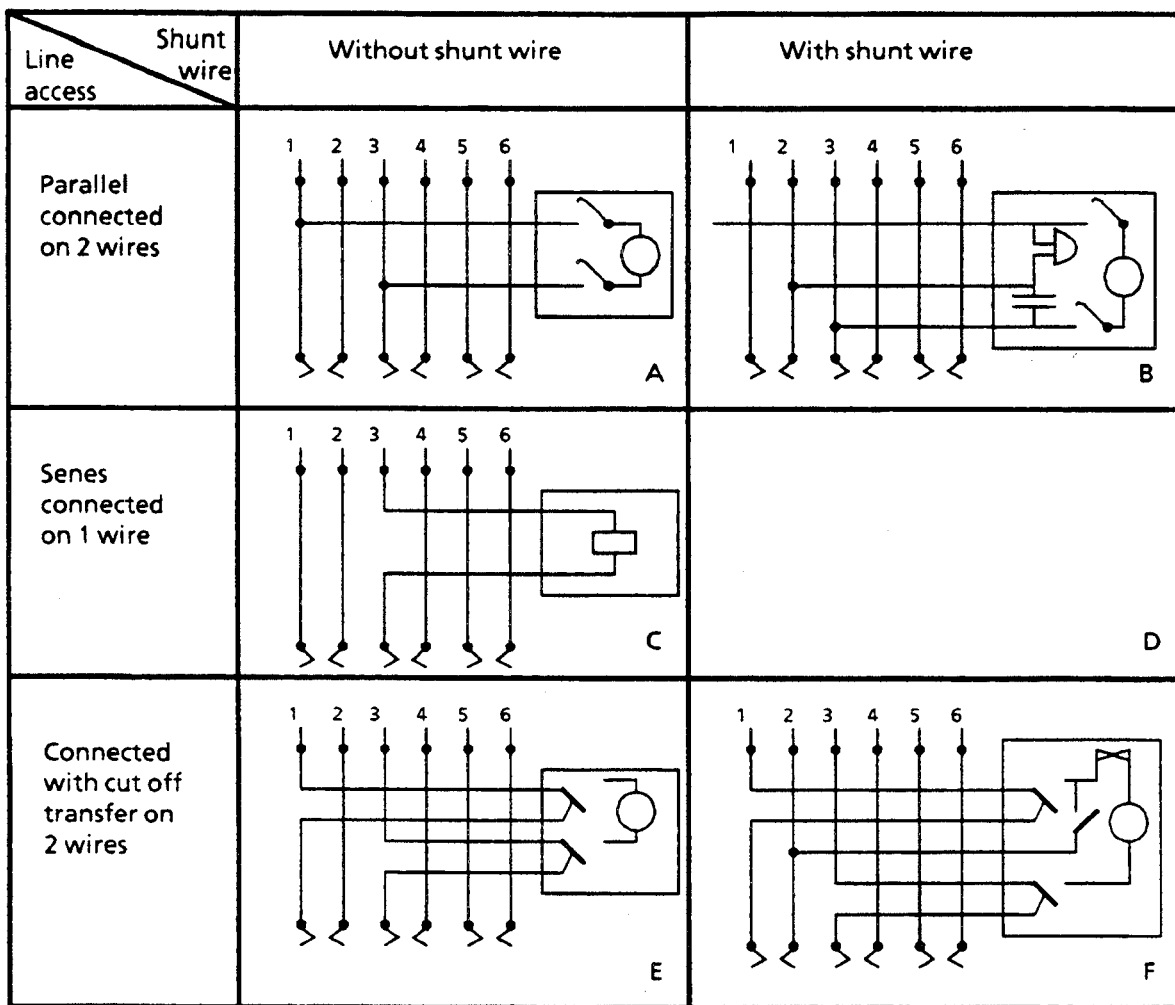
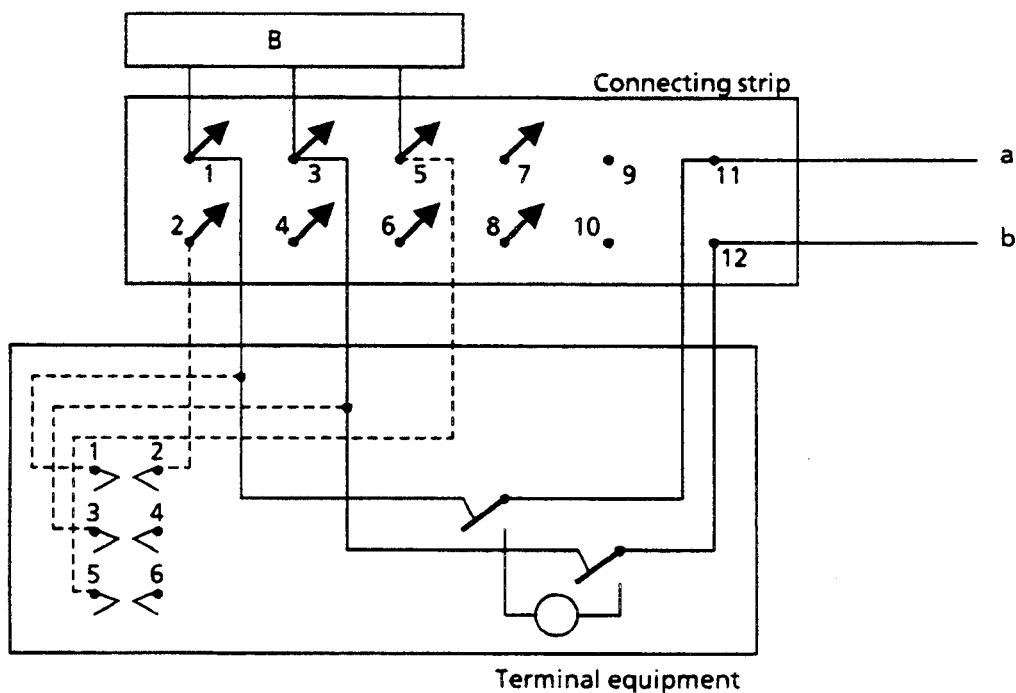


Figure 8.3 (F) 1.2: Multiple terminal connection with "gigogne" plug or incorporated socket

- d) by using a connecting strip as described in figure 8.3 (F) 1.3, only for some types of TE (e.g. meter pulse detector).



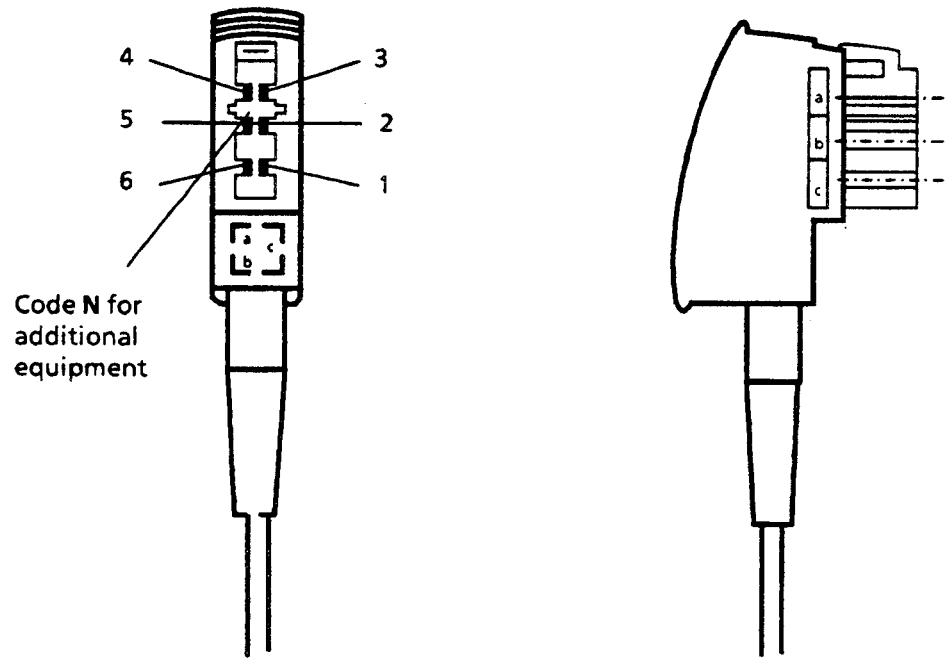
- B : RC network for testing the line
- : used for an incorporated socket
- ↗ : to the 8-pole sockets in the subscriber's premises
- ⏏ : transfer contact if there is a conservation circuit
- : conversation circuit, if it exists

Figure 8.3 (F) 1.3: Multiple terminal connection with connecting strip

8.3 (D) 1

For simple multiple connection to PSTN in principle the connection method described in paragraph 8.2 is used but the plug and socket have other codings. Figure 8.3 (D) 1.1 shows the plug with code N used for all TE which are not telephones. Figure 8.3 (D) 1.2 describes the fitting socket.

For TE with switching facilities (e.g. telephone PABXs) or special type TE which cannot expediently be connected to DIN 41 715 type sockets, the Deutsche Bundespost uses other appropriate inter-connection devices.



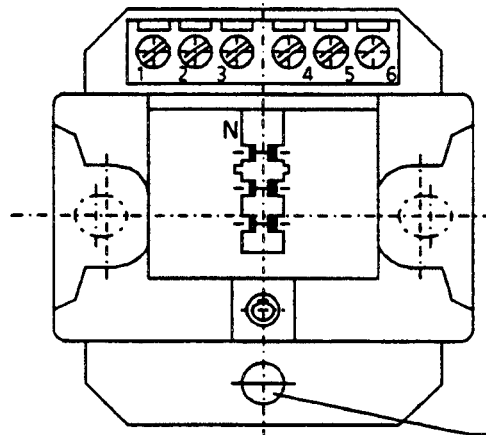
Conductor codes :

- 1 --> a
- 2 --> b
- 3 --> W
- 4 --> E
- 5 --> b₂
- 6 --> a₂

6-way right angle plug type R 1 conforming to DIN Standard 41 715 Part 3

Figure 8.3 (D) 1.1: 6-way plug with code N for all TE except telephone sets

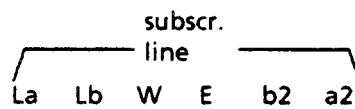
Exploded view of wall socket



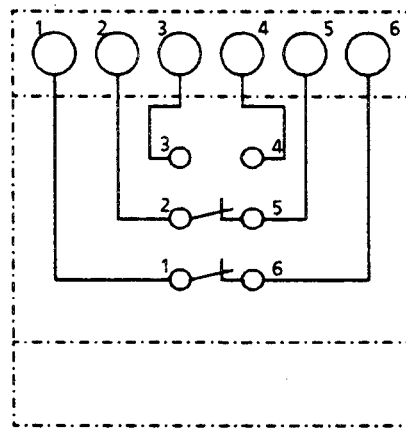
Showing code N

Space for 16-kHz suppressor

Block diagram:



Wall socket



With break contacts

-Configuration of code-

Plug

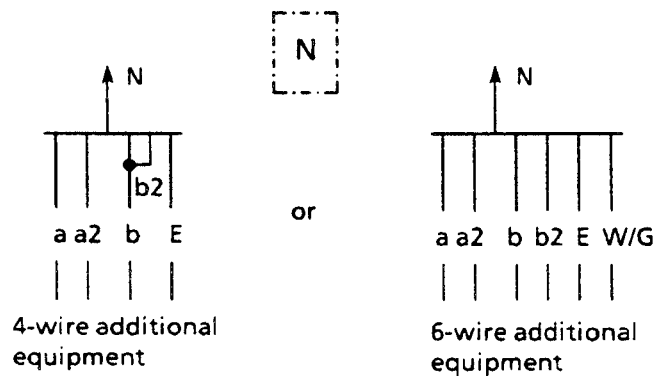
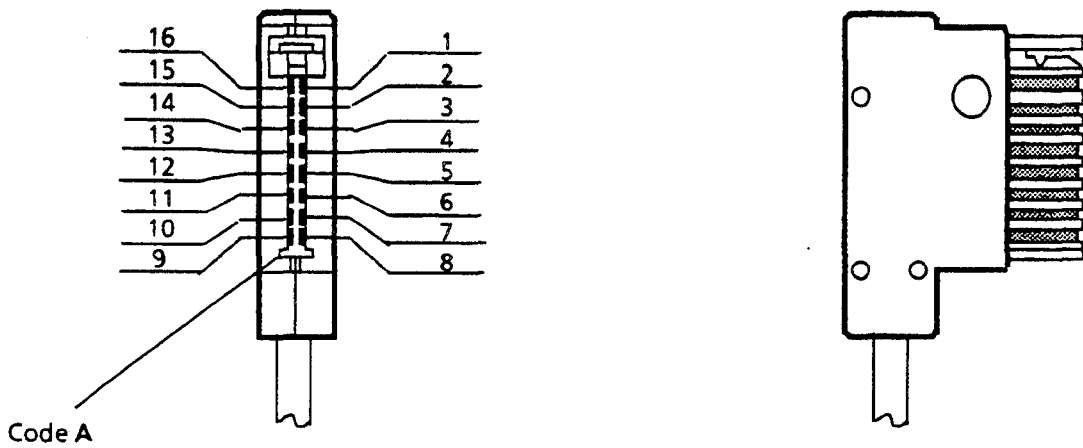


Figure 8.3 (D) 1.2: Simple wall socket with code N

8.3 (D) 2

For connecting TEs to the PSTN, which use more than six wires (e.g. multi-line telephones), the plug shown in figure 8.3 (D) 2 is used.



16-way right angle plug type T conforming to DIN Standard 41 715 Part 5

Figure 8.3 (D) 2: 16 way plug for all TEs using more than 6 wires

8.3 (D) 3

Interaction between various items of terminal equipment

The interaction of various TE with the telephone is detailed by its assignment to different connection arrangements and priority versions (see table 8.3 (D) 3)

Table 8.3 (D) 3: Connection arrangements and priority versions

Terminal equipment / function	Variants of connection and priority						
	A1	A2	A3	A4	A5	B	C
Telephone						X	
Adaptation unit data			X	X			
Facsimile apparatus			X	X			
Adaptation unit BTX			X	X			
Terminal equipment for other telecommunication purposes	X	X	X	X	X	X	X
Multi-services equipment	1)	1)	1)	1)	1)	1)	1)
PABX and telecommunication systems						X	
AE, telephone answering set	X						
AE, AWAG, AWUG	X		X		X		
AE, dialling aid	X	X					
AE, recording device		X					
AE, call identifier, VF ringer ²⁾							
AE for ciphony				X			
AE for on-the-spot sound recordings				X			
AE, conference equipment				X			
AE, call distribution system	X						
AE, others ³⁾							

1) Corresponding to implemented facilities (functions).

2) Between "a" and "b" wire, such as ringing detection circuitry or ringer.

- 3) Depending on their function they are connected in series (e.g. charge indicator, blocking facility) or between "W" and "b" wire (e.g. VF ringing).

The following paragraphs describe the particular variants and the related requirements for their inter-connection.

8.3 (D) 3.1 Interworking between telephones and group A additional equipment

- 1) Additional Group A equipment, AE (A), is connected in series before other TEs. Using this kind of connection, different priority modes are possible. The kind of priority for the individual AEs (A) is given in the relevant Aspect 3 requirements.
- 2) If an AE (A) which is ready for operation detects an incoming call, it shall establish connection to the line. During operation, the response of the AE (A) shall correspond to one of the following priority and interworking modes.

8.3 (D) 3.1.1 Interworking mode A1

The additional equipment must only change over the active state if no loop current passes through the additional equipment (no loop current is detected). The additional equipment should terminate its operation (go into quiescent condition) as soon as loop current is detected (see figure 8.3 (D) 3.1.1).

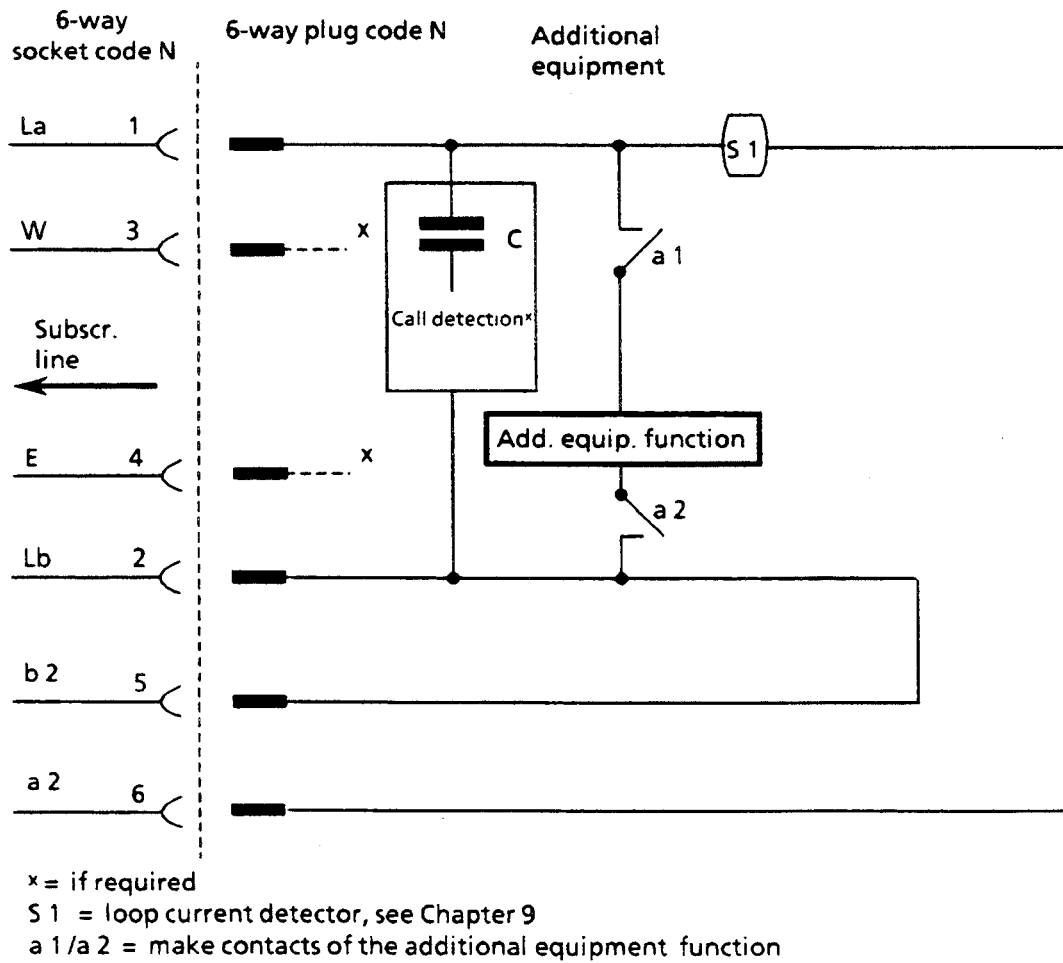


Figure 8.3 (D) 3.1.1: Circuit diagram of modes A1 and A2

8.3 (D) 3.1.2

Interworking mode A2

The additional equipment must only change over the active state if loop current passes through the additional equipment (loop current is detected)(see figure 8.3 (D) 3.1.1).

When initiated by manual intervention and changing over to the active state on a line in quiescent condition (no loop current flows), the AE shall revert to the idle state within two seconds.

8.3 (D) 3.1.3

Interworking mode A3

The additional equipment must only change over to the active state if no loop current passes through the additional equipment (no loop current is detected). An existing connection from the active additional equipment is not affected by the seizure or release of equipment associated with the additional equipment. The line is only switched back to the associated equipment at the end of the transmission. An acoustic signal should indicate the transfer of the line if the associated equipment is in the active state (loop current is detected). If no indication of the transfer of the line by additional equipment is given when loop current is detected, the operating instructions for the additional equipment must contain a note warning users that in such cases unwanted chargeable connections may not have been released. The circuit diagram of mode A3 is shown in figure 8.3 (D) 3.1.3.

8.3 (D) 3.1.4

Interworking mode A4

The additional equipment must only change over the active state if loop current passes through the additional equipment (loop current is detected). If associated equipment is still in the active state (e.g. handset of telephone still off hook), the transfer of the line when the additional equipment reverts to the idle state must be indicated by acoustic means. If no indication of the transfer of the line by additional equipment is given when loop current is detected, the operating instructions for the additional equipment must contain a note warning users that in such cases unwanted chargeable connections may not have been released. The circuit diagram of mode A4 is shown in figure 8.3 (D) 3.1.3.

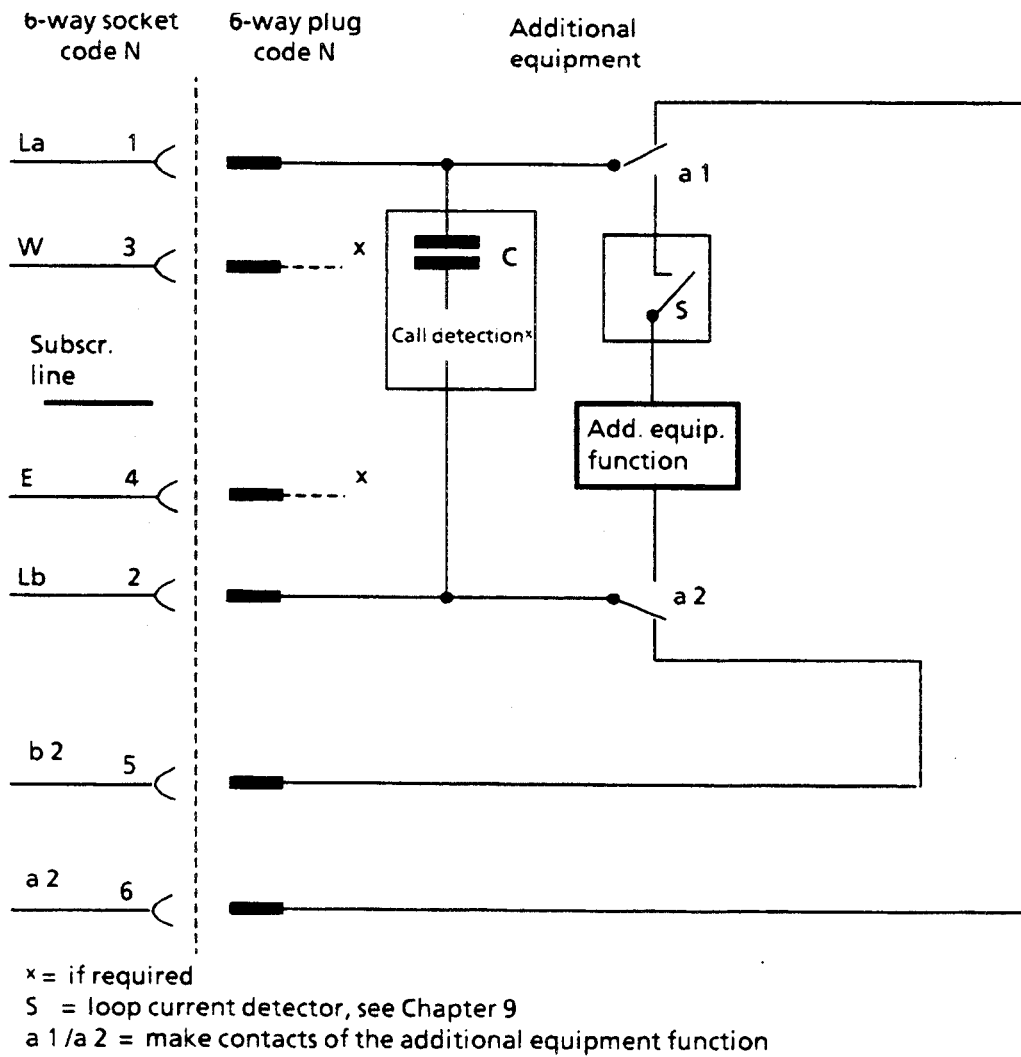


Figure 8.3 (D) 3.1.3: Circuit diagram of modes A3 and A4

8.3 (D) 3.1.5 Interworking mode A5

The additional equipment can in all cases be connected to the line. In the event of a telephone connection involving associated equipment, the additional equipment interrupts the connection for 2 to 6 seconds to check whether the line can be seized and whether the dial tone is received. If the telephone line cannot be seized or no dial tone is detected, the AE may interrupt the line up to three minutes after it performs a second line seizure. If the telephone line cannot be seized or no dial tone is detected or after an unsuccessful call attempt, the AE has to transfer the line to the associated equipment. The circuit diagram of mode A5 is shown in figure 8.3 (D) 3.1.5.

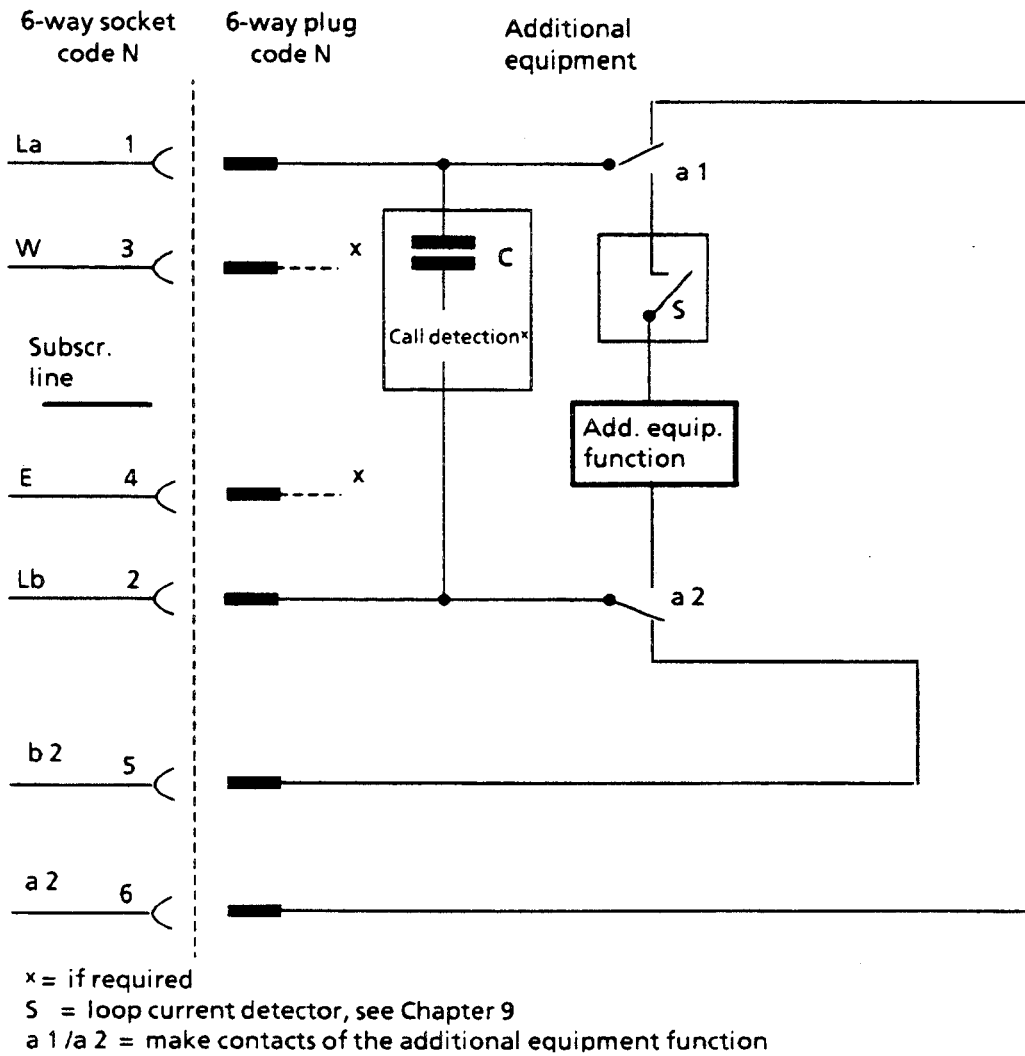


Figure 8.3 (D) 3.1.5: Circuit diagram of mode A5

8.3 (D) 3.2

Interworking between telephones and group B additional equipment

Group B additional equipment electrically behind the telephone must be connected to the PSTN access either by means of extended line terminals (see the example given in figure 8.3 (D) 3.2) or via a manual or automatic two-way switch. A connection involving group B additional equipment is interrupted in any case by off-hook handset of the telephone. The loop is then held by the telephone set. For Group B additional equipment the connection method described in section 8.2 (D) 1 is used.

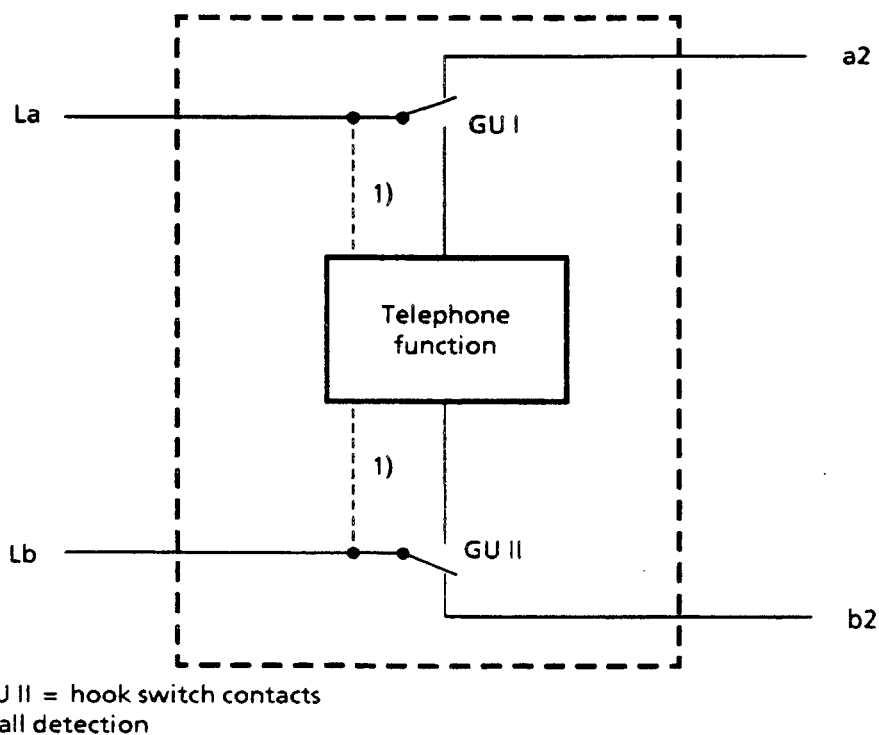


Figure 8.3 (D) 3.2: Basic structures of a telephone with extended speech wires

8.3 (D) 3.3 Interworking between telephones and additional equipment detecting and evaluating incoming calls

Additional equipments detecting and evaluating incoming calls are connected to the telephone set via a separate conductor (W-wire) and via the b-wire. Several equipments detecting and evaluating incoming calls may be switched in parallel. Figure 8.3 (D) 3.3.a and Figure 8.3 (D) 3.3.b shows a functional description of the W-wire.

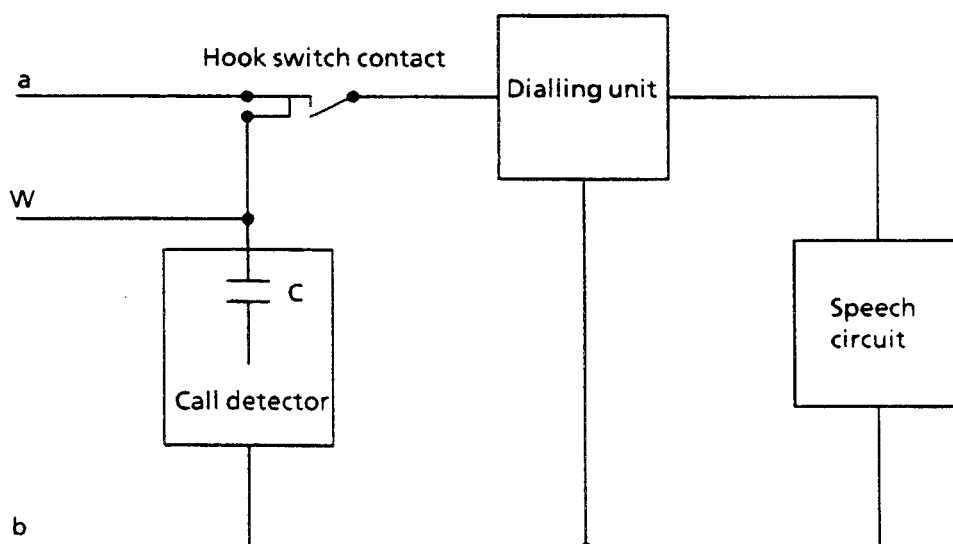


Figure 8.3 (D) 3.3.a: Functional description of W-wire with telephone in quiescent condition

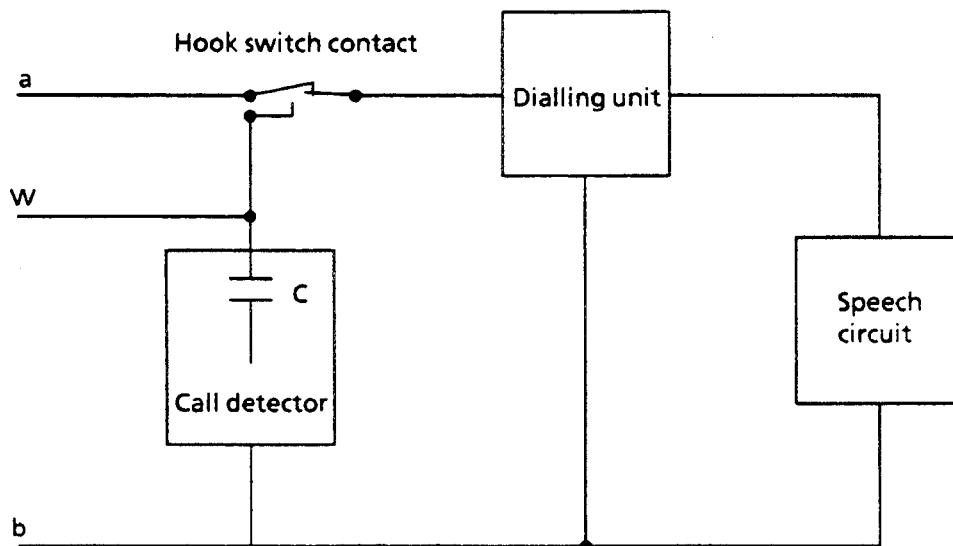


Figure 8.3 (D) 3.3.b: Functional description of W-wire with telephone in loop condition

8.3 (GR) 1

The connection method described in paragraph 8.2 is used. No special and additional connection method is needed.

8.3 (IS) 1

All simple multiple terminal connection to the PSTN shall be described in figure 8.3 (IS) 1. When a TE is operated all other TEs connected to the line shall be blocked.

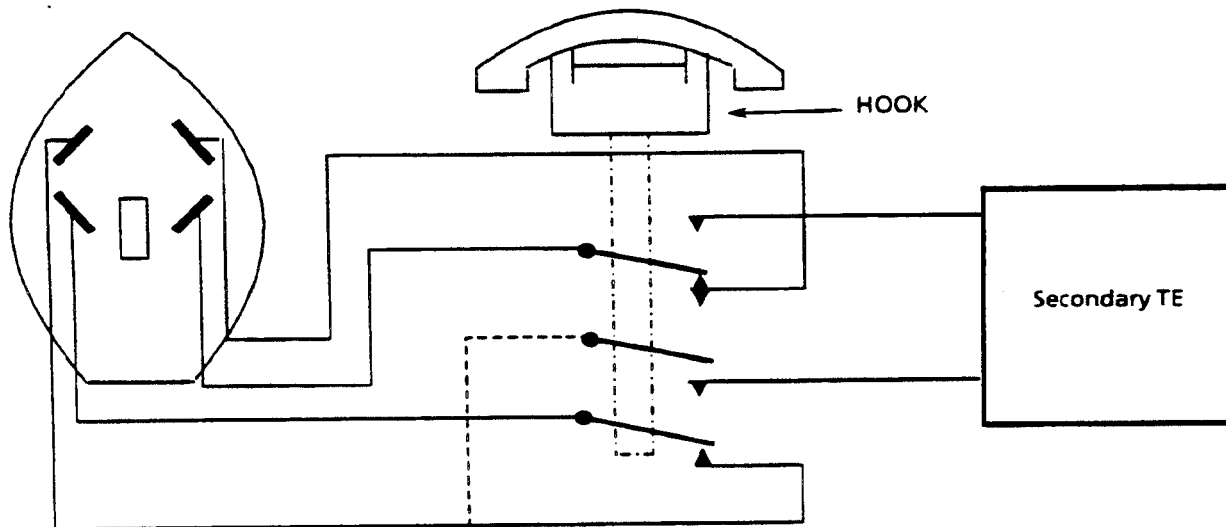


Figure 8.3 (IS) 1: Connection of secondary TE

8.3 (IRL) 1

Telecom Eireann has the monopoly up to all points at which the PSTN and subscriber's private installation come into contact. The Jacks Modular 1M/1 provides the master socket for the physical connection for the subscriber's equipment to the network. If further outlets are required then secondary sockets (Jacks Modular 1S, or Wall Mounting No. 1) may be wired into the Jacks Modular 1M/1. Further secondary sockets may be wired from the master socket or from the secondary sockets but not from Wall Mounting No. 1.

8.3 (I) 1

Mechanical parameters

The terminals that can cause the loop condition to be transferred from a second TE connected at the same subscriber's line must be equipped with the combined plug/socket described in figure 8.3 (I) 1.

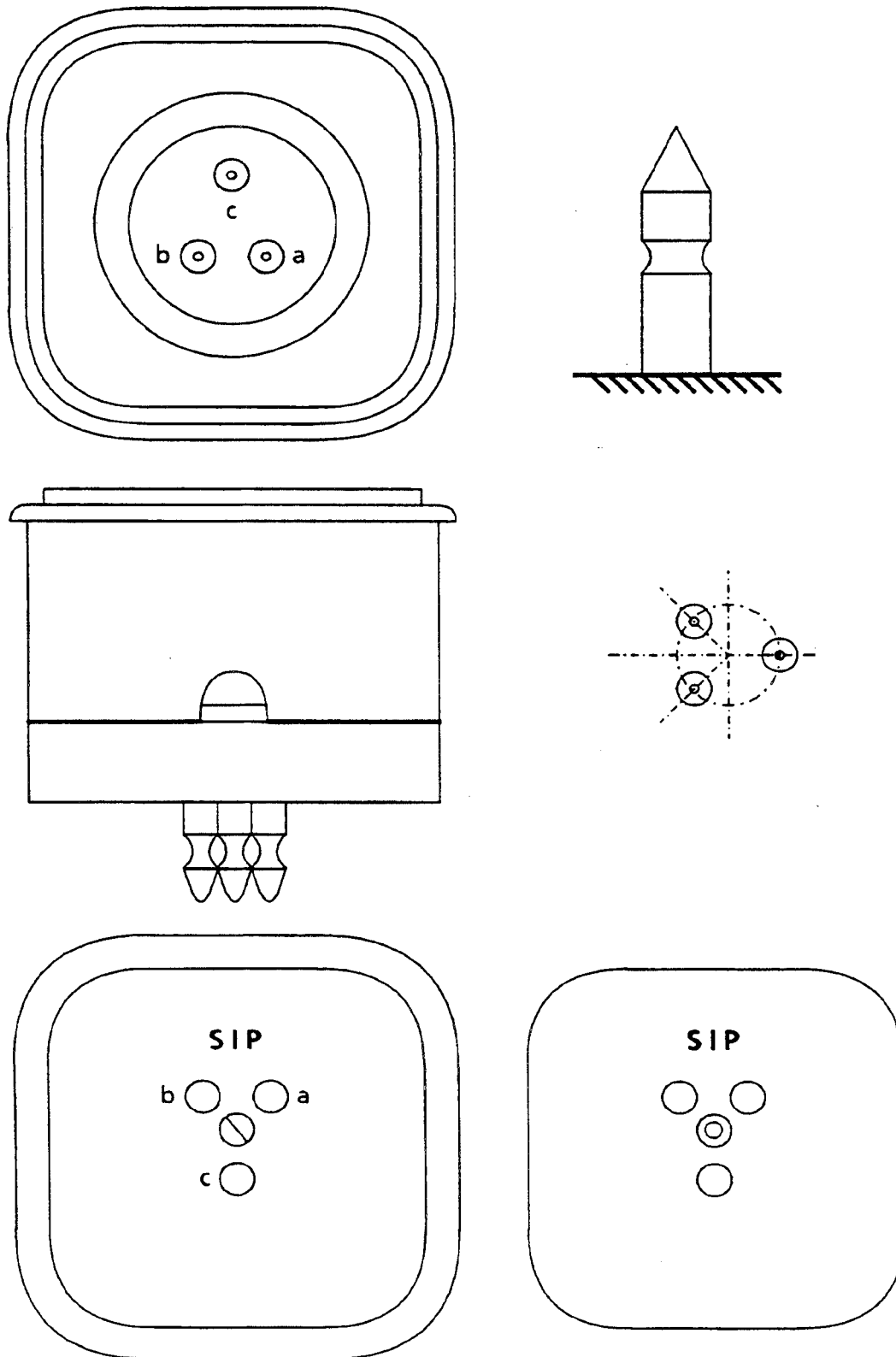


Figure 8.3 (I) 1: Combined plug and socket

8.3 (I) 2

Termination configuration

The internal circuits of plug/socket and TE must be configured in a way that assure that only one TE at a time can receive and/or transmit speech band signals.

This condition implies that one of the terminals must be always master to the others (slaves) meaning that it can cause the loop condition to be transferred from another TE.

8.3 (I) 3

Electrical parameters related to termination

The insulation resistance between two pins of the plug/socket shall not be less than 5 000 Mohms.

The measure shall be made only after the plug/socket under test has had its test voltage $V_t = 500 \text{ V}$ applied for at a time $t = 30 \text{ s}$.

Moreover an alternate voltage test between metallic parts electrically separated from each other shall be made; a rms voltage of value 1 000 V (frequency 50 Hz) shall be applied for the period of 30 s.

8.3 (L) 1

For multiple terminal connection to the PSTN line the eight pole plug and socket system, shown in figure 8.3 (L) 1.1 and 8.3 (L) 1.2, should be used. A four pole socket should be installed in parallel to the eight pole socket, accordingly to the wiring plan shown in figure 8.3 (L) 1.3.

ADo 8

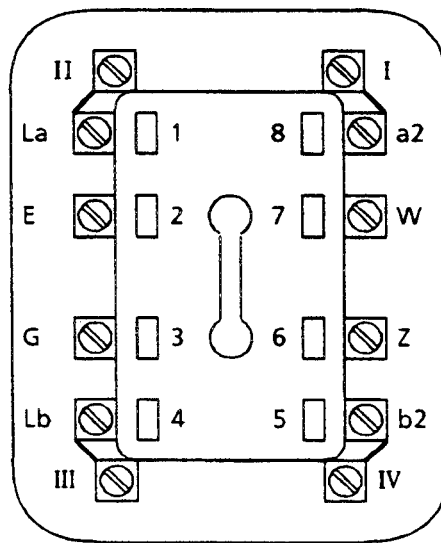


Figure 8.3 (L) 1.1: Standard socket

ADoS 8

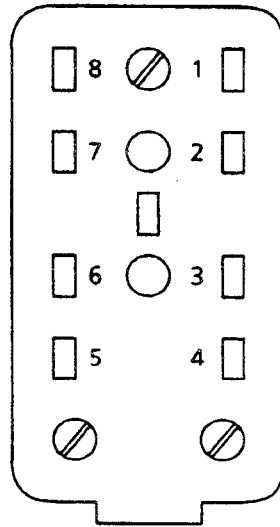


Figure 8.3 (L) 1.2: Standard plug

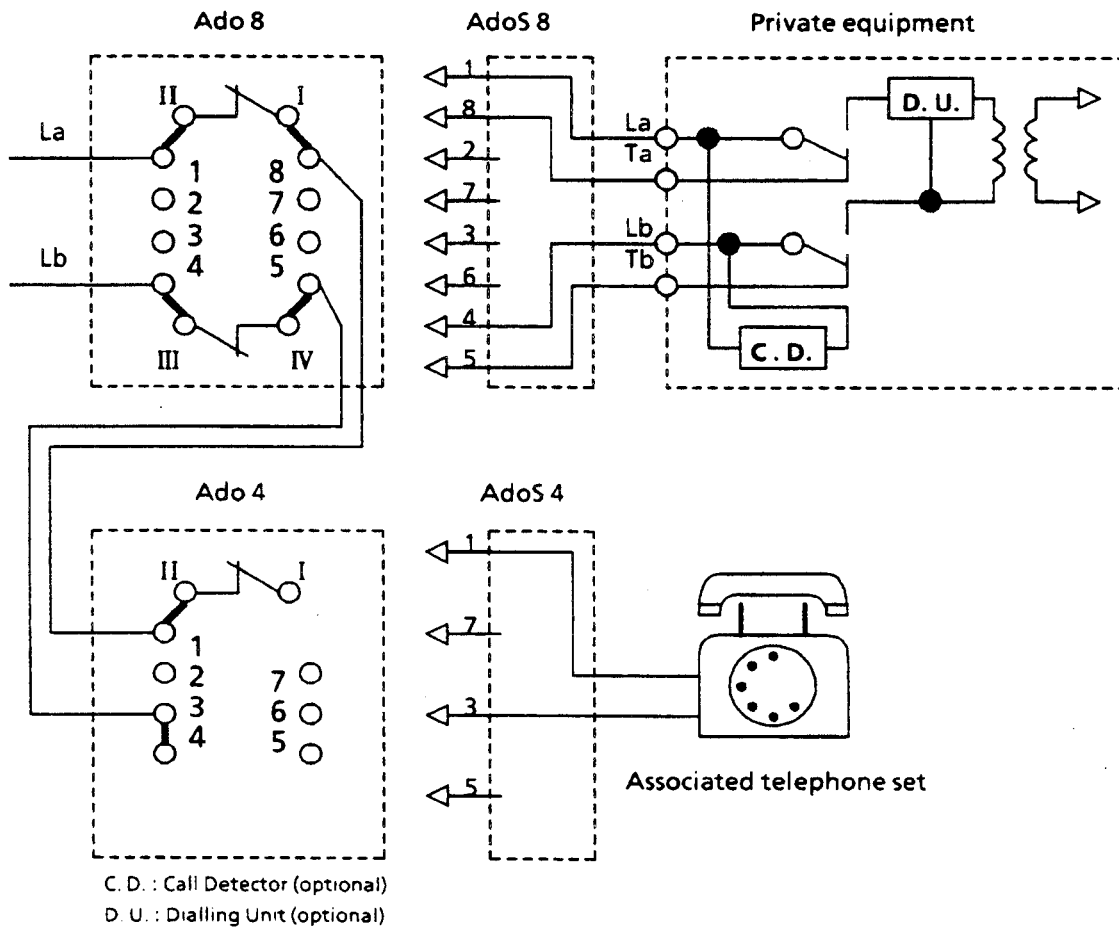


Figure 8.3 (L) 1.3: Wiring plan for multiple terminal connection for PSTN (modem, fax, etc.)

8.3 (M) 1 Information not available at the moment.

8.3 (NL) 1 Multipoint connection is also done with a distribution frame. The equipment can be connected in parallel on the same connection box. In special cases

(sublet) a second distribution frame is placed next to the first one (figure 8.3 (NL) 1). Also in this case the connection boxes will be supplied by PTT.

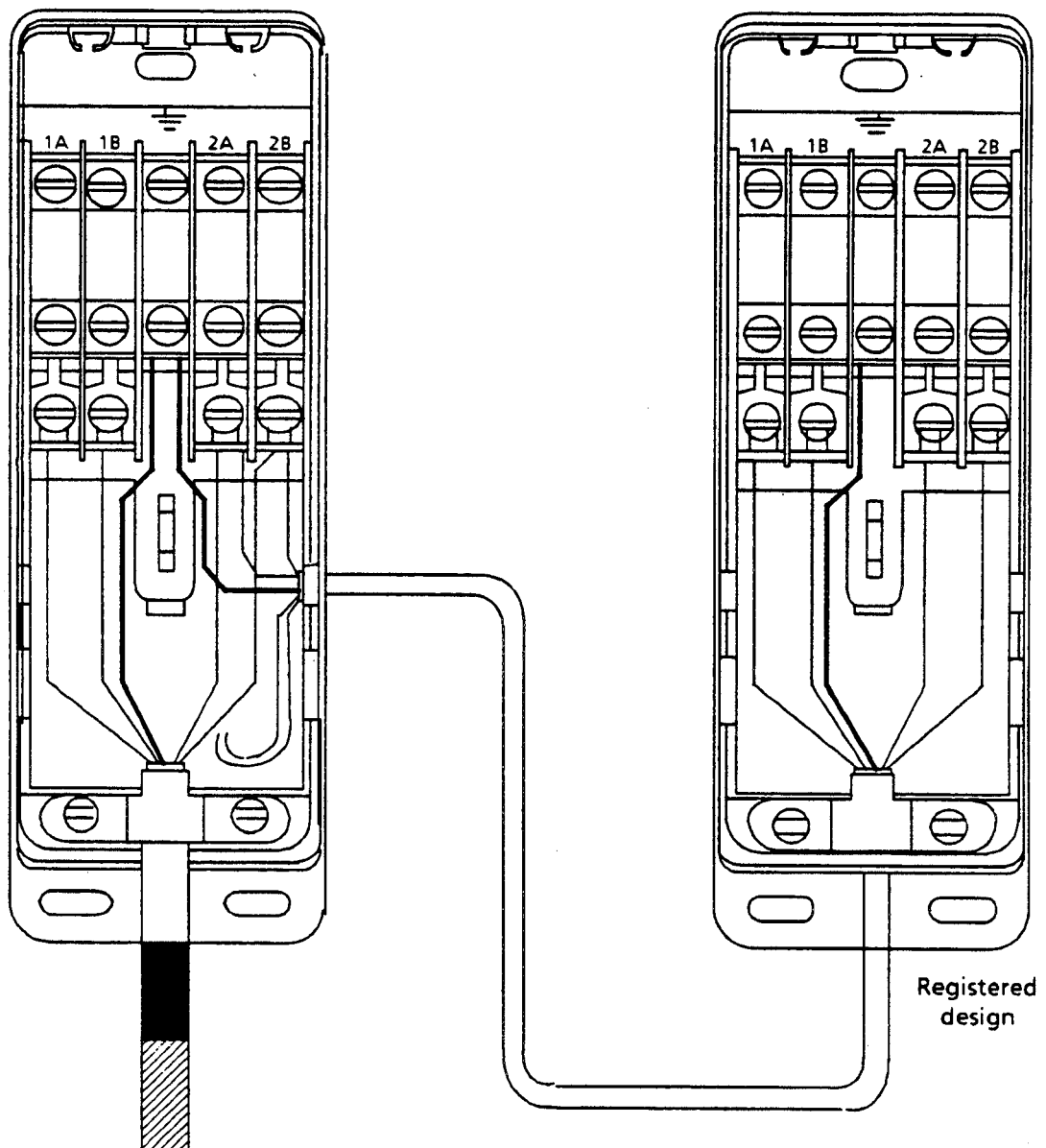


Figure 8.3 (NL) 1

- 8.3 (P) 1** No special connection methods are used besides those described in paragraph 8.2.
- Plug/sockets, connection boxes and distribution frames may be used according to the rules described in paragraph 8.1.
- 8.3 (E) 1** **General**
- The contents in section 8.2 (E) 1 shall be applied.
- 8.3 (E) 2** **Single line series connection method (Series)**
- PROVISION 1:** The single line series connection method may be used, either in a terminal equipment which is prepared for being connected in series mode to only a line, or for every line connected in series mode in a multiline terminal equipment.

PROVISION 2: See also the alternative connection method stipulated in section 8.3 (E) 3.

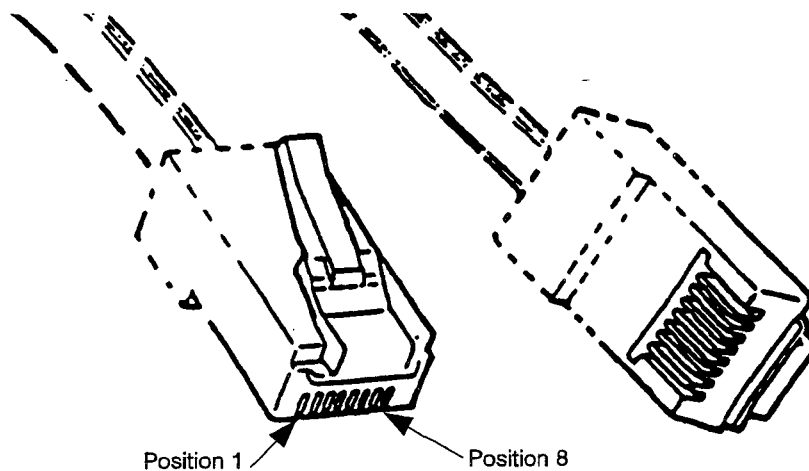
Terminal equipments that use the single line series connection method shall be provided with a miniature 8-position unkeyed plug (see in figure 8.3 (E) 2 an illustrated representation of the plug and its contact numeration), where:

- a) the line input terminals ("a1", "b1") shall be respectively connected to contacts 4 and 5;
- and
- b) the line output terminals ("a2", "b2") shall be respectively connected to contacts 1 and 8;

NOTE b.1: The contact 1 is the normal return of contact 4.

NOTE b.2: The contact 8 is the normal return of contact 5.

- and
- c) the contact 6, when provided and when necessary, is used as the common reference terminal for 50 Hz metering pulses reception (see section 1.4.3 (E) 1);
- and
- d) the contacts 2, 3, and 7, may be provided, and in any case shall be isolated between them and from any part of the terminal equipment.



NOTE: (Normative)
See the note in figure 8.2 (E) 2.

Figure 8.3 (E) 2: Miniature 8-position unkeyed plug

8.3 (E) 3 Alternative single line series connection method (Series)

PROVISION 1: The alternative single line series connection method may be used, either in a terminal equipment which is prepared for being connected in series mode to only a line, or for every line connected in series mode in a multiline terminal equipment.

PROVISION 2: This alternative connection method may be used in terminal equipments which provide a socket so as to permit an associated terminal equipment, equipped with a plug as required in section 8.2 (E) 2, to be connected to its line output terminals.

Terminal equipments that use the alternative single line series connection method shall be provided for every involved line with a miniature 6-position plug and a miniature 6-position socket (see in figures 8.2 (E) 2 and 8.3 (E) 3 illustrated representations of the plug and socket, and their contact numeration), where:

- a) the line input terminals ("a1", "b1") shall be respectively connected to plug contacts 3 and 4;
- and
- b) the line output terminals ("a2", "b2") shall be respectively connected to select contacts 3 and 4;

NOTE b.1: The socket contact 3 is the normal return of plug contact 3.

NOTE b.2: The socket contact 4 is the normal return of plug contact 4.

- and
- c) the plug contact 5 and the socket contact 5, when provided and when necessary, are used as the common reference terminal for 50 Hz metering pulses reception (see section 1.4.3 (E) 1), either:
 - i) both of them, shorted together;
 - or
 - ii) one of them, then the other may not be provided or be isolated from any part of the terminal equipment;
- and
- d) the plug contacts 1, 2, and 6, and the socket contacts 1, 2, and 6, may not be provided, and in any case shall be isolated between them and from any part of the terminal equipment.

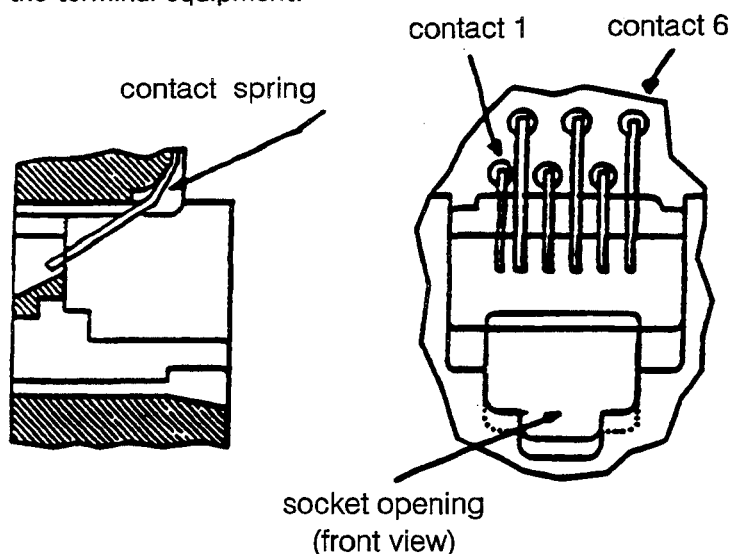


Figure 8.3 (E) 3: Miniature 6-position socket

8.3 (E) 4

Multiline parallel connection method

PROVISION 1:

The multiline parallel connection method may be used, either in a terminal equipment which is prepared for being connected in parallel mode to only a line, or for every ten lines connected in parallel mode in a multiline terminal equipment.

Terminal equipments that use the multiline parallel connection method shall be provided for every ten involved lines with a connector type D-sub, with

50-positions suitable for being furnished with male contacts, and with female shield, where:

- a) the line terminals "a1,i", "b1,i") of each line shall be connected as stipulated in table 8.3 (E) 4;
- and
- b) the contact 50, when provided and where necessary, is used as the common reference terminal for 50 Hz metering pulses reception (see section 1.4.3 (E) 1);
- and
- c) when less than ten lines are wired;
 - either
 - i) the contacts that correspond to the first lines shall be used;
 - or
 - ii) the user's manual shall include a dedicated warning with information indicating which of the permitted contacts are used;
- and
- d) the unused contacts may not provided and, in any case, shall be isolated between them and from any part of the terminal equipment.

PROVISION 2: The multiline terminal equipments prepared for being connected in parallel mode to more than ten lines shall repeat the connection method stipulated in this section.

Table 8.3 (E) 4: Multiline parallel connection method

LINE NUMBER	LINE TERMINALS	
	Contact a1,i	Contact b1,i
1	1	2
2	3	4
3	5	6
4	7	8
5	9	10
6	11	12
7	13	14
8	15	16
9	17	18
10	37	38
Common reference terminal		50
Contacts to be used in series mode		19 to 36 39, 40
Contacts reserved		41 to 49

8.3 (E) 5 Multiline series connection method (Series)

PROVISION 1: The multiline series connection method may be used, either in a terminal equipment which is prepared for being connected in series mode to only a line, or for every ten lines(when some of the lines are connected in series mode) in a multiline terminal equipment.

Terminal equipments that use the multiline series connection method shall be provided for every ten involved lines with a connector type D-Sub, with 50-positions suitable for being furnished with male contacts, and with female shield, where:

- a) the line input terminals ("a1,i", b1,i"), and the line output terminals ("a2,i", "b2,i") of each line shall be connected as stipulated in table 8.3 (E) 5;

NOTE a.1: Each contact "a2,i" is the normal return of its respective contact "a1,i".

NOTE a.2: Each contact "b2,i" is the normal return of its respective contact "b1,i".

and

- b) the contact 50, when provided and when necessary, is used as the common reference terminal for 50 Hz metering pulses reception (see section 1.4.3 (E) 1);

and

- c) when less than ten lines are wired;

either:

- i) the contents that correspond to the first lines shall be used;

or

- ii) the user's manual shall include a dedicated warning with information indicating which of the permitted contacts are used;

and

- d) the unused contacts may not be provided and, in any case, shall be isolated between them and from any part of the terminal equipment.

PROVISION 2: The multiline terminal equipments prepared for being connected in series mode to more than ten lines shall repeat the connection method stipulated in this section.

PROVISION 3: The multiline terminal equipments prepared for being connected partly of their lines in parallel mode, and the others in series mode, shall follow the table 8.3 (E) 4 or 8.3 (E) 5 according to the mode of connection of each line.

Table 8.3 (E) 5: Multiline series connection method (Series)

LINE NUMBER	LINE INPUT TERMINALS		LINE OUTPUT TERMINALS	
	(i) Contact a1,i	Contact b1,i	Contact a2,i	Contact b2,i
1	1	2	19	20
2	3	4	21	22
3	5	6	23	24
4	7	8	25	26
5	9	10	27	28
6	11	12	29	30
7	13	14	31	32
8	15	16	33	34
9	17	18	35	36
10	37	38	39	40
Common reference terminal		50		
Contacts reserved		41 to 49		

8.3 (E) 6 Single line auxiliary connectors

PROVISION: Terminal equipments may be provided with single line auxiliary connectors in order to allow an easy connection to the network of other terminal equipments which are equipped with a plug as required in section 8.2 (E) 2.

Terminal equipments that use single line auxiliary connectors in some of their lines, shall be provided for every involved line with a miniature 6-

position socket (see figure 8.3 (E) 3 an illustrated representation of the socket and its contact numeration), then:

- a) for terminal equipments which use the connection method required in section 8.2 (E) 2, the socket contacts shall be respectively connected to their homonymous plug contacts;

and/or

- b) for series terminal equipments which use the connection method required in section 8.3 (E) 2, the socket contacts may be associated:

- i) to the line input terminals, then:

- 1) socket contacts 3 and 4 shall be respectively connected to plug contacts 4 and 5;

- 2) socket contact 5 may be connected to plug contact 6, when they are provided and when necessary;

and/or

- ii) to the line output terminals, then:

- 1) socket contacts 3 and 4 shall be respectively connected to plug contacts 1 and 8;

- 2) socket contact 5 may be connected to plug contact 6, when they are provided and when necessary;

and/or

- c) for series terminal equipments which use the connection method required in section 8.3 (E) 3, the socket contacts may be associated:

- i) to the line input terminals, then the auxiliary socket contacts shall be connected to their homonymous plug contacts;

and/or

- ii) to the line output terminals, then the auxiliary socket contacts shall be connected to their homonymous socket contacts;

and/or

- d) for terminal equipments which use the connection method required in section 8.3 (E) 4, then:

- i) the contacts 3 and 4 ("a1", "b1") of each auxiliary socket shall be respectively connected to their homonymous male contacts ("a1,i", "b1,i") of the involved line (i);

and

- ii) every socket contact 5 may be connected to male contact 50, when they are provided and when necessary;

and/or

- e) for terminal equipments which use the connection method required in section 8.3 (E) 5, the socket contacts may be associated

- i) to the line input terminals of one line, then:

- 1) contacts 3 and 4 ("a1", "b1") or every socket shall be respectively connected to their homonymous male contacts ("a1,i", "b1,i") of the input of the involved line (i);

- 2) every contact 5 may be connected to male contact 50, when they are provided and when necessary;

and/or

- ii) to the line terminals, then:

- 1) contacts 3 and 4 ("a1", "b1") of every socket shall be connected to male contacts ("a2,i", "b2,i") of the output of the involved line (i);
- 2) every socket contact 5 may be connected to male contact 50, when they are provided and when necessary.

8.3 (E) 7

Multiline auxiliary connectors

PROVISION 1:

Terminal equipments may be provided with multiline auxiliary connectors in order to allow an easy connection to the network of other terminal equipments which are equipped with a connector as required in section 8.3 (E) 4.

Terminal equipments that use multiline auxiliary connectors in some of their lines with a connector type D-Sub, with 50-positions suitable for being furnished with female contacts, and with male shield, then

- a) for terminal equipments which use the connection method required in section 8.2 (E) 2;
 - i) the female contacts ("a1,i", "b1,i") that correspond to the line (i) shall be respectively connected to contacts 3 and 4 of all or a part of the plugs;
and
 - ii) the female contact 50 may be connected to contact(s) 5 of the involved plug(s), when they are provided and when necessary;
- and/or
- b) for terminal equipments which use the connection method required in section 8.3 (E) 2, the female contacts may be associated:
 - i) to pairs of line input terminals, then:
 - 1) the female contacts ("a1,i", "b1,i") that correspond to the line (i) shall be respectively connected to contacts 4 and 5 of all or a part of the plugs;
and
 - 2) the female contact 50 may be connected to contact(s) 6 of the involved plug(s), when they are provided and when necessary;
 - ii) to pairs of line output terminals, then:
 - 1) the female contacts ("a1,i", "b1,i") that correspond to the line (i) shall be respectively connected to contacts 1 and 8 of all or a part of the plugs;
and
 - 2) the female contact 50 may be connected to contact(s) 6 of the involved plug(s), when they are provided and when necessary;
- and/or
- c) for terminal equipments which use the connection method required in section 8.3 (E) 3, the female contacts may be associated:
 - i) to pairs of line input terminals, then:
 - 1) the female contacts ("a1,i", "b1,i") that correspond to the line (i) shall be respectively connected to contacts 3 and 4 of all or a part of the plugs;
and
 - 2) the female contact 50 may be connected to contact(s) 5 of the involved plug(s), when they are provided and when necessary;
 - ii) to pairs of line output terminals, then:

- 1) the female contacts ("a1,i", "b1,i") that correspond to the line (i) shall be respectively connected to contacts 3 and 4 of all or a part of the sockets;

and

- 2) the female contact 50 may be connected to contact(s) 5 of the involved socket(s), when they are provided and when necessary;

and/or

- d) for terminal equipments which use the connection method required in section 8.3 (E) 4, the female contacts shall be connected to their homonymous male contacts;

and/or

- e) for terminal equipments which use the connection method required in section 8.3 (E) 5, the female contacts may be associated:

- i) to pairs of line input terminals, then the female contacts shall be connected to their homonymous male contacts;

and/or

- ii) to pairs of line output terminals, then:

- 1) the female contacts ("a1,i", "b1,i") shall be connected to male contacts ("a2,i", "b2,i");

- 2) the female contact 50 may be connected to male contact 50, when they are provided and when necessary;

and

- f) when a multiline auxiliary connector

- i) is wired over part of the lines of the terminal equipment;

or

- ii) the wired female contacts are not those that correspond to the first lines;

or

- iii) the order of the lines is transposed in the internal wiring;

then, the user's manual shall include a dedicated warning, with information indicating which wiring is provided in the terminal equipment.

PROVISION 2:

It is not permitted to wire a multiline auxiliary connector simultaneously to pair(s) of line input terminals and to pair(s) of line output terminals.

8.3 (S) 1

For simple multiple connection to PSTN an intermediate plug is provided (see figure 8.3 (S) 1.1). This plug makes it possible to connect two devices to one jack. In principle, the intermediate plug functions in the same way as an extra jack connected to the line. An intermediate plug contains a terminal strip or block where different types of connections can be implemented for the connected equipment. The contact functions incorporated into the jacks and intermediate plugs, in combination with the contact functions provided in the items of connected equipment, make it possible to implement a number of different connection configuration. The devices can be connected in any desired order (first device before the second or vice versa). Moreover, they can either be connected in parallel across the line or in cascade along the line. As a result, there are four main connections which are shown in figure 8.3 (S) 1.2 to figure 8.3 (S) 1.5.

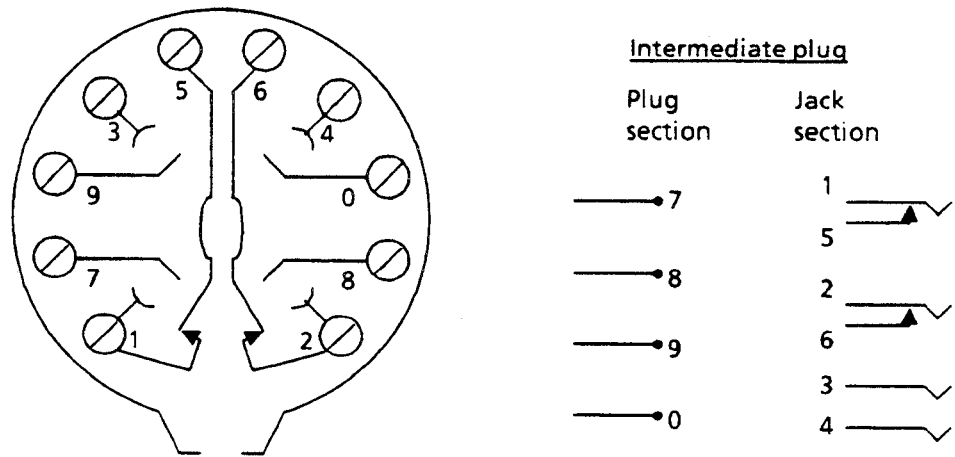


Figure 8.3 (S) 1.1: Intermediate plug

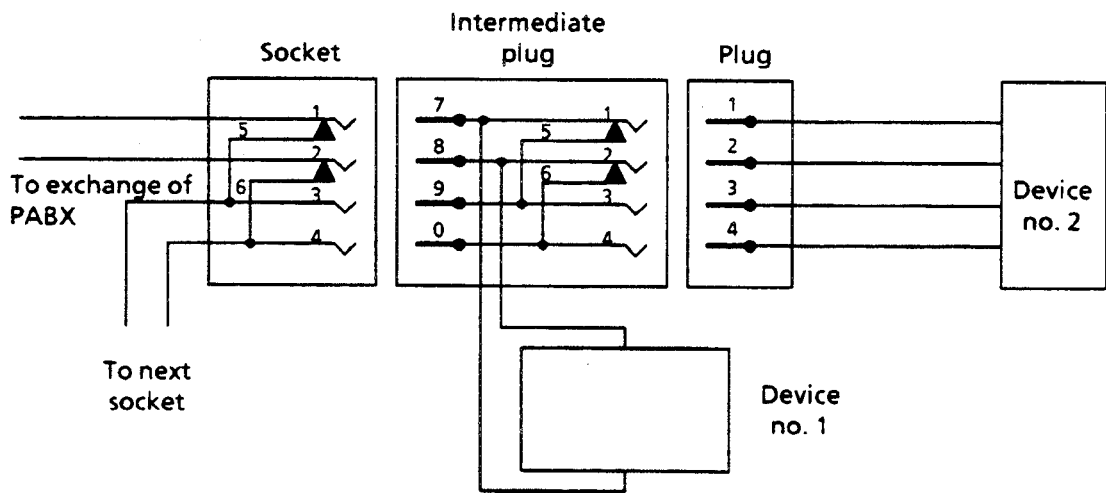


Figure 8.3 (S) 1.2: Parallel connection to line with device no. 1 in front of device no. 2

Typical example: Ringing signal detector

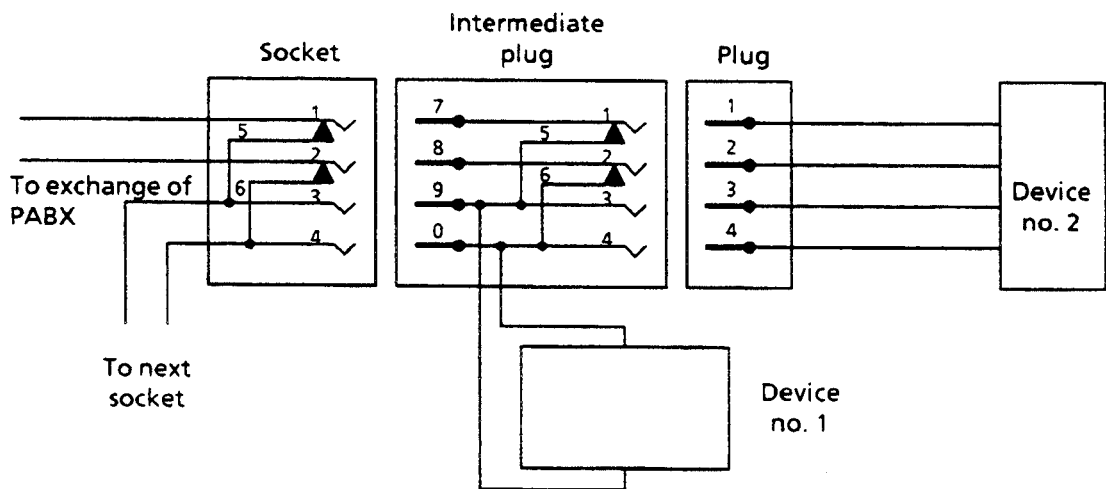


Figure 8.3 (S) 1.3: Parallel connection to line with device no. 1 behind device no. 2

Typical example: Auxiliary loudspeaking unit

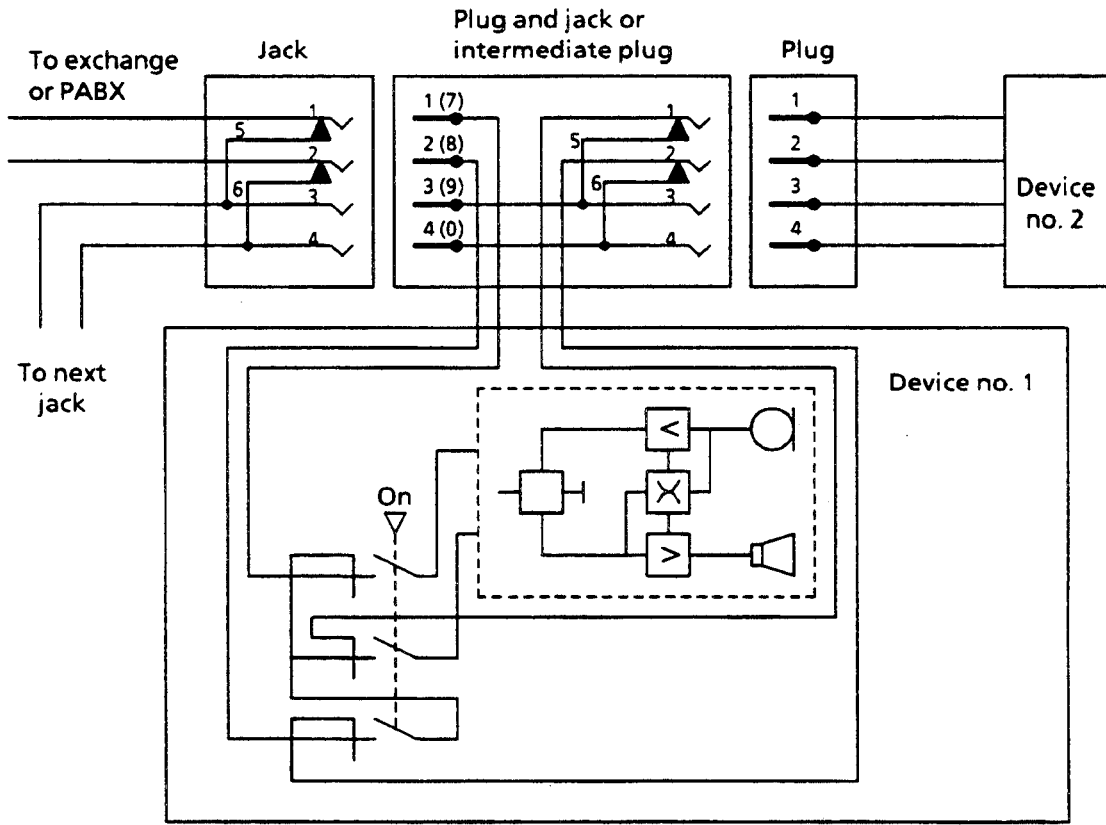


Figure 8.3 (S) 1.4: Cascade connection to line with device no. 1 in front of device no. 2

Typical example: Automatic dialler

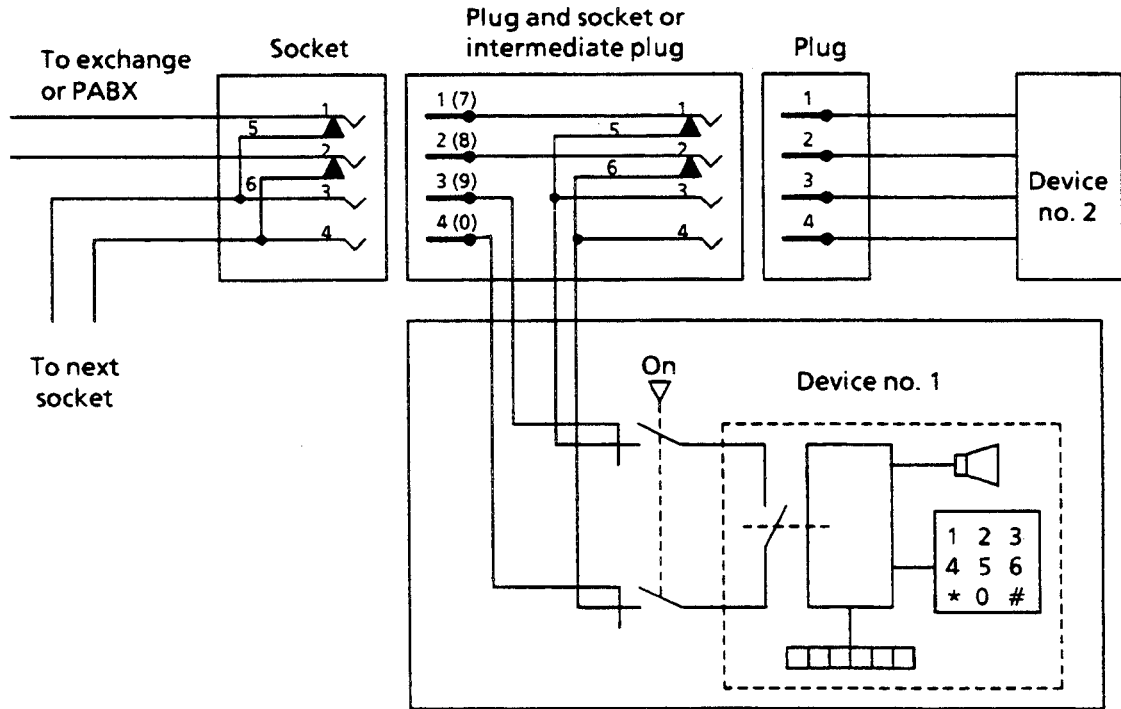


Figure 8.3 (S) 1.5: Cascade connection to line with device no. 1 behind device no. 2

8.3 (CH) 1

TE can be used in parallel or series combination, depending on their functions. Series as well as parallel connection of different TE must be made together with the installation system, in other words: each TE has to be connected separately to a suitable socket. A maximum of 3 telephones may be connected in parallel. Direct series or parallel connections from equipment to equipment are only approved if the equipment in question is mechanically combined.

The different methods of connection are specified in figure 8.3 (CH) 1.1 to figure 8.3 (CH) 1.8. T + T 83 configuration for a series TE behind PABX for decadic dialling (earth signal) is under study.

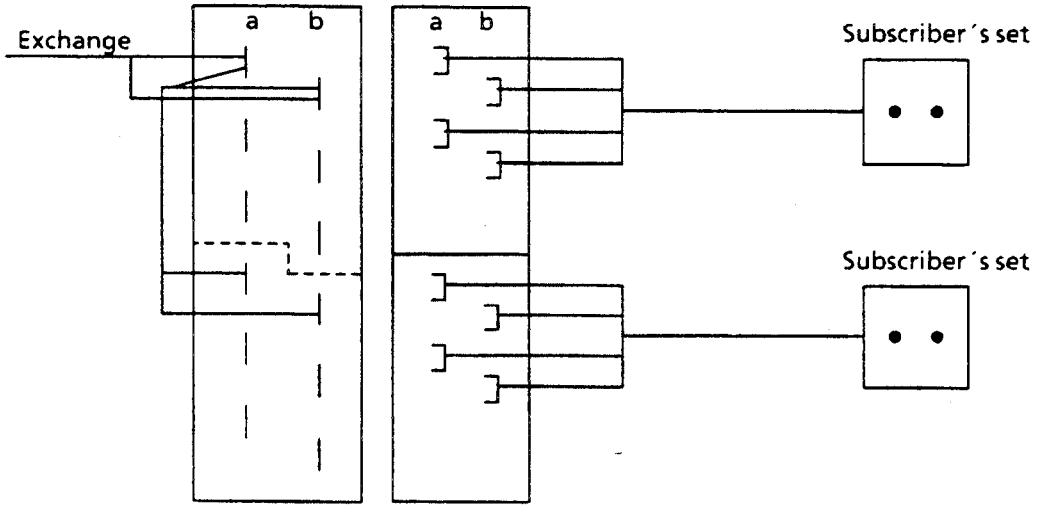
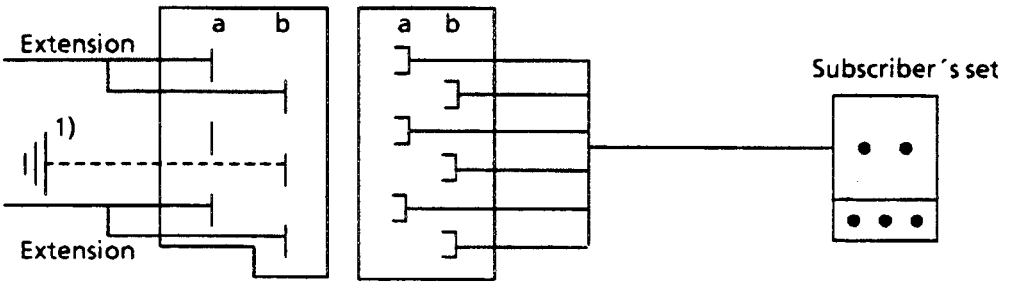


Figure 8.3 (CH) 1.1: T + T 83 connection system with subscriber's sets in parallel



1) For decadic dialling (loop pulsing) needed

Figure 8.3 (CH) 1.2: T + T 83 connection system with 1 two-extension subscriber's set connected to a PABX

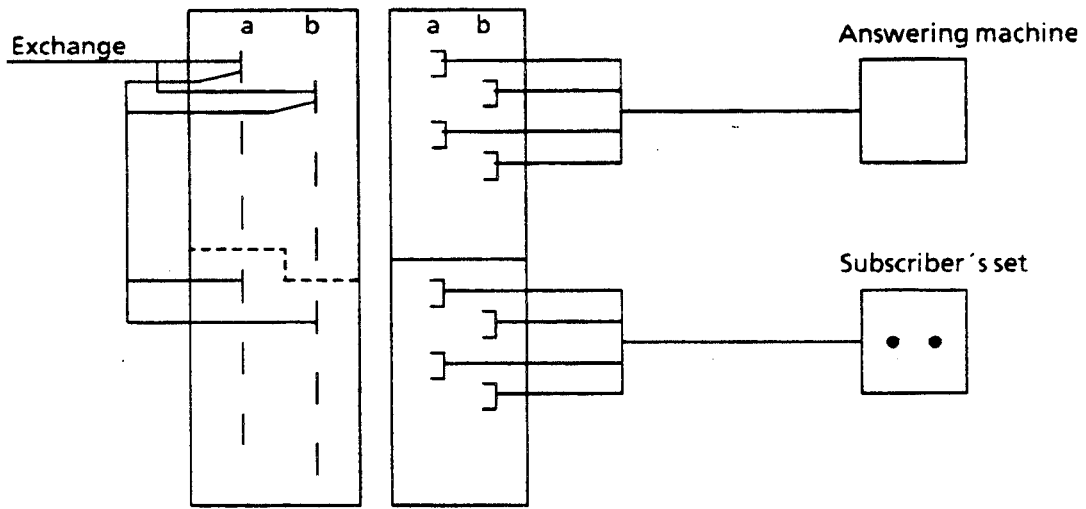


Figure 8.3 (CH) 1.3: T + T 83 connection system with 1 subscriber's set and answering machine in parallel

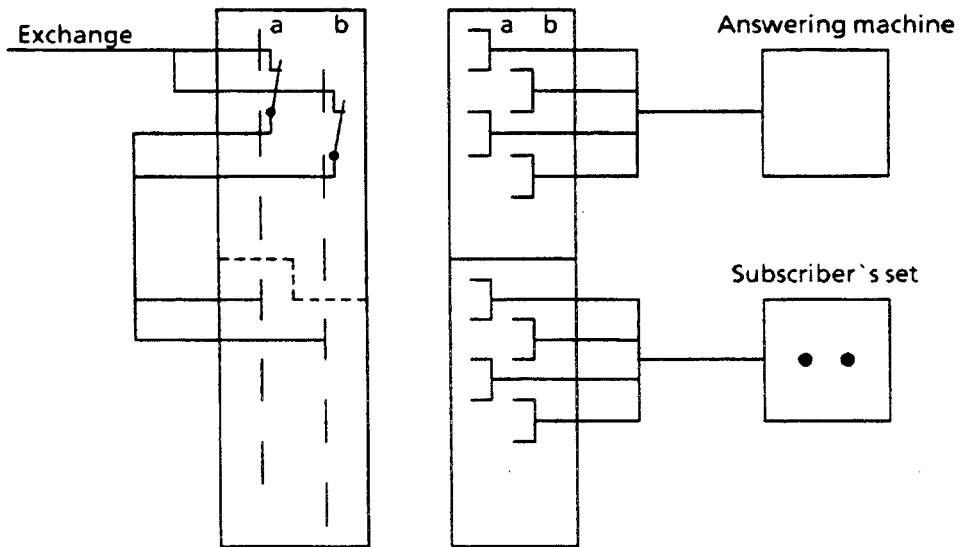


Figure 8.3 (CH) 1.4: T + T 83 connection system with 1 subscriber's set and answering machine in series

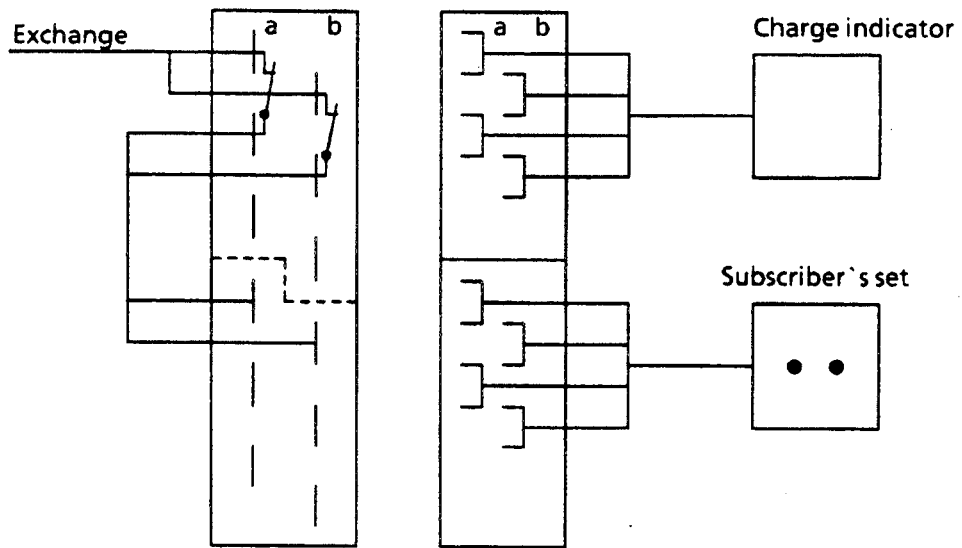


Figure 8.3 (CH) 1.5: T + T 83 connection system with 1 subscriber's set with separate charge indicator

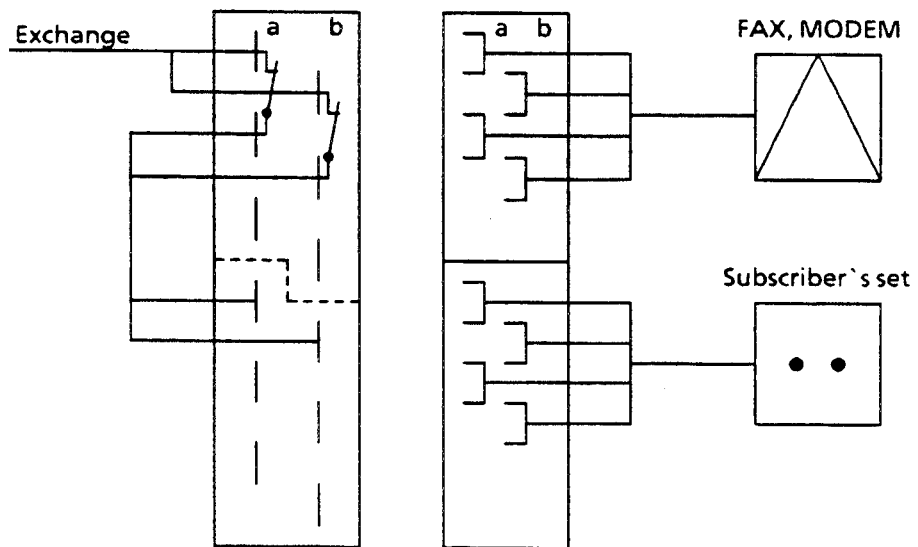


Figure 8.3 (CH) 1.6: T + T 83 connection system with 1 subscriber's set with PSTN modem or fax

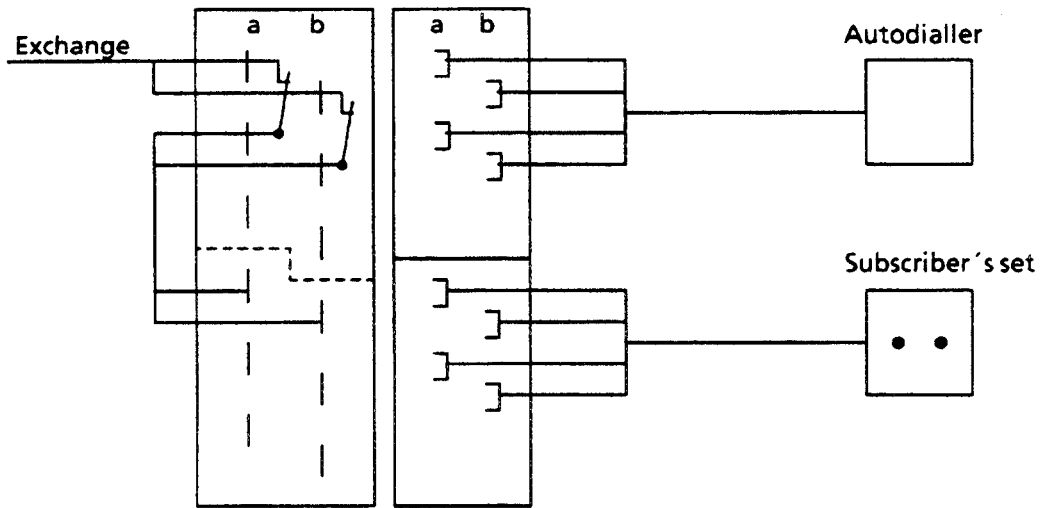


Figure 8.3 (CH) 1.7: T + T 83 connection system with 1 subscriber's set with autodialler

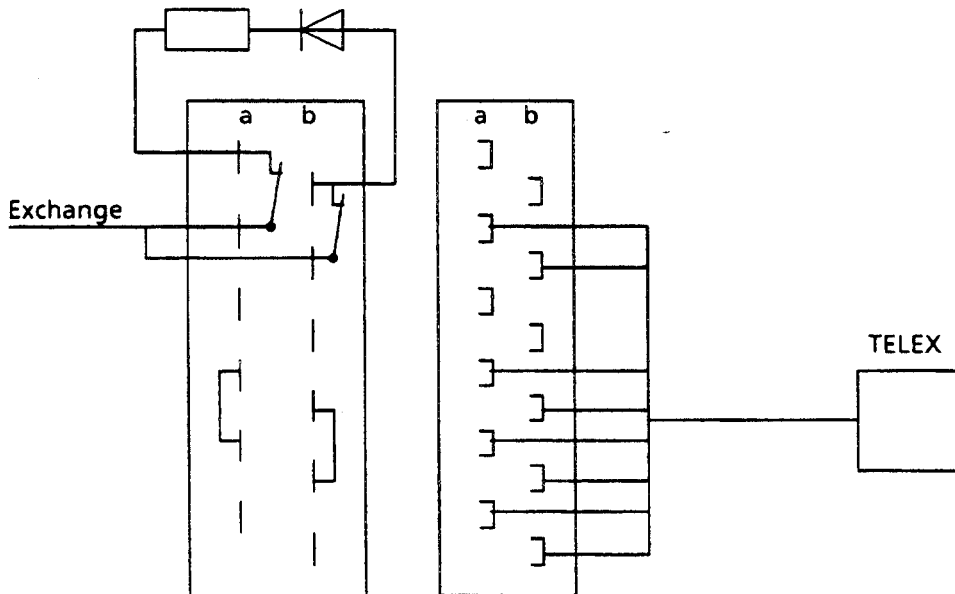


Figure 8.3 (CH) 1.8: T + T 83 connection system with telex

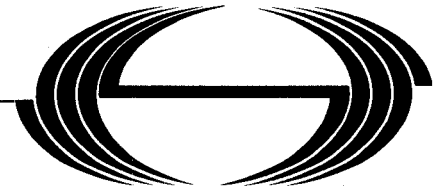
The telephone cord can be fixed tightly (e.g. screwed) to the TE (screwed connections shall only be accessible by tools). Between telephone cord and TE a plug system can also be used. If a 6-pin FCC type is used, wires must be connected according to paragraph 8.2.

The present mandatory PTT connection system between the TE cord and the inhouse installation for simple multiple terminal is the T + T 83 system. The T + T 87 plug is only for telephones. Depending on the application of the TE a different (mechanical) plug locking code is used, thus preventing connection of unsuitable TE.

A multiple terminal connection for PSTN access has no influence on the wiring between the contacts of the TE and the T + T 83/87 plug.

- 8.3 (CH) 2** For telematic equipment (e.g. FCC plug) no pin assignments are prescribed.
- 8.3 (GB) 1** Multiple terminal connections cover a variety of configurations; examples are:
- a) provision of simple series connection;
 - b) provision of simple parallel connection (examples are shown in figure 8.2 (GB) 1;
 - c) combined series and parallel connections;
 - d) complex interconnection configurations.

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**Attachments to Public Switched Telephone Network (PSTN);
General technical requirements for equipment connected to
an analogue subscriber interface in the PSTN**

Chapter 9: Special functions

(Candidate NET 4)

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Foreword

Chapter 9 of this European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI). The text of this ETS may be utilized, wholly or in part, for the establishment of NET 4.

For historical purposes, this ETS was drafted in the form of a NET. However, until a final decision to adopt this ETS as NET 4 has been agreed by the Technical Recommendations Application Committee (TRAC), the terms NET or NET 4 in this document should be read as ETS or ETS 300 001 respectively.

This ETS comprises ten chapters:

"Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

- Chapter 1 - General
- Chapter 2 - DC characteristics
- Chapter 3 - Ringing signal characteristics
- Chapter 4 - Transmission characteristics
- Chapter 5 - Calling functions
- Chapter 6 - Answering function
- Chapter 7 - Power failure
- Chapter 8 - Connection methods
- Chapter 9 - Special functions**
- Chapter 10 - Additional unclassified requirements

Refer to Chapter 1 (General) of this ETS for information on the structure and details of how to use this ETS. The national designations, used to identify national variations to requirements and tests within this ETS, are given in section 1.9 of Chapter 1 (page 60).

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9 Special functions

9.1 Register recall

Register recall is a time calibrated break pulse of the dc loop presented to the PSTN by the TE in order to cause the PSTN to initiate certain facilities.

The time calibrated register recall break pulse can be sent to PSTN by a manual action on the TE or automatically by the TE.

In the case of a manual action, the break period duration shall be independent of the time that the relevant button is depressed. Compliance shall be checked by inspection.

The register recall conditions includes:

- a pre-break period;
- a break period;
- a post-break period;

as shown in figure 9.1.

The further requirements in this section relate to the values of loop current, measured at various times, during the register recall condition.

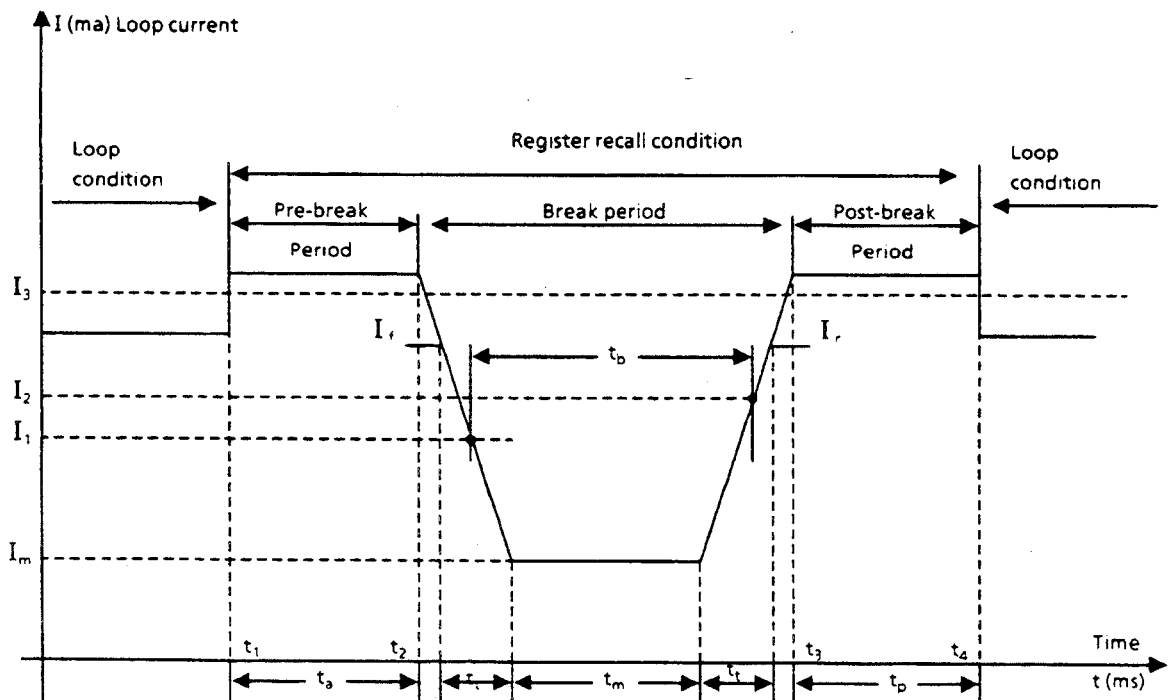


Figure 9.1: Register call

9.1 (E) 1 (This section shall be applied in addition to section 9.1)

NOTE 1: The register recall facility with a timed break pulse, when it is provided, is used only in conjunction with the DTMF dialling system (see requirements in sections 10.5 (E) 5 and 10.5 (E) 7).

NOTE 2: The register recall facility with a ground loop is not used in the analogue access interface of the PSTN.

NOTE 3: The requirements stipulated for the register recall with a timed break pulse are partly related with the contents of the CEPT Recommendation T/CS 20-09 (Brussels, 1980), and the CCITT Recommendation E.161 (Blue Book).

PROVISION 1: The provisions 2 and 5 shall be applied to all Spanish sections (E) in section 9.1 of this Chapter 9.

PROVISION 2: All the requirements related with the register recall facility shall be met with the dc feeding excitation stipulated in the associated testing methods, when it is not indicated in the requirement.

PROVISION 3: It is considered that the register recall condition includes also:

- a change from loop condition to register recall condition;
- a change from register recall condition to loop condition.

PROVISION 4: At the start of the register recall, the TE assumes the register recall condition or (only for series TEs) takes the loop condition from an associated TE connected to the line output terminals.

PROVISION 5: At the end of the register recall, the TE leaves the register recall condition; this can be done reverting to its own loop condition, or for series TE allowing an associated TE connected to the line output terminals to come to the loop condition.

NOTE 4: When the register recall with a timed break is done manually, it is recommended that the manual control should be able to accept a new manual order within 50 milliseconds from the moment that the control has been released and the TE has also reverted to the loop condition.

With TE in the register recall condition, it shall meet the following general requirements:

a) when the register recall with a timed break is done manually with a push-button;

i) the push button shall:

either

- 1) be designated with the character R (capital letter);
- or
- 2) not be designated with any character;

and

ii) when the TE is provided with manual controls other than the register recall push-button and the 12 (or 16) push button dialling keypad, the register recall push-button shall be designated;

and

iii) the designation of the register recall push-button, when provided, shall be on or next to the push-button;

NOTE a: It is recommended that the register recall push-button should be near but separate from the dialling keypad.

and

b) the requirement in section 2.2.2.1 (E) 1;

and

c) the requirement in section 10.2 (E) 1 (for multiline TEs);

and

d) all associated transmission circuitry inside the TE, if provided, shall be inhibited;

and

e) all ac signals from acoustic transducers intended to be used for sending purposes, if provided, shall be inhibited;

PROVISION e: The acoustic excitation, when necessary, is stipulated in the associated testing method.

and

f) all ac signals from an associated TE connected to the line output terminals shall be inhibited (for series TE).

Compliance shall be checked by the tests outlined in section A.9.1 (E) 1.

A.9 Special functions

A.9.1 Register recall

The TEUT is connected as shown in figure A.9.1, with feeding conditions V_f , R_f , and I_f set as described in table A.9.1, and is placed in loop condition. The TE is caused, by some appropriate means, to emit a register recall pulse.

The instantaneous current or line voltage values shall be recorded.

Table A.9.1: Register call

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	R_s (Ω)	
Austria	60		19, 60	100	
Belgium	48	600		1 000	
Cyprus	48	800		R_s included in R_f	
Denmark	150	10 k	$16 - I_{max.}$	500	yes
Finland	48	0, 910		800	
France	49, 49, 54	3 260, 1 300, 200		100	
Germany	not mandatory				
Greece					
Iceland	48		$14 - I_{max.}$	100	
Ireland	not mandatory				
Italy	48	800		1 000	
Luxembourg	60		19, 60	100	
Malta					
Netherlands	42, 66	2 040, 700		100	
Norway	24 60	1 100 3 400		100	
Portugal			not applic.	200	yes
Spain	48	250, 850, 1 950	not applic.	250	yes
Sweden	33 45	2 100 2 100		100 100	yes
Switzerland	48	1 200		R_s included in R_f	
U. Kingdom	50	400	25 - 100	R_s included in R_f	

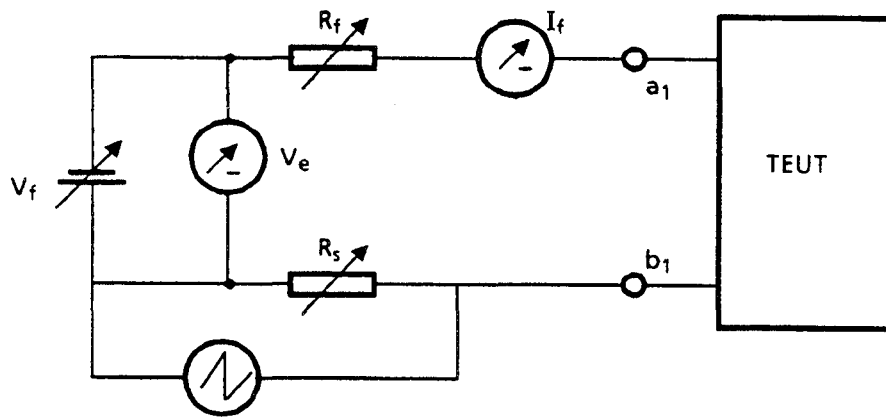


Figure A.9.1: Register call

- A.9.1 (DK) 1** The measurements are documented by means of oscilloscope displays or the like. Bouncing and similar phenomena shall not exceed 5 ms. During the interruption of the dc loop, the resistance between the line terminals of the TEUT shall be at least 100 kohms at dc voltages up to 150 V.
- A.9.1 (P) 1** The following dc feeding condition values shall be used:
- V_f (V) = 45
 R_f (Ω) = 1 600
 and
 V_f (V) = 55
 R_f (Ω) = 200
- A.9.1 (E) 1** General requirements.
- The general testing procedure to follow is to check, by inspection and according with the user's manual and any other technical documentation, whether the TEUT is provided with the register recall facility and how the timed break pulse can be emitted.
- The specific testing procedures are as follows:
- A.9.1 (E) 1.a** Check by inspection.
- A.9.1 (E) 1.b** The procedure of test in section A.2.2.2.1 (E) 1 is followed.
- A.9.1 (E) 1.c** The procedure of test in section A.10.2 (E) 1 is followed when necessary.
- A.9.1 (E) 1.d** The procedure of test in section A.10.5 (E) 6.1.e is followed.
- A.9.1 (E) 1.e** The procedure of test in section A.10.5 (E) 6.1.f is followed.
- A.9.1 (E) 1.f** The procedure of test in section A.10.5 (E) 6.1.g is followed.
- A.9.1 (E) 2** Break period.
- A.9.1 (E) 2.1** Break period duration,
- The procedure of test in section A.9.1 is followed, where the tests are undertaken for each polarity of the voltage source (V_f).
- A.9.1 (E) 2.2** The procedure of test in section A.9.1 (E) 2.1 is followed, where the resistor (R_f) takes only the values of 250 ohms and 1 950 ohms.

- A.9.1 (E) 2.3** Fall time and rise time of the current.
- The procedure of test in section A.9.1 (E) 2.2 is followed, for the front edge and the rear edge of the break pulse.
- A.9.1 (E) 3** Pre-break and post-break period.
- A.9.1 (E) 3.1** Pre-break and post-break resistance.
- The procedures of test in sections A.5.3.2 (E) 1 and A.5.3.5 (E) 1 are followed when necessary.
- A.9.1 (E) 3.2** Pre-break and post-break period duration.
- The procedure of test in section A.9.1 (E) 2.1 is followed when necessary.
- A.9.1 (E) 3.3** Transient response of loop current during the register recall with a timed break pulse.
- The testing procedures are as follows:
- A.9.1 (E) 3.3.a** The procedure of test in section A.10.5 (E) 6.2.a is followed.
- A.9.1 (E) 3.3.b** The procedure of test in section A.10.5 (E) 6.2.b is followed.
- A.9.1 (E) 3.3.c** The procedure of test in section A.10.5 (E) 6.2.e is followed.
- A.9.1 (S) 1** The current values measured during the register recall pulse shall be 0,32 mA or less for $V_f = 33$ V and 0,44 mA or less for $V_f = 45$ V during 90 ± 40 ms.

9.1.1 Break period

- a) The time interval from when the loop current crosses the limit value I_1 (mA) for the first time at the front edge of the break pulse to when the loop current crosses the limit value I_2 (mA) for the last time at the rear edge of the break pulse shall have the nominal value t_b (ms) with the tolerance Δt_b (ms), as specified in table 9.1.1.
- b) During the break period, there shall be a period not shorter than t_m (ms) during which the loop current shall be lower than I_m (mA) or the resistance between the line terminals shall be greater than R_1 (k Ω), as specified in table 9.1.1.
- c) The fall time during which the loop current falls from the I_f (mA) to I_m (mA) and the rise time during which the loop current rises from I_m (mA) to I_r (mA) shall be shorter than t_t (ms), as specified in table 9.1.1.

The requirements for a), b) and, c) shall be met with feeding values in the ranges specified in table 9.1.1.

Compliance shall be checked by the tests outlined in section A.9.1.

Table 9.1.1: Break period

COUNTRY	REQUIREMENT VALUES						
	V_f (V)	R_f (Ω)	I_f (mA)	t_b (ms)	Δt_b (ms)	I_1 (mA)	I_2 (mA)
Austria				100	± 20	18	18
Belgium	48		$20 - I_{max}$	125	30	15	15
Cyprus	48	440 - 1 740		50 - 150		10	10
Denmark			$16 - I_{max}$	90	40	8	8
Finland	48	800 - 1 710		90	± 40	not spec.	
France	49 - 54	200 - 3 260		270	± 50	5	5
Germany	not mandatory						
Greece							
Iceland	48		$14 - I_{max}$	90	40	0,5	0,5
Ireland	not mandatory						
Italy	44, 52	720, 1 880		90	40	15	15
Luxembourg	not mandatory						
Malta							
Netherlands	42 - 66	800 - 2 140		110	20	8	8
Norway	24 60	360 - 1 100 360 - 3 400		105	25	13,5	13,5
Portugal	45 - 55	400 - 1 800	N/A	160 - 300	0	1	8
Spain	48	250 + 250 - 250 + 1 950	N/A				
Sweden	33, 45	2 200	N/A				
Switzerland	43 - 57	2 200 - 600		50 - 130		I'	I'
U. Kingdom	50	400	0 - 125	not spec.	not spec.	not spec.	not spec.

Table 9.1.1 cont.: Break period

COUNTRY	REQUIREMENT VALUES						Remarks
	t_m (ms)	I_m (mA)	t_t (ms)	I_f (mA)	I_r (mA)	R_1 (k Ω)	
Austria	80 - 120					100	
Belgium	95	2,5					
Cyprus	60 - 140	0,5	10	20	20		
Denmark	50					100	yes
Finland	not spec.					70	
France	40	1					
Germany	not mandatory						
Greece							
Iceland	50 - 130	0,5					
Ireland	not mandatory						
Italy	50					50	
Luxembourg	not mandatory						
Malta							
Netherlands	90 - 130	0,5					
Norway	80	0,5					yes
Portugal	160	1	20	20	20	N/A	
Spain		$\leq 0,48$	≤ 5	15	18	N/A	yes
Sweden	50 - 130					100	yes
Switzerland	50 - 130	I'	15	I'	I'	80	yes
U. Kingdom	not specified						yes

9.1.1 (DK) 1 Depressing the R-key for 50 ms or longer shall cause disconnection of the dc loop.

9.1.1 (N) 1 t_b is the maximum and t_m is the minimum acceptable break period.

9.1.1 (E) 1 Break period duration.
(Requirement to be applied instead of paragraph a in section 9.1.1).

With TE in the register recall condition, the break pulse shall be done in such a manner that:

- a) the period between the instant that the loop current crosses downward, for the first time, the 15 mA limit in the front edge of the break pulse, and the instant that the loop current crosses upward for the last time the 18 mA limit in the rear edge of the break pulse, shall not be greater than 130 ms;
- and
- b) the period between the instant that the loop current crosses downward, for the last time, the 4 mA limit in the front edge of the break pulse, and the instant that the loop current crosses upward for the first time the 4 mA limit in the rear edge of the break pulse, shall not be lower than 50 ms.

PROVISION: See the third paragraph in section 9.1.

Compliance shall be checked by the tests outlined in section A.9.1 (E) 2.1.

9.1.1 (E) 2 Break period current.

(Requirement to be applied instead of paragraph b in section 9.1.1).

With TE in the register recall condition, the equivalent loop resistance between the two line terminals during the net break period shall have such a value that the loop current shall not be greater than $480 \mu\text{A}$, tested at a dc voltage of 48 V.

PROVISION: The meaning given for the term net is to exclude the fall time and the rise time of the loop current (see the requirements in section 9.1.1 (E) 3).

Compliance shall be checked by the tests outlined in section A.9.1 (E) 2.2.

9.1.1 (E) 3 Fall time and rise time of the current.

(Requirement to be applied instead of paragraph c in section 9.1.1).

With TE in the register recall condition:

a) the break pulse shall be established in such a manner that the period between the instant that the loop current crosses for the first time the 15 mA limit, and the instant that the loop current crosses for the last time the $480 \mu\text{A}$ limit, shall not be greater than 5 ms;

and

b) the post break period, when it exists, or the loop condition, shall be established in such a manner that the period between the instant that the loop current crosses for the first time the $480 \mu\text{A}$ limit, and the instant that the loop current crosses for the last time the 18 mA limit, shall not be greater than 5 ms.

Compliance shall be checked by the tests outlined in section A.9.1 (E) 2.3.

9.1.1 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.

9.1.1 (CH) 1
$$I' = I_1 = I_2 = I_f = I_r = 0,7 \times \frac{V_f}{R_f + 250}$$

9.1.1 (GB) 1 For TE sending a register recall signal, the loop current shall be interrupted for a period of time in the range 53 ms to 103 ms.

This period is defined as the time between the start of the exponential fall and the start of the exponential rise of the current I_f . During this period, I_f shall be of value equal to or less than 0,5 mA;

9.1.2 Pre-break and post-break period

a) From the time t_1 when the TE assumes the register recall condition until time t_2 when the break pulse is generated and, from the time t_3 when the TE completes the break pulse until time t_4 when it reverts to loop condition, the loop current shall be greater than I_3 (mA) or, the resistance between the line terminals shall not be greater than R_2 (ohms) or, the additional voltage drop shall be greater than U (V), as specified in table 9.1.2.

b) The time intervals t_1 to t_2 and t_3 to t_4 shall be respectively shorter than t_a (ms) and t_p (ms), as specified in table 9.1.2.

The requirements for a) and b) shall be met with feeding values in the ranges specified in table 9.1.2.

Compliance shall be checked by the tests outlined in section A.9.1.

Table 9.1.2: Pre-break and post-break conditions

COUNTRY	REQUIREMENT VALUES				
	V_f (V)	R_f (Ω)	I_f (mA)	R_s (Ω)	t_a (ms)
Austria	not mandatory				
Belgium	48	█	20 - I_{max}	█	not spec.
Cyprus	not mandatory				
Denmark					
Finland					
France	49 - 54	200 - 3 260	100		
Germany	not mandatory				
Greece					
Iceland	not mandatory				
Ireland	not mandatory				
Italy	44, 52	720, 1 880			100
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	45 - 55	400 - 1 800	not applic.	200	not applic.
Spain	48	250 - 1 950	not applic.	250	1 200
Sweden	not applicable				
Switzerland	43 - 57	2 200 - 600			≤ 100
U. Kingdom	not specified				

Table 9.1.2 cont.: Pre-break and post-break conditions

COUNTRY	REQUIREMENT VALUES				Remarks
	t_p (ms)	I_3 (mA)	R_2 (Ω)	U (V)	
Austria	not mandatory				
Belgium	not specified				yes
Cyprus	not mandatory				
Denmark					
Finland					
France					yes
Germany	not mandatory				
Greece					
Iceland	not mandatory				
Ireland	not mandatory				
Italy	100	18			
Luxembourg	not mandatory				
Malta					
Netherlands					yes
Norway	not mandatory				
Portugal	not applic.	20	not applic.	not applic.	
Spain	1 200	not applic.	400	not applic.	yes
Sweden	not applicable				
Switzerland	≤ 100	Loop for ≥ 250 ms			yes
U. Kingdom	not specified				

9.1.2 (B) 1

The Belgian requirement for 9.1.2 is as follows:

From the time t_1 when the TE assumes the register recall condition until time t_2 when the break pulse is generated, and from the time t_3 when the TE completes the break pulse until t_4 when it reverts to the loop condition, the voltage U (V) across the line terminals shall not increase more than 2,5 V.

9.1.2 (F) 1

- in the range 200 - 1 300 Ω , $I_3 = 17$ mA;
- in the range 1 300 - 5 125 Ω , $I_3 = 12$ mA.

9.1.2 (F) 2

For the pre-break and the post-break periods, the loop current shall be lower than 75 mA. However, the loop current can exceed 75 mA for periods no longer than 5 ms.

9.1.2 (NL) 1

After the break, the duration of the loop condition shall be at least 150 ms.

9.1.2 (E) 1

Pre-break and post-break resistance.
(Remark to paragraph a in section 9.1.2).

The resistance (R_2) shall be tested at dc loop currents between 18,5 and 100 mA.

Compliance shall be checked by the tests outlined in section A.9.1 (E) 3.1.

9.1.2 (E) 2

Pre-break and post-break period duration.
(Remark to paragraph b in section 9.1.2).

The time intervals (t_1) to (t_2), and (t_3) to (t_4), may respectively take a value equal to (t_a) to (t_p).

Compliance shall be checked by the tests outlined in section A.9.1 (E) 3.2.

9.1.2 (E) 3

Transient response of loop current during the register recall with a break pulse.

(Requirement to be applied in addition to sections 9.1.2, 9.1.2 (E) 1, and 9.1.2 (E) 2).

With TE in the register recall condition, it shall meet the following requirements:

a) Change from loop condition to register recall condition:

When the TE assumes the register recall condition and a pre-break period exists, that condition shall be established in such a manner that the TE meets the requirements in sections 10.5 (E) 6.2.a.i and 10.5 (E) 6.2.a.ii, where the provision "a" shall be applied when necessary;

and

b) Transient during pre-break and post-break periods:

The resistance (R_2) stipulated in the requirement in section 9.1.2 (paragraph a) shall be maintained in such a manner that the period between the instant that the loop current crosses downward for the first time the 15 mA limit, and the instant that the loop current crosses upward for the last time the 15 mA limit, if it exists, shall not be greater than 1,5 ms;

and

c) Change from register recall condition to loop condition:

When the TE leaves the register recall condition and a post-break period exists, changing to its own loop condition, or (for series TE) transferring the loop condition to an associated TE connected to the line output terminals, that loop condition shall be established in such a manner that the TE meets the requirements in sections 10.5 (E) 6.2.e.i and 10.5 (E) 6.2.e.ii, where the provision "e" shall be applied where necessary.

Compliance shall be checked by tests outlined in section A.9.1 (E) 3.3.

9.1.2 (CH) 1

During the pre-break and the post-break period, a non-mandatory resistance drop may occur for (t_a and t_b) no more than 100 ms. The loop state, however, must be met in the post-break phase for at least 250 ms.

9.2 Meter pulse reception

9.2.1 12 or 16 kHz meter pulses

The reception of 12 or 16 kHz meter pulses is performed by detecting a transverse signal between the line terminals with a normal frequency of 12 kHz or 16 kHz.

Detection of meter pulses may be provided by a separate unit dedicated to this purpose or by a unit incorporated in a TE having other functions.

The requirements of this section shall be met only by TEs intended to receive meter pulses transmitted from the PSTN.

9.2.1 (E) 1 (This section shall be applied in addition to section 9.2.1).

NOTE 1: The TE shall be in whatever condition it can be, and it is understood that it meets the relevant requirements in other chapters.

NOTE 2: When a TE has a 12 kHz receiver, such a receiver may be prepared for showing either a high impedance (bridging mode) or a low impedance (terminating mode) at the frequency of the metering pulses.

NOTE 3: Network compatibility cannot be expected if several 12 kHz metering pulse receivers showing a low impedance are simultaneously connected to the same line.

PROVISION 1: The provisions 2 and 3 shall be applied to all Spanish sections (E) in section 9.2.1 of this Chapter 9.

PROVISION 2: All the requirements related with the reception of metering pulses shall be met with the dc feeding excitation stipulated in the associated testing methods, when it is not indicated in the requirements.

PROVISION 3: It is not explicitly necessary to use both dc polarities.

Compliance shall be checked by the tests outlined in section A.9.2.1.1 (E) 1.

9.2.1.1 Sensitivity and selectivity

The receiver shall respond to meter pulses applied between line terminals through an impedance of Z_G (Ω) with an open circuit ac rms voltages "e" (mV) and frequencies "f" (kHz) within area "I" of figure 9.2.1.1, and shall not respond to signals having frequencies and voltages within area "II" of the same figure.

The mask of figure 9.2.1.1 is determined by linking the points (f_i , e_i) given in tables 9.2.1.1.a and 9.2.1.1.b.

The requirements shall be met with the terminating impedances Z_G , Z_L and with feeding values V_f , R_f , I_f in the ranges specified in table 9.2.1.1.c.

The requirements shall be met with presence and absence of loop current.

Compliance shall be checked by the tests outlined in section A.9.2.1.1.

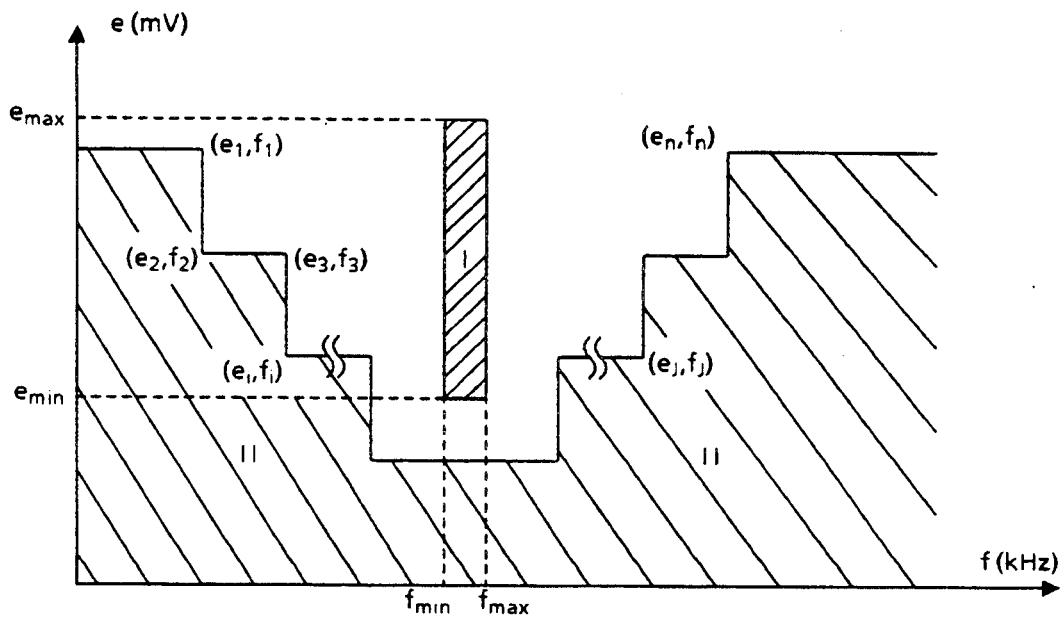


Figure 9.2.1.1: Receiver selectivity and sensitivity

Table 9.2.1.1.a: Area of detection

COUNTRY	REQUIREMENT VALUES			
	f_{\min} (kHz)	f_{\max} (kHz)	e_{\min} (mV)	e_{\max} (mV)
Austria	11,928	12,072	100	5 000
Belgium	15,840	16,160	105	2 200
Cyprus	15,840	16,160	100	4 000
Denmark	not mandatory			
Finland	15,95	16,05	130	8 500
France	11,880	12,120	105	4 000
Germany	15,92	16,08	61,6	9 757
Greece	15,840	16,160	97	6 000
Iceland	11,88	12,12	45	2 100
Ireland	11,88	12,12	45	2 600
Italy				
Luxembourg	15,92	16,08	110	9 000
Malta				
Netherlands				
Norway	15,840	16,160	50	2 000
Portugal	11,880	12,120	105	5 200
Spain	11,88	12,12	210	4 800
Sweden	11,9	12,1	5,5, 17,4	447
Switzerland	11,88	12,12	110	10 000
U. Kingdom	no requirement			

Table 9.2.1.1.b: Area of non-detection

COUNTRY	REQUIREMENT VALUES			
	f_1 (kHz)	f_2 (kHz)	f_i (kHz)	f_n (kHz)
	e_1 (mV)	e_2 (mV)	e_i (mV)	e_n (mV)
Austria				
Belgium				
Cyprus	14/400	16/20		18/400
Denmark	not mandatory			
Finland				
France				
Germany	not mandatory			
Greece	15,250/97	16/52		16,750/97
Iceland	9/2 100	11/25	11/25	15/2 100
Ireland	10/6 000	10/4,5	14/4,5	14/6 000
Italy				
Luxembourg	13,5/385	16/17,5		20,5/385
Malta				
Netherlands				
Norway				
Portugal	10/2 000	10/500		14/2 000
Spain	11,4 < 800	not applic. 100	not applic. 100	12,6 < 800
Sweden				
Switzerland				
U. Kingdom	no requirement			

Table 9.2.1.1.c: Terminating conditions

COUNTRY	REQUIREMENT VALUES							Remarks
	Z _L (Ω)	Z _G (Ω)	Loop Condition	Quiescent Condition	V _f (V)	R _f (Ω)	I _f (mA)	
Austria	600	200	yes	no	60		19 - 60	yes
Belgium	200	200	yes	no	48		20 - I _{max.}	yes
Cyprus	600	200	yes	no	48	440 - 1 740		
Denmark	not mandatory							
Finland	200	not spec.	yes	no	48	800 - 1 710		yes
France	600	200	yes	yes	48		25 - 60	yes
Germany	200	0	yes	no	60	1 000, 2 530		yes
Greece	200	200	yes	no	44 - 66		20 - 80	
Iceland	200	200	yes	yes	48		14 - 70	
Ireland	200	200	yes	no	48		20 - 100	
Italy		200	yes	no	44, 52	720, 1 880		yes
Luxembourg	600	200	yes	no	60		19 - 60	
Malta								
Netherlands								
Norway	200	200	yes	no	60	460 - 3 100		yes
Portugal	200	200	yes	N/A	45 - 55	300 - 1 800	N/A	yes
Spain	10 H + 300 Ω	200	yes	yes	48	500 - 2 200	N/A	yes
Sweden	200	200	yes	yes				yes
Switzerland	600	200			43 - 57	2 200 - 600		yes
U. Kingdom	no requirement							

9.2.1.1 (A) 1

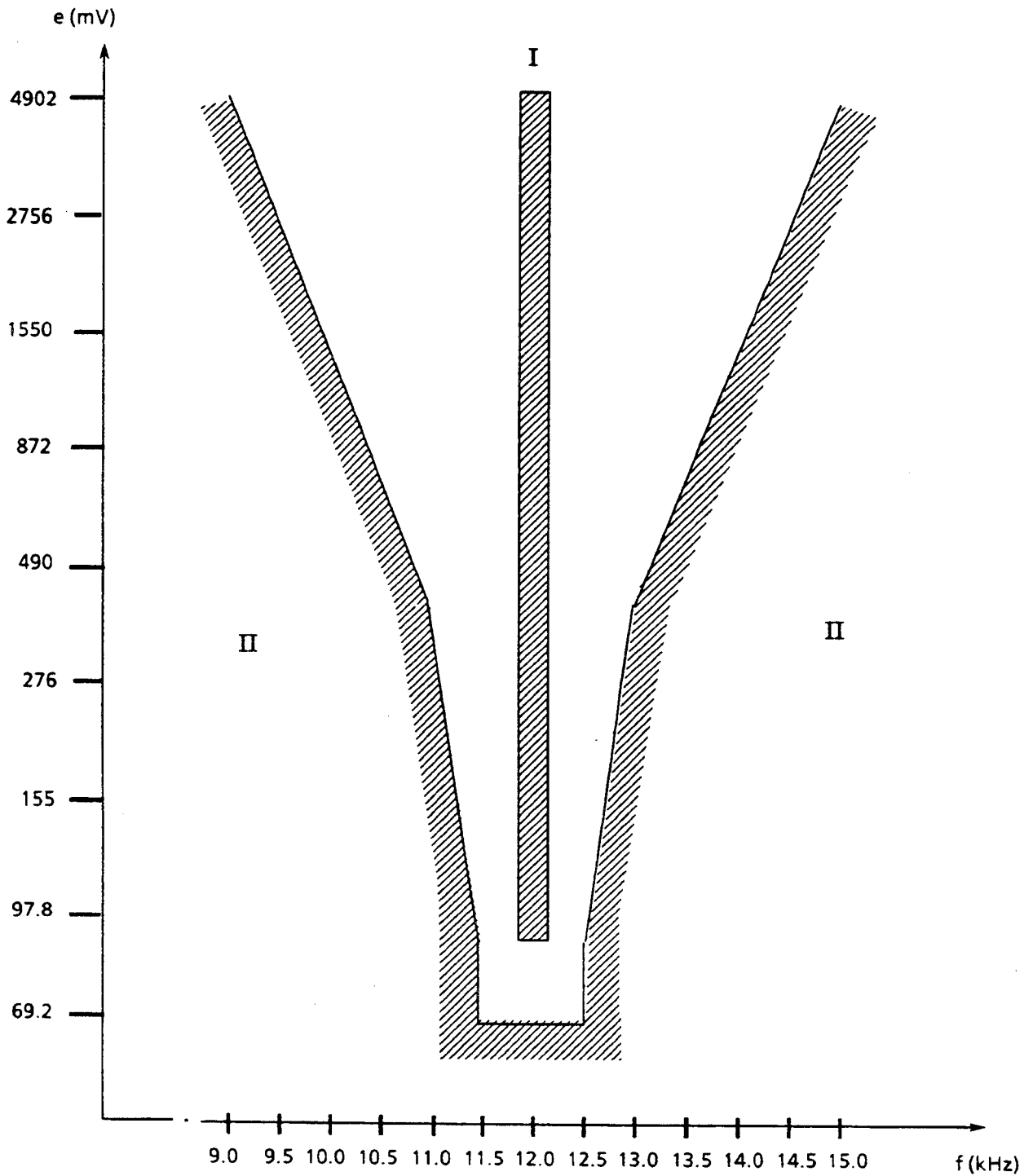


Figure 9.2.1.1 (A) 1: Receiver selectivity and sensitivity

9.2.1.1.a (B) 1

The TE shall also have another setting for long lines and in this case the voltage limits of the mask shall be reduced by a factor 0,6 (sensitivity increased by 4.4 dB).

9.2.1.1.b (B) 1 The values of table 9.2.1.1.b: Area of non-detection are as follows:

Table 9.2.1.1.b (B) 1

	n = 1	n = 2	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8	n = 9	n = 10	n = 11	n = 12
f_n (kHz)	14	14	14,75	14,75	15,25	15,25	16,75	16,75	17,25	17,25	18	18
e_n (mV)	2 000	500	500	200	200	50	50	200	200	500	500	2 000

The TE shall also have another setting for long lines and in this case the voltage limits of the mask shall be reduced by a factor 0,6.

9.2.1.1.c (SF) 1 The call charge meter shall operate at a frequency of 16 kHz \pm 50 Hz and at a voltage of 130 mV ... 8,5 V at the terminals of the equipment.

The selectivity of the equipment shall be according to figure 9.2.1.1.c (SF) 1.

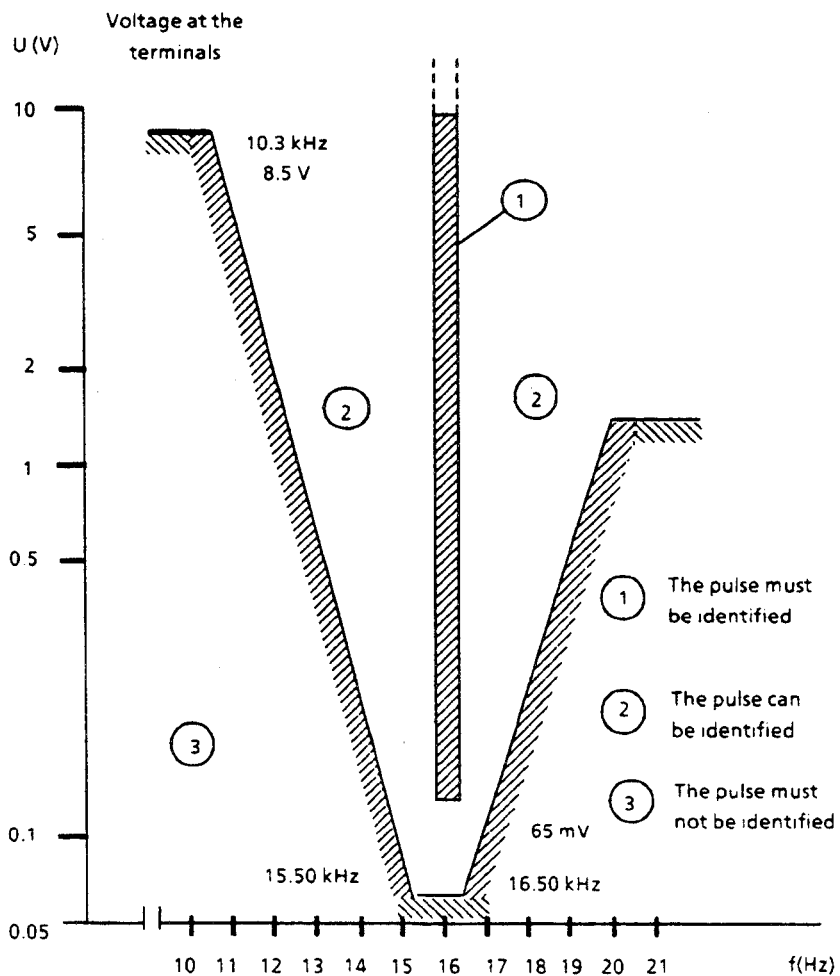


Figure 9.2.1.1.c (SF) 1

9.2.1.1.b (F) 1 The values of table 9.2.1.1.b: Area of non-detection are as follows:

Table 9.2.1.1.b (F) 1

	n = 1	n = 2	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8	n = 9	n = 10	n = 11	n = 12
f_n	≤ 10	10	10,75	10,75	11,25	11,25	12,75	12,75	13,25	13,25	14	≥ 14
e_n	1 500	500	500	200	200	50	50	200	200	500	500	1 500

9.2.1.1 (F) 2 In the case of a terminating unit: $V_f = 46 - 54$ V; $R_f = 300 - 1\ 400$ ohms.

9.2.1.1 (F) 3 In the quiescent condition, it is required to detect at least 1 meter pulse until 2 s after the release of the line and to inhibit the detector at the latest 1 mn after the release of the line.

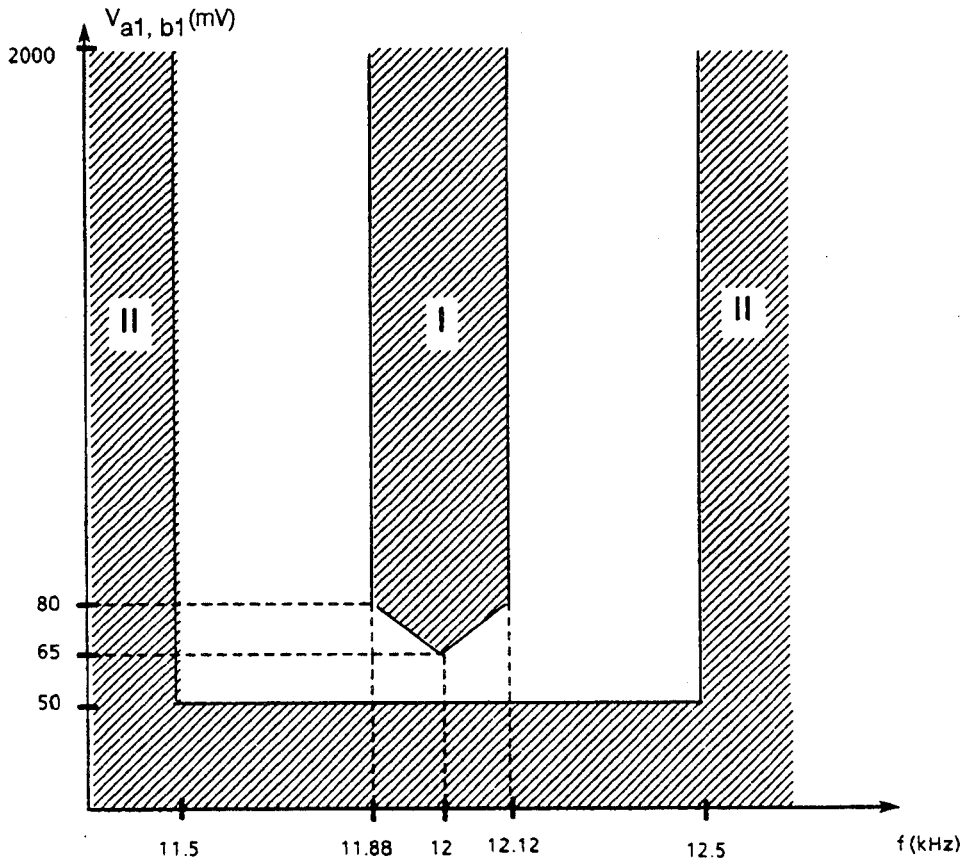
9.2.1.1 (F) 4 The receiver shall not respond to:

- a) discharge of a capacitor of value $4\ \mu\text{F}$, beforehand charged with 100 V, applied to the line terminals as described in section A.9.2.1.1 (F) 3;
- b) decadic dialling (loop pulsing) of a parallel connected TE as described in section A.9.2.1.1 (F) 4;
- c) random short breaks of the feeding current of duration not higher than 200 ms, as described in section A.9.2.1.1 (F) 5;
- d) feeding polarity inversion as described in section A.9.2.1.1 (F) 6;
- e) ringing signal and "off-hook" from a connected TE during the ringing period, as described in section A.9.2.1.1 (F) 7.

9.2.1.1 (F) 5 The meter pulse detection shall also be correct during a register recall.

9.2.1.1 (D) 1 The 16 kHz meter pulse ac rms voltages "e", given in table 9.2.1.1.a, are measured with a generator internal resistance of 0 ohm at a load resistance of 200 ohms.

9.2.1.1.a,b (I) 1



- I Area of detection
- II Area of non-detection

Test values:	11888 Hz	80 mV
	12000 Hz	65 mV
	12120 Hz	80 mV

Area of detection I is limited to 2 400 mV.
 Area of detection II is limited to 2 000 mV.

Figure 9.2.1.1.a (I) 1

9.2.1.1.c (I) 1

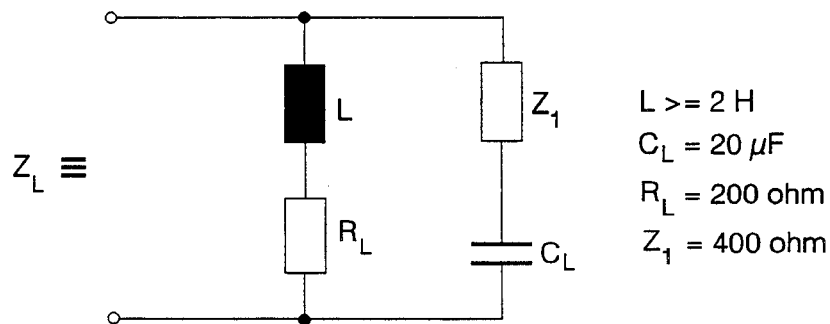


Figure 9.2.1.1.c (I) 1

9.2.1.1.a (N) 1

Equipment with e_{\min} between $50 \text{ mV}_{\text{rms}}$ and $90 \text{ mV}_{\text{rms}}$ is allowed if it is installed by an installation company licensed by NTRA.

9.2.1.1.b (N) 1

The values of table 9.2.1.1.b: Area of non-detection are as follows:

Table 9.2.1.1.b (N) 1

	n = 1	n = 2	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8	n = 9	n = 10	n = 11	n = 12
f_n (kHz)	≤ 10	10	10,75	10,75	11,25	11,25	12,75	12,75	13,25	13,25	14	≥ 14
e_n (mV _{rms})	1 500	500	500	200	200	50	50	200	200	500	500	894

9.2.1.1.c (N) 1

I_{max} for terminated connected TE see definition in Chapter 1.

I_{max} for series-connected TE = 100 mA.

9.2.1.1.b (P) 1

f_3 (kHz) = 10 750	f_8 (kHz) = 12 750
e_3 (mV) = 500	e_8 (mV) = 200
f_4 (kHz) = 10 750	f_9 (kHz) = 13 250
e_4 (mV) = 200	e_9 (mV) = 200
f_5 (kHz) = 11 250	f_{10} (kHz) = 13 250
e_5 (mV) = 200	e_{10} (mV) = 500
f_6 (kHz) = 11 250	f_{11} (kHz) = 14
e_6 (mV) = 50	e_{11} (mV) = 500
f_7 (kHz) = 12 750	f_{12} (kHz) = f_n (kHz) = 14
e_7 (mV) = 50	e_{12} (mV) = e_n (mV) = 2 000

9.2.1.1 (E) 1

12 kHz receiver sensitivity.
(Requirement to be applied instead of section 9.2.1.1).

With TE in whatever condition it can be, during the moments in which it is prepared for receiving 12 kHz metering pulses, it shall receive as normal metering pulses a series of 50 pulses with open circuit ac rms voltages from 210 mV to 4,8 V and frequencies from 11,88 kHz to 12,12 kHz, in a sequence which is made up by 50 ms of signal and 70 ms of pause, applied between the line terminals through a resistor of 200 ohms.

PROVISION:

When the receiver is prepared to be used in bridging mode, an additional resistor of 200 ohms shall be connected between the line terminals.

Compliance shall be checked by the tests outlined in section A.9.2.1.1 (E) 2.

9.2.1.1 (E) 2

12 kHz receiver immunity.
(Requirement to be applied in addition to section 9.2.1.1 (E) 1).

With TE in whatever condition it can be, during the moments in which it is prepared for receiving 12 kHz metering pulses, it shall be immune and shall not interpret as normal metering pulses any pulse of the series of 50 pulses of the signals stipulated in table 9.2.1.1 (E) 2, where:

- the metering signals "i" to "iv" are applied between the line terminals through a resistor of 200 ohms;
- the ac signal type "v" is applied between the line terminals through a resistor of 600 ohms;
- the signal type "vi" is 10 series of 10 dialling pulses as stipulated in the associated testing method.

PROVISION:

See the provision in the requirement in section 9.2.1.1 (E) 1.

Compliance shall be checked by the tests outlined in section A.9.2.1.1 (E) 3.

Table 9.2.1.1 (E) 2: 12 kHz receiver immunity

Signal type	Open circuit ac rms	Frequency range	Duration	
			Signal	Pause
i	$210 \text{ mV} \leq e \leq 4,8 \text{ V}$	$f = 12 \text{ kHz}$	$\leq 30 \text{ ms}$	$\geq 50 \text{ ms}$
ii	$e \leq 100 \text{ mV}$	$f = 12 \text{ kHz}$	$\geq 50 \text{ ms}$	$\geq 70 \text{ ms}$
iii	$e < 800 \text{ mV}$	$f = 11,4 \text{ kHz}$	$\geq 50 \text{ ms}$	$\geq 70 \text{ ms}$
iv	$e < 800 \text{ mV}$	$f = 12,6 \text{ kHz}$	$\geq 50 \text{ ms}$	$\geq 70 \text{ ms}$
v	$e = 5 \text{ V}$	$300 \text{ Hz} \leq f \leq 3,4 \text{ kHz}$	$\geq 50 \text{ ms}$	$\geq 70 \text{ ms}$
vi	See text			

9.2.1.1.a (S) 1 The meter pulse detector shall be able to adjust in two steps, high sensitivity and low sensitivity.

9.2.1.1.a (S) 2 Feeding conditions, see Chapter 1, section 1.5.2.

9.2.1.1.b (S) 1 The values of table 9.2.1.1.b: Area of non-detection are as follows:

Table 9.2.1.1.b (S) 1

	n = 1	n = 2	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8	n = 9	n = 10
f_n	4,0	4,0	10	11	11	11,7	12,3	13	13	17
e_n	6 500	775	775	13,8	5,5	2,7	2,7	5,5	13,8	775

9.2.1.1.b (S) 2 In the case of low sensitivity the values of f_1/e_1 to f_4/e_4 and f_9/e_9 , f_{10}/e_{10} are the same as in table 9.2.1.1.b (S) 1 but:

$$f_5 = 11 / e_5 = 8,7$$

$$f_6 = 11,7 / e_6 = 8,7$$

$$f_7 = 12,3 / e_7 = 8,7$$

$$f_8 = 13 / e_8 = 8,7$$

9.2.1.1.a (CH) 1 Charge metering at the subscriber's premises is not mandatory. If it is introduced, however, then the requirements of subclause 9.2 must be met.

For charge meters integrated into the equipment specific properties of the other NET 4 chapters must be met accordingly in addition to the properties specific for the charge meter.

For series-connected charge meters the relevant requirements of the other NET 4 chapters such as those concerning e.g. insulation, series resistance, symmetry, attenuation and effect on the desired signals must be met.

9.2.1.1.b (CH) 1

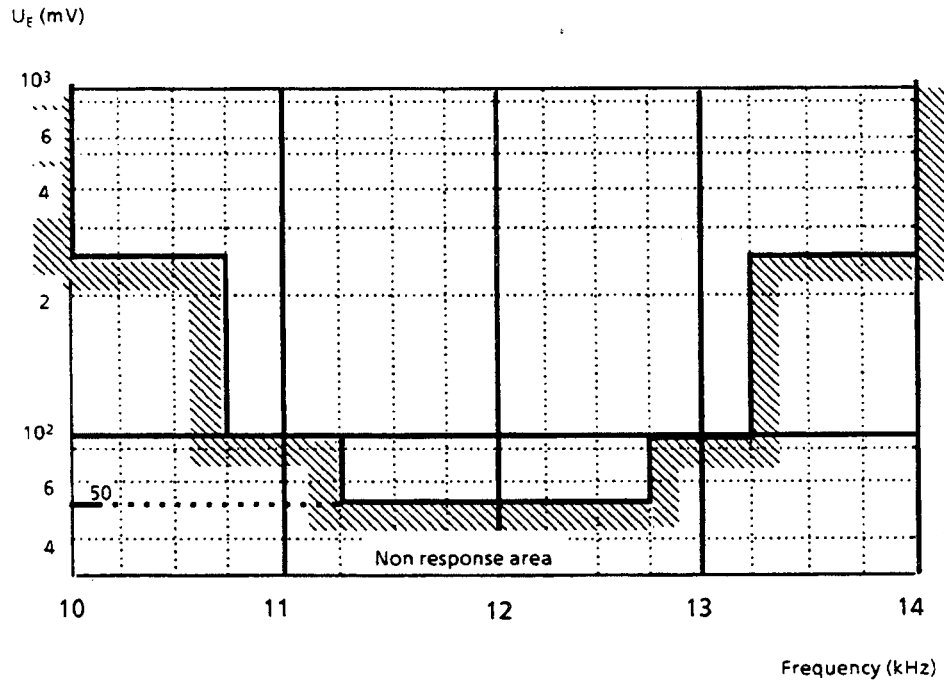


Figure 9.2.1.1 (CH) 1

9.2.1.1.c (CH) 1 After loop states, the receiver must be capable of responding to one meter pulse in quiescent period of 600 ms.

A.9.2.1.1 Selectivity and sensitivity

The TEUT is connected as shown in figure A.9.2.1.1.a in the case of a separate unit intended to be connected in series with another TE or, as shown in figure A.9.2.1.1.b in the case of a terminating unit.

The test is carried out with a switch "S" in both open and closed positions (presence and absence of loop current, respectively), or in the closed position (presence of loop current), with meter pulses of duration t_1 (ms) separated by intervals of at least t_2 (ms) as specified in table A.9.2.1.1.

The feeding conditions V_f , R_f , I_f and the test parameters are described in table A.9.2.1.1.

The frequency and level steps are determined either by table A.9.2.1.1, or a suitable way to obtain a curve $e = f(f)$.

Table A.9.2.1.1: Selectivity and sensitivity

COUNTRY	TEST VALUES				
	t_1 (ms)	t_2 (ms)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	50	50	60		19, 60
Belgium	150	250	48	400, 1 600	
Cyprus	80	300	48	800	
Denmark	not mandatory				
Finland	100, 300	100	48	800, 1 710	
France	75	75	48		25, 60
Germany	80, 365	135	60	1 000, 2 530	
Greece	≥ 50	90	60		20, 35
Iceland	120	100	48		14, I_{max} .
Ireland	120	≥ 400	48		20 - 100
Italy	80	200	44, 48, 52	1 880, 1 100, 720	
Luxembourg	80, 365	135	60		19, 60
Malta					
Netherlands					
Norway	120	120	60	3 100	
Portugal	120	not applic.	48	300 - 1 800	not applic.
Spain			48	500, 1 100, 2 200	N/A
Sweden	120	100			
Switzerland	50	1 000	43	2 200	
U. Kingdom	no requirement				

Table A.9.2.1.1 cont.: Selectivity and sensitivity

COUNTRY	TEST VALUES				Remarks
	f_1 (kHz)	f_2 (kHz)	f_i (kHz)	f_n (kHz)	
	e_1 (mV)	e_2 (mV)	e_i (mV)	e_n (mV)	
Austria					yes
Belgium					yes
Cyprus	15,84/100	15,84/4 000	16,16/4 000	16,16/100	
Denmark	not mandatory				
Finland					yes
France					yes
Germany	15,92/61,6	15,92/9 757	16,08/9 757	16,08/61,67	yes
Greece	15,840/97	15,840/6 000	16,16/6 000	16,16/97	
Iceland	11,88/45	11,88/2 100	12,12/2 100	12,12/45	
Ireland	11,88/45	11,88/2 600	12,12/2 600	12,12/45	
Italy					yes
Luxembourg	15,92/110	15,92/9 000	16,08/9 000	16,08/110	
Malta					
Netherlands					
Norway					yes
Portugal					yes
Spain					yes
Sweden					yes
Switzerland	curve e/f (f)				
U. Kingdom	no requirement				

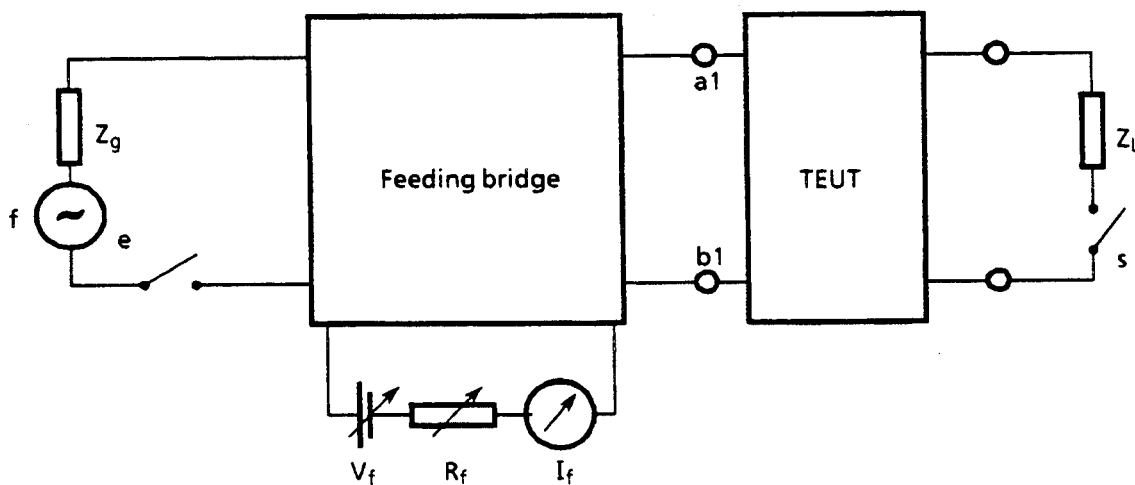


Figure A.9.2.1.1.a: Series connection

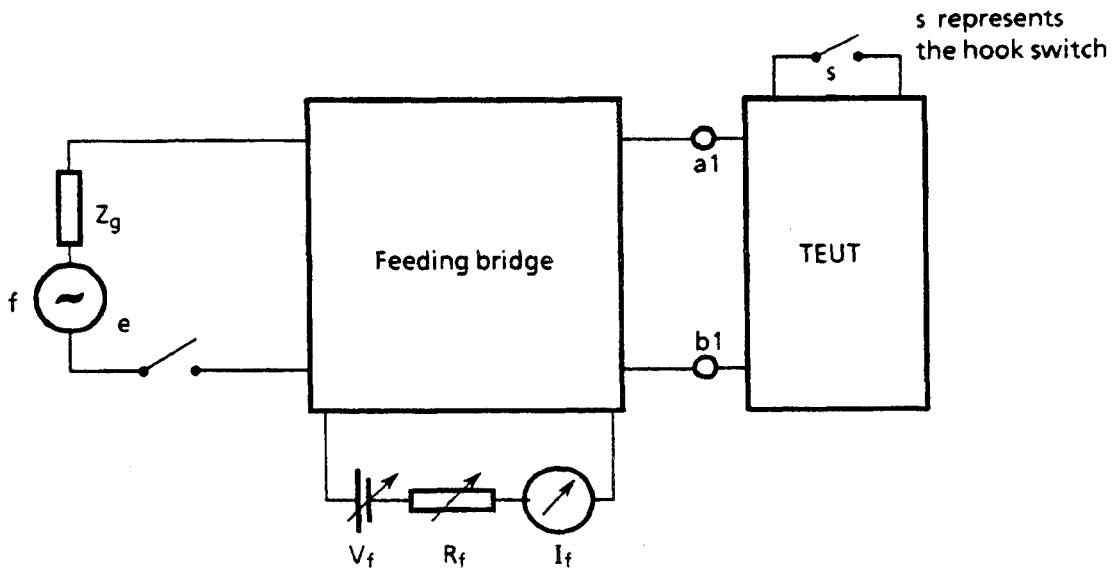


Figure A.9.2.1.1.b: Terminating connection

A.9.2.1.1 (A) 1

Curve see 9.2.1.1 (A) 1.

A.9.2.1.1 (B) 1

The frequency range and level steps are determined in a suitable way to obtain a curve $e = f(f)$ within the frequency range $f = 14 - 18$ kHz and the voltage range $e = 2\ 200 - 30$ mV.

The tests are carried out for both sensitivities.

A.9.2.1.1 (SF) 1

The frequency and level steps are determined in a suitable way to obtain a curve $e = f(f)$ within the frequency range $f = 10 - 20$ kHz and the voltage range $e = 130 - 8\ 500$ mV.

A.9.2.1.1 (F) 1

The values of table A.9.2.1.1 cont. are as follows:

Table A.9.2.1.1 (F) 1.a

	n = 1	n = 2	n = 3	n = 4	n = 5	n = 6	n = 7
f_n	4	6	10	10,75	11,25	11,88	11,88
e_n	1 500	1 500	1 500	500	200	105	50

Table A.9.2.1.1 (F) 1.b

	n = 8	n = 9	n = 10	n = 11	n = 12	n = 13	n = 7	n = 14
f_n	12	12	12	12,12	12,12	13,25	13,25	14
e_n	50	105	4 000	50	105	200	500	1500

A.9.2.1.1 (F) 2

In the case of a terminating unit: $V_f = 46, 54$ V; $R_f = 1\ 400, 300$ ohms.

A.9.2.1.1 (F) 3

The TEUT is connected as shown in figure A.9.2.1.1 (F) 3.

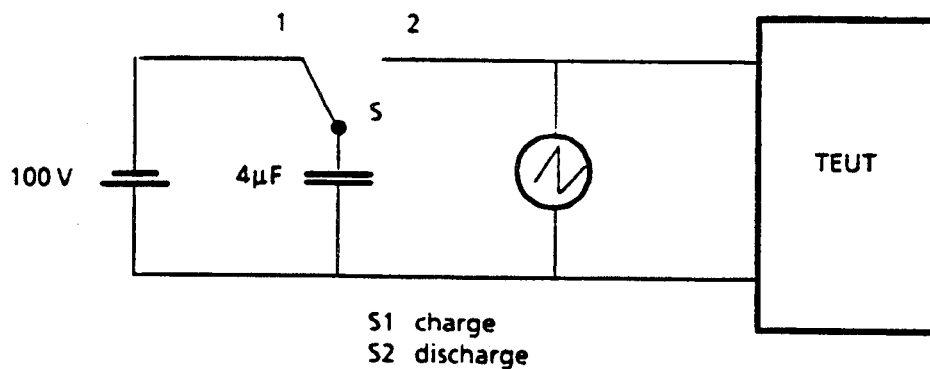


Figure A.9.2.1.1 (F) 3

A.9.2.1.1 (F) 4 The test is carried out using figure A.9.2.1.1 (F) 4.

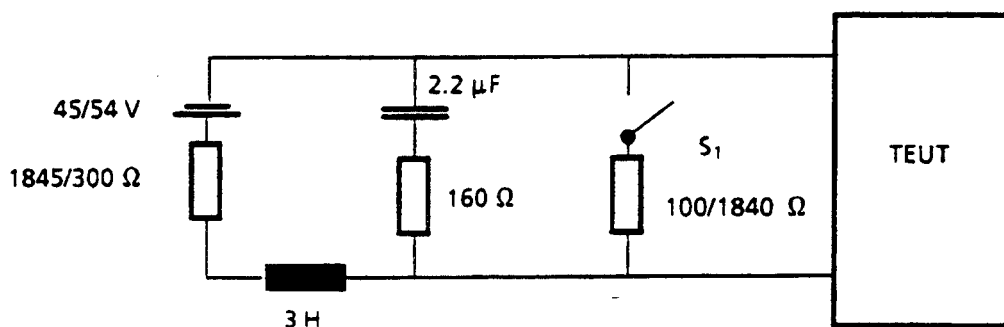


Figure A.9.2.1.1 (F) 4: Immunity to decadic dialling from a parallel connected TE

A.9.2.1.1 (F) 5 The test carried out using figure A.9.2.1.1 (F) 5, with random breaks of duration of 200 ms.

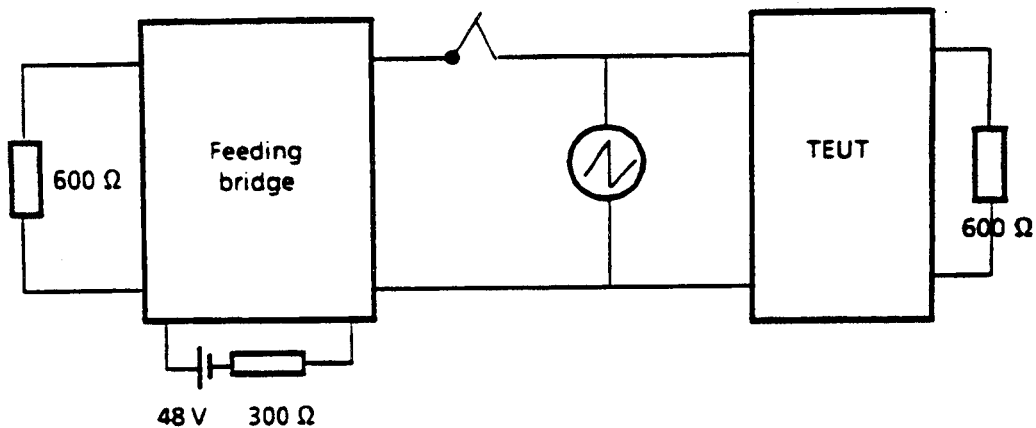


Figure A.9.2.1.1 (F) 5: Immunity to random feeding breaks

A.9.2.1.1 (F) 6 The test is carried out using figure A.9.2.1.1 (F) 6.

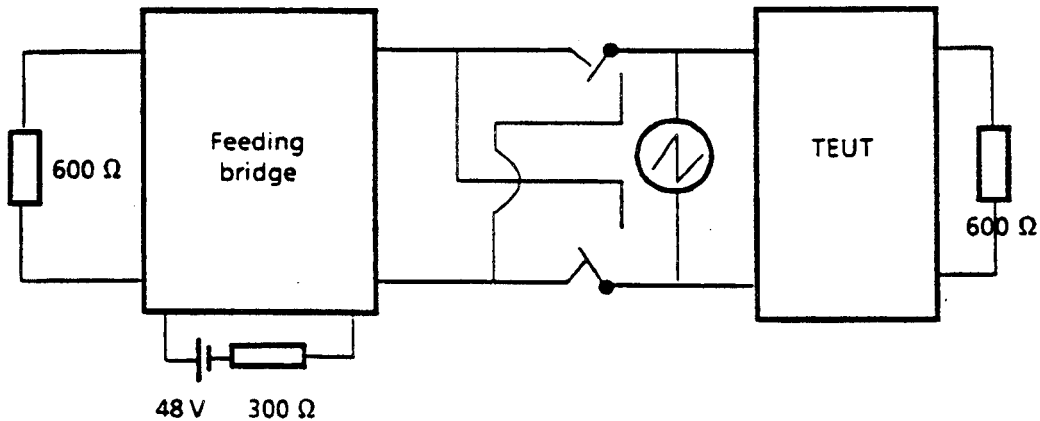


Figure A.9.2.1.1 (F) 6: Immunity to polarity inversion

A.9.2.1.1 (F) 7 The test is carried out using figure A.9.2.1.1 (F) 7.

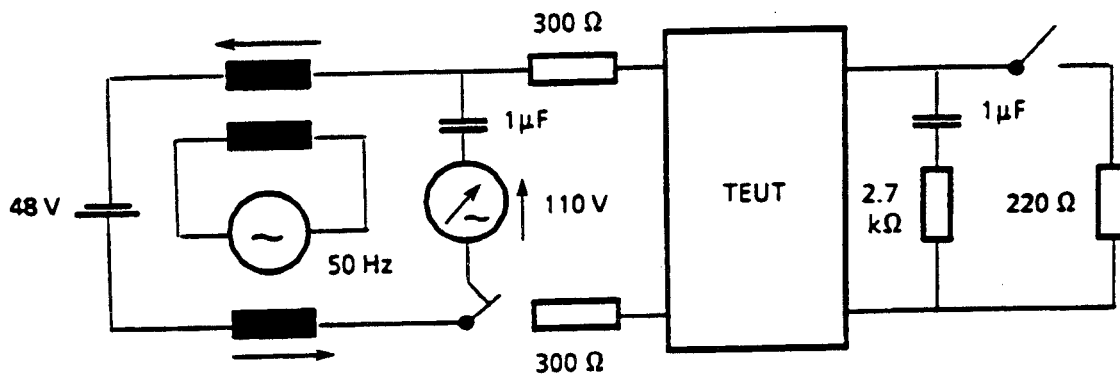


Figure A.9.2.1.1 (F) 7: Immunity to ringing signal

- A.9.2.1.1 (D) 1 The 16 kHz meter pulse ac rms voltages "e", given in table A.9.2.1.1, are measured with a generator internal resistance of 0 ohm at a load resistance of 200 ohms.
- A.9.2.1.1 (I) 1 See 9.2.1.1.a (I) 1.
- A.9.2.1.1 (N) 1 See table 9.2.1.1.a and remark 9.2.1.1.b (N) 1.
- A.9.2.1.1 (P) 1 The curve $e = e(f)$ is obtained for the frequencies f (Hz) = 10, 10 750, 11 250, 11 500, 11 750, 12, 12 250, 12 500, 12 750, 13 250, 14 using one metering pulse in each measurement.
- A.9.2.1.1 (E) 1 General of 12 kHz receiver.

The testing procedure to follow is:

- a) to check, by inspection and according with the user's manual and by any other technical documentation, whether the TEUT is provided with the facility of receiving metering pulses from the network, for what kind of them it is prepared to receive, and how it can be controlled whether a metering pulse has been received or not;

and

- b) to check that relevant tests in other sections have been carried out;
- and
- c) to determine, by inspection and according with the user's manual and by any other technical documentation, whether the TEUT has a high or a low impedance metering pulse receiver.

A.9.2.1.1 (E) 2 12 kHz receiver sensitivity.

The TEUT is connected as shown in figure A.9.2.1.1.b, and for series TE as shown in figure A.9.2.1.1.a.

The dc voltage source (V_f) takes the value of 48 V. The resistor (R_f) takes the value of 500 ohms when the TEUT is in the quiescent condition or in high impedance condition and the values of 500, 1 100, and 2 200 ohms, when it is in whatever other condition.

The feeding bridge shall be as stipulated in section 1.5 (E) 1.

The resistor (Z_G) takes a value of 200 ohms.

The values of the generator open circuit ac rms voltage (e), the generator frequency (f), are indicated in table A.9.2.1.1 (E) 2, and the sequence of the signal switch (unnamed) is indicated in the associated requirements in section 9.2.1.1 (E) 1.

The tests shall be carried out by inspection with the signals indicated, checking that all the metering pulses are received.

PROVISION 1: When the TEUT is a series TE, the tests are carried out with the switch (S) closed in figure A.9.2.1.1.a, where the impedance (Z_L) is formed by a circuit with an inductor of a value no lower than 10 H in series with a resistor of 300 ohms.

PROVISION 2: The additional resistor of 200 ohms, when necessary (see provision in the associated requirement in section 9.2.1.1 (E) 1), is connected in the ac port, behind the two capacitors (C_f) and in parallel with the generator (e).

Table 9.2.1.1 (E) 2: 12 kHz receiver sensitivity

Frequency (f) (kHz)	Voltage (e)
11,88	4,8 V
11,88	210 mV
12	210 mV
12,12	210 mV
12,12	4,8 V

A.9.2.1.1 (E) 3 12 kHz receiver immunity.

A.9.2.1.1 (E) 3.a The procedure of test in section A.9.2.1.1 (E) 2 is followed with the signals "i" to "iv" stipulated in table A.9.2.1.1 (E) 3.

A.9.2.1.1 (E) 3.b The procedure of test in section A.9.2.1.1 (E) 2 is followed, where the resistor (Z_G) takes a value of 600 ohms, with the signals "v" stipulated in table A.9.2.1.1 (E) 3.

A.9.2.1.1 (E) 3.c The procedure of test in sections A.6.2.3 and A.6.2.3 (E) 1 is followed for the signal type "vi".

The tests shall be done by inspection with the signals indicated, checking that the testing signal is interpreted as a metering pulse.

Table A.9.2.1.1 (E) 3: 12kHz receiver immunity

Signal type	Frequency (f)	Voltage (V)	Switch (unnamed)	
			Closed	ms Opened
i	12 kHz	210 mV	30	50
	12 kHz	4,8 V	30	50
ii	12 kHz	100 mV	100	100
iii	11,4 kHz	775 mV	100	100
iv	12,6 kHz	775 mV	100	100
v	425 Hz	5 V	200	200
	600 Hz	5 V	200	200
	1000 Hz	5 V	200	200
	3,4 kHz	5 V	200	200
vi	See Text			

A.9.2.1.1 (S) 1 Steps of "f" and "e" values in a suitable way to obtain a curve $e = f(f)$.

A.9.2.1.1 (S) 2 Feeding conditions, see Chapter 1, section 1.5.2.

9.2.1.2 Timing

- a) The receiver shall respond to a series of meter pulses within area "I" of figure 9.2.1.1 with a duration between t_3 (ms) and t_4 (ms), and a pause of at least t_5 (ms). It must not respond to single pulses shorter than t_6 (ms).
- b) The receiver shall not take into account signal interruptions of t_7 (ms).

The values of these durations are given in table 9.2.1.2.

The requirements shall be met with the terminating impedances Z_G and Z_L and feeding values V_f , R_f , I_f in the ranges specified in table 9.2.1.1.c.

The requirements shall be met with the presence or absence of loop current.

Compliance shall be checked using the tests outlined in section A.9.2.1.2.

Table 9.2.1.2: Timing

COUNTRY	REQUIREMENT VALUES					Remarks
	t_3 (ms)	t_4 (ms)	t_5 (ms)	t_6 (ms)	t_7 (ms)	
Austria	≥ 20		50	15	8	yes
Belgium	80	> 80	220	30	not spec.	yes
Cyprus	80	300	100	30	20	
Denmark	not mandatory					
Finland	100	300	100	not spec.	not spec.	
France	75	130	75	30	20	
Germany	80	365	135		5	
Greece	50		90	30		
Iceland	100	200	130	60	20	
Ireland	100	300	400	80	not spec.	
Italy	80	170	200	30	10	
Luxembourg	80	365	195	60		
Malta						
Netherlands						
Norway	120	180	120	50	5	
Portugal	120	250	120	30	20	yes
Spain	50	50	= 70	≤ 30	N/A	yes
Sweden	90	130	60	80	40	
Switzerland	50	140	90	35	20	
U. Kingdom	not mandatory					

9.2.1.2 (A) 1 Metering pulses shall be detected within a time of 500 ms after the end of the loop condition.

9.2.1.2 (B) 1 The remark in table 9.2.1.1.c is still applicable here.

9.2.1.2 (P) 1 The requirements shall be met with presence of loop current.

9.2.1.2 (E) 1 The requirements in sections 9.2.1.1 (E) 1 and 9.2.1.1 (E) 2 shall be applied.

A.9.2.1.2 Timing

The TEUT is connected as shown in figure A.9.2.1.1.a in the case of a separate unit intended to be connected in series with a TE, or as shown in figure A.9.2.1.1.b in the case of a terminating unit.

The test is carried out with switch "S" in both open and closed positions (presence and absence of loop current, respectively), or only in the closed position (presence of loop current) as specified in table 9.2.1.1.c.

a) The detection tests are carried out with a series of "n" pulses of duration t_8 (ms) separated by pauses of duration t_9 (ms) as indicated in table A.9.2.1.2.a.

The values of the generator open circuit voltages e_i (mv) associated with the measurement frequencies f_i (kHz) are given in table A.9.2.1.2.a.

- b) The signal interruption of t_7 (ms), which shall not be recognised, is carried out in the middle of a signal of duration t_4 (ms), emitted at the nominal meter frequency f_b (kHz) with a level e_b (mV). The parameters values are given in table A.9.2.1.2.b.

The test parameters Z_G and Z_L are set as described in table 9.2.1.1.c, and the feeding values V_f , R_f , I_f are described in table A.9.2.1.2.a.

Table A.9.2.1.2.a: Timing, paragraph a

COUNTRY	TEST VALUES					
	n	t_8 (ms)	t_9 (ms)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	100	50	50	60		19, 60
Belgium	10	80, 20	320	48	400, 1 600	
Cyprus	10	80, 300	100	48	800	
Denmark	not mandatory					
Finland	not spec.	100, 300	100	48	800, 1 710	
France	10	30, 75, 400	75	48, 48		25, 60
Germany	10	80, 365	135	60	1 000, 2 530	
Greece	10	60	90	60		20, 35
Iceland	10	100, 140, 180	130	48		14, I_{max} .
Ireland	10	100, 120, 140	≥ 400	48		20 - 100
Italy	5	80, 125, 170	200	44, 48, 52	1 880, 1 100, 720	
Luxembourg	10	80, 365	135	60		19, 60
Malta						
Netherlands						
Norway	10	45, 120	120	60	460, 3 100	
Portugal	≥ 10	120	120	48	300, 1 800	N/A
Spain				48	500, 1 100, 2 200	N/A
Sweden	9	91	61			
Switzerland	10	55	90	48	2 200	
U. Kingdom	not mandatory					

Table A.9.2.1.2.a cont.: Timing, paragraph a

COUNTRY	TEST VALUES			
	f_1 (kHz)	f_2 (kHz)	f_i (kHz)	f_n (kHz)
	e_1 (mV)	e_2 (mV)	e_i (mV)	e_n (mV)
Austria				
Belgium	16/250			
Cyprus	16/100			
Denmark	not mandatory			
Finland	16/130	16/8 500		
France	12/105	12/4 000		
Germany	15,92/61,6	15,92/9 757	16,08/9 757	16,08/61,6
Greece	15,840/97	15,840/6 000	16,16/6 000	16,16/97
Iceland	12/45	12/2 100		
Ireland	11,88/45	11,88/2 600	12,12/2 600	12,12/45
Italy				
Luxembourg	15,92/110	15,92/9 000	16,08/9 000	16,08/110
Malta				
Netherlands				
Norway	15,84/50	16,16/50		
Portugal	11,880/105	12/105		12,120/105
Spain				
Sweden				
Switzerland	11,88/110	12,12/110	11,88/10 000	12,12/10 000
U. Kingdom	not mandatory			

Table A.9.2.1.2.b: Timing, paragraph b

COUNTRY	TEST VALUES				Remarks
	f_b (kHz)	e_b (mV)	t_4 (ms)	t_7 (ms)	
Austria	12,0	100	50	8	yes
Belgium	not mandatory				yes
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France	12	4 000	400	20	yes
Germany	16	9 757	365	5	yes
Greece					
Iceland	12	2 100	140	20	
Ireland	not specified				
Italy	12	65	170	10	yes
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	16	2 000	150	5	yes
Portugal	12	4 400	250	20	
Spain	not mandatory				yes
Sweden	12	5,5, 24,5		40	yes
Switzerland	12	2 000	140	20	
U. Kingdom	not mandatory				

A.9.2.1.2 (A) 1 Curve see 9.2.1.1 (A) 1.

A.9.2.1.2 (B) 1 The receiver shall respond with $t_8 = 80$ ms and it shall not respond with $t_8 = 20$ ms.

A.9.2.1.2 (F) 1 In the case of a terminating unit: $V_f = 46/54$ V; $R_f = 1\ 400/300$ ohms.

A.9.2.1.2 (D) 1 The 16 kHz meter pulse ac rms voltages "e", given in table A.9.2.1.2.b, are measured with a generator internal resistance of 0 ohm at a load resistance of 200 ohms.

A.9.2.1.2.a (I) 1 See 9.2.1.1.a (I) 1.

A.9.2.1.2 (N) 1 $e_1/e_2 = 90$ mV_{rms} for TE which is installed by an installation company licensed by NTRA.

A.9.2.1.2.a (S) 1
 $f_1 = 11,9/ e_1 = 5,5, 17,4$
 $f_2 = 12 / e_2 = 5,5, 17,4$
 $f_3 = 12,1/ e_3 = 5,5, 17,4$

A.9.2.1.2.a (S) 2 Feeding conditions, see Chapter 1, section 1.5.2.

A.9.2.1.2 (E) 1 The procedures of test in sections A.9.2.1.1 (E) 2 and A.9.2.1.1 (E) 3 are followed.

9.2.1.3 Attenuation at meter pulse frequencies for series-connected TE

When the meter pulse detection unit is connected in series with a TE in loop condition, the insertion loss of the detection unit shall be higher than a (dB) in the frequency range f_1 (kHz) up to f_2 (kHz), with an open circuit voltage e_1 (mV) to e_2 (mV), as specified in table 9.2.1.3.

The requirements shall be met with terminating impedances Z_G (Ω) and Z_L (Ω) as specified in table 9.2.1.3, and with feeding values V_f , R_f , I_f in the ranges specified in table 9.2.1.3.

Compliance shall be checked by the tests outlined in section A.9.2.1.3.

Table 9.2.1.3: Attenuation at meter pulse frequencies for series-connected TE

COUNTRY	REQUIREMENT VALUES				
	a (dB)	f_1 (kHz)	f_2 (kHz)	e_1 (mV)	e_2 (mV)
Austria	46	11,928	12,072	100	5 000
Belgium	17	15,840	16,160	30	2 200
Cyprus	35	15,840	16,160	100	4 000
Denmark	not mandatory				
Finland	40	16		130	8 500
France	30	11,88	12,12	105	4 000
Germany		15,92	16,08	9 757	61,6
Greece	43	15,840	16,160	6 000	97
Iceland	35	11,88	12,12	45	2 100
Ireland	not mandatory				
Italy	30	11,880	12,120	2 000	
Luxembourg		15,92	16,08	9 000	110
Malta					
Netherlands					
Norway	35	15,840	16,160	2 000	50
Portugal	not mandatory				
Spain	36	12	N/A	3 000	N/A
Sweden	53	11,9	12,1		447
Switzerland	3511,88	12,12	110	1 200	
U. Kingdom	not mandatory				

Table 9.2.1.3 cont.: Attenuation at meter pulse frequencies for series-connected TE

COUNTRY	REQUIREMENT VALUES					Remarks
	Z _G (Ω)	Z _L (Ω)	V _f (V)	R _f (Ω)	I _f (mA)	
Austria	200	600	60		19 - 60	
Belgium	200	200	48		20 - I _{max.}	
Cyprus	200	600	48	440 - 1 740		
Denmark	not mandatory					
Finland	200	200	48	800 - 1 710		
France	200	600	48	300	25 - 60	yes
Germany	0	200	60	100, 2 530		yes
Greece	200	200	44 - 66		20 - 80	
Iceland	200	200	48		14 - 70	
Ireland	not mandatory					
Italy	200		44 - 52	720 - 1 880		yes
Luxembourg	200	600	60		19 - 60	
Malta						
Netherlands						
Norway	200	200	60	460 - 3 100		yes
Portugal	not mandatory					
Spain	200	200	48	500 - 2 200	N/A	yes
Sweden	200	200				
Switzerland	200	200	48	1 200		
U. Kingdom	not mandatory					

9.2.1.3 (F) 1 In the case of a terminating unit: V_f = 46 - 54 V; R_f = 300 - 1 400 ohms.

9.2.1.3 (D) 1 The meter pulse detection units are transparent and the insertion loss shall not be higher than 0,5 dB.

9.2.1.3 (D) 2 The 16 kHz meter pulse ac rms voltages "e", given in table A.9.2.1.3, are measured with a generator internal resistance of 0 ohm at a load resistance of 200 ohms.

9.2.1.3 (I) 1 See figure 9.2.1.1.c (I) 1.

9.2.1.3 (N) 1 Insertion loss in the frequency band 300 - 3 400 Hz shall be in accordance with the requirements outlined in Chapter 4.

9.2.1.3 (E) 1 12 kHz metering pulses attenuation (series).
(Requirement to be applied instead of section 9.2.1.3).

With series TE in whatever condition it can be, during the moments in which it is prepared for receiving 12 kHz metering pulses:

- a) in bridging mode, it shall meet the requirement in section 4.3 (E) 1 for the frequency of 12 kHz, so that the provision 1, in the requirement in section 4.3 (E) 1, shall not be taken into account;

and/or

- b) in terminating mode, it shall meet the requirement in section 4.3 (E) 1 for the frequency of 12 kHz in such a way that the insertion loss exhibited shall be greater than 36 dB.

Compliance shall be checked by the tests outlined in section A.9.2.1.3 (E) 1.

A.9.2.1.3 Attenuation at meter pulse frequencies for series-connected TE

The TEUT is connected as shown in figure A.9.2.1.3.

The feeding conditions V_f , R_f , I_f and the other parameters are specified in table A.9.2.1.3.

The insertion loss is then determined for each set of test values according to formula A.9.2.1.3:

$$a = 20 \log_{10} \left[\frac{U_1}{U_2} \right] \text{ (dB)} \quad \text{Formula A.9.2.1.3}$$

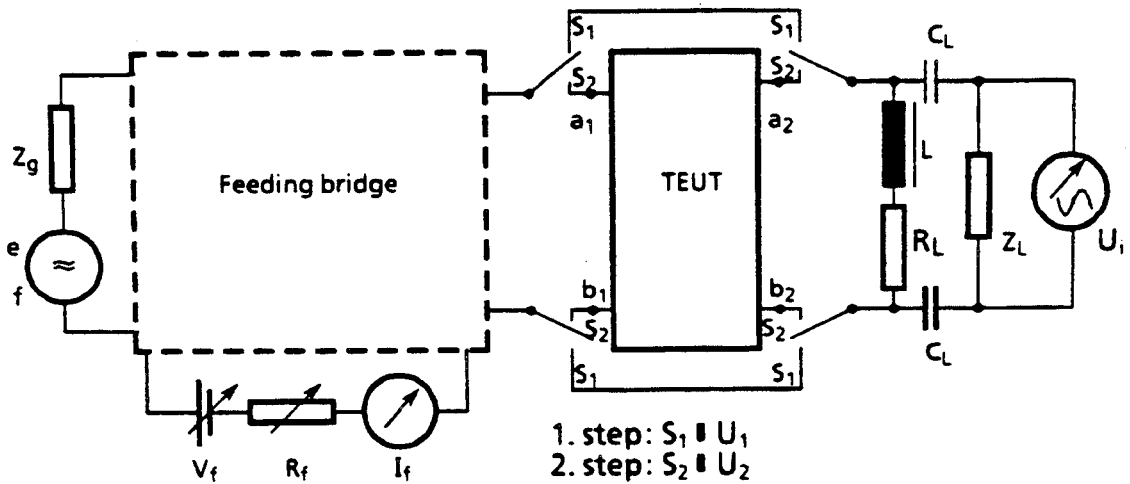


Figure A.9.2.1.3: Attenuation at meter pulses for series-connected TE

Table A.9.2.1.3: Attenuation at meter pulses for series-connected TE

COUNTRY	TEST VALUES			
	f_1 (kHz)	e_1 (mV)	C_L (μ F)	L (H)
Austria	11,928, 12,072	5 000	10	5
Belgium	16	250	20	5
Cyprus	16	1 000	50	5
Denmark	not mandatory			
Finland	16	2 600	≥ 16	≥ 6
France	11,88, 12, 12,12	4 000	100	10
Germany	16	775	≥ 10	15
Greece	16	775		
Iceland	12	2 100	≥ 2	≥ 2
Ireland	not mandatory			
Italy	11,975, 12, 12,025	2 000	≥ 40	≥ 2
Luxembourg	16	775	≥ 10	15
Malta				
Netherlands				
Norway	16	2 000	≥ 20	≥ 10
Portugal	not mandatory			
Spain	12	3 000	≥ 20	≥ 10
Sweden	12	500	2	2
Switzerland	11,88, 12,12	1 200	≥ 47	5
U. Kingdom	not mandatory			

Table A.9.2.1.3 cont.: Attenuation at meter pulses for series-connected TE

COUNTRY	TEST VALUES				Remarks
	R_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	600	60		19,60	
Belgium	300	48	400, 1 600		
Cyprus	300	48	800		
Denmark	not mandatory				
Finland	400	48	800, 1 710		
France		48	300	25, 60	yes
Germany	50	60	1 000, 2 530		
Greece					
Iceland	600	48		14, I_{max} .	
Ireland	not mandatory				
Italy	200	44, 48, 52	1 880, 1 100, 720		
Luxembourg	600	60		19, 60	
Malta					
Netherlands					
Norway		60	460, 3 100		
Portugal	not mandatory				
Spain	300	48	500, 1 100, 2 200	N/A	yes
Sweden	0				yes
Switzerland	200	48	1 200		
U. Kingdom	not mandatory				

A.9.2.1.3 (F) 1 In the case of a terminating unit: $V_f = 46, 54$ V; $R_f = 1\ 400, 300$ ohms.

A.9.2.1.3 (E) 1 12 kHz metering pulses attenuation (series).

The procedure of test in section A.9.2.1.3 is followed.

The feeding bridge shall be as stipulated in section 1.5 (E) 1.

The tests shall also be made when the resistor (R_L) is changed for an open circuit.

A.9.2.1.3 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.

9.2.1.4 Return loss at meter pulse frequencies

The input impedance between the line terminals shall have a return loss, in relation to the specified reference impedance Z_r (Ω), not less than a (dB) at a voltage up to V_{t1} (V) or V_{t2} (V) (see figure A.9.2.1.4) within the frequency range f_1 (kHz) up to f_2 (kHz), as specified in table 9.2.1.4.

The return loss of the input impedance Z_i in relation to the reference impedance Z_r (Ω) is calculated as follows:

$$a = 20 \log_{10} \left| \frac{Z_i + Z_r}{Z_i - Z_r} \right| \text{ dB} \quad \text{Formula 9.2.1.4}$$

where both impedances are complex values.

The requirements shall be met with terminating impedances $Z_G (\Omega)$, $Z_L (\Omega)$ and with feeding values V_f , R_f , I_f as specified in table 9.2.1.4.

The requirements shall be met with the presence and absence of loop current.

Compliance shall be checked by the tests outlined in section A.9.2.1.4.

Table 9.2.1.4: Return loss at meter pulse frequencies

COUNTRY	REQUIREMENT VALUES				
	a (dB)	f ₁ (kHz)	f ₂ (kHz)	Z _r (Ω)	V _{t1} (mV)
Austria	16	11,928	12,072	200	775
Belgium	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France		11,88	12,12	200	
Germany	not mandatory				
Greece					
Iceland	12	11,88	12,12	200	
Ireland	not mandatory				
Italy	25	11,975	12,025	240	
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	9	15,5	16,5	200	1 500
Portugal	not mandatory				
Spain	10	11,88	12,12	200	5 000
Sweden	12	11,94	12,06	200	
Switzerland		11,88	12,12		
U. Kingdom	not mandatory				

Table 9.2.1.4 cont.: Return loss at meter pulse frequencies

COUNTRY	REQUIREMENT VALUES						Remarks
	V_{t2} (mV)	V_f (V)	R_f (Ω)	I_f (mA)	Z_G (Ω)	Z_L (Ω)	
Austria		60		19 - 60	200	600	
Belgium				not mandatory			
Cyprus				not mandatory			
Denmark				not mandatory			
Finland							
France		48		25 - 60	0	600	yes
Germany				not mandatory			
Greece							
Iceland		48		14 - 70	200	200	
Ireland							
Italy	80	44 - 52	720 - 1 880		240	400	yes
Luxembourg				not mandatory			
Malta							
Netherlands							
Norway		60	460 - 3 100		50	200	yes
Portugal				not mandatory			
Spain	N/A	48	500 - 2 200	N/A	≤ 50	10 H + 300 Ω	yes
Sweden	500				200	200	yes
Switzerland		43 - 57	2 200 - 600				yes
U. Kingdom				not mandatory			

9.2.1.4 (F) 1

The modulus of the input impedance shall be between 100 Ω and 500 Ω within the frequency range f_1 (kHz) up to f_2 (kHz), as specified in table 9.2.1.4, when an emf of voltage up to 4 V is applied through 200 Ω between line terminals.

In the same conditions, the real part of the input impedance shall be greater than 100 Ω .

9.2.1.4 (F) 2

In the case of a terminating unit: $V_f = 46, 54$ V; $R_f = 300 - 1 400$ Ω .

9.2.1.4 (I) 1

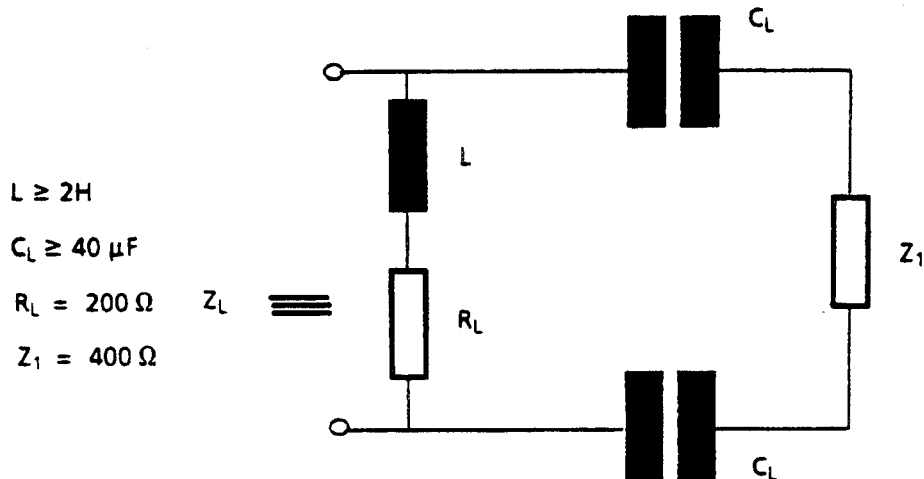


Figure 9.2.1.4 (I) 1

9.2.1.4 (N) 1

The return loss in the frequency band 300 - 3 400 Hz for a series-connected TE shall be greater than 12 dB for line currents between 17 and I_{max} .

The impedance Z_L and the reference impedance $Z_r = 120 \text{ ohms} + 820 \text{ ohms} / 110 \text{ nF}$.

9.2.1.4 (P) 1

It may be mandatory on terminal standards or NET.

9.2.1.4 (E) 1

Input impedance in terminating mode.

With TE in whatever condition it can be, during the moments in which it is prepared for receiving 12 kHz metering pulses in terminating mode, the value of the complex impedance between two line terminals shall meet the requirement in section 9.2.1.4, where the voltage (V_{t1}) is considered as the open circuit ac rms voltage (e).

Compliance shall be checked by the tests outlined in section A.9.2.1.4 (E) 1.

9.2.1.4 (E) 2

Input impedance in bridging mode.

With TE in whatever condition it can be, during the moments in which it is prepared for receiving 12 kHz metering pulses in bridging mode, the value of the modulus of the complex impedance between the two line terminals shall not be lower than 5 kΩ, tested with the signals stipulated in section 9.2.1.4 and 9.2.1.4 (E) 1.

Compliance shall be checked by the tests outlined in section A.9.1.4 (E) 2.

9.2.1.4 (S) 1

Feeding conditions, see Chapter 1, section 1.5.2.

9.2.1.4 (S) 2

For meter pulse receivers the requirements in remark 4.1.1 (S) 1 shall be replaced by the following:

The return loss in interface A and B, measured against a circuit according to figure 9.2.1.4 (S) 2, shall fulfil the following requirements when the other interface is connected to a circuit also according to the same figure.

Frequency (Hz)	Return loss (dB)
200 - 300	16
300 - 600	18
600 - 2 000	20
2 000 - 3 400	15
3 400 - 3 800	12

$$\text{Return loss} = 20 \log_{10} \frac{Z + Z_{\text{Ref}}}{Z - Z_{\text{Ref}}} \text{ dB}$$

where Z_{Ref} = reference impedance
 Z = input impedance when the equipment is terminated with Z_{Ref}

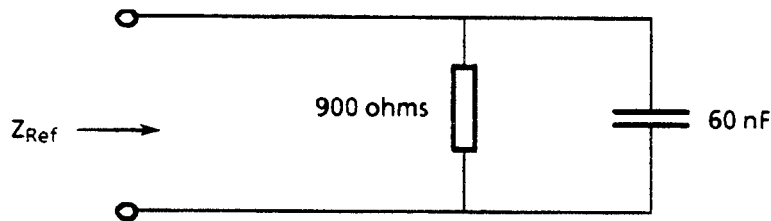


Figure 9.2.1.4 (S) 2: Circuit for return loss measurement.

9.2.1.4 (CH) 1 Impedance requirement

Impedance modulus: 600 - 1 200 Ω
 Phase angle: +35...-70 Deg
 Level: 100 - 1 000 mV

A.9.2.1.4 Return loss at meter pulse frequencies

The TEUT is connected as shown in figure A.9.1.4 in the case of a separate unit intended to be connected in series with another TE, and as shown in figure A.9.2.1.4 in the case of an integrated terminating unit.

The test is carried out with switch "S" in both, open and closed positions (presence and absence of loop current, respectively), or only in the closed position (loop condition), as described in table 9.2.2.1.c.

The feeding parameters V_f , R_f , I_f and the other test parameters are adjusted as described in table A.9.2.1.4.

The return loss is determined, using the set-up shown in figures A.9.2.1.4.a and B, and by using formula 9.2.1.4:

$$a = 20 \log_{10} \frac{V_{t1}}{2U} \text{ dB} \quad \text{Formula A.9.2.1.4}$$

Table A.9.2.1.4: Return loss at meter pulse frequencies

COUNTRY	TEST VALUES			
	f_1 (kHz)	V_{t1} (mV)	V_{t2} (mV)	R (Ω)
Austria	11,928, 12,072	0,775		600
Belgium	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	11,88, 12, 12,12			
Germany	not mandatory			
Greece				
Iceland	12			
Ireland	not mandatory			
Italy	11,975, 12, 12,025		80	
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	15,5, 16, 16,5	1 500		600
Portugal	not mandatory			
Spain	11,88, 12, 12,12	5 000	N/A	10 k
Sweden	12		500	
Switzerland	11,88 - 12,12			
U. Kingdom	not mandatory			

Table A.9.2.1.4 cont.: Return loss at meter pulse frequencies

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	60		19, 60	
Belgium		not mandatory		
Cyprus		not mandatory		
Denmark		not mandatory		
Finland				
France	48		25, 60	yes
Germany		not mandatory		
Greece				
Iceland	48		14, I_{max} .	
Ireland				
Italy	44, 48, 52	1 880, 1 100, 720		
Luxembourg		not mandatory		
Malta				
Netherlands				
Norway	60	460, 3 100		yes
Portugal		not mandatory		
Spain	48	500, 1 100, 2 200	N/A	yes
Sweden				yes
Switzerland	48	1 200		
U. Kingdom		not mandatory		

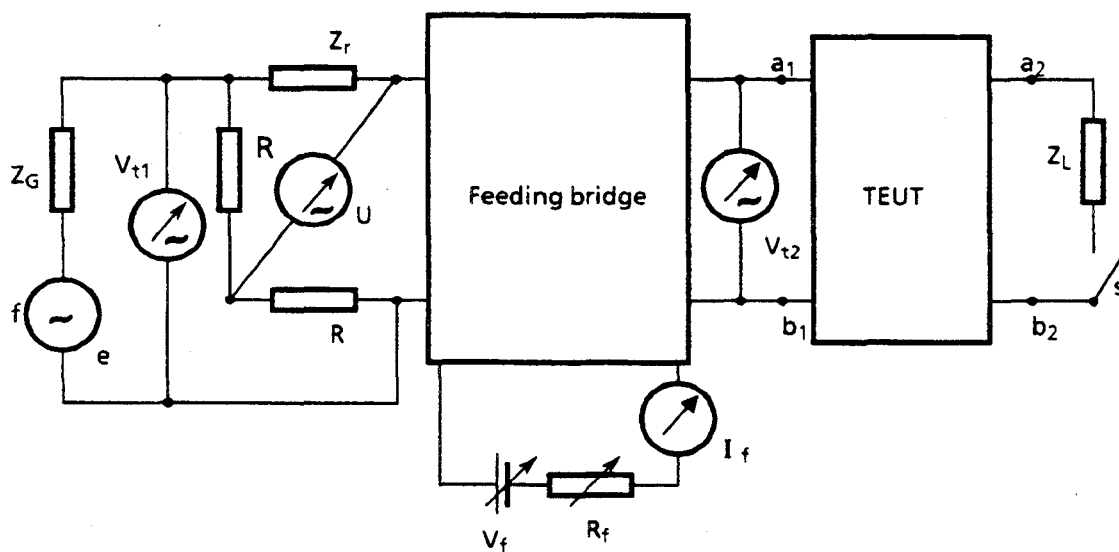


Figure A.9.2.1.4.a: Series connection

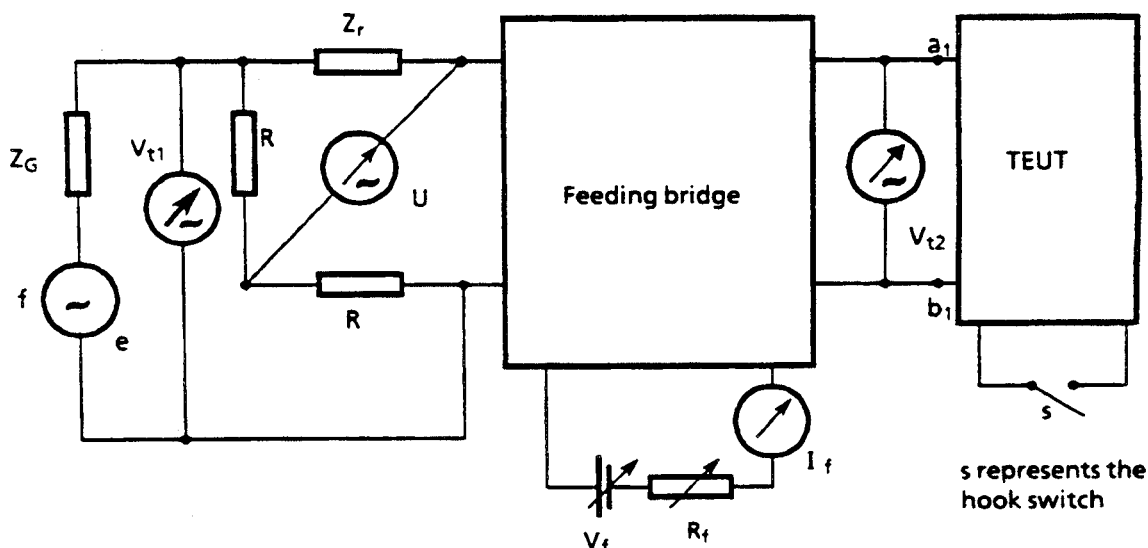


Figure A.9.2.1.4.b: Terminating connection

A.9.2.1.4 (F) 1 The test may also be carried out using figures A.9.2.1.4.a and b, by replacing the circuit at link side of the feeding bridge by an impedance meter with an internal impedance of 200 Ω and an emf voltage of 4 V.

A.9.2.1.4 (F) 2 In the case of a terminating unit: $V_f = 46, 54$ V; $R_f = 1\ 400, 300$ ohms.

A.9.2.1.4 (N) 1 The test is carried out in loop condition only (S in closed position).

A.9.2.1.4 (E) 1 Input impedance in terminating mode.

The TEUT is connected as shown in figure A.9.2.1.4.b, and for series TE as shown in figure A.9.2.1.4.a.

The procedure of test in section A.9.2.1.4 is followed, where the resistor (R_f) takes the value of 500 ohms when the TEUT is in quiescent condition or in the high impedance condition, and the values of 500, 1 100, and 2 200 ohms, when it is in whatever other condition.

The feeding bridge shall be as stipulated in section 1.5 (E) 1.

The generator open circuit ac rms voltage (e) takes the value stipulated in the associated requirement in section 9.2.1.4 (E) 1.

PROVISION 1: The provision 1 in section A.9.2.1.1 (E) 2 shall be applied for the figure A.9.2.1.4.a.

PROVISION 2: In order to validate the test results, it shall be necessary to check that when a resistor of 200 ohms ($\pm 1\%$) is connected instead of the TEUT, the resultant return loss values are not lower than 30 dB.

PROVISION 3: See the provisions 1 to 5 in section A.4.1.1 (E) 1.

A.9.2.1.4 (E) 2 Input impedance in bridging mode.

The procedure of test in section A.4.1.1 (E) 1 is followed, where the resistor (R_f) takes the value of 200 ohms, the generator open circuit ac rms voltage (e) takes the values stipulated in section A.9.2.1.4.

PROVISION: When the TEUT is a series TE, the tests are also carried out when a circuit with an inductor of a value no lower than 10 H in series with a resistor of 300 ohms is connected to the line output terminals.

A.9.2.1.4 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.

9.2.2 50 Hz meter pulses

The reception of 50 Hz meter pulses is performed by detecting a longitudinal signal between the two line terminals and a common signal earth terminal, with a nominal frequency of 50 Hz.

The requirements of this section shall be met only by TEs intended to receive meter pulses transmitted from the PSTN.

9.2.2 (B) 1 The Belgian PSTN does not provide 50 Hz meter pulses. The requirements of 9.2.2 are not mandatory.

9.2.2 (N) 1 50 Hz meter pulses are not provided in Norway. The requirements are not mandatory.

9.2.2 (E) 1 (This section shall be applied in addition to section 9.2.2).

NOTE 1: See NOTE 1 in section 9.2.1 (E) 1.

NOTE 2: The 50 Hz metering pulses are received from the network in a longitudinal mode as a signal simultaneously applied to the two line terminals with respect to a common reference terminal (see section 1.4.3 (E) 1).

NOTE 3: Network compatibility cannot be expected if several 50 Hz metering pulse receivers are simultaneously connected to the same line.

PROVISION: The provision 2 in section 9.2.1 (E) 1 shall be applied to all Spanish sections (E) in section 9.2.2 of this Chapter 9.

Compliance shall be checked by the tests outlined in section A.9.2.2.1 (E) 1.

9.2.2.1 Input longitudinal impedance at 50 Hz

The modulus of the input impedance of the TE with presence of loop current shall not be less than R ($k\Omega$) at a voltage up to U (V) at a frequency between f_1 (Hz) and f_2 (Hz), when measured as shown in figure A.9.2.2.1.

The requirement parameters are given in table 9.2.2.1.

Compliance shall be checked using the tests outlined in section A.9.2.2.1.

Table 9.2.2.1: Input longitudinal impedance at 50 Hz

COUNTRY	REQUIREMENT VALUES						
	R (k Ω)	f ₁ (Hz)	f ₂ (Hz)	U (V)	V _f (V)	R _f (Ω)	I _f (mA)
Austria	not mandatory						
Belgium							
Cyprus	not mandatory						
Denmark	not mandatory						
Finland	not mandatory						
France	8	50	50	100	48	300	25 - 60
Germany	not mandatory						
Greece							
Iceland	50 Hz meter pulses not used						
Ireland	not mandatory						
Italy	not stated						
Luxembourg	not mandatory						
Malta							
Netherlands	6,7	48	52	100	42 - 66	800 - 2 140	
Norway							
Portugal	not mandatory						
Spain		50	N/A		48		
Sweden	not applicable						
Switzerland	50 Hz meter pulses not used						
U. Kingdom	not mandatory						

Table 9.2.2.1 cont.: Input longitudinal impedance at 50 Hz

COUNTRY	REQUIREMENT VALUES		Remarks
	Z_G (Ω)	Z_L (Ω)	
Austria	not mandatory		
Belgium			
Cyprus	not mandatory		
Denmark	not mandatory		
Finland	not mandatory		
France	< 30		yes
Germany	not mandatory		
Greece			
Iceland			
Ireland	not mandatory		
Italy	not stated		
Luxembourg			
Malta			
Netherlands	1 400	600	yes
Norway			
Portugal	not mandatory		
Spain	50	N/A	yes
Sweden	not applicable		
Switzerland			
U. Kingdom	not mandatory		

9.2.2.1 (F) 1

In addition, the modulus of the longitudinal input impedance shall not be greater than 12 k Ω in the conditions defined in table 9.2.2.1.

9.2.2.1 (F) 2

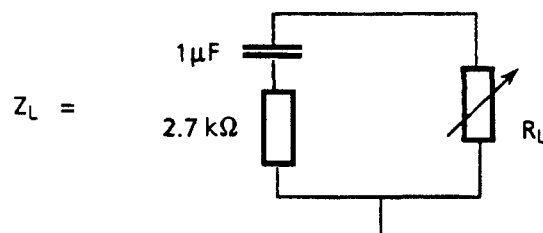


Figure 9.2.2.1 (F) 2: Load impedance at 50 Hz

R_L is adjusted to obtain the range 25 - 60 mA.

9.2.2.1 (NL) 1

- a) The input longitudinal impedance at 50 Hz must be at least 1 M Ω when a TE without meter pulse reception is tested.

- b) The input longitudinal impedance at 50 Hz must be at least 6,7 k Ω when a TE with meter pulse reception is tested.

9.2.2.1 (E) 1 Impedance between line terminals and the common reference terminal.
(Requirement to be applied instead of section 9.2.2.1).

With TE in whatever condition it can be, during the moments in which it is prepared for receiving 50 Hz metering pulses, the value of the modulus of the complex impedance between the two line terminals and the common reference terminal, shall not be lower than 7,5 k Ω , tested with a signal with an open circuit ac rms voltage of 100 V and the frequency 50 Hz, applied through two equivalent resistors of 500 Ω .

Compliance shall be checked by the tests outlined in section A.9.2.2.1 (E) 2.

A.9.2.2.1 Input longitudinal impedance at 50 Hz

The TEUT is connected as shown in figure A.9.2.2.1.

The switch of the pulse generator is closed.

The feeding parameters V_f , R_f , I_f and the other test parameters are as described in table A.9.2.2.1.

The modulus of the input impedance is determined using formula A.9.2.2.1:

$$R = \frac{U}{I} \qquad \text{Formula A.9.2.2.1}$$

Table A.9.2.2.1: Input longitudinal impedance at 50 Hz

COUNTRY	TEST VALUES					Remarks
	f_1 (Hz)	U (V)	V_f (v)	R_f (Ω)	I_f (mA)	
Austria	not mandatory					
Belgium						
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	50	40, 100	48	300	25, 60	
Germany	not mandatory					
Greece						
Iceland						
Ireland						
Italy						
Luxembourg						
Malta						
Netherlands	50	100	48	1 130		
Norway						
Portugal	not mandatory					
Spain						yes
Sweden						
Switzerland						
U. Kingdom						

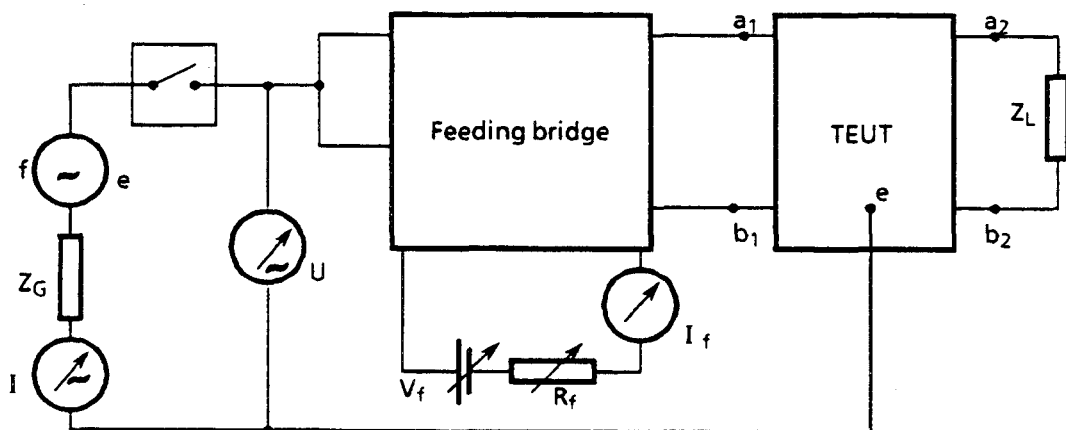


Figure A.9.2.2.1: Input longitudinal impedance at 50 Hz

- A.9.2.2.1 (E) 1 The procedures of test in paragraphs "a" and "b" of section A.9.2.1.1 (E) 1 are followed.
- A.9.2.2.1 (E) 2 Impedance between line terminals and the common reference terminal.

The TEUT is connected as shown in figure A.9.2.2.1 (E) 2.

The dc voltage source (V_f) takes the value of 48 V. The resistors (R_1) and (R_2) take the value of 400 ohms.

The generator output resistance (R_G) takes the value of 50 ohms.

The value of the capacitors (C_1) and (C_2) shall not be lower than 100 μF .

The generator open circuit ac rms voltage (e) and frequency (f) take the values stipulated in the associated requirement in section 9.2.2.1 (E) 1.

The switch (S_1) is closed.

The modulus of the complex impedance ($||Z_i||$) is calculated using formula A.9.2.2.1 (E) 2, where V_1 and V_2 are respectively the voltmeter (U_1) and (U_2) readings in volts and I is the ammeter reading in milliamperes, at the testing frequency value.

$$||Z_i|| \quad (k\Omega) = \frac{V_1 (V) + V_2 (V)}{2 \times I (mA)} \quad \text{Formula A.9.2.2.1 (E) 2}$$

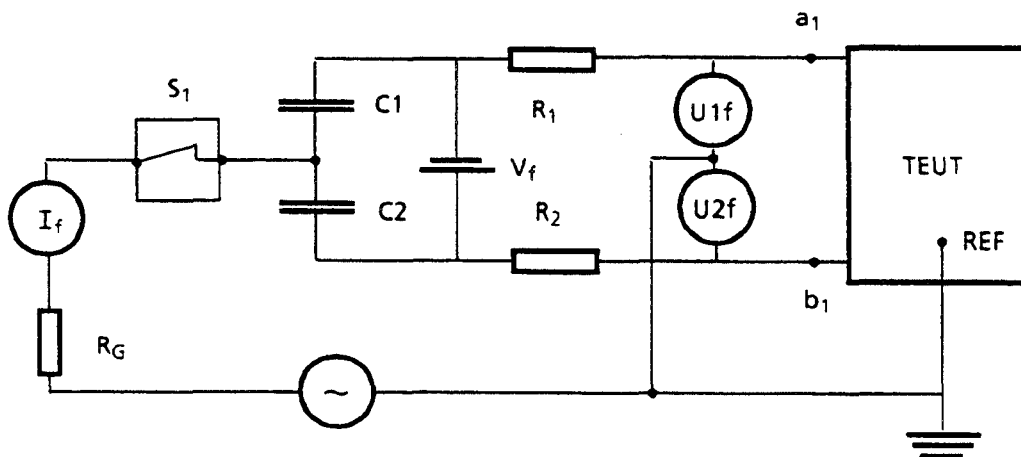


Figure A.9.2.2.1 (E) 2: Impedance between line terminals and the common reference terminal

9.2.2.2 Sensitivity

The meter pulse detection circuitry of the TE with presence of loop current shall be activated when a signal in the frequency range f_1 (Hz) to f_2 (Hz), with a level between U_1 (V) and U_2 (V), and a sending period between t_{S1} (ms) and t_{S2} (ms), are applied to the line terminals.

The detector shall recognise each signal in any series of signals having the characteristics above, and separated by pause periods of value higher than t_{p1} (ms).

The requirement parameter values are given in table 9.2.2.2.

The requirements shall be met with the terminating impedances Z_G and Z_L and with dc feeding values V_f , R_f , I_f in the ranges specified in table 9.2.2.2.

Compliance shall be checked using the test outlined in section A.9.2.2.2.

Table 9.2.2.2: 50 Hz meter pulse detector sensitivity

COUNTRY	REQUIREMENT VALUES					
	f ₁ (Hz)	f ₂ (Hz)	U ₁ (V)	U ₂ (V)	t _{s1} (ms)	t _{s2} (ms)
Austria	not mandatory					
Belgium						
Cyprus	48	52	30	80	80	300
Denmark	not mandatory					
Finland	not applicable					
France	48	52	36	70	75	400
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy	not stated					
Luxembourg						
Malta						
Netherlands	48	52	55	100	70	200
Norway						
Portugal	not mandatory					
Spain	49,5	50,5				
Sweden	not applicable					
Switzerland						
U. Kingdom	not mandatory					

Table 9.2.2.2 cont.: 50 Hz meter pulse detector sensitivity

COUNTRY	REQUIREMENT VALUES						Remarks
	t_{p1} (ms)	Z_G (Ω)	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory						
Belgium							
Cyprus	400		600	48	440 - 1 740		
Denmark	not mandatory						
Finland	not applicable						
France	75			48	300	25 - 60	yes
Germany	not mandatory						
Greece							
Iceland							
Ireland	not mandatory						
Italy	not stated						
Luxembourg							
Malta							
Netherlands	130	1 400	600	42 - 66	800 - 2 140		yes
Norway							
Portugal	not mandatory						
Spain		50	N/A	48			yes
Sweden	not applicable						
Switzerland							
U. Kingdom	not mandatory						

9.2.2.2 (F) 1 Compliance shall be checked by the test outlined in section A.9.2.2.2 (F) 1.

9.2.2.2 (F) 2 In quiescent condition it is required to detect at least 1 meter pulse until after the release of the line.

9.2.2.2 (NL) 1 Pulses that are longer than as specified must be considered to be one pulse.

9.2.2.2 (E) 1 (Requirement to be applied instead of section 9.2.2.2).

With TE in whatever condition it can be, during the moments in which it is prepared for receiving 50 Hz metering pulses, it shall receive as normal metering pulses a series of 50 pulses with open circuit ac rms voltages from 60 V to 100 V and the frequencies from 49,5 Hz to 50,5 Hz, in a sequence which is made up by:

- a) 50 ms of signal and 90 ms of pause;
- and
- b) 70 ms of signal and 70 ms of pause

applied longitudinally between the two line terminals and the common reference terminal through two equivalent resistors of 500 ohms.

Compliance shall be checked by the tests outlined in section A.9.2.2.2 (E) 1.

A.9.2.2.2 50 Hz meter pulses detector sensitivity

The TEUT is connected as shown in figure A.9.2.2.1.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.2.2.2.

For each feeding condition established and for each set of parameter values given in table A.9.2.2.2, a check must be performed to ensure that the detector recognises each of the "n" signals of the series.

Each line of the table A.9.2.2.2 forms a set of parameter values. The number of sets "n", to be checked, is to be specified in the table A.9.2.2.2.

Table A.9.2.2.2: 50 Hz meter pulse detector sensitivity

COUNTRY	TEST VALUES					
	i = 1 to n	f (Hz)	U (V)	t _s (ms)	t _p (ms)	n
Austria	not mandatory					
Belgium						
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	1	50	36	75	75	10
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy						
Luxembourg						
Malta						
Netherlands		50	55, 100	70, 200	130	
Norway						
Portugal	not mandatory					
Spain	50					
Sweden	not applicable					
Switzerland						
U. Kingdom	not mandatory					

Table A.9.2.2.2 cont.: 50 Hz meter pulse detector sensitivity

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria				
Belgium				
Cyprus		not mandatory		
Denmark		not mandatory		
Finland				
France	48	300	25, 60	yes
Germany		not mandatory		
Greece				
Iceland				
Ireland				
Italy				
Luxembourg		not mandatory		
Malta				
Netherlands	48	1 130		
Norway				
Portugal		not mandatory		
Spain				yes
Sweden				
Switzerland				
U. Kingdom		not mandatory		

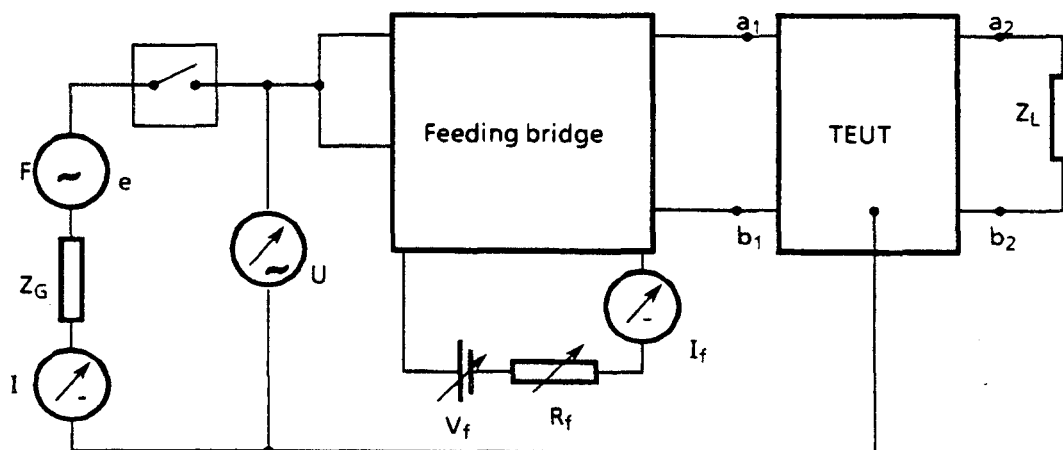


Figure A.9.2.2.2: 50 Hz meter pulse detector sensitivity

A.9.2.2.2 (F) 1

The test is carried out using figure A.9.2.2.2 (F) 1.

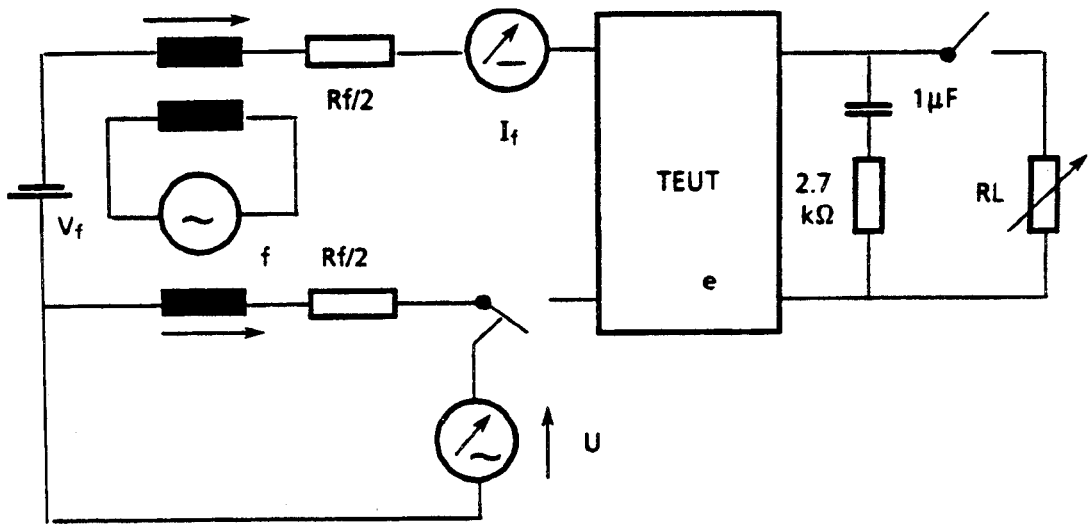


Figure A.9.2.2.2 (F) 1: 50 Hz meter pulse detector sensitivity

A.9.2.2.2 (F) 2 Other sets of test parameter values:

i (Set No)	f (Hz)	U (V)	t _s (ms)	t _p (ms)	n
2	50	36	400	75	10
3	50	70	75	75	10
4	50	70	400	75	10

A.9.2.2.2 (E) 1

The procedure of test in section A.9.2.2.1 (E) 1 is followed with the signals stipulated in table A.9.2.2.2 (E) 1.

The switch (S₁) follows the two sequences indicated in the associated requirement in section 9.2.2.2 (E) 1.

The tests shall be done by inspection with the signals indicated, checking that all the metering pulses are received.

Table A.9.2.2.2 (E) 1: 50 Hz meter pulse detector sensitivity

Frequency (f) (Hz)	Voltage (e) (V)
49,5	100
49,5	60
50	60
50,5	60
50,5	100

9.2.2.3 Insensitivity

The meter pulse detection circuitry of the TE, with presence of loop current, shall not be activated when any series of the following signals are applied to the line terminals:

a) "outband signals" with:

frequency of value lower than f_3 (Hz) or higher than f_4 (Hz) and;

- any level of value lower than U_3 (V);
- any value of sending period;
- any value of pause period.

b) "weak signals" with:

level of value lower than U_4 (V) and;

- any value of frequency;
- any value of sending period;
- any value of pause period.

c) "short signals" with:

sending period of value lower than t_{S3} (ms) and;

- any value of frequency;
- any value of level;
- any pause of value higher than t_{p2} (ms).

d) The meter pulse detection circuitry shall not recognise two pulses when one meter pulse as specified in 9.2.2.2 is interrupted for a period of t_i (ms).

The requirement values are given in table 9.2.2.3.

The requirements shall be met with feeding values V_f , R_f , I_f in the ranges specified in table 9.2.2.3.

Compliance shall be checked using the tests outlined in section A.9.2.2.3.

Table 9.2.2.3: 50 Hz meter pulse detector insensitivity

COUNTRY	REQUIREMENT VALUES				
	f_3 (Hz)	f_4 (Hz)	U_3 (V)	U_4 (V)	t_{s3} (ms)
Austria	not mandatory				
Belgium					
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France				26	30
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not stated				
Luxembourg	not mandatory				
Malta					
Netherlands				15	50
Norway					
Portugal	not mandatory				
Spain	N/A	N/A	N/A	= 25	≤ 20
Sweden	not applicable				
Switzerland					
U. Kingdom	not mandatory				

Table 9.2.2.3 cont.: 50 Hz meter pulse detector insensitivity

COUNTRY	REQUIREMENT VALUES					Remarks
	t_{p2} (ms)	t_i (ms)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory					
Belgium						
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	75	20	48	300	25 - 60	yes
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy	not stated					
Luxembourg	not mandatory					
Malta						
Netherlands	280	< 5	42 - 66	800 - 2 140		yes
Norway						
Portugal	not mandatory					
Spain	≥ 70	N/A	48			yes
Sweden	not applicable					
Switzerland						
U. Kingdom	not mandatory					

9.2.2.3 (F) 1 Compliance shall be checked by the test outlined in section A.9.2.2.3 (F) 1.

9.2.2.3 (F) 2 In quiescent condition it is required to inhibit the detector 1 mn at the latest after the release of the line.

9.2.2.3 (F) 3 The receiver shall not respond to:

- a) discharge of a capacitor of value 4 μ F, beforehand charged with 100 V, applied to the line terminals as described in section A.9.2.1.1 (F) 3;
- b) decadic dialling (loop pulsing) of a parallel connected TE as described in section A.9.2.1.1 (F) 4;
- c) random short breaks of the feeding current of duration not higher than 200 ms, as described in section A.9.2.1.1 (F) 5;
- d) feeding polarity inversion as described in section A.9.2.1.1 (F) 6;
- e) ringing signal and "off-hook" from a connected TE during the ringing period, as described in section A.9.2.1.1 (F) 7.

9.2.2.3 (NL) 1 The requirements in this paragraph are not mandatory but only recommended for type approval.

9.2.2.3 (NL) 2 The TE is not allowed to consume a loop current of more than 5 mA if a signal with a voltage of 90 V and a frequency of 25 ± 2 Hz is connected at the line terminal.

9.2.2.3 (E) 1 50 Hz receiver immunity.
 (Requirement to be applied instead of section 9.2.2.3).

With TE in whatever condition it can be, during the moments in which it is prepared for receiving 50 Hz metering pulses, it shall be immune and shall not interpret as normal metering pulses any pulse of the series of 50 pulses of the signals stipulated in table 9.2.2.3 (E) 1, when they are applied as in the requirement in section 9.2.2.2 (E) 1.

Compliance shall be checked by the tests outlined in section A.9.2.2.3 (E) 1.

Table 9.2.2.3 (E) 1: 50 Hz receiver immunity

Signal type	Open circuit ac rms	Frequency	Duration	
			Signal	Pause
i	$60 \text{ V} \leq e \leq 100 \text{ V}$	$f = 50 \text{ Hz}$	$\leq 20 \text{ ms}$	$\geq 70 \text{ ms}$
ii	$e = 25 \text{ V}$	$f = 50 \text{ Hz}$	$\geq 70 \text{ ms}$	$\geq 70 \text{ ms}$

9.2.2.3 (E) 2 Ringing signal immunity.
 (Requirement to be applied in addition to section 9.2.2.3 (E) 1).

With TE in the quiescent condition, during the moments in which it is prepared for receiving 50 Hz metering pulses, it shall be immune and shall not interpret as normal metering pulses any pulse of a series of 50 pulses with an open circuit ac rms voltage of 75 V and frequency 25 Hz, with a sequence of 140 ms of signal and 140 ms of pause, simultaneously superimposed to a dc voltage of 48 V, applied between each one of the two line terminals and the common reference terminal, shorted together with the other line terminal, through a resistor of 200 ohms, when a resistor of 1 k Ω in series with a capacitor of 1 μF is connected between the line terminals.

Compliance shall be checked by the tests outlined in section A.9.2.2.3 (E) 2.

A.9.2.2.3 Insensitivity

The TEUT is connected as shown in figure A.9.2.2.2.

The dc feeding conditions V_f , R_f , I_f are adjusted as described in table A.9.2.2.3.a for all cases.

For each established feeding condition, and for each set of parameter values given in tables A.9.2.2.3.a, b, c, a check must be performed to ensure that the detector is not activated by any of the "n" signals of the series, and each set of parameter values given in table A.9.2.2.3.d, a check must be performed to ensure that the detector recognises only one meter pulse.

The tables A.9.2.2.3.a, b, c and d refer, respectively, to cases a, b, c, and d mentioned in section 9.2.2.3.

Each line of these tables forms a set of parameter values.

The number of sets "n", to be checked is specified in table A.9.2.2.2.a, A.9.2.2.2.b, A.9.2.2.2.c, and A.9.2.2.2.d.

Table A.9.2.2.3.a: 50 Hz meter pulse detector insensitivity (case a)

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	U (V)	t _s (ms)	t _p (ms)
Austria	not mandatory				
Belgium					
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy					
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway					
Portugal	not mandatory				
Spain	not mandatory				
Sweden	not applicable				
Switzerland					
U. Kingdom	not mandatory				

Table A.9.2.2.3.a cont.: 50 Hz meter pulse detector insensitivity (case a)

COUNTRY	TEST VALUES			
	n	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium				
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France		48	300	25, 60
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy				
Luxembourg				
Malta				
Netherlands		48	1 130	
Norway				
Portugal	not mandatory			
Spain		48		
Sweden	not applicable			
Switzerland				
U. Kingdom	not mandatory			

Table A.9.2.2.3.b: 50 Hz meter pulse detector insensitivity (case b)

COUNTRY	TEST VALUES					
	i = 1 to n	f (Hz)	U (V)	t _s (ms)	t _p (ms)	n
Austria	not mandatory					
Belgium						
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	1	50	26	400	75	10
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy						
Luxembourg	not mandatory					
Malta						
Netherlands	1	50	15	200	280	
Norway						
Portugal	not mandatory					
Spain		50				50
Sweden	not applicable					
Switzerland						
U. Kingdom	not mandatory					

Table A.9.2.2.3.c: 50 Hz meter pulse detector insensitivity (case c)

COUNTRY	TEST VALUES					
	i = 1 to n	f (Hz)	U (V)	t _s (ms)	t _p (ms)	n
Austria	not mandatory					
Belgium						
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	2	50	70	30	75	10
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy						
Luxembourg	not mandatory					
Malta						
Netherlands	1	50	100	50	280	
Norway						
Portugal	not mandatory					
Spain		50				50
Sweden	not applicable					
Switzerland						
U. Kingdom	not mandatory					

Table A.9.2.2.3.d: 50 Hz meter pulse detector insensitivity (case d)

COUNTRY	TEST VALUES					Remarks
	i = 1 to n	f (Hz)	U (V)	t _s (ms)	t _i (ms)	
Austria	not mandatory					
Belgium						
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	3	50	70	400	20	yes
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy						
Luxembourg	not mandatory					
Malta						
Netherlands	1	50	65	200	5	
Norway						
Portugal	not mandatory					
Spain	not mandatory					yes
Sweden	not applicable					
Switzerland						
U. Kingdom	not mandatory					

A.9.2.2.3 (F) 1

The test is carried out using figure A.9.2.2.2 (F) 1. For case e) described in section 9.2.2.3 (F) 3 the common signal earth terminal of the TEUT is connected to the polarity + of the dc feeding source in figure A.9.2.1.1 (F) 7.

A.9.2.2.3 (E) 1

50 Hz receiver immunity.

The procedure of test in section A.9.2.2.2 (E) 1 is followed with the signals stipulated in table A.9.2.2.3 (E) 1, where also the sequence of the switch (S₁) is indicated.

The tests shall be done by inspection with the signals indicated, checking that any metering pulse is interpreted as such.

Table A.9.2.2.3 (E) 1: 50 Hz receiver immunity

Signal type	Frequency (f) (Hz)	Voltage (e) (V)	Switch (S ₁)	
			Closed (ms)	Opened
i	50	100	20	70
	50	100	20	140
ii	50	25	70	70
	50	25	140	140

A.9.2.2.3 (E) 2

Ringing signal immunity.

The TEUT is connected as shown in figure A.9.2.2.3 (E) 2.

The dc voltage (V_f) takes the value of 48 V.

The resistor (R_G) takes the value of 200 ohms.

The resistor (R₁) takes the value of 1 kΩ, and the capacitor (C₁) takes the value of 1 μF.

The tests are undertaken for both positions of the switch (S₂).

The generator open circuit ac rms voltage (e), and the generator frequency (f) takes the values stipulated in the associated requirement in section 9.2.2.3 (E) 2, where also the sequence for the switch (S₁) is indicated.

The tests shall be done by inspection with the signal indicated, checking that any signal pulse is interpreted as a metering pulse.

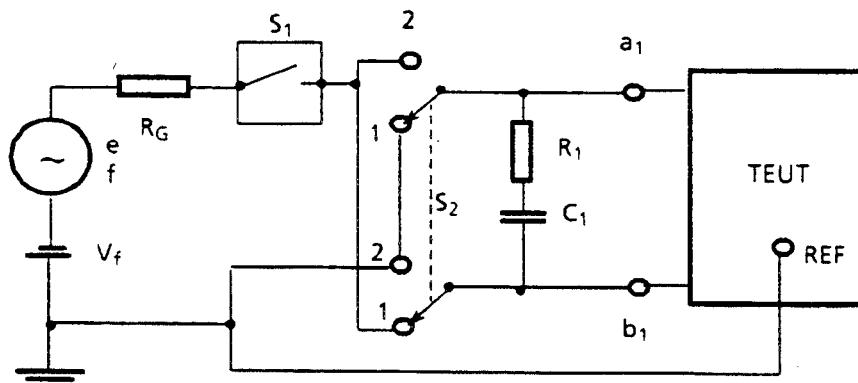


Figure A.9.2.2.3 (E) 2: Ringing signal immunity

9.3 Disabling of echo control devices

The requirement of this section shall only be applied for TE that are intended to transmit at any time tones for disabling the echo control devices inside the PSTN.

The disabling of echo suppressors is performed by the TE in loop condition sending a $2\ 100 \pm 15$ Hz tone for a period of $3,3 \pm 0,7$ s, at a level between p_1 (dBm) and p_2 (dBm) measured on a load impedance Z_L (Ω), as specified in table 9.3.

In the case of automatic answering, the tone shall be preceded by a silent period between 1,8 s and 2,5 s following the establishment of the dc loop condition, and shall be followed by a silent period

of 75 ± 20 ms after which energy shall be maintained, without signal gaps exceeding 100 ms, in order to maintain the disabled state of echo control devices in the network.

If it is intended to disable network echo cancellers as well as echo suppressors, then the TE shall reverse the phase of the tone intervals of between 425 ms and 475 ms, such that the phase is within 180 ± 10 degrees in less than 1 ms and that the amplitude of the 2 100 Hz tone is not more than 3 dB below its steady state value for more than 400 μ s.

The send period shall be:

- less than 2,6 s if a calling station response is received. In this case the 2 100 Hz tone may be discontinued after detection of the calling station response for a continuous period of 100 ms;
- greater than 4 s, but less than 10 s, for applications where an automatically answering TE is permanently dedicated to receiving calls only from acoustically coupled originating stations, in order to compensate for operator reaction time in placing the telephone handset on the acoustic coupler.

The requirements shall be met with dc feeding values V_f , R_f , I_f in the ranges specified in table 9.3.

Compliance shall be checked using the test outlined in section A.9.3.

Table 9.3: Disabling of echo control devices

COUNTRY	REQUIREMENT VALUES						Remarks
	P_1 (dBm)	P_2 (dBm)	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	under study						
Belgium	-6	-8	600	48		$20 - I_{max}$	yes
Cyprus	-16	-10	600	48	440 - 1 740		
Denmark	not mandatory						
Finland	not mandatory						
France	-15	0	600	46 - 54	300 - 1 400		yes
Germany	not mandatory						
Greece							
Iceland	-6	-14	600	48		$14 - I_{max}$	
Ireland	not mandatory						
Italy	-15	-3	600	44, 52	720, 1 880		
Luxembourg	not mandatory						
Malta							
Netherlands							
Norway	not mandatory						
Portugal	not mandatory						yes
Spain	-6	-14	600	48	500 - 2 200	N/A	yes
Sweden	not mandatory						
Switzerland	-8	-6	600	43 - 57	2 200 - 600		yes
U. Kingdom	not mandatory						yes

9.3 (B) 1 In the case of non-automatic answering, the tone shall be preceded by a silent period of between 1,8 s and 2,5 s following the establishment of the dc loop condition and shall persist for at least 400 ms. It shall be followed by a silent period of 75 ± 20 ms before sending of data commences.

9.3 (F) 1 The ability to reduce the send period duration of the echo suppressor disabling the tone in case of reception of calling station, are not mandatory but only optional.

9.3 (F) 2 The echo suppressor disabling tone level shall be the same as the data level (see section 4.4.2 (F) 2).

9.3 (P) 1 It may be mandatory on terminal standards or NET.

9.3 (E) 1 TE with echo control devices disabling tones.
(The requirements in this section 9.3 (E) 1 shall be applied instead of section 9.3).

PROVISION 1: The requirements of this section shall only be applied for TEs that are intended to transmit in any moment tones for disabling the echo control devices inside the network.

PROVISION 2: All the requirements related with the echo control disabling tone facility shall be met with the dc feeding excitation stipulated in the associated testing methods.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.

9.3 (E) 1.1 General.

NOTE 1: The TE is in loop condition or in the high impedance condition, and it is understood that it meets the relevant requirements of other sections and in particular the requirements in Chapters 2 and 4, unless another indication is made in this section 9.3 (E) 1.

NOTE 2: A TE that is prepared for disabling an echo control device may be prepared for transmitting:

a) an echo suppressor disabling tone, then it shall be done according with the requirements in sections 9.3 (E) 1.2;

and/or

b) an echo canceller disabling tone, then it shall be done according to the requirements in sections 9.3 (E) 1.3.

NOTE 3: It should be noted that the communications obtained through the PSTN may be served using circuits that include:

a) no echo devices;

or

b) only echo control suppressors;

or

c) only echo cancellers;

or

d) echo suppressor(s) and echo canceller(s).

NOTE 4: It should be noted that for a guaranteed disabling of echo control devices by the disabling tone, the other party (or parties) of the telecommunication circuit(s) involved is (are) supposed not sending useful signals to the line, or with pause periods with a duration no lower than 1,2 seconds, until the moment in which all the echo control devices become disabled.

NOTE 5: It should be noted that echo control devices may become re-enabled if all parties of the telecommunications circuit(s) involved are not sending useful signals to the line during a continuous period with a duration no lower than 100 ms.

NOTE 6: The requirements stipulated in this section 9.3 (E) 1 are related with the contents of the CCITT Recommendations G. 164 (Blue Book), G.165 (Blue Book), and V.25 (Blue Book).

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.1.

9.3 (E) 1.2 Echo suppressor disabling tone.

9.3 (E) 1.2.1 General of echo suppressor disabling tone.

NOTE 1: The particular requirements for this tone are included in sections 9.3 (E) 1.2.2 to 9.3 (E) 1.2.7.

NOTE 2: Reference to other common requirements is made in section 9.3 (E) 1.2.8.

NOTE 3: The echo suppressor disabling tone can also be used as the identification signal required in sections 10.5 (E) 8, 10.5 (E) 9, 10.6 (E) 4, and 10.6 (E) 5.

PROVISION: The acoustic excitation, when necessary, is stipulated in the associated testing method.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.2.1.

9.3 (E) 1.2.2 Tone frequency.

With TE transmitting an echo suppressor disabling tone, the nominal frequency of that single tone shall be 2 100 Hz.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.2.2.

9.3 (E) 1.2.3 Frequency tolerance.

With TE transmitting an echo suppressor disabling tone, the value of the frequency stipulated in the requirement in section 9.3 (E) 1.2.2 shall be maintained within the range ± 15 Hz, when the output tone is applied to a load resistor between 400 ohms and 900 ohms connected to the line terminals.

PROVISION: With TE in the high impedance condition, the output tone shall be applied over a load resistor with a value of a half of the values stipulated.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.2.3.

9.3 (E) 1.2.4 Signal format.

With TE transmitting an echo suppressor disabling tone, this tone

a) shall be continuous

and

b) shall

either

i) not have any intermediate phase reversals;

or

ii) have intermediate phase reversals.

NOTE b.ii: It is understood that this tone with intermediate phase reversals may simultaneously be used as an echo canceller disabling tone (see the requirement in section 9.3 (E) 1.3.4.b).

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.2.4.

9.3 (E) 1.2.5 Output tone power level.

With TE transmitting an echo suppressor disabling tone, the output tone shall be controlled in such a manner that the mean power level shall not be during the period of emission

a) greater than -6 dBm;

and

b) lower than -14 dBm;

when the output power is measured over a load resistor of 600 ohms connected to the line terminals.

PROVISION: See the provision in the requirement in section 9.3 (E) 1.2.3.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.2.5.

9.3 (E) 1.2.6 Signal timing.

With TE transmitting an echo suppressor disabling tone, the duration of the tone shall be supervised by the TE in such a manner that it shall not be lower than 425 ms, when the output tone is applied to a load resistor of 600 ohms connected to the line terminals.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.2.6.

9.3 (E) 1.2.7 Speech and tone signal attenuation.

With TE transmitting an echo suppressor disabling tone, it shall meet the requirements in sections 5.4.8 and 5.4.8 (E) 1.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.2.7.

9.3 (E) 1.2.8 Other requirements.

NOTE 1: The following notes and provisions of this section 9.3 (E) 1.2.8 give reference to common requirements, when necessary.

NOTE 2: Signal rise and fall times:

It is not included any mandatory reference in order to limit the maximum values of the duration of these times.

PROVISION 1: Unwanted frequency components:

Reference is made to the requirements in sections 4.4.3.1 (E) and 10.4 (E) 3.

PROVISION 2: Transient response of the loop current during tone transmission:

Reference is made to the requirements in sections 2.4.2 (E) and 10.2 (E) 2.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.2.8.

9.3 (E) 1.3 Echo canceller disabling tone.

9.3 (E) 1.3.1 General of echo canceller disabling tone.

NOTE 1: The particular requirements for this tone are included in sections 9.3 (E) 1.3.2 to 9.3 (E) 1.3.7.

NOTE 2: Reference to other common requirements is made in section 9.3 (E) 1.3.8.

NOTE 3: The echo canceller disabling tone can also be used as the identification signal required in sections 10.5 (E) 8, 10.5 (E) 9, 10.6 (E) 4, and 10.6 (E) 5.

PROVISION: See the provision in section 9.3 (E) 1.2.1.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.3.1.

9.3 (E) 1.3.2 Tone frequency.

With TE transmitting an echo canceller disabling tone, the nominal frequency of that single tone shall be 2 100 Hz.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.3.2.

9.3 (E) 1.3.3 Frequency tolerance.

With TE transmitting an echo canceller disabling tone, the value of the frequency stipulated in the requirement in section 9.3 (E) 1.3.2 shall be maintained within the range ± 15 Hz, when the output tone is applied to a load resistor between 400 and 900 ohms connected to the line terminals.

PROVISION: See the provision in section 9.3 (E) 1.2.3.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.3.3.

9.3 (E) 1.3.4 Signal format.

With TE transmitting an echo canceller disabling tone, this tone

a) shall be continuous;

and

b) shall have intermediate phase reversals, then

i) the duration of the period between two consecutive phase reversals shall

1) not be lower than 425 ms;

and

2) not be greater than 475 ms;

and

ii) the phase shall be within 180 ± 10 degrees in the course of at the most 1 ms;

and

iii) the period between the instant that the amplitude of the peak envelope of the output tone crosses downward for the first time the limit of the 70% of its steady value, and the instant that the amplitude of the peak envelope of the output tone crosses upward for the last time the limit of the 70% of its steady value, shall not be greater than 400 μ s.

NOTE b: See NOTE b.ii in the requirement in section 9.3 (E) 1.2.4.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.3.4.

9.3 (E) 1.3.5 Output tone power level.

With TE transmitting an echo canceller disabling tone, the output tone shall be controlled in such a manner that the mean power level shall, during the period of emission, not be

a) greater than -6 dBm;

and

b) lower than -14 dBm;

when the output power is measured over a load resistor of 600 ohms connected to the line terminals.

PROVISION: See the provision in the requirement in section 9.3 (E) 1.2.3.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.3.5.

9.3 (E) 1.3.6 Signal timing.

With TE transmitting an echo canceller disabling tone, the duration of the tone shall be supervised by the TE in such a manner that it shall not be lower than 1 100 ms, when the output tone is applied to a load resistor of 600 ohms connected to the line terminals.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.3.6.

9.3 (E) 1.3.7 Speech and tone signal attenuation.

With TE transmitting an echo canceller disabling tone, it shall meet the requirements in sections 5.4.8 and 5.4.8 (E) 1.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.3.7.

9.3 (E) 1.3.8 Other requirements.

NOTE 1: The following notes and provisions of this section 9.3 (E) 1.3.8 give reference to common requirements, when necessary.

NOTE 2: Signal rise and fall times:

It is not included any mandatory reference in order to limit the maximum values of the duration of these times.

PROVISION 1: Unwanted frequency components:

Reference is made to the requirements in sections 4.4.3.1 (E) and 10.4 (E) 3.

PROVISION 2: Transient response of the loop current during tone transmission:

Reference is made to the requirements in sections 2.4.2 (E) and 10.2 (E) 2.

Compliance shall be checked by the tests outlined in section A.9.3 (E) 1.3.8.

9.3 (CH) 1 For multifunctional terminals and in the case of automatic answering, the silent period of between 1,8 s and 2,5 s following the establishment of the dc loop condition may not always be fulfilled. This matter is under study.

9.3 (GB) 1 See Chapter 4, section 4.4.2 for maximum tone power levels permitted.

A.9.3 Disabling of echo control devices

The TEUT is connected as shown in figure A.9.3.

The dc feeding conditions V_f , R_f and I_f are as described in table A.9.3.

The TEUT is then placed in loop condition, and caused to send the echo control device disabling tone, as outlined in its associated instructions for use in the case of manual sending or by ringing in case of an automatic answering TEUT.

The frequency and sending level of the tone from the TEUT are measured on the loop impedance Z_L using an analyser with an accuracy better than a% and b% respectively, as specified in table A.9.3.

The timing parameters are measured using an instrument capable of measuring and displaying instantaneous values.

Table A.9.3: Disabling of echo control devices

COUNTRY	TEST VALUES					Remarks
	a (%)	V_f (V)	R_f (Ω)	I_f (mA)	b (%)	
Austria	under study					
Belgium	0,2	48	400, 1 600		5	
Cyprus	0,1	48	800		2	
Denmark	not mandatory					
Finland	not mandatory					
France		46, 54	1 400, 300			
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy		48	800			
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	$\pm 0,2$	48	500, 1 100, 2 200	N/A	$\pm 0,2$ dB	yes
Sweden	not applicable					
Switzerland	0,01	48	1 200		1	
U. Kingdom	not mandatory					

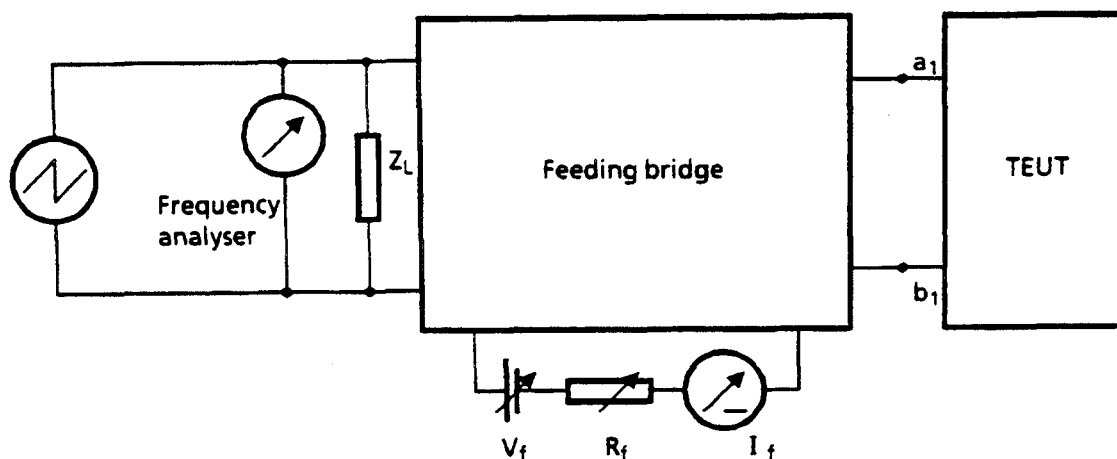


Figure A.9.3: Disabling of echo control devices

A.9.3 (E) 1 TE with echo control devices disabling tones.

A.9.3 (E) 1.1 General.

The testing procedure to follow is to check, by inspection and according with the user's manual and any other technical documentation, whether the TEUT is provided with the facility of transmitting an echo control disabling tone and how it can be operated.

A.9.3 (E) 1.2 Echo suppressor disabling tone.

A.9.3 (E) 1.2.1 General of echo suppressor disabling tone.

No requirement, so no testing method is included.

A.9.3 (E) 1.2.2 Tone frequency.

The procedure of test in section A.9.3 is followed, where the resistor (R_f) takes only the value of 1 100 ohms.

The input impedance of the instrument (or analyser) shall be greater than 50 k Ω .

A.9.3 (E) 1.2.3 Frequency tolerance.

The procedure of test in section A.9.3 is followed using the instrument stipulated in sections A.9.3 and A.9.3 (E) 1.2.2, where the tests are undertaken for each polarity of the voltage source, and the resistor (Z_L) takes also the values of 400 and 900 ohms.

A.9.3 (E) 1.2.4 Signal format.

The procedure of test in section A.9.3 (E) 1.2.2 is followed.

A.9.3 (E) 1.2.5 Output tone power level.

The procedure of test in section A.9.3 is followed using the instrument stipulated in sections A.9.3 and A.9.3 (E) 1.2.2, where the tests are undertaken for each polarity of the voltage source.

See also the provision 5 in section A.4.4.2.1 (E) 1.

A.9.3 (E) 1.2.6 Signal timing.

The procedure of test in section A.9.3 (E) 1.2.5 is followed, where the resistor (R_f) takes only the values of 500 and 2 200 ohms.

A.9.3 (E) 1.2.7 Speech and tone signal attenuation.

The procedures of test in sections A.5.4.8 and A.5.4.8 (E) 1 are followed.

A.9.3 (E) 1.2.8 Other requirements.

The testing procedure to follow is to check that relevant tests have been carried out.

A.9.3 (E) 1.3 Echo canceller disabling tone.

A.9.3 (E) 1.3.1 General of echo canceller disabling tone.

No requirement, so any testing method is included.

A.9.3 (E) 1.3.2

Tone frequency.

The procedure of test in section A.9.3 (E) 1.2.2 is followed.

A.9.3 (E) 1.3.3

Frequency tolerance.

The procedure of test A.9.3 (E) 1.2.3 is followed.

A.9.3 (E) 1.3.4

Signal format.

The procedure of test A.9.3 (E) 1.2.4 is followed.

A.9.3 (E) 1.3.5

Output tone power level.

The procedure of test A.9.3 (E) 1.2.5 is followed.

A.9.3 (E) 1.3.6

Signal timing.

The procedure of test A.9.3 (E) 1.2.6 is followed.

A.9.3 (E) 1.3.7

Speech and tone signal attenuation.

The procedure of test A.9.3 (E) 1.2.7 is followed.

A.9.3 (E) 1.3.8

Other requirements.

The testing procedure to follow is to check that the relevant tests have been carried out.

9.4 Loop current detection

Loop current detectors D1 and D2 as shown in figures 9.4.a and 9.4.b, can be used by series-connected TE for:

- a) determination of the operational state (loop or quiescent) of the TE connected to the second port a_2 , b_2 (function dedicated to D1);
- b) detection of the operational state (loop or quiescent) of the line connected to the first port a_1 , b_1 (function dedicated to D2).

Both functions D1 and D2 may be combined and realised as one detector.

The requirements for implementing D1 and/or D2 in the TE, as well as the operations resulting from the loop current detection are specified in other chapters of NET 4 or in terminal standards, depending on the type of the series-connected TE.

The electrical requirements can be different, according to whether the series-connected TE is of type A or type B, as shown in figures 9.4.a and 9.4.b, respectively.

The function of the detectors D1 and D2 can be either the detection of the presence of loop current, or the detection of the absence or interruption of loop current.

In this section the following definitions are used:

- "activated" : the detector recognises the appearance of loop current;
"deactivated" : the detector recognises the disappearance of loop current.

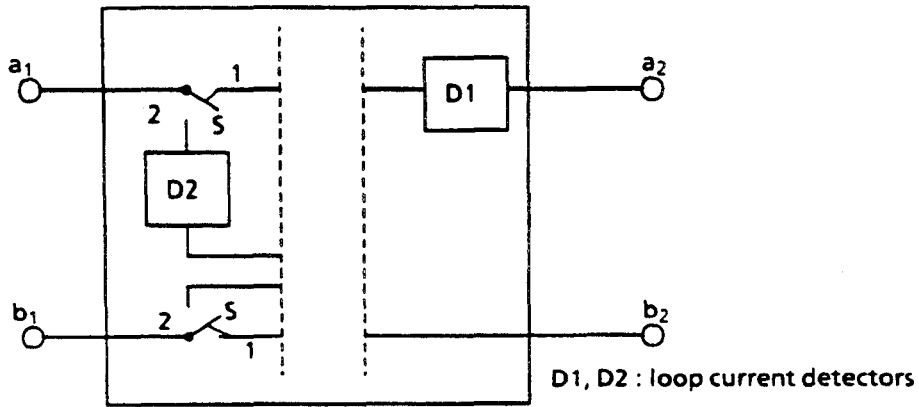


Figure 9.4.a: Loop current detection, type A

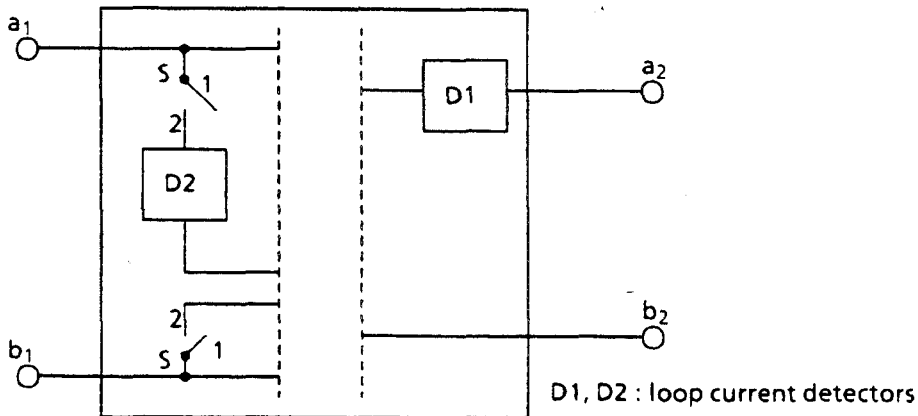


Figure 9.4.b: Loop current detection, type B

9.4 (D) 1 Loop current interruptions at the beginning of a call, caused by the network (up to one second), shall not be evaluated by the detector.

9.4 (D) 2 Instead of using a loop current detector D1, it is possible to use another method of detecting the operational state of the TE connected to the second port. The requirements are given in section 9.4.1.2.2 (D) 5.

9.4.1 Loop current detector D1

9.4.1.1 Series-connected TE with switch S in position 1

For a series-connected TE of type A or B, with its switch S in position 1, capable of detecting loop current due to a TE connected to its second port, the loop current detector D1 shall:

- a) be activated when current value is greater than I_1 (mA) for a period of at least t_1 (ms);
- b) not be activated when current value is greater than I_1 (mA) for a period shorter than t_2 (ms);
- c) be deactivated when current value is lower than I_2 (mA) for a period of at least t_3 (ms);
- d) not be deactivated when current value is lower than I_2 (mA) for a period shorter than t_4 (ms).

Requirement values are shown in table 9.4.1.1.

Compliance shall be checked using the tests outlined in section A.9.4.1.1.

Table 9.4.1.1: Loop current detector D1 - Switch S in position 1

COUNTRY	REQUIREMENT VALUES						Remarks
	I ₁ (mA)	I ₂ (mA)	t ₁ (ms)	t ₂ (ms)	t ₃ (ms)	t ₄ (ms)	
Austria	19						
Belgium							not mandatory
Cyprus							not mandatory
Denmark							not mandatory
Finland							not mandatory
France	5						
Germany	15	5	200	100			yes
Greece							
Iceland							not mandatory
Ireland							not mandatory
Italy							not mandatory
Luxembourg							not mandatory
Malta							
Netherlands							
Norway							not mandatory
Portugal							not mandatory
Spain							not mandatory
Sweden							not mandatory
Switzerland							under study
U. Kingdom							not mandatory

9.4.1.1 (D) 1

This requirement is only applicable for type A loop current detection shown in figure 9.4.a.

TEs using these detections are described in sections 8.3 (D) 3.1.3 to 8.3 (D) 3.1.5.

Section 2.5 (D) 1 shall be taken into account.

9.4.1.1 (E) 1

NOTE 1: The TEUT is considered as a whole in its realisation, so that any particular subpart is considered alone, whichever is its specific purpose.

The general aim of the mandatory access requirements is to stipulate the reactions of the TE when specific testing signals are applied to its line terminals, or to check the characteristics of the outgoing signals coming from the TE.

It is worth noting that the specific testing signals used are closely related with the network tone and other signals that come outside through the network connection point.

NOTE 2: The requirements in Chapters 2 and 3, in related Spanish sections (E), and also in sections in 10.2 (E) and 10.3 (E) shall be applied. A more specific reference is

made to sections 2.2.1.1 (E) 1, 2.4.1 (E) 2, 2.4.2 (E) 2, 2.4.2 (E) 3, 2.5 (E) 1, 10.2 (E) 2.1, 3.3 (E) 1, 10.3 (E) 3, 10.3 (E) 4, and 10.3 (E) 5.

A.9.4.1.1 Series-connected TE with switch S in position 1

The TEUT is connected as shown in figure A.9.4.1.1 and its switch S is in position 1.

The feeding conditions V_f , R_f are as described in table A.9.4.1.1.

The load resistor R_L is adjusted so as to obtain the values of loop current I_1 and then I_2 , as described in table 9.4.1.1, when switch T is closed.

With the loop current I adjusted to I_1 , a test is performed to check whether the detector D1 is activated when the switch T closes for t_1 (ms) and not activated when the switch T closes only for t_2 (ms).

With the loop current I adjusted to I_2 , a test is performed to check whether the detector is deactivated when the switch T opens for t_3 (ms) after a close period of t_5 (ms), and not deactivated when the switch T opens for only t_4 (ms), after a close period of t_6 (ms).

The values of the test parameters t_1 , t_2 , t_3 , t_4 are given in table 9.4.1 and the values of the test parameters t_5 and t_6 are given in table A.9.4.1.1.

Table A.9.4.1.1: Loop current detector D1 - Switch S in position 1

COUNTRY	TEST VALUES					Remarks
	t_5 (ms)	t_6 (ms)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria			60		19, 60	
Belgium			not mandatory			
Cyprus			not mandatory			
Denmark			not mandatory			
Finland						
France			48	300		
Germany			60	1 000, 2 530		
Greece						
Iceland			not mandatory			
Ireland			not mandatory			
Italy			not mandatory			
Luxembourg			not mandatory			
Malta						
Netherlands						
Norway			not mandatory			
Portugal			not mandatory			
Spain			not mandatory			
Sweden						yes
Switzerland			under study			
U. Kingdom			not mandatory			

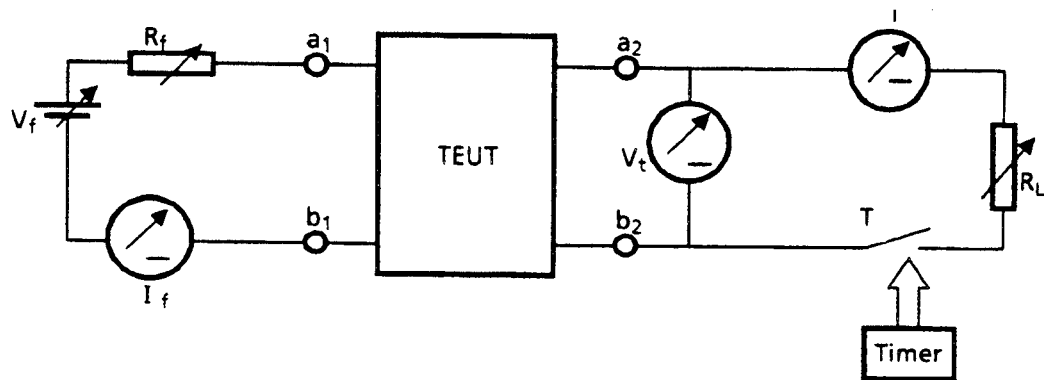


Figure A.9.4.1.1: Loop current detector D1 - Switch S in position 1

A.9.4.1.1 (S) 1 No time requirements but TE with such a feature shall function in the current range 10 - 50 mA.

9.4.1.2 Series-connected TE with switch S in position 2

9.4.1.2.1 Type A

For a series-connected TE of type A, with its switch S in position 2, capable of detecting loop current due to a TE connected to its second port, the loop current detector D1 shall:

- a) be activated when TE's second port is loaded with a resistor of value lower than R_{L1} (k Ω) for a period of at least t_1 (ms);
- b) not be activated when TE's second port is loaded with a resistor of value lower than R_{L1} (k Ω) for a period shorter than t_2 (ms);
- c) be deactivated when TE's second port is loaded with a resistor of value higher than R_{L2} (k Ω) for a period of at least t_3 (ms);
- d) not be deactivated when TE's second port is loaded with a resistor of value higher than R_{L2} (k Ω) for a period shorter than t_4 (ms).

Moreover, the internal dc source necessary to feed the TE connected to the second port, shall present a voltage of value between V_{t1} (V) and V_{t2} (V), through a resistor of value R_{L3} (Ω) and shall have a maximum short circuit current of I_{SC} (mA).

Requirement values are shown in table 9.4.1.2.1.

Compliance shall be checked by the tests outlined in section A.9.4.1.2.1.

Table 9.4.1.2.1: Loop current detector D1 - Switch S in position 2, type A

COUNTRY	REQUIREMENT VALUES					
	R_{L1} (k Ω)	R_{L2} (k Ω)	R_{L3} (k Ω)	V_{t1} (V)	V_{t2} (V)	I_{sc} (mA)
Austria	4	100	4	5	60	60
Belgium	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland	not mandatory					
France						
Germany						
Greece						
Iceland	not mandatory					
Ireland	not mandatory					
Italy	not stated					
Luxembourg						
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden	not mandatory					
Switzerland	under study					
U. Kingdom	not mandatory					

Table 9.4.1.2.1 cont.: Loop current detector D1 - Switch S in position 2, type A

COUNTRY	REQUIREMENT VALUES				Remarks
	t ₁ (ms)	t ₂ (ms)	t ₃ (ms)	t ₄ (ms)	
Austria					yes
Belgium		not mandatory			
Cyprus		not mandatory			
Denmark		not mandatory			
Finland					
France					
Germany					yes
Greece					
Iceland		not mandatory			
Ireland		not mandatory			
Italy		not stated			
Luxembourg		not mandatory			
Malta					
Netherlands					
Norway		not mandatory			
Portugal		not mandatory			
Spain		not mandatory			yes
Sweden		not mandatory			
Switzerland		under study			
U. Kingdom		not mandatory			

- 9.4.1.2.1 (A) 1** Switch S shall change to position 1 within 200 ms after R_{L1} is connected to the second port.
- 9.4.1.2.1 (D) 1** Requirements c) and d) shall not be applied.
- 9.4.1.2.1 (D) 2** The load resistor shall be 2,2 kohms; a test shall be carried out. The voltage across the resistor shall be at least 6 V. If not, or if the loop detector does not detect the loop, a second test shall be performed, with a load resistor of 22 kohms. The voltage drop upon the resistor shall be ≥ 6 V and the detector shall detect the loop.
- 9.4.1.2.1 (D) 3** The TE shall disconnect (by two contacts) within 200 ms after the TE which is connected to the second port seizes the line.

TEs using these detections are described in sections 8.3 (D) 3.1.3 to 8.3 (D) 3.1.5.
- 9.4.1.2.1 (D) 4** The loop current detector shall be ready for operation at the latest one second after the additional equipment has established connection to the line.
- 9.4.1.2.1 (D) 5** In order to detect the operational state of a TE which is connected to the second port, the second port may be switched internally via a 2-pole switch

to an internal dc feeding source. The internal feeding source shall in any case not come into contact with the line.

The feeding voltage shall be between 6 V and 60 V and the maximum short circuit current shall not exceed 60 mA.

The requirements for detection and evaluation are described in sections 9.4.1.2.1 to 9.4.1.2.1 (D) 4.

9.4.1.2.1 (E) 1

NOTE: See NOTES 1 and 2 in section 9.4.1.1 (E) 1.

A.9.4.1.2.1 Type A

The TEUT is connected as shown in figure A.9.4.1.1 and with switch S in position 2.

The feeding conditions V_f , R_f are described in table A.9.4.1.2.1.

The load resistor R_L is adjusted to the value R_{L1} , as described in table 9.4.1.2.1, and a test is performed to check whether the detector D1 is activated when the switch T closes for t_1 (ms) and is not activated when the switch T closes for only t_2 (ms).

Then the load resistor R_L is adjusted to the value R_{L2} , as described in table 9.4.1.2.1, and a test is performed to check whether the detector deactivated when the switch T opens for t_3 (ms) after a close period of t_5 (ms) and is not deactivated when the switch T opens for only for t_4 (ms) after a close period of t_6 (ms).

The values of the test parameters t_1 , t_2 , t_3 , t_4 are given in table 9.4.1.2.1 and the values of the test parameters t_5 and t_6 are given in table A.9.4.1.2.1.

Then the load resistor R_L is adjusted to the value R_{L3} , as described in table 9.4.1.2.1, and the value of dc voltage V_t is measured when the switch T is closed.

At the end, the load resistor R_L is short-circuited and the value of dc current I (I_{SC}) is measured when the switch T is closed.

Table A.9.4.1.2.1: Loop current detector D1 - Switch S in position 2, type A

COUNTRY	TEST VALUES					Remarks
	t_5 (ms)	t_6 (ms)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria			60		19, 60	
Belgium			not mandatory			
Cyprus			not mandatory			
Denmark			not mandatory			
Finland						
France						
Germany			60	1 000, 2 530		
Greece						
Iceland			not mandatory			
Ireland			not mandatory			
Italy			not stated			
Luxembourg			not mandatory			
Malta						
Netherlands						
Norway			not mandatory			
Portugal			not mandatory			
Spain			not mandatory			
Sweden			not mandatory			
Switzerland			under study			
U. Kingdom			not mandatory			

9.4.1.2.2 Type B

For a series-connected TE of type B, with its switch S in position 2, capable of detecting loop current due to a TE connected to its second port, the loop current detector D1 shall:

- a) be activated when TE's second port is loaded with a resistor of value lower than R_{L1} (k Ω) for a period of at least t_1 (ms);
- b) not be activated when TE's second port is loaded with a resistor of value lower than R_{L1} (k Ω) for a period shorter than t_2 (ms);
- c) be deactivated when TE's second port is loaded with a resistor of value higher than R_{L2} (k Ω) for a period of at least t_3 (ms);
- d) not be deactivated when TE's second port is loaded with a resistor of value higher than R_{L2} (k Ω) for a period shorter than t_4 (ms).

Moreover, the voltage measured at a load resistor value R_{L3} (Ω) which is connected to a second port, shall be higher than V_t (V) for all feeding conditions described in table 9.4.1.2.2.

Requirement values are shown in table 9.4.1.2.2.

Compliance shall be checked by the tests outlined in section A.9.4.1.2.2.

Table 9.4.1.2.2: Loop current detector D1 - Switch S in position 2, type B

COUNTRY	REQUIREMENT VALUES			
	R_{L1} (k Ω)	R_{L2} (k Ω)	R_{L3} (k Ω)	V_t (V)
Austria	4	100	4	5
Belgium	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France				
Germany	2,2, 22		2,2, 22	6
Greece				
Iceland	not mandatory			
Ireland	not mandatory			
Italy	not stated			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden	not mandatory			
Switzerland	under study			
U. Kingdom	not mandatory			

Table 9.4.1.2.2 cont.: Loop current detector D1 - Switch S in position 2, type B

COUNTRY	REQUIREMENT VALUES				Remarks
	t ₁ (ms)	t ₂ (ms)	t ₃ (ms)	t ₄ (ms)	
Austria					yes
Belgium					not mandatory
Cyprus					not mandatory
Denmark					not mandatory
Finland					
France					
Germany	200	100			yes
Greece					
Iceland					not mandatory
Ireland					not mandatory
Italy					not stated
Luxembourg					
Malta					
Netherlands					
Norway					not mandatory
Portugal					not mandatory
Spain					not mandatory
Sweden					not mandatory
Switzerland					under study
U. Kingdom					not mandatory

9.4.1.2.2 (A) 1 Switch S shall change to position 1 within 200 ms after R_{L1} is connected to the second port.

9.4.1.2.2 (D) 1 Requirements c) and d) shall not be applied.

9.4.1.2.2 (D) 2 The load resistor shall be 2,2 kohms; a test shall be carried out. The voltage across the resistor shall be at least 6 V. If not, or if the loop detector does not detect the loop, a second test shall be performed, with a load resistor of 22 kohms. The voltage drop upon the resistor shall be ≥ 6 V and the detector shall detect the loop.

9.4.1.2.2 (D) 3 The TE shall disconnect (by two contacts) within 200 ms after the TE which is connected to the second port seizes the line.

TEs using these detections are described in sections 8.3 (D) 3.1.1. and 8.3 (D) 3.1.2.

9.4.1.2.2 (D) 4 The loop current detector shall be ready for operation at the latest one second after the additional equipment has established connection to the line.

9.4.1.2.2 (D) 5 In order to detect the operational state of a TE which is connected to the second port may be switched internally via a 2-pole switch to an internal dc

feeding source. The internal feeding source shall in any case not come into contact with the line.

The feeding voltage shall be between 6 V and 60 V and the maximum short circuit current shall not exceed 60 mA.

The requirements for detection and evaluation are described in sections 9.4.1.2.1 (D) 4. to 9.4.1.2.2.

9.4.1.2.2 (E) 1

NOTE: See NOTES 1 and 2 in section 9.4.1.1 (E) 1.

A.9.4.1.2.2 Type B

The TEUT is connected as shown in figure A.9.4.1.1 and with switch S in position 2.

The feeding conditions V_f , R_f are described in table A.9.4.1.2.2.

The load resistor R_L is adjusted to the value R_{L1} , as described in table 9.4.1.2.2, and a test is performed to check whether the detector D1 is activated when the switch T closes for t_1 (ms) and not activated when the switch T closes for only t_2 (ms).

Then the load resistor R_L is adjusted to the value R_{L2} , as described in table 9.4.1.2.2, and a test is performed to check whether the detector deactivated when the switch T opens for t_3 (ms) after a close period of t_5 (ms) and is not deactivated when the switch T opens for only for t_4 (ms) after a close period of t_6 (ms).

The values of the test parameters t_1 , t_2 , t_3 , t_4 are given in table 9.4.1.2.2 and the values of the test parameters t_5 and t_6 are given in table A.9.4.1.2.2.

Then the load resistor R_L is adjusted to the value R_{L3} , as described in table 9.4.1.2.2, and the value of dc voltage V_t is measured when the switch T is closed.

Table A.9.4.1.2.2: Loop current detector D1 - Switch S in position 2, type B

COUNTRY	TEST VALUES					Remarks
	t_5 (ms)	t_6 (ms)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria			60		19, 60	
Belgium			not mandatory			
Cyprus			not mandatory			
Denmark			not mandatory			
Finland						
France						
Germany			60	2 530		
Greece						
Iceland			not mandatory			
Ireland			not mandatory			
Italy			not stated			
Luxembourg			not mandatory			
Malta						
Netherlands						
Norway			not mandatory			
Portugal			not mandatory			
Spain			not mandatory			
Sweden			not mandatory			
Switzerland			under study			
U. Kingdom			not mandatory			

9.4.1.3 Series-connected TE loop current detector immunity

TE which is placed in series with the PSTN network termination point and with other TE which itself is approved for connection to the PSTN and which has loop current detection capability is tested according to the method outlined in section A.9.4.1.3.

The loop current detection circuitry of the series-connected TE shall not respond to the applied ringing current when a circuit consisting of R (k Ω) in series with C (μ F) is connected directly across the line terminals or leads intended to be connected to other TE.

Compliance shall be checked using the test outlined in section A.9.4.1.3.

Table 9.4.1.3: Series-connected TE loop current detector immunity

COUNTRY	REQUIREMENT VALUES		Remarks
	R (kΩ)	C (μF)	
Austria	1	4	
Belgium	1	4	
Cyprus	1	4	
Denmark	not mandatory		
Finland	not mandatory		
France	not mandatory		
Germany	not mandatory		
Greece	1	4	
Iceland	not mandatory		
Ireland	not mandatory		
Italy	not mandatory		
Luxembourg	not mandatory		
Malta			
Netherlands	not mandatory		
Norway	1	4	
Portugal	not mandatory		
Spain			yes
Sweden	not mandatory		
Switzerland	not mandatory		
U. Kingdom	not mandatory		

9.4.1.3 (E) 1

NOTE 1: See NOTES 1 and 2 in section 9.4.1.1 (E) 1.

NOTE 2: Particular reference is made to section 10.3 (E) 4.2.

A.9.4.1.3 Series-connected TE loop current detector immunity

The TEUT is placed in the quiescent condition when connected as shown in figure A.9.4.1.3. The ringing generator "e" is set to the rms output voltage value "e" at a frequency of f (Hz). The switch, S, is opened and closed for times t_1 and t_2 respectively.

The values of e, f, V_t , R_f , t_1 , and t_2 are shown in table A.9.4.1.3.

Response of the loop current detector circuitry shall be checked by inspection.

Table A.9.4.1.3: Series-connected TE loop current detector immunity

COUNTRY	TEST VALUES						Remarks
	e (V)	f (Hz)	V_f (V)	R_f (Ω)	t_1 (s)	t_2 (s)	
Austria	60	50	60	500		cont. signal	
Belgium	75	25	48	1 000	3	1	
Cyprus	80	25	48	800	3	1,5	
Denmark			not mandatory				
Finland			not mandatory				
France			not mandatory				
Germany			not mandatory				
Greece	80	25, 50	60	500	4	1	
Iceland			not mandatory				
Ireland			not mandatory				
Italy			not mandatory				
Luxembourg			not mandatory				
Malta			not mandatory				
Netherlands			not mandatory				
Norway				460	4	1	yes
Portugal			not mandatory				
Spain			not mandatory				
Sweden			not mandatory				
Switzerland			not mandatory				
U. Kingdom			not mandatory				

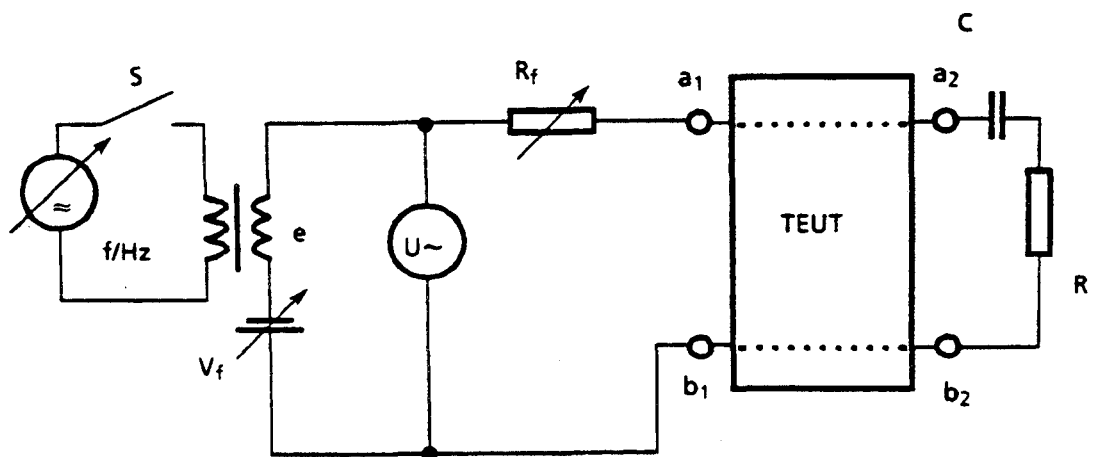


Figure A.9.4.1.3: Series-connected TE loop current detector immunity

A.9.4.1.3 (N) 1 The test shall be carried out with the following ringing signals:

Ringling signal	Curve form	Frequency (Hz)	dc component V
90 V _{rms}	sine	25	60
60 V _{rms}	sine	25	90
155 V _{p - p}	square	25	80

9.4.2 Loop current detector D2

For a series-connected TE of type A or type B with its switch S in position 2, capable of detecting loop current interruption of the line connected to its first port, the loop current detector D2 shall:

- a) be activated when current value is greater than I_1 (mA) for a period of at least t_1 (ms);
- b) not be activated when current value is greater than I_1 (mA) for a period shorter than t_2 (ms);
- c) be deactivated when current value is lower than I_2 (mA) for a period of at least t_3 (ms);
- d) not be deactivated when current value is lower than I_2 (mA) for a period shorter than t_4 (ms).

The requirements for TE of type B shall be met when a second port is loaded with a resistor of value R_L (k Ω).

Requirement values are shown in table 9.4.2.

Compliance shall be checked using the tests outlined in section A.9.4.2.

Table 9.4.2: Loop current detector D2

COUNTRY	REQUIREMENT VALUES							Remarks
	I_1 (mA)	I_2 (mA)	t_1 (ms)	t_2 (ms)	t_3 (ms)	t_4 (ms)	R_L (k Ω)	
Austria	19	3			190	150	≥ 100	yes
Belgium								not mandatory
Cyprus								not mandatory
Denmark								not mandatory
Finland								
France								
Germany								not mandatory
Greece								
Iceland								not mandatory
Ireland								not mandatory
Italy								not stated
Luxembourg								not mandatory
Malta								
Netherlands								
Norway								not mandatory
Portugal								not mandatory
Spain								not mandatory
Sweden								not mandatory
Switzerland								under study
U. Kingdom								not mandatory

9.4.2 (A) 1 These requirements shall also be met by TE with handsfree function.

9.4.2 (E) 1

NOTE: See NOTES 1 and 2 in section 9.4.1.1 (E) 1.

A.9.4.2 Loop current detector D2

The TEUT is connected as shown in figure A.9.4.2 and its switch S is in position 2.

The feeding voltage V_f is as described in table A.9.4.2.

For TE of type B the load resistor R_L is adjusted as described in table 9.4.2.

The feeding resistor R_f is adjusted so as to obtain the values of loop current I_1 and then I_2 , as described in table 9.4.2.1, when the switch T is closed.

With loop current I adjusted to I_1 , a test is performed to check whether the detector D1 is activated when the switch T closes for t_1 (ms) and is not activated when the switch T closes for only t_2 (ms).

With loop current I adjusted to I_2 , a test is performed to check whether the detector is deactivated when the switch T opens for t_3 (ms) after a close period of t_5 (ms), and is not deactivated when the switch T opens for only t_4 (ms) after a close period of t_6 (ms).

The values of the test parameters t_1 , t_2 , t_3 , t_4 are given in table 9.4.2.1, and the values of the test parameters t_5 and t_6 are given in table A.9.4.2.

Table A.9.4.2: Loop current detector D2

COUNTRY	TEST VALUES					Remarks
	t_5 (ms)	t_6 (ms)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria			60		19, 60	
Belgium			not mandatory			
Cyprus			not mandatory			
Denmark			not mandatory			
Finland						
France						
Germany			not mandatory			
Greece						
Iceland			not mandatory			
Ireland			not mandatory			
Italy			not stated			
Luxembourg			not mandatory			
Malta						
Netherlands						
Norway			not mandatory			
Portugal			not mandatory			
Spain			not mandatory			
Sweden			not mandatory			
Switzerland			under study			
U. Kingdom			not mandatory			

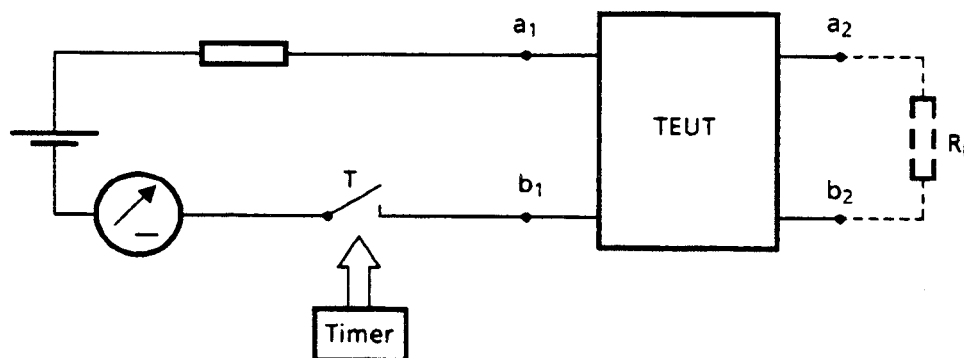


Figure A.9.4.2: Loop current detector D2

9.5 PSTN tone detection

The following sections deal with tones sent by the PSTN to the TE when the TE is in loop condition.

The detection of these tones, as treated herein, is followed by the generation of other signals inside the TE destined to cause the TE to initiate or to prevent it from initiating a certain subsequent action.

The necessity to implement these detection facilities, as well as the subsequent actions, are specified in other chapters of this document, or in TE standards, depending on the type of TE.

The tones covered by the present requirements are:

- Dial tone;
- Special dial tone;
- Busy tone;
- Congestion tone;
- Ringing tone;
- Special information tone.

9.5 (CH) 1 For TEs with automatic calling functions, the specified values for recognition of the tone signals (e.g. "busy tone", "congestion tone", "ringing tone" and "special information tone") relevant for steering subsequent functions have yet to be harmonised as far as possible by ETSI. The short term aim for Switzerland is to specify requirements for tone detection valuable for the great majority of calls (national and international) originating in Switzerland. For each country the values of the relevant signals, as they are generated in the respective network, can be found in Chapter 1.

9.5.1 Dial tone detection

Dial tone detection is closely linked to the calling function and therefore described in subclause 5.2.

9.5.2 Special dial tone detection

9.5.2.1 Special dial tone detector sensitivity

For TE capable of detecting a special dial tone, the relevant detector shall be activated, when a signal in the frequency range from f_1 (Hz) up to f_2 (Hz), with a level between p_1 (dBm) and p_2 (dBm) measured on a load impedance Z_L (Ω), a send period between t_{on1} (ms) and t_{on2} (ms) and a pause between t_{off1} (ms) and t_{off2} (ms) is applied through an impedance Z_G (Ω) to the line terminals for a period of at least t_{d1} (s).

The subsequent action shall occur not later than t_a (s) after the beginning of application of the special dial tone.

The requirement values f_1 , f_2 , p_1 , p_2 , t_{on1} , t_{on2} , t_{off1} , t_{off2} , t_{d1} and t_a are shown in table 9.5.2.1.

The requirements shall be met with dc feeding values V_f , R_f , I_f in the ranges specified in table 9.5.2.1.

Compliance shall be checked using the tests outlined in section A.9.5.2.1.

Table 9.5.2.1: Special dial tone detector sensitivity

COUNTRY	REQUIREMENT VALUES				
	f_1 (Hz)	f_2 (Hz)	P_1 (dBm)	P_2 (dBm)	Z_G (Ω)
Austria			-26	-16	600
Belgium	415	460	-18	0	600
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France	425, 315	455, 345	-27	-10	600
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	410	440	-25	-6	600
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway					
Portugal	400	450	-30	-5	600
Spain	not mandatory				
Sweden					
Switzerland	see para 5.2				
U. Kingdom	not mandatory				

Table 9.5.2.1 cont.: Special dial tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	600	60		19 - 60
Belgium	600	48		20 - I_{max} .
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	600	46 - 54	300 - 1 400	
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	600	44, 52	720, 1 880	
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	600	60	460 - 3 100	
Portugal	600	45 - 55	400 - 1 800	not applic.
Spain	not mandatory			
Sweden				
Switzerland	see para. 5.2			
U. Kingdom	not mandatory			

Table 9.5.2.1 cont.: Special dial tone detector sensitivity

COUNTRY	REQUIREMENT VALUES						Remarks	
	t_{on1} (ms)	t_{on2} (ms)	t_{off1} (ms)	t_{off2} (ms)	t_{d1} (s)	t_a (s)		
Austria						2	yes	
Belgium	950	1 050	200	300	2,3	5		
Cyprus	not mandatory							
Denmark	not mandatory							
Finland								
France	continuous				2	3	yes	
Germany	not mandatory							
Greece								
Iceland							yes	
Ireland	not mandatory							
Italy	∞	∞	0	0	2	4	yes	
Luxembourg	not mandatory							
Malta								
Netherlands							yes	
Norway							4	yes
Portugal	800	1 200	160	240	3		yes	
Spain	not mandatory						yes	
Sweden							yes	
Switzerland	see para. 5.2						yes	
U. Kingdom	not mandatory							

9.5.2.1 (A) 1 $f_1 + f_2$... continuous tones
 $f_2 - f_1 \geq 25$ Hz

$340 \text{ Hz} \leq f_1 \leq 425 \text{ Hz}$
 $400 \text{ Hz} \leq f_2 \leq 450 \text{ Hz}$

9.5.2.1 (F) 1 The special dial tone is a continuous composed signal (similar to the second dial tone) with two frequency components of respective values 440 ± 15 Hz and 330 ± 15 Hz. The level of 330 Hz component is $3,5 \pm 1$ dB higher than the level of 440 Hz component. The values given in the tables of section 9.5.2 correspond to global levels.

9.5.2.1 (F) 2 The detection of the special dial tone shall not be disturbed by interruption of signal of a duration of not more than 30 ms.

9.5.2.1 (IS) 1 Special dial tone characteristics are:

Frequency : 425 ± 25 Hz
Nominal value : -10 dBm
Cadence : 400 ms tone, 40 ms pause with 10% tolerance.

9.5.2.1 (I) 1 Continuous tone.

9.5.2.1 (NL) 1 The special dial tone is the same as the normal dial tone with tone interruptions of 35 - 75 ms every 450 - 550 ms. Testing of the dial tone detector on the sensitivity for special dial tone is not mandatory.

9.5.2.1 (N) 1 The special dial tone is a continuous signal consisting of two alternating tones. The frequencies are 470 ± 15 Hz and 425 ± 15 Hz. The alternating intervals are 400 ± 40 ms.

9.5.2.1 (P) 1 t_a (s) = 3 to start dialling, for TE having automatic or manual initiation of dialling in accordance with section 5.6.3.

9.5.2.1 (E) 1

NOTE 1: See NOTE 1 in section 9.4.1.1 (E) 1.

NOTE 2: Useful information about the special dial tone may be found in section 1.7.7 (E) 1.2.

NOTE 3: Particular attention should be paid to the requirements in sections 5.2 (E) and 10.5 (E) 4.

9.5.2.1 (S) 1 Special dial tone characteristics are:

Frequency : 425 ± 15 Hz
Nominal value : -10 dBm
Cadence : 320 ms tone, 10 - 40 ms pause with 10% tolerance.

For special dial tone detection requirements, see Chapter 5, section 5.2.

9.5.2.1 (CH) 1 Special dial tone, like dial tone, is linked to the calling function and is therefore described in subclause 5.2.

A.9.5.2.1 Special dial tone detector sensitivity

The TEUT is connected as shown in figure A.9.5.2.1 and steps have to be undertaken in order to activate the special dial tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.5.2.1.

For each feeding conditions established and for each set of parameter values given in table A.9.5.2.1, a check must be performed to ensure that the detector indicates the presence of the special dial tone.

Each line of table A.9.5.2.1 forms one set of parameter values. The number of sets "n" are shown in table A.9.5.2.1.

Table A.9.5.2.1: Special dial tone detector sensitivity

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria			-26, -16		
Belgium		425, 450	-18	1 000	250
Cyprus			not mandatory		
Denmark			not mandatory		
Finland					
France	1	440, 330	-27	continuous	
Germany					
Greece					
Iceland					
Ireland			not mandatory		
Italy	3	410, 425, 440	-25, -15,-6		
Luxembourg			not mandatory		
Malta					
Netherlands					
Norway	1	425, 470	-30		
Portugal		400, 450	-30	800, 1 200	160, 240
Spain			not mandatory		
Sweden					
Switzerland			see para. 5.2		
U. Kingdom			not mandatory		

Table A.9.5.2.1 cont.: Special dial tone detector sensitivity

COUNTRY	TEST VALUES				Remarks
	t_{d1} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria		60		19, 60	yes
Belgium		48	400, 1 600		
Cyprus		not mandatory			
Denmark		not mandatory			
Finland					
France	2	48	600		yes
Germany					
Greece					
Iceland					
Ireland		not mandatory			
Italy	2	44, 48, 52	1 880, 1 100, 720		yes
Luxembourg		not mandatory			
Malta					
Netherlands					
Norway	4	60	3 100		yes
Portugal	3	48	400, 1 800	not applicable	
Spain		not mandatory			
Sweden					
Switzerland		see para. 5.2			
U. Kingdom		not mandatory			

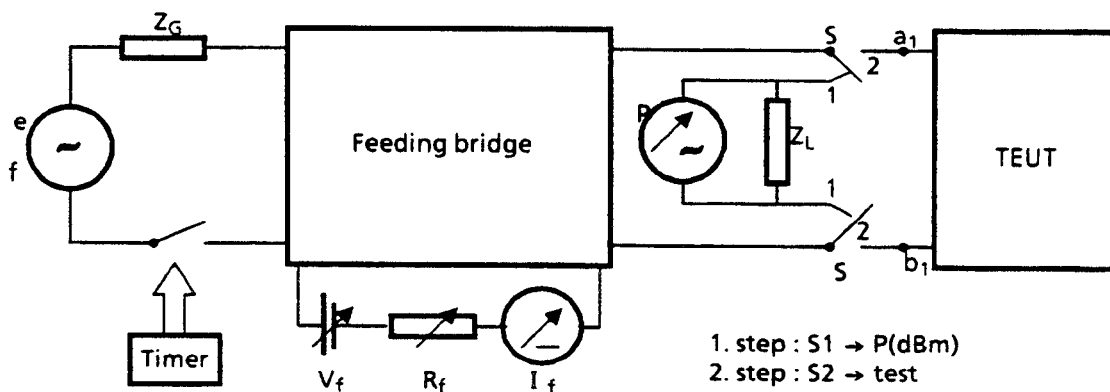


Figure A.9.5.2.1: Special dial tone detector sensitivity

A.9.5.2.1 (A) 1

Frequency combinations:

- 340 + 400 Hz
- 425 + 450 Hz

A.9.5.2.1 (F) 1 Other sets of test parameter values:

i (Set No)	f (Hz)	p (dBm)	t_d (s)	V_f (V)	R_f (Ω)
2	440 + 330	-10	2	48	600
3	425 + 315	-27	2	48	600
4	455 + 345	-27	2	48	600
5	440 + 330	-27	2	46	1 400
6	440 + 330	-27	2	54	300

A.9.5.2.1 (F) 2 It is verified that the signal described in test set no. 1 is still detected with an interruption of 30 ms in the middle of the signal period.

A.9.5.2.1 (I) 1 Continuous tone.

A.9.5.2.1 (N) 1 Continuous tone, alternating between the two frequencies.

9.5.2.2 Special dial tone detector insensitivity

For TE capable of detecting special dial tone, the relevant detector shall not be activated, if any of the following signals are applied through an impedance Z_G (Ω) to the line terminals:

a) "outband signals" with:

frequency of value lower than f_3 (Hz) or higher than f_4 (Hz) and;

- any level of value lower than p_3 (dBm), measured on a load impedance Z_L (Ω);
- any value of cadence t_{on}/t_{off} ;
- any value of duration.

b) "weak signals" with:

level of value lower than p_4 (dBm), measured on a load impedance Z_L (Ω) and;

- any value of frequency;
- any value of cadence t_{on}/t_{off} ;
- any value of duration.

c) "improperly cadenced" signals with:

t_{on} of value lower than t_{on3} (ms) and any value of t_{off} , or t_{on} of value higher than t_{on4} (ms) and any value of t_{off} , or t_{off} of value lower than t_{off3} (ms) and any value of t_{on} or t_{off} of value higher than t_{off4} (ms) and any value of t_{on} and;

- any value of frequency;
- any value of level;
- any value of duration.

d) "short signals" with:

duration of value lower than t_{d2} (s) and;

- any value of frequency;
- any value of level;
- any value of cadence t_{on}/t_{off} .

The requirement values are given in table 9.5.2.2.

The requirements shall be met with feeding values V_f , R_f , I_f in the ranges specified in table 9.5.2.2.

Compliance shall be checked using the test outlined in section A.9.5.2.2.

Table 9.5.2.2: Special dial tone detector insensitivity

COUNTRY	REQUIREMENT VALUES				
	f_3 (Hz)	f_4 (Hz)	P_3 (dBm)	P_4 (dBm)	t_{on3} (ms)
Austria	not mandatory				
Belgium	350	550	8	-28	850
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	250	600	-10	-50	
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	350	550	-6	-48/	
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	160	not applic.	0	-45	600
Spain	not mandatory				
Sweden					
Switzerland	see para. 5.2				
U. Kingdom	not mandatory				

Table 9.5.2.2 cont.: Special dial tone detector insensitivity


COUNTRY	REQUIREMENT VALUES			
	t_{on4} (ms)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	1 150	48		20 - $I_{max.}$
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	46 - 54		300 - 1 400	
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	44, 52		720, 1 880	
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not applic.	45 - 55	400 - 1 880	not applic.
Spain	not mandatory			
Sweden				
Switzerland	see para. 5.2			
U. Kingdom	not mandatory			

Table 9.5.2.2 cont.: Special dial tone detector insensitivity

COUNTRY	REQUIREMENT VALUES			Remarks
	t_{off3} (ms)	t_{off4} (ms)	t_{d2} (s)	
Austria		not mandatory		
Belgium	150	350	1,1	
Cyprus		not mandatory		
Denmark		not mandatory		
Finland				
France			1	yes
Germany		not mandatory		
Greece				
Iceland				
Ireland		not mandatory		
Italy			2	yes
Luxembourg		not mandatory		
Malta				
Netherlands				
Norway		not mandatory		
Portugal		not applicable		
Spain		not mandatory		yes
Sweden				yes
Switzerland		see para. 5.2		
U. Kingdom		not mandatory		

9.5.2.2 (F) 1 The "improperly cadenced" signal, for which the detector shall not be activated, is the busy tone.

Compliance shall be checked using the test outlined in A.9.5.2.2.b.

9.5.2.2 (I) 1 Continuous tone.

9.5.2.2 (E) 1

NOTE: See NOTES 1 and 3 in section 9.5.2.1 (E) 1.

9.5.2.2 (S) 1 See remark 9.5.2.1 (S) 1.

A.9.5.2.2 Special dial tone detector insensitivity

The TEUT is connected as shown in figure A.9.5.2.1 and steps have to be undertaken in order to activate the special dial tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.5.2.2.a.

For each of the feeding conditions established and for each set of parameter values given in tables A.9.5.2.2.a, b, c, and d, a check must be performed to ensure that the detector is not activated.

The tables A.9.5.2.2.a, b, c, and d refer, respectively, to cases a, b, c and d mentioned in requirement section 9.5.2.2.

Each line of these tables forms a set of parameter values. The number of sets "n" will be specified by each Administration.

Table A.9.5.2.2.a: Special dial tone detector insensitivity for case a

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria	not mandatory				
Belgium		345, 555	7	1 000	250
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	1	250	-10	continuous	
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	2	350, 550	-6		
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal		159	-1	1 000	200
Spain	not mandatory				
Sweden					
Switzerland	see para. 5.2				
U. Kingdom	not mandatory				

Table A.9.5.2.2.a cont.: Special dial tone detector insensitivity for case a

COUNTRY	TEST VALUES			
	t_d (s)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	■	48	400, 1 600	■
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	6	48	600	
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	2	44, 48, 52	1 880, 1 100, 720	
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	10	48	400, 1 800	not applic.
Spain	not mandatory			
Sweden				
Switzerland	see para. 5.2			
U. Kingdom	not mandatory			

Table A.9.5.2.2.b: Special dial tone detector insensitivity for case b

COUNTRY	TEST VALUES					
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)
Austria	not mandatory					
Belgium		425, 450	-29	1 000	250	
Cyprus	not mandatory					
Denmark	not mandatory					
Finland	not mandatory					
France	2	330, 440	-50	continuous		6
Germany	not mandatory					
Greece	not mandatory					
Iceland	not mandatory					
Ireland	not mandatory					
Italy	1		-48			
Luxembourg	not mandatory					
Malta	not mandatory					
Netherlands	not mandatory					
Norway	not mandatory					
Portugal		425	-46	1 000	200	10
Spain	not mandatory					
Sweden	not mandatory					
Switzerland	see para. 5.2					
U. Kingdom	not mandatory					

Table A.9.5.2.2.c: Special dial tone detector insensitivity for case c

COUNTRY	TEST VALUES					
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)
Austria	not mandatory					
Belgium		425, 450	-6	800, 1 200	140, 360	
Cyprus	not mandatory					
Denmark	not mandatory					
Finland	not mandatory					
France	3	440	-10	500	500	6
Germany	not mandatory					
Greece	not mandatory					
Iceland	not mandatory					
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta	not mandatory					
Netherlands	not mandatory					
Norway	not mandatory					
Portugal		425	0	590	250	10
Spain	not mandatory					
Sweden	not mandatory					
Switzerland	see para. 5.2					
U. Kingdom	not mandatory					

Table A.9.5.2.2.d: Special dial tone detector insensitivity for case d

COUNTRY	TEST VALUES						Remarks
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)	
Austria	not mandatory						
Belgium		425, 450	-6	1 000	250	0,900	
Cyprus	not mandatory						
Denmark	not mandatory						
Finland	not mandatory						
France	4	440, 330	-10	continuous		1	yes
Germany	not mandatory						
Greece	not mandatory						
Iceland	not mandatory						
Ireland	not mandatory						
Italy	1					2	yes
Luxembourg	not mandatory						
Malta	not mandatory						
Netherlands	not mandatory						
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						
Sweden	not mandatory						
Switzerland	see para. 5.2						
U. Kingdom	not mandatory						

A.9.5.2.2.a, b (F) 1 Other sets of test parameter values:

i (Set No)	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)
1 bis	600	-10	continuous		6
3 bis	440	-10	500	500	6

A.9.5.2.2.a, b (I) 1 Continuous tone.

A.9.5.2.2.c (I) 1 Any cadenced tone.

9.5.3 Busy tone detection

9.5.3.1 Busy tone detector sensitivity

For TE, capable of detecting a busy tone, the relevant detector shall be activated, when a signal in the frequency range from f_1 (Hz) up to f_2 (Hz), with a level of value between p_1 (dBm) and p_2 (dBm), measured on a load impedance Z_L (Ω), a send period of value between t_{on1} (ms) and t_{on2} (ms) and a pause of value between t_{off1} (ms) and t_{off2} (ms) is applied through an impedance Z_G (Ω), to the line terminals for a period of at least t_{d1} (s).

The subsequent action shall occur not later than t_a (s) after the beginning of application of the busy tone.

The requirement values f_1 , f_2 , p_1 , p_2 , t_{on1} , t_{on2} , t_{off1} , t_{off2} , t_{d1} and t_a are shown in table 9.5.3.1.

The requirements shall be met with dc feeding values V_f , R_f , I_f in the ranges specified in table 9.5.3.1.

Compliance shall be checked using the tests outlined in section A.9.5.3.1.

Table 9.5.3.1: Busy tone detector sensitivity

COUNTRY	REQUIREMENT VALUES				
	f_1 (Hz)	f_2 (Hz)	p_1 (dBm)	p_2 (dBm)	Z_G (Ω)
Austria	380	520	-43	-6,5	600
Belgium	415	460	-21	-4	600
Cyprus	400	450	-30	-10	600
Denmark	not mandatory				
Finland	325	525	-20,5	-5	600
France	425	455	-40	-10	600
Germany	380	490	-43	-4	600
Greece					
Iceland					
Ireland	420	430	0	-16	600
Italy	410	440	-43	-6	600
Luxembourg	380	520	-43	-6,5	600
Malta					
Netherlands	340	550	-25,7	-3,8	600
Norway	350	500	0	-30	600
Portugal	300	450	-30	-5	600
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	see remark				

Table 9.5.3.1 cont.: Busy tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	600	60		19 - 60
Belgium	600	48		20 - $I_{max.}$
Cyprus	600	48	440 - 1 740	
Denmark	not mandatory			
Finland	600	48	800 - 1 710	
France	600	46 - 54	300 - 1 400	
Germany	600	60	1 000 - 2 530	
Greece				
Iceland				
Ireland	600	48		20 - 100
Italy	600	44, 52	720, 1 880	
Luxembourg	600	60		19 - 60
Malta				
Netherlands	600	42 - 66	800 - 2 140	
Norway	600	60	460 - 3 100	
Portugal	600	45 - 55	300 - 1 800	not applic.
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	see remark			

Table 9.5.3.1 cont.: Busy tone detector sensitivity

COUNTRY	REQUIREMENT VALUES						Remarks
	t _{on1} (ms)	t _{on2} (ms)	t _{off1} (ms)	t _{off2} (ms)	t _{d1} (s)	t _a (s)	
Austria						10	yes
Belgium	450	550	450	550	1,55	5	
Cyprus	450	550	450	550	3	0	
Denmark	not mandatory						
Finland							yes
France	450	550	450	550	3		
Germany	432/110	528/180	432/435	528/505	not spec.	not spec.	yes
Greece							
Iceland							yes
Ireland	375	750	375	750	not spec.	not spec.	
Italy	450	550	450	550	2	4	
Luxembourg	450 or 180	550	450	550	not specified		
Malta							
Netherlands	400 or 180	600 or 330	600 resp 330	400 resp 180			yes
Norway	100	600	100	600	4	20	
Portugal	400	600	400	600	20		yes
Spain	not mandatory						yes
Sweden							yes
Switzerland	under study, see general remark						
U. Kingdom	see remark						yes

9.5.3.1 (A) 1

t_{on1} = 240 ms, or 320 ms t_{off1} = 240 ms, or 320 ms
t_{on2} = 360 ms, or 480 ms t_{off2} = 360 ms, or 480 ms

9.5.3.1 (A) 2

Busy tones received from other countries are not included in these requirements.

9.5.3.1 (SF) 1

Busy tone consists of signals whose frequency is 425 ± 100 Hz. The nominal duration of the signal period is 300 ms likewise the nominal duration of the pause period between the signals. The accepted deviation range of the busy tone is that the allowed duration of the signal and pause periods summed together is 500 ... 700 ms and the allowed ratio between the signal and pause periods is 0,67 ... 1,7.

9.5.3.1 (D) 1

For calls routed to direct dialling, in PABXs or to exchanges in other countries, the tones and cadences may vary.

9.5.3.1 (IS) 1 Busy tone detection is not mandatory.

Busy tone characteristics are:

Frequency : 425 ± 25 Hz
Nominal value : -10 dBm
Cadence : 250 ms tone, 250 ms pause with 10% tolerance.

9.5.3.1 (NL) 1 The values of p_1 and p_2 are calculated from the requirements $e_1 = 80$ mV and $e_2 = 1$ V.

9.5.3.1 (P) 1 t_a (s) = 30, to revert to the quiescent condition for TE having transmission duration automatically controlled by monitoring the flow of information (information-related control of loop condition), except for TE using the backward channel according to CCITT Recommendations V.23, V.26 bis or V.27 ter.

9.5.3.1 (E) 1

NOTE 1: See NOTE 1 in section 9.4.1.1 (E) 1.

NOTE 2: Useful information about the busy tone may be found in section 1.7.3 (E) 1.

NOTE 3: Particular attention should be paid to the requirements in sections 10.5 (E) 10.6 and in 10.5 (E) 11.

9.5.3.1 (S) 1 Busy tone detection is not mandatory.

Busy tone characteristics are:

Frequency : 425 ± 15 Hz
Level (nominal): -10 dBm
Cadence : 250 ms tone, 250 ms pause with 10% tolerance.

9.5.3.1 (GB) 1 Detection of busy tone is specified only for TE having either auto-calling or auto-clearing functions. See chapters 5 and 6.

A.9.5.3.1 Busy tone detector sensitivity

The TEUT is connected as shown in figure A.9.5.2.1 and steps have to be undertaken in order to activate the busy dial tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.5.3.1.

For each of the feeding conditions established and for each set of parameter values given in tables A.9.5.3.1, a check must be performed to ensure that the detector indicates presence of busy tone.

Each line of table A.9.5.3.1 forms one set of parameter values. The number of sets "n" are shown in table A.9.5.3.1.

Table A.9.5.3.1: Busy tone detector sensitivity

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria		380, 520	-43, -6,5		
Belgium		425, 450	-21	500	500
Cyprus	1	425	-30	500	500
Denmark	not mandatory				
Finland					
France	1	440	-40	500	500
Germany	1	425	-43	480	480
Greece					
Iceland					
Ireland	1	425	-12	500	500
Italy	3	410, 425, 440	-43, -25, -6	450, 500, 550	450, 500, 550
Luxembourg		380, 520	-43, -6,5		
Malta					
Netherlands		340, 425, 550	-25,7, -3,8	180, 600	330, 400
Norway		350, 425, 550	-30	100, 400, 600	100, 400, 600
Portugal		300, 450	-30	400, 600	400, 600
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table A.9.5.3.1 cont.: Busy tone detector sensitivity

COUNTRY	TEST VALUES				Remarks
	t_{d1} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria		60		19, 60	yes
Belgium		48	400, 1 600		
Cyprus	10	48	800		
Denmark	not mandatory				
Finland	not spec.	48	800, 1 710		yes
France	10	48	600		yes
Germany		60	2 530		
Greece					
Iceland					
Ireland	not specified	48		20 - 80	
Italy	2	44, 48, 52	1 880, 1 100, 720		
Luxembourg		60		19, 60	
Malta					
Netherlands		48	1 130		yes
Norway	10	60	3 100		yes
Portugal	20	48	300, 1 800	not applic.	
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

A.9.5.3.1 (A) 1

t_{on1} = 240 ms, 320 ms, 360 ms, 480 ms
 t_{on2} = 240 ms, 320 ms, 360 ms, 480 ms.

A.9.5.3.1 (SF) 1

Terminating of the loop condition upon the receipt of busy tone.

The test set-up is given in figure A.9.5.3.1 (SF) 1. The busy tone used as the test signal is defined in the following way:

"Busy tone consists of signals whose frequency is 425 ± 100 Hz. The nominal duration of the signal period is 300 ms likewise the nominal duration of the pause period between the signals. The accepted deviation range of the busy tone is that the allowed duration of the signal and pause periods summed together is 500 ... 700 ms and the allowed ratio between the signal and pause periods is 0,67 ... 1,7".

The test is made with the nominal duration of the signal and pause and with the maximum and minimum duration of the signal.

The level of the test signal is -5 dBu (436 mV) across the resistor of 600 Ω . The resistor is then removed and replaced with the TEUT.

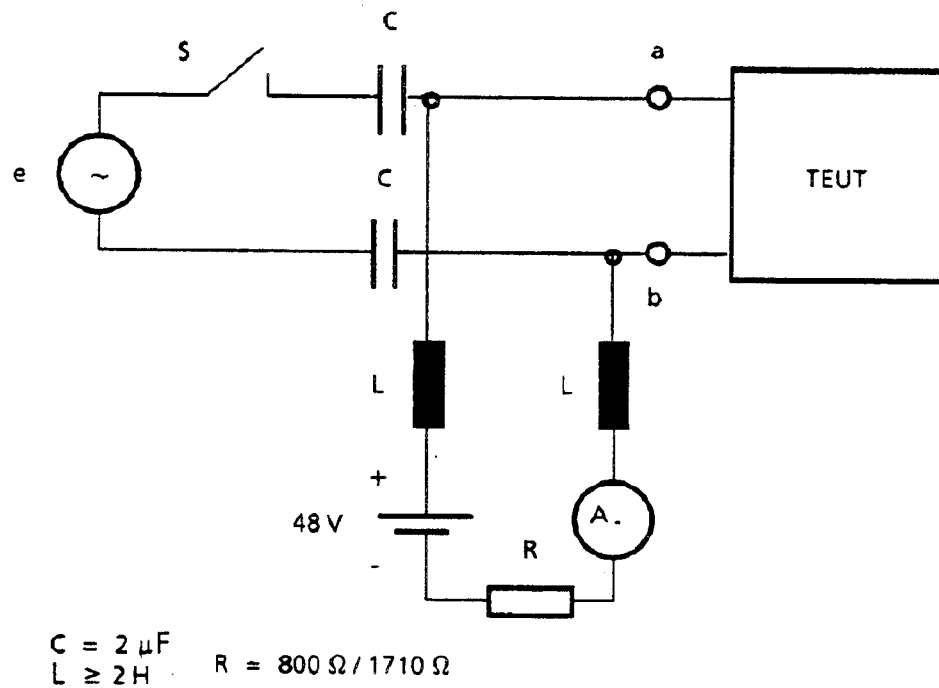


Figure A.9.5.3.1 (SF) 1

A.9.5.3.1 (F) 1 Other sets of test parameter values:

i (Set No)	f (Hz)	p (dBm)	t_{on} (ms)	t_{off} (ms)	t_d (s)	V_f (V)	R_f (Ω)
2	440	-10	500	500	10	48	600
3	425	-40	500	500	10	48	600
4	455	-40	500	500	10	48	600
5	440	-40	450	450	10	48	600
6	440	-40	550	550	10	48	600
7	440	-40	500	500	10	46	1 400
8	440	-40	500	500	10	54	300

A.9.5.3.1 (NL) 1 The value of "p" is calculated from the requirement of $e_1 = 80 \text{ mV}$ and $e_2 = 1 \text{ V}$.

A.9.5.3.1 (NL) 2 A sufficient amount of combinations have to be tested.

A.9.5.3.1 (N) 1

i	f (Hz)	t_{on} (ms)	t_{off} (ms)
1	425	100	100
2	425	600	600
3	425	100	600
4	350	600	100
5	100	100	100
6	100	100	100
7	425	400	400

9.5.3.2 Busy tone detector insensitivity

For TE capable of detecting busy tone, the relevant detector shall not be activated, if any of the following signals are applied through an impedance Z_G (Ω) to the line terminals:

a) "outband signals" with:

frequency of value lower than f_3 (Hz) or higher than f_4 (Hz) and;

- any level of value lower than p_3 (dBm), measured on a load impedance Z_L (Ω);
- any value of cadence t_{on}/t_{off} ;
- any value of duration.

b) "weak signals" with:

level of value lower than p_4 (dBm), measured on a load impedance Z_L (Ω) and;

- any value of frequency;
- any value of cadence t_{on}/t_{off} ;
- any value of duration.

c) "improperly cadenced" signals with:

t_{on} of value lower than t_{on3} (ms) and any value of t_{off} , or t_{on} of value higher than t_{on4} (ms) and any value of t_{off} , or t_{off} of value lower than t_{off3} (ms) and any value of t_{on} or t_{off} of value higher than t_{off4} (ms) and any value of t_{on} and;

- any value of frequency;
- any value of level;
- any value of duration.

d) "short signals" with:

duration of value lower than t_{d2} (s) and;

- any value of frequency;
- any value of level;
- any value of cadence t_{on}/t_{off} .

The requirement values are given in table 9.5.3.2.

The requirements shall be met with feeding values V_f , R_f , I_f in the ranges specified in table 9.5.3.2.

Compliance shall be checked using the test outlined in section A.9.5.3.2.

Table 9.5.3.2: Busy tone detector insensitivity

COUNTRY	REQUIREMENT VALUES					
	f ₃ (Hz)	f ₄ (Hz)	P ₃ (dBm)	P ₄ (dBm)	t _{on3} (ms)	t _{on4} (ms)
Austria	not mandatory					
Belgium	350	550	4	-28	400	600
Cyprus	not mandatory					
Denmark	not mandatory					
Finland	not mandatory					
France	250	600	-10	-50		
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands	-31,8					
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden						
Switzerland	under study					
U. Kingdom	not mandatory					

Table 9.5.3.2 cont.: Busy tone detector insensitivity

COUNTRY	REQUIREMENT VALUES						Remarks
	t_{off3} (ms)	t_{off4} (ms)	t_{d2} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory						
Belgium	400	600	0,6	48		20 - $I_{max.}$	
Cyprus	not mandatory						
Denmark	not mandatory						
Finland	not mandatory						
France			3	46 - 54	300 - 1 400		yes
Germany	not mandatory						
Greece	not mandatory						
Iceland	not mandatory						
Ireland	not mandatory						
Italy	400 600		2	44, 52 720, 1 880			
Luxembourg	not mandatory						
Malta	not mandatory						
Netherlands				42 - 66	800 - 2 140		yes
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						yes
Sweden	not mandatory						
Switzerland	under study, see general remark						
U. Kingdom	not mandatory						

9.5.3.2 (F) 1 The "improperly cadenced" signals, for which the detector shall not be activated, are dial tone, second dial tone, call progress tone and ringing tone.

Compliance shall be checked using the tests outlined in A.9.5.3.2 (F) 1.

9.5.3.2 (NL) 1 The value of p_4 is calculated from the requirement of $e_4 = 40$ mV.

9.5.3.2 (E) 1

NOTE: See NOTES 1 to 3 in section 9.5.3.1 (E) 1.

A.9.5.3.2 Busy tone detector insensitivity

The TEUT is connected as shown in figure A.9.5.2.1 and steps have to be undertaken in order to activate the busy tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.5.3.2.a.

For each of the feeding conditions established and for each set of parameter values given in table A.9.5.3.2.a, b, c, and d, a check must be performed to ensure that the detector is not activated.

The tables A.9.5.2.2.a, b, c and d refer respectively to cases a, b, c and d mentioned in requirement section 9.5.3.2.

Each line of these tables forms a set of parameter values. The number of sets "n" will be specified by each Administration.

Table A.9.5.3.2.a: Busy tone detector insensitivity for case a

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria	not mandatory				
Belgium		345, 555	3	500	500
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	1	250	-10	500	500
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study				
U. Kingdom	not mandatory				

Table A.9.5.3.2.a cont.: Busy tone detector insensitivity for case a

COUNTRY	TEST VALUES			
	t_d (s)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	■	48	400, 1 600	■
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table A.9.5.3.2.b: Busy tone detector insensitivity for case b

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria	not mandatory				
Belgium		425, 450	-29	500	500
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	2	440	-50	500	500
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands	6	340, 425, 550	-31,8	500 250	500 250
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study				
U. Kingdom	not mandatory				

Table A.9.5.3.2.b cont.: Busy tone detector insensitivity for case b

COUNTRY	TEST VALUES			
	t_d (s)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	■	48	400, 1 600	■
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands	20	48	1 130	
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remarks			
U. Kingdom	not mandatory			

Table A.9.5.3.2.c: Busy tone detector insensitivity for case c

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria	not mandatory				
Belgium		425, 450	-8	390, 610	390, 610
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	3	440	-10	continuous	
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study				
U. Kingdom	not mandatory				

Table A.9.5.3.2.c cont.: Busy tone detector insensitivity for case c

COUNTRY	TEST VALUES			
	t_d (s)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	■	48	400, 1 600	■
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table A.9.5.3.2.d: Busy tone detector insensitivity for case d

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria	not mandatory				
Belgium		425, 450	-8	500	500
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	4	440	-10	500	500
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study				
U. Kingdom	not mandatory				

Table A.9.5.3.2.d cont.: Busy tone detector insensitivity for case d

COUNTRY	TEST VALUES				Remarks
	t_d (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory				
Belgium	0,42	48	400, 1 600		
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	3	48	600		yes
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	1				
Luxembourg	not mandatory				
Malta					
Netherlands					yes
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

A.9.5.3.2.a,c (F) 1 Other sets of test parameter values:

i (Set No)	f (Hz)	p (dBm)	t_{on} (ms)	t_{off} (ms)	t_d (s)	V_f (V)	R_f (Ω)
1 bis	600	-10	500	500	10	48	600
3 bis	440 + 330	-10	Continuous		10	48	600
3 ter	440	-10	50	50	10	48	600
3 quarto	440	-10	1 500	3 500	10	48	600

A.9.5.3.2.b (NL) 1 The value of "p" is calculated from the requirement of $e = 40$ mV.

9.5.4 Busy tone detection

9.5.4.1 Congestion tone detector sensitivity

For TE, capable of detecting a congestion tone, the relevant detector shall be activated, when a signal in the frequency range from f_1 (Hz) up to f_2 (Hz), with a level of value between p_1 (dBm) and p_2 (dBm), measured on a load impedance Z_L (Ω), a send period of value between t_{on1} (ms) and t_{on2} (ms) and a pause of value between t_{off1} (ms) and t_{off2} (ms) is applied through an impedance Z_G (Ω), to the line terminals for a period of at least t_{d1} (s).

The subsequent action shall occur not later than t_a (s) after the beginning of application of the congestion tone.

The requirement values f_1 , f_2 , p_1 , p_2 , t_{on1} , t_{on2} , t_{off1} , t_{off2} , t_{d1} and t_a are shown in table 9.5.4.1.

The requirements shall be met with dc feeding values V_f , R_f , I_f in the ranges specified in table 9.5.4.1.

Compliance shall be checked using the tests outlined in section A.9.5.4.1.

Table 9.5.4.1: Congestion tone detector sensitivity

COUNTRY	REQUIREMENT VALUES				
	f_1 (Hz)	f_2 (Hz)	p_1 (dBm)	p_2 (dBm)	Z_G (Ω)
Austria	380	470	-43	-16	600
Belgium	415	460	-21	-4	600
Cyprus	400	450	-30	-10	600
Denmark	not mandatory				
Finland	not mandatory				
France	identical to busy tone				
Germany	380	490	-43	-4	600
Greece					
Iceland	identical to busy tone				
Ireland	not mandatory				
Italy	410	440	-43	-6	600
Luxembourg	380	520	-43	-6,5	
Malta					
Netherlands	340	550	-25,7	-3,8	600
Norway	350	500	0	-30	600
Portugal	300	450	-30	-5	600
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table 9.5.4.1 cont.: Congestion tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	600	60		19 - 60
Belgium	600	48		20 - $I_{max.}$
Cyprus	600	48	440 - 1 740	
Denmark	not mandatory			
Finland				
France	identical to busy tone			
Germany	600	60	1 000 - 2 530	
Greece				
Iceland	identical to busy tone			
Ireland	not mandatory			
Italy	600	44, 52	720, 1 880	
Luxembourg	600	60		19 - 60
Malta				
Netherlands	600	42 - 66	800 - 2 140	
Norway	600	60	460 - 3 100	
Portugal	600	45 - 55	300 - 1 800	not applic.
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table 9.5.4.1 cont.: Congestion tone detector sensitivity

COUNTRY	REQUIREMENT VALUES						Remarks
	t_{on1} (ms)	t_{on2} (ms)	t_{off1} (ms)	t_{off2} (ms)	t_{d1} (s)	t_a (s)	
Austria	160	240	160	240		10	yes
Belgium	155	179	155	179	1	5	
Cyprus	225	275	225	275	3	10	
Denmark	not mandatory						
Finland							
France	identical to busy tone						
Germany	216/432	264/528	216/432	264/528			yes
Greece							
Iceland	identical to busy tone						
Ireland	not mandatory						
Italy	180	220	180	220	2	4	
Luxembourg	220	260	220	260	not specified		
Malta							
Netherlands	180	330	330	180			yes
Norway	100	600	100	600	4	20	
Portugal	160	240	160	240	20		yes
Spain	not mandatory						yes
Sweden							yes
Switzerland	under study, see general remark						
U. Kingdom	not mandatory						yes

9.5.4.1 (A) 1 Congestion tones received from other countries are not included in these requirements.

9.5.4.1 (A) 2 For TE with answering function $p_1 = -26$ dBm.

9.5.4.1 (NL) 1 The values of p_1 and p_2 are calculated from the requirements of $e_1 = 80$ mV and $e_2 = 1$ V.

9.5.4.1 (D) 1 For calls routed to exchanges in other countries, the tones and cadences may vary.

9.5.4.1 (P) 1 t_a (s) = 30, to revert to the quiescent condition for TE having transmission duration automatically controlled by monitoring the flow of information (information-related control of loop condition), except for TE using the backward channel according to CCITT Recommendations V.23, V.26 bis or V.27 ter.

9.5.4.1 (E) 1

NOTE 1: See NOTE 1 in section 9.4.1.1 (E) 1.

NOTE 2: Useful information about the congestion tone may be found in section 1.7.4 (E) 1.

NOTE 3: Particular attention should be paid to the requirements in sections 10.5 (E) 10.6 and in 10.5 (E) 11.

9.5.4.1 (S) 1 Congestion tone detection is not mandatory.

Congestion tone characteristics are:

Frequency : 425 ± 15 Hz

Level (nominal): -10 dBm

Cadence : 250 ms tone, 750 ms pause with 10% tolerance.

9.5.4.1 (GB) 1 Detection of congestion tone is specified only for TE having either auto-calling or auto-clearing functions. See chapters 5 and 6.

A.9.5.4.1 Congestion tone detector sensitivity

The TEUT is connected as shown in figure A.9.5.2.1 and steps have to be undertaken in order to activate the congestion tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.5.4.1.

For each of the feeding conditions established and for each of the parameter values given in table A.9.5.4.1, a check must be performed to ensure that the detector indicates presence of the congestion tone.

Each line of table A.9.5.4.1 forms one set of parameter values. The number of sets "n" are shown in table A.9.5.4.1.

Table A.9.5.4.1: Congestion tone detector sensitivity

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria		380, 470	-43, -16	160, 240	160, 240
Belgium		425, 450	-21	167	167
Cyprus	1	450	-30	250	250
Denmark	not mandatory				
Finland					
France	identical to busy tone				
Germany	1	425	-43	240	240
Greece					
Iceland	identical to busy tone				
Ireland	not mandatory				
Italy	3	410, 425, 440	-43, -25, -6	180, 200, 220	180, 200, 220
Luxembourg		380, 520	-43, -6,5	240	240
Malta					
Netherlands	12	340, 425, 550	-25,7, -3,8	180 330	330 180
Norway		350, 425, 500	-30	100, 250, 600	100, 250, 600
Portugal		300, 450	-30	160, 240	160, 240
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table A.9.5.4.1 cont.: Congestion tone detector sensitivity

COUNTRY	TEST VALUES				Remarks
	t_{d1} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria		60		19, 60	yes
Belgium		48	400, 1 600		
Cyprus	10	48	440 - 1 740		
Denmark	not mandatory				
Finland					
France	identical to busy tone				
Germany		60	2 530		
Greece					
Iceland					
Ireland	not mandatory				
Italy	2	44, 48, 52	1 880, 1 100, 720		
Luxembourg		60		19, 60	
Malta					
Netherlands		48	1 130		yes
Norway	4	60	3 100		yes
Portugal	20	48	300, 1 800	not applic.	
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

A.9.5.4.1 (A) 1 For TE only with answering function $p = -26$ dBm, -16 dBm.

A.9.5.4.1 (NL) 1 The value of "p" is calculated from the requirement $e_1 = 80$ mV and $e_2 = 1$ V.

A.9.5.4.1 (N) 1

i	f (Hz)	t_{on} (ms)	t_{off} (ms)
1	425	100	100
2	425	600	600
3	425	100	600
4	425	600	100
5	350	100	100
6	500	100	100
7	425	250	250

9.5.4.2 Congestion tone detector insensitivity

For TE capable of detecting congestion tone, the relevant detector shall not be activated, if any of the following signals are applied through an impedance Z_G (Ω) to the line terminals:

a) "outband signals" with:

- frequency of value lower than f_3 (Hz) or higher than f_4 (Hz) and;
- any level of value lower than p_3 (dBm), measured on a load impedance Z_L (Ω);
 - any value of cadence t_{on}/t_{off} ;
 - any value of duration.

b) "weak signals" with:

- level of value lower than p_4 (dBm), measured on a load impedance Z_L (Ω) and;
- any value of frequency;
 - any value of cadence t_{on}/t_{off} ;
 - any value of duration.

c) "improperly cadenced" signals with:

- t_{on} of value lower than t_{on3} (ms) and any value of t_{off} , or t_{on} of value higher than t_{on4} (ms) and any value of t_{off} , or t_{off} of value lower than t_{off3} (ms) and any value of t_{on} or t_{off} of value higher than t_{off4} (ms) and any value of t_{on} and;
- any value of frequency;
 - any value of level;
 - any value of duration.

d) "short signals" with:

- duration of value lower than t_{d2} (s) and;
- any value of frequency;
 - any value of level;
 - any value of cadence t_{on}/t_{off} .

The requirement values are given in table 9.5.4.2.

The requirements shall be met with feeding values V_f , R_f , I_f in the ranges specified in table 9.5.4.2.

Compliance shall be checked using the test outlined in section A.9.5.4.2.

Table 9.5.4.2: Congestion tone detector insensitivity

COUNTRY	REQUIREMENT VALUES					
	f_3 (Hz)	f_4 (Hz)	p_3 (dBm)	p_4 (dBm)	t_{on3} (ms)	t_{on4} (ms)
Austria	not mandatory					
Belgium	350	550	4	-28	143	191
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	identical to busy tone					
Germany	not mandatory					
Greece						
Iceland	identical to busy tone					
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands	-31,8					
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden						
Switzerland	under study					
U. Kingdom	not mandatory					

Table 9.5.4.2 cont.: Congestion tone detector insensitivity

COUNTRY	REQUIREMENT VALUES						Remarks
	t_{off3} (ms)	t_{off4} (ms)	t_{d2} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory						
Belgium	143	191	0,191	48		$20 \cdot I_{max}$	
Cyprus	not mandatory						
Denmark	not mandatory						
Finland							
France	identical to busy tone						
Germany	not mandatory						
Greece							
Iceland	identical to busy tone						
Ireland	not mandatory						
Italy	160	240	0,800	44, 52	720, 1 880		
Luxembourg	not mandatory						
Malta							
Netherlands					42 - 66	800 - 2 140	yes
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						yes
Sweden							
Switzerland	under study, see general remark						
U. Kingdom	not mandatory						

9.5.4.2 (NL) 1 The value of p_4 is calculated from the requirement of $e_4 = 40$ mV.

9.5.4.2 (E) 1

NOTE: See NOTES 1 to 3 in section 9.5.4.1 (E) 1.

A.9.5.4.2 Congestion tone detector insensitivity

The TEUT is connected as shown in figure A.9.5.2.1 and steps have to be undertaken in order to activate the congestion tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.5.4.2.a.

For each of the feeding conditions established and for each set of parameter values given in table A.9.5.4.2.a, b, c, and d, a check must be performed to ensure that the detector is not activated.

The tables A.9.5.2.2.a, b, c and d refer respectively to cases a, b, c and d mentioned in requirement section 9.5.4.2.

Each line of these tables forms a set of parameter values. The number of sets "n" will be specified by each Administration.

Table A.9.5.4.2.a: Congestion tone detector insensitivity for case a

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria	not mandatory				
Belgium		345, 555	3	167	167
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	identical to busy tone				
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study				
U. Kingdom	not mandatory				

Table A.9.5.4.2.a cont.: Congestion tone detector insensitivity for case a

COUNTRY	TEST VALUES			
	t_d (ms)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	■	48	400, 1 600	■
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	identical to busy tone			
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands		48	1 130	
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table A.9.5.4.2.b: Congestion tone detector insensitivity for case b

COUNTRY	TEST VALUES					
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)
Austria	not mandatory					
Belgium		425, 450	-29	167	167	
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	identical to busy tone					
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands	3	340, 425, 550	-31,8	250	250	20
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden						
Switzerland	under study					
U. Kingdom	not mandatory					

Table A.9.5.4.2.c: Congestion tone detector insensitivity for case c

COUNTRY	TEST VALUES					
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)
Austria	not mandatory					
Belgium		425, 450	-29	135	200	
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	identical to busy tone					
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden						
Switzerland	under study					
U. Kingdom	not mandatory					

Table A.9.5.4.2.d: Congestion tone detector insensitivity for case d

COUNTRY	TEST VALUES						Remarks
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (s)	
Austria	not mandatory						
Belgium		425, 450	-8	167	167	0,15	
Cyprus	not mandatory						
Denmark	not mandatory						
Finland							
France	identical to busy tone						
Germany	not mandatory						
Greece							
Iceland							
Ireland	not mandatory						
Italy	not mandatory						
Luxembourg	not mandatory						
Malta							
Netherlands							yes
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						
Sweden							
Switzerland	under study						
U. Kingdom	not mandatory						

A.9.5.4.d (NL) 1 The value of p is calculated from the requirement of e = 40 mV.

9.5.5 Ringing tone detection

9.5.5.1 Ringing tone detector sensitivity

For TE, capable of detecting a ringing tone, the relevant detector shall be activated, when a signal in the frequency range from f_1 (Hz) up to f_2 (Hz), with a level of value between p_1 (dBm) and p_2 (dBm), measured on a load impedance Z_L (Ω), a send period of value between t_{on1} (ms) and t_{on2} (ms) and a pause of value between t_{off1} (ms) and t_{off2} (ms) is applied through an impedance Z_G (Ω), to the line terminals for a period of at least t_{d1} (s).

The subsequent action shall occur not later than t_a (s) after the beginning of application of the ringing tone.

The requirement values f_1 , f_2 , p_1 , p_2 , t_{on1} , t_{on2} , t_{off1} , t_{off2} , t_{d1} and t_a are shown in table 9.5.5.1.

The requirements shall be met with dc feeding values V_f , R_f , I_f in the ranges specified in table 9.5.5.1.

Compliance shall be checked using the tests outlined in section A.9.5.5.1.

Table 9.5.5.1: Ringing tone detector sensitivity

COUNTRY	REQUIREMENT VALUES				
	f_1 (Hz)	f_2 (Hz)	P_1 (dBm)	P_2 (dBm)	Z_G (Ω)
Austria	380	520	-43	-6,5	600
Belgium	415	460	-21	-4	600
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	425	455	-40	-10	600
Germany	380	490	-43	-4	600
Greece					
Iceland					
Ireland	not mandatory				
Italy	410	440	-43	-6	600
Luxembourg	380	520	-43	-6,5	600
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table 9.5.5.1 cont.: Ringing tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	600	60		19 - 60
Belgium	600	48		20 - I_{max} .
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	600	46 - 54	300 - 1 400	
Germany	600	60	1 000 - 2 530	
Greece				
Iceland				
Ireland	not mandatory			
Italy	600	44, 52	720, 1 880	
Luxembourg	600	60		19 - 60
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table 9.5.5.1 cont.: Ringing tone detector sensitivity

COUNTRY	REQUIREMENT VALUES						Remarks
	t _{on1} (ms)	t _{on2} (ms)	t _{off1} (ms)	t _{off2} (ms)	t _{d1} (s)	t _a (s)	
Austria	800	1 200	4 000	6 000		60	yes
Belgium	900	1 100	2 900	3 100	5,1	10	
Cyprus	not mandatory						
Denmark	not mandatory						
Finland							
France	1 350	1 650	3 150	3 850	10		yes
Germany	900	1 100	3 600	4 400			yes
Greece							
Iceland							yes
Ireland	not mandatory						
Italy	900	1 100	3 600	4 400			
Luxembourg	900	1 100	3 500	4 500		60	
Malta							
Netherlands							
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						yes
Sweden							yes
Switzerland	under study, see general remark						
U. Kingdom	not mandatory						yes

9.5.5.1 (A) 1 Ringing tones received from other countries are not included in these requirements.

9.5.5.1 (F) 1 In order to detect also a ringing tone soon stopped because of a quick "off-hook" from the called party, it is required to recognise as ringing tone a signal of 440 ± 15 Hz with duration of 300 ms, followed by an absence of signal of at least 4 s. In case of detection of a ringing tone stop, the ringing tone shall be considered as stopped by detection of an absence of signal between 4 and 5 s.

9.5.5.1 (D) 1 For calls routed to exchanges in other countries, the tones and cadences may vary.

9.5.5.1 (IS) 1 Ringing tone detection is not mandatory.

Ringing tone characteristics are:

Frequency : 425 ± 25 Hz

Level (nominal): -10 dBm

Cadence : 1,2 s tone, 4,7 s pause with 10% tolerance.

9.5.5.1 (E) 1

NOTE 1: See NOTE 1 in section 9.4.1.1 (E) 1.

NOTE 2: Useful information about the ringing tone may be found in section 1.7.4 (E) 1.

NOTE 3: Particular attention should be paid to the requirements in sections 10.5 (E) 10.6.

9.5.5.1 (S) 1 Ringing tone detection is not mandatory.

Ringling tone characteristics are:

Frequency : 425 ± 15 Hz

Level (nominal): -10 dBm

Cadence : 1 000 ms tone, 5 000 ms pause with 10% tolerance.

9.5.5.1 (GB) 1 Detection of ringing tone is specified only for TE having an auto-calling function. See chapter 5.

A.9.5.5.1 Ringing tone detector sensitivity

The TEUT is connected as shown in figure A.9.5.2.1 and steps have to be undertaken in order to activate the ringing tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.5.5.1.

For each of the feeding conditions established and for each set of parameter values given in table A.9.5.5.1, a check must be performed to ensure that the detector indicates presence of ringing tone.

Each line of table A.9.5.5.1 forms one set of parameter values. The number of sets "n" are shown in table A.9.5.5.1.

Table A.9.5.5.1: Ringing tone detector sensitivity

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria		380, 520	-43, -6,5	800, 1 200	4 000, 6 000
Belgium		425, 450	-21	1 000	3 000
Cyprus		not mandatory			
Denmark		not mandatory			
Finland					
France	1	440	-40	1 500	3 500
Germany	1	425	-43	1 000	4 000
Greece					
Iceland					
Ireland		not mandatory			
Italy	3	410, 425, 440	-43, -25, -6	900, 1 000, 1 100	3 600, 4 000, 4 400
Luxembourg		380, 520	-43, -6,5	900, 1 100	3 500, 4 500
Malta					
Netherlands					
Norway		not mandatory			
Portugal		not mandatory			
Spain		not mandatory			
Sweden					
Switzerland		under study, see general remark			
U. Kingdom		not mandatory			

Table A.9.5.5.1 cont.: Ringing tone detector sensitivity

COUNTRY	TEST VALUES				Remarks
	t_{d1} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria		60		19, 60	
Belgium		48	400, 1 600		
Cyprus		not mandatory			
Denmark		not mandatory			
Finland					
France	10	48	600		yes
Germany		60	2 530		
Greece					
Iceland					
Ireland		not mandatory			
Italy		44, 48, 52	1 880, 1 100, 720		
Luxembourg		60		19, 60	
Malta					
Netherlands					
Norway		not mandatory			
Portugal		not mandatory			
Spain		not mandatory			
Sweden					
Switzerland		under study, see general remark			
U. Kingdom		not mandatory			

A.9.5.5.1 (F) 1 Other sets of test parameter values:

i (Set No)	f (Hz)	p (dBm)	t_{on} (ms)	t_{off} (ms)	t_d (s)	V_f (V)	R_f (Ω)
2	440	-10	1 500	3 500	10	48	600
3	425	-40	1 500	3 500	10	48	600
4	455	-40	1 500	3 500	10	48	600
5	440	-40	1 350	3 150	10	48	600
6	440	-40	1 650	3 850	11	48	600
7	440	-40	1 500	3 500	10	46	1 400
8	440	-40	1 500	3 500	10	54	300
9 ¹⁾	440	-40	300	5 000	5,3	48	600
10 ²⁾	440	-40	1 500	4 000	22	48	600

1) This sequence shall be considered as ringing tone stopped in case of recognition of ringing tone stop.

2) This sequence shall be considered as ringing tone stopped in case of recognition of ringing tone stop.

9.5.5.2 Ringing tone detector insensitivity

For TE capable of detecting ringing tone, the relevant detector shall not be activated, if any of the following signals are applied through an impedance Z_G (Ω) to the line terminals:

a) "outband signals" with:

frequency of value lower than f_3 (Hz) or higher than f_4 (Hz) and;

- any level of value lower than p_3 (dBm), measured on a load impedance Z_L (Ω);
- any value of cadence t_{on}/t_{off} ;
- any value of duration.

b) "weak signals" with:

level of value lower than p_4 (dBm), measured on a load impedance Z_L (Ω) and;

- any value of frequency;
- any value of cadence t_{on}/t_{off} ;
- any value of duration.

c) "improperly cadenced" signals with:

t_{on} of value lower than t_{on3} (ms) and any value of t_{off} , or t_{on} of value higher than t_{on4} (ms) and any value of t_{off} , or t_{off} of value lower than t_{off3} (ms) and any value of t_{on} or t_{off} of value higher than t_{off4} (ms) and any value of t_{on} and;

- any value of frequency;
- any value of level;
- any value of duration.

d) "short signals" with:

duration of value lower than t_{d2} (s) and;

- any value of frequency;
- any value of level;
- any value of cadence t_{on}/t_{off} .

The requirement values are given in table 9.5.5.2.

The requirements shall be met with feeding values V_f , R_f , I_f in the ranges specified in table 9.5.5.2.

Compliance shall be checked using the test outlined in section A.9.5.5.2.

Table 9.5.5.2: Ringing tone detector insensitivity

COUNTRY	REQUIREMENT VALUES					
	f_3 (Hz)	f_4 (Hz)	P_3 (dBm)	P_4 (dBm)	t_{on3} (ms)	t_{on4} (ms)
Austria	not mandatory					
Belgium	350	550	4	-28	800	1 200
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	250	600	-10	-50		
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden						
Switzerland	under study, see general remark					
U. Kingdom	not mandatory					

Table 9.5.5.2 cont.: Ringing tone detector insensitivity

COUNTRY	REQUIREMENT VALUES						Remarks
	t_{off3} (ms)	t_{off4} (ms)	t_{d2} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory						
Belgium	2 800	3 200	1,2	48		20 - I_{max} .	
Cyprus	not mandatory						
Denmark	not mandatory						
Finland							
France					46 - 54	300 - 1 400	yes
Germany	not mandatory						
Greece							
Iceland							
Ireland	not mandatory						
Italy	not mandatory						
Luxembourg	not mandatory						
Malta							
Netherlands							
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						yes
Sweden							
Switzerland	under study, see general remark						
U. Kingdom	not mandatory						

9.5.5.2 (F) 1 The "improperly cadenced" signals, for which the detector shall be activated, are call progress tone and busy tone.

Compliance shall be checked using the tests outlined in A.9.5.5.2 (F) 1.

9.5.5.2 (E) 1

NOTE: See NOTES 1 to 3 in section 9.5.5.1 (E) 1.

A.9.5.5.2 Ringing tone detector insensitivity

The TEUT is connected as shown in figure A.9.5.2.1 and steps have to be undertaken in order to activate the ringing tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.5.5.2.a.

For each of the feeding conditions established and for each set of parameter values given in table A.9.5.5.2.a, b, c, and d, a check must be performed to ensure that the detector is not activated.

The tables A.9.5.5.2.a, b, c and d refer respectively to cases a, b, c and d mentioned in requirement section 9.5.5.2.

Each line of these tables forms a set of parameter values. The number of sets "n" will be specified by each Administration.

Table A.9.5.5.2.a: Ringing tone detector insensitivity for case a

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria	not mandatory				
Belgium		345, 555	3	1 000	3 000
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	1	250	-10	1 500	3 500
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table A.9.5.5.2.a cont.: Ringing tone detector insensitivity for case a

COUNTRY	TEST VALUES			
	t_d (s)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	■	48	400, 1 600	■
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table A.9.5.5.2.b: Ringing tone detector insensitivity for case b

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria	not mandatory				
Belgium		425, 450	-29	1 000	3 000
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	2	440	-50	1 500	3 500
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table A.9.5.5.2.b cont.: Ringing tone detector insensitivity for case b

COUNTRY	TEST VALUES			
	t_d (s)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	■	48	400, 1 600	■
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table A.9.5.5.2.c: Ringing tone detector insensitivity for case c

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria	not mandatory				
Belgium		425, 450	-8	750	3 250
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	3	440	-10	500	500
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table A.9.5.5.2.c cont.: Ringing tone detector insensitivity for case c

COUNTRY	TEST VALUES			
	t_d (s)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	■	48	400, 1 600	■
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table A.9.5.5.2.d: Ringing tone detector insensitivity for case d

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)
Austria	not mandatory				
Belgium		425, 450	-8	1 000	3 000
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table A.9.5.5.2.d cont.: Ringing tone detector insensitivity for case d

COUNTRY	TEST VALUES				Remarks
	t_d (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory				
Belgium	1,1	48	400, 1 600		
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					yes
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

A.9.5.5.2.a,c (F) 1 Other sets of test parameter values:

i (Set No)	f (Hz)	p (dBm)	t_{on} (ms)	t_{off} (ms)	t_d (s)	V_f (V)	R_f (Ω)
2	440	-10	1 500	3 500	10	48	600
1 bis	600	-10	1 500	3 500	10	48	600
3 bis	440	-10	50	50	10	48	600

9.5.6 Special information tone detection

9.5.6.1 Special information tone detector sensitivity

For TE, capable of detecting a special information tone, the relevant detector shall be activated, when:

- 3 successive tones are sent in the frequency ranges from f_{a1} (Hz) up to f_{a2} (Hz), from f_{b1} (Hz) up to f_{b2} (Hz) and from f_{c1} (Hz) up to f_{c2} (Hz), respectively;
- the level of each tone, measured on a load impedance Z_L (Ω), has a value between p_1 (dBm) and p_2 (dBm);
- each tone is sent for a period of value between t_{on1} (ms) and t_{on2} (ms);

- the 3 tones are separated by 2 pauses of maximum t_p (ms);
- the triple combination is repeated after a pause of value between t_{off1} (ms) and t_{off2} (ms);
- the signal composed as above is applied through an impedance Z_G (Ω) to the line terminals for a period of at least t_{d1} (s).

The subsequent action shall occur not later than t_a (s) after the beginning of application of the special information tone.

The requirement values are shown in table 9.5.6.1.

The requirements shall be met with dc feeding values V_f , R_f , I_f in the ranges specified in table 9.5.6.1.

Compliance shall be checked using the tests outlined in section A.9.5.6.1.

Table 9.5.6.1: Special information tone detector sensitivity

COUNTRY	REQUIREMENT VALUES				
	f_{a1} (Hz)	f_{a2} (Hz)	f_{b1} (Hz)	f_{b2} (Hz)	f_{c1} (Hz)
Austria	850	1 050	1 300	1 500	1 700
Belgium	895	905	1 375	1 385	1 855
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	900	1 000	1 350	1 450	1 750
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table 9.5.6.1 cont.: Special information tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	f_{c2} (Hz)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	1 900	60		19 - 60
Belgium	1 865	48		20 - I_{max} .
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France				
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	1 850	44, 52	720, 1 880	
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table 9.5.6.1 cont.: Special information tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	p_1 (dBm)	p_2 (dBm)	Z_G (Ω)	Z_L (Ω)
Austria	-43	-9,5	600	600
Belgium	-21	-4	600	600
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France				
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	-32	-15	600	600
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table 9.5.6.1 cont.: Special information tone detector sensitivity

COUNTRY	REQUIREMENT VALUES							Remarks
	t _{on1} (ms)	t _{on2} (ms)	t _p (ms)	t _{off1} (ms)	t _{off2} (ms)	t _{d1} (s)	t _a (s)	
Austria	230	430	0	750	1 250		10	yes
Belgium	260	400	0	750	1 250	2,7	5	
Cyprus	not mandatory							
Denmark	not mandatory							
Finland								
France								
Germany	not mandatory							
Greece								
Iceland								yes
Ireland	not mandatory							
Italy	300	360	20	900	1 100			
Luxembourg	not mandatory							
Malta								
Netherlands								
Norway	not mandatory							
Portugal	not mandatory							
Spain	not mandatory							yes
Sweden								yes
Switzerland	under study see general remark							
U. Kingdom	not mandatory							yes

9.5.6.1 (A) 1 Special information tones received from other countries are not included in these requirements.

9.5.6.1 (IS) 1 Special information tone detection is not mandatory.

Special information tone characteristics are:

Frequency: 950 ± 50 Hz, 1 400 ± 50 Hz, 1 800 ± 50 Hz

Nominal level: -20 dBm

Cadence: The three consecutive tones are each sent about 330 ms. The three tones are separated by two pauses, each of which lasts a maximum of 30 ms. This triple tone combination is repeated after a pause lasting about 1 s.

9.5.6.1 (E) 1

NOTE 1: See NOTE 1 in section 9.4.1.1 (E) 1.

NOTE 2: Useful information about the special information tone may be found in section 1.7.5 (E) 1.

9.5.6.1 (S) 1 Special information tone (SIT) detection is not mandatory.

SIT characteristics are:

Frequency: 950 ± 50 Hz, 1 400 ± 50 Hz, 1 800 ± 50 Hz
Level (nominal): -20 dBm
Cadence: The three consecutive tones are each sent about 330 ms.
The three tones are separated by two pauses, each of which lasts a maximum of 30 ms. This triple tone combination is repeated after pauses lasting about 1 s.

9.5.6.1 (GB) 1 Detection of special information tone is specified only for TE having an auto-calling function. See Chapter 5.

A.9.5.6.1 Special information tone detector sensitivity

The TEUT is connected as shown in figure A.9.5.2.1 and steps have to be undertaken in order to activate the special tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.5.6.1.

For each of the feeding conditions established and for each set of parameter values given in table A.9.5.6.1, a check must be performed to ensure that the detector indicates presence of the special information tone.

Each line of table A.9.5.6.1 forms one set of parameter values. The number of sets "n" are shown in table A.9.5.6.1.

Table A.9.5.6.1: Special information tone detector sensitivity

COUNTRY	TEST VALUES				
	i = 1 to n	f _a (Hz)	f _b (Hz)	f _c (Hz)	p (dBm)
Austria		850, 1 050	1 300, 1 500	1 700, 1 900	-43, -9,5
Belgium		900	1 380	1 860	-21
Cyprus		not mandatory			
Denmark		not mandatory			
Finland					
France					
Germany		not mandatory			
Greece					
Iceland					
Ireland		not mandatory			
Italy	3	900, 950, 1 000	1 350, 1 400, 1 450	1 750, 1 800, 1 850	-32, -25, -15
Luxembourg		not mandatory			
Malta					
Netherlands					
Norway		not mandatory			
Portugal		not mandatory			
Spain		not mandatory			
Sweden					
Switzerland		under study, see general remark			
U. Kingdom		not mandatory			

Table A.9.5.6.1 cont.: Special information tone detector sensitivity

COUNTRY	TEST VALUES		
	V_f (V)	R_f (Ω)	I_f (mA)
Austria	60		19, 60
Belgium	48	400, 1 600	
Cyprus		not mandatory	
Denmark		not mandatory	
Finland			
France			
Germany		not mandatory	
Greece			
Iceland			
Ireland		not mandatory	
Italy	44, 48, 52	1 880, 1 100, 720	
Luxembourg		not mandatory	
Malta			
Netherlands			
Norway		not mandatory	
Portugal		not mandatory	
Spain		not mandatory	
Sweden			
Switzerland		under study, see general remark	
U. Kingdom		not mandatory	

Table A.9.5.6.1 cont.: Special information tone detector sensitivity

COUNTRY	TEST VALUES					Remarks
	i = 1 to n	t _{on} (ms)	t _p (ms)	t _{off} (ms)	t _{d1} (s)	
Austria		230, 430		750, 1 250		
Belgium		330	0	1 000		
Cyprus		not mandatory				
Denmark		not mandatory				
Finland						
France						
Germany		not mandatory				
Greece						
Iceland						
Ireland		not mandatory				
Italy		300, 330, 360	0, 10, 20	900, 1 000, 1 100		
Luxembourg		not mandatory				
Malta						
Netherlands						
Norway		not mandatory				
Portugal		not mandatory				
Spain		not mandatory				
Sweden						
Switzerland		under study, see general remark				
U. Kingdom		not mandatory				

9.5.6.2 Special information tone detector insensitivity

For TE capable of detecting special information tone, the relevant detector shall not be activated, if any of the following signals are applied through an impedance Z_G (Ω) to the line terminals:

a) "outband signals" with:

- frequency f_a of value lower than f_{a3} (Hz) or higher than f_{a4} (Hz) or
- frequency f_b of value lower than f_{b3} (Hz) or higher than f_{b4} (Hz) or
- frequency f_c of value lower than f_{c3} (Hz) or higher than f_{c4} (Hz) and,
 - any level of value lower than p_3 (dBm), measured on a load impedance;
 - any value of cadence t_{on}/t_{off} ;
 - any value of duration;
 - any value of pause between the tones.

b) "weak signals" with:

- level of value lower than p_4 (dBm), measured on a load impedance and;
 - any value of frequency;
 - any value of cadence t_{on}/t_{off} ;
 - any value of duration;
 - any value of pause between the tones.

c) "improperly cadenced" signals with:

t_{on} of value lower than t_{on3} (ms) and any value of t_{off} , or t_{on} of value higher than t_{on4} (ms) and any value of t_{off} , or t_{off} of value lower than t_{off3} (ms) and any value of t_{on} or t_{off} of value higher than t_{off4} (ms) and any value of t_{on} and;

- any value of frequency;
- any value of level;
- any value of duration;
- any value of pause between tones.

d) "short signals" with:

duration of value lower than t_{d2} (s) and;

- any value of frequency;
- any value of level;
- any value of cadence t_{on}/t_{off} ;
- any value of pause between the tones.

The requirement values are given in table 9.5.6.2.

The requirements shall be met with feeding values V_f , R_f , I_f in the ranges specified in table 9.5.6.2.

Compliance shall be checked using the test outlined in section A.9.5.6.2.

Table 9.5.6.2: Special information tone detector insensitivity

COUNTRY	REQUIREMENT VALUES				
	f_{a3} (Hz)	f_{a4} (Hz)	f_{b3} (Hz)	f_{b4} (Hz)	f_{c3} (Hz)
Austria	not mandatory				
Belgium	800	1 000	1 280	1 480	1 760
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table 9.5.6.2 cont.: Special information tone detector insensitivity


COUNTRY	REQUIREMENT VALUES			
	f_{c4} (Hz)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	1 960	48		20 - I_{max} .
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France				
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table 9.5.6.2 cont.: Special information tone detector insensitivity

COUNTRY	REQUIREMENT VALUES			
	p_3 (dBm)	p_4 (dBm)	Z_G (Ω)	Z_L (Ω)
Austria	not mandatory			
Belgium	4	-28	600	600
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France				
Germany	not mandatory			
Greece				
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland	under study, see general remark			
U. Kingdom	not mandatory			

Table 9.5.6.2 cont.: Special information tone detector insensitivity

COUNTRY	REQUIREMENT VALUES					Remarks
	t_{on3} (ms)	t_{on4} (ms)	t_{off3} (ms)	t_{off4} (ms)	t_{d2} (s)	
Austria	not mandatory					
Belgium	190	470	500	1 500	1,4	
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France						
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					yes
Sweden						
Switzerland	under study, see general remark					
U. Kingdom	not mandatory					

9.5.6.2 (E) 1

NOTE: See NOTES 1 and 2 in sections 9.5.6.1 (E) 1.

A.9.5.6.2 Special information tone detector insensitivity

The TEUT is connected as shown in figure A.9.5.2.1 and steps have to be undertaken in order to activate the special information tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.5.6.2.a.

For each of the feeding conditions established and for each set of parameter values given in table A.9.5.6.2.a, b, c, and d, a check must be performed to ensure that the detector is not activated.

The tables A.9.5.6.2.a, b, c and d refer respectively to cases a, b, c and d mentioned in requirement section 9.5.6.2.

Each line of these tables forms a set of parameter values. The number of sets "n" will be specified by each Administration.

Table A.9.5.6.2.a: Special information tone detector insensitivity for case a

COUNTRY	TEST VALUES				
	i = 1 to n	f _a (Hz)	f _b (Hz)	f _c (Hz)	p (dBm)
Austria	not mandatory				
Belgium	780, 900, 900		1 380, 1 260, 1 380	1 860, 1 860, 1 980	3
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany	not mandatory				
Greece					
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland	under study, see general remark				
U. Kingdom	not mandatory				

Table A.9.5.6.2.a cont.: Special information tone detector insensitivity for case a

COUNTRY	TEST VALUES					
	t_{on} (ms)	t_{off} (ms)	t_d (ms)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory					
Belgium	330	1 000	■	48	400, 1 600	■
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France						
Germany	not mandatory					
Greece						
Iceland						
Ireland	not mandatory					
Italy	not mandatory ^a					
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden						
Switzerland	under study, see general remark					
U. Kingdom	not mandatory					

Table A.9.5.6.2.b: Special information tone detector insensitivity for case b

COUNTRY	TEST VALUES							
	i = 1 to n	f _a (Hz)	f _b (Hz)	f _c (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (ms)
Austria	not mandatory							
Belgium		900	1 380	1 860	-29	330	1 000	
Cyprus	not mandatory							
Denmark	not mandatory							
Finland								
France								
Germany	not mandatory							
Greece								
Iceland								
Ireland	not mandatory							
Italy	not mandatory							
Luxembourg								
Malta								
Netherlands								
Norway	not mandatory							
Portugal	not mandatory							
Spain	not mandatory							
Sweden								
Switzerland	under study, see general remark							
U. Kingdom	not mandatory							

Table A.9.5.6.2.c: Special information tone detector insensitivity for case c

COUNTRY	TEST VALUES							
	i = 1 to n	f _a (Hz)	f _b (Hz)	f _c (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (ms)
Austria	not mandatory							
Belgium		900	1 380	1 860	-8	180	1 510	
Cyprus	not mandatory							
Denmark	not mandatory							
Finland								
France								
Germany	not mandatory							
Greece								
Iceland								
Ireland	not mandatory							
Italy	not mandatory							
Luxembourg								
Malta								
Netherlands								
Norway	not mandatory							
Portugal	not mandatory							
Spain	not mandatory							
Sweden								
Switzerland	under study, see general remark							
U. Kingdom	not mandatory							

Table A.9.5.6.2.d: Special information tone detector insensitivity for case d

COUNTRY	TEST VALUES								Remarks
	i = 1 to n	f _a (Hz)	f _b (Hz)	f _c (Hz)	p (dBm)	t _{on} (ms)	t _{off} (ms)	t _d (ms)	
Austria	not mandatory								
Belgium		900	1 380	1 860	-8	330	1 000		
Cyprus	not mandatory								
Denmark	not mandatory								
Finland									
France									
Germany	not mandatory								
Greece									
Iceland									
Ireland	not mandatory								
Italy	not mandatory								
Luxembourg									
Malta									
Netherlands									
Norway	not mandatory								
Portugal	not mandatory								
Spain	not mandatory								
Sweden									
Switzerland	under study, see general remark								
U. Kingdom	not mandatory								

9.6 Detection of remote party signals

The following sections deal with signals sent by the remote party of the TE.

The detection of these signals, as treated here, is followed by the generation of other signals inside the TE destined to cause the TE to initiate or to prevent it from initiating a certain subsequent action.

The necessity to implement these detection facilities, as well as the subsequent actions, are specified in other chapters of this document, or in the TE standards, depending on the type of TE.

The signals covered by the present requirements are:

- answering tone;
- speech signal;
- data signal;
- remote activation tone.

9.6 (S) 1 Not mandatory.

9.6.1 Answering tone detection

NOTE: For TE using the detection of the echo control devices disabling tone as detection of answering tone, it is recommended to keep the requirements given in table 9.6.1, where the values follow the CCITT Recommendation V.25 and complete them for unspecified requirements.

The meaning of the parameter symbols are the same as those given in sections 9.6.1.1 and 9.6.1.2.

Table 9.6.1: 2 100 Hz answering tone detection

ANSWERING TONE DETECTOR SENSITIVITY								
f_1	f_2	p_1	p_2	t_{d1}	t_{ph1}	t_{ph2}	Z_G	Z_L
(Hz)	(Hz)	(dBm)	(dBm)	(ms)	(ms)	(ms)	(Ω)	(Ω)
2 078	2 122	-43	-10	600	425	475	600	600
ANSWERING TONE DETECTOR INSENSITIVITY								
f_3	f_4	p_3	p_4	t_{d2}	Z_G	Z_L		
(Hz)	(Hz)	(dBm)	(dBm)	(ms)	(Ω)	(Ω)		
1 900	2 350	-10	-48	100	600	600		

9.6.1.1 Answering tone detector sensitivity

For TE capable of detecting answering tone, the detector of answering tone shall be activated, when a signal in the frequency range from f_1 (Hz) up to f_2 (Hz), with a level of value between p_1 (dBm) and p_2 (dBm) measured on a load impedance Z_L (Ω), is applied through an impedance Z_G (Ω) to the line terminals for a period of at least t_{d1} (s).

Phase reversals on the tone at intervals of value between t_{ph1} (ms) and t_{ph2} (ms) as shown in section 9.3 shall not disturb its detection by the TE.

The requirement values are shown in table 9.6.1.1.

The requirements shall be met with dc feeding values V_f , R_f , I_f in the ranges specified in table 9.6.1.1.

Compliance shall be checked using the tests outlined in section A.9.6.1.1.

Table 9.6.1.1: Answering tone detector sensitivity

COUNTRY	REQUIREMENT VALUES				
	f ₁ (Hz)	f ₂ (Hz)	P ₁ (dBm)	P ₂ (dBm)	t _{d1} (ms)
Austria	2 050	2 150	-43	-6,5	
Belgium	f - 22	f + 22	-43	-6	2 600
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	2 078	2 122	-43	-10	600
Germany	not mandatory				
Greece					
Iceland	not mandatory				
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg					
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden	not mandatory				
Switzerland	2 078	2 122	-43	-3	
U. Kingdom	not mandatory				

Table 9.6.1.1 cont.: Answering tone detector sensitivity

COUNTRY	REQUIREMENT VALUES							Remarks
	t_{ph1} (ms)	t_{ph2} (ms)	Z_G (Ω)	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria			600	600	60		19 - 60	
Belgium	425	475	600	600	48		20 - I_{max}	yes
Cyprus			not mandatory					
Denmark			not mandatory					
Finland								
France	425	475	600	600	46 - 54	300 - 1 400		
Germany			not mandatory					yes
Greece								
Iceland			not mandatory					
Ireland			not mandatory					
Italy								yes
Luxembourg								
Malta								
Netherlands								
Norway			not mandatory					
Portugal			not mandatory					yes
Spain			not mandatory					yes
Sweden			not mandatory					
Switzerland	425	475			43 - 57	2 200 - 600		
U. Kingdom			not mandatory					

9.6.1.1 (B) 1

The parameter f (Hz) may be a frequency value between 700 and 3 000 Hz, declared by the manufacturer of the TE. This parameter is used throughout this section 9.6.1.

For modems and facsimile equipments capable of detecting answering tone, the value of " f " shall be equal to 2 100 Hz.

9.6.1.1 (D) 1

For Germany, the requirement in section 9.6.1.1 is not an access requirement and is therefore not generally mandatory.

Terminal standards may specify this requirement as mandatory. The approval requirements are then stated in the terminal NET.

9.6.1.1 (I) 1

For Italy, the requirement in section 9.6.6.1 is not an access requirement.

9.6.1.1 (P) 1

It may be mandatory on terminal standards or NET.

9.6.1.1 (E) 1

NOTE 1: See NOTE 1 in section 9.4.1.1 (E) 1.

NOTE 2: Particular attention should be paid to the requirement in section 10.5 (E) 9.2.a.

A.9.6.1.1 Answering tone detector sensitivity

The TEUT is connected as shown in figure A.9.6.1.1 and steps have to be undertaken in order to activate the answering tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.6.1.1.

For each feeding condition established and for each set of parameter values given in table A.9.6.1.1, it has to be checked whether the detector indicates presence of the answering tone.

Each line of table A.9.6.1.1 forms one set of parameter values. The number of sets "n" are specified in table A.9.6.1.1.

Table A.9.6.1.1: Answering tone detector sensitivity

COUNTRY	TEST VALUES				
	i = 1 to n	f (Hz)	p (dBm)	t _{d1} (ms)	t _{ph} (ms)
Austria		2 050, 2 150	-43, -6,5		
Belgium		f	-43	2 600	
Cyprus			not mandatory		
Denmark			not mandatory		
Finland					
France	1	2 100	-43	600	450
Germany			not mandatory		
Greece					
Iceland			not mandatory		
Ireland			not mandatory		
Italy			not mandatory		
Luxembourg					
Malta					
Netherlands					
Norway			not mandatory		
Portugal			not mandatory		
Spain			not mandatory		
Sweden					
Switzerland			TE type depending		
U. Kingdom			not mandatory		

Table A.9.6.1.1 cont.: Answering tone detector sensitivity

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	60		19, 60	
Belgium	48	400, 1 600		
Cyprus		not mandatory		
Denmark		not mandatory		
Finland				
France	48	600		yes
Germany		not mandatory		
Greece				
Iceland		not mandatory		
Ireland		not mandatory		
Italy		not mandatory		
Luxembourg				
Malta				
Netherlands				
Norway		not mandatory		
Portugal		not mandatory		
Spain		not mandatory		
Sweden		not mandatory		
Switzerland		TE type depending		
U. Kingdom		not mandatory		

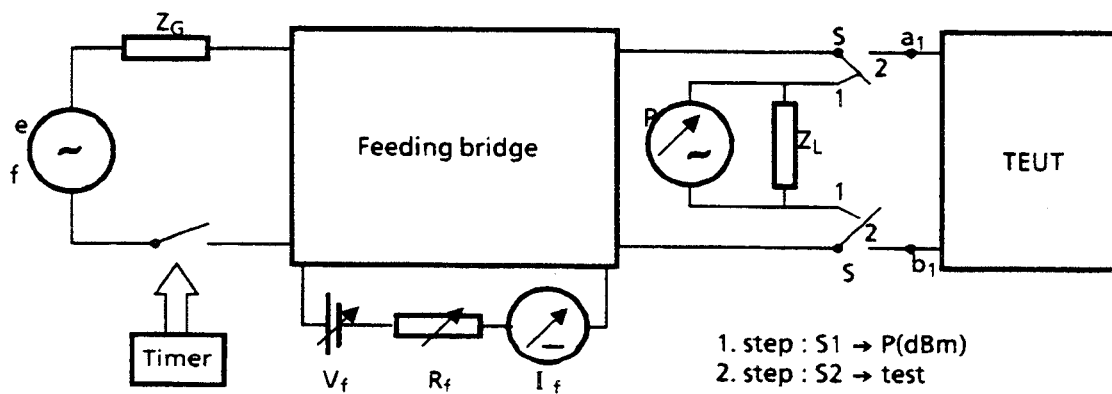


Figure A.9.6.1.1: Answering tone detector

A.9.6.1.1 (F) 1 Other sets of test parameter values:

i (Set No)	f (Hz)	p (dBm)	t _d (s)	t _{ph} (ms)	V _f (V)	R _f (Ω)
2	2 100	-10	600	450	48	600
3	2 078	-43	600	450	48	600
4	2 122	-43	600	450	48	600
5	2 100	-43	600	425	48	600
6	2 100	-43	600	475	48	600
7	2 100	-43	600	450	46	1 400
8	2 100	-10	600	450	54	300

9.6.1.2 Answering tone detector insensitivity

For TE capable of detecting answering tone, the detector of answering tone shall not be activated, when, in loop condition, any of the following signals is applied through an impedance Z_G (Ω) to the line terminals:

a) "outband signals" with:

- frequency of value lower than f₃ (Hz) or higher than f₄ (Hz) and;
- any level of value lower than p₃ (dBm), measured on a load impedance Z_L (Ω);
- any value of duration.

b) "weak signals" with:

- level of value lower than p₄ (dBm), measured on a load impedance Z_L (Ω) and;
- any value of frequency;
- any value of duration.

d) "short signals" with:

- duration of value lower than t_{d2} (ms) and;
- any value of frequency;
- any value of level.

The requirement values are given in table 9.6.1.2.

The requirements shall be met with feeding values V_f, R_f, I_f in the ranges specified in table 9.6.1.2.

Compliance shall be checked using the test outlined in section A.9.6.1.2.

Table 9.6.1.2: Answering tone detector insensitivity

COUNTRY	REQUIREMENT VALUES								Remarks
	f_3 (Hz)	f_4 (Hz)	p_3 (dBm)	p_4 (dBm)	t_{d2} (ms)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory								
Belgium	f - 150	f + 150	-6	-43	100	48		20 - I_{max} .	
Cyprus	not mandatory								
Denmark	not mandatory								
Finland	not mandatory								
France	1 900	2 350	-10	-48	100	46 - 54	300 - 1 400		
Germany	not mandatory								yes
Greece	not mandatory								
Iceland	not mandatory								
Ireland	not mandatory								
Italy	not mandatory								
Luxembourg	not mandatory								
Malta	not mandatory								
Netherlands	not mandatory								
Norway	not mandatory								
Portugal	not mandatory								
Spain	not mandatory								yes
Sweden	not mandatory								
Switzerland	TE type depending								
U. Kingdom	not mandatory								

9.6.1.2 (D) 1 For Germany, the requirement in section 9.6.1.2 is not an access requirement and is therefore not generally mandatory.

Terminal standards may specify this requirement as mandatory. The approval requirements are then stated in the terminal NET.

9.6.1.2 (E) 1

NOTE: See NOTES 1 and 2 in section 9.6.1.1 (E) 1.

A.9.6.1.2 Answering tone detector insensitivity

The TEUT is connected as shown in figure A.9.6.1.1 and steps have to be undertaken in order to activate the answering tone detection.

The dc feeding conditions V_f , R_f , I_f are as described in table A.9.6.1.2.a.

For each of the feeding conditions established and for each set of parameter values given in table A.9.6.1.2.a, b, and c, it has to be checked whether the detector is not activated.

The tables A.9.6.1.2.a, b, and c refer respectively to the cases a, b, and c mentioned in requirement section 9.6.1.2.

Each line of these tables forms a set of parameter values. The number of sets "n" are specified in table A.9.6.1.2.a, b and c.

Table A.9.6.1.2.a: Answering tone detector insensitivity for case a

COUNTRY	TEST VALUES						
	i = 1 to n	f (Hz)	p ₃ (dBm)	t _d (s)	V _f (V)	R _f (Ω)	I _f (mA)
Austria	not mandatory						
Belgium	█	(f - 160) (f + 160)	-6	4	48	400, 1 600	█
Cyprus	not mandatory						
Denmark	not mandatory						
Finland	not mandatory						
France	1	1 900	-10	4	48	600	
Germany	not mandatory						
Greece	not mandatory						
Iceland	not mandatory						
Ireland	not mandatory						
Italy	not mandatory						
Luxembourg	not mandatory						
Malta	not mandatory						
Netherlands	not mandatory						
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						
Sweden	not mandatory						
Switzerland	TE type depending						
U. Kingdom	not mandatory						

Table A.9.6.1.2.b: Answering tone detector insensitivity for case b

COUNTRY	TEST VALUES			
	i = 1 to n	f (Hz)	P4 (dBm)	t _d (s)
Austria				not mandatory
Belgium		f	-48	4
Cyprus				not mandatory
Denmark				not mandatory
Finland				
France	2	2 100	-48	4
Germany				not mandatory
Greece				
Iceland				
Ireland				not mandatory
Italy				not mandatory
Luxembourg				
Malta				
Netherlands				
Norway				not mandatory
Portugal				not mandatory
Spain				not mandatory
Sweden				not mandatory
Switzerland				TE type depending
U. Kingdom				not mandatory

Table A.9.6.1.2.c: Answering tone detector insensitivity for case c

COUNTRY	TEST VALUES				Remarks
	i = 1 to n	f (Hz)	p _d (dBm)	t _d (s)	
Austria	not mandatory				
Belgium		f	-6	0,1	
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France	3	2 100	-10	0,100	yes
Germany	not mandatory				
Greece	not mandatory				
Iceland	not mandatory				
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta	not mandatory				
Netherlands	not mandatory				
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden	not mandatory				
Switzerland	TE type depending				
U. Kingdom	not mandatory				

A.9.6.1.2.a (F) 1 Other sets of parameter values:

i (Set No)	f (Hz)	p (dBm)	t _d (s)	V _f (V)	R _f (Ω)
1 bis	2 350	-10	4 000	48	600

9.6.2 Speech signal detection

Speech signal detection is described in section 6.4.2.2.

9.6.2 (E) 1

NOTE 1: See NOTE 1 in section 9.4.1.1 (E) 1.

NOTE 2: Particular attention should be paid to the requirement in sections 10.5 (E) 9.2.b, 10.5 (E) 10.4.b, and 10.5 (E) 10.5.

9.6.3 Data signal detection

Data signal detection is described in section 6.4.2.1.

Speech signal detection is described in section 6.4.2.2.

9.6.3 (E) 1

NOTE 1: See NOTE 1 in section 9.4.1.1 (E) 1.

NOTE 2: Particular attention should be paid to the requirement in sections 10.5 (E) 10.4 and 10.5 (E) 10.5.

9.6.4 Remote activation tone detection

Remote activation tone detection is described in 6.4.2.3.

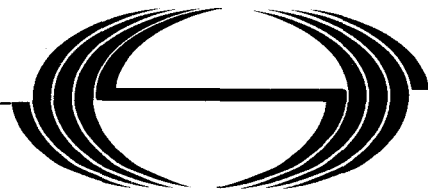
9.6.4 (E) 1

NOTE 1: See NOTE 1 in section 9.4.1.1 (E) 1.

NOTE 2: Particular attention should be paid to the requirement in sections 10.5 (E) 10.4 and 10.5 (E) 10.5.

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**Attachments to Public Switched Telephone Network (PSTN);
General technical requirements for equipment connected to
an analogue subscriber interface in the PSTN****Chapter 10: Additional unclassified requirements**

(Candidate NET 4)

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Foreword

Chapter 10 of this European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI). The text of this ETS may be utilized, wholly or in part, for the establishment of NET 4.

For historical purposes, this ETS was drafted in the form of a NET. However, until a final decision to adopt this ETS as NET 4 has been agreed by the Technical Recommendations Application Committee (TRAC), the terms NET or NET 4 in this document should be read as ETS or ETS 300 001 respectively.

This ETS comprises ten chapters:

"Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

- Chapter 1 - General
- Chapter 2 - DC characteristics
- Chapter 3 - Ringing signal characteristics
- Chapter 4 - Transmission characteristics
- Chapter 5 - Calling functions
- Chapter 6 - Answering function
- Chapter 7 - Power failure
- Chapter 8 - Connection methods
- Chapter 9 - Special functions
- Chapter 10 - Additional unclassified requirements**

Refer to Chapter 1 (General) of this ETS for information on the structure and details of how to use this ETS. The national designations, used to identify national variations to requirements and tests within this ETS, are given in section 1.9 of Chapter 1 (page 60).

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10 Additional unclassified requirements

10.0 Introduction

This chapter contains additional unclassified aspect 2 national requirements, with their associated tests.

These additional requirements are grouped into nine sub-sections, numbered 10.1 to 10.9, which relate to the subject matter of each of the previous chapters of this NET.

Each sub-section is further divided into national sections which contain the additional requirements (if any) for each Administration.

The presentation and format of these requirements follow the same system used throughout the document. The numbering follows the system used for remark numbering and consists of three parts:

- part one, is the number of the sub-section and hence the chapter of which it refers;
- part two, is the national designator, in brackets;
- part three, indicates the order of the remark.

in line with the general presentation rules contained in Chapter 1, section 1.3.

10.1 General

10.1 (A) Austria

10.1 (A) 1 Switching contacts for series connected TE

Series connected TE (excl. PABX) capable to transmit speech and/or data signals shall be disconnected in the quiescent condition from the line with two contacts (one for line a and the other for line b). Circuits for detection, e.g. loop current detection, ringing signal detection, may remain in the lines a and/or b or between the lines a and b.

10.1 (D) Germany

10.1 (D) 1 Preliminary remarks

10.1 (D) 1.1 Unless specified differently, the values of the following paragraphs are limit values which have to be observed under operating conditions. The values take account of fabrication spread and component tolerances.

10.1 (D) 1.2 Telephone sets and auxiliaries are measured by means of a connecting cord according to 10.1 (D) 2.12. Distribution or connector terminals intended for linking to analogue connection points are used as test points for systems and for TE intended for stationary installation.

10.1 (D) 1.3 Those requirements for TE which are not applicable for network access of PABX and telecommunications systems are specially identified by means of *.

10.1 (D) 1.4 If in this document a measurement arrangement is not given for a requirement or a given measurement arrangement is not sufficiently clear, the national measurement regulations set out in the 1 TR 2, Part 4 or, if not available, in the FTZ 12 TR 21 "Measurement of terminal equipment" have to be applied.

- 10.1 (D) 1.5 The application of some of the requirements in this document to PABXs which are covered by this document may in some cases not be possible or advisable.
- 10.1 (D) 2 **General requirements**
- 10.1 (D) 2.1 The TE must operate reliably, and its design must comply with established rules of technology.
- 10.1 (D) 2.2 The TE must be designed to ensure that, when the equipment is connected and operated, it has no adverse effects on the operating personnel or on the quality and reliability of the public telecommunications network, including all TE connected to the telecommunications network. This must apply even if the TE is disturbed.
- 10.1 (D) 2.3 In order to prevent any changes being made, no components in the TE may be accessible to the user. This does not apply to:
- components which are designed for normal use;
 - elements essential for operation (e.g. , buttons);
 - components which can be replaced for maintenance reasons (e.g. fuses and lamps).
- 10.1 (D) 2.4* Telecommunication cords which are designed for external connection must be protected against inadvertent disconnection. For approval testing the equipment must be presented with a cord according to 10.1 (D) 2.12.
- 10.1 (D) 2.5 Interfaces for peripheral equipment are permitted. The interface must be designed such that the arrangement satisfies the requirements of the approval irrespective of the peripheral equipment connected. Measure required to satisfy the approval requirements may be implemented in the peripheral system provided the interface can be activated only by TE, and the design and functionality of such TE are identical with the approved peripheral system. In this case, approval will apply to the overall TE. The interfaces of the peripheral equipment must be designed to ensure that the voltage insulation of the TE is not affected if it inadvertently comes into contact with live components.
- 10.1 (D) 2.6* The processes of switching terminal equipment on and off, or the processes of seizing a line or terminating the seizure must not produce a ring signal (bell ding).
- 10.1 (D) 2.7 The connected equipment must be able to withstand occasional interruptions of the supply current of $t \leq 5$ ms without any consequences for the operating mode. See also section 10.5 (D) 1.10.
- 10.1 (D) 2.8 It must be possible to detect that an access line has been seized by a TE within a period of $t \leq 500$ ms after the line has been seized (e.g. lamp, audible tones, etc.).
- 10.1 (D) 2.9 TE may be designed such that the energy required for their operation and for programming of performance features can be taken from the telecommunications network. Chapter 2 contains further details on the direct current resistance which restricts the amount of energy available from the network.
- 10.1 (D) 2.10 Short term seizure is permitted if required for the programming of performance features for telecommunications purposes. However, the generation of signals which might be interpreted as dialling signals must be prevented.

10.1 (D) 2.11

Telephone sets and telephone-type TE must provide a w-wire. Figure 10.1 (D) 2 depicts the function of the w-wire. The on-hook dialling and handsfree talking keys must switch the w-wire only if during depressing the keys the loop current is available on the line.

10.1 (D) 2.12

The resistance of a wire of a connection cord used for TE which when installed are connected in series with a telephone must not exceed 1,25 ohm. The resistance of a wire of a connecting cord used for telephones must not exceed 5 ohms.

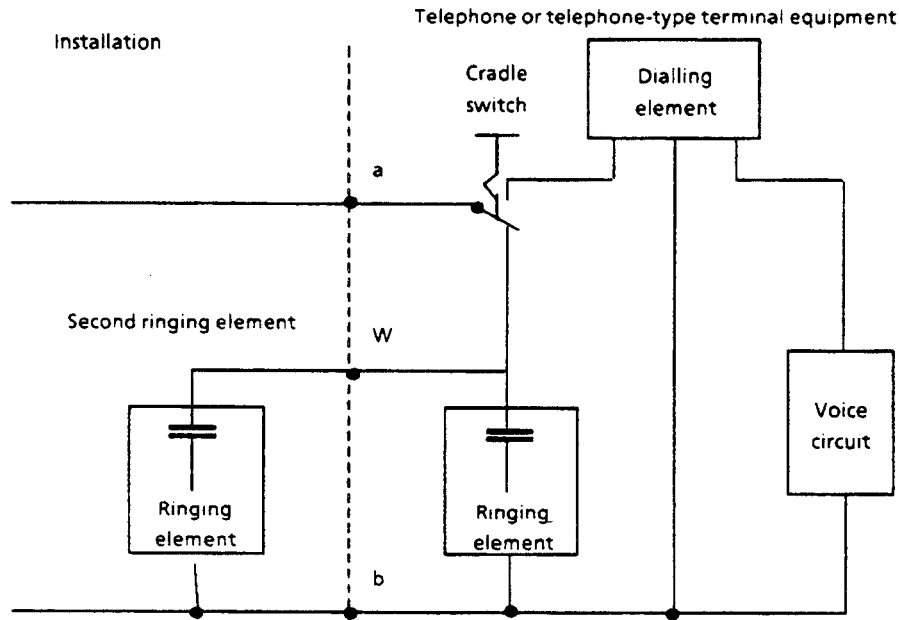


Figure 10.1 (D) 2

10.1 (D) 3

TE not receiving approval for a specific public communication service

TE not receiving approval for a specific public communication service shall in the case of protocol compatibility with TE of one or several services fulfil specific additional requirements.

10.1 (D) 3.1

Voice terminals in the telephone service

TE capable of transmitting voice shall comply with the specifications for the telephone service and shall have approval to take part in that service.

10.1 (D) 3.2

Specifications for TE used for other communication purposes and capable of interworking with facsimile equipment

- 1) The equipment shall transmit the following identifications as image information:
 - **MOBILAK** in the case of acoustic coupling
 - **MOBILFC** when connected to a mobile radiotelephone access (C-network)
 - **CCT-FAX** in the case of a galvanic connection. This applies to TE outside the categories A and B of the facsimile service.

Combinations of identifications are possible.
- 2) This identification shall be so secured that there is no possibility of its contents being deleted or modified by the user. The contents of the identification shall be permanent.

- 3) When the document transmission is in progress, this identification shall be printed on each receiving paper.
- 4) The characters of the identification shall be at least 3 mm high and shall be contained in a field at least 1,5 times higher than the selected character height. The reference information represented in the field shall appear on the paper in the upper margin in vertical direction 4 mm below the start of the actual "image" area.

10.1 (GR) Greece

10.1 (GR) 1.1 The TE must operate reliably, and its design must comply with established rules of technology.

10.1 (GR) 1.2 The TE must be designed to ensure that, when the equipment is connected and operated, it has no adverse effects on the operating personnel or on the quality and reliability of the public communications network, including all TE connected to the telecommunications network. This must apply even if the TE is disturbed.

10.1 (GR) 1.3 In order to prevent any changes being made, no components in the TE may be accessible to the user.

10.1 (GR) 1.4 The connected equipment must be able to withstand occasional interruptions of the supply current of $t \leq 150$ ms without any consequences for the operating mode.

10.1 (N) Norway

10.1 (N) 1 Safety and protection

10.1 (N) 1.1 Overvoltage arresters

Overvoltage arresters shall have a nominal dc operating voltage of at least 210 V between the line terminals, and at least 420 V towards earth/chassis.

10.1 (N) 1.2 Resistibility to overvoltages and overcurrents

The resistibility to overvoltages and overcurrents shall be in line with CCITT Recommendation K.21.

For overcurrents from the feeding arrangements in the PSTN a requirement related to the B criterion defined in K.21 applies in national safety regulation.

10.1 (N) 1.3 Dielectric barrier between telecom line terminals and mains terminals - impulse voltage resistibility

To ensure that the equipment can resist high voltage surges which may arise on power lines from lightning, the equipment must provide an adequate electrical separation between the port for connection of the telecommunication line and mains terminals.

Compliance shall be checked by applying to the electrical separation 10/700 μ s test impulses with a test voltage of 6 kV.

Ten impulses shall be applied with at least 10 s between consecutive impulses, the polarity being reversed between the impulses. During the test breakdown through the insulation (with damage of it) shall not occur.

Compliance is checked by subjecting the insulation to a test where the insulation resistance shall not be less than 4 Mohms when measured at 500 V dc.

10.1 (P)

Portugal

10.1 (P) 1

Two ports TE, not series-connected, with dedicated TE

TE, not series-connected, provided with one port intended to be attached to a PSTN CP and in addition which provides a second port for attachment of a dedicated TE (e.g. PABX with dedicated telephone sets), shall be tested as a one-port TE with its second port terminated by the dedicated TE.

10.1 (P) 2

Two ports TE, not series connected, with TE approved for connection to the PSTN

TE, not series connected, provided with one port intended to be attached to a PSTN CP and in addition which provides a second port for attachment of another TE which itself is approved for connection to the PSTN, shall be tested as a one-port TE with its second port terminated by the other TE unless otherwise stated.

10.1 (E)

Spain

10.1 (E) 1

Test Order

It makes no matter in which order the tests are carried out, however, the tests in sections A.2.6 and A.2.6 (E) 2, A.3.2 (E) 1, A.3.2 (E) 2, and A.10.4 (E) 4 shall be carried out before other tests are made.

10.1 (S)

Sweden

10.1 (S) 1

It should be noted, in conjunction with this access NET, that for telephone sets and PABX equipment reference is also made to existing national specifications.

10.2 DC characteristics

10.2 (A)

Austria

10.2 (A) 1

Bouncing time

The bouncing time in the case of switching functions shall be ≤ 5 ms.

10.2 (A) 2

Time of loop interruptions

During operation loop interruptions of the a/b wires shall not exceed 5 ms.

10.2 (A) 3

Signals to the line before operation

The TE shall not apply any signals to the line until it is ready for operation.

10.2 (SF)

Finland

10.2 (SF) 1

Leakage current in the quiescent condition

The TEUT is in the quiescent condition. The leakage current between two line terminals of the TE must not exceed the value of 0,4 mA when dc voltage of 200 V is applied to the terminals of the equipment.

A.10.2 (SF) 1 Leakage current in the quiescent condition

The TEUT is in the quiescent condition and connected as shown in figure A.10.2 (SF) 1.

The voltage $V_t = 200$ V is applied to the terminals of the equipment and the current I is measured.

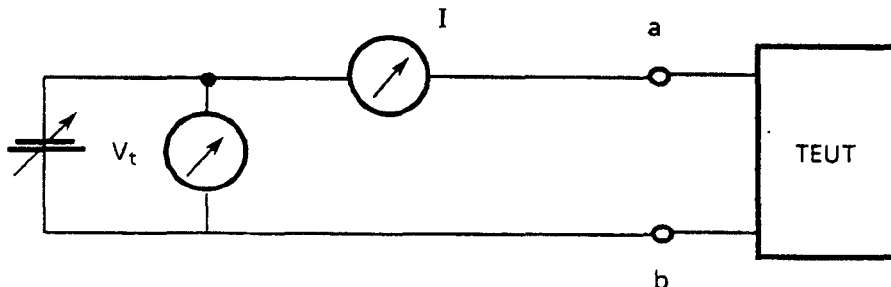


Figure A.10.2 (SF) 1: Test set-up

10.2 (SF) 2 Overvoltages

After being exposed to the overvoltages coming from the PSTN the TEUT must meet the requirements related to:

- Insulation resistance between the line terminals in the quiescent condition, section 2.2.1.1.
- Insulation resistance between line terminals and earth in the quiescent condition, section 2.2.1.3.
- Input impedance, TE in the quiescent condition, section 4.1.1.
- Transmission levels, section 4.4.
- Successive call attempts to the same number, section 5.6.3.2.
- Sensitivity of the ringing signal reception, section 6.2.1.
- Power failure, paragraph 7.
- Safety, level 1 requirement.

The overvoltage susceptibility is tested according to the test outlined in the test section.

If the equipment is damaged by the overvoltages in such a way that the user can clearly notice it, the requirements stated above, except safety, need not be fulfilled.

A.10.2 (SF) 2 Overvoltages

Lightening surge simulation is made according to the CCITT Recommendation K.21 (only tests without added protection).

The terminal equipment shall meet the following requirements when being exposed to overvoltages defined in K.21: Impedance in quiescent state, insulation resistance in quiescent state, insulation resistance to earth,

sensitivity of the ringing detector, sending level, automatic repeat of dialling, disturbances and electrical safety.

If the equipment is damaged by the overvoltages in such a way the user clearly notices, the requirements stated above need not be fulfilled except the requirements for electrical safety.

10.2 (F)

France

10.2 (F) 1

TE working shall not be disturbed by any feeding interruption from the PSTN of duration not longer than 200 ms. In particular, when this feeding interruption occurs during dialling state (but between the digits), the possible stored digits shall not be reset. Feeding interruption can occur 64 ms after the detection of loop current by the public exchange.

In addition, from the re-application of the feeding source, the loop current shall reach a value higher than 26 mA after 50 ms.

Compliance shall be checked using the following test figure

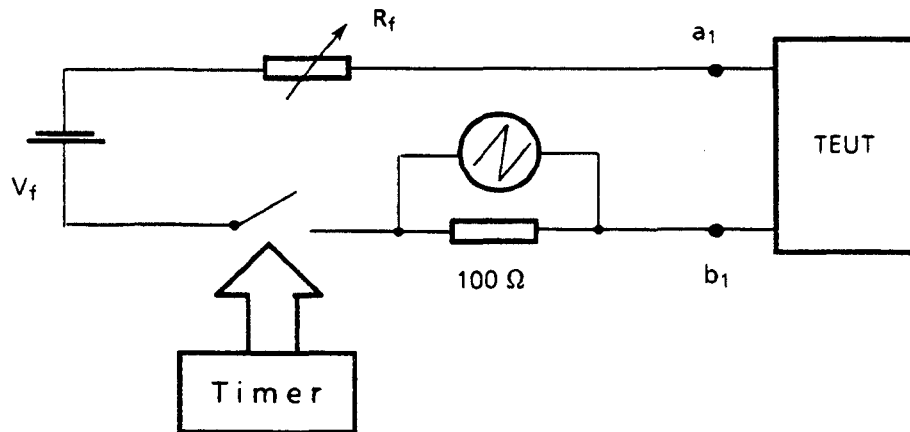


Figure 10.2 (F) 1: Immunity to dc breaks from PSTN

Test 1:

For both cases $V_f = 48 \text{ V}/R_f = 200 \Omega$ and $V_f = 48 \text{ V}/R_f = 1\,300 \Omega$, it is checked that:

- a) during dialling state, a random feeding interruption occurring between digits does not reset the remaining stored digits;
- b) during any loop state a random feeding interruption of 200 ms does not disturb the TE working and the loop current reaches a value higher than 26 mA no later than 50 ms after the end of the feeding interruption.

Test 2:

The TEUT is set from quiescent state to loop state, and 64 ms after the loop current has reached 5,2 mA, the feeding is interrupted for 200 ms. Then it is checked that the loop current reaches a value higher than 26 mA no later than 50 ms after the end of the feeding interruption.

During this test, the following feeding conditions are applied:

- before feeding interruption: $V_f = 52 \text{ V}$, $R_f = 8\,125 \Omega$;
- after feeding interruption: $V_f = 48 \text{ V}$, $R_f = 1\,340 \Omega$.

10.2 (F) 2

The loop state shall be clearly indicated by the user.

10.2 (F) 3

In order to guarantee a call transfer from a telephone set to another, it is required for telephone sets, when connected as shown in figure 10.2 (F) 3.a, that the loop current reaches a value higher than 20 mA no later than 10 ms after the opening of the switch S as described in figure 10.2 (F) 3.b.

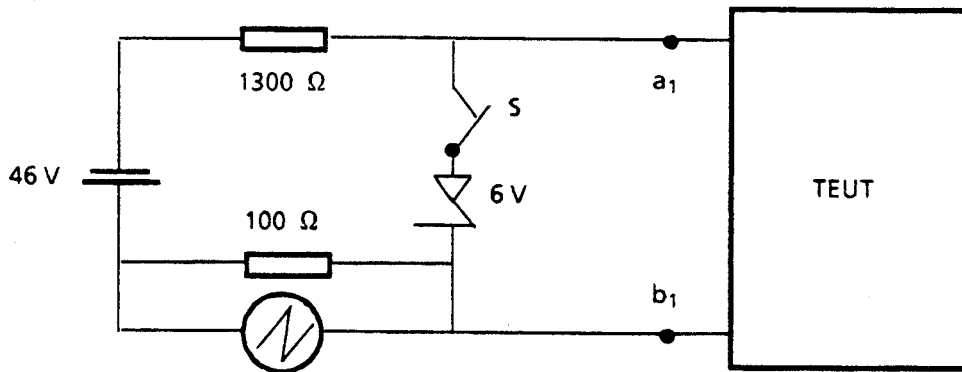


Figure A.10.2 (F) 3.a: Transfer test

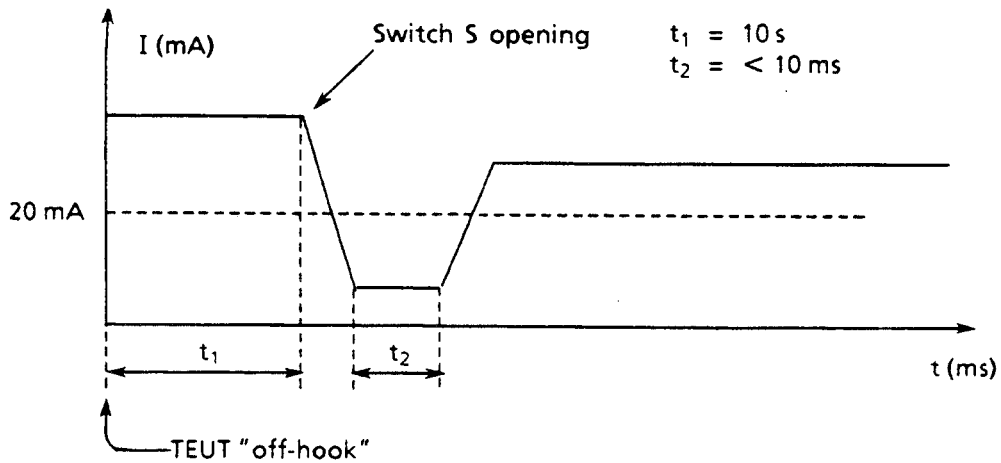


Figure A.10.2 (F) 3.b: Transfer timing

10.2 (D)

Germany

10.2 (D) 1

DC specifications

10.2 (D) 1.1

A maximum setting pulse $t_{set} \leq 3$ ms may occur during the transition from the dialling state to the connection state (cf. figure 10.2 (D) 1.a).

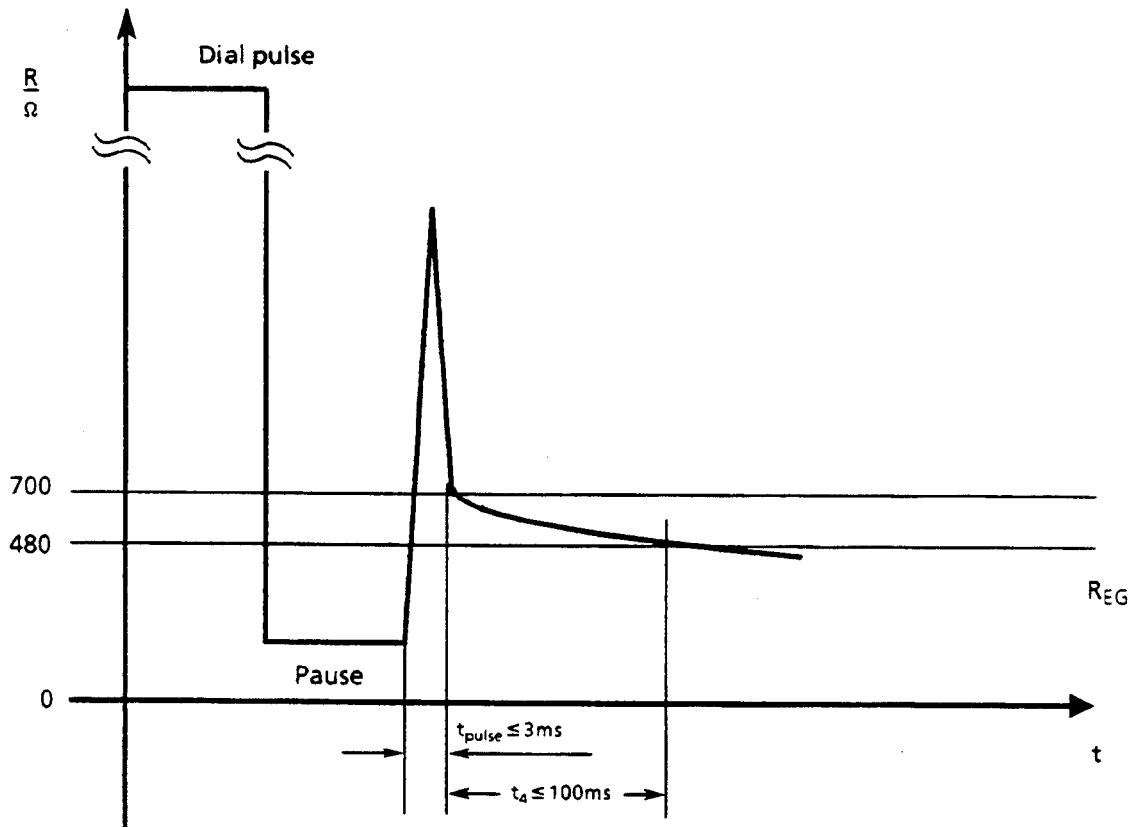


Figure 10.2 (D) 1.a

Immediately after the setting pulse, the permissible dc resistance of $R \leq 480$ ohms may be exceeded by 220 ohms. The permissible dc resistance of $R = 480$ ohms must be attained within $t_{4\max} = 100$ ms (cf. figure 10.2 (D) 1.a).

10.2 (D) 1.2

In order to establish whether an item of terminal equipment is ready to operate or convey speech, a measurement is performed in the voice mode after the transition from the idle mode or dialling mode. This must be achieved within ≤ 500 ms. For charge metering equipment this time is ≤ 5 s.

10.2 (D) 1.3

The TE must operate reliably with a supply current between 19 mA and 60 mA. Up to 120 mA may occur when the earth button is used. Values of ≥ 12 volts are required as rated supply voltages when through-connected TEs are fed from this TE.

10.2 (D) 1.4

All disturbance due to switching functions of the TE on the line must have been debounced within $t \leq 5$ ms. This does not apply to manually-operated switches and keys.

10.2 (D) 1.5

Tes which are connected in series with other TEs shall not significantly affect the generation of pulses (during pulse dialling of the through connected TE). When ideal dialling pulses (pulse 60 ms, pause 40 ms, rise time 10 μ s, supply current 20 mA) are applied, the rise and drop times must not exceed a total of 1 ms. TE supporting parallel access are treated as 4-poles. Measuring circuit see figure 10.2 (D) 1.b.

10.2 (D) 1.6

For measurements according to 10.2 (D) 1.5, the resistance between the a and b wire must be $R_{a1b1} \geq 5$ M Ω while contact k is open; for series-connected charge metering devices, the resistance is $R_{a1b1} \geq 1$ M Ω .

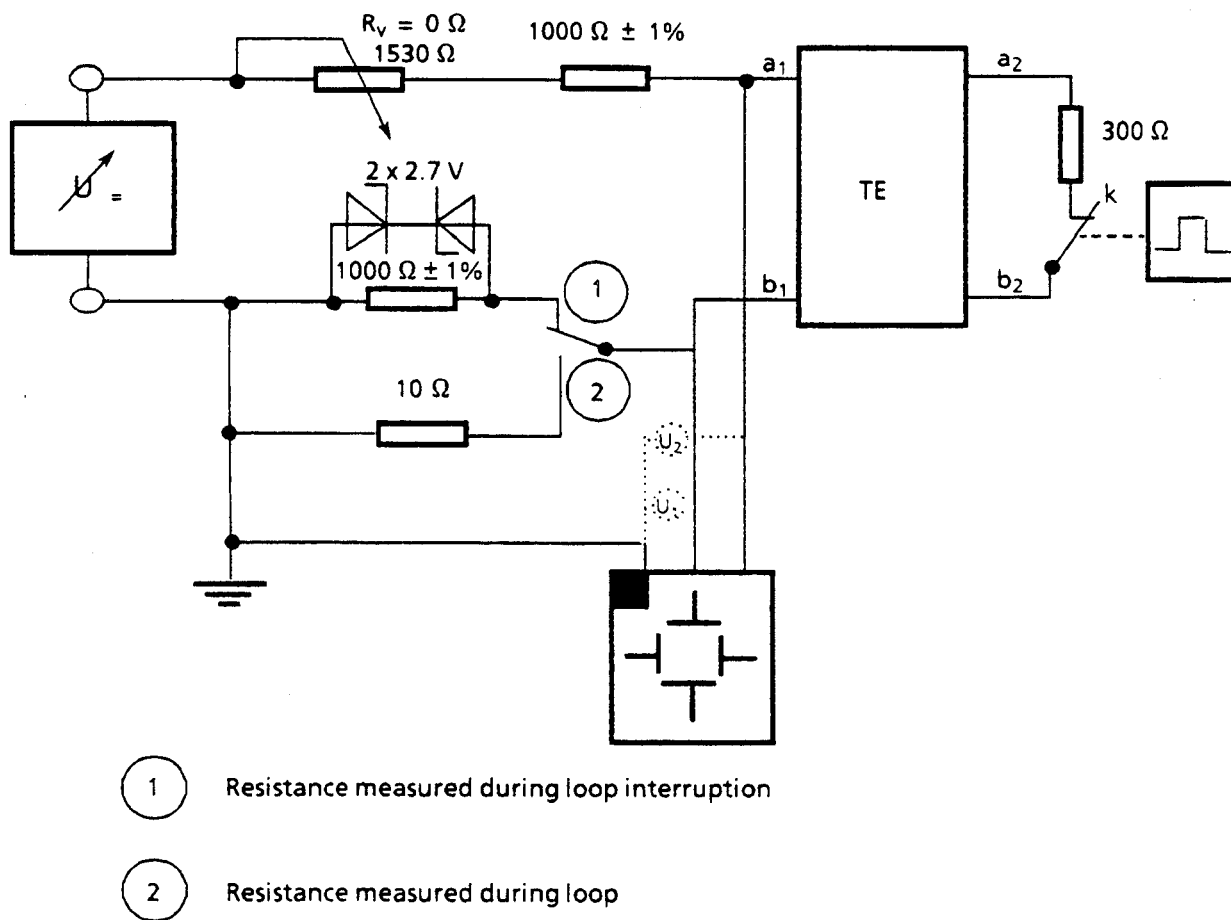


Figure 10.2 (D) 1.b

10.2 (N) Norway

10.2 (N) 1 Immunity to current interruptions during loop condition

The TE shall maintain its loop condition for current interruptions equal to or shorter than 400 ms.

A.10.2 (N) 1

The TEUT is connected as shown in figure A.10.2 (N) 1. After the TE is placed in loop condition, the feeding current is cut off for 400 ms.

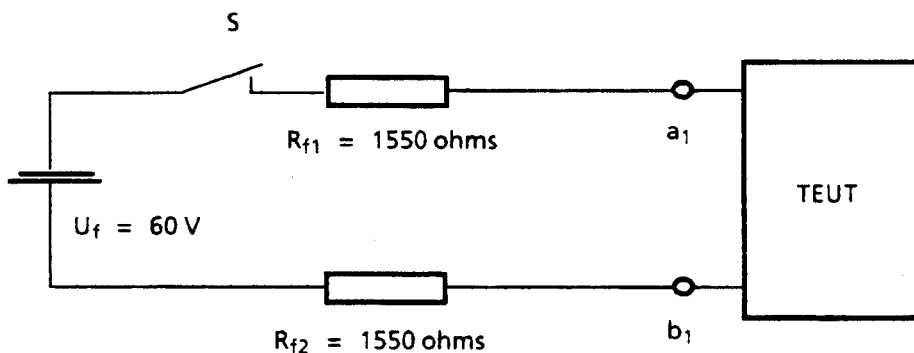


Figure A.10.2 (N) 1

10.2 (P) Portugal

10.2 (P) 1 Immunity to an external loop current interruption

When in loop condition, the TE shall sustain one loop current interruption for a maximum period of 110 ms with no effects on its normal operation. Besides, 10 ms after that interruption the loop current shall reach a value not less than 20 mA.

Compliance shall be checked using the tests outlined in section A.10.2 (P) 1.

A.10.2 (P) 1 Immunity to an external loop current interruption

The TEUT is connected as shown in figure A.10.2 (P) 1.a or A.10.2 (P) 1.b, as appropriate. Switch S_t is closed and the TEUT is placed in the loop condition.

Then switch S_t is opened for a period of 110 ms and the line current is measured according to the requirement.

After the interruption, the TEUT shall continue to operate normally in order to perform as usual its functions related with the network interworking.

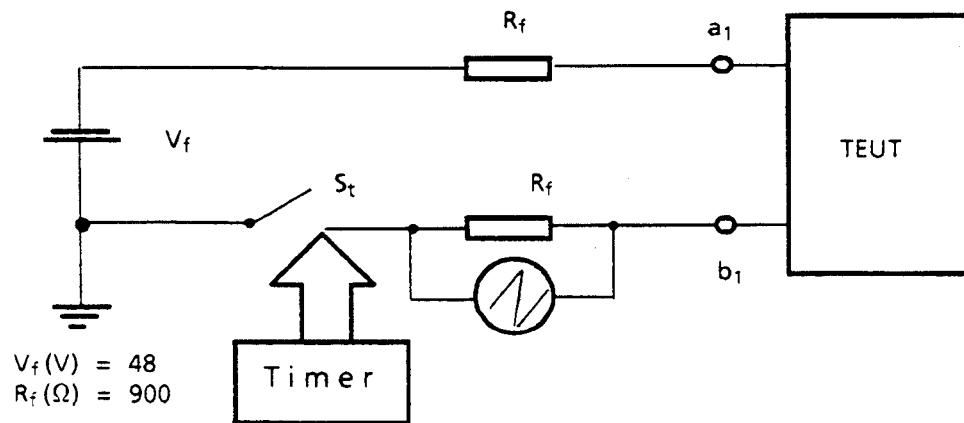


Figure A.10.2 (P) 1.a: Immunity to an external loop current interruption - one-port TE

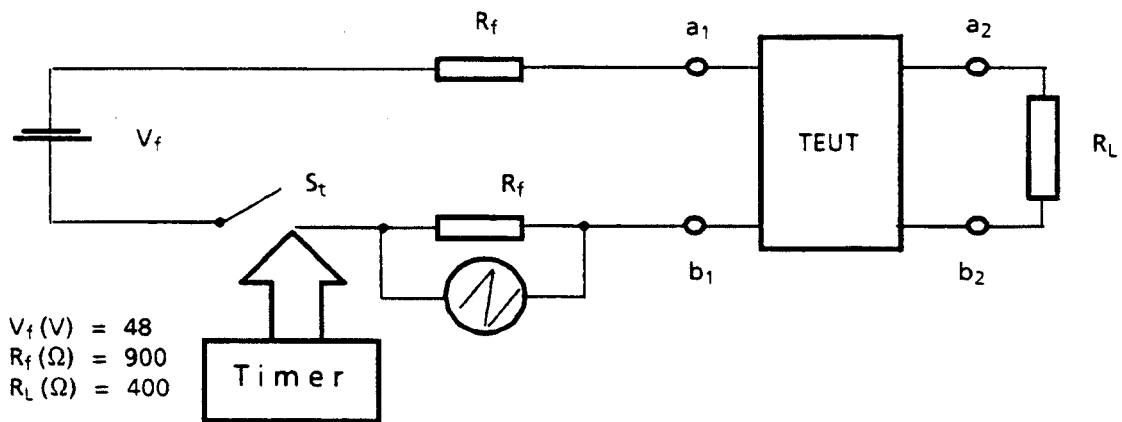


Figure A.10.2 (P) 1.b: Immunity to an external loop current interruption - series connected TE

10.2 (P) 2 Loop current interruptions and variations caused by the TE

During loop condition, if the operation of TE causes any dc line current interruption or variation, the loop current shall reach a value not less than 20 mA not later than 10 ms after the commencement of that interruption or variation.

This requirement does not apply to interruptions or variations caused by dialling or signalling procedures.

Compliance shall be checked using the tests outlined in section A.10.2 (P) 2.

A.10.2 (P) 2 Loop current interruptions and variations caused by the TE

The TEUT is connected as shown in figure A.2.4.2 and placed in the loop state.

Then the TEUT is caused to make interruptions or variations of the loop current related with its operation and the line current is measured according to the requirement.

10.2 (P) 3 Polarity reversal

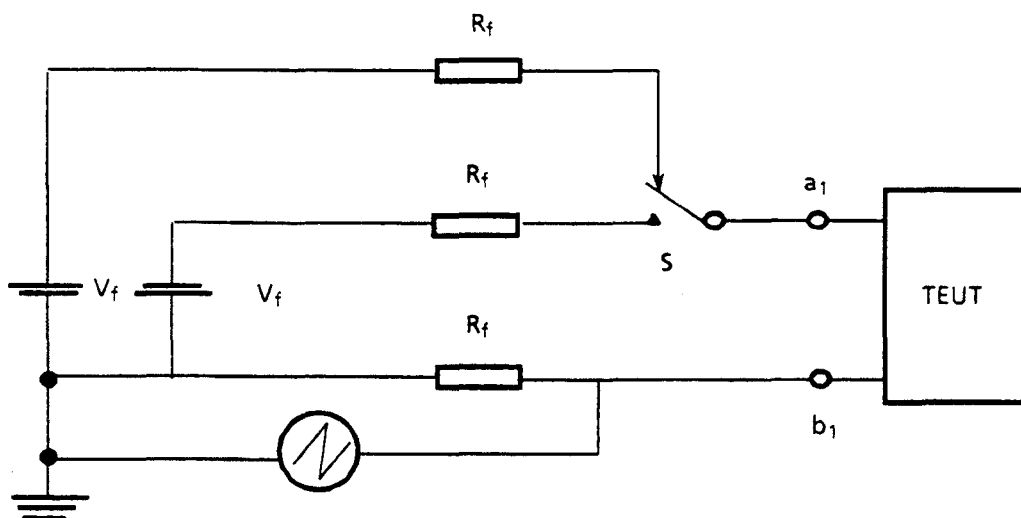
In loop condition, 4 ms after a polarity reversal of the dc voltage applied to the line terminals of the TE, the line current shall reach a value not less than 20 mA.

Compliance shall be checked using the tests outlined in section A.10.2 (P) 3.

A.10.2 (P) 3 Polarity reversal

The TEUT is connected as shown in figure A.10.2 (P) 3.a or A.10.2 (P) 3.b, as appropriate, and placed in the loop state.

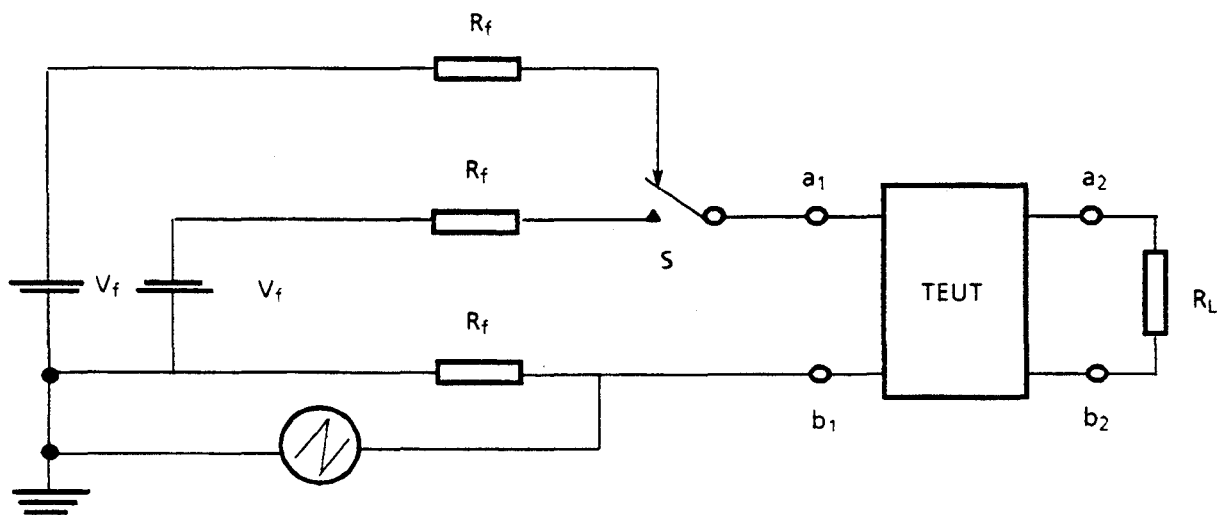
Then a polarity reversal of the dc voltage is applied to the line terminals of the TEUT using switch S and the line current is measured according to the requirement.



$$V_f \text{ (V)} = 48$$

$$R_f \text{ (\Omega)} = 200$$

Figure A.10.2 (P) 3.a: Polarity reversal - one-port TE



$$V_f \text{ (V)} = 40$$

$$R_f \text{ (\Omega)} = 200$$

$$R_L \text{ (\Omega)} = 400$$

Figure A.10.2 (P) 3.b: Polarity reversal - series connected TE

10.2 (E)

Spain

10.2 (E) 1

Insulation resistance between line terminals of two lines (multi-line)

With a multi-line TE, independently if any of the lines is in quiescent condition or in loop condition, the insulation resistance between each one of the two line terminals of one line, and any of the two line terminals of any other line, shall not be lower than 100 MΩ, tested at dc voltages of up to 100 V.

Compliance shall be checked by the tests outlined in section A.10.2 (E) 1.

A.10.2 (E) 1

Insulation resistance between line terminals of two lines (multi-line)

The TEUT is connected as shown in figure A.10.2 (E) 1.

The dc test voltage, V_t , takes the value of 100 V; the tests are undertaken for each polarity of the dc test voltage.

The dc feeding voltages, V_{f1} and V_{f2} , take the value of 48 V. The feeding resistors, R_{f1} and R_{f2} take the value of 1 100 Ω .

The insulation resistance, R_1 , is calculated using formula A.10.2 (E) 1, where V_t is the test voltage value expressed in volts, and I is the measured value of current expressed in microamperes, resulting from the application of the given test voltage.

The tests are undertaken for all the combinations of the switches S_1 and S_2 , and for all the combinations of conditions for every couple of lines.

$$R_1 = \frac{V_t (V)}{I (\mu A)}$$

Formula A.10.2 (E) 1

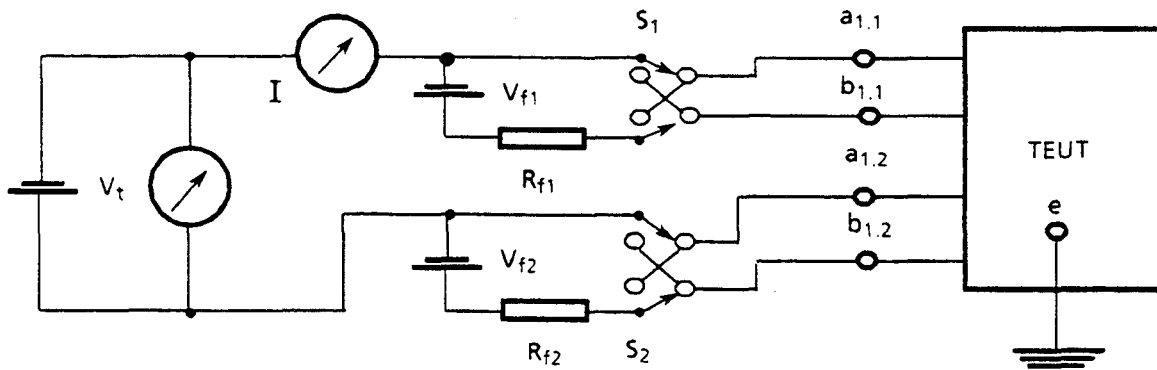


Figure A.10.2 (E) 1: Insulation resistance between line terminals of two lines (multi-line)

10.2 (E) 2

Susceptibility to dc transients from the network

10.2 (E) 2.1

Transients after a change to the opposite polarity

With TE in the loop condition, when it happens a change to the opposite polarity, the loop condition shall be maintained in such a manner that the loop current shall comply with the limits according with the mask of figure 10.2 (E) 2.1 where:

- $t_1 \equiv$ instant in that the switch takes the new polarity
- $t_2 = t_1 + 2 \text{ ms}$
- $t_3 = t_1 + 10 \text{ ms}$
- $I_1 \equiv$ Stationary value of the loop current for the original polarity
- $I_2 = I_1 - 1 \text{ mA}$
- $I_3 = I_1 + 1 \text{ mA}$
- $I_4 \equiv$ Stationary value of the loop current for the new polarity
- $I_5 = I_4 + 1 \text{ mA}$
- $I_6 = I_4 - 1 \text{ mA}$
- $I_7 = 125 \text{ mA}$
- $I_8 = -125 \text{ mA}$
- $I_9 = -18 \text{ mA}$
- $I_{10} = -100 \text{ mA}$

Compliance shall be checked by the tests outlined in section A.10.2 (E) 2.1.

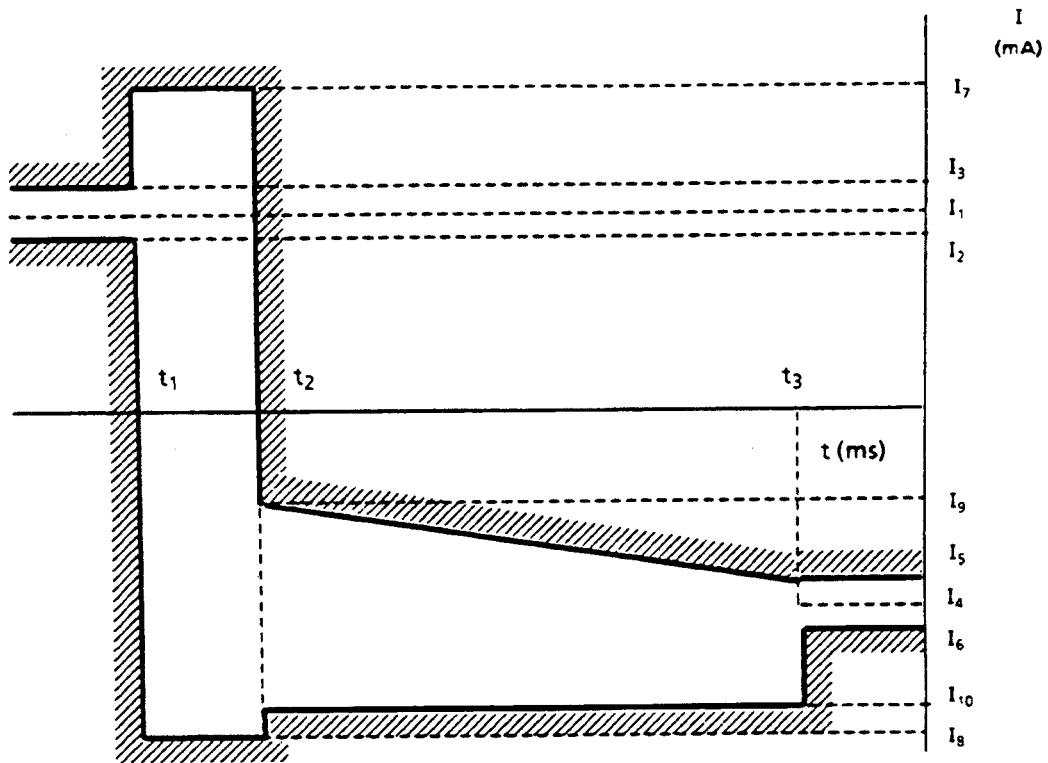


Figure 10.2 (E) 2.1: Transient after a change to the opposite polarity

10.2 (E) 2.2

Transient after a line interruption

With TE in the loop condition, when it happens a line interruption of at the most 50 ms, the loop condition shall be maintained in such a manner that the loop current shall be greater than 18 mA after 5 ms from the line restoration.

This requirement shall, however, not be applied to TE which, when they are in loop condition under automatic control, are prepared for establishing the quiescent condition according with the events 10.5 (E) 10.7.a.i and/or 10.6 (E) 6.7.i. This exception to the requirement shall not be applied in the period between the instant that the TE establishes the loop condition (see requirement 10.5 (E) 2) and the instant that the TE starts the dialling sequence (see requirement 10.5 (E) 3).

Compliance shall be checked by the tests outlined in section A.10.2 (E) 2.2.

A.10.2 (E) 2

Susceptibility to dc transients from the network

A.10.2 (E) 2.1

Transient after a change to the opposite polarity

The TEUT is connected as shown in figure A.10.2 (E) 2.1.

The feeding voltages, V_{f1} and V_{f2} , take the value of 48 V. The two feeding resistors, R_{f1} and R_{f2} , take the value of 250 Ω ; the test shall also be made when these resistors take the value of 1 100 Ω .

The change of switch S_1 shall be effected in the course of at most 0,2 ms and the test shall be made in both opposite directions of change.

A suitable instrument is used to documents the loop current variations as consequence of the change of switch S_1 .

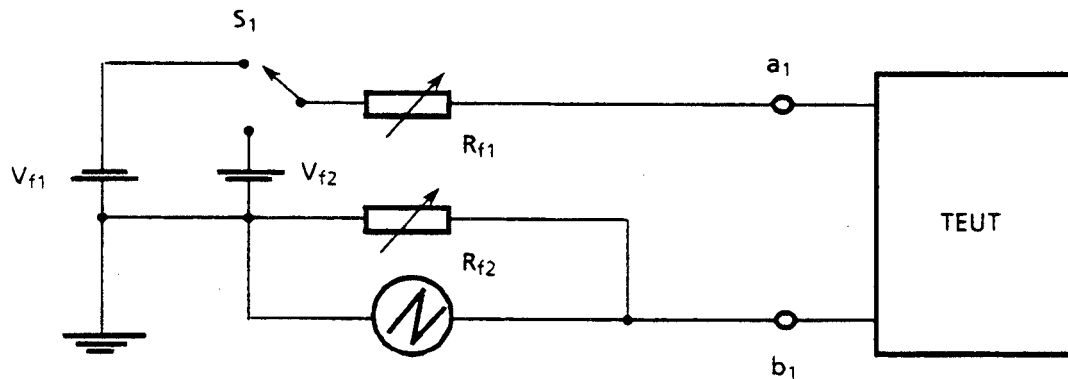


Figure A.10.2 (E) 2.1: Transient after a change to the opposite polarity

A.10.2 (E) 2.2 Transient after a line interruption

The TEUT is connected as shown in figure A.10.2 (E) 2.2, where the switch, S_1 , is normally closed.

The feeding voltage, V_f , takes the value of 48 V. The feeding resistors, R_{f1} and R_{f2} , take the value of 250 Ω ; the test shall also be made when these resistors take the value of 1 100 Ω .

The switch S_1 is opened during a period with a duration of 50 ms.

A suitable instrument is used to document the loop current after the switch S_1 is closed again.

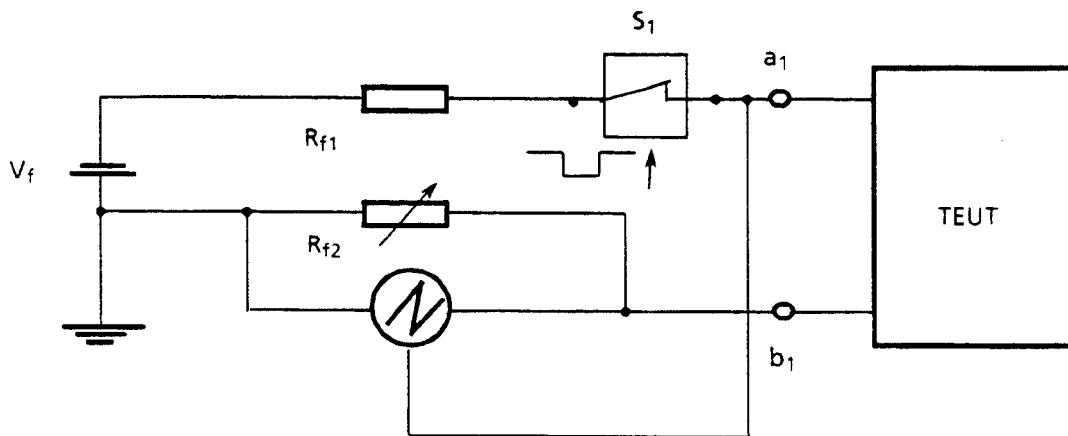


Figure A.10.2 (E) 2.2: Transient after a line interruption

10.3 Ringing signal characteristics

10.3 (A) Austria

10.3 (A) 1 DC flow in the ringing condition

In the ringing condition the TE shall not admit more than 0,3 mA dc.

A.10.3 (A) 1

DC flow in the ringing condition

The TEUT is connected as shown in figure A.10.3 (A) 1.

$$V_f = 64 \text{ V}, R_f = 500 \text{ ohms}, e = 65 \text{ V}_{\text{rms}} / 50 \text{ Hz}$$

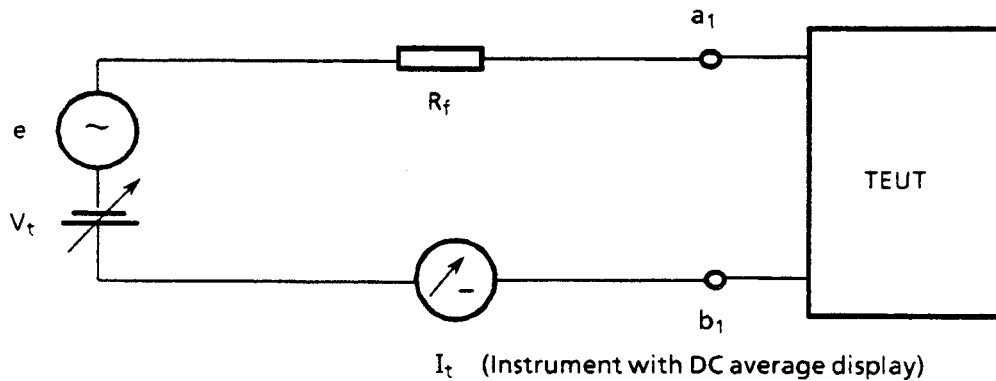


Figure 1.10.3 (A) 1: DC flow in the ringing condition

10.3 (B)

Belgium

10.3 (B) 1

TE identification

For TE with ringing detectors, the mean value of the active component of the ringing current shall be greater than I_r at V_s volt for measuring frequency f .

Requirement values:

$$I_r = 50 \mu\text{A}$$

$$V_s = 5 \text{ V}_{\text{rms}}$$

$$f = 25 \text{ Hz}$$

Compliance for this subsection shall be determined by measurement according to the corresponding tests outlined in section A.3.z.

A.10.3 (B) 1

TE identification

The TEUT is arranged as shown in figure A.10.3 (B) 1, with generator "e" set to $V_s = 5 \text{ V}$ and frequency $f = 25 \text{ Hz}$.

The mean value of the active component of the ringing current I_r is determined using the expression:

$$I_r = 2 I$$

where I is the value of the current indicated by the dc ammeter

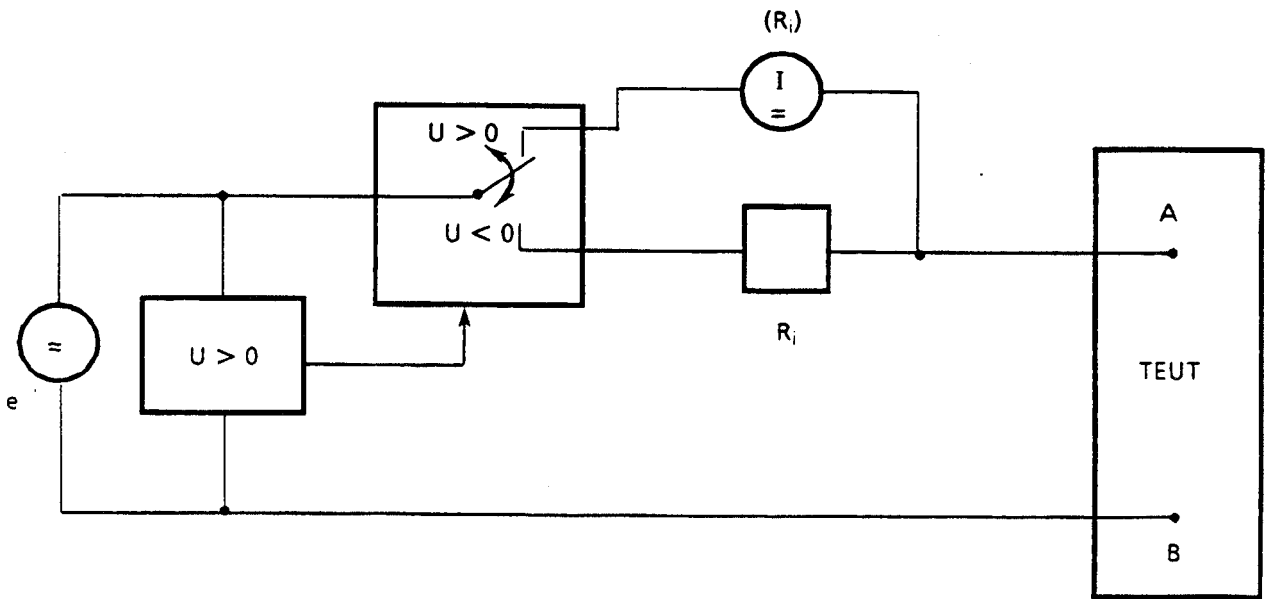


Figure A.10.3 (B) 1

10.3 (DK) 1 **Impedance to earth**

Both in the on-hook state and the off-hook state, a TE shall have an impedance with a magnitude of at least 1 Mohm between the line terminals and earth at ac voltage up to 120 V in the frequency range up to 55 Hz.

A.10.3 (DK) 1 The measurement principle is shown in figure A.10.3 (DK) 1.

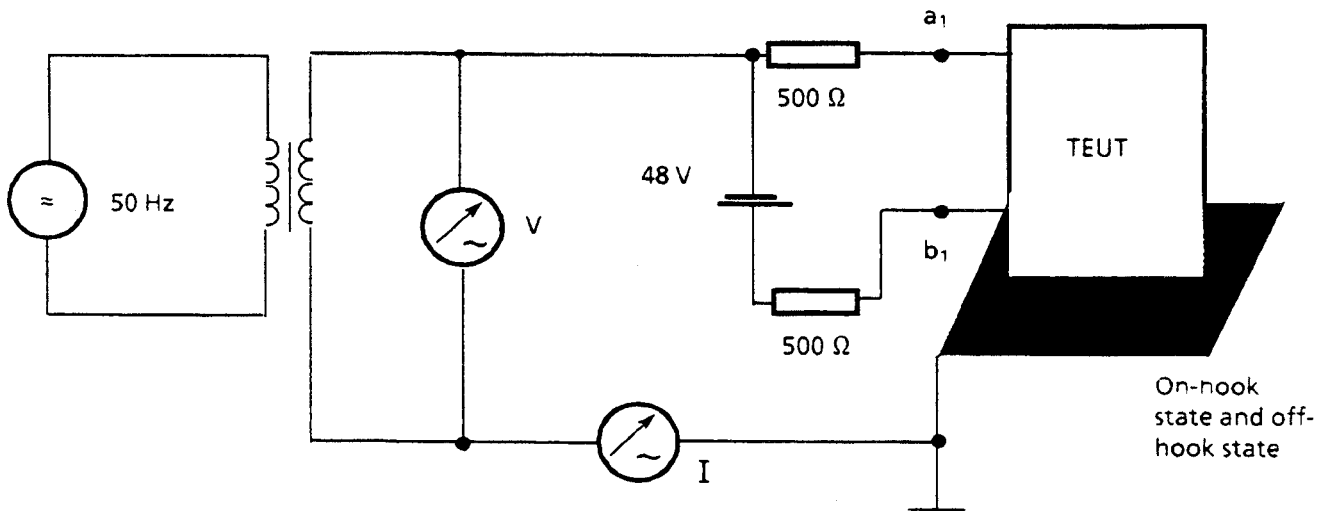


Figure A.10.3 (DK) 1

The impedance is measured with the TEUT in its normal position (standing or suspended) on a metal plate, which at all sides is at least 5 cm larger than the TEUT. Measurements are carried out with reference to the metal plate, which is connected to any accessible electrically conductive parts of the TEUT, with $U = 120 \text{ V}$ and $f = 50 \text{ Hz}$.

10.3 (F)

France

10.2 (F) 1

The level of any individual frequency component due to a possible distortion of the ringing signal applied to the TE in ringing state shall not exceed the limits shown in figure 10.3 (F) 1.a for a ringing signal level of $90 V_{rms}$ and a feeding dc voltage of 54 V.

Compliance shall be checked using figure 10.3 (F) 1.b.

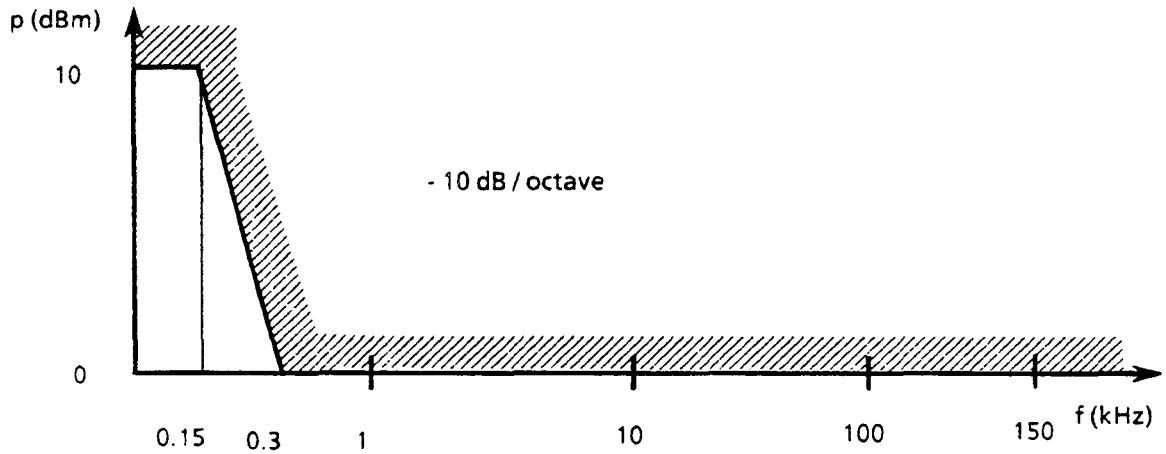


Figure 10.3 (F) 1.a: Maximum of harmonic level from TE in ringing state

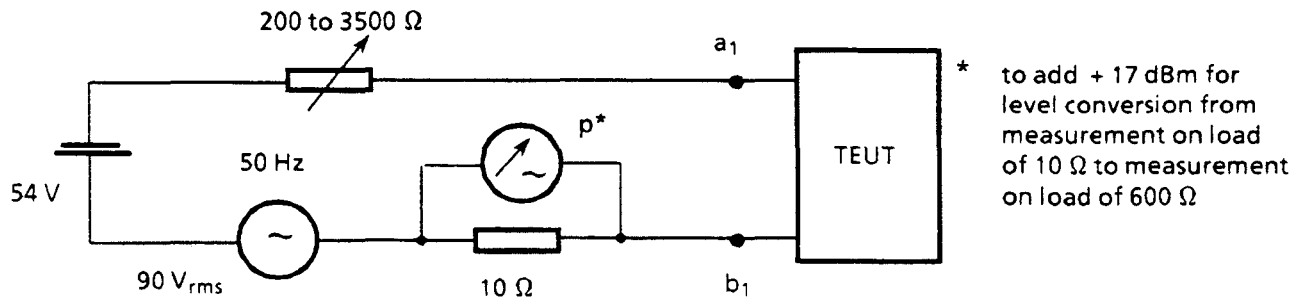


Figure 10.3 (F) 1.b: Test of harmonic distortion from TE in ringing state

10.3 (F) 2

Series-connected TE in quiescent condition shall exhibit an insertion loss for ringing signal of frequency 50 Hz less than $2 V_{rms}$ ($1 V_{rms}$ under study) in the following conditions:

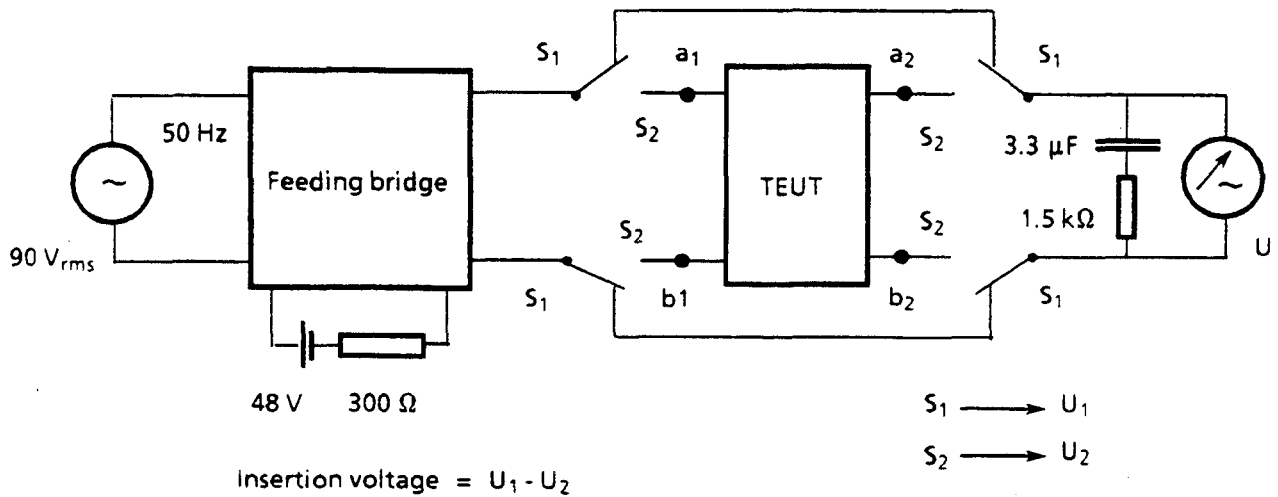


Figure 10.3 (F) 2: Series-connected TE insertion loss at 50 Hz

10.3 (D)

Germany

10.3 (D) 1

Call detection and signalling

The following requirements are applicable for galvanically connected terminal equipment which detects and evaluates the incoming call on the access line. The type of evaluation is not specified.

10.3 (D) 2

General

10.3 (D) 2.1

If the ringing detection circuitry or ringer initiates automatic linking to the access line, then the TE may only be linked to the line when it is fully ready for operation within a time period of 500 ms.

10.3 (D) 2.2

If an automatic linking feature is used, the TE must link to the access line no later than the end of the fifth call signal. Possible exceptions are stated in the terminal requirements.

10.3 (D) 3

Signalling

10.3 (D) 3.1

The type of signalling is optional; the switching off of the signalling device is allowed.

10.3 (D) 3.2

If the incoming call is signalled acoustically, then a sound pressure level of $L \geq 66$ dB (A) must be generated for an ac voltage of 45 V in the frequency range between 23 Hz and 54 Hz without the connection of a four terminal network ($R_{iG} = 0$ ohm).

Compliance shall be checked using the test outlined in section A.6.2.1.

10.3 (I)

Italy

10.3 (I) 1

Ringing signal input capacitance

With the TE in the quiescent condition, the value of the input capacitance for dc voltage shall be:

- a) $1 \mu\text{F}$ ($\pm 10\%$) for TE with ringer or with ring detection circuitry which produces directly a discernible signal to indicate the presence of ringing signal;

- b) $0,3 \mu\text{F}$ ($\pm 10\%$) for TE with ringing signal detection circuitry which generates electrical signals which indicate the presence of ringing signal.

Compliance shall be checked by the test outlined in section A.10.3 (I) 1.

A.10.3 (I) 1

Ringing signal input capacitance

The input capacitance of the TE shall be checked by the discharging on a known resistor and measuring the resulting time constant.

The TEUT is placed in the quiescent condition and is connected as shown in figure A.10.3 (I) 1.a.

The dc voltage source takes the value of 48 V, the charge resistor R_c takes the value of 2 k Ω and the discharge resistor R_f takes the value of 20 k Ω .

The voltage across the resistor R_f is applied to the input of a time counter, triggered at $V_1 = 17,7 \text{ V}$ ($= 48/\text{exp}(1)$).

The switch S is initially set to position 0, where it is left for a sufficient time to charge the internal capacitance of the TEUT and, in any case, for not less than 50 ms.

At the time t_0 , S is switched to a position 1 and the voltage transient shown in figure 10.3 (I) 1.b is observed across resistor R_f . The time interval

$$T(s) = t_1 - t_0$$

is measured by the counter.

The input capacitance C of the TE is given by formula A.10.3 (I) 1

$$C(\mu\text{F}) = \frac{T}{R_f} \quad \text{Formula A.10.3 (I) 1}$$

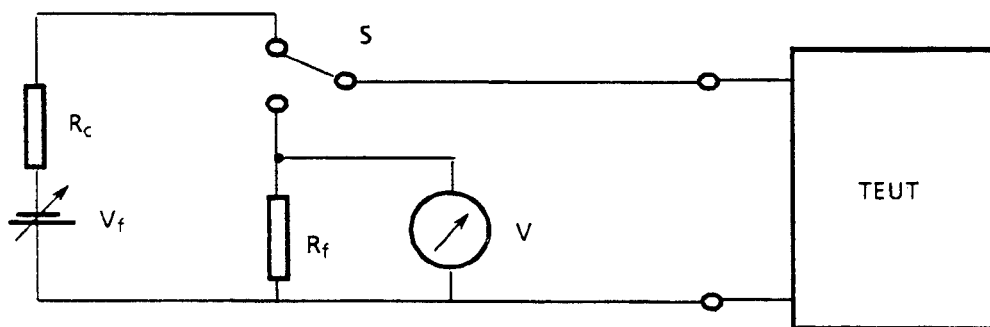


Figure A.10.3 (I) 1.a

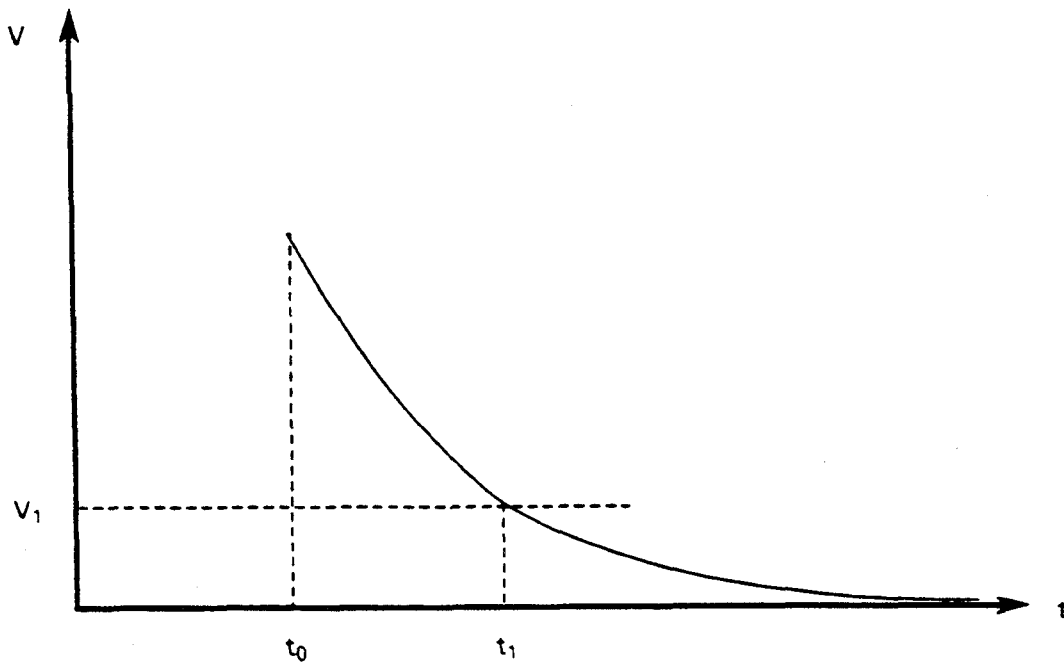


Figure A.10.3 (I) 1.b

10.3 (N) Norway

10.3 (N) 1 Insertion loss for ringing currents

Series-connected TE shall not contribute an insertion loss of more than 2 dB for ringing currents at the frequencies 25 and 50 Hz.

Compliance shall be checked by using the test outlined in section A.10.3 (N) 1.

A.10.3 (N) 1 The TEUT is connected as shown in figure A.10.3 (N) 1, where the feeding voltage V_f is 60 V, the ac generator open circuit voltage "e" is $75 V_{rms}$, the feeding resistor R_f is 5 Ω , and the load impedance consists for a $1 \mu F$ capacitor (C_L), and an 8 Ω resistor (R_L). The value of the insertion loss (A) is calculated using the formula $A = 20 \log (V_2/V_1)$, where V_1 and V_2 are the voltmeter readings with switch S_1 in position 1 and 2, respectively. The measurement is made at $f = 25$ Hz and $f = 50$ Hz.

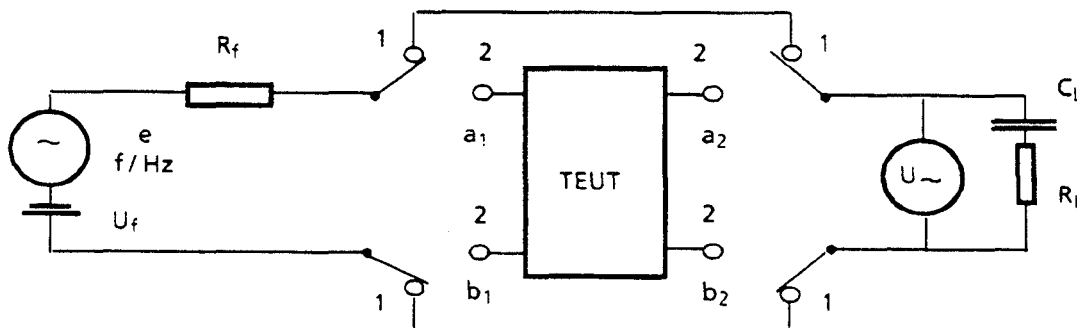


Figure A.10.3 (N) 1

10.3 (E) Spain

PROVISION: See the provision in section A.3.1.1 (E) 1.

10.3 (E) 1 Ringing signal input characteristics

10.3 (E) 1.1 Ringing signal maximum input capacitance

With TE in the quiescent condition, the value of the reactance component of the complex impedance between two line terminals shall not be lower than the equivalent to a lossless with a value of:

- a) $1,1 \mu\text{F}$ ($= 1 \mu\text{F} + 10\%$) for TE in which the received ringing signal is directly converted to an acoustic signal;
- or
- b) $0,37 \mu\text{F}$ ($\cong 0,33 \mu\text{F} + 10\%$) for TE with a ringing signal receiver-detector other than a direct converter;

tested with a ringing signal with open circuit ac rms voltages from 35 V to 75 V and frequencies from 20 Hz to 30 Hz, simultaneously superimposed to a dc voltage of 48 V, applied between the line terminals through a resistor of 200Ω .

This requirement shall not be applied for TE without any kind of ringing signal receiver-detector.

For the purposes of this requirement the ratios stipulated in the requirements in sections 3.1.1 (E) 1, and 3.1.2 (E) 1, are used with a pseudo-meaning of modulus of a complex impedance (in $k\Omega$).

Compliance shall be checked by the tests outlined in section A.10.3 (E) 1.1.

10.3 (E) 1.2 Ringing signal maximum direct current

With TE in the quiescent condition, the dc loop current across the two line terminals shall not be greater than 0,6 mA, tested with the signals stipulated in the requirement in section 10.3 (E) 1.1.

Compliance shall be checked by the tests outlined in section A.10.3 (E) 1.2.

A.10.3 (E) 1 Ringing signal input characteristics

A.10.3 (E) 1.1 Ringing signal maximum input capacitance

The TEUT is connected as shown in figure A.10.3 (E) 1.1.

The dc voltage source (V_f) and the resistor (R_f) take the values stipulated in the requirement in section 10.3 (E) 1.1.

The tests shall be made at the ac generator open circuit rms voltages (e) and the frequencies (f) indicated in table A.10.3 (E) 1.1.

A suitable instrument (e.g. a double channel storage oscilloscope) is used to measure the temporal advance (t) of the ringing current to the voltage.

The equivalent (C), for each couple voltage-frequency, is calculated using formulas A.10.3 (E) 1.1.a and A.10.3 (E) 1.1.b, where (R) is the ratio calculated in test in section A.3.1.1 (E) 1, here used as a modulus of a complex impedance (in $k\Omega$), and (t) is the temporal advance in milliseconds.

When due to distortion some difficulties arise trying to measure the temporal advance (t), it is feasible instead of measuring the temporal

advance (t) to check, for each couple voltage-frequency, that its value is clearly greater than the value (t₀) calculated using formula A.10.3 (E) 1.1.c, where

R is the ratio calculated in test in section A.3.1.1 (E) 1, here used as a modulus of a complex impedance (in kΩ), and

C₀ is the maximum value of the equivalent allowed in the requirement in section 10.3 (E) 1.1.

When more difficulties arise invalidating the test methods stated above, selective ac voltmeter and selective ac ammeter shall be used to measure the temporal advance (t).

$$\alpha(\Omega) = - \left(\frac{t \text{ (ms)}}{1\ 000} \times 360 (\Omega) \times f \text{ (Hz)} \right) \quad \text{Formula A.10.3 (E) 1.1.a}$$

$$C \text{ (}\mu\text{F)} = \frac{-10^3}{2 \times \Pi \times f \text{ (Hz)} \times R \text{ (k}\Omega) \times \sin (\alpha (\Omega))} \quad \text{Formula A.10.3 (E) 1.1.b}$$

$$t_0 \text{ (ms)} = \frac{1\ 000}{360 (\Omega) \times f \text{ (Hz)}} \times \arcsin \frac{10^3}{2 \times \Pi \times f \text{ (Hz)} \times R_4 \text{ (k}\Omega) \times C_0 \text{ (}\mu\text{F)}} \quad \text{Formula A.10.3 (E) 1.1.c}$$

Table A.10.3 (E) 1.1: Testing voltages and frequencies

e (V)	f (Hz)
35	20
35	25
35	30
75	20
75	25
75	30

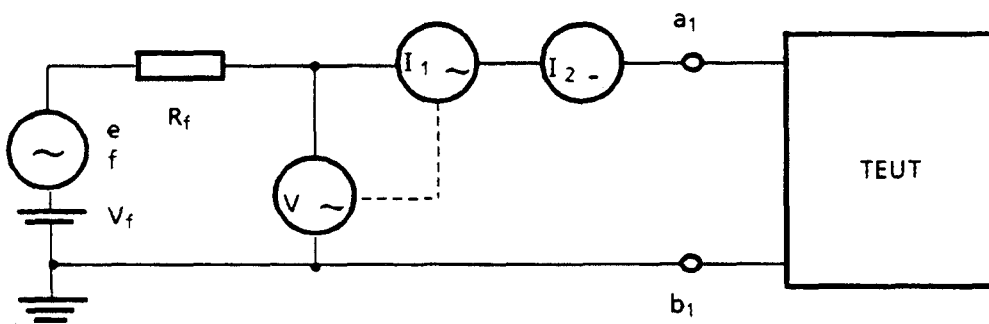


Figure A.10.3 (E) 1.1: Input characteristics

A.10.3 (E) 1.2

Ringling signal maximum direct current

The procedure of test in section A.10.3 (E) 1.1 is followed.

The ammeter (I₂) readings shall fulfil the limit stipulated in the requirement in section 10.3 (E) 1.2.

10.3 (E) 2

Ringling signal impedance between line terminals and accessible parts (and earth)

With TE in the quiescent condition, the value of the modulus of the complex impedance between the line terminals, when shorted together, and any accessible part, connected to the earth terminal if it is provided, shall have such a value that the ratio between the applied voltage (in V) and the measured current (in μA) shall not be lower than 1, tested with a ringing signal with an open circuit ac rms voltage of 75 V and frequency 25 Hz, simultaneously superimposed to a dc voltage of 48 V, applied through a resistor of 200 Ω .

This requirement shall not be applied for TE with a 50 Hz metering pulses receiver, while the reference terminal (see section 1.4.3 (E) 1) is connected to the earth protection terminal, when it exists.

Compliance shall be checked by the tests outlined in section A.10.3 (E) 2.

A.10.3 (E) 2

Ringling signal impedance between line terminals and accessible parts (and earth)

The TEUT is connected as shown in figure A.10.3 (E) 2.

The testing laboratory shall use a suitable earth plate related with the TEUT.

The voltage source (V_f), the resistor (R_f), and the ac generator open circuit voltage (e) and frequency (f) take the values stipulated in the requirement in section 10.3 (E) 2.

The voltage current ratio (R , in millions) is calculated using formula A.10.3 (E) 2, where V is the voltmeter reading in volts and I is the ammeter reading in micro-amperes.

$$R \text{ (M)} = \frac{V \text{ (V)}}{I \text{ (\mu A)}} \quad \text{Formula A.10.3 (E) 2}$$

NOTE: The testing laboratory shall take into account the requirement in section 10.3 (E) 2 which refers to all accessible parts.

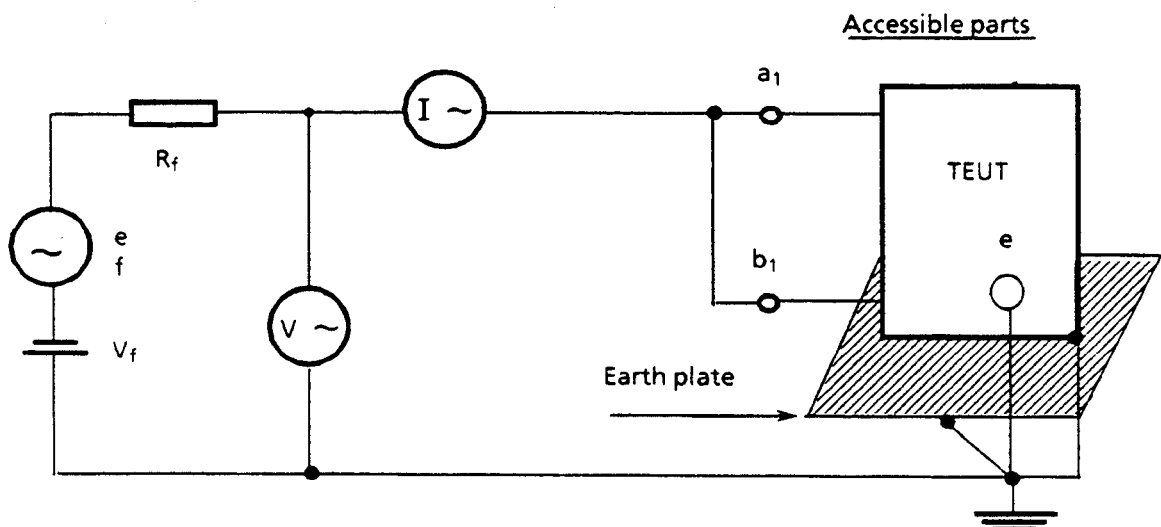


Figure A.10.3 (E) 2: Impedance between line terminals and accessible parts (and earth)

10.3 (E) 3 Ringing signal insertion loss (series)

With series TE in the quiescent condition, the insertion loss exhibited shall not be greater than

- a) 2,5 dB for series TE in which the received ringing signal is directly converted to an acoustic signal;
- or
- b) 12 dB for series TE without a direct converter;

tested with a ringing signal with an open circuit ac rms voltage of 75 V and frequencies from 20 Hz to 30 Hz, simultaneously superimposed to a dc voltage of 48 V, applied between the line input terminals through a resistor of 1 kΩ, when a series resistor of 1 kΩ in series with a of 1 μF are connected to the line output terminals.

This requirement shall, however, not be applied for series TE which are prepared for disconnecting the associated TE from the line, while this associated TE is disconnected from the line.

Compliance shall be checked by the tests outlined in section A.10.3 (E) 3.

A.10.3 (E) 3 Ringing signal insertion loss (series)

The series TEUT is connected as shown in figure A.10.3 (E) 3.

The voltage source (V_f), the resistors (R_f) and (R_L), the (C_L), and the generator open circuit rms voltage (e) take the values stipulated in the requirement in section 10.3 (E) 3. The tests shall be made at the following ac generator frequency (f) values: 20 Hz, 25 Hz, and 30 Hz.

The insertion loss (L) is calculated using formula A.10.3 (E) 3, where V_1 and V_2 are the voltmeter readings in volts, when the switch (S_1) is respectively in the positions 1 and 2.

$$L \text{ (dB)} = 20 \times \log_{10} \frac{V_1 \text{ (V)}}{V_2 \text{ (V)}} \quad \text{Formula A.10.3 (E) 3}$$

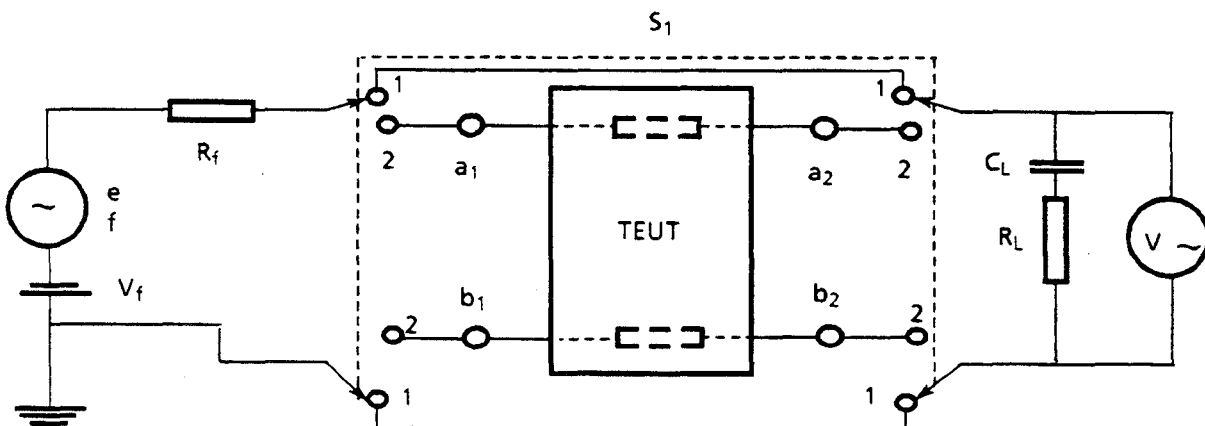


Figure A.10.3 (E) 3: Insertion loss

10.3 (E) 4 **Line detector immunity**

10.3 (E) 4.1 **Line voltage detector immunity**

When the TE in the quiescent condition is prepared for monitoring the dc voltage between the line terminals, the existence of this detector shall not cause that the TE performs improper actions over the line, tested with a ringing signal with an open circuit ac rms voltage of 75 V and frequency of 25 Hz, in a sequence which is made up of 1,5 seconds of signal and 3 seconds of pause, simultaneously superimposed to a dc voltage of 48 V, applied through a resistor of 200 Ω .

An action that the TE does automatically over the line, which is not in accordance with the contents of the user's manual, is considered as an improper action.

Compliance shall be checked by the tests outlined in section A.10.3 (E) 4.1.

A.10.3 (E) 4.1 **Line voltage detector immunity**

The TEUT is connected as shown in figure A.10.3 (E) 4.1, where switch (S_1) follows the sequence stipulated in the requirement in section 10.3 (E) 4.1.

The inspection procedure is followed as stipulated in the requirement in section 10.3 (E) 4.1, where (e) is the open circuit voltage when switch (S_1) is in its closed state.

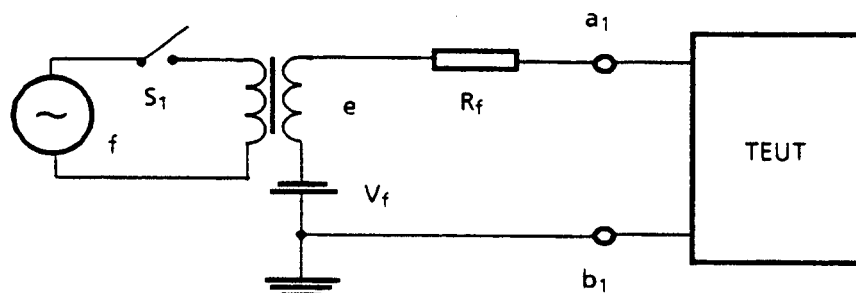


Figure A.10.3 (E) 4.1: Line voltage detector immunity

10.3 (E) 4.2 **Loop current detector immunity (series)**

Loop current detector immunity (series)
(Requirement to be applied instead of section 9.4.1.3)

When the series TE in the quiescent condition is prepared for monitoring or detect the loop current between the line and the associated terminal, the existence of this detector shall not cause that the TE performs improper actions over the line, tested with a ringing signal with an open circuit ac_{rms} voltage of 75 V and frequency of 25 Hz, in a sequence which is made up by 1,5 seconds of signal and 3 seconds of pause, simultaneously superimposed to a dc voltage of 48 V, applied between the line input terminals through a resistor of 200 Ω , when a resistor of 1 k Ω in series with a of 4 μ F are connected to the line output terminals.

An action that the TE does automatically over the line, which is not in accordance with the contents of the user's manual, is considered an improper action.

Compliance shall be checked using the tests outlined in section A.10.3 (E) 4.2.

A.10.3 (E) 4.2 Loop current detector immunity (series)

The series TEUT is connected as shown in figure A.10.3 (E) 4.2, where the switch (S_1) follows the sequence stipulated in the requirement in section 10.3 (E) 4.2.

The inspection procedure is followed as stipulated in the requirement in section 10.3 (E) 4.2, where (e) is the open circuit voltage when the switch (S_1) is in its closed state.

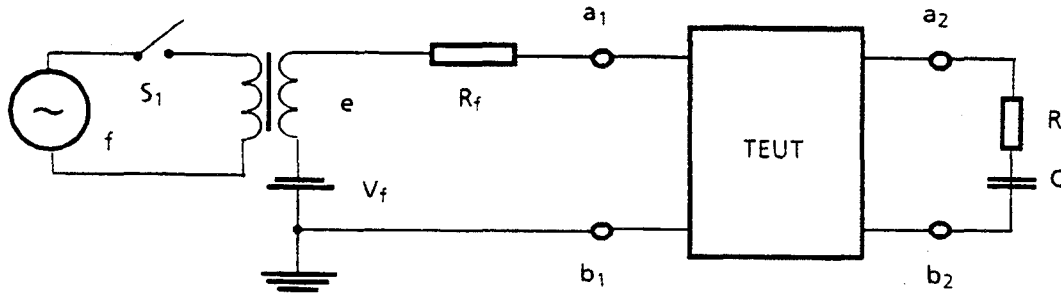


Figure A.10.3 (E) 4.2: Loop current detector immunity (series)

10.3 (E) 5 Ringing signal distortion (series)

With series TE in the quiescent condition, the waveform of the voltage between the line output terminals shall be a periodic and symmetrical 25 Hz signal, tested with a ringing signal with an open circuit ac rms voltage of 75 V and frequency of 25 Hz, simultaneously superimposed to a dc voltage of 48 V, applied between the line input terminals through a resistor of 500 Ω , when a resistor of 1 k Ω in series with a of 1 μ F are connected to the line output terminals.

This requirement shall, however, not be applied for series TE which are prepared for disconnecting the associated TE from the line, while this associated TE is disconnected from the line.

A.10.3 (E) 5 Ringing signal distortion (series)

The series TEUT is connected as shown in figure A.10.3 (E) 5.

The test procedure is followed as stipulated in the requirement in section 10.3 (E) 5.

A suitable instrument is used to document the waveform of the voltage between the line output terminals.

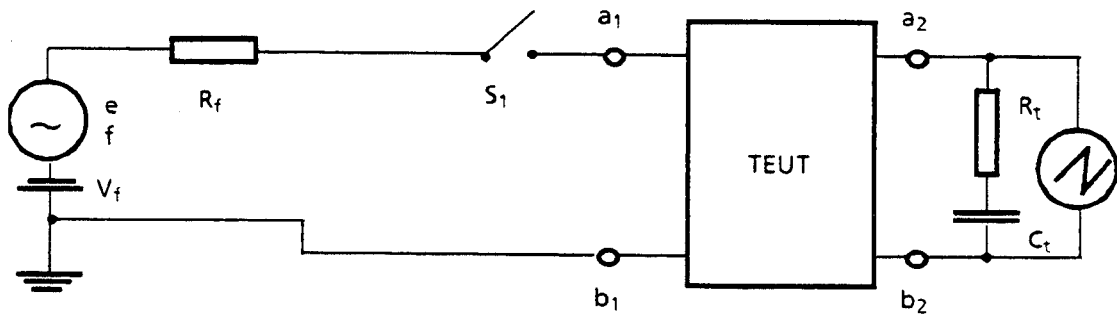


Figure A.10.3 (E) 5: Ringing signal distortion

10.3 (CH)

Switzerland

10.3 (CH) 1

Ringling characteristics (TE placed in quiescent condition with its ringing detector able to function).

Timing of ringer signs:

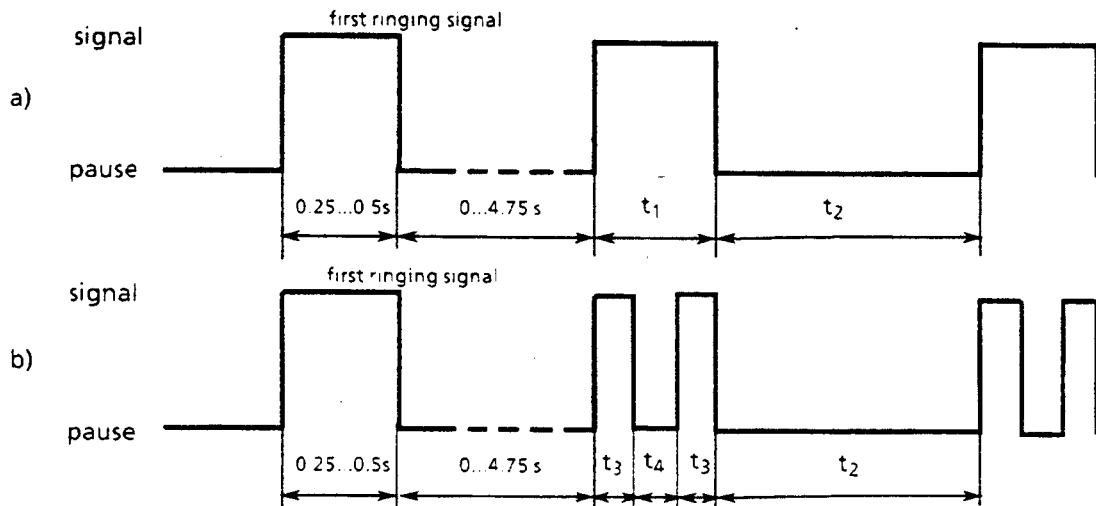


Figure 10.3 (CH) 1: Timing of ringer signals

The first ringing sign, particularly from an exchange, can differ:

Signal: 0,25...0,5 s and pause 0...4,75 s.

Critical timing and tests:

For a): t_1 : 0,7 s and t_2 : 5 s

For b): t_3 : 0,2 s, t_4 and t_2 : 5 s

The ringer or ringing detector producing discernible signals must work normally on a ringing current source of 60...90 V emf in the entire source resistance range of 1...6 k Ω (purely resistive) in the frequency range 21...55 Hz and at least respond to ringing signals in the entire range response times mentioned above.

For 20 V eff at the device's terminals, the ringer or ringing detector must still respond correctly at 25 Hz and 50 Hz to ringing signals with critical timing mentioned above and cease to respond at a permanent signal of 8 V.

At 3 V eff there should not be any noticeable perception in the whole tone frequency range (20 Hz...20 kHz).

The ringing current is superimposed on a dc voltage of up to 57 V. The ringing detector must not, however, draw any dc current

In the case of acoustic ringing the sound level (with an ac voltage of 70 V and a purely resistive 4 k Ω source resistance, in the frequency range 21...55 Hz) must be at least 60 dBA at a maximum volume setting. Volume and tone may be adjustable. The sound levels are based on a room size of 6,9 m x 4,3 m x 3 m = 89 m³ and 0,5 s average echo time. The sound level is evaluated (as average) over a circle of 50 cm diameter using a rotating test microphone; the base point of the vertical rotating plane being 1 m from the apparatus horizontally.

The ringing must be clearly distinguishable in the active state. The response time shall not exceed \pm 520 ms and the disconnection delay +100 ms.

If the call detection device initiates the automatic activation of the subscriber line, the TE must only switch itself on if it is ready for operation. In this case the TE must be connected to the telephone circuit not before the second ringing sign and 2 s after the 5th ringing sign at the latest (see above, timing of ringer sign, c).

10.4 Transmission characteristics

10.4 (A) Austria

10.4 (A) 1 Frequency range of signal frequency signals

Signal frequency signals sent to the PSTN by TE shall be within a frequency range from 920 Hz up to 2 115 Hz.

10.4 (B) Belgium

10.4 (B) 1 Cross-talk

For multi-line TE, the cross-talk attenuation between the line terminals of two accesses placed in the loop condition shall be greater than 75 dB when an ac signal of 0 dBm, at 1 100 Hz is applied to one of the accesses of the TE.

The requirement shall be met at the dc feeding conditions:

$$I_f = 20 - 90 \text{ mA}$$

$$V_f = 48 \text{ V}$$

A.10.4 (B) 1 Cross-talk

The TE is connected as shown in figure A.10.4 (B) 1 and the two accesses are placed in the loop condition ($I_f = 25; 55 \text{ mA}$, $V_f = 48 \text{ V}$). The impedances Z_q and Z_L are equal to 600 ohms.

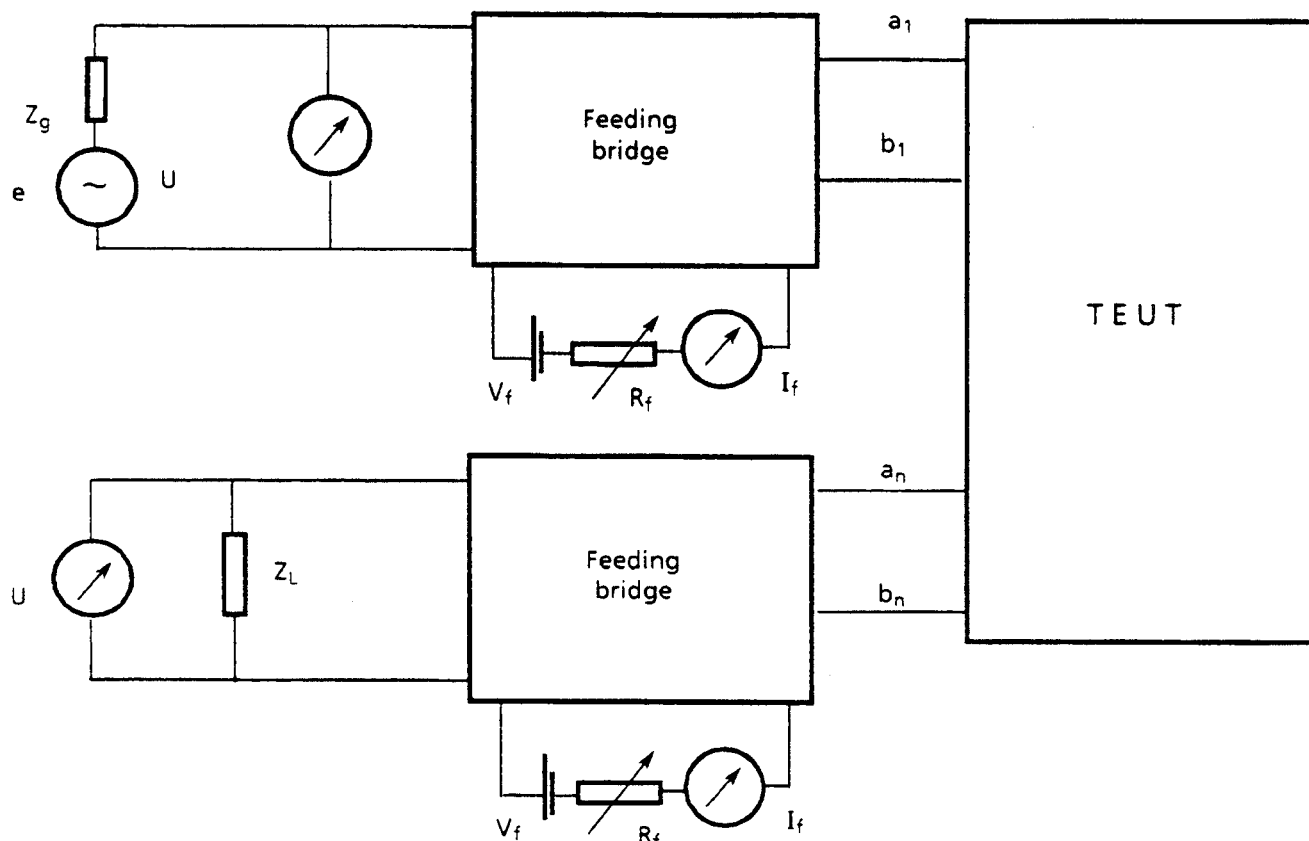


Figure A.10.4 (B) 1

10.4 (D) **Germany**

10.4 (D) 1 **General**

The test arrangements and measurement procedures for these sections are described in the national specifications FTZ 12 TR 21 "Measurement of terminal equipment".

10.4 (D) 2 **General requirements for all TEs**

10.4 (D) 2.1 **Directional independence**

The requirements have to be fulfilled in both transmission directions unless otherwise stated.

10.4 (D) 2.2 **Polarity independence**

In cases where requirements in other sections of this document have to be tested independently of polarity, also the related requirements for transmission have to be met independently of polarity.

10.4 (D) 2.3 **Feedback circuits**

In cases where requirements in other sections of this document have to be tested independently of polarity, also the related requirements for transmission have to be met independently of polarity.

10.4 (D) 2.3 Feedback circuits

Within TEs intended for linking to the public analogue network, electrical feedback circuits must not be established.

10.4 (D) 2.4 Resistance against meter pulse signals

In cases where wanted signals and meter pulse signals are simultaneously applied to the TE, the TE has to fulfil the approval requirements. The test is carried out using a signal of 120 ms \pm 10 ms on-time and 220 ms \pm 20 ms off-time with a frequency of 16 kHz \pm 80 Hz. The sending level of the meter pulse signal is +22 dB (775 mV) on 200 ohms; the sending level of the unwanted signal shall be -35 dB (775 mV) unless otherwise stated in terminal requirements.

10.4 (D) 2.5 Input sensitivity of TEs with handshake capability

TEs with handshake capability (e.g. facsimile equipment) shall operate reliably at the minimum and maximum receiving levels when the minimum and maximum sending levels are applied to the TE.

10.4 (D) 2.6 Resistance against external voltages

External voltages in the frequency range of 10 kHz up to 200 kHz, which superimpose a wanted signal, must not change the wanted signal by more than 0,5 dB and must not affect other operational conditions. The sending level is -20 dB (775 mV).

10.4 (N) Norway**10.4 (N) 1 Cross-talk**

Speech signals of less than -80 dBm on the line terminals shall not be amplified to levels intelligible in a loudspeaker or handset/headset.

10.4 (P) Portugal**10.4 (P) 1 Degree of unbalance about earth for a TE not series-connected provided with one port intended to be attached to a PSTN CP and in addition which provides a second port for attachment of another TE which itself is approved for connection to the PSTN****10.4 (P) 1.1 Longitudinal conversion loss of a TE in quiescent condition**

The longitudinal conversion loss of a TE in quiescent condition shall be greater than each value of α_q over its corresponding frequency range, Δf , at the dc feeding values shown below.

ΔV_f (V)	= 45 - 55
ΔR_f (Ω)	= 300 - 1 800
α_{q1} (dB)	= 40
Δf_1 (Hz)	= 40 - 300
α_{q2} (dB)	= 50
Δf_2 (Hz)	= 300 - 600
α_{q3} (dB)	= 55
Δf_3 (Hz)	= 600 - 3 400

Compliance shall be checked using the tests outlined in section A.4.2.2.1.

10.4 (P) 1.2

Longitudinal conversion loss of a TE in loop condition

The longitudinal conversion loss of a TE in the loop condition shall be greater than each value of α_1 over its corresponding frequency range, Δf , at the dc feeding values shown below.

$$\begin{aligned}\Delta V_f (V) &= 45 - 55 \\ \Delta R_f (\Omega) &= 300 - 1\ 800 \\ \alpha_{11} (dB) &= 40 \\ \Delta f_1 (Hz) &= 40 - 300 \\ \alpha_{12} (dB) &= 50 \\ \Delta f_2 (Hz) &= 300 - 600 \\ \alpha_{13} (dB) &= 55 \\ \Delta f_3 (Hz) &= 600 - 3\ 400\end{aligned}$$

Compliance shall be checked using the tests outlined in section A.4.2.2.2.

10.4 (P) 2

Insertion loss for a TE not series-connected provided with one port intended to be attached to a PSTN CP and in addition which provides a second port for attachment of another TE which itself is approved for connection to the PSTN

The TE shall exhibit an insertion loss for the frequency range 300 Hz to 3 400 Hz less than 1 dB, at the dc excitation conditions

$$\begin{aligned}V_f (V) &= 45 - 55 \\ R_f (\Omega) &= 300 - 1\ 800\end{aligned}$$

This requirement shall not apply to TE having a digital switching.

Compliance shall be checked using the tests outlined in section A.4.3.

10.4 (E)

Spain

PROVISION 1: See provision 1 in section 4.1.1 (E) 1.

PROVISION 2: See the provisions 1 to 5 in section A.4.1.1 (E) 1.

10.4 (E) 1

Impedance at output port (series)

10.4 (E) 1.1

Transverse return loss at output port (series)

NOTE 1: It is not included any mandatory access requirement in order to limit the minimum transverse return loss at output port (TRL2), however, a requirement about that matter is possible to be required, when necessary, for certain TEs in their respective specification.

NOTE 2: The meaning given for the term (TRL2) is according with the CCITT Recommendation G. 117 (Blue Book).

10.4 (E) 1.2

Impedance linearity (series)

PROVISION 1: See the provision 1 in section 4.1.2 (E) 1.

With series TE in both quiescent condition and high impedance condition, it shall comply

either

a) the user's manual shall include inside a square the following sentence:

"Este equipo terminal puede perturbar las condiciones de acceso a la red de un equipo transmisor de señales codificadas, cuando este esté conectado a sus terminales de salida de línea."

NOTE a: The English sentence is: "This TE can disturb the network access conditions of a code signal sender TE when it is connected to its output line terminals".

or

b) the input-output impedance shall have such a linearity that the rms voltage of the output port reflected signal for the second and third harmonics shall be 50 dB lower than the rms voltage of the fundamental input signal, tested with a signal with an open ac rms voltage of 1,5 V and frequencies from 300 Hz to 1 700 Hz, applied between the line output terminals through a resistor of 600 ohms, when a resistor of 600 ohms is connected to the line input terminals.

PROVISION b: This requirement shall not be applied for harmonic components above 3,4 kHz.

PROVISION 2: See the provision 3 in section 4.2.2.1 (E) 1.

Compliance shall be checked by the tests outlined in section 10.4 (E) 1.2.

A.10.4 (E) 1 Impedance at output port (series)

A.10.4 (E) 1.1 Transverse return loss at output port (series)

NOTE: A testing method will be included when a requirement about transverse return loss at output port (TRL2) becomes necessary.

A.10.4 (E) 1.2 Impedance linearity (series)

The testing procedure to follow is:

either

a) check that the user's manual includes the specified sentence;

or

b) the series TEUT is connected as shown in figure A.10.4 (E) 1.2.

The dc voltage source (V_f), the resistor (R_f), the inductors (L_1) and (L_2), and the capacitors (C_1) and (C_2), take the values stipulated in test A.4.1.2 (E) 1.

The resistors (R_G) and (R_L) take the value of 600 ohms.

The tests shall be made at the ac generator open circuit rms voltage (e) stipulated in the requirement in section 10.4 (E) 1.2. The generator frequency (f) takes the values of the centre frequencies of one-third of an octave in preferred series from 315 Hz to 1 600 Hz, and at 300 Hz, and 1 700 Hz.

The attenuation factors (AF2) for the second harmonic, and (AF3) for the third harmonic, are calculated using formulas A.10.4 (E) 1.2.a and A.10.4 (E) 1.2.b where V_1 is the voltmeter (V_1) reading in volts at the testing frequency (f), V_{22} is the voltmeter (V_2) reading in volts at the frequency (2 x f), and V_{23} is the voltmeter (V_2) reading in volts at the frequency (3 x f).

$$AF2 \text{ (dB)} = 20 \times \log_{10} \frac{V_1 \text{ (V)}}{V_{22} \text{ (V)}} \quad \text{Formula A.10.4 (E) 1.2.a}$$

$$AF3 \text{ (dB)} = 20 \times \log_{10} \frac{V_1 \text{ (V)}}{V_{23} \text{ (V)}}$$

Formula A.10.4 (E) 1.2.b

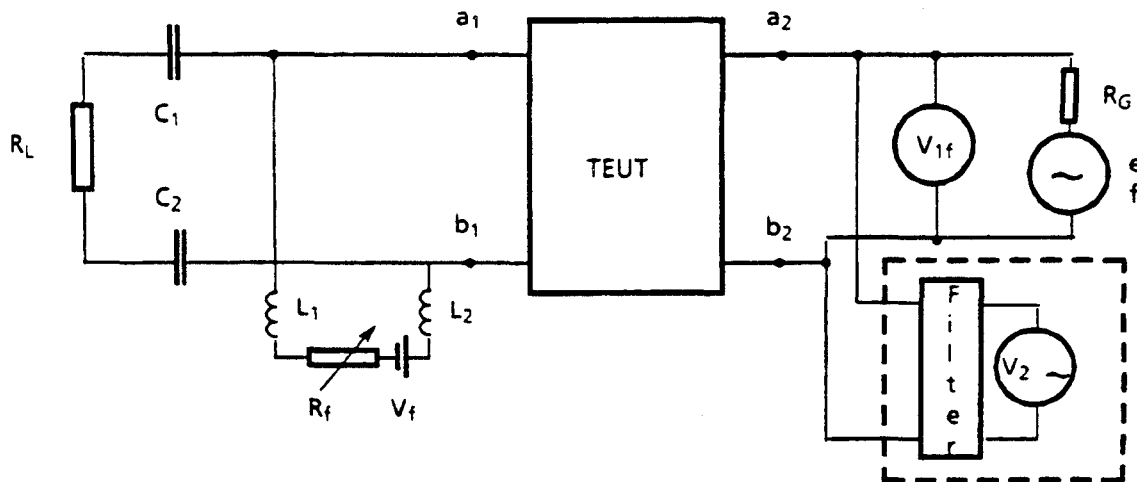


Figure A.10.4 (E) 1.2: Impedance linearity (series)

10.4 (E) 2

Impedance between line terminals and accessible parts (and earth)

10.4 (E) 2.1

Impedance between line terminals and accessible parts (and earth) in quiescent condition

With TE in the quiescent condition, the value of the modulus of the complex impedance between the line terminals, when shorted together, and any accessible part, connected to the earth terminal if it is provided, shall not be lower than the values stipulated in table 10.4 (E) 2.1 over the frequency ranges indicated, tested with a signal with an open circuit ac rms voltage of 3 V and frequencies from 300 Hz to 12 kHz, applied through a resistor of 600 ohms.

PROVISION:

This requirement shall not be applied for TE with a 50 Hz metering pulse receiver, while the reference terminal is connected to the earth protection terminal, when it exists.

Compliance shall be checked by the tests outlined in section A.10.4 (E) 2.1.

Table 10.4 (E) 2.1: Impedance between line terminals and accessible parts (and earth) in quiescent condition

Modulus limit	Frequency range
30 kΩ	300 Hz < f ≤ 3,4 kHz
10 kΩ	f = 12 kHz

10.4 (E) 2.2

Impedance between line terminals and accessible parts (and earth) in loop condition

With TE in the loop condition, the value of the modulus of the complex impedance between each one of the two line terminals, and any accessible part, connected to the earth terminal, if provided, shall not be lower than the values stipulated in requirement in section 10.4 (E) 2.1, tested with the signals stipulated in requirement in section 10.4 (E) 2.1.

PROVISION 1: This requirement shall also be applied with TE in the high impedance condition.

PROVISION 2: See the provision in section 10.4 (E) 2.1.

Compliance shall be checked by the tests outlined in section A.10.4 (E) 2.2.

A.10.4 (E) 2 Impedance between the line terminals and accessible parts

A.10.4 (E) 2.1 Impedance between the line terminals and accessible parts in quiescent condition

The TEUT is connected as shown in figure A.10.4 (E) 2.1.

The testing laboratory shall use a suitable earth plate related with the TEUT.

The dc voltage source (V_f) takes the value of 48 V and the resistor (R_f) takes the value of 600 ohms.

The test shall be made at the ac generator open circuit rms voltage (e) stipulated in the requirement in section 10.4 (E) 2.1. The generator frequency (f) takes at least the values of the centre frequencies of one octave in preferred series from 500 Hz to 2 000 Hz, and at 300 Hz, 3,4 kHz, and 12 kHz.

The modulus of the complex impedance ($||Z_e||$) is calculated using formula A.10.4 (E) 2.1, where V is the voltmeter reading in volts and I is the ammeter reading in microamperes, at each testing frequency value.

$$||Z_e|| \quad (\text{M}\Omega) = \frac{V \text{ (V)}}{I \text{ (\mu A)}} \quad \text{Formula A.10.4 (E) 2.1}$$

NOTE: The testing laboratory shall take into account the requirement in section 10.4 (E) 2.1 which refers to all accessible parts.

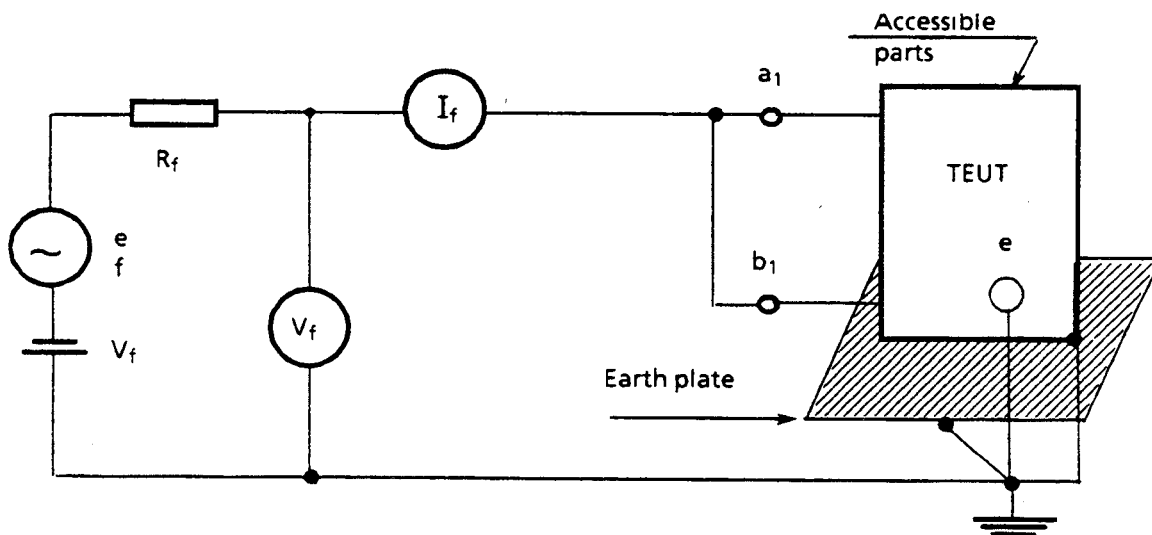


Figure A.10.4 (E) 2.1: Impedance between line terminals and accessible parts (and earth) in loop condition

A.10.4 (E) 2.2

Impedance between line terminals and accessible parts (and earth) in loop condition

The procedure of test A.10.4 (E) 2.1 is followed using the circuit shown in figure A.10.4 (E) 2.2, where the dc voltage sources (V_{f1}) and (V_{f2}) take the value of 48 V, the resistor (R_{f1}) takes the value of 600 ohms, and the resistor (R_{f2}) takes the value of 1 100 ohms.

NOTE: The testing laboratory shall take into account the requirement in section 10.4 (E) 2.2 which refers to all accessible parts.

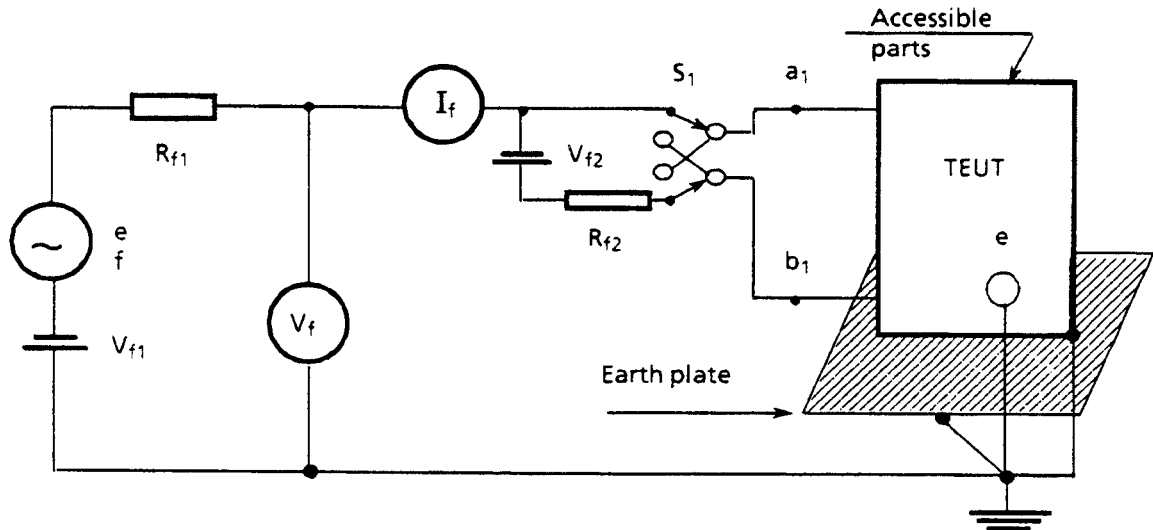


Figure A.10.4 (E) 2.2: Impedance between line terminals and accessible parts (and earth) in loop condition

10.4 (E) 3 Output signal characteristics

PROVISION: See provisions 1, 2 and 3 in section 4.4.1 (E) 1.

10.4 (E) 3.1 Longitudinal output level

NOTE 1: It is not included any mandatory access requirement in order to limit the maximum Longitudinal Output Level (LOL) originated from the ac signals transmitted from the TE, however, a requirement about that matter is possible to be required, when necessary, for certain TEs, in their respective specification.

NOTE 2: The meaning given for the term LOL is according with the CCITT Recommendation G.117 (Blue Book).

10.4 (E) 3.2 Output signal balance loss

NOTE 1: It is not included any mandatory access requirement in order to limit the minimum Output Signal Balance (OSB) of the ac signals transmitted from the TE, however, a requirement about that matter is possible to be required, when necessary, for certain TEs, in their respective specification.

NOTE 2: The meaning given for the term OSB is according with the CCITT Recommendation G.117 (Blue Book) and 0,9 (Blue Book)(formerly O.121).

10.4 (E) 3.3 Longitudinal interference threshold level

NOTE 1: It is not included any mandatory access requirement in order to limit the minimum longitudinal interference threshold level for the ac signals received for the TE, however, a requirement about that matter is possible to be required, when necessary, for certain TEs, in their respective specification.

NOTE 2: The meaning given for the term longitudinal interference threshold level is according with the CCITT Recommendation G.117 (Blue Book).

A.10.4 (E) 3 Output signal characteristics**A.10.4 (E) 3.1 Longitudinal output level**

NOTE: A testing method will be included when a requirement about Longitudinal Output Level (LOL) becomes necessary.

A.10.4 (E) 3.2 Output signal balance

NOTE: A testing method will be included when a requirement about Output Signal Balance loss (OSB) becomes necessary.

A.10.4 (E) 3.3 Longitudinal interference threshold level

NOTE: A testing method will be included when a requirement about longitudinal interference threshold level becomes necessary.

10.4 (E) 4 Protection against acoustic shocks

PROVISION 1: This requirement shall be applied only for TEs with some acoustic transducers intended to be used for the purpose of listening and capable of being placed near the ear.

With TE in the loop condition, the output acoustic pressure from any acoustic transducer like the above indicated shall be controlled in such a manner that the maximum peak value of its instantaneous acoustic pressure level shall not be in any moment greater than 126 dB relative to a sound pressure level of 20 μ Pa, tested with an impulse as stipulated in the test method in section A.10.4 (E) 4, applied between the line terminals.

PROVISION 2: This requirement shall also be applied for self-generated acoustic impulses produced when the TE changes from loop condition to quiescent condition, and from quiescent condition to loop condition, as well as when the TE starts, performs, or finishes a dialling sequence (reference is made to the requirements under sections 5.3 and 5.4 and to the associated Spanish sections (E) in order to understand the performances of that sequence), tested when no ac signals are applied between the line terminals.

PROVISION 3: No manufacturing tolerance is allowed which would permit this pressure level to be exceeded by any TE.

Compliance shall be checked by the tests outlined in section A.10.4 (E) 4.

A.10.4 (E) 4 Protection against acoustic shocks

The TEUT is connected as shown in figure A.10.4 (E) 4, with switch (S_1) in position 1.

The dc voltage source (V_f) takes the value of 48 V, and a resistor (R_f) takes the value of 1 100 ohms.

The diodes (D_1) and (D_2) have a peak reverse breakdown voltage of more than 3 kV.

The dc voltage source (V_1) takes the value of 1 500 V and the resistor (R_1) takes the value of 1 100 ohms.

The capacitor (C_1) takes the value of 20 μ F, and a capacitor (C_2) takes the value of 200 nF. The resistors (R_2), (R_3), and (R_4) take the values of respectively 50 Ω , 15 Ω , and 25 Ω .

The earpiece of the TEUT shall be acoustically terminated by couplers or artificial ear assemblies according with

- a) the IEC publication 126, for measurements on insert earphones;
- or
- b) the IEC publication 318, for measurements on supra-aural earphones.

Other earpieces, if provided, shall be adequately terminated to avoid the testing results to become disturbed.

The TEUT is caused to generate their absolute maximum output signal according with the user's manual.

Switch (S_1) is changed to its position 2, and the instantaneous acoustic pressure shall be measured by a sound level meter according with the IEC publication 651 (1979), or according with the IEC publication 179 (1965), in peak detection mode with the A-weighted scale.

When the provision 2 in section 10.4 (E) 4 is applied, switch (S_1) shall be in position 1.

The test procedures shall be carried out at least three times and the result with the maximum value shall be chosen.

PROVISION:

This test shall be carried out before certain other tests (see section 10.1 (E) 1).

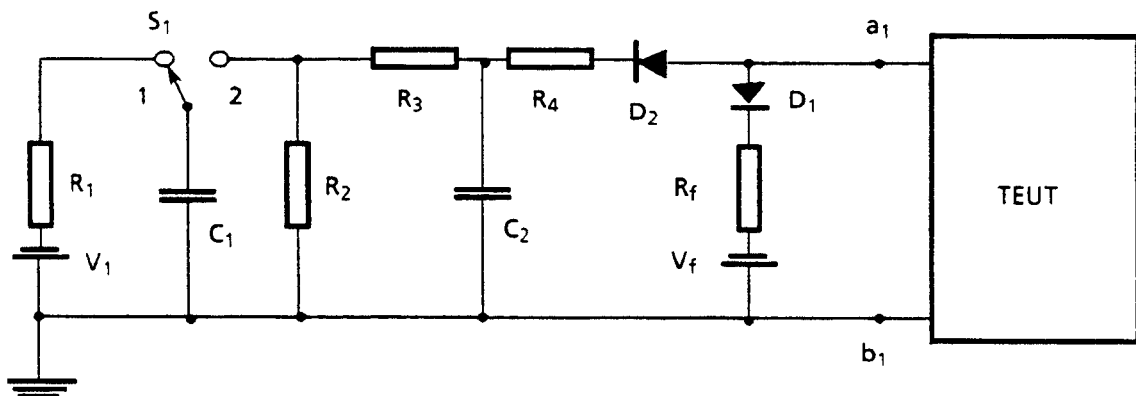


Figure A.10.4 (E) 4: Protection against acoustic shocks

10.4 (E) 5

Cross-talk between input terminals of two lines (multi-line)

With multi-line TE, the protection against cross-talk between the input line terminals of any line in loop condition and the input line terminals of another line in the three following conditions, quiescent condition, loop condition, or high impedance condition, shall not be lower than 65 dB, tested with a signal with an open circuit ac rms voltage of 1,5 V and

frequencies from 300 Hz to 3,4 kHz, applied between the line terminals of a line through a resistor of 600 ohms, when the unwanted signal is measured over a resistor of 600 ohms connected to the line terminals of the other line.

This requirement shall, however, not be applied between two lines in loop condition or high impedance condition, while these two lines are involved in the same communication (e.g. three party conference, etc.).

Compliance shall be checked by the tests outlined in section A.10.4 (E) 5.

A.10.4 (E) 5 Cross-talk between input terminals of two lines (multi-line)

The TEUT is connected as shown in figure A.10.4 (E) 5.

The dc voltage sources (V_{f1}) and (V_{f2}) take the value of 48 V. The resistors (R_{f1}) and (R_{f2}) take the value of 1 100 ohms.

The value of the inductors (L_1), (L_2), (L_3), and (L_4) shall not be lower than 5 H. The value of the capacitors (C_1), (C_2), (C_3), and (C_4) shall not be lower than 20 μ F.

The generator output resistance (R_G) takes the value of 600 ohms.

The load resistor (R_L) takes the value of 600 ohms.

The tests shall be made at the ac generator open circuit rms voltage (e) stipulated in section 10.4 (E) 5. The generator frequency (f) takes at least the values of the centre frequencies of one octave in preferred series from 500 Hz to 2 000 Hz, and at 300 Hz and 3,4 kHz.

The cross-talk protection (CTP) is calculated using formula A.10.4 (E) 5, where V_1 is the voltmeter (V_1) reading in volts, and V_2 is the voltmeter (V_2) reading in volts, at each testing frequency value.

$$\text{CTP (dB)} = 20 \times \log_{10} \frac{V_1 \text{ (V)}}{V_2 \text{ (V)}} \quad \text{Formula A.10.4 (E) 5}$$

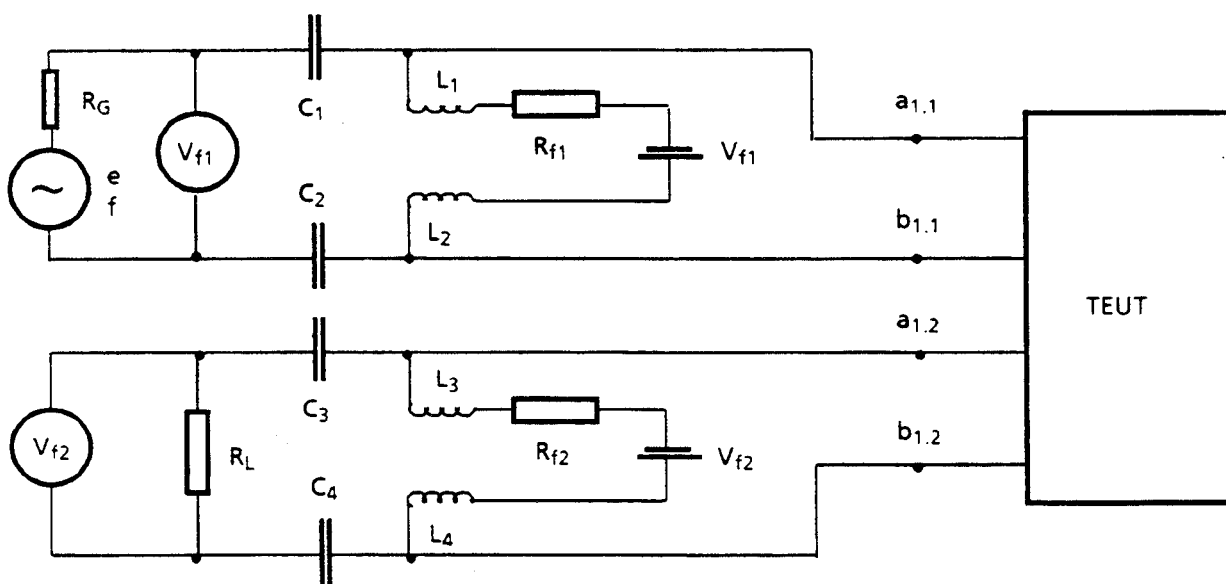


Figure A.10.4 (E) 5: Cross-talk between input terminals of two lines (multi-line)

10.4 (S) Sweden

10.4 (S) 1 General transmission requirement

The equipment must be designed so that the specified limit values cannot be exceeded by actuating any easily accessible control/adjustment devices. It is, however, allowed to design the equipment so as to make it possible to set send levels of up to 0 dBm (e.g. by steps of 1,0 dB) by other means after obtaining a special permit applying to a certain subscriber.

10.4 (S) 2 Impedance to earth

The impedance to earth, measured with ac-linked branches must, in both the idle and connected states, exceed the following values in the specified frequency band:

0	-	55	Hz	1	Mohm
55	-	300	Hz	100	kohms
300	-	4 000	Hz	20	kohms
4 000	-	90 000	Hz	3	kohms

This requirement must be fulfilled when an electrically conducting casing is earthed and also when equipment with an insulating casing is placed on an earthed metal sheet.

10.4 (S) 3 Equipment for acoustic coupling is not covered by requirements for approval testing, but it shall be designed so that it cannot disturb the telecommunications network.

A.10.4 (S) 3 Acoustic coupling requirements

Tests are carried out by connecting the device under test to the handset of the telephone in the manner specified in the equipment's user's manual (if the arrangement to be used is not set forth unambiguously in the user's manual, the connection shall normally be made in the manner that provides the highest output level). The level is measured across 600 ohms on the line side of the telephone set using an instrument that reads rms values.

For measurements during sending a telephone set having the transmission data shown in the figure is assumed. The frequency response curves of the figure is measured according to CCITT Recommendation P.64. If a telephone set having different sensitivity is used, the levels that are measured must be corrected at the frequencies in question.

NOTE: The frequency response curve presented in figure A.10.4 (S) 3 cannot be used directly to obtain the relationship between sound pressure and line level when acoustic coupling equipment is connected to a telephone set. The type of coupling, the cavities that are formed, etc... can result in a frequency response curve that differs widely from that obtained in a free sound field.

dB rel 1 V/pa

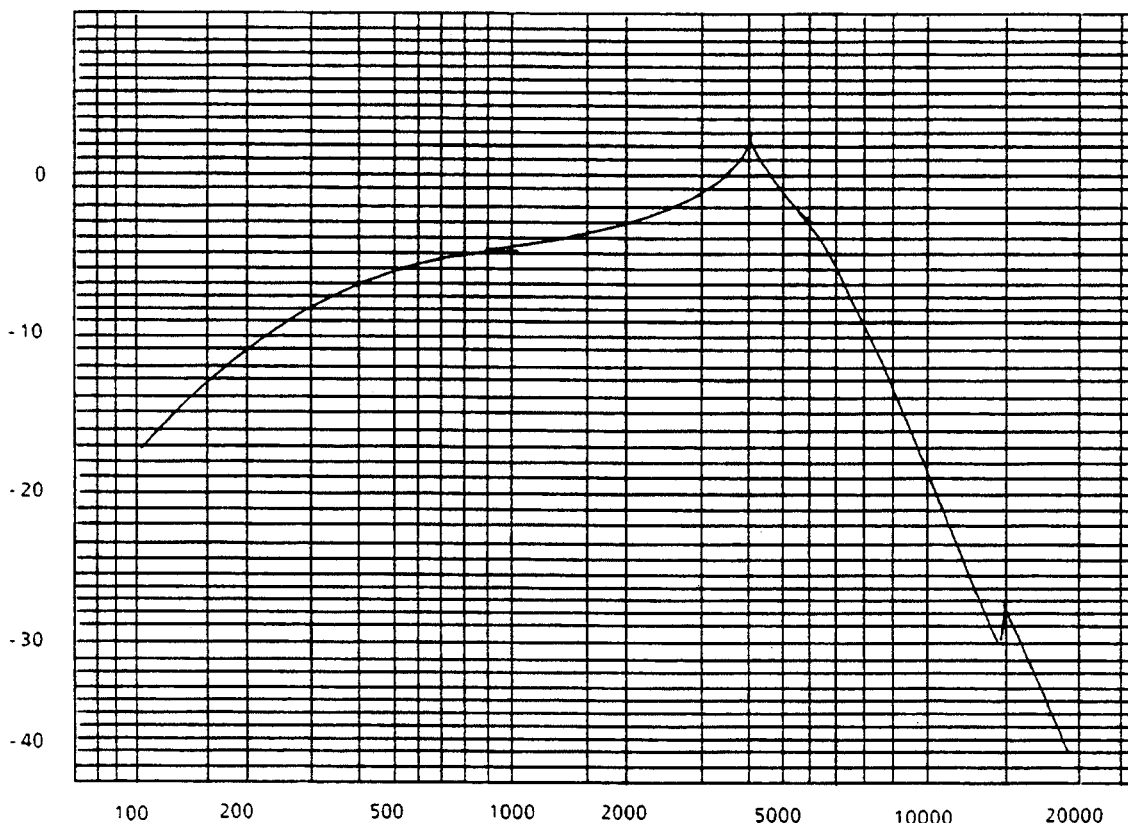


Figure A.10.4 (S) 3: Frequency response curve

10.4 (S) 4

There shall be complete secrecy between equipment connected to one socket and equipment connected to another socket with the exception of a maximum 100 ms transient stage, during which even parallel connection is allowed.

Measurement of the cross-talk between the TEs shall be made by supplying a test tone at the frequency 1 020 Hz and at the level 0 dBm to the connection pins 1 and 2 of the plug if the plug is the type used by Swedish Telecom, respectively contacts 4 and 5, if the plug is designed according to SS-ISO 8877. The power level into a load of 600 ohms at the connection pins 3 and 4, if the plug is of the type used by Swedish Telecom, respectively at the contacts 3 and 6 if the plug is designed according to SS-ISO 8877, shall not exceed -78 dBm. An instrument cord of a specified cord of a specified maximum length shall be used for the measurement.

10.4 (GB) 1

Multi-line series-connected TE crosstalk attenuation

Multi-line series-connected TE, when in a mode that does not involve dialling or ringing, the crosstalk attenuation between separate circuits of the TE at frequencies in the range 300 Hz to 3 400 Hz shall be not less than 70 dB.

Compliance shall be checked by the test described in A.10.4 (GB) 1.

A.10.4 (GB) 1

The multi-line series-connected TE is connected in the circuit shown in figure A.10.4 (GB) 1. A sinusoidal test signal of 1,0 V ac rms is used.

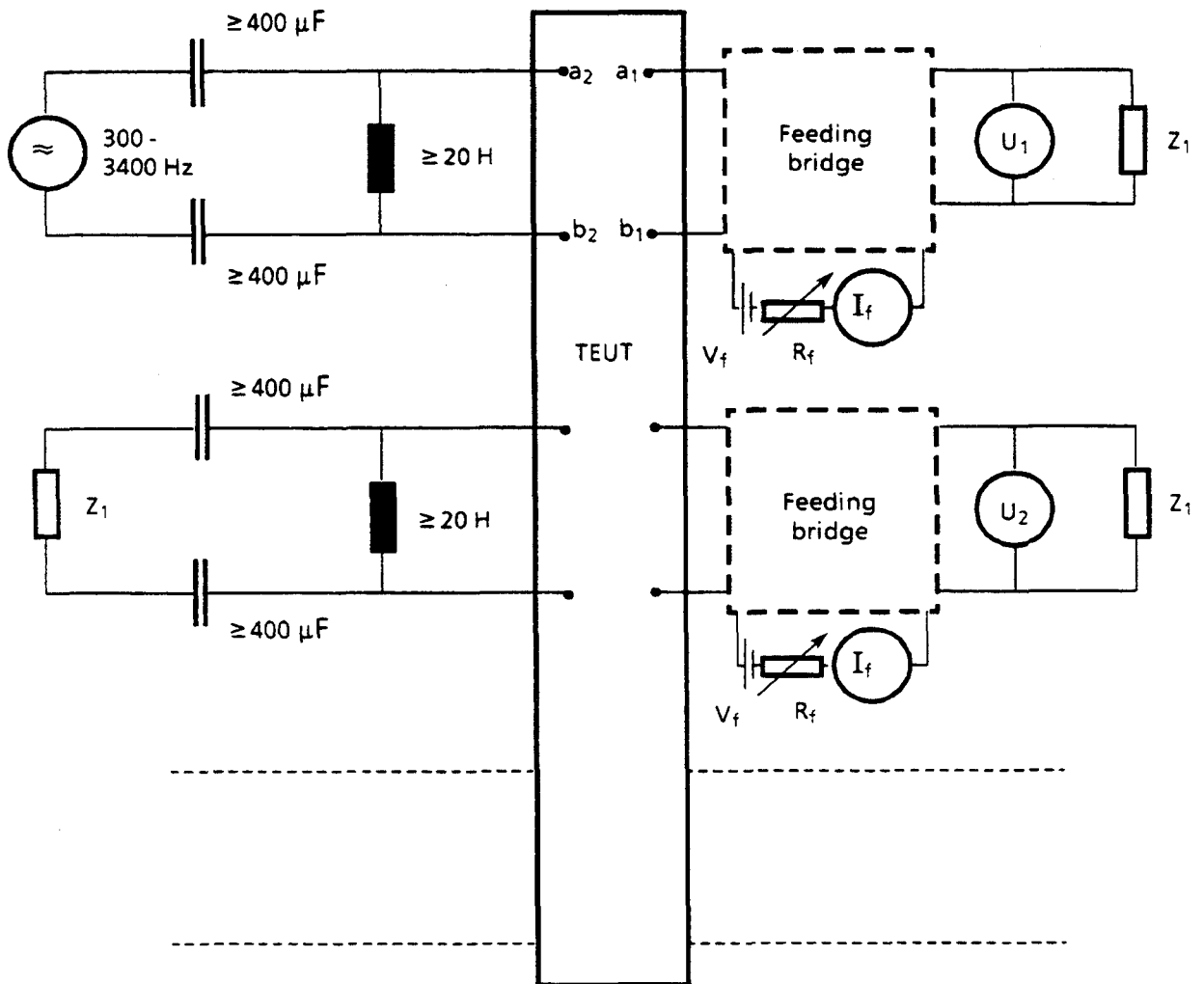
Voltages U_1 and U_2 are measured by a selective level measuring set. Cross-talk attenuation, expressed in dB, is calculated according to the formula A.10.4 (GB) 1.

$$\text{Cross-talk attenuation} = 20 \log_{10} \frac{U_1}{U_2} \text{ dB} \quad \text{Formula A.10.4 (GB) 1}$$

Where the TEUT has ten lines or fewer, the cross-talk tests are carried out on all pairs of lines. Where the number of lines exceeds ten, the number of pairs of lines to be tested is reduced by taking account of modularity of construction of the TEUT, but at least 50 combinations are tested.

In such cases the tests are carried out as follows:

Taking one module at random, cross-talk measurements are made on up to 25 combinations taken at random within the module. At least a further 25 combinations are tested, made up from one pair taken at random in the first module tested against one or more pairs in each remaining modules.



Z_1 is the network shown in figure 4.1.2 (GB) 1.

Figure A.10.4 (GB) 1: Cross-talk test circuit

10.5 Calling function

10.5 (A) Austria

10.5 (A) 1 Bouncing time

The bouncing time of the dialling contacts shall be ≤ 3 ms.

10.5 (A) 2 Decadic dialling distortion caused from a series connected TE

A series connected TE can cause a distortion on decadic dialling pulses, which are sent out from a second attached TE. The break and make time of the decadic dialling pulses to the PSTN may be thereby longer or shorter for a certain time t_d . The value of the time t_d shall not exceed $\pm 0,5$ ms.

A.10.5 (A) 2 Decadic dialling distortion caused from a series connected TE

The TEUT is connected as shown in figure A.10.5 (A) 2.

$V_f = 60$ V, $I_f = 19$ mA, 60 mA, $R_s = 100$ ohms.

The measurement of the dialling pulse timing from a second attached TE (e.g. telephone set) shall be made one time with the switch S opened and one time with the switch S closed. The results of the time values have to be compared.

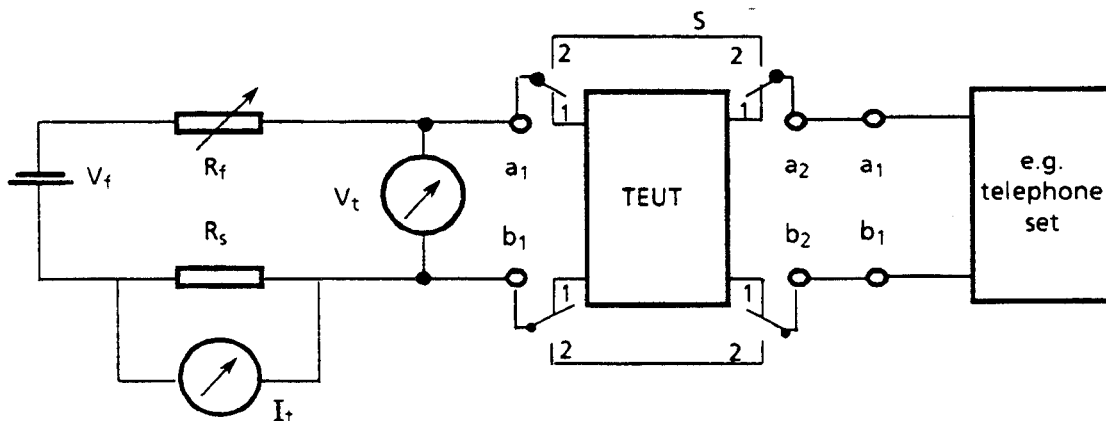


Figure A.10.5 (A) 2: Decadic dialling distortion caused from a series connected TE

10.5 (A) 3 Automatic initiation of dialling in PABX

TE with automatic initiation of dialling and connected in PABX shall be controlled after the establishment of loop condition only by a timer function.

The time period t_1 shall be > 2 s.

After the trunk line access function a dial tone detection is required. The dial tone detection is not required if the PABX includes a dial tone detection.

10.5 (B) Belgium

10.5 (B) 1 Dialling system for TE with automatic calling functions

TE with automatic calling functions shall be able to provide either decadic dialling and MFPB (DTMF) signals.

Compliance shall be checked by inspection.

10.5 (F) France

10.5 (F) 1 TEs with only decadic dialling (loop pulsing) as dialling facility are not authorised to be connected to the PSTN. TEs with dialling facility shall offer either only DTMF (MFPB) dialling or both dialling systems (loop pulsing and DTMF).

10.5 (F) 2 TEs in decadic dialling state shall either shunt the wire connected to pin 1 with the wire connected to pin 2 (see section 8.2 (F)) or exhibit a device which limits the voltage between these wires below 6 V.

10.5 (F) 4 Any "on-hook" of duration higher than 350 ms during manually initiated dialling shall stop the sending of the possible remaining stored digits and reset all digits stored during this dialling.

10.5 (F) 5 In the case of manual dialling or initiation of dialling, the sending on the line of the call number shall be indicated either acoustically or visually to the user.

10.5 (F) 6 TE with dialling facility shall be able to dial a number of at least 13 digits for national use or a number of at least 16 digits for national and international use.

10.5 (F) 7 TE with full automatic calling facility, intended to call manual answering TE and able to dial more than 4 different call numbers*, shall conform, in addition to section 5.6, to the following requirements:

- a) not to provide system allowing sequences with autogeneration of call numbers;
- b) send to the PSTN, as first message, an identification speech signal indicating clearly the name and call number of the calling party (this message shall not be alterable by the user);
- c) to invalidate any call number having caused two successive premature "on-hook" before the end of the message;
- d) able to limit the call periods in particular time ranges;
- e) no recall to the same number for the same message more than two times per day (under study);

* TE with call number storage facility from an associated software is considered to be able to dial more than 4 different call numbers.

10.5 (D) Germany

10.5 (D) 1 Dialling

10.5 (D) 1.1 The following conditions are applicable for TE which is able to generate dialling information for establishing a call.

- 10.5 (D) 1.2** A distinction is made between the pulse dialling method and the multi-frequency method. It is permissible for the user to switch between the dialling methods. The dialling method which is set must be protected (e.g. by special operating procedure or reposing switch) so that it cannot be changed inadvertently.
- 10.5 (D) 1.3** TE may be switched over to other signalling systems in the operating mode. TE which provides the possibility of temporarily setting the dialling device for other signalling systems must automatically return to the preset dialling mode after the transition from the idle to the operating mode and also, for instance, after a signal button has been operated.
- 10.5 (D) 1.4** Any method may be used for entering the dialling information. If the information is entered by means of pressing buttons, the dialling information must be reliably recorded if the individual buttons are pressed for ≥ 40 ms and if the buttons are pressed at intervals of ≥ 100 ms. For testing purposes, buttons are pressed for 40 ms and at intervals of 100 ms.
- 10.5 (D) 1.5** A memory for storing a minimum of 16 digits must be provided for direct dialling by means of push button operation. This is to store a number which is entered quickly until the dialling operation has been completed.
- 10.5 (D) 1.6** If for the entering of the call number by direct dialling a keypad is used which is arranged in four lines and three columns, the matrix given in CCITT Q.11 is recommended. See figure 10.5 (D) 1.6.

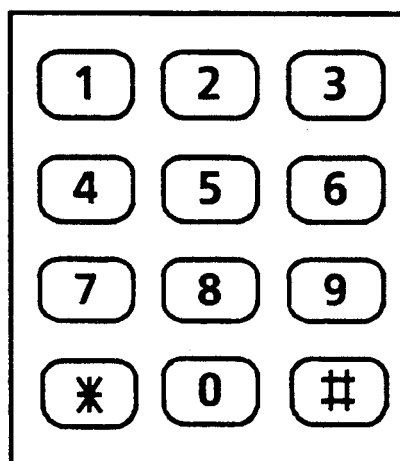


Figure 10.5 (D) 1.6

The keys which bear the inscription * and # shall, in the pulse dialling mode, not be assigned any direct dialling function.

- 10.5 (D) 1.7** No undefined characters may be generated when several operating elements are pressed simultaneously. In the DTMF dialling mode it is permitted to generate signal frequencies from table 5.4.2.a by depressing several keys at the same time.
- 10.5 (D) 1.8** If a key is permanently depressed, then it must be interpreted as a single key stroke.
- 10.5 (D) 1.9** When the first key depression starts to be effective (ready for dialling), the dc resistance of the TE may be ≤ 700 ohms for $t \leq 30$ ms.

- 10.5 (D) 1.10 During the interdigit period, loop interruptions ≤ 150 ms on the network must not affect pulse generation.
- 10.5 (D) 1.11 The dialling procedure shall be interrupted automatically both when the cradle switch is actuated for ≥ 300 ms, provided a cradle switch detection is included in the TE, and when the loop interruption of 300 ms occurs during the inter-digital period, with no cradle switch detection built in.
- 10.5 (D) 1.12 The bounce times of a pulse contact must be ≤ 3 ms and must be terminated within the values stated for pulses and pauses.
- 10.5 (D) 2 **Manual initiation of dialling from memories without automatic redialling**
- This section specifies the requirements for
- initiation of dialling from memories;
 - transmission initiation;
 - transmission duration control.
- 10.5 (D) 2.1 **Definitions, flow of functions**
- 10.5 (D) 2.1.1 Call up from memories means that the dialling processes are not initiated by direct dialling (e.g. by pressing a destination key).
- 10.5 (D) 2.1.2 The initiation of a dialling function must be performed manually; automatic redialling or initiation of dialling processes is not allowed.
- 10.5 (D) 2.1.3 Manual initiation is normally made by the user operating a "start" button or by some other physical action.
- 10.5 (D) 2.1.4 As a result of this initiation the TE commences the appropriate dialling procedure.
- 10.5 (D) 2.1.5 Figure 10.5 (D) 2 gives an overview of the various combinations within a calling procedure from memories, which is intended to show how the subsections which follow fit together during a normal calling procedure.
- 10.5 (D) 2.1.6 TEs with automatic calling function are capable of performing repeat call attempts to any one number, or to different numbers one after another.

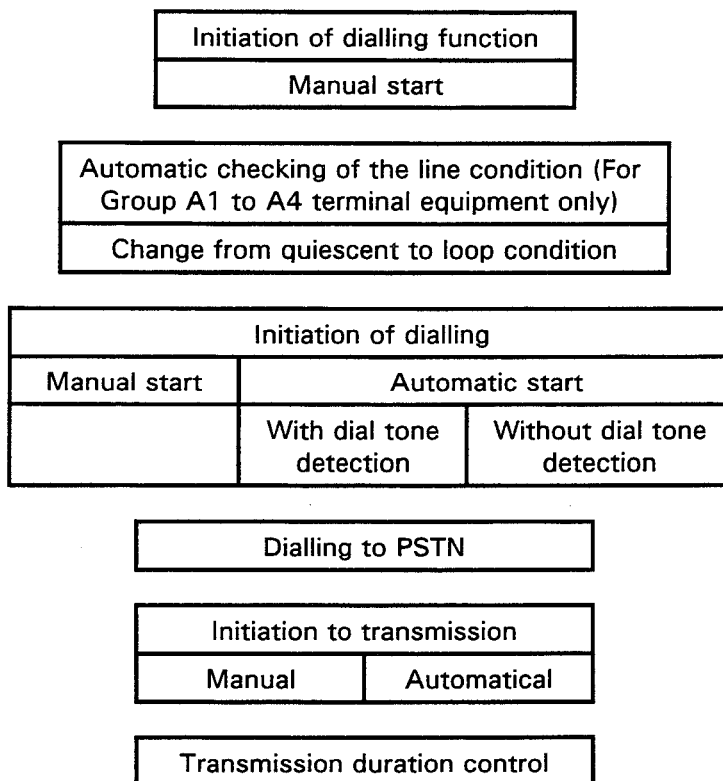


Figure 10.5 (D) 2

- 10.5 (D) 2.2 General requirements**
- 10.5 (D) 2.2.1 Particular reference is made to paragraph 10.1 (D) 2.5.
- 10.5 (D) 2.2.2 TE with number storage facilities must not initiate dialling when unoccupied or erased memory locations have been called up.
- 10.5 (D) 2.2.3 TE with automatic on-hook dialling facilities must include a call progress monitor in order to enable audible and/or visible monitoring of the progress of the call attempt.
- 10.5 (D) 2.3 Automatic checking of line condition for Group A terminal equipment**
- Prior to assuming the loop condition, the Group A additional equipment (see 8.3 (D) 3.1) must check the line condition (whether busy or not) and must react in accordance with its interworking mode.
- 10.5 (D) 2.4 Initiation of dialling**
- 10.5 (D) 2.4.1 Initiation of dialling may be controlled manually, or automatically.
- 10.5 (D) 2.4.2 Automatic initiation of dialling must be controlled by a dial tone detector and/or by a timer function, within the TE.
- 10.5 (D) 2.4.3 If the TE includes a dial tone detector, dialling must not be initiated until the dial tone has been detected.
- 10.5 (D) 2.4.4 If the TE includes a timer function, dialling must not be initiated until a time period of 2,5 s has elapsed, but must be initiated before the time period of 6,5 s has elapsed, following the establishment of the loop condition.

10.5 (D) 2.5 Initiation of transmission

10.5 (D) 2.5.1 Initiation of transmission may be controlled manually, or automatically.

10.5 (D) 2.5.2 If the initiation of transmission is effected automatically, immediately after dialling has been completed the TE shall switch to its transmitting part.

10.5 (D) 2.6 Transmission duration control

The control of the transmission duration is up to the user. An automatic return to idle state is not required.

10.5 (P) Portugal

10.5 (P) 1 Loop current interruption during the interpulsing period in decadic dialling

When dialling with loop pulsing, during the interpulsing period, the TE shall sustain, with no effects on its normal operation, one loop current interruption for a maximum period of 110 ms starting 100 ms after time t_g (see section 5.3.1.2 (P) 1) in the last break pulse of the previous pulse train. Besides, 10 ms after that interruption the loop current shall reach a value not less than 20 mA.

Compliance shall be checked by the tests outlined in section A.10.5 (P) 1.

A.10.5 (P) 1 Loop current interruption during the interpulsing period in decadic dialling

The TEUT is connected as shown in figure A.10.2 (P) 1. Switch S_t is closed and the TEUT is caused to emit a dialling signal of two successive pulse trains.

Then, 100 ms after time t_g in the last break pulse of the first pulse train, switch S_t is opened for 110 ms and the line current is measured according to the requirement.

After the interruption, the TEUT shall continue to operate normally in order to perform as usual its functions related with the network interworking.

10.5 (P) 2 Switching after dialling condition

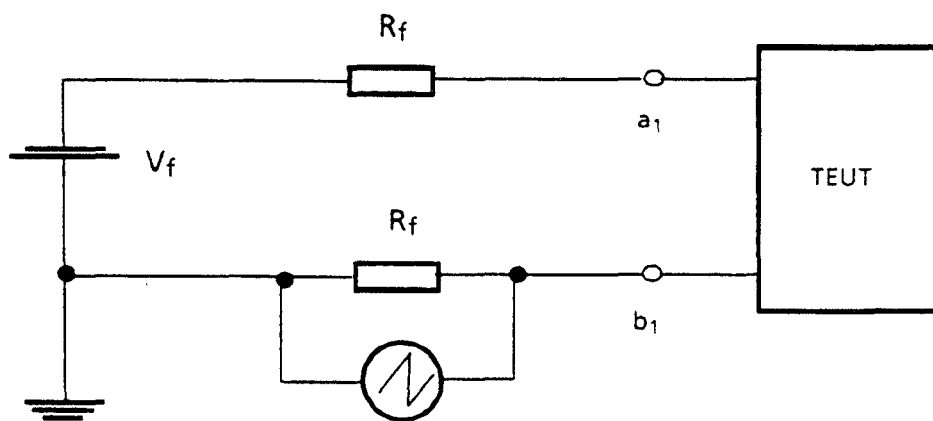
TE capable of dialling shall at termination of the dialling condition revert to the loop condition in such a way that the loop current shall reach a value not less than 20 mA, 4 ms after the commencement of that change.

Compliance shall be checked by the tests outlined in section A.10.5 (P) 2.

A.10.5 (P) 2 Switching after dialling condition

The TEUT is connected as shown in figure A.10.5 (P) 2 and placed in the loop condition. After that it is caused to enter the dialling condition.

The loop current shall be registered during a change from the dialling condition to the loop condition.



$$V_f (V) = 48$$
$$R_f (\Omega) = 200$$

Figure A.10.5 (P) 2: Switching after dialling condition

10.5 (E)

Spain

PROVISION:

See the provisions 1 to 4 in section 5.2.1 (E) 1.

10.5 (E) 1

General

(The contents of this section shall be used for Spain (E) as more appropriate than the contents of section 5.1)

A TE with a calling function is a terminal that is prepared for providing one or several of the following facilities:

- a) establishment of loop condition;
- and/or
- b) start of the dialling sequence (with or without automatic dial tone reception);
- and/or
- c) dialling sequence (in whatever mode, loop pulsing, DTMF signals, or both, it may be done);
- and/or
- d) establishment of dialling sequence after a dialling sequence;
- and/or
- e) sending of identification signals;
- and/or
- f) control of the duration of the loop condition;
- and/or
- g) control of automatic call attempts.

Depending on what of these facilities are provided by the TE, it shall meet the relevant requirements included in sections from 10.5 (E) 2 to 10.5 (E) 11 and also in the Spanish sections (E) of Chapter 5.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 1.

A.10.5 (E) 1 General

The testing procedure to follow is to check by inspection and according with the user's manual and by any other technical documentation which facilities are provided by the TEUT.

10.5 (E) 2 Establishment of loop condition

PROVISION: Each individual call shall begin with the establishment of loop condition, either in the TE or in another associated TE.

With TE in the quiescent condition, it shall be able

either

- a) to change to loop condition, according with the requirements in sections 2.4.1 (E) 1 and 2.3 (E) 1;

PROVISION a: This change can be done either manually or automatically.

or

- b) to enable other associated TE to assume the loop condition, according with the requirement in section 2.4.1 (E) 2.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 2.

A.10.5 (E) 2 Establishment of loop condition

The testing procedure to follow is to check that relevant tests have been carried out.

10.5 (E) 3 Start of dialling sequence

10.5 (E) 3.1 Manual start and automatic start with dial tone

When the TE in the loop condition is prepared for dialling

- a) the start of dialling sequence can be done
 - either
 - i) manually, controlled by the user;
 - and/or
 - ii) automatically, then the TE shall have a dial tone receiver according with the requirements in sections 5.2.1 (E) 1.a, 5.2.2 (E) 1, 10.5 (E) 4.2, so that the dialling sequence shall not start until the dial tone from the network has been received;

NOTE: In the Spanish network a second intermediate dial tone is implemented for international outgoing calls.

and

- b) the restart of the dialling sequence, when an international call attempt is going on, can be done
 - either
 - i) manually, controlled by the user;
 - and/or
 - ii) automatically, then the TE shall have a dial tone receiver according with the requirements in sections 5.2.1 (E) 1.b, 5.2.2 (E) 1, 10.5 (E) 4.1.b, and 10.5 (E) 4.2, so that the dialling sequence shall not restart until the intermediate dial tone from the network has been received.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 3.1.

10.5 (E) 3.2 Automatic start without dial tone

When the TE in the loop condition is prepared for dialling and has a dial tone receiver that is intended for automatic start and/or restart of the dialling sequence,

a) it shall end the call attempt and establish the quiescent condition according with the requirements in sections 2.2.1.1 or 2.2.1.1 (E) 1, within a period no greater than

i) 15 seconds from the change to loop condition;

and/or

ii) 15 seconds from the end of the international service prefix dialling;

when no signal is applied to the line terminals or under the conditions stipulated in the requirements in sections 5.2.2 (E) 1 and 10.5 (E) 4.2.

and

b) the maximum number of successive unsuccessful (without any intermediate manual control and no dial tone has been received) call attempts to any number in any period of 60 minutes shall not be greater than 4 attempts;

and

c) the duration of the period between the change to quiescent condition at the end of one call attempt and the change of loop condition at the beginning of the following call attempt, shall not be lower than 2 seconds.

PROVISION 1: The meaning given for the term call attempt is a sequence of operations made automatically by the TE trying to obtain, or taking part in the obtaining of, a communication with the desired called number.

PROVISION 2: However, for alarm transmitter TEs, it is possible to start and/or restart the dialling sequence after a waiting period of at least 7 seconds has elapsed, when

either

i) the present call attempt is not the first one, while the TE is connected to only a line;

or

ii) at least an unsuccessful call attempt has been done over each of the other lines, while the TE is connected to more than one line;

and

iii) all the preceding call attempts have been waiting for the dial tone during a period of at least 7 seconds.

PROVISION 3: However, for TE that after manual establishment of the loop condition activate a call progress monitor in order to enable audible monitoring of the progress of the call attempt, it is possible to start and/or restart the dialling sequence after a waiting period of at least 7 seconds.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 3.2.

A.10.5 (E) 3 Start of dialling sequence

A.10.5 (E) 3.1 Manual start and automatic start with dial tone

The TEUT is connected as shown in figure A.5.2.1.

The dc voltage source (V_f) takes the value of 48 V, and the resistor (R_f) takes the value of 1 100 Ω .

The generator output resistance (Z_G) takes the value of 600 Ω .

The switch (S_t) is normally opened, and the switch (S) is in its position 2.

A suitable instrument is used to document both the dc changes and the ac voltage between the line terminals.

The tests shall be made with a generator open circuit ac rms voltage (e) of 275 mV. The generator frequency (f) takes the value of 425 Hz for the requirement in section 10.5 (E) 3.1.a, and 600 Hz for the requirement in section 10.5 (E) 3.1.b.

Check by inspection using the instrument, and closing the switch (S_t) when necessary, the relevant facilities of the TEUT.

A.10.5 (E) 3.2 Automatic start without dial tone

The procedure of test in section A.10.5 (E) 3.1 is followed, where the switch (S_t) is either opened, or closed when the testing signals used in the tests in sections A.5.2.2 (E) 1 and A.10.5 (E) 4.2 are applied.

Check by inspection the relevant facilities of the TEUT using the instrument.

10.5 (E) 4 Dial tone reception

10.5 (E) 4.1 General of dial tone reception

With TE in the loop condition, which has a dial tone receiver that, because of the requirement in section 10.5 (E) 3.1.a.ii and/or in section 10.5 (E) 3.1.b.ii, is intended for automatic start and/or restart of the dialling sequence, the transverse return loss (TRL) in relation to a resistor of 600 Ω ($\pm 1\%$) shall not be:

- a) lower than 10 dB during the period from two seconds after the establishment of loop condition to the start of dialling, tested with a signal with an open circuit ac rms voltage of 1,55 V and frequencies from 320 Hz to 480 Hz, applied between the line terminals through the reference resistor of 600 Ω ;

and/or

- b) lower than 12 dB during the period from the end of international service prefix dialling to the restart of dialling, tested with the signals stipulated in paragraph a, with frequencies from 570 Hz to 630 Hz.

NOTE: Reference is made to the requirement in section 4.1.2 (E) 1.

Compliance is checked using the tests outlined in section A.10.5 (E) 4.1.

10.5 (E) 4.2 Dial tone receiver immunity

With TE in the loop condition, which has a dial tone receiver that, because of the requirement in section 10.5 (E) 3.1.a.ii and/or in section 10.5 (E) 3.1.b.ii, is intended for automatic start and/or restart of the dialling sequence, it shall:

neither

a) start the dialling sequence;

nor

b) restart the dialling sequence;

after a series of single, stray, short noise pulses are applied between the line terminals as stipulated in the associated testing method.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 4.2.

A.10.5 (E) 4 Dial tone reception

A.10.5 (E) 4.1 General of dial tone reception

The procedure of test in section A.4.1.2 (E) 4.1 is followed where the tests shall be made at the generator open circuit ac rms voltage (e) stipulated in the associated requirement, and the generator frequency (f) takes the values of 320 Hz, 425 Hz, and 480 Hz for the requirement in section 10.5 (E) 4.1.a, and the value of 600 Hz for the requirement in section 10.5 (E) 4.1.b.

A.10.5 (E) 4.2 Dial tone receiver immunity

The TEUT is connected as shown in figure A.10.5 (E) 4.2, where the instrument, the dc voltage source (V_f), the resistor (R_f), the inductors (L_1) and (L_2), and the capacitors (C_1) and (C_2), are as stipulated in the test in section A.5.2.1 (E) 1 for figure A.5.2.1, and

- the dc voltage source (V_1) takes the value of 100 V, and the resistor (R_1) takes the value of 10 Ω ;
- the resistor (R_2) takes the value of 10 Ω , and the resistor (R_3) takes the value of 600 Ω ;
- the capacitor (C_3) takes the value of 1 μF ;
- the switch (S_1) shall be operated at a frequency of 1 Hz.

NOTE: See also the test in section A.10.5 (E) 3.2.

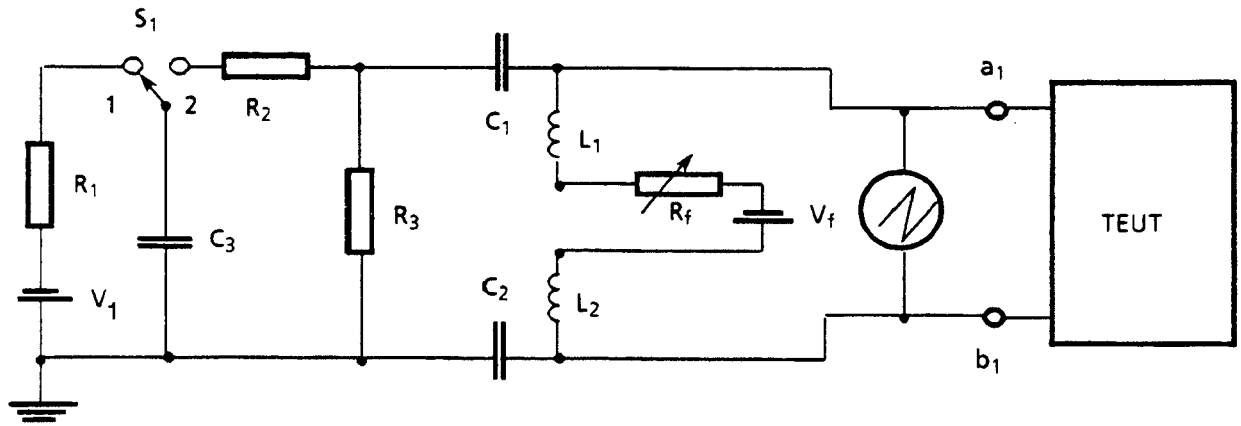


Figure A.10.5 (E) 4.2: Dial tone receiver immunity

10.5 (E) 5

Dialling sequence

PROVISION 1: At the start of the dialling sequence, the TE assumes the dialling or signalling state; this assumption can be done from its own loop condition, or for series TE taking the loop condition from an associated TE connected to the line output terminals.

PROVISION 2: The dialling sequence can be done

- 2a) dialling with loop pulsing;
- or
- 2b) dialling with DTMF signals;
- or
- 2c) dialling with a train of DTMF signals and loop pulsing.

PROVISION 3: When the dialling sequence is wholly or partly done with loop pulsing, it shall be done according with the requirements stipulated in sections 5.3, 5.3 (E), and 10.5 (E) 6.

PROVISION 4: When the dialling sequence is wholly or partly done with DTMF signals, it shall be done according with the requirements stipulated in sections 5.4, 5.4 (E), and 10.5 (E) 7.

When the TE in the dialling sequence is only prepared for dialling with DTMF signals, the user's manual shall include inside a square the following sentence:

"Este equipo terminal debe conectarse solamente a líneas que dispongan de la facilidad suplementaria de marcación multifrecuencia"

NOTE: The equivalent English sentence is: "This TE shall only be connected to the lines where the supplementary facility of dialling with multifrequency signals is provided".

PROVISION 5: The dialling sequence can be done

- a) wholly manually;
- or
- b) wholly automatically;

or

- c) partly manually and partly automatically.

PROVISION 6: At the end of the dialling sequence, the TE leaves the dialling or signalling state; this can be done reverting to its own loop condition, or for series TE allowing an associated TE connected to the line output terminals to come back to the loop condition.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 5.

A.10.5 (E) 5 Dialling sequence

The testing procedure to follow is to check that, when necessary, the user's manual includes the required sentence.

10.5 (E) 6 Dialling with loop pulsing

10.5 (E) 6.1 General of dialling with loop pulsing

With TE in the dialling condition, during the dialling sequence with loop pulsing, it shall meet the following requirements:

- a) When the dialling sequence with loop pulsing is done manually with a rotary dial
- i) the holes through the moving dial shall contain only digits;
- and
- ii) the digits on the dial shall be arranged in the following anti-clockwise order:
1, 2, 3,...,9,0;

PROVISION a1: For the purpose of this requirement, it is permitted, however, to have cavities instead of holes, and/or to have a designation additional to the digits, when the user's manual includes the sentence mentioned in the following provision a2.

PROVISION a2: The user's manual, under the conditions of the provision a1 above, shall include inside a square the following sentence:

"La realización y/o designación del disco de marcación de este equipo terminal es diferente de la de los aparatos telefónicos más frecuentemente usados".

NOTE a2: The equivalent English sentence is: "The implementation and/or the designation of the rotary dial of this TE are different from those of the more frequently used telephone sets".

or

- b) when the dialling sequence with loop pulsing is done manually with a keypad
- i) the designation of the push-buttons shall be on or next to the push-buttons;
- and
- ii) when the designation is on the push-buttons, it shall contain only a digit (or a symbol) (or a letter) on each push-button;
- and
- iii) the push-buttons shall be arranged in the "1, 2, 3" order, according with the CEPT Recommendation T/CS 34-01 (Innsbruck, 1981)(see also CCITT Recommendation E.161, Blue Book), where it is not required to supply the buttons *, #, A, B, C, and D;

PROVISION b1: For the purpose of this requirement, it is permitted, however, to have other arrangement and/or to have a designation additional to the digits (or symbols), when the user's manual includes the sentence in the following provision b2.

PROVISION b2: The user's manual, under the conditions of the provision b1 above, shall include inside a square the following sentence:

"La disposición y/o designación de los pulsadores del teclado de marcación de este equipo terminal es diferente de la de los aparatos telefónicos más frecuentemente usados".

NOTE b2: The equivalent English sentence is: "The arrangement and/or designation of the push-buttons of the dialling keypad of this TE are different from those of the mire frequently used telephone sets".

and

c) the requirement in section 2.2.2.1 (E) 1;

and

d) the requirement in section 10.2 (E) 1 (for multi-line TE);

and

e) all associated transmission circuitry inside the TE, if provided, shall be inhibited;

and

f) all ac signals from acoustic transducers intended to be used for sending purposes, if provided, shall be inhibited;

PROVISION f1: For the TE it is possible to activate the acoustic transducers during the interdigital period, but only after the first 25 ms of the period.

PROVISION f2: The acoustic excitation, when necessary, is stipulated in the associated testing method.

and

g) all ac signals from an associated TE connected to the line output terminals shall be inhibited (for series TE).

Compliance shall be checked by the tests outlined in section A.10.5 (E) 6.1.

A.10.5 (E) 6 Dialling with loop pulsing

A.10.5 (E) 6.1 General of dialling with loop pulsing

The testing procedures are as follows.

A.10.5 (E) 6.1.a Check by inspection.

Check, when necessary, that the user's manual includes the required sentence.

A.10.5 (E) 6.1.b The procedure of test in section A.10.5 (E) 6.1.a is followed.

A.10.5 (E) 6.1.c The procedure of test in section A.2.2.2 (E) 1 is followed.

A.10.5 (E) 6.1.d The procedure of test in section A.10.2 (E) 1 is followed when necessary.

A.10.5 (E) 6.1.e The procedure of test in section A.10.5 (E) 3.1 is followed, where the switch (S_t) is opened. Check by inspection and using the instrument that any ac signals are not significantly modulated over the dialling pulses.

A.10.5 (E) 6.1.f The procedure of test in section A.10.5 (E) 6.1.e is followed. (See the provisions 2 to 4 in section A.4.1.1 (E) 1, and the provisions 3 and 4 in section A.4.4.2.1 (E) 1).

A.10.5 (E) 6.1.g The procedure of test in section A.10.5 (E) 6.1.e is followed, applying a signal with an open circuit ac rms voltage of 490 mV and frequency 1 kHz, between the line output terminals through a resistor of 600 ohms.

10.5 (E) 6.2 Transient response of loop current during dialling with loop pulsing

With TE in the dialling condition with loop pulsing, it shall meet the following requirements:

a) Change from loop condition to signalling state:

When the TE assumes the signalling state a predigital period exists, this condition shall be established in such a manner that

i) the period between the instant that the loop current crosses downward for the first time the 15 mA limit, and the instant that the loop current crosses upward for the last time the 15 mA limit, if it exists, shall not be greater than 2 ms;

and

ii) the total duration of the transient shall not be greater than 10 ms;

PROVISION a: For this requirement, when necessary, the associated TE is supposed equivalent to an ideal resistor of 300 ohms.

b) transient during signalling state:

The resistance stipulated in the requirements in sections 5.3.2, 5.3.3.2, 5.3.4.2, and 5.3.5 shall be maintained in such a manner that the period between the instant that the loop current crosses downward for the first time the 15 mA limit, and the instant that the loop current crosses upward for the last time the 15 mA limit, if it exists, shall not be greater than 1,5 ms;

and

c) transient after a line interruption:

When a line interruption of at the most 50 ms occurs, the resistance stipulated in the requirements in sections 5.3.2, 5.3.3.2, 5.3.4.2, and 5.3.5 shall be maintained in such a manner that;

i) the loop current shall cross upward the 18 mA limit for the last time within 1,5 ms from the line restoration;

and

ii) the dialling sequence shall not be cancelled and shall continue in its normal way;

and

d) signal clipping:

The dialling sequence;

i) shall be done in the desired way;

and

ii) shall be done in such a manner that;

either

1) the peak value of the voltage signal between the line terminals shall not be lower than 100 V;

or

2) when the peak value of the voltage signal between line terminals is lower than 100 V, the peak value of the loop current during the break period shall be not greater than 4 mA.

NOTE d.ii: It is recommended that when an arrester is connected between the line terminals, its spark-over voltage ($I \geq 1$ mA) should not be lower than 100 V, and its switching-off voltage ($I \leq 480 \mu\text{A}$) should be at least 60 V.

tested with a dc voltage of 56 V, applied between line terminals, through a resistor of 500 ohms in series with an ideal inductor of 10 H.

and

e) change from signalling state to loop condition:

When the TE leaves the signalling state, changing to its own loop condition, or (for series TEs) transferring the loop condition to an associated TE connected to the line output terminals, and when a postdigit period has existed, that loop condition shall be established in such a manner that:

i) the period between the instant that the loop current crosses downward for the first time the 15 mA limit, and the instant that the loop current crosses upward for the last time the 15 mA limit, if it exists, shall not be greater than 2 ms;

and

ii) the total duration of the transient shall not be greater than 10 ms.

PROVISION e: See the provision a.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 6.2.

A.10.5 (E) 6.2 **Transient response of loop current during dialling with loop pulsing**

The testing procedures are as follows:

A.10.5 (E) 6.2.a The TEUT is connected as shown in figure A.5.3. The voltage source (V_f) takes the value of 48 V; the tests are undertaken for each polarity of the voltage source. The resistor (R_f) takes the values of 250 ohms and 1 950 ohms. The resistor (R_s) takes the value of 250 ohms. A suitable instrument is used to document the dc loop current (I_f) through the resistor (R_s). (See also the procedure of test in section A.2.4.2 (E) 1, and for series TE the procedure of test in section A.2.4.2 (E) 3).

A.10.5 (E) 6.2.b The procedure of test in section A.10.5 (E) 6.2.a is followed.

A.10.5 (E) 6.2.c The procedure of test in section A.10.5 (E) 6.2.a is followed using figure A.10.2 (E) 2.2.

A.10.5 (E) 6.2.d The TEUT is connected as shown in figure A.10.5 (E) 6.2. The voltage source (V_f) takes the value of 56 V; the tests are undertaken for each polarity of the voltage source. The resistor (R_f) takes the value of 600 ohms. The resistor (R) takes the value of 100 ohms. The inductor (L) takes the value of 10 H. A suitable instrument is used to document the voltage between the line terminals and the loop current through them. Check also that the voltage signal is not cut below 100 V, or that the peak current is not above 4 mA.

A.10.5 (E) 6.2.e The procedure of test in section A.10.5 (E) 6.2.a is followed. (See also the procedure of test in section A.2.4.2 (E) 1, and for series TEs the procedure of test in section A.2.4.2 (E) 2).

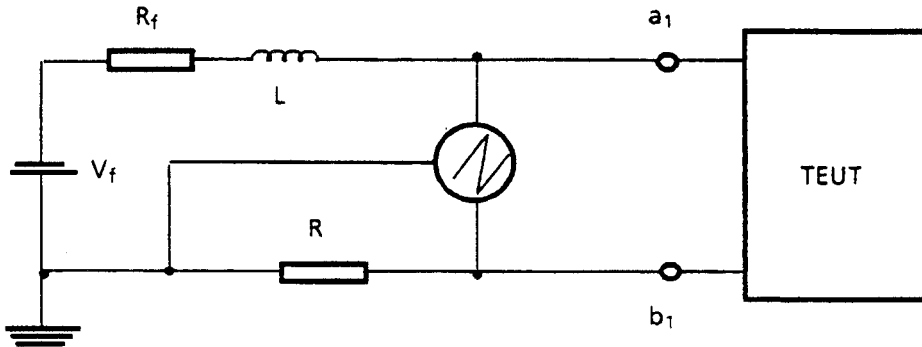


Figure A.10.5 (E) 6.2: Transient response of loop current during dialling with loop pulsing, signal clipping

10.5 (E) 6.3 Fall and rise time of the current

NOTE: Reference is made to figures 5.3.

10.5 (E) 6.3.1 Fall time of the current

With TE in the dialling condition with loop pulsing, the break pulses shall be established in such a manner that the period between the instant that the loop current crosses for the first time the 15 mA limit (I_h), and the instant that the loop current crosses

- a) for the last time the 4 mA limit (I_l), shall not be greater than 2 ms;
- and
- b) for the last time the 480 μ A limit (I_3), shall not be greater than 5 ms.

Compliance shall be checked by the tests the tests outlined in section A.10.5 (E) 6.3.1.

10.5 (E) 6.3.2 Rise time of the current

With TE in the dialling condition with loop pulsing, the make pulse after each break pulse shall be established in such a manner that the period between the instant that the loop current crosses:

- a) for the first time the 480 μ A limit (I_4), and the instant that the loop current crosses for the last time the 18 mA limit (I_g), shall not be greater than 5 ms;
- and
- b) for the first time the 4 mA limit (I_e), and the instant that the loop current crosses for the last time the 18 mA limit (I_g), shall not be greater than 2 ms.

PROVISION 1: This requirement shall also be applied for the interpulsing period, after the last break pulse of an intermediate digit.

PROVISION 2: This requirement shall also be applied for the postpulsing period, when it exists, after the last break pulse of the last digit.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 6.3.2.

A.10.5 (E) 6.3 Fall and rise times of the current

A.10.5 (E) 6.3.1 Fall time of the current

The procedure of test in section A.10.5 (E) 6.2.a is followed.

The digit 0 shall be emitted.

A suitable instrument is used to document the dc loop current (I_t) through the resistor (R_s) during the front edges of the break pulses, or at least for the third and seventh break pulses.

A.10.5 (E) 6.3.2 Rise time of the current

The procedure of test in section A.10.5 (E) 6.2.a is followed.

The digit 0 shall be emitted.

A suitable instrument is used to document the dc loop current (I_t) through the resistor (R_s) during the rear edges of the break pulses, or at least for the third and seventh break pulses.

10.5 (E) 6.4 Sequence length

With TE in the dialling condition with loop pulsing, it shall:

- a) be able to dial sequences with a length of at least 16 digits, when automatic dialling is provided;

PROVISION a1: For the purpose of the requirement a pause inside the automatic dialling may be considered as a digit.

PROVISION a2: For the purpose of the requirement it is permitted only a length of at least 12 digits when the TE allows the user to dial manually, before or after an automatic partial sequence, at least four more digits.

and

- b) allow the user to dial sequences with a length of at least 16 digits, when manual dialling by a keypad is provided.

PROVISION b: See the provision in section 5.3.4.1 (E) 1.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 6.4.

A.10.5 (E) 6.4 Sequence length

The procedure of test in section A.5.3 is followed.

Any series of sixteen digits chosen at random shall be emitted.

10.5 (E) 7 **Dialling with DTMF signals**

10.5 (E) 7.1 **General of dialling with DTMF signals**

With the TE in the dialling condition, during the dialling sequence with DTMF signals, it shall meet the following requirements:

- a) when the dialling sequence with DTMF signals is done manually with a keypad;
 - i) the designation of the push-buttons shall be on or next to the push-buttons;
- and
- ii) when the designation is on the push-buttons, it shall contain only a digit (or a symbol) (or a letter) on each push-button;
- and
- iii) the push-buttons shall be arranged in the "1, 2, 3" order, according with the CEPT Recommendation T/CS 34-01 (Innsbruck, 1981) (see also CCITT Recommendation E.161, Blue Book), where it is not required to supply the buttons A, B, C, and D;

PROVISION a.iii.1: For the purpose of this requirement, it is permitted, however, to have only ten push-buttons (1 to 9, and 0) when the user's manual includes the sentence mentioned in the following provision a.iii.2.

PROVISION a.iii.2: The user's manual, under the conditions of the provision a.iii.1, shall include inside a square the following sentence:

"El teclado de marcación de este equipo terminal no tiene los pulsadores * y # (estrella y cuadro) cuyas señales asociadas pueden ser necesarias para el acceso a algunas de las facilidades suplementarias de la red".

NOTE a.iii.2: The equivalent English sentence is: "The dialling keypad of this TE does not have the push-buttons * and # (star and square) whose associated signals may be needed to access to certain supplementary facilities in the network".

PROVISION a: See the provisions b1, b2, and b3 in section 10.5 (E) 6.1.b.

- and
- b) the requirement in section 2.2.2.1 (E) 1;
- and
- c) the requirement in section 10.2 (E) 1 (for multi-line TE);
- and
- d) the requirement in section 2.3 (E) 1;
- and

PROVISION 1: The dialling sequence with DTMF signals is divided in various instants or periods.

- 1) a change from loop condition to signalling state;
- 2) a series of DTMF signals, sometimes separated by pauses;
- 3) a change from signalling state to loop condition.

PROVISION 2: When the dialling sequence with DTMF signals is done manually, without signal timing, it is considered as several dialling sequences of a digit.

NOTE: The requirement stipulated in this section 10.5 (E) 7, and in sections 5.4 and 5.4 (E) of Chapter 5 are related with the contents of CEPT Recommendations T/CS 46-02 (Nice, 1985) and T/CS 34-08 (Nice, 1985), and CCITT Recommendation Q.23 (Blue Book).

Compliance shall be checked by the tests outlined in section A.10.5 (E) 7.1.

A.10.5 (E) 7 Dialling with DTMF signals

A.10.5 (E) 7.1 General of dialling with DTMF signals

The testing procedures are as follows:

A.10.5 (E) 7.1.a Check by inspection.

Check, when necessary, that the user's manual includes the required sentence(s).

A.10.5 (E) 7.1.b The procedure of test in section A.2.2.2.1 (E) 1 is followed.

A.10.5 (E) 7.1.c The procedure of test in section A.10.2 (E) 1 is followed when necessary.

A.10.5 (E) 7.1.d The procedure of test in section A.2.3 (E) 1 is followed.

10.5 (E) 7.2 Transient response of loop current during dialling with DTMF signals

With TE in the dialling condition with DTMF signals, it shall meet the following requirements:

- a) When the TE
 - i) assumes the signalling state, changing, from loop condition to signalling state;
 - or
 - ii) is in the signalling state;
 - or
 - iii) leaves the signalling state, changing from signalling state to loop condition;

the dc conditions shall be maintained in such a manner that

- a1) the period between the instant that the loop current crosses downward for the first time the 15 mA limit, and the instant that the loop current crosses upward for the last time the 15 mA limit, if it exists, shall not be greater than 2 ms;

and

- a2) the total duration of each transient shall not be greater than 5ms;

PROVISION a: For this requirement, when necessary, the associated TE is supposed equivalent to an ideal resistor of 300 ohms.

and

- b) the requirement in section A.10.2 (E) 2.2.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 7.2.

A.10.5 (E) 7.2 Transient response of loop current dialling with DTMF signals

The test procedures are as follows:

A.10.5 (E) 7.2.a The procedures of test in sections A.10.5 (E) 6.2.a and A.10.5 (E) 6.2.e are followed.

A.10.5 (E) 7.2.b The procedure of test in section A.10.5 (E) 6.2.a is followed using figure A.10.2 (E) 2.2.

10.5 (E) 7.3 Dial tone susceptibility

With TE in the dialling condition with DTMF signals, it shall not be adversely affected while a dial tone is being applied so that the requirements in sections 5.4.2 (and 5.4.2 (E) 1) to 5.4.4 shall be met, tested with a signal with an open circuit ac rms voltage of 1 550 mV (0 dBm, over a load resistor of 600 ohms) and a frequency of 425 Hz, applied between the line terminals, through a resistor of 600 ohms.

PROVISION: This requirement shall, however, not be applied for TEs which in the dialling condition with DTMF signals are prepared for automatically change to dialling condition with loop pulsing if when it transmits a DTMF signal tone is still present.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 7.3.

A.10.5 (E) 7.3 Dial tone susceptibility

The procedures of test in sections A.5.4.2 (plus A.5.4.2 (E) 1), and A.5.4.4 (plus A.5.4.4 (E) 1), are followed, where the TEUT is connected as shown in figure A.5.4.4, the resistor (Z_L) takes a value of 600 ohms, and the generator open circuit ac rms voltage (e) and frequency (f) are as stipulated in the associated requirement in section 10.5 (E) 7.3.

The DTMF analyser shall reject the dial tone component.

10.5 (E) 7.4 Sequence length

With TE in the dialling condition with DTMF signals, it shall:

- a) be able to dial sequences with a length of at least 16 digits, when automatic dialling is provided;

PROVISION a1: For the purpose of this requirement a pause inside the automatic dialling may be considered as a digit.

PROVISION a2: For the purpose of this requirement it is permitted only a length of at least 12 digits when the TE allows the user to dial manually, before or after an automatic partial sequence, at least four more digits.

and

- b) allow the user to dial sequences with a length of at least 16 digits, when manual dialling is provided.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 7.4.

A.10.5 (E) 7.4 Sequence length

The procedure of test in section A.5.4.2 is followed.

Any series of DTMF signals chosen at random shall be emitted.

10.5 (E) 8 Establishment of loop condition after a dialling sequence

When the TE, after a dialling sequence, leaves the signalling state changing to its loop condition, the restoration of this loop condition shall be done

- a) providing an acoustic reception of ac signals from the line;
 - either
 - i) by a handset;
 - or
 - ii) by a handsfree loudspeaker;
 - or
 - b) transferring the ac signals from the line to an associated TE;
 - or
 - c) alerting the user that the call control may be assumed manually, then
 - i) the alert signal shall be an acoustic signal and shall last until the manual control is activated;
 - and
 - ii) if the manual control is not activated within a period no greater than 35 seconds from the establishment of the loop condition, the TE shall:
 - either
 - 1) establish automatically the quiescent condition;
 - or
 - 2) start to transmit an identification signal;
 - or
 - d) leaving the call under the automatic control of the TE, then the TE shall start to transmit an identification signal within a period no greater than 5 seconds from the establishment of the loop condition.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 8.

A.10.5 (E) 8 Establishment of loop after a dialling sequence

The TEUT is connected as shown in figure A.5.2.1.

The dc voltage source (V_f) takes only the value of 48 V, and the resistor (R_f) takes the value of 1 100 ohms.

Switch (S_t) is closed, and switch (S) is in its position 2. The resistor (Z_G) takes the value of 600 ohms, and the generator (e) is changed for a short circuit.

A suitable instrument is used to document both the dc changes and the ac signals from the TEUT. The instrument shall have an input dc resistance of no lower than 1 M Ω and an input impedance of no lower than 50 k Ω .

The tests shall be done by inspection using the instrument.

10.5 (E) 9 Identification signals

10.5 (E) 9.1 General of identification signals

When the TE in the loop condition shall transmit an identification signal as a consequence of the requirements in sections 10.5 (E) 8.c or 10.5 (E) 8.d, this identification signal shall

a) last the time stipulated in the requirement in section 10.5 (E) 9.2;

and

b) have;

either

i) the form of a coded signal, then it shall meet the requirement in section 10.5 (E) 9.3;

or

ii) other form than a coded signal, then it shall meet the requirement in section 10.5 (E) 9.4.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 9.1.

10.5 (E) 9.2 Identification signal timing

When the TE in loop condition shall transmit an identification signal, it shall be transmitted:

a) till at least a correct identification signal has been received from the called subscriber;

PROVISION a: A correct identification signal is a signal which, as stipulated also in the option b of the requirement in section 10.5 (E) 10.4, is in accordance with the modes of operation indicated in the user's manual.

or

b) till at least 5 seconds after a called subscriber has answered the call, for the TEs which are prepared for monitoring the progress of the call;

PROVISION b: The meaning given for the term "to monitor the progress of a call" is to distinguish by the TE when a signal, as stipulated in the option "a" of the requirement in section 10.5 (E) = 10.4, with a sequence which is made up by 0,5 seconds of signal and 2 seconds of pause, has been applied between the line terminals, after the TE has started to transmit its own identification signal.

or

c) till at least 5 seconds after one 12 kHz metering pulse has been received from the line, for TEs which are prepared for receiving such kind or metering pulses (see the requirements in section 9.2.1);

NOTE c: For the TEs which are prepared for receiving metering pulses it should be taken into account that certain kind of calls may not generate any metering pulse from the network.

- or
d) till at least 5 seconds after one 50 Hz metering pulse has been received from the line, for TEs which are prepared for receiving such kind of metering pulses (see requirements in section 9.2.2);

NOTE d: See NOTE c.

- or
e) till a manual control provided for assuming the call control by the user has been activated (see the requirements in sections 10.5 (E) 10.2.a and 10.5 (E) 10.2.b;

- or
f) till the TE has established the quiescent condition.

PROVISION f: See the requirements in sections 10.5 (E) 10 in general and more particularly the requirements in sections 10.5 (E) 10.2.c and 10.5 (E) 10.6.

PROVISION: Whichever are the procedures provided by the TE for finishing the transmission of the identification signal, such transmission shall last until at most 1,5 minutes from the change to loop condition after a dialling sequence.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 9.2.

10.5 (E) 9.3 Identification tones

When the TE in the loop condition shall be transmit an identification signal in the form of a coded signal (see option 10.5 (E) 9.1.b.i), this signal shall be

either

- i) continuous;

or

- ii) intermittent, then

- 1) The signal duration shall not be lower than 0,2 seconds;

and

- 2) the pause duration shall not be greater than 3,5 seconds;

and shall consist

either

- a) of one or more frequencies, then

- 1) all frequencies shall be in the frequency range from 675 Hz to 2 200 Hz;

and

- 2) the mean power level shall be during the periods of emission between the maximum power level permitted in the requirement in section 4.4.2.2 (E) 1 and -18 dBm;

NOTE a.2: See also the requirements in sections 9.3 (E) for a signal 2 100 Hz tone.

when the output signal is applied to a load resistor of 600 ohms connected to the line terminals;

- or
b) of one of a sequence of more than one DTMF signals which are according with the requirements in sections 5.4 and 10.5 (E) 7.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 9.3.

10.5 (E) 9.4 Other identification signals

When the TE in the loop condition shall transmit an identification signal in other form than a coded signal (see option 10.5 (E) 9.1.b.ii), this signal shall be:

either

- i) repeated;

- 1) without pauses;

or

- 2) with pauses of duration that shall not be greater than 2 seconds;

or

- ii) sent continuously;

and shall consist

- a) of a verbal announcement;

or

- b) music;

or

- c) other mixed signal.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 9.4.

A.10.5 (E) 9 Identification signals

A.10.5 (E) 9.1 General of identification signals

The procedure of test in section A.10.5 (E) 8 is followed.

Check by inspection and according with the user's manual and any other technical documentation which kind of identification signals are provided by the TEUT.

A.10.5 (E) 9.2 Identification signal timing

The procedure of test in section A.10.5 (E) 8 is followed.

- A.10.5 (E) 9.2.a** The signals stipulated in the test in section A.10.5 (E) 10.4.b shall be used when necessary.

- A.10.5 (E) 9.2.b** Check by inspection. During the first 30 seconds a signal with a generator open circuit ac rms voltage (e) of 49 mV and frequency (f) of 425 Hz is applied through a resistor (Z_G) of 600 ohms, where the switch (S_t) follows the sequence of 1,5 seconds closed and 3 seconds opened. Immediately after, the generator open circuit ac rms voltage (e) is changed to the value stipulated in the requirement in section 10.5 (E) 10.4, the generator

frequency (f) takes the values of 425 Hz, 1 000 Hz, and 2 200 Hz, where every frequency is presented during one third of the 0,5 second period that the switch (S_t) is closed, with pauses (switch opened) of 2 seconds.

NOTE b: The testing signal used is an artificial and rudimentary representation of a generic analogue signal.

A.10.5 (E) 9.2.c The procedure of test in section A.10.5 (E) 9.2.b is followed, where the resistor (Z_G) takes the value of 200 ohms, the generator open circuit ac rms voltage (e) takes the value of 210 mV, the generator frequency (f) takes the value of 12 kHz, and the switch (S_t) is closed once during 50 ms.

A.10.5 (E) 9.2.d The procedure of test in section A.9.2.2.1 (E) 2 is followed, where the generator open circuit ac rms voltage (e) takes the value of 60 V, the generator frequency (f) takes the value of 50 Hz, the switch (S_1) is closed once during 50 ms, and an instrument as in test in section A.10.5 (E) 8 is used instead of the voltmeters (V_1) and (V_2).

A.10.5 (E) 9.2.e Check by inspection.

A.10.5 (E) 9.2.f Check by inspection.

A.10.5 (E) 9.3 **Identification tones**

The procedure of test in section A.10.5 (E) 9.1 is followed.

The characteristics of the instrument used shall take into account the provision 5 in section A.4.4.2.1 (E) 1.

A.10.5 (E) 9.4 **Other identification signals**

The procedure of test in section A.10.5 (E) 9.3 is followed.

10.5 (E) 10 **Loop condition duration control**

10.5 (E) 10.1 **General of loop condition duration control**

PROVISION 1: The following provisions 2 to 4 in this section 10.5 (E) 10.1 shall be applied for the requirements in sections 10.5 (E) 10.2 to 10.5 (E) 10.7.

PROVISION 2: The control of the loop condition can be done:

2a) wholly manually;

or

2b) wholly automatically;

or

2c) partly manually and partly automatically, in whatever order of succession it may be.

PROVISION 3: The meaning given in this section 10.5 (E) 10 for the term "in automatic control of loop condition" is that the TE is in the loop condition

either

3a) after the call has been left under the automatic control of the TE, and after the transmission of the identification signal has ended;

or

- 3b) after the communication has been manually left under the automatic control of the TE.

PROVISION 4: The meaning given in this section 10.5 (E) 10 for the term "continuous receiving mode of operation" is that the TE is in a functional mode which

either

- 4a) shall have continuous receiving signals through its line terminals;

or

- 4b) is capable of continuously distinguishing the possible signals received through its line terminals;

independently of whether the TE is simultaneously sending signals or not.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 10.1.

10.5 (E) 10.2 Change from automatic control to manual control

With TE in automatic control of loop condition, when it:

- a) is prepared for allowing the user to assume the control of the communication in a manual mode, as a consequence of its own automatic procedures, then
 - i) the TE shall alert the user with an acoustic signal;
- and
- ii) the alert signal shall last until the manual control is activated;
- and
- iii) the TE shall establish automatically the quiescent condition if the manual control has not been activated before a period no greater than 35 seconds from the start of the alert signal has ended;

PROVISION a.iii: However, for alarm receiver equipment it is permitted to extend the limit up to 5 minutes.

or

- b) has a manual control provided for assuming the control of the communication by the user, then

- i) the TE shall transfer the control to manual mode;

or

- ii) when the transfer delay is greater than 2 seconds after the manual control has been activated, the TE shall:

- 1) indicate, either acoustically or optically, that the order has been received;

and

- 2) follow the procedure stipulated in "a";

or

- c) has a manual control provided for changing to quiescent condition, then the TE shall

- i) establish automatically the quiescent condition;

and

- ii) indicate, either acoustically or optically, that the order has been received, when the establishment delay is greater than 2 seconds after the manual control has been activated.

PROVISION: This requirement shall also be applied while the TE is transmitting an identification signal (see requirements in section 10.5 (E) 9).

Compliance shall be checked by the tests outlined in section A.10.5 (E) 10.2.

10.5 (E) 10.3 Duration control not related with information transferred

With TE in automatic control of loop condition, when it is prepared for preserving the loop condition without any control related with the information transferred or received through its line terminals, it shall

either

- a) establish the quiescent condition;

or

- b) allow the user to assume control of the communication in a manual mode as stipulated in section 10.5 (E) 10.2.a;

within a period no greater than 1,5 minutes from the change to loop condition after dialling sequence, or from the change of automatic control.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 10.3.

10.5 (E) 10.4 Preservation of loop condition related with information transfer

With TE in automatic control of loop condition, when it is prepared for preserving the loop condition with a control related with the information or signals received through its line terminals, either with simultaneous sending or not, this loop condition shall be maintained, while a signal with an open circuit ac rms voltage of 11 mV (-43 dBm, over a load resistor of 600 ohms) and one of the following frequency ranges and sequences:

- a) from 300 Hz to 3,4 kHz, with a sequence which is made up by 5 seconds of signal and 5 seconds of pause;

or

- b) in accordance with the modes of operation indicated in the user's manual;

is applied between the line terminals through a resistor of 600 ohms.

PROVISION: This requirement shall not be applied for TEs which are prepared to be in a functional mode different from a continuous receiving mode of operation, while they are in such different mode.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 10.4.

10.5 (E) 10.5 Liberation of loop condition control related with information transfer

With TE in automatic control of the loop condition, when it is received through its line terminals, either with simultaneous sending or not, it shall

either

a) establish the quiescent condition no later than 10 seconds;

or

b) allow the user to assume the control of the communication in a manual mode as stipulated in section 10.5 (E) 10.2.a;

after a signal as stipulated in the relevant option of the requirement in section 10.5 (E) 10.4, with an open circuit ac rms voltage of 15,5 mV (-40 dBm, over a load resistor of 600 ohms) is applied to the line terminals, and its open circuit ac rms voltage has been decreased to a voltage no greater than 6,17 mV (-48 dBm, over a load resistor of 600 ohms) for a continuous period of 1,5 minutes.

PROVISION 1: However, for alarm transmitter TE it is permitted to extend the limit from 1,5 minutes up to 15 minutes when a listening function for surveillance purposes is provided for the TE.

PROVISION 2: This requirement shall not be applied for TEs which are prepared to be in a functional mode different from a continuous receiving mode of operation, while they are in such different condition, unless the option ii in the requirement in section 10.5 (E) 10.7.a is used.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 10.5.

10.5 (E) 10.6 Liberation of loop condition related with ac network signals

With TE in automatic control of loop condition, when it is prepared for preserving the loop condition with a control related with the information or signals received through its line terminals, either with simultaneous sending or not, it shall establish the quiescent condition no later than

a) 10 seconds after a signal frequency, continuous or interrupted, or a series of single frequencies, with or without pauses, in the frequency range from 320 Hz to 480 Hz, with an open circuit ac rms voltage greater than 49 mV (-30 dBm, over a load resistor of 600 ohms) has been applied between the line terminals through a resistor of 600 ohms for a continuous period of 20 seconds;

and

b) 60 seconds after a signal with an open circuit ac rms voltage greater than 49 mV (-30 dBm, over a load resistor of 600 ohms), frequencies from 320 Hz to 480 Hz, and with a sequence which is made up by 1,5 seconds of signal and 3 seconds of pause, is applied between the line terminals through a resistor of 600 ohms.

PROVISION: This requirement shall also be applied while the TE is transmitting an identification signal (see the requirements in sections 10.5 (E) 9).

Compliance shall be checked by the tests outlined in section A.10.5 (E) 10.6.

10.5 (E) 10.7 Liberation of loop condition control related with other network signals

With TE in automatic control of loop condition, when it is prepared for preserving the loop condition with a control related with the information or signals received through its line terminals, either with simultaneous sending or not, and

a) when it is in a functional mode different from a continuous receiving mode of operation, it shall:

either

i) establish the quiescent condition no later than 10 seconds after any one of the following actions have occurred:

- 1) a change to the opposite polarity has been produced between the line terminals;
- 2) a line interruption with a duration of at least 1 ms has been produced;

or

ii) to have periods of continuous receiving mode of operation, then

- 1) such periods shall not be separated more than 3 minutes;

and

- 2) during such periods the TE shall meet the requirement in section 10.5 (E) 10.5, where the applied signal shall be decreased during a period equal to:

2.1) the shortest period of continuous receiving mode of operation for which the TE is prepared;

or

2.2) 1,5 minutes;

whichever is the shorter.

- b) when it is prepared for monitoring the progress of the call (see provision b in the requirement in section 10.5 (E) 9.2), and the permission of the provision 2 in the requirement in section 10.5 (E) 11.3 is used it shall establish the quiescent condition as stipulated in a.i.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 10.7.

A.10.5 (E) 10

Loop condition duration control

A.10.5 (E) 10.1

General of loop condition duration control

The procedure of test in section A.10.5 (E) 8 is followed.

Check by inspection and according with the user's manual and any other technical documentation which kind of controls of the duration of the loop condition are provided by the TEUT.

PROVISION:

Sometimes, it could be necessary to use carrier frequencies (tones) or other characteristic ac signals with the purpose of keeping the TEUT in automatic control of the loop condition. This kind of signals are called "auxiliary test signals".

The signals used shall be in accordance with the modes of operation indicated in the user's manual.

A.10.5 (E) 10.2

Change from automatic control to manual control

The procedure of test in section A.10.5 (E) 8 is followed.

When necessary, check by inspection using the instrument.

A.10.5 (E) 10.3 Duration control not related with information transferred

The procedure of test in section A.10.5 (E) 8 is followed.

The test shall be done by inspection using the instrument and taking into account in what instant the TE changes to the quiescent condition or allows the user to assume the call control.

A.10.5 (E) 10.4 Preservation of loop condition related with information transfer

The procedure of test in section A.10.5 (E) 8 is followed, where the generator open circuit ac rms voltage (e) takes the value stipulated in the associated requirement in section 10.5 (E) 10.4.

A.10.5 (E) 10.4.a The generator frequency (f) takes the values of 425 Hz, 1 000 Hz, and 2 200 Hz, where every frequency is presented during one third of 0,5 seconds cyclically during the 5 seconds that switch (S_t) is closed, with pauses (switch opened) of 5 seconds.

NOTE a: See NOTE b in section A.10.5 (E) 9.2.b.

A.10.5 (E) 10.4.b The generator frequency (f) and the switch (S_t) shall be in accordance with the associated requirement in section 10.5 (E) 10.4.b. (See also the provision in section A.10.5 (E) 10.1).

A.10.5 (E) 10.5 Liberation of loop condition control related with information transfer

The procedures of test in section A.10.5 (E) 10.4 are followed, where the generator open circuit ac rms voltage (e) takes respectively the values of 15,5 mV and 5,5 mV (-40 dBm and -49 dBm, over a load resistor (Z_L) of 600 ohms).

A.10.5 (E) 10.6 Liberation of loop condition control related with ac network signals

The procedure of test in section A.10.5 (E) 8 is followed.

When auxiliary test signals are used (see the provision in section A.10.5 (E) 10.1), they shall be switched off simultaneously with the application of the stipulated testing signals.

A.10.5 (E) 10.6.a The generator open circuit ac rms voltage (e) and frequency (f) are stipulated in table A.10.5 (E) 10.6.a, where also the sequences of switch (S_t) are indicated.

A.10.5 (E) 10.6.b The generator open circuit ac rms voltage (e) and frequency (f) are stipulated in table A.10.5 (E) 10.6.b. The sequence of switch (S_t) is as stipulated in table A.10.5 (E) 10.6.b. The sequence of switch (S_t) is as stipulated in the associated requirement in section A.10.5 (E) 10.6.b.

Table A.10.5 (E) 10.6.a: Liberation of loop condition control related with information transfer, tone test signals

Frequency (f) (Hz)	Voltage (e) (mV)	Switch (S _t)	
		Continuous	(ms) Opened
320	55	Continuous	0
425	55	Continuous	0
425	490	Continuous	0
480	55	Continuous	0
425	55	1 000	100
425	55	320	20
320	55	200	200
320	55	3 x 200	2 x 200 + 600
320	55	2 x 200	1 x 200 + 600
425	55	200	200
425	55	3 x 200	2 x 200 + 600
425	55	2 x 200	1 x 200 + 600
425	55	2 x 235	1 x 150 + 500
480	55	200	200
480	55	3 x 200	2 x 200 + 600
480	55	2 x 200	1 x 200 + 600

Table A.10.5 (E) 10.6.b: Liberation of loop condition control related with information transfer, ringing tone test signals

Frequency (f) (Hz)	Voltage (e) (mV)
320	55
425	490
425	55
480	55

A.10.5 (E) 10.7 Liberation of loop condition control related with other network signals

A.10.5 (E) 10.7.a.i.1 The procedure of test in section A.10.5 (E) 2.1 is followed, where the resistors (R_{f1}) and (R_{f2}) take the value of 550 ohms.

When auxiliary test signals are used (see the provision in section A.10.5 (E) 10.1), they shall be switched off after the polarity reversal.

A.10.5 (E) 10.7.a.i.2 The procedure of test in section A.10.5 (E) 2.2 is followed, where the resistors (R_{f1}) and (R_{f2}) take the value of 550 ohms, and switch (S₁) is opened during a period with a duration of one millisecond.

When auxiliary test signals are used (see the provision in section A.10.5 (E) 10.1), they shall be switched off after the line interruption.

A.10.5 (E) 10.7.a.ii The procedure of test in section A.10.5 (E) 10.5 is followed.

A.10.5 (E) 10.7.b The procedures of test in sections A.10.5 (E) 10.7.a.i.1 and A.10.5 (E) 10.7.a.i.2 are followed.

10.5 (E) 11 Call attempts

PROVISION 1: See the provision 1 in the requirement in section 10.5 (E) 3.2.

PROVISION 2: An attempt is considered as a call attempt when the call has progressed at least until the change to loop condition after a dialling sequence.

10.5 (E) 11.1 Successive call attempts to different numbers

When the TE is prepared for automatically performing several successive call attempts to different called numbers without any intermediate manual control, the duration of the period between the instant that the TE changes to quiescent condition at the end of one call attempt to one called number, and the instant that the TE changes to the loop condition at the beginning of the following call attempt to other called numbers, shall not be lower than two seconds.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 11.1.

10.5 (E) 11.2 Successive call attempts to one number

When the TE is prepared for automatically performing several successive attempts to the same called number without any intermediate control:

- a) the duration of the period between the instant that the TE changes to quiescent condition at the end of the first call attempt, and the instant that the TE changes to loop condition at the beginning of the second call attempt, shall not be lower than 5 seconds;

PROVISION a: However, for alarm transmitter equipment it is permitted to reduce this limit down to 2 seconds.

and

- b) the duration of the period between the instant that the TE changes to quiescent condition of the second call attempt or any subsequent call attempt, and the instant that the TE changes to loop condition at the beginning of the next call attempt, shall not be lower than 1 minute.

PROVISION b: See provision a.

Compliance shall be checked by the tests outlined in section A.10.5 (E) 11.2.

10.5 (E) 11.3 Total number of repeat call attempts

When the TE is prepared for automatically performing several call attempts, either successive or not, to the same called number without any intermediate manual control, the maximum number of repeat call attempts to each number in any period of 60 minutes shall not be greater than 4 attempts.

PROVISION 1: However, for alarm transmitter equipment it is permitted to extend this limit up to 15 call attempts.

PROVISION 2: However, for TEs which are prepared for monitoring the progress of the call (see provision b in the requirement in section 10.5 (E) 9.2), it is permitted

to extend this limit up to 15 call attempts. (See the requirement in section 10.5 (E) 10.7.b).

Compliance shall be checked by the tests outlined in section A.10.5 (E) 11.3.

A.10.5 (E) 11 Call attempts

A.10.5 (E) 11.1 Successive call attempts to different numbers

The procedure of test in section A.10.5 (E) 8 is followed.

When a dial tone is required (i.e. for start or restart of the dialling sequence), the procedure of test in section A.10.5 (E) 3.1 is followed.

When a busy or congestion tone is required, the procedure of test in section A.10.5 (E) 3.1 is followed, with the generator open circuit ac rms voltage (e) and frequency (f) stipulated in table A.10.5 (E) 11.1, where also the sequences of switch (S_t) are indicated.

Table A.10.5 (E) 11.1: Successive call attempts to different numbers, nominal busy and congestion tone test signals

Frequency (f) (Hz)	Voltage (e) (mV)	Switch (S _t)	
		Closed (ms)	Opened
425	490	200	200
425	490	3 x 200	2 x 200 + 600
425	490	2 x 200	1 x 200 + 600
425	490	2 x 235	1 x 150 + 500

A.10.5 (E) 11.2 Successive call attempts to one number

The procedure of test in section A.10.5 (E) 11.1 is followed.

A.10.5 (E) 11.3 Total number of repeat call attempts

The procedure of test in section A.10.5 (E) 11.1 is followed.

10.5 (S) Sweden

10.5 (S) 1 Symbols

The symbols star(*) and square (#) shall have a shape easily identified as the corresponding symbols described in CCITT Recommendation Q.11 (E.161).

A keypad, that is solely intended for decadic pulsing, shall not be signed with symbols, that can be identified as star or square, since standardised procedures with these symbols imply pushbutton tone signalling.

If the register recall signal is provided, the corresponding button shall be designed with the letter R (capital) on or next to the button. The designation R shall not be used in any other sense.

10.6 Equipment with a ringing detector

10.6 (A) Austria

10.6 (A) 1 Ringing signal frequency range for TE connected in PABX

For TE connected in PABX the frequency range Δf shall be 20 - 60 Hz.

A.10.6 (A) 1 Ringing signal frequency range for TE connected in PABX

For TE connected in PABX the frequency values f_1 are 20 Hz and 60 Hz.

10.6 (B) Belgium

10.6 (B) 1 Power feeding of telephone sets

Telephone sets shall be solely fed by the telephone line for the basic telephony functions (incoming or outgoing calls, speech communication).

A telephone set providing supplementary facilities may use an additional power source.

Compliance shall be checked by inspection.

10.6 (F) France

10.6 (F) 1 Automatic answering TE shall not answer to incoming call if it is not able to complete correctly its functions, for instance, when the message support is missing, the recording capacity is insufficient, etc. However, the TE is authorised to answer one time in order to detect the hitch.

10.6 (F) 2 Automatic answering TE shall revert to quiescent condition no later than 6 mm when it is not able to complete correctly its functions, for instance, when the message support is blocked.

10.6 (P) Portugal

10.6 (P) 1 Insensitivity to ringing signals

For TE with the ability to detect ringing signals and subsequently capable of automatically establishing a loop condition in itself or a related TE, the loop condition shall not be established when ringing signals specified in section 6.3.1, but interrupted so as to produce signals with a duration of up to 100 ms which are repeated at intervals of 1 s or more, are applied to its line terminals.

The requirement shall be met for dc excitations

$$V_f (V) = 45 - 55$$
$$R_f (\Omega) = 300 - 1\ 800$$

Compliance shall be checked by the tests outlined in section A.10.6 (P) 1.

A.10.6 (P) 1 Insensitivity to ringing signals

The test shall be performed at all combinations of the following values:

- U (V_{rms}) = 30, 120
- V_f (V) = 45, 55
- R_f (Ω) = 500
- f (Hz) = $16^{2/3}$, 26
- t_{on} (s) = 0,1
- t_{off} (s) = 1

10.6 (E) Spain

PROVISION: See provisions 1 to 4 in section 6.2.1 (E) 1.

10.6 (E) 1 General

(The content of this section shall be used for Spain as more appropriate than the content of section 6.1).

A TE with an answering function is a terminal that is prepared for providing one or several of the following facilities:

- a) Establishment of loop condition from ringing condition;
- and/or
- b) be in loop condition after the automatic change from ringing condition;
- and/or
- c) sending of identification signals;
- and/or
- d) control of the duration of the loop condition.

Depending on what these facilities are provided by the TE, it shall meet the relevant requirements included in sections from 10.6 (E) 2 to 10.6 (E) 6 and also in the Spanish sections (E) of Chapter 5.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 1.

A.10.6 (E) 1 General

The testing procedure to follow is to check by inspection and according with the user's manual and any other technical documentation which facilities are provided by the TEUT.

10.6 (E) 2 Establishment of loop condition from ringing condition

10.6 (E) 2.1 General of the change to loop condition

PROVISION 1: Each individual answer of an incoming call shall begin with the establishment loop condition, when the TE is previously in the ringing state or condition.

PROVISION 2: When the TE in the ringing condition is prepared for providing or allowing the change to loop condition, this shall be done

- either
- a) manually by the user;

and/or

- b) automatically by the TE.

PROVISION 3: When the TE allows the user to manually change to loop condition; it shall meet the requirement in section 10.6 (E) 2.2.

PROVISION 4: When the TE is prepared for automatic change to loop condition, it shall meet the requirement in section 10.6 (E) 2.3.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 2.1.

10.6 (E) 2.2 Manual change to loop condition

When the TE in the ringing condition is prepared for allowing a manual change to loop condition, it shall meet the following requirements:

- a) The TE shall

either

- a1) not be able to alert the user that he may answer the call manually, then the user's manual shall include inside a square the following sentence:

"Este equipo terminal no dispone de avisador acústico para llamadas entrantes"

NOTE a1: The equivalent English sentence is: "This TE does not incorporate any acoustic alerting module for incoming calls."

or

- a2) be able to alert the user that he may answer the call manually, then

- i) the alert signal may be an acoustic or an optical signal;

and

- ii) when the alert signal is acoustic;

either

- 1) the mean acoustic output pressure level shall not be lower than 65 dBPWL, tested with a ringing signal with an open circuit ac rms voltage of 35 V and frequency 25 Hz, simultaneously superimposed to a dc voltage of 48 V, applied between the line terminals through a resistor of 200 ohms;

or

- 2) the user's manual shall include inside a square the following sentence:

"El volumen del avisador acústico para llamadas entrantes de este equipo terminal puede ser insuficiente en ciertos ámbitos de utilización"

NOTE ii.2: The equivalent English sentence is: The output level of the acoustic alerting module for incoming calls of this TE may be insufficient in certain environments of use".

and

- iii) when the alert signal is only optical, the user's manual shall include the sentence stipulated in the requirement a1;

and

- iv) the alert signal shall be present during periods:

1) no lower than 1,3 seconds;

and

2) no greater than 1,7 seconds;

tested with a signal as stipulated in the requirement ii.1, with a sequence of 1,5 seconds of signal and 3 seconds of pause;

and

v) the alert signal shall last until the TE in the ringing condition changes:

either

1) to quiescent condition, when the ringing signal disappears;

or

2) to loop condition, after the manual control has been activated;

and

b) when the manual control has been activated, the change to loop condition shall be done according with the requirements in sections 2.4.1 (E) 1 and 2.3 (E) 1.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 2.2.

10.6 (E) 2.3

Automatic changes to loop condition

When the TE in the ringing condition is prepared for providing an automatic change to loop condition, it shall meet the following requirements:

a) The TE shall have a ringing signal receiver according with the requirements in sections in 6.2 (E) and in 10.6 (E) 3;

and

b) the change to loop condition shall be done according with the requirements in sections 2.4.1 (E) 1 and 2.3 (E) 1;

and

c) the change to loop condition shall be:

either

i) immediate;

or

ii) delayed, dependant upon other conditions which relate to the successful completion of the call by the TE.

PROVISION:

In any case, the TE shall be immune as stipulated in the requirements in sections 6.2.2 (E) 1, 6.2.3 (E) 1, and in 10.6 (E) 3.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 2.3.

A.10.6 (E) 2

Establishment of loop condition from ringing condition

A.10.6 (E) 2.1

General of the change to loop condition

Check by inspection and according with the user's manual and any other technical documentation which kind of answer is provided by the TEUT.

A.10.6 (E) 2.2 Manual change to loop condition

The test procedures are as follows:

A.10.6 (E) 2.2.a The TEUT is connected as shown in figure A.6.2.1. The dc voltage source (V_f) takes the value of 48 V, and the resistor (R_f) takes the value of 200 ohms. The value of the open circuit ac rms voltage (e) when the switch (S) is closed takes the value of 35 V. The generator frequency (f) takes the value of 25 Hz.

A.10.6 (E) 2.2.a.a1 Check that the user's manual includes the required sentence, when necessary.

A.10.6 (E) 2.2.a.a2.ii.1 The test shall be done with the switch (S) closed and in a reverberation room.

A.10.6 (E) 2.2.a.a2.ii.2 Check that the user's manual includes the required sentence, when necessary.

A.10.6 (E) 2.2.a.a2.iii Check that the user's manual includes the required sentence when necessary.

A.10.6 (E) 2.2.a.a2.iv The procedure of test in section A.10.6 (E) 2.2.a is followed, where the switch (S) follows the sequence indicated in the associated requirement in section 10.6 (E) 2.2.a.a2.iv.

A.10.6 (E) 2.2.a.a2.v Check by inspection the following method of test in section A.10.6 (E) 2.2.a, using the switch (S).

A.10.6 (E) 2.2.b Check that relevant tests have been carried out.

A.10.6 (E) 2.3 Automatic change to loop condition

The procedure of test in section A.10.6 (E) 2.2.a is followed.

Check by inspection and according with the user's manual and any other technical documentation which kind of automatic answer is provided by the TEUT.

10.6 (E) 3 Ringing signal reception

10.6 (E) 3.1 Ringing signal receiver immunity

With TE in the ringing condition, which has a ringing signal receiver that is intended for automatically establishing the loop condition according with the requirement in section 10.6 (E) 2.3, it shall not establish the loop condition after a series of single, stray, short noise pulses as stipulated in the associated testing method, are applied between the line terminals.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 3.1.

10.6 (E) 3.2 Change of polarity susceptibility

With TE in the ringing condition, which has a ringing signal receiver that is intended for automatically establishing the loop condition according with the requirement in section 10.6 (E) 2.3, it shall not establish the loop condition after the application between the line terminals of several changes to the opposite polarity as stipulated in the associated testing method.

PROVISION: For series TEs, this requirement shall also be applied when a resistor of 300 ohms is connected to the line output terminals.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 3.2.

A.10.6 (E) 3 Ringing signal reception

A.10.6 (E) 3.1 Ringing signal receiver immunity

The procedure of test in section A.10.5 (E) 4.2 is followed.

A.10.6 (E) 3.2 Change of polarity susceptibility

The TEUT is connected as shown in figure A.10.2 (E) 2.1.

The voltage sources (V_{f1}) and (V_{f2}) take the value of 48 V. The resistors (R_{f1}) and (R_{f2}) take the value of 250 ohms.

The test shall be done by inspection, when the switch (S_1) is operated four times with 5 seconds between two consecutive changes.

PROVISION: For series TEs the test shall also be made when a resistor of 300 ohms is connected to the line output terminals.

10.6 (E) 4 Loop condition after the automatic change from ringing condition

When the TE has automatically changed from ringing condition to loop condition, it shall:

- a) provide an acoustic reception of ac signals from the line, and an electric emission of ac signals to the line, by means of a handsfree system (loudspeaker plus a microphone);

or

- b) transfer the ac signals from the line to an associated TE, and from an associated TE to the line;

or

- c) leave the answer under the automatic control of the TE, then the TE shall start to transmit an identification signal within a period no greater than 5 seconds from the establishment of the loop condition.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 4.

A.10.6 (E) 4 Loop condition after automatic change from the ringing condition

The TEUT is connected as shown in figure A.5.2.1.

The dc voltage source (V_f) takes the value of 48 V, and the resistor (R_f) takes the value of 1 100 ohms.

The generator output resistance (Z_G) takes the value of 200 ohms, the generator open circuit ac rms voltage (e) takes the value of 40 V, and the generator frequency (f) takes the value of 25 Hz.

The sequence of the switch (S_f) is 1,5 seconds closed and 3 seconds opened, until the TEUT changes to loop condition; after that the switch (S_f) shall remain opened. The switch (S) is in its position 2.

A suitable instrument is used to document both the dc changes and the ac signals from the TEUT. The instrument shall have an input dc resistance no lower than 1 M Ω and an input impedance no lower than 50 k Ω .

The tests shall be done by inspection and using the instrument.

10.6 (E) 5 Identification signals

10.6 (E) 5.1 General of identification signals

When the TE in the loop condition shall transmit an identification signal as a consequence of the requirement in section 10.6 (E) 4.c, this identification signal shall:

a) last the time stipulated in the requirement in section 10.6 (E) 5.2;

and

b) have

either

i) the form of a coded signal, then it shall meet the requirement in section 10.6 (E) 5.3;

or

ii) other form than a coded signal, then it shall meet the requirement in section 10.6 (E) 5.4.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 5.1.

10.6 (E) 5.2 Identification signal timing

When the TE in the loop condition shall transmit an identification signal, it shall be transmitted:

a) during a period of at least

i) 2,6 seconds, for continuous identification tones (see option 10.6 (E) 5.3.i);

or

ii) 5 seconds, for identification signals other than continuous identification tones;

or

b) till at least a correct identification signal has been received from the calling subscriber;

PROVISION b: A correct identification signal is a signal which, as stipulated also in the option "b" of the requirement in section 10.6 (E) 6.4, is in accordance with the modes of operation indicated in the user's manual.

or

c) till a manual control provided for assuming the control of the communication by the user has been activated (see the requirements in sections 10.6 (E) 6.2.a and 10.6 (E) 6.2.b);

or

d) till the TE has established the quiescent condition.

PROVISION d: See the requirements in section 10.6 (E) 6 in general and more particularly the requirements in sections 10.6 (E) 6.2.c and 10.6 (E) 6.6.

PROVISION: Whichever are the procedures provided by the TE for finishing the transmission of the identification signal, such transmission shall last until at most 1,5 minutes from the change to loop condition after the automatic change from ringing condition.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 5.2.

10.6 (E) 5.3 Identification tones

When the TE in the loop condition shall transmit an identification signal in the form of a coded signal (see option 10.6 (E) 5.1.b.i), this signal shall be:

either

i) continuous;

or

ii) intermittent, then

1) the signal duration shall not be lower than 0,2 seconds;

and

2) the pause duration shall not be greater than 2 seconds;

and shall consist:

either

a) of one or more frequencies, then

1) all the frequencies shall be in the frequency range from 675 Hz to 2 200 Hz;

and

2) the mean power level shall be during the periods of emission between the maximum power level permitted in the requirement in section 4.4.2.2 (E) 1 and -18 dBm;

NOTE a.2: See also the requirements in sections 9.3 (E), for a single 2 100 Hz tone.

when the output signal is applied to a load resistor of 600 ohms connected to the line terminals;

or

b) of one or a sequence of more than one DTMF signals which are according with the requirements in sections 5.4 and 10.5 (E) 7.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 5.3.

10.6 (E) 5.4 Other identification signals

When the TE in the loop condition shall transmit an identification signal in other form than a coded signal (see option 10.6 (E) 5.1.b.ii), this signal shall be:

either

i) repeated

- 1) without pauses;
- or
- 2) with pauses of a duration that shall not be greater than 2 seconds;

or
ii) sent continuously;

and shall consist:

either
a) of a verbal announcement;

or
b) music;

or
c) other mixed signal.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 5.4.

A.10.6 (E) 5 Identification signals

A.10.6 (E) 5.1 General of identification signals

The procedure of test in section A.10.5 (E) 9.1 is followed.

A.10.6 (E) 5.2 Identification signal timing

The procedure of test in section A.10.5 (E) 8 is followed.

A.10.6 (E) 5.2.a Check by inspection.

A.10.6 (E) 5.2.b The signals stipulated in the test in section A.10.6 (E) 6.4.b shall be used when necessary.

A.10.6 (E) 5.2.c Check by inspection.

A.10.6 (E) 5.2.d Check by inspection.

A.10.6 (E) 5.3 Identification tones

The procedure of test in section A.10.5 (E) 9.3 is followed.

A.10.6 (E) 5.4 Other identification signals

The procedure of test in section A.10.5 (E) 9.4 is followed.

10.6 (E) 6 Loop condition duration control

10.6 (E) 6.1 General of loop condition duration control

PROVISION 1: The following provisions 2 to 4 in this section 10.6 (E) 6.1 shall be applied for the requirements in sections 10.6 (E) 6.2 to 10.6 (E) 6.7.

PROVISION 2: The control of the loop condition can be done:

- 2a) wholly manually;

or
2b) wholly automatically;

or
2c) partly manually and partly automatically, in whatever order of succession it may be.

PROVISION 3: The meaning given in this section 10.6 (E) 6 for the term "in automatic control of loop condition" is that the TE is in the loop condition

either

3a) after the answer has been left under the automatic control of the TE, and after the transmission of the identification signal has ended;

or

3b) after the communication has been manually left under the automatic control of the TE.

PROVISION 4: The meaning given in this section 10.6 (E) 6 for the term "continuous receiving mode of operation" is that the TE is in a functional mode in which:

either

4a) it shall have continuous receiving signals through its line terminals;

or

4b) it is capable of continuously distinguishing the possible signals received through its line terminals;

independently of whether the TE is simultaneously sending signals or not.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 6.1.

10.6 (E) 6.2

Change from automatic control to manual control

With TE in automatic control of loop condition, when it:

a) is prepared for allowing the user to assume the control of the communication in a manual mode, as a consequence of its own automatic procedures, then

i) the TE shall alert the user with an acoustic signal;

and

ii) the alert signal shall last until the manual control is activated;

and

iii) the TE shall establish automatically the quiescent condition if the manual control has not been activated before a period of no greater than 35 seconds from the start of the alert signal has ended;

PROVISION a.iii: However, for alarm receiver equipment, it is permitted to extend the limit up to 5 minutes.

or

b) has a manual control provided for assuming the control of the communication by the user, then

i) the TE shall transfer the control to manual mode;

or
ii) when the transfer delay is greater than 2 seconds after a manual control has been activated, the TE shall:

1) indicate, either acoustically or optically, that the order has been received;

and

2) follow the procedure stipulated in "a";

or

c) has a manual control provided for changing to quiescent condition, then the TE shall:

i) establish automatically the quiescent condition;

and

ii) indicate, either acoustically or optically, that the order has been received, when the establishment delay is greater than 2 seconds after the manual control has been activated.

PROVISION: This requirement shall also be applied while the TE is transmitting an identification signal (see the requirements in sections 10.6 (E) 5).

Compliance shall be checked by the tests outlined in section A.10.6 (E) 6.2.

10.6 (E) 6.3 **Duration control not related with information transferred**

With TE in automatic control of loop condition, when it is prepared for preserving the loop condition without any control related with the information transferred or received through its line terminals, it shall:

either

a) establish the quiescent condition;

or

b) allow the user to assume the control of the communication in a manual mode as stipulated in section 10.6 (E) 6.2.a;

within a period no greater than 1,5 minutes from the change of loop condition after the automatic change from ringing condition, or from the change to automatic control.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 6.3.

10.6 (E) 6.4 **Preservation of loop condition control related with information transfer**

With TE in automatic control of loop condition, when it is prepared for preserving the loop condition with a control related with the information or signals received through its line terminals, either with simultaneous sending or not, this loop condition shall be maintained, while a signal with an open circuit ac rms voltage of 11 mV (-43 dBm, over a load resistor of 600 ohms) and one of the following frequency ranges and sequences:

a) from 300 Hz to 3,4 kHz, with a sequence which is made up by 5 seconds of signal and 5 seconds of pause;

- or
b) in accordance of the modes of operation indicated in the user's manual;

is applied between the line terminals through a resistor of 600 ohms.

PROVISION: This requirement shall not be applied for TE which are prepared to be in a functional mode different from a continuous receiving mode of operation, while they are in such different mode.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 6.4.

10.6 (E) 6.5 Liberation of loop condition control related with information transfer

With TE in automatic control of loop condition, when it is prepared for preserving the loop condition with a control related with information or signals received through its line terminals, either with simultaneous sending or not, it shall:

- either
a) establish the quiescent condition no later than 10 seconds;

- or
b) allow the user to assume the control of the communication in a manual mode as stipulated in section 10.6 (E) 6.2.a;

after a signal as stipulated in the relevant option of the requirement in section 10.6 (E) 6.4, with an open circuit ac rms voltage of 15,5 mV (-40 dBm, over a load resistor of 600 ohms) is applied to the line terminals, and its open circuit ac rms voltage has been decreased to a value no greater than 6,17 mV (-48 dBm, over a load resistor of 600 ohms) for a continuous period of 1,5 minutes.

PROVISION 1: However, for alarm transmitter TE it is permitted to extend the limit from 1,5 minutes up to 15 minutes when a listening function for surveillance purposes is provided for the TE.

PROVISION 2: This requirement shall not be applied for TE which are prepared to be in a functional mode different from a continuous receiving mode of operation, while they are in such different condition, unless the option "ii" in the requirement in section 10.6 (E) 6.7 is used.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 6.5.

10.6 (E) 6.6 Liberation of loop condition control related with ac network signals

With TE in automatic control of loop condition, when it is prepared for preserving the loop condition with a control related with the information or signals received through its line terminals, either with simultaneous sending or not, it shall establish the quiescent condition no later than:

- a) 10 seconds, after a single frequency, continuous or interrupted, or a series of single frequencies, with or without pauses, in the frequency range from 320 Hz to 480 Hz , with an open circuit ac rms voltage greater than 49 mV (-30 dBm, over a load resistor of 600 ohms) has been applied between the line terminals through a resistor of 600 ohms for a continuous period of 20 seconds;

and

- b) 60 seconds after a signal with an open circuit ac rms voltage greater than 49 mV (-30 dBm, over a load resistor of 600 ohms), frequencies from 320 Hz to 480 Hz, and with a sequence which is made up by 1,5 seconds of signal and 3 seconds of pause, is applied between the line terminals through a resistor of 600 ohms.

PROVISION: This requirement shall also be applied while the TE transmitting an identification signal (see the requirements in section 10.6 (E) 5).

Compliance shall be checked by the tests outlined in section A.10.6 (E) 6.6.

10.6 (E) 6.7 Liberation of loop condition control related with other network signals

With TE in automatic control of loop condition, when it is prepared for preserving the loop condition with a control related with the information or signals received through its line terminals, either with simultaneous sending or not, and when it is in a functional mode different from a continuous receiving mode of operation, it shall:

either

- i) establish the quiescent condition no later than 10 seconds after any one of the following actions have occurred:

- 1) A change to the opposite polarity has been produced between the line terminals;
- 2) a line interruption with a duration of at least 1 ms has been produced;

or

- ii) to have periods of continuous receiving mode of operation, then

- 1) such periods shall not be separated more than 3 minutes;

and

- 2) during such periods the TE shall meet the requirement in section 10.6 (E) 6.5, where the applied signal shall be decreased during a period equal to

- a) the shortest period of continuous receiving mode of operation for which the TE is prepared;

or

- b) 1,5 minutes;

whichever is the shorter.

Compliance shall be checked by the tests outlined in section A.10.6 (E) 6.7.

A.10.6 (E) 6 Loop condition duration control

A.10.6 (E) 6.1 General of loop condition duration control

The procedure of test A.10.5 (E) 10.1 is followed.

A.10.6 (E) 6.2 Change from automatic control to manual control

The procedure of test in section A.10.5 (E) 10.2 is followed.

- A.10.6 (E) 6.3** **Duration control not related with information transferred**
The procedure of test in section A.10.5 (E) 10.3 is followed.
- A.10.6 (E) 6.4** **Preservation of loop condition control related with information transfer**
The procedures of test in section A.10.5 (E) 10.4 are followed.
- A.10.6 (E) 6.5** **Liberation of loop condition control related with information transfer**
The procedures of test in section A.10.5 (E) 10.5 are followed.
- A.10.6 (E) 6.6** **Liberation of loop condition control related with ac network signals**
The procedures of test in section A.10.5 (E) 10.6 are followed.
- A.10.6 (E) 6.7** **Liberation of loop condition control related with other network signals**
- A.10.6 (E) 6.7.i.1** The procedure of test in section A.10.5 (E) 10.7.a.i.1 is followed.
- A.10.6 (E) 6.7.i.2** The procedure of test in section A.10.5 (E) 10.7.a.i.2 is followed.
- A.10.6 (E) 6.7.ii** The procedure of test in section A.10.5 (E) 10.7.a.ii is followed.
- 10.6 (S)** **Sweden**
- 10.6 (S) 1** If the incoming message recording capacity is exceeded while a recording is in progress, the calling party shall be so notified in some way, e.g. by means of short tone bursts. In response to subsequent calls, the telephone answering machine shall not send any announcement advising the called party to record a message. However, the telephone answering machine shall not start without sending some kind of answer.
- 10.7 Power failure**
- 10.7 (D)** **Germany**
- 10.7 (D) 1** For TEs with telephone functions, which are power supplied by external sources, it is necessary, in the event of a failure of the external power supply, that the basic functions of a telephone be operable. In this case there shall be a note, e.g. in the user instructions: In case of power supply not operable.
- 10.7 (D) 2** When the TE is switched on or during return of the power supply after its interruption, the internal voltages have to be switched on in such a manner (sequence) that an undisturbed operation is guaranteed.
- 10.7 (D) 3** For battery powered TEs these requirements apply accordingly.
- 10.7 (D) 4** The signal earth of an equipment must not be used as protection earth.
- 10.8 Connection methods**
- 10.8 (D)** **Germany**
- 10.8 (D) 1** General requirements
- 10.8 (D) 1.1** Interconnection devices (elements to interconnect the installation cable with the TE) have to be designed according to relevant requirements in DIN 41 715.

10.8 (D) 1.2 Interconnection devices have to ensure that the parallel connection of telephones in operational state is impossible. When using the interconnection devices described in sections 8.2 and 8.3 also the related assignments of pins and wires have to be used.

10.8 (D) 2 **Group C auxiliary equipment AE (C)**

10.8 (D) 2.1 Auxiliaries in Group C are connected like a second handset in accordance with figure 10.8 (D) 1.a.



Figure 10.8 (D) 2.a: Connection of an auxiliary (C)

10.8 (D) 2.2 Group C auxiliary equipment must be connected via a transformer with isolated windings, which has been reliably electrically isolated in accordance with VDE 0804/1.83, item 18, and with capacitors arranged symmetrically in series for dc isolation.

10.8 (D) 2.3 The capacitors must be self-healing and must be designed for a test voltage of ≥ 50 V.

10.8 (D) 2.4 If dc isolation is achieved only by one capacitor in series with the transformer, then this capacitor must be self-healing and designed for a test voltage of ≥ 100 V. Polarized capacitors must not be used.

10.8 (D) 2.5 If Group C auxiliaries are connected to heavy-duty circuits, the reliable electrical isolation must be provided in accordance with VDE 0804/01.83, item 14. If the components used are designed for a rated dc voltage of at least 1 000 V, then one capacitor is sufficient.

10.8 (D) 2.6 AE (C) must be fitted with a connector as detailed in figure 10.8 (D) 2.b.

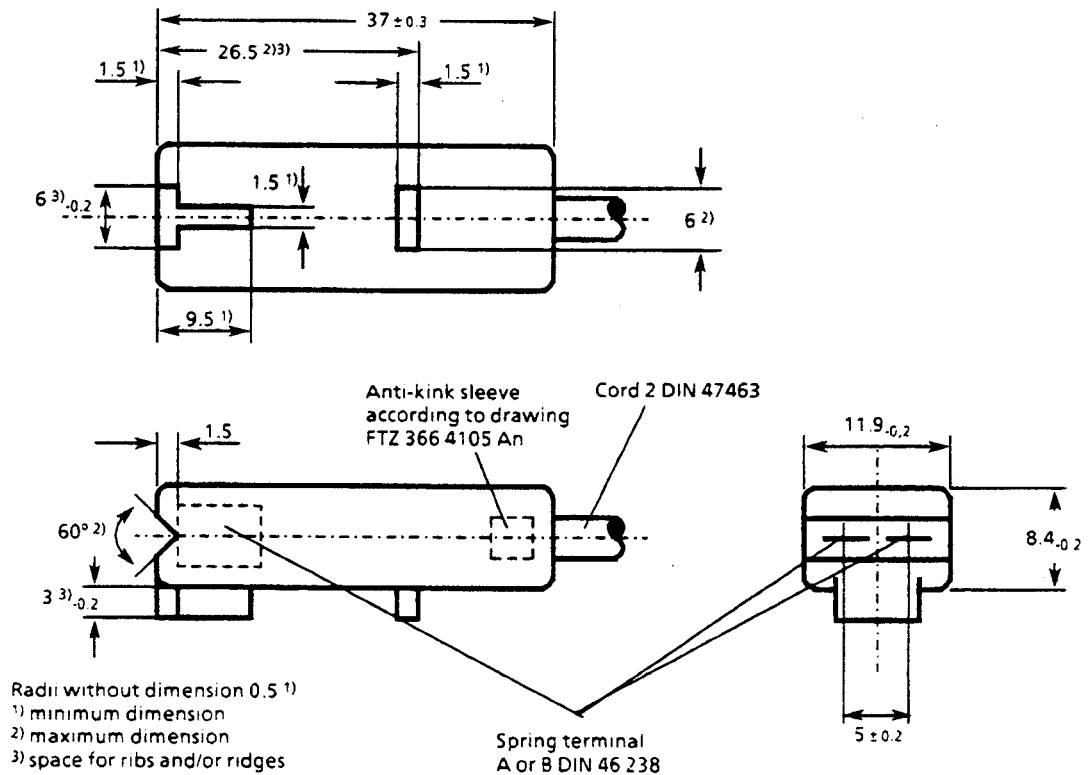


Figure 10.8 (D) 2.b: Connector for auxiliary (C)

10.8 (D) 2.7 Any plug-in connections in the cable between the telephone and the AE (C) must be designed to ensure that the voltage insulation of the telephone is not adversely affected if live components are inadvertently touched.

10.8 (D) 2.8 The input capacity of AE (C) at terminals Z1/Z2 must not exceed 180 pF against earth. No overvoltage suppressors against earth must be used.

10.9 Special function

10.9 (F) France

10.9 (F) 1 The DTMF (MFPB) detectors used to remote activation from a PSTN connection point to one another shall conform to the requirements contained in this section, referring to test figure A.9.5.2.1 (with $Z_G = Z_L = 600$ ohms) and the following abbreviations:

- f_L : low group component frequency
- f_L min (Hz): 682 - 753 - 834 - 922
- f_L nom (Hz): 697 - 770 - 852 - 941
- f_L max (Hz): 712 - 787 - 870 - 960
- p_L : level of the lower frequency component
- f_H : high group component frequency
- f_H min (Hz): 1 186 - 1 311 - 1 450 - 1 604
- f_H nom (Hz): 1 209 - 1 336 - 1 477 - 1 633
- f_H max (Hz): 1 232 - 1 361 - 1 504 - 1 662
- p_H : level of the higher frequency component
- t_{on}/t_{off} : sending cadence
- f_i : frequency of interference signal generated simultaneously with the DTMF signal
- p_i : level of interference signal

The detection of the combinations assigned to characters A, B, C,D is optional.

The test is carried out for at least the combinations assigned to characters 1, 5, 9 and, in case of option, D.

a) Conditions of detection

The detector shall recognise the correct combination (in accordance with the signalling code described in section 5.4.3) when the following DTMF signals are applied through 600 ohms line terminals:

Table 10.9 (F) 1.a1

f_L (Hz)	p_L (dBm)	f_H (Hz)	p_H (dBm)	t_{on}/t_{off} (ms)	f_i (Hz)	p_i (dBm)	V_f (V)	R_f (Ω)
min	-6	min	-4	100/100			54	300
nom	-6	nom	-4	100/100			54	300
max	-6	max	-4	100/100			54	300
min	-15	min	-15	70/70			48	900
nom	-15	nom	-15	70/70			48	900
max	-15	max	-15	70/70			48	900
min	-37	min	-45	50/50			46	1 400
nom	-37	nom	-45	50/50			46	1 400
max	-37	max	-45	50/50			46	1 400
nom	-37	nom	-45	50/50	50	-7	46	1 400
nom	-37	nom	-45	50/50	330	-60	46	1 400
nom	-37	nom	-45	50/50	440	-60	46	1 400
nom	-37	nom	-45	50/50	12 k	-60	46	1 400

The detection shall not be disturbed by break of at most 20 ms in the DTMF signal. To this end, it is verified that the detector recognise only one time the correct combination in each of the following sequences where $t_{on}/t_{off} = 40/20$ 40/40 ms is representative of a 100/40 ms cadence with a 20 ms break in the sending period:

Table 10.9 (F) 1.a2

f_L (Hz)	p_L (dBm)	f_H (Hz)	p_H (dBm)	t_{on}/t_{off} (ms)	f_i (Hz)	p_i (dBm)	V_f (V)	R_f (Ω)
nom	-37	nom	-45	50/20/50/50	50	-7	46	1 400
nom	-37	nom	-45	50/20/50/50	330	-60	46	1 400
nom	-37	nom	-45	50/20/50/50	440	-60	46	1 400
nom	-37	nom	-45	50/20/50/50	12 k	-35	46	1 400
nom	-37	nom	-45	50/20/50/50			46	1 400

b) Conditions of non-detection

The detector shall not be activated when the following signals are applied through 600 ohms to the line terminals:

Table 10.9 (F) 1.b

f_L (Hz)	p_L (dBm)	f_H (Hz)	p_H (dBm)	t_{on}/t_{off} (ms)	f_i (Hz)	p_i (dBm)	V_f (V)	R_f (Ω)
min	-45	min	-54	100/100			48	300
nom	-45	nom	-54	100/100			48	300
max	-45	max	-54	100/100			48	300
nom	-15	max	-15	20/100			48	300
nom	-6	max	-4	20/100			48	300
								300

10.9 (IS) Iceland

10.9 (IS) 1 The button for recall of the register must be separated from any other keypad used for dialling and shall be marked "R" (register recall).

10.9 (N) Norway

10.9 (N) 1 Meter pulse reception

The longitudinal conversion loss in the frequency band 15 kHz - 17 kHz shall be greater than 50 dB.

10.10 Additional unclassified requirements

10.10 (F) France

10.10 (F) 1 In order to ensure a permanent basic telephone service, it is required for telephone sets and series-connected TEs to be able to work normally, without any intervention, after being exposed to the overvoltages coming from the PSTN as shown in the following test.

The test is made using the overvoltage pulses generator described in figure A.10.10 (F) 1.a.

The shape of the test pulses is shown in figure A.10.10 (F) 1.b.

The test set-up is shown in A.10.10 (F) 1.c for telephone sets, and in A.10.10 (F) 1.d for series-connected TEs.

The pulse generator peak voltage measured without load is fixed at 1 kV.

TEs are tested both with 10 pulses in quiescent condition and with five pulses in loop condition.

The pulses are separated by 60 s intervals, with a pulse polarity inversion between two successive pulses.

Document history		
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