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ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

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Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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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, 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. Section 1.3 provides further details on the structure and how to use this ETS.

Transposition dates	
Date of adoption of this ETS:	31 March 1996
Date of latest announcement of this ETS (doa):	30 June 1996
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	31 December 1996
Date of withdrawal of any conflicting National Standard (dow):	31 December 1996

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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 certification authority. This certificate is then recognised as valid in all other signatory countries, avoiding the need for the 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 two categories; access NETs and terminal NETs as described below;

a) Access NET

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.

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.

b) 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.

1.1.4 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 ETS 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 ETS 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 (BG) 1 This ETS does not form the type approval requirements for equipment that contain certain call routing or certain switching functions, in these cases Bulgarian national requirements apply and reference shall be made to the Bulgarian Approval Authority in order to determine the totality of applicable requirements and associated tests.

This ETS is applicable for telecommunications systems in which the a/b input wires are switched galvanically to the extension lines.

1.2 (SF) 1 This document does not form the type approval requirements for TE that contain call routing and switching functions except very small PBXs or key systems with 1 or 2 trunk lines. For TE with more trunk lines, the national standards apply.

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 ETS 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 type approval specification defines the requirements to be met by all terminal equipment intended for connection to analogue accesses (with the exception of emergency telephone and direct dialling-in accesses) in the telephone network / ISDN of Deutsche Bundespost TELEKOM. Where a technical test is provided for reference is made to the corresponding measurement method. Where compliance with a specific requirement is not verified by means of a test, the requirement shall nevertheless befulfilled if it is applicable to the area(s) for which a terminal is designed.

Unless otherwise stated, the requirements given in this type approval specification apply to the network termination of the analogue switched access, i.e. the refer exclusively to this interface and shall also be met in the case where several terminals are to be used collectively at this one interface.

1.2 (D) 2 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 Impulskennzeichengabe (IKZ);
- telephone accesses with Gleichstromkennzeichengabe (GKZ);
- accesses for Group 1 fixed connections (leased lines);
- accesses for the warning and alarm service.

For these accesses special regulations apply.

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, nor the additional access requirements for those especially designated for the support of PSTN facilities (i.e. PSTN Calling Line Identification presentation) or for the use of specific PSTN properties (i.e. battery reversal as seizure / release indication). 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 (CH) 1 For legal purposes the Swiss national requirements apply. The present document was up-dated according to the last version (July 1995) of the Swiss national requirements and can be used for every kind of TE (e.g.: voice, data or PABX). The Swiss national requirements are based on the present document (technical aspects) and introduce additional regulatory aspects.

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 ETS

This ETS 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 ETS 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 national 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 ETS

The following terms are given particular meaning within this ETS. 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 metallically 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 separate 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).

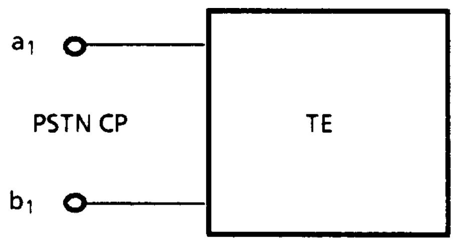


Figure 1.4.4.1.a: One-port TE

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).

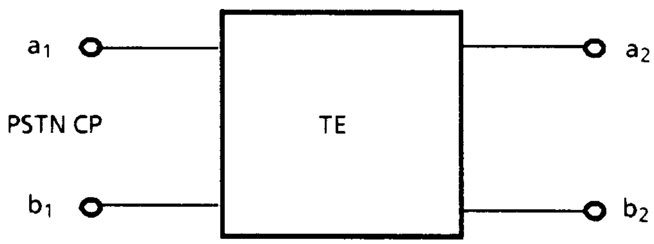


Figure 1.4.4.1.b: Series-connected TE

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

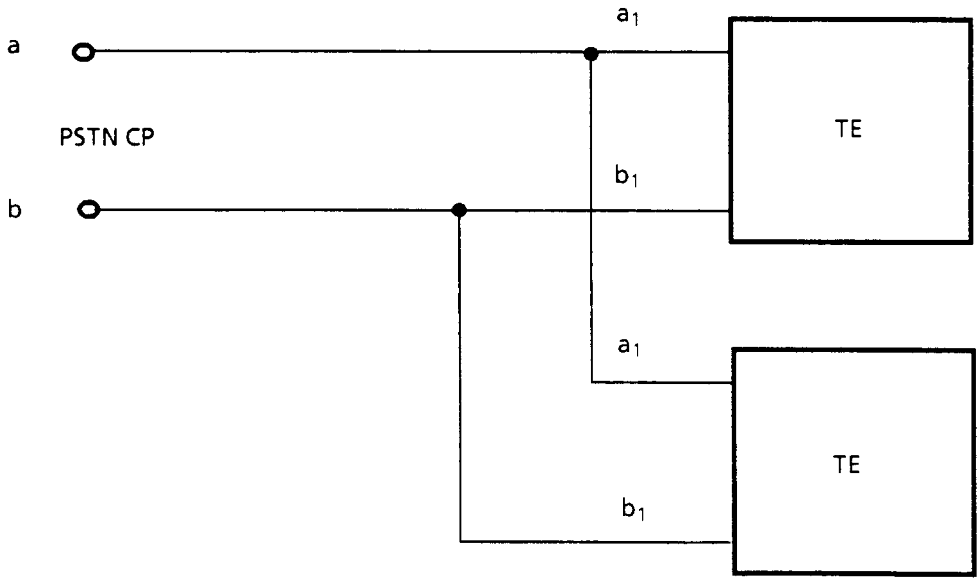


Figure 1.4.4.1.c: Parallel connected TE

1.4.4.1 (A) 1 For TE with telephony functions (e.g. telephone set) a parallel connection in loop condition is not permitted. This requirement shall be fulfilled at series-connected TE generally. Reference is made to chapter 8.

1.4.4.1 (D) 1 Terminal equipment is equipment which is intended for connection to the telephone network / ISDN of Deutsche Bundespost TELEKOM, i.e.:

a) which is intended to be directly connected to the network termination of the telephone network / ISDN of Deutsche Bundepost TELEKOM or

b) which is intended to interwork with a telecommunications network and thereby be directly or indirectly connected to the network termination of the telephone network / ISDN of Deutsche Bundespost TELEKOM,

in order to transmit, process or receive information.

1.4.4.1 (DK) 1 A PABX is

- either a TE with one port to the PSTN CP (NCP-port) and one port for attachment of a second TE (TE-port), where the second TE is not excited solely by loop current from the NCP-port,
- or a TE with more than two ports, whereof at least one NCP-port and one TE-port.

A PABX shall, unless specified otherwise, comply at each NCP-port with the requirements to a one-port TE.

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.

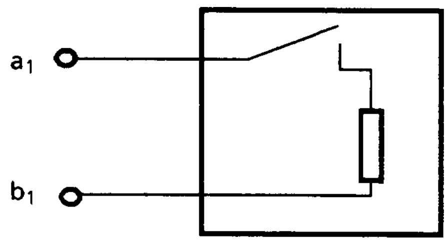


Figure 1.4.4.2.a: One-port TE (loop holding)

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.

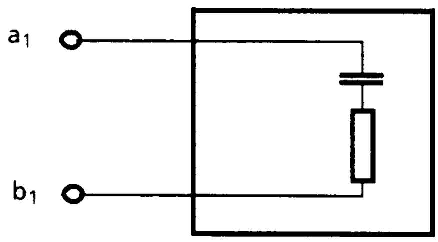


Figure 1.4.4.2.b: One-port TE (non-loop holding)

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.

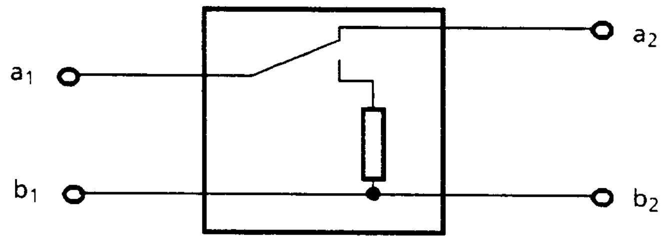


Figure 1.4.4.2.c: Series-connected TE (loop holding, output disconnected)

Type 3 (II): The loop is held and the output port remains connected (e.g. answering machine), see figure 1.4.4.2.d.

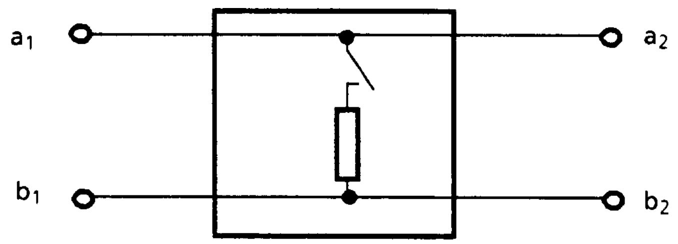


Figure 1.4.4.2.d: Series-connected TE (loop holding, output connected)

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.

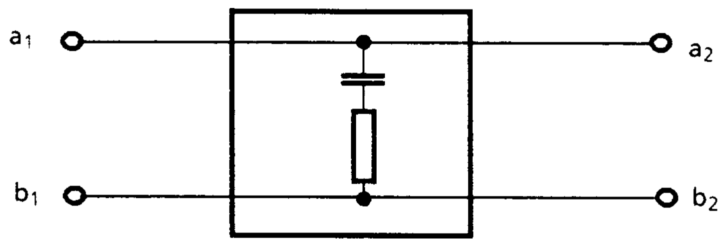
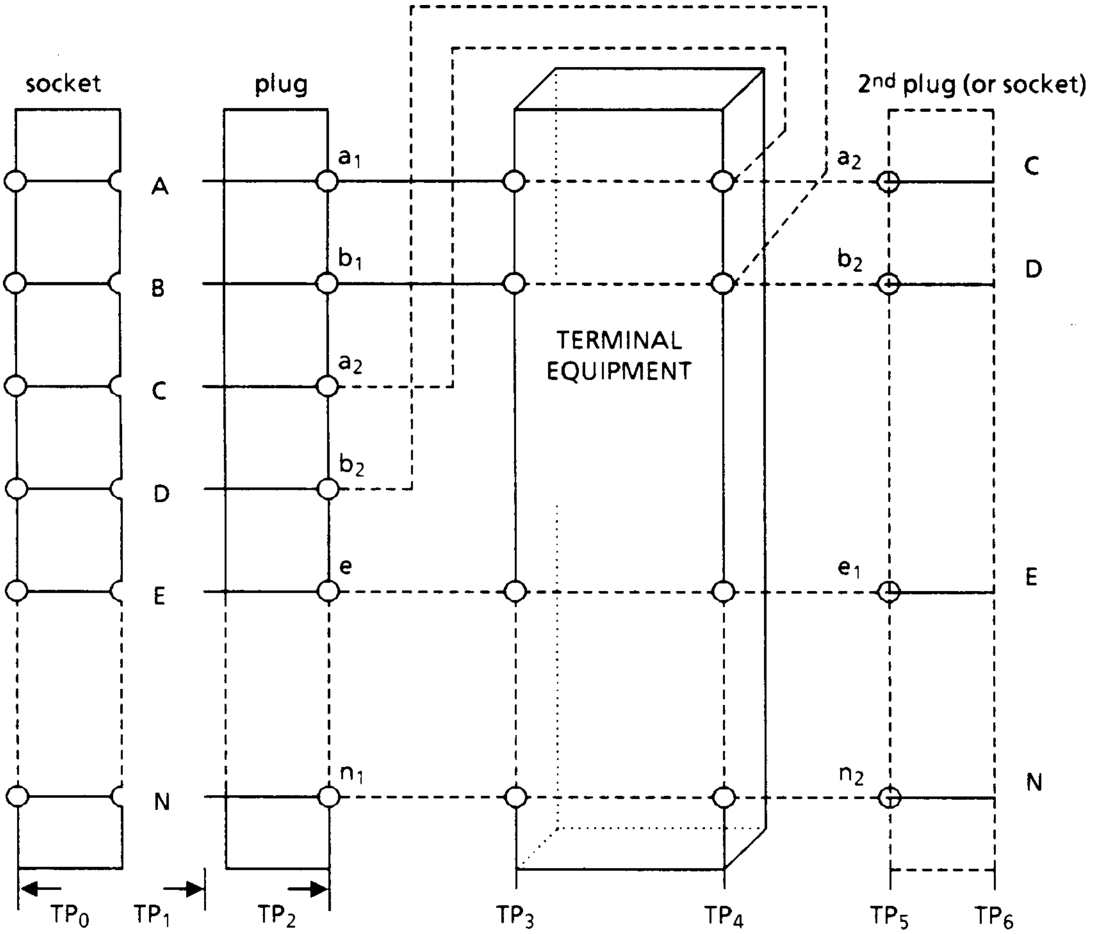


Figure 1.4.4.2.e: Series-connected TE (non-loop holding)

1.4.4.3 Reference model of a TE

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



TP = Testing point (see Figure 1.4.4.4)

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).

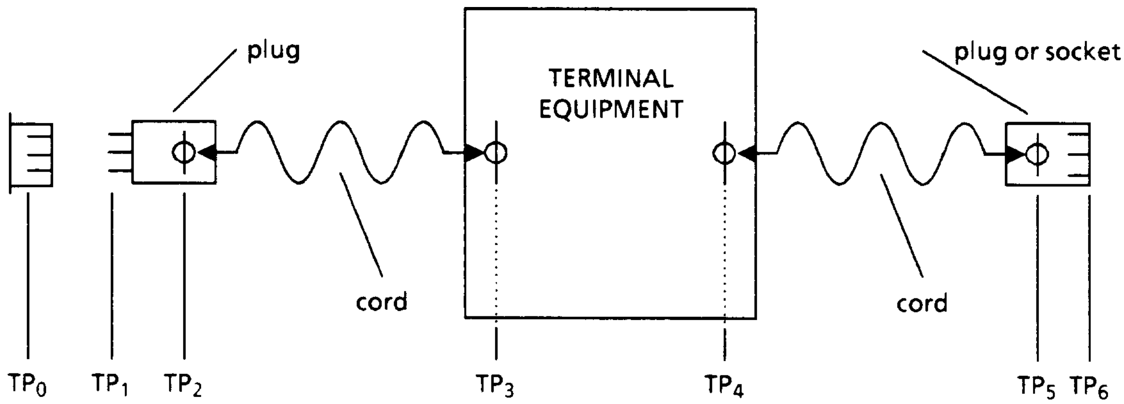


Figure 1.4.4.4: Definition of testing point

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
Bulgaria		X		X				
Cyprus		X		X				yes
Denmark		X		X	X		X	yes
Finland		X		X	X		X	yes
France		X		X	X		X	
Germany		X						yes
Greece		X		X	X		X	yes
Hungary		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		X	yes
U. Kingdom		X	X	X	X	X	X	

1.4.4.4 (A) 1 Testing point TP_1 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 TP_2 (or TP_3) and TP_5 (or TP_4).

1.4.4.4 (CY) 1 TP_3 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 TP_3 and TP_4, 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 TP_1). If the TE is provided with a permanent connection (e.g. screws), the testing shall be performed using TP_3.

In case of a series-connected TE testing point TP_4 or TP_6 is used, depending on whether the series-connected TE has plug and cord or a permanent connection.

1.4.4.4 (D) 1 See 1.2 (D) 1.

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 TP_3 and TP_4 if it exists.

1.4.4.4 (H) 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 TP_3 and TP_4.

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 TP_3. The test points for series-connected equipment where applicable on port a_2b_2 shall be the second plug or socket if supplied with the TE, or else TP_4.

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 TP_3 and TP_4 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 TP_3.

1.4.4.4 (N) 2 If the TE is provided with a cord, TP_6 is used. If the TE is provided with a permanent connection, the If the TE is provided with a 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 TP_0 shall be used.

1.4.4.4 (P) 2 Testing point TP_2 shall be used for TE provided with a cord or a cord and a connection box.

1.4.4.4 (P) 3 Testing point TP_2 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 TP_3 and TP_4 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 protective earth) terminal or lead, then the testing point 3 (TP_3) (or testing point TP_4) is used in certain test arrangements together with the accessible parts.

1.4.4.4 (CH) 1 If a TE is fitted with a connecting cable, the plug on the connecting cable acts as the interface (TP_1) for the tests.

If a TE is not fitted with a connecting cable, the connecting point of the TE acts as the interface (TP_3) for the tests. Following values (representing the characteristics of a cable) shall be reduced from the required limits: series resistance (as per section A.2.5) 10 Ω, insertion loss (as per sections A.4.1.1 and A.4.3) 0,1 dB. All the other characteristics of a cable are not relevant.

1.4.4.4 (S) 1 If the TE is provided with a cord(s), the type approval shall include the plug/socket and cord, and testing shall be performed using TP_1 and TP_6 respectively. If the TE is provided with a permanent connection (e.g. screws), the testing shall be performed using TP_3. If the TE is provided with a socket, the secondary side testing shall be performed using TP_4.

1.4.5 States or conditions of TE

The states below are always states of TE.

1.4.5 (D) 1 **Automatic dialling**

Automatic dialling is defined as the process whereby the dialling information is automatically transmitted after seizure of a line.

Automatic line seizure

Automatic line seizure refers to seizure of the line not immediately succeeding a manual operating procedure.

The Communication state

commences after dialling, in the case of an outgoing call. The dividing lines between the interdigital state and the dialling state and the interdigital state and the communication state (see annex 5) are indefinite,

commences after answering of the call, in the case of an incoming call,

ends with the transition of the terminal equipment to the quiescent state.

Dialling

Dialling begins with the emission of the first digit and ends with the last digit necessary for establishment of the call.

Interdigital state

The interdigital state commences on conclusion of the emission of one digit and ends when emission of the next digit commences or with the beginning of the communication state, as appropriate.

Operating states

The following operating states exist:

quiescent state,
off-hook condition;
dialling state;
interdigital state,
communication state,
ringing state,
as well as the transitions to these states.

Switching signals

Switching signals are electrical characters for signalling between terminal equipment and equipment of the telephone network/ISDN.

Telecommunication messages

Telecommunication messages are electrical signals generated by terminal equipment and which are not required for communication with the telephone network/ISDN of Deutsche Bundepost TELEKOM.

Transient states

outgoing call: from the quiescent state to the off-hook condition (T1), incoming call: from the ringing state to the communication state (T2),

call clearing: from the communication state to the quiescent state (T3).

Wanted signals

Telecommunication messages, audible tones and signals, as well as recorded messages from the network, are regarded as wanted signals.

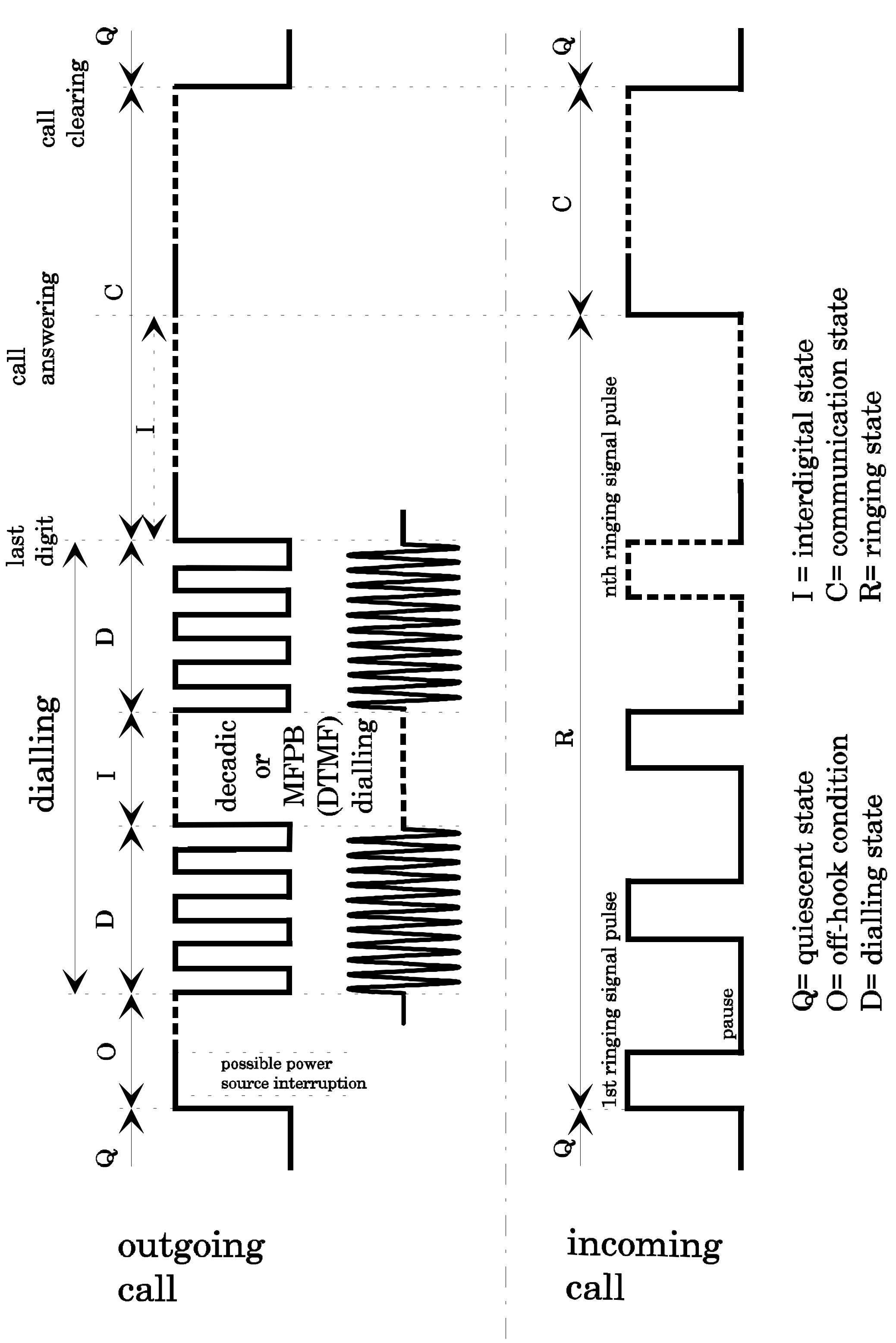


Figure 1.4.5 (D) 1: Diagram of operating states for outgoing / incoming calls

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 (D) 1 Quiescent state

The quiescent state is characterized by the fact that the terminal equipment is neither in a transient state nor in the dialling, ringing, off-hook, interdigital or communication state.

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 or 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.

1.4.5.2 (D) 1 Ringing state

The ringing state commences with the reception of the first ringing signal and ends with the answering of the call or when no further ringing signals are received.

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 (D) 1 Off-hook condition

The Off-hook condition commences when the terminal equipment has reached the stationary dc resistance level and ends with the transition to the dialling state or the quiescent state.

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.

1.4.5.4 (D) 1 Dialling state

The Dialling state is the operating state from the beginning to the end of the transmission of dialling information (digits and interdigital pauses).

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 "a_1" and "b_1" ("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 "a_1" and "b_1" ("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 "a_2" and "b_2" ("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.

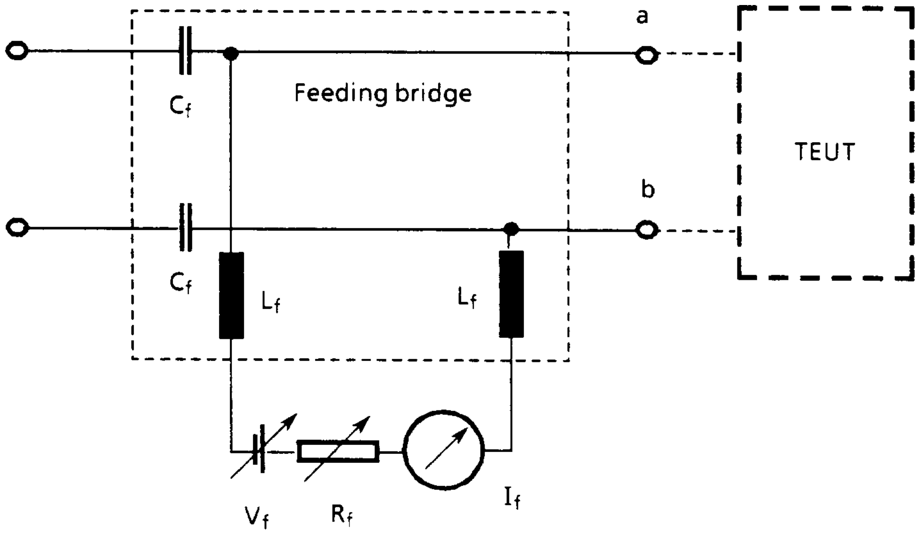


Figure 1.5: Idealised feeding bridge circuit

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

1.5 (D) 1 Feeding bridge A

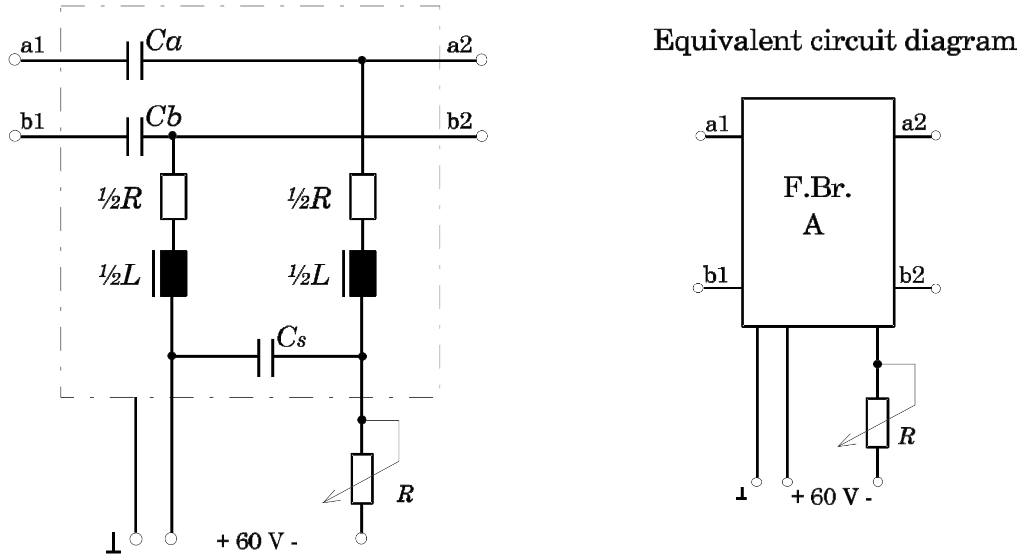


Figure 1.5.a (D) 1

Feeding bridge A serves to supply direct current to the TEUT with simultaneous decoupling of the ac circuits. The circuit diagram and the equivalent circuit diagram are illustrated in figure 1.5.a.

The feeding bridge shall work within the current range from 0 mA to 60 mA.

Unless otherwise specified, the following values shall apply for all dc values and at

superimposed ac voltages in the frequency range 10 Hz to 200 kHz with a level of up to +15 dB (775 mV).

The feeding bridge shall remain stable at all current values.

The following conditions apply to the circuit components:

Table 1.5.a (D) 1

Inductance	$L \geq 10$ H at $I = 0$ mA to 60 mA
Measuring voltage	equivalent to a magnetic flux-density of 2 mT
Measuring frequency	300 Hz
DC resistance	$R = 1000\ \Omega$
Capacitance	$Ca = Cb \geq 47\ \mu$F $Cs \geq 100\ \mu$F

Return loss

a) measured against 600 Ω in the case of a termination with 600 Ω

Table 1.5.b (D) 1

Frequency range	α
200 Hz ≤ f ≤ 4 kHz	≥ 40 dB

b) measured against Z_R in the case of a termination with Z_R

Table 1.5.c (D) 1

Frequency range	α
200 Hz ≤ f ≤ 500 Hz	≥ 33 dB
500 Hz < f ≤ 2.5 kHz	≥ 40 dB
2.5 kHz < f ≤ 4 kHz	≥ 33 dB

Composite loss, measured between Z_R

Table 1.5.d (D) 1

Frequency range	a_c
10 Hz ≤ f ≤ 200 Hz	≤ 0.5 dB
200 Hz < f ≤ 4 kHz	≤ 0.05 dB
4 kHz < f ≤ 100 kHz	≤ 0.5 dB
100 kHz < f ≤ 200 kHz	≤ 1 dB

Balance, measured as the degree of unbalance about earth at a1, b1 in the case of a termination with 600 Ω at a2, b2.

Table 1.5.e (D) 1

Frequency range	a_u
50 Hz ≤ f ≤ 200 Hz	≥ 60 dB
200 Hz < f ≤ 4 kHz	≥ 75 dB

Feeding voltage

In the case of an integrated power supply unit fed from the mains, the dc feeding voltage shall be 60 V. The dc feeding voltage may be adjustable.

DC resistance

The dc resistance of the feeding bridge shall be 1 000 Ω. The value shall be divided symmetrically between both wires (a and b). In the case of feeding bridges with an integrated power supply unit, it shall be possible to increase the dc resistance by means of a preconnected resistance R (see also figure 1.5.a (D) 1).

Weighted noise power level

The weighted noise power level measured with a phosphometer in accordance with CCITT Recommendation O.41 is measured at line terminals a1 and b1 at 600 Ω. Line terminals a2 and b2 are also loaded with 600 Ω. The weighted noise power level measured shall be ≤ -85 dBmp.

Single-frequency levels

The single-frequency levels are measured selectively (relative to a bandwidth $b = 80$ Hz) at line terminals a1 and b1 at Z_R in the frequency range $50 \text{ Hz} \leq f \leq 200 \text{ kHz}$ and shall be $\leq$ -85 dB (950 mV). Line terminals a2 and b2 are also loaded with Z_R.

Feeding bridge B

Feeding bridge B serves to supply the TEUT with direct current with simultaneous decoupling of the ac circuits. In addition, feeding bridge B serves to feed the metering pulses. The circuit diagram and equivalent circuit diagram are illustrated in figure 1.5.b.

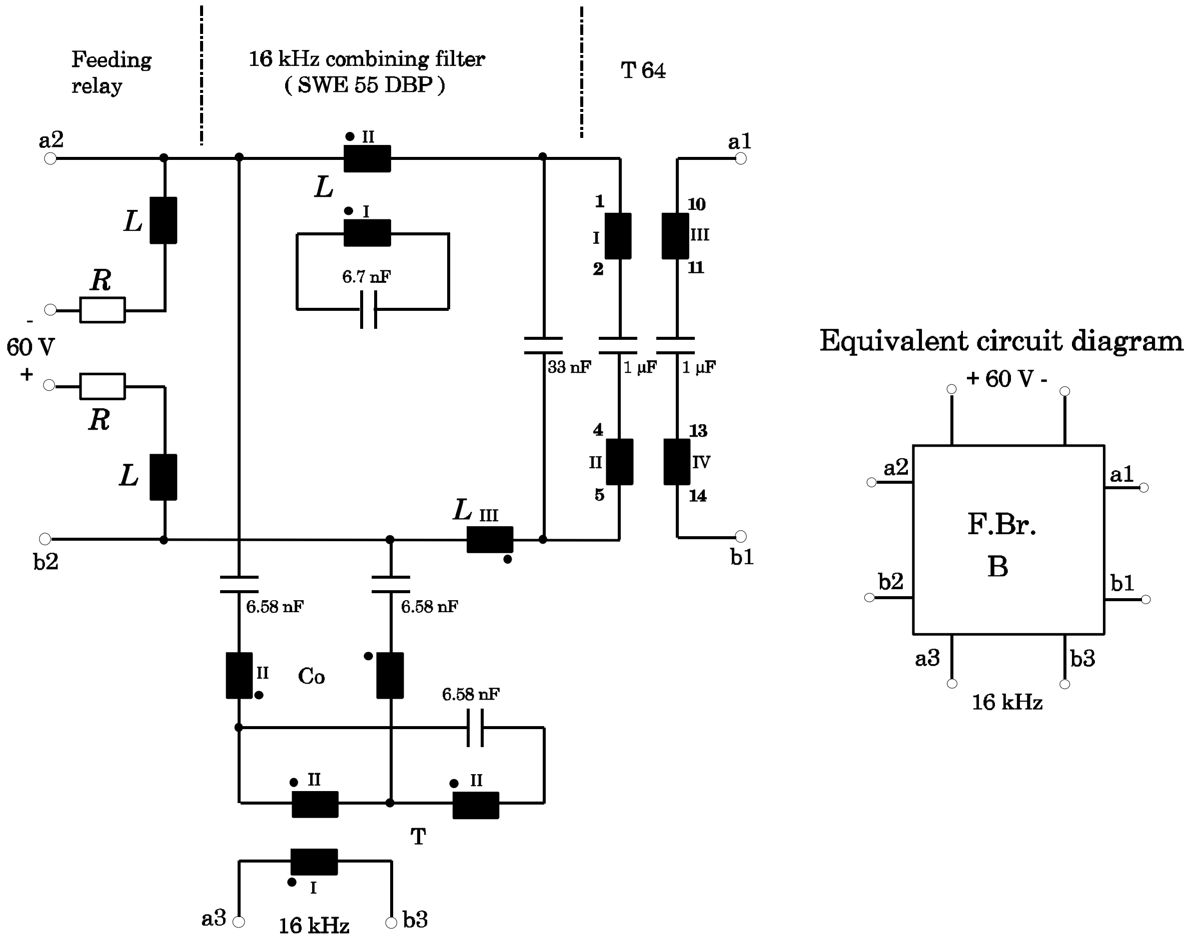


Figure 1.5.b (D) 1

Circuit characteristics

The feeding bridge shall work at current values of 0 mA ≤ I ≤ 60 mA and shall meet the following requirements.

Direction of transmission a1 / b1 ⇒ a2 / b2

Composite loss within the frequency range 200 Hz ≤ f ≤ 4 kHz

a_c ≤ 2,0 dB

Termination: line terminals a1 / b1 and a2 / b2 each 600 Ω; a3 / b3 short-circuited

Direction of transmission a3 / b3 ⇒ a1 / b1

Suppression loss at 16 kHz a_c ≥ 60 dB

Direction of transmission a3 / b3 ⇒ a2 / b2

Composite loss in direction of transmission under the following conditions:

Table 1.5.f (D) 1

Frequency	f = 16 kHz
Transmitter internal resistance	R_i = 200 Ω
Receiver internal resistance	R_e = 600 Ω

a_c ≤ 1,6 dB

Input impedance at 16 kHz at a3 / b3 : $|Z|$ ≈ 135 Ω

Characteristics of the 16 kHz combining filter

Rejector circuit (L + 6.7 nF)

Table 1.5.g (D) 1

Effective inductance	L ≈ 14.6 mH (tuning at 16 kHz)
Circuit capacitance	C = 6.7 nF ± 0.5 %
Q factor	Q = 182 ± 5

Acceptor circuit (Co + 2 • 6.58 nF)

Table 1.5.h (D) 1

Effective inductance	L ≈ 30.1 mH (tuning at 16 kHz)
Circuit capacitance	C = 6.58 nF ± 0.5 % (2 in series)
Q factor	Q = 195 ± 5

Tuned transformer (*T* + 6.58 nF)

Table 1.5.i (D) 1

Effective inductance	$L \approx 15$ mH (tuning at 16 kHz)
Circuit capacitance	$C = 6.58$ nF $\pm$ 0.5 %
Q factor	$Q = 195 \pm 5$

Characteristics of the feeding bridge components

Feeding coil *L* (per coil):

Table 1.5.j (D) 1

Inductance	$L = 1$ H $\pm$ 5 % for $I_{=}$ from 0...60 mA
Copper resistance	$R \approx 120\ \Omega$ (tuning with *R* to 500 $\Omega \pm 1$ %)
Coil quality at 1 kHz	$Q = 30 \pm 2$

Speech transformer T 64 (per coil):

Table 1.5.k (D) 1

Inductance	$L = 380$ mH $\pm$ 10 %
Copper resistance	$R = 5\ \Omega \pm 10$ %

Feeding voltage

In the case of an integrated power supply unit, the dc feeding voltage shall be 60 V. The dc feeding voltage may be adjustable.

Weighted noise power level

The weighted noise power level is measured at line terminals a1 and b1 at 600 Ω.

Line terminals a2 and b2 are also loaded with 600 Ω. The weighted noise power level measured shall correspond to ≤ -85 dBmp.

Single-frequency levels

The single-frequency levels are measured selectively (relative to a bandwidth b = 80 Hz) at line terminals a1 and b1 at Z_R within the frequency range 50 Hz ≤ f ≤ 200 kHz and shall be ≤ -85 dB (950 mV). Line terminals a2 and b2 are also loaded with Z_R.

1.5 (DK) 1 The values are typical for the Danish PSTN.

1.5 (I)1 $C_f \geq 47$ µF; $L_f \geq 5$ 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 0 Ω, 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 ± 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 ± 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		
Bulgaria	60	1 000 - 2 200	20 - 60	yes
Cyprus	43 - 53	400 - 1 740	20 - 100	
Denmark	44 - 56	500 - 2 400	$\leq I_{max.}$	yes
Finland	44 - 58	800 - 1 710		
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	
Hungary	48 - 10	440 - 2 400	$20 - I_{max}$	
Iceland	43 - 56	800 - 2 400	14 - 70	
Ireland	48	0 - 5 000	20 - 100	
Italy	44 - 52	720 - 1 880		
Luxembourg	60		14 - 60	
Malta				
Netherlands	42 - 66	800 - 2 140		yes
Norway	24 - 60	460 - 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	≥ 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 idle to loop condition of the PSTN line circuit: 1.-.60 mA.

Transient time of the PSTN line circuit to go from idle to loop condition: (loop current ≥ 19 mA): ≤ 40 ms.

ΔV_f in loop condition of the PSTN line circuit: ≤ 64 V

ΔI_f in loop condition of the PSTN line circuit: 19.-.60 mA.

In new exchanges exists a limitation for the current to a nominal value of 30 mA.

NOTE: The maximum value for Δv_f will be possibly changed in the future from 64 V to 72 V. The value of 72 V should be taken into consideration in the idle condition, ringing state and pulse dialling function during the break pulses.

1.5.1 (BG) 1

General comments on supply arrangements:

Exchange supply voltages V_f:

Nominal 48 V, limits: 44 and 52 V;

Nominal 60 V, limits: 54 and 66 V;

ΔI_f in feeding condition of PSTN line circuit: 20...60 mA. In the Bulgarian network a limitation of the feeding current to a value of "n" mA for new exchanges is under study.

1.5.1 (DK) 1

$$I_{max.} = \frac{56\ V}{500\ \Omega + R_{TEUT}}$$

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 ΔV_f = 42 - 66 V and ΔR_f = 800 - 2 140 Ω 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 in general be complied with at current values between 17 mA and maximum line current.

For some characteristics, specific requirements are given for line current values between 15 mA and 17 mA.

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 tables 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 register 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 — <u>General comments on supply arrangements:</u>

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. A permanent supply in the idle state is not guaranteed by the PSTN. A constant current power supply may be used during loop condition.

dc resistance of the subscriber line:

R_L = 0 to 2 x 350 Ω (for PABXs: 0 to 2 x 250 Ω)

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.

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	≥ 500	19, 60	
Belgium	48	400, 1 600		
Bulgaria	60	1 000, 2 200		
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	
Hungary	48		20, I_{max}	yes
Iceland	48		14, $I_{max.}$	yes
Ireland	48	0, 5 000	20, 100	
Italy	44, 48, 52	1 880, 1 100, 720		yes
Luxembourg	60		14, 60	
Malta				
Netherlands	42, 48, 66	800, 1 130, 2 140		yes
Norway	24, 40, 60	460, 1 200, 2 000, 3 100, 3 500		
Portugal	45, 48, 55		not applicable	yes
Spain	48	500, 1 700, 2 200		yes
Sweden			$I_{min.}$, 25, $I_{max.}$	yes
Switzerland	50	2 300, 1 000, 500		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 (H) 1 I_{max} is the current established at R_f = 440 ohms.

1.5.2 (I) 1 The TEUT shall meet the requirements at the dc feeding condition specified in table 1.5.1. However, unless otherwise stated only for testing purposes the following combinations shall be used:

44 V/1 880 ohm and 52 V/720 ohm.

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 Ω
48 V belongs to R_f = 1 130 Ω
66 V belongs to R_f = 800 Ω

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

a) 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 Ω (except in cases c) and d) below):

b) The upper limit of I shall be determined by connecting V_f = 60 V and R_f = 1 200 Ω (except in case d) below).

c) 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 Ω. The upper limit shall be as in b) above.

d) When measuring loudness ratings the lower limit of I shall be determined by connecting V_f = 50 V and R_f = 2 800 Ω. The upper limit shall be determined by connecting V_f = 50 V and R_f = 1 600 Ω.

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 ± 10% and frequency 50 Hz ± 2%.

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

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 (D) 1 The type approval tests shall, in principle, be carried out under climatic conditions in accordance with DIN IEC 721 Part 3-3 Climatic class 3C3. Type approval test may, upon application, also be performed in another testing environment.

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 (BG) 1 For capacitances and inductances the tolerance is ± 5%.

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

1.6.3 Test equipment accuracy

The test equipment accuracy is assumed to be ± 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 ± 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.

1.6.6.1 (D) 1 See 1.2 (D)1.

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	490	-26,0	-16,0	
Belgium	420	455	-20	-4	
Bulgaria	380	470	-25	-5	yes
Cyprus	325 + 425	375 + 475	-22	-7	yes
Denmark	400	450	-26	-6,5	
Finland	400	450	-20	-14	yes
France	425	455	-25	-10	
Germany					yes
Greece	400	475	-25	-4	yes
Hungary	375	475	-25	-5	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	340	550	-25,7	-3,8	
Norway	410	440	-30	-8 ± 2	yes
Portugal	300	450	-30	-5	
Spain	410	440	-20	-5	yes
Sweden	400	450	-30	-10	
Switzerland	400	450	-23	0	yes
U. Kingdom	350	440	-27	0	yes

1.7.1 (BG) 1 Cadence (ms):

1. Tone	1. Pause	2. Tone	2. Pause
250 ± 25	750 ± 25	750 ± 75	1 000 ± 100

or

1. Tone	1. Pause	2. Tone	2. Pause
250 ± 25	300 ± 30	700 ± 70	800 ± 80

1.7.1 (CY) 1 Combination of two frequencies: nominal 350 Hz + 450 Hz continuous.

1.7.1 (SF) 1 Dial tone is a continuous tone. The frequency for the dial tone is 425 Hz ± 25 Hz.

Special dial tone is composed of tone signals lasting for 650 ms ± 50 ms. The pause between the tone signals lasts for 25 ms ± 10 ms (interrupted dial tone). The frequency for the tone signals is 425 Hz ± 25 Hz.

Dial tone for Centrex access is composed of three tone signals, each lasting for 200 ms ± 25 ms. Pauses between the tone signals last for 300 ms ± 25 ms. The pause between the tone periods lasts for 800 ms ± 100 ms. The frequency for the tone signals is 425 Hz ± 25 Hz.

1.7.1 (D) 1 Dial tone

Type of tone: continuous tone

Frequency: f = 425 Hz ± 10%
or f = 450 Hz ± 10%

Harmonic distortion factor: h≤25%

Level: 0 dB(950 mV) to -29 dB(950 mV)

1.7.1 (H) 1 Continuous tone.

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

1.7.1 (I) 1 Cadence: pulse 0,2 ± 10% s, pause 0,2 ± 10% s, pulse 0,6 ± 10% s, pause 1 ± 10% s.

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 Hz, f_2 = 480 Hz;
or
f_1 = 360 Hz, f_2 = 540 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 In some cases "special dial tone" may be supplied. It corresponds to the superimposition of a second frequency component as shown in the following figure 1.7.1 (CH) 1.

The "special dial tone" is 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):

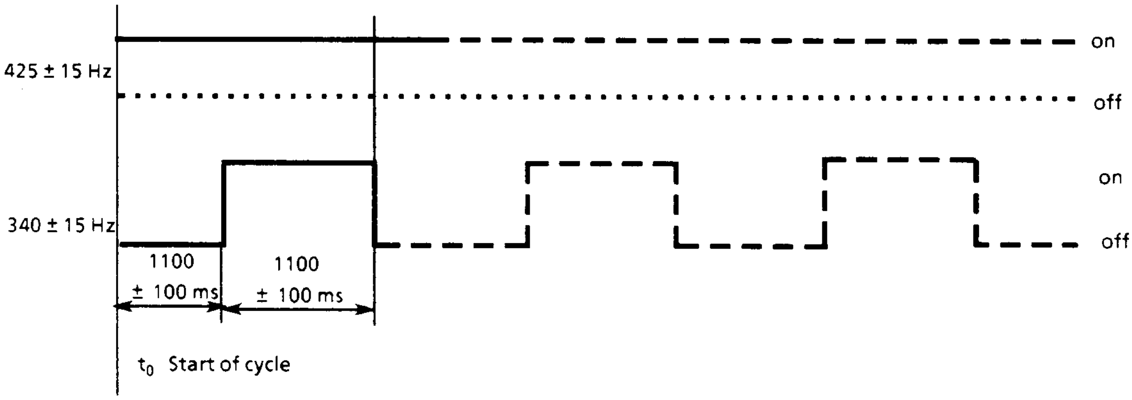


Figure 1.7.1 (CH) 1

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 ± 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 ± 25%.

1.7.1 (GB) 3 A second dial tone at a single frequency of 1 111 Hz ± 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	490	-43,0	-6,5	1/5 ± 20%	
Belgium	420	455	-37	-4	1/3 ± 0,1	
Bulgaria	380	470	-43	-5	0,67+2,5/3 +6 or 1/4 ± 10% or 1/9 ± 10%	
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	400	450	-20	-14	1/4	yes
France	425	455	-38	-10	1,5/3,5 ± 10%	yes
Germany						yes
Greece	400	475	under study		1/4	
Hungary	375	475	-38	-5	1,25/3,75 20%	
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 (BG) 1 Before the normal cyclic ringing tone an "immediate ringing tone" with a length between 200 and 1 000 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 9 s.

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

1.7.2 (SF) 1 Ringing tone is composed of tone signals lasting for 1 000 ms ± 250 ms. The pause between the tone signals lasts for 4 000 ms ± 250 ms. The frequency for the tone signals is 425 Hz ± 25 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 Ringing tone

Type of tone: pulsed tone

Frequency: f = 425 Hz ± 10%
or f = 450 Hz ± 10%

Harmonic distortion factor: h ≤ 25%

Level: 0 dB(950 mV) to -47 dB(950 mV)

Cadence	1st pulse	90 ms < t < 275 ms
	or	450 ms < t < 1 100 ms
	1st pause	0 ms < t < 4 400 ms
	following pulses	790 ms < t < 1 100 ms
	following pauses	3 700 ms < t < 4 400 ms

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 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 (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 ± 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	490	-43,0	-6,5		yes
Belgium	420	455	-37	-4	(500/500) ± 50	
Bulgaria	380	470	-43	-5	200/500 ± 10% or 150/475 ± 10% or 250/250 ± 10% or 500/500 ± 10%	yes
Cyprus	400	450	-25	-10	500/500	yes
Denmark	400	450	-43	-6,5	450/450 ± 20% or 250/250 ± 10%	
Finland	400	450	-20	-14	300/300	yes
France	425	455	-38	-10	500/500 ± 10%	
Germany						yes
Greece	400	475	under study		300/300	
Hungary	375	475	-38	-5	300/300 20%	
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	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 (BG) 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 (CY) 1 The nominal frequency is 425 Hz.

1.7.3 (SF) 1 Busy tone is composed of tone signals lasting for 300 ms ± 25 ms. The pause between the tone signals lasts also for 300 ms ± 25 ms. The frequency for the tone signals is 425 Hz ± 25 Hz.

1.7.3 (D) 1 Busy tone

Type of tone: pulsed tone

Frequency: f = 425 Hz ± 10%
or f = 450 Hz ± 10%

Harmonic distortion factor: h ≤ 75%

Level: 0 dB(950 mV) to -47 dB(950 mV)

Cadence	pulse	432 ms < t < 528 ms
	pause	432 ms < t < 528 ms
	or pulse	97 ms < t < 203 ms
	pause	382 ms < t < 578 ms

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 (GB) 1 Cadence tolerance is ±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	-37	-4	(167/167) ± 12	
Bulgaria	380	470	-43	-5	200/500 ± 10% or 150/475 ± 10% or 250/250 ± 10% or 500/500 ± 10%	yes
Cyprus	400	450	-25	-10	250/250	yes
Denmark	400	450	-43	-6,5	450/450 ± 20% or 250/250 ± 10%	
Finland	400	450	-20	-14	200 - 250 200 - 250	yes
France	425	455	-38	-10	500/500 ± 10%	
Germany						yes
Greece	400	475	under study		300/300	
Hungary	375	475	-38	-5	300/300 20%	
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 (BG) 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 (CY) 1 The nominal frequency is 425 Hz.

1.7.4 (SF) 1 Congestion tone is composed of tone signals lasting for 200 ms ± 25 ms. The pause between the tone signals lasts also for 200 ms ± 25 ms. The frequency for the tone signals is 425 Hz ± 25 Hz.

1.7.4 (D) 1 Congestion tone

Type of tone: pulsed tone

Frequency: f = 425 Hz ± 10%
or f = 450 Hz ± 10%

Harmonic distortion factor: h ≤ 75%

Level: 0 dB (950 mV) to -47 dB (950 mV)

Cadence	pulse	216 ms < t < 264 ms
	pause	216 ms < t < 264 ms
	or pulse	97 ms < t < 203 ms
	pause	382 ms < t < 578 ms

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 x 170)/(2 x 190 + 580).

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

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 ± 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	-9,0		yes
Belgium			-42	-4		yes
Bulgaria	950, 1 400, 1 800 ± 50 Hz		-37	-5	0,33/0 + 0,03	
Cyprus	not used					
Denmark						yes
Finland			-27	-21		yes
France						yes
Germany	not used					
Greece	not used					
Hungary	950, 1 400, 1 800		-25	-8		yes
Iceland						yes
Ireland						yes
Italy			-32	-15		yes
Luxembourg	not used					
Malta						
Netherlands			-23	-12		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 ± 50 / 1 400 ± 50 / 1 800 ± 50 Hz

Cadence:
330 ms ± 70 ms for each tone;
1 000 ms ± 20% pause after the 3 tones.

1.7.5 (B) 1 Two information tones are used in Belgium

1) On the analogue exchanges the information tone is emitted with the following sequence:
900 Hz ± 5 Hz during 330 ± 70 ms followed by;
1 380 Hz ± 5 Hz during 330 ± 70 ms followed by;
1 860 Hz ± 5 Hz during 330 ± 70 ms followed by a pause of 1 ± 0,25 s.

2) On the digital exchanges the information tone is emitted with the following sequence:
950 Hz ± 50 Hz during 330 ± 70 ms followed by;
1 400 Hz ± 15 Hz during 330 ± 70 ms followed by;
1 800 Hz ± 50 Hz during 330 ± 70 ms followed by a pause of 1 ± 0,25 s.

1.7.5 (DK) 1 f_1 = 950 ± 50 / 1 400 ± 50 / 1 800 ± 50 Hz;
p_1 = -43 dBm;
p_2 = -6,5 dBm.

Cadence:
330 ms ± 70 ms for each tone;
maximum 30 ms pause after tone 1 and tone 2;
1 000 ms ± 250 ms pause after the 3 tones.

1.7.5 (SF) 1 Special information tone consists of three successive tone signals, each lasting for 330 ms ± 70 ms. Between these tone signals there may be a pause of up to 30 milliseconds. The silent period between the tone periods lasts for 1 000 ms ± 250 ms. The frequencies used for the three tone signals are 950 Hz ± 25 Hz, 1 400 Hz ± 25 Hz and 1 800 Hz ± 25 Hz, sent in that order.

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 ± 250 ms between each set of three tones.

p_1 = -40 dBm (for the tone 950 Hz);
p_2 = -10 dBm.

1.7.5 (H) 1 Special Information Tone (SIT) which warns the subscriber that the call hasn't been completed owing to other reason than the called party's busy state or congestion.

1.7.5 (H) 2 Level of different frequencies may differ with 3 dB. Permissible deviations of the frequencies 50 Hz.

1.7.5 (H) 3 Cadence of the signal: $f_1/f_2/f_3$/pause = 330/330/1 000 ms 20%.

1.7.5 (IS) 1 f_1 = 950 ± 50 Hz;
f_2 = 1 400 ± 50 Hz;
f_3 = 1 800 ± 50 Hz;
p_1 = -55 dBm, p_2 = -20 dBm for 1 800 Hz.

1.7.5 (IRL) 1

Frequencies:	950 ± 5 Hz, 1 400 ± 5 Hz, 1 800 ± 5 Hz;
Level range:	0 dBm to -16 dBm;
Typical level:	-12 dBm;
Cadence:	Silent period of 1 000 ± 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:

f_1 = 950 ± 50 Hz t_1 = 330 ± 30 ms
f_2 = 1 400 ± 50 Hz t_2 = 330 ± 30 ms
f_3 = 1 800 ± 50 Hz t_3 = 330 ± 30 ms

pause between each set phase 0 - 20 ms
pause between each set of three signals 1 000 ms ± 10%

1.7.5 (NL) 1

There are two different sets of tones:

1) f_1 = 950 ± 50 Hz t_1 = 330 ± 70 ms
f_2 = 1 400 ± 50 Hz t_2 = 330 ± 70 ms
f_3 = 1 800 ± 50 Hz t_1 = 330 ± 70 ms

pause between each signal 0 - 30 ms;
pause between each set of three signals 1 000 ± 250 ms.

2) f_1 = 100 - 200 Hz t_1 = 500 ± 50 ms
f_2 = 340 - 550 Hz t_2 = 500 ± 50 ms

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

1.7.5 (N) 1

The following values apply:

f_1 = 950 ± 50 Hz t_1 = 330 ± 10%
f_2 = 1 400 ± 50 Hz t_2 = 330 ± 10%
f_3 = 1 800 ± 50 Hz t_3 = 330 ± 10%

pause between each set phase 0 - 20 ms;
pause between each set of three signals 1 000 ± 10%.

p_1 = -30 dBm
p_2 = -8 ± 2 dBm

1.7.5 (P) 1

Special information tone according to CCITT Recommendation E. 180:

f_1 (Hz) = 900, 1 350, 1 750 (3 tones);
f_2 (Hz) = 1 000, 1 450, 1 850 (3 tones);

Cadence(s) = 0,330 ± 0,070 for each tone, with a gap between tones of up to 30 ms/1 ± 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 ± 50;
f_b = 1 400 ± 50;
f_c = 1 800 ± 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 ± 50, f_2 = 1 400 ± 50;
f_3 = 1 800 ± 50 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.

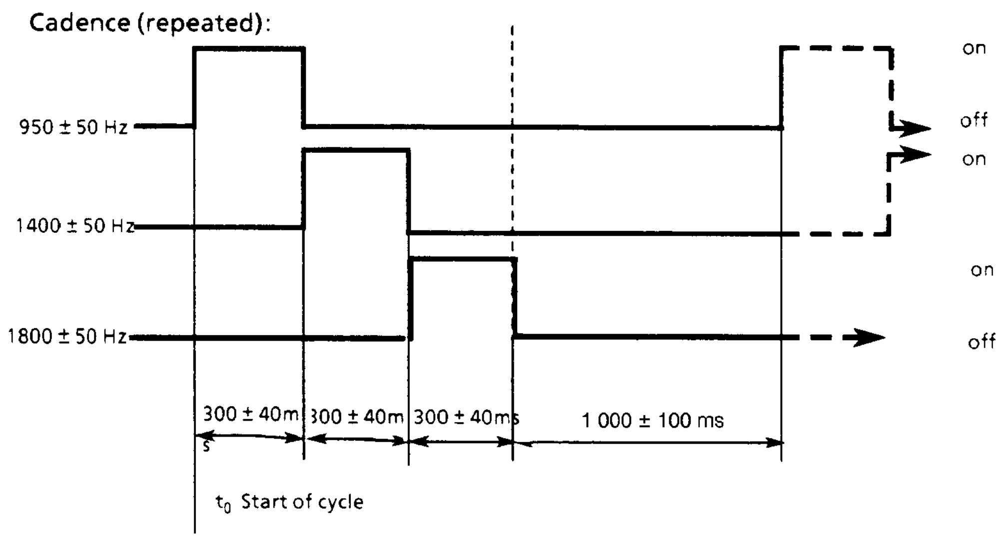


Figure 1.7.5 (CH) 1

1.7.5 (GB) 1

f_1 = 950 ± 50 Hz;
f_2 = 1 400 ± 50 Hz;
f_3 = 1 800 ± 50 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				
Bulgaria	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				
Hungary	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:

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 1.7.7: 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
Bulgaria	under study					
Cyprus						yes
Denmark						yes
Finland			-27	-21		yes
France	425 + 315	455 + 345	-30	-10	continuous	yes
Germany	not used					
Greece	not used					
Hungary						yes
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
Simultaneous two continuous frequencies

$f_1 + f_2$;
340 Hz $\leq f_1 \leq$ 425 Hz
400 Hz $\leq f_2 \leq$ 450 Hz
$f_2 - f_1 >$ 25 Hz;
p_1 = -26,0 dBm (total level);
p_2 = -16,0 dBm (total level).

1.7.7 (A) 2 Acknowledgement tone
Simultaneous two continuous frequencies

$f_1 + f_2$;
340 Hz $\leq f_1 \leq$ 425 Hz;
400 Hz $\leq f_2 \leq$ 450 Hz;
$f_2 - f_1 >$ 25 Hz;
positive: Tone: 1 000 ms ± 20% Pause: 5 000 ms ± 20%;
negative: Tone: 400 ms ± 20% Pause: 400 ms ± 20%;
p_1 = -26,0 dBm (total level);
p_2 = -16,0 dBm (total level).

1.7.7 (A) 3 Intrusion tone

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

Cadence:

1. Tone	1. Pause	2. Tone	2. Pause
150 ± 20%	150 ± 20%	150 ± 20%	1 950 ± 20%

1.7.7 (A) 4 Call waiting tone

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

Cadence:

Tone	Pause
40 ± 10 ms	1 950 ms ± 20%

1.7.7 (B) 1 International dial tone

f_1 (Hz) = (900/1 020/1 140) ± 5;
p_1 (dBm) = -28;
p_2 (dBm) = -4;
cadence = 330 ± 70 ms for each tone, without pause.
This tone is provided by certain electro-mechanical public exchanges for the use of the international network.

1.7.7 (B) 2 Special dial tone

f_1 (Hz) = 420;
f_2 (Hz) = 455;
p_1 (dBm) = -20;
p_2 (dBm) = -4;
cadence (ms) = (1 000/250) ± 50.

1.7.7 (B) 3 Special confirmation tone

f_1 (Hz) = 420;
f_2 (Hz) = 455;
p_1 (dBm) = -20;
p_2 (dBm) = -4;
cadence (ms) = (40/40) ± 5.

1.7.7 (BG) 1 It is planned in near future to implement a new local and transit digital exchanges in Bulgarian PSTN. All tones including for other purposes shall be applied in conformity with CCITT Blue book Recommendations E180 and E182.

1.7.7 (CY) 1 Number unobtainable tone

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

1.7.7 (CY) 2 Call waiting tone

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

1.7.7 (CY) 3 Warning tone

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

1.7.4 (D) 1 **Special dial tone**

Type of tone: continuous tone

Frequency: f = 425 Hz ± 10% and 400 Hz ± 10%

Harmonic distortion factor: h ≤ 25%

Level: 0 dB(950 mV) to -29 dB(950 mV)

Intrusion tone

Type of tone: pulsed tone

Frequency: 2,5 Hz ≤ f ≤ 467,5 Hz
or f = 450 Hz ± 10%

Harmonic distortion factor: h ≤ 25%

Level: -6 dB(950 mV) to -53 dB(950 mV)

Cadence	pulse 1	172 ms < t < 294 ms
	pause 1	172 ms < t < 294 ms
	pulse 2	172 ms < t < 294 ms
	pause 2	t = 1 280 ms

Call waiting tone

Type of tone: pulsed tone applied once for 27,9 s ≤ t ≤ 32,1 s for each incoming call when a call is in progress

Frequency: f = 425 Hz ± 10%

Harmonic distortion factor: h ≤ 25%

Level: -6 dB(950 mV) to -53 dB(950 mV)

Cadence	pulse 1	180 ms ≤ t ≤ 220 ms
	pause 1	180 ms ≤ t ≤ 220 ms
	pulse 2	180 ms ≤ t ≤ 220 ms
	pause 2	4 500 ms ≤ t ≤ 5 500 ms

Special information tone

Type of tone: three tones in immediate succession with subsequent pause

Frequency: f = 950 Hz ± 52 Hz
followed by f = 1 400 Hz ± 52 Hz
followed by f = 1 800 Hz ± 52 Hz

Harmonic distortion factor: h ≤ 6%

Level: -6 dB(950 mV) to -53 dB(950 mV)

Cadence	each tone:	258 ms ≤ t ≤ 402 ms
	pause	745 ms ≤ t ≤ 1 255 ms

1.7.7 (DK) 1 Special dial tone

f_1 (Hz) = 425 ± 10, p_1 (dBm) = -21, p_2 (dBm) = -6,5;
f_2 (Hz) = 375 ± 10, p_1 (dBm) = -23, p_2 (dBm) = -8,5.

Cadence:

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

1.7.7 (SF) 1 Intrusion tone consists of two tone signals, both lasting for 200 ms ± 25 ms. Between these tone signals there is a pause of 300 ms ± 25 ms. The silent period between the tone periods lasts for 1 300 ms ± 100 ms. The frequency for the tone signals is 425 Hz ± 25 Hz.

Call waiting tone consists of two tone signals, both lasting for 150 ms ± 25 ms. Between the tone signals there is a pause lasting also for 150 ms ± 25 ms. The silent period between the tone periods lasts for 800 ms ± 250 ms. The frequency for the tone signals is 425 Hz ± 25 Hz.

Call waiting tone for informative ringing consists of tone signals lasting for 150 ms ± 25 ms. The pause between the tone signals lasts for 8 000 ± 250 ms. The frequency for the tone signals is 425 ms ± 25 Hz.

Queue tone consists of three successive tone signals. The first tone signal lasts for 650 ms ± 50 ms, the second tone signal 325 ms ± 25 ms and the third tone signal 1 300 ms ± 100 ms. The pause between tone signals 1 and 2 lasts for 325 ms ± 25 ms and between tone signals 2 and 3 not more than 30 ms. Silent periods between the tone periods last for 2 600 ms ± 200 ms. The frequency for the first and the second tone signal is 950 Hz ± 25 Hz, and for the third tone signal 1 400 Hz ± 25 Hz.

1.7.7 (F) 1 Special dial tone

Used as second dial tone and as special dial tone, but with p1 = -25 dBm for special dial tone.

The frequency component 330 ± 15 Hz is emitted from the public exchange with an accentuation of 3,5 ± 1 dB with respect to the frequency component 440 ± 15 Hz.

1.7.7 (F) 2 Howler tone

f_1 = 425 Hz;
f_2 = 455 Hz;
p_1 = -25 dBm;
p_2 = -10 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 V and R_f = 8 225 Ω.

1.7.7 (H) 1 Second dialling tone which is sent continuously and is composed of two signals with different frequencies (f_a, f_b):

f_a = 425 5 Hz; f_b = f_a + 25 2 Hz;
p_a = -26...-6 dBm, p_b = p_a -(5 1) dBm.

1.7.7 (H) 2 Intrusion tone

f_1 = 425 5 Hz, p_1 = -46 dBm, p_2 = -13 dBm;
cadence: signal/pause/signal/pause: 300/300/300/1 500 ms 20%.

1.7.7 (H) 3 Call waiting tone

f_1 = 425 5 Hz, p_1 = -25 dBm, p_2 = -5 dBm;
cadence: signal/pause: 400/1 960 ms 20%.

1.7.7 (I) 1 Special dial tone

f_1 = 410 Hz; f_2 = 440 Hz; p_1 = -25 dBm; p_2 = -6 dBm;
cadence: continuous tone

1.7.7 (I) 2 Intrusion tone

f_1 = 410 Hz; f_2 = 440 Hz; p_1 = -30 dBm; p_2 = -11 dBm;
cadence: pulse 200 ± 10% ms, pause 200 ± 10% ms;
pulse 200 ± 10% ms, pause 1 400 ± 10% ms.

1.7.7 (I) 3 Waiting tone

f_1 = 410 Hz; f_2 = 440 Hz; p_1 = -25 dBm; p_2 = -10 dBm;
single shot 1 s ± 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	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	450-550/9 200-9 800
Paging acceptance tone	1 575	1 625	-25,7	-3,8	continuous

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 ms ± 10%.

p_1 = -30 dBm;
p_2 = -8 ± 2 dBm.

1.7.7 (N) 2 Warning tone

f = 1 400 Hz ± 50 Hz, signal/pause = 400/15 000 ms ± 10%, p_2 = -22 ± 2 dBmO.

1.7.7 (N) 3 Intrusion tone

f = 1 400 Hz ± 50 Hz, one tone burst 2 000 ms ± 10%, p_2 = -22 ± 2 dBmO.

1.7.7 (N) 4 Call waiting tone

f = 1 400 Hz ± 50 Hz, signal/pause/signal/pause/signal/pause = 200/2 000/200/90 000/200/90 000 ms ± 10%, p_2 = -22 ± 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 ± 20% / 0,2 ± 20%.

1.7.7 (P) 2 Positive indication tone as defined in CCITT Recommendation E. 182.
Cadence(s) = 1 ± 20% / 0,2 ± 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 Hz, f_2 = 630 Hz;
p_1 = -21 dBm, p_2 = -5 dBm.

1.7.7 (E) 1.2 Special dial tone

The characteristics presented for the special dial tone are:
f_1 = 410 Hz, f_2 = 440 Hz;
p_1 = -20 dBm, p_2 = -5 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 Hz, f_2 = 440 Hz;
p_1 = -35 dBm, p_2 = -6 dBm;
cadence (ms) = (2 x 200) / (200 + 600);
or
f_1 - $f_2 \equiv$ 320 Hz - 480 Hz or 360 Hz - 540 Hz;
p_1 = -35 dBm, p_2 = -5 dBm;
cadence (ms) = (2 x 235) / (190 + 490) or (2 x 235) / (150 + 500).

1.7.7 (E) 1.4 Call waiting tone

The characteristics presented for the call waiting tone are:
f_1 = 410 Hz, f_2 = 440 Hz;
p_1 = -15 dBm, p_2 = -6 dBm.
cadence (ms) = (2 x 600) / (200 + 1 000).

1.7.7 (E) 1.5 Warning tone

The characteristics presented for the warning tone are:
f_1 = 1 350 Hz, f_2 = 1 450 Hz;
p_1 = -60 dBm, p_2 = -33 dBm.
cadence (s) = 0,4/5.

This tone is also used in general as intrusion tone.

1.7.7 (S) 1 Special dial tone

f_1 = 400, f_2 = 450, p_1 = -25, p_2 = -10. Cadence: 320/40.

Warning tone

f_1 = 1 379, f_2 = 1 421, p_1 = -40, p_2 = -25. Cadence: 100/1 500.

Call waiting tone

f_1 = 400, f_2 = 450, p_1 = -25, p_2 = -10. Cadence: 200/500/200 (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.

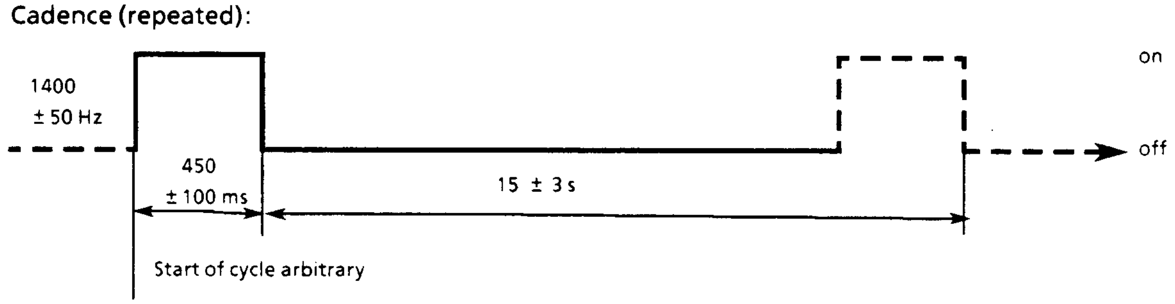


Figure 1.7.7 (CH) 1.1

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.

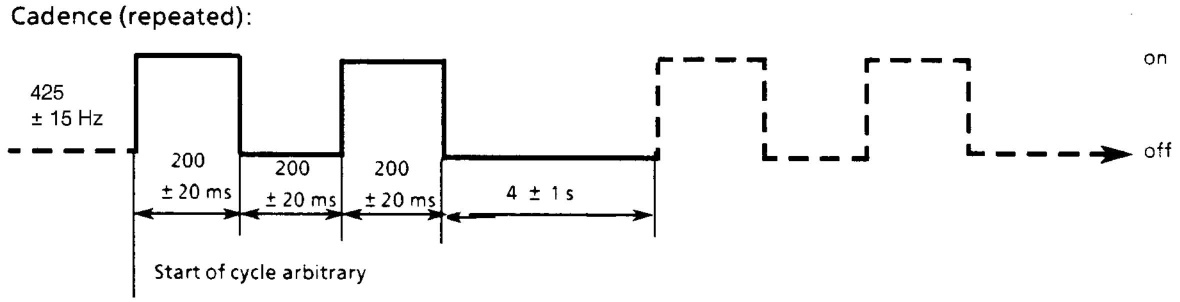


Figure 1.7.7 (CH) 1.2

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.

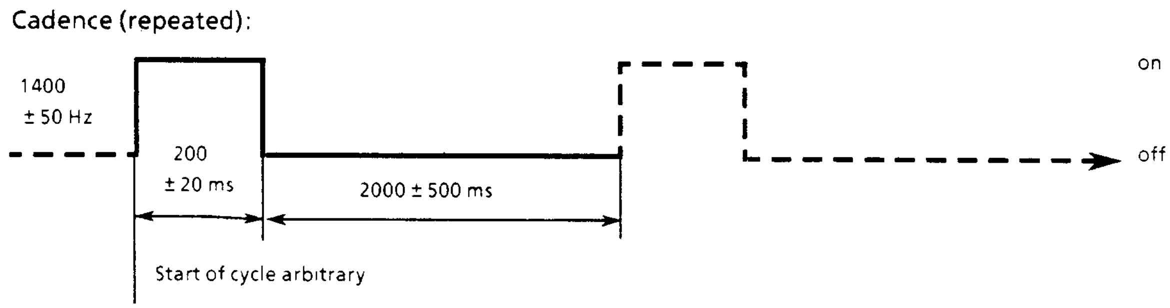


Figure 1.7.7 (CH) 1.3

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.

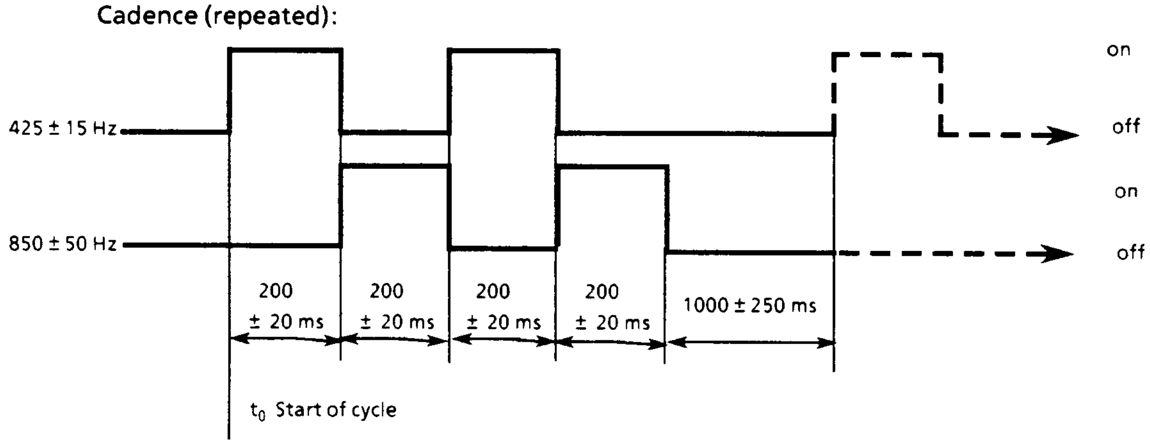


Figure 1.7.7 (CH) 1.4

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 ± 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	50 mV	2,5 V		200	yes
Belgium	15 840	16 160	-18	+17	80 min. on/ 220 min. pause	200	
Bulgaria	15 840	16 160	-18	+17	50 min. on/ 100 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	-23	+21		220	yes
Greece	15 250	16 750	-18	+18	50/90	200	yes
Hungary	11 940	12 060	-25	+10		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:

f_1 = 48 Hz;
f_2 = 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 (kΩ)
48	52	36	70	125 ± 25	>160	10

1.7.8 (D) 1 **Communication state in the case of outgoing calls**

The functions of terminal equipment relevant to communication with the telephone network/ISDN shall not be impaired by incoming metering pulsed with the following characteristics:

Table 1.7.8 (D) 1

Frequency	f = 16 kHz ± 80 Hz
Waveform	sinusoidal
Harmonic distortion	h ≤ 10%
Level	+21 dB(950mV) ≥ p ≥ -23 dB(950mV) measured at Z_r (see appendix AO, section 4.1)
Make period	78 ms ≤ t ≤ 1 020 ms
Breal period	t ≥ 132 ms

The impedance for metering pulses within the frequency range 15,92 kHz ≤ f ≤ 16,08 kHz shall be |Z| ≥ 220 Ω.

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

1.7.8 (H) 1 Level are given in dB (775 mV).

1.7.8 (H) 2 Duration of the 12 kHz pulses shall be 150 50 ms; however, the pulse repetition cycle shall not be shorter than 400 ms.

1.7.8 (NL) 1 Pulses are common mode.

The power level of the pulses is between 65 - 100 V (emf) from a source with max. 1 400 Ω resistance.

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 ± 1%.

The open circuit ac_{rms} output voltage is (4 ± 0,8) V. The signal is presented through an output equivalent resistance of 200 Ω ± 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	55	26	66	1/5 ± 20%	yes
Belgium	23	27	75	90	1/3	yes
Bulgaria	22	55	30	90	0,67 +2,5/3 + 6 or 1/4 ± 10% or 1/9 ± 10%	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	22	28	35	82,5	1/4	yes
France	48	52	25 V/2 kΩ	90	1,5/3,5 ± 10%	
Germany	see 1.7.9 (D) 1					yes
Greece	16	50	25	90	1/4	
Hungary	20	30	44	100	1,25/3,75 10%	yes
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 ac-voltage is superimposed a dc-voltage 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 (BG) 1 Before the normal cyclic ringing signal an "immediate ringing signal" with a length between 200 and 1 000 ms is given. The pause between this pre-ringing signal and the first ringing signal in the ringing cycle may be between 0 and 9 s.

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.

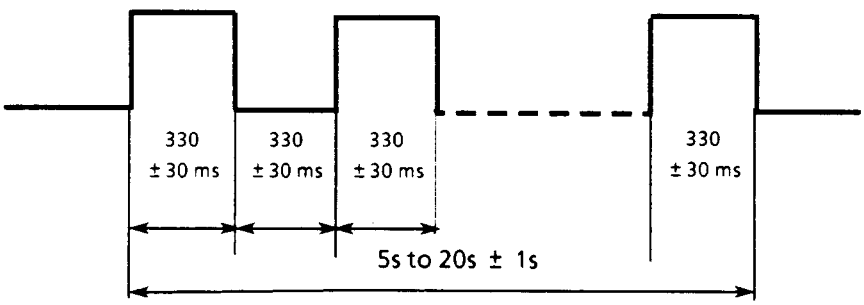


Figure 1.7.9 (DK) 1

1.7.9 (SF) 1 The duration of the rings and pauses composing the ringing signal may vary from their nominal values as follows:

Nominal value (range)	Accepted deviation
200 ms	+ 250 ms / - 100 ms
400 ms - 800 ms	± 250 ms
1 000 ms - 4 000 ms	± 500 ms

The ringing signal indicating a normal call is composed of rings lasting for 1 000 ms and pauses between rings lasting for 4 000 ms. The first ring is sent to the called access at the latest 500 ms after the call establishment phase has terminated. The duration of the first ring may be 250...1 250 ms. The duration may be even longer if the first ring is combined with the first periodical ring.

If the user has subscribed to the "informative ringing" supplementary service, a call destined to the main number of the access shall be indicated by using the normal ringing signal. The ringing cadences for the additional numbers are as follows:

- The ringing period related to the first supplementary number is composed of two rings lasting for 800 ms and a pause between them lasting for 400 ms. There is a pause of 4 000 ms between the ringing periods.
- The ringing period related to the second supplementary number is composed of two rings lasting for 400 ms and a pause between them lasting for 200 ms. There is a pause of 2 000 ms between the ringing periods.
- The ringing period related to the third supplementary number is composed of a ring lasting for 500 ms, a pause lasting for 2 000 ms and a ring lasting for 1 000 ms. There is a pause of 2 000 ms between the ringing periods.

1.7.9 (D) 1 **Ringing signal detecting function**

Terminal equipment with a ringing signal detecting function shall detect the following ringing signal:

Table 1.7.9 (D) 1: Description of ringing signals

ac ringing current	32 V ≤ V_{ac} ≤ 75 V
Frequency	23 Hz < f < 28 Hz
Superimposed feeding voltage	0 V ≤ V_{dc} ≤ 85 V
First ringing signal pulsed	250 ms < t < 6,5 s
Further ringing signal pulses	790 ms < t < 1 100 ms
Ringing signal pause	3,5 s < t < 5,5 s
Harmonic distortion factor	≤ 15%

1.7.9 (H) 1 Nominal frequency: 25 Hz. An immediate first ringing pulse is sent to the line for at least 670 ms.

1.7.9 (H) 2 The ringing signal is sent to the line simultaneously superimposed to the voltage of battery feeding of the exchange.

1.7.9 (H) 3 The ac voltage V_1 is measured by terminating the PSTN line with the two-pole shown below:

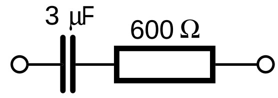


Figure 1.7.9 (H) 3: Two-pole terminal

1.7.9 (IRL) 1 Cadence as shown repeated.

1.7.9 (NL) 1 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 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 ± 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.

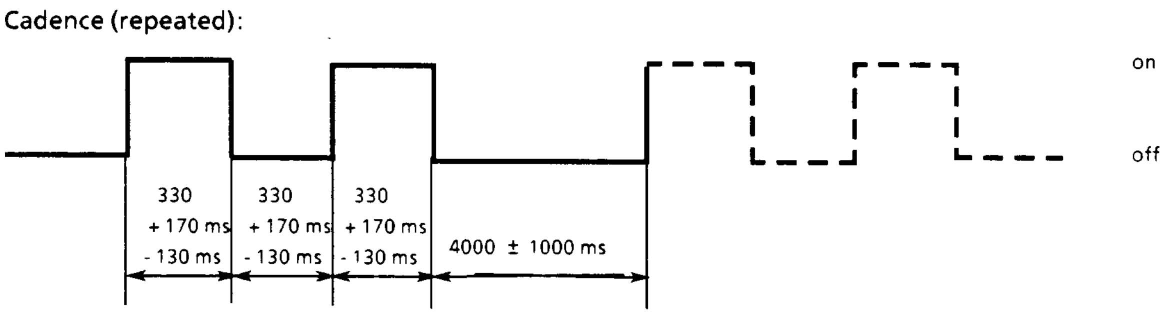


Figure 1.7.9 (CH) 2

1.7.9 (CH) 3 Alarm call: continuous call.

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

1.7.9 (CH) 4 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 kΩ (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:

a) Normal ringing

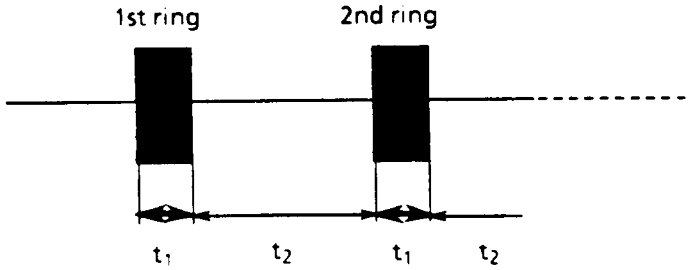


Figure 1.7.9 (CH) 1.a: Normal ringing

b) Central exchange ringing in PABX

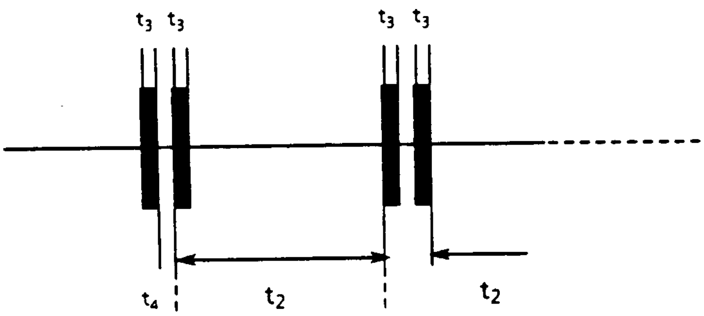


Figure 1.7.9 (CH) 1.b: Central exchange ringing in PABX

Ringing bursts and pauses correspond to the following general conditions:

- Ringing burst: 200 ms (t_3: 330 ms [2]) to 1 200 ms (t_1: 1 000 ms [2]);
- Pause: 200 ms (t_4: 330 ms [2]) to 5 000 ms (t_2: 4 000 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.

c) Continuous ringing (for alarm purposes):

For TE with the capability of detecting ringing 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 should occur for continuous ringing or for only one ringing burst in the case of automatic establishment of the loop condition).

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 ± 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
°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
dBr	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 (D) 1

a_c	composite loss
α	return loss
a_u	unbalance about earth
ac	alternating current
A	Ampere
b	bandwidth
b	break pulse
BAPT	Bundesamt für Post und Telekommunikation (Federal Office for Posts and Telecommunications)
C	Capacitance
CCITT	Comité Consultatif International Télégraphique et Téléphonique (International Telegraph and Telephone Consultative Committee)
CEPT	Conférence Européenne des Administrations des Postes et des Télécommunications (European Conference of Postal and Telecommunications Administrations)
CH1/CH2	Measuring Channel 1/2
Co	Coil
dB	decibel
dBm	decibel relative to 1 mW

dc	direct current
DIN	Deutsches Institut für Normung e.V. (German Institute for Standardization)
DTMF	Dual Tone Multi-Frequency Dialling
Σ	sum
e	external
E	Signal earth connection
E	Receiving
f	frequency
F	Farad
F.Br.	Feeding Bridge
FTZ	Forschungs- und Technologiezentrum der Deutschen Bundespost TELEKOM (Deutsche Bundespost TELEKOM Research and Technology Centre)
G	Generator
GND	Ground (reference earth)
h	harmonic distortion factor
Hz	Hertz (cycles per second)
i	internal
I	Current
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
l	lower
k	kilo (103)
L	Low pass
L	Inductance
LRGP	Loudness Rating Guard Position
m	make pulse
M	Meter
M	mega (106)
MFPB	Multi-Frequency Push Button Dialling
ms	millisecond
n	nano (10-9)
NR	Noise Rating
NTA	Network Termination Analogue
Ω	ohm
p	level
P	Parallel
Pa	Pascal
PE	Protective Earth
pk	peak to peak
Q	Q factor
R	Resistance, Resistor
rms	root mean square
RR	Ringing current Relay
s	second
s	symmetry
S	Switch
S	Sending
SLR	Sending Loudness Rating
t	time
T	Transformer
T	Transient state
T 64	Transformer type 64
TE	Terminal Equipment
TEUT	Terminal Equipment Under Test
TR	Technische Richtlinie (Technical Standard)
u	Upper
µ	micro (10-6)
V	Voltage
Z	Impedance
ZE	Measuring impedance
ZR	Reference impedance
ZV	Zulassungsvorschrift (Type Approval Specification)

1.9 National designators

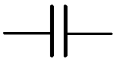
The following country designators are used within the numbering system employed in this document:

Country	National Designation
Austria	A
Belgium	B
Bulgaria	BG
Cyprus	CY
Denmark	DK
Finland	SF
France	F
Germany	D
Greece	GR
Hungary	H
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:

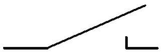

Resistor


Capacitance


Inductance


Diode

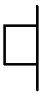

Ground

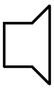

Switch

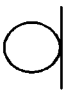

AC Generator

Alternating voltage meter

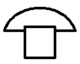
Alternating current meter


Receiver

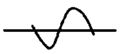

Loudspeaker

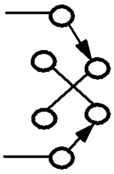

Microphone


Indicating Instrument. General Symbol

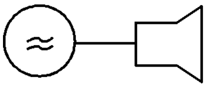

Telephone Set. General Symbol


Continuously variable

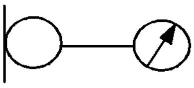

AC General Symbol



Pole inverter

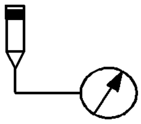


Artificial mouth with low frequency generator

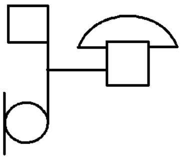


IEC 318

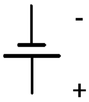
Artificial ear with sound pressure meter



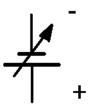
Measuring microphone with sound pressure meter



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

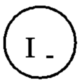


Direct voltage source

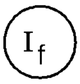


Direct voltage source, adjustable

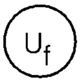
Direct voltage meter



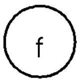
Direct current meter



Alternating current meter, selective

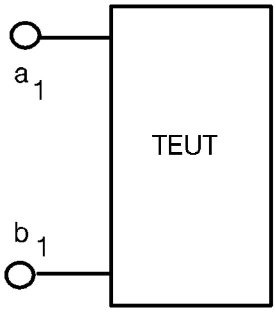


Alternating voltage meter, selective

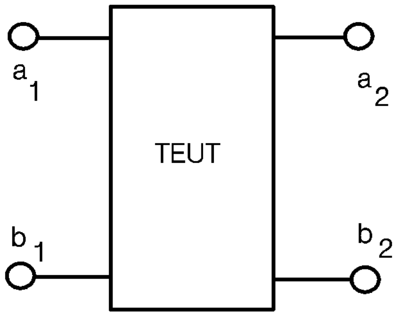


Frequency meter, possibly selective

Oscilloscope



One-port TE



Series-connected TE

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 (D) 1 References

1) FTZ Richtlinie 1 TR 110: "Technische Beschreibung der analogen Telefonanschlüsse am Telefonnetz/ISDN der Deutschen Bundespost Telekom".

2) "Telecommunications Type Approval Ordinance" of 22 March 1991, with its first amendment of 28 September 1992".

3) CCITT P.56: "Objective Measurement of Arctive Speech Level", Blue Book, Geneva, 1988.

4) CCITT P.79: "Calculation of Loundness Ratings", Blue Book, Geneva, 1988.

5) CEPT Recommendation T/CS 46-02: "Multifrequency Signalling System to be used for Push-Button Telephones".

6) DIN 41 715 (1991): "Elektrische Nachrichtentechnik, Steckverbinder für Telekimmunikations-Anschluβ-einheiten".

7) DIN 47 467 (1986): "Fernmeldeschnur mit Kunststoff-Isolierhülle und Auβenhülle".

8) DIN IEC 721, Part 3-3 (1990): "Classification of environmental conditions; Part 3: Classification of groups of environmental parameters and their severities; Stationary use at weather-protected locations".

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.

History

Document history	
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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

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

*
Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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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, 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.

Transposition dates	
Date of adoption of this ETS:	31 March 1996
Date of latest announcement of this ETS (doa):	30 June 1996
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	31 December 1996
Date of withdrawal of any conflicting National Standard (dow):	31 December 1996

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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	
Bulgaria	X	
Cyprus	X	
Denmark	X	yes
Finland	X	
France	X	
Germany	X	yes
Greece	X	
Hungary	X	
Iceland	X	
Ireland	X	yes
Italy	X	
Luxembourg	X	
Malta		
Netherlands	X	yes
Norway	X	
Portugal	X	
Spain	X	
Sweden	X	
Switzerland	X	
U. Kingdom	X	

2.1 (DK) 1 A TE, which uses polarity for supplementary services, may be polarity dependent. From the PSTN a defined polarity cannot be guaranteed.

2.1 (D) 1 **General**

The values specified in the following sections are, unless otherwise stated, minimum/maximum values and shall be met under normal operating conditions, i.e. during electrical connection with the analogue network termination (NTA) of the telephone network / ISDN.

The TE shall fulfil all requirements independently of the polarity.

Only those forms of electrical energy specified in this type approval specification shall be fed from the TE to the interconnection points.

The power feeding parameters and resistance of the TE are specified in the following figure.

The dc resistance of the TE between earth potential (protective earth) and the a-wire, and between earth potential (protective earth) and the b-wire shall be $R \geq 1\ \text{M}\Omega$ at a voltage of $V \leq 105$ V and $R \geq 100\ \text{k}\Omega$ at a voltage of 105 V < $V \leq 150$ V.

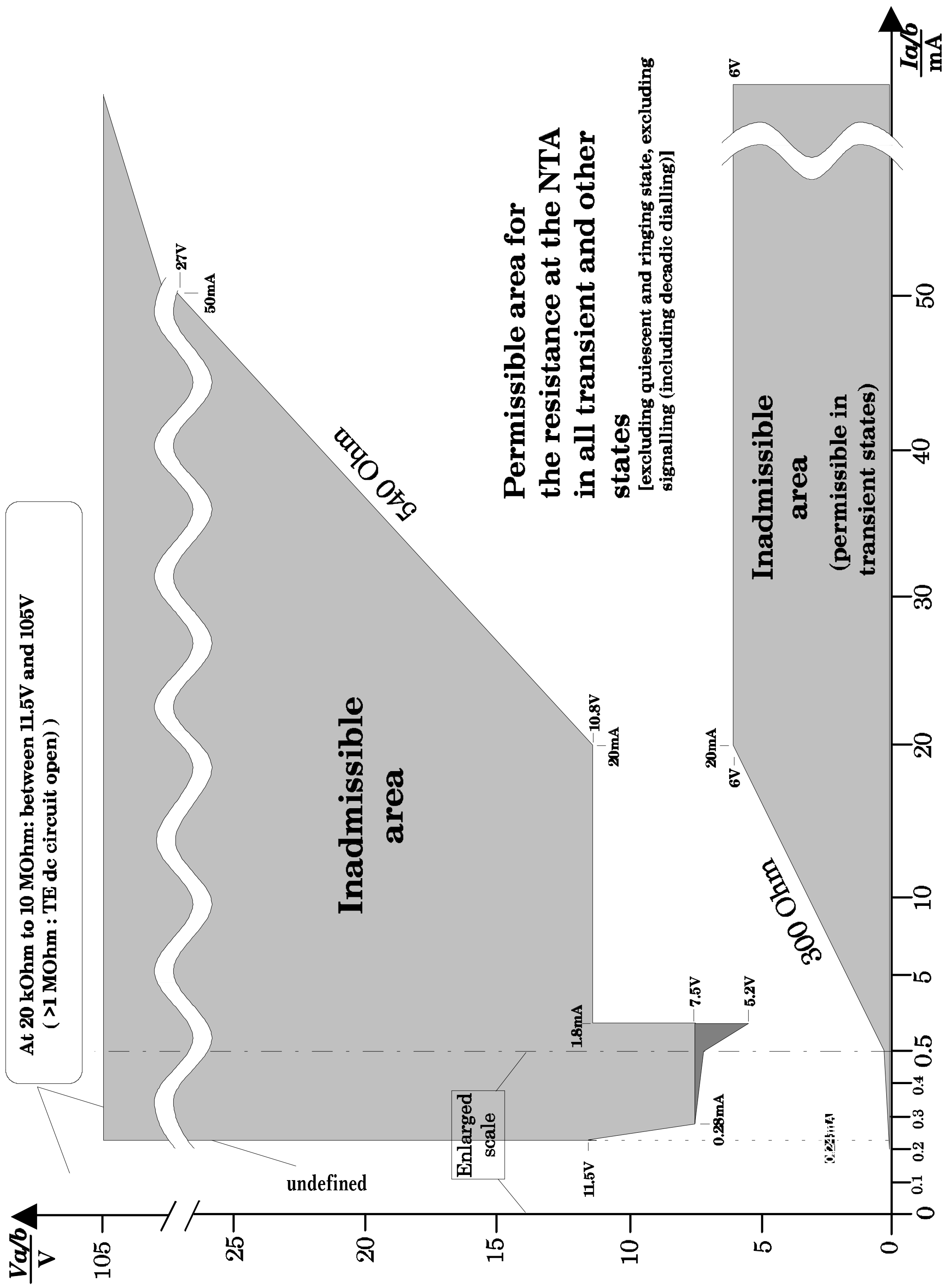


Figure 2.1 (D) 1: DC voltage / DC characteristics at the NTA

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 mandatory	Remarks
Austria	X	
Belgium	X	
Bulgaria	X	
Cyprus	X	
Denmark	X	
Finland	X	
France	X	
Germany	X	yes
Greece	X	
Hungary	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 **Measurement of the electrical power supply**

The measuring circuit illustrated in figure A.2.1.a (D) 1 is used for the measurement of the electrical dc voltage supplied to the NTA by the terminal (TEUT).

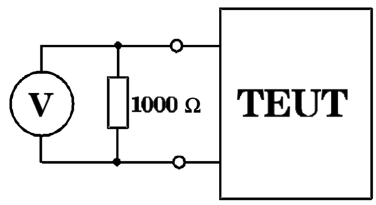


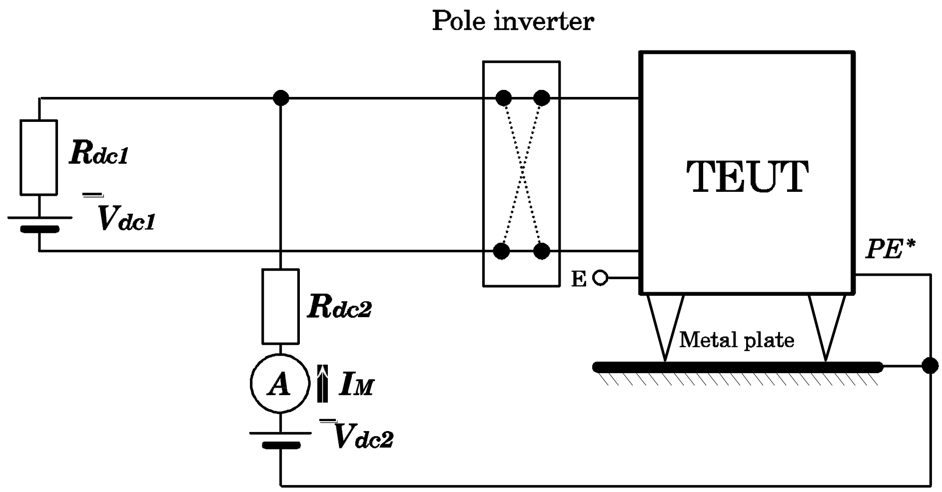
Figure A.2.1.a (D) 1

The dc voltage from the TEUT shall be $V \leq 0{,}1$ V at the resistor (1 000 Ω ± 0,5%) between the a- and b-wires. The measurement is carried out with the TEUT in both a "quasi-quiescent state", and, by manipulation of operating elements (loop closure), in a "quasi-off-hook condition".

NOTE: The supply of power within the frequency range from 10 Hz to 200 kHz is covered by the measuring circuits for sections 4.4.1 (D) 1, 4.4.3.1 (D) 1 and 4.5.2 (D) 2.

Measurement of the dc resistance between a-wire and earth potential (protective earth) and between b-wire and earth potential (protective earth)

The measuring circuit illustrated in figure A.2.1.b (D) 1 is used for the measurement.



∗ if provided

V_{dc1} = 63 V	R_{dc1} = 2,2 kΩ	R_{dc2} = 2,2 kΩ

Figure A.2.1.b (D) 1

The TEUT shall be supplied with the dc voltage V_{dc1} required for normal operation.

TEUT without an earth connection are tested on a metal plate.

The measuring dc voltage V_{dc2} is connected to the points of the TEUT specified by the manufacturer to be for connection to earth potential (PE). The signal earth connection E at the terminal side of the NTA, where provided, shall not be connected for the measurement.

The current reading I_M is taken at the ammeter. I_M shall correspond to the respective value assigned to each measuring dc voltage V_{dc2} in table A.2.1 (D) 1 for the different operating states (quiescent state, off-hook condition, communication state).

Table A.2.1 (D) 1

V_{dc2}	I_M
105 V	≤ 0.105 mA
150 V	≤ 1.47 mA

In the case of this measuring arrangement, care shall be taken to ensure sufficient insulation resistance of the dc voltage source V_{dc1} against earth potential (protective earth).

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

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 (MΩ)	R_2 (MΩ)	R_3 (MΩ)	$V_{tmax.}$ (V)	
Austria	5	1	not mandatory	100	yes
Belgium	5	100	100	100	yes
Bulgaria	5	not mandatory	not mandatory	100	yes
Cyprus	5	10	10	100	
Denmark	1	10	10	250	yes
Finland	1	not mandatory	5	100	yes
France	5	5	not mandatory	100	yes
Germany	1	1	not mandatory	≤ 100	yes
Greece	5	100	100	100	
Hungary	5	10		100	yes
Iceland	1	10	10	100	
Ireland	5	10	not mandatory	100	
Italy	5	100	not mandatory	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	100	
Switzerland	5	10	not mandatory	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 (MΩ), R_2 (MΩ), R_3 (MΩ), 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 TE) which are designed as one-port TE and pulse metering equipments which are designed as series-connected TE without an external power supply the insulation resistance R_1 shall not be less than 1 MΩ.

2.2.1 (A) 2 R_2 is only valid for TE with earth terminals (e.g. TE with a power supply and the power supply is designed with an earth terminal). R_2 is not mandatory for TE with a signal earth terminal.

2.2.1 (B) 1 R_1 shall also be greater than or equal to 1 MΩ when tested with V_{tmax} = 200 V.

2.2.1 (BG) 1 TE used for implementation of auxiliary subordinate applications with memory and indicators may have insulation resistance R_1 of at least 1 MΩ .

2.2.1 (BG) 2 For section 2.2.1.3, this requirement is a safety requirement and thus outside the scope of this ETS.

2.2.1 (DK) 1 For a PABX: R_2 = 5 MΩ, R_3 = 5 MΩ.

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 MΩ but not less than 0,5 MΩ, 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:

$R_1 \geq 1$ MΩ at $V_t = 180$ V;

$R_2 \geq 1$ MΩ at $V_t = 130$ V.

2.2.1 (D) 1 See 2.1 (D) 1.

2.2.1 (D) 2 **Quiescent state**

The dc resistance of the TE $R \geq 1$ MΩ shall be reached within $t = 30$ s on application of a voltage within the range 11,5 V $\leq V \leq$ 105 V via preconnected resistors $R_{\Sigma} = 3$ kΩ or upon polarity reversal of this voltage. The dc resistance of the TE shall subsequently not fall below $R = 1$ MΩ.

Repeated automatic switching on and off of the TE without call establishment or call answering is not permissible if this causes the dc resistance to fall below $R = 1$ MΩ.

Likewise, it is not permissible to draw energy in order to support internal processes of the terminal equipment if this causes the dc resistance to fall below $R = 1$ MΩ.

The TE shall withstand a load with a dc voltage of $V = 63$ V (internal resistance 140 Ω) and $V = 85$ V (internal resistance 1 340 Ω), superimposed in each case by an ac voltage $V_{rms} = 75$ V (25 Hz). The duration of the load is 6,5 s. All remaining requirements contained in this type approval specification shall be fulfilled subsequent to the load.

2.2.1 (H) 1 In case of TE which receives continuous battery charging current from the PSTN exchange (e.g. remote pulse metering equipment), $R_1 \geq 1$ MΩ is required. However, if the TE is a payphone equipment, at = 48 V, $R_1 \geq 17$ kΩ is necessary.

2.2.1 (H) 2 Requirement for value of R_3 is a safety requirement and thus is outside the scope of this document.

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 MΩ: 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) / IZI (kΩ) at 25 Hz	≤ 0,2	≤ 0,5	≤ 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 note
13 - 20	1,0	1,0	1,5
> 20	0,5	1,0	1,5
NOTE: However, if in this case c ≤ 0,6 (µF) and |Z| ≥ 12 kΩ, the connection factor, B-type, shall be fixed to 1,5.			

2.2.1 (NL) 1.3 Minimum impedance in the range 300 - 3 400 Hz (section 4.1)

Impedance (kΩ)	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 (CH) 1 Insulation measured 60 s after application at 100 V. For TE with DC through-connection (series-connected) the requirements are tested with a load resistor RL = ∞.

R_3 is a safety requirement, therefore not essential as a Telecom requirement.

R_1 = 1 MΩ is acceptable for TE which cannot be connected in parallel.

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) µA or, where the REN = 0, not greater than 5 µA.

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 (D) 1 See 2.2.1 (D) 2.

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:

$$R_1 = \frac{V_t}{I} \qquad \text{Formula A.2.2.1.1}$$

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 V_t (V)	Remarks
Austria	100	yes
Belgium	100	yes
Bulgaria	100	
Cyprus	100	
Denmark	45 and 250	
Finland	100	
France	180	
Germany	25, 50, 75, 100, 150	
Greece	100	
Hungary	100	
Iceland	100	
Ireland	100	
Italy	100	
Luxembourg	100	
Malta		
Netherlands	100	
Norway	100	yes
Portugal	100	yes
Spain	100	yes
Sweden	100	
Switzerland	Insulation measured 60 s after the application of 100 V	
U. Kingdom	50	yes

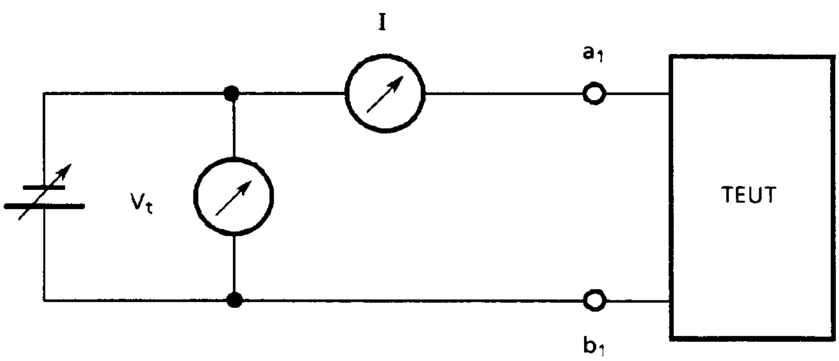


Figure A.2.2.1.1: Line terminal to line terminal

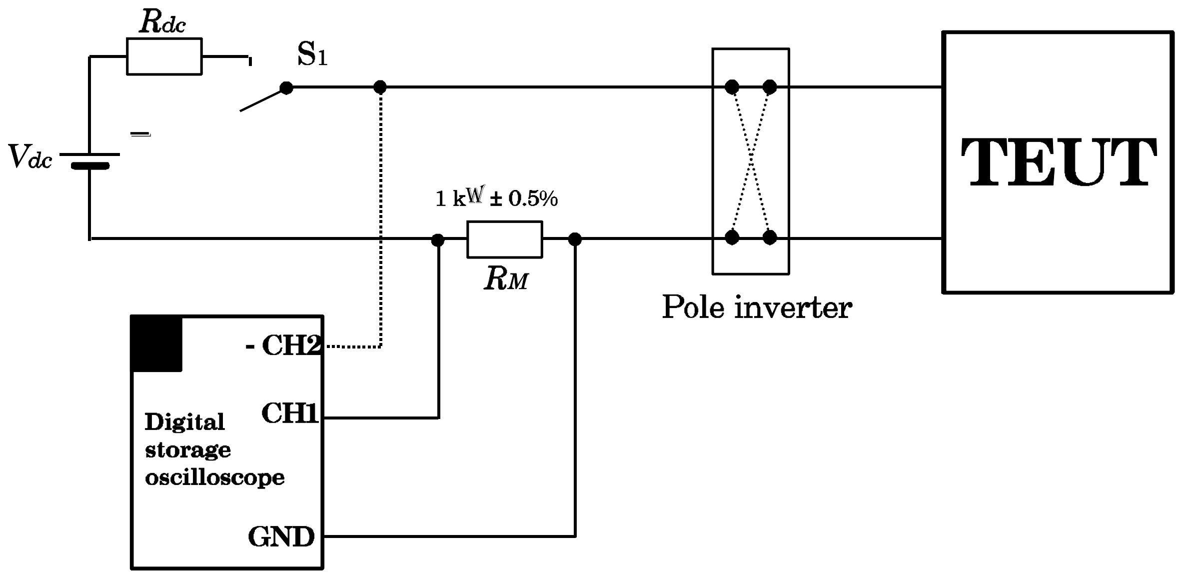
A.2.2.1.1 (A) 1 The value of current I shall be measured 30 s after the voltage has been applied.

A.2.2.1.1 (B) 1 The test for section 2.2.1 (B) 1 is the same as A.2.2.1.1 but with V_t =200 V.

A.2.2.1.1 (BG) 1 The value of current I shall be measured 60 s after the voltage has been applied.

A.2.2.1.1 (D) 1 **Measurement of the dc resistance in the quiescent state**

The measuring circuit illustrated in figure A.2.2.1.1.a (D) 1 is used for the measurement.



R_{dc} = 2 kΩ

Figure A.2.2.1.1.a (D) 1

Before the first measurement, care shall be taken to ensure that no residual energy remains in the energy storage of the TEUT fed from the NTA during normal operation.

In the case of measurement "a", the voltage V_{dc} is set to 63 V and switch S1 activated. After 30 s the voltage reading V_M is taken at the system multimeter or digital oscilloscope connected in parallel to R_M . The dc resistance of the TEUT is $R_{TEUT} \geq 1$ MΩ, when V_M corresponds to the value given in table A.2.2.1.1.a (D) 1 for measurement "a". The value specified for V_M shall subsequently not be exceeded whilst the TEUT is in the quiescent state.

The measurement is repeated with reversed polarity of the TEUT. The pole inverter shall only be operated when switch S1 is open.

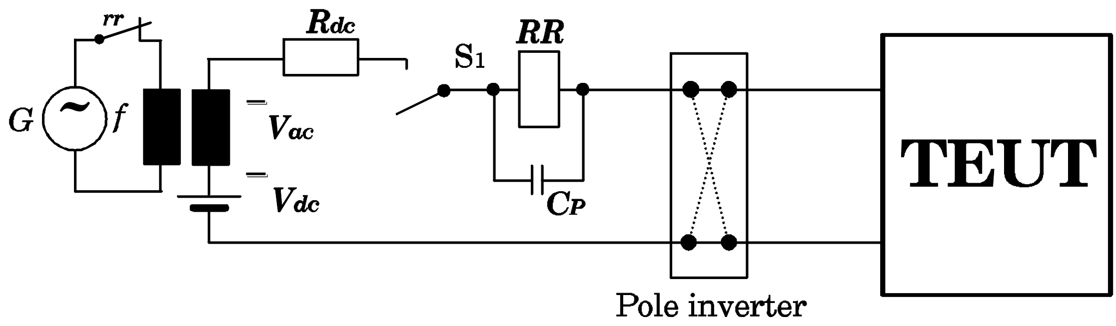
Measurements "b" and "c" shall subsequently be carried out according to the same procedure at voltages of V_{dc} = 11,5 V and V_{dc} = 105 V respectively.

Table A.2.2.1.1.a (D) 1

Measurement	V_{dc}	V_M (CH1)
a	63 V	≤ 62,8 mV
b	11.5 V	≤ 11,5 mV
c	105 V	≤ 105 mV

Load test in the quiescent state

The measuring circuit illustrated in figure A.2.2.1.1.b (D) 1 is used for the measurement.



$RR \leq 20\ \Omega$	$C_P = 1000\ \mu F$

Figure A.2.2.1.1.b (D) 1

The terminal equipment (TEUT) is charged, in the quiescent state, with a mixed voltage consisting of a dc and an ac voltage as illustrated in figure A.2.2.1.1.b (D) 1. The ringing voltage is coupled via a ringing voltage transformer (see section 10.1 (D) 1.1). A differentiation is made between the two loads "a" and "b":

Load "a"

Table A.2.2.1.1.b (D) 1

V_{dc}	63 V (dc voltage)
V_{ac}	75 V (25 Hz ac voltage)
R_{dc}	140 Ω

Load "b"

V_{dc}	85 V (dc voltage)
V_{ac}	75 V (25 Hz ac voltage)
R_{dc}	1340 Ω

The duration of the load is t = 6.5 s in each case.

The load test is repeated after approx. 60 s with reversed polarity of the TEUT. The pole inverter shall only be operated when switch S1 is open.

Where the terminal equipment carries out automatic call answering during the first ringing signal, the ringing current supply is, in the case of a direct current of approx. 15 mA, interrupted by the relay *RR* within approx. 15 ms.

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 (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.

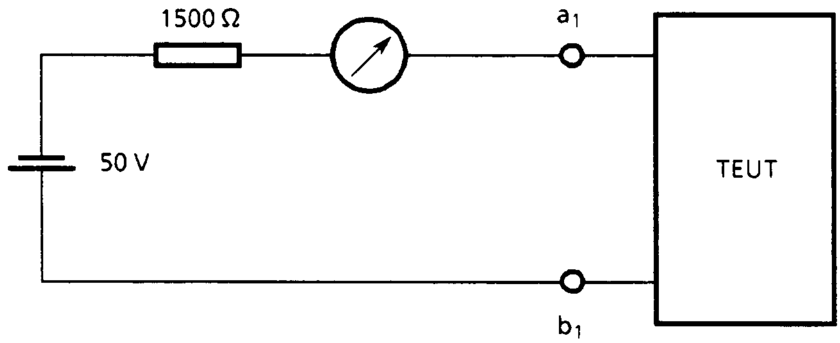


Figure A.2.2.1.1 (GB) 1: Line terminal to line terminal

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 (A) 1 This section is only valid for TE with earth terminals. See section 2.2.1 (A) 2

2.2.1.2 (D) 1 See 2.2.1 (D) 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 MΩ, tested at dc voltages of up to 100 V.

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

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

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 V_t (V)	Remarks
Austria	100	yes
Belgium	100	
Bulgaria	not mandatory	
Cyprus	100	
Denmark	45 and 250	
Finland	not mandatory	
France	130	
Germany	25, 50, 75, 100	yes
Greece	100	
Hungary	100	
Iceland	100	
Ireland	100	
Italy	100	
Luxembourg	100	
Malta		
Netherlands	100	
Norway	100	
Portugal	100	yes
Spain	100	yes
Sweden	100	
Switzerland	Insulation measured 60 s after the application of 100 V	
U. Kingdom	100	yes

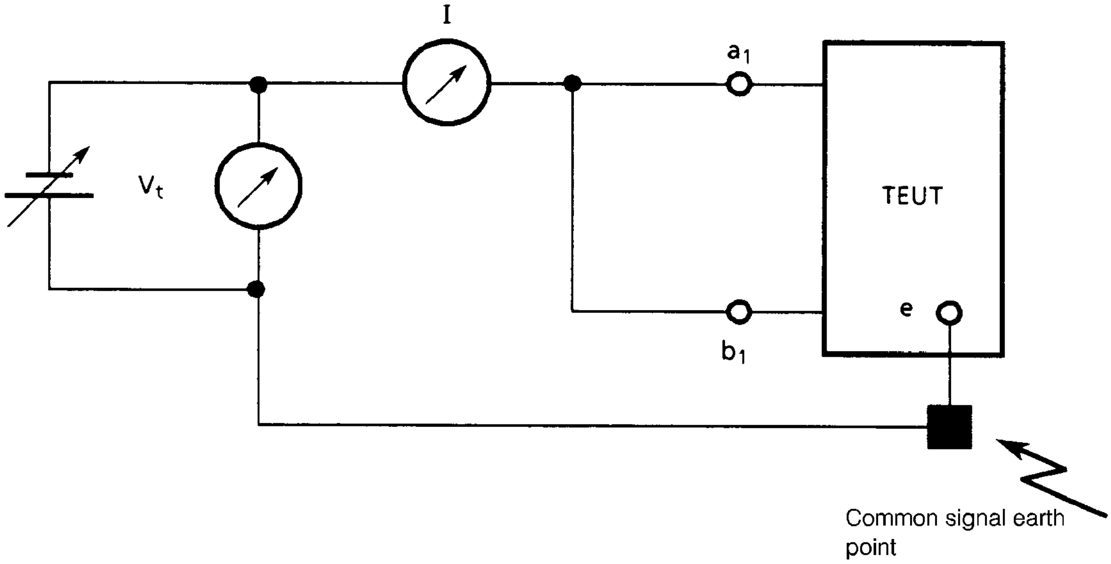


Figure A.2.2.1.2: Line terminals to signal earth

A.2.2.1.2 (A) 1 This section is only valid for TE with earth terminals. See section 2.2.1 (A) 2.

A.2.2.1.2 (D) 1 See A.2.2.1.1 (D) 1.

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.

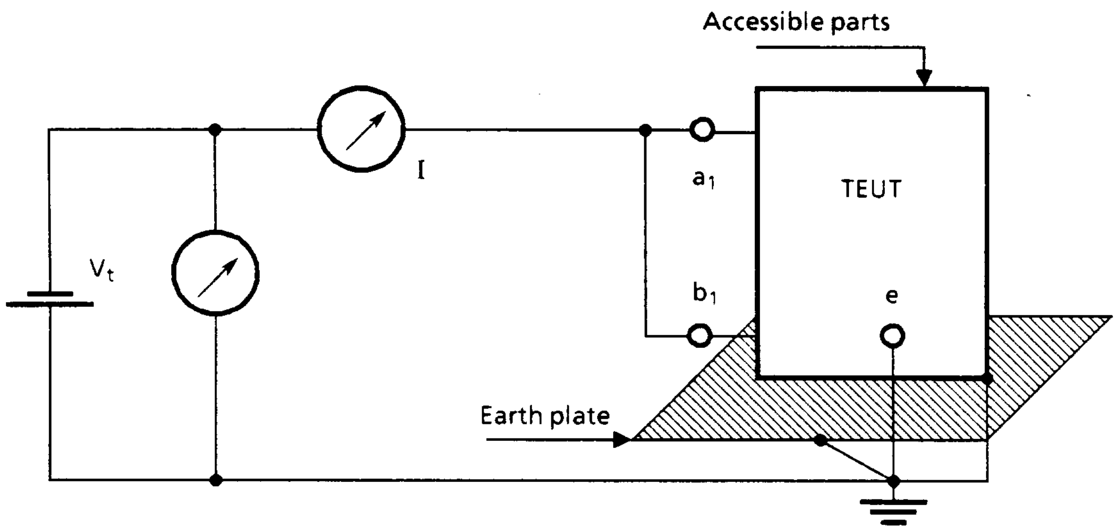


Figure A.2.2.1.2 (E) 1: Insulation resistance between line terminals and accessible parts (and earth) in quiescent condition

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.

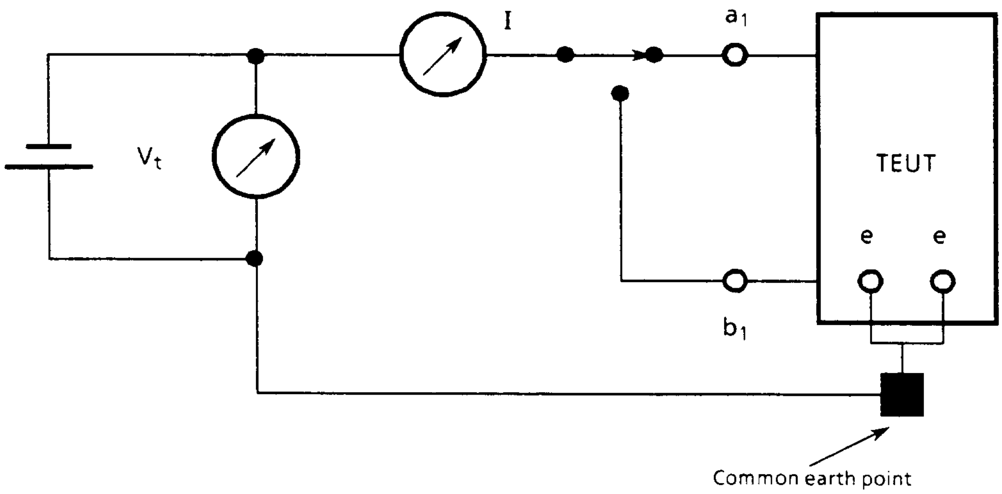


Figure A.2.2.1.2 (GB) 1: Line terminals to signal earth

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 (D) 1 See 2.2.1 (D) 2.

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:

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

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

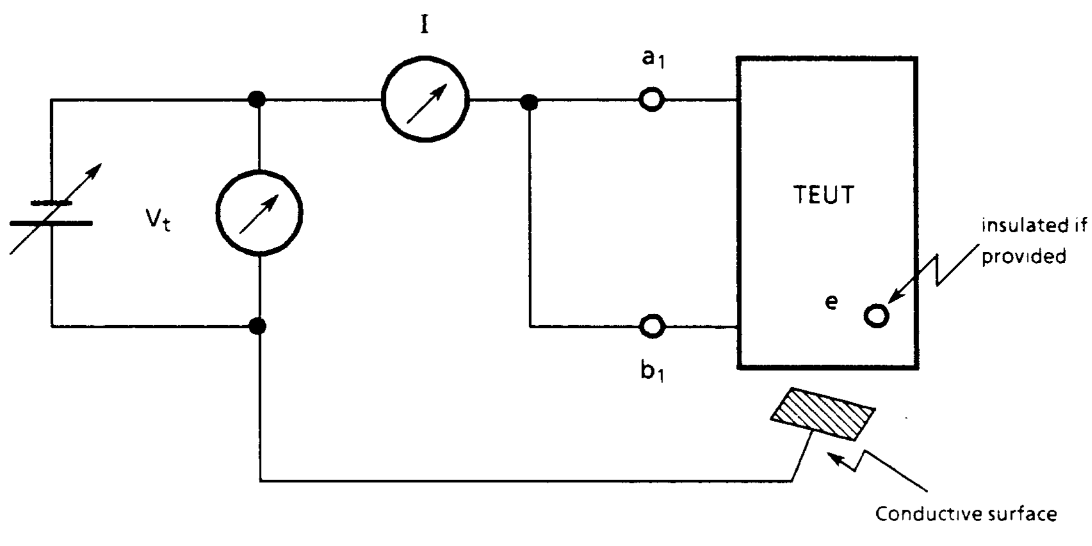


Figure A.2.2.1.3: Line terminals to user accessible parts

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.2.2.1.2 (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 (MΩ)	R_5 (MΩ)	$V_{tmax.}$ (V)	
Austria	not mandatory	not mandatory	not mandatory	
Belgium	not mandatory	not mandatory	not mandatory	
Bulgaria	not mandatory	not mandatory	not mandatory	
Cyprus	not mandatory	not mandatory	not mandatory	
Denmark	10	10	250	yes
Finland	not mandatory	5	100	
France	not mandatory	not mandatory	not mandatory	
Germany	not mandatory	not mandatory	not mandatory	
Greece	100	100	100	
Hungary	not mandatory	not mandatory	not mandatory	
Iceland	10	10	100	
Ireland	10	not mandatory	100	
Italy	100	not mandatory	100	
Luxembourg	not mandatory			
Malta				
Netherlands	10	not mandatory	100	
Norway	10	10	100	
Portugal	5	5	100	
Spain			100	yes
Sweden	10	10	100	
Switzerland	10	not mandatory	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 (MΩ), see sections 2.2.2.1 and 2.2.2.2.

2.2.2 (D) 1 Off-hook condition

If, after a power supply for $t \geq 500$ ms, a power source interruption of $t \leq 100$ ms occurs, the effective dc resistance at the NTA shall reach $R \leq 700\ \Omega$ within 10 ms and $R \leq 540\ \Omega$ after a further maximum of 90 ms.

Power source interruptions of $100\text{ ms} < t \leq 600$ ms shall be withstood after a power supply for $t \geq 600$ ms. The dc resistance of the TE after the end of this power source interruption shall reach $R \leq 700\ \Omega$ within 10 ms and $R \leq 540\ \Omega$ after a further maximum of 90 ms.

In the case of power source interruptions of $t > 600$ ms, the dc resistance of the terminal equipment after the end of this power source interruption shall reach $R \leq 700\ \Omega$ within 10 ms and $R \leq 540\ \Omega$ after a further maximum of 90 ms, otherwise the terminal equipment shall assume the quiescent state in accordance with section 9.2.1 (D) 1.

The above mentioned requirements apply at feeding conditions as specified in the first paragraph of section 2.4.1 (D) 1.

TE shall only draw the necessary electrical energy from the network of Deutsche Bundespost TELEKOM required for its telecommunications operation and for the user facilities recognized for such operation, including the programming and adjustments associated with such user facilities (see section 2.2.2 (D) 1). The dc resistance values specified in section 2.1 (D) 1 shall be adhered to whilst energy is drawn. Signals which are processed by the network of Deutsche Bundespost TELEKOM as switching signals (including digits) shall not be generated at the NTA as a result of drawing energy.

Telecommunications purposes

User facilities which use the telephone network / ISDN free of charge in order to transmit information, in any form whatsoever, shall not be permitted.

The following user facilities may be approved as they serve the purpose of the telephone network / ISDN:

- user facilities which support the establishment of calls, and the activation and deactivation of these facilities;
- user facilities which support the answering of calls, and the activation and deactivation of these facilities;
- user facilities used whilst a call is in progress, and the activation and deactivation of these facilities;
- user facilities, and the activation and deactivation of the facilities, which prevent or abort the establishment of calls to subscriber numbers / groups of subscriber numbers barred by the operator of the terminal equipment. Calls to such numbers may only be made via paths not routed over the access, i.e. the access must not be occupied during this procedure.

No additional digits other than the digit sequence effecting automatic call clearing shall be emitted. If, for example, the digit sequence effecting automatic call clearing contains n digits (n = 1, 2, ...), the dialling procedure shall be terminated after the n^{th} digit. The loop for the initiation of a defined call clearing procedure shall be opened at the latest 500 ms after emission of the last digit of the digit sequence effecting automatic call clearing.

- the user facility, and the activation and deactivation of the facility, for the purposes of total mechanical and electrical barring.
- verification as to whether one or several of the above-mentioned user facilities are activated or deactivated.

2.2.2 (H) 1 In Hungary, this requirement is considered as a safety requirement and hence is outside the scope of this document.

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 (D) 1 No requirement.

2.2.2.1 (DK) 1 The definition of R_4 in section 2.2.2 and formula A.2.2.2.1 are in disagreement. In loop condition it is not possible to measure each line separately in the measurement set-up shown in figure A.2.2.2.1. If R_4 is redefined to resistance between the line terminals when shorted together, there is agreement with the formula (600 Ω is a short circuit compared to MΩ resistance).
This definition is used for the Danish values.

For a PABX R_4 = 5 MΩ.

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 MΩ, tested at dc voltages of up to 100 V.

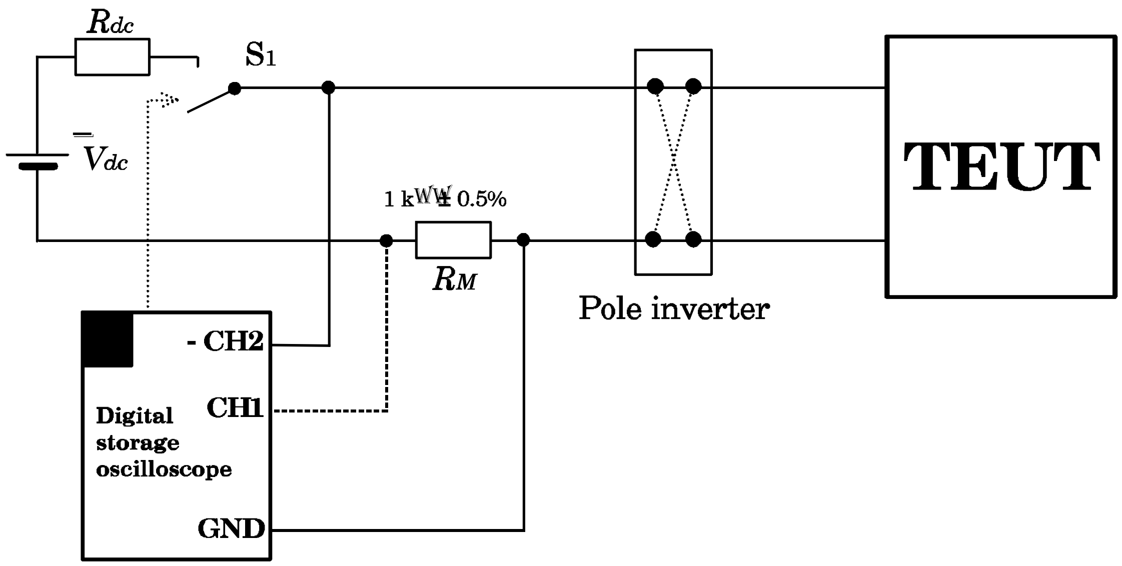
Compliance shall be checked using the test outlined in section A.2.2.2.1 (E) 1.

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 (D) 1 Measurement of the dc resistance after a power source interruption in the off-hook condition

The measuring circuit illustrated in figure A.2.2.2 (D) 1 is used for the measurement.



V_{dc} = 63 V	R_{dc} = 1 600 Ω

Figure A.2.2.2 (D) 1

The effective resistance following an interruption to the feeding current of a terminal (TEUT) is recorded by means of a system multimeter or a digital storage oscilloscope capable of transferring data for further processing.

The measurement commences either upon closure of S1 or upon subsequent loop closure in the TEUT, depending on the type of TEUT. S1 is opened t_1 after application of the loop current ($I \geq 20$ mA) for the specified length of the power source interruption t_2.

Table A.2.2.2.a (D) 1

Measurement	t_1	t_2
a	500 ms	95 ms
b1	600 ms	105 ms
b2	600 ms	595 ms
c	600 ms	≥ 605 ms

In the case of measurements "a" and "b", the voltage V_{TEUT} (-CH2) shall adhere to the values specified in table A.2.2.2.b (D) 1, t_3 after S1 is closed again. In the case of measurement "c", either the values for V_{TEUT} (-CH2) shall be adhered to or the voltage V_M (CH1) shall be ≤ 62,8 mV after t_3 = 1 s, i.e. $R_{TEUT} \geq 1$ MΩ (-CH2) shall be disconnected, where necessary).

Table A.2.2.2.b (D) 1

t_3	**V_{TEUT} (-CH 2)**	**equivalent to R_{TEUT}**
10 ms	6,0 V.....13,4 V	≤ 700 Ω
100 ms	6,0 V.....10,8 V	≤ 540 Ω

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

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	
Bulgaria	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	
Hungary	not mandatory	not mandatory	not mandatory	
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	100	38	1 000	
Switzerland	100 (measurement 60 s after)	50	1 000	
U. Kingdom	not mandatory	not mandatory	not mandatory	

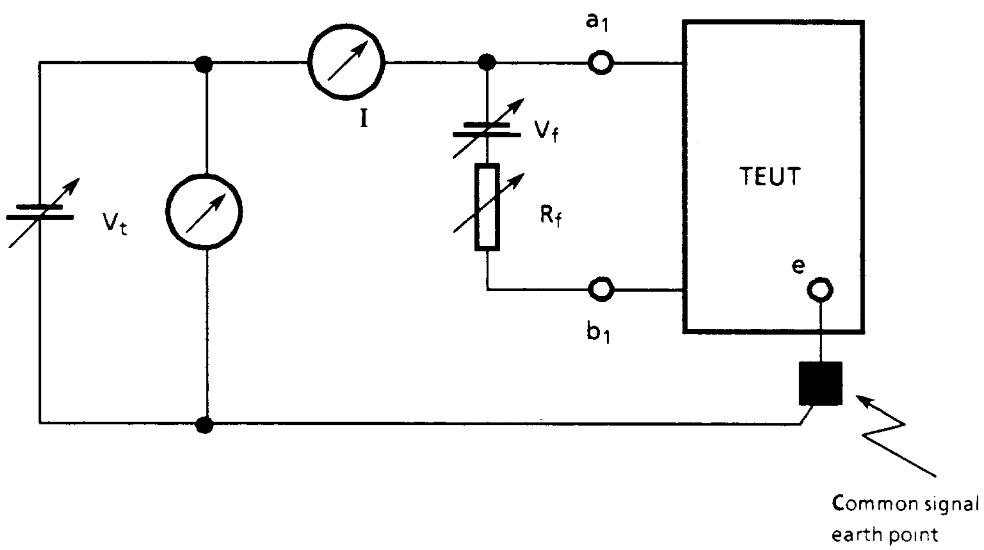


Figure A.2.2.2.1: Insulation resistance for TE in loop condition, line terminals to signal earth

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.

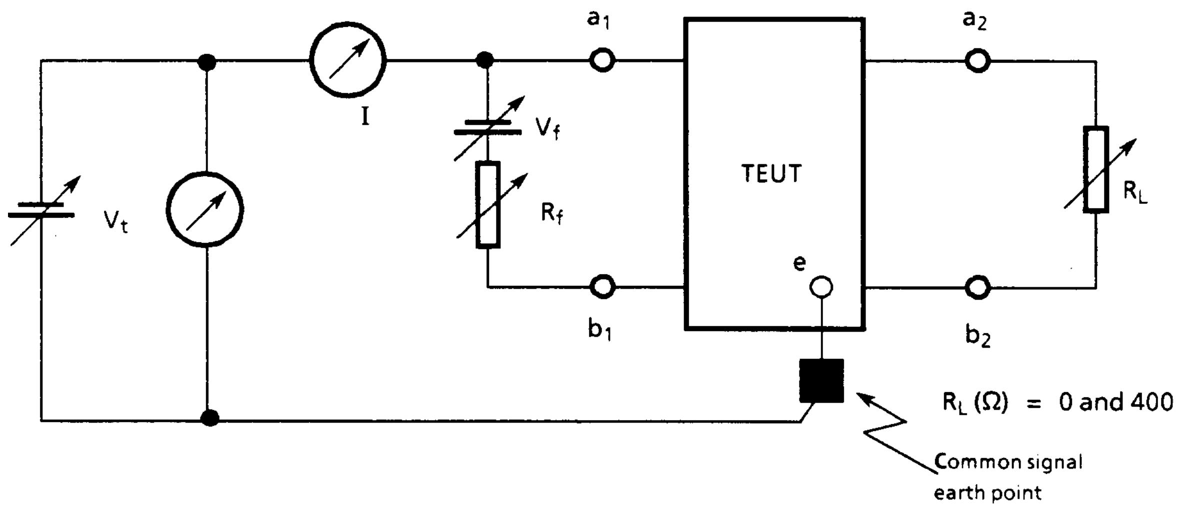


Figure A.2.2.2.1 (P) 1: Insulation resistance for TE in loop condition, line terminals to signal earth - Series-connected TE

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.

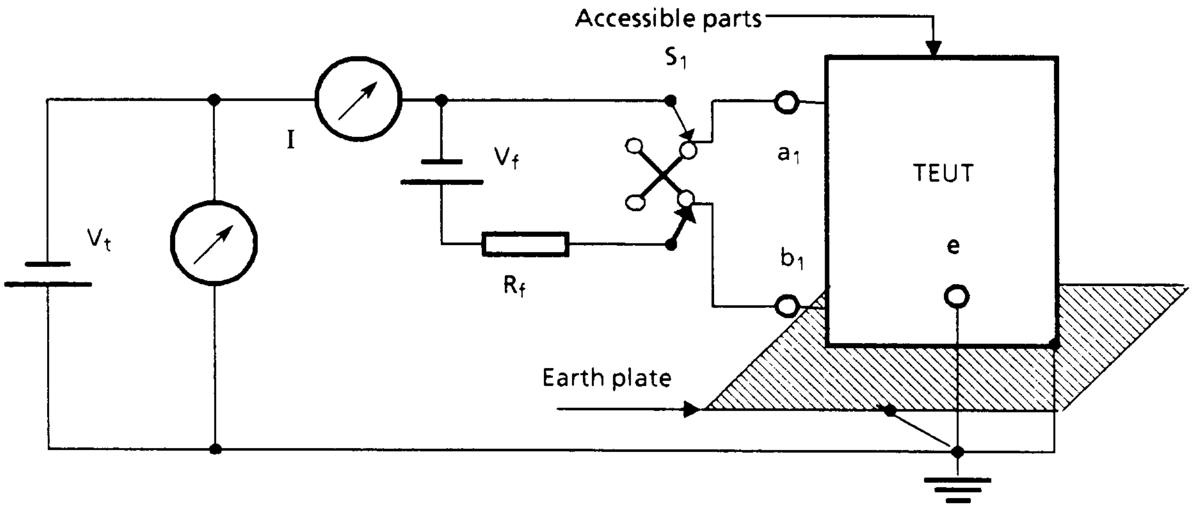


Figure A.2.2.2.1 (E) 1: Insulation resistance between line terminals and accessible parts (and earth) in loop condition

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 (BG) 1 This Bulgarian requirement is considered in Bulgaria as a safety requirement and hence is outside the scope of this ETS.

2.2.2.2 (DK) 1 The definition of R_5 in section 2.2.2 and formula A.2.2.2.2 are in disagreement. In loop condition it is not possible to measure each line separately in the measurement set-up shown in figure A.2.2.2.2. If R_5 is redefined to resistance between the line terminals when shorted together, there is agreement with the formula (600 Ω is a short circuit compared to MΩ resistance).
This definition is used for the Danish values.

For a PABX R_5 = 5 MΩ.

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 <u>safety</u> 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	
Bulgaria	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	
Hungary	not mandatory	not mandatory	not mandatory	
Iceland	100	48	800	
Ireland	not mandatory			
Italy	not mandatory	not mandatory	not mandatory	
Luxembourg	100			
Malta				
Netherlands	not mandatory			
Norway	100	60	1 200	
Portugal	100	48	400	yes
Spain				yes
Sweden	100	38	1 000	
Switzerland		not mandatory		
U. Kingdom	not mandatory	not mandatory	not mandatory	

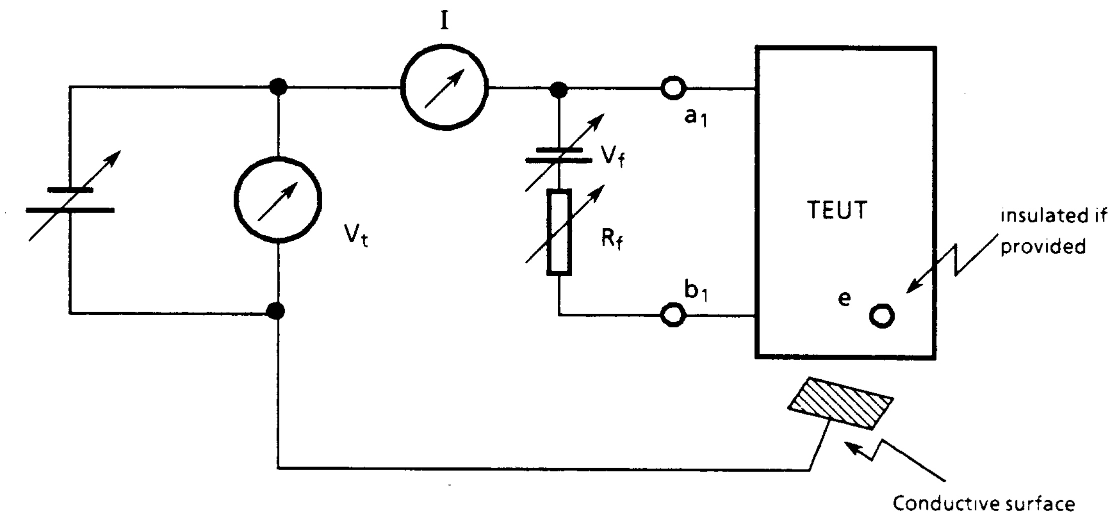


Figure A.2.2.2.2: Insulation resistance for TE in loop condition, line terminals to user accessible parts

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.

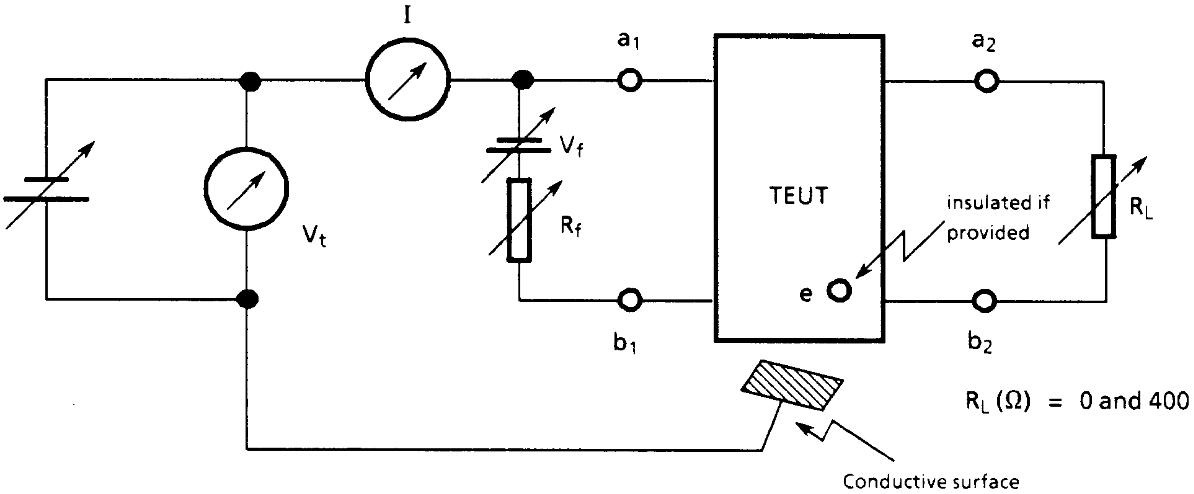


Figure A.2.2.2.2 (P) 1: Insulation resistance for TE in loop condition, line terminals to user accessible parts - Series-connected TE

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.

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	≤ 500	19 .. 60	
Belgium			2.3 (B) 1
Bulgaria	100 - 480	20 .. 60	2.3 (BG) 1
Cyprus	400	20 .. 100	2.3 (CY) 1
Denmark			2.3 (DK) 1 and 2.3 (DK) 2
Finland	≤ 400	20 .. 50	2.3 (SF) 1
France			2.3 (F) 1
Germany	≤ 540	20 .. 60	2.3 (D) 1
Greece	≤ 400	20 .. 80	2.3 (GR) 1
Hungary			2.3 (H) 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) 2
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	≤ 400	18 .. 100	2.3 (CH) 1
U. Kingdom		0 .. 125	2.3 (GB) 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 (BG)1

Loop resistance R:

1) V_f= 60 V, $R_f \leq$ 2 080 R ≤ 320;
2) V_f= 60 V, $R_f \leq$ 2 200 R ≤480 with a voltage drop at the TE of ≥ 6 V;
3) V_f= 60 V, $R_f \leq$ 28 700 R ≤ 2 250;
4) V_f= 60 V, $R_f \leq$ 219 k R ≤ 22 000.

2.3 (B) 2

$$I_{max} = \frac{53V}{360\ \Omega + R_{TEUT}\Omega}$$

2.3 (CY) 1 Loop mark U = f (I)

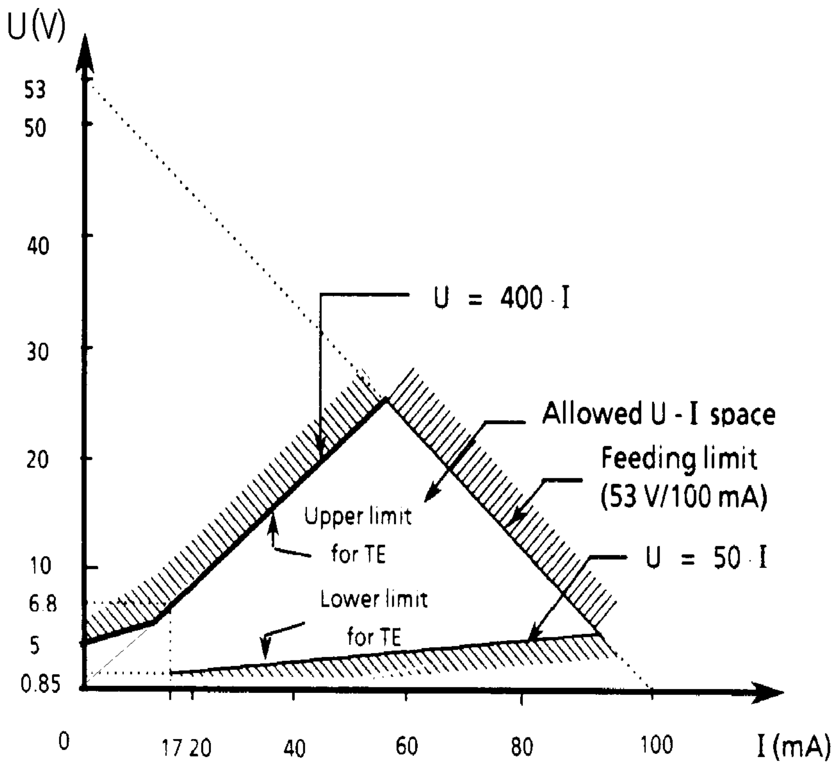


Figure 2.3 (CY) 1

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 I_{max} within the limits shown in figure 2.3 (DK) 1. The current-voltage characteristic shall be never decreasing curve, and there should be no instabilities, particularly below 16 mA

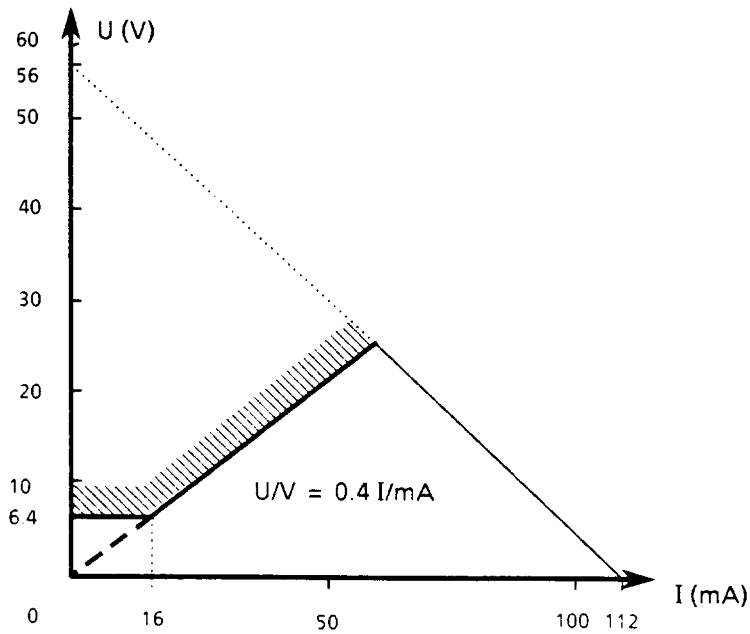


Figure 2.3 (DK) 1: dc current and loop resistance

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 I_{max} within the limits shown in figure 2.3 (DK) 2. The current-voltage characteristic shall be never decreasing curve, and there should be no instabilities, particularly below 16 mA

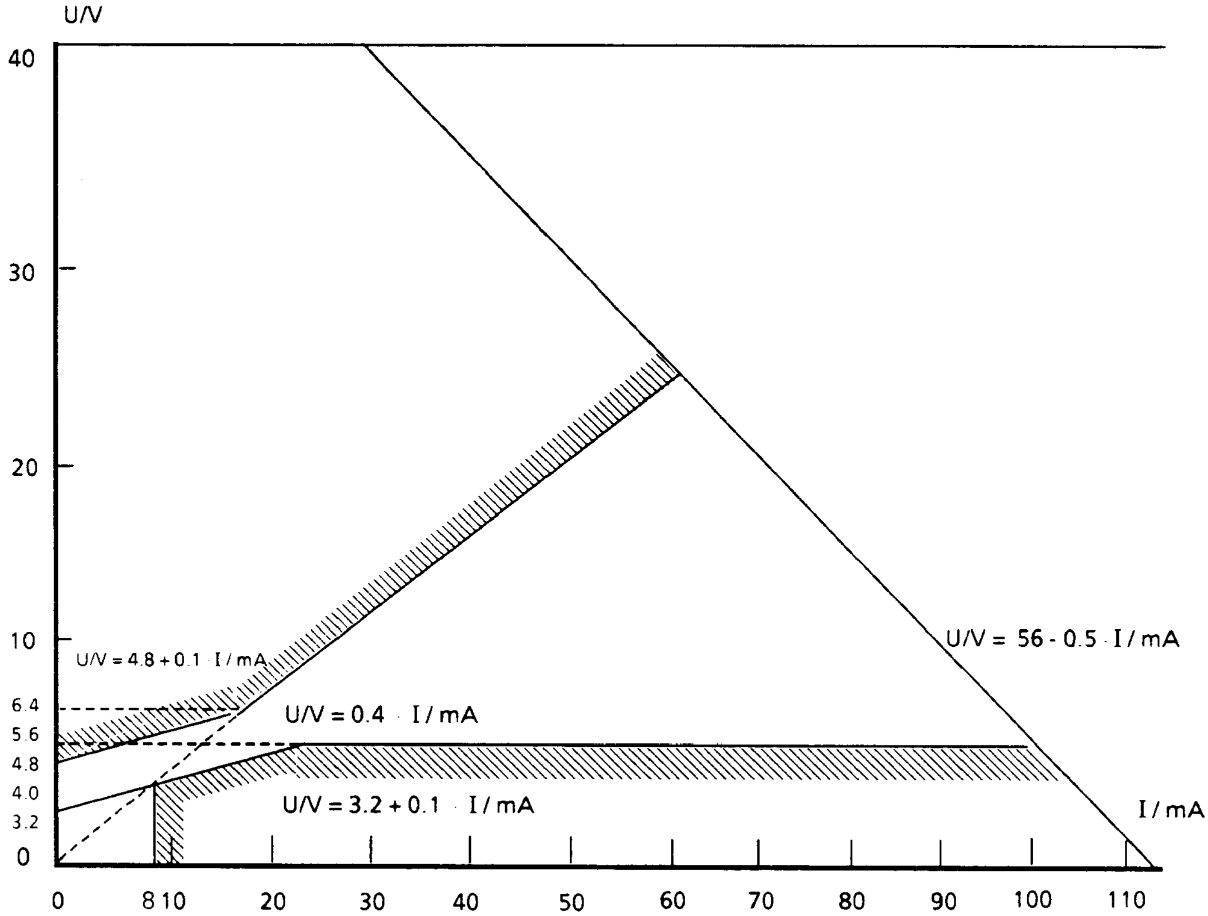


Figure 2.3 (DK) 2: Limits for the current-voltage characteristic of the dc loop in a telephone set

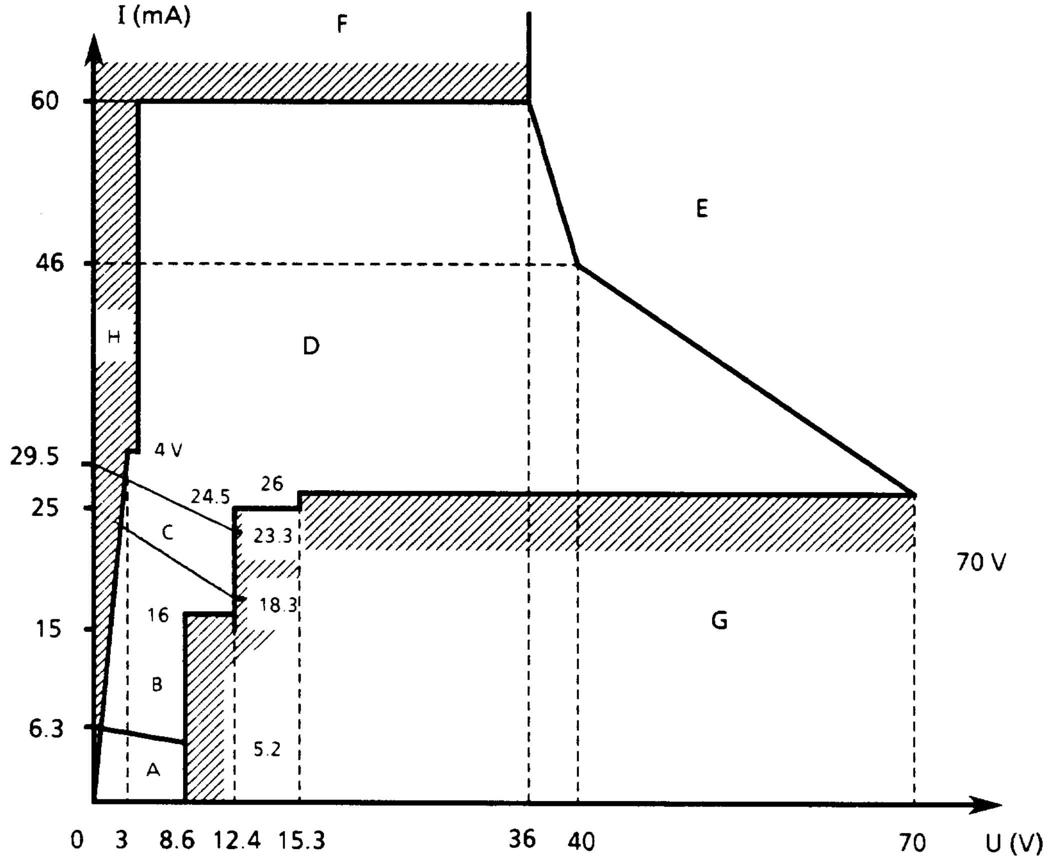
2.3 (SF) 1 TE is also allowed to work using the "constant current" principle. In that case the loop current shall fall between 20 and 50 mA in all feeding conditions mentioned in table 1.5.1.

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.

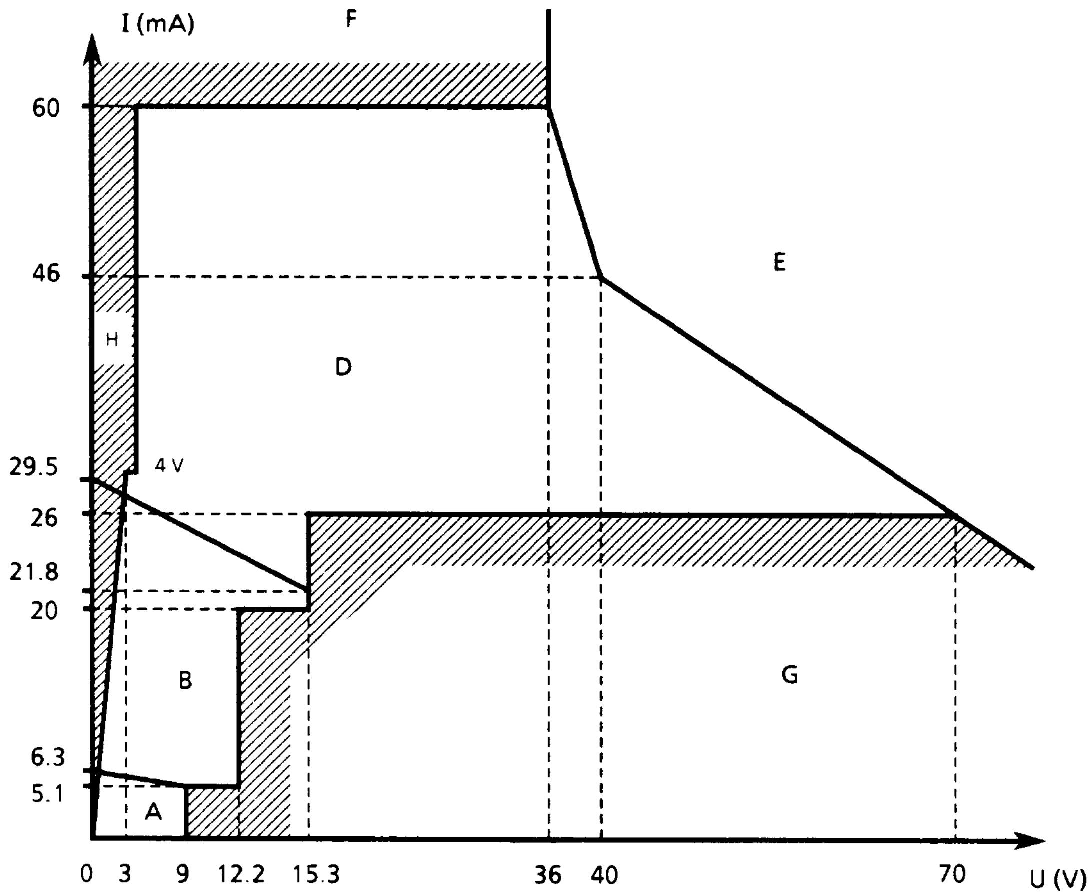
The loop mask of figure 2.3 (F) 1.a is to apply to the general type of TE.

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 See 2.1 (D) 1.

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:

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

2.3 (H) 1 The loop current shall be equal or higher than 20 mA when connected to a feeding source 48 V with a series resistance R_f variable from 440 ohms up to 2 000 ohms.

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.

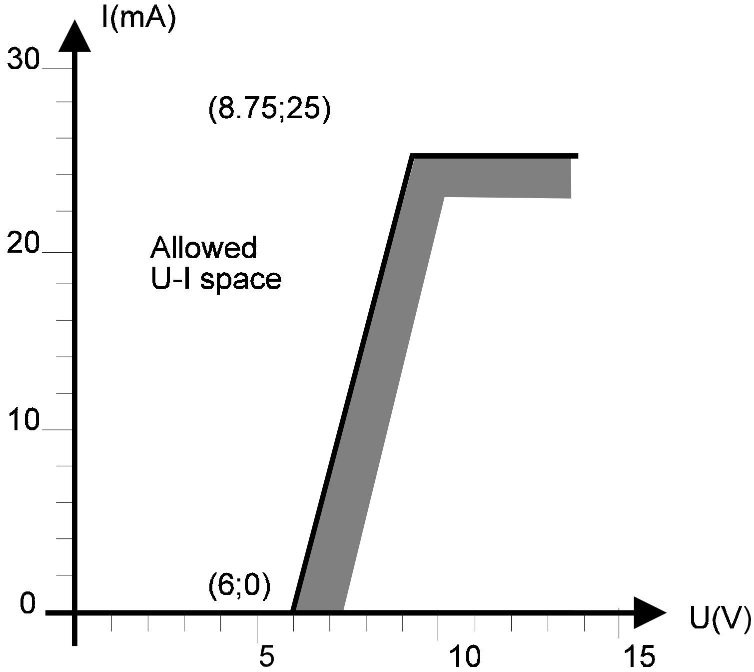


Figure 2.3 (I) 1: DC conditions : allowed U - I space

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.

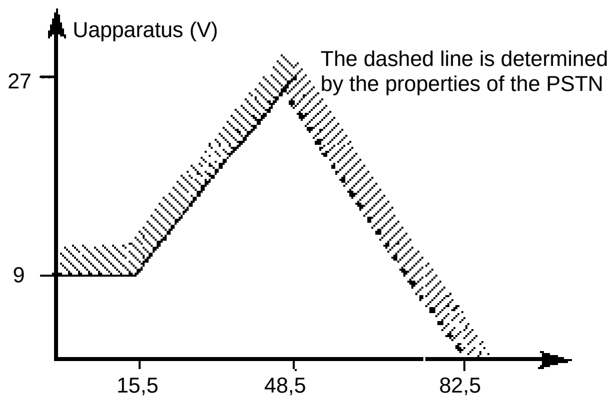


Figure 2.3 (NL) 1: DC current and loop resistance

2.3 (NL) 2 The TE shall comply with the DC-mask of figure 2.3 (NL) 1 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 $U_{apparatus}$ 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.

The design of the PSTN is based upon the conditions that the terminal equipment will have a total dc resistance of maximum 450 ohms. The loop resistance shall be verified up to maximum line current for both polarities.

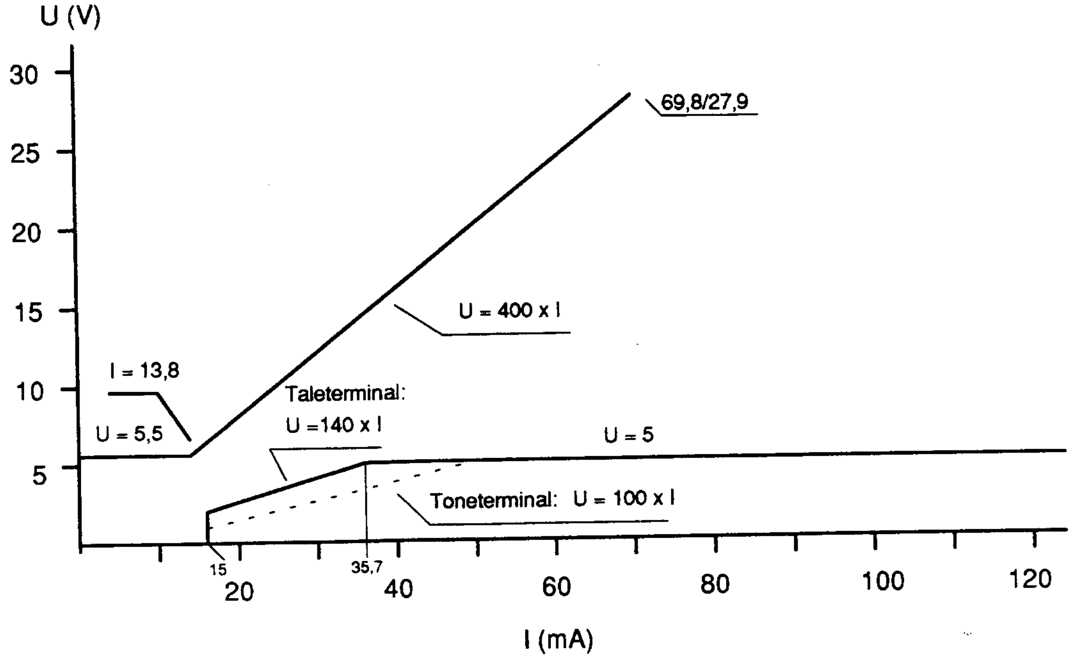


Figure 2.3 (N) 1

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.

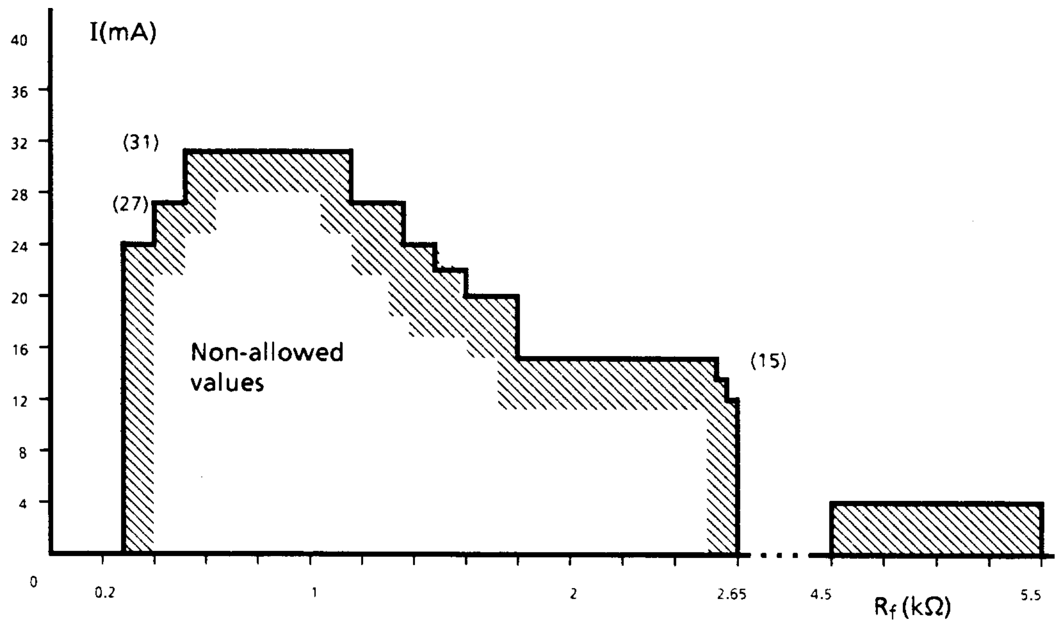


Figure 2.3 (P) 1: DC current and loop resistance

2.3 (E) 1 Resistance in loop condition

With TE in the loop condition, the equivalent loop resistance 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.

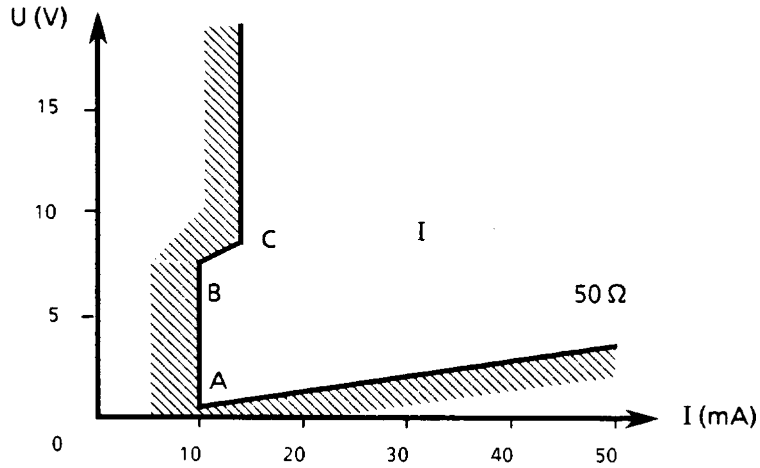
2.3 (E) 2 Resistance in high impedance condition

With TE in the high impedance condition, the equivalent loop resistance between the two line terminals shall not be lower than 50 kΩ 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.



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

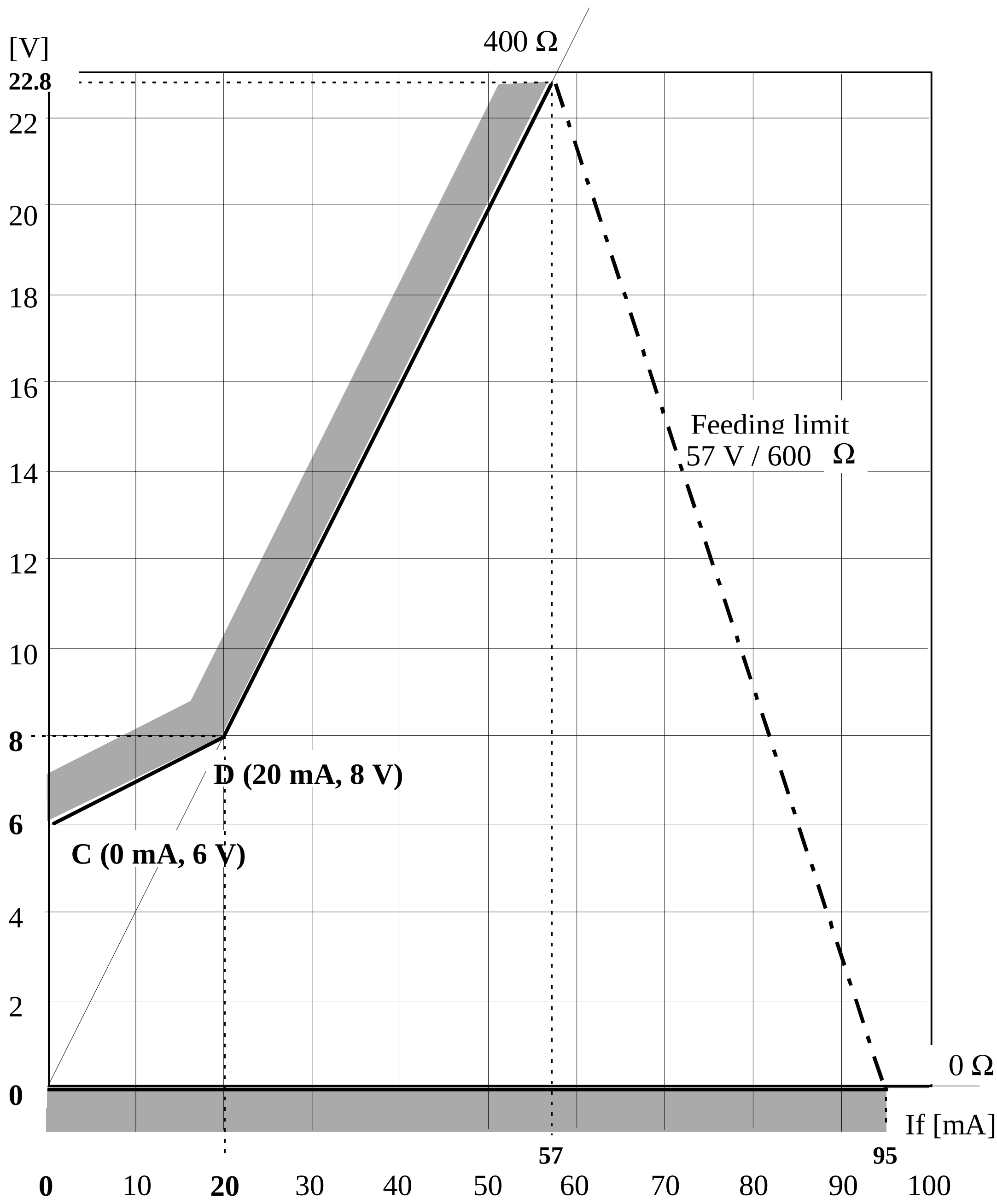


Figure 2.3 (CH) 1: DC current and loop resistance

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.

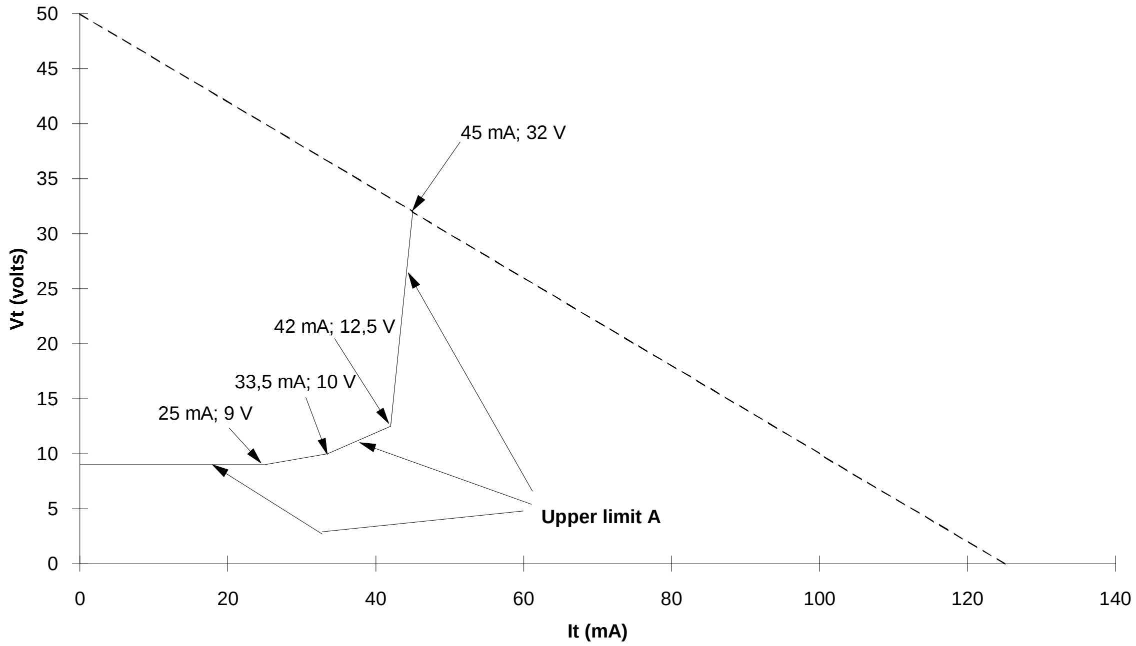


Figure 2.3 (GB) 1: Loop resistance (dc mask)

A.2.3 DC current and loop resistance

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

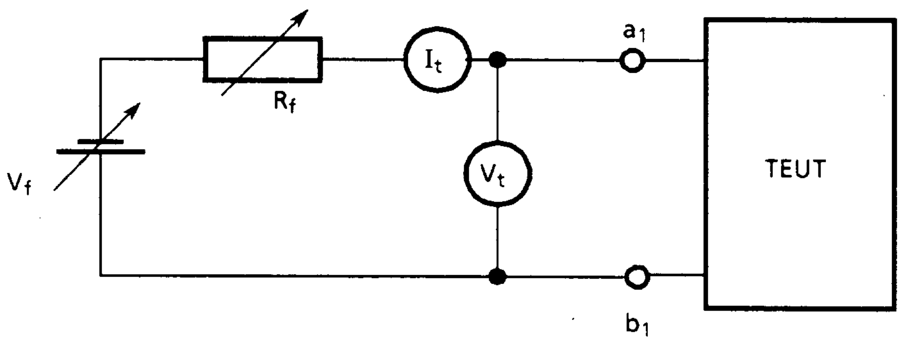


Figure A.2.3: DC current and loop resistance

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 V_f (V)	R_f (Ω)	V_t (V)	I_t (mA)	Remarks
Austria	60			19, 60	
Belgium	48	400, 800 1 200, 1 600			
Bulgaria	60	1 000, 2 080, 2 200		60 max.	
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
Hungary	48			20 - I_{max}	
Iceland	43 - 56	800 min.		14 - 60	
Ireland					yes
Italy	48	800 - 5 000			yes
Luxembourg	60			14 - 60	
Malta					
Netherlands	42, 48, 66	800, 1 130, 2 140		dc-charact.	yes
Norway	60	adjustable	measured values	10, 13,8, 15, 35,7, 45, 60, $I_{max.}$	
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 = 2, 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.

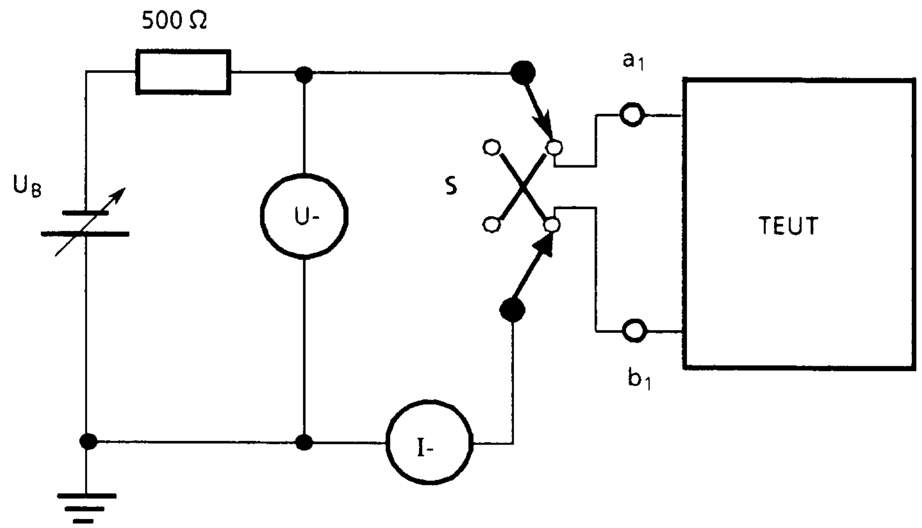


Figure A.2.3 (DK) 1

A.2.3 (F) 1 In the case of overfeeding:

V_f (V) = 82 - 104 and R_f (Ω) = 1 400 - 5 225

A.2.3 (D) 1 See A.2.1 (D) 1.

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:

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

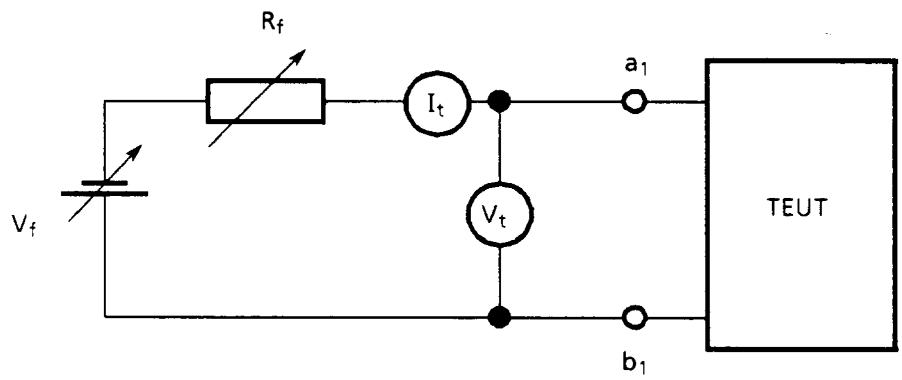


Figure A.2.3 (GR) 1

A.2.3 (IRL) 1

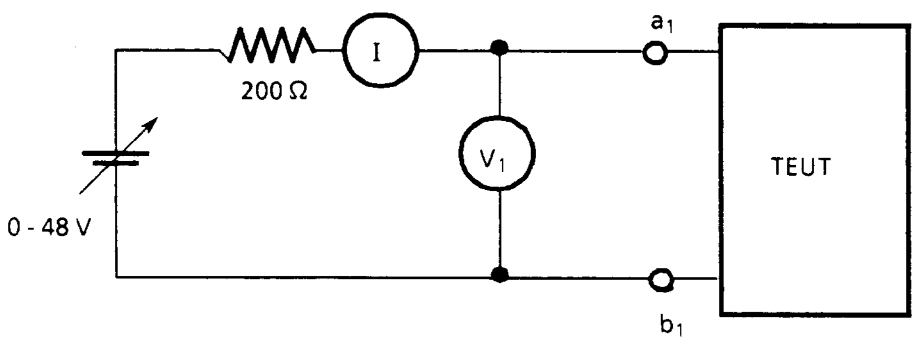


Figure A.2.3 (IRL) 1

1) Adjust V_f to give currents of I = 20 - 100 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.

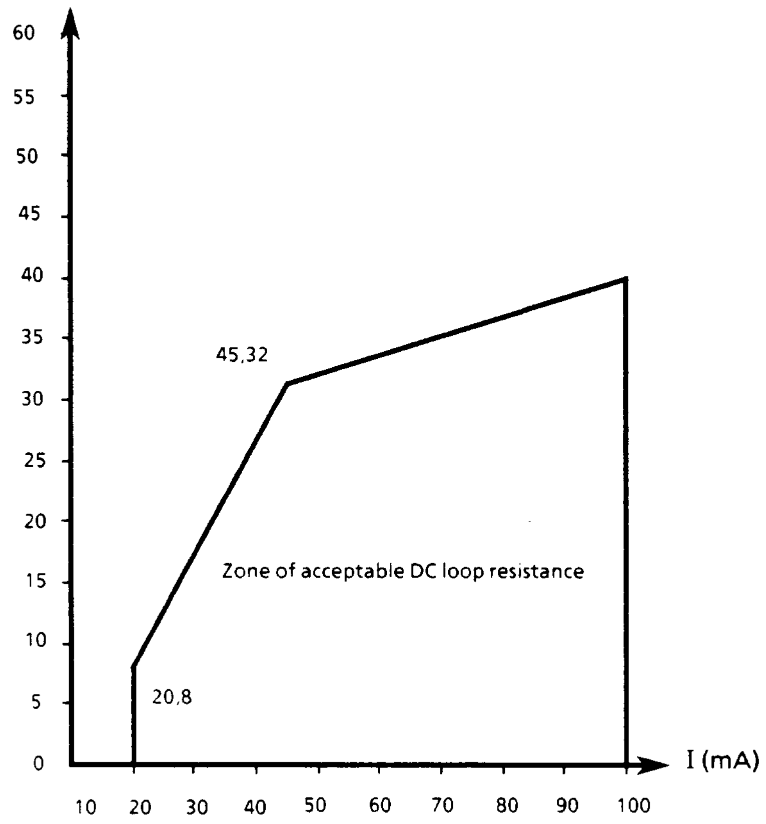


Figure A.2.3 (IRL) 2: DC current and loop resistance; dc mask

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:

Vf	Rf
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 It 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 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 in milliamperes.

A.2.3 (CH) 1 Measured with increasing and decreasing voltage V_f. Steps shall be of 1 V or smaller and have a minimal duration of 300 ms.

A.2.3 (GB) 1 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			yes
Belgium	not mandatory		
Bulgaria	150	1 mA	
Cyprus	100	1 mA	
Denmark	100	± 10%	
Finland	not mandatory		
France			yes
Germany	150		yes
Greece	not mandatory		
Hungary	not mandatory	not mandatory	
Iceland	not mandatory		
Ireland	not mandatory		
Italy			yes
Luxembourg	100	1 mA	
Malta			
Netherlands	not mandatory		
Norway			yes
Portugal	100	not applicable	yes
Spain			yes
Sweden	not mandatory		
Switzerland	20	+/-10%	yes
U. Kingdom	not mandatory	not mandatory	

2.4.1 (A) 1 The loop current shall be 19 mA, within 600 ms from the loop seizure. Additionally the loop current shall be ≥ 1,25 mA at a dc-voltage of 5 V applied on the line terminals a_1 and b_1, within 300 ms from the loop seizure.

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 82 to 104	200 to 8 125 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 to 54 V and R_L = 200 to 800 ohms (without overfeeding)

V_f = 82 to 104 V and R_L = 1 300 to 1 630 ohms (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 ≤ 150 mA for t_c ≤ 0,3 s,
I limit regularly decreases from (0.3 s,150 mA) to (0,327 s, 125 mA),
I ≤ 125 mA for 0,327 s ≤ t_c ≤ 2 s,
I ≤ 60 mA for t_c ≥ 2 s.

The requirement shall be met in the following feeding conditions:

V_f = 54 V and R_L = 200 ohms (without overfeeding)

V_f = 104 V and R_L = 1 300 ohms (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 ≤ 150 mA for t_c ≤ 0,3 s,
I limit regularly decreases from (0,3 s, 150 mA) to (0,4 s, 60 mA),
I ≤ 60 mA for t_c ≥ 0,4s.

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 V and R = 1 340/200 Ω 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.

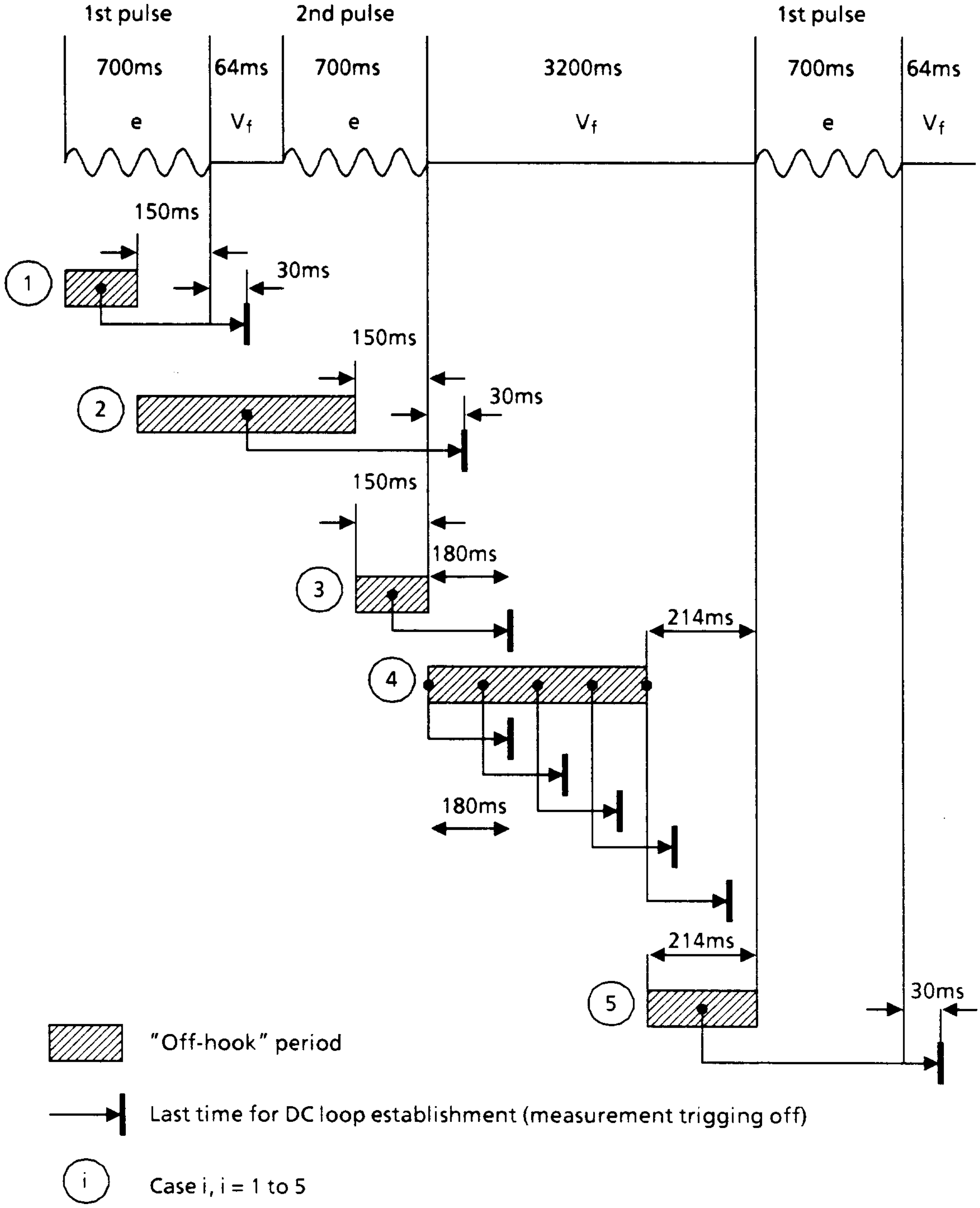


Figure 2.4.1 (F) 4

2.4.1 (D) 1 Transition from the quiescent state to the off-hook condition

In the case of a feeding voltage of $V = 63$ V and preconnected resistors of $R_{\Sigma} = 2.6$ kΩ, the permissible range for "$I \geq 20$ mA", as shown in 2.1 (D) 1, shall be reached within a period of $t \leq 60$ ms, after which the resistance limits may be exceeded in individual instances of up to 3 ms with a total duration of ≤ 6 ms. The deviation from the resistance limits ends when the resistance level falls below $R = 700$ Ω. After $t_{\Sigma} = 120$ ms, at the latest, the dc resistance shall be within the permissible range for "$I \geq 20$ mA", as shown in section 2.1 (D) 1.

The permissible range for "$I \geq 0.28$ mA", as shown in section 2.1 (D) 1, shall, In the case of a feeding voltage of $V = 63$ V and preconnected resistors of $R_{\Sigma} = 196$ kΩ, be reached within a period of $t \leq 60$ ms and shall be adhered to at these feeding conditions for at least 5 s. The requirements specified in the first paragraph of section 2.4.1 (D) 1 shall apply.

The permissible range for "$I \geq 1.8$ mA", as shown in 2.1 (D) 1, shall, in the case of a feeding voltage of $V = 63$ V and preconnected resistors of $R_{\Sigma} = 32$ kΩ, be reached within a period of $t \leq 60$ ms. The requirements specified in the first paragraph of section 2.4.1 (D) 1 shall apply.

In the case of manual line seizure, signalling of the ability to receive digits shall be discernible at the user interface of the TE within $t \leq 500$ ms after application of the dial tone or special dial tone at the NTA.

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.

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.

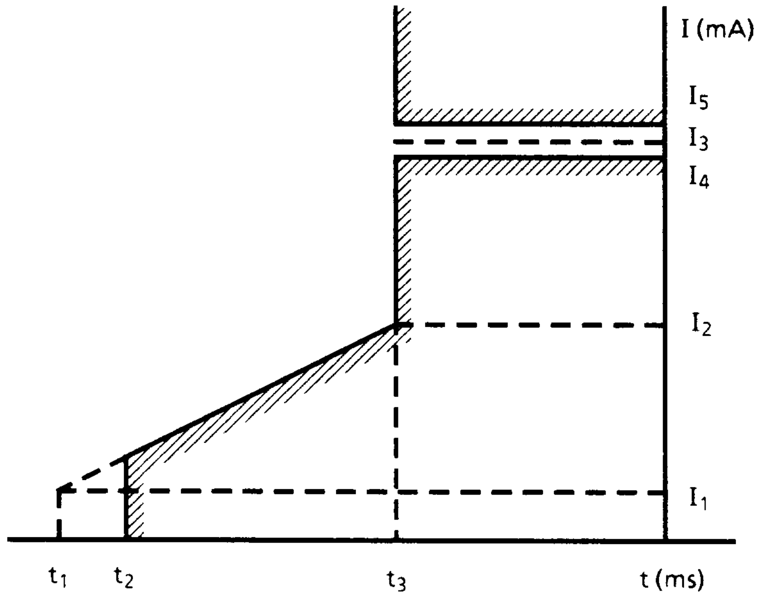


Figure 2.4.1 (E) 1: Change from quiescent condition to loop condition

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 When the TE is caused to change from loop state to quiescent state, the transient period for changing from 15 mA to < 5 mA 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 in its 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 V_f (V)	TEST VALUES R_f (Ω)	Remarks
Austria	60		yes
Belgium	not mandatory		
Bulgaria	60	1 000, 2 080, 2 200	yes
Cyprus	48	220	
Denmark	48	400	
Finland	not mandatory		
France			yes
Germany			yes
Greece	not mandatory		
Hungary	not mandatory		
Iceland	not mandatory		
Ireland	not mandatory		
Italy	48	900	yes
Luxembourg	not mandatory		
Malta			
Netherlands	not mandatory		
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	50	2 300, 500	
U. Kingdom	not mandatory		

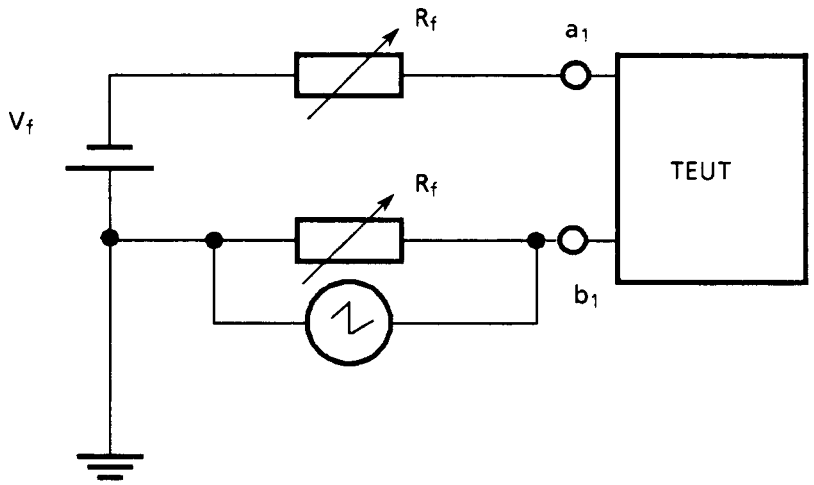


Figure A.2.4.1: Transient response

A.2.4.1 (A) 1 The TEUT is connected as shown in figure A.2.4.1 (A) 1. Before the test is carried out, a stable loop current of 20 mA adjusted by R_L is necessary. The measuring point for the loop current during the test is at 19 mA.

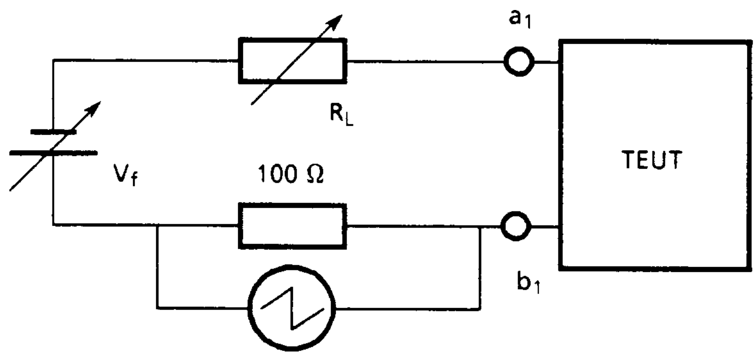


Figure A.2.4.1 (A) 1

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

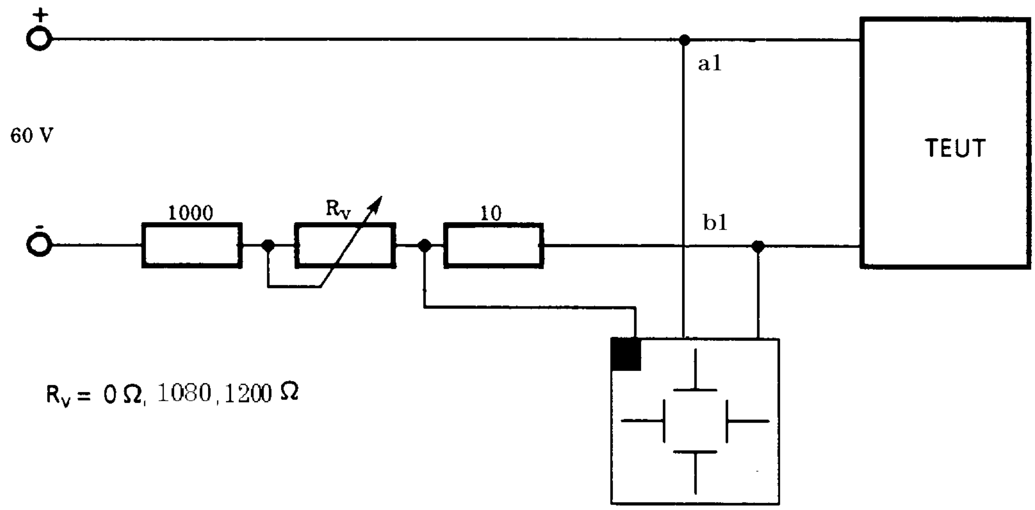


Figure A.2.4.1 (BG) 1: Transient response

The transient response ends when the current-voltage ratio corresponds to the required d.c. resistance of the TEUT.

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.

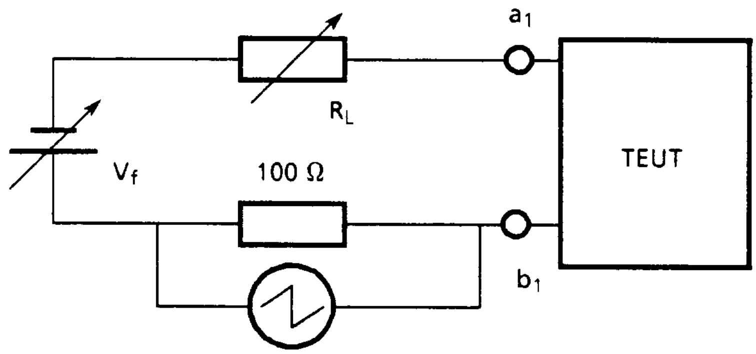


Figure A.2.4.1 (F) 1

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.

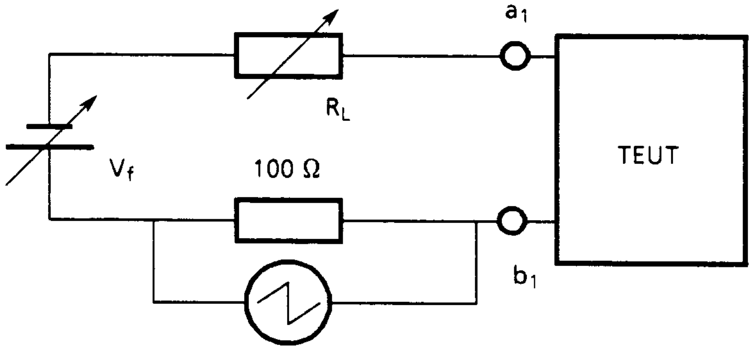


Figure A.2.4.1 (F) 2

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.

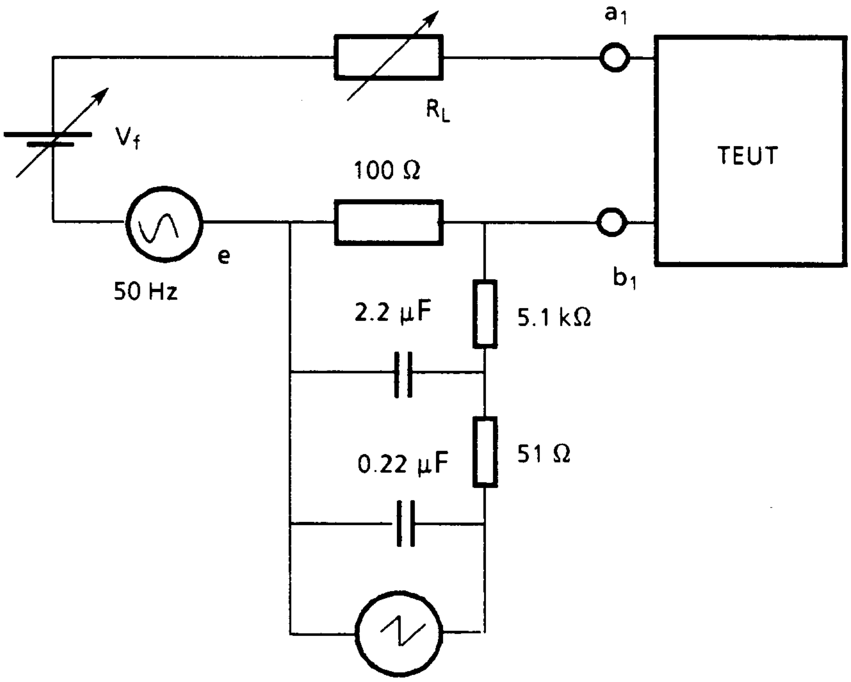


Figure A.2.4.1 (F) 3

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.

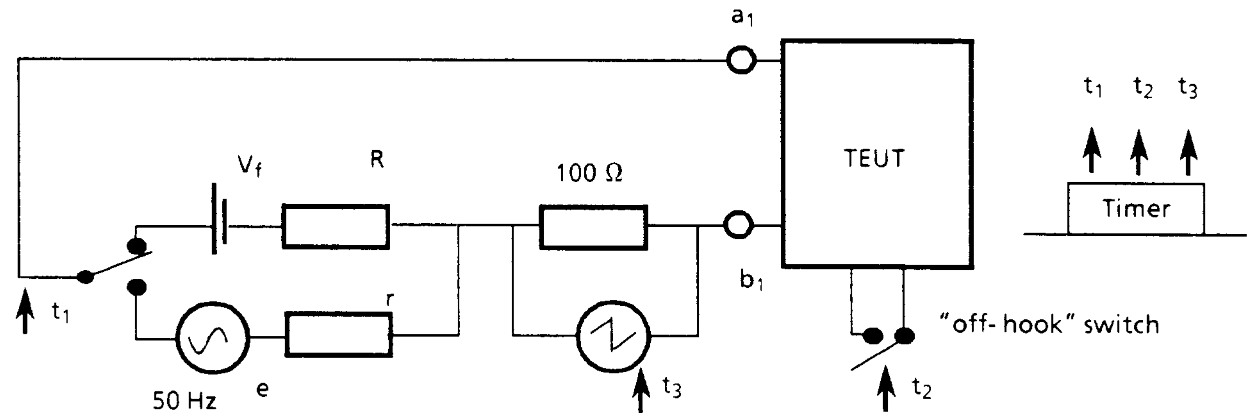
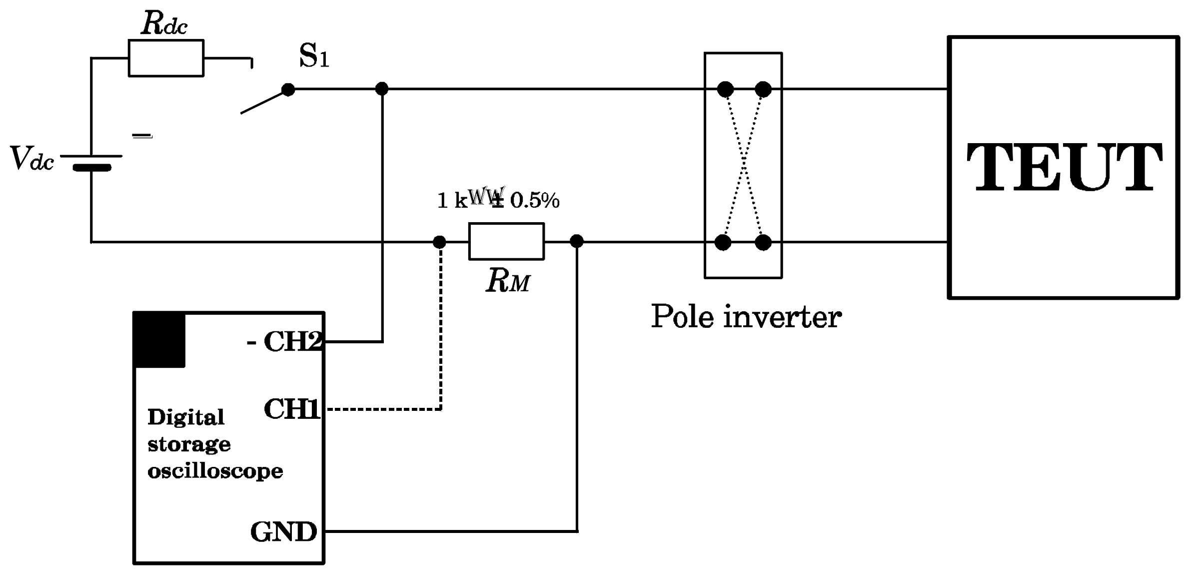


Figure A.2.4.1 (F) 4

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 Measurement of dc resistance during the transition from the quiescent state to the off-hook condition

The measuring circuit illustrated in figure A.2.4.1.a (D) 1 is used for the measurement.



V_{dc} = 63 V	R_{dc} = 1 600 Ω

Figure A.2.4.1.a (D) 1

The transition of a terminal (TEUT) from the quiescent state to the off-hook condition is recorded using the measuring arrangement illustrated in figure A.2.4.1.a (D) 1 by means of a system multimeter or a digital oscilloscope capable of transferring data for further processing.

The measurement commences either upon closure of S1 or upon subsequent loop closure in the TEUT, depending on the type of TEUT. The measurement values are determined and recorded at regular intervals (≤ 1 ms) for the duration of the measurement (e.g. 150 ms).

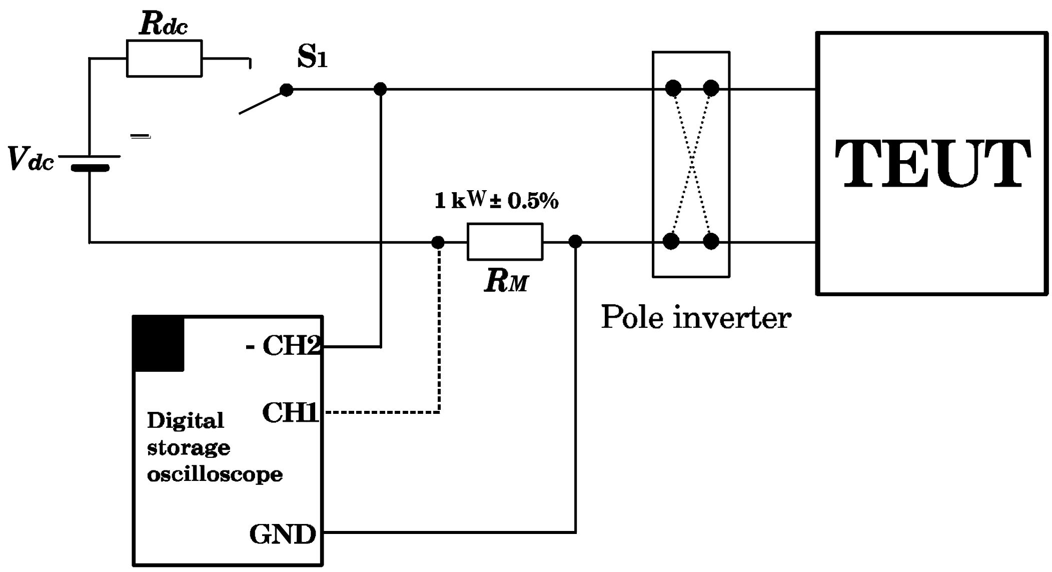
The voltage V_{TEUT} (-CH2) at the TEUT 60 ms after loop closure shall be within the range 6,0 V ≤ V_{TEUT} ≤ 10,8 V.

Deviations from the specified voltage range limits V_{TEUT} are permitted 60 ms to 120 ms after loop closure for a total period of ≤ 6 ms (each deviation ≤ 3 ms). The deviation from the specified voltage range ends when the voltage V_{TEUT} (-CH2) is 6,0 V ... 13,4 V.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

Measurement of the dc resistance during the transition from the quiescent state to the off-hook condition at low feeding currents

The measuring circuit illustrated in figure A.2.4.1.b (D) 1 is used for the measurement.



V_{dc} = 63 V

Figure A.2.4.1.b (D) 1

The transition of a terminal (TEUT) from the quiescent state to the off-hook condition at a low feeding current is recorded using the measuring arrangement illustrated in figure A.2.4.1.b (D) 1 by means of a system multimeter or a digital oscilloscope capable of transferring data for further processing.

The measurement commences either upon closure of S1 or upon subsequent loop closure in the TEUT, depending on the type of TEUT. The corresponding measurement values are determined and recorded at regular intervals (≤ 1 ms) for the duration of the measurement (e.g. 150 ms).

The voltage V_{TEUT} at the TEUT 60 ms after loop closure shall correspond to the respective values specified for measurements "a" and "b" in table .

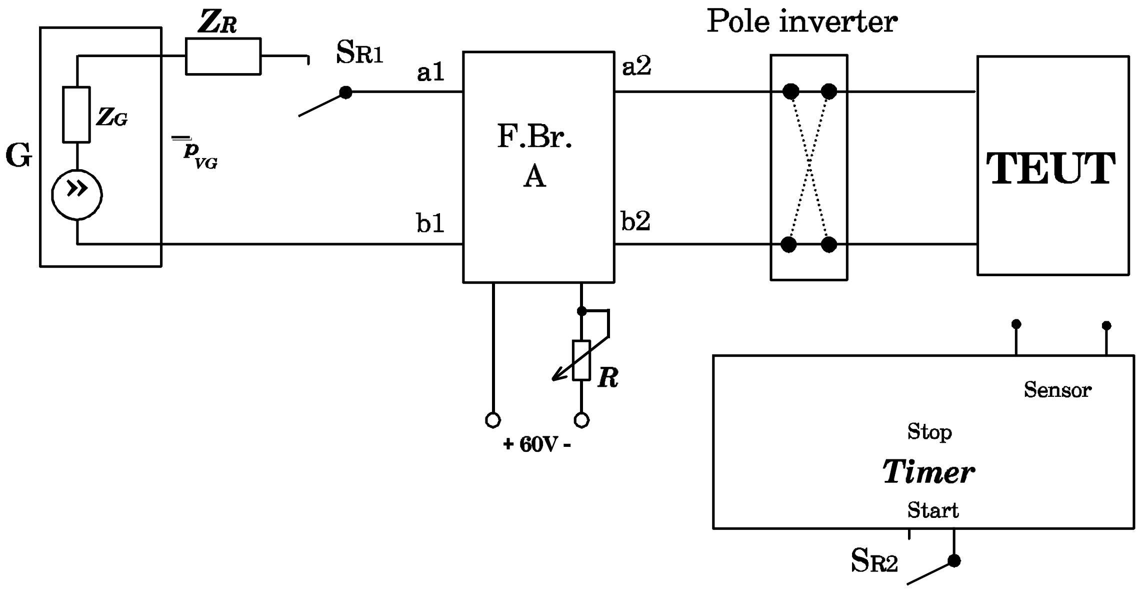
Table A.2.4.1.a (D) 1

Measurement	R_{dc}	V_{TEUT} (-CH2)
a	195 kΩ	0,1 V...7,5 V
b	31 kΩ	0,58 V...5,2 V

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

Signalling of the ability of the telephone network / ISDN to accept digits

The measuring circuit illustrated in figure A.2.4.1.c (D) 1 is used for the measurement.



$Z_G \approx 0\ \Omega$

Figure A.2.4.1.c (D) 1

The measurement is carried out with the parameters specified in table A.2.4.1.b (D) 1.

Table A.2.4.1.b (D) 1

Power supply:	Dial tone:
V = 60 V	p_{VG} = -23 dB(950 mV)
R = 1 460 Ω	f = 425 Hz

The ability of the telephone network/ISDN to receive digits is signalled to the TE by means of the dial tone. The signal shall be discernible at the equipment interface within $t \leq 500$ ms.

The TEUT is supplied with dc loop current by manual seizure of the line. The dial tone is subsequently applied by means of switch SR1 and the timer simultaneously started by means of switch SR2. Signalling of the ability to receive digits is detected at the equipment interface by a suitable sensor and the timer stopped.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

A.2.4.1 (I) 1 The time shall be measured starting from the moment in which the current reaches for the first time 1 mA.

A.2.4.1 (N) 1 R_f is 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 ohm;
60 V_{dc} - R_{f2} = 3 000 ohm.

The measurements shall be performed for at least 100 ms.

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.

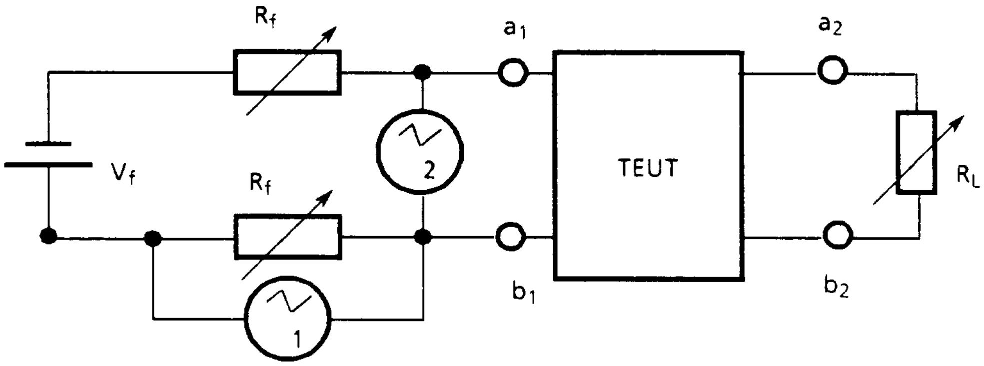


Figure A.2.4.1 (P) 2: Transient response, quiescent to loop state - Series-connected TE

Vf (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.

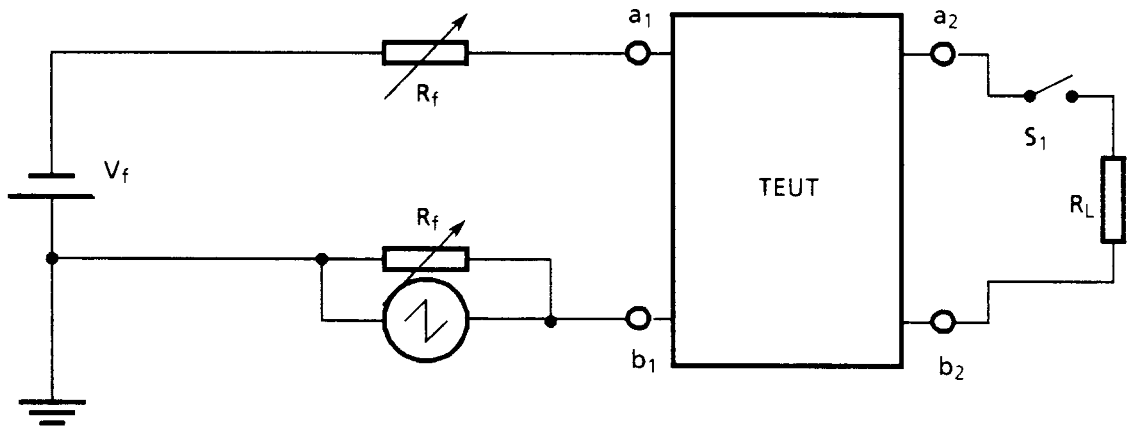


Figure A.2.4.1 (E) 2: Change from quiescent condition to loop condition of an associated TE (series)

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	
Bulgaria	25	5	
Cyprus	15	5	
Denmark	15	5	
Finland	15	5	
France	20	10	
Germany			yes
Greece	not mandatory		
Hungary	not mandatory	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	not mandatory	yes

2.4.2 (A) 1 In this case the current interruption (loop current ≤ 18 mA) shall be less than 5 ms.

2.4.2 (D) 1 Loop interruptions

When not in the signalling state, the terminal equipment shall not cause loop interruptions at the NTA with a duration of $t \geq 5$ ms (see section 10.2 (D) 1.5 "Communication state" for exception).

In the case of successive loop interruptions with a duration of $t \leq 5$ ms, the time interval between individual interruptions shall be $t \geq 50$ ms. Loop interruptions are in this case defined as a deviation from the permissible range for "$I \geq 20$ mA", as shown in 2.1 (D) 1.

2.4.2 (N) 1 Call transfer at B-subscriber.

Call transfer to another terminal equipment shall not generate breaks between 5 ms and 700 ms in the loop current. Transfer of a call between units in the same equipment shall not cause breaks between 35 ms and 700 ms in the loop current. Breaks are defined as loop current below 13,5 mA

2.4.2 (N) 2 Call transfer at A-subscriber.

During through connection to another equipment the line current shall not be less than 13,5 mA for more than 5 ms. Transfer of a connection between units in the same equipment shall not cause a loop current below 13,5 mA for more than 35 ms.

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 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 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 output terminals change from quiescent condition to loop condition, the change of the series TE shall be done 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 5 ms.

For this requirement, the associated TE is supposed 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 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 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.

2.4.2 (GB) 1

NOTE: The duration of an undesignated interruption or random break in the dc path caused by the TEUT should not exceed 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 V_f (V)	R_{f1} (Ω)	R_{f2} (Ω)	R_L (Ω)	Remarks
Austria	60		100	500	yes
Belgium	48	600	1 000	300	
Bulgaria	60	1 080	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					
Greece	not mandatory				
Hungary	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	40 60	1 900 3 000	100 100	400	yes
Portugal	48	900	900	400	
Spain	48	250, 1 100	250, 1 100	300	yes
Sweden	38	900	100	600	
Switzerland	50	2 300	100	300	
U. Kingdom	not mandatory	not mandatory	not mandatory	not mandatory	

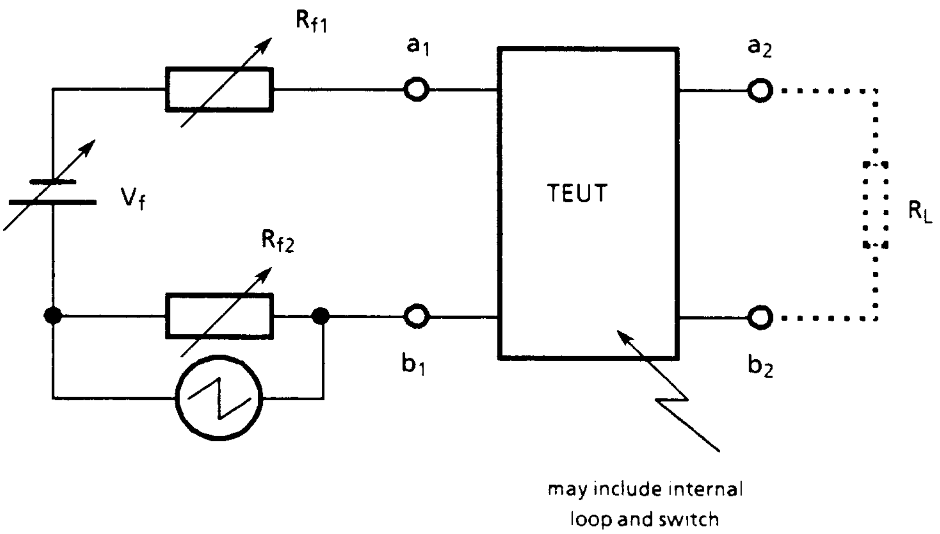


Figure A.2.4.2: Loop current transfer

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

A.2.4.2 (N) 1 Two tests shall be carried out for each of 2.4.2 (N) 1 and 2.4.2 (N) 2. The measurements shall be performed for 1 000 ms as a minimum

A.2.4.2 (E) 1 Transient during loop condition

The procedure of 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 250 Ω; the test shall also be made when these resistors take the value of 1 100 Ω. 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 300 Ω.

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	25	not mandatory	yes
Belgium	40		yes
Bulgaria	10		yes
Cyprus	20	not mandatory	
Denmark	not applicable	not applicable	yes
Finland	200	not mandatory	
France			yes
Germany			
Greece	110		
Hungary	100		
Iceland	20	not mandatory	yes
Ireland	20	not mandatory	yes
Italy		5	
Luxembourg	20		
Malta			
Netherlands	100	not mandatory	
Norway	25	not mandatory	
Portugal	100	not applicable	
Spain	50	not applied	yes
Sweden	75	not mandatory	
Switzerland	35	not mandatory	
U. Kingdom	10		yes

2.5 (A) 1 For pulse metering equipment without power supply R_S = 100 Ω.

2.5 (A) 2 If the TE is assigned for the connection to a PSTN line from a PABX with DC-DDI function the values for R_S must be fulfilled at a loop current of $\geq$ 14 mA. Additionally must be placed between the line terminals a_1 and a_2 or b_1 and b_2 only linear components.

R_S for line currents $\leq$ 19 mA under study.

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

2.5 (BG) 1 For pulse metering equipment R_S = 150 Ω or V_S = 2,5V

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.

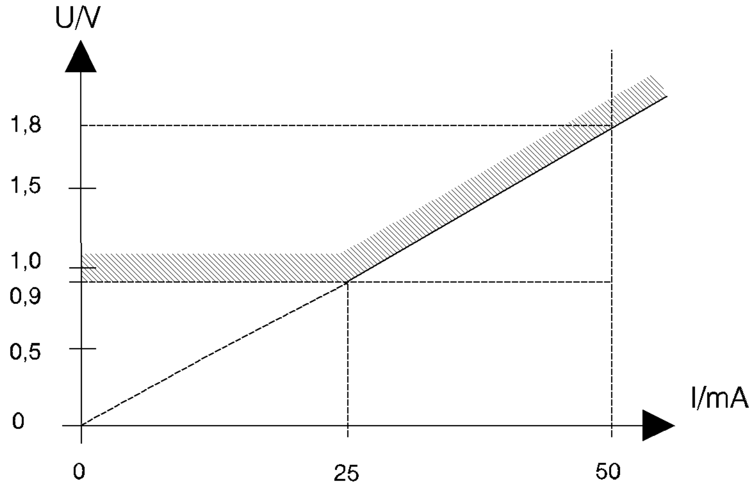


Figure 2.5 (DK) 1: DC current - Voltage characteristics for serial device

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.

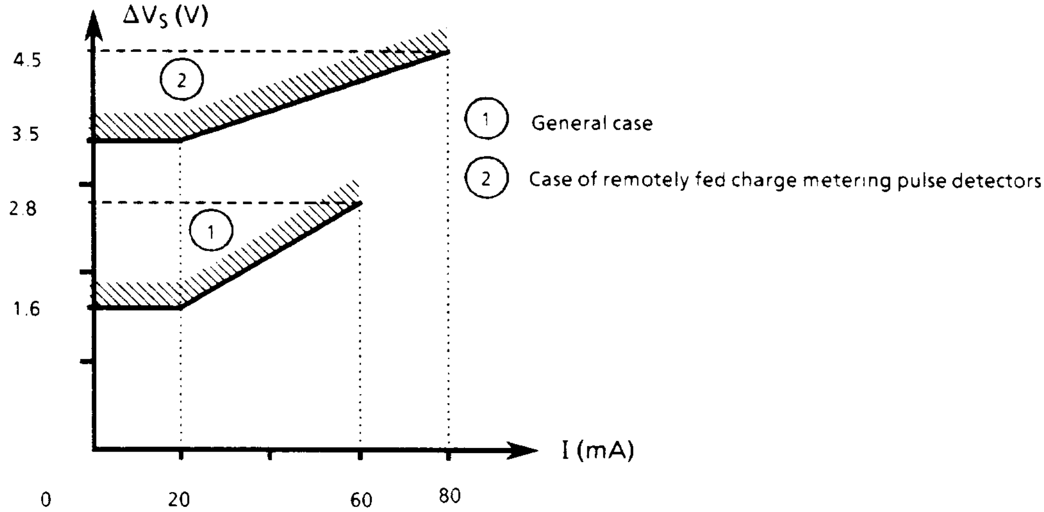


Figure 2.5 (F) 1: Insertion mask V_s = f (I)

2.5 (D) 1 No requirement.

2.5 (IRL) 1 Requirement applies for all loop currents between 20 to 100 mA.

2.5 (H) 1 For remote pulse metering equipment $V_s \leq 3$ V.

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 (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 a 10 ohm resistor 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 a 50 ohm resistor for line currents greater than 40 mA (see NOTE).

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 O,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 (see 4.3 (GB) 2).

(II) The series TE shall be supplied with Instructions for Use 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.

NOTE: Requirement 1(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 1(II) is primarily intended to apply to series apparatus which has series elements such as opto-couplers or relay coils.

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:

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

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

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

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
Bulgaria	60	1 000, 2 080	300	
Cyprus	48	800	400	yes
Denmark				yes
Finland	48	800, 1 710	400	yes
France				yes
Germany				
Greece	60	600 - 2 600	400	
Hungary	48	440 - 2 000	400	
Iceland	48	800, 2 400	400	
Ireland				yes
Italy	44	1 880	200	
Luxembourg	60		500	
Malta				
Netherlands	48	1 130	560	
Norway	60	460, 3 500	400	
Portugal	45, 55	1 150, 2 500	0 and 400	
Spain	43 - 56	300 - 2300	100	yes
Sweden	33 - 60	variable	0	yes
Switzerland	50	2 300	300	
U. Kingdom	50	400 min.	600	yes

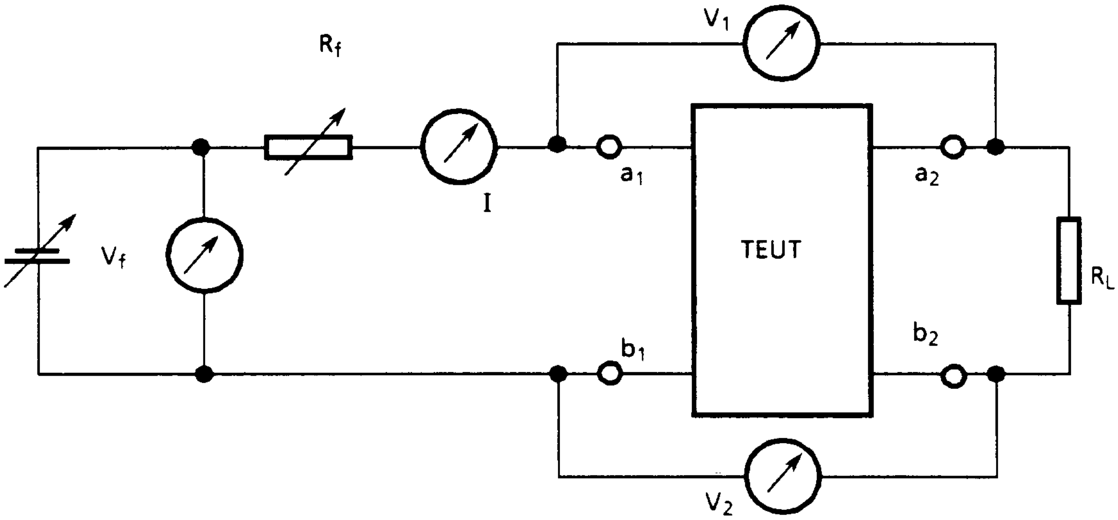


Figure A.2.5: Series resistance

A.2.5 (A) 1 I = 19 mA, 60 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

$R_{s1} \leq 40\ \Omega$

$$R_{s2} = \frac{V_2}{I}$$ Formula A.2.5 (B) 1.b

$R_{s2} \leq 40\ \Omega$

A.2.5 (CY) 1

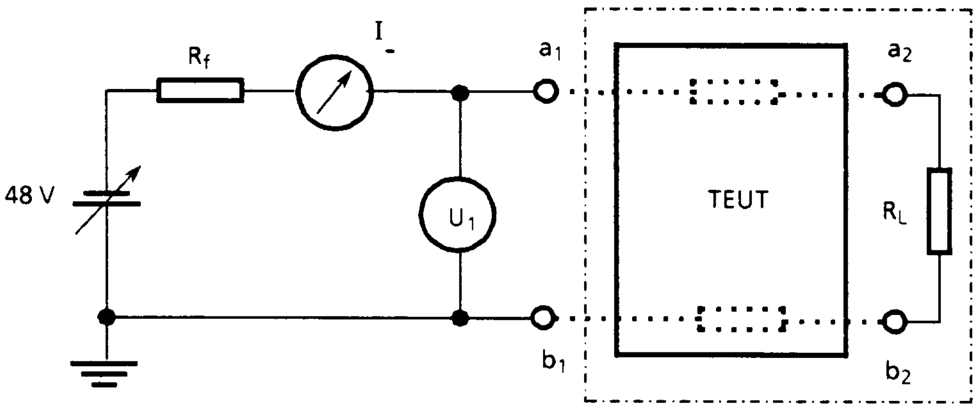


Figure A.2.5 (CY) 1

R_f = 800 ohms R_L = 400 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 for both polarities of the dc-voltage.

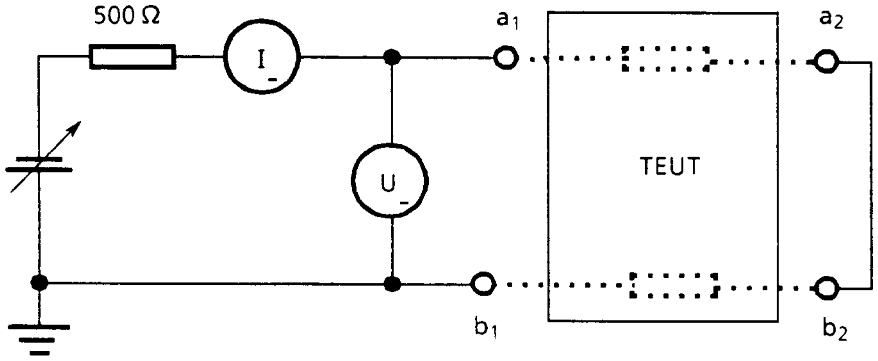


Figure A.2.5 (DK) 1: Series resistance

A.2.5 (SF) 1 The measuring set-up is given in figure A.2.5 (SF) 1.

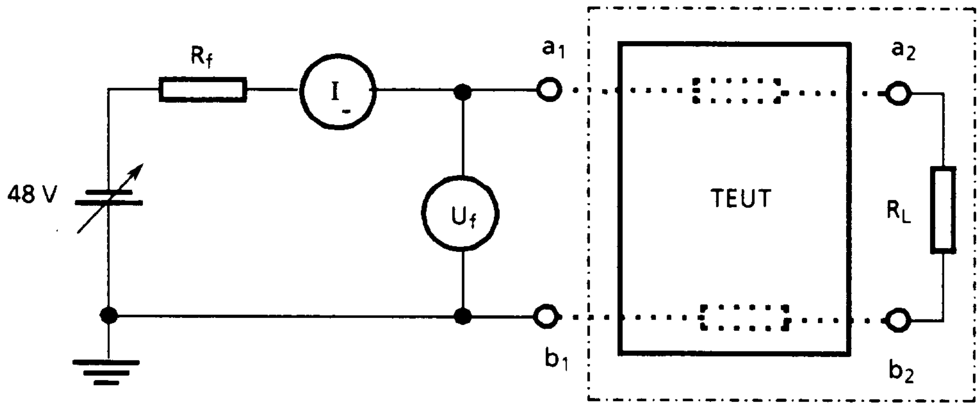


Figure A.2.5 (SF) 1: Series resistance

R_f = 800, 1 710 ohms R_L = 400 ohms

The series resistance is calculated using formula A.2.5 (SF) 1:

$$R_S = \frac{U_f}{I} - R_L \qquad \text{Formula A.2.5 (SF) 1}$$

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.

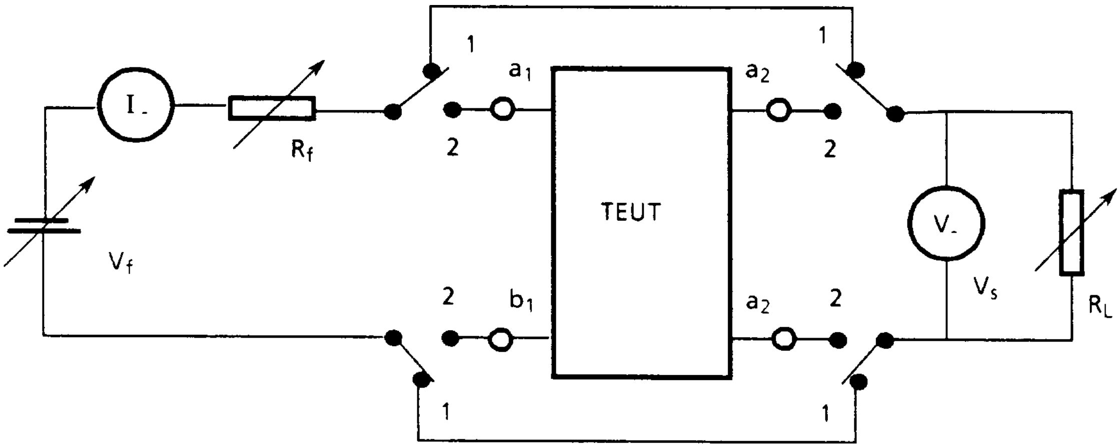


Figure A.2.5 (F) 1

Table A.2.5 (F) 1

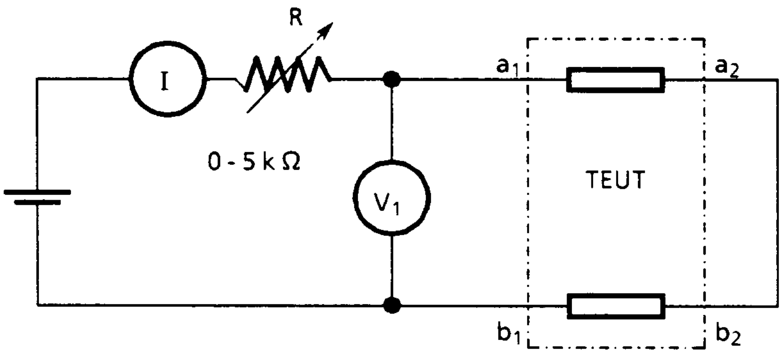
V_f (V)	R_f (Ω)	I_f (mA)
45	1 400	25
54	300	60

The voltage drop is calculated using formula A.2.5 (F) 1:

$\Delta V_s = |V_{s1}| - |V_{s2}|$,   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 (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.

$$R+ = \left[\frac{V_{t2}\,(V)}{I_{t2}\,(mA)} - \frac{V_{t1}\,(V)}{I_{t1}\,(mA)}\right] \times 1\,000 \qquad \text{Formula A.2.5 (E) 1.}$$

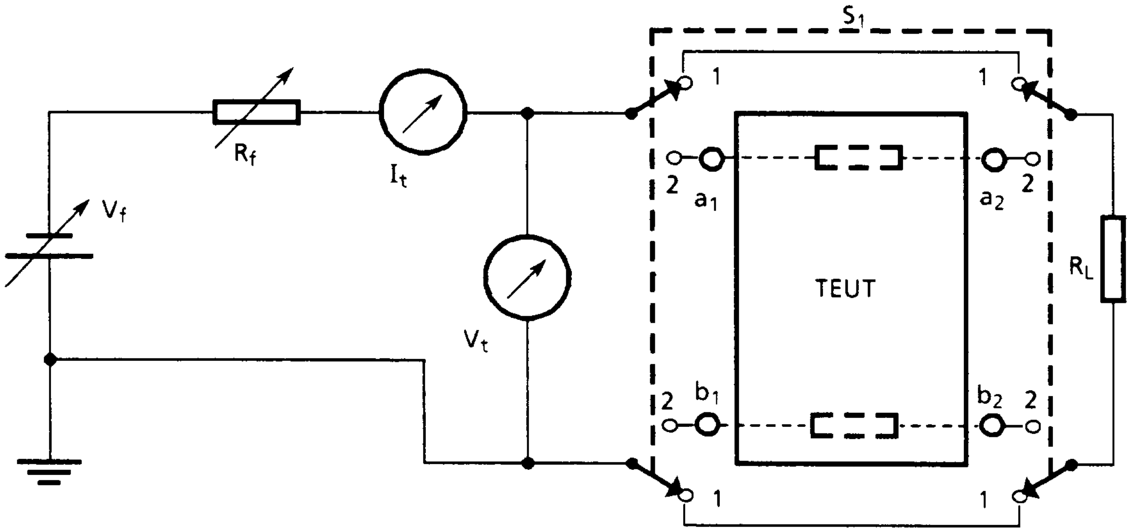


Figure A.2.5 (E) 1: Insertion loop resistance (series)

A.2.5 (S) 1 Test shall be undertaken for I = 10, 25 and 50 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 400 Ω (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	
Bulgaria	66	500		5	300 resistive	
Cyprus	66	300	125	5	300 resistive	yes
Denmark	56	220		30	0	yes
Finland	not mandatory					
France	54	300		5	600 resistive	
Germany						
Greece	66		100	5	400 resistive	
Hungary	not mandatory					yes
Iceland	56	400	125	30		
Ireland	not mandatory					
Italy	not mandatory	not mandatory	not mandatory	not mandatory	not mandatory	
Luxembourg	66	300		5		
Malta						
Netherlands	66	400		1	0	
Norway	not mandatory	not mandatory		not mandatory	not mandatory	
Portugal	not mandatory					
Spain	66	300	125	5	100	yes
Sweden	not mandatory					
Switzerland	50	500			300	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 (H) 1 The requirement for the overload susceptibility shall be met according to section 3.2 (dc mixed with 50 Hz ac instead of pure dc) on TE with or without ringing detection.

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 Following overload tests apply with the presently described feeding conditions:

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. The acoustic shock for TE with transducers to be applied to the human ear (e.g. handset receiver) shall not exceed the limits mentioned in TBR 8, annex C. This test is to be conducted with R_f = 2 300 and a 19 dB V_{EMF} (open circuit voltage).

3. The Tests defined under CCITT Recommendation K.21, table 1, Test 1, Criterion A.

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_o 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_o, the value of the feeding voltage is reduced so as to maintain the current at a value I_o 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	not mandatory	
Belgium		
Bulgaria		
Cyprus	As per section 2.6	yes
Denmark		
Finland	not mandatory	
France		
Germany		
Greece		yes
Hungary		yes
Iceland		
Ireland	not mandatory	
Italy	not mandatory	
Luxembourg		
Malta		
Netherlands	not mandatory	
Norway		
Portugal		
Spain		yes
Sweden	not mandatory	
Switzerland	See section 2.6	
U. Kingdom	not mandatory	

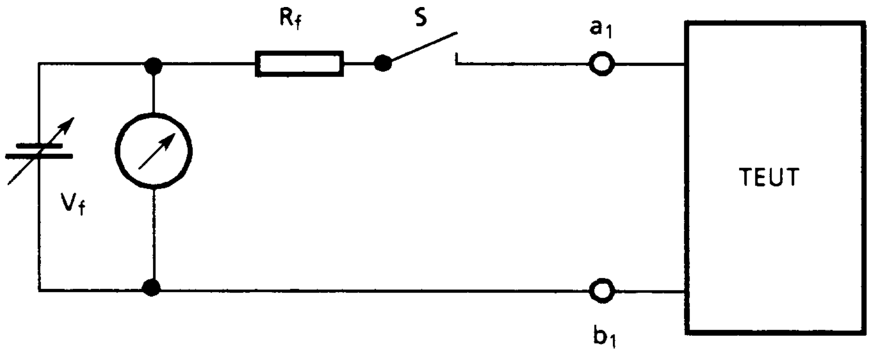


Figure A.2.6: DC overload susceptibility

A.2.6 (B) 1

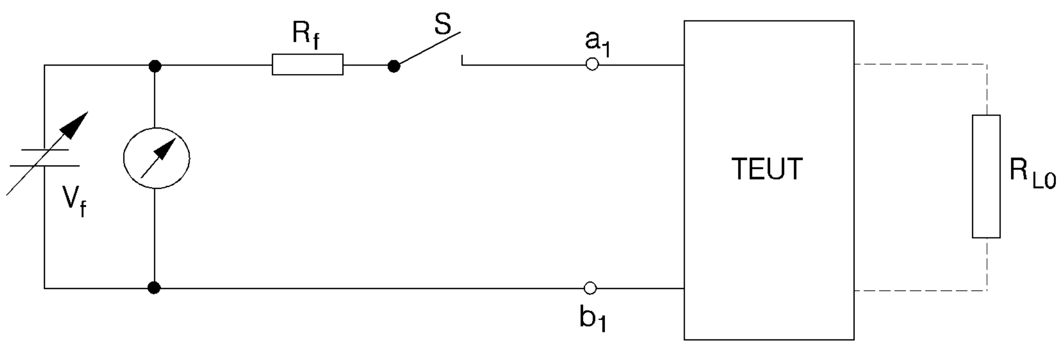


Figure A.2.6 (B) 1: DC Overload susceptibility

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.

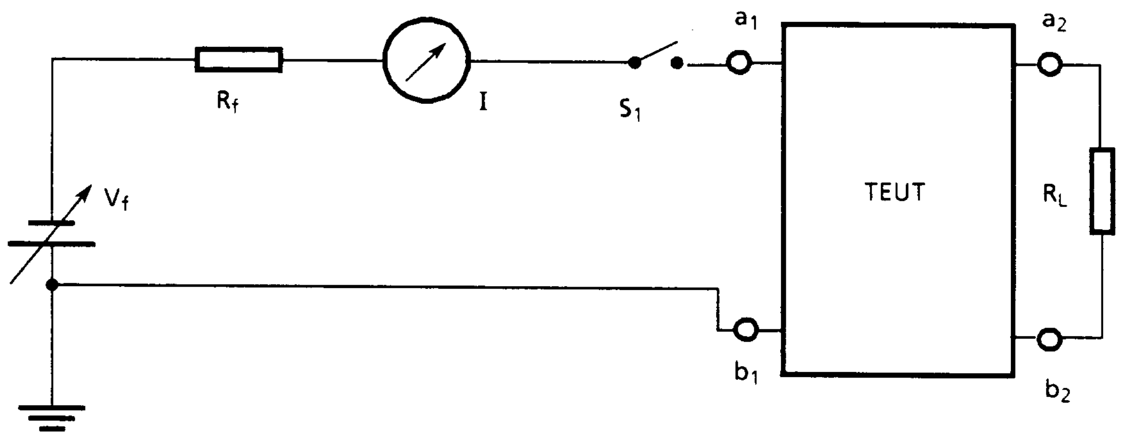


Figure A.2.6 (E) 2: DC overload susceptibility (series)

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Chapter 3: Ringing signal characteristics

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

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Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

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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, 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.

Transposition dates	
Date of adoption of this ETS:	31 March 1996
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Date of withdrawal of any conflicting National Standard (dow):	31 December 1996

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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}.

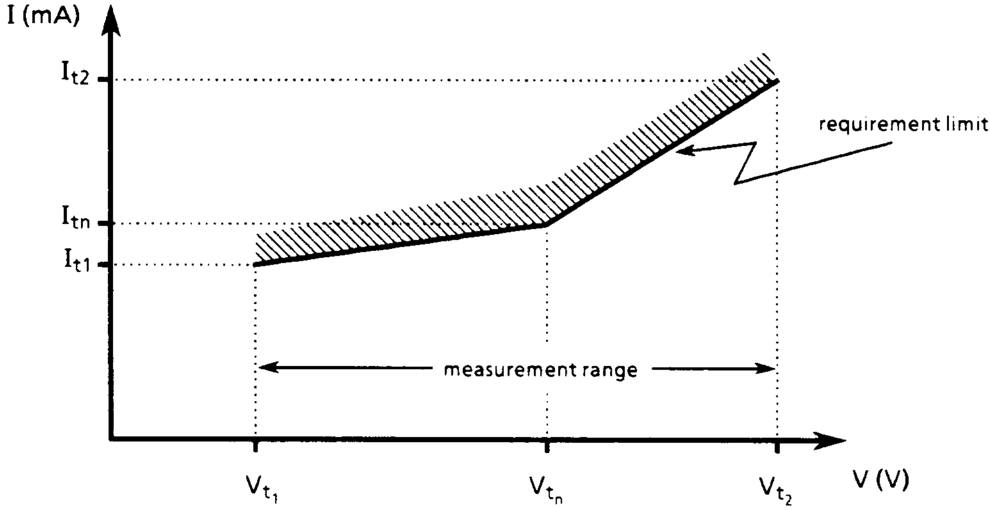


Figure 3.1: Voltage-current limits

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 (NL) 1 At any instantaneous moment of the ringing signal the magnitude of the voltage to current ratio V_t/I_t at 25 Hz shall be ≥ 3,5 kΩ.

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 TE shall be marked with its ringer equivalence number (REN).

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 * 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 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.

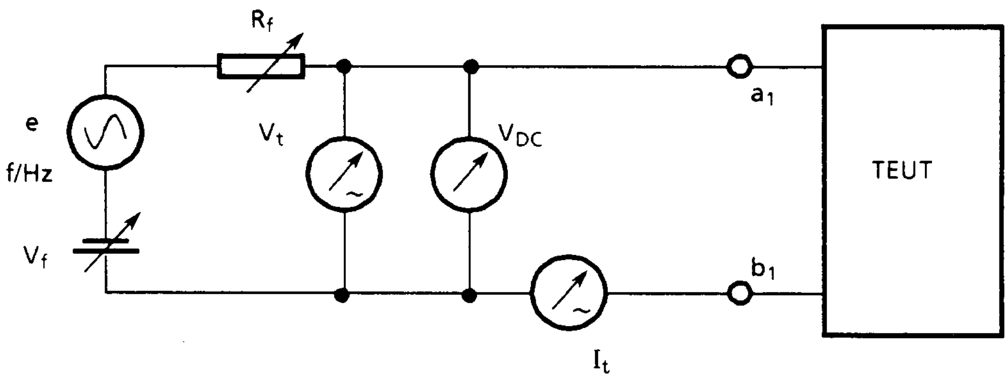


Figure A.3.1 - Input voltage-current characteristics

A.3.1 (NL) 1 For the testing arrangement, see figure A.3.1 with:

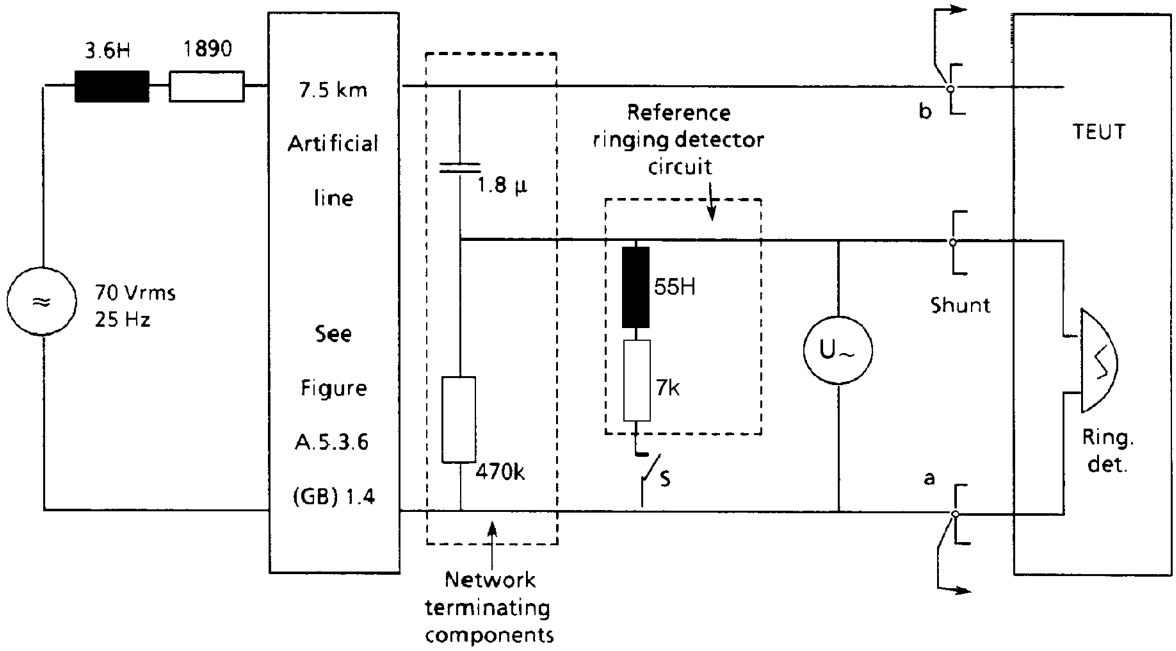
e = 90 V, 25 Hz; V_f = 66 V; R_f = 800 Ω and V_t and I_t are instruments for registering waveforms.
The waveforms of V_t and I_t at 25 Hz are registered. For each peak value of V_t and I_t the ratio V_t/I_t is calculated and shall conform to the requirement.

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.

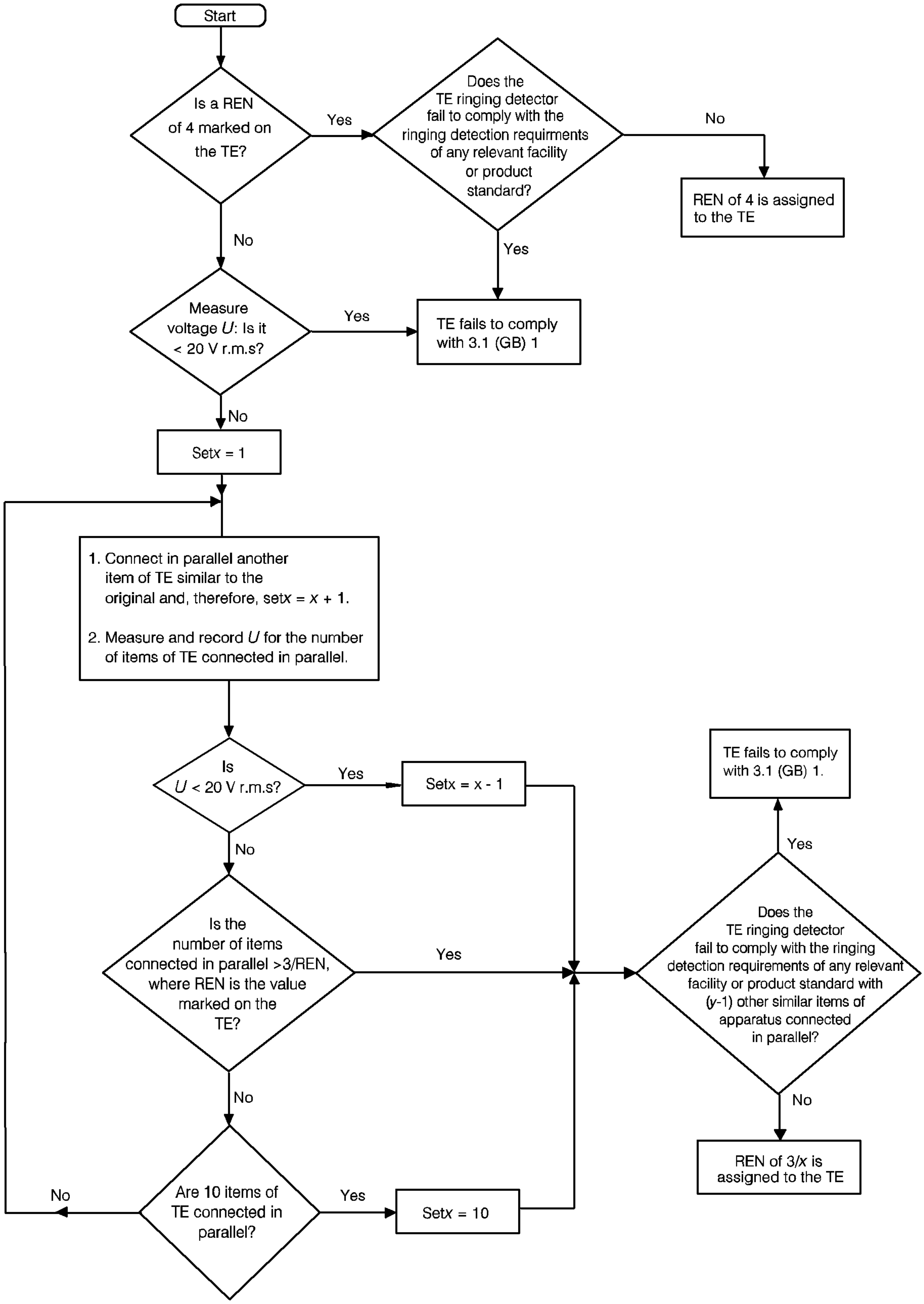


NOTE: See 8.2 (GB) 1.

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 $\geq$ 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
Bulgaria	25 ± 3	50 ± 5	30	90		3,75	11,2		
Cyprus	25		25	80		2	24		
Denmark	See subclause 3.1.2								
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
Hungary	20	30	40	100		10	25		
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	35	90	$(90 - 800 * I_{tn})$				yes
Norway	25		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 These values are valid for series-connected TE or one-port TE which are assigned for the connection to the PSTN CP in addition to the telephone set.

For one-port TE which are assigned for the connection to the PSTN CP instead of a telephone set the values in section 3.1.2 are valid.

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 comprised between 0,3 µF and 1 µF. The value shall be verified by examination of the electrical diagrams.

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 µF.

3.1.1 (D) 1 **Ringing impedance**

TE at the NTA shall meet the following requirements for the ringing impedance at the NTA whilst in the ringing state:

In the case of ringing signal pulses (as specified in section 1.7.9 (D) 1, table 1.7.9 (D) 1), an effective impedance of:

$$2\ \mathrm{k\Omega} \leq |Z| \leq 20\ \mathrm{k\Omega}$$

$$\mathrm{Re}(Z) \geq 450\ \Omega$$

$$0{,}35\ \mathrm{mF} \leq C \leq 3{,}4\ \mathrm{mF}$$

$$t = R \bullet C \leq 10\ \mathrm{ms}$$

shall be reached at the latest 40 ms after application at the NTA. The dc resistance of the terminal equipment at the NTA shall adhere to a value of $R \geq 100$ kΩ during the ringing signal pulse.

The dc resistance of the TE at the NTA shall be $R \geq 1$ MΩ at the latest 150 ms after the end of the ringing signal pulse.

3.1.1 (GR) 1 The equivalent capacitance across a_1 and b_1 shall be: C = 1± 10% µF

3.1.1 (IRL) 1 In the quiescent state TE shall have an input impedance equivalent to either

a) resistor of value between 1 kΩ and 60 kΩ in series with a capacitance of value 1,8 µF ± 50%;
or
b) 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 V_{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 ≥ 3,5 kΩ. The capacitive reactance component of the voltage to current ratio shall be ≤ 1,1 µF. 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 ≥ 16 kohms.

When ringing signals are applied to equipment in quiescent condition, the ringing detector shall react fast enough to avoid that the public exchange detects false loop condition.

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

Frequencies \ Voltages (rms)	30 V ≤ V ≤ 80 V	80 V < V ≤ 120 V
15 Hz ≤ f ≤ 30 Hz	5 kΩ	4 kΩ
30 Hz < f ≤ 55 Hz	4 kΩ	3 kΩ

Table 3.1.1 (P) 1b: Absolute value

Frequencies \ Voltages (rms)	30 V ≤ V ≤ 80 V	80 V < V ≤ 120 V
15 Hz ≤ f ≤ 30 Hz	8 kΩ	6 kΩ
30 Hz < f ≤ 55 Hz	6 kΩ	5 kΩ

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 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 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 kΩ

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 The present requirements apply to every TE during the ringing phase, independently of having or not a ringing detector and the kind of detector it may have.

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 value of 8 kΩ. Values down to 4 kΩ are acceptable for TE which cannot be connected in parallel. The applied test voltage is superimposed on a dc voltage of up to 57 V.

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		
Bulgaria	60	1 000	adjustable	30, 50, 90	
Cyprus	48	800	adjustable	25, 80	
Denmark	not applicable				
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	
Hungary	48	500	adjustable	40, 50, 100	
Iceland	48	800		30, 60, 90	
Ireland					yes
Italy	48	800	adjustable	20, 50, 80	yes
Luxembourg	60	500	adjustable		
Malta					
Netherlands	66	800	90		yes
Norway	40, 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	50	500	adjustable	30	yes
U. Kingdom	not applicable				yes

A.3.1.1 (D) 1 **Measurement of the ringing impedance in the ringing state**

The measuring circuit illustrated in figure A.3.1.1.a (D) 1 a is used for the measurement of the impedance of the ringing circuit.

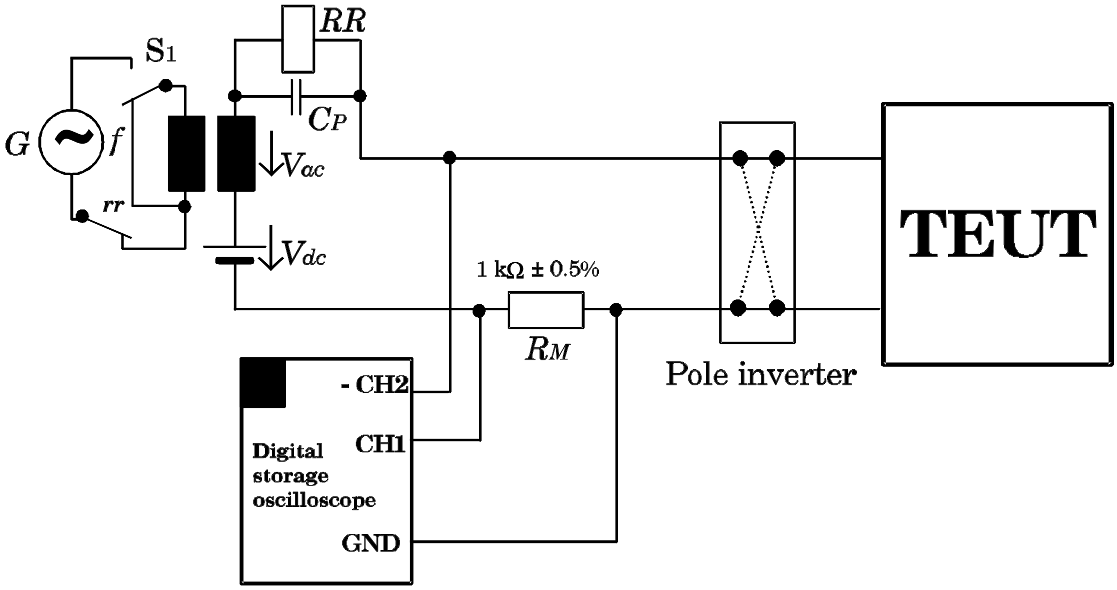


Figure A.3.1.1.a (D) 1

Whilst the voltage at the TEUT to a large extent usually remains sinusoidal, the voltage at R_M proportional to the current shall be determined from the transient envelope by Fourier analysis. The following is calculated from both voltages (r.m.s. values of the fundamental components):

- absolute value of impedance $Z = (V_{TEUT} / V_M) \bullet 1\,000\ \Omega$

The following is calculated from the time difference determined between the two voltages:

- phase angle of impedance $\varphi_{TEUT\text{-}M} = (t_{TEUT\text{-}M} / 40\ \text{ms}) \bullet 360°$

The following formulas apply for the RC equivalent circuit:

$$R = Z \bullet \cos\varphi \quad \tau = R \bullet C \qquad C = \frac{1}{\omega \bullet Z \bullet \sin\varphi} \quad \text{where} \ \ \omega = 2 \bullet \pi \bullet 25\text{s}^{-1}$$

with the symbols as follows:

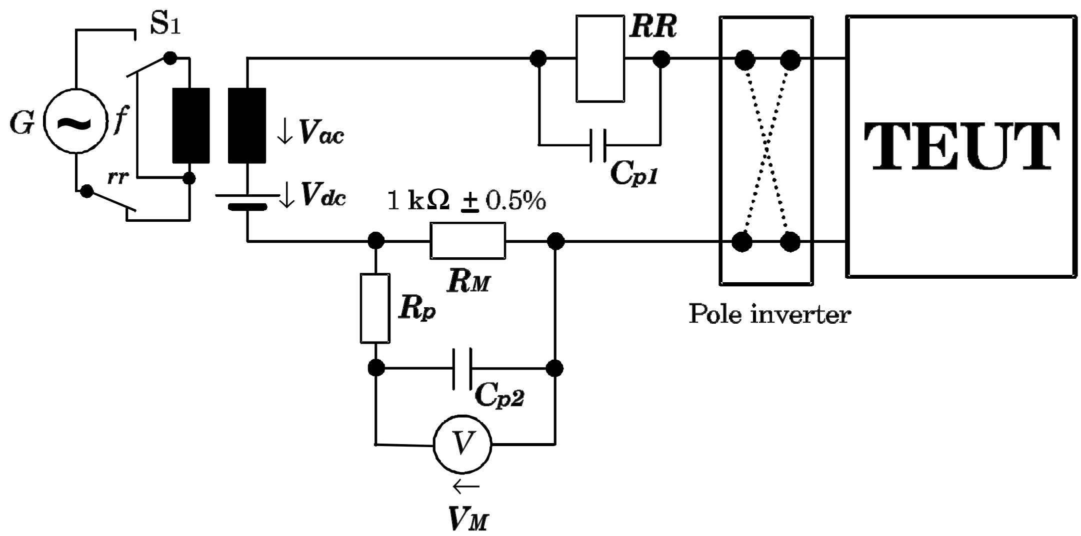
Z = absolute value of impedance	R = series resistance of the equivalent circuit
φ = phase angle of impedance	C = series capacitance of the equivalent circuit
t = time constant value	w = angular frequency

Where the TE carries out automatic call answering during the first ringing signal, the supply of the ringing current is, in the case of a direct current of approx. 15 mA, interrupted by the relay *RR* within approx. 15 ms.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

Proof of the dc resistance during the ringing state

The measuring circuit illustrated in figure A.3.1.1.b (D) 1 is used for the measurement of the dc resistance during the ringing state.



V_{dc} = 63 V	V_{ac} = 75 V	f = 25 Hz	$RR \leq 20\ \Omega$	C_{p1} = 1000 µF	R_p = 10 kΩ	C_{p2} = 20 µF

Figure A.3.1.1.b (D) 1

Switch S1 is closed for t = 5s. The voltage V_M (arithmetic mean value) is read at the voltmeter ($R_i \geq 1$ MΩ).

The dc resistance of the TEUT is ≥ 100 kΩ, where V_M is ≤ 624 mV .

Where the TE carries out automatic call answering during the first ringing signal, the supply of the ringing current is, in the case of a direct current of approx. 15 mA, interrupted by the relay *RR* within approx. 15 ms.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

A.3.1.1 (IRL) 1 Ringing frequency impedance

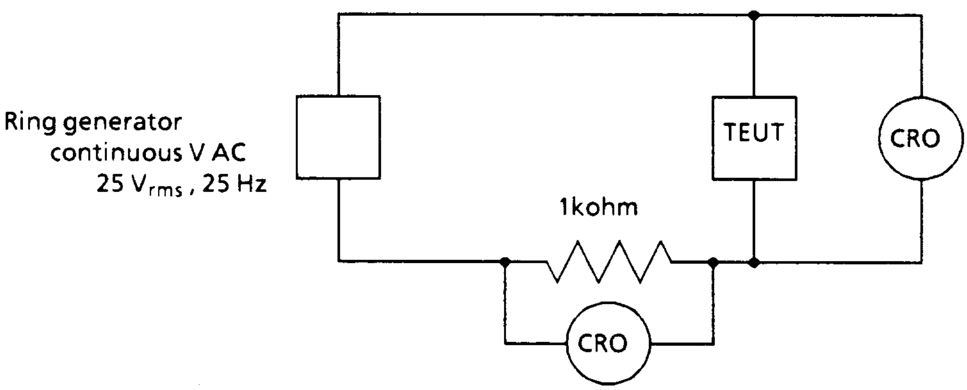


Figure A.3.1.1. (IRL) 1a

a) Check visually where possible otherwise measure V, I and 0 on scope at 25 Hz, with V = 25 V_{rms}

b) X - Y Display Method

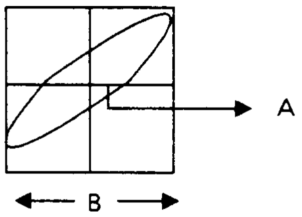


Figure A.3.1.1 (IRL) 1.b

$|Z| = \frac{|V|}{|I|}$ $\qquad 0 = \sin -1 \frac{|A|}{|B|}$ $\qquad$ Formula A.3.1.1 (IRL) 1.a

From inspection, 0 is normally positive, i.e., I leading V.

If, from inspection, circuit is simple R in series with C, calculate IZI and 0 as a check at 25 Hz.

$Z = R^2 + Xn^2$ $\qquad 0 = \tan -1 \frac{|Xc|}{|R|}$ $\qquad$ Formula A.3.1.1 (IRL) 1.b

Plot (IZI, 0) 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 0 directly.

Tests to be carried out in both the power up and power down modes of the TEUT.

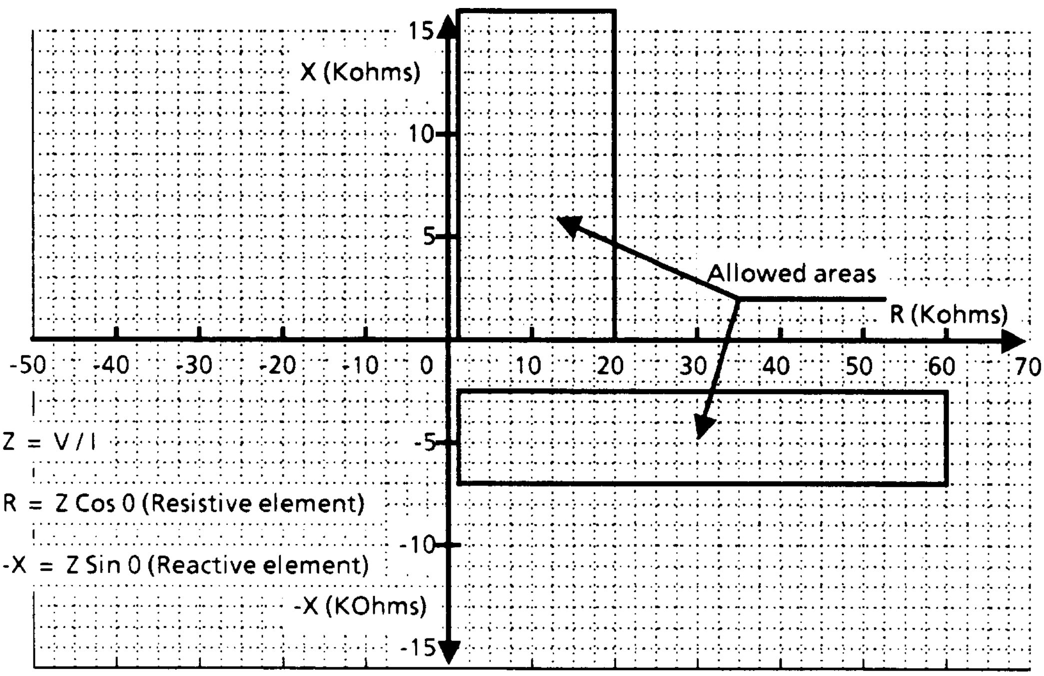


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Figure A.3.1.1 (IRL) 1c: Ringing impedance.

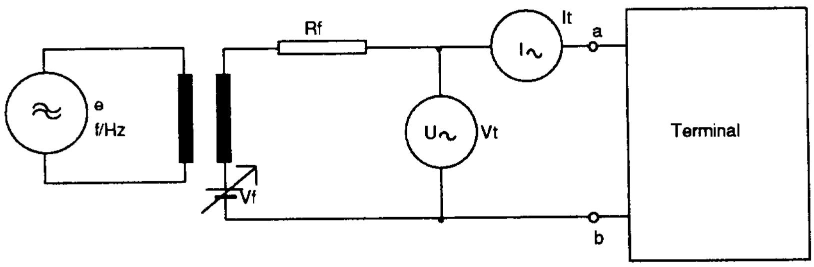
A.3.1.1 (I) 1 See Chapter 10.3 "Additional unclassified requirements".

A.3.1.1 (I) 2 The tests are carried out a continuous AC signal at the frequency values of 25 Hz and 50 Hz.

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.

A.3.1.1 (N) 1 Two measurements are carried out with the following corresponding values:
90 V_{rms}/60 V dc;
28 V_{rms}/40 V dc.

A.3.1.1 (N) 2 The input impedance $|z|$ is determined as shown in figure A.3.1.1 (N) 1.



"e" shall be adjusted to V_t shows the correct value. The resistance R_f shall be 1 200 ohms. V_t and I_t shall be measured by "true rms" instruments. The impedance is calculated from the formula:

$$|Z| = \frac{V_t}{I_t}$$

Figure A.3.1.1 (N) 1: Measurements of input impedance of ringing signal

A.3.1.1 (N) 3 The ringing detector reaction shall be verified according to figure A.3.1.1 (N) 2. The current conditions shall be measured from the moment the current is interrupted by the switch S.
The current shall be equal to or less than 10 mA after 1 ms and equal to or less than 4 mA after 6 ms.

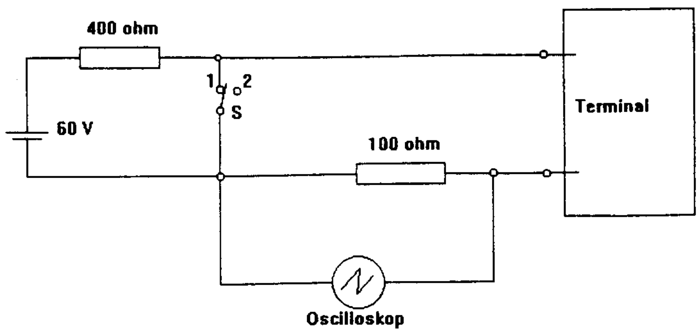


Figure A.3.1.1 (N) 2

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.

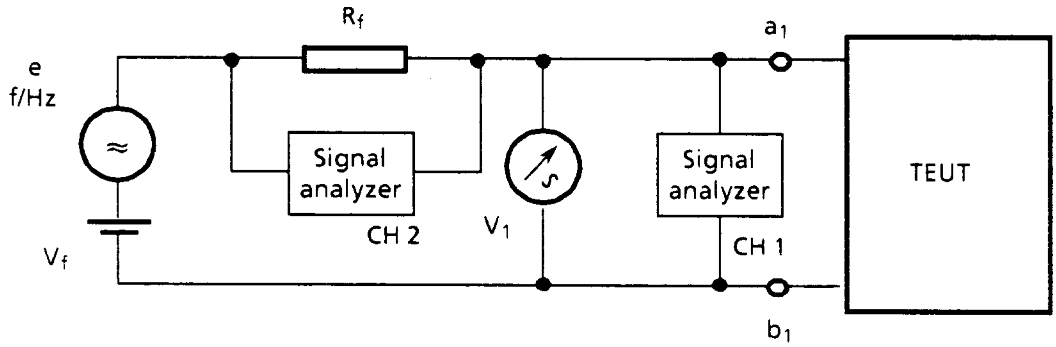


Figure A.3.1.1.(P) 1: Input voltage-current characteristics - Ringing detectors producing electrical signals

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.

$$R\ (k) = \frac{V_t\ (V)}{I_t\ (mA)} \qquad \text{Formula A.3.1.1 (E) 1}$$

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 table 1.5.2.

A.3.1.1 (CH) 1 Test signal frequencies: f_1 = 25 Hz, f_2 = 50 Hz

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		25	60					yes
Belgium	23	27	20	90		4	18		yes
Bulgaria	25 ± 3	50 ± 5	30	90					yes
Cyprus	25		25	80		2	24		
Denmark	25 ± 5		0	120	45	0	24, 375	5, 625	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
Hungary	20	30	40	100		10	25		
Iceland	22	28	30	90		4	12		
Ireland									yes
Italy	20	50	20	80		5	20		yes
Luxembourg	25		25	120					
Malta									
Netherlands	23	35	25	90	$(90 - 800 * I_{tn})$				yes
Norway	25		28	90					yes
Portugal	15	55	30	120	80	not applic.	not applic.	not applic.	yes
Spain	20	30							yes
Sweden									yes
Switzerland	See sections 3.1.1 and 6.2								
U. Kingdom	not applicable								yes

3.1.2 (A) 1 This section is valid for one port TE (telephone sets or one-port TE which are assigned for the connection to the PSTN CP instead of a telephone set).

3.1.2 (A) 2 Values for electronic sounders: I_{t1} = 1 - 6,2 mA, I_{t2} = 2,4 - 15 mA

Values for electromechanical sounders: V_{t1} = 60V, I_{t1} = 2,4 - 24 mA

The ringing circuit of the TE has to include a capacitor 0,47 µF (±20%) 1 µF (±20%).

3.1.2 (A) 3 With one-port TE (telephone sets or equivalent TEs) the insertion loss of the ring detection circuitry shall be ≤ 0,2 dB for all DTMF frequencies.

3.1.2 (B) 1 The remark in 3.1.1 is also applicable here in 3.1.2.

3.1.2 (BG) 1 Values for electronic sounders: I_{t1} = 3,75 mA, I_{t2} = 11,25 mA.

Values for electromechanical sounders: I_{t1} = 7,5 mA, I_{t2} = 22,5 mA.

3.1.2 (DK) 1 In addition to the requirement in 3.1.2, if the AC-currents I_{tn} or I_{t2} are above 1,5 or 12 mA respectively, the equipment shall, 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 kohm.

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 µF.

3.1.2 (D) 1 See 3.1.1 (D) 1.

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 ± 10% µF.

3.1.2 (IRL) 1 In the quiescent state TE shall have an impedance equivalent 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 V_{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_{tn}/I_{tn} at 25 Hz shall be ≥ 3,5 kΩ. The capacitive reactance component of the voltage to current ratio shall be ≤ 1,1 µF. 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 ≥ 8 kohms. When ringing signals are applied to equipment in quiescent condition, the ringing detector shall react fast enough to avoid that the public exchange detects false loop condition.

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

Voltages (rms) / Frequencies	30 V ≤ V ≤ 80 V	80 V < V ≤ 120 V
15 Hz ≤ f ≤ 30 Hz	5 kΩ	4 kΩ
30 Hz < f ≤ 55 Hz	4 kΩ	3 kΩ

Table 3.1.2 (P) 1.b: Absolute value

Voltages (rms) / Frequencies	30 V ≤ V ≤ 80 V	80 V < V ≤ 120 V
15 Hz ≤ f ≤ 30 Hz	8 kΩ	6 kΩ
30 Hz < f ≤ 55 Hz	6 kΩ	5 kΩ

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 kΩ and a minimum absolute value of 2 kΩ.

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 kΩ	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 kΩ

3.1.2 (S) 2 For equipment (lines) to which other TEs are not intended to be connected in parallel, the value shall be ≥ 8 kΩ.

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	25, 60	yes
Belgium	48	1 000	75		
Bulgaria	60	1 000	adjustable	30, 90	
Cyprus	48	800	adjustable	25, 80	
Denmark	48	500		45, 120	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	
Hungary	48	500	adjustable	40, 50, 100	
Iceland	48	800		30, 60, 90	
Ireland					yes
Italy	48	800	adjustable	20, 50, 80	yes
Luxembourg	60	500	adjustable		
Malta					
Netherlands	66	800	90		yes
Norway	40, 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					
U. Kingdom	not applicable				yes

A.3.1.2 (A) 1 For electromechanical sounders V_t = 60 V

A.3.1.2 (DK) 1 If either of the currents I_{tn} or I_{t2} exceed the values stated in section 3.1.2 (DK) 1, 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:

$r_z = 5 * [(I_E^2 - I_R^2 - I_Z^2) / I_Z^2]$ kohms

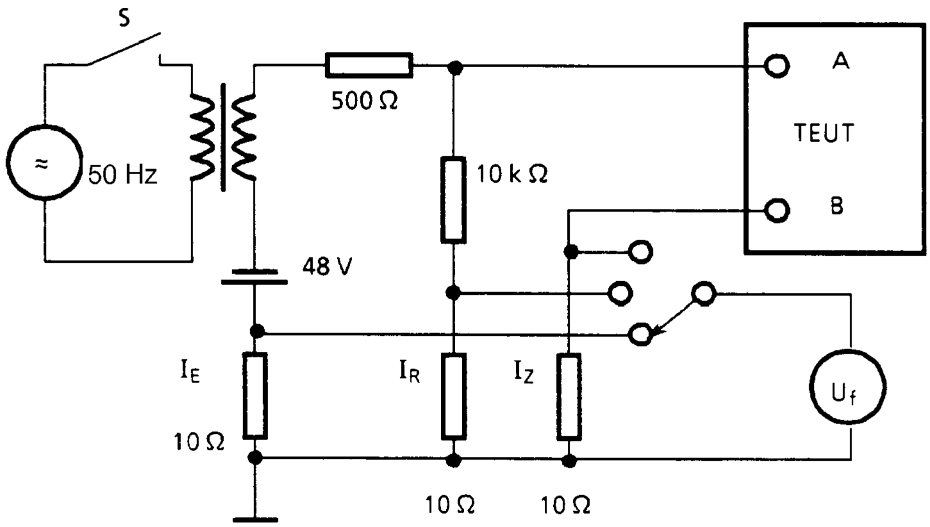


Figure A.3.1.2 (DK) 1

A.3.1.2 (IRL) 1 Ringing frequency impedance

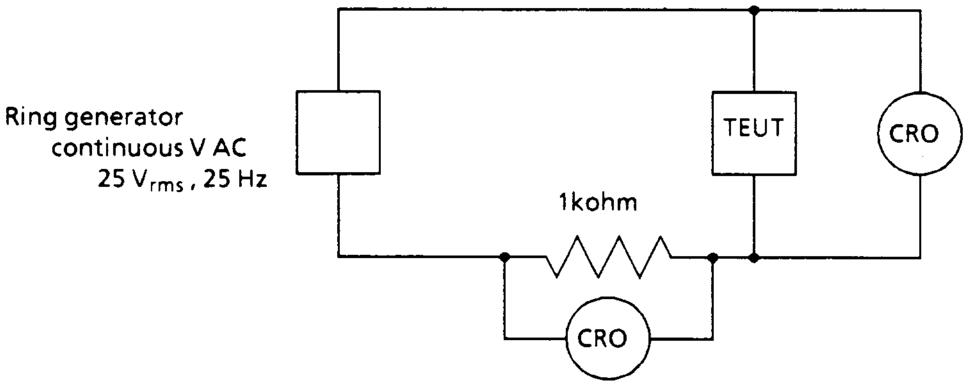
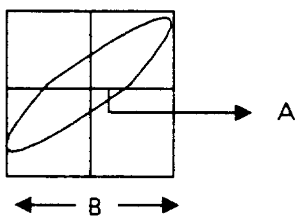


Figure A.3.1.2 (IRL) 1.a

a) Check visually where possible otherwise measure V, I, and 0 on scope at 25 Hz, with V = 25 V_{rms}

b) X - Y Display Method



$|Z| = \frac{|V|}{|I|}$ $0 = \sin -1 \frac{|A|}{|B|}$ Formula A.3.1.2 (IRL) 1.a

From inspection, 0 is normally positive, i.e., I leading V.

If, from inspection, circuit is simple R in series with C, calculate |Z| and 0 as a check at 25 Hz.

$Z = R^2 + Xn^2$ $0 = \tan -1 \frac{|Xc|}{|R|}$ Formula A.3.1.2 (IRL) 1.b

c) Alternative Method

Display voltage and current waveforms simultaneously on scope and measure phase difference 0 directly.

Tests to be carried out in both the power up and power down modes of the TEUT.

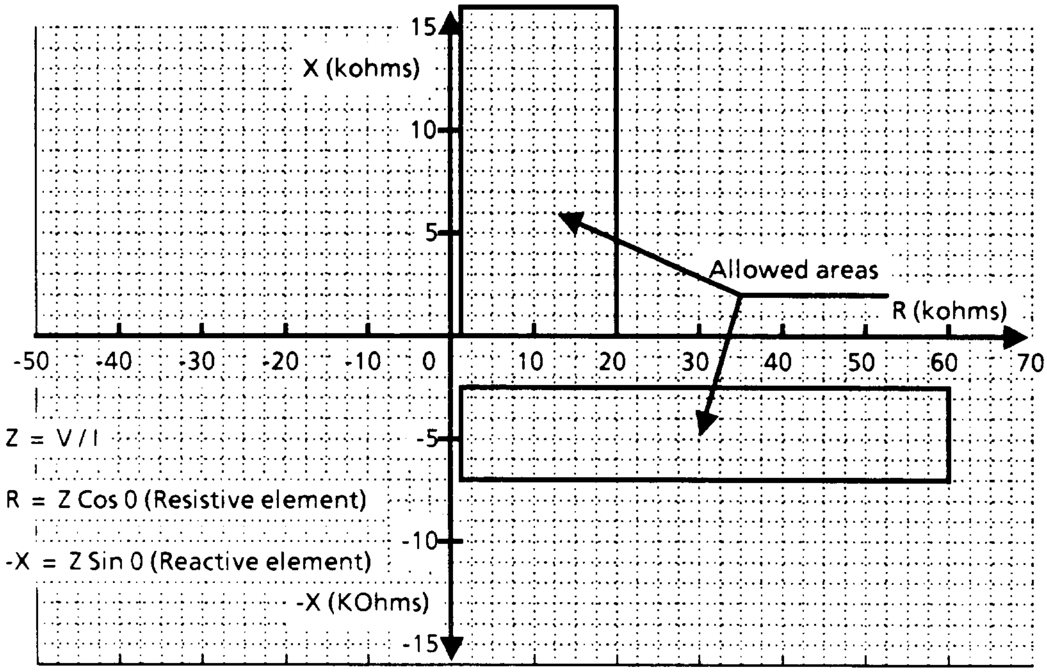


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Figure A.3.1.2 (IRL) 1c: Ringing impedance

A.3.1.2 (I) 1 See chapter 10.3 "Additional unclassified requirements."

A.3.1.2 (I) 2 The tests are carried out with a continuous AC signal at the frequency values of 25 Hz and 50 Hz.

t_{on} = 1 s t_{off} = 4 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.

A.3.1.2 (N) 1 For measurement please refer to A.3.1.1 (N) 1, 2 and 3.

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.

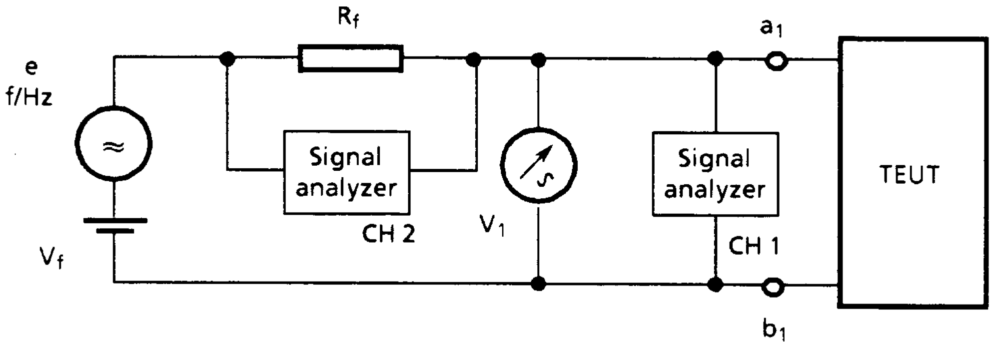

Figure A.3.1.2 (P) 1: Input voltage-current characteristics - Ringing detectors producing discernible signals

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 table 1.5.2.

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			yes
Belgium	23	27	20	90		2	9		yes
Bulgaria	not applicable								
Cyprus	25		25	80		2	24		
Denmark	see clause 3.1.2								
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
Hungary	20	30	40	100		10	25		
Iceland	22	28	30	90		4	12		
Ireland									yes
Italy	not mandatory								
Luxembourg	25		25	120					
Malta									
Netherlands	23	27	35	90	$(90 - 800 * I_{tn})$				yes
Norway	25		28	90					yes
Portugal	15	55	30	120	80	not applic.	not applic.	not applic.	yes
Spain	20	30							yes
Sweden									yes
Switzerland	See section 3.1.1								
U. Kingdom	not applicable								yes

3.1.3 (A) 1 The remark in 3.1.1 is also valid here in 3.1.3.

3.1.3 (B) 1 The remark in 3.1.1 is also applicable here in 3.1.3.

3.1.3 (GR) 1 The equivalent capacitance across a_1 and b_1 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 ≥ 3,5 kΩ. The capacitive reactance component of the voltage to current ratio shall be ≤ 1,1 μF. 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 ≥ 16 kohms. When ringing signals are applied to equipment in quiescent condition, the ringing detector shall react fast enough to avoid that the public exchange detects false loop condition.

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 V ≤ V ≤ 80 V	80 V < V ≤ 120 V
15 Hz ≤ f ≤ 30 Hz	5 kΩ	4 kΩ
30 Hz < f ≤ 55 Hz	4 kΩ	3 kΩ

Table 3.1.3 (P) 1b: Absolute value

Frequencies \ Voltages (rms)	30 V ≤ V ≤ 80 V	80 V < V ≤ 120 V
15 Hz ≤ f ≤ 30 Hz	8 kΩ	6 kΩ
30 Hz < f ≤ 55 Hz	6 kΩ	5 kΩ

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 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 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 kΩ	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 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 kΩ.

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		
Bulgaria	not applicable				
Cyprus	48	800	adjustable	25, 80	
Denmark	not applicable				
Finland	48	800	not defined	35, 75	
France	54	300		90	
Germany	not mandatory				
Greece	60	500		25, 55, 75	
Hungary	48	500	adjustable	40, 50, 100	
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					
U. Kingdom	not applicable				yes

A.3.1.3 (IRL) 1 Ringing frequency impedance

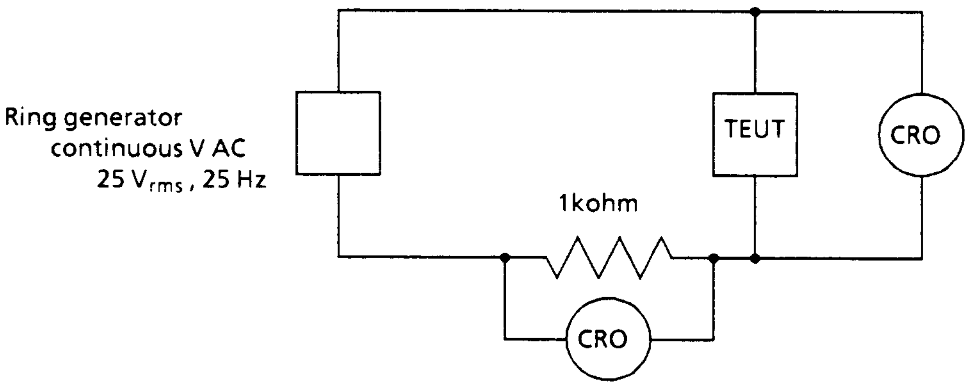

Figure A.3.1.3 (IRL) 1a

a) Check visually where possible otherwise measure V, I and 0 on scope at 25 Hz, with V = 25 V_{rms}

b) X-Y Display Method

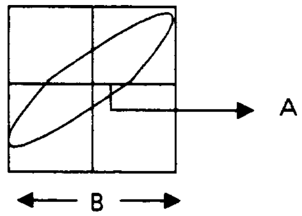

Figure A.3.1.3 (IRL) 1.b

$|Z| = \frac{|V|}{|I|}$ $0 = \sin -1 \frac{|A|}{|B|}$ Formula A.3.1.3 (IRL) 1.a

From inspection, 0 is normally positive, i.e., I leading V.
If, from inspection, circuit is simple R in series with C, calculate |Z| and 0 as a check at 25 Hz.

$Z = R^2 + Xn^2$ $0 = \tan -1 \frac{|Xc|}{|R|}$ Formula A.3.1.3 (IRL) 1.b

Plot (IZI, 0) 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 0 directly.
Tests to be carried out in both the power up and power down modes of the TEUT.

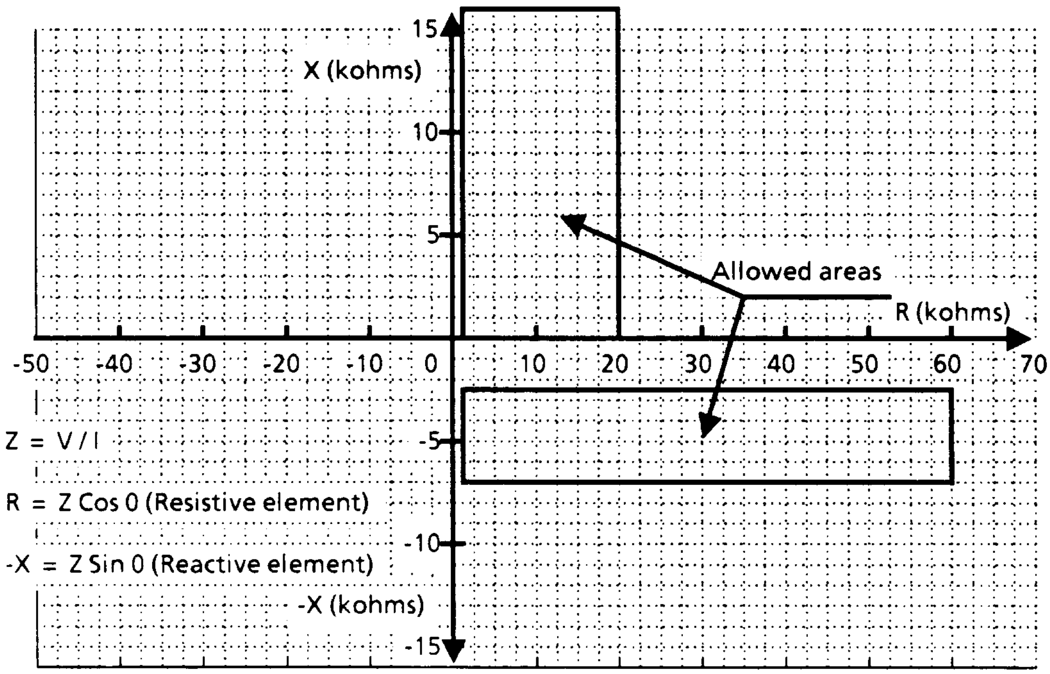

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Figure A.3.1.3 (IRL) 1.c: Ringing impedance

A.3.1.3 (I) 1 See Chapter 10.3 "Additional unclassified requirements".

A.3.1.3 (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.

A.3.1.3 (N) 1 For measurement please refer to A.3.1.1 (N) 1, 2 and 3.

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.

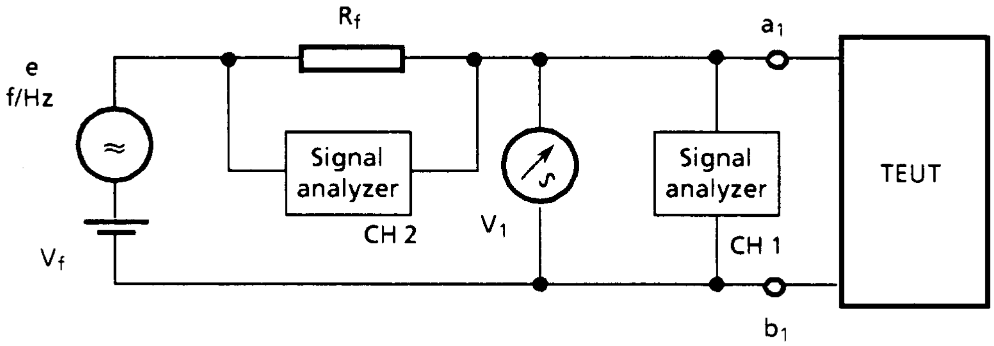

Figure A.3.1.3 (P) 1: Input voltage- current characteristics - TE without ringing signal detection facilities

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 table 1.5.2.

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.

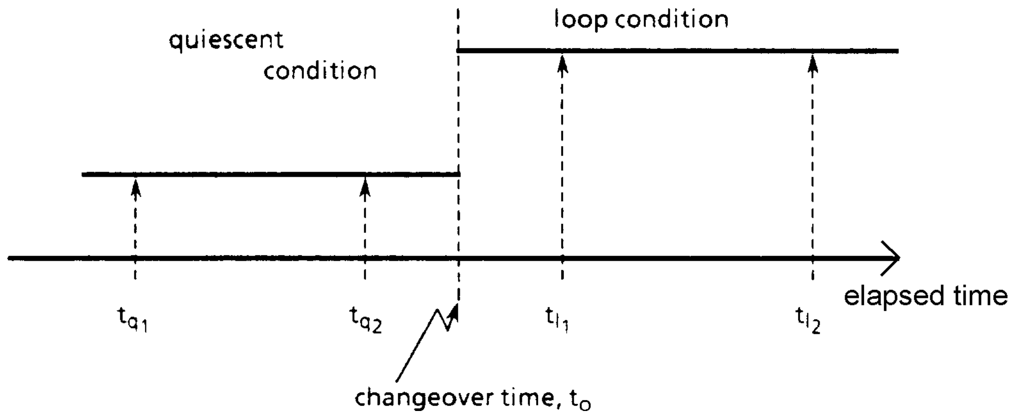

Figure 3.2: Overload susceptibility

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
Bulgaria	110	60	500	50	0	∞	0
Cyprus	not mandatory						
Denmark	130	56	150	25			
Finland	not mandatory						
France	not mandatory						
Germany							
Greece	135	66	500	25	50	∞	0
Hungary	100	48	200	50		∞	0
Iceland	not mandatory						
Ireland		48	1 200	17	25	2	0
Italy	not mandatory						
Luxembourg	not mandatory						
Malta							
Netherlands	90	66	800	25		∞	0
Norway	not mandatory						
Portugal	120	55	500	15	30	∞	0
Spain	90	56	300	25	N/A	∞	0
Sweden	not mandatory						
Switzerland	80 mA or 90 V	50	500	25			
U. Kingdom	not mandatory						

Table 3.2.b: Overload periods

COUNTRY	REQUIREMENT VALUES				Remarks
	t_{q2} - t_{q1}	t_0 - t_{q2}	t_{l1} - t_0	t_{l2} - t_{l1}	
Austria	not mandatory				
Belgium	60 s	not applicable	not applicable	1 s	
Bulgaria	15 s	not applicable	not applicable	not applicable	
Cyprus	not mandatory				
Denmark	0	0	0	1 300 ms	
Finland	not mandatory				
France	not mandatory				
Germany	15 s	not applicable	not applicable	not applicable	
Greece	1 min.	1 s ≥	1 s ≥	2 s	
Hungary	60 s	not applicable	not applicable	2 s	
Iceland	not mandatory				
Ireland	25				
Italy	not mandatory				
Luxembourg					
Malta					
Netherlands	60 s			2 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				5 s	yes
U. Kingdom	not mandatory				

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 Ringing 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 kΩ in series with a capacitor of 4 µF 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 (see also section 2.6 (CH) 1):

The TE shall withstand the superposition of the 25 Hz ringing current with the maximum supply current without damage.

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!

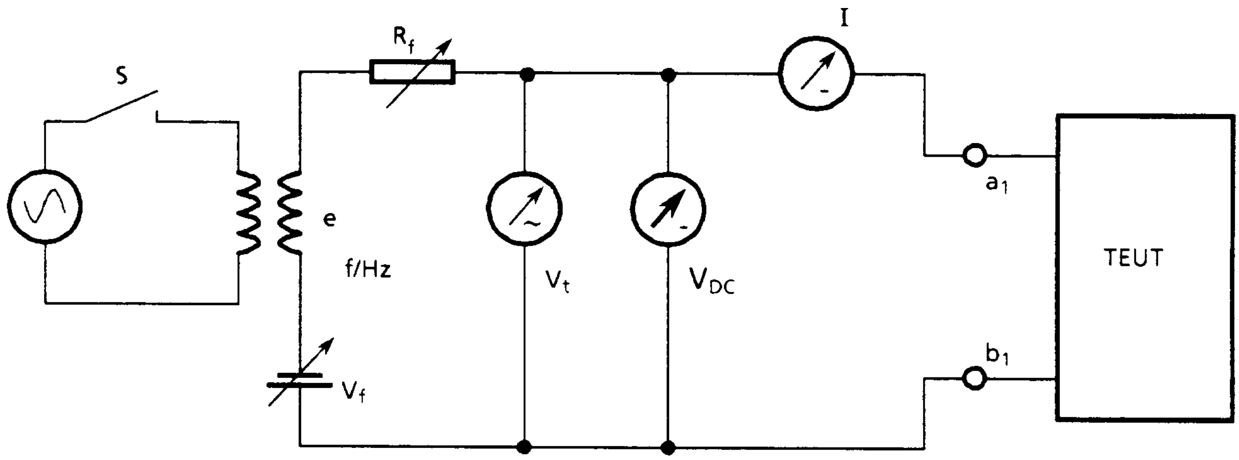

Figure A.3.2: Overload susceptibility

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
Bulgaria	60	1 000	110	15	0	
Cyprus	not mandatory					
Denmark	56	150	130	1,3	60	yes
Finland	not mandatory					
France	not mandatory					
Germany						
Greece	66	500	135			
Hungary	48	200	100			yes
Iceland	not mandatory					
Ireland	48	1 200	75	2	0	
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands	66	800	90			yes
Norway	not mandatory					
Portugal	55	500	120	1,3		
Spain	56	300	90			yes
Sweden	not mandatory					
Switzerland	50	500	80 mA or 90 V	5	∞	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_{l2} - t_{l1}) 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.

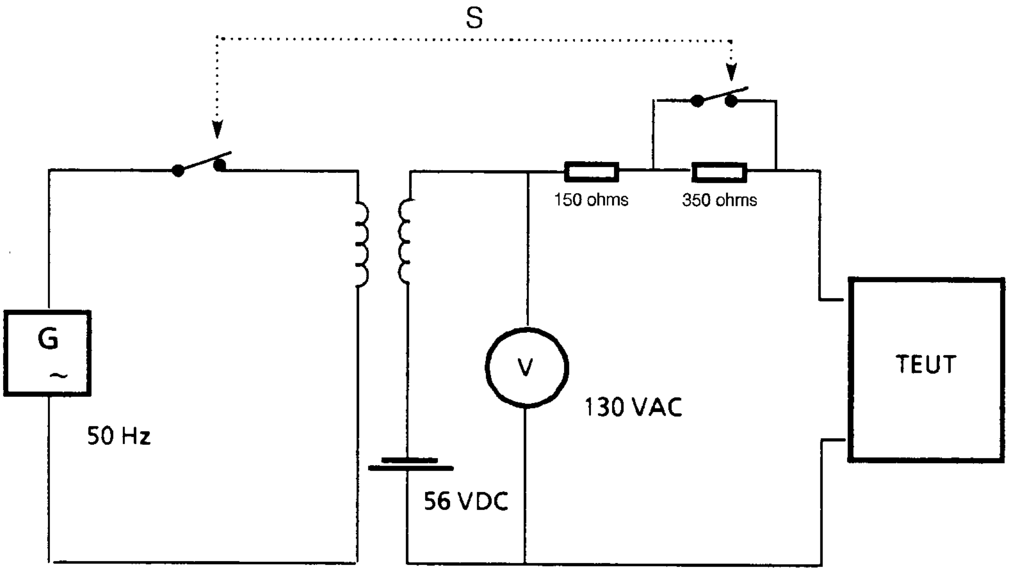

Figure A.3.2 (DK) 1

A.3.2 (H) 1 The switch S is closed only during the periods (t_{q2} - t_{q1}) and (t_{l2} - t_{l1}) as specified in table 3.2.

A.3.2 (NL) 1 Measurement with f = 25 Hz. The switch S is closed during the periods (t_{q2} - t_{q1}) and (t_{l2} - t_{l1}) as specified in table 3.2.b.

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 feeding 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)

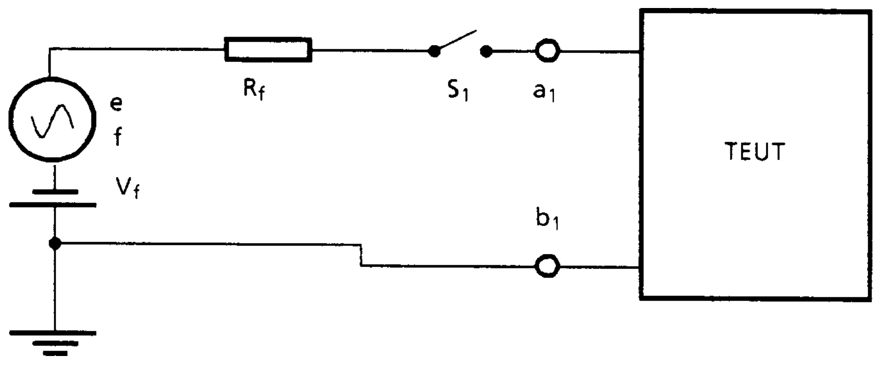

Figure A.3.2 (E) 1: Overload susceptibility

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.

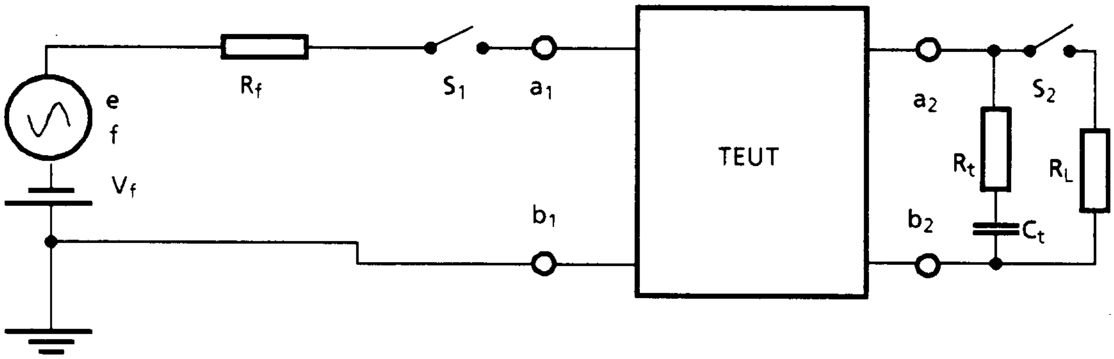

Figure A.3.2 (E) 2: Overload susceptibility (series)

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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Chapter 4: Transmission characteristics

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European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

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Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

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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, 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.

Transposition dates	
Date of adoption of this ETS:	31 March 1996
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Date of withdrawal of any conflicting National Standard (dow):	31 December 1996

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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 (kΩ)
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 (kΩ)	Z_2 (kΩ)	Z_3 (kΩ)	Z_4 (kΩ)	V_{t1} (V_{rms})	V_{t2} (V_{rms})	V_f (V)	
Austria	not mandatory							
Belgium	20	20				1	48	
Bulgaria	15	15	not applicable	not applic.	1,5		60	yes
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	
Hungary	under study							
Iceland	30	30		5		1	48	
Ireland	50	25	10		1			
Italy	10	10				0,775	44 - 52	yes
Luxembourg								
Malta								
Netherlands					1,5		66	yes
Norway	50	25			measured value	0,775	60	yes
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 (BG) 1 The considered frequency range is 200...3 400 Hz.

4.1.1 (DK) 1 In quiescent condition a TE shall have an impedance between the line terminals, whose magnitude at ac voltages up to 1,5 V is greater than or equal to the following requirement:

30 kohms for 200 Hz $\leq$ f $\leq$ 4 kHz
decreasing by a factor of 2/octave for 4 kHz < f $\leq$ 18 kHz.

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 (N) 1 The impedance shall exceed 5 kohms in the frequency range 15 $\leq$ f $\leq$ 7 kHz.

4.1.1 (P) 1 z_1(kΩ) = 15 in the frequency range Δf_1 (Hz): 300 $\leq f_1 <$ 2 000.

z_4(kΩ) = 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 $\leq$ f $\leq$ 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 of both interfaces of the meter pulse receiver and at the interface towards other TEs, measured against a circuit according to the figure below, shall fulfil the following requirements when the other interface of the meter pulse receiver 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

$$\text{Return loss} = 20 \log_{10} \left| \frac{Z + Z_{Ref}}{Z - Z_{Ref}} \right| \text{dB}$$

where Z_{Ref} = reference impedance
Z = input impedance when the equipment is terminated with Z_{Ref}

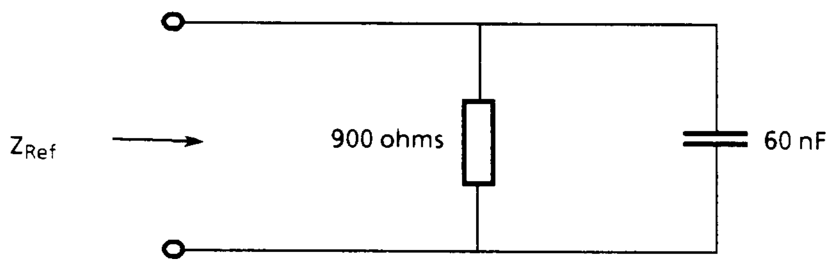


Figure 4.1.1 (S) 1: Circuit for return loss measurement

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 The insertion loss on a parallel connection shall be:

in the speech range (300 ... 3 400 Hz):
- for standard TE ≤ 0,2 dB;
- for TE which cannot be connected in parallel ≤ 4 dB;

in the charge metre range (12 ± 0,12 kHz):
- for standard TE ≤ 1 dB;
- for TE which cannot be connected in parallel ≤ 4 dB;
- for TE with charge metre receivers ≤ 4 dB.

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 = 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 transducers 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_l.

The values of the modulus of impedance are calculated using formula A.4.1.1,

$$Z_n = \frac{V_{t2}}{I} \qquad \text{Formula A.4.1.1}$$

where V_{t2} is either the rms value set in table A.4.1.1 or the 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	not mandatory					
Belgium	300		1	400	48	
Bulgaria	300		1,5	1 000	60	
Cyprus	200		1,5	440	48	
Denmark	200		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	
Hungary	under study					
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				1 000	48	yes
Sweden	200		1			yes
Switzerland				500	50	yes
U. Kingdom	300		1,0			yes

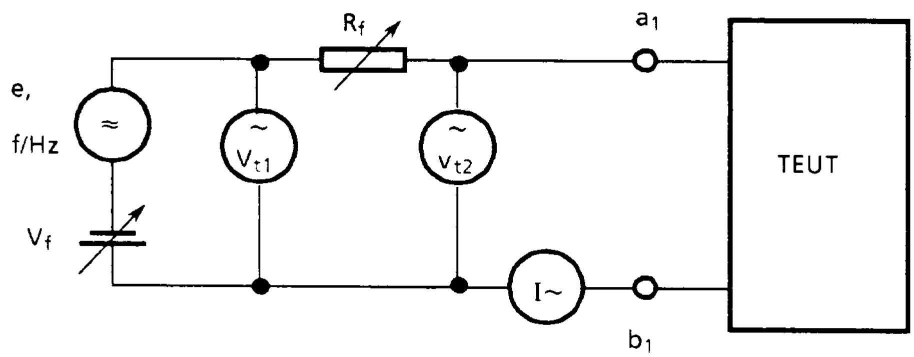


Figure A.4.1.1: Input impedance of TE in quiescent condition

A.4.1.1 (F) 1

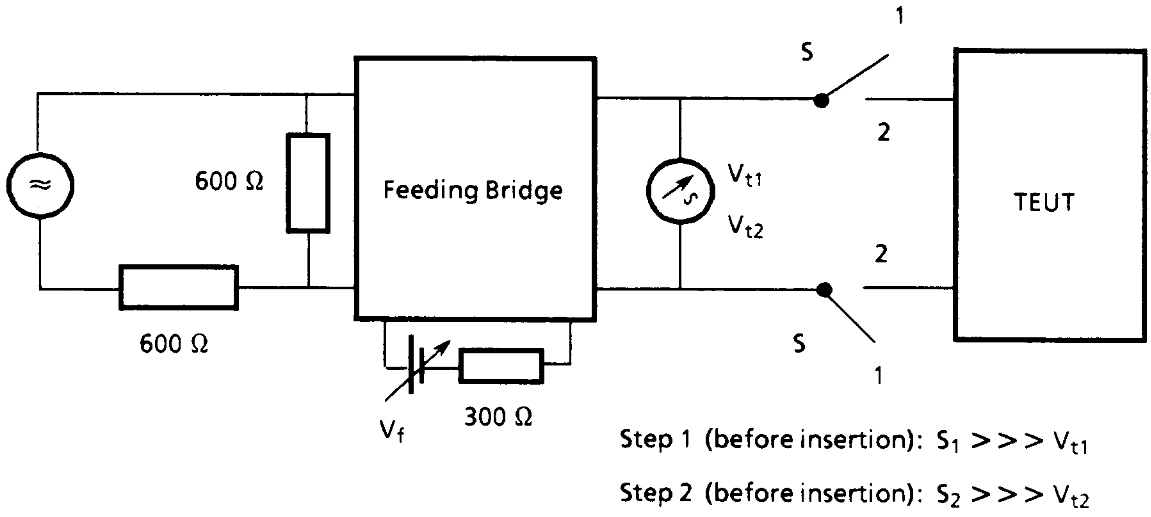


Figure A.4.1.1 (F) 1: Parallel insertion loss

a dB = 20 log (V_{t1} / V_{t2})
V_f = 3V up to 70V

A.4.1.1 (N) 1 The values of the impedances are calculated using formula A.4.1.1 (N) 1:

$$Z_n = \frac{V_{t2} \times 10^4}{V_{t1} - V_{t2}} \qquad \text{Formula A.4.1.1 (N) 1}$$

The impedance shall exceed 5 kohms in the frequency range 15 ≤ f ≤ 17 kHz.

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 (ll Z_n ll) 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 Chapter 1, table 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 The insertion loss on a parallel connection shall be measured as the attenuation introduced when the TE is installed in parallel with a 600 Ω load supplied from a purely resistive 600 Ω generator.

The test level is

+ 3 dBm in the speech range

i.e.: Δf_1: 300 - 3 400 Hz, V_{t2}: + 3 dBm,

+ 20 dBm in the charge meter range

i.e.: $\Delta f'_1$: 12 ± 0,12 kHz, V'_{t2}: + 20 dBm.

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

$$\alpha = 20 \times \log_{10} \left| \frac{Z_i + Z_r}{Z_i - Z_r} \right| \text{ (dB)} \qquad \text{Formula 4.1.2}$$

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
Bulgaria	300 - 3 400	20 - 60	600 or (220 + 820//115 nF)		0,245 - 0,775	14	
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	> 6	yes
Greece	300 - 3 400	20 - 80	600		0,775	14	yes
Hungary	300 - 3 400	20 - I_{max}	600	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//110 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		(270 + 750//150 nF)		0,5	6	yes
Switzerland	300 - 3 400		(220 + 820//115 nF)		0,0775 - 0,775	8	yes
U. Kingdom	200 - 4 000	25 - 100	See remarks	0,316		See remarks	yes

4.1.2 (B) 1 Requirements for digital PBXs with analogue interface:

The reference impedance used is the network described in figure 4.1.2 (B) 1.a.

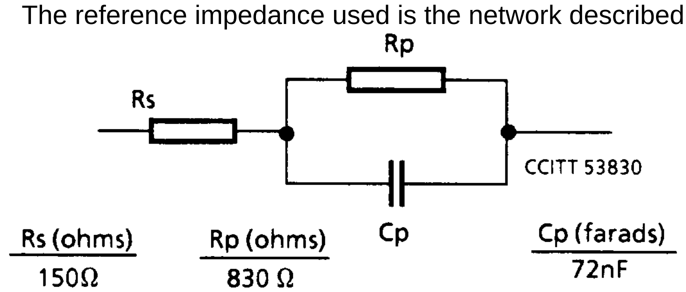


Figure 4.1.2 (B) 1.a: Complex impedance Z_c

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.

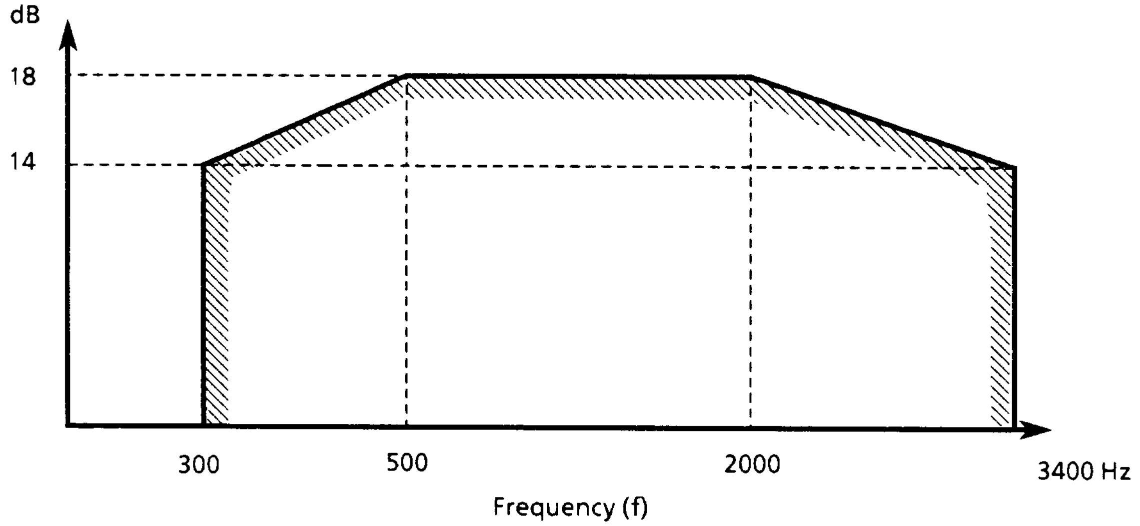


Figure 4.1.2 (B) 1.b: Minimum values of the return loss

4.1.2 (BG) 1 The input impedance Z is specified for Δf 300 - 3 400 Hz as a return loss with respect to the following network:

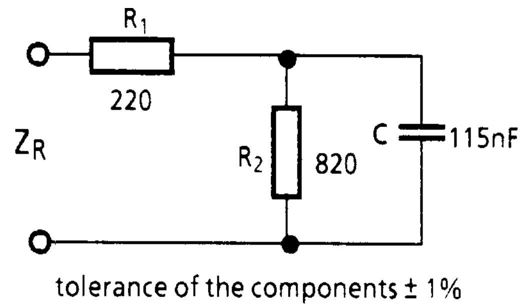


Figure 4.1.2 (BG) 1

or to a resistance of 600 ohms ± 0,1%, the choice of which is stated by the supplier.

4.1.2 (DK) 1 For TE usable for voice telephony, the reference impedance is shown in figure 4.1.2 (DK) 1.a. This reference impedance can be used for all types of TE.

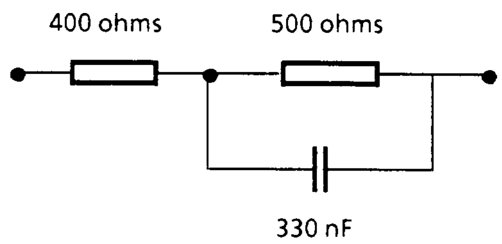


Figure 4.1.2 (DK) 1.a

For TE usable for voice telephony, 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.
For PABX the requirements are stated in the relevant Danish regulations.

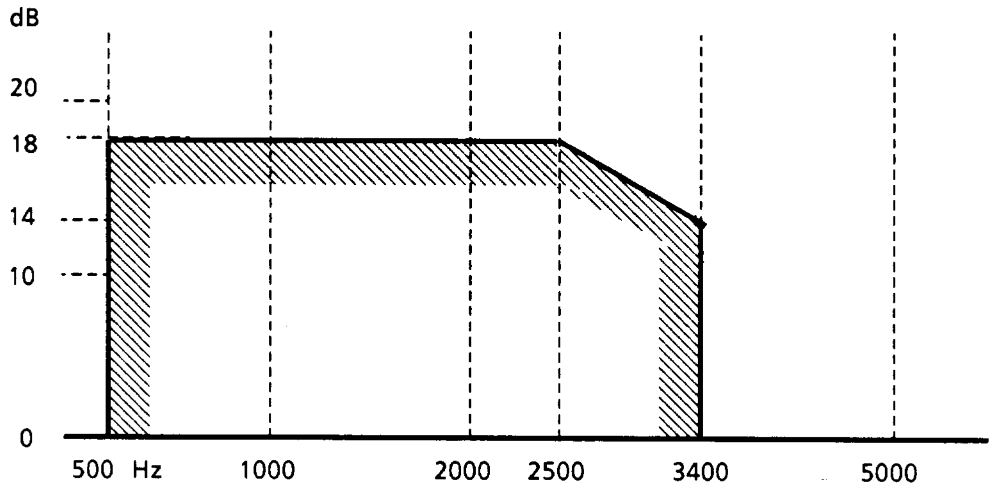


Figure 4.1.2 (DK) 1.b

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 V up to 54 V
R_f = 300 ohms up to 1 400 ohms

4.1.2 (F) 4 In the event of distortion for V_{t1} = 1,55 V, the requirement applies up to V_{t1} = 0,92 V.

4.1.2 (D) 1 Return loss

The return loss of the terminal equipment, measured against Z_R (see 10.1 (D) 1.1), shall adhere to the following value:

300 Hz ≤ f ≤ 3400 Hz	$\alpha \geq 6$ dB

4.1.2 (GR) 1 For telephone set, the reference impedance is shown in figure 4.1.2 (GR) 1.

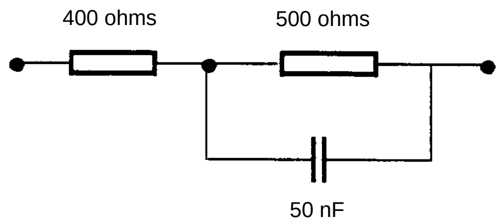


Figure 4.1.2 (GR) 1

4.1.2 (H) 1 In the case of telephone set V_{t1} = 0,25 V_{rms}.

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.

$\Delta V_f(V)$ = 42 - 66
$\Delta R_f(\Omega)$ = 800 - 2 140

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:

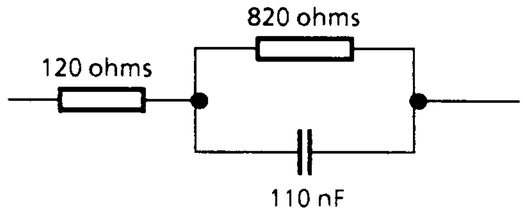


Figure 4.1.2 (N) 1

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 Ω.

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 (P) 1 Voltage and resistance ranges, respectively ΔV_f and ΔR_f, are applicable instead of ΔI_f.

$\Delta V_f(V)$ = 45 - 55
$\Delta R_f(\Omega)$ = 300 - 1 800

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.

With TE in 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 1 000 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

TRL limit	Frequency range
10 dB	300 Hz $\leq f_1 \leq$ 500 Hz
12 dB	500 Hz $< f_1 \leq$ 800 Hz
14 dB	800 Hz $< f_1 <$ 3 000 Hz
10 dB	3 000 Hz $\leq f_1 \leq$ 3,4 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 1 000 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 Chapter 1, table 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 for handset telephony equipment in the frequency range Δ_f shall comply with the mask defined in figure 4.1.2 (S) 3.

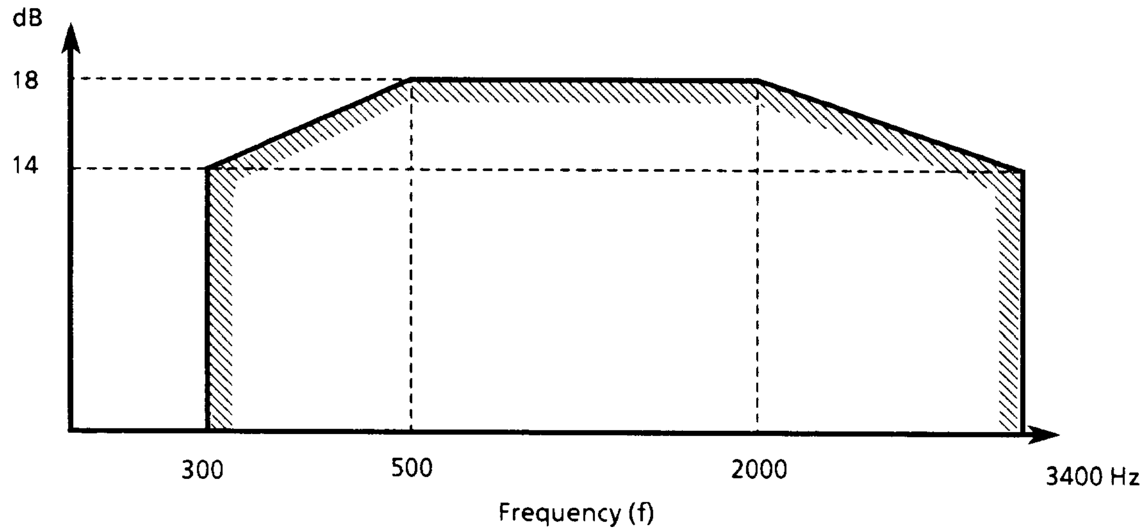


Figure 4.1.2 (S) 3: Minimum values of the return loss for handset telephony equipment

4.1.2 (CH) 1

There are additional requirements (14 dB return loss or 14 dB echo return loss) for voice telephony TE. In the speech range (Δf = 300 ... 3 400 Hz) the return loss is specified with respect to the following network:

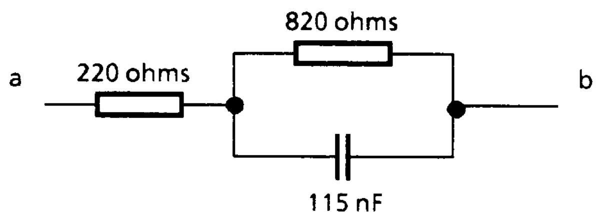


Figure 4.1.2 (CH) 1

In the charge metre range (12 ± 0,12 kHz) the insertion loss shall be:

- for standard TE ≤ 2 dB
- for TE which cannot be connected in parallel ≤ 4 dB
- for TE with charge metre receivers ≤ 4 dB;

See also remarks on sections 4.3, A.4.3 (CH) 1.

4.1.2 (GB) 1

The return loss shall not be less than 12 dB 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 of the TE 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 ± 30) Ω ± 30 Ω 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.

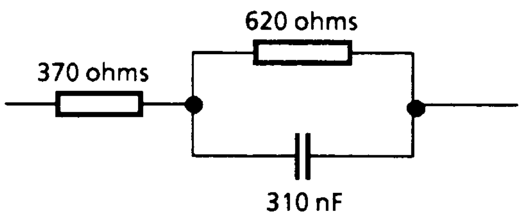


Figure 4.1.2 (GB) 1

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 ± 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_l (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.

$$\alpha = 20 \log_{10} \frac{V_{t1}}{2 \times U} \text{ (dB)} \qquad \text{Formula A.4.1.2}$$

Measurements are carried out at a limited number of dc excitation values V_f, R_f or I_f.

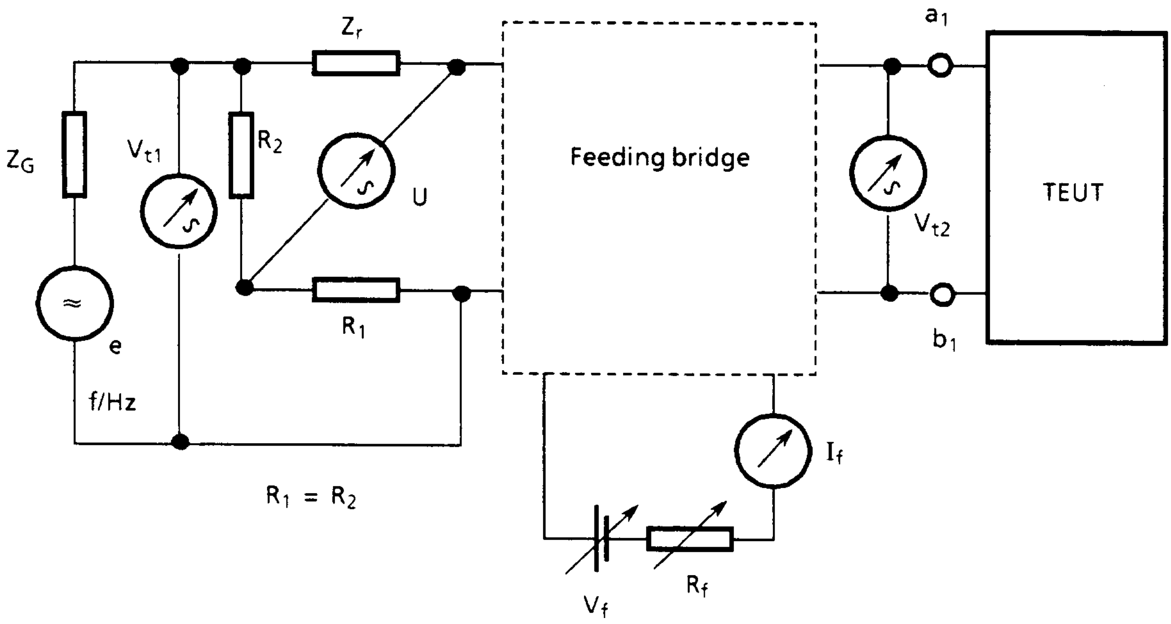


Figure A.4.1.2: Input impedance of TE in loop condition
The feeding bridge is specified in section 1.5.

Table A.4.1.2: Input impedance of TE in loop condition

COUNTRY	TEST VALUES								Remarks
	f_l (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		600	
Belgium	300	0		400, 1 600	48		0,775	600	
Bulgaria	300	0		1 000, 2 200	60		0,245, 0,775	600	yes
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									
Greece	300	0	20, 35, 55		60		0,775	600	
Hungary	300	0	20 - I_{max}		48	0,775		600	yes
Iceland	300	0	14 - I_{max}		48	1,5		600	
Ireland	200		20 - 100		48	1			
Italy	300	0		800 - 1 800	48		0,775		yes
Luxembourg	300		14, 60		60				
Malta									
Netherlands	300	0		800, 1 130, 2 140	42, 48, 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	300	0					0,5		yes
Switzerland	300	0		500, 2 300	50	0,775		600	yes
U. Kingdom	200	0	25 - 100	400 min.	50	0,632			yes

A.4.1.2 (BG) 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 (DK) 1 The return loss is determined as 20 $\log_{10}(U_1/U_2)$ dB. Measurements are carried out at a loop current of 8 mA, with E = 0,775 V and at loop currents of 16 mA, 32 mA and I_{max} with E = 1,5 V at the frequencies f = 0,3, 0,5, 1,0, 2,5 and 3,4 kHz. I_{max} is the loop current when the equipment is fed with 56 V through 500 ohms.

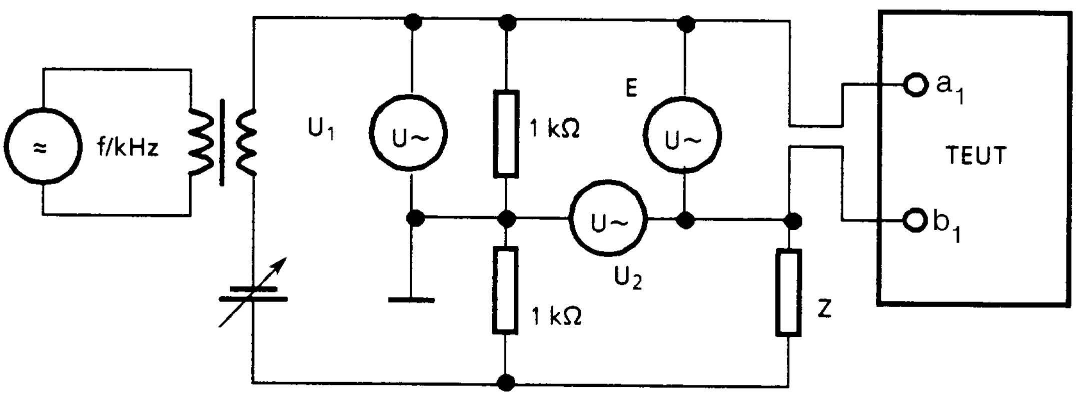


Figure A.4.1.2 (DK) 1

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 ≥ 100µF.

A.4.1.2 (F) 1 For telephone sets, the test is carried out either by putting the microphone in a silent (< 40 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:

$$|Z| = \frac{V_1 - V_2}{\frac{V_2}{600} - \frac{V_1}{400}}$$ Formula A.4.1.2 (F) 2

referring to figure A.4.1.2 (F) 2:

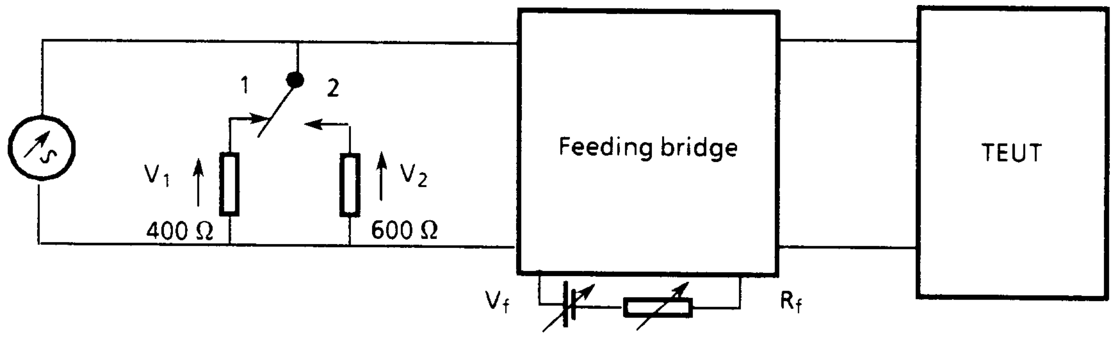


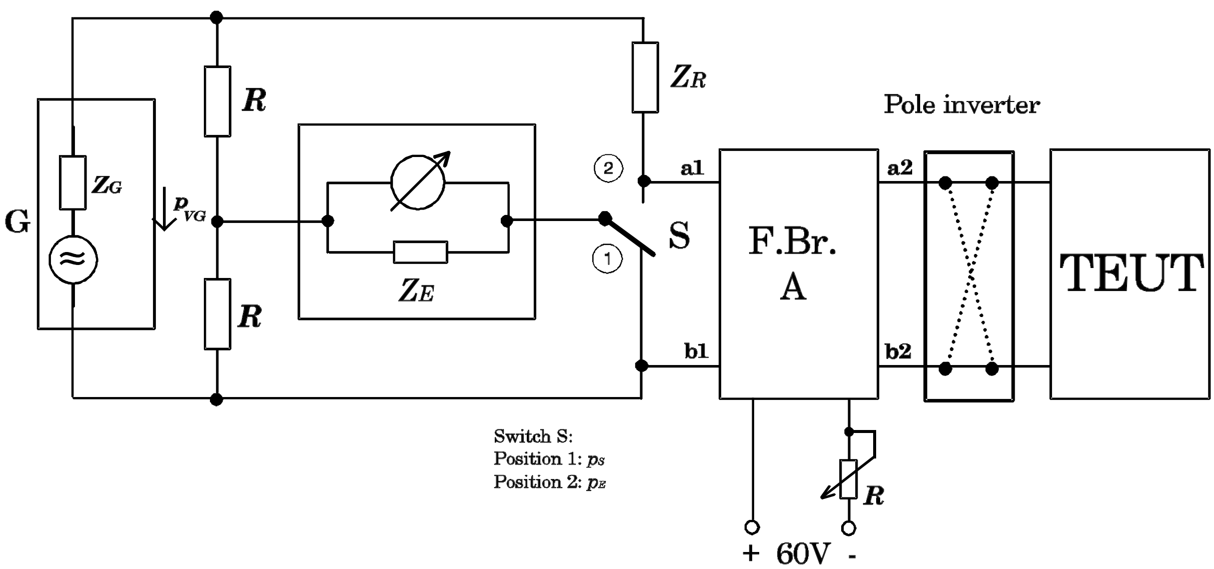
Figure A.4.1.2 (F) 2: Modulus of impedance by DTMF dialling

(V_f, R_f) = (54V, 300 ohms) and (45V, 1 400 ohms)

A.4.1.2 (F) 3 In the event of distortion for V_{t1} = 1,55V, the test is carried out with V_{t1} = 0,92 V.

A.4.1.2 (D) 1 Measurement of the return loss in the communication state

The measuring circuit illustrated in figure A.4.1.2 (D) 1 is used for the measurement of the return loss in a bridge circuit against the reference impedance Z_R. The difference between the two bridge resistors R (values between 100 Ω and 1 000 Ω permissible) shall be less than 0,1%. The measurement is carried out with resistance values of R = 0 Ω and 1 460 Ω.



R = 0 Ω and 1 460 Ω	$Z_G \approx 0$ Ω	$Z_E \geq 100$ kΩ

Figure A.4.1.2 (D) 1

The sending level p_S, measured with switch S in position 1, is set to -10 dB (950 mV). The impedance Z_G of the generator is approximately 0 Ω and that of the receiver Z_E should be greater than 100 kΩ (earth-free, balanced).

The measuring signal to be used should take the characteristics of the TEUT into consideration. Sine waves or a pink noise signal shall preferably be used.

The return loss α is calculated from the sending level read at the receiver p_E with switch S in position 2 using the following formula:

$$\alpha = p_S - p_E \qquad \alpha \text{ in dB}$$

The measurement is carried out without the emission of wanted signals.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

A.4.1.2 (H) 1 In the case of the telephone set, $V_{t1} = 0{,}25\ V_{rms}$.

A.4.1.2 (I) 1 For telephone sets, the test is carried out either by putting the microphone in a silent area (< 40 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:

$$\alpha = 20 \times \log \frac{U_1}{U_2} \qquad \text{Formula 4.1.2 (N) 1}$$

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:

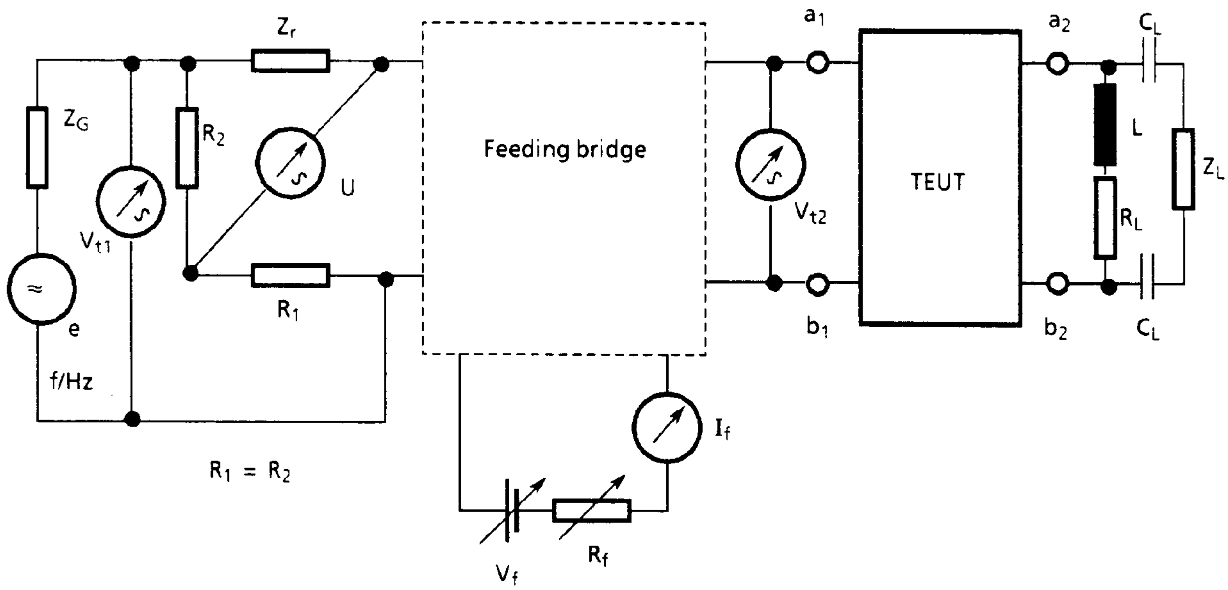


Figure A.4.1.2 (P) 1: Input impedance of TE in loop condition - TE provided with one port intended to be attached to the PSTN and a second port to which another TE, which itself is approved for connection to the PSTN, is connected

L (H) ≥ 5
$R_L(\Omega)$ = 400
$C_L(\mu F)$ ≥ 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 Chapter 1, table 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 In the charge metre range the insertion loss is to be measured as per section A.4.1.1, i.e.: Δf_4 : 11 880 - 12 120 Hz : + 20 dBm, 600 Ω generator 600 Ω load.

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 ± 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.

$$ERL = 3{,}24 - 10\ \log_{10} \sum_{i=1}^{n} (A_i + A_{i-1}) \times (\log_{10}\ f_i - \log_{10}\ f_{i-1})\ dB$$

Formula A.4.1.2 (GB) 1

where:

A_i is the return loss power ratio at frequency f_i expressed as $A_i = 10^{-(\text{decibel return loss at fi})/10}$;
A_o is the ratio at f_o = 300 Hz;
A_n is the ratio at f_n = 3 400 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 for TE in both quiescent and loop conditions.

4.2 (D) 1 Unbalance about earth

The degree of unbalance about earth at the NTA caused by the terminal equipment shall fulfil the following requirements:

50 Hz ≤ *f* ≤ 300 Hz	a_u ≥ 30 dB
300 Hz < *f* ≤ 600 Hz	a_u ≥ 40 dB
600 Hz < *f* ≤ 3 400 Hz	a_u ≥ 46 dB

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:

$$\alpha = 20 \log_{10} \frac{e}{V_t} \qquad \text{Formula A.4.2}$$

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	
Bulgaria	X	
Cyprus	X	
Denmark	X	X
Finland	X	
France	X	
Germany		
Greece		X
Hungary	not applicable	
Iceland	X	
Ireland		
Italy	X	
Luxembourg	not mandatory	
Malta		
Netherlands	X	
Norway	X	
Portugal	X	
Spain	X	
Sweden	X	
Switzerland	X	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	≥ 20	300	≥ 5	600	600	600	
Belgium	20	300	5	600	600	600	yes
Bulgaria	50	300	5	600		600	
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							yes
Greece	20	400	5	600			
Hungary	≥ 50	400	> 5	600		600	yes
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	≥ 10	600	600	600	yes
Portugal	≥ 50	400	≥ 5	600	600	600	
Spain	≥ 20	300	≥ 10		600		yes
Sweden	≥ 200	600	> 4	600		600	yes
Switzerland	≥ 47	300	≥ 5	600	600	600	yes
U. Kingdom		600		600			yes

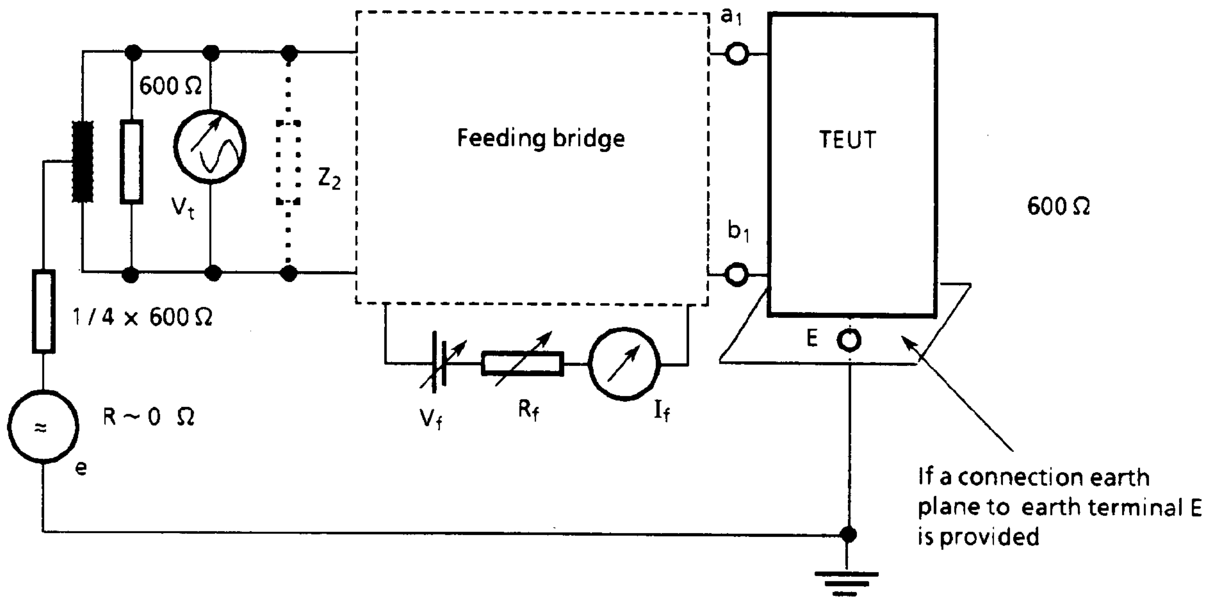
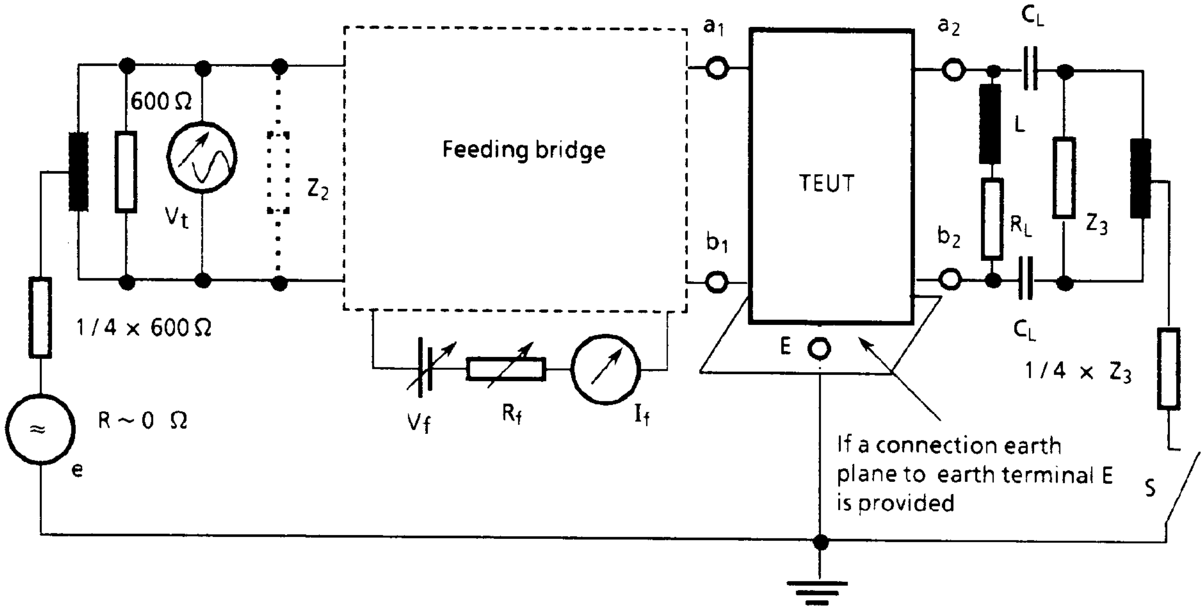


Figure A.4.2.a: Degree of unbalance about earth - one-port TE
Feeding bridge as specified in Chapter 1

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 ITU-T Recommendation 0.9, Paragraph 3.2.



Switch S open: Measurement of longitudinal conversion loss.
Switch S closed: Measurement of longitudinal conversion transfer loss.

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).

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:

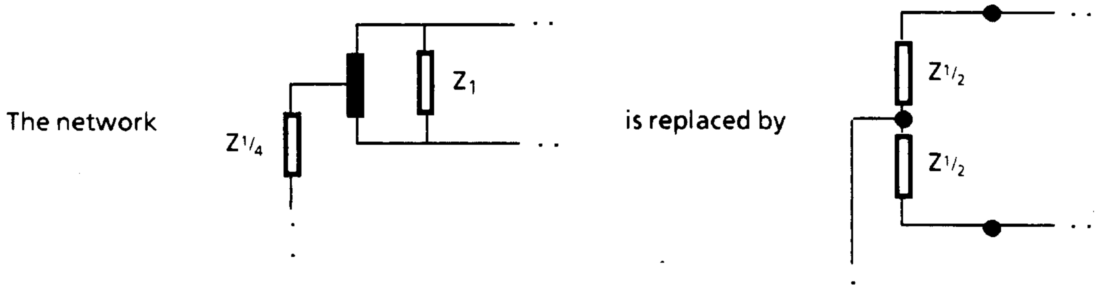


Figure A.4.2 (B) 1

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:

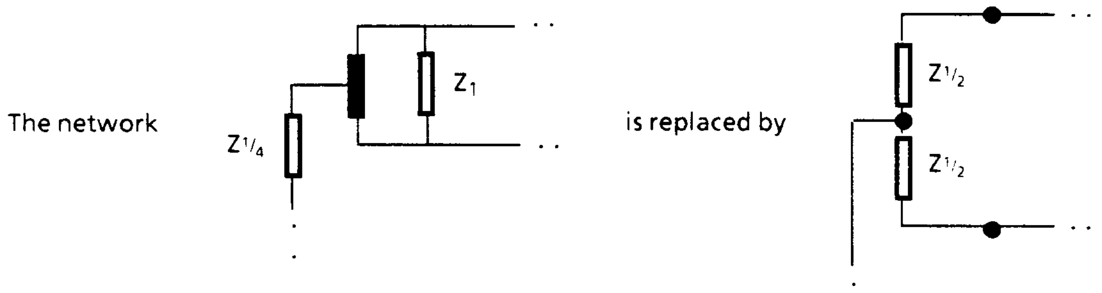
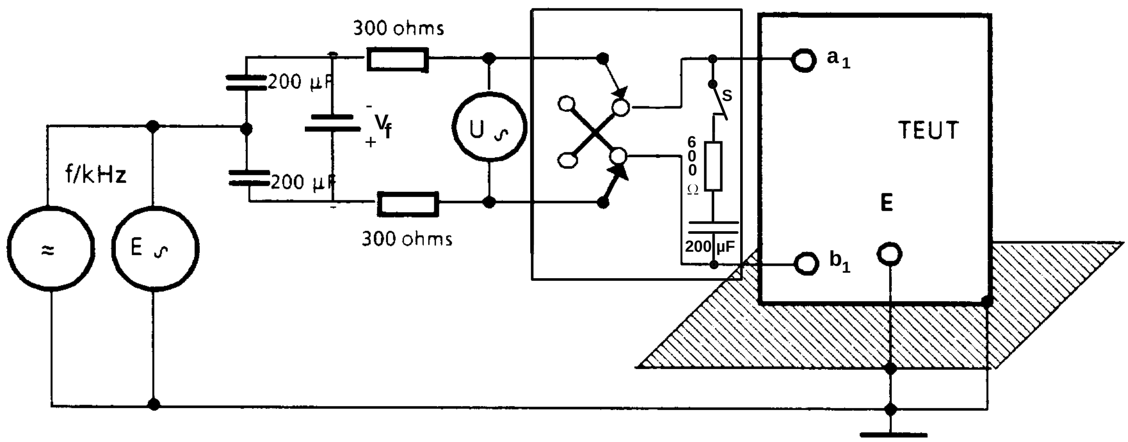


Figure A.4.2 (CY) 1

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.



NOTE: When the TEUT is in loop condition, the 600 ohms resistor shall be disconnected.

Figure A.4.2.a (DK) 1

Here, the balance ratio to earth is determined as 20 x $\log_{10}$ (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.

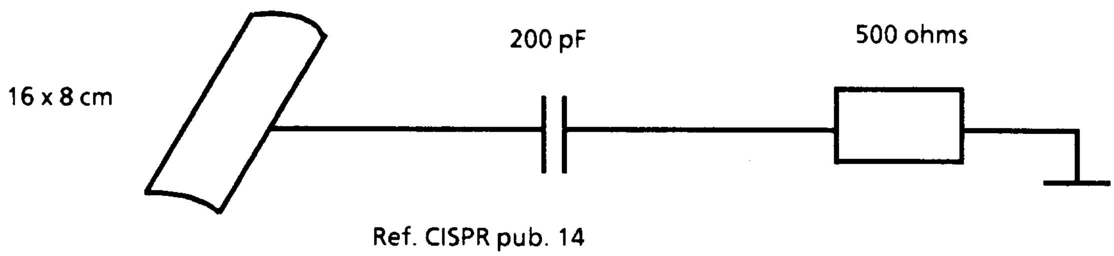


Figure A.4.2.b (DK) 1

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
E/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 µF.

A.4.2 (F) 1

Figures A.4.2.a and A.4.2.b are used by

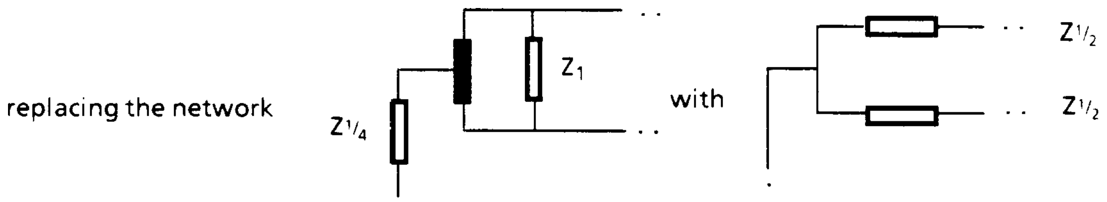
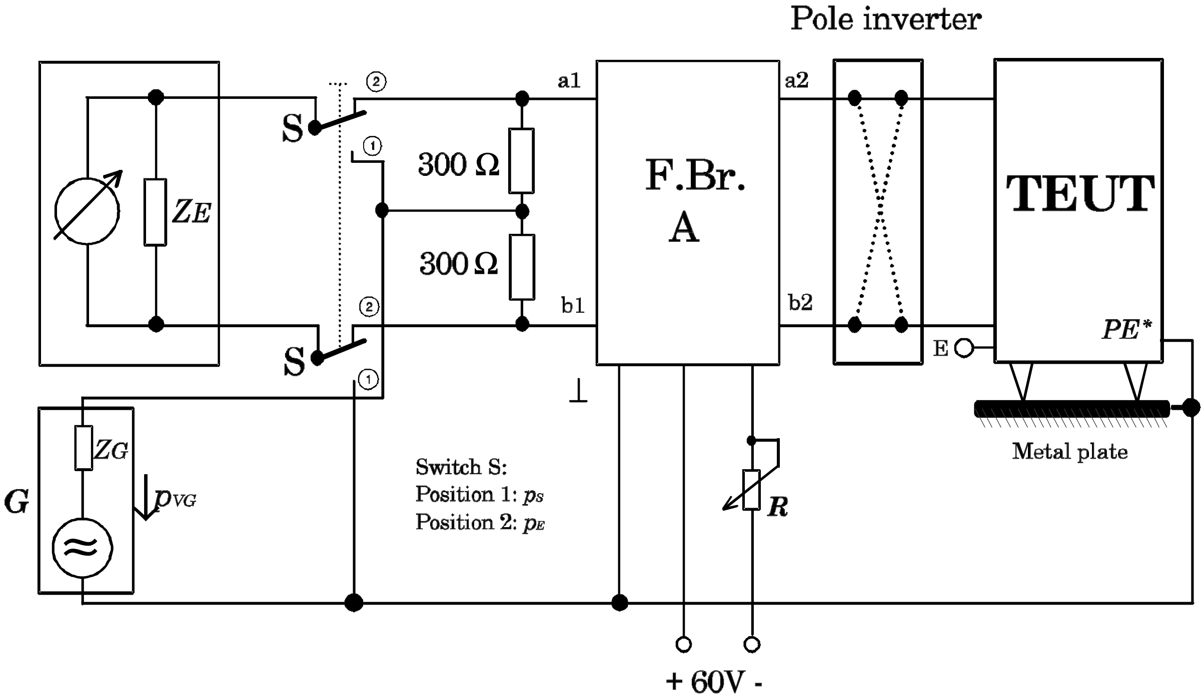


Figure A.4.2 (F) 1

A.4.2 (D) 1

Measurement of the unbalance about earth in the communication state

The balance of the terminal equipment (TEUT) is measured as the degree of unbalance about earth. For the purposes of the measurement, the sending level p_S is fed from a low-impedance sine-wave generator (Z_G approx. 0 Ω) between the middle of a 600 Ω terminating resistor and earth, as shown in the measuring arrangement illustrated in figure A.4.2 (D) 1. The difference between the two 300 Ω resistors shall be < 0,1 %. The sending level p_S is 0 dB(775 mV). The receiving level p_E is measured with a high-impedance measuring receiver with an impedance of Z_E > 25 kΩ (balanced, earth-free input port) connected in parallel to the terminal equipment (TEUT). The measurement is carried out with R = 0 Ω and 1 460 Ω.



R = 0 Ω and 1 460 Ω	$Z_G \approx 0\ \Omega$	$Z_E \geq 25\ \mathrm{k}\Omega$

* protective earth (PE) and/or earth wire where provided

Figure A.4.2 (D) 1

The unbalance about earth is calculated using the formula:

$$a_u = p_S - p_E \qquad a_u \text{ in dB}$$

The protective earth and/or earth connection of the terminal equipment (TEUT) shall be used as earth (in accordance with any given manufacturer's guidelines). Terminal equipment (TEUT) without an earth connection shall be mounted on a metal plate which shall be connected with the reference potential of the measuring circuit. The signal earth connection E, if provided, shall not be connected for the measurement. This measurement is carried out in accordance with CCITT Recommendation O.9 (Blue Book), section 2.1, "Longitudinal Conversion Loss LCL".

No wanted signals shall be emitted during the measurement.

In order to reduce the influence of outband noise on the measurement result, the voltage level p_E should preferably be measured selectively. The measurement is carried out for each polarity of the TEUT. Where the balance of the measuring circuit is sufficient, the measurement result shall not vary by more than 2 dB. The requirement is deemed to be fulfilled where the higher of the two measurement values meets the specified limit.

A.4.2 (H) 1 The TE earth terminal shall be wired to the earth reference point of the test circuit.

A.4.2 (H) 2 In the test circuits shown in figures A.4.2.a and A.4.2.b, the following changes can be made:

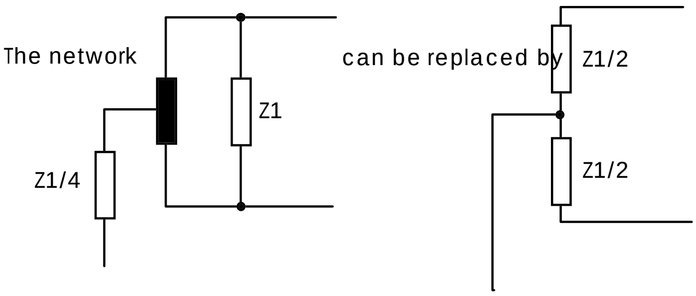


Figure A.4.2 (H) 2: Modification in the test circuit

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:

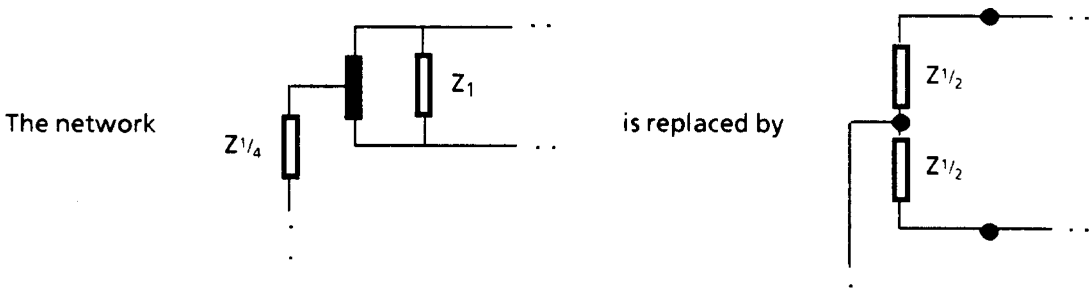


Figure A.4.2 (I) 1

Same as above for the impedance Z_3. The requirement in this section is mandatory only for TEs provided with earth terminals.

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:

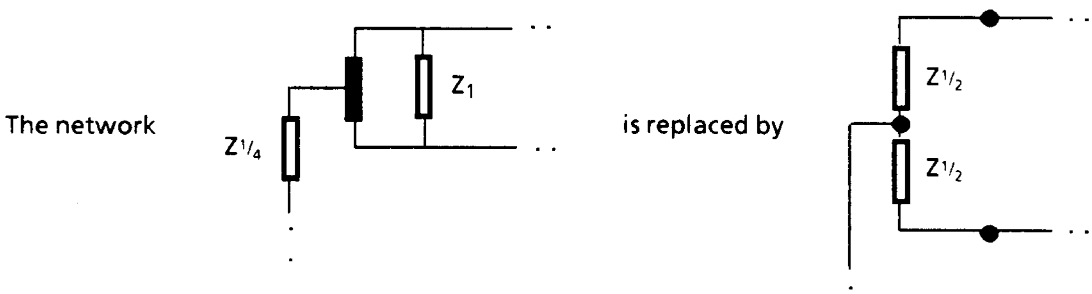


Figure A.4.2 (NL) 1

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:

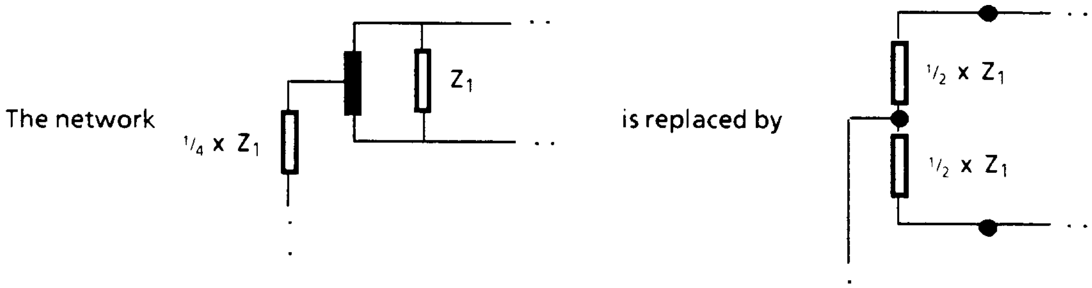


Figure A.4.2 (N) 1

A.4.2 (N) 3 Z_2 is used for tests of one port TE (ref. figure A.4.2.a) in quiescent condition only.

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 handset, 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.

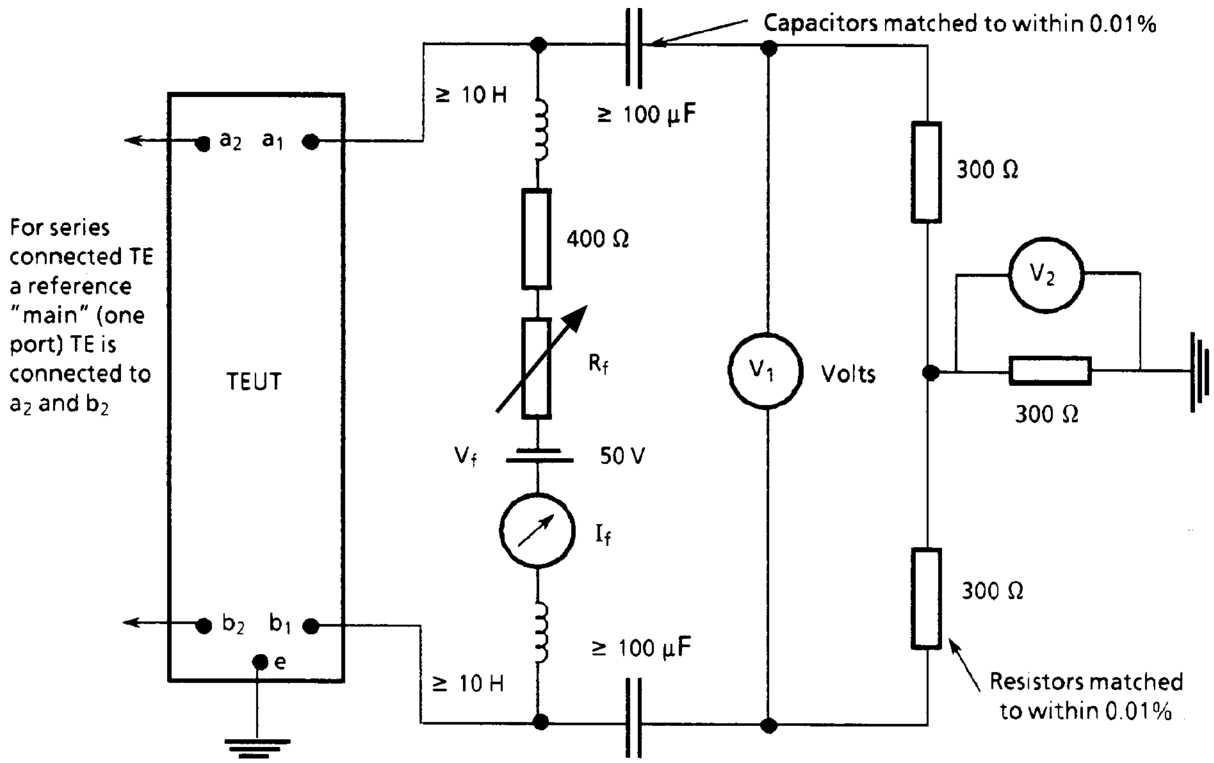


Figure A.4.2 (GB) 1.a: Signal balance about earth test circuit

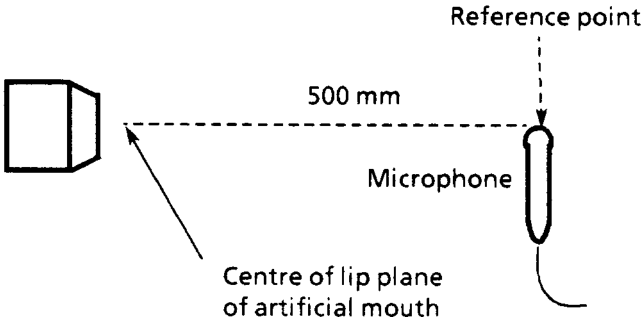


Figure A.4.2 (GB) 1.b : Microphone reference point

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:

$$\text{Signal balance} = 20 \times \log_{10} \left(\frac{V_1}{V_2} \right) \text{ dB} \qquad \text{Formula A.4.2 (GB) 1}$$

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 αq 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 values for one-port TE, quiescent condition

COUNTRY	REQUIREMENT VALUES ΔV_f (V)	ΔR_f (Ω)
Austria	60	
Belgium	48	400
Bulgaria	60	1 000, 2 200
Cyprus	48	800
Denmark	0 - 25	600
Finland	48	800
France	3 - 70	300
Germany		
Greece	44 - 66	600
Hungary	not mandatory	
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	43 - 57	2 200 - 600
U. Kingdom	not mandatory	

Table 4.2.1.1 (continued): Longitudinal conversion loss values for one-port TE, quiescent condition

COUNTRY	REQUIREMENT VALUES α_{q1} (dB)	Δf_1 (Hz)	α_{q2} (dB)	Δf_2 (Hz)	α_{q3} (dB)	Δf_3 (Hz)	α_{q4} (dB)	Δf_4 (Hz)	Remarks
Austria	52	300 - 3 400							
Belgium	48	300 - 3 400							yes
Bulgaria	30	50 - 300	52	300 - 4 000					
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									
Greece	40	40 - 300	40	300 - 3 400	52 - 6 dB/oct.	3 400 - 18 000			
Hungary	not mandatory								
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 - 17 000	yes
Switzerland	42	40 - 300	52	300 - 3 400	N/A	N/A	N/A	N/A	yes
U. Kingdom	not mandatory								

4.2.1.1 (B) 1 The requirement values for PBXs with analogue interface are:

α_{q1}(dB) = 40
Δ_{f1} (Hz) = 300 - 600
α_{q2}(dB) = 46
Δ_{f2} (Hz) = 600 - 3 400

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 MΩ when a TE without meter pulse reception is tested.

b) The longitudinal input impedance at 50 Hz must be at least 6,7 kΩ 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 the 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

LCL limit	Frequency range
52 dB	f = 50 Hz
40 dB	50 Hz < f < 300 Hz
50 dB	300 Hz ≤ f ≤ 600 Hz
55 dB	600 Hz < f ≤ 3,4 kHz
44 dB	f = 12 kHz

Table 4.2.1.1 (E) 1.b: Impedance unbalance about earth, voltage values

Testing voltage (e)	Frequency range
e = 7 V	f = 50 Hz
e = 5 V	50 Hz < f < 300 Hz
e = 3 V	300 Hz < f ≤ 12 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 for TE which cannot be connected in parallel shall be:

$\geq$ 40 dB in the frequency range 40 to 300 Hz and;
$\geq$ 46 dB in the frequency range 300 to 3 400 Hz.

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 in parallel with the circuit.

DC feeding conditions are established using the relevant values of V_f and R_f, and for each frequency, f_t, 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
Bulgaria	60	1 000	600
Cyprus	48	440	600
Denmark	25	600	600
Finland	48	800	600
France	48	300	600
Germany			
Greece	60	600	600
Hungary	not mandatory	not mandatory	not mandatory
Iceland	48	800	600
Ireland	48	5 000	600
Italy	44, 52	1 880, 720	600
Luxembourg	60	1 000	600
Malta			
Netherlands	42, 48, 66	800, 1 130, 2 140	600
Norway	60	1 200	600
Portugal	48	300 - 1 800	600
Spain	48	1 100	
Sweden	48	1 600	600
Switzerland	50	500, 2 300	600
U. Kingdom	not mandatory	not mandatory	not mandatory

Table A.4.2.1.1 (continued): 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							
Bulgaria	775	50 - 300	775	300 - 4 000					
Cyprus	1500	40 - 3 400	1 500	15 000 - 17 000					
Denmark	10^4	50	5 000	100	830	600	500	1000 - 13600	yes
Finland	775	40 - 3 400							
France	775	50 - 300	775	300 - 3 400					
Germany									
Greece	775	40 - 18 000							yes
Hungary	not mandatory								
Iceland	775	40 - 600	775	600 - 3 400					
Ireland	1 000	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, 90, 160	775	320	775	600, 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	
Switzerland	775	40 - 300	775	300 - 3 400					
U. Kingdom									

A.4.2.1.1 (DK) 1 The TEUT is connected as shown in figure A.4.2 (DK) 1.

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 (RG) 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.

$$\text{LCL (dB)} = 20 \times \log_{10} \frac{V_1\,(V)}{V_2\,(V)} \qquad \text{Formula A.4.2.1.1 (E) 1}$$

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.

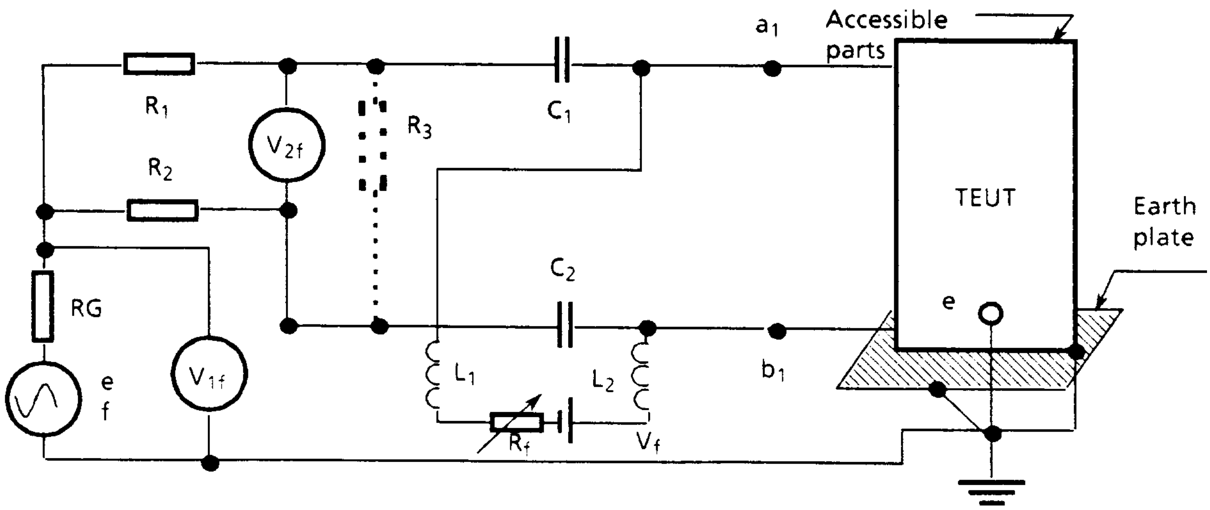


Figure A.4.2.1.1 (E) 1: Impedance unbalance about earth, longitudinal conversion loss

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 - $I_{max.}$
Bulgaria	60	1 000 - 2 200	
Cyprus	48	800	20 - 100
Denmark			8 - $I_{max.}$
Finland	48	800 - 1 710	
France	45 - 54	300 - 1 400	
Germany			
Greece	44 - 66		20 - 80
Hungary	48		20 - $I_{max.}$
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	See section 4.2.1.1		
U. Kingdom	50	400 min.	25 - 100

Table 4.2.1.2 (continued): Longitudinal conversion loss values for one-port TE, loop condition

COUNTRY	REQUIREMENT VALUES								Remarks
	α_{l1} (dB)	Δ_{f1} (Hz)	α_{l2} (dB)	Δf_2 (Hz)	α_{l3} (dB)	Δf_3 (Hz)	α_{l4} (dB)	Δf_4 (Hz)	
Austria	52	300 - 3 400							
Belgium	48	300 - 3 400							yes
Bulgaria	30	50 - 300	52	300 - 4 000					
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									
Greece	40	40 - 300	40	300 - 3 400	52-6 dB/oct.	3 400 - 18 000			
Hungary	40	300 - 600	46	600 - 3 400					
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	10 000 - 17 000	yes
Switzerland									
U. Kingdom	46	300 - 3 400							yes

4.2.1.2 (B) 1 The requirement values for PBXs with analogue interface are:

α_{q1} (dB) = 40
Δ_{f1} (HZ) = 300 - 600
α_{q2} (dB) = 46
Δ_{f2} (HZ) = 600 - 3 400

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 MΩ when a TE without meter pulse reception is tested.

b) The longitudinal input impedance at 50 Hz must be at least 6,7 kΩ 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 Chapter 1, table 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_t, 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_t, Δ_f are shown in table A.4.2.1.2.b; Z_1 = 600 Ω.

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	
Bulgaria	60	1 000 - 2 200	
Cyprus	48	800	
Denmark			8, 16, 25, $I_{max.}$
Finland	48	800, 1 710	
France	48	300	
Germany			
Greece	60		20, 35, 55
Hungary	48		20, $I_{max.}$
Iceland	48		14, $I_{max.}$
Ireland	48	5 000	20, 50, 100
Italy	44, 52	1 880, 720	
Luxembourg	60		14, 60
Malta			
Netherlands	42, 48, 66	800, 1 130, 2 140	
Norway	60	1 200	
Portugal	48	300 - 1 800	not applicable
Spain	48	500, 1 100, 1 700	
Sweden			
Switzerland	See section A.4.2.1.1		
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, Δ_f 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, 3 400							
Belgium	775	300 - 3 400							
Bulgaria	775	50 - 300	775	300 - 4 000					
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	yes
Finland	775	40 - 3 400							
France	775	50 - 300	775	300 - 3 400					
Germany									
Greece	775	40 - 18 000							yes
Hungary	775	300 - 600	775	600 - 3 400					
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	See section A.4.2.1.1								
U. Kingdom	1 000 ± 10%	300 - 3 400							yes

A.4.2.1.2 (DK) 1 The TEUT is connected as shown in figure A.4.2 (DK) 1.

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 A.4.2.1.1 (E) 1.

A.4.2.1.2 (S) 1 Feeding conditions see Chapter 1, table 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.

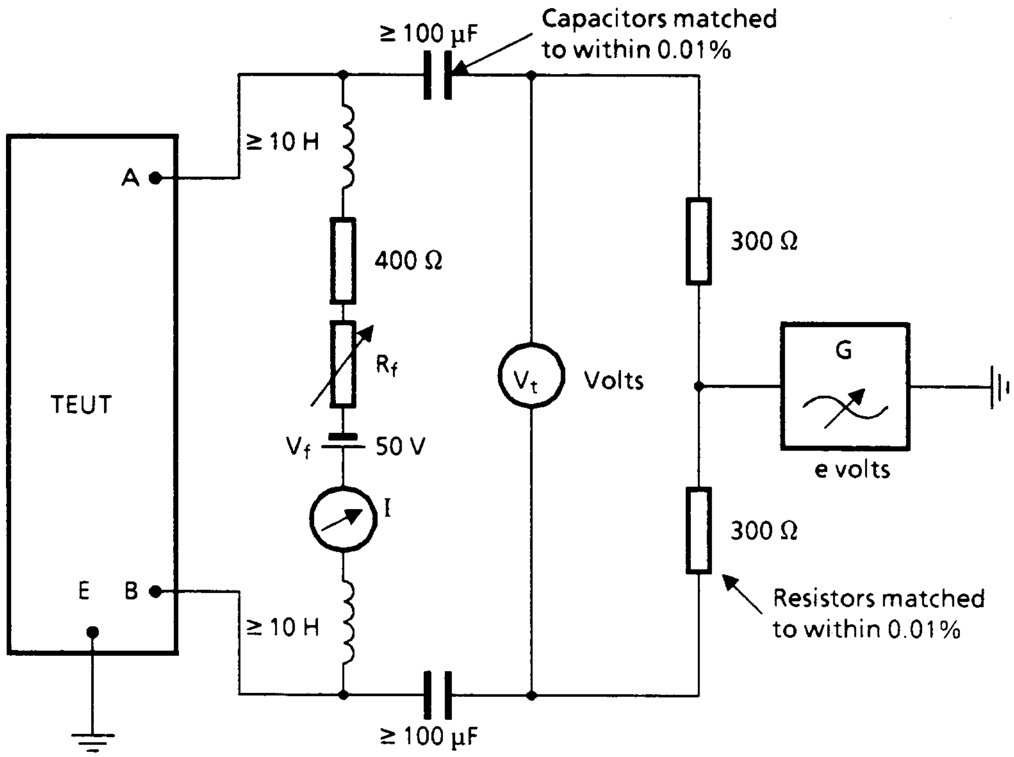


Figure A.4.2.1.2 (GB) 1: Impedance balance test circuit

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 αq 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
Bulgaria	60	1 000 - 2 200
Cyprus	48	800
Denmark	0 - 25	600
Finland	48	800
France	3 - 70	300
Germany		
Greece	44 - 66	600
Hungary	not mandatory	
Iceland	48	800
Ireland	48	5 000
Italy	not mandatory	
Luxembourg	60	1 000
Malta		
Netherlands	42 - 66	800 - 2 140
Norway	not mandatory	
Portugal	45 - 55	300 - 1 800
Spain	48	1 100
Sweden		
Switzerland	See section 4.2.1.1	
U. Kingdom	not mandatory	

Table 4.2.2.1.a (continued): 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						
Bulgaria	30	50 - 300	52	300 - 4 000				
Cyprus	50	40 - 3 400	50	15 000 - 17 000				
Denmark	50	40 - 600	55	600 - 3 400	-6 dB/oct.	> 3 400		
Finland	40	40 - 300	50	300 - 600	55	600 - 3 400		
France	40	50 - 300	50	300 - 3 400				
Germany								
Greece	40	40 - 300	40	300 - 3 400	52 -6 dB/oct.	3 400 - 18 000		
Hungary	not mandatory							
Iceland	40	40 - 600	46	600 - 3 400				
Ireland	40	40 - 300	50	300 - 600	52	600 - 3 400		
Italy	not mandatory							
Luxembourg	52	300 - 3 400						
Malta								
Netherlands	not mandatory							
Norway	not mandatory							
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								
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	
Bulgaria	not mandatory	
Cyprus	not mandatory	
Denmark	not mandatory	
Finland	not mandatory	
France	not mandatory	
Germany	not mandatory	
Greece	not mandatory	
Hungary	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	not mandatory	
U. Kingdom	not mandatory	

Table 4.2.2.1.b (continued): Longitudinal conversion transfer loss values for series-connected TE, quiescent condition

COUNTRY	REQUIREMENT VALUES								Remarks
	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	not mandatory								
Bulgaria	not mandatory								
Cyprus	not mandatory								
Denmark	not mandatory								
Finland	not mandatory								
France	not mandatory								
Germany	not mandatory								
Greece	not mandatory								yes
Hungary	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	600 - 3 400	50	10 000 - 17 000	yes
Switzerland									
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 MΩ when a TE without meter pulse reception is tested.

b) The longitudinal input impedance at 50 Hz must be at least 6,7 kΩ 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

LCTL limit	Frequency range
52 dB	f = 50 Hz
40 dB	50 Hz < f < 300 Hz
50 dB	300 Hz ≤ f ≤ 600 Hz
55 dB	600 Hz < f ≤ 3,4 kHz
44 dB	f = 12 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	≥ 5 MΩ	600	≥ 20 000
Bulgaria	60	1 000, 2 200	∞	600	600
Cyprus	48	800	300	600	600
Denmark	25				
Finland	48	800, 1 710	400	600	600
France					
Germany	60	1 000, 2 530	300	600	
Greece	60	600	400	600	600
Hungary	not mandatory				
Iceland	48	800	400	600	600
Ireland	48	5 000		600	
Italy	not mandatory				
Luxembourg	60	1 000	300	600	600
Malta					
Netherlands	42, 48, 66	800, 1 130, 2 140	∞	600	600
Norway	not mandatory				
Portugal	48	300 - 1 800	400	600	600
Spain	48	1 100	300		600
Sweden				600	600
Switzerland	50	500, 2 300	300	600	600
U. Kingdom	not mandatory				

Table A.4.2.2.1 (continued): 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							
Bulgaria	775	50 - 300	775	300 - 4 000					
Cyprus	1 500	40 - 3 400	1 500	15 000 - 17 000					
Denmark									yes
Finland	775	40 - 3 400							
France	775	50 - 300	775	300 - 3 400					
Germany									
Greece	775	40 - 18 000							yes
Hungary	not mandatory								
Iceland	775	40 - 600	775	600 - 3 400					
Ireland	1 000	40, 200	1 000	400	1000	1 200, 3 400			
Italy	not mandatory								
Luxembourg	775	300 - 3 400							
Malta									
Netherlands	not mandatory								
Norway	not mandatory								
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 - 300	775	300 - 3 400	See also section A.4.2.1.1				
U. Kingdom									

A.4.2.2.1 (DK) 1 A second connection port of the TE is open. Both ac excitation and measuring frequencies are stated in A.4.2 (DK) 1.

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 4.2.2.1 (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.

$$\text{LCTL (dB)} = 20 \times \log_{10} \frac{V_1\ (V)}{V_3\ (V)} \qquad \text{Formula A.4.2.2.1 (E) 1}$$

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.

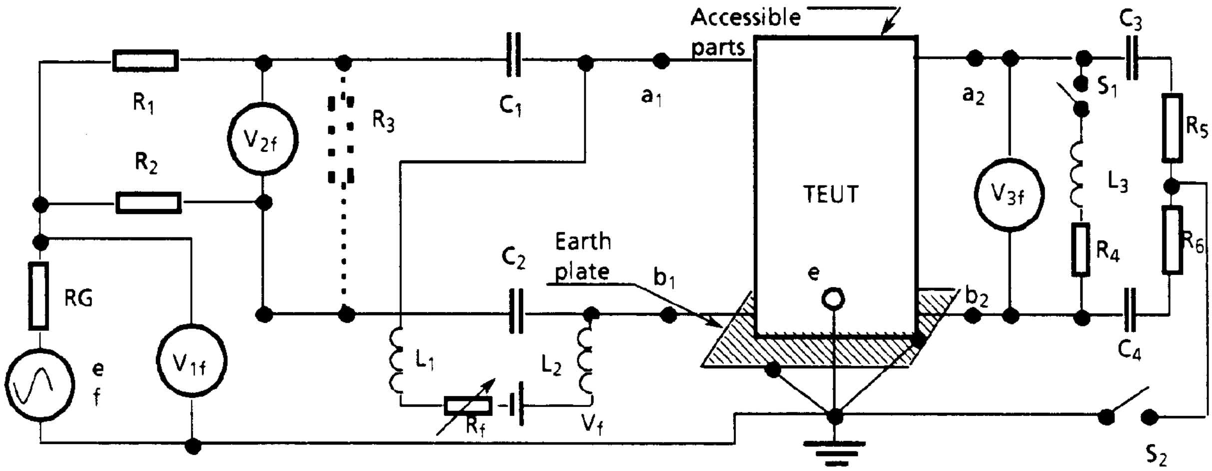


Figure A.4.2.2.1 (E) 1: Impedance unbalance about earth, longitudinal conversion transfer loss (Series)

A.4.2.2.1 (S) 1 Feeding conditions see Chapter 1, table 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_l 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 -$I_{max.}$
Bulgaria	60	1 000, 2 200	
Cyprus	48	440 - 1 740	20 - 100
Denmark			8 - $I_{max.}$
Finland	48	800 - 1 710	
France	48		25 - 60
Germany			
Greece	44 - 66		20 - 80
Hungary	48		20 - $I_{max.}$
Iceland	48		14 - $I_{max.}$
Ireland	48	5 000	20 - 100
Italy	not mandatory		
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	See section 4.2.1.1		
U. Kingdom	50	400 min.	25, 40

Table 4.2.2.2.a (continued): Longitudinal conversion loss values for series-connected TE, loop condition

COUNTRY	REQUIREMENT VALUES							
	α_{l1} (dB)	Δ_{f1} (Hz)	α_{l2} (dB)	Δ_{f2} (Hz)	α_{l3} (dB)	Δ_{f3} (Hz)	α_{l4} (dB)	Δ_{f4} (Hz)
Austria	not mandatory							
Belgium	48	300 - 3 400						
Bulgaria	30	50 - 300	52	300 - 4 000				
Cyprus	50	40 - 3 400	50	15 000 - 17 000				
Denmark	50	40 - 600	55	600 - 3 400	-6dB/oct.	> 3 400		
Finland	40	40 - 300	50	300 - 600	55	600 - 3 400		
France	40	50 - 300	50	300 - 3 400				
Germany								
Greece	40	40 - 300	40	300 - 3 400	52 -6dB/oct.	3 400 - 18 000		
Hungary	40	300 - 600	46	600 - 3 400				
Iceland	40	40 - 600	46	600 - 3 400				
Ireland	40	40 - 300	50	300 - 600	52	600 - 3 400		
Italy	not mandatory							
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								
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	
Bulgaria		not mandatory	
Cyprus		not mandatory	
Denmark			
Finland		not mandatory	
France		not mandatory	
Germany		not mandatory	
Greece		not mandatory	
Hungary		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		not mandatory	
U. Kingdom		not mandatory	

Table 4.2.2.2.b (continued): Longitudinal conversion transfer loss values for series-connected TE, loop condition

COUNTRY	REQUIREMENT VALUES								Remarks
	α_{l1} (dB)	Δf_1 (Hz)	α_{l2} (dB)	Δf_2 (Hz)	α_{l3} (dB)	Δf_3 (Hz)	α_{l4} (dB)	Δf_4 (Hz)	
Austria	not mandatory								
Belgium	not mandatory								
Bulgaria	not mandatory								
Cyprus	not mandatory								
Denmark									yes
Finland	not mandatory								
France	not mandatory								
Germany	not mandatory								
Greece	not mandatory								
Hungary	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	600 - 3 400	50	10 000 - 17 000	yes
Switzerland									
U. Kingdom	not mandatory								yes

4.2.2.2 (DK) 1 A series-connected TE, which can itself be in the loop condition (figures 1.4.4.2.c and 1.4.4.2.d), shall comply with the requirement in subclause 4.2.1.2 when the second connection port is open.

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 MΩ when a TE without meter pulse reception is tested.

b) The longitudinal input impedance at 50 Hz must be at least 6,7 kΩ 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}, Δ_{f1} 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	
Bulgaria	60	1 000, 2 200	300	50	5	
Cyprus	48	800	300	50	5	20, 100
Denmark						8, 25, $I_{max.}$
Finland	48	800, 1 710	400	≥ 16	≥ 6	
France	48		300	100	10	25, 60
Germany						
Greece	60		400	20	5	20, 35, 55
Hungary	48		400	≥ 50	≥ 5	20 - $I_{max.}$
Iceland	48	800	400	≥ 2	≥ 4	
Ireland	48	5 000	800			20, 50, 100
Italy	not mandatory					
Luxembourg	60	1 000	300			
Malta						
Netherlands	42, 48, 66	800, 1 130, 2 140				
Norway	60	1 200	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	50	500 , 2 300	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
Bulgaria	600	600
Cyprus	600	600
Denmark		
Finland	600	600
France	600	
Germany		
Greece	600, 200	600, 200
Hungary	600	
Iceland	600	600
Ireland	600	600
Italy	not mandatory	
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 (continued): Values of the AC excitation parameters "e", f_{ti}, Δ_{fi} 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							
Bulgaria	775	50 - 300	775	300 - 4 000					
Cyprus	1 500	40 - 3 400	1 500	15 000 - 17 000					
Denmark									yes
Finland	775	40 - 3 400							
France	775	50 - 300	775	300 - 3 400					
Germany									
Greece	775	40 - 18 000							yes
Hungary	775	300 - 600	775	600 - 3 400					
Iceland	775	40 - 600	775	600 - 3 000					
Ireland	1 000	40, 200	1 000	400	1 000	1 200, 3 400			
Italy	not mandatory								
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 - 3 400							
U. Kingdom	1 000 ± 10%	300 - 3 400 Hz							

A.4.2.2.2 (DK) 1 The TE is through-connected and the second connection port is attached to a 600 Ω ac-load. Both ac excitation and measuring frequencies are stated in section A.4.2 (DK) 1.

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 Hz - 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 Chapter 1, table 1.5.2.

Table A.4.2.2.2.c: Test conditions for longitudinal conversion transfer loss

COUNTRY	TEST carried out (yes/no)	Remarks
Austria	no	
Belgium	no	
Bulgaria	no	
Cyprus	no	
Denmark	no	
Finland	no	
France	no	
Germany	no	
Greece	no	
Hungary	no	
Iceland	no	
Ireland		
Italy	no	
Luxembourg	no	
Malta		
Netherlands	no	
Norway	no	
Portugal	no	
Spain	yes	yes
Sweden	yes	
Switzerland	no	
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.

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	0,5	not mandatory	20 -$I_{max.}$	48		
Bulgaria	0,3	0,5		60	1 000 - 2 200	yes
Cyprus	0,25	0,5	20 - 100	48	440 - 1 740	
Denmark	0,25	0,5	8 - $I_{max.}$			yes
Finland		not mandatory		48	800 - 1 710	yes
France	0,3		25 - 60	48	300	
Germany						
Greece	0,35	0,5	20 - 80	0 - 60		
Hungary	0,5	not mandatory	20 - $I_{max.}$	48		yes
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	0,5	1		43, -57	2 200, -600	yes
U. Kingdom	0,5	not mandatory	25, 40	50	400 min	yes

4.3 (A) 1 Frequency range: Δf_2 = 11 928 Hz- 12 072 Hz.

4.3 (A) 2 For pulse metering equipments $a_2 \geq 46$ dB in the frequency range Δf_2.

4.3 (A) 3 For TE which are provided with a switching matrix an insertion loss of $a_1 \leq 1$ dB is permitted.

4.3 (BG) 1 Frequency range: Δf_2 = 15 840 - 16 160 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 the 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 (BG) 2 In the frequency range 23 Hz to 54 Hz, the insertion loss is measured as the difference of rms voltages.

U_G = 30 V to 90 V
$R_1 = 0\ \Omega$
$U_1 - U_2 \leq 1,0$ V at U_G = 30 V
$U_1 - U_2 \leq 1,5$ V at U_G = 90 V

The compliance is checked using the test outlined in section A.4.3 (BG) 2.

4.3 (DK) 1 TE designed for supplementary services may use frequencies above voice band and shall comply with Danish specifications.

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 (H) 1 Frequency range, if the TE does not use these frequencies for operation:

11 928 Hz - 12 072 Hz.

4.3 (H) 2 Table 4.3 is not mandatory for PABXs.

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 the 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 Hz ≤ f_1 ≤ 3,4 kHz	3 V	600 Ω
1,0 dB	f_1 = 12 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 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 : $a_3 \leq 1$ 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:

$$\alpha_i = 20 \log_{10} \left(\frac{U_1}{U_2} \right) \qquad \text{Formula A.4.3}$$

Table A.4.3: Series-connected TE insertion loss

COUNTRY	TEST VALUES			
	C_L (µF)	R_L (Ω)	L (H)	Z (Ω)
Austria	≥ 20	300	≥ 5	600
Belgium	20	300	5	600
Bulgaria	50	300	5	600
Cyprus	50	300	5	600
Denmark				600
Finland	≥ 16	400	≥ 6	600
France	100	300	10	600
Germany				
Greece	20	400	5	600
Hungary	≥ 50	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	≥ 100	600	≥ 10	
Switzerland	≥ 47	300	≥ 5	600
U. Kingdom	≥ 400	0	≥ 20	see fig. 4.1.2 (GB) 1

Table A.4.3 (continued): 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	
Bulgaria		0,5	300 - 3 400	600	1 000, 2 200	60	yes
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							
Greece	20, 35, 55	0,775		600		60	yes
Hungary	20, I_{max}	0,775	300 - 3 400	600		48	
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, 720	44, 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, 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					yes
Switzerland				600	500, 2 300	50	yes
U. Kingdom	25, 40	0,1	300 - 3 400	see fig. 4.1.2 (GB) 1	400	50	yes

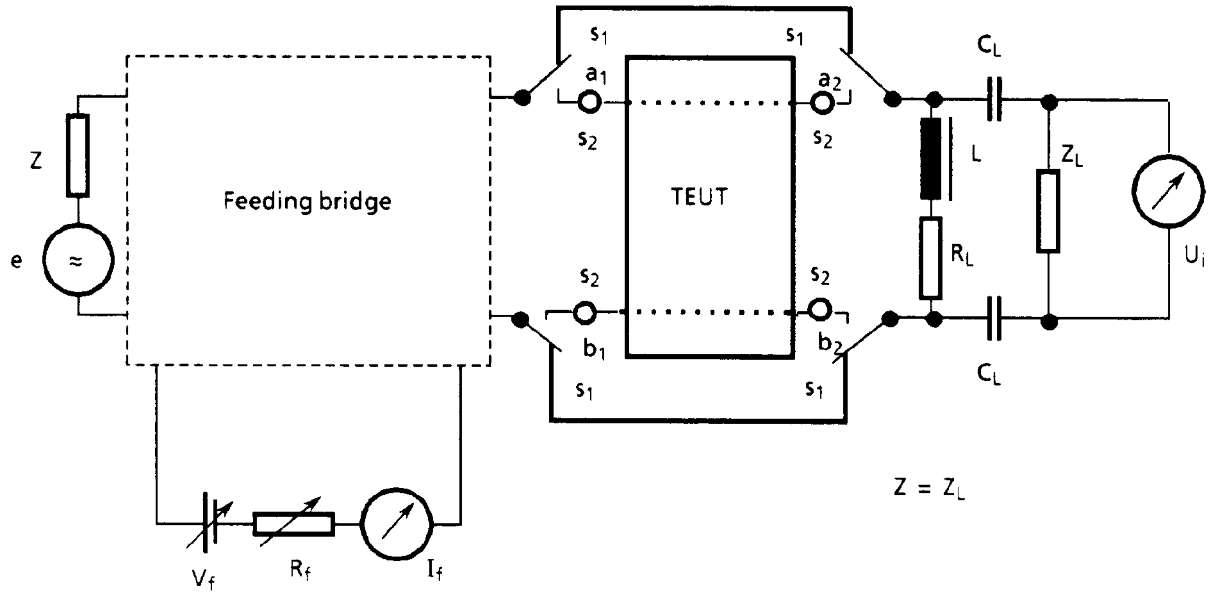


Figure A.4.3: Series-connected TE insertion loss
Feeding bridge as specified in Chapter 1

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 Ω for 300 Hz - 3 400 Hz

$Z = Z_L$ = 200 Ω for 11 928 Hz - 12 072 Hz

A.4.3 (BG) 1 In the frequency range 15,84 kHz to 16,16 kHz, U_1= 2,4 V and $Z = Z_L$ = 200 Ω.

A.4.3 (BG) 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 (BG) 2. A dc feeding voltage of 60 V is applied via a feeding resistor of 2 200 ohms. The test is carried out at 23 Hz and 54 Hz and Z_L = 4 000 Ω.

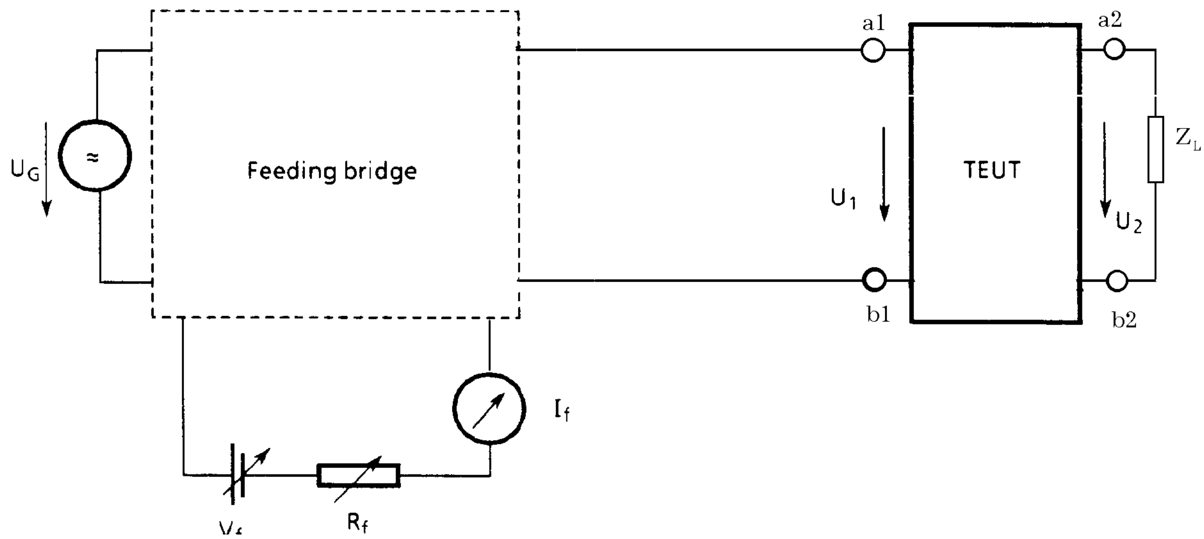


Figure A.4.3 (BG) 2

A.4.3 (DK) 1 The principle of test is shown in figure A.4.3 (DK) 1.

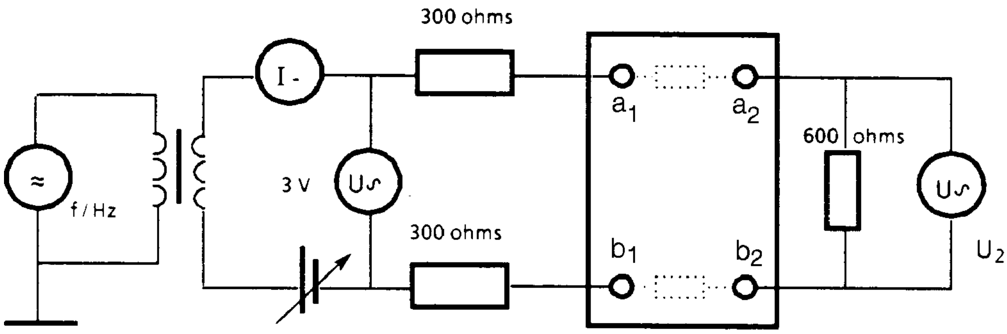


Figure A.4.3 (DK) 1

The voltage U_2 is measured and the insertion loss is then calculated according to formula A.4.3 (DK) 1.

$$A = 20 \times \log_{10} \left(\frac{1.5}{U_2} \right) \text{ dB} \qquad \text{Formula A.4.3 (DK) 1}$$

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 µF.

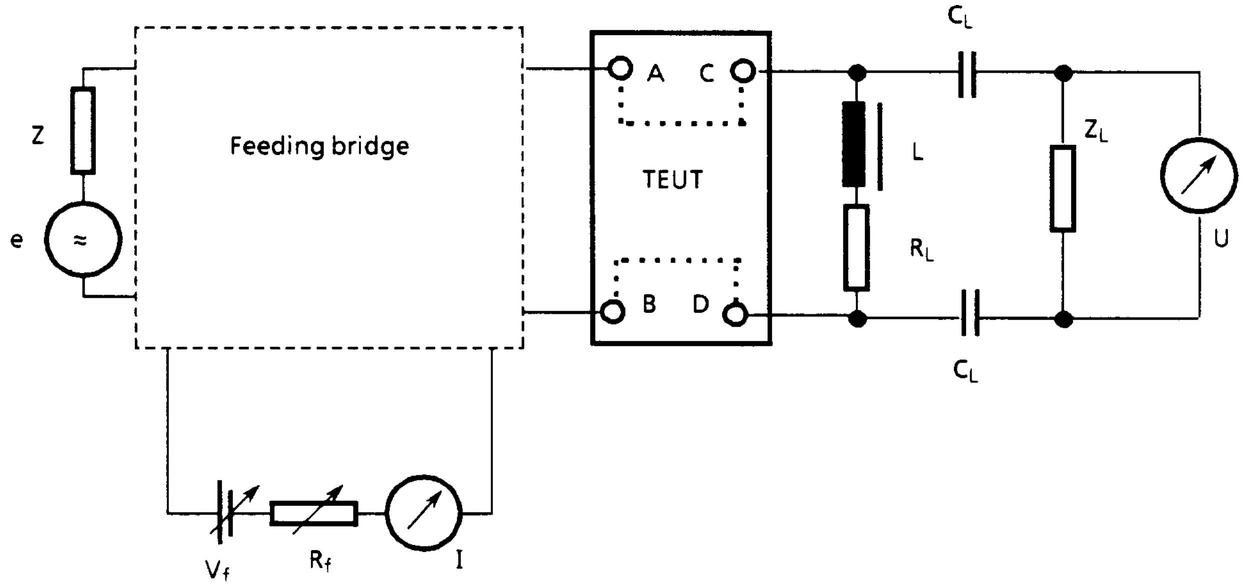


Figure A.4.3 (SF) 1

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 (H) 1 The measuring frequencies f_t shall be paced 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 (IRL) 1 To measure a_3 as specified in 4.3 (IRL) 1, Z_L is replaced by a resistor of value 8 kΩ, Z replaced by a resistor of value 5 kΩ, 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 (Vf) takes the value of 48 V. The resistor (R_f) takes the value of 500 ohms; the tests shall also be made when this 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 µF. 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).

$$\alpha\ (\mathrm{dB}) = 20 \times \log_{10} \frac{V_1\ (\mathrm{V})}{V_2\ (\mathrm{V})} \qquad \text{Formula A.4.3 (E) 1}$$

A.4.3 (S) 1 $Z = Z_L = 600\ \Omega$ for 300 Hz - 3 400 Hz.

$Z = Z_L = 200\ \Omega$ for 11 940 Hz - 12 060 Hz.

A.4.3 (S) 2 Feeding conditions, see Chapter 1, table 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 The following values for U_i (rms, figure A.4.3, across Z_L) are to be used:

for Δ_{f1} (300 Hz - 3 400 Hz): + 3 dB (rel. 775 mV)
for Δ_{f2} (11 880 Hz- 12 120 Hz): + 20 dB (rel. 775 mV)
for Δ_{f3} (21 Hz - 55 Hz): 30 V

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 (ΔR_f,ΔV_f). $V_{tmax.}$, Z_L are shown in table 4.4.1.

This 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	yes
Bulgaria	1,1	600		1 000 - 2 200	60	yes
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
Hungary	1,5	600	20 - I_{max}		48	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		600		800 - 2 140	42 - 66	yes
Norway	3,5	600		460 - 3 100	60	
Portugal	1,5	600	not applicable	300 - 1 800	45 - 55	
Spain				500 - 1 700	48	yes
Sweden	1,1	600				yes
Switzerland	+ 10 dBVpeak	600		2 200 - 600	43 - 57	yes
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} = 1,55 V.

4.4.1 (B) 1 For a digital PBX the value of Z_L is equal to Z_C as defined in section 4.1.2 (B) 1.

4.4.1 (BG) 1 Not applicable to live speech to which telephonometry requirements apply.

4.4.1 (F) 1 Not applicable to live speech TE to which telephonometry requirements apply.

4.4.1 (F) 2 V_{tmax} = 3 V for modems.

4.4.1 (D) 1 **Sending level**

NOTE: The maximum sending level which can be transmitted by the telephone network is +3dB (950 mV).

Terminal equipment with electrical source

The mean long-term level as specified in CCITT P.56 within the frequency range 300 Hz ≤ f ≤ 3 400 Hz shall not exceed a value of -9 dB (950 mV).

The maximum short-term (≤ 10 ms) sending level caused by single level peaks shall not exceed a value of +9 dB (950 mV).

Terminal equipment with electro-acoustic coupling

In the case of terminal equipment with electro-acoustic coupling, the mean long-term level and the maximum sending level within the frequency range 200 Hz $\leq f \leq$ 4000 Hz are determined by means of the sending loudness rating and the maximum value in the sending direction respectively.

- mean long-term level: SLR $\geq$ 0 dB ; measured in accordance with CCITT P.79 with p_S = -4.7 dB(Pa);
- maximum level: $\leq$ +6.3 dB(950 mV) ; measured with p_S = +15 dB(Pa); f = 1000 Hz.

4.4.1 (GR) 1 Not applicable for live speech TE to which telephonometry requirements apply.

4.4.1 (H) 1 Not applicable to TE transmitting live speech to which telephonometry 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 (NL) 1 Requirement values: V_{tmax} = 2,45 V_{eff}.

4.4.1 (E) 1 (Requirement to be applied instead of section 4.4.1).

PROVISION 1: The following provisions 2 and 3 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 V_{tmax} =1,1 V for code signals;
V_{tmax} =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 (CH) 1 The present requirement also applies during MFPB (DTMF) dialling.

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_t 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 µs and a detection bandwidth from 200 Hz to 4 000 Hz at least.

Table A.4.4.1: Maximum transmission levels

COUNTRY	TEST VALUES V_f (V)	R_f (Ω)	I_f (mA)	Remarks
Austria	60		19, 60	
Belgium	48	400, 1 600		
Bulgaria	60	1 000, 2 200		
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	
Hungary	48		20, I_{max}	
Iceland	48		14, I_{max}	
Ireland			100	
Italy	44, 48, 52	1 880, 720		
Luxembourg	60		14, 60	
Malta				
Netherlands	48	1 130		yes
Norway	60	460		yes
Portugal	55	300	not applicable	
Spain	48	500, 1 100, 1 700		yes
Sweden				yes
Switzerland	50	2 300, 500		yes
U. Kingdom	50	400 min.	25 - 100	yes

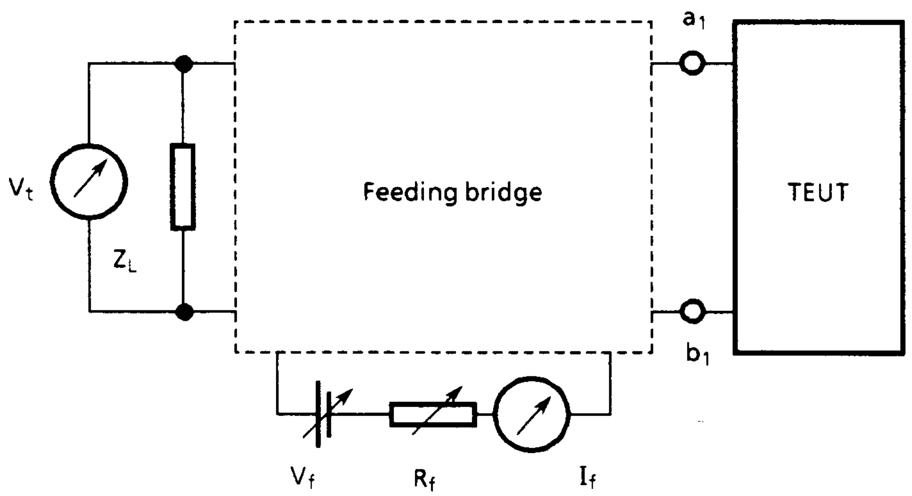


Figure A.4.4.1: Maximum transmission levels Feeding bridge as specified in Chapter 1

A.4.4.1 (DK) 1 The principle of test is shown in figure A.4.4.1 (DK) 1.

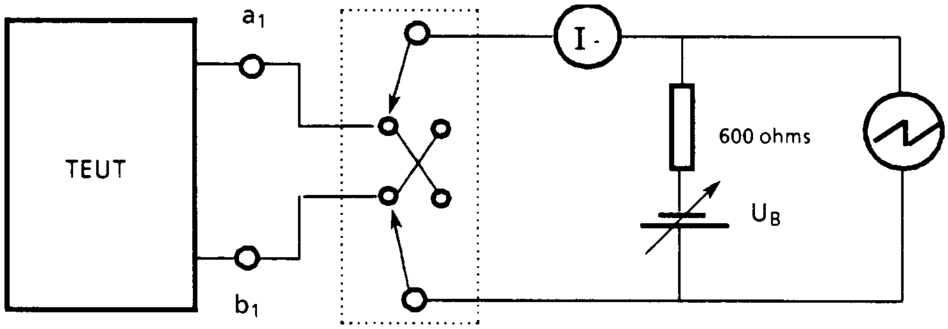
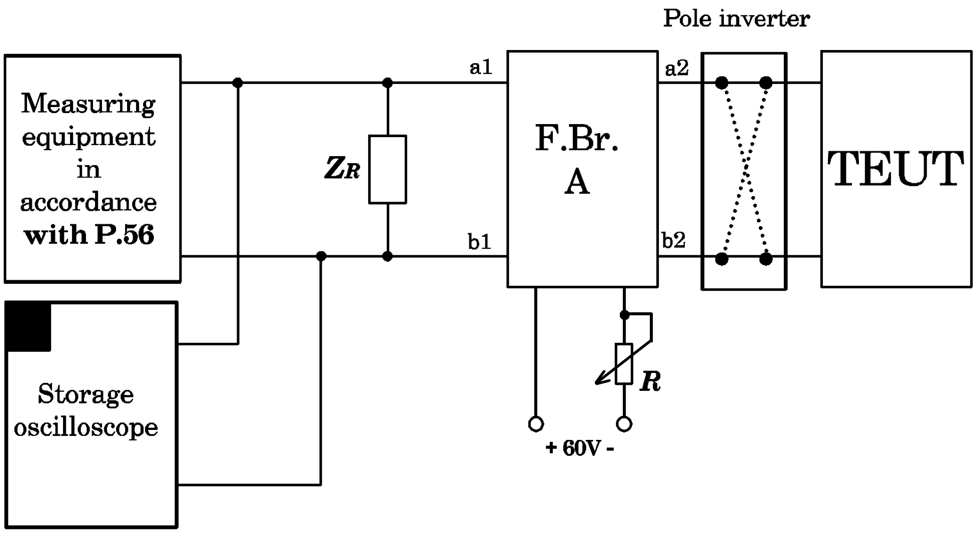


Figure A.4.4.1 (DK) 1

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 (D) 1 Measurement of the sending level in the communication state

The measuring circuit illustrated in figure A.4.4.1 (D) 1 is used for the measurement of the sending level in the communication state.



$R = 0\ \Omega$ and $1\,200\ \Omega$

Figure A.4.4.1 (D) 1

In the measurement of the sending level, a distinction is made between the mean long-term level and the maximum sending level. The mean long-term level is measured using measuring equipment in accordance with CCITT Recommendation P.56, Method B, and the (differential mode) peak level determined using a storage oscilloscope.

The measurement is carried out for all possible wanted signals of the terminal equipment (TEUT) with the terminal equipment in the communication state.

Both the monitoring of the maximum sending level and the measurement of the mean long-term level are carried out for each polarity of the terminal equipment (TEUT) and at R of $0\ \Omega$ and $1\,200\ \Omega$. In both cases the terminal equipment (TEUT) is terminated with Z_R.

The maximum sending level is monitored by means of a storage oscilloscope.

Two different limits shall be observed. The voltage level V_{pk} = 3,8 V equivalent to +3 dB (950 mV) may be exceeded for a period of $t \leq$ 10 ms. A voltage level of V_{pk} = 7,6 V equivalent to +9 dB (950 mV) shall not be exceeded under any circumstances. The mean long-term level is measured using measuring equipment in accordance with CCITT Recommendation P.56, Method B. Only the displayed long-term level value is analyzed.

The measurement period for the measurement of the mean long-term level shall be selected according to the type of wanted signal and shall be specified. The minimum measurement period should, however, be at least 10 seconds, even in the case of wanted signals with near-constant levels. In the case of the emission of recorded speech or speech-like wanted signals with largely fluctuating sending levels, the measurement period should be extended accordingly.

Measurement of the maximum value in the sending direction

The measuring circuit illustrated in figure A.4.4.1 (D) 2 is used for the measurement.

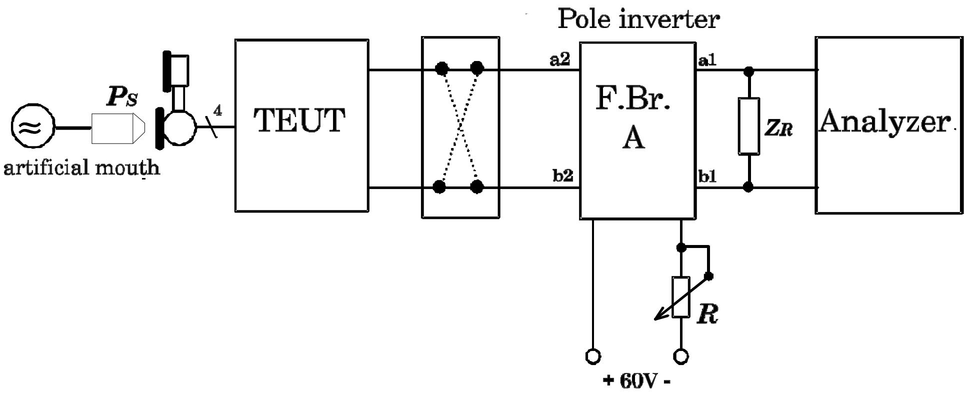


Figure A.4.4.1 (D) 2

- Terminal equipment with handset

The measurement and calculation of the SLR is carried out in accordance with CCITT Recommendations P.64, P.65, P.79, with the handset mounted at the artificial ear and mouth at the LRGP.

p_S = -4,7dB(Pa) ; R = 0 Ω

The maximum emitted sending level is recorded using a level meter.

The TEUT is positioned as for the SLR measurement.

p_S = +15dB(Pa) ; R = 0 Ω ; f = 1 000 Hz

- Terminal equipment without handset

The measurement and calculation of the SLR is carried out in accordance with CCITT Recommendations P.64, P.65, P.79, with the TEUT positioned in accordance with CCITT P.34 (Blue Book), Figure 3.

p_S = -4,7dB(Pa) ; R = 0 Ω

The maximum emitted sending level is recorded with a level meter.

The TEUT is positioned as for the SLR measurement.

p_S= +15dB(Pa) ; R = 0 Ω ; f = 1 000 Hz

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

A.4.4.1 (NL) 1 The maximum level is measured with an instrument according IEC 651 (Level meters), type O (laboratory reference), averaging time F. The highest measured value is recorded.

A.4.4.1 (N) 1 For terminal equipment where signals are generated acoustically (i.e. telephone sets) the measuring arrangement shall be according to ITU-T Recommendations P.64 and P.34 respectively. The sound pressure shall be adjusted to a sine signal of 15 dBPa and a frequency of 1 000 Hz at the Mouth Reference Point (MRP).
When recording test signals, in terminal equipment sending stored information, the distance between the sound source and the equipment shall, if nothing else is specified in the user manual, be the same as when measuring loudspeaking telephone sets.

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 dBSPL (at the mouth reference point) with the handset over the artificial head, or 80 dBSPL (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 (CH) 1 The measurement is conducted for voice terminals and Through Connecting Equipment (TCE, e.g. PABX) with a 1 s and 1 kHz sine.

The following test levels are to be used:

for TCE:

+1 dBVEMF if the test signal is supplied to the PSTN-NCP (connection point) by the PSTN (multi-line TE);

+8 dBVEMF if the test signal is supplied to an analogue branch interface by a downstream TE;

+1 dBm0 if the test signal is supplied by

an ISDN interface or by;
a 0 dBr point as per I-ETS 300 003, section 4.2.1.

for voice TE:

+15 dBPa at the MRP (Mouth Reference Point) used for the acoustic measurements.

NOTE 1: If it is not possible or sensible to feed in such a test signal (e.g. normal functioning is operated with other level ranges or the properties of the interface or signal differ considerably from those on a standardized interface), the manufacturer must guarantee that this requirement will be observed.

NOTE 2: The requirement is also deemed as met if I-ETS 300 004 is met.

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 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 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 (ΔV_f, ΔR_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	-10,0	-9,0	-9,0	600	19 - 60	60		
Belgium	-6	-6	-6	600	20 - $I_{max.}$	48		yes
Bulgaria	-10	-10	-10	600		60	1 000 - 2 200	yes
Cyprus	-10	-10	-10	600		48	440 - 1 740	
Denmark	-10	-10	-10	600	8 - $I_{max.}$			
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		
Hungary	-6	0	0	600	20 - $I_{max.}$	48		
Iceland	-10	-10	-10	600	14 - $I_{max.}$	48		
Ireland	-10	-10		600	20 - 100	48		
Italy	-3	-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	yes
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	-10	9	-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 (BG) 1 Not applicable to live speech to which telephonometry requirements apply.

4.4.2 (F) 1 Not applicable to live speech TE to which telephonometry requirements apply.

4.4.2 (D) 1 See section 4.4.1 (D) 1.

4.4.2 (I) 1 This requirement does not apply to telephone set.

4.4.2 (NL) 1 Not applicable to live speech TE to which telephony requirements apply.

4.4.2 (N) 1 No level adjustment to be user accessible.

4.4.2.1 (B) 1 For digital PBX capable to transmit recorded, synthetic or line, speech or music, the value of Z_L is equal to Z_C as defined in section 4.1.2 (B) 1.

4.4.2.1 (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 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) 2 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 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		
Bulgaria	60	1 000, 2 200		
Cyprus	48	800		
Denmark			35	yes
Finland	48	800, 1 710		
France	46, 54	1 400 resp. 300		
Germany				
Greece	60		20, 35, 55	
Hungary	48		20, I_{max}	
Iceland	48		14, I_{max}	
Ireland	48	5000	100	
Italy	44, 52	1 880, 720		yes
Luxembourg	60		14, 60	
Malta				
Netherlands	48	1 130		
Norway	60	460		yes
Portugal	55	300	not applicable	
Spain	48	500, 1 700		yes
Sweden				yes
Switzerland	50	2 300, 500		
U. Kingdom	50	400 min.	25 - 100	yes

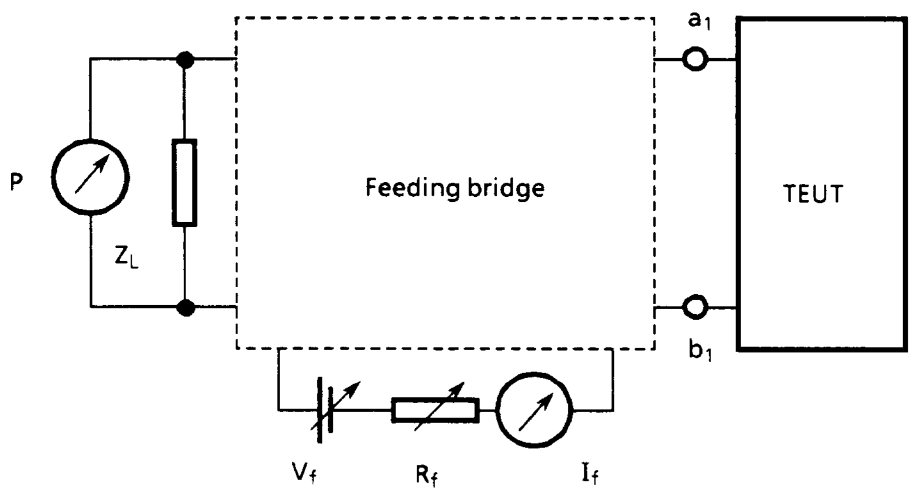


Figure A.4.4.2: Speech band power levels of signals sent to line
Feeding bridge as specified in Chapter 1

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 Any possibility to adjust the level outside the specified levels, shall either be blocked or the description shall be removed from the user manual. This shall be verified by testing and control of the equipment and the user manual.

A.4.4.2 (N) 2 During testing or recorded signals, the sound levels at the Mouth Reference Point shall be -4,7 dBPa. The transmission level shall be measured as an average of active conversation over a period of 10 s.
The line shall be replaced by a resistance of 600 ohms during the measurement. Any recording possibilities of voice signals from the telephone line shall be simulated by recording a signal of -10 dBm. The signal level is the average value of active conversation during a period of 10 s.

A.4.4.2 (S) 1 Feeding conditions see Chapter 1, table 1.5.2.

A.4.4.2 (CH) 1 The measurement is also to be conducted for voice terminals and Through Connecting Equipment (TCE, e.g. PABX).

The following test levels are to be used:

for TCE:

-19 dBVEMF if the test signal is supplied to the PSTN-NCP (connection point) by the PSTN (multi-line TE);

-12 dBVEMF if the test signal is supplied to an analogue branch interface by a downstream TE;

-19 dBm0 if the test signal is supplied by

an ISDN interface or by;
a 0 dBr point as per I-ETS 300 003, section 4.2.1.

for voice TE:

-15 dBPa at the MRP (Mouth Reference Point) used for the acoustic measurements.

NOTE 1: If it is not possible or sensible to feed in such a test signal (e.g. normal functioning is operated with other level ranges or the properties of the interface or signal differ considerably from those on a standardised interface), the manufacturer must guarantee that this requirement will be observed.

NOTE 2: The requirement is also deemed as met if I-ETS 300 004 is met.

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 dBSPL (at the mouth reference point) with the handset mounted on the artificial head, or 75 dBSPL (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 detection bandwidths indicated with a reading accuracy of ± 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, where the resistor (R_f) takes only the values of 500 ohms and 1 700 ohms, and it is not explicitly necessary to use both polarities.

The load resistor (R_L) takes the values stipulated in the requirement in section 4.4.2.1 (E) 1.

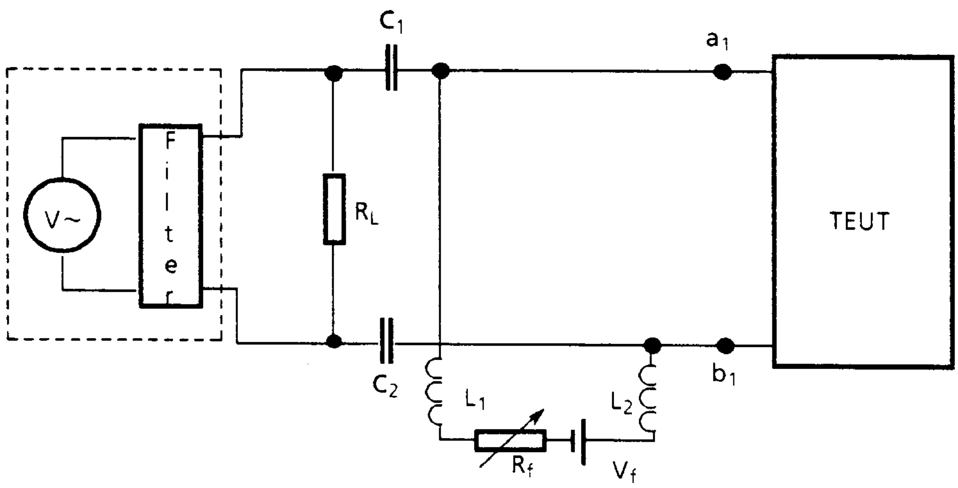


Figure A.4.4.2.1 (E) 1: Levels of recorded, synthetic or live, speech or music

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 (ΔR_f,ΔV_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 (A) 1 $P_{d1} = P_{d2}$ = -6,0 dBm for code signals.

4.4.2.2 (A) 2 TEs with acoustic coupling:

TE which are designed for electro-acoustic coupling to a telephone handset shall have a sound pressure level which produces a transmission power level at the PSTN connection point not higher than -9,0 dBm. The measurement is carried out in conjunction with a normal telephone set with nominal acoustic values.

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 section 4.4.1 (D) 1.

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 in the range of (-3 ± 0,5) dBm up to (-15 ± 1) dBm. If the level is adjustable, it shall be in step ≤ 2 dB.

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 power 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 conexion 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 ± 25 Hz;

5b) 2 500 Hz ± 25 Hz;

5c) 2 600 Hz ± 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 ± 25 Hz;

6a.ii) 2 280 Hz ± 25 Hz;

6a.iii) 2 400 Hz ± 50 Hz;

6a.iv) 2 500 Hz ± 25 Hz;

6a.v) 2 600 Hz ± 25 Hz;

or

6b) the energy density in the 1 800 Hz ± 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 in the frequency range 200 Hz to 3 800 Hz 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 a setting at which the mean power level is equal to or less than -13 dBm.

c) For terminal equipment where the power level is adjustable and is capable of generating power levels greater than -13 dBm, when this is set to an indicated output power level that is greater than -13 dBm, the one minute mean power level shall not exceed the indicated level.

d) For terminal equipment where the power level is adjustable, the means of adjustment shall meet one of the following requirements:

Adjustable power level terminal equipment in adjustment classes (1) to (3) are those classes of TE in which the means of adjustment shall not be available to the user.

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.

Adjustable power level terminal equipment in class (4) is that category of TE in which the means of adjustment shall be available to the user.

For terminal equipment that is capable of generating power levels greater than -13 dBm, the method of setting the power level and the means of indicating a setting shall be given in the Instructions for Use.

Adjustment class (4) is available only for non-speech TE.

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.

e) The total power level in a 10 Hz bandwidth contained wholly within the frequency range 30 Hz to 4 000 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.

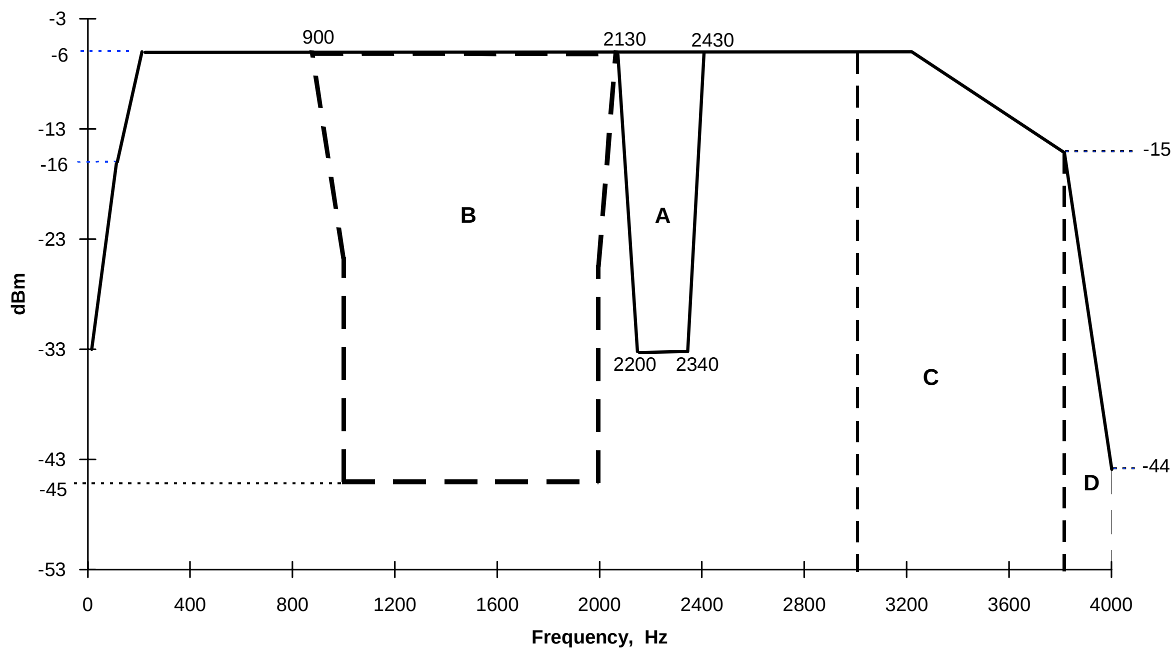
Where there is no signal in area B, the total power in the frequency range 2 220 Hz to 2 340 Hz shall not be greater than -33 dBm.

Table 4.4.2.2 (GB) 1: Co-ordinates of limit curves for power level in a 10 Hz bandwidth

Limit curve	Frequency (Hz)	Power level in a 10 Hz bandwidth (dBm)	Limit curve	Frequency (Hz)	Power level in a 10 Hz bandwidth (dBm)
Upper limit (note 1)	30 100 200 3 000	-33 -16 -6 -6	Upper limit continued	3 200 3 800 4 000	-6 -15 -44
Area A	2 130 2 200 2 340 2 430 2 130	-6 -33 -33 -6 -6	Area C (note 2)	3 000 3 200 3 800 3 800 3 000 3 000	-6 -6 -15 -60 -60 -6
Area B	900 1 000 1 000 2 000 2 000 2 130 900	-6 -23 -45 -45 -23 -6 -6	Area D (note 1)	3 800 3 800 4 000 4 000 3 800	-15 -60 -60 -44 -15

NOTE 1: Signals transmitted at allowable levels in Area C may be relatively highly attenuated in the network and may therefore not be effectively received by the terminal at the destination. In particular it will generally be the case that no significant signal will be received in Area D.

NOTE 2: The curve is shown in figure 4.4.2.2 (GB) 1. It is recommended that suppression of signals to less than -33 dBm should continue below 30 Hz.



NOTE: See Figure 4.4.3.1 (GB) 1 for values over 4 000 Hz.

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 1: 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.

PROVISION 2: It is assumed that the TEUT would fulfil, when necessary, the provisions 5 and 6 in the associated requirement in section 4.4.2.2 (E) 1, if the procedure of test were followed.

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 Recommendation: 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 to be used. This recommendation 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

$$\left(\frac{1}{60}\right) \int_{t=Tn}^{t=Tn+60} (V^2)\, dt$$

where t and Tn 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 3 800 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 3 995 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		-37...-70	-70	600	48		20 - $I_{max.}$	yes
Bulgaria		-37...-70	-70	600	60	1 000 - 2 200		yes
Cyprus	-33	-37	-70	600	48	40 - 1 740		yes
Denmark	-33	-37...-60	-60	600			8 - $I_{max.}$	yes
Finland				600				yes
France				600	46 - 54	300 - 1 400		yes
Germany								yes
Greece	-33...-37	-37...-70	-70					yes
Hungary	-33	-37...-70	-70	600	48		20 - $I_{max.}$	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				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				120	43 - 57	600 - 2 200		yes
U. Kingdom			-60...-70	600	50	400 min.	25 - 100	yes

4.4.3.1 (A) 1 The transmission frequency response shall drop 6 dB/octave above 4 300 Hz beginning with -37 dB.

4.4.3.1 (A) 2 Δf_2 4 300 Hz $\leq f_2 \leq$ 193 kHz;

Δf_3 193 kHz $\leq f_3 \leq$ 2 MHz.

4.4.3.1 (A) 3 The power level is measured with a bandwidth of 100 Hz.

4.4.3.1 (B) 1 In the frequency band 3 400 Hz - 4 300 Hz: -12 dBm.

In the frequency band 4 000 Hz - 4 300 Hz: -33 dBm

In the frequency band 4 300 Hz - 28 000 Hz: -37 dBm at 4 300 Hz, then falling at 12 dB per octave to 28 kHz.

In the frequency band 28 kHz - 150 kHz: -70 dBm.

4.4.3.1 (B) 2 For digital PBX, the value of Z_L is equal to Z_C as defined in section 4.1.2 (B) 1.

4.4.3.1 (BG) 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 ≤ 125 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...150 kHz: -70 dBm;
- in the quiescent condition (4,3 kHz...200 kHz): -72 dBm.

During this test, the microphone shall be disconnected.

4.4.3.1 (CY) 1 In the frequency band 4,3 kHz to 28 kHz falling at 12 dB per octave.

4.4.3.1 (DK) 1 From -37 dBm at 4,3 kHz the limit drops 12 dB/octave to -60 dBm at 16,2 kHz. It says at -60 dBm to 150 kHz.

4.4.3.1 (SF) 1 The transmission frequency response shall drop at least 12 dB/octave from 3 400 Hz to 12 kHz beginning from -33 dBm. On frequencies from 12 kHz to 100 kHz the transmission level shall not be higher than -55 dBm.

4.4.3.1 (F) 1 Applicable in loop condition only, with the limits below:

3,4 kHz	: -6 dBm
3,4 kHz - 6,8 kHz	: -6 dBm per octave
6,8 kHz - 64 kHz	: -15 dB per octave
64 kHz - 150 kHz	: -60 dBm

4.4.3.1 (F) 2 Not applicable to live speech TE.

4.4.3.1 (D) 1 **Unwanted single-frequency components**

The level of any unwanted single-frequency components produced by the terminal equipment with and without the wanted signal and sent to the NTA at the centre frequencies relative to a bandwidth b = 80 Hz

Table 4.4.3.1 (D) 1

50 Hz ≤ f ≤ 250 Hz	-40 dB(950 mV)
4.6 kHz ≤ f ≤ 100 kHz	-43 dB(950 mV)
100 kHz < f ≤ 200 kHz	-55 dB(950 mV)

shall not exceed the values given in table 4.4.3.1 (D) 1. Speech in the form of real-time wanted signals or reproduced signals at the NTA shall not be taken into account.

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 (H) 1 In the frequency band 4 300 Hz - 28 000 Hz:

at 4 300 Hz - 37 dBm, then between 4 300 Hz and 28 000 Hz is falling at a rate of 12 dB/octave.

4.4.3.1 (I) 1 In the frequency band 3 400 Hz - 4 300 Hz:
-33 dBm

In the frequency band 4 300 Hz - 28 000 Hz:
-37 dBm at 4 300 Hz, then falling at 12 dB per octave to 28 kHz

In the frequency band 28 kHz - 150 kHz:
-70 dBm.

This requirement does not apply to live speech TE.

4.4.3.1 (NL) 1 Not applicable to live speech TE to which telephony requirements apply.

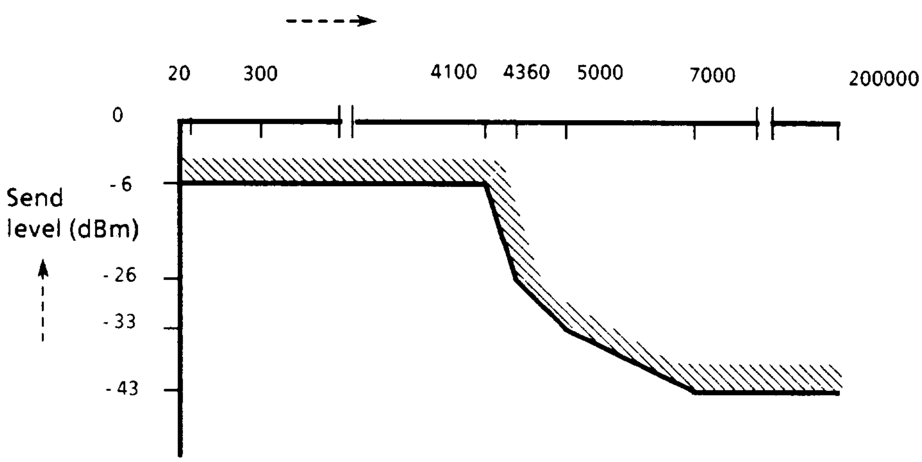


Figure 4.4.3.1 (NL) 1

4.4.3.1 (N) 1 The power level of any individual frequency components during sending and DTMF-signalling shall not exceed:

-33 dBm for frequencies between 3,9 kHz and 4,3 kHz;
-37 dBm at 4,3 kHz falling 12 dB/octave to 16 kHz;
-60 dBm in the frequencies between 16 kHz and 100 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(dBm) = -37 for 4,3 kHz, decreasing by 12 dB/octave in the frequency range 4,3 kHz $\leq f_2 <$ 16 kHz.

a_2(dBm) = -60 in the frequency range 16 kHz $\leq f_2 <$ 28 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 130 milliseconds (±5 ms) 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.

PROVISION 3: This requirement shall, however, not be applied to ac signals originated exclusively from live speech.

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 100 milliseconds (±5 ms) 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 1: See the provisions 2 and 3 in section 4.4.2.1 (E) 1.

PROVISION 2: See the provision 3 in section 4.4.3.1 (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

Power level limit	Frequency range
-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 40 milliseconds (±2 ms) 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	$3{,}4 < f \leq 4$	300 Hz	300
-33	$4 < f \leq 8$	1 kHz	300
$3{,}7 - 40{,}6 * \log_{10} fc$	$8 < f \leq 28$	4 kHz	300
-55	$28 < f < 200$	4 kHz	300

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 8 milliseconds (± 1 ms) 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.

PROVISION 3: See the provision 3 in section 4.4.3.1 (E) 1.

Compliance shall be checked using the tests outlined in section A.4.4.3 (E) 4.

4.4.3.1 (S) 1 These requirements also apply to series-connected and parallel connected TEs in quiescent condition.

Individual frequency components in the 3,4 kHz - 150 kHz band shall not exceed the values shown on the curve in figure 4.4.3.1 (S) 1.

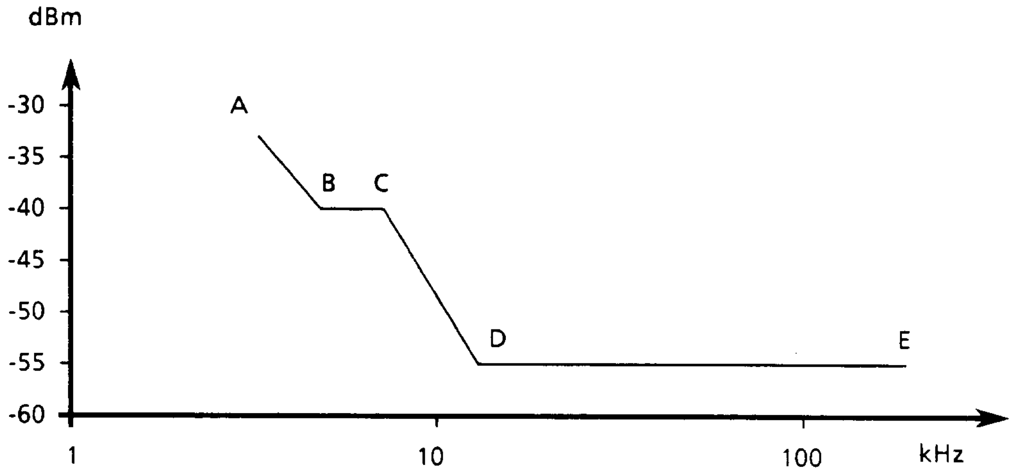


Figure 4.4.3.1 (S) 1

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.

4.4.3.1 (S) 2 Feeding conditions see Swedish remark Chapter 1, section 1.5.2.

4.4.3.1 (CH) 1 The present requirement is also to be applied during the dialling phase.

The upper limits (measured with a 120 Ω load in dBm) are given by the straight lines (logarithmic frequency scale) defined by the following points:

Point designation,	Frequency (kHz),	Max. sending power (dBm),	Bandwidth (kHz)
G,	4.3,	-29,	0,3
H,	5,	-36,	0,3
I,	7,	-46,	0,3
J,	7,	-41,	1
K,	200,	-41,	1
L,	200,	-45,	10
M,	2 000,	-45,	10

Exceptionally during MFPB/ DTMF signals (dialling or end-to-end transmission) the level of single frequency components may exceed the above limits if the result does not exceed -35 dBm per component.

During pulse dialling, the Quasi Peak (CISPR) measurement results may be 10 dB above the limits. This is a provisional measure until an internationally harmonised requirement will apply to this type of signalling.

For TE with DC through-connection (series-connected) the requirements are tested with a load resistor RL = 300 Ω.

This requirement is based on prTBR 15 (June 95 or later) section 4.2.3.

4.4.3.1 (GB) 1 The total power level in any 3 kHz bandwidth wholly above 4,0 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 +/-(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 (See note).

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.

NOTE: The tolerance above is equal to +/- 50 parts per million.

Table 4.4.3.1 (GB) 1: Co-ordinates of power level limit curve

Centre frequency (kHz)	3 kHz Power level (dBm)
5,5	-40
8,9	-40
50	-70
1000	-70
2000	-58
4000	-46
7998,5	-34
NOTE: The curve is shown in figure 4.4.3.1 (GB) 1. It is recommended that suppression of signals to less than -34 dBm continue above 8 MHz.	

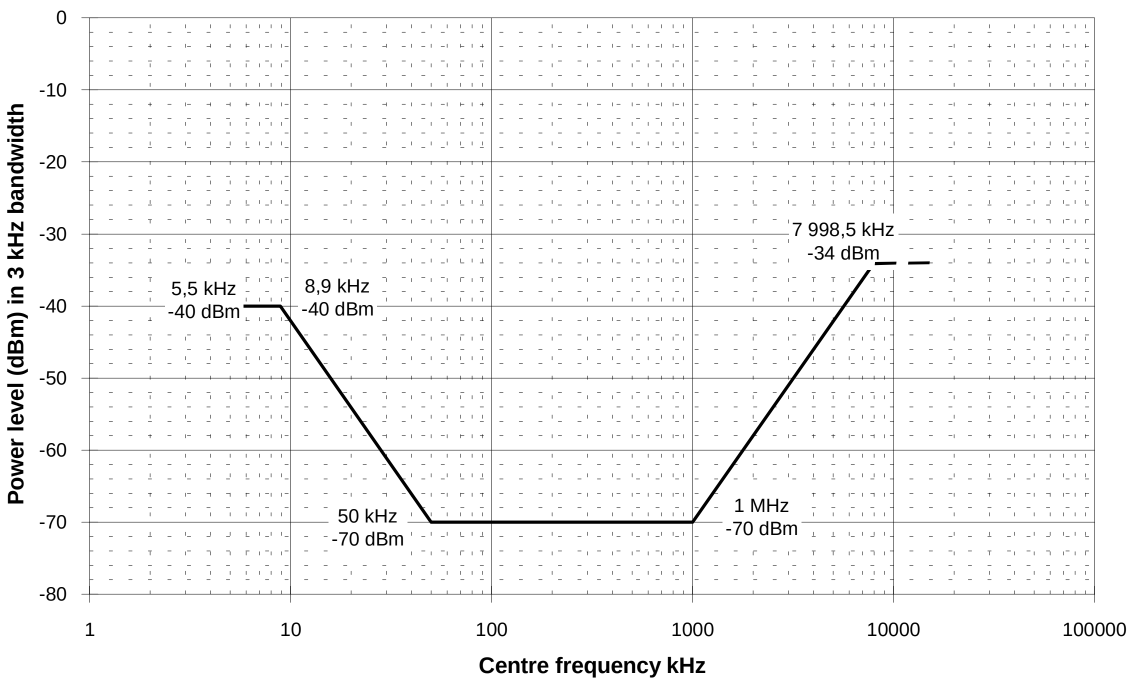


Figure 4.4.3.1 (GB) 1: Power level limit of the output power from the TE

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		-37 ... -70	-70	600	48		20 - $I_{max.}$	yes
Bulgaria		-37...-70	-70	600	60	1 000 - 2 200		yes
Cyprus	-33	-37	-70	600	48	440 - 1 740		yes
Denmark	-33	-37...-60	-60	600			8 - $I_{max.}$	yes
Finland				600				yes
France				600	46 - 54	300 - 1 400		yes
Germany								
Greece	-33...-37	-37...-70	-70	600	0 - 60		20 - 80	yes
Hungary	-33	-37...-70	-70	600	48		20 - $I_{max.}$	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				600	60	460 - 3 100		yes
Portugal	-33		-60	600	45 - 55	300 - 1 800	N/A	yes
Spain								yes
Sweden				600				yes
Switzerland	Section 4.4.3.1 applies							
U. Kingdom	-60...-70				50	400 min.	25 - 100	yes

4.4.3.2 (A) 1 The transmission frequency response shall drop 6 dB/octave above 4 300 Hz beginning from -37 dB.

4.4.3.2 (A) 2 Δf_2 4 300 Hz $\leq f_2 \leq$ 193 kHz;

Δf_3 193 kHz $\leq f_3 \leq$ 2 MHz.

4.4.3.2 (A) 3 The power level is measured with a bandwidth of 100 Hz.

4.4.3.2 (B) 1 In the frequency band 3 400 Hz - 4 300 Hz: -12 dBm.

In the frequency band 4 000 Hz - 4 300 Hz: -33 dBm

In the frequency band 4 300 Hz - 28 000 Hz: -37 dBm at 4 300 Hz, then falling at 12 dB per octave to 28 kHz.

In the frequency band 28 kHz - 150 kHz: -70 dBm.

4.4.3.2 (B) 2 For digital PBX capable to transmit data or code signal, the value of Z_L is equal to Z_C, as defined in section 4.1.2 (B) 1.

4.4.3.2 (BG) 1 The Bulgarian remark in section 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 kHz to 28 kHz falling at 12 dB per octave.

4.4.3.2 (DK) 1 The frequency range Δf_1 in table 4.4.3.2.a is:

3 800 Hz $\leq f_1 <$ 4 300 Hz.
From -37 dBm at 4,3 kHz the limit drops 12 dB/octave to -60 dBm at 16,2 kHz. It stays at -60 dBm to 150 kHz.

TE designed for supplementary services may use frequencies above voice band and shall comply with Danish specifications.

4.4.3.2 (SF) 1 The transmission frequency response shall drop at least 12 dB/octave from 3 400 Hz to 12 kHz beginning from -33 dBm. On frequencies from 12 kHz to 100 kHz the transmission level shall not be higher than -55 dBm.

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;

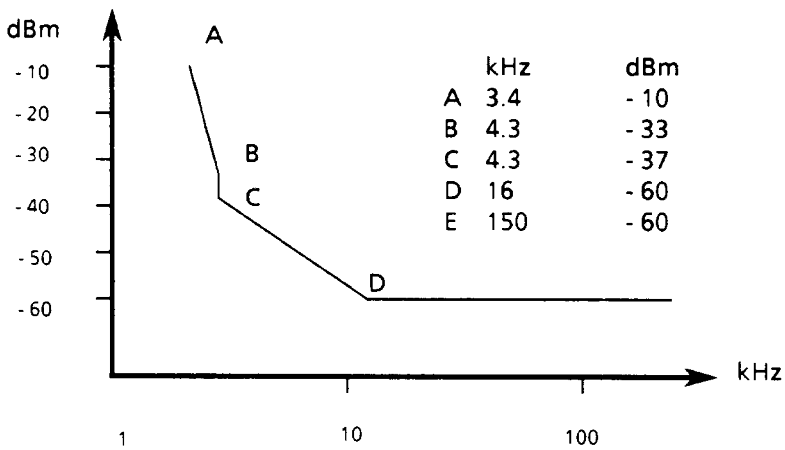


Figure 4.4.3.2 (F) 1.a: Code signals

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.

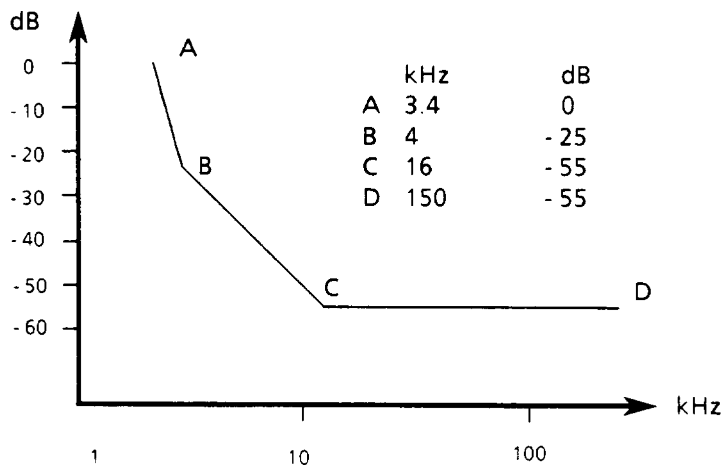


Figure 4.4.3.2 (F) 1.b: Data signals

4.4.3.2 (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 (H) 1 In the frequency band 4 300 Hz - 28 000 Hz:

at 4 300 Hz -37 dBm, then between 4 300 Hz and 28 000 Hz is falling at a rate of 12 dB/octave.

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 B and shall be within the following limits:

Frequency range (Hz)	**Maximum level (dBm)**	**B (Hz)**
20 - 250	-30	**30**
3 750 - 4 000	-30	30
4 000 - 12 000	-35	100
12 000 - 163 k	-55	100
163 k - 358 k	-65	100

4.4.3.2 (NL) 1

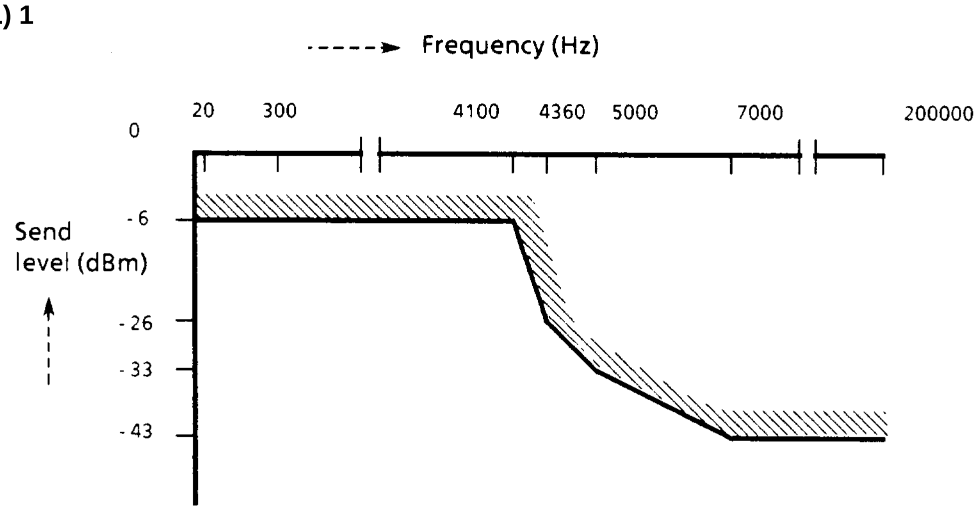


Figure 4.4.3.2 (NL) 1

4.4.3.2 (N) 1 The power level of any individual frequency components during sending and DTMF-signalling shall not exceed:

-33 dBm for frequencies between 3,9 kHz and 4,3 kHz;
-37 dBm at 4,3 kHz falling 12 dB/octave to 16 kHz;
-60 dBm in the frequencies between 16 kHz and 100 kHz.

4.4.3.2 (P) 1 a_5(dBm) = -37 for 4,3 kHz, decreasing by 12 dB/octave in the frequency range

4,3 kHz $\leq f_2 <$ 16 kHz

a_5 (dBm) = -60, in the frequency range 16 kHz $\leq f_2 <$ 28 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 also apply to series-connected and parallel connected TEs in quiescent condition. They also include outband spectra intentionally sent to line

Individual frequency components in the 3,4 kHz - 150 kHz band shall not exceed the values shown on the curve in figure 4.4.3.2 (S) 1.

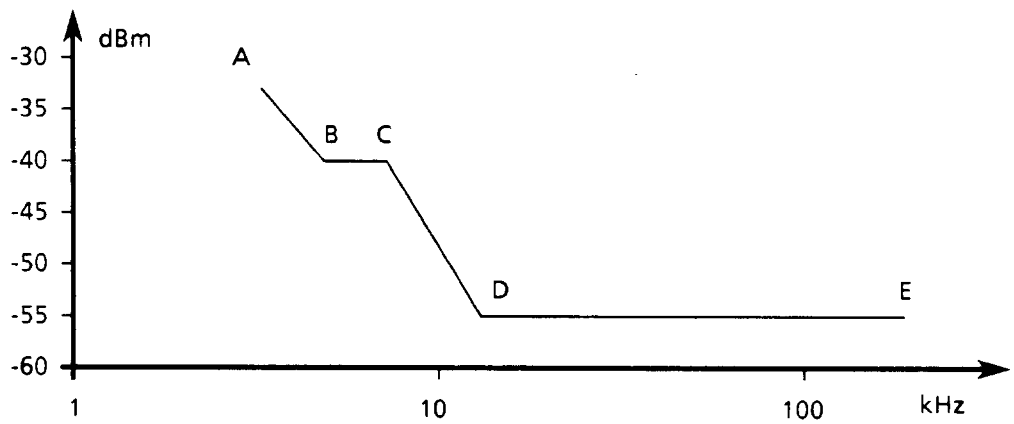


Figure 4.4.3.2 (S) 1

Table 4.4.3.2 (S) 1

Point	Frequency (kHz)	Level (dBm)
A	3,9	-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 (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 4,0 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 +/-(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 (see note).

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

Centre frequency (kHz)	3 kHz Power level (dBm)
5,5	-40
8,9	-40
50	-70
1000	-70
2000	-58
4000	-46
7998,5	-34
NOTE: The curve is shown in figure 4.4.3.1 (GB) 1. It is recommended that suppression of signals to less than -34 dBm continue above 8 MHz.	

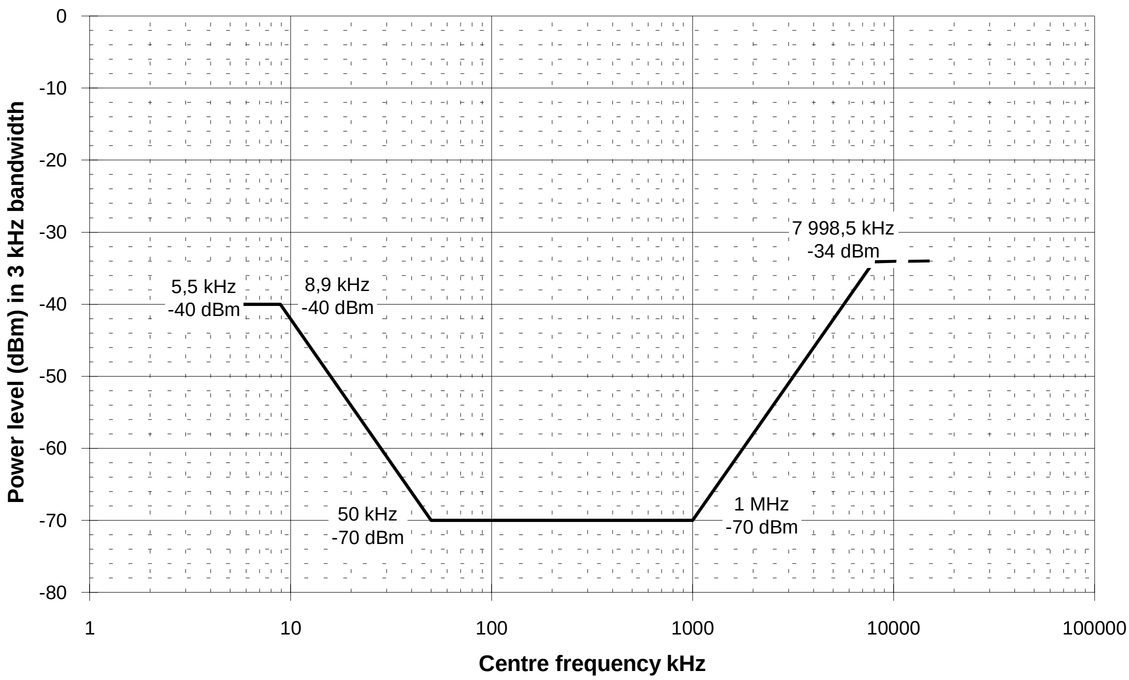


Figure 4.4.3.2 (GB) 1: Power level limit of the output power level from the TE

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		
Bulgaria	60	1 000, 2 200		
Cyprus	48	800		
Denmark			35	yes
Finland	48	800, 1 710		
France	46, 54	1 400, 300		
Germany				yes
Greece	60		20, 35, 55	
Hungary	48		20, $I_{max.}$	
Iceland	48		14, $I_{max.}$	
Ireland				
Italy	44, 52	1 880, 720		
Luxembourg	60		14, 60	
Malta				
Netherlands	48	1130		
Norway	60	460		
Portugal	55	300	not applicable	
Spain	48	500, 1 700		yes
Sweden				yes
Switzerland	50	2 300		yes
U. Kingdom	50	400 min.	25 - 100	yes

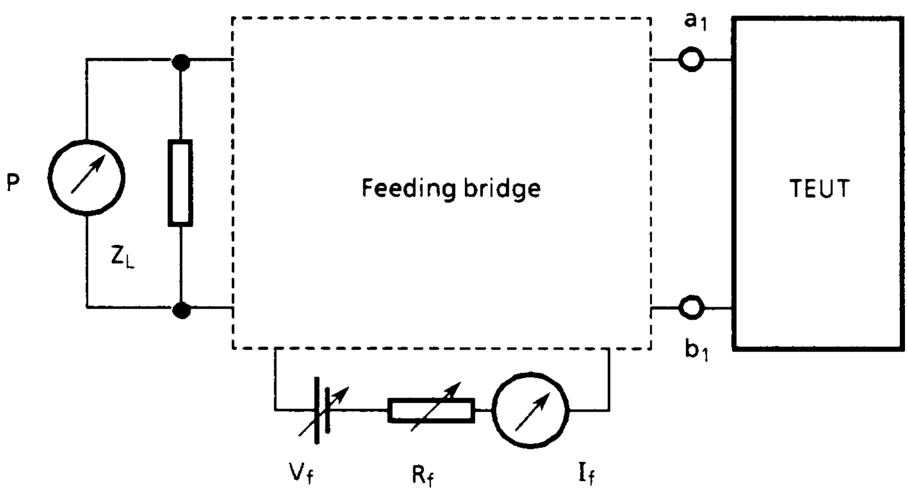


Figure A.4.4.3: Unwanted outband signal sent to line
Feeding bridge as specified in Chapter 1

A.4.4.3 (DK) 1 The test principle is shown in figure A.4.4.3 (DK) 1.

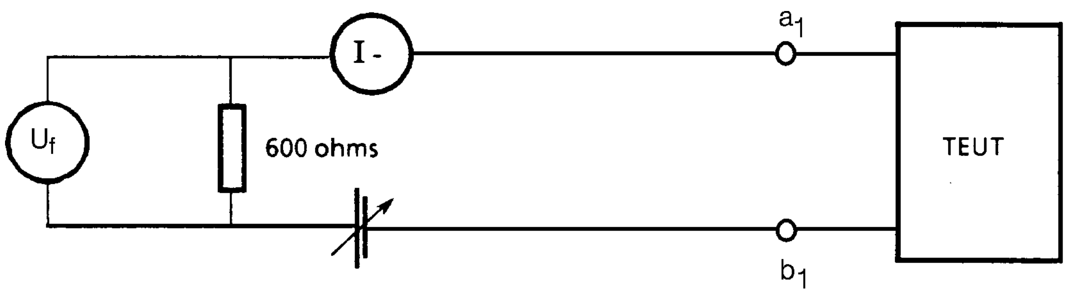


Figure A.4.4.3 (DK) 1

A.4.4.3 (D) 1 Measurement of unwanted single-frequency components

The measuring circuit illustrated in figure A.4.4.3 (D) 1 is used for the measurement.

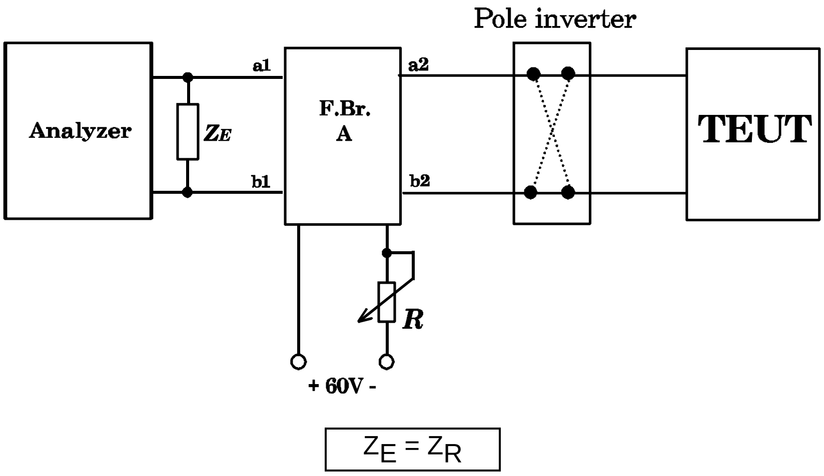


Figure A.4.4.3 (D) 1

The measurement of unwanted single-frequency components is carried out with the TEUT in the following operating states:

- quiescent state
- off-hook condition
- communication state
- MFPB (DTMF) dialling state

The analyzer used shall have the following technical characteristics:

Table A.4.4.3 (D) 1

Centre frequency range	50 Hz ≤ f ≤ 200 kHz
Bandwidth	b ≤ 80 Hz
Integration time	approx. 100 ms

The direct current is supplied to the TEUT in all cases via a feeding bridge (see section 1.5 (D) 1) with a set nominal voltage of 60 V and a preconnected resistance R of 0 Ω, 1 000 Ω, 1 460 Ω.

Measurements with bandwidths of less than 80 Hz are permitted. However, the sum level of all spurious components present within an 80 Hz window is to be used in all cases for the assessment of the interference spectrum. The specified measuring range limits apply to the mean value of the 80 Hz bandpass filter.

In the measurement of outband unwanted single-frequency components, the type of terminal equipment (TEUT), the possible operating procedures and the different types of wanted signal shall be taken into consideration.

Terminal equipment capable of transmitting speech to the NTA in the form of real-time wanted signals or reproduced signals is tested in the communication state without the wanted signal.

In the case of equipment requiring speech in order to initiate transmission (speech switch, etc.), a suitable signal shall be applied, e.g. a pulsed, band-limited noise signal within the range 700 Hz $\leq f \leq$ 1 kHz. The spectral components of this signal shall be 15 dB below the required values for the unwanted single-frequency components.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

A.4.4.3 (E) 1 All TE total outband output power level:

The procedure of test in section A.4.4.2.1 (E) 1 is followed.

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 may be used.

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 Chapter 1, table 1.5.2.

A.4.4.3 (CH) 1 The TE is measured with the maximum setting for sending levels. The tests are conducted in the phase (quiescent phase, dial tone recognition, busy or ringing tone recognition, dialling signal output and transmission phase) which causes the highest possible interference emission.

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 4,0 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 5,5 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 5,5 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 7,0 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.

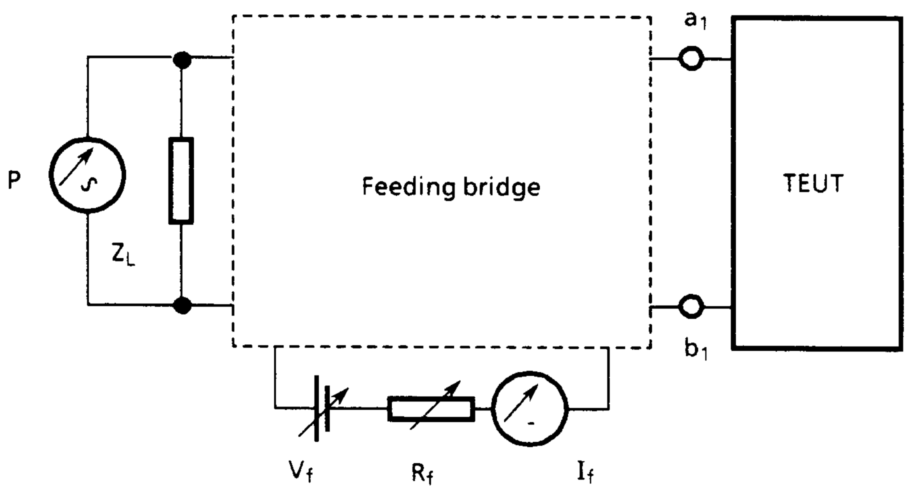


Figure A.4.5: Noise level Feeding bridge as specified in Chapter 1

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
Bulgaria	60	1 000, 2 200			yes
Cyprus	48	800			
Denmark			35		yes
Finland	not mandatory				
France	46, 54	1 400, 300			yes
Germany					
Greece	60		20, 35, 55		yes
Hungary	48		20, $I_{max.}$		
Iceland	48		14, $I_{max.}$		
Ireland	not mandatory				
Italy	48	1 100			yes
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	50	500, 2 300			yes
U. Kingdom	50	400 min.	25 - 100	3 000	yes

A.4.5 (B) 1 In quiescent condition, R_f = 400 Ω.

A.4.5 (BG) 1 For telephone sets, the tests carried out either by putting the microphone in a silent (< 40 dB(A)/20µPa) and anechoic area or by replacing the microphone with its equivalent resistance.

A.4.5 (DK) 1 The test principle is shown in figure A.4.5 (DK) 1.

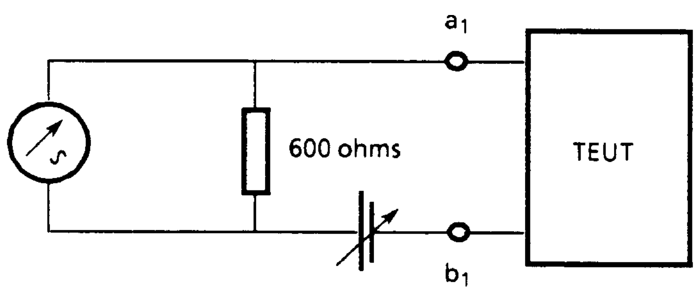


Figure A.4.5 (DK) 1

A.4.5 (F) 1 V_f = 48 V and R_f = 300 Ω in quiescent condition.

A.4.5 (F) 2 For telephone sets, the tests carried out either by putting the microphone in a silent (< 40 dB(A)/20µPa) 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 Hz and f_2 = 3 400 Hz, respectively.

A.4.5 (I) 1 For telephone sets, these tests shall be carried out in a quiet area (ambient noise ≤ 30 dB (A)). The ear piece will be coupled to an artificial ear according to IEC 318.

A.4.5 (I) 2 For automatic answering machine it is permitted ≤ -45 dBmp.

A.4.5 (S) 1 Feeding conditions, see Chapter 1, table 1.5.2.

A.4.5 (CH) 1 For TE with DC through-connection (series-connected) the requirements are tested with a load resistor RL = 300 Ω.

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		-65	600	19 - 60	60		
Belgium	-67	-67	600	20 - $I_{max.}$	48		yes
Bulgaria	-72	-72	600		60	1 000 - 2 200	
Cyprus	-64	-64	600		48	440 - 1 740	
Denmark							yes
Finland	not mandatory						
France	-64	-64	600		46 - 54	300 - 1 400	
Germany							
Greece	-64	-64	600	20 - 80	44 - 66		
Hungary	-64	-64	600	20 - $I_{max.}$	48		
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	-60	-60	600		42 - 66	800 - 2 140	yes
Norway	-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	-72	-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 Ω.

4.5.1 (B) 2 For digital PBX the value of Z_L is equal to Z_C as defined in section 4.1.2 (B) 1.

4.5.1 (DK) 1 For PABX the requirements are stated in the relevant Danish regulations.

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 The requirement is only mandatory during the quiescent condition and the voice telephony service. Therefore it is to be considered in the present document as mandatory for the quiescent condition and as a recommendation for the loop condition.

-54 dBmp during the quiescent condition applies as the limit for TE that cannot be installed in parallel.

For cordless telephones the limit value of -60 dBmp is tolerated during the voice telephony service.

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 only for one 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 µF.

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 only 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 ± 0,1% connected across terminals a_2 and b_2 of the TEUT.

A.4.5.1 (GB) 2 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 ± 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.

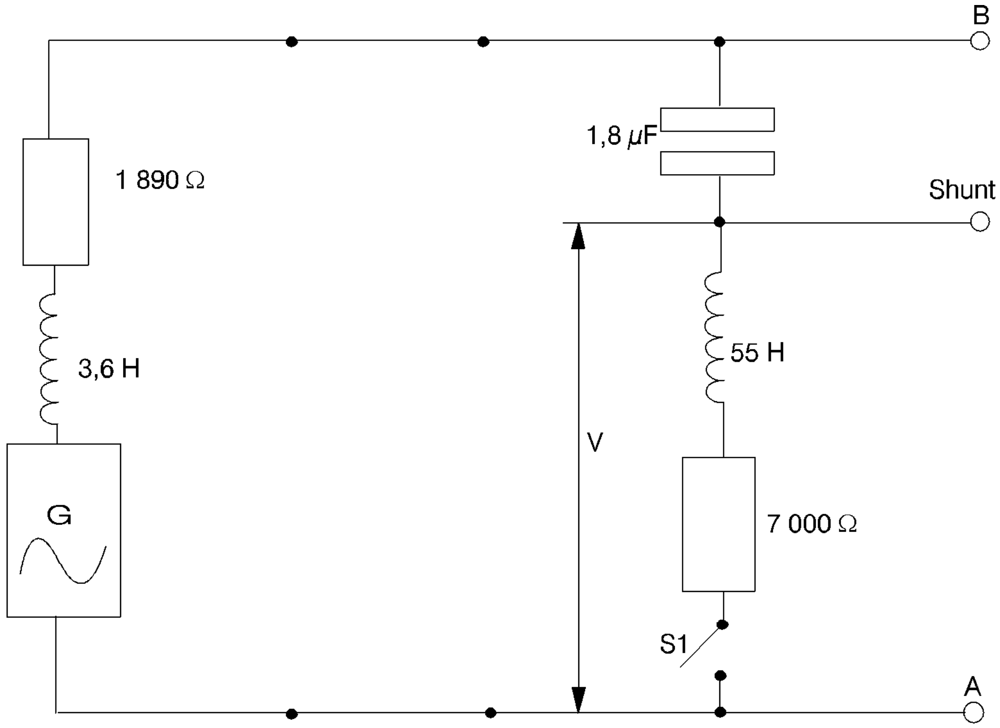


Figure A.4.5.1 (GB) 1: Unwanted signals test circuit

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} and 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				
Bulgaria				
Cyprus	not mandatory			
Denmark		-50		-50
Finland	not mandatory			
France				
Germany				
Greece	10	1	10	1
Hungary	not mandatory			
Iceland	not mandatory			
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands	not mandatory			
Norway	not mandatory			
Portugal	not mandatory	0,775	not mandatory	0,775
Spain				
Sweden	not mandatory			
Switzerland	not mandatory			
U. Kingdom	7,75 to 0,245		17,3 to 0,245	

Table 4.5.2 (continued): 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
Bulgaria	600				1 000, 2 200	60	yes
Cyprus	not mandatory						
Denmark	600		0,02 - 150	0 - $I_{max.}$			yes
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	
Hungary	not mandatory						
Iceland	not mandatory						
Ireland	not mandatory						
Italy	not mandatory						
Luxembourg	not mandatory						
Malta							
Netherlands	not mandatory						
Norway	not mandatory						
Portugal	600	not mandatory	3,4 - 150	N/A	300 - 1 800	45 - 55	
Spain					500 - 1 700	48	yes
Sweden							
Switzerland	not mandatory						
U. Kingdom	600	5,5 kHz- 89 kHz (quies.)	4,0- 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 (B) 2 For digital PBX the value of Z_L is equal to Z_C, as defined in section 4.1.2 (B) 1.

4.5.2 (BG) 1 The requirements of sections 4.4.3.1 and 4.4.3.2 shall be applied in this section.

4.5.2 (DK) 1 For PABX the requirements are stated in the relevant Danish regulations.

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 section 4.4.3.1 (D) 1.

4.5.2 (D) 2 **Unweighted outband noise**

The unweighted outband noise at the NTA produced by the terminal equipment within the frequency range 20 Hz $\leq f \leq$ 20 kHz shall be $V \leq$ 5,0 mV at 600 Ω.

Exception shall be made for the following (signal) components in the communication state:

- in general within the frequency range 300 Hz $\leq f \leq$ 3400 Hz;
- in the case of speech in the form of real-time wanted signals or reproduced speech which cannot be disabled within the frequency range 200 Hz $\leq f \leq$ 4600 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 130 milliseconds (± 5 ms) greater than -45 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 8 milliseconds (±1 ms) 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 (kHz)	Bandwidth	Load resistor (Ω)
-55	3,4 kHz < f ≤ 4 kHz	300 Hz	37,5
-55	4 kHz < f ≤ 8 kHz	1 kHz	37,5
-55	8 kHz < f ≤ 28 kHz	4 kHz	37,5
-55	28 kHz < f ≤ 200 kHz	4 kHz	37,5
-55	200 kHz < f ≤ 1 MHz	4 kHz	37,5

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 130 milliseconds (±5 ms) greater than -42 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 8 milliseconds (±1 ms) 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 (kHz)	Bandwidth	Load resistor (Ω)
-52	3,4 kHz < f ≤ 4 kHz	300 Hz	75
-52	4 kHz < f ≤ 8 kHz	1 kHz	75
-52	8 kHz < f ≤ 28 kHz	4 kHz	75
-52	28 kHz < f ≤ 200 kHz	4 kHz	75
-52	200 kHz < f ≤ 1 MHz	4 kHz	75

4.5.2 (GB) 1 The requirements for outband noise (unweighted) in any 3 kHz bandwidth above

1. 4,0 kHz with TE in the loop state;
2. 5,5 kHz with TE in the quiescent state;

are given in 4.4.3.1 (GB) 1.

A.4.5.2 Outband noise (Unweighted)

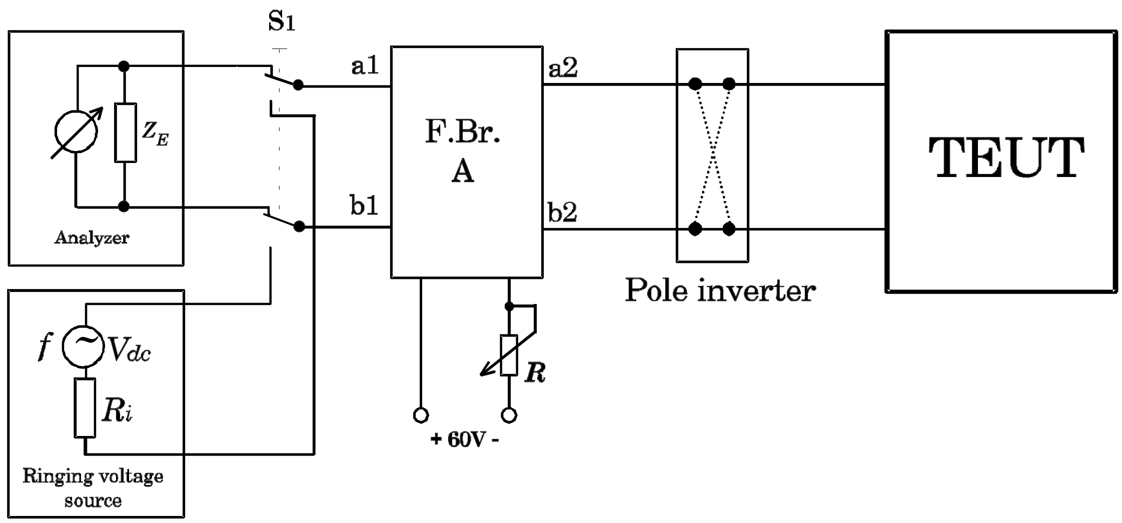
The test shall be carried out using a frequency selective instrument with a bandwidth of "f" Hz capable of measuring peak voltage levels within this bandwidth.

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 (D) 1 **Measurement of unweighted outband noise**

The measuring circuit illustrated in figure A.4.5.2 (D) 1 is used for the measurement.

The measuring impedance Z_E shall be non-reactive and have a value of 600 Ω, independent of the impedance of the TEUT.



Z_E = 600 Ω	V_{dc} = 32 V	f = 25 Hz	R_i = 140 Ω

Figure A.4.5.2 (D) 1

The measurement is carried out with the TEUT in all operating states.

In the ringing state, measurements are taken during the pauses only. In order to operate the terminal equipment (TEUT) under the normal operating conditions of the ringing state, the connection is effected via a feeding bridge with a nominal voltage of 60 V and a resistance R of 0 Ω, and with a ringing voltage source with V_{dc} = 32 V, f = 25 Hz and R_i = 140 Ω. The ringing current is applied via both contacts of S1 for 1s prior to the measurement. The duration of the measurement is 1s ≤ t ≤ 3s.

The unweighted outband noise produced by the TEUT is measured with a filter by the analyzer with the TEUT in the quiescent state, the off-hook condition and the ringing state. The frequency range from 300 Hz to 3 400 Hz is eliminated in the communication state by means of a suitable filter. In the case of TEUT with speech signals or speech-like signals, whose emission cannot be suppressed, the frequency range from 200 Hz to 4 600 Hz is eliminated. The maximum value of ≤ 5 mV for the outband noise applies in the communication state as in all other operating states.

Internal functions of the TEUT shall be performed in all operating states during the measurement, unless the equipment is caused to change its operating state.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

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 only be made when the resistor (R_f) takes the values of 500 ohms and 1 700 ohms.

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Chapter 5: Calling function

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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Contents

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, 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.

Transposition dates	
Date of adoption of this ETS:	31 March 1996
Date of latest announcement of this ETS (doa):	30 June 1996
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	31 December 1996
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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.

5.1 (D) 1 Dialling

Only signals of one of the dialling methods specified in section 5.3 (D) 1 and section 5.4 (D) 1 shall be sent during dialling.

After a manually initiated outgoing call, dialling shall generally be possible within a period of $t \leq 20$ s after application of the dial tone or special dial tone at the NTA, unless the transmission of dialling information is restricted by permitted functions (see Chapter 2, 2.2.2 (D) 1).

After an automatically initiated outgoing call, dialling shall generally commence automatically within a period of 2,5 s $\leq t \leq$ 10 s after the off-hook condition has been reached. Exception is made for terminal equipment with dial tone processing, which may commence dialling within a period of 200 ms $\leq t \leq$ 20 s after application of the dial tone.

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	490	-26	-16	600	600		60		19 - 60	yes
Belgium	415	460	-20	-3	600	600	0,85	48		20 - $I_{max.}$	yes
Bulgaria	380	470	-25	-5	600	600	0,80	60	1 000 - 2 200		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	375	475	-20	-14	600	600	4	48	800 - 1 710		
France	425	455	-27	-10	600	600	2	45 - 54	300 - 1 845		yes
Germany											
Greece	400	475		0	600	600	2	44 - 66		20 - 80	
Hungary	375	475	-25	-5	600	600	2	48		20 - $I_{max.}$	
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	340	550	-25,7	-3,8	600	600	> 1 < 2	42 - 66	800 - 2 140		yes
Norway	350	500	-30	-6	600	600	0,8	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					yes
Switzerland	375	475	-23	0	600	600	2	43 - 57	2 200 - 600		yes
U. Kingdom	not mandatory										

5.2.1 (A) 1 The real activation of the dial tone detector is not relevant for type approval. Only the start of the outgoing dialling is required (see section 5.6.3.1).

5.2.1 (B) 1

1) The values in the table are related to the National Dial Tone (NDT).

2) For TE capable of International Dial Tone (IDT) detection, two options are allowed:

α) individual detection of the 3 characteristic frequencies, which means that the detector shall possess 3 selective networks reacting respectively to the frequencies 900 Hz, 1 020 Hz and 1 140 Hz. For each selective network the selectivity shall be so that they shall react under a level between -28 dBm and -3 dBm to frequencies deviating no more than 10 Hz from the nominal frequency. It is only necessary to detect the presence of the three frequencies when applied for a period of at least 2,4 s. It is not required to verify their succession.

β) detection of one of the following frequencies: 900 Hz ± 10 Hz, 1 020 Hz ± 10 Hz, 1 140 Hz ± 10 Hz within the same level limits as above. The IDT shall be recognised when the signal is applied for a period of at least 2,4 s.

3) For PBXs, one broadband detector for both NDT and IDT is allowed. In this case, the PBX shall recognise signals with a frequency between 415 Hz and 1 150 Hz, a level between -28 dBm and -3 dBm and a duration of more than 1 600 ms for the IDT.

4) For digital PBXs, the impedances Z_G and Z_L are equal to Z_c (Belgian complex impedance defined in Chapter 4, section 4.1.2).

5.2.1 BG) 1 The dial tone detector shall not be activated during incoming calls.

5.2.1 (BG) 2 If the dial tone detector does not detect the PSTN dial tone within 20 s of the application of the dial tone, the TE shall not start the dialling procedure.

5.2.1 BG) 3 If the TE includes a dial tone detector, the dialling procedure shall start within $t \geq 2$ s and ≤ 5 s after the application of the PSTN dial tone.

5.2.1 (BG) 4 If during dialling a pre-pulsing condition of ≥ 650 ms to ≤ 1 300 ms is realised within the TE, the TE shall start dialling directly after the detection of the dial tone.

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 ± 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 (I) 1 Cadenced signal as follows: 2 successive pulses respectively,

t_{onA} = (200 ± 10%) ms;
t_{onB} = (600 ± 10%) ms separated by a pause;
t_{offA} = (200 ± 10%) ms and repeated after a pause;
t_{offB} = (1 000 ± 10%) ms.

In the future the dial tone will be a continuous tone. Alternatively, as a valid dial tone, may be detected any sine signal with pulse duration longer than 400 ms.

5.2.1 (NL) 1 This requirement is only mandatory in case of alarm-equipment.

5.2.1 (NL) 2 The special dial tone is the same as the normal dial tone with tone interruptions of 35 ms - 75 ms every 450 ms - 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 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 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.

With TE in the loop condition, which has a dial tone receiver that, because of the requirements in Chapter 10, sections 10.5 (E) 3.1.a.ii and/or in 10.5 (E) 3.1.b.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 to 0 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 Feeding conditions, see Chapter 1, section 1.5.2.

The detector shall accept the following cadence:

Tone ≥ 300 ms;
Pause ≤ 50 ms.

5.2.1 (CH) 1

1 See also Chapter 1, section 1.7 (summary of network tones and signals).

2 For dial tone recognition the following requirements shall be fulfilled:

2a The TE shall either automatically recognise the dial tone or give the user an audible indication thereof (e.g. in the telephone handset or the loudspeaker of the call tracer).

2b Before automatic dialling is initiated, the TE shall recognise a dial tone or the TE shall make a dialling halt ("time-out") of 3 s ... 10 s. A pause of 3 to 10 s ("time-out") before the start of dialling, instead of a dial tone receiver, is therefore permitted.

2c In the case of automatic dial tone recognition, the TE shall meet the requirements of the present section shown in the table 5.2.1. The first dialling signal shall be emitted at the latest 2 s after the start of the dial tone.

3 Other network tones recognition:

3a Busy and congestion tone (see also CCITT Rec. E 180):

A TE shall recognise both a busy and an congestion tone as described in the test of section A.5.2 and release the line within 8 s. This time (8 s) corresponds to a recognition time of less than 3 s and a release time of maximum of 5 s.

3b Ringing tone (see also CCITT Rec. E 180):

The recognition of the ringing tone can be useful to consider a call as unsuccessful. A connection is regarded as unsuccessful (e.g. for automatic redial) and released at the earliest after 11 ringing tone cycles. In the case of alarm systems or similar installations, the line may be released after 15 s.

A.5.2.1 Dial tone detector sensitivity

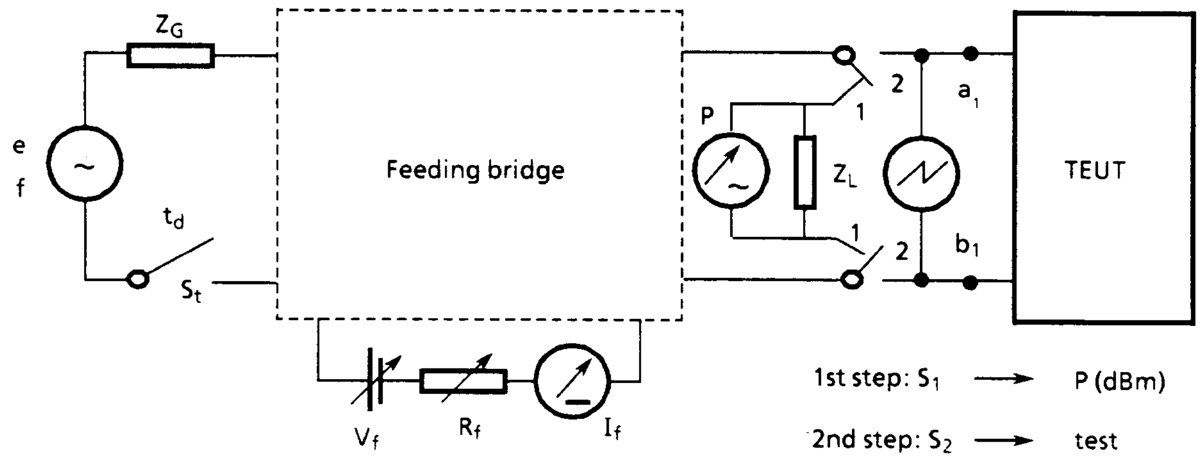
The TEUT is connected as shown in figure A.5.2.1.

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, 490	-26, -16	60		19, 60	
Belgium	415, 460	-20	48	400		yes
Bulgaria	425	-25	60	1 000, 2 200		
Cyprus	350 + 450	-22, -7	48	800		
Denmark	350, 425, 500	0, -35			16, $I_{max.}$	
Finland	375, 425, 475	-20	48	800, 1 710		
France	440	-27	48	600		yes
Germany						yes
Greece	425, 450	- 0, -27	60		20, 35	
Hungary	375, 425, 475	-25, -5	48		20, $I_{max.}$	
Iceland	400, 425, 450	-30	48		14, $I_{max.}$	
Ireland	not mandatory					
Italy	410, 440	-25, -12, -6	44, 52	1 880, 720		
Luxembourg	425, 450	-26, -6,5	60		19, 60	
Malta						
Netherlands	340, 425, 550	-25,7, -3,8	48	1 130		
Norway	350, 500	-6, -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, 425, 475	-23, 0, -8	50	2 300, 500		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) 1.2). For option α) and β), the parameter values are:

f_a (Hz)	f_b (Hz)	f_c (Hz)	p (dBm)	t_d (ms)	V_f (V)	R_f (Ω)
890	1 010	1 130	-28	260 each frequency	48	400
910	1 030	1 150	-28	400 each frequency	48	400

The signal is emitted during 2,4 s.

3) For the broadband detector, the values are:

Sequence	f (Hz)	p (dBm)	t_d (s)	V_f (V)	R_f (Ω)
first detection (NDT)	415	-28	0,850	48	400
second detection (IDT)	1 150	-28	1,6	48	400

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:

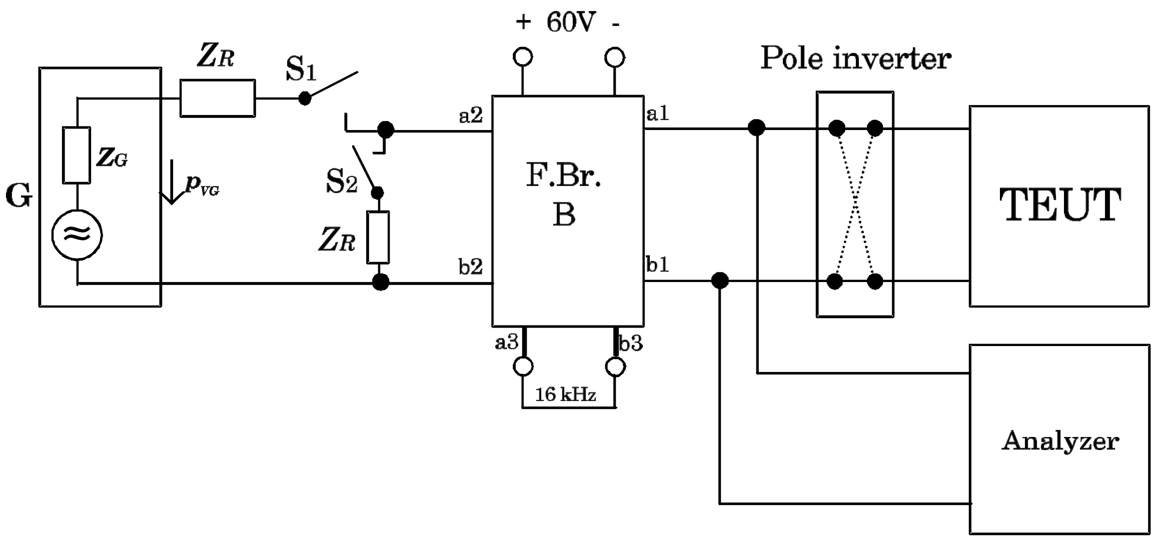
Table A.5.2.1 (F) 1.b

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 (D) 1 Initiation of dialling in the case of outgoing calls

The measuring circuit illustrated in figure A.5.2.1 (D) 1 is used for the measurement.



$Z_G \approx 0\ \Omega$

Figure A.5.2.1 (D) 1

The measurement is carried out with the parameters specified in table A.5.2.1 (D) 1.

Table A.5.2.1 (D) 1

Power supply:	Dial tone
V = 60 V	p_{VG} = +6 dB (950 mV) and -23 dB (950 mV)
	f = 425 Hz

The TEUT is set to both decadic dialling and MFPB (DTMF) dialling (where available).

Line seizure by the TEUT, application of the dial tone and transmission of the dialling information or transition to the quiescent state are measured with a suitable analyzer.

Measurement:

a) Switch S2 is open. The dial tone is applied by means of S1 approx. 1 s after seizure of the line by the TEUT:

- In the case of manual line seizure and initiation of dialling, the TEUT shall be able to commence dialling at the latest 20 s after application of the dial tone.

- In the case of automatic line seizure, TEUT equipped with a dial tone detector shall commence dialling within 200 ms $\leq t \leq$ 20 s after application of the dial tone.

b) Switch S2 is closed. No dial tone is applied after automatic line seizure by the TEUT; switch S1 remains open:

- In the case of TEUT with a timer function, dialling shall commence after 2,5 s ≤ *t* ≤ 10 s.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

A.5.2.1 (E) 1 The procedure of test in Chapter 10, section A.10.5 (E) 3.1 is followed, where the resistor (R_f) takes only the values of 500 ohms and 2 200 ohms; it is assumed that the TEUT would fulfil the associated requirement, if the test procedure were repeated when the resistor (R_f) takes the value of 1 100 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	1 550	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	1 550	Continuous	0
5.2.1 (E) 1.b	-	570	27,5	Continuous	0
	-	570	1 550	Continuous	0
	-	600	27,5	Continuous	0
	-	630	27,5	Continuous	0
	-	630	1 550	Continuous	0

A.5.2.1 (S) 1 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.

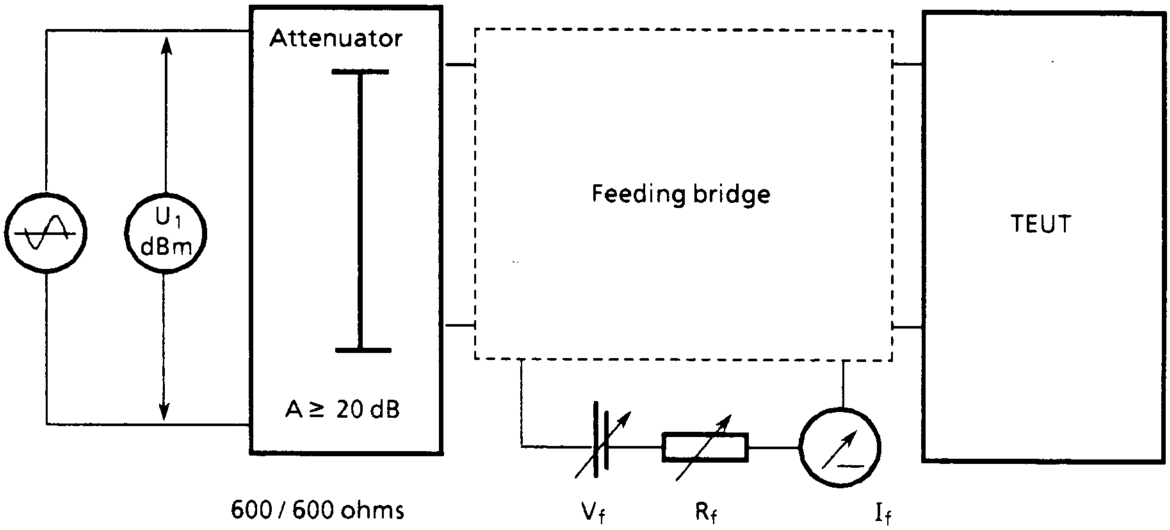


Figure A.5.2.1 (S) 1

A.5.2.1 (S) 2 Feeding conditions, see Chapter 1, table 1.5.2.

A.5.2.1 (S) 3 The TEUT shall accept a dial tone with a frequency of 425 Hz, a level of -5 dBm and the following cadence applied at its terminals for 2 s:

Tone 320 ms, Pause 50 ms.

A.5.2.1 (CH) 1 The dial tone receiver shall respond to the following signals:

- -23 dBm and 0 dBm each at 375 Hz, 425 Hz and 475 Hz. The tone lasts 2 s;

- -8 dBm at 425 Hz and 2 s tone duration, superimposed with one of the following interfering signals in each case: -8 dBm at 50 Hz and 2 kHz, -28 dBm at 225 Hz and 1 kHz.

NOTE: In some cases the dial tone is superimposed with a second tone. This tone superimposition is referred to as special dial tone. Recommendation: for special dial tones, the response time of the receiver should be < 1 s.

The busy/congestion tone receiver shall respond to the following signals:

- -38 dBm and -4 dBm each at 375 Hz, 425 Hz and 500 Hz and a tone/pause duration in accordance with the nominal value (busy tone 500 ms / 500 ms, congestion tone 200 ms / 200 ms);

- -8 dBm at 425 Hz, each with a tone/pause duration of 440 ms / 660 ms, 660 ms / 440 ms, 180 ms / 120 ms and 120 ms / 180 ms.

The ringing tone receiver shall respond to the following signals:

- 35 cycles of -38 dBm and -4 dBm each at 375 Hz, 425 Hz and 500 Hz, with a tone/pause duration of 1 s / 4 s;

- 35 cycles of -8 dBm at 425 Hz, each with a tone/pause duration of 0,67 s / 3 s, 0,67 s / 6 s, 2.5 s / 3 s and 2,5 s / 6 s.

5.2.2 Dial tone detector insensitivity

For TE capable of detecting dial tone, the relevant detector shall not be activated within t_d (s), 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						
Belgium	600	600	160	700	-3	-45		
Bulgaria	not mandatory							
Cyprus	not mandatory							
Denmark	600	600	110	2 000	0	-45	1 200	
Finland	600	600				-52	500	
France	600	600	160	900	-10	-50		
Germany	not mandatory							
Greece	600	600	350	525	0	-45	200	
Hungary	600	600				-45	600	
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								
Netherlands	600	600				-31,8		
Norway	not mandatory							
Portugal	600	600	160	not applic.	0	-45	600	not applic.
Spain	600	600	160	1 000		-45		
Sweden	600	600					800	
Switzerland	600	600	225	1 000	-28	-48	550	180
U. Kingdom	not mandatory							

Table 5.2.2 (continued): 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
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark					16, $I_{max.}$	yes
Finland	not mandatory		44 - 58	800 - 1 710		
France			45 - 54	300 - 1 845		yes
Germany	not mandatory					
Greece			44 - 66		20 - 80	
Hungary			48		20, $I_{max.}$	
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	not mandatory					
Portugal	not applicable	not applicable	45 - 55	300 - 1 800	not applicable	
Spain			48	500 - 2 200		yes
Sweden						yes
Switzerland	550	180	43 - 57	2 200 - 600		yes
U. Kingdom	not mandatory					

5.2.2 (A) 1 Frequencies and levels in area N.A. in figure 5.2.2 (A) 1 shall not activate the dial tone detector respectively dialling until the TE revert to the idle state (see section 5.6.3.1).

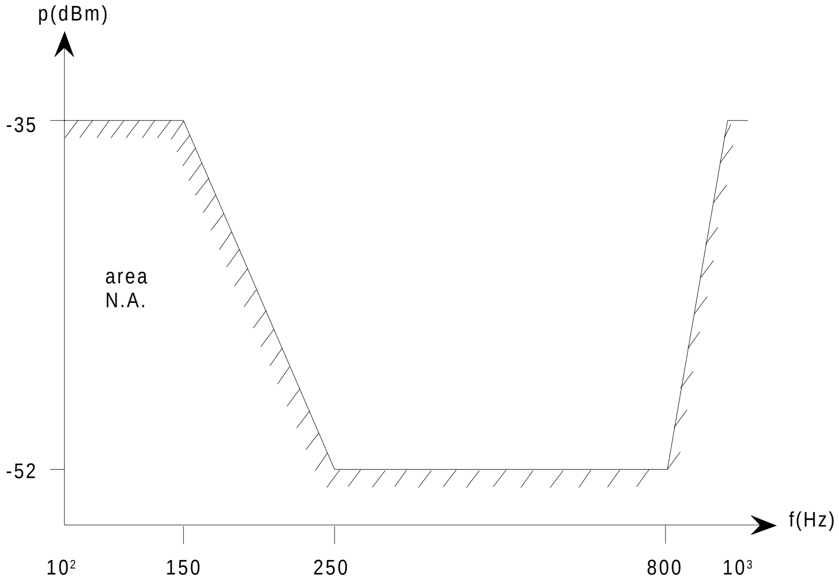


Figure 5.2.2 (A) 1

5.2.2 (B) 1

1) For TE capable of detecting a dial tone, the relevant detector shall not be activated, in loop condition, if "short" signals with a duration lower than t_d(ms) = 550 and:
   - any value of frequency;
   - any value of level;
   - any value of cadence t_{on}/t_{off};

   are applied.

2) The values in the table are related to the NDT detector.

3) For TE with IDT detector:
   option α)
   case a) Each selective network shall not be activated by signals with a level less than -3 dBm and with a frequency deviating more than 50 Hz from the nominal frequency of the selective network.

   case b) Each selective network shall not be activated when weak signals with a level lower than -36 dBm are applied with the nominal frequencies.

   option β)
   case a) The selective network shall not be activated by signals with a level less than -3 dBm and with a frequency deviating more than 50 Hz from the nominal frequency of the selective network.

   case b) The selective network shall not be activated when weak signals with a level lower than -36 dBm are applied with the nominal frequencies.

   case c) The selective circuit shall not be activated when each frequency is emitted during a time lower than 210 ms or greater than 450 ms.

4) For PBXs with a broadband detector the values in the table 5.2.2 are the following:

Z_G (Ω)	=	600
Z_L (Ω)	=	600
f_3 (Hz)	=	350
f_4 (Hz)	=	1 250
p_3 (dBm)	=	0
p_4 (dBm)	=	-32
t_{on1}	=	1 200 ms in the case of IDT detection.

5) For digital PBXs the impedances Z_G and Z_C are equal to Z_c (Belgian complex impedance defined in section 4.1.2).

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 For type approval purpose the requirements in this section are not mandatory.

5.2.2 (NL) 1 This requirement is only mandatory in case of alarm-equipment.

5.2.2 (NL) 2 The detector shall be insensitive for signals with a frequency between 340 and 550 Hz, a level between -25,7 dBm and -3,8 dBm and with the following cadences:

1) tone on : 180 ms - 330 ms
tone off : 330 ms - 180 ms

2) tone on : 400 ms - 600 ms
tone off : 600 ms - 400 ms

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 Chapter 10, 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	≤ 2 000 mV	≤ +2,2 dBm	320 Hz ≤ f_1 ≤ 480 Hz	< 950 ms	≥ 250 ms
ii	≤ 2 000 mV	≤ +2,2 dBm	570 Hz ≤ f_1 ≤ 630 Hz	< 950 ms	≥ 250 ms
iii	< 8,7 mV	< -45 dBm	300 Hz ≤ f_1 ≤ 3,4 kHz	Continuous	
iv	≤ 2 000 mV	≤ +2,2 dBm	16 Hz ≤ f_1 ≤ 160 Hz	Continuous	
v	≤ 490 mV	≤ -10 dBm	1 000 Hz ≤ f_1 ≤ 3,4 kHz	Continuous	

5.2.2 (S) 1 Dial tone detectors shall comply 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.

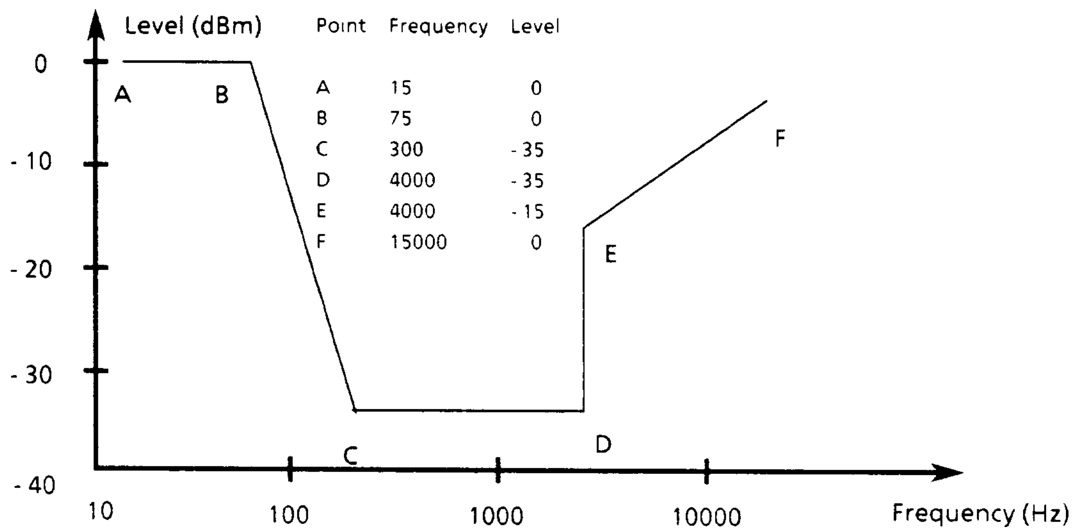


Figure 5.2.2 (S) 1

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

5.2.2 (S) 2 Feeding conditions, see Chapter 1, section 1.5.2.

5.2.2 (S) 3 The detector shall not accept the following cadence:

tone ≤ 340 ms, Pause ≥ 100 ms.

5.2.2 (CH) 1 The dial tone receiver shall not respond to the following signals:

- weak (-48 dBm) signals;
- busy or congestion tone signals;
- possible disturbing signals (e.g. from the mains or speech band).

The busy tone receiver shall not respond to the following signals (see also CCITT Recommendation E.180):

- weak (-48 dBm) signals;
- ringing tone signals.

The ringing tone receiver shall not respond to the following signals (see also CCITT Recommendation E.180):

- weak (-48 dBm) signals;
- busy tone signals.

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					30
Belgium	160, 700	-3	continuous	0	20
Bulgaria	not mandatory				
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			
Hungary	not mandatory				
Iceland	50, 4 000	+2,2 (50 Hz) 0 (4 kHz)			5
Ireland	not mandatory				
Italy	350, 550	-6	right cadence		
Luxembourg	not mandatory				
Malta					
Netherlands	not mandatory				
Norway	not mandatory				
Portugal	159	-1	∞	0	10
Spain			continuous	0	15
Sweden					
Switzerland	375, 425, 475	-48	2 000		2
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					30
Belgium	425, 450	-45	continuous	0	20
Bulgaria			not mandatory		
Cyprus			not mandatory		
Denmark	425	-46			4
Finland	425	-52			
France	440	-50	continuous		6
Germany			not mandatory		
Greece	425	-45			
Hungary	425	-45	continuous		
Iceland	50, 4 000	+2,2 - -40			5
Ireland			not mandatory		
Italy	425	-48	right cadence		
Luxembourg			not mandatory		
Malta					
Netherlands	425	-31,8	continuous		10
Norway			not mandatory		
Portugal	400	-46	∞	0	10
Spain			continuous	0	15
Sweden					
Switzerland	425	-4, -23	200	200	4
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			not mandatory		
Belgium			not mandatory		
Bulgaria			not mandatory		
Cyprus			not mandatory		
Denmark	425	0			1,1
Finland	425	-14			0,5
France	440	-10	50	50	6
Germany			not mandatory		
Greece	425	0	200	200	
Hungary	425	-5	590	250	10
Iceland			not mandatory		
Ireland			not mandatory		
Italy	425	-6	200	200	
Luxembourg			not mandatory		
Malta					
Netherlands	425	-3,8	250, 500	250, 500	
Norway			not mandatory		
Portugal	400	0	590	250	10
Spain			925	250	15
Sweden	425	-5	790		
Switzerland	c1) 50, 2 000 c2) 225, 1 000	c1) -8 c2) -28	2 000 2 000		2 2
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	yes
Belgium	48	400		yes
Bulgaria		not mandatory		
Cyprus		not mandatory		
Denmark			16, $I_{max.}$	yes
Finland	48	800, 1 710		
France	48	600		yes
Germany		not mandatory		
Greece	60		20, 35	
Hungary	48		20, $I_{max.}$	
Iceland	48		14, $I_{max.}$	
Ireland		not mandatory		
Italy	48	1 100		
Luxembourg		not mandatory		
Malta				
Netherlands	48	1 130		yes
Norway		not mandatory		yes
Portugal	48	460	not applicable	
Spain	48	500, 1 100, 2 200		yes
Sweden				yes
Switzerland	50	500, 2 300		yes
U. Kingdom		not mandatory		

A.5.2.2 (A) 1 Values for "f" and "p" see figure 5.2.2 (A) 1.

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 (Hz) = 425, 450
p (dBm) = -3
t_d (s) = 0,550

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 option α:

case a

i = 1 to 6	f_a (Hz)	f_b (Hz)	f_c (Hz)	p (dBm)
1	850	1 020	1 140	-3
2	900	970	1 140	-3
3	900	1 020	1 090	-3
4	950	1 020	1 140	-3
5	900	1 070	1 140	-3
6	900	1 020	1 190	-3

NOTE 1: Each successive frequency is emitted during 330 ms, and the signal has a total duration of 20 s.

case b

f_a (Hz)	f_b (Hz)	f_c (Hz)	p (dBm)
900	1 020	1 140	-36

NOTE 2: Each successive frequency is emitted during 330 ms, and the signal has a total duration of 20 s.

IDT option β:

case a

The relevant lines in the table IDT option α, case a, shall be applied.

case b

f_a (Hz)	f_b (Hz)	f_c (Hz)	p (dBm)
900	1 020	1 140	-36

NOTE 3: Each successive frequency is emitted during 330 ms, and the signal has a total duration of 20 s.

case c:

f_a (Hz)	f_b (Hz)	f_c (Hz)	t_{on} each successive frequency (ms)	t_{off} each successive frequency (ms)	p (dBm)
900 900	1 020 1 020	1 140 1 140	210 450	420 900	-3 -3

NOTE 4: The signal has a total duration of 20 s.

4) For PBXs with a broadband detector:

- in table A.5.2.2 a, f (Hz) = 160, 1 190
- in table A.5.2.2.b, f (Hz) = 425, 1 140 and p (dBm) = -36
- in the remark 1) above,
  test 1: f (Hz) = 425 during t_d(s) = 0,550;
  the TE shall not detect the NDT.

  test 2: f (Hz) = 425 during t_d(s) = 0,850 and
  f (Hz) = 1 140 during t_d (s) = 1,200;
  the TE shall not detect the IDT.

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.

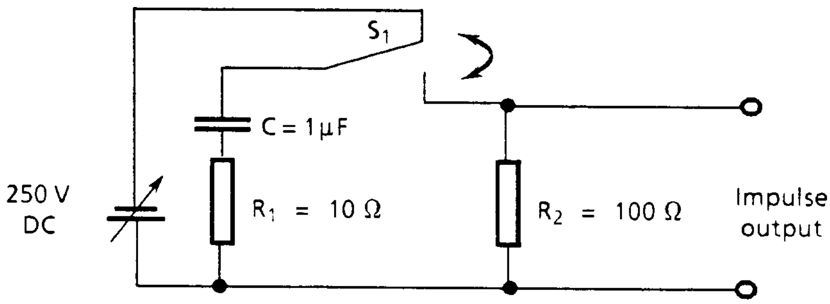


Figure A.5.2.2 (DK) 1: Impulse generator

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 (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 Chapter 10, section A.10.5 (E) 3.2.

Table A.5.2.2 (E) 1: Dial tone detector insensitivity

Signal type	Frequency (f) (Hz)	Voltage (e) (mV)	Switch (St) Closed	(ms)	Opened
i	425	2 000	925		250
ii	600	2 000	925		250
iii	425	7,75	Continuous		0
	600	7,75	Continuous		0
	1 000	7,75	Continuous		0
iv	25	2 000	Continuous		0
	50	2 000	Continuous		0
	100	2 000	Continuous		0
	150	2 000	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)

Alt. 1 in 5.2.2 (S) 1		Alt. 2 in 5.2.2 (S) 1	
f (Hz)	p (dBm)	f (Hz)	p (dBm)
16	0	16	+5
75	0	290	+5
15 000	0	610	0

Case b)

f (Hz)	p (dBm)	f (Hz)	p (dBm)
300	- 35	300	-45
425	-35	425	-45
4 000	-35	600	-45

Case c) Addition to table A.5.2.2.c.

f (Hz)	p (dBm)	t_{on} (ms)	t_{off} (ms)	t_d (S)
425	-5	340	100	5

A.5.2.2 (CH) 1 The dial tone receiver shall not respond to the following signals:

- a) -48 dBm at 375 Hz, 425 Hz and 475 Hz. The tone lasts 2 s;
- b) 10 cycles at 200 ms tone and 200 ms pause with -4 dBm and -23 dBm at 425 Hz;
- c1) -8 dBm at 50 Hz and 2 kHz and c2)-28 dBm at 225 Hz and 1 kHz. Tones last 2 s.

With the following signals the busy tone receiver shall not respond:

- 35 cycles of -48 dBm at 425 Hz, tone/pause duration 500 ms / 500 ms.
- 35 cycles of -8 dBm at 425 Hz, each with a tone/pause duration of 0,67 s / 3 s, 0,67 s / 6 s, 2,5 s / 3 s and 2,5 s / 6 s.
- -8 dBm at 425 Hz with the following time sequence: 1 acyclical signal of 0,25 s tone / 0,25 s pause followed by 10 cycles of 1 s tone / 4 s pause.

With the following signals the ringing tone receiver shall not respond:

- 35 cycles of -48 dBm at 425 Hz, tone/pause duration of 1 s / 4 s;
- 35 cycles of -8 dBm at 425 Hz, tone/pause duration of 500 ms / 500 ms.

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.

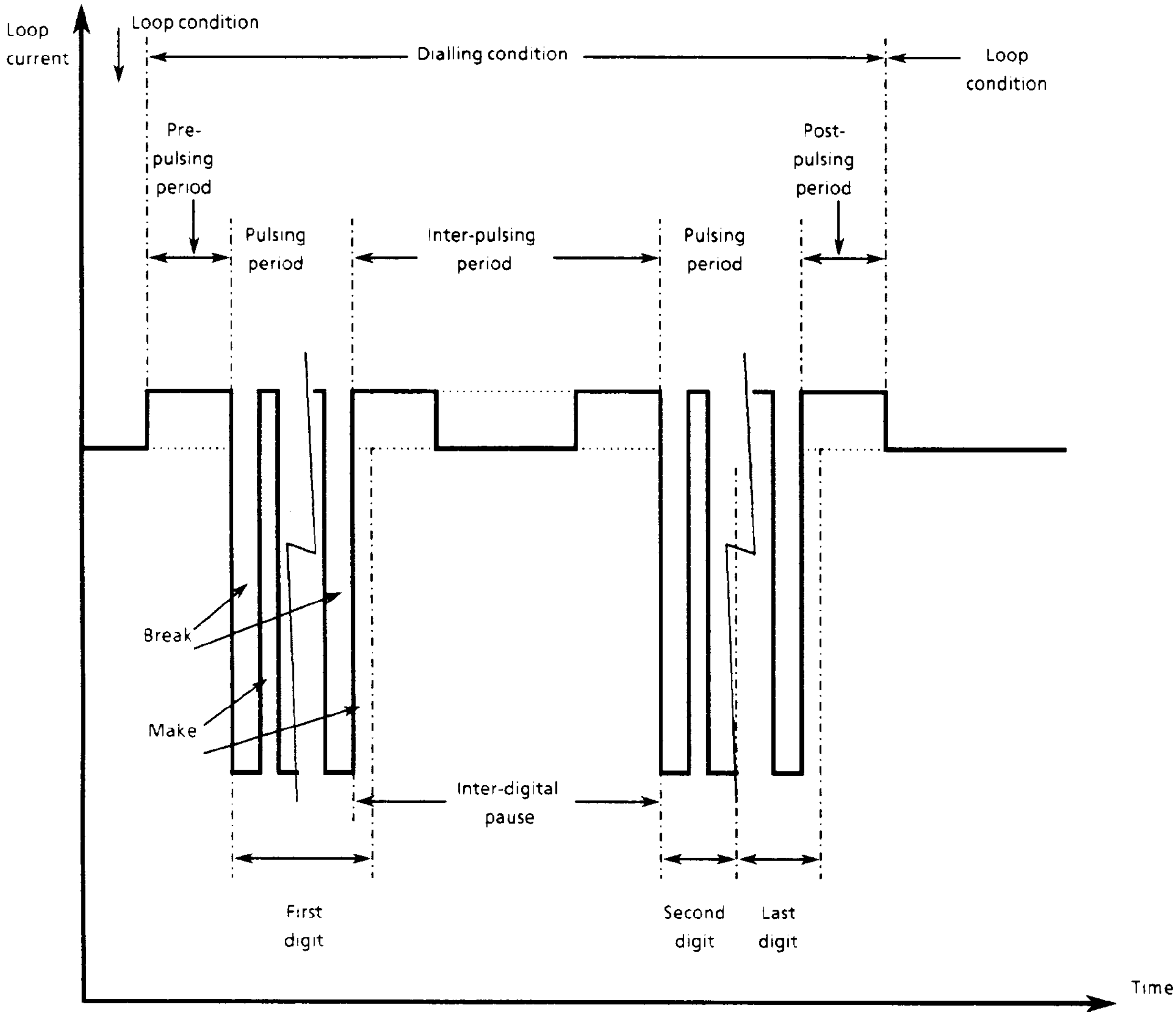
The requirements in this section relate to those values of time at which the value of the loop current is above or below the specified limits.

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 - $I_{max.}$	
Bulgaria	60	1 000, 2 200	20 - 60	
Cyprus	48	440 - 1 740		
Denmark			17,5 - 70	yes
Finland	44 - 58	800 - 1 710		
France	45 - 54 86 - 104	300 - 1 745 1 300 - 3 250		
Germany				yes
Greece	44 - 66		20 - 80	
Hungary	48		20 - $I_{max.}$	
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

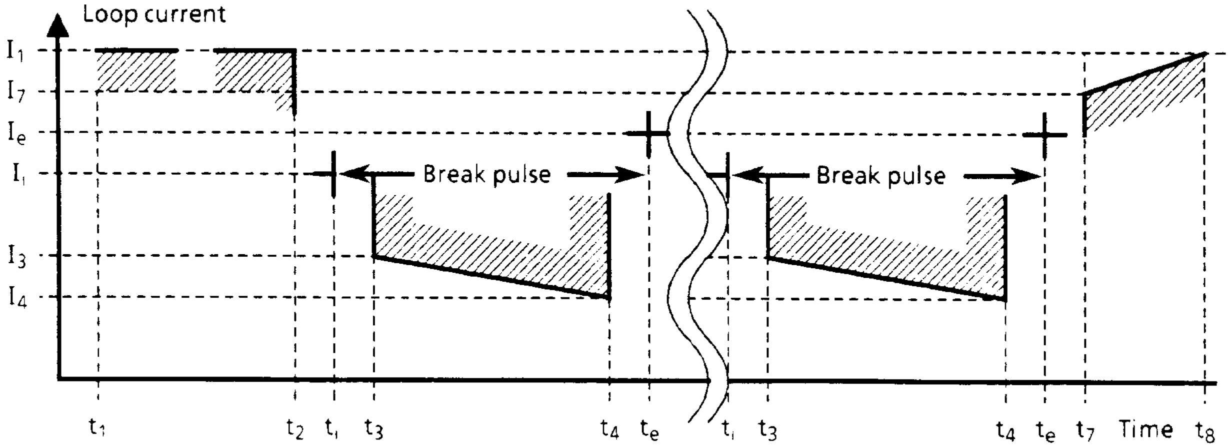


Figure 5.3.b: Loop current during pre-pulsing, first break pulse, last break pulse and post pulsing periods

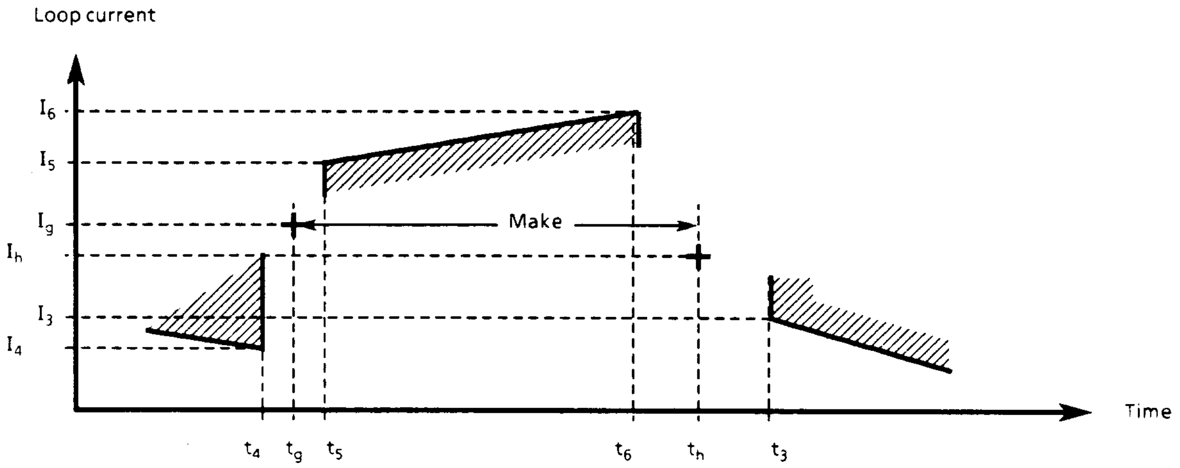


Figure 5.3.c: Loop current between two break pulses

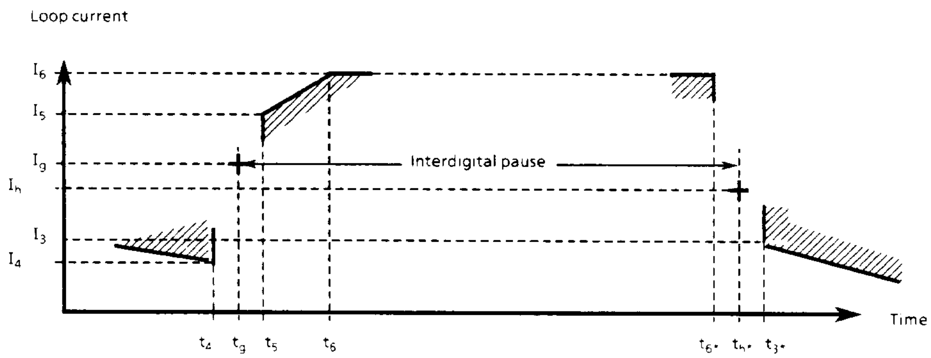


Figure 5.3.d: Loop current during interdigital pause

5.3 (A) 1 One-port TE which are assigned for the connection to the PSTN CP in addition to the telephone set shall be provided with MFPB (DTMF) dialling. Decading dialling is not permitted for such TE.

5.3 (DK) 1 A TE with calling function shall be provided with MFPB (DTMF).

5.3 (D) 1 **Decadic dialling state**

In the case of decadic dialling, at feeding conditions as specified in the first paragraph of Chapter 2, section 2.4.1 (D) 1, the loop current in the connecting circuit shall be decreased for every pulse of a digit (break pulse). A maximum of 10 break pulses for each digit is permissible, as specified in the following table.

Table 5.3 (D) 1

Digit 1	1 break pulse
Digit 2	2 break pulses
...	...
Digit 0	10 break pulses

The dc loop resistance levels for the make and break pulses of a pulse train and during the make and break periods shall be within the permissible limits specified in section 5.3 (D) 1.

The time interval between the end of the last pulse of a digit and the beginning of the first pulse of the following digit (interdigital pause) shall be as follows:

Table 5.3 (D) 2

Manual dialling	$t > 680$ ms
Automatic dialling	680 ms $\leq t \leq$ 6,5 s

During the interdigital pause, the dc resistance shall be within the permissible range, as shown in Chapter 2, section 2.1 (D) 1, with a current of $I \geq 20$ mA.

DC resistance and timing conditions for the decadic dialling state

Dependent on the dc resistance levels of the terminal equipment during the make pulse (R_m) and during the break pulse (R_b), the make period (t_m) and the break period (t_b) measured between the instantaneous values 20 mA shall be within the specified limits. The additional requirements ($t_m + t_b$) and (t_m / t_b) shall be fulfilled.

Table 5.3 (D) 3

R_m	R_b	t_m	t_b	$t_m + t_b$	t_m / t_b
≥ 5 MΩ	≤ 80 Ω	52...71 ms	35...46 ms	90...110 ms	1.40...1.80
≥ 100 kΩ	≤ 280 Ω	53...67 ms	37...45 ms	90...110 ms	1.45...1.55
≥ 100 kΩ	≤ 390 Ω	56...64 ms	37...43 ms	95...105 ms	1.45...1.55

The make period t_m and the break period t_b are determined at a voltage of V_{dc} = 63 V and resistances of R_{dc} = 0 Ω , 1 200 Ω.

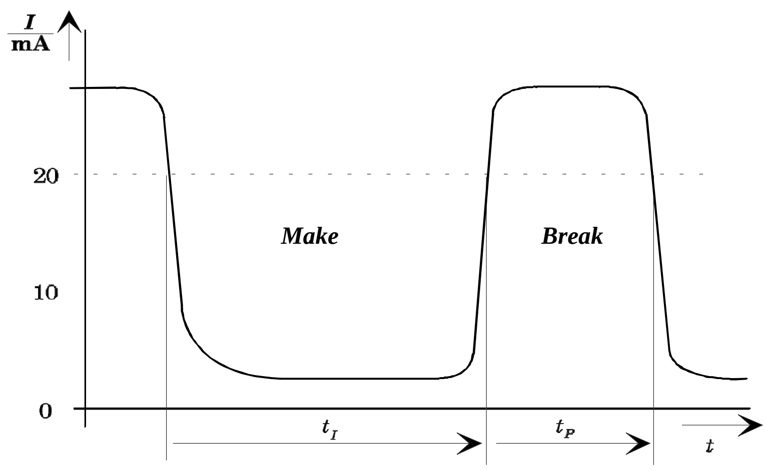


Figure 5.3 (D) 1

At a voltage of V_{dc} = 63 V and resistances of R_{dc} = 0 Ω, 1200 Ω, the loop current shall comply with the following tolerance mask for the pulse edges.

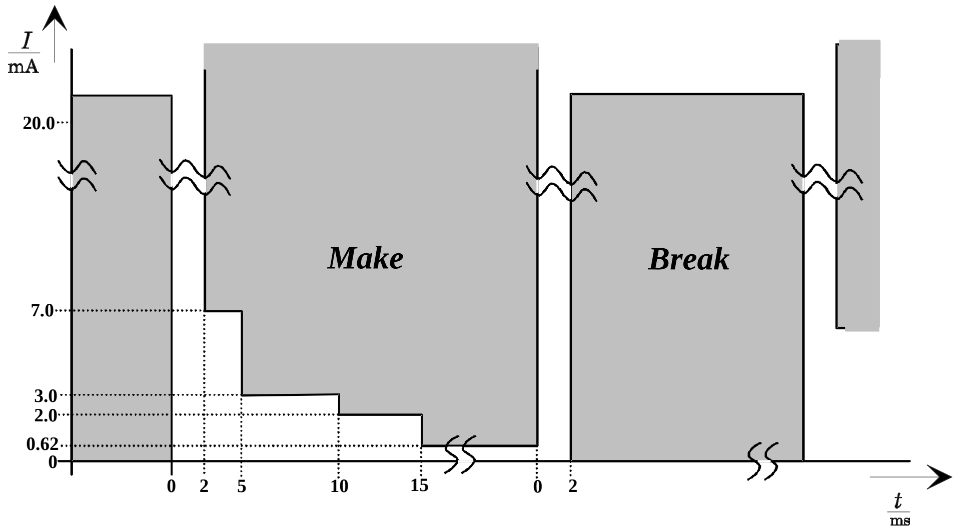


Figure 5.3 (D) 2

5.3 (N) 1 Dialling shall be carried out by using MFPB bursts as described in section 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 Chapter 10, 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.

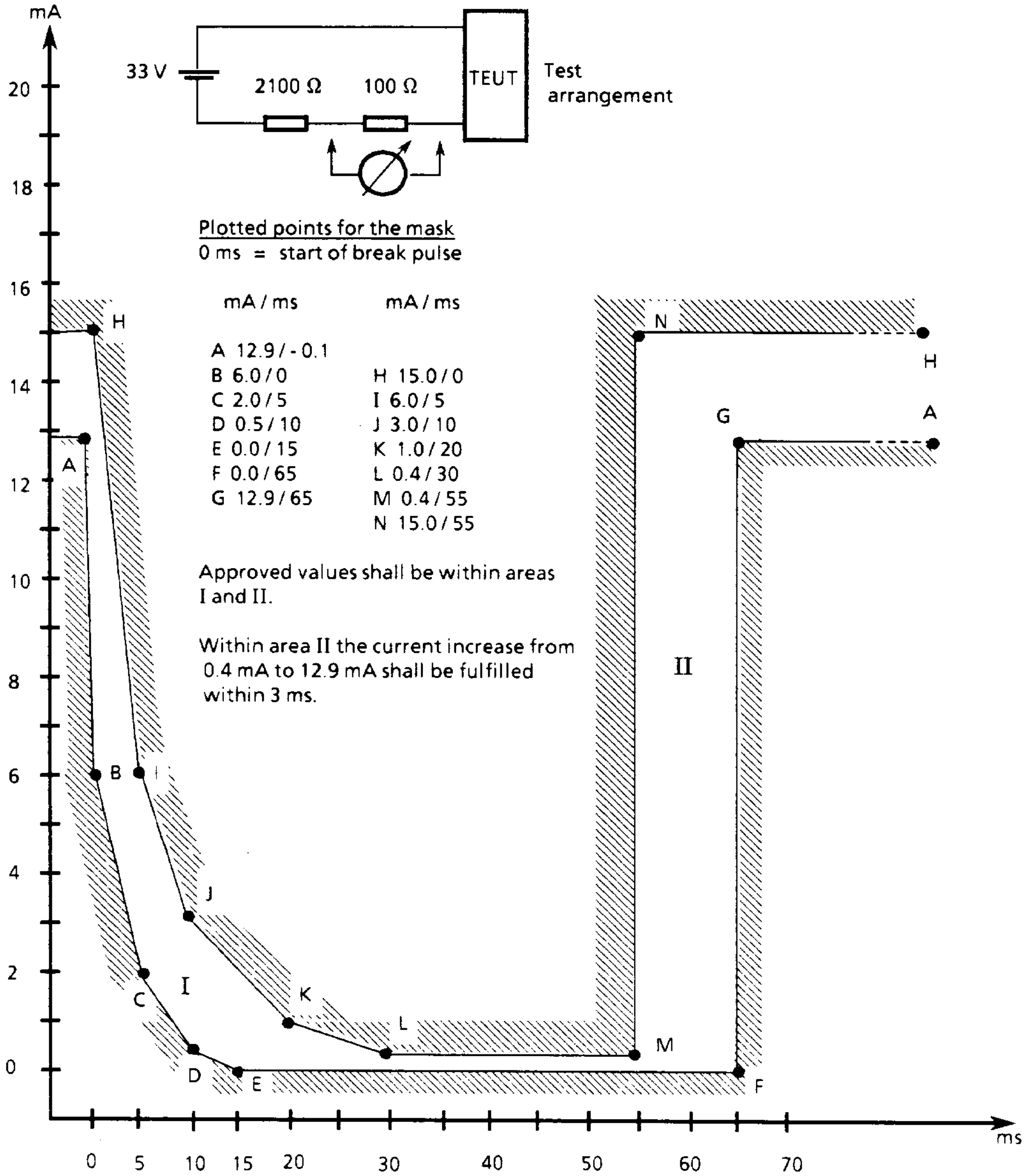


Figure 5.3 (S) 1.a: Mask for decadic pulsing, break, 33 V

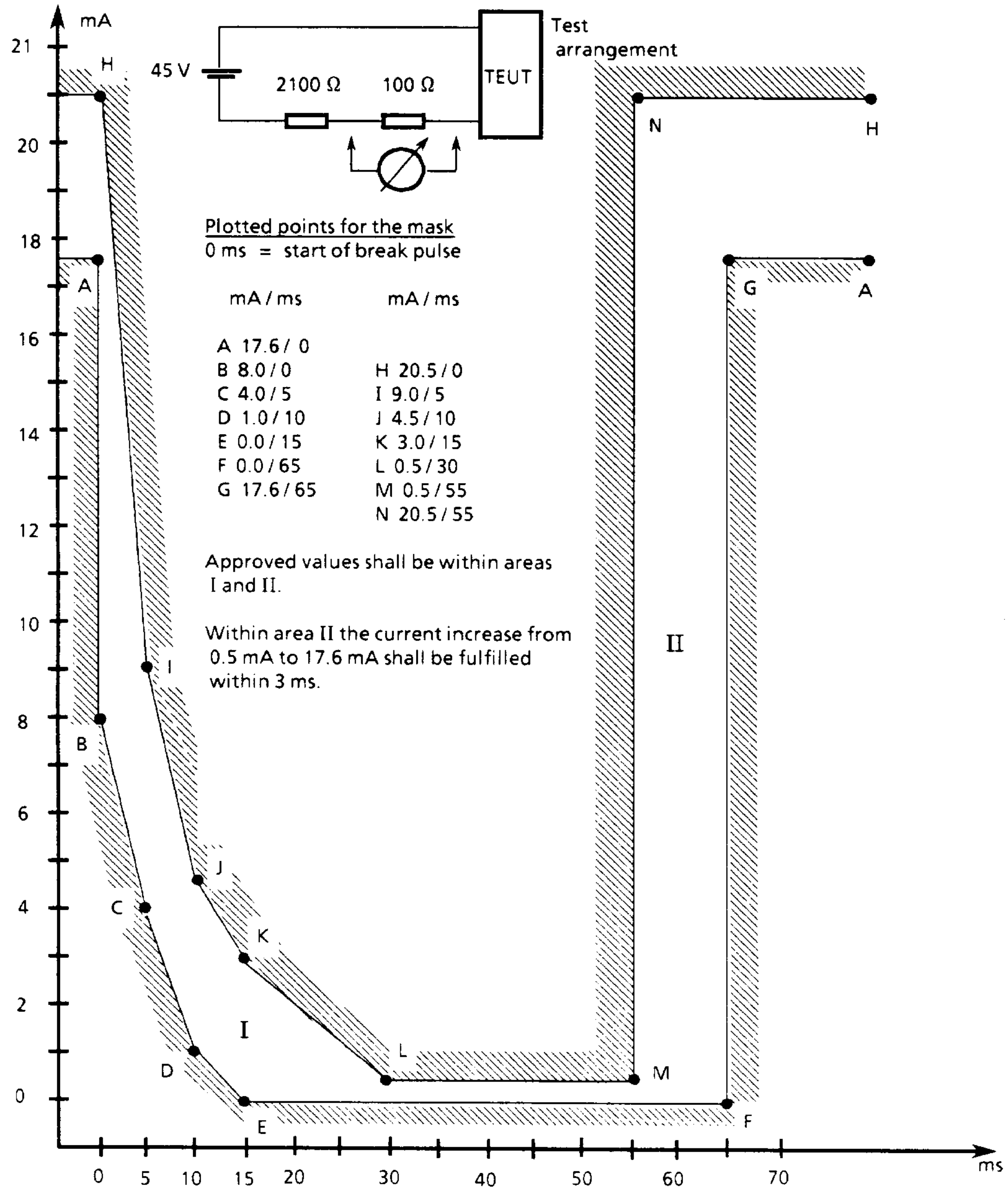


Figure 5.3 (S) 1.b: Mask for decadic pulsing, break, 45 V

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.

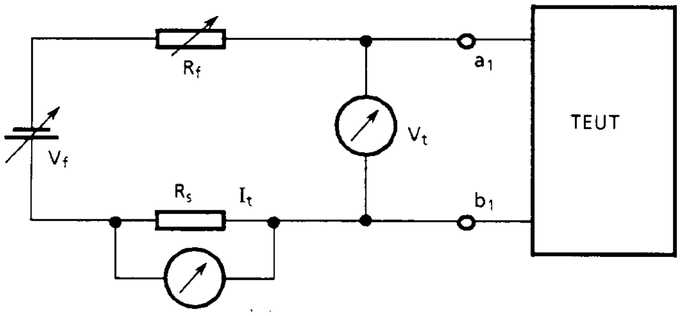
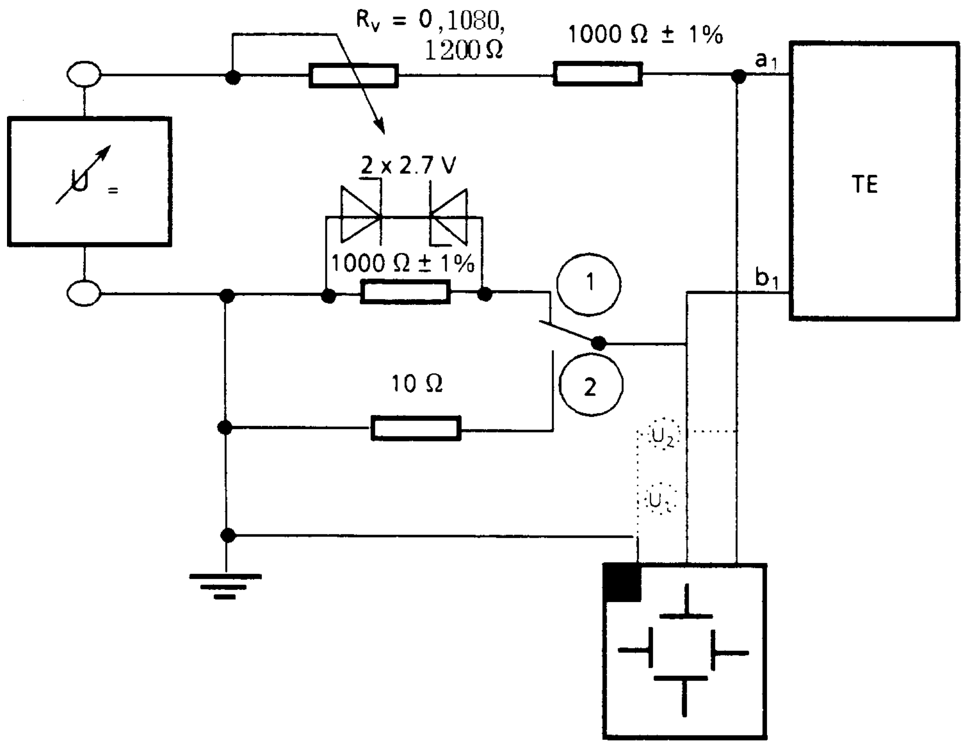


Figure A.5.3: Decadic dialling test circuit

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	
Bulgaria	60	1 000, 2 080, 2 200			yes
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	
Hungary	48		20, $I_{max.}$	400	
Iceland	48		14, $I_{max.}$	not specified	
Ireland	48		20 - 100	not specified	
Italy	44, 52	1 280, 120		600	
Luxembourg	60		19, 60	100	
Malta					
Netherlands	42, 66	2 040, 700		100	
Norway					
Portugal	45, 55	100, 1 600	not applicable	200	yes
Spain	48	250, 1 950		250	
Sweden	33, 45	2 100		100	
Switzerland	50	1 000		100	yes
U. Kingdom	50	400	see remark	included in R_f	yes

A.5.3 (BG) 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 A.5.3 (BG)1). For measuring the resistance during loop, a resistor of 10 ohms is used.



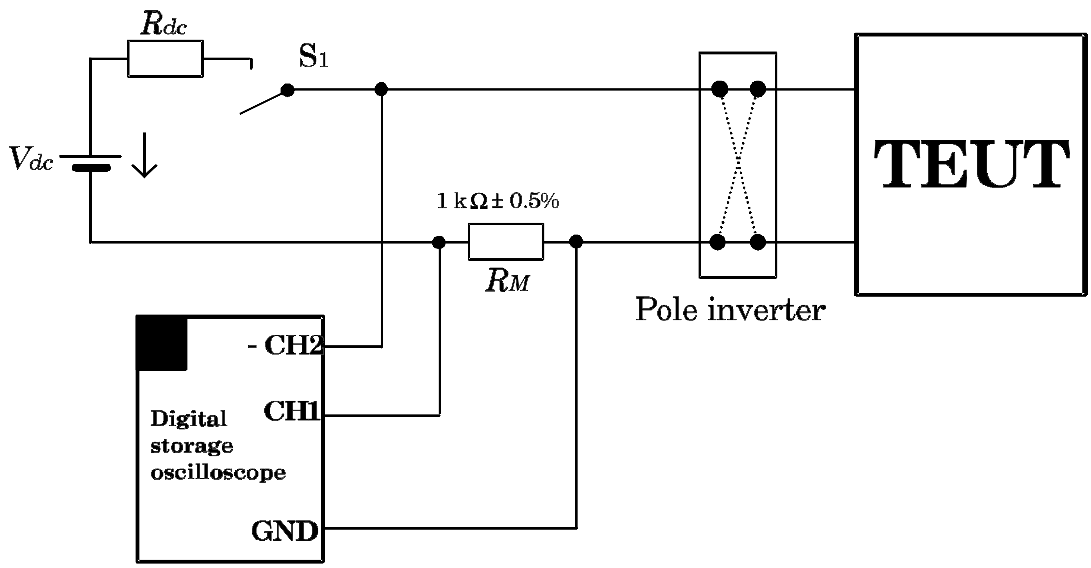
1 Resistance measured during loop interruption

2 Resistance measured during loop

figure A.5.3 (BG) 1

A.5.3 (D) 1 **Measurement of the dialling pulses**

The measuring circuit illustrated in figure A.5.3 (D) 1 a) is used for the measurement.



V_{dc} = 63 V	R_{dc} = 0 Ω or 1 200 Ω

Figure A.5.3 (D) 1 a)

With switch S1 closed, the generation of the dialling pulses is represented on a storage oscilloscope. The Terminal Equipment under test (TEUT) shall be stimulated to emit dialling pulses by means of appropriate operating procedures.

The resistance values specified in section 5.3 (D) 1 are adhered to by the TEUT where:

- the voltage V_M corresponds to the values given in table A.5.3 (D) 1 a) for the resistance level during the make pulse R_m and
- the voltage V_{TEUT} corresponds to the values given in table A.5.3 (D) 1 b) for the resistance level during the break pulse R_b.

The measurement values are read in each case at the centre point of the make and break pulses.

Table A.5.3 (D) 1 a)

R_m	V_M (CH 1)	
	R_{dc} = 0 Ω	R_{dc} = 1 200 Ω
≥ 5 MΩ	≤ 13 mV	≤ 13 mV
≥ 100 kΩ	≤ 624 mV	≤ 616 mV

Table A.5.3 (D) 1 b)

R_b	V_{TEUT} (-CH 2)	
	R_{dc} = 0 Ω	R_{dc} = 1200 Ω
≤ 80 Ω	≤ 4,67 V	≤ 2,21 V
≤ 280 Ω	≤ 13,8 V	≤ 7,11 V
≤ 390 Ω	≤ 17,7 V	≤ 9,49 V

The pulse edges are determined at the beginning of the make pulse and at the beginning of the break pulse. Where V_{dc} = 63 V and R_{dc} = 0 Ω, 1 200 Ω the values shown in figure A.5.3 (D) 1 b) shall be adhered to, i.e. the values shall lie outside the shaded area. In the case of this measurement, the requirement for resistance value R_b as specified in section 5.3 (D) 1 is met when the voltage V_M (CH 1) during the break period is equivalent to the values given in table A.5.3 (D) 1 c). In the case of terminal equipment with $R_m \geq 5$ MΩ, the voltage during the make period shall be V_M (CH1) ≤ 13 mV for t = 30 ms until the end of the make period. The input port -CH2 shall be disconnected, where necessary.

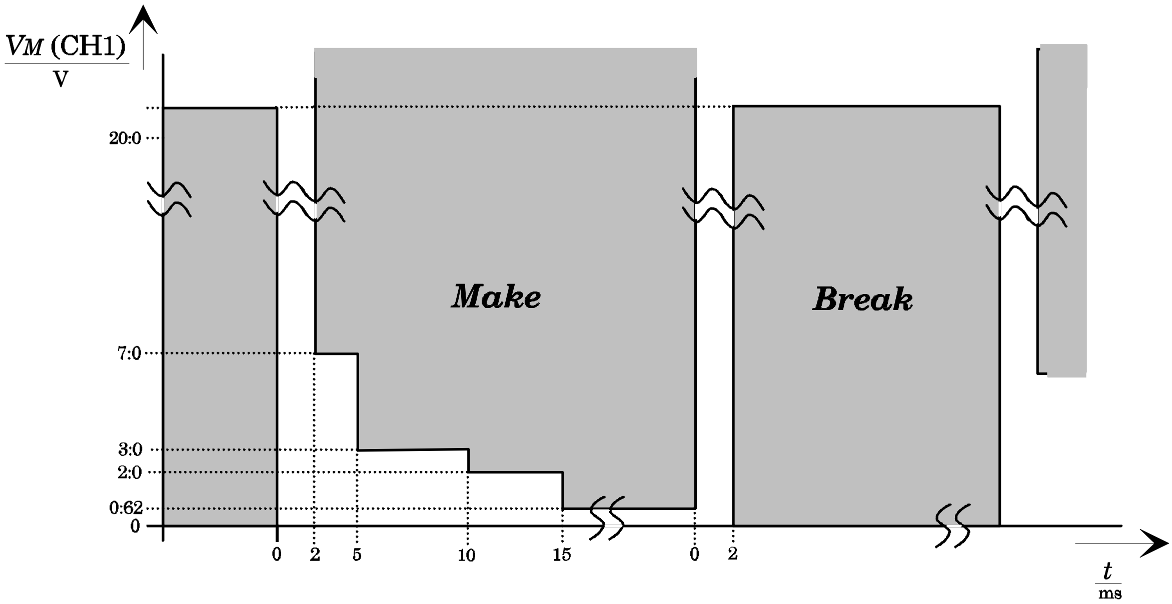


Figure A.5.3 (D) 1 b)

Table A.5.3 (D) 1 c)

R_b	V_M (CH 1)	
	R_{dc} = 0 Ω	R_{dc} = 1200 Ω
≤ 80 Ω	≥ 58,3 V	≥ 27,6 V
≤ 280 Ω	≥ 49,2 V	≥ 25,4 V
≤ 390 Ω	≥ 45,3 V	≥ 24,3 V

The make period t_m and the break period t_b are recorded at V_{dc} = 63 V and R_{dc} = 0 Ω, 1 200 Ω. The instantaneous values V_M (CH1) = 20 V according to figure A.5.3 (D) 1 c) are used to determine the timing. The measured time values shall fulfil the requirements specified in Annex 2 for t_m, t_b, $t_m + t_b$ and t_m / t_b for the relevant resistance (R_m, R_b).

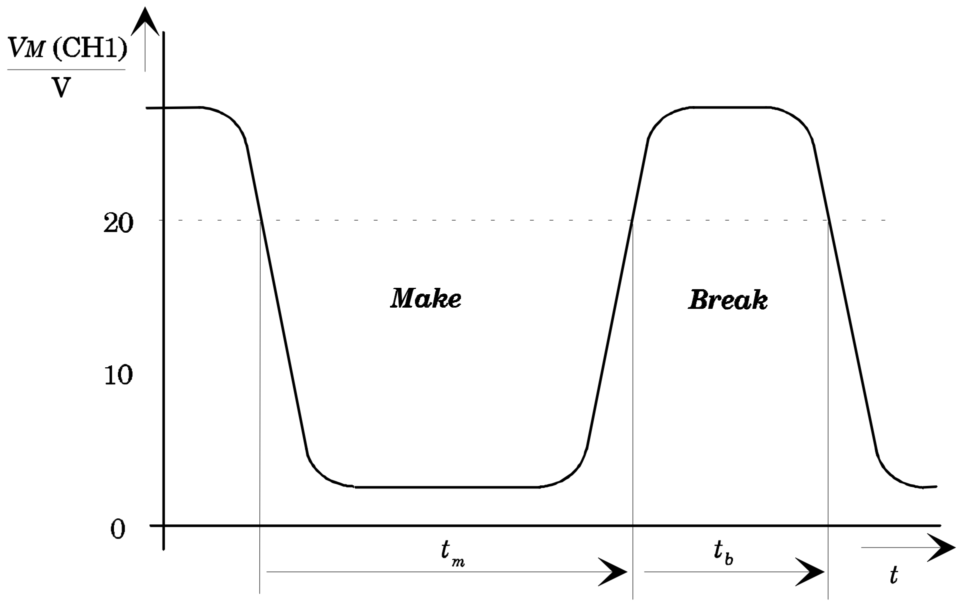


Figure A.5.3 (D) 1 c)

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

Measurement of the generation of the dialling pulses with feeding bridge B

The measuring circuit illustrated in figure A.5.3 (D) 1 d) is used for the measurement.

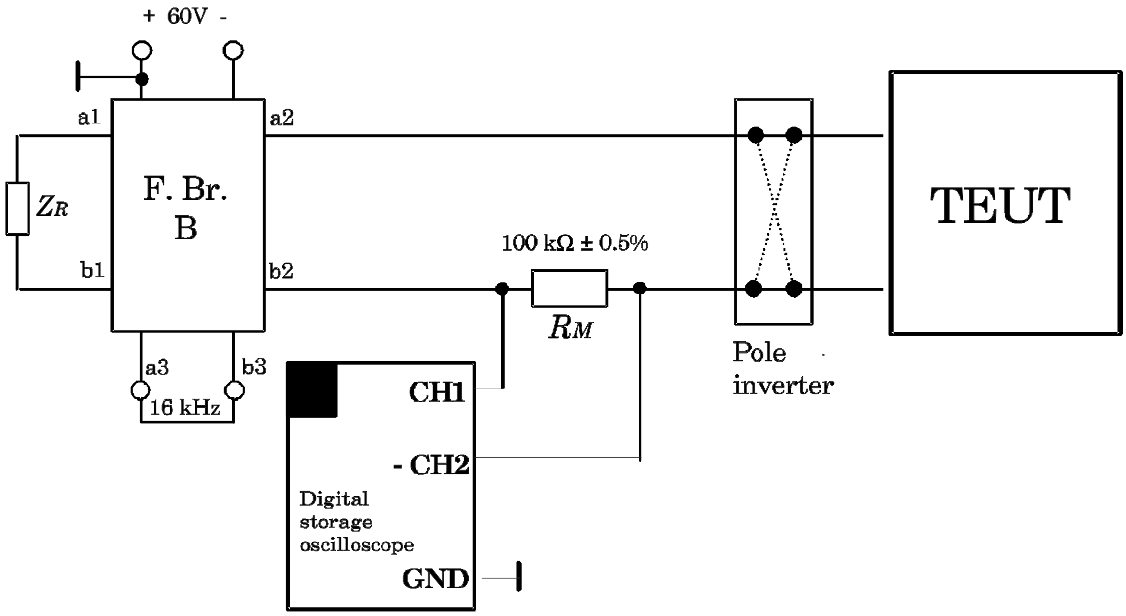


Figure A.5.3 (D) 1 d)

The effects of inductance and case capacitance in a feeding bridge circuit and of the 16 kHz combining filter in the exchange on the generation of the dialling pulses in a terminal (TEUT) are examined by monitoring the loop current. For this purpose, the input ports CH1 and -CH2 of a storage oscilloscope are connected with the measuring resistor $R_M = 100\ \Omega$. The differential mode voltage level is measured.

Although the edges of the dialling pulses emitted by the TEUT are consequently altered, in comparison with the measurement illustrated in figure A.5.3 (D) 1 a), the following shall apply:

- the sum of the make period and the break period shall meet the requirement for $t_m + t_b$ as specified in section 5.3 (D) 1 (measurement point 2,0 V);
- the value for the minimum break period t_b as specified in section 5.3 (D) 1 shall be met (measurement point 2,0 V).

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

A.5.3 (P) 1 Feeding conditions for the tests in sections A.5.3.1, A.5.3.3.1 and A.5.3.4.1:

V_f (V) = 48
R_f (Ω) = 200
R_s (Ω) = 200

A.5.3 (CH) 1 The requirement in section 5.3.1.2 is to be tested with the following values:

Rf: 2 300, 1 000 and 500.

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 See section 5.3 (D) 1.

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 ± x HZ.

2) Break period: The time interval (t_e - t_i) 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	
Bulgaria	40	20, 25		60		0,6	1	yes
Cyprus	33 ± 3	15	15	67 ± 5	10	10	1	
Denmark	27 - 41	8	8	56 - 80	8	8		
Finland		12,5	12,5		12,5	12,5		yes
France	33 ± 4	17	17	66 ± 7	5	5	1	yes
Germany								yes
Greece	38,5 ± 3	12	18	61,5 ± 3	18	12	1	
Hungary	33 1/3	15	15	66 2/3	15	15	1	yes
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	17,6	17,6					yes
Switzerland	40 ± 5	15	15	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 (BG) 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 33 ms - 46 ms;
- break 52 ms - 69 ms;
- ratio between break and make;
  limit values 1,4 : 1 and 1,7 : 1.

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 ms - 44 ms;
- break 54 ms - 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 $R_m \leq 320$ ohms, and during the break period R_b shall be ≥ 100 kohms

- make 38 ms - 42 ms;
- break 57 ms - 63 ms;
- ratio between pulse and pause;
  limit values 1,45 : 1 and 1,55 : 1.

5.3.1.2 (BG) 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 (BG) 3 The total time of a pulse train generated by dialling 0 shall not exceed the tolerance of 1 000 ms ± 100 ms.

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 See section 5.3 (D) 1.

5.3.1.2 (H) 1 The tolerances of make and break periods are defined by formula:

$$\frac{t_{break}}{t_{make}} = 2 \pm 0,2$$

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 to 1,7
$1/(T_b + T_m) = (10 \pm 1)$ 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.

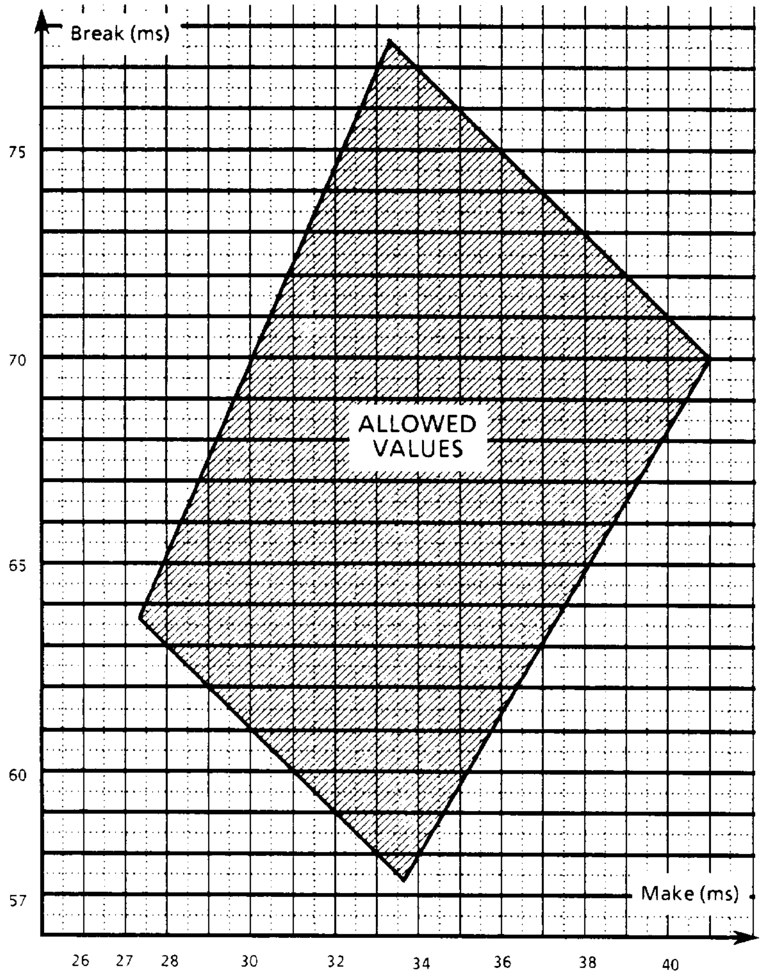


Figure 5.3.1.2 (P) 3: Dialling pulse timing

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 ± 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) 1. However, make period requirement values only apply to text arrangement in figure 5.3 (S) 1.b.

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_i, 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 section 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_i.

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:

$$f_d = \frac{1}{t}$$ 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 section 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_i.

The dialling frequency f_d is then calculated according to formula A.5.3.1.2.b:

$$f_d = \frac{10}{(t + t_m)}$$ 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	
Bulgaria	no	yes	
Cyprus	yes	no	
Denmark	not mandatory	not mandatory	
Finland	yes	no	
France	yes	no	
Germany			
Greece	yes	no	
Hungary	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	not applicable		yes
Switzerland	not specified		yes
U. Kingdom	yes	no	

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.

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.

$$f_d\ (\mathrm{Hz}) = \frac{9}{T\ (\mathrm{ms})} \times 1\,000$$

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.

$$B / M (\%) = \frac{\Sigma \text{ tbi (ms)}}{\Sigma \text{ tbi (ms)} + \Sigma \text{ tmi (ms)}} \times 100 \qquad \text{Formula A.5.3.1.2 (E) 2}$$

A.5.3.1.2 (S) 1 See remark in section 5.3 (S) 1. However, make period requirement values only apply to test arrangement in figure 5.3 (S) 1.b.

A.5.3.1.2 (CH) 1 The requirement is to be tested with the following values of R_f: 2 300, 1 000 and 500.

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	not mandatory	not mandatory	500	
Belgium				yes
Bulgaria	650 - 1 300		480	
Cyprus		not mandatory		
Denmark		not mandatory		
Finland		not mandatory		
France		20		yes
Germany				
Greece	not specified	I_f		
Hungary				yes
Iceland				
Ireland	≥ 250	20	450	
Italy	≤ 1 000	18		yes
Luxembourg	650 - 1 300		480	
Malta				
Netherlands		not mandatory		
Norway				
Portugal				yes
Spain	≤ 1 200	not applicable	400	yes
Sweden				
Switzerland	≤ 1 500	see section 2.4.2	see section 2.3	
U. Kingdom	≥ 240	not specified	not specified	yes

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 (H) 1 The time interval $(t_2 - t_1)$ is not specified.

5.3.2 (H) 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 (I) 1 Feeding setting for loop condition: V_f = 44 volt and R_f = 1 880 ohm.

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.

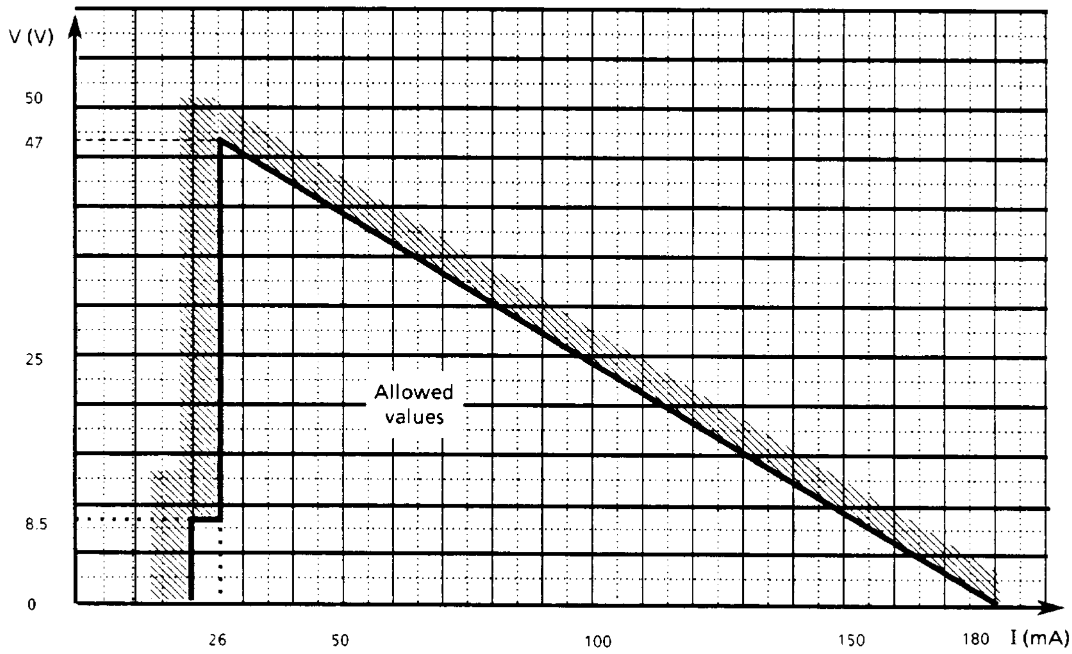


Figure 5.3.2 (P) 1: Pre-pulsing period current and loop resistance

5.3.2 (P) 2 t_2 - time in the beginning of the falling edge of the current.

$t_2 = t_i$, 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 (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 section 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 It and, if needed, of the voltage V_t 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 I_f (mA)	Remarks
Austria	19, 60	
Belgium		
Bulgaria		
Cyprus	not mandatory	
Denmark	not mandatory	
Finland	not mandatory	
France		
Germany		
Greece		
Hungary	20, $I_{max.}$	
Iceland	not mandatory	
Ireland	20 - 80	
Italy		
Luxembourg	not mandatory	
Malta		
Netherlands	not mandatory	
Norway		
Portugal		
Spain		yes
Sweden		
Switzerland		
U. Kingdom	not specified	

A.5.3.2 (E) 1 The time t_2 is determined by the instant that the loop current crosses downward for the first time the 18,5 mA limit before the first break pulse is generated.

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		
Bulgaria	54 - 66	0,6	0,6	100 k	yes
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		
Hungary					yes
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 µA	480 µA	not applicable	yes
Sweden					yes
Switzerland	52	not specified	not specified	≥ 80 kΩ	
U. Kingdom		not specified	not specified	not specified	yes

5.3.3.1 (BG) 1 See section 5.3.1.2 (BG) 1.

5.3.3.1 (SF) 1 The resistance between the two line terminals shall be ≥ 70 kΩ of the break period.

5.3.3.1 (D) 1 See section 5.3 (D) 1.

5.3.3.1 (H) 1 The resistance of TE between the two line terminals shall be:

after t_i + 10 ms ≥ 100 kΩ, within the period from t_i + 20 ms up to t_e - 5 ms ≥ 150 kΩ.

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 in section 5.3 (S) 1.

5.3.3.1 (GB) 1 See remark in section 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:

$$R_t = \frac{V_t}{I_t} \qquad \text{Formula A.5.3.3.1}$$

and shall be greater than the value R_b 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	
Belgium	48	600	1 000		
Bulgarian	60	2 200	1 000		
Cyprus	48	800	not specified	not specified	
Denmark	150	10 000	500		
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	
Hungary	48		400	20, $I_{max.}$	
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, 700	100		
Norway					
Portugal	48	200	200	not applicable	yes
Spain	48	250, 1 950	250		yes
Sweden					yes
Switzerland	50	1 000	100		
U. Kingdom	50	400	not specified		yes

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 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) 1.

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 (t_6 - t_5) (ms)	I_5 (mA)	I_6 (mA)	R_m (Ω)	Remarks
Austria	38	not mandatory	not mandatory	350	
Belgium	30	20	20		
Bulgaria					yes
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		
Hungary					yes
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 (BG) 1 See section 5.3.1.2 (BG) 1.

5.3.3.2 (SF) 1 The resistance between the line terminals shall be ≤ 300 Ω 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 (D) 1.

5.3.3.2 (H) 1 The resistance between the line terminals, after t_e + 10 ms and until t_i - 3 ms, shall be: ≤ 350 Ω.

5.3.3.2 (I) 1 During the period T_6 - T_5, the drop voltage across the line terminals of the TE shall be ≤ 5,5 V with a loop current of 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.

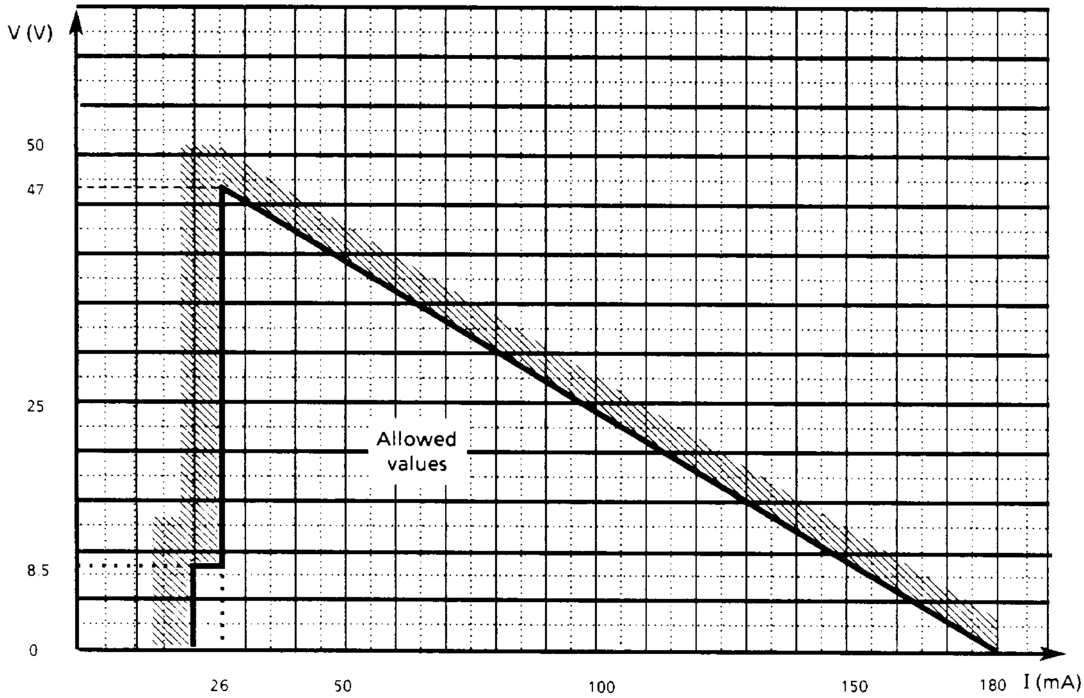


Figure 5.3.3.2 (P) 2: Make pulse period current and loop resistance

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 Chapter 10, section 10.5 (E) 6.3.

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) 1.

5.3.3.2 (CH) 1

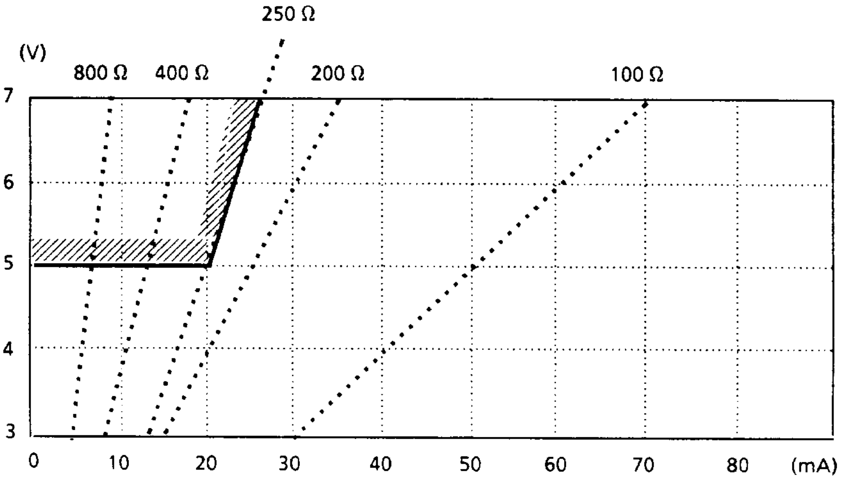


Figure 5.3.3.2 (CH) 1

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 I_f (mA)	Remarks
Austria	19, 60	
Belgium		
Bulgaria		
Cyprus	20, 80	
Denmark		
Finland		
France		
Germany		
Greece		
Hungary	20, $I_{max.}$	
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 (E) 1 The TEUT is connected as shown in figure A.5.3.

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 time t_5 is determined by the instant that the loop current crosses upward for the last time the 18,5 mA after the former break pulse is generated. The time t_6 is determined by the instant that the loop current crosses downward for the first time the 18,5 mA limit before the following break pulse.

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.

$$R_m\ (\Omega) = \frac{V_t\ (V)\ \times\ 1\,000}{I_t\ (mA)}$$ Formula A.5.3.3.2 (E) 1

A.5.3.3.2 (S) 1 See remark in section 5.3 (S) 1.

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 (D) 1 See section 5.3 (D) 1.

5.3.4.1.1 Automatic or stored-digit outpulsing

For decadic dialling using equipment capable of accepting and storing digits faster than the specified outpulsing 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 outpulsing

The decadic dialling using equipment which outpulses 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 + 450 - 50	not mandatory	yes
Belgium	700 ± 300	400	
Bulgaria	760 - 1 000	200	yes
Cyprus	450 - 1 000	not mandatory	
Denmark	450 - 900	450	
Finland	≥ 720	not mandatory	
France	900 ± 100		
Germany		not mandatory	
Greece	720 - 1 000	400	
Hungary	600 - 900	350	
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	620	
U. Kingdom	720 min.	240	yes

5.3.4.1 (A) 1 With TE which include PABX functions a interdigital pause up to 3,5 s is permissible before the last outgoing digit.

5.3.4.1 (BG) 1 Rotary dials normally have a lost motion time of at least 200 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.

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 Requirement values only apply to test arrangement in figure 5.3 (S) 1.b.

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 digit 0 shall be emitted several times.

A.5.3.4.1 (S) 1 Measurements only apply to test arrangement in figure 5.3 (S) 1.b.

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 $(t_{6*} - t_5)$ (ms)	R_m (Ω)	Remarks
Austria	≤ 1 300	500	yes
Belgium	400		
Bulgaria		320	
Cyprus	not mandatory		
Denmark		200	yes
Finland	not mandatory		
France	800		yes
Germany			
Greece	$(t_h - t_g) - 80$		
Hungary			yes
Iceland	not mandatory		
Ireland	not mandatory		
Italy	750 - 1 000		
Luxembourg	not mandatory		
Malta			
Netherlands	700		
Norway			
Portugal			yes
Spain			yes
Sweden			
Switzerland	See sections 2.3 and 2.4.2		
U. Kingdom			yes

5.3.4.2 (A) 1

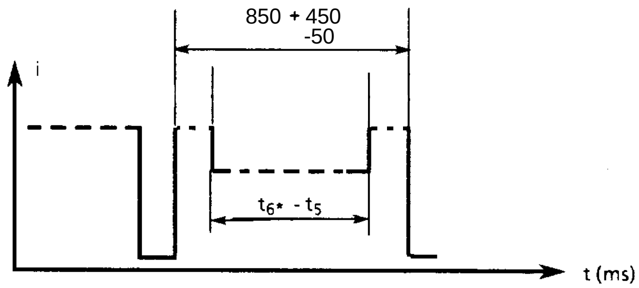


Figure 5.3.4.2 (A) 1: Period $(t_{6*} - t_5)$

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.

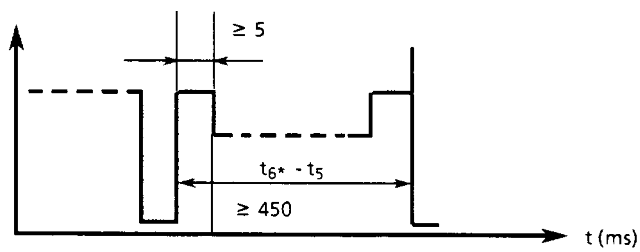


Figure 5.3.4.2 (DK) 1

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 (D) 1 See section 5.3 (D)1.

5.3.4.2 (H) 1 During the interdigital pause the loop current flowing through the TE shall not decrease below 20 mA.

5.3.4.2 (P) 1 $(t_5 - t_g)(ms) = 4$

$t_6^* = t_h^*$

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.

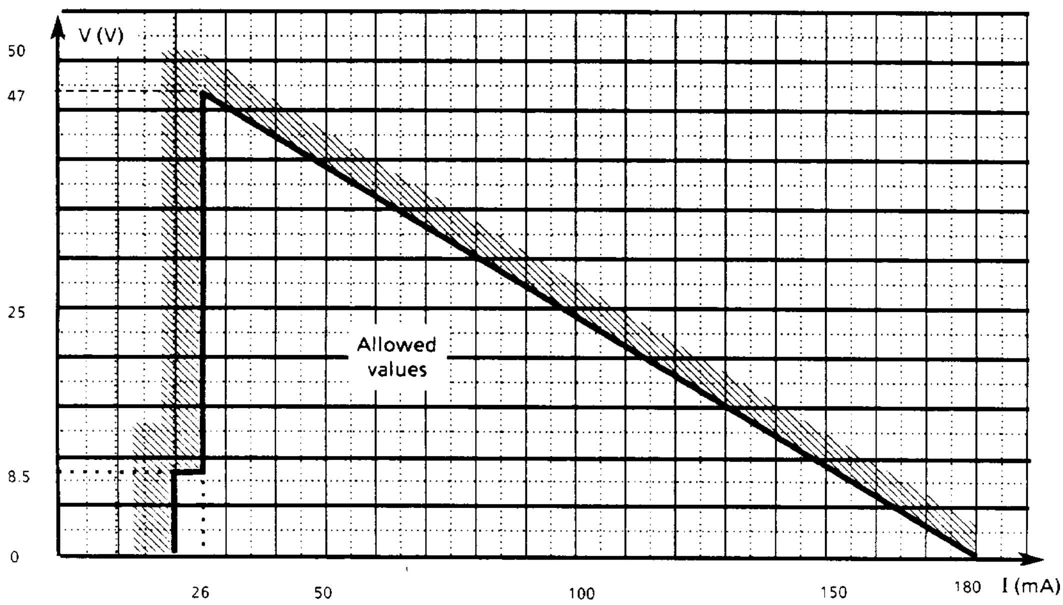


Figure 5.3.4.2 (P) 2: Interpulsing period current and loop resistance

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 Chapter 10, section 10.5 (E) 6.3.

Compliance shall be checked by the tests outlined in section A.5.3.4.2 (E) 1.

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 in section 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		yes
Belgium		
Bulgaria		
Cyprus	not mandatory	
Denmark		
Finland	not mandatory	
France		
Germany		
Greece		
Hungary		
Iceland	not mandatory	
Ireland	not mandatory	
Italy		
Luxembourg	not mandatory	
Malta		
Netherlands		
Norway		
Portugal		
Spain		yes
Sweden		
Switzerland		
U. Kingdom	see earlier remark	yes

A.5.3.4.2 (A) 1 The resistance R_t shall not be greater than the value R_m specified in table 5.3.4.2.

A.5.3.4.2 (E) 1 The procedure of test in section A.5.3.3.2 (E) 1 is followed.

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 figure 5.3 b, or the resistance between the line terminals shall not be greater than Rpo as shown in table 5.3.5.

The interval (t_8 - t_7) is defined in table 5.3.5. The current I_1 is 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	not mandatory	not mandatory	500	yes
Belgium	≥ 30	20		
Bulgaria	0 - 1 000		see 2.3 (BG) 1.1), 2)	
Cyprus		not mandatory		
Denmark	5 - 900		200	
Finland		not mandatory		
France	0 - 1 000	17		yes
Germany				
Greece	≤ 100	I_f		
Hungary		not mandatory		
Iceland		not mandatory		
Ireland		not mandatory		
Italy	≤ 1 000	18		yes
Luxembourg	650 - 1 300		480	
Malta				
Netherlands		not mandatory		
Norway				
Portugal				yes
Spain	≤ 1 200	not applicable	400	yes
Sweden				yes
Switzerland	≤ 1 500		see sections 2.3 and 2.4	
U. Kingdom	28	not specified	not specified	yes

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 (I) 1 Feeding setting for loop condition:

V_f = 44 volt and R_f = 1 880 ohm.

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.

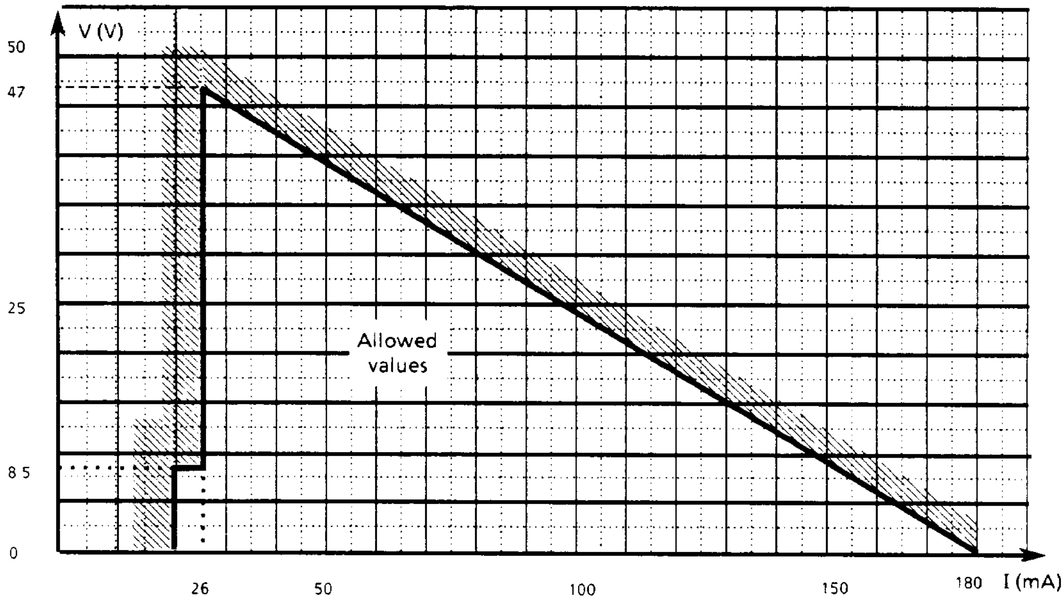


Figure 5.3.5 (P) 1: Post-pulsing period

5.3.5 (P) 2 $(t_7 - t_e)(ms) = 4$

5.3.5.(E) 1 The resistance (R_{po}) 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 the involved acoustic transducers are intended to be used for the purpose of listening and placed far from the ear.

5.3.5 (S) 1 Requirements only apply to test arrangement in figure 5.3 (S) 1.b.

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. 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

$$R_t = \frac{V_t}{I_t} \qquad \text{Formula A.5.3.5}$$

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 I_f (mA)	Remarks
Austria	19, 60	
Belgium		
Bulgaria		
Cyprus	not mandatory	
Denmark		
Finland		
France		
Germany		
Greece		
Hungary	not mandatory	
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 time t_7 is determined by the instant that the loop current crosses upward for the last time the 18,5 mA limit after the last break pulse is generated.

A.5.3.5 (S) 1 Measurements only apply to test arrangement in figure 5.3 (S) 1.b.

A.5.3.5 (GB) 1 Compliance with the requirements for immunity to interruptions in the loop current specified in sections 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 section 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		≤ 240		≤ 1,1	
Belgium	not mandatory				
Bulgaria					yes
Cyprus	not mandatory				
Denmark	300	1 000	0,09	0,55	
Finland	not mandatory				
France					
Germany	not mandatory				
Greece	100	200		1,5	
Hungary	not mandatory				yes
Iceland	not mandatory				
Ireland	not mandatory				
Italy					yes
Luxembourg	not mandatory				
Malta					
Netherlands					yes
Norway					
Portugal	not mandatory				
Spain	not mandatory				yes
Sweden					
Switzerland	according to section 4.4.3.1				
U. Kingdom	not mandatory				yes

5.3.6 (BG) 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 (H) 1 The transient peak voltage shall be: $V_t \geq 100$ V.

5.3.6 (I) 1 During the dialling function the pulse voltage across the apparatus terminals or leads provided for connection to the network shall be not higher than 300 volts.

5.3.6 (NL) 1 V_t shall be limited to a peak value of 140 volts.

5.3.6 (E) 1 Note: Reference is made to the requirement in Chapter 10, section 10,5 (E) 6.2.d.

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:

$$R_x = \frac{(T_1 \times R_{f2}) - (T_2 \times R_{f1})}{T_2 - T_1}$$ Formula A.5.3.6.a

$$C_x = \frac{T_1}{R_{f1} + R_x}$$ 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				yes
Belgium	not mandatory			
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	56	1 000	3 000	
Finland	not mandatory			
France				
Germany				
Greece	60	1 500	2 400	
Hungary				yes
Iceland	not mandatory			
Ireland	not mandatory			
Italy				yes
Luxembourg	not mandatory			
Malta				
Netherlands	66	800		yes
Norway				
Portugal	not mandatory			
Spain	not mandatory			
Sweden				yes
Switzerland	See section A.4.4.3.1			
U. Kingdom	not mandatory			yes

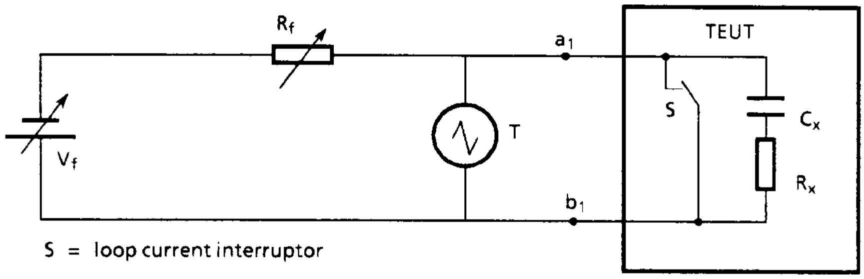


Figure A.5.3.6: Spark quenching

A.5.3.6 (A) 1 The values of the used resistor and capacitor shall be inspected in the circuit diagram of the TE.

A.5.3.6 (H) 1 The TE is connected as shown in the following figure:

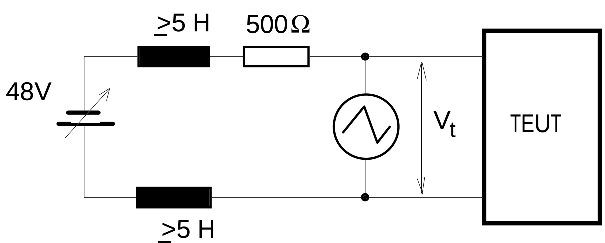
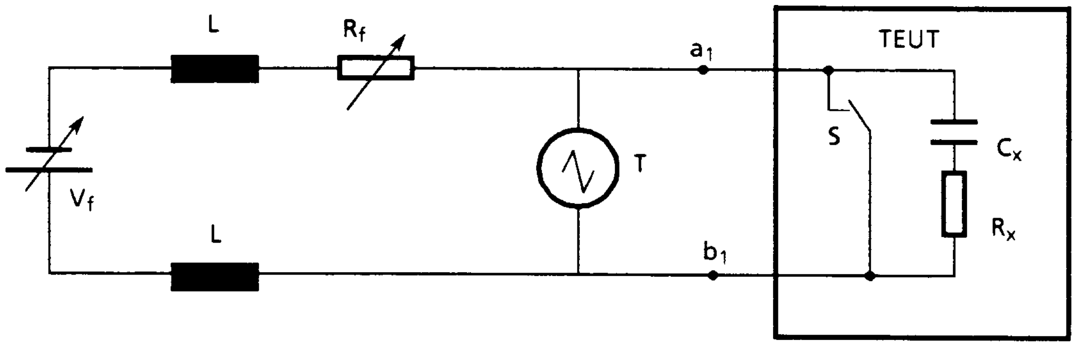


Figure A.5.3.6 (H) 1: Connection of TEUT

A.5.3.6 (I) 1 The TE is connected as shown in figure A.5.3.6 (I) 1.



S = loop current interruptor
L = 1 H
R_f = 720 Ω and V_f = 52 V

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 = 4 H.

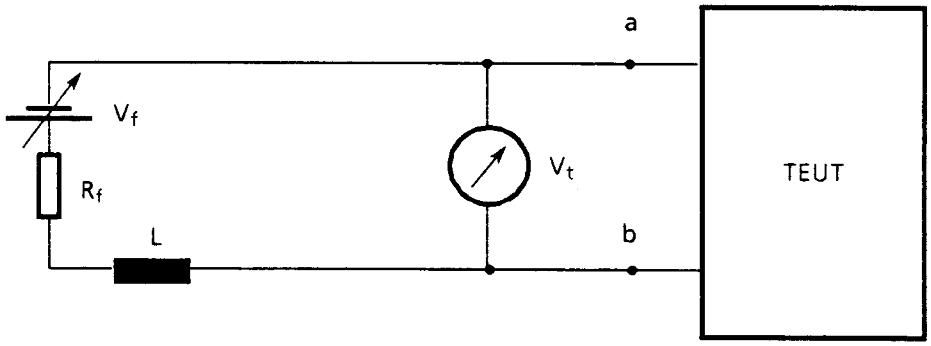


Figure A.5.3.6 (NL) 1: Spark quenching

A.5.3.6 (S) 1 See remark in section 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.

Alternatively, when the TE has a REN = 3 and the user instructions clearly state that any telephone connected to the line has to be plugged into the socket provided on the TE, then the TE to be tested is plugged into one of the sockets of a typical installation as specified in the GB remarks of Chapter 8 and a reference telephone is plugged into the socket provided on that TE.

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.

In the special case when REN = 4, the first test is made with the reference instrument connected alone and a second test is made with only the TEUT connected.

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 µF 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. (See note).

   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 ± 0,2 pulses per second and a break period of 67% ± 1%, when connected to the typical installation with no other TE connected in parallel.

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.

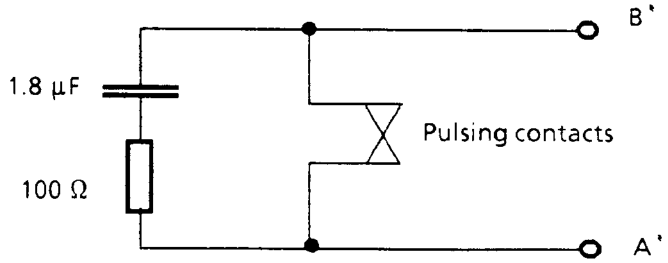
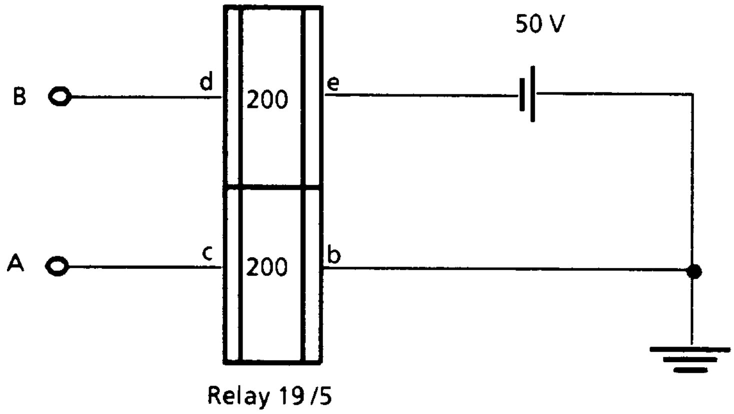


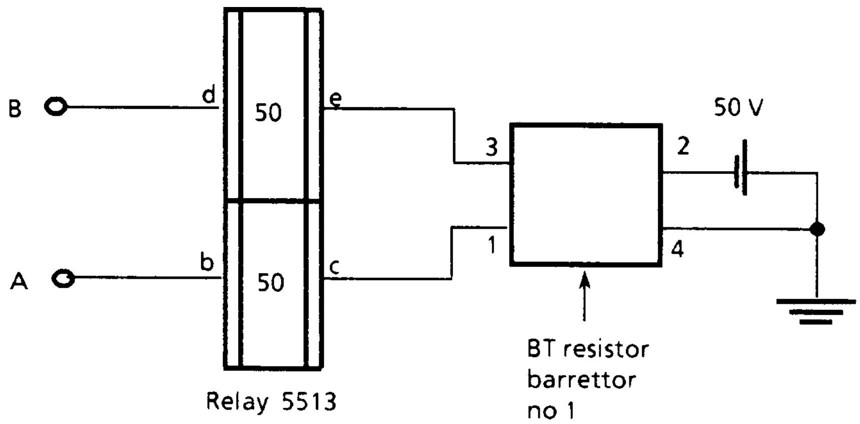
Figure A.5.3.6 (GB) 1.1: Reference source



a) Resistance per coil: 200 Ω ± 10%
^{I}operate ≤ 14 mA
^{I}release ≥ 4,5 mA
Armature travel: 0,64 ± 0,05 mm
Residual gap: 0,30 ± 0,05 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 Ω ± 10%
^{I}operate ≤ 24 mA
^{I}release ≥ 10 mA
Armature travel: 0,64 ± 0,05 mm
Residual gap: 0,28 ± 0,05 mm

Figure A.5.3.6 (GB) 1.2.b: Pulse detection circuit

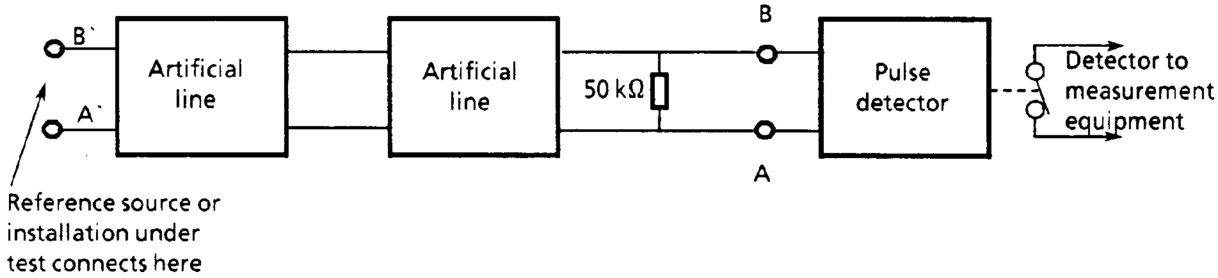


Figure A.5.3.6 (GB) 1.3: Scheme of measurement circuit

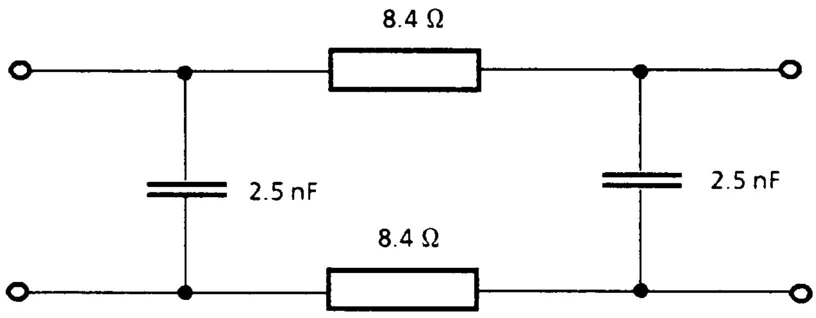


Figure A.5.3.6 (GB) 1.4: Artificial line segment, 0,1 km length

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 Hz ± 0,2 Hz and a break period of 67 ± 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 (D) 1 MFPB (DTMF) dialling state

The MFPB (DTMF) sender shall meet the following requirements at feeding conditions as specified in the first paragraph of Chapter 2, section 2.4.1 (D) 1. This also applies where a dial tone or special dial tone is present.

The effective dc resistance of the terminal equipment at the NTA shall be within the permissible range for "$I \geq 20$ mA", as shown in Chapter 2, section 2.1 (D) 1.

The return loss of the terminal equipment, measured against Z_R (see Chapter 10, section 10.1 (D) 1.1), shall adhere to the following value during the signal send time and the minimum interdigital pause (see table 5.4 (D) 5):

Table 5.4 (D) 1

600 Hz $\leq f \leq$ 1 700 Hz	$\alpha \geq$ 14 dB

The unbalance about earth at the NTA caused by the terminal equipment shall adhere to the following values during the signal send time and the minimum interdigital pause (see table 5.4 (D) 5):

Table 5.4 (D) 2

50 Hz $\leq f \leq$ 300 Hz	$a_u \geq$ 30 dB
300 Hz $< f \leq$ 600 Hz	$a_u \geq$ 46 dB
600 Hz $< f \leq$ 3 400 Hz	$a_u \geq$ 52 dB

Each MFPB (DTMF) signalling character shall be assigned one frequency from the lower and one frequency from the higher frequency group, according to table 5.4 (D) 3.

Table 5.4 (D) 3: Nominal frequencies for MFPB (DTMF) signalling characters

Lower nominal frequencies (Hz)	Upper nominal frequencies (Hz)		
	1 209	1 336	1 477
697	1	2	3
770	4	5	6
852	7	8	9
941		0	

The MFPB (DTMF) signalling frequencies may deviate from their respective nominal frequencies by $d \leq$ 1,8% during the signal send time.

The envelope of the MFPB (DTMF) signalling character shall correspond to the curve illustrated in figure 5.4 (D) 1 and to the requirements specified in table 5.4 (D) 4 and table 5.4 (D) 5.

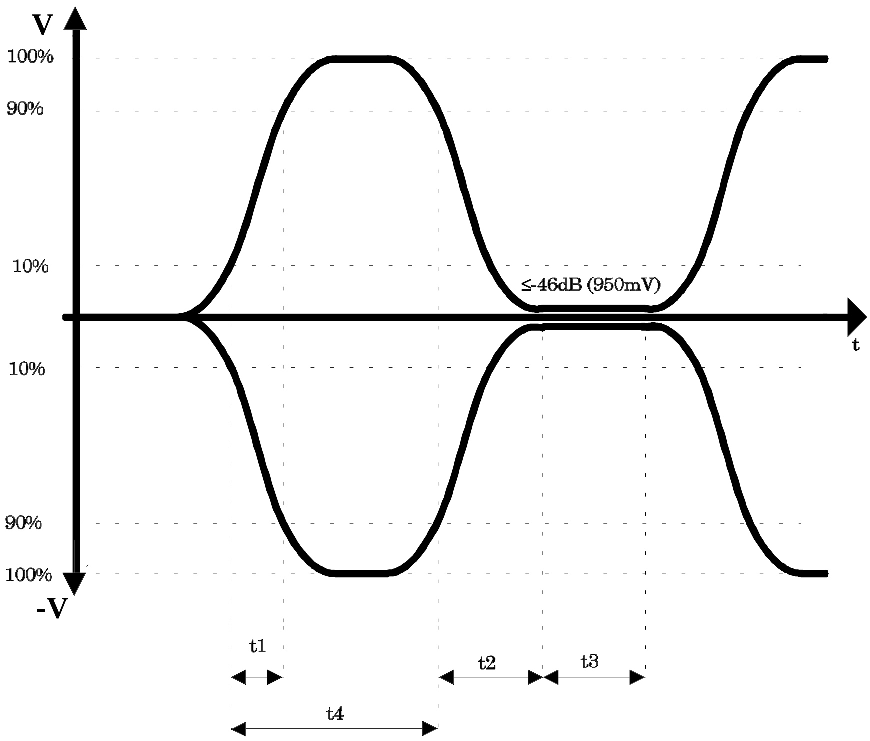


Figure 5.4 (D) 1: MFPB (DTMF) transient timing

Table 5.4 (D) 4 : Timing conditions applicable to figure 5.4 (D) 1

Rise time	$t_1 \leq 7$ ms
Fall time	$t_2 \leq 5$ ms
Interdigital pause	$t_3 \geq 80$ ms
Signal send time	$t_4 \geq 65$ ms

Table 5.4 (D) 5

	Signalling character	Interdigital pause	Minimum level in dB (950mV) f_l	Minimum level in dB (950mV) f_u	Maximum level in dB (950mV) f_l	Maximum level in dB (950mV) f_u
Automatic dialling or manual dialling with automatic timer function	65 ms ≤ t ≤ 100 ms	80 ms ≤ t ≤ 6 500 ms	-16	-14	-10,5	-8,5
Manual dialling without timer function	t ≥ 65 ms	t ≥ 80 ms	-16	-14	-13	-11

The nominal voltage level of the higher of the two nominal frequencies of an MFPB (DTMF) signalling character shall be 0,5 dB ≤ d_{Pl} ≤ 3,5 dB greater than the nominal voltage level of the lower of the two nominal frequencies.

Within the frequency range 250 Hz < f < 4 600 Hz, the sum level of all non-signal-associated frequencies shall be at least 23 dB below the respective sum level of the signalling character or at least 20 dB below the respective level of the single frequency of the signalling character, as appropriate.

5.4.1 General requirements

TE using MFPB (DTMF) signalling shall, whilst in the signalling state, meet requirements for loop condition outlined in Chapter 2, sections 2.2.2, 2.3 and Chapter 4, sections 4.1.2, and 4.2 of this ETS.

Compliance shall be checked using the relevant tests.

Table 5.4.1: General requirements for MFPB dialling

COUNTRY	REQUIREMENT VALUES 2.2.2	2.3	4.1.2	4.2	Remarks
Austria	no	yes	yes	yes	
Belgium	yes	yes	yes	yes	
Bulgaria	no	yes	yes	no	
Cyprus	no	yes	yes	yes	
Denmark	yes	yes	yes	yes	yes
Finland	not mandatory				
France	yes	yes	yes	yes	
Germany					yes
Greece	yes	yes	yes	yes	
Hungary	no	yes	no	no	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	yes
U. Kingdom	no	yes	yes	yes	yes

5.4.1 (DK) 1 TE with calling function shall be provided with MFBP (DTMF).

5.4.1 (D) 1 See section 5.4 (D) 1.

5.4.1 (H) 1 A telephone set shall be provided with MFPB (DTMF) facility.

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 Chapter 2, section 2.3.

5.4.1 (E) 1 See general requirements in Chapter 10, section 10.5 (E) 7.1.

5.4.1 (CH) 1 Sections 4.4.1 and 4.4.3.1 of Chapter 4, have to be fulfilled as well.

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 Hz to 3 400 Hz, during MFPB signalling. See Chapter 4, section 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 V_f (V)	R_f (Ω)	I_f (mA)	n (%)	Remarks
Austria	60		19 - 60	± 1,5	
Belgium	48		20 - $I_{max.}$	1,5	
Bulgaria	60	1 000 - 2 200		± 1,5	
Cyprus	48	440 - 1 740	20 - 100	1,5	
Denmark			16 - $I_{max.}$	1,5	
Finland	44 - 58	800 - 1 710		± 1,5	
France	46 - 54 89 - 104	300 - 1 400 1 400 - 2 960		1,5	
Germany					yes
Greece	44 - 66		20 - 80	± 1,6	
Hungary	48		20 - $I_{max.}$	± 1,5	
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 (D) 1 See section 5.4 (D) 1.

5.4.2 (N) 1 Maximum line current, I_{max}, is defined in Chapter 1, section 1.5.1 (N) 1.

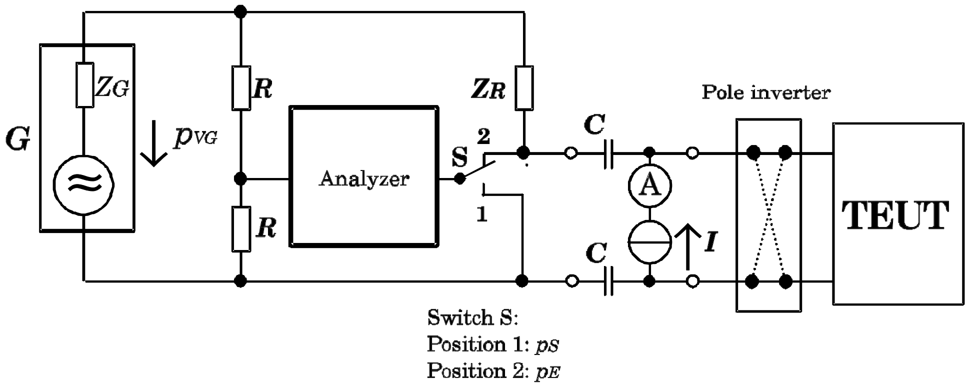
5.4.2 (E) 1 The frequency tolerance shall be maintained within the range stipulated, when the output signal is applied to a load resistor (Z_L) between 400 ohms and 900 ohms.

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 (D) 1 Measurement of the return loss in the MFPB (DTMF) dialling state

The measuring circuit illustrated in figure A.5.4 (D) 1 is used for the measurement.



R = 100 Ω to 1 000 Ω	$Z_G \approx 0$ Ω

Figure A.5.4 (D) 1

The difference between the two feeding bridge resistors R (values of between 100 Ω and 1 000 Ω are permitted) shall be less than 0,1%. The coupling capacitors C should be ≥ 10 µF.

The sending level, measured with switch S in position 1, is set to p_S = -10 dB (950mV), i.e. p_{VG} = -4 dB(950 mV). The receiving level p_E is measured with switch S in position 2.

The input port of the analyzer shall be earth-free and balanced and have an input impedance of > 25 kΩ within the range 400 Hz...2 000 Hz. The equipment shall be able to record the level to be measured reliably within 50 ms. The measurement is carried out with direct currents of I = 20 mA and I = 40 mA and with 3 measuring frequencies, with one measuring frequency in each of the lower, middle and upper sub-band of the range of 600 Hz....1 700 Hz.

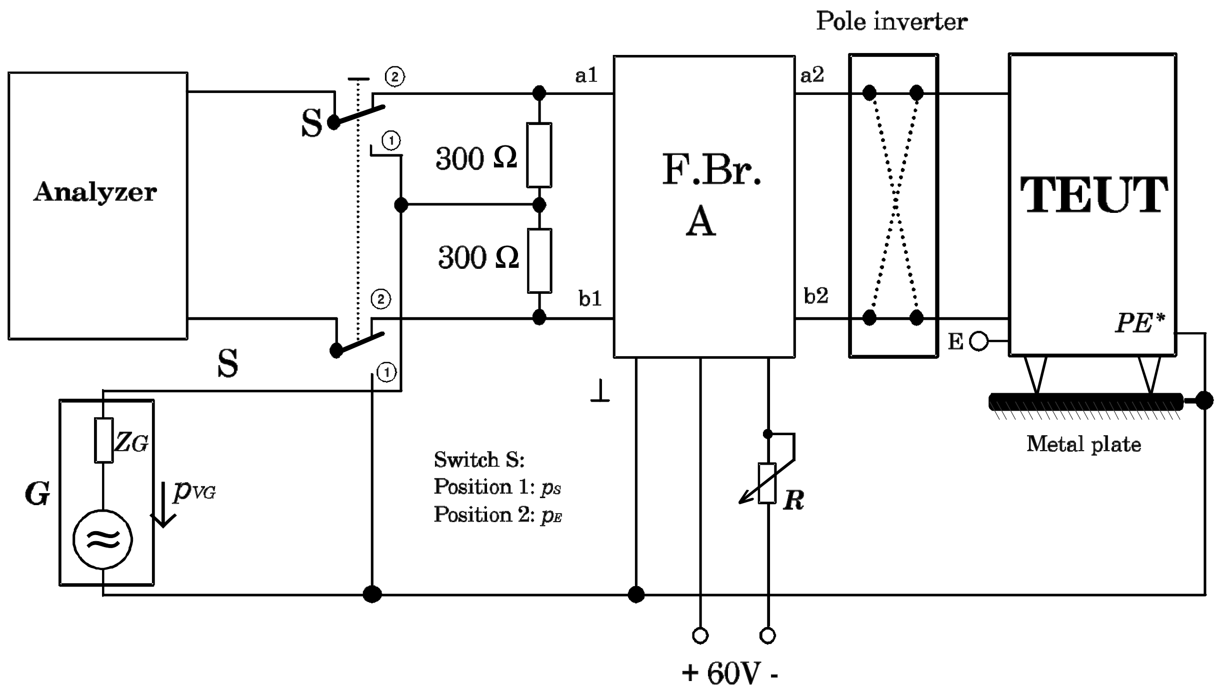
The return loss is calculated using the formula: $a_\alpha = p_S - p_E$.

Where the wanted signal and the MFPB (DTMF) level are emitted via the same source impedance, the measurement may also be carried out in the communication state as specified in section A 4.1.2 (D) 1.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

Measurement of the unbalance about earth in the MFPB (DTMF) dialling state

The measuring circuit illustrated in figure A.5.4 (D) 2 is used for the measurement.



R = 0 Ω and 1 460 Ω	$Z_G \approx 0$ Ω

* if provided

Figure A.5.4 (D) 2

The balance of a TEUT is measured as the degree of unbalance about earth. The difference between the two 300 Ω resistors shall be < 0,1 %.

The sending level p_S of the measuring signal within the frequency range 50 Hz ≤ f ≤ 3 400 Hz is 0 dB (755 mV). The receiving level p_E is measured by means of an analyzer. The equipment shall be balanced and earth-free and have an input impedance of ≥ 25 kΩ. The inherent balance of the measurement set-up (excluding the TEUT) shall be at least 10 dB greater than the specified requirement values. The measurement is preferably carried out at the limits of the frequency ranges given in table 5.4 (D) 2 (see section 5.4 (D) 1).

$$a_u = p_S - p_E \qquad \text{in dB.}$$

The measuring dc voltage is connected to the points of the TEUT specified by the manufacturer to be for connection to earth potential (PE). The signal earth connection E of the terminal equipment at the NTA, where provided, shall not be connected for the measurement.

Measurements are carried out for each polarity of the TEUT (with R = 0 Ω and 1 460 Ω).

Where the wanted signal and the MFPB (DTMF) level are emitted via the same source impedance, the measurement may also be carried out in the communication state as specified in section A 4.2.1 (D) 1.

Measurement of the frequency, harmonics and nominal level and pre-emphasis of MFPB (DTMF) signalling characters

The frequency of MFPB (DTMF) signals and the non-signal-associated frequency components can be measured by means of the measuring circuit illustrated in figure A.5.4 (D) 3. The nominal level and the pre-emphasis are also determined using this measuring arrangement.

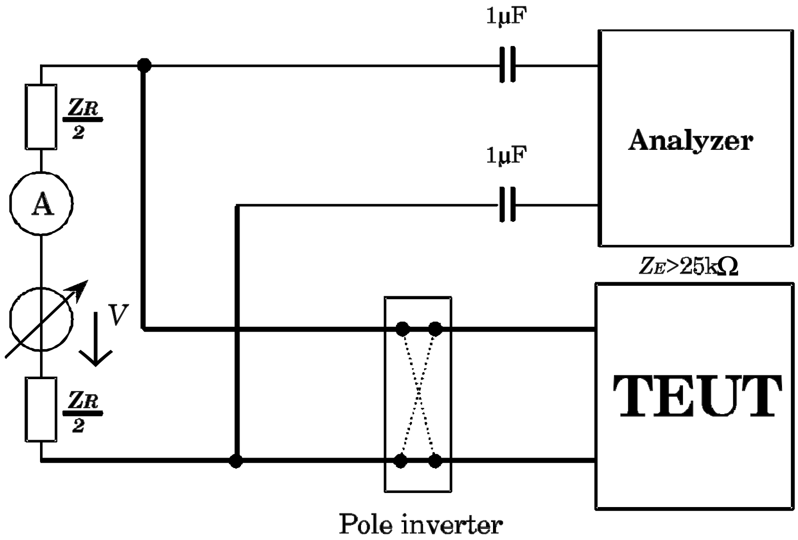


Figure A.5.4 (D) 3

The measurement commences with the emission of the signalling character.

The measurement is carried out at currents of 20 mA and 40 mA. Each value shall be set by means of the dc voltage source *V*.

The sum level of the non-signal-associated components is calculated from the single-frequency levels as follows:

$$p = 10 \bullet \lg\left(10^{\frac{p_{V1}}{10dB}} + 10^{\frac{p_{V2}}{10dB}} + \ldots + 10^{\frac{p_{Vn}}{10dB}}\right) \text{ dB}$$

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

MFPB (DTMF) dialling / envelope

The measuring circuit illustrated in figure A.5.4 (D) 4 is used for the measurement of the envelope of an MFPB (DTMF) signal.

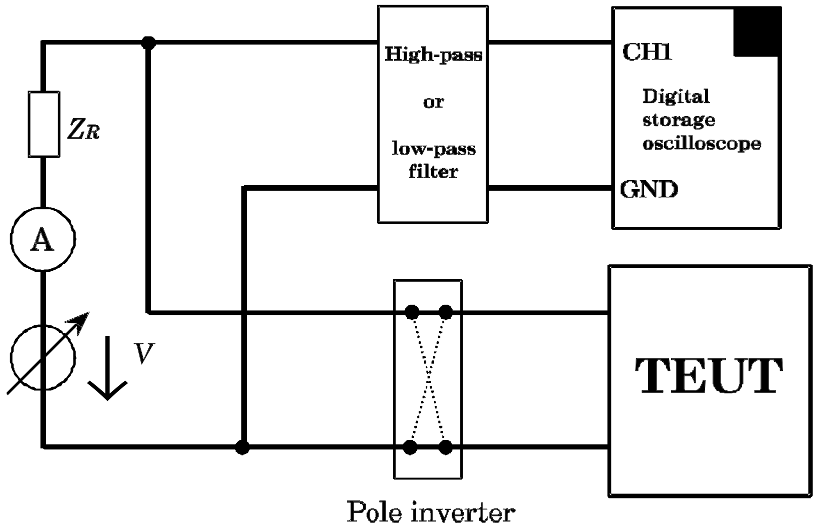


Figure A.5.4 (D) 4

The measurement and analysis commences with the emission of the MFPB (DTMF) signal. In order to prevent beats between the two frequencies from impairing the analysis of the envelope, the sum signal may be separated for selective filtering by means of a high-pass or low-pass filter.

The measurement is carried out at currents of 20 mA and 40 mA. Each value shall be set by means of the dc voltage source *V*.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

Measurement of the dc resistance of an MFPB (DTMF) sender

The measuring circuit illustrated in figure A.5.4 (D) 5 is used for the measurement of the dc resistance of an MFPB (DTMF) signal.

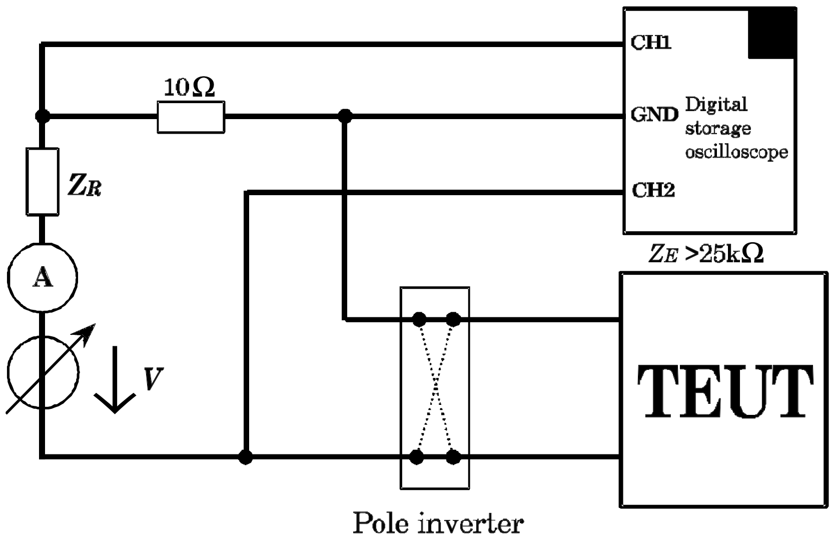


Figure A.5.4 (D) 5

The dc resistance is determined by recording the current and voltage on a digital oscilloscope during signalling.

The measurement is carried out at currents of 20 mA and 40 mA. Each value shall be set by means of the dc voltage source *V*.

The digital storage oscilloscope is used to record the current at the 10 Ω resistor and the voltage in the communication state via CH1 and CH2 respectively. If the dc resistance during the emission of the signalling character does not remain constant, the max. value is determined by optical averaging of the transient timing illustrated on the oscilloscope. The resistance is calculated.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

A.5.4.2 Signalling frequencies and format

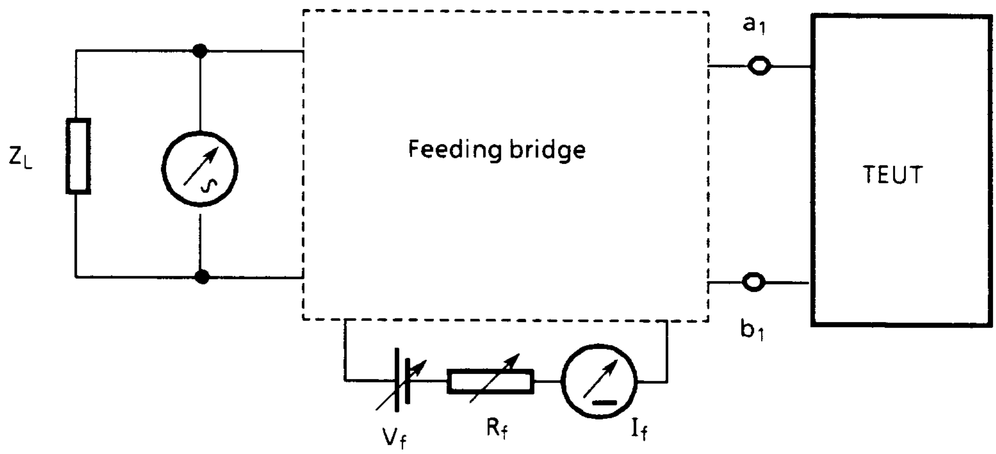
The TEUT is connected as shown in figure A.5.4.2 and placed in the signalling state. The MFPB sender is caused to output, in turn, all provided combinations of the signalling frequencies.

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 the 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		yes
Bulgaria	220 +820/115 nF or 600	60	1 000, 2 200		
Cyprus	600	48	800		
Denmark	600			16, $I_{max.}$	
Finland	600	48	800, 1 710		
France	600	46, 54	1 400 resp. 300		
Germany					yes
Greece	600	60		20, 35	
Hungary	600	48		20, $I_{max.}$	
Iceland	600	48		14, $I_{max.}$	
Ireland	600	48		20, 100	
Italy	600	44, 52	1 880, 720		
Luxembourg	600	60		19, 60	
Malta					
Netherlands	600	42, 48, 66	2 140, 1 130, 800		
Norway	600	60	adjustable	15 - $I_{max.}$	
Portugal	600			not applicable	yes
Spain	600	48	500, 2 200		yes
Sweden	600				yes
Switzerland	600	50	2 300, 500		
U. Kingdom	600	50	400	40	yes

A.5.4.2 (B) 1 For digital PBX the value of Z_L is equal to Z_C as defined in Chapter 4, section 4.1.2 (B) 1.

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 kΩ.

When the frequency tolerance is tested, it is assumed that the TEUT would fulfil the associated requirement if the test procedure were repeated when 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, table 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		
Bulgaria		
Cyprus		yes
Denmark	only A, B, C, D not mandatory	
Finland		
France		yes
Germany		yes
Greece		
Hungary		yes
Iceland		
Ireland		
Italy		
Luxembourg		
Malta		
Netherlands		
Norway		
Portugal		
Spain		yes
Sweden		
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 (D) 1 See section 5.4 (D) 1.

5.4.3 (H) 1 Pushbuttons A, B, C, D are optional, but all other frequency combinations are required.

5.4.3 (H) 2 If the set can be switched over from pulse transmitting mode to DTMF mode by one of the combination buttons, so the switchover must not result transmission of any of the DTMF frequencies.

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 cuåles 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.

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 dB ± 1 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 A.5.4.4.

Table 5.4.4.a: Sending levels options

	Sending level options	
	Option 1	Option 2
High group	-9 dBm ± 2 dB	-6 dBm ± 2 dB
Low group	-11 dBm ± 2 dB	-8 dBm ± 2 dB

Table 5.4.4.b: Sending levels

COUNTRY	REQUIREMENT VALUES					Remarks
	b (dBm)	Z_L (Ω)	f (Hz)	Option 1	Option 2	
Austria	-16	600	380 - 490	no	yes	
Belgium	-4	600	420 - 455	no	yes	yes
Bulgaria		600		no	yes	
Cyprus	-7	600	350 + 450	no	yes	
Denmark	0	600	425	yes	no	yes
Finland	not mandatory	600	not mandatory	yes	yes	
France	-20	600	440	no	yes	yes
Germany						yes
Greece	0	600	400 - 475	no	yes	
Hungary	not mandatory	600	not mandatory	see remark		yes
Iceland	0	600	425	yes	yes	
Ireland						
Italy	-6	600	425	no	yes	
Luxembourg	-6,5	600	380 - 490	no	yes	
Malta						
Netherlands	not mandatory	600	not mandatory	yes	no	
Norway	-6	600	425	yes	no	
Portugal	-5	600	425	yes	no	
Spain		600		no	yes	yes
Sweden	-5	600	425	yes	no	
Switzerland	0, -23	600	375 - 475	no	yes	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 PBXs, 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. For these PBXs, the value of Z_L is equal to Z_C as defined in Chapter 4, section 4.1.2 (B) 1.

5.4.4 (DK) 1 For PABX the minimum level shall be reduced by 1,5 dB.

5.4.4 (F) 1 In addition, the maximum peak levels shall be lower than 3 V.

5.4.4 (D) 1 See Chapter 4, section 4.4.1 (D) 1.

5.4.4 (D) 2 The pre-emphasis between the upper and lower frequency groups shall be +2 dB ± 1,5 dB.

5.4.4 (H) 1 The signal levels at a 600 ohms load of the TE:

High group -5 ... -9 dBm
Low group by 3 ± 1 dB less than of the high group

5.4.4 (E) 1 The requirement in Chapter 10, section 10.5 (E) 7.3 shall be applied when dial tone is used.

5.4.4 (CH) 1 A level difference (between higher and lower frequency components) in the range 2 +2/-1 dB is accepted.

The level of each component shall be in the range +2/-3 dB (referred to the corresponding nominal value -6 dBm and -8 dBm).

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.

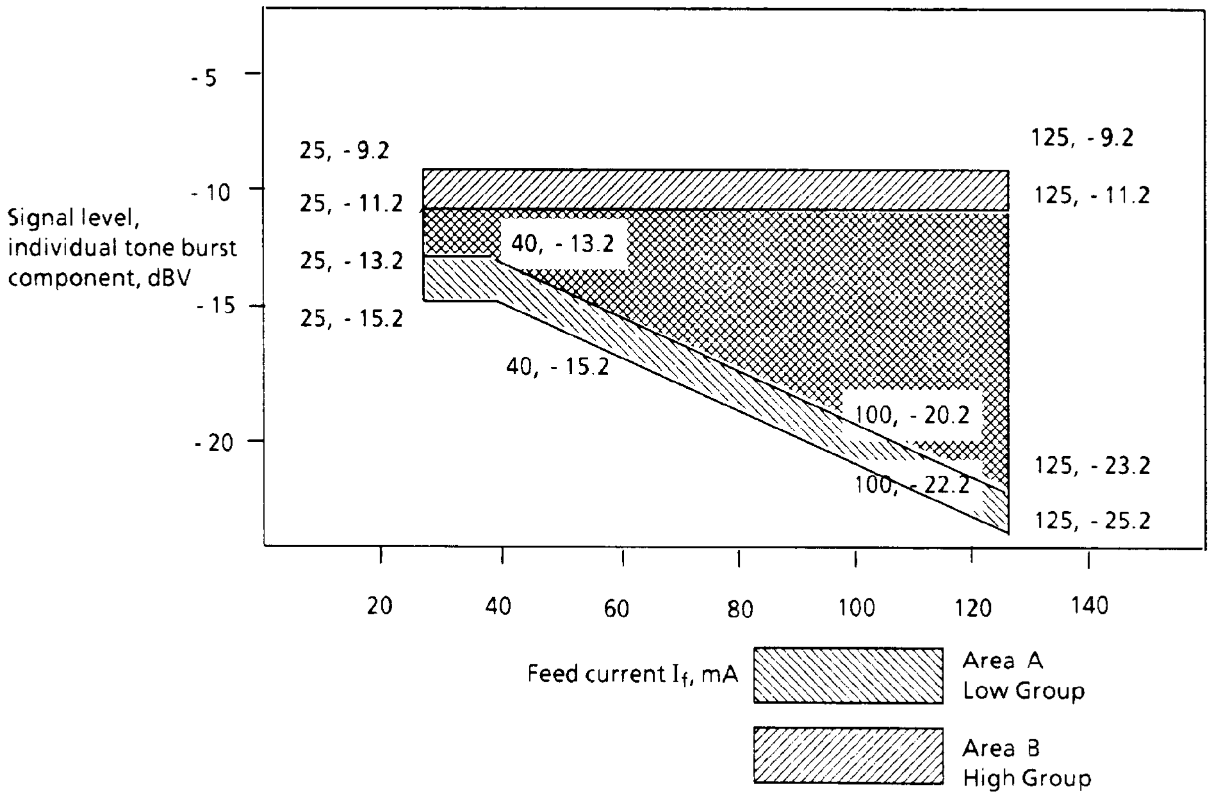


Figure 5.4.4 (GB) 1: Sending levels

A.5.4.4 Sending levels

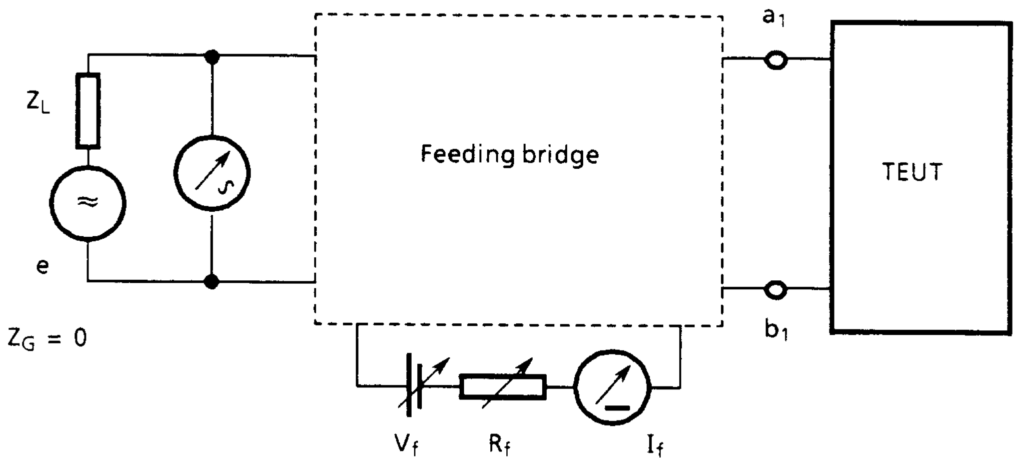
The TEUT is connected as shown in figure A.5.4.4 and placed in the signalling state. The MFPB sender is caused to output, in turn, all provided combinations of the signalling frequencies.

The level of each output signal is evaluated using an instrument capable of measuring each frequency component with an accuracy better than ± 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 Hz, p = -16 dBm, Z_L = 600 Ω	
Belgium		
Bulgaria	mandatory	
Cyprus	Dial tone: 350 + 450 Hz, b = -7 dBm, Z_L = 600 Ω	
Denmark		
Finland		
France		
Germany		
Greece		
Hungary		
Iceland		
Ireland	mandatory	
Italy		
Luxembourg	mandatory	
Malta		
Netherlands	mandatory	
Norway	mandatory	
Portugal		yes
Spain		yes
Sweden		
Switzerland	Dial tone: f: 425 Hz; b: -8 dBm	
U. Kingdom		yes

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 shall also be made when the resistor (R_f) takes the value of 1 100 ohms.

The AC signal generator (e) is changed for a short-circuit.

A.5.4.4 (GB) 1 See section 5.4.4 (GB) 1 for feeding conditions.

5.4.5 Unwanted frequency components

The TE 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	X	600	yes
Belgium	X	X	600	yes
Bulgaria	X	X	600	
Cyprus	X		600	yes
Denmark	X		600	yes
Finland			600	yes
France	X		600	yes
Germany				yes
Greece	X	X	600	
Hungary	X	X	600	yes
Iceland	X	X	600	
Ireland	X	X	600	
Italy	X	X	600	
Luxembourg		X	600	
Malta				
Netherlands	X	X	600	yes
Norway	X		600	
Portugal		X	600	yes
Spain				yes
Sweden	X		600	yes
Switzerland	X	b) Replaced by section 4.4.3.1 (120 Ω)	600	
U. Kingdom	X	X	600	yes

5.4.5 (A) 1 Requirement b:

- in the frequency band 300 Hz - 3 400 Hz: -33 dBm
- in the frequency band 4 300 Hz - 193 kHz: -37 dBm at 4 300 Hz falling 6 dB/octave
- in the frequency band 193 kHz - 2 MHz: -70 dBm.

The level is measured in a bandwidth of 100 Hz.

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 (B) 2 For digital PBX the value of Z_L is equal to Z_C as defined in section 4.1.2 (B) 1.

5.4.5 (CY) 1 This requirement shall also be met during interdigital pauses.

5.4.5 (DK) 1 The requirement "b" is:

- in the frequency band 300 Hz - 4 300 Hz: -33 dBm;
- in the frequency band 4 300 Hz - 16 200 Hz: - 37 dB at 4 300 Hz falling 12 dB/octave to 16 200 Hz;
- in the frequency band 16,2 kHz - 150 kHz: -60 dBm.

5.4.5 (DK) 2 This requirement shall be met also during the interdigital pauses.

5.4.5 (SF)1 The transmission frequency response shall drop at least 12 dB/octave from 3 400 Hz to 12 kHz beginning from -33 dBm. On frequencies from 12 kHz to 100 kHz the transmission level shall not be higher than -55 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 Hz - 3 400 Hz: -33 dBm;
- in the frequency band 3 400 Hz - 4 300 Hz: -37 dBm;
- in the frequency band 4,3 kHz - 28 kHz: -37 dBm at 4,3 kHz falling 6 dB/octave to 28 kHz;
- in the frequency band 28 kHz - 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 Hz - 3 400 Hz are also taken into account in the total.

5.4.5 (D) 1 See Chapter 4, section 4.4.3.1 (D) 1.

5.4.5 (H) 1 When a multifrequency signal is sent, the level of any individual unwanted frequency component shall not exceed the limits:

within 300 Hz - 4 300 Hz	-33 dBm
within 4 300 Hz - 12 000 Hz at 4 300 Hz	-37 dBm
and then dropping at 12 dB/octave to 12 000 Hz	
within 12 kHz - 150 kHz	-55 dBm

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 Chapter 4, section 4.4.3.1 (E) 1, where the provision 1 and the provision 3 of Chapter 4, section 4.4.2.1 (E) 1 are not applicable.

and

c) during the period of emission of each one of the DTMF signals the low frequency outband output power level shall meet with the requirement in Chapter 4, section 4.4.3.1 (E) 2, where the provision 3 of Chapter 4, section 4.4.2.1 (E) 1 is not applicable;

PROVISION c: When the maximum signal period is shorter than the period specified in the requirement in Chapter 4, section 4.4.3.1 (E) 2, 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 Chapter 4, section 4.4.3.1 (E) 3, where the provision 2 is not applicable;

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 Chapter 4, section 4.4.3.1 (E) 4, where the provision 2 is not applicable;

NOTE: It is not included in the dialling condition with DTMF signals any mandatory requirement about the Longitudinal Output Level (LOL) (see Chapter 10, section 10.4 (E) 3.1), nor about Output Signal Balance loss (OSB) (see Chapter 10, 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 Chapter 4, 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 Chapter 4, section 4.5.2 (E) 1.2.b, where the provision 2 is not applicable.

Compliance shall be checked by the tests outlined in section A.5.4.5 (E) 1.

5.4.5 (NL) 1 During interdigital pauses the level of any individual frequency in the band 300 Hz - 3 400 Hz shall be below -40 dBm. Periodical signals shorter than 20 ms followed by a pause 40 ms shall not be taken into account.

5.4.5 (S) 1 When a multifrequency tone signal is sent, the level of any individual unwanted frequency component:

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 Hz - 4 300 Hz: -33 dBm;
- within 4 300 Hz - 12 000 Hz: -37 dBm at 4 300 Hz and then dropping at 12 dB per octave to 12 000 Hz;
- 12 kHz - 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 Hz - 3 400 Hz frequency band nor exceed the values shown on the curve in Chapter 4, figure 4.4.3.1 (S) 1 in the 3,4 kHz - 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 dBm.

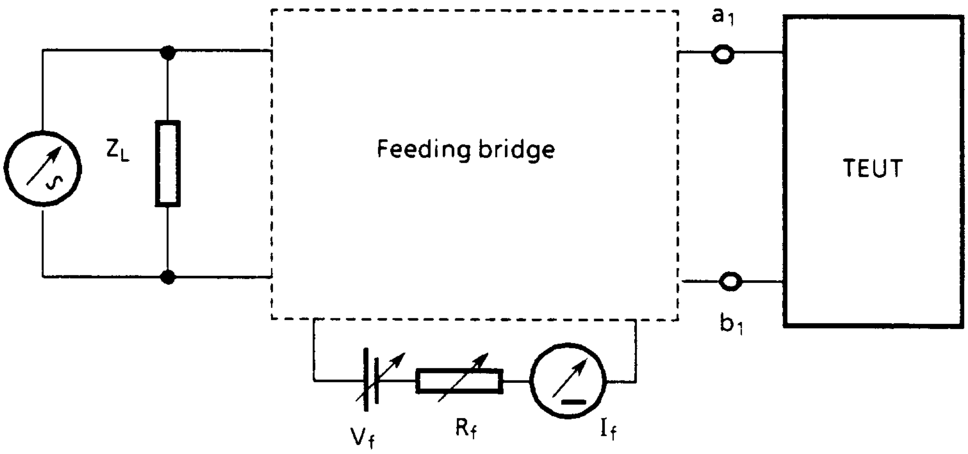
In addition during signalling, for any single unwanted frequency component in the frequency range 300 Hz to 3 400 Hz the power level shall be not greater than -33 dBm, and above 3 400 Hz the power level shall be not greater than the limit values shown in Chapter 4, section 4.4.3.1 (GB) 1. Compliance 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 the 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 the 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 it is not explicitly necessary to undertake the tests are for each polarity of the dc voltage source (V_f). The signal power due to both frequency components shall be substracted 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 It is assumed that the TEUT would fulfil the associated requirement, if the test in Chapter 4, section A.4.4.3 (E) 1 were followed, when the resistor (R_f) takes the values of 500 ohms and 2 200 ohms.

PROVISION b: For the assumption above the TEUT is supposed 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 It is assumed that the TEUT would fulfil the associated requirement, if the test in Chapter 4, section A.4.4.3 (E) 2 were followed, when the resistor (R_f) takes the values of 500 ohms and 2 200 ohms.

PROVISION c: When the maximum signal period is shorter than the period specified in the associated requirement, the TEUT is supposed to generate its highest signal to pause ratio.

A.5.4.5 (E) 1.d It is assumed that the TEUT would fulfil the associated requirement, if the test in Chapter 4, section A.4.4.3 (E) 3 were followed, when the resistor (R_f) takes the values of 500 ohms and 2 200 ohms.

A.5.4.5 (E) 1.e It is assumed that the TEUT would fulfil the associated requirement, if the test in Chapter 4, section A.4.5.2 (E) 1.2 were followed, when the resistor (R_f) takes the values of 500 ohms and 2 200 ohms.

A.5.4.5 (E) 1.f It is assumed that the TEUT would fulfil the associated requirement, if the test in Chapter 4, section A.4.5.1 (E) 1.2 were followed, when the resistor (R_f) takes the values of 500 ohms and 2 200 ohms.

A.5.4.5 (E) 1.g It is assumed that the TEUT would fulfil the associated requirement, if the test in Chapter 4, section A.4.4.3 (E) 4 were followed, when the resistor (R_f) takes the values of 500 ohms and 2 200 ohms.

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

$U_u = 0{,}9\ Up$ Formula 5.4.6.a

The minimum reference value U_l is defined as in formula 5.4.6.b

$U_l = 0{,}1\ Up$ Formula 5.4.6.b

The rise time of the output signal arising from a MFPB (DTMF) sender is defined as the 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 the tests outlined in section A.5.4.6

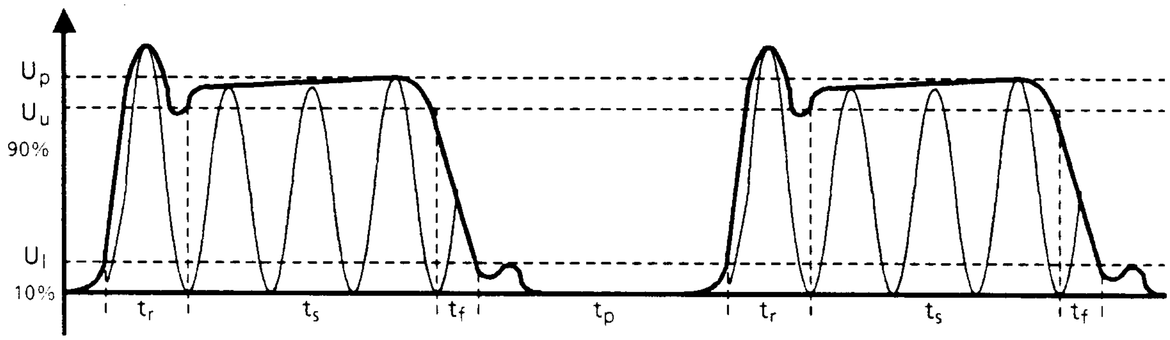


Figure 5.4.6: MFPB transient timing

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 - $I_{max.}$	
Bulgaria	60	1 000 - 2 200		
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				
Greece		not mandatory		
Hungary	48		20 - $I_{max.}$	
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		
Sweden				yes
Switzerland	43 - 57	2 200 - 600		
U. Kingdom	50	≥ 400	25 - 100	yes

5.4.6 (D) 1 See section 5.4 (D) 1.

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 actuated.

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.

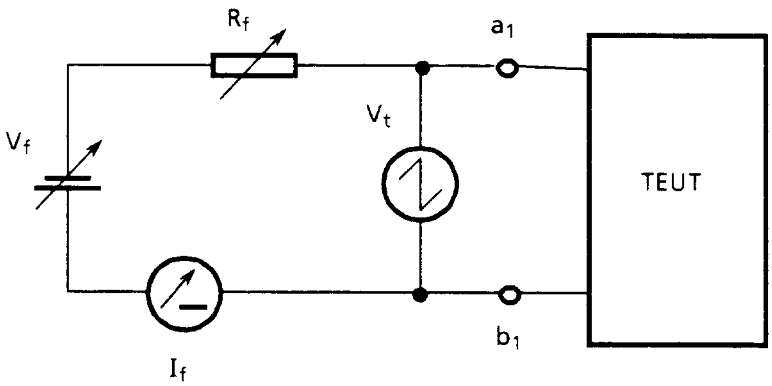


Figure A.5.4.6: MFPB transient timing

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		
Bulgaria	60	1 000, 2 200		
Cyprus	48	800		
Denmark		600	16, $I_{max.}$	
Finland		not mandatory		
France	48	600		
Germany				
Greece		not mandatory		
Hungary	48		20, $I_{max.}$	yes
Iceland	48		14, $I_{max.}$	
Ireland		not mandatory		
Italy	44, 52	1 880, 720		
Luxembourg	60		19, 60	
Malta				
Netherlands	48	1 130		
Norway	60	460, 3 100		yes
Portugal				yes
Spain	48	500, 2 200		
Sweden				yes
Switzerland	50	2 300, 500		
U. Kingdom	50	400	40	yes

A.5.4.6 (H) 1 The TEUT is connected as shown below:

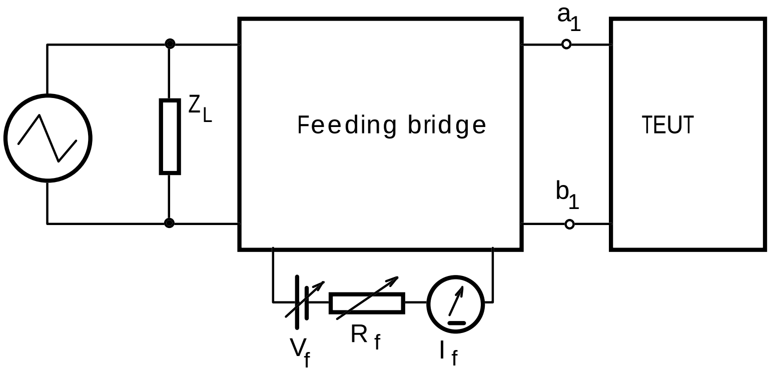


Figure A.5.4.6 (H) 1: Test circuit

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.

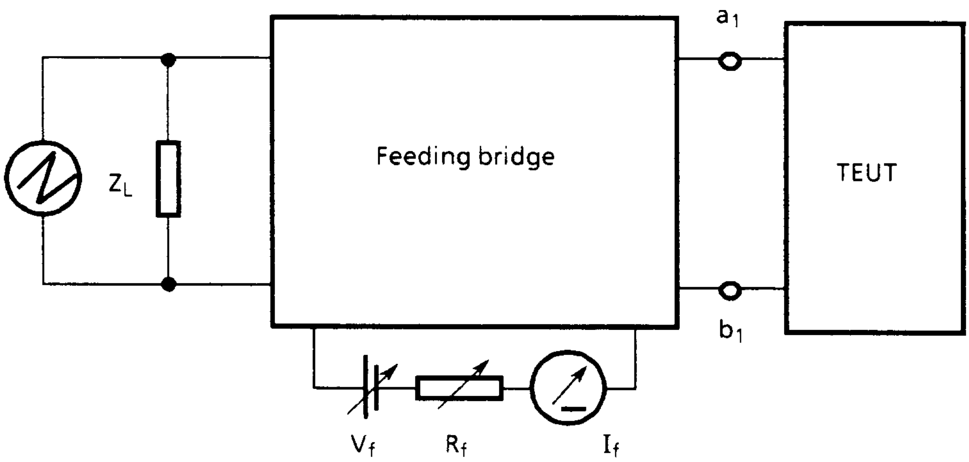


Figure A.5.4.6 (N) 1

A.5.4.6 (P) 1 Same dc feeding condition values as in section A.5.4.2 (P) 1.

A.5.4.6 (S) 1 Feeding conditions, see Chapter 1, table 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 t_r (ms)	Remarks
Austria	10	
Belgium	7	
Bulgaria	7	
Cyprus	7	
Denmark	7	
Finland	not mandatory	
France	5	
Germany		yes
Greece	not mandatory	
Hungary	7	
Iceland	7	
Ireland	7	
Italy	not mandatory	
Luxembourg	7	
Malta		
Netherlands	7	
Norway	7	yes
Portugal	18	yes
Spain	10	
Sweden	7	
Switzerland	7	
U. Kingdom	15	

5.4.6.1 (D) 1 See section 5.4 (D) 1.

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.5.4.6.

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 5.4.6.1.

Table A.5.4.6.1: MFPB signal rise time

COUNTRY	TEST VALUES	Remarks
Austria	not mandatory	
Belgium	mandatory	
Bulgaria	mandatory	
Cyprus	mandatory	
Denmark		
Finland		
France		
Germany	mandatory	
Greece		
Hungary		
Iceland		
Ireland	mandatory	
Italy	not mandatory	
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.

5.4.6.2 (D) 1 See section 5.4 (D) 1.

Table 5.4.6.2: MFPB signal fall time

COUNTRY	REQUIREMENT VALUES t_f (ms)	Remarks
Austria	10	
Belgium	7	
Bulgaria	10	
Cyprus	7	
Denmark	7	
Finland	not mandatory	
France	5	
Germany	not mandatory	
Greece	not mandatory	
Hungary	not mandatory	
Iceland	7	
Ireland	not mandatory	
Italy	not mandatory	
Luxembourg	not mandatory	
Malta		
Netherlands	7	
Norway	not mandatory	
Portugal	18	
Spain	10	
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 of section 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	not mandatory	
Belgium	mandatory	
Bulgaria	mandatory	
Cyprus	mandatory	
Denmark		
Finland		
France		
Germany		
Greece		
Hungary		
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	
Bulgaria	65	65	
Cyprus	70	70	
Denmark	65	$\geq (t_s - 10), \geq 65$	yes
Finland	65	65	
France	65	65	
Germany		not mandatory	yes
Greece	78		
Hungary	70	70	yes
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 (D) 1 See section 5.4 (D) 1.

5.4.7.1 (H) 1 t_s includes the rise time
t_p includes the fall time

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 inside a square 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 of international numbers with this TE can become unsuccessful".

PROVISION 3: The signal send time (t_s) is defined as the period between the time that the amplitude of the peak envelope of the output signal exceeds for the last time the value $\mu = 0,5\ \mu p$, and the time that the amplitude of the peak envelope of the output signal is for the first time less then the value $\mu = 0,5\ \mu p$.

PROVISION 4: The signal send time (t_p) is defined as the period between the time that the amplitude of the peak envelope of the output signal is for the last time greater than the value $\mu = 0,5\ \mu p$, and the time that the amplitude of the peak envelope of the output signal exceeds for the first time the value $\mu = 0,5\ \mu p$.

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	mandatory	
Belgium	mandatory	
Bulgaria	mandatory	
Cyprus	mandatory	
Denmark		
Finland		
France		
Germany		
Greece		
Hungary	mandatory	
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 Check, when necessary, that the user's manual includes the required sentence.

5.4.7.2 MFPB senders with automatic operation

MFPB (DTMF) senders 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 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	80 (+70, -10)	80 (+70, -10)	yes
Belgium	65 min.	65 min.	
Bulgaria	65 - 110	65 - 110	
Cyprus	70 - 120	70 - 120	
Denmark	65 - 130	$\geq (t_s - 10), \geq 65$	
Finland	≥ 65	≥ 65	
France	65 - 130	65 - 130	
Germany			yes
Greece			
Hungary	≥ 70	≥ 70	yes
Iceland	≥ 65	≥ 65	
Ireland	65 - 120	65	
Italy	65 - 150	65 - 150	
Luxembourg	80 ± 10	80 ± 10	
Malta			
Netherlands	≥ 65	≥ 65	yes
Norway	≥ 65	≥ 65	
Portugal	65 - 150	65 - 150	
Spain	≥ 65	135 - 1 200	yes
Sweden	≥ 65	≥ 65	yes
Switzerland	≥ 65	≥ 65	
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 (A) 2 With TE which include PABX functions a signal pause up to 3,5 s is permissible before the last outgoing digit.

5.4.7.2 (D) 1 See section 5.4 (D) 1.

5.4.7.2 (H) 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 inside a square the following sentence:

"La marcación automatica de números internacionales con este equipo terminal puede llegar a ser infructuosa".

NOTE: The equivalent English sentence is: "The automatic dialling of international numbers with this TE can become unsuccessful".

PROVISION 3: See the provisions 3 and 4 in section 5.4.7.1 (E) 1.

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	mandatory	
Belgium	mandatory	
Bulgaria	mandatory	
Cyprus	mandatory	
Denmark		
Finland		
France		
Germany		
Greece		
Hungary	mandatory	
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 the 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 the 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 α (dB)	Remarks
Austria	not mandatory	
Belgium	50	
Bulgaria	50	
Cyprus	50	
Denmark	50	
Finland	not mandatory	
France	55	
Germany	not mandatory	
Greece		
Hungary	not mandatory	
Iceland	not mandatory	
Ireland	not mandatory	
Italy	50	
Luxembourg	not mandatory	
Malta		
Netherlands		yes
Norway	50	
Portugal	30	
Spain	50	yes
Sweden	50	
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

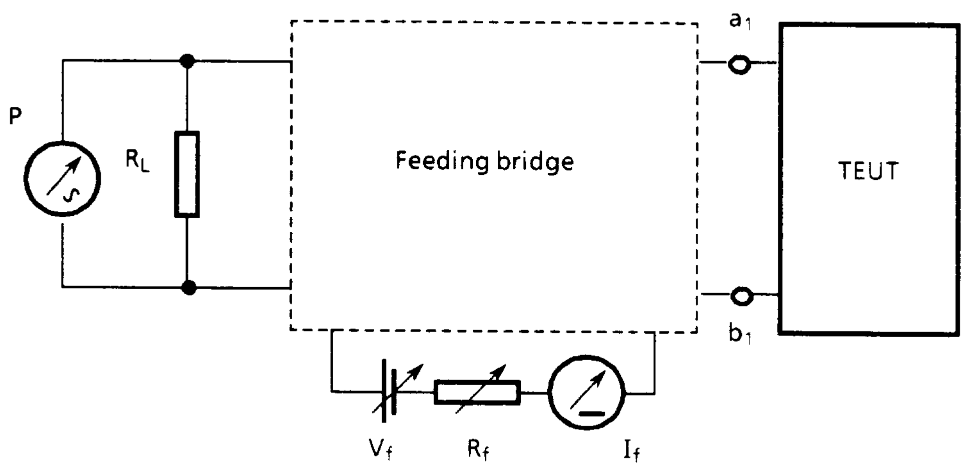
The TEUT is arranged as shown in figure A.5.4.8. It is caused to assume loop condition, and is caused to send continuously to line speech-band signals appropriate to its normal manner of use.

The level of signals is measured across the line termination impedance, R_L, over a bandwidth, $\Delta_{f.}$ Values R_L and Δf 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 A.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 the 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
Bulgaria	300 - 3 400	600	
Cyprus	30 - 3 400	600	
Denmark	1 000	600	yes
Finland	not mandatory		
France	1 100	600	
Germany	not mandatory		
Greece			
Hungary	not mandatory		
Iceland	not mandatory		
Ireland	not mandatory		
Italy	300 - 3 400	600	yes
Luxembourg	not mandatory		
Malta			
Netherlands			yes
Norway	1 100	600	yes
Portugal	300 - 3 400	600	yes
Spain	300 - 3 400	600	yes
Sweden	630, 1 000 - 2 000	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 (DK) 1 The test is carried out only for terminal equipment with electro-acoustic transducers as follows:

The sound pressure at a distance of 25 mm from the artificial mouth is adjusted to -4,7 dB rel. 1 Pa at 1 kHz. The artificial mouth is positioned successively with the lip ring against the electro-acoustic transducers.

U_f is measured at loop currents of 16 mA and $I_{max.}$ both with and without DTMF signalling at a single two-tone combination. The attenuation is determined from 20 $\log_{10}$ of the ratio between the two voltages at each of the two loop currents.

A.5.4.8 (I) 1 The TE is arranged as shown in figure A.5.4.8. It is caused to assume the loop condition, and it is caused to send continuously to line a sine signal E at one of the frequency values included in the effective bandwidth of the third octave filter of 315 Hz. The signal shall be applied by an Artificial Mouth, to the sender of the TE, positioning the handset at LRGP. Adjust the power level P_1 of the signal, measured at the line terminals on a 600 ohm load, at the value -13 dBm. Then the TE is caused to assume the DTMF signalling state and the level P_2 of the signal E shall be measured. Verify that P_2 is at least 50 dB lower than P_1. Measurements shall be carried out by filtering the measured signal with a 1/3 oct. filter centred on the frequency of 315 Hz.

A.5.4.8 (NL) 1 Same tests as in section A.5.4.5.

A.5.4.8 (N) 1 The TEUT is connected as shown in figure A.5.4.8 (N) 1. A sinewave signal (f) of 1 100 Hz is applied via an artificial mouth. The signal shall be adjusted to produce and output signal (P_1) with level -10dBm across Z_L.

Then the level (P_2) of the 1 100 Hz signal shall be tested when DTMF signals are sent from the terminal equipment.

The attenuation (A) is the difference between P_1 and P_2 expressed in dB.

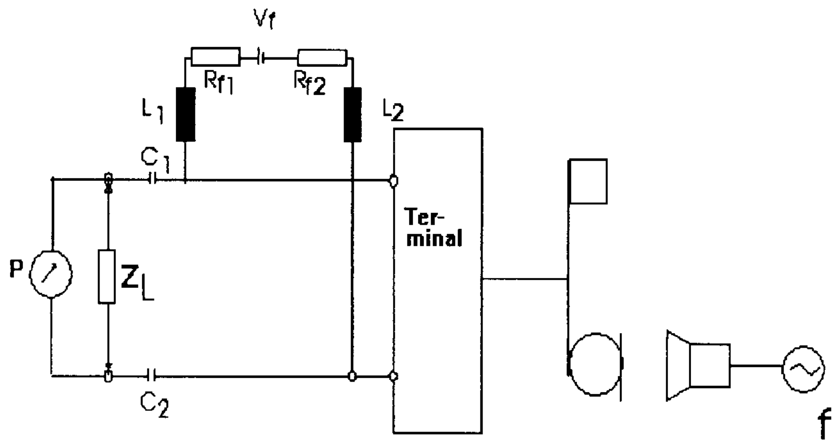


Figure A.5.4.8 (N) 1

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 Chapter 4, section A.4.4.1 (E) 1 shall be applied.

The signal power due to both frequency components, when it is present, shall be substracted from the total power within the bandwidth required, then 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.

A.5.4.8 (S) 1 The test is only carried out for telephone sets.

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 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	1,3	60		19 - 60	yes
Belgium	not mandatory				
Bulgaria	0,5	60	2 200		
Cyprus	not mandatory				
Denmark	2			16 - $I_{max.}$	
Finland	not mandatory				
France	1	46 - 54 86 - 104	200 - 1 300 300 - 2 860		
Germany					yes
Greece	0,1	44 - 66		20 - 80	
Hungary	not mandatory				
Iceland	not mandatory				
Ireland	1	48		20, 100	
Italy	0,5	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 .-.1,5	43 - 57	2 200 - 600		yes
U. Kingdom	not specified				

5.5 (A) 1 The time t_s includes the transient time of the transmission (speech) circuit and starts from the end of the last break pulse or MFPB signal.

5.5 (A) 2 For TEs with MFPB dialling the time t_s shall be within 70 ms - 1 300 ms.

5.5 (D) 1 See also Chapter 2, section 2.4.1 (D) 1.

5.5 (P) 1 It may be mandatory on terminal standards or NET.

5.5 (E) 1 The requirements in Chapter 10, sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to Chapter 10, 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_s (ms).

5.5 (S) 2 Feeding conditions, see Chapter 1, section 1.5.2.

5.5 (CH) 1 With pulse dialling, this time is measured after the last loop interrupt in the pulse series of a digit and t_s has no monimal limit (can be t_s = 0). With DTMF, this time is measured after the end of the send time of a dialling signal and has to be $t_s \geq 65$ ms.

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 conditions or any 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.

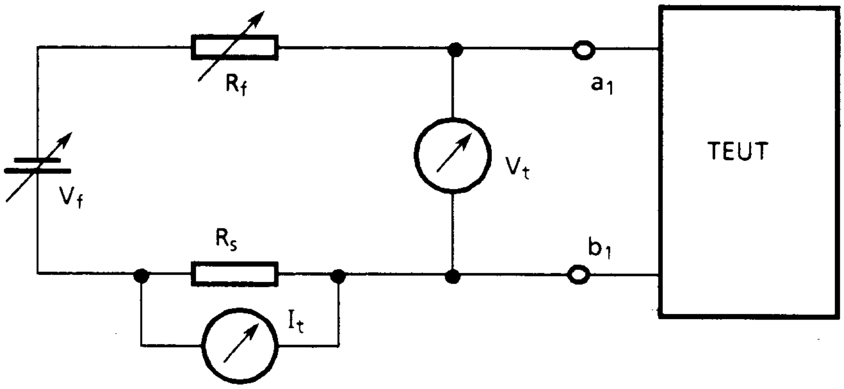


Figure A.5.5: Switching after dialling condition

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				
Bulgaria	60	2 200		10	
Cyprus	not mandatory				
Denmark			16, $I_{max.}$	600	
Finland	not mandatory				
France	46, 54	1 300 resp. 200		100	
Germany					
Greece	60		20, 35	100	
Hungary	not mandatory				
Iceland	not mandatory				
Ireland	48	5 000		0	
Italy	44, 52	1 280, 120		600	
Luxembourg	60		19, 60	100	
Malta					
Netherlands	48	1 130		0	
Norway	not mandatory				
Portugal	not mandatory				yes
Spain					yes
Sweden					yes
Switzerland	50	1 000		100	
U. Kingdom	not specified				

A.5.5 (P) 1 It may be mandatory on terminal standards or NETs.

A.5.5 (E) 1 See remark in section 5.5 (E) 1.

A.5.5 (S) 1 Feeding conditions, see Chapter 1, table 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.

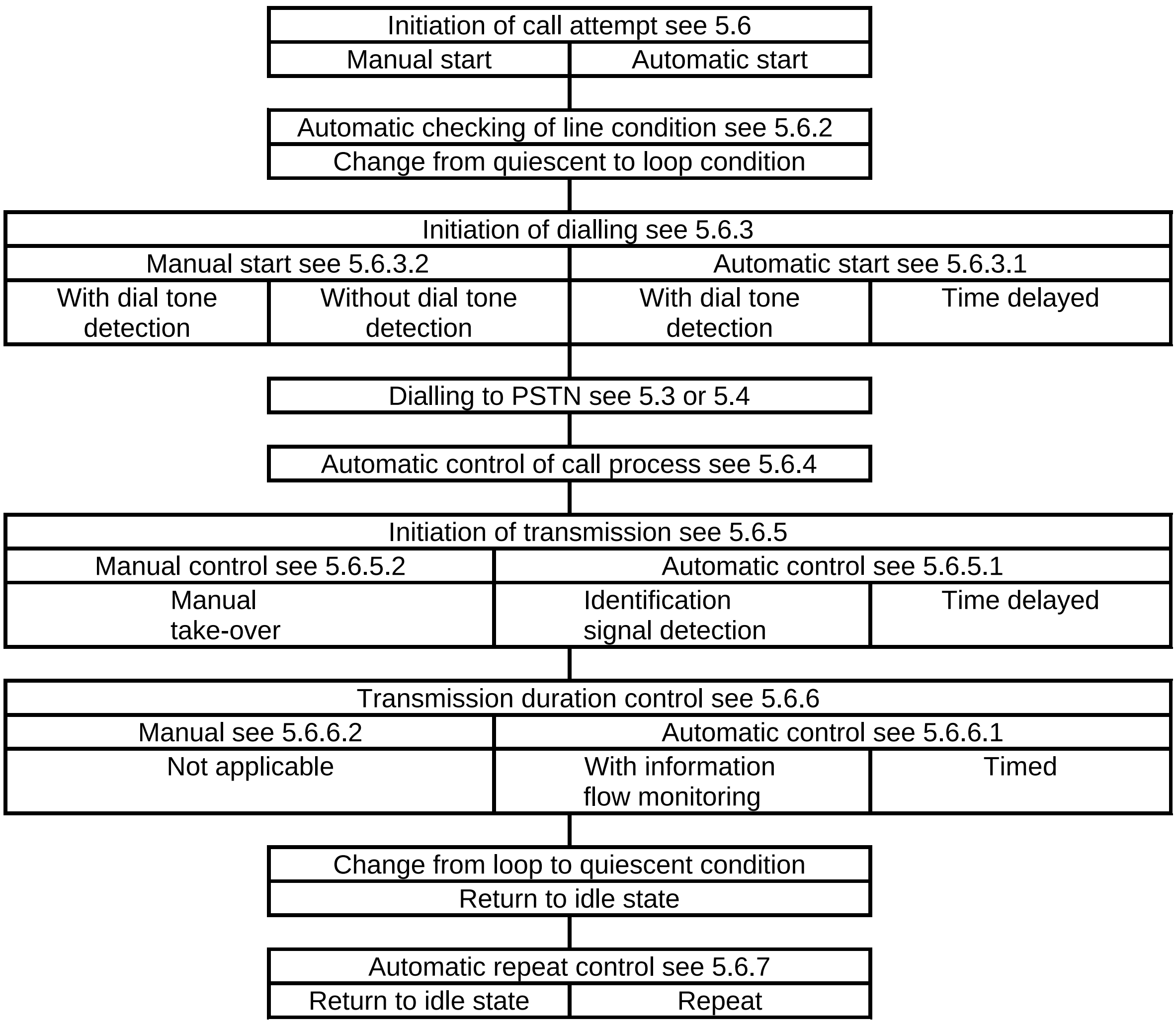


Diagram 5.6: Overview of automatic calling procedure

5.6 (A) 1 Sequences such as short term line seizure followed by loop termination followed by reseizure of the line prior to each dialling operation, are not permissible.

5.6 (D) 1 See section 5.6.7.1 (D) 1

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	
Bulgaria	yes	
Cyprus	yes	
Denmark	yes	
Finland	yes	
France	yes	
Germany		
Greece	yes	
Hungary	no	
Iceland	yes	
Ireland	no	
Italy	yes	
Luxembourg	yes	
Malta		
Netherlands	no	
Norway	no	yes
Portugal	yes	
Spain	no	yes
Sweden	no	
Switzerland	yes	
U. Kingdom	no	yes

5.6.1 (N) 1 The type approval is valid if the equipment 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 (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 mandatory yes/no	Remarks
Austria	yes	yes
Belgium	yes	
Bulgaria	yes	
Cyprus	yes	
Denmark	yes	
Finland	no	
France	yes	yes
Germany	yes	
Greece	yes	
Hungary	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 (A) 1 TE which are intended for the connection to several PSTN lines shall not seizure the lines and dial simultaneous.

NOTE: Additional requirements are under study.

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 mandatory (yes/no)	Remarks
Austria	yes	
Belgium	yes	
Bulgaria	yes	
Cyprus	yes	
Denmark	yes	
Finland	no	
France	yes	yes
Germany	yes	
Greece	no	
Hungary	yes	
Iceland	yes	
Ireland	no	
Italy	no	
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 µPa) 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.

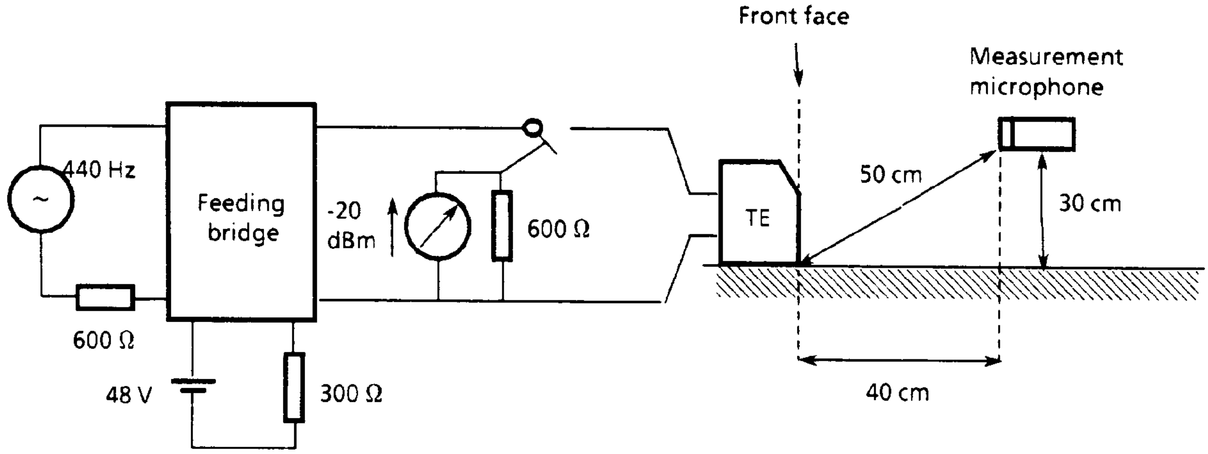


Figure 5.6.1.3 (F) 2: Audible monitoring

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 Chapter 10, sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to Chapter 10, 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, section 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 mandatory (yes/no)	Remarks
Austria	no	
Belgium	no	yes
Bulgaria	yes	
Cyprus	no	
Denmark	no	
Finland	no	
France	yes	yes
Germany		
Greece		
Hungary	no	
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 (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 s to 15 s before the call attempt.

The ringing signal detection shall conform to Chapter 6, 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 Chapter 9, section 9.4.1.1.

5.6.2 (P) 1 It may be mandatory on terminal standards or NETs.

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	1,5	30	yes	yes	yes
Belgium	2	5	3		yes	yes	yes
Bulgaria			2 - 5	20	yes	no	yes
Cyprus	2	5	3	10	yes	yes	
Denmark	2	10	10	25	yes	yes	yes
Finland	2	5	4	60	no	no	
France	2	3	3	6 - 12			yes
Germany							yes
Greece	2	5	4	20	no	yes	
Hungary			2	20	yes	no	
Iceland	6	not spec.	4	10	yes	yes	
Ireland	3,5	4,5	1 ± 0,5	10	no	no	
Italy	2,7	10	4	20	no	no	
Luxembourg			2 - 5	20	yes	yes	
Malta							
Netherlands	4	8	1 - 2	5 - 40	no	no	
Norway	3	not spec.	4	20	no	no	
Portugal	2,5	5	3	10	no	yes	yes
Spain							yes
Sweden	not applic.	idem	2	60	yes	no	
Switzerland	3	10	2	5 - 21	no	no	
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 (A) 3 If the dial tone is applied for $t_2 \leq 0{,}5$ s dialling shall not start.

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 (BG) 1 For TE with automatic initiation of dialling or automatic repeat call attempts a dial tone detector is mandatory.

5.6.3.1 (DK) 1 For PABX a dial tone detector is not mandatory.

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 Chapter 9, section 9.5.2).

5.6.3.1 (D) 1 See section 5.1 (D) 1.

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 Chapter 10, 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 (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

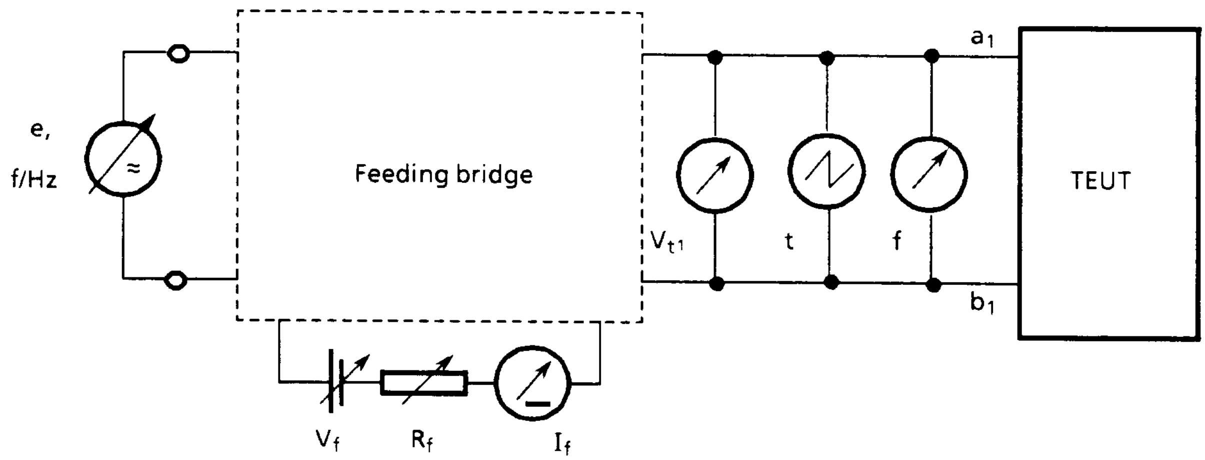
A.5.6.3.1 Automatic initiation of dialling

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 the 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		
Bulgaria	60	2 200		
Cyprus	48	800		
Denmark			16, $I_{max.}$	
Finland	48	800, 1 710		
France	48	600		
Germany				
Greece	60		20, 35	
Hungary	48		20, $I_{max.}$	
Iceland	48		14, $I_{max.}$	
Ireland	48	5 000		
Italy	48	1 100		
Luxembourg	60		19, 60	
Malta				
Netherlands	42	2 140		
Norway	60	3 100		
Portugal	48	300, 1 800	not applicable	
Spain			25	
Sweden				yes
Switzerland	50	1 000		
U. Kingdom	50	400	$\geq$ 25	yes

A.5.6.3.1 (E) 1 See remark in section 5.6.3.1 (E) 1.

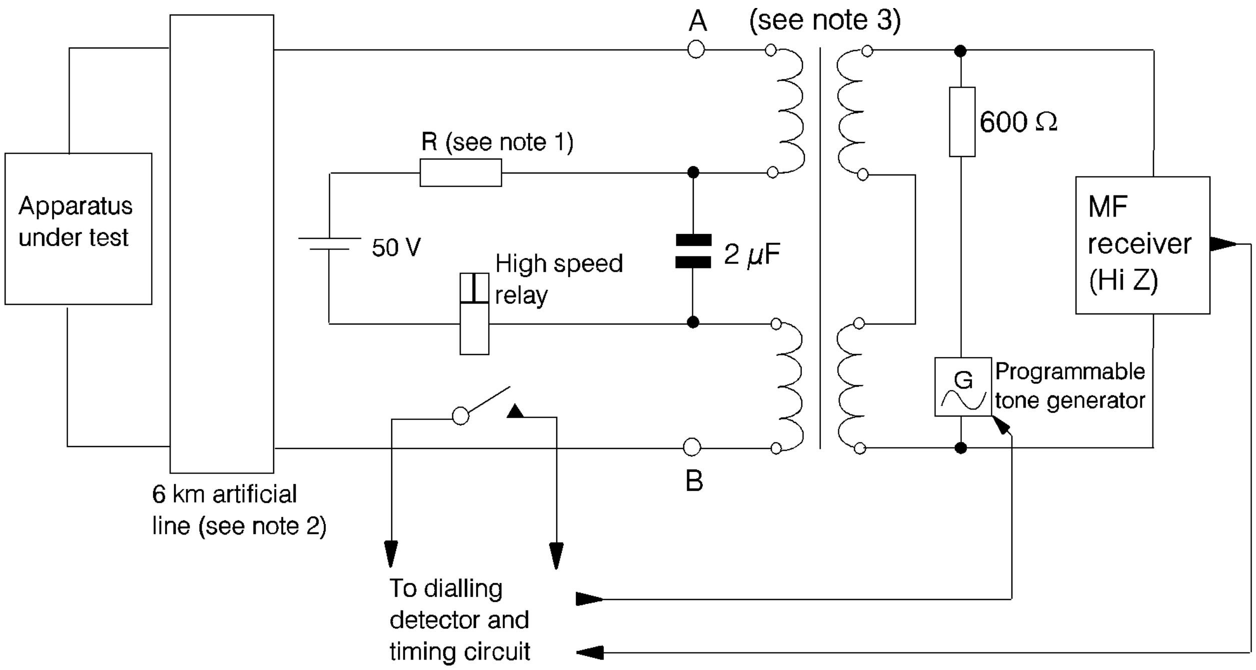
A.5.6.3.1 (GB) 1 The characteristics of the tones used for testing are given in table A.5.6.3.1 (GB) 1.

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 Ω ± 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 (DK) 1 When actual dialling is to be initiated manually, the dial tone shall be indicated audibly or visually to the user. An indication shall occur when the dial tone complies with the frequency and level requirements in section 5.2. The times t_2 and t_3 have no significance.

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 (D) 1 See section 5.1 (D) 1.

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 the various dc feeding condition values shown in table A.5.6.3.1.

A.5.6.3.2 (DK) 1 The test shall only ensure that dial tone is indicated audibly or visually (with the frequency response and levels of the detector for the latter being tested (clause 5.2), and the dialling starts when the appropriate manual action is made.

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 mandatory (yes/no)	Remarks
Austria	no	
Belgium	no	yes
Bulgaria	no	
Cyprus	no	
Denmark	no	
Finland	no	
France	no	
Germany	no	
Greece	no	
Hungary	no	
Iceland	no	
Ireland	no	
Italy	no	
Luxembourg	no	
Malta		
Netherlands	no	yes
Norway	no	
Portugal	no	
Spain		yes
Sweden	no	
Switzerland	no	
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 Chapter 9, sections 9.5.3 and 9.5.4.

The TE shall revert to the idle state within 20 s.

5.6.4 (E) 1 The requirements in Chapter 10, sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to Chapter 10, 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 an 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	100	not mandatory	
Belgium		80		yes
Bulgaria		100		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				
Greece		not mandatory		
Hungary		not mandatory		
Iceland		not mandatory		
Ireland		not mandatory		
Italy		not mandatory	not mandatory	
Luxembourg	not mandatory	100	not mandatory	
Malta				
Netherlands		not mandatory		
Norway	not mandatory	not mandatory	not mandatory	
Portugal	not applicable	90	not applicable	yes
Spain				yes
Sweden		not mandatory		
Switzerland	not mandatory	100	not mandatory	
U. Kingdom		not mandatory		

5.6.5 (B) 1 Time periods t_4 and t_6 may be specified on terminal standards.

5.6.5.1 (BG) 1 Time periods t_4 and t_6 may be specified on terminal standards.

5.6.5.1 (BG) 2 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 (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 Chapter 9, 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 ± 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 Chapter 9, 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 (P) 1 Time periods t_4 and t_6 may be specified on terminal standards or NETs.

5.6.5.1 (E) 1 The requirements in Chapter 10, sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to Chapter 10, sections 10.5 (E) 8 and 10.5 (E) 9.2.

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 t_7 (s)	Remarks
Austria	not mandatory	
Belgium	80	
Bulgaria	100	
Cyprus	not mandatory	
Denmark	90	
Finland	not mandatory	
France		yes
Germany		
Greece	not mandatory	
Hungary	60	
Iceland	not mandatory	
Ireland	not mandatory	
Italy	not mandatory	
Luxembourg	100	
Malta		
Netherlands	not mandatory	
Norway	not mandatory	
Portugal	90	
Spain		yes
Sweden	not mandatory	
Switzerland	180 only for automatic controlled line seizures, not mandatory for manual procedures	
U. Kingdom	not mandatory	

5.6.5.2 (E) 1 The requirements in Chapter 10, sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to Chapter 10, section 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 section 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 transmission 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 may be controlled automatically by either monitoring the flow of information or by a timer within the TE. When the 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 (D) 1 No requirement.

5.6.6.1 Automatic transmission duration control

Transmission duration 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	100	100	yes
Belgium	300	60	
Bulgaria	100	60	
Cyprus	90	20	
Denmark	60	15	yes
Finland	not mandatory	90	
France	180	180	yes
Germany			yes
Greece	90	60	
Hungary	not mandatory		
Iceland	not mandatory		
Ireland	not mandatory		
Italy	not mandatory		yes
Luxembourg	100	60	
Malta			
Netherlands	not mandatory		
Norway	180		yes
Portugal	90		yes
Spain			yes
Sweden	not mandatory		
Switzerland	180	100	yes
U. Kingdom	i) 60, ii) 180, iii) 240 - 300	not mandatory	yes

5.6.6.1 (A) 1 If the TE recognizes an information signal from the called TE within the period t_9 the period t_9 can start renewed. See also Chapter 6, 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) 2 Depending on the type of the controlled information, Chapter 6, sections 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) 3 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 (D) 1 No requirement.

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 -60 dBm for more than 20 s.

5.6.6.1 (N) 2 If the busy/congestion dial tone is detected, the line must be released within 20 s.

5.6.6.1 (N) 3 The connection shall be released within 5 s if a carrier signal is lost.

5.6.6.1 (N) 4 Equipment using ETSI and/or ITU-T standardized protocols shall, if transmission problems occur, clear the connection as specified within the standard/recommendation.

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 Chapter 10, sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to Chapter 10, 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 (CH) 1 The following requirements shall be applied:

1. General requirement (for automatic and non-automatic TE): Releasing a connection manually shall be possible at all times; a TE shall complete the release of a connection within 5 s.

2. Specific requirements for automatic TE (e.g.: automatic answering machine or automatic dialling device):

a) Manual operation shall have priority over the automatic operation for network access. For example an answering machine shall not prevent a terminating call from being answered manually. The user shall be informed if TE with automatic operation are likely to interfere with or interrupt existing connections (e.g. alarm systems).

b) The connection shall not last more than 3 min unless at least one of the following automatic release functions are implemented:

- busy/congestion tones recognition as per section 5.2;
- level monitoring of transmission signals as per Chapter 6, section 6.4.2.1;
- loop current monitoring as per Chapter 6, section 6.4.4;
- ringing tone recognition as per section 5.2.

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_8(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_9(s) after the test signal has been removed.

The values of t_8 and t_9 are shown in table 5.6.6.1.

Measurements are carried out at the 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	
Bulgaria	yes	
Cyprus	yes	
Denmark	no	
Finland	no	
France	yes	
Germany		
Greece		
Hungary	not mandatory	
Iceland	not mandatory	
Ireland	no	
Italy	no	
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 (P) 1 See section 5.6.6.1 (P) 1.

5.6.6.2 (E) 1 The requirements in Chapter 10, sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to Chapter 10, 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 the 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	0,5	
Belgium	5	1	
Bulgaria	5	1	yes
Cyprus	5	1	
Denmark	2	1/30	
Finland	5	1	yes
France			yes
Germany			yes
Greece	5	1	
Hungary	5	1	
Iceland	5	1	
Ireland	5	1	
Italy	5	1	
Luxembourg	5	1	
Malta			
Netherlands	5	1	
Norway	5	1	yes
Portugal	60	1	
Spain			yes
Sweden	3	1	yes
Switzerland	5	1	yes
U. Kingdom	5	i) 1, ii) 2, iii) 3, iv) 10	yes

5.6.7.1 (BG) 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 (SF) 1 The dialling to a different number shall not start earlier than 2 s after the establishment of the subscriber loop.

If the equipment is able to identify the dial tone of the public exchange the dialling may start earlier.

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 s 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 In the case of automatic dialling, terminal equipment shall fulfil the requirements specified in either a) or b).

a) After every automatically initiated unsuccessful call attempt, a time interval of at least $t = 30$ s shall elapse after transition to the quiescent state before the next automatically initiated outgoing call,

b) If the time interval between unsuccessful call attempts is $5 \text{ s} \leq t \leq 30$ s, up to 12 call attempts may be made successively. A new series of call attempts may be begun:

- if a call was successfully established on the 12th dialling attempt (of the previous sequence) at the latest;
- in the case of manual intervention;
- if a time interval of $t \geq 120$ min was maintained.

NOTE: The requirements specified in a) and b) apply to the interface of the terminal equipment. If several terminals should be used at one analogue switched access, the above requirements shall be met by each individual terminal.

5.6.7.1 (N) 1 Equipment with the possibility to repeat a call attempt automatically, is defined as:

- equipment able to perform call repetition to the same number automatically;
- equipment which is controlled by external software on call repetition. In this case the necessary restrictions shall be performed within the terminal equipment.

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 and 10.5 (E) 11.2.

5.6.7.1 (S) 1 For alarm calls $t_{11} = 3$ s.

5.6.7.1 (CH) 1 a TE detects one of the following situations, it is considered that it recognises an unsuccessful call attempt:

- no dial tone 5 s ... 21 s after line seizure;
- busy tone (subscriber busy or congestion tone);
- more than 11 ringing cycles of a ringing tone;
- prior to the transmission phase no signal (100 s pause).

Requirement 1: A TE may only carry out automatic redialling if it recognises an unsuccessful call attempt.

Requirement 2: If a TE does not recognise any unsuccessful call attempt (in the case of a successful connection with an incompatible destination), it may carry out automatic redialling a maximum of five times.

See also section 5.6.6.1 (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					
	}	1min	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
6 th 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 cleardown to reseizure.

A.5.6.7.1 Repeat call attempts

The TEUT is connected as shown in figure A.5.6.3.1 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 time 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 called 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 repeat call attempts

COUNTRY	REQUIREMENT VALUES			Remarks
	t_{12} (hrs)	n_1	n_2	
Austria	1	12	12	yes
Belgium	1	4	15	yes
Bulgaria				yes
Cyprus	1	4	15	
Denmark	∞	10	10	yes
Finland	1	4	not specified	yes
France	1	6	16	yes
Germany				yes
Greece	1	4	not specified	
Hungary	∞	8	15	
Iceland		10	10	
Ireland	1	4	15	
Italy	1	4	15	yes
Luxembourg	1	4	15	
Malta				
Netherlands	1	15		yes
Norway		not mandatory		
Portugal	not applicable	4	15	yes
Spain				yes
Sweden	1	10	15	
Switzerland	∞	5 or ∞	5 or ∞	yes
U. Kingdom	2	5 or 7	5 or 7	yes

5.6.7.2 (A) 1 The recognition of metering pulses for a successful call (see section 5.6.7.2 b) is not applicable in the Austrian PSTN.

The TE shall not attempt more than 12 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 12 unsuccessful attempts the TE has to stop the dialling function.

Restart of the dialling function is possible by manual intervention on the TE by the user, occurrence of a new event and by remote control via the subscriber line.

5.6.7.2 (A) 2 TE without a recognition for a successful call and a manual dial start (e.g. simple automatic dialler) shall not attempt more than 4 call attempts to any one number. After 4 call attempts the TE has to stop the dialling function. Restart or stop of the dialling function is only possible by manual intervention on the TE by the user.

TE without a recognition for a successful call and a automatic dial start (e.g. simple alarm devices) shall not attempt more than 4 call attempts from each memory location. After 4 call attempts from each used memory location the TE has to stop the dialling function. Restart of the dialling function is only possible by manual intervention on the TE by the user or by occurrence of a new event.

For TE with answering tone recognition (e.g. modem, fax) a following dial repetition function is also permitted.

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 (BG) 1 See section 5.6.7.1 (BG) 1.

5.6.7.2 (DK) 1 Section 5.6.7.2 b) is not valid in Denmark.

5.6.7.2 (SF) 1 The call attempts to the same number are not limited when using TE for alarm purposes.

5.6.7.1 (SF) 2 The call attempts to different numbers are not limited.

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 section 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 (NL) 1 Repeat call attempts shall not be more than 15 call attempts to one specific number within one time period of 1 hour.

5.6.7.2 (P) 1 For telemetry calls, $n_2 = 15$.

5.6.7.2 (E) 1 The requirements in Chapter 10, sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to Chapter 10, sections in 10.5 (E) 11, and more specifically to section 10.5 (E) 11.3.

5.6.7.2 (CH) 1 $n_1 = n_2 = \infty$ if the TE recognises an unsuccessful call attempt according to section 5.6.7.1 (CH) 1, otherwise $n_1 = n_2 = 5$.

5.6.7.2 (GB) 1 Refer to section 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 the various dc feeding condition values as shown in table A.5.6.3.1.

5.7 Identification signals

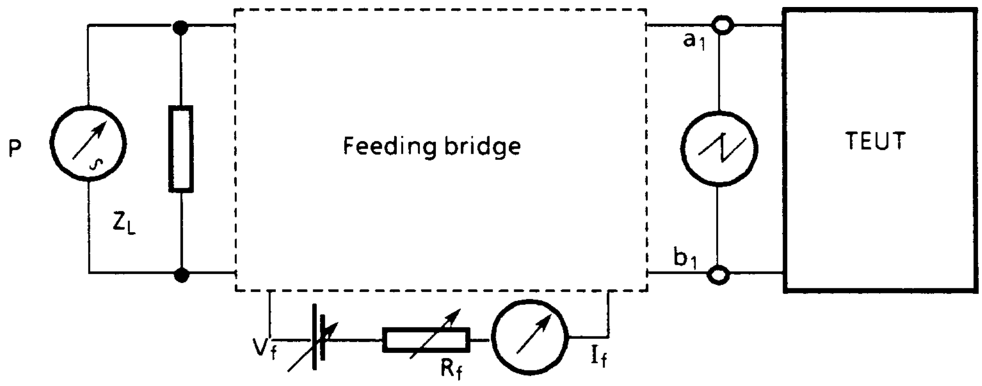
For TE capable of automatically establishing a call, an identification signal consisting of speech or data-related tones shall be sent by the TE no later than t_1 seconds after the completion of the dialling function.

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 mandatory	Remarks
Austria	yes	
Belgium	yes	
Bulgaria	no	
Cyprus	yes	
Denmark	yes	
Finland	no	
France		
Germany	no	
Greece		
Hungary	no	
Iceland	no	
Ireland	yes	
Italy	no	
Luxembourg	yes	
Malta		
Netherlands	no	
Norway	no	
Portugal	no	yes
Spain		yes
Sweden	no	
Switzerland	no	
U. Kingdom	no	

A.5.7 (P) 1 It may be mandatory on terminal standards or NET.

A.5.7 (E) 1 See the 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 Chapter 4, 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
Bulgaria	not mandatory		
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	
Hungary	not mandatory		
Iceland	not mandatory		
Ireland	5	800 - 2 200	
Italy	not mandatory		
Luxembourg	5	800 - 2 200	
Malta	not stated		
Netherlands	not mandatory		
Norway	not mandatory		
Portugal	not mandatory		yes
Spain			yes
Sweden	not mandatory		
Switzerland	not mandatory		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. Maximum output level -6 dBm.

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 Hz ± 10 Hz or another tone related to the binary "1" in the modem. It shall not have power in the band 2 100 Hz ± 250 Hz. The identification signal is sent during periods from 0,5 s to 0,7 s, followed by pauses from 1,5 s 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 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 (DK) 1 An identification signal in the form of a code signal shall consist of one or more frequencies in the frequency range 300 Hz - 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 MFPB (DTMF) as identification signal.

5.7.1 (F) 1 See section 5.6.5 (F) 2.

5.7.1 (P) 1 It may be mandatory on terminal standards or NETs.

5.7.1 (E) 1 The requirements in Chapter 10, sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to Chapter 10, 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 not mandatory for automatic devices.

If identification signals are used directly after the answer, they shall not be confused with the network generated tones.

If signalling tones or announcement texts are used in the TE for the call handling of connections, they shall observe the following requirements (tests with V_f = 50 V, R_f = 500 Ω and 2 300 Ω):

- The sending levels shall be ≥ -20 dBm (measurement method complying with Chapter 4, section A.4.4.2.2).

- The noise voltage (incl. distortion factor components) shall be 20 dB lower than the sending levels, or weaker (measurement method complying with section A.5.4.5.a).

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 Chapter 4, 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 Chapter 6, 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	
Bulgaria	no	
Cyprus	no	
Denmark	no	
Finland	no	
France		yes
Germany	no	
Greece		
Hungary	no	
Iceland	no	
Ireland	no	
Italy	no	
Luxembourg	no	
Malta		
Netherlands	no	
Norway	no	
Portugal	no	yes
Spain		yes
Sweden	no	
Switzerland	See section 5.7.1	
U. Kingdom	no	

5.7.2 (F) 1 See section 5.6.5 (F) 2.

5.7.2 (P) 1 It may be mandatory on terminal standards or NETs.

5.7.2 (E) 1 The requirements in Chapter 10, sections 10.5 (E) 8 to 10.5 (E) 11 shall be applied. Particular reference is made to Chapter 10, sections 10.5 (E) 8 and 10.5 (E) 9, and more specifically to section 10.5 (E) 9.4.

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Chapter 6: Answering function

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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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, 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.

Transposition dates	
Date of adoption of this ETS:	31 March 1996
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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	25 - 60	40 - 55	20,60	500	200	
Belgium	25 - 75	23 - 27	48	1 000	250	
Bulgaria	30 - 90	22 - 52	60	2 200	not spec.	
Cyprus	30 - 85	23,5 - 26,5	48	440 - 1 740	200	
Denmark	40 - 120	25 ± 2,5	44 - 56	500 - 2 400	200	
Finland	35 - 75	25 ± 3	44 - 58	800 - 1 710	not spec.	
France	28 - 90	50 ± 10 %	0,45 - 54	300	200	yes
Germany			0	0	200	yes
Greece	25 - 90	16 - 50	44 - 66	500	200	
Hungary	40 - 100	20 - 30	48	500	400	
Iceland	30 - 90	22 - 28	48	800	200	
Ireland	25 - 75	17, 25	43 - 53	5 000	not spec.	
Italy	26 - 80	20 - 50	48	800	200	yes
Luxembourg	45 - 75	25 ± 10%	60	500	200	
Malta						
Netherlands	35 - 90	23 - 27	66	800	200	
Norway	28 - 90	25 ± 3	24 60	460 - 1 200 460 - 3 500	350	yes
Portugal	30 - 120	16 2/3 ± 10 % 25 ± 20 %	45 - 55	500 - 2 500	10 s	yes
Spain		20 - 30	48	200		yes
Sweden	30 - 90	25 ± 3; 50 ± 1	33 - 60	800 - 2 200	200	
Switzerland	20 - 90	21 - 55	43 - 57	2 200 - 600		yes
U. Kingdom	not specified					yes

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 See section 1.7.9 (D) 1.

6.2.1 (I) 1 The ringing signal detector shall be activated when a ringing signal of voltage V = 70 V_{rms} and frequency f = 25 Hz is applied to TE line terminal through a 10 kohm resistor.

6.2.1 (I) 2 The ringing signal detector shall be activated when a ringing signal of voltage V = 70 V_{rms} and frequency f = 25 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:

-$\Delta U = 40 - 60$, $\Delta f = 25 \pm 3$, $\Delta V_f = 70 - 90$, $\Delta R_f = 1\ 200$

The signal peak level is Vf + $\sqrt{2}$ x U.
-U = 155 Vp - p (square wave), $f = 25 \pm 3$, $V_f = 80$, $R_f = 1\ 200$

The signal peak level is V_f + 1/2 x $V_{p - p}$.

6.2.1 (P) 1 Cadence:
$t_{on}(s) = 1 \pm 0{,}2$
$t_{off}(s) = 5 \pm 1$

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 (CH) 1 If a TE recognises a ringing signalling from the PSTN (ringing signals are sinusoidal), it must pass it on correctly to the ringing device or produce measurable display within 11 s or seize automatically the line of the called subscriber according to section 6.3 if the user has not intentionally switched off the ringing function.

Sensitivity of the ringing detector: The ringing detector must respond at voltages ≥ 20 V for a ringing signal duration of 240 ms followed by 10 cycles of 4 s pause / 1 s signal at 25 Hz +/-3 Hz and 50 Hz +/-3 Hz. Displaying and automatic line seizure are at 40 dBA for acoustic ringing devices and before the 11th cycle for automatic TE.

See also section 1.7.9.

6.2.1 (CH) 2 If a voice TE has an alerting module following requirements apply:

- TE-specific functions shall not prevent an indication of the ringing signalling (The indication of a ringing signalling shall not be prevented, even if the TE is seized with internal connections or other supplementary functions).

- If the ringing signal is not indicated by an electro-acoustic ringing device, the manufacturer must inform the user accordingly.

- The following 3 requirements shall be fulfilled with the alerting module set to deliver the maximum output:

a) The TE must pass on a ringing signal (Starting) within 10 s;
b) The TE must pass on the end-of-call (Stopping) within 6,5 s;
c) In the active state, the electro-acoustic ringing device (option) must have a volume of ≥ 50 dBA and ≤ 120 dBA on the maximum volume setting (TBR 8, section 10.2.1, "Alerting module, Sound pressure level").

NOTE: Due to the risk of collision, the PSTN interface circuits should be (recommendation) blocked for outgoing calls immediately after call recognition.

6.2.1 (GB) 1 Ringing signal detector sensitivity is defined in terms of ringer equivalence number (REN), the requirements and compliance tests for which are specified in Chapter 3.

NOTE: When ringing 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 ringing 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.

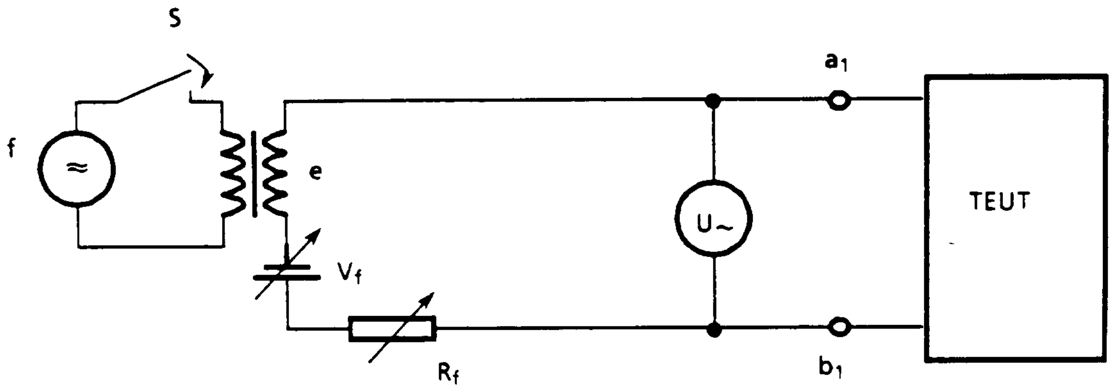


Figure A.6.2.1: Ringing signal detector sensitivity

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	25, 60	40, 55	20, 60	500	
Belgium	25	25	48	1 000	
Bulgaria	30, 90	25, 50	60	1 000	
Cyprus	30, 85	25	48	800	
Denmark	40, 120	25	48	500	
Finland	35	25	48	800	yes
France	28, 90	50	0, 48	300	
Germany					
Greece	25, 50, 75	25, 50	60	500	
Hungary	40, 100	20, 30	48	500	
Iceland	30, 90	25	48	800	
Ireland	25	25	48	5 000	
Italy	26, 80	25, 50	48	800	
Luxembourg	45, 75	25	60	500	
Malta					
Netherlands	35, 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	
Switzerland	20, 60 24	22, 53 25, 50	50 50	1 000 1 000	yes
U. Kingdom					yes

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 (N) 1 U corresponds to open circuit-voltages.

The following signal combinations shall be tested:

28 V_{rms}, 22 Hz, 24 V dc;
28 V_{rms}, 28 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 0,8 s on/4 s off.

The square wave signals shall be tested with a half-pulse relation of 50/50 and 60/40.

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 AC 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 (s)	Switch (S) Opened (s)
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 (CH) 1 The measurements for section 6.2.1 (CH) 1 are conducted with a 240 ms ringing signal, 4 s pause, 1 s ringing signal at 20 V and 60 V, 22 Hz and 53 Hz. The threshold for an acoustic device is 40 dBA.

A.6.2.1 (CH) 2 The measurements for starting and stopping are conducted in accordance with TBR 8, annex A.3, "Audible alerting module", with a 240 ms ringing signal, 4 s pause, 1 s ringing signal at 24 V, 25 Hz and 50 Hz. The threshold for an acoustic device is 40 dBA (TBR 8, subclause 10.2.2.1, "Alerting module control, Starting" and TBR 8, subclause 10.2.2.2, "Alerting module control, Stopping").

The **starting** delay is measured from the start of the electric ringing signal to the start of the output ringing signal

The **stopping** delay is measured from the end of the electric ringing signal to the end of the output ringing signal

The measurements for the acoustical output of the **electro-acoustic** ringing device are conducted in accordance with TBR 8, annex A.3, "Audible alerting module", during 10 cycles ringing signal (1 s ringing, 4 s pause) of 24V ringing voltage at 25 Hz and 50 Hz.

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 - 55	60	500	
Belgium	10	23 - 27	48	1 000	
Bulgaria	9	22 - 52	60	1 000 - 2 200	yes
Cyprus	10	25	48	440 - 1 740	
Denmark	17	25 ± 2,5; 50 ± 5	44 - 56	500 - 2 400	
Finland	10	20 - 3 400	44 - 58	800 - 1 710	
France	10	50 ± 10 %	45 - 54	300	yes
Germany					
Greece	15	16 - 50	44 - 66	500	
Hungary	12	20 - 30	48	500	
Iceland	10	22 - 28	48	800	
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	10	25 ± 10%	60	500	
Malta					
Netherlands	not mandatory				
Norway	17	50 ± 1	24 60	460 - 1 200 460 - 3 500	
Portugal	12	16 2/3 ± 10 % 25 ± 20 %	45 - 55	500 - 2 500	yes
Spain			48	200	yes
Sweden	10	25 ± 3; 50 ± 1	60	1 200	
Switzerland	≤ 8	21 - 55	43 - 57	2 200 - 600	yes
U. Kingdom	not mandatory				

6.2.2 (BG) 1 When connecting to an ac source U_G = 72 V (R_{iG} = 0 ohm), in the frequency range f ≤ 18 Hz and 5 kHz ≥ f ≥ 64Hz, call: 1 s, pause 4 s, the ringing detector shall no longer respond and operate.

6.2.2 (F) 1 Not applicable to TE with automatic answering function, for which section 6.3.2 is used.

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 the 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 V ≤ e_1 ≤ 75 V	20 Hz ≤ f_1 ≤ 30 Hz	≤ 190 ms	≥ 1 000 ms
ii	35 V ≤ e_1 ≤ 75 V	20 Hz ≤ f_1 ≤ 30 Hz	> 190 ms ≤ 600 ms	≥ 1 000 ms
iii	e_1 = 25 V	20 Hz ≤ f_1 ≤ 30 Hz	Continuous	
iv	e_1 = 25 V	f_1 = 50 Hz	Continuous	
v	e_1 ≤ 775 mV	300 Hz ≤ f_1 ≤ 3,4 kHz	Continuous	

6.2.2 (CH) 1 The ringing detector should not (recommendation) 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 Hz - 3 400 Hz) there should be (recommendation) no noticeable reaction of the ringing detector.

In the case of automatic establishment of the loop condition, see 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.

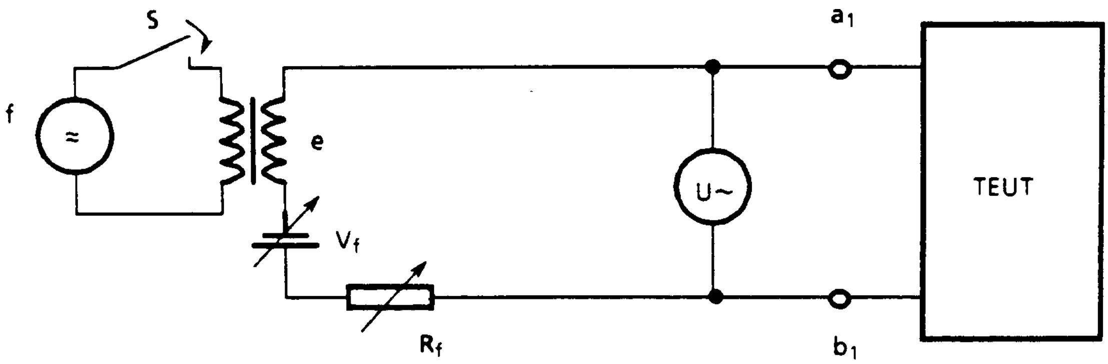


Figure A.6.2.2: Ringing signal detector insensitivity

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, 55	60	500	
Belgium	10	25	48	1 000	
Bulgaria	9	25, 50	60	1 000	
Cyprus	10	25	48	800	
Denmark	17	25, 50	48	500	
Finland	10	25	48	800	
France	10	50	48	300	
Germany					
Greece	5, 15	25, 50, 425	60	500	
Hungary	12	20, 25, 30	48	500	
Iceland	10	22, 25, 28	48	800	
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	10	25	60	500	
Malta					
Netherlands	not mandatory				
Norway	17	50	24, 60	1 200	yes
Portugal	12	16 2/3 ± 10 % 25 ± 20 %	45, 55	500	
Spain			48	200	yes
Sweden	10	22, 28, 50	60	1 200	yes
Switzerland	8	25, 50	50	1 000	yes
U. Kingdom	not mandatory				

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 (12 cycles) repeated for 1 s ringing and 4 s pause (no activation of ringing detectors shall occur).

6.2.3 Immunity to decadic dialling from a 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	yes
Bulgaria	9 - 11	60	40	60	1 000	
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 ± 3	38,5 ± 3	44 - 66	500	
Hungary	9 - 11			48	500	yes
Iceland	not mandatory					
Ireland	9 - 11	64 - 70	36 - 30	43 - 53	5 000	yes
Italy	not mandatory					
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 (B) 1 This section is not applicable for PBX.

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_l (see figure A.6.2.3 (F) 1):

L_f = 3 H (representative of the inductance of the feeding bridge)

R_l: 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 (H) 1 The tolerances of make and break periods are defined by formula:

$$\frac{t_{break}}{t_{make}} = 2 \pm 0,2$$

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.

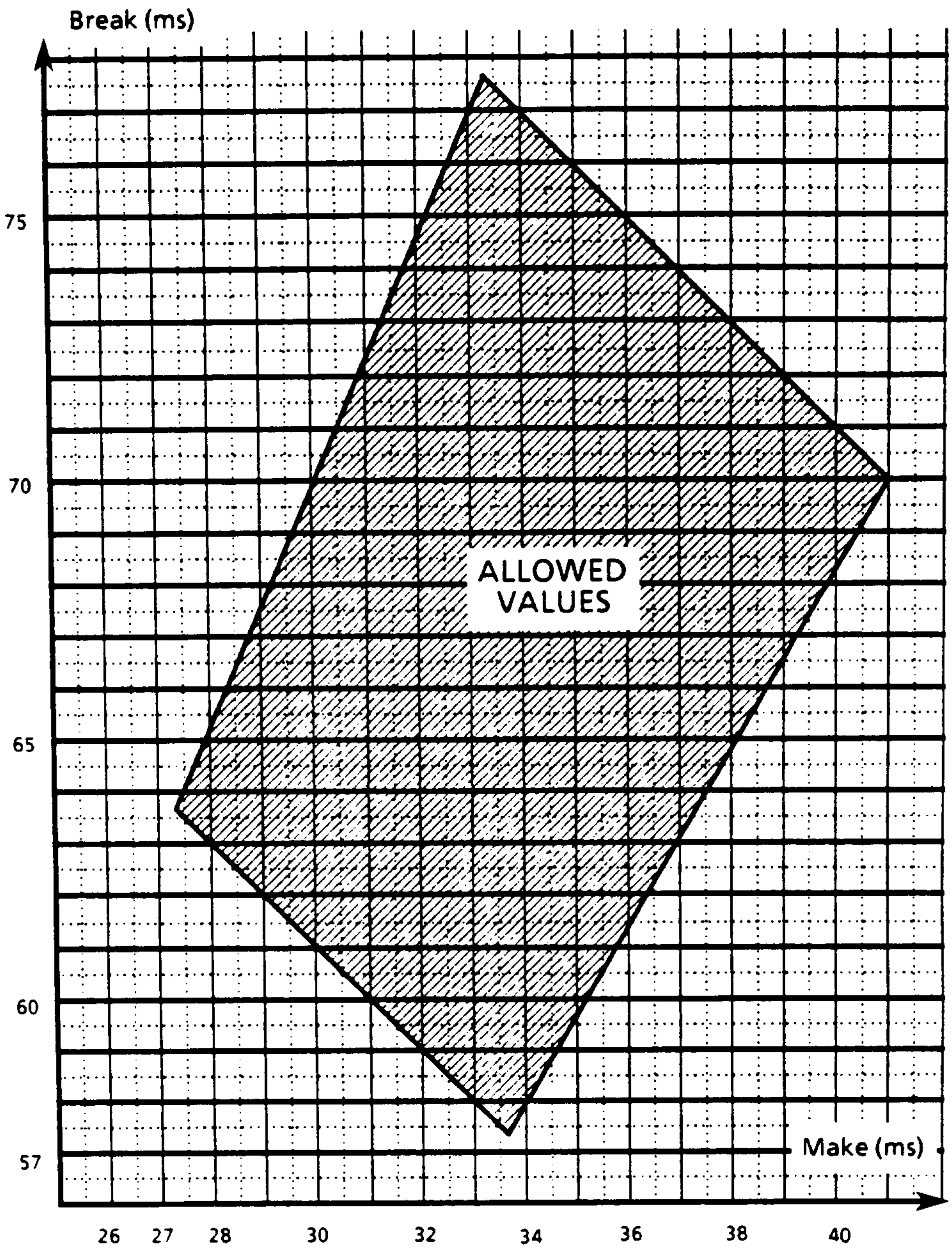


Figure 6.2.3 (P) 1: Immunity to decadic dialling from a parallel TE

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 not 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 (S) 3 This requirement is only applicable to a TE with automatic answering function.

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 which can be used conducively in a parallel installation. This requirement is 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.

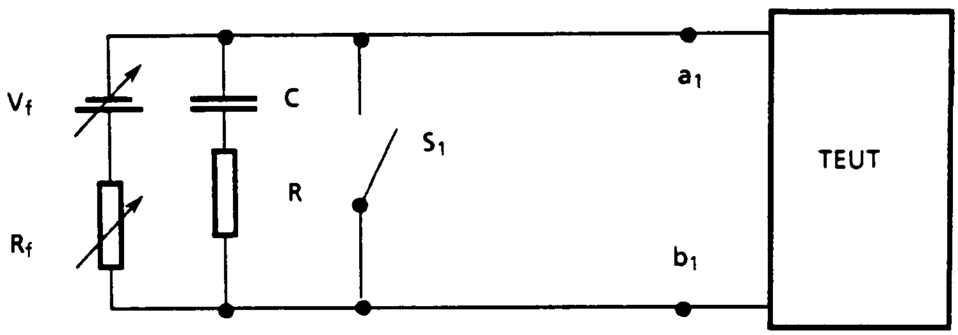


Figure A.6.2.3: Immunity to decadic dialling from a parallel TE

Table A.6.2.3: Immunity to decadic dialling from a parallel TE

COUNTRY	TEST VALUES							Remarks
	C (µF)	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	
Bulgaria	1	220	10	40	60	60	1 000	
Cyprus	1	600	10	33	67	48	800	
Denmark	not mandatory							
Finland								
France	2,2	160		33	66	45, 54	1 845, 300	yes
Germany	not mandatory							
Greece	1 ± 10 %	100 ± 10 %	10	38,5	61,5	60	500	
Hungary	1	200	10	33	66	48	500	yes
Iceland	not mandatory							
Ireland	1	2 900	10	66,6	33,3	48	5 000	yes
Italy	not mandatory							
Luxembourg	1	220	10	40	60	60	1 000	
Malta								
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 Ω + 12 H	yes
U. Kingdom			10	33	67	50	200+200 relay	yes

A.6.2.3 (A) 1 This test shall be done at least six times with digit 0 at 5 s intervals 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 H

R_l = 100, 1 840 Ω

Other parameter values: see table A.6.2.3.

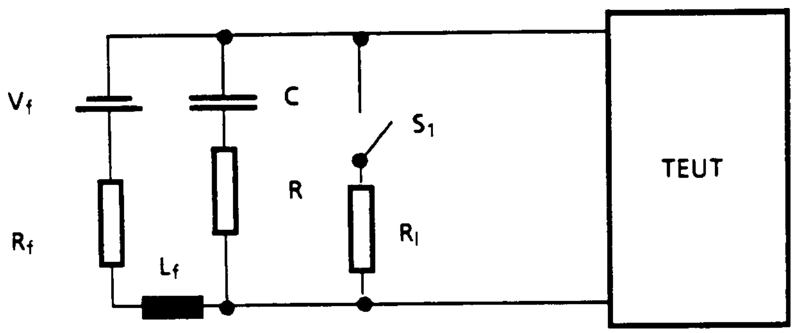


Figure A.6.2.3 (F) 1: Immunity to decadic dialling from a parallel TE

A.6.2.3 (H) 1 The test arrangement is as follows:

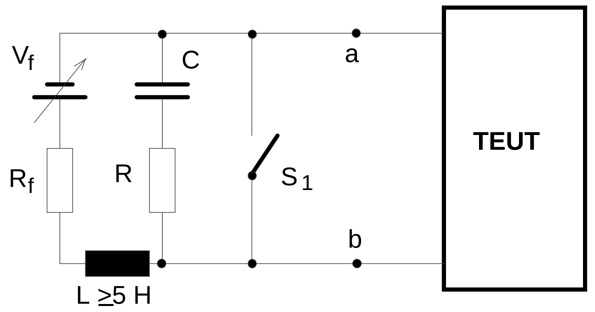


Figure A.6.2.3 (H) 1: Test of immunity to decadic dialling from a parallel TE

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 H

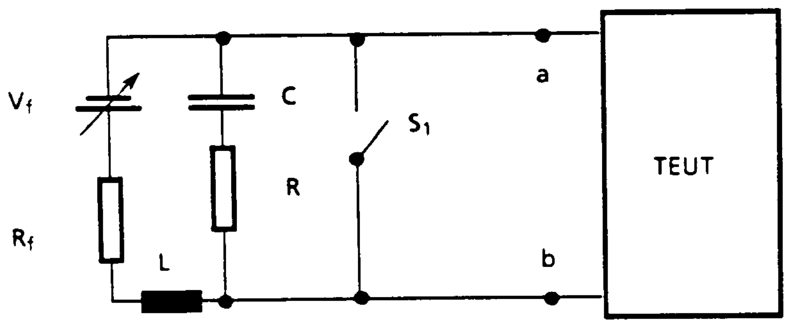


Figure A.6.2.3 (I) 1: Ringing detection in parallel connected equipment

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.

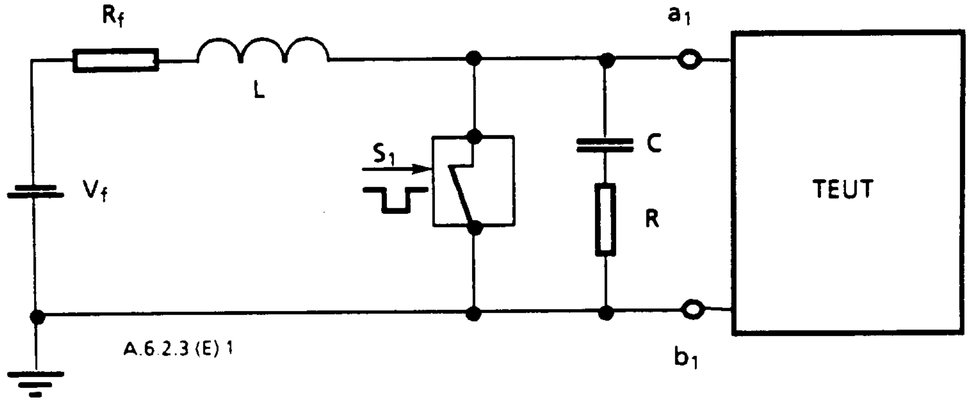


Figure A.6.2.3 (E) 1: Immunity to decadic dialling from a parallel TE

A.6.2.3 (S) 1 The test arrangement is as follows:

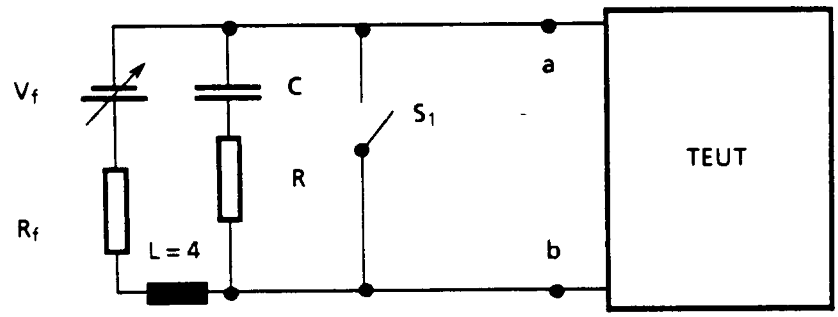


Figure A.6.2.3 (S) 1: Ringing detection in parallel connected equipment

A.6.2.3 (CH) 1 The test circuit is as shown in figure A.6.2.3 (CH) 1. The additional inductance in series to Rf has the value of Lf = 12 H ± 2 H.

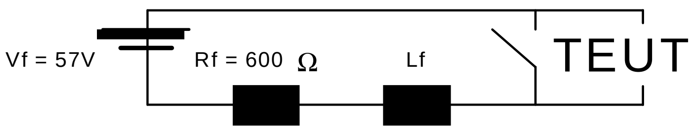


Figure A.6.2.3 (CH) 1: Immunity to decadic dialling

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.

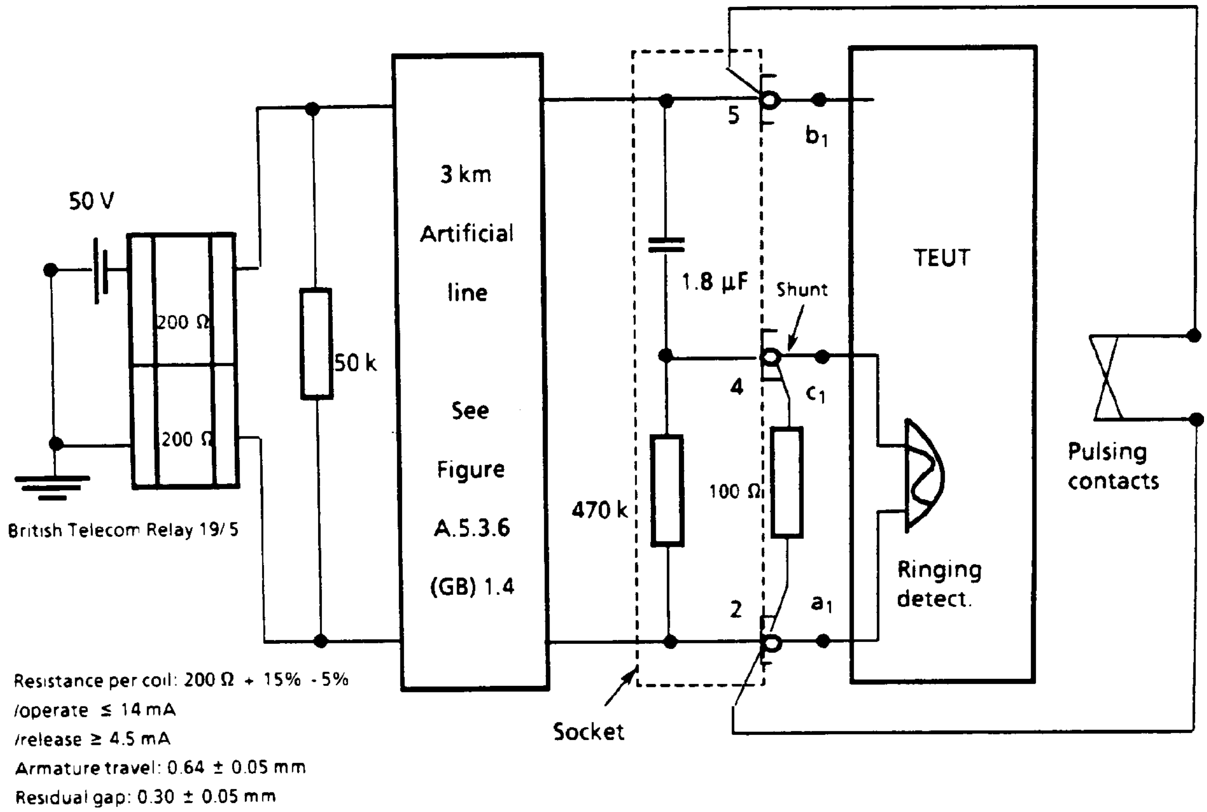


Figure A.6.2.3 (GB) 1: Immunity to decadic dialling

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.

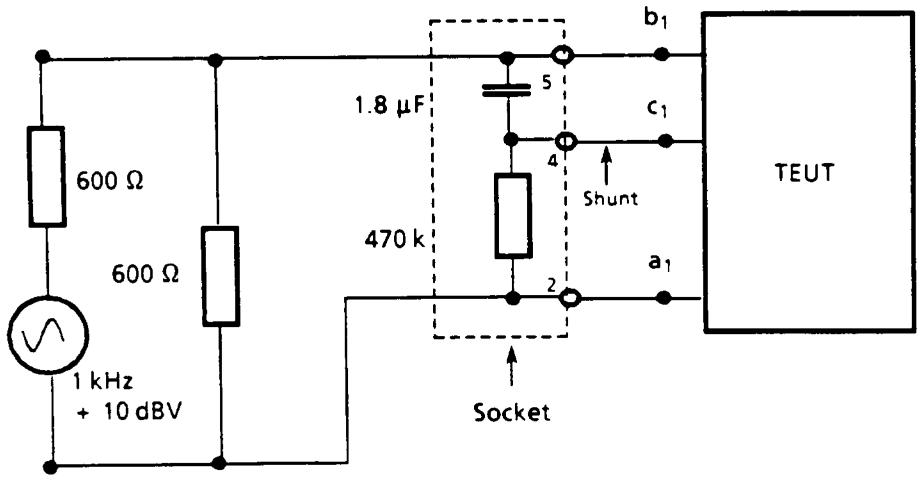


Figure A.6.2.3 (GB) 2: Immunity to speech signals

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	
Bulgaria	60	1 000 - 2 200			30 - 90	22 - 52	yes
Cyprus	48	440 - 1 740	6	20	30 - 85	23,5 - 26,5	
Denmark	44 - 56	500 - 2 400	1,5	60	40 - 120	25 ± 10 %	
Finland	44 - 58	800 - 1 710	1	not spec.	35 - 75	25 ± 3	
France	45 - 54	300	5	15	25 - 90	50 ± 10 %	yes
Germany							yes
Greece	44 - 66	500		20	25 - 90	16 - 50	
Hungary	not mandatory						
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 ± 10%	
Malta							
Netherlands	66	800	1		35 - 90	25	
Norway	24 60	460 - 1 200 460 - 3 500			28 - 90	25 ± 3	yes
Portugal	45 - 55	500 - 2 500	0,8		30 - 120	16 2/3 ± 10 % 25 ± 20 %	yes
Spain							yes
Sweden	not mandatory						
Switzerland	43 - 57	2 200 - 600	0,05		20 - 60	21 - 55	yes
U. Kingdom	not applicable						yes

6.3.1 (A) 1 The establishment of the loop condition shall be after the fifth complete ringing signal at the latest. An early establishment of the loop condition is recommended.

6.3.1 (A) 2 The ringing signal (sinus wave) may be distorted by parallel connected ringing circuits, in particular by TE with electro-mechanical ringers. This circumstance should be considered at the design of the ringing detection circuit.

6.3.1 (BG) 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, but at the latest after the 5th ringing signal.

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 s - 2 s
1st pause: 0 s - 3,5 s
2nd and following pulses: 1,5 s ± 10%
2nd and following pauses: 3,5 ± 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:

	1st case	2nd case
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 V
R_f = 300 Ω

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 s
t_2 = 45 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 On application of ringing signals as specified in section 1.7.9 (D) 1, terminal equipment with an automatic call answering function shall accept a call within t = 60 s after the end of the 1st ringing signal pulse, i.e. the dc resistance of the terminal equipment shall, after this period, be within the permissible range for "$I \geq$ 20 mA", as shown in section 2.1 (D) 1. Automatic answering of a call is also permissible during the 1st ringing signal pulse.

The timing for automatic call answering may be

- manually adjustable;
- changed as a result of a manually pre-programmed time (e.g. time of day);
- altered only by the processing of received telecommunication messages.

NOTE: Automatic call answering functions may be activated and deactivated.

6.3.1 (I) 1 For facsimile and modem equipments, the following t_1 and t_2 values may be used:

t_1 = 300 ms;
t_2 = 60 seconds.

6.3.1 (N) 1 The TE shall be able to detect all ringing signals within 3 ringing pulses, or as described in the user manuals. The TE shall also detect the following signals:

- ΔU = 40 - 60, Δf = 25 ± 3, ΔV_f = 70 - 90, ΔRf = 1 200;

The signal peak level is $V_f + \sqrt{2} \times U$.

-U = 155 Vp - p (square wave), f = 25 ± 3, V_f = 80, Rf = 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 (CH) 1 If a TE has automatic answering functions after call recognition it may seize the line automatically and following requirements:

- The TE's standard setting must carry out a line seizure at the earliest after the first ringing cycle (when the second ringing is recognised) and at the latest before the eleventh ringing cycle;
- As an additional option a TE may have a setting possibility for line seizure on recognition of the first ringing. Line seizure shall not occur on ringing signals ≤ 50 ms (section 6.3.2);
- Requirements in section 6.2 are to be fulfilled.

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 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.

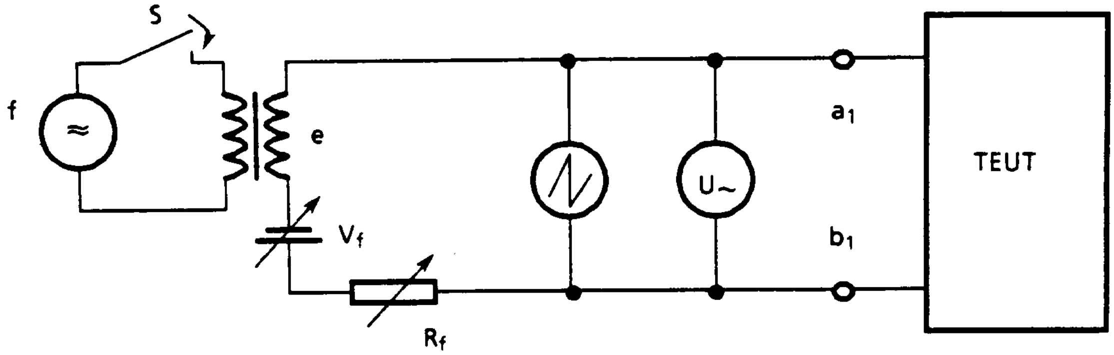


Figure A.6.3.1: Automatic establishment of loop condition

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	25, 60	20, 60	500	40, 55	0,8 and 1,2	4 and 6	
Belgium	25	48	1 000	25	1	3	
Bulgaria	30, 90	60	2 200	22, 52	1	4 and 9	
Cyprus	30, 85	48	800	25	1,5	3	
Denmark	40	48	500	25	0,75	7,5	
Finland	35, 75	48	800	25	0,75	5	
France	25, 90	48	300	50			yes
Germany							yes
Greece	25, 50, 75	60	500	25, 50	1	4	
Hungary	not mandatory						
Iceland	not mandatory						
Ireland	25	48	5 000	25	0,4	0,2	yes
Italy	26, 80	48	800	25, 50	1	4	
Luxembourg	45, 75	60	500	25	1	4	
Malta							
Netherlands	35, 90	66	800	25	1	4	
Norway			1 200		0,8	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						
Switzerland	20, 60	50	1 000	22, 53	1	4	yes
U. Kingdom	not applicable						yes

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:

$V_f = 48$ 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	

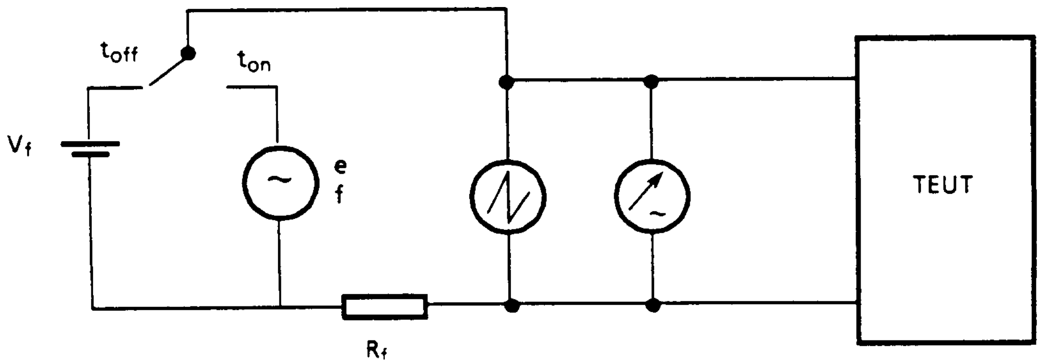


Figure A.6.3.1 (F) 1: Automatic establishment of loop condition (non-polarised call)

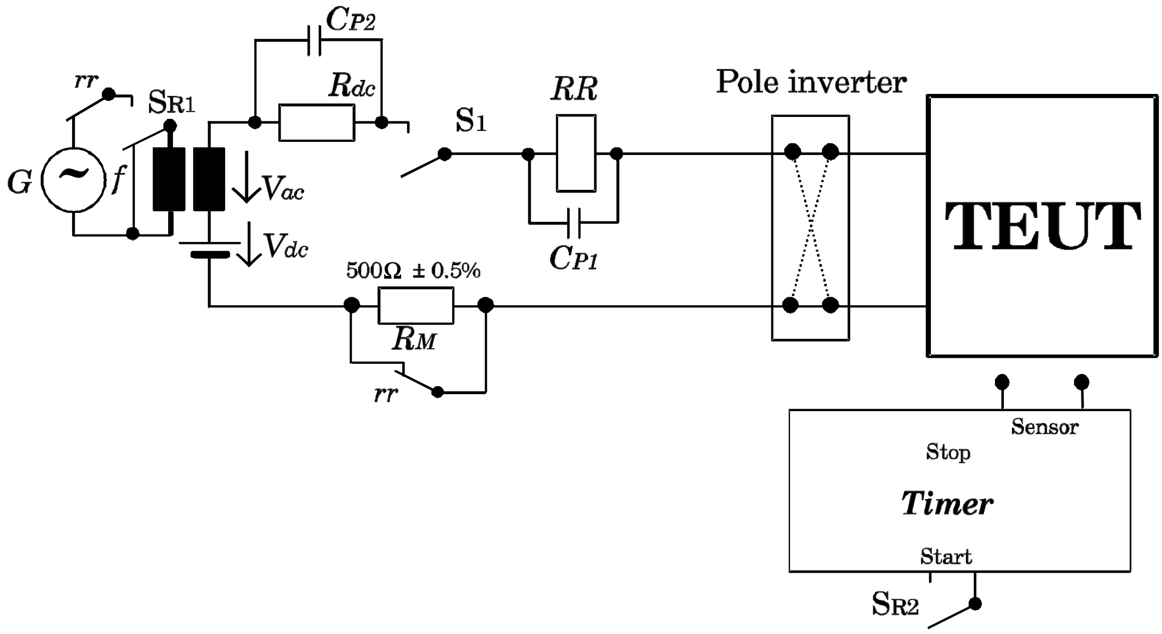
A.6.3.1 (F) 2 The TEUT is connected as shown in figure A.6.3.1 with $V_f = 48$ V and $R_f = 300\ \Omega$ as feeding conditions. Five ringing sequences of frequency f = 50 Hz, voltage U = 90 V_{rms}, duration t_{on} = 1,5 s, pause t_{off} = 8 s are applied between the line terminals, and it is checked 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 Ringing detecting circuit

The measuring circuit illustrated in figure A.6.3.1 (D) 1 is used for the measurement.



V_{dc} = 63 V	f = 25 Hz	R_{dc} = 500 Ω	C_{P2} = 220 µF	t_{break} = 4 s
V_{ac} = 32 V; 75 V	$RR \leq$ 20 Ω	C_{P1} = 1 000 µF	$t_{1st\ ring}$ = 250 ms	$t_{2nd\ to\ nth\ call}$ = 1 s

Figure A.6.3.1 (D) 1

The ringing signal detecting function of a terminal (TEUT) is measured by means of a timer.

The dc feeding voltage V_{dc} is applied at the TEUT by means of switch S1. The ringing signal V_{ac} is subsequently coupled periodically by means of switch SR1 and the timer simultaneously started by means of switch SR2. The ringing signal is detected at the equipment interface by a suitable sensor. The timer is stopped by *RR* in order to record the time for automatic call answering.

In the case of TEUT with automatic call answering, the sensor is connected in parallel to the resistor R_M.

In the case of a direct current of approx. 15 mA, *RR* shall interrupt the generation of ringing signals within approx 15 ms and transmit a signal to the timer.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

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 (N) 1 U corresponds to open-circuit voltages.

The following signal combinations shall be tested:

28 V_{rms}, 22 Hz, 24 V dc
28 V_{rms}, 28 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 the remark in section 6.3.1 (E) 1.

A.6.3.1 (CH) 1 The tests are similar to the ones in section A.6.2.1 (CH) 1. They are conducted with a 240 ms ringing signal followed by 10 cycles of 4 s pause, 1 s ringing signal at 20 V and 60 V, 22 Hz and 53 Hz.

A.6.3.1 (GB) 1 The test circuit is shown in figure A.6.3.1 (GB) 1.

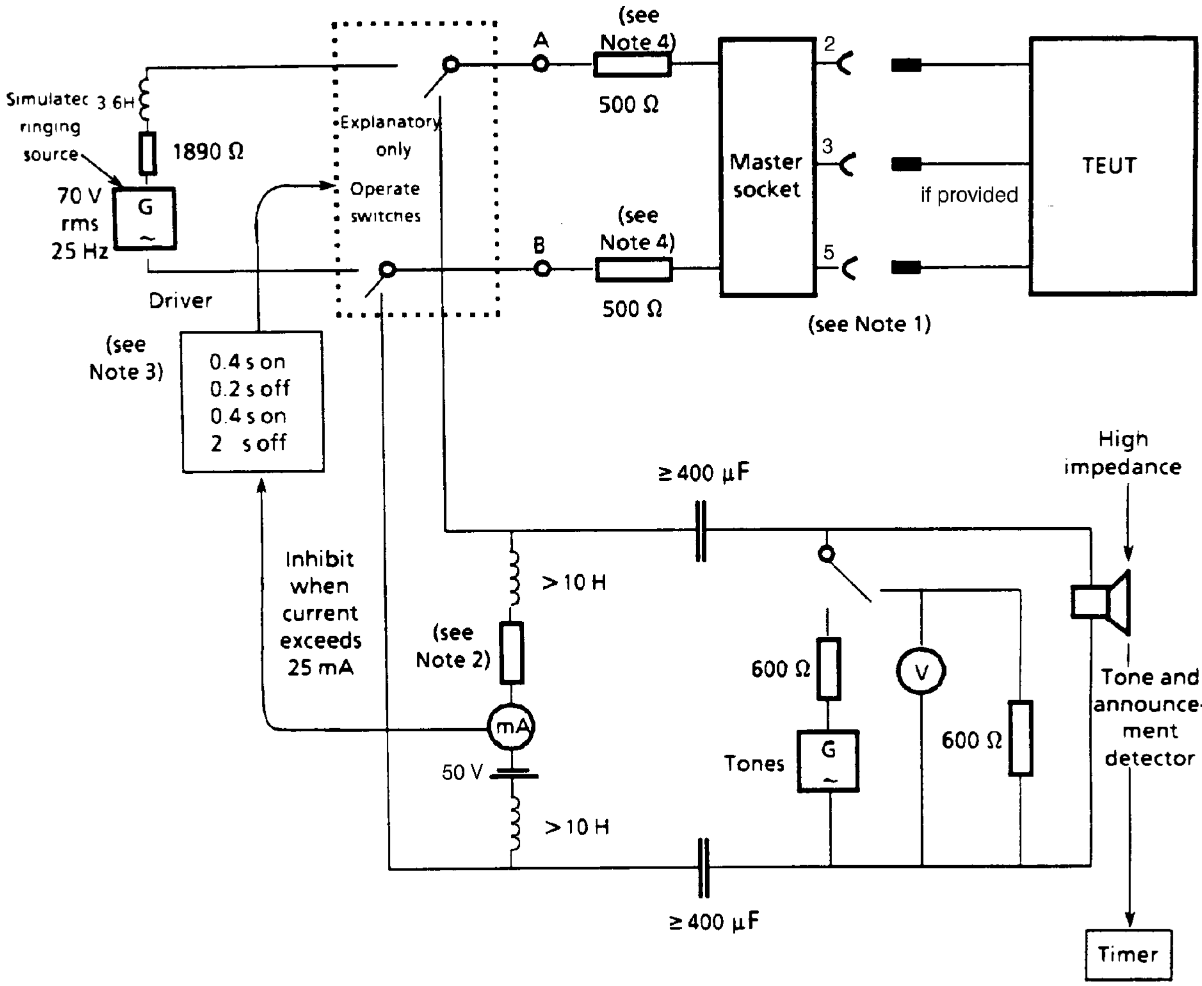


Figure A.6.3.1 (GB) 1: Auto-answer test circuit

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 ± 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})	Δ_f (Hz)	ΔV_f (V)	ΔR_f (Ω)	t_3 (s)	
Austria	10	40 - 55	60	500		yes
Belgium	10	23 - 27	48	1 000	40	
Bulgaria	9	22 - 52	60	1 000 - 2 200	not spec.	yes
Cyprus	10	25	48	440 - 1 740	25	
Denmark	120	25 ± 2,5; 50 ± 5	44 - 56	500 - 2 400	≤ 0,090	yes
Finland	10	20 - 3 400	44 - 58	800 - 1 710	20	
France	10	50 ± 10 %	45 - 54	300	25	yes
Germany						yes
Greece	15	0 - 50	44 - 66	500	20	
Hungary	12	20 - 50	48	500	20	yes
Iceland	not mandatory					
Ireland	3		43 - 53	5 000		yes
Italy	15	20 - 50	48	800	30	
Luxembourg	10	25 ± 10%	60	500	20	
Malta						
Netherlands	15	25	66	800	30	yes
Norway	17	50	24 60	460 - 1 200 460 - 3 500	20	
Portugal	12	16 2/3 ± 10 % 25 ± 20 %	45 - 55	500 - 2 500	20	
Spain						yes
Sweden	not mandatory					
Switzerland	20 - 60	21 - 55	43 - 57	2 200 - 600	∞, ≤ 0,05	yes
U. Kingdom	not mandatory					

6.3.2 (A) 1 The TE shall not react at least on 6 ringing signals of 1 s ± 20% duration interrupted by pauses of 5 s ± 20%.

6.3.2 (BG) 1 See section 6.2.2 (BG) 1.

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_{on}/t_{off} = 1 500 ms/3 500 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 Hz and a voltage U = 90 V_{rms} is applied for 100 ms, with the feeding conditions V_f = 48 V and R_f = 300 Ω.

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 µF, 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 **Call indication**

Call indicators may be activated and deactivated. Where the call indicator is activated, indication of ringing signals as specified in section 1.7.9 (D) 1 shall be discernible at the equipment interface $t \leq 5{,}5$ s after application at the NTA.

A call indicator shall be deactivated at the end of the ringing state.

6.3.2 (H) 1 The following sequence shall be applied during 20 s:
1st pulse: 1,25 s
1st pause: 3,75 s
2nd pulse: 1,25 s
etc.
If the TE gives an answer only after n ringing pulses:
$t_3 = n \cdot 5 + 20$ s.

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_{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 (CH) 1 In the standard setting a TE shall not seize the line in the case of a continuous ringing signal of 60 V and 25 Hz.

In the additional option setting the TE shall not seize the line on ringing signals $\leq$ 50 ms.

An automatic TE which can be used conducively in a parallel installation must meet the requirements in section 6.2.3 (immunity to dial signal "0" dialled ten times, from a set with pulse dialling connected in parallel).

Requirements in section 6.2 are to be fulfilled.

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.

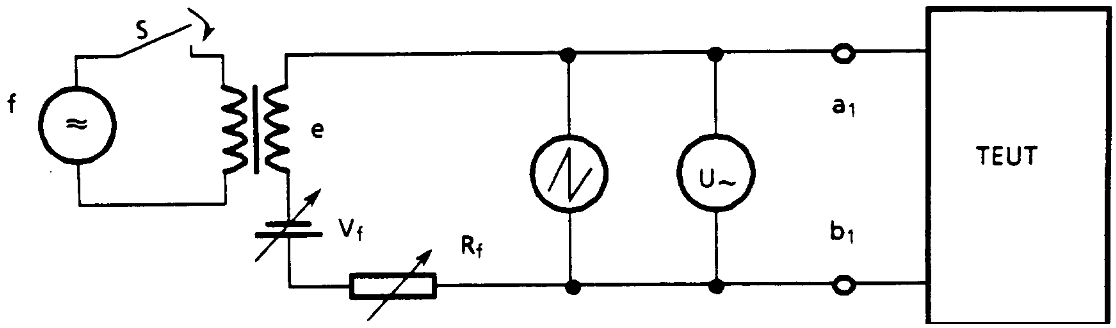


Figure A.6.3.2: Insensitivity to ringing signal

The test shall be performed at all combinations of the values given in table A.6.3.2.

NOTE: The signal 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.6.3.2: 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, 55		yes
Belgium	10	48	1 000	25	40	
Bulgaria	9	60	2 200	22, 52	not spec.	yes
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						yes
Greece	5, 15	60	500	25, 50	20	
Hungary	12	48	500	25, 50	20	yes
Iceland	not mandatory					
Ireland	3	48	5 000	25	30	yes
Italy	15	48	800	25, 50	30	
Luxembourg	10	60	500	25	20	
Malta						
Netherlands	15, 90	66	800	25		yes
Norway	17	60, 24	1 200	50	20	yes
Portugal	12	45, 55	500	16 2/3 ± 10 % 25 ± 20 %	20	
Spain						yes
Sweden	not mandatory					
Switzerland	60	50	1 000	25	20 and 0,05	
U. Kingdom	not mandatory					

A.6.3.2 (A) 1 The TE shall not react at least on 6 ringing signals of 12 s duration interrupted by pauses of 4 s.

A.6.3.2 (BG) 1 See remark 6.3.2 (BG) 1.

A.6.3.2 (DK) 1 The TEUT is connected as shown in figure A.6.3.2 (DK) 1. After activation of S_1 the TEUT shall not establish loop condition.

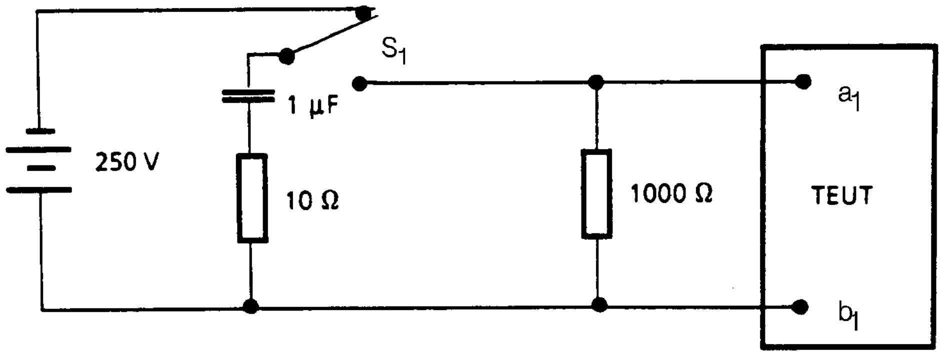


Figure A.6.3.2 (DK) 1

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.

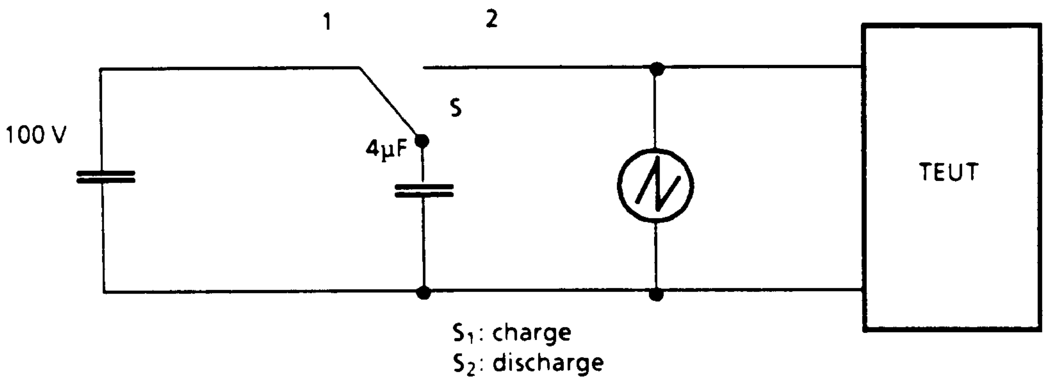


Figure A.6.3.2 (F) 3: Immunity to discharge of capacitor

A.6.3.2 (D) 1 See section A.6.3.1 (D) 1.

A.6.3.2 (H) 1 See remark to table 6.3.2.

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}
1	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.

A.6.3.2 (NL) 4 Test with decadic dialling from parallel TE, see figure A.6.3.2 (NL) 1.

t_{make} = 38,5 ms ± 7,5 ms
t_{break} = 63,5 ms ± 10 ms
L = 4 H
R = 330 Ω
S_1 = dialling contact
S_2 = closed during dialling and opened during interdigit pause.

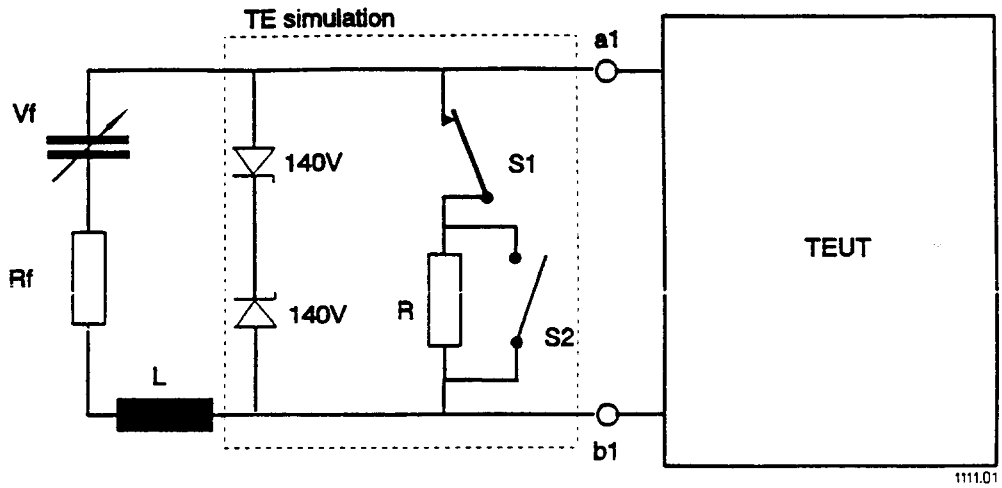


Figure A.6.3.2 (NL) 1: Decadic dialling from a parallel TE

A.6.3.2 (N) 1 U corresponds to open-circuit voltage.

A.6.3.2 (E) 1 See the remark in section 6.3.2 (E) 1.

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 be either 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
Bulgaria	0,5 - 3	2,6	300 - 3 400	60	1 000 - 2 200		-15	yes
Cyprus	2,5	2,6 - 4	2 100 ± 15	48	440 - 1 740		-10	
Denmark	5	3	300 - 2 200	44 - 56	500 - 2 400		-16	yes
Finland	not spec.	not spec.		44 - 58	800 - 1 710			yes
France			2 100 ± 15	46 - 54	300 - 1 400			yes
Germany								yes
Greece	not mandatory							
Hungary								yes
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		-15	yes
Norway	not mandatory							
Portugal	2,5	not applic.	not applic.	45 - 55	300 - 1 800		-15	
Spain								yes
Sweden	not mandatory							yes
Switzerland	not mandatory							yes
U. Kingdom	2,5	2,6	1 600 - 2 500				-25	yes

6.3.3 (A) 1 Speech signal: t_4 = 5 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 = not mandatory
Tone signal: t_5 = 2,6 s; it shall not be longer than 4 s.
Maximum output level -6 dBm.

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 answering tone is the same as the signal level or is fixed between -6 and -8 dBm.

6.3.3 (BG) 1 For Bulgaria, 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 (DK) 1 Ringing tone, see section 1.7.2, shall not be used as the first signal after answer.

6.3.3 (SF) 1 In case that the terminal equipment with automatic answering function gives an audible signal to the A-subscriber, it shall be either a queue tone according to the remark 1.7.7 (SF) 1 or a speech message. The requirement does not apply to alarm transferring systems which are allowed to send any kind of signal.

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 s;
t_{4max} = 2,5 s;
t_{5min} = 2,6 s;
t_{5max} = 4 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 See section 10.2 (D) 1.5. 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 (H) 1 In case of individual TEs the related national standards may specify this requirement.

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 (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 Answering signals, if implemented, have to fulfil the following requirements (the same as per section 5.7.1).

Identification signals (e.g. calling tones) according to CCITT Recommendations T.30 (FAX) and V.25 (Modems) are not mandatory for automatic devices.

If identification signals are used directly after the answer, they shall not be confused with the network generated tones.

If signalling tones or announcement texts are used in the TE for the call handling of connections, they must observe the following requirements:

- The sending levels must be ≥ -20 dBm (measurement method complying with section A.4.4.2.2).

- The noise voltage (incl. distortion factor components) must be 20 dB lower than the sending levels, or weaker (measurement method complying with section A.5.4.5.a).

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.

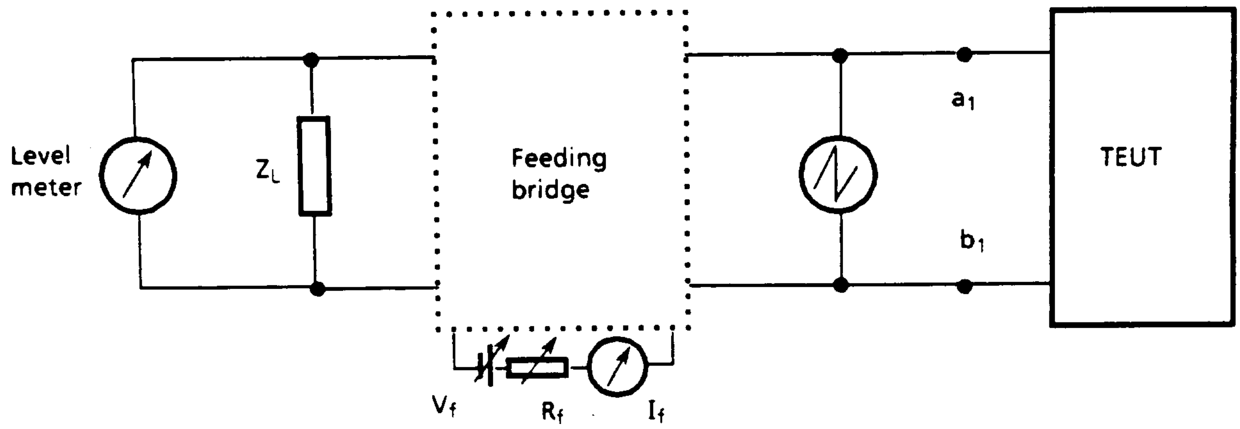


Figure A.6.3.3: Answering signal
The feeding bridge is as specified in Chapter 1

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		yes
Bulgaria	600	60	1 000, 2 200		
Cyprus	600	48	800		
Denmark	600			50	
Finland					
France	600	46, 54	1 400, 300		
Germany					
Greece	600	60	500		
Hungary					yes
Iceland	not mandatory				
Ireland	600	48	5 000	20, 80	
Italy	600	44, 52	1 880, 720		
Luxembourg	600	60		19, 60	
Malta					
Netherlands	600	48	1 130		
Norway	not mandatory				
Portugal	600	48	300 - 1 800	not applic.	
Spain					yes
Sweden	not mandatory				
Switzerland	600	50	500, 2 300		
U. Kingdom	not applicable				yes

A.6.3.3 (B) 1 For digital PBX capable of automatically altering its state from the quiescent condition to the loop condition, the value of Z_L is equal to Z_C as defined in section 4.1.2 (B) 1.

A.6.3.3 (B) 2 The tests are undertaken for each polarity.

A.6.3.3 (H) 1 See the remark in table 6.3.3.

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	100	60		19 - 60	yes
Belgium	300	48		20 - I_{max}	
Bulgaria	not mandatory				
Cyprus	90	48	440 - 1 740		
Denmark	1 200	44 - 56	500 - 2 400		yes
Finland	90	44 - 58	800 - 1 710		yes
France	180	46 - 54	300 - 1 400		yes
Germany	not mandatory				yes
Greece	90	44 - 66		20 - 80	
Hungary					yes
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	180	43 - 57	2 200 - 600		yes
U. Kingdom	not mandatory				

6.4.1 (A) 1 An extension of value t_6 is only possible if information-related control of loop condition is provided.

6.4.1 (A) 2 With TE which send out an announcement only $t_6 \leq 180$ s is permitted.

6.4.1 (A) 3 With TE which are assigned for value added services a loop current detector (see section 9.4.2) shall be provided.

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 (H) 1 In case of individual TEs the related national standards may specify this requirement.

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 The following requirements shall be applied (as per section 5.6.6.1):

General requirement (for automatic and non-automatic TE): Releasing a connection manually shall be possible at all times; a TE shall complete the release of a connection within 5 s.

Specific requirements for automatic TE (e.g.: automatic answering machine or automatic dialling device):

- Manual operation must have priority over the automatic operation for network access. For example an answering machine shall not prevent a terminating call from being answered manually. The user must be informed if TE with automatic operation are likely to interfere with or interrupt existing connections (e.g. alarm systems).

- The connection shall not last more than 3 min unless at least one of the following automatic release functions are implemented:

- busy/congestion tones recognition as per section 5.2,
- level monitoring of transmission signals as per section 6.4.2.1
- loop current monitoring as per section 6.4.4,
- ringing tone recognition as per section 5.2.

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.

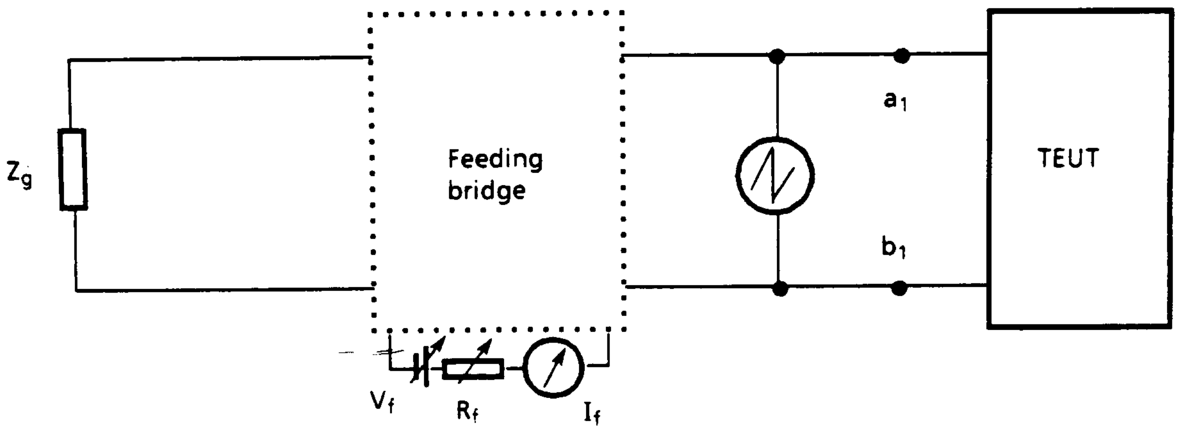


Figure A.6.4.1: TE without information-related control of loop condition

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		yes
Bulgaria	not mandatory				
Cyprus	600	48	800		
Denmark				50	
Finland	600	48	800, 1 710		
France	600	48	300		
Germany	not mandatory				
Greece	600	60		20, 35	
Hungary					yes
Iceland	600	48		14 - $I_{max.}$	
Ireland	600	48	5 000	20, 80	yes
Italy	600	44, 52	1 880, 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	50	1 000		
U. Kingdom	not applicable				

A.6.4.1 (B) 1 For digital PBX with automatic control of loop condition but without information-related control of this loop condition, the value of Z_L is equal to Z_C as defined in section 4.1.2 (B) 1.

A.6.4.1 (H) 1 See the remark in table 6.4.1.

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	≤ 100	60		19 - 60	yes
Belgium	-48	-43	5 - 60	48		20 - I_{max}	
Bulgaria	not mandatory						
Cyprus	-48	-43	20	48	440 - 1 740		
Denmark							yes
Finland	-48	-43	90	44 - 58	800 - 1 710		
France	-48			46 - 54	300 - 1 400		yes
Germany	not mandatory						yes
Greece	-43	-33	40	44 - 66		20 - 80	
Hungary	-48	-43	under study	48		20 - I_{max}	
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	-60	-43		60	460 - 3 100		yes
Portugal	-48			45 - 55	300 - 1 800	not applicable	yes
Spain							yes
Sweden	not mandatory						
Switzerland	-48	-28	100	43 - 57	2 200 - 600		
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 (A) 2 To avoid inactive data connections an "activity monitoring" of the transmit and receive data line (interface function 103 and 104) for continuous 1 or 0 is recommended (standard value 10 minutes).

6.4.2.1 (DK) 1 At the latest 20 minutes after reception of a voice band signal with a piece of information which unambiguously means continuation of the loop condition and is perceived as such the equipment shall return to the quiescent condition.

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 -60 dBm for more than 20 s, the power level shall be averaged over a period of 0,2 s.

6.4.2.1 (N) 2 The connection shall be released within 5 s if a carrier signal is lost.

6.4.2.1 (N) 3 Equipment using ETSI and/or ITU-T standardized protocols shall, if transmission problems occur, clear the connection as specified within the standard/recommendation.

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(dBm) = -43
t_7(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(dBm) = Not applicable
t_7(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.

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.

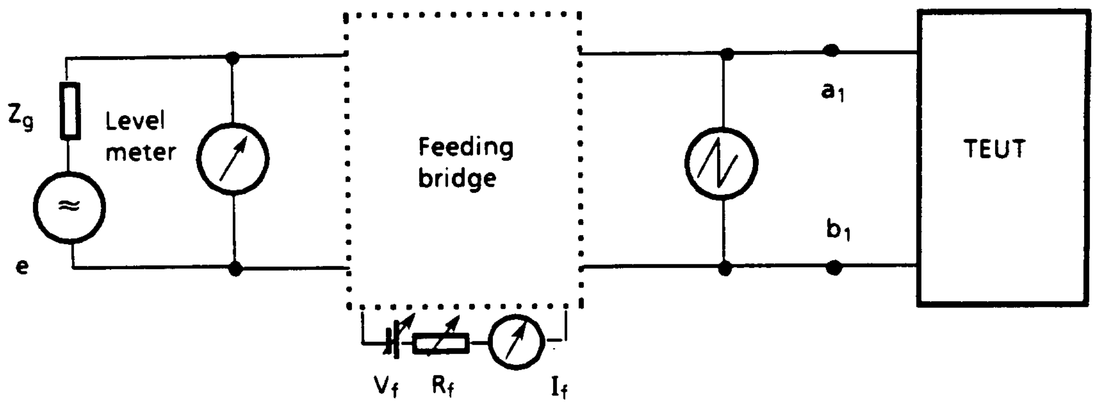


Figure A.6.4.2.1: Data or code signal related control

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	100	
Belgium		600	48	400		-48	-43		yes
Bulgaria	not mandatory								
Cyprus		600	48	800		-48	-43	20	
Denmark									yes
Finland		600	48	800, 1 710		-48	-43	90	yes
France									yes
Germany	not mandatory								
Greece		600	60			-43, -45	-30, -35	20, 40	yes
Hungary		600	48		20, $I_{max.}$	-48	-43	not spec.	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, 52	1 880, 720		-48	-43		
Luxembourg		600	60		19, 60	-48	-43		
Malta									
Netherlands	not mandatory								
Norway	variable	600	60	3 100		-60	-43		yes
Portugal		600	48	300 - 1 800	N/A	N/A	N/A		yes
Spain									yes
Sweden	not mandatory								
Switzerland		600	50	1 000		-48	-28	100	
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 a_3 = -43 dBm 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 5 dB (a_2 = -48 dBm) and the time needed by the TE for entering the quiescent condition is recorded.

b) Starting again the loop condition (a_3), the level of the signal is decreased to a_2 only during t = 0,8 x t_7 and then increased to a_3: the TE shall stay in 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 a_2(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 V
R_f = 300 Ω
f = frequencies corresponding to the bits "0" and "1" in case of FSK modulation or carried frequency in the other cases,
e = 1,55 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 dBm < t_{h1} < -45 dBm
-46 dBm < t_{h2} < -43 dBm
t_{h2} - t_{h1} > 2 dB

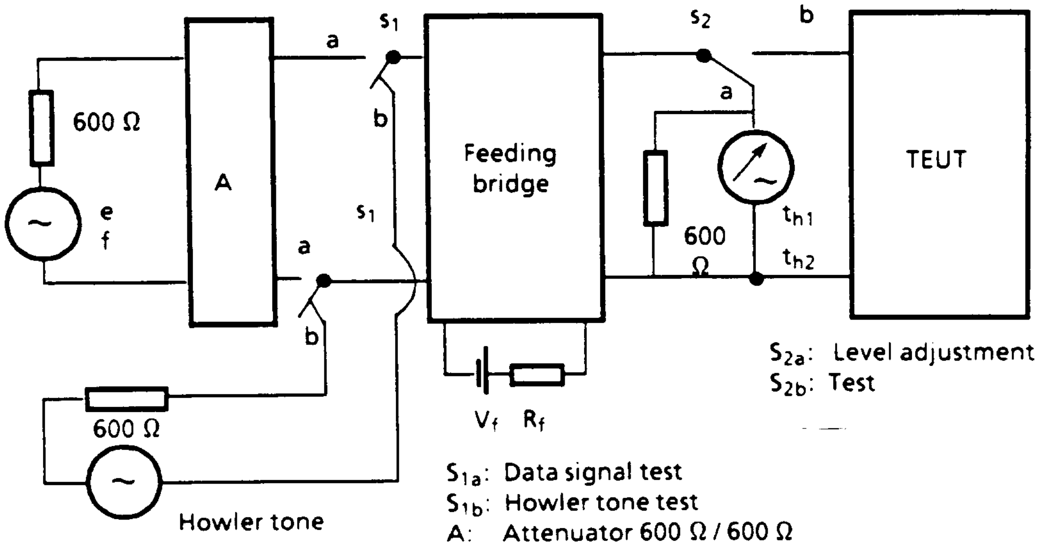


Figure A.6.4.2.1 (F) 1.a: Data signal control for half-duplex and FSK full-duplex modems

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 V
R_f = 300 Ω
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 substracting respectively the adjusted values of A from -10 dBm.

It is verified:

-48 dBm < t_{h1} < -45 dBm
-46 dBm < t_{h2} < -43 dBm
t_{h2} - t_{h1} > 2 dB

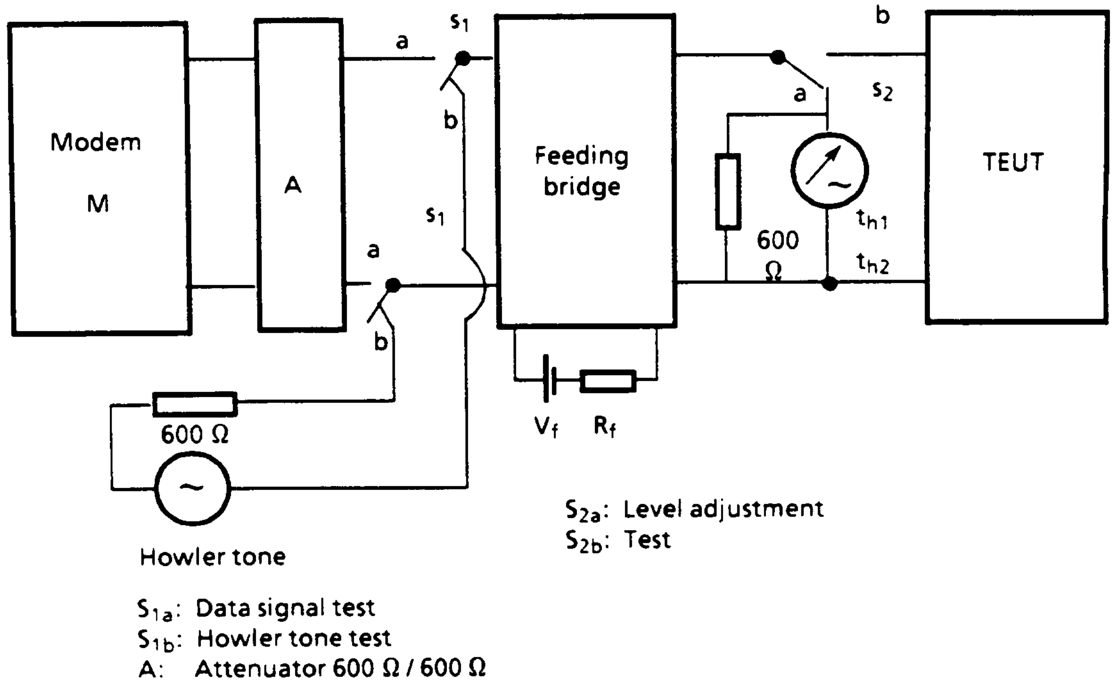


Figure A.6.4.2.1 (F) 1.b: Data signal control for full-duplex (except FSK) modems

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 ms/500 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 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 (H) 1 Value of t_7 is under study.

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 (P) 1 e(V) = 6 x 10^{-3} to test the requirement concerning a_2(dBm).

A.6.4.2.1 (P) 2 e(V) = 12 x 10^{-3} to test the requirement concerning a_3(dBm) where applicable.

A.6.4.2.1 (P) 3 t_7(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.

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	10	10	60		19 - 60	yes
Belgium	-40	-50	10 - 30	5	48		20 - I_{max}	
Bulgaria	-40	-52	15		60	1 000 - 2 200		yes
Cyprus	-43	-48	20	10	48	440 - 1 740		
Denmark								yes
Finland	not spec.	-52	not spec.	90	44 - 58	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	
Hungary	-45	-52	under study		48		20 - I_{max}	
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	-60	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	-28	-48	100	5	43 - 57	2 200 - 600		
U. Kingdom	not mandatory							

6.4.2.2 (A) 1 The TE shall also revert to the idle state within 10 s if a dialling tone or congestion tone rather than speech is detected (see section 6.4.3).

6.4.2.2 (BG) 1 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 ETS, stated conditions are valid only if no service-related requirements exist for the equipment under consideration.

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 outside the 300 Hz - 3 400 Hz frequency band, having a power level below the values indicated by the diagram in figure 5.2.2 (S) 1.

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.

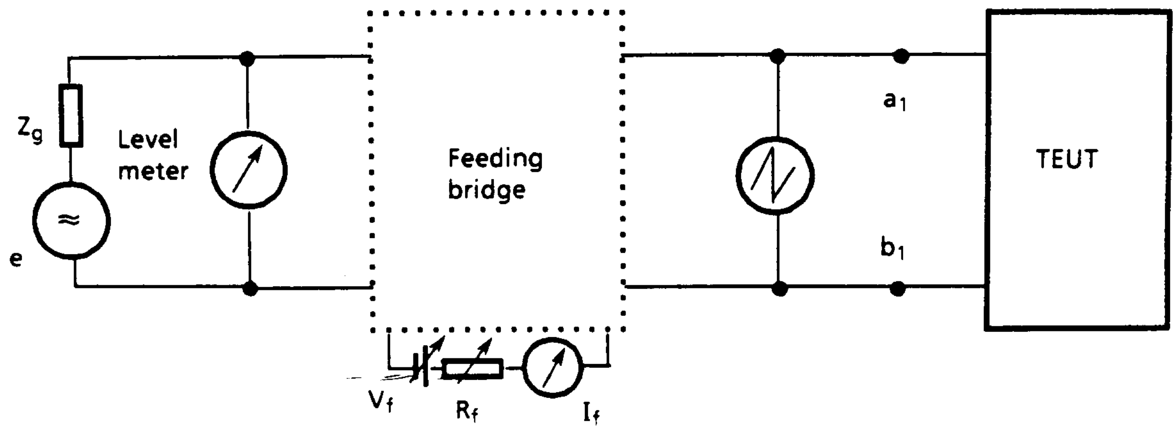


Figure A.6.4.2.2: Incoming speech or other non-data signal related control

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	
Bulgaria	variable	600	60	2 200	
Cyprus		600	48	800	
Denmark					
Finland		600	48	800, 1 710	
France					
Germany	not mandatory				
Greece		600	60		
Hungary		600	48		20, $I_{max.}$
Iceland		600	48		14, $I_{max.}$
Ireland		600	48	5 000	20, 80
Italy	not stated	600	48	1 100	
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			25
Switzerland		600	50	1 000	
U. Kingdom	not mandatory				

Table A.6.4.2.2 (continued): 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	-40	-48			yes
Bulgaria	-40	-50	15		
Cyprus	-43	-48	20	10	
Denmark					yes
Finland		-52		90	yes
France					yes
Germany	not mandatory				
Greece	-30, -25	-48, -55	20, 30		yes
Hungary	-45	-52	under study		
Iceland	-48	-48	20	10	
Ireland	-43	-48	20		
Italy	-34	-40			
Luxembourg					
Malta					
Netherlands	not mandatory				
Norway	-43	-60	20	10	
Portugal	not applicable	not applicable	20	10	yes
Spain					yes
Sweden	-50	-60	20	10	yes
Switzerland	-28	-48	100	5	
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 (A) 2 Additional test concerning 6.4.2.2 (A) 1, see section A.6.4.3.

A.6.4.2.2 (B) 1 For the test, the generator "e" is adjusted to produce the rms voltage levels a_4 and a_5 at the TE line terminals.

The times t_8 and t_9 are results of the test and have to be within the limits specified in 6.4.2.2.

A.6.4.2.2 (B) 2 For digital PBX with incoming speech and other non-data signal related control of loop condition, the value of Z_L is equal to Z_C, as defined in section 4.1.2 (B) 1.

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 a_4(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:

$V_f = 48$ 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.

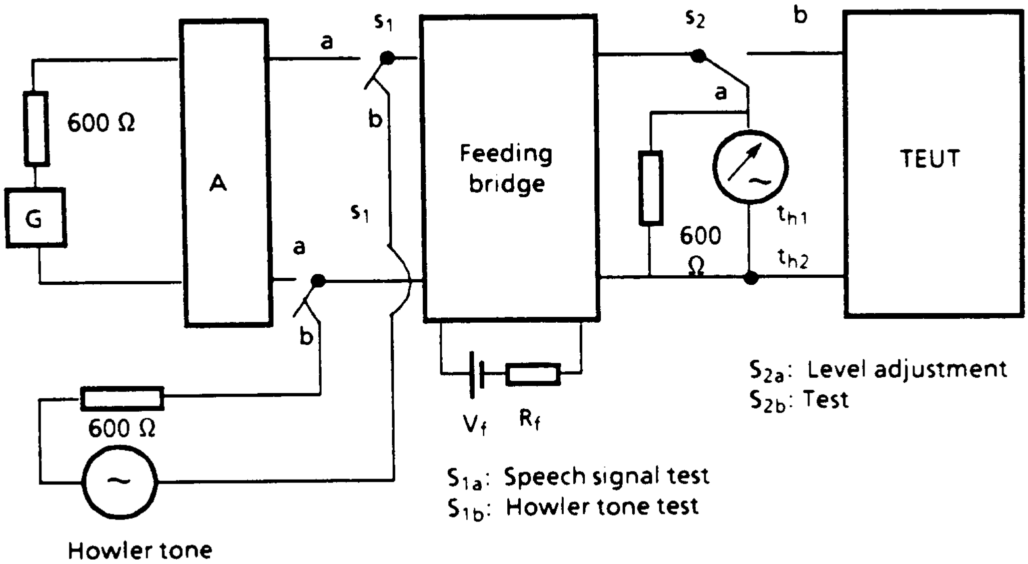


Figure A.6.4.2.2 (F) 1: Speech signal control

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 ms/500 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 ms/500 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 V
R_f = 300 Ω.

A.6.4.2.2 (GR) 1 I_f = 20, 35, 55 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 (P) 1 e(V) = 12 x 10^{-3} to test the requirement concerning a_4(dBm).

A.6.4.2.2 (P) 2 e(V) = 6 x 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 After being activated a test is made that the TE, for the following combinations of frequencies outside the speech band and levels, is not kept activated:

(Hz)	17	33	50	100	150	200	250	5 000	12 000
(dBm)	0	0	0	-7	-18	-25	-31	-30	-6

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	100	60		19 - 60	yes
Belgium	not mandatory					yes
Bulgaria	not mandatory					
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
Hungary	not mandatory					
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	The same as per sections 6.4.2.1 and 6.4.2.2					
U. Kingdom	not mandatory					

6.4.2.3 (A) 1 With TE which are assigned for value added services a loop current detector (see section 9.4.2) shall be provided.

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_cs, 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 Δf = 0 - 60 V dc ΔIf = 20 - 80 mA.

6.4.2.3 (E) 1 The remark in section 6.4.2.1 (E) 1 shall be applied.

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.

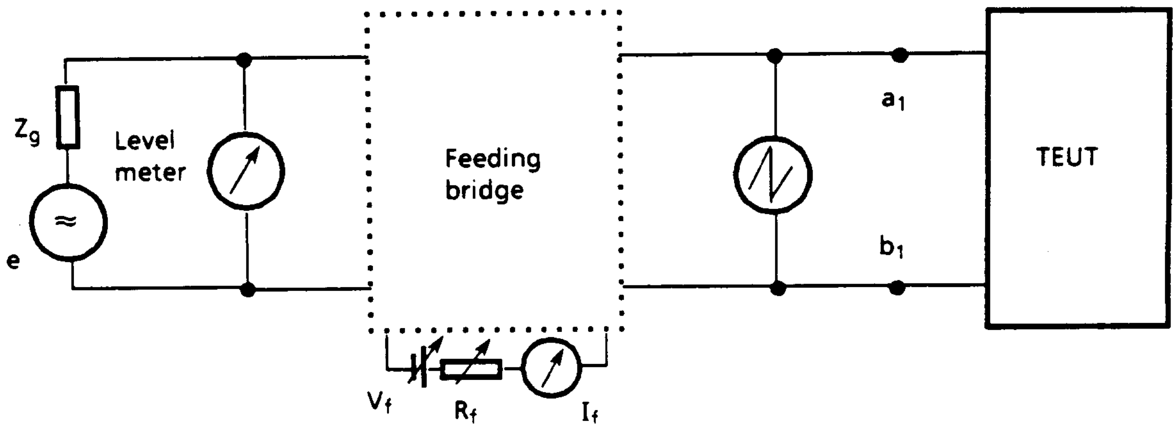


Figure A.6.4.2.3: Remotely transmitted control signals

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						
Bulgaria	not mandatory						
Cyprus	not mandatory						
Denmark							yes
Finland							
France							yes
Germany	not mandatory						
Greece		600	60			-48, -55	yes
Hungary	not mandatory						
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							
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 V

R_f = 300 Ω

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.

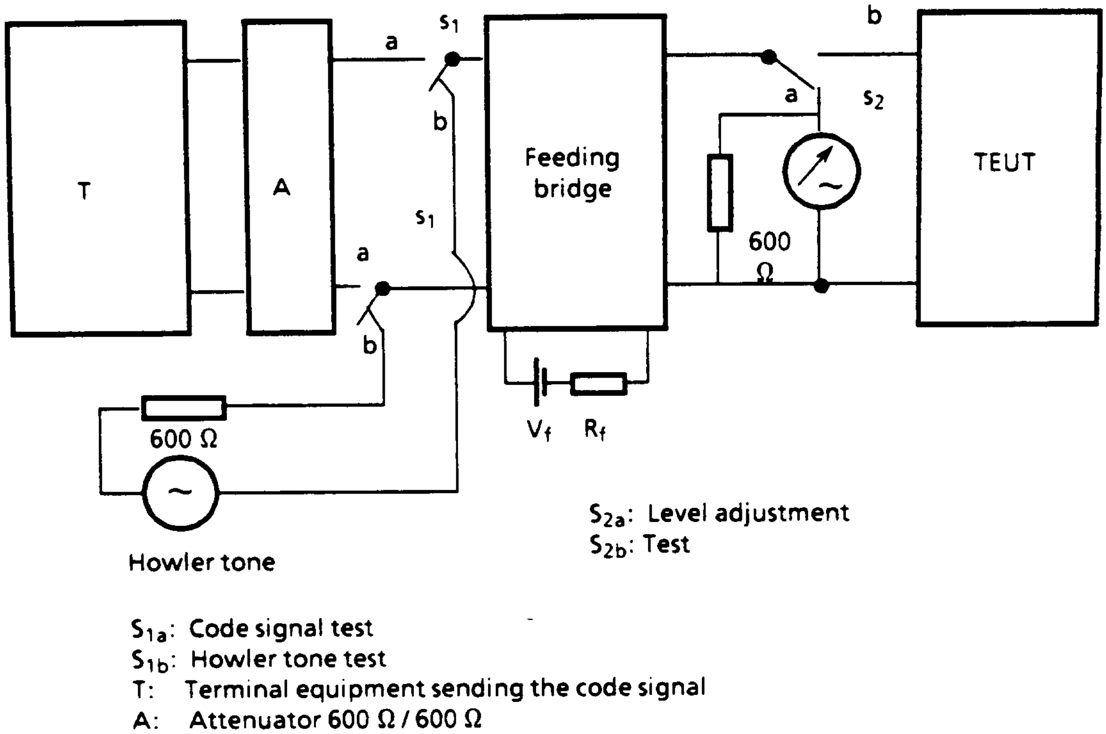


Figure A.6.4.2.3 (F) 1: Remote control

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 ms/500 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 ms/500 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 V
R_f = 300 Ω.

A.6.4.2.3 (GR) 1 I_f = 20, 35, 55 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
Bulgaria	yes	no	no	no
Cyprus	no	yes	yes	no
Denmark	not mandatory			
Finland	no	yes	no	no
France				howler tone
Germany	no	no	no	no
Greece				
Hungary	yes	yes	yes	no
Iceland	not mandatory			
Ireland	yes	yes	no	no
Italy				
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	opt, Sect.5.2	opt, Sect.5.2	opt, Sect.5.2	opt, Sect.6.4.2
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	20	60		19 - 60	yes
Belgium	5	48		20 - I_{max}	yes
Bulgaria	not mandatory				yes
Cyprus	10	48	440 - 1 740		
Denmark	not mandatory				
Finland	90	44 - 58	800 - 1 710		
France		46 - 54	300 - 8 225		yes
Germany	not mandatory				
Greece	10	0 - 60			yes
Hungary	20	48		20 - I_{max}	
Iceland	not mandatory				
Ireland	20	48	5 000	20 - 80	
Italy	10	44 - 52	720 - 1 880		yes
Luxembourg	not mandatory				
Malta					
Netherlands	20	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	see sections 5.2 and 6.4.2	43 - 57	2 200 - 600		yes
U. Kingdom	180				yes

6.4.3 (A) 1 This section is mandatory if incoming speech or other non-data signal related control is provided.

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 (BG) 1 See also section 5.6.3.1.

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 (GR) 1 If the detectors of the relevant tones are present, then conformance of the TE with the requirements of this section is mandatory.

Δf = 0 - 60 V dc   If = 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 180 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.

See sections 5.2 for network tones and 6.4.2 for all other tones.

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 tone related control of loop condition

The test circuit shown below shall be used.

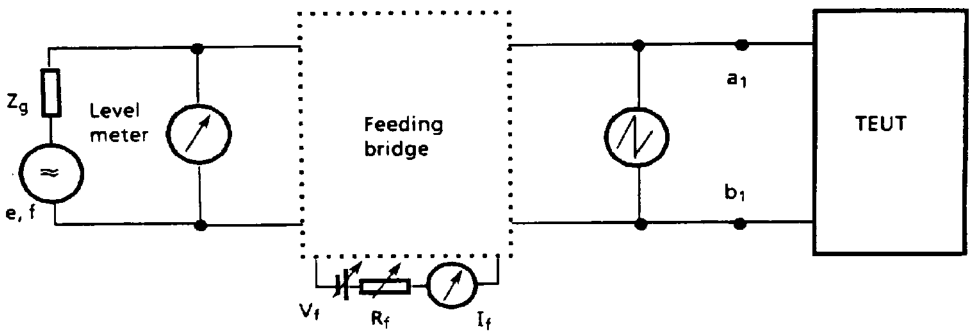


Figure A.6.4.3: TE with network tone related control of loop condition

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	
Bulgaria	not mandatory					
Cyprus			600	48	800	
Denmark	not mandatory					
Finland			600	48	800, 1 710	
France						
Germany	not mandatory					
Greece				60		
Hungary			600	48		20 - I_{max}
Iceland	not mandatory					
Ireland			600	48	5 000	20, 80
Italy			600	44, 52	1 880, 720	
Luxembourg	not mandatory					
Malta						
Netherlands			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	See section 5.2, other PSTN tones					
U. Kingdom	not mandatory					

Table A.6.4.3 (continued): TE with network tone related control of loop condition

COUNTRY	TEST VALUES			Remarks
	e_2 (V)	f_2 (Hz)	t_{11} (s)	
Austria				yes
Belgium	0,150	425, 450		yes
Bulgaria				
Cyprus		425	10	
Denmark	not mandatory			
Finland			90	
France				yes
Germany				
Greece				yes
Hungary			20	yes
Iceland	not mandatory			
Ireland				
Italy	0,080	400 - 500	10	yes
Luxembourg	not mandatory			
Malta				
Netherlands	80×10^{-3}	340, 425, 550	20	yes
Norway		425	20	yes
Portugal	55×10^{-3}	300 - 450	30	yes
Spain				yes
Sweden	not mandatory			
Switzerland				
U. Kingdom				yes
NOTE:	e_1, f_1 ringing signal; e_2, f_2 network tone			

A.6.4.3 (A) 1 Level and frequencies for dial tone:

a = -16 dBm, f = 380 Hz and 490 Hz, tone duration 10 s.

Level, frequency and cadence for congestion tone:

a = -16 dBm, f = 425 Hz, cadence = 200 ms/200 ms, tone duration 10 s.

A.6.4.3 (B) 1 Cadence for the signals:

dial tone: continue
busy tone: t_{on} = 500 ms / t_{off} = 500 ms
congestion tone: t_{on} = 167 ms / t_{off} = 167 ms.

A.6.4.3 (B) 2 For digital PBX with network tone related control of loop condition, the value of Z_L is equal to Z_C as defined in section 4.1.2 (B) 1.

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 V
R_f = 8 225 Ω

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 V
R_f = 300 Ω

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 V
R_f = 8 225 Ω

and it is checked whether the TE revert to quiescent condition.

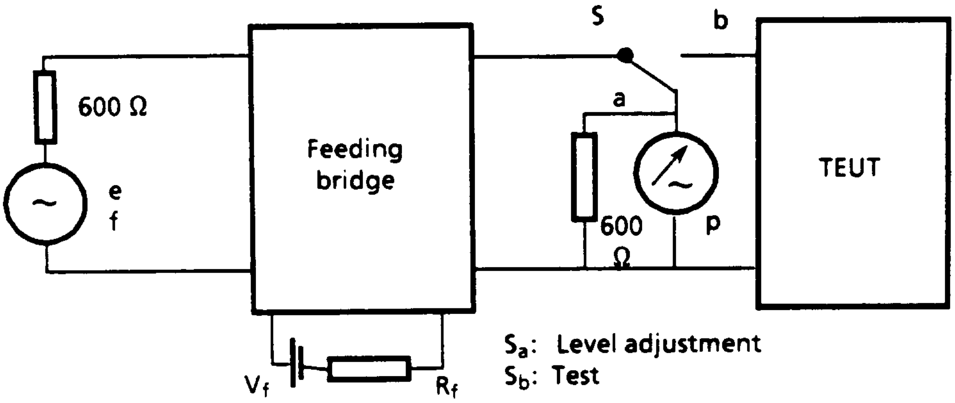


Figure A.6.4.3 (F) 1: Detection of howler tone

A.6.4.3 (GR) 1 I_f = 20, 35, 55 mA.

For Z_g = 0, e_1 is adjusted to give across a_1, b_1 a voltage equal to U = 25, 50, 75 V_{rms} for frequencies f_1 = 25, 50 Hz.

For Z_g = 600 Ω, e_2 is adjusted to give across Zg a voltage U = 775 mV at a frequency f = 425 Hz.

t_{11} is just observed.

A.6.4.3 (H) 1 Levels and frequencies of the network tones, see section 1.7.

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 the congestion tone during loop condition. The congestion tone characteristics are reported in section 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 Tests shall be carried out at a sending level of -30 dBm and with the following cadences:

200 ms ON and 200 ms OFF;
600 ms ON and 600 ms OFF.

A.6.4.3 (P) 1 Dial tone is a continuous signal.

A.6.4.3 (P) 2 Cadence for busy tone:

$t_{on}(s) = 0,5$
$t_{off}(s) = 0,5$

A.6.4.3 (P) 3 Cadence for congestion tone:

$t_{on}(s) = 0,2$
$t_{off}(s) = 0,2$

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 the 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	not mandatory	10	60	19 - 60		yes
Belgium	R_f increased by at least 600 Ω		5	48		20 - I_{max}	yes
Bulgaria		not mandatory					
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					
Hungary		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	operate: line break 90 ms, 5 mA	immunity: break 70 ms, 0mA	0,5	43 - 57	2 200 - 600		yes
U. Kingdom		not mandatory					yes

6.4.4 (A) 1 This requirement is mandatory for TE which are assigned for value added services.

Requirements for loop current detector, see section 9.4.2.

6.4.4 (B) 1 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 70 ms may occur, but these shall not be recognised. The use of this criterion is not mandatory, as it is not available at all exchanges, but if it is implemented in the TE (option) shall fulfil the present requirement.

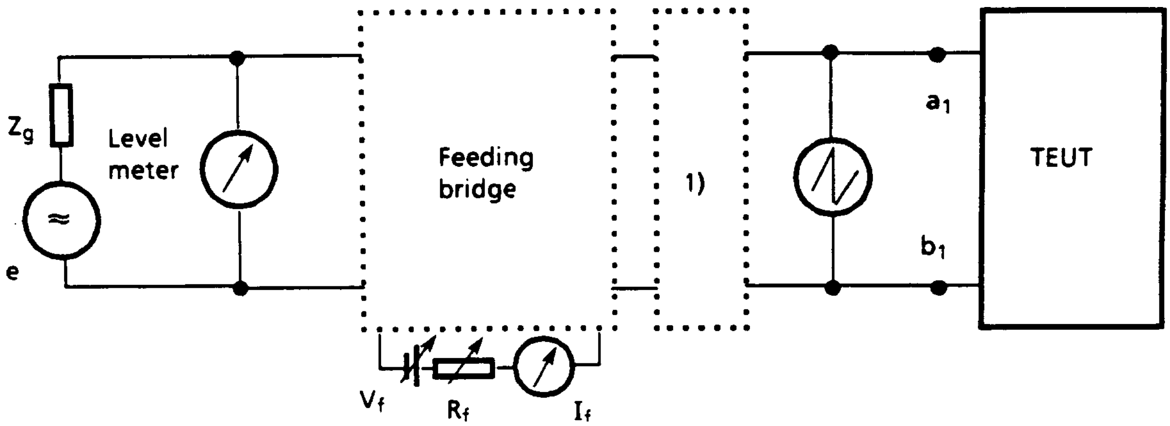
6.4.4 (GB) 1

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
Bulgaria	not mandatory							
Cyprus	not mandatory							
Denmark	not mandatory							
Finland								
France	0	600	46	8 225		polarity inversion		yes
Germany	not mandatory							
Greece	not mandatory							
Hungary	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			50	500, 2 300		90 ms, 5 mA	70 ms, 0 mA	
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 600 Ω.

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:

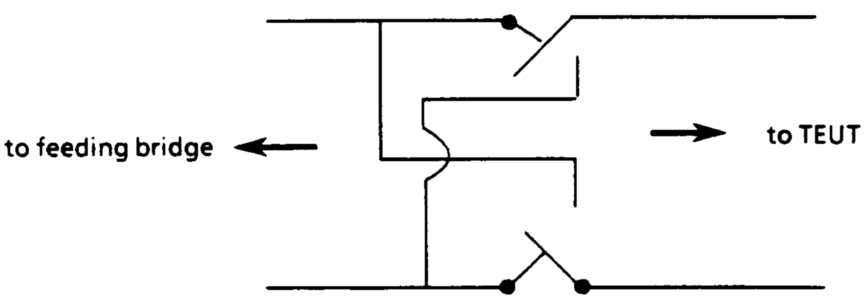


Figure A.6.4.4 (F) 1

A.6.4.4 (E) 1 See the remark in section 6.4.4 (E) 1.

History

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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 7: Power failure

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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Contents

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Foreword

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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

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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	
Bulgaria	yes	yes
Cyprus	yes	yes
Denmark	yes	
Finland	yes	
France	yes	yes
Germany	yes	yes
Greece	yes	yes
Hungary	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	no	yes

7.1 (A) 1 The requirements of this chapter are applicable for TEs with a 220 V 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 buffer battery.

7.1 (A) 2 One short line seizure (loop condition ≤ 500 ms) is permitted if power source interruption or re-application of the power source occurs.

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 series-connected TE (e.g. answering machines) the lines "a" and "b" through the TE shall not be interrupted.

7.1 (A) 6 One-port TE (telephone sets or equivalent TE) shall provide a ringing circuitry as outlined in section 3.1.2. A ringer function is not required. With TE with a handset the ringing circuitry shall be provided in the on-hook position.

7.1 (BG) 1 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 (BG) 2 Values of requirements shall be maintained.

7.1 (BG) 3 Stored call numbers shall either remain or be cleared.

7.1 (BG) 4 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 (BG) 5 With series-connected TE (e.g. answering machines) the lines "a" and "b" through the TE shall not be interrupted.

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 (D) 1 Restoration of power at the NTA

If the terminal equipment is in the quiescent state, it shall behave as described in section 2.2 "Quiescent state" on restoration of power.

If the terminal equipment is not in the quiescent state, it shall assume a defined operating state (with the exception of the dialling state) on restoration of power.

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 (H) 1 For TE with 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 shall 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 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 TE shall not obstruct traffic to or from another TE that is connected to the same line.

7.1 (CH) 1 All the TE requirements shall be wholly satisfied and proper operation shall be guaranteed for external power supplies having the following tolerances:

- external power supply voltage: 198 ... 244 V;
- battery operation (recommendation): 15% below the nominal voltage.

Uncontrolled procedures which could interfere with proper operation of the PSTN and other TE shall 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 shall connect through the line if their proper functioning is no longer assured. After the problem is removed, the TE shall 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 should (recommendation) be satisfied, in addition to the conditions stated above. The users shall 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.

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.

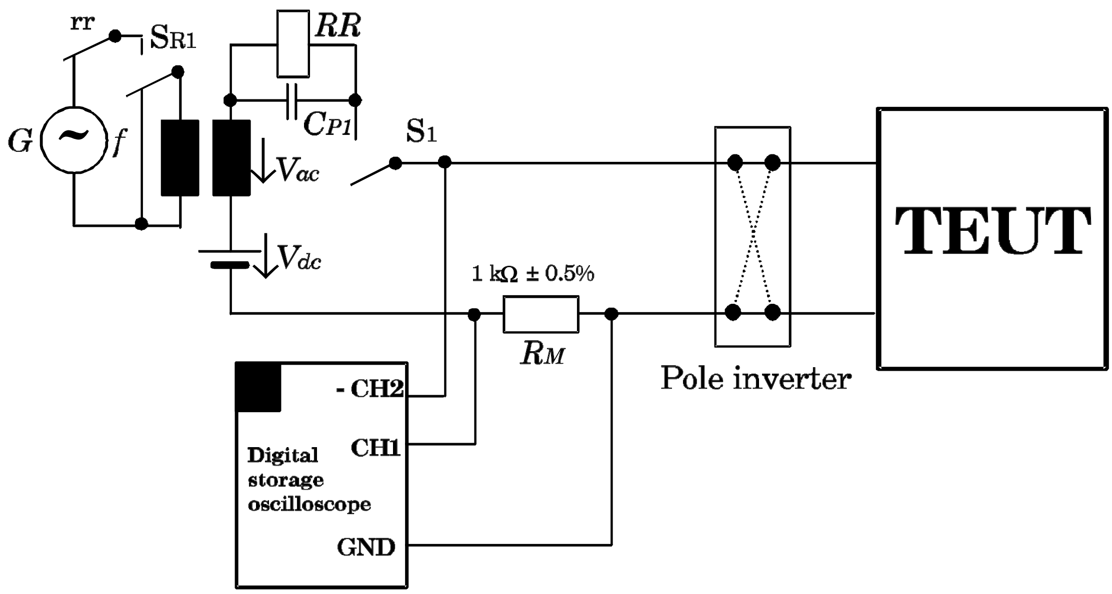
Table A.7.1: Power failure with the TE in quiescent condition

COUNTRY	TEST VALUES	Remarks
	Mandatory	
Austria	yes	
Belgium	yes	
Bulgaria	yes	
Cyprus	yes	
Denmark		
Finland	yes	
France		
Germany	yes	yes
Greece	yes	
Hungary	yes	
Iceland		
Ireland	yes	
Italy	yes	
Luxembourg	yes	
Malta		
Netherlands		
Norway	yes	
Portugal	yes	
Spain		yes
Sweden	yes	
Switzerland	yes	yes
U. Kingdom	no	

A.7.1 (D) 1 Restoration of power at the NTA

a) TEUT in the quiescent state

The circuit illustrated in figure A.7.1 (D) 1 is used for the measurement.



V_{dc} = 63 V	V_{ac} = 75 V	f = 25 Hz	$RR \leq 20\ \Omega$	C_P = 1 000 µF

Figure A.7.1 (D) 1

Switch S1 is closed before the measurement commences. Power is then fed to the TEUT via the NTA. The TEUT is in the quiescent state; this is verified by the measurement of the quiescent current via V_M (CH1). After a period $t_1 > 30$ s switch S1 is opened and the power failure simulated.

The restoration of power at the NTA is simulated after $t_2 = 60$ s by closing switch S1.

The voltage is measured via R_M (CH1) in order to verify that the TEUT is still in the quiescent state after restoration of power at the NTA. The TEUT is in the quiescent state if the voltage level at R_M 30 s after restoration of power is $V_M \leq 62{,}8$ mV.

The measurement is repeated with reversed polarity of the TEUT.

b) TEUT in the ringing state

The circuit illustrated in figure A.7.1 (D) 1 is used for the measurement.

Switch S1 is closed at the beginning of the measurement. The ringing state is initiated after 30 s by means of switch SR1. After the application of 3 ringing signal pulses, power at the NTA is interrupted for $t = 60$ s by means of S1. The terminal equipment (TEUT) is subsequently monitored as specified in bullet point e).

The measurement is repeated with reversed polarity of the TEUT.

c) TEUT in the off-hook condition / communication state

The circuit illustrated in figure A.7.1 (D) 1 is used for the measurement.

Switch S1 is closed at the beginning of the measurement. The TEUT is placed in the off-hook condition or communication state. After $t = 30$ s, switch S1 is opened for a period of $t_2 = 60$ s. The terminal equipment (TEUT) is subsequently monitored as specified in bullet point e).

The measurement is repeated with reversed polarity of the TEUT.

d) TEUT in the dialling state

The circuit illustrated in figure A.7.1 (D) 1 is used for the measurement.

Switch S1 is closed before the measurement commences. The TEUT is placed in the decadic dialling or MFPB (DTMF) dialling state; this is monitored on the oscilloscope. During the generation of the dialling pulses by the TEUT, switch S1 is opened and the power failure at the NTA simulated.

The restoration of power at the NTA is simulated after $t_2 = 60$ s by closing switch S1. The terminal equipment (TEUT) is subsequently monitored as specified in bullet point e).

The measurement is repeated with reversed polarity of the TEUT.

e) Determination of the state of the equipment after restoration of power at the NTA

- the TEUT is in the quiescent state if the voltage V_M is ≤ 62,8 mV;
- the TEUT is in the off-hook condition or communication state if the voltage V_{TEUT} (-CH2) is = 6 V to 22,1 V;
- an oscilloscope is used to determine whether the TEUT has inadmissibly assumed the MFPB (DTMF) or decadic dialling state.

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.

It is assumed that the TEUT would fulfil the associated requirement if the test procedure were 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

The compliance is based on the user's declaration. It should be tested (recommendation) 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: $V_f = 50$ V, $R_f = 1\,000\ \Omega$.

7.2 Power failure with TE in conditions other than the quiescent condition.

TE which, whilst in any condition other than the 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 that "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 which it reverted 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	REQUIREMENT VALUES		Remarks
	Mandatory	t (s)	
Austria	yes	1	yes
Belgium	yes	15	
Bulgaria	yes	10	
Cyprus	yes	10	yes
Denmark	yes	1	
Finland	yes	not specified	
France	yes	1	yes
Germany	yes		yes
Greece	yes	3	yes
Hungary	yes	15	
Iceland	yes		
Ireland	yes		
Italy	yes	1	yes
Luxembourg	yes	10	
Malta			
Netherlands	no		
Norway	yes	5	
Portugal	yes	1	
Spain	yes	3	yes
Sweden	yes	10	yes
Switzerland	yes	10	yes
U. Kingdom	no		yes

7.2 (A) 1 After the revision in the quiescent condition section 7.1 is valid.

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 (D) 1 See section 7.1 (D) 1.

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.

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 A.7.2 (E) 1.

7.2 (S) 1 In the event of a power failure, the TE shall not obstruct traffic to or from another TE that is connected to the same line.

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.

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. For multi-line terminal equipment with live speech facilities, this requirement shall be met on at least one PSTN exchange line connection.

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.

A.7.2 (E) 1 The procedure of test in A.7.1 (E) 1 is followed.

A.7.2 (CH) 1 The remarks stated in A.7.1 (CH) 1 apply.

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ETSI

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ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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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 single 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 to the requirements in this chapter 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 (DK) 1 Danish specifications in chapter 8 are for information only.

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. The tone ringer serves as a line termination and shall conform to the requirements for a telephone set ringer. 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 installation of the socket(s) which is (are) connected to the PSTN 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 with telephony functions in loop condition is not allowed.

8.1 (B) 1 In Belgium, the basic termination is a four pole socket (shown in figures 8.1(B) 1.1 or 8.1 (B) 1.2), provided and installed by BELGACOM at the subscriber's premises. This socket also contains an electrical load (RC Network) which terminates the PSTN line (a and b wires). There are two versions of this RC network:

- old model: $R = 4\ 700\ \Omega$ in series with $C = 1\ \mu F$. When a plug is inserted into the socket, the RC network is automatically disconnected from the line;

- new model: $R = 47\ k\Omega$ in series with $C = 0{,}47\ \mu F$ permanently connected between the a and b wires.

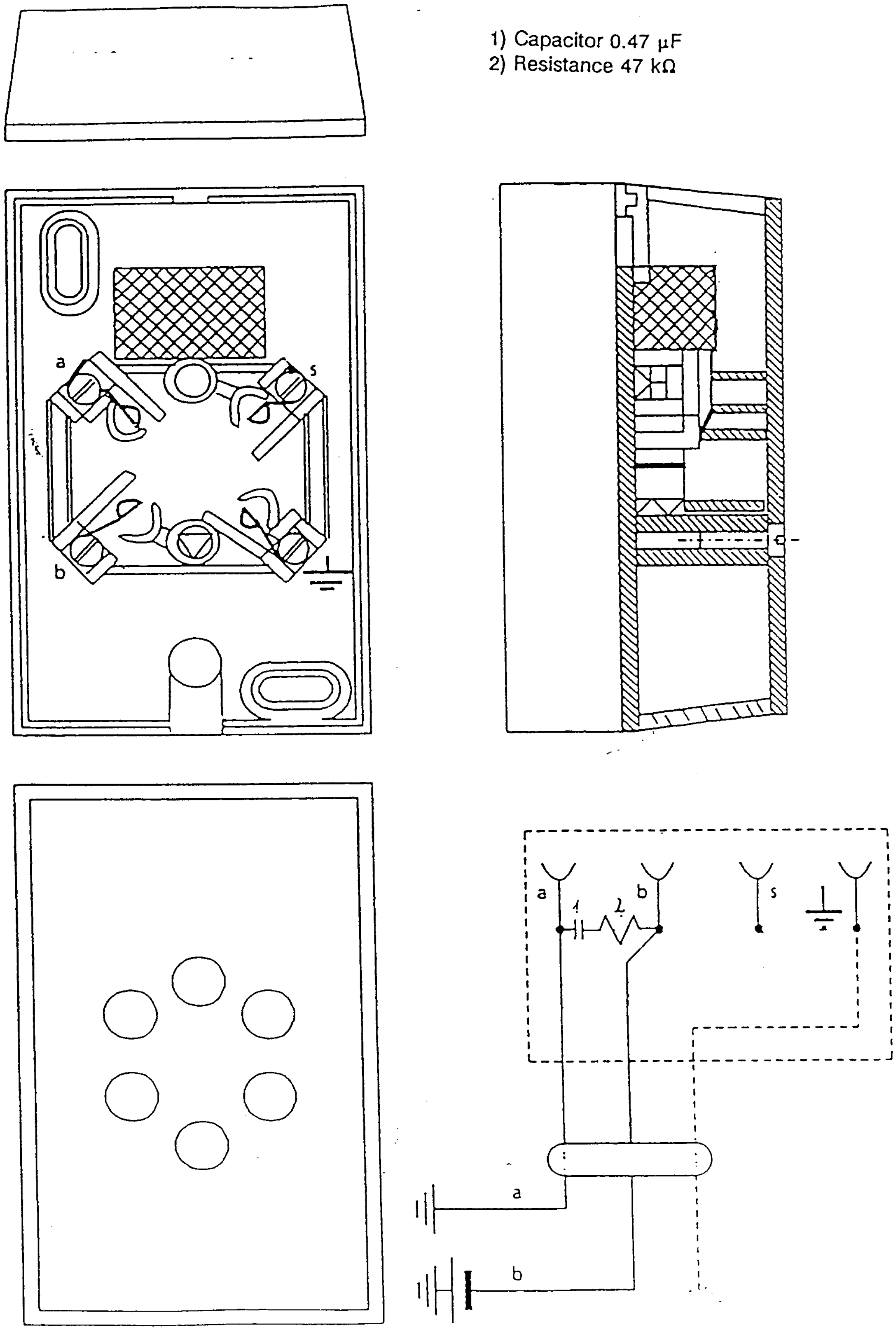


Figure 8.1 (B) 1.1: Belgian standard socket (new model)

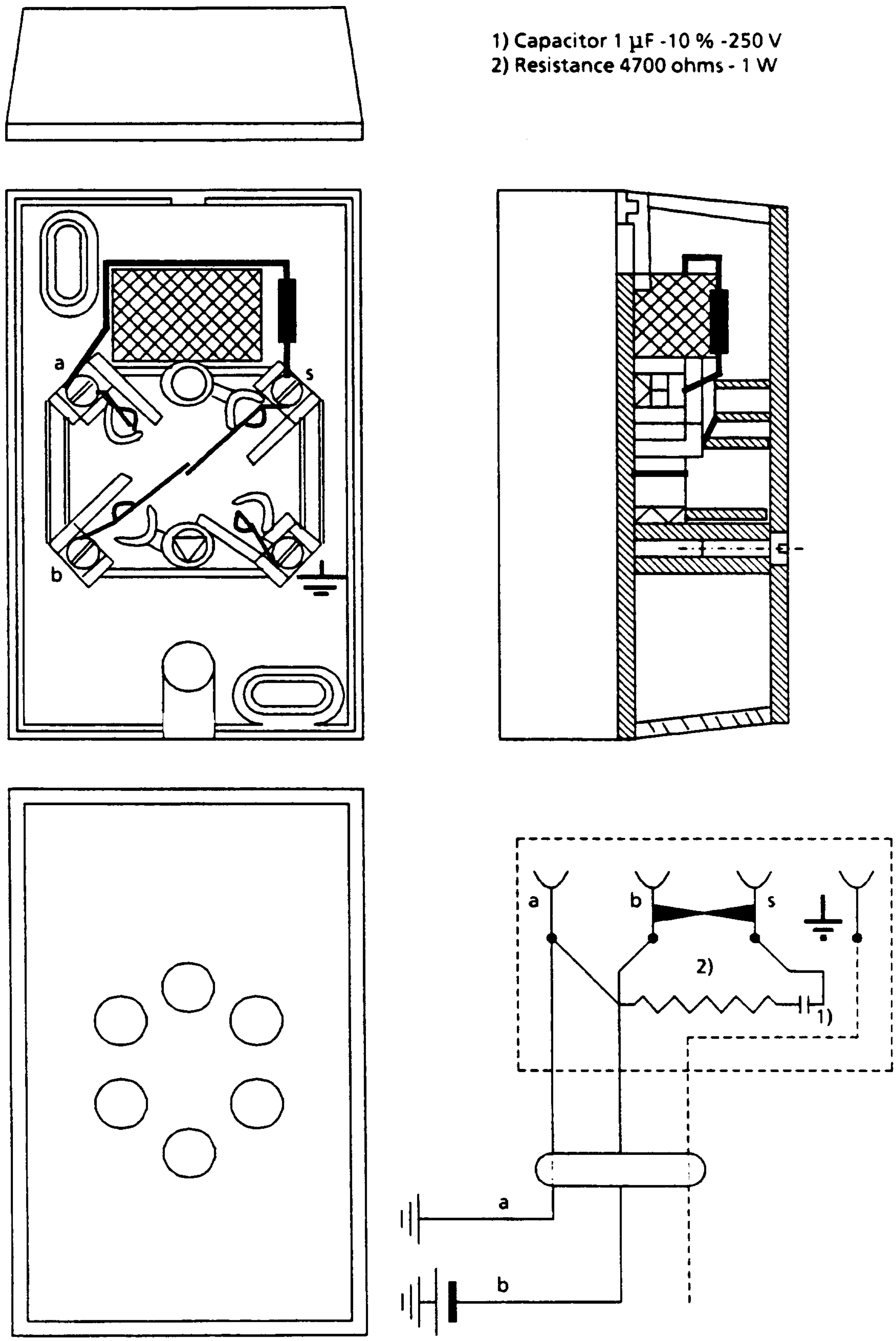


Figure 8.1 (B) 1.2: Belgian standard socket (old model)

8.1 (BG) 1 The normal method of presentation of the standard analogue subscriber interface of the PSTN is by means of a socket on the network termination, to which TE is connected by means of a multi-contact plug complying with Bulgarian standard, BDS 4060-87.

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 (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 µF) 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.

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 (H) 1 In Hungary, the physical realisation of connections to PSTN are regulated by Basic Technical Plans as well as by national standards. these regulations apply, first of all, to subscriber TEs and do not cover the connection points of separated or private (PABX) networks.

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 1.3.

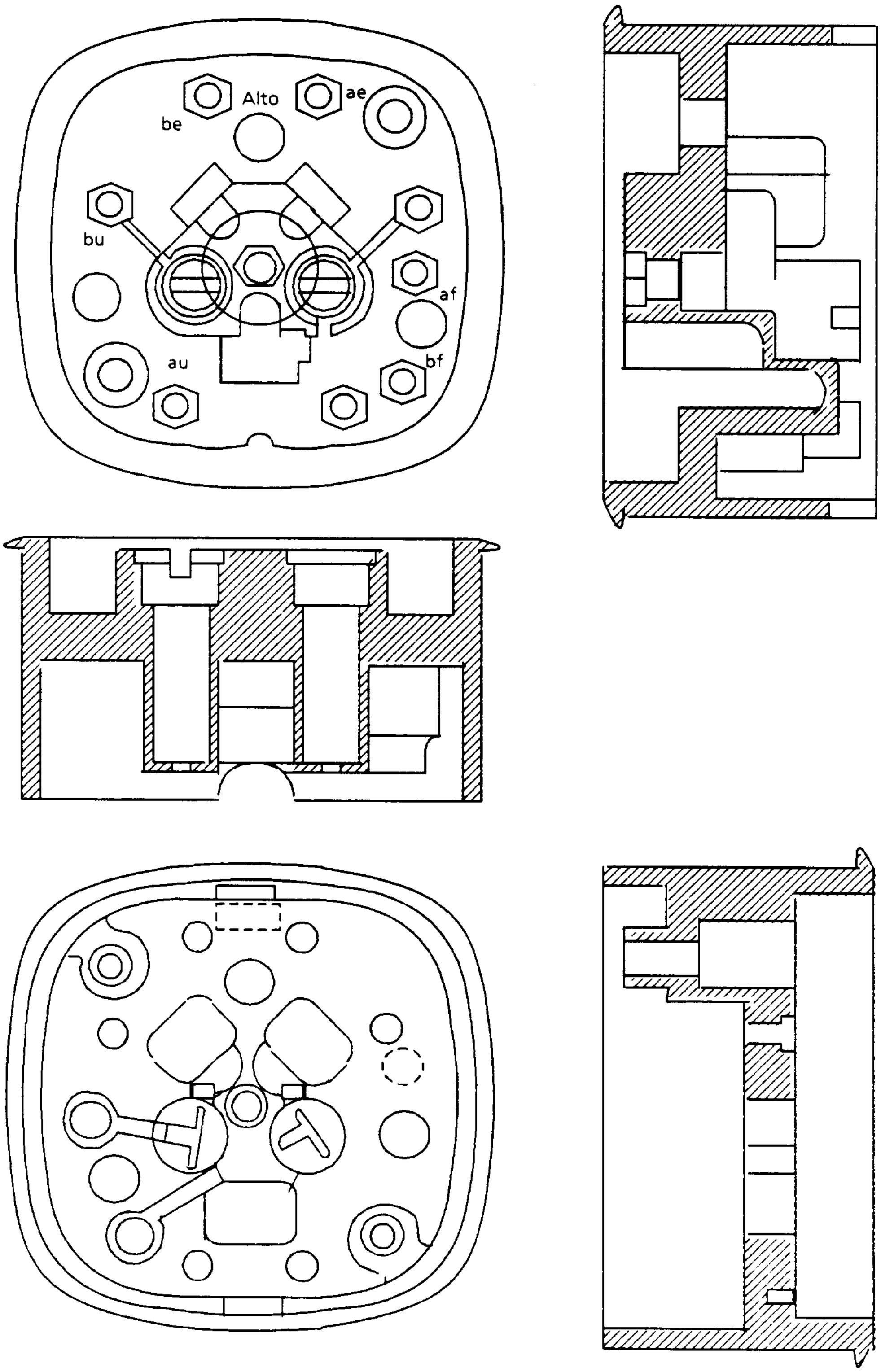


Figure 8.1 (I) 1.1

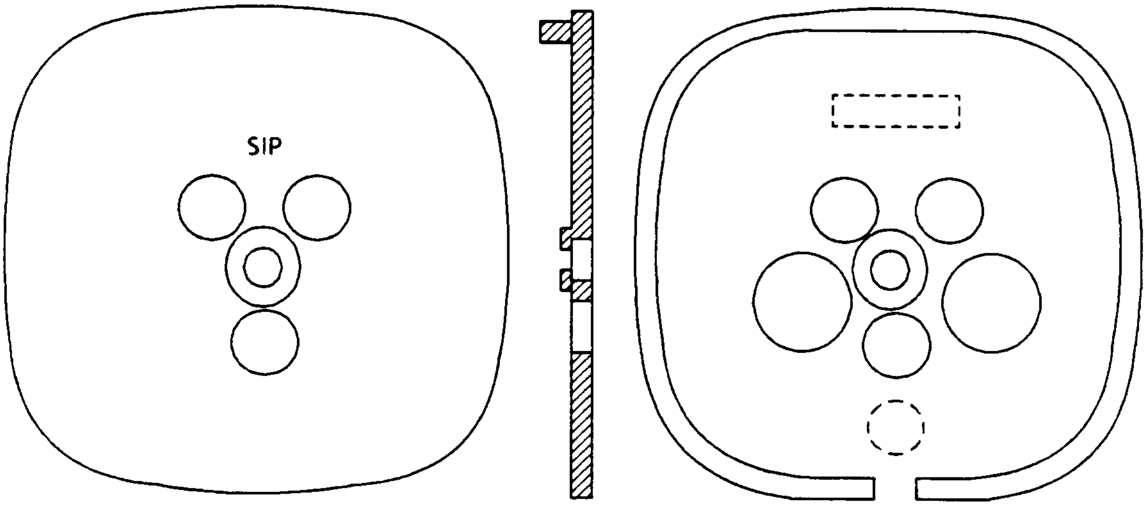


Figure 8.1 (I) 1.2

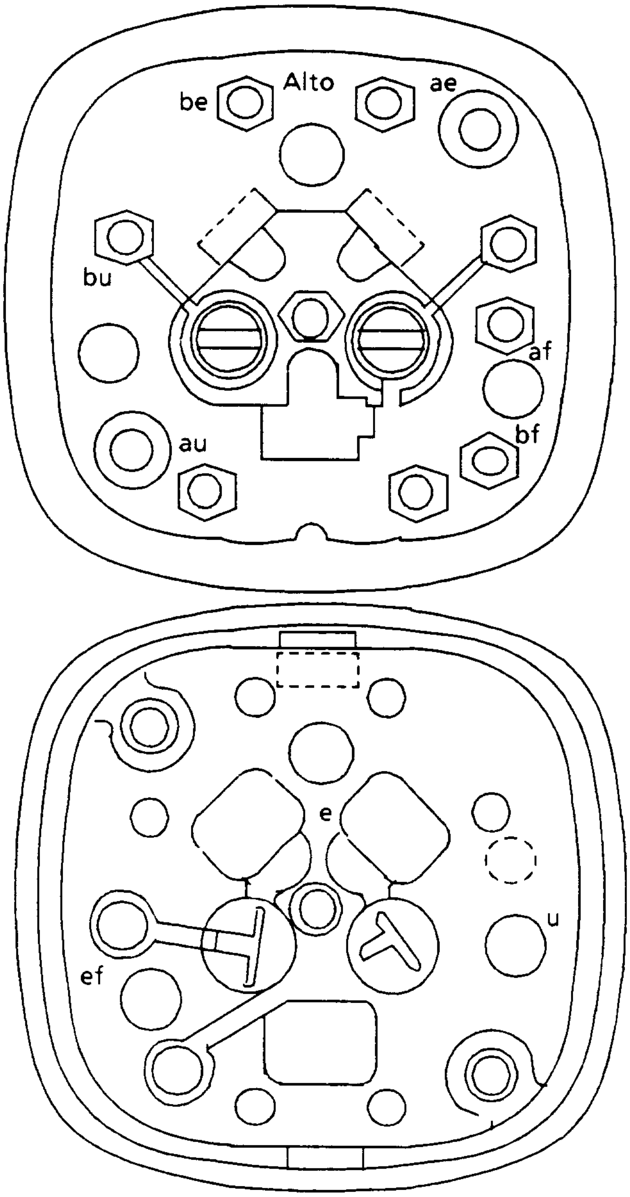
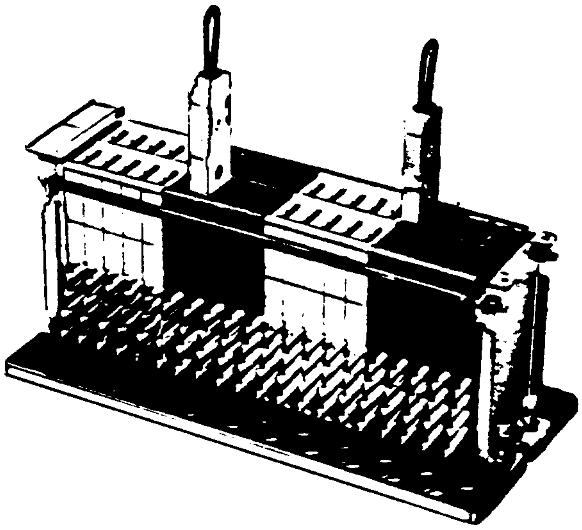


Figure 8.1 (I) 1.3

Multiple terminations (e.g. PABX) must be connected to PSTN using the device described in figure 8.1 (I) 1.4.



Dimensions in mm

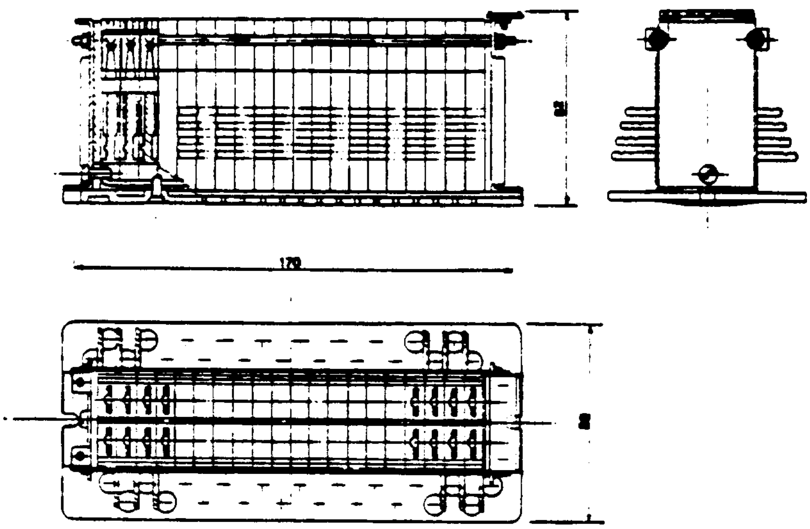


Figure 8.1 (I) 1.4

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.

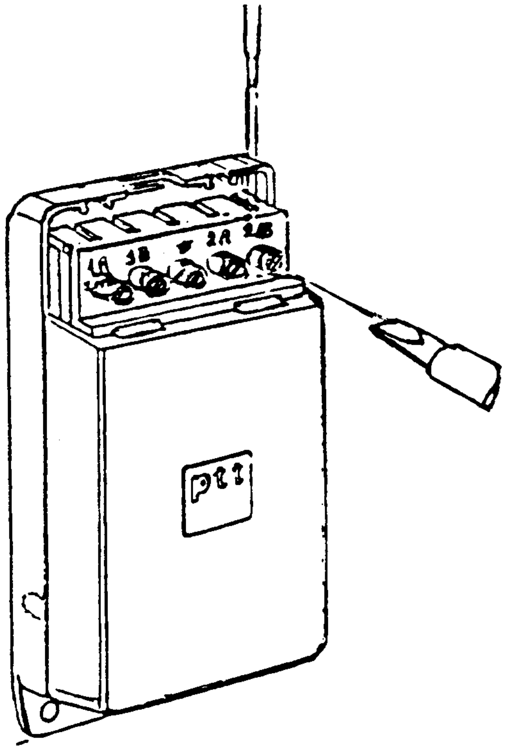


Figure 8.1 (NL) 1.1

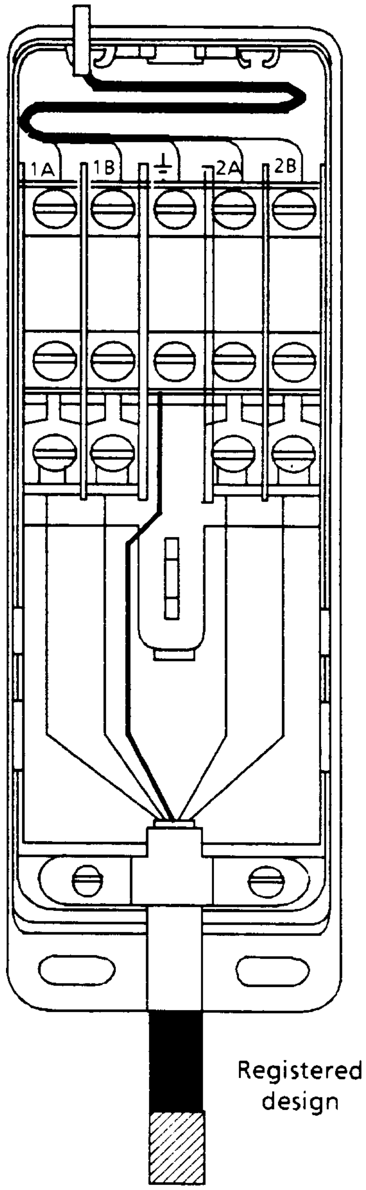


Figure 8.1 (NL) 1.2

The wiring in the house including plugs and sockets are owned by the subscriber.

8.1 (N) 1 Single PSTN lines are in Norway terminated by a standard socket provided by the public operator Telenor AS. The socket constitutes the boundary towards the public operator. The standard socket is an 8-pole modular socket (EN 28877).

Only the first, standardised socket is provided by Telenor AS as part of the PSTN subscription. Additional sockets shall be installed by an installation company licensed by Norwegian Telecommunication Authority (NTA). 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 Telenor AS property).

According to Norwegian regulations, multiple line PSTN terminations (normally provided to business subscriber's) are handled differently from the single 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 NTA.

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 former public telecommunications network operators - Telefones de Lisboa e Porto (TLP) and Correios e Telecomunicações de Portugal (CTT) (from mid-1994, TLP and CTT were merged into a unique operator, called Portugal Telecom) - 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 content of this section is 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 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 kΩ in series with a capacitor of 1 µF and, when provided, it is permanently connected across the two wires of the line, for telemetering and maintenance purposes. In the future it is planed to use some parts of the network, instead of this passive termination circuit, an active remote operated circuit is used; 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.

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.

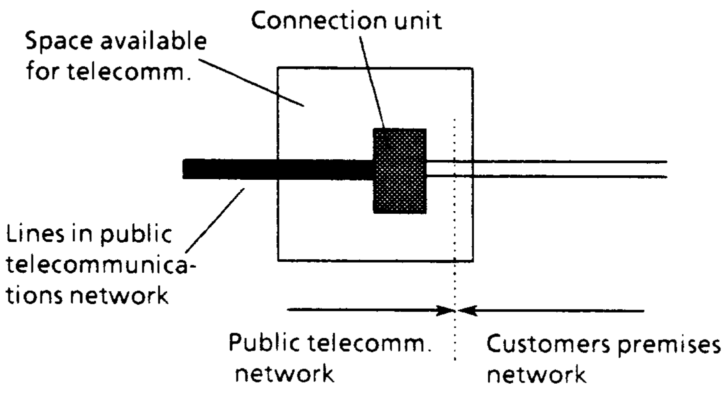


Figure 8.1 (S) 1

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.

No pin assignments are mandatory requirements. The information in the present Chapter presents the current market situation.

The present PTT connection system between the TE cord and the in-house 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 normally tested with the T + T 83/87 plug or for critical measurements at the connecting contacts of the TE. See also section 1.4.4.4.

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.

Figures 8.2 (A) 1.3 and 8.2 (A) 1.6 show the design of the PTT plug. The sockets on the panel and the plugs are all marked with user guidance symbols (triangle, circle and telephone handset) to ensure correct allocation.

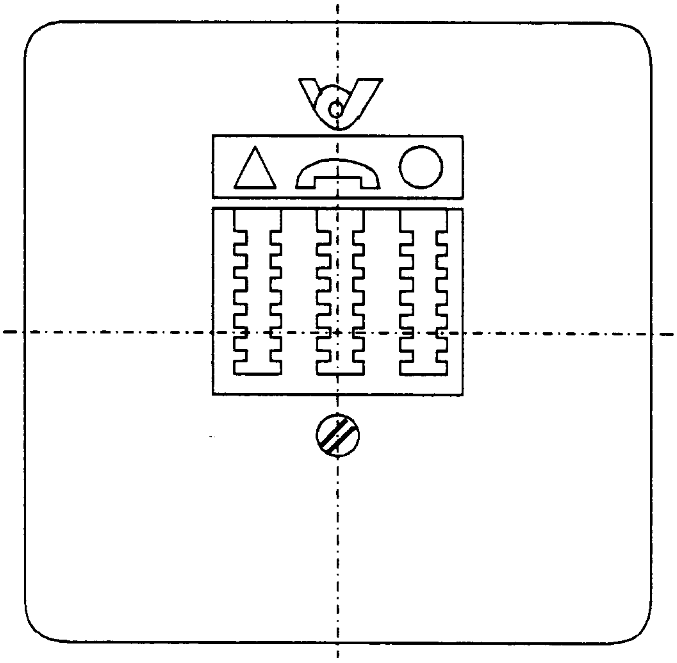


Figure 8.2 (A) 1.1: Threefold socket

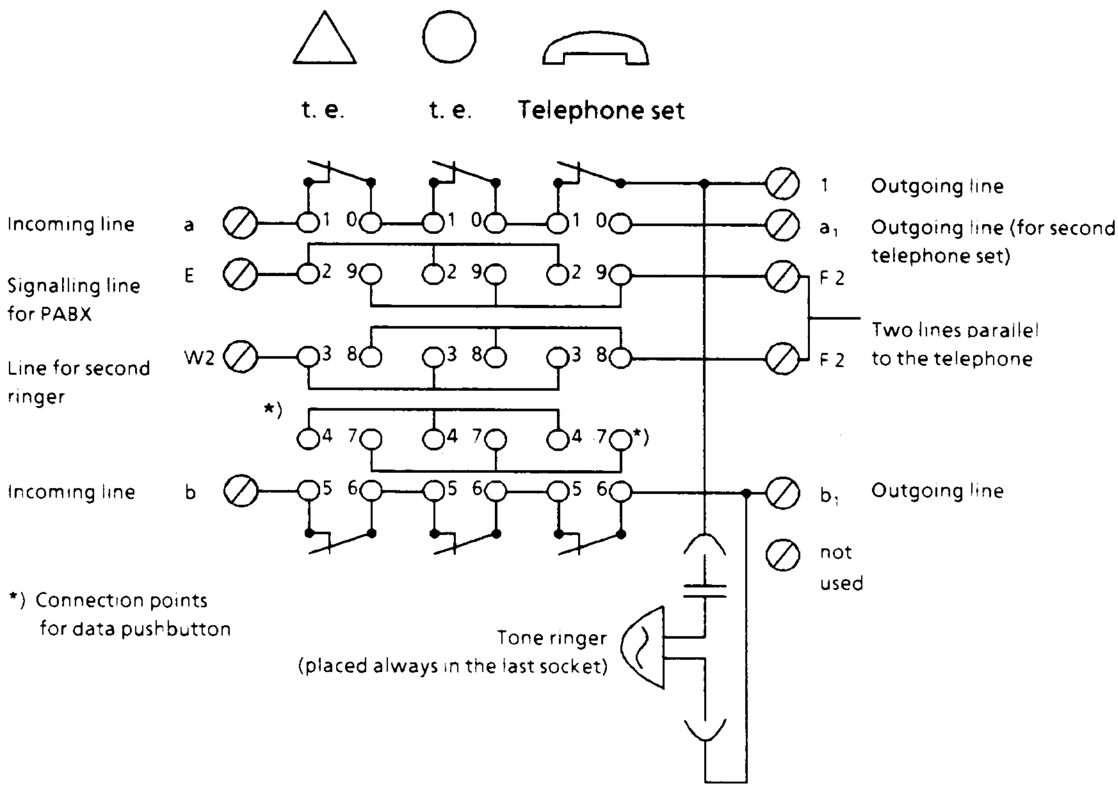


Figure 8.2 (A) 1.2: Circuit diagram of the threefold socket

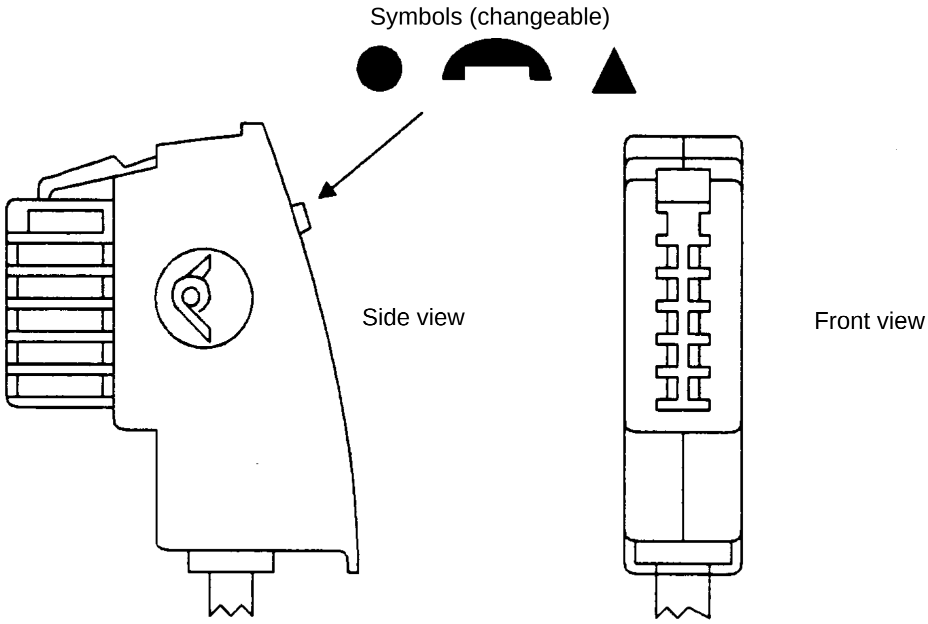


Figure 8.2 (A) 1.3: Plug

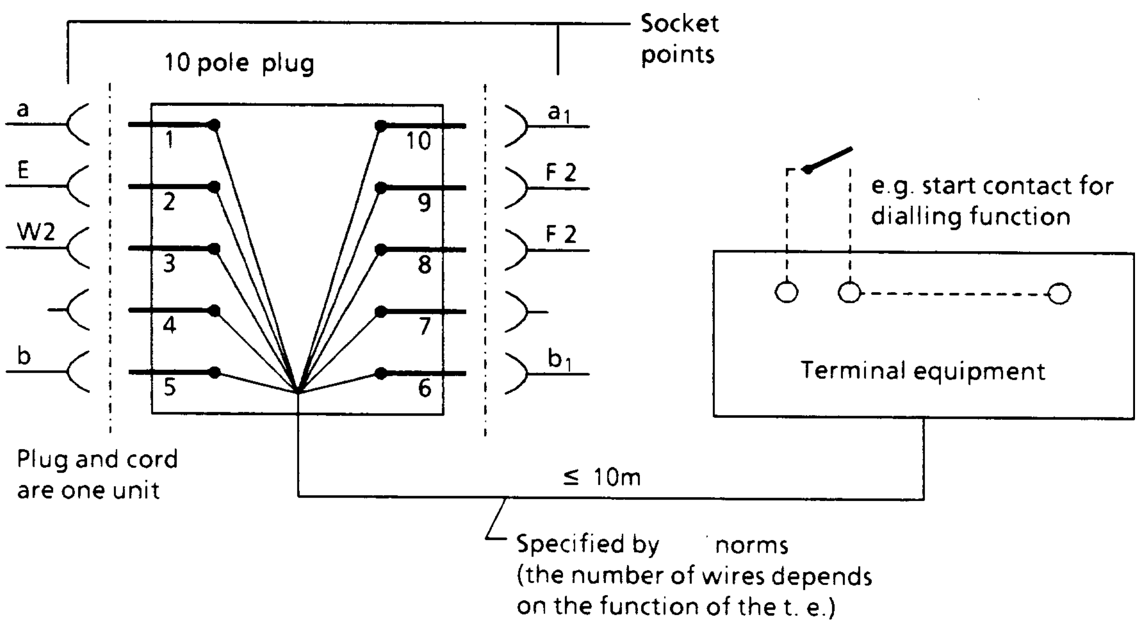


Figure 8.2 (A) 1.4: Plug and cord

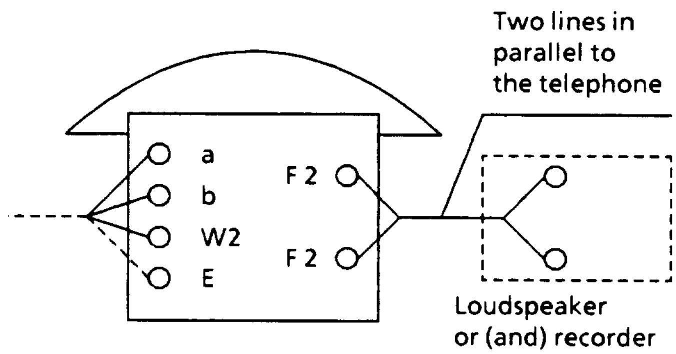


Figure 8.2 (A) 1.5: Direct connection for loudspeaker or (and) recorder to the telephone set

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.

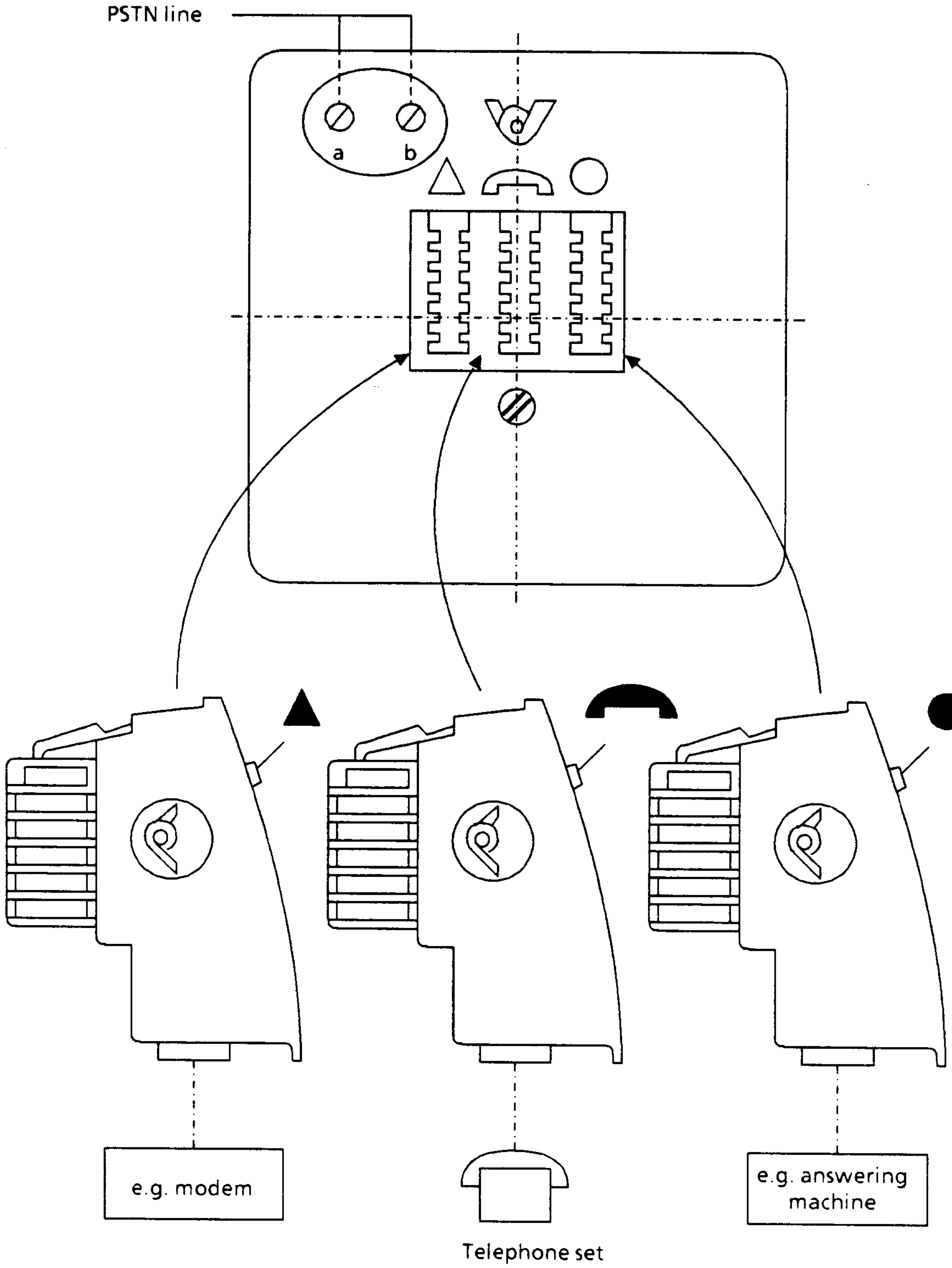


Figure 8.2 (A) 1.6: Plug and socket system for single and multiple connection

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 sockets shown in figures 8.1 (B) 1.1 and 8.1 (B) 1.2. All characteristics of this plug can be found in the Belgian document BE/SP-212.

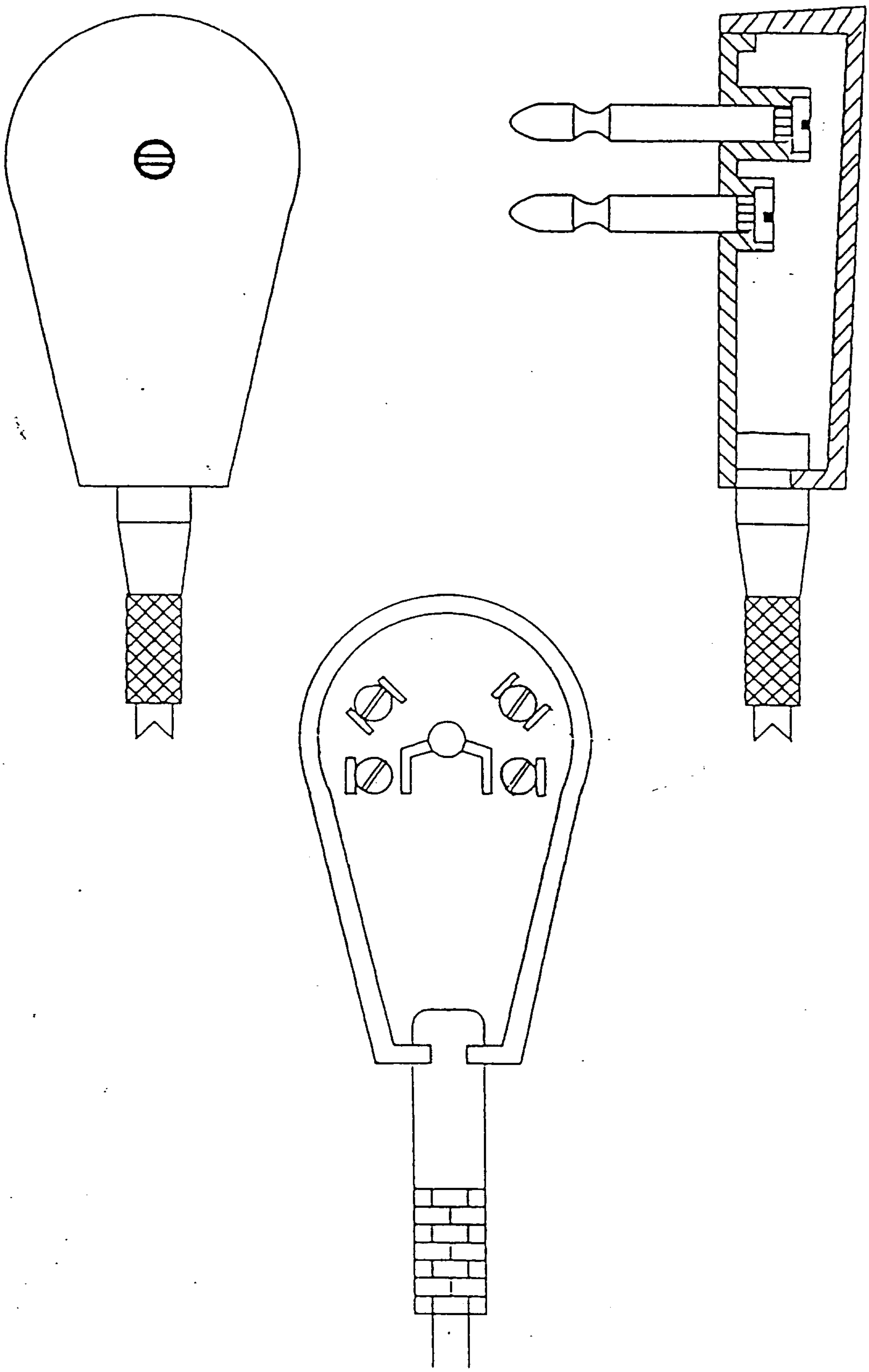


Figure 8.2 (B) 1: Belgian standard simple plug

8.2 (B) 2 **Series-connected TE**

Series-connected TE are fitted with an intermediated plug, the pattern of which is described in figure 8.2 (B) 2. This intermediate plug is compatible with the standard socket shown in figure 8.1 (B) 1 and with the plug described in section 8.2 (B) 1. All the characteristics of this plug can be found in the Belgian document BE/PS-212.

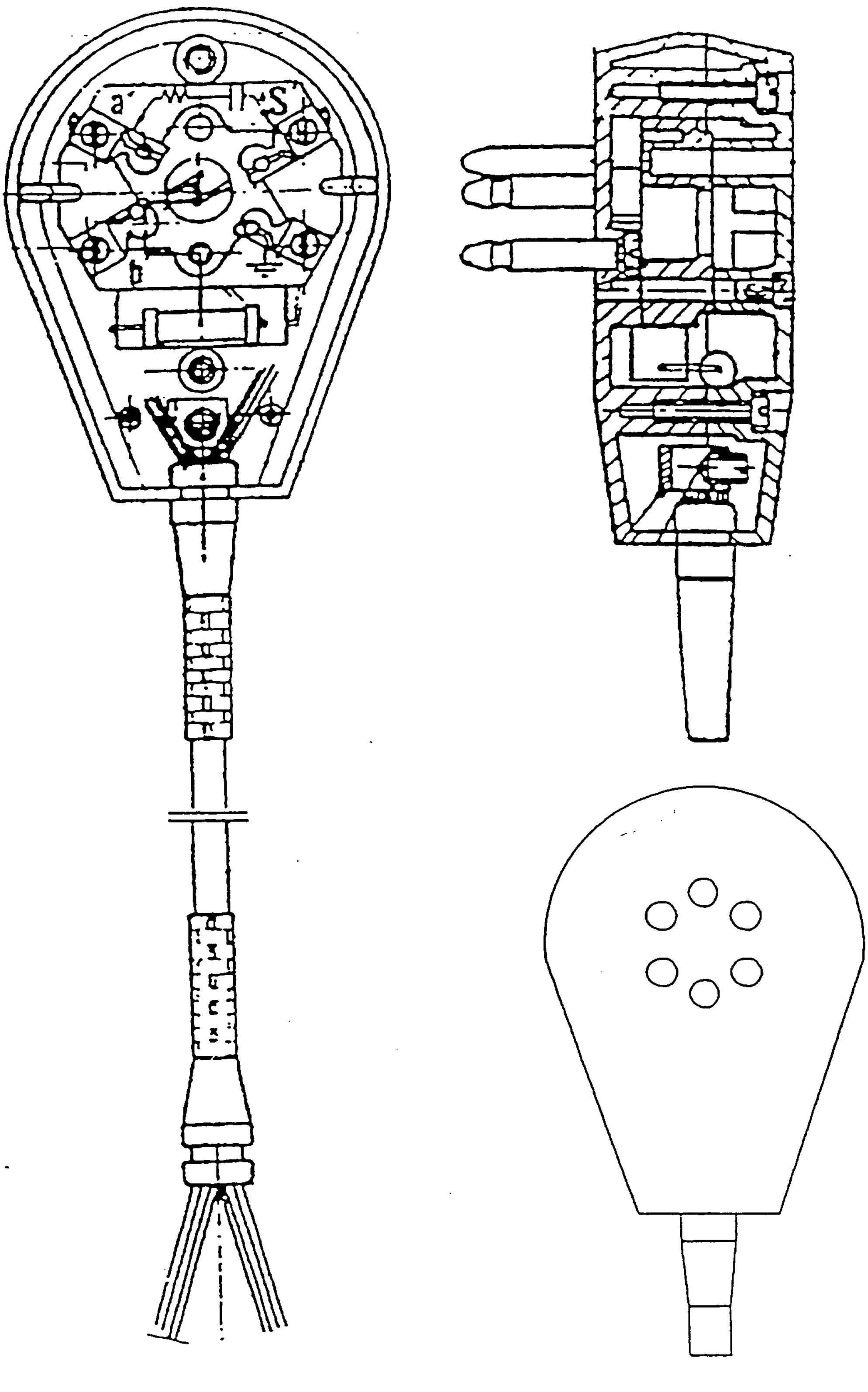


Figure 8.2 (B) 2: Belgian standard intermediate plug

8.2 (BG) 1 **Normal connection method**

The TE plug to fit the socket which normally presents the interface of the PSTN is specified in BDS 4060-87. The dimension of standard plug and socket is shown in figure 8.2 (BG) 1. The plug and socked may have 4 or 6 contact points. Contacts 2 and 1 are omitted from the variants with 4 contact points.

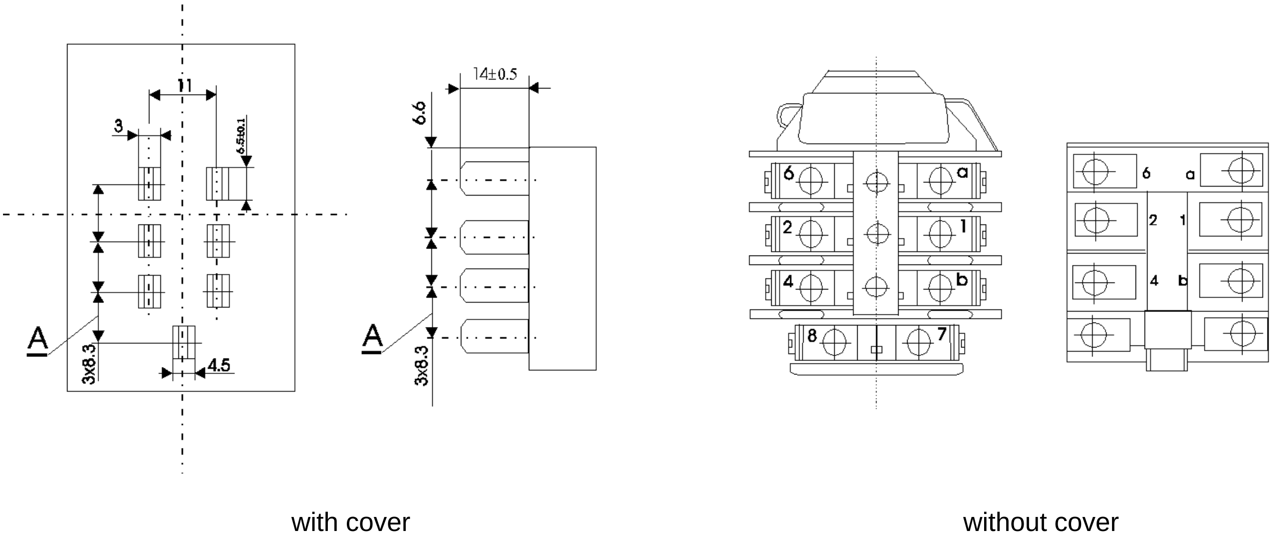


Fig. 8.2 (BG) 1 Standard socket and plug system with 6-contact points

The allocation of the plug is as follows:

Contact	Allocation
1	not used
2	not used
b	B wire
4	additional ringer
a	A wire
6	short circuiting bridge to **a** when additional ringer is used

Additional sockets may be added for portable TE. A parallel connection of TE in loop condition is not allowed. When the plug is inserted into the socket, the hardwired circuit behind this socket is disconnected (see figure 8.2 (BG) 1 where pos. 7 and 8 on the socket are loop disconnect contact).

8.2 (BG) 2 Plug and socket systems with another design are permissible if they conform to the requirements, specified in BDS 4060 - 87, excepted p.2.3.9.

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.

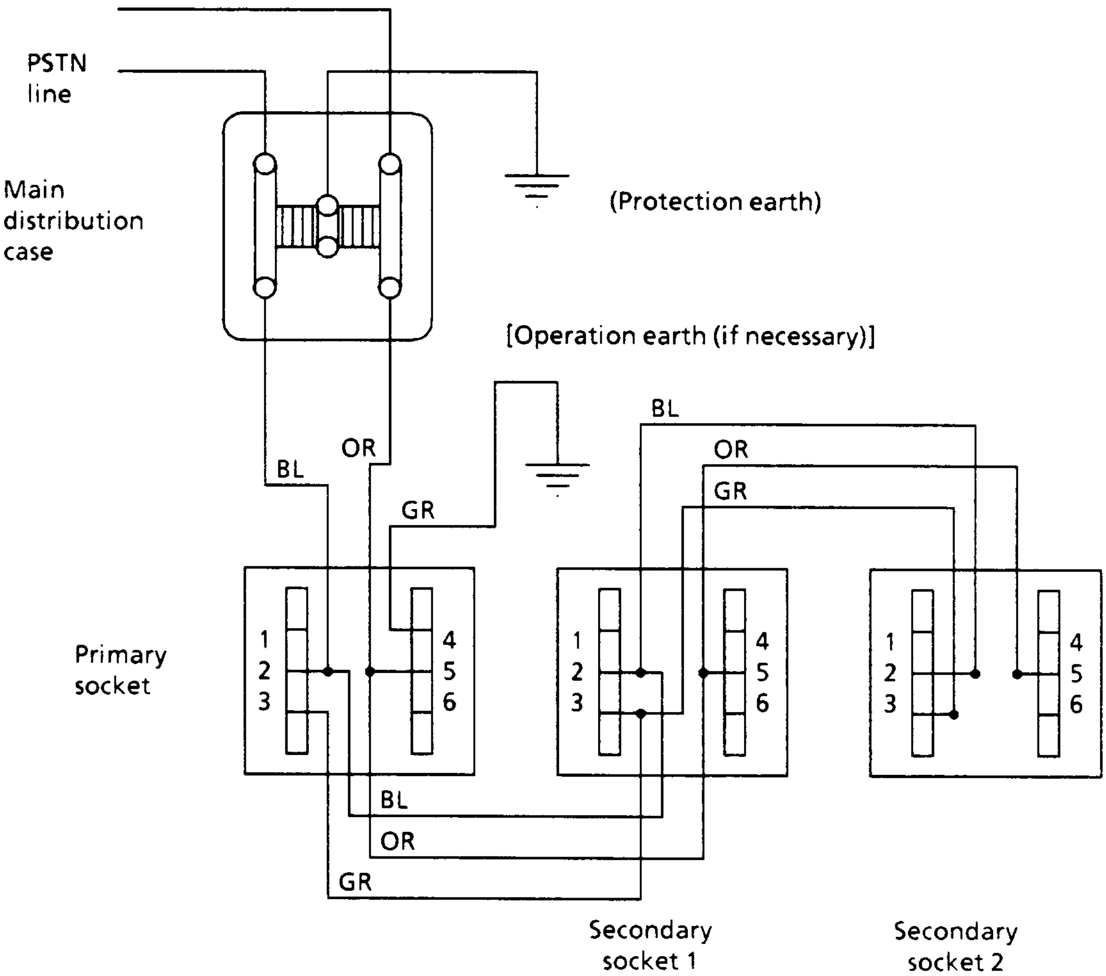


Figure 8.2 (CY) 2.1: Typical internal wiring installation

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.

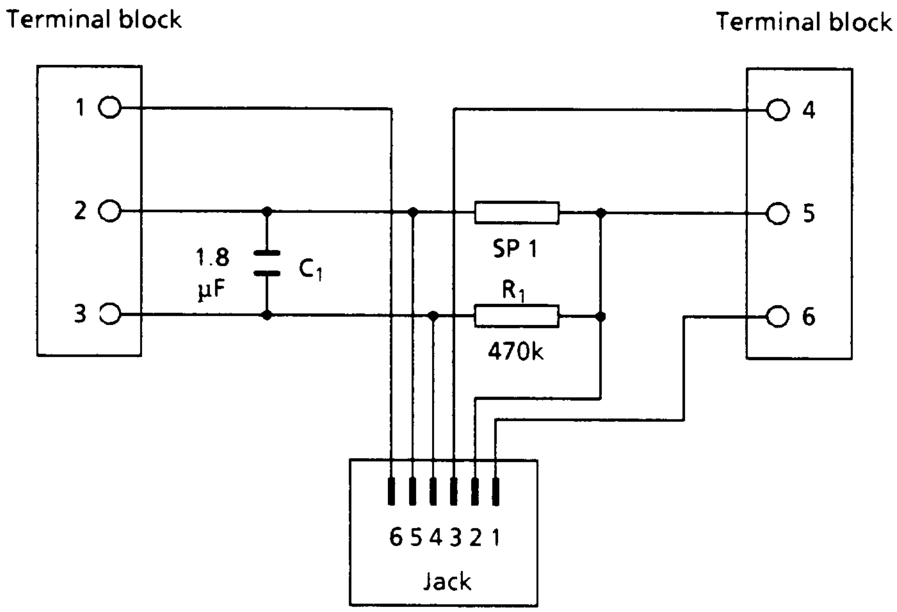


Figure 8.2 (CY) 2.2: Telecommunications line socket circuit schematic

A pictorial description of the plug being employed is shown in figure 8.2 (CY) 1.3.

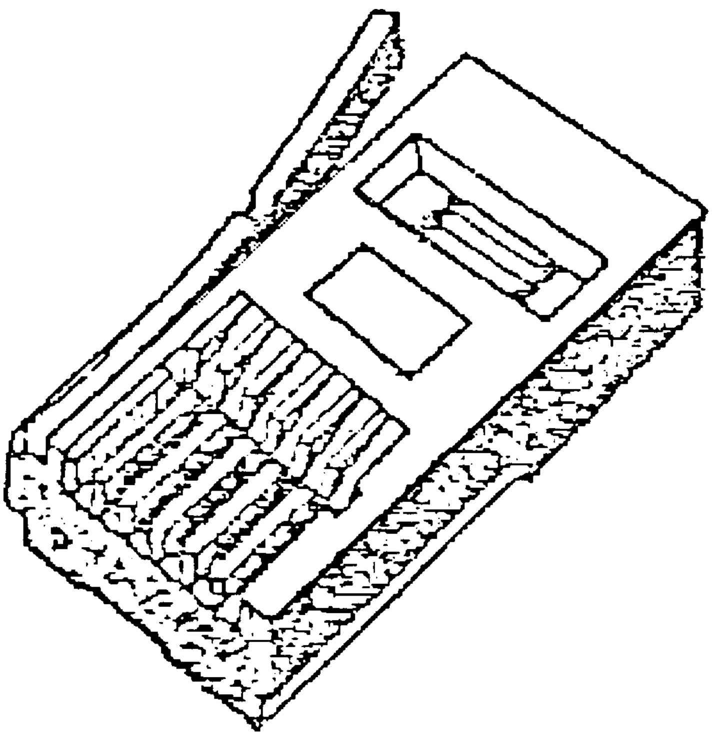


Figure 8.2 (CY) 1.3: Plug used to connect terminal equipment onto Cyprus Telecommunication Administrations PSTN

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.

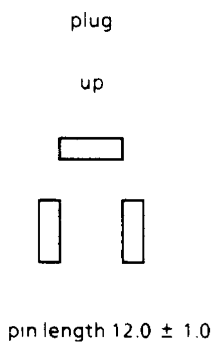


Figure 8.2 (DK) 2.1: Pin positions in 3-pole plug and socket connections

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.

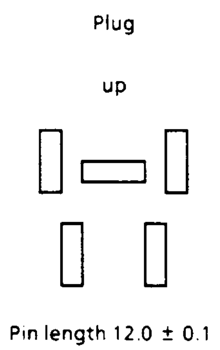


Figure 8.2 (DK) 3.1: Pin positions in 5-pole plug and socket connections

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.

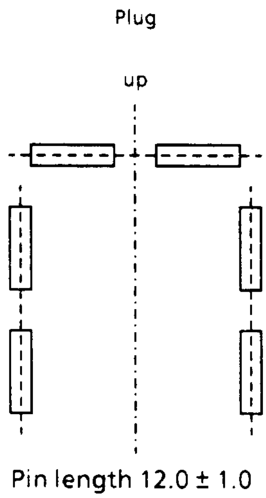


Figure 8.2 (DK) 4.1: Pin positions in 6-pole plug and socket connections

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.

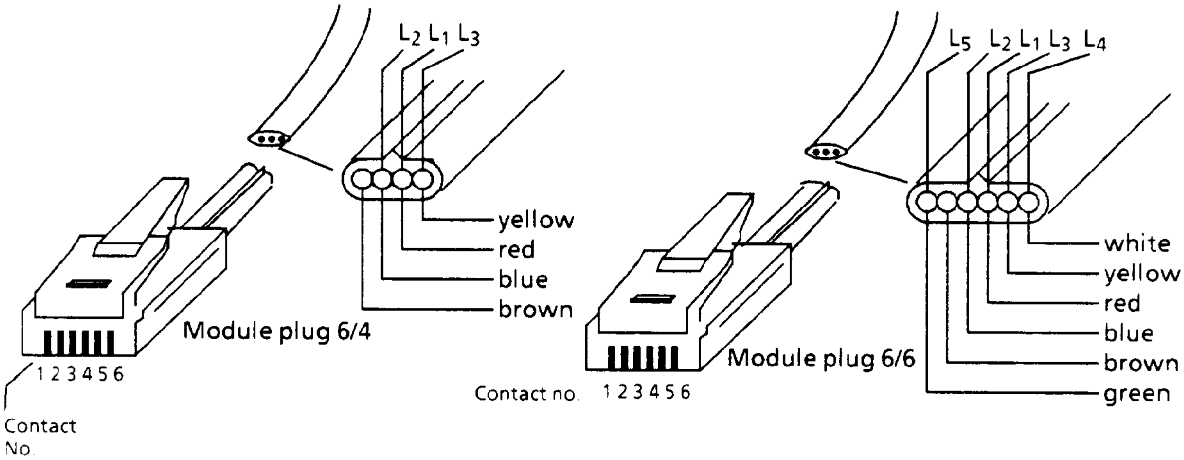


Figure 8.2 (DK) 5.1.1: Module plug and socket connections 6/4 and 6/6

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.

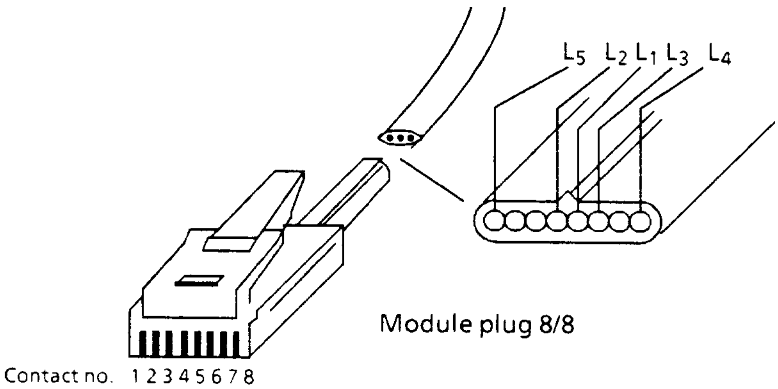


Figure 8.2 (DK) 5.2.1: Module plug and socket connections 8/8

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.

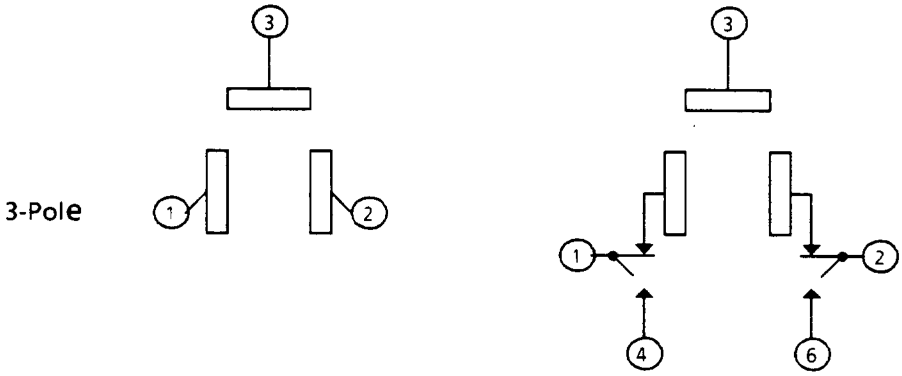


Figure 8.2 (DK) 6.1.1: Marking of clamps of 3-pole socket

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.

8.2 (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.

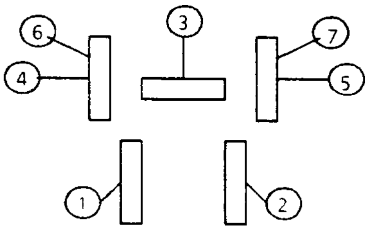


Figure 8.2 (DK) 6.2.1: Marking of the clamps of 5-pole socket

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: L_1- or a-wire
pin no. 2: L_2- or b-wire
pin no. 3: L_3- 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.

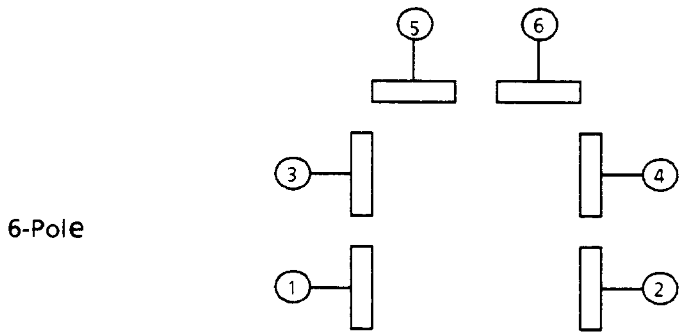


Figure 8.2 (DK) 6.3.1: Marking of clamps of 6-pole socket

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.

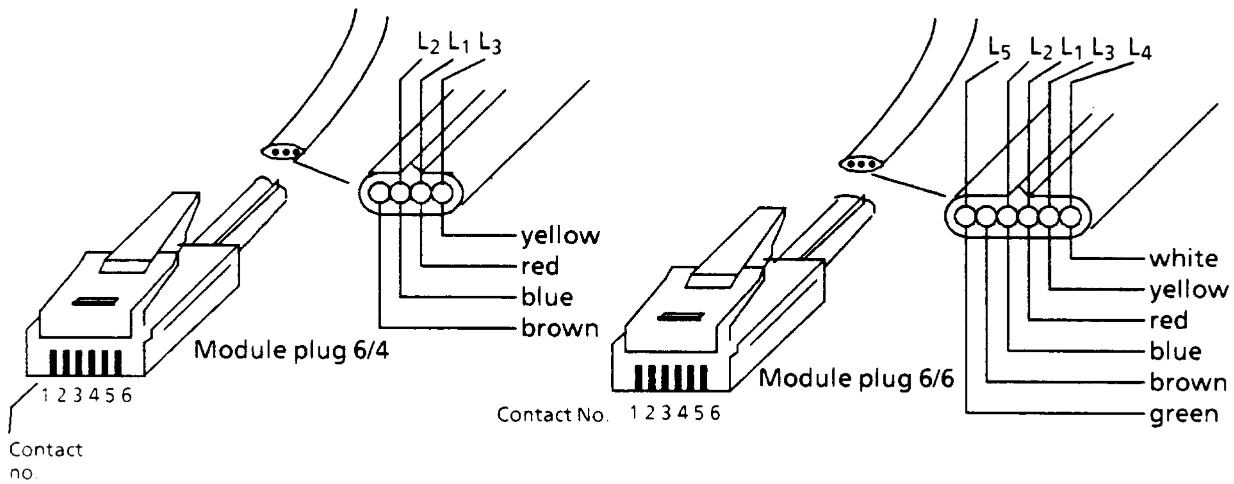


Figure 8.2 (DK) 6.4.1.1: Module and plug and socket connections 6/4 and 6/6

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: L_2- or b-wire
pin no. 4: L_1- or a-wire
pin no. 5: L_3- 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

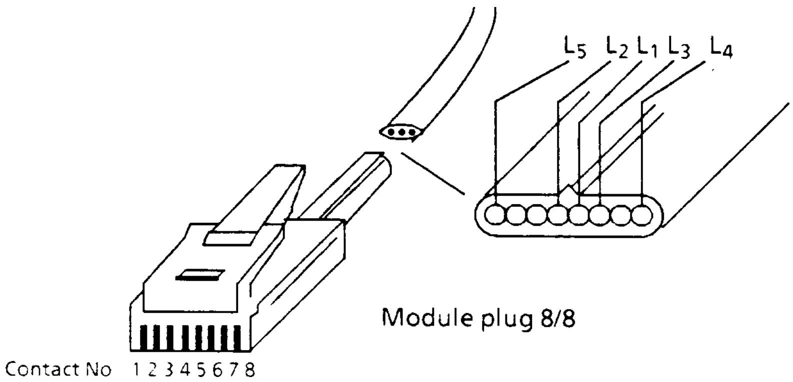


Figure 8.2 (DK) 6.4.2.1: Module plug and socket connections 8/8

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: L_2- or b-wire
pin no. 5: L_1- 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	
Contact resistance -wire-terminal (in socket)	≤ 10 mohm	≤ 2 mohm	Dry circuit	IEC 352 or DIN 41 640 part 5	Mounting / demounting 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 -single contact	≤ 10 mohm ≤ 20 mohm	≤ 5 mohm ≤ 10 mohm	Dry circuit Dry circuit	IEC 352 or DIN 41 640 part 5	After 200 times insertion/removal. Cycle time 5 secs.
Insulating resistance	≥ 500 Mohm	none	500 V dc		Without wire.
Flash-over voltage	≥ 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.

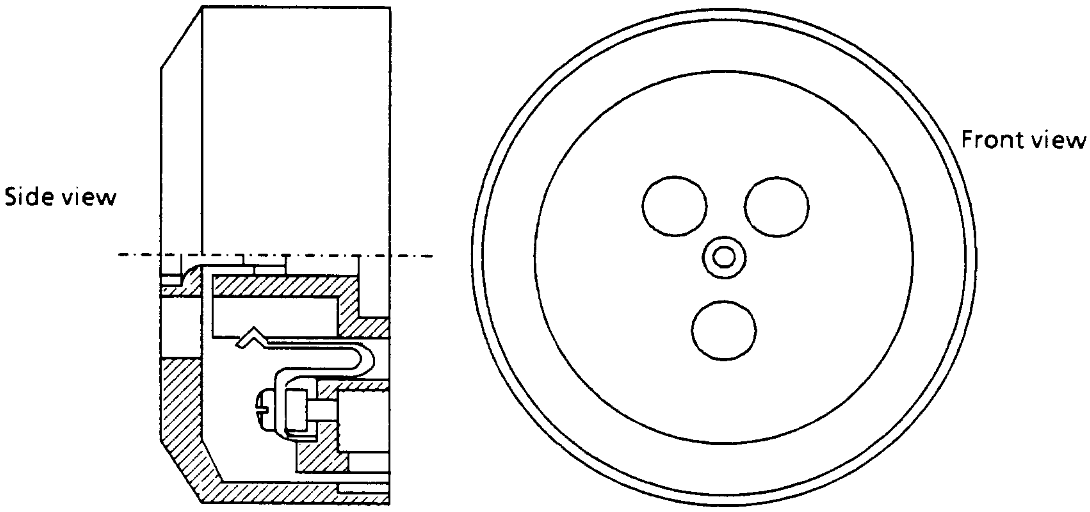


Figure 8.2 (SF) 1.1: Basic 3-pole socket (seen from front)

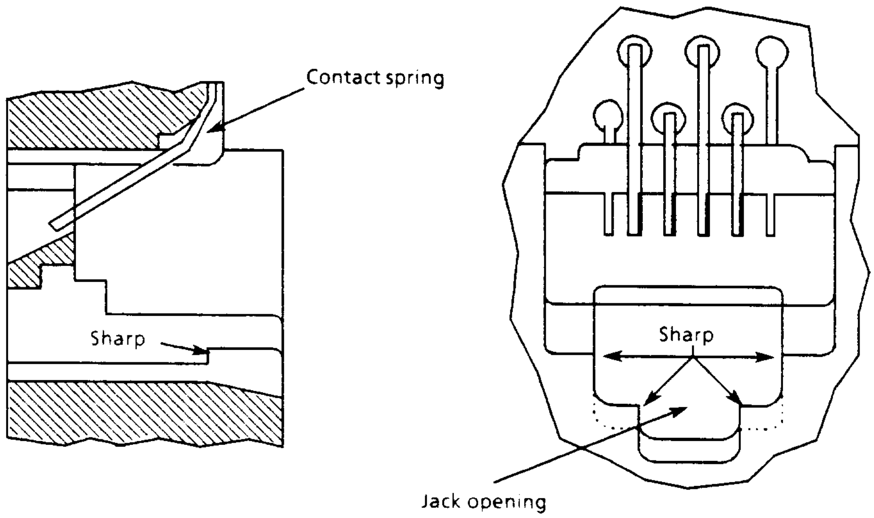
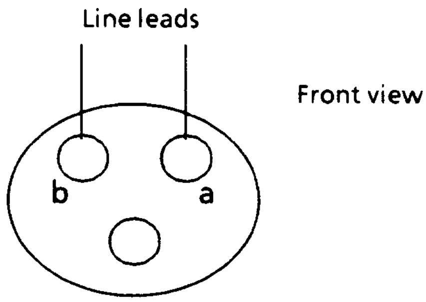


Figure 8.2 (SF) 1.2: Mini socket, very limited use (seen from front)

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.



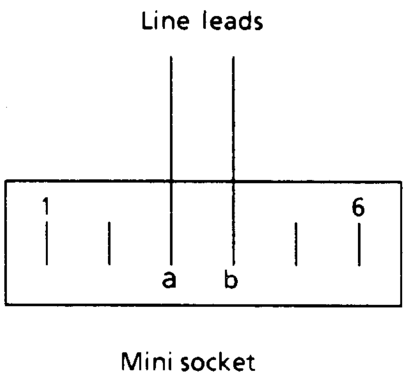


Figure 8.2 (SF) 1.3: Socket wiring for basic 3-pole socket

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.

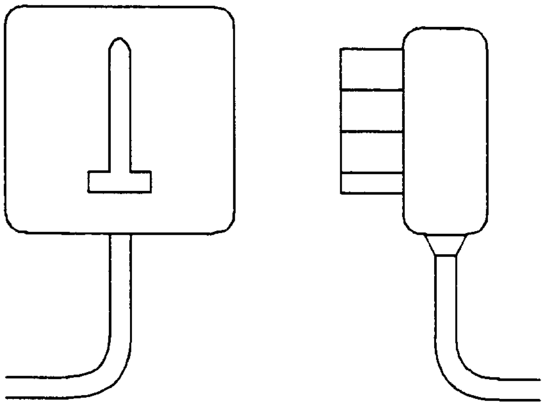


Figure 8.2 (F) 1.1: Plug and socket

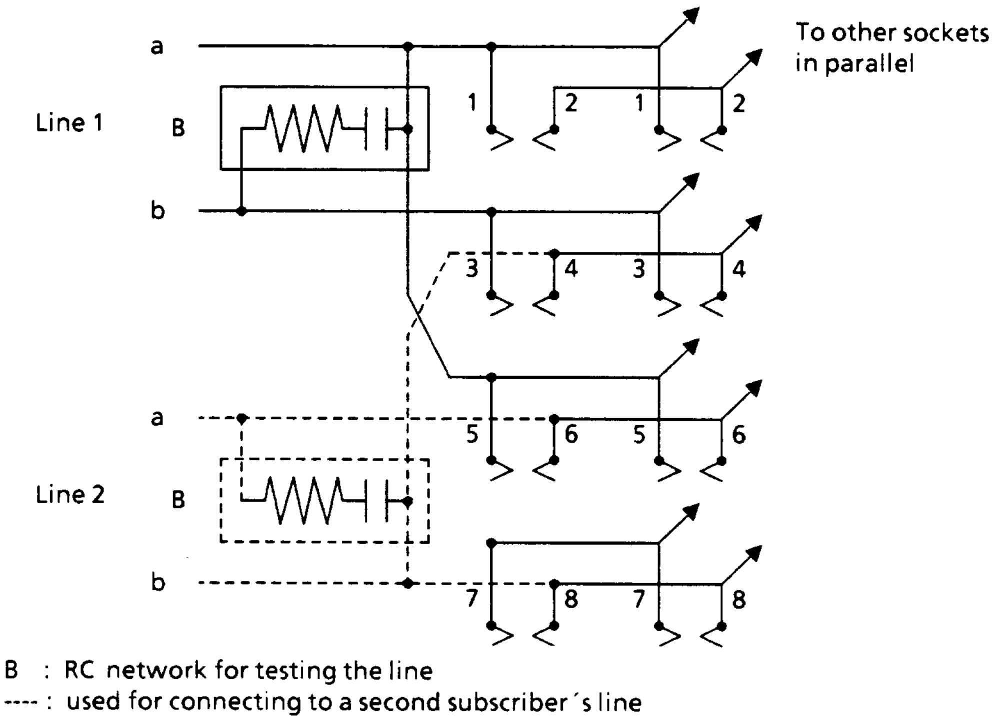


Figure 8.2 (F) 1.2: Wiring plan at subscriber's premises (new version)

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		shunt wire(*) of line 2
8		"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.

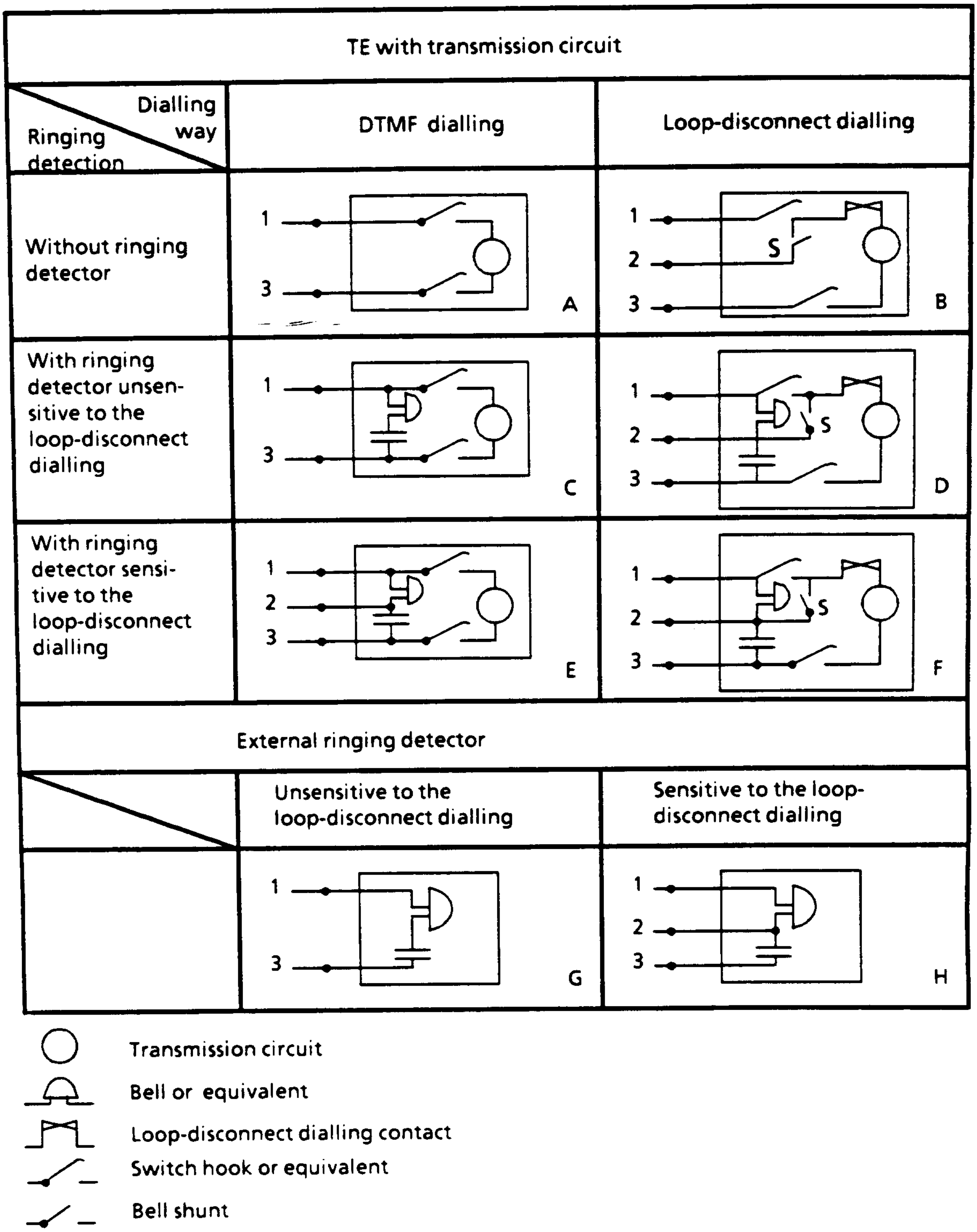


Figure 8.2 (F) 1.3: Single terminal connection

8.2 (D) 1 Connection methods

The plug with which the terminal equipment is connected to the network at the socket shall comply with DIN 41 715, Part 3. Notwithstanding DIN 41 715, Part 3, the plug code "N" or "F" is not compulsory. Code "Z" is not permissible.

In accordance with DIN 41 715, Part 3, section 4.5.1, the pin allocation shall be as follows:

contact number 1 a-wire;
contact number 2 b-wire.

The cord between the terminal equipment and the plug shall comply with DIN 47 467, Part 4.

If the cord is of the type that is plugged into the terminal equipment, the user instructions shall contain details regarding the replacement of the cord (including data about the replacement cord, e.g. specification of the catalogue number or description of the electrical characteristics).

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.

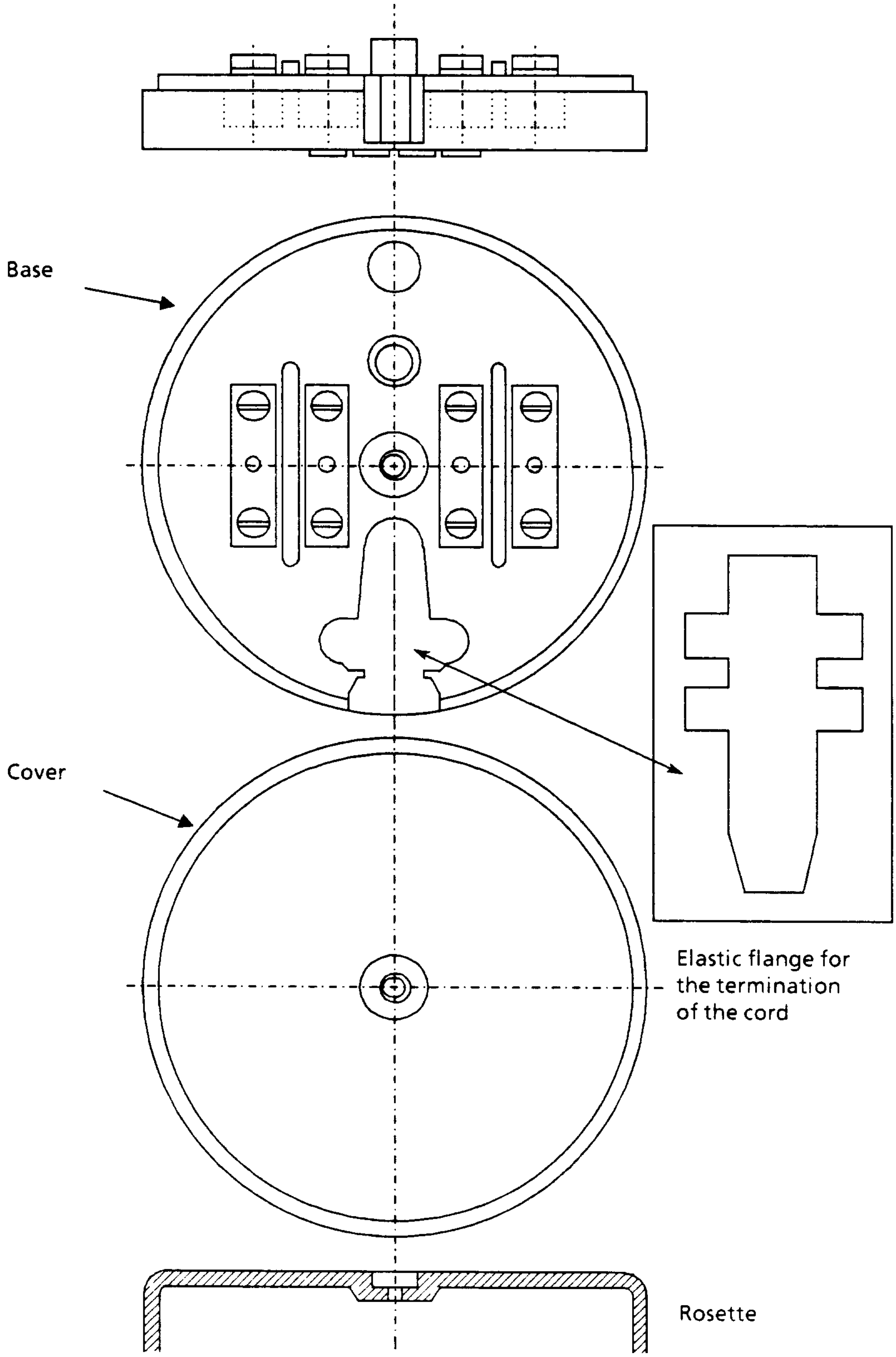


Figure 8.2 (GR) 1: Telephone set termination box

8.2 (H) 1 Information is given for physical appearance and functional distribution of wires of connections accepted in Hungary for analogue TEs.

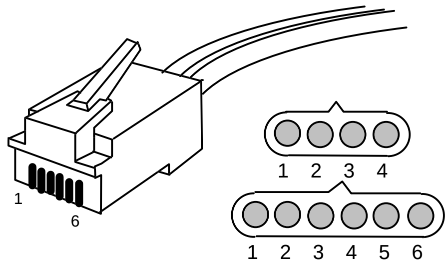


Figure 8.2 (H) 1: Plug and cable wires

Distribution of wires:

Wires in the cable	1	2	3	4	5	6
4	(L_1')	L_1 (B)	L_2 (A)	(L_2')		
6		(L_1')	L_1 (B)	L_2 (A)	(L_2')	

(L_1') and (L_2') are the outlets in the case of series-connected TE.

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.

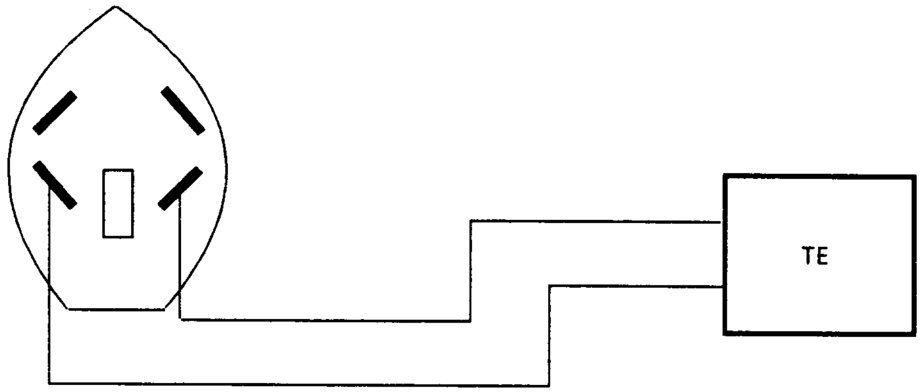


Figure 8.2 (IS) 1: Basic four pole socket

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.

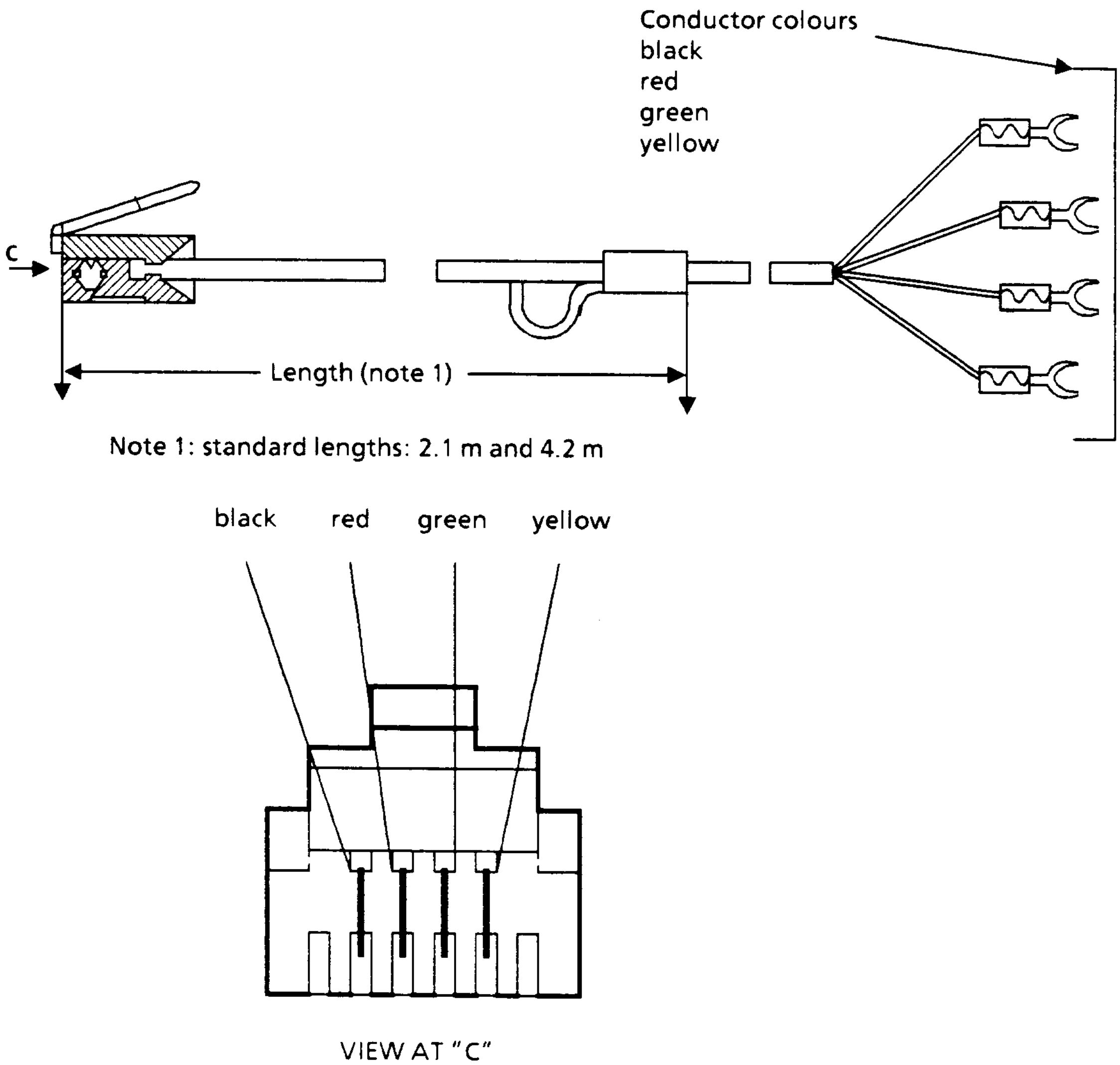


Figure 8.2 (IRL) 1: Modular plug

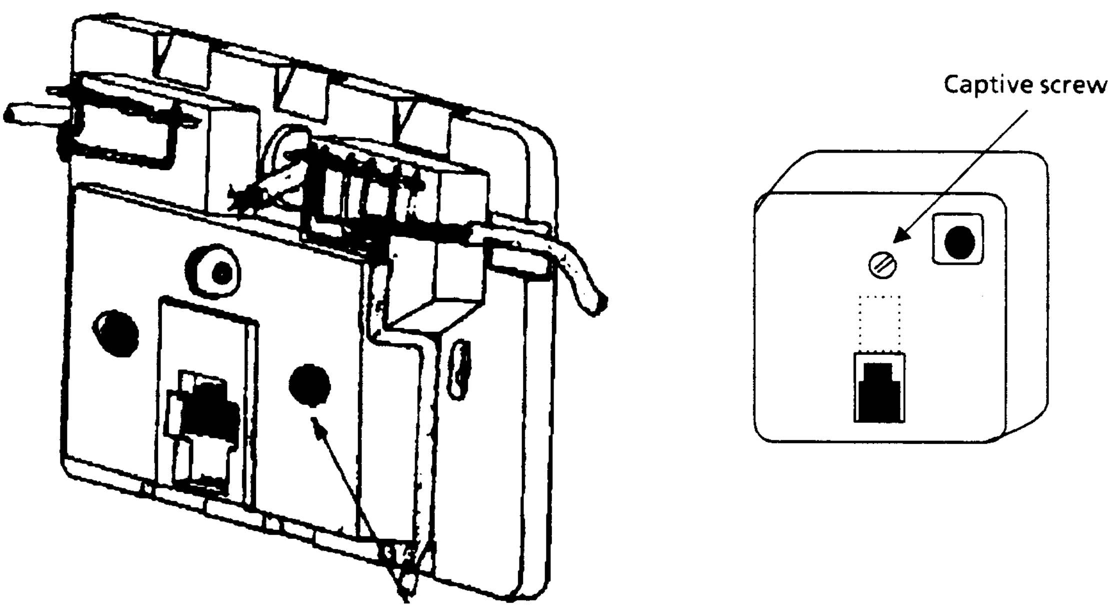


Figure 8.2 (IRL) 2: Jacks Modular 1M/1

Apertures allow for check that R.C. network is or is not present.

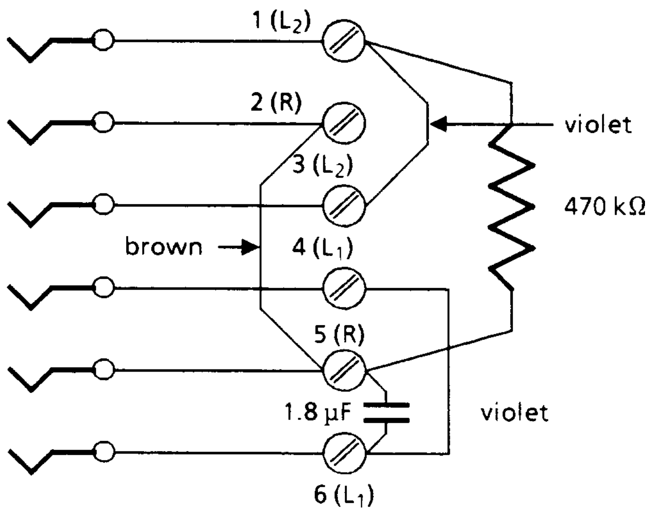


Figure 8.2 (IRL) 3: Wiring of Jacks Modular 1M/1

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.

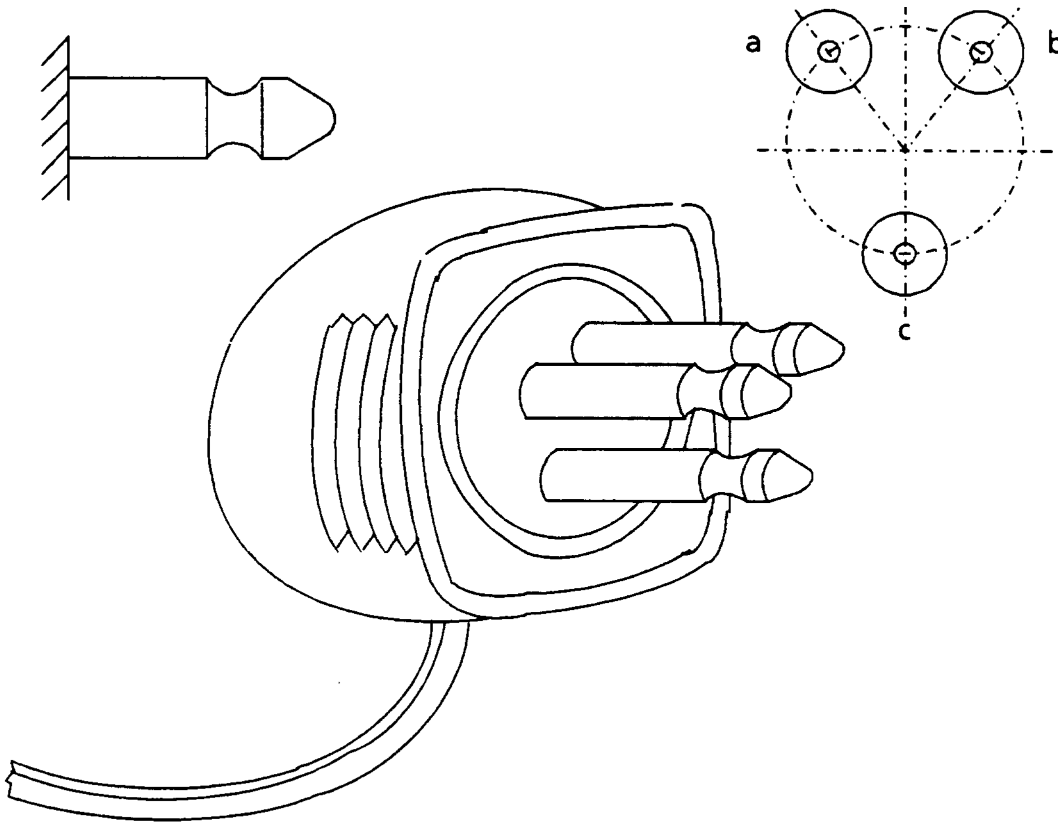


Figure 8.2 (I) 1: 3-pole plug

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.

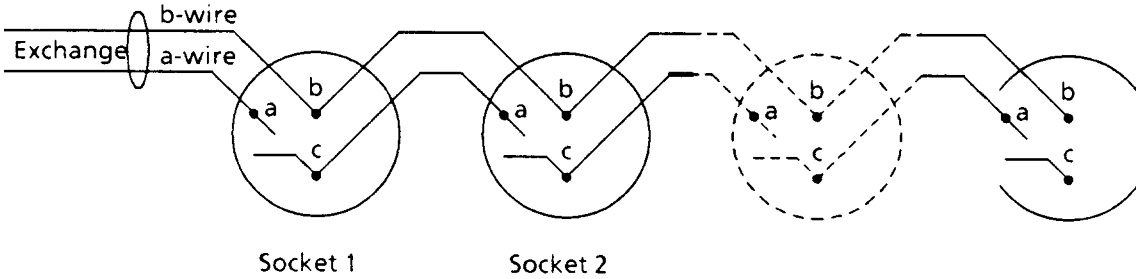


Figure 8.2 (I) 2: Wiring plant at subscriber's premises

The socket makes the contact between "a" 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).

Non-voice terminals, even if provided with voice facilities, are allowed to have only a and b wires in case of single connection to the PSTN. This characteristic shall be referred in the TE's user guide.

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 V applied for a time t = 30 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 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

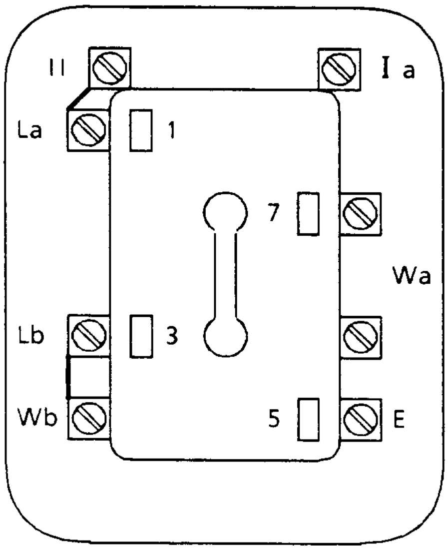


Figure 8.2 (L) 1.1: Standard socket

ADoS 4

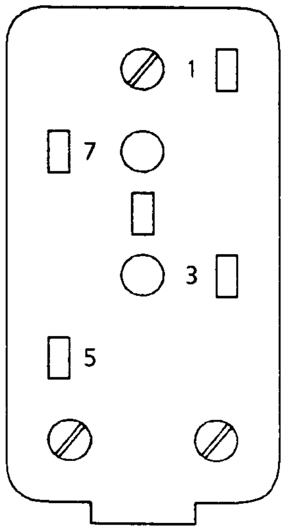


Figure 8.2 (L) 1.2: Standard plug

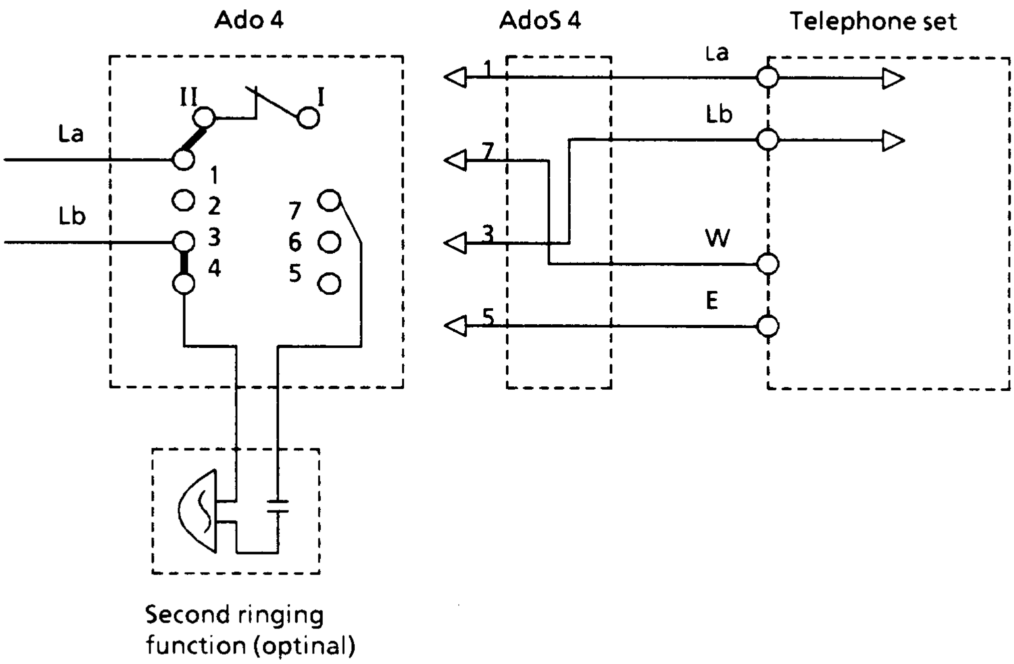


Figure 8.2 (L) 1.3: Wiring plan for single terminal connection for PSTN

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.

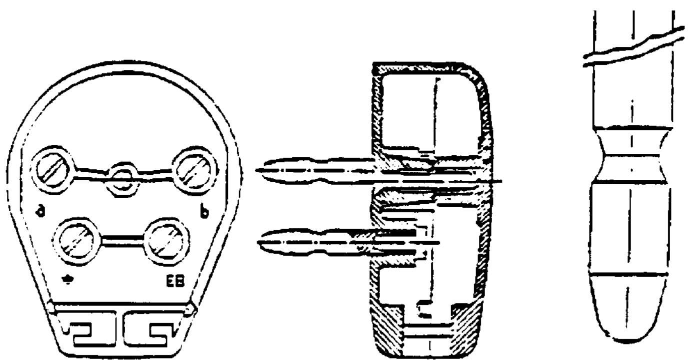


Figure 8.2 (NL) 1.1: 4-pin plug of PTT

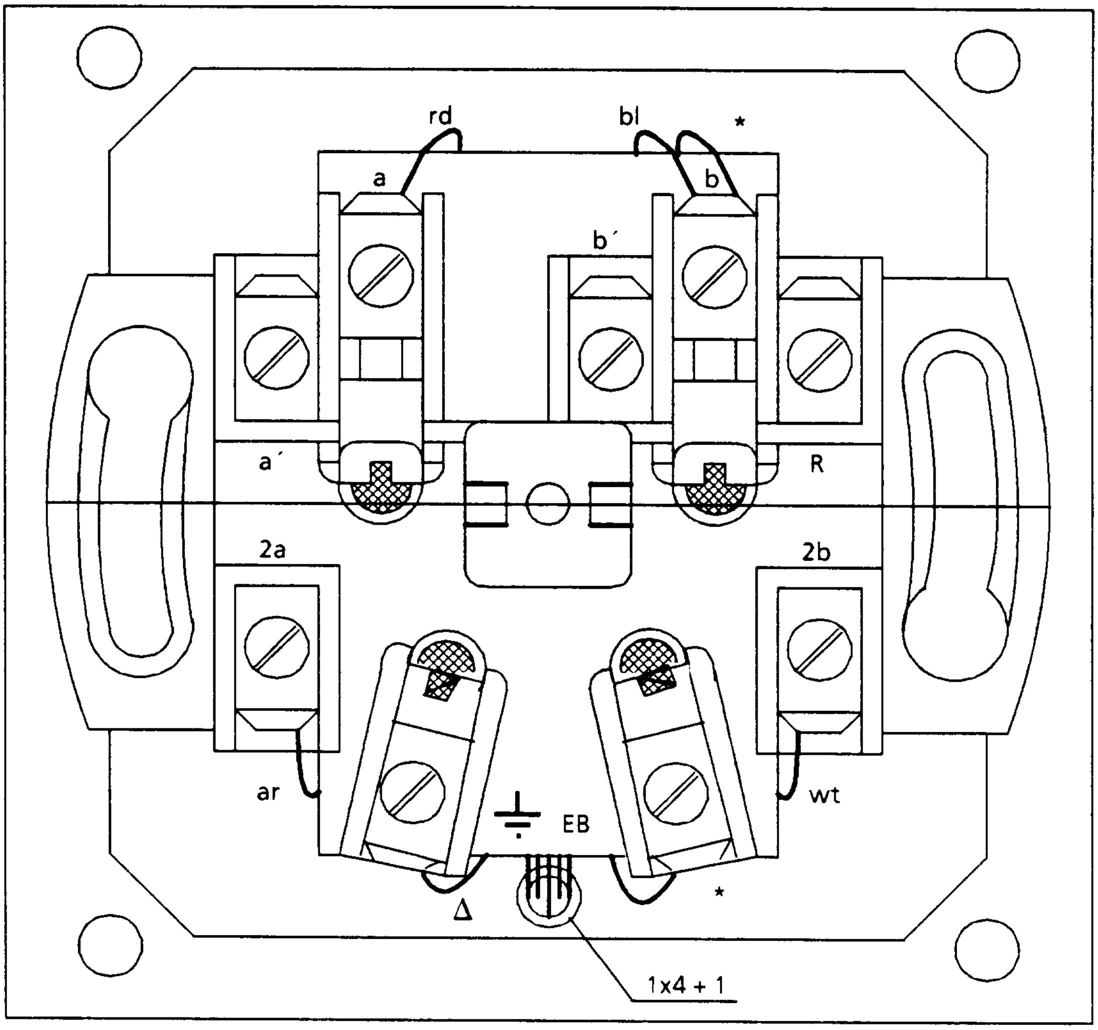


Figure 8.2 (NL) 1.2: Socket of PTT

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 an 8-pole (EN 28877) plug.

The 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. (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.

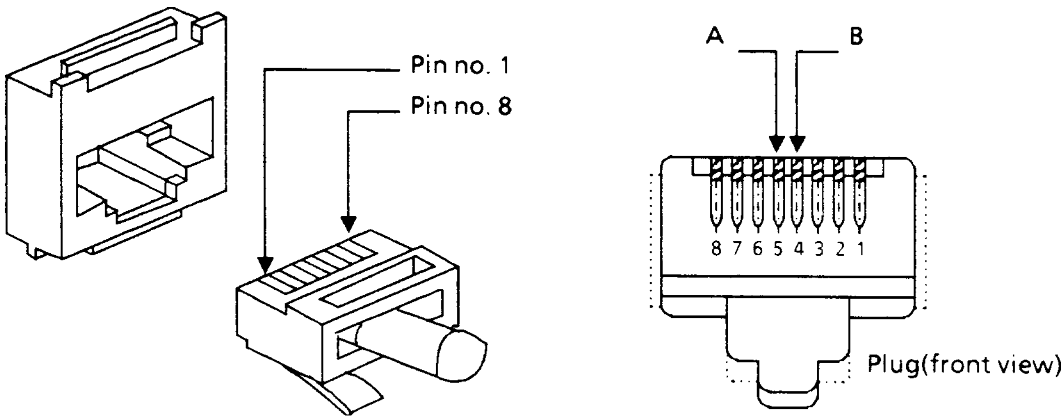


Figure 8.2 (N) 1: 8-pole modular socket and plug with wiring scheme

The 8-pole plug, 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 Telenor AS provided sockets which are the boundary towards the public network of Telenor AS. 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.

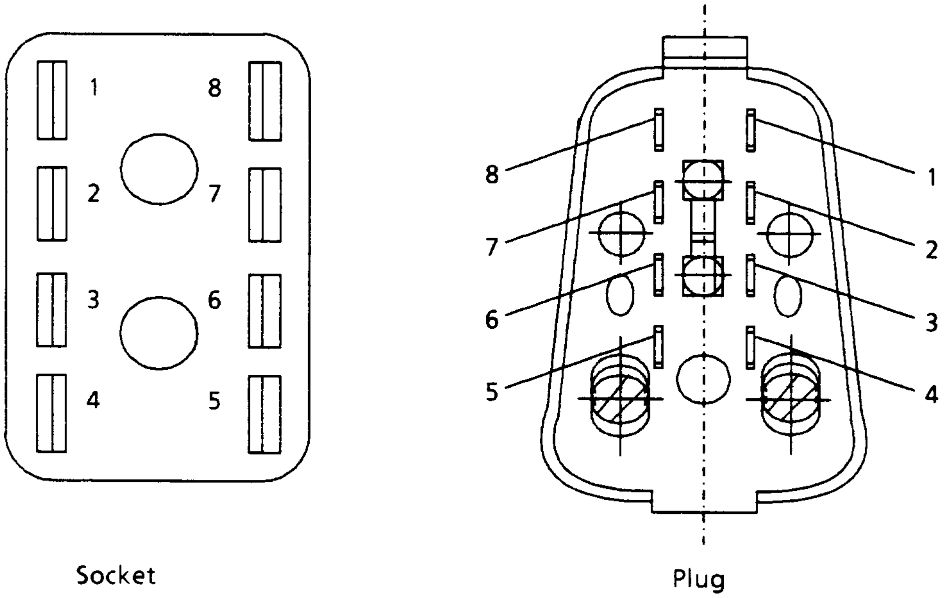


Figure 8.2 (P) 1: Special socket and plug ADO 8 / ADOS 8.

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 kohms ± 10%; C = 1.8 µF ± 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.

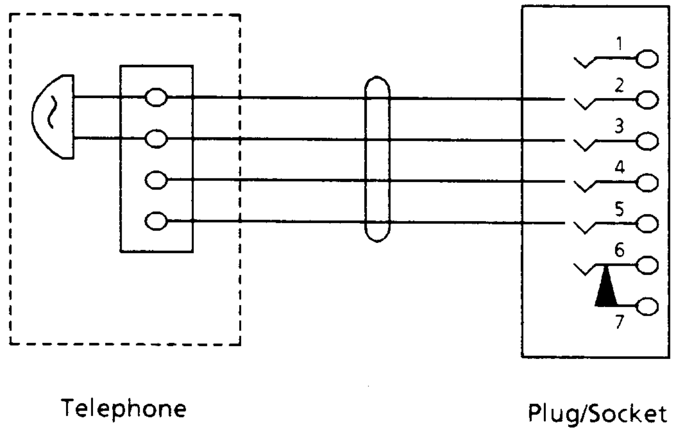


Figure 8.2 (P) 2.1: Connection of single telephone sets with "high impedance ringers"

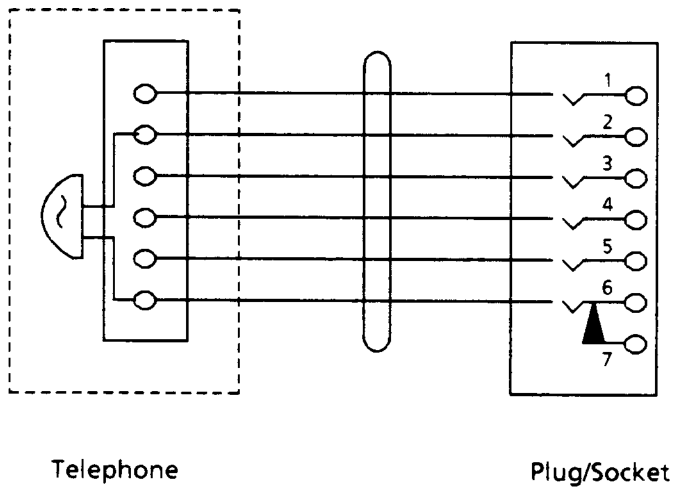


Figure 8.2 (P) 2.2: Connection of single telephone sets with "low impedance ringers"

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 a protective earth 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

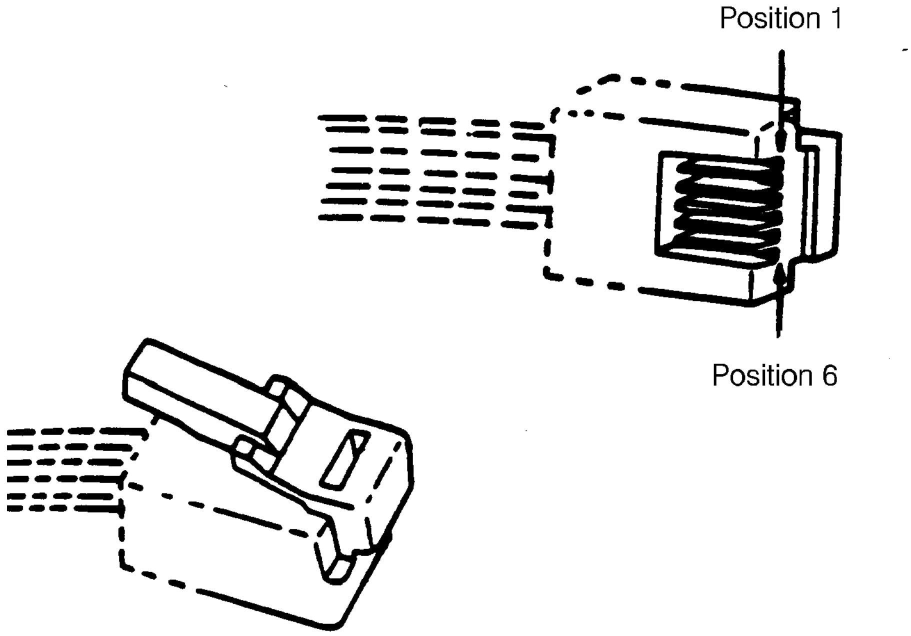
a) the line terminals ("a1", "b1") shall be respectively connected to contacts 3 and 4;

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 Swedish type of socket

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.

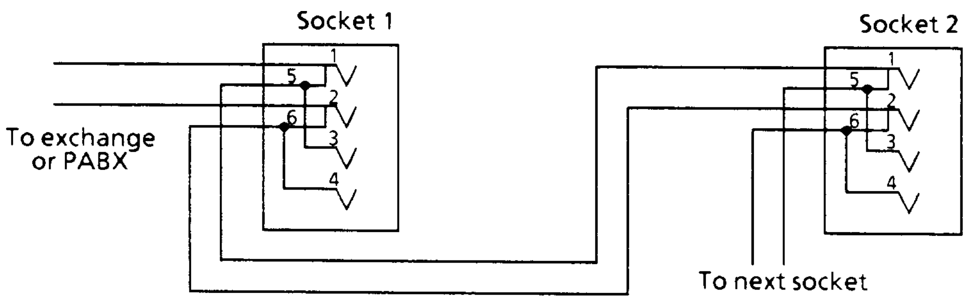


Figure 8.2 (S) 1.1: Wiring of sockets

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.

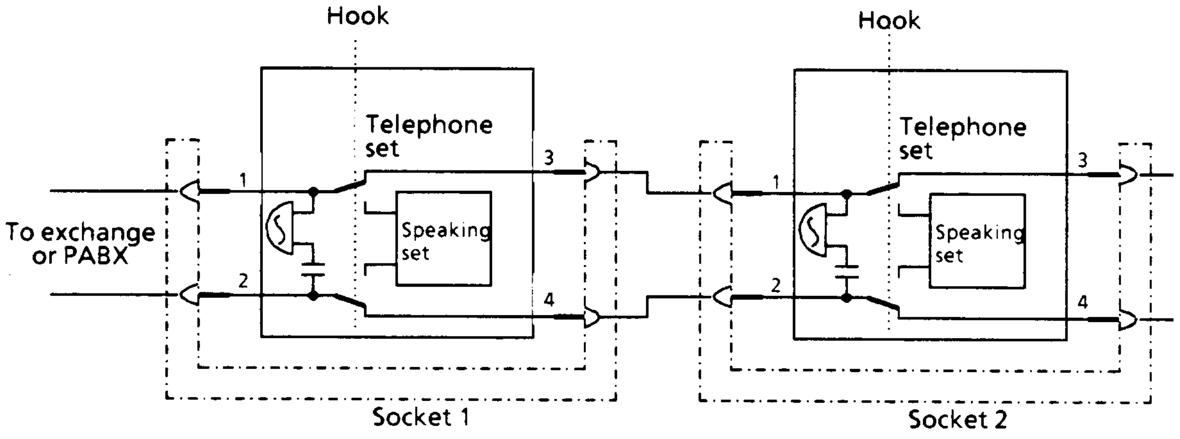


Figure 8.2 (S) 1.2: Wiring of sockets

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 both 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.

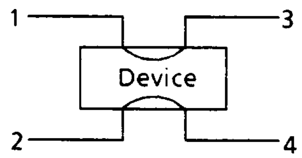


Figure 8.2 (S) 1.3: Wiring of used plug

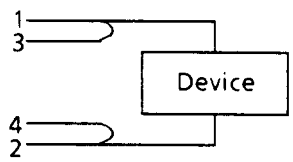


Figure 8.2 (S) 1.4: Wiring of used plug

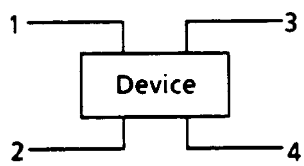


Figure 8.2 (S) 1.5: Wiring of used plug

The device cord shall be connected to the plug as shown in figure 8.2 (S) 1.6.

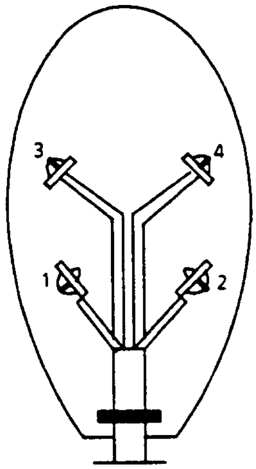


Figure 8.2 (S) 1.6: Wiring of the used plug

8.2 (S) 2 Installation with sockets according to ISO 8877 (3 places).

The plug 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 the use of the T + T 83 or T + T 87 plug is recommended. The T + T 87 plug is normally 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.

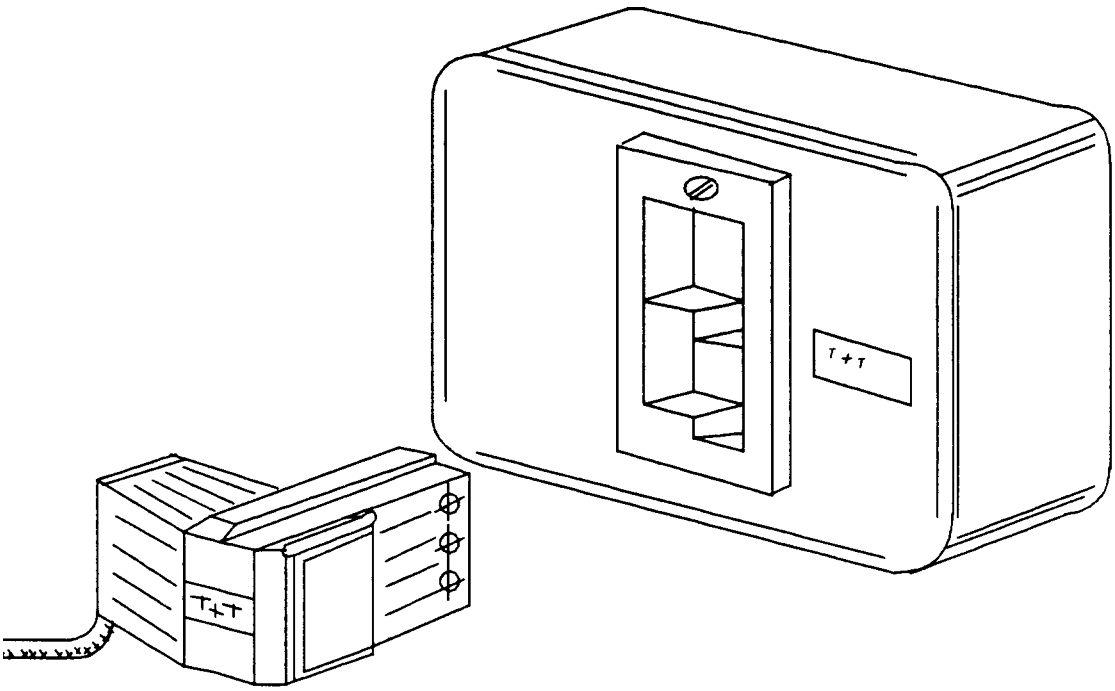


Figure 8.2 (CH) 1.1: Plug and plug socket T + T 83

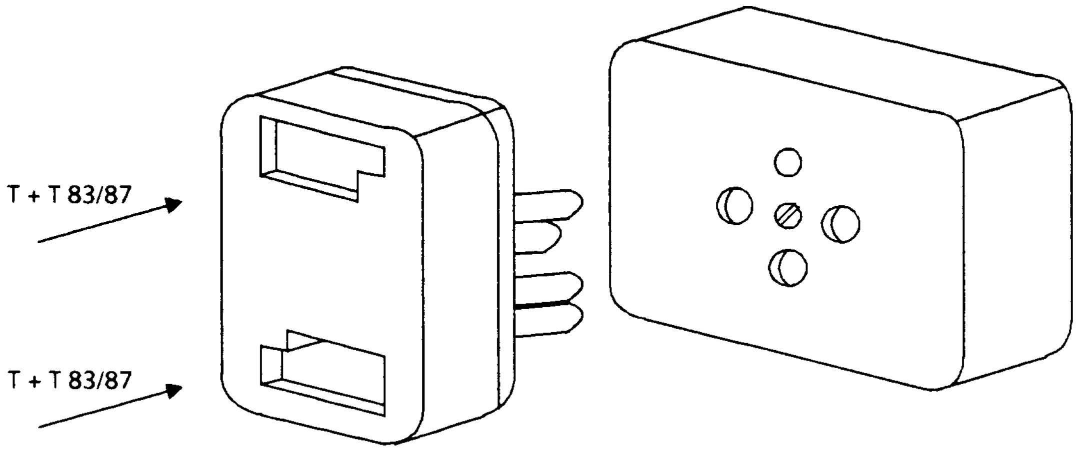


Figure 8.2 (CH) 1.2: Adapter plug and plug socket (old version)

The line cord can be fixed tightly (e.g. screwed) to the TE (screwed connections shall only be accessible by tools). Between line cord and TE a plug system can also be used. If a 6-pin FCC type is used, wires should (recommendation) be connected according to figure 8.2 (CH) 1.3 to figure 8.2 (CH) 1.4.

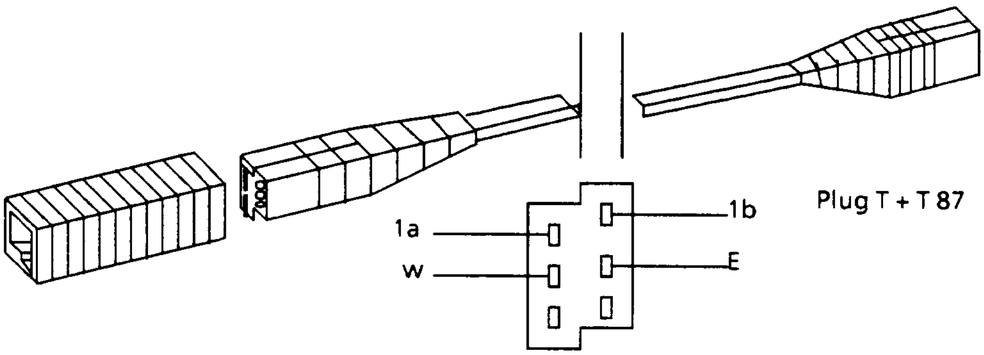


Figure 8.2 (CH) 1.3: Extension cable

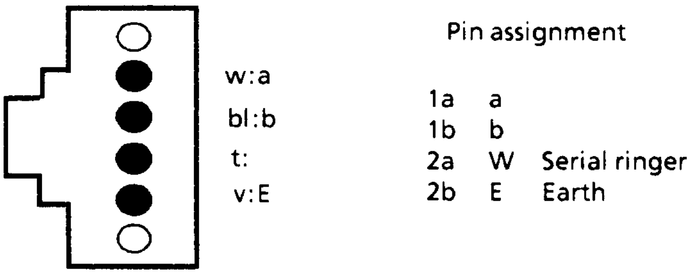


Figure 8.2 (CH) 1.4: Wire assignment if FCC plug on terminal side

The different methods of connection are specified in figure 8.2 (CH) 1.5 to figure 8.2 (CH) 1.8.

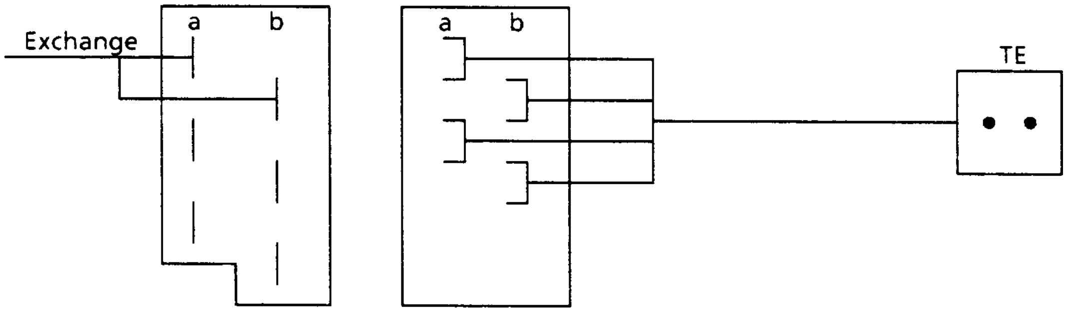


Figure 8.2 (CH) 1.5: T + T 83 connection system with single TE

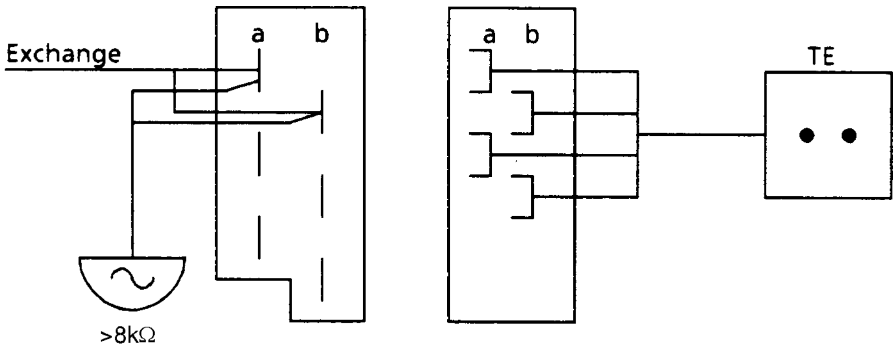


Figure 8.2 (CH) 1.6: T + T 83 connection system with single TE with parallel ringer

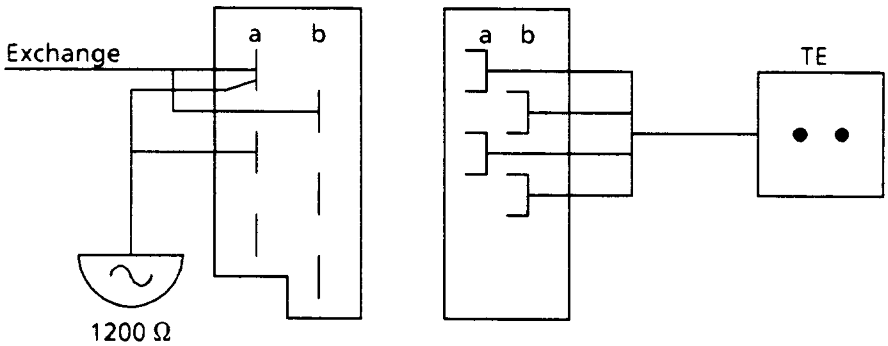
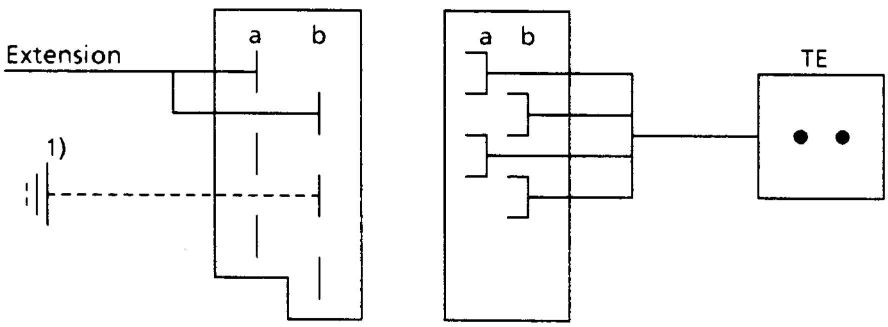


Figure 8.2 (CH) 1.7: T + T 83 connection with single TE with typical (< 1 200 Ω) serial ringer



1) Earth signalling (register recall, e.g. behind PABX) if implemented.

Figure 8.2 (CH) 1.8: 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:

Contact no.	Allocation
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.

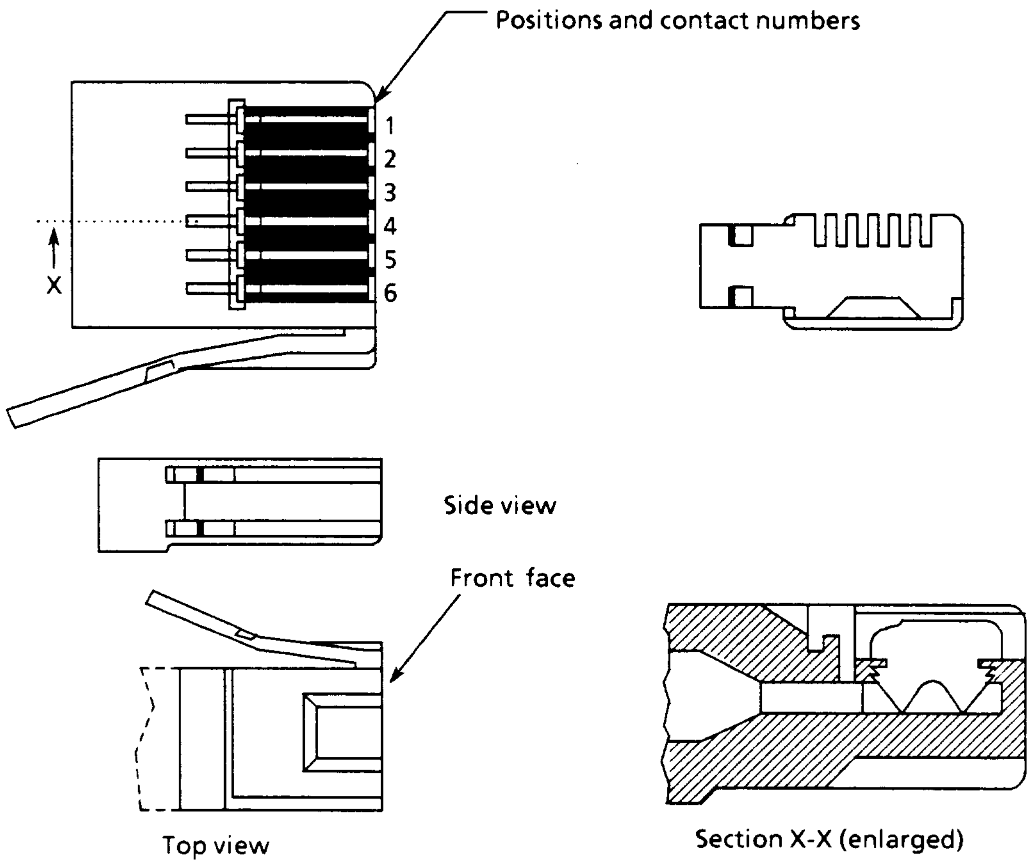
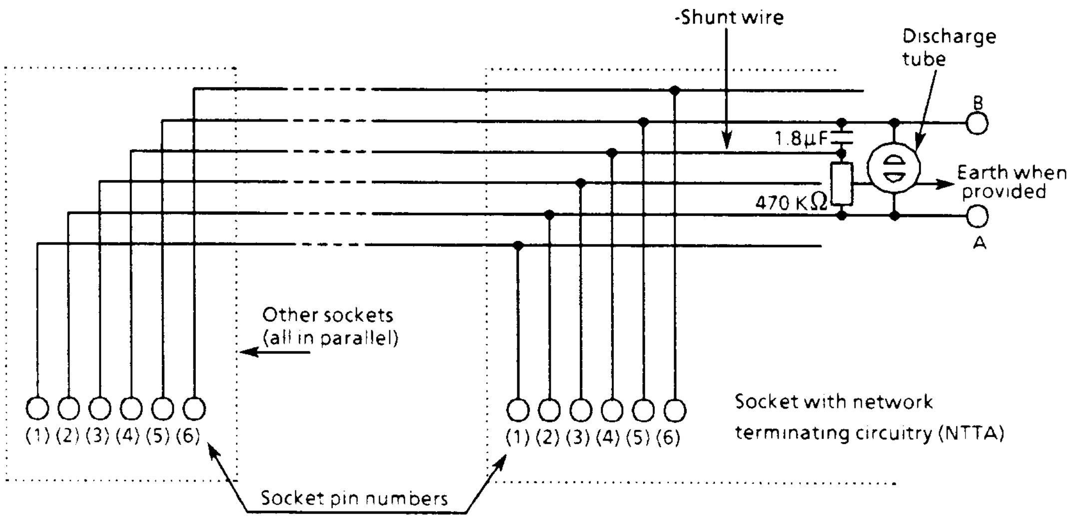


Figure 8.2 (GB) 1.1: Diagram of plug



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

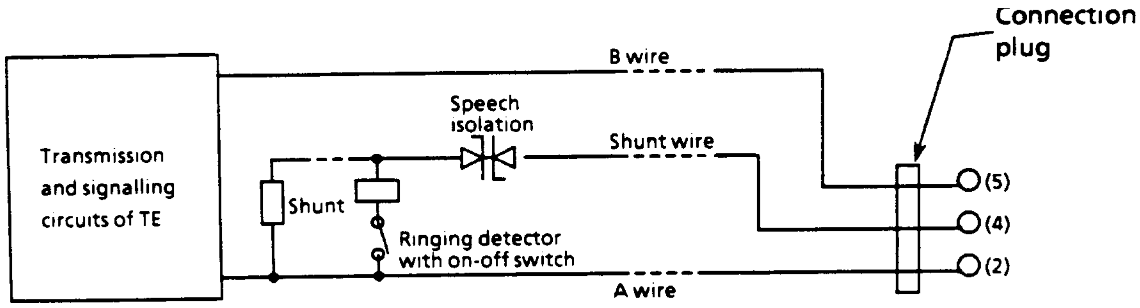


Figure 8.2 (GB) 1.3: Simplified circuit of TE suitable for 3-wire connection

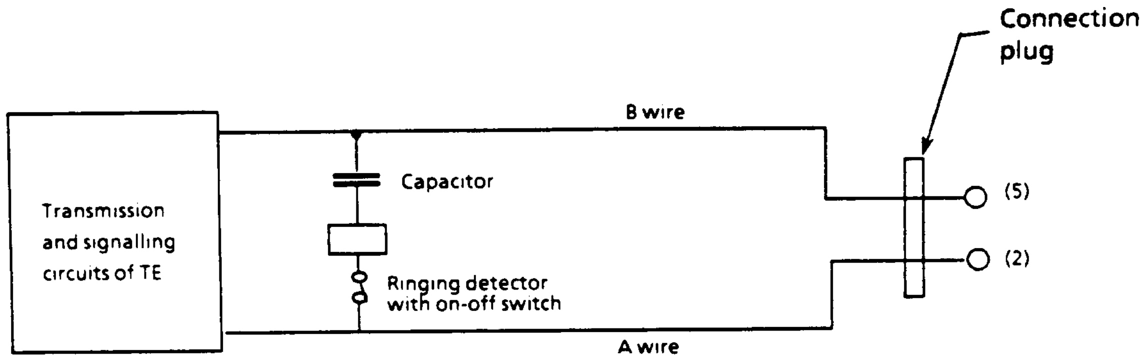


Figure 8.2 (GB) 1.4: Simplified circuit of TE suitable for 2-wire connection

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 ± 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 (BG) 1 The simple multiple terminal connection for PSTN - access has to be made with an intermediate plug, compatible with the simple socket and plug system, described in section 8.2 (BG). The wiring depends on the TE type.

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.

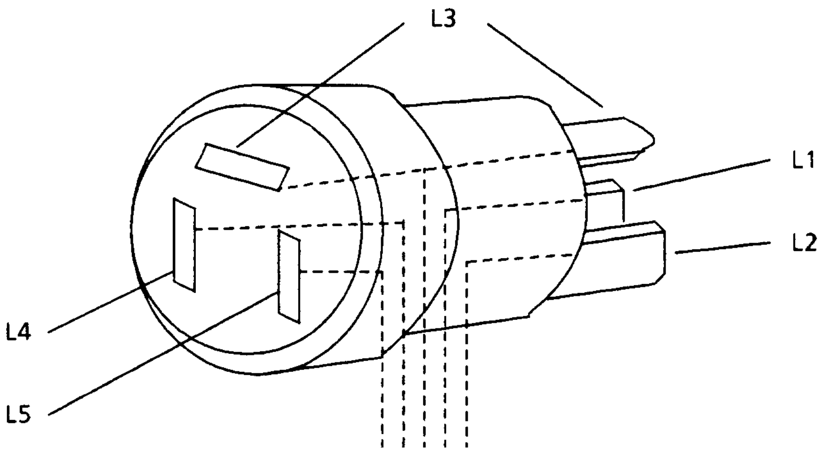


Figure 8.3 (DK) 1.1: Special 3-pole plug - the marking of clamps

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

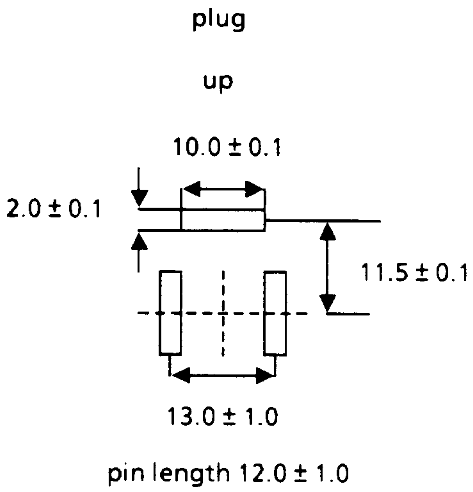


Figure 8.3 (DK) 1.2: Pin positions

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.

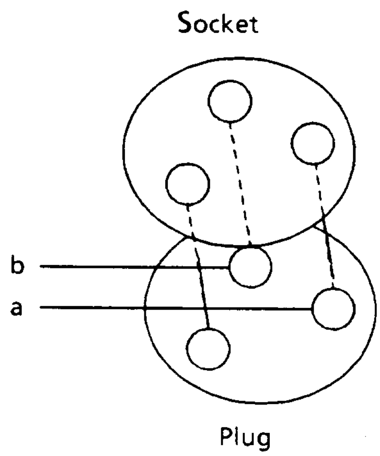


Figure 8.3 (SF) 1: Extension plug wiring

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;

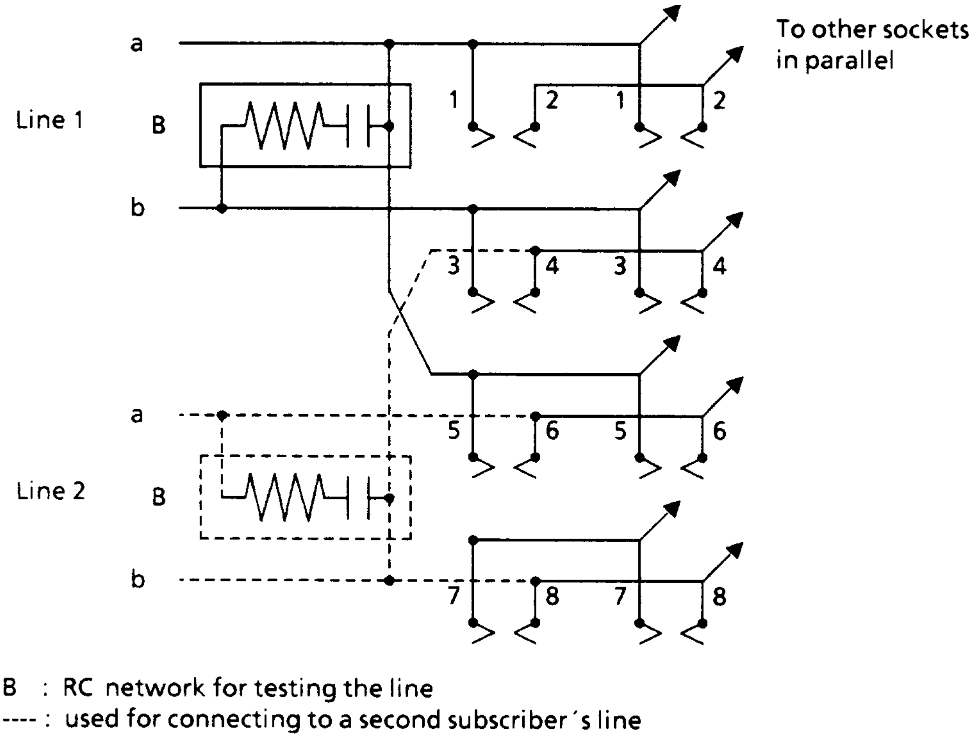


Figure 8.3 (F) 1.1: Wiring plan at subscriber's premises (new version)

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;

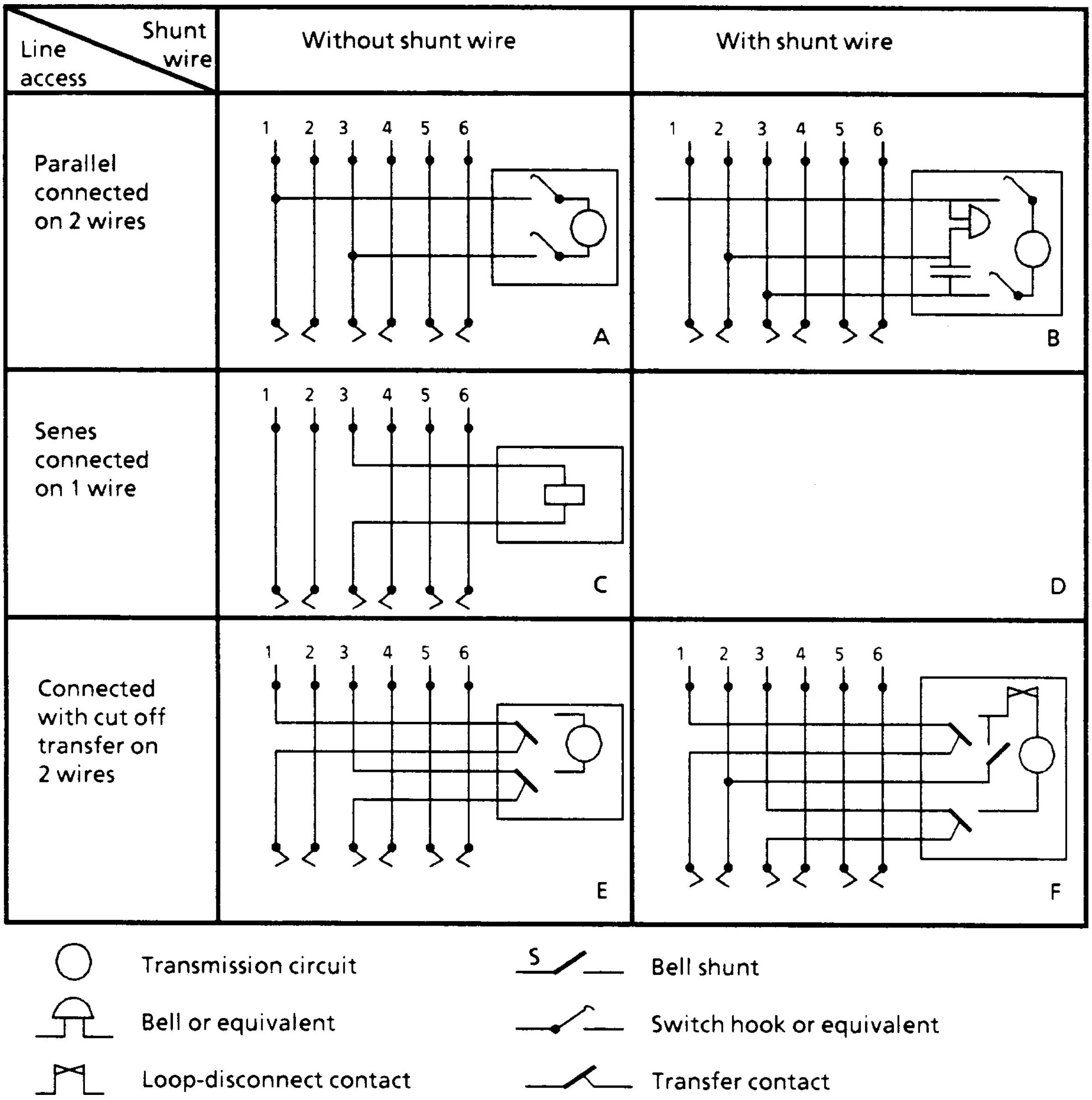


Figure 8.3 (F) 1.2: Multiple terminal connection with "gigogne" plug or incorporated socket

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).

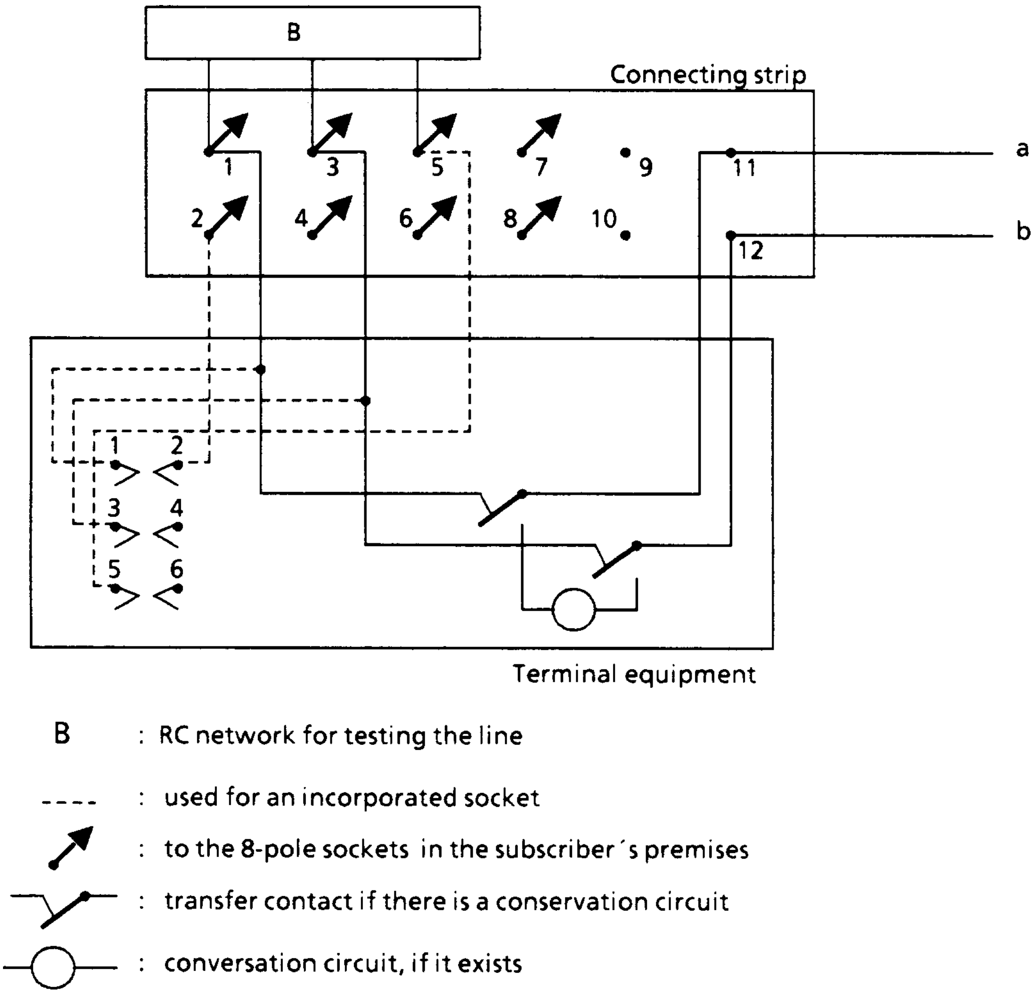


Figure 8.3 (F) 1.3: Multiple terminal connection with connecting strip

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.

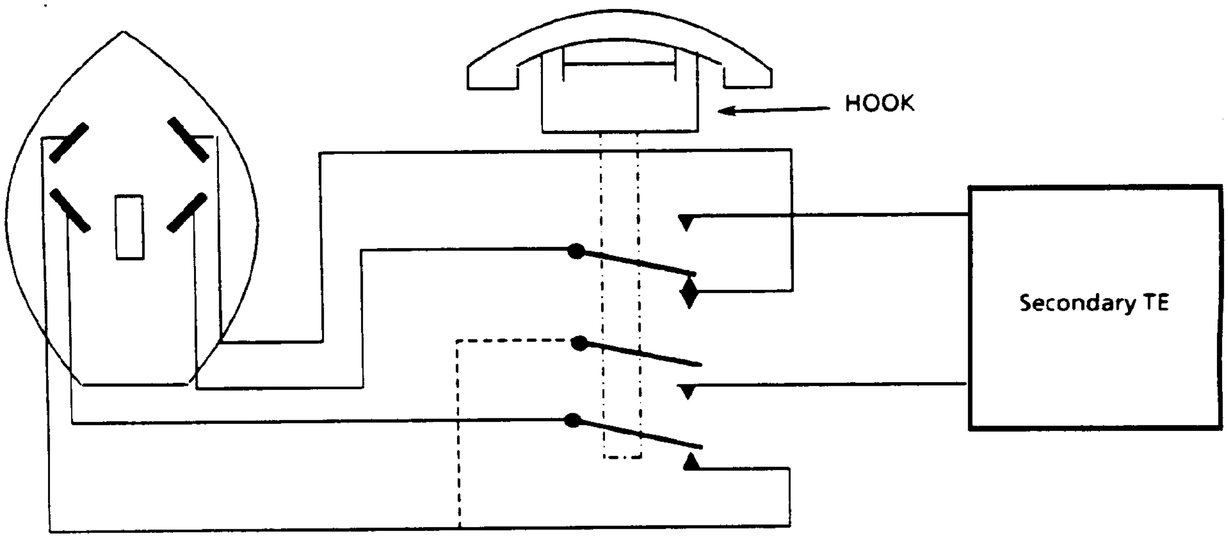


Figure 8.3 (IS) 1: Connection of secondary TE

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.

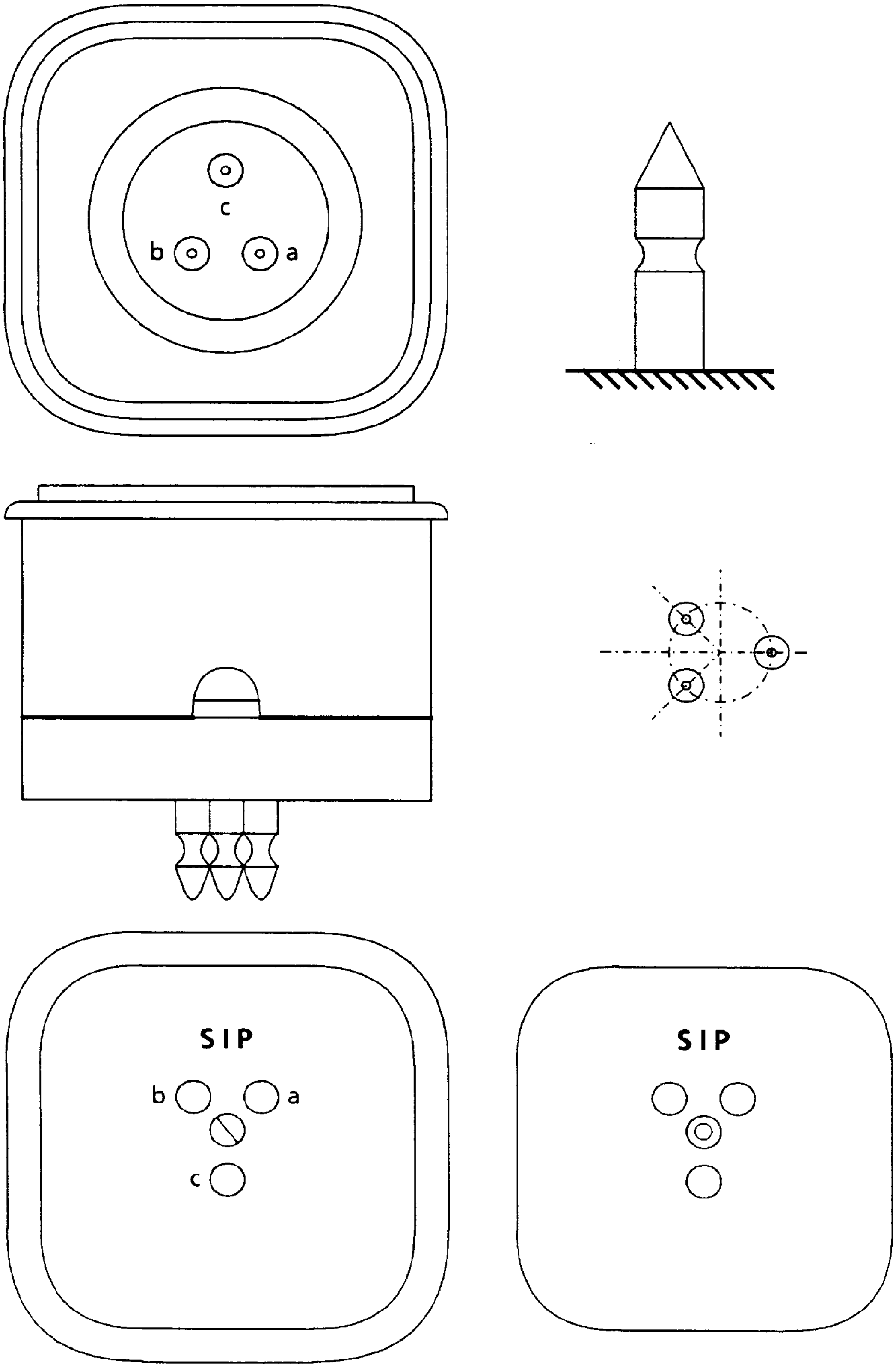


Figure 8.3 (I) 1: Combined plug and socket

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 V applied for at a time t = 30 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 without discharges.

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.

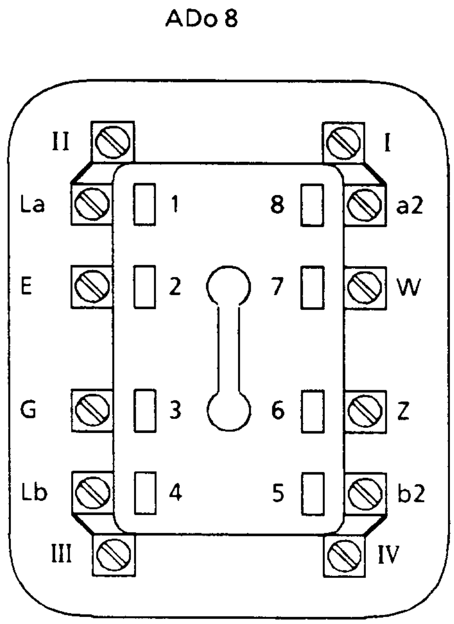


Figure 8.3 (L) 1.1: Standard socket

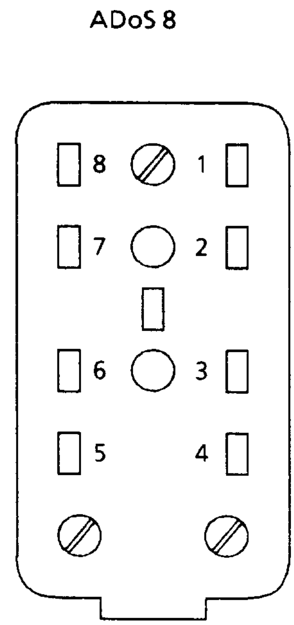


Figure 8.3 (L) 1.2: Standard plug

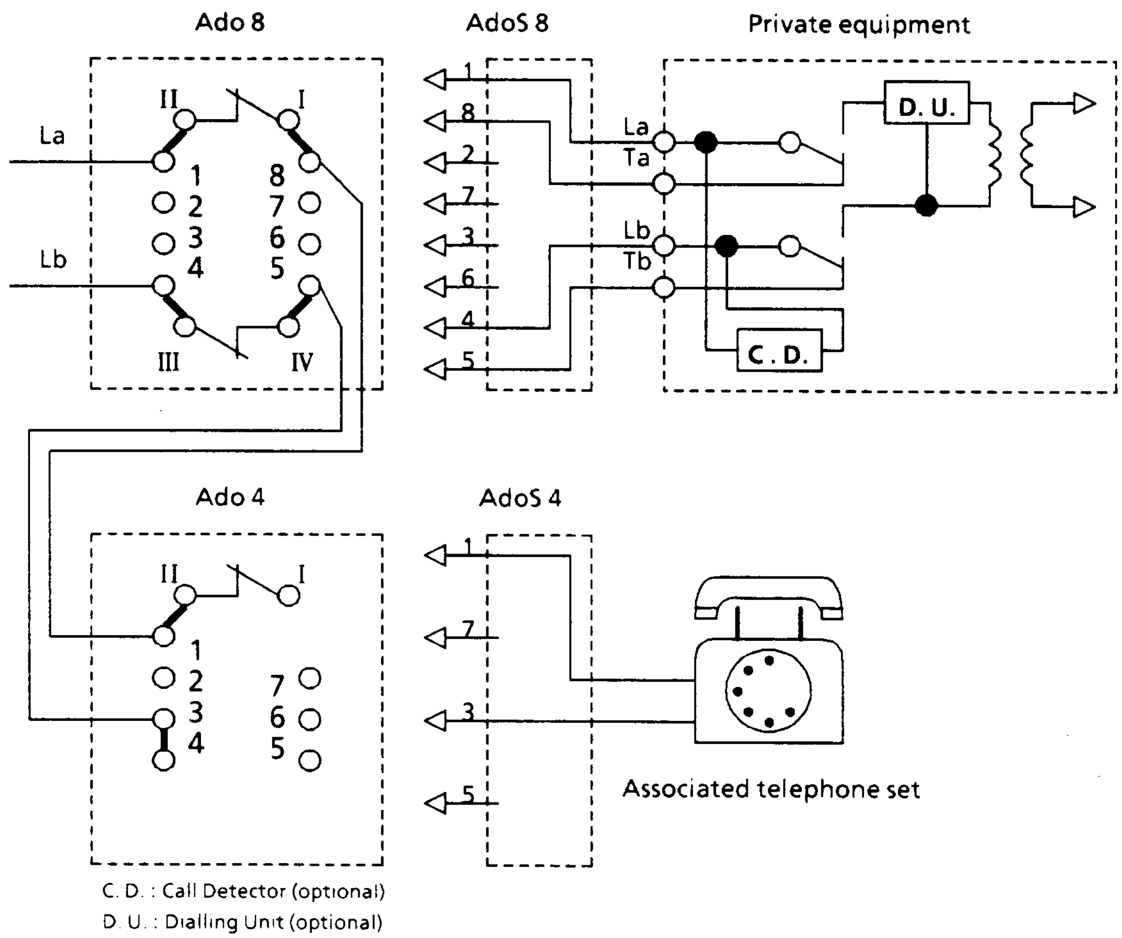


Figure 8.3 (L) 1.3: Wiring plan for multiple terminal connection for PSTN (modem, fax, etc.)

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.

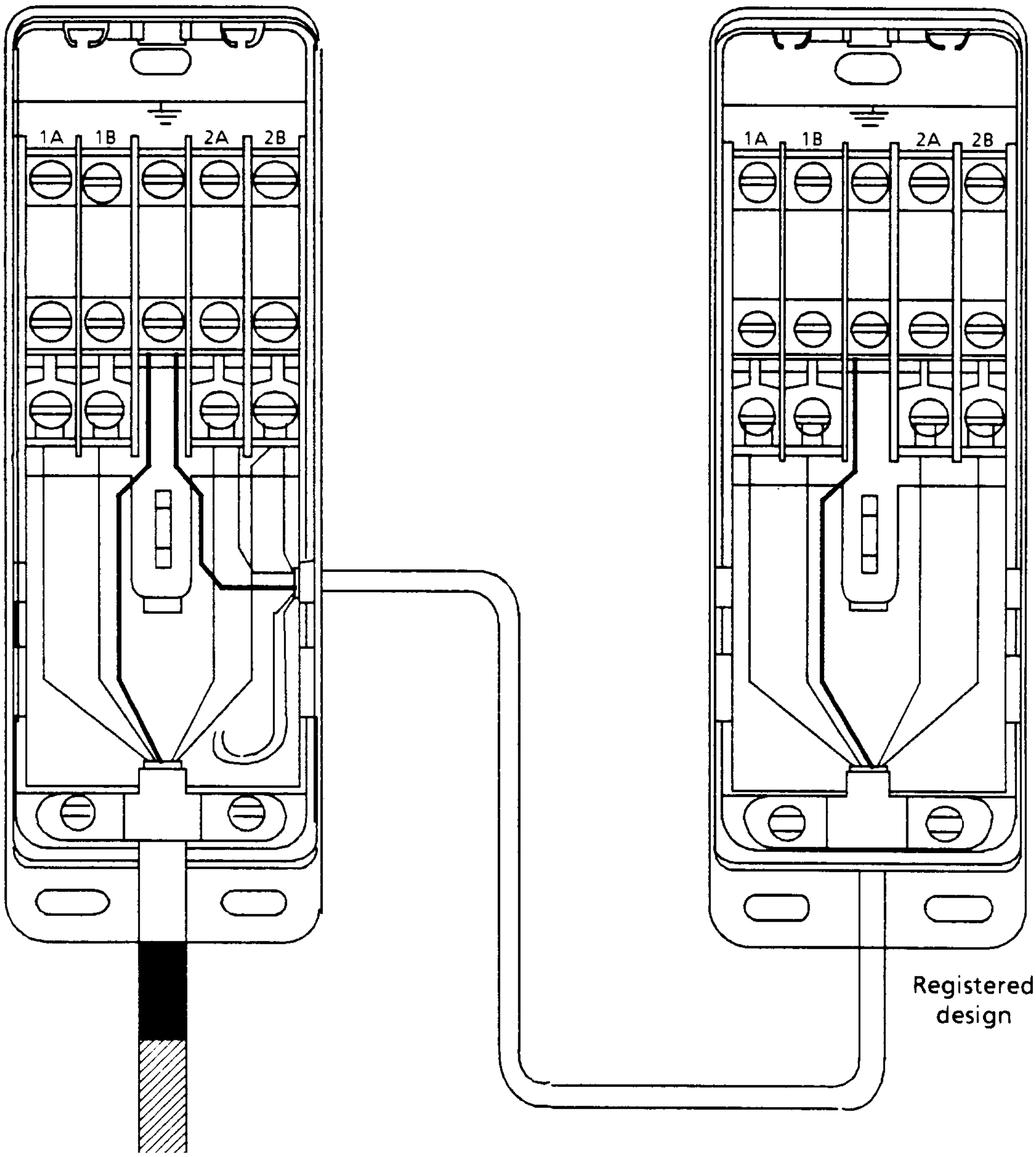


Figure 8.3 (NL) 1

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.

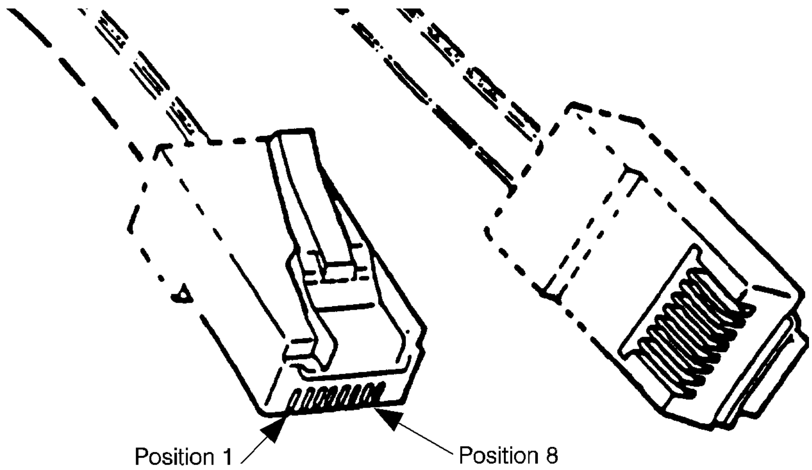
NOTE b.2: The contact 8 is the normal return of contact 5.

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 socket 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.

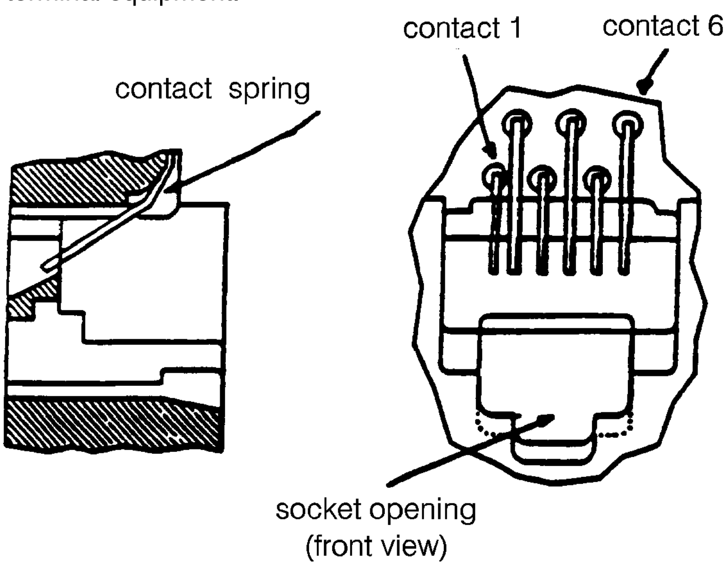


Figure 8.3 (E) 3: Miniature 6-position socket

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 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 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	
(i)	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 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 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 in 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 output terminals of one line, 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 shall be provided for every ten involved 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 socket. In principle, the intermediate plug functions in the same way as an extra socket 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 sockets 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 configurations. 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.

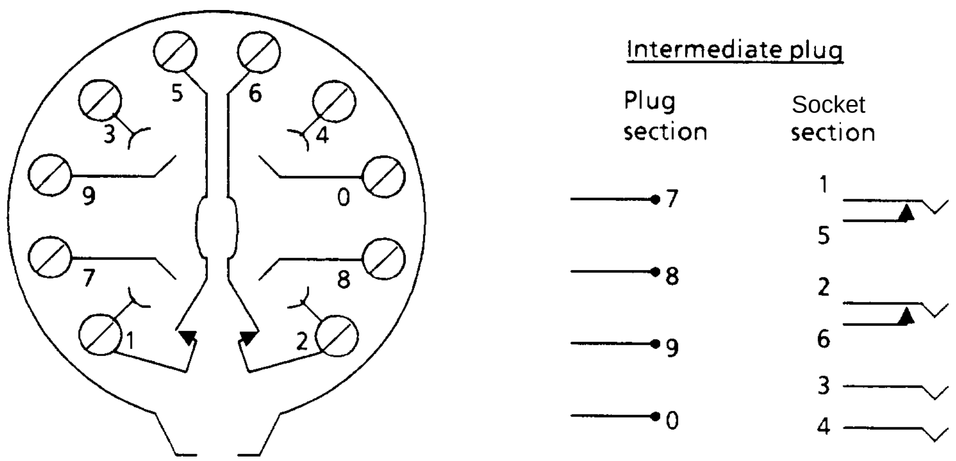


Figure 8.3 (S) 1.1: Intermediate plug

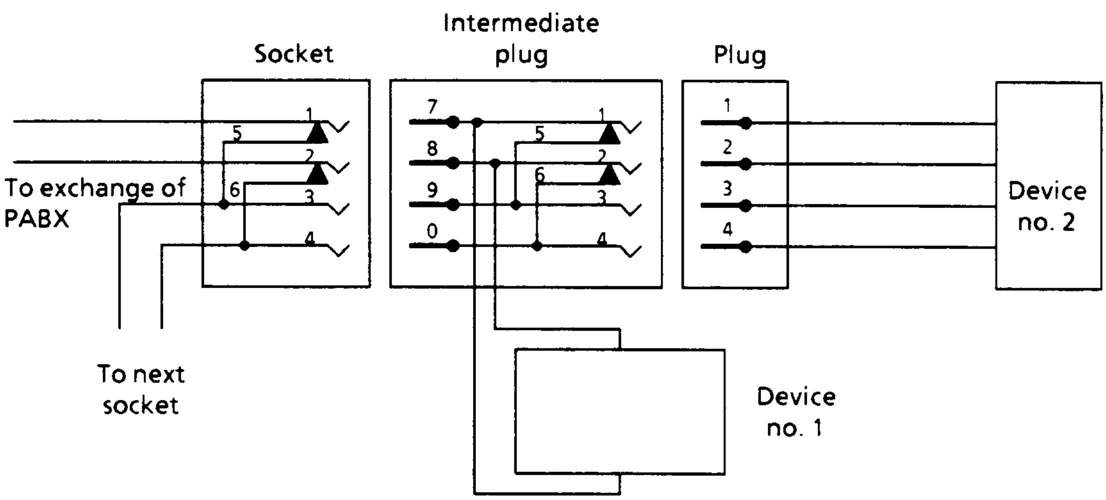


Figure 8.3 (S) 1.2: Parallel connection to line with device no. 1 in front of device no. 2

Typical example: Ringing signal detector

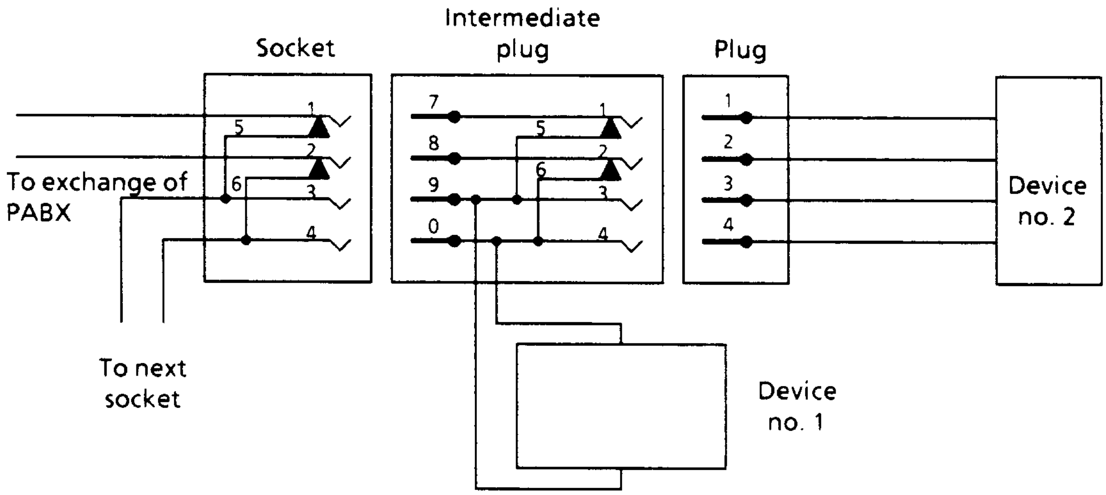


Figure 8.3 (S) 1.3: Parallel connection to line with device no. 1 behind device no. 2

Typical example: Auxiliary loudspeaking unit

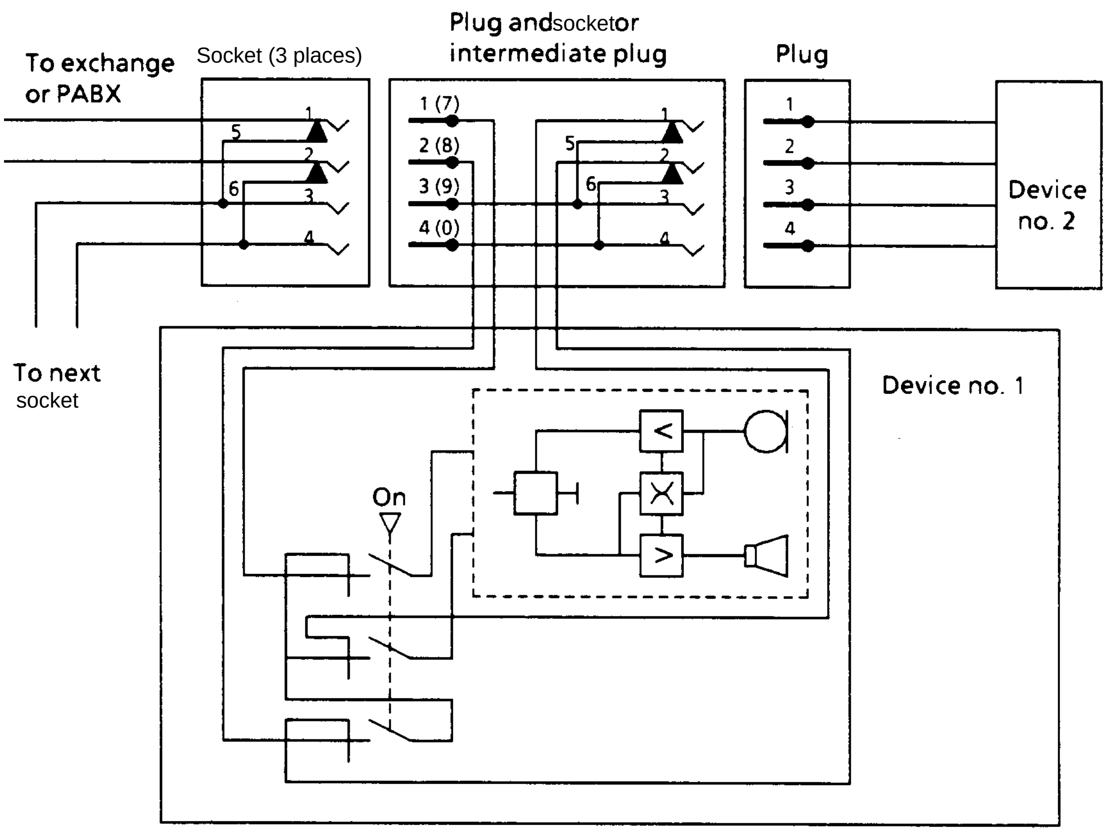


Figure 8.3 (S) 1.4: Cascade connection to line with device no. 1 in front of device no. 2

Typical example: Automatic dialler

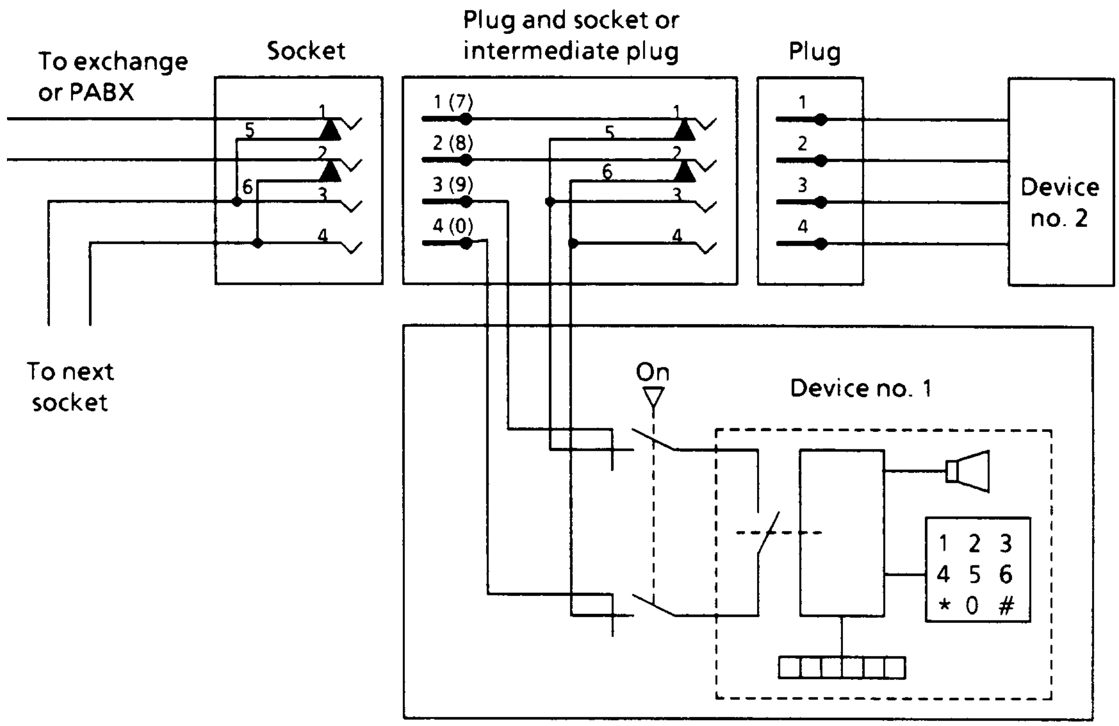


Figure 8.3 (S) 1.5: Cascade connection to line with device no. 1 behind device no. 2

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 are normally to be made together with the installation system, in other words: each TE is normally to be connected separately to a suitable socket. A maximum of 3 TE may be connected in parallel. Direct series or parallel connections from equipment to equipment may be approved.

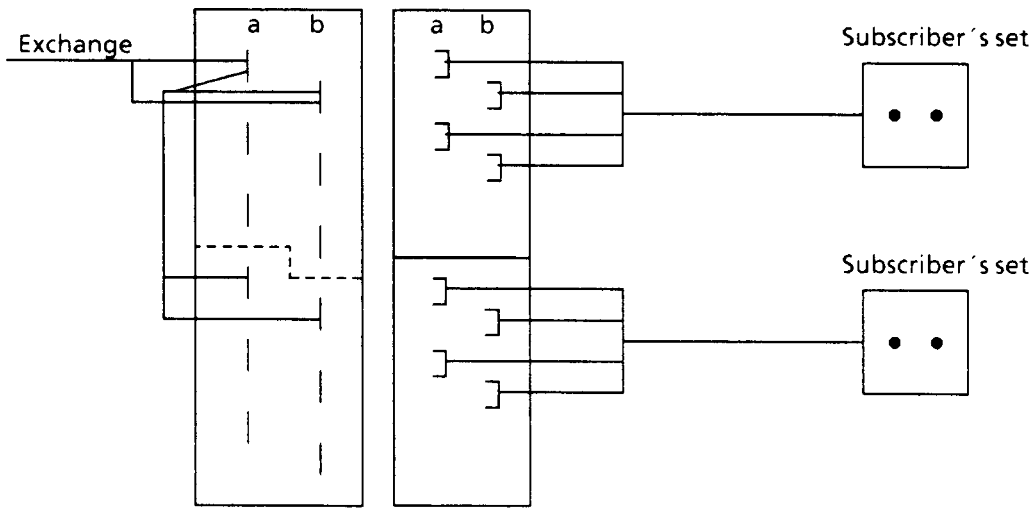
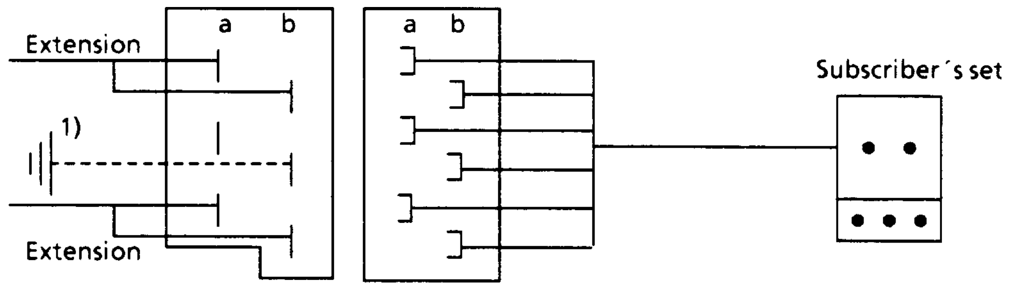


Figure 8.3 (CH) 1.1: T + T 83 connection system with subscriber's sets in parallel



1) Earth signalling if implemented.

Figure 8.3 (CH) 1.2: T + T 83 connection system with 1 two-line subscriber's set

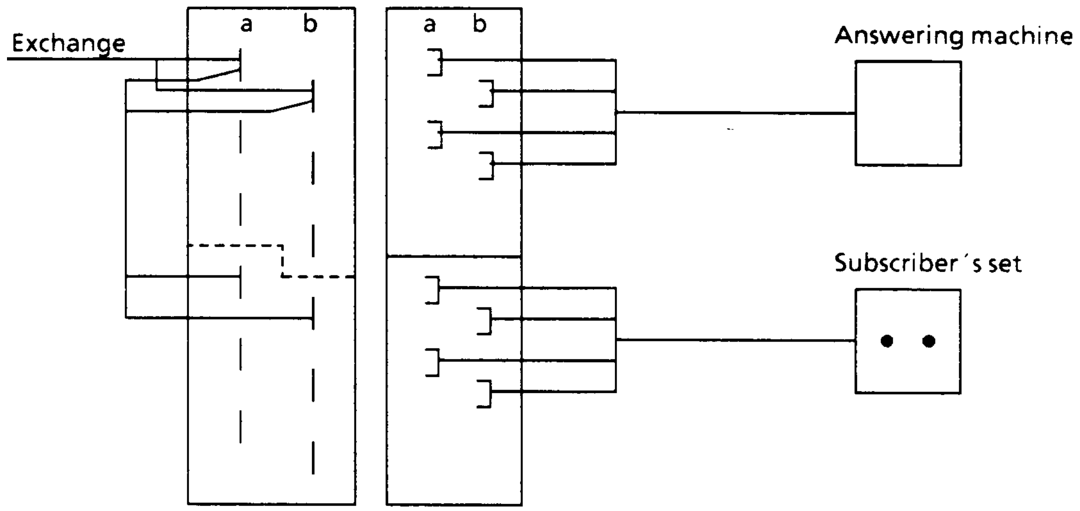


Figure 8.3 (CH) 1.3: T + T 83 connection system with 1 subscriber's set and answering machine in parallel

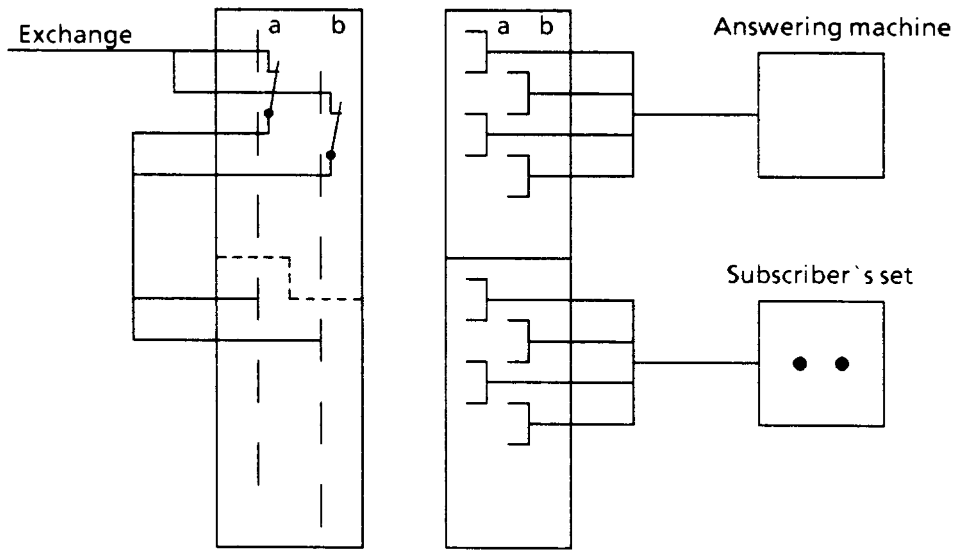


Figure 8.3 (CH) 1.4: T + T 83 connection system with 1 subscriber's set and answering machine in series

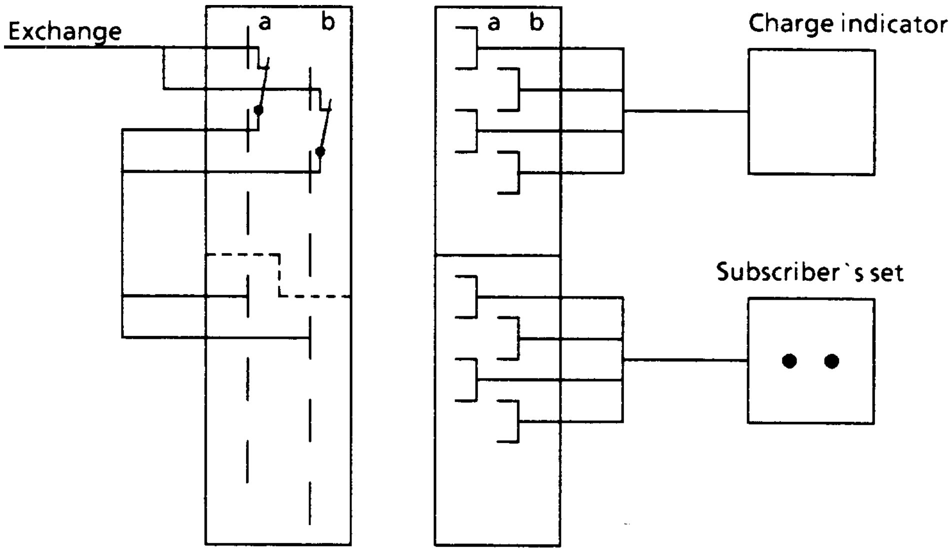


Figure 8.3 (CH) 1.5: T + T 83 connection system with 1 subscriber's set with separate charge indicator

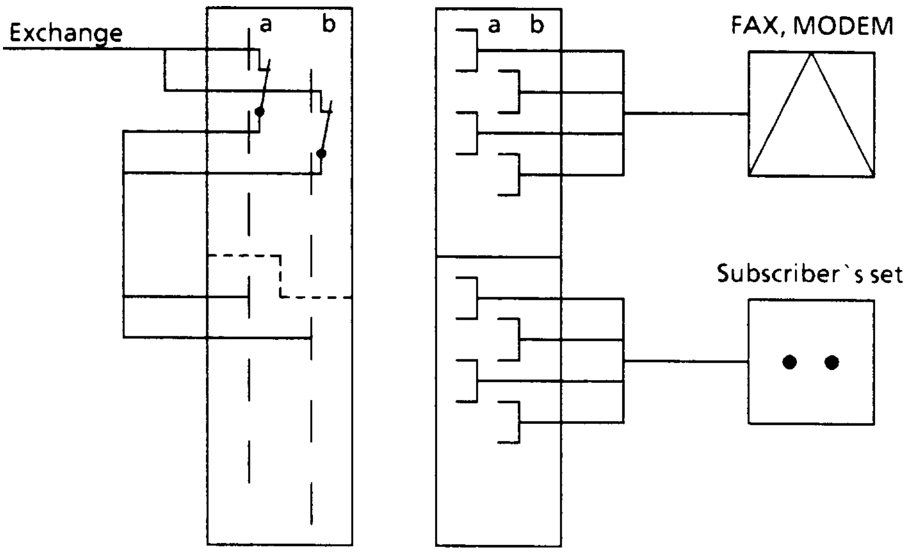


Figure 8.3 (CH) 1.6: T + T 83 connection system with 1 subscriber's set with PSTN modem or fax

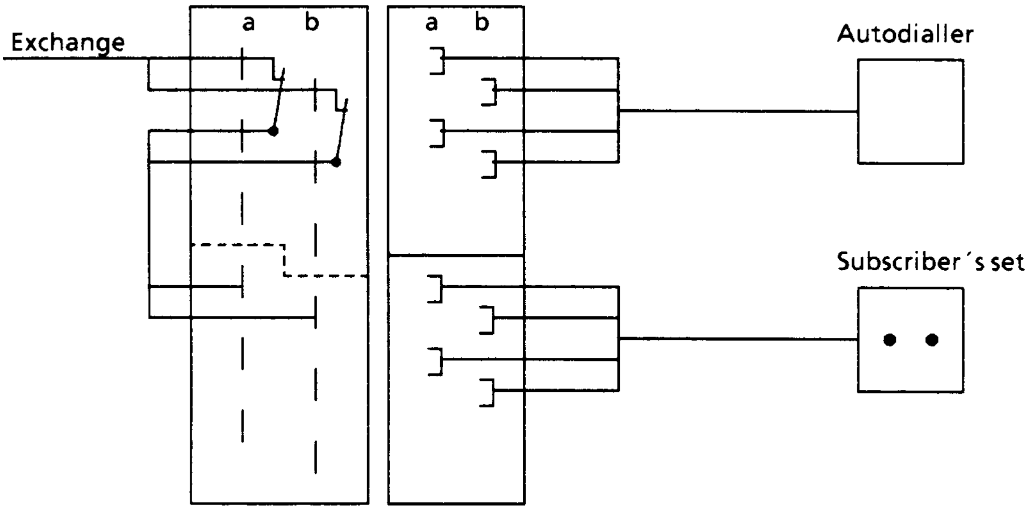


Figure 8.3 (CH) 1.7: T + T 83 connection system with 1 subscriber's set with autodialler

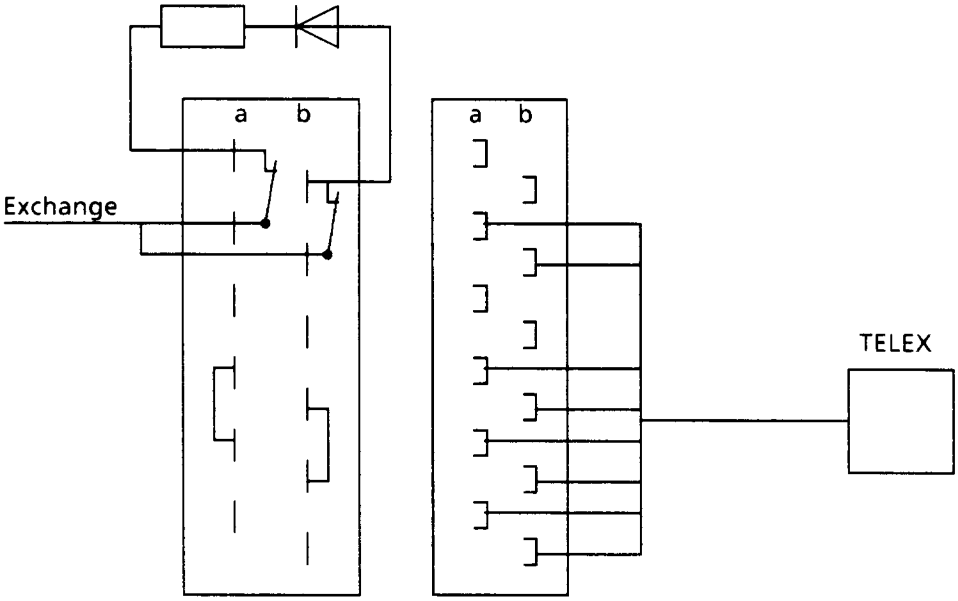


Figure 8.3 (CH) 1.8: T + T 83 connection system with telex

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 should be connected according to paragraph 8.2.

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 No pin assignments are prescribed. The information in the present Chapter presents the current market situation.

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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Chapter 9: Special functions

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

*

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

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, 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.

Transposition dates	
Date of adoption of this ETS:	31 March 1996
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Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	31 December 1996
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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 condition 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.

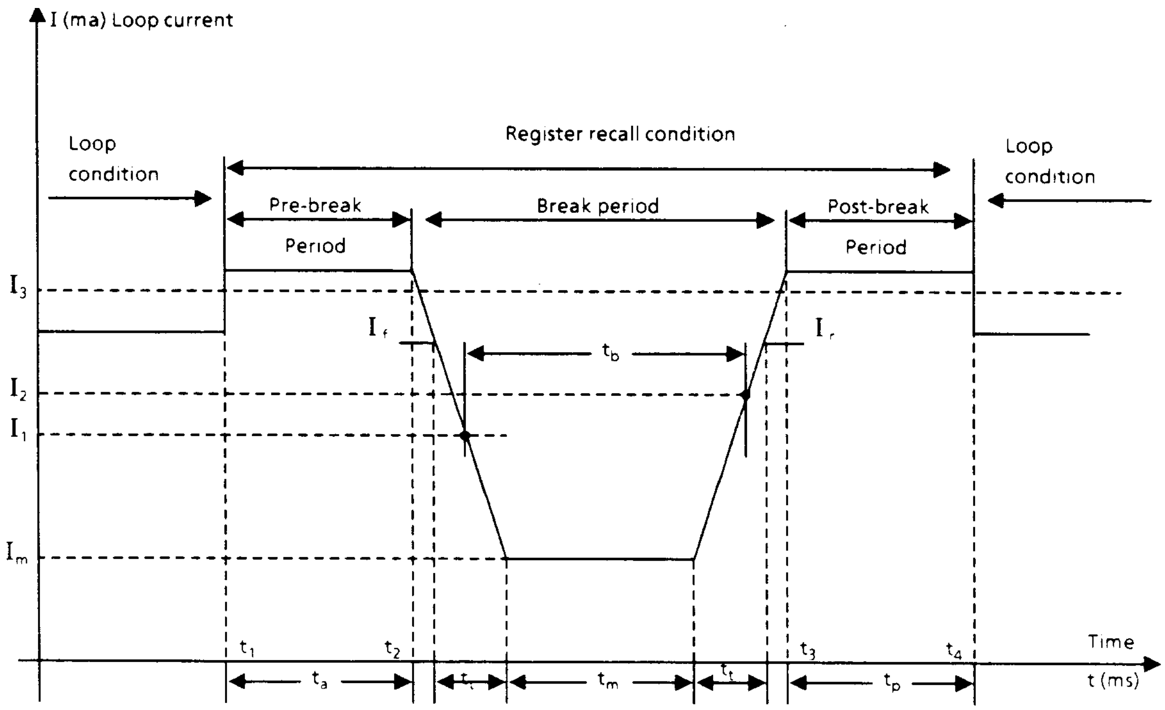


Figure 9.1: Register recall

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 the 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 back 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 terminal voltage values shall be recorded.

Table A.9.1: Register recall

COUNTRY	TEST VALUES				Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	R_s (Ω)	
Austria	60		19, 60	≥ 500	
Belgium	48	600		1 000	
Bulgaria	60	1 200		1 000	
Cyprus	48	800		R_s included in R_f	
Denmark	150	10 k		500	yes
Finland	48	0, 910		800	
France	49, 49, 54	3 260, 1 300, 200		100	
Germany	not mandatory				
Greece					
Hungary	48		20 - $I_{max.}$	400	
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	40 60	1 900 3 400		100	
Portugal			not applic.	200	yes
Spain	48	250, 1 950	not applic.	250	yes
Sweden	33 45	2 100 2 100		100 100	yes
Switzerland	50	500, 2 300		100	
U. Kingdom	50	400	25 - 100	R_s included in R_f	

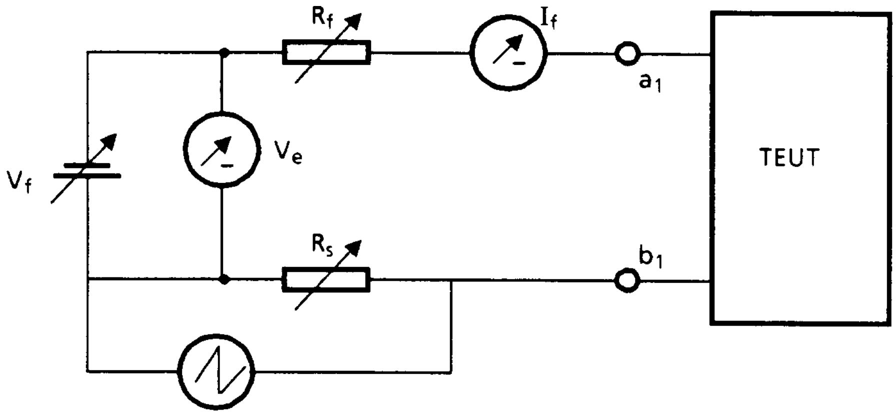


Figure A.9.1: Register recall, measurement of impedance during break period

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.

For measurement of time of break period the TEUT is connected as shown in figure A.9.1 with following test values:
V_f = 56 V, R_f = 500 Ω and R_s = 500 Ω.

Measurement documentation could be an oscilloscope picture.

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 It is assumed that the TEUT fulfils the associated requirement.

A.9.1 (E) 1.c It is assumed that the TEUT fulfils the associated requirement 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.

A.9.1 (E) 2.2 The procedure of test in section A.9.1 (E) 2.1 is followed.

A.9.1 (E) 2.3 Fall time and rise time of the current.

The procedure of test in section A.9.1 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 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 (kΩ), 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	60		19 - 60	100	± 20	18	18
Belgium	48		20 - $I_{max.}$	125	30	15	15
Bulgaria	60	1 200		90	40		
Cyprus	48	440 - 1 740		50 - 150		10	10
Denmark			16 - $I_{max.}$	90	40	8	8
Finland	44 - 58	800 - 1 710		90	± 40	12,5	12,5
France	49 - 54	200 - 3 260		270	± 50	5	5
Germany	not mandatory						
Greece							
Hungary	48		20 - $I_{max.}$	90	30	15	15
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	40 60	460 - 2 200 460 - 3 500		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							
Switzerland	43 - 57	2 200 - 600		90	± 40	15	15
U. Kingdom	50	400	0 - 125	not spec.	not spec.	not spec.	not spec.

Table 9.1.1 (continued): Break period

COUNTRY	REQUIREMENT VALUES						Remarks
	t_m (ms)	I_m (mA)	t_t (ms)	I_f (mA)	I_r (mA)	R_1 (kΩ)	
Austria	≥ 80					100	
Belgium	95	2,5					
Bulgaria	50 - 130					100	
Cyprus	60 - 140	0,5	10	20	20		
Denmark	50			16	16	100	yes
Finland	50 - 130					70	
France	40	1					
Germany	not mandatory						
Greece							
Hungary							yes
Iceland	50 - 130	0,5					
Ireland	not mandatory						
Italy	50					50	
Luxembourg	not mandatory						
Malta							
Netherlands	90 - 130	0,5					
Norway	80	0,5					
Portugal	160	1	20	20	20	N/A	
Spain		≤ 0,48	≤ 5	15	18	N/A	yes
Sweden	50 - 130					100	yes
Switzerland	50	0,7	15	15	15	80	
U. Kingdom	not specified						yes

9.1.1 (DK) 1 Depressing the R-key for 50 ms or longer, manually or automatically, shall cause disconnection of the dc loop. For measurement of break period, see section A.9.1. The current shall be less $I_f = I_r$ for a maximum of 140 ms.

9.1.1 (H) 1 The resistance of TE between the two line terminals shall be:

after t_i + 10 ms ≥ 100 kΩ within the period from t_i + 20 ms up to t_e - 5 ms ≥ 150 kΩ.

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 µA, 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 µA 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 µA 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 (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 expotential fall and the start of the expotential 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.
Bulgaria	not specified				
Cyprus	not mandatory				
Denmark					
Finland	not mandatory				
France	49 - 54	200 - 3 260	100		
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland	not mandatory				
Ireland	not mandatory				
Italy	not mandatory				
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			≤ 1 500
U. Kingdom	not specified				

Table 9.1.2 (continued): 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
Bulgaria	not specified				
Cyprus	not mandatory				
Denmark					yes
Finland	not mandatory				
France					yes
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland	not mandatory				
Ireland	not mandatory				
Italy	not mandatory				
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	$250 \leq t_p \leq 1\,500$	as per sections 2.3 and 2.4.2 during t_p			
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 (DK) 1 From 10 ms after the end of break period the current shall be > 16 mA during at least 5 ms.

9.1.2 (F) 1

- in the range 200 Ω - 1 300 Ω, I_3 = 17 mA;
- in the range 1 300 Ω - 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) and (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 when necessary.

Compliance shall be checked by tests outlined in section A.9.1 (E) 3.3.

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 (D) 1 Transition from the communication state to the quiescent state

After initiation of the procedure for the establishment of the quiescent state, the terminal equipment shall increase the effective dc resistance at the NTA to $R \geq 1$ MΩ at the feeding condition specified in the first paragraph of section 10.2 (D) 1.5, and at feeding currents of between 1,8 mA and 17 mA. The duration of the increase in resistance to $R \geq 1$ MΩ shall be $t \leq 1$ s.

In the case of automatic operation, the terminal equipment shall maintain this value for $t \geq 1{,}5$ s.

In the case of outgoing line seizure in the terminal equipment, the impedance shall be $|Z| \geq 220\ \Omega$ for a period of $t \geq 1\,400$ ms after the dc resistance of $R \geq 1$ MΩ for metering pulses within the frequency range 15,92 kHz $\leq f \leq$ 16,08 kHz has been reached.

See also Chapter 1, section 1.7.8 (D) 1.

9.2.1 (N) 1 The requirements for meter pulse reception are mandatory only for payphones.

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 (CH) 1 The requirements for the 12 kHz meter pulse reception are not mandatory. If a receiver is included in the TE the insertion loss shall be ≤ 4 dB according to sections 4.1.1 and 4.1.2.

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 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.

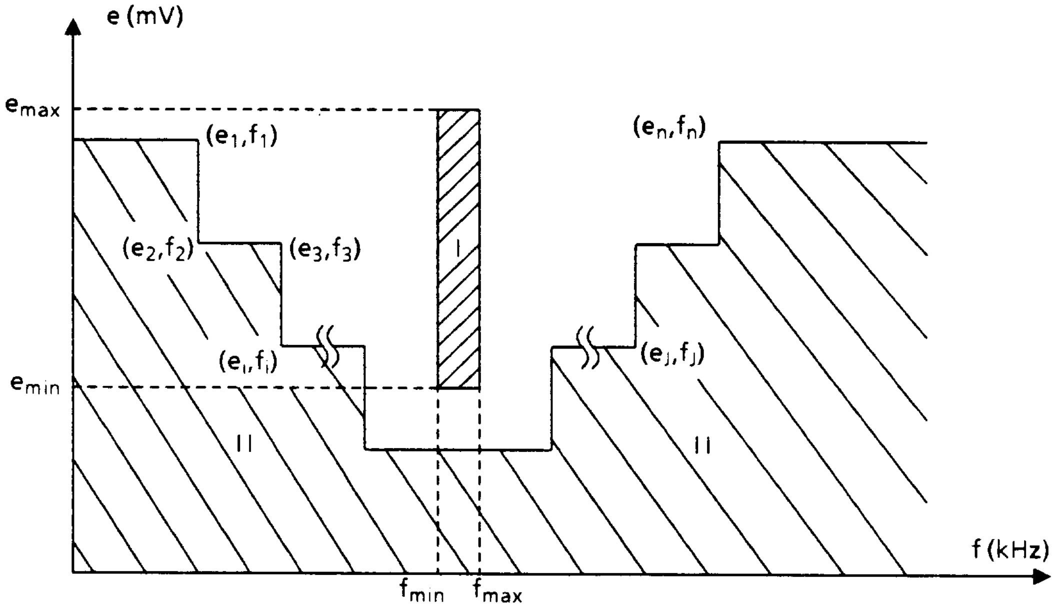


Figure 9.2.1.1: Receiver selectivity and sensitivity

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	60	3 300
Bulgaria	15,84	16,16	97	6 000
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
Hungary	11,88	12,12	87	4 900
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	90	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	141, 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) e_1 (mV)	f_2 (kHz) e_2 (mV)	f_i (kHz) e_i (mV)	f_n (kHz) e_n (mV)
Austria				
Belgium				
Bulgaria	not mandatory			
Cyprus	14/400	16/20		18/400
Denmark	not mandatory			
Finland				
France				
Germany	not mandatory			
Greece	15,250/97	16/52		16,750/97
Hungary				
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
Bulgaria	200	0	yes	yes	60	1 000, 2 200		yes
Cyprus	600	200	yes	no	48	440 - 1 740		
Denmark	not mandatory							
Finland	200	not spec.	yes	no	44 - 58	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	
Hungary	200	200	yes		48		20 - $I_{max.}$	yes
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	0	yes	yes				yes
Switzerland	600	200			43 - 57	2 200 - 600		yes
U. Kingdom	no requirement							

9.2.1.1 (A) 1

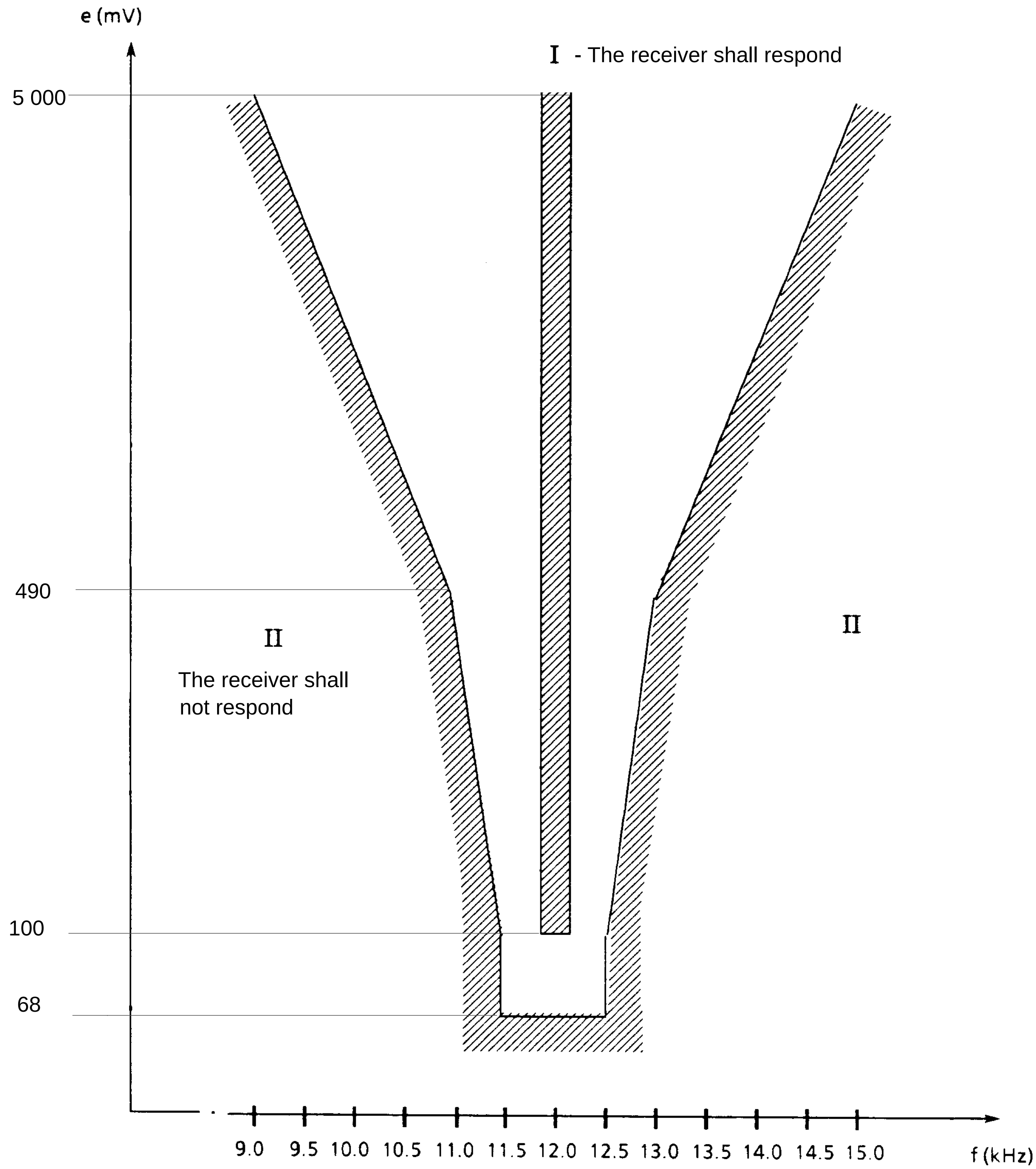


Figure 9.2.1.1 (A) 1: Receiver selectivity and sensitivity

9.2.1.1 (A) 2 The value of Z_L is valid for Z_L shown in figure A.9.2.1.1.a.

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)	1 200	300	300	120	120	30	30	120	120	300	300	1 200

9.2.1.1 (BG) 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.c (SF) 1 The call charge meter shall operate at a frequency of 16 kHz ± 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.

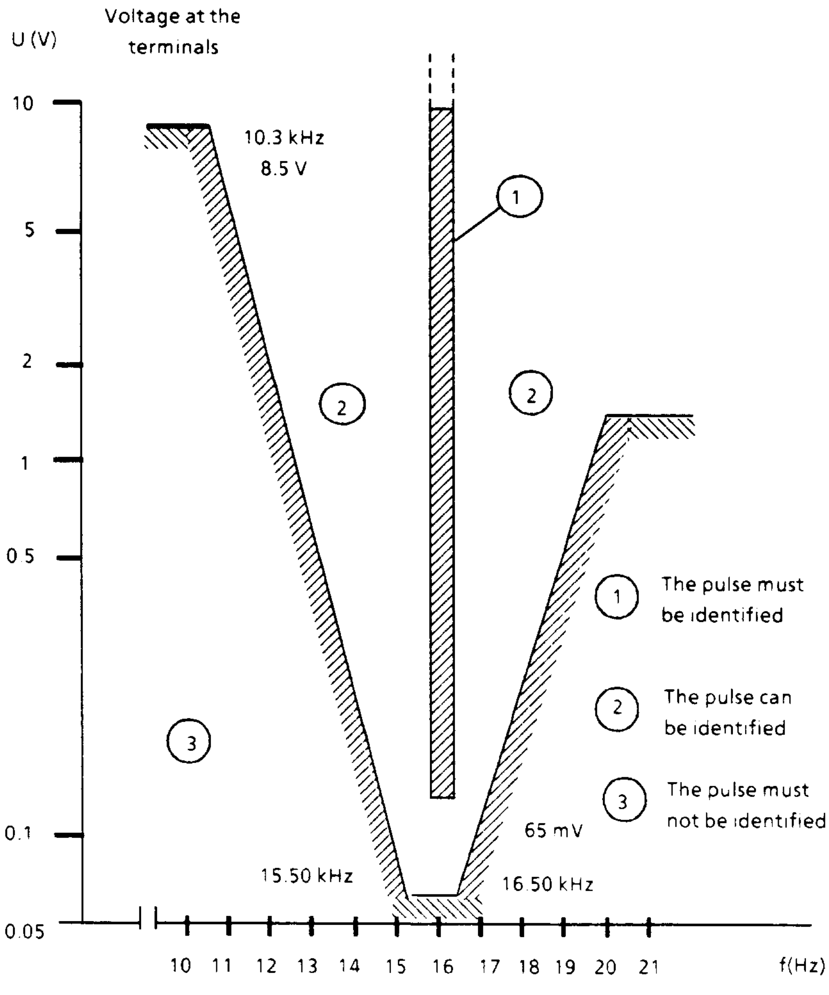


Figure 9.2.1.1.c (SF) 1

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 µF, 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.

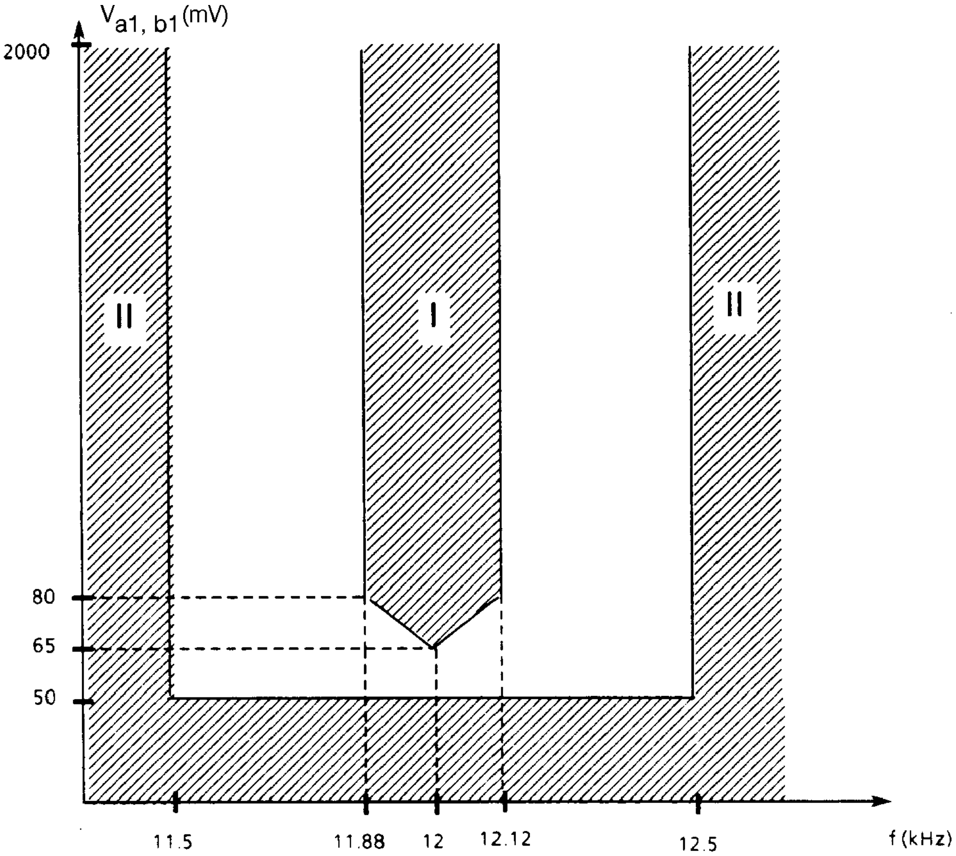
9.2.1.1 (F) 5 The meter pulse detection shall also be correct during a register recall.

9.2.1.1 (H) 1 The values in table 9.2.1.1.b are as follows:

f_i	10	10	11	11	13	13	14	14
e_i	4 900	870	870	27,5	27,5	870	870	4 900

9.2.1.1 (H) 2 After finishing the loop state, the receiver shall be capable of receiving one meter pulse in quiescent state within 500 ms.

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 See figure 9.2.1.4 (I) 1.

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)	≤ 13	13	14	14	15	15	17	17	18	18	19	19
e_n(mV_{rms})	895	503	503	90	90	28	28	90	90	503	503	895

9.2.1.1.c (N) 1 I_{max} for terminated connected TE see definition in Chapter 1.

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:

a) the metering signals "i" to "iv" are applied between the line terminals through a resistor of 200 ohms;

b) the ac signal type "v" is applied between the line terminals through a resistor of 600 ohms;

c) the signal type "vi" is 10 series of 10 dialling pulses as stipulated in the associated testing method.

PROVISION c: For series TE this requirement shall also be applied when the series of pulses are applied to the line output terminals.

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 mV ≤ e ≤ 4,8 V	f = 12 kHz	≤ 30 ms	≥ 50 ms
ii	e ≤ 100 mV	f = 12 kHz	≥ 50 ms	≥ 70 ms
iii	e < 800 mV	f = 11,4 kHz	≥ 50 ms	≥ 70 ms
iv	e < 800 mV	f = 12,6 kHz	≥ 50 ms	≥ 70 ms
v	e = 5 V	300 Hz ≤ f ≤ 3,4 kHz	≥ 50 ms	≥ 70 ms
vi	See text			

9.2.1.1.a (S) 1 The meter pulse detector should be able to adjust in two steps, high sensitivity and low sensitivity, according to the values of e_{min} and e_{max} in table 9.2.1.1.a.

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 (kHz)	4,0	4,0	10	11	11	11,7	12,3	13	13	17
e_n (mV)	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.b (CH) 1

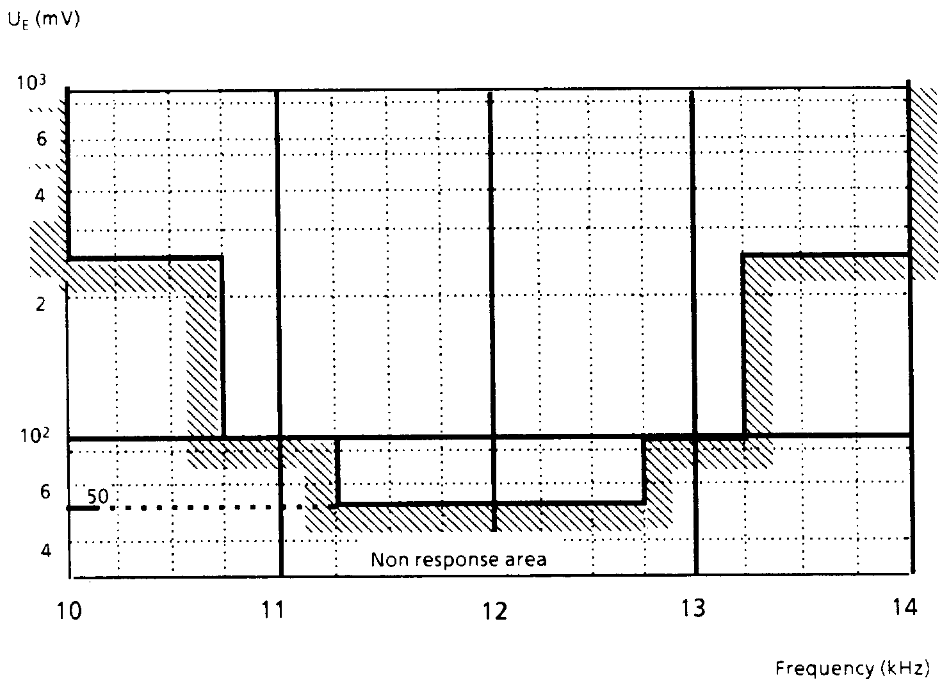


Figure 9.2.1.1 (CH) 1

9.2.1.1.c (CH) 1 After loop states, the receiver should 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 only 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 in 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	
Bulgaria	50, 300	135	60	1 000, 2 200	
Cyprus	80	300	48	800	
Denmark	not mandatory				
Finland	100, 300	100	48	800, 1 710	
France	75	75	48		25, 60
Germany					
Greece	≥ 50	90	60		20, 35
Hungary	50	50	48		20, $I_{max.}$
Iceland	120	100	48		14, $I_{max.}$
Ireland	120	≥ 400	48		20 - 100
Italy	80	200	44, 52	1 880, 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			25
Switzerland	50	1 000	50	2 300	
U. Kingdom	no requirement				

Table A.9.2.1.1 (continued): Selectivity and sensitivity

COUNTRY	TEST VALUES f_1 (kHz) e_1 (mV)	f_2 (kHz) e_2 (mV)	f_i (kHz) e_i (mV)	f_n (kHz) e_n (mV)	Remarks
Austria					yes
Belgium					yes
Bulgaria	15,84/97	15,84/6 000	16,16/6 000	16,16/97	
Cyprus	15,84/100	15,84/4 000	16,16/4 000	16,16/100	
Denmark	not mandatory				
Finland					yes
France					yes
Germany					yes
Greece	15,840/97	15,840/6 000	16,16/6 000	16,16/97	
Hungary					yes
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), figure 9.2.1.1 (CH) 1				
U. Kingdom	no requirement				

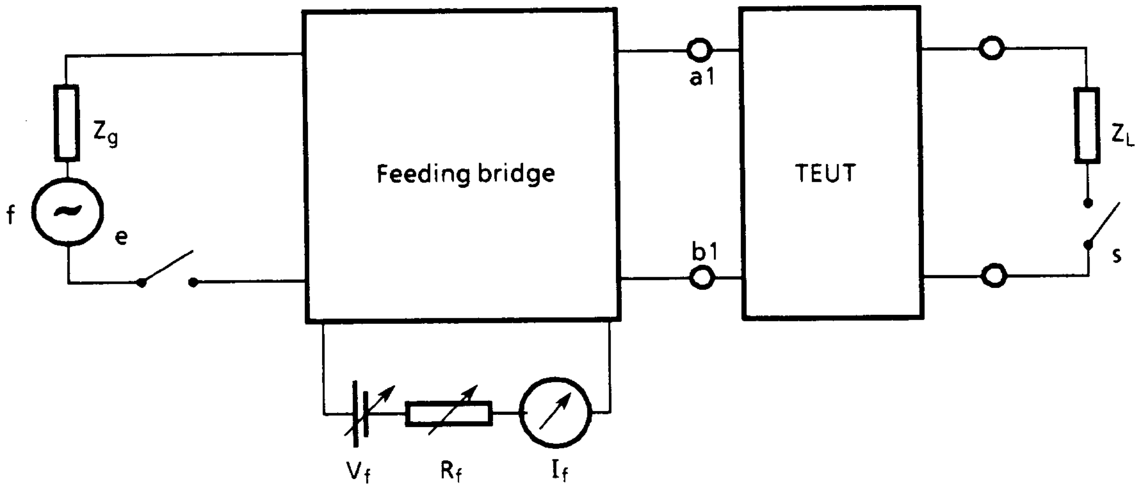


Figure A.9.2.1.1.a: Series connection

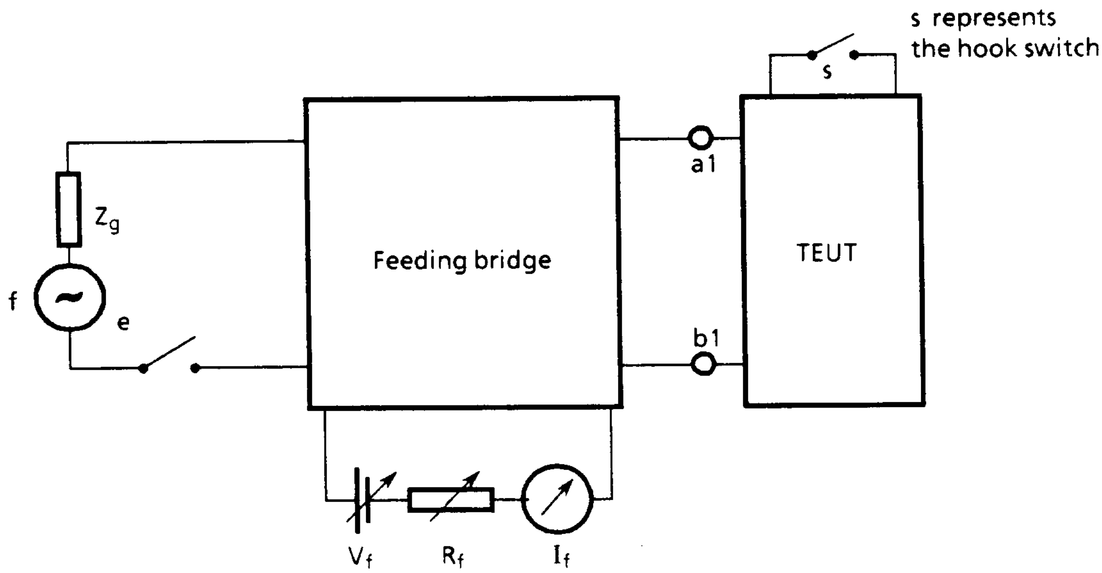


Figure A.9.2.1.1.b: Terminating connection

A.9.2.1.1 (A) 1 Values for e and f, see figure 9.2.1.1 (A) 1.

A.9.2.1.1 (B) 1 The frequency and levels steps are determined in a suitable way to obtain a curve e = f (f).

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 kHz - 20 kHz and the voltage range e = 130 mV - 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.

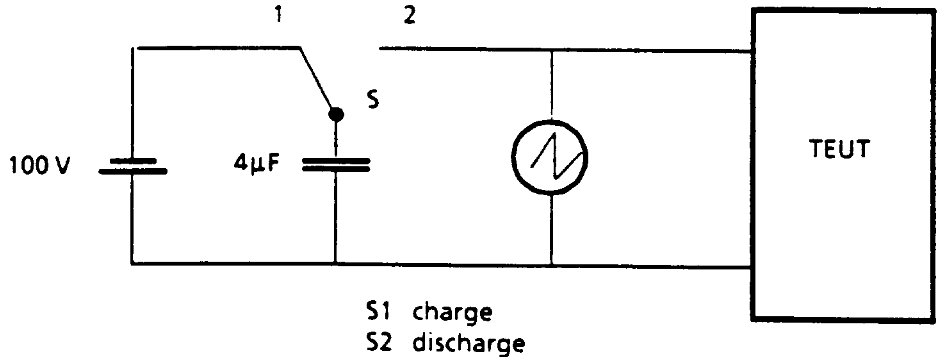


Figure A.9.2.1.1 (F) 3

A.9.2.1.1 (F) 4 The test is carried out using figure A.9.2.1.1 (F) 4.

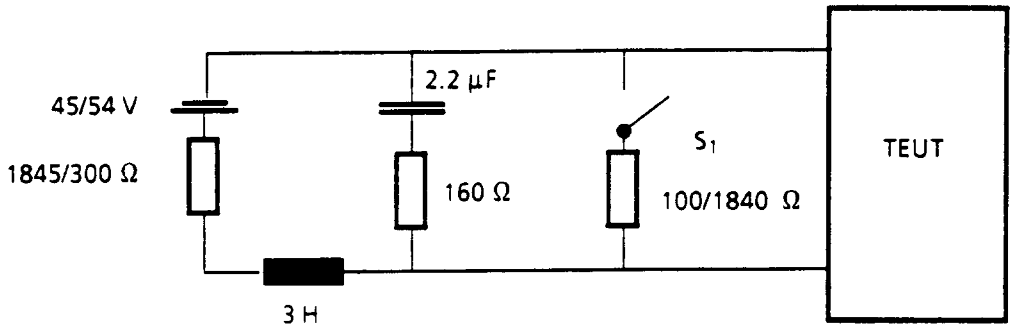


Figure A.9.2.1.1 (F) 4: Immunity to decadic dialling from a parallel connected TE

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.

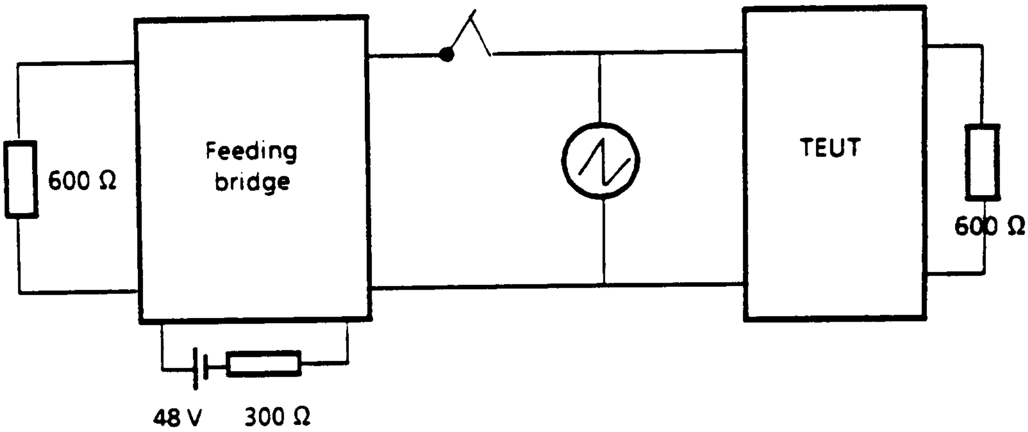


Figure A.9.2.1.1 (F) 5: Immunity to random feeding breaks

A.9.2.1.1 (F) 6 The test is carried out using figure A.9.2.1.1 (F) 6.

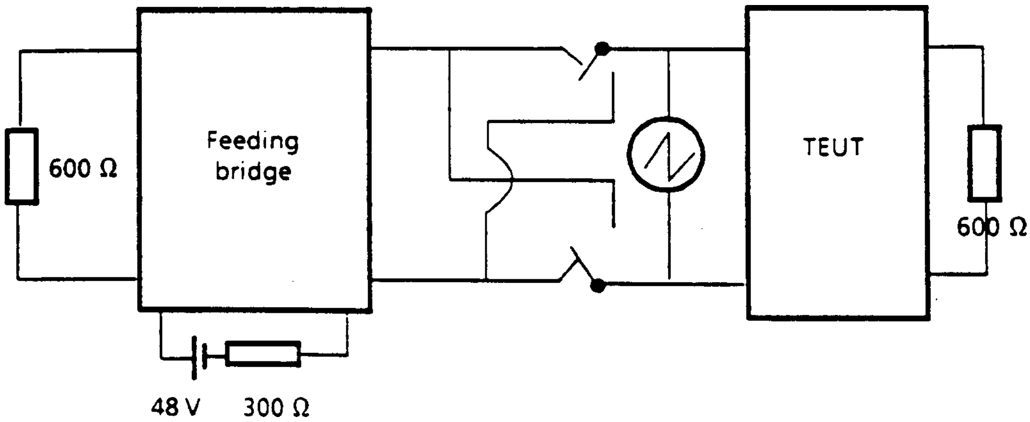


Figure A.9.2.1.1 (F) 6: Immunity to polarity inversion

A.9.2.1.1 (F) 7 The test is carried out using figure A.9.2.1.1 (F) 7.

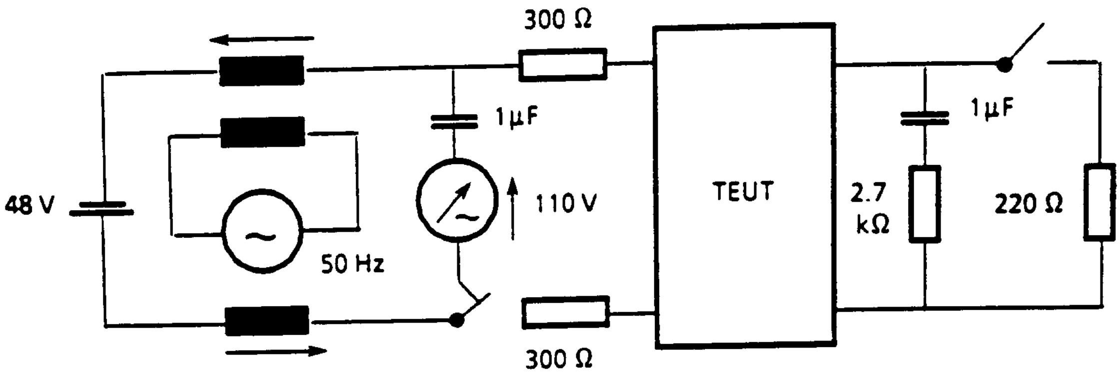
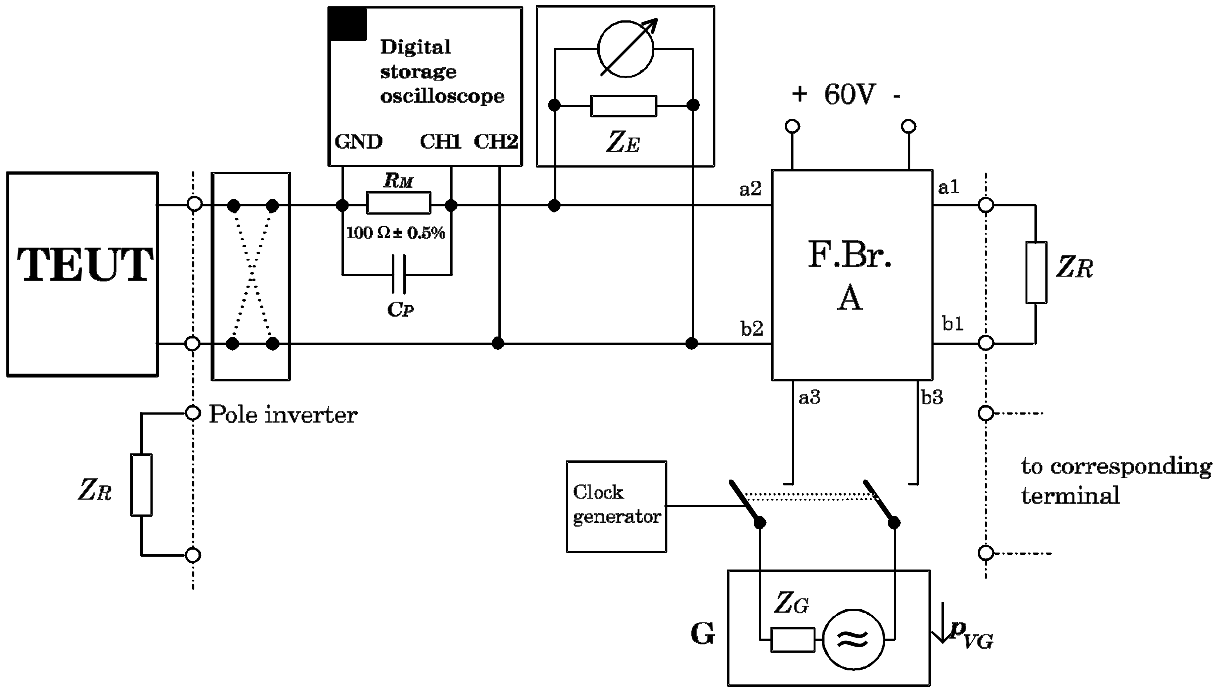


Figure A.9.2.1.1 (F) 7: Immunity to ringing signal

A.9.2.1.1 (D) 1 **Measurement of the influence of metering pulses in the communication state**

The measurement of immunity to metering pulses is carried out with the measuring arrangement illustrated in figure A.9.2.1.1 (D) 1 and in the communication state only. The metering pulses are applied from a source via both contacts of a clock generator to line terminals a3 and b3 of feeding bridge B (see Chapter 1, section 1.5 (D) 1). In order to adjust the respective sending level p_S , the feeding bridge is connected to line terminals a1 / b1 and a2 / b2 with a terminating impedance of Z_R , and the sending level measured with a high-impedance receiver ($Z_E \geq 100$ kΩ). The dc resistance is measured during feeding of the metering pulses with the aid of the storage oscilloscope and the measuring resistor of 100 Ω.



$Z_G \approx 0\ \Omega$	$Z_E \geq 100\ \text{k}\Omega$	$C_P = 1\ \mu\text{F}$

Figure A.9.2.1.1 (D) 1

The measurement is carried out with the frequencies 15 920 Hz, 16 000 Hz and 16 080 Hz and with a sending level p_S = +21 dB (950 mV). The source impedance Z_G is approximately 0 Ω. The make and break periods as given in table A.9.2.1.1 (D) 1 are adjusted by means of the clock generator.

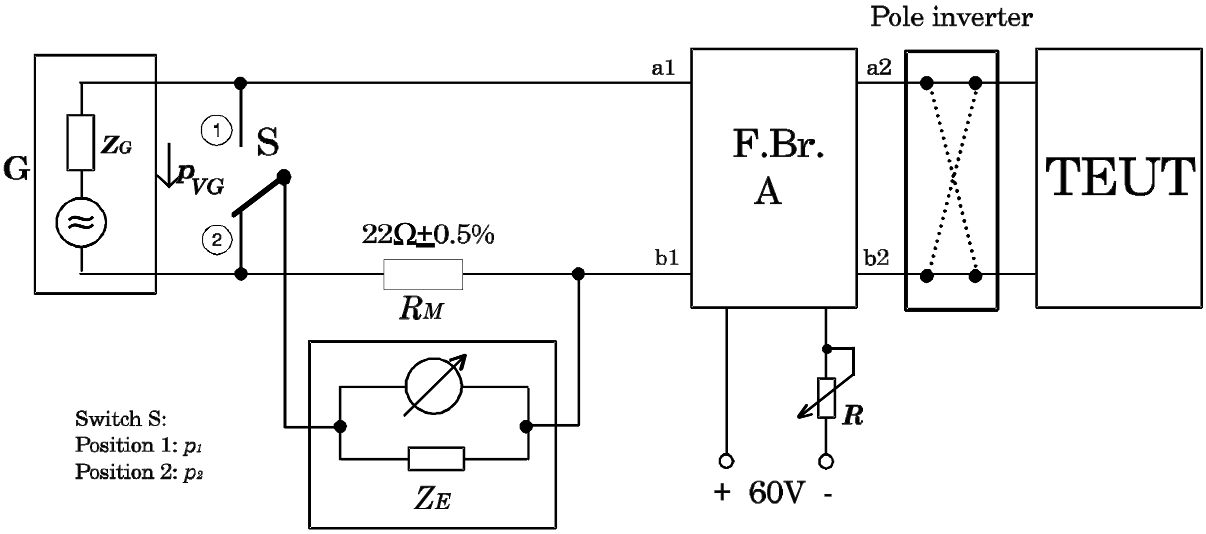
Table A.9.2.1.1 (D) 1

Make	Break
1 000 ms	1 000 ms

The terminal equipment (TEUT) shall not leave the communication state during feeding of the metering pulses. This is monitored by measuring the direct current. Levels shall not deviate from the permissible range as shown in Appendix 1 for "$I \geq 20$ mA" for periods longer than those specified in Chapter 10, section 10.2 (D) 1.5.

Measurement of the impedance for metering pulses

The measuring circuit illustrated in figure A.9.2.1.1 (D) 2 is used in order to measure the impedance of the terminal equipment (TEUT) for metering pulses.



R = 0 Ω and 1 460 Ω	$Z_G \approx 0\ \Omega$	$Z_E \geq 25\ k\Omega$

Figure A.9.2.1.1 (D) 2

The direct current of the TEUT is supplied via feeding bridge A (see Chapter 1, section 1.5 (D) 1) at the nominal voltage 60 V with R = 0 Ω and 1 460 Ω.

The measurements are carried out during outgoing calls in the absence of wanted signals with the TEUT in the communication state.

For the purposes of this measurement, the metering signal is fed by the generator (low-impedance, balanced and earth-free output port) as a continuous signal at the frequencies 15,92 kHz, 16 kHz and 16,08 kHz and monitored as the voltage level p_1 with a (selective) measuring receiver (high-impedance, balanced and earth-free input port) connected in parallel to the terminal equipment (TEUT) with switch S in position 1:

with R = 0 Ω where p_1 = +21 dB (950 mV),

with R = 1 460 Ω where p_1 = -23 dB (950 mV).

The voltage level p_2 is subsequently measured in each case at the resistor R_M = 22 Ω, with switch S in position 2.

The required value $Z \geq 220\ \Omega$ is met where the requirement:

$p_2 \leq p_1$ - 20 dB

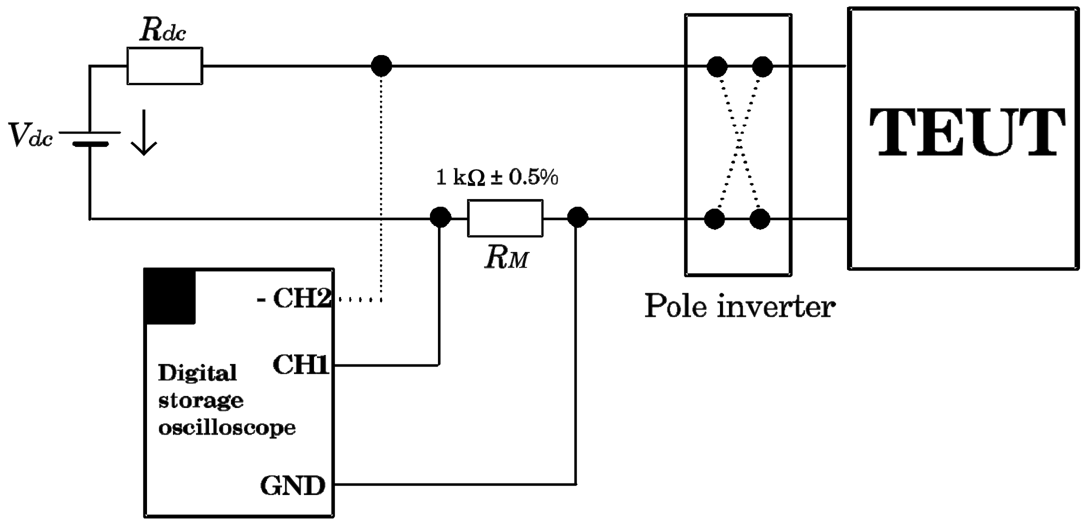
is fulfilled.

This value shall also be monitored after interruption to the feeding current in the TEUT for the period required to reach the dc resistance, as calculated in accordance with A.9.2.1.1 (D) 1 (the following measurement), and subsequently for the same period of time extended by 1,4 s.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

Measurement of the dc resistance during the transition from the communication state to the quiescent state

The measuring circuit illustrated in figure A.9.2.1.1 (D) 3 is used for the measurement.



V_{dc} = 63 V

Figure A.9.2.1.1 (D) 3

The dc resistance of a terminal (TEUT) during the transition from the communication state to the quiescent state is recorded by means of a system multimeter or a digital oscilloscope capable of transferring data for further processing.

Measurement "c" commences with a resistance R_{dc} as given in table A.9.2.1.1 (D) 2 for measurement "a" or "b" and shall be increased during the measurement to R_{dc} as given for measurement "c". The voltage V_M (CH1), which shall correspond to the value specified for measurement "c" in table A.9.2.1.1 (D) 2, is subsequently recorded.

The measurement commences in all three cases (measurements "a", "b" and "c") with the variation in the loop current in the TEUT. The voltage level V_M is determined at R_M using a digital voltmeter. The dc resistance of the TEUT is $R_{TEUT} \geq 1$ MΩ, where V_M meets the corresponding value given in table A.9.2.1.1 (D) 2 for measurements "a" , "b" and "c". These values shall be reached at the latest 1s after the variation in the loop current.

Table A.9.2.1.1 (D) 2

Measurement	R_{dc}	V_M (CH1)
a	0 Ω	≤ 63 mV
b	1 200 Ω	≤ 63 mV
c	30 kΩ	≤ 63 mV

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

A.9.2.1.1 (H) 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 = 10 - 14 kHz and the voltage range e = 5 000 mV...50 mV.

A.9.2.1.1 (I) 1 See 9.2.1.1.a (I) 1.

A.9.2.1.1 (N) 1 See 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) = 10 000, 10 750, 11 250, 11 500, 11 750, 12, 12 250, 12 500, 12 750, 13 250, 14 000
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 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 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 also 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 any 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
	1 000 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 two curves e = f(f) for high and low sensitivity.

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 shall 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	200	220	30	not spec.	
Bulgaria	50	300	100	30	5	
Cyprus	80	300	100	30	20	
Denmark	not mandatory					
Finland	100	300	100	not spec.	not spec.	
France	75	130	75	30	20	
Germany						yes
Greece	50		90	30		
Hungary	50	> 50	50	15	5	
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	70	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 (D) 1 See Chapter 1, section 1.7.8 (D) 1 and Chapter 9, section 9.2.1 (D).

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	
Bulgaria	100	50, 100, 300	100	60	1 000, 2 200	
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						
Greece	10	60	90	60		20, 35
Hungary	50	50	350	48		20, $I_{max.}$
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, 52	1 880, 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			25
Switzerland	10	55	90	50	2 300	
U. Kingdom	not mandatory					

Table A.9.2.1.2.a (continued): Timing, paragraph a

COUNTRY	TEST VALUES			
	f_1 (kHz) e_1 (mV)	f_2 (kHz) e_2 (mV)	f_i (kHz) e_i (mV)	f_n (kHz) e_n (mV)
Austria				
Belgium	16/250			
Bulgaria	15,84/97	15,84/6 000	16,16/6 000	16,16/97
Cyprus	16/100			
Denmark	not mandatory			
Finland	16/130	16/8 500		
France	12/105	12/4 000		
Germany				
Greece	15,840/97	15,840/6 000	16,16/6 000	16,16/97
Hungary	12/87	12/4 900		
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	15,84/90	16,16/90		
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	
Belgium	not mandatory				yes
Bulgaria	16	6 000	300	5	
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France	12	4 000	400	20	yes
Germany					
Greece					
Hungary	12	87	150	5	
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	
Portugal	12	4 400	250	20	
Spain	not mandatory				yes
Sweden	12	5,5, 17,4	130	40	yes
Switzerland	12	2 000	140	20	
U. Kingdom	not mandatory				

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: Vf = 46/54 V; R_f = 1 400/300 ohms.

A.9.2.1.2.a (I) 1 See 9.2.1.1.a (I) 1.

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 (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
Bulgaria	40	16		6 000	
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					
Greece	43	15,840	16,160	6 000	97
Hungary	40	11,928	12,072	1 550	
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			not mandatory		
Portugal			not mandatory		
Spain	36	12	N/A	3 000	N/A
Sweden	53	11,9	12,1		447
Switzerland	35	11,88	12,12	110	1 200
U. Kingdom			not mandatory		

Table 9.2.1.3 (continued): 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 - $I_{max.}$	
Bulgaria	0	200	60	1 000, 2 200		
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						
Greece	200	200	44 - 66		20 - 80	
Hungary	200	200	48		20 - $I_{max.}$	
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	not mandatory					
Portugal	not mandatory					
Spain	200	200	48	500 - 2 200	N/A	yes
Sweden	200	200				yes
Switzerland	200	200	43 - 57	2 200 - 600		
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 ohms - 1 400 ohms.

9.2.1.3 (I) 1 See figure 9.2.1.4 (I) 1.

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.

9.2.1.3 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.

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:

$$a = 20 \log_{10} \left[\frac{U1}{U2} \right] \text{(dB)} \qquad \text{Formula A.9.2.1.3}$$

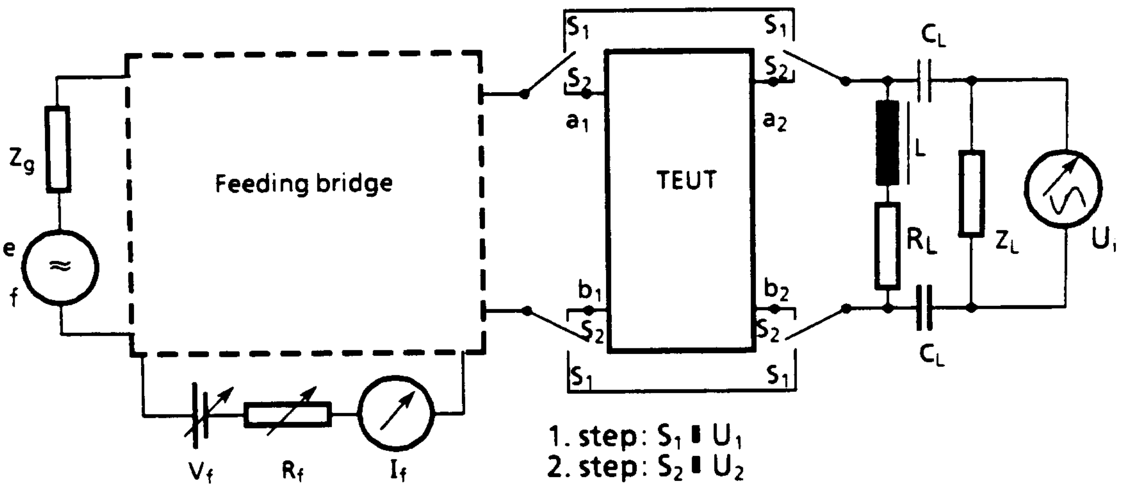


Figure A.9.2.1.3: Attenuation at meter pulses for series-connected TE

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 (µF)	L (H)
Austria	11,928, 12,072	5 000	10	5
Belgium	16	250	20	5
Bulgaria	16	6 000	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				
Greece	16	775		
Hungary	11,928; 12; 12,072	1 550	≥ 10	≥ 5
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	not mandatory			
Portugal	not mandatory			
Spain	12	3 000	≥ 20	≥ 10
Sweden	12	500	≥ 10	≥ 2
Switzerland	11,88, 12,12	1 200	≥ 47	≥ 5
U. Kingdom	not mandatory			

Table A.9.2.1.3 (continued): 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	500	60		19,60	
Belgium	300	48	400, 1 600		
Bulgaria	300	60	1 000, 2 200		
Cyprus	300	48	800		
Denmark	not mandatory				
Finland	400	48	800, 1 710		
France		48	300	25, 60	yes
Germany					
Greece					
Hungary	400	48			
Iceland	600	48		14, $I_{max.}$	
Ireland	not mandatory				
Italy	200	44, 52	1 880, 720		
Luxembourg	600	60		19, 60	
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	300	48	500, 1 100, 2 200	N/A	yes
Sweden				25	
Switzerland	200	50	1 000		
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.

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:

$$a = 20 \log_{10} \left| \frac{Z_i + Z_r}{Z_i - Z_r} \right| \text{ dB} \qquad \text{Formula 9.2.1.4}$$

where both impedances are complex values.

The requirements shall be met with terminating impedances Z_G (Ω), Z_L (Ω) and with feeding values V_f, R_f, I_f as specified in table 9.2.1.4.

The requirements shall be met with presence and absence of loop current.

Compliance shall be checked by the tests outlined in section A.9.2.1.4.

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				
Bulgaria	16	15,84	16,16	200	775
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France		11,88	12,12	200	
Germany	not mandatory				
Greece					
Hungary	16	11,88	12,12	200	
Iceland	12	11,88	12,12	200	
Ireland	not mandatory				
Italy	14	11,925	12,080	240	
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
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 (continued): 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	yes
Belgium	not mandatory						
Bulgaria		60	1 000, 2 200		200	200	
Cyprus	not mandatory						
Denmark	not mandatory						
Finland							yes
France		48		25 - 60	0	600	yes
Germany	not mandatory						
Greece							
Hungary		48		20 - $I_{max.}$	200	200	
Iceland		48		14 - 70	200	200	
Ireland							
Italy	80	44 - 52	720 - 1 880		0	see fig. 9.2.1.4 (I) 1	yes
Luxembourg	not mandatory						
Malta							
Netherlands							
Norway	not mandatory						
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 (A) 1 Not mandatory, but recommended.

9.2.1.4 (SF) 1 The absolute value of the input impedance of the call charge meter terminated with a resistance of 200 Ω at the subscriber terminals and measured at the line terminals shall be 140 Ω...300 Ω.

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 Ω - 1 400 Ω.

9.2.1.4 (I) 1

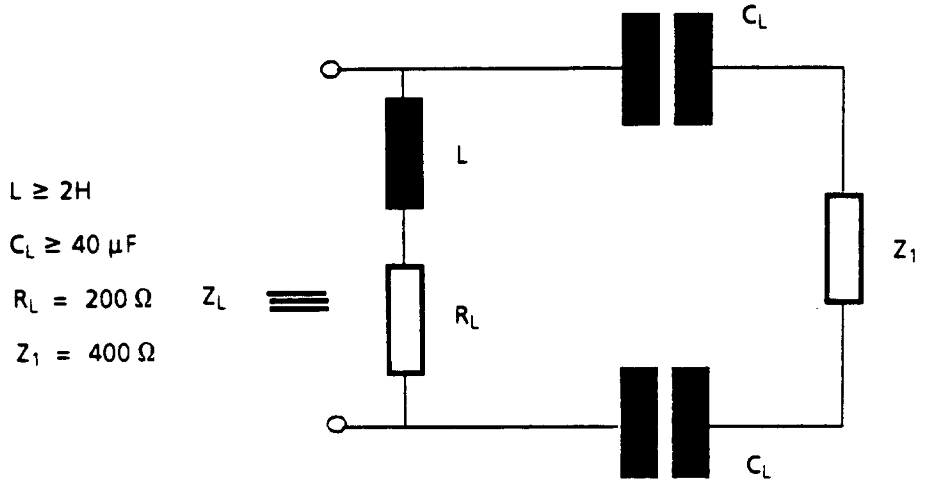


Figure 9.2.1.4 (I) 1

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.9.2.1.4 (E) 2.

9.2.1.4 (S) 1 Feeding conditions, see Chapter 1, section 1.5.2.

9.2.1.4 (CH) 1 See insertion loss requirements in sections 4.1.1 and 4.1.2 (≤ 4 dB). Impedance recommendation:

Impedance modulus: 600 Ω - 1 200 Ω
Phase angle: +35...-70 Deg
Level: 100 mV - 1 000 mV

A.9.2.1.4 Return loss at meter pulse frequencies

The TEUT is connected as shown in figure A.9.2.1.4.a 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.b 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.

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 A.9.2.1.4:

$$a = 20 \log_{10} \frac{V_{t1}}{2U} \text{ dB} \qquad \text{Formula A.9.2.1.4}$$

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	775		600
Belgium	not mandatory			
Bulgaria	16	775		600
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	11,88, 12, 12,12			
Germany	not mandatory			
Greece				
Hungary	11,88; 12; 12,12			
Iceland	12			
Ireland	not mandatory			
Italy	11,925, 12, 12,080		80	
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
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 (continued): Return loss at meter pulse frequencies

COUNTRY	TEST VALUES V_f (V)	R_f (Ω)	I_f (mA)	Remarks
Austria	60		19, 60	
Belgium		not mandatory		
Bulgaria	60	1 000, 2 200		
Cyprus		not mandatory		
Denmark		not mandatory		
Finland				
France	48		25, 60	yes
Germany		not mandatory		
Greece				
Hungary	48		20, $I_{max.}$	
Iceland	48		14, $I_{max.}$	
Ireland				
Italy	44, 52	1 880, 720		
Luxembourg		not mandatory		
Malta				
Netherlands				
Norway		not mandatory		
Portugal		not mandatory		
Spain	48	500, 1 100, 2 200	N/A	yes
Sweden			25	
Switzerland	50	1 000		
U. Kingdom		not mandatory		

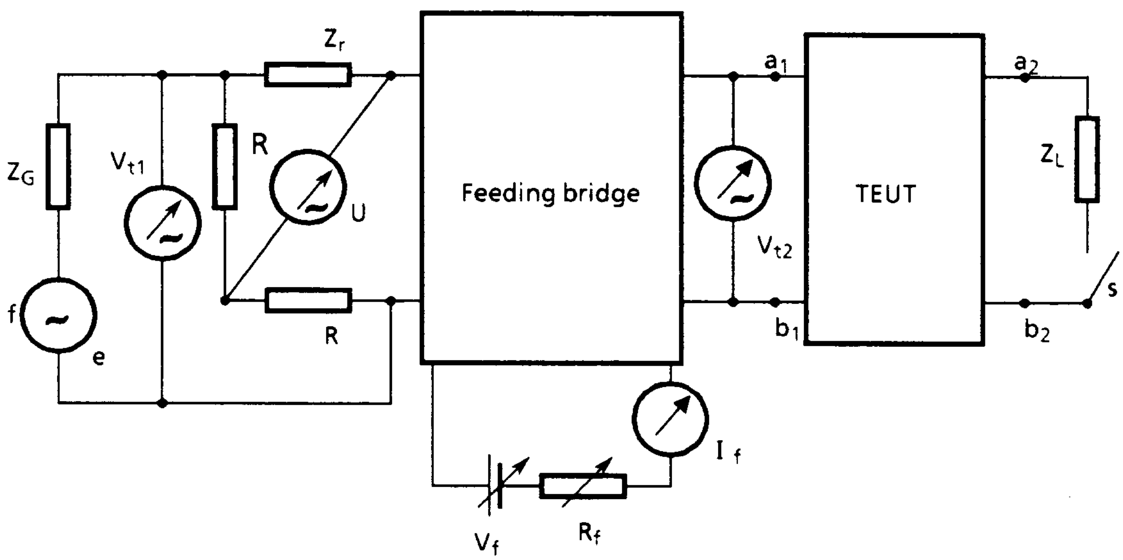


Figure A.9.2.1.4.a: Series connection

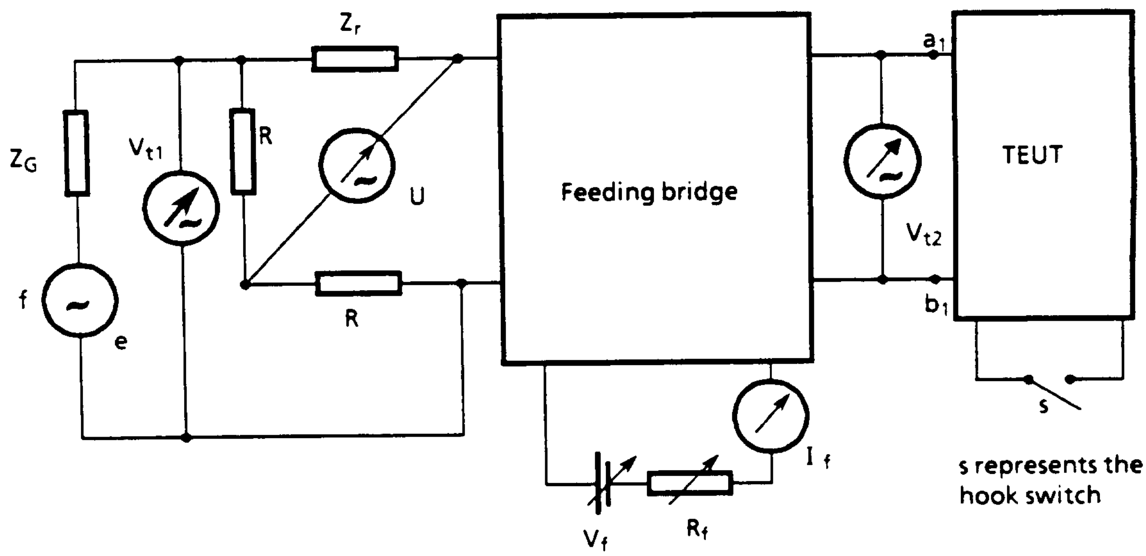


Figure A.9.2.1.4.b: Terminating connection

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 (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 the 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 (± 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 generator open circuit ac rms voltage (e) takes the values stipulated in the associated requirement in section 9.2.1.4 (E) 2, and the generator frequency (f) 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.

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 (kΩ) 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 (kΩ)	f_1 (Hz)	f_2 (Hz)	U (V)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory						
Belgium							
Bulgaria	50 Hz meter pulses not used						
Cyprus	not mandatory						
Denmark	not mandatory						
Finland	not mandatory						
France	8	50	50	100	48	300	25 - 60
Germany	not mandatory						
Greece							
Hungary	not applicable						
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 (continued): Input longitudinal impedance at 50 Hz

COUNTRY	REQUIREMENT VALUES		Remarks
	Z_G (Ω)	Z_L (Ω)	
Austria	not mandatory		
Belgium			
Bulgaria	not mandatory		
Cyprus	not mandatory		
Denmark	not mandatory		
Finland	not mandatory		
France	< 30		yes
Germany	not mandatory		
Greece			
Hungary	not applicable		
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 kΩ in the conditions defined in table 9.2.2.1.

9.2.2.1 (F) 2

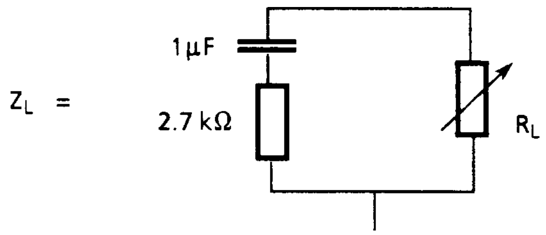


Figure 9.2.2.1 (F) 2: Load impedance at 50 Hz

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 MΩ when a TE without meter pulse reception is tested.

b) The input longitudinal impedance at 50 Hz must be at least 6,7 kΩ 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 kΩ, 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						
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	50	40, 100	48	300	25, 60	
Germany	not mandatory					
Greece						
Hungary						
Iceland						
Ireland						
Italy						
Luxembourg						
Malta						
Netherlands	50	100	48	1 130		
Norway						
Portugal	not mandatory					
Spain						yes
Sweden						
Switzerland						
U. Kingdom						

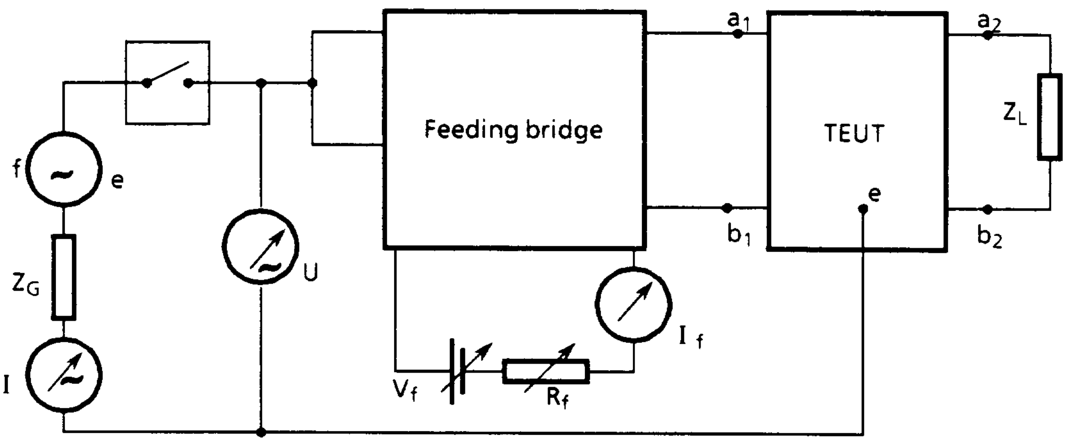


Figure A.9.2.2.1: Input longitudinal impedance at 50 Hz

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 (||Zi||) 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.

$$|Zi| \quad (k\Omega) = \frac{V_1\,(V) + V_2\,(V)}{2 \times I\,(mA)} \qquad \text{Formula A.9.2.2.1 (E) 2}$$

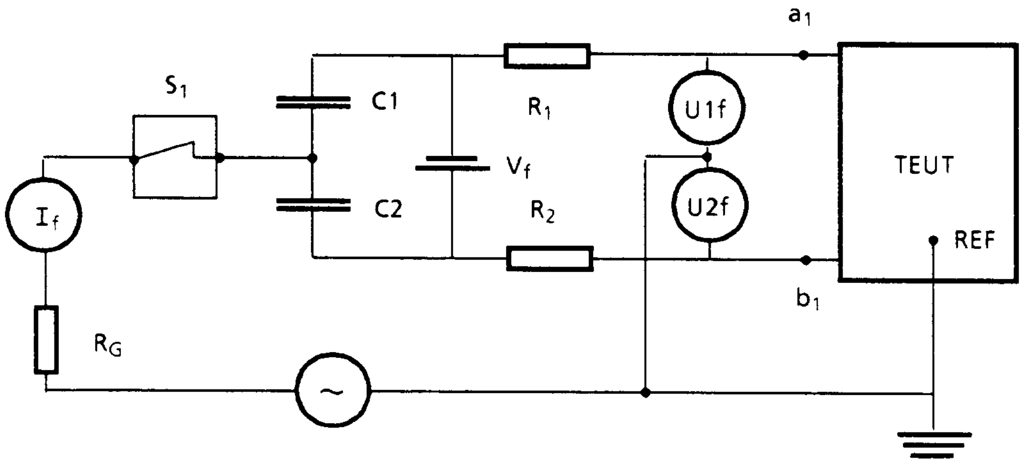


Figure A.9.2.2.1 (E) 2: Impedance between line terminals and the common reference terminal

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), is 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						
Bulgaria	not mandatory					
Cyprus	48	52	30	80	80	300
Denmark	not mandatory					
Finland	not applicable					
France	48	52	36	70	75	400
Germany	not mandatory					
Greece						
Hungary	not applicable					
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 (continued): 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							
Bulgaria	not mandatory						
Cyprus	400		600	48	440 - 1 740		
Denmark	not mandatory						
Finland	not applicable						
France	75			48	300	25 - 60	yes
Germany	not mandatory						
Greece							
Hungary	not applicable						
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						
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	1	50	36	75	75	10
Germany	not mandatory					
Greece						
Hungary						
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 (continued): 50 Hz meter pulse detector sensitivity

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory			
Belgium				
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	48	300	25, 60	yes
Germany	not mandatory			
Greece				
Hungary				
Iceland				
Ireland				
Italy				
Luxembourg	not mandatory			
Malta				
Netherlands	48	1 130		
Norway				
Portugal	not mandatory			
Spain				yes
Sweden				
Switzerland				
U. Kingdom	not mandatory			

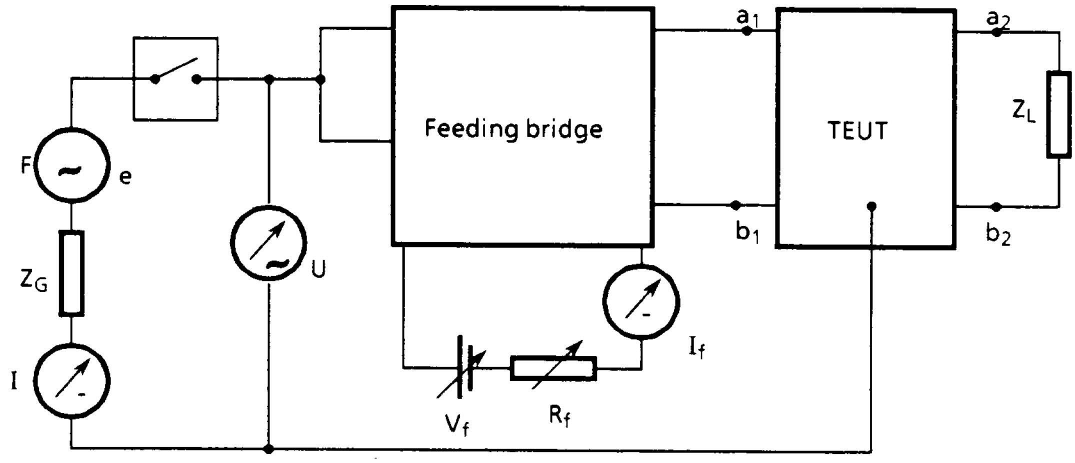


Figure A.9.2.2.2: 50 Hz meter pulse detector sensitivity

A.9.2.2.2 (F) 1 The test is carried out using figure A.9.2.2.2 (F) 1.

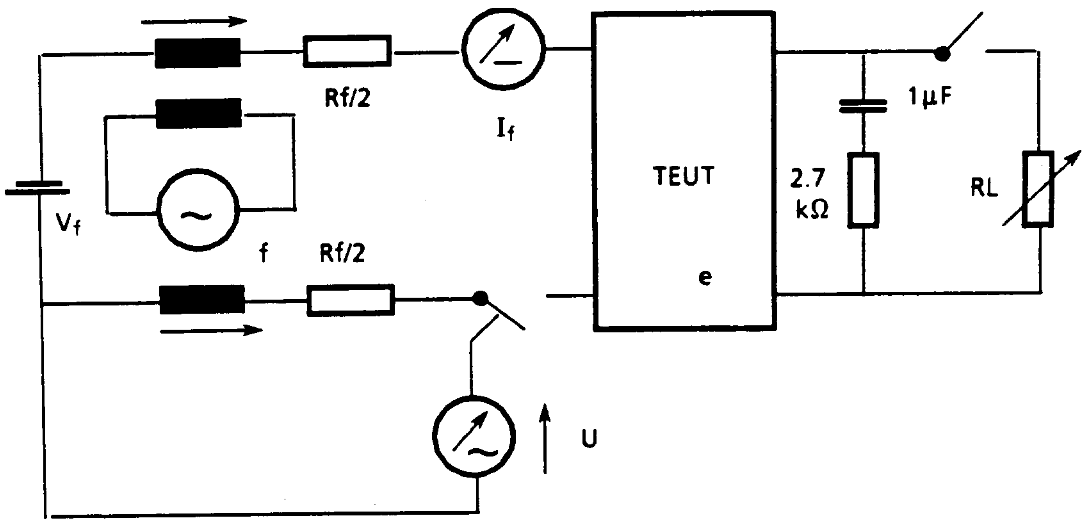


Figure A.9.2.2.2 (F) 1: 50 Hz meter pulse detector sensitivity

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.9.2.2.2 (E) 2 is followed with the signals stipulated in table A.9.2.2.2 (E) 1.

The switch (S_1) 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_l (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					
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France				26	30
Germany	not mandatory				
Greece					
Hungary	not applicable				
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 (continued): 50 Hz meter pulse detector insensitivity

COUNTRY	REQUIREMENT VALUES t_{p2} (ms)	t_i (ms)	V_f (V)	R_f (Ω)	I_f (mA)	Remarks
Austria	not mandatory					
Belgium						
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	75	20	48	300	25 - 60	yes
Germany	not mandatory					
Greece						
Hungary	not applicable					
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 µF, 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 Hz ± 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 V ≤ e ≤ 100 V	f = 50 Hz	≤ 20 ms	≥ 70 ms
ii	e = 25 V	f = 50 Hz	≥ 70 ms	≥ 70 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 kΩ 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					
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany	not mandatory				
Greece					
Hungary					
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 (continued): 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				
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France		48	300	25, 60
Germany	not mandatory			
Greece				
Hungary				
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						
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	1	50	26	400	75	10
Germany	not mandatory					
Greece						
Hungary						
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						
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	2	50	70	30	75	10
Germany	not mandatory					
Greece						
Hungary						
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						
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	3	50	70	400	20	yes
Germany	not mandatory					
Greece						
Hungary						
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 (S_1) 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)	Switch (S_1) Opened (ms)
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 source (V_f) takes the value of 48 V.

The resistor (R_G) takes the value of 200 ohms.

The resistor (R_1) takes the value of 1 kΩ, and the capacitor (C_1) takes the value of 1 µF.

It is not explicitly necessary to undertake the tests for both positions of the switch (S_2).

The generator open circuit ac rms voltage (e), and the generator frequency (f) take the values stipulated in the associated requirement in section 9.2.2.3 (E) 2, where also the sequence for the switch (S_1) is indicated.

The tests shall be done by inspection with the signal indicated, checking that any signal pulse is interpreted as a metering pulse.

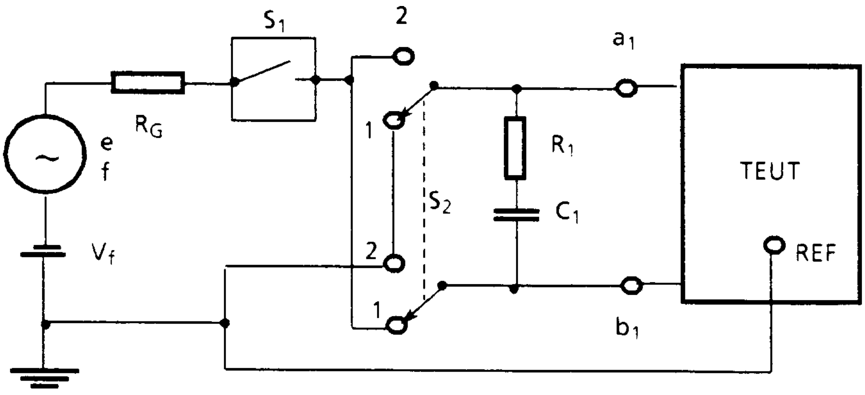


Figure A.9.2.2.3 (E) 2: Ringing signal immunity

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 ± 15 Hz tone for a period of 3,3 ± 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 of 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 at 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 µs.

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	not mandatory						
Belgium	-6	-8	600	48		20 - $I_{max.}$	yes
Bulgaria	not mandatory						
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							yes
Greece							
Hungary	not mandatory						
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 ms ± 20 ms before sending of data commences.

9.3 (B) 2 For digital PBX capable of disabling echo control devices, the value of Z_L is equal to Z_C as defined in section 4.1.2 (B) 1.

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 (D) 1 **Disabling tone**

Where a disabling tone is transmitted by the terminal equipment, it shall meet the following requirements at the NTA:

Table 9.3 (D) 1

Frequency	2 100 Hz ± 15 Hz
Sending level	-9 dB (950 mV) ± 3 dB
Send period	4 s ± 0,7 s

The disabling tone shall implement a periodic phase shift of 180° ± 10° at intervals of 450 ms ± 25 ms. The phase shall be reversed within t ≤ 1 ms so that the amplitude of the disabling tone is 3 dB below the sending level for t ≥ 400 µs.

NOTE: The disabled state is maintained where the wanted signal level within the frequency range 390 Hz ≤ f ≤ 3 kHz is ≥ -28 dB (950 mV). A drop in level to ≤ -32 dB (950 mV) for t ≥ 100 ms causes the equipment in the network to be reactivated.

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 the 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 control devices;

or

b) only echo 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 output tone crosses downward for the first time the limit of the 70% of its steady state value, and the instant that the amplitude of the output tone crosses upward for the last time the limit of the 70% of its steady state value, shall not be greater than 400 µs.

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 Echo control disabling devices are not submitted to requirements specific to their function.

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	not mandatory					
Belgium	0,2	48	400, 1 600		5	
Bulgaria	not mandatory					
Cyprus	0,1	48	800		2	
Denmark	not mandatory					
Finland	not mandatory					
France		46, 54	1 400, 300			
Germany	not mandatory					
Greece						
Hungary	not mandatory					
Iceland						
Ireland	not mandatory					
Italy		48	800			
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	± 0,2	48	500, 1 100, 2 200	N/A	± 0,2 dB	yes
Sweden	not applicable					
Switzerland	0,01	50	1 000		1	
U. Kingdom	not mandatory					

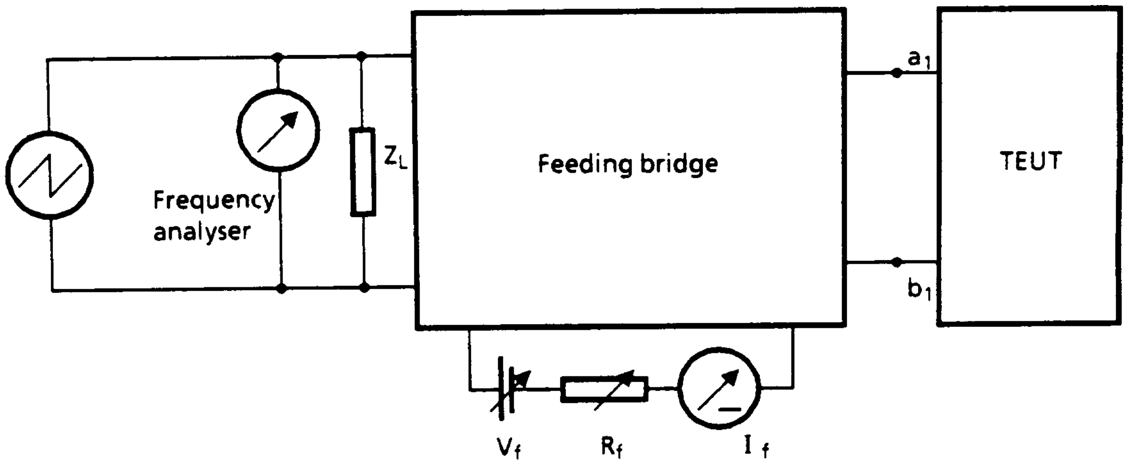


Figure A.9.3: Disabling of echo control devices

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 kΩ.

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 resistor (R_f) takes only the values of 500 ohms and 2 200 ohms. It is assumed that the TEUT would fulfil the associated requirement, if the procedure were repeated when the resistor (Z_L) also takes the values of 400 ohms 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.

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 ohms 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.

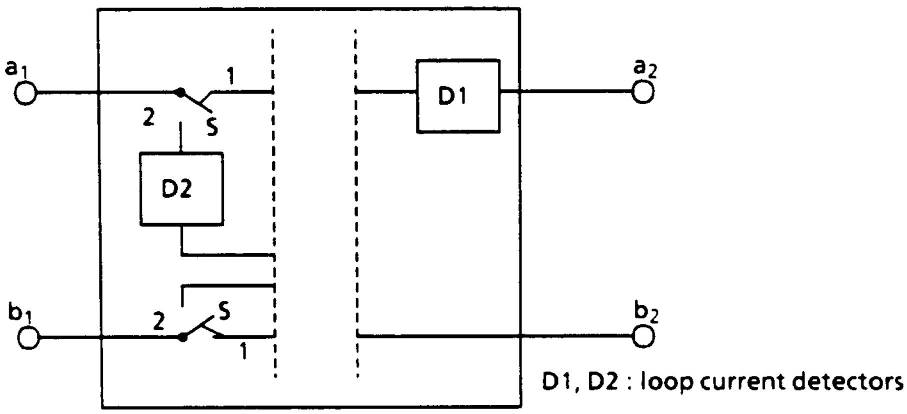


Figure 9.4.a: Loop current detection, type A

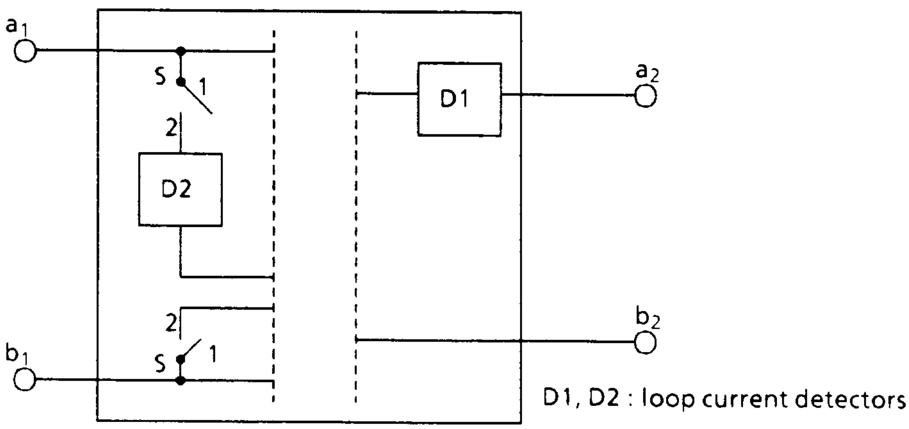


Figure 9.4.b: Loop current detection, type B

9.4 (D) 1 No requirement.

9.4 (CH) 1 Loop current detection, if implemented in a TE, shall fulfil the requirements in sections 6.4.1 (CH) 1 and 6.4.4.

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	not mandatory						
Belgium	not mandatory						
Bulgaria	not mandatory						
Cyprus	not mandatory						
Denmark	not mandatory						
Finland	not mandatory						
France	5						
Germany							
Greece							
Hungary	not mandatory						
Iceland	not mandatory						
Ireland	not mandatory						
Italy	not mandatory						
Luxembourg	not mandatory						
Malta							
Netherlands							
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						yes
Sweden	not mandatory						
Switzerland							
U. Kingdom	not mandatory						

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 the network 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	not mandatory					
Belgium	not mandatory					
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France			48	300		
Germany						
Greece						
Hungary	not mandatory					
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						
U. Kingdom	not mandatory					

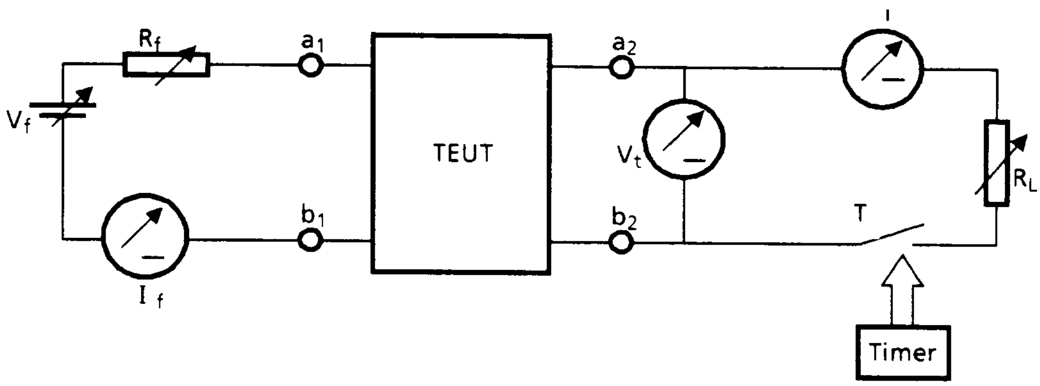


Figure A.9.4.1.1: Loop current detector D1 - Switch S in position 1

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} (kΩ) 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} (kΩ) 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} (kΩ) 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} (kΩ) 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} (kΩ)	R_{L2} (kΩ)	R_{L3} (kΩ)	V_{t1} (V)	V_{t2} (V)	I_{sc} (mA)
Austria	not mandatory					
Belgium	not mandatory					
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland	not mandatory					
France						
Germany						
Greece						
Hungary	not mandatory					
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						
U. Kingdom	not mandatory					

Table 9.4.1.2.1 (continued): 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	not mandatory				
Belgium	not mandatory				
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany					yes
Greece					
Hungary	not mandatory				
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					
U. Kingdom	not mandatory				

9.4.1.2.1 (D) 1 No requirement.

9.4.1.2.1 (D) 2 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) 3 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) 4 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 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	not mandatory					
Belgium	not mandatory					
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France						
Germany						
Greece						
Hungary	not mandatory					
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						
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} (kΩ) 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} (kΩ) 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} (kΩ) 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} (kΩ) 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} (kΩ)	R_{L2} (kΩ)	R_{L3} (kΩ)	V_t (V)
Austria	not mandatory			
Belgium	not mandatory			
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland	not mandatory			
France				
Germany				
Greece				
Hungary	not mandatory			
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				
U. Kingdom	not mandatory			

Table 9.4.1.2.2 (continued): 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	not mandatory				
Belgium	not mandatory				
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany					
Greece					
Hungary	not mandatory				
Iceland	not mandatory				
Ireland	not mandatory				
Italy	not stated				
Luxembourg					
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				yes
Sweden	not mandatory				
Switzerland					
U. Kingdom	not mandatory				

9.4.1.2.2 (E) 1 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 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	not mandatory					
Belgium	not mandatory					
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France						
Germany						
Greece						
Hungary	not mandatory					
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						
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 (kΩ) in series with C (µF) 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	not mandatory		
Belgium	1	4	
Bulgaria	not mandatory		
Cyprus	1	4	
Denmark	not mandatory		
Finland	not mandatory		
France	not mandatory		
Germany	not mandatory		
Greece	1	4	
Hungary	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			
U. Kingdom	not mandatory		

9.4.1.3 (E) 1 See notes 1 and 2 in section 9.4.1.1 (E) 1.

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_f, 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	not mandatory						
Belgium	75	25	48	1 000	3	1	
Bulgaria	not mandatory						
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	
Hungary	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	not mandatory						
Sweden	not mandatory						
Switzerland							
U. Kingdom	not mandatory						

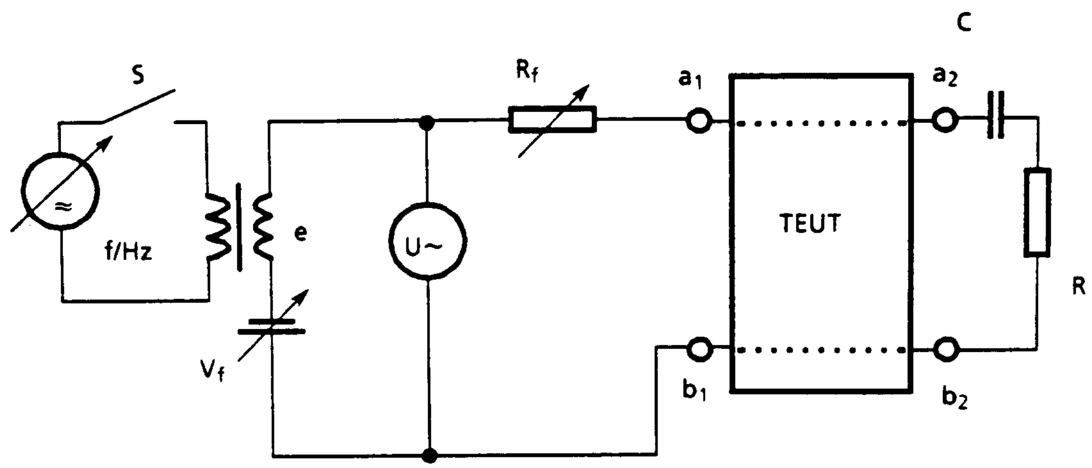


Figure A.9.4.1.3: Series-connected TE loop current detector immunity

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 (kΩ).

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 (kΩ)	
Austria								yes
Belgium	not mandatory							
Bulgaria	not mandatory							
Cyprus	not mandatory							
Denmark	not mandatory							
Finland	not mandatory							
France								
Germany	not mandatory							
Greece								
Hungary	not mandatory							
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								
U. Kingdom	not mandatory							

9.4.2 (A) 1 These requirements are mandatory for TE (one-port TE or series-connected TE) which are assigned for value added services. Value added services are only possible at electronic switching centres (designated as OES).

9.4.2 (A) 2 The loop current detector shall detect loop current interruptions from the PSTN. OES switching centres transmit a disconnect pulse (DC loop current interruption ≥ 200 ms) to the called party 10 s after termination of the call by the remote party. Switching centres of older design do not have this capability (except in special circumstances).

Requirements for the loop current detector:

- a loop current interruption (loop current ≤ 3 mA) with a duration of ≥ 190 ms shall be recognised as disconnect pulse.

- loop current interruptions of duration ≤ 150 ms shall not be recognised as disconnect pulse.

- the TE shall revert from the loop condition to the quiescent condition ≤ 1 s after completion of the disconnect pulse.

9.4.2 (E) 1 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 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 is not activated when the switch T closes for only 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 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

<table>
<tr><th rowspan="2">COUNTRY</th><th colspan="5">TEST VALUES</th><th rowspan="2">Remarks</th></tr>
<tr><th>t_5 (ms)</th><th>t_6 (ms)</th><th>V_f (V)</th><th>R_f (Ω)</th><th>I_f (mA)</th></tr>
<tr><td>Austria</td><td></td><td></td><td>60</td><td></td><td>19, 60</td><td></td></tr>
<tr><td>Belgium</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Bulgaria</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Cyprus</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Denmark</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Finland</td><td colspan="5"></td><td></td></tr>
<tr><td>France</td><td colspan="5"></td><td></td></tr>
<tr><td>Germany</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Greece</td><td colspan="5"></td><td></td></tr>
<tr><td>Hungary</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Iceland</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Ireland</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Italy</td><td colspan="5">not stated</td><td></td></tr>
<tr><td>Luxembourg</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Malta</td><td colspan="5"></td><td></td></tr>
<tr><td>Netherlands</td><td colspan="5"></td><td></td></tr>
<tr><td>Norway</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Portugal</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Spain</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Sweden</td><td colspan="5">not mandatory</td><td></td></tr>
<tr><td>Switzerland</td><td colspan="5"></td><td></td></tr>
<tr><td>U. Kingdom</td><td colspan="5">not mandatory</td><td></td></tr>
</table>

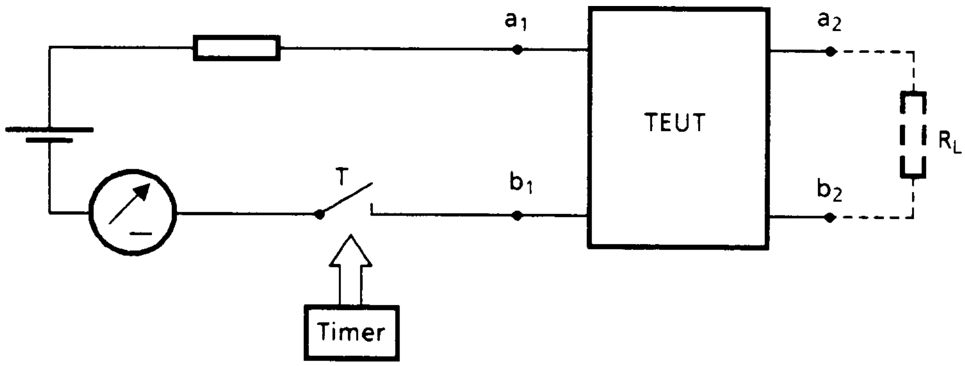


Figure A.9.4.2: Loop current detector D2

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 (D) 1 See Chapter 1, sections 1.7.1 (D) 1, 1.7.3 (D) 1, 1.7.4 (D) 1, 1.7.7 (D) 1 and chapter 6, section 6.4.3 (D) 1.

9.5 (I) 1 The requirements in this section do not apply to answering machine, see Chapter 6, section 6.4.3.

9.5 (CH) 1 Recognition of the Public Network tone signals, if implemented in a TE, shall fulfil the requirements in Chapter 5, section 5.2.

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	not mandatory				
Belgium					
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France	425, 315	455, 345	-27	-10	600
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	410	440	-25	-6	600
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	400	450	-30	-5	600
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table 9.5.2.1 (continued): Special dial tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium				
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	600	46 - 54	300 - 1 400	
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	600	44, 52	720, 1 880	
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	600	45 - 55	400 - 1 800	not applic.
Spain	not mandatory			
Sweden				
Switzerland				
U. Kingdom	not mandatory			

Table 9.5.2.1 (continued): 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	not mandatory						
Belgium							
Bulgaria	not mandatory						
Cyprus	not mandatory						
Denmark	not mandatory						
Finland							
France	continuous				2	3	yes
Germany	not mandatory						
Greece							
Hungary	not mandatory						
Iceland							yes
Ireland	not mandatory						
Italy	∞	∞	0	0	2	4	yes
Luxembourg	not mandatory						
Malta							
Netherlands							yes
Norway	not mandatory						
Portugal	800	1 200	160	240	3		yes
Spain	not mandatory						yes
Sweden							yes
Switzerland							
U. Kingdom	not mandatory						

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 ± 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 (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 Chapter 1, section 1.7.7 (E) 1.2.

NOTE 3: Particular attention should be paid to the requirements in Chapter 5, sections 5.2 (E) and 10.5 (E) 4.

9.5.2.1 (S) 1 Special dial tone characteristics are:

Frequency : 425 Hz ± 15 Hz
Nominal value : -10 dBm
Cadence : 320 ms tone, 10 ms - 40 ms pause with 10% tolerance.

For special dial tone detection requirements, see Chapter 5, section 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 of the 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	not mandatory				
Belgium					
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	1	440, 330	-27	continuous	
Germany					
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	3	410, 440	-25, -15,-6		
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal		400, 450	-30	800, 1 200	160, 240
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.2.1 (continued): Special dial tone detector sensitivity

COUNTRY	TEST VALUES				Remarks
	t_{d1} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory				
Belgium					
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	2	48	600		yes
Germany					
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	2	44, 52	1 880, 720		yes
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	3	48	400, 1 800	not applicable	
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

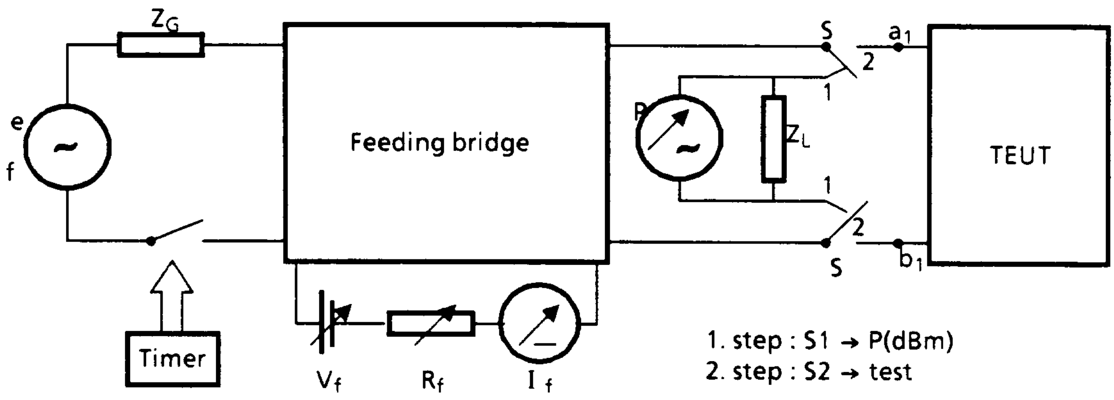


Figure A.9.5.2.1: Special dial tone detector sensitivity

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.

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 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 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					
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France	250	600	-10	-50	
Germany	not mandatory				
Greece					
Hungary	not mandatory				
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					
U. Kingdom	not mandatory				

Table 9.5.2.2 (continued): Special dial tone detector insensitivity

COUNTRY	REQUIREMENT VALUES			
	t_{on4} (ms)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium				
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France		46 - 54	300 - 1 400	
Germany	not mandatory			
Greece				
Hungary	not mandatory			
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				
U. Kingdom	not mandatory			

Table 9.5.2.2 (continued): Special dial tone detector insensitivity

COUNTRY	REQUIREMENT VALUES			Remarks
	t_{off3} (ms)	t_{off4} (ms)	t_{d2} (s)	
Austria	not mandatory			
Belgium				
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France			1	yes
Germany	not mandatory			
Greece				
Hungary	not mandatory			
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				
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 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					
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	1	250	-10	continuous	
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	2	350, 550	-6	continuous	
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal		159	-1	1 000	200
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.2.2.a (continued): 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				
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	6	48	600	
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	2	44, 52	1 880, 720	
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	10	48	400, 1 800	not applic.
Spain	not mandatory			
Sweden				
Switzerland				
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						
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	2	330, 440	-50	continuous		6
Germany	not mandatory					
Greece						
Hungary	not mandatory					
Iceland						
Ireland	not mandatory					
Italy	1	425	-48	continuous		
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal		425	-46	1 000	200	10
Spain	not mandatory					
Sweden						
Switzerland						
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						
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	3	440	-10	500	500	6
Germany	not mandatory					
Greece						
Hungary	not mandatory					
Iceland						
Ireland	not mandatory					
Italy						
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal		425	0	590	250	10
Spain	not mandatory					
Sweden						
Switzerland						
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							
Bulgaria	not mandatory						
Cyprus	not mandatory						
Denmark	not mandatory						
Finland							
France	4	440, 330	-10	continuous		1	yes
Germany	not mandatory						
Greece							
Hungary	not mandatory						
Iceland							
Ireland	not mandatory						
Italy	1	425	-6	continuous		2	yes
Luxembourg	not mandatory						
Malta							
Netherlands							
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						
Sweden							
Switzerland							
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	not mandatory				
Belgium	415	460	-37	-3	600
Bulgaria	not mandatory				
Cyprus	400	450	-30	-10	600
Denmark	not mandatory				
Finland	375	475	-20	-14	600
France	425	455	-40	-10	600
Germany					
Greece					
Hungary	375	475	-38	-5	600
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	-6	-30	600
Portugal	300	450	-30	-5	600
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	see remark				

Table 9.5.3.1 (continued): Busy tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	600	48		20 - $I_{max.}$
Bulgaria	not mandatory			
Cyprus	600	48	440 - 1 740	
Denmark	not mandatory			
Finland	600	44 - 58	800 - 1 710	
France	600	46 - 54	300 - 1 400	
Germany				
Greece				
Hungary	600	48		20 - $I_{max.}$
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				
U. Kingdom	see remark			

Table 9.5.3.1 (continued): 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	not mandatory						
Belgium	450	550	450	550	2,5	5	yes
Bulgaria	not mandatory						
Cyprus	450	550	450	550	3	0	
Denmark	not mandatory						
Finland							
France	450	550	450	550	3		
Germany							yes
Greece							
Hungary	240	500	240	500	not spec.	not spec.	
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	600	600	400			
Norway	200	600	200	600	not spec.	20	
Portugal	400	600	400	600	20		yes
Spain	not mandatory						yes
Sweden							yes
Switzerland							
U. Kingdom	see remark						yes

9.5.3.1 (B) 1 For digital PBX capable of detecting a busy tone, the values of Z_G and Z_L are equal to Z_C as defined in Chapter 4, section 4.2.1 (B) 1.

9.5.3.1 (D) 1 See Chapter 1, section 1.7.3 (D) 1 and Chapter 6, section 6.4.3 (D) 1.

9.5.3.1 (IS) 1 Busy tone detection is not mandatory.

Busy tone characteristics are:

Frequency : 425 Hz ± 25 Hz
Nominal value : -10 dBm
Cadence : 250 ms tone, 250 ms pause with 10% tolerance.

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 Chapter 1, section 1.7.3 (E) 1.

NOTE 3: Particular attention should be paid to the requirements in Chapter 10, 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 Hz ± 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 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 table A.9.5.3.1, a check shall 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	not mandatory				
Belgium	1 2 3 4	415 415 460 460	-37 -37 -37 -37	450 550 450 550	450 550 450 550
Bulgaria	not mandatory				
Cyprus	1	425	-30	500	500
Denmark	not mandatory				
Finland		375, 425, 475	-20		
France	1	440	-40	500	500
Germany					
Greece					
Hungary		425	-38, -5	240, 500	240, 500
Iceland					
Ireland	1	425	-12	500	500
Italy	3	410, 440	-43, -6	500	500
Luxembourg		380, 520	-43, -6,5		
Malta					
Netherlands	18	340, 425, 550	-25,7, -3,8	400, 500	600, 500
Norway		425	-30	200, 600	200, 600
Portugal		300, 450	-30	400, 600	400, 600
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.3.1 (continued): Busy tone detector sensitivity

COUNTRY	TEST VALUES				Remarks
	t_{d1} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory				
Belgium	2,5	48	400		
Bulgaria	not mandatory				
Cyprus	10	48	800		
Denmark	not mandatory				
Finland	not spec.	48	800, 1 710		yes
France	10	48	600		yes
Germany					
Greece					
Hungary	48			20 - $I_{max.}$	
Iceland					
Ireland	not specified	48		20 - 80	
Italy	2	48	1 100		
Luxembourg		60		19, 60	
Malta					
Netherlands		48	1 130		
Norway	not specified	60	3 100		
Portugal	20	48	300, 1 800	not applic.	
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

A.9.5.3.1 (SF) 1 The test set-up is given in figure A.9.5.3.1 (SF) 1.

The test is made with the nominal duration of the signal and pause and with the maximum and minimum duration of the signal and pause.

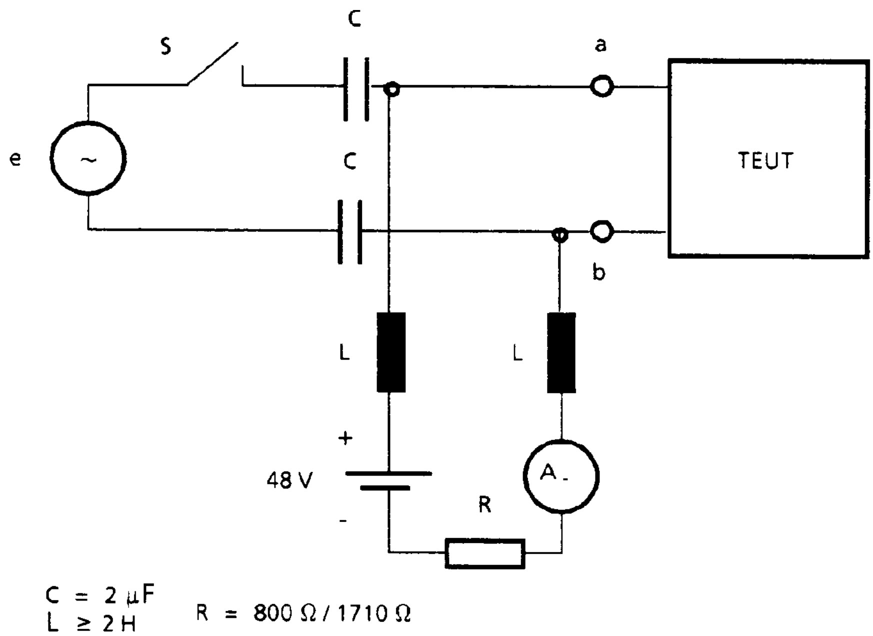


Figure A.9.5.3.1 (SF) 1

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

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 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 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	160	700	-3	-45	400	600
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland	not mandatory					
France	250	600	-10	-50		
Germany	not mandatory					
Greece						
Hungary	not mandatory					
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						
U. Kingdom	not mandatory					

Table 9.5.3.2 (continued): 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	0,55	48		20 - $I_{max.}$	
Bulgaria	not mandatory						
Cyprus	not mandatory						
Denmark	not mandatory						
Finland							
France			3	46 - 54	300 - 1 400		yes
Germany	not mandatory						
Greece							
Hungary	not mandatory						
Iceland							
Ireland	not mandatory						
Italy	not mandatory						
Luxembourg	not mandatory						
Malta							
Netherlands				42 - 66	800 - 2 140		
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						yes
Sweden							
Switzerland							
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 (E) 1 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 shall 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	1 2	160 700	-3 -3	500 500	500 500
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	1	250	-10	500	500
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.3.2.a (continued): 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	20	48	400	
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland				
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	1 2	425 450	-45 -45	500 500	500 500
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	2	440	-50	500	500
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands	3	340, 425, 550	-31,8	500	500
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.3.2.b (continued): 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	20	48	400	
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Hungary	not mandatory			
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				
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	1 2 3 4	425 425 450 450	-3 -3 -3 -3	400 600 400 600	400 600 400 600
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	3	440	-10	continuous	
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.3.2.c (continued): 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	20	48	400	
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland				
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	1 2	425 450	-3 -3	500 500	500 500
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	4	440	-10	500	500
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.3.2.d (continued): 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	0,55	48	400		
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	3	48	600		yes
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
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

9.5.4 Congestion 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	not mandatory				
Belgium	415	460	-37	-3	600
Bulgaria	not mandatory				
Cyprus	400	450	-30	-10	600
Denmark	not mandatory				
Finland	not mandatory				
France	identical to busy tone				
Germany					
Greece					
Hungary					
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	-6	-30	600
Portugal	300	450	-30	-5	600
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table 9.5.4.1 (continued): Congestion tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	600	48		20 - $I_{max.}$
Bulgaria	not mandatory			
Cyprus	600	48	440 - 1 740	
Denmark	not mandatory			
Finland				
France	identical to busy tone			
Germany				
Greece				
Hungary				
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				
U. Kingdom	not mandatory			

Table 9.5.4.1 (continued): 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	not mandatory						
Belgium	155	179	155	179	1	5	yes
Bulgaria	not mandatory						
Cyprus	225	275	225	275	3	10	
Denmark	not mandatory						
Finland							
France	identical to busy tone						
Germany							
Greece							
Hungary							yes
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			
Norway	200	600	200	600	not spec.	20	
Portugal	160	240	160	240	20		yes
Spain	not mandatory						yes
Sweden							yes
Switzerland							
U. Kingdom	not mandatory						yes

9.5.4.1 (B) 1 For digital PBX capable of detecting a busy tone, the values of Z_G and Z_L are equal to Z_C as defined in section 4.2.1 (B) 1.

9.5.4.1 (H) 1 For the congestion tone requirements, see section 9.5.3.

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 Chapter 1, section 1.7.4 (E) 1.

NOTE 3: Particular attention should be paid to the requirements in Chapter 10, 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 Hz ± 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	not mandatory				
Belgium	1 2 3 4	415 415 460 460	-37 -37 -37 -37	155 179 155 179	155 179 155 179
Bulgaria	not mandatory				
Cyprus	1	450	-30	250	250
Denmark	not mandatory				
Finland					
France	identical to busy tone				
Germany					
Greece					
Hungary					
Iceland	identical to busy tone				
Ireland	not mandatory				
Italy	3	410, 440	-43, -6	200	200
Luxembourg		380, 520	-43, -6,5	240	240
Malta					
Netherlands	18	340, 425, 550	-25,7, -3,8	180, 250 330	330, 250 180
Norway		425	-30	200 600	200 600
Portugal		300, 450	-30	160, 240	160, 240
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.4.1 (continued): Congestion tone detector sensitivity

COUNTRY	TEST VALUES				Remarks
	t_{d1} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory				
Belgium	1	48	400		
Bulgaria	not mandatory				
Cyprus	10	48	440 - 1 740		
Denmark	not mandatory				
Finland					
France	identical to busy tone				
Germany					
Greece					
Hungary					yes
Iceland					
Ireland	not mandatory				
Italy	2	48	1 100		
Luxembourg		60		19, 60	
Malta					
Netherlands		48	1 130		
Norway	not specified	60	3 100		
Portugal	20	48	300, 1 800	not applic.	
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

A.9.5.4.1 (H) 1 See section A.9.5.3.

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 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 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	160	700	-3	-45	143	191
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland	not mandatory					
France	identical to busy tone					
Germany	not mandatory					
Greece						
Hungary	not mandatory					
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						
U. Kingdom	not mandatory					

Table 9.5.4.2 (continued): 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	0,179	48		20 - $I_{max.}$	
Bulgaria	not mandatory						
Cyprus	not mandatory						
Denmark	not mandatory						
Finland	not mandatory						
France	identical to busy tone						
Germany	not mandatory						
Greece							
Hungary	not mandatory						
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		
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						yes
Sweden							
Switzerland							
U. Kingdom	not mandatory						

9.5.4.2 (E) 1 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 tables 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	1 2	160 700	-3 -3	167 167	167 167
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	identical to busy tone				
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.4.2.a (continued): Congestion 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	20	48	400	
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	identical to busy tone			
Germany	not mandatory			
Greece				
Hungary	not mandatory			
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				
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	1 2	425 450	-45 -45	167 167	167 167	20 20
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	identical to busy tone					
Germany	not mandatory					
Greece						
Hungary	not mandatory					
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						
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	1 2 3 4	425 425 450 450	-3 -3 -3 -3	143 191 143 191	143 191 143 191	20 20 20 20
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France	identical to busy tone					
Germany	not mandatory					
Greece						
Hungary	not mandatory					
Iceland						
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden						
Switzerland						
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	1 2	425 450	-3 -3	167 167	167 167	0,179 0,179	
Bulgaria	not mandatory						
Cyprus	not mandatory						
Denmark	not mandatory						
Finland							
France	identical to busy tone						
Germany	not mandatory						
Greece							
Hungary	not mandatory						
Iceland							
Ireland	not mandatory						
Italy	not mandatory						
Luxembourg	not mandatory						
Malta							
Netherlands							
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						
Sweden							
Switzerland							
U. Kingdom	not mandatory						

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	not mandatory				
Belgium	415	460	-37	-3	600
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France	425	455	-40	-10	600
Germany					
Greece					
Hungary	375	475	-38	-5	600
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					
U. Kingdom	not mandatory				

Table 9.5.5.1 (continued): Ringing tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	Z_L (Ω)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	600	48		20 - $I_{max.}$
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland	not mandatory			
France	600	46 - 54	300 - 1 400	
Germany				
Greece				
Hungary	600	48		20 - $I_{max.}$
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				
U. Kingdom	not mandatory			

Table 9.5.5.1 (continued): 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	not mandatory						
Belgium	900	1 100	2 900	3 100	10	60	yes
Bulgaria	not mandatory						
Cyprus	not mandatory						
Denmark	not mandatory						
Finland	not mandatory						
France	1 350	1 650	3 150	3 850	10		yes
Germany							yes
Greece							
Hungary	1 000	1 500	3 000	4 500			
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							
U. Kingdom	not mandatory						yes

9.5.5.1 (B) 1 For digital PBX capable of detecting a ringing tone, the values of Z_G and Z_L are equal to Z_C as defined in section 4.1.2 (B) 1.

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 See Chapter 1, section 1.7.2 (D) 1 and Chapter 6, section 6.4.3 (D) 1.

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 1.7.2 (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.

Ringing 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 the 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	not mandatory				
Belgium	1	415	-37	900	2 900
	2	415	-37	1 100	3 100
	3	460	-37	900	2 900
	4	460	-37	1 100	3 100
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	1	440	-40	1 500	3 500
Germany					
Greece					
Hungary		425	-38, -5	1 000, 1 500	3 000, 4 500
Iceland					
Ireland	not mandatory				
Italy	3	410, 440	-43, -6	1 000	4 000
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					
U. Kingdom	not mandatory				

Table A.9.5.5.1 (continued): Ringing tone detector sensitivity

COUNTRY	TEST VALUES				Remarks
	t_{d1} (s)	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory				
Belgium	10	48	400		
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	10	48	600		yes
Germany					
Greece					
Hungary	48			20 - $I_{max.}$	
Iceland					
Ireland	not mandatory				
Italy		48	1 100		
Luxembourg		60		19, 60	
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
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 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 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	160	700	-3	-45	800	1 200
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland	not mandatory					
France	250	600	-10	-50		
Germany	not mandatory					
Greece						
Hungary	not mandatory					
Iceland						
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden						
Switzerland						
U. Kingdom	not mandatory					

Table 9.5.5.2 (continued): 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	1,1	48		20 - $I_{max.}$	
Bulgaria	not mandatory						
Cyprus	not mandatory						
Denmark	not mandatory						
Finland	not mandatory						
France				46 - 54	300 - 1 400		yes
Germany	not mandatory						
Greece							
Hungary	not mandatory						
Iceland							
Ireland	not mandatory						
Italy	not mandatory						
Luxembourg	not mandatory						
Malta							
Netherlands							
Norway	not mandatory						
Portugal	not mandatory						
Spain	not mandatory						yes
Sweden							
Switzerland							
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 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	1 2	160 700	-3 -3	1 000 1 000	3 000 3 000
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	1	250	-10	1 500	3 500
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.5.2.a (continued): 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	20	48	400	
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland				
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	1 2	425 450	-45 -45	1 000 1 000	3 000 3 000
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	2	440	-50	1 500	3 500
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.5.2.b (continued): 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	20	48	400	
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland				
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	1 2 3 4	425 425 450 450	-3 -3 -3 -3	800 1 200 800 1 200	2 800 3 200 2 800 3 200
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	3	440	-10	500	500
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.5.2.c (continued): 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	20	48	400	
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	10	48	600	
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland				
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	1	425	-3	1 000	3 000
	2	450	-3	1 000	3 000
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.5.2.d (continued): 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		
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					yes
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
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	not mandatory				
Belgium	850	1 050	1 300	1 500	1 700
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France					
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table 9.5.6.1 (continued): Special information tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	f_{c2} (Hz)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	1 900	48		20 - $I_{max.}$
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland	not mandatory			
France				
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland				
U. Kingdom	not mandatory			

Table 9.5.6.1 (continued): Special information tone detector sensitivity

COUNTRY	REQUIREMENT VALUES			
	p_1 (dBm)	p_2 (dBm)	Z_G (Ω)	Z_L (Ω)
Austria	not mandatory			
Belgium	-42	-3	600	600
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland	not mandatory			
France				
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland				
U. Kingdom	not mandatory			

Table 9.5.6.1 (continued): 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	not mandatory							
Belgium	260	400	0	750	1 250	5	10	yes
Bulgaria	not mandatory							
Cyprus	not mandatory							
Denmark	not mandatory							
Finland	not mandatory							
France								
Germany	not mandatory							
Greece								
Hungary	not mandatory							
Iceland								yes
Ireland	not mandatory							
Italy	not mandatory							
Luxembourg	not mandatory							
Malta								
Netherlands								
Norway	not mandatory							
Portugal	not mandatory							
Spain	not mandatory							yes
Sweden								yes
Switzerland								
U. Kingdom	not mandatory							yes

9.5.6.1 (B) 1 For digital PBX capable of detecting a special information tone, the values of Z_G and Z_L are equal to Z_C as defined in section 4.1.2 (B) 1.

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	not mandatory				
Belgium	1	850	1 300	1 700	-42
	2	850	1 300	1 700	-42
	3	1 050	1 500	1 900	-42
	4	1 050	1 500	1 900	-42
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.6.1 (continued): Special information tone detector sensitivity

COUNTRY	TEST VALUES		
	V_f (V)	R_f (Ω)	I_f (mA)
Austria		not mandatory	
Belgium	48	400	
Bulgaria		not mandatory	
Cyprus		not mandatory	
Denmark		not mandatory	
Finland			
France			
Germany		not mandatory	
Greece			
Hungary		not mandatory	
Iceland			
Ireland		not mandatory	
Italy		not mandatory	
Luxembourg		not mandatory	
Malta			
Netherlands			
Norway		not mandatory	
Portugal		not mandatory	
Spain		not mandatory	
Sweden			
Switzerland			
U. Kingdom		not mandatory	

Table A.9.5.6.1 (continued): 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	not mandatory					
Belgium	1 2 3 4	260 400 260 400	0 0 0 0	750 1 250 750 1 250	5 5 5 5	
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France						
Germany	not mandatory					
Greece						
Hungary	not mandatory					
Iceland						
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden						
Switzerland						
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 is 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	1 100	1 250	1 550	1 650
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France					
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table 9.5.6.2 (continued): Special information tone detector insensitivity

COUNTRY	REQUIREMENT VALUES			
	f_{c4} (Hz)	V_f (V)	R_f (Ω)	I_f (mA)
Austria	not mandatory			
Belgium	1 950	48		20 - $I_{max.}$
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland	not mandatory			
France				
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland				
U. Kingdom	not mandatory			

Table 9.5.6.2 (continued): Special information tone detector insensitivity

COUNTRY	REQUIREMENT VALUES			
	p_3 (dBm)	p_4 (dBm)	Z_G (Ω)	Z_L (Ω)
Austria	not mandatory			
Belgium	-3	-50	600	600
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland	not mandatory			
France				
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg	not mandatory			
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden				
Switzerland				
U. Kingdom	not mandatory			

Table 9.5.6.2 (continued): 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	1,2	yes
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland	not mandatory					
France						
Germany	not mandatory					
Greece						
Hungary	not mandatory					
Iceland						
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					yes
Sweden						
Switzerland						
U. Kingdom	not mandatory					

9.5.6.2 (B) 1 For digital PBX capable of detecting a special information tone, the values of Z_G and Z_L are equal to Z_C as defined in section 4.1.2 (B) 1.

9.5.6.2 (E) 1 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	1	800	1 400	1 800	-3
	2	1 100	1 400	1 800	-3
	3	950	1 250	1 800	-3
	4	950	1 550	1 800	-3
	5	950	1 400	1 650	-3
	6	950	1 400	1 950	-3
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France					
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland					
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg	not mandatory				
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.5.6.2.a (continued): 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	5 000	48	400	
Bulgaria	not mandatory					
Cyprus	not mandatory					
Denmark	not mandatory					
Finland						
France						
Germany	not mandatory					
Greece						
Hungary	not mandatory					
Iceland						
Ireland	not mandatory					
Italy	not mandatory					
Luxembourg	not mandatory					
Malta						
Netherlands						
Norway	not mandatory					
Portugal	not mandatory					
Spain	not mandatory					
Sweden						
Switzerland						
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	1	950	1 400	1 800	-50	330	1 000	5 000
Bulgaria	not mandatory							
Cyprus	not mandatory							
Denmark	not mandatory							
Finland								
France								
Germany	not mandatory							
Greece								
Hungary	not mandatory							
Iceland								
Ireland	not mandatory							
Italy	not mandatory							
Luxembourg								
Malta								
Netherlands								
Norway	not mandatory							
Portugal	not mandatory							
Spain	not mandatory							
Sweden								
Switzerland								
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	1	950	1 400	1 800	-3	190	500	5 000
	2	950	1 400	1 800	-3	470	1 500	5 000
Bulgaria	not mandatory							
Cyprus	not mandatory							
Denmark	not mandatory							
Finland								
France								
Germany	not mandatory							
Greece								
Hungary	not mandatory							
Iceland								
Ireland	not mandatory							
Italy	not mandatory							
Luxembourg								
Malta								
Netherlands								
Norway	not mandatory							
Portugal	not mandatory							
Spain	not mandatory							
Sweden								
Switzerland								
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	1	950	1 400	1 800	-3	330	1 000	1,2	
Bulgaria	not mandatory								
Cyprus	not mandatory								
Denmark	not mandatory								
Finland									
France									
Germany	not mandatory								
Greece									
Hungary	not mandatory								
Iceland									
Ireland	not mandatory								
Italy	not mandatory								
Luxembourg									
Malta									
Netherlands									
Norway	not mandatory								
Portugal	not mandatory								
Spain	not mandatory								
Sweden									
Switzerland									
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 (D) 1 No requirement.

9.6 (S) 1 Not mandatory.

9.6 (CH) 1 Detection of remote party signals, if implemented in a TE, shall fulfil the requirements in section 6.4.

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	not mandatory				
Belgium	f - 22	f + 22	-43	-6	600
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland	not mandatory				
France	2 078	2 122	-43	-10	600
Germany	not mandatory				
Greece					
Hungary	not mandatory				
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					
U. Kingdom	not mandatory				

Table 9.6.1.1 (continued): 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	not mandatory							
Belgium	425	475	600	600	48		20 - $I_{max.}$	yes
Bulgaria	not mandatory							
Cyprus	not mandatory							
Denmark	not mandatory							
Finland	not mandatory							
France	425	475	600	600	46 - 54	300 - 1 400		
Germany	not mandatory							
Greece								
Hungary	not mandatory							
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								
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 (B) 2 For digital PBX capable of detecting answering tone, the values of Z_G and Z_L are equal to Z_C as defined in Chapter 4, section 4.1.2 (B) 1.

9.6.1.1 (BG) 1 For Bulgaria, the requirement in section 9.6.1.1 is not an access requirement and is therefore not generally mandatory.

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 Chapter 10, 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	not mandatory				
Belgium	1	f	-43	600	450
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	1	2 100	-43	600	450
Germany	not mandatory				
Greece					
Hungary	not mandatory				
Iceland	not mandatory				
Ireland	not mandatory				
Italy	not mandatory				
Luxembourg					
Malta					
Netherlands					
Norway	not mandatory				
Portugal	not mandatory				
Spain	not mandatory				
Sweden					
Switzerland					
U. Kingdom	not mandatory				

Table A.9.6.1.1 (continued): Answering tone detector sensitivity

COUNTRY	TEST VALUES			Remarks
	V_f (V)	R_f (Ω)	I_f (mA)	
Austria	not mandatory			
Belgium	48	400, 1 600		
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	48	600		yes
Germany	not mandatory			
Greece				
Hungary	not mandatory			
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				
U. Kingdom	not mandatory			

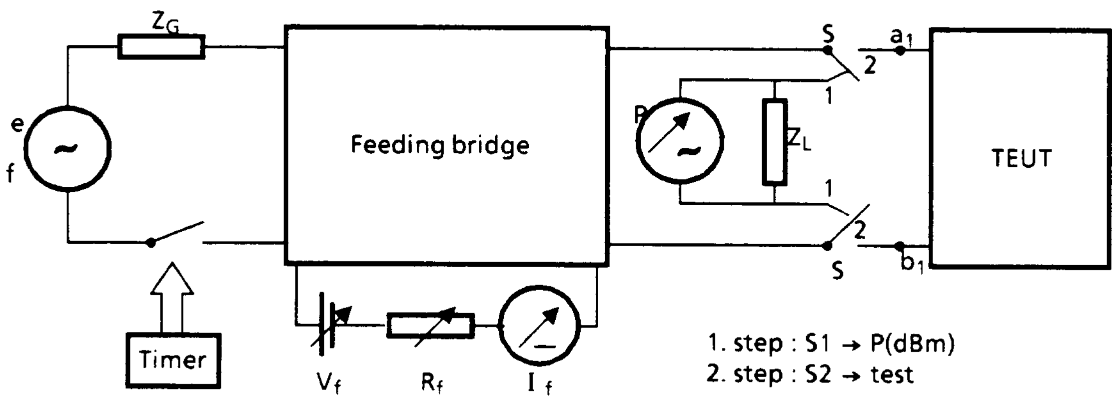


Figure A.9.6.1.1: Answering tone detector

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 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 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 duration.

c) "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 - $I_{max.}$	
Bulgaria	not mandatory								
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								
Greece									
Hungary	not mandatory								
Iceland	not mandatory								
Ireland	not mandatory								
Italy	not mandatory								
Luxembourg									
Malta									
Netherlands									
Norway	not mandatory								
Portugal	not mandatory								
Spain	not mandatory								yes
Sweden	not mandatory								
Switzerland									
U. Kingdom	not mandatory								

9.6.1.2 (E) 1 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	
Bulgaria	not mandatory						
Cyprus	not mandatory						
Denmark	not mandatory						
Finland							
France	1	1 900	-10	4	48	600	
Germany	not mandatory						
Greece							
Hungary	not mandatory						
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							
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)	p_4 (dBm)	t_d (s)
Austria	not mandatory			
Belgium		f	-48	4
Bulgaria	not mandatory			
Cyprus	not mandatory			
Denmark	not mandatory			
Finland				
France	2	2 100	-48	4
Germany	not mandatory			
Greece				
Hungary	not mandatory			
Iceland				
Ireland	not mandatory			
Italy	not mandatory			
Luxembourg				
Malta				
Netherlands				
Norway	not mandatory			
Portugal	not mandatory			
Spain	not mandatory			
Sweden	not mandatory			
Switzerland				
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	
Bulgaria	not mandatory				
Cyprus	not mandatory				
Denmark	not mandatory				
Finland					
France	3	2 100	-10	0,100	yes
Germany	not mandatory				yes
Greece					
Hungary	not mandatory				
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					
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 (D) 1 No requirement.

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 (D) 1 No requirement.

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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ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

*

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

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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, 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.

Transposition dates	
Date of adoption of this ETS:	31 March 1996
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Date of withdrawal of any conflicting National Standard (dow):	31 December 1996

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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 The TE shall not apply any signals to the line which do not correspond with the present operation.

10.1 (A) 2 The TE placed in quiescent condition shall not apply an ac or dc voltage ≥ 0,1 V to the line terminals a_1 and b_1.
Compliance shall be checked using the test outlined in section A.10.1 (A) 2.

A.10.1 (A) 2 The test is carried out using the arrangement shown in figure A.10.1 (A) 2.

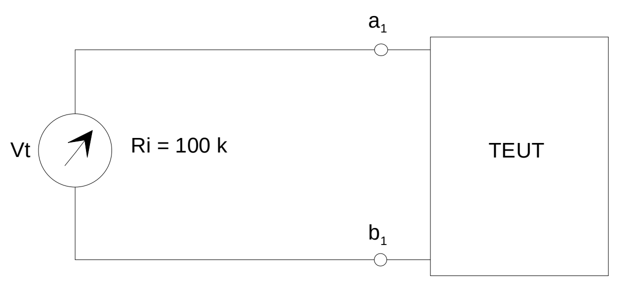


Figure A.10.1 (A) 2

10.1 (A) 3 The PSTN and terminal specific values respectively adjustments of the TE shall be so designed, that no inadvertenly change is possible by the user. This shall be also considered with TE which cooperate with additional devices or an external "communication software".

10.1 (D) Germany

10.1 (D) 1 General requirements

10.1 (D) 1.1 General

General remarks

The measuring circuits contained in this section generally illustrate only the fundamental configuration of the measuring arrangement and include the necessary indications regarding the implementation and the particularities of the individual measurements.

Relevant specialist knowledge of measurement technology and of the basic physical principles of the individual requirements contained in this ETS and sufficient familiarity with the use, characteristics and operating procedures of the Terminal Equipment Under Test (TEUT) are required.

In the case of all measurements, the TEUT shall, where possible, be operated under normal operating conditions, particularly with regard to the direct currents. For this purpose, test aids, such as reference impedance, feeding bridges, etc. are used in addition to the measuring equipment. Certain measurements require the wanted signal to be disabled or suppressed, e.g. by means of the measuring circuit.

Additional equipment required in order to stimulate the TEUT to enter the relevant operating states shall be made available with the TEUT, where necessary.

Measuring circuits

In general the terminals to be tested are illustrated in the measuring circuits as bipolar test items. Standard symbols have been used for the test aids reference impedance, feeding bridge A and feeding bridge B. All specified test aids shall be regarded as idealised, unless otherwise stated.

Equipment required in order to stimulate the TEUT to enter the relevant operating states shall not influence the measurement result. Such equipment is not explicitly illustrated in the measuring circuits.

Due care shall be taken in the configuration of the measuring circuit. This applies especially to the effects of possible disturbance variables caused by the measurement set-up on the measurement result.

Measuring equipment

It is assumed that the measuring equipment used corresponds to current engineering standards. The characteristics and accuracy of the measuring equipment shall be appropriate to the purpose of the measurement.

Test aids

Reference impedance Z_R

The following circuit is used as the reference impedance Z_R in the measurement methods:

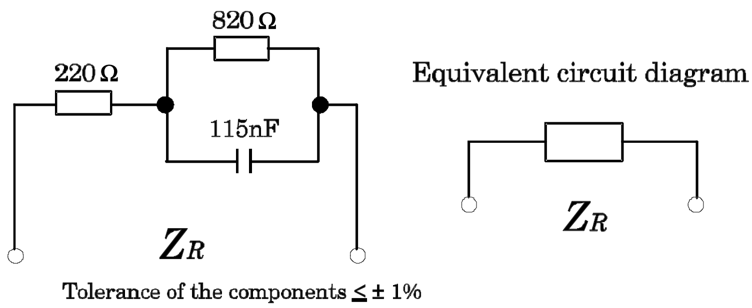


Figure 10.1 (D) 1.1

Anechoic conditions

Anechoic conditions are used for measurements on terminal equipment with electro-acoustic coupling where ambient noise may affect the measurement result. It is therefore necessary to maintain the acoustic interference at a low level by using an anechoic chamber for the measurements. The interfering noise level shall be lower than NR 15 (NR = Noise Rating) in accordance with ISO TR 1996. The values for NR 15 are contained in the following table.

Table 10.1 (D) 1.1

Octave centre frequency in Hz	Max. sound pressure level in dB rel. to 20 μPa
63	47
125	35
250	26
500	19
1 000	15
2 000	12
4 000	9
8 000	7

There are no requirements regarding sound propagation, i.e. the minimum dimensions of the chamber are determined by the measurement set-up for the measurement to be carried out.

Ringing voltage transformer

The ringing voltage transformer illustrated in figure 10.1 (D) 1.2 is used for measurements in the ringing state and load tests for matching and dc decoupling between a 25 Hz ringing voltage source or amplifier and the measuring circuit.

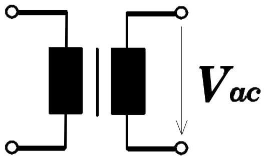


Figure 10.1 (D) 1.2

Table 10.1 (D) 1.2

Turns ratio	matched to the ringing source
Output voltage V_{ac}	32 V open-circuit operation 75 V open-circuit operation
DC resistance of output winding	≤ 10 Ω
AC resistance	see load

Load

The 75 V output port shall be able to withstand a short-term load with a 63 V dc voltage connected in series with an ohmic resistance 500 Ω (dc bias). The ac voltage shall hereby not decrease by more than 8%.

Ringing current relay *RR*

The relay *RR* serves to disable the ringing current upon call answering in the TEUT. In the case of a direct current of 15 mA, the ringing current supply is disabled within a period *t* of approx. 15 ms. The coil resistance of the relay is $R \leq 20\ \Omega$.

Constant current source

Equivalent circuit diagram

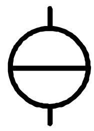


Figure 10.1 (D) 1.3

The constant current source is used in those cases where the transient effects of a feeding bridge may impair the measurement result.

Nominal values:

I = constant within the adjustment range 15 mA to 60 mA with a dc resistance of the TEUT from 0 Ω to 1 000 Ω.

Maximum permissible current deviation within this load range: 0,25 mA.

Type of feeding: balanced

Unweighted noise level: ≤ -75 dBm, measured at a load of 600 **Ω.**

Impedance, measured as the return loss of the constant current source parallel to Z_R against Z_R:

α > 40 dB from 50 Hz to 4 000 Hz, test level +10 dB (950 mV).

Transient effects caused by connected inductors shall not damage this test aid.

Neither a capacitive nor an inductive load shall cause spurious oscillations.

Measurement procedures

Unless otherwise specified, TEUT with electro-acoustic coupling are placed in an anechoic chamber. Where provided, the handset shall be suspended in free air and the loudspeaker disconnected.

10.1 (D) 1.2 See Chapter 2, section 2.4.2 (D) 1.

10.1 (D) 1.3 See Chapter 2, section 2.2.1 (D) 1.

10.1 (D) 1.4 See Chapter 2, section 2.2.2 (D) 1.

10.1 (GR) Greece

10.1 (GR) 1.1 The TE shall operate reliably, and its design shall comply with established rules of technology.

10.1 (GR) 1.2 The TE shall 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 shall 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 shall be able to withstand occasional interruptions of the supply current of $t \leq 150$ ms without any consequences for the operating mode.

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 fore 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, A.2.6 (E) 1, 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 (DK) **Denmark**

10.2 (DK) 1 **Polarity reversal transient**

For a TE which is not using polarity as supplementary service and is in loop condition, if the polarity is reversed within 0,2 ms, the time interval from when the current is the first time decreased to 0,9 times its original value in one direction until it is continuous above 15 mA in the other direction shall be less than 10 ms, when the TE is supplied by 48 V through 2 times 1 200 Ω.

A.10.2 (DK) 1 **Polarity reversal transient**

The test principle is shown in figure A.10.2 (DK) 1.

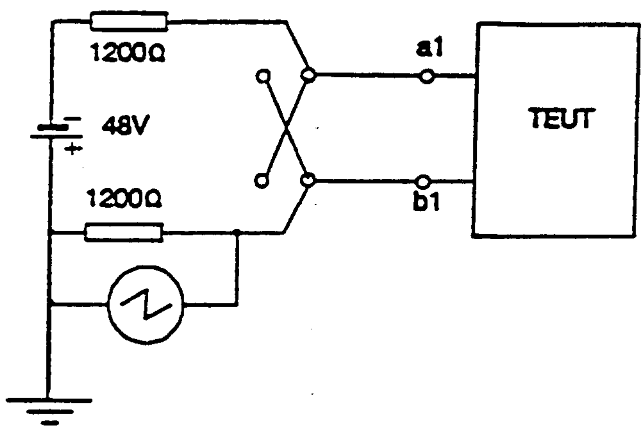


Figure A.10.2 (DK) 1

10.2 (SF) **Finland**

10.2 (SF) 1 **Overvoltage arresters between the line terminals**

Overvoltage arresters between the line terminals shall not operate when the dc-voltage between the line terminals is 200 V or less.

A.10.2 (SF) 1 **Leakage current in the quiescent condition**

The test is carried out by the following means:

The TEUT is in 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. It may not exceed the value of 0,4 mA.

If the TEUT is designed to use current in quiescent state (see remark 2.2.1.1 (SF) 1), the test is not carried out as mentioned but the dc-operating voltage of the overvoltage arresters shall be determined using some other reliable method.

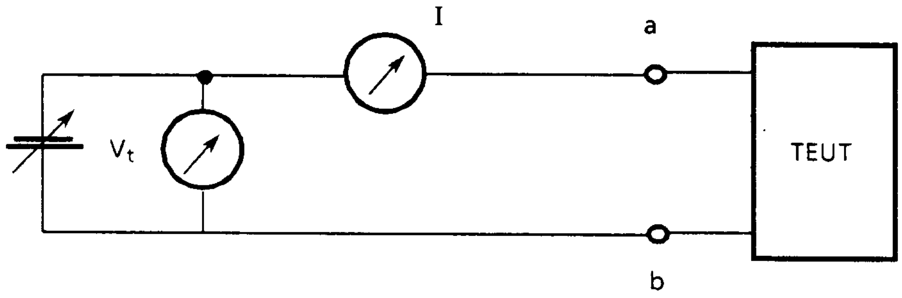


Figure A.10.2 (SF) 1: Test set-up

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

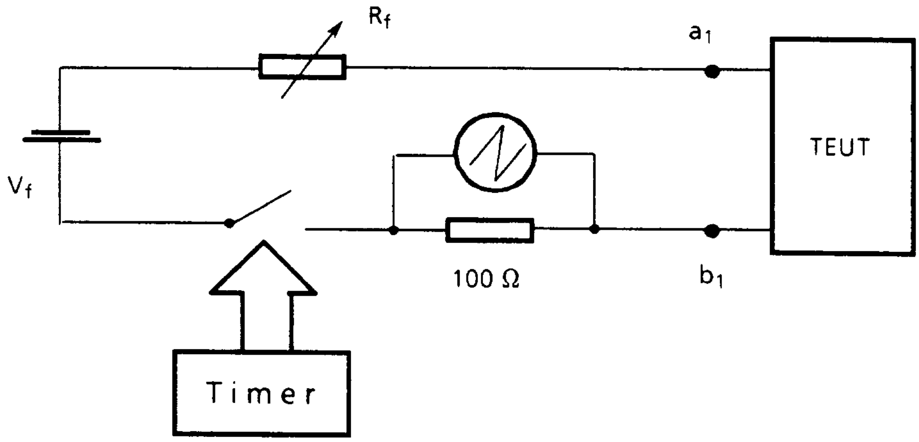


Figure 10.2 (F) 1: Immunity to dc breaks from PSTN

Test 1: For both cases V_f = 48 V/R_f = 200 Ω and V_f = 48 V/R_f = 1 300 Ω, 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 V, R_f = 8 125 Ω;
- after feeding interruption: V_f = 48 V, R_f = 1 340 Ω.

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.

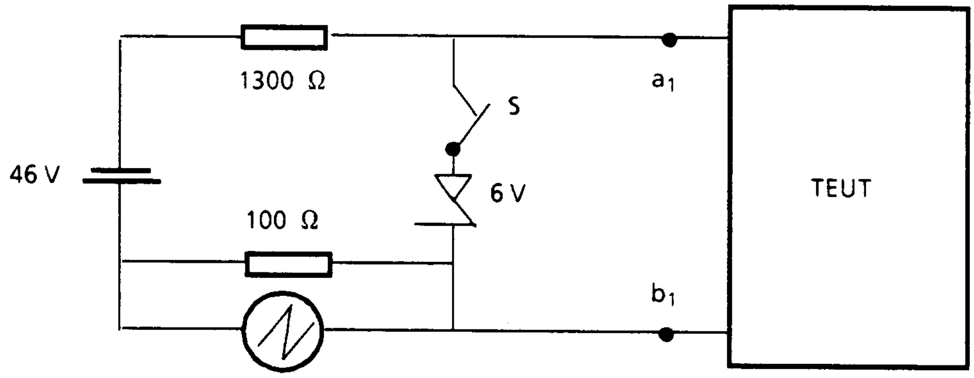


Figure A.10.2 (F) 3.a: Transfer test

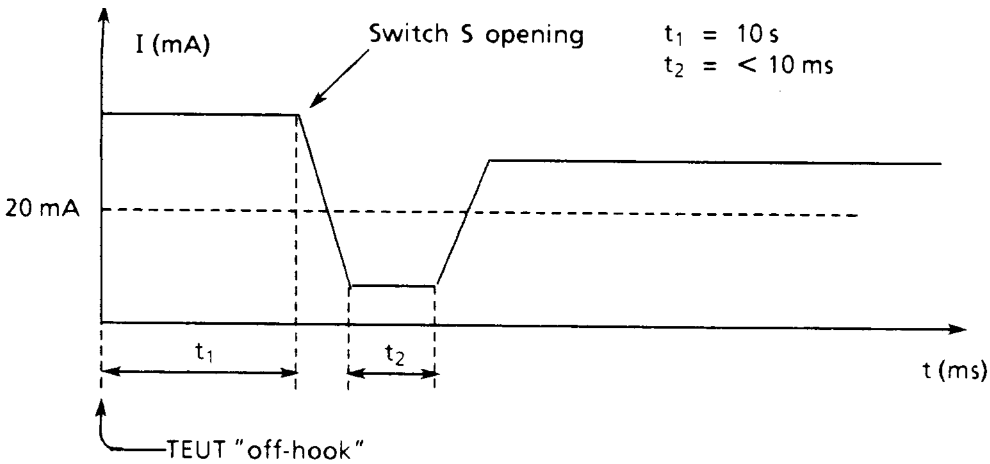


Figure A.10.2 (F) 3.b: Transfer timing

10.2 (D) Germany

10.2 (D) 1 DC specifications

10.2 (D) 1.1 DC resistance variations

DC resistance variations between the a-wire and the b-wire at the NTA may be caused by the terminal equipment during internal switching processes in all operating states, with the exception of the signalling state, transient states and permissible loop interruptions in accordance with Chapter 2, sections 2.4.2 (D) 1 and 10.2 (D) 1.5, within the permissible range for "$I \geq 20$ mA", as shown in section 2.1 (D) 1, on the condition that the variation remains $\leq 6\ \Omega$/ms. During the emission of an MFPB (DTMF) signalling character, a variation in the dc resistance within the range 3 Ω/ms to 6 Ω/ms shall not exceed 15 ms.

10.2 (D) 1.2 see Chapter 2, section A.2.2.1.1 (D) 1 and A.2.4.1 (D) 1

10.2. (D) 1.3 Power source interruption

The terminal equipment shall be able to withstand interruptions to the power source which occur via the telephone network / ISDN for a period of $t \leq 5$ ms without the operating state being affected. This requirement does not apply to the dialling state.

10.2 (D) 1.4 Transition from the ringing state to the communication state

The transition from the ringing state to the communication state shall, in the case of an applied dc voltage of $V = 63$ V and preconnected resistors of $R_{\Sigma} = 2\,100\ \Omega$, not exceed a total of $t = 120$ ms.

The permissible range for "$I \geq 20$ mA", as shown in Chapter 2, section 2.1 (D) 1, shall be reached for the first time within 60 ms, after which the resistance may be exceeded in individual instances as specified in the first paragraph of Section 2.4.1 (D) 1.

The dc resistance of the terminal equipment shall be within the permissible range for "$I \geq 20$ mA", as shown in 2.1 (D) 1, after $t_{\Sigma} = 120$ ms at the latest. This shall apply even where the preconnected resistors are increased to $R_{\Sigma} = 2\,600\ \Omega$ at a dc voltage of $V = 63$ V.

The terminal equipment shall, in the case of a closed dc loop, meet all the requirements contained in this type approval specification following a 250 ms load with a dc voltage of $V_{dc} = 63$ V, superimposed by an ac voltage of $V_{rms} = 75$ V (25 Hz), with a preconnected resistance (a-wire) $R = 500\ \Omega$.

10.2 (D) 1.5 Communication state

In the communication state, the effective resistance of the terminal equipment at the NTA shall, in the case of a dc voltage of $V = 63$ V and preconnected resistors of $R_{\Sigma} = 2{,}6$ kΩ, be within the permissible range for current values of "$I \geq 20$ mA", as shown in Chapter 2, section 2.1 (D) 1.

Automatic loop interruptions may only occur within the communication state for a period of $t \leq 80$ ms. The speed of the variation in resistance is not restricted. In the case of successive loop interruptions (with a duration of $t \leq 80$ ms) the time interval between individual interruptions shall be $t \geq 100$ ms.

Where tones are emitted within 10 s after call answering, they shall differ by at least 20% in frequency or by at least 50% in timing from the audible tones specified in Chapter 1, sections 1.7.1 (D) 1 to 1.7.7 (D) 1.

In the case of automatic answering of an incoming call, terminal equipment shall revert to the quiescent state

- after 180 s, at the latest, where no equipment for the detection of incoming telecommunication messages is activated;

- at the latest 60 s after no telecommunication messages have been received, where equipment for the detection of incoming telecommunication messages is activated.

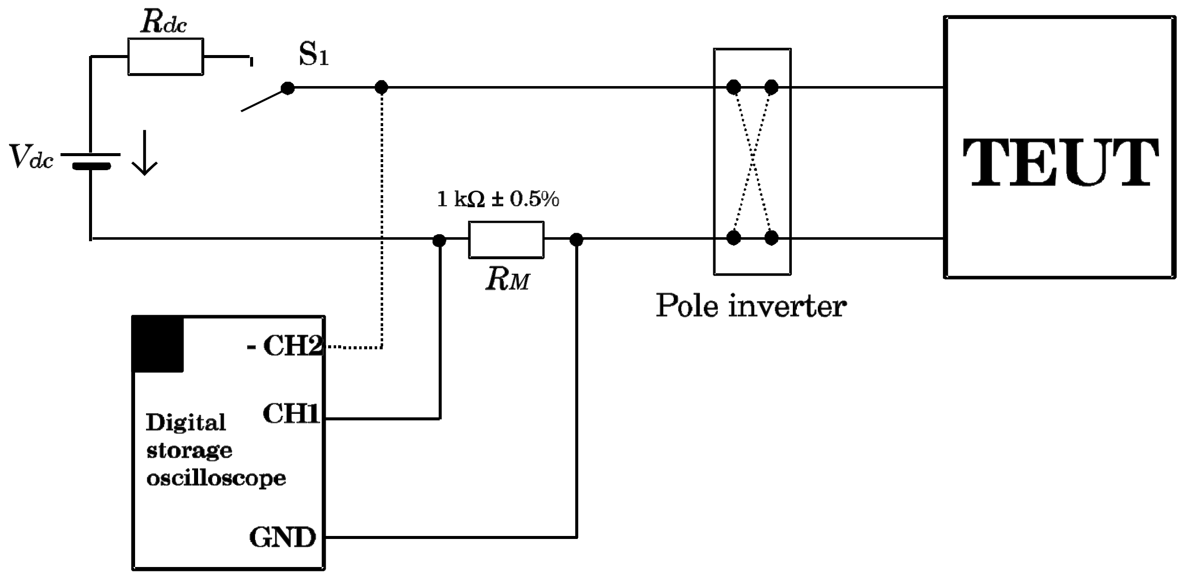
10.2 (D) 1.6 Optional control functions in the communication state

Where a defined hookswitch flash (switching signal) for communication with the telephone network / ISDN is possible within the communication state by means of loop interruption, the length of the interruptions shall be between 170 ms and 900 ms. The dc resistance shall be $R \geq 100$ kΩ for the duration of such loop interruptions.

Also Chapter 2, see section 2.4.2 (D) 1

A.10.2 (D) 1 Measurement of power source interruptions

The measuring circuit illustrated in figure A.10.2 (D) 1.1 is used for the measurement.



V_{dc} = 63 V	R_{dc} = 0 Ω or 1 200 Ω

Figure A.10.2 (D) 1.1

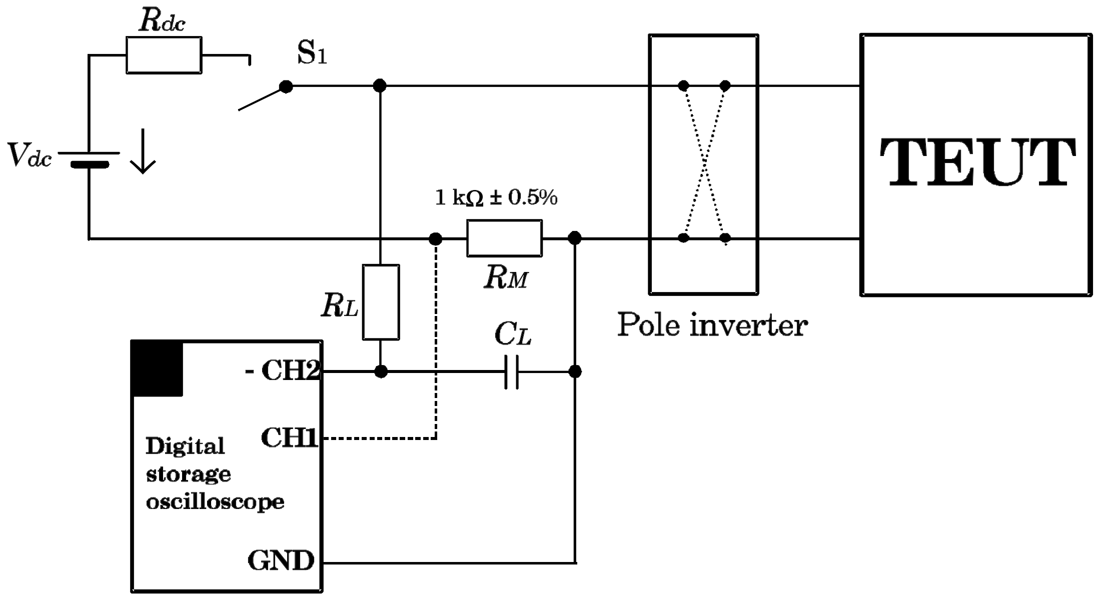
Before the measurement, the voltage V_{dc} is set to 63 V, switch S1 closed and the terminal equipment (TEUT) placed in the off-hook condition / communication state (R_{dc} = 0 Ω or 1 200 Ω).

S1 is then opened for t = 5 ms. The TEUT shall not change its state (e.g. start decadic dialling).

The behaviour of the feeding current over time is monitored by means of a digital oscilloscope with V_M (CH1).

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

Measurement of the duration of dc resistance variations



V_{dc} = 63 V	R_{dc} = 0 Ω or 1200 Ω	$R_L \geq$ 10 kΩ	$\tau = R_L \bullet C_L \approx$ 2 ms

Figure A.10.2 (D) 1.2

The measuring arrangement with a system multimeter or a digital oscilloscope capable of transferring data for further processing as illustrated in figure A.10.2 (D) 1.2 is used for the measurement of the duration of the variations in the dc resistance caused by a terminal (TEUT).

A low-pass filter in front of the input port (-CH2) serves to reduce the effect of the wanted signal on the measurement values.

During the measurement, the dc loop across switch S1 and the TEUT is closed. The measurement is started by the initiation of internal switching processes. From this point onwards, the individual measurement values V_{TEUT} are determined and recorded at regular intervals (≤ 1 ms) for the duration of the measurement (e.g. 150 ms).

- All individual measurement values shall fulfil the following requirements:

6,0 V ≤ V_{TEUT} ≤ 22,1 V (for R_{dc} = 0 Ω)

or 6,0 V ≤ V_{TEUT} ≤ 12,4 V (for R_{dc} = 1 200 Ω).

- The duration of the dc resistance variation is arithmetically calculated from the individual measurement values $V_{TEUT\,t}$ and their corresponding times t:

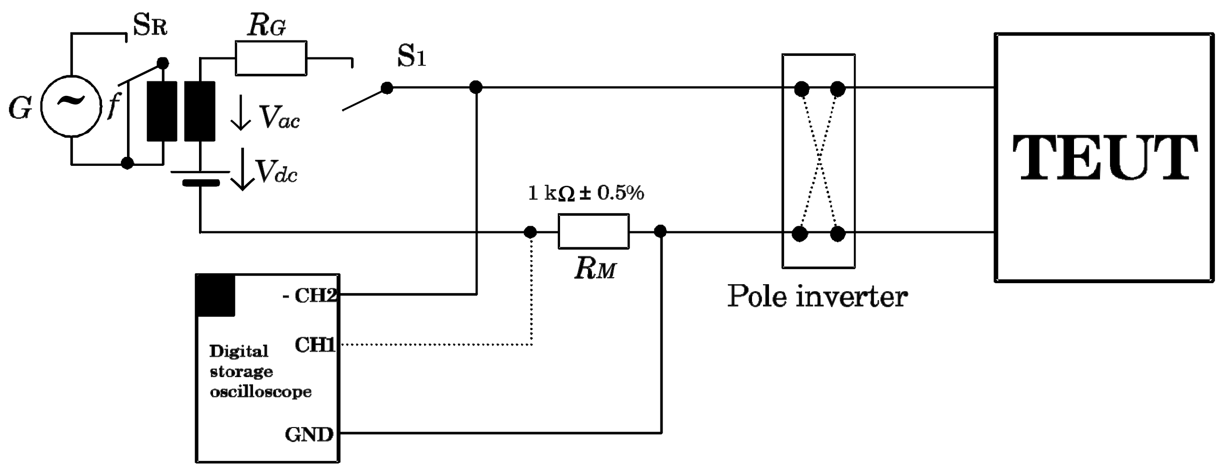
$$\frac{\Delta R_{TEUT}}{\Delta t} = \left(\frac{V_{TEUTt2}}{V_{dc} - V_{TEUTt2}} - \frac{V_{TEUTt1}}{V_{dc} - V_{TEUTt1}} \right) \bullet \frac{R_M + R_{dc}}{t_2 - t_1}$$

The value 6 Ω/ms shall not be exceeded. During emission of an MFPB (DTMF) signalling character, a variation in the dc resistance within the range 3 Ω/ms to 6 Ω/ms shall not exceed 15 ms.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

Measurement of the dc resistance during the transition from the ringing state to the communication state

The measuring circuit illustrated in figure A.10.2 (D) 1.3 is used for the measurement.



V_{dc} = 63 V

Figure A.10.2 (D) 1.3

The transition of a terminal (TEUT) from the ringing state to the communication state is recorded using the measuring arrangement illustrated in figure A.10.2 (D) 1.3 by means of a system multimeter or a digital oscilloscope capable of transferring data for further processing. The measurement is carried out without a ringing signal. If terminals require a ringing signal for their transition to the communication state, this signal may be coupled by appropriate means via SR with a voltage of V_{ac} = 75 V.

The dc feeding voltage V_{dc} is applied at the TEUT by means of switch S1. The measurement commences upon loop closure in the TEUT. The corresponding measurement values are determined and recorded at regular intervals (≤ 1 ms) for the duration of the measurement (e.g. 150 ms). The voltage level V_{TEUT} at the TEUT shall be within the ranges specified in table A.10.2 (D) 1.1 for measurements "a" and "b" and measurement "c" 60 ms and 120 ms after closure of the loop respectively.

Table A.10.2 (D) 1.1

Measurement	R_G	V_{TEUT} (-CH2)
a	0 Ω	6,0 V ... 22,1 V
b	1 100 Ω	6,0 V ... 12,9 V
c	1 600 Ω	6,0 V ... 10,8 V

Deviations from the voltage range limits V_{TEUT} specified in the table are permitted 60 ms to 120 ms after loop closure for a total period of ≤ 6 ms (each deviation ≤ 3 ms).

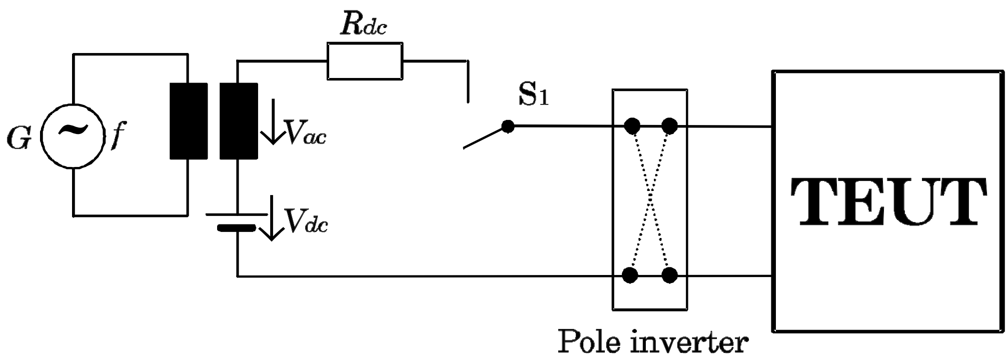
The deviation from the specified voltage range ends when:

- the voltage V_{TEUT} (-CH2) = 6,0 V ... 26,0 V, in the case of measurement "a"
- the voltage V_{TEUT} (-CH2) = 6,0 V ... 15,8 V, in the case of measurement "b".

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

Load test in the communication state

The measuring circuit illustrated in figure A.10.2 (D) 1.4 is used for the measurement.



V_{dc} = 63 V	R_{dc} = 500 Ω	V_{ac} = 75 V*	f = 25 Hz

∗ sinusoidal ; h ≤ 15%

Figure A.10.2 (D) 1.4

With the dc path of the terminal equipment (TEUT) closed, switch S1 is closed and the TEUT thereby charged with a mixed voltage consisting of a dc voltage V_{dc} and an ac voltage V_{ac} as illustrated in figure A.10.2 (D) 1.4. The ringing voltage is coupled via a ringing voltage transformer (see section 10.1 (D) 1.1).

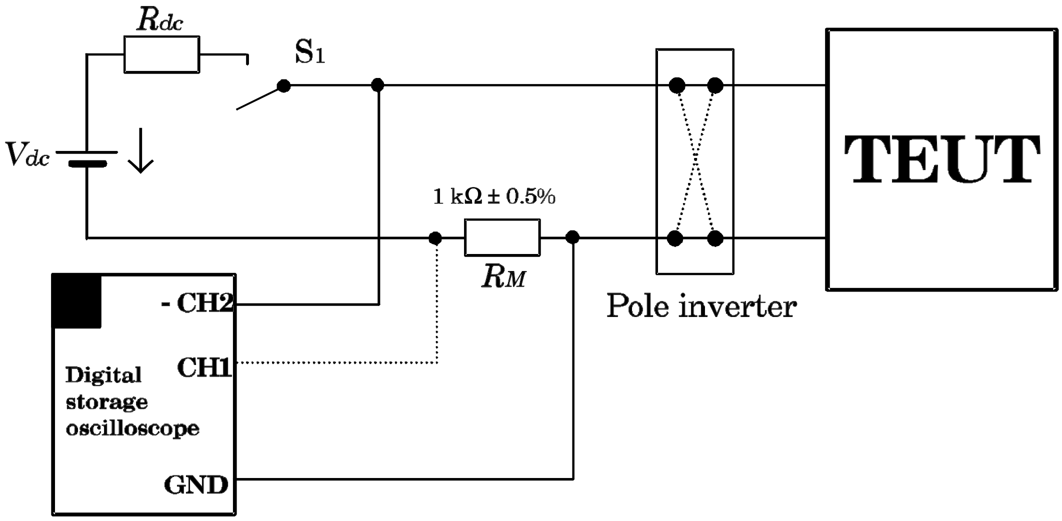
The duration of the load is t = 250 ms.

The load test is repeated after approx. 4 s with reversed polarity of the TEUT.

The pole inverter may only be operated when switch S1 is open.

Measurement of the dc resistance in the communication state

The measuring circuit illustrated in figure A.10.2 (D) 1.5 is used for the measurement.



V_{dc} = 63 V

Figure A.10.2 (D) 1.5

The dc resistance of a terminal (TEUT) in the communication state is recorded by means of a system multimeter or a digital oscilloscope capable of transferring data for further processing.

The dc feeding voltage is applied at the TEUT by means of switch S1 and the TEUT subsequently placed in the communication state.

- DC resistance

Depending on the resistance level R_{dc}, the voltage V_{TEUT} at the TEUT shall adhere to the values given in table A.10.2 (D) 1.2 for measurements "a" , "b" and "c".

Table A.10.2 (D) 1.2

Measurement	R_{dc}	V_{TEUT} (-CH2)
a	0 Ω	6,0 V...22,1 V
b	900 Ω	6,0 V...13,9 V
c	1 600 Ω	6,0 V...10,8 V

- Transient processes in the terminal equipment

In the case of internal switching processes in the terminal equipment (TEUT), the upper voltage limits specified in table A.10.2 (D) 1.2 may be exceeded for $t \leq$ 80 ms.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

10.2 (N) **Norway**

10.2 (N) 1 **Immunity against interruptions in the dc loop**

During the connection procedure (before dial tone is received from the public exchange), there may be an interruption in the line current of up to 400 ms. The equipment shall be designed to prevent the line current falling below 13,5 mA from 30 ms after this interruption is terminated.

Break is defined as line current below 13,5 mA.

The measurement shall be performed under the following conditions:

- power source 40 V_{dc} and resistance 2 000 ohms;
- power source 60 V_{dc} and resistance 3 100 ohms.

The text is performed using a break of 400 ms.

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.

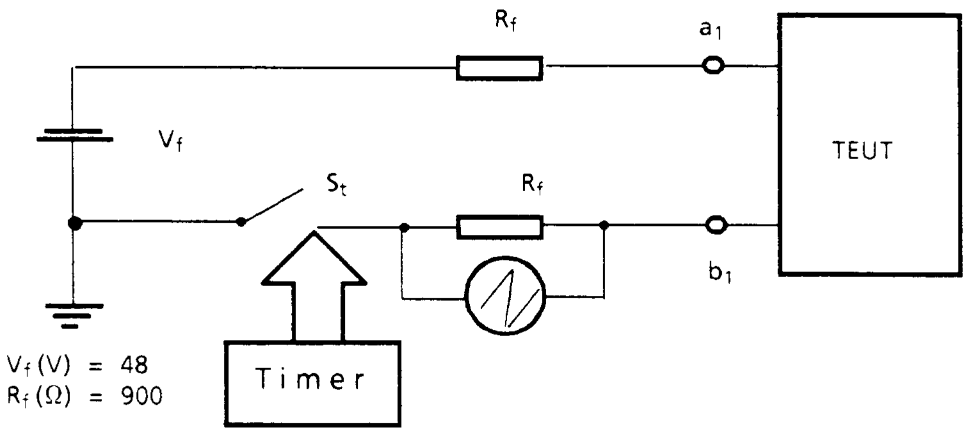


Figure A.10.2 (P) 1.a: Immunity to an external loop current interruption - one-port TE

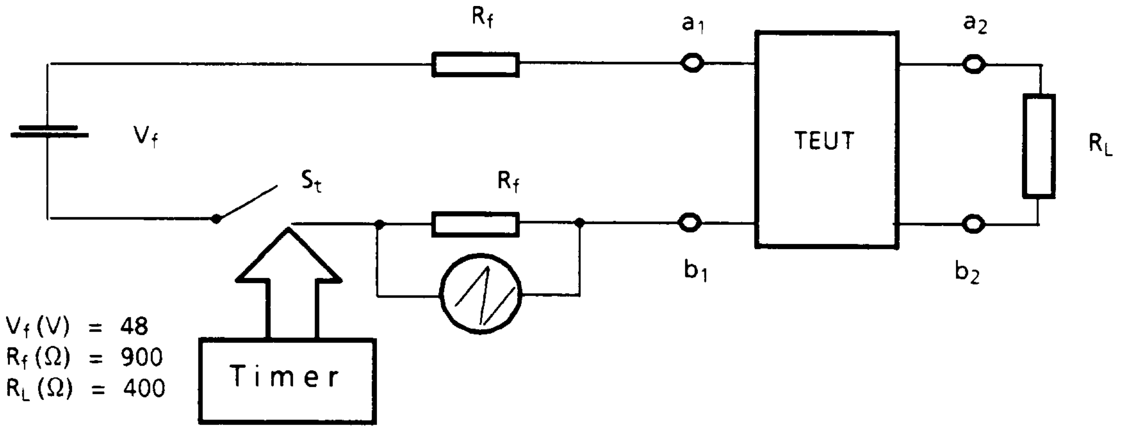


Figure A.10.2 (P) 1.b: Immunity to an external loop current interruption - series connected TE

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

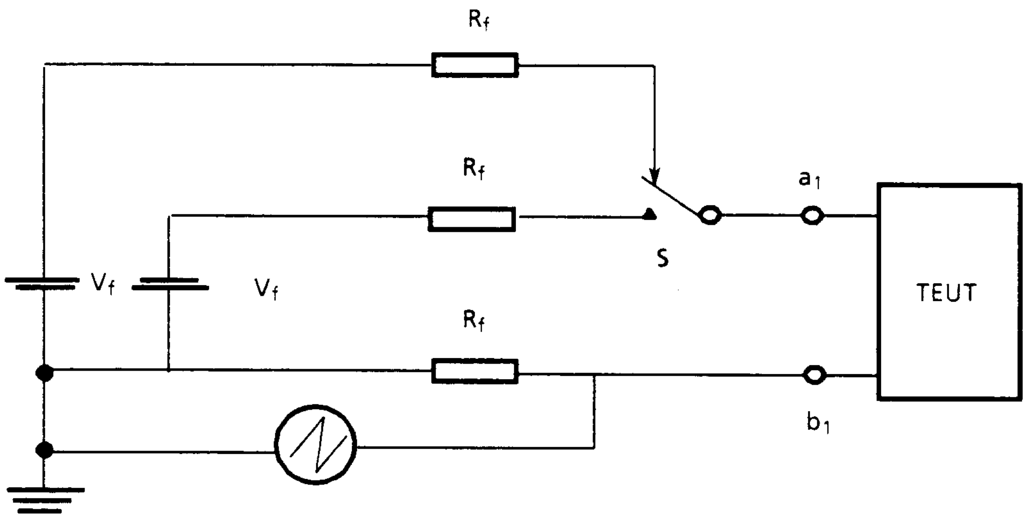
In loop condition, 4 ms after a polarity reversal of the dc voltage applied to the line terminals of the TE, the line current shall reach a value not less than 20 mA.

Compliance shall be checked using the tests outlined in section A.10.2 (P) 3.

A.10.2 (P) 3 Polarity reversal

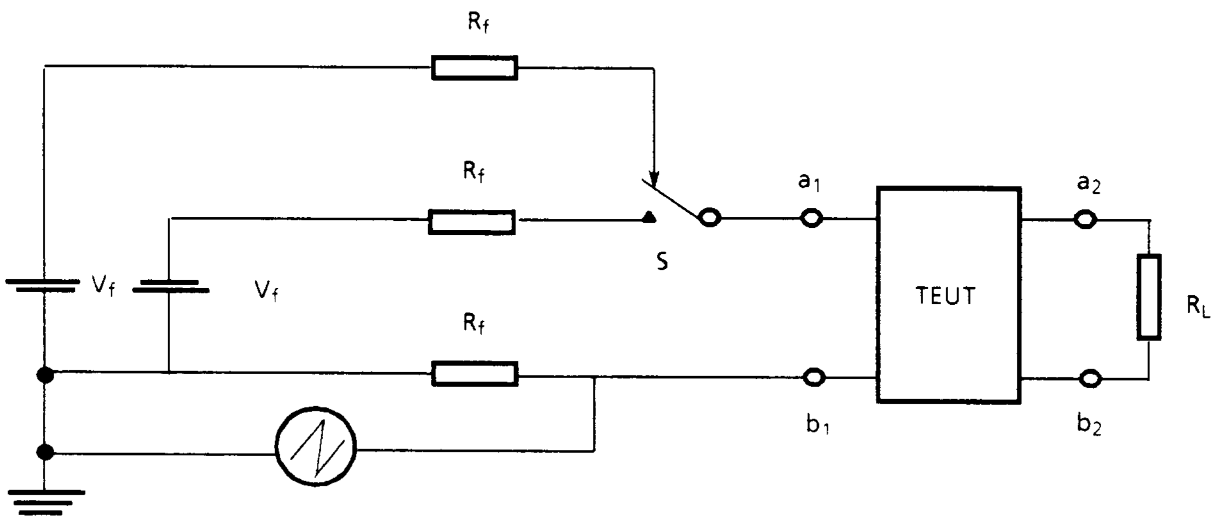
The TEUT is connected as shown in figure A.10.2 (P) 3.a or A.10.2 (P) 3.b, as appropriate, and placed in the loop state.

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 (V) = 48
R_f (Ω) = 200

Figure A.10.2 (P) 3.a: Polarity reversal - one-port TE



V_f (V) = 40
R_f (Ω) = 200
R_L (Ω) = 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_I, 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 the 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. The test shall be done over a pair of lines, for the combinations quiescent/quiescent, quiescent/loop and loop/loop. It is assumed that other possible combinations of lines and conditions fulfil the stipulated requirement.

$$R_i = \frac{V_t\,(V)}{I\,(\mu A)}$$ Formula A.10.2 (E) 1

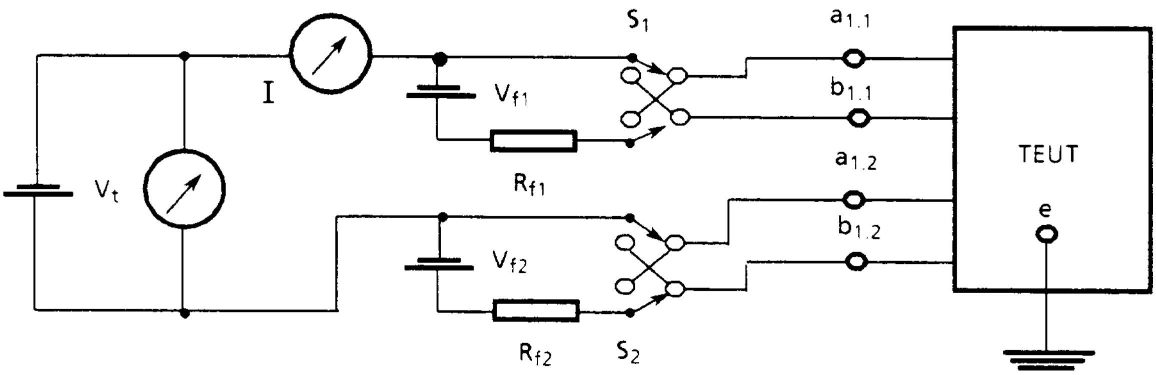


Figure A.10.2 (E) 1: Insulation resistance between line terminals of two lines (multi-line)

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
$t_2 = t_1 + 2$ ms
$t_3 = t_1 + 10$ ms
$I_1 \equiv$ Stationary value of the loop current for the original polarity
$I_2 = I_1 - 1$ mA
$I_3 = I_1 + 1$ mA
$I_4 \equiv$ Stationary value of the loop current for the new polarity
$I_5 = I_4 + 1$ mA
$I_6 = I_4 - 1$ mA
$I_7 = 125$ mA
$I_8 = -125$ mA
$I_9 = -18$ mA

I_{10} = -100 mA

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.

Compliance shall be checked by the tests outlined in section A.10.2 (E) 2.1.

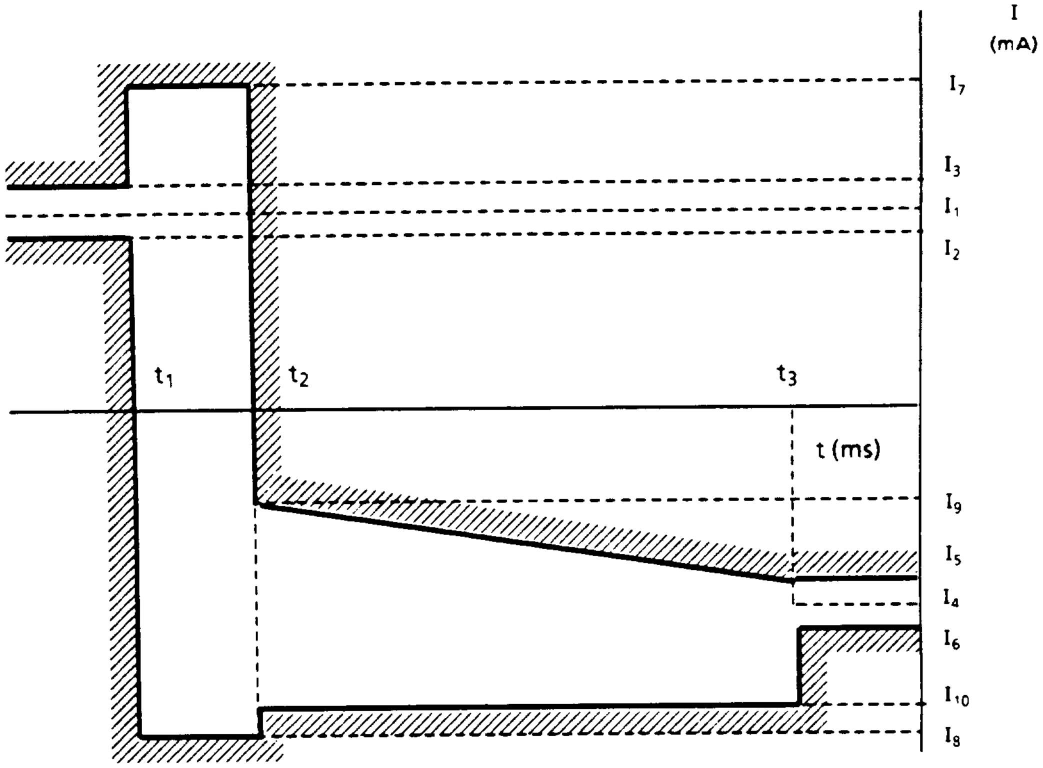


Figure 10.2 (E) 2.1: Transient after a change to the opposite polarity

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.

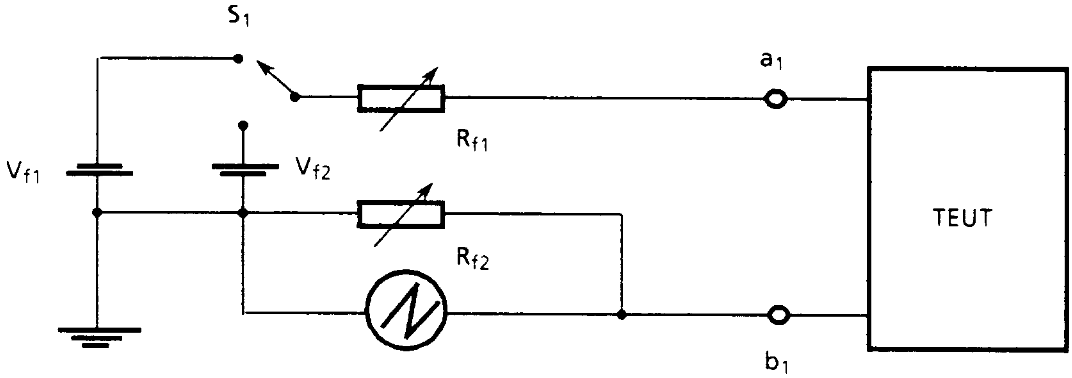


Figure A.10.2 (E) 2.1: Transient after a change to the opposite polarity

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.

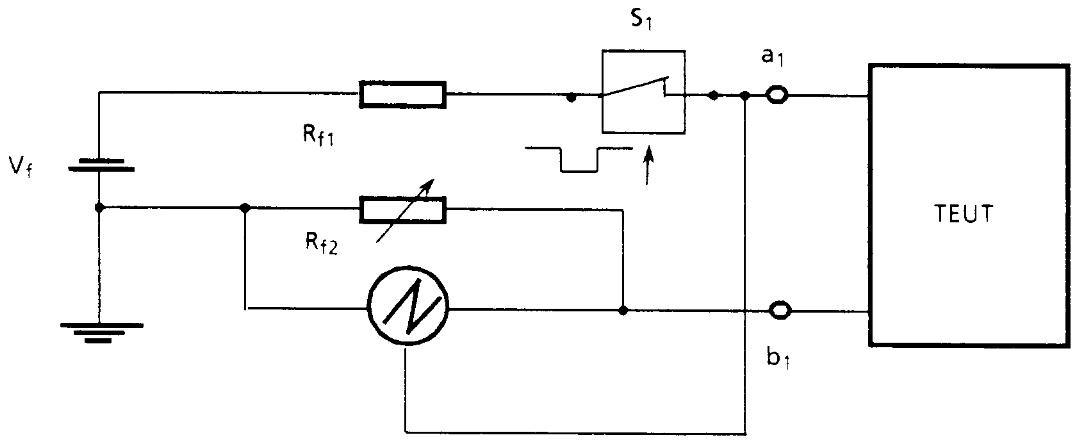


Figure A.10.2 (E) 2.2: Transient after a line interruption

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 V, R_f = 500 ohms, e = 66 V_{rms}/ 50 Hz

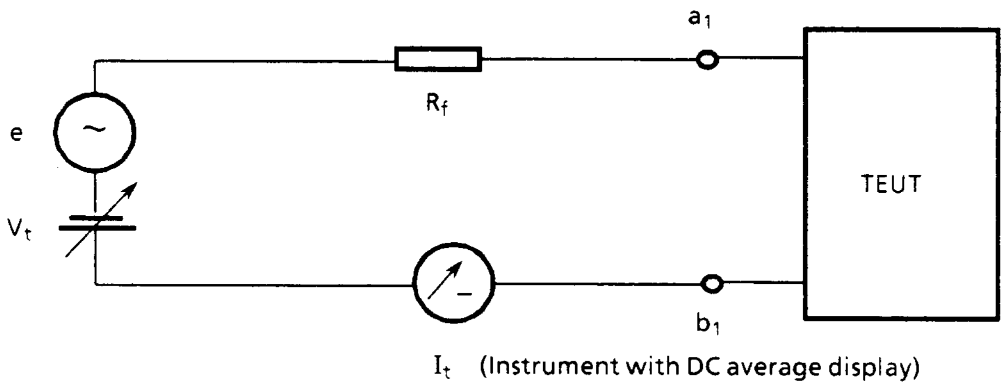


Figure A.10.3 (A) 1: DC flow in the ringing condition

10.3 (B) Belgium

10.3 (B) 1 TE identification

For TE, 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 µA
V_s = 5 V_{rms}
f = 25 Hz

Compliance for this subsection shall be determined by measurement according to the corresponding tests outlined in section A.10.3 (B) 1.

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 V and frequency f = 25 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

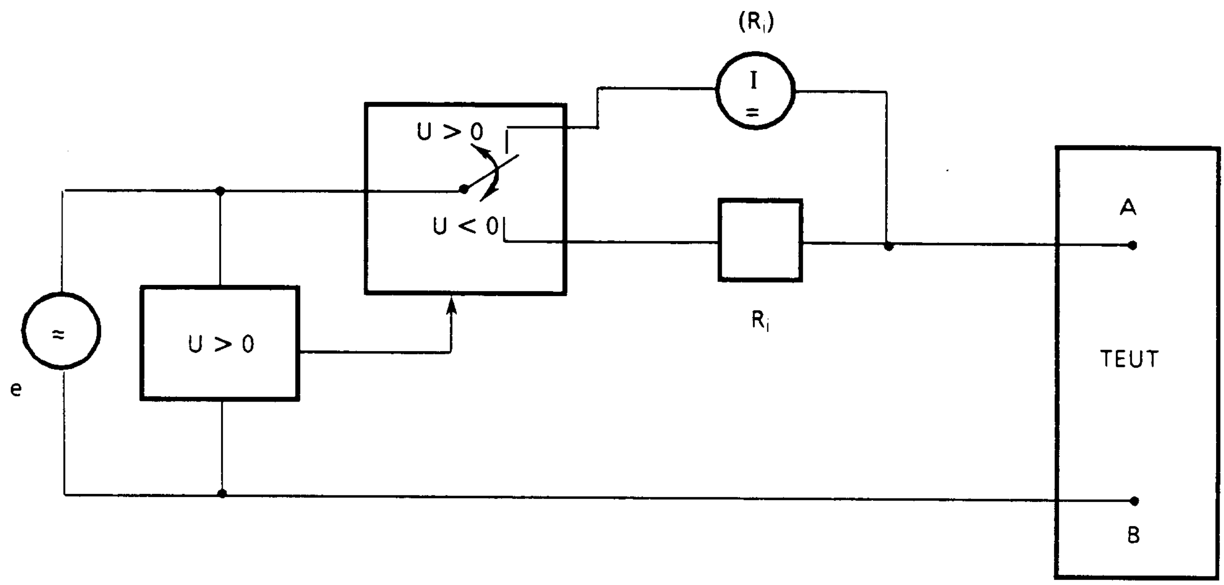


Figure A.10.3 (B) 1

10.3 (DK) **Denmark**

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.

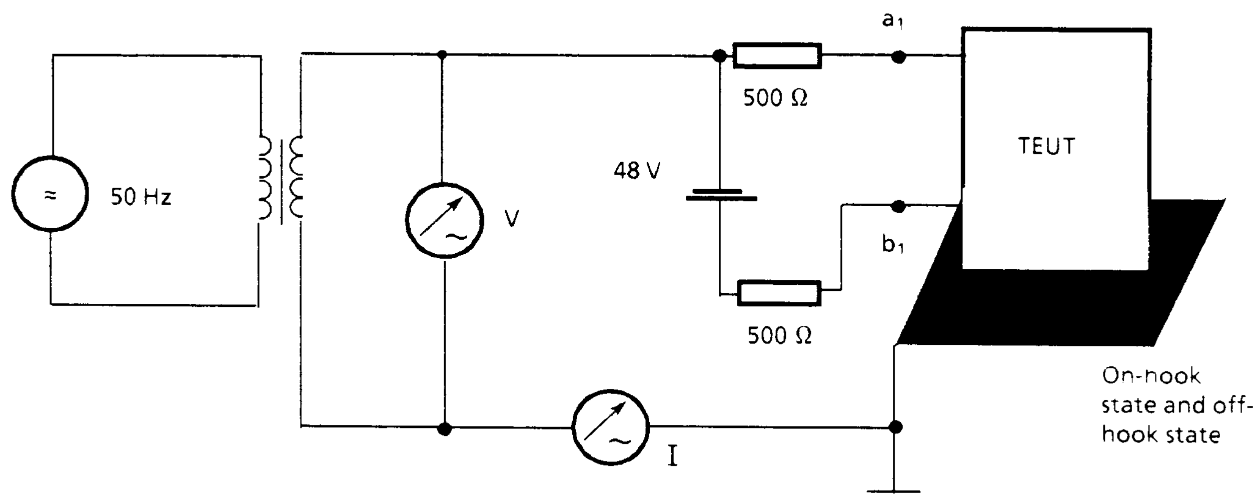


Figure A.10.3 (DK) 1

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 V and f = 50 Hz.

10.3 (DK) 2 **DC current component during ringing**

The DC current component during a burst of ringing voltage shall be less than 1,5 mA, when the TE in the ringing condition is subjected to 56 V_{DC} superimposed with 120 V_{AC}, 25 Hz.

A.10.3 (DK) 2 **DC component during ringing**

The test principle is shown in figure A.10.3 (DK) 2.

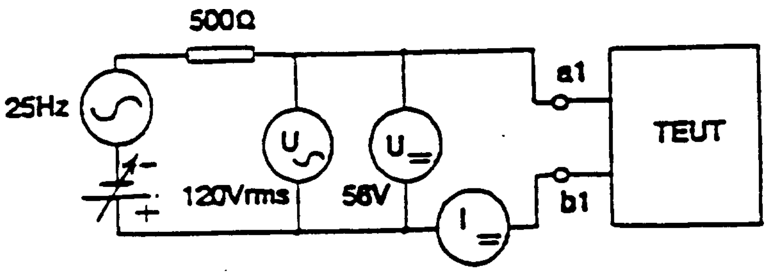


Figure A.10.3 (DK) 2

10.3 (F) **France**

10.3 (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.

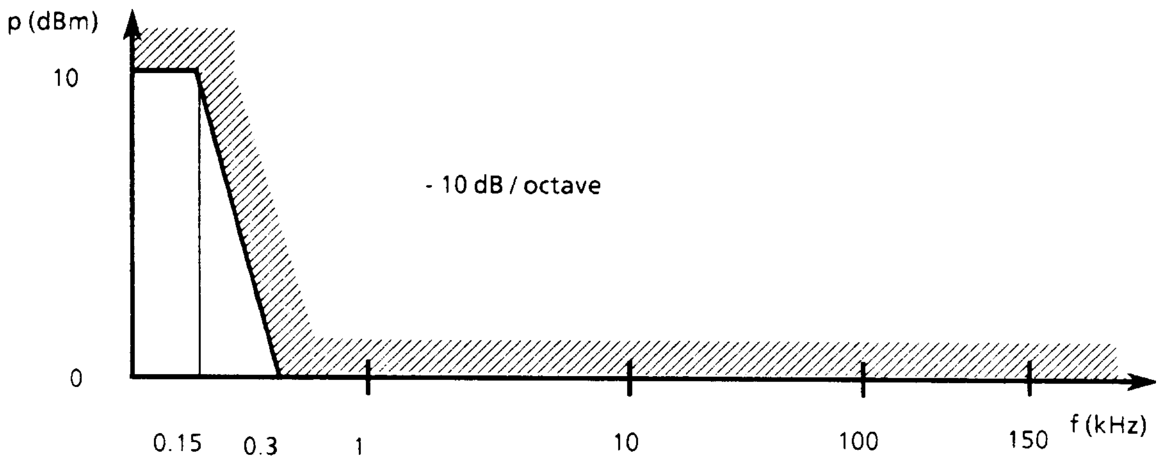


Figure 10.3 (F) 1.a: Maximum of harmonic level from TE in ringing state

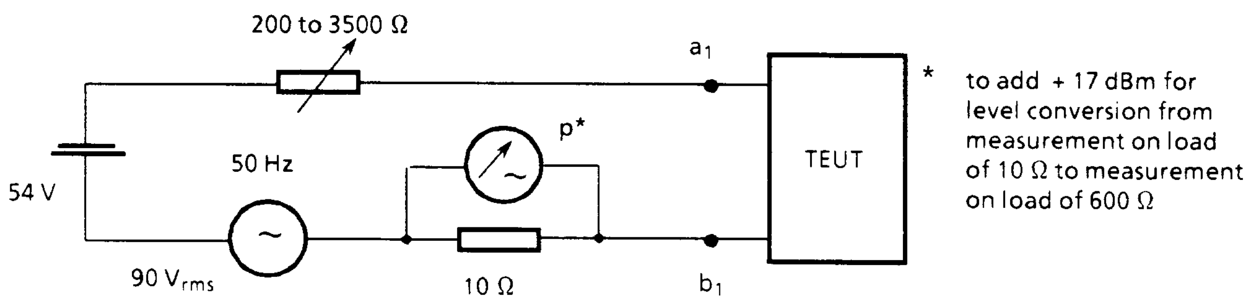


Figure 10.3 (F) 1.b: Test of harmonic distortion from TE in ringing state

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:

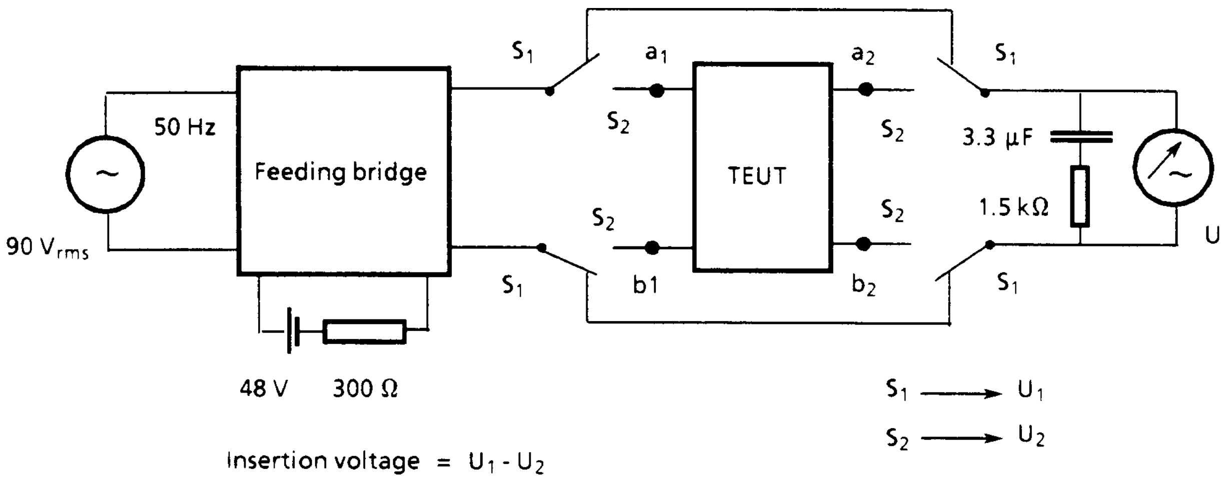


Figure 10.3 (F) 2: Series-connected TE insertion loss at 50 Hz

10.3 (D) **Germany**

10.3 (D) 1 **General**

10.3 (D) 1.1 See Chapter 1, section 1.7.9 (D) 1 and Chapter 6, section 6.3.1 (D) 1.

10.3 (D) 1.2 **Telecommunication messages**

Telecommunication messages may be sent or processed, as appropriate, by the called terminal equipment only after call answering if the dc resistance is within the permissible range for "$I \geq 20$ mA", as shown in Chapter 2, section 2.1 (D) 1. The processing of messages is defined as any logical conversion of signals.

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) within the range 0,8 ÷ 1,1 µF for TE with ringer or with ring detection circuitry which produces directly a discernible signal to indicate the presence of ringing signal;

b) ≤ 1,1 µF 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**

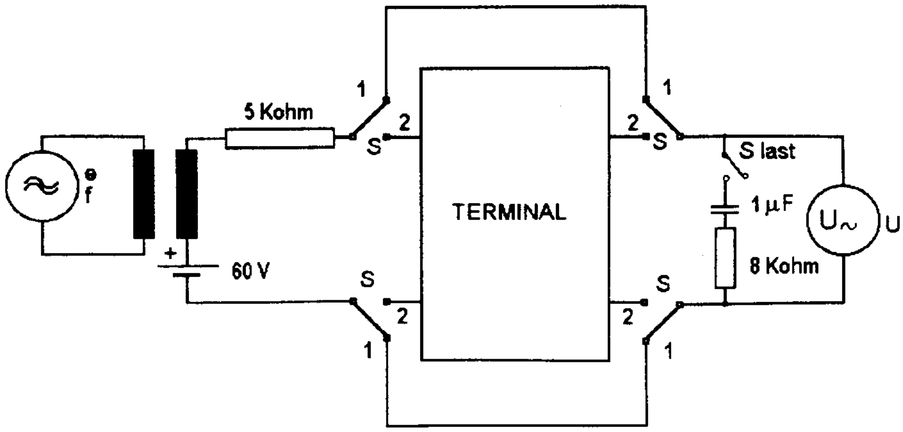
Compliance of the capacitance value shall be checked by inspection.

10.3 (N) **Norway**

A.10.3 (N) 1 **Attenuation for series connected equipment**

The attenuation added to by equipment which may be connected in series between a terminal equipment (i.e. telephone set) and the telephone line shall be below 2 dB for a 25 Hz ringing signal.

The attenuation is calculated from the formula A = 20 log (U_1/U_2). The measurement is performed according to figure A.10.3 (N) 1. U_1 and U_2 are the registered values with the switch S in position 1 and 2 respectively.



"e" shall be adjusted till U shows 75 V_{rms} with switch S_{load} open. S_{load} shall be closed during the measurement of the attenuation.

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 the two line terminals shall not be lower than the equivalent to a lossless capacitor with a value of:

a) 1,1 µF (= 1 µF + 10%) for TE in which the received ringing signal is directly converted to an acoustic signal;

or

b) 0,37 µF (≅ 0,33 µF + 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 200 Ω.

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 kΩ).

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 capacitor (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 Chapter 3, section A.3.1.1 (E) 1, here used as a modulus of a complex impedance (in kΩ), 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 (t_0) calculated using formula A.10.3 (E) 1.1.c, where

R is the ratio calculated in test in Chapter 3, section A.3.1.1 (E) 1, here used as a modulus of a complex impedance (in kΩ), and

C_0 is the maximum value of the equivalent capacitor 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).

$$\alpha(^{\circ}) = -\left(\frac{t\,(\text{ms})}{1\,000} \times 360\,(^{\circ}) \times f\,(\text{Hz})\right)$$

Formula A.10.3 (E) 1.1.a

$$C\,(\mu\text{F}) = \frac{-10^3}{2 \times \Pi \times f(\text{Hz}) \times R\,(\text{k}\Omega) \times \sin(\alpha\,(^{\circ}))}$$

Formula A.10.3 (E) 1.1.b

$$t_0\,(\text{ms}) = \frac{1\,000}{360\,(^{\circ}) \times f\,(\text{Hz})} \times \arcsin \frac{10^3}{2 \times \Pi \times f\,(\text{Hz}) \times R\,(\text{k}\Omega) \times C_0\,(\mu\text{F})}$$

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

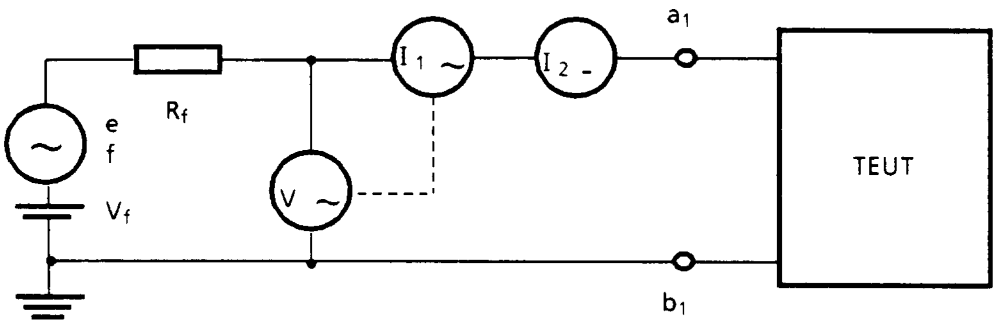


Figure A.10.3 (E) 1.1: Input characteristics

A.10.3 (E) 1.2 Ringing signal maximum direct current

The procedure of test in section A.10.3 (E) 1.1 is followed.

The ammeter (I_2) readings shall fulfil the limit stipulated in the requirement in section 10.3 (E) 1.2.

10.3 (E) 2 Ringing 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 Ringing 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.

$$R\ (M) = \frac{V\ (V)}{I\ (\mu A)} \qquad \text{Formula A.10.3 (E) 2}$$

NOTE: The testing laboratory shall take into account the requirement in section 10.3 (E) 2 which refers to all accessible parts.

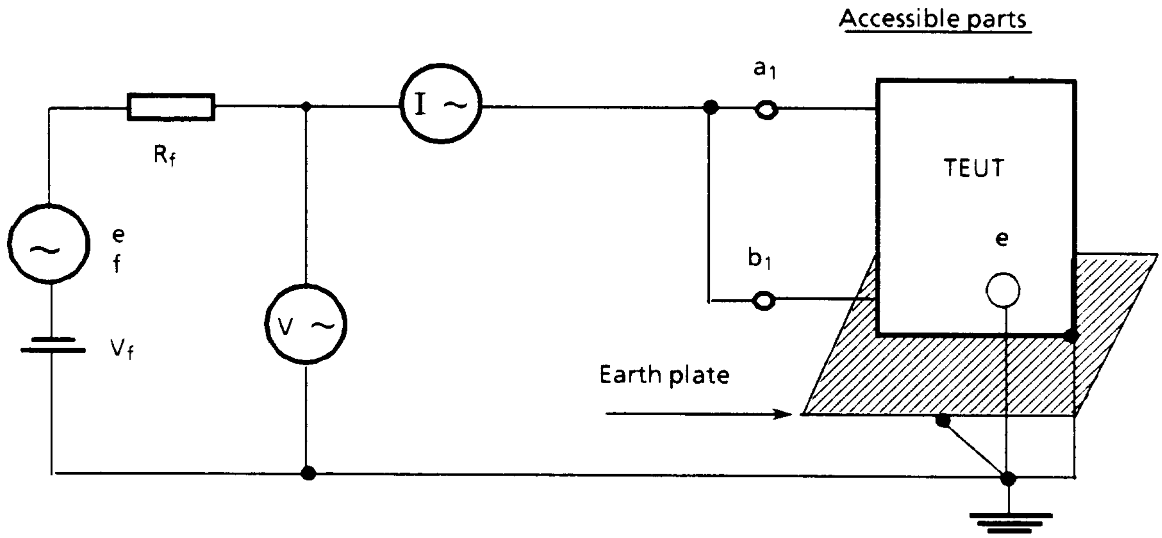


Figure A.10.3 (E) 2: Impedance between line terminals and accessible parts (and earth)

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) 1 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 resistor of 1 kΩ in series with a capacitor 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 capacitor (C_L), and the AC 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.

$$L\ (\mathrm{dB}) = 20 \times \log_{10} \frac{V_1\ (\mathrm{V})}{V_2\ (\mathrm{V})}$$ Formula A.10.3 (E) 3

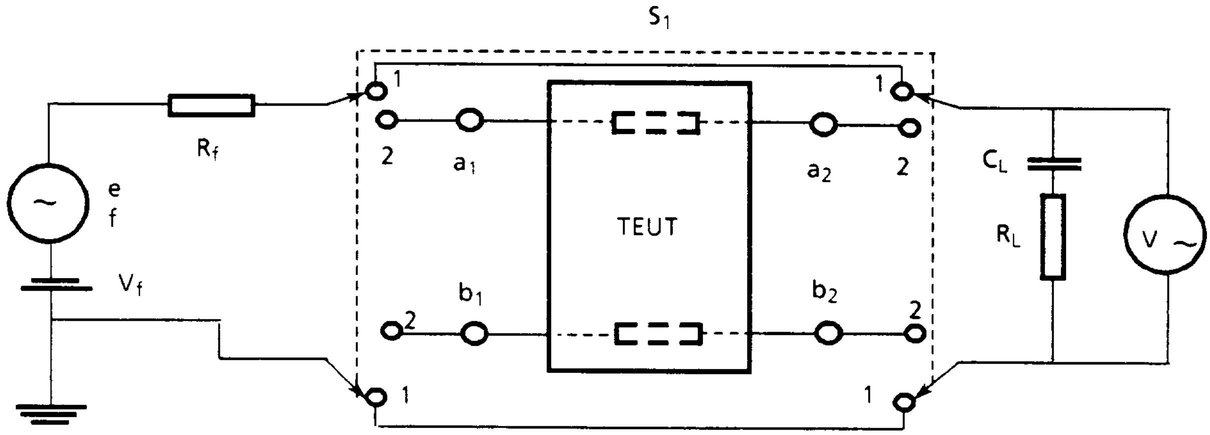


Figure A.10.3 (E) 3: Insertion loss

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 between the line terminals 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.

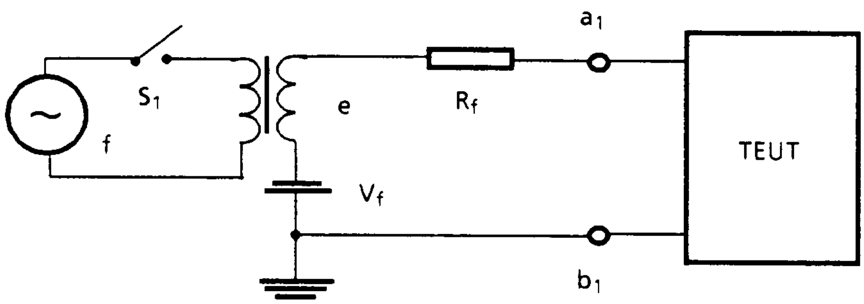


Figure A.10.3 (E) 4.1: Line voltage detector immunity

10.3 (E) 4.2 **Loop current detector immunity (series)**

(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 kΩ in series with a capacitor of 4 µF 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.

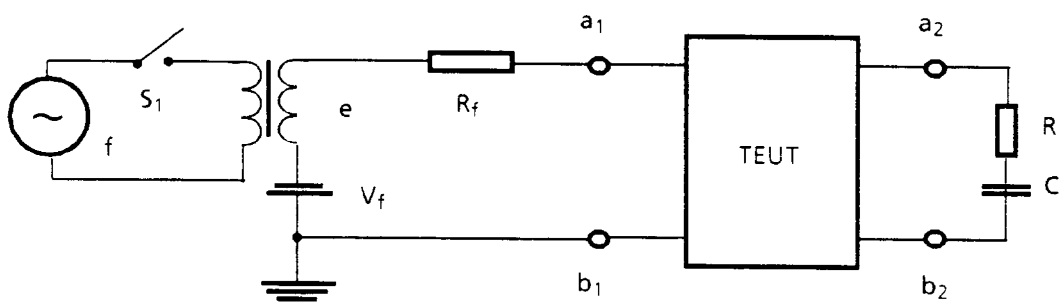


Figure A.10.3 (E) 4.2: Loop current detector immunity (series)

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 ± 2 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 kΩ in series with a capacitor 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.

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.

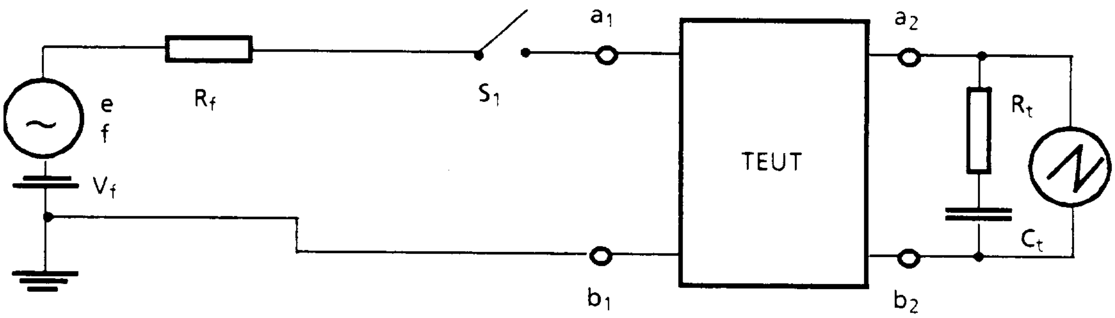


Figure A.10.3 (E) 5: Ringing signal distortion

10.3 (CH) **Switzerland**

10.3 (CH) 1 The present section is an information not a requirement: ringing characteristics (TE placed in quiescent condition with its ringing detector able to function).

Timing of ringer signs:

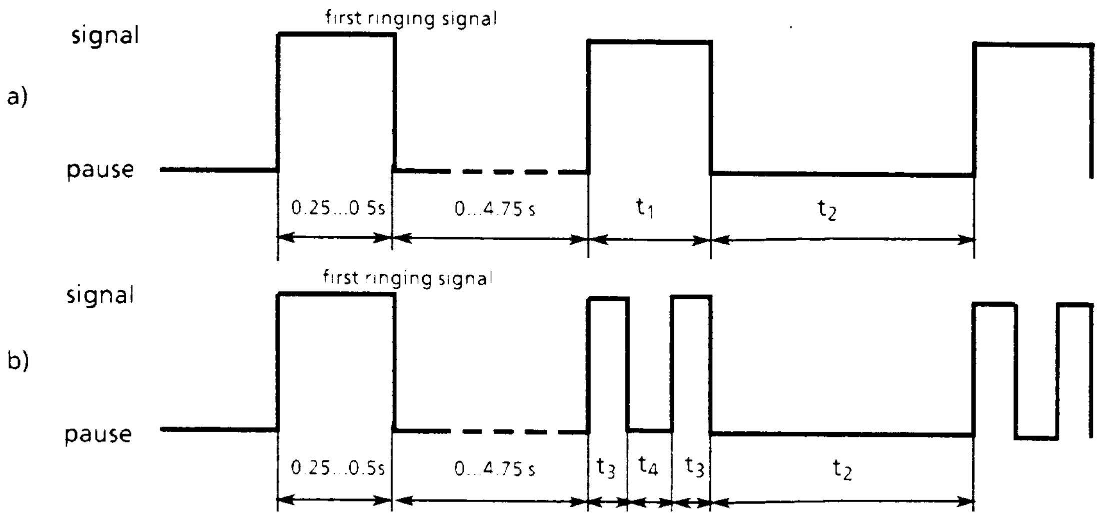


Figure 10.3 (CH) 1: Timing or ringer signals

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 V...90 V emf in the entire source resistance range of 1 kΩ...6 kΩ (purely resistive) in the frequency range 21 Hz...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

10.3 (GB) 1 3 - wire connection

For TE suitable for 3-wire connection, ringing detectors shall not operate during loop disconnect dialling. A shunt shall be connected between the "A" wire and "shunt" during the dialling period but the shunt shall be removed when the TE is idle.

Compliance shall be checked by the test of A.10.3 (GB) 1. During the test of A.10.3 (GB) 1, bell tinkle shall not be detected.

NOTE: The shunt referred to is typically a resistance of approximately 100 Ω.

10.3 (GB) 2 2 - wire connection

TE suitable for 2 - wire connection, except for those types identified in the following list, shall be subject to the test of a.10.3 (GB) 1 and during the test bell tinkle shall not be detected.

Exceptions:

a) TE that, if approved, would be subject to marking in accordance with the Telecommunications Apparatus (Bell Noise-Labelling) Order 1985;

b) TE with a REN of 4;

c) TE entirely or primarily concerned with data transmission or dedicated to multi-station or multi-line layouts supervised by a call-connect system or a cluster controller.

A.10.3 (GB) 1 The TE to be tested is plugged into one of the sockets of a typical installation as shown in figure 8.2 (GB) 1.2 or connected in the manner specified by the supplier and indicated in the instructions for use. The line terminals or leads intended for connection to the basic network loop are connected to the test circuit of figure A.5.3.6 (GB) 1.3 at an artificial line length of 3 km using the pulse detector circuit of figure A.5.3.6 (GB) 1.2a to energise the TE.

For TE with REN values other than 4, two tests are made for the detection of bell tinkle as follows.

a) Generation of bell tinkle pulses by the TE under test:

   1) A dummy ringer as shown in figure 20 is connected between pin 2 and pin 4 of another socket of the installation.

   2) Activation of the TE loop disconnect dialling circuits is effected by dialling a series of digits, for example "1" followed by a series of digits "0".

   3) Bell tinkle is detected if the peak to peak voltage across the dummy ringer exceeds 50 V, measured using a high impedance (greater than 1 Mohm) detector.

   4) The dummy ringer is then removed from the installation.

b) Susceptibility of the ringing detector in the TE under test to bell tinkle pulses.

1) A reference source as described in A.5.3.6 (GB) 1 (with the spark quench circuit removed) is connected between pin 2 and pin 5 of another socket of the installation.

2) A 100 ohm resistor is connected between pin 2 and pin 5 of either the above socket or another socket of the installation.

3) Bell tinkle is detected if at any time when reference source is active, the ringing detector in the TE under test responds in sympathy with the loop disconnect pulses generated by the reference source.

10.4 Transmission characteristics

10.4 (A) Austria

10.4 (A) 1 Frequency range of single frequency signals

Single frequency signals sent to the PSTN by TE shall be within a frequency range from 920 Hz up to 2 115 Hz.

10.4 (A) 2 Crosstalk in loop condition

For TE provided with more than one PSTN CP the crosstalk loss between the ports shall be ≥ 65 dB in the frequency range 300 Hz - 3 400 Hz.

10.4 (B) Belgium

10.4 (B) 1 Cross-talk

The TE with more than one PSTN access, 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 - $I_{max.}$
V_f = 48 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 (V_f = 48 V; R_f = 400 Ω, 1 600 Ω), the impedances Z_G and Z_L are equal to Z_C as defined in Chapter 4, section 4.1.2 (B) 1 for digital PBX and to 600 Ω for the other equipments.

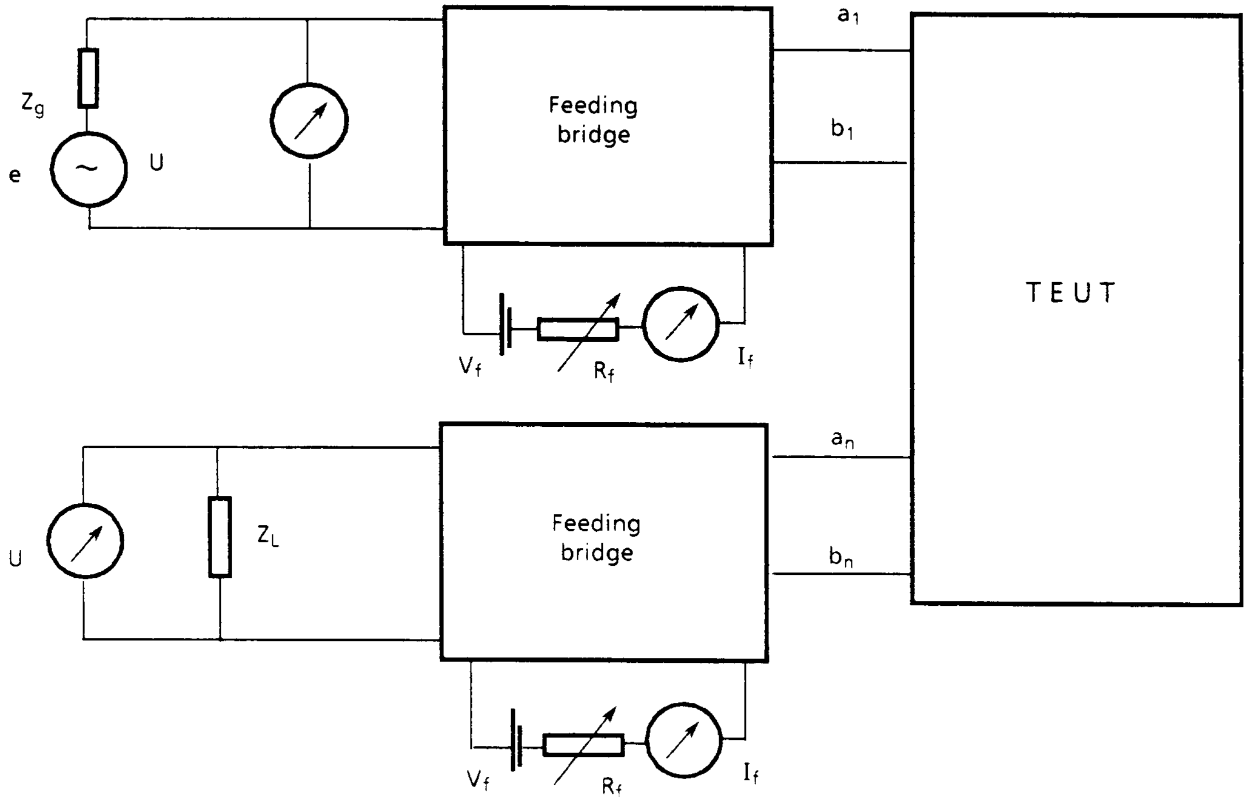


Figure A.10.4 (B) 1

10.4 (D) Germany

10.4 (D) 1 General requirements for all TEs

10.4 (D) 1.1 Polarity independence

See Chapter 1, section 1.2 (D) 1.

10.4 (D) 1.2 Resistance against meter pulse signals

See Chapter 1, section 1.7.8 (D) 1.

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_l 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_{l1} (dB) = 40
Δf_1 (Hz) = 40 - 300
α_{l2} (dB) = 50
Δf_2 (Hz) = 300 - 600
α_{l3} (dB) = 55
Δf_3 (Hz) = 600 - 3 400

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

V_f (V) = 45 - 55
R_f (Ω) = 300 - 1 800

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 at least 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).

$$AF2\ (dB) = 20 \times \log_{10} \frac{V_1\ (V)}{V_{22}\ (V)} \qquad \text{Formula A.10.4 (E) 1.2.a}$$

$$AF3\ (dB) = 20 \times \log_{10} \frac{V_1\ (V)}{V_{23}\ (V)}$$ Formula A.10.4 (E) 1.2.b

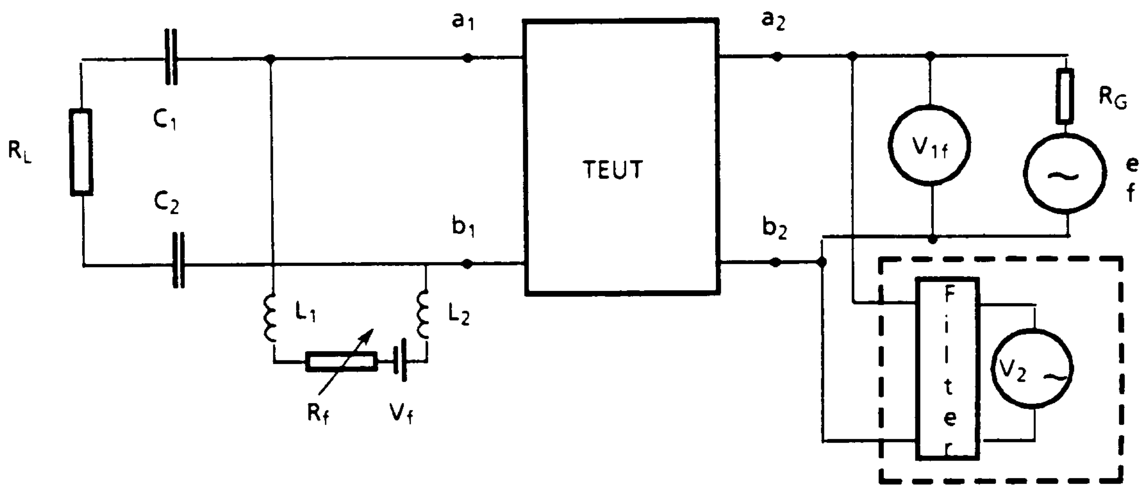


Figure A.10.4 (E) 1.2: Impedance linearity (series)

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 1 000 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 (and earth)

A.10.4 (E) 2.1 Impedance between the line terminals and accessible parts (and earth) 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 1 000 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 ($||Ze||$) 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.

$$||Ze|| \quad (M\Omega) = \frac{V\ (V)}{I\ (\mu A)} \qquad \text{Formula A.10.4 (E) 2.1}$$

NOTE: The testing laboratory shall take into account the requirement in section 10.4 (E) 2.1 which refers to all accessible parts.

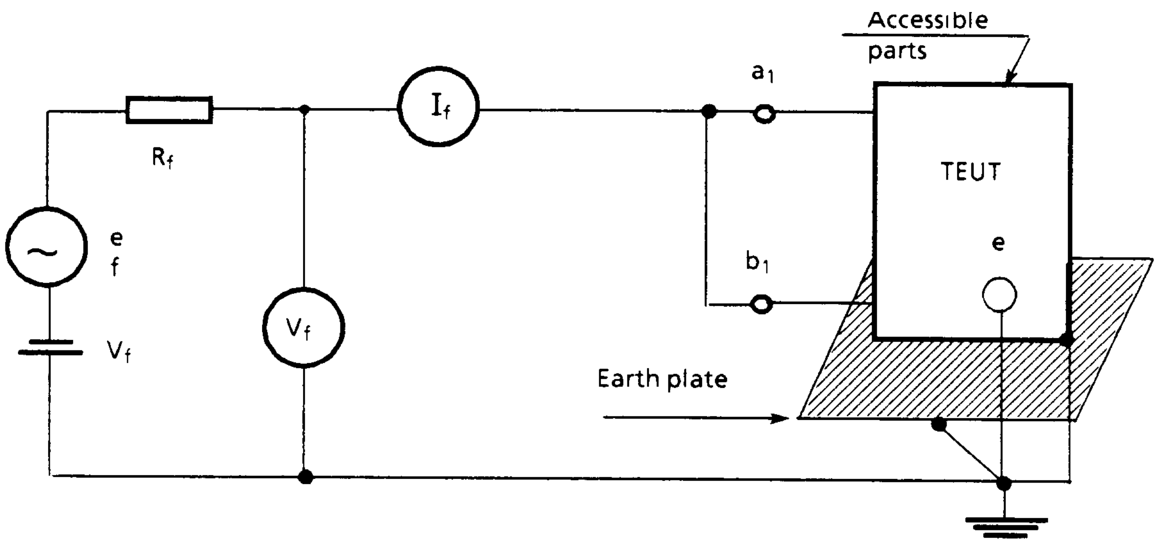


Figure A.10.4 (E) 2.1: Impedance between line terminals and accessible parts (and earth) in quiescent condition

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 1 000 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.

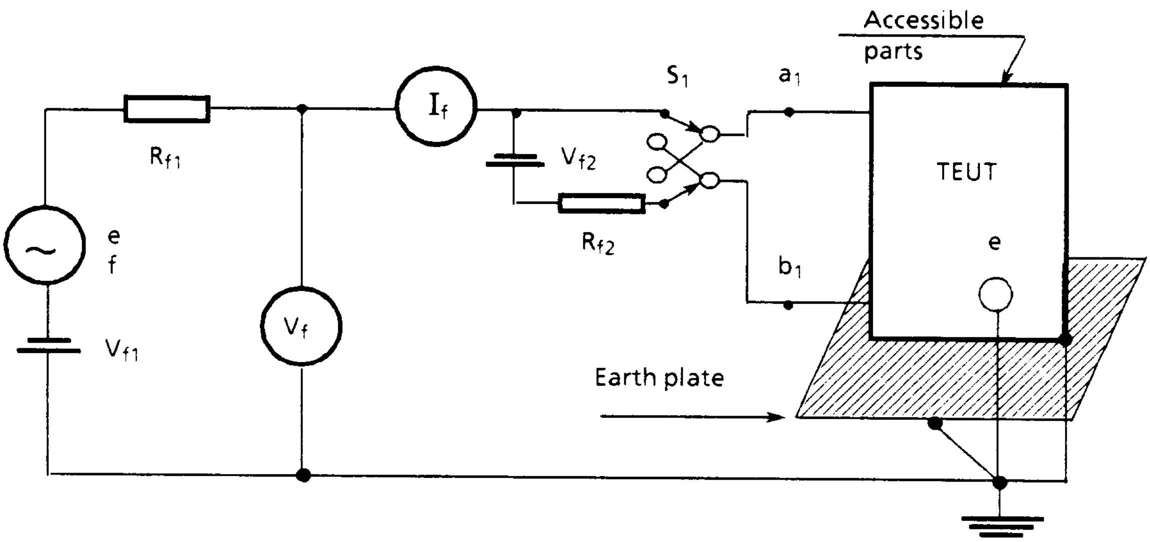


Figure A.10.4 (E) 2.2: Impedance between line terminals and accessible parts (and earth) in loop condition

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 µPa, 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 Chapter 5, 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 1 000 ohms.

The capacitor (C_1) takes the value of 20 µF, 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 its absolute maximum output acoustic 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).

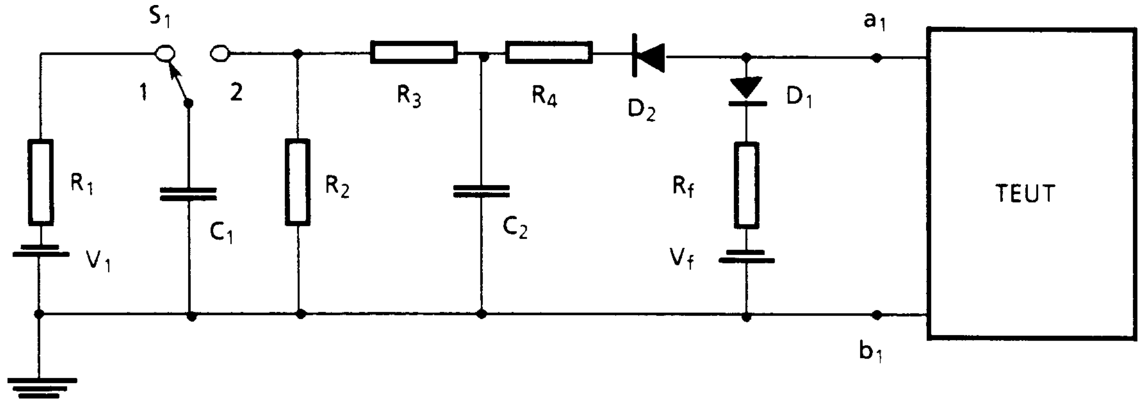


Figure A.10.4 (E) 4: Protection against acoustic shocks

10.4 (E) 5 Cross-talk between input terminals of two lines (multi-line)

With a 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 µF.

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.

$$CTP\ (dB) = 20 \times \log_{10} \frac{V_1\ (V)}{V_2\ (V)}$$ Formula A.10.4 (E) 5

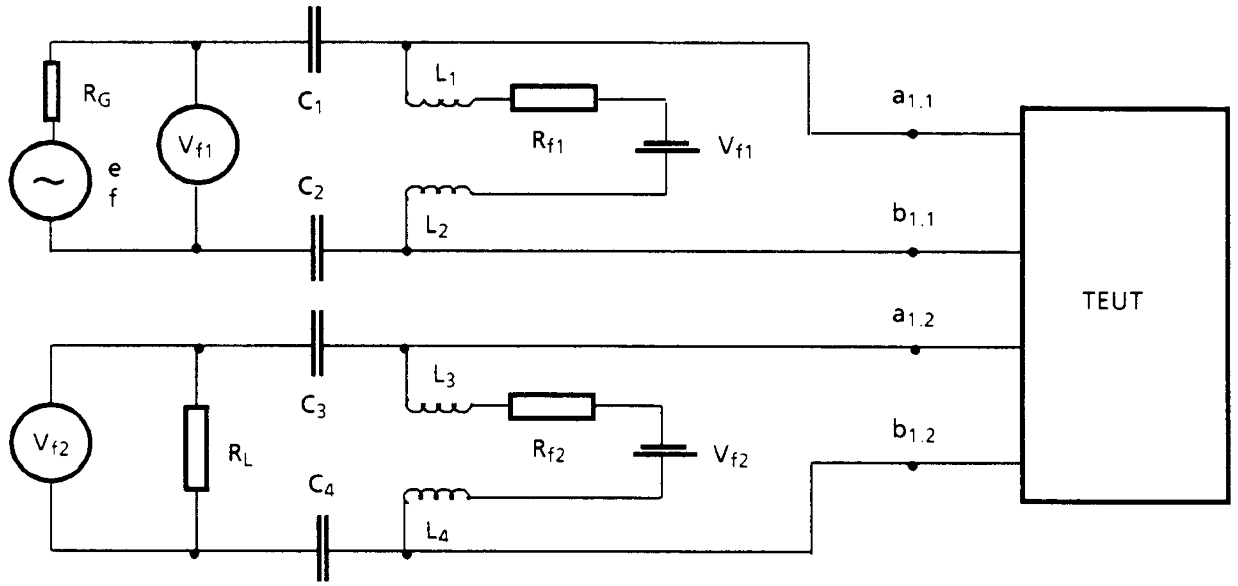


Figure A.10.4 (E) 5: Cross-talk between input terminals of two lines (multi-line)

10.4 (S) Sweden

10.4 (S) 1 General transmission requirement

The equipment shall 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 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) 2 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 shall be corrected at the frequencies in question.

NOTE: The frequency response curve presented in figure A.10.4 (S) 2 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.

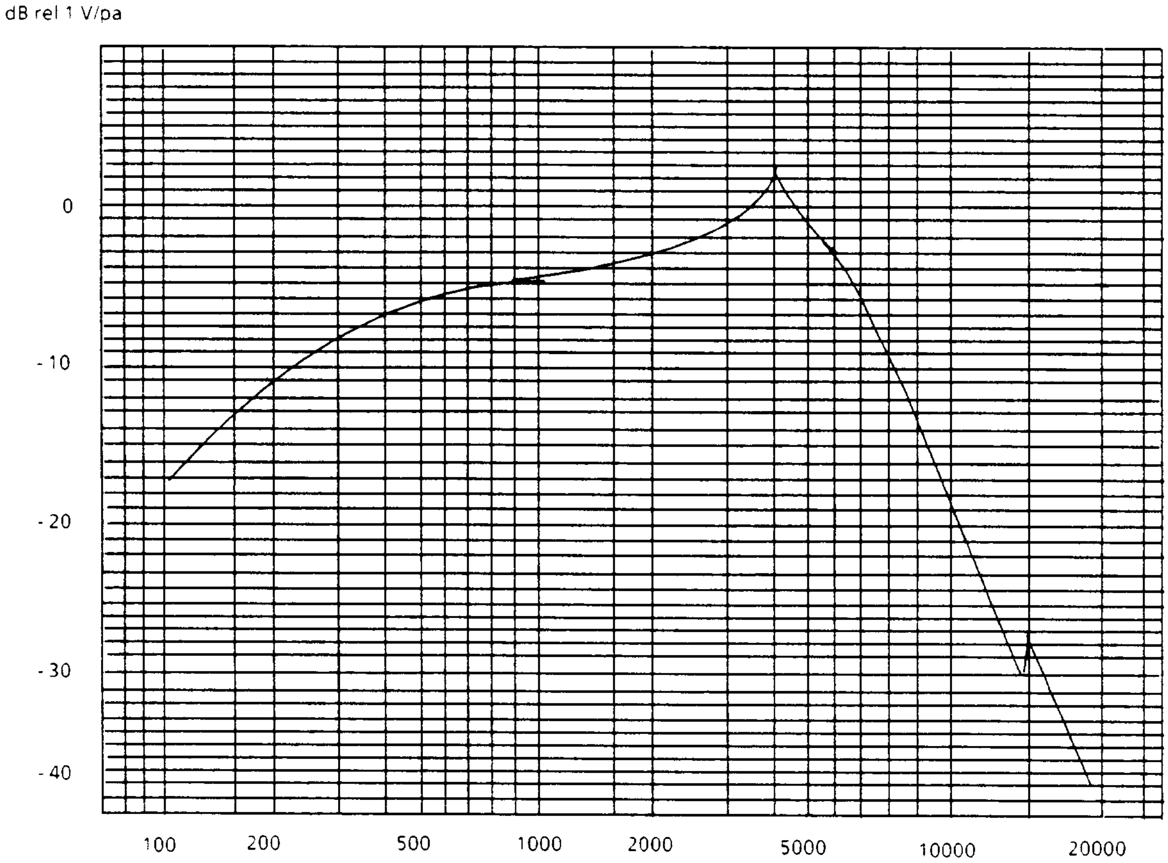


Figure A.10.4 (S) 2: Frequency response curve

10.4 (S) 3 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 of the Swedish type (2 places), respectively contacts 4 and 5, if the plug is designed according to ISO 8877 (2 places). The power level into a load of 600 ohms at the connection pins 3 and 4, if the plug is of the Swedish type (2 places), respectively at the contacts 3 and 6 if the plug is designed according to ISO 8877 (2 places), shall not exceed -78 dBm.

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.

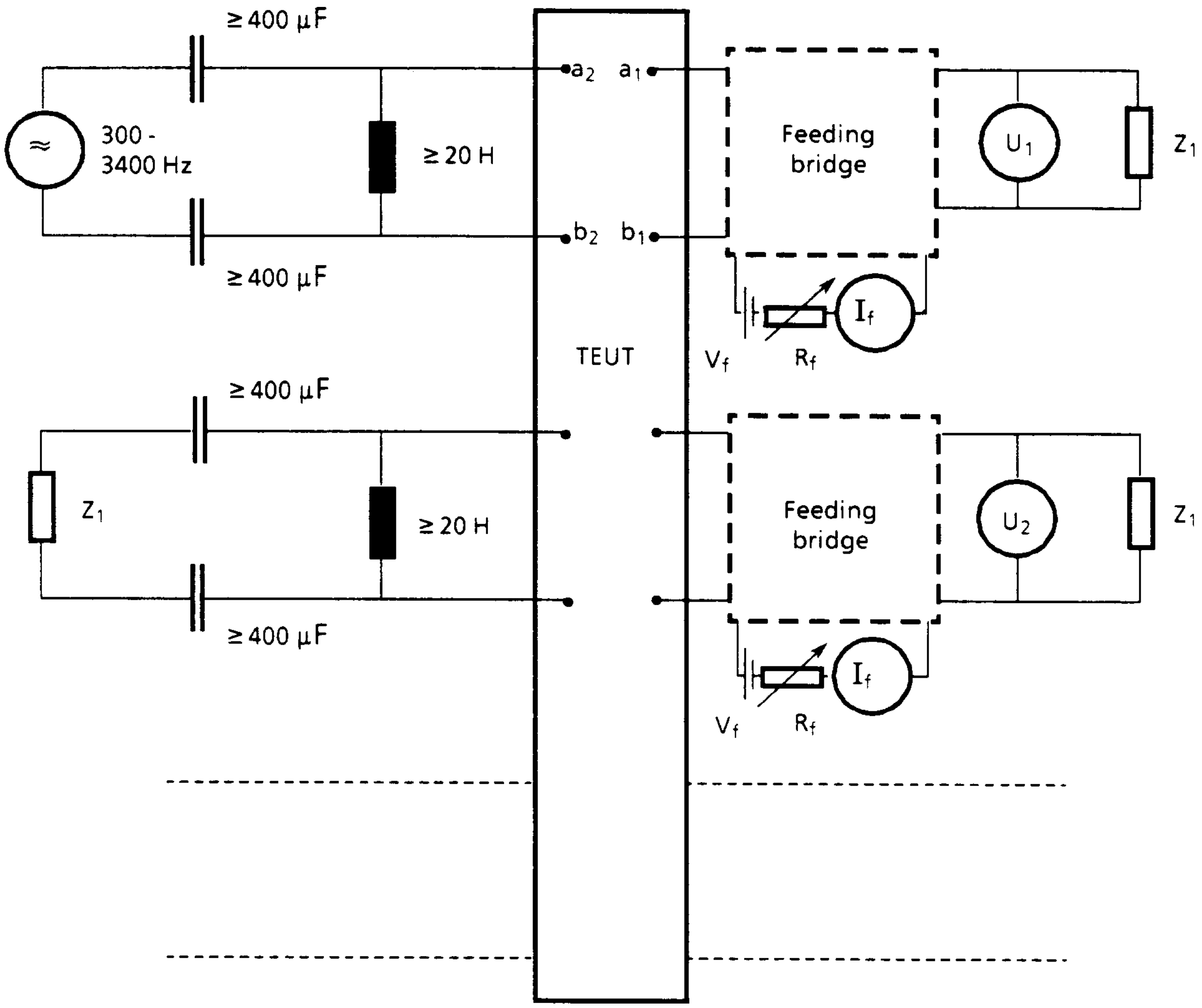
Voltages U_1 and U_2 are measured by a selective level measuring set. Cross-talk attenuation, expressed in dB, is calculated according to the formula A.10.4 (GB) 1.

$$\text{Cross-talk attenuation} = 20 \log_{10} \frac{U_1}{U_2} \text{ dB} \qquad \text{Formula A.10.4 (GB) 1}$$

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. (bounce times shall be fully contained within the specified periods of current interruption and current pulse).

10.5 (A) 2 Decadic dialling distortion caused from a series or parallel connected TE

A series or parallel 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 ± 0,5 ms.

A.10.5 (A) 2 Decadic dialling distortion caused from a series or parallel connected TE

The series connected 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. The time values shall be read off at a current value of 18 mA.

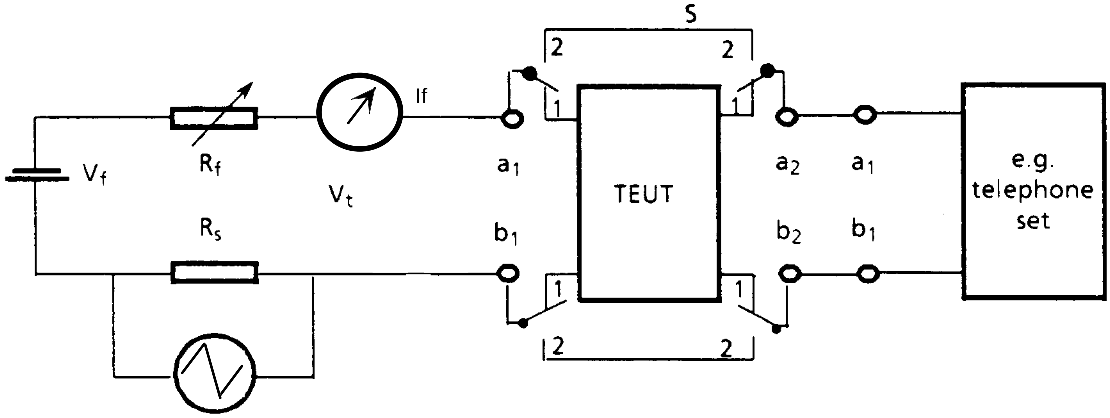


Figure A.10.5 (A) 2: Decadic dialling distortion caused from a series connected TE

For parallel connected TEUT an equivalent test shall be carried out.

10.5 (A) 3 **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 shall be 2 s - 5 s.

After the trunk line access function (see section 10.9 (A) 1) a dial tone detection or timer function according to Chapter 5, section 5.6.3 is required. The dial tone detection or timer function is not required if the PABX includes a dial tone detection.

10.5 (B) **Belgium**

10.5 (B) 1 **TE with automatic calling functions**

It is mandatory that a TE with automatic calling functions has an IDT detectors. This kind of TE is not agreed to dial international calls when it is connected on public electro-mechanical exchanges.

It is mandatory that a TE with automatic dialling functions is able to dial in decadic or MFPB mode. If it provides only MFPB signals it is not agreed to be connected on public electro-mechanical exchanges.

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 Chapter 8, 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 Chapter 5, 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 See Chapter 5, section 5.1 (D) 1.

10.5 (D) 1.2 See Chapter 2, section 2.4.2 (D) 1.

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 See Chapter 5, section 5.1 (D) 1.

10.5 (D) 2.1.3 See Chapter 5, section 5.6.7.1 (D) 1.

10.5 (D) 2.2 Initiation of dialling

10.5 (D) 2.2.1 See Chapter 5, section 5.1 (D) 1.

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 Chapter 5, 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

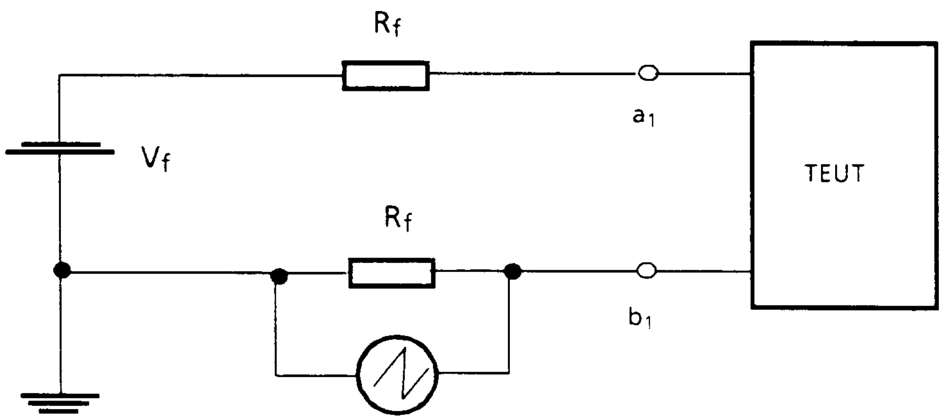
TE capable of dialling shall at termination of the dialling condition revert to the loop condition in such a way that the loop current shall reach a value not less than 20 mA, 4 ms after the commencement of that change.

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 (Ω) = 200

Figure A.10.5 (P) 2: Switching after dialling condition

10.5 (E) Spain

PROVISION: See the provisions 1 to 4 in Chapter 5, 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 Chapter 5, 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 loop condition 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 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 Chapter 2, 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 Chapter 2, 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 Chapter 5, sections 5.2.1 (E) 1.a, 5.2.2 (E) 1 and 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 Chapter 5, 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 Chapter 2, 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 Chapter 5, 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 to 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 a 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.

PROVISION 4: However, for TE that after the start of dialling sequence activate a call progress monitor in order to enable audible monitoring of the progress of the call attempt, it is possible to restart the dialling sequence after a waiting period of at least 4 seconds.

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 Chapter 5, 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 Chapter 5, 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 (±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 Chapter 4, section 4.1.2 (E) 1.

Compliance shall be checked by 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 Chapter 4, 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 Chapter 5, 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.

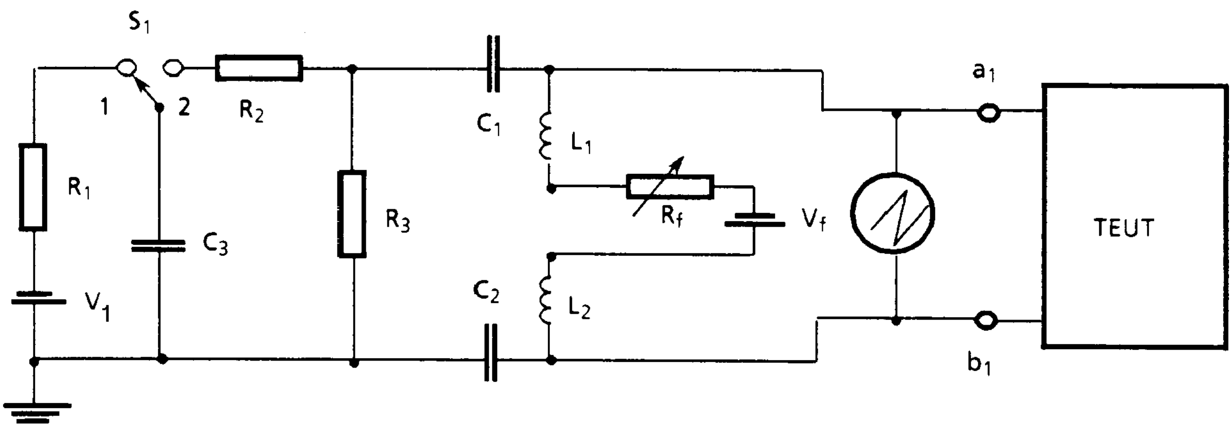


Figure A.10.5 (E) 4.2: Dial tone receiver immunity

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 Chapter 5, sections 5.3 and 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 Chapter 5, sections 5.4 and 5.4 (E), and 10.5 (E) 7.

When the TE in the dialling condition 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 mentioned 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 differente 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 more frequently used telephone sets".

and
c) the requirement in Chapter 2, 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 at least 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 It is assumed that the TEUT fulfils the stipulated requirement.

A.10.5 (E) 6.1.d It is assumed that the TEUT fulfils the stipulated requirement 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 Chapter 4, section A.4.1.1 (E) 1, and the provisions 3 and 4 in Chapter 4, 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.

and

b) transient during signalling state:

The resistance stipulated in the requirements in Chapter 5, 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 ($I \leq 480$ µA) 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 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_t) 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 It is assumed that the TEUT would fulfil the associated requirement if the test procedure in section A.10.5 (E) 6.2.a were 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 resistor (R_f) takes the value of 400 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 Chapter 2, section A.2.4.2 (E) 1, and for series TEs the procedure of test in Chapter 2, section A.2.4.2 (E) 2).

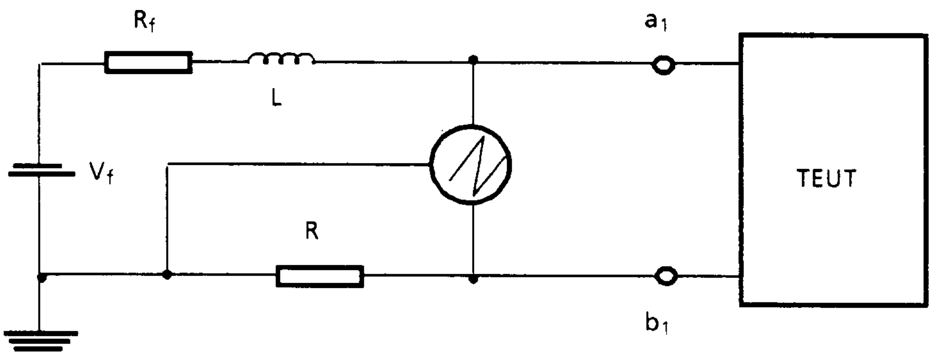


Figure A.10.5 (E) 6.2: Transient response of loop current during dialling with loop pulsing, signal clipping

10.5 (E) 6.3 **Fall and rise time of the current**

NOTE: Reference is made to Chapter 5, figure 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_i), shall not be greater than 2 ms;

and

b) for the last time the 480 µA limit (I_3), shall not be greater than 5 ms.

Compliance shall be checked by 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 µA 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 Chapter 5, 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 Chapter 5, 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 facilides 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 Chapter 2, 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 Chapter 2, section 2.3 (E) 1;

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 It is assumed that the TEUT fulfils the stipulated requirement.

A.10.5 (E) 7.1.c It is assumed that the TEUT fulfils the stipulated requirement when necessary.

A.10.5 (E) 7.1.d It is assumed that the TEUT fulfils the stipulated requirement.

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 5 ms;

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 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 It is assumed that the TEUT would fulfil the associated requirement, if the test procedure in section A.10.5 (E) 6.2.a were 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 Chapter 5, 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 the dial 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 Chapter 5, 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 (R_f) takes only the values of 500 ohms and 2 200 ohms, 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 signals 1, 5, 9 and 0 (or, when it is not provided, the signal ∅) shall be analysed.

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 Chapter 5, 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 condition after a dialling sequence

The TEUT is connected as shown in Chapter 5, 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.

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 MΩ and an input impedance of no lower than 50 kΩ.

The tests shall be done by inspection and 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 the 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 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 Chapter 9, section 9.2.1);

NOTE c: For 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 Chapter 9, 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 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 Chapter 4, section 4.4.2.2 (E) 1 and -18 dBm;

NOTE a.2: See also the requirements in Chapter 9, 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 or a sequence of more than one DTMF signals which are according with the requirements in Chapter 5, section 5.4 and section 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 Chapter 9, 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 Chapter 4, 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 a dialling sequence, or from the change to 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 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 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 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

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 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 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 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 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 control 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, where the stipulated testing signals are applied continuously during the test.

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 the associated requirement in section 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)		
		Closed	(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.10.2 (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.10.2 (E) 2.2 is followed, where the resistors (R_{f1}) and (R_{f2}) take the value of 550 ohms, and switch (S_1) 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 progresses 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 call attempts to the same called number without any intermediate manual 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 detection in PABX

For TE connected in PABX the frequency range Δf shall be 22 Hz - 55 Hz.

Ringing signals with following time values shall be recognised:

minimum ringing signal length: 180 ms,
minimum and maximum interval between two ringing signals:
90 ms and 6 s (non-periodic ringing signals sequences shall also recognised).

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 22 Hz and 55 Hz.

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 (Ω) = 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 Chapter 6, 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 Chapter 6, 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 which of 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 of 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 Chapter 2, 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 change 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 Chapter 6, section in 6.2 (E) and in section 10.6 (E) 3;

and
b) the change to loop condition shall be done according with the requirements in Chapter 2, 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 Chapter 6, sections 6.2.2 (E) 1 and 6.2.3 (E) 1, and in section 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 Chapter 6, 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 following the 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.

When the TEUT passes the inspection mode, it is assumed that it fulfils the requirements referenced in the associated requirement in section 10.6 (E) 2.3.b.

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 ringing condition

The TEUT is connected as shown in Chapter 5, 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_t) is 1,5 seconds closed and 3 seconds opened, until the TEUT changes to loop condition; after that the switch (S_t) 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 MΩ and an input impedance no lower than 50 kΩ.

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 Chapter 4, 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 Chapter 5, section 5.4 and section 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 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 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 to 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 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 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 (B) **Belgium**

10.7 (B) 1 For TEs with telephone functions, which are powered 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.

10.7 (D) **Germany**

10.7 (D) 1 **Operation with external power supply**

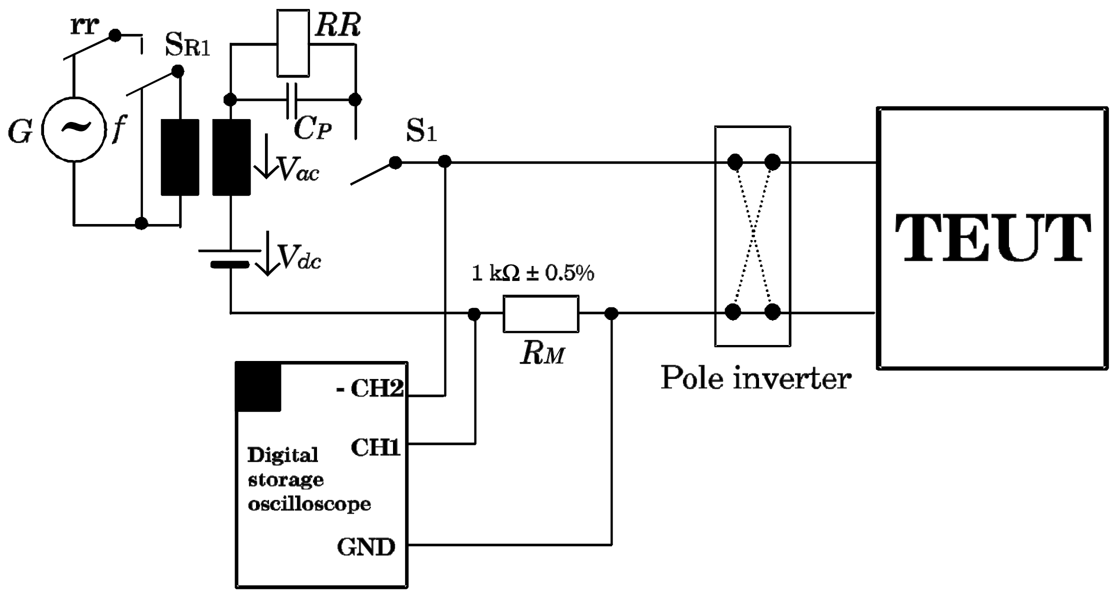
Terminal equipment with an external power supply shall revert to the quiescent state in the event of failure of the external power supply if the operating state at the time of failure cannot be continued.

A.10.7 (D) 1 Operation with external power supply

Preliminary note

"External power supply" is when operating current is supplied to the terminal equipment (TEUT) not only via the NTA of the telephone network / ISDN (e.g. as for a standard telephone), but also via an additional external power supply (e.g. 230 V, low-voltage plug-in power supply or batteries accessible to the user). A "failure of the external power supply" shall be simulated by interruption of power (e.g. by disconnection of the mains plug or the plug-in power supply or by the removal of the non-rechargeable or rechargeable batteries from the compartment).

Measurement



V_{dc} = 63 V	V_{ac} = 75 V	f = 25 Hz	$RR \leq 20\ \Omega$	C_P = 1 000 µF

Figure A.10.7 (D) 1

The circuit illustrated in figure A.10.7 (D) 1 is used for the measurement. The "failure of the external power supply" is initiated by appropriate means.

The TEUT is stimulated to assume the given operating states in succession and in each case failure of the external power supply is simulated once. It is then verified as to whether the TEUT remains in its operating state at the time of failure or reverts to the quiescent state.

The operating state conforms to requirements, if those specified in Chapter 7, section 7.1 (D) 1 are met. If these requirements are not fulfilled, the TEUT shall revert to the quiescent state.

Determination of the state of the equipment after failure of the external power supply:

- The TEUT is in the quiescent state when the voltage V_M (CH1) is $\leq$ 62,8 mV.
- The TEUT is in the off-hook condition or communication state when the voltage V_{TEUT} (-CH2) is 6 V to 22,1 V.
- An oscilloscope is used to determine whether the TEUT has inadmissibly assumed the MFPB (DTMF) or decadic dialling state.

The polarity of the TEUT is reversed by means of a pole inverter and the measurement repeated.

10.8 Connection methods

10.8 (D) Germany

10.8 (D) 1 General requirements

10.8 (D) 1.1 See Chapter 8, section 8.2 (D) 1.

10.9 Special function

10.9 (A) Austria

10.9 (A) 1 Series-connected TE with feeding functions to the second port

Series-connected TE may apply for certain functions a dc or ac voltage to the second port (a_2 and b_2 leads). These voltages shall not under any circumstances reach the PSTN line. The open-circuit dc and ac voltage shall be ≤ 60 V, each voltage measured on the leads a_2 and b_2.

10.9 (A) 2 Loop reseizure function

TE may be provided with an automatic loop current interruption function to reseizure the line. The time duration of the automatic loop current interruption shall be 1,5 s (-250 ms/+0 ms). Loop current interruptions up to 3 s are permissible.

10.9 (A) 3 TE connection to TFE-1 subscriber terminals

TE may be designed for use on TFE-1 subscriber lines (carrier frequency subscriber transmission system). All TE functions shall be guaranteed for a loop current of ≥ 6 mA. Ringing current circuits shall respond in the frequency range up to 65 Hz.

10.9 (A) 4 Secondary ringer attachment

Telephone sets and similar devices may be provided with a connection point "W2" for connecting an external "second ringer" parallel to the TE ringer. The connection point W2 shall be disconnected from the line a or b during decadic dialling.

10.9 (A) 5 Last number memory function

TE may be provided with a last number memory function. If such TE are connected in PABX and the last number memory is able to store a trunk line access function, between the trunk line access function and the subsequent dialling shall be a dial tone detection or timer function according to Chapter 5, section 5.6.3. The dial tone detection or timer function is not required if the PABX includes a dial tone detection.

After transmission of the digits it is not permissible to transmit earthing or register recall signals.

10.9 (A) 6 Trunk line access functions

Depending on the PABX design TE may be provided with various trunk line access functions. Trunk line access functions are:

- earth button function (earthing the line a and/or b before or after line seizure), the time duration of the earthing pulse shall be ≥ 200 ms;

- register recall function (flash function), see Chapter 9, section 9.1;

- access code.

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 Chapter 9, 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 Chapter 5, 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) <u>Conditions of non-detection</u>

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 shall 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 requirement is mandatory only for payphones. The longitudinal conversion loss in the frequency band 15 kHz - 17 kHz shall be greater than 50 dB.

10.9 (CH) Switzerland

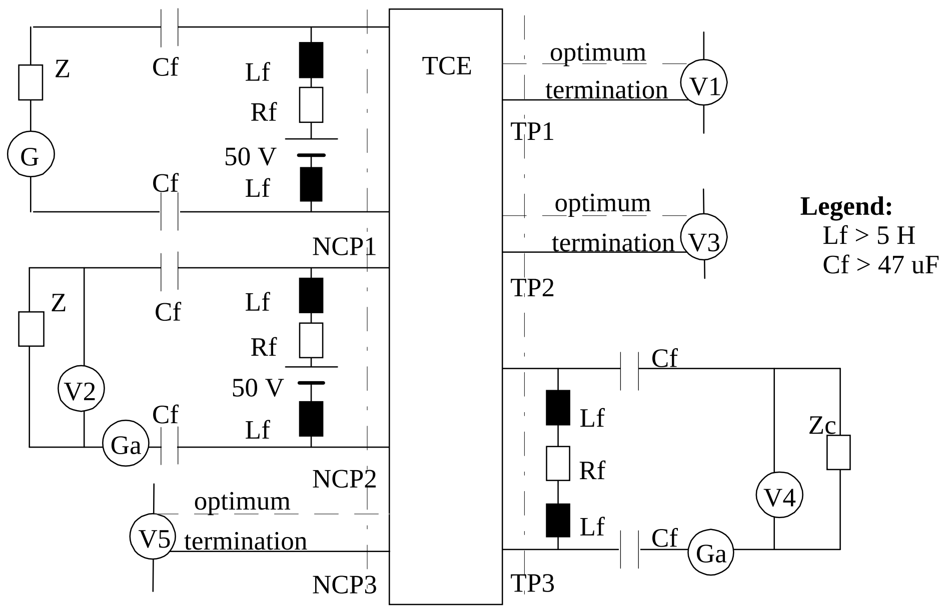
In the present section the following abbreviations are used:

EMF	Electromotive force
NCP	Network Connection Point of a TA
NTP	Network Termination Point of the PN
OFCOM	Federal Office for Communications (BAKOM)
PN	Public Network
TCE	Through Connecting Equipment
TP	Termination Point of a branch of a TCE

10.9 (CH) 1 Multiline TE (option)

10.9 (CH) 1.1 **Insulation:** The Network Connection Points (NCPs) shall be insulated against each other (tests equivalent to EN 41 003, Section 4.5, case c).

10.9 (CH) 1.2 **Crosstalk:** Crosstalk attenuation shall be at least 68 dB.



NOTE 1: The optimum termination in figure 10.9 (CH) 1.1 corresponds to the nominal termination impedance in the case of an analogue TP or NCP, or to the digital measuring device in the case of a digital TP or NCP.

Test: The measurements are conducted with Vf = 50 V, Rf = 1 000 Ω the reference complex impedance used for return loss measurements, connection G-V1 and the following test levels:

for TCE (Through Connecting Equipment):

-9 dBVEMF if the test signal is supplied to the PSTN-NCP by the PSTN (multi-line TE);

-2 dBVEMF if the test signal is supplied to an analogue branch interface by a downstream TE;

-9 dBm0 if the test signal is supplied by an ISDN interface or by;

a 0 dBr point as per I-ETS 300 003, section 4.2.1.

for voice TE

-4,7 dBPa at the MRP (Mouth Reference Point) used for the acoustic measurements.

The following crosstalk measurements as per figure 10.9 (CH) 1.2 must be carried out: G-V2, G-V3, G-V4 and G-V5. Ga is an activating signal generator as I-ETS 300 004, section 5.2.1.4. The possible combinations are illustrated below in section 10.9 (CH) 2.

NOTE 2: The requirement is also deemed as met if I-ETS 300 004, section 5.2.1.4 is met.

Figure 10.9 (CH) 1.2 : Measurement circuit for crosstalk

10.9 (CH) 1.3 **Simultaneous line seizures (option):** In automatic mode, a TE shall not carry out more than a maximum of 15 seizures of subscriber lines from one exchange simultaneously. Every new group of subscriber lines may only be seized at the earliest 5 s after the previous one.

10.9 (CH) 1.4 Connections with another NCP (option):

A conference is a linkage, in terms of transmission technology, between connections. Call forwarding is a conference between a terminating and originated call with the switched network.

NOTE 1: Connections between NCPs are limited to conferences between terminating calls (e.g. telekiosk) and call forwardings.

NOTE 2: Call forwarding is permitted if the called subscriber remains the same (to be verified in accordance with the manufacturer's declaration or note in the product documentation).

NOTE 3: Conferences between terminating calls and call forwardings are considered as supplementary functions.

Requirement 1: The TE shall release the connection after a maximum connection duration of 2 hours.

Requirement 2: Both forward and reverse release of connections shall be guaranteed. TEs with analogue NCP shall provide an automatic release as per Chapter 5, section 5.6.6.1 (CH) 1.

NOTE 4: I-ETS 300 004 states recommendations for voice services supported by TCEs aiming the promotion of a minimal voice quality for the subscribers of the Public Network. In the case of call forwarding a signal processing in the voice band is recommended.

NOTE 5: In the case of call forwarding the TCE should send the calling subscriber an announcement or signalling tones until the called subscriber answers.

10.9 (CH) 2 TCE (Through Connecting Equipment) with DC-decoupling (option)

Every possible combination of TCE interfaces to the NCP shall not affect the satisfactory interworking of the TCE with the PN. The test is to be based on the "worst case" specified by the manufacturer.

10.9 (CH) 2.1 Connection with standardised branch interface (option)

The testing device provided by the testing institute is connected to the TP. The testing device shall satisfy the OFCOM requirements. It can be a TE. A test report on the testing device shall be available at the testing institute. The applicable requirements are to be complemented by the following one.

A TE can supply the sending levels required under Chapter 5, sections 5.4.4 and 5.7 and Chapter 6, section 6.3.3 up to 3 dB lower at the NCP (incl. installation). In this case the test is conducted taking into account a relative level of -2 dBr as per I-ETS 300 004, annex B, table B.1.

10.9 (CH) 2.2 Tie line (option)

Tie lines are connections between two TCEs. The appropriate testing device is connected to the tie line connection in accordance with the manufacturer's indications.

10.9 (CH) 2.3 Connection with another NCP (option)

The appropriate PN simulator is connected to the NCP concerned. The PN simulator is available at the testing institute and shall be described in accordance with section 10.9 (CH) 2.1.

10.9 (CH) 3 **System with TCE and system-specific TE (option)**

Every possible combination of a system-specific TE to the NCP shall not affect the satisfactory interworking of the TCE with the PN. The appropriate testing device, to be supplied by the manufacturer, is connected to the TP. The testing device is normally a system-specific TE. The test is to be based on the "worst case" specified by the manufacturer.

From the system-specific TE to the NCP the same requirements shall be met as for

- TE on the NCP or;
- the combination of TCE and TE on the standardised TP. In this case the test is conducted taking into account above section 10.9 (CH) 2.1.

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.

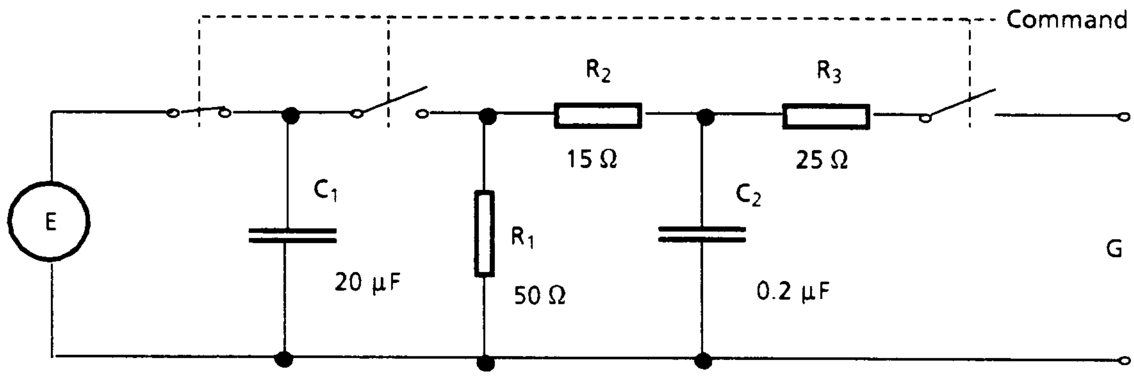


Figure A.10.10 (F) 1.a: Overvoltage generator

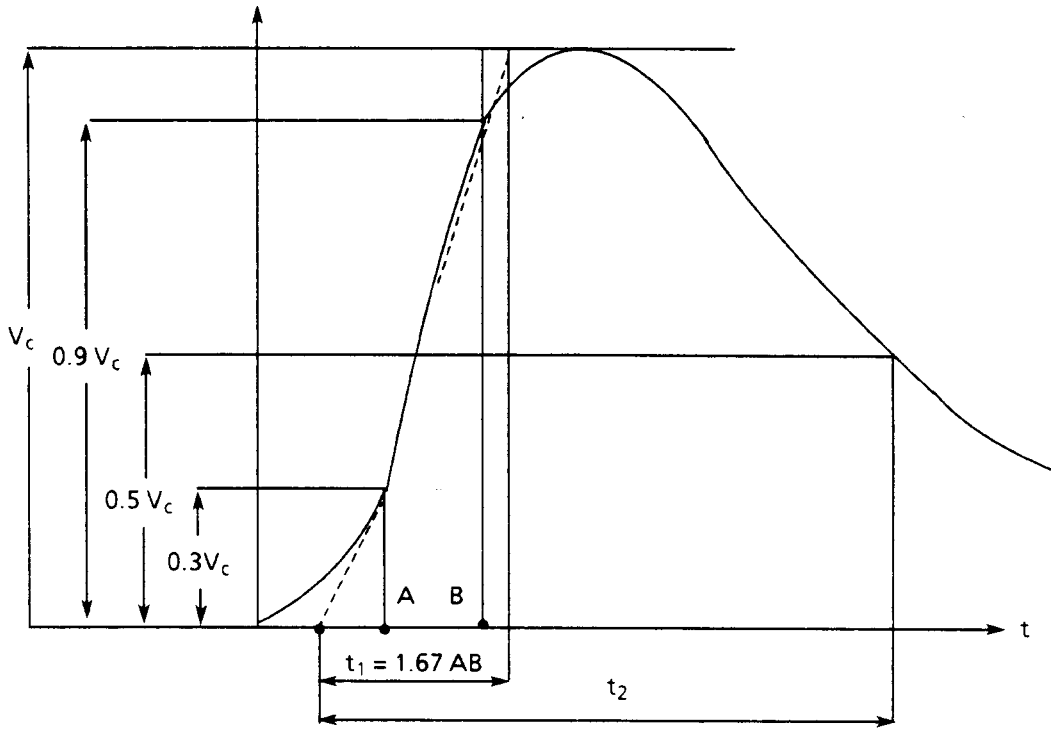


Figure A.10.10 (F) 1.b: Shape of test pulses

L = 1 W R = 300 Ω

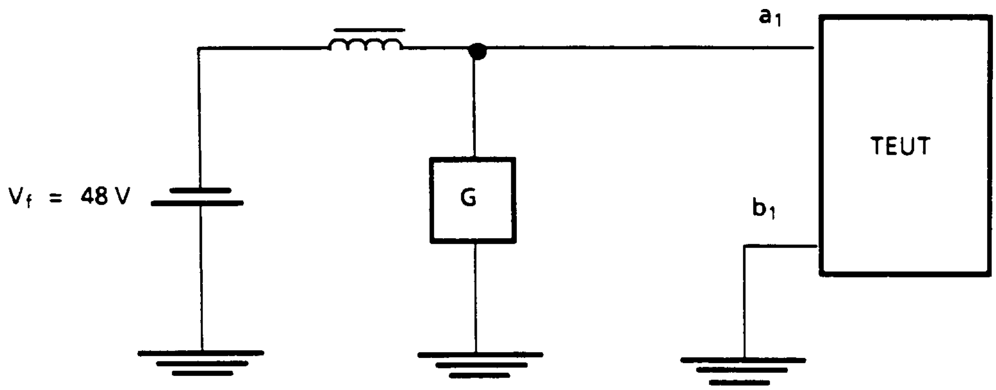


Figure A.10.10 (F) 1.c: Test set-up for telephone sets

L = 1 W R = 300 Ω

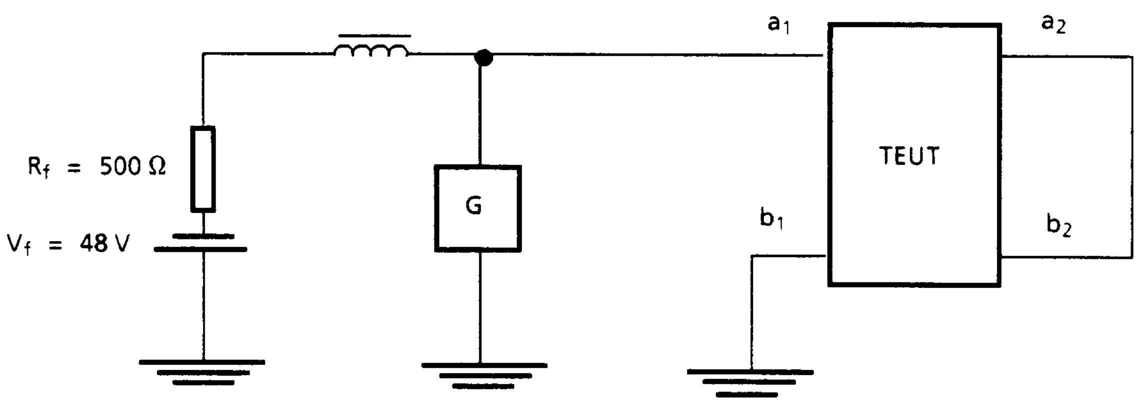


Figure A.10.10 (F) 1.d: Test set-up for series-connected TEs

10.10 (N) Norway

10.10 (N) 1 Use of codes for country configuration

Codes for country configuration are switch positions or software codes containing all, or some, of the parameters which are specified in the regulations relating to type approval for each single country.
These switches or software possibilities are allowed to be accessible for the user under the following conditions:

- the equipment shall comply to all the requirements of these regulations when a position, e.g. Norway, is used;
- all possible settings of sending levels shall be within the maximum levels specified in these regulations;
- a setting marked "Europe" is not allowed without complying to all Norwegian requirements.

The availability shall be verified by inspection of the equipment and the user documentation.
If this function is available, the following subclauses shall be tested for all possibilities:

- A.4.4 "Transmission levels";
- A.5.4.4 "Sending levels".

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