

# ETSI TS 103 021-1 V1.1.1 (2003-08)

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*Technical Specification*

**Access and Terminals (AT);  
Harmonized basic attachment requirements for Terminals for  
connection to analogue interfaces of the Telephone Networks;  
Update of the technical contents of TBR 021, EN 301 437,  
TBR 015, TBR 017;  
Part 1: general aspects**

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Reference

DTS/AT-010107-01

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Keywords

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**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
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## Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Access and Terminals (AT).

The present document has been produced by ETSI in response to the increasing world-wide use of ETSI TBR documents, and the request of the experts in the area to maintain their technical contents in light of the change of the regulatory regime in Europe. It is the intention of ETSI to maintain the present document, in line with the conclusions of TR 101 844 [6].

The central document for the development of the present one is TBR 021 [7] which was originally produced by ETSI in response to a mandate from the European Commission to satisfy a Council Directive which no longer applies.

The present document is part 1 of a multipart deliverable covering technical updates to the TBRs:

**Part 1: "General aspects";**

Part 2: "Basic transmission and protection of the network from harm".

Part 3: "Basic Interworking with the Public Telephone Network", standardizes the aspects of interworking with the network. This part 3 only applies to TE intended for switched networks".

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## Introduction

The present document specifies a harmonized set of basic requirements for terminals that will allow them to be connected to analogue interfaces of Telephone Networks (TN) e.g. PSTNs, non-switched "voice band" leased lines or Private Telephone Networks. It covers all relevant aspects to ensure network compatibility and connectivity.

The existing analogue presentation of Public Switched Telephone Networks (PSTNs) in European countries is technically somewhat different, due to historical reasons. The services being offered to the end users also differ to a certain extent.

Although different, the networks, however, have many basic commonalities. By restricting the requirements to cover only the interworking that is essential for the establishment of a call to/from a terminal, the signalling aspects can be simplified and harmonized.

During the development of TBR 021 [7] and EN 301 437 [8] it was also frequently noted that TBR 015 [9] and TBR 017 [10] specified similar requirements, the products were developed on the same technical basis and apparently all these 4 standards could largely converge in a single one.

The continuous use of analogue terminals in world-wide networks is a measure of the need for such equipment. This type of equipment is undergoing constant and rapid development, and it is therefore imperative that the delay in, and cost of, market introduction caused by the network specific characteristics should be the minimum possible. Otherwise, new innovative products may be delayed. Also, countries where the market is comparatively small may never benefit from these products, if the cost of market introduction is too high.

According to the former European regulatory regime, Terminal Equipment (TE) intended to be connected to the Public Network was required, among other things, to:

- do not cause harm to the network;
- be able to interwork with the network in order to set up, hold, modify, charge for and clear down a connection;
- interwork via the network, in "justified" (identified in other legislation) cases.

The requirements for Terminal Equipment (TE) in the present document are based on the assumption that the relevant access characteristics of the network comply to or are comparable with ES 201 970 [11], which is believed to cover the majority of PSTN implementations. In TBR 021 [7] only a single connected terminal was considered, the values in the requirements were based on TEs consuming all network resources. In the present document the parallel connection of up to four TE is considered and it is also assumed that only one of them is in the loop state at any one time. EG 201 120 [12] gives guidance on the parallel and/or series connection of TEs in an installation.

As was the case with TBR 021 [7] the present document is intended primarily for use within the Pan-European region, however, it is considered that it may be equally applicable on a world wide basis should the relevant authorities or network operators choose to use it.

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# 1 Scope

The present document is a part of a multipart document. It specifies basic compatibility and interoperability aspects, including basic transmission, which are applicable to all Terminal Equipment (TE) intended to be connected to analogue interfaces of public or private, switched or non-switched telephone networks. The present document is applicable to a TE which is capable of accessing an analogue telephone network line at the Network Termination Point (NTP).

The present document specifies the connection arrangements (plug or socket, of the supplier's choice) to be provided by the TE. Any connection/mechanical/wiring adapter that may be required between the terminal and the existing NTP is outside the scope of the present document.

The present document is intended to ensure that no harm occurs to the network.

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# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

- [1] TIA/EIA/IS-968 (2001): "Telecommunications - Telephone Terminal Equipment - Technical Requirements for Connection of Terminal Equipment to the Telephone Network".
- [2] Void.
- [3] ITU-T Recommendation G.100 (2001): "Definitions used in Recommendations on general characteristics of international telephone connections and circuits".
- [4] CENELEC EN 28877 (1989): "Information processing systems - Interface connector and contact assignments for ISDN basic access interface located at reference points S and T".
- [5] ETSI EG 201 450 (V1.1.1): "Guidance on the identification of Harmonized Standards and/or other technical specifications for Radio equipment and Telecommunications Terminal Equipment (R&TTE) covering requirements under Article 3.1 of Directive 1999/5/EC".
- [6] ETSI TR 101 844: "Access and Terminals (AT); Study of the global usage and acceptance of non-radio TBRs and associated documents".
- [7] ETSI TBR 021: "Terminal Equipment (TE); Attachment requirements for pan-European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of TE (excluding TE supporting the voice telephony service) in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signalling".
- [8] ETSI EN 301 437: "Terminal Equipment (TE); Attachment requirements for pan-European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of TE supporting the voice telephony service in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signalling".
- [9] ETSI TBR 015: "Business Telecommunications (BTC); Ordinary and Special quality voice bandwidth 2-wire analogue leased lines (A2O and A2S); Attachment requirements for terminal equipment interface".

- [10] ETSI TBR 017: "Business TeleCommunications (BTC); Ordinary and Special quality voice bandwidth 4-wire analogue leased lines (A4O and A4S); Attachment requirements for terminal equipment interface".
- [11] ETSI ES 201 970: "Access and Terminals (AT);Public Switched Telephone Network (PSTN); Harmonized specification of physical and electrical characteristics at a 2-wire analogue presented Network Termination Point (NTP)".
- [12] ETSI EG 201 120: "Public Switched Telephone Network (PSTN); Method of rating terminal equipment so that it can be connected in series and/or in parallel to a Network Termination Point (NTP)".

## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**connection to earth:** connection to earth means that all the following points, as applicable are connected to the earth point during measurement:

- a point in the TE which is intended to be connected to mains earth (in practice this might be carried out by connecting to the earth of the mains source which is supplying the TE);
- connector points which are intended to be connected to earth during the normal operation of the apparatus.

**loop state:** state where the TE draws sufficient DC current to activate the exchange

**Network Termination Point (NTP):** physical point at the boundary of the Telephone network intended to accept the connection of a TE

NOTE: See figure 1 of TS 103 021-1.

**Public Switched Telephone Network (PSTN):** term is used to describe the ordinary telephone system including subscriber lines, local exchanges and the complete system of trunks and the exchange hierarchy which makes up the network

**reference impedance  $Z_R$ :** complex impedance made up of 270 ohms in series with a parallel combination of 750 ohms and 150 nF

**return loss:** As described in ITU-T Recommendation G.100 [3]

**Terminal Connection Point (TCP):** point of the TE intended to be connected to the TN

NOTE: A connection/wiring adapter may be required between the terminal and the existing national network termination point in individual countries. Such an adapter is outside the scope of the present document (see figure 1).

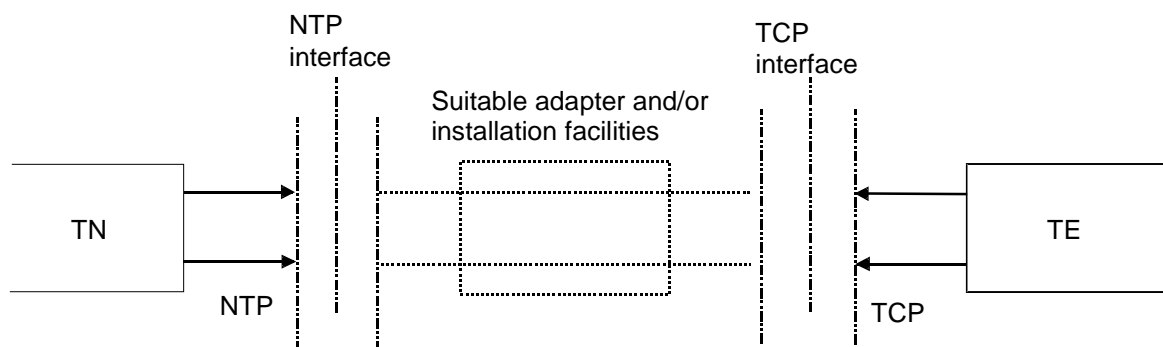


Figure 1: Terminal Connection Point and Network Termination Point

**Telephone Network (TN):** a telecommunication network mainly exchanging voice band signals

NOTE: TN is a general term for PSTN, non-switched leased lines and private telephone networks.

**Terminal Equipment (TE):** equipment intended to be connected to the TN; i.e.:

- to be connected directly to the termination (NTP) of a TN; or
- to interwork with a TN being connected directly or indirectly to the NTP,

in order to send, process or receive information

NOTE 1: The system of connection may be wire, radio, optical or other electromagnetic system.

NOTE 2: TE intended to be connected to public networks may be subject to particular regulatory treatment, whereas TE intended to be connected to private networks are usually not subject to particular regulatory treatment.

## 3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

A2O	Ordinary quality voice bandwidth 2-wire analogue leased line
A2S	Special quality voice bandwidth 2-wire analogue leased line
A4O	Ordinary quality voice bandwidth 4-wire analogue leased line
A4S	Special quality voice bandwidth 4-wire analogue leased line
AC	Alternating Current
DC	Direct Current
DTMF	Dual Tone Multi-Frequency
EMC	ElectroMagnetic Compatibility
LVD	Low Voltage Directive
NTP	Network Termination Point
PSTN	Public Switched Telephone Network
RT	Requirements Table
TCP	Terminal Connection Point
TE	Terminal Equipment
TN	Telephone Network

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## 4 Requirements

### 4.1 User information

**Justification:** Where the origination or reception of calls by the TE is invoked, or otherwise controlled by other equipment external to the TE, the TE shall still be capable of fulfilling the requirements at the interface to the Telephone Network.

**Requirement:** Where the origination or reception of calls by the TE is invoked, or otherwise controlled by other equipment external to the TE, the manufacturer or supplier of the TE shall declare the conditions that need to be met by such external devices so as to enable the user to ensure that their use does not cause the TE to fail to meet the basic requirements.

### 4.2 Physical characteristics of the connection to the TN

**Justification:** Interworking with the TN is assured by requiring the TE to interwork with different networks, where different features may be offered, but where all networks can perform the basic interworking on two wires. To facilitate the use of adapters, the TE requires a known type of connection arrangement.



NOTE: The behaviour of the connection between TE and the TN differs if the TE is intended for PSTN or leased lines and in this last case if it is a 2- or 4-wire interface. This implies that corresponding physical characteristics are different and in the present document treated in different clauses.

This clause (including all the requirements specified in it) is not applicable to multi-line equipment. This type of TE has therefore no specific technical requirement applicable to the physical characteristics of the connection.

#### 4.2.1 PSTN

**Requirement:** The TE shall provide a connector either as a plug or as a socket. The connector, if a plug, shall be capable of connecting with a miniature 6-contact socket as specified in TIA/EIA/IS-968 [1] clause (b) and if a socket, shall be capable of connecting with a miniature 6-contact plug as specified in TIA/EIA/IS-968 [1].

NOTE 1: The TE may include a means (e.g. a lead) which adapts the interface of the TE to the connector described in this clause upon which the TCP is presented. The requirements of the present document apply at the TCP and this means is considered to be an integral part of the TE.

NOTE 2: This 6-contact connector is often referred to as RJ 11/12.

**Table 1: Contact assignments**

Contact number	Contact function
1	Unspecified
2	Unspecified
3/4	TCP
5	Unspecified
6	Unspecified

**Test:** By visual inspection. The interworking capability shall be verified through the tests in annex A. The TE shall comply with the relevant provisions of the present document when tested via contact pins 3 and 4 as shown in table 1. In the case of multiline or integrated equipment the TCP may be presented to the NTP using other methods of connection.

#### 4.2.2 Leased lines with analogue 2-wire interfaces (A2O and A2S)

**Requirement:** The TE shall provide one or more of the following connection methods:

- an 8-contact plug of the type specified in EN 28877 [4] with contact assignments as specified in table 2; (a 6-contact plug as described in clause 4.2.1 can be alternatively used)
- a set of connection contacts (e.g. an insulation displacement connector or screw terminal block) to which solid conductors with diameters in the range 0,4 mm to 0,6 mm may be connected;
- a wiring arrangement connected by any means to the TE, with unterminated solid wire conductors with diameters in the range 0,4 mm to 0,6 mm at the distant end from the TE.

Where a) and c) are provided, these may be detachable by the user such that only one is connected to the TE at any one time.

NOTE: The normal presentation of the leased line is by means of a socket.

**Table 2: Contact assignments**

Contact number	Contact Function
1	Unused
2	Unused
3	Unused
4/5	TCP
6	Unused
7	Unused
8	Unused

**Test:** There shall be a visual inspection that one or more of the connection methods are provided. The contact assignments and connection methods are tested indirectly through the tests in annex A.

### 4.2.3 Leased line with analogue 4-wire interfaces(A4O and A4S)

The TE shall provide one or more of the following connection methods:

- an 8-contact plug of the type specified in EN 28877 [4] with contact assignments as specified in table 3; (a 6-contact plug as described in clause 4.2.1 can be alternatively used);
- a set of connection contacts (e.g. an insulation displacement connector or screw terminal block) to which solid conductors with diameters in the range 0,4 mm to 0,6 mm may be connected;
- a wiring arrangement connected by any means to the TE, with unterminated solid wire conductors with diameters in the range 0,4 mm to 0,6 mm at the distant end from the TE.

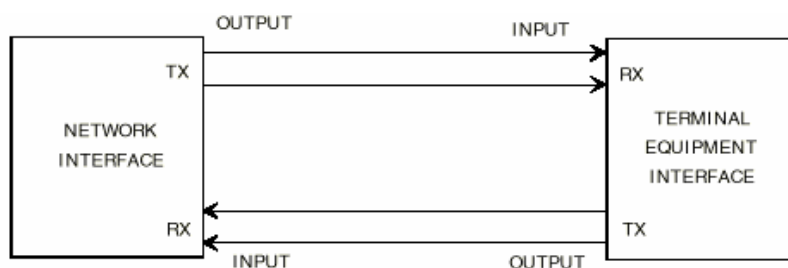
Where a) and c) are provided, these may be detachable by the user such that only one is connected to the TE at any one time.

NOTE: The most common presentation of the leased line is by means of a socket.

**Table 3: Contact assignment**

Contact number	Contact Function
1	Unused
2	Unused
3/6	Transmit pair (TE output port)
4/5	Receive pair (TE input port)
7	Unused
8	Unused

NOTE: The transmit pair is the output from the TE. The receive pair is the input to the TE. Where the terms "output" and "input" are used without qualification in the present document, they refer to the TE considered at the TCP.



NOTE 1: There shall be a visual inspection that one or more of the connection methods are provided. The contact assignments and connection methods are tested indirectly through the tests in annex A.

NOTE 2: By confirming the presence of such declaration.

**Figure 2**

## 4.3 Overvoltage

There are no overvoltage requirements in the present document. This area is assumed to be covered by safety and/or EMC requirements.

## 4.4 Safety

There are no safety requirements in the present document, EG 201 450 [5] gives guidance in this area.

## 4.5 EMC

There are no EMC requirements in the present document, EG 201 450 [5] gives guidance in this area.

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## Annex A (informative): Testing

### A.1 General

This annex describes the general test aspects to determine the compliance of a TE against the requirements of the present multipart document.

TE may require the provision of external termination or stimuli in order to assess its conformity with the present document. In this case, such termination or stimuli shall be provided in order for the tests to be carried out but shall not influence the results of measurements which shall be obtained under the normal operating condition of the TE. In order to facilitate this, it may be necessary for the supplier to provide additional equipment or information or special TE settings for the purpose of test.

The test configurations given do not imply a specific realization of test equipment or arrangement or use of specific test devices for conformance testing. The test parameters defined in this annex are "ideal" parameters. Test equipment inaccuracies or component tolerances are not prescribed for test implementations, with the exception of guidance and information notes. Any deviations from the ideal which are present when using real test implementations shall be taken into account in calculating measurement uncertainty. Correction of systematic effects may be used to reduce measurement uncertainty.

The test equipment shall be a device, or group of devices, generating a stimulus signal and providing the test conditions (e.g. feeding conditions) conforming to this annex and capable of monitoring the received signal from the interface.

If inconsistencies are discovered between the test annex and the requirements, then the requirements shall take precedence in problem resolution.

#### A.1.1 Test environment

All tests shall be performed under non-condensing conditions at:

- an ambient temperature in the range from +15°C to +35°C;
- a relative humidity in the range from 5 % to 85 %;
- an air pressure in the range 86 kPa to 106 kPa.

For TE which is not designed to operate over the entire specified environmental range, all tests shall be performed at any point within the operational range specified by the supplier.

For TE which is directly powered (either wholly or partly) from the mains supply, all tests shall be carried out within  $\pm 5$  % of the rated voltage of the TE. If the equipment is powered by other means and those means are not supplied as part of the apparatus (e.g. batteries, DC supplies and stabilized AC supplies) all tests shall be carried out within the power supply limit declared by the supplier. If the power supply is AC, the test shall be conducted within  $\pm 4$  % of the rated frequency.

#### A.1.2 Powered state

Tests shall be carried out, where appropriate, with the TE powered on, under normal operating conditions defined by the supplier.

### A.1.3 Measurements to earth

Where a measurement to earth is defined and the supplier's instructions state that a connection to earth is intended, then all the following points, as applicable, shall be connected to the earth point of the test set-up:

- a point in the TE which is intended to be connected to mains earth (in practice this might be carried out by connecting to the earth of the mains source which is supplying the TE);
- connector points which are intended to be connected to earth, or could be connected to earth during the normal operation of the TE.

Where the TE has absolutely no possibility to be connected to earth, for example by one of the above points, then the test does not apply.

### A.1.4 Equivalent test methods

Laboratories may use other test methods provided they are electrically equivalent to those specified.

Where test methods other than those specified are used, the test report shall include statements that uniquely identify the selected test methods. However, full technical details of the test methods need not be included in the test report.

NOTE: This is intended to allow traceability where alternative test methods are used.

### A.1.5 Additional information to support the test

It is necessary for the supplier to provide facilities to allow all tests to be carried out. Examples of these facilities could be the following:

- a facility for the TE to remain in the loop state without transmitting signals; and
- a facility to transmit all types of signal (e.g. all data rates in case of a modem) that the TE transmits while not receiving any signal.

NOTE: The special test facilities such as those in a) and b) above need not to be provided in the product finally marketed, but provided by the supplier when needed.

However if alternative methods are feasible these are also acceptable.

## A.2 Test impedances

### A.2.1 Reference impedance

Where the test defines the use of the reference impedance called  $Z_R$ , then this shall be as follows:

**Reference impedance  $Z_R$ :** This is a complex impedance made up of  $270 \Omega$  in series with a parallel combination of  $750 \Omega$  and  $150 \text{ nF}$  as shown in figure A.1.

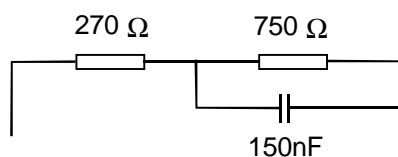


Figure A.1: Reference impedance

Practical realizations of the reference impedance required for the performance of the tests shall have a return loss against  $Z_R$  exceeding 40 dB within the frequency range 200 Hz to 4 300 Hz.

## A.2.2 Non-reactive line termination

All resistors specified for testing shall be nominally non-reactive, such that any resistor or group of resistors shall have a reactive impedance at any frequency in the range to be measured, not exceeding 0,5 % of the nominal resistance.

## A.3 Feeding bridge

The feeding bridge specified in this annex is a piece of test equipment used to:

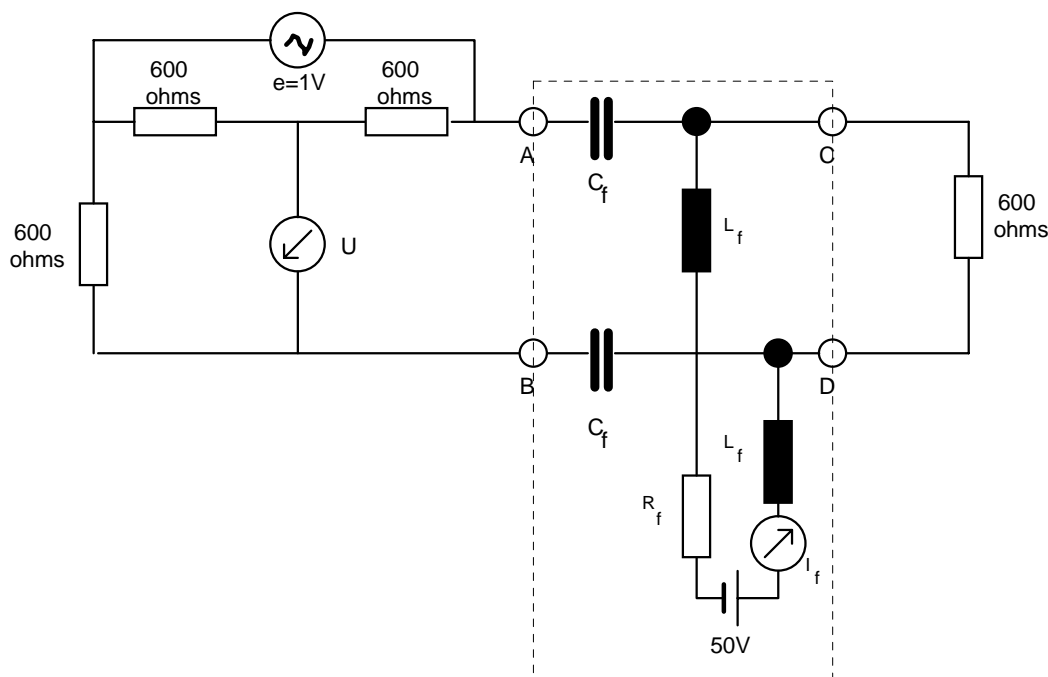
- apply to the TE electrical conditions consistent with those defined in the test;
- suitably couple measurement equipment to the TE.

The feeding bridge is assumed to be ideal, so that:

- DC feeding and AC termination of the TE are as defined in the test;
- all measurements are referenced to the TE (e.g. the feeding bridge does not cause an attenuation or delay, in the parameter to be measured, between the TE and the measuring equipment).

If requested by the supplier (e.g. for TE with an adaptive filter) the TE shall be reset before repeating a test with a different feeding condition.

Within individual test cases, "AC termination of TE" defines the total AC impedance to be seen by the TE including all test equipment (as applicable, feeding bridge, measuring equipment, reference impedance fixtures, etc.).



NOTE: In the absence of the d.c. feeding circuit, the return loss shall be greater than 40 dB.

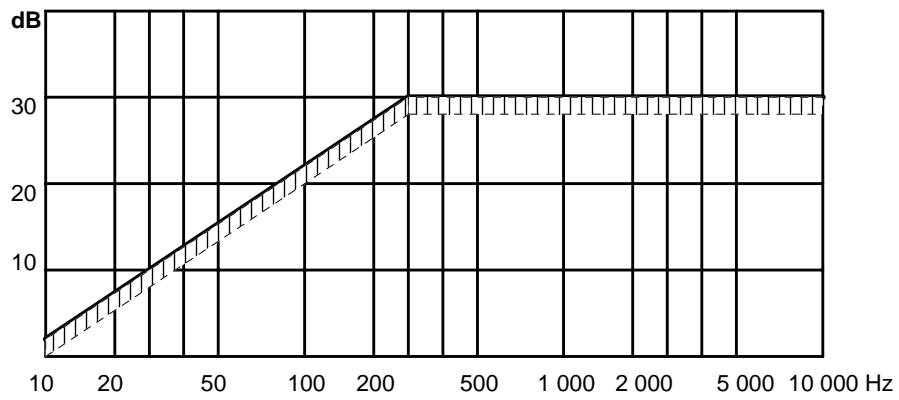
**Figure A.2: Return loss test arrangement for the d.c. feeding circuit**

When measured with the circuit shown in figure A.2, the return loss of the d.c. feeding circuit shall have a value greater than that given in figure A.3 for all values of  $R_f$  and at all frequencies at which it is used.

The return loss (in dB) is calculated from the formula:

$$RL = 20 \log_{10} \left| \frac{e}{2U} \right|$$

where  $e$  is the generator voltage and  $U$  is the voltage measured by the measuring set.



**Figure A.3: Minimum limit for return loss**

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## Annex B (informative): Requirements Table (RT)

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Users of the present document may freely reproduce annex B which contains this RT proforma so that it may be used for its intended purpose. Users may further publish the completed RT.

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## B.1 Guidance for completion of the RT

### B.1.1 Condition table

For the requirements, there is a table of condition questions.

The Reference column contains references in the form C.x where:

- C: means Condition;
- x: uniquely identifies the element of the table.

The Condition column contains a question, the answer to which determines whether the corresponding requirement(s) in the Requirements Table shall be mandatory.

The Status column identifies whether a "Yes" or "No" answer causes relevant requirements to be mandatory for the TE. The following codes are used:

- M: means that the relevant requirements are mandatory;
- N: means that the relevant requirements are not applicable.
- O: means that the relevant requirements are optional.

The Support column is blank for the user to complete.

### B.1.2 Requirements table

The Number column provides an unique identifier to each requirement.

The Reference column lists the clause reference in the present document where the requirement may be found.

The Requirement column gives the clause title of the relevant clause, supplemented by any additional information necessary to identify the requirement.

The Status column contains one of the following items:

- M: means that the requirement is mandatory;
- C.x: means that the requirement is mandatory if the relevant condition is met.

In some cases, two or more Conditions are included in the status column. The requirement shall be mandatory (or optional) if the Boolean combination of them is true.

The Support column is blank for the user to complete.



**Table B.1: Condition table**

Reference	Condition	Status	Support (Y/N)	Comment
C.1.	Is the TE intended for use on the PSTN ?	If YES then M else N		
C.2.	Is the TE intended for 2-wire analogue leased lines (A2O and A2S) ?	If YES then O.1 else N		
C.3.	Is the TE intended for 4-wire analogue leased lines (A4O and A4S) ?	If YES then O.2 else N		

**Table B.2: Requirements table**

No.	Reference	Requirement	Status	Support (Y/N)
R.1.	4.2.1	6-contact plug (or socket) as specified in TIA/EIA/IS-968 [1]	C.1	
R.2.	4.2.2 (a)	8-contact plug as specified in EN 28877 [4]	C.2	
R.3.	4.2.2 (b)	Contacts for termination of solid wire conductors	C.2	
R.4.	4.2.2 (c)	Unterminated solid wire conductors	C.2	
R.5.	4.2.3 (a)	8-contact plug as specified in EN 28877 [4]	C.3	
R.6.	4.2.3 (b)	Contacts for termination of solid wire conductors	C.3	
R.7.	4.2.3 (c)	Unterminated solid wire conductors	C.3	

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## Annex C (informative): Bibliography

- Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits (The Low Voltage Directive).
- Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (The EMC Directive).
- Council Directive 91/263/EEC of 29 April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity". (The TTE Directive).
- Council Directive 98/13/EC of the European Parliament and of the Council of 12 February 1998 relating to telecommunications terminal equipment and satellite earth station equipment, including the mutual recognition of their conformity.
- Council Directive 1999/5/CE of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (The R&TTE Directive).
- ITU-T Recommendation G.117 (1996): "Transmission aspects of unbalance about earth".
- ETSI EG 201 121: "A guide to the application of TBR 021".

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## History

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