

**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**



Reference

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Contents

Intellectual Property Rights.....	5
Foreword	5
Introduction	5
1 Scope.....	7
2 References.....	8
3 Definitions and abbreviations	9
3.1 Definitions	9
3.1.1 General terms	9
3.1.2 States	9
3.2 Abbreviations.....	9
4 Requirements	9
4.1 General requirement.....	10
4.2 Physical characteristics of the connection to the PSTN	10
4.3 Requirements in all conditions.....	10
4.3.1 Polarity	10
4.4 General requirements in quiescent state.....	10
4.4.1 DC resistance	10
4.4.2 Characteristics of TE for ringing signals	10
4.4.2.1 Impedance.....	10
4.4.2.2 Transient response	10
4.4.2.3 DC current	11
4.4.3 Impedance unbalance about earth	11
4.4.4 Resistance to earth.....	11
4.5 Ringing signal detector sensitivity	11
4.5.1 Non-audible ringing detectors	11
4.5.2 Audible ringing detectors	11
4.6 Transition from quiescent to loop state.....	11
4.6.1 Acceptance of breaks in the loop in a call attempt	11
4.6.2 Loop current characteristics	12
4.7 General loop steady state requirements.....	12
4.7.1 DC characteristics	12
4.7.2 Impedance	13
4.7.3 Sending level limitations	13
4.7.3.1 Mean sending levels	13
4.7.3.2 Instantaneous voltage.....	13
4.7.3.3 Voltage level in a 10 Hz bandwidth.....	14
4.7.3.4 Sending levels above 4,3 kHz.....	14
4.7.4 Impedance unbalance about earth	14
4.7.4.1 Longitudinal Conversion Loss.....	14
4.7.4.2 Output Signal Balance	14
4.7.5 Resistance to earth.....	14
4.8 Call attempt.....	14
4.8.1 Automatic dialling.....	15
4.8.1.1 Dialling without dial tone detection.....	15
4.8.1.2 Dialling with dial tone detection.....	15
4.8.2 DTMF signalling.....	15
4.8.2.1 Frequency combinations	15
4.8.2.2 Signalling levels.....	15
4.8.2.2.1 Absolute levels.....	15
4.8.2.2.2 Level difference	15
4.8.2.3 Unwanted frequency components	15
4.8.2.4 Tone duration	16

4.8.2.5	Pause duration	16
4.8.3	Automatically repeated call attempts.....	16
4.9	Transition from loop to quiescent state.....	16
4.10	Safety	16
4.11	EMC.....	16
Annex A (normative): Test methods		17
A.1	General	17
A.1.1	Equipment connection	17
A.1.2	Test environment	18
A.1.2.1	Acoustic environment for tests	18
A.1.3	Equivalent test methods	18
A.1.4	Additional information to support the test	18
A.2	Test impedances and feeding bridge	19
A.2.1	Reference impedance	19
A.2.2	Non-reactive line termination	19
A.2.3	Feeding bridge	19
A.3	Details for testing voice stimulated TE.....	19
A.3.1	Voice signal to be used during tests	19
A.3.1.1	Type	19
A.3.1.2	Levels	20
A.3.2	Electro-acoustic interfaces	21
A.3.2.1	Handset.....	21
A.3.2.2	Hands-free.....	21
A.3.2.3	Headset.....	21
A.3.2.4	Other interfaces	21
A.3.3	Electrical interfaces simulations	21
A.3.3.1	Analogue 2-wire NTP (Network Termination Points).....	21
A.3.3.2	Analogue 2-wire TCP (TCP of TE behind TCE).....	21
A.3.3.3	Other harmonized interfaces.....	21
A.3.3.4	Non harmonized interfaces.....	21
A.4	Test methods	21
A.4.1	Ringling signal detector sensitivity	22
A.4.2	General loop state requirements,sending level limitations	23
A.4.2.1	Mean sending levels	23
A.4.2.2	Instantaneous voltage	24
A.4.3	Call attempt, DTMF signalling	25
A.4.3.1	Unwanted frequency components.....	25
Annex B (normative): Requirements Table (RT)		27
B.1	Guidance for completion of the RT	27
B.1.1	Condition table.....	27
B.1.2	Requirements table.....	27
Annex C (informative): Reasons for omitting 10 Hz signal limitations		30
Bibliography		31
History		32

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Project Analogue Terminals and Access (ATA), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 83/189/EEC (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document is intended to become a Harmonized Standard as requested by the above mentioned mandate, the reference of which will be published in the Official Journal of the European Communities referencing the Council Directive relating to telecommunications terminal equipment and satellite earth station equipment, including the mutual recognition of their conformity (Directive 98/13/EC [13]).

A common technical regulation may be established by the European Commission in accordance with the Directive.

Technical specifications relevant to the 98/13/EC Directive [13] are given in the Requirements Table (RT) in annex B.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	3 months after doa
Date of withdrawal of any conflicting National Standard (dow):	9 months after doa

Introduction

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

Terminal equipment is undergoing constant and rapid development, and it is therefore imperative that the delay in, and cost of, market introduction caused by the approval procedures is the minimum possible. Otherwise, new innovative products may be available to Europe at later dates than to other regions in the world. Also, countries in Europe where the market is comparatively small may never benefit from these products, if the cost of market introduction is too high.

According to directive 98/13/EC [13], a Terminal Equipment (TE) is required, among other things, to:

- not cause harm to the network - Article 5(d);

- be able to inter-work with the network in order to set up, hold, modify, charge for and clear down a connection - Article 5(f);
- inter-work via the public telecommunications network, in justified cases - Article 5(g).

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

The present document specifies a harmonized set of requirements which will allow terminals that are capable of supporting any voice telephony service, to be analogue connected to the existing European PSTNs. It covers all relevant essential requirements in directive 98/13/EC [13]. All safety requirements are covered by the LVD and therefore there are no requirements for Articles 5(a) and 5(b). All EMC requirements are covered by the EMC directive and therefore no requirements for Articles 5(c) are included in the present document. Article 5(e) is not applicable for a non-radio system. Article 5(g) is only applicable for voice terminals that support the voice telephony justified case service.

The present document specifies the connection arrangements (plug or socket, at the supplier's choice) to be provided by the terminal equipment. An 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.

The pan-European approval requirements for TE access to an analogue presented PSTN are related to the network's capabilities. A single terminal may consume all of this (given) capability, or it can be shared by a number of terminals all being connected to the NTP in an arbitrary combination of parallel and/or series connection in which case the performance of each individual terminal will need to be better than required by the present document to ensure satisfactory inter-working with the network. Connection of terminal equipment in series and/or parallel is a national matter, but guidance may be found in EG 201 120 [1].

NOTE: On certain networks, some lines are unable to provide a line current as high as 18 mA. Where for the purpose of the present document, a TE that has been declared by the manufacturer to be for use only on lines providing a loop current greater than 18 mA, the supplier should convey this limitation in its use to the end user, but the way in which this is expressed is left to the manufacturer.

1 Scope

The present document specifies the technical characteristics (electrical and mechanical interface requirements and access control protocol) under Articles 5(d) and 5(f) of Directive 98/13/EC [13] to be provided by a single terminal equipment which is intended:

- a) for pan-European approval; and
- b) for connection by 2-wires to an analogue interface of a PSTN. This interface is characterized by DC loop seizure and clearing, uses low frequency AC ringing signals below the speech pass-band to indicate an incoming call and in the transmission phase has an approximate bandwidth of 3 kHz at the network termination point; and
- c) for supporting any voice telephony service.

The objective of the present document is to ensure that no harm occurs to the public network, and to ensure inter-working between the network and a single terminal so that calls can be routed successfully through the network.

The present document applies to terminal equipment that is intended to originate and/or receive calls. Where it is intended to originate calls the present document specifies the requirements for DTMF signalling. If other signalling methods are provided, in addition to DTMF, these other signalling methods, if they are intended to be used in certain European countries, may be subject to additional national regulations.

A test is given for each requirement in the present document including measurement methods. The terminal equipment may be stimulated to perform the tests by additional equipment if necessary.

The present document specifies the connection arrangements (plug or socket, at the suppliers choice) to be provided by the terminal equipment. An 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.

Where the origination or reception of calls by the terminal equipment is invoked, or otherwise controlled, by other equipment external to the terminal equipment, the terminal equipment still needs to be capable of fulfilling the essential requirements under Articles 5(d) and 5(f) at the interface to the public network. The present document requires the manufacturer or supplier of the terminal equipment to declare the conditions met by such external devices so that their use does not cause the terminal equipment to fail to meet the essential requirements.

NOTE 1: Terminal to terminal inter-operability for handset telephony is addressed in TBR 38 [10].

NOTE 2: Facilities for Supplementary signalling (e.g. reception of metering pulses from the network) if provided in the terminal, and intended to be used in certain European countries, may be subject to the appropriate National Regulations.

NOTE 3: The Electromagnetic Compatibility (EMC) and safety requirements fall beyond the scope of the present document. These requirements are covered by Directives 89/336/EEC [12] (EMC) and 73/23/EEC [11] (Safety).

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, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, subsequent revisions do apply.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] 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)".
- [2] EG 201 121: "A guide to the application of TBR 21".
- [3] ITU-T Recommendation P.38: "Transmission characteristics of operator telephone systems (OTS)".
- [4] ITU-T Recommendation P.51: "Artificial mouth".
- [5] ITU-T Recommendation P.56: "Objective measurement of active speech level".
- [6] ITU-T Recommendation P.59: "Artificial conversational speech".
- [7] ITU-T Recommendation P.340: "Transmission characteristics of hands-free telephones".
- [8] TBR 10: "Digital Enhanced Cordless Telecommunications (DECT); General terminal attachment requirements: Telephony applications".
- [9] TBR 21: "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".
- [10] TBR 38: "Public Switched Telephone Network (PSTN); Attachment requirements for a terminal equipment incorporating an analogue handset function capable of supporting the justified case service when connected to the analogue interface of the PSTN in Europe".
- [11] 73/23/EEC: "Council Directive 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".
- [12] 89/336/EEC: "Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility".
- [13] 98/13/EC: "Directive 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".
- [14] TR 101 149: "2-wire analogue voice band interfaces; Terminal Equipment transmitting voice signals; Test simulation for level limitation requirements".
- [15] IEC 651: "Sound levels meters".
- [16] ITU-T Recommendation G.101: "The transmission plan".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TBR 21 [9] and the following apply.

3.1.1 General terms

As defined in TBR 21 [9].

3.1.2 States

As defined in TBR 21 [9].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply together with those in TBR 21 [9].

ACTE	Advisory Committee for Terminal Equipment
CTR	Common Technical Regulation
dB	decibel
dB(A)	dB(A), "A" weighted sound pressure level with respect to 20 mPa, expressed in dB
dBPa	Sound level relative to 20 mPa measured using the A-weighting defined in IEC 651 [15]
dBPa(A)	sound pressure level with respect to 1 Pa, expressed in dB
dBVemf	"A" weighted sound pressure level with respect to 1 Pa, expressed in dB
emf	voltage level with respect to 1 Vemf, expressed in dB
emf	electromotive force
HFRP	Hands-Free Reference Point
ITU	International Telecommunications Union
MRP	Mouth Reference Point
Pa	Pascal
SDSS	Server Display and Script Services
TBR	Technical Basis for Regulation
TEUT	Terminal Equipment Under Test

4 Requirements

Requirement and test: The requirement and associated test of clause 4 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to be capable of sending signals to and/or receiving signals from the PSTN.

NOTE 1: The pan-European approval requirements for TE access to an analogue presented PSTN are related to the network's capabilities. A single terminal may consume all of this (given) capability, or it can be shared by a number of terminals all being connected to the NTP in an arbitrary combination of parallel and/or series connection in which case the performance of each individual terminal will need to be better than required by this TBR to ensure satisfactory inter-working with the network. Connection of terminal equipment in series and/or parallel is a national matter, but guidance may be found in EG 201 121 [2].

NOTE 2: The feeding voltage value of 50 V D.C. in the requirement and test parts is only a harmonized test value. It does not necessarily reflect the real PSTN supply voltages.

4.1 General requirement

Requirement and test: The requirement and associated test of subclause 4.1 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Articles 5(d) and 5(f) TE Where the origination or reception of calls by the TE is invoked, or otherwise controlled by other equipment external to the TE, the TE should still be capable of fulfilling the essential requirements of the directive at the interface to the public network.

4.2 Physical characteristics of the connection to the PSTN

Requirement and test: The requirement and associated test of subclause 4.2 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires a TE to be galvanically connected to the two wires presented by the network at the NTP. To facilitate the use of adapters, the TE requires a known type of connection arrangement.

4.3 Requirements in all conditions

4.3.1 Polarity

Requirement and test: The requirement and associated test of subclause 4.3.1 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to operate with both polarities, since a fixed polarity is cannot be guaranteed.

4.4 General requirements in quiescent state

4.4.1 DC resistance

Requirement and test: The requirement and associated test of subclause 4.4.1 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to present a sufficiently high DC resistance in quiescent state so as not to disturb the basic call control and to prevent the malfunction of network call control equipment.

4.4.2 Characteristics of TE for ringing signals

4.4.2.1 Impedance

Requirement and test: The requirement and associated test of subclause 4.4.2.1 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to present an impedance to ringing signals that does not overload the ringing supply and thus prevent other users from receiving a call arrival signal.

4.4.2.2 Transient response

Requirement and test: The requirement and associated test of subclause 4.4.2.2 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the current transient to be limited at the beginning of a ringing signal.

4.4.2.3 DC current

Requirement and test: The requirement and associated test of subclause 4.4.2.3 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to avoid creating DC current due to asymmetric load of the ringing signal (e.g. caused by the use of over-voltage arrestors). This requirement avoids false seizure of the PSTN.

4.4.3 Impedance unbalance about earth

Requirement and test: The requirement and associated test of subclause 4.4.3 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(d); Protection of the PSTN from harm. Unbalance may produce levels of cross-talk that disturb the service of other users of the PSTN connected to other pairs in the same cable.

4.4.4 Resistance to earth

Requirement and test: The requirement and associated test of subclause 4.4.4 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to present a sufficiently high DC resistance to earth in the quiescent state to prevent the malfunction of network call control equipment.

4.5 Ringing signal detector sensitivity

4.5.1 Non-audible ringing detectors

Requirement and test: The requirement and associated test of subclause 4.5 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to be capable of detecting or indicating to the user that valid ringing signals are being received.

4.5.2 Audible ringing detectors

Requirement: If the TE provides a means to audibly alert the user that a ringing signal has been detected and the detector is enabled, the TE shall produce a Sound Pressure Level of at least 55 dBA at a distance of 1 m from the surface of the TE when measured as described in annex A, subclause A.4.1 and supplied with ringing signals of 30 V rms. at 25 Hz and 50 Hz with a cadence of 1 s ON and 5 s OFF superimposed on a voltage of 50 V DC.

NOTE: This requirement is additional to the requirement in clause 4.5 of TBR 21 [9].

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to be capable of detecting or indicating to the user that valid ringing signals are being received.

Test: The test shall be conducted according to annex A, subclause A.4.1.

NOTE: Some PSTNs generate signals as low as 24 V rms. Particularly for electro-acoustic ringers without local power supply, it is recognized that this voltage may be insufficient to produce an acoustic output expected from some users or suitable for applications in noisy surroundings.

4.6 Transition from quiescent to loop state

4.6.1 Acceptance of breaks in the loop in a call attempt

Requirement and test: The requirement and associated test of subclause 4.6.1 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to be capable of accepting breaks in the loop current during establishment of loop state.

4.6.2 Loop current characteristics

Requirement and test: The requirement and associated test of subclause 4.6.1 of TBR 21 [9] shall apply, except tables 3 and 4. These tables of TBR 21 [9] shall be replaced by the table 1 (replacing table 3 of TBR 21 [9]) and table 2 (replacing table 4 of TBR 21 [9]) of the present subclause. The test method description shall be adapted accordingly.

For TE declared by the manufacturer for use only on lines providing a loop current of 18 mA or greater, the resistor of 2 800 Ω shall be replaced by a resistor of 2 300 Ω .

Table 1: TE current characteristics with feeding resistors which are not used during the loop steady state

Condition		Requirements		
Feeding voltage	Feeding resistance	Time (ms)		Current (mA)
Vf	Rf	t1-t0	t2-t01	If1
50 V DC	150 k Ω	400	400	0,30
50 V DC	36 k Ω	400	400	1,25
50 V DC	24 k Ω	400	400	1,86
50 V DC	8 k Ω	400	400	5,00

Table 2: TE current characteristics with feeding resistors which are used during the loop steady state

Condition		Requirements				
Feeding voltage	Feeding resistance	Time (ms)			Current (mA)	
Vf	Rf	t1-t0	t2-t01	t3-t01	If1	If2
50 V DC	2,8 k Ω	30	500	1 200	15,0	14,6
50 V DC	2,3 k Ω	30	500	1 200	18,2	17,8
50 V DC	230 Ω	20	500	1 200	49,6	49,6

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to be capable of seizing the line.

4.7 General loop steady state requirements

The requirements during the loop steady state apply when the TE has been in the loop state for a minimum of 1,2 s with a line feeding current which can be obtained when the TE is connected to a source of 50 V DC in series with a resistor within the range of 2 800 Ω to 230 Ω . For TE declared by the manufacturer for use only on lines providing a loop current of 18 mA or greater, the resistor of 2 800 Ω shall be replaced by a resistor of 2 300 Ω .

4.7.1 DC characteristics

Requirement and test: The requirement and associated test of subclause 4.7.1 of TBR 21 [9] shall apply.

NOTE: In TBR 21 [9] to test this subclause it is foreseen a measurement point at a feed resistance of 3 200 Ω . This point shall be replaced by an equivalent one at a feed resistance of 2 800 Ω (or 2 300 Ω , as appropriate, according to the text of subclause 4.7).

Justification: 98/13/EC [13], Article 5(f); European PSTN have differing DC characteristics Inter-working with the PSTN requires the TE to present a sufficiently low DC resistance in loop state.

4.7.2 Impedance

Requirement and test: The requirement and associated test of subclause 4.7.2 of TBR 21 [9] shall apply.

NOTE: In TBR 21 [9] to test this subclause it is foreseen a measurement point at a feed resistance of 3 200 Ω . This point shall be replaced by an equivalent one at a feed resistance of 2 800 Ω (or 2 300 Ω , as appropriate, according to the text of subclause 4.7).

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to present an impedance which permits proper functioning of call control and the maintenance of stability in the PSTN.

4.7.3 Sending level limitations

4.7.3.1 Mean sending levels

Requirement: When stimulated by a Pseudo Speech Signal at a level defined in subclause A.3.1.2, table A.1A, column "Nominal", the mean sending level in the frequency range 200 Hz to 3 800 Hz over a one-minute period shall not be greater than -9,7 dBV when the TE interface is terminated with the reference impedance Z_R . This requirement does not apply to DTMF signals. TE in the scope and meeting the requirements of TBR 38 [10], subclauses 4.2.1.1 and 4.2.2.1 or TBR 10 [8] shall be deemed to be compliant with the requirements of this subclause.

Justification: 98/13/EC [13], Article 5(d); Protection of the PSTN from harm requires the signal sent into the PSTN by the TE to be limited so that the interfering effects of the signal can be predicted and avoided.

NOTE: This requirement is not identical to the requirement in the corresponding clause in TBR 21 [9], but provides statistically for a mean sending level to line equivalent to that stated in TBR 21 [9].

Test: The test shall be conducted according to annex A, subclause A.4.2.1.

4.7.3.2 Instantaneous voltage

Requirement: Both of the following requirements shall be fulfilled:

- a) during DTMF signalling or when stimulated with the pseudo speech signal at a level defined in subclause A.3.1.2, table A.1A, column "5 Vpp", the peak to peak voltage measured in the frequency band 100 Hz to 20 kHz shall not exceed 5,0 V when the TE interface is terminated with the reference impedance Z_R ; and
- b) when stimulated with the pseudo speech signal at a level defined in subclause A.3.1.2, table A.1A, column "8 Vpp", the peak to peak voltage measured in the frequency band 100 Hz to 20 kHz shall not exceed 8,0 V when the TE interface is terminated with the reference impedance Z_R .

NOTE 1: It is recognized that the general limit can be relaxed for exceptional circumstances. The statistical nature of speech signals enables voice stimulated TE to make use of this exception. A lower level could be imposed on voice stimulated terminals by reducing the stimulus, but this might then be interpreted as requiring signals to be limited by the TE to this lower level. This would then result in unnecessary clipping of speech giving rise to reduced overall performance.

The relaxation in b) could also be permitted for other types of TE. This would however require a limit to be specified for the number of samples that would be permitted to exceed the limit or for it to be possible to make a judgement about the statistical probability of a TE producing such signals. This would unduly complicate the testing process for TE within the scope of TBR 21 [9].

NOTE 2: This requirement is not identical to the requirement in the corresponding clause in TBR 21 [9], for the reasons given in note 1.

Justification: 98/13/EC [13], Article 5(d); Protection of the PSTN from harm requires the signal sent into the PSTN by the TE to be limited so that the interfering effects of the signal can be predicted and avoided.

Test: The test shall be conducted according to annex A, subclause A.4.2.2.

4.7.3.3 Voltage level in a 10 Hz bandwidth

Requirement: None.

NOTE: For the reasons given in annex C of the present document, Voice Telephony Terminals meeting subclauses 4.7.3.1 and 4.7.3.2 comply with the requirements for the voltage level in a 10 Hz bandwidth as given in the corresponding clause of TBR 21 [9].

4.7.3.4 Sending levels above 4,3 kHz

Requirement and test: The requirement and associated test of subclause 4.7.3.4 of TBR 21 [9] shall apply when the TE is stimulated with the appropriate signal as specified in clause A.3.

NOTE: In TBR 21 [9] to test this subclause it is foreseen a measurement point at a feed resistance of 3 200 Ω . This point shall be replaced by an equivalent one at a feed resistance of 2 800 Ω (or 2 300 Ω , as appropriate, according to the text of subclause 4.7).

Justification: 98/13/EC [13], Article 5(d); Protection of the PSTN from harm requires the signal sent into the PSTN by the TE to be limited so that the interfering effects of the signal can be predicted and avoided.

4.7.4 Impedance unbalance about earth

Justification: 98/13/EC [13], Article 5(d); Protection of the PSTN from harm. Unbalance may produce levels of cross-talk that disturb the service of other users of the PSTN connected to other pairs in the same cable.

4.7.4.1 Longitudinal Conversion Loss

Requirement and test: The requirement and associated test of subclause 4.7.4.1 of TBR 21 [9] shall apply.

NOTE: In TBR 21 [9] to test this subclause it is foreseen a measurement point at a feed resistance of 3 200 Ω . This point shall be replaced by an equivalent one at a feed resistance of 2 800 Ω (or 2 300 Ω , as appropriate, according to the text of subclause 4.7).

4.7.4.2 Output Signal Balance

Requirement and test: The requirement and associated test of subclause 4.7.4.2 of TBR 21 [9] shall apply when the TE is stimulated with the appropriate signal as specified in clause A.3.

NOTE: In TBR 21 [9] to test this subclause it is foreseen a measurement point at a feed resistance of 3 200 Ω . This point shall be replaced by an equivalent one at a feed resistance of 2 800 Ω (or 2 300 Ω , as appropriate, according to the text of subclause 4.7).

4.7.5 Resistance to earth

Requirement and test: The requirement and associated test of subclause 4.7.5 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to present a sufficiently high DC resistance to earth in loop states so as not to disturb the basic call control function.

4.8 Call attempt

The requirements of subclause 4.7 shall also apply during a call attempt.

For TE declared by the manufacturer for use only on lines providing a loop current of 18 mA or greater, the resistor of 2 800 Ω shall be replaced by a resistor of 2 300 Ω .

This subclause shall only apply to TE that the manufacturer intends to be used to generate outgoing calls.

4.8.1 Automatic dialling

This requirement applies only to a TE with an automatic seizing and dialling function. It applies when the TE is in automatic dialling mode.

4.8.1.1 Dialling without dial tone detection

Requirement and test: The requirement and associated test of subclauses 4.8.1.1 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN is assured by requiring a TE with automatic dialling not to send its digits before the network is ready to receive digits under normal conditions.

4.8.1.2 Dialling with dial tone detection

Requirement and test: The requirement and associated test of subclauses 4.8.1.2 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires a TE with automatic dialling to be capable of sending its digits during the time period when the network is ready to receive digits.

4.8.2 DTMF signalling

4.8.2.1 Frequency combinations

Requirement and test: The requirement and associated test of subclause 4.8.2.1 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires digits to be transmitted as particular combinations of frequencies in order to be interpreted correctly by the network.

4.8.2.2 Signalling levels

4.8.2.2.1 Absolute levels

Requirement and test: The requirement and associated test of subclause 4.8.2.2.1 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the levels of the two frequencies to be constrained in order to be interpreted correctly by the network.

4.8.2.2.2 Level difference

Requirement and test: The requirement and associated test of subclause 4.8.2.2.2 of TBR 21 [9] shall apply.

NOTE: In TBR 21 [9] to test this subclause it is foreseen a measurement point at a feed resistance of 3 200 Ω . This point shall be replaced by an equivalent one at a feed resistance of 2 800 Ω (or 2 300 Ω , as appropriate, according to the text of subclause 4.8).

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the difference in levels of the two frequencies to be constrained in order to be interpreted correctly by the network.

4.8.2.3 Unwanted frequency components

Requirement: When transmitting any DTMF tone combination **in the presence of dial tone** during a call attempt, the total sending level of all unwanted frequency components in the frequency range 250 Hz to 4 300 Hz shall be at least 20 dB below **the level of the** low group frequency component.

For the purpose of this requirement, the dial tone is defined as a single tone signal, delivered from a generator with a source impedance equal to Z_R , with a frequency of 425 Hz, whose level is -10 dBV when measured across the reference impedance Z_R .

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the levels of signals, other than the two frequencies being used to represent the digit, to be constrained in order to be interpreted correctly.

NOTE: The additional words **in the presence of dial tone** are intended to clarify that even TE that dials without first detecting the dial tone, the TE should nevertheless have dial tone present during this test.

Test: The test shall be conducted according to subclause A.4.3.

4.8.2.4 Tone duration

This requirement applies where the DTMF signalling tone duration is controlled automatically by the TE.

Requirement and test: The requirement and associated test of subclause 4.8.2.4 of TBR 21 [9] shall apply.

NOTE: For correct operation of supplementary services such as SCWID (Spontaneous Call Waiting Identification) and SDSS (Server Display and Script Services), DTMF tone bursts will need to be no longer than 90 ms.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to send DTMF tones for a minimum period of time in order that the receivers in the exchange can recognize the digit being sent.

4.8.2.5 Pause duration

This requirement applies where the DTMF signalling tone duration is controlled automatically by the TE.

Requirement and test: The requirement and associated test of subclause 4.8.2.5 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to provide a minimum period of "Tone Off" between DTMF digits in order that the receivers in the exchange can determine the end of any digit from the start of the next.

4.8.3 Automatically repeated call attempts

Requirement and test: The requirement and associated test of subclause 4.8.3 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(d); Protection of the PSTN from harm is achieved by limiting the number of automatically repeated call attempts from the TE.

4.9 Transition from loop to quiescent state

Requirement and test: The requirement and associated test of subclause 4.9 of TBR 21 [9] shall apply.

Justification: 98/13/EC [13], Article 5(f); Inter-working with the PSTN requires the TE to be capable of releasing the line.

4.10 Safety

There are no safety requirements under the present document.

NOTE: Safety requirements are imposed under directive 73/23/EEC [11], and Articles 5(a) and 5(b) of directive 98/13/EC [13].

4.11 EMC

There are no EMC requirements under the present document.

NOTE: There are no specific EMC requirements arising from Article 5(c) in directive 98/13/EC [13] and consequently, all EMC aspects are covered by directive 89/336/EEC [12].

Annex A (normative): Test methods

A.1 General

This annex describes the test principles to determine the compliance of a TE against the requirements of the present 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 need to 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 do this, it may be necessary for the supplier to provide additional equipment or information 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. The accuracy of test equipment and/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 Equipment connection

The tests shall be applied at the Terminal Connection Point.

Table A.1

Contact number	Test socket connected to
1	Unconnected (note 1)
2	Unconnected (note 1)
3/4	TCP
5	Unconnected (note 1)
6	Unconnected (note 1)
NOTE 1: For special application, pins (other than 3 and 4) may be intended to be additionally in contact with the NTP. In this case the supplier shall indicate the function of such pins and during the test they will be connected as would be intended during normal operation.	
NOTE 2: See subclause A.1.4 of TBR 21 [9] for additional connections for performing measurements to earth.	
NOTE 3: A special test adapter may be needed to connect the TE with the test instruments, however this adapter should not modify the characteristics of the TE.	

A.1.2 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 ± 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, stabilized AC supplies, DC) 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 ± 4 % of the rated frequency limit.

A.1.2.1 Acoustic environment for tests

The characteristics of the acoustic environment, such that it will have a negligible effect on the measurements being made and the repeatability of results is dependant on the type of acoustically stimulated terminal. The following types, headset, handset and handsfree have been identified. The supplier shall declare which of these is representative of the normal intended use of the TEUT and if none of these are representative, provide details of the environment for the normal intended use for the TEUT.

A.1.3 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.1.4 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) a facility to remain in the loop state without transmitting signals; and
- b) a facility to transmit all types of signal 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 and feeding bridge

A.2.1 Reference impedance

Subclause A.2.1 of TBR 21 [9] shall apply.

A.2.2 Non-reactive line termination

Subclause A.2.2 of TBR 21 [9] shall apply.

A.2.3 Feeding bridge

Subclause A.3 of TBR 21 [9] shall apply.

A.3 Details for testing voice stimulated TE

The following is based on TR 101 149 [14]. In principle the contents of this clause will affect the following subclauses:

- 4.7.3.1 Mean sending level;
- 4.7.3.2 Instantaneous voltage;
- 4.7.3.4 Sending levels above 4,3 kHz;
- 4.7.4.2 Output Signal Balance;
- 4.8.2.3 Unwanted frequency components.

A.3.1 Voice signal to be used during tests

A.3.1.1 Type

Pink Noise: For the purpose of the present document the pink noise test signal, adjusted at the relevant Reference Point, shall be band limited to the frequency range 200 Hz to 3 800 Hz.

There are two recommended methods of achieving this, the choice of which depends upon the filtering technique used.

- a) Where analogue filters are used the slopes of the band limiting filter shall be at least 24 dB/octave and the out-of-band attenuation shall be at least 25 dB (see figure A.1). The third octave spectrum of electrically generated pink noise shall be equalized to within ± 1 dB, while acoustically generated pink noise shall be equalized (in free field) to within ± 3 dB.

NOTE 1: When measured with 1/3 octave bandwidth at standard frequencies, an ideal filtered pink noise signal will be attenuated 1,1 dB at 200 Hz and 0,9 dB at 4 kHz compared to a non-filtered pink noise signal.

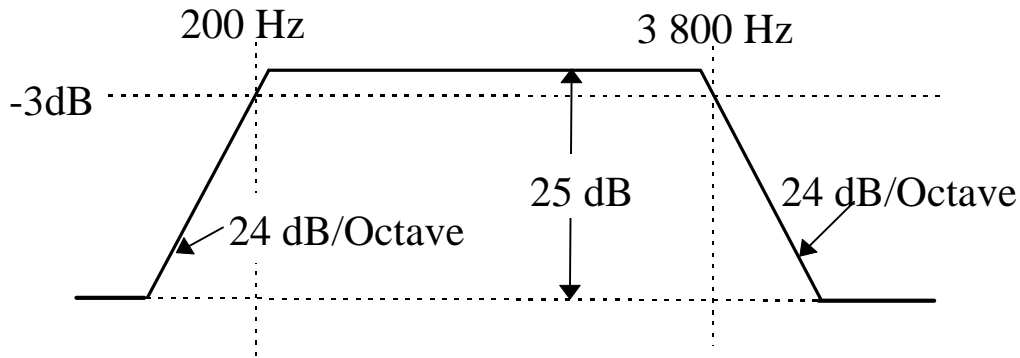


Figure A.1: Response for the band-limiting filter

- b) Where digital filters are used the detail of a) above applies, but with the 3dB attenuation points set at 225 Hz and 3 563 Hz instead of 200 Hz and 3 800 Hz.

Speech Test Signal: This shall be band-limited pink noise (see definition above) that is continuously modulated to be ON for a period of 250 ms \pm 5 ms and OFF for a period of 150 ms \pm 5 ms. The signal level specified refers to the level of the signal during the ON period.

Pseudo Speech Signal: This shall be a speech test signal (see definition above) with 11 cycles and then followed by a period of 5,6 seconds \pm 20 ms OFF giving an activity ratio of approximately 28 %.

NOTE 2: The total OFF time after the 11th ON burst will be 5,75 s.

NOTE 3: The timing tolerances given above will result in a tolerance for the r.m.s. level of \pm 0,1 dB.

This Pseudo Speech Signal is repeated for as long as is necessary for any measurements to be made.

Where the Supplier declares that the Pseudo Speech Signal is not appropriate for the intended use of the TE, an alternative test signal may be specified by the Supplier providing that the overall activity ratio during a one minute period shall be within the range of 23 % to 33 %. Any alternative signal shall be adjusted to give the same r.m.s. level over a one minute period as the level for the pseudo speech signal.

NOTE 4: The activity factor of 27,6 % can be found in ITU-T Recommendation P.59 [6].

A.3.1.2 Levels

Table A.1A: Input signal levels (ON)

		except for A.4.7.3.2	A.4.7.3.2 only	A.4.7.3.2 only
Stimulating point:	Stimulated point:	Nominal	5 Vpp	8 Vpp
Analogue NTP simulator	TCP	-12 dBVemf	-7 dBVemf	+3 dBVemf
Digital (NTP or TCP or other)	TCP or ICP or other	-12,5 dBm0	-7,5 dBm0	+2,5 dBm0
Analogue TCP simulator	ICP	-4 dBVemf	+1 dBVemf	+11 dBVemf
MRP of a handset or headset	Microphone	-4,7 dBPa	+0 dBPa	+10 dBPa
HFRP of a handsfree	Microphone	-28,7 dBPa	-24 dBPa	-14 dBPa
NOTE 1: Analogue interfaces (PSTN-TCP and ICP) shall be stimulated with generators presenting a source impedance of Z_R defined in TBR 21[9]. Equalization and level calibration of the pink noise signal shall be done with the generator disconnected from the load.				
NOTE 2: dBm0 is the level expressed in dB with respect to the 0dB _r Point as referred to in ITU-T Recommendation G.101 [16]. In the present document this is used together with the stimulation of digital interfaces.				

A.3.2 Electro-acoustic interfaces

A.3.2.1 Handset

Mouth Reference Point (MRP): Generally the appropriate Mouth Reference Point from ITU-T Recommendations P.340 [7] and P.56 [5], shall be used. Where a supplier has declared that the ITU-T MRP would be inappropriate for the intended use of the TE, then the microphone positioning described by the supplier shall be applied.

A.3.2.2 Hands-free

Hands-Free Reference Point (HFRP): A point located on the axis of the artificial mouth, at 50 cm from the lip ring, where the level calibration is made in free field. It corresponds to the measurement point n°11, as defined in ITU-T Recommendation P.51 [4].

A.3.2.3 Headset

For headsets the same measuring methods apply as for handsets. If the microphone positioning for testing is not defined by the manufacturer, it will correspond to the "corner of the mouth" position as defined in the ITU-T Recommendation P.38 [3], clause 1, note.

A.3.2.4 Other interfaces

TE with other transducers arrangements will be tested in accordance with the manufacturer's instructions.

A.3.3 Electrical interfaces simulations

A.3.3.1 Analogue 2-wire NTP (Network Termination Points)

The analogue 2-wire NTP simulation is the one used for the tests in TBR 21 [9].

A.3.3.2 Analogue 2-wire TCP (TCP of TE behind TCE)

The analogue 2-wire TCP simulation is derived from TBR 21 [9]. For test purposes it will have an equivalent DC-resistance of 400 Ω and an impedance of Z_R as defined in TBR 21 [9] (270 Ω + (750 Ω // 150 nF)).

A.3.3.3 Other harmonized interfaces

Should be simulated according the corresponding standards.

A.3.3.4 Non harmonized interfaces

Should be simulated according the manufacturers instructions.

A.4 Test methods

One test may cover more than one requirement. The scope of each test is defined under the heading "purpose". Where a test specifies 2 800 Ω (or 2,8 k Ω) for the DC feeding series resistance and the manufacturer has declared that the TE is intended for use only on lines providing a loop current of 18 mA or greater this resistor shall be replaced by a resistor of 2 300 Ω (or 2,3 k Ω).

A.4.1 Ringing signal detector sensitivity

Requirement: Subclause 4.5.2.

Purpose: To determine the ability of the TE to respond to ringing signals as stated in the requirements part.

Measurement principle:

Preamble: Set the TE in quiescent state with answering facility enabled.

Test state: Quiescent state.

Test configuration:

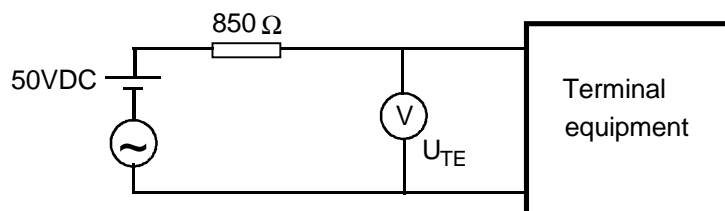


Figure A.2

DC feeding arrangement: Feed Voltage = 50 V DC.

Measurement points:

The ringing signal shall have a sinusoidal source of 25 Hz and 50 Hz and a cadence of 1 s ON and 5 s OFF. U_{TE} shall be measured during the "on" period of the signal.

$$U_{TE} = 30 \text{ Vrms}$$

Safety Warning:

This test presents the potential for a shock hazard. Ensure satisfactory safety precautions are implemented to reduce the risk of electric shock.

Measurement execution:

Using the test configuration shown in figure A.2, apply, one at a time, each one of the ringing signals described in "Measurement points" to the circuit to determine whether the TE produces a Sound Pressure Level of at least 55 dBA at a distance of 1 m. The sound level (dBA rms) shall be measured with a sliding time window of 100 ms. The highest reading shall be registered as measurement result.

Formal processing: None.

Verdict:

If TE responds to the all the ringing signals above described in "Measurement points" by producing a Sound Pressure Level of at least 55 dBA then Pass; else Fail.

Guidance:

For automatic answering TE, after the stimulation to cause the seizure, the requirement stated in subclause 4.6.2 and its associated test case apply.

A.4.2 General loop state requirements, sending level limitations

A.4.2.1 Mean sending levels

Requirement: Subclause 4.7.3.1.

Purpose:

To check that the mean sending level in the frequency range 200 Hz to 3 800 Hz over a one-minute period shall not be greater than -9,7 dBV when the TE interface is terminated with the reference impedance Z_R .

Measurement principle:

Preamble: Set the TE in loop state.

Test state: The TE shall be in loop state and stimulated using the appropriate test signal.

Test configuration:

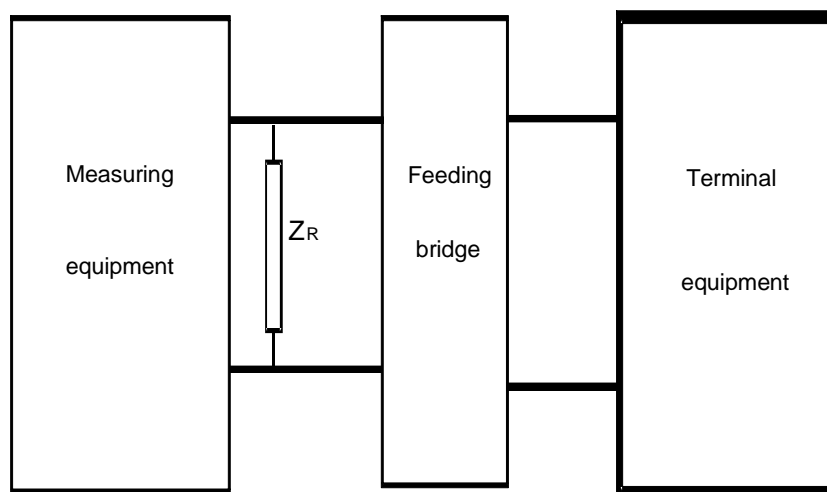


Figure A.3

DC feeding arrangement:

Feed voltage: 50 V. Feed resistance: each of the following: 230 Ω , and 2 800 Ω (or 2 300 Ω as appropriate). Polarity shall be switched between each feed resistance.

AC termination of TE: Z_R

Measurement points: The TE is stimulated using the appropriate test signal.

Measurement execution:

The TE shall be set in loop state and stimulated by applying a pseudo speech signal at the nominal excitation level. The pseudo speech signal shall be applied for the duration of the measurement. The mean sending level in the frequency range 200 Hz to 3 800 Hz transmitted across the terminal connection point shall be determined over a one-minute period.

Formal processing: None.

Verdict: If the mean level over a one-minute period is less than or equal to -9,7 dBV then Pass; else Fail.

Guidance:

Terminal equipment with adjustable output level is set up in accordance with the supplier's instructions for intended use, or in the absence of instructions, is set to send at its maximum level. The terminal equipment is then operated in accordance with its intended use.

A.4.2.2 Instantaneous voltage

Requirement: Subclause 4.7.3.2.

Purpose: To check that the peak to peak voltage of the TE complies with subclause 4.7.3.2.

Measurement principle:

Preamble: Set the TE in loop state.

Test state: The TE shall be in loop state and stimulated using the appropriate test signal.

Test configuration:

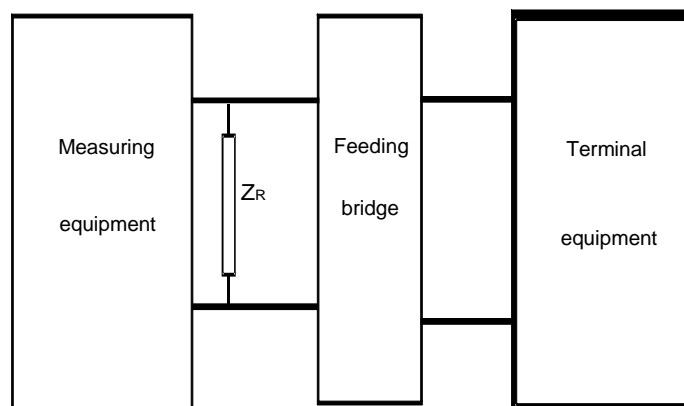


Figure A.4

DC feeding arrangement:

Feed voltage: 50 V. Feed resistance: each of the following: 230 Ω , and 2 800 Ω (or 2 300 Ω as appropriate). Polarity shall be switched between each feed resistance.

AC termination of TE: Z_R .

Measurement points: The TE is:

- stimulated using the appropriate test signal;
- exercised to send to line DTMF signals.

Measurement execution:

The TE shall be set in the loop state and stimulated using a pseudo speech signal at the two levels specified. The peak to peak voltage transmitted across the terminal connection point, shall be measured.

Formal processing: None.

Verdict: If:

- a) the peak to peak voltage for DTMF signals and the lower level of stimulus is not higher than 5,0 V; and
- b) the peak to peak voltage for the higher level of stimulus is not higher than 8,0 V,
 - then Pass;
 - else Fail.

Guidance:

Terminal equipment with adjustable output level is set up in accordance with the supplier's instructions for intended use, or in the absence of instructions, is set to send at its maximum level. The terminal equipment is then operated in accordance with its intended use.

A.4.3 Call attempt, DTMF signalling

Guidance: Dial tone may be necessary to activate dialling.

A.4.3.1 Unwanted frequency components

Requirement: Subclause 4.8.2.3.

Purpose:

To check the total sending level of all unwanted frequency in the frequency range 250 Hz to 4 300 Hz. The level shall be at least 20 dB below the level of the low group frequency component, when transmitting any DTMF tone combination during call attempt including in the presence of dial tone.

Measurement principle:

Preamble: Set the TE in loop state.

Test state: Dialling.

Test configuration:

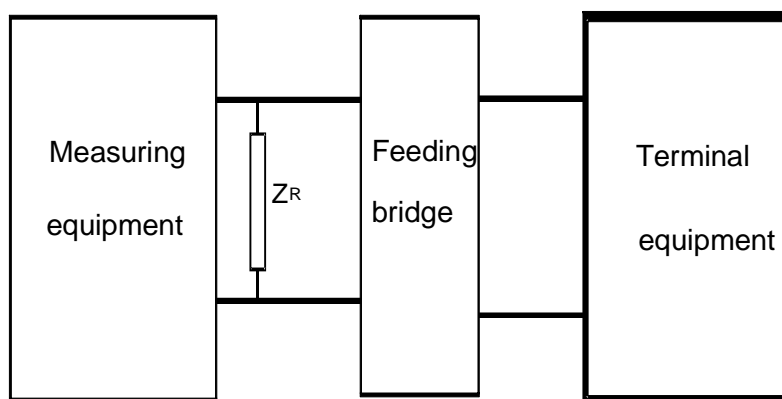


Figure A.5

DC feeding arrangement:

Feed voltage: 50 V. Feed resistance: each of the following: 230 Ω , and 2 800 Ω (or 2 300 Ω as appropriate). Polarity shall be switched between each feed resistance.

AC termination of TE: Z_R .

Dial Tone:

During calibration, a load exhibiting the characteristics of the reference impedance Z_R is substituted for the TE, in order that a consistent level of dial tone is applied.

Measurement points:

Where all characters of table 9 are available:

- select digits A, 6, 8, *;

else, if all numerals are available:

- select digits 3, 5, 7 and 0;

else,

- select all available digits.

Measurements are carried out for the first and third digit in a dialling sequence of a least 3 digits, for all the relevant digits as defined above.

Measurement execution:

For each digit to be tested, the TE is set in the loop state, transmitting at least 3 times the concerned DTMF character. Measurement shall be made during the sending period as defined in subclause 4.8.2.4 (minimum duration 65 ms). The test is carried with a suitable frequency analyzer making use of a measurement window of 65 ms, starting from 5 ms before the start of the DTMF signal, and using a Hanging window for the Fast Fourier Transformation. For the purpose of this test, the start of the DTMF signal is defined as the instant that the signal level has raised with 5 to 10 % with respect to the level of the dial tone only.

The TE is set in the loop state, stimulated using the speech test signal and exercised to send DTMF characters to the line.

Measurement shall be made during the sending period as defined in subclause 4.8.2.4 (minimum duration 65 ms).

Formal processing: Integration of all signal levels is divided in 4 parts:

- a) from 250 Hz up to 425 Hz;
- b) from 425 Hz up to the lower DTMF component;
- c) from the lower DTMF component up to the higher DTMF component;
- d) from the higher DTMF component up to 4 300 Hz.

Summation of all four parts gives the total unwanted sending level result. The dial tone and frequencies up to 50 Hz on either side of the DTMF components shall be excluded from the summation. This result is compared with the level of the lower DTMF component.

Verdict:

If the total unwanted signal level is at least 20 dB below the level of the lower DTMF component for all available digits then Pass; else Fail.

Guidance: The total unwanted sending level is calculated from the following formula:

$$\Sigma = \sqrt{a^2 + b^2 + c^2 + d^2}$$

Where:

a, b, c and d represent the four voltages described in the Formal processing.

Annex B (normative): Requirements Table (RT)

Notwithstanding the provisions of the copyright clause related to the text of the present document, ETSI grants that users of the present document may freely reproduce the RT in this annex so that it can be used for its intended purposes and may further publish the completed RT.

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.

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 subclause 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 on 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 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 controlled by an external device for the origination and/or the reception of a call?	If YES then M else N		
C.2.	Does the TE intended to have a connection to earth?	If YES then M else N		
C.3.	Is the TE intended to be in loop state?	If YES then M else N		
C.4.	Is the TE intended for call answer?	If YES then M else N		
C.4A	Is the TE intended to answer a call with an audible ringing detector?	If YES then M else N		
C.5.	Is the TE intended for call set-up?	If YES then M else N		
C.6.	Is the TE intended for dialling with DTMF?	If YES then M else N		
C.7.	Is the TE intended for automatic dialling without dial tone detection?	If YES then M else N		
C.8.	Is the TE intended for automatic dialling with a dial tone detection?	If YES then M else N		
C.9.	Is the TE intended for use in receiving mode?	If YES then M else N		
C.10.	Is the TE intended for use in transmitting mode?	If YES then M else N		
C.11.	Does the TE intended for making internally generated automatically repeated call attempt?	If YES then M else N		
C.12.	Is the TE intended for automatically controlled signalling tone duration?	If YES then M else N		
C.13.	Is the TE intended for automatically controlled signalling pause duration?	If YES then M else N		
C.14.	Is the TE only intended to function on lines that provide greater than 18mA of line current?	If YES then M else C.15.		The test resistance of 2 800 Ω is replaced by 2 300 Ω
C.15.	The answer to above C.14 is "No"?	If YES then M else C.14.		Test resistance remains as 2 800 Ω
C.16	Is the TE intended to answer a call with a non-audible ringing detector?	If YES then M else N		

Table B.2: Requirements table

No.	Reference	Requirement	Status	Support (Y/N)
R.1.	4.1	General requirement	C.1	
R.2.	4.2	Physical characteristics of connection to the PSTN	M	
R.3.	4.3.1	Polarity	M	
R.4.	4.4.1	DC resistance	M	
R.5.	4.4.2.1	Impedance	M	
R.6.	4.4.2.2	Transient response	M	
R.7.	4.4.2.3	DC-current	M	
R.8.	4.4.3	Impedance unbalance about earth	C.2	
R.9.	4.4.4	Resistance to earth	C.2	
R.10.	4.5.1	Non-audible ringing detectors sensitivity	C.4 and C.16	
R.11.	4.5.2	Audible ringing detectors	C.4 and C.4A	
R.12.	4.6.1	Acceptance of breaks in the loop in a call attempt	C.5	
R.13.	4.6.2	Loop current characteristics	C.3 and (C.14 or C.15)	
R.14.	4.7.1	DC characteristics	C.3 and (C.14 or C.15)	
R.15.	4.7.2	Impedance	C.3 and (C.14 or C.15)	
R.16.	4.7.3.1	Mean sending levels	C.3 and (C.14 or C.15)	
R.17.	4.7.3.2	Instantaneous voltage	C.3 and (C.14 or C.15)	
R.18.	4.7.3.3	Not required see Annex C	(C.14 or C.15)	
R.19.	4.7.3.4	Sending levels above 4,3 kHz	C.3 and (C.14 or C.15)	
R.20.	4.7.4.1	Longitudinal Conversion Loss	C.2 and C.3 and C.9 and (C.14 or C.15)	
R.21.	4.7.4.2	Output Signal Balance	C.2 and C.3 and C.10 and (C.14 or C.15)	
R.22.	4.7.5	Resistance to earth	C.2 and (C.4 or C.5)	
R.23.	4.8.1.1	Dialling without dial tone detection	C.7	
R.24.	4.8.1.2	Dialling with dial tone detection	C.8	
R.25.	4.8.2.1	Frequency combinations	C.6	
R.26.	4.8.2.2 1	Absolute levels	C.6 and (C.14 or C.15)	
R.27.	4.8.2.2.2	Level difference	C.6 and (C.14 or C.15)	
R.28.	4.8.2.3	Unwanted frequency components	C.6 and (C.14 or C.15)	
R.29.	4.8.2.4	Tone duration	C.6 and C.12	
R.30.	4.8.2.5	Pause duration	C.6 and C.13	
R.31.	4.8.3	Automatically repeated call attempts	C.11	
R.32.	4.9	Transition from loop to quiescent state	C.3	

Annex C (informative): Reasons for omitting 10 Hz signal limitations

Assume the TE has a flat frequency response – any roll off at the band edges will only reduce the power density and make it easier to meet the requirement.

Pink noise has the characteristic of equal power per octave i.e. the power density falls at 3dB/octave.

Let the power to line of the band limited pink noise be P_{tot} .

Bandwidth of 200 Hz to 3 800 Hz = 4,25 octaves.

Power per octave = $P_{tot}/4,25$.

For pink noise, the highest signal density occurs at the lowest frequencies i.e. at 200 Hz.

The lowest octave 200 Hz to 400 Hz contains 20 intervals of 10 Hz.

Average power per 10 Hz bandwidth in this octave = $P_{tot}/(4,25 \times 20) = P_{tot}/85$.

$P_{tot}/85 = -19,3$ dB relative to P_{tot} .

Now there is a power density difference of 3 dB across the octave, so the level of the lowest frequency will be 1,5 dB higher than the average power, i.e. $-19,3 + 1,5$ dB rel $P_{tot} = -17,8$ dB rel P_{tot} .

Now for the same pseudo speech signal stimulus of $-4,7$ dBPa, the maximum mean sending level according to subclause 4.7.3.1 is $-9,7$ dBV. This is averaged over 1 minute so to get the instantaneous level we have to compensate for the activity ratio of the pseudo speech signal.

For an activity ratio of 27,5 %, the active power is 5,6 dB higher than the mean power.

The maximum power in a 10 Hz bandwidth is $-17,8 + 5,6$ dB rel $P_{tot} = -12,2$ dB rel P_{tot}

The maximum power in a 10 Hz bandwidth is thus $-12,2$ dB rel $-9,7$ dBV = $-21,9$ dBV.

Maximum permitted power in a 10 Hz bandwidth at 200 Hz = $-6,7$ dBV.

Therefore voice TE will never fail this requirement if they meet the 1 minute mean sending level.

The requirement for the voltage level in a 10 Hz bandwidth (subclause 4.7.3.3) can therefore safely be deleted as it serves no purpose for voice stimulated TE and only adds unnecessary cost to the conformance testing.

Bibliography

The following material, though not specifically referenced in the body of the present document, gives supporting information.

Miniature 6-position plug as described in FCC 47, CFR 68.500: Code of Federal Regulations (USA); Title 47 Telecommunication; Chapter 1 Federal Communications Commission, Part 68 Connection of Terminal Equipment to the Telephone Network; Subpart F Connectors; Section 68.500 Specification.

NOTE: The above document can be obtained from:

Superintendent of Documents
Washington DC 20402
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91/263/EEC: "Council Directive 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".

History

Document history			
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