



TECHNICAL
BASIS for
REGULATION

FINAL DRAFT
pr **TBR 8**

June 1998

Second Edition

Source: DTA

Reference: RTBR/DTA-004044

ICS: 33.020

Key words: ISDN, telephony, 3,1 kHz, teleservice, terminal

**Integrated Services Digital Network (ISDN);
Telephony 3,1 kHz teleservice;
Attachment requirements for handset terminals**

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Contents

Foreword	7
1 Scope	9
2 Normative references	9
3 Definitions and abbreviations	11
3.1 Definitions	11
3.2 Abbreviations	12
4 General	12
5 Safety requirements	12
6 ElectroMagnetic Compatibility (EMC) requirements	12
7 Call control functions	13
7.1 Information element codings specific for the Telephony 3,1 kHz teleservice	13
7.1.1 Bearer Capability information element	13
7.1.2 High Layer Compatibility (HLC) information element	14
7.1.3 Low Layer Compatibility (LLC) information element	14
7.2 Outgoing calls, inclusion and coding of the compatibility elements	15
7.3 Incoming calls - compatibility checking	15
8 Transmission aspects	16
8.1 General	16
8.1.1 Encoding	16
8.1.2 Volume control	16
8.2 Speech performance characteristics (handset telephony 3,1 kHz)	17
8.2.1 Sensitivity - frequency response	17
8.2.1.1 Sending	17
8.2.1.2 Receiving	17
8.2.2 Sending and Receiving Loudness Ratings (SLR and RLR)	18
8.2.2.1 Nominal values	18
8.2.2.2 Volume control	18
8.2.3 Sidetone	18
8.2.3.1 Talker sidetone	18
8.2.3.2 Listener sidetone	19
8.2.4 Terminal Coupling Loss (TCL)	19
8.2.4.1 Weighted Terminal Coupling Loss (TCLw)	19
8.2.4.2 Stability loss	19
8.2.5 Distortion	19
8.2.5.1 Sending	19
8.2.5.1.1 Method 1 (Pseudo random noise stimulus)	19
8.2.5.1.2 Method 2 (Sinusoidal test signal)	20
8.2.5.2 Receiving	20
8.2.5.2.1 Method 1 (Pseudo random noise signal)	20
8.2.5.2.2 Method 2 (Sinusoidal test signal)	21
8.2.5.3 Sidetone	21
8.2.6 Variation of gain with input level	21
8.2.6.1 Sending	21
8.2.6.2 Receiving	21
8.2.7 Out-of-band signals	22
8.2.7.1 Discrimination against out-of-band input signals (sending)	22

	8.2.7.2	Spurious out-of-band (receiving).....	22
8.2.8		Noise.....	23
	8.2.8.1	Sending.....	23
	8.2.8.2	Receiving.....	23
	8.2.8.3	Level of sampling frequency (receiving).....	23
8.2.9		Acoustic shock.....	23
8.2.10		Delay.....	23
9		Operation under restricted power conditions.....	24
10		Testing and approval methodology.....	24
Annex A (normative): Test specification for voice transmission aspects.....			25
A.1		General conditions for testing.....	25
A.1.1		Environment for tests.....	25
A.1.2		Test equipment interface.....	25
A.1.3		Test equipment requirements.....	25
	A.1.3.1	Electro-acoustic equipment.....	25
	A.1.3.2	Test equipment for digital telephone sets.....	25
		A.1.3.2.1 Codec approach and specification.....	25
		A.1.3.2.2 Direct digital processing approach.....	27
A.1.4		Alternative test methods.....	27
A.1.5		Accuracy of test equipment.....	27
A.1.6		Bandwidth.....	27
A.1.7		Powering.....	27
A.2		Transmission requirements testing.....	28
A.2.1		Sensitivity/frequency response.....	28
	A.2.1.1	Sending.....	28
	A.2.1.2	Receiving.....	28
A.2.2		Loudness ratings.....	28
	A.2.2.1	Sending Loudness Rating (SLR).....	28
	A.2.2.2	Receiving Loudness Rating (RLR).....	29
A.2.3		Sidetone.....	29
	A.2.3.1	Talker sidetone.....	29
	A.2.3.2	Listener sidetone.....	29
		A.2.3.2.1 Sound field calibration.....	29
		A.2.3.2.2 Measurement and calculation of LSTR.....	30
		A.2.3.2.3 Measurement and calculation of the value of the D-factor.....	30
A.2.4		Terminal Coupling Loss.....	31
	A.2.4.1	Weighted Terminal Coupling Loss (TCLw).....	31
	A.2.4.2	Stability loss.....	31
A.2.5		Distortion.....	32
	A.2.5.1	Sending.....	32
		A.2.5.1.1 Method 1.....	32
		A.2.5.1.2 Method 2.....	33
	A.2.5.2	Receiving.....	33
		A.2.5.2.1 Method 1.....	33
		A.2.5.2.2 Method 2.....	33
	A.2.5.3	Sidetone.....	33
A.2.6		Variation of gain with input level.....	34
	A.2.6.1	Sending.....	34
	A.2.6.2	Receiving.....	34
A.2.7		Out-of-band signals.....	34
	A.2.7.1	Discrimination against out-of-band input signal.....	34
	A.2.7.2	Spurious out-of-band signals.....	34
A.2.8		Noise.....	34
	A.2.8.1	Sending.....	34
	A.2.8.2	Receiving.....	35
	A.2.8.3	Level of sampling frequency (receiving).....	35
A.2.9		Delay.....	35

Annex B (normative):	Abstract Test Suite (ATS) in electronic form for the call control functions	37
B.1	The TTCN Graphical form (TTCN.GR)	37
B.2	The TTCN Machine Processable form (TTCN.MP)	37
Annex C (informative):	Acoustic shock requirements	38
C.1	Continuous signal	38
C.2	Peak signal	38
Annex D (normative):	Description of the cross-correlation method	39
D.1	Test signal	39
D.2	Calculation	39
Annex E (normative):	TBR Requirements Table (TBR-RT)	40
E.1	Guidance for completion of the TBR-RT	40
E.2	Call control functions requirements TBR-RT	41
E.3	Transmission aspects requirements TBR-RT	41
Annex F (informative):	Test Report Format	43
F.1	Identification	43
F.1.1	Identification of the Document	43
F.1.2	Identification of the testing laboratory	43
F.1.3	Identification of the client	43
F.1.4	Identification of the test item	43
F.1.5	Use of subcontractors	43
F.2	Test conditions	44
F.3	Test equipment	44
F.4	Test results	44
F.4.1	Call control functions	44
F.4.2	Speech transmission characteristics	44
F.4.3	Power feeding	44
F.5	Summary and conclusion	44
Annex G (normative):	List of supported telecommunication services	45
G.1	Basic telecommunication services	45
G.2	Supplementary services	45
Annex H (informative):	Bibliography	46
History	49

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Foreword

This final draft Technical Basis for Regulation (TBR) has been produced by the ETSI Project Digital Terminals and Access (DTA), and is now submitted for the Voting phase of the ETSI standards 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).

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 are given in the TBR-Requirements Table (TBR-RT) in annex E.

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

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1 Scope

This Technical Basis for Regulation (TBR) specifies the technical requirements under Article 5(g) of Directive 98/13/EC for Terminal Equipment Type 1 (TE1 see [1]) for the telephony 3,1 kHz teleservice to be attached to the pan-European Integrated Services Digital Network (ISDN) at an interface at the coincident S and T reference point for a basic access.

The objective of this TBR is to ensure interworking via the network.

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

This TBR specifies the Article 5(g) requirements for TE1 that:

- a) are intended for participation in calls that use those on-demand circuit mode basic services that are specified in clause G.1;
- b) optionally use those supplementary services that are specified in clause G.2;
- c) are capable of handling either incoming calls only, outgoing calls only or both incoming and outgoing calls.

This TBR is applicable to simple 3,1 kHz telephony terminals as well as to the 3,1 kHz telephony function of multimedia or multi-service terminals and includes all functions necessary to provide real-time 2-way speech conversation. This TBR only applies to items of terminal equipment with an integral user-network interface for ISDN basic access, and which have a handset. Where a function is indicated as optional, it need not be provided, but, where such a function is provided, the terminal needs to conform to the requirements and tests specified in this TBR.

This TBR is not applicable to:

- a) terminal equipment specially designed for the disabled (e.g., with amplification of received speech as an aid for the hard-of-hearing);
- b) terminal equipment using a radio link (e.g., cordless telephones);
- c) terminal equipment for hostile environments;
- d) terminal equipment with a switching function which is not covered by the definition of TE1.

NOTE: Terminals that meet the requirements of this TBR will also be suitable for connection to the S reference point for interworking via the public network.

2 Normative references

This TBR incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this TBR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies. Informative references can be found in annex H.

- [1] CCITT Recommendation I.411 (1988): "ISDN user-network interfaces - Reference configurations".
- [2] ITU-T Recommendation P.10: "Vocabulary of terms on telephone transmission quality and telephone sets".
- [3] ITU-T Recommendation G.701 (1993): "Vocabulary of digital transmission and multiplexing, and pulse code modulation (PCM) terms".
- [4] IEC 651: "Sound level meters".

- [5] TBR 3 (1995) including Amendment 1 (1998): "Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using ISDN basic access".
- [6] ITU-T Recommendation G.101 (1996): "The transmission plan".
- [7] ETS 300 111 (1992): "Integrated Services Digital Network (ISDN); Telephony 3,1 kHz teleservice, Service description".
- [8] ITU-T Recommendation G.122 (1993): "Influence of national systems on stability and talker echo in international connections".
- [9] ETS 300 102-1 (1993): "Integrated Services Digital Network (ISDN); User-network interface layer 3, Specifications for basic call control".
- [10] CCITT Recommendation G.711 (1988): "Pulse code modulation (PCM) of voice frequencies".
- [11] CCITT Recommendation G.223 (1988): "Assumptions for the calculation of noise on hypothetical reference circuits for telephony".
- [12] ITU-T Recommendation P.51 (1996): "Artificial mouth".
- [13] ITU-T Recommendation P. 57 (1996): "Artificial ears".
- [14] ITU-T Recommendation O.133 (1993): "Equipment for measuring the performance of PCM encoders and decoders".
- [15] ITU-T Recommendation G.712 (1996): "Transmission performance characteristics of pulse code modulation channels".
- [16] ITU-T Recommendation P.64 (1997): "Determination of sensitivity/frequency characteristics of local telephone systems".
- [17] ISO 3 (1973): "Preferred numbers - series of preferred numbers".
- [18] ITU-T Recommendation P.79 (1993): "Calculation of loudness ratings".
- [19] IEC 225: "Octave, half-octave and third-octave band filters intended for the analysis of sound and vibrations".
- [20] CCITT Recommendation O.131 (1988): "Quantizing distortion measuring equipment using a pseudo-random noise test signal".
- [21] CCITT Recommendation O.132 (1988): "Quantizing distortion measuring equipment using a sinusoidal test signal".
- [22] ISO/IEC 9646: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this TBR, the relevant definitions as given in ITU-T Recommendation P.10 [2] and ITU-T Recommendation G.701 [3], apply plus the following:

Acoustic Reference Level (ARL): The acoustic level which gives -10 dBm₀ at the digital interface.

dB(A): Sound level relative to 20 mPa measured using the A-weighting defined in IEC 651 [4].

dBPa: Sound pressure level relative to 1 Pa (no weighting).

dBPa(A): Sound level relative to 1 Pa measured using the A-weighting defined in IEC 651 [4].

D-factor: The computed average of the difference between the sending sensitivity using an artificial mouth and that using a diffuse room noise source.

designated terminal: The terminal which is permitted to draw power from power source 1 under restricted power conditions as specified in TBR 3 [5].

digital interface: The interface at the coincident S and T reference point. The digital interface shall be a 0 dBr point according to ITU-T Recommendation G.101 [6].

multimedia terminal: A terminal that simultaneously supports two or more media.

multiservice terminal: A terminal that supports two or more teleservices.

pink noise: A noise signal where the power spectrum is diminishing by 3 dB/octave.

restricted power condition: The condition indicated by the reversed polarity of the phantom voltage at the coincident S and T reference point, as defined in TBR 3 [5].

NOTE 1: For some networks restricted power condition will be the normal operating mode.

telephony 3,1 kHz teleservice: As defined in ETS 300 111 [7].

NOTE 2: Work is currently being undertaken by ETSI to analyse the mouth-to-ear characteristics of voice communication. The results of this work could have consequences for the essential requirements of this TBR.

Terminal Coupling Loss (TCL): The frequency dependent coupling loss between the receiving port and the sending port of a terminal due to:

- acoustical coupling at the user interface;
- electrical coupling due to crosstalk in the handset cord or within the electrical circuits;
- seismic coupling through the mechanical parts of the terminal.

NOTE 3: The receiving port and the sending port of a digital voice terminal is a 0 dBr point.

NOTE 4: The coupling at the user interface depends on the conditions of use.

Weighted Terminal Coupling Loss (TCLW): The weighted terminal coupling loss using the weighting of ITU-T Recommendation G.122 [8].

3,1 kHz telephony terminal: A terminal that supports the telephony 3,1 kHz teleservice as described in ETS 300 111 [7].

3.2 Abbreviations

For the purposes of this TBR, the relevant abbreviations given in ITU-T Recommendation P.10 [2] and ITU-T Recommendation G.701 [3], apply plus the following:

ARL	Acoustic Reference Level
BC	Bearer Capability
DTS	Digital Test Sequence
EMC	ElectroMagnetic Compatibility
ERP	Ear Reference Point
HLC	High Layer Compatibility
ICS	Implementation Conformance Statement
ISDN	Integrated Services Digital Network
IUT	Implementation Under Test
LE	acoustic earcap LEakage
LLC	Low Layer Compatibility
LmeST	SideTone path loss
LRGP	Loudness Rating Guard-ring Position
LSTR	Listener SideTone Rating
MFPB	Multi Frequency PushButton
MRP	Mouth Reference Point
STMR	SideTone Masking Rating
TBR	Technical Basis for Regulation
TBR-RT	Technical Basis for Regulation - Requirements Table
TCL	Terminal Coupling Loss
TCLw	Weighted Terminal Coupling Loss
TE	Terminal Equipment
RLR	Receiving Loudness Ratings
SLR	Sending Loudness Ratings

4 General

Each requirement in this TBR is either applicable to all Terminal Equipment (TE) within the scope of this TBR, or only applicable to certain TE, depending on the functions implemented within the TE. Annex E specifies the relationship between the requirements and the terminal. The supplier shall provide information on the functions implemented in the terminal and this information shall be used to determine which requirements apply and the manner in which the tests are to be performed. This information may be provided in the form of a complete TBR Requirements Table (TBR-RT) proforma (a blank TBR-RT proforma is provided in annex E).

Since the verification of the voice transmission depends on the proper operation of the call control functions, the verification of the call control tests shall be performed before verification of the voice transmission tests.

5 Safety requirements

There are no safety requirements under this TBR.

NOTE: Safety requirements are imposed under the Low Voltage Directive (73/23/EEC) and articles 5 (a) and 5 (b) of Directive 98/13/EC.

6 ElectroMagnetic Compatibility (EMC) requirements

There are no EMC requirements under this TBR.

NOTE: EMC requirements are imposed under the EMC Directive (89/336/EEC). Requirements for conducted emissions will be added to this TBR when appropriate.

7 Call control functions

At least one of the following shall be implemented:

- outgoing calls;
- incoming calls.

NOTE: The option chosen should not conflict with the option chosen for TBR 3 [5].

7.1 Information element codings specific for the Telephony 3,1 kHz teleservice

7.1.1 Bearer Capability information element

Reference: ETS 300 102-1, subclause 4.5.5 and ETR 18, subclause 6.3.

Definition: The purpose of the Bearer Capability information element is to indicate a requested CCITT Recommendation I.231 bearer.

The coding of the BC information element used in this TBR are given in figure 1 and figure 2.

8	7	6	5	4	3	2	1	
Bearer capability information element identifier								Octet 1
0	0	0	0	0	1	0	0	
Length of information element								Octet 2
0	0	0	0	0	0	1	1	
1	0 0 CCITT		0	0	0	0	0	Octet 3
1	0 0 Circuit Mode		1	0	0	0	0	Octet 4
1	0 1 Layer 1		0	0	0	1	1	Octet 5
64 kbit/s G.711 A-law								

Figure 1: Coding of Bearer capability (BC) information element indicating speech

8	7	6	5	4	3	2	1	
Bearer capability information element identifier								Octet 1
0	0	0	0	0	1	0	0	
Length of information element								Octet 2
0	0	0	0	0	0	1	1	
1	0 0 CCITT		1	0	0	0	0	Octet 3
1	0 0 Circuit Mode		1	0	0	0	0	Octet 4
1	0 1 Layer 1		0	0	0	1	1	Octet 5
3,1 kHz Audio 64 kbit/s G.711 A-law								

Figure 2: Coding of Bearer capability (BC) information element indicating 3,1 kHz audio

7.1.2 High Layer Compatibility (HLC) information element

Reference: ETS 300 102-1, subclause 4.5.16 and ETR 18, subclause 6.3.

Definition: The purpose of the HLC information element is to provide a means which should be used by the remote user for compatibility checking.

The coding of the HLC information used in this TBR is given in figure 3.

8	7	6	5	4	3	2	1	
0	1	1	1	1	1	0	1	Octet 1
High layer compatibility information element identifier								
0	0	0	0	0	0	1	0	Octet 2
Length of information element								
1	0	0	1	0	0	0	1	Octet 3
CCITT		First			Protocol Profile			
1	0	0	0	0	0	0	1	Octet 4
Telephony								

Figure 3: Coding of High Layer Compatibility (HLC) information element indicating telephony

7.1.3 Low Layer Compatibility (LLC) information element

Reference: ETS 300 102-1, subclause 4.5.18 and ETR 18, subclause 6.3

Definition: The purpose of the LLC information element is to provide a means which should be used for compatibility checking by an addressed entity (e.g. a remote user or an interworking unit or a high layer function network node addressed by the calling user). The LLC information element is transferred transparently by an ISDN between the call originating entity (e.g. the calling user) and the addressed entity.

The coding of the LLC information element used in this TBR are given in figure 4 and figure 5.

8	7	6	5	4	3	2	1	
0	1	1	1	1	1	0	0	Octet 1
Low layer compatibility information element identifier								
0	0	0	0	0	0	1	0	Octet 2
Length of information element								
1	0	0	0	0	0	0	0	Octet 3
Coding CCITT		Information Transfer Capability = Speech						
1	0	0	1	0	0	0	0	Octet 4
Transfer Mode = Circuit		Information Transfer Rate = 64 kbit/s						

Figure 4: Coding of the LLC information element indicating speech

8	7	6	5	4	3	2	1	
0	1	1	1	1	1	0	0	Octet 1
Low Layer Compatibility information element identifier								
0	0	0	0	0	0	1	1	Octet 2
Length of information element								
1	0	0	0	0	0	0	0	Octet 3
Coding CCITT		Information Transfer Capability = Speech						
1	0	0	1	0	0	0	0	Octet 4
Transfer Mode = Circuit		Information Transfer Rate = 64 kbit/s						
1	0	1	0	0	0	1	1	Octet 5
Layer 1 Identity		User info layer 1 protocol = Recommendation G.711 A-law						

Figure 5: Coding of the LLC information element indicating speech, CCITT Recommendation G.711 [10] A-law

7.2 Outgoing calls, inclusion and coding of the compatibility elements

Reference: ETS 300 102-1, subclause 5.1 and I-ETS 300 245-1, subclause 5.1.

Requirement: Provision for outgoing calls is optional (see clause 7). If provided the following shall apply.

- a) The coding of the Bearer Capability (BC) information element in an outgoing SETUP message shall be as described in figure 1.
- b) The HLC information element shall be included in the SETUP message and shall be encoded as described in figure 3.
- c) The LLC information element is optional in an outgoing SETUP message. If included in an outgoing SETUP message than it shall be encoded as described in either figure 4 or figure 5.

An outgoing SETUP message may contain two BC and/or HLC information elements. In this case, the first BC and/or HLC information element shall be coded as described in this subclause. The coding of the second BC, HLC and LLC is not specified in this TBR.

Test: These requirements a), b) and c) shall be tested according to the procedures of annex B, by performing Test case TC20002a.

7.3 Incoming calls - compatibility checking

Reference: ETS 300 102-1, subclause 5.2 and I-ETS 300 245-1, subclause 5.2.

Requirement: Provision for incoming calls is optional (see 7). If provided, the following shall apply.

An incoming SETUP message containing any valid combination of BC, HLC and LLC information elements, as listed in table 1, items a to f shall be accepted by the terminal according to the procedures of ETS 300 102-1.

If the LLC information element is present and its content does not match the content of the BC information element it shall be ignored, see table 1, item g.

If the coding of the BC information element is 3,1 kHz audio, the incoming call shall be accepted if the received SETUP message also contains a Progress indicator information element with progress description #1 or #3 (in this case the call is a 3,1 kHz telephony call, but the originating interface is not an ISDN, see ETS 300 102-1, subclause 5.2.6), see table 1, item h.

Table 1: Combination of codings of BC, HLC, LLC and PI which shall be accepted by the terminal

Test	BC	HLC	LLC	PI
a	figure 1	-	-	not relevant
b	figure 1	figure 3	-	not relevant
c	figure 1	-	figure 4	not relevant
d	figure 1	-	figure 5	not relevant
e	figure 1	figure 3	figure 4	not relevant
f	figure 1	figure 3	figure 5	not relevant
g	figure 1	figure 3	incompatible (e.g. μ law)	not relevant
h	figure 2	-	-	PI = #1 or #3

NOTE 1: In association with the support of other bearer services than those specified in this TBR or teleservices other than telephony 3,1 kHz, a multimedia or multiservice terminal may accept, as compatible, incoming calls with codings of the BC, HLC, and LLC information elements other than those specified in this TBR.

NOTE 2: An incoming SETUP message may contain two BC and/or HLC information elements. In this case, only the first BC and HLC information element is relevant.

Test: The requirements a) to h) shall be tested according to the procedures of annex B, by performing test cases TC10005a to TC10005h.

8 Transmission aspects

8.1 General

8.1.1 Encoding

Reference: I-ETS 300 245-2, subclause 5.1.1.

Requirement: The encoding law shall conform to CCITT Recommendation G.711 [10] (A-law) at 64 kbit/s.

Test: Conformance to this requirement shall be verified by applying incoming test signals encoded in A-law at 64 kbit/s, and decoding outgoing test signals using the A-law for all the relevant tests of this clause.

8.1.2 Volume control

Reference: I-ETS 300 245-2, subclause 5.1.3.

Requirement: Unless stated otherwise, the requirements shall apply for all positions of the user-controlled receiving volume control, if provided.

Test: Compliance tests shall be carried out at the maximum of this volume control, where provided, unless stated otherwise.

8.2 Speech performance characteristics (handset telephony 3,1 kHz)

8.2.1 Sensitivity - frequency response

8.2.1.1 Sending

Reference: I-ETS 300 245-2, subclause 5.2.1.1.

Requirement: The sending sensitivity - frequency response (from the Mouth Reference Point (MRP) to the digital interface) shall be within a mask which can be drawn between the points given in table 2. The mask is drawn with straight lines between the break points in table 2 on a logarithmic (frequency) - linear (dB sensitivity) scale.

Table 2: Sending sensitivity/frequency mask

Frequency (Hz)	Upper limit	Lower limit
100	-10	
200	0	
300	0	-14
1 000	0	-8
2 000	4	-8
3 000	4	-8
3 400	4	-11
4 000	0	

All sensitivity values are dB on an arbitrary scale.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.1.1.

8.2.1.2 Receiving

Reference: I-ETS 300 245-2, subclause 5.2.1.2.

Requirement: The receiving sensitivity-frequency response (from the digital interface to the Ear Reference Point (ERP)) shall be within the mask which can be drawn between the points given in table 3. The mask is drawn with straight lines between the break points in table 3 on a logarithmic (frequency) - linear (dB sensitivity) scale.

Table 3: Receiving sensitivity/frequency mask

Frequency (Hz)	Upper limit	Lower limit
100	-6	
200	0	
300	2	-9
500	*	-7
1 000	0	-7
3 000	4	-7
3 400	4	-12
4 000	4	

All sensitivities are dB on an arbitrary scale.

* = the limit at intermediate frequencies lies on a straight line drawn between the given values on a logarithmic (frequency) - linear (dB) scale.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.1.2.

8.2.2 Sending and Receiving Loudness Ratings (SLR and RLR)

8.2.2.1 Nominal values

Reference: I-ETS 300 245-2, subclause 5.2.2.1.

Requirement: The nominal values are:

- SLR = 7 dB;
- RLR = 3 dB.

The tolerances on both SLR and RLR are $\pm 3,5$ dB.

Test: Compliance shall be checked by the tests described in annex A, subclauses A.2.2.1 and A.2.2.2.

8.2.2.2 Volume control

Reference: I-ETS 300 677, subclause 4.1.4.

Requirement: For TE with a user-controlled receiving volume control, the speech performance characteristics requirements apply with the user-controlled receiving volume control at the setting where the RLR is as close as possible to 3 dB, unless stated otherwise. This setting is to be taken as the nominal setting of the volume control.

Test: Compliance tests of annex A will be carried out at the setting of the volume control where the RLR is as close as possible to 3 dB, unless otherwise specified in the appropriate requirement.

8.2.3 Sidetone

8.2.3.1 Talker sidetone

Reference: I-ETS 300 245-2, subclause 5.2.3.1.

Requirement:

- a) The value of the SideTone Masking Rating (STMR) shall be 13 dB to 18 dB when corrected to nominal values of SLR and RLR (SLR = 7 dB, RLR = 3 dB).
- b) Where a user-controlled receiving volume control is provided the STMR shall meet the requirement given above at the setting where the RLR is equal to the nominal value (RLR = 3 dB).

NOTE: Correction to nominal values can be calculated using the formula
 $STMR - (SLR - 7 + RLR - 3)$.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.3.1.

8.2.3.2 Listener sidetone

Reference: I-ETS 300 245-2, subclause 5.2.3.2.

Requirement:

- a) The value of the Listener SideTone Rating (LSTR) shall be not less than 13 dB when corrected to nominal values of SLR and RLR (SLR = 7 dB, RLR = 3 dB).
- b) Where a user-controlled receiving volume control is provided, LSTR shall meet the requirement given above at the setting where the RLR is equal to the nominal value (RLR = 3 dB).

NOTE: Correction to nominal values can be calculated using the formula
 $LSTR - (SLR - 7 + RLR - 3)$.

- c) Where the apparatus supplier has requested the use of a type 3.2 artificial ear as described in annex A, subclause A.1.3.1, conformance to the requirement specified in item a) of this subclause shall be checked by verifying that the value of the D-factor as measured in annex A, subclause A.2.3.2.3 is equal to or greater than 0.

Test: Compliance shall be checked by the relevant test described in annex A, subclause A.2.3.2.

8.2.4 Terminal Coupling Loss (TCL)

8.2.4.1 Weighted Terminal Coupling Loss (TCLw)

Reference: I-ETS 300 245-2, subclause 5.2.4.1.

Requirement:

- a) When corrected to the nominal values of SLR and RLR (SLR = 7 dB, RLR = 3 dB), the TCLw shall not be less than 40 dB.
- b) For all positions of the user controlled volume control the TCLw shall not be less than 35 dB.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.4.1.

8.2.4.2 Stability loss

Reference: I-ETS 300 245-2, subclause 5.2.4.2.

Requirement: With the handset lying on and the transducers facing a hard surface, the attenuation from the digital input to the digital output shall be at least 6 dB at all frequencies in the range of 200 Hz to 4 kHz.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.4.2.

8.2.5 Distortion

8.2.5.1 Sending

The terminal shall meet the requirements of both subclauses 8.2.5.1.1 and 8.2.5.1.2.

8.2.5.1.1 Method 1 (Pseudo random noise stimulus)

Reference: I-ETS 300 245-2, subclause 5.2.5.1.1.

Requirement: The ratio of signal-to-total distortion (harmonic and quantizing) power of the digitally encoded signal output by the terminal equipment shall be greater than the limits given in table 4 unless the sound pressure at the MRP is greater than +5 dBPa.

Table 4: Limits for signal-to-total distortion ratio for method 1

Sending level dB relative to ARL	Receiving level at the digital interface	Sending Ratio (dB)	Receiving Ratio (dB)
-45	-55 dBm0	5,0	5,0
-30	-40 dBm0	20,0	20,0
-24	-34 dBm0	25,5	25,5
-17	-27 dBm0	30,2	30,6
-10	-20 dBm0	32,4	33,0
0	-10 dBm0	33,0	33,7
+4	-6 dBm0	30,0	30,0
+7	-3 dBm0	20,0	20,0

Limits for intermediate levels are found by drawing straight lines between the break points in table 4 on a linear (dB signal level) - linear (dB ratio) scale.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.5.1.1.

8.2.5.1.2 Method 2 (Sinusoidal test signal)

Reference: I-ETS 300 245-2, subclause 5.2.5.1.2.

Requirement: The ratio of signal-to-total distortion power measured with the proper noise weighting (see table 4 of CCITT Recommendation G.223 [11]) shall be greater than the limits given in table 5 unless the sound pressure at the MRP is greater than +10 dBPa.

Table 5: Limits for signal-to-total distortion ratio for method 2

Sending level dB relative to ARL	Receiving level at the digital interface	Sending Ratio (dB)	Receiving Ratio (dB)
-35	-45 dBm0	17,5	17,5
-30	-40 dBm0	22,5	22,5
-20	-30 dBm0	30,7	30,5
-10	-20 dBm0	33,3	33,0
0	-10 dBm0	33,7	33,5
+7	-3 dBm0	28,0	28,0
+10	0 dBm0	22,0	22,0

Limits for intermediate levels are found by drawing straight lines between the break points in table 5 on a linear (dB signal level) - linear (dB ratio) scale.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.5.1.2.

8.2.5.2 Receiving

The terminal shall meet the requirements of both subclauses 8.2.5.2.1 and 8.2.5.2.2.

8.2.5.2.1 Method 1 (Pseudo random noise signal)

Reference: I-ETS 300 245-2, subclause 5.2.5.2.1.

Requirement: The ratio of signal-to-total distortion (harmonic and quantizing) power of the signal in the artificial ear shall be greater than the limits given in table 4 unless the signal in the artificial ear is greater than +5 dBPa or is less than -50 dBPa.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.5.2.1.

8.2.5.2.2 Method 2 (Sinusoidal test signal)

Reference: I-ETS 300 245-2, subclause 5.2.5.2.2.

Requirement: The ratio of signal-to-total distortion power measured in the artificial ear with the psophometric noise weighting (see table 4 of CCITT Recommendation G.223 [11]) shall be greater than the limits given in table 5 of this TBR unless the signal in the artificial ear is greater than +10 dBPa or is less than -50 dBPa.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.5.2.2.

8.2.5.3 Sidetone

Reference: I-ETS 300 245-2, subclause 5.2.5.3.

Requirement: The third harmonic distortion generated by the terminal equipment shall not be greater than 10 %.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.5.3.

8.2.6 Variation of gain with input level

8.2.6.1 Sending

Reference: I-ETS 300 245-2, subclause 5.2.6.1.

Requirement: The gain variation relative to the gain for Acoustic Reference Level (ARL) shall remain within the limits given in table 6.

Table 6: Variation of gain with input level, sending

Sending dB relative to ARL	Upper limit (dB)	Lower limit (dB)
+13	1	-11
+4	1	-2
-20	1	-2
-30	1	
-35	6	

The limits for intermediate levels can be found by drawing straight lines between the break points in the table on a linear (dB signal level) - linear (dB gain) scale.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.6.1.

8.2.6.2 Receiving

Reference: I-ETS 300 245-2, subclause 5.2.6.2.

Requirement: The gain variation relative to the gain at an input level of -10 dBm₀, shall be within the limits given in table 7.

Table 7: Variation of gain with input level, receiving

Receiving level at the digital interface	Upper limit (dB)	Lower limit (dB)
+3 dBm0	1	-11
-6 dBm0	1	-2
-50 dBm0	1	-2

The limits for intermediate levels can be found by drawing straight lines between the break points in the table on a linear (dB signal level) - linear (dB gain) scale.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.6.2.

8.2.7 Out-of-band signals

8.2.7.1 Discrimination against out-of-band input signals (sending)

Reference: I-ETS 300 245-2, subclause 5.2.7.1.

Requirement: With any sinewave signal above 4,6 kHz and up to 8 kHz applied at the MRP at a level of -4,7 dBPa, the level of any image frequency produced at the digital interface shall be less than a reference level obtained at 1 kHz (-4,7 dBPa at MRP) by at least the amount (in dB) specified in table 8.

Table 8: Discrimination levels - sending

Applied sine-wave frequency	Limit (minimum) *
4,6 kHz	30 dB
8,0 kHz	40 dB

* = the limit at intermediate frequencies lies on a straight line drawn between the given values on a logarithmic (frequency) - linear (dB) scale.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.7.1.

8.2.7.2 Spurious out-of-band (receiving)

Reference: I-ETS 300 245-2, subclause 5.2.7.2.

Requirement: With a digitally-simulated sinewave signal in the frequency range of 300 Hz to 3,4 kHz and at a level of -10 dBm0 applied at the digital interface, the level of spurious out-of-band image signals in the frequency range of 4,6 kHz to 8 kHz measured selectively in the artificial ear shall be less than the in-band acoustic level produced by a digital signal at 1 kHz set at the level specified in table 9.

Table 9: Discrimination levels - receiving

Image Signal frequency	Equivalent Input Signal Level *
4,6 kHz	-45 dBm0
8,0 kHz	-55 dBm0

* = the limit at intermediate frequencies lies on a straight line drawn between the given values on a logarithmic (frequency) - linear (dB) scale.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.7.2.

8.2.8 Noise

8.2.8.1 Sending

Reference: I-ETS 300 245-2, subclause 5.2.8.1.

Requirement: The noise produced by the apparatus in the sending direction shall not be greater than -64 dBm_{0p}.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.8.1.

8.2.8.2 Receiving

Reference: I-ETS 300 245-2, subclause 5.2.8.2.

If no user-controlled receiving volume control is provided, or, if it is provided, at the setting of the user-controlled receiving volume control at which the RLR is equal to the nominal value, the noise measured in the artificial ear contributed by the receiving equipment alone shall not be greater than -57 dBPa(A) when driven by a PCM signal corresponding to the decoder output value number 1.

Where a volume control is provided, the measured noise shall not be greater than -54 dBPa(A) at the maximum setting of the volume control.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.8.2.

8.2.8.3 Level of sampling frequency (receiving)

Reference: I-ETS 300 245-2, subclause 5.2.8.3.

Requirement: The level of the 8 kHz measured selectively in the artificial ear shall be less than -70 dBPa.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.8.3.

8.2.9 Acoustic shock

Reference: I-ETS 300 245-2, subclause 5.2.9.

The prevention of acoustic shock is a safety requirement arising from the Low Voltage Directive (73/23/EEC). In the absence of any relevant safety standard, advice can be found in annex C.

8.2.10 Delay

Reference: I-ETS 300 245-2, subclause 5.2.10.

Requirement: The sum of the delays from the MRP to the digital interface and from the digital interface to the ERP shall not be greater than 5,0 ms.

Test: Compliance shall be checked by the test described in annex A, subclause A.2.9.

9 Operation under restricted power conditions

Reference: I-ETS 300 245-1, subclause 7.4.

Requirement: Where a terminal is capable of being a designated terminal, it shall, when under restricted power conditions and restricted power is the only power available to the terminal, be capable of providing, as a minimum, the functions necessary to support the telephony 3,1 kHz teleservice and to provide for real-time 2-way speech conversation.

Test: Compliance shall be checked by ensuring that the terminal meets the requirements of clause 8 of this TBR under restricted power conditions when restricted power is the only power available to the terminal.

10 Testing and approval methodology

Those functions and procedures which are optional, as indicated in this TBR, shall be subject to a conformance test if they are implemented in the terminal equipment. Whether an optional function/procedure has been implemented shall be indicated by the TBR-RT.

The tolerance limits specified in this TBR are to be used at type examination tests. The requirements of this TBR shall not be used in a quality assessment system or a verification of non-compliance to this TBR without an appropriate sampling plan.

The interpretation of the results recorded in a test report for the measurements described in this TBR shall be as follows:

- a) the measurement uncertainty is defined as the combined effects of all sources of errors at a confidence level of at least 95 %;
- b) the manufacturing tolerances and the measurement uncertainties shall be included in the limit value;
- c) the actual measurement uncertainty of the test laboratory carrying out the measurements, for each particular measurement, shall be included in the test report.

Compliance shall be tested using the tests specified in annex A and B of this TBR.

In the case of TE using technologies for which the test specifications in annex A are not suitable to prove conformance to this TBR (e.g. non-linear systems), equivalent evaluation methods can be used, see subclause A.1.5. The methods shall be documented by the supplier and evaluated by the test house.

Annex A (normative): Test specification for voice transmission aspects

A.1 General conditions for testing

A.1.1 Environment for tests

The environmental conditions for the testing laboratory can be found in TBR 3 [5], annex B, subclause B.1.4.

A.1.2 Test equipment interface

The interface on the test equipment connected to the terminal under test shall be capable of providing the signalling and supervision necessary for the terminal to be working in all test modes. The connection of the test equipment to the terminal under test at the coincident S and T reference point shall be in accordance with TBR 3 [5], subclause 9.1.

A.1.3 Test equipment requirements

A.1.3.1 Electro-acoustic equipment

The artificial mouth shall conform to ITU-T Recommendation P.51 [12].

The artificial ear shall conform to ITU-T Recommendation P.57 [13], type 1. The apparatus supplier is permitted to request the use of a type 3.2 artificial ear. Then the test results shall be corrected as specified in ITU-T Recommendation P.57 [13]. When this artificial ear is used, the low leakage option of the type 3.2 artificial ear shall be adopted, and no leakage correction shall be made in the calculations of RLR and STMR (i.e. $LE = 0$). The value of the D-factor shall be used instead of LSTR, see subclause 8.2.3.2 and annex A, subclause A.2.3.2.

The sound level measurement equipment shall conform to IEC 651 [4], type 1.

A.1.3.2 Test equipment for digital telephone sets

A.1.3.2.1 Codec approach and specification

Codec approach: In this approach, a codec is used to convert the companded digital input/output bit-stream of the telephone set to the equivalent analogue values, so that existing test procedures and equipment can be used. This codec shall be a high-quality codec whose characteristics are as close as possible to ideal. The specification for such a codec is given below.

Codec specification: A practical implementation of an ideal codec may be called a reference codec (see ITU-T Recommendation O.133 [14], Section 4). For the reference codec, characteristics such as attenuation/frequency distortion, idle channel noise, quantizing distortion, etc., shall be better than the requirements specified in ITU-T Recommendation G.712 [15] so as not to mask the corresponding parameters of the set under test. A suitable reference codec may be realized by using:

- a) at least 14 bit linear A/D and D/A converters of high quality and transcoding the output signal to the A-law PCM format;
- b) a filter response that meets the requirements of figure A.1.

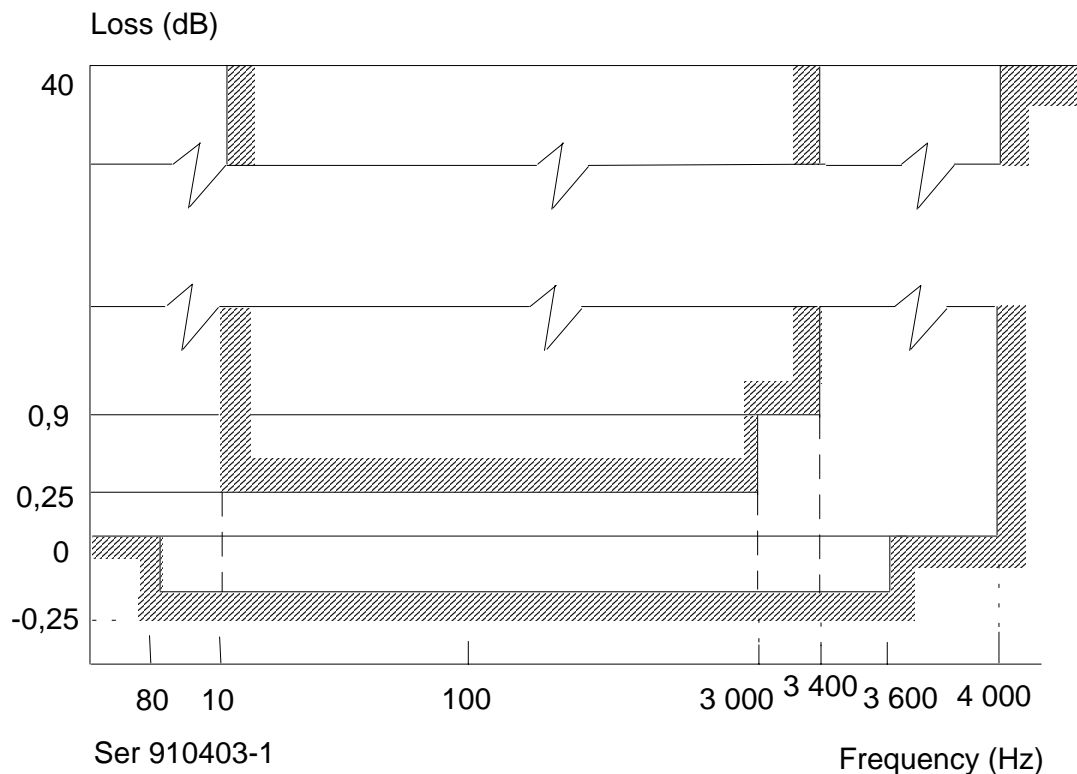


Figure A.1: Attenuation/frequency distortion of the sending or receiving sides of the reference codec

Definition of 0 dBr point:

D/A converter: a Digital Test Sequence (DTS) representing the PCM equivalent of an analogue sinusoidal signal whose rms value is 3,14 dB (A-law) below the maximum full-load capacity of the codec shall generate 0 dBm across a 600 ohm load.

A/D converter: a 0 dBm signal generated from a 600 ohm source shall give the digital test sequence (DTS) representing the PCM equivalent of an analogue sinusoidal signal whose RMS value is 3,14 dB (A-law) below the maximum full-load capacity of the codec.

DTS is defined as a periodic sequence of character signals as defined in CCITT Recommendation G.711 [10], table 5.

Reference, ITU-T Recommendation G.101 [6], figure 2.

Analogue interface: The output and input impedances, return loss and longitudinal conversion losses of the analogue interface of the reference codec shall be in accordance with ITU-T Recommendation O.133 [14], section 3.1.1.

Digital interface: The fundamental requirements for the reference codec digital interface are given in the appropriate ITU-T/CCITT Recommendations (e.g. CCITT I.430 series of Recommendations for ISDN telephone sets).

A.1.3.2.2 Direct digital processing approach

In this approach, the companded digital input/output bit-stream of the telephony terminal is operated upon directly.

A.1.4 Alternative test methods

The requirements of this TBR were written on the basis of the standard test methods described in this annex. For some parameters, it is recognized that alternative test methods may exist. It shall be the responsibility of the test house to ensure that any alternative method used is equivalent to that described in this annex.

A.1.5 Accuracy of test equipment

Unless specified otherwise, the accuracy of measurements made by test equipment shall be better than:

Item	Accuracy
Electrical Signal Power	$\pm 0,2$ dB for levels ≥ -50 dBm
Electrical Signal Power	$\pm 0,4$ dB for levels < -50 dBm
Sound pressure	$\pm 0,7$ dB
Time	± 5 %
Frequency	$\pm 0,2$ %

Unless specified otherwise, the accuracy of the signals generated by the test equipment shall be better than:

Quantity	Accuracy
Sound pressure level at MRP	± 1 dB for 200 Hz to 4 kHz ± 3 dB for 100 Hz to 200 Hz
Electrical excitation levels	and 4 kHz to 8 kHz
Frequency generation	$\pm 0,4$ dB (see note 1) ± 2 % (see note 2)
NOTE 1:	Across the whole frequency range.
NOTE 2:	When measuring sampled systems, it is advisable to avoid measuring at sub-multiples of the sampling frequency. There is a tolerance of ± 2 % on the generated frequencies, which may be used to avoid this problem, except for 4 kHz where only the -2 % tolerance may be used.

The measurements results shall be corrected for the measured deviations from the nominal level.

A.1.6 Bandwidth

It shall be the responsibility of the test house to select an appropriate bandwidth for selective measurements.

A.1.7 Powering

Where the TE supports more than one powering mode (i.e. normal and restricted power mode; or local and restricted power mode) then the normal or local power mode shall be used for testing unless otherwise stated.

A.2 Transmission requirements testing

A.2.1 Sensitivity/frequency response

A.2.1.1 Sending

- a) The handset is mounted in the LRGP (see ITU-T Recommendation P.64 [16]). The earpiece is sealed to the knife-edge of an artificial ear.
- b) A pure tone signal with a sound level of -4,7 dBPa shall be applied at the MRP as described in ITU-T Recommendation P.64 [16], using an artificial mouth conforming to ITU-T Recommendation P.51 [12].
- c) A digital measuring instrument, or high-quality digital decoder followed by an analogue level measuring set, shall be connected at the interface.
- d) Measurements shall be made at one twelfth-octave intervals as given by the R.40 series of preferred numbers in ISO 3 [17] for frequencies from 100 Hz to 4 kHz inclusive.

At each frequency, the output level for a sound pressure of -4,7 dBPa shall be measured.

A.2.1.2 Receiving

- a) The handset is mounted in the LRGP and the earpiece is sealed to the knife-edge of the artificial ear.
- b) A digital signal generator shall be connected at the digital interface delivering a signal equivalent to a pure tone level of -16 dBm0, see ITU-T Recommendation P.64 [16].
- c) Measurements shall be made at one twelfth-octave intervals as given by the R.40 series of preferred numbers in ISO 3 [17] for frequencies from 100 Hz to 4 kHz inclusive.

At each frequency, the sound pressure in the artificial ear shall be measured by connecting a suitable measuring set to the artificial ear.

A.2.2 Loudness ratings

A.2.2.1 Sending Loudness Rating (SLR)

- a) The handset is mounted as described in subclause A.2.1.1. The sending sensitivity shall be measured at each of the 14 frequencies given in table 1 of ITU-T Recommendation P.79 [18], bands 4 to 17.
- b) The sensitivity is expressed in terms of dBV/Pa and the SLR shall be calculated according to ITU-T Recommendation P.79 [18], formula 2.1, over bands 4 to 17, using $m = 0,175$ and the sending weighting factors from ITU-T Recommendation P.79 [18], table 1.

NOTE: ITU-T Recommendation P.64 [16] allows the use of alternative signal sources for measurement of loudness ratings. If such a signal source is used, it is the responsibility of the test house to ensure that the method used is equivalent to that described above.

A.2.2.2 Receiving Loudness Rating (RLR)

- a) The handset is mounted as described in subclause A.2.1.2. The receiving sensitivity shall be measured at each of the 14 frequencies listed in table 1 of ITU-T Recommendation P.79 [18], bands 4 to 17.
- b) The sensitivity is expressed in terms of dBPa/V and the RLR shall be calculated according to ITU-T Recommendation P.79 [18], formula 2.1, over bands 4 to 17, using $m = 0,175$ and the receiving weighting factors from table 1 of ITU-T Recommendation P.79 [18].
- c) The artificial ear sensitivity shall be corrected using the leakage correction of table 2 of ITU-T Recommendation P.79 [18].

NOTE: ITU-T Recommendation P.64 [16] allows the use of alternative signal sources for measurement of loudness ratings. If such a signal source is used, it is the responsibility of the test house to ensure that the method used is equivalent to that described above.

A.2.3 Sidetone

For the tests described in subclauses A.2.3.1 and A.2.3.2, the digital input of the terminal shall be driven by a PCM signal corresponding to decoder value number 1.

A.2.3.1 Talker sidetone

- a) The handset is mounted in the LRGP and the earpiece is sealed to the knife-edge of the artificial ear. A pure tone signal of -4,7 dBPa shall be applied at the MRP. For each frequency given in ITU-T Recommendation P.79 [18], table 4, bands 1 to 20, the sound pressure in the artificial ear shall be measured.
- b) Where a user controlled volume control is provided, the measurements shall be carried out at a setting which is as close as possible to the nominal value of the RLR (RLR = 3 dB).
- c) The Sidetone path loss (L_{meST}), as expressed in dB, and the SideTone Masking Rate (STMR) (in dB) shall be calculated from the formula 2.1 of ITU-T Recommendation P.79 [18], using $m = 0,225$ and the weighting factors of in table 3 of ITU-T Recommendation P.79 [18].

NOTE: ITU-T Recommendation P.64 [16] allows the use of alternative signal sources for measurement of loudness ratings. If such a signal source is used, it is the responsibility of the test house to ensure that the method used is equivalent to that described above.

A.2.3.2 Listener sidetone

A.2.3.2.1 Sound field calibration

The diffuse sound field is calibrated in the absence of any local obstacles. The averaged field shall be uniform to within ± 3 dB within a radius of 0,15 m of the MRP, when measured in one-third octave bands according to IEC 225 [19] from 100 Hz to 8 kHz (bands 1 to 20).

NOTE 1: The pressure intensity index, as defined in ISO 9614, may prove to be a suitable method for assessing the diffuse field.

NOTE 2: Where more than one loudspeaker is used to produce the desired sound field, the loudspeakers may require to be fed with non-coherent electrical signals to eliminate standing waves and other interference effects.

A.2.3.2.2 Measurement and calculation of LSTR

- a) The sound field shall be calibrated as specified in subclause A.2.3.2.1.
- b) Where a user controlled volume control is provided, the measurements shall be carried out at a setting which is as close as possible to the nominal value of the RLR (RLR = 3 dB).
- c) Where adaptive techniques or voice switching circuits are not used (need to be declared by the supplier of the telephony terminal) the spectrum shall be band limited (50 Hz to 10 kHz) "pink noise" to within ± 3 dB and the level shall be adjusted to 70 dB(A) (-24 dBPa(A)). The tolerance for this level is ± 1 dB.

In other cases the level shall be adjusted to 50 dB(A) (-44 dBPa(A)). The tolerance for this level is ± 1 dB.

- d) The artificial mouth and ear are placed in the correct position relative to MRP, the handset is mounted at LRGP and the ear piece is sealed to the knife-edge of the artificial ear.
- e) Measurements are made on one-third octave bands according to IEC 225 [19] for the 20 bands centred at 100 Hz to 8 kHz (bands 1 to 20). For each band the sound pressure in the artificial ear shall be measured by connecting a suitable measuring set to the artificial ear.

NOTE 3: There may be problems with the signal to noise ratio. If it is less than 10 dB in any band, the microphone noise level and the noise level of any out-of-band signals need to be subtracted from the measured sidetone level (power subtraction).

- f) The listener sidetone path loss is expressed in dB and the LSTR shall be calculated from ITU-T Recommendation P.79 [18], formula 2.1, using $m = 0,225$ and the weighting factors in table 3 of ITU-T Recommendation P.79 [18].

A.2.3.2.3 Measurement and calculation of the value of the D-factor

- a) The sound field shall be calibrated as specified in subclause A.2.3.2.1.
- b) Where adaptive techniques or voice switching circuits are not used (need to be declared by the supplier of the telephony terminal) the spectrum shall be band limited (50 Hz to 10 kHz) "pink noise" to within ± 3 dB and the level shall be adjusted to 70 dB(A) (-24 dBPa(A)). The tolerance for this level is ± 1 dB.

In other cases the level shall be adjusted to 50 dB(A) (-44 dBPa(A)). The tolerance for this level is ± 1 dB.

- c) The handset is mounted as described in subclause A.2.1.1. Measurements are made on one-third octave bands according to IEC 225 [19] for the 14 bands centred at 200 Hz to 4 kHz (bands 4 to 17). For each band the diffuse sound sensitivity $S_{si}(\text{diff})$ is measured. The sensitivity shall be expressed in terms of dBV/Pa.
- d) The direct sound sensitivity shall be measured using the test set-up specified in subclause A.2.1.1 and a pink noise test signal on one-third octave bands according to IEC 225 [19] for the 14 bands centred at 200 Hz to 4 kHz (bands 4 to 17). For each band the direct sound sensitivity $S_{si}(\text{direct})$ is measured. The sensitivity shall be expressed in terms of dBV/Pa.
- e) The value of the D-factor shall be calculated according to ITU-T Recommendation P.79 [18], annex E, formulas E2 and E3, over the bands from 4 to 17, using the coefficients K_i from table E1 of ITU-T Recommendation P.79 [18].

A.2.4 Terminal Coupling Loss

A.2.4.1 Weighted Terminal Coupling Loss (TCLw)

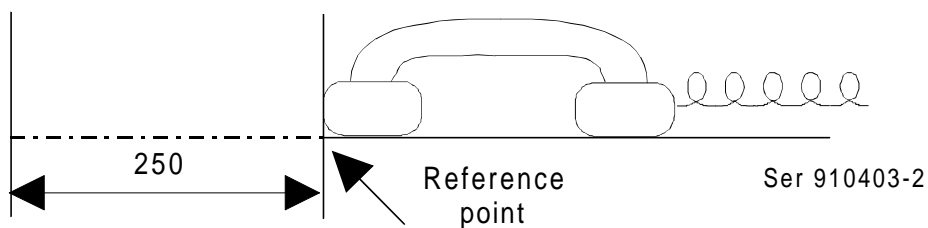
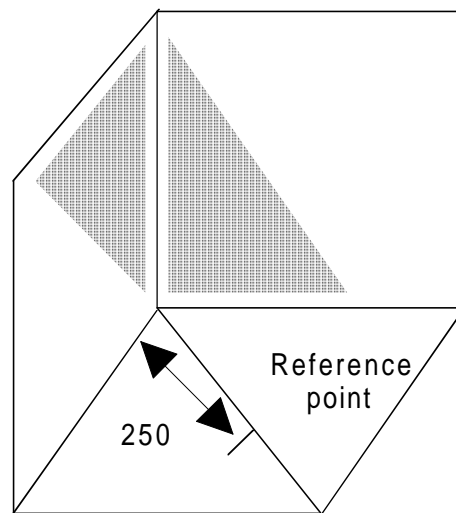
The handset is suspended in free air in such a way that the inherent mechanical coupling of the handset is not effected. The testing shall be made under free field condition (the deviation from ideal free field conditions shall be less than 1 dB). The ambient noise level shall be less than 30 dB(A). The attenuation from digital input to digital output shall be measured using a pure tone at one-twelfth octave intervals as given in the R.40 series of preferred numbers in ISO 3 [17] for frequencies from 300 Hz to 3 350 Hz.

The input signal shall be -10 dBm0. The TCLw is calculated according to ITU-T Recommendation G.122 [8], annex B, clause B.4 (trapezoidal rule).

A.2.4.2 Stability loss

With an input signal of -10 dBm0, the attenuation from digital input to digital output shall be measured using a pure tone at one-twelfth octave intervals for frequencies from 200 Hz to 4 kHz under the following conditions:

- a) the handset, with the transmission circuit fully active, shall be positioned on one inside surface that is of three perpendicular plane, smooth, hard surfaces forming a corner. Each surface shall extend 0,5 m from the apex of the corner. One surface shall be marked with a diagonal line, extending from the corner formed by the three surfaces, and a reference position 250 mm from the corner, as shown in figure A.2;
- b) the handset, with the transmission circuit fully active, shall be positioned on the defined surface as follows:
 - 1) the mouthpiece and earcap shall face towards the surface;
 - 2) the handset shall be placed centrally, the diagonal line with the earcap nearer to the apex of the corner;
 - 3) the extremity of the handset shall coincide with the normal to the reference point, as shown in figure A.2.



NOTE: All dimensions in mm.

Figure A.2: Handset position for stability loss test

A.2.5 Distortion

A.2.5.1 Sending

A.2.5.1.1 Method 1

The handset is mounted at the LRGP and the earpiece is sealed to the knife-edge of the artificial ear. A band-limited noise signal corresponding to CCITT Recommendation O.131 [20] shall be applied at the MRP. The level of this signal is adjusted until the output of the terminal is -10 dBm0. The level of the signal at the MRP is then the ARL.

The test signal shall be applied at the following levels:

-45, -40, -35, -30, -24, -20, -17, -10, -5, 0, 4, 7 dB relative to ARL.

The ratio of signal to total distortion power of the digital signal output shall be measured (see ITU-T Recommendation G.712 [15], appendix I and CCITT Recommendation O.131 [20]).

A.2.5.1.2 Method 2

The handset is mounted at the LRGP and the earpiece is sealed to the knife-edge of the artificial ear.

A sinewave signal with a frequency in the range 1 004 Hz to 1 025 Hz shall be applied at the MRP.

The level of this signal is adjusted until the output of the terminal is -10 dBm₀. The level of the signal at the MRP is then the ARL.

The test signal shall be applied at the following levels:

-35, -30, -25, -20, -15, -10, -5, 0, 7, 10 dB relative to ARL.

The ratio of the signal to total distortion power of the digital signal output shall be measured with the psophometric noise weighting (see ITU-T Recommendation G.712 [15] and CCITT Recommendation O.132 [21]).

A.2.5.2 Receiving

A.2.5.2.1 Method 1

The handset is mounted at LRGP and the earpiece is sealed to the knife-edge of the artificial ear.

A digitally simulated band-limited noise signal corresponding to CCITT Recommendation O.131 [20] shall be applied at the digital interface at the following levels:

-55, -50, -45, -40, -34, -30, -27, -20, -15, -10, -6, -3 dBm₀.

The ratio of signal to total distortion power shall be measured in the artificial ear (see ITU-T Recommendations G.712 [15], appendix I and CCITT Recommendation O.131 [20]).

A.2.5.2.2 Method 2

The handset is mounted at the LRGP and the earpiece is sealed to the knife-edge of the artificial ear.

A digitally simulated sinewave signal with a frequency in the range 1 004 Hz to 1 025 Hz shall be applied at the digital interface at the following levels:

-45, -40, -35, -30, -25, -20, -15, -10, -3, 0 dBm₀.

The ratio of the signal-to-total distortion power shall be measured with the psophometric noise weighting in the artificial ear (see ITU-T Recommendation G.712 [15] and CCITT Recommendation O.132 [21]).

A.2.5.3 Sidetone

The handset is mounted at the LRGP and the earpiece is sealed to the knife-edge of the artificial ear. An instrument capable of measuring the third harmonic distortion of signals with fundamental frequencies in the range of 315 Hz to 1 kHz shall be connected to the artificial ear.

A pure-tone signal of -4,7 dBPa shall be applied at the MRP at frequencies of 315 Hz, 500 Hz, and 1 kHz. For each frequency, the third harmonic distortion shall be measured in the artificial ear.

A.2.6 Variation of gain with input level

A.2.6.1 Sending

The handset is mounted at the LRGP and the earpiece is sealed to the knife-edge of the artificial ear.

A sinewave signal with a frequency in the range 1 004 Hz to 1 025 Hz shall be applied at the MRP. The level of this signal is adjusted until the output of the terminal is -10 dBm0. The level of the signal at the MRP is then the ARL.

The test signal shall be applied at the following levels:

-45, -40, -35, -30, -25, -20, -15, -10, -5, 0, 4, 10, 13 dB relative to ARL.

The variation of gain relative to the gain for the ARL shall be measured.

NOTE: Selective measurement may be used to avoid the effects of ambient noise.

A.2.6.2 Receiving

The handset is mounted at the LRGP and the earpiece is sealed to the knife-edge of the artificial ear.

A digitally simulated sinewave signal with a frequency in the range 1 004 Hz to 1 025 Hz shall be applied at the digital interface at the following levels:

-50, -45, -40, -35, -30, -25, -20, -15, -10, -6, 0, 3 dBm0.

The variation of gain relative to the gain at an input level of -10 dBm0 shall be measured in the artificial ear.

NOTE: Selective measurement may be used to avoid the effects of ambient noise.

A.2.7 Out-of-band signals

A.2.7.1 Discrimination against out-of-band input signal

The handset is mounted at the LRGP and the earpiece is sealed to the knife-edge of the artificial ear.

For input signals at frequencies of 4,65 kHz, 5 kHz, 6 kHz, 6,5 kHz, 7 kHz and 7,5 kHz at the level specified in subclause 8.2.7.1, the level of any image frequencies at the digital interface shall be measured.

A.2.7.2 Spurious out-of-band signals

The handset is mounted at the LRGP and the earpiece is sealed to the knife-edge of the artificial ear.

For input signals at the frequencies 500 Hz, 1 000 Hz, 2 000 Hz, and 3 150 Hz applied at the level specified in subclause 8.2.7.2, the level of spurious out-of-band image signals at frequencies of up to 8 kHz shall be measured selectively in the artificial ear.

A.2.8 Noise

A.2.8.1 Sending

With the handset mounted at the LRGP and the earpiece sealed to the knife-edge of the artificial ear in a quiet environment (ambient noise less than 30 dBA), the noise level at the digital output shall be measured with apparatus including psophometric weighting according to CCITT Recommendation G.223 [11], table 4.

A.2.8.2 Receiving

The handset is mounted at the LRGP and the earpiece is sealed to the knife-edge of the artificial ear. A signal corresponding to decoder output value number 1 shall be applied at the digital interface. The level of the noise shall be measured in the artificial ear.

The ambient noise for this measurement shall not exceed 30 dBA.

A.2.8.3 Level of sampling frequency (receiving)

Under the conditions specified in subclause A.2.8.2, the level at 8 kHz in the artificial ear shall be measured selectively.

A.2.9 Delay

The handset is mounted at the LRGP. The earpiece is sealed to the knife-edge of the artificial ear. The delay (D) in send and receive direction shall be measured separately from MRP to digital interface (Ds) and from digital interface to ERP (Dr).

The delay shall be measured alternatively:

- a) by the cross-correlation method as described in annex D;
- b) by the method based on group delay as described in the following.

The choice of the test method shall be based on mutual agreement between the test house and the apparatus supplier.

The acoustic input level shall be -4,7 dBPa. The electrical input level shall be -10 dBm0.

For each of the nominal frequencies (F0) given in table A.1 in turn, the delay at each value of F0 is derived from the measurements at the corresponding values of F1 and F2.

Table A.1: Frequencies for delay measurement

F ₀	F ₁	F ₂
500	480	520
630	610	650
800	780	820
1 000	980	1 020
1 250	1 230	1 270
1 600	1 580	1 620
2 000	1 980	2 020
2 500	2 480	2 520

The measurement configuration is shown in figure A.3.

For each value of F_0 , the delay is evaluated as follows:

- 1) output the frequency F_1 from the frequency-response analyser;
- 2) measure the phase shift in degrees between CH1 and CH2 (P_1);
- 3) output the frequency F_2 from the frequency-response analyser;
- 4) measure the phase shift in degrees between CH1 and CH2 (P_2);
- 5) compute the delay in milliseconds from the formula;

$$D = \frac{-1\,000 \times (P_2 - P_1)}{360 \times (F_2 - F_1)}$$

- 6) calculate the average of D for the 8 values of F_0 .

The measured phases P_2 and P_1 shall be used as original values. When using this formula, a negative delay at individual frequencies can occur. Care shall be taken that this real effect is not confused with measurement effects caused by passing 360° .

The delay introduced by the artificial mouth shall be measured by mounting the artificial ear microphone, or equivalent, at the MRP. The delay of all additional test equipment shall be determined. The values of these delays are needed for the derivation of the measurement results.

The delay of the item under test is deduced from the formula:

$$D = D_s + D_r = D_{sm} + D_{rm} - D_E$$

where
 D_E is the delay of the test equipment;
 D_{sm} is the measured delay in send direction;
 D_{rm} is the measured delay in receive direction.

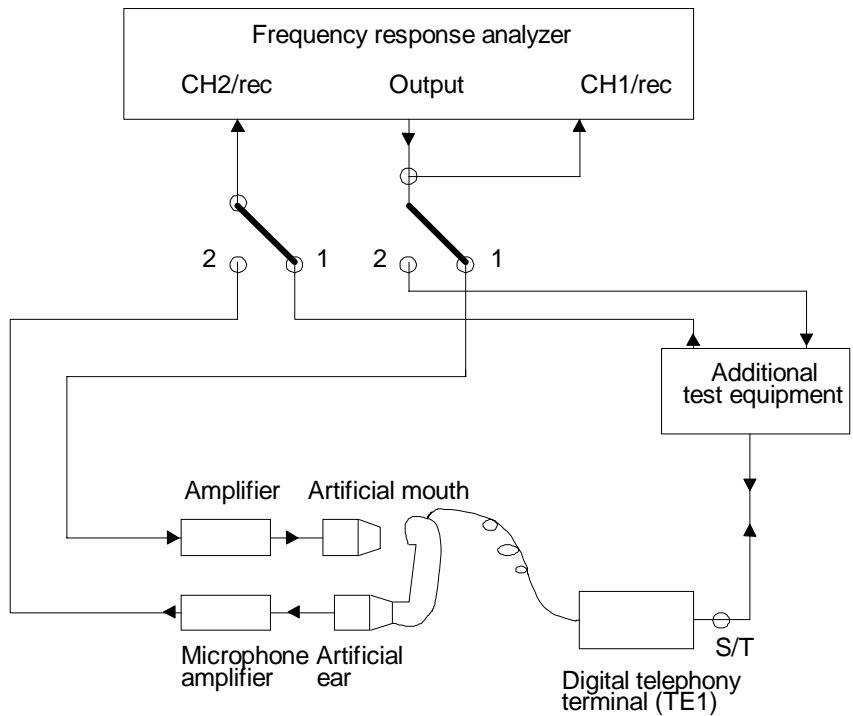


Figure A.3: Configuration for delay measurements

Annex B (normative): Abstract Test Suite (ATS) in electronic form for the call control functions

This ATS has been produced using the Tree and Tabular Combined Notation (TTCN) according to ISO/IEC 9646-3 [22].

The ATS was developed on a separate TTCN software tool and therefore the TTCN tables are not completely referenced in the table of contents. The ATS itself contains a test suite overview part which provides additional information and references.

B.1 The TTCN Graphical form (TTCN.GR)

The TTCN.GR representation of this ATS is contained in an Adobe Portable Document Format™ file (TBR8V2R5.PDF) contained in archive 008__bv.LZH which accompanies the present document.

B.2 The TTCN Machine Processable form (TTCN.MP)

The TTCN.MP representation corresponding to this ATS is contained in an ASCII file (TBR8V2R5.MP) contained in archive 008__bv.LZH which accompanies the present document.

NOTE: According to ISO/IEC 9646-3 [22], in case of a conflict in interpretation of the operational semantics of TTCN.GR and TTCN.MP, the operational semantics of the TTCN.GR representation takes precedence.

Annex C (informative): Acoustic shock requirements

The prevention of acoustic shock is a safety requirement arising from the Low Voltage Directive (73/23/EEC). In the absence of any relevant safety standard, a supplier's self-declaration may be based on the following recommendations.

The limits advised are based on sound pressure levels measured in an ITU-T Recommendation P.57 [13], type 1 artificial ear. For other types of artificial ears different sound pressure levels may be required.

C.1 Continuous signal

With a digitally encoded signal representing the maximum possible signal at the digital interface, the sound pressure level in the artificial ear should not exceed 24 dBPa (rms).

Compliance shall be checked by the following test:

- a) the handset is mounted in the LRGP and the earpiece is sealed to the knife-edge of the artificial ear;
- b) a digital signal generator is connected at the digital interface. It is set to deliver the digitally encoded equivalent of a square-wave, with a peak code equal to the maximum code which can be sent over the digital interface at frequencies in one-third octave intervals as given by the R.10 series of preferred numbers in ISO 3 [17] for frequencies from 200 Hz to 4 kHz. For each frequency, the sound pressure in the artificial ear should be measured.

C.2 Peak signal

The receiving equipment should limit the peak sound pressure in the artificial ear to less than 36 dBPa.

Conformance test methods are for further study. Until such methods exist, compliance should be checked by the suppliers' declaration of conformance.

Annex D (normative): Description of the cross-correlation method

D.1 Test signal

The character of the test signal shall be:

- periodical white noise;
- crest factor 11 dB \pm 1 dB;
- time period $T/2 \geq 10$ ms;
- band limitation according to a one-third octave solution.

Table D.1

Upper limit		Lower limit	
100 Hz	-30 dB		
400 Hz	0 dB		
		500 Hz	-2 dB to $-\infty$
		2 500 Hz	+5 dB to $-\infty$
3 000 Hz	+8,75 dB		
20 000 Hz	-16 dB		

D.2 Calculation

The cross-correlation function $\Phi_{xy}(\tau)$ between the input signal $S_x(t)$ and the output signal $S_y(t)$ is calculated in the time domain:

$$\Phi_{xy}(\tau) = \lim_{T \rightarrow \infty} \frac{1}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} S_x(t) S_y(t + \tau) dt$$

The measurement window T shall be exactly identical with the time period T of the test signal.

The delay is calculated from the envelope $E(\tau)$ of the cross-correlation function $\Phi_{xy}(\tau)$. The maximum of the envelope function occurs in correspondence to the measured delay. The envelope $E(\tau)$ is calculated by the Hilbert transformation $H\{\Phi_{xy}(\tau)\}$ of the cross-correlation:

$$H\{\Phi_{xy}(\tau)\} = \int_{-\infty}^{+\infty} \frac{\Phi_{xy}(u)}{\pi(\tau - u)} du$$

$$E(\tau) = \sqrt{[\Phi_{xy}(\tau)]^2 + \{H[\Phi_{xy}(\tau)]\}^2}$$

It is assumed that the measured delay is less than $T/2$. The delay of the test equipment shall be subtracted from the calculated result.

Annex E (normative): TBR Requirements Table (TBR-RT)

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

The purpose of this TBR-RT is to state the logical inter-relationship of the various requirements within this TBR, and their dependence on the implementation or non-implementation of options within particular items of TE.

The contents of this TBR-RT can also perform a similar function to that of an Implementation Conformance Statement (ICS). Therefore, in order to facilitate the provision of information by the manufacturers to test laboratories, a blank column for "Support" has been added so that the TBR-RT may be copied and used as part of an ICS proforma (additional information to identify uniquely the IUT shall be needed).

NOTE: The relevant PIXIT for this TBR can be found in TBR 3, annex E [5].

It is not a requirement of this TBR that information is provided to laboratories in this way, and other methods for providing information (e.g. ICSs for the base standards identified in the scope) may be used.

E.1 Guidance for completion of the TBR-RT

The Number column, when taken with the table number, provides a unique identifier to each requirement (i.e. E1.6 is item 6 in table E.1).

The reference column lists the subclause reference in the TBR where the requirement can be found.

The TBR 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: support for the requirement is mandatory;
- c<n>: support for the requirement is mandatory, if the relevant condition <n> is met;
- o: support for the requirement is optional, but if supported shall be implemented in accordance with the requirement;
- o<n>: support for the requirement is optional, subject to certain options being selected according to the numbered footnote;
- n/a: support for the requirement is not applicable;
- x: support for the requirement is excluded or prohibited.

The outcome of a condition may be any of the other status values listed.

The support column is blank for the user to complete.

These tables shall be completed for the normal configuration of the TE. Where the TE supports additional configurations within its intended purpose, and many of these configurations present differing support responses invoking different test options, the additional tables shall be completed appropriate to the different configurations.

E.2 Call control functions requirements TBR-RT

Table E.1: General conditions table

No.	Condition	Status	Support (Y/N)
1	Does the terminal include the LLC information element in an outgoing SETUP message?	c1	
2	Is the TE intended to operate as a designated terminal?	o	
3	Does the terminal have a user-controlled receiving volume control?	o	
4	Does the terminal support outgoing calls?	o1	
5	Does the terminal support incoming calls?	o1	
6	Is the terminal intended to be measured using the artificial ear type 3.2 instead of type 1?	o	
c1 = o if E1.4 else n/a o1 = at least one option shall be chosen in alignment with TBR 3 [5]. NOTE: The entry in support for items no 1, 2, 4 and 5 shall be the same as for TBR 3 [5].			

Table E.2: Call control functions requirements table

No.	Reference	TBR Requirement	Status	Support (Y/N)
1	7.2 a)	Outgoing calls, Coding of the compatibility elements, BC information element	c2	
2	7.2 b)	Outgoing calls, Coding of the compatibility elements, HLC information element	c2	
3	7.2 c)	Outgoing calls, Coding of the compatibility elements, LLC information element	c1, c2	
4	7.3 a)	Incoming calls, Compatibility checking	c3	
5	7.3 b)	Incoming calls, Compatibility checking	c3	
6	7.3 c)	Incoming calls, Compatibility checking	c3	
7	7.3 d)	Incoming calls, Compatibility checking	c3	
8	7.3 e)	Incoming calls, Compatibility checking	c3	
9	7.3 f)	Incoming calls, Compatibility checking	c3	
10	7.3 g)	Incoming calls, Compatibility checking	c3	
c1 = m if E1.1 else n/a c2 = m if E1.4 else n/a c3 = m if E1.5 else n/a				

E.3 Transmission aspects requirements TBR-RT

Table E.3: General requirements table

No.	Reference	TBR Requirement	Status	Support (Y/N)
1	8.1.1	Encoding	m	
2	8.1.2	Volume control	c1	
c1 = m if E1.3 else n/a				

Table E.4: Speech performance characteristics (handset telephony 3,1 kHz) requirements table

No.	Reference	TBR Requirement	Status	Support (Y/N)
1	8.2.1.1	Sensitivity - frequency response - Sending	m	
2	8.2.1.2	Sensitivity - frequency response - Receiving	m	
3	8.2.2.1	Sending and Receiving Loudness Ratings (SLR and RLR) - Normal value	m	
4	8.2.2.2	Sending and Receiving Loudness Ratings (SLR and RLR) - Volume control	c1	
5	8.2.3.1a)	Sidetone - Talker sidetone	c2	
6	8.2.3.1b)	Sidetone - Talker sidetone	c1	
7	8.2.3.2a)	Sidetone - Listener sidetone	c3	
8	8.2.3.2b)	Sidetone - Listener sidetone	c4	
9	8.2.3.2c)	Sidetone - Listener sidetone	c5	
10	8.2.4.1a)	Weighted Terminal Coupling Loss (TCLw)	c2	
11	8.2.4.1b)	Weighted Terminal Coupling Loss (TCLw)	c1	
12	8.2.4.2	Stability Loss	m	
13	8.2.5.1.1	Distortion - Sending - Method 1 (Pseudo random noise stimulus)	m	
14	8.2.5.1.2	Distortion - Sending - Method 2 (Sinusoidal test signal)	m	
15	8.2.5.2.1	Distortion - Receiving - Method 1 (Pseudo random noise stimulus)	m	
16	8.2.5.2.2	Distortion - Receiving - Method 2 (Sinusoidal test signal)	m	
17	8.2.5.3	Distortion - Sidetone	m	
18	8.2.6.1	Variation of gain with input level - Sending	m	
19	8.2.6.2	Variation of gain with input level - Receiving	m	
20	8.2.7.1	Out-of-band signals - Discrimination against out-of-band input signals (sending)	m	
21	8.2.7.2	Out-of-band signals - Spurious out-of-band (receiving)	m	
22	8.2.8.1	Noise - Sending	m	
23	8.2.8.2a)	Noise - Receiving	c2	
24	8.2.8.2b)	Noise - Receiving	c1	
25	8.2.8.3	Noise - Level of sampling frequency (receiving)	m	
27	8.2.10	Delay	m	
c1 = m if E1.3 else n/a		c2 = n/a if E1.3 else m		
c3 = n/a if E1.3 or E1.6 else m		c4 = m if E1.3 and not E1.6 else n/a		
c5 = m if E1.6 else n/a				

Table E.5: Operation under restricted power conditions requirements table

No.	Reference	TBR Requirement	Status	Support (Y/N)
1	9.1	Normal operation of a designated terminal	c1	
c1 = m if E1.2 else n/a				

Annex F (informative): Test Report Format

This annex gives guidance on the format of the test report to be used by accredited test laboratories when reporting on the results of testing equipment to the requirements specified in this TBR. Text enclosed by [* and *] is comment, for guidance purpose only, and is not included in the real test report.

F.1 Identification

F.1.1 Identification of the Document

Number:

Date:

Number of pages:

Annexes to the test report:

Test Laboratory Manager: [* Name *]

Signature: [* Signature *]

[* The test report shall have a unique identification repeated on every page. The report shall be paginated, and the number of pages shall be indicated on each page. The signature shall indicate the person accepting the responsibility for the test report on behalf of the testing laboratory. *]

F.1.2 Identification of the testing laboratory

Name:

Address:

Accreditation Reference:

Telephone No:

Telex No:

Telefax No:

F.1.3 Identification of the client

Name:

Address:

Telephone No:

Telex No:

Telefax No:

F.1.4 Identification of the test item

Name:

Version:

Manufacturer's Name:

Manufacturer's Address:

Telephone No:

Telex No:

Telefax No:

Supplier's Name:

Supplier's Address:

Telephone No:

Telex No:

Telefax No:

F.1.5 Use of subcontractors

[* If subcontractors have been employed to carry out part(s) of the tests, they shall be identified against each clause for which they have performed tests. *]

F.2 Test conditions

The environmental conditions under which the equipment was tested were as follows:

Temperature: [* value *] °C

Relative humidity: [* value *] %

Air Pressure: [* value *] kPa

[* any other environmental conditions including voltage and frequency of power supply, if equipment under test uses power supplied from a source within the laboratory *]

[* If the environmental conditions were changed during the execution of the tests, this section of the report shall indicate the range of values for the various environmental parameters under which the tests were performed and the precise value under which a given test was performed shall be specified in each paragraph of the test results presentation. *]

F.3 Test equipment

F.4 Test results

[* The presentation of the test results shall follow the structure of the TBR, and refer to the relevant subclause of the TBR. The following text is for guidance only. The testing laboratory may choose to present more or less details when appropriate. However, the information which is indicated as required in this test report format shall be included. Optional features implemented in the test item shall be tested. *]

F.4.1 Call control functions

[* See clause 7. Test results of the tests of annex B. *]

F.4.2 Speech transmission characteristics

[* See clause 8. Test results of the tests of annex A. *]

F.4.3 Power feeding

[* See subclause 9.1. *]

F.5 Summary and conclusion

[* A summary of any deviation from the requirements and a conclusion whether or not the test item meets the requirements of this document, shall be included. Any particular event which occurred during the test execution shall also be described. If there were no particular events this shall be explicitly stated. *]

Annex G (normative): List of supported telecommunication services

G.1 Basic telecommunication services

This TBR is applicable to TE supporting on-demand circuit mode basic telecommunication services based on the following bearer capability:

- circuit-mode 3,1 kHz audio (ETS 300 084) (relevant only for incoming calls);
- circuit-mode speech (ETS 300 083).

G.2 Supplementary services

This TBR is applicable to TE that optionally supports:

- a) any supplementary service invoked by stimulus signalling (ETS 300 122-1); or
- b) any supplementary service invoked by functional signalling where the call state is not altered other than by the procedure defined for basic call. This includes the following:
 - Multiple Subscriber Number (MSN) supplementary service (ETS 300 052-1);
 - Direct Dialling In (DDI) supplementary service (ETS 300 064-1);
 - Subaddressing (SUB) supplementary service (ETS 300 061-1);
 - Calling Line Identification Presentation (CLIP) supplementary service (ETS 300 092-1);
 - Calling Line Identification Restriction supplementary (CLIR) service (ETS 300 093-1);
 - Terminal Portability (TP) supplementary service (ETS 300 055-1);
 - Connected Line Identification Presentation (COLP) supplementary service (ETS 300 097-1);
 - Connected Line Identification Restriction (COLR) supplementary service (ETS 300 098-1);
 - Call Waiting (CW) supplementary service (ETS 300 058-1);
 - Advice Of Charge (AOC) supplementary service (ETS 300 182-1);
 - Malicious Call Identification (MCID) supplementary service (ETS 300 130-1);
 - Call Hold (HOLD) supplementary service (ETS 300 141-1);
 - Three-Party (3PTY) supplementary service (ETS 300 188-1);
 - Conference call add-on (CONF) supplementary service (ETS 300 185-1);
 - Closed User Group (CUG) supplementary service (ETS 300 138-1);
 - Freephone (FPH) supplementary service (ETS 300 210-1);
 - User-to-User Signalling (UUS) supplementary service (ETS 300 286-1);
 - Diversion supplementary services (CFU, CFB, CFNR and CD) (ETS 300 207-1);
 - Explicit Call Transfer (ECT) supplementary service (ETS 300 369-1);
 - Completion of Calls to Busy Subscriber (CCBS) supplementary service (ETS 300 359-1).

Other supplementary services that may be defined in the future may be included in this category.

Annex H (informative): Bibliography

For the purposes of this TBR, the following informative references have been given.

- CCITT Recommendation P.35 (1996): "Handset telephones".
- ITU-T Recommendation P.58 (1993): "Head and torso simulator for telephonometry".
- ISO/DIS 9614-1: "Acoustics determination of sound power levels of noise sources using sound intensity - Measurement at discrete points".
- CCITT Recommendation I.231(1988): "Circuit-mode bearer service categories".
- ETR 18 (fourth edition, 1996): "Integrated Services Digital Network (ISDN); Application of the BC, HLC and LLC information elements by terminals supporting ISDN services".
- I-ETS 300 245-1 (1996): "Integrated Services Digital Network (ISDN); Technical characteristics of telephony terminals; Part 1: General".
- ETS 300 052-1 (1991): "Integrated Services Digital Network (ISDN); Multiple Subscriber Number (MSN) supplementary service, Digital Subscriber Signalling System No. one (DSS1) protocol, Part 1: Protocol specification".
- ETS 300 055-1 (1991): "Integrated Services Digital Network (ISDN); Terminal Portability (TP) supplementary service, Digital Subscriber Signalling System No. one (DSS1) protocol, Part 1: Protocol specification".
- ETS 300 058-1 (1991): "Integrated Services Digital Network (ISDN); Call Waiting (CW) supplementary service, Digital Subscriber Signalling System No. one (DSS1) protocol, Part 1: Protocol specification".
- ETS 300 061-1 (1991): "Integrated Services Digital Network (ISDN); Subaddressing (SUB) supplementary service, Digital Subscriber Signalling System No. one (DSS1) protocol, Part 1: Protocol specification".
- ETS 300 064-1 (1996): "Integrated Services Digital Network (ISDN); Direct Dialling In (DDI) supplementary service, Digital Subscriber Signalling System No. one (DSS1) protocol, Part 1: Protocol specification".
- ETS 300 083 (1993): "Integrated Services Digital Network (ISDN); Circuit mode structured bearer service category usable for speech information transfer, Terminal requirements for end-to-end compatibility".
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History

Document history	
September 1994	First Edition
October 1997	Public Enquiry PE 9807: 1997-10-17 to 1998-02-13
June 1998	Vote V 9836: 1998-06-29 to 1998-09-11