

STN	Digitálne bezšnúrové telekomunikácie (DECT) Spoločné rozhranie (CI) Časť 8: Kódovanie a prenos hovoru a zvuku	STN EN 300 175-8 V2.8.1 87 0175
------------	--	---

Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 8: Speech and audio coding and transmission

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 06/20

Obsahuje: EN 300 175-8 V2.8.1:2019

130734

ETSI EN 300 175-8 V2.8.1 (2019-12)



**Digital Enhanced Cordless Telecommunications (DECT);
Common Interface (CI);
Part 8: Speech and audio coding and transmission**

Reference

REN/DECT-00328

Keywords

7 kHz, audio, broadband, codec, DECT,
handsfree, IMT-2000, loudspeaking, mobility,
narrowband, quality, radio, speech, TDD, TDMA,
telephony, terminal

ETSI

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

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

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2019.

All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members.

3GPP™ and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

oneM2M™ logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners.

GSM® and the GSM logo are trademarks registered and owned by the GSM Association.

Contents

Intellectual Property Rights	15
Foreword.....	15
Modal verbs terminology.....	15
1 Scope	16
2 References	16
2.1 Normative references	16
2.2 Informative references.....	18
3 Definition of terms, symbols and abbreviations.....	20
3.1 Terms.....	20
3.2 Symbols.....	21
3.3 Abbreviations	22
4 Configurations	24
4.1 Reference configuration	24
4.1.1 Basic configuration	24
4.1.2 Portable Part (PP)	25
4.1.2.1 Functional organization.....	25
4.1.2.2 Volume control	25
4.1.3 Fixed Part (FP).....	26
4.1.3.1 Digital interface.....	26
4.1.3.2 Analog interface	27
4.1.3.3 FP adaptive volume control	27
4.1.3.4 Voice over IP (VoIP) interface.....	27
4.2 Test configurations	28
5 Encoding.....	28
5.0 General	28
5.1 32 kbit/s full term (ADPCM) G.726.....	29
5.1.1 Algorithm.....	29
5.1.2 Bit sequence.....	29
5.1.3 Characteristics of G.726 ADPCM codec	29
5.2 64 kbit/s PCM G.711.....	29
5.2.1 Algorithm.....	29
5.2.2 Bit sequence.....	29
5.2.3 Characteristics of G.711 PCM codec.....	30
5.2.4 Automatic detection of FAX/modem tone and switch to G.711	30
5.3 Wideband speech codec G.722 at 64 kbit/s.....	30
5.3.0 General.....	30
5.3.1 Algorithm.....	30
5.3.2 Bit sequence.....	30
5.3.3 Characteristics of G.722 wideband codec.....	30
5.3.4 Optional Packet Loss Concealment algorithm (PLC).....	31
5.4 Wideband speech codec G.729.1 up to 32 kbit/s.....	31
5.4.1 Algorithm.....	31
5.4.2 Bit sequence.....	31
5.4.3 Characteristics of G.729.1 codec	31
5.4.4 Packet Loss Concealment algorithm (PLC).....	32
5.4.5 Supported bit rate in DECT	32
5.5 Super-wideband MPEG-4 speech and audio coding	32
5.5.1 Algorithm.....	32
5.5.2 64 kbit/s, MPEG-4 ER AAC-LD codec.....	33
5.5.3 32 kbit/s, MPEG-4 ER AAC-LD codec.....	33
5.6 Narrowband, wideband and super-wideband/fullband LC3plus speech and audio coding	34
5.6.1 Algorithm.....	34
5.6.2 NB mode at 32 kbit/s gross bit rate.....	34
5.6.3 WB mode at 32 kbit/s gross bit rate.....	35

5.6.4	SWB mode at 64 kbit/s gross bit rate.....	35
5.6.5	FB mode at 64 kbit/s gross bit rate	35
5.6.6	FB mode at 96 kbit/s gross bit rate	36
5.6.7	FB mode at 128 kbit/s gross bit rate	36
6	Transmission aspects.....	37
6.1	Relative level.....	37
6.2	Acoustic reference level	37
6.3	Volume control.....	37
7	Audio specifications.....	37
7.1	Overall description	37
7.1.1	Introduction to DECT audio specifications	37
7.1.2	Introduction to the audio types	37
7.1.3	List of Audio types	38
7.1.4	Audio types for Portable Parts.....	39
7.1.5	Audio types for Fixed Parts	40
7.1.6	Complete DECT system	40
7.1.7	Structure of the specification of the audio types.....	40
7.1.8	Audio Types and codecs.....	48
7.1.9	Audio Types and physical interfaces	48
7.2	Audio types applicable to Portable Parts.....	48
7.2.0	General.....	48
7.2.1	Performance levels of DECT Portable Parts (handsets).....	48
7.2.2	Type 0: Reference PP (RePP).....	49
7.2.3	PP Type 1a: "Classic" GAP narrowband handset.....	50
7.2.3.1	Introduction.....	50
7.2.3.2	Compatible services and codecs.....	50
7.2.3.3	Specification.....	50
7.2.4	PP Type 1b: "Improved" GAP narrowband handset.....	50
7.2.4.1	Introduction.....	50
7.2.4.2	Compatible services and codecs.....	51
7.2.4.3	Specification.....	51
7.2.5	PP Type 1c: HATS-tested "standard" narrowband handset	51
7.2.5.1	Introduction.....	51
7.2.5.2	Compatible services and codecs.....	51
7.2.5.3	Specification.....	51
7.2.6	PP Type 1d: HATS-tested "improved" narrowband handset.....	52
7.2.6.1	Introduction.....	52
7.2.6.2	Compatible services and codecs.....	52
7.2.6.3	Specification.....	52
7.2.7	PP Type 3a: HATS tested narrowband "standard" loudspeaking handsfree	52
7.2.7.1	Introduction.....	52
7.2.7.2	Compatible services and codecs.....	52
7.2.7.3	Specification.....	53
7.2.8	PP Type 3b: HATS tested narrowband "improved" loudspeaking handsfree	53
7.2.8.1	Introduction.....	53
7.2.8.2	Compatible services and codecs.....	53
7.2.8.3	Specification.....	53
7.2.9	PP Type 2a: P.311-tested wideband handset.....	53
7.2.9.1	Introduction.....	53
7.2.9.2	Compatible services and codecs.....	53
7.2.9.3	Specification.....	53
7.2.10	PP Type 2b: HATS-tested "standard" wideband handset or headset	54
7.2.10.1	Introduction.....	54
7.2.10.2	Compatible services and codecs.....	54
7.2.10.3	Specification.....	54
7.2.11	PP Type 2c: HATS tested "improved" wideband handset or headset	54
7.2.11.1	Introduction.....	54
7.2.11.2	Compatible services and codecs.....	54
7.2.11.3	Specification.....	54
7.2.12	PP Type 4a: HATS tested wideband "standard" loudspeaking handsfree	55

7.2.12.1	Introduction.....	55
7.2.12.2	Compatible services and codecs.....	55
7.2.12.3	Specification.....	55
7.2.13	PP Type 4b: HATS tested wideband "improved" loudspeaking and handsfree.....	55
7.2.13.1	Introduction.....	55
7.2.13.2	Compatible services and codecs.....	55
7.2.13.3	Specification.....	55
7.2.14	PP Type 5a: super-wideband 14 kHz handset or headset.....	56
7.2.14.1	Introduction.....	56
7.2.14.2	Compatible services and codecs.....	56
7.2.14.3	Specification.....	56
7.2.15	PP Type 5b: super-wideband 14 kHz loudspeaking handsfree.....	56
7.2.15.1	Introduction.....	56
7.2.15.2	Compatible services and codecs.....	56
7.2.15.3	Specification.....	56
7.2.16	PP Type 6: PPs with external 2 wire, 3,1 kHz telephony interface.....	56
7.2.16.1	Introduction.....	56
7.2.16.2	Compatible services and codecs.....	56
7.2.16.3	Specification.....	56
7.2.17	PP Type 7a: fullband 20 kHz handset or headset.....	56
7.2.17.1	Introduction.....	56
7.2.17.2	Compatible services and codecs.....	57
7.2.17.3	Specification.....	57
7.2.18	PP Type 7b: fullband 20 kHz loudspeaking handsfree.....	57
7.2.18.1	Introduction.....	57
7.2.18.2	Compatible services and codecs.....	57
7.2.18.3	Specification.....	57
7.2.19	PP Type 7c, d, e: fullband 20 kHz stereo audio device.....	57
7.2.19.1	Introduction.....	57
7.2.19.2	Compatible services and codecs.....	57
7.2.19.3	Specification.....	57
7.3	Audio transmission types applicable to Fixed Parts.....	57
7.3.0	General.....	57
7.3.1	FP Type 0: Reference FP (ReFP).....	58
7.3.2	FP Type 1a: "classical" Fixed Part for ISDN Network.....	58
7.3.2.1	Introduction.....	58
7.3.2.2	Compatible services and codecs.....	59
7.3.2.3	Specifications.....	59
7.3.2.3.1	Transcoding and equalization.....	59
7.3.2.3.2	PP type detection.....	59
7.3.2.3.3	Activation of audio processing functions.....	59
7.3.2.3.4	Transmission specification.....	60
7.3.3	FP Type 1b: Fixed Part for ISDN Network.....	60
7.3.3.1	Introduction.....	60
7.3.3.2	Compatible services and codecs.....	60
7.3.3.3	Specification.....	60
7.3.3.3.1	Transcoding and equalization.....	60
7.3.3.3.2	PP type detection.....	61
7.3.3.3.3	Activation of audio processing functions.....	61
7.3.3.3.4	Transmission specification.....	61
7.3.4	FP Type 2: FP with analog 2-wire interface, 3,1 kHz service.....	61
7.3.4.1	Introduction.....	61
7.3.4.2	Compatible services, physical interfaces and codecs.....	62
7.3.4.3	Specification.....	62
7.3.4.3.1	Transcoding, equalization and conversion.....	62
7.3.4.3.2	PP type detection and activation of audio processing functions.....	62
7.3.4.3.3	Transmission specification.....	62
7.3.5	FP Type 3: VoIP narrowband Fixed Part.....	62
7.3.5.1	Introduction.....	62
7.3.5.2	Compatible services, physical interfaces and codecs.....	63
7.3.5.3	Specification.....	63
7.3.5.3.1	Transcoding and equalization.....	63

7.3.5.3.2	PP type detection	64
7.3.5.3.3	Activation of audio processing functions	64
7.3.5.3.4	Transmission specification	64
7.3.6	FP Type 4: ISDN wideband Fixed Part	65
7.3.6.1	Introduction	65
7.3.6.2	Compatible services and codecs	65
7.3.6.3	Specification	65
7.3.6.3.1	Transcoding and equalization	65
7.3.6.3.2	PP type detection	65
7.3.6.3.3	Activation of audio processing functions	65
7.3.6.3.4	Transmission specification	66
7.3.7	FP Type 5: VoIP wideband, super-wideband or fullband Fixed Part	66
7.3.7.1	Introduction	66
7.3.7.2	Compatible services, physical interfaces and codecs	66
7.3.7.3	Specification	67
7.3.7.3.1	Transcoding and equalization	67
7.3.7.3.2	PP type detection	67
7.3.7.3.3	Activation of audio processing functions	67
7.3.7.3.4	Transmission specification	68
7.3.8	FP Type 6a: FP handling an Internal call inside a DECT FP (any service)	68
7.3.8.1	Introduction	68
7.3.8.2	Compatible services, physical interfaces and codecs	68
7.3.8.3	Specification	68
7.3.9	FP Type 6b: FP handling an n-party conference inside a DECT FP (any service)	68
7.3.9.1	Introduction	68
7.3.9.2	Compatible services, physical interfaces and codecs	68
7.3.9.3	Specification for the conference bridge	69
7.3.10	FP Type 7: DECT Repeater Part (REP)	69
7.3.10.1	Introduction	69
7.3.10.2	Compatible services, physical interfaces and codecs	69
7.3.10.3	Specification	69
7.4	Additional features	69
7.4.1	Introduction	69
7.4.2	Echo canceller in Fixed Part	70
7.4.3	Echo suppressor in Fixed Part	70
7.5	Transmission characteristics for Portable Parts	71
7.5.1	Transmission characteristics for Portable Part type 1a ("Classic GAP" handset)	71
7.5.1.1	PP frequency responses	71
7.5.1.1.1	Sending	71
7.5.1.1.2	Receiving	72
7.5.1.2	PP sending and receiving loudness ratings	72
7.5.1.2.1	Nominal values	72
7.5.1.2.2	User-controlled volume control in PP	72
7.5.1.2.3	PP adaptive volume control	73
7.5.1.3	Sidetone	73
7.5.1.3.1	Talker sidetone	73
7.5.1.3.2	Listener sidetone	74
7.5.1.4	Terminal coupling loss	74
7.5.1.4.1	Weighted Terminal Coupling Loss (TCLw)	74
7.5.1.4.2	Stability loss	74
7.5.1.5	Distortion	75
7.5.1.5.1	Sending	75
7.5.1.5.2	Receiving	75
7.5.1.5.3	Sidetone	75
7.5.1.6	Out of band signals	75
7.5.1.6.1	Sending (discrimination against out of band input signals)	75
7.5.1.6.2	Receiving (spurious out of band signals)	76
7.5.1.7	Noise	76
7.5.1.7.1	Sending	76
7.5.1.7.2	Band-limited noise	76
7.5.1.7.3	Receiving	76
7.5.1.7.4	Level of sampling frequency (receiving)	77

7.5.1.8	Acoustic shock	77
7.5.1.8.0	General	77
7.5.1.8.1	Continuous signal	77
7.5.1.8.2	Peak signal.....	77
7.5.1.9	PP Delay.....	77
7.5.1.10	PP ambient noise rejection	77
7.5.2	Additional requirements for PP type 1b ("improved GAP" handset)	78
7.5.2.0	General	78
7.5.2.1	Terminal coupling loss.....	78
7.5.2.1.1	Weighted Terminal Coupling Loss (TCLw).....	78
7.5.2.2	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	78
7.5.2.3	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	78
7.5.2.4	Activation in Sending Direction.....	79
7.5.2.5	Activation in Receiving Direction.....	79
7.5.3	Transmission characteristics for PP types 1c and 1d (HATS tested, narrowband telephony handsets).....	80
7.5.3.1	Frequency responses	80
7.5.3.1.1	Sending	80
7.5.3.1.2	Receiving.....	81
7.5.3.2	Sending and receiving loudness ratings	83
7.5.3.2.1	Nominal values.....	83
7.5.3.2.2	Void.....	83
7.5.3.2.3	Void.....	83
7.5.3.2.4	Microphone mute.....	83
7.5.3.2.5	Positional robustness	84
7.5.3.3	Sidetone.....	84
7.5.3.3.1	Sidetone masking rating (STMR).....	84
7.5.3.3.2	Void.....	84
7.5.3.3.3	Sidetone delay	84
7.5.3.4	Terminal coupling loss	84
7.5.3.4.1	Terminal Coupling Loss weighted (TCLw).....	84
7.5.3.4.2	Stability loss	85
7.5.3.5	Distortion	85
7.5.3.5.1	Sending Distortion.....	85
7.5.3.5.2	Receiving Distortion.....	85
7.5.3.6	Out of band signals.....	85
7.5.3.6.1	Out-of-band Signals in Send direction	85
7.5.3.6.2	Out-of-band signals in receiving direction	86
7.5.3.7	Noise	86
7.5.3.7.1	Sending.....	86
7.5.3.7.2	Receiving.....	86
7.5.3.8	Acoustic shock	87
7.5.3.8.0	General	87
7.5.3.8.1	Continuous signal	87
7.5.3.8.2	Void.....	87
7.5.3.9	Delay.....	87
7.5.3.10	Void.....	87
7.5.3.11	Double Talk Performance	87
7.5.3.11.0	General	87
7.5.3.11.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	87
7.5.3.11.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	88
7.5.3.11.3	Detection of Echo Components during Double Talk.....	88
7.5.3.11.4	Minimum activation level and sensitivity of double talk detection	89
7.5.3.12	Switching characteristics.....	89
7.5.3.12.0	General	89
7.5.3.12.1	Activation in Sending Direction	89
7.5.3.12.2	Activation in Receiving Direction	90
7.5.3.12.3	Silence Suppression and Comfort Noise Generation.....	90
7.5.3.12.4	Performance in sending direction in the presence of background noise	90
7.5.3.12.5	Speech Quality in the Presence of Background Noise.....	90
7.5.3.12.6	Quality of Background Noise Transmission (with Far End Speech).....	91
7.5.3.12.7	Void.....	91
7.5.3.12.8	Positional Robustness of Speech Quality in the Presence of Background Noise	91

7.5.3.13	Quality of echo cancellation.....	91
7.5.3.13.0	General	91
7.5.3.13.1	Temporal echo effects	91
7.5.3.13.2	Spectral Echo Attenuation	91
7.5.3.13.3	Variable echo path.....	92
7.5.4	Transmission characteristics for PP types 3a and 3b (narrowband loudspeaking and handsfree devices).....	92
7.5.4.1	Sending sensitivity/frequency response	92
7.5.4.2	Receive sensitivity/frequency response.....	93
7.5.4.3	Send loudness rating	95
7.5.4.4	Receive loudness rating.....	95
7.5.4.5	Sending distortion	96
7.5.4.6	Receiving distortion	96
7.5.4.7	Out-of-band signals in sending direction	97
7.5.4.8	Out-of-band signals in receiving direction.....	97
7.5.4.9	Sending noise	97
7.5.4.10	Receiving noise	97
7.5.4.11	Terminal Coupling Loss weighted (TCLw)	98
7.5.4.12	Stability Loss.....	98
7.5.4.13	Double Talk Performance	98
7.5.4.13.0	General	98
7.5.4.13.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	98
7.5.4.13.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	99
7.5.4.13.3	Detection of Echo Components during Double Talk.....	100
7.5.4.13.4	Minimum activation level and sensitivity of double talk detection	100
7.5.4.14	Switching characteristics.....	100
7.5.4.14.0	General	100
7.5.4.14.1	Activation in Sending Direction	100
7.5.4.14.2	Activation in Receiving Direction	101
7.5.4.14.3	Silence Suppression and Comfort Noise Generation.....	101
7.5.4.14.4	Performance in sending direction in the presence of background noise.....	101
7.5.4.14.5	Speech Quality in the Presence of Background Noise.....	101
7.5.4.14.6	Quality of Background Noise Transmission (with Far End Speech).....	102
7.5.4.15	Quality of echo cancellation.....	102
7.5.4.15.0	General	102
7.5.4.15.1	Temporal echo effects	102
7.5.4.15.2	Spectral Echo Attenuation	102
7.5.4.15.3	Variable echo path.....	103
7.5.4.16	Microphone mute	103
7.5.4.17	Delay	103
7.5.5	Transmission characteristics for PP type 2a (P.311 tested, wideband handset).....	103
7.5.5.0	General	103
7.5.5.1	Sending characteristics.....	103
7.5.5.1.1	Loudness rating	103
7.5.5.1.2	Sensitivity/frequency characteristics	104
7.5.5.1.3	Noise.....	104
7.5.5.1.4	Distortion.....	104
7.5.5.1.5	Discrimination against out-of-band input signals	104
7.5.5.2	Receiving characteristics.....	104
7.5.5.2.1	Loudness rating	104
7.5.5.2.2	Sensitivity/frequency characteristics	104
7.5.5.2.3	Noise.....	104
7.5.5.2.4	Distortion.....	105
7.5.5.2.5	Spurious out-of-band receiving signals	105
7.5.5.3	Sidetone characteristics	105
7.5.5.3.1	Talker sidetone	105
7.5.5.3.2	Sidetone distortion.....	105
7.5.5.4	Echo path loss characteristics.....	105
7.5.5.4.1	Weighted terminal coupling loss	105
7.5.5.4.2	Stability loss	106
7.5.6	Transmission characteristics for PP type 2b and 2c (HATS tested wideband handsets)	106
7.5.6.1	Frequency responses	106

7.5.6.1.1	Sending.....	106
7.5.6.1.2	Receiving.....	107
7.5.6.2	Send and receive loudness ratings.....	110
7.5.6.2.1	Nominal values.....	110
7.5.6.2.2	Void.....	110
7.5.6.2.3	Void.....	110
7.5.6.2.4	Microphone mute.....	110
7.5.6.2.5	Positional robustness.....	111
7.5.6.3	Sidetone.....	111
7.5.6.3.1	Sidetone masking rating (STMR).....	111
7.5.6.3.2	Void.....	111
7.5.6.3.3	Sidetone delay.....	111
7.5.6.4	Terminal coupling loss.....	111
7.5.6.4.1	Terminal Coupling Loss (TCL).....	111
7.5.6.4.2	Stability loss.....	112
7.5.6.5	Distortion.....	112
7.5.6.5.1	Sending Distortion.....	112
7.5.6.5.2	Receiving Distortion.....	112
7.5.6.6	Noise.....	113
7.5.6.6.1	Sending.....	113
7.5.6.6.2	Receiving.....	113
7.5.6.7	Acoustic shock.....	113
7.5.6.7.0	General.....	113
7.5.6.7.1	Continuous signal.....	113
7.5.6.8	Delay.....	113
7.5.6.9	Void.....	114
7.5.6.10	Double talk Performance.....	114
7.5.6.10.0	General.....	114
7.5.6.10.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	114
7.5.6.10.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	114
7.5.6.10.3	Detection of Echo Components during Double Talk.....	115
7.5.6.10.4	Minimum activation level and sensitivity of double talk detection.....	116
7.5.6.11	Switching characteristics.....	116
7.5.6.11.0	General.....	116
7.5.6.11.1	Activation in Sending Direction.....	116
7.5.6.11.2	Activation in Receiving Direction.....	116
7.5.6.11.3	Silence Suppression and Comfort Noise Generation.....	116
7.5.6.11.4	Performance in Sending in the Presence of Background Noise.....	116
7.5.6.11.5	Speech Quality in the Presence of Background Noise.....	117
7.5.6.11.6	Quality of Background Noise Transmission (with Far End Speech).....	117
7.5.6.11.7	Void.....	117
7.5.6.11.8	Positional Robustness of Speech Quality in the Presence of Background Noise.....	117
7.5.6.12	Quality of echo cancellation.....	118
7.5.6.12.0	General.....	118
7.5.6.12.1	Temporal echo effects.....	118
7.5.6.12.2	Spectral Echo Attenuation.....	118
7.5.6.12.3	Variable echo path.....	118
7.5.6.13	Out of band signals.....	119
7.5.6.13.1	Out-of-band signals in sending direction.....	119
7.5.6.13.2	Out-of-band signals in receiving direction.....	119
7.5.7	Transmission characteristics for PP types 4a and 4b (HATS Tested wideband loudspeaking and handsfree devices).....	119
7.5.7.1	Sending sensitivity/frequency response.....	119
7.5.7.2	Receive sensitivity/frequency response.....	120
7.5.7.3	Send loudness rating.....	122
7.5.7.4	Receive loudness rating.....	122
7.5.7.5	Sending distortion.....	123
7.5.7.6	Receiving distortion.....	123
7.5.7.7	Out-of-band signals in sending direction.....	124
7.5.7.8	Out-of-band signals in receiving direction.....	124
7.5.7.9	Sending noise.....	124
7.5.7.10	Receiving noise.....	124

7.5.7.11	Terminal Coupling Loss.....	125
7.5.7.12	Stability Loss.....	125
7.5.7.13	Double Talk Performance	125
7.5.7.13.0	General	125
7.5.7.13.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	126
7.5.7.13.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	126
7.5.7.13.3	Detection of Echo Components during Double Talk.....	127
7.5.7.13.4	Minimum activation level and sensitivity of double talk detection	127
7.5.7.14	Switching characteristics.....	127
7.5.7.14.0	General	127
7.5.7.14.1	Activation in Sending Direction	127
7.5.7.14.2	Activation in Receiving Direction.....	128
7.5.7.14.3	Silence Suppression and Comfort Noise Generation.....	128
7.5.7.14.4	Performance in sending direction in the presence of background noise	128
7.5.7.14.5	Speech Quality in the Presence of Background Noise.....	128
7.5.7.14.6	Quality of Background Noise Transmission (with Far End Speech).....	129
7.5.7.15	Quality of echo cancellation.....	129
7.5.7.15.1	Temporal echo effects	129
7.5.7.15.2	Spectral Echo Attenuation	129
7.5.7.15.3	Variable echo path.....	130
7.5.7.16	Microphone mute	130
7.5.7.17	Delay	130
7.5.8	Transmission characteristics for PP type 5a ("super-wideband 14 kHz handset or headset")	130
7.5.8.1	Frequency responses	130
7.5.8.1.1	Sending.....	130
7.5.8.1.2	Receiving.....	132
7.5.8.2	Send and receive loudness ratings.....	133
7.5.8.2.1	Send Loudness Rating	133
7.5.8.2.2	Receive Loudness Rating	134
7.5.8.3	Sidetone.....	134
7.5.8.3.1	Sidetone Masking Rating STMR (Mouth to ear).....	134
7.5.8.3.2	Sidetone Delay.....	134
7.5.8.4	Terminal Coupling Loss.....	135
7.5.8.4.1	Unweighted Terminal Coupling Loss.....	135
7.5.8.4.2	Stability Loss	135
7.5.8.5	Distortion	135
7.5.8.5.1	Sending Distortion.....	135
7.5.8.5.2	Receiving Distortion.....	136
7.5.8.6	Noise	136
7.5.8.6.1	Sending.....	136
7.5.8.6.2	Receiving.....	136
7.5.8.7	Acoustic shock.....	136
7.5.8.7.0	General	136
7.5.8.7.1	Continuous signal	137
7.5.8.8	Delay	137
7.5.8.9	Double talk performance	137
7.5.8.9.0	General	137
7.5.8.9.1	Attenuation range in send direction during double talk $A_{H,S,dt}$	137
7.5.8.9.2	Attenuation range in receive direction during double talk $A_{H,R,dt}$	138
7.5.8.9.3	Detection of echo components during double talk	138
7.5.8.10	Switching Characteristics.....	139
7.5.8.10.0	Note	139
7.5.8.10.1	Activation in send direction.....	139
7.5.8.10.2	Silence suppression and comfort noise generation	139
7.5.8.10.3	Performance in Sending in the Presence of Background Noise.....	139
7.5.8.10.4	Speech quality in the presence of background noise	140
7.5.8.10.5	Positional Robustness of Speech Quality in the Presence of Background Noise	140
7.5.8.10.6	Quality of background noise transmission (with far end speech).....	141
7.5.8.11	Quality of echo cancellation.....	141
7.5.8.11.1	Temporal echo effects	141
7.5.8.11.2	Spectral echo attenuation.....	141

7.5.8.11.3	Variable echo path.....	141
7.5.9	Transmission characteristics for PP type 5b ("super-wideband 14 kHz loudspeaking and handsfree devices")	142
7.5.9.1	Sending sensitivity/frequency response	142
7.5.9.2	Receive sensitivity/frequency response.....	143
7.5.9.2.1	Handheld terminal	143
7.5.9.2.2	Desktop terminal	143
7.5.9.2.3	Terminals intended to be used simultaneously by several users.....	144
7.5.9.3	Sending loudness rating	144
7.5.9.3.1	Nominal Value.....	144
7.5.9.3.2	Microphone mute.....	144
7.5.9.4	Receive loudness rating.....	145
7.5.9.5	Sending distortion	145
7.5.9.5.1	Signal to harmonic distortion versus frequency	145
7.5.9.5.2	Signal to harmonic distortion for higher input level.....	146
7.5.9.6	Receiving distortion	146
7.5.9.7	Sending noise	147
7.5.9.8	Receiving noise	147
7.5.9.9	Terminal Coupling Loss.....	147
7.5.9.9.1	Unweighted Terminal Coupling Loss.....	147
7.5.9.9.2	Stability Loss	147
7.5.9.10	Double Talk Performance	147
7.5.9.10.0	General	147
7.5.9.10.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	148
7.5.9.10.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	148
7.5.9.10.3	Detection of Echo Components during Double Talk.....	149
7.5.9.10.4	Minimum activation level and sensitivity of double talk detection.....	149
7.5.9.11	Switching characteristics.....	149
7.5.9.11.0	Note	149
7.5.9.11.1	Activation in Sending Direction	150
7.5.9.11.2	Silence Suppression and Comfort Noise Generation.....	150
7.5.9.11.3	Performance in sending direction in the presence of background noise.....	150
7.5.9.11.4	Speech Quality in the Presence of Background Noise.....	150
7.5.9.11.5	Quality of Background Noise Transmission (with Far End Speech).....	151
7.5.9.12	Quality of echo cancellation.....	151
7.5.9.12.1	Temporal echo effects	151
7.5.9.12.2	Spectral Echo Attenuation	151
7.5.9.12.3	Variable echo path.....	152
7.5.9.13	Delay	152
7.5.10	Transmission characteristics for PP type 7a ("fullband 20 kHz handset or headset").....	152
7.5.10.1	Frequency responses	152
7.5.10.1.1	Sending.....	152
7.5.10.1.2	Receiving.....	154
7.5.10.2	Send and receive loudness ratings.....	155
7.5.10.2.1	Send Loudness Rating	155
7.5.10.2.2	Receive Loudness Rating	156
7.5.10.3	Sidetone.....	157
7.5.10.3.1	Sidetone Masking Rating STMR (Mouth to ear).....	157
7.5.10.3.2	Sidetone Delay.....	157
7.5.10.4	Terminal Coupling Loss.....	157
7.5.10.4.1	Unweighted Terminal Coupling Loss.....	157
7.5.10.4.2	Stability Loss	157
7.5.10.5	Distortion	157
7.5.10.5.1	Sending Distortion.....	157
7.5.10.5.2	Receiving Distortion.....	158
7.5.10.6	Noise	158
7.5.10.6.1	Sending.....	158
7.5.10.6.2	Receiving.....	159
7.5.10.7	Acoustic shock	159
7.5.10.7.0	General	159
7.5.10.7.1	Continuous signal	159
7.5.10.8	Delay	159

7.5.10.9	Double talk Performance.....	159
7.5.10.9.0	General	159
7.5.10.9.1	Attenuation range in send direction during double talk $A_{H,S,dt}$	160
7.5.10.9.2	Attenuation range in receive direction during double talk $A_{H,R,dt}$	160
7.5.10.9.3	Detection of echo components during double talk	161
7.5.10.10	Switching Characteristics.....	161
7.5.10.10.0	Note	161
7.5.10.10.1	Activation in send direction.....	161
7.5.10.10.2	Silence suppression and comfort noise generation	162
7.5.10.10.3	Performance in Sending in the Presence of Background Noise.....	162
7.5.10.10.4	Speech quality in the presence of background noise	162
7.5.10.10.5	Positional Robustness of Speech Quality in the Presence of Background Noise	163
7.5.10.10.6	Quality of background noise transmission (with far end speech).....	163
7.5.10.11	Quality of echo cancellation.....	163
7.5.10.11.1	Temporal echo effects	163
7.5.10.11.2	Spectral echo attenuation.....	163
7.5.10.11.3	Variable echo path.....	164
7.5.11	Transmission characteristics for PP type 7b ("fullband 20 kHz loudspeaking and handsfree devices") ..	164
7.5.11.1	Sending sensitivity/frequency response	164
7.5.11.2	Receive sensitivity/frequency response.....	165
7.5.11.2.0	General	165
7.5.11.2.1	Handheld terminal	165
7.5.11.2.2	Desktop terminal	166
7.5.11.2.3	Terminals intended to be used simultaneously by several users.....	167
7.5.11.3	Sending loudness rating	167
7.5.11.3.1	Nominal Value.....	167
7.5.11.3.2	Microphone Mute	167
7.5.11.4	Receive loudness rating.....	167
7.5.11.5	Sending distortion	168
7.5.11.5.1	Signal to harmonic distortion versus frequency	168
7.5.11.5.2	Signal to harmonic distortion for higher input level.....	168
7.5.11.6	Receiving distortion	169
7.5.11.7	Sending noise	169
7.5.11.8	Receiving noise	169
7.5.11.9	Terminal Coupling Loss.....	170
7.5.11.9.1	Unweighted Terminal Coupling Loss.....	170
7.5.11.9.2	Stability Loss	170
7.5.11.10	Double Talk Performance	170
7.5.11.10.0	General	170
7.5.11.10.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	170
7.5.11.10.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	171
7.5.11.10.3	Detection of Echo Components during Double Talk.....	171
7.5.11.10.4	Minimum activation level and sensitivity of double talk detection.....	172
7.5.11.11	Switching characteristics.....	172
7.5.11.11.0	Note	172
7.5.11.11.1	Activation in Sending Direction	172
7.5.11.11.2	Silence Suppression and Comfort Noise Generation.....	172
7.5.11.11.3	Performance in sending direction in the presence of background noise	172
7.5.11.11.4	Speech Quality in the Presence of Background Noise.....	173
7.5.11.11.5	Quality of Background Noise Transmission (with Far End Speech).....	173
7.5.11.12	Quality of echo cancellation.....	173
7.5.11.12.1	Temporal echo effects	173
7.5.11.12.2	Spectral Echo Attenuation	174
7.5.11.12.3	Variable echo path.....	174
7.5.11.13	Delay.....	174
7.5.12	Transmission characteristics for PP type 7c, d, e ("fullband 20 kHz stereo audio device")	174
7.6	Transmission characteristics for Fixed Parts	175
7.6.1	Transmission characteristics for FP type 1a ("Classic" Fixed Part with ISDN Network interface, 3,1 kHz service).....	175
7.6.1.1	Reduction of echo from PP	175
7.6.1.2	FP Network echo control	176

7.6.1.3	FP adaptive volume control	176
7.6.1.4	FP Delay.....	176
7.6.2	Transmission characteristics for FP type 1b ("new" Fixed Part with ISDN Network interface, 3,1 kHz service)	176
7.6.2.0	General	176
7.6.2.1	FP Network echo control	176
7.6.2.2	FP adaptive volume control	177
7.6.2.3	FP Delay.....	177
7.6.3	Transmission characteristics for FP type 2 (Fixed Part with analog 2-wire interface, 3,1 kHz service)...	177
7.6.3.1	FP adaptive volume control	177
7.6.3.2	Network echo control.....	177
7.6.3.3	Additional requirements for DECT FP provided with a 2-wire PSTN interface.....	178
7.6.3.3.0	Test methods.....	178
7.6.3.3.1	General requirements.....	178
7.6.3.3.2	Speech performance characteristics.....	179
7.6.3.4	FP Delay.....	179
7.6.4	Transmission characteristics for FP type 3 (Fixed Part with VoIP interface, 3,1 kHz service)	180
7.6.4.1	Void.....	180
7.6.4.2	Void.....	180
7.6.4.3	Adaptive volume control.....	180
7.6.4.4	Clock accuracy	180
7.6.4.5	Send Jitter.....	180
7.6.4.6	Send and receive delay - round trip delay	180
7.6.5	Transmission characteristics for FP type 4 (Fixed Part with ISDN network interface, wideband service).....	181
7.6.5.1	FP adaptive volume control	181
7.6.5.2	FP Delay.....	181
7.6.6	Transmission characteristics for FP type 5 (Fixed Part with VoIP interface, wideband, super-wideband or fullband service).....	181
7.6.6.1	Void.....	181
7.6.6.2	Void.....	181
7.6.6.3	FP adaptive volume control	181
7.6.6.4	Clock accuracy	182
7.6.6.5	Send Jitter.....	182
7.6.6.6	Send and receive delay - round trip delay	182
8	Additional features	183
8.1	Loudspeaking hands-free and headset facilities	183
8.1.1	Loudspeaking hands-free facility.....	183
8.1.2	Headset facility	183
8.2	Tandem with mobile radio network.....	183
8.2.0	General.....	183
8.2.1	Tandem with GSM	183
8.2.1.0	Configuration	183
8.2.1.1	Network echo control.....	184
8.2.1.2	Terminal coupling loss.....	184
8.2.1.3	The GSM mobile transmitter operates in continuous mode	184
8.2.1.4	The GSM mobile transmitter operates in discontinuous mode, DTX	184
8.3	DECT connected to the GSM fixed network.....	184
8.3.0	General.....	184
8.3.1	Network echo control.....	184
8.3.2	Terminal coupling loss.....	185
8.4	Wireless Relay Stations (WRS).....	185
8.4.0	General.....	185
8.4.1	Modified FP network echo control requirements for implementation of 2 and 3 CRFP links in cascade.....	185
Annex A (informative):	Description of "reference" echo control devices.....	187
A.0	General	187
A.1	Handset echo	187
A.1.0	Applicability.....	187

A.1.1	Overview	187
A.1.1.1	Connection to the PSTN/ISDN	187
A.1.1.1.0	General	187
A.1.1.1.1	Local and national calls	187
A.1.1.1.2	Long distance connections with echo control devices in the PSTN/ISDN, e.g. calls via satellites	187
A.1.1.2	Connection to the GSM network	188
A.1.2	Implementation of the FP echo control function	188
A.1.2.0	General	188
A.1.2.1	Suppression threshold	189
A.1.2.2	Static characteristics of activation control	189
A.1.2.3	Dynamic characteristics of activation control	189
A.2	Network echo	189
A.2.0	Applicability	189
A.2.1	Soft suppressor implementation of requirement 2	190
A.2.1.0	General	190
A.2.1.1	Static characteristics	191
A.2.1.2	Dynamic characteristics	191
A.2.2	Additional echo control for a 2-wire interface of requirement 1	191
A.2.3	Echo canceller used for both requirements 1 and 2	192
Annex B (informative): Local loop application		193
B.0	General	193
B.1	DECT tethered local loop replacement with 2-wire PP end system	193
B.1.0	Configuration	193
B.1.1	TCLw requirements	193
B.1.2	Network echo	194
Annex C (informative): GSM Discontinuous Transmission (DTX), and Voice Activity Detection (VAD)		195
Annex D (informative): Speech levels in relation to ambient room noise and examples of adaptive volume control settings		196
Annex E (informative): Echo related topics		197
E.1	Summary table on echo parameters for PPs and FPs	197
E.2	General information about Delay-Echo interaction for DECT terminals	203
Annex F (informative): Guidelines on specific requirements		206
F.1	Delay considerations for FPs with VoIP interface	206
F.1.1	Delay considerations for FP type 3 (Fixed Part with VoIP interface, 3,1 kHz service)	206
F.1.1.0	General	206
F.1.1.1	Send delay	206
F.1.1.2	Receive delay	207
F.1.2	Delay considerations for FP type 5 (Fixed Part with VoIP interface, wideband, super-wideband or fullband service)	208
F.1.2.0	General	208
F.1.2.1	Send Delay	208
F.1.2.2	Receive delay	209
F.2	Derivation of Delay requirements for PPs and FPs with VoIP interface	210
Annex G (informative): Bibliography		212
Annex H (informative): Change history		213
History		214

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Digital Enhanced Cordless Telecommunications (DECT).

The present document is part 8 of a multi-part deliverable ([1] to [7]). Full details of the entire series can be found in part 1 [1].

Further details of the DECT system may be found in ETSI TR 101 178 [i.6] and ETSI ETR 043 [i.7].

National transposition dates	
Date of adoption of this EN:	28 November 2019
Date of latest announcement of this EN (doa):	29 February 2020
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 August 2020
Date of withdrawal of any conflicting National Standard (dow):	31 August 2021

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document is one of the parts of the specification of the Digital Enhanced Cordless Telecommunications (DECT) Common Interface (CI).

This part of the DECT CI specifies the speech and audio coding and transmission requirements.

In order to ensure satisfactory interworking of different portable and fixed units, it is necessary to specify the transmission performance of the analog information over the digital link. This requires not only use of a common speech algorithm, but also standardization of frequency responses, reference speech levels (or loudness) at the air interface and various other parameters.

The present document applies to DECT equipment which includes all the necessary functions to provide real-time two-way speech conversation and stereo audio transmission. Several speech services are defined in the present document, including conventional 3,1 kHz telephony, wideband 7 kHz voice transmission, super-wideband 14 kHz and fullband 20 kHz service. DECT Fixed part providing such services may be connected to the public circuit switched (PSTN/ISDN) network, to private networks or to the Voice over Internet Protocol (VoIP) network.

Tethered fixed point local loop applications are not required to comply with the requirements of the present document.

For the DECT systems which connect to the Public Switched Telephone Network (PSTN) via an analog interface, the additional requirements, which are implemented in the FP, have as much as possible been aligned with ETSI TBR 038 [29].

A summary of the control and the use of the DECT echo control functions, to guide on need for options to manufacturers and installers, is found in annex A.

Information concerning test methods can be found in ETSI EN 300 176-1 [9] and ETSI EN 300 176-2 [10] (previously covered by ETSI TBR 010 [i.5]). The test methods take into account that DECT is a digital system.

The present document includes New Generation DECT, a further development of the DECT standard introducing wideband speech, improved data services, new slot types and other technical enhancements.

In addition, the present document includes DECT Evolution, providing SWB and FB speech and audio capabilities and a new speech coding algorithm for NB and WB allowing to increase the audio quality of the NB and WB speech service and improve bandwidth efficiency.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] ETSI EN 300 175-1: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 1: Overview".
- [2] ETSI EN 300 175-2: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 2: Physical Layer (PHL)".
- [3] ETSI EN 300 175-3: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 3: Medium Access Control (MAC) layer".

- [4] ETSI EN 300 175-4: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 4: Data Link Control (DLC) layer".
- [5] ETSI EN 300 175-5: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 5: Network (NWK) layer".
- [6] ETSI EN 300 175-6: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 6: Identities and addressing".
- [7] ETSI EN 300 175-7: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Part 7: Security features".
- [8] Void.
- [9] ETSI EN 300 176-1: "Digital Enhanced Cordless Telecommunications (DECT); Test specification; Part 1: Radio".
- [10] ETSI EN 300 176-2: "Digital Enhanced Cordless Telecommunications (DECT); Test specification; Part 2: Audio and speech".
- [11] Recommendation ITU-T G.701: "Vocabulary of digital transmission and multiplexing, and pulse code modulation (PCM) terms".
- [12] Recommendation ITU-T G.726: "40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)".
- [13] Recommendation ITU-T G.711 (1988): "Pulse Code Modulation (PCM) of voice frequencies".
- [14] Recommendation ITU-T G.722 (2012): "7 kHz audio-coding within 64 kbit/s".
- [15] Void.
- [16] Void.
- [17] Recommendation ITU-T G.729.1 (2006): "G.729-based Embedded Variable bit-rate coder: An 8-32 kbit/s scalable wideband coder bitstream interoperable with G.729".
- [18] Void.
- [19] ISO/IEC 14496-3:2009: "Information technology -- Coding of audio-visual objects -- Part 3: Audio" (ISO/IEC JTC1/SC29/WG11 (MPEG)).
- [20] Recommendation ITU-T P.311 (2011): "Transmission characteristics for wideband digital handset and headset telephones".
- [21] Recommendation ITU-T P.10: "Vocabulary for performance, quality of service and quality of experience".
- [22] Recommendation ITU-T P.340: "Transmission characteristics and speech quality parameters of hands-free terminals".
- [23] Recommendation ITU-T P.58: "Head and torso simulator for telephony".
- [24] Recommendation ITU-T G.111: "Loudness Ratings (LRs) in an international connection".
- [25] Recommendation ITU-T G.1020: "Performance parameter definitions for quality of speech and other voiceband applications utilizing IP networks".
- [26] Recommendation ITU-T P.57: "Artificial ears".
- [27] Recommendation ITU-T P.502: "Objective test methods for speech communication systems using complex test signals".
- [28] Recommendation ITU-T P.51: "Artificial mouth".

- [29] ETSI TBR 038: "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".
- [30] Recommendation ITU-T G.131: "Talker echo and its control".
- [31] ETSI ETS 300 540: "Digital cellular telecommunications system (Phase 2) (GSM); Transmission planning aspects of the speech service in the GSM Public Land Mobile Network (PLMN) system (GSM 03.50)".
- [32] Recommendation ITU-T O.41: "Psophometer for use on telephone-type circuits".
- [33] Recommendation ITU-T P.360: "Efficiency of devices for preventing the occurrence of excessive acoustic pressure by telephone receivers and assessment of daily noise exposure of telephone users".
- [34] ETSI TS 103 634: " Digital Enhanced Cordless Telecommunications (DECT); Low Complexity Communication Codec plus (LC3plus)".
- [35] ITU-T Recommendation P.581: "Use of head and torso simulator (HATS) for hands-free and handset terminal testing".
- [36] ETSI TS 102 924: "Speech and multimedia Transmission Quality (STQ); Transmission requirements for Super-Wideband / Fullband handset and headset terminals from a QoS perspective as perceived by the user".
- [37] ETSI TS 102 925: "Speech and multimedia Transmission Quality (STQ); Transmission requirements for Super-Wideband / Fullband handsfree and conferencing terminals from a QoS perspective as perceived by the user".
- [38] Void.
- [39] Void.
- [40] Void.
- [41] ETSI TS 103 281: "Speech and multimedia Transmission Quality (STQ); Speech quality in the presence of background noise: Objective test methods for super-wideband and fullband terminals".
- [42] Recommendation ITU-T P.79: "Calculation of loudness ratings for telephone sets".
- [43] ETSI TS 126 071: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Mandatory speech CODEC speech processing functions; AMR speech Codec; General description (3GPP TS 26.071)".
- [44] ETSI TS 126 171: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; General description (3GPP TS 26.171)".
- [45] ETSI TS 126 441: "Universal Mobile Telecommunications System (UMTS); LTE; Codec for Enhanced Voice Services (EVS); General overview (3GPP TS 26.441)".
- [46] IETF RFC 6716: "Definition of the Opus Audio Codec".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] IETF RFC 791 (STD 5): "Internet Protocol".
- [i.2] IETF RFC 768 (STD 6): "User Datagram Protocol".
- [i.3] IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications".
- [i.4] Void.
- [i.5] ETSI TBR 010: "Digital Enhanced Cordless Telecommunications (DECT); General Terminal Attachment Requirements; Telephony Applications".
- [i.6] ETSI TR 101 178: "Digital Enhanced Cordless Telecommunications (DECT); A High Level Guide to the DECT Standardization".
- [i.7] ETSI ETR 043: "Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI); Services and facilities requirements specification".
- [i.8] ETSI ES 202 737: "Speech and multimedia Transmission Quality (STQ); Transmission requirements for narrowband VoIP terminals (handset and headset) from a QoS perspective as perceived by the user".
- [i.9] ETSI ES 202 738: "Speech and multimedia Transmission Quality (STQ); Transmission requirements for narrowband VoIP loudspeaking and handsfree terminals from a QoS perspective as perceived by the user".
- [i.10] ETSI ES 202 739: "Speech and multimedia Transmission Quality (STQ); Transmission requirements for wideband VoIP terminals (handset and headset) from a QoS perspective as perceived by the user".
- [i.11] ETSI ES 202 740: "Speech and multimedia Transmission Quality (STQ); Transmission requirements for wideband VoIP loudspeaking and handsfree terminals from a QoS perspective as perceived by the user".
- [i.12] ETSI I-ETS 300 245-6: "Integrated Services Digital Network (ISDN); Technical characteristics of telephony terminals; Part 6: Wideband (7 kHz), loudspeaking and hands free telephony".
- [i.13] Recommendation ITU-T G.113 (2007): "Transmission impairments due to speech processing".
- [i.14] Recommendation ITU-T G.107 (2009): "The E-model: a computational model for use in transmission planning".
- [i.15] Recommendation ITU-T G.108 (1999): "Application of the E-model: A planning guide".
- [i.16] Recommendation ITU-T G.109 (1999): "Definition of categories of speech transmission quality".
- [i.17] Recommendation ITU-T G.729: "Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction (CS-ACELP)".
- [i.18] Recommendation ITU-T G.101 (2003): "The transmission plan".
- [i.19] Recommendation ITU-T G.164 (1988): "Echo suppressors".
- [i.20] Recommendation ITU-T G.165 (1993): "Echo cancellers".
- [i.21] Recommendation ITU-T G.168 (2009): "Digital network echo cancellers".
- [i.22] IEEE 802.11™: "IEEE Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".
- [i.23] IEEE 802.3™: "IEEE Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications".
- [i.24] Recommendation ITU-T Y.1541: "Network performance objectives for IP-based services".

- [i.25] ETSI EG 202 396-3: "Speech and multimedia Transmission Quality (STQ); Speech quality performance in the presence of background noise; Part 3: Background noise transmission - Objective test methods".
- [i.26] Recommendation ITU-T P.310: "Transmission characteristics for narrow-band digital handset and headset telephones".
- [i.27] TIA-920.130-A: "Telecommunications Telephone Terminal Equipment Transmission Requirements for Wideband Digital Wireline Telephones with Headset".

koniec náhľadu – text ďalej pokračuje v platenej verzii STN