



SLOVENSKI STANDARD
oSIST prEN 300 175-8 V2.8.5:2022
01-marec-2022

**Digitalne izboljšane brezvrvične telekomunikacije (DECT) - Skupni vmesnik (CI) - 8.
del: Kodiranje in prenos govora in zvoka**

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

iTeh STANDARD
PREVIEW
(standards.itech.ai)

Ta slovenski standard je istoveten z: ETSI EN 300 175-8 V2.8.5 (2021-12)

[oSIST prEN 300 175-8 V2.8.5:2022](https://standards.itech.ai/catalog/standards/sist/2a529b6d-53d4-45bd-9124-deb86e7a4ccf/osist-pren-300-175-8-v2-8-5-2022)

<https://standards.itech.ai/catalog/standards/sist/2a529b6d-53d4-45bd-9124-deb86e7a4ccf/osist-pren-300-175-8-v2-8-5-2022>

ICS:

33.070.30	Digitalne izboljšane brezvrvične telekomunikacije (DECT)	Digital Enhanced Cordless Telecommunications (DECT)
-----------	--	---

oSIST prEN 300 175-8 V2.8.5:2022 **en**

**iTeh STANDARD
PREVIEW
(standards.iteh.ai)**

[oSIST prEN 300 175-8 V2.8.5:2022](https://standards.iteh.ai/catalog/standards/sist/2a529b6d-53d4-45bd-9124-deb86e7a4ccf/osist-pren-300-175-8-v2-8-5-2022)

<https://standards.iteh.ai/catalog/standards/sist/2a529b6d-53d4-45bd-9124-deb86e7a4ccf/osist-pren-300-175-8-v2-8-5-2022>

Draft **ETSI EN 300 175-8** V2.8.5 (2021-12)



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

[oSIST prEN 300 175-8 V2.8.5:2022](https://standards.iteh.ai/catalog/standards/sist/2a529b6d-53d4-45bd-9124-deb86e7a4ccf/osist-pren-300-175-8-v2-8-5-2022)

<https://standards.iteh.ai/catalog/standards/sist/2a529b6d-53d4-45bd-9124-deb86e7a4ccf/osist-pren-300-175-8-v2-8-5-2022>

Reference

REN/DECT-00358

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 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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/CommitteeSupportStaff.aspx>

<https://standards.iteh.ai/catalog/standards/sist/2a529b6d-53d4-45>

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

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 2021.

All rights reserved.

Contents

Intellectual Property Rights	17
Foreword.....	17
Modal verbs terminology.....	17
1 Scope	18
2 References	18
2.1 Normative references	18
2.2 Informative references.....	20
3 Definition of terms, symbols and abbreviations.....	22
3.1 Terms.....	22
3.2 Symbols.....	24
3.3 Abbreviations	24
4 Configurations	26
4.1 Reference configuration	26
4.1.1 Basic configuration	26
4.1.2 Portable Part (PP)	27
4.1.2.1 Functional organization.....	27
4.1.2.2 Volume control	28
4.1.3 Fixed Part (FP).....	28
4.1.3.1 Digital interface.....	28
4.1.3.2 Analog interface	29
4.1.3.3 FP adaptive volume control	30
4.1.3.4 Voice over IP (VoIP) interface.....	30
4.2 Test configurations	31
5 Encoding.....	31
5.0 General	31
5.1 32 kbit/s full term (ADPCM) G.726.....	31
5.1.1 Algorithm.....	31
5.1.2 Bit sequence.....	31
5.1.3 Characteristics of G.726 ADPCM codec.....	31
5.2 64 kbit/s PCM G.711.....	32
5.2.1 Algorithm.....	32
5.2.2 Bit sequence.....	32
5.2.3 Characteristics of G.711 PCM codec.....	32
5.2.4 Automatic detection of FAX/modem tone and switch to G.711.....	32
5.3 Wideband speech codec G.722 at 64 kbit/s.....	32
5.3.0 General.....	32
5.3.1 Algorithm.....	32
5.3.2 Bit sequence.....	33
5.3.3 Characteristics of G.722 wideband codec.....	33
5.3.4 Optional Packet Loss Concealment algorithm (PLC).....	33
5.4 Wideband speech codec G.729.1 up to 32 kbit/s.....	34
5.4.1 Algorithm.....	34
5.4.2 Bit sequence.....	34
5.4.3 Characteristics of G.729.1 codec	34
5.4.4 Packet Loss Concealment algorithm (PLC).....	34
5.4.5 Supported bit rate in DECT	35
5.5 Super-wideband MPEG-4 speech and audio coding	35
5.5.1 Algorithm.....	35
5.5.2 64 kbit/s, MPEG-4 ER AAC-LD codec.....	35
5.5.3 32 kbit/s, MPEG-4 ER AAC-LD codec.....	36
5.6 Narrowband, wideband, super-wideband, fullband, FBHR and ultra-band LC3plus speech and audio coding.....	36
5.6.1 Algorithm.....	36
5.6.2 NB mode at 32 kbit/s gross bit rate and 10 ms frame size	37

5.6.3	WB mode at 32 kbit/s gross bit rate and 10 ms frame size	37
5.6.4	SWB mode at 64 kbit/s gross bit rate and 10 ms frame size	38
5.6.5	FB mode at 64 kbit/s gross bit rate and 10 ms frame size	38
5.6.6	FB mode at 96 kbit/s gross bit rate and 10 ms frame size	38
5.6.7	FB mode at 128 kbit/s gross bit rate and 10 ms frame size	39
5.6.8	FB mode at 128 kbit/s gross bit rate and 5 ms frame size	39
5.6.9	FB mode at 160 kbit/s gross bit rate and 5 ms frame size	39
5.6.10	FB mode at 192 kbit/s gross bit rate and 5 ms frame size	40
5.6.11	FB mode at 128 kbit/s gross bit rate and 2,5 ms frame size	40
5.6.12	FB mode at 256 kbit/s gross bit rate and 2,5 ms frame size	40
5.6.13	FBLFE mode at 32 kbit/s gross bit rate and 10 ms frame size	40
5.6.14	FBLFE mode at 64 kbit/s gross bit rate and 5 ms frame size	41
5.6.15	FB stereo mode at 128 kbit/s gross bit rate and 10 ms frame size	41
5.6.16	FB stereo mode at 256 kbit/s gross bit rate and 5 ms frame size	41
5.6.17	FB stereo mode at 320 kbit/s gross bit rate and 2,5 ms frame size	41
5.6.18	FB stereo mode at 512 kbit/s gross bit rate and 2,5 ms frame size	42
5.6.19	FBHR mode at 128 kbit/s gross bit rate and 10 ms frame size	42
5.6.20	FBHR mode at 160 kbit/s gross bit rate and 10 ms frame size	42
5.6.21	FBHR mode at 192 kbit/s gross bit rate and 10 ms frame size	42
5.6.22	UBHR mode at 160 kbit/s gross bit rate and 10 ms frame size	43
5.6.23	UBHR mode at 192 kbit/s gross bit rate and 10 ms frame size	43
5.6.24	UBHR mode at 256 kbit/s gross bit rate and 10 ms frame size	43
5.6.25	UBHR mode at 320 kbit/s gross bit rate and 10 ms frame size	43
6	Transmission aspects	44
6.1	Relative level	44
6.2	Acoustic reference level	44
6.3	Volume control	44
7	Audio specifications	44
7.1	Overall description	44
7.1.1	Introduction to DECT audio specifications	44
7.1.2	Introduction to the audio types	44
7.1.3	List of Audio types	45
7.1.4	Audio types for Portable Parts	46
7.1.5	Audio types for Fixed Parts	47
7.1.6	Complete DECT system	47
7.1.7	Structure of the specification of the audio types	48
7.1.8	Audio Types and codecs	56
7.1.9	Audio Types and physical interfaces	56
7.2	Audio types applicable to Portable Parts	56
7.2.0	General	56
7.2.1	Performance levels of DECT Portable Parts (handsets)	56
7.2.2	Type 0: Reference PP (RePP)	58
7.2.3	PP Type 1a: "Classic" GAP narrowband handset	58
7.2.3.1	Introduction	58
7.2.3.2	Compatible services and codecs	58
7.2.3.3	Specification	58
7.2.4	PP Type 1b: "Improved" GAP narrowband handset	59
7.2.4.1	Introduction	59
7.2.4.2	Compatible services and codecs	59
7.2.4.3	Specification	59
7.2.5	PP Type 1c: HATS-tested "standard" narrowband handset	59
7.2.5.1	Introduction	59
7.2.5.2	Compatible services and codecs	59
7.2.5.3	Specification	59
7.2.6	PP Type 1d: HATS-tested "improved" narrowband handset	60
7.2.6.1	Introduction	60
7.2.6.2	Compatible services and codecs	60
7.2.6.3	Specification	60
7.2.7	PP Type 3a: HATS tested narrowband "standard" loudspeaking handsfree	60
7.2.7.1	Introduction	60

7.2.7.2	Compatible services and codecs.....	61
7.2.7.3	Specification.....	61
7.2.8	PP Type 3b: HATS tested narrowband "improved" loudspeaking handsfree.....	61
7.2.8.1	Introduction.....	61
7.2.8.2	Compatible services and codecs.....	61
7.2.8.3	Specification.....	61
7.2.9	PP Type 2a: P.311-tested wideband handset.....	61
7.2.9.1	Introduction.....	61
7.2.9.2	Compatible services and codecs.....	61
7.2.9.3	Specification.....	61
7.2.10	PP Type 2b: HATS-tested "standard" wideband handset or headset.....	62
7.2.10.1	Introduction.....	62
7.2.10.2	Compatible services and codecs.....	62
7.2.10.3	Specification.....	62
7.2.11	PP Type 2c: HATS tested "improved" wideband handset or headset.....	62
7.2.11.1	Introduction.....	62
7.2.11.2	Compatible services and codecs.....	62
7.2.11.3	Specification.....	62
7.2.12	PP Type 4a: HATS tested wideband "standard" loudspeaking handsfree.....	63
7.2.12.1	Introduction.....	63
7.2.12.2	Compatible services and codecs.....	63
7.2.12.3	Specification.....	63
7.2.13	PP Type 4b: HATS tested wideband "improved" loudspeaking and handsfree.....	63
7.2.13.1	Introduction.....	63
7.2.13.2	Compatible services and codecs.....	63
7.2.13.3	Specification.....	63
7.2.14	PP Type 5a: super-wideband 14 kHz handset or headset.....	64
7.2.14.1	Introduction.....	64
7.2.14.2	Compatible services and codecs.....	64
7.2.14.3	Specification.....	64
7.2.15	PP Type 5b: super-wideband 14 kHz loudspeaking handsfree.....	64
7.2.15.1	Introduction.....	64
7.2.15.2	Compatible services and codecs.....	64
7.2.15.3	Specification.....	64
7.2.16	PP Type 6: PPs with external 2 wire, 3,1 kHz telephony interface.....	64
7.2.16.1	Introduction.....	64
7.2.16.2	Compatible services and codecs.....	64
7.2.16.3	Specification.....	64
7.2.17	PP Type 7a: fullband 20 kHz handset or headset.....	64
7.2.17.1	Introduction.....	64
7.2.17.2	Compatible services and codecs.....	65
7.2.17.3	Specification.....	65
7.2.18	PP Type 7b: fullband 20 kHz loudspeaking handsfree.....	65
7.2.18.1	Introduction.....	65
7.2.18.2	Compatible services and codecs.....	65
7.2.18.3	Specification.....	65
7.2.19	PP Type 7c, d, e, f: fullband 20 kHz stereo audio device.....	65
7.2.19.1	Introduction.....	65
7.2.19.2	Compatible services and codecs.....	65
7.2.19.3	Specification.....	65
7.2.20	PP Type 7g: FBHR 24 kHz headset device.....	66
7.2.20.1	Introduction.....	66
7.2.20.2	Compatible services and codecs.....	66
7.2.20.3	Specification.....	66
7.2.21	PP Type 7h: FBHR 24 kHz loudspeaking device.....	66
7.2.21.1	Introduction.....	66
7.2.21.2	Compatible services and codecs.....	66
7.2.21.3	Specification.....	66
7.2.22	PP Type 7i: FBLFE 250 Hz loudspeaking device.....	66
7.2.22.1	Introduction.....	66
7.2.22.2	Compatible services and codecs.....	66
7.2.22.3	Specification.....	66

7.2.23	PP Type 7j: fullband 20 kHz low-latency microphone device.....	66
7.2.23.1	Introduction.....	66
7.2.23.2	Compatible services and codecs.....	66
7.2.23.3	Specification.....	67
7.2.24	PP type 8a: ultra-band 48 kHz headset device.....	67
7.2.24.1	Introduction.....	67
7.2.24.2	Compatible services and codecs.....	67
7.2.24.3	Specification.....	67
7.2.25	PP type 8b: ultra-band 48 kHz loudspeaking device.....	67
7.2.25.1	Introduction.....	67
7.2.25.2	Compatible services and codecs.....	67
7.2.25.3	Specification.....	67
7.3	Audio transmission types applicable to Fixed Parts.....	67
7.3.0	General.....	67
7.3.1	FP Type 0: Reference FP (ReFP).....	68
7.3.2	FP Type 1a: "classical" Fixed Part for ISDN Network.....	68
7.3.2.1	Introduction.....	68
7.3.2.2	Compatible services and codecs.....	68
7.3.2.3	Specifications.....	69
7.3.2.3.1	Transcoding and equalization.....	69
7.3.2.3.2	PP type detection.....	69
7.3.2.3.3	Activation of audio processing functions.....	69
7.3.2.3.4	Transmission specification.....	69
7.3.3	FP Type 1b: Fixed Part for ISDN Network.....	70
7.3.3.1	Introduction.....	70
7.3.3.2	Compatible services and codecs.....	70
7.3.3.3	Specification.....	70
7.3.3.3.1	Transcoding and equalization.....	70
7.3.3.3.2	PP type detection.....	70
7.3.3.3.3	Activation of audio processing functions.....	71
7.3.3.3.4	Transmission specification.....	71
7.3.4	FP Type 2: FP with analog 2-wire interface, 3,1 kHz service.....	71
7.3.4.1	Introduction.....	71
7.3.4.2	Compatible services, physical interfaces and codecs.....	71
7.3.4.3	Specification.....	72
7.3.4.3.1	Transcoding, equalization and conversion.....	72
7.3.4.3.2	PP type detection and activation of audio processing functions.....	72
7.3.4.3.3	Transmission specification.....	72
7.3.5	FP Type 3: VoIP narrowband Fixed Part.....	72
7.3.5.1	Introduction.....	72
7.3.5.2	Compatible services, physical interfaces and codecs.....	72
7.3.5.3	Specification.....	73
7.3.5.3.1	Transcoding and equalization.....	73
7.3.5.3.2	PP type detection.....	73
7.3.5.3.3	Activation of audio processing functions.....	74
7.3.5.3.4	Transmission specification.....	74
7.3.6	FP Type 4: ISDN wideband Fixed Part.....	74
7.3.6.1	Introduction.....	74
7.3.6.2	Compatible services and codecs.....	74
7.3.6.3	Specification.....	75
7.3.6.3.1	Transcoding and equalization.....	75
7.3.6.3.2	PP type detection.....	75
7.3.6.3.3	Activation of audio processing functions.....	75
7.3.6.3.4	Transmission specification.....	75
7.3.7	FP Type 5: VoIP wideband, super-wideband, FBHR, fullband or ultra-band Fixed Part.....	76
7.3.7.1	Introduction.....	76
7.3.7.2	Compatible services, physical interfaces and codecs.....	76
7.3.7.3	Specification.....	76
7.3.7.3.1	Transcoding and equalization.....	76
7.3.7.3.2	PP type detection.....	77
7.3.7.3.3	Activation of audio processing functions.....	77
7.3.7.3.4	Transmission specification.....	77

7.3.8	FP Type 6a: FP handling an Internal call inside a DECT FP (any service)	78
7.3.8.1	Introduction	78
7.3.8.2	Compatible services, physical interfaces and codecs	78
7.3.8.3	Specification.....	78
7.3.9	FP Type 6b: FP handling an n-party conference inside a DECT FP (any service)	78
7.3.9.1	Introduction	78
7.3.9.2	Compatible services, physical interfaces and codecs	78
7.3.9.3	Specification for the conference bridge.....	78
7.3.10	FP Type 7: DECT Repeater Part (REP).....	79
7.3.10.1	Introduction	79
7.3.10.2	Compatible services, physical interfaces and codecs	79
7.3.10.3	Specification.....	79
7.4	Additional features	79
7.4.1	Introduction.....	79
7.4.2	Echo canceller in Fixed Part	80
7.4.3	Echo suppressor in Fixed Part.....	80
7.5	Transmission characteristics for Portable Parts	81
7.5.1	Transmission characteristics for Portable Part type 1a ("Classic GAP" handset)	81
7.5.1.1	PP frequency responses.....	81
7.5.1.1.1	Sending	81
7.5.1.1.2	Receiving.....	81
7.5.1.2	PP sending and receiving loudness ratings.....	82
7.5.1.2.1	Nominal values	82
7.5.1.2.2	User-controlled volume control in PP	82
7.5.1.2.3	PP adaptive volume control.....	83
7.5.1.3	Sidetone.....	83
7.5.1.3.1	Talker sidetone	83
7.5.1.3.2	Listener sidetone.....	83
7.5.1.4	Terminal coupling loss	84
7.5.1.4.1	Weighted Terminal Coupling Loss (TCLw).....	84
7.5.1.4.2	Stability loss	84
7.5.1.5	Distortion	85
7.5.1.5.1	Sending.....	85
7.5.1.5.2	Receiving	85
7.5.1.5.3	Sidetone	85
7.5.1.6	Out-of-band signals	85
7.5.1.6.1	Sending (discrimination against out of band input signals).....	85
7.5.1.6.2	Receiving (spurious out of band signals).....	86
7.5.1.7	Noise	86
7.5.1.7.1	Sending.....	86
7.5.1.7.2	Band-limited noise.....	86
7.5.1.7.3	Receiving.....	86
7.5.1.7.4	Level of sampling frequency (receiving).....	86
7.5.1.8	Acoustic shock	87
7.5.1.8.0	General	87
7.5.1.8.1	Continuous signal	87
7.5.1.8.2	Peak signal.....	87
7.5.1.9	PP Delay.....	87
7.5.1.10	PP ambient noise rejection	87
7.5.2	Additional requirements for PP type 1b ("improved GAP" handset)	87
7.5.2.0	General	87
7.5.2.1	Terminal coupling loss	88
7.5.2.1.1	Weighted Terminal Coupling Loss (TCLw).....	88
7.5.2.2	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	88
7.5.2.3	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	88
7.5.2.4	Activation in Sending Direction.....	89
7.5.2.5	Activation in Receiving Direction.....	89
7.5.3	Transmission characteristics for PP types 1c and 1d (HATS tested, narrowband telephony handsets).....	90
7.5.3.1	Frequency responses	90
7.5.3.1.1	Sending.....	90
7.5.3.1.2	Receiving.....	91
7.5.3.2	Sending and receiving loudness ratings	93

7.5.3.2.1	Nominal values	93
7.5.3.2.2	Void	93
7.5.3.2.3	Void	93
7.5.3.2.4	Microphone mute.....	94
7.5.3.2.5	Positional robustness	94
7.5.3.2.6	Send Loudness Level.....	94
7.5.3.2.7	Receive Loudness Level.....	94
7.5.3.3	Sidetone.....	95
7.5.3.3.1	Sidetone masking rating (STMR).....	95
7.5.3.3.2	Void	95
7.5.3.3.3	Sidetone delay	95
7.5.3.4	Terminal coupling loss.....	95
7.5.3.4.1	Terminal Coupling Loss weighted (TCLw).....	95
7.5.3.4.2	Stability loss	95
7.5.3.5	Distortion	96
7.5.3.5.1	Sending Distortion.....	96
7.5.3.5.2	Receiving Distortion.....	96
7.5.3.6	Out-of-band signals	96
7.5.3.6.1	Out-of-band Signals in Send direction	96
7.5.3.6.2	Out-of-band signals in receiving direction	97
7.5.3.7	Noise	97
7.5.3.7.1	Sending.....	97
7.5.3.7.2	Receiving.....	97
7.5.3.8	Acoustic shock	98
7.5.3.8.0	General	98
7.5.3.8.1	Continuous signal	98
7.5.3.8.2	Void.....	98
7.5.3.9	Delay	98
7.5.3.10	Void.....	98
7.5.3.11	Double Talk Performance	98
7.5.3.11.0	General	98
7.5.3.11.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	99
7.5.3.11.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	99
7.5.3.11.3	Detection of Echo Components during Double Talk	100
7.5.3.11.4	Minimum activation level and sensitivity of double talk detection	100
7.5.3.12	Switching characteristics.....	100
7.5.3.12.0	General	100
7.5.3.12.1	Activation in Sending Direction	101
7.5.3.12.2	Activation in Receiving Direction	101
7.5.3.12.3	Silence Suppression and Comfort Noise Generation.....	101
7.5.3.12.4	Performance in sending direction in the presence of background noise.....	101
7.5.3.12.5	Speech Quality in the Presence of Background Noise.....	102
7.5.3.12.6	Quality of Background Noise Transmission (with Far End Speech).....	102
7.5.3.12.7	Void	102
7.5.3.12.8	Positional Robustness of Speech Quality in the Presence of Background Noise	102
7.5.3.13	Quality of echo cancellation.....	103
7.5.3.13.0	General	103
7.5.3.13.1	Temporal echo effects	103
7.5.3.13.2	Spectral Echo Attenuation.....	103
7.5.3.13.3	Variable echo path.....	103
7.5.4	Transmission characteristics for PP types 3a and 3b (narrowband loudspeaking and handsfree devices).....	104
7.5.4.1	Sending sensitivity/frequency response	104
7.5.4.2	Receive sensitivity/frequency response.....	105
7.5.4.3	Send loudness rating	106
7.5.4.4	Receive loudness rating.....	107
7.5.4.5	Sending distortion	107
7.5.4.6	Receiving distortion	108
7.5.4.7	Out-of-band signals in sending direction	108
7.5.4.8	Out-of-band signals in receiving direction.....	109
7.5.4.9	Sending noise	109
7.5.4.10	Receiving noise	109

7.5.4.11	Terminal Coupling Loss weighted (TCLw)	109
7.5.4.12	Stability Loss.....	110
7.5.4.13	Double Talk Performance	110
7.5.4.13.0	General	110
7.5.4.13.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	110
7.5.4.13.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	111
7.5.4.13.3	Detection of Echo Components during Double Talk.....	111
7.5.4.13.4	Minimum activation level and sensitivity of double talk detection	112
7.5.4.14	Switching characteristics.....	112
7.5.4.14.0	General	112
7.5.4.14.1	Activation in Sending Direction	112
7.5.4.14.2	Activation in Receiving Direction.....	113
7.5.4.14.3	Silence Suppression and Comfort Noise Generation.....	113
7.5.4.14.4	Performance in sending direction in the presence of background noise	113
7.5.4.14.5	Speech Quality in the Presence of Background Noise.....	113
7.5.4.14.6	Quality of Background Noise Transmission (with Far End Speech).....	114
7.5.4.15	Quality of echo cancellation.....	114
7.5.4.15.0	General	114
7.5.4.15.1	Temporal echo effects	114
7.5.4.15.2	Spectral Echo Attenuation.....	114
7.5.4.15.3	Variable echo path.....	115
7.5.4.16	Microphone mute	115
7.5.4.17	Delay.....	115
7.5.4.18	Send Loudness Level	115
7.5.4.19	Receive Loudness Level.....	116
7.5.5	Transmission characteristics for PP type 2a (P.311 tested, wideband handset).....	116
7.5.5.0	General	116
7.5.5.1	Sending characteristics.....	117
7.5.5.1.1	Loudness rating	117
7.5.5.1.2	Sensitivity/frequency characteristics	117
7.5.5.1.3	Noise.....	117
7.5.5.1.4	Distortion.....	117
7.5.5.1.5	Discrimination against out-of-band input signals	117
7.5.5.2	Receiving characteristics.....	117
7.5.5.2.1	Loudness rating	117
7.5.5.2.2	Sensitivity/frequency characteristics	118
7.5.5.2.3	Noise.....	118
7.5.5.2.4	Distortion.....	118
7.5.5.2.5	Spurious out-of-band receiving signals	118
7.5.5.3	Sidetone characteristics	119
7.5.5.3.1	Talker sidetone	119
7.5.5.3.2	Sidetone distortion.....	119
7.5.5.4	Echo path loss characteristics.....	119
7.5.5.4.1	Weighted terminal coupling loss	119
7.5.5.4.2	Stability loss	119
7.5.6	Transmission characteristics for PP type 2b and 2c (HATS tested wideband handsets)	119
7.5.6.1	Frequency responses	119
7.5.6.1.1	Sending.....	119
7.5.6.1.2	Receiving.....	121
7.5.6.2	Send and receive loudness ratings.....	124
7.5.6.2.1	Nominal values	124
7.5.6.2.2	Void.....	124
7.5.6.2.3	Void.....	124
7.5.6.2.4	Microphone mute.....	124
7.5.6.2.5	Positional robustness	125
7.5.6.2.6	Send Loudness Level.....	125
7.5.6.2.7	Receive Loudness Level.....	125
7.5.6.3	Sidetone.....	125
7.5.6.3.1	Sidetone masking rating (STMR).....	125
7.5.6.3.2	Void.....	126
7.5.6.3.3	Sidetone delay	126
7.5.6.4	Terminal coupling loss.....	126

7.5.6.4.1	Terminal Coupling Loss (TCL).....	126
7.5.6.4.2	Stability loss	126
7.5.6.5	Distortion	127
7.5.6.5.1	Sending Distortion.....	127
7.5.6.5.2	Receiving Distortion.....	127
7.5.6.6	Noise	127
7.5.6.6.1	Sending.....	127
7.5.6.6.2	Receiving.....	128
7.5.6.7	Acoustic shock.....	128
7.5.6.7.0	General	128
7.5.6.7.1	Continuous signal	128
7.5.6.8	Delay.....	128
7.5.6.9	Void.....	129
7.5.6.10	Double talk Performance.....	129
7.5.6.10.0	General	129
7.5.6.10.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	129
7.5.6.10.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	130
7.5.6.10.3	Detection of Echo Components during Double Talk.....	130
7.5.6.10.4	Minimum activation level and sensitivity of double talk detection.....	131
7.5.6.11	Switching characteristics.....	131
7.5.6.11.0	General	131
7.5.6.11.1	Activation in Sending Direction.....	131
7.5.6.11.2	Activation in Receiving Direction.....	131
7.5.6.11.3	Silence Suppression and Comfort Noise Generation.....	131
7.5.6.11.4	Performance in Sending in the Presence of Background Noise.....	131
7.5.6.11.5	Speech Quality in the Presence of Background Noise.....	132
7.5.6.11.6	Quality of Background Noise Transmission (with Far End Speech).....	132
7.5.6.11.7	Void.....	133
7.5.6.11.8	Positional Robustness of Speech Quality in the Presence of Background Noise	133
7.5.6.12	Quality of echo cancellation.....	133
7.5.6.12.0	General	133
7.5.6.12.1	Temporal echo effects	133
7.5.6.12.2	Spectral Echo Attenuation.....	133
7.5.6.12.3	Variable echo path.....	134
7.5.6.13	Out-of-band signals.....	134
7.5.6.13.1	Out-of-band signals in sending direction.....	134
7.5.6.13.2	Out-of-band signals in receiving direction.....	134
7.5.7	Transmission characteristics for PP types 4a and 4b (HATS Tested wideband loudspeaking and handsfree devices).....	134
7.5.7.1	Sending sensitivity/frequency response	134
7.5.7.2	Receive sensitivity/frequency response.....	135
7.5.7.3	Send loudness rating	137
7.5.7.4	Receive loudness rating.....	138
7.5.7.5	Sending distortion	138
7.5.7.6	Receiving distortion	139
7.5.7.7	Out-of-band signals in sending direction	139
7.5.7.8	Out-of-band signals in receiving direction.....	140
7.5.7.9	Sending noise	140
7.5.7.10	Receiving noise.....	140
7.5.7.11	Terminal Coupling Loss.....	140
7.5.7.12	Stability Loss.....	141
7.5.7.13	Double Talk Performance	141
7.5.7.13.0	General	141
7.5.7.13.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	142
7.5.7.13.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	142
7.5.7.13.3	Detection of Echo Components during Double Talk.....	143
7.5.7.13.4	Minimum activation level and sensitivity of double talk detection.....	143
7.5.7.14	Switching characteristics.....	143
7.5.7.14.0	General	143
7.5.7.14.1	Activation in Sending Direction.....	144
7.5.7.14.2	Activation in Receiving Direction.....	144
7.5.7.14.3	Silence Suppression and Comfort Noise Generation.....	144

7.5.7.14.4	Performance in sending direction in the presence of background noise	144
7.5.7.14.5	Speech Quality in the Presence of Background Noise	145
7.5.7.14.6	Quality of Background Noise Transmission (with Far End Speech)	145
7.5.7.15	Quality of echo cancellation	145
7.5.7.15.1	Temporal echo effects	145
7.5.7.15.2	Spectral Echo Attenuation	145
7.5.7.15.3	Variable echo path	146
7.5.7.16	Microphone mute	146
7.5.7.17	Delay	146
7.5.7.18	Send Loudness Level	147
7.5.7.19	Receive Loudness Level	147
7.5.8	Transmission characteristics for PP type 5a ("super-wideband 14 kHz handset or headset")	148
7.5.8.1	Frequency responses	148
7.5.8.1.1	Sending	148
7.5.8.1.2	Receiving	149
7.5.8.2	Send and receive loudness ratings	150
7.5.8.2.1	Send Loudness Rating	150
7.5.8.2.2	Receive Loudness Rating	151
7.5.8.2.3	Send Loudness Level	152
7.5.8.2.4	Receive Loudness Level	152
7.5.8.3	Sidetone	152
7.5.8.3.1	Sidetone Masking Rating STMR (Mouth to ear)	152
7.5.8.3.2	Sidetone Delay	152
7.5.8.4	Terminal Coupling Loss	153
7.5.8.4.1	Unweighted Terminal Coupling Loss	153
7.5.8.4.2	Stability Loss	153
7.5.8.5	Distortion	153
7.5.8.5.1	Sending Distortion	153
7.5.8.5.2	Receiving Distortion	154
7.5.8.6	Noise	154
7.5.8.6.1	Sending	154
7.5.8.6.2	Receiving	154
7.5.8.7	Acoustic shock	155
7.5.8.7.0	General	155
7.5.8.7.1	Continuous signal	155
7.5.8.8	Delay	155
7.5.8.9	Double talk performance	155
7.5.8.9.0	General	155
7.5.8.9.1	Attenuation range in send direction during double talk $A_{H,S,dt}$	155
7.5.8.9.2	Attenuation range in receive direction during double talk $A_{H,R,dt}$	156
7.5.8.9.3	Detection of echo components during double talk	156
7.5.8.10	Switching Characteristics	157
7.5.8.10.0	Note	157
7.5.8.10.1	Activation in send direction	157
7.5.8.10.2	Silence suppression and comfort noise generation	157
7.5.8.10.3	Performance in Sending in the Presence of Background Noise	157
7.5.8.10.4	Speech quality in the presence of background noise	158
7.5.8.10.5	Positional Robustness of Speech Quality in the Presence of Background Noise	158
7.5.8.10.6	Quality of background noise transmission (with far end speech)	159
7.5.8.11	Quality of echo cancellation	159
7.5.8.11.1	Temporal echo effects	159
7.5.8.11.2	Spectral echo attenuation	159
7.5.8.11.3	Variable echo path	160
7.5.9	Transmission characteristics for PP type 5b ("super-wideband 14 kHz loudspeaking and handsfree devices")	160
7.5.9.1	Sending sensitivity/frequency response	160
7.5.9.2	Receive sensitivity/frequency response	161
7.5.9.2.1	Handheld terminal	161
7.5.9.2.2	Desktop terminal	161
7.5.9.2.3	Terminals intended to be used simultaneously by several users	162
7.5.9.3	Sending loudness rating	162

7.5.9.3.1	Nominal Value.....	162
7.5.9.3.2	Microphone mute.....	163
7.5.9.4	Receive loudness rating.....	163
7.5.9.5	Sending distortion	164
7.5.9.5.1	Signal to harmonic distortion versus frequency	164
7.5.9.5.2	Signal to harmonic distortion for higher input level	164
7.5.9.6	Receiving distortion	164
7.5.9.7	Sending noise	165
7.5.9.8	Receiving noise	165
7.5.9.9	Terminal Coupling Loss.....	166
7.5.9.9.1	Unweighted Terminal Coupling Loss.....	166
7.5.9.9.2	Stability Loss	166
7.5.9.10	Double Talk Performance	166
7.5.9.10.0	General	166
7.5.9.10.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	166
7.5.9.10.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	167
7.5.9.10.3	Detection of Echo Components during Double Talk.....	167
7.5.9.10.4	Minimum activation level and sensitivity of double talk detection	168
7.5.9.11	Switching characteristics.....	168
7.5.9.11.0	Note	168
7.5.9.11.1	Activation in Sending Direction	168
7.5.9.11.2	Silence Suppression and Comfort Noise Generation.....	168
7.5.9.11.3	Performance in sending direction in the presence of background noise.....	169
7.5.9.11.4	Speech Quality in the Presence of Background Noise.....	169
7.5.9.11.5	Quality of Background Noise Transmission (with Far End Speech).....	169
7.5.9.12	Quality of echo cancellation.....	170
7.5.9.12.1	Temporal echo effects	170
7.5.9.12.2	Spectral Echo Attenuation.....	170
7.5.9.12.3	Variable echo path.....	170
7.5.9.13	Delay	171
7.5.9.14	Send Loudness Level	171
7.5.9.15	Receive Loudness Level	171
7.5.10	Transmission characteristics for PP type 7a ("fullband 20 kHz handset or headset").....	172
7.5.10.1	Frequency responses	172
7.5.10.1.1	Sending	172
7.5.10.1.2	Receiving	173
7.5.10.2	Send and receive loudness ratings.....	175
7.5.10.2.1	Send Loudness Rating	175
7.5.10.2.2	Receive Loudness Rating	175
7.5.10.2.3	Send Loudness Level.....	176
7.5.10.2.4	Receive Loudness Level.....	176
7.5.10.3	Sidetone.....	176
7.5.10.3.1	Sidetone Masking Rating STMR (Mouth to ear).....	176
7.5.10.3.2	Sidetone Delay.....	177
7.5.10.4	Terminal Coupling Loss.....	177
7.5.10.4.1	Unweighted Terminal Coupling Loss.....	177
7.5.10.4.2	Stability Loss	177
7.5.10.5	Distortion	177
7.5.10.5.1	Sending Distortion.....	177
7.5.10.5.2	Receiving Distortion.....	178
7.5.10.6	Noise	178
7.5.10.6.1	Sending	178
7.5.10.6.2	Receiving.....	178
7.5.10.7	Acoustic shock	179
7.5.10.7.0	General	179
7.5.10.7.1	Continuous signal	179
7.5.10.8	Delay	179
7.5.10.9	Double talk Performance.....	179
7.5.10.9.0	General	179
7.5.10.9.1	Attenuation range in send direction during double talk $A_{H,S,dt}$	179
7.5.10.9.2	Attenuation range in receive direction during double talk $A_{H,R,dt}$	180

7.5.10.9.3	Detection of echo components during double talk	180
7.5.10.10	Switching Characteristics	181
7.5.10.10.0	Note	181
7.5.10.10.1	Activation in send direction.....	181
7.5.10.10.2	Silence suppression and comfort noise generation	181
7.5.10.10.3	Performance in Sending in the Presence of Background Noise.....	182
7.5.10.10.4	Speech quality in the presence of background noise	182
7.5.10.10.5	Positional Robustness of Speech Quality in the Presence of Background Noise	182
7.5.10.10.6	Quality of background noise transmission (with far end speech).....	183
7.5.10.11	Quality of echo cancellation.....	183
7.5.10.11.1	Temporal echo effects	183
7.5.10.11.2	Spectral echo attenuation.....	183
7.5.10.11.3	Variable echo path.....	184
7.5.11	Transmission characteristics for PP type 7b ("fullband 20 kHz loudspeaking and handsfree devices") ..	184
7.5.11.1	Sending sensitivity/frequency response	184
7.5.11.2	Receive sensitivity/frequency response.....	185
7.5.11.2.0	General	185
7.5.11.2.1	Handheld terminal	185
7.5.11.2.2	Desktop terminal	186
7.5.11.2.3	Terminals intended to be used simultaneously by several users.....	187
7.5.11.3	Sending loudness rating	187
7.5.11.3.1	Nominal Value.....	187
7.5.11.3.2	Microphone Mute	187
7.5.11.4	Receive loudness rating.....	188
7.5.11.5	Sending distortion	188
7.5.11.5.1	Signal to harmonic distortion versus frequency	188
7.5.11.5.2	Signal to harmonic distortion for higher input level	189
7.5.11.6	Receiving distortion	189
7.5.11.7	Sending noise	190
7.5.11.8	Receiving noise	190
7.5.11.9	Terminal Coupling Loss.....	190
7.5.11.9.1	Unweighted Terminal Coupling Loss.....	190
7.5.11.9.2	Stability Loss.....	190
7.5.11.10	Double Talk Performance	191
7.5.11.10.0	General	191
7.5.11.10.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	191
7.5.11.10.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	192
7.5.11.10.3	Detection of Echo Components during Double Talk.....	192
7.5.11.10.4	Minimum activation level and sensitivity of double talk detection.....	193
7.5.11.11	Switching characteristics.....	193
7.5.11.11.0	Note	193
7.5.11.11.1	Activation in Sending Direction	193
7.5.11.11.2	Silence Suppression and Comfort Noise Generation.....	193
7.5.11.11.3	Performance in sending direction in the presence of background noise.....	193
7.5.11.11.4	Speech Quality in the Presence of Background Noise.....	194
7.5.11.11.5	Quality of Background Noise Transmission (with Far End Speech).....	194
7.5.11.12	Quality of echo cancellation.....	195
7.5.11.12.1	Temporal echo effects	195
7.5.11.12.2	Spectral Echo Attenuation	195
7.5.11.12.3	Variable echo path.....	195
7.5.11.13	Delay	195
7.5.11.14	Send Loudness Level	195
7.5.11.15	Receive Loudness Level	196
7.5.12	Transmission characteristics for PP type 7c, d, e, f ("fullband 20 kHz stereo audio device")	196
7.5.13	Transmission characteristics for PP type 7g ("FBHR 24 kHz headset device")	196
7.5.14	Transmission characteristics for PP type 7h ("FBHR 24 kHz loudspeaking device").....	197
7.5.15	Transmission characteristics for PP type 7i ("FBLFE 250 Hz (LFE) loudspeaking device").....	197
7.5.16	Transmission characteristics for PP type 7j ("fullband 20 kHz low-latency microphone device")	197
7.5.17	Transmission characteristics for PP type 8a ("ultra-band 48 kHz headset device")	197
7.5.18	Transmission characteristics for PP type 8b ("ultra-band 48 kHz loudspeaking device").....	197
7.6	Transmission characteristics for Fixed Parts	197