

ETSI EN 300 176-2 V2.3.1 (2019-12)



Digital Enhanced Cordless Telecommunications (DECT); Test specification; Part 2: Audio and speech

iTeh STANDARD PREVIEW
(standards.iteh.ai)
Full standards catalog
https://standards.iteh.ai/catalog/standards/sis/60-6a2b-4519-a568-60cd3627d5b8/etsi-en-300-176-2-v2-3-1-2019-12

Reference

REN/DECT-00343

Keywords

7 kHz, audio, codec, DECT, handsfree, IMT-2000, loudspeaking, mobility, narrowband, quality, radio, regulation, speech, superwideband, TDD, TDMA, telephony, terminal, testing, voice, wideband

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	16
Foreword.....	16
Modal verbs terminology.....	17
1 Scope	18
2 References	19
2.1 Normative references	19
2.2 Informative references.....	22
3 Definition of terms, symbols and abbreviations.....	24
3.1 Terms.....	24
3.2 Symbols.....	27
3.3 Abbreviations	27
4 Interpretation of the measurement results	29
5 General test requirements	29
5.0 General	29
5.1 Test philosophy	30
5.1.1 Testable items	30
5.1.2 Testing of the codecs	30
5.1.3 Testing of the audio types.....	30
5.1.4 Devices with analog line interfaces	30
5.1.5 Equipment supporting an ETSI approved profile.....	30
5.1.6 Equipment not supporting an ETSI approved profile.....	31
5.1.7 Applicant's declaration.....	32
6 General testing conditions	32
6.1 Low noise room.....	32
6.2 Lower Tester (LT).....	32
6.2.1 Description.....	32
6.2.2 Connections between the EUT and the LT.....	32
6.2.3 Functions and abilities	33
6.2.4 Measurement uncertainty.....	33
6.3 Power and environment.....	33
6.3.1 Environment for tests.....	33
6.3.2 Power supply limitations	33
6.3.3 Power source.....	33
6.4 Test configurations	34
6.4.1 General.....	34
6.4.2 Testing a DECT system	34
6.4.3 Testing a separate PP or FP	34
6.4.4 Reference FP (ReFP) and Reference PP (RePP).....	35
6.5 Digital signal levels	36
6.5.1 Digital signal levels for codecs G.711 and G.726.....	36
6.6 General test conditions	36
6.7 Ideal codecs (for codecs G.726, G.711, G.722, G.729.1, MPEG-AAC and LC3plus).....	37
6.7.0 General.....	37
6.7.1 Ideal codec for codecs G.726, G.711 and LC3plus in NB mode	37
6.7.2 Ideal codec for codecs G.722, G.729.1, MPEG-4 and LC3plus (wideband mode)	38
6.7.3 Ideal codec for MPEG-4 or LC3plus (super-wideband mode)	39
6.7.4 Ideal codec for LC3plus in fullband mode.....	39
6.8 Electro-acoustical equipment	39
6.8.0 General.....	39
6.8.1 Artificial mouth and artificial ear	39
6.8.2 Head and Torso Simulator (HATS).....	39
6.9 Speech coding scheme.....	40
6.9.1 Requirement for speech coding algorithm	40

6.9.2	Applicant's declaration on speech coding algorithm.....	40
6.9.3	Requirement for the TAP in the FP	40
6.9.4	Applicant's declaration on the TAP in the FP	40
6.10	Test setup.....	40
6.10.1	Set up for handset type 1a or 1b.....	40
6.10.2	Set up for handset type 2a.....	40
6.10.3	Set up for handset or headset other than type 1a, 1b or 2a.....	41
6.10.3.0	Super-wideband and fullband applications	41
6.10.3.1	Positioning handset or headset	41
6.10.3.2	Position and calibration of HATS	41
6.10.4	Set up for hands-free measurements	42
6.10.4.0	Super-wideband and fullband applications	42
6.10.4.1	Positioning handsfree	43
6.10.4.2	Position and calibration of HATS	49
6.10.4.2.1	Sending.....	49
6.10.4.2.2	Receiving.....	49
6.10.5	Set up for measurements in loudspeaking mode.....	50
6.10.6	Setup for background noise simulation.....	50
6.10.7	Setup of variable echo path.....	51
6.10.8	Setup for testing positional robustness of handsets.....	53
7	Test of audio specifications.....	54
7.1	Overall description	54
7.1.1	Introduction to DECT audio specifications	54
7.1.2	Introduction to the audio types	54
7.1.3	List of Audio types	55
7.1.4	Audio types for Portable Parts	56
7.1.5	Audio types for Fixed Parts	57
7.1.6	Complete DECT system	57
7.1.7	Structure of the specification of the audio types.....	58
7.1.8	Audio Types and codecs.....	65
7.1.9	Audio Types and physical interfaces.....	65
7.2	Audio types applicable to Portable Parts.....	66
7.2.0	General.....	66
7.2.1	Performance levels of DECT Portable Parts (handsets).....	66
7.2.2	Type 0: Reference PP (RePP).....	67
7.2.3	PP Type 1a: "Classic" GAP narrowband handset.....	67
7.2.3.1	Introduction.....	67
7.2.3.2	Compatible services and codecs.....	67
7.2.3.3	Specification.....	68
7.2.4	PP Type 1b: "Improved" GAP narrowband handset.....	68
7.2.4.1	Introduction.....	68
7.2.4.2	Compatible services and codecs.....	68
7.2.4.3	Specification.....	68
7.2.5	PP Type 1c: HATS-tested "standard" narrowband handset.....	68
7.2.5.1	Introduction.....	68
7.2.5.2	Compatible services and codecs.....	68
7.2.5.3	Specification.....	69
7.2.6	PP Type 1d: HATS-tested "improved" narrowband handset.....	69
7.2.6.1	Introduction.....	69
7.2.6.2	Compatible services and codecs.....	69
7.2.6.3	Specification.....	69
7.2.7	PP Type 3a: HATS tested narrowband "standard" loudspeaking handsfree	69
7.2.7.1	Introduction.....	69
7.2.7.2	Compatible services and codecs.....	70
7.2.7.3	Specification.....	70
7.2.8	PP Type 3b: HATS tested narrowband "improved" loudspeaking handsfree	70
7.2.8.1	Introduction.....	70
7.2.8.2	Compatible services and codecs.....	70
7.2.8.3	Specification.....	70
7.2.9	PP Type 2a: P.311-tested wideband handset.....	70
7.2.9.1	Introduction.....	70

7.2.9.2	Compatible services and codecs.....	70
7.2.9.3	Specification.....	70
7.2.10	PP Type 2b: HATS-tested "standard" wideband handset	71
7.2.10.1	Introduction.....	71
7.2.10.2	Compatible services and codecs.....	71
7.2.10.3	Specification.....	71
7.2.11	PP Type 2c: HATS tested "improved" wideband handset or headset	71
7.2.11.1	Introduction.....	71
7.2.11.2	Compatible services and codecs.....	71
7.2.11.3	Specification.....	71
7.2.12	PP Type 4a: HATS tested wideband "standard" loudspeaking handsfree	72
7.2.12.1	Introduction.....	72
7.2.12.2	Compatible services and codecs.....	72
7.2.12.3	Specification.....	72
7.2.13	PP Type 4b: HATS tested wideband "improved" loudspeaking and handsfree	72
7.2.13.1	Introduction.....	72
7.2.13.2	Compatible services and codecs.....	72
7.2.13.3	Specification.....	73
7.2.14	PP Type 5a: super-wideband 14 kHz handset or headset.....	73
7.2.14.1	Introduction.....	73
7.2.14.2	Compatible services and codecs.....	73
7.2.14.3	Specification.....	73
7.2.15	PP Type 5b: super-wideband 14 kHz loudspeaking handsfree	73
7.2.15.1	Introduction.....	73
7.2.15.2	Compatible services and codecs.....	73
7.2.15.3	Specification.....	73
7.2.16	PP Type 6: PPs with external 2 wire, 3,1 kHz telephony interface.....	73
7.2.16.1	Introduction.....	73
7.2.16.2	Compatible services and codecs.....	73
7.2.16.3	Specification.....	73
7.2.17	PP Type 7a: fullband 20 kHz handset or headset.....	74
7.2.17.1	Introduction.....	74
7.2.17.2	Compatible services and codecs.....	74
7.2.17.3	Specification.....	74
7.2.18	PP Type 7b: fullband 20 kHz loudspeaking handsfree	74
7.2.18.1	Introduction.....	74
7.2.18.2	Compatible services and codecs.....	74
7.2.18.3	Specification.....	74
7.2.19	PP Type 7c, d, e: fullband 20 kHz stereo audio device.....	74
7.2.19.1	Introduction.....	74
7.2.19.2	Compatible services and codecs.....	74
7.2.19.3	Specification.....	74
7.3	Audio transmission types applicable to Fixed Parts.....	75
7.3.0	General.....	75
7.3.1	FP Type 0: Reference FP (ReFP).....	75
7.3.2	FP Type 1a: "classical" Fixed Part for ISDN Network	76
7.3.2.1	Introduction.....	76
7.3.2.2	Compatible services and codecs.....	76
7.3.2.3	Specifications	76
7.3.2.3.1	Transcoding and equalization	76
7.3.2.3.2	PP type detection	77
7.3.2.3.3	Activation of audio processing functions	77
7.3.2.3.4	Transmission specification	77
7.3.3	FP Type 1b: Fixed Part for ISDN Network	77
7.3.3.1	Introduction.....	77
7.3.3.2	Compatible services and codecs.....	77
7.3.3.3	Specification.....	78
7.3.3.3.1	Transcoding and equalization.....	78
7.3.3.3.2	PP type detection	78
7.3.3.3.3	Activation of audio processing functions	78
7.3.3.3.4	Transmission specification	79
7.3.4	FP Type 2: FP with analog 2-wire interface, 3,1 kHz service	79

7.3.4.1	Introduction.....	79
7.3.4.2	Compatible services, physical interfaces and codecs	79
7.3.4.3	Specification.....	79
7.3.4.3.1	Transcoding, equalization and conversion	79
7.3.4.3.2	PP type detection and activation of audio processing functions	79
7.3.4.3.3	Transmission specification	80
7.3.5	FP Type 3: VoIP narrowband Fixed Part.....	80
7.3.5.1	Introduction.....	80
7.3.5.2	Compatible services, physical interfaces and codecs	80
7.3.5.3	Specification.....	81
7.3.5.3.1	Transcoding and equalization	81
7.3.5.3.2	PP type detection	81
7.3.5.3.3	Activation of audio processing functions	81
7.3.5.3.4	Transmission specification	82
7.3.6	FP Type 4: ISDN wideband Fixed Part	82
7.3.6.1	Introduction.....	82
7.3.6.2	Compatible services and codecs.....	82
7.3.6.3	Specification.....	82
7.3.6.3.1	Transcoding and equalization	82
7.3.6.3.2	PP type detection	82
7.3.6.3.3	Activation of audio processing functions	83
7.3.6.3.4	Transmission specification	83
7.3.7	FP Type 5: VoIP wideband, super-wideband or fullband Fixed Part	83
7.3.7.1	Introduction.....	83
7.3.7.2	Compatible services, physical interfaces and codecs	84
7.3.7.3	Specification.....	84
7.3.7.3.1	Transcoding and equalization	84
7.3.7.3.2	PP type detection	84
7.3.7.3.3	Activation of audio processing functions	85
7.3.7.3.4	Transmission specification	85
7.3.8	FP Type 6a: FP handling an Internal call inside a DECT FP (any service)	85
7.3.8.1	Introduction.....	85
7.3.8.2	Compatible services, physical interfaces and codecs	85
7.3.8.3	Specification.....	86
7.3.9	FP Type 6b: FP handling an n-party conference inside a DECT FP (any service).....	86
7.3.9.1	Introduction.....	86
7.3.9.2	Compatible services, physical interfaces and codecs	86
7.3.9.3	Specification for the conference bridge.....	86
7.3.10	FP Type 7: DECT Repeater Part (REP).....	86
7.3.10.1	Introduction.....	86
7.3.10.2	Compatible services, physical interfaces and codecs	86
7.3.10.3	Specification.....	86
7.4	Additional features	87
7.4.1	Introduction.....	87
7.4.2	Echo canceller in Fixed Part	87
7.4.3	Echo suppressor in Fixed Part.....	88
7.5	Transmission characteristics for Portable Parts.....	89
7.5.1	Transmission characteristics for Portable Part type 1a ("Classic GAP" handset)	89
7.5.1.1	PP frequency responses.....	89
7.5.1.1.1	Sending.....	89
7.5.1.1.2	Receiving.....	90
7.5.1.2	PP sending and receiving loudness ratings.....	90
7.5.1.2.1	Nominal values.....	90
7.5.1.2.2	User-controlled volume control in PP	91
7.5.1.2.3	PP adaptive volume control.....	92
7.5.1.3	Sidetone.....	92
7.5.1.3.1	Talker sidetone	92
7.5.1.3.2	Listener sidetone.....	92
7.5.1.4	Terminal coupling loss.....	94
7.5.1.4.1	Weighted Terminal Coupling Loss (TCLw).....	94
7.5.1.4.2	Stability loss	95
7.5.1.5	Distortion	96

7.5.1.5.1	Sending.....	96
7.5.1.5.2	Receiving.....	96
7.5.1.5.3	Sidetone.....	97
7.5.1.6	Out of band signals.....	97
7.5.1.6.1	Sending (discrimination against out of band input signals).....	97
7.5.1.6.2	Receiving (spurious out of band signals).....	97
7.5.1.7	Noise.....	98
7.5.1.7.1	Sending.....	98
7.5.1.7.2	Band-limited noise.....	98
7.5.1.7.3	Receiving.....	98
7.5.1.7.4	Level of sampling frequency (receiving).....	99
7.5.1.8	Acoustic shock.....	99
7.5.1.8.1	Continuous signal.....	99
7.5.1.8.2	Peak signal.....	99
7.5.1.9	PP Delay.....	99
7.5.1.10	PP ambient noise rejection.....	101
7.5.2	Additional requirements for PP type 1b ("improved GAP" handset).....	101
7.5.2.0	General.....	101
7.5.2.1	Terminal coupling loss.....	101
7.5.2.1.1	Weighted Terminal Coupling Loss (TCLw).....	101
7.5.2.2	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	102
7.5.2.3	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	103
7.5.2.4	Activation in Sending Direction.....	104
7.5.2.5	Activation in Receiving Direction.....	105
7.5.3	Transmission characteristics for PP types 1c and 1d (HATS tested, narrowband telephony handsets).....	106
7.5.3.1	Frequency responses.....	106
7.5.3.1.1	Sending.....	106
7.5.3.1.2	Receiving.....	108
7.5.3.2	Sending and receiving loudness ratings.....	111
7.5.3.2.1	Nominal values.....	111
7.5.3.2.2	Void.....	112
7.5.3.2.3	Void.....	112
7.5.3.2.4	Microphone mute.....	112
7.5.3.2.5	Positional robustness.....	112
7.5.3.3	Sidetone.....	113
7.5.3.3.1	Sidetone masking rating (STMR).....	113
7.5.3.3.2	Void.....	113
7.5.3.3.3	Sidetone delay.....	113
7.5.3.4	Terminal coupling loss.....	114
7.5.3.4.1	Terminal Coupling Loss weighted (TCLw).....	114
7.5.3.4.2	Stability loss.....	114
7.5.3.5	Distortion.....	116
7.5.3.5.1	Sending Distortion.....	116
7.5.3.5.2	Receiving Distortion.....	116
7.5.3.6	Out of band signals.....	117
7.5.3.6.1	Out-of-Band Signals in Send direction.....	117
7.5.3.6.2	Out-of-band signals in receiving direction.....	117
7.5.3.7	Noise.....	118
7.5.3.7.1	Sending.....	118
7.5.3.7.2	Receiving.....	119
7.5.3.8	Acoustic shock.....	119
7.5.3.8.0	General.....	119
7.5.3.8.1	Continuous signal.....	119
7.5.3.8.2	Void.....	119
7.5.3.9	Delay.....	119
7.5.3.10	Void.....	120
7.5.3.11	Double Talk Performance.....	120
7.5.3.11.0	General.....	120
7.5.3.11.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	121
7.5.3.11.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	122
7.5.3.11.3	Detection of Echo Components during Double Talk.....	123
7.5.3.11.4	Minimum activation level and sensitivity of double talk detection.....	124

7.5.3.12	Switching characteristics.....	124
7.5.3.12.0	General	124
7.5.3.12.1	Activation in Sending Direction	125
7.5.3.12.2	Activation in Receiving Direction	125
7.5.3.12.3	Silence Suppression and Comfort Noise Generation.....	125
7.5.3.12.4	Performance in sending direction in the presence of background noise.....	126
7.5.3.12.5	Speech Quality in the Presence of Background Noise.....	126
7.5.3.12.6	Quality of Background Noise Transmission (with Far End Speech).....	127
7.5.3.12.7	Void	128
7.5.3.12.8	Positional Robustness of Speech Quality in the Presence of Background Noise	128
7.5.3.13	Quality of echo cancellation.....	128
7.5.3.13.0	General	128
7.5.3.13.1	Temporal echo effects	128
7.5.3.13.2	Spectral Echo Attenuation	129
7.5.3.13.3	Variable echo path.....	129
7.5.4	Transmission characteristics for PP types 3a and 3b (narrowband loudspeaking and handsfree devices).....	130
7.5.4.1	Sending sensitivity/frequency response	130
7.5.4.2	Receive sensitivity/frequency response.....	131
7.5.4.3	Send loudness rating	133
7.5.4.4	Receive loudness rating.....	134
7.5.4.5	Sending distortion	135
7.5.4.6	Receiving distortion	135
7.5.4.7	Out-of-band signals in sending direction	136
7.5.4.8	Out-of-band signals in receiving direction.....	136
7.5.4.9	Sending noise	137
7.5.4.10	Receiving noise.....	137
7.5.4.11	Terminal Coupling Loss weighted (TCLw).....	138
7.5.4.12	Stability Loss.....	138
7.5.4.13	Double Talk Performance	139
7.5.4.13.0	General	139
7.5.4.13.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	139
7.5.4.13.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	141
7.5.4.13.3	Detection of Echo Components during Double Talk.....	141
7.5.4.13.4	Minimum activation level and sensitivity of double talk detection.....	143
7.5.4.14	Switching characteristics.....	143
7.5.4.14.0	General	143
7.5.4.14.1	Activation in Sending Direction	143
7.5.4.14.2	Activation in Receiving Direction	144
7.5.4.14.3	Silence Suppression and Comfort Noise Generation.....	144
7.5.4.14.4	Performance in sending direction in the presence of background noise.....	144
7.5.4.14.5	Speech Quality in the Presence of Background Noise.....	145
7.5.4.14.6	Quality of Background Noise Transmission (with Far End Speech).....	146
7.5.4.15	Quality of echo cancellation.....	146
7.5.4.15.0	General	146
7.5.4.15.1	Temporal echo effects	146
7.5.4.15.2	Spectral Echo Attenuation	147
7.5.4.15.3	Variable echo path.....	148
7.5.4.16	Microphone mute	148
7.5.4.17	Delay.....	149
7.5.5	Transmission characteristics for PP type 2a (P.311 tested, wideband handset).....	149
7.5.5.0	General	149
7.5.5.1	Sending characteristics.....	149
7.5.5.1.1	Loudness rating	149
7.5.5.1.2	Sensitivity/frequency characteristics	150
7.5.5.1.3	Noise.....	150
7.5.5.1.4	Distortion.....	150
7.5.5.1.5	Discrimination against out-of-band input signals.....	150
7.5.5.2	Receiving characteristics.....	150
7.5.5.2.1	Loudness rating	150
7.5.5.2.2	Sensitivity/frequency characteristics	151
7.5.5.2.3	Noise.....	151

7.5.5.2.4	Distortion.....	151
7.5.5.2.5	Spurious out-of-band receiving signals	151
7.5.5.3	Sidetone characteristics	152
7.5.5.3.1	Talker sidetone	152
7.5.5.3.2	Sidetone distortion.....	152
7.5.5.4	Echo path loss characteristics.....	152
7.5.5.4.1	Weighted terminal coupling loss	152
7.5.5.4.2	Stability loss	152
7.5.6	Transmission characteristics for PP type 2b and 2c (HATS tested wideband handsets)	152
7.5.6.1	Frequency responses	152
7.5.6.1.1	Sending.....	152
7.5.6.1.2	Receiving.....	154
7.5.6.2	Send and receive loudness ratings.....	157
7.5.6.2.1	Nominal values.....	157
7.5.6.2.2	Void.....	159
7.5.6.2.3	Void.....	159
7.5.6.2.4	Microphone mute.....	159
7.5.6.2.5	Positional robustness	159
7.5.6.3	Sidetone.....	160
7.5.6.3.1	Sidetone masking rating (STMR).....	160
7.5.6.3.2	Void.....	160
7.5.6.3.3	Sidetone delay	160
7.5.6.4	Terminal coupling loss.....	161
7.5.6.4.1	Terminal Coupling Loss (TCL).....	161
7.5.6.4.2	Stability loss	162
7.5.6.5	Distortion	163
7.5.6.5.1	Sending Distortion.....	163
7.5.6.5.2	Receiving Distortion.....	164
7.5.6.6	Noise	164
7.5.6.6.1	Sending.....	164
7.5.6.6.2	Receiving.....	165
7.5.6.7	Acoustic shock.....	165
7.5.6.7.0	General	165
7.5.6.7.1	Continuous signal.....	165
7.5.6.8	Delay.....	166
7.5.6.9	Void.....	166
7.5.6.10	Double talk Performance.....	166
7.5.6.10.0	General	166
7.5.6.10.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	167
7.5.6.10.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	168
7.5.6.10.3	Detection of Echo Components during Double Talk.....	169
7.5.6.10.4	Minimum activation level and sensitivity of double talk detection.....	170
7.5.6.11	Switching characteristics.....	171
7.5.6.11.0	General	171
7.5.6.11.1	Activation in Sending Direction	171
7.5.6.11.2	Activation in Receiving Direction.....	171
7.5.6.11.3	Silence Suppression and Comfort Noise Generation.....	172
7.5.6.11.4	Performance in Sending in the Presence of Background Noise.....	172
7.5.6.11.5	Speech Quality in the Presence of Background Noise.....	172
7.5.6.11.6	Quality of Background Noise Transmission (with Far End Speech).....	173
7.5.6.11.7	Void.....	174
7.5.6.11.8	Positional Robustness of Speech Quality in the Presence of Background Noise	174
7.5.6.12	Quality of echo cancellation.....	174
7.5.6.12.0	General	174
7.5.6.12.1	Temporal echo effects	174
7.5.6.12.2	Spectral Echo Attenuation.....	175
7.5.6.12.3	Variable echo path.....	175
7.5.6.13	Out of band signals.....	176
7.5.6.13.1	Out-of-band signals in sending direction.....	176
7.5.6.13.2	Out-of-band signals in receiving direction	176
7.5.7	Transmission characteristics for PP types 4a and 4b (HATS Tested wideband loudspeaking and handsfree devices).....	177

7.5.7.1	Sending sensitivity/frequency response	177
7.5.7.2	Receive sensitivity/frequency response.....	178
7.5.7.3	Send loudness rating	180
7.5.7.4	Receive loudness rating.....	181
7.5.7.5	Sending distortion	182
7.5.7.6	Receiving distortion	182
7.5.7.7	Out-of-band signals in sending direction	183
7.5.7.8	Out-of-band signals in receiving direction.....	184
7.5.7.9	Sending noise	184
7.5.7.10	Receiving noise	185
7.5.7.11	Terminal Coupling Loss.....	185
7.5.7.12	Stability Loss.....	186
7.5.7.13	Double Talk Performance	187
7.5.7.13.0	General	187
7.5.7.13.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	187
7.5.7.13.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	189
7.5.7.13.3	Detection of Echo Components during Double Talk.....	189
7.5.7.13.4	Minimum activation level and sensitivity of double talk detection	191
7.5.7.14	Switching characteristics.....	191
7.5.7.14.0	General	191
7.5.7.14.1	Activation in Sending Direction	192
7.5.7.14.2	Activation in Receiving Direction	192
7.5.7.14.3	Silence Suppression and Comfort Noise Generation.....	192
7.5.7.14.4	Performance in sending direction in the presence of background noise.....	193
7.5.7.14.5	Speech Quality in the Presence of Background Noise.....	193
7.5.7.14.6	Quality of Background Noise Transmission (with Far End Speech).....	194
7.5.7.15	Quality of echo cancellation.....	195
7.5.7.15.1	Temporal echo effects	195
7.5.7.15.2	Spectral Echo Attenuation	195
7.5.7.15.3	Variable echo path.....	196
7.5.7.16	Microphone mute	196
7.5.7.17	Delay	196
7.5.8	Transmission characteristics for PP type 5a ("super-wideband 14 kHz handset or headset")	197
7.5.8.1	Frequency responses	197
7.5.8.1.1	Sending.....	197
7.5.8.1.2	Receiving.....	199
7.5.8.2	Send and receive loudness ratings.....	201
7.5.8.2.1	Send Loudness Rating	201
7.5.8.2.2	Receive Loudness Rating	202
7.5.8.3	Sidetone.....	203
7.5.8.3.1	Sidetone Masking Rating STMR (Mouth to ear).....	203
7.5.8.3.2	Sidetone Delay.....	204
7.5.8.4	Terminal Coupling Loss.....	204
7.5.8.4.1	Unweighted Terminal Coupling Loss.....	204
7.5.8.4.2	Stability Loss	205
7.5.8.5	Distortion	206
7.5.8.5.1	Sending Distortion.....	206
7.5.8.5.2	Receiving Distortion.....	207
7.5.8.6	Noise	208
7.5.8.6.1	Sending.....	208
7.5.8.6.2	Receiving.....	208
7.5.8.7	Acoustic shock	209
7.5.8.7.0	General	209
7.5.8.7.1	Continuous signal	209
7.5.8.8	Delay	209
7.5.8.9	Double talk Performance.....	211
7.5.8.9.0	General	211
7.5.8.9.1	Attenuation range in send direction during double talk $A_{H,S,dt}$	211
7.5.8.9.2	Attenuation range in receive direction during double talk $A_{H,R,dt}$	212
7.5.8.9.3	Detection of echo components during double talk	213
7.5.8.10	Switching Characteristics.....	215

7.5.8.10.0	Note	215
7.5.8.10.1	Activation in send direction.....	215
7.5.8.10.2	Silence suppression and comfort noise generation	215
7.5.8.10.3	Performance in Sending in the Presence of Background Noise.....	216
7.5.8.10.4	Speech quality in the presence of background noise	216
7.5.8.10.5	Positional Robustness of Speech Quality in the Presence of Background Noise	217
7.5.8.10.6	Quality of background noise transmission (with far end speech).....	217
7.5.8.11	Quality of echo cancellation.....	218
7.5.8.11.1	Temporal echo effects	218
7.5.8.11.2	Spectral echo attenuation.....	219
7.5.8.11.3	Variable echo path.....	219
7.5.9	Transmission characteristics for PP type 5b ("super-wideband 14 kHz loudspeaking and handsfree devices")	220
7.5.9.1	Sending sensitivity/frequency response	220
7.5.9.2	Receive sensitivity/frequency response.....	221
7.5.9.2.1	Handheld terminal	221
7.5.9.2.2	Desktop terminal	222
7.5.9.2.3	Terminals intended to be used simultaneously by several users.....	223
7.5.9.3	Sending loudness rating	223
7.5.9.3.1	Nominal Value.....	223
7.5.9.3.2	Microphone mute.....	223
7.5.9.4	Receive loudness rating.....	224
7.5.9.5	Sending distortion	225
7.5.9.5.1	Signal to harmonic distortion versus frequency	225
7.5.9.5.2	Signal to harmonic distortion for higher input level	226
7.5.9.6	Receiving distortion	226
7.5.9.7	Sending noise	227
7.5.9.8	Receiving noise	228
7.5.9.9	Terminal Coupling Loss.....	228
7.5.9.9.1	Unweighted Terminal Coupling Loss.....	228
7.5.9.9.2	Stability Loss	229
7.5.9.10	Double Talk Performance	230
7.5.9.10.0	General	230
7.5.9.10.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	230
7.5.9.10.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	231
7.5.9.10.3	Detection of Echo Components during Double Talk.....	232
7.5.9.10.4	Minimum activation level and sensitivity of double talk detection	234
7.5.9.11	Switching characteristics.....	234
7.5.9.11.0	Note	234
7.5.9.11.1	Activation in Sending Direction	234
7.5.9.11.2	Silence Suppression and Comfort Noise Generation.....	234
7.5.9.11.3	Performance in sending direction in the presence of background noise.....	235
7.5.9.11.4	Speech Quality in the Presence of Background Noise.....	235
7.5.9.11.5	Quality of Background Noise Transmission (with Far End Speech).....	236
7.5.9.12	Quality of echo cancellation.....	237
7.5.9.12.1	Temporal echo effects	237
7.5.9.12.2	Spectral Echo Attenuation	237
7.5.9.12.3	Variable echo path.....	238
7.5.9.13	Delay	238
7.5.10	Transmission characteristics for PP type 7a ("fullband 20 kHz handset or headset").....	240
7.5.10.1	Frequency responses	240
7.5.10.1.1	Sending	240
7.5.10.1.2	Receiving.....	242
7.5.10.2	Send and receive loudness ratings.....	244
7.5.10.2.1	Send Loudness Rating	244
7.5.10.2.2	Receive Loudness Rating	245
7.5.10.3	Sidetone.....	246
7.5.10.3.1	Sidetone Masking Rating STMR (Mouth to ear).....	246
7.5.10.3.2	Sidetone Delay.....	246
7.5.10.4	Terminal Coupling Loss.....	247
7.5.10.4.1	Unweighted Terminal Coupling Loss.....	247
7.5.10.4.2	Stability Loss	247

7.5.10.5	Distortion	249
7.5.10.5.1	Sending Distortion.....	249
7.5.10.5.2	Receiving Distortion.....	249
7.5.10.6	Noise	250
7.5.10.6.1	Sending.....	250
7.5.10.6.2	Receiving.....	251
7.5.10.7	Acoustic shock.....	251
7.5.10.7.0	General	251
7.5.10.7.1	Continuous signal	251
7.5.10.8	Delay.....	252
7.5.10.9	Double talk Performance.....	253
7.5.10.9.0	General	253
7.5.10.9.1	Attenuation range in send direction during double talk $A_{H,S,dt}$	254
7.5.10.9.2	Attenuation range in receive direction during double talk $A_{H,R,dt}$	255
7.5.10.9.3	Detection of echo components during double talk	255
7.5.10.10	Switching Characteristics.....	257
7.5.10.10.0	Note	257
7.5.10.10.1	Activation in send direction.....	258
7.5.10.10.2	Silence suppression and comfort noise generation	258
7.5.10.10.3	Performance in Sending in the Presence of Background Noise.....	258
7.5.10.10.4	Speech quality in the presence of background noise	259
7.5.10.10.5	Positional Robustness of Speech Quality in the Presence of Background Noise	260
7.5.10.10.6	Quality of background noise transmission (with far end speech).....	260
7.5.10.11	Quality of echo cancellation.....	261
7.5.10.11.1	Temporal echo effects	261
7.5.10.11.2	Spectral echo attenuation.....	261
7.5.10.11.3	Variable echo path.....	262
7.5.11	Transmission characteristics for PP type 7b ("fullband 20 kHz loudspeaking and handsfree devices") ..	262
7.5.11.1	Sending sensitivity/frequency response.....	262
7.5.11.2	Receive sensitivity/frequency response.....	263
7.5.11.2.0	General	263
7.5.11.2.1	Handheld terminal	264
7.5.11.2.2	Desktop terminal	264
7.5.11.2.3	Terminals intended to be used simultaneously by several users.....	266
7.5.11.3	Sending loudness rating	266
7.5.11.3.1	Nominal Value.....	266
7.5.11.3.2	Microphone Mute	266
7.5.11.4	Receive loudness rating.....	267
7.5.11.5	Sending distortion	268
7.5.11.5.1	Signal to harmonic distortion versus frequency	268
7.5.11.5.2	Signal to harmonic distortion for higher input level.....	269
7.5.11.6	Receiving distortion	269
7.5.11.7	Sending noise	270
7.5.11.8	Receiving noise	270
7.5.11.9	Terminal Coupling Loss.....	271
7.5.11.9.1	Unweighted Terminal Coupling Loss.....	271
7.5.11.9.2	Stability Loss	272
7.5.11.10	Double Talk Performance	272
7.5.11.10.0	General	272
7.5.11.10.1	Attenuation Range in Sending Direction during Double Talk $A_{H,S,dt}$	273
7.5.11.10.2	Attenuation Range in Receiving Direction during Double Talk $A_{H,R,dt}$	274
7.5.11.10.3	Detection of Echo Components during Double Talk.....	275
7.5.11.10.4	Minimum activation level and sensitivity of double talk detection	277
7.5.11.11	Switching characteristics.....	277
7.5.11.11.0	Note	277
7.5.11.11.1	Activation in Sending Direction	277
7.5.11.11.2	Silence Suppression and Comfort Noise Generation.....	277
7.5.11.11.3	Performance in sending direction in the presence of background noise	278
7.5.11.11.4	Speech Quality in the Presence of Background Noise.....	278
7.5.11.11.5	Quality of Background Noise Transmission (with Far End Speech).....	279
7.5.11.12	Quality of echo cancellation.....	280

7.5.11.12.1	Temporal echo effects	280
7.5.11.12.2	Spectral Echo Attenuation	280
7.5.11.12.3	Variable echo path	281
7.5.11.13	Delay	281
7.5.12	Transmission characteristics for PP type 7c, d, e ("fullband 20 kHz stereo audio device")	283
7.6	Transmission characteristics for Fixed Parts	283
7.6.1	Transmission characteristics for FP type 1a ("Classic" Fixed Part with ISDN Network interface, 3,1 kHz service)	283
7.6.1.1	Reduction of echo from PP	283
7.6.1.2	FP Network echo control	285
7.6.1.3	FP adaptive volume control	286
7.6.1.4	FP Delay	287
7.6.2	Transmission characteristics for FP type 1b ("new" Fixed Part with ISDN Network interface, 3,1 kHz service)	288
7.6.2.0	General	288
7.6.2.1	FP Network echo control	288
7.6.2.2	FP adaptive volume control	289
7.6.2.3	FP Delay	289
7.6.3	Transmission characteristics for FP type 2 (Fixed Part with analog 2-wire interface, 3,1 kHz service)	291
7.6.3.1	FP adaptive volume control	291
7.6.3.2	Network echo control	291
7.6.3.3	Additional requirements for DECT FP provided with a 2-wire PSTN interface	293
7.6.3.3.0	Test methods	293
7.6.3.3.1	General requirements	294
7.6.3.3.2	Speech performance characteristics	294
7.6.3.4	FP Delay	295
7.6.4	Transmission characteristics for FP type 3 (Fixed Part with VoIP interface, 3,1 kHz service)	296
7.6.4.1	Void	296
7.6.4.2	Void	296
7.6.4.3	Adaptive volume control	296
7.6.4.4	Clock accuracy	297
7.6.4.5	Send Jitter	297
7.6.4.6	Send and receive delay - round trip delay	298
7.6.5	Transmission characteristics for FP type 4 (Fixed Part with ISDN network interface, wideband service)	300
7.6.5.1	FP adaptive volume control	300
7.6.5.2	FP Delay	300
7.6.6	Transmission characteristics for FP type 5 (Fixed Part with VoIP interface, wideband, super-wideband or fullband service)	301
7.6.6.1	Void	301
7.6.6.2	Void	301
7.6.6.3	FP adaptive volume control	301
7.6.6.4	Clock accuracy	302
7.6.6.5	Send Jitter	302
7.6.6.6	Send and receive delay - round trip delay	303
8	Testing of the audio codecs	305
8.1	Test philosophy	305
8.2	Testing requirements for speech coding and packet loss concealment algorithms	305
8.2.1	G.726 ADPCM codec operating at 32 kbit/s	305
8.2.2	G.711 PCM codec operating at 64 kbit/s	305
8.2.3	G.722 wideband codec operating at 64 kbit/s	305
8.2.4	Packet loss Concealment (PLC) for codec G.722	306
8.2.5	G.729.1 wideband codec operating at 30 kbit/s with PLC algorithm	306
8.2.6	MPEG-4 ER AAC-LD super-wideband codec operating at 64 kbit/s	306
8.2.7	MPEG-4 ER AAC-LD wideband codec operating at 32 kbit/s	306
8.2.8	LC3plus narrowband, wideband, super-wideband, fullband codec operating at 32 and 64 kbit/s	306
9	Additional features	307
9.1	Loudspeaking hands-free and headset facilities	307
9.1.1	Loudspeaking hands-free facility	307
9.1.2	Headset facility	307