CTIA Speech Performance Recommendations

Version 2.1

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CTIA Certification Program

1400 16th Street, NW

Suite 600

Washington, DC 20036

certification@ctia.org

1.202.785.0081

www.ctia.org/certification

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Section 1   Introduction

1.1   Purpose

The purpose of this document is to recommend test methods for measuring the performance of 3GPP and 3GPP2 speech capable wireless devices, in both narrowband (NB) and wideband (WB) modes.

1.2   Scope

This document defines a set of standard test measurements, with associated test setup and test signal conditions for wideband and narrowband mode. Devices designed for LTE, GSM/UMTS and CDMA are recommended to be tested per the respective standard contained herein. Results are informative at this point.

1.3   Applicable Documents

The following documents are referenced in this test plan:

[1]   3GPP TS26.132 v14.1.0 (2017-06): 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Speech and video telephony terminal acoustic test specification (Release 14)

[2]   ETSI TS 103 106, v1.4.1 (2016-11): Speech and multimedia Transmission Quality (STQ): Speech quality performance in the presence of background noise: Background noise transmission for mobile terminals – objective test methods.

[3]   ETSI ES 202 396-1, v.1.7.1 (2017-08): Speech and multimedia Transmission Quality (STQ): Speech quality performance in the presence of background noise: Part 1: Background noise simulation technique and background noise database

[4]   3GPP2 C.S0056-A v.1.0 (2013-03): Electro-Acoustic Recommended Minimum Performance Specification for cdma2000 mobile stations

[5]   ITU-T Recommendation P.57 Ed. 6 (2011-12): Artificial Ears

[6]   ITU-T Recommendation P.58 Ed. 4 (2013-05): Head and torso simulator for telephonometry

[7]   ITU-T Recommendation P.64 Ed. 8 (2007-11): Determination of sensitivity/frequency characteristics of local telephone systems

[8]   ITU-T Recommendation P.380 Ed. 1 (2003-11): Electro-acoustic measurements on headsets

[9]   ITU-T Recommendation P.581 Ed. 3 (2014-02): Use of head and torso simulator (HATS) for hands-free and handset terminal testing

[10]   IEEE 269-2010: IEEE Standard Methods for Measuring Transmission Performance of Analog and Digital Telephone Sets, Handsets, and Headsets

[11]   3GPP TS 26.131 v14.1.0 (2017-06): 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Terminal acoustic characteristics for telephony; Requirements (Release 14)

[12]   ETSI TS 103 224 V1.3.1 (2017-07): A sound field reproduction method for terminal testing including a background noise database.

[13]   ITU-T P.381 Ed. 4 (2017-03): Technical requirements and test methods for the universal wired headset or headphone interface of digital mobile terminals

[14]   ITU-T Recommendation P.863 (09/2014): Perceptual objective listening quality assessment

[15]   ITU-T Recommendation P.863.1 (09/2014): Application guide for Recommendation ITU-T P.863

[16]   ETSI TS 103 334 V1.1.1 (2018-01): Speech and multimedia Transmission Quality (STQ); Transmission requirements for wearable wireless terminals from a QoS perspective as perceived by the user

1.4   Acronyms and Definitions

DRP – Drum Reference Point

ERP – Ear Reference Point

HATS – Head and Torso Simulator

HFRP – Hands Free Reference Position

MECRP – Manufacturer Ear Cap Reference Position

MRP – Mouth Reference Point

NB – Narrowband

SFR – Send Frequency Response

SLR – Sending Loudness Rating

SND – Sending or Transmit direction

SWB – Super-wideband

RCV – Receive direction

RFR – Receive Frequency Response

RLR – Receiving Loudness Rating

WB – Wideband

Section 2   Test Cases

2.1   Narrowband Test Cases

2.1.1   Test Cases for 3GPP and 3GPP2 Methods

Harmonization of 3GPP and 3GPP2 standards permits a common set of test methods, as listed in the tables below.

2.1.1.1   Handset Mode

TABLE 2.1-1 NARROWBAND HANDSET MODE TEST CASES AND APPLICABLE SETTINGS

Handset Narrowband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Appl. Force [N]	Document	Rev.	Sect.
NB-001[1]	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	nominal	8	3GPP TS 26.132	14.1.0	7.2.2.2
						3GPP2 C.S0056-A	1.0	2.1.2.2
NB-002[1] / NB-018	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	8 / 13	3GPP TS 26.132	14.1.0	7.2.2.2
						3GPP2 C.S0056-A	1.0	2.1.2.2
NB-003[1]	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	7.2.2.1
						3GPP2 C.S0056-A	1.0	2.2.2.2
NB-004[1]	Idle Channel Noise SND	n/a[2]	n/a	nominal	8	3GPP TS 26.132	14.1.0	7.3.1
						3GPP2 C.S0056-A	1.0	2.2.4.2
NB-005[1]	Idle Channel Noise RCV	n/a[2]	n/a	maximum	8	3GPP TS 26.132	14.1.0	7.3.2
						3GPP2 C.S0056-A	1.0	2.1.3.2
NB-006	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	8	3GPP TS 26.132	14.1.0	7.4.2
						3GPP2 C.S0056-A	1.0	2.1.1.2
NB-007	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	7.4.1
						3GPP2 C.S0056-A	1.0	2.2.1.2
NB-008[1]	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	2	3GPP TS 26.132	14.1.0	7.7.3
						3GPP2 C.S0056-A	1.0	2.2.3.2
NB-009	Quality in presence of ambient noise: SMOS, NMOS, GMOS	real speech	-1.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	7.12
		ETSI TS 103 106				3GPP2 C.S0056-A	1.0	2.7.2
NB-010[1]	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	7.10.3
NB-011						3GPP2 C.S0056-A	1.0	2.6.2
NB-012[1]	Max acoustic pressure	PeakLevel[3]	+3 dBm0	maximum	13	IEEE 269	2010	7.13.1
NB-013 / NB-014	STMR (Sidetone Masking Rating)	P.501 real speech	-4.7 dBPa	nominal, F = 8 / maximum, F = 13		3GPP TS 26.132	14.1.0	7.5.1.2
						3GPP2 C.S0056-A	1.0	2.5.1.2
NB-015	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	7.5.4
						3GPP2 C.S0056-A	1.0	2.5.2.2
NB-074	Delay and speech quality with packet jitter and loss[4]	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	7.10.4

Handset Narrowband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Appl. Force [N]	Document	Rev.	Sect.
NB-076	Speech Quality (reference condition)	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	7.10.4
	Note 1: If Device supports both UMTS and GSM mode, the Test IDs (marked with **1**) are to be performed and documented for both modes. **Note 2:** A test signal, such as CSS bursts, may have to be intermittently applied to prevent 'silent mode' operation of the MS. Such a test signal should be documented by the tester, if used. **Note 3:** The PeakLevel test signal from [4] is used for test case NB-012. **Note 4:** Test case for Voice over LTE only.							

2.1.1.2 Handheld Hands-free/Speakerphone Mode

TABLE 2.1-2 NARROWBAND HANDHELD HANDS-FREE/SPEAKERPHONE MODE TEST CASES AND APPLICABLE SETTINGS

HH Hands-free Narrowband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Distance	Document	Rev.	Sect.
NB-040	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	HFRP**1**	3GPP TS 26.132	14.1.0	7.2.4.2
						3GPP2 C.S0056-A	1.0	Note[2]
NB-041	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	HFRP**1**	3GPP TS 26.132	14.1.0	7.2.4.1
						3GPP2 C.S0056-A	1.0	Note[2]
NB-042	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	HFRP**1**	3GPP TS 26.132	14.1.0	7.4.6
						3GPP2 C.S0056-A	1.0	Note[2]
NB-043	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	HFRP**1**	3GPP TS 26.132	14.1.0	7.4.5
						3GPP2 C.S0056-A	1.0	Note[2]
NB-044	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	HFRP**1**	3GPP TS 26.132	14.1.0	7.7.2
						3GPP2 C.S0056-A	1.0	Note[2]
NB-075	Quality in presence of ambient noise: SMOS, NMOS, GMOS	real speech from TS 103 106	+1.3 dBPa	maximum	HFRP**1**	3GPP TS 26.132	14.1.0	7.12.2
	Note 1: See section 2.3.2 (Device positioning Handheld Hands-free / Speakerphone mode for HFRP acceptable value). **Note 2:** For 3GPP2 Test Cases; Handheld Hands-free mode is not in the scope of reference [4], and while testing should be carried out in a similar fashion and methodology as per reference [1], radio system setup shall be in compliance with reference [4].							

2.1.1.3 Headset Mode

TABLE 2.1-3 NARROWBAND HEADSET MODE TEST CASES AND APPLICABLE SETTINGS

Headset Narrowband Test Cases		Measurement Setup			Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Document	Rev.	Sect.

					3GPP TS 26.132	14.1.0	7.2.2.2
NB-060 / NB-061	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	nominal / maximum	3GPP2 C.S0056-A	1.0	**N**ote[2]
NB-062	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	7.2.2.1
					3GPP2 C.S0056-A	1.0	Note[2]
NB-063	Idle Channel Noise SND	n/a[1]	n/a	nominal	3GPP TS 26.132	14.1.0	7.3.1
					3GPP2 C.S0056-A	1.0	Note[2]
NB-064	Idle Channel Noise RCV	n/a[1]	n/a	maximum	3GPP TS 26.132	14.1.0	7.3.2
					3GPP2 C.S0056-A	1.0	Note[2]
NB-065	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	3GPP TS 26.132	14.1.0	7.4.2
					3GPP2 C.S0056-A	1.0	Note[2]
NB-066	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	7.4.1
					3GPP2 C.S0056-A	1.0	Note[2]
NB-067	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	3GPP TS 26.132	14.1.0	7.7.3
					3GPP2 C.S0056-A	1.0	Note[2]
NB-068	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	7.10.3
					3GPP2 C.S0056-A	1.0	Note[2]
NB-069 / NB-070	STMR (Sidetone Masking Rating)	P.501 real speech	-4.7 dBPa	nominal / maximum	3GPP TS 26.132	14.1.0	7.5.1.2
					3GPP2 C.S0056-A	1.0	Note[2]
NB-071	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	7.5.4
					3GPP2 C.S0056-A	1.0	Note[2]
	Note 1: A test signal, such as CSS bursts, may have to be intermittently applied to prevent 'silent mode' operation of the MS. Such a test signal should be documented by the tester, if used. **Note 2:** For 3GPP2 Test Cases; Headset mode is not in the scope of reference [4], and while testing should be carried out in a similar fashion and methodology as per reference [1], radio system setup shall be in compliance with reference [4].							

2.1.1.4 Headset Interface Mode

TABLE 2.1-4 NARROWBAND HEADSET INTERFACE MODE TEST CASES AND APPLICABLE SETTINGS

Headset Interface Narrowband Test Cases		Measurement Setup			Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Document	Rev.	Sect.
NB-080 / NB-081	Level in Receive for Nominal speech input level	P.501 real speech	-16 dBm0	nominal / maximum	ITU-T P.381	4	7.1.4
NB-082	Level in Send for Nominal speech input Level	P.501 real speech	-60 dBV	nominal	ITU-T P.381	4	7.1.3
NB-083	Noise in Send	n/a[1]	n/a	nominal	ITU-T P.381	4	7.1.11
NB-084	Noise in Receive	n/a[1]	n/a	nominal	ITU-T P.381	4	7.1.12
NB-085	Receiving frequency response	P.501 real speech	-16 dBm0	nominal	ITU-T P.381	4	7.1.8
NB-086	Sending frequency response	P.501 real speech	-60 dBV	nominal	ITU-T P.381	4	7.1.7
NB-087	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	ITU-T P.381	4	7.1.18
NB-088	Delay (Send + Receive) (ms)	single word	-60 dBV	nominal	ITU-T P.381	4	7.1.2
NB-089 / NB-090	Sidetone Loss STMR	P.501 real speech	-60 dBV	nominal / maximum	ITU-T P.381	4	7.1.9
NB-091	Sidetone delay	P.501 real speech	-60 dBV	nominal	ITU-T P.381	4	7.1.10
	Note 1: A test signal, such as CSS bursts, may have to be intermittently applied to prevent 'silent mode' operation of the MS. Such a test signal should be documented by the tester, if used. **Note 2:** For 3GPP2 Test Cases; Headset mode is not in the scope of reference [4], and while testing should be carried out in a similar fashion and methodology as per reference [1], radio system setup shall be in compliance with reference [4].						

2.1.1.5 Additional Test Cases, Handset and Headset, for 3GPP Methods

Two additional test cases for each of Handset and Headset are added for 3GPP methods only.

TABLE 2.1-5 NARROWBAND ADDITIONAL TEST CASES FOR 3GPP METHODS IN HANDSET AND HEADSET MODES

Handset/Headset Narrowband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Appl. Force [N]	Document	Rev.	Sect.
NB-016	Handset Distortion, SND	Sinusoidal	5, 0, -4.7, -10, -15, -20 dBPa	nominal	8	3GPP TS 26.132	14.1.0	7.8.1
NB-017	Handset Distortion, RCV	Sinusoidal + activation	0, -3, -10, -16, -20, -30, -40, -45 dBm0	nominal	8	3GPP TS 26.132	14.1.0	7.8.2
NB-072	Headset Distortion, SND	Sinusoidal	5, 0, -4.7, -10, -15, -20 dBPa	nominal	8	3GPP TS 26.132	14.1.0	7.8.1
NB-073	Headset Distortion, RCV	Sinusoidal+ activation	0, -3, -10, -16, -20, -30, -40, -45 dBm0	nominal	8	3GPP TS 26.132	14.1.0	7.8.2

2.1.1.6 Wrist-worn Wearables Mode

TABLE 2.1-6. NARROWBAND WRIST-WORN WEARABLES MODE TEST CASES AND APPLICABLE SETTINGS

Wearables Narrowband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Distance	Document	Rev.	Sect.
NB-077	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	HFRP[1]	3GPP TS 26.132	14.1.0	7.2.4.2
						3GPP2 C.S0056-A	1.0	Note[2]
NB-078	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dB Pa	nominal	HFRP[1]	3GPP TS 26.132	14.1.0	7.2.4.1
						3GPP2 C.S0056-A	1.0	Note[2]
NB-079	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	HFRP[1]	3GPP TS 26.132	14.1.0	7.4.6
						3GPP2 C.S0056-A	1.0	Note[2]
NB-092	SFR - Send frequency response	P.501 real speech	-4.7 dB Pa	nominal	HFRP[1]	3GPP TS 26.132	14.1.0	7.4.5
						3GPP2 C.S0056-A	1.0	Note[2]
NB-093	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	HFRP[1]	3GPP TS 26.132	14.1.0	7.7.2
						3GPP2 C.S0056-A	1.0	Note[2]
NB-094	Quality in presence of ambient noise: SMOS, NMOS, GMOS	Real speech	+1.3 dB Pa	maximum	HFRP[1]	3GPP TS 26.132	14.1.0	7.12.2
	Note 1: See section 2.4.4 (Device positioning Wrist-worn Wearables mode for HFRP acceptable value)							
	Note 2: For 3GPP2 Test Cases; Wearable Hands-free mode is not in the scope of reference [4], and while testing should be carried out in a similar fashion and methodology as per reference [1], radio system setup shall be in compliance with reference [4].							

2.1.2   Radio Networks and Codecs

For a device which supports narrowband functionality, testing shall be performed over UMTS Band II (1900 MHz) on AMR 12.2 kbps. The specific UMTS radio carrier frequency and channel number tested on shall be documented. In a device which supports both GSM and UMTS, Narrowband Test IDs in Table 2.1-1 marked with "1" shall be tested over GSM PCS band 1900 MHz on AMR 12.2 kbps.

Tests shall be performed for one of the channel pairs listed in the tables below.

TABLE 2.1-7. NARROWBAND UMTS RX AND TX TEST FREQUENCIES

Band	Channel Pair (UARFCN)	Designation	Frequency (MHz)
UMTS 1900 (3GPP BAND II)	9262	CH4-TX	1852.40
	9662	CH4-RX	1932.40
	9400	CH5-TX	1880.00
	9800	CH5-RX	1960.00
	9538	CH6-TX	1907.60
	9938	CH6-RX	1987.60

TABLE 2.1-8 NARROWBAND GSM RX AND TX TEST FREQUENCIES

Band	Channel Pair	Designation	Frequency (MHz)
GSM 1900 (PCS)	512	CH4-TX	1850.20
	512	CH4-RX	1930.20
	661	CH5-TX	1880.00
	661	CH5-RX	1960.00
	810	CH6-TX	1909.80
	810	CH6-RX	1989.80

For a device which supports CDMA, testing shall be performed using **EVRC-S03 8.55 kbps** in Radio Configuration 3 and, if supported, also using **EVRC-B-S068 6.6 kbps** *(Note: This does deviate from the C.S0056 standard).* Either cell band 850 MHz channel 384 **or** PCS band 1900 MHz channel 600 shall be used and documented accordingly.

Note: Test SIMs/PRLs in non-RF shielded environments may be required on any type of device and shall be documented.

2.2 Wideband Test Cases

2.2.1 Test Cases for 3GPP and 3GPP2 Methods

Harmonization of 3GPP and 3GPP2 standards permits a common set of test methods, as listed in the tables below.

2.2.1.1 Handset Mode

TABLE 2.2-1 WIDEBAND HANDSET MODE TEST CASES AND APPLICABLE SETTINGS

Handset Wideband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Appl. Force [N]	Document	Rev.	Sect.
WB-001[1]	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	nominal	8	3GPP TS 26.132	14.1.0	8.2.2.2
						3GPP2 C.S0056-A	1.0	2.1.2.2
WB-002[1] / WB-018	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	8 / 13	3GPP TS 26.132	14.1.0	8.2.2.2
						3GPP2 C.S0056-A	1.0	2.1.2.2
WB-003[1]	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	8.2.2.1
						3GPP2 C.S0056-A	1.0	2.2.2.2
WB-004[1]	Idle Channel Noise SND	n/a[2]	n/a	nominal	8	3GPP TS 26.132	14.1.0	8.3.1
						3GPP2 C.S0056-A	1.0	2.2.4.2
WB-005[1]	Idle Channel Noise RCV	n/a[2]	n/a	maximum	8	3GPP TS 26.132	14.1.0	8.3.2
						3GPP2 C.S0056-A	1.0	2.1.3.2
WB-006	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	8	3GPP TS 26.132	14.1.0	8.4.2
						3GPP2 C.S0056-A	1.0	2.1.1.2
WB-007	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	8.4.1
						3GPP2 C.S0056-A	1.0	2.2.1.2
WB-008[1]	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	2	3GPP TS 26.132	14.1.0	8.7.3
						3GPP2 C.S0056-A	1.0	2.2.3.2
WB-009	Quality in presence of ambient noise: SMOS, NMOS, GMOS	real speech / ETSI TS 103 106	-1.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	8.12
						3GPP2 C.S0056-A	1.0	2.7.2
WB-010[1]	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	8.10
WB-011						3GPP2 C.S0056-A	1.0	2.6.2
WB-012[1]	Max acoustic pressure	Peak Level[3]	+3 dBm0	maximum	13	IEEE 269	2010	7.13.1
WB-013 / WB-014	STMR (Sidetone Masking Rating)	P.501 real speech	-4.7 dBPa	nominal, F = 8 / maximum, F = 13		3GPP TS 26.132	14.1.0	8.5.1
						3GPP2 C.S0056-A	1.0	2.5.1.2
WB-015	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	8.5.4
						3GPP2 C.S0056-A	1.0	2.5.2.2
WB-074	Delay and speech quality with packet jitter and loss[4]	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	8.10.4
WB-076	Speech Quality (reference condition)	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	8.10.4

Handset Wideband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Appl. Force [N]	Document	Rev.	Sect.
WB-077	Bandwidth for Bandwidth Extension	P.501 real speech	-4.7 dBPa	nominal	8	ITU-T P.863.1 Suppl. 27	2017	7.2
	Note 1: If Device supports AMR-WB in both UMTS and LTE modes, in addition to covering all Test IDs in LTE mode, the Test IDs (marked with ¹) are to be performed and documented for UMTS mode as well. **Note 2:** A test signal, such as CSS bursts, may have to be intermittently applied to prevent 'silent mode' operation of the MS. Such a test signal should be documented by the tester, if used. **Note 3:** The PeakLevel test signal from [4] is used for test case WB-012. **Note 4:** Test case for Voice over LTE only.							

2.2.1.2   Handheld Handsfree / Speakerphone Mode

TABLE 2.2-2 WIDEBAND HANDHELD HANDSFREE / SPEAKERPHONE MODE TEST CASES AND APPLICABLE SETTINGS

HH Hands-free Wideband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Distance	Document	Rev.	Sect.
WB-040	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	HFRP¹	3GPP TS 26.132	14.1.0	8.2.4.2
						3GPP2 C.S0056-A	1.0	Note²
WB-041	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dB Pa	nominal	HFRP¹	3GPP TS 26.132	14.1.0	8.2.4.1
						3GPP2 C.S0056-A	1.0	Note²
WB-042	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	HFRP¹	3GPP TS 26.132	14.1.0	8.4.6
						3GPP2 C.S0056-A	1.0	Note²
WB-043	SFR - Send frequency response	P.501 real speech	-4.7 dB Pa	nominal	HFRP¹	3GPP TS 26.132	14.1.0	8.4.5
						3GPP2 C.S0056-A	1.0	Note²
WB-044	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	HFRP¹	3GPP TS 26.132	14.1.0	8.7.2
						3GPP2 C.S0056-A	1.0	Note²
WB-075	Quality in presence of ambient noise: SMOS, NMOS, GMOS	real speech from TS 103 106	+1.3 dBPa	maximum	HFRP¹	3GPP TS 26.132	14.1.0	8.12.2
	Note 1: See section 2.3.2 (Device positioning Handheld Hands-free / Speakerphone mode for HFRP acceptable value). **Note 2:** For 3GPP2 Test Cases; Handheld Hands-free mode is not in the scope of reference [4], and while testing should be carried out in a similar fashion and methodology as per reference [1], radio system setup shall be in compliance with reference [4].							

2.2.1.3 Headset Mode

TABLE 2.2-3 WIDEBAND HEADSET MODE TEST CASES AND APPLICABLE SETTINGS

Headset Wideband Test Cases		Measurement Setup			Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Document	Rev.	Sect.
WB-060 WB-061	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	nominal maximum	3GPP TS 26.132	14.1.0	8.2.2.2
					3GPP2 C.S0056-A	1.0	Note[2]
WB-062	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	8.2.2.1
					3GPP2 C.S0056-A	1.0	Note[2]
WB-063	Idle Channel Noise SND	n/a[1]	n/a	nominal	3GPP TS 26.132	14.1.0	8.3.1
					3GPP2 C.S0056-A	1.0	Note[2]
WB-064	Idle Channel Noise RCV	n/a[1]	n/a	maximum	3GPP TS 26.132	14.1.0	8.3.2
					3GPP2 C.S0056-A	1.0	Note[2]
WB-065	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	3GPP TS 26.132	14.1.0	8.4.2
					3GPP2 C.S0056-A	1.0	Note[2]
WB-066	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	8.4.1
					3GPP2 C.S0056-A	1.0	Note[2]
WB-067	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	3GPP TS 26.132	14.1.0	8.7.3
					3GPP2 C.S0056-A	1.0	Note[2]
WB-068	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	8.10.3
					3GPP2 C.S0056-A	1.0	Note[2]
WB-069 WB-070	STMR (Sidetone Masking Rating)	P.501 real speech	-4.7 dBPa	nominal maximum	3GPP TS 26.132	14.1.0	8.5.1.2
					3GPP2 C.S0056-A	1.0	Note[2]
WB-071	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	8.5.4
					3GPP2 C.S0056-A	1.0	Note[2]
	Note 1: A test signal, such as CSS bursts, may have to be intermittently applied to prevent 'silent mode' operation of the MS. Such a test signal should be documented by the tester, if used. **Note 2:** For 3GPP2 Test Cases; Handheld Hands-free mode is not in the scope of reference [4], and while testing should be carried out in a similar fashion and methodology as per reference [1], radio system setup shall be in compliance with reference [4].							

2.2.1.4 Headset Interface Mode

TABLE 2.2-4 WIDEBAND HEADSET INTERFACE MODE TEST CASES AND APPLICABLE SETTINGS

Headset Interface Wideband Test Cases		Measurement Setup			Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Document	Rev.	Sect.
WB-080 / WB-081	Level in Receive for Nominal speech input level	P.501 real speech	-16 dBm0	nominal / maximum	ITU-T P.381	4	7.1.4
WB-082	Level in Send for Nominal speech input Level	P.501 real speech	-60 dBV	nominal	ITU-T P.381	4	7.1.3
WB-083	Noise in Send	n/a[1]	n/a	nominal	ITU-T P.381	4	7.1.11
WB-084	Noise in Receive	n/a[1]	n/a	nominal	ITU-T P.381	4	7.1.12
WB-085	Receiving frequency response	P.501 real speech	-16 dBm0	nominal	ITU-T P.381	4	7.1.8
WB-086	Sending frequency response	P.501 real speech	-60 dBV	nominal	ITU-T P.381	4	7.1.7
WB-087	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	ITU-T P.381	4	7.1.18
WB-088	Delay (Send + Receive) (ms)	single word	-60 dBV	nominal	ITU-T P.381	4	7.1.2
WB-089 / WB-090	Sidetone Loss STMR	P.501 real speech	-60 dBV	nominal / maximum	ITU-T P.381	4	7.1.9
WB-091	Sidetone delay	P.501 real speech	-60 dBV	nominal	ITU-T P.381	4	7.1.10
	Note 1: A test signal, such as CSS bursts, may have to be intermittently applied to prevent 'silent mode' operation of the MS. Such a test signal should be documented by the tester, if used. **Note 2:** For 3GPP2 Test Cases; Headset mode is not in the scope of reference [4], and while testing should be carried out in a similar fashion and methodology as per reference [1], radio system setup shall be in compliance with reference [4].						

2.2.1.5 Additional Test Cases, Handset and Headset, for 3GPP Methods

Two additional test cases for each of Handset and Headset are added for 3GPP methods only.

Table 2.2-5 WIDEBAND ADDITIONAL TEST CASES FOR 3GPP METHODS IN HANDSET AND HEADSET MODES

Handset/Headset Wideband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Appl. Force [N]	Document	Rev.	Sect.
WB-016	Handset Distortion, SND	Sinusoidal	5, 0, -4.7, -10, -15, -20 dBPa	nominal	8	3GPP TS 26.132	14.1.0	8.8.1
WB-017	Handset Distortion, RCV	Sinusoidal + activation	0, -3, -10, -16, -20, -30, -40, -45 dBm0	nominal	8	3GPP TS 26.132	14.1.0	8.8.2
WB-072	Headset Distortion, SND	Sinusoidal	5, 0, -4.7, -10, -15, -20 dBPa	nominal	8	3GPP TS 26.132	14.1.0	8.8.1
WB-073	Headset Distortion, RCV	Sinusoidal+ activation	0, -3, -10, -16, -20, -30, -40, -45 dBm0	nominal	8	3GPP TS 26.132	14.1.0	8.8.2

2.2.1.6 Wrist-worn Wearables Mode

TABLE 2.2-6 WIDEBAND WRIST-WORN WEARABLES MODE TEST CASES AND APPLICABLE SETTINGS

Wearables Wideband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Distance	Document	Rev.	Sect.
WB-078	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	HFRP[1]	3GPP TS 26.132	14.1.0	8.2.4.2
						3GPP2 C.S0056-A	1.0	Note[2]
WB-079	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dB Pa	nominal	HFRP[1]	3GPP TS 26.132	14.1.0	8.2.4.1
						3GPP2 C.S0056-A	1.0	Note[2]
WB-092	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	HFRP[1]	3GPP TS 26.132	14.1.0	8.4.6
						3GPP2 C.S0056-A	1.0	Note[2]
WB-093	SFR - Send frequency response	P.501 real speech	-4.7 dB Pa	nominal	HFRP[1]	3GPP TS 26.132	14.1.0	8.4.5
						3GPP2 C.S0056-A	1.0	Note[2]
WB-094	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	HFRP[1]	3GPP TS 26.132	14.1.0	8.7.2
						3GPP2 C.S0056-A	1.0	Note[2]
WB-095	Quality in presence of ambient noise: SMOS, NMOS, GMOS	Real speech	+1.3 dB Pa	maximum	HFRP[1]	3GPP TS 26.132	14.1.0	8.12.2
	Note 1: See section 2.4.4 (Device positioning Wrist-worn Wearables mode for HFRP acceptable value)							
	Note 2: For 3GPP2 Test Cases; Wearable Hands-free mode is not in the scope of reference [4], and while testing should be carried out in a similar fashion and methodology as per reference [1], radio system setup shall be in compliance with reference [4].							

2.2.2   Radio Networks and Codecs

For a device which supports wideband functionality, testing shall be performed over LTE Band IV (1700 MHz) on AMR-WB 12.65 kbps. The specific UMTS radio carrier frequency and channel number tested on shall be documented. In a device which supports AMR wideband over LTE as well as UMTS, Wideband Test IDs in Table 2.2-1 marked with "1" shall also be covered over UMTS Band II (1900 MHZ) on AMR 12.65 kbps. In a device which supports AMR wideband over UMTS but not over LTE, all Test IDs shall be tested over UMTS Band II (1900 MHz) on AMR 12.65 kbps.

For a device which supports super-wideband, testing shall be performed using EVS-SWB at 13.2 kbps.

TABLE 2.2-7 WIDEBAND/SUPER-WIDEBAND LTE / VOLTE RX AND TX TEST FREQUENCIES

Band	Channel Bandwidth (MHz)	Channel	Designation	Frequency (MHz) [center of DL RB allocation]
LTE 1700 (3GPP Band IV)	10	20000	CH_8-TX	1711.58
	10	2000	CH_8-RX	2115
	10	20175	CH_9-TX	1732.5
	10	2175	CH_9-RX	2132.5
	10	20350	CH_{10}-TX	1753.42
	10	2350	CH_{10}-RX	2150

TABLE 2.2-8 WIDEBAND UMTS RX AND TX TEST FREQUENCIES

Band	Channel Pair (UARFCN)	Designation	Frequency (MHz)
UMTS 1900 (3GPP BAND II)	9262	CH_4-TX	1852.40
	9662	CH_4-RX	1932.40
	9400	CH_5-TX	1880.00
	9800	CH_5-RX	1960.00
	9538	CH_6-TX	1907.60
	9938	CH_6-RX	1987.60

For a device which supports CDMA, testing shall be performed on EVRC-NW SO-73 8.5 kbps in Radio Configuration 3. Either cell band 850 MHz channel 384 or PCS band 1900 MHz channel 600 shall be used and documented accordingly.

Note: Test SIMs/PRLs in non-RF shielded environments may be required on any type of device and shall be documented.

2.3 Super-wideband Test Cases

2.3.1   Test Cases for 3GPP Methods

Test cases for super-wideband are available from 3GPP, as noted in the tables below,

2.3.1.1 Handset Mode

TABLE 2.3-1 SUPER-WIDEBAND HANDSET MODE TEST CASES AND APPLICABLE SETTINGS

Handset Super-Wideband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Appl. Force [N]	Document	Rev.	Sect.
SWB-001	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	nominal	8	3GPP TS 26.132	14.1.0	9.2.2.2
SWB-002 / SWB-035	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	8 / 13	3GPP TS 26.132	14.1.0	9.2.2.2
SWB-003	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	9.2.2.1
SWB-004	Idle Channel Noise SND	n/a[1]	n/a	nominal	8	3GPP TS 26.132	14.1.0	9.3.1
SWB-005	Idle Channel Noise RCV	n/a[1]	n/a	maximum	8	3GPP TS 26.132	14.1.0	9.3.2
SWB-006	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	8	3GPP TS 26.132	14.1.0	9.4.2
SWB-007	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	9.4.1
SWB-008	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	2	3GPP TS 26.132	14.1.0	9.7.3
SWB-009	Quality in presence of ambient noise: SMOS, NMOS, GMOS	real speech	-1.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	9.12
SWB-010	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	9.10
SWB-012	Max acoustic pressure	Peak Level[2]	+3 dBm0	maximum	13	IEEE 269	2010	7.13.1
SWB-013 / SWB-014	STMR (Sidetone Masking Rating)	P.501 real speech	-4.7 dBPa	nominal, F = 8 / maximum, F = 13		3GPP TS 26.132	14.1.0	9.5.1
SWB-015	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	9.5.4
SWB-016	Delay and speech quality with packet jitter and loss[3]	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	9.10.4
SWB-036	Handset Distortion, SND	Sinusoidal	5, 0, -4.7, -10, -15, -20 dBPa	nominal	8	3GPP TS 26.132	14.1.0	9.8.1
SWB-037	Handset Distortion, RCV	Sinusoidal + activation	0, -3, -10, -16, -20, -30, -40, -45 dBm0	nominal	8	3GPP TS 26.132	14.1.0	9.8.2
SWB-076	Speech Quality (reference condition)	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	14.1.0	9.10.4
	Note 1: A test signal, such as CSS bursts, may have to be intermittently applied to prevent 'silent mode' operation of the MS. Such a test signal should be documented by the tester, if used. Note 2: The PeakLevel test signal from [4] is used for test case SWB-012. Note 3: Test case for Voice over LTE only.							

2.3.1.2 Handheld Handsfree / Speakerphone Mode

TABLE 2.3-2 SUPER-WIDEBAND HANDHELD HANDSFREE / SPEAKERPHONE MODE TEST CASES AND APPLICABLE SETTINGS

HH Hands-free Super-Wideband Test Cases		Measurement Setup				Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Distance	Document	Rev.	Sect.
SWB-017	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	HFRP[1]	3GPP TS 26.132	14.1.0	9.2.4.2
SWB-018	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dB Pa	nominal	HFRP[1]	3GPP TS 26.132	14.1.0	9.2.4.1
SWB-019	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	HFRP[1]	3GPP TS 26.132	14.1.0	9.4.6
SWB-020	SFR - Send frequency response	P.501 real speech	-4.7 dB Pa	nominal	HFRP[1]	3GPP TS 26.132	14.1.0	9.4.5
SWB-021	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	HFRP[1]	3GPP TS 26.132	14.1.0	9.7.2
SWB-022	Quality in presence of ambient noise: SMOS, NMOS, GMOS	real speech from TS 103 106	+1.3 dBPa	maximum	HFRP1	3GPP TS 26.132	14.1.0	9.12.2
	Note 1: See section 2.3.2 (Device positioning Handheld Hands-free / Speakerphone mode for HFRP acceptable value).							

2.3.1.3 Headset Mode

TABLE 2.3-3 SUPER-WIDEBAND HEADSET MODE TEST CASES AND APPLICABLE SETTINGS

Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Document	Rev.	Sect.
Headset Super-Wideband Test Cases		Measurement Setup			Standards Reference for each Test ID		
SWB-023 / SWB-024	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	nominal / maximum	3GPP TS 26.132	14.1.0	9.2.2.2
SWB-025	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	9.2.2.1
SWB-026	Idle Channel Noise SND	n/a[1]	n/a	nominal	3GPP TS 26.132	14.1.0	9.3.1
SWB-027	Idle Channel Noise RCV	n/a[1]	n/a	maximum	3GPP TS 26.132	14.1.0	9.3.2
SWB-028	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	3GPP TS 26.132	14.1.0	9.4.2
SWB-029	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	9.4.1
SWB-030	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	3GPP TS 26.132	14.1.0	9.7.3
SWB-031	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	9.10.3
SWB-032 / SWB-033	STMR (Sidetone Masking Rating)	P.501 real speech	-4.7 dBPa	nominal / maximum	3GPP TS 26.132	14.1.0	9.5.1.2
SWB-034	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	14.1.0	9.5.4
SWB-072	Headset Distortion, SND	Sinusoidal	5, 0, -4.7, -10, -15, -20 dBPa	nominal	3GPP TS 26.132	14.1.0	9.8.1
SWB-073	Headset Distortion, RCV	Sinusoidal+ activation	0, -3, -10, -16, -20, -30, -40, -45 dBm0	nominal	3GPP TS 26.132	14.1.0	9.8.2
	Note 1: A test signal, such as CSS bursts, may have to be intermittently applied to prevent 'silent mode' operation of the MS. Such a test signal should be documented by the tester, if used.						

2.3.1.4   Headset Interface Mode

TABLE 2.3-4 SUPER-WIDEBAND HEADSET INTERFACE MODE TEST CASES AND APPLICABLE SETTINGS

Headset Interface Super-Wideband Test Cases		Measurement Setup			Standards Reference for each Test ID		
Test ID	Parameter (Metric)	Test Signal	Level	DUT Volume Control	Document	Rev.	Sect.
SWB-080 / SWB-081	Level in Receive for Nominal speech input level	P.501 real speech	-16 dBm0	nominal / maximum	ITU-T P.381	4	7.1.4
SWB-082	Level in Send for Nominal speech input Level	P.501 real speech	-60 dBV	nominal	ITU-T P.381	4	7.1.3
SWB-083	Noise in Send	n/a[1]	n/a	nominal	ITU-T P.381	4	7.1.11
SWB-084	Noise in Receive	n/a[1]	n/a	nominal	ITU-T P.381	4	7.1.12
SWB-085	Receiving frequency response	P.501 real speech	-16 dBm0	nominal	ITU-T P.381	4	7.1.8
SWB-086	Sending frequency response	P.501 real speech	-60 dBV	nominal	ITU-T P.381	4	7.1.7
SWB-087	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	ITU-T P.381	4	7.1.18
SWB-088	Delay (Send + Receive) (ms)	single word	-60 dBV	nominal	ITU-T P.381	4	7.1.2
SWB-089 / SWB-090	Sidetone Loss STMR	P.501 real speech	-60 dBV	nominal / maximum	ITU-T P.381	4	7.1.9
SWB-091	Sidetone delay	P.501 real speech	-60 dBV	nominal	ITU-T P.381	4	7.1.10
	Note 1: A test signal, such as CSS bursts, may have to be intermittently applied to prevent 'silent mode' operation of the MS. Such a test signal should be documented by the tester, if used. **Note 2:** For 3GPP2 Test Cases; Headset mode is not in the scope of reference [4], and while testing should be carried out in a similar fashion and methodology as per reference [1], radio system setup shall be in compliance with reference [4].						

2.3.2   Radio Networks and Codecs

For further guidance, please see clause 2.2.3.

2.4   Device Positioning

2.4.1   Handset Mode

When testing a handset telephone, the device is mounted on the HATS in position and orientation as described in ITU-T P.64 [7] as per Annex E and the Manufacturers Ear Cap Reference Position. If no Ear Cap Position is declared by the Manufacturer, the Standard Position per Annex E shall be used. As

defined in P.64 Annex E, the Standard Position angles A, B, and C are reproduced in Table 2.4-1. Note that the tolerance of these values is to within ±0.1°, as given by the precision of the values.

TABLE 2.4-1 HANDSET STANDARD POSITION ANGLES

Angle	Value [degrees]
A	21.2
B	-12.9
C	2.3

For handsets where MECRP is provided, the values for Table P.64/E.1, reproduced below as Table 2.4-2, must be reported. See the user guide from the specific HATS' manufacturer for relative angle positioning.

TABLE 2.4-2 TABLE FOR REPORTING MECRP POSITIONING VALUES

MECRP (delta from actual ECRP)	
Axis	**Delta [mm]**
y_e	
z_e	
Angle Settings	
Angle	Delta from standard angle [°]
A	
B	
C	

The artificial mouth shall conform to ITU-T P.58 [6]. The artificial ear shall conform to ITU-T P.57 [5]. Type 3.3 artificial ear shall be used. The applied force shall be as indicated in Table 2.1-1 and Table 2.2-1.

Note: Measurements of noise suppression performance in alternate positions may be desirable. The test report shall include details of handset position and orientation in accordance with Annex E of ITU-T P.64 [7].

For tests requiring a Nominal volume setting and a user controllable receive volume control is provided on the Device under test, the setting shall be chosen such that the nominal RLR of 2 dB is met as closely as possible. For tests where a Maximum volume setting is required, the user controllable volume control shall be set to the maximum setting.

OEMs strive to meet the receiving frequency response mask at Nominal Receive volume, so in case the Receiving Frequency response is failing, MECRP values should be reconfirmed or the Device under Test slightly re-adjusted as the HATS artificial pinna is pliable and the Device may seal up the ear concha cavity, resulting in a bass heavy response. Alternatively, the Device may not seal well to the pinna and have a weak bass response, a remount or ever so slight adjustment may correct this. Reconfirm the Nominal RLR after any such adjustment and document settings.

2.4.2   Handheld Handsfree/Speakerphone Mode

When testing a handheld handsfree telephone, the device is mounted in the HATS HFRP in position and orientation as described in 3GPP TS 26.132 [1] as per Section 5.1.3.3. The distance dHF and the angle ΘHF between the HATS Reference point and the device display is defined by the Manufacturer; if no such position is declared a Standard Position of 42-cm and angle of 0° will be used. Testing with HATS shall be in compliance with ITU-T P.581 [9]. The artificial mouth shall conform to ITU-T P.58 [6]. The artificial ear shall conform to ITU-T P.57 [5]. Type 3.3 artificial ear may be used.

2.4.3 Headset Mode

When testing a telephone including a headset, the headset is mounted in its recommended wearing position as described in 3GPP TS 26.132 [1] per Section 5.1.2 and per ITU-T P.380 [8] Clause 6. The OEM Device manufacturer should provide at least one Headset to be used for this test. For first time tests of headsets; 5 repeat measurements with refit of the headset in the pinna is recommended and the average of at least 3 consistent measurements be reported. The artificial mouth shall conform to ITU-T P.58 [6]. The artificial ear shall conform to ITU-T P.57 [5]. Type 3.3 artificial ear shall be used.

2.4.4 Wrist-worn Wearables Mode

When testing a wrist-worn wearables device, the device is mounted in front of the HATS, similar to the HATS HFRP, as shown in Figure 1. The distance from device to HATS lip-ring d_{HF} and the angle Θ_{HF} between the HATS Reference point and the device is defined by the Manufacturer. If d_{HF} and Θ_{HF} are not defined by the manufacturer, then the distance d_{HF} and the angle Θ_{HF} between the HATS Reference point and the device visual user interface should be 32cm and angle 0°. The artificial arm should be mounted parallel to the lip plane of the HATS, as shown in Figure 1, with the device visual user interface positioned normal to the HATS lip plane.

The device under test should be mounted on an artificial arm, with dimensions consistent with [REF: relevant clause of OTA Test Plan] If the artificial arm is constructed of rigid material, it should be covered with a compliant material. A cloth of thickness 2±1 mm, or compliant material (Shore-A 25±10) of the same thickness should be used to cover the surface of the arm in vicinity of the device under test. The compliant material should be placed between the device and the arm, and sized so that the material extends at least 1 cm along the arm beyond each side of the device. The device should be mounted on the arm, on top of the compliant material, so that it can be repositioned intentionally, but not so tightly that the surface of the arm is deformed or that the device under test cannot be rotated or repositioned. Wrist-worn devices are often equipped with straps that provide for a discrete range of diameters. One approach is to select the tightest option and then open by one step to somewhat lessen the tightness of mounting.
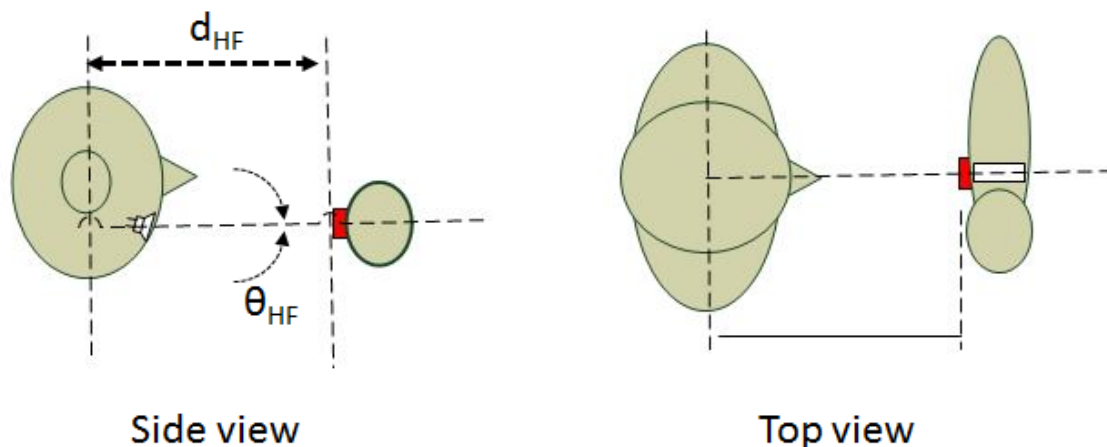

Side view   Top view

FIGURE 2.4-1 FIGURE DEVICE UNDER TEST (IN RED) MOUNTED ON ARM POSITIONED IN FRONT OF HATS

The artificial mouth shall conform to ITU-T P.58 [6]. The artificial ear shall conform to ITU-T P.57 [5]. Type 3.3 artificial ear may be used.

The HATS HFRP must be adjusted for the distance d_{HF}. If the distance d_{HF} of 32 cm is used, the HFRP correction should be 16.0 dB.

2.5 Test Methods for Quality in the Presence of Ambient Noise

2.5.1 Speech Material

Appropriate speech material are referenced in Annex C of ETSI TS 103 106 [2]. Only the last 16 sentences are used for individual predictions, then the 16 numbers are averaged into per-condition scores. The first 4 sentences are used to secure a steady voice channel.

2.5.2 Background Noise Simulation and Spectral Validation

Background noise simulation is to be in accordance with ETSI ES 202 396-1 [3] for handsets, note the test room requirements in section 6.1. If an office type room is used, reverberation time should be in the interval 0.2 s < RT60 < 0.7 s between 100 Hz and 8 kHz, and noise floor should be below 30 dBSPL(A). Background noise types to be used are listed in Tables 2d and 2h of 3GPP TS 26.132 [1]. For hand-held speakerphones, the preferred background noise simulation is found in ETSI TS 103 224 [12]. Noise types are found in Tables 2d2 and 2h2.

In particular, reliable results require accurate simulation of background noise levels and power spectra. It is required to perform spectral validation for each noise type to be used. Spectral validation consists of recording the simulated background noise, and recording at the two HATS artificial ears. After appropriate application of Independent of Direction equalization to the DRP recordings, the measured power spectra are compared to the power spectra of the source noise signals, in 1/3rd octave bands. The measured power spectra shall be within ±3dB of the reference source power spectra.

A final check on the background noise simulation shall be conducted using the method described in Appendix A .

2.5.3 Measurement Procedure

Measurements shall follow the requirements in TS 103 106 [2], Section 9, with the background noise setup in accordance to ETSI ES 202 396-1 [3].

Appendix A Verification Method for Background Noise Simulation

Objective

This method is based on 3GPP contribution S4-130400, Reference scores for 3Quest [A1]. The goal is to provide an additional validation of the background noise simulation.

Method

After the background noise simulation has been set up and verified to be in compliance with requirements in ETSI ES 202 396-1 [3] and the HATS properly equalized with speech levels set, recordings are taken using the method of ETSI TS 103 106 [2], but with measurement microphones used to provide the required 'processed' and 'unprocessed' signals. A measurement microphone placed at HATS MRP is used to provide the 'processed' signal (i.e., good SNR), while the HATS ear with ID equalization is used to provide the noisy 'unprocessed' signal (i.e., poor SNR).

The speech and noise levels are as referenced for Test Case NB-009 of Table 1. One additional measurement is taken using speech but no additional background noise.

Reference scores using ETSI TS 103 106 [2] are computed in both wideband and narrowband modes, with the proxy 'processed' signal (recorded at MRP) filtered appropriately as in TABLE A-1. Both Highpass and Lowpass filters are applied to simulate the effect of the telephone channel of corresponding bandwidth. No filter (other than ID equalization) is applied to the proxy 'unprocessed" signal (recorded at DRP)

TABLE A-1 FILTERS FOR REFERENCE SCORES

Test Case	Highpass filter	Lowpass filter
Narrowband	4th order, at 100 Hz	4th order, at 4000 Hz
Wideband	4th order, at 100 Hz	4th order, at 8000 Hz

Reference scores should be within ±0.2 MOS of the values in Table A-2 for Narrowband and Table A-3 for wideband. Filenames are taken from ETSI ES 202 396-1 [3].

TABLE A-2 REFERENCE SCORES FOR NARROWBAND

Condition	Filename	SMOS	NMOS
Recording in pub	Pub_Noise_binaural_V2	3.1	2.0
Recording at pavement	Outside_Traffic_Road_binaural	3.0	1.9
Recording at pavement	Outside_Traffic_Crossroads_binaural	3.3	2.5
Recording at departure platform	Train_Station_binaural	3.4	2.4
Recording at the drivers position	Fullsize_Car1_130Kmh_binaural	3.8	2.4
Recording at sales counter	Cafeteria_Noise_binaural	3.9	2.5
Recording in a cafeteria	Mensa_binaural	4.1	2.7
Recording in business office	Work_Noise_Office_Callcenter_binaural	4.3	3.1
Quiet	<none>	4.7	3.9

TABLE A-3 REFERENCE SCORES FOR WIDEBAND [FROM A2]

Condition	Filename	SMOS	NMOS
Recording in pub	Pub_Noise_binaural_V2	4.2	2.4
Recording at pavement	Outside_Traffic_Road_binaural	3.3	2.6
Recording at pavement	Outside_Traffic_Crossroads_binaural	4.3	2.3
Recording at departure platform	Train_Station_binaural	4.3	3.0
Recording at the drivers position	Fullsize_Car1_130Kmh_binaural	4.4	2.8
Recording at sales counter	Cafeteria_Noise_binaural	4.4	2.8
Recording in a cafeteria	Mensa_binaural	4.5	3.1
Recording in business office	Work_Noise_Office_Callcenter_binaural	4.6	3.4
Quiet	<none>	4.6	4.3

References

[A1] S4-130400, Reference scores for 3Quest, Qualcomm, 3GPP SA4#73, 15-19 March 2013, Qingdao, China [http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_73/Docs/S4-130400.zip].

[A2] S4-131124, Summary of reference scores for ETSI TS 103 106, Qualcomm, 3GPP SA4#75, 23-27 September 2013, Vancouver, CA. [http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_75/Docs/S4-131124.zip]

Appendix B Change History

Date	Version	Description
November 2014	1.0	• Initial release
May 2016	1.1	• Added LTE to list of transmission technologies • Updated references to 3GPP Release 13 • Corrected citation for max acoustic pressure test NB-012 and clarified test signal • Added wideband test cases section 2.2 • Clarified language in Device Positioning section 2.3
December 2016	2.0	• Changed title to Speech Performance Recommendations • Added super-wideband test cases, section 2.3 • Added handset speech delay and quality with jitter and packet loss, test cases NB-074 and WB-074 • Added background noise for hand-held speakerphone, NB-075 and WB-075
January 2018	2.1	• Added Speech Quality P.863 for Handset, test cases NB-076, WB-076 and SWB-076 • Added Background Noise for Super-wideband speech, test cases SWB-009 and SWB-022 • Added Distortion for Super-wideband speech, test cases SWB-036, SWB-037, SWB-072, SWB-073 • Added Handset Bandwidth extension, test case WB-077 • Added Headset Interface testing as sections 2.1.1.4, 2.2.1.4 and 2.3.1.4, test cases NB-080 – NB-091, WB-080 – WB-091, and SWB-080 – SWB-091 • Added Wearables Mode testing as sections 2.1.1.6, 2.2.1.6 and 2.4.4, test cases NB-077 – NB-079, NB-092 – NB-094, WB-078 – WB-079, and WB-092 – WB-095. • Updated references to 3GPP Release 14, and latest revision of referenced standards. Added Standard [16] in section 1.3.