



# CTIA Speech Performance Recommendations

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CTIA Certification Program  
1400 16<sup>th</sup> Street, NW  
Suite 600  
Washington, DC 20036

[certification@ctia.org](mailto:certification@ctia.org)

1.202.785.0081

[www.ctia.org/certification](http://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 v13.3.0 (2016-06) 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Speech and video telephony terminal acoustic test specification (Release 13)
- [2] ETSI TS 103 106, v1.3.1 (2014-04) 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, v1.6.1 (2015-06) 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 P.57 Ed. 6 (2011-12) Artificial Ears
- [6] ITU-T P.58 Ed. 4 (2013-05) Head and torso simulator for telephonometry
- [7] ITU-T P.64 Ed. 8 (2007-11) Determination of sensitivity/frequency characteristics of local telephone systems
- [8] ITU-T P.380 Ed. 1 (2003-11) Electro-acoustic measurements on headsets
- [9] ITU-T 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 v13.3.0 (2016-06) 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Terminal acoustic characteristics for telephony; Requirements (Release 13)
- [12] ETSI TS 103 224 (2015-08):V1.2.1 " A sound field reproduction method for terminal testing including a background noise database."

## 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 <sup>1</sup>	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	nominal	8	3GPP TS 26.132	13.3.013.3.0	7.2.2.2
						3GPP2 C.S0056-A	1.0	2.1.2.2
NB-002 <sup>1</sup> NB-018	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	8 13	3GPP TS 26.132	13.3.013.3.0	7.2.2.2
						3GPP2 C.S0056-A	1.0	2.1.2.2
NB-003 <sup>1</sup>	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	13.3.013.3.0	7.2.2.1
						3GPP2 C.S0056-A	1.0	2.2.2.2
NB-004 <sup>1</sup>	Idle Channel Noise SND	n/a <sup>2</sup>	n/a	nominal	8	3GPP TS 26.132	13.3.013.3.0	7.3.1
						3GPP2 C.S0056-A	1.0	2.2.4.2
NB-005 <sup>1</sup>	Idle Channel Noise RCV	n/a <sup>2</sup>	n/a	maximum	8	3GPP TS 26.132	13.3.0	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	13.3.0	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	13.3.0	7.4.1
						3GPP2 C.S0056-A	1.0	2.2.1.2
NB-008 <sup>1</sup>	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	2	3GPP TS 26.132	13.3.0	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	13.3.0	7.12
		ETSI TS 103 106				3GPP2 C.S0056-A	1.0	2.7.2
NB-010 <sup>1</sup>	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	8	3GPP TS 26.132	13.3.0	7.10.3
NB-011						3GPP2 C.S0056-A	1.0	2.6.2
NB-012 <sup>1</sup>	Max acoustic pressure	PeakLevel <sup>3</sup>	+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		3GPP TS 26.132	13.3.0	7.5.1.2
				maximum, F = 13		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	13.3.0	7.5.4
						3GPP2 C.S0056-A	1.0	2.5.2.2
NB-074	Delay and speech quality with packet jitter and loss <sup>4</sup>	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	13.3.0	7.10.4
<p><b>Note 1:</b> If Device supports both UMTS and GSM mode, the Test IDs (marked with <sup>1</sup>) are to be performed and documented for both modes.</p> <p><b>Note 2:</b> 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.</p> <p><b>Note 3:</b> The PeakLevel test signal from [4] is used for test case NB-012.</p> <p><b>Note 4:</b> Test case for Voice over LTE only.</p>								



### 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 <sup>1</sup>	3GPP TS 26.132	13.3.0	7.2.4.2
						3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-041	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	7.2.4.1
						3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-042	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	7.4.6
						3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-043	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	7.4.5
						3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-044	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	7.7.2
						3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-075	Quality in presence of ambient noise: SMOS, NMOS, GMOS	real speech from TS 103 106	+1.3 dBPa	maximum	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	7.12.2
<p><b>Note 1:</b> See section 2.3.2 (Device positioning Handheld Hands-free / Speakerphone mode for HFRP acceptable value).</p> <p><b>Note 2:</b> 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].</p>								

### 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.	Sept.
NB-060 NB-061	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	nominal	3GPP TS 26.132	13.3.0	7.2.2.2
maximum				3GPP2 C.S0056-A	1.0	Note <sup>2</sup>	
NB-062	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	7.2.2.1
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-063	Idle Channel Noise SND	n/a <sup>1</sup>	n/a	nominal	3GPP TS 26.132	13.3.0	7.3.1
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-064	Idle Channel Noise RCV	n/a <sup>1</sup>	n/a	maximum	3GPP TS 26.132	13.3.0	7.3.2
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-065	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	3GPP TS 26.132	13.3.0	7.4.2
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-066	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	7.4.1
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-067	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	3GPP TS 26.132	13.3.0	7.7.3
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-068	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	7.10.3
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
NB-069 NB-070	STMR (Sidetone Masking Rating)	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	7.5.1.2
maximum				3GPP2 C.S0056-A	1.0	Note <sup>2</sup>	
NB-071	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	7.5.4
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
<p><b>Note 1:</b> 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.</p> <p><b>Note 2:</b> 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].</p>							

### 2.1.2 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 2.1-4 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	13.3.0	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	13.3.0	7.8.2
NB-072	Headset Distortion, SND	Sinusoidal	5, 0, -4.7, -10, -15, -20 dBPa	nominal	8	3GPP TS 26.132	13.3.0	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	13.3.0	7.8.2

### 2.1.3 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 2.1-5 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 2.1-6 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 <sup>1</sup>	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	nominal	8	3GPP TS 26.132 3GPP2 C.S0056-A	13.3.0 1.0	8.2.2.2 2.1.2.2
WB-002 <sup>1</sup> WB-018	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	8 13	3GPP TS 26.132 3GPP2 C.S0056-A	13.3.0 1.0	8.2.2.2 2.1.2.2
WB-003 <sup>1</sup>	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132 3GPP2 C.S0056-A	13.3.0 1.0	8.2.2.1 2.2.2.2
WB-004 <sup>1</sup>	Idle Channel Noise SND	n/a <sup>2</sup>	n/a	nominal	8	3GPP TS 26.132 3GPP2 C.S0056-A	13.3.0 1.0	8.3.1 2.2.4.2
WB-005 <sup>1</sup>	Idle Channel Noise RCV	n/a <sup>2</sup>	n/a	maximum	8	3GPP TS 26.132 3GPP2 C.S0056-A	13.3.0 1.0	8.3.2 2.1.3.2
WB-006	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	8	3GPP TS 26.132 3GPP2 C.S0056-A	13.3.0 1.0	8.4.2 2.1.1.2
WB-007	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132 3GPP2 C.S0056-A	13.3.0 1.0	8.4.1 2.2.1.2
WB-008 <sup>1</sup>	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	2	3GPP TS 26.132 3GPP2 C.S0056-A	13.3.0 1.0	8.7.3 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 3GPP2 C.S0056-A	13.3.0 1.0	8.12 2.7.2
WB-010 <sup>1</sup>	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	8	3GPP TS 26.132	13.3.0	8.10
WB-011						3GPP2 C.S0056-A	1.0	2.6.2
WB-012 <sup>1</sup>	Max acoustic pressure	Peak Level <sup>3</sup>	+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 3GPP2 C.S0056-A	13.3.0 1.0	8.5.1 2.5.1.2
WB-015	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132 3GPP2 C.S0056-A	13.3.0 1.0	8.5.4 2.5.2.2
WB-074	Delay and speech quality with packet jitter and loss <sup>4</sup>	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	13.3.0	8.10.4
<p><b>Note 1:</b> 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 <sup>1</sup>) are to be performed and documented for UMTS mode as well.</p> <p><b>Note 2:</b> 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.</p> <p><b>Note 3:</b> The PeakLevel test signal from [4] is used for test case WB-012.</p> <p><b>Note 4:</b> Test case for Voice over LTE only.</p>								

### 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	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	8.2.4.2
						3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-041	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dB Pa	nominal	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	8.2.4.1
						3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-042	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	8.4.6
						3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-043	SFR - Send frequency response	P.501 real speech	-4.7 dB Pa	nominal	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	8.4.5
						3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-044	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	8.7.2
						3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-075	Quality in presence of ambient noise: SMOS, NMOS, GMOS	real speech from TS 103 106	+1.3 dBPa	maximum	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	8.12.2
<p><b>Note 1:</b> See section 2.3.2 (Device positioning Handheld Hands-free / Speakerphone mode for HFRP acceptable value).</p> <p><b>Note 2:</b> 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].</p>								

### 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	3GPP TS 26.132	13.3.0	8.2.2.2
maximum				3GPP2 C.S0056-A	1.0	Note <sup>2</sup>	
WB-062	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	8.2.2.1
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-063	Idle Channel Noise SND	n/a <sup>1</sup>	n/a	nominal	3GPP TS 26.132	13.3.0	8.3.1
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-064	Idle Channel Noise RCV	n/a <sup>1</sup>	n/a	maximum	3GPP TS 26.132	13.3.0	8.3.2
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-065	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	3GPP TS 26.132	13.3.0	8.4.2
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-066	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	8.4.1
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-067	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	3GPP TS 26.132	13.3.0	8.7.3
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-068	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	8.10.3
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-069 / WB-070	STMR (Sidetone Masking Rating)	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	8.5.1.2
				maximum	3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
WB-071	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	8.5.4
					3GPP2 C.S0056-A	1.0	Note <sup>2</sup>
<p><b>Note 1:</b> 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.</p> <p><b>Note 2:</b> 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].</p>							

## 2.2.2 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 2.2-4 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	13.3.0	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	13.3.0	8.8.2
WB-072	Headset Distortion, SND	Sinusoidal	5, 0, -4.7, -10, -15, -20 dBPa	nominal	8	3GPP TS 26.132	13.3.0	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	13.3.0	8.8.2

## 2.2.3 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.

TABLE 2.2-5 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 <sub>8</sub> -TX	1711.58
	10	2000	CH <sub>8</sub> -RX	2115
	10	20175	CH <sub>9</sub> -TX	1732.5
	10	2175	CH <sub>9</sub> -RX	2132.5
	10	20350	CH <sub>10</sub> -TX	1753.42
	10	2350	CH <sub>10</sub> -RX	2150



TABLE 2.2-6 WIDEBAND 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

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.

For a device which supports super-wideband, testing shall be performed using EVS at 24.4 kbps.

## 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	13.3.0	9.2.2.2
SWB-002	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	maximum	8	3GPP TS 26.132	13.3.0	9.2.2.2
SWB-018					13			
SWB-003	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	13.3.0	9.2.2.1
SWB-004	Idle Channel Noise SND	n/a <sup>1</sup>	n/a	nominal	8	3GPP TS 26.132	13.3.0	9.3.1
SWB-005	Idle Channel Noise RCV	n/a <sup>1</sup>	n/a	maximum	8	3GPP TS 26.132	13.3.0	9.3.2
SWB-006	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	8	3GPP TS 26.132	13.3.0	9.4.2
SWB-007	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	13.3.0	9.4.1
SWB-008	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	2	3GPP TS 26.132	13.3.0	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	13.3.0	9.12
SWB-010	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	8	3GPP TS 26.132	13.3.0	9.10
SWB-012	Max acoustic pressure	Peak Level <sup>2</sup>	+3 dBm0	maximum	13	IEEE 269	2010	7.13.1

SWB-013	STMR (Sidetone Masking Rating)	P.501 real speech	-4.7 dBPa	nominal, F = 8		3GPP TS 26.132	13.3.0	9.5.1
SWB-014				maximum, F = 13				
SWB-015	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	13.3.0	9.5.4
SWB-016	Delay and speech quality with packet jitter and loss <sup>3</sup>	P.501 real speech	-4.7 dBPa	nominal	8	3GPP TS 26.132	13.3.0	9.10.4
<p><b>Note 1:</b> 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.</p> <p><b>Note 2:</b> The PeakLevel test signal from [4] is used for test case SWB-012.</p> <p><b>Note 3:</b> Test case for Voice over LTE only.</p>								

### 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 <sup>1</sup>	3GPP TS 26.132	13.3.0	9.2.4.2
SWB-018	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dB Pa	nominal	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	9.2.4.1
SWB-019	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	9.4.6
SWB-020	SFR - Send frequency response	P.501 real speech	-4.7 dB Pa	nominal	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	9.4.5
SWB-021	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	9.7.2
SWB-022	Quality in presence of ambient noise: SMOS, NMOS, GMOS	real speech from TS 103 106	+1.3 dBPa	maximum	HFRP <sup>1</sup>	3GPP TS 26.132	13.3.0	9.12.2
<b>Note 1:</b> See section 2.3.2 (Device positioning Handheld Hands-free / Speakerphone mode for HFRP acceptable value).								

### 2.3.1.3 Headset Mode

TABLE 3-1 SUPER-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.
SWB-023	RLR (dB) - Receive Loudness Rating	P.501 real speech	-16 dBm0	nominal	3GPP TS 26.132	13.3.0	9.2.2.2
SWB-024				maximum			
SWB-025	SLR (dB) - Sending Loudness Rating	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	9.2.2.1
SWB-026	Idle Channel Noise SND	n/a <sup>1</sup>	n/a	nominal	3GPP TS 26.132	13.3.0	9.3.1
SWB-027	Idle Channel Noise RCV	n/a <sup>1</sup>	n/a	maximum	3GPP TS 26.132	13.3.0	9.3.2
SWB-028	RFR - Receive frequency response	P.501 real speech	-16 dBm0	nominal	3GPP TS 26.132	13.3.0	9.4.2

SWB-029	SFR - Send frequency response	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	9.4.1
SWB-030	TCLw (weighted terminal coupling loss)	P.501 compressed speech	-10 dBm0	maximum	3GPP TS 26.132	13.3.0	9.7.3
SWB-031	Round-trip Delay (ms)	single word	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	9.10.3
SWB-032 SWB-033	STMR (Sidetone Masking Rating)	P.501 real speech	-4.7 dBPa	nominal maximum	3GPP TS 26.132	13.3.0	9.5.1.2
SWB-034	Sidetone delay	P.501 real speech	-4.7 dBPa	nominal	3GPP TS 26.132	13.3.0	9.5.4
<p><b>Note 1:</b> 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.</p>							

## 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  $\pm 0.1^\circ$ , 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 <sub>e</sub>	
Z <sub>e</sub>	
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 falling, 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  $\Theta_{HF}$  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.

## 2.5 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  $0.2 \text{ s} < RT60 < 0.7 \text{ s}$  between 100 Hz and 8 kHz, and noise floor should be below 30 dB SPL(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  $\pm 3\text{dB}$  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	4 <sup>th</sup> order, at 100 Hz	4 <sup>th</sup> order, at 4000 Hz
Wideband	4 <sup>th</sup> order, at 100 Hz	4 <sup>th</sup> order, at 8000 Hz

Reference scores should be within  $\pm 0.2$  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](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](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	<ul style="list-style-type: none"> <li>Initial release</li> </ul>
May 2016	1.1	<ul style="list-style-type: none"> <li>Added LTE to list of transmission technologies</li> <li>Updated references to 3GPP Release 13</li> <li>Corrected citation for max acoustic pressure test NB-012 and clarified test signal</li> <li>Added wideband test cases section 2.2</li> <li>Clarified language in Device Positioning section 2.3</li> </ul>
December 2016	2.0	<ul style="list-style-type: none"> <li>Changed title to Speech Performance Recommendations</li> <li>Added super-wideband test cases, section 2.3</li> <li>Added handset speech delay and quality with jitter and packet loss, test cases NB-074 and WB-074</li> <li>Added background noise for hand-held speakerphone, NB-075 and WB-075</li> </ul>