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Audio Requirements for ODM phone project

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Change History

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2. ABBREVIATIONS

3GPP	3rd Generation Partnership Project
IHF	Internal hands free equal to HHHF
HHHF	Hand held hands free equal to IHF
TDMA	Time division multiple access
HP	Hand portable
ITU-T	International Telecommunication Union
DRP	Drum Reference Point
DUT	Device Under Test
ERP	Ear Reference Point
GSM	Global System Mobile
	(Groupe Speciale Mobile)
HATS	Head and Torso Simulator
LRGP	Loudness Rating Guard ring Position
MRP	Mouth Reference Point
OTA	Over the air
THD+N	Total Harmonic Distortion and Noise
TA	Type Approval
UI	User Interface

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3. INTRODUCTION

This document specifies audio requirements for ODM phone project. The objective requirements are based on 3gpp TS 26.131 and 3gpp TS 26.132 specifications, ITU-T recommendations and Nokia's specifications.

Subjective requirements are based on Nokia's requirements.

Nokia reserves itself the right to make changes to this document.

4.   MEASUREMENT EQUIPMENT

All objective measurements shall be executed in anechoic environment. Used equipment shall fulfill 3gpp TS 26.132 specification and ITU-T recommendations.

Measurements shall be made in an anechoic chamber. The chamber shall have a lower cut off frequency of 300Hz or lower (measured according to ISO 3745) and a noise floor below 30dB(A). Wedge-tip to opposite wedge-tip distance shall be at least 0.7m.

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5. OBJECTIVE MEASUREMENT REQUIREMENTS

All objective testing conditions and configuration shall be done according to 3gpp TS 26.132 latest release (v6.0.0).

5.1 Hand portable

Audio measurement results must fulfill 3gpp TS 26.131 limits. If Nokia specified target value is given, that limit must also be fulfilled. Test configuration and conditions shall be according to TS 26.132. Measurements are executed according to 3gpp TS 26.132 in anechoic environment using LRGP test head and type 3.2 low leak ear coupler, and over the ear (OTA) measurement setup.

	TS 26.131	Nokia specified target value	Volume level setting
SLR	8 +/- 3 dB		Nom
RLR nom	2 +/- 3 dB		Nom
RLR max	RLR shall not be less than (louder than) -13 dB.	-11..-13 dB	Max
Sending frequency response	According to TS 26.131 narrow band		Nom
Receiving frequency response	According to TS 26.131 narrow band		Nom
Sending idle noise	-64 dBm0p	-70 dBm0p	Nom
Receiving idle noise nom	-57 dB Pa (A).	-65 dBPa (A).	Nom
Receiving idle noise max vol	-54 dB Pa (A).	-60 dBPa (A).	Max
Sending distortion	According to TS 26.131		Nom
Receiving distortion	According to TS 26.131		Nom
Echo return loss	At least 46 dB	At least 55 dB	Nom
STMR*	18 +/-5 dB	18 dB*	Nom

Table 1 Requirements for Hand Portable mode

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*) CTTL type approval requirement is most probably based on older version of 3gpp specification and STMR limit is 13 +/- 5. CTTL TA requirement must be fulfilled.

RLR must be measured using all volume steps. RLR maximum shall be -11..-13 dB. RLR difference between volume steps shall be 2 dB. Difference between minimum volume and maximum volume shall be at least 18 dB. Number of volume steps shall be at least 10.

STMR value must be measured using all volume steps. STMR shall not be less than (louder than) 18 dB with any volume step. STMR value shall be tuned so that it will increase 1 dB / volume step above nominal volume level. Target values for STRM are given in Table 2.

Volume step	STMR
Nom	18 dB
Nom+1	19 dB
Nom+2	20 dB
Nom+3	21 dB
In generally:	
Nom+n	18+n dB

Table 3 STMR values for Hand Portable mode

There must not be audible TDMA noise in receiving or sending path. Receiving and sending idle noise shall be measured with all available GSM bands and with three traffic channels (low mid and hi) in each band. Idle noise values must be in limits with all bands and channels. TDMA noise peaks shall not be higher than 6dB compared to floor noise in spectrum. TDMA measurements shall be executed with minimum volume setting. Max PCL level must be used.

Audio performance must be verified (measured) with all available bands and codecs (for example EFR, FR, HR, AMR).

5.2 Hand Held Hands free

Measurements for HHHF shall be executed in anechoic room according to 3gpp TS 26.132. Free field measurement microphone and discrete P. 51 artificial mouth shall be used. Distance d_{HF} shall be 300 mm. Audio measurement results must fulfill 3gpp TS 26.131 limits. If Nokia specified target value is given, that limit must also be fulfilled.

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	TS 26.131	Nokia specified target value	Volume level setting
SLR	13 +/- 4 dB		Nom
RLR nom	6 +12 / - 4 dB		Nom
RLR max		Less than (louder than) 6 dB	Max
Sending frequency response	According to TS 26.131 narrow band HHHF		Nom
Receiving frequency response	According to TS 26.131 narrow band HHHF		Nom
Sending idle noise	-64 dBm0p		Nom
Receiving idle noise nom	-57 dB Pa (A).		Nom
Receiving idle noise max vol	-54 dB Pa (A).		Max
Sending distortion	According to TS 26.131		Nom
Receiving distortion	According to TS 26.131		Nom
Echo return loss	At least 40 dB		Nom
Echo return loss	At least 33 dB		Max
STMR		No sidetone	Nom

Table 4 Requirements for HHHF

RLR shall be measured using all volume steps. RLR maximum shall be at least 6 dB. RLR difference between volume steps shall be 2 dB. Difference between minimum volume and maximum volume shall be at least 18 dB. Number of volume steps shall be at least 10.

There must not be audible TDMA noise in receiving or sending path. Receiving and sending idle noise shall be measured with all available GSM bands and with three traffic channels (low mid and hi) in each band. Idle noise values must be in limits with all bands and channels. TDMA noise peaks shall not be higher than 6dB compared to floor noise in spectrum. TDMA measurements shall be executed with minimum volume setting.

5.3 Bluetooth Headsets

Measurements are executed using head and torso simulator with type 3.3 artificial ear.

Functionality of all BT headsets mentioned in marketing material shall be verified. Functionality includes pairing, volume control from phone and from headset, send/end button functionality and subjective testing.

Nokia Bluetooth headsets can use same tuning parameters. Sending and receiving loudness ratings and echo canceller shall be tuned. The side tone should be switched off. No equalization is needed.

		Nokia specified target value for BT headset TBD e.g. HS-26W	Used volume level
SLR		10 +/-3 dB	Nom
RLR		8 +/-3 dB	Nom
RLR max		Less than (louder than) -3 dB	Max
ERL		At least 46 dB	Nom
Receiving idle noise		-57 dB Pa (A)	Nom
Sending idle noise		-64 dBm0p	Nom
Sending distortion		According to TS 26.131	Nom
Receiving distortion		According to TS 26.131	Nom

Table 5 Requirements for Bluetooth headsets

5.4 Wired accessories

Measurements are executed using head and torso simulator with vest and using type 3.3 artificial ear. Following values are for Nokia headsets HS-40 and HS-47. There is no need to equalize receiving or sending frequency response. High Pass filter can be used to cut off the lowest frequencies. RLR, SLR, STMR and ERL should be tuned.

	Nokia specified target value	Volume level setting

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SLR	10 +/-3 dB	Nom
RLR nom	6 +/- 3 dB	Nom
RLR max	-2 +/-3 dB	Max
Sending frequency response	*	Nom
Receiving frequency response	*	Nom
Sending idle noise	-64 dBm0p	Nom
Receiving idle noise nom	-57 dB Pa (A).	Nom
Receiving idle noise max vol	-54 dB Pa (A).	Max
Sending distortion		Nom
Receiving distortion		Nom
Echo return loss	At least 46 dB	Nom
STMR	23 +/-5 dB	Nom

*) no need to equalize receiving or sending frequency response

Table 6 Requirements for wired headsets

RLR shall be measured using all volume steps. RLR difference between volume steps shall be 2 dB. Difference between minimum volume and maximum volume shall be at least 18 dB. Number of volume steps shall be at least 10.

STMR value shall be measured using all volume steps. STMR shall not be less than (louder than) 18 dB with any volume step.

There must not be audible TDMA noise in receiving or sending path. Receiving and sending idle noise shall be measured with all available GSM bands and with three traffic channels (low mid and hi) in each band. Idle noise values must be in limits with all bands and channels. TDMA noise peaks shall not be higher than 6dB compared to floor noise in spectrum. TDMA measurements shall be executed with minimum volume setting.

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5.5 Ringing tones

Ringing tone sound pressure level shall be measured in anechoic environment. Measurement microphone of hand portable SPL level meter shall be at 5 cm distance from phone's sound output port. Audio analyzer shall be set to measure fast (125 ms) RMS with A-weighting.

All ringing tones shall be measured with maximum volume and vibra shall be switched off.

10% of all ringing tones shall be louder than 100 dBSPL @ 5 cm.

Update for ringing tone loudness requirement and measurement method can be required. In that case ringing tone loudness is defined in Zwicker dynamic (10%) loudness level. Loudness level median shall be more than 100 phons at 10 cm distance in free-field when using loudest ringing tone and maximum ringing volume level.

There shall be possibility to adjust ringing tone volume levels.

5.6 UI and warning tones

There shall be possibility to adjust UI and warning tone volume levels.

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6.   SUBJECTIVE MEASUREMENT REQUIREMENTS

Audio quality shall be verified with subjective testing. Nokia specified reference phones can be used for different testing modes. When testing subjectively used operator, network and all essential conditions shall be documented.

Subjective testing shall be done at least with following setups and environment:

- Hand portable mode in office environment and in noisy environment

- Hand held hands free in office environment

- Bluetooth headsets in office environment and in noisy environment

- Wired Headsets in office environment and in noisy environment

Special care shall take into account with following cases:

- Doubletalk performance (can both test persons speak and hear each others simultaneously)

- Echo performance (can you hear your own voice)

- Is speech intelligible also in noisy environment?

- Is there audible TDMA noise or some other disturbances?

- Is the side tone in pleasant level?

- Sound quality / distortion

- Can you set the volume to a pleasant level? Is the volume scale wide enough?

- Sound quality / distortion

- Volume control working also from phone side with Bluetooth devices

- Send/end button functionality with headsets

Subjective testing shall also include music listening

- Volume control functionality with music player

- Can you set the volume to a pleasant level? Is the volume scale wide enough?

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7.   SAFETY REQUIREMENTS

These measurements are used to ensure that the product will not harm the end-user's hearing.

Measurements shall be made in an anechoic chamber. The chamber shall have a lower cut off frequency of 300Hz or lower (measured according to ISO 3745) and a noise floor below 30dB(A). Wedge-tip to opposite wedge-tip distance shall be at least 0.7m.

Maximum volume settings shall be used. Battery shall be fully loaded and AC charger can be connected.

In speech tests (chapter 8.1) specified limit must not be exceeded with any test signal. Test signal corresponding 0 dB Full Scale in GSM domain shall be used. Test signal must include following parts: 1 kHz sine at 0dBFS, multisine bursts at 0dBFS, fast linear sine sweeps (chirps) at 0dBFS.

MP3 corresponding 0dBFS shall be used in music player tests.

Product must comply with terminal audio voltage level according to EN-50332-2 (150 mV rms).

Following test cases can be measured using three different test setups:

HATS ERP

Head and torso simulator with type 3.3 ear coupler. In accessory case earplug is inserted as realistic as possible to the ear coupler.

In HP case handset is attached using handset positioner. Use standardized Hats position defined in ITU-T P.64.

Limit values are defined in ERP therefore DRP to ERP correction is needed.

FREE FIELD

Anechoic free field environment and Free Field measurement microphone is needed. Place measurement microphone in 10 cm distance from phones sound output port.

TYPE 1

Use type 1 ear coupler defined in ITU-T P.57.

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7.1 Speech mode

Test case	Test method / setup	Limit for acceptance
Speech, HP mode	HATS ERP	<118 dBSPL A-weighted fast RMS
Speech, HP mode, improbable use	Type1	<125 dBSPL A-weighted fast RMS
Speech accessory (wired & BT)	HATS ERP	<118 dBSPL A-weighted fast RMS
Speech, IHF normal usage	Free field	<118 dBSPL A-weighted fast RMS
Speech, IHF foreseeable misuse (Earpiece sound ports towards ERP)	HATS ERP	<125 dBSPL A-weighted fast RMS

Table 7 Acoustic shock requirements for Speech mode

7.2 Ringing tones, MP3 and other UI tones

Test case	Test method	Limit for acceptance
Ringing tones, normal usage	Free field	<118 dBSPL A-weighted fast RMS
Ringing tones, foreseeable misuse	HATS ERP	<125 dBSPL A-weighted fast RMS
Ringing tones, accessories	HATS ERP	<118 dBSPL A-weighted fast RMS
Music player through IHF, normal usage	Free field	<118 dBSPL A-weighted fast RMS
Music player through IHF, foreseeable misuse	HATS ERP	<125 dBSPL A-weighted fast RMS
Music player, accessory	HATS ERP	<125 dBSPL A-weighted fast RMS
Warning and keypad tones, accessory	HATS ERP	<118 dBSPL A-weighted fast RMS
Warning and keypad tones, accessory during call	HATS ERP	<118 dBSPL A-weighted fast RMS
Warning and keypad tones, HP mode, during call	HATS ERP	<118 dBSPL A-weighted fast RMS

Table 8 Acoustic shock requirements for tones

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7.3   Module level testing and single technical fault case

These test cases ensure that the product is safe even if a single technical fault occurs. The purpose of these tests is to simulate technical fault situation and limits mentioned below must not be exceeded at any situation.

Earpiece or speaker integrated to phone mechanics shall be tested. Phone is attached to Hats using handset positioner as described in HATS ERP setup.

Transducer is driven with external amplifier. Drive signal amplitude is set to the absolute maximum analogue voltage that can be delivered by the phone baseband circuitry. This is specified as the maximum deliverable output from the phone amplifier, plus amplifier circuitry. If there are some attenuating components (serial resistors) in audio lines, these shall be added to measurement circuitry.

Acceptance limit for earpiece and speaker <136 dBSPL peak @ HATS ERP

Headset single fault

Headset is driven directly using external signal source and amplifier. Maximum amplitude over the audio interface is used as signal amplitude. HATS ERP setup is used. Headset is placed to Hats pinna as realistic as possible.

Acceptance limit: < 129 dBSPL peak @ HATS ERP

8.   ACOUSTIC DESIGN REQUIREMENTS

Earpiece acoustic design shall be leak tolerant. Type Approval measurements will be executed with type 3.2 low leak ear coupler.

HHHF Speaker shall be optimized for speech and conference call use.

Microphone shall be designed so that there is no mechanical leakage or coupling from earpiece to microphone.

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9. MEASUREMENT REPORTS

Audio measurements shall be executed for each proto build or as seen necessary. Audio test reports shall be provided to Nokia.

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- REFERENCES

/1 3gpp TS 26.131 release 6.0.0

Owner :
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/2 3gpp TS 26.132 release 6.0.0

Owner :
Document ID :
Source : http://www.3gpp.org/

/3 ITU-T P series

Owner :
Document ID :
Source : http://www.itu.int