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

Reference

DTS/STQ-240

Keywords

speech, terminal

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

Copyright Notification

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Speech and multimedia Transmission Quality (STQ).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

The present document covers wireless wearable speech terminals. It aims to enhance the interoperability and end-to-end quality with all other types of terminals.

The advanced signal processing of terminals is targeted to speech signals. Therefore, wherever possible speech signals are used for testing in order to achieve mostly realistic test conditions and meaningful results.

1 Scope

The present document provides speech transmission performance requirements for wireless terminals; it is limited to wearable terminals, including devices worn on the user's wrist. Headsets are out of scope.

In contrast to other standards which define minimum performance requirements it is the intention of the present document to specify terminal equipment requirements which enable manufacturers and service providers to enable good quality end-to-end speech performance as perceived by the user, whatever be the radio link (terminals may implement different radio links with the access network).

When an additional radio link between the terminal and external electroacoustical devices is used (e.g. Bluetooth® link), the standard will address the overall quality.

In the present document objective measurement methodologies and requirements for wireless wearable speech terminals are given.

In addition to basic testing procedures, the present document describes advanced testing procedures taking into account further quality parameters as perceived by the user.

The requirements available in the present document will ensure a high compatibility across access networks with all types of terminals.

It is the aim to optimize the listening and talking quality, conversational performance, as well as the use in noisy environments. Related requirements and test methods will be defined in the present document.

For all the functions, the standard will consider the limitations in audio performance due to different form factors (e.g. size, shape, wearing style and location).

Terminals which are not intended to be connected to public networks are outside the scope of the present document.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 126 171 (V6.0.0): "Digital cellular telecommunications system (Phase 2 +); Universal Mobile Telecommunications System (UMTS); AMR speech codec, wideband; General description (3GPP TS 26.171 version 6.0.0 Release 6)".

[2] Recommendation ITU-T G.122: "Influence of national systems on stability and talker echo in international connections".

[3] Recommendation ITU-T G.711: "Pulse code modulation (PCM) of voice frequencies".

[4] Recommendation ITU-T G.726: "40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)".

[5] Recommendation ITU-T G.729: "Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction (CS-ACELP)".

[6] Recommendation ITU-T G.729.1: "G.729 based Embedded Variable bit-rate coder: An 8-32 kbit/s scalable wideband coder bitstream interoperable with G.729".

[7] Recommendation ITU-T P.56: "Objective measurement of active speech level".

[8] Recommendation ITU-T P.57: "Artificial ears".

[9] Recommendation ITU-T P.58: "Head and torso simulator for telephonometry".

[10] Recommendation ITU-T P.79: "Calculation of loudness ratings for telephone sets".

[11] Recommendation ITU-T P.340: "Transmission characteristics and speech quality parameters of hands-free terminals".

[12] Recommendation ITU-T P.342: "Transmission characteristics for narrow-band digital loudspeaking and hands-free telephony terminals".

[13] Recommendation ITU-T P.501: "Test signals for use in telephonometry".

[14] Recommendation ITU-T P.502: "Objective test methods for speech communication systems using complex test signals".

[15] Recommendation ITU-T P.581: "Use of head and torso simulator (HATS) for hands-free terminal testing".

[16] Recommendation ITU-T O.41: "Psophometer for use on telephone-type circuits".

[17] IEC 61260: "Electroacoustics - Octave-band and fractional-octave-band filters".

[18] ETSI TS 146 010: "Digital cellular telecommunications system (Phase 2+); Full-rate speech; Transcoding (3GPP TS 46.010 Release 9)".

[19] ETSI TS 146 060: "Digital cellular telecommunications system (Phase 2+); Enhanced Full Rate (EFR) speech transcoding (3GPP TS 46.060 Release 9)".

[20] CTIA: "Test Plan for Wireless Device Over-the-Air Performance, V3.7".

NOTE: Available at: https://www.ctia.org/docs/default-source/certification/ctia-test-plan-for-wireless-device-over-the-air-performance-ver-3-7.pdf?sfvrsn=2.

[21] ETSI TS 103 106 (03-2013) (V1.2.1): "Speech and multimedia Transmission Quality (STQ); Speech quality performance in the presence of background noise: Background noise transmission for mobile terminals-objective test methods".

[22] ETSI TS 103 224: "Speech and multimedia Transmission Quality (STQ); A sound field reproduction method for terminal testing including a background noise database".

[23] Recommendation ITU-T P.863: "Perceptual objective listening quality assessment".

[24] Recommendation ITU-T P.863.1: "Application guide for Recommendation ITU-T P.863".

[25] ETSI TS 126 441 (V12.0.0): "Universal Mobile Telecommunications System (UMTS); LTE; EVS Codec General Overview (3GPP TS 26.441 version 12.0.0 Release 12)".

[26] Recommendation ITU-T G.722.2: "Wideband coding of speech at around 16 kbit/s using Adaptive Multi-Rate Wideband (AMR-WB)".

[27] Recommendation ITU-T P.1010: "Fundamental voice transmission objectives for VoIP terminals and gateways.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Recommendation ITU-T P.1100: "Narrowband hands-free communication in motor vehicles".

[i.2] IEC 61672 (Edition 1.0): "Electroacoustics - Sound level meters".

[i.3] ETSI EG 201 377-1: "Speech and multimedia Transmission Quality (STQ); Specification and measurement of speech transmission quality; Part 1: Introduction to objective comparison measurement methods for one-way speech quality across networks".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

NOTE: This may contain additional information.

artificial ear: device for the calibration of earphones incorporating an acoustic coupler and a calibrated microphone for the measurement of the sound pressure and having an overall acoustic impedance similar to that of the median adult human ear over a given frequency band

codec: combination of an analogue-to-digital encoder and a digital-to-analogue decoder operating in opposite directions of transmission in the same equipment

freefield equalization: artificial head is equalized flat in such a way that for frontal sound incidence in anechoic conditions

handsfree telephony terminal: telephony terminal using a loudspeaker associated with an amplifier as a telephone receiver and which can be used without a handset

Head And Torso Simulator (HATS) for telephonometry: manikin extending downward from the top of the head to the waist, designed to simulate the sound pick-up characteristics and the acoustic diffraction produced by a median human adult and to reproduce the acoustic field generated by the human mouth

Mouth Reference Point (MRP): point located on axis and 25 mm in front of the lip plane of a mouth simulator

nominal setting of the volume control: when a receive volume control is provided, the setting which results in a value of RLR closest to the nominal value of RLR = 2 dB

wearable: speech terminal that is worn on the user's body, typically on the wrist

NOTE: At this time, headsets are not considered in the present document.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

a.c.	alternative current
$A_{H,S,dt}$	attenuation range in send direction during double talk
AM-FM	Amplitude Modulation – Frequency Modulation
AMR	Adaptive Multi-Rate codec
AMR-NB	Adaptive Multi Rate Narrowband
AMR-WB	Adaptive Multi Rate Wideband
CDMA	Code Division Multiple Access
CS	Composite Source
CSS	Composite Source Signal

DECT	Digital Enhanced Cordless Telecommunications
DFT	Discrete Fourier Transform
DRP	Drum Reference Point
EL	Echo Loss
EVS-NB	Enhanced Voice Services Narrowband
FFT	Fast Fourier Transform
G-MOS-LQOn	Overall transmission quality narrowband
GSM	Global System for Mobile communication
HATS	Head And Torso Simulator
HF	Hands Free
HFRP	Hands Free Reference Point
IEC	International Electrotechnical Commission
ITU-T	International Telecommunication Union - Telecommunication
LTE	Long Term Evolution (3GPP)
MOS	Mean Opinion Score
MOS-LQO	Mean Opinion Score - Listening Quality Objective
MRP	Mouth Reference Point
NB	Narrow Band
N-MOS-LQOn	Transmission quality of the background noise narrowband
OTT	Over The Top
P_{HFRP}	Sound Pressure at the Handsfree Reference Point
PLC	Packet Loss Concealment
P_{MRP}	Sound Pressure at the Mouth Reference Point
PN	Pseudo random Noise
POI	Point Of Interconnect
QoS	Quality of Service
RF	Radio Frequency
RLR max	Receive Loudness Rating corresponding to the maximum setting of the volume control
RLR	Receive Loudness Rating
SLR	Send Loudness Rating
S-MOS-LQOn	Transmission quality of the speech narrowband
TCL_W	Terminal Coupling Loss (weighted)
TOSQA	Telecom Objective Speech Quality Asssessment
UMTS	Universal Mobile Telecommunications System
VoLTE	Voice over LTE
WIFI	Wireless Fidelity
WIMAX™	Worldwide Interoperability for Microwave ACCess

4 Configurations and interfaces

4.1 Access networks

The present document applies to any wireless terminal whatever the access network, e.g. GSM, UMTS, VoLTE, DECT, Bluetooth®, WI-FI™, WIMAX™, CDMA.

4.2 Additional (radio) links between the terminal and external electroacoustical devices

The present document also applies when an additional radio link exists between the wireless terminal and external electro acoustic devices, e.g. Bluetooth®.

5 Test Configurations

5.1 Set-up interface

The generic schematic is applicable to any wireless link.

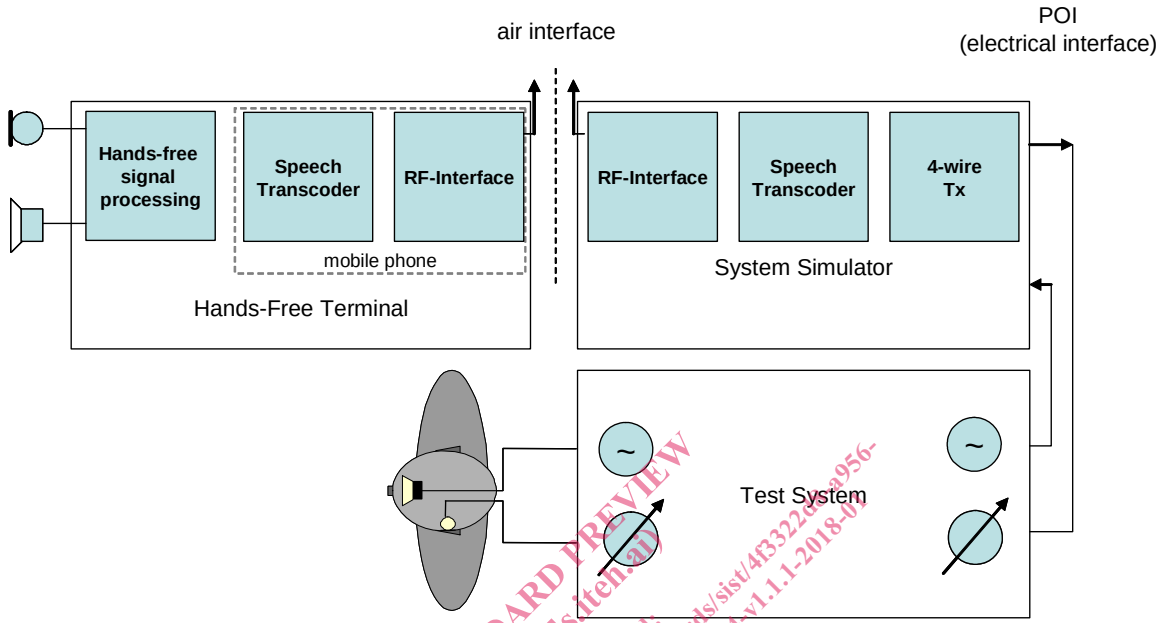

Figure 5.1: Set-up interface

NOTE: The "whole" terminal includes all the components from "RF interface" to the transducers and may include an additional (radio) link. The air interface considered in the figure is not the additional radio link.

5.2 Set-up for terminals

5.2.1 Introduction

For electroacoustical testing, HATS as described in Recommendation ITU-T P.58 [9] shall be used.

The preferred way of testing a terminal is to connect it to a network simulator with exact defined settings and access points. The test sequences are fed in either electrically using a reference codec or using the direct signal processing approach, or acoustically using ITU-T specified devices.

When a coder with variable bit rate is used for testing terminal electroacoustical parameters, the bit rate giving the best characteristics or the most commonly used should be selected, e.g.:

- AMR-NB (ETSI TS 126 171 [1]): 12,2 kbit/s;
- Recommendation ITU-T G.729.1 [6]: 32 kbit/s.

5.2.2 Wrist-worn terminal

HATS measurement equipment shall be configured to the wrist-worn UE according to figure 5.2. The HATS should be positioned so that the HATS Reference Point is at a distance d_{HF} from the centre point of the visual display of the wrist-worn terminal. The distance d_{HF} is specified by the manufacturer. A vertical angle θ_{HF} may be specified by the manufacturer. In case it is not specified the distance d_{HF} shall be 32 cm and θ_{HF} shall be 0.

NOTE: The nominal distance of 32 cm corresponds to lip plane-HATS reference point distance (12 cm) with an additional 20 cm giving a realistic figure as a reference usage of wrist-worn terminals.

The artificial mouth shall conform to Recommendation ITU-T P.58 [9].

The HATS HFRP shall 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.

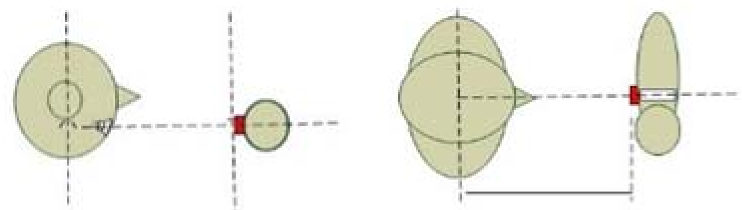

Figure 5.2: Configuration of wrist-worn terminal relative to the HATS

The device under test should be mounted on an artificial arm, with dimensions consistent with those in Appendix Q.5 of [19]. 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 the 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. Devices intended for users with different sized wrists, e.g. children and adults, can be accommodated by the artificial arm referenced in Appendix Q.5 of [20].

Note that the configuration and nominal geometric parameters above and in figure 5.2 reflect typical usage. As users may also operate their devices in other positions, testing in a variety of positions and orientations with respect to the HATS may be informative.

5.2.3 Additional wearable styles

For future study.

5.3 Acoustical environment

In general different acoustical environments have to be taken into account: either room noise and background noise are an inherent part of the test environment or room noise and background noise shall be eliminated to such an extent that their influence on the test results can be neglected.

Unless stated otherwise, measurements shall be conducted under quiet and "anechoic" conditions. Considering this, the test laboratory, in the case where its test room does not conform to anechoic conditions as given in Recommendation ITU-T P.342 [12], has to present difference in results for measurements due to its test room. In case where an anechoic room is not available the test room has to be an acoustically treated room with few reflections and a low noise level.

In cases where real or simulated background noise is used as part of the testing environment, the original background noise shall not be noticeably influenced by the acoustical properties of the room.

In all cases where the performance of acoustic echo cancellers shall be tested, a realistic room, which represents the typical user environment for the terminal shall be used.