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SERIES P: TERMINALS AND SUBJECTIVE AND
OBJECTIVE ASSESSMENT METHODS

Voice terminal characteristics

Transmission characteristics for wideband digital handset and headset telephones

Recommendation ITU-T P.311



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Recommendation ITU-T P.311

Transmission characteristics for wideband digital handset and headset telephones

Summary

Recommendation ITU-T P.311 provides audio performance requirements for wideband (8000 Hz) handset and headset telephones.

Requirements and test methods are specified for the major audio transmission parameters affecting wideband audio, including sending and receiving levels, frequency response, noise, distortion, sidetone, stability, echo path and delay. Wideband audio represents a considerable departure from traditional narrow-band telephony, offering significantly improved quality.

Major changes over the previous version of this Recommendation (2005) are as follows:

- The structure of the Recommendation is modified, the objective measurement methods originally in Annex A have been transferred into the main body.
- In addition to sinusoidal and noise signals, speech-like stimulus signals as described in Recommendation ITU-T P.50 and Recommendation ITU-T P.501 are also recommended for the measurements.
- HATS method is used for better simulation of real telephone communication.
- Specific headset requirements are incorporated.
- Some technical requirements and related test methods have been modified based on the latest research, e.g., frequency response, distortion, STMR, *D*-factor, and delay.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T P.311	1995-04-18	12
2.0	ITU-T P.311	1998-02-27	12
3.0	ITU-T P.311	2005-06-06	12
4.0	ITU-T P.311	2011-03-01	12

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Recommendation ITU-T P.311

Transmission characteristics for wideband digital handset and headset telephones

1 Scope

This Recommendation provides audio performance requirements and test methods for digital handset and headset telephones capable of transmitting an audio bandwidth extending beyond the conventional telephony bandwidth of 300 Hz to 3400 Hz, to a bandwidth of approximately 100 Hz to 8000 Hz. Such telephones are known as wideband audio telephones, and will make use of digital encoding schemes such as in [ITU-T G.722]. IP terminals may support other coding algorithms. Wideband audio telephones are expected to be used in new services such as high quality audio conferencing, video conferencing and multimedia applications.

The requirements listed in this Recommendation are primarily applicable to telephones using ITU-T G.722 encoding at 64 kbit/s, but should also be used as the basis of requirements for other wideband audio encoding schemes. This is still under study in ITU-T.

Conventional telephone band (300 Hz-3400 Hz) digital handset telephones using encoding according to [ITU-T G.711] and [ITU-T G.726] are covered by [ITU-T P.310].

2 Normative references

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T G.122] Recommendation ITU-T G.122 (1993), *Influence of national systems on stability and talker echo in international connections.*
- [ITU-T G.711] Recommendation ITU-T G.711 (1988), *Pulse code modulation (PCM) of voice frequencies.*
- [ITU-T G.722] Recommendation ITU-T G.722 (1988), *7 kHz audio-coding within 64 kbit/s.*
- [ITU-T G.726] Recommendation ITU-T G.726 (1990), *40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM).*
- [ITU-T G.729.1] Recommendation ITU-T G.729.1 (2006), *G.729-based embedded variable bit-rate coder: An 8-32 kbit/s scalable wideband coder bitstream interoperable with G.729.*
- [ITU-T G.1020] Recommendation ITU-T G.1020 (2006), *Performance parameter definitions for quality of speech and other voiceband applications utilizing IP networks.*
- [ITU-T I.412] Recommendation ITU-T I.412 (1988), *ISDN user-network interfaces – Interface structures and access capabilities.*
- [ITU-T P.10] Recommendation ITU-T P.10/G.100 (2006), *Vocabulary for performance and quality of service.*
- [ITU-T P.50] Recommendation ITU-T P.50 (1999), *Artificial voices.*
- [ITU-T P.51] Recommendation ITU-T P.51 (1996), *Artificial mouth.*



- [ITU-T P.57] Recommendation ITU-T P.57 (2009), *Artificial ears*.
- [ITU-T P.58] Recommendation ITU-T P.58 (1996), *Head and torso simulator for telephonometry*.
- [ITU-T P.64] Recommendation ITU-T P.64 (2007), *Determination of sensitivity/frequency characteristics of local telephone systems*.
- [ITU-T P.79] Recommendation ITU-T P.79 (2007), *Calculation of loudness ratings for telephone sets*.
- [ITU-T P.310] Recommendation ITU-T P.310 (2009), *Transmission characteristics for narrow-band digital handset and headset telephones*.
- [ITU-T P.380] Recommendation ITU-T P. 380 (2003), *Electro-acoustic measurements on headsets*.
- [ITU-T P.501] Recommendation ITU-T P.501 (2009), *Test signals for use in telephonometry*.
- [ITU-T P.581] Recommendation ITU-T P.581 (2009), *Use of head and torso simulator (HATS) for hands-free and handset terminal testing*.
- [ITU-T P.1010] Recommendation ITU-T P.1010 (2004), *Fundamental voice transmission objectives for VoIP terminals and gateways*.
- [ETSI TS 126 171] ETSI TS 126 171 V9.0.0 (2010), *Speech codec speech processing functions; Adaptive Multi-Rate – Wideband (AMR-WB) speech codec; General description (3GPP TS 26.171 version 9.0.0 Release 9)*.
- [IEC 61672-2] IEC 61672-2 (2003), *Electroacoustics – Sound level meters – Part 2: Pattern evaluation tests*.

3 Definitions and abbreviations

3.1 Definitions

This Recommendation defines the following terms:

3.1.1 diffuse field equalization: Equalization of the HATS sound pick-up, equalization of the difference, in dB, between the spectrum level of the acoustic pressure at the ear-drum reference point (DRP) and the spectrum level of the acoustic pressure at the HATS reference point (HRP) in a diffuse sound field with the HATS absent using the reverse nominal curve given in Table 3 of [ITU-T P.58].

3.1.2 ear-drum reference point (DRP): Point located at the end of the ear canal, corresponding to the ear-drum position.

3.1.3 ear reference point (ERP): A virtual point for geometric reference located at the entrance to the listener's ear, traditionally used for calculating telephonometric loudness ratings.

3.1.4 HATS position: The HATS position is the correct handset position in handset measurement, it will give more realistic results compared with LRGP. See Annexes D, E and F of [ITU-T P.64] for detailed information.

3.1.5 head and torso simulator (HATS): Manikin extending 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 adult, and to reproduce the acoustic field generated by the human mouth.

3.1.6 wideband telephony: Transmission of speech with a nominal passband wider than 300 Hz-3400 Hz, usually understood to be 100 Hz-8000 Hz.

3.2 Abbreviations

This Recommendation also uses the following abbreviations (relevant abbreviations in [ITU-T P.10] will also apply):

CSS	Composite Source Signal
DRP	Ear-Drum Reference Point
ERP	Ear Reference Point
LRGP	Loudness Rating Guard Ring Position
LSTR	Listener Sidetone Rating
MRP	Mouth Reference Point
NR	Noise Reduction
PN	Pseudorandom Noise
RLR	Receiving Loudness Rating
SLR	Sending Loudness Rating
STMR	Sidetone Masking Rating
TCL	Terminal Coupling Loss
TCLw	Weighted Terminal Coupling Loss

4 Test arrangement

4.1 Test environment

Unless stated otherwise, measurements shall be conducted under anechoic or quiet conditions:

For some headsets or handset terminals with small dimension, an anechoic room will be required. An anechoic room used in wideband test shall be practically free-field down to a lowest frequency of 150 Hz, the handset or headset coupled with the HATS shall lie totally within this free-field volume. Satisfied free-field conditions are met if deviations from the ideal free-field conditions are less than ± 1 dB.

Depending on the distance from terminal transducers to mouth and ear, a quiet office room may be sufficient, e.g., for handsets where the artificial mouth and artificial ear are located close to the acoustical transducers. In that case, a test room may be used which meets the following criteria:

- 1) The difference of sound pressure between the mouth opening and that at 5.0, 7.5 and 10 cm in front of the centre of the lip ring is within ± 0.5 dB of that which exists in a known acoustic free-field.
- 2) The difference of sound pressure between the mouth opening and the ear canal entrance point (EEP) at both the left and right ears of the HATS does not differ by more than ± 1 dB from that which exists in a known free-field.

The ambient noise level shall be less than -64 dBPa(A) for all the tests, except for the condition when a simulated or real noise is used as part of the test environment. The test environment shall be free of mechanical disturbances.

4.2 Test set-up

4.2.1 General description

To achieve the most realistic simulation of the "average" subscriber, all measurements are performed by using HATS. Although HATS is thoroughly described in [ITU-T P.58], the exact