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OBJECTIVE ASSESSMENT METHODS

Voice terminal characteristics

Transmission characteristics for wideband digital loudspeaking and hands-free telephony terminals

CAUTION !

PREPUBLISHED RECOMMENDATION

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Recommendation ITU-T P.341

Transmission characteristics for wideband digital loudspeaking and hands-free telephony terminals

Summary

Recommendation ITU-T P.341 provides audio performance requirements for wideband audio (8000 Hz) digital loudspeaking and hands-free 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, stability, echo path and delay. Associated test methods are also given. Wideband audio represents a considerable departure from traditional telephony, offering significantly improved quality.

Main 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 ITU-T P.50 and ITU-T P.501 are also recommended for the measurements.
- HATS method is introduced for better compliance with practical application.
- Some technical requirements and related test methods have been modified according to new development, e.g. frequency response, distortion and delay in sending and receiving direction.

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Recommendation ITU-T P.341

Transmission characteristics for wideband digital loudspeaking and hands-free telephony terminals

1 Scope

This Recommendation provides audio performance requirements and test methods for loudspeaking and hands-free telephones capable of transmitting an audio bandwidth extending beyond the conventional telephony bandwidth of 300 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, videoconferencing and multimedia applications.

The requirements listed in this Recommendation are primarily applicable to telephones using 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 Study Group 12.

General information on hands-free terminals, which includes switching characteristics, can be found in [ITU-T P.340] and information on acoustic echo controllers in [ITU-T G.167].

For loudspeaking telephones which do not provide full hands-free operation, the relevant parts of this Recommendation may be used.

Conventional telephone band (300 Hz-3400 Hz) digital hands-free telephones using encoding according to [ITU-T G.711] and [ITU-T G.726] are covered by [ITU-T P.342]. Audio performance requirements for wideband headset terminals are included in [ITU-T P.311]. Specifications for car mounted wideband hands-free terminals are included in [ITU-T P.1110]. Transmission characteristics for narrow-band cordless and mobile digital terminals are included in [ITU-T P.313].

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.114] Recommendation ITU-T G.114 (2003), *One-way transmission time*

[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 I.412] Recommendation ITU-T I.412 (1993), *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.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.311] Recommendation ITU-T P.311 (2011), *Transmission characteristics for wideband digital handset and headset telephones*
- [ITU-T P.340] Recommendation ITU-T P.340 (2000), *Transmission characteristics and speech quality parameters of hands-free terminals*
- [ITU-T P.342] Recommendation ITU-T P.342 (2009), *Transmission characteristics for narrow-band digital loudspeaking and hands-free telephony terminals*
- [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.1110] Recommendation ITU-T P.1110 (2009), *Wideband hands-free communication in motor vehicles*
- [IEC 61672-2] IEC 61672-2 (2003), *Electroacoustics – Sound level meters – Part 2: Pattern evaluation tests*
- [ETSI TS 126 171] ETSI TS 126 171 (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)*

3 Definitions and abbreviations

3.1 Definitions

This Recommendation defines the following terms:

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

3.1.2 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.

3.1.3 Free-field equalization: artificial head is equalized in such a way that for frontal sound incidence in anechoic conditions the frequency response of the artificial head is flat.

3.1.4 Group-audio terminal: a speakerphone set primarily designed for use by several users,

which will not be equipped with a handset.

3.1.5 Hands-free Reference Point (HFRP): A point located on the axis of the artificial mouth, at 50 cm from the outer plane of the lip ring, where the level calibration is made under free-field conditions. It corresponds to measurement point No. 11 defined in [ITU-T P.51].

3.1.6 Hands-free terminal (HFT): A telephone set that does not require the use of hands during the communications session; examples are headset, speakerphone and group-audio terminal.

3.1.7 HATS hands-free reference point (HATS HFRP): Corresponds to a reference point "n" from [ITU-T P.58]: "n" shall be one of the points numbered from 11 to 17 and defined in Table 6a of [ITU-T P.58] (coordinates of far field front point). The HATS HFRP depends on the location(s) of the microphones of the terminal under test: the appropriate axis lip-ring/HATS HFRP shall be as close as possible to the axis lip-ring/speakerphone microphone under test.

3.1.8 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.

3.1.9 Loudspeaking function: Function of a handset telephone using a loudspeaker associated with an amplifier as a telephone receiver. It shall be used with a handset to transmit sending signals.

3.1.10 Speakerphone set: A telephone set using a loudspeaker as a telephone receiver with or without an embedded microphone as a transmitter; it may be used without a handset.

3.1.11 Wideband telephony: Transmission of speech with a nominal pass-band wider than 300-3400 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
HFT	Hands-free Terminal
LST	Loudspeaking Terminal
MRP	Mouth Reference Point
RLR	Receiving Loudness Rating
SLR	Sending Loudness Rating
TCL	Terminal Coupling Loss
TCL _w	Weighted Terminal Coupling Loss

4 Test arrangement

4.1 Test environment

4.1.1 Free-field condition

To ensure repeatability of tests, the environment for all measurements shall be free-field (anechoic) down to the lowest frequency of the 1/3-octave band centered at 125 Hz.

Satisfactory free-field conditions are deemed to exist where errors, due to the departure from ideal

conditions, do not exceed the limits reported in Table 1, inside a sphere centered at point B in Figure 1, with one-meter radius, in the absence of the test table.

Table 1 – Allowable departure from ideal conditions

1/3 Octave centre frequency (Hz)	Allowable departure (dB)
≤630	±1.5
800 to 5000	±1.0
≥6300	±1.5

The test signal used for the verification of free-field conditions shall be –20 dBPa at the HFRP. A wideband noise signal shall be used and third octave spectrum measurements shall be carried out at the measurement points. Measurements shall be made along the seven axes numbered 1 to 7 in Figure 1. The sound source (the artificial mouth) shall be placed at positions equivalent to B or C as appropriate. Measurement points along each axis, taken from the lip plane of the artificial mouth, shall be at distances of 315 mm, 400 mm, 500 mm, 630 mm, 800 mm and 1000 mm.

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