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SERIES P: TERMINALS AND SUBJECTIVE AND OBJECTIVE ASSESSMENT METHODS

Voice terminal characteristics

Technical requirements and test methods for multi-microphone wired headset or headphone interfaces of digital wireless terminals

Recommendation ITU-T P.382

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Recommendation ITU-T P.382

Technical requirements and test methods for multi-microphone wired headset or headphone interfaces of digital wireless terminals

Summary

Headset/headphone interfaces of diameter 3.5 mm and 2.5 mm have been widely used in digital mobile terminals during recent years. Nowadays, the consumer is free to choose either the headset/headphone originally provided by the terminal manufacturer or others that are offered separately. However, the quality of service/quality of experience (QoS/QoE) perceived by users is influenced by both the electrical performance of the interface and the compatibility between the terminal and the connected headset/headphone. Recommendation ITU-T P.382 specifies critical physical and electroacoustical characteristics for the universal headset interface with more than four terminals and provides corresponding test methods.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T P.382	2016-07-29	12	11.1002/1000/12971

Keywords

Connector, headphone, headset, interface, terminals.

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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Technical requirements and test methods for multi-microphone wired headset or headphone interfaces of digital wireless terminals

1 Scope

This Recommendation specifies electrical requirements and test methods for a multi-microphone headset/headphone interface used in digital mobile terminals.

The principle of this recommendation is to ensure adequate compatibility between the digital mobile terminal and the universal and multi-microphone wired analogue headset/headphone, and to have better user experience. The universality of the multi-microphone headset/headphone interface will facilitate the separation of sales between digital mobile terminals and headsets/headphones. One of the benefits is that users are free to choose their favourite type of headset or headphone in the market. In the long run, it will reduce E-waste.

Furthermore, the universal interface can be used as the electric coupling design in hands-free systems and hearing aids for wider harmonization.

To give specifications to manufacturers and encourage them to adopt the universal headset interface, the mechanical dimensions are shown in an Appendix for at least configurations with five poles.

This Recommendation applies to digital mobile terminals with physical analogue audio output/input interface that need to support headsets with >1 microphone. Other similar ICT equipment may also refer to this Recommendation.

This Recommendation does not apply to terminals designed solely for digital headset/headphone usage.

2 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 P.56] Recommendation ITU-T P.56 (2011), *Objective measurement of active speech level*.

[ITU-T P.57] Recommendation ITU-T P.57 (2011), *Artificial ears*.

[ITU-T P.58] Recommendation ITU-T P.58 (2013), *Head and torso simulator for telephonometry*.

[ITU-T P.380] Recommendation ITU-T P.380 (2003), *Electro-acoustic measurements on headsets.*

[ITU-T P.381] Recommendation ITU-T P.381 (2014), *Technical requirements and test methods for the universal wired headset or headphone interface of digital mobile terminals.*

[ITU-T P.501] Recommendation ITU-T P.501 (2012), *Test signals for use in telephonometry*.

[ITU-T P.863] Recommendation ITU-T P.863 (2014), *Perceptual objective listening quality assessment*.

[IEC 60268-1] IEC 60268-1 (1985), *Sound system equipment – Part1: General.*

[IEC 61260-1] IEC 61260-1 (2014), *Electroacoustics – Octave-band and fractional-octave-band filters – Part I: Specifications.*

[EN 50332-1] EN 50332-1 (2013), *Sound system equipment: Headphones and earphones associated with personal music players – Maximum sound pressure level measurement methodology – Part 1: General method for one package equipment*.

[EN 50332-2] EN 50332-2 (2013), *Sound system equipment: Headphones and earphones associated with personal music players – Maximum sound pressure level measurement methodology – Part 2: Matching of sets with headphones if either or both are offered separately, or are offered as one package equipment but with standardised connectors between the two allowing to combine components of different manufacturers or different design*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 codec [b-ITU-T G.701]: Combination of an analogue-to-digital encoder and a digital-to-analogue decoder operating in opposite directions of transmission in the same equipment.

3.1.2 composite source signal (CSS) [b-ITU-T P.10]: Signal composed in time by various signal elements.

3.1.3 eardrum reference point (DRP) [b-ITU-T P.10]: A point located at the end of the ear canal, corresponding to the eardrum position.

3.1.4 earphone [b-IEC 60268-7]: Electroacoustic transducer by which acoustic oscillations are obtained from electric signals and intended to be closely coupled acoustically to the ear.

3.1.5 headset [b-ITU-T P.10]: A device which includes telephone receiver and transmitter which is typically secured to the head or the ear of the wearer.

3.1.6 mean opinion score – listening-only quality objective (MOS-LQO) [b-ITU-T P.800.1]: The score is calculated by means of an objective model which aims at predicting the quality for a listening-only test situation. Objective measurements made using the model given in [ITU-T P.863] give results in terms of MOS-LQO.

3.1.7 mouth reference point (MRP) [b-ITU-T P.10]: Point 25 mm in front of and on the axis of the lip plane of the artificial mouth or a typical human mouth (see Figure A.1 of [ITU-T P.64]).

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 artificial ear: A device which incorporates an acoustic coupler and a calibrated microphone for measuring sound pressure, and which has an overall acoustic impedance similar to that of the average adult ear over a given frequency band.

NOTE – This definition is based on that in [b-ITU-T P.10].

3.2.3 head and torso simulator (HATS) for telephonometry: A manikin that extends downwards from the top of the head to the waist. It is designed to simulate the sound pick-up characteristics and

the acoustic diffraction produced by the average adult, and to reproduce the acoustic field generated by the human mouth.

NOTE – This definition is based on that given in [b-ITU-T P.10].

3.2.4 headphone: An object based on the assembly of one or two earphones on a headband or chin-band, the use of which may be optional (e.g., with intra-concha earphones).

NOTE – This definition is based on that given in [b-IEC 60268-7]).

3.2.6 receive: The receiving direction of the signal transmission, usually from the measurement system to the device under test (DUT).

3.2.7 send: The sending direction of the signal transmission, usually from the device under test (DUT) to the measurement system.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

$A_{H,R,dt}$	Attenuation range in the receiving direction during double talk
$A_{H,S,dt}$	Attenuation range in the sending direction during double talk
DRP	Drum Reference Point
DUT	Device Under Test
ERP	Ear Reference Point
ESD	Electrostatic Discharge
FFT	Fast Fourier Transform
GND	Ground
HATS	Head and Torso Simulator
HP	Headphone
HTCLw	Headset Terminal Coupling Loss weighted
L	Left audio channel
MIC	Microphone
MOS-LQO	Mean Opinion Score – Listening-only Quality Objective
MRP	Mouth Reference Point
POI	Point of Interconnection
QoE	Quality of Experience
QoS	Quality of Service
R	Right audio channel
RMS	Root Mean Square
TCLw	weighted Terminal Coupling Loss
THD	Total Harmonic Distortion

5 General description

Generally, if a headset or a headphone is used, the overall user experience during a call highly depends on both the terminal and the connected headset/headphone. Although the acoustic quality of the headset/headphone is usually the weak link, more consideration with regard to the physical and electrical performance of the universal interface is needed.

This Recommendation specifies new terminals to be implemented for compatibility with the universal concentric connector interface for successful interconnection of the digital mobile terminal and the headset/headphone, including the plug connector and the socket connector. Normally, the socket connector is fixed inside the terminal, with the outside rim level with the surrounding shell of the terminal. Particularly, if the outside rim is lower than the surrounding shell, the dimension of the plug hand grip shall not influence the precise mating.

6 Physical characteristics

6.1 General rules

Two types of concentric socket connectors are recommended for use: 2.5 mm and 3.5 mm diameter socket connectors. An isometric view of the plug and the socket connector is shown in Figure 1 of [ITU-T P.381].

If the terminal is equipped with a headset interface and designed for both communication and audio-playing, the fixed connector shall be a 3.5 mm diameter or 2.5 mm diameter concentric socket connector. Detailed dimensional information for socket connectors with more than four contact points is given in Appendices I to III. Some terminals with curved edges may not work well with the dimensions given in Appendices I to III. For these cases, in Appendices I to III, optional dimensions are given, which are fully compatible with connectors complying with the dimensions specified.

NOTE – The contact points here do not include special points reserved for other functions.

6.2 Pin assignments

This clause gives an illustration of pin assignments of the socket connector with five contact points and those of the mated plug, as shown in Figure 1.

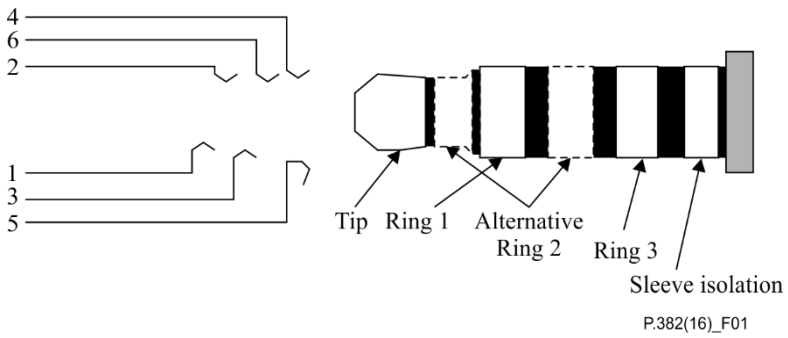


Figure 1 – Pin assignments of a socket connector with five contact points

The physical pinout order of the universal interface is important and should coordinate with the connected headset/headphone.

A socket connector with five contact points shall be compatible with both the plug connector with three poles and the plug connector with four poles specified in [ITU-T P.381].

It is recommended that terminals be able to identify different plugs intelligently and automatically.

It is recommended that a normally open switch be used on the socket connector to detect when the plug is fully inserted.

6.2.1 Recommended pin assignment

Point 1 of the socket is to be connected to the tip of the plug, linking it to the left-hand channel of the receiver (L audio). Point 2 is to be connected to ring 2, linking it to the transducer (MIC2+), where MIC denotes microphone. Point 3 is to be connected to ring 1, linking it to the right-hand channel of

the receiver (R audio). Points 4 and 5 are to be connected to the sleeve, linking it to ground (GND). Point 6 is to be connected to ring 3, linking it to the transducer (MIC+).

Referring to Figure 1:

- 1 is the contact point of the tip, linking it to the left-hand channel of the receiver (HPL audio);
- 2 is the contact point of ring 2, linking it to the transducer (MIC2+);
- 3 is the contact point of ring 1, linking it to the right-hand channel of the receiver (HPR audio);
- 4 is the contact point of the sleeve, linking it to the GND;
- 5 is the bushing of the socket, linking it to the GND when it is made of conductive material;
- 6 is the contact point of ring 3, linking it to the transducer (MIC+).

The headset pole order from the tip to the sleeve is recommended to be HPL/MIC2/HPR/MIC/GND.

It is agreed that the pinout order of HPL/MIC2/HPR/MIC/GND (in which HP is headphone) has an advantage in electrostatic discharge (ESD) protection and allows for both plastic and metallic convertors.

6.2.2 Alternate pin assignment

Point 1 of the socket is to be connected to the tip of the plug, linking it to the left-hand channel of the receiver (L audio). Point 2 is to be connected to ring 1, linking it to the right-hand channel of the receiver (R audio). Points 3 and 5 are to be connected to ring 2, linking it to GND. Point 4 is to be connected to the sleeve, linking it to the transducer (MIC+).

Referring to Figure 1:

- 1 is the contact point of the tip, linking it to the left-hand channel of the receiver (HPL audio).
- 2 is the contact point of ring 1, linking it to the right-hand channel of the receiver (HPR audio).
- 3 is the contact point of ring 2, linking it to the transducer (MIC2+).
- 4 is the contact point of the sleeve, linking it to the transducer (MIC+).
- 5 is the bushing of the socket, linking it to the transducer (MIC+).
- 6 is the contact point of ring 2, linking it to GND when it is made of conductive material.

The pinout order for the alternate headset plug is HPL/HPR/MIC2/GND/MIC, from the tip to the sleeve.

7 Electrical interface specification

7.1 Communication mode

Test set-ups and requirements in this mode are harmonized with the existing [ITU-T P.381] specification, so only the general test set-up is repeated here. Refer to [ITU-T P.381] for requirements and specific test set-ups.

7.1.1 Test set-up

Test set-ups are shown in Figures 3 and 4 of [ITU-T P.381].

7.1.1.1 Input and output characteristics of the test system for connecting to the headset connector

The output of the test system connected to the interface in send of the headset connector must be DC resistant. The output impedance shall be between 1 Ω and 10 kΩ. The dynamic range of the test system shall be consistent with (or exceed) the level range provided by headset microphones.

The input of the test system connected to the receiving interfaces of the headset connectors shall have an input impedance of 32 Ω. The dynamic range shall be consistent with (or exceed) the output level range provided by the electrical output of digital mobile terminals' headset outputs.

The common ground impedance (between sending and receiving sides) for the test system shall be ≤0.05 Ω.

7.1.1.2 Test signals and test signal levels

If not specified otherwise, fullband real speech signals are used for the measurements that can be found in [ITU-T P.501]. Detailed information about the test signal used is to be found in the corresponding clause of this Recommendation.

All test signals – which are used in receive – have to be band limited. The band limitation is achieved by bandpass filtering in the frequency range between 100 Hz and 4 kHz using a bandpass filter providing ≥24 dB/octave for narrowband mode. In wideband mode, the band limitation is achieved by bandpass filtering in the frequency range between 100 Hz and 8 kHz, using a bandpass filter providing ≥24 dB/octave. In send, the test signals are used without band limitation.

For real speech, the test signal levels are referred to the [ITU-T P.56] active speech level of the (band limited in receiving direction) test signal, calculated over the complete test sequence, if not described otherwise. For other test signals, the test signal levels are referred to the average level of the (band limited in receiving direction) test signals, averaged over the complete test sequence length.

If not stated otherwise, the nominal average signal levels for the measurements are as follows:

- −16 dBm0 (absolute signal power level, in decibels, referred to a point of zero relative level) in receive.
- −60 dBV (decibels relative to 1 V) in send [typical equivalent microphone signal level corresponding to −4.7 dBPa (decibels at 1 Pa) at the mouth reference point (MRP)].
- The receive volume control is adjusted to the setting that produces the level closest to −39 dBV considering binaural headsets.

NOTE – If different networks' signal levels are to be used in tests, this is stated in individual test. The Lombard effect (increased talker speech level due to high background noise) is considered in the background noise tests.

Some tests require exact synchronization of test signals in the time domain. Therefore, it is necessary to take the delays of the terminals into account. When analysing signals, any delay introduced by the test system, codecs and terminals have to be taken into account accordingly.

Test set-ups and requirements in this mode are harmonized with the existing [ITU-T P.381] specification.

7.1.2 Delay

The detailed requirements are found in clause 7.1.2.1 of [ITU-T P.381].

The test details are found in clause 7.1.2.2 of [ITU-T P.381].

7.1.3 Level in send for nominal speech input level

The detailed requirements are found in clause 7.1.3.1 of [ITU-T P.381].

The test details are found in clause 7.1.3.2 of [ITU-T P.381].

7.1.4 Level in receive for nominal speech input level

The detailed requirements are found in clause 7.1.4.1 of [ITU-T P.381].

The test details are found in clause 7.1.4.2 of [ITU-T P.381].

7.1.5 Level in send for low and high speech input levels

The detailed requirements are found in clause 7.1.5.1 of [ITU-T P.381].

The test details are found in clause 7.1.5.2 of [ITU-T P.381].

7.1.6 Linearity in receive

The linearity in receive is for further study

7.1.7 Sending frequency response

The detailed requirements are found in clause 7.1.7.1 of [ITU-T P.381].

The test details are found in clause 7.1.7.2 of [ITU-T P.381].

7.1.8 Receiving frequency response

The detailed requirements are found in clause 7.1.8.1 of [ITU-T P.381].

The test details are found in clause 7.1.8.2 of [ITU-T P.381].

7.1.9 Sidetone loss

The detailed requirements are found in clause 7.1.9.1 of [ITU-T P.381].

The test details are found in clause 7.1.9.2 of [ITU-T P.381].

7.1.10 Sidetone delay

The detailed requirements are found in clause 7.1.10.1 of [ITU-T P.381].

The test details are found in clause 7.1.10.2 of [ITU-T P.381].

7.1.11 Noise in send

The detailed requirements are found in clause 7.1.11.1 of [ITU-T P.381].

The test details are found in clause 7.1.11.2 of [ITU-T P.381].

7.1.12 Noise in receive

The detailed requirements are found in clause 7.1.12.1 of [ITU-T P.381].

The test details are found in clause 7.1.12.2 of [ITU-T P.381].

7.1.13 Sending distortion

The detailed requirements are found in clause 7.1.13.1 of [ITU-T P.381].

The test details are found in clause 7.1.13.2 of [ITU-T P.381].

7.1.14 Receive distortion

The detailed requirements are found in clause 7.1.14.1 of [ITU-T P.381].

The test details are found in clause 7.1.14.2 of [ITU-T P.381].

7.1.15 Noise cancellation test in send

The detailed requirements are found in clause 7.1.15.1 of [ITU-T P.381].

The test details are found in clause 7.1.15.2 of [ITU-T P.381].

7.1.16 One-way speech quality in send

The detailed requirements are found in clause 7.1.16.1 of [ITU-T P.381].

The test details are found in clause 7.1.16.2 of [ITU-T P.381].

7.1.17 One-way speech quality in receive

The detailed requirements are found in clause 7.1.17.1 of [ITU-T P.381].

The test details are found in clause 7.1.17.2 of [ITU-T P.381].

7.1.18 Weighted terminal coupling loss (TCLw)

The detailed requirements are found in clause 7.1.18.1 of [ITU-T P.381].

The test details are found in clause 7.1.18.2 of [ITU-T P.381].

7.1.19 Temporal echo effects

The detailed requirements are found in clause 7.1.19.1 of [ITU-T P.381].

The test details are found in clause 7.1.19.2 of [ITU-T P.381].

7.1.20 Double talk performance

7.1.20.1 Attenuation range in send during double talk, $A_{H,S,dt}$

The detailed requirements are found in clause 7.1.20.1.1 of [ITU-T P.381].

The test details are found in clause 7.1.20.1.2 of [ITU-T P.381].

7.1.20.2 Attenuation range in receive during double talk, $A_{H,R,dt}$

The detailed requirements are found in clause 7.1.20.2.1 of [ITU-T P.381].

The test details are found in clause 7.1.20.2.2 of [ITU-T P.381].

7.1.20.3 Detection of echo components during double talk

The detailed requirements are found in clause 7.1.20.3.1 of [ITU-T P.381].

The test details are found in clause 7.1.20.3.2 of [ITU-T P.381].

7.1.21 Activation in send

The detailed requirements are found in clause 7.1.21.1 of [ITU-T P.381].

The test details are found in clause 7.1.21.2 of [ITU-T P.381].

7.2 Multimedia playback

Test set-ups and requirements in this mode are harmonized with the existing [ITU-T P.381] specification.

7.2.1 Test set-up

General test set-ups are described in clause 7.2.1 of [ITU-T P.381].

7.2.2 Output level in multimedia playback mode

The detailed requirements are found in clause 7.2.2.1 of [ITU-T P.381].

The test details are found in clause 7.2.2.2 of [ITU-T P.381].

7.2.3 Frequency response in multimedia playback mode

The detailed requirements are found in clause 7.2.3.1 of [ITU-T P.381].

The test details are found in clause 7.2.3.2 of [ITU-T P.381].

7.2.4 Noise in multimedia playback mode

The detailed requirements are found in clause 7.2.4.1 of [ITU-T P.381].

The test details are found in clause 7.2.4.2 of [ITU-T P.381].

7.2.5 Distortion in multimedia playback mode

The detailed requirements are found in clause 7.2.5.1 of [ITU-T P.381].

The test details are found in clause 7.2.5.2 of [ITU-T P.381].

7.2.6 Receiving crosstalk

The detailed requirements are found in clause 7.2.6.1 of [ITU-T P.381].

The test details are found in clause 7.2.6.2 of [ITU-T P.381].

7.3 Multimedia record

7.3.1 Test set-up

The test set-up is shown in Figure 2.

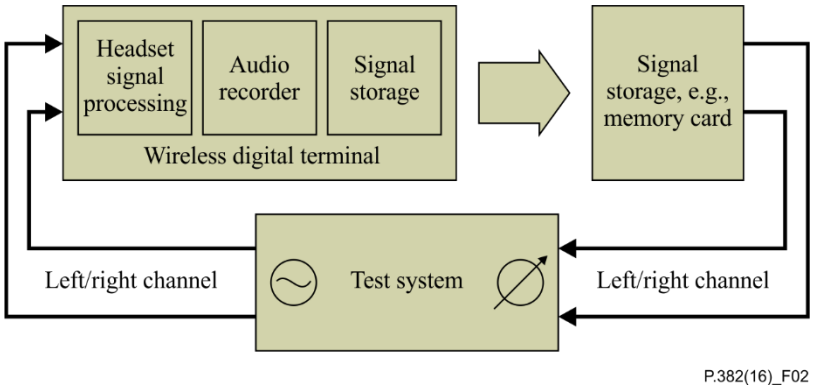


Figure 2 – Test arrangement for testing the electrical headset interface

7.3.1.1 Input and output characteristics of the test system for connecting to the headset connector

The output of the test system connected to the sending interface of the headset connector must be DC resistant. The output impedance shall be between 1 Ω and 10 kΩ. The dynamic range shall be consistent with (or exceed) the level range provided by headset microphones.

The input of the test system connected to the receive interfaces of the headset connectors shall have an input impedance of 32 Ω. The dynamic range shall be consistent with (or exceed) the output level range provided by the electrical output of digital mobile terminals' headset outputs.

7.3.1.2 Test signals and test signal levels

All input signal levels are stated in decibels relative to 1 V, as they are electrically output from the test system into each device headset socket microphone input channel.

All output signal levels stated in this section are relative to decibels relative to full scale (dBFS), where 0 dBFS represents the root mean square (RMS) level of a full-scale sinusoidal signal.

Programme simulation noise as defined in [IEC 60268-1] is used for the measurements. Detailed information about the test signal used is to be found in the corresponding clause of this Recommendation.

The programme simulation noise according to [EN 50332-1] and [EN 50332-2] is band limited by design and requires no filtering.

All test signal levels are referred to the average level of the test signals, averaged over the complete test sequence length, if not described otherwise.

Some tests require exact synchronization of test signals in the time domain. Therefore, it is necessary to take the delays of the terminals into account. When analysing signals, any delay introduced by the test system, codecs and terminals have to be taken into account accordingly.

7.3.2 Input level in multimedia record mode

7.3.2.1 Requirement

The level is measured as the digital input level generated by the output stereo file of the mobile terminal recorder when injecting a stereo signal at the input of the headset interface.

The input level shall be −29.0 dBFS ±3 dB when playing programme simulation noise at −60 dBV at the mobile terminal inputs.

For a stereo recording, the offset between left and right channel shall be less than 1 dB.

7.3.2.2 Test set-up

1) The test arrangement is according to Figure 2.
2) The test signal used for the measurements shall be programme simulation noise providing sufficient signal energy to 22 kHz. The test signal level is −60 dBV.
3) For the calculation, the averaged level of the encoded file in the signal storage is used. The output level is determined up to 22 kHz.
4) The output level is expressed in decibels relative to full scale.

7.3.3 Frequency response in multimedia record mode

7.3.3.1 Requirement

The frequency response is evaluated from a digital output file of the mobile terminal recorder when injecting a signal at the input of the headset interface.

The frequency response shall be within ±2 dB between 500 Hz and 18 kHz when programme simulation noise at −60 dBV is electrically presented at the mobile terminal inputs. The requirement applies to each stereo channel individually.

7.3.3.2 Test set-up

1) The test arrangement is according to Figure 2.
2) The test signal used for the measurements shall be programme simulation noise providing sufficient signal energy to 22 kHz. The test signal level is −60 dBV.
3) The sending frequency response is determined in 1/12th octave intervals, as given in [IEC 61260-1] for frequencies from 100 Hz to 18 kHz inclusive, measured at the point of interconnection (POI). In each 1/12th octave band, the power density spectrum of the measured signal is compared to the power density spectrum of the input signal averaged over the complete test sequence length.
4) The sensitivity is expressed in decibels relative to full scale per decibel relative to 1 V.

7.3.4 Acoustic input range in multimedia record mode

7.3.4.1 Requirement

The acoustic input range is evaluated from a digital stereo output file of the mobile terminal recorder when injecting a signal at the input of the headset interface.

The input range shall be 50 dB when playing programme simulation noise at −40 dBV and at −90 dBV at the mobile terminal inputs.

7.3.4.2 Test set-up

1) The test arrangement is according to Figure 2.
2) The test signal used for the measurements shall be programme simulation noise. The test signal levels are −40.0 dBV and −90.0 dBV.
3) The recorded files are compared to the input and no temporal clipping should be observed for either input level.
4) The acoustic input range is expressed in decibels.

7.3.5 Phase response in multimedia record mode

7.3.5.1 Requirement

The phase response is evaluated from a digital stereo output file of the mobile terminal recorder when injecting a stereo signal at the input of the headset interface.

The phase response shall be in phase, as confirmed by the transfer function, when programme simulation noise at −60 dBV is electrically presented at the mobile terminal inputs.

7.3.5.2 Test set-up

1) The test arrangement is according Figure 2.
2) The test signal used for the measurements shall be programme simulation noise. The test signal level is −60.0 dBV.
3) The recorded file is compared to the input and the channel specific transfer functions individually computed.
4) The output left and right responses are compared to one another.

7.3.6 Distortion at maximum acoustic input in multimedia record mode

7.3.6.1 Requirement

The total harmonic distortion is evaluated from a digital output file of the mobile terminal recorder when injecting a signal at the input of the headset interface.

The harmonic distortion + noise shall be at least 30 dB between the signal level in the frequency range between 50 Hz and 18 kHz when a sinusoidal signal at −40.0 dBV is electrically presented at the mobile terminal inputs.

7.3.6.2 Test set-up

1) The test arrangement is according to Figure 2.
2) The test signal used for the measurements shall be a sinusoidal signal at 50 Hz and 1 kHz. The test signal level is −40.0 dBV and the duration shall be <1 s. An activation short conditioning sequence of male or female P.501 speech may be needed, in which case it shall be inserted prior to the sinusoidal signal at the nominal signal level.
3) The spectral distribution of the recorded file is analysed with a 4k fast Fourier transform (FFT), and the total harmonic distortion (THD) + noise is computed using a flat top window.
4) The output distortion response is expressed in decibels.

7.3.7 Cross-talk in multimedia record mode

7.3.7.1 Requirement

The cross-talk is evaluated from a digital stereo output file of the mobile terminal recorder when injecting a stereo signal at the input of the headset interface.

The cross-talk shall be below 50 dB, as confirmed by the transfer function, when programme simulation noise at −40 dBV is electrically presented at the mobile terminal inputs.

7.3.7.2 Test set-up

1) The test arrangement is according to Figure 2.
2) The test signal used for the measurements shall be programme simulation noise. The test signal level is −40.0 dBV.
3) The recorded file is compared to the input and the channel specific transfer functions individually computed.
4) The cross-talk is calculated between MICL input/left channel record and right channel record, as well as MICR input/right channel record and left channel record, respectively.

7.3.8 Time offset/sampling accuracy in multimedia record mode

7.3.8.1 Requirement

The time offset is evaluated from a digital stereo output file of the mobile terminal recorder when injecting a stereo signal at the input of the headset interface.

The recorded file's sinusoidal frequency shall deviate less than 0.1%, when the input sinusoidal 1 kHz signal at −60 dBV is electrically presented at the mobile terminal inputs.

7.3.8.2 Test set-up

1) The test arrangement is according to Figure 2.
2) The test signal used for the measurements shall be a 1 kHz sinusoidal signal. The test signal level is −60.0 dBV.
3) The recorded file is compared to the input and the transfer function computed. The spectral distribution of the output signal is analysed with a 4k FFT and the windowing used is the flat top window.
4) The output left and right responses are individually computed.

8 Headset specification

8.1 Communication mode

Test set-ups and requirements in this mode are mostly harmonized with the existing [ITU-T P.381] specification, except for clause 8.1.7, which, due to the multiple microphones, needs a specific test.

8.1.1 Test set-up

General test set-ups are described in clause 8.1.1 of [ITU-T P.381].

8.1.2 Sensitivity in send

The detailed requirements are found in clause 8.1.2.1 of [ITU-T P.381].

The test details are found in clause 8.1.2.2 of [ITU-T P.381].

8.1.3 Sensitivity in receive

The detailed requirements are found in clause 8.2.2.1 of [ITU-T P.381].

The test details are found in clause 8.2.2.2 of [ITU-T P.381].

8.1.4 Sending frequency response

The detailed requirements are found in clause 8.1.4.1 of [ITU-T P.381].

The test details are found in clause 8.1.4.2 of [ITU-T P.381].

8.1.5 Receiving frequency response

The detailed requirements are found in clause 8.1.5.1 of [ITU-T P.381].

The test details are found in clause 8.1.5.2 of [ITU-T P.381].

8.1.6 Idle channel noise in send

The detailed requirements are found in clause 8.1.6.1 of [ITU-T P.381].

The test details are found in clause 8.1.6.2 of [ITU-T P.381].

8.1.7 Distortion in send

The detailed requirements are found in clause 8.1.7.1 of [ITU-T P.381].

The test details are found in clause 8.1.7.2 of [ITU-T P.381].

8.1.8 Weighted headset terminal coupling loss (HTCLw) [for further study]

8.1.8.1 Requirement

The coupling loss is evaluated from the electrical interface microphone left/right lines when injecting a stereo signal at the electrical receiver input of the headset interface.

The coupling loss shall be below 65 dB, as confirmed by each transfer function, when programme simulation noise at −22 dBV is electrically presented at the mobile terminal inputs.

8.1.8.2 Test set-up

1) The test arrangement is according to Figure 3.
2) The test signal used for the measurements shall be programme simulation noise. The test signal level is −22.0 dBV.
3) The headset microphone output is compared to the headset receiver input and the channel specific transfer functions are individually computed in the frequency range between 50 Hz and 18 kHz.
4) The coupling loss is calculated between HPL input and MIC L output, as well as HPR Input and MICR output, respectively. Coupling loss between HPL input and MIC R output, as well as HPR Input and MICL output, should be confirmed to also comply with the requirement.

8.2 Multimedia playback mode

Test set-ups and requirements in this mode are harmonized with the existing [ITU-T P.381] specification.

8.2.1 Test set-up

General test set-ups are described in clause 8.2.1 of [ITU-T P.381].

8.2.2 Sensitivity in multimedia playback mode

The detailed requirements are found in clause 8.2.2.1 of [ITU-T P.381].

The test details are found in clause 8.2.2.2 of [ITU-T P.381].

8.2.3 Distortion in multimedia playback mode

The detailed requirements are found in clause 8.2.3.1 of [ITU-T P.381].

The test details are found in clause 8.2.3.2 of [ITU-T P.381].

8.2.4 Receiving crosstalk

The detailed requirements are found in clause 8.2.4.1 of [ITU-T P.381].

The test details are found in clause 8.2.4.2 of [ITU-T P.381].

8.3 Multimedia record mode

8.3.1 Test set-up

The test set-up is shown in Figure 3.

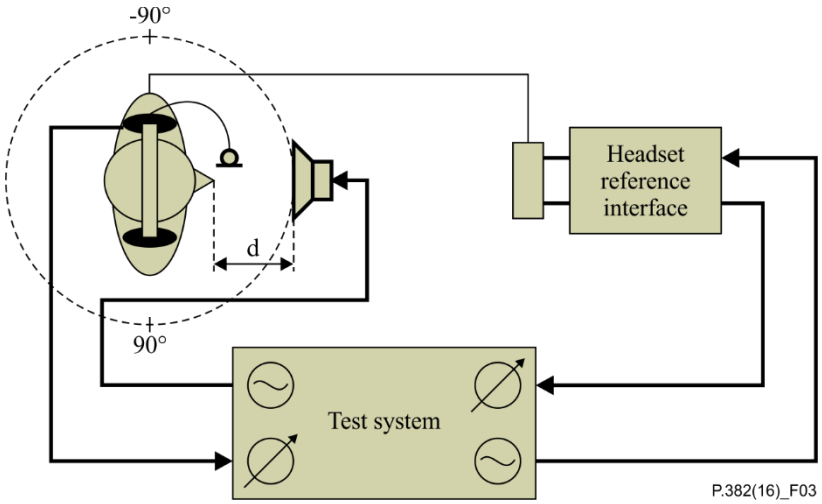


Figure 3 – Test arrangement for testing the headset

8.3.1.1 Input and output characteristics of the test system for connecting the headset

The output impedance shall be <2 Ω. The RMS output voltage shall be adjusted not to overdrive an artificial mouth or loudspeaker adjacent to the head and torso simulator (HATS). The common ground impedance (between sending and receiving sides) for the test system shall be ≤0.05 Ω.

8.3.1.2 Test signals and test signal levels

Sinusoidal signals are used, and signals analysed in 1/12th octave bands.

All test signal levels are referred to the average level of the test signals, averaged over the complete test sequence length, if not described otherwise.

The nominal average signal level for the measurements is −28.7 dBPa at the MRP.

Some tests require exact synchronization of test signals in the time domain. Therefore, it is necessary to take the delays of the terminals into account. When analysing signals, any delay introduced by the test system, codecs and terminals has to be taken into account accordingly.

8.3.1.3 Positioning of the headsets

Recommendations for the set-up and positioning of headsets are given in [ITU-T P.380]. If not stated otherwise, headsets shall be placed in their recommended wearing position. Some insert earphones might not fit properly in type 3.3 ear simulators. For such insert type headsets, a type 2 of [ITU-T P.57] ear simulator may be used in conjunction with the HATS mouth simulator. The HATS should be equipped with two artificial ears as specified in [ITU-T P.57]. For binaural headsets, two artificial ears are required.

8.3.1.4 Position and calibration of reference loudspeaker

The reference loudspeaker or mouth shall be calibrated and equalized at the appropriate distance for each test case. The calibration and equalization shall be performed using a free field microphone for 1/12th octave band spacing. During equalization, type 3.3 HATS is removed from the sound field.

8.3.2 Frequency response in multimedia record mode

8.3.2.1 Requirement

The frequency response is evaluated from the stereo signal of the headset reference interface when reproducing a mono signal at the output of the reference loudspeaker. A reference microphone is placed by the microphone under test and this reference signal is used to evaluate the frequency response.

The frequency response shall be inside the mask in Table 1 for each stereo channel individually when sinusoidal signals at −28.7 dBPa are acoustically output from the reference loudspeaker. The requirement is only applicable for 0° incidence.

Table 1

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
200	5	−5
5 000	5	−5
14 000	0	−20
NOTE 1 – All sensitivity values are expressed in decibels on an arbitrary scale. NOTE 2 – The limits for intermediate frequencies lie on a straight line drawn between the given values on a logarithmic (frequency) – linear (decibel) scale.		

8.3.2.2 Test set-up

1) The test arrangement is according to Figure 3. The reference loudspeaker is placed at d = 50 cm distance from the HATS MRP. A reference microphone is placed by the microphone under test.
2) The headset is mounted on the HATS, which is rotated from −90° to 90° in steps of 45° and the microphone electrical signals are picked up by the test system.
3) For the test, sinusoidal signals are used in the bandwidth between 200 Hz and 14 kHz. The duration of each sine waves shall be <1 s. The signals are played over the free-standing loudspeaker or artificial mouth at −28.7 dBPa, measured at the HATS MRP.
4) The sending frequency response is analysed with a 4k FFT and determined in 1/12th octave intervals, as given in [IEC 61260-1] for frequencies from 200 Hz to 14 kHz inclusive, measured at the POI. In each 1/12th octave band, the power density spectrum of the measured signal is compared to the power density spectrum of the input signal using a flat top window, and averaged over the complete test sequence length.

8.3.3 Maximum acoustic input in multimedia record mode

8.3.3.1 Requirement

The maximum acoustic input is evaluated from the individual left and right signals of the headset reference interface when reproducing a mono signal at the output of the reference loudspeaker.

The maximum acoustic input shall be linear in level to the programme simulation noise signal, as the levels 0 dBPa and +16 dBPa are acoustically output from the reference loudspeaker.

8.3.3.2 Test set-up

1) The test arrangement is according to Figure 3. The reference loudspeaker is placed at d = 10 cm distance from the HATS MRP, then the HATS is rotated 90° left and right, respectively, so each headset MIC is measured in front of the reference loudspeaker.
2) Programme simulation noise as defined in [IEC 60268-1] is used for the measurements. Detailed information about the test signal used is to be found in the corresponding clause of

this Recommendation. The programme simulation noise according to [EN 50332-1] and [EN 50332-2] is band limited by design and requires no filtering.

3) The test levels are 0 dBPa and +16 dBPa, as measured at the headset MIC location.

4) The electrical MIC output signal is analysed with a 4k FFT, and the transfer function referenced to the acoustic spectral density and computed using a flat top window.

8.3.4 Distortion at maximum acoustic input in multimedia record mode

8.3.4.1 Requirement

The distortion at maximum acoustic input is evaluated from the individual left and right signals of the headset reference interface when reproducing a mono signal at the output of the reference loudspeaker.

The THD + noise shall be <30 dB, as sinusoidal signals at level +20.7 dBPa are acoustically output from the reference loudspeaker.

8.3.4.2 Test set-up

1) The test arrangement is according to Figure 3. The reference loudspeaker is placed at 10 cm distance from the HATS MRP, then the HATS is rotated 90° left and right, respectively, so that each headset MIC is measured in front of the reference loudspeaker.

2) For the test, a sinusoidal signal at frequencies of 315 Hz and 1 000 Hz is used. The duration of the sine wave shall be <1 s. The sinusoidal signal levels shall be 20.7 dBPa at the ear reference point (ERP).

3) The signal to harmonic distortion ratio is measured selectively up to 10 kHz.

9 Function requirements for terminals with the universal headset interface

Refer to clause 9 of [ITU-T P.381] for functional requirements and impedance ranges for the terminals that should be supported.

Annex A

Interpolation method for diffuse-field correction

(This annex forms an integral part of this Recommendation.)

For measurements requiring diffuse-field correction values for closer frequency spacing than 1/12th octave bands, linear interpolation on a log scale from the 1/12th octave band interpolated values in Table 14B of [ITU-T P.58] shall be used.

Appendix I

Audio connectivity for sockets with five contact points

(This appendix does not form an integral part of this Recommendation.)

This appendix illustrates the dimensions of the concentric plug and socket connector with five contact points.

I.1 Plug connector of diameter 2.5 mm with five poles

The 2.5 mm diameter plug connector with five poles is for further study.

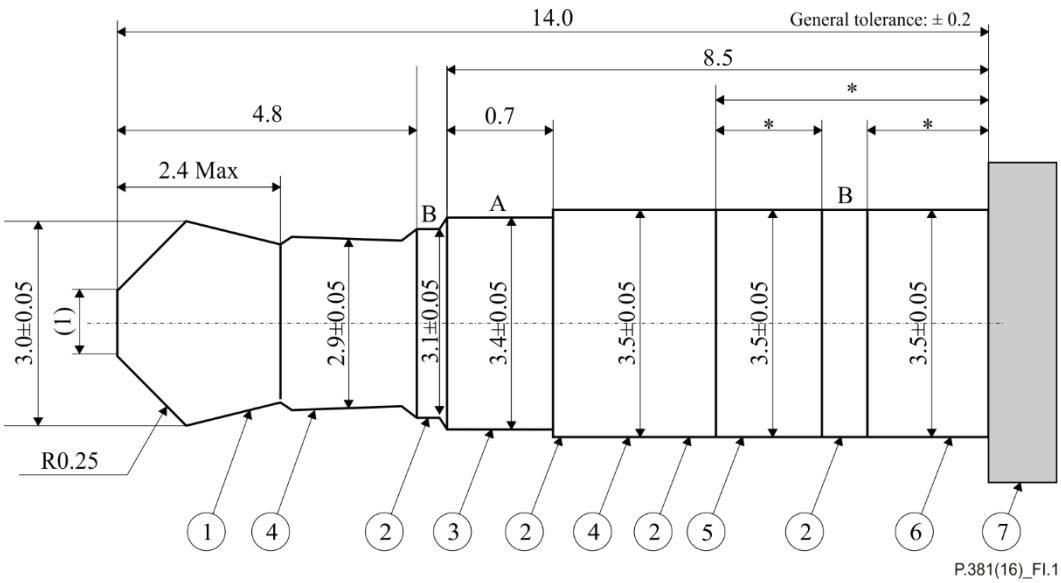
I.2 Socket connector of diameter 2.5 mm with five contact points

The 2.5 mm diameter socket connector with five poles is for further study.

I.3 Plug connector of diameter 3.5 mm with five poles

Figure I.1 shows the shape and dimensions of the 3.5 mm diameter plug connector with five poles. The width of strip A along the axial direction is 0.15 mm and shall be free of sharp edges at its corners. Junctions B should be free of burr or flash.

NOTE – "Flash" here refers to a rough edge or ridge on the surface.



① tip made of conductive material
② insulating rings
③ ring 1 made of conductive material
④ available spaces for a conductive ring 2
⑤ ring 3 made of conductive material
⑥ sleeve made of conductive material
⑦ illustration of the hand grip at the end of a plug

*Dimensions intentionally left out, refer to drawings in [ITU-T P.381] for dimensional guidelines.

Figure I.1 – Shape and dimensions of the 3.5mm diameter plug connector with five poles

The grip dimensions of the five pole connector shall be harmonized with the [ITU-T P.381] dimensions for optimum compatibility.

I.4 Socket connector of diameter 3.5 mm with five contact points

The socket should be able to mate and cooperate with the plug reliably. The dimensions (see Table I.1) and the positioning for each contact spring are illustrated in Figure I.2. Considering the tolerance of the plug dimension and positioning of the socket contact spring, in addition to the shift of the practical contact point location caused by the width of the spring, the minimum distance between the contact point of the ring 2 spring and that of the sleeve spring is recommended to be more than 2.4 mm. If bushing of the socket is made of conductive material, the contact area of the sleeve spring may exceed the given range indicated in Figure I.2, so bushing of the socket should not be longer than 2.4 mm.

Table I.1 – Specific spring contact dimensions for five contact points

Dimension	**Five pole socket: length** (mm)
Tip	11.95
Ring 1	7.6
Ring 2	Not defined
Ring3	3.7
Sleeve	1.0
NOTE – The above shall be contact dimensions with a plug inserted	

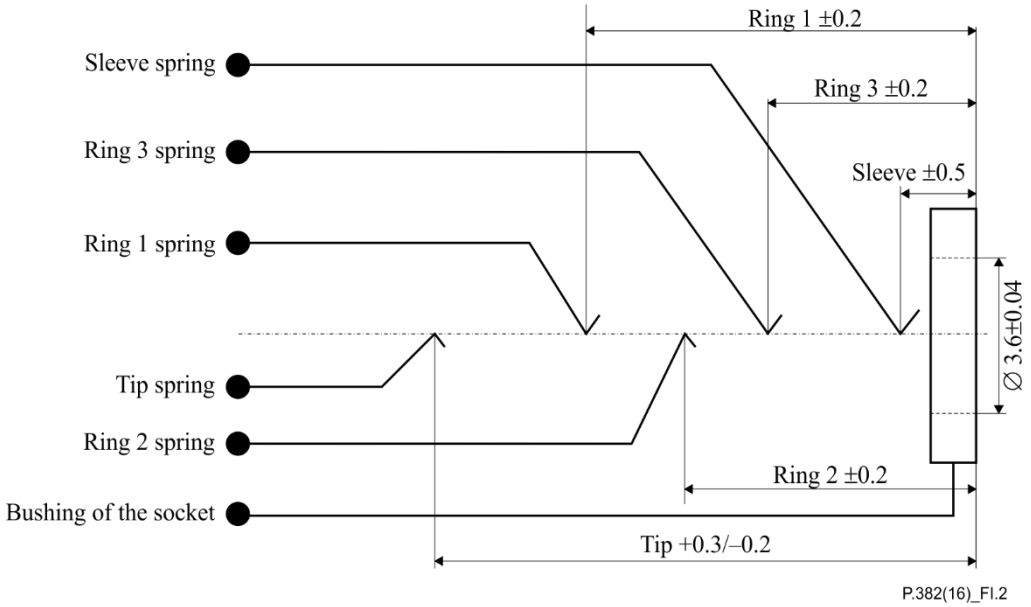


Figure I.2 – Dimensions of the 3.5mm diameter socket with five contact points and positioning of each contact spring

Appendix II

Audio connectivity for sockets with six contact points

(This appendix does not form an integral part of this Recommendation.)

This appendix illustrates the optional dimensions of the concentric plug and socket connector with six contact points and is for further study.

Appendix III

Audio connectivity for sockets with less than five contact points

(This appendix does not form an integral part of this Recommendation.)

Refer to Appendices I to III of [ITU-T P.381] for illustrations of dimensions of the concentric plug and socket connector with three and four contact points.

Appendix IV

Other considerations

(This appendix does not form an integral part of this Recommendation.)

Refer to Appendix IV of [ITU-T P.381] for illustrations of other considerations when implementing a five pole plug and socket.

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