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Recommendation

ITU-T P.382 (03/2023)

SERIES P: Telephone transmission quality, telephone installations, local line networks

Voice terminal characteristics

Technical requirements and test methods for analogue wired multi-microphone headsets or headphones and corresponding universal interface of terminals

ITU-T P-SERIES RECOMMENDATIONS

TELEPHONE TRANSMISSION QUALITY, TELEPHONE INSTALLATIONS, LOCAL LINE NETWORKS

Vocabulary and effects of transmission parameters on customer opinion of transmission quality	P.10–P.19
Voice terminal characteristics	P.30–P.39
Reference systems	P.40–P.49
Objective measuring apparatus	P.50–P.59
Objective electro-acoustical measurements	P.60–P.69
Measurements related to speech loudness	P.70–P.79
Methods for objective and subjective assessment of speech quality	P.80–P.89
Voice terminal characteristics	**P.300–P.399**
Objective measuring apparatus	P.500–P.599
Measurements related to speech loudness	P.700–P.709
Methods for objective and subjective assessment of speech and video quality	P.800–P.899
Audiovisual quality in multimedia services	P.900–P.999
Transmission performance and QoS aspects of IP end-points	P.1000–P.1099
Communications involving vehicles	P.1100–P.1199
Models and tools for quality assessment of streamed media	P.1200–P.1299
Telemeeting assessment	P.1300–P.1399
Statistical analysis, evaluation and reporting guidelines of quality measurements	P.1400–P.1499
Methods for objective and subjective assessment of quality of services other than speech and video	P.1500–P.1599

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T P.382

Technical requirements and test methods for analogue wired multi-microphone headsets or headphones and corresponding universal interface of terminals

Summary

Recommendation ITU-T P.382 specifies critical physical and electroacoustic characteristics for a universal headset interface with more than four terminals and provides corresponding test methods. Headset or 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 or HP originally provided by the terminal manufacturer or others that are offered separately. However, the quality of service or quality of experience perceived by users is influenced by both the electrical performance of the interface and the compatibility between the terminal and the connected headset or headphone.

History

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Keywords

Connector, headphone, headset, interface, terminals.

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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.

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Table of Contents

Recommendation ITU-T P.382

Technical requirements and test methods for analogue wired multi-microphone headsets or headphones and corresponding universal interface of terminals

1 Scope

This Recommendation specifies electrical requirements and test methods for a multi-microphone headset or headphone (HP) interface used in digital mobile terminals. It is also applicable to terminals with a digital headset interface combined with an external adapter for an analogue (universal) headset interface. The combination is measured as one device.

The principle of this Recommendation is to ensure adequate compatibility between the digital mobile terminal and the universal and multi-microphone wired analogue headset or HP, and to provide better user experience. The universal multi-microphone headset or HP interface enables the separation of sales between digital mobile terminals and headsets or HPs. One benefit is that users are free to choose their favourite type of headset or HP in the market, which in the long run 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 provide instructions 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 a physical analogue audio output and input interface that needs to support headsets with more than one microphone. Other similar information and communication technology equipment may also lie within the scope of this Recommendation.

This Recommendation does not apply to terminals designed solely for digital headset or HP 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.58] Recommendation ITU-T P.58 (2023), *Head and torso simulator for telephonometry*.

[ITU-T P.64] Recommendation ITU-T P.64 (2022), *Determination of sensitivity/frequency characteristics of local telephone systems.*

[ITU-T P.381] Recommendation ITU-T P.381 (2023), *Technical requirements and test methods for analogue wired headsets or headphones and corresponding universal interface of terminals*.

[ITU-T P.501] Recommendation ITU-T P.501 (2020), *Test signals for use in telephony and other speech-based applications*.

[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] CENELEC 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] CENELEC 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 artificial ear [ITU-T P.381]: A device that 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 – Definition based on that in [b-ITU-T P.10].

3.1.2 codec [ITU-T P.381]: Combination of an analogue-to-digital encoder and a digital-to-analogue decoder operating in opposite directions of transmission in the same equipment.

NOTE – This definition is based on that in [b-ITU-T G.701].

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 head and torso simulator (HATS) for telephonometry [ITU-T P.381]: 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 – Definition is based on that in [b-ITU-T P.10].

3.1.6 headphone (HP) [ITU-T P.381]: An object based on the assembly of one or two earphones on a headband or chinband, the use of which may be optional (e.g., with intra-concha earphones).

NOTE –Definition based on that in [b-IEC 60268-7]).

3.1.7 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.

3.1.8 mean opinion score-listening-only quality objective (MOS-LQO) [ITU-T P.381]: A score calculated by means of an objective model that aims to predict the quality for a listening-only test situation.

NOTE 1 – Objective measurements made using the model given in [b-ITU-T P.863] give results in terms of MOS-LQO.

NOTE 2 – This definition is base on that given in [b-ITU-T P.800.1].

3.1.9 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]).

3.1.10 Receive [ITU-T P.381]: The receiving direction of the signal transmission, usually from the measurement system to the device under test.

3.1.11 Send [ITU-T P.381]: The sending direction of the signal transmission, usually from the device under test to the measurement system.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

DC	Direct Current
DRP	eardrum Reference Point
DUT	Device Under Test
EL	Echo Loss
FB	Fullband
FFT	Fast Fourier Transform
GND	Ground
HATS	Head and Torso Simulator
HP	Headphone
HTCL	Headset Terminal Coupling Loss
HTCLw	weighted Headset Terminal Coupling Loss
L	Left
LQO	Listening only Quality Objective
MIC	Microphone
MIC1	primary Microphone
MIC2	secondary Microphone
MOS-LQO	Mean Opinion Score-Listening only Quality Objective
MRP	Mouth Reference Point
NB	Narrowband
POI	Point of Interconnection
R	Right
RMS	Root Mean Square
SWB	Super-wideband
TCL	Terminal Coupling Loss
TCLw	weighted Terminal Coupling Loss
THD	Total Harmonic Distortion
WB	Wideband

5 General description

Generally, if a headset or HP is used, the overall user experience during a call highly depends on both the terminal and the connected headset or HP. Although the acoustic quality of the headset or HP 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 connection points that are compatible with the universal concentric connector interface for successful interconnection of the digital mobile terminal and the headset or HP, including the plug connector and the socket connector. Normally, the socket connector is fixed inside the terminal, with the outside rim of the socket level with the surrounding shell of the terminal.

6 Physical characteristics

6.1 General rules

Two types of concentric socket connectors of different diameters are recommended for use: 2.5 mm; and 3.5 mm. An isometric view of the plug and socket connectors is shown in Figure 6-1 of [ITU-T P.381].

If the terminal is equipped with a headset interface designed for both communication and audio playback and this multi-microphone interface is utilized, the fixed connector shall be a 3.5 mm diameter or 2.5 mm diameter concentric socket connector. Detailed dimensions for socket and the plug connectors with more than four contact points are given in Appendices I to III. Some terminals with curved edges may not work well with the dimensions given in Appendices I to III.

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.

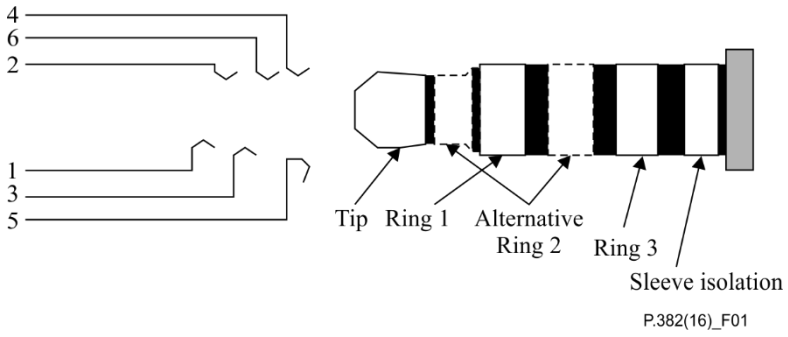


Figure 1 – Pin assignments of a socket connector with five contact points

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

A socket connector with five contact points shall be compatible with both the three pole and four pole plugs 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 (L) audio channel of the receiver. Point 2 is to be connected to ring 2, linking it to the transducer secondary microphone+ (MIC2+) (right (R) recording channel) of the device under test (DUT). Point 3 is to be connected to ring 1, linking it to the R audio channel of the receiver. 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 primary microphone+ (MIC1+) (L recording channel) of the DUT.

Referring to Figure 1:

- 1 is the contact point of the tip, linking it to the L channel of the receiver (HP L 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 R channel of the receiver (HP R 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 (MIC1+).

In summary, the pole order from the tip to the sleeve of the headset plug is HP L/MIC2/HP R/MIC1/GND.

The pinout order of HP L/MIC2/HP R/MIC1/GND has the advantage of electrostatic discharge protection and allows for both plastic and metallic convertors.

6.2.2 Alternative pin assignment

Referring to Figure 1:

- 1 is the contact point of the tip, linking it to the L channel of the receiver (HP L audio);
- 2 is the contact point of ring 1, linking it to the R channel of the receiver (HP R 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 (MIC1+);
- 5 is the bushing of the socket, linking it to the transducer (MIC1+):
- 6 is the contact point of ring 2, linking it to GND when it is made of conductive material.

In summary, the alternative pole order from the tip to the sleeve of the headset plug is: HP L/HP R/MIC2/GND/MIC1.

7 Terminal electrical interface specification

7.1 Communication mode (terminal)

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. See [ITU-T P.381] for requirements and specific test set-ups.

7.1.1 Test set-up for the communication mode (terminal)

Test set-ups are shown in Figures 7-1 and 7-2 of [ITU-T P.381].

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

The output of the test system connected to the interface in Send of the headset connector must be direct current (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 MICs.

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 the digital mobile terminal headset outputs.

The common GND 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 (FB) real speech signals specified in [ITU-T P.501] are used for the measurements. Detailed information about the test signal used is specified in the corresponding clause of this Recommendation.

All test signals used in Receive tests have to be band limited with ≥24 dB/octave roll off, achieved by bandpass filter. The signal should be band limited between:

– in narrowband (NB) mode, 100 Hz and 4 kHz;

– in wideband (WB) mode, 100 Hz and 8 kHz;

– in super-wideband (SWB) mode, 50 Hz and 16 kHz;

– in FB mode, 20 Hz and 20 kHz.

For real speech, the test signal levels are in accordance with 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 specified otherwise. Other test signal levels are calculated as the average level over the complete test sequence length of the test signals. For the receiving direction, the signal should be band limited.

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

- −16 dBm0 (absolute signal power level, in decibels, relative to a point of zero relative level) in Receive;
- −60 dBV (decibels relative to 1 V) in Send [typical equivalent signal level of a microphone (MIC) of the DUT 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 when considering binaural headsets.

NOTE – If different network signal levels are used, it should be noted and stated in the 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 delays 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 for the communication mode (terminal)

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

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

7.1.3 Level in Send for nominal speech input level for the communication mode (terminal)

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

The test details are specified 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 specified in clause 7.1.4.1 of [ITU-T P.381].

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

7.1.5 Level in Send for low and high speech input levels for the communication mode (terminal)

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

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

7.1.6 Linearity in Receive for the communication mode (terminal)

The linearity in Receive is for further study

7.1.7 Sending frequency response for the communication mode (terminal)

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

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

7.1.8 Receiving frequency response for the communication mode (terminal)

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

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

7.1.9 Sidetone loss for the communication mode (terminal)

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

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

7.1.10 Sidetone delay for the communication mode (terminal)

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

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

7.1.11 Noise in Send for the communication mode (terminal)

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

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

7.1.12 Noise in Receive for the communication mode (terminal)

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

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

7.1.13 Sending distortion for the communication mode (terminal)

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

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

7.1.14 Receive distortion for the communication mode (terminal)

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

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

7.1.15 Noise cancellation test in Send for the communication mode (terminal)

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

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

7.1.16 One-way speech quality in Send for the communication mode (terminal)

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

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

7.1.17 One-way speech quality in Receive for the communication mode (terminal)

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

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

7.1.18 Terminal coupling loss for the communication mode (terminal)

The detailed requirements for weighted terminal coupling loss (TCLw) and terminal coupling loss (TCL) are specified in clause 7.1.18.1 of [ITU-T P.381].

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

7.1.19 Temporal echo effects for the communication mode (terminal)

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

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

7.1.20 Double talk performance for the communication mode (terminal)

7.1.20.1 Attenuation range in Send during double talk, $A_{H,s,dt}$

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

The test details are specified 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 specified in clause 7.1.20.2.1 of [ITU-T P.381].

The test details are specified 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 specified in clause 7.1.20.3.1 of [ITU-T P.381].

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

7.1.21 Activation in Send for the communication mode (terminal)

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

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

7.2 Multimedia playback (terminal)

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

7.2.1 Test set-up for the multimedia playback mode (terminal)

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

7.2.2 Output level for the multimedia playback mode (terminal)

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

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

7.2.3 Frequency response for the multimedia playback mode (terminal)

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

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

7.2.4 Noise for the multimedia playback mode (terminal)

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

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

7.2.5 Distortion for the multimedia playback mode (terminal)

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

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

7.2.6 Receiving crosstalk for the multimedia playback mode (terminal)

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

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

7.3 Multimedia record (terminal)

7.3.1 Test set-up for the multimedia record mode (terminal)

The test set-up is shown in Figure 2.

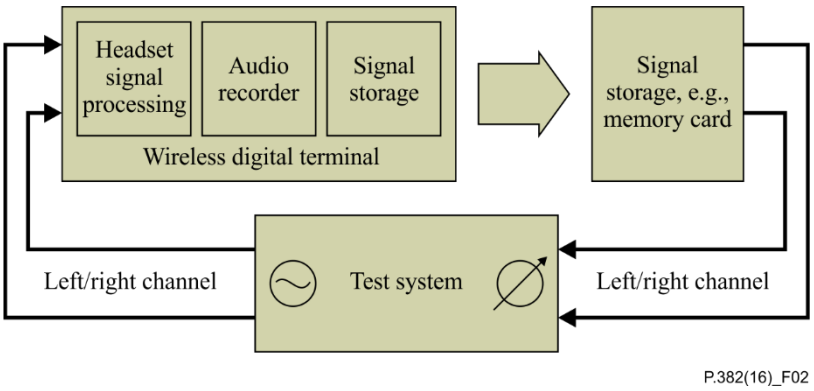


Figure 2 – Set-up for testing the electrical headset interface

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 MICs.

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 the digital mobile terminal headset outputs.

7.3.1.2 Test signals and test signal levels

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

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

Programme simulation noise as specified in [IEC 60268-1] is used for the measurements. Detailed information about the test signal used is specified 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 relative to the average level over the complete test sequence length of the test signals, if not specified 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 delays introduced by the test system, codecs and terminals have to be taken into account accordingly.

7.3.2 Input level for the multimedia record mode (terminal)

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 applying a stereo signal to 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 L and R channel shall be <1 dB.

7.3.2.2 Test

1) The test set-up 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 for the multimedia record mode (terminal)

7.3.3.1 Requirement

The frequency response is evaluated from a digital output file of the mobile terminal recorder when applying a signal to 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

1) The test set-up 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 one-12th octave bands, as given in [IEC 61260-1] for frequencies from 100 Hz to 18 kHz inclusive, measured at the point of interconnection (POI). In each one-12th octave band, the power density spectrum of the measured signal is compared to that 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 for the multimedia record mode (terminal)

7.3.4.1 Requirement

The acoustic input range is evaluated from a digital stereo output file of the mobile terminal recorder when applying a signal to 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

1) The test set-up 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 for the multimedia record mode (terminal)

7.3.5.1 Requirement

The phase response is evaluated from a digital stereo output file of the mobile terminal recorder when applying a stereo signal to 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

1) The test set-up 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 L and R 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 (THD) is evaluated from a digital output file of the mobile terminal recorder when applying a signal to the headset interface.

The THD + 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

1) The test set-up 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. A short activation and conditioning sequence of male or female ITU-T P.501 speech may be needed, in which case it shall be input prior to the sinusoidal signal at the nominal signal level.
3) The spectral distribution of the recorded file is analysed with a 4k-point fast Fourier transform (FFT), and the THD + noise is computed using a flat top window.
4) The output distortion response is expressed in decibels.

7.3.7 Cross-talk for the multimedia record mode (terminal)

7.3.7.1 Requirement

The cross-talk is evaluated from a digital stereo output file of the mobile terminal recorder when applying a stereo signal to 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

1) The test set-up 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 MIC1 and MIC2, as well as vice versa, MIC2 versus MIC1.

7.3.8 Time offset and sampling accuracy for the multimedia record mode (terminal)

7.3.8.1 Requirement

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

The recorded file's sinusoidal frequency shall deviate by <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

1) The test set-up 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-point FFT and the windowing used is the flat top window.
4) The output L and R responses are individually computed.

8 Headset specification

8.1 Communication mode (headset)

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 MICs, needs a specific test.

8.1.1 Test set-up (headset)

The test set-up is specified in clause 8.1.1 of [ITU-T P.381].

8.1.2 Sensitivity in Send (headset)

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

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

8.1.3 Sensitivity in Receive (headset)

The detailed requirements are specified in clause 8.1.3.1 of [ITU-T P.381].

The test details are specified in clause 8.1.3.2 of [ITU-T P.381].

8.1.4 Sending frequency response (headset)

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

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

8.1.5 Receiving frequency response (headset)

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

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

8.1.6 Idle channel noise in Send (headset)

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

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

8.1.7 Distortion in Send (headset)

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

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

8.1.8 Headset terminal coupling loss (headset)

8.1.8.1 Requirement

For speech transmission, the weighted headset terminal coupling loss (HTCLw) for NB, and headset terminal coupling loss (HTCL) for WB, SWB and FB is evaluated for the electrical interface MIC1 or MIC2 lines when applying a stereo signal to the electrical receiver of the headset interface.

The coupling loss shall be <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

1) The test set-up 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 MIC 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 HP L input and MIC1 output, as well as HP R input and MIC2 output, respectively. Coupling loss between HP L input and MIC2 output, as well as HP R Input and MIC1 output, should be confirmed to also comply with the requirement.
5) For NB mode, HTCLw is calculated according to clause B.4 of [ITU-T G.122] (trapezoidal rule). In WB, SWB and FB mode, HTCL is calculated as the echo loss (EL) from 50 Hz to 18 kHz. For the calculation, the averaged test signal level at each frequency band takes as reference the averaged measured echo signal level in each frequency band. For the measurement, a time window has to be applied that is adapted to the duration of the actual test signal. The EL is calculated by the following equations. The form of the first is generalized from that specified in clause B.4 of [ITU-T G.122] to calculate EL based on tabulated data, which allows the calculation of EL within any frequency range between f_0 and f_N.

$$L_e = C - 10\log_{10}\sum_{i=1}^{N}(A_i + A_{i-1})(\log_{10} f_i - \log_{10} f_{i-1}),$$

$$\text{where} \quad C = 10\log_{10} 2\,(\log_{10} f_N - \log_{10} f_0),$$

where

A_0 is the output/input power ratio at frequency $f_0 = 50$ Hz;

A_1 is the output/input power ratio at frequency f_i;

A_N is the output/input power ratio at frequency $f_N = 18$ kHz

8.2 Multimedia playback mode (headset)

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

8.2.1 Test set-up (headset)

The test set-up is specified in clause 8.2.1 of [ITU-T P.381].

8.2.2 Sensitivity for the multimedia playback mode (headset)

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

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

8.2.3 Distortion for the multimedia playback mode (headset)

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

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

8.2.4 Receiving crosstalk for the multimedia playback mode (headset)

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

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

8.3 Multimedia record mode (headset)

8.3.1 Test set-up (headset)

The test set-up is shown in Figure 3.

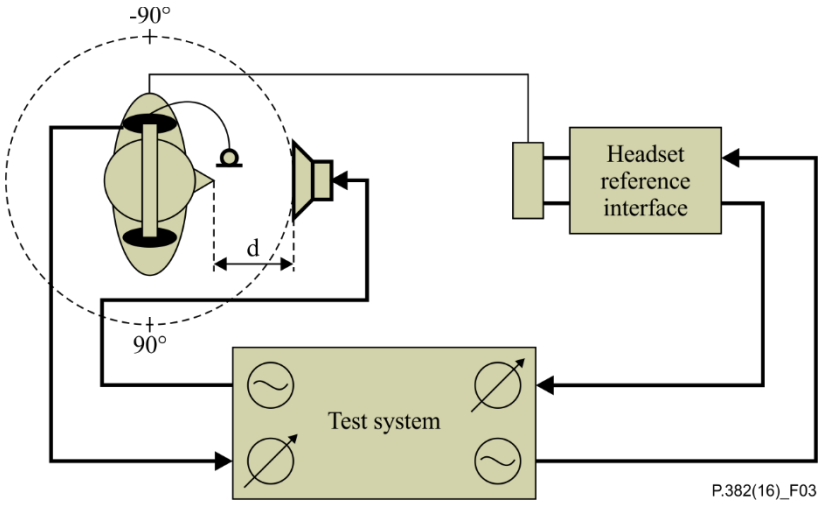


Figure 3 – Set-up for testing the headset

Requirements for HATS and ear simulators are specified in clause 8.2.1 of [ITU-T P.381].

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 HATS. The common GND 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 one-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 delays introduced by the test system, codecs and terminals have to be taken into account accordingly.

8.3.1.3 Positioning of the headsets

The same guidelines and requirements on headset positioning apply as in clause 8.1.1.3 of [ITU-T P.381].

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 and is analysed in one-12th octave bands. During equalization, the HATS is removed from the sound field.

8.3.2 Frequency response for the multimedia record mode (headset)

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 close to the MIC under test and this reference measurement 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

1) The test set-up is according to Figure 3. The reference loudspeaker is placed at d = 50 cm distance from the HATS MRP. A reference microphone is placed close to the MIC under test.
2) The headset is mounted on the HATS, which is rotated from −90° to 90° in steps of 45° and the MIC 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 wave 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-point FFT and determined in one-12th octave bands, as given in [IEC 61260-1] for frequencies from 200 Hz to 14 kHz inclusive, measured at the POI. In each one-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 for the multimedia record mode (headset)

8.3.3.1 Requirement

The maximum acoustic input is evaluated from the individual L and R 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

1) The test set-up 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° L and R, respectively, so each headset MIC is measured in front of the reference loudspeaker.
2) Programme simulation noise as specified in [IEC 60268-1] is used for the measurements. Detailed information about the test signal used is specified 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-point 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 for the multimedia record mode (headset)

8.3.4.1 Requirement

The distortion at maximum acoustic input is evaluated from the individual L and R 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

1) The test set-up is according to Figure 3. The reference loudspeaker is placed at 10 cm distance from the HATS MRP, then the HATS is rotated 90° L and R, 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.
3) The signal to harmonic distortion ratio is measured selectively up to 10 kHz.

9 Function requirements for terminals with the universal headset interface

See 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 one-12th octave bands, linear interpolation on a logarithmic scale from one-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 concentric plug and socket connectors 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.

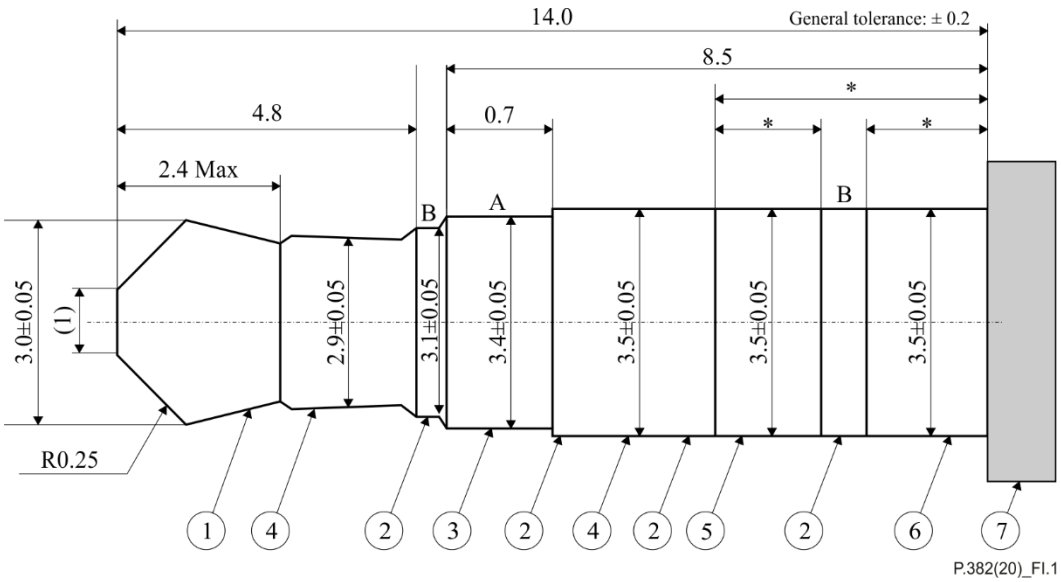
I.2 Socket connector of diameter 2.5 mm with five contact points

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 3.5 mm 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 – Entries shall be contact dimensions with a plug inserted	

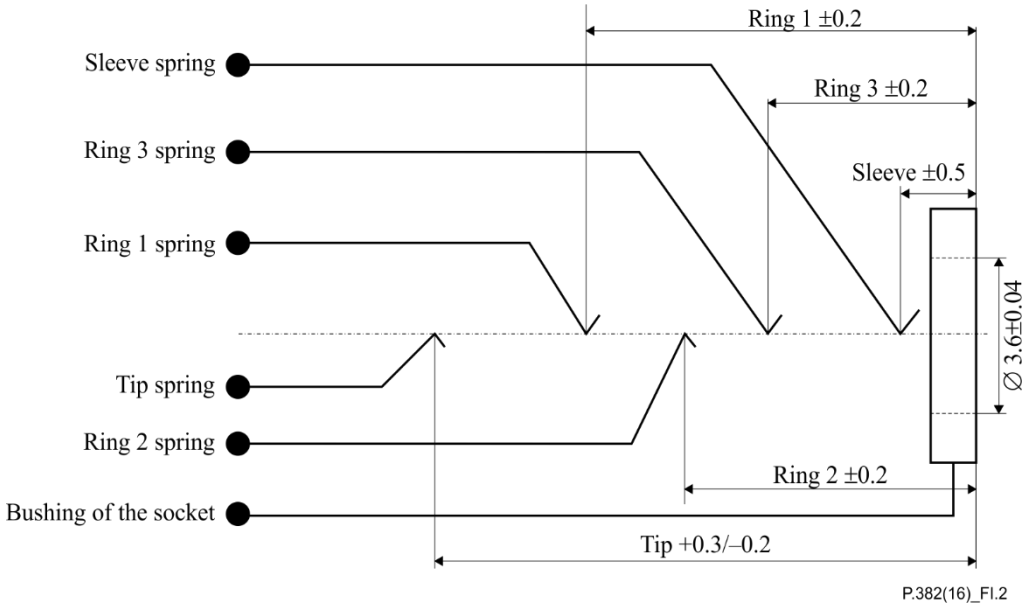


Figure I.2 – Dimensions of the 3.5 mm diameter socket with five contact points and positioning of each contact spring

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 concentric plug and socket connectors with six contact points and is for further study.

Appendix III

Audio connectivity for sockets with fewer 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 concentric plug and socket connectors 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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