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SERIES P: TELEPHONE TRANSMISSION QUALITY, TELEPHONE INSTALLATIONS, LOCAL LINE NETWORKS

Voice terminal characteristics

Electro-acoustic measurements on headsets

Recommendation ITU-T P.380

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Recommendation ITU-T P.380

Electro-acoustic measurements on headsets

Summary

Recommendation ITU-T P.380 provides testing methods for headsets using the head and torso simulator. The Recommendation addresses the following topics: selection of artificial ears, classification of headsets, positioning of headsets on the head and torso simulator (HATS), test repeatability and contents of the measurement report.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T P.380	2003-11-13	12	11.1002/1000/7040
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Keywords

Artificial ear, head and torso simulator, headsets, testing methods.

* 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.

FOREWORD

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

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

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

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In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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1 Scope

This Recommendation is the result of a study held within ITU-T for defining the electro-acoustic testing methodologies for headsets, which provide the best correlation with the performance of headsets in real use, when using the couplers currently recommended in [ITU-T P.57].

The results of this round robin test, aiming to compare the acoustic behaviour of headsets placed on humans and on the head and torso simulator (HATS), can be found in the Bibliography.

The recommended test methodology is based on the use of HATS, as this is the best approximation of acoustical conditions occurring in the real use of headsets.

This Recommendation focuses specifically on headsets and overrules [ITU-T P.57] regarding the applicability rules of artificial ears to specific receivers, as long as these devices belong to the headsets.

This Recommendation is complementary to the relevant [ITU-T P.64], [ITU-T P.79], etc., which specify the electro-acoustic and telephonometric testing methods that are applicable to the telephone devices.

The recommendation of performance descriptors, such as masks or limit values, is left to the relevant performance standards.

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.57] Recommendation ITU-T P.57 (2021), *Artificial ears*.

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

[ITU-T P.79] Recommendation ITU-T P.79 (2007), *Calculation of loudness ratings for telephone sets*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 CL: Centre of lips of head and torso simulator.

3.2.2 headset: Apparatus for telephony comprising essentially a "hands-free" handset which is typically secured to the head of the wearer. It includes a telephone microphone and a telephone receiver.

3.2.3 recommended test position (RTP): Corresponds to the position in which the headset should be placed on HATS, e.g., as instructed by the manufacturer. In all the cases, the RTP should resemble the RWP on humans.

3.2.4 recommended wearing position (RWP): Corresponds to the position in which a headset should be placed on humans according to the intended use (e.g., as instructed by the manufacturer in the user manual, etc.).

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

HATS Head And Torso Simulator

RTP Recommended Test Position

RWP Recommended Wearing Position

RLR Receive Loudness Rating

STMR Sidetone Masking Rating

5 Conventions

None.

6 Types of headsets

This Recommendation covers the headsets equipped with receivers and microphones as defined below.

6.1 Receiver

With reference to the definitions provided in [ITU-T P.57], the following receiver types are covered:

– Insert-type;
– Intra-concha;
– Supra-concha;
– Supra-aural.

6.2 Microphone

This Recommendation covers headsets equipped with microphones positioned as follows:

– In front of and around the mouth (e.g., long booms);
– At the cheek (e.g., short booms);
– At the ear;
– At the neck (e.g., hanging down or collar clip);
– At the chest (e.g., hanging down or clip).

7 Artificial ear selection

Type 4.3 artificial ear is preferred for insert-type headsets, intra-concha headsets, supra-concha headsets and supra-aural headsets.

Type 4.4 artificial ear is preferred for insert-type headsets[1], intra-concha headsets, supra-concha headsets and Supra-aural headsets.

Type 3.3 artificial ear may be used for insert-type headsets[2], intra-concha headsets, supra-concha headsets and supra-aural headsets.

Type 3.4 artificial ear may be used for insert-type headsets[2] and intra-concha[3] headsets.

In case artificial ears of Type 3 are used and obtain different measurement results against Type 4 artificial ears, the results from Type 4 artificial ear shall take precedence.

8 Positioning and measurement of the headset

8.1 Measurements

The positioning methodology provided in this Recommendation has been validated [b-ITU-T SG12 Cont54], [b-ITU-T SG12 Cont47], and shall be used, for measuring the frequency response and loudness ratings [ITU-T P.79] for both receive and send directions.

This positioning of the headset on the HATS is, however, also recommended for performing measurements related to other electro-acoustic parameters such as sidetone masking rating (STMR), D-factor, distortion, etc.

Furthermore, special conditions apply to headsets in some respects.

Some headsets are binaural devices. In case the required receive loudness rating (RLR) is only specified for a monaural device, the corresponding required RLR for a binaural device should be 6 dB higher (for each of the receivers measured separately). In a similar way, other receive related requirements should be adapted for binaural devices.

8.2 Positioning

For a given headset, one single position shall be defined to test all the electro-acoustic parameters on a given HATS.

The reasons for this provision are the following:

– This is close to what happens in real life, so this procedure is consistent with the basic goal of the Recommendation, e.g., resembling the real-use conditions;

– It is simple;

– It allows for sidetone (and other related) measurements to be performed.

The positioning of the headset shall reflect the way it is intended by the manufacturer to be used in a real situation.

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[1] The Type 4.4 artificial ear simulator cannot be used for insert-type headsets where the acoustic outlet of the receiver is placed beyond the reference plane in the ear canal of the Type 4.4 artificial ear.

[2] It should be noted that, in some cases, the use of Type 3.3 or Type 3.4 ear simulator with an insert headset could provide a seal greater than that occurring on humans, leading to an overestimation of the level of the frequency response curve in the low frequency region (below 1 kHz). This is especially true for headsets relying on a close sealing with the ear canal.

[3] Only for intra-concha headsets where the acoustic outlet of the receiver face towards the ear canal the Type 3.4 artificial ear can be used.

For this reason, the manufacturer's user's guide should provide a recommended wearing position describing in a precise way how the device should be placed on the user's head.

From this recommended wearing position (RWP), the recommended test position shall be derived, as close as possible to the RWP.

Also, the RTP description should hopefully be provided by the manufacturer and shall state in which way the receiving part of the headset shall be placed against or inside the ear simulator, and describe the positioning of the microphone, once the receiver(s) of the headset has been placed on the ear simulator.

The exact positioning of the microphone shall be specified by using geometric coordinates relative to the centre of the lips.

NOTE – A good laboratory practice may refer to [ITU-T P.64], which defines "a set of Cartesian axes with origin at CL, the centre of the lips", and further defines the axes as follows:

– x-axis: horizontal axis of the mouth, with positive direction into the mouth;

– y-axis: horizontal, perpendicular to the x-axis, with positive direction towards the side of the mouth on which the handset is held;

– z-axis: vertical, with positive direction upwards.

The way in which the coordinates are defined and checked is left to the choice of the manufacturer, or of the test lab in case the RTP is not defined by the manufacturer, but it should be noted that the closer the microphone is to the mouth, the more sensitive the results will be to any inaccuracy of the geometrical positioning.

As an essential complementary information, the manufacturer shall state what is the recommended orientation of the microphone towards the mouth.

In the case where no RWP information is available for the headset under test, then a suitable RWP and the derived RTP shall be defined by the testing lab, aiming at best-guessing the expected real-use position. All the relevant parameters of these assumed positions shall be reported together with the measurement results.

9 Test repeatability

Due to the sensitivity of the test results to the headset positioning, the tests shall be repeated at least five times by completely repositioning the headset, following the rules described in this Recommendation.

The test report shall individually provide the test results for each repetition, plus any additional statistical analysis as required.

NOTE 1 – It is recommended that the test operators get acquainted with the specific headset characteristics by running some preliminary learning test sessions.

NOTE 2 – The use of positioning jigs can improve the test repeatability so that no repetition is required. This generally applies to all tests from test repetitions carried out by a single operator to tests carried out at different laboratories. However, the jig must be customized or adjusted for the particular type of headset under test, fully respecting the positioning principles outlined for the RTP. The purpose of the jig is to reduce the variability of test results, especially for microphones, without changing the mean of the test results. Thus, care must be taken to validate the designed jig for its intended use, and it should be verified that the jig does not introduce a bias to the results (i.e., the jig should be verified by comparing the mean of results obtained with and without the jig).

10 Measurement report

The following information shall be reported additionally to the generally requested information:

– Precise description of the positioning of the headset used for the tests, along with pictures when relevant.

– The number of measurements taken into account in the calculation of the statistic parameters.

Bibliography

[b-ITU-T P.58] Recommendation ITU-T P.58 (2021), *Head and torso simulator for telephonometry*.

[b-ITU-T SG12 Cont54] ITU-T SG12 Study Period 2001 Contribution 54 (2003), *Conclusions of the Round Robin Test on headsets: Receiving side*.
<https://www.itu.int/md/T01-SG12-C-0054/e>

[b-ITU-T SG12 Cont47] ITU-TSG12 Study Period 2001 Contribution 47 (2002), *Rapporteur report – Workshop on Headsets/Sending Part*.
<https://www.itu.int/md/T01-SG12-C-0047/e>

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