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Foreword

This European Telecommunication Standard (ETS) was produced by the Terminal Equipment (TE) Technical Committee (TE) of the European Telecommunications Standards Institute (ETSI).

An ETSI standard may be given I-ETS status either because it is regarded as a provisional solution ahead of a more advanced standard, or because it is immature and requires a "trial period". The life of an I-ETS is limited to three years after which it can be converted into an ETS, have it's life extended for a further two years, be replaced by a new version, or be withdrawn.

This I-ETS is compiled as a separate, but complementary I-ETS to the requirements given in I-ETS 300 677.

Proposed announcement date	
Date of adoption of this I-ETS:	12 January 1996
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Introduction

This I-ETS provides a set of common test methods suitable for deriving the electro-acoustic requirements of an analogue telephony terminal as described in clause 1 (Scope). These test methods do not exactly simulate actual network components (e.g. local line sections, exchange feeding bridges) which are different in each country, but provide a common basis for comparing the performance of different telephony terminals.

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1 Scope

This I-ETS specifies test methods for the conformance testing of electro-acoustic characteristics of analogue handset telephony terminals communicating across the European Public Switched Telephone Networks (PSTNs).

NOTE: Tests for access requirements are contained in another standard e.g. ETS 300 001 [1].

2 Normative references

This I-ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this I-ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETS 300 001 (NET 4): "Attachments to the Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

[2] ITU-T Recommendation P.64 (1993): "Determination of sensitivity/frequency characteristics of local telephone systems".

[3] ITU-T Recommendation P.51 (1993): "Artificial mouth".

[4] ITU-T Recommendation P.57 (1993): "Artificial ears".

[5] IEC 651: "Sound level meters".

[6] CCITT Handbook on Telephonometry, ITU, Geneva (1992).

[7] ISO 3 (1973): "Preferred numbers - Series of preferred numbers".

[8] ITU-T Recommendation P.79 (1993): "Calculation of loudness ratings for telephone sets".

[9] CCITT Recommendation O.41 (1988): "Psophometer for use on telephone-type circuits".

[10] ITU-T Recommendation G.122 (1993): "Influence of national systems on stability talker echo in international connections".

3 Abbreviations

For the purposes of this I-ETS, the abbreviations in ITU-T Recommendation P.10 apply along with the following:

ERL	Echo Return Loss
LRGP	Loudness Rating Guard-ring Position
MRP	Mouth Reference Point
RL	Return Loss
RLR	Receiving Loudness Rating
SLR	Sending Loudness Rating
STMR	Sidetone Masking Rating
TE	Terminal Equipment

4 Speech transmission compliance tests

4.1 General conditions for testing

4.1.1 Environment for tests

The environmental conditions which shall apply for the testing laboratory are specified in subclause 1.6 of ETS 300 001 (NET 4) [1].

4.1.2 Accuracy of measurements and test equipment setting

Unless specified otherwise, the accuracy of measurements made by test equipment shall be equal to or better than:

Item	Accuracy
Electrical signal level	± 0,2 dB for levels ≥ - 50 dBm ± 0,4 dB for levels < - 50 dBm
Sound pressure	± 0,7 dB
Frequency	± 0,2 %

Unless specified otherwise, the accuracy of the signals generated by the test equipment shall be better than:

Quantity	Accuracy
Sound pressure level at Mouth Reference Point (MRP)	± 3 dB for frequencies from 100 Hz to 200 Hz ± 1 dB for frequencies from 200 Hz to 4 000 Hz ± 3 dB for frequencies from 4 000 Hz to 8 000 Hz
Electrical excitation levels	± 0,4 dB across the whole frequency range.
Frequency generation	± 2 % (see note)
Specified component values	± 1 %
NOTE: This tolerance may be used to avoid measurements at critical frequencies, e.g. those due to sampling operations within the terminal under test.	

4.1.3 Order of tests

Tests are made in any order except where otherwise specified.

Where testing involves taking measurements using different feeding resistances, measurements shall be made with the largest loop resistance, then at lesser values of resistance, decreasing sequentially to the minimum, in order to avoid a heating effect in the test arrangement.

4.1.4 Acoustic environment

Acoustic tests shall be carried out in an environment where the ambient noise is insufficient to influence the acoustic measurements being made.

Tests for noise and Echo Return Loss (ERL) shall be carried out in an environment where the ambient noise is less than - 64 dBPa(A).

4.1.5 Handset mounting

Unless otherwise stated in a particular test, where the mouthpiece of the TE is fixed relative to the earcap, the handset shall be placed in the Loudness Rating Guard-ring Position (LRGP) as described in annex C of ITU-T Recommendation P.64 [2].

In the case of a moveable microphone part, measurements are to be carried at the setting for normal usage as defined by the manufacturer.

Where the mouthpiece of the TE is separate from the earpiece, the front plane of the mouthpiece shall be mounted 15 mm in front of the lip ring and coaxial with the artificial mouth.

The earcap shall be applied to the artificial ear.

4.1.6 Test levels

4.1.6.1 Sending

Unless otherwise stated in this I-ETS or in a relevant terminal standard, a pure tone signal with a sound pressure level of - 4,7 dBPa shall be applied at the Mouth Reference Point (MRP) as described in ITU-T Recommendation P.64 [2].

4.1.6.2 Receiving

Unless otherwise stated in this I-ETS or in a relevant terminal standard, a pure tone signal with an e.m.f of - 12 dBV from a 600 Ω resistive source shall be connected between the terminals A and B shown in figure 1.

4.1.6.3 Sidetone

Unless otherwise stated in this I-ETS or in a relevant terminal standard, a pure tone signal with a sound pressure level of - 4,7 dBPa shall be applied at the MRP as described in ITU-T Recommendation P.64 [2].

4.1.7 Volume control

Where a user-controlled volume control is provided, compliance tests shall be carried out at a setting of the volume control as specified in the appropriate requirement.

4.1.8 Test equipment requirements

Artificial mouth: the artificial mouth shall conform to ITU-T Recommendation P.51 [3].

Artificial ear: the ITU-T Recommendation P.57 [4] Type 1 shall be used unless another artificial ear described in that Recommendation is requested by the terminal supplier.

Where a Type 1 ear is not used:

a) the sound pressure measurements shall be referred to the Ear Reference Point (ERP) by the correction characteristics specified in ITU-T Recommendation P.57 [4];

b) no leakage correction shall be made in the calculations of Receiving Loudness Rating (RLR) (i.e. L_E=0).

Sound level measuring equipment: the sound level measuring equipment shall conform to IEC publication 651 [5], type 1.

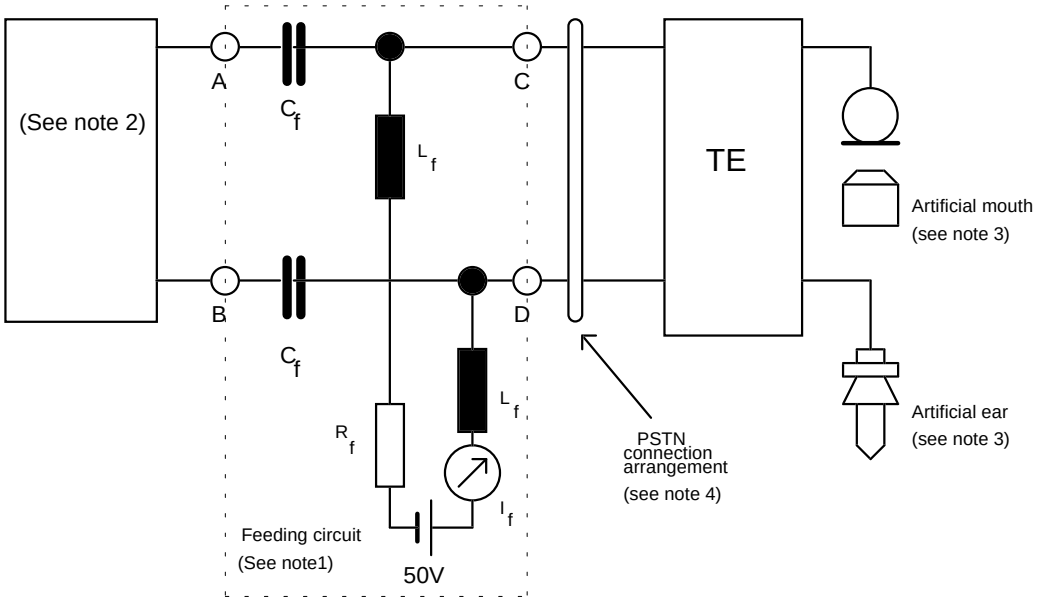
The d.c. feeding circuit shall be based upon subclause 1.2.3 of the Handbook on Telephonometry [6]. The feed resistance values are specified in subclause 4.2 of this I-ETS.

4.1.9 Alternative test methods

The requirements of this test specification were written on the basis of the standard test methods described in this I-ETS. For some parameters it is recognised that alternative test methods may exist. It is the responsibility of the test house to ensure that any alternative method used is equivalent to that described in this I-ETS.

4.1.10 Testing arrangements

All tests for transmission performance shall be carried out with the TE connected to the test arrangement shown in figure 1.



NOTE 1: The d.c. feeding circuit shown is an idealised arrangement. Performance requirements are given in figures 3 and 5.

NOTE 2 The equipment used for testing is connected between terminals A and B shown in and consists of the following as appropriate: a signal generator, a measuring set, the network either of figure 6, or figure 7, or figure 8 or a 600 Ω resistor.

NOTE 3: The artificial mouth and ear are described in ITU-T Recommendations P.51 [3] and P.57 [4] respectively. The TE handset is mounted in the LRGP and the earcap is applied to the artificial ear.

NOTE 4: The PSTN connection arrangement is described in ETS 300 001 (NET 4) [1].

Figure 1: Circuit for measurement of transmission characteristics

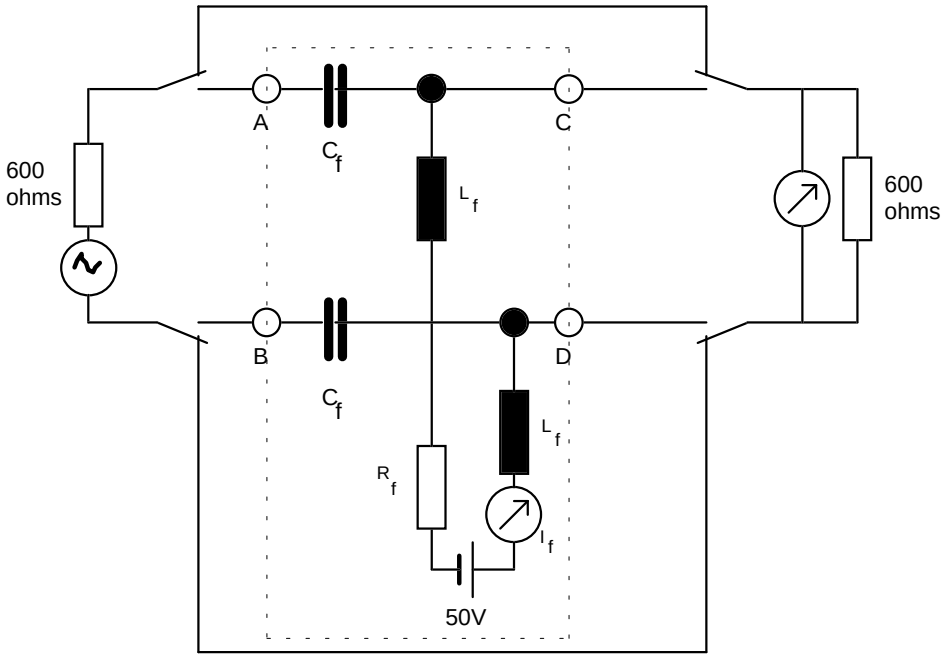


Figure 2: Insertion loss test arrangement for the d.c. feeding circuit

When measured with the circuit shown in figure 2, the insertion loss of the d.c. feeding circuit shown in figure 1 shall have a value less than that given in figure 3 (below) for all resistances and frequencies at which it is used.

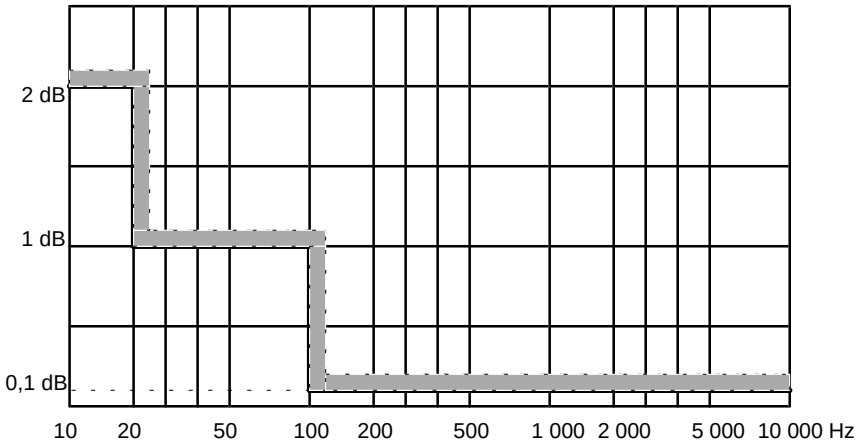
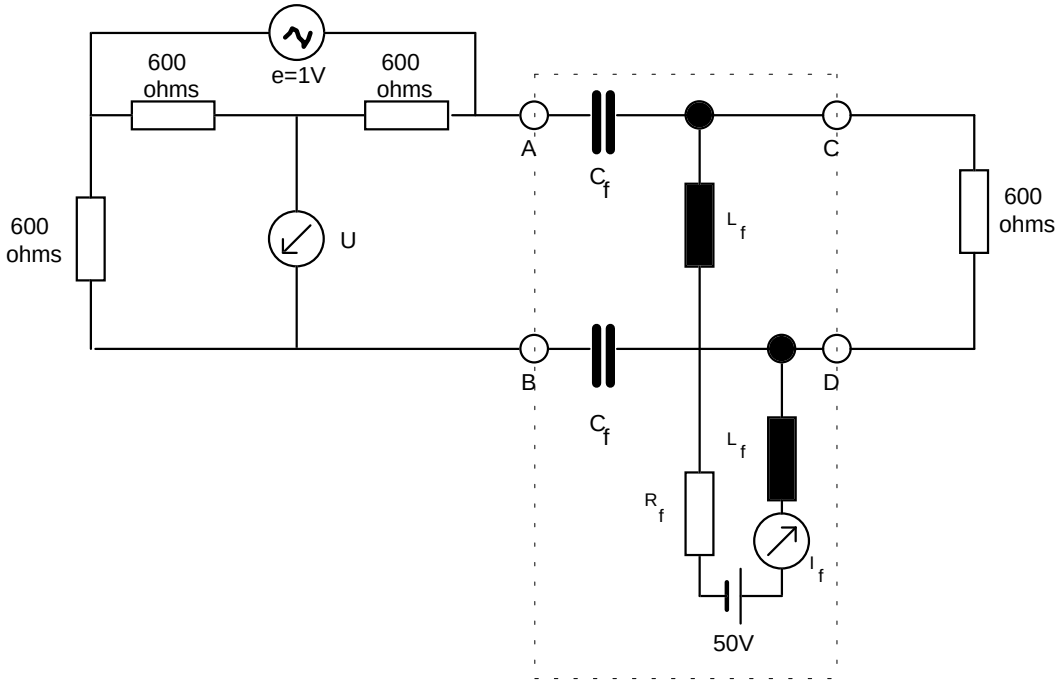


Figure 3: Maximum limit for insertion loss



NOTE: In the absence of the d.c. feeding circuit, the return loss shall be greater than 40 dB.

Figure 4: Return loss test arrangement for the d.c. feeding circuit

When measured with the circuit shown in figure 4, the return loss of the d.c. feeding circuit shown in figure 1 shall have a value greater than that given in figure 5 for all values of R_f and at all frequencies at which it is used.

The return loss is calculated from the formula:

$$RL = 20\log_{10}\left(\frac{e}{2U}\right) dB$$

where e is the generator voltage and U is the voltage measured by the measuring set.

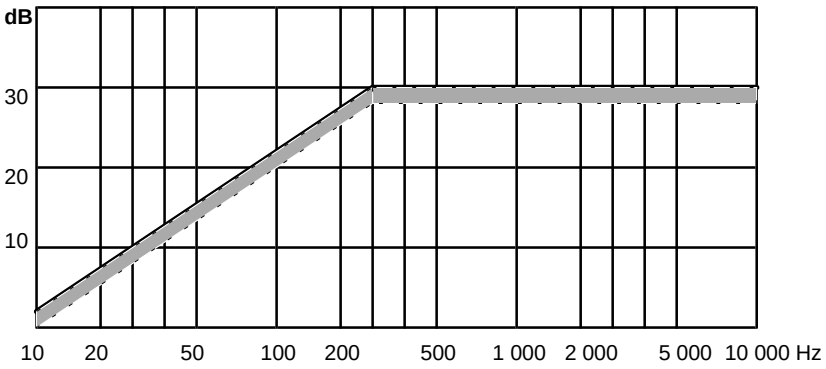


Figure 5: Minimum limit for return loss

4.2 Speech transmission performance tests

All tests for transmission performance shall be carried out with the TE connected to the test arrangements specified in subclause 4.1.10.

Values of R_f are chosen from those given in table 1 to give the required range appropriate to the requirement under test.

Table 1: Feed resistor R_f values

R_f (ohms)	2 800	2 300	2 000	1 600	1 300	1 000	800	500
NOTE: Assuming a voltage drop of about 7,5 V across the TE, the approximate currents given above would flow. Actual currents will depend on the characteristics of the terminal.								
Current (mA)	15	18	21	27	33	42	53	85

4.2.1 Sensitivity/frequency response

4.2.1.1 Sending

A measuring set calibrated in dBV, with an impedance of 600 Ω, shall be connected between terminals A and B shown in figure 1.

The sending sensitivity/frequency response shall be determined by the procedure described in clauses 6 and 9 of ITU-T Recommendation P.64 [2]. The output voltage is measured at the fundamental frequency of the stimulus. The results are expressed in dB V/Pa.

Measurements shall be made for R_f set to the appropriate value(s) given in the relevant terminal standard, at 1/12 octave intervals at the preferred frequencies given by the R40 series of preferred numbers in ISO 3 [7] for those frequencies from 100 Hz to 8 kHz that are specified in the relevant terminal standard.

4.2.1.2 Receiving

A signal generator shall be connected between terminals A and B shown in figure 1.

The receiving sensitivity/frequency response shall be determined by the procedure described in clauses 7 and 9 of ITU-T Recommendation P.64 [2]. The sound pressure is measured at the fundamental frequency of the stimulus. The results are expressed in dB Pa/V.

Measurements shall be made for R_f set to the appropriate value(s) given in the relevant terminal standard, at 1/12 octave intervals at the preferred frequencies given by the R40 series of preferred numbers in ISO 3 [7] for those frequencies from 100 Hz to 8 kHz that are specified in the relevant terminal standard.

4.2.2 Loudness ratings

4.2.2.1 Sending

A measuring set calibrated in dBV, with an impedance of 600 Ω, shall be connected between terminals A and B shown in figure 1. Measurements shall be performed at each of the 14 frequencies given in table 1 of ITU-T Recommendation P.79 [8], bands 4 to 17, to yield values of the sending sensitivity, expressed in dB V/Pa.

Measurements shall be made at the values of feeding resistance, R_f, specified in the relevant terminal standard.

The Sending Loudness Rating (SLR) (in dB) for each value of R_f specified shall be calculated according to the formula 2-1 of ITU-T Recommendation P.79 [8], over bands 4 to 17, using m = 0,175 and the sending weighting factors from table 1 of ITU-T Recommendation P.79 [8].

NOTE: ITU-T Recommendation P.65 allows the use of alternative signal sources for measurement of loudness ratings, e.g. noise rather than sinusoidal signals. These alternative methods are believed to produce the same results.

4.2.2.2 Receiving

A signal generator shall be connected between terminals A and B shown in figure 1.

Measurements shall be performed at each of the 14 frequencies given in table 1 of ITU-T Recommendation P.79 [8], bands 4 to 17, to yield values of the receiving sensitivity, expressed in dB Pa/V.

Measurements shall be made at the values of feeding resistance, R_f, specified in the relevant terminal standard.

The Receiving Loudness Rating (RLR) (in dB) for each value of R_f specified shall be calculated according to the formula 2-1 of ITU-T Recommendation P.79 [8], over bands 4 to 17, using m = 0,175 and the receiving weighting factors from table 1 of ITU-T Recommendation P.79 [8].

The Type 1 artificial ear sensitivity shall be corrected using the real ear correction (L_E) of table 2 of ITU-T Recommendation P.79 [8].

NOTE 1: The values of real ear correction of table 2 of ITU-T Recommendation P.79 [8] were derived for one type of handset conforming to the shape defined in CCITT Recommendation P.35.

NOTE 2: ITU-T Recommendation P.65 allows the use of alternative signal sources for measurement of loudness ratings, e.g. noise rather than sinusoidal signals. These methods are believed to produce the same results.

4.2.3 Sidetone Masking Rating

The sidetone sensitivity/frequency response shall be determined by the procedure described in clauses 6 and 9 of ITU-T Recommendation P.64 [2]. The sound pressure shall be measured in the artificial ear at the fundamental frequency of the stimulus. The results are expressed in dB.

Measurements shall be made with each of the following three terminating impedances connected to terminals A and B shown in figure 1:

a) the impedance shown in figure 6, which represents a short line terminated with 600 Ω:

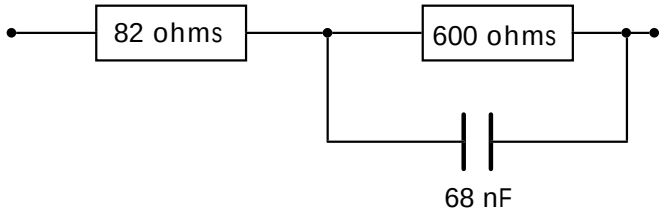


Figure 6: Terminating impedance - impedance a)

For impedance "a", the measurement shall be made with the minimum value of feeding resistance R_f specified in the relevant terminal standard.

b) the impedance shown in figure 7, which is the harmonized European impedance:

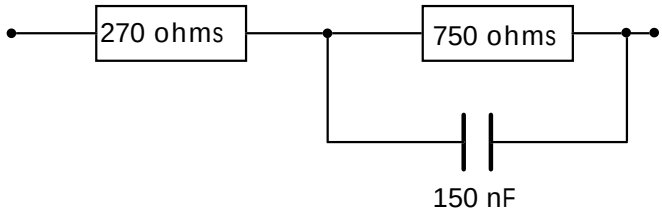


Figure 7: Terminating impedance - impedance b)

For impedance "b", the measurement shall be made with the appropriate value of feeding resistance R_f specified in the relevant terminal standard.

c) The impedance shown in figure 8, which is intended to represent a very long line:

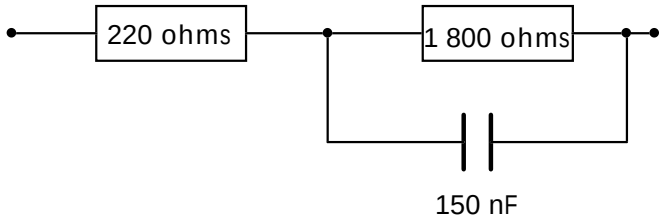


Figure 8: Terminating impedance - impedance c)

For impedance "c", the measurement shall be made with the maximum value of feeding resistance R_f specified in the relevant terminal standard.

The Sidetone Masking Rating (STMR) (in dB) shall be calculated according to the formula 2-1 of ITU-T Recommendation P.79 [8], over bands 1 to 20, using m = 0,225 and the weighting factors of column headed W_{MSi} of table 3 of ITU-T Recommendation P.79 [8] irrespective of which artificial ear is used.

NOTE: ITU-T Recommendation P.65 allows the use of alternative signal sources for measurement of loudness ratings e.g. noise rather than sinusoidal signals. These methods are believed to produce the same results.

4.2.4 Distortion

4.2.4.1 Sending

A 600 Ω resistor shall be connected between terminals A and B shown in figure 1.

A high impedance measuring set, capable of measuring harmonic distortion up to the 5th harmonic of signals with fundamental frequencies in the range 315 Hz to 1 000 Hz, shall be connected between terminals A and B shown in figure 1.

Pure tones at frequencies of 315 Hz, 500 Hz and 1 000 Hz shall be applied at the MRP. The total harmonic distortion, d_t, shall be determined from the equation:

$$d_t = 100\sqrt{\frac{v_2^2 + v_3^2 + v_4^2 + v_5^2}{v_1^2 + v_2^2 + v_3^2 + v_4^2 + v_5^2}}\%$$

The distortion at any particular harmonic n can be determined from the equation:

$$d_n = 100\sqrt{\frac{v_n^2}{v_1^2 + v_n^2}}\%$$

where, in each equation v_n is the measured r.m.s voltage at harmonic n measured for each frequency and at the maximum and minimum values of feeding resistance, R_f, specified in the relevant terminal standard.

4.2.4.2 Receiving

A signal generator shall be connected between terminals A and B shown in figure 1.

A measuring set, capable of measuring harmonic distortion up to the 5th harmonic of signals with fundamental frequencies in the range 315 Hz to 1 000 Hz, shall be connected to the artificial ear.

The generator is operated at frequencies of 315 Hz, 500 Hz and 1 000 Hz. The total harmonic distortion, d_t, shall be determined from the equation:

$$d_t = 100\sqrt{\frac{p_2^2 + p_3^2 + p_4^2 + p_5^2}{p_1^2 + p_2^2 + p_3^2 + p_4^2 + p_5^2}}\%$$

The distortion at any particular harmonic n can be determined from the equation:

$$d_n = 100\sqrt{\frac{p_n^2}{p_1^2 + p_n^2}}\%$$

where in each equation, p_n is the measured r.m.s sound pressure at harmonic n which is measured for each frequency and at the maximum and minimum values of feeding resistance, R_f, specified in the relevant terminal standard.

4.2.4.3 Sidetone

A 600 Ω resistor shall be connected between terminals A and B shown in figure 1.

A measuring set, capable of measuring harmonic distortion up to the 5th harmonic of signals with fundamental frequencies in the range 315 Hz to 1 000 Hz, shall be connected to the artificial ear.

Pure tones at frequencies of 315 Hz, 500 Hz and 1 000 Hz shall be applied at the MRP. The total harmonic distortion, d_t, shall be determined from the equation:

$$d_t = 100\sqrt{\frac{p_2^{\,2} + p_3^{\,2} + p_4^{\,2} + p_5^{\,2}}{p_1^{\,2} + p_2^{\,2} + p_3^{\,2} + p_4^{\,2} + p_5^{\,2}}}\ \%$$

where p_n is the measured r.m.s sound pressure at harmonic n measured for each frequency and at the maximum and minimum values of feeding resistance, R_f, specified in the relevant terminal standard.

4.2.4.4 Sending power handling capability

A 600 Ω resistor shall be connected between terminals A and B shown in figure 1.

A high impedance measuring set, capable of measuring harmonic distortion, shall be connected to terminals A and B shown in figure 1.

A pure tone at the frequency and level specified in the relevant terminal standard is applied at the MRP.

The total harmonic distortion up to the fifth harmonic shall be measured at the maximum and minimum values of feeding resistance R_f specified in the relevant terminal standard.

4.2.4.5 Receiving power handling capability

A signal generator shall be connected between terminals A and B shown in figure 1.

An measuring set, capable of measuring harmonic distortion, shall be connected to the artificial ear.

The signal generator is set to deliver a pure tone at the level and frequency specified in the relevant terminal standard.

The total harmonic distortion up to the fifth harmonic shall be measured at the maximum and minimum values of feeding resistance R_f specified in the relevant terminal standard.

4.2.5 Linearity (variation of gain with input level)

4.2.5.1 Sending

The following test shall be used where a simple test of linearity is required.

The test shall be carried out at the value of R_f specified in the relevant terminal standard.

A pure tone signal with a frequency of 1 000 Hz at each of the levels specified in the relevant terminal standard shall be applied at the MRP.

The sending sensitivity shall be determined as defined in clause 6 of ITU-T Recommendation P.64 [2].

NOTE: Telephones using non-linear and time variant signal processing techniques require a more complex test procedure.

4.2.5.2 Receiving

The following test shall be used where a simple test of linearity is required.

The test shall be carried out at the value of R_f specified in the relevant terminal standard.

A pure tone signal with a frequency of 1 000 Hz at each of the levels specified in the relevant terminal standard shall be applied at terminals A and B shown in figure 1.

The receiving sensitivity shall be determined as defined in clause 7 of ITU-T Recommendation P.64 [2].

NOTE: Telephones using non-linear and time variant signal processing techniques will require a more complex test procedure.

4.2.6 Noise

4.2.6.1 Sending

A 600 Ω resistor shall be connected between terminals A and B shown in figure 1.

A measuring set of high impedance, calibrated in dBm and using psophometric weighting according to table 4 of CCITT Recommendation O.41 [9] shall be connected between terminals A and B shown in figure 1.

The noise level shall be measured by averaging over a minimum period of 1 s. The measurement is made three times and the lowest value of the three measurements shall be selected as a determination of the noise level.

Measurements shall be made at the maximum and minimum values of feeding resistance, R_f, specified in the relevant terminal standard.

NOTE: This test does not test for noise correlated with the signal which may be caused by non-linear and time variant signal processing techniques.

4.2.6.2 Receiving

A 600 Ω resistor shall be connected between terminals A and B shown in figure 1.

A measuring set calibrated in dBPa and using A-weighting shall be connected to the artificial ear shown in figure 1.

Measurements shall be made at the maximum and minimum values of feeding resistance, R_f, specified in the relevant terminal standard.

The noise level shall be measured by averaging over a minimum period of 1 s. The measurement is made three times and the lowest value of the three measurements shall be selected as a determination of the noise level.

NOTE: This test does not test for noise correlated with the signal which may be caused by non-linear and time variant signal processing techniques.

4.2.7 Echo Return Loss

A suitable measuring set for measuring impedance shall be connected between terminals A and B shown in figure 1.

The earcap shall be applied to the artificial ear.

Measurements shall be made with the value(s) of R_f specified in the relevant terminal standard.

The test level across terminals A and B shown in figure 1 shall be - 18 dBV ± 3 dB.

The input impedance of the apparatus shall be measured at frequencies spaced not greater than one-twelfth of an octave apart, within the range 300 Hz to 3 400 Hz inclusive.

NOTE 1: The frequencies do not need to be harmonically related.

For each value of impedance measured, the Return Loss (RL) (in dB) shall be calculated from the formula:

$$RL = 20\log_{10}\left|\frac{Z_b + Z_t}{Z_b - Z_t}\right| \text{ dB}$$

where:

Z_t is the apparatus impedance, measured;

Z_b is the reference impedance shown in figure 7.

For each value of R_f specified, the ERL shall be calculated (in dB), in accordance with ITU-T Recommendation G.122 [10], using the formula:

$$ERL = 3,24 - 10\log_{10}\sum_{i=1}^{n}(A_i + A_{i-1}) \times (\log_{10} f_i - \log_{10} f_{i-1}) \text{dB}$$

where:

A_i is the return loss power ratio at frequency f_i expressed as:

$A_i = 10^{-}$(decibel return loss at fi)/10;

A_0 is the ratio at f_0 = 300 Hz;

A_n is the ratio at f_n = 3 400 Hz.

NOTE 2: The test method specified does not include all of the mechanical and acoustic feedback effects which may occur in normal use. However, these effects usually can be ignored.

4.2.8 Instability

Measurements shall be made under the following conditions:

a) at the minimum value of the feeding resistance, R_f specified in the relevant terminal standard with a resistance of 600 Ω connected between terminals A and B shown in figure 1;

b) at the maximum value of the feeding resistance, R_f specified in the relevant terminal standard with the impedance shown in figure 8 connected between terminals A and B shown in figure 1.

The handset shall be positioned on one inside surface that is of three perpendicular plane, smooth, hard surfaces forming a corner. Each surface shall extend 0,5 m from the apex of the corner. One surface shall be marked with a diagonal line extending from the corner formed by the three surfaces, as shown in figure 9.

The handset, with the transmission circuit fully active, shall be positioned on the defined surface as follows:

1) the mouthpiece and earcap shall face towards the surface;

2) the handset shall be placed centrally along the diagonal line with the earcap nearer to the apex of the corner;

3) the extremity of the handset shall coincide with the normal to the reference point, as shown in figure 9.

If necessary, the position of the handset should be adjusted to achieve the "just off-hook" position.

Checks shall be made to establish that the signal level resulting from any sustained audio frequency oscillation (up to 10 kHz) measured between terminals A and B as shown in figure 1 is less than 10 mV.

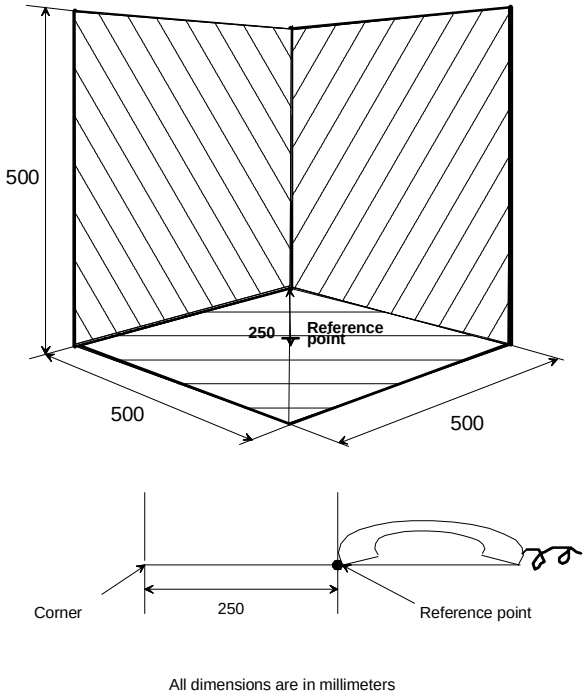


Figure 9: Handset position for instability test

Where the mouthpiece of the handset is separate from the earpiece:

- the telephone shall be mounted in free air with the mouthpiece in a normal position;

- the earcap is pointed directly at the mouthpiece with a distance of 150 mm between the front planes of each.

If necessary, the telephone should be placed in the off-hook position.

Checks shall be made to establish that the signal level resulting from any sustained audio frequency oscillation (up to 10 kHz) measured between terminals A and B shown in figure 1 is less than 10 mV.

Annex A (normative): Maximum signal sent to line

A.1 Maximum signal sent to line

Where the relevant access requirement contains no test for the maximum signal to line when driven by an acoustic input, the following test shall be used:

A measuring set capable of measurement in the frequency range 200 Hz to 10 kHz, with a non-reactive impedance of 600 Ω and calibrated in dBV, shall be connected between terminals A and B shown in figure 1.

A sinusoidal signal at a frequency of 1 000 Hz and a sound pressure level of 20 dBPa shall be applied to the MRP.

The output voltage shall be measured at the values of feeding resistance, R_f, specified in the relevant terminal standard.

NOTE: When this test is used, limits appropriate to speech signals shall be used (e.g. 8V peak-to-peak).

Annex B (informative): Acoustic shock

B.1 Continuous signal

A frequency generator with a non-reactive source impedance of 600 Ω is connected between terminals A and B shown in figure 1.

Measurements are made at the values of feeding resistance, R_f, specified in the relevant terminal standard.

The frequency generator is set to deliver pure tone signals at an e.m.f. of 24 dBV r.m.s at 1/3 octave intervals at the preferred frequencies given by the R10 series of preferred numbers in ISO 3 [7] for frequencies from 200 Hz to 10 kHz.

For each band the sound pressure in the artificial ear is measured.

Annex C (informative): Immunity to out-of-band signalling

C.1 Sending

The following test should be used where a test is required to evaluate the effect on speech performance of out-of-band signalling such as meter pulses.

Two measurements should be made:

a) one reference measurement without out-of-band signalling;
b) a second measurement with out-of-band signalling.

The difference in dB between the two measurement results represents the disturbing effect of the out-of-band signalling on the speech performance.

The measurements should be made at the maximum value of feeding resistance R_f specified in the relevant terminal standard with the terminating impedance of figure 7 (subclause 4.2.3) connected between terminals A and B shown in figure 1 (subclause 4.1.10).

A pure tone signal with a frequency of 1 000 Hz at the level specified in the relevant terminal standard should be applied at the MRP.

The level of the output signal appearing across terminals A and B shown in figure 1 (subclause 4.1.10) should be measured selectively.

A signal representative of the out-of-band signalling (in terms of level, frequency and period) should be applied in series with the terminating impedance by a generator of negligible source impedance.

The level of the output signal should be measured again and the disturbing effect determined by averaging the result over the period of application of the out-of-band test signal.

NOTE 1: This test does not test for:

- the degradation due to total harmonic distortion in the voice band;
- the performances of non-linear and time variant signal processing techniques;
- the effect of more complex out-of-band signals.

NOTE 2: For the purpose of these tests, the insertion loss and return loss of the feeding circuit should meet the same limits up to 20 kHz as are otherwise applied at 10 kHz.

C.2 Receiving

The following test should be used where a test is required to evaluate the effect on speech performance of out-of-band signalling such as meter pulses.

Two measurements should be made:

a) one reference measurement without out-of-band signalling;
b) a second measurement with out-of-band signalling.

The difference in dB between the two measurement results represents the disturbing effect of the out-of-band signalling on the speech performance.

The measurements should be made at the maximum value of feeding resistance R_f specified in the relevant terminal standard with the terminating impedance of figure 7 (subclause 4.2.3) connected between terminals A and B shown in figure 1 (subclause 4.1.10).

A pure tone signal with a frequency of 1 000 Hz at the level specified in the relevant terminal standard should be applied in series with the terminating impedance by a generator of negligible source impedance.

The level of the output signal appearing at the receiver should be measured selectively.

A signal representative of the out-of-band signalling (in terms of level, frequency and period) also should be applied in series with the terminating impedance by a generator of negligible source impedance.

The level of the output signal should be measured again and the disturbing effect determined by averaging the result over the period of application of the out-of-band test signal.

NOTE 1: This test does not test for:

- the degradation due to total harmonic distortion in the voice band;
- the performances of non-linear and time variant signal processing techniques;
- the effect of more complex out-of-band signals.

NOTE 2: For the purpose of these tests, the insertion loss and return loss of the feeding circuit should meet the same limits up to 20 kHz as are otherwise applied at 10 kHz.

Annex D (informative): Bibliography

For the purposes of this I-ETS, the following documents have been referenced informatively:

- ITU-T Recommendation P.10 (1993): "Vocabulary of terms on telephone transmission quality and telephone sets".

- ITU-T Recommendation P.65 (1993): "Objective instrumentation for the determination of loudness ratings".

- CCITT Recommendation P.35 (1988): "Handset telephones".

- I-ETS 300 677: "Public Switched Telephone Network (PSTN); Requirements for handset telephony".

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