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First edition
2003-04

Electroacoustics – Sound level meters –

Part 2: Pattern evaluation tests

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROACOUSTICS – SOUND LEVEL METERS –

Part 2: Pattern evaluation tests

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
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International Standard IEC 61672-2 has been prepared by IEC technical committee 29: Electroacoustics, in cooperation with the International Organization of Legal Metrology (OIML).

This standard, in conjunction with IEC 61672-1, cancels and replaces IEC 60651 (1979) and IEC 60804 (2000).

The text of this standard is based on the following documents:

FDIS	Report on voting
29/532/FDIS	29/538/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

At the time of publication of this standard, the IEC 61672 series was scheduled to consist at least of the following parts under the general title *Electroacoustics – Sound level meters*:

- Part 1: Specifications
- Part 2: Pattern evaluation tests
- Part 3: Periodic tests

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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ELECTROACOUSTICS – SOUND LEVEL METERS –

Part 2: Pattern evaluation tests

1 Scope

This part of IEC 61672 provides details of the tests necessary to verify conformance to all mandatory specifications given in IEC 61672-1:2002 for conventional sound level meters, integrating-averaging sound level meters and integrating sound level meters. Pattern evaluation tests apply for each channel of a multi-channel sound level meter, as appropriate. Tests and test methods are applicable to class 1 and class 2 sound level meters. The aim is to ensure that all testing laboratories use consistent methods to perform pattern evaluation tests.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60942, *Electroacoustics – Sound calibrators*

IEC 61000-4-2:2001, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test – Basic EMC Publication*¹

IEC 61000-4-3:2002, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test – Basic EMC Publication*²

IEC 61000-4-6:2001, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields – Basic EMC Publication*³

IEC 61000-6-2:1999, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61094-1, *Measurement microphones – Part 1: Specifications for laboratory standard microphones*

IEC 61183, *Electroacoustics – Random-incidence and diffuse-field calibration of sound level meters*

IEC 61672-1:2002, *Electroacoustics – Sound level meters – Part 1: Specifications*

¹ Edition 1.2 consisting of Edition 1:1995 consolidated with amendments 1:1998 and 2:2000.

² Edition 2.1 consisting of Edition 2:2002 consolidated with amendment 1:2002.

³ Edition 1.1 consisting of Edition 1:1996 consolidated with amendment 1:2000.

CISPR 16-1:1999, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus* ⁴

CISPR 22:1997, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

ISO Express Guide, *Guide to the expression of uncertainty in measurement*

ISO/IEC, *International vocabulary of basic and general terms in metrology*

3 Terms and definitions

For the purposes of this standard, in addition to the terms and definitions given in IEC 61672-1, the terms and definitions given in IEC 61000-4-2:2001, IEC 61000-4-3:2002, IEC 61000-4-6:2001, the *Guide to the expression of uncertainty in measurement* and the *International vocabulary of basic and general terms in metrology* also apply.

4 Submission for testing

4.1 At least three specimens of the same pattern of sound level meter shall be submitted for pattern evaluation testing. As a minimum, the testing laboratory shall select two of the specimens for testing. At least one of the two specimens shall then be tested fully according to the procedures of this standard. The testing laboratory shall decide whether the full tests shall also be performed on the second specimen or whether limited testing is adequate to approve the pattern.

4.2 An instruction manual and all items or accessories that are identified in the instruction manual as integral components for the normal mode of operation shall be submitted along with the sound level meters. Examples of additional items or accessories include a microphone extension device or cable and peripheral equipment.

4.3 If the manufacturer of the sound level meter supplies devices that are to be connected to the sound level meter by cables, then the devices and cables shall be submitted with the sound level meter.

4.4 A calibrated sound calibrator of a model specified in the instruction manual for the sound level meter shall be supplied with the sound level meter. An instruction manual for the sound calibrator shall also be provided. The model of the calibrator shall conform to the specifications of IEC 60942 for the class, as required by 5.2.2 of IEC 61672-1:2002.

5 Marking of the sound level meter and information in the instruction manual

5.1 It shall be verified that the sound level meter is marked according to the requirements of Clause 8 of IEC 61672-1:2002.

5.2 Before conducting any tests, it shall be verified that the instruction manual contains all the information that is required by Clause 9 of IEC 61672-1:2002 as relevant to the facilities provided by the sound level meter.

⁴ In English, CISPR stands for International Special Committee on Radio Interference.

5.3 If the sound level meter does not conform to the requirements of 5.1 and 5.2, no pattern evaluation tests shall be performed.

5.4 After completion of all tests, the information shall be reviewed to ensure that it is correct within the appropriate tolerance limits.

6 Mandatory facilities and general requirements

6.1 No test specified in this part of IEC 61672 shall be omitted unless the sound level meter does not possess the facility described for the test.

NOTE Where the design of a sound level meter, which has been pattern approved, is changed and a new pattern approval is requested, then, at the discretion of the testing laboratory, it is not necessary to repeat those tests for electroacoustical performance characteristics that are not affected by the design change.

6.2 A conventional sound level meter shall be verified to be able to display A-frequency-weighted and F-time-weighted sound level, and to be able to indicate overload and under-range conditions, if applicable.

6.3 An integrating-averaging sound level meter shall be verified to be able to display A-weighted time-average sound level, and to be able to indicate overload and under-range conditions, if applicable.

6.4 An integrating sound level meter shall be verified to be able to display A-weighted sound exposure level, and to be able to indicate overload and under-range conditions, if applicable.

6.5 All display devices for the sound level meter shall be verified to be able to display sound levels or sound exposure levels with the resolution required by 5.15.3 of IEC 61672-1:2002. The range of the display shall be at least the minimum specified in 5.15.3 of IEC 61672-1:2002.

6.6 Where a sound level meter is capable of measuring maximum or peak sound levels, or both, it shall be verified that a "hold" feature is provided.

6.7 A class 1 sound level meter shall be verified to have frequency-weighting C, at least for pattern evaluation testing.

6.8 If the sound level meter is capable of indicating peak C sound levels, it shall be verified that the capability to display C-weighted, time-weighted sound level or C-weighted, time-average sound level is also provided, at least for pattern evaluation testing.

6.9 For sound level meters with multiple level ranges, it shall be verified that the level range overlap conforms to the specifications of 5.5.8 of IEC 61672-1:2002.

6.10 For sound level meters that can display more than one measurement quantity, it shall be verified that there is a clear means to ascertain the quantity that is being displayed.

6.11 If the sound level meter does not possess the mandatory facilities listed in 6.2 through 6.10, as applicable, the sound level meter does not conform to the specifications of IEC 61672-1:2002 and no pattern evaluation tests shall be performed.

6.12 For all pattern evaluation tests, the configuration of the sound level meter, or the multi-channel sound level meter system, shall be as specified in the instruction manual for one of the normal modes of operation, including required accessories. The configuration shall include a windscreen if a windscreen is an integral component for the normal mode of operation, or if the instruction manual states that the sound level meter conforms to the specifications of IEC 61672-1 with a windscreen installed around the microphone. The model of the windscreen shall be as stated in the instruction manual for use with the sound level meter. All configurations of the sound level meter that are stated in the instruction manual as conforming to the requirements of IEC 61672-1 shall be tested.

6.13 If the instruction manual states that the sound level meter conforms to the specifications of IEC 61672-1 with optional facilities installed, the combination with the optional facilities installed shall also be tested to verify conformance to the relevant specifications.

6.14 If an electrical output is provided on the sound level meter and the testing laboratory intends to utilize the electrical output instead of the display device, the laboratory shall verify that changes in the levels of applied acoustical or electrical input signals produce changes in the signal levels indicated on the display device and at the electrical output in accordance with 5.16.3 of IEC 61672-1:2002. This requirement applies to each channel of a multi-channel system.

NOTE Where multiple outputs are present, if an output is specified in the instruction manual for testing, this output should be used for the pattern evaluation tests.

6.15 For all tests, the sound level meter shall be powered from its preferred supply. If the instruction manual specifies internal batteries of a particular type, such batteries shall be installed for the pattern evaluation tests.

6.16 The sound level meter shall be allowed to reach equilibrium with the prevailing environmental conditions before switching on the power to perform a test.

6.17 Tests for conformance to the specifications for the effects of changes in environmental conditions preferably should be conducted before tests for conformance to the specifications for electroacoustical performance.

6.18 If the sound level meter has more than one signal-processing channel, pattern evaluation tests shall be performed for each channel that utilizes unique signal processing techniques. For multi-channel systems with the same functional equivalence in all channels, the number of channels to be tested may be less than the number of channels, at the discretion of the testing laboratory.

NOTE 1 For a multi-channel system, the number of channels to be tested should be determined from consideration of a scenario for which there is an array of microphones supplying signals to each input with each channel processing the signals in an identical manner. Selection of how many and which channels to test should consider differences, as described in the instruction manual, in the implementation of signal-processing techniques in the various channels.

NOTE 2 If the sound level meter is a multi-channel device (for example, a sound level meter with two or more separate signal inputs with non-parallel processing of digitized data by time-sharing, but quasi-parallel display for the displayed signals), it should be possible to test the channels for identical functionality either by setting the functions of the channels for identical processing and reading the display(s) or by allowing the channel functionality to rotate by a special test setting procedure thereby allowing comparison of display(s).

6.19 Conformance to the specifications of IEC 61672-1 is verified when measured deviations from design goals, extended by the actual expanded uncertainties of measurement of the testing laboratory, lie fully within the applicable tolerance limits. A positive value for a measured extended deviation shall be not greater than the corresponding positive tolerance limit. A negative value for a measured extended deviation shall be not less than the corresponding negative tolerance limit.

6.20 The testing laboratory shall use instruments with current calibrations for the appropriate quantities. The calibrations shall be traceable to national standards, as required.

6.21 Laboratories performing pattern evaluation tests shall calculate all uncertainties of measurements in accordance with the guidelines given in the *Guide to the expression of uncertainty in measurement*. Metrological terms are defined in the *International vocabulary of basic and general terms in metrology*. Actual expanded uncertainties shall be calculated for a level of confidence of 95 %, using the necessary coverage factor.

NOTE 1 When a testing laboratory is only required to perform a single measurement, it is necessary for the laboratory to make an estimate of the random contribution to the total measurement uncertainty. The estimate may be determined from an earlier evaluation of several measurements for a similar sound level meter.

NOTE 2 Generally a coverage factor of 2 approximates to a level of confidence of 95 %, unless the contributions are such that it is necessary to use a different coverage factor to maintain the 95 % level of confidence.

6.22 The actual expanded uncertainties of measurement shall not exceed the corresponding maximum expanded uncertainties of measurement from Annex A of IEC 61672-1:2002. When this condition is not achieved, the result of the test shall not be used to demonstrate conformance to a specification and pattern approval shall not be granted.

NOTE Calculation of the expanded uncertainty of measurement for a particular test should consider at least five components. The first component is the uncertainty attributed to calibration of the individual instruments and equipment used to perform the test, including the sound calibrator, where applicable. The second component is any contribution resulting from environmental effects or adjustments. The third component is any small errors that may be present in the applied signals and are considered as uncertainties. The fourth component is any random uncertainty attributed to repeated measurements and dependent on the characteristics of the sound level meter under test. The fifth component is, where applicable, an uncertainty contribution for reading the indication from the display device of the sound level meter under test. For digital display devices that indicate signal levels with a resolution of 0,1 dB, the uncertainty component should be taken as a rectangular distribution with semi-range of 0,05 dB.

6.23 For legal metrology purposes, the tolerance limits around the design goals specified in IEC 61672-1 shall be considered to be the maximum permissible errors for pattern evaluation, initial verification and subsequent verification.

7 Environmental, electrostatic and radio-frequency tests

7.1 General

7.1.1 Before conducting, but not during, the tests described in the various subclauses of Clause 7, the indication at the calibration check frequency shall be checked by application of the sound calibrator specified in 4.4 and adjusted, if necessary, to indicate the required sound pressure level under reference environmental conditions. The adjustment shall use the procedure given in the instruction manual for the sound level meter. For multi-channel devices, the corresponding indications shall be checked for all channels selected for testing.

7.1.2 Environmental conditions at the time of checking the indication shall be recorded.

7.1.3 The effect of environmental conditions on the sound pressure level produced by the sound calibrator shall be accounted for in accordance with the procedure in the instruction manual for the sound calibrator and data from its calibration. The effects shall be evaluated relative to the sound pressure level produced under reference conditions.