

Sound level meters – revised international specification standard

By Sue Dowson

International specification standards for acoustical instruments are produced by the IEC (International Electrotechnical Commission) committee IEC/TC29 'Electroacoustics'. This committee, in common with other IEC committees, has global membership, currently having 24 participating countries and 13 observing countries. IEC/TC29 has various Working Group (WGs) and Maintenance Teams (MTs) covering specific instruments and areas – sound level meters, sound calibrators, microphones, hearing aids, audiometric equipment, filters, audio-frequency induction loop systems, head and ear simulators, EMC, and instruments for the measurement of aircraft noise. National Committees provide expert members for these WGs and MTs. In the UK the National Committee is the British Standards Institution (BSI) and experts are nominated from the parallel BSI committee on Electroacoustics, EPL29.

The Maintenance Team responsible for sound level meters, MT4, has recently been revising the IEC 61672 series of standards on sound level meters. The series currently consists of 3 parts – Part 1 'Specifications' published 2002 [1], Part 2 'Pattern evaluation tests' published 2003 [2] and Part 3 'Periodic tests' published 2006 [3]. These standards were also adopted in the UK as BS EN standards with the same number ie. BS EN 61672-1 etc. Pattern evaluation is a wide ranging full test against all the specifications of the standard for a model of instrument. It is mandatory in some countries, so is important for manufacturers who are exporting, and is usually performed by National Metrology Institutes, with one of the main centres being at PTB, Germany. Periodic testing, often known as periodic verification, is limited testing of an *individual specimen* of sound level meter on a regular basis, and assures the user that the performance of an instrument still conforms to the applicable specifications for a limited set of key tests, for the environmental conditions under which the tests were performed. Periodic testing is normally performed by accredited laboratories – in the UK the accrediting body is the United Kingdom Accreditation Service (UKAS). Use of a sound level meter proven to meet a particular class is often required by method standards such as those produced by ISO TC43 – 'Acoustics'.

The standardisation process itself is well defined by IEC, and documents must progress through various stages from preliminary stage to publication stage. These 3 revised sound level meter documents are currently at the last stage of the process, the Final Draft International Standard or FDIS stage, having completed the earlier stages with discussions within the MT and approval via National Committees of the necessary drafts along the way. The National Committees will now vote for the final time on these FDIS documents. At this stage it is a simple 'vote in favour/ vote against/ abstain' process with comments only required for any 'against' votes. The IEC closing date for voting is 16 August 2013,

and if, as is strongly expected, these documents receive a positive vote under the IEC acceptance criteria, they will be published as IEC 61672 Edition 2, by IEC within 1.5 months of the circulation of the Report of Voting.

So how does the revised standard differ from the current versions, and how will this affect manufacturers, users and those testing sound level meters?

The 3 Parts have been revised to incorporate some changes resulting from experience in using Edition 1, to include some further possibilities for testing, and to incorporate a newly agreed Policy of TC29 on measurement uncertainty and conformance assessment. The aim of this Policy is to make the standards clearer to understand for manufacturers, test houses and users. The policy follows the guidance in ISO/IEC Guide 98 [4], but specifications in the standard are now defined in terms of acceptance limits, with maximum permitted uncertainties of measurement for manufacturers/test houses given separately, rather than as the combined tolerance limits given in Edition 1.

Conformance to a performance specification is demonstrated when a measured deviation from a design goal equals or does not exceed the corresponding acceptance limit(s) **AND** the testing laboratory has demonstrated that the associated uncertainty of measurement equals or does not exceed the maximum permitted uncertainty.

The relationship between tolerance limits, acceptance limits and maximum permitted uncertainties is shown in Figure 1.

Where AI = acceptance interval, TI = tolerance interval, U_{max} = guard band for the maximum-permitted uncertainty of measurement for a 95 % coverage interval, AL = lower acceptance limit, AU = upper acceptance limit, TL = lower tolerance limit and TU = upper tolerance limit.

Other main changes include:

- clarification of some definitions
- updating of references
- improved clarity on provision of under-range indicators
- fuller inclusion of sound level meters fitted with random incidence microphones
- where a sound level meter has the ability to display C-weighted peak measurements, a new requirement that a display of C weighted time-averaged sound levels must also be available
- addition of specification and test for long term stability
- addition of specification and test for high level stability
- requirement for manufacturer to provide advice on minimising the effect of mechanical vibration on indicated sound levels
- removal of Annexes on AU weighting and time weighting I
- addition of a detailed Annex giving example assessments of conformance to the specifications of the standard i.e. how to apply the new Policy **P18**

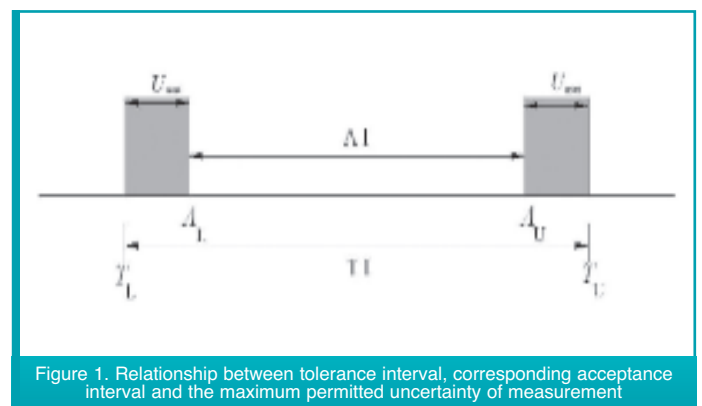


Figure 1. Relationship between tolerance interval, corresponding acceptance interval and the maximum permitted uncertainty of measurement

- **◀P17** minor changes to account for practicalities gained from experience in use of Edition 1 e.g. levels of test signals required etc
- changes to the adjustment using a sound calibrator at the calibration check frequency to allow optimised performance across the full specified frequency range
- allowance of use of a comparison coupler for periodic tests, so the standard now gives a choice for acoustical testing of comparison couplers, sound calibrators where a special ring applied to the microphone may be necessary to avoid 'grid resonance' problems at high frequencies, and electrostatic actuators, as well as free-field testing. The aim here is to minimise the time and hence the cost of acoustical testing by providing more choice. Of course for these tests, and others, appropriate correction data has to be supplied and the standard is more explicit on what must be supplied. It now contains references to the recently published IEC 62585 [5], which provided manufacturers and others with information on how to measure these corrections. If the uncertainties of measurement on the correction data supplied are not provided this uncertainty is now assumed to be the maximum permitted, which may result in a failure of the meter to conform to the specifications
- use of the actual microphone response (rather than average or typical) for periodic testing
- self-generated noise both with the microphone installed and replaced by an electrical input signal device is now just reported, rather than being used as a conformance criteria.

One of the aims of the revision has therefore been to make the standard clearer for manufacturers, and make periodic testing easier for test houses to perform, both by providing additional testing options, but importantly aiming to ensure all the relevant information on corrections etc is readily available.

For the purchasers and users of sound level meters – following

publication of the revised standard instruments will start to become available that have been manufactured according to Edition 2 of IEC 61672, and this will be clear from the markings as the year of publication of the standard must be included. When the meter undergoes a periodic test this will be performed using Part 3 of Edition 2. Sound level meters manufactured according to the Edition 1 of the standard will continue to be tested against IEC 61672-3: 2006 (BS EN 61672-3:2006 [6]). If you have a much older sound level meter originally manufactured to IEC 60651 or IEC 60804, then in the UK the British Standard BS 7580: Part 1:1997 [7] remains the appropriate standard for periodic testing.

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References

1. IEC 61672-1:2002, *Electroacoustics - Sound level meters - Part 1: Specifications*
2. IEC 61672-2:2003, *Electroacoustics - Sound level meters - Part 2: Pattern evaluation tests*
3. IEC 61672-3:2006, *Electroacoustics - Sound level meters - Part 3: Periodic tests*
4. ISO/IEC Guide 98-4:2012, *Evaluation of measurement data – The role of measurement uncertainty in conformance assessment (JCGM 106 from the Joint Committee for Guides in Metrology)*
5. IEC 62585:2012, *Electroacoustics - Methods to determine corrections to obtain the free-field response of a sound level meter*
6. BS EN 61672-3:2006, *Electroacoustics. Sound level meters. Periodic tests*
7. BS 7580-1:1997, *Specification for the verification of sound level meters*