The revised IEC Standard for frequency analysis in sound and vibration measuring instruments

By Richard Tyler AVI

On 14 February the revised standard for octave and fractional band filters, IEC 61260-1 Ed. 1 was published. Publication of this Part 1 alone was not the original intention of IEC TC29/MT19, the committee responsible for its update, and this article aims to explain the current situation as well as trying to avoid some confusion with the previous version.

The original IEC 61260:1995 Ed. 1 has been under review for many years, with a view to producing a three-part document: Part 1 with revised specifications and the latest approach to uncertainty of measurement; Part 2 with tests for pattern evaluation; and Part 3 with tests for periodic testing, following the approach used by the latest sound level meter standard IEC 61672. The initial aim was to publish all three parts at the same time so that design and verification of any new filters could take place in the full knowledge of all the requirements from the outset. It was also expected that the revised version would be IEC 61260 Ed. 2.

Progress of the revised Standard

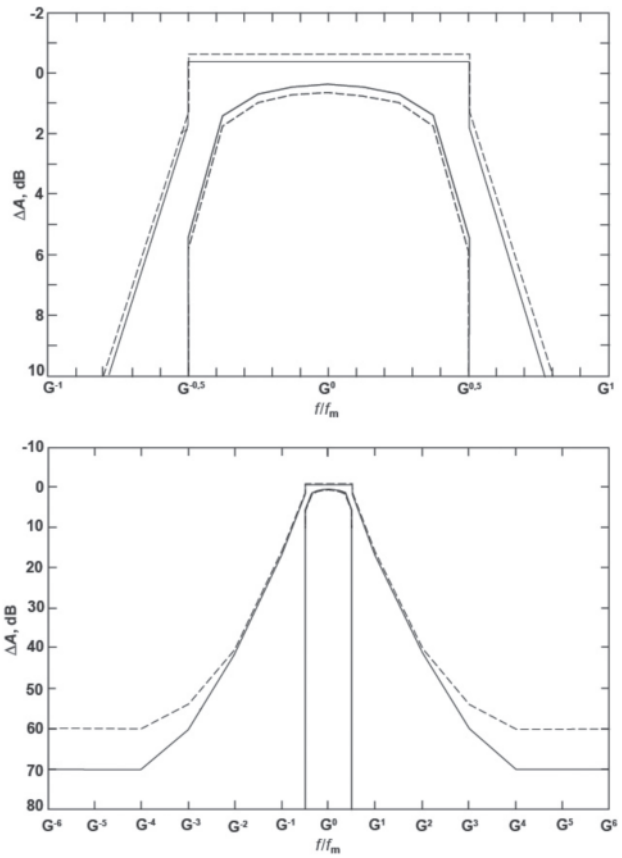
The Committee produced the full text for Part 1, and then started to draw up text for Parts 2 and 3. In order to gain worldwide views and judge the acceptability of Part 1, it was circulated to National Committees for comments, as is the case with all IEC Standards, and proceeded with some comments received through the various stages to a CDV (Committee Draft for Vote) stage. Although a number of significant comments were received, including a No vote from the UK for reasons to be explained later in this article, IEC Central Office at first agreed to a second CDV stage, during which the Drafts of Part 2 and 3 would also be available to National Committees for comment, but several months later reversed its earlier decision (deciding it was now outside IEC "rules") and instead the document was circulated as a Final Draft International Standard (FDIS) with no Part 2 or 3 available at the same time.

Although there were some adverse comments and with the UK still voting against the document, sufficient positive votes were received for it to proceed to publication with no further alterations. However, prior to publication, this document was altered to become IEC 61260-1:2014 Ed.1 as IEC Central Office decided that, now the Standard was in three parts, its Edition number was reset to 1 because the previous edition did not have 3 parts, which to this author's mind is extremely confusing for the Standard user. At present, both editions are available from the IEC store for purchase, so anyone interested in purchasing a copy of the new Standard should ensure that it is the 2014 version they are purchasing if they require the new edition. Parts 2 and 3 have now been circulated once for comment to National Committees, with significant numbers of comments received. These parts will follow the IEC path for revision, and it is hoped that fast progress can be made, such that publication in about a year's time may be possible.

Requirements in the revised Standard

The new Standard is based on the assumption that stand-alone filter sets are unlikely to exist, and that the filters will be part of an instrument measuring sound or vibration. The basic filter shape requirements have not changed from the previous edition, but Class 0 filters have been removed from the Standard and no longer exist. The requirements for an octave band filter are as shown in the following figure.

Acceptance limits on minimum and maximum relative attenuation as a function of f/f_m for class 1 and class 2 octave-band filters



x-axis: Normalized frequency f/f_m – logarithmic scale.
y-axis: Relative attenuation A in decibels.
Solid lines apply to Class 1 filters, dotted lines to Class 2 filters.

The other changes to the main specifications are not too significant: only filters with centre frequencies to Base 10 are permitted, all filters in a filter set must meet the same Class, and if the filters are to be used for measuring reverberation time, the filter decay time in each band must be specified. However, one additional feature is now specified that is very significant in the design of instruments that read more than one filter band simultaneously. Filters are now required to be time-invariant, so that all data processed by a filter is analysed sufficiently frequently that no relevant data is omitted. An elegant test to prove this was devised, which is quick and easy to carry out, but presents severe problems in the verification of the signal being applied. This signal is a sinewave that is swept at an exponential rate from well below the centre frequency of the lowest filter centre frequency in the filter set, to well above the centre frequency of the highest filter centre frequency. The rate can be quite rapid, so a sweep lasting only 30 seconds can be sufficient to test every filter in a filter set 20 Hz – 20kHz for the time-invariant parameter. P32

P30 Commercial generators that produce frequency sweeps are available, but these do not always produce an exponential rate of change, which is essential for the correct operation of this test. ***Proving that a sweep generator maintains a constant amplitude output during the sweep, that the sweep is truly exponential and that the frequencies supplied are accurate is proving quite a challenge, and with no solution currently proven that would satisfy an external assessment, such as that required for independent accreditation (UKAS in the UK).*** In Part 1 of the revised Standard, a maximum permitted expanded uncertainty of measurement of just 0.20 dB is currently the limit for any laboratory attempting this test. (If they have larger uncertainties, they are not allowed to verify the filter set). Tests are planned to try to quantify an approach to testing and derive a meaningful associated uncertainty budget for a sweep generator, but with nothing proven at the time of voting, the UK considered it appropriate to vote No to the FDIS for Part 1 until this figure was shown to be achievable, as mentioned above. Now the Standard is published, what will happen if the subsequent testing shows this figure to be unrealistic will be interesting, as it is mandatory for all Pattern Evaluation laboratories to undertake this test, and they can only issue Pattern Approval if they can show their uncertainties for all tests are less than or equal to the maximum permitted figures given in Part 1 of the Standard. Testing sweep generators in an appropriate fashion to establish the uncertainties is now planned by a few committee members for late March 2014 onwards, so it is hoped that early indications of an approach that appears to conform to the required uncertainty budget can be proven.

It is recognised that proving the performance of a sweep generator may be beyond some periodic verification laboratories to achieve, (due to lack of sophisticated test equipment for example), so the IEC Committee members are now considering making this test optional for Periodic testing. However, this may only be possible for filter sets that have been successfully pattern evaluated, as this will verify the design of the filters and the design will not change during the lifetime of the filter. It is a pity that such a quick and elegant test is so difficult to verify with a known uncertainty, but until this issue is resolved, it is quite difficult to see the way forward for completing the text of Parts 2 and 3 of the Standard.

Conclusion

The aim of the revision of IEC 61260 was to produce requirements and tests that would define filter performance for many years to come. At present, there are no tests specified, and until Parts 2 and 3 are published, it will be a while before these are defined. Until then, work will continue to try and provide a reliable, achievable set of tests that prove a filter is fit for purpose without taking many hours to perform, so ensuring the tests can be performed at a realistic cost.

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