The changing face of emi compliance

The implications of CISPR 16-1-1's recent update to include spectrum analysers for emi compliance measurement. By **Andy Coombes**.

The world of electromagnetic interference (emi) measurement is undergoing a rethink, thanks to the release by the International Electrotechnical Commission of Edition 3 of the CISPR 16-1-1 standard; otherwise known as CISPR 16-1-1:2010.

CISPR 16-1-1 specifies the characteristics and performance of equipment for measuring radio disturbance in the 9kHz to 18GHz frequency range, as well as providing requirements for specialised equipment for discontinuous disturbance measurements. The reason for the rethink is that the 2010 version of this standard now allows spectrum analysers to be used to test emi, in addition to dedicated, but more costly, emi receivers.

Any change in CISPR 16-1-1 has an impact on how all types of electronic equipment are tested in Europe, as CISPR 16-1-1 defines the measurement apparatus, measurement methods, measurement uncertainty and test facilities used by all electrical product groups. So, whilst the addition of spectrum analysers to the apparatus one can use for testing emi might not sound of great consequence, it has the potential to change the way in which every single electrical product is tested in the future. Indeed, radio and tv receivers (covered by Edition 4 of CISPR 13) are the first product group to adopt CISPR 16-1-1:2010 and it will come into force for other types of equipment in the following months to years, depending upon the next review date of individual product standards.

It is worth noting that whilst CISPR 16-1-1 is an international standard, it covers primarily European emi emissions measurement, with similar regulations in force on other continents. In the US, the equivalent standard for emc emissions measurement is ANSI 63.2 (the American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10Hz to 40GHz), where spectrum analysers have always been used for emission compliance measurement.

With the world of interference changing all the time, emi measurement standard updates tend to reflect new detector developments or new broadband technologies. But, as in the case of CISPR 16-1-1:2010, closer alignment with the US standard is likely to have played a part in the adoption of spectrum analysers for emi measurement. Another catalyst is the potential cost saving to end users, thanks to general purpose spectrum analysers being much cheaper than dedicated emi test receivers.

However, there is a temptation to believe that

any spectrum analyser can be used to make emi compliance measurements and this is not the case. CISPR 16-1-1:2010 allows spectrum analysers without preselection filters to be used for such measurements in some limited conditions – not all.

Although the spectrum analyser does not need a preselector, CISPR 16-1-1 still requires some very specific functions that are not generally incorporated in a general purpose spectrum analyser's feature set just yet. These include a quasi peak detector that is capable of measuring pulsed signals with repetition frequency equal to or exceeding 20 pulses per second. In addition, a linear average detector with meter time constant (used to simulate a critically damped indicating instrument) is necessary order to detect intermittent, unsteady or drifting narrowband disturbances. Meanwhile, it has been suggested that a spectrum analyser used for emi measurements has 6dB bandwidths of 200Hz, 9kHz, 120kHz and an impulse bandwidth of 1MHz. Alternative emission measurements with 100Hz, 10kHz and 100kHz bandwidth are acceptable, as long as the results are not ambiguous. It is possible to use a different bandwidth and compensate by applying a margin of error.

So, when can a spectrum analyser without preselection be used? A spectrum analyser without preselection adds a level of uncertainty to the test procedure, so it really is only possible to test emi in this scenario if the disturbance characteristics are known; for example, with something like a television, where the characteristics of all sources of disturbance are well defined. A spectrum analyser without pre-selection can be used when the device under test does not repeat pulsed disturbance at a frequency of less than 20Hz.

Another scenario is when the difference in amplitude between the peak and quasi peak signals does not exceed defined values. Again, with a tv, there's little likelihood of the difference exceeding the source values, but for products such as household appliances, electric tools and automotive components, the difference cannot be known. Notably, with high amplitude or broadband signals, a spectrum analyser without preselection is vulnerable to overloading the front end. It is advised that when measuring low level spurious signals in the presence of a strong fundamental signal, a filter is inserted at the measuring receiver's input, to provide adequate attenuation at the fundamental frequency to protect the input circuits of the receiver from overload or damage.

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For users who plan to carry out emi precompliance testing using a spectrum analyser, it is worth bearing in mind that the results of tests on the disturbance characteristics may not show the necessary precision, so that the quasi peak measurement will need to be repeated with a fully compliant measuring receiver in order to achieve a valid outcome. A validation procedure is described in CISPR 16-2 that enables test engineers to determine the suitability of an instrument to emi compliance.

As with all new standards, there will be a transition period to ensure there is time for people to fully adjust to the new changes. This is likely to mean that whilst few spectrum analysers yet boast quasi peak or linear average detectors, or the bandwidths mentioned earlier, these features may become more common over time as test manufacturers react to the demands of this new legislation. Both Rohde & Schwarz' range of compliance and precompliance instruments meet the latest requirements of CISPR 16-1-1, with the precompliance units including all the detectors and filters necessary.

What remains critical for this industry is that emi emissions measurement is in no way 'watered down' by changing regulation. This is unlikely to be the case, but with emi having been the subject of more column inches of late than might be expected from something so tightly monitored, changes to CISPR must not compromise the rigour of emi testing. One source of many of the most recent mentions was Toyota's mass recall of models with faulty accelerator pedals. Though the company has insisted the problems are purely mechanical, electrical issues – emi in particular – have been implicated as a cause of some of the fault conditions. EMI testing may have just become slightly cheaper, but certainly no easier.

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