Know Your Standards

IEC 61000-3 series

As threatened last time, we continue our review with Part 3 of IEC 61000, whose Sections include two of the most important EMC standards, applying in Europe now and under active consideration (no doubt with many changes) in the Americas. Derived national standards apply in several other countries.

IEC TR61000-3-1

We start on a low note; in 1998 this was supposed to be a Technical Report giving an overview of the whole series. It was abandoned in 2011 after zero progress.

IEC 61000-3-2

This is one of the two controversial emission standards on 'low-frequency conducted disturbances', those known to their friends (and enemies) as 'mains harmonics'. It is a product-family standard, with a huge 'family', and applies to *everything* that has a household-type mains plug, or draws up to 16 A per phase. (OK, I know the risks of absolute statements - somewhere someone may make a product so abstruse that it would *never* be used on the public electricity supply, so doesn't have to meet this standard.)

It divides products into four classes, A to D, where Class A applies to most product types, Class B applies to mostly hand-held power tools, used for short periods only, Class C applies to 'lighting equipment', which has a complicated definition; it imposes strict limits because of the large proportion of the network load that is due to lighting, while Class D applies to computers and TV sets, which, unless they include mitigation measures, draw current from the mains supply as short pulses, whose low-odd-order harmonic currents are almost in the same phase for all products, so add arithmetically. The 3rd, 9th, 15th etc. add in the neutral wire of 3-phase and neutral distribution cables, and can cause severe overheating (theoretically the current can be 2.8 times the fundamental current). The 5th harmonic propagates into the Medium Voltage network, where it can excite resonance, which is very bad news for system overvoltage and reliability.

Classes A, B and D have each their own set of limits, but Class C doesn't; for some lighting products, the class A limits apply, for others, the class D limits and for yet others either a special set of limits or a 'special current waveform'. So there aren't unambiguous 'Class C limits' as such; one has to refer to 'table 1', 'table 2', 'table 3' or 'special waveform'.

The measurements involve quite a lot of data processing, so a special harmonic analyser is required, described in IEC 61000-4-7.

Current work on this standard includes a series of amendments to take new technology into account, notably LED lamps and new types of dimmers, which are new and controversial issues.

IEC 61000-3-3

This is the other 'terrible twin' of 'low-frequency conducted emissions', with 61000-3-2. It is a product-family standard applying to everything that can be connected to the public electricity supply and draws up to 16 A per phase. What it limits are voltage changes (reductions only), due to inrush current and load current fluctuations, especially repetitive fluctuations that can cause lighting to flicker. A special measuring system is required to evaluate this, the 'flickermeter' specified in IEC 61000-4-15.

IEC TR 61000-3-4

This deals with harmonic current emissions for products drawing more than 75 A per phase. It is advisory, because the connection of such products to the public supply always involves negotiation with the network operator. Before IEC 61000-3-12 was produced, it applied to products drawing more than 16 A per phase.

IEC TS 61000-3-5

This is a Technical Specification, of the type that is not intended to be converted to a standard. It deals with the same subject as 61000-3-3 but for products drawing more than 75 A per phase. The precise reason why it is a TS and not a TR is obscure, but, as for TRs, it cannot be notified under the EMC Directive in Europe.

IEC TR 61000-3-6

This Report is about harmonic emissions directly into the Medium Voltage (MV), High Voltage (HV) and Extra-High Voltage (EHV) networks. It is advisory because all such connections of loads are negotiated with the network operator.

IEC TR 61000-3-7

This Report complements IEC TR 61000-3-6, in dealing with voltage fluctuations due to loads on MV, HV and EHV systems. It is, of course, advisory.

IEC 61000-3-8

This standard specifies emission levels, frequency bands and disturbance levels for mains signalling ('ripple control'), which is mainly used by electricity suppliers, not in Britain but extensively elsewhere. There are three frequency bands defined for use in Europe - 3 kHz to 9 kHz, 9 kHz to 95 kHz and 95 kHz to 148.5 kHz. The upper band stops just short of the LF ('long wave') broadcast band in Europe. Controversy has recently arisen because some countries outside Europe want the bands extended to 500 kHz, because they do not have LF broadcasting. It isn't clear why different frequency ranges cannot be specified for different continents or ITU Regions.

IEC 61000-3-9

This was intended to be a standard for emission limits for interharmonics (currents at frequencies not related to the power frequency), but a controversial alternative approach has been

developed - measuring harmonic currents with a bandwidth equal to the power frequency, so that harmonics and any interharmonics are added together. This has been shown to result in equipment that does not cause any problem in practice nevertheless exceeding the limits. After a very long discussion over several years, a solution to this has appeared, which may be adopted during 2013. If so, IEC 61000-3-9 will be deleted from the programme of work of IEC SC77A.

IEC 61000-3-10

This was intended to be a standard for emissions in the frequency range from the 40th harmonic to 9 kHz, but no progress could be made over many years, due to changing technologies and lack of data on which to base realistic requirements. It is still in the programme of work, but no group is at present assigned to work on it.

IEC 61000-3-11

This standard complements IEC 61000-3-3 for products drawing more than 16 A but less than 75 A per phase, and for products drawing less than 16 A per phase which cannot meet IEC 61000-3-5.

IEC 61000-3-12

This standard complements IEC 61000-3-2 for products drawing more than 16 A but less than 75 A per phase. It takes a very different approach from that of IEC 61000-3-2, basing limits on the ratio of the load impedance to the supply impedance.

IEC TR 61000-3-13

This advisory Report is about emission limits for unbalanced loads connected to MV, HV and EHV systems.

IEC TR 61000-3-14

This Report concerns the assessment of emission limits for harmonics, interharmonics, voltage fluctuations and unbalance for loads connected to LV systems.

IEC TR 61000-3-15

This Report is about emission and immunity limits for dispersed generation systems - a complex matter. It was originally intended as standard, then as a TS and finally, considering that the technology is not yet mature, it remains a Report, *but perhaps not for ever.*

At present, there are no more Sections of Part 3, but there might be in future. Next time, we look at IEC 61000-5 series and perhaps the 61000-6 series as well.

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