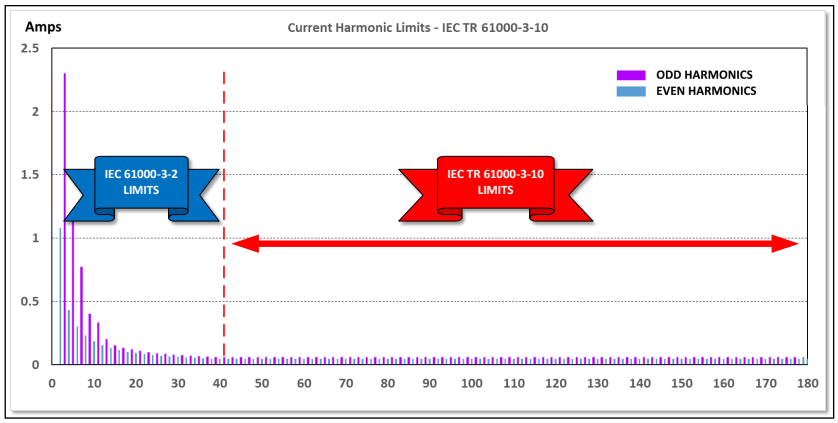
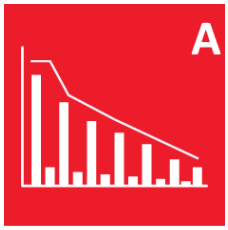
IEC 61000-3 Future Emission Standards Preview



RELEVANT IEC REPORTS

- IEC TR 61000-3-10
- IEC 61000-3-16
- IEC 61000-3-17
- IEC TR 61000-3-18



HARMONICS

1 Preface

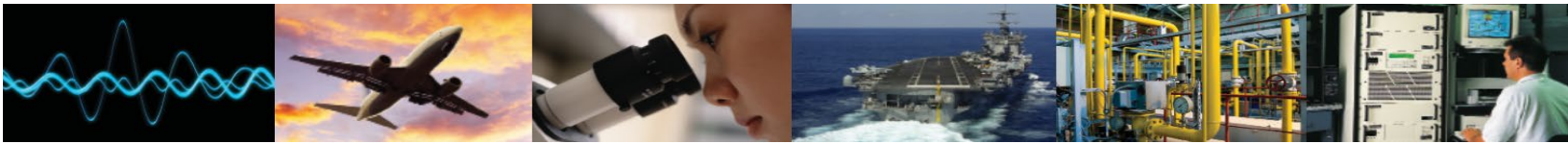
This application note provides a preview and analysis of potential impact on existing EMC test systems for Harmonics and Flicker compliance testing in use by many test labs around the world. At this time, several IEC Technical committees are working on-standards relating to Harmonics Current emissions and Flicker from Distributed Generators (DG) energy sources. These new emission standard will expand on the existing IEC 61000-3-2 and IEC 61000-3-12 Harmonic Emissions and IEC 61000-3-3 and IEC 61000-3-11 Flicker standards which have been in place for many years. Also, the IEC working group is developing the new standard IEC 61000-3-10 which sets emission limits in the range from 2-9 kHz.

IEC 61000-3-16 (harmonic emissions) is at the CD stage, and as these documents become published IEC test standards, there is a high probability that legacy Harmonics and Flicker test systems will not meet all of the new test standard requirements, and require major upgrades or replacement.

The implications of the following Technical Reports are considered in this paper:

Report Number	Subject
IEC TR 61000-3-10	Emission limits in the frequency range from 2 kHz to 9 kHz
IEC 61000-3-16	Electromagnetic compatibility (EMC) - Part 3-16: Limits - Limits for harmonic currents produced by energy supplying equipment connected to public low-voltage systems with a rated current less than or equal to 75 A per phase
IEC 61000-3-17	EC 61000-3-17: Electromagnetic compatibility (EMC) - Part 3-17: Limits - Limitation of voltage changes, voltage fluctuations for LV generators
IEC TR 61000-3-18	Limits- Assessment of network characteristics for the application of harmonic emission limits for equipment to be connected to LV distribution systems not currently covered by IEC 61000-3-2 and/or 61000-3-12. To develop IEC TR 61000-3-18: Assessment of harmonic emission limits for equipment to be connected to LV distribution systems with nominal voltage other than 230 V and 230/400 V – Complement to IEC 61000-3-2 and 61000-3-12 (Under WG1 supervision).

Table 1: List of Future IEC Standards under development



This is a forward looking document and the actual outcome of the IEC committees work is not yet known so any potential impact on existing EMC test systems is speculative at this time. However, for those considering acquiring new Harmonics and Flicker test equipment or upgrading their existing systems, the information in this paper may be of value in making the best possible equipment selection or asking the right questions of their equipment vendors.

2 Relevance

The IEC 61000-3-16 and IEC TR 61000-3-18 drafts in the works expand on the existing harmonics emissions standards in several ways, specifically:

The Distributed Generators targeted by these new standards exist already in many forms, for example:

- Solar and Wind Inverters connected to the public utility grid
- On Board Electric Vehicle Chargers that are Bi-directional and can be used for Energy Storage Systems
- Standby or backup generators that are used to shave peak energy demand during peak usage times.

What these DG's have in common is that they are able to return energy back to the power grid. That means they have to meet several safety requirement such as anti-islanding detection.

For compliance testing, the implications is that the Harmonics and Flicker test system AC power source must be able to act as a grid simulator and must therefore be bi-directional.

The TR 61000-3-10 draft standard deals with expansion of the current emission frequency range from the 50Hz / 60Hz to 2000Hz / 2400Hz called out in the IEC 61000-3-2 and IEC 61000-3-12 Harmonic Emissions standards to a frequency span from 2 kHz to 9 kHz. The significance of the this extended frequency range is illustrated by Figure 2-1 and Figure 2-1 that compare the original 40 harmonics window to the projected 180 harmonics window for the case of 50Hz. (9000 Hz / 50 Hz = 180 Harmonics) although actual **limits** have not been established yet.

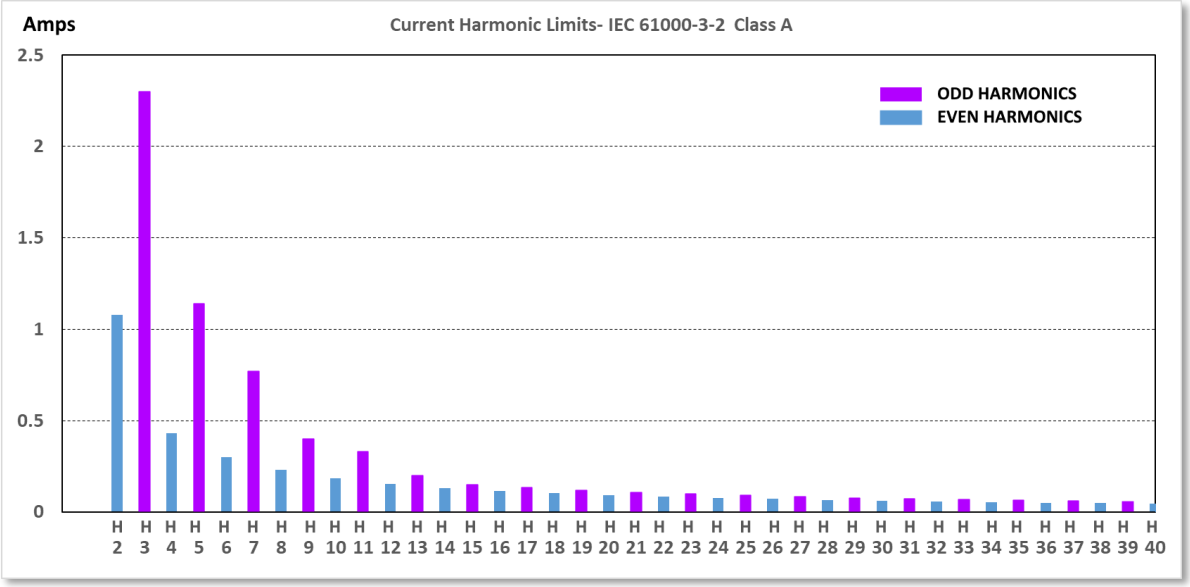


Figure 2-1: IEC 61000-3-2 Standard Harmonics range from 2 - 40

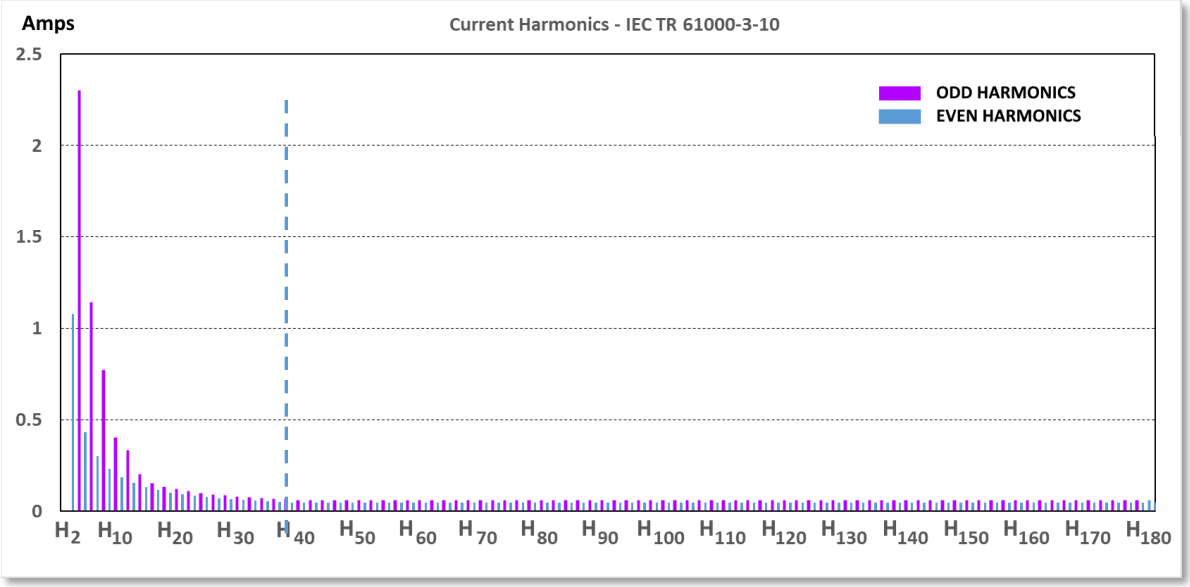


Figure 2-2: IEC TR 61000-3-10 Proposed Harmonics range from 2 - 180

This potential frequency range extension has several implications for existing EMC test systems, such as:

1. The harmonic current and voltage measurement bandwidth of the EMC test system must be at least five times higher than what is required today. Instead of supporting voltage and current harmonics measurement up to 2400Hz, the measurement must now support at least 9000Hz. Not all Harmonics and Flicker test systems were designed with this bandwidth and associated digital sampling rate requirements in mind.

2. The impact on Harmonics and Flicker test systems is that the AC power source must be able to supporting these higher frequency harmonic current emissions without unduly attenuating them as a result of a high output inductance in the power source used. This is especially pertinent to PWM Switch mode AC power sources which have a significant amount of output inductance in their low pass output filters used to reduce output switching noise. A source output impedance that is too high will result in lower than actual current harmonic amplitude measurements resulting in a false PASS result.

3 Pacific Power ECTS2 Series EMC Test Systems

The ECTS2 Series of EMC test systems was developed with the above considerations in mind and is already 'future'. The following technical provisions are already in place on ECTS2 test systems:

3.1 Measurement Support Capabilities for Higher Harmonics

IEC TR 61000-3-10 — The higher measurement bandwidth required to support harmonic measurements up to 9kHz is met by the ECTS2's Harmonics and Flicker measurement module through its real-time sampling rate of 25,600 Samples/sec at 50Hz and 30,720 Samples/sec at 60Hz. This ensures it can measure harmonics and inter harmonics over a frequency range up to 12 kHz for 50Hz applications or 15 kHz for 60Hz applications. Existing EMC Test Systems from leading EMC equipment vendors may not support these higher sampling rates.
New harmonics limit pass/fail limits defined by a future IEC 61000-3-10 test standard can be added to the Pacific Power Harmonics and Flicker software once they are established by the IEC without any further hardware impact

IEC 61000-3-16 — New harmonics pass/fail limits for bidirectional DG equipment, once they are established by this new standard, can be added to the existing Harmonics and Flicker software without any further hardware impact.

IEC 61000-3-17 — Test levels in a future IEC 61000-3-17 test standards are expected to be similar to those of IEC 61000-3-3. If not, a new limit set can be added by a software update only with no further hardware impact.
Also, a new current based flicker measurement may be added by IEC 61000-3-17. Such a method is already supported by the ECTS2 systems.

IEC TR 61000-3-18 — This Technical Report (TR) is being developed to provide guidance on network topology and sensitivity to harmonics. In the future, this technical report may assist in updating various emission standards. The harmonics limits for IEC TR 61000-3-18 are still under development but voltages higher than 230Vac L-N are already supported by the ECTS2 Test Systems based on the AFX or AZX Series AC and DC regenerative AC source.

3.2 Distributed Generator EUT Support Capabilities

Available ECTS2 Systems configurations to support distributed power generation products are based on AZX Series regenerative AC and DC power source models, ranging in power from 30kVA to 100kVA. (See Figure 3-1).

IEC 61000-3-16 — For EUT testing of equipment that can generate power back to the Utility grid, ECTS2 Systems can be configured with an AZX Series regenerative AC and DC Power Source. AZX power sources range in power from 30kVA/kW to 200kVA/kW, easily covering the less than 75A per phase requirements of IEC 61000-3-12 and IEC 61000-3-16.

IEC 61000-3-17 — For testing voltage fluctuations and Flicker of EUT's that feed back power into the grid (i.e. regenerative equipment).

Figure 3-1: Regenerative EMC Test System

Existing ECTS2 customer that own an AFX or LMX power source based ECTS2 system can add an AZX AC and DC power source to their existing ECTS2 test systems. That way the retain all measurement hardware and software as well as any Lumped impedances and/or Electronic Power Transfer Switch units from their original system and retain a significant portion of their original investment.

4 Summary

Harmonic and Flicker EMC test systems represent a significant capital investment and must be 'future proof' to ensure a long useable working life to recoup this investment. As such, it behooves the buyer to consider not only present technical requirements that have to be met but also potential future requirements. A forward looking approach can avoid costly mistakes requiring possible retrofits or replacement before the economic life cycle of the test equipment has expired.

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