

Recent Developments in EMC Standards and Regulations

from July 2004 *High Frequency Electronics*
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Standards and regulations for electromagnetic compatibility are continually being examined for their applicability to current equipment and spectrum usage. This report includes some recent activities in this field, including both study and completed regulations.

Standards

A proposed standard for the measurement of human exposure to electromagnetic fields below 100 kHz is being studied by the IEEE C95 standard committee. Among the sources of human exposure to frequencies from 0 to 100 kHz are 60 Hz alternating current in home electrical wiring and high-power distribution lines, airport metal detectors and in-store anti-theft systems. The current IEEE standard, IEEE C95.3, addresses the measurement and computation of magnetic and electric fields outside and inside the human body at frequencies of 100 kHz to 300 GHz. The proposed IEEE PC95.3.1 will do the same below 100 kHz. It is important to note that these standards do not address the safety or biological effects of exposure to these fields. IEEE C95.1, C95.6 and other standards set acceptable limits for human exposure to electromagnetic fields.

IEEE PC95.3.1, "Recommended Practice for Measurements and Computation of Electric, Magnetic and Electromagnetic Fields With Respect to Human Exposure to Such Fields, 0-100 kHz," will describe how to measure and compute the fields in air and the fields and currents induced in the bodies of people exposed to these fields and will address the instruments used and how to calibrate them.

The new standard will be used by engineers, biophysicists and other specialists familiar with electromagnetic field theory and exposure to electromagnetic fields. In addition, it will be useful to researchers studying the biological effects of these fields, field-measurement instrument manufacturers, and those involved in hazard assessment.

FCC Activities

The Federal Communications Commission regulates EMC in two primary ways—through the emissions limits established in various regulations, most importantly in Part 15 of its Rules and Regulations (47CFR); and by its spectrum management actions, which allocate bandwidth to the various radio services.

The FCC has addressed several specific spectrum management issues recently. The 1.6 GHz or mobile-satellite service (MSS) operators with satellite systems that utilize code division multiple access (CDMA) and time division multiple access (TDMA) technologies will share 3.1 megahertz of spectrum at 1618.25–1621.35 MHz. Previously, only CDMA MSS operators had access to this spectrum. The plan adopted by the FCC encourages CDMA and TDMA MSS operators to coordinate spectrum use amongst themselves.

In the 2.4 GHz band, the FCC allocated the 2495–2500 MHz band to fixed and mobile except aeronautical mobile services, in order to provide additional spectrum to the 2500–2650 MHz band to accommodate the relocation of MDS channels 1 and 2. As a result, the FCC moved the band in which S-band MSS operators may provide ancillary terrestrial component (ATC) operations from 2492.5–2498 MHz to 2487.5–2493 MHz. CDMA MSS will continue to be permitted to operate in the 2495–2500 MHz band on a shared basis. The FCC is also exploring whether CDMA and TDMA MSS operators feasibly could share an additional 2.25 megahertz of spectrum at 1616.0–1618.25 MHz.

Looking well into the future, a spectrum management task that will present a challenge to the FCC is the re-farming of VHF television channels after the transition to digital television (DTV) is completed and all TV stations are operating on UHF channels. The challenge is in determining what services will be able to use the 72 MHz of newly-available spectrum, that has highly desirable VHF propagation characteristics. At this time, only a few candidate services have been identified.

Part 15 of the FCC Rules was last revised in 1999, although there are several proposals in discussion that would alter portions of it, plus an exploration of a new method of measuring the potential for interference. Among the proposed changes to Part 15 are new measurement methods designed specifically for the proposed controversial Broadband over Power Lines (BPL) service. Opponents of BPL are already on record as believing that existing Part 15 standards will not prevent harmful interference from being experienced, and that any relaxation of Part 15 will exacerbate the interference potential. Opponents also question whether changes to a key standard like Part 15 are appropriate when the intent is to accommodate one set of unlicensed spectrum users, possibly at the expense of increased interference to licensed users.

The Commerce Department, through the National Telecommunications and Information Agency (NTIA) states that existing Part 15 limits are sufficient, and that additional technical measures are required beyond those limits to minimize interference to licensed radio services.

As a reminder to readers, it should be noted that Part 15 has a clause that prohibits interference to licensed services, regardless of whether the actual radiation is within stated limits. The rule also provides no protection for interference to unlicensed users of the spectrum.

As reported in the May issue [1], the FCC has begun an inquiry into the use of “interference temperature” as a metric for undesirable radiation. If some form of spectral density is eventually adopted, Part 15 could change dramatically in the way it defines radiation limits.

International Standards

In the world EMC arena, the European Union is the best organized, and clearest in its mission regarding standards and regulations. In its charter for this realm of activity, the EMC Directive, the mission of EMC regulation is stated clearly as a set of appropriate rules for protection from interference and immunity from interference at expected signal levels. EU EMC rules are updated regularly, with active participation by all members’ regulatory agencies, industry experts, and professional organizations.

Selectively, the U.S. has modified some of its EMC standards and regulations to “harmonize” with those of the EU and other worldwide bodies. The primary areas of cooperation are in product certification, to assure that there is no undue burden on a U.S. company that wishes to sell its products worldwide, and the same for international companies selling products in the U.S. market. These efforts have been largely successful.

The strength of the EU position on EMC, and the open participation in its standards activities has created many international efforts at harmonization. In some cases, a comprehensive set of standards can be adopted, at least in part, by a small country that does not have sufficient resources to develop regulations independently. Larger countries can participate through the IEC or other international membership bodies and participate directly in the harmonization process.

One area of strong cooperation is in the area of measurement methods. For example, the Special International Committee on Radio Interference (CISPR), part of the International Electrotechnical Commission (IEC) has an ongoing in-depth study of such measurement topics as receiver specifications, validation of test sites, calibration of various test devices, testing in anechoic, absorber-lined and transverse electromagnetic (TEM) waveguide chambers. The results of the various discussions eventually become part of a CISPR document that describes the official methodology for testing to IEC standards.

In a recent action, IEC 61000-4-21 was released, establishing a common reference for using reverberation chambers to evaluate the performance of electric and electronic equipment when subjected to radio-frequency electromagnetic fields and for determining the levels of radio-frequency radiation emitted from electric and electronic equipment. The document provides a general overview of the theory of reverberating chambers, describes detailed step-by-step calibration procedures for different chamber operating modes, and includes guidelines for emissions and immunity measurements as well as special applications like shielding effectiveness and antenna efficiency measurements.

In other international activity, ETSI and CENELEC have set up a joint working group to examine EMC requirements for extensive conducted transmission networks. The purpose of the group is to formulate immunity and emission requirements based on a common approach for CATV, powerline and telecommunications networks. This is first such group to examine these types of extended structures as a single entity.

Summary

Electromagnetic compatibility standards and regulations are essential for the successful operation of most products that use radio technology in one of its many applications. International cooperation is essential, given the global nature of today’s marketplace

1. “A Summary of Recent Actions by the FCC,” *High Frequency Electronics*, vol. 3 no. 5, May 2004.