Basic Knowledge of EMC Standards

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1 | Introduction

This chapter summarizes basic information about EMC standards, including:
– What are EMC standards?
– Why EMC standards are so important and must be complied with?
– What types of EMC tests are being conducted?

2 | Beginning of EMC Standards

In order to put an electrical or electronics device on the market, the device is required to comply with EMC standards during its development, design, and manufacture. The EMC standards define the frequency range and limit of unnecessary radiation to prevent telecommunication and broadcasting devices (such as those that use an assigned frequency range for radio communication) and electrical/electronics devices from being interrupted, causing interference, or other similar problems.

Frequency range assignment is critical for ensuring important radio communication (e.g. fire services or police radio) and TV broadcasting, and preventing radio interference. The EMC standards play an important role in adjusting the frequency range assignment.

Another purpose of the EMC standards is to protect electrical/electronics devices from being subject to various interferences (including lightning surges and static electricity) or damage, by minimizing hazards found in their operating environments.

3 | Classification of the Standards

(1) International Standards: ISO, IEC/CISPR, etc.
(2) Regional Standards: EN, ASEAN, etc.
(3) National Standards: JIS, BS, ANCI etc.
(4) Industrial Standards: JEITA, SEMI, etc.
(5) Form Standards: Bluetooth, USB, HDMI, etc.

The important thing to note is that international standards are developed by the organizations that meet the commercially agreed principles of the WTO (World Trade Organization) (i.e. to ensure transparency, openness, impartiality and consensus, effectiveness and relevance, coherence, and to address the concerns of developing countries). These above mentioned organizations include ISO, IEC, and ITU.

Regional standards are developed to ensure impartiality in trade, imports and exports to/from the relevant region. The EN standard is a typical example.

National standards are established when a country needs to have customized standards that suit the actual situation in the country. Such national standards may be incorporated in laws and regulations, and operated along with penalties.

Industrial standards may define codes and standards for issues such as inter connectivity between devices. Usually, these codes and standards do not involve legal actions. The USB and HDMI standards are famous examples.

It is important to note that the compliance with the standards is related to commerce and trade issues. Consequently the systems to ensure measurement methods and accuracy (e.g. ISO7025: management system of testing and calibration laboratories) play as important a role as the designated limit values and frequency ranges in the operation of these standards.

The standards and operating rules are created and operated globally. This movement is based on the idea that "radio waves used as the means of information-communication play an extremely important role in the fields of national security, economic activity, and social activity."

4 | IEC Standards

The major international standards for the EMC sector are IEC (International Electrotechnical Commission) standards and CISPR (Comité international spécial des perturbations radioélectriques) standards. In the U.S., IEEE standards are more popular and used as the international standards in the field, e.g. antenna calibration tests. The procedures for establishing an IEC or CISPR standard include a conference of representatives from various countries. An IEC or CISPR standard is usually reviewed and revised once every 5 years, in order to keep its technological level equal to the current situation.

5 | Hierarchy of Standards

Most international standards such as IEC are maintained systematically. For example, EMC standards are systematized as follows:
(1) Basic EMC publications/Technical report
   These standards describe the general EMC specifications that are not limited to specific product or product families.
   (e.g. Terms: IEC61000 series, CISPR16)
(2) Generic EMC standards
   These standards are applied to products that are not subject to any specific product/product family EMC standards.
   (e.g. IEC61000-6 series)
(3) Product family EMC standards

The standards comprehensively applied to similar products are referred to as product family EMC standards. These standards define test, operating, and installation conditions, and so on.

(4) Product EMC standards

The standards applied only to the specific product are referred to as product EMC standards.

The standards of (4) have the highest priority and those of (1) have the lowest priority. Products are required to comply with the standards according to this priority.

6 CISPR Standards

The CISPR standards are employed as national standards in various countries, and considered to be the global standard. Japan is way behind in shifting to international standards as compared with other countries. For example, JIS standard may still be based on CISPR standard of 10 years ago. In the future, Japan needs to employ the international standards pro actively to take advantage of them to help in trade negotiations, to further her international contributions, and help solve environmental problems, and thus play a leading role in Asia.

Table 1 shows a list of CISPR standards. If you check this list considering the above mentioned standard system, you will see that some of these standards assume state-of-the-art products with future technologies.

Table 1 List of CISPR Standards

Standard No. (Rev.)		Contents	Issued (Year)
CISPR 11, Rev. 4.1		Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement	2004
CISPR 12, Rev. 5.1		Vehicles, boats and internal combustion engines – Radio disturbance characteristics – Limits and methods of measurement for the protection of off-board receivers	2005
CISPR 13, Rev. 4.2		Sound and television broadcast receivers and associated equipment – Radio disturbance characteristics – Limits and methods of measurement	2006
CISPR 14		Electromagnetic compatibility (EMC): Requirements for household appliances, electric tools and similar apparatus	
	14-1, Rev. 5.0	Part 1: Emission	2005
	14-2, Rev. 1.1	Part 2: Immunity	2001
CISPR 15, Rev. 7.1		Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment	2007
CISPR 16		Specification for radio disturbance and immunity measuring apparatus and methods	
CISPR 16-1		Part 1-1: Radio disturbance and immunity measuring apparatus	
	16-1-1, Rev. 2.1	Measuring apparatus	2006
	16-1-2, Rev. 1.2	Ancillary equipment – Conducted disturbances	2006
	16-1-3, Rev. 2.0	Ancillary equipment – Disturbance power	2004
	16-1-4, Rev. 2.0	Antennas and test sites for radiated disturbance measurements	2007
	16-1-5, Rev. 1.0	Antenna calibration test sites for 30 MHz to 1 000 MHz	2003
CISPR 16-2		Part 2: Methods of measurement of disturbances and immunity	
	16-2-1, Rev. 1.1	Conducted disturbance measurements	2005
	16-2-2, Rev. 1.2	Measurement of disturbance power	2005
	16-2-3, Rev. 2.0	Radiated disturbance measurements	2006
	16-2-4, Rev. 1.0	Immunity measurements	2003
CISPR 16-3, Rev. 2.0		Part 3: CISPR technical reports	2003
CISPR 16-4		Part 4: Uncertainties, statistics and limit modelling	
	16-4-1, Rev. 1.1	Uncertainties in standardized EMC tests	2005
	16-4-2, Rev. 1.0	Uncertainty in EMC measurements	2003
	16-4-3, Rev. 2.0	Statistical considerations in the determination of EMC compliance of mass-produced products	2004
	16-4-4, Rev. 1.0	Statistics of complaints and a model for the calculation of limits (Technical report)	2003
	16-4-5, Rev. 1.0	Conditions for the use of alternative test methods (Technical report)	2006
CISPR 17, Rev. 1.0		Methods of measurement of the suppression characteristics of passive radio interference filters and suppression components	1981
CISPR 18		Radio interference characteristics of overhead power lines and high voltage equipment	
	18-1, Rev. 1.0	Part 1: Description of phenomena	1982
	18-2, Rev. 1.0	Part 2: Methods of measurement and procedures for determining limits	1986
	18-3, Rev. 1.0	Part 3: Code of practice for minimizing the generation of radio noise	1986
CISPR 19, Rev. 1.0		Guidance on the Use of Substitution Method for Measurement of Radiation from Microwave Ovens for Frequencies Above 1 GHz	1983
CISPR 20, Rev. 6.0		Sound and television broadcast receivers and associated equipment – Immunity characteristics – Limits and methods of measurement	2006
CISPR 21, Rev. 2.0		Interference to Mobile Radio Communications in the Presence of Impulsive Noise: Method of Judging Degradation and Measures to Improve Performance	1999
CISPR 22, Rev. 6.0		Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement	2008
CISPR 23, Rev. 1.0		Determination of Limits of Radio Interference for Industrial Scientific and Medical Equipment	1987
CISPR 24, Rev. 1.0		Information technology equipment – Immunity characteristics – Limits and methods of measurement	1997
CISPR 25, Rev. 2.0		Vehicles, boats and internal combustion engines – Radio disturbance characteristics – Limits and methods of measurement for the protection of on-board receivers	2002
CISPR 28, Rev. 1.0		Industrial, scientific and medical equipment (ISM) – Guidelines for emission levels within the bands designated by the ITU	1997
CISPR 29, Rev. 1.0		Television broadcast receivers and associated equipment – Immunity characteristics – Methods of objective picture assessment	2004
CISPR 30, Rev. 1.0		Test method on electromagnetic emissions from elecronic ballasts for single- and double-capped fluorescent lamps	2001
CISPR 31, Rev. 1.0		Database on the characteristics of radio services	2003
IEC 61000-4-20, Rev. 1.0		Testing and measurement techniques – Emission and immunity testing in transverse elctromagnetic (TEM) waveguides	2003
IEC 61000-4-21, Rev. 1.0		Testing and measurement techniques – Reverberation chamber test methods	2003
IEC 61000-6-3, Rev. 2.0		Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments	2006
IEC 61000-6-4, Rev. 2.0		Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments	2006
IEC pas62437, Rev. 1.0		Radio disturbance characteristics for vehicles and boats—Limits and methods of measurement—Specifications for active antennas	2005