

The image shows the interior of an anechoic chamber, characterized by a dense array of white, pyramidal-shaped electromagnetic absorbers designed to eliminate reflections. A red wireframe antenna structure is suspended in the center, connected to a small electronic device. To the right, a blue mechanical arm or probe is visible, extending into the chamber. The lighting is bright, creating a high-contrast environment.

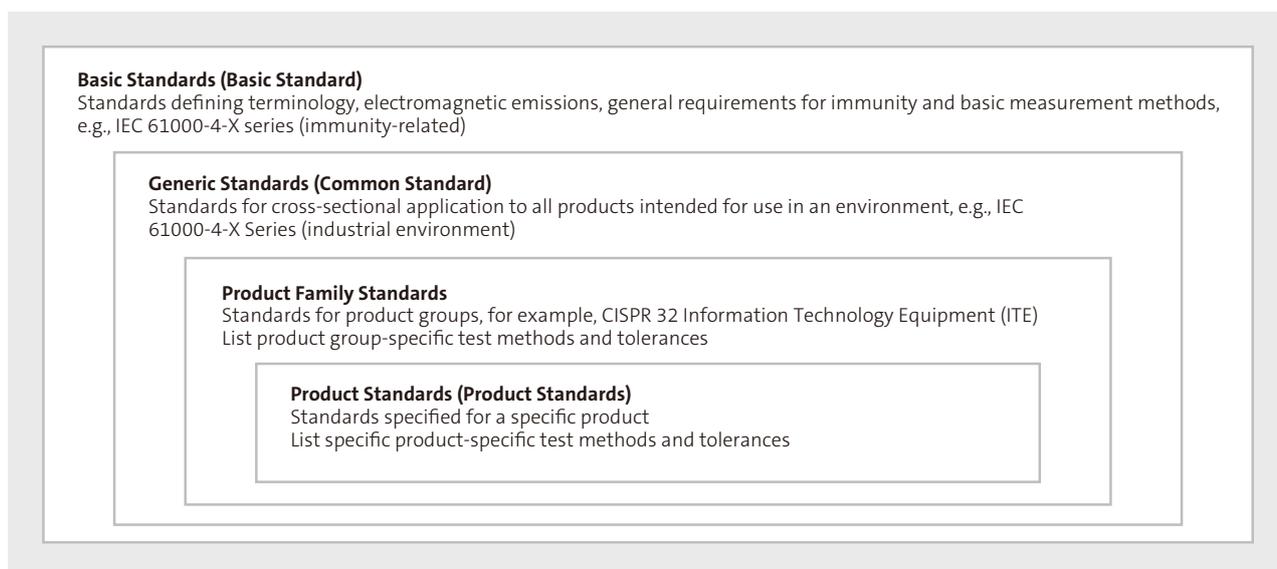
Primer on Key EMC Standards

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EMC Standards

In this white paper we'll discuss what electromagnetic compatibility (EMC) standards are and how they're created. EMC standards typically include EMC measurement methods, instrument specifications and criteria for determining whether test results pass or fail. The standards are classified into the following four types.



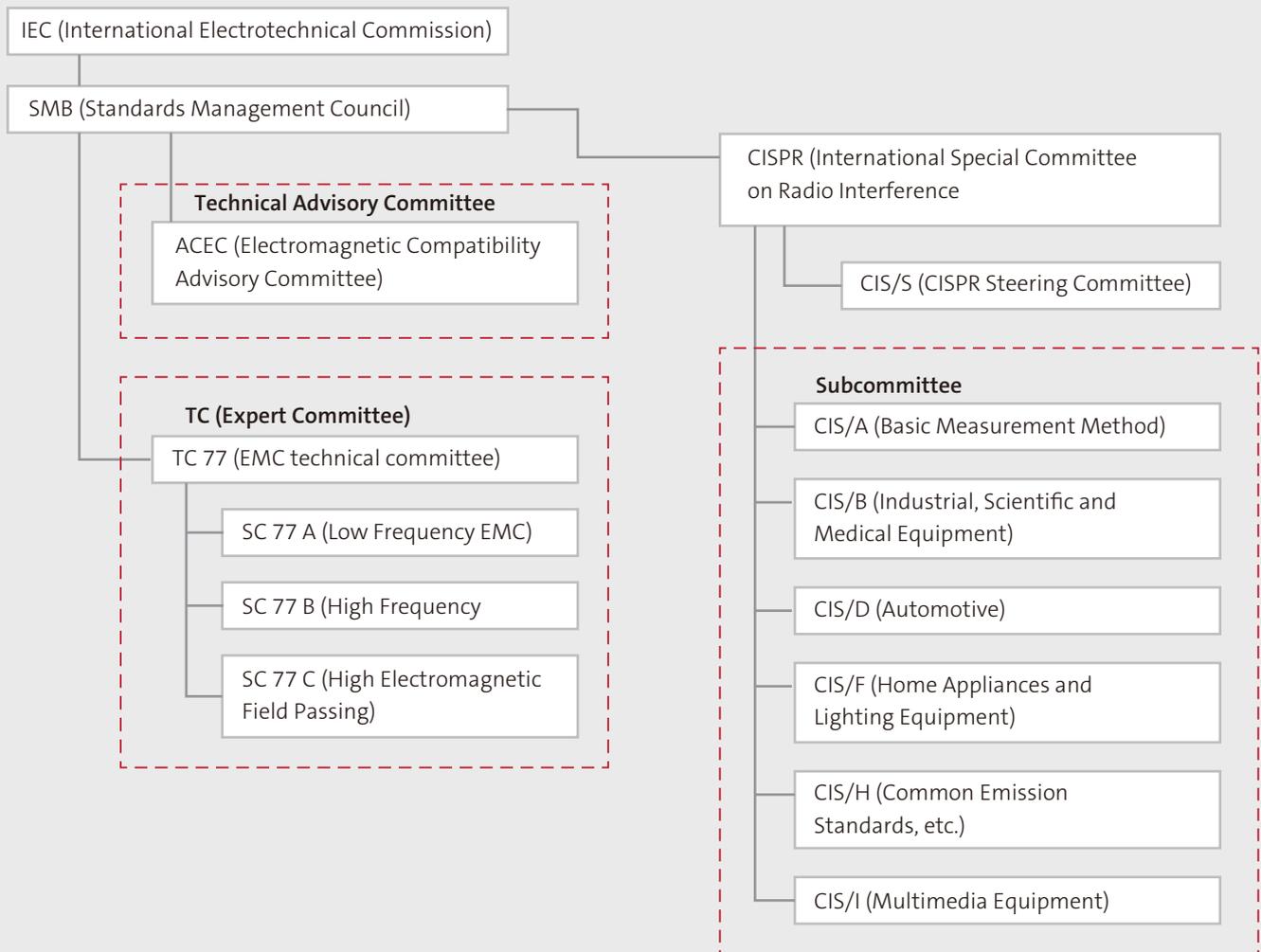
When applying standards to products, applicable standards may or may not be specified by law, industry, etc., and if so, they take precedence. If a standard is not specified, you select the standard to be used in the following order: product group standard, common standard and basic standard.



International standards

Many EMC standards are written and published by the International Electrotechnical Commission (IEC) and the International Special Committee on Radio Interference (CISPR). IEC was established in 1908 with the aim of standardization and international cooperation in the field of electrical and electronic technology. The IEC prepares and publishes international standards for all electrical, electronic and related technologies. Standards and technical reports related to EMC are prepared by a Technical Committee (TC77), a professional group within the IEC.

CISPR is a special committee of the IEC. CISPR was founded in 1934 to set standards for controlling electromagnetic interference in electrical and electronic devices. It also has a subcommittee that publishes standards for each product group. See the organization chart below, excerpted to show organizations related to EMC.





Regional regulations and standards

In addition to the international standards such as IEC and CISPR, regional regulations and standards also exist. Significant standards areas are highlighted below.

Japan

The Electrical Appliances and Material Safety Act regulates many of the general-facing electrical products intended for use in Japan. For items designated as specified electrical appliances (116 items) and non-specified electrical appliances (341 items), manufacturers and importers are obliged to confirm that the product complies with the standard and displays the mark. The standards used are recognized in accordance with IEC international standards.

In addition, VCCI, the Association for Self-Regulation of Radio Interference devices, such as information processing equipment, voluntarily regulates information processing equipment with regard to EMC. Although it is a voluntary organization for OEMs, it is required to satisfy the requirements of VCCI for the member OEMs. VCCI's technical standards refer to the international standard CISPR.

European Union (EU)

The EU market has been forced to comply with EMC directives since January 1996. The EMC Directive provides for requirements called “mandatory requirements” for each product area. Products that comply with the requirements of the Directive are allowed to be freely distributed within the EU. The requirements of the EMC Directive are not detailed technical requirements, but rather delineate that the products must meet the essential requirements for EMC. The essential requirements call for the electromagnetic disturbance generated by a device to not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended, and that the same device has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use. One way of satisfying the essential requirements is for a device to meet EMC technical standards and with successful results the CE marking is used as a means of displaying conformity. Technical standards referenced in the Official Journal use European harmonized standards (EN standards) that refer to international standards.

With the transition from the R&TTE Directive in 2016 to the Radio Equipment Directive (RED), broadcast receivers and radios, such as televisions that were previously subject to the EMC Directive, are now subject to the RED because they use radio functions. On the other hand, communication terminal devices, e.g., line connected telephones, that do not have radio functions that were subject to the R&TTE Directive are now classified as equipment subject to the EMC Directive.



United States

The Federal Communications Commission (FCC) has issued rule CFR: Title 47. Telecommunication that provides technical regulations for radiofrequency equipment or their components. CFR Title 47 has many parts, with key EMC-related regulations including:

- Part 15 Radio Frequency Equipment
- Part 18 ISM Equipment
- Part 2 Radio Frequency Equipment General Regulations.

In addition, each part has a subpart specified by the type of equipment. Within the FCC rules, measurement standards are incorporated by reference and used to demonstrate compliance with the FCC rules applicable to a product. American National Standards Institute (ANSI) Accredited Standards Committee C63 typically writes these measurement standards. C63 is a major United States EMC standards developer focused on many aspects of emission and immunity measurements, instrumentation and resources for test lab competency and quality control.

For your reference, here's how to use FCC Part 15.

	FCC Part 15
Subpart A General	Scope of application, definition, label request, information for the user, measurement method, measurement frequency range, etc.
Subpart B Unintentional radiation equipment	Equipment authorization, exemption, information for the user, tolerances, special equipment, individual requirements
Subpart C	Additional provisions for equipment authorization, prohibited bandwidth, tolerances and radiated emissions
Subpart D	Scope of application, definition, equipment authorization, coordination with fixed station microwave operations, measurement methods, tolerances, individual requirements
Subpart E	Scope, definition, cross-reference, general requirements
Subpart F	Scope of application, definition, cross-reference, commercially available, individual requirements, and measurement methods for ultra wide-band (UWB) equipment

Canada

The Certification and Engineering Bureau of Innovation, Science and Economic Development Canada (ISED Canada) provides a certification service for radio equipment and a registration service for terminal equipment in Canada. Testing of either radio or terminal equipment to establish compliance with ISED Canada standards is performed in private sector laboratories. These laboratories are required to be approved in accordance with the provisions of a departmental procedure. ISED Canada uses both international and C63 standards in their Interference Causing Equipment Standards.

Regional standards, including other major regions, are summarized in the table below.

Country	Regulatory Body		Standard	Reference standard	Laws and regulations
Australia	ACMA	Australian Communications and Media Authority	AS/NZS CISPR	IEC/CISPR	EMC Framework
Canada	ISED	Innovation, Science and Economic Development Canada	RSSs/ RSPs/ ICES	(CISPR and C63)	ISED Canada
China	CNCA	Certification and Accreditation Administration of the People's Republic of China	GB	IEC/CISPR	China Compulsory Certification: CCC China Compulsory Certification
European Union	--	--	EN	IEC/CISPR/ETSI	EMC Directives/Radio Equipment Directive
Japan	VCCI	VCCI Association	VCCI	IEC/CISPR	Voluntary regulations
Japan	METI	Ministry of Economy	JIS	IEC/CISPR	Electrical Appliances and Material Safety Act
South Korea	MSIT	Ministry of Science and ICT	KN	IEC/CISPR	Radio Law
New Zealand	MBIE	Ministry of Business, Innovation and Employment	AS/NZS CISPR	IEC/CISPR	EMC Framework
South Africa	SABS	South African Bureau of Standards	SANS	IEC/CISPR	Standards Act, 2008
Taiwan	BSMI	Bureau of Standards, Metrology and Inspection	CNS	IEC/CISPR	Product Testing Method (Commodity Inspection Act)
United Kingdom	--	--	EN	IEC/CISPR/ETSI	EMC Regulations/ Radio Equipment Regulations
United States	FCC	Federal Communications Commission	FCC CFR 47/KDBs	C63	FCC

1. UWB (Ultra wide-band) transmitters are widely open to frequencies in Japan, the United States, Europe, and other countries, and their use is expanding. UWB is a technology that distributes radio waves over a very wide band and communicates with weak radio waves.

EMC

**Note: This article is current as of December 2020.*

Expansion of test frequency

Since EMC regulation began in the 1960s, standards have become clearer and more consistent with regional standards. As technology advances, EMC standards continue to change.

In the 2000s, EMC's test frequency band was expanding as the performance of IT equipment, such as PCs, improved and processing speed increased dramatically. With the speed of the product, the frequency band of noise generated when the equipment is activated has increased to the GHz band. CISPR 22 is an international standard for emissions of information technology devices such as PCs which moved to CISPR 32 around 2005. Against this background, it added jamming tests from 1 to 6 GHz. Currently, FCC regulations stipulate the test frequency band up to 40 GHz according to the operating frequency of the product.

CISPR 32, 35 Transition to multimedia standards

In the past, CISPR 13 (emission standard) and CISPR 20 (immunity standard) were established as product group standards for audio and broadcast receivers (AV equipment) such as radios and televisions. CISPR 22 (emission standard) and CISPR 24 (immunity standard) were the standards of the product group of information technology equipment (IT equipment) such as PCs mentioned above.

However, in recent years, microcomputers have been used for the control of AV devices such as TVs and DVD recorders, making them indistinguishable from AV devices. These microcomputers improve TV reception functions and recording. As mentioned above, two products that had similar functionality, component configuration and EMC characteristics had to be evaluated by different standards. As a result, manufacturers have called for the integration of the two product group standards. CISPR 32 was published in 2012 and CISPR 35 in 2018.

CISPR 32, an emission standard for multimedia devices, covers two products: AV equipment and IT equipment, with the applications of traditional CISPR 13 and CISPR 22. Even if the device has only AV functions, CISPR 32 applies. Similarly, CISPR 35, covers traditional CISPR 20 and CISPR 24 applications.

In Japan, CISPR 32 was nationally standardized as VCCI-CISPR 32 in 2016 and CISPR 32 in 2017, but CISPR 35d is currently under consideration for standardization.

Mutual Approval Agreement for Telecommunications Equipment

The Mutual Recognition Agreement (MRA) is a bilateral agreement that allows the certification of equipment from one country to be carried out in another country. The signing of an MRA facilitates the import and export of telecommunications equipment, electrical appliances, etc., with the aim of reducing the burden on companies and promoting bilateral trade.

EMC testing for automotive equipment

The automotive industry is undergoing a once-in-a-decade period of transformation due to technological innovations, including connected vehicles, autonomous driving, ride sharing and electric vehicles.

In electric vehicles and connected automobiles, electromagnetic noise that occurs when in-vehicle parts operate can cause serious accidents if it causes electromagnetic interference. As a result, a demand is growing for EMC testing for automotive components. In October 2016, CISPR 25:2016 Ed.4 Annex I, an international standard, added a new method for evaluating automotive components for electric and hybrid vehicles. This required EMC testing is done in a real-load environment that simulates driving. In January 2019, similar tests were added to ISO 11452-2 Ed.3 Clause 8 and GB/T 36282-2018.

Standard	Test Focus
CISPR 25	Automotive component EMC testing
ISO 1145-2	Part 2: Absorber-lined shielded enclosure
ISO 11452-3	C Part 3: Transverse electromagnetic (TEM) cell
ISO 11452-4	Part 4: Harness excitation methods
ISO 11452-5	Part 5: Stripline
ISO 11452-7	Part 7: Direct radio frequency power injection
ISO 11452-8	Part 8: Immunity to magnetic fields
ISO 11452-9	Part 9: Portable transmitters
ISO 11452-10	Part 10: Immunity to conducted disturbances in the extended audio frequency range
ISO 10605	Electrical disturbances from electrostatic discharge
ISO 7637-2, 3	Immunity under test to transient pulses
ISO 16750-2	Environmental testing



Construction machinery industry with accelerated electrification

Electromagnetic interference between electronic components due to electromagnetic noise emanating from construction machinery equipped with connected sensors and electric batteries may lead to serious accidents. EMC testing is becoming increasingly important to prevent accidents caused by this electromagnetic noise and interference.

In December 2015, the Ministry of Land, Infrastructure, Transport and Tourism of Japan announced the introduction of an initiative aimed at improving safety and the productivity of the entire construction production system and creating an attractive construction site by introducing measures such as “full use of ICT (ICT earthworks)” at construction sites*2.

In Europe, compliance with EU harmonized laws and regulations requires the display of CE markings on

construction equipment. One of these requirements, EN 13309:2010, is being replaced by one of the requirements, EN ISO 13766-1,2:2018, that is scheduled to be enforced in 2021. In this standard, the upper frequency limit of the radiated immunity required by EMC has been increased so radio irradiation is required on the construction vehicle. In addition, Canada, Australia, Russia, the Persian Gulf States and African countries are considering future compliance with these standards.

UL engineering experts can help you test and certify for EMC compliance where you plan to sell your product. UL’s Global Market Access team can simplify your product launch by helping you fill out and submit the regulatory paperwork required by local customs agencies. We work with authorities in more than 150 countries, so you don’t have to worry about speaking the local language or understanding the local culture and requirements. We will handle that for you so that you can focus on what you do best — building the best products.

To learn more or contact a UL representative at www.UL.com/emc.

Endnotes

- EMC Regulations and Testing Overview in Key Countries (UL Apex Co., Ltd.)
- EMC Introductory Course Measurement evaluation and regulatory response to electromagnetic interference (Kazuken Yamada, Toshihiro Ikegami, Hidefumi Sano)
- “Global EMC Standards and Regulations” (2020 Data Edition) I. EMC-related International Standardization Organizations and EMC Standards (Tokyo City University/ Masaman Tokuda), II. EMC regulations and mutual approvals in each country (Murata Manufacturing Co., Ltd. Toshiro Tsubouchi / VCCI Association Masahiro Hoshino)
https://event.jma.or.jp/TF_EM2020
- Ministry of Internal Affairs and Communications Reiwa White Paper (Reiwa 2)
- Mutual approval of telecommunications equipment (MRA) of the Ministry of Internal Affairs and Communications
<https://www.tele.soumu.go.jp/j/sys/equ/mra/index.htm>
- International standardization (ISO/IEC) and regional standardization activities
<https://www.jisc.go.jp/international/index.html> (Japan Kogyo Standards Research Association)
- Holding of the i-Construction Committee, Ministry of Land, Infrastructure, Transport and Tourism, December 11, 2015
http://www.mlit.go.jp/report/press/kanbo08_hh_000322.html
- “Company Quarterly Report Industry Map 2019 Edition”, September 6, 2018, Japan Construction Machinery Manufacturers Association



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