TÜV SÜD Americas

eBook

An Introduction to Electromagnetic Compatibility

Table of **Contents**

What is EMC, EMI, and RFI?

Electromagnetic compatibility (EMC) is required because of the fact that all electric devices or installations influence each other when interconnected or close to each other. EMC is a measure of a device's ability to operate as intended in a shared operating environment without affecting the operability of other equipment in the same environment. A key concern here is the potential interference with licensed and unlicensed transmitters and the reception of the transmitted signal. This is especially true in the residential environment and is the primary reason unintentional RF emission limits are stricter in the residential environment.

Electromagnetic interference (EMI) is the electromagnetic disturbance affecting the performance of a device. Most sources of EMI are another electronic device or electrical system, but there are cases when EMI can have an environmental source, such as an electrical storm, a power surge, electrostatic discharge (ESD) or solar radiation. If the interference is in the radio frequency spectrum, it is also known as radio frequency interference (RFI). Interference is typically broken down into either transient of continuous events and can produce different effects on the victim circuitry.

Radiofrequency interference (RFI) is a specific subset of EMI. It is inclusive of electromagnetic currents between 3 kilohertz and 300 gigahertz, which also covers most Wi-Fi signal ranges. RFI occurs when electronic devices become exposed to external electromagnetic fields, resulting in unwanted RF signals that disrupt operability. This is typically considered a continuous interfering phenomena since the interference source could be situated locally to the affected device and potentially result in complete lack of functionality.

In most situations, EMC is used when referring to a device, component or installation's emissions, and EMI is used when talking about a device, component or installation's immunity or resistance to unwanted interference.

Why is EMC Compliance Important?

The hazards of not having EMC compliance built into market offerings are many. Some markets/countries require proof of EMC compliance, while others allow for self-declaration. Marketing a device that generates excessive unintentional RF emissions, or that is overly susceptible to common everyday phenomena (ESD, voltage transients or unintentional and intentional radiated RF), may tarnish the reputation of the equipment and the manufacturer of the equipment. This could potentially require removing the product from the market temporarily or permanently.

Benefits of EMC Testing

EMC testing should be baked into product concept and design from the earliest product development stages. This has multiple benefits for the manufacturer:

- Avoiding overengineering of products and the associated expenses
- Avoiding product failure of new devices or components that are ready to go to market
- Avoiding inevitable delays and hidden expenses connected to redesigning and retesting
- Avoiding being shut out of specific markets due to non-compliance with their EMC regulations

By taking action to cover all potential EMC requirements before bringing a product to market, manufacturers can open up a broader customer base and avoid having to complete new testing for each market they choose to enter (and potentially having to redesign products not built to pass more stringent specifications.)

Country and Region-Specific EMC Regulations

For most markets, there is specific regulatory guidance to help manufacturers as they develop new products and prepare to launch them. In the following pages, we will explore the requirements for most of the major regions and countries.

North America

FCC 47 CFR Part 15 Sub-Part B

FCC 47 CFR Part 18 Sub-Part C

ISED (Canada)

Europe

EMC Directive 2014/30/EU

In-Vitro Diagnostic Medical Device Regulation 2017/746

Medical Device Regulation 2017/745

Australia

AMCA Requirements

Korea

RRA Requirements

Japan

VCCI Mark

North America

FCC 47 CFR Part 15 Sub-Part B

This specific regulation affects what are known as unintentional radiators, which are devices that by design:

- Use digital logic
- Employ electrical signals operating at radio frequencies within the product
- Send radio frequency signals by conduction to associated equipment via connected wiring (but is not intended to emit RF energy wirelessly by radiation or induction)

The majority of today's electronic products and electrical devices utilize digital logic, operating between 9 kHz to 3000 GHz and thus regulated under FCC 47 CFR Part 15 Subpart B. Examples include but are far from limited to items such as:

- Digital Wrist watches
- Television sets
- Personal computers and printers
- Phones
- Garage door receivers
- RF universal remote controls
- Cash registers

Additionally, many products formerly classified as incidental radiators – such as basic electrical power tools and motors now use digital logic and are thus also included.

FCC 47 CFR Part 18 Sub-Part C

The definition of industrial, scientific and medical (ISM) equipment includes all equipment or appliances that are designed to generate and locally use RF energy for ISM, domestic or similar purposes, excluding any applications that may overlap from the field of telecommunication.

According to FCC 47 CFR Part 18 Sub-Part C, ISM equipment may be operated on any frequency above 9 kHz with a few exceptions as covered under other regulations. Specific frequency bands have been designated for use by ISM equipment, and others have been specifically prohibited.

ISED (Canada)

The ISED process used in Canada includes test specifications for EMC that are very similar to FCC processes.

ICES-003: ICES-003 requires verification for general digital device emissions relevant to digital circuitry (not extended to receivers or transmitters), mandating compliance with radiated and conducted emissions. There are two sets of limits: Class A, marketed solely for use in business/industrial/commercial environments, and Class B, marketed for use in a residential environment, even if also used in industrial or commercial environments.

IC RSS 210: This Radio Standards Specification (RSS) lays out specifications for license-exempt low-power intentional radiators, requiring certification for both these and receivers for RSS-210 transmitters.

IC RSS 310: This RSS lays out the specifications for low-power license-exempt radio communication devices (LPDs) which can be defined as Category II equipment, and is thus exempt from certification although it must comply with all requirements set out in various IC RSS standards.

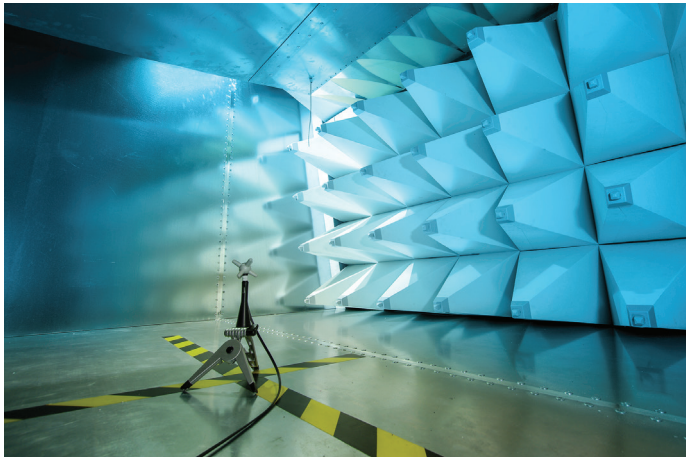
Europe

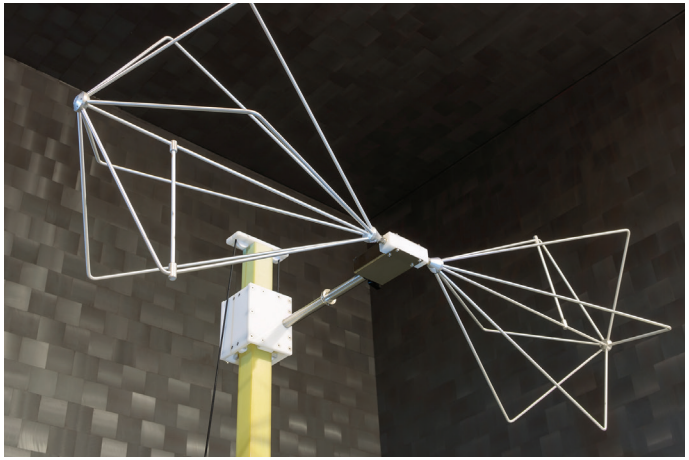
EMC Directive 2014/30/EU

This directive is not safety-related, but simply regulates the electromagnetic compatibility of equipment, apparatus and fixed installations. Equipment must comply with the essential requirements of the EMC Directive at the time it is launched on the market or put into service.

Requirements are designed to require that such products have immunity to electromagnetic disturbances and that they limit electromagnetic emissions to ensure they do not affect radio and telecommunications or other similar equipment.

This EMC Directive does not regulate the safety of equipment in respect of people, domestic animals or property, therefore, it is not a safety-related Directive.





In-Vitro Diagnostic Medical Device Regulation 2017/746

The In-Vitro Diagnostic Medical Device Regulation (IVDR) 2017/746 covers any in-vitro diagnostic medical device which is, alone or in combination with other devices or components, intended by the manufacturer to be used in-vitro.

This includes any:

- Reagent or reagent product
- Calibrator
- Control material
- Kit
- Instrument, apparatus or piece of equipment
- Software or system

Medical Device Regulation

The Medical Devices Regulation (MDR) 2017/745 replaced both the Medical Device Directive (MDD) and the Active Implantable Medical Device Directive (AIMD). This is designed to:

- Improve conformity assessment for medical devices
- Enhance the quality, safety and reliability of medical devices on the EU market
- Strengthen transparency of medical device information
- Strengthen vigilance and market surveillance of devices already in use

This MDR requires certification by a Notified Body to obtain the CE mark.

Australia

AMCA Requirements

EMC compliance is legislated in Australia under the Radiocommunications Act 1992. Compliance with Radiocommunications Labelling (Electromagnetic Compatibility) Notice 2017 and additional applicable EMC standards is mandatory for electrical and electronic devices to be placed on the Australian market. Immunity testing is not required but strongly recommended, especially if expansion to the EU market is planned.

Korea

RRA Requirements

Access to the South Korean market is achieved through KC certification, which is granted by the South Korean authority National Radio Research Agency (RRA.) This certification is required for companies launching products with radio technology in South Korea.

Inclusion of a local representative is mandated, as is regulatory testing in a local laboratory. Once acquired, KC certification is valid permanently, so unchanged devices need not conduct a recertification process.

The RRA requirements are similar to those mandated in other countries, and noncompliance will result in the product not being allowed to be sold on the market. Strict attention to detail is necessary. Any mismatched company information or even a misspelling can lead to a denial.

Japan

VCCI Mark

The VCCI Mark is a voluntary certification applicable to IT equipment in Japan. The responsible Japanese authority is the Japanese Voluntary Control Council for Interference by Information Technology, which was founded by Japanese industry associations.

The Japanese government then initiated it to impose standards on electromagnetic compatibility (EMC) among electronic device manufacturers.

Most types of electrical equipment, including audio-visual equipment, lighting products, IT technology, switches, cables and lab equipment is included. Products that can achieve a VCCI Mark are divided into two categories:

- Category A (all products except household appliances)
- Category B (household appliances)

The VCCI Mark is not a mandatory requirement in Japan. However, it has been a well-regarded indicator for high quality standards.

Industry Specific EMC Testing

EMC testing spans multiple industries, including but not limited to:

- Medical devices
- Industrial
- Automotive
- Lighting
- Aerospace & Defense
- Wireless/Multimedia/Point of Sale (POS)
- Appliances
- Laboratory Equipment

EMC Certification

Common EMC/EMI testing includes one or more of the following tests, based on the type of and intended use for the product in question:

- Signal and control port immunity to RF voltage
- Conducted disturbances immunity
- Conducted emissions (continuous and discontinuous interference)
- Electrostatic discharge (ESD) immunity
- Electrical fast transient / burst immunity
- Immunity from radiated RF fields
- Immunity to induced RF voltages
- Power frequency magnetic field immunity/ oscillatory waves immunity
- Unintentional radiated emissions
- Voltage fluctuation/flicker
- Harmonic current emissions
- Lightning surge immunity

Learn more about TÜV SÜD's EMC Services

www.tuvsud.com/en-us/services/testing/electromagnetic-compatibility-testing

info-us@tuvsud.com

TÜV SÜD helps companies complete an EMC evaluation and carry out EMC/EMI testing that prepares your company for bringing products to market in one or more countries. We have the advantage of multiple labs in multiple countries, allowing us to do on-site (in-situ) testing.

We focus on future-proofing products by completing many different types of testing at once, allowing companies to confidently market in multiple markets without delays related to recertifying for a new country's regulations and potentially having to stop and redesign.

TÜV SÜD AMERICA HEADQUARTERS
401 Edgewater Place, Suite 500
Wakefield, MA 01880
United States of America
+1 978 573 2500