

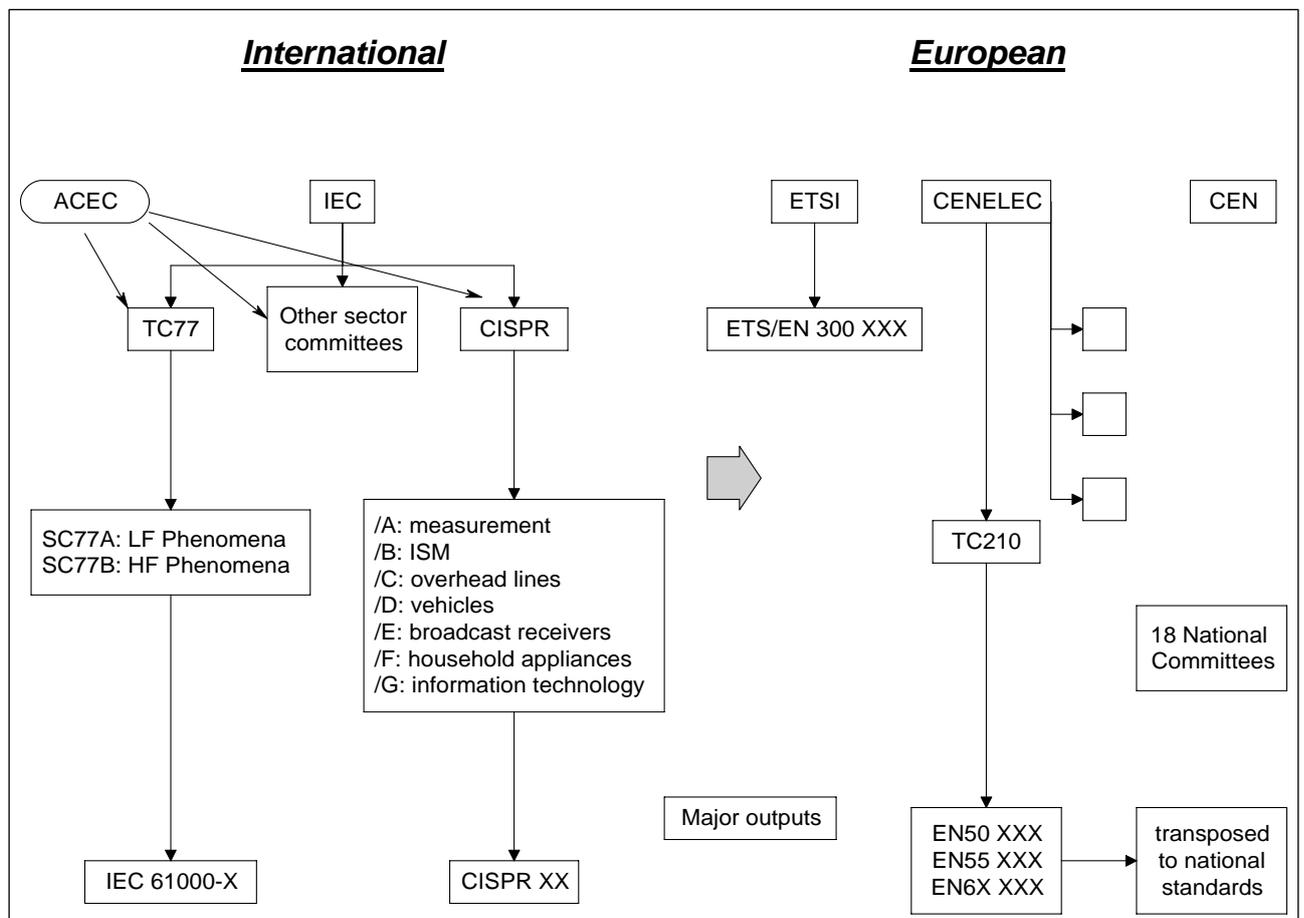
IEC and CISPR Standards

With thanks to Gideon Wiid, PhD student, and Paul van der Merwe EE Eng, 2 May, 2007

EMC Definition:

Electromagnetic compatibility itself is defined as [1]:

"the ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment."



IEC - International Electro-Technical Commission

- Prepares and publishes international standards for all electrical, electronic and related technologies.
- Promotes international cooperation on all questions of electro-technical standardization and related matters in the fields of electricity, electronics and related technologies.

Three classes of standards are prepared:

- **Basic Standards**

These standards provide general and fundamental rules in order to achieve EMC, which can be applied to all products, systems and networks. Basic Standards serve as a reference

and are not applicable to specific products. They provide general information on the way the EM Disturbance is taking place and provide to limits which must be adhere to.

- **Generic Standards**

Generic EMC Standards are applicable to a specific environment. The standard then provides essential requirements and test procedures which must be applied to any product operating in this environment. The standard also provides limits and test procedures.

- **Product Standard**

These are standards that apply to specific products or families of products and provide test procedures and limits for these products.

ACEC - Advisory Committee on Electromagnetic Compatibility

Co-ordination of the IEC's work on EMC between the many committees involved, to prevent the development of conflicting standards.

IEC Principle EMC Bodies

An international structure of bodies which are responsible for defining EMC standards for the purpose of the EMC Directive are controlled by the International Electrotechnical Commission (IEC). The IEC promotes the international co-operation on all questions of standardization and are made up of National Committees representing the electrotechnical interest of their respective countries. One of the technical committees devoted full time to Electromagnetic Compatibility (EMC) work is the International Special Committee on Radio Interference, or CISPR, which is the acronym for its French title. CISPR publications deal with limits and measurement of the radio interference characteristics of potentially disturbing sources.

The other main EMC committee, TC77, is concerned with EMC between equipment including networks. The co-operation and co-ordination of all the committees of the IEC is handled by the ACEC, which is the Advisory Committee on EMC.

Standards

Given below is an indication of the IEC Standards that are available.

Basic EMC Standards

CISPR 16 is a series of standards and is published under the general title *Specification for radio disturbance and immunity measuring apparatus and methods*.

- CISPR 16-1-1 Measuring apparatus
- CISPR 16-1-2 Ancillary equipment – Conducted disturbances
- CISPR 16-1-3 Ancillary equipment – Disturbance power
- CISPR 16-1-4 Ancillary equipment – Radiated disturbances
- CISPR 16-1-5 Antenna cal. test sites for 30 MHz to 1 000 MHz
- CISPR 16-2-1 Conducted disturbance measurements
- CISPR 16-2-2 Measurement of disturbance power
- CISPR 16-2-3 Radiated disturbance measurements
- CISPR 16-2-4 Immunity measurements
- CISPR 16:3-x Reports and recommendations, further information and radio disturbance in general are given.
- CISPR 16:4-x Information related to uncertainties, statistics and limits.

Generic EMC Standards

- IEC 61000-6-3 Generic Emission Standard for residential, commercial and light –industrial environment
IEC 61000-6-4 Generic Emission Standard for industrial environment

Product Standards

- CISPR 11 Limits and methods of measurement of radio disturbance characteristics of industrial, scientific & medical (ISM) radiofrequency equipment
CISPR 12 Limits and methods of measurement of radio disturbance characteristics of vehicles, motor boats and spark -ignited engine driven devices
CISPR 13 Limits and methods of measurement of radio disturbance characteristics of sound and television broadcast receivers and associated equipment
CISPR 14-1 Limits and methods of measurement of radio disturbance characteristics of electrical motor-operated and thermal appliances for household and similar purposes, electric tools and similar electric apparatus
CISPR 14-2 Requirements for household appliances, tools and similar apparatus. Part 2: Immunity
CISPR 15 Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
CISPR 20 Limits and methods of measurement of immunity characteristics of sound and television broadcast receivers and associated equipment
CISPR 22 Limits and methods of measurement of radio disturbance characteristics of ITE
CISPR 24 Limits and methods of measurement of the immunity characteristics of ITE
CISPR 25 Limits and methods of measurement of radio disturbance characteristics for the protection of receivers used on board vehicles

CISPR Committee and Typical Standards

CISPR 11

CISPR 11:2003 *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement.*

This standard is specifically concerned with apparatus that generates energy in the ISM frequency band, and specifies the emission levels for such apparatus. The standard is also applied to equipment used in industrial or medical laboratory applications, and specifies the amount of radio-frequency emission allowed for such equipment.

The standard starts off with a list of frequencies designated for ISM use. Then there is the classification of ISM equipment which separates the equipment into different groups and different classes. The classes and group divisions are as follows:

- Class A – Equipment for use in all establishments other than domestic.
- Class B – Equipment for use in domestic establishments.
- Group 1 – RF energy generated is needed for internal functioning.
- Group 2 – RF energy generated for material treatment and spark erosion.

Then the standard explains the different limits of electromagnetic disturbances, for example limits of thermal disturbance voltage, electromagnetic radiation etc. For each limit that is explained the corresponding frequency band is also given.

From here the standard moves on to general measurement requirements, special provisions for the test site and finally the radiation measurement in the 1 – 18 GHz frequency band is

specified. For this measurement the exact test arrangement, the type of receiving antenna to be used, validation and calibration of test site and measuring procedure all of which is explained in detail. It concludes with comments on measuring *in situ*, safety precautions to be followed and assessment of conformity of equipment.

Some examples of ISM equipment:

r.f. heating equipment and installations; induction cooking appliances; microwave ovens and cooking appliances; r.f. excited welding equipment; spot welders; microwave therapy equipment; ultrasonic equipment; medical and industrial X-ray equipment;

CISPR 22

This concerns the measurements of spurious signals generated by *Information Technology Equipment (ITE)* and the limits are specified for the frequency range 9 kHz – 400 GHz. It provides the relevant information regarding the measurement setup, calibration procedures, particulars on the type of antenna that is used as measuring device, the open area test site, etc.

TC77 - Technical Committee 77

The main task of TC 77 and its three subcommittees is to prepare **Basic** and **Generic** EMC publications specifying electromagnetic environments, emissions, immunity, test procedures, measurement techniques, etc. A most important part of this is the description and classification of the EM environment so that product committees can in turn specify the characteristics of the particular products they are standardizing.

Subcommittees

In general terms this means covering immunity and related questions over the whole frequency range, with subcommittees

<u>SC 77A</u>	dealing with low-frequency phenomena (up to and including 9 kHz),
<u>SC 77B</u>	handling high-frequency continuous and transient phenomena, including electrostatic discharges, for example, and
<u>SC 77C</u>	covering high-power transients such as the EM fields produced by high-altitude nuclear detonations (HEMP).

Structure of IEC 61000

The structure of the IEC 61000 series reflects the subjects dealt with by Basic EMC publications. As can be seen in the table below, they include terminology, descriptions of electromagnetic phenomena and the EM environment, measurement and testing techniques, and guidelines on installation and mitigation. Note that Part 3 does not contain Basic EMC publications but is listed here for completeness as it is part of the 61000 series. This large and considerably subdivided series of standards and technical reports will eventually consist of nine parts. Since the titles of Parts 7 and 8 are still open, the present structure is as follows:

Part 1: General

- General considerations (introduction, fundamental principles, safety)
- Definitions, terminology

Part 2: Environment

- Description of the environment
- Classification of the environment
- Compatibility levels

Part 3: Limits

- Emission limits

- Immunity limits (insofar as they do not fall under the responsibility of product committees)

Part 4: Testing and measurement techniques

- Measurement techniques
- Testing techniques

Part 5: Installation and mitigation guidelines

- Installation guidelines
- Mitigation methods and devices

Part 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into several parts published either as International Standards or as technical specifications or technical reports, some of which have already been published as sections. Others will be published by a part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

Some Specific IEC 61000 Documents:

IEC61000-3-3 edition 1.2 (International Standard)

Part 3-3: Limits-

Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection

Scope:

Detail:

Overall Observation:

IEC61000-4-1 edition 3.0 (International Standard)

Part 4-1:

Testing and measurement techniques –

Overview of IEC 61000-4 series

Scope:

This part covers testing and measuring techniques for electric and electronic equipment (apparatus and systems) in its electromagnetic environment, to give applicability assistance and to provide general recommendations concerning the choice of relevant tests.

IEC61000-4 series standards structure:

- Scope
- Normative References
- Terms and Definitions
- General
- Test levels/Limits
- Test equipment
- Test set-up
- Test procedures
- Evaluation of test results
- Test report

Details on the following:

- *Selection of Tests*, eg. design test during development, type tests, acceptance tests, production tests
- *Factors surrounding selection of tests*, eg. Types of disturbances, environmental conditions, economic constraints, equipment characteristics
- Applicable standard priority: 1. Dedicated product standard, 2. Product family standard, 3. Generic standard (also guide to applicability of standards)
- Minimum requirements for test reports, eg. EUT identification, test equipment identification, environmental conditions, any special conditions