

TECHNICAL REPORT

RAPPORT TECHNIQUE



BASIC EMC PUBLICATION
PUBLICATION FONDAMENTALE EN CEM

**Electromagnetic compatibility (EMC) –
Part 2-5: Environment – Description and classification of electromagnetic
environments**

**Compatibilité électromagnétique (CEM) –
Partie 2-5: Environnement – Description et classification des environnements
électromagnétiques**



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ELECTROMAGNETIC COMPATIBILITY (EMC) –**Part 2-5: Environment –
Description and classification of electromagnetic environments**

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IEC 61000-2-5, which is a technical report, has been prepared by technical committee 77: Electromagnetic compatibility.

It has the status of a basic EMC publication in accordance with IEC Guide 107.

This second edition cancels and replaces the first edition published in 1995 and constitutes a technical revision.

The significant technical changes with respect to the previous edition are the following:

- the description of the radiated electromagnetic environment has been done in more detail and the considered interference sources have been updated;
- the concept of location classes has been reviewed and modified;
- the disturbance levels for the various location classes have been reviewed, modified and the phenomena have been described in more detail.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
77/385/DTR	77/390/RVC

Full information on the voting for the approval of this Technical Report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 2-5: Environment – Description and classification of electromagnetic environments

1 Scope and object

Knowledge of the electromagnetic environment that exists at locations where electrical and electronic equipment and systems are intended to be operated is an essential precondition in the process of achieving electromagnetic compatibility. This knowledge can be obtained by various approaches, including a site survey of an intended location, the technical assessment of the equipment and system as well as the general literature.

This part of IEC 61000

- introduces the concept of disturbance degrees and defines these for each electromagnetic phenomena,
- classifies into various location classes and describes them by means of attributes,
- provides background information on the different electromagnetic phenomena that may exist within the environment and
- compiles tables of compatibility levels for electromagnetic phenomena that are considered to be relevant for those location classes.

This part of IEC 61000 is intended for guidance for those who are in charge of considering and developing immunity requirements. It also gives basic guidance for the selection of immunity levels. The data are applicable to any item of electrical or electronic equipment, sub-system or system that operates in one of the locations as considered in this Technical Report.

NOTE 1 It should be noted that immunity requirements and immunity levels determined for items of equipment which are intended to be used at a certain location class are not inevitably bound to the electromagnetic environment present at the location, but also to requirements of the equipment itself and the application in which it is used (e.g. when taking into account requirements regarding availability, reliability or safety). These could lead to more stringent requirements with respect to immunity levels or with respect to applicable performance criteria. These levels may also be established for more general purposes such as in generic and product standards, taking into account statistical and economic aspects as well as common experience in certain application fields.

NOTE 2 Electromagnetic phenomena in general show a broad range of parameters and characteristics and hence cannot be related one-to-one to standardized immunity tests which basically reflect the impact of electromagnetic phenomena by a well described test set-up. Nonetheless, this report follows an approach to correlate electromagnetic phenomena and standardized immunity tests up to a certain extent. This might allow users of this report to partly take into account standardized immunity tests such as given for example in the IEC 61000-4 series, when specifying immunity requirements.

The descriptions of electromagnetic environments in this report are predominantly generic ones, taking into account the characteristics of the location classes under consideration. Hence, it should be kept in mind that there might be locations for which a more specific description is required in order to conclude on immunity requirements applicable for those specific locations.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050(161):1990, *International Electrotechnical Vocabulary – Chapter 161: Electromagnetic compatibility*
Amendment 1 (1997)
Amendment 2 (1998)

IEC 60118-4:2006, *Electroacoustics – Hearing aids – Part 4: Induction loop systems for hearing aid purposes – Magnetic field strength*

IEC 60364-4-44:2007, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC/TR 61000-1-4:2005, *Electromagnetic compatibility (EMC) – Part 1-4: General – Historical rationale for the limitation of power-frequency conducted harmonic current emissions from equipment, in the frequency range up to 2 kHz*

IEC 61000-2-2:2002, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC 61000-2-3:1992, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 3: Description of the environment – Radiated and non-network-frequency-related conducted phenomena*

IEC 61000-2-4:2002, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

IEC 61000-2-8:2002, *Electromagnetic compatibility (EMC) – Part 2-8: Environment – Voltage dips and short interruptions on public electric power supply systems with statistical measurement results*

IEC 61000-2-9:1996, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 9: Description of HEMP environment – Radiated disturbance*

IEC 61000-2-12:2003, *Electromagnetic compatibility (EMC) – Part 2-12: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public medium-voltage power supply systems*

IEC 61000-2-13:2005, *Electromagnetic compatibility (EMC) – Part 2-13: Environment – High-power electromagnetic (HPEM) environments – Radiated and conducted*

IEC 61000-3-12:2004, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤75 A per phase*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
Amendment 1 (2007)
Amendment 2 (2010)

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*
Amendment 1 (2010)

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2008, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-9:1993, *Electromagnetic compatibility (EMC) – Part 4-9: Testing and measurement techniques – Pulse magnetic field immunity test*
Amendment 1 (2000)

IEC 61000-4-10:1993, *Electromagnetic compatibility (EMC) – Part 4-10: Testing and measurement techniques – Damped oscillatory magnetic field immunity test*
Amendment 1 (2000)

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-12:2006, *Electromagnetic compatibility (EMC) – Part 4-12: Testing and measurement techniques – Ring wave immunity test*

IEC 61000-4-13:2002, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*
Amendment 1 (2009)

IEC 61000-4-14:1999, *Electromagnetic compatibility (EMC) – Part 4-14: Testing and measurement techniques – Voltage fluctuation immunity test for equipment with input current not exceeding 16 A per phase*
Amendment 1 (2001)
Amendment 2 (2009)

IEC 61000-4-16:1998, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz*
Amendment 1 (2001)
Amendment 2 (2009)

IEC 61000-4-18:2006, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*
Amendment 1 (2010)

IEC 61000-4-27:2000, *Electromagnetic compatibility (EMC) – Part 4-27: Testing and measurement techniques – Unbalance, immunity test for equipment with input current not exceeding 16 A per phase*
Amendment 1 (2009)

IEC 61000-4-28:1999, *Electromagnetic compatibility (EMC) – Part 4-28: Testing and measurement techniques – Variation of power frequency, immunity test for equipment with input current not exceeding 16 A per phase*
Amendment 1 (2001)
Amendment 2 (2009)

CISPR/TR 16-4-1:2009, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-1: Uncertainties, statistics and limit modelling – Uncertainties in standardized EMC tests*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document the terms and definitions given in IEC 60050(161) as well as the following apply

NOTE For brevity, instead of repeating the wording "device, equipment or system", the term "item" is used in this report.

3.1.1

blackout

cutoff of electrical power, especially as a result of a shortage, a mechanical failure, or overuse by consumers

NOTE A power cut due to a short or long-term electric power loss in an area.

3.1.2

brownout

reduction or cutback in electric power, especially as a result of a shortage, a mechanical failure, or overuse by consumers

NOTE Reduction in the voltage of commercially supplied power. It is caused by the failure of the generation, transmission, or distribution system, or deliberately by the power utility when demand exceeds supply. The consumer may or may not notice the difference. In the worst case, damage may result.

3.1.3

burst

sequence of a limited number of distinct pulses or an oscillation of limited duration

[IEC 60050-161:1990, 161-02-07]

3.1.4

burst (in TDMA)

signals transmitted by a terminal in the form of a block of predetermined structure during a time interval allotted to the terminal by a TDMA protocol

[IEC 60050-725:1994, 725-14-15]

3.1.5

characteristic impedance of a medium

wave impedance for a travelling wave in a specific medium

[IEC 60050-705:1995, 705-03-23, modified]

NOTE The characteristic impedance of a homogeneous isotropic medium is given by $\eta_i = \sqrt{\mu/\varepsilon}$,

where

μ is the permeability of the homogeneous isotropic medium, and
 ε is the permittivity of the homogeneous isotropic medium.

3.1.6**(electromagnetic) compatibility level**

specified electromagnetic disturbance level used as a reference level for co-ordination in the setting of emission and immunity limits

[IEC 60050-161:1990, 161-03-10]

NOTE 1 By convention, the compatibility level is chosen so that there is only a small probability that it will be exceeded by the actual disturbance level. However, electromagnetic compatibility is achieved only if emission and immunity levels are controlled such that, at each location, the disturbance level resulting from the cumulative emissions is lower than the immunity level for each device, equipment and system situated at this same location.

NOTE 2 The compatibility level may be phenomenon, time or location dependent.

3.1.7**disturbance degree**

specified, quantified intensity within a range of disturbance levels corresponding to a particular electromagnetic phenomenon encountered in the environment of interest

3.1.8**disturbance level**

amount of magnitude of an electromagnetic disturbance, measured and evaluated in a specified way

3.1.9**earth port**

cable port other than signal, control or power port, intended for connection to earth

3.1.10**electric field**

constituent of an electromagnetic field which is characterized by the electric field strength E together with the electric flux density D

[IEC 60050-121:1998, 121-11-67]

3.1.11**electromagnetic compatibility****EMC**

ability of a device, equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

[IEC 60050-161:1990, 161-01-07, modified]

3.1.12**electromagnetic disturbance**

any electromagnetic phenomenon which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter

NOTE An electromagnetic disturbance may be electromagnetic noise, an unwanted signal or a change in the propagation medium itself.

[IEC 60050-161:1990, 161-01-05]