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BASIC EMC PUBLICATION

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

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

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This Redline version provides you with a quick and easy way to compare all the changes between this standard and its previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

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

It forms Part 2-5 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

This third edition cancels and replaces the second published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) the description of the radiated electromagnetic environment has been updated taking into account recent communication technologies;
b) some conducted phenomena and respective interference sources have been described in more detail.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
77/525A/DTR	77/526/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 document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The reader's attention is drawn to the fact that Annex E lists some “in-some-country” clauses on differing practices regarding a particular electromagnetic phenomenon.

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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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 document.

NOTE 1 This document considers relevant electromagnetic phenomena when describing and classifying electromagnetic environments (except HEMP and HPEM which are covered in other IEC 61000-2 standards). It makes use of the specification of technologies, of published data and of results from measurements. Not all electromagnetic phenomena considered here are described in detail in this document, but rather in other documents of the IEC 61000-2 series from which the relevant information and data are taken and used in this document. For more detailed information about those phenomena the user is referred to this series. See also Annex F for an overview of the various parts of the IEC 61000-2 series.

NOTE 2 It ~~should be~~ is 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~~ can 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 3 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 setup. Nonetheless, this document follows an approach to correlate electromagnetic phenomena and standardized immunity tests up to a certain extent. This might allow users of this document to partly take into account standardized immunity tests such as given for example in IEC 61000-4 (all parts), when specifying immunity requirements.

The descriptions of electromagnetic environments in this document 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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* (available at www.electropedia.org)
~~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 TR 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 TR 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*~~ *Impulse 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~~ 2015, *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 61000-4-19, *Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports*

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*~~

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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 forms Part 2-5 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

This third edition cancels and replaces the second published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) the description of the radiated electromagnetic environment has been updated taking into account recent communication technologies;
b) some conducted phenomena and respective interference sources have been described in more detail.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
77/525A/DTR	77/526/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 document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The reader's attention is drawn to the fact that Annex E lists some “in-some-country” clauses on differing practices regarding a particular electromagnetic phenomenon.

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

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

1 Scope

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 document.

NOTE 1 This document considers relevant electromagnetic phenomena when describing and classifying electromagnetic environments (except HEMP and HPEM which are covered in other IEC 61000-2 standards). It makes use of the specification of technologies, of published data and of results from measurements. Not all electromagnetic phenomena considered here are described in detail in this document, but rather in other documents of the IEC 61000-2 series from which the relevant information and data are taken and used in this document. For more detailed information about those phenomena the user is referred to this series. See also Annex F for an overview of the various parts of the IEC 61000-2 series.

NOTE 2 It is 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 can 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 3 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 setup. Nonetheless, this document follows an approach to correlate electromagnetic phenomena and standardized immunity tests up to a certain extent. This might allow users of this document to partly take into account standardized immunity tests such as given for example in IEC 61000-4(all parts), when specifying immunity requirements.

The descriptions of electromagnetic environments in this document 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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* (available at www.electropedia.org)

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

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

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

IEC TR 61000-2-8, *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, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 9: Description of HEMP environment – Radiated disturbance*

IEC 61000-2-12, *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, *Electromagnetic compatibility (EMC) – Part 2-13: Environment – High-power electromagnetic (HPEM) environments – Radiated and conducted*

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

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

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

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

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

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

IEC 61000-4-9, *Electromagnetic compatibility (EMC) – Part 4-9: Testing and measurement techniques – Impulse magnetic field immunity test*

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

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

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

IEC 61000-4-13, *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*

IEC 61000-4-14, *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*

IEC 61000-4-16:2015, *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*

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

IEC 61000-4-19, *Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports*

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

IEC 61000-4-28, *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*