

# TECHNICAL REPORT



BASIC EMC PUBLICATION

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

**Document Preview**

[IEC TR 61000-2-5:2017](https://standards.iteh.ai/catalog/standards/iec/0c013217-1ec4-47ef-a54d-ce707f329d18/iec-tr-61000-2-5-2017)

<https://standards.iteh.ai/catalog/standards/iec/0c013217-1ec4-47ef-a54d-ce707f329d18/iec-tr-61000-2-5-2017>





**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2017 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

**About the IEC**

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

**About IEC publications**

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

**IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)**

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

**IEC publications search - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)**

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

**IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)**

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

**Electropedia - [www.electropedia.org](http://www.electropedia.org)**

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

**IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)**

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

**IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)**

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [csc@iec.ch](mailto:csc@iec.ch).

[IEC TR 61000-2-5:2017](https://standards.iteh.ai/catalog/standards/iec/0c013217-1ec4-47ef-a54d-ce707b29d18/iec-tr-61000-2-5-2017)

<https://standards.iteh.ai/catalog/standards/iec/0c013217-1ec4-47ef-a54d-ce707b29d18/iec-tr-61000-2-5-2017>



# TECHNICAL REPORT



BASIC EMC PUBLICATION

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

Document Preview

[IEC TR 61000-2-5:2017](https://standards.iteh.ai/catalog/standards/iec/0c013217-1ec4-47ef-a54d-ce707f329d18/iec-tr-61000-2-5-2017)

<https://standards.iteh.ai/catalog/standards/iec/0c013217-1ec4-47ef-a54d-ce707f329d18/iec-tr-61000-2-5-2017>

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 33.100.20

ISBN 978-2-8322-3856-1

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	7
1 Scope <del>and object</del> .....	9
2 Normative references .....	10
3 Terms, definitions and abbreviated terms .....	12
3.1 Terms and definitions.....	12
3.2 Abbreviated terms.....	19
4 User's guide for this document.....	23
4.1 Approach .....	23
4.2 Rationale for classification system .....	26
4.3 Electromagnetic environment phenomena.....	26
4.4 Relationship of disturbance levels to CISPR limits .....	27
4.5 Simplification of the electromagnetic environment database.....	27
5 Low-frequency electromagnetic phenomena .....	30
5.1 Conducted low-frequency phenomena .....	30
5.1.1 Harmonics of the fundamental power frequency.....	30
5.1.2 Power supply network voltage amplitude and frequency changes .....	32
5.1.3 Power supply network common mode voltages .....	34
5.1.4 Signalling voltages in power supply networks .....	37
5.1.5 Islanding supply networks.....	38
5.1.6 Induced low-frequency voltages.....	39
5.1.7 DC voltage in AC networks .....	39
5.2 Radiated low-frequency phenomena .....	40
5.2.1 Magnetic fields .....	40
5.2.2 Electric fields.....	41
6 High-frequency electromagnetic phenomena .....	42
6.1 Conducted high-frequency phenomena .....	42
6.1.1 General .....	42
6.1.2 Direct conducted CW phenomena.....	43
6.1.3 Induced continuous wave.....	47
6.1.4 Transients .....	48
6.2 Radiated high frequency phenomena .....	51
6.2.1 General .....	51
6.2.2 Radiated continuous oscillatory disturbances.....	53
6.2.3 Radiated modulated disturbances .....	53
6.2.4 Radiated pulsed disturbances.....	75
7 Electrostatic discharge .....	78
7.1 General.....	78
7.2 ESD currents .....	78
7.3 Fields produced by ESD currents.....	79
8 Classification of environments .....	80
8.1 General.....	80
8.2 Location classes .....	80
8.3 Residential location class.....	82
8.3.1 Description of residential locations .....	82
8.3.2 Equipment typical to the residential location .....	82

8.3.3	Boundaries relevant for equipment operated at residential locations .....	83
8.3.4	Interfaces and ports to residential locations .....	84
8.3.5	Attributes of residential locations .....	84
8.4	Commercial/public location class .....	86
8.4.1	Description of commercial/public locations .....	86
8.4.2	Equipment and interference sources existent in commercial/public locations .....	86
8.4.3	Boundaries relevant for equipment operated at commercial/public locations .....	86
8.4.4	Interfaces and ports to commercial/public locations .....	87
8.4.5	Attributes of commercial/public locations .....	87
8.5	Industrial location class .....	89
8.5.1	Description of industrial locations .....	89
8.5.2	Equipment and interference sources <del>existent</del> present in industrial locations .....	90
8.5.3	Boundaries relevant for equipment operated at industrial locations .....	90
8.5.4	Interfaces and ports to industrial locations .....	91
8.5.5	Attributes of industrial locations .....	91
8.6	Types of power supply networks .....	94
8.7	Alterations in electromagnetic environments .....	96
8.7.1	General .....	96
8.7.2	The electromagnetic environments of Smart Grid .....	97
8.8	Further conducted electromagnetic phenomena .....	97
8.8.1	Description of conducted phenomena other than those in Clause 4 and Clause 5 .....	97
8.8.2	<b>REIN</b> Repetitive electrical impulse noise .....	98
8.8.3	<b>SHINE</b> Single high intensity noise event .....	98
8.9	Mitigation aspects .....	99
8.10	Description of location classes with regard to the requirements of EMC basic standards .....	100
9	Principles of the selection of immunity levels .....	103
9.1	Approach .....	103
9.2	Uncertainties .....	103
9.2.1	Uncertainties in the test situation .....	103
9.2.2	Uncertainties in the application situation .....	103
9.2.3	Dealing with uncertainties .....	103
9.3	Dealing with high density sources .....	104
9.4	Criticality criteria .....	104
10	Disturbance levels of the various location classes .....	105
Annex A (informative)	Compatibility levels/disturbance levels for location classes .....	106
Annex B (informative)	Radiated continuous disturbances .....	116
Annex C (informative)	Review of the historical assignment of radiated disturbance degrees .....	125
C.1	General .....	125
C.2	Revised analysis of radiated disturbance degrees .....	125
C.2.1	Analysis .....	125
C.2.2	Detailed derivations .....	127
Annex D (informative)	Radiated pulsed disturbances .....	131
Annex E (informative)	Power line telecommunications (PLT) .....	136

Annex F (informative) Distributed generation .....	138
Annex G (informative) Information on disturbance and compatibility levels available in documents of the IEC 61000-2 series .....	139
Bibliography.....	143
Figure 1 – Schematic of the two-step approach used for classification with phenomenon-oriented input tables and location-oriented output tables .....	24
Figure 2 – Ports of entry (POEs) of electromagnetic disturbances into equipment.....	25
Figure 3 – Typical voltage waveforms for dip and interruption (10 ms/horizontal division).....	33
Figure 4 – Typical configuration of the converter in a PDS .....	35
Figure 5 – Voltage and current waveforms of each PDS portion (1 ms/horizontal division).....	36
Figure 6 – Measured common mode voltage at the input terminal of a converter.....	36
Figure 7 – Concept of location classes.....	81
Figure 8 – Situation for TN-C power installation systems .....	95
Figure 9 – Situation for TN-S power installation systems.....	96
Figure 10 – Examples of electromagnetic environments associated with the Smart Grid .....	97
Figure B.1 – Typical waveforms for radiated disturbances.....	117
Figure C.1 – Problem geometry .....	126
Figure D.1 – Measured electric field and electric field derivative from a cloud-to-ground lightning strike measured at a distance of 30 m.....	131
Figure D.2 – Measured electric field from an electrostatic discharge event at a distance of 0,1 m .....	132
Figure D.3 – Measured magnetic field (two measurements) from an electrostatic discharge event at a distance of 0,1 m.....	132
Figure D.4 – Measured electric field in kV/m versus time in $\mu$ s in a 500 kV power substation .....	133
Figure F.1 – Example of disturbance voltages for electrical energy storage system (140 kVA) in situ with the frequency range of 9 kHz to about 30 MHz.....	138
Figure F.2 – Example of disturbance voltages from a photovoltaic inverter (21 kW) in situ with the frequency range of 9 kHz to about 30 MHz.....	138
Table 1 – Principal phenomena causing electromagnetic disturbances .....	28
Table 2 – Disturbance degrees and levels for harmonic voltages in power supply networks (in percentage to fundamental voltage, $U_n/U_1$ ).....	31
Table 3 – Disturbance degrees and levels for voltage changes within normal operating range (in percentage of nominal voltage, $\Delta U/U_n$ ) .....	32
Table 4 – Disturbance degrees and levels for voltage unbalance (in percentage of $U_{neg}/U_{pos}$ ) .....	34
Table 5 – Disturbance degrees and levels for power frequency variation .....	34
Table 6 – Disturbance degrees and levels for common mode voltages.....	37
Table 7 – Disturbance degrees and levels for signalling voltages in <del>power</del> low and medium-voltage systems (in per cent of nominal voltage $U_n$ ) .....	38
Table 8 – Disturbance degrees and levels for low-frequency, common mode induced voltages in signal and control cables.....	39

Table 9 – Disturbance degrees and levels for low-frequency magnetic fields at various frequencies .....	41
Table 10 – Disturbance degrees and levels for low-frequency electric fields .....	42
<b>Table 11 – Disturbance degrees and levels of direct CW voltages .....</b>	<b>46</b>
Table 12 – Disturbance degrees and levels of induced CW voltages with respect to reference ground .....	48
Table 13 – Disturbance degrees and levels for conducted unidirectional transients in low-voltage AC power systems .....	50
Table 14 – Disturbance degrees and levels for conducted oscillatory transients in low-voltage AC power systems .....	51
Table 15 – Radiation sources .....	52
Table 16 – Disturbance degrees, levels (in V/m, r.m.s.) and distance to source – Radiated continuous oscillatory disturbances .....	53
Table 17 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Amateur radio bands below 30 MHz .....	54
Table 18 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – 27 MHz CB band .....	55
Table 19 – Disturbance degrees, levels (in V/m, r.m.s.) <b>and distance to source</b> – Analogue communication services below 30 MHz .....	56
Table 20 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Analogue communication services above 30 MHz .....	57
Table 21 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Mobile and portable phones .....	57
<b>Table 22 – Disturbance degrees, levels (in V/m, r.m.s.) and distance to source – Mobile and portable phones (continued) .....</b>	<b>58</b>
Table 23 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Base stations .....	60
<b>Table 24 – Disturbance degrees, levels (in V/m, r.m.s.) and distance to source – Base stations (continued) .....</b>	<b>61</b>
Table 25 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Medical and biological telemetry items .....	63
<b>Table 26 – Disturbance degrees, levels (in V/m, r.m.s.) and distance to source – Digital-television broadcast (VHF) .....</b>	<b>64</b>
<b>Table 27 – Disturbance degrees, levels (in V/m, r.m.s.) and distance to source – Digital-television broadcast (UHF) .....</b>	<b>65</b>
<b>Table 28 – Disturbance degrees, levels (in V/m, r.m.s.) and distance to source – Digital-television broadcast (UHF) (continued) .....</b>	<b>66</b>
Table 29 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Unlicensed radio services .....	67
Table 30 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Unlicensed radio services (continued) .....	68
Table 31 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Amateur radio bands above 30 MHz .....	69
Table 32 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Paging service base station .....	70
Table 33 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Other RF items (1 of 6) .....	70
Table 34 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Other RF items (2 of 6) .....	71



Table 35 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, rms) and distance to source – Other RF items (3 of 6) .....	71
Table 36 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Other RF items (4 of 6) .....	72
Table 37 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – Other RF items (5 of 6) .....	72
Table 38 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, rms) and distance to source – Other RF items (6 of 6) .....	73
Table 39 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in V/m, r.m.s.) and distance to source – RFID and railway transponder systems .....	74
Table 40 – Disturbance degrees, levels <del>for modulated radiation disturbances</del> (in $\mu$ A/m, r.m.s.) and distance to source – RFID and railway transponder systems .....	75
Table 41 – Disturbance degrees, levels (in rate of rise) and distance to source – Radiated pulsed disturbances .....	77
Table 42 – Disturbance degrees, levels <del>for pulsed radiation disturbances</del> (in V/m, Pk) and distance to source – RADAR systems .....	78
Table 43 – Disturbance degrees and levels for pulsed disturbances (rate of rise) caused by ESD .....	79
Table 44 – Disturbance degrees and levels for radiated field gradients caused by ESD .....	79
Table 45 – Examples of equipment present in the residential location class .....	83
Table 46 – Attributes of the residential location class .....	85
Table 47 – Attributes of various types of the commercial/public location class .....	88
Table 48 – Attributes of various types of the industrial location class .....	92
Table 49 – Overview of phenomena versus basic standard, related table and subclause ....	101
Table A.1 – Disturbance levels in the residential location class .....	107
Table A.2 – Disturbance levels in the commercial/public location class .....	110
Table A.3 – Disturbance levels in the industrial location class .....	113
Table B.1 – Examples of field strengths from authorized transmitters .....	118
Table B.2 – Specifications of mobile and portable units .....	119
Table B.3 – Specifications of base stations .....	120
Table B.4 – Specification of other typical RF items .....	120
Table B.5 – Data regarding RFID technology .....	121
Table B.6 – Frequency allocations of TETRA system (in Europe) .....	121
Table B.7 – Amateur radiofrequencies (ITU regions 1 to 3) .....	122
Table C.1 – Radiated disturbance degrees defined in Edition 1 .....	125
Table D.1 – Data regarding RADAR systems .....	134
Table D.2 – Examples for civil RADAR systems .....	135
Table G.1 – Overview of the IEC 61000-2 series .....	140



## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### ELECTROMAGNETIC COMPATIBILITY (EMC) –

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

#### FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

**This redline version of the official IEC Standard allows the user to identify the changes made to the 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.

<https://standards.ieh.ai/catalog/standards/iec/0c013217-1ec4-47ef-a54d-ce707b29d18/iec-tr-61000-2-5-2017>

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 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.

<https://standards.iteh.ai/> 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](http://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~~

### 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 and the following apply.

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

##### 3.1.1

##### **active infeed converter**

##### **AIC**

self-commutated electronic power converter of all technologies, topologies, voltages and sizes which is connected between the AC power supply network (lines) and usually a stiff DC side (current source or voltage source) and which can convert electric power in both directions (generative or regenerative) and control the reactive power or the power factor

Note 1 to entry: Some active infeed converters can additionally control the harmonics to reduce the distortion of an applied AC voltage or current.

##### 3.1.2

##### **blackout**

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

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

##### 3.1.3

##### **brownout**

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