IEC 61000-6-1

Edition 3.0 2016-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity standard for residential, commercial and light-industrial environments

Compatibilité électromagnétique (CEM) – Partie 6-1: Normes génériques – Norme d'immunité pour les environnements résidentiels, commerciaux et de l'industrie légère

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 6-1: Generic standards – Immunity standard for residential, commercial and light-industrial environments

FOREWORD

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International Standard IEC 61000-6-1 has been prepared by IEC technical committee 77: Electromagnetic compatibility.

This third edition cancels and replaces the second edition published in 2005. This edition constitutes a technical revision.

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

a) improvement of the environmental description;
b) extension of the frequency range for the radio-frequency electromagnetic field test according to IEC 61000-4-3;

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c) amended test levels at particular frequencies for the radio-frequency electromagnetic field test according to IEC 61000-4-3;

d) change of the repetition frequency for the fast transients immunity test according to IEC 61000-4-4;

e) introduction of requirements according to IEC 61000-4-34;

f) revision of the test levels;

g) consideration of measurement uncertainty;

h) addition of Annex A.

The text of this standard is based on the following documents:

FDIS	Report on voting
77/520/FDIS	77/522/RVD

Full information on the voting for the approval of this standard 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.

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 publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

IEC 61000 is published in separate parts according to the following structure:

Part 1: General

General considerations (introduction, fundamental principles)

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 the 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 with the part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 6-1: Generic standards – Immunity standard for residential, commercial and light-industrial environments

1 Scope

This part of IEC 61000 for EMC immunity requirements applies to electrical and electronic equipment intended for use in residential, commercial, public and light-industrial locations. Immunity requirements in the frequency range 0 Hz to 400 GHz are covered. No tests need to be performed at frequencies where no requirements are specified.

This generic EMC immunity standard is applicable if no relevant dedicated product or product-family EMC immunity standard exists.

This standard applies to electrical and electronic equipment intended to be operated in

- residential locations, as defined in 3.8, both indoor and outdoor,
- commercial, public and light industrial locations, as defined in 3.9, both indoor and outdoor.

This standard applies also to equipment which is battery operated or is powered by a non-public, but non-industrial, low voltage power distribution system if this equipment is intended to be used in the locations defined in 3.8 or 3.9.

This standard defines the immunity test requirements for equipment specified in the scope in relation to continuous and transient, conducted and radiated disturbances, including electrostatic discharges.

The immunity requirements have been selected to ensure an adequate level of immunity for equipment operating within residential, commercial, public and light-industrial locations. The levels do not, however, cover extreme cases, which may occur at any location, but with an extremely low probability of occurrence. Not all disturbance phenomena have been included for testing purposes in this standard, but only those considered as relevant for the equipment covered by this standard. These test requirements represent essential electromagnetic compatibility immunity requirements. They are specified for each port considered.

NOTE 1 Information on other disturbance phenomena is given in IEC TR 61000-4-1.

NOTE 2 Safety considerations are not covered by this standard.

NOTE 3 In special cases, situations will arise where the levels of disturbances may exceed the test levels specified in this standard, for example where a hand-held transmitter is used in proximity to equipment. In these instances, special mitigation measures may have to be employed.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *International Electrotechnical Vocabulary – Part 161: Electromagnetic compatibility* (available at: www.electropedia.org)

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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*
IEC 61000-4-3:2006/AMD1:2007
IEC 61000-4-3:2006/AMD2:2010

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques –Surge immunity test*

IEC 61000-4-6:2013, *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 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-20:2010, *Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides*

IEC 61000-4-21:2011, *Electromagnetic compatibility (EMC) – Part 4-21: Testing and measurement techniques – Reverberation chamber test methods*

IEC 61000-4-22:2010, *Electromagnetic compatibility (EMC) – Part 4-22: Testing and measurement techniques – Radiated emissions and immunity measurements in fully anechoic rooms (FARs)*

IEC 61000-4-34:2005, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase*
IEC 61000-4-34:2005/AMD1:2009

3 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 Additional definitions related to EMC and to relevant phenomena are given in other IEC and CISPR publications.

3.1
port
particular interface of the equipment which couples this equipment with or is influenced by the external electromagnetic environment

Note 1 to entry: Examples of ports of interest are shown in Figure 1. The enclosure port is the physical boundary of the equipment (e.g. enclosure). The enclosure port provides for radiated and electrostatic discharge (ESD) energy transfer, whereas the other ports provide for conducted energy transfer, either by direct injection or by induction.

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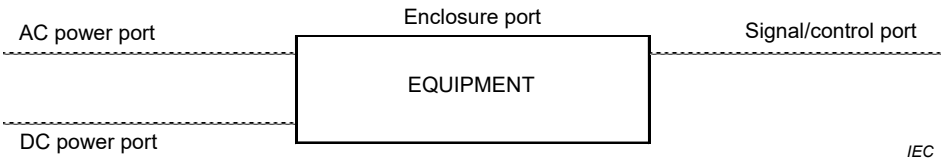

Figure 1 – Equipment ports

3.2
enclosure port
physical boundary of the equipment through which electromagnetic fields may radiate or on which they may impinge

3.3
signal/control port
port at which a conductor or cable intended to carry signals is connected to the equipment

EXAMPLE Analog inputs, outputs and control lines; data buses; communication networks, etc.

3.4
power port
port at which a conductor or cable, carrying the electrical input/output power needed for the operation (functioning), is connected to the equipment

3.5
public mains network
electricity lines to which all categories of consumers have access and which are operated by an electrical power supply and/or distribution organization for the purpose of supplying electrical energy

3.6
long distance line
line connected to a signal/control port and which inside a building is longer than 30 m, or which leaves the building (including a line installed outdoors)

3.7
low voltage
voltage having a value below a conventionally adopted limit

Note 1 to entry: Low voltage is typically considered as a set of voltage levels used for the distribution of electricity and whose upper limit is generally accepted to be 1 000 V AC or 1 500 V DC.

[SOURCE: IEC 60050-151:2001, 151-15-03]

3.8
residential location
location which exists as an area of land designated for the construction of domestic dwellings, and is characterized by the fact that equipment is directly connected to a low-voltage public mains network or connected to a dedicated DC source which is intended to interface between the equipment and the low-voltage mains network

EXAMPLE Examples of residential locations are: houses, apartments, farm buildings used for living.

Note 1 to entry: The function of a domestic dwelling is to provide a place for one or more people to live. A dwelling can be a single, separate building (as in a detached house) or a separate section of a larger building (as in an apartment in an apartment block).

Note 2 to entry: The connection between location and electromagnetic environment is given in 3.11.

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3.9
commercial, public and light-industrial location
location exemplified by areas of the city centre, offices, public transport systems (road/train/underground), and modern business centres containing a concentration of office automation equipment (PCs, fax machines, photocopiers, telephones, etc.), and characterized by the fact that equipment is directly connected to a low-voltage public mains network or connected to a dedicated DC source which is intended to interface between the equipment and the low-voltage mains network

EXAMPLE Examples of commercial, public or light-industrial locations are:

- retail outlets, for example shops, supermarkets;
- business premises, for example offices, banks, hotels, data centres;
- areas of public entertainment, for example cinemas, public bars, dance halls;
- places of worship, for example temples, churches, mosques, synagogues;
- outdoor locations, for example petrol stations, car parks, amusement and sports centres;
- general public locations, for example parks, amusement facilities, public offices;
- hospitals, educational institutions, for example schools, universities, colleges;
- public traffic area, railway stations, and public areas of an airport;
- light-industrial locations, for example workshops, laboratories, service centres.

Note 1 to entry: The connection between location and electromagnetic environment is given in 3.11.

3.10
DC distribution network
local DC electricity supply network in the infrastructure of a certain site or building intended for flexible use by one or more different types of equipment and ensuring continuous power supply independently from the conditions of the public mains network

Note 1 to entry: Connection to a remote local battery is not regarded as a DC distribution network, if such a link comprises only power supply for a single piece of equipment.

3.11
electromagnetic environment
totality of electromagnetic phenomena existing at a given location

Note 1 to entry: In general, the electromagnetic environment is time-dependent and its description may need a statistical approach.

Note 2 to entry: It is very important not to confuse the electromagnetic environment and the location itself.

[SOURCE: IEC 60050-161:1990, 161-01-01, modified – Note 2 to entry has been added.]

4 Performance criteria

A functional description and a definition of the equipment under test's (EUT) specific performance criteria, during or as a consequence of immunity testing, shall be provided by the manufacturer and noted in the test report. They shall be consistent with one of the following general criteria for each test as specified in Table 1 to Table 4:

a) Performance criterion A: The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. If the performance level is not specified by the manufacturer, this may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

b) Performance criterion B: The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. However, during the test

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degradation of performance is allowed but no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

c) Performance criterion C: Temporary loss of function is allowed during the test, provided the function is self-recoverable or can be restored by the operation of the controls.

If, as a result of the application of the tests defined in this standard, the EUT becomes dangerous or unsafe, it shall be deemed to have failed the test.

5 Conditions during testing

The equipment under test (EUT) shall be tested in the expected most susceptible operating mode, for example identified by performing limited pre-tests. This mode shall be consistent with normal applications. The configuration of the test sample shall be varied to achieve maximum susceptibility consistent with typical applications and installation practice. The configuration and mode of operation during the tests shall be precisely noted in the test report.

If the equipment is part of a system, or can be connected to auxiliary equipment, the equipment shall be tested while connected to the minimum representative configuration of auxiliary equipment necessary to exercise the ports. Auxiliary equipment may be simulated.

In cases where a manufacturer's specification requires external protection devices or measures which are clearly specified in the user's manual, the test requirements of this standard shall be applied with the external protection devices or measures in place.

If the equipment has a large number of similar ports or ports with many similar connections, a sufficient number shall be selected to simulate actual operating conditions and to ensure that all the different types of termination are covered. Justification for the selection of the tested ports shall be included in the test report.

The tests shall be carried out at one single set of parameters within the operating ranges of temperature, humidity and atmospheric pressure specified for the product and at the rated supply voltage, unless otherwise indicated in the basic standard.

6 Product documentation

If the manufacturer is using his own specification for an acceptable level of EMC performance or degradation of EMC performance during or after the testing required by this standard, this fact shall be stated in the user documentation. This specification itself shall be made available upon request.

7 Applicability

The application of tests for evaluation of immunity depends on the particular equipment, its configuration, its ports, its technology and its operating conditions.

Tests shall be applied to the relevant ports of the equipment according to Table 1 to Table 4. Tests shall only be carried out where the relevant ports exist.

It may be determined from consideration of the electrical characteristics and usage of particular equipment that some of the tests are inappropriate and therefore unnecessary. In such a case, the decision and justification not to test shall be recorded in the test report.

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