

# Electromagnetic compatibility (EMC) —

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

**ORIGINAL**

The European Standard EN 61000-6-1:2001 has the status of a  
British Standard

ICS 33.100.20

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## National foreword

This British Standard is the official English language version of EN 61000-6-1:2001. It was derived by CENELEC from IEC 61000-6-1:1997. It supersedes BS EN 50082-1:1998 which will be withdrawn on 2004-07-01.

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by common modification tags **Ⓔ** **Ⓒ**

The UK participation in its preparation was entrusted by Technical Committee GEL/210, EMC-Policy, to Subcommittee GEL/210/12, Basic and Generic standards, which has the responsibility to:

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- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
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**Electromagnetic compatibility (EMC)  
Part 6-1: Generic standards -  
Immunity for residential, commercial and  
light-industrial environments  
(IEC 61000-6-1:1997, modified)**

Compatibilité électromagnétique (CEM)  
Partie 6-1: Normes génériques -  
Immunité pour les environnements  
résidentiels, commerciaux et de  
l'industrie légère  
(CEI 61000-6-1:1997, modifiée)

Elektromagnetische Verträglichkeit (EMV)  
Teil 6-1: Fachgrundnormen -  
Störfestigkeit -  
Wohnbereich, Geschäfts- und  
Gewerbebereiche sowie Kleinbetriebe  
(IEC 61000-6-1:1997, modifiziert)

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Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

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### Foreword

The text of the International Standard IEC 61000-6-1:1997, prepared by IEC TC 77, Electromagnetic compatibility, together with the common modifications prepared by the Technical Committee CENELEC TC 210, Electromagnetic compatibility (EMC), was submitted to the formal vote and was approved by CENELEC as EN 61000-6-1 on 2001-07-03.

This European Standard supersedes EN 50082-1:1997.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2002-04-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2004-07-01

Annexes designated "normative" are part of the body of the standard. In this standard, annex ZA is normative. Annex ZA has been added by CENELEC.

### Endorsement notice

The text of the International Standard IEC 61000-6-1:1997 was approved by CENELEC as a European Standard with agreed common modifications as given below.

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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 sections which can be published either as International Standards or technical reports.

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## **ELECTROMAGNETIC COMPATIBILITY (EMC) –**

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

#### **1 Scope and object**

This section of IEC 61000-6 for EMC immunity requirements applies to electrical and electronic apparatus intended for use in residential, commercial and light-industrial environments, as described in clause 4, for which no dedicated product or product-family immunity standard exists.

Immunity requirements in the frequency range 0 Hz to 400 GHz are covered.

Where a relevant dedicated product or product-family EMC immunity standard exists, it shall take precedence over all aspects of this generic standard.

This standard applies to apparatus intended to be directly connected to a low-voltage public mains network or connected to a dedicated d.c. source which is intended to interface between the apparatus and the low-voltage public mains network. This standard applies also to apparatus which is battery operated or is powered by a non-public, but non-industrial, low-voltage power distribution system if this apparatus is intended to be used in the locations described in clause 4.

Apparatus intended to be connected to an industrial power network and apparatus intended to be operated in an industrial environment are covered by the industrial generic standard, IEC 61000-6-2.

The object of this standard is to define the immunity test requirements for apparatus defined in the scope in relation to continuous and transient, conducted and radiated disturbances including electrostatic discharges.

These test requirements represent essential electromagnetic compatibility immunity requirements.

The immunity requirements have been selected to ensure an adequate level of immunity for apparatus at residential, commercial 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.

Test requirements are specified for each port considered.

**NOTE** – 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 an apparatus. In these instances, special mitigation measures may have to be employed.

## 2 Normative references

NOTE Normative references to international publications are listed in the annex ZA (normative).

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### 3 Definitions

Definitions related to EMC and to relevant phenomena are given in IEC 60050(161) and in other IEC and CISPR publications.

The following particular definitions are used in this standard:

**3.1 port:** Particular interface of the specified apparatus with the external electromagnetic environment (see figure 1).

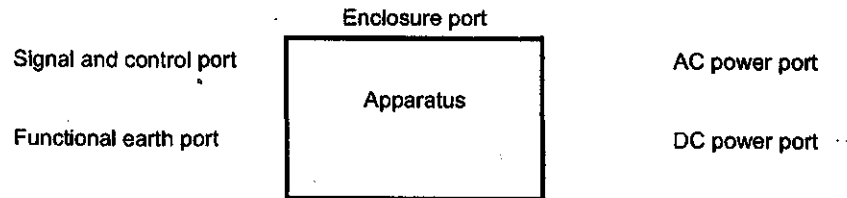


Figure 1 – Examples of ports

**3.2 enclosure port:** The physical boundary of the apparatus which electromagnetic fields may radiate through or impinge on.

**3.3 cable port:** A point at which a conductor or a cable is connected to the apparatus. Examples are signal, control and power ports.

**3.4 public mains network:** Electricity lines to which all categories of consumers have access and which are operated by a supply or distribution undertaking for the purpose of supplying electrical energy.

**3.5 functional earth port:** Cable port other than signal, control or powerport, intended for connection to earth for purposes other than electrical safety.

### 4 Description of locations

The environments encompassed by this standard are residential, commercial and light-industrial locations, both indoor and outdoor. The following list, although not comprehensive, gives an indication of locations which are included:

- residential properties, for example houses, apartments;
- retail outlets, for example shops, supermarkets;
- business premises, for example offices, banks;
- areas of public entertainment, for example cinemas, public bars, dance halls;
- outdoor locations, for example petrol stations, car parks, amusement and sports centres;
- light-industrial locations for example workshops, laboratories, service centres.

Locations which are characterised by being supplied directly at low voltage from the public mains network are considered to be residential, commercial or light-industrial.

## 5 Performance criteria

The variety and the diversity of the apparatus within the scope of this standard makes it difficult to define precise criteria for the evaluation of the immunity test results.

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

A functional description and a definition of performance criteria, during or as a consequence of the EMC testing, shall be provided by the manufacturer and noted in the test report, based on the following criteria:

**Performance criterion A:** The apparatus 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 apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. 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 apparatus if used as intended.

**Performance criterion B:** The apparatus 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 apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. 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 apparatus if used as intended.

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

## 6 Conditions during testing

The tests shall be made in the frequency bands being investigated, with the EUT in the most susceptible operating mode consistent with normal applications. The configuration of the test sample shall be varied to achieve maximum susceptibility.

If the apparatus is part of a system, or can be connected to auxiliary apparatus, the apparatus shall be tested while connected to the minimum representative configuration of auxiliary apparatus necessary to exercise the ports in a similar manner to that described in CISPR 22.

In cases where a manufacturer's specification specifically 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.

The configuration and mode of operation during the tests shall be precisely noted in the test report. It is not always possible to test every function of the apparatus; in such cases the most critical mode(s) of operation shall be selected.

If the apparatus 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.

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

## **7 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 shall be stated in the user documentation. This specification shall be made available upon request.

## **8 Applicability**

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

Tests shall be applied to the relevant ports of the apparatus according to tables 1 to 5. Tests shall only be carried out where the relevant ports exist.

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

## **9 Immunity test requirements**

The immunity test requirements for apparatus covered by this standard are given on a port by port basis.

Tests shall be conducted in a well-defined and reproducible manner.

The tests shall be carried out individually as single tests in sequence. The sequence of testing is optional.

The description of the test, the test generator, the test methods, and the test set-up to be used are given in basic standards which are referred to in the following tables.

The contents of these basic standards are not repeated here, however modifications or additional information needed for the practical application of the tests are given in this standard.

Table 1 – Immunity – Enclosure port

	Environmental phenomena	Test specifications	Units	Basic standards	Remarks	Performance criterion
1.1	Power-frequency magnetic field	50, 60 3	Hz A/m	IEC 61000-4-8	The test shall be carried out at the frequencies appropriate to the power supply frequency. Equipment intended for use in areas supplied only at one of these frequencies need only be tested at that frequency. See notes 1 and 2	A
1.2	Radio-frequency electromagnetic field. Amplitude modulated	80 to 1 000 3 80	MHz V/m % AM (1 kHz)	IEC 61000-4-3	The test level specified is the r.m.s. value of the unmodulated carrier.	A
1.3	Electrostatic discharge	±4 (charge voltage)	kV	IEC 61000-4-2	See basic standard for applicability of contact and/or air discharge test	B
		±8 (charge voltage)	kV			B C

NOTES

- 1 Applicable only to apparatus containing devices susceptible to magnetic fields.
- 2 For CRTs, the acceptable jitter depends upon the character size and is calculated for a test level of 1 A/m: jitter (mm) = (3 x character size (mm) + 1) / 40. As jitter is linearly proportional to the magnetic field strength, tests can be carried out at other test levels extrapolating the maximum jitter level appropriately.

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**Table 2 – Immunity – Ports for signal lines and control lines**

	Environmental phenomena	Test specifications	Units	Basic standards	Remarks	Performance criterion
2.1	Radio-frequency common mode	0,15 to 80 3 80	MHz V % AM (1 kHz)	IEC 61000-4-6	See notes 1, 2, ① ② The test level specified is the r.m.s. value of the unmodulated carrier	A
2.2	Fast transients	±0,5 5/50 5	kV (charge voltage) T <sub>r</sub> /T <sub>h</sub> ns Repetition frequency kHz	IEC 61000-4-4	See note 2. Capacitive clamp used	B
<b>NOTES</b>						
1 The test level can also be defined as the equivalent current into a 150 Ω load.						
2 Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m.						
① ②						

Table 3 – Immunity – DC input and d.c. output power ports

Environmental phenomena	Test specifications	Units	Basic standards	Remarks	Performance criterion
3.1 Radio-frequency common mode	0,15 to 80 3 80	MHz V % AM (1 kHz)	IEC 61000-4-6	See notes 1, 2, ① ② The test level specified is the r.m.s. value of the unmodulated carrier	A
3.2 Surges line-to-earth line-to-line	1,2/50 (8/20) ±0,5 ±0,5	Tr/Th µs KV (charge voltage) KV (charge voltage)	IEC 61000-4-5	③ For application to input ports see note 3 ④	B
3.3 Fast transients	±0,5 5/50 5	KV (charge voltage) Tr/Th ns Repetition frequency kHz	IEC 61000-4-4	⑤ For application to input ports see note 3 ④	B

NOTES

- 1 The test level can also be defined as the equivalent current into a 150 Ω load.
- 2 Applicable only to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 3 m.
- ③ Not applicable to input ports intended for connection to a battery or a rechargeable battery which must be removed or disconnected from the apparatus for recharging. Apparatus with a d.c. power input port intended for use with an a.c.-d.c. power adaptor shall be tested on the a.c. power input of the a.c.-d.c. power adaptor specified by the manufacturer or, where none is so specified, using a typical a.c.-d.c. power adaptor. The test is applicable to d.c. power input ports intended to be connected permanently to cables longer than 10 m. ④

**Table 4 – Immunity – Input and output a.c. power ports**

Environmental phenomena	Test specifications	Units	Basic standards	Remarks	Performance criterion
4.1 Radio-frequency common mode	0,15 to 80 3 80	MHz V % AM (1 kHz)	IEC 61000-4-6	The test level specified is the r.m.s. value of the unmodulated carrier. See notes 1, 2, 3	A
4.2 Voltage dips	30	% reduction periods	IEC 61000-4-11	Voltage shift at zero crossing.	B
	0,5	% reduction periods			C
4.3 Voltage interruptions	> 95 250	% reduction periods	IEC 61000-4-11	Voltage shift at zero crossing. See note 2	C
4.4 Surges line-to-earth line-to-line	1,2/50 (8/20)	T <sub>r</sub> /T <sub>f</sub> µs	IEC 61000-4-5		B
	±2	kV (charge voltage)			
4.5 Fast transients	±1	kV (charge voltage)	IEC 61000-4-4		B
	5/50	T <sub>r</sub> /T <sub>f</sub> ns			
	5	Repetition frequency kHz			

**NOTES**

1 The test level can also be defined as the equivalent current into a 150 Ω load.

2 Applicable only to input ports.





Table 5 – Immunity – Functional earth ports

	Environmental phenomena	Test specifications	Units	Basic standards	Remarks	Performance criterion
5.1	Radio-frequency common mode	0,15 to 80 3 80	MHz V % AM (1 kHz)	IEC 61000-4-6	See notes 1, 2, 3 The test level specified is the r.m.s. value of the unmodulated carrier	A
5.2	Fast transients	±0,5 5/50 5	kV (charge voltage) Tr/Th ns Repetition frequency /kHz	IEC 61000-4-4	See note 2 3 Capacitive clamp used 3	B

NOTES

1 The test level can be defined as the equivalent current into a 150 Ω load.

2 Applicable only to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 3 m.

3 3

**Annex ZA**  
(normative)

**Normative references to international publications  
with their corresponding European publications**

This European Standard incorporates by undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter.

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When there is an undated reference to a basic standard, then either the latest edition or (if the date of withdrawal of conflicting standards associated with the latest edition has not expired) the superseded edition may be applied. After the date of withdrawal, the latest edition shall be applied.

<u>Publication</u>	<u>Title</u>	<u>EN/HD</u>
IEC 60050-161	International Electrotechnical Vocabulary (IEV) Chapter 161: Electromagnetic compatibility	-
IEC 61000-4-2	Electromagnetic compatibility (EMC) Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2
IEC 61000-4-3	Electromagnetic compatibility (EMC) Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3
IEC 61000-4-4	Electromagnetic compatibility (EMC) Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	EN 61000-4-4
IEC 61000-4-5	Electromagnetic compatibility (EMC) Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5
IEC 61000-4-6	Electromagnetic compatibility (EMC) Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio- frequency fields	EN 61000-4-6
IEC 61000-4-8	Electromagnetic compatibility (EMC) Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	EN 61000-4-8
IEC 61000-4-11	Electromagnetic compatibility (EMC) Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	EN 61000-4-11
IEC 61000-6-2	Electromagnetic compatibility (EMC) Part 6-2: Generic standards - Immunity for industrial environments	EN 61000-6-2
CISPR 22	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	EN 55022

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