
Electromagnetic compatibility (EMC) - Part 4-23: Testing and measurement techniques - Test methods for protective devices for HEMP and other radiated disturbances (IEC 61000-4-23:2000)

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EUROPEAN STANDARD

EN 61000-4-23

NORME EUROPÉENNE

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English version

**Electromagnetic compatibility (EMC)
Part 4-23: Testing and measurement techniques -
Test methods for protective devices for HEMP
and other radiated disturbances
(IEC 61000-4-23:2000)**

Compatibilité électromagnétique (CEM)
Partie 4-23: Techniques d'essai et
de mesure -
Méthodes d'essai pour les dispositifs de
protection pour perturbations IEMN-HA
et autres perturbations rayonnées
(CEI 61000-4-23:2000)

Elektromagnetische Verträglichkeit (EMV)
Teil 4-23: Prüf- und Messverfahren -
Prüfverfahren für Geräte zum Schutz
gegen HEMP und andere gestrahlte
Störgrößen
(IEC 61000-4-23:2000)

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SIST EN 61000-4-23:2002

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This European Standard was approved by CENELEC on 2000-11-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 77C/92/FDIS, future edition 1 of IEC 61000-4-23, prepared by SC 77C, High power transient phenomena, of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61000-4-23 on 2000-11-01.

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) 2001-08-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2003-11-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A, B, C, D and E are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61000-4-23:2000 was approved by CENELEC as a European Standard without any modification.

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-161	1990	International Electrotechnical Vocabulary (IEV) - Chapter 161: Electromagnetic compatibility	-	-
IEC 60096-1	1986	Radio-frequency cables Part 1: General requirements and measuring methods	-	-
IEC 60625	Series	Programmable measuring instruments - Interface system (byte serial, bit parallel)	-	-
IEC 61000-2-9	1996	Electromagnetic compatibility (EMC) Part 2: Environment -- Section 9: Description of HEMP environment - Radiated disturbance	EN 61000-2-9	1996
IEC 61000-5-3	1999	Part 5: Installation and mitigation guidelines Section 3: HEMP protection concepts	-	-
ANSI/IEEE Std 488.1	1987	Standard IEEE Standard Digital Interface for Programmable Instrumentation, 02-Feb-1988	-	-

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61000-4-23

Première édition
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BASIC EMC PUBLICATION

Compatibilité électromagnétique (CEM) –

Partie 4-23:

Techniques d'essai et de mesure –

Méthodes d'essai pour les dispositifs

**de protection pour perturbations IEMN-HA
et autres perturbations rayonnées**

Electromagnetic compatibility (EMC) –

Part 4-23:

Testing and measurement techniques –

Test methods for protective devices for HEMP

and other radiated disturbances

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International Electrotechnical Commission
Международная Электротехническая Комиссия

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For price, see current catalogue*

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –**Part 4-23: Testing and measurement techniques –
Test methods for protective devices for HEMP
and other radiated disturbances**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61000-4-23 has been prepared by subcommittee 77C: High power transient phenomena, of IEC technical committee 77: Electromagnetic compatibility. It has the status of a basic EMC publication in accordance with IEC Guide 107.

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

FDIS	Report on voting
77C/92/FDIS	77C/97/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 3.

Annexes A, B, C, D and E are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2007. At this date, the publication will be

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

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 (in so far 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 and 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: 61000-6-1).

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-23: Testing and measurement techniques – Test methods for protective devices for HEMP and other radiated disturbances

1 Scope

This part of IEC 61000 provides the basic reasons behind HEMP testing and gives a brief description of the most important concepts for shielding element testing. For each test, the following basic information is provided:

- theoretical foundation of the test (the test concept);
- test set-up;
- required equipment;
- test procedures;
- data processing.

This International Standard does not provide information on requirements for specific levels for testing.

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2 Normative references (standards.iteh.ai)

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61000. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61000 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(161), *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

IEC 60096-1:1986, *Radio-frequency cables – Part 1: General requirements and measuring methods*

IEC 60625 (all parts), *Programmable measuring instruments – Interface system (byte serial, bit parallel)*

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

IEC 61000-5-3, *Electromagnetic compatibility (EMC) – Part 5-3: Installation and mitigation guidelines – HEMP protection concepts. Basic EMC publication*

ANSI/IEEE Std 488.1:1987, *Standard IEEE Standard Digital Interface for Programmable Instrumentation, 02-Feb-1988*

3 Definitions

For the purposes of this part of IEC 61000, the following definitions, together with those in IEC 60050(161) apply.

3.1

aperture

opening in an electromagnetic barrier (shield) through which EM fields may penetrate

3.2

aperture point-of-entry

aperture port-of-entry

aperture points-of-entry including intentional or inadvertent holes, cracks, openings or other discontinuities in a shield surface

NOTE Intentional aperture points of entry are provided for personnel and/or equipment entry and egress and for ventilation through an electromagnetic barrier.

3.3

attenuation

reduction in magnitude (as a result of absorption and scattering) of an electric or magnetic field, a current or a voltage, usually expressed in decibels

3.4

bandwidth

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3.4.1

(of a device)

width of a frequency band over which a given characteristic of an equipment or transmission channel does not differ from its reference value by more than a specified amount or ratio
[IEV 161-06-09]

3.4.2

(of an emission or signal)

width of the frequency band outside which the level of any spectral component does not exceed a specified percentage of a reference level
[IEV 161-06-10]

3.5

bounded wave simulator

type of simulator for producing electromagnetic fields in a localized region of space referred to as a "test volume"

3.6

box

enclosure that contains electrical equipment

NOTE Such boxes usually contain modules of subsystems.

3.7

broadband

wideband

3.7.1

(of an emission)

emission which has a bandwidth greater than that of a particular measuring apparatus or receiver
[IEV 161-06-11]

3.7.2**(device)**

device whose bandwidth is such that it is able to accept and process all the spectral components of a particular emission
[IEV 161-06-12]

3.8**circuit**

collection of interconnected electronics forming one or more closed paths

3.9**conductive point-of-entry****conductive port-of-entry****penetrating conductor**

electrical wire or cable or other conductive object, such as a metal rod, which passes through the electromagnetic barrier

3.10**coupling**

interaction of electromagnetic fields with electrical systems, whereby part of the energy of the field is transferred to the system

3.11**current injection**

process, by which through some external means, a current is forced to flow in a circuit at a desired location. For EMP testing purposes, it is a process by which simulated EMP transient current pulses are introduced into a component, circuit or system to measure damage or upset thresholds

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3.12**current injection test****CIT**

test technique using current injection

3.13**cut-off frequency (for a waveguide)**

lowest frequency for which there is no attenuation of the electromagnetic fields propagating in a lossless waveguide. Below this frequency, the fields attenuate exponentially with distance along the waveguide

3.14**dipole**

straight antenna, usually fed in the centre, that produces maximum radiation in a plane normal to its principal axis

3.15**direct drive**

excitation of an electrical system by directly applying a voltage or current source (either transient or continuous wave) to system cables or surfaces as a means of simulating the effects of transient EM pulses (see current injection)

3.16**direct field penetration**

penetration of the system shielding by the EM field

3.17**direction of propagation**

direction of the electromagnetic plane-wave propagation vector k , which is perpendicular to the plane containing the vectors of the electric and the magnetic fields

3.18**electric field strength****E**

magnitude of the electric field vector of an electromagnetic wave, or of a field created by an electric charge distribution measured in volts per metre

3.19**electromagnetic barrier shield**

topologically closed surface made to prevent or limit EM fields and conducted transients from entering the enclosed space. The barrier consists of the shield surface and points-of-entry treatments, and it encloses the protected volume

3.20**electromagnetic disturbance**

any electromagnetic phenomenon which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter
[IEV 161-01-05]

iTeh STANDARD PREVIEW**3.21****electromagnetic environment (standards.iteh.ai)**

totality of electromagnetic phenomena existing at a given location
[IEV 161-01-01]

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3.22**electromagnetic pulse (EMP)****nuclear electromagnetic pulse (NEMP)**

all types of electromagnetic fields produced by a nuclear explosion. Also referred to as nuclear electromagnetic pulse (NEMP)

3.23**electromagnetic radiation**

a) phenomenon by which energy in the form of electromagnetic waves emanates from a source into space

b) energy transferred through space in the form of electromagnetic waves

[IEV 161-01-10]

3.24**electromagnetic topology**

description of the interconnection of shields or electromagnetic barriers in a system that limit the EMP environment within the system

3.25**external coupling**

process by which an incident electromagnetic field strikes the exterior portions of a conducting system enclosure and induces current and charge

3.26**gasket**

flexible element, normally electrically conductive, used to seal an aperture in an enclosure

3.27**hardening**

the process of decreasing vulnerability of a system or component by design techniques, e.g. protecting against, or decoupling from, an undesirable external environment, such as EMP

3.28**high-altitude electromagnetic pulse****HEMP**

electromagnetic pulse produced when a nuclear explosion occurs outside the earth's atmosphere, typically above an altitude of 30 km

3.29**magnetic field strength****H**

magnitude of the magnetic field vector of an electromagnetic wave, or the field produced by a current flowing in a wire, loop antenna, etc.

3.30**overall shielding****global shielding**

protection of an entire entity by use of a single shielding enclosure or some practical equivalent, such as the protection of the contents of an entire building by shielding the entire building

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3.31**parallel plate EMP simulator**

test apparatus using the electromagnetic field between the plates of a parallel plate transmission line to approximate an EMP. The apparatus usually consists of a pulse generator, tapered input and output sections on the line, and a terminating resistor to minimize reflections

3.32**penetration**

transfer of electromagnetic energy through an electromagnetic barrier from one volume to another. This can occur by field diffusion through the barrier, by field leakage through apertures, and by electrical current passing through conductors connecting the two volumes (wires, cables, conduits, pipes, ducts, etc.)

3.33**point-of-entry (PoE)****port-of-entry (PoE)**

physical location (point/port) on the electromagnetic barrier, where EM energy may enter or exit a topological volume, unless an adequate PoE protective device is provided. A PoE is not limited to a geometrical point. PoEs are classified as aperture PoEs or conductor PoEs according to the type of penetration. They are also classified as architectural, mechanical, structural or electrical PoEs according to the architectural engineering discipline in which they are usually encountered