
Elektromagnetna združljivost (EMC) – 4-20. del: Preskusne in merilne tehnike – Preskušanje oddajanja in odpornosti pri prečnih elektromagnetnih (TEM) valovih (IEC 61000-4-20:2003)

Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides (IEC 61000-4-20:2003)

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EUROPEAN STANDARD

EN 61000-4-20

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**Electromagnetic compatibility (EMC)
Part 4-20: Testing and measurement techniques –
Emission and immunity testing
in transverse electromagnetic (TEM) waveguides
(IEC 61000-4-20:2003)**

Compatibilité électromagnétique (CEM)
Partie 4-20: Techniques d'essai
et de mesure –
Essais d'émission et d'immunité
dans les guides d'onde TEM
(CEI 61000-4-20:2003)

Elektromagnetische Verträglichkeit (EMV)
Teil 4-20: Prüf- und Messverfahren -
Messung der Störaussendung
und Störfestigkeit in transversal-
elektromagnetischen (TEM-) Wellenleitern
(IEC 61000-4-20:2003)

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SIST EN 61000-4-20:2005
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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.

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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 CIS/A/419/FDIS, future edition 1 of IEC 61000-4-20, prepared by CISPR SC A, Radio-interference measurements and statistical methods, in cooperation with SC 77B, High frequency phenomena, of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61000-4-20 on 2003-04-01.

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) 2004-01-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-04-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes A, B, C and ZA are normative and annexes D and E are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61000-4-20:2003 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

CISPR 14	NOTE	Harmonized in EN 55014 series (not modified).
CISPR 20	NOTE	Harmonized as EN 55020:2002 (not modified).
IEC 61000-2-9	NOTE	Harmonized as EN 61000-2-9:1996 (not modified).

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	- ¹⁾	International Electrotechnical Vocabulary (IEV) Chapter 161: Electromagnetic compatibility	-	-
IEC 60068-1	- ¹⁾	Environmental testing Part 1: General and guidance	EN 60068-1	1994 ²⁾
IEC 61000-2-11	- ¹⁾	Electromagnetic compatibility (EMC) Part 2-11: Environment - Classification of HEMP environments	-	-
IEC 61000-4-3	- ¹⁾	Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	2002 ²⁾
IEC 61000-4-23	- ¹⁾	Part 4-23: Testing and measurement techniques - Test methods for protective devices for HEMP and other radiated disturbances	EN 61000-4-23	2000 ²⁾
IEC/TR 61000-4-32	- ¹⁾	Electromagnetic compatibility (EMC) - Part 4-32: Testing and measurement techniques - HEMP simulator compendium	-	-
IEC/TR 61000-5-3	- ¹⁾	Part 5: Installation and mitigation guidelines -- Section 3: HEMP protection concepts	-	-

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
CISPR 16-1	- ¹⁾	Specification for radio disturbance and immunity measuring apparatus and methods Part 1: Radio disturbance and immunity measuring apparatus	-	-
CISPR 16-2	- ¹⁾	Part 2: Methods of measurement of disturbances and immunity	-	-
CISPR 22 (mod)	- ¹⁾	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	EN 55022	1998 ²⁾

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INTERNATIONAL STANDARD

IEC 61000-4-20

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Electromagnetic compatibility (EMC) –

Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides

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International Electrotechnical Commission
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –**Part 4-20: Testing and measurement techniques –
Emission and immunity testing in
transverse electromagnetic (TEM) waveguides**

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.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
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- 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 61000-4-20 has been prepared by CISPR subcommittee A: Radio interference measurements and statistical methods, in cooperation with subcommittee 77B: High-frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

This standard forms Part 4-20 of IEC 61000. 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:

Committee draft	Report on voting
CIS/A/419/FDIS	CIS/A/435/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.

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

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

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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 (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

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Each part is further subdivided into several parts, published either as International Standards, 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 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides

1 Scope and object

This part of IEC 61000 relates to emission and immunity test methods for electrical and electronic equipment using various types of transverse electromagnetic (TEM) waveguides. This includes open (for example, striplines and EMP simulators) and closed (for example, TEM cells) structures, which can be further classified as one-, two-, or multi-port TEM waveguides. The frequency range depends on the specific testing requirements and the specific TEM waveguide type.

The object of this standard is to describe

- TEM waveguide characteristics, including typical frequency ranges and EUT-size limitations;
- TEM waveguide validation methods for EMC measurements;
- the EUT (i.e. EUT cabinet and cabling) definition;
- test set-ups, procedures, and requirements for radiated emission testing in TEM waveguides and
- test set-ups, procedures, and requirements for radiated immunity testing in TEM waveguides.

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2 Normative references

The following referenced documents are indispensable for the application 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), *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

IEC 60068-1, *Environmental testing – Part 1: General and guidance*.

IEC 61000-2-11, *Electromagnetic compatibility (EMC) – Part 2-11: Environment – Classification of HEMP environments*. Basic EMC publication

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

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

IEC/TR 61000-4-32, *Electromagnetic compatibility (EMC) – Part 4-32: Testing and measurement techniques – HEMP simulator compendium*

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

CISPR 16-1, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus*

CISPR 16-2, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2: Methods of measurement of disturbances and immunity*

CISPR 22, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this part of IEC 61000, the definitions given in IEC 60050(161) (IEV), as well as the following, apply.

3.1.1

transverse electromagnetic (TEM) mode

waveguide mode in which the components of the electric and magnetic fields in the propagation direction are much less than the primary field components across any transverse cross-section

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3.1.2

TEM waveguide

open or closed transmission line system, in which a wave is propagating in the transverse electromagnetic mode to produce a specified field for testing purposes

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3.1.3

TEM cell

enclosed TEM waveguide, often a rectangular coaxial line, in which a wave is propagated in the transverse electromagnetic mode to produce a specific field for testing purposes. The outer conductor completely encloses the inner conductor

3.1.4

two-port TEM waveguide

TEM waveguide with input/output measurement ports at both ends

3.1.5

one-port TEM waveguide

TEM waveguide with a single input/output measurement port. Such TEM waveguides typically feature a broadband line termination at the non-measurement-port end

3.1.6**stripline**

terminated transmission line consisting of two or more parallel plates between which a wave is propagated in the transverse electromagnetic mode to produce a specific field for testing purposes. Usually the sides are open for EUT access and monitoring

3.1.7**inner conductor or septum**

inner conductor of a coaxial transmission line system, often flat in the case of a rectangular cross-section. The inner conductor may be positioned symmetrically or asymmetrically with respect to the outer conductor

3.1.8**outer conductor or housing**

outer conductor of a coaxial transmission line system, often having a rectangular cross-section

3.1.9**characteristic impedance**

for any constant phase wave-front, the magnitude of the ratio of the voltage between the inner conductor and the outer conductor to the current on either conductor. The characteristic impedance is independent of the voltage/current magnitudes and depends only on the cross-sectional geometry of the transmission line. TEM waveguides are typically designed to have a 50 Ω characteristic impedance. TEM waveguides with a 100 Ω characteristic impedance are often used for transient testing

3.1.10**anechoic material**

material that exhibits the property of absorbing, or otherwise reducing, the level of electromagnetic energy reflected from that material

3.1.11**broadband line termination**

termination which combines a low-frequency discrete-component load, to match the characteristic impedance of the TEM waveguides (typically 50 Ω), and a high-frequency anechoic-material volume

3.1.12**correlation algorithm**

mathematical routine for converting TEM waveguide voltage measurements to open-area test sites (OATS), semi-anechoic chamber (SAC), or free space field strength levels

3.1.13**EUT type**

grouping of products with sufficient similarity in electromagnetic characteristics to allow testing with the same test installation and the same test protocol

3.1.14**exit cable**

cable that connects the EUT to equipment external to the TEM waveguide or exiting the usable test volume defined in 5.1.2.