

INTERNATIONAL STANDARD

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BASIC EMC PUBLICATION

PUBLICATION FONDAMENTALE EN CEM

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

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



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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

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International Standard IEC 61000-4-20 has been prepared by 77B: High-frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility, in cooperation with CISPR (International Special Committee on Radio Interference) subcommittee A: Radio interference measurements and statistical methods.

This second edition cancels and replaces the first edition published in 2003 and its amendment 1 (2006), and constitutes a technical revision.

It forms Part 4-20 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

The main changes with respect to the first edition of this standard and its amendment are the following:

- consistency of terms (e.g. test, measurement, etc.) has been improved;

- clauses covering test considerations, evaluations and the test report have been added;
- references to large TEM waveguides have been eliminated;
- a new informative annex has been added to deal with calibration of E-field probes.

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

FDIS	Report on voting
77B/637/FDIS	77B/641/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 of 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 the base publication and its amendments will remain unchanged until the stability result date indicated on the IEC web site 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
- 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, published either as International Standards, Technical Specifications or Technical Reports, some of which have already been published as sections. Others are and will be published with the part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

This part of IEC 61000 is an International Standard which gives emission, immunity and HEMP transient testing requirements.

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. These types include open structures (for example, striplines and electromagnetic pulse simulators) and closed structures (for example, TEM cells). These structures 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 tests;
- 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.

NOTE Test methods are defined in this standard for measuring the effects of electromagnetic radiation on equipment and the electromagnetic emissions from equipment concerned. The simulation and measurement of electromagnetic radiation is not adequately exact for quantitative determination of effects for all end-use installations. The test methods defined are structured for a primary objective of establishing adequate repeatability of results at various test facilities for qualitative analysis of effects.

This standard does not intend to specify the tests to be applied to any particular apparatus or system(s). The main intention of this standard is to provide a general basic reference for all interested product committees of the IEC. For radiated emissions testing, product committees should select emission limits and test methods in consultation with CISPR standards. For radiated immunity testing, product committees remain responsible for the appropriate choice of immunity tests and immunity test limits to be applied to equipment within their scope. This standard describes test methods that are separate from those of IEC 61000-4-3.¹

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 – Chapter 161: Electromagnetic compatibility*

IEC 61000-2-11:1999, *Electromagnetic compatibility (EMC) – Part 2-11: Environment – Classification of HEMP environments*

¹ These other distinct test methods may be used when so specified by product committees, in consultation with CISPR and TC 77.

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*

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

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

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

CISPR 16-1-4, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Antennas and test sites for radiated disturbance measurements*

CISPR 16-2-3:2006, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*

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

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050(161), as well as the following, apply.

3.1.1

transverse electromagnetic mode

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

3.1.2

TEM waveguide

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

3.1.3

TEM cell

closed TEM waveguide, often a rectangular coaxial transmission line, in which a wave is propagated in the transverse electromagnetic mode to produce a specific field for testing purposes and with an outer conductor completely enclosing an inner conductor

3.1.4

two-port TEM waveguide

TEM waveguide with input/output ports at both ends

3.1.5

one-port TEM waveguide

TEM waveguide with a single input/output port