

INTERNATIONAL STANDARD

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BASIC EMC PUBLICATION
PUBLICATION FONDAMENTALE EN CEM

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

**Compatibilité électromagnétique (CEM) –
Partie 4-21: Techniques d'essai et de mesure – Méthodes d'essai en chambre
réverbérante**



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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms, definitions and abbreviations	9
3.1 Terms and definitions	9
3.2 Abbreviations	12
4 General	13
5 Test environments and limitations	13
6 Applications.....	14
6.1 Radiated immunity.....	14
6.2 Radiated emissions	14
6.3 Shielding (screening) effectiveness	14
7 Test equipment.....	14
8 Chamber validation.....	15
9 Testing	16
10 Test results, test report and test conditions	16
Annex A (informative) Reverberation chamber overview	17
Annex B (normative) Chamber validation for mode-tuned operation	41
Annex C (normative) Chamber validation and testing for mode-stirred operation.....	50
Annex D (normative) Radiated immunity tests.....	56
Annex E (normative) Radiated emissions measurements	61
Annex F (informative) Shielding effectiveness measurements of cable assemblies, cables, connectors, waveguides and passive microwave components.....	68
Annex G (informative) Shielding effectiveness measurements of gaskets and materials.....	72
Annex H (informative) Shielding effectiveness measurements of enclosures	82
Annex I (informative) Antenna efficiency measurements	89
Annex J (informative) Direct evaluation of reverberation performance using field anisotropy and field inhomogeneity coefficients	91
Annex K (informative) Measurement uncertainty for chamber validation – Emission and immunity testing.....	100
Bibliography.....	107
Figure A.1 – Typical field uniformity for 200 independent tuner steps.....	32
Figure A.2 – Theoretical modal structure for a 10,8 m × 5,2 m × 3,9 m chamber	32
Figure A.3 – Theoretical modal structure with small Q-bandwidth (high Q) superimposed on 60 th mode.....	33
Figure A.4 – Theoretical modal structure with greater Q-bandwidth (lower Q) superimposed on 60 th mode	33
Figure A.5 – Typical reverberation chamber facility.....	34
Figure A.6 – Theoretical sampling requirements for 95 % confidence.....	34
Figure A.7 – Normalized PDF of an electric field component at a fixed location for a measurement with a single sample	35

Figure A.8 – Normalised PDF of the mean of an electric field component at one fixed location for a measurement with N independent samples	35
Figure A.9 – Normalised PDF of the maximum of an electric field component at a fixed location for a measurement with N independent samples	36
Figure A.10 – Chamber working volume.....	37
Figure A.11 – Typical probe data	37
Figure A.12 – Mean-normalized data for x-component of 8 probes	38
Figure A.13 – Standard deviation of data for E -field components of 8 probes.....	38
Figure A.14 – Distribution of absorbers for loading effects test	39
Figure A.15 – Magnitude of loading from loading effects test	39
Figure A.16 – Standard deviation data of electric field components for eight probes in the loaded chamber	40
Figure B.1 – Probe locations for chamber validation	49
Figure C.1 – Received power (dBm) as a function of tuner rotation (s) at 500 MHz	55
Figure C.2 – Received power (dBm) as a function of tuner rotation (s) at 1 000 MHz	55
Figure D.1 – Example of suitable test facility.....	60
Figure E.1 – Example of suitable test facility.....	66
Figure E.2 – Relating to the calculation of the geometry factor for radiated emissions	67
Figure F.1 – Typical test set-up	71
Figure G.1 – Typical test set-up.....	80
Figure G.2 – Typical test fixture installation for gasket and/or material testing	80
Figure G.3 – Test fixture configured for validation.....	81
Figure H.1 – Typical test enclosure installation for floor mounted enclosure testing	88
Figure H.2 – Typical test enclosure installation for bench mounted enclosure testing.....	88
Figure J.1 – Theoretical and typical measured distributions for field anisotropy coefficients in a well-stirred chamber	97
Figure J.2 – Theoretical and typical measured distributions for field anisotropy coefficients in a poorly stirred chamber	98
Figure J.3 – Typical measured values for field anisotropy coefficients as a function of N in a well-stirred chamber	99
Figure K.1 – Average emitted power as a function of frequency for a typical unintentional radiator	105
Figure K.2 – Estimated standard uncertainty.....	105
Figure K.3 – Mean normalized width (in dB) of a $\eta\%$ -confidence interval	106
Figure K.4 – Individual mean-normalized interval boundaries (in linear units) for maximum field strength as a function of the number of independent stirrer positions N	106
Table B.1 – Sampling requirements	48
Table B.2 – Field uniformity tolerance requirements.....	48
Table J.1 – Typical values for total field anisotropy coefficients for ‘medium’ and ‘good’ reverberation quality	96

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-21: Testing and measurement techniques – Reverberation chamber test methods

FOREWORD

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International Standard IEC 61000-4-21 has been prepared by subcommittee 77B: High frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility, in co-operation with CISPR subcommittee A: Radio-interference measurements and statistical methods.

It forms Part 4-21 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

This second edition cancels and replaces the first edition published in 2003. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the first edition.

- In Clause 8, the use and specifications of *E*-field probes for application to reverberation chambers has been added. Additional Notes refer to general aspects and procedures of

probe calibrations. The specified range for linearity of the probe response is larger and covers an asymmetric interval compared to that for use in anechoic chambers (see Annex I of IEC 61000-4-3), because

- the fluctuations of power and fields in reverberation chambers exhibit a larger dynamic range, and
- the chamber validation procedure is based on using maximum field values, as opposed to the field itself or its average value,

respectively.

- In Annex A, additional guidance and clarifications on the use of reverberation chambers at relatively low frequencies of operation (i.e., close to the lowest usable frequency of a given chamber) are given, and its implications on the estimation of field uncertainty are outlined. Guidelines on cable-layout have been added. A rationale has been added that explains the relaxation of the field uniformity requirement below 400 MHz, being a compromise between scientific-technical and economical reasons when using chambers around 100 MHz. A first-order correction for the threshold value of the correlation coefficient at relatively low numbers of tuner positions has been added. Issues regarding the use of non-equidistant tuner positions at low frequencies are discussed in an additional Note.
- In Annex B, symmetric location of the field probes when the chamber exhibits cylindrical symmetry has been disallowed, as such placement could otherwise yield a false indication of field uniformity and chamber performance at different locations. The difference between start frequency for chamber validation and lowest test frequency has been clarified. The tuner sequencing for chamber validation and testing is now specified to be equal in both cases. In sample requirements for chamber validation, emphasis is now on the required minimum number of independent tuner steps to be used, whereas the minimum recommended number of samples per frequency interval has been replaced with the number of independent samples that the tuner can provide per frequency, for use in case when the chamber validation fails for the required minimum number.
- Annex C now contains more quantitative guidance on the setting of the maximum permissible stirring speeds that warrant quasi-static conditions of operation for chamber validation and testing. Consideration is given to all characteristic time scales of all components or subsystems of a measurement or test. Specific issues relating to chamber validation, immunity testing and bandwidth are addressed. Particular requirements for field probes when used with mode stirred operation are listed.
- In Annex D, a requirement for the EUT and equipment not to occupy more than 8 % of the total chamber volume in immunity testing has been added. The maximum number of frequency points and the formula to calculate these points have been generalized. A mandatory specification for including the measurement equipment, test plan and cable layout in the test report has been added to resolve any dispute in case of discrepancies, particularly for low-frequency immunity testing.
- Annex E has been extended with further guidance on the value of EUT directivity to be used in the estimation of radiated power and field. Extended estimates have been added for the maximum directivity of electrically large, anisotropically radiating EUTs and for radiated emissions in the presence of a ground plane. A mandatory specification for including the measurement equipment, test plan and cable layout in the test report has been added to resolve any dispute in case of discrepancies, particularly for low-frequency emissions testing.
- In Annex I, some clarifications on antenna efficiency measurements have been added.
- A new Annex K has been added that covers measurement uncertainty in reverberation chambers. The intrinsic field uncertainty for chamber validation, immunity and emissions measurements is quantified. Other contributors to measurement uncertainty are listed.

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

CDV	Report on voting
77B/619/CDV	77B/640/RVC

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 the stability 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.

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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

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).

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-21: Testing and measurement techniques – Reverberation chamber test methods

1 Scope

This part of IEC 61000 considers tests of immunity and intentional or unintentional emissions for electric and/or electronic equipment and tests of screening effectiveness in reverberation chambers. It establishes the required test procedures for performing such tests. Only radiated phenomena are considered.

The objective of this part is to establish a common reference for using reverberation chambers to evaluate the performance of electric and electronic equipment when subjected to radio-frequency electromagnetic fields and for determining the levels of radio-frequency radiation emitted from electric and electronic equipment.

NOTE Test methods are defined in this part for measuring the effect of electromagnetic radiation on equipment and the electromagnetic emissions from equipment concerned. The simulation and measurement of electromagnetic radiation is not adequate for quantitative determination of effects. The defined test methods are organized with the aim to establish adequate reproducibility and repeatability of test results and qualitative analysis of effects.

This part of IEC 61000 does not intend to specify the tests to be applied to a particular apparatus or system. Its main aim is to give a general basic reference to all concerned product committees of the IEC. The product committees should select emission limits and test methods in consultation with CISPR. The product committees remain responsible for the appropriate choice of the immunity tests and the immunity test limits to be applied to their equipment. Other methods, such as those covered in IEC 61000-4-3, CISPR 16-2-3 and CISPR 16-2-4 may be used.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):1990, *International Electrotechnical Vocabulary – Chapter 161: Electromagnetic compatibility*

Amendment 1 (1997)

Amendment 2 (1998)

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

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

Amendment 1 (2007)

¹ For further information consult with CISPR (International Special Committee on Radio Interference) or Technical Committee 77 (Electromagnetic compatibility).