

INTERNATIONAL STANDARD

NORME INTERNATIONALE



INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE
COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

BASIC EMC PUBLICATION
PUBLICATION FONDAMENTALE EN CEM

**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**

**Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques –
Partie 1-4: Appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Antennes et emplacements d'essai pour les mesures des perturbations rayonnées**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and definitions clause of IEC publications issued between 2002 and 2015. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et définitions des publications IEC parues entre 2002 et 2015. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE
COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS
RADIOÉLECTRIQUES

BASIC EMC PUBLICATION

**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**

**Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques –
Partie 1-4: Appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Antennes et emplacements d'essai pour les mesures des perturbations rayonnées**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.100.10; 33.100.20

ISBN 978-2-8322-3861-5

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

REDLINE VERSION

VERSION REDLINE



INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE
COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

BASIC EMC PUBLICATION
PUBLICATION FONDAMENTALE EN CEM

**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**

**Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques –
Partie 1-4: Appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Antennes et emplacements d'essai pour les mesures des perturbations rayonnées**

CONTENTS

FOREWORD.....	7
INTRODUCTION (to Amendment 1)	9
1 Scope.....	10
2 Normative references.....	10
3 Terms, definitions and abbreviations	11
3.1 Terms and definitions	11
3.2 Abbreviations.....	15
4 Antennas for measurement of radiated radio disturbance	16
4.1 General	16
4.2 Physical parameter for radiated emission measurements	16
4.3 Frequency range 9 kHz to 150 kHz	16
4.3.1 General	16
4.3.2 Magnetic antenna	16
4.3.3 Shielding of loop antenna.....	17
4.4 Frequency range 150 kHz to 30 MHz.....	17
4.4.1 Electric antenna.....	17
4.4.2 Magnetic antenna	17
4.4.3 Balance/cross-polar performance of antennas.....	17
4.5 Frequency range 30 MHz to 1 000 MHz.....	17
4.5.1 General	17
4.5.2 Low-uncertainty antenna for use if there is an alleged non-compliance to the <i>E</i> -field limit.....	18
4.5.3 Antenna characteristics.....	18
4.5.4 Balance of antenna	20
4.5.5 Cross-polar response of antenna.....	21
4.6 Frequency range 1 GHz to 18 GHz.....	22
4.6.1 General	22
4.6.2 Receive antenna.....	23
4.7 Special antenna arrangements – Loop antenna system	25
5 Test sites for measurement of radio disturbance field strength for the frequency range of 30 MHz to 1 000 MHz.....	25
5.1 General.....	25
5.2 OATS.....	26
5.2.1 General	26
5.2.2 Weather protection enclosure	26
5.2.3 Obstruction-free area.....	26
5.2.4 Ambient radio frequency environment of a test site.....	29
5.2.5 Ground plane.....	29
5.2.6 OATS validation procedure
5.3 Test site Suitability for of other ground-plane test sites.....	34
5.3.1 General Other ground-plane test sites.....	34
5.3.2 Normalized site attenuation for alternative test sites Test sites without ground plane (FAR)	35
5.3.3 Site attenuation.....
5.3.4 Conducting ground plane
5.4 Test site suitability without ground plane validation.....	40

5.4.1	Measurement considerations for free space test sites, as realized by fully absorber lined shielded enclosures General	40
5.4.2	Site performance Overview of test site validations	40
5.4.3	Site validation criteria Principles and values of the NSA method for OATS and SAC	49
5.4.4	Reference site method for OATS and SAC	56
5.4.5	Validation of an OATS by the NSA method	62
5.4.6	Validation of a weather-protection-enclosed OATS or a SAC	65
5.4.7	Site validation for FARs	68
5.5	Evaluation of set-up table and antenna tower	76
5.5.1	General	76
5.5.2	Evaluation procedure for set-up table influences	76
6	Reverberating chamber for total radiated power measurement	78
6.1	General	78
6.2	Chamber	78
6.2.1	Chamber size and shape	78
6.2.2	Door, openings in walls, and mounting brackets	78
6.2.3	Stirrers	79
6.2.4	Test for the efficiency of the stirrers	79
6.2.5	Coupling attenuation	80
7	TEM cells for immunity to radiated disturbance measurement	81
8	Test sites for measurement of radio disturbance field strength for the frequency range 1 GHz to 18 GHz	81
8.1	General	81
8.2	Reference test site	81
8.3	Validation of the test site	81
8.3.1	General	81
8.3.2	Acceptance criterion for site validation	82
8.3.3	Site validation procedures – Evaluation of S_{VSWR}	83
8.4	Alternative test sites	96
9	Common mode absorption devices	96
9.1	General	96
9.2	CMAD S-parameter measurements	96
9.3	CMAD test jig	96
9.4	Measurement method using the TRL calibration	98
9.5	Specification of ferrite clamp-type CMAD	100
9.6	CMAD performance (degradation) check using spectrum analyzer and tracking generator	100
	Annex A (normative) Parameters of antennas	103
	Annex B (normative) Monopole (1 m rod) antenna performance equations and characterization of the associated antenna matching network	110
	Annex C (normative) Loop antenna system for magnetic field induced-current measurements in the frequency range of 9 kHz to 30 MHz	115
	Annex D (normative) Construction details for open area test sites in the frequency range of 30 MHz to 1 000 MHz (see Clause 5)	124
	Annex E (normative) Validation procedure of the open area test site for the frequency range of 30 MHz to 1 000 MHz (see Clause 5) (Void)	128
	Annex F (informative) Basis for 4 dB site acceptability criterion (see Clause 5)	136
	Annex G (informative) Examples of uncertainty budgets for site validation of a COMTS using RSM with a calibrated antenna pair	138

Bibliography 141

Figure 1 – Schematic of radiation from EUT reaching an LPDA antenna directly and via ground reflections on a 3 m site, showing the half beamwidth, φ , at the reflected ray..... 19

Figure 2 – Obstruction-free area of a test site with a turntable (see 5.2.3)..... 26

Figure 3 – Obstruction-free area with stationary EUT (see 5.2.3) 27

~~Figure 4 – Configuration of equipment for measuring site attenuation in horizontal polarization (see 5.2.6 and Annex E) 28~~

~~Figure 5 – Configuration of equipment for measuring site attenuation in vertical polarization using tuned dipoles (see 5.2.6 and Annex E)..... 29~~

~~Figure 6 – Typical antenna positions for alternative test site – Vertical polarization NSA measurements 30~~

~~Figure 7 – Typical antenna positions for alternative test site – Horizontal polarization NSA measurements 31~~

~~Figure 8 – Typical antenna positions for alternative test site – Vertical polarization NSA measurements for a smaller EUT 32~~

~~Figure 9 – Typical antenna positions for alternative test site – Horizontal polarization NSA measurements for a smaller EUT 33~~

~~Figure 10 – Graph of theoretical free space NSA as a function of the frequency for different measurement distances (see Equation (10)) 34~~

~~Figure 11 – Measurement positions for the site validation procedure 35~~

~~Figure 12 – Example of one measurement position and antenna tilt for the site validation procedure 36~~

~~Figure 13 – Typical free space reference site attenuation measurement set-up 37~~

Figure 14 – Position of the antenna relative to the edge above a rectangle set-up table (top view) 59

Figure 15 – Antenna position above the set-up table (side view) 59

<https://www.cispr16.com/18-b08c-4240-b60a-634c70d20394/cispr-16-2010> Figure 16 – Example of a typical paddle stirrer 60

Figure 17 – Range of coupling attenuation as a function of frequency for a chamber using the stirrer shown in Figure 16 61

Figure 18 – Transmit antenna *E*-plane radiation pattern example (this example is for informative purposes only) 65

Figure 19 – Transmit antenna *H*-plane radiation pattern (this example is for informative purposes only) 66

Figure 20 – S_{VSWR} measurement positions in a horizontal plane (see 8.3.3.2.2 for description) 67

Figure 21 – S_{VSWR} positions (height requirements) 69

Figure 22 – Conditional test position requirements 75

Figure 23 – Definition of the reference planes inside the test jig 77

Figure 24 – The four configurations for the TRL calibration 79

Figure 25 – Limits for the magnitude of S_{11} , measured according to provisions of 9.1 to 9.3 80

Figure 26 – Example of a 50 Ω adaptor construction in the vertical flange of the jig 81

Figure 27 – Example of a matching adaptor with balun or transformer 82

Figure 28 – Example of a matching adaptor with resistive matching network 82

Figure 29 – Configuration of equipment for measuring site attenuation in horizontal polarization 34

Figure 30 – Configuration of equipment for measuring site attenuation in vertical polarization using tuned dipoles.....	35
Figure 31 – Test point locations for 3 m test distance	39
Figure 32 – Paired test point locations for all test distances	41
Figure 33 – Example of paired test point selection for a test distance of 10 m	42
Figure 34 – Illustration of an investigation of influence of antenna mast on A_{APR}	42
Figure 35 – Typical antenna positions for a weather-protected OATS or a SAC – Vertical polarization validation measurements	47
Figure 36 – Typical antenna positions for a weather-protected OATS or a SAC – Horizontal polarization validation measurements.....	47
Figure 37 – Typical antenna positions for a weather-protected OATS or a SAC – Vertical polarization validation measurements for a smaller EUT.....	48
Figure 38 – Typical antenna positions for a weather-protected OATS or a SAC – Horizontal polarization validation measurements for a smaller EUT.....	48
Figure 39 – Measurement positions for FAR site validation	50
Figure 40 – Example of one measurement position and antenna tilt for FAR site validation	51
Figure 41 – Typical quasi free-space reference SA measurement set-up.....	54
Figure 42 – Theoretical free-space NSA as a function of frequency for different measurement distances [see Equation (38)]	56
Figure 43 – RX antenna E -plane radiation pattern example with limit for 3 m distance and 2 m EUT width.....	23
Figure 44 – Determination of maximum useable EUT width using half power beam-width.....	24
Figure 45 – Determination of maximum useable EUT height using half power beam-width	24
Figure A.1 – Short dipole antenna factors for $R_L = 50 \Omega$	86
Figure B.1 – Method using network analyzer.....	92
Figure B.2 – Method using measuring receiver and signal generator	93
Figure B.3 – Example of capacitor mounting in dummy antenna.....	93
Figure C.1 – The loop-antenna system, consisting of three mutually perpendicular large-loop antennas	96
Figure C.2 – A large-loop antenna containing two opposite slits, positioned symmetrically with respect to the current probe C	97
Figure C.3 – Construction of the antenna slit	98
Figure C.4 – Example of antenna-slit construction using a strap of printed circuit board to obtain a rigid construction	98
Figure C.5 – Construction for the metal box containing the current probe.....	99
Figure C.6 – Example showing the routing of several cables from an EUT to ensure that there is no capacitive coupling from the leads to the loop.....	99
Figure C.7 – The eight positions of the balun-dipole during validation of the large-loop antenna	100
Figure C.8 – Validation factor for a large loop-antenna of 2 m diameter	100
Figure C.9 – Construction of the balun-dipole	101
Figure C.10 – Conversion factors C_{dA} [for conversion into $\text{dB}(\mu\text{A}/\text{m})$] and C_{dV} (for conversion into $\text{dB}(\mu\text{V}/\text{m})$) for two standardized measuring distances d	102
Figure C.11 – Sensitivity S_D of a large-loop antenna with diameter D relative to a large-loop antenna having a diameter of 2 m	102

Figure D.1 – The Rayleigh criterion for roughness in the ground plane 105

Table 1 – Normalized site attenuation (recommended geometries for tuned half-wave dipoles with horizontal polarization)
Table 2 – Normalized site attenuation* (recommended geometries for broadband antennas)
Table 3 – Maximum dimensions of test volume versus test distance
Table 4 – Frequency ranges and step sizes
Table 5 – S_{VSWR} test position designations	70
Table 6 – S_{VSWR} reporting requirements	75
Table 7 – Site validation methods applicable for OATS, OATS-based, SAC and FAR site types	29
Table 8 – Theoretical normalized site attenuation, A_N – Recommended geometries for tuned half-wave dipoles, with horizontal polarization	31
Table 9 – Theoretical normalized site attenuation, A_N – Recommended geometries for tuned half-wave dipoles, vertical polarization	32
Table 10 – Theoretical normalized site attenuation ^a , A_N – Recommended geometries for broadband antennas	33
Table 11 – Mutual impedance correction factors for NSA test using resonant tunable dipoles spaced 3 m apart	36
Table 12 – Example template for A_{APR} data sets	38
Table 13 – RSM frequency steps	38
Table 14 – Maximum dimensions of test volume versus test distance	49
Table 15 – Frequency ranges and step sizes for FAR site validation	51
Table D.1 – Maximum roughness for 3 m, 10 m and 30 m measurement distances	105
Table E.1 – Normalized site attenuation^a – Recommended geometries for broadband antennas
Table E.2 – Normalized site attenuation – Recommended geometries for tuned half-wave dipoles, horizontal polarization
Table E.3 – Normalized site attenuation – Recommended geometries for tuned half-wave dipoles, vertical polarization
Table E.4 – Mutual coupling correction factors for geometry using resonant tunable dipoles spaced 3 m apart
Table F.1 – Error budget	112
Table G.1 – Antenna pair reference site attenuation calibration using the averaging technique	114
Table G.2 – Antenna pair reference site attenuation calibration using REFTS	115
Table G.3 – COMTS validation using an antenna pair reference site attenuation	116

INTERNATIONAL ELECTROTECHNICAL COMMISSION
INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

**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**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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 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 IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights

This consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

CISPR 16-1-4 edition 3.2 contains the third edition (2010-04) [documents CISPR/A/885/FDIS and CISPR/A/891/RVD] and its corrigendum (2010-12), its amendment 1 (2012-07) [documents CISPR/A/995/FDIS and CISPR/A/1005/RVD] and its amendment 2 (2017-01) [documents CISPR/A/1994/FDIS and CISPR/A/1203/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard CISPR 16-1-4 has been prepared by CISPR subcommittee A: Radio-interference measurements and statistical methods.

This edition includes the following significant technical change with respect to the previous edition: provisions are added to address evaluation of a set-up table in the frequency range above 1 GHz.

It has the status of a basic EMC publication in accordance with IEC Guide 107, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications*.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of CISPR 16 series, under the general title *Specification for radio disturbance and immunity measuring apparatus and methods*, 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 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION (to Amendment 1)

This amendment introduces the Reference Site Method (RSM). In addition to introducing new content, Clause 5 is significantly restructured. To aid the reader in navigating this amendment, the following table provides a comparison of subclauses in the existing Edition 3.0 with those in this amendment. This introduction will be removed before the subsequent edition is published.

Comparison of Clause 5 between original Edition 3.0 and Amendment 1

Original Edition 3.0		Amendment 1	
5	Test sites for the measurement of radio disturbance field strength for the frequency range of 30 MHz to 1 000 MHz	5	Test sites for the measurement of radio disturbance field strength for the frequency range of 30 MHz to 1000 MHz
5.1	General	5.1	General
5.2	OATS	5.2	OATS
5.2.1	General	5.2.1	General
5.2.2	Weather protection enclosure	5.2.2	Weather protection enclosure
5.2.3	Obstruction-free area	5.2.3	Obstruction-free area
5.2.4	Ambient radio frequency environment of a test site	5.2.4	Ambient radio frequency environment of a test site
5.2.5	Ground plane	5.2.5	Ground plane
5.2.6	OATS validation procedure		
5.3	Test site suitability for other ground-plane test sites	5.3	Suitability of other test sites
5.3.1	General	5.3.1	Other ground-plane test sites
5.3.2	Normalized site attenuation for alternative test sites	5.3.2	Test sites without ground plane (FAR)
5.3.3	Site attenuation		
5.3.4	Conducting ground plane		
5.4	Test site suitability without ground plane	5.4	Test site validation
5.4.1	Measurement considerations for free space test sites, as realized by fully-absorber-lined shielded enclosures	5.4.1	General
5.4.2	Site performance	5.4.2	Overview of test site validations
5.4.3	Site validation criteria	5.4.3	Principles and values of the NSA method for OATS and SAC
		5.4.4	Reference site method for OATS and SAC
		5.4.5	Validation of an OATS by the NSA method
		5.4.6	Validation of a weather-protection-enclosed OATS or a SAC
		5.4.7	Site validation for FARs
5.5	Evaluation of set-up table and antenna tower	5.5	Evaluation of set-up table and antenna tower
5.5.1	General	5.5.1	General
5.5.2	Evaluation procedure for set-up table influences	5.5.2	Evaluation procedure for set-up table influences

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

1 Scope

This part of CISPR 16 specifies the characteristics and performance of equipment for the measurement of radiated disturbances in the frequency range 9 kHz to 18 GHz. Specifications for antennas and test sites are included.

NOTE In accordance with IEC Guide 107, CISPR 16-1-4 is a basic EMC publication for use by product committees of the IEC. As stated in Guide 107, product committees are responsible for determining the applicability of the EMC standard. CISPR and its sub-committees are prepared to co-operate with product committees in the evaluation of the value of particular EMC tests for specific products.

The requirements of this publication apply at all frequencies and for all levels of radiated disturbances within the CISPR indicating range of the measuring equipment.

Methods of measurement are covered in Part 2-3, and further information on radio disturbance is given in Part 3 of CISPR 16. Uncertainties, statistics and limit modelling are covered in Part 4 of CISPR 16.

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.

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 16-1-5:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-5: Radio disturbance and immunity measuring apparatus – Antenna calibration test sites for 30 MHz to 1 000 MHz*

CISPR 16-1-6:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-6: Radio disturbance and immunity measuring apparatus – EMC antenna calibration*

CISPR 16-1-6:2014/AMD1:2016

CISPR 16-2-3:2010, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*

CISPR/TR 16-3:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 3: CISPR technical reports*

~~Amendment 1(2005)~~

~~Amendment 2(2006)~~

CISPR 16-4-2, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements*