Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-5: Radio disturbance and immunity measuring apparatus – Antenna calibration sites and reference test sites for 5 MHz to 18 GHz

Spécification des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Partie 1-5: Appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Emplacements d'étalonnage d'antenne et emplacements d'essai de référence pour la plage comprise entre 5 MHz et 18 GHz
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This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.

This Consolidated version of CISPR 16-1-5 bears the edition number 2.1. It consists of the second edition (2014-12) [documents CISPR/A/1086A/FDIS and CISPR/A/1097/RVD] and its amendment 1 (2016-12) [documents CISPR/A/1183/FDIS and CISPR/A/1198/RVD]. The technical content is identical to the base edition and its amendment.
This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard CISPR 16-1-5 has been prepared by CISPR subcommittee A: Radio-interference measurements and statistical methods.

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 edition includes the following significant technical changes with respect to the previous edition:

– site validation methods for other sites covered in CISPR 16-1-6 are added;
– smaller step sizes are specified for swept-frequency measurements;
– the minimum ground plane size is increased;
– other miscellaneous technical and editorial refinements are included.

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

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

The committee has decided that the contents of this amendment and the base 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.

**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

This standard describes validation procedures for Calibration Test Sites (CALTS) that are used to calibrate antennas in the frequency range 5 MHz to 18 GHz. The associated antenna calibration procedures are described in CISPR 16-1-6.

Due to problems with suppressing ground reflections in the frequency range 30 MHz to 200 MHz, the main function of a reflecting ground plane is for the calibration of dipole, biconical, and hybrid antennas over the frequency range for which their H-plane patterns are uniform. The free-space antenna factor, $F_a$, for dipole antennas may be measured in a free-space environment above 200 MHz. Because of the difficulty of reducing reflections from objects that surround an antenna, and in particular the ground surface, a flat metal ground plane is used to ensure reproducibility of results and to enable the ground reflected signal to be precisely removed mathematically.

Requirements for the construction of a CALTS are given in Annex A. The specifications and validation procedures for a CALTS are given in Clause 4. The most precise way of validating a CALTS is to use calculable dipole antennas, which are the basis of the validation procedure in this standard. The design principles of calculable antennas are given in Annex B, and the theory and methods for calculating site insertion loss (SIL) are given in Annex C and Annex D.

Validation procedures for other antenna calibration sites are given in Clause 5 through Clause 7. Where an antenna calibration method utilizes the ground reflection, a CALTS is required. The validation methods are summarized in Table 1 with reference to the associated antenna calibration methods in CISPR 16-1-6.

All site validation methods involve the measurement of SIL between two antennas. It is critical that the validation of the site itself not be unduly compromised by reflections from antenna supports; see A.3 for associated guidance.
Table 1 – Summary of site validation methods by subclause number

<table>
<thead>
<tr>
<th>Calibration site(s)</th>
<th>CISPR 16-1-5 validation method(s) Subclause</th>
<th>CISPR 16-1-6:2014 calibration method(s) Subclause</th>
<th>Frequency range MHz</th>
<th>Antenna type(s)</th>
<th>Polarization</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 CALTS for monopoles</td>
<td>4.10</td>
<td>G.1</td>
<td>5 to 30</td>
<td>Monopole</td>
<td>VP</td>
<td>With tolerance of ± 1 dB</td>
</tr>
<tr>
<td>2 CALTS or SACa</td>
<td>4, 7.2</td>
<td>8.4</td>
<td>30 to 1000</td>
<td>Biconical, LPDA, hybrid</td>
<td>HP</td>
<td>SSM</td>
</tr>
<tr>
<td>3 CALTS or SAC</td>
<td>4</td>
<td>9.2.2</td>
<td>30 to 300</td>
<td>Biconical, hybrid, dipole</td>
<td>HP or VP</td>
<td>At large height or with absorber on ground</td>
</tr>
<tr>
<td>4 FAR</td>
<td>5.3.2</td>
<td>9.2.2</td>
<td>30 to 300</td>
<td>Biconical, hybrid, dipole</td>
<td>HP</td>
<td></td>
</tr>
<tr>
<td>5 REFTS CALTS</td>
<td>4.7</td>
<td>9.3</td>
<td>30 to 300</td>
<td>Biconical, hybrid</td>
<td>VP</td>
<td></td>
</tr>
<tr>
<td>6 Free space</td>
<td>6.1</td>
<td>9.4.2</td>
<td>200 to 18000</td>
<td>LPDA, hybrid, horn</td>
<td>VP</td>
<td></td>
</tr>
<tr>
<td>7 Free space</td>
<td>6.2</td>
<td>9.4.4</td>
<td>200 to 18000</td>
<td>LPDA, hybrid, horn</td>
<td>VP (or HP)</td>
<td>With absorber on ground</td>
</tr>
<tr>
<td>8 FAR</td>
<td>5.3.3</td>
<td>9.5</td>
<td>1000 to 18000</td>
<td>Horn, LPDA</td>
<td>HP or VP</td>
<td></td>
</tr>
<tr>
<td>9 FAR</td>
<td>5.3.2</td>
<td>9.2 and 9.4</td>
<td>140 to 1000</td>
<td>LPDA, hybrid</td>
<td>HP or VP</td>
<td></td>
</tr>
<tr>
<td>10 CALTS</td>
<td>4.6</td>
<td>B.4, B.5</td>
<td>30 to 300</td>
<td>Biconical, dipole</td>
<td>HP</td>
<td></td>
</tr>
<tr>
<td>11 Transfer of properties of a validated site to a site not validated by methods in other clauses</td>
<td>7.1</td>
<td>A.9.4</td>
<td>30 and above</td>
<td>Any, but not monopole or loop</td>
<td>HP or VP</td>
<td>Use primarily for SAM and FAR, for particular antenna types and frequencies, except 5.3</td>
</tr>
</tbody>
</table>

a A CALTS is well specified as being free of reflecting obstacles, and if the antenna supports have negligible reflections the ground plane itself is likely to provide results that agree with the theoretical performance to better than 0.5 dB. However for a Semi Anechoic Chamber (SAC), it is important that the entire allowed acceptance criterion of 1 dB is not taken up by wall reflections, leaving no latitude for other uncertainty components such as reducing reflections from masts and cables.
SPECFICATION FOR RADIO DISTURBANCE AND IMMUNITY
MEASURING APPARATUS AND METHODS –

Part 1-5: Radio disturbance and immunity measuring apparatus –
Antenna calibration sites and reference test sites for 5 MHz to 18 GHz

1 Scope

This part of CISPR 16 specifies the requirements for calibration sites in the frequency range 5 MHz to 18 GHz used to perform antenna calibrations according to CISPR 16-1-6. It also specifies the requirements for reference test sites (REFTS) that are used for the validation of compliance test sites (COMTS) in the frequency range 30 MHz to 1 000 MHz according to CISPR 16-1-4.

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

Measurement instrumentation specifications are given in CISPR 16-1-1 and CISPR 16-1-4. Further information and background on uncertainties in general is given in CISPR 16-4, which can also be helpful in establishing uncertainty estimates for the calibration processes of antennas and site validation measurements.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CISPR 16-1-4:2010/AMD 1:2012


IEC 60050 (all parts), International Electrotechnical Vocabulary (available at <http://www.electropedia.org>)

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

NOTE Full terms for abbreviations not already given in 3.1 are listed in 3.2.

1 Numbers in square brackets refer to the bibliography.