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COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

BASIC EMC PUBLICATION
PUBLICATION FONDAMENTALE EN CEM

AMENDMENT 2
AMENDEMENT 2

Specification for radio disturbance and immunity measuring apparatus and methods –

Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements

**Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques –
Partie 2-3: Méthodes de mesure des perturbations et de l'immunité – Mesurages des perturbations rayonnées**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SPECIFICATION FOR RADIO DISTURBANCE AND
IMMUNITY MEASURING APPARATUS AND METHODS –**

**Part 2-3: Methods of measurement of disturbances and immunity –
Radiated disturbance measurements**

AMENDMENT 2

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Amendment 2 to CISPR 16-2-3:2016 has been prepared by CISPR subcommittee A: Radio-interference measurements and statistical methods.

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

Draft	Report on voting
CIS/A/1391/FDIS	CIS/A/1397/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Amendment is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications/.

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2 Normative references

Replace the existing reference to CISPR 16-1-4:2010, modified by CISPR 16-2-3:2016/AMD1:2019, with the following reference:

CISPR 16-1-4:2019, *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 16-1-4:2019/AMD1:2020

CISPR 16-1-4:2019/AMD2:2023

3.1.9 common-mode absorption device

Replace the existing source, modified by CISPR 16-2-3:2016/AMD1:2019, with the following:

[SOURCE: CISPR 16-1-4:2019, 3.1.7]

Add, after the existing term 3.1.35, added by CISPR 16-2-3:2016/AMD1:2019, the following new term and definition:

3.1.36 feed point of a shielded loop antenna

location of the slit in the shielding of a loop antenna

Note 1 to entry: The feed point of a shielded loop antenna is important for a correct set-up. The location of the feed point has an influence on the site insertion loss between two magnetic field antennas [24], [25].

7.1.1 General remarks and overview of test methods

Replace the existing third paragraph of this subclause, added by CISPR 16-2-3:2016/AMD1:2019, by the following new third paragraph:

The magnetic field strength component of a disturbance is typically measured at frequencies up to 30 MHz. Generally, in magnetic field strength measurements, the horizontal and vertical components of the field at the position of the receiving antenna are measured when using the distant single antenna procedure. If an LLAS is used, the three orthogonal magnetic dipole moments of the EUT are measured.

Delete the existing NOTE 2 of this subclause, added by CISPR 16-2-3:2016/AMD1:2019.

7.1.2.1 Frequency range 9 kHz to 30 MHz

Delete the existing NOTE from under b), added by CISPR 16-2-3:2016/AMD1:2019.

7.3.1 Measurand

Replace, in the ninth paragraph of this subclause, the existing reference to Equation (35) of CISPR 16-1-4:2010/AMD1:2012, modified by CISPR 16-2-3:2016/AMD1:2019, with a reference to Equation (13) of CISPR 16-1-4:2019.

7.7.2.1 Measurement method

Replace, in the second paragraph of this subclause, the existing reference to 4.3.2 of CISPR 16-1-4:2010, modified by CISPR 16-2-3:2016/AMD1:2019, with a reference to 4.3.2 of CISPR 16-1-4:2019.

Add, after the existing subclause 7.10, the following new subclause:

<https://standards.iteh.ai/catalog/standards/sist/6692590d-21b2-4167-8773-2d89ce7a10ae/cispr-16-2-3:2016/AMD2:2023>
7.11 Open-area test site or semi-anechoic chamber measurements (9 kHz to 30 MHz)

7.11.1 Measurand

The quantity to be measured is the maximum magnetic field strength emitted by the EUT, at each of the three orthogonal directions X, Y and Z as shown in Figure 25 and Figure 26 (see 7.11.3), with the reference point of the receive antenna set at 1,3 m above the ground plane, at the horizontal measurement distance from the EUT as specified in the applicable product standard, over all angles in the azimuth plane. This quantity shall be determined with the following provisions:

- a) the frequency range of interest is 9 kHz to 30 MHz;
- b) the quantity shall be expressed in dB(μ A/m);
- c) a SAC/OATS measurement site shall be used that complies with the applicable validation requirements in CISPR 16-1-4;
- d) a measuring receiver compliant with CISPR 16-1-1, and a loop antenna compliant with CISPR 16-1-4, shall be used;
- e) the measurement distance may be 3 m, 5 m, or 10 m, and should be used with the restriction given in Table 10 (see 7.1.2.1);
- f) the measurement distance is the horizontal projection to the ground plane of the distance between the boundary of the EUT and the antenna reference point;
- g) the reference point of the loop antenna shall be the centre of the loop;
- h) the three loop antenna orientations shall be in accordance with the following:

- X – the plane of the loop antenna is perpendicular to the ground plane and perpendicular to the measurement axis (line connecting the projection of the reference point of the loop antenna to the ground plane with the centre of the turntable);
 - Y – the plane of the loop antenna is perpendicular to the ground plane and coplanar with the measurement axis;
 - Z – the plane of the loop antenna is parallel to the ground plane.
- i) the EUT is configured and operated in accordance with CISPR specifications;
 - j) magnetic field antenna factors (see 3.1.2.5 in CISPR 16-1-6:2014 [2]) shall be used.

NOTE Some standards allow measurements at 30 m distance; however, this distance is not specified because 30 m test sites are rarely available.

The measurand H is derived from the maximum voltage reading V_r by using the magnetic field antenna factor F_{aH} and Equation (23):

$$H = V_r + A_c + F_{aH} \quad (23)$$

where

- H is the magnetic field strength in dB(μ A/m) as in the measurand description;
- V_r is the maximum received voltage in dB(μ V) as per the provisions in the measurand description;
- A_c is the loss in dB of the cable between the loop antenna and the measuring receiver;
- F_{aH} is the magnetic field antenna factor of the loop antenna in dB($\Omega^{-1}\text{m}^{-1}$).

7.11.2 Test site requirements

The test site shall conform with the specifications for 9 kHz to 30 MHz in CISPR 16-1-4 with regard to its physical and electrical properties, and for its site validation.

7.11.3 General measurement method

The concept of the set-up for radiated disturbance measurements made at an OATS or in a SAC is shown in Figure 25 for table-top EUTs and in Figure 26 for floor-standing EUTs.

The EUT is installed at the specified height above the ground plane and operated normally, in accordance with 6.4. The loop antenna is positioned at the specified measurement distance and height above the ground plane.

The feed point of the loop antenna shall be set as shown in Figure 27. The figure shows two alternative locations of the feed point, either one of which is applicable for the measurement. However, for practical reasons the upper location is preferred for X and Y orientations [24], [25].

For each loop antenna orientation, the EUT is rotated in the horizontal plane to determine the maximum level at each emission frequency.

If the cables have an influence on the measurement result, they should be equipped with ferrite cores. It is recommended that ferrites with a minimum impedance of 50 Ω at 25 MHz are placed on the loop antenna cables every 20 cm along their entire length.

Dimensions in metres

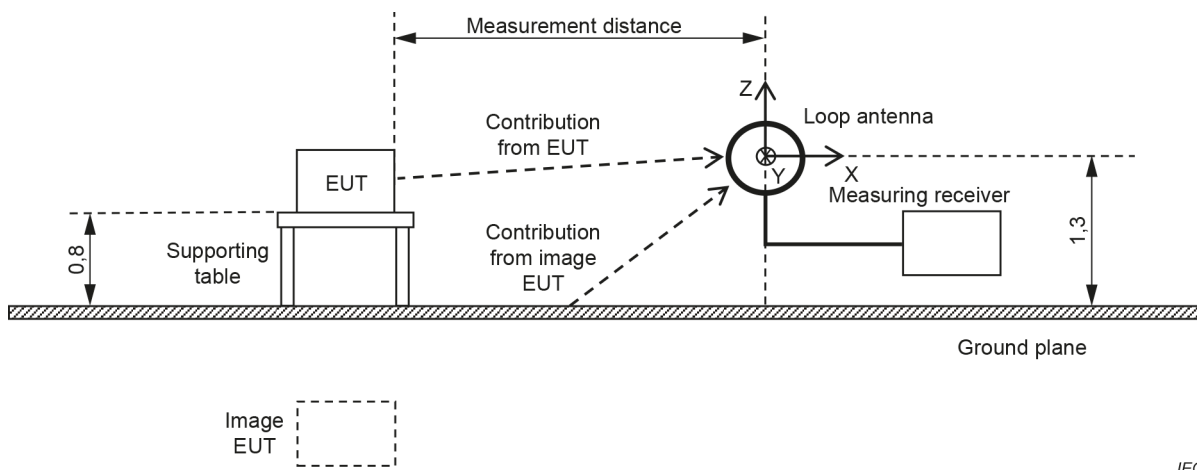


Figure 25 – Concept of magnetic field strength measurement set-up at an OATS or in a SAC for table-top EUT

Dimensions in metres

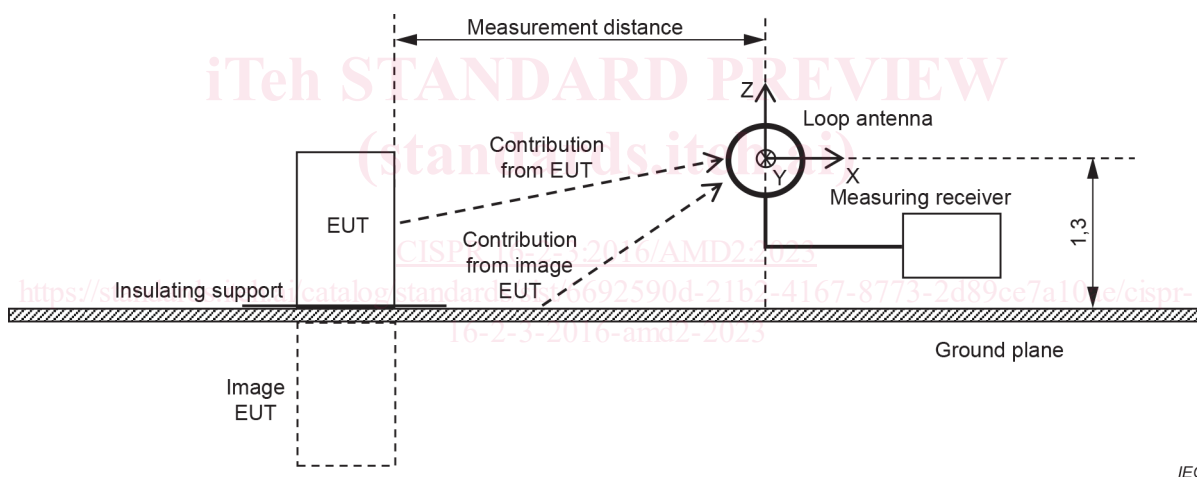


Figure 26 – Concept of magnetic field strength measurement set-up at an OATS or in a SAC for floor-standing EUT

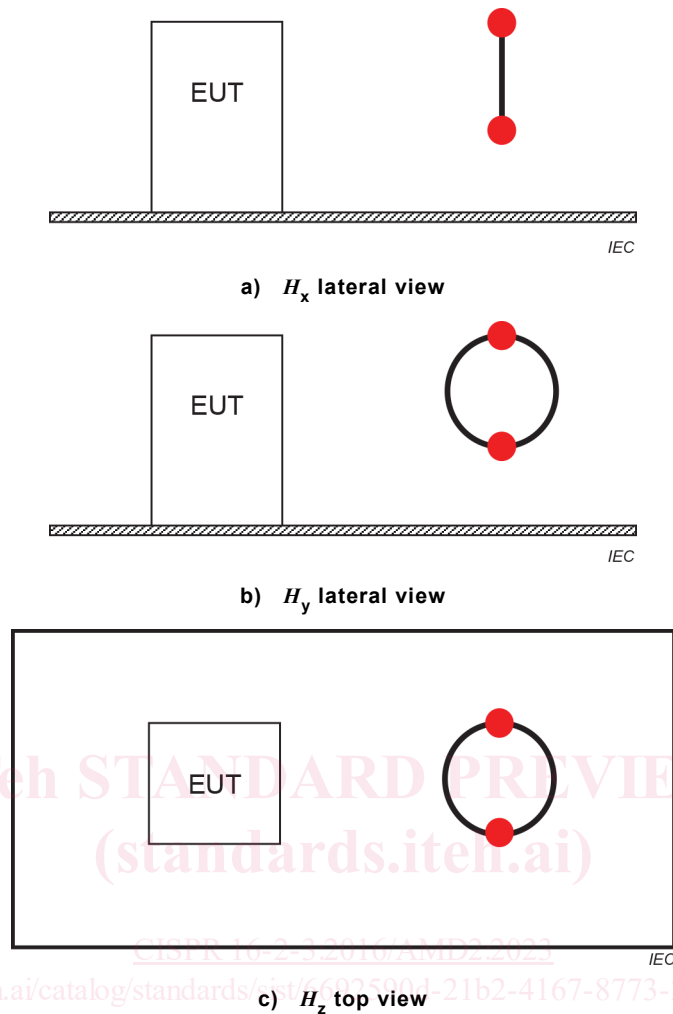


Figure 27 – Feed point location

7.11.4 Measurement distance and EUT dimensions

The measurement distance is the horizontal projection to the ground plane of the distance between the boundary of the EUT (see Figure 8) and the antenna reference point.

If limits are defined at a distance greater than 10 m (e.g. 30 m), the results shall be extrapolated using the procedures specified in the applicable product standard. In case such procedures are not specified in the applicable product standard, the extrapolation procedure in 7.7.2.2 may be used instead. The extrapolation process shall be described in the test report.

NOTE Due to the fact that measurements in this frequency range are always performed in the near field of the radiating source, the extrapolation does not follow the simple inverse distance law.

The EUT dimension should not exceed the maximum EUT volume in Table 10 (see 7.1.2.1).

7.11.5 Antenna height

For magnetic field strength measurements, the reference point of the loop antenna shall be set at a height of 1,3 m above the ground plane. This height applies for all antenna orientations X, Y, and Z.

7.11.6 Product standard specification details

7.11.6.1 General

In addition to specifying the detailed measurement method and the disturbance parameters to be measured, product standards shall include other relevant details as outlined in the following subclauses.

7.11.6.2 Test environment

The influence of the test environment shall be considered so as to ensure correct functioning of the EUT. Important parameters in the physical environment shall be specified, e.g. temperature and humidity.

The electromagnetic environment needs special consideration to ensure accurate disturbance measurements. The ambient radio noise levels measured at the test site with the EUT de-energized should be at least 6 dB below the limit. It is recognized that this margin cannot always be realized at all frequencies. However, when the measured levels of ambient radio noise plus EUT emissions are not above the limit, the EUT shall be considered to be in compliance with the limit. See 6.2.2 and Annex A for further guidance about ambient levels and resulting measurement errors.

If the ambient field strength level at frequencies within the specified measurement ranges exceeds the limit(s), the following alternatives may be used:

- a) Perform measurements at a closer distance (either 3 m or 5 m instead of 10 m; or 3 m instead of 5 m) and extrapolate results to the distance at which the limit is specified. The extrapolation formula shall be as recommended by the applicable product standard or it shall be verified by measurements at no less than three different distances. This alternative does not apply if the specified measurement distance is 3 m;
- b) Compare the amplitude of the EUT disturbance at the frequency under investigation with the amplitude of the disturbance of a related or unrelated nearby frequency, in an alternative shielded room or absorber-lined shielded room which does not need to be a COMTS. The amplitude of the EUT disturbance at the frequency under investigation can be estimated by measuring the amplitude of the adjacent frequency disturbance and making a comparison;
- c) Use a narrower measuring receiver bandwidth for narrowband disturbances from the EUT occurring near an RF ambient when both are within the standard bandwidth, see A.4.

7.11.6.3 EUT operating conditions and arrangement

The EUT operating conditions and arrangement are detailed in 6.4.

For table-top EUTs the table height shall be 0,8 m. Floor-standing EUTs shall be separated from metallic contact with the ground plane by up to 15 cm of insulation.

7.11.7 Measurement uncertainty for OATS and SAC

General and basic considerations about uncertainties in standardized EMC tests are given in CISPR 16-4-1. Measurement instrumentation uncertainty aspects specific to results of radiated disturbance measurements at an OATS or in a SAC in the frequency range 9 kHz to 30 MHz are given in CISPR 16-4-2.

7.11.8 Field strength measurements at other sites

For practical reasons, test sites similar to an OATS but without any metal ground plane may be prescribed for some products, e.g. ISM equipment and motor vehicles. For open-field test sites (OTS), the reference point of the receive antenna is set 1,3 m above the surface. The other provisions given in 7.11.1 (except for bullet c), feed point location in 7.11.3, and 7.11.4 through 7.11.6, shall remain applicable.

A.1 General

Replace, in the second paragraph of this clause, the existing reference to 5.2.4 of CISPR 16-1-4:2010, modified by CISPR 16-2-3:2016/AMD1:2019, with a reference to 6.2.4 of CISPR 16-1-4:2019.

A.4.2 Pre-testing the EUT in a shielded room

Replace, in the first paragraph of this subclause, the existing reference to Annex E of CISPR 16-1-4:2010, (Annex A of [4]), modified by CISPR 16-2-3:2016/AMD1:2019, with 6.5 of CISPR 16-1-4:2019.

F.2.4 1 GHz to 18 GHz

Replace, in the first paragraph of this subclause, added by CISPR 16-2-3:2016/AMD1:2019, the existing reference to 4.6.1 of CISPR 16-1-4:2018 with 4.6.1 of CISPR 16-1-4:2019.

Bibliography

Add, at the end of the existing list, modified by CISPR 16-2-3:2016/AMD1:2019, the following two new references:

- [24] Fujii, K., Basic characteristics of magnetic field antenna factor of loop antennas for EMI measurements, *IEICE Communications Express*, DOI: 10.1587/comex.2022XBL0102
- [25] Fujii, K., Effects of feed gap arrangements of loop antennas on site validation for EMI measurements below 30 MHz, *IEICE Communications Express*, DOI: 10.1587/comex.2022XBL0127

<https://standards.itec.ai/catalog/standards/sist/6692590d-21b2-4167-8773-2d89ce7a10ae/cispr-16-2-3-2016-amd2-2023>
