SIST

# SLOVENSKI STANDARD
# SIST EN 55016-1-4:2007/A1:2008

**01-junij-2008**

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**Specifikacija za merilne naprave in metode za merjenje radiofrekvenļ nih motenj in odpornosti - 1-4. del: Merilne naprave za merjenje radiofrekvenļ nih motenj in odpornosti - Pomoģna oprema - Sevane motnje (CISPR 16-1-4:2007/A1:2007)**

Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-4: Radio disturbance and immunity measuring apparatus - Ancillary equipment - Radiated disturbances

Anforderungen an Geräte und Einrichtungen sowie Festlegung der Verfahren zur Messung der hochfrequenten Störaussendung (Funkstörungen) und Störfestigkeit - Teil 1-4: Geräte und Einrichtungen zur Messung der hochfrequenten Störaussendung (Funkstörungen) und Störfestigkeit - Zusatz-/Hilfseinrichtungen - Gestrahlte Störaussendung



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 - Matériels auxiliaires - Perturbations rayonnées

**Ta slovenski standard je istoveten z: EN 55016-1-4:2007/A1:2008**

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**ICS:**

| | | |
|---|---|---|
| 17.240 | Merjenje sevanja | Radiation measurements |
| 33.100.20 | Imunost | Immunity |

**SIST EN 55016-1-4:2007/A1:2008 en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 55016-1-4/A1

February 2008

ICS 33.100.10; 33.100.20

English version

# Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-4: Radio disturbance and immunity measuring apparatus - Ancillary equipment - Radiated disturbances

(CISPR 16-1-4:2007/A1:2007)

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 - Matériels auxiliaires - Perturbations rayonnées (CISPR 16-1-4:2007/A1:2007)

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This amendment A1 modifies the European Standard EN 55016-1-4:2007; it was approved by CENELEC on 2008-02-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**



Ref. No. EN 55016-1-4:2007/A1:2008 E

## Foreword

The text of document CISPR/A/750/FDIS, future amendment 1 to CISPR 16-1-4:2007, prepared by CISPR SC A, Radio-interference measurements and statistical methods, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 55016-1-4:2007 on 2008-02-01.

The following dates were fixed:

| | | |
|---|---|---|
| – latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2008-11-01 |
| – latest date by which the national standards conflicting with the amendment have to be withdrawn | (dow) | 2011-02-01 |

## Endorsement notice

The text of amendment 1:2007 to the International Standard CISPR 16-1-4:2007 was approved by CENELEC as an amendment to the European Standard without any modification.

CISPR 16-1-4

Edition 2.0 2007-10

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

AMENDMENT 1

AMENDEMENT 1



## Specification for radio disturbance and immunity measuring apparatus and methods –
## Part 1-4: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Radiated disturbances

## 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 – Matériels auxiliaires – Perturbations rayonnées

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# FOREWORD

This amendment has been prepared by subcommittee A of CISPR: Radio-interference measurements and statistical methods.

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

| FDIS | Report on voting |
|---|---|
| CISPR/A/750/FDIS | CISPR/A/760/RVD |

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the maintenance 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



In this amendment, the use of a balanced dipole antenna (the CISPR tuned dipole) as a physical reference for radiated emission measurements in the frequency range between 30 MHz and 300 MHz is deleted. It is replaced by the requirement that in this frequency range the quantity to be measured is the electric field strength that can be determined using different types of antennas, provided that the antenna factor and the associated uncertainty are known.

This fundamental change of measurand in the frequency range between 30 MHz and 300 MHz was subject to thorough investigations and discussion within CISPR A, and brings it into line with the measurand that already applies in the rest of the frequency range 9 kHz to 1 GHz, and indeed above 1 GHz. The decision for this change has been supported by the results of a questionnaire. More details on the rationale for the decision to introduce the ‘electric field’ measurand instead of the CISPR reference dipoles can be found in the CISPR Maintenance Cycle Report CISPR/A/541/MCR.

CISPR/A/541/MCR explains that the need for a CISPR reference dipole no longer exists, due to improvements in the calibration of antennas used for EMC compliance testing and the increased implementation of quality systems in test and calibration laboratories in accordance with ISO 17025. Moreover, Clause 4 of CISPR 16-1-4 covers the frequency range 9 kHz to 1 GHz, yet a reference antenna is only specified in the range 30 MHz to 300 MHz, which seems to make this frequency range an exception to the general rule.

In other words, most measurements of physical quantities are made with an instrument that is traceable to national standards. There is no need for measurement of electric field strength in the frequency range 30 MHz to 300 MHz to deviate from this, especially when application of such a physical reference antenna may give a greater uncertainty to the intended measurand than a regular calibrated broadband antenna. Moreover, these days, the CISPR reference dipole is rarely used in practice because it is impractical from a operational point of view (time consuming). The new measurand is the field strength as defined by the limit level in dBµV/m and as required by the method of measurement. If various operators follow the same measurement method, involving calibrated antennas, a high degree of reproducibility is ensured.

A consequence of using the tuned dipole antenna as a reference is that the antenna uncertainties in CISPR 16-4-2 require the field strength measured by a broadband antenna to be referred to the field strength that would have been measured had a tuned dipole been used. The ramifications would be dependent on the difference in radiation patterns and mutual coupling of a dipole compared to a broadband antenna (including height dependence of antenna factor). This practice can actually result in larger EMC measurement uncertainties than if the field strength were derived from the traceably calibrated broadband antenna. The relating of the behaviour of the commonly used broadband antenna to the extremely rarely used tuned dipole in the notes to the uncertainty budget in CISPR 16-4-2, requires specialist knowledge to understand.

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CONTENTS

*Add, on page 5, to the list of tables the titles of the new figures as follows:*





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## 3 Terms and definitions

**3.5**
**antenna**

*Replace the existing Note 2 by the following new note:*

NOTE 2 This term covers various devices such as the wire antenna, free-space-resonant dipole and hybrid antenna.

**3.8**
**site attenuation**

*Replace, on page 17, the existing text with the following:*

Site attenuation is defined as the minimum site insertion loss measured between two polarization-matched antennas located on a test site when one antenna is moved vertically over a specified height range and the other is set at a fixed height.

**3.9**
**test antenna**

*Delete the existing definition 3.9, and replace it with the following new definition of site insertion loss:*

**3.9**
**site insertion loss**
the loss between a pair of antennas placed at specified positions on a test site, when a direct electrical connection between the generator output and receiver input is replaced by transmitting and receiving antennas placed at the specified positions

**3.12**
**quasi-free space test-site**

*Replace the existing wording of this definition with the following:*

facility for radiated emission measurements, or antenna calibration, that is intended to achieve free-space conditions. Unwanted reflections from the surroundings are kept to a minimum in order to satisfy the site acceptance criterion applicable to the radiated emission measurement or antenna calibration procedure being considered

*Add, after definition 3.13, the following new definitions:*

**3.14**
**cross-polar response**
measure of the rejection by the antenna of the cross-polarised field, when the antenna is rotated in a uniform electromagnetic field



**3.15**
**hybrid antenna**
conventional wire-element log-periodic dipole array (LPDA) antenna with boom lengthened at the open-circuit end to add one broadband dipole (e.g., biconical or bow-tie), such that the infinite balun (boom) of the LPDA serves as a voltage source for the broadband dipole. Typically a common-mode choke is used at this end of the boom to minimize parasitic (unintended) RF currents on the outer conductor of the coaxial cable flowing into the receiver

**3.16**
**low uncertainty antenna**
good quality robust biconical or LPDA antenna, whose antenna factor is reproducible to better than ±0,5 dB, used for the measurement of E-field strength at a defined point in space

NOTE It is further described in A.2.2.

**3.17**
**semi-anechoic chamber**
**SAC**

shielded enclosure, in which five of the six internal surfaces are lined with radio-frequency-energy absorbing material (i.e., RF absorber), which absorbs electromagnetic energy in the frequency range of interest, and the bottom horizontal surface is a conducting ground plane for use with OATS test set-ups

**3.18**
**common mode absorption device**
**CMAD**
a device that may be applied on cables leaving the test volume in radiated emission measurements to reduce the compliance uncertainty

**3.19**
**insertion loss**
the loss arising from the insertion of a device into a transmission line, expressed as the ratio of voltages immediately before and after the point of insertion of a device under test, before and after the insertion. It is equal to the inverse of the transmission $S$-parameter, $|1/S_{21}|$

**3.20**
**reflection coefficient**
the ratio of a common quantity to both the reflected and incident travelling waves. Hence, the voltage reflection coefficient is defined as the ratio of the complex voltage of the reflected wave to the complex voltage of the incident wave. The voltage reflection coefficient is equal to the scattering parameter $S_{11}$

**3.21**
**short-open-load-through (SOLT) or through-open-short-match (TOSM) calibration method**
calibration method for a vector network analyser using three known impedance standards – short, open, and match/load, and a single transmission standard – through. The SOLT method is widely used, and the necessary calibration kits with 50 Ω characteristic impedance components are commonly available. A full two-port error model includes six error terms for each of the forward and reverse directions, for a total of twelve separate error terms, which requires twelve reference measurements to perform the calibration

**3.22**
**scattering parameters (S-parameters)**
a set of four parameters used to describe the properties of a two-port network inserted into a transmission line



**3.23**
**through-reflect-line (TRL) calibration**
calibration method for a vector network analyser using three known impedance standards “Through”, “Reflect” and “Line” for the internal or external calibration of the VNA. Four reference measurements are needed for this calibration

**3.24**
**vector network analyser**
**VNA**
a network analyser capable of measuring complex values of the four $S$-parameters $S_{11}$, $S_{12}$, $S_{21}$, $S_{22}$

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## 4 Antennas for measurement of radiated radio disturbance

*Add the following sentence to the beginning of the first paragraph*

Antennas of the type that are used for radiated emissions measurements, having been calibrated, shall be used to measure the field strength, taking into account their radiation patterns and mutual coupling with their surroundings.

*In the second paragraph, replace the first sentence* “The antenna shall be substantially plane polarised.” *by* “The antenna shall be linearly polarised.”

*In the third sentence of the second paragraph, after* “above ground” *add* “or above the absorber in a FAR”.

**4.1 Accuracy of field-strength measurements**

*Replace the existing title with the following new title.*

**4.1 Physical parameter for radiated emissions measurements**

*Add the following paragraph to the beginning of the subclause:*

The physical parameter for radiated emission measurements made against an emission limit expressed in volts per metre is E-field strength measured at a defined point in space relative to the position of the equipment under test (EUT). More specifically, for measurements in the frequency range 30 MHz to 1 000 MHz on an OATS or in a SAC, the measurand is the maximum field strength as a function of horizontal and vertical polarization and at heights between 1 m and 4 m, and at a horizontal distance of 10 m from the EUT, while the EUT is rotated over all angles in the azimuth plane.

**4.2.1 Magnetic antenna**

*Delete the last sentence of the first paragraph of the Note, i.e.:* "This assumption is justified…. H level in dB(μA/m)."

*Delete also the second paragraph of the Note:* "It should be clearly understood that the above fixed E and H ratio applies only under far-field conditions".

**4.2.2 Balance of antenna**



*Replace the existing title and text of this subclause with the following:*

**4.2.2 Shielding of loop antenna**



Inadequate shielding of a loop antenna can result in E-field response. The E-field discrimination of the antenna shall be evaluated by rotating the antenna in a uniform field, such that the plane of the loop remains parallel to the E-field vector. When the plane of the loop antenna is perpendicular to the magnetic flux and then the antenna is rotated so that its plane is parallel to the magnetic flux the measured response shall decrease by at least 20 dB.

**4.3.1 Electric antenna**

*Delete, in the second paragraph, the words* "1 m length" *and add the following sentence:* "Annex B states that the antenna factor derived by the Equivalent Capacitor Substitution Method (ECSM) has greater uncertainties for monopole lengths greater than one-eighth of a wavelength".

*Delete the third paragraph i.e.* "Where the distance…..10% of the distance".

**4.3.3 Balance of antenna**

*Replace the existing title with the following new title.*

**4.3.3 Cross-polar response of antenna**

*Modify the text as follows:*

If a balanced electric field antenna is used, it shall comply with the requirement of 4.4.3. If a balanced magnetic field antenna is used, it shall comply with the requirement of 4.2.2."

### 4.4 Frequency range 30 MHz to 300 MHz

*Replace the existing title with the following new title.*

### 4.4 Frequency range 30 MHz to 1 000 MHz

*After the title of 4.4, add the following text:*

In this frequency range the measurements are of the electric field, so magnetic field antennas are not included. The antenna shall be a dipole-like antenna designed to measure the electric field. This includes tuned dipole antennas, whose element pairs are either straight rods or conical in shape, and dipole arrays such as the log-periodic dipole array (LPDA) antenna, comprising a series of staggered sets of straight rod elements, and hybrid antennas.

#### 4.4.1 Electric antenna

*Delete the entire subclause, including 4.4.1, 4.4.1.1, 4.4.1.2 and 4.4.1.3:*

*Add a new subclause 4.4.1 as follows:*

#### 4.4.1 Low-uncertainty antenna for use if there is an alleged non-compliance to the E-field limit

For lower measurement uncertainty, the value of E-field strength measured by a typical biconical antenna or LPDA antenna is preferred, in particular over hybrid antennas. Typical biconical and LPDA antennas are defined in Annex A and only calibrated antennas shall be used.



NOTE 1 Improved uncertainties are achieved by using the biconical antenna over the frequency range 30 MHz to 250 MHz and the LPDA antenna over the range 250 MHz to 1 GHz. Alternatively, a change-over frequency of 200 MHz can be used, but uncertainties due to phase centre variations of the LPDA will be higher and must be included in the reported radiated emissions measurement uncertainty budget.

NOTE 2 The measurement uncertainty of radiated emissions from an EUT depends on many different influence factors such as the quality of the site, antenna factor uncertainty, antenna type, and the measurement receiver characteristics. The reason for defining low-uncertainty antennas is to limit other antenna influences on the measurement uncertainty, such as the effect of mutual coupling with a ground plane, the radiation pattern with respect to height scanning, and the variable phase centre position. Verification of effects of these influences is a comparison of the readings of the two antennas at the selected change-over frequency, which should give the same value of E-field strength within a margin of ± 1 dB.

*Add the following new subclause 4.4.2:*

#### 4.4.2 Antenna characteristics

Since, at the frequencies in the range 300 MHz to 1 000 MHz, the sensitivity of the simple dipole antenna is low, a more complex antenna may be used. Such antenna shall be as follows.

a) The antenna shall be linearly polarized, which shall be evaluated by applying the cross-polarization test procedure of 4.4.4.

b) Balanced dipole antennas, such as tuned-dipole and biconical antennas, shall have validated balun performance, which shall be evaluated by applying the balance test procedure of 4.4.3. This also applies to hybrid antennas below 200 MHz.

c) A test site with a conducting ground plane is assumed. The amplitude of the received signal will be reduced if either or both the direct and ground reflected signals from the EUT to the antenna are not entering the mainlobe of the radiation pattern of the antenna at its peak. The peak is usually in the boresight direction of the antenna. This reduction in amplitude is taken to be an error in the radiated emission: the ensuing uncertainty tolerance is based on the beamwidth, $2\varphi$, see Figure 20.