SLOVENSKI STANDARD

SIST EN 61000-4-3:2006/A1:2008

01-junij-2008

Elektromagnetna zdruġljivost (EMC) - 4-3. del: Preskusne in merilne tehnike - Preskuġanje odpornosti proti sevanim radiofrekvenļnim elektromagnetnim poljem (IEC 61000-4-3:2006/A1:2007)

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

Elektromagnetische Verträglichkeit (EMV) - Teil 4-3: Prüf- und Messverfahren - Prüfung der Störfestigkeit gegen hochfrequente elektromagnetische Felder

Compatibilité électromagnétique (CEM) - Partie 4-3: Techniques d'essai et de mesure - Essai d'immunité aux champs électromagnétiques rayonnés aux fréquences radioélectriques

Ta slovenski standard je istoveten z: **EN 61000-4-3:2006/A1:2008**

ICS:

33.100.20	Imunost	Immunity

SIST EN 61000-4-3:2006/A1:2008 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61000-4-3/A1

February 2008

ICS 33.100.20

English version

Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3:2006/A1:2007)

Compatibilité électromagnétique (CEM) -
Partie 4-3: Techniques d'essai
et de mesure -
Essai d'immunité aux champs
électromagnétiques rayonnés
aux fréquences radioélectriques
(CEI 61000-4-3:2006/A1:2007)

Elektromagnetische Verträglichkeit (EMV) -
Teil 4-3: Prüf- und Messverfahren -
Prüfung der Störfestigkeit gegen
hochfrequente elektromagnetische Felder
(IEC 61000-4-3:2006/A1:2007)

This amendment A1 modifies the European Standard EN 61000-4-3:2006; 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 61000-4-3:2006/A1:2008 E

Foreword

The text of document 77B/546/FDIS, future amendment 1 to IEC 61000-4-3:2006, prepared by SC 77B, High frequency phenomena, of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 61000-4-3:2006 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 IEC 61000-4-3:2006 was approved by CENELEC as an amendment to the European Standard without any modification.

IEC 61000-4-3

Edition 3.0 2007-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

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

**Compatibilité électromagnétique (CEM) –
Partie 4-3: Techniques d'essai et de mesure – Essai d'immunité aux champs électromagnétiques rayonnés aux fréquences radioélectriques**

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FOREWORD

This amendment has been prepared by subcommittee 77B: High frequency phenomena of IEC technical committee 77: Electromagnetic compatibility.

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

FDIS	Report on voting
77B/546/FDIS	77B/556/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.

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CONTENTS

Add, to the existing list of annexes, the following new title:

Annex I (informative) Calibration method for E-field probes

Page 25

Add, at the end of the sixth dashed item (beginning with "– An isotropic field sensor"), the following new sentence:

Annex I provides a calibration method for E-field probes.

Page 111

Add the following new annex:

Annex I
(informative)

Calibration method for E-field probes

I.1 Overview

E-field probes with broad frequency range and large dynamic response are extensively used in the field uniformity calibration procedures in accordance with IEC 61000-4-3. Among other aspects, the quality of the field probe calibration directly impacts the uncertainty budget of a radiated immunity test.

Generally, probes are subject to relatively low field strengths, e.g. 1 V/m – 30 V/m, during the field uniformity calibration in accordance with IEC 61000-4-3. Therefore a calibration of the E-field probes used within IEC 61000-4-3 shall take the intended frequency and dynamic ranges into consideration.

Currently probe calibration results may show differences when the probe is calibrated in different calibration laboratories. Therefore the environment and method for a field probe calibration are to be specified. This annex provides relevant information on calibration of probes to be used in IEC 61000-4-3.

For frequencies above the several hundred megahertz to gigahertz range, using standard gain horn antennas to establish a standard field inside an anechoic chamber is one of the most widely used methods for calibrating probes for IEC 61000-4-3 applications. However, there is a lack of an established method for validating the test environment for field probe calibrations.

In using this method, differences have been observed between calibration laboratories, beyond their reported measurement uncertainties.

Field probe calibrations in the 80 MHz to a few hundred megahertz range that are usually carried out in TEM waveguides are generally found to be more reproducible.

This informative annex therefore concentrates on improving the probe calibration procedures with horn antennas in anechoic chambers to which a comprehensive calibration procedure is depicted.

I.2 Probe calibration requirements

I.2.1 General

The calibration of E-Field probes intended to be used for UFA calibration procedure as defined in IEC 61000-4-3 shall satisfy the following requirements.

I.2.2 Calibration frequency range

The frequency range shall normally cover 80 MHz to 6 GHz but it may be limited to the frequency range required by the tests.

I.2.3 Frequency steps

To be able to compare test results between different calibration laboratories, it is necessary to use fixed frequencies for the calibration.

80 MHz to 1 GHz:

Use the following frequencies for the calibration of E-field probes (typically 50 MHz step width)

80, 100, 150, 200,..., 950, 1 000 MHz

1 GHz to 6 GHz:

Use the following frequencies for the calibration of E-field probes (200 MHz step width)

1 000, 1 200, 1 400,..., 5 800, 6 000 MHz

NOTE It is not intended to measure a probe at 1 GHz twice, but in case it is used up to or from 1 GHz, the probe needs to be measured at that frequency.

I.2.4 Field strength

The field strength at which a probe is calibrated should be based on the field strength required for the immunity test. As the preferred method for uniformity field calibration is carried out at field strength of at least 1,8 times the field strength to be applied to the EUT, it is recommended that the probe calibration be carried out at twice the intended test field strength (see Table I.1). If a probe is to be used at different field levels, it has to be calibrated at multiple levels according to its linearity, at least the minimum and maximum levels. See also I.3.2.

NOTE 1 This also covers the 1 dB compression requirement of the power amplifier.

NOTE 2 The calibration is performed using CW signals without modulation.

Table I.1 – Calibration field strength level

Calibration level	Calibration field strength
1	2 V/m
2	6 V/m
3	20 V/m
4	60 V/m
X	Y V/m

NOTE X,Y is an open calibration level which can be higher or lower than one of the other levels 1-4. This level may be given in the product specification or test laboratory.

I.3 Requirements for calibration instrumentation

I.3.1 Harmonics and spurious signals

Any harmonics or spurious signals from the power amplifiers shall be at least 20 dB below the level at the carrier frequency. This is required for all field strength levels used during calibration and linearity check. Since the harmonic content of power amplifiers is usually worse at higher power levels, the harmonic measurement may be performed only at the highest calibration field strength. The harmonic measurement can be performed using a calibrated spectrum analyzer which is connected to the amplifier output through an attenuator, or through a directional coupler.

NOTE 1 The antenna may have additional influence on harmonic content and may need to be checked separately.

Calibration laboratories shall perform a measurement to validate that the harmonic and/or spurious signals from the amplifier satisfy the requirements for all measurement setups. This may be done by connecting a spectrum analyzer to Port 3 of the directional coupler (replacing the power meter sensor with the spectrum analyzer input – see Figure I.2).

NOTE 2 It should be assured that the power level does not exceed the maximum allowable input power of the spectrum analyzer. An attenuator may be used.

The frequency span shall cover at least the third harmonic of the intended frequency. The validation measurement shall be performed at the power level that will generate the highest intended field strength.

Harmonic suppression filters may be used to improve the spectrum purity of the power amplifier(s) (see Annex D).

I.3.2 Linearity check for probe

The linearity of the probe which is used for the chamber validation according to I.4.2.5 shall be within ±0,5 dB from an ideal linear response in the required dynamic range (see Figure I.1). Linearity shall be confirmed for all intended range settings if the probe has multiple ranges or gain settings.

In general probe linearity does not change significantly with frequency. Linearity checking can be performed at a spot frequency that is close to the central region of the intended use of frequency range, and where the probe response versus frequency is relatively flat. The selected spot frequency is to be documented in the calibration certificate.

The field strength for which the linearity of the probe is measured should be within –6 dB to +6 dB of the field strength which is used during the validation of the chamber, with a sufficiently small step size, e.g. 1 dB. Table I.2 shows an example of the field strength levels to be checked for a 20 V/m application.

Table I.2 – Example for the probe linearity check

Signal level dB	Calibration field strength V/m
-6,0	13,2
-5,0	14,4
-4,0	14,8
-3,0	15,2
-2,0	16,3
-1,0	18,0
0	20,0
1,0	22,2
2,0	24,7
3,0	27,4
4,0	30,5
5,0	34,0
6,0	38,0

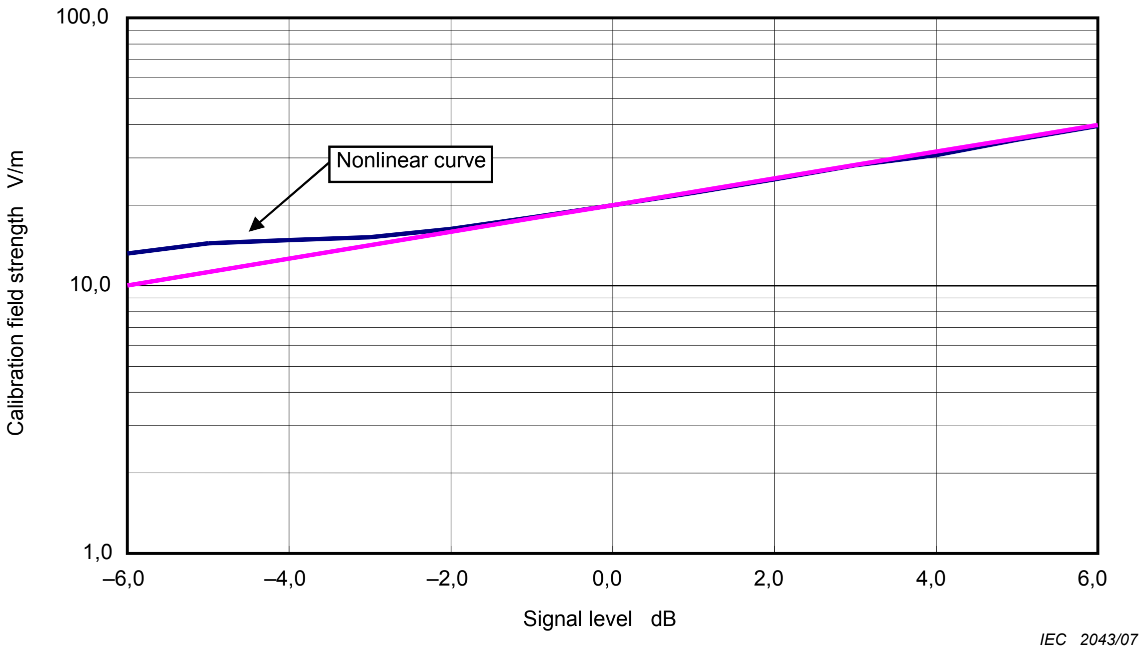

Figure I.1 – Example of linearity for probe

I.3.3 Determination of the gain of the standard horn antennas

Far field gain of the standard pyramidal horn antennas can be determined fairly accurately (less than 0,1 dB of uncertainties have been reported in [1][1]). The far-field gain is typically valid for distances greater than $8D^2 / \lambda$ (where D is the largest dimension of the horn aperture, and λ is the wavelength). Calibrations of field probes at such distances may not be practical due to the large anechoic chamber and high power amplifiers required. Field probes are typically calibrated in the near field region of the transmitting antennas. The near-field gain of standard gain horn antennas have been determined by using equations such as those described in [2]. The gain is computed based on the physical dimensions of a standard pyramidal horn, and by assuming a quadratic phase distribution at the horn aperture. The gain determined in this manner is inadequate for use in performing the chamber VSWR test and subsequent probe calibrations.

The equations (as given in [2]) were derived using aperture integration, by assuming that no reflection occurs at the aperture of the horn and that the field incident on the aperture is a TE_{10} mode, but with a quadratic phase distribution across the aperture. Some approximations were applied during the integration to obtain the close form result. Other effects such as multiple reflections from the horn edge, and higher order modes at the aperture are not accounted for. Depending on the frequency and horn design, the error is generally in the order of ±0,5 dB, but can be larger.

For better accuracy, a numerical method using full wave integration can be used. For example, the uncertainties in the gain calculation by a numerical method can be reduced to less than 5 % [3].

The gain of a horn antenna can also be determined experimentally. For example, the gain can be determined at reduced distances with a three-antenna method by an extrapolation technique, such as that described in [4], or some variations of the method.

[1] Figures in square brackets refer to the reference documents in Clause I.6.

It is recommended that the distance between the horn antenna and the probe under test be at least $0{,}5D^2 / \lambda$ during the calibration. Large uncertainties in determining gains can result from a closer distance. The standing waves between the antenna and the probe can also be large for closer distances, which again would result in large measurement uncertainties in the calibration.

I.4 Field probe calibration in anechoic chambers

I.4.1 Calibration environments

The probe calibration should be performed in a fully anechoic room (FAR) or in a semi-anechoic chamber with absorbers on the ground plane which satisfies the requirement of I.4.2.

When a FAR is used, the recommended minimum size of the FAR internal working volume for performing the probe calibration is 5 m (D) × 3 m (W) × 3 m (H).

NOTE 1 For frequencies above several hundred MHz, using standard gain horn antennas to establish a standard field inside an anechoic chamber is one of the most widely used methods for calibrating field probes for IEC 61000-4-3 applications. At lower frequencies, such as 80 MHz to several hundred MHz, the use of an anechoic chamber may not be practical. So the field probe may be calibrated in other facilities also used for immunity tests against electromagnetic fields. Therefore, TEM waveguides etc. are included in this annex as alternative calibration environments for these lower frequencies.

The system and the environment used for probe calibration shall meet the following requirements.

NOTE 2 Alternatively, the electric field can be established using a transfer probe (see I.5.4).

I.4.2 Validation of anechoic chambers for field probe calibration

The probe calibration measurements assume a free space environment. A chamber VSWR test using a field probe shall be performed to determine whether it is acceptable for subsequent probe or sensor calibration. The validation method characterizes the performance of the chamber and absorbing material.

Each probe has a specific volume and physical size, for example the battery case and/or the circuit board. In other calibration procedures, a spherical quiet zone is guaranteed in the calibration volume. The specific requirements of this annex concentrate on a VSWR test for test points located at the antenna beam axes.

Test fixtures and their influences (such as the fixtures to hold the probe, which may be exposed to electromagnetic fields and interfere with the calibration) cannot be entirely evaluated. A separate test is required to validate the influences of the fixtures.

I.4.2.1 Measuring net power to a transmitting device using directional couplers

Net power delivered to a transmitting device can be measured with a 4-port bi-directional coupler, or two 3-port single directional couplers connected back-to-back (forming the so-called “dual directional coupler”). A common setup using a bi-directional coupler to measure the net power to a transmitting device is shown in Figure I.2.