

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



BASIC EMC PUBLICATION  
PUBLICATION FONDAMENTALE EN CEM

**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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INTERNATIONAL  
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INTERNATIONALE

## Publication IEC 61000-4-3 (Edition 3.0 – 2008) I-SH 01

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

#### INTERPRETATION SHEET 1

This interpretation sheet has been prepared by SC 77B: High frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
77B/568/ISH	77B/573/RVD

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

IEC 61000-4-3 contains quick checks embedded in the field calibration process (subclause 6.2), in which the operator tests whether the amplifier is able to produce the desired RF power without saturation.

Step j) of the calibration process as per 6.2.1 describes this check for the constant field strength calibration method:

- j) Confirm that the test system (e.g. the power amplifier) is not in saturation. Assuming that  $E_c$  has been chosen as 1,8 times  $E_t$ , perform the following procedure at each calibration frequency:*
- j-1) Decrease the output from the signal generator by 5,1 dB from the level needed to establish a forward power of  $P_C$ , as determined in the above steps (-5,1 dB is the same as  $E_c / 1,8$ );*
- j-2) Record the new forward power delivered to the antenna;*
- j-3) Subtract the forward power measured in step j-2 from  $P_C$ . If the difference is between 3,1 and 5,1 dB, then the amplifier is not saturated and the test system sufficient for testing. If the difference is less than 3,1 dB, then the amplifier is saturated and is not suitable for testing.*

The corresponding check within the constant power calibration method as per 6.2.2 is defined as step m):

- m) Confirm that the test system (e. g. the power amplifier) is not in saturation. Assuming that  $E_c$  has been chosen as 1,8 times  $E_t$ , perform the following procedure at each calibration frequency:*
- m-1) Decrease the output from the signal generator by 5,1 dB from the level needed to establish a forward power of  $P_C$ , as determined in the above steps (-5,1 dB is the same as  $E_c / 1,8$ );*

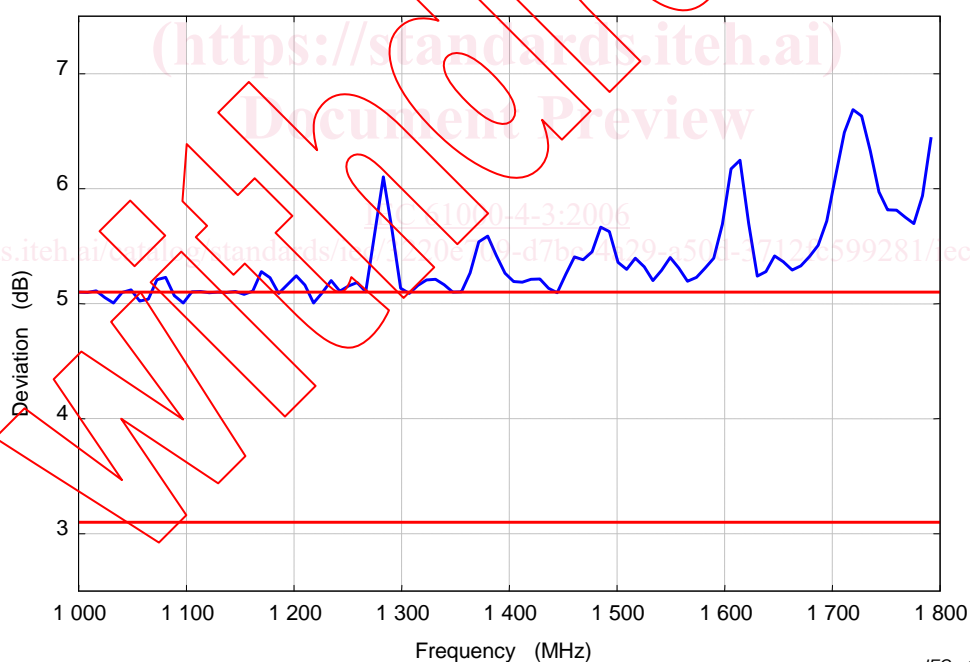
*m-2) Record the new forward power delivered to the antenna;*

*m-3) Subtract the forward power measured in step m-2 from  $P_C$ . If the difference is between 3,1 dB and 5,1 dB, then the amplifier is not saturated and the test system is sufficient for testing. If the difference is less than 3,1 dB, then the amplifier is saturated and is not suitable for testing.*

Some amplifiers show deviations of more than 5,1 dB without causing any problems during testing. That behaviour is caused by their special functional principle (above all travelling wave tube amplifiers). Figures 1 and 2 show some measurement results obtained from a semiconductor amplifier as well as from a TWT amplifier.

The text described in j-3, respectively m-3, unfortunately gives no clear answers on the usability of these amplifiers.

After discussion at the 20<sup>th</sup> meeting of SC 77B/WG 10 on October, 22 - 26, 2007, the experts of WG 10 unanimously expressed their opinion that j-3 and m-3 are to be interpreted such that amplifiers showing a deviation of more than 5,1 dB are suitable for testing. E.g. the amplifiers having a characteristic as shown in Figures 1 and 2 can be used to perform tests according to IEC 61000-4-3.



IEC 1342/08

Target field strength is 30 V/m.

**Figure 1 – Deviation as defined in step j-3 for a 200 W TWT-amplifier**

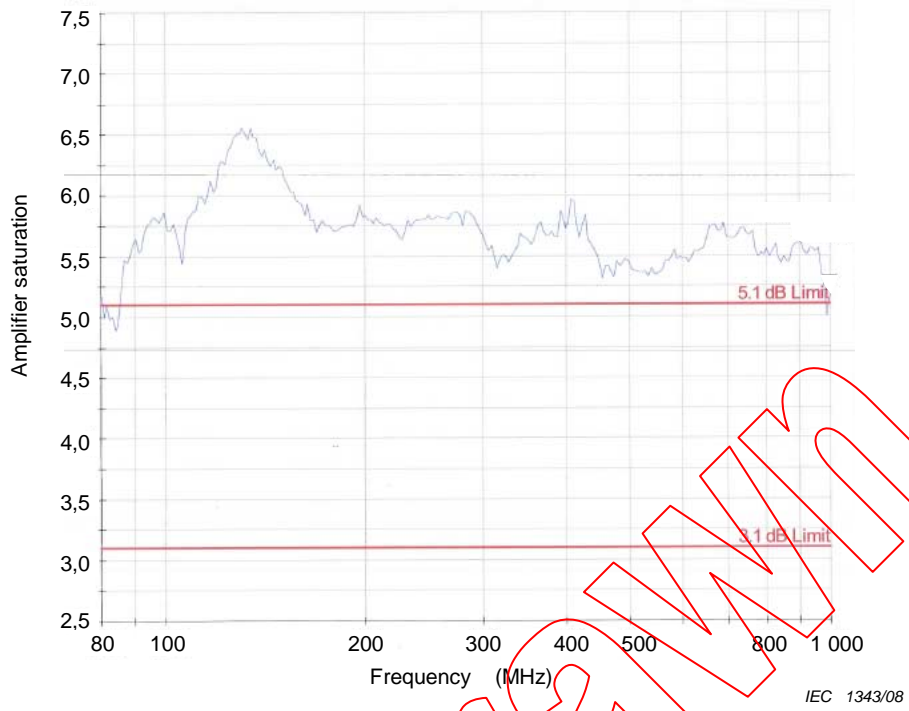


Figure 2 – Deviation as defined in step j-3 for a semiconductor amplifier

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

## FOREWORD

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International Standard IEC 61000-4-3 has been prepared by subcommittee 77B: High frequency phenomenon, of IEC technical committee 77: Electromagnetic compatibility.

It forms part 4-3 of IEC 61000. 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*.

The test frequency range may be extended up to 6 GHz to take account of new services. The calibration of the field as well as the checking of power amplifier linearity of the immunity chain are specified.

This consolidated version of IEC 61000-4-3 consists of the third edition (2006) [documents 77B/485/FDIS and 77B/500/RVD], its amendment 1 (2007) [documents 77B/546/FDIS and 77B/556/RVD], its amendment 2 (2010) [documents 77B/626/FDIS and 77B/629/RVD] and its interpretation sheet 1 of August 2008.

The technical content is therefore identical to the base edition and its amendments and has been prepared for user convenience.

It bears the edition number 3.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

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

The committee has decided that the contents of the base publication and its amendments 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

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- 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 publication using a colour printer.**

## INTRODUCTION

This standard is part of the IEC 61000 series, according to the following structure:

### **Part 1: General**

General considerations (introduction, fundamental principles)  
Definitions, terminology

### **Part 2: Environment**

Description of the environment  
Classification of the environment  
Compatibility levels

### **Part 3: Limits**

Emission limits  
Immunity limits (in so far as they do not fall under the responsibility of the product committees)

### **Part 4: Testing and measurement techniques**

Measurement techniques  
Testing techniques

### **Part 5: Installation and mitigation guidelines**

Installation guidelines  
Mitigation methods and devices

### **Part 6: Generic standards**

### **Part 9: Miscellaneous**

Each part is further subdivided into several parts, published either as international standards or as technical specifications or technical reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and a second number identifying the subdivision (example: 61000-6-1).

This part is an International Standard which gives immunity requirements and test procedures related to radiated, radio-frequency, electromagnetic fields.

## **ELECTROMAGNETIC COMPATIBILITY (EMC) –**

### **Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test**

#### **1 Scope and object**

This part of IEC 61000 is applicable to the immunity requirements of electrical and electronic equipment to radiated electromagnetic energy. It establishes test levels and the required test procedures.

The object of this standard is to establish a common reference for evaluating the immunity of electrical and electronic equipment when subjected to radiated, radio-frequency electromagnetic fields. The test method documented in this part of IEC 61000 describes a consistent method to assess the immunity of an equipment or system against a defined phenomenon.

NOTE 1 As described in IEC Guide 107, this is a basic EMC publication for use by product committees of the IEC. As also stated in Guide 107, the IEC product committees are responsible for determining whether this immunity test standard should be applied or not, and if applied, they are responsible for determining the appropriate test levels and performance criteria. TC 77 and its sub-committees are prepared to co-operate with product committees in the evaluation of the value of particular immunity tests for their products.

This part deals with immunity tests related to the protection against RF electromagnetic fields from any source.

Particular considerations are devoted to the protection against radio-frequency emissions from digital radiotelephones and other RF emitting devices.

NOTE 2 Test methods are defined in this part for evaluating the effect that electromagnetic radiation has on the equipment concerned. The simulation and measurement of electromagnetic radiation is not adequately exact for quantitative determination of effects. The test methods defined are structured for the primary objective of establishing adequate repeatability of results at various test facilities for qualitative analysis of effects.

This standard is an independent test method. Other test methods may not be used as substitutes for claiming compliance with this standard.

#### **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.

IEC 60050(161), *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

### 3 Terms and definitions

For the purposes of this part of IEC 61000, the following definitions, together with those in IEC 60050(161) apply.

#### 3.1

##### **amplitude modulation**

process by which the amplitude of a carrier wave is varied following a specified law

#### 3.2

##### **anechoic chamber**

shielded enclosure which is lined with radio-frequency absorbers to reduce reflections from the internal surfaces

##### 3.2.1

##### **fully anechoic chamber**

shielded enclosure whose internal surfaces are totally lined with anechoic material

##### 3.2.2

##### **semi-anechoic chamber**

shielded enclosure where all internal surfaces are covered with anechoic material with the exception of the floor, which shall be reflective (ground plane)

##### 3.2.3

##### **modified semi-anechoic chamber**

semi-anechoic chamber which has additional absorbers installed on the ground plane

#### 3.3

##### **antenna**

transducer which either emits radio-frequency power into space from a signal source or intercepts an arriving electromagnetic field, converting it into an electrical signal

#### 3.4

##### **balun**

device for transforming an unbalanced voltage to a balanced voltage or vice versa

[IEV 161-04-34]

#### 3.5

##### **continuous waves (CW)**

electromagnetic waves, the successive oscillations of which are identical under steady-state conditions, which can be interrupted or modulated to convey information

#### 3.6

##### **electromagnetic (EM) wave**

radiant energy produced by the oscillation of an electric charge characterized by oscillation of the electric and magnetic fields

#### 3.7

##### **far field**

region where the power flux density from an antenna approximately obeys an inverse square law of the distance.

For a dipole this corresponds to distances greater than  $\lambda/2\pi$ , where  $\lambda$  is the wavelength of the radiation

### **3.8 field strength**

The term "field strength" is applied only to measurements made in the far field. The measurement may be of either the electric or the magnetic component of the field and may be expressed as V/m, A/m or W/m<sup>2</sup>; any one of these may be converted into the others.

NOTE For measurements made in the near field, the term "electric field strength" or "magnetic field strength" is used according to whether the resultant electric or magnetic field, respectively, is measured. In this field region, the relationship between the electric and magnetic field strength and distance is complex and difficult to predict, being dependent on the specific configuration involved. Inasmuch as it is not generally feasible to determine the time and space phase relationship of the various components of the complex field, the power flux density of the field is similarly indeterminate.

### **3.9 frequency band**

continuous range of frequencies extending between two limits

### **3.10**

**$E_c$**   
field strength applied for calibration

### **3.11**

**$E_t$**   
carrier field strength applied for testing

### **3.12**

#### **full illumination**

test method in which the EUT face being tested fits completely within the UFA (Uniform Field Area).

This test method may be applied for all test frequencies

### **3.13**

#### **human body-mounted equipment**

equipment which is intended for use when attached to or held in close proximity to the human body.

This term includes hand-held devices which are carried by people while in operation (e.g. pocket devices) as well as electronic aid devices and implants

### **3.14**

#### **independent windows method**

test method (using 0,5 m × 0,5 m UFA) in which the EUT face being tested does not fit completely within the UFA.

This test method may be applied for test frequencies greater than 1 GHz

### **3.15**

#### **induction field**

predominant electric and/or magnetic field existing at a distance  $d < \lambda/2\pi$ , where  $\lambda$  is the wavelength, and the physical dimensions of the source are much smaller than distance  $d$

### **3.16**

#### **intentional RF emitting device**

device which radiates (transmits) an electromagnetic field intentionally. Examples include digital mobile telephones and other radio devices