IEC 61000-4-3

Edition 3.0 2006-02

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

IEC 61000-4-3:2006

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:
Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,…). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:
Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

IEC 61000-4-3

Edition 3.0 2006-02

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

PRICE CODE XA
CODE PRIX

ICS 33.100.20

ISBN 2-8318-8487-X

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);

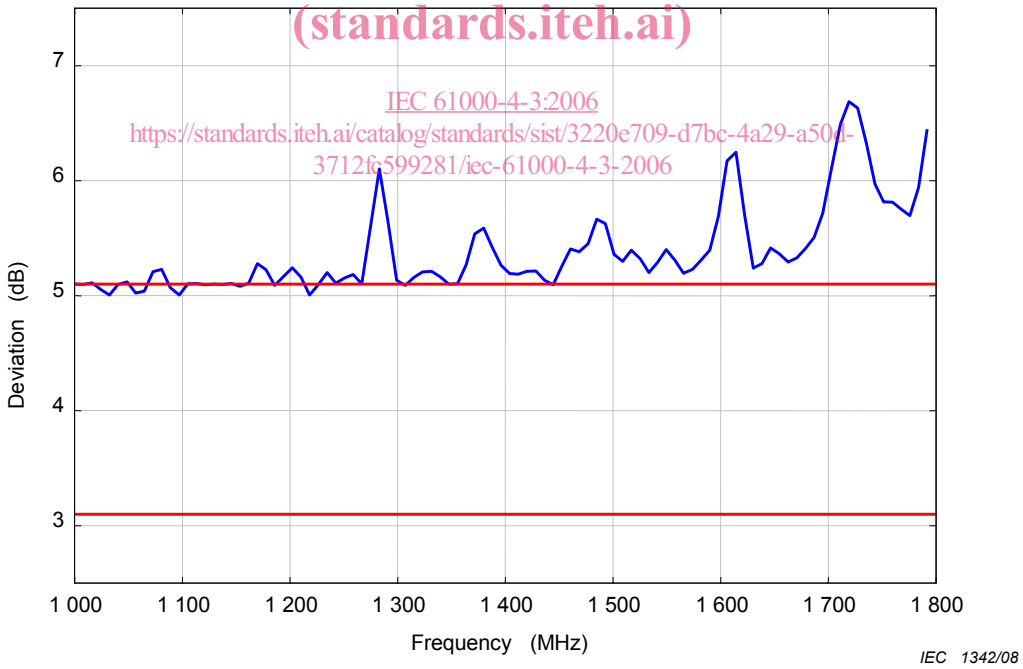
m-2) Record the new forward power delivered to the antenna;

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 20th 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.



Target field strength is 30 V/m.

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

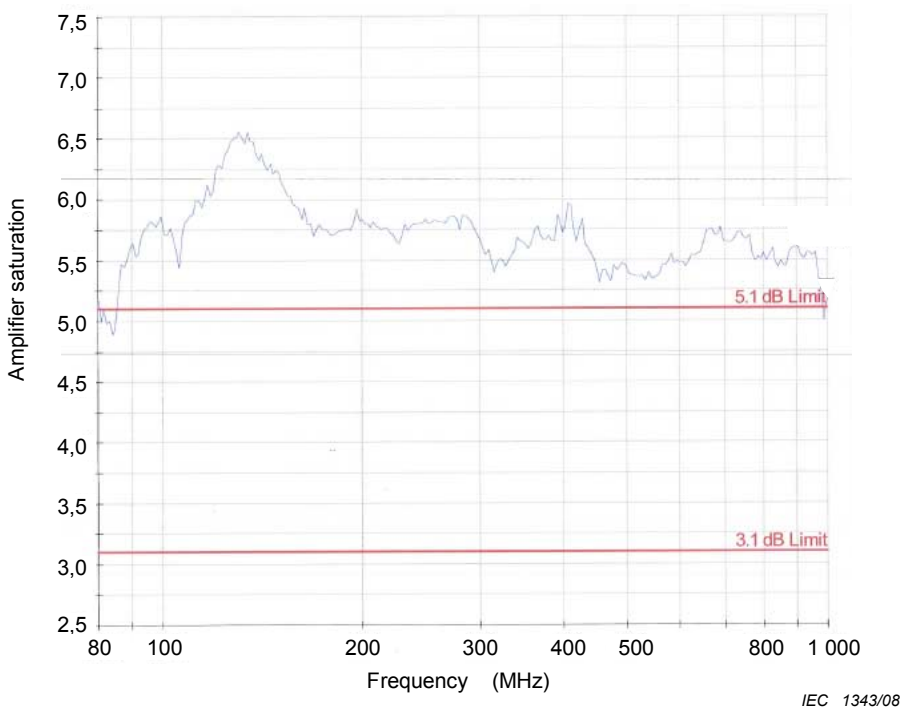


Figure 2 – Deviation as defined in step j-3 for a semiconductor amplifier

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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*.

This third edition cancels and replaces the first edition published in 2002 and its amendment 1 (2002), and constitutes a technical revision. 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.

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

FDIS	Report on voting
77B/485/FDIS	77B/500/RVD

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

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

The committee has decided that the contents of this 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.

The contents of the interpretation sheet 1 of August 2008 have been included in this copy.

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 λ 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/m²; 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 λ 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

3.17
isotropic
having properties of equal values in all directions

3.18
maximum RMS value
highest short-term RMS value of a modulated RF signal during an observation time of one modulation period.

The short-term RMS is evaluated over a single carrier cycle. For example, in Figure 1b), the maximum RMS voltage is:

$$V_{\text{maximum RMS}} = V_{\text{p-p}} / (2 \times \sqrt{2}) = 1{,}8 \text{ V}$$

3.19
non-constant envelope modulation
RF modulation schemes in which the amplitude of the carrier wave varies slowly in time compared with the period of the carrier itself. Examples include conventional amplitude modulation and TDMA

3.20
Pc
forward power needed to establish the calibration field strength

3.21
partial illumination
test method (using a minimum sized UFA of 1,5 × 1,5 m) in which the EUT face being tested does not fit completely within the UFA.

This test method may be applied for all test frequencies.

3.22
polarization
orientation of the electric field vector of a radiated field

3.23
shielded enclosure
screened or solid metal housing designed expressly for the purpose of isolating the internal from the external electromagnetic environment. The purpose is to prevent outside ambient electromagnetic fields from causing performance degradation and to prevent emission from causing interference to outside activities

3.24
sweep
continuous or incremental traverse over a range of frequencies

3.25
TDMA (time division multiple access)
time multiplexing modulation scheme which places several communication channels on the same carrier wave at an allocated frequency. Each channel is assigned a time slot during which, if the channel is active, the information is transmitted as a pulse of RF power. If the channel is not active no pulse is transmitted, thus the carrier envelope is not constant. During the pulse, the amplitude is constant and the RF carrier is frequency- or phase-modulated