



**NSAI**  
Standards

Irish Standard  
I.S. EN 61000-4-4:2012

# Electromagnetic compatibility (EMC) -- Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test (IEC 61000-4-4:2012 (EQV))

## I.S. EN 61000-4-4:2012

*Incorporating amendments/corrigenda issued since publication:*

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation - recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

<i>This document replaces:</i> EN 61000-4-4:2004/A1:2010	<i>This document is based on:</i> EN 61000-4-4:2012 EN 61000-4-4:2004/A1:2010	<i>Published:</i> 9 November, 2012 26 March, 2010
This document was published under the authority of the NSAI and comes into effect on:  14 November, 2012		ICS number: 33.100.20
<b>NSAI</b> 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie  W NSAI.ie	<b>Sales:</b> T +353 1 857 6730 F +353 1 857 6729 W standards.ie
Údarás um Chaighdeáin Náisiúnta na hÉireann		

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 61000-4-4**

November 2012

ICS 33.100.20

Supersedes EN 61000-4-4:2004 + A1:2010

English version

**Electromagnetic compatibility (EMC) -  
Part 4-4: Testing and measurement techniques -  
Electrical fast transient/burst immunity test  
(IEC 61000-4-4:2012)**

Compatibilité électromagnétique (CEM) -  
Partie 4-4: Techniques d'essai  
et de mesure -  
Essai d'immunité aux transitoires  
électriques rapides en salves  
(CEI 61000-4-4:2012)

Elektromagnetische Verträglichkeit (EMV) -  
Teil 4-4: Prüf- und Messverfahren -  
Prüfung der Störfestigkeit gegen schnelle  
transiente elektrische Störgrößen/Burst  
(IEC 61000-4-4:2012)

This European Standard was approved by CENELEC on 2012-06-04. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard 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 CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard 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 CEN-CENELEC Management Centre has the same status as the official versions.

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

**CENELEC**

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of document 77B/670/FDIS, future edition 3 of IEC 61000-4-4, prepared by SC 77B "High frequency phenomena" of IEC/TC 77 "Electromagnetic compatibility" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61000-4-4:2012.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-05-09
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-06-04

This document supersedes EN 61000-4-4:2004 + A1:2010.

EN 61000-4-4:2012 includes the following significant technical changes with respect to EN 61000-4-4:2004 + A1:2010:

This edition improves and clarifies simulator specifications, test criteria and test setups.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

## Endorsement notice

The text of the International Standard IEC 61000-4-4:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61000-4-2:2008	NOTE	Harmonised as EN 61000-4-2:2009 (not modified).
IEC 61000-4-4:2004	NOTE	Harmonised as EN 61000-4-4:2004 (not modified).
IEC 61000-4-4:2004/A1:2010	NOTE	Harmonised as EN 61000-4-4:2004/A1:2010 (not modified).
IEC 61000-4-5:2005	NOTE	Harmonised as EN 61000-4-5:2006 (not modified).

## **Annex ZA**

(normative)

### **Normative references to international publications with their corresponding European publications**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-161	1990	International Electrotechnical Vocabulary (IEV) - Chapter 161: Electromagnetic compatibility	-	-

*This page is intentionally left BLANK.*

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms, definitions and abbreviations .....	7
3.1 Terms and definitions .....	7
3.2 Abbreviations .....	10
4 General .....	10
5 Test levels.....	10
6 Test equipment.....	11
6.1 Overview .....	11
6.2 Burst generator .....	11
6.2.1 General .....	11
6.2.2 Characteristics of the fast transient/burst generator.....	12
6.2.3 Calibration of the characteristics of the fast transient/burst generator .....	14
6.3 Coupling/decoupling network for a.c./d.c. power port.....	15
6.3.1 Characteristics of the coupling/decoupling network.....	15
6.3.2 Calibration of the coupling/decoupling network .....	16
6.4 Capacitive coupling clamp .....	17
6.4.1 General .....	17
6.4.2 Calibration of the capacitive coupling clamp .....	18
7 Test setup .....	20
7.1 General.....	20
7.2 Test equipment .....	20
7.2.1 General .....	20
7.2.2 Verification of the test instrumentation .....	20
7.3 Test setup for type tests performed in laboratories .....	21
7.3.1 Test conditions .....	21
7.3.2 Methods of coupling the test voltage to the EUT .....	24
7.4 Test setup for in situ tests .....	26
7.4.1 Overview .....	26
7.4.2 Test on power ports and earth ports .....	26
7.4.3 Test on signal and control ports.....	27
8 Test procedure .....	28
8.1 General.....	28
8.2 Laboratory reference conditions .....	28
8.2.1 Climatic conditions .....	28
8.2.2 Electromagnetic conditions.....	28
8.3 Execution of the test.....	28
9 Evaluation of test results .....	29
10 Test report.....	29
Annex A (informative) Information on the electrical fast transients .....	30
Annex B (informative) Selection of the test levels .....	32
Annex C (informative) Measurement uncertainty (MU) considerations .....	34
Bibliography.....	43

Figure 1 – Simplified circuit diagram showing major elements of a fast transient/burst generator .....	12
Figure 2 – Representation of an electrical fast transient/burst .....	13
Figure 3 – Ideal waveform of a single pulse into a 50 $\Omega$ load with nominal parameters $t_r = 5$ ns and $t_w = 50$ ns .....	13
Figure 4 – Coupling/decoupling network for a.c./d.c. power mains supply ports/terminals .....	16
Figure 5 – Calibration of the waveform at the output of the coupling/decoupling network .....	17
Figure 6 – Example of a capacitive coupling clamp .....	18
Figure 7 – Transducer plate for coupling clamp calibration .....	19
Figure 8 – Calibration of a capacitive coupling clamp using the transducer plate .....	19
Figure 9 – Block diagram for electrical fast transient/burst immunity test .....	20
Figure 10 – Example of a verification setup of the capacitive coupling clamp .....	21
Figure 11 – Example of a test setup for laboratory type tests .....	22
Figure 12 – Example of test setup using a floor standing system of two EUTs .....	23
Figure 13 – Example of a test setup for equipment with elevated cable entries .....	24
Figure 14 – Example of a test setup for direct coupling of the test voltage to a.c./d.c. power ports for laboratory type tests .....	25
Figure 15 – Example for in situ test on a.c./d.c. power ports and protective earth terminals for stationary, floor standing EUT .....	26
Figure 16 – Example of in situ test on signal and control ports without the capacitive coupling clamp .....	27
Table 1 – Test levels .....	11
Table 2 – Output voltage peak values and repetition frequencies .....	15
Table C.1 – Example of uncertainty budget for voltage rise time ( $t_r$ ) .....	36
Table C.2 – Example of uncertainty budget for EFT/B peak voltage value ( $V_P$ ) .....	37
Table C.3 – Example of uncertainty budget for EFT/B voltage pulse width ( $t_w$ ) .....	38
Table C.4 – $\alpha$ factor (Equation (C.4)) of different unidirectional impulse responses corresponding to the same bandwidth of the system $B$ .....	40



## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

### ELECTROMAGNETIC COMPATIBILITY (EMC) –

#### Part 4-4: Testing and measurement techniques – Electrical fast transient/burst 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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 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 61000-4-4 has been prepared by subcommittee 77B: High frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

It forms Part 4-4 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 second edition published in 2004 and its amendment 1 (2010) and constitutes a technical revision.

This third edition improves and clarifies simulator specifications, test criteria and test setups.

**I.S. EN 61000-4-4:2012**

61000-4-4 © IEC:2012

– 5 –

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

FDIS	Report on voting
77B/670/FDIS	77B/673/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 list of all currently available parts of the IEC 61000 series, under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC web site.

The committee has decided that the contents of this publication will remain unchanged until the stability 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.

**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 document using a colour printer.**

## INTRODUCTION

IEC 61000 is published in separate parts, 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 are published with the part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

This part is an international standard which gives immunity requirements and test procedures related to electrical fast transients/bursts.

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

### **Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test**

#### **1 Scope**

This part of IEC 61000 relates to the immunity of electrical and electronic equipment to repetitive electrical fast transients. It gives immunity requirements and test procedures related to electrical fast transients/bursts. It additionally defines ranges of test levels and establishes test procedures.

The object of this standard is to establish a common and reproducible reference in order to evaluate the immunity of electrical and electronic equipment when subjected to electrical fast transient/bursts on supply, signal, control and earth ports. 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 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 is applied or not, and if applied, they are responsible for determining the appropriate test levels and performance criteria.<sup>1</sup>

The standard defines:

- test voltage waveform;
- range of test levels;
- test equipment;
- calibration and verification procedures of test equipment;
- test setups;
- test procedure.

The standard gives specifications for laboratory and in situ tests.

#### **2 Normative references**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-161:1990, *International Electrotechnical Vocabulary – Chapter 161: Electromagnetic compatibility*

#### **3 Terms, definitions and abbreviations**

##### **3.1 Terms and definitions**

For the purposes of this document, the terms and definitions of IEC 60050-161, as well as the following apply.

---

<sup>1</sup> TC 77 and its subcommittees are prepared to co-operate with product committees in the evaluation of the value of particular immunity tests for their products.

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

- 
- Looking for additional Standards? Visit Intertek Inform Infostore
  - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-