

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

This document is a preview generated by EVS

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 61000-4-4:2012 sisaldab Euroopa standardi EN 61000-4-4:2012 ingliskeelset teksti.	This Estonian standard EVS-EN 61000-4-4:2012 consists of the English text of the European standard EN 61000-4-4:2012.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 09.11.2012.	Date of Availability of the European standard is 09.11.2012.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 33.100.20

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Aru 10, 10317 Tallinn, Eesti; www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:
Aru 10, 10317 Tallinn, Estonia; www.evs.ee; phone 605 5050; e-mail info@evs.ee

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 document is a preview generated by EVS

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 Ω 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 – α factor (Equation (C.4)) of different unidirectional impulse responses corresponding to the same bandwidth of the system B	40

Generated by EVS

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.¹

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.

¹ 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.