

Electromagnetic compatibility (EMC) —

Part 4-4: Testing and measurement techniques — Electrical fast transient/burst immunity test

ICS 33.100.20

National foreword

This British Standard is the UK implementation of EN 61000-4-4:2004+A1:2010. It is identical to IEC 61000-4-4:2004, incorporating amendment 1:2010, and corrigenda August 2006 and June 2007. It supersedes BS EN 61000-4-4:2004 which will be withdrawn on March 2013.

The UK participation in its preparation was entrusted by Technical Committee GEL/210, EMC — Policy committee, to Subcommittee GEL/210/12, EMC basic, generic and low frequency phenomena standardization.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 2 February 2005

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Amendments/corrigenda issued since publication

Amd. No.	Date	Comments
16840 Corrigendum No.1	31 January 2007	Implementation of IEC corrigendum August 2006, replacement of Figure 4
	30 April 2008	Implementation of IEC corrigendum June 2007, revision of subclause 6.2.2
	31 May 2010	Implementation of IEC amendment 1:2010 with CENELEC endorsement A1:2010; Subclause 6.2.2 replaced

ISBN 978 0 580 67578 2

English version

Electromagnetic compatibility (EMC)
Part 4-4: Testing and measurement techniques -
Electrical fast transient/burst immunity test
(IEC 61000-4-4:2004)

Compatibilité électromagnétique (CEM)
Partie 4-4: Techniques d'essai
et de mesure -
Essais d'immunité aux transitoires
électriques rapides en salves
(CEI 61000-4-4:2004)

Elektromagnetische Verträglichkeit (EMV)
Teil 4-4: Prüf- und Messverfahren -
Prüfung der Störfestigkeit gegen schnelle
transiente elektrische Störgrößen/Burst
(IEC 61000-4-4:2004)

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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.

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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

Foreword

The text of document 77B/419/FDIS, future edition 2 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 was approved by CENELEC as EN 61000-4-4 on 2004-10-01.

This European Standard supersedes EN 61000-4-4:1995 + A1:2001 + A2:2001.

This new edition improves and clarifies simulator specifications, test criteria and test set-ups. Only common mode injection is required.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2005-07-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2007-10-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61000-4-4:2004 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61000-4-4 NOTE Harmonized as EN 61000-4-4:1995 (not modified).

Foreword to amendment A1

The text of document 77B/621/FDIS, future amendment 1 to IEC 61000-4-4:2004, 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 61000-4-4:2004 on 2010-03-01.

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

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) 2010-12-01
- latest date by which the national standards conflicting
with the amendment have to be withdrawn (dow) 2013-03-01

Endorsement notice

The text of amendment 1:2010 to the International Standard IEC 61000-4-4:2004 was approved by CENELEC as an amendment to the European Standard without any modification.

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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 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 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 61000-4 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 for evaluating 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 61000-4 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 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.

The standard defines:

- test voltage waveform;
- range of test levels;
- test equipment;
- verification procedures of test equipment;
- test set-up;
- test procedure.

The standard gives specifications for laboratory and post-installation tests.

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 60050-161:1990, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

3 Terms and definitions

For the purposes of this document, the following terms and definitions, together with those in IEC 60050-161 apply.

NOTE Several of the most relevant terms and definitions from IEC 60050-161 are presented among the definitions below.

3.1

burst

sequence of a limited number of distinct pulses or an oscillation of limited duration

[IEV 161-02-07]

3.2

calibration

set of operations which establishes, by reference to standards, the relationship which exists, under specified conditions, between an indication and a result of a measurement

NOTE 1 This term is based on the "uncertainty" approach.

NOTE 2 The relationship between the indications and the results of measurement can be expressed, in principle, by a calibration diagram.

[IEV 311-01-09]

3.3

coupling

interaction between circuits, transferring energy from one circuit to another

3.4

common mode (coupling)

simultaneous coupling to all lines versus the ground reference plane

3.5

coupling clamp

device of defined dimensions and characteristics for common mode coupling of the disturbance signal to the circuit under test without any galvanic connection to it

3.6

coupling network

electrical circuit for the purpose of transferring energy from one circuit to another

3.7

decoupling network

electrical circuit for the purpose of preventing EFT voltage applied to the EUT from affecting other devices, equipment or systems which are not under test

3.8

degradation (of performance)

undesired departure in the operational performance of any device, equipment or system from its intended performance

NOTE The term "degradation" can apply to temporary or permanent failure.

[IEV 161-01-19]

3.9

EFT/B

electrical fast transient/burst

3.10

electromagnetic compatibility (EMC)

ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

[IEV 161-01-07]

3.11

EUT

equipment under test

3.12

ground reference plane

flat conductive surface whose potential is used as a common reference

[IEV 161-04-36]

3.13

immunity (to a disturbance)

ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

[IEV 161-01-20]

3.14

port

particular interface of the EUT with the external electromagnetic environment

3.15

rise time

interval of time between the instants at which the instantaneous value of a pulse first reaches 10 % value and then the 90 % value

[IEV 161-02-05, modified]

3.16

transient

pertaining to or designating a phenomenon or a quantity which varies between two consecutive steady states during a time interval which is short compared with the time-scale of interest

[IEV 161-02-01]

3.17

verification

set of operations which is used to check the test equipment system (e.g. the test generator and the interconnecting cables) and to demonstrate that the test system is functioning within the specifications given in Clause 6

NOTE 1 The methods used for verification may be different from those used for calibration.

NOTE 2 The procedure of 6.1.2 and 6.2.2 is meant as a guide to insure the correct operation of the test generator, and other items making up the test set-up so that the intended waveform is delivered to the EUT.

NOTE 3 For the purpose of this basic EMC standard this definition is different from the definition given in IEC 311-01-13.

4 General

The repetitive fast transient test is a test with bursts consisting of a number of fast transients, coupled into power supply, control, signal and earth ports of electrical and electronic equipment. Significant for the test are the high amplitude, the short rise time, the high repetition rate, and the low energy of the transients.

The test is intended to demonstrate the immunity of electrical and electronic equipment when subjected to types of transient disturbances such as those originating from switching transients (interruption of inductive loads, relay contact bounce, etc.).

5 Test levels

The preferred test levels for the electrical fast transient test, applicable to power, ground, signal and control ports of the equipment are given in Table 1.

Table 1 – Test levels

Open circuit output test voltage and repetition rate of the impulses				
Level	On power port, PE		On I/O (input/output) signal, data and control ports	
	Voltage peak kV	Repetition rate kHz	Voltage peak kV	Repetition rate kHz
1	0,5	5 or 100	0,25	5 or 100
2	1	5 or 100	0,5	5 or 100
3	2	5 or 100	1	5 or 100
4	4	5 or 100	2	5 or 100
X ^a	Special	Special	Special	Special
NOTE 1 Use of 5 kHz repetition rates is traditional; however, 100 kHz is closer to reality. Product committees should determine which frequencies are relevant for specific products or product types.				
NOTE 2 With some products, there may be no clear distinction between power ports and I/O ports, in which case it is up to product committees to make this determination for test purposes.				
^a "X" is an open level. The level has to be specified in the dedicated equipment specification.				

These open-circuit output voltages will be displayed on the EFT/B generator. For selection of levels, see Annex B.

6 Test equipment

The verification procedures of 6.1.2 and 6.2.2 are meant as a guide to insure the correct operation of the test generator, coupling/decoupling networks, and other items making up the test set-up so that the intended waveform is delivered to the EUT.