Electromagnetic compatibility (EMC) –

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

This English-language version is derived from the original bilingual publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.
Electromagnetic compatibility (EMC) –

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

© IEC 2004 Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11  Telefax: +41 22 919 03 00  E-mail: inmail@iec.ch  Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE V
For price, see current catalogue
CONTENTS

FOREWORD ........................................................................................................................................... 7
INTRODUCTION ...................................................................................................................................... 11

1 Scope .................................................................................................................................................. 13
2 Normative references ......................................................................................................................... 13
3 Terms and definitions ......................................................................................................................... 15
4 General ............................................................................................................................................... 19
5 Test levels .......................................................................................................................................... 19
6 Test equipment ................................................................................................................................... 19
6.1 Burst generator ............................................................................................................................... 21
6.2 Coupling/decoupling network for a.c./d.c. mains supply port ...................................................... 23
6.3 Capacitive coupling clamp ............................................................................................................. 27
7 Test set-up ......................................................................................................................................... 27
7.1 Test equipment ............................................................................................................................... 29
7.2 Test set-up for type tests performed in laboratories ...................................................................... 29
7.3 Test set-up for post-installation tests ........................................................................................... 33
8 Test procedure ..................................................................................................................................... 35
8.1 Laboratory reference conditions ................................................................................................. 35
8.2 Execution of the test ....................................................................................................................... 37
9 Evaluation of test results .................................................................................................................. 37
10 Test report ......................................................................................................................................... 39

Annex A (informative) Information on the electrical fast transients ....................................................... 55
Annex B (informative) Selection of the test levels .................................................................................. 59

Bibliography ........................................................................................................................................... 63

Figure 1 – Simplified circuit diagram of a fast transient/burst generator ............................................. 41
Figure 2 – General graph of a fast transient/burst .............................................................................. 41
Figure 3 – Waveshape of a single pulse into a 50 Ω load ..................................................................... 43
Figure 4 – Coupling/decoupling network for a.c./d.c. power mains supply ports/terminals ............... 43
Figure 5 – Construction of the capacitive coupling clamp .................................................................. 45
Figure 6 – Block diagram for electrical fast transient/burst immunity test ....................................... 45
Figure 7 – General test set-up for laboratory type tests ...................................................................... 47
Figure 8 – Example of a test set-up for rack mounted equipment ...................................................... 47
Figure 9 – Example of a test set-up for direct coupling of the test voltage to a a.c./d.c. power supply ports/terminal for laboratory purposes ........................................................................ 49
Figure 10 – Example of test set-up for application of the test voltage by the capacitive coupling clamp for laboratory test purposes .............................................................. 49
Figure 11 – Example for post-installation test on a.c./d.c. power supply ports and protective earth terminals for stationary, floor-mounted EUT .................................................................51
Figure 12 – Example for post-installation test on a.c. mains supply port and protective earth terminals for non-stationary mounted EUT ...........................................................................53
Figure 13 – Example of post-installation test on communications and I/O ports without the capacitive coupling clamp ...............................................................................................53
Figure 14 – Verification of the waveform at the common mode output of the coupling/decoupling network ..................................................................................................................25

Table 1 – Test levels ...........................................................................................................19
Table 2 – Output voltage peak values and repetition rates ..............................................23
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 provides no marking procedure to indicate its approval and cannot be held responsible 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.

6) All users should ensure that they have the latest edition of this publication.

7) 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 sub-committee 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 second edition improves and clarifies simulator specifications, test criteria and test set-ups. Only common mode injection is required.
The text of this standard is based on the following documents:

<table>
<thead>
<tr>
<th>FDIS</th>
<th>Report on voting</th>
</tr>
</thead>
<tbody>
<tr>
<td>77B/419/FDIS</td>
<td>77B/424/RVD</td>
</tr>
</tbody>
</table>

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 corrigendum of August 2006 and June 2007 have been included in this copy.
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.
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.