

Australian/New Zealand Standard™

Electromagnetic compatibility (EMC)

Part 4.4: Testing and measurement techniques—Electrical fast transient/burst immunity test



AS/NZS IEC 61000.4.4:2013

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee TE-003, Electromagnetic Interference. It was approved on behalf of the Council of Standards Australia on 22 May 2013 and on behalf of the Council of Standards New Zealand on 23 April 2013.
This Standard was published on 20 June 2013.

The following are represented on Committee TE-003:

Australian Broadcasting Corporation
Australian Communications and Media Authority
Australian Industry Group
Australian Information Industry Association
Consumer Electronics Suppliers Association
Consumers Federation of Australia
Curtin University of Technology
Department of Defence, Australia
Electrical Compliance Testing Association
Energy Networks Association
Engineers Australia
Lighting Council New Zealand
Lighting Council of Australia
Ministry of Economic Development, New Zealand
National Measurement Institute
Wireless Institute Australia

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.saiglobal.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the online catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

Australian/New Zealand Standard™

Electromagnetic compatibility (EMC)

Part 4.4: Testing and measurement techniques—Electrical fast transient/burst immunity test

Originally as AS/NZS 61000.4.4:2006.
Jointly revised and designated AS/NZS IEC 61000.4.4:2013.

COPYRIGHT

© Standards Australia Limited/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, Private Bag 2439, Wellington 6140.

ISBN 978 1 74342 478 0

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee TE-003, Electromagnetic Interference, to supersede AS/NZS 61000.4.4:2006.

The objective 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 Standard describes a consistent method to assess the immunity of equipment or a system against a defined phenomenon.

This Standard is identical with, and has been reproduced from IEC 61000-4-4, Ed. 2.0 (2012), *Electromagnetic compatibility (EMC), Part 4-4: Testing and measurement techniques—Electrical fast transient/burst immunity test*.

As this Standard is reproduced from an International Standard, the following applies:

- (a) Its number appears on the cover and title page while the International Standard number appears only on the cover.
- (b) In the source text 'this part of IEC 61000' should read 'this Australian/New Zealand Standard'.
- (c) A full point substitutes for a comma when referring to a decimal mark.

None of the normative references in the source document have been adopted as Australian or Australian/New Zealand Standards.

The term 'informative' has been used in this Standard to define the application of the annex to which it applies. An informative annex is only for information and guidance.

CONTENTS

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 electrical 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

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.

AUSTRALIAN/NEW ZEALAND STANDARD

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 the IEC 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 procedure 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 60050-101:1990, *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.