IEC 61000-4-24

Edition 2.1 2023-08
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

colour inside

Electromagnetic compatibility (EMC) – Part 4-24: Testing and measurement techniques – Test methods for protective devices for HEMP conducted disturbance

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.100.01

ISBN 978-2-8322-7451-4

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

IEC 61000-4-24

Edition 2.1 2023-08
CONSOLIDATED VERSION

REDLINE VERSION

colour inside

Electromagnetic compatibility (EMC) – Part 4-24: Testing and measurement techniques – Test methods for protective devices for HEMP conducted disturbance



IEC 61000-4-24:2015-11+AMD1:2023-08 CSV(en)

CONTENTS

FOREWORD 5
INTRODUCTION 7
1 Scope 8
2 Normative references 8
3 Terms, definitions and abbreviated terms 8
3.1 Terms and definitions 8
3.2 Abbreviated terms 10
4 Test methods for protective devices (excluding filter) for conducted disturbance 10
4.1 General 10
4.2 Test setup 11
4.3 Pulse generator 11
4.4 Launching line 11
4.5 Test fixtures 12
4.5.1 General 12
4.5.2 Type A fixtures 12
4.5.3 Type B fixtures 12
4.6 Termination 13
4.7 Oscilloscope 14
4.8 Test procedure 14
4.8.1 Adjustment of the pulse generator 14
4.8.2 Verification procedures 14
4.8.3 Test 15
4.8.4 Final examination of the DUT 15
4.9 Referring to this standard 15
5 Measurement method for HEMP combination filters 16
5.1 Verification setup 16
5.2 Measurement setup 16
5.3 Measurement instrument 17
5.3.1 Pulse generators 17
5.3.2 Oscilloscope 19
5.3.3 Current sensors 19
5.3.4 Test loads 19
5.4 Test modes required 19
5.5 Measurement procedure 21
5.5.1 General 21
5.5.2 Verification of pulses 21
5.5.3 Measurement procedure 21
5.6 Evaluation of test results 22
5.7 Test report 23
6 Measurement method of HEMP protectors for RF antenna ports 23
6.1 General 23
6.2 Test level and injection waveform specification 24
6.3 Verification of test level 24
6.4 Measurement procedure 25
6.5 Evaluation of test results 25
6.6 Test report 26

Annex A (informative) Investigation for the establishment of a measurement setup 27
A.1 General 27
A.2 Variation of the cable connected for the measurement of short-circuit current 27
A.3 Variation of the length of the cable L2 connected for the measurement of residual current 30
A.4 Variation of load impedance and cable length for connection between load and ground 34
A.5 Variation of the cable length between load and ground 36
Annex B (informative) Test method for the quantitative determination of the direct response behaviours of a coaxial surge protector 39
Annex C (informative) Residual measurements for antenna port protectors 43
C.1 Evaluating the required protection for RF antenna ports 43
C.2 Evaluating the required protection for RF antenna ports 45
Bibliography 48

Figure 1 – Test setup for testing protective devices 11
Figure 2 – Example of a type B test fixture (universal) 14
Figure 3 – Typical setup for verification of the pulse test level 16
Figure 4 – Example of test setup using one or two shielded enclosures 17
Figure 5 – Example of test setup using a shielded enclosure 17
Figure 6 – Double exponential waveform 19
Figure 7 – Example of wiring setup of a single line DUT 20
Figure 8 – Example of wiring setup for a mutually coupled multi-line DUT 20
Figure 9 – Typical verification setup 24
Figure 10 – Typical measurement setup 25
Figure A.1 – Setup for calibration 27
Figure A.2 – Peak current calibration results with 9 mm^2 cables: 1 000 A ± 4 % 28
Figure A.3 – Rise time calibration results with 9 mm^2 cables 29
Figure A.4 – FWHM calibration results with 9 mm^2 cables 29
Figure A.5 – Peak current calibration results with 4 mm^2 cables: 1 000 A ± 8 % 29
Figure A.6 – Rise time calibration results with 4 mm^2 cables 30
Figure A.7 – FWHM calibration results with 4 mm^2 cables 30
Figure A.8 – Measurement setup for residual current 31
Figure A.9 – Measurement result of peak current with variation of measurement cable L2 32
Figure A.10 – Measurement result of peak rate of rise with variation of measurement cable L2 32
Figure A.11 – Measurement result of root action with variation of measurement cable L2 32
Figure A.12 – Variation of the position of current sensor 2 on the measurement cable L2 33
Figure A.13 – Peak current with variation of cable L2 and at different positions 33
Figure A.14 – Peak rate of rise with variation of cable L2 and at different positions 34
Figure A.15 – Root action with variation of cable L2 and at different positions 34
Figure A.16 – Measurement result of peak current with variation of load impedance. 35
Figure A.17 – Measurement result of peak rate of rise with variation of load impedance 35

Figure A.18 – Measurement result of root action with variation of load impedance. 36
Figure A.19 – Variation of the length of cable L3 connected between load and ground plane 36
Figure A.20 – Measurement result of peak current with variation of measurement cable L3 37
Figure A.21 – Measurement result of peak rate of rise with variation of measurement cable L3 37
Figure A.22 – Measurement result of root action with variation of measurement cable L3 38
Figure B.1 – Test setup with a power divider for testing protective devices 39
Figure B.2 – Waves propagating along the branches 40
Figure B.3 – Simplified test setup for testing protective devices 41
Figure C.1 – Transceiver with antenna port shown 43
Figure C.2 – Protectors on RX and TX signal path internal to the transceiver after the RF port 44
Figure C.3 – Protector internal to equipment for RX side protection and outside the equipment at the antenna port for transmit and port protection 44
Figure C.4 – N-type RF antenna port protector using GDTs 45
Figure C.5 – Typical antenna system with RF-HEMP protector (DUT) 46

Table 1 – Overview of conducted early-time HEMP (CEP) test requirements defined in other specifications 18
Table 2 – Overview of conducted intermediate-time HEMP (CIP) test requirements defined in other specifications 18
Table 3 – Test mode and DUT wiring setup 21
Table 4 – Performance criteria of filter against early-time HEMP – AC power port with nominal load 2 Ω 22
Table 5 – Performance criteria of filter against early-time HEMP – DC power port with nominal load 2 Ω 22
Table 6 – Performance criteria of filter against early-time HEMP – Signal, data and control port with nominal load 50 Ω 23
Table 7 – Pulsed current injection test level for RF antenna ports 24
Table 8 – Performance criteria of filters against early-time HEMP – RF antenna ports 25
Table A.1 – Measurement results for the waveform calibration of short-circuit current 28
Table A.2 – Measurement results for variation of the cable length at the measurement points 31
Table A.3 – Measurement results for variation of the load impedance 35
Table A.4 – Measurement results for variation of the cable length between load and ground 37

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-24: Testing and measurement techniques – Test methods for protective devices for HEMP conducted disturbance

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.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 61000-4-24 edition 2.1 contains the second edition (2015-11) [documents 77C/245/FDIS and 77C/250/RVD] and its amendment 1 (2023-08) [documents 77C/330/FDIS and 77C/331/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 61000-4-24 has been prepared by subcommittee 77C: High power transient phenomena, of IEC technical committee 77: Electromagnetic compatibility.

It forms Part 4-24 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

This second edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) A new Clause 5: Measurement method for HEMP combination filters, which contains 5.1 Verification setup, 5.2 Measurement setup, 5.3 Measurement instrument, 5.4 Test modes, 5.5 Measurement procedures, 5.6 Evaluation of test results, which introduced performance criteria of filter, and 5.7 Test report.
b) A new informative Annex A: Investigation for the establishment of a measurement setup, which was based on Clause 5.
c) A new informative Annex B: Test method for the quantitative determination of the direct response behaviours of a coaxial surge protector.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

The committee has decided that the contents of this document and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document 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

This standard is part of the IEC 61000 series of standards, 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

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, 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: IEC 61000-6-1).

The IEC has initiated the preparation of standardized methods to protect civilian society from the effects of high power electromagnetic (HPEM) environments. Such effects could disrupt systems for communications, electric power, information technology, etc.

This part of IEC 61000 is an international standard that establishes the required test procedures for protective devices for HEMP conducted disturbance, such as gas discharge tubes, varistors, two-port SPDs and HEMP combination filters.

The application of this standard is, however, not dependent on access to other sections and parts of the IEC 61000, except for those specifically referred to.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-24: Testing and measurement techniques – Test methods for protective devices for HEMP conducted disturbance

1 Scope

This part of IEC 61000 deals with methods for testing protective devices for HEMP conducted disturbance. It includes two-terminal elements, such as gas discharge tubes, varistors, and two-port SPDs, such as HEMP combination filters. It covers testing of voltage breakdown and voltage-limiting characteristics but also methods to measure the residual voltage and/or the residual current, peak rate of rise and root action for the case of very fast changes of voltage and current as a function of time.

This standard does not cover insertion loss measurement methods.

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 61000-2-10:2021, *Electromagnetic compatibility (EMC) – Part 2-10: Environment – Description of HEMP environment – Conducted disturbance*

IEC 61000-4-24

Edition 2.1 2023-08
CONSOLIDATED VERSION

FINAL VERSION

colour inside

Electromagnetic compatibility (EMC) – Part 4-24: Testing and measurement techniques – Test methods for protective devices for HEMP conducted disturbance



IEC 61000-4-24:2015-11+AMD1:2023-08 CSV(en)

CONTENTS

FOREWORD 5
INTRODUCTION 7
1 Scope 8
2 Normative references 8
3 Terms, definitions and abbreviated terms 8
3.1 Terms and definitions 8
3.2 Abbreviated terms 10
4 Test methods for protective devices (excluding filter) for conducted disturbance 10
4.1 General 10
4.2 Test setup 11
4.3 Pulse generator 11
4.4 Launching line 11
4.5 Test fixtures 12
4.5.1 General 12
4.5.2 Type A fixtures 12
4.5.3 Type B fixtures 12
4.6 Termination 13
4.7 Oscilloscope 14
4.8 Test procedure 14
4.8.1 Adjustment of the pulse generator 14
4.8.2 Verification procedures 14
4.8.3 Test 15
4.8.4 Final examination of the DUT 15
4.9 Referring to this standard 15
5 Measurement method for HEMP combination filters 16
5.1 Verification setup 16
5.2 Measurement setup 16
5.3 Measurement instrument 17
5.3.1 Pulse generators 17
5.3.2 Oscilloscope 19
5.3.3 Current sensors 19
5.3.4 Test loads 19
5.4 Test modes required 19
5.5 Measurement procedure 21
5.5.1 General 21
5.5.2 Verification of pulses 21
5.5.3 Measurement procedure 21
5.6 Evaluation of test results 22
5.7 Test report 23
6 Measurement method of HEMP protectors for RF antenna ports 23
6.1 General 23
6.2 Test level and injection waveform specification 24
6.3 Verification of test level 24
6.4 Measurement procedure 25
6.5 Evaluation of test results 25
6.6 Test report 26

Annex A (informative) Investigation for the establishment of a measurement setup 27
A.1 General 27
A.2 Variation of the cable connected for the measurement of short-circuit current 27
A.3 Variation of the length of the cable L2 connected for the measurement of residual current 30
A.4 Variation of load impedance and cable length for connection between load and ground 34
A.5 Variation of the cable length between load and ground 36
Annex B (informative) Test method for the quantitative determination of the direct response behaviours of a coaxial surge protector 39
Annex C (informative) Residual measurements for antenna port protectors 43
C.1 Evaluating the required protection for RF antenna ports 43
C.2 Evaluating the required protection for RF antenna ports 45
Bibliography 48

Figure 1 – Test setup for testing protective devices 11
Figure 2 – Example of a type B test fixture (universal) 14
Figure 3 – Typical setup for verification of the pulse test level 16
Figure 4 – Example of test setup using one or two shielded enclosures 17
Figure 5 – Example of test setup using a shielded enclosure 17
Figure 6 – Double exponential waveform 19
Figure 7 – Example of wiring setup of a single line DUT 20
Figure 8 – Example of wiring setup for a mutually coupled multi-line DUT 20
Figure 9 – Typical verification setup 24
Figure 10 – Typical measurement setup 25
Figure A.1 – Setup for calibration 27
Figure A.2 – Peak current calibration results with 9 mm^2 cables: 1 000 A ± 4 % 28
Figure A.3 – Rise time calibration results with 9 mm^2 cables 29
Figure A.4 – FWHM calibration results with 9 mm^2 cables 29
Figure A.5 – Peak current calibration results with 4 mm^2 cables: 1 000 A ± 8 % 29
Figure A.6 – Rise time calibration results with 4 mm^2 cables 30
Figure A.7 – FWHM calibration results with 4 mm^2 cables 30
Figure A.8 – Measurement setup for residual current 31
Figure A.9 – Measurement result of peak current with variation of measurement cable L2 32
Figure A.10 – Measurement result of peak rate of rise with variation of measurement cable L2 32
Figure A.11 – Measurement result of root action with variation of measurement cable L2 32
Figure A.12 – Variation of the position of current sensor 2 on the measurement cable L2 33
Figure A.13 – Peak current with variation of cable L2 and at different positions 33
Figure A.14 – Peak rate of rise with variation of cable L2 and at different positions 34
Figure A.15 – Root action with variation of cable L2 and at different positions 34
Figure A.16 – Measurement result of peak current with variation of load impedance. 35
Figure A.17 – Measurement result of peak rate of rise with variation of load impedance 35

Figure A.18 – Measurement result of root action with variation of load impedance. 36
Figure A.19 – Variation of the length of cable L3 connected between load and ground plane 36
Figure A.20 – Measurement result of peak current with variation of measurement cable L3 37
Figure A.21 – Measurement result of peak rate of rise with variation of measurement cable L3 37
Figure A.22 – Measurement result of root action with variation of measurement cable L3 38
Figure B.1 – Test setup with a power divider for testing protective devices 39
Figure B.2 – Waves propagating along the branches 40
Figure B.3 – Simplified test setup for testing protective devices 41
Figure C.1 – Transceiver with antenna port shown 43
Figure C.2 – Protectors on RX and TX signal path internal to the transceiver after the RF port 44
Figure C.3 – Protector internal to equipment for RX side protection and outside the equipment at the antenna port for transmit and port protection 44
Figure C.4 – N-type RF antenna port protector using GDTs 45
Figure C.5 – Typical antenna system with RF-HEMP protector (DUT) 46

Table 1 – Overview of conducted early-time HEMP (CEP) test requirements defined in other specifications 18
Table 2 – Overview of conducted intermediate-time HEMP (CIP) test requirements defined in other specifications 18
Table 3 – Test mode and DUT wiring setup 21
Table 4 – Performance criteria of filter against early-time HEMP – AC power port with nominal load 2 Ω 22
Table 5 – Performance criteria of filter against early-time HEMP – DC power port with nominal load 2 Ω 22
Table 6 – Performance criteria of filter against early-time HEMP – Signal, data and control port with nominal load 50 Ω 23
Table 7 – Pulsed current injection test level for RF antenna ports 24
Table 8 – Performance criteria of filters against early-time HEMP – RF antenna ports 25
Table A.1 – Measurement results for the waveform calibration of short-circuit current 28
Table A.2 – Measurement results for variation of the cable length at the measurement points 31
Table A.3 – Measurement results for variation of the load impedance 35
Table A.4 – Measurement results for variation of the cable length between load and ground 37

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-24: Testing and measurement techniques – Test methods for protective devices for HEMP conducted disturbance

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.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 61000-4-24 edition 2.1 contains the second edition (2015-11) [documents 77C/245/FDIS and 77C/250/RVD] and its amendment 1 (2023-08) [documents 77C/330/FDIS and 77C/331/RVD].

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 61000-4-24 has been prepared by subcommittee 77C: High power transient phenomena, of IEC technical committee 77: Electromagnetic compatibility.

It forms Part 4-24 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

This second edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) A new Clause 5: Measurement method for HEMP combination filters, which contains 5.1 Verification setup, 5.2 Measurement setup, 5.3 Measurement instrument, 5.4 Test modes, 5.5 Measurement procedures, 5.6 Evaluation of test results, which introduced performance criteria of filter, and 5.7 Test report.
b) A new informative Annex A: Investigation for the establishment of a measurement setup, which was based on Clause 5.
c) A new informative Annex B: Test method for the quantitative determination of the direct response behaviours of a coaxial surge protector.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

The committee has decided that the contents of this document and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document 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

This standard is part of the IEC 61000 series of standards, 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

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, 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: IEC 61000-6-1).

The IEC has initiated the preparation of standardized methods to protect civilian society from the effects of high power electromagnetic (HPEM) environments. Such effects could disrupt systems for communications, electric power, information technology, etc.

This part of IEC 61000 is an international standard that establishes the required test procedures for protective devices for HEMP conducted disturbance, such as gas discharge tubes, varistors, two-port SPDs and HEMP combination filters.

The application of this standard is, however, not dependent on access to other sections and parts of the IEC 61000, except for those specifically referred to.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-24: Testing and measurement techniques – Test methods for protective devices for HEMP conducted disturbance

1 Scope

This part of IEC 61000 deals with methods for testing protective devices for HEMP conducted disturbance. It includes two-terminal elements, such as gas discharge tubes, varistors, and two-port SPDs, such as HEMP combination filters. It covers testing of voltage breakdown and voltage-limiting characteristics but also methods to measure the residual voltage and/or the residual current, peak rate of rise and root action for the case of very fast changes of voltage and current as a function of time.

This standard does not cover insertion loss measurement methods.

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 61000-2-10:2021, *Electromagnetic compatibility (EMC) – Part 2-10: Environment – Description of HEMP environment – Conducted disturbance*