

MADALPINGELISED ALALISVOOLUVÄLJUNDIGA  
TOITEALLIKAD. OSA 3: ELEKTROMAGNETILINE  
ÜHILDUVUS

Low-voltage switch mode power supplies - Part 3:  
Electromagnetic compatibility (EMC)

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN IEC 61204-3:2018 sisaldab Euroopa standardi EN IEC 61204-3:2018 ingliskeelset teksti.	This Estonian standard EVS-EN IEC 61204-3:2018 consists of the English text of the European standard EN IEC 61204-3:2018.
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 07.09.2018.	Date of Availability of the European standard is 07.09.2018.
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](mailto:standardiosakond@evs.ee).

ICS 29.200, 33.100

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:  
Koduleht [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto: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:

Homepage [www.evs.ee](http://www.evs.ee); phone +372 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

English Version

**Low-voltage switch mode power supplies - Part 3:  
Electromagnetic compatibility (EMC)  
(IEC 61204-3:2016)**

Alimentations à découpage basse tension - Partie 3:  
Compatibilité électromagnétique (CEM)  
(IEC 61204-3:2016)

Stromversorgungsgeräte für Niederspannung mit  
Gleichstromausgang - Teil 3: Elektromagnetische  
Verträglichkeit (EMV)  
(IEC 61204-3:2016)

This European Standard was approved by CENELEC on 2018-07-09. 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

## European foreword

The text of document 22E/174/FDIS, future edition 3 of IEC 61204-3, prepared by SC 22E "Stabilized power supplies" of IEC/TC 22 "Power electronic systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61204-3:2018.

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) 2019-04-09
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2021-07-09

This document supersedes EN 61204-3:2000.

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

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

## Endorsement notice

The text of the International Standard IEC 61204-3:2016 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 60364-4-41	NOTE	Harmonized as HD 60364-4-41.
IEC 60664-1	NOTE	Harmonized as EN 60664-1.
IEC 61000-1-2	NOTE	Harmonized as EN 61000-1-2.
IEC 61000-3-11	NOTE	Harmonized as EN 61000-3-11.
IEC 61558-1	NOTE	Harmonized as EN 61558-1.
IEC 62040-1	NOTE	Harmonized as EN 62040-1.
ISO/IEC 17025	NOTE	Harmonized as EN ISO/IEC 17025.
CISPR 14-1:2005	NOTE	Harmonized as EN 55014-1:2006 (not modified).
CISPR 15	NOTE	Harmonized as EN 55015.

## Annex ZA

(normative)

### Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-121	-	International Electrotechnical Vocabulary (IEV) -- Part 121: Electromagnetism	-	-
IEC 60050-151	-	International Electrotechnical Vocabulary - Part 151: Electrical and magnetic devices	-	-
IEC 60050-161	-	International Electrotechnical Vocabulary (IEV) -- Chapter 161: Electromagnetic compatibility	-	-
IEC 60050-551	-	International Electrotechnical Vocabulary (IEV) -- Part 551: Power electronics	-	-
IEC 60065	-	Audio, video and similar electronic apparatus - Safety requirements	EN 60065	-
IEC 60146-1-1	-	Semiconductor convertors - General requirements and line commutated convertors -- Part 1-1: Specifications of basic requirements	-	-
IEC 60601-1	-	Medical electrical equipment - Part 1: General requirements for basic safety and essential performance	EN 60601-1	-
IEC 60950-1	-	Information technology equipment - Safety - Part 1: General requirements	EN 60950-1	-
IEC 61000-3-2	2014	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current - 16 A per phase)	EN 61000-3-2	2014
IEC 61000-3-3	-	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current - 16 A per phase and not subject to conditional connection	EN 61000-3-3	-

IEC 61000-3-12	-	Electromagnetic compatibility (EMC) -- Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase	EN 61000-3-12	-
IEC 61000-4-2	-	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	-
IEC 61000-4-3	-	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	-	-
IEC 61000-4-4	-	Electromagnetic compatibility (EMC) -- Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	EN 61000-4-4	-
IEC 61000-4-5	-	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	-
IEC 61000-4-6	-	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	-
IEC 61000-4-8	-	Electromagnetic compatibility (EMC) -- Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	EN 61000-4-8	-
IEC 61000-4-11	-	Electromagnetic compatibility (EMC) -- Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	EN 61000-4-11	-
IEC 61000-6-1	-	Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments	EN 61000-6-1	-
IEC 61000-6-2	-	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments	EN 61000-6-2	-
IEC 61000-6-3	-	Electromagnetic compatibility (EMC) -- Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments	EN 61000-6-3	-
IEC 61000-6-4	-	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments	EN IEC 61000-6-4	-
IEC 61010-1	-	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements	EN 61010-1	-
IEC 62368-1	-	Audio/video, information and communication technology equipment - Part 1: Safety requirements	EN 62368-1	-

CISPR 11	-	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement	EN 55011	-
CISPR 16-1	series	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus	EN 55016-1	series
CISPR 16-1-2	2014	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-2: Radio disturbance and immunity measuring apparatus - Coupling devices for conducted disturbance measurements	EN 55016-1-2	2014
CISPR 16-1-3	-	Specification for radio disturbance and immunity measuring apparatus and methods -- Part 1-3: Radio disturbance and immunity measuring apparatus - Ancillary equipment - Disturbance power	EN 55016-1-3	-
CISPR 16-2-1	2014	Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-1: Methods of measurement of disturbances and immunity - Conducted disturbance measurements	EN 55016-2-1	2014
CISPR 16-2-2	-	Specification for radio disturbance and immunity measuring apparatus and methods -- Part 2-2: Methods of measurement of disturbances and immunity - Measurement of disturbance power	EN 55016-2-2	-
CISPR 16-2-3	-	Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-3: Methods of measurement of disturbances and immunity - Radiated disturbance measurements	EN 55016-2-3	-

## CONTENTS

FOREWORD .....	4
1 Scope and object .....	6
1.1 Scope .....	6
1.1.1 Equipment covered by this document .....	6
1.1.2 Additional requirements .....	6
1.1.3 Exclusions .....	6
1.1.4 Types of power supply .....	7
1.1.5 Configurations and combinations of power supplies .....	7
1.2 Object .....	8
2 Normative references .....	8
3 Terms and definitions .....	10
4 Applicability of tests to different PSU technologies .....	13
5 General requirements and test conditions .....	14
5.1 General requirements .....	14
5.2 Test conditions .....	14
6 Emission requirements .....	14
6.1 General .....	14
6.2 Low frequency phenomena ( $f \leq 9$ kHz; AC input only) .....	14
6.2.1 Commutation notches .....	14
6.2.2 Current harmonics and interharmonics .....	14
6.2.3 Voltage fluctuations and flicker .....	15
6.3 High frequency conducted emission .....	15
6.3.1 General .....	15
6.3.2 High frequency conducted emission for input power ports .....	15
6.3.3 High frequency conducted emission for DC output power ports .....	16
6.4 High frequency radiated emission .....	16
6.4.1 General .....	16
6.4.2 Radiated disturbance measurements .....	16
6.4.3 Measurement of disturbance power .....	16
6.4.4 Restrictions for the application of interference power measurement .....	17
7 Immunity requirements .....	18
7.1 Performance criteria .....	18
7.2 Basic immunity requirements, high frequency disturbances .....	18
7.2.1 General .....	18
7.2.2 Immunity level for residential, commercial and light industrial environment .....	18
7.2.3 Immunity level for industrial environment .....	21
8 Power supply families aspects .....	24
9 Statistical aspects .....	25
10 Safety aspects .....	25
11 Test report .....	25
Annex A (normative) Guidelines on the classification of PSUs .....	26
A.1 General .....	26
A.2 Stand alone power supplies .....	26
A.3 Component power supplies .....	26



Annex B (informative) Commutation notches.....	28
Annex C (informative) Calculation and simulation of the input current harmonics .....	29
Annex D (informative) Special considerations for DC/DC converters .....	30
D.1 General.....	30
D.2 Emission .....	30
D.3 Immunity .....	30
Annex E (informative) Critical frequency for high frequency power measurement.....	33
Annex F (normative) Guidelines on power supply families.....	34
F.1 General.....	34
F.2 Emission .....	34
F.3 Immunity performance .....	34
Annex G (informative) Summary of classification of environments and limits .....	36
G.1 Residential, commercial and light industrial environment .....	36
G.2 Industrial environment.....	36
G.3 Special applications .....	36
G.4 Special considerations for DC/DC converters .....	37
Annex H (normative) Emission limits .....	38
Bibliography.....	40
Figure 1 – Examples of ports .....	11
Figure 2 – Test set-up for the measurement of disturbance power .....	17
Table 1 – Criteria to prove the performance of a PSU against EM disturbances .....	18
Table 2 – Immunity – Enclosure port – Residential, commercial and light industrial environment.....	19
Table 3 – Immunity – Ports for signal lines and control lines Residential, commercial and light industrial environment .....	19
Table 4 – Immunity – DC input and output power ports Residential, commercial and light industrial environment .....	20
Table 5 – Immunity – AC input power ports – Residential, commercial and light industrial environment.....	21
Table 6 – Immunity – Enclosure port – Industrial environment.....	22
Table 7 – Immunity – Ports for signal lines and control lines – Industrial environment.....	22
Table 8 – Immunity – DC input and output power ports – Industrial environment.....	23
Table 9 – Immunity – AC input power ports – Industrial environment.....	24
Table A.1 – Classification of power supplies and the relevant EMC standards .....	27
Table D.1 – Immunity – DC input power ports – Input category a .....	31
Table D.2 – Immunity – DC input power ports – Input category b .....	31
Table D.3 – Immunity – Enclosure port – Input categories a and b .....	32
Table H.1 – Limits of mains terminal disturbance voltage (AC input port).....	38
Table H.2 – Limits of mains terminal disturbance voltage (DC input and DC output power port) .....	38
Table H.3 – Limits for electromagnetic radiation/interference power disturbance (all field strength limits refer to quasi-peak measurements) .....	39
Table H.4 – Disturbance power limits for the frequency range 30 MHz to 300 MHz .....	39

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**LOW-VOLTAGE SWITCH MODE POWER SUPPLIES –****Part 3: Electromagnetic compatibility (EMC)**

## 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.

International Standard IEC 61204-3 has been prepared by subcommittee 22E: Stabilized power supplies, of IEC technical committee 22: Power electronic systems and equipment.

IEC 61204-3 has the status of a product family standard.

This third edition cancels and replaces the second edition published in 2011. This edition constitutes a technical revision.

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

- a) the title has been changed by deleting the wording "DC output-" from the title and adding "switch mode" in the title;
- b) changes in the scope: 1.1.1 Equipment covered by this document;
- c) update of the normative references to the latest editions or dated references;

- d) change of wording or/and notes regarding the requirements of CENELEC Guide 24 and IEC Guide 107;
- e) revision of the emission limits to align with the latest editions of the applicable normative references;
- f) revision of the immunity requirements to align with the latest editions of the applicable normative references;
- g) correction of typographical errors.

The text of this standard is based on the following documents:

FDIS	Report on voting
22E/174/FDIS	22E/176/RVD

Full information on the voting for the approval of this document 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.

A list of all parts of IEC 61204 series, under the general title *Low-voltage power supplies, d.c. output*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

## LOW-VOLTAGE SWITCH MODE POWER SUPPLIES –

### Part 3: Electromagnetic compatibility (EMC)

#### 1 Scope and object

##### 1.1 Scope

##### 1.1.1 Equipment covered by this document

This part of IEC 61204 specifies the electromagnetic compatibility (EMC) requirements for switch mode power supply (SMPS) units supplied by source voltages up to 1 000 V AC or 1 500 V DC providing AC and/or DC output(s), except inverter output(s) establishing AC mains (see exceptions under 1.1.3.)

NOTE 1 This document by definition covers DC/DC converters.

NOTE 2 Power supplies can provide accessory AC mains socket outlets, when such outputs are supplied from the AC mains.

NOTE 3 Ringing generators used in telecoms applications are covered by this document.

This product standard covers both stand alone and component power supply (PSU) units as defined in this document. It covers PSU units for use in or with IT equipment normally covered by IEC 60950-1 and/or IEC 62368-1; PSU units for use in or with measurement, control and laboratory equipment normally covered by IEC 61010-1; PSU units for use in or with medical equipment – normally covered by IEC 60601-1; PSU units for use in or with audio, video and similar electronic apparatus – normally covered by IEC 60065 and/or IEC 62368-1. It also covers DC power and distribution equipment and DC/DC converters.

Where no standard exist, use of this document for other applications is not precluded.

##### 1.1.2 Additional requirements

Requirements additional to those specified in this document may be necessary for

- PSUs intended for operation in special environments (for example, extremes of temperature; excessive dust, moisture or vibration; flammable gases; and corrosive or explosive atmospheres);
- PSUs intended to be used in vehicles, on board ships or aircraft, or in tropical countries;
- PSUs intended for use where ingress of water is possible.

NOTE Attention is drawn to the fact that authorities in some countries impose additional requirements for health, environmental and similar reasons.

##### 1.1.3 Exclusions

This document does not apply to

- motor-generator sets;
- uninterruptible power supplies (UPS) to IEC 62040-1;
- PSUs covered by IEC 61558-1 (i.e. power supply units incorporating safety isolating transformers providing SELV or PELV output(s) in accordance with IEC 60364-4-41) and PSUs for use with household and other consumer products, except those covered by IEC 60065 and IEC 60950-1 and/or IEC 62368-1;
- transformers covered by IEC 61558-1;

- step-down converters covered by IEC 60146-1-1;
- PSUs and converters intended for DC supplied bulb lamps, halogen lamps or LED lamps covered by CISPR 15.

#### **1.1.4 Types of power supply**

Two types of power supplies are covered by this document:

##### **a) stand alone (or end-product) power supplies**

Power supplies intended for free-standing operation (individual apparatus).

This part of IEC 61204 is applicable to PSUs developed as a unit with a direct function and sold on the market as a stand alone unit.

##### **b) component power supplies**

These can be divided into two categories:

###### **1) component power supplies considered as equivalent to stand alone power supplies (apparatus)**

This part of IEC 61204 is applicable to this category of component PSUs. These PSUs are considered to be apparatus with respect to their EMC requirements, for example those PSUs intended for use in installations or sold to the general public, cases where no further EMC tests are anticipated. This does not include PSUs sold as spares for repair which have been tested as part of an overall equipment.

###### **2) component power supplies intended for a professional installer**

This part of IEC 61204 is applicable to this category of power supplies only as an aid to specify relevant EMC requirements in order that various end-product standards may be met.

These are component power supplies that are intended for incorporation into a final product by a professional installer. These products may be sold to a professional installer or placed on the market for specialized distribution and use. Further EMC tests of the assembly are assumed.

#### **1.1.5 Configurations and combinations of power supplies**

##### **1.1.5.1 Modular PSUs**

A PSU with a single primary circuit or module and separate output modules forming a single unit, synchronized or not, meets the requirements defined in this document as a single component or apparatus type of PSU.

##### **1.1.5.2 Power supply systems**

An easily relocatable system containing several PSUs in parallel, in series or combination with a single input connection complies with this document as a single component or apparatus type of PSU. It is the responsibility of the system supplier to ensure EMC compliance with this document or with a specific EMC standard of the end product.

##### **1.1.5.3 Power supply installations**

When a number of PSUs are used in an installation and are supplied by a distributed AC or DC network, then this is a power installation. This type of arrangement is not easily relocatable. Each individual PSU complies with this document and this is the responsibility of the PSU manufacturer who also provides information on the correct installation of his product. The EMC considerations of the final installation are the responsibility of the professional installer.