

Electromagnetic Compatibility (EMC) - Part 4-10: Testing and measurement techniques - Damped oscillatory magnetic field immunity test

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 61000-4-10:2017 sisaldab Euroopa standardi EN 61000-4-10:2017 ingliskeelset teksti.	This Estonian standard EVS-EN 61000-4-10:2017 consists of the English text of the European standard EN 61000-4-10:2017.
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 24.02.2017.	Date of Availability of the European standard is 24.02.2017.
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.

ICS 25.040.40, 35.100.05

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; telefon 605 5050; e-post 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; phone +372 605 5050; e-mail info@evs.ee

English Version

**Electromagnetic compatibility (EMC) -
Part 4-10: Testing and measurement techniques - Damped
oscillatory magnetic field immunity test
(IEC 61000-4-10:2016)**

Compatibilité électromagnétique (CEM) -
Partie 4-10: Techniques d'essai et de mesure - Essai
d'immunité du champ magnétique oscillatoire amorti
(IEC 61000-4-10:2016)

Elektromagnetische Verträglichkeit (EMV) -
Teil 4-10: Prüf- und Messverfahren - Prüfung der
Störfestigkeit gegen gedämpft schwingende Magnetfelder
(IEC 61000-4-10:2016)

This European Standard was approved by CENELEC on 2016-08-11. 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: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 77B/730/CDV, future edition 2 of IEC 61000-4-10, prepared by SC 77B "High frequency phenomena" of IEC/TC 77 "Electromagnetic compatibility" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61000-4-10:2017.

The following dates are fixed:

- latest date by which the document has to be (dop) 2017-08-24
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2020-02-24
standards conflicting with the
document have to be withdrawn

This document supersedes EN 61000-4-10:1993.

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

Endorsement notice

The text of the International Standard IEC 61000-4-10:2016 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 61000-4-18 NOTE Harmonized as EN 61000-4-18.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When 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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050	Series	International Electrotechnical Vocabulary (IEV)	-	-

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope and object.....	8
2 Normative references.....	8
3 Terms, definitions and abbreviated terms	9
3.1 Terms and definitions	9
3.2 Abbreviations	10
4 General.....	10
5 Test levels.....	10
6 Test instrumentation	11
6.1 General.....	11
6.2 Damped oscillatory wave generator	11
6.2.1 General.....	11
6.2.2 Performance characteristics of the generator connected to the standard induction coil	12
6.3 Standard induction coil	14
6.4 Calibration of the test system	14
7 Test setup	15
7.1 Test equipment	15
7.2 Verification of the test instrumentation	15
7.3 Test setup for table-top EUT.....	16
7.4 Test setup for floor standing EUT	16
7.5 Test setup for damped oscillatory field applied in-situ	18
8 Test procedure	18
8.1 General.....	18
8.2 Laboratory reference conditions	18
8.2.1 Climatic conditions	18
8.2.2 Electromagnetic conditions	18
8.3 Execution of the test	19
9 Evaluation of test results.....	19
10 Test report.....	20
Annex A (informative) Information on the field distribution of standard induction coils	21
A.1 General.....	21
A.2 Determination of the coil factor	21
A.2.1 General.....	21
A.2.2 Coil factor calculation	21
A.3 1 m × 1 m standard induction coil	22
A.4 1 m × 2,6 m standard induction coil with reference ground plane	23
A.5 1 m × 2,6 m standard induction coil without reference ground plane	24
Annex B (informative) Selection of the test levels	26
Annex C (informative) Damped oscillatory magnetic field frequency	28
Annex D (informative) Measurement uncertainty (MU) considerations	29
D.1 General.....	29
D.2 Legend	29

D.3	Uncertainty contributors to the peak current and to the damped oscillatory magnetic field measurement uncertainty	29
D.4	Uncertainty of peak current and damped oscillatory magnetic field calibration	30
D.4.1	General.....	30
D.4.2	Peak current	30
D.4.3	Further MU contributions to amplitude and time measurements	32
D.4.4	Rise time of the step response and bandwidth of the frequency response of the measuring system	32
D.4.5	Impulse peak distortion due to the limited bandwidth of the measuring system.....	33
D.5	Application of uncertainties in the damped oscillatory wave generator compliance criterion	34
Annex E (informative)	3D numerical simulations	35
E.1	General.....	35
E.2	Simulations	35
E.3	Comments	35
Bibliography	41
Figure 1	– Simplified schematic circuit of the test generator for damped oscillatory magnetic field	12
Figure 2	– Waveform of short-circuit current in the standard coils	13
Figure 3	– Waveform of short-circuit current showing the repetition time T_{rep}	13
Figure 4	– Example of a current measurement of standard induction coils	14
Figure 5	– Example of test setup for table-top equipment.....	16
Figure 6	– Example of test setup for floor standing equipment showing the horizontal orthogonal plane.....	17
Figure 7	– Example of test setup for floor standing equipment showing the vertical orthogonal plane.....	17
Figure 8	– Example of test setup using the proximity method	18
Figure A.1	– Rectangular induction coil with sides $a + b$ and c	22
Figure A.2	– +3 dB isoline for the magnetic field strength (magnitude) in the x - y plane for the 1 m \times 1 m induction coil	22
Figure A.3	– +3 dB and –3 dB isolines for the magnetic field strength (magnitude) in the x - z plane for the 1 m \times 1 m induction coil	23
Figure A.4	– +3 dB isoline for the magnetic field strength (magnitude) in the x - z plane for the 1 m \times 2,6 m induction coil with reference ground plane	23
Figure A.5	– +3 dB and –3 dB isolines for the magnetic field strength (magnitude) in the x - y plane for the 1 m \times 2,6 m induction coil with reference ground plane	24
Figure A.6	– +3 dB isoline for the magnetic field strength (magnitude) in the x - y plane for the 1 m \times 2,6 m induction coil without reference ground plane	24
Figure A.7	– +3 dB and –3 dB isolines for the magnetic field strength (magnitude) in the x - z plane for the 1 m \times 2,6 m induction coil without reference ground plane	25
Figure E.1	– Current with period of 1 μ s and H-field in the center of the 1 m \times 1 m standard induction coil	36
Figure E.2	– H_x -field along the side of 1 m \times 1 m standard induction coil in A/m	36
Figure E.3	– H_x -field in direction x perpendicular to the plane of the 1 m \times 1 m standard induction coil	37
Figure E.4	– H_x -field along the side in dB for 1 m \times 1 m standard induction coil	37

Figure E.5 – H_x -field along the diagonal in dB for the 1 m × 1 m standard induction coil.....	38
Figure E.6 – H_x -field plot on y - z plane for the 1 m × 1 m standard induction coil.....	38
Figure E.7 – H_x -field plot on x - y plane for the 1 m × 1 m standard induction coil	39
Figure E.8 – H_x -field along the vertical middle line in dB for the 1 m × 2,6 m standard induction coil	39
Figure E.9 – H_x -field 2D-plot on y - z plane for the 1 m × 2,6 m standard induction coil.....	40
Figure E.10 – H_x -field 2D-plot on x - y plane at $z = 0,5$ m for the 1 m × 2,6 m standard induction coil	40
Table 1 – Test levels.....	11
Table 2 – Peak current specifications of the test system	15
Table 3 – Waveform specifications of the test system	15
Table D.1 – Example of uncertainty budget for the peak of the damped oscillatory current impulse (I_p)	31
Table D.2 – α factor (see equation (D.6)) of different unidirectional impulse responses corresponding to the same bandwidth of the system B	33
Table D.3 – β factor (equation (D.12)) of the damped oscillatory waveform.....	34

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 (insofar 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: IEC 61000-6-1).

This part is an international standard which gives immunity requirements and test procedures related to "damped oscillatory magnetic field".