

**RAADIOHÄIRINGUTE JA HÄIRINGUTALUVUSE
MÕÕTESEADMED JA -MEETODID. OSA 2-3: HÄIRINGUTE
JA HÄIRINGUTALUVUSE MÕÕTEMEETODID.
KIIRGUSHÄIRINGUTE MÕÕTMINE**

**Specification for radio disturbance and immunity
measuring apparatus and methods - Part 2-3: Methods
of measurement of disturbances and immunity -
Radiated disturbance measurements**

EVS

EESTI STANDARDI EESSÕNA**NATIONAL FOREWORD**

See Eesti standard EVS-EN 55016-2-3:2010 sisaldab Euroopa standardi EN 55016-2-3:2010 ingliskeelset teksti.	This Estonian standard EVS-EN 55016-2-3:2010 consists of the English text of the European standard EN 55016-2-3:2010.
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 04.06.2010.	Date of Availability of the European standard is 04.06.2010.
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 33.100.10, 33.100.20

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

**Specification for radio disturbance and immunity measuring apparatus
and methods -**

**Part 2-3: Methods of measurement of disturbances and immunity -
Radiated disturbance measurements
(CISPR 16-2-3:2010)**

Spécifications des méthodes
et des appareils de mesure
des perturbations radioélectriques
et de l'immunité aux perturbations
radioélectriques -
Partie 2-3: Méthodes de mesure
des perturbations et de l'immunité -
Mesures des perturbations rayonnées
(CISPR 16-2-3:2010)

Anforderungen an Geräte
und Einrichtungen sowie Festlegung
der Verfahren zur Messung
der hochfrequenten Störaussendung
(Funkstörungen) und Störfestigkeit -
Teil 2-3: Verfahren zur Messung
der hochfrequenten Störaussendung
(Funkstörungen) und Störfestigkeit -
Messung der gestrahlten Störaussendung
(CISPR 16-2-3:2010)

This European Standard was approved by CENELEC on 2010-06-01. 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 Central Secretariat 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 Central Secretariat 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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document CISPR/A/886/FDIS, future edition 3 of CISPR 16-2-3, prepared by CISPR SC A, Radio-interference measurements and statistical methods, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 55016-2-3 on 2010-06-01.

This European Standard supersedes EN 55016-2-3:2006.

This EN 55016-2-3:2010 includes the following significant technical changes with respect to EN 55016-2-3:2006: addition of the measurand for radiated emissions measurements in an OATS and a SAC in the range of 30 MHz to 1 000 MHz, and addition of a new normative annex on the determination of suitability of spectrum analysers for compliance tests. Also, numerous maintenance items are addressed to make the standard current with respect to other parts of the EN 55016 series.

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*.

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

The following dates were fixed:

- | | | |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2011-03-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2013-06-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard CISPR 16-2-3:2010 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:

- | | | |
|------------------------|------|---|
| [1] CISPR 11:2009 | NOTE | Harmonized as EN 55011:2009 (modified). |
| [3] CISPR 22:2008 | NOTE | Harmonized as EN 55022:200X ¹⁾ (modified). |
| [4] IEC 61140:2001 | NOTE | Harmonized as EN 61140:2002 (not modified). |
| [6] ISO/IEC 17000:2004 | NOTE | Harmonized as EN ISO/IEC 17000:2004 (not modified). |
| [7] IEC 61000-4-21 | NOTE | Harmonized as EN 61000-4-21. |

¹⁾ At draft stage.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
CISPR 14-1	2005	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission	EN 55014-1	2006
CISPR 16-1-1	-	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus	EN 55016-1-1	-
CISPR 16-1-2	2003	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-2: Radio disturbance and immunity measuring apparatus - Ancillary equipment - Conducted disturbances	EN 55016-1-2	2004
CISPR 16-1-4	2010	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-4: Radio disturbance and immunity measuring apparatus - Antennas and test sites for radiated disturbance measurements	EN 55016-1-4	2010
CISPR 16-2-1	2008	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	2009
CISPR 16-4-1	-	Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-1: Uncertainties, statistics and limit modelling - Uncertainties in standardized EMC tests	-	-
CISPR 16-4-2	-	Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-2: Uncertainties, statistics and limit modelling - Uncertainty in EMC measurements	EN 55016-4-2	-
CISPR/TR 16-4-5	-	Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-5: Uncertainties, statistics and limit modelling - Conditions for the use of alternative test methods	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-161	1990	International Electrotechnical Vocabulary (IEV) - Chapter 161: Electromagnetic compatibility	-	-
IEC 61000-4-3	2006	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	2006
IEC 61000-4-20	-	Electromagnetic compatibility (EMC) - Part 4-20: Testing and measurement techniques - Emission and immunity testing in transverse electromagnetic (TEM) waveguides	EN 61000-4-20	-

CONTENTS

FOREWORD.....	6
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	9
4 Types of disturbance to be measured	13
4.1 General.....	13
4.2 Types of disturbance	13
4.3 Detector functions	14
5 Connection of measuring equipment.....	14
6 General measurement requirements and conditions	14
6.1 General.....	14
6.2 Disturbance not produced by the equipment under test	14
6.2.1 General	14
6.2.2 Compliance (conformity assessment) testing	14
6.3 Measurement of continuous disturbance.....	15
6.3.1 Narrowband continuous disturbance	15
6.3.2 Broadband continuous disturbance	15
6.3.3 Use of spectrum analyzers and scanning receivers.....	15
6.4 Operating conditions of the EUT.....	15
6.4.1 Normal load conditions	15
6.4.2 The time of operation.....	15
6.4.3 Running-in time	15
6.4.4 Supply	16
6.4.5 Mode of operation.....	16
6.5 Interpretation of measuring results	16
6.5.1 Continuous disturbance	16
6.5.2 Discontinuous disturbance.....	16
6.6 Measurement times and scan rates for continuous disturbance	16
6.6.1 General	16
6.6.2 Minimum measurement times	17
6.6.3 Scan rates for scanning receivers and spectrum analyzers	17
6.6.4 Scan times for stepping receivers	18
6.6.5 Strategies for obtaining a spectrum overview using the peak detector	19
7 Measurement of radiated disturbances	22
7.1 Introductory remarks	22
7.2 Loop-antenna system measurements (9 kHz to 30 MHz)	23
7.2.1 General	23
7.2.2 General measurement method.....	23
7.2.3 Test environment.....	24
7.2.4 Configuration of the equipment under test	24
7.2.5 Measurement uncertainty for LAS.....	25
7.3 Open-area test site or semi-anechoic chamber measurements (30 MHz to 1 GHz)	25
7.3.1 Measurand	25
7.3.2 Test site requirements	26
7.3.3 General measurement method.....	26

7.3.4	Measurement distance.....	27
7.3.5	Antenna height variation.....	27
7.3.6	Product specification details.....	27
7.3.7	Measurement instrumentation.....	29
7.3.8	Field-strength measurements on other outdoor sites.....	29
7.3.9	Measurement uncertainty for OATS and SAC.....	29
7.4	Fully-anechoic room measurements (30 MHz to 1 GHz).....	30
7.4.1	Test set-up and site geometry.....	30
7.4.2	EUT position.....	32
7.4.3	Cable layout and termination.....	33
7.4.4	Measurement uncertainty for FAR.....	34
7.5	Radiated emission measurement method (30 MHz to 1 GHz) and radiated immunity test method (80 MHz to 1 GHz) with common test set-up in semi-anechoic chamber.....	34
7.5.1	Applicability.....	34
7.5.2	EUT perimeter definition and antenna-to-EUT separation distance.....	34
7.5.3	Uniform test volume.....	35
7.5.4	Specifications for EUT set-up in common emissions/immunity test setup.....	36
7.5.5	Measurement uncertainty for common emission/immunity set-up and method.....	41
7.6	Fully-anechoic room and absorber-lined OATS/SAC measurements (1 GHz to 18 GHz).....	41
7.6.1	Quantity to measure.....	41
7.6.2	Measurement distance.....	41
7.6.3	Set-up and operating conditions of the equipment under test (EUT).....	41
7.6.4	Measurement site.....	42
7.6.5	Measurement instrumentation.....	42
7.6.6	Measurement procedure.....	42
7.6.7	Measurement uncertainty for FAR.....	49
7.7	<i>In situ</i> measurements (9 kHz to 18 GHz).....	49
7.7.1	Applicability of and preparation for <i>in situ</i> measurements.....	49
7.7.2	Field-strength measurements <i>in situ</i> in the frequency range 9 kHz to 30 MHz.....	50
7.7.3	Field-strength measurements <i>in situ</i> in the frequency range above 30 MHz.....	51
7.7.4	<i>In situ</i> measurement of the disturbance effective radiated power using the substitution method.....	52
7.7.5	Documentation of the measurement results.....	56
7.7.6	Measurement uncertainty for <i>in situ</i> method.....	56
7.8	Substitution measurements (30 MHz to 18 GHz).....	56
7.8.1	General.....	56
7.8.2	Test site.....	56
7.8.3	Test antennas.....	57
7.8.4	EUT configuration.....	57
7.8.5	Test procedure.....	57
7.8.6	Measurement uncertainty for substitution method.....	58
7.9	Reverberation chamber measurements (80 MHz to 18 GHz).....	58
7.10	TEM waveguide measurements (30 MHz to 18 GHz).....	58
8	Automated measurement of emissions.....	58

8.1	Introduction – precautions for automated measurements	58
8.2	Generic measurement procedure.....	59
8.3	Pre-scan measurements	59
8.3.1	General	59
8.3.2	Determination of the required measurement time.....	59
8.3.3	Pre-scan requirements for different types of measurements	60
8.4	Data reduction.....	61
8.5	Emission maximization and final measurement.....	62
8.6	Post-processing and reporting.....	63
Annex A	(informative) Measurement of disturbances in the presence of ambient emissions	64
Annex B	(informative) Use of spectrum analyzers and scanning receivers	78
Annex C	(informative) Scan rates and measurement times for use with the average detector	81
Annex D	(informative) Explanation of APD measurement method applying to the compliance test.....	85
Annex E	(normative) Determination of suitability of spectrum analyzers for compliance tests	87
Bibliography	88
Figure 1	– Measurement of a combination of a CW signal (NB) and an impulsive signal (BB) using multiple sweeps with maximum hold	19
Figure 2	– Example of a timing analysis	20
Figure 3	– A broadband spectrum measured with a stepped receiver	21
Figure 4	– Intermittent narrowband disturbances measured using fast short repetitive sweeps with maximum hold function to obtain an overview of the emission spectrum.....	22
Figure 5	– Concept of magnetic field induced current measurements made with the loop antenna system.....	24
Figure 6	– Concept of electric field strength measurements made on an open-area test site (OATS) or semi-anechoic chamber (SAC) showing the direct and reflected rays arriving at the receiving antenna	26
Figure 7	– Typical FAR site geometry, where a , b , c , e depend upon the room performance	30
Figure 8	– Typical test set-up for table-top equipment within the test volume of a FAR	31
Figure 9	– Typical test set-up for floor-standing equipment within the test volume of a FAR	32
Figure 10	– Positions of reference planes for uniform field calibration (top-view)	35
Figure 11	– Test set-up for table-top equipment.....	39
Figure 12	– Test set-up for table-top equipment – Top view	39
Figure 13	– Test set-up for floor-standing equipment	40
Figure 14	– Test set-up for floor-standing equipment – Top view	40
Figure 15	– Measurement method above 1 GHz, receive antenna in vertical polarization.....	43
Figure 16	– Illustration of height scan requirements for two different categories of EUTs	45
Figure 17	– Determination of the transition distance	55
Figure 18	– Substitution method set-up geometries for: a) measurement, b) calibration	57
Figure 19	– Process to give reduction of measurement time	59

Figure A.1 – Flow diagram for the selection of bandwidths and detectors and the estimated measurement errors due to that selection	66
Figure A.2 – Relative difference in adjacent emission amplitudes during preliminary testing	68
Figure A.3 – Disturbance by an unmodulated signal (dotted line)	69
Figure A.4 – Disturbance by an amplitude-modulated signal (dotted line)	69
Figure A.5 – Indication of an amplitude-modulated signal as a function of modulation frequency with the QP detector in CISPR bands B, C and D	70
Figure A.6 – Indication of a pulse-modulated signal (pulse width 50 μ s) as a function of pulse repetition frequency with peak, QP and average detectors	71
Figure A.7 – Disturbance by a broadband signal (dotted line)	71
Figure A.8 – Unmodulated EUT disturbance (dotted line)	72
Figure A.9 – Amplitude-modulated EUT disturbance (dotted line)	73
Figure A.10 – Increase of peak value with superposition of two unmodulated signals	74
Figure A.11 – Determination of the amplitude of the disturbance signal by means of the amplitude ratio d and the factor i [see Equation (A.3) and Equation (A.6)]	75
Figure A.12 – Increase of average indication measured with a real receiver and calculated from Equation (A.8)	76
Figure C.1 – Weighting function of a 10 ms pulse for peak (PK) and average detections with (CISPR AV) and without (AV) peak reading: meter time constant 160 ms	83
Figure C.2 – Weighting functions of a 10 ms pulse for peak (PK) and average detections with (CISPR AV) and without (AV) peak reading: meter time constant 100 ms	83
Figure C.3 – Example of weighting functions (of a 1 Hz pulse) for peak (PK) and average detections as a function of pulse width: meter time constant 160 ms	84
Figure C.4 – Example of weighting functions (of a 1 Hz pulse) for peak (PK) and average detections as a function of pulse width: meter time constant 100 ms	84
Figure D.1 – Example of APD measurement Method 1 for fluctuating disturbances	85
Figure D.2 – Example of APD measurement Method 2 for fluctuating disturbances	86
Table 1 – Minimum scan times for the three CISPR bands with peak and quasi-peak detectors	17
Table 2 – Applicable frequency ranges and document references for CISPR radiated emission test sites and test methods	23
Table 3 – Minimum dimension of w (w_{\min})	44
Table 4 – Example values of w for three antenna types	45
Table 5 – Horizontal polarization correction factors as a function of frequency	54
Table 6 – Recommended antenna heights to guarantee signal interception (for pre-scan) in the frequency range 30 MHz to 1 000 MHz	61
Table A.1 – Combinations of EUT disturbance and ambient emissions	65
Table A.2 – Measurement error depending on the detector type and on the combination of ambient and disturbing signal spectra	77
Table C.1 – Pulse suppression factors and scan rates for a 100 Hz video bandwidth	82
Table C.2 – Meter time constants and the corresponding video bandwidths and maximum scan rates	82
Table E.1 – Maximum amplitude difference between peak and quasi-peak detected signals	87