

© Copyright SEK. Reproduction in any form without permission is prohibited.

EMC – Utrustning och metoder för mätning av radiostörningar och immunitet – Del 2-3: Mätning av utstrålade störningar

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

Som svensk standard gäller europastandarden EN 55016-2-3:2006. Den svenska standarden innehåller den officiella engelska språkversionen av EN 55016-2-3:2006.

Nationellt förord

Europastandarden EN 55016-2-3:2006

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **CISPR 16-2-3, Second edition, 2006 - Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-3: Methods of measurement of disturbances and immunity - Radiated disturbance measurements**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 55016-2-3, utgåva 1, 2005, SS-EN 55016-2-3/A1, utgåva 1, 2005 och SS-EN 55016-2-3/A2, utgåva 1, 2005, gäller ej fr o m 2009-11-01.

ICS 33.100.10; 33.100.20

Denna standard är fastställd av Svenska Elektriska Kommissionen, SEK,

som också kan lämna upplysningar om **sakinnehållet** i standarden.

Postadress: SEK, Box 1284, 164 29 KISTA

Telefon: 08 - 444 14 00. Telefax: 08 - 444 14 30

E-post: sek@sekom.se. Internet: www.sekom.se

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a säkerhet, prestanda, dokumentation, utförande och skötsel av elprodukter, elanläggningar och metoder. Genom att utforma sådana standarder blir säkerhetskraven tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringssarbetet inom elområdet

Svenska Elektriska Kommissionen, SEK, svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringssarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringssverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK

Box 1284
164 29 Kista
Tel 08-444 14 00
www.sekom.se

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 16-2-3:2006)**

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 16-2-3:2006)

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 16-2-3:2006)

This European Standard was approved by CENELEC on 2006-11-01. 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, 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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document CISPR/A/657/FDIS, future edition 2 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 2006-11-01.

This European Standard supersedes EN 55016-2-3:2004 + A1:2005 + A2:2005.

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) 2007-08-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2009-11-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard CISPR 16-2-3:2006 was approved by CENELEC as a European Standard without any modification.

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 13 (mod)	2001	Sound and television broadcast receivers and associated equipment - Radio disturbance characteristics - Limits and methods of measurement	EN 55013	2001
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	2003	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	2004
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	2003	Specification for radio disturbance and immunity measuring apparatus and methods Part 1-4: Radio disturbance and immunity measuring apparatus - Ancillary equipment - Radiated disturbances	EN 55016-1-4	2004
CISPR 16-1-5	2003	Specification for radio disturbance and immunity measuring apparatus and methods Part 1-5: Radio disturbance and immunity measuring apparatus - Antenna calibration test sites for 30 MHz to 1 000 MHz	EN 55016-1-5	2004
CISPR 16-2-1	2003	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	2004
CISPR 16-2-2	2003	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	2004

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
CISPR 16-2-4	2003	Specification for radio disturbance and immunity measuring apparatus and methods Part 2-4: Methods of measurement of disturbances and immunity - Immunity measurements	EN 55016-2-4	2004
CISPR 16-3 A1	2003 2005	Specification for radio disturbance and immunity measuring apparatus and methods Part 3: CISPR technical reports	-	-
CISPR 16-4-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods Part 4-1: Uncertainties, statistics and limit modeling - Uncertainties in standardized EMC tests	-	-
CISPR 16-4-2	2003	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	2004
CISPR 16-4-3	2003	Specification for radio disturbance and immunity measuring apparatus and methods Part 4-3: Uncertainties, statistics and limit modelling - Statistical considerations in the determination of EMC compliance of mass-produced products	-	-
IEC 61000-4-3	- ¹⁾	Electromagnetic compatibility (EMC) Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	2006 ²⁾

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

CONTENTS

1 Scope	13
2 Normative references	13
3 Terms and definitions	15
4 Types of disturbance to be measured	21
5 Connection of measuring equipment	23
6 General measurement requirements and conditions	25
7 Measurement of radiated disturbances	41
8 Automated measurement of emissions	123
Annex A (informative) Measurement of disturbances in the presence of ambient emissions	135
Annex B (informative) Use of spectrum analyzers and scanning receivers (see clause 6)	163
Annex C (informative) Example of the uncertainty budget	169
Annex D (informative) Scan rates and measurement times for use with the average detector	171
Annex E (informative) Explanation of APD measurement method applying to the compliance test	179
Figure 1 – Measurement of a combination of a CW signal (“NB”) and an impulsive signal (“BB”) using multiple sweeps with maximum hold	35
Figure 2 – Example of a timing analysis	37
Figure 3 – A broadband spectrum measured with a stepped receiver	39
Figure 4 – Intermittent narrowband disturbances measured using fast short repetitive sweeps with maximum hold function to obtain an overview of the emission spectrum	39
Figure 5 – Concept of electric field strength measurements made on an open area test site (OATS) with the direct and reflective rays arriving at the receiving antenna	43
Figure 6 – Typical test set-up in FAR, where a, b, c and e depend on the room performance	51
Figure 7 – Typical test set-up for table-top equipment within the test volume of a FAR	55
Figure 8 – Typical test set-up for floor standing equipment within the test volume of a FAR	57
Figure 9 – Test set-up for tabletop equipment	71
Figure 10 – Test set-up for tabletop equipment, Top view	73
Figure 11 – Test set-up for floor-standing equipment	75
Figure 12 – Test set-up for floor-standing equipment, Top view	77
Figure 13 – Position of planes for uniform field calibration (top-view)	79
Figure 14 – Measurement method above 1 GHz, receive antenna in vertical polarization	85
Figure 15 – Illustration of height scan requirements for two different categories of EUTs	89

Figure 16 – Method of measurement – Substitution method (see 7.4.1 and 7.4.3).....	101
Figure 17 – Determination of the transition distance	115
Figure 18 – Concept of magnetic field induced current measurements made with the loop antenna system.....	121
Figure A.1 – Flow diagram for the selection of bandwidths and detectors and the estimated measurement errors due to that selection	139
Figure A.2 – Relative difference in adjacent emission amplitudes during preliminary testing	143
Figure A.3 – Disturbance by an unmodulated signal (dotted line)	145
Figure A.4 – Disturbance by an amplitude-modulated signal (dotted line).....	145
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	147
Figure A.6 – Indication of a pulse-modulated signal (pulse width 50 µs) as a function of pulse repetition frequency with peak, QP and average detectors.....	149
Figure A.7 – Disturbance by a broadband signal (dotted line)	149
Figure A.8 – Unmodulated EUT disturbance (dotted line)	151
Figure A.9 – Amplitude-modulated EUT disturbance (dotted line).....	151
Figure A.10 – Increase of peak value with superposition of two unmodulated signals (U_a - level of ambient emission; U_i - level of EUT disturbance)	157
Figure A.11 – Determination of the amplitude of the disturbance signal by means of the amplitude ratio d and the factor i	157
Figure A.12 – Increase of average indication measured with a real receiver and calculated from equation (A.8)	159
Figure D.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.....	175
Figure D.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.....	175
Figure D.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	177
Figure D.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	177
Figure E.1 – Example of APD measurement method 1 for fluctuating disturbances	181
Figure E.2 – Example of APD measurement method 2 for fluctuating disturbances	183
Table 1 – Minimum scan times for the three CISPR bands with peak and quasi-peak detectors	31
Table 2 – Minimum dimension of w (w_{min}).....	87
Table 3 – Example values of w for three antenna types	89
Table 4 – Recommended antenna heights to guarantee signal interception (for prescan) in the frequency range 30 MHz to 1000 MHz.....	129

Table A.1 – Combinations of EUT disturbance and ambient emissions.....	137
Table A.2 – Measurement error depending on the detector type and on the combination of ambient and disturbing signal spectra	161
Table C.1 – Uncertainty budget for emission measurements in a 3 m FAR.....	169
Table D.1 – Pulse suppression factors and scan rates for a 100 Hz video bandwidth	173
Table D.2 – Meter time constants and the corresponding video bandwidths and maximum scan rates	175

SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements

1 Scope

This part of CISPR 16 is designated a basic standard, which specifies the methods of measurement of radiated disturbance phenomena in the frequency range 9 kHz to 18 GHz.

2 Normative references

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.

CISPR 13:2001, *Sound and television broadcast receivers and associated equipment – Radio disturbance characteristics – Limits and methods of measurement*

CISPR 14-1:2005, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

CISPR 16-1-1:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

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*

CISPR 16-1-4:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Ancillary equipment - Radiated disturbances*

CISPR 16-1-5:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-5: Radio disturbance and immunity measuring apparatus – Antenna calibration and site validation*

CISPR 16-2-1:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements*