

# **SLOVENSKI STANDARD**

## **SIST EN 55016-4-2:2011**

**01-december-2011**

**Nadomešča:**

**SIST EN 55016-4-2:2005**

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**Specifikacija za merilne naprave in metode za merjenje radijskih motenj in  
odpornosti - 4-2. del: Modeliranje negotovosti, statistike in mejnih vrednosti -  
Negotovost merilnih instrumentov (CISPR 16-4-2:2011)**

Specification for radio disturbance and immunity measuring apparatus and methods -  
Part 4-2: Uncertainties, statistics and limit modelling - Measurement instrumentation  
uncertainty

**iTeh STANDARD PREVIEW**  
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Anforderungen an Geräte und Einrichtungen sowie Festlegung der Verfahren zur  
Messung der hochfrequenten Störaussendung (Funkstörungen) und Störfestigkeit - Teil  
4-2: Unsicherheiten, Statistik und Modelle zur Ableitung von Grenzwerten (Störmodell) -  
Messgeräte-Unsicherheit (CISPR 16-4-2:2011)

Spécifications des méthodes et des appareils de mesure des perturbations  
radioélectriques et de l'immunité aux perturbations radioélectriques - Partie 4-2:  
Incertitudes, statistiques et modélisation des limites - Incertitudes de mesure de  
l'instrumentation

**Ta slovenski standard je istoveten z: EN 55016-4-2:2011**

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**ICS:**

17.220.20	Merjenje električnih in magnetnih veličin	Measurement of electrical and magnetic quantities
33.100.01	Elektromagnetna združljivost na splošno	Electromagnetic compatibility in general

**SIST EN 55016-4-2:2011**

**en**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 55016-4-2**

October 2011

ICS 33.100.10; 33.100.20

Supersedes EN 55016-4-2:2004

English version

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

**Part 4-2: Uncertainties, statistics and limit modelling -  
Measurement instrumentation uncertainty  
(CISPR 16-4-2:2011)**

Spécifications des méthodes et des  
appareils de mesure des perturbations  
radioélectriques et de l'immunité aux  
perturbations radioélectriques -  
Partie 4-2: Incertitudes, statistiques  
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Anforderungen an Geräte und  
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This European Standard was approved by CENELEC on 2011-07-13. 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.

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# 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/942/FDIS, future edition 2 of CISPR 16-4-2, 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 55016-4-2 on 2011-07-13.

This European Standard supersedes EN 55016-4-2:2004.

EN 55016-4-2:2011 includes the following significant technical additions with respect to EN 55016-4-2:2004:

– Methods of conducted disturbance measurements

- on the mains port using a voltage probe,
- on the telecommunication port using an AAN (ISN),
- on the telecommunication port using a CVP, and
- on the telecommunication port using a current probe.

– Methods of radiated disturbance measurements

- in the frequency range 30 MHz to 1 000 MHz using a FAR, and
- in the frequency range 1 GHz to 18 GHz using a FAR.

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) | 2012-04-13 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn   | (dow) | 2014-07-13 |

Annex ZA has been added by CENELEC.

## Endorsement notice

The text of the International Standard CISPR 16-4-2:2011 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 11	-	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement	EN 55011	-
CISPR 12	-	Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of off-board receivers	EN 55012	-
CISPR 13	-	Sound and television broadcast receivers and associated equipment - Radio disturbance characteristics - Limits and methods of measurement	EN 55013	-
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	-	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	-
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 16-1-4	-	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	-
CISPR 16-2-1	-	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	-
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	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
CISPR 16-2-3	2010	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	2010
CISPR 16-3	-	Specification for radio disturbance and immunity measuring apparatus and methods - Part 3: CISPR technical reports	-	-
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 16-4-3	-	Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-3: Uncertainties, statistics and limit modeling - Statistical considerations in the determination of EMC compliance of mass-produced products	-	-
CISPR 22 (mod)	2008	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	EN 55022	2010
ISO/IEC Guide 98-3	-	Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)	-	-
ISO/IEC Guide 99	-	International vocabulary of metrology - Basic and general concepts and associated terms (VIM)	-	-

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CISPR 16-4-2

Edition 2.0 2011-06

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE  
COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

BASIC EMC PUBLICATION  
PUBLICATION FONDAMENTALE EN CEM

Itch STANDARD PREVIEW  
(standards.itech.ai)

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

**Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty**

**Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques –  
Partie 4-2: Incertitudes, statistiques et modélisation des limites – Incertitudes de mesure de l'instrumentation**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

# SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

## Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty

## 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.
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International Standard CISPR 16-4-2 has been prepared by CISPR subcommittee A: Radio-interference measurements and statistical methods.

This second edition cancels and replaces the first edition published in 2003. It constitutes a technical revision.

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

- Methods of conducted disturbance measurements
  - on the mains port using a voltage probe,
  - on the telecommunication port using an AAN (ISN),

- on the telecommunication port using a CVP, and
  - on the telecommunication port using a current probe.
- Methods of radiated disturbance measurements
- in the frequency range 30 MHz to 1 000 MHz using a FAR, and
  - in the frequency range 1 GHz to 18 GHz using a FAR.

This publication has the status of a basic EMC standard in accordance with IEC Guide 107:2009, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications*.

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

FDIS	Report on voting
CISPR/A/942/FDIS	CISPR/A/952/RVD

Full information on the voting for the approval of this standard 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 the CISPR 16 series can be found, under the general title *Specification for radio disturbance and immunity measuring apparatus and methods*, on the IEC website.

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

**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 publication using a colour printer.**

## INTRODUCTION

The CISPR 16-4 series, *Specification for radio disturbance and immunity measuring apparatus and methods – Uncertainties, statistics and limit modelling*, contains information related to uncertainties, statistics and limit modelling, and consists of the following five parts:

- Part 4-1: Uncertainties in standardized EMC tests,
- Part 4-2: Measurement instrumentation uncertainty,
- Part 4-3: Statistical considerations in the determination of EMC compliance of mass-produced products,
- Part 4-4: Statistics of complaints and a model for the calculation of limits for the protection of radio services, and
- Part 4-5: Conditions for the use of alternative test methods.

For practical reasons, standardized electromagnetic compatibility (EMC) tests are simplified representations of possible electromagnetic interference (EMI) scenarios that a product may encounter in practice. Consequently, in an EMC standard, the measurand, the limit, measurement instruments, measurement set-up, measurement procedure and measurement conditions are simplified but are still meaningful (representative). Here meaningful means that there is a statistical correlation between compliance of the product with a limit, based on a standardized EMC test using standardized test equipment, and a high probability of actual EMC of the same product during its life cycle. Part 4-4 provides methods based on statistics to derive meaningful disturbance limits to protect radio services.

In general, a standardized EMC test should be developed such that reproducible results are obtained if different parties perform the same test with the same EUT. However, various uncertainty sources limit the reproducibility of a standardized EMC.

Part 4-1 is a technical report that consists of a collection of informative reports that address all relevant uncertainty sources that may be encountered during EMC compliance tests. Typical examples of uncertainty sources are the EUT itself, the measurement instrumentation, the set-up of the EUT, the test procedures and the environmental conditions.

Part 4-2 describes a specific category of uncertainties, i.e. measurement instrumentation uncertainties. In this part, examples of MIU budgets are given for most of the CISPR measurement methods. Also in this part, normative requirements are given on how to apply the MIU when determining compliance of an EUT with a disturbance limit (i.e. conformity assessment decision).

Part 4-3 is a technical report that describes the statistical treatment of test results when compliance tests are performed on samples of mass-produced products. This treatment is known as the 80 %/80 % rule.

Part 4-4 is a technical report that contains CISPR recommendations for the collation of statistical data on interference complaints and for the classification of interference sources. Also, models for the calculation of limits for various modes of interference coupling are given.

Part 4-5 is a technical report describing a method to enable product committees to develop limits for alternative test methods, using conversions from established limits.

## SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

### Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty

## 1 Scope

This part of CISPR 16-4 specifies the method of applying Measurement Instrumentation Uncertainty (MIU) when determining compliance with CISPR disturbance limits. The material is also relevant to any EMC test when interpretation of the results and conclusions reached will be impacted by the uncertainty of the measurement instrumentation used during testing.

NOTE In accordance with IEC Guide 107, CISPR 16-4-2 is a basic EMC standard for use by product committees of the IEC. As stated in Guide 107, product committees are responsible for determining the applicability of the EMC standard. CISPR and its sub-committees are prepared to co-operate with technical committees and product committees in the evaluation of the applicability of this standard for specific products.

The annexes contain the background material used in providing the amount of MIU found in generating the CISPR values shown in Clauses 4 through 8 and hence provide valuable background material for those needing both initial and further information on MIU and how to take individual uncertainties in the measurement chain into account. The annexes, however, are not intended to be a tutorial or user manual or to be copied when making uncertainty calculations. For that purpose, the references shown in the bibliography, or other widely recognized documents, may be used.

Measurement instrumentation specifications are given in the CISPR 16-1 series, while the methods of measurement are covered in the CISPR 16-2 series. Further information and background on CISPR and radio disturbances is given in CISPR 16-3. The other parts of the CISPR 16-4 series contain further information on uncertainties in general, statistics and limit modelling. See the introduction of this part for more information on the background and on the content of the CISPR 16-4 series.

## 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 11, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

CISPR 12, *Vehicles, boats and internal combustion engines – Radio disturbance characteristics – Limits and methods of measurement for the protection of off-board receivers*

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

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*

CISPR 16-1-2, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-2: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Conducted disturbances*

CISPR 16-1-3, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-3: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Disturbance power*

CISPR 16-1-4, *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*

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

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*

CISPR 16-2-3:2010, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*

CISPR 16-3, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 3: CISPR technical reports*

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 16-4-3, *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*

CISPR 22:2008, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC Guide 99, *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

### **3 Terms, definitions, symbols and abbreviations**

#### **3.1 Terms and definitions**

For the purposes of this document, the terms and definitions given in ISO/IEC Guide 98-3 and ISO/IEC Guide 99, as well as the following apply.

NOTE General terms and definitions used in the expression of uncertainty are contained in ISO/IEC Guide 98-3. General metrology definitions are contained in ISO/IEC Guide 99. Relevant basic definitions are not repeated here.

**3.1.1****measurement instrumentation uncertainty****MIU**

parameter, associated with the result of a measurement, that characterises the dispersion of the values that could reasonably be attributed to the measurand, induced by all relevant input quantities that are related to the measurement instrumentation

**3.2 Symbols**

For the purposes of this document, the symbols given in Clauses 3, 5, 6, 7 and 8 apply, as well as the following.

**3.2.1 General symbols**

$X_i$	input quantity
$x_i$	estimate of $X_i$
$\delta X_i$	correction for input quantity
$u(x_i)$	standard uncertainty of $x_i$
$c_i$	sensitivity coefficient
$y$	result of a measurement (the estimate of the measurand), corrected for all recognised significant systematic effects, in logarithmic units, e.g. dB( $\mu$ V/m)
$u_c(y)$	(combined) standard uncertainty of $y$ , in dB
$U(y)$	expanded uncertainty of $y$ , in dB
$U_{\text{cispr}}$	CISPR criterion for the expanded MIU evaluated in this standard for each specific measurement method, in dB
$U_{\text{lab}}$	expanded MIU determined by the test laboratory, in dB
$k$	coverage factor
$a^+$	upper abscissa of a probability distribution
$a^-$	lower abscissa of a probability distribution

**3.2.2 Symbols for measured quantities**

$E$	disturbance electric field strength, in dB( $\mu$ V/m)
$I$	disturbance current, in dB( $\mu$ A)
$P$	disturbance power, in dB(pW)
$V$	disturbance voltage, in dB( $\mu$ V)

**3.2.3 Symbols for input quantities common to all disturbance measurements**

$a_c$	attenuation of the connection between the receiver and the ancillary equipment (e.g. AMN, antenna etc.), in dB
$\delta M$	correction for the error caused by mismatch, in dB
$V_r$	receiver voltage reading, in dB( $\mu$ V)
$\delta V_{\text{sw}}$	correction for receiver sine wave voltage inaccuracy, in dB
$\delta V_{\text{pa}}$	correction for imperfect receiver pulse amplitude response, in dB
$\delta V_{\text{pr}}$	correction for imperfect receiver pulse repetition rate response, in dB
$\delta V_{\text{nf}}$	correction for the effect of the receiver noise floor, in dB