



**SLOVENSKI STANDARD**  
**SIST EN 55017:2011**

**01-november-2011**

---

**Postopki za merjenje dušenja pasivnih EMC filtrskih naprav (CISPR 17:2011)**

Methods of measurement of the suppression characteristics of passive EMC filtering devices  
(CISPR 17:2011)

Verfahren zur Messung der Entstöreeigenschaften von passiven EMV-Filtern (CISPR 17:2011)

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

Méthodes de mesure des caractéristiques d'antiparasitage des dispositifs de filtrage CEM passifs (CISPR 17:2011)

[SIST EN 55017:2011](#)

[https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-](https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-3c03ff69487f/sist-en-55017-2011)

[3c03ff69487f/sist-en-55017-2011](https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-3c03ff69487f/sist-en-55017-2011)

**Ta slovenski standard je istoveten z: EN 55017:2011**

---

**ICS:**

33.100.99      Drugi vidiki v zvezi z EMC      Other aspects related to  
EMC

**SIST EN 55017:2011**

**en**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 55017:2011](#)

<https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-3c03ff69487f/sist-en-55017-2011>

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 55017**

September 2011

ICS 33.100.01

English version

**Methods of measurement of the suppression characteristics of passive  
EMC filtering devices**  
(CISPR 17:2011)

Méthodes de mesure des caractéristiques  
d'antiparasitage des dispositifs de filtrage  
CEM passifs  
(CISPR 17:2011)

Verfahren zur Messung der  
Entstöreeigenschaften von passiven EMV-  
Filtern  
(CISPR 17:2011)

**iTeh STANDARD PREVIEW**

This European Standard was approved by CENELEC on 2011-07-15. 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, 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/941/FDIS, future edition 2 of CISPR 17, 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 55017 on 2011-07-15.

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) 2012-04-15
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2014-07-15

Annex ZA has been added by CENELEC.

---

### Endorsement notice

The text of the International Standard CISPR 17:2011 was approved by CENELEC as a European Standard without any modification. (standards.iteh.ai)

In the official version, for Bibliography, the following note has to be added for the standard indicated:

CISPR 12:2007 <https://standards.iteh.ai/catalog/standards/sist-en-55017-2011> Harmonized as EN 55012:2007 (not modified) 0-47a3-852d-3c03ff69487f/sist-en-55017-2011

---

## 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>
IEC 60050-161	-	International Electrotechnical Vocabulary (IEV) - Chapter 161: Electromagnetic compatibility	-	-

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 55017:2011](https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-3c03ff69487f/sist-en-55017-2011)

<https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-3c03ff69487f/sist-en-55017-2011>

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 55017:2011](#)

<https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-3c03ff69487f/sist-en-55017-2011>



CISPR 17

Edition 2.0 2011-06

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



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

**Methods of measurement of the suppression characteristics of passive EMC filtering devices**

(standards.iteh.ai)

**Méthodes de mesure des caractéristiques d'antiparasitage des dispositifs de filtrage CEM passifs**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE **XB**  
CODE PRIX

ICS 33.100.01

ISBN 978-2-88912-526-5

## CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references .....	9
3 Terms, definitions and abbreviations .....	9
3.1 Terms and definitions .....	9
3.2 Abbreviations .....	12
4 Classification of EMC filtering devices .....	12
4.1 Insertion loss.....	14
4.1.1 Insertion loss calculation .....	14
4.1.2 Asymmetrical (common) mode.....	14
4.1.3 Symmetrical (differential) mode .....	14
4.1.4 Unsymmetrical mode .....	14
4.2 Impedance .....	14
4.3 <i>S</i> -parameters .....	15
4.3.1 General .....	15
4.3.2 Two-port <i>S</i> -parameters .....	15
4.3.3 Four-port <i>S</i> -parameters.....	16
5 Insertion loss measurement.....	17
5.1 General.....	17
5.2 Measurement set-up.....	18
5.2.1 General.....	18
5.2.2 Test equipment.....	18
5.2.3 Asymmetrical (common mode) test circuit.....	19
5.2.4 Symmetrical (differential mode) test circuit .....	19
5.2.5 Unsymmetrical test circuit.....	20
5.3 Measurement methods (procedure) .....	21
5.3.1 General .....	21
5.3.2 Measurement without bias .....	22
5.3.3 Measurement with bias .....	22
5.4 Calibration and verification .....	23
5.4.1 General .....	23
5.4.2 Validation of test set-up without bias .....	23
5.4.3 Validation of test set-up with bias .....	24
5.5 Uncertainty.....	26
6 Impedance measurement .....	26
6.1 General.....	26
6.2 Direct method.....	26
6.2.1 Measurement set-up and procedure .....	26
6.2.2 Calibrations of the test set-up.....	27
6.2.3 Measurement uncertainty .....	27
6.3 Indirect method .....	27
6.3.1 Measurement set-up and procedure .....	27
6.3.2 Calibration of the test set-up.....	29
6.3.3 Measurement uncertainty .....	29
7 <i>S</i> -parameter measurement.....	30



7.1	Measurement set-up and procedure .....	30
7.1.1	General .....	30
7.1.2	Test fixture .....	31
7.2	Calibration of test set-up .....	36
7.3	Measurement uncertainties .....	36
8	Presentation of results.....	36
8.1	General.....	36
8.2	Insertion loss.....	37
8.3	Impedance .....	37
8.4	<i>S</i> -parameters.....	37
Annex A	(normative) Uncertainty estimation for the measurement of the suppression characteristics of EMC filtering devices .....	38
Annex B	(informative) Examples of test boxes for insertion loss measurement.....	43
Annex C	(informative) Insertion loss test methods with non-50 $\Omega$ systems .....	47
Annex D	(informative) Realization of the buffer-network for insertion loss measurement .....	49
Annex E	(informative) Insertion loss measurement – General discussion .....	51
Annex F	(informative) Set-up for impedance measurement .....	54
Annex G	(informative) <i>S</i> -parameter measurement of common-mode choke coils .....	59
Annex H	(informative) Measurement set-up for <i>S</i> -parameters of a DUT without wire leads .....	64
Bibliography	.....	66
Figure 1	– Measurement arrangement for <i>S</i> -parameters of a two-terminal device .....	15
Figure 2	– Measurement arrangement for <i>S</i> -parameters of a three-terminal device .....	15
Figure 3	– Measurement arrangement for four-port <i>S</i> -parameters.....	16
Figure 4	– Test circuit for insertion loss measurement (example: 4-line-filter) .....	18
Figure 5	– Test circuit for asymmetrical insertion loss measurement (example: 4-line-filter) .....	19
Figure 6	– Test circuit for symmetrical insertion loss measurement (example: 4-line-filter).....	20
Figure 7	– Test circuit for unsymmetrical insertion loss measurement (example: 4-line filter) .....	21
Figure 8	– Test circuit for insertion loss measurement without bias .....	22
Figure 9	– Test circuit for insertion loss measurement with bias .....	22
Figure 10	– Test circuit for verification of measurement circuit without bias .....	23
Figure 11	– Test circuit for verification of measurement circuit with bias .....	25
Figure 12	– One-port measurement of a two-terminal device .....	28
Figure 13	– <i>S</i> -parameter measurements for evaluating the impedance of a device in a series connection.....	28
Figure 14	– <i>S</i> -parameter measurements for evaluating the impedance of a device in a shunt connection.....	28
Figure 15	– Two-port <i>S</i> -parameter measurement set-up .....	30
Figure 16	– An alternative measurement system specifically for the insertion loss of a DUT (using a combination of tracking generator and measuring receiver).....	31
Figure 17	– Symbolic expressions.....	32
Figure 18	– Test fixture for a two-terminal device (series connection) .....	32

Figure 19 – Test fixture for a two-terminal device (shunt connection).....	33
Figure 20 – Test fixture for a three-terminal filter .....	33
Figure 21 – Test fixture for a two-terminal device with leads .....	34
Figure 22 – Test fixture for a three-terminal filter with leads.....	35
Figure 23 – Test fixture for a core device.....	35
Figure 24 – Example of the standards for TRL calibration .....	36
Figure B.1 – Design of typical test box for general-purpose filters.....	43
Figure B.2 – 3D view of typical test box for general purpose filters .....	44
Figure B.3 – Design of typical test box for feedthrough components .....	45
Figure B.4 – 3D view of typical test box for feedthrough components.....	45
Figure C.1 – Test circuit.....	47
Figure D.1 – Example of connecting buffer-networks for test with bias.....	49
Figure E.1 – Test circuit for insertion loss measurement, reference measurement (filter replaced by a short circuit).....	51
Figure E.2 – Test circuit for insertion loss measurement, measurement of filter under test...	52
Figure F.1 – Measurement set-up for a leaded device (DUT) .....	54
Figure F.2 – Four-terminal test fixture for a leaded device (DUT).....	55
Figure F.3 – Measurement set-up for an SMD.....	55
Figure F.4 – Clamp-type test fixture.....	56
Figure F.5 – Coaxial test fixture for an SMD.....	56
Figure F.6 – Press-type test fixture for an SMD.....	57
Figure F.7 – Connection for CMCC measurement.....	57
Figure F.8 – Test fixture and measurement set-up for an SMD common-mode choke coil ...	58
Figure G.1 – Common-mode choke coil .....	59
Figure G.2 – Set-up for measurements of common-mode characteristics .....	59
Figure G.3 – Test fixture for an SMD.....	60
Figure G.4 – Test fixture for a leaded device .....	60
Figure G.5 – Set-up for measurements of differential-mode characteristics .....	61
Figure G.6 – Test fixture for an SMD.....	61
Figure G.7 – Test fixture for a leaded device .....	61
Figure G.8 – Set-up for measurement of four-port $S$ -parameters .....	62
Figure G.9 – Test fixture for the four-port $S$ -parameters of an SMD .....	62
Figure G.10 – Test fixture for the four-port $S$ -parameters of a leaded device .....	63
Figure H.1 – $S$ -parameters measurement of a DUT without leads .....	64
Figure H.2 – Procedure for TRL calibration .....	65
Table 1 – Examples of EMC filtering devices .....	13
Table 2 – Conditions and target values for validation of test set-up without bias .....	24
Table 3 – Conditions and target values for validation of test set-up with bias .....	25
Table A.1 – Measurement uncertainty of insertion loss (example) .....	40
Table A.2 – Measurement uncertainty of impedance.....	41
Table A.3 – Measurement uncertainties of $ S_{21} $ and $ S_{12} $ (example).....	41
Table A.4 – Measurement uncertainties of $ S_{11} $ and $ S_{22} $ (example).....	41

Table D.1 – Specifications of the elements of buffer-networks ..... 50

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 55017:2011

<https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-3c03ff69487f/sist-en-55017-2011>

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## METHODS OF MEASUREMENT OF THE SUPPRESSION CHARACTERISTICS OF PASSIVE EMC FILTERING DEVICES

## 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 CISPR 17 has been prepared by CISPR subcommittee A: Radio interference measurements and statistical methods.

This second edition cancels and replaces the first edition published in 1981. It is a technical revision.

This edition includes the following significant technical change with respect to the previous edition: new measurement methods are added to characterize the more technologically sophisticated EMC filtering devices currently available.

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

FDIS	Report on voting
CISPR/A/941/FDIS	CISPR/A/951/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.

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.**

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 55017:2011](#)

<https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-3c03ff69487f/sist-en-55017-2011>

## INTRODUCTION

The suppression characteristics of EMC filters and components used for the suppression of EM disturbances, referred to in this standard as EMC filtering devices, are a function of numerous variables such as impedance of the circuits to which they connect, operating voltage and current, and ambient temperature. This standard specifies uniform test methods that will enable comparison of filtering and suppression characteristics determined by test laboratories or specified by manufacturers.

The first edition of CISPR 17 (1981) prescribed the measurement methods of insertion loss mainly for power-line filters. Today, however, many types of sophisticated EMC filters and suppression components can be found in various electronic devices. Those filters need to be characterized using standardized measurement methods. New methods for measurement of impedance and  $S$ -parameters for such EMI devices are included in this second edition.

In addition, the following insertion loss measurement methods from the first edition have been deleted because they are no longer in use in the industry:

- measurement method with a bias voltage for insertion loss measurement,
- in situ method, and
- worst-case methods.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 55017:2011](https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-3c03ff69487f/sist-en-55017-2011)

<https://standards.iteh.ai/catalog/standards/sist/41e539bc-bb60-47a3-852d-3c03ff69487f/sist-en-55017-2011>

# METHODS OF MEASUREMENT OF THE SUPPRESSION CHARACTERISTICS OF PASSIVE EMC FILTERING DEVICES

## 1 Scope

This International standard specifies methods to measure the radio interference suppression characteristics of passive EMC filtering devices used in power and signal lines, and in other circuits.

The defined methods may also be applied to combinations of over-voltage protection devices and EMC filtering devices.

The measurement method covers the frequency range from 9 kHz to several GHz depending on the device and test circuit.

NOTE Measurement methods in this standard may be applied up to 40 GHz.

The standard describes procedures for laboratory tests (type tests) as well as factory tests. Test methods with and without bias conditions are defined.

Measurement procedures are provided for unbiased and bias conditions. Measurements under bias conditions are performed to determine potential non-linear behaviour of the EMC filtering devices such as saturation effects in inductors with magnetic cores. This testing serves to show the usability in a specific application (such as frequency converters that produce high amplitudes of common mode pulse current and thus may drive inductors into saturation). Measurement under bias conditions may be omitted if the non-linear behaviour can be determined by other methods (e.g. separate saturation measurement of the inductors used).

## 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.

IEC 60050-161, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

## 3 Terms, definitions and abbreviations

### 3.1 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in IEC 60050-161, apply.

#### 3.1.1

##### **bias current**

d.c. or a.c. mains (power) frequency current flowing through the current conductor(s) of the EMC filtering device under test