SLOVENSKI STANDARD
SIST EN 55016-1-1:2010/A2:2014

01-november-2014

Specifikacija merilnih naprav in metod za merjenje radijskih motenj in odpornosti - 1-1. del: Merilne naprave za merjenje radijskih motenj in odpornosti - Merilne naprave - Dopolnilo A2

Specification for radio disturbance and immunity measuring apparatus and methods -- Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus

Anforderungen an Geräte und Einrichtungen sowie Festlegung der Verfahren zur Messung der hochfrequenten Störaussendung (Funkstörungen) und Störfestigkeit -- Teil 1-1: Geräte und Einrichtungen zur Messung der hochfrequenten Störaussendung (Funkstörungen) und Störfestigkeit - Messgeräte

Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques -- Partie 1-1: Appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques - Appareils de mesure

Ta slovenski standard je istoveten z: EN 55016-1-1:2010/A2:2014

ICS:

17.220.20	Merjenje električnih in magnetnih veličin	Measurement of electrical and magnetic quantities
33.100.20	Imunost	Immunity

SIST EN 55016-1-1:2010/A2:2014 en

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 55016-1-1:2010/A2

September 2014

ICS 33.100.10

English Version

Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus (CISPR 16-1-1:2010/A2:2014)

Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques - Partie 1-1: Appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques - Appareils de mesure (CISPR 16-1-1:2010/A2:2014)

Anforderungen an Geräte und Einrichtungen sowie Festlegung der Verfahren zur Messung der hochfrequenten Störaussendung (Funkstörungen) und Störfestigkeit - Teil 1-1: Geräte und Einrichtungen zur Messung der hochfrequenten Störaussendung (Funkstörungen) und Störfestigkeit - Messgeräte (CISPR 16-1-1:2010/A2:2014)

This amendment A2 modifies the European Standard EN 55016-1-1:2010; it was approved by CENELEC on 2014-08-04. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment 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 amendment 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

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

Ref. No. EN 55016-1-1:2010/A2:2014 E

Foreword

The text of document CIS/A/1070/FDIS, future CISPR 16-1-1:2010/A2, prepared by CISPR SC A "Radio-interference measurements and statistical methods" of CISPR "International special committee on radio interference" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 55016-1-1:2010/A2:2014.

The following dates are fixed:

– latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-05-04
– latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-08-04

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 CISPR 16-1-1:2010/A2:2014 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:

CISPR 15	NOTE	Harmonized as EN 55015.
CISPR 22	NOTE	Harmonized as EN 55022.
CISPR 25	NOTE	Harmonized as EN 55025.
CISPR 32	NOTE	Harmonized as EN 55032.

CISPR 16-1-1

Edition 3.0 2014-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

BASIC EMC PUBLICATION
PUBLICATION FONDAMENTALE EN CEM

AMENDMENT 2
AMENDEMENT 2

Specification for radio disturbance and immunity measuring apparatus and methods –
Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus

Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques –
Partie 1-1: Appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Appareils de mesure

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX N

ICS 33.100.10

ISBN 978-2-8322-1655-2

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

FOREWORD

This amendment has been prepared by subcommittee CIS/A: Radio-interference measurements and statistical methods, of IEC technical committee CISPR: International special committee on radio interference.

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

FDIS	Report on voting
CIS/A/1070/FDIS	CIS/A/1075/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this amendment and the base 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 document using a colour printer.

4.4.1 Amplitude relationship (absolute calibration)

Add, after the existing first paragraph, the following new text:

When external preamplifiers are used, refer to Annex J for applicable requirements.

7.5.2 Amplitude relationship

Add, after the existing paragraph and Note, the following new text:

When external preamplifiers are used, refer to Annex J for applicable requirements.

Add, after the existing Annex I, the following new annex:

Annex J
(normative)

Requirements when using an external preamplifier with a measuring receiver

J.1 General

Using an external preamplifier at the input of a measuring receiver shall be considered carefully as, while it improves system sensitivity, it may invalidate the system's compliance with the overload requirements of this standard. Further, an external preamplifier may invalidate the usability of a spectrum analyzer without preselection for the measurement of impulsive signals with pulse repetition frequencies down to 20 Hz using the quasi-peak detector as specified in 4.4.2.

Therefore the operator of a measuring system that includes an external preamplifier shall determine the limitations of the system and shall apply linearity checks for the test system. Automated measurement results with external preamplifiers need to be verified using a final manual linearity check. The information given in this annex provides guidance for the user of emission measurement systems.

J.2 Considerations for optimum emission measurement system design

Internally, measuring receivers are designed to achieve optimum sensitivity while avoiding overload. Built-in preselection in the measuring receiver avoids overload by impulsive signals. In spite of preselection, measuring receivers usually have no linearity reserve for quasi-peak measurements of a single pulse above the specified indication range. Missing preselection in measuring receivers causes problems with quasi-peak detection of impulsive signals with low PRF.

The use of an external broadband preamplifier shall be considered only after all other possible measures for improving the system sensitivity have been exhausted, e.g. using measuring receivers with built-in preamplifiers, using antennas of sufficient gain, or using low loss connecting cables. An external preamplifier need only be added when the disturbance limit and all of the emissions expected and emissions to be measured are very close to the system noise level, e.g. for compliance with Class 5 radiated disturbance limits of CISPR 25 [17]. If high emission signals or high ambients are expected, external preamplifiers are not recommended.

From experience, external preamplifiers are not needed for radiated disturbance measurements to Class B limits of CISPR 11, CISPR 22 [16] and CISPR 32 [18], either at 3 m or at 10 m measurement distance, when measuring receivers with built-in preamplifiers including preselection and low-loss antenna cables are used. The same situation applies for radiated disturbance measurements to CISPR 14-1, CISPR 15 [15], and the generic emission standards, as well as for disturbance power measurements.

External preamplifiers are not recommended for conducted disturbance measurements below 30 MHz; their use may cause harmonics in the presence of high-level disturbance at frequencies below 150 kHz, where many emission standards do not specify disturbance limits.

If an external preamplifier is added for improved sensitivity, the following needs to be considered:

a) preamplifiers have a wide bandwidth, i.e. they are susceptible to overload by impulsive signals and high level narrowband signals;

b) preamplifiers may produce intermodulation products and harmonics; this is especially important when measurements are made on an OATS and/or in the presence of radio transmission equipment;

c) preamplifiers increase the signal level at the receiver input and thus may overload the receiver input stages, a condition which cannot be avoided entirely by the receiver's built-in preselection;

d) the gain in sensitivity will be less than the gain in signal level, thus limiting the dynamic range of the preamplifier/receiver combination;

NOTE 1 The gain in sensitivity is understood as the difference between the noise figure without preamplifier and the system noise figure with preamplifier.

e) for maximum sensitivity in the frequency range above 1 GHz, the preamplifier is mounted/connected directly to the measurement antenna;

f) use of an external preamplifier requires that an accurate gain versus frequency characterization be accounted for in the measurement result;

g) the uncertainty of the gain as a function of temperature and aging, as well as the additional mismatch uncertainty between the preamplifier output port and the receiver input port, shall be included in the uncertainty budget for the measurement; the input impedance shall, as far as possible, comply with the requirements for the measuring receiver and shall be included in the uncertainty budget;

h) for CISPR Band E, a system consisting of an external preamplifier and a measuring receiver shall be designed such that it cannot be overloaded by signals of lower frequency bands, and/or by any signal whose out-of-band or spurious signals are to be measured; e.g. the ISM signal of a microwave oven shall not drive the system into overload.

The gain in sensitivity is determined using the following quantities and equations:

$$F = \frac{P_{ie}}{kT_0 B} \text{ and,} \qquad (J.1)$$

$$\text{for an amplifier, } F = \frac{P_o}{gkT_0 B} \qquad (J.2)$$

where

F is the noise factor, with 10 lg$F$ = noise figure (often denoted by the symbol NF);

P_{ie} is the equivalent noise input power;

P_o is the noise output power;

g is calculated from the gain, G = 10 lg$g$, respectively $g = 10^{G/10}$

k is Boltzmann's constant = 1,38 × 10^{-23} Ws/K and kT_0 = 4 × 10^{-21} W/Hz

T_0 is the absolute reference room temperature (293 K);

B is the noise bandwidth (e.g. of the measuring receiver).

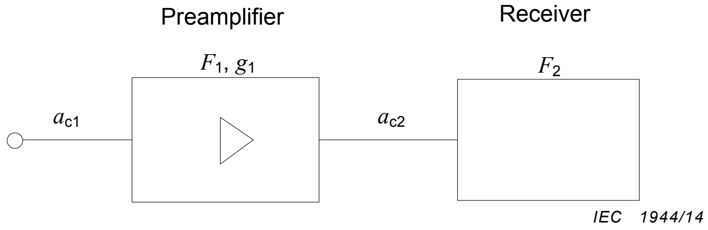

Figure J.1 – Receiver with preamplifier

In Figure J.1, assuming that the cable attenuation a_{c2} = 0 dB, then

$$10 \lg F_{tot} = a_{c1} + 10 \lg \left(F_1 + \frac{F_2 - 1}{g_1} \right) \qquad (J.3)$$

where F_{tot} is the noise factor of the system at the input cable with a_{c1}.

If $a_{c2} \neq 0$ dB, then the preamplifier gain factor g_1 in Equation (J.3) has to be replaced by $10^{(G_1 - a_{c2})/10}$. Cable attenuation a_{c1} = 0 dB is achieved by mounting and/or connecting the preamplifier directly to the antenna. If $a_{c1} \neq 0$ dB, then the cable attenuation a_{c1} adds to the system noise figure as shown by Equation (J.3).

State-of-the-art preamplifiers typically have noise figures of 3 dB or less, corresponding to a noise factor of F_1 = 2. Receivers with built-in preamplifiers typically have noise figures around 8 dB, corresponding to a noise factor F_2 = 6,3. This high noise factor is due to attenuation caused by preselection and other internal insertion losses of the receiver. Receivers without built-in preamplifiers typically have noise figures around 15 dB, corresponding to a noise factor F_2 = 31,6.

NOTE 2 The noise figure 10 lgF_2 of a measuring receiver can be determined from the indicated noise level using

$$10 \lg F_2 = V_{Nav} + 67 - 10 \lg B_N - w_{Nav}$$

where

V_{Nav} is the receiver noise floor with linear average detection, in dB(μV);

B_N is the noise bandwidth of the measuring receiver, in Hz;

w_{Nav} is the noise weighting factor for linear average detection, in dB.

EXAMPLE If V_{Nav} = –10,7 dB(μV), B_N = 85 kHz (for B_6 = 120 kHz), and w_{Nav} = –1 dB, then the noise figure 10 lgF_2 = 8 dB.

The quantity w_{Nav} is the difference between the indications of the linear average detector and the r.m.s. detector for Gaussian noise [19]; values for quasi-peak detection w_{Nqp} are approximately 4 dB for Band B, and 6 dB for Bands C/D; for peak detection w_{Npk} is up to 12 dB, depending on measurement time.

The noise bandwidth B_N is close to the 3 dB bandwidth B_3 of the measuring receiver. A rough approximation is given by B_N = 1,1 B_3. See [19] for details about specific filter implementations.

Considering a given preamplifier noise figure of 3 dB, it will be acceptable to achieve a system noise figure 10 lgF_{tot} = 4 dB, corresponding to a noise factor of 2,51. This requires that $(F_2 - 1)/g_1$ = 0,51, or $g_1 = (F_2 - 1)/0{,}51$.

- For receivers with a built-in preamplifier, the resulting gain is g_1 = 10,39, or G_1 = 10,2 dB.