SLOVENSKI STANDARD
oSIST prEN 50715:2021

01-julij-2021

Specifikacija za merilne naprave in metode za merjenje radijskih motenj in odpornosti - 4-3. del: Modeliranje negotovosti, statistike in mejnih vrednosti - Statistični vidiki in določanje skladnosti z EMC serijsko proizvedenih izdelkov

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

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Ta slovenski standard je istoveten z: **prEN 50715:2021**

ICS:

33.100.01	Elektromagnetna združljivost na splošno	Electromagnetic compatibility in general

oSIST prEN 50715:2021 **en,fr,de**

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 50715

May 2021

ICS

English Version

Electromagnetic compatibility - Radio frequency emission - Statistical considerations in the determination of compliance for mass-produced products with emission requirements

Compatibilité électromagnétique - Émissions radiofréquences - Considérations statistiques pour la détermination de la conformité des produits de série aux exigences en matière d'émissions

To be completed

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2021-07-30.

It has been drawn up by CLC/TC 210.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CENELEC 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

CENELEC

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

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36 **European foreword**

37 This document [*CLC standard reference*] has been prepared by CLC/TC/SR/SC **XX** "***Title***".

38 This document is currently submitted to the Enquiry/ Primary Questionnaire.

39 The following dates are proposed:

• latest date by which the existence of this document has to be announced at national level	(doa)	dor + 6 months
• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	dor + 12 months
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	dor + 36 months (to be confirmed or modified when voting)

4

40 # INTRODUCTION

41 This introduction is for information of the CENELEC NC's only and will not be part of the final standard.

42 The creation of this standard is part of the so called "long term solution" for the problem, that the
43 European Commission does not want to list any standard under the European EMCD or RED, as long
44 as it contains a reference to the significance of CISPR-limits for type approved equipment.

45 Note: The significance of CISPR-limits for type approved equipment is that on a statistical basis at least
46 80 % of the mass-produced equipment complies with the limits with at least 80 % confidence. which
47 says that on a statistical basis at least 80 % of the mass-produced equipment shall comply with the limits
48 with at least 80 % confidence.

49 This "long term solution" contained the following steps:

50 1. CENELEC produces a separate document, containing all provisions for the statistical evaluation of
51   RFI measurements on mass produced equipment.
52   This document will not be listed under any Directive, but shall define the state of the art in Europe
53   for the evaluation of radio frequency emission of mass produced products.

54 2. CENELEC deletes all text about statistical considerations in the European versions of the CISPR
55   radio emission standards like CISPR 11, CISPR 14-1 and CISPR 15.

56 3. With these common modifications, the European radio emission standards will be again listed under
57   the EMCD and RED.

58 This standard is based on CISPR TR 16-4-3 "SPECIFICATION FOR RADIO DISTURBANCE AND
59 IMMUNITY MEASURING APPARATUS AND METHODS – Part 4-3: Uncertainties, statistics and limit
60 modelling – Statistical considerations in the determination of EMC compliance of mass-produced
61 products"

62 Additionally it contains specific provisions, given only in the product standards CISPR 11, CISPR 14-1
63 and CISPR 15.

prEN 50715:2021 (E)

1 Scope

This document defines statistical considerations for the evaluation of radio frequency emission of mass produced products.

Note 1   It is based on CISPR TR 16-4-3.

The reasons for such statistical considerations are:

a)   that the abatement of interference aims that the majority of the products to be approved shall not cause interference;

b)   that the CISPR limits should be suitable for the purpose of type approval of mass- produced products as well as approval of single-produced products;

c)   that to ensure compliance of mass-produced products with the CISPR limits, statistical techniques have to be applied;

d)   that it is important for international trade that the limits shall be interpreted in the same way in every country;

Therefore, this document specifies requirements and provides guidance based on statistical techniques. EMC compliance of mass-produced products with the requirements of this document are based on the application of statistical techniques that reassure the consumer, with an 80 % degree of confidence, that 80 % of the products of a type being investigated comply with the emission limits.

This document does not define limits or measuring methods. It can be used only after radio frequency emission measurements have been performed according to the applicable radio frequency emission standard.

Note 2   Clause 4 gives some general requirements on the interpretation of CISPR radio disturbance limits and specifies different methods, which can be used alternatively. Clause 5 gives some specific requirements for certain product groups.

Note 3   The 80 %/80 % rule protects the consumer from non-compliant products, but it says hardly anything about the manufacturer's risk, whether a type of products will be accepted during a second statistical evaluation. More information on the acceptance probability for a repeated measurement is given in CISPR 16-4-3.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 55011, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

EN 55014-1, *Electromagnetic Compatibility - Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

EN 55015, *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*

CISPR TR 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*

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

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3 Terms and Definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- • IEC Electropedia: available at https://www.electropedia.org/

- • ISO Online browsing platform: available at https://www.iso.org/obp

4 Interpretation of CISPR radio disturbance limits

4.1 Significance of a CISPR limit

A CISPR limit is a limit recommended to national authorities for incorporation in national standards, relevant legal regulations and official specifications. It is also recommended that international organizations use these limits.

The significance of the limits for type approved equipment shall be that on a statistical basis at least 80 % of the mass-produced equipment complies with the limits with at least 80 % confidence.

4.2 General

4.2.1 Equipment producing continuous disturbance

Evaluations shall be made either:

a) on a sample of equipment of the type using the statistical method of evaluation in accordance with 4.3, or

b) for simplicity's sake, on one unit only.

Subsequent tests are recommended from time to time on equipment taken at random from the production, especially if option b) above has been followed.

4.2.2 Equipment producing discontinuous disturbance (clicks)

Evaluations shall be made on one unit only.

NOTE   The evaluation of discontinuous disturbance (clicks) is described in EN 55014-1.

Subsequent tests are recommended from time to time on units taken at random from the production. In the case of controversy with regard to the result of an evaluation, the following shortened procedure is applied:

If the first unit is tested and fails, three additional units shall be tested at the same frequency or frequencies at which the first unit failed. The three additional units are judged according to the same requirements as applied to the first unit. If all three additional units comply with all relevant requirements, the final result of the evaluation is PASS. If one or more units do not comply with all relevant requirements, the final result of the evaluation is FAIL.

4.3 Compliance with limits for equipment in large-scale production

4.3.1 General

Statistically assessed compliance with the limits shall be made according to one of the three methods described below or to some other test which ensures compliance with the requirements of 4.1.

The test according to 4.3.2 or 4.3.3 should be performed on a sample of not less than 5 items of the type, but if, in exceptional circumstances, 5 items are not available, then a sample of at least 3 shall be used.

143 The test according to 4.3.2 should be performed on a sample of not less than 7 items.

144 It is recommended to start the evaluation with the method described in 4.3.2 and only in case the test
145 has not been passed to continue with the more extensive methods described in 4.3.3 and 4.3.4.

4.3.2 Method based on a general margin to the limit

147 Compliance with the requirements of this standard is given when the measured values from all items of
148 the sample are under the limit and the margin to the limit is not less than the general margin, given in
149 Table 1 below.

150 **Table 1 – General margin to the limit for statistical evaluation**

Sample size (n)	3	4	5	6
General margin to the limit (dB)	3,8	2,5	1,5	0,7

151 This method shall not be used to consider a product as non-compliant with the requirements of this
152 standard.

153 NOTE   The general margin to the limit has been calculated using the conservative value σ_{max} = 6,0 dB for the
154 standard deviation in a product group. For further information on this method see CISPR 16-4-3.

155 In Table 1, values are given only for a sample size up to n = 6 because for n = 7 or higher the method
156 given in 4.3.4 can be applied, where the binomial distribution without an additional margin is used.

4.3.3 Test based on the non-central t-distribution

158 Compliance with the requirements of this standard is judged from the following relationship:

159 $$\overline{x} + kS_n \leq 0 \qquad\qquad (1)$$

160 where

161 $\overline{x}$ is the arithmetic mean of the values x_n of n items in the sample;

162 S_n is the standard deviation of the sample with

163 $$S\frac{2}{n} = \sum (x - \overline{x}_n)^2 / (n-1); \qquad (2)$$

164 The quantities x_n, $\overline{x}$ and S_n are expressed logarithmically (dB(μV), dB(pW) or dB(μV/m).

165 k is the factor, derived from tables of the non-central t-distribution, which ensures with 80 %
166 confidence that 80 % or more of the type is below the limit; the value of k depends on the sample size
167 n and is given in Table 2 below.

168 **Table 2 — Factor k for the application of the non-central t-distribution**

n	3	4	5	6	7	8	9	10	11	12
k	2,04	1,69	1,52	1,42	1,35	1,3	1,27	1,24	1,21	1,2

169 x_n is determined as follows:

170 –   for each of the frequency ranges specified below, the differences between the measured values and
171   the limit are calculated. The difference is negative where the measured value is below the limit and
172   positive where it is higher than the limit.

173 For the nth individual unit, x_n is the difference value at the frequency where the difference curve is at

174 maximum.

8

175 NOTE 1   If all measured values are below the limit, x_n is the shortest distance to the limit. If some of the measured
176 values are above the limit, x_n is highest value by which the limit is exceeded.

177 The statistical evaluation shall be carried out separately for the frequency sub-ranges, given in Clause 5.

178 If all measured values are under the limit and the test is failed only due to a high standard deviation, it
179 shall be investigated whether this high standard deviation has been caused by a maximum of x_n at the
180 borderline between two frequency sub-ranges. In this case the evaluation has to be done according to
181 4.3.4.

182 NOTE 2   Figure 1 illustrates the possible difficulties if a maximum of the measured disturbances occurs near the
183 borderline between two frequency sub-ranges. "U" is the measured disturbance voltage; "f" is the frequency. Here
184 two units with different characteristics out of a sample are shown. For broadband disturbances the value of the
185 maximum as well as the frequency of the maximum can change from unit to unit, differences as between unit 1 and
186 unit 2 in a sample are typical. An average value and standard deviation is calculated for all units (of which two are
187 shown) for each sub-range. In this example the calculated standard deviation is much higher for subrange 1 than
188 subrange 2 (e.g. consider how different the values of x_1 and x_2 are at the borderline). Even though the average for
189 subrange 1 is much lower than subrange 2, after taking into consideration the high value of S_n multiplied by the
190 factor out of Table 11, in rare cases this could lead to the sample set failing the given criteria. Since this is simply a
191 consequence of the way in which the frequency sub-ranges have been defined, no statistically meaningful
192 conclusion can be drawn regarding compliance with the requirements of this standard.
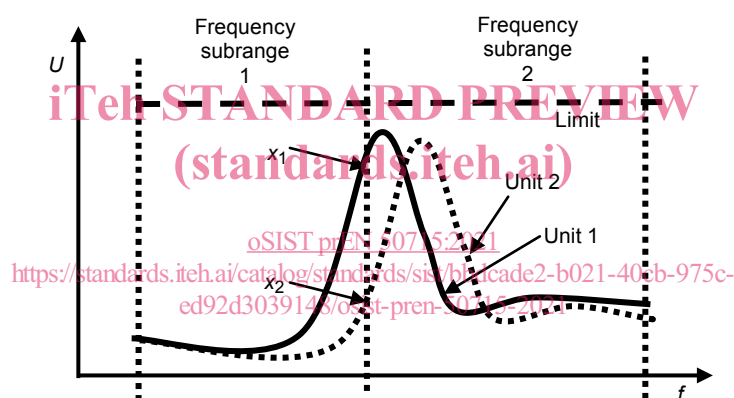
IEC   1904/08

193

194 **Figure 1 Unit-to-unit variation of the sub-range maximum**

195 NOTE 3   This Figure is taken from CISPR 14-1, Ed. 7.

196 **4.3.4   Test based on the binomial distribution**

197 Compliance with the requirements of this standard is judged from the condition that, from a sample of
198 size n, the number of units that generate an interference level above the applicable limit shall not exceed
199 c, as given in Table 3.

200 **Table 3 — Application of the binomial distribution**

n	7	14	20	26	32
c	0	1	2	3	4