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oSIST prEN IEC 61000-4-41:2024
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**Elektromagnetna združljivost (EMC) - 4-41. del: Preskusne in merilne tehnike -
Preskusi odpornosti proti širokopasovnemu sevanju**

Electromagnetic compatibility (EMC) - Part 4-41: Testing and measurement techniques -
Broadband radiated immunity tests

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TITLE:

Electromagnetic compatibility (EMC) - Part 4-41: Testing and measurement techniques - Broadband radiated immunity tests

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76 INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROMAGNETIC COMPATIBILITY (EMC)

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Part 4-41: Testing and measurement techniques – Broadband radiated immunity tests

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FOREWORD

87 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising
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119 International Standard IEC 61000-4-41 has been prepared by subcommittee 77B: High
120 frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

121 It forms Part 4-41 of IEC 61000. It has the status of a basic EMC publication in accordance with
122 IEC Guide 107.

123 The text of this International Standard is based on the following documents:

Draft	Report on voting
77B/xxxx/FDIS	77B/xxxx/RVD

124

125 Full information on the voting for its approval can be found in the report on voting indicated in
126 the above table.

127 The language used for the development of this is English.

128 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
129 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available
130 at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are
131 described in greater detail at <http://www.iec.ch/standardsdev/publications>.

132 A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic*
133 *compatibility (EMC)*, can be found on the IEC website.

134 The committee has decided that the contents of this document will remain unchanged until the
135 stability date indicated on the IEC website under webstore.iec.ch in the data related to the
136 specific document. At this date, the document will be

- 137 • reconfirmed,
- 138 • withdrawn,
- 139 • replaced by a revised edition, or
- 140 • amended.

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INTRODUCTION

147 IEC 61000 is published in separate parts according to the following structure:

148 Part 1: General

149 General considerations (introduction, fundamental principles)

150 Definitions, terminology

151 Part 2: Environment

152 Description of the environment

153 Classification of the environment

154 Compatibility levels

155 Part 3: Limits

156 Emission limits

157 Immunity limits (in so far as they do not fall under the responsibility of the product
158 committees)

159 Part 4: Testing and measurement techniques

160 Measurement techniques

161 Testing techniques

162 Part 5: Installation and mitigation guidelines

163 Installation guidelines

164 Mitigation methods and devices

165 Part 6: Generic standards

166 Part 9: Miscellaneous

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167 Each part is further subdivided into several parts, published either as international standards
168 or as technical specifications or technical reports, some of which have already been published
169 as sections. Others will be published with the part number followed by a dash and a second
170 number identifying the subdivision (example: IEC 61000-6-1).

171 This part is an international standard which gives immunity requirements and test procedures
172 related to radiated disturbances generated by broadband signals.

173 Modern digital communication signals operate on multiple frequencies such as Orthogonal
174 Frequency Division Multiplexing (OFDM) and use bandwidths ranging from tens of MHz to
175 hundreds of MHz, all while employing in-band time-division multiplexing (TDM) and/or
176 Frequency Domain Division (FDD) transmission technology. Such broadband signals could
177 cause a performance degradation and/or malfunctions of other equipment. In this document,
178 the disturbance is not a frequency sweep of a narrowband signal but a broadband signal with
179 coexisting multiple frequencies which is stepped through the desired frequency range.

180 Examples of broadband signals are LTE signals and 5G mobile communication signals.

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ELECTROMAGNETIC COMPATIBILITY (EMC)

Part 4-41: Testing and measurement techniques – Broadband radiated immunity tests

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189 **1 Scope**

190 This part of IEC 61000 relates to broadband radiated disturbances created by, for example,
191 communication devices or services, transmitters or industrial electromagnetic sources or any
192 other devices capable of generating such a signal.

193 The object of this document is to establish a common reference for evaluating the immunity of
194 electrical and electronic equipment when subjected to broadband radiated electromagnetic
195 fields.

196 This document specifies testing in frequency ranges above 80 MHz, limited only by the
197 capabilities of the test instrumentation.

198 **2 Normative references**

199 The following documents are referred to in the text in such a way that some or all of their content
200 constitutes requirements of this document. For dated references, only the edition cited applies.
201 For undated references, the latest edition of the referenced document (including any
202 amendments) applies.

203 IEC 60050 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at
204 <<http://www.electropedia.org>>)

205 IEC 61000-4-3:2020 Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement
206 techniques - Radiated, radio-frequency, electromagnetic field immunity test

207 **3 Terms and definitions**

208 For the purposes of this document, the following terms and definitions apply.

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

- 211 • IEC Electropedia: available at <http://www.electropedia.org/>
- 212 • ISO Online browsing platform: available at <http://www.iso.org/obp>

213 **3.1** 214 **auxiliary equipment**

215 **AE**
216 equipment necessary to provide the equipment under test (EUT) with the signals required for
217 normal operation and equipment to verify the performance of the EUT

218 **3.2** 219 **equivalent carrier field strength**

220 cumulative field strength caused by the radiation of broadband signal, expressed in V/m

221 **3.3**
 222 **broadband signal**
 223 signal where the energy is distributed over several megahertz, either by a broadband nature of
 224 the signal itself or by a collection of subcarriers

225 Note 1 to entry in typical applications a broadband signal could be as wide as 5 MHz to 100 MHz

226 **3.4**
 227 **duty cycle**
 228 fraction of the period time where a repetitive signal is above a specified threshold

229 **3.5**
 230 **test generator**
 231 generator capable of generating the required test signal

232 Note 1 to entry The test generator can, for example, include a vector signal generator, modulation sources,
 233 attenuators, broadband power amplifiers and filters, etc. See Annex A for additional information on test generator.

234 **3.6**
 235 **white noise**
 236 **flat random noise**
 237 random noise which has a continuous spectrum and a constant power spectral density in the
 238 frequency band considered

239 [SOURCE: IEC 60050-702:1992, 702-08-39]

240 **3.7**
 241 **electric field spectral density**
 242 quantity derived from the electric Power Spectral Density (PSD) of a broadband signal

243
 244 Note 1 to entry Further information can be found in Annex D
 245

246 **4 General**

247 The source of disturbance covered by this part of IEC 61000 is an electromagnetic field,
 248 consisting of broadband signals, generated by, for example, communication devices or services,
 249 transmitters or industrial electromagnetic sources or any other devices capable of generating
 250 such a signal.

251 – The frequency range covered by this document is specified in Table 3Table 3.
 252

253

254 **5 Test levels and test signal**

255 **5.1 Test levels**

256 The test levels are given in terms of an equivalent carrier field strength consistent with the
257 level-setting process and the electric field spectral density spread out to the test signal
258 bandwidth.

259 The levels in columns 3 to 6 of Table 1 show the electric field spectral density derived from the
260 power spectral density of the broadband test signal assuming that the different spectrum
261 components are uncorrelated.

262 The test level is derived from the UFA level-setting process. The signal power to generate the
263 test levels of Table 1 should be equal to the total power of the broadband signal.

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Table 1 – Test levels

Test Level	Equivalent carrier field strength V/m	Electric Field Spectral Density $\text{dB}\left(\frac{\mu\text{V}}{\text{m}\cdot\sqrt{\text{Hz}}}\right)$			
		<i>BW</i> = 5 MHz	<i>BW</i> = 20 MHz	<i>BW</i> = 40 MHz	<i>BW</i> = 100 MHz
1	1	53,0	47,0	44,0	40,0
2	3	62,5	56,5	53,5	49,5
3	10	73,0	67,0	64,0	60,0
4	30	82,5	76,5	73,5	69,5

Note 5 MHz and 40 MHz bandwidth (*BW*) are indicated for the convenience of the product committee.

268 This document does not suggest that a single test level is applicable over the entire frequency
 269 range. The product committees shall select the frequency range(s) to be tested as well as the
 270 appropriate test level(s). See Annex D giving guidance for product committees on the selection
 271 of test levels.

272 Product committees may use test levels other than those listed in Table 1. However, once the
 273 equivalent carrier field strength is determined, the test levels for each bandwidth follow the
 274 relationship between the test levels in this table.

275 5.2 Test signal

276 Real broadband communication signals today are largely based on OFDM. The parameters
 277 (number of carriers, modulation per carrier, etc.) are so diverse that an internationally agreed
 278 set of parameters that is representative of all conceivable broadband communication services
 279 does not seem to make sense. In accordance with the nature of the interference, a band-limited
 280 noise is therefore specified as the test signal. The signal can be generated on the one hand by
 281 a physical noise generator with a filter, on the other hand by an arbitrary waveform generator,
 282 which periodically plays a pseudo-noise code. With the latter, care must be taken that the
 283 sequence is long enough to produce a spectrum that is as continuous as possible.

284 An additional important parameter of the test signal is the crest factor. The crest factor is defined
 285 as the relation between peak amplitude and RMS and is usually expressed in dB. The crest
 286 factor of the signal generator output signal shall be at least 10 dB. Information on test signal
 287 characterization is given in Annex F.

288 Note The higher the crest factor the higher the compression demand on the power amplifier.

289