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Integrirana vezja - Vrednotenje elektromagnetne združljivosti (EMC) oddajnikov-sprejemnikov - 6. del: Oddajniki-sprejemniki PSI5

Integrated circuit - EMC Evaluation of transceivers - Part 6: PSI5 transceivers

iTeh STANDARD

Circuits intégrés - Évaluation de la CEM des émetteurs-récepteurs - Partie 6: Émetteurs-récepteurs PSI5

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TITLE:

Integrated circuit – EMC Evaluation of transceivers – Part 6: PSI5 transceivers

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NOTE FROM TC/SC OFFICERS:

The comments for 47A/1123/CD were reviewed in SC 47A WG 9 meeting which was held on 2021-10-01 and 2021-12-01 and all technical issues were resolved and addressed in 47A/1125A/CC, so the project will move forward as CDV.

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INTEGRATED CIRCUIT – EMC EVALUATION OF TRANSCEIVERS

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Part 6: PSI5 transceivers

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FOREWORD

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165 IEC 62228-6 has been prepared by subcommittee 47A: Integrated circuit, of IEC technical
 166 committee 47: Semiconductor Device. It is an International Standard.

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

Draft	Report on voting
47A/XX/CD	47A/XX/RVD

168

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

171 The language used for the development of this International Standard is English.

172 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
 173 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available

174 at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are
175 described in greater detail at www.iec.ch/standardsdev/publications.

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

- 179 • reconfirmed,
- 180 • withdrawn,
- 181 • replaced by a revised edition, or
- 182 • amended.

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184

INTRODUCTION

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INTEGRATED CIRCUITS – EMC EVALUATION OF TRANSCEIVERS

Part 6: PSI5 transceivers

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204 1 Scope

205 This document specifies test and measurement methods for EMC evaluation of Peripheral
206 Sensor Interface 5 (PSI5) transceiver integrated circuits (ICs) under network condition. It
207 defines test configurations, test conditions, test signals, failure criteria, test procedures, test
208 setups and test boards. It is applicable for PSI5 satellite ICs (e.g. sensors) and ICs with
209 embedded PSI5 transceivers (e.g. PSI5 Electronic control unit IC). The document covers

- 210 • the emission of RF disturbances,
- 211 • the immunity against RF disturbances,
- 212 • the immunity against impulses and
- 213 • the immunity against electrostatic discharges (ESD).

214 2 Normative references

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

219 IEC 61967-1, *Integrated circuits – Measurement of electromagnetic emissions – Part 1:*
220 *General conditions and definitions*

<https://standards.iteh.ai/catalog/standards/sist/8b280d30-6171854-842d-496a31b12/osist-pr-en-iec-62228-6-1-2022>

221 IEC 61967-4, *Integrated circuits – Measurement of electromagnetic emissions – Part 4:*
222 *Measurement of conducted emissions – 1 Ω / 150 Ω direct coupling method*

223 IEC 62132-1, *Integrated circuits – Measurement of electromagnetic immunity – Part 1: General*
224 *and definitions*

225 IEC 62132-4, *Integrated circuits – Measurement of electromagnetic immunity 150 kHz to 1 GHz*
226 *– Part 4: Direct RF Power Injection Method*

227 IEC 62215-3, *Integrated circuits – Measurement of impulse immunity - Part 3: Non-synchronous*
228 *transient injection method*

229 IEC 62228-1, *Integrated circuits – EMC evaluation of transceivers – Part 1: General conditions and*
230 *definitions*

231 ISO 7637-2, *Road vehicles, electrical disturbances by conduction and coupling – Part 2: Electrical*
232 *transients along supply lines only*

233 ISO 10605, *Road vehicles - Test methods for electrical disturbances from electrostatic*
234 *discharge*

235 3 Terms and definitions

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

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

- 239 • IEC Electropedia: available at <https://www.electropedia.org/>
- 240 • ISO Online browsing platform: available at <https://www.iso.org/obp>

241 3.1

242 global pin

243 carries a signal or power, which enters or leaves the application board without any active
244 component in between

245 3.2

246 mandatory components, pl

247 components needed for proper function and/or technical requirements of IC as specified by the
248 IC manufacturer

249 3.3

250 PSI5 satellite IC (sensor device)

251 PSI5 satellite or sensor transceiver with access to PSI5 signal

252 3.4

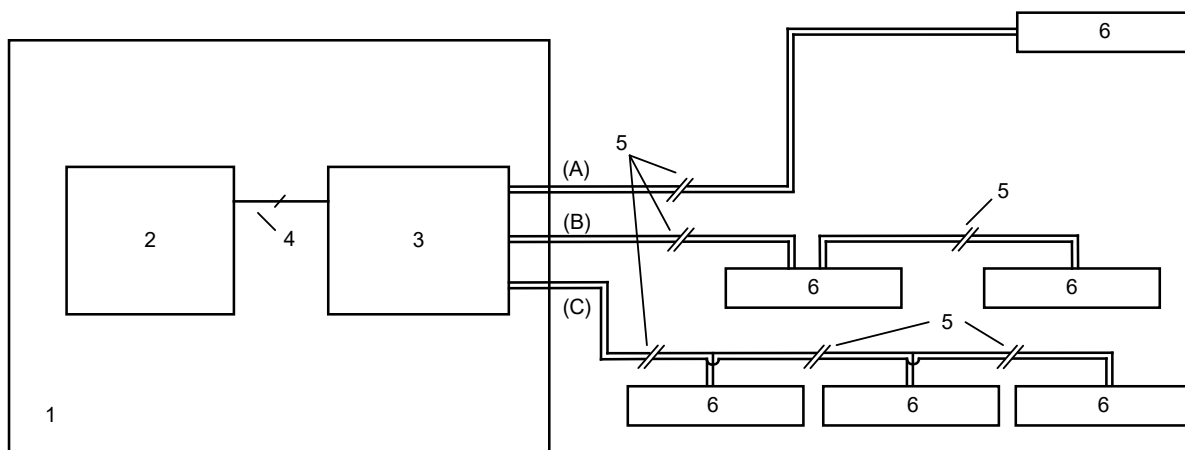
253 IC with embedded PSI5 transceiver (ECU device)

254 IC with integrated PSI5 transceiver cell and PSI5 protocol handler with access to PSI5 signal
255

256 4 General

258 The intention of this document is to evaluate the EMC performance of PSI5 transceiver ICs
259 under application in minimal operating conditions (or in a minimal network). PSI5 transceiver
260 ICs are in general available in two types as PSI5 satellite IC and as IC with embedded PSI5
261 transceiver.

262 PSI5 transceiver system overview is shown in Figure 1.



263

Key

1	Electronic Control Unit (ECU)	6	PSI5 Sensor ICs
2	Microcontroller	(A)	Point-to-Point topology
3	IC with embedded PSI5	(B)	Daisy-chain topology
4	Digital interface	(C)	Bus topology
5	Two wire current interface (PSI5)		

264

Figure 1 – PSI5 system overview

265 The sensors are connected to the ECU with two wires, using the same lines for power supply
 266 and data transmission. The IC with embedded PSI5 (e.g. transceiver ASIC in the ECU) provides
 267 a pre-regulated voltage to the sensors and reads in the transmitted sensor data.

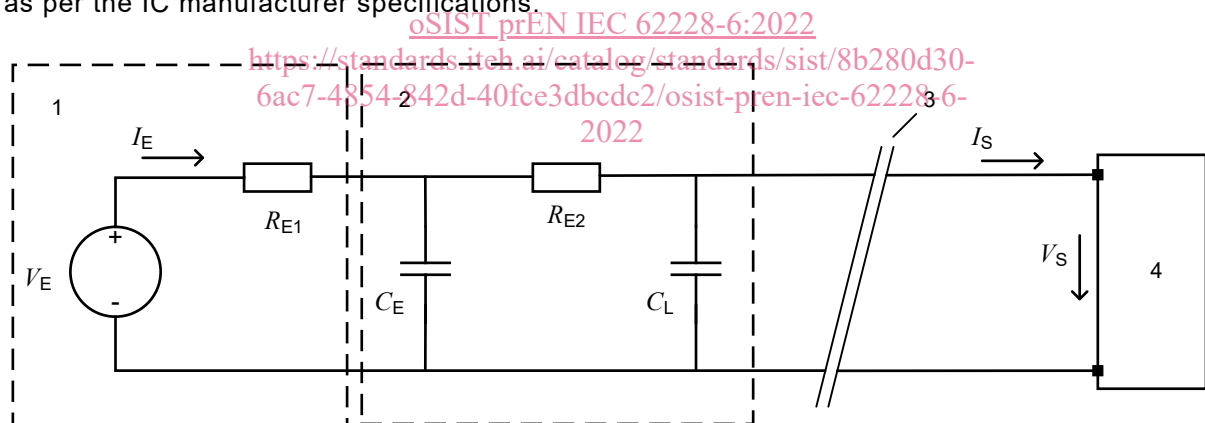
268 The physical layer of PSI5 for EMC evaluation shall have the following characteristics, as shown
 269 in Table 1 [1].

270 **Table 1 – PSI5 Physical layer electrical characteristics**

No.	Parameter	Variable	Minimum	Typical	Maximum	Unit
1	Supply Voltage	V_{SSmax}, V_{CEmax}	4		16,5	V
2	Reverse polarity protection (standard)	$t < 80$ ms	-105			mA
3	Reverse polarity protection (extended)	$t < 50$ ms	-130			mA
4	Internal ECU resistance	R_{E1}	9		10	Ω
5	PSI5 ECU Filter capacitor ^a	C_E	9	10	11	nF
6	PSI5 ECU Filter resistor	R_{E2}	2	2,2	2,5	Ω
7	PSI5 ECU Filter capacitor ^a	C_L	9	10	11	nF

^a Symmetrical values for C_E and C_L are proposed to have a balanced filter on PSI5.

271 An example of the typical PSI5 network, with a single sensor and the equivalent model, is shown
 272 in Figure 2. Most implementations will have a mandatory PSI5 ECU filter (PSI5 bus filter) used
 273 on the ECU side as shown in Figure 2. Sensor side may also have additional filter components
 274 as per the IC manufacturer specifications.



275

Key

- 1 PSI5 ECU IC
- 2 PSI5 ECU Filter (PSI5 bus filter)
- 3 Two-wire PSI5 interface
- 4 PSI5 Satellite IC / Sensor

276 **Figure 2 – Example PSI5 wiring diagram with a single sensor and equivalent model**

277 The evaluation of the EMC characteristics of PSI5 transceivers shall be performed in functional
 278 operation modes for RF emission, RF immunity and impulse immunity tests and on a single
 279 unpowered transceiver IC for electrostatic discharge tests.

280 The approach of these tests is to determine the EMC performance on dedicated global pins of
 281 the PSI5 transceiver which are considered as EMC relevant in the application. For a PSI5
 282 satellite IC or for an embedded PSI5 transceiver IC these pins are at least PSI+ (PSI_DATA),
 283 PSI- (PSI_GND) and V_{BAT}, if available.

284 The test methods used for the EMC characterization are based on the international standards
 285 for IC EMC tests and are described in Table 2.

286

Table 2 – Overview of required measurements and tests

Transceiver mode	Required test	Test method	Evaluation	Functional operation mode
Functional (powered)	RF emission	150 Ω direct coupling (IEC 61967-4)	Spectrum	Asynchronous
				Synchronous
	RF immunity	DPI (IEC 62132-4)	Function	Synchronous ^a
				Asynchronous Low-power ^b
	Impulse immunity	Non-synchronous transient injection (IEC 62215-3)	Function	Synchronous ^a
				Asynchronous Low-power ^b
Passive (unpowered)	ESD	Contact discharge (ISO 10605)	Damage	Off

^a If the PSI5 transceiver under test does not support Synchronous mode, Asynchronous mode shall be used.

^b The test with asynchronous low-power mode is recommended with the motivation to evaluate the RF and Impulse immunity performance with lower power supply levels on the interface. If the PSI5 transceiver does not support low-power mode, the test can be omitted.

287 The 150 Ω direct coupling, DPI and impulse immunity test methods are chosen for the
 288 evaluation of the EMC characteristic of transceivers in functional modes. These three test
 289 methods are based on the same approach using conductive coupling. Therefore, it is possible
 290 to use the same test board for all tests in functional operation mode, which reduces the effort
 291 and increases the reproducibility and comparability of test results.

292 The ESD test is performed on a passive transceiver IC on a separate test board.

293 It is recommended to perform all measurements and tests with soldered transceivers on special
 294 test boards to ensure application like conditions and to avoid setup effects due to sockets. Test
 295 circuits and board design requirements for emission, immunity and ESD tests are described in
 296 Annex A and Annex B respectively.

297 Since PSI5 transceivers are mostly implemented with PSI5 ECU filter (PSI5 bus filter), the EMC
 298 performance of the PSI5 transceiver is evaluated with a bus filter at the PSI+/PSI- pins. In
 299 consequence, the frequency characteristics of these filter elements should be taken into
 300 account for the interpretation of the test results. Annex C provides example test limits and levels
 301 for PSI5 transceivers in automotive application.

302 5 Test and operating conditions

303 5.1 Supply and ambient conditions

304 For all tests and measurements under operating conditions the settings are based on systems
 305 with 12 V power supply, which is the main application of PSI5 transceivers. If a transceiver is
 306 designed or targeted for higher power supply voltages the test conditions and test targets shall
 307 be adapted and documented accordingly. The defined supply and ambient conditions for
 308 functional operation are given in Table 3.