SLOVENSKI STANDARD
oSIST prEN IEC 62228-6:2022

01-maj-2022

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

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

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

Ta slovenski standard je istoveten z: **prEN IEC 62228-6:2022**

ICS:

31.200	Integrirana vezja, mikroelektronika	Integrated circuits. Microelectronics
33.100.01	Elektromagnetna združljivost na splošno	Electromagnetic compatibility in general

oSIST prEN IEC 62228-6:2022 **en**

47A/1132/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:	
IEC 62228-6 ED1	
DATE OF CIRCULATION:	CLOSING DATE FOR VOTING:
2022-03-18	**2022-06-10**
SUPERSEDES DOCUMENTS:	
47A/1123/CD, 47A/1125A/CC	

IEC SC 47A : INTEGRATED CIRCUITS

SECRETARIAT:	SECRETARY:
Japan	Mr Yoshinori FUKUBA
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐
	Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☒ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY

☒ SUBMITTED FOR CENELEC PARALLEL VOTING ☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

Attention IEC-CENELEC parallel voting

The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.

The CENELEC members are invited to vote through the CENELEC online voting system.

This document is still under study and subject to change. It should not be used for reference purposes.

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

TITLE:

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

PROPOSED STABILITY DATE: 2027

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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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTEGRATED CIRCUIT – EMC EVALUATION OF TRANSCEIVERS

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FOREWORD

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

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

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

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

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

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in 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.
183

INTRODUCTION

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INTEGRATED CIRCUITS – EMC EVALUATION OF TRANSCEIVERS

Part 6: PSI5 transceivers

1 Scope

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

- the emission of RF disturbances,
- the immunity against RF disturbances,
- the immunity against impulses and
- the immunity against electrostatic discharges (ESD).

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.

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

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

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

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

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

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

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

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

3.1
global pin
carries a signal or power, which enters or leaves the application board without any active component in between

3.2
mandatory components, pl
components needed for proper function and/or technical requirements of IC as specified by the IC manufacturer

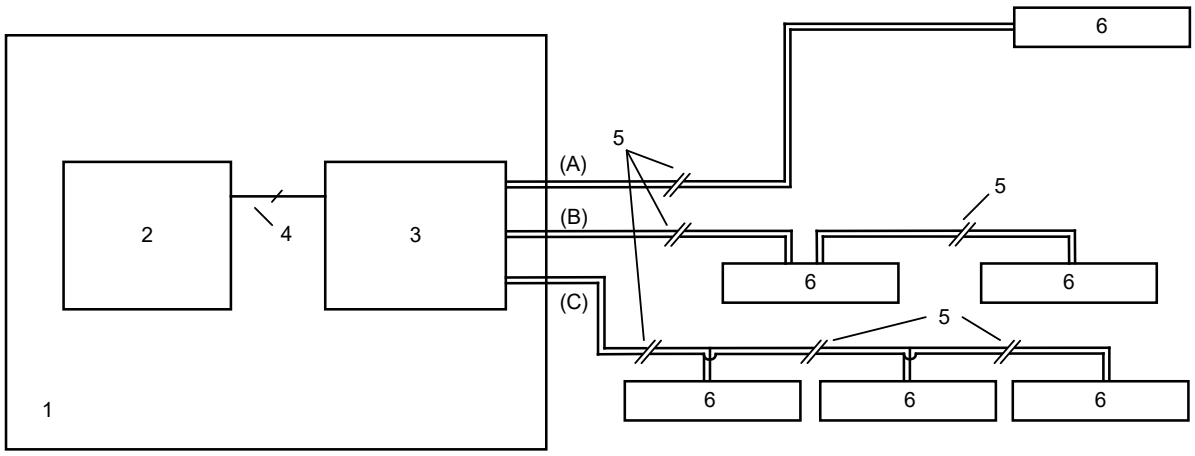
3.3
PSI5 satellite IC (sensor device)
PSI5 satellite or sensor transceiver with access to PSI5 signal

3.4
IC with embedded PSI5 transceiver (ECU device)
IC with integrated PSI5 transceiver cell and PSI5 protocol handler with access to PSI5 signal

4 General

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

PSI5 transceiver system overview is shown in Figure 1.



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)		

Figure 1 – PSI5 system overview

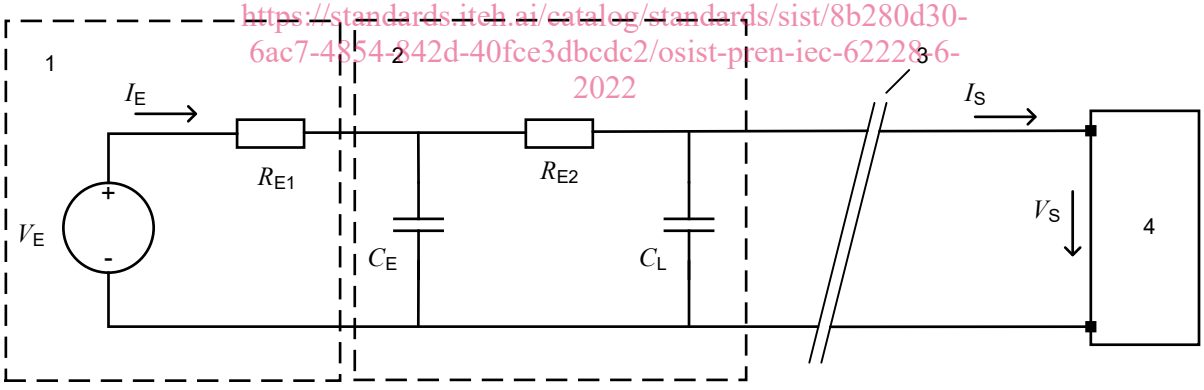
The sensors are connected to the ECU with two wires, using the same lines for power supply and data transmission. The IC with embedded PSI5 (e.g. transceiver ASIC in the ECU) provides a pre-regulated voltage to the sensors and reads in the transmitted sensor data.

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

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.						

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



Key

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

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

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

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

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

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 Impluse 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.

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

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

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

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

5 Test and operating conditions

5.1 Supply and ambient conditions

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