



SLOVENSKI STANDARD SIST EN IEC 62228-7:2022

01-junij-2022

Integrirana vezja - Vrednotenje elektromagnetne združljivosti (EMC) oddajnikov-sprejemnikov - 7. del: Oddajniki-sprejemniki CXPI (IEC 62228-7:2022)

Integrated circuits - EMC evaluation of transceivers - Part 7: CXPI transceivers (IEC 62228-7:2022)

Integrierte Schaltungen - Bewertung der elektromagnetischen Verträglichkeit von Sende-Empfangsgeräten – Teil 7: CXPI-Sende-Empfangsgeräte (IEC 62228-7:2022)

Circuits intégrés - Évaluation de la CEM des émetteurs-récepteurs - Partie 7: Émetteurs-récepteurs CXPI (IEC 62228-7:2022)

Ta slovenski standard je istoveten z: EN IEC 62228-7:2022

<https://standards.itec.ai/catalog/standards/sist/9b86821b-be41-4edd-89b6-28a5e72bf3c1/sist-en-iec-62228-7-2022>

ICS:

31.200	Integrirana vezja, mikroelektronika	Integrated circuits. Microelectronics
--------	-------------------------------------	---------------------------------------

SIST EN IEC 62228-7:2022

en

**iTeh STANDARD
PREVIEW
(standards.iteh.ai)**

[SIST EN IEC 62228-7:2022](https://standards.iteh.ai/catalog/standards/sist/9b80821b-be41-4edd-89b6-28a5e72bf3c1/sist-en-iec-62228-7-2022)

<https://standards.iteh.ai/catalog/standards/sist/9b80821b-be41-4edd-89b6-28a5e72bf3c1/sist-en-iec-62228-7-2022>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN IEC 62228-7

April 2022

ICS 31.200

English Version

**Integrated circuits - EMC evaluation of transceivers - Part 7:
CXPI transceivers
(IEC 62228-7:2022)**

Circuits intégrés - Évaluation de la CEM des émetteurs-
récepteurs - Partie 7: Émetteurs-récepteurs CXPI
(IEC 62228-7:2022)

Integrierte Schaltungen - Bewertung der
elektromagnetischen Verträglichkeit von Sende-
Empfangsgeräten - Teil 7: CXPI-Sende-Empfangsgeräte
(IEC 62228-7:2022)

This European Standard was approved by CENELEC on 2022-03-29. 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.

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 European Standard 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, 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.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN IEC 62228-7:2022 (E)**European foreword**

The text of document 47A/1130/FDIS, future edition 1 of IEC 62228-7, prepared by SC 47A "Integrated circuits" of IEC/TC 47 "Semiconductor devices" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62228-7:2022.

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) 2022-12-29
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2025-03-29

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice
PREVIEW

The text of the International Standard IEC 62228-7:2022 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

CISPR 16-1-1

NOTE Harmonized as EN IEC 55016-1-1

SIST EN IEC 62228-7:2022
<http://standards.iteh.ai/catalog/standards/sist/9b80821b-be41-4edd-89b6-28a5e72bf3c1/sist-en-iec-62228-7-2022>

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61967-1	-	Integrated circuits - Measurement of electromagnetic emissions - Part 1: General conditions and definitions	EN IEC 61967-1	-
IEC 61967-4	-	Integrated circuits - Measurement of electromagnetic emissions - Part 4: Measurement of conducted emissions - 1 ohm/150 ohm direct coupling method	EN IEC 61967-4	-
IEC 62132-1	-	Integrated circuits - Measurement of electromagnetic immunity - Part 1: General conditions and definitions	EN 62132-1	-
IEC 62132-4	2006	Integrated circuits - Measurement of electromagnetic immunity 150 kHz to 1 GHz - Part 4: Direct RF power injection method	EN 62132-4	2006
IEC 62215-3	-	Integrated circuits - Measurement of impulse immunity - Part 3: Non-synchronous transient injection method	EN 62215-3	-
IEC 62228-1	-	Integrated circuits - EMC evaluation of transceivers - Part 1: General conditions and definitions	EN IEC 62228-1	-
ISO 7637-2	-	Road vehicles - Electrical disturbances from conduction and coupling - Part 2: Electrical transient conduction along supply lines only	-	-
ISO 10605	-	Road vehicles - Test methods for electrical disturbances from electrostatic discharge	-	-
ISO 20794-4	-	Road vehicles - Clock extension peripheral interface (CXPI) - Part 4: Data link layer and physical layer	-	-

**iTeh STANDARD
PREVIEW
(standards.iteh.ai)**

[SIST EN IEC 62228-7:2022](https://standards.iteh.ai/catalog/standards/sist/9b80821b-be41-4edd-89b6-28a5e72bf3c1/sist-en-iec-62228-7-2022)

<https://standards.iteh.ai/catalog/standards/sist/9b80821b-be41-4edd-89b6-28a5e72bf3c1/sist-en-iec-62228-7-2022>



IEC 62228-7

Edition 1.0 2022-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE



iTeh STANDARD**Integrated circuits – EMC evaluation of transceivers –
Part 7: CXPI transceivers****(standards.iteh.ai)****Circuits intégrés – Évaluation de la CEM des émetteurs-récepteurs –
Partie 7: Émetteurs-récepteurs CXPI****SIST EN IEC 62228-7:2022**

[https://standards.iteh.ai/catalog/standards/sist/9b80821b-
be41-4edd-89b6-28a5e72bf3c1/sist-en-iec-62228-7-
2022](https://standards.iteh.ai/catalog/standards/sist/9b80821b-be41-4edd-89b6-28a5e72bf3c1/sist-en-iec-62228-7-2022)

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.200

ISBN 978-2-8322-1083-2

**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.**

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms, definitions and abbreviated terms	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	8
4 General	9
5 Test and operating conditions.....	11
5.1 Supply and ambient conditions.....	11
5.2 Test operation modes	11
5.3 Test configuration	12
5.3.1 General test configuration for functional test.....	12
5.3.2 General test configuration for unpowered ESD test.....	13
5.3.3 Coupling ports and coupling networks for functional tests.....	13
5.3.4 Coupling ports and coupling networks for unpowered ESD tests	14
5.3.5 Power supply with decoupling network.....	15
5.4 Test signals	15
5.4.1 General	15
5.4.2 Test signals for normal operation mode	15
5.4.3 Test signal for wake-up from sleep mode.....	17
5.5 Evaluation criteria.....	18
5.5.1 General	18
5.5.2 Evaluation criteria in functional operation modes during exposure to disturbances.....	18
5.5.3 Evaluation criteria in unpowered condition after exposure to disturbances.....	20
5.5.4 Status classes	21
6 Test and measurement	21
6.1 Emission of RF disturbances.....	21
6.1.1 Test method	21
6.1.2 Test setup	21
6.1.3 Test procedure and parameters	22
6.2 Immunity to RF disturbances.....	22
6.2.1 Test method	22
6.2.2 Test setup	23
6.2.3 Test procedure and parameters	24
6.3 Immunity to impulses	26
6.3.1 Test method	26
6.3.2 Test setup	26
6.3.3 Test procedure and parameters	27
6.4 Electrostatic discharge (ESD)	30
6.4.1 Test method	30
6.4.2 Test setup	30
6.4.3 Test procedure and parameters	32
7 Test report.....	32
Annex A (normative) CXPI test circuits	33
A.1 General.....	33

A.2	CXPI test circuit for functional tests on standard type-A CXPI transceiver ICs.....	33
A.3	CXPI test circuit for functional tests on standard type-B CXPI transceiver ICs.....	36
A.4	CXPI test circuit for functional tests on ICs with embedded CXPI transceiver.....	38
A.5	CXPI test circuit for unpowered ESD test on a standard type-A CXPI transceiver IC	39
A.6	CXPI test circuit for unpowered ESD test on a standard type-B CXPI transceiver IC	40
Annex B (normative)	Test circuit boards.....	42
B.1	Test circuit board for functional tests	42
B.2	ESD test	43
Annex C (informative)	Examples for test limits for CXPI transceiver in automotive application	44
C.1	General.....	44
C.2	Emission of RF disturbances.....	44
C.3	Immunity to RF disturbances.....	44
C.4	Immunity to impulse	44
C.5	Electrostatic discharge (ESD)	44
Annex D (informative)	Example of setting for test signals.....	45
Annex E (informative)	Points to note for impulse immunity measurement for functional status class A _{1C}	47
E.1	General.....	47
E.2	Points to note when testing Pulse 1	47
Bibliography	49
Figure 1	– PHY sub-layers overview and CXPI transceiver types	10
Figure 2	– General test configuration for tests in functional operation modes	12
Figure 3	– General test configuration for unpowered ESD test	13
Figure 4	– Coupling ports and networks for functional tests	13
Figure 5	– Coupling ports and networks for unpowered ESD tests	14
Figure 6	– Principal drawing of the maximum deviation in the I-V characteristic	20
Figure 7	– Test setup for measurement of RF disturbances	21
Figure 8	– Test setup for DPI tests.....	23
Figure 9	– Test setup for impulse immunity tests	27
Figure 10	– Test setup for direct ESD tests.....	31
Figure A.1	– General drawing of the circuit diagram of the test network for standard type-A CXPI transceiver ICs for functional tests	35
Figure A.2	– General drawing of the circuit diagram of the test network for standard type-B CXPI transceiver ICs for functional tests	37
Figure A.3	– General drawing of the circuit diagram of the test network for ICs with embedded CXPI transceiver for functional tests	39
Figure A.4	– A general drawing of the test circuit diagram for testing direct ESD of CXPI transceiver in unpowered mode	40
Figure A.5	– A general drawing of the test circuit diagram for testing direct ESD of CXPI standard Type-B transceiver in unpowered mode.....	41
Figure B.1	– Example of IC interconnections of CXPI signal	42
Figure B.2	– Example of ESD test board for CXPI transceiver ICs	43
Figure D.1	– Example of signal setting for standard type-A in 2 transceiver configuration.....	45

Figure D.2 – Example of signal setting for standard type-B in 2 transceiver configuration.....	46
Figure E.1 – Relationship between ISO 7637-2 Pulse 1 and transceiver VBAT supply	47
Figure E.2 – Transceiver VBAT supply image when t_2 time is shortened.....	48
Table 1 – Types for CXPI transceiver.....	9
Table 2 – Overview of required measurement and tests	10
Table 3 – Supply and ambient conditions for functional operation	11
Table 4 – Definition of coupling ports and coupling network components for functional tests	14
Table 5 – Definitions of coupling ports for unpowered ESD tests.....	15
Table 6 – Communication test signal TX1	16
Table 7 – Communication test signal TX2	17
Table 8 – Communication test signal TX3	17
Table 9 – Wake-up test signal TX4	18
Table 10 – Evaluation criteria for standard type-A in functional operation modes	19
Table 11 – Evaluation criteria for standard type-B in functional operation modes	19
Table 12 – Evaluation criteria for ICs with embedded CXPI transceiver in functional operation modes	20
Table 13 – Parameters for emission measurements.....	22
Table 14 – Settings for the RF measurement equipment.....	22
Table 15 – Specifications for DPI tests	24
Table 16 – Required DPI tests for functional status class AIC evaluation of standard type-A.....	25
Table 17 – Required DPI tests for functional status class AIC evaluation of standard type-B.....	25
Table 18 – Required DPI tests for functional status class AIC evaluation of ICs with embedded CXPI transceiver.....	25
Table 19 – Required DPI tests for functional status class CIC, D1IC or D2IC evaluation of standard CXPI transceiver ICs and ICs with embedded CXPI transceiver.....	26
Table 20 – Specifications for impulse immunity tests	28
Table 21 – Parameters for impulse immunity tests	28
Table 22 – Required impulse immunity tests for functional status class AIC evaluation of standard type-A	29
Table 23 – Required impulse immunity tests for functional status class AIC evaluation of standard type-B	29
Table 24 – Required impulse immunity tests for functional status class AIC evaluation of ICs with embedded CXPI transceiver	29
Table 25 – Required impulse immunity tests for functional status class CIC, D1IC or D2IC evaluation of standard CXPI transceiver ICs and ICs with embedded CXPI transceiver.....	30
Table 26 – Specifications for direct ESD tests.....	32
Table B.1 – Parameter ESD test circuit board	43
Table C.1 – Example of limits for impulse immunity for functional status class C _{IC} or D _{IC}	44

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INTEGRATED CIRCUITS –
EMC EVALUATION OF TRANSCEIVERS –**

Part 7: CXPI transceivers

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62228-7 has been prepared by subcommittee 47A: Integrated circuits, of IEC technical committee 47: Semiconductor devices. It is an International Standard.

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

Draft	Report on voting
47A/1130/FDIS	47A/1133/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 at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 62228 series, published under the general title *Integrated circuits – EMC evaluation of transceivers*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document 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.

PREVIEW
(standards.iteh.ai)

SIST EN IEC 62228-7:2022

<https://standards.iteh.ai/catalog/standards/sist/9b80821b-be41-4edd-89b6-28a5e72bf3c1/sist-en-iec-62228-7-2022>

INTEGRATED CIRCUITS – EMC EVALUATION OF TRANSCEIVERS –

Part 7: CXPI transceivers

1 Scope

This part of IEC 62228 specifies test and measurement methods for the EMC evaluation of CXPI transceiver ICs under network condition. It defines test configurations, test conditions, test signals, failure criteria, test procedures, test setups and test boards. This specification is applicable for standard CXPI transceiver ICs and ICs with embedded CXPI transceiver and 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.

[SIST EN IEC 62228-7:2022](https://standards.itec.org/standards/sist-en-iec-62228-7-2022)

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 conditions and definitions*

IEC 62132-4:2006, *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 from conduction and coupling – Part 2: Electrical transient conduction along supply lines only*

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

ISO 20794-4, *Road vehicles – Clock extension peripheral interface (CXPI) – Part 4: Data link layer and physical layer*

ISO 20794-7:2020, *Road vehicles – Clock extension peripheral interface (CXPI) – Part 7: Data link and physical layer conformance test plan*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC 62228-1, IEC 61967-1 and IEC 62132-1, as well as the following apply.

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

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

3.1 Terms and definitions

3.1.1

global pin

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

3.1.2

standard CXPI transceiver IC

standalone CXPI transceiver according to ISO 20794-4 or IC with integrated CXPI transceiver cell with access to CXPI RXD and TXD signal

3.1.3

IC with embedded CXPI transceiver

IC with integrated CXPI transceiver cell and CXPI protocol handler but without access to CXPI RXD or TXD signal

3.1.4

mandatory components, pl

components needed for proper function of IC as specified by the IC manufacturer

3.2 Abbreviated terms

ASSP	application specific standard product
CRC	cyclic redundancy check
CXPI	Clock Extension Peripheral Interface
DLL	data link layer
EN	enable
FI	frame information
IBS	inter byte space
NRZ	non-return to zero
PCB	printed circuit board
PID	protected identifier
PMA	physical media attachment
PS	physical signalling
PWM	pulse width modulation
RX _{PWM}	output signal for receiver in CXPI bus-line driver
RXD _{NRZ}	output signal for receiver in CXPI codec circuit

TX _{PWM}	input signal for transmitter in CXPI bus-line driver
TXD _{NRZ}	input signal for transmitter in CXPI codec circuit
UART	universal asynchronous receiver / transmitter

4 General

The intention of this document is to evaluate the EMC performance of CXPI transceiver ICs under application conditions in a minimal network. CXPI Transceiver ICs are generally classified into three types, as listed in Table 1.

Figure 1 shows a sample configuration of each type of CXPI transceiver IC. The overview of the PHY sublayers is following ISO 20794-4. Standard type-A comprises a CXPI transceiver IC that contains the PS sublayer and the PMA sublayer. Standard type-B contains only the PMA sublayer. The Embedded type includes a microcontroller or ASSP function, in addition to the functions of Standard type-A. The PMA sublayer transmits and receives communication data on the bus line in the PWM signal format. The PS sublayer has the clock generation function, the encoding and decoding of CXPI frames and the bit-wise collision resolution logic. The microcontroller or ASSP transmits and receives the communication data in the NRZ signal format according to the specifications of the application.

Table 1 – Types for CXPI transceiver

Transceiver classification	CXPI transceiver type	Communication sublayer implementation
Standard CXPI transceiver IC	Standard type-A	with PMA and PS sublayer
	Standard type-B	with PMA sublayer only
IC with embedded CXPI transceiver	Embedded type	with PMA, PS sublayer and DLL

<https://standards.iteh.ai/catalog/standards/sist/9b80821b-be41-4edd-89b6-28a5e72bf3c1/sist-en-iec-62228-7-2022>