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

Integrated circuits - EMC evaluation of transceivers - Part 7: CXPI transceivers

Integrierte Schaltungen - Bewertung der elektromagnetischen Verträglichkeit von Sende-Empfangsgeräten – Teil 7: CXPI-Sende-Empfangsgeräte

Circuits intégrés - évaluation de la CEM des émetteurs-récepteurs - Partie 7: émetteurs-récepteurs CXPI

**Ta slovenski standard je istoveten z: prEN IEC 62228-7:2025**

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TITLE:

**Integrated circuits - EMC evaluation of transceivers - Part 7: CXPI transceivers**

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47A/1175A/CC of 47A/1166/CD were reviewed and addressed all comments, and SC47A decided next step to be CDV on the SC47A plenary meeting held at 2024-11-28(47A/1177/RM Decision 47A-2024-08).

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

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**Part 7: CXPI transceivers**

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200 committee 47: Semiconductor devices. It is an International Standard.

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

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

202

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

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



206 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in  
207 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available  
208 at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are  
209 described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

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

212 The committee has decided that the contents of this document will remain unchanged until the  
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- 215 • reconfirmed,
- 216 • withdrawn,
- 217 • replaced by a revised edition, or
- 218 • amended.

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# INTEGRATED CIRCUITS – EMC EVALUATION OF TRANSCEIVERS –

## Part 7: CXPI transceivers

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### 1 Scope

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

- 235 • the emission of RF disturbances,
- 236 • the immunity against RF disturbances,
- 237 • the immunity against impulses and
- 238 • the immunity against electrostatic discharges (ESD).

### 2 Normative references

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

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

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

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

250 IEC 62132-4, *Integrated circuits – Measurement of electromagnetic immunity 150 kHz to 1 GHz*  
251 *– Part 4: Direct RF power injection method*

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

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

256 ISO 7637-2, *Road vehicles – Electrical disturbances from conduction and coupling – Part 2:*  
257 *Electrical transient conduction along supply lines only*

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

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

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

### 264 **3 Terms, definitions and abbreviated terms**

265 For the purposes of this document, the terms and definitions given in IEC 62228-1, IEC 61967-  
 266 1 and IEC 62132-1, as well as the following apply.

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

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

#### 271 **3.1 Terms and definitions**

##### 272 **3.1.1**

##### 273 **global pin**

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

##### 276 **3.1.2**

##### 277 **standard CXPI transceiver IC**

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

##### 280 **3.1.3**

##### 281 **IC with embedded CXPI transceiver**

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

##### 284 **3.1.4**

##### 285 **mandatory components, pl**

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

##### 287 **3.1.5**

##### 288 **commander node**

289 node that provides the schedule master management (include ReqTypeID transmission), the  
 290 primary clock and optionally the sleep message transmission management

##### 291 **3.1.6**

##### 292 **responder node**

293 node other than commander node connected to the CXPI network

294

#### 295 **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
RXD	receive data
TXD	transmit data
PWM	pulse width modulation
RX <sub>PWM</sub>	PMA receiver interface signal
RXD <sub>NRZ</sub>	PS receiver interface signal
TX <sub>PWM</sub>	PMA transmit interface signal
TXD <sub>NRZ</sub>	PS transmit interface signal
UART	universal asynchronous receiver / transmitter

296

297 **4 General**

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

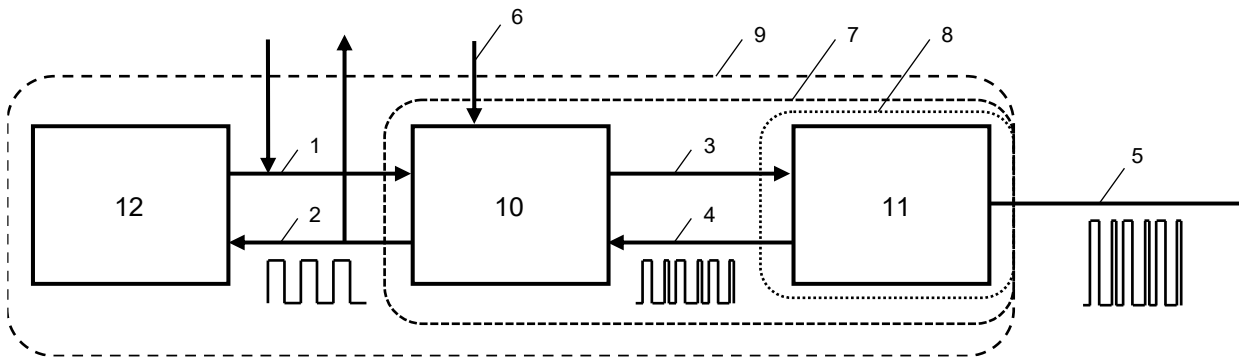
301 Figure 1 shows a sample configuration of each type of CXPI transceiver IC. The overview of  
 302 the PHY sublayers is following ISO 20794-4. Standard type-A comprises a CXPI transceiver IC  
 303 that contains the PS sublayer and the PMA sublayer. Standard type-B contains only the PMA  
 304 sublayer.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

310

**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

311



312

313 **Key**

- 314 1 TXD<sub>NRZ</sub>
- 315 2 RXD<sub>NRZ</sub>
- 316 3 TX<sub>PWM</sub>
- 317 4 RX<sub>PWM</sub>
- 318 5 CXPI network
- 319 6 Clock (commander node only, provided externally or from micro controller)
- 320 7 Standard type-A
- 321 8 Standard type-B
- 322 9 Embedded type
- 323 10 PS
- 324 11 PMA
- 325 12 Microcontroller or ASSP etc. including DLL

326 **Figure 1 – PHY sub-layers overview and CXPI transceiver types**

327 The evaluation of the EMC characteristics of CXPI transceivers shall be performed in functional  
 328 operation modes under network conditions for RF emission, RF immunity and impulse immunity  
 329 tests, and on a single unpowered transceiver IC for electrostatic discharge tests.

330 The aim of these tests is to determine the EMC performance on dedicated global pins of the  
 331 CXPI transceiver that are considered EMC relevant in the application. For a standard CXPI  
 332 transceiver IC and an IC with an embedded CXPI transceiver, these pins are VBAT and CXPI.

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

335 **Table 2 – Overview of required measurement and tests**

Transceiver mode	Required test	Test method	Evaluation	Functional operation mode
Functional (powered)	RF emission	150 Ω direct coupling (IEC 61967-4)	Spectrum	Normal
	RF immunity	DPI (IEC 62132-4)	Function	Normal
				Sleep
	Impulse immunity	Non-synchronous transient injection (IEC 62215-3)	Function	Normal
Sleep				
Passive (unpowered)	ESD	Contact discharge (ISO 10605)	Damage	Unpowered

336

337 The RF emission, RF immunity and impulse immunity test methods are selected for the  
 338 evaluation of EMC characteristic of transceivers in functional (powered) modes. These three

339 test methods are based on the same approach using conductive coupling. Therefore, it is  
 340 possible to use the same test board for all tests in functional operation mode, which reduces  
 341 the effort required and increases the reproducibility and comparability of test results.

342 The ESD test is performed on passive (unpowered) transceiver IC on a separate test board.

343 A general drawing of a schematic with more details of the CXPI transceiver test network for the  
 344 targeted EMC test is given in Annex A. All measurements and tests should be done with  
 345 soldered transceivers on test boards as described in Annex B, to ensure application like  
 346 conditions and avoid setup effects by sockets.

347 Annex C provides example test limits and levels for CXPI transceivers in automotive application.

348 In general, the test definition is done for standard CXPI transceiver ICs. For ICs with embedded  
 349 CXPI transceivers some adaptations are necessary which are described in this document.  
 350 Specific adaptations shall be done individually for the dedicated IC but shall follow the general  
 351 definitions identified.

## 352 5 Test and operating conditions

### 353 5.1 Supply and ambient conditions

354 For all tests and measurements under operating conditions, the settings are based on systems  
 355 with a 12 V power supply, which is the main application for CXPI transceivers. If a transceiver  
 356 is designed or targeted for a higher power supply voltage, the test conditions and test targets  
 357 shall be adapted and documented accordingly. The defined supply and ambient conditions for  
 358 functional operation are given in Table 3. Although the standard voltage of  $V_{CC_{ext}}$  is 5 V, other  
 359 voltages such as 3,3 V may be supplied depending on the product.

360 **Table 3 – Supply and ambient conditions for functional operation**

Parameter	Value
Voltage supply $V_{BAT_{ext}}^a$	(14 ± 0,2) V (default)
Voltage supply $V_{CC_{ext}}^a$	(5 ± 0,1) V (default), (3,3 ± 0,1) V
Test temperature	(23 ± 5) °C
<sup>a</sup> $V_{ext}$ means voltage at external terminal on the test board as shown e.g. in Figure A.1	

361

362 For RF emission measurements, the ambient noise floor shall be at least 6 dB below the applied  
 363 target limit and documented in the test report.

364 Unpowered ESD tests shall be carried out without any supply voltage, and the requirements of  
 365 ISO 10605 climatic environmental conditions shall be applied.

### 366 5.2 Test operation modes

367 The CXPI transceiver ICs shall be tested in powered functional operation modes and in the  
 368 unpowered mode. The functional operation modes are normal mode and sleep mode.

### 369 5.3 Test configuration

#### 370 5.3.1 General test configuration for functional test

371 The test configuration in general consists of CXPI transceivers with mandatory external  
 372 components and components for filtering and decoupling ( $CXPI_{ext}$  node) in a minimal test  
 373 network, where filtered power supplies, signals, monitoring probes and coupling networks are