



# SLOVENSKI STANDARD

## SIST EN 50121-3-2:2015

01-julij-2015

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**Železniške naprave - Elektromagnetna združljivost - 3-2. del: Vozna sredstva - Naprave**

Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus

Bahnanwendungen - Elektromagnetische Verträglichkeit - Teil 3-2: Bahnfahrzeuge - Geräte

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Applications ferroviaires - Compatibilité électromagnétique - Partie 3-2: Matériel roulant - Appareils

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**ICS:**

33.100.01	Elektromagnetna združljivost na splošno	Electromagnetic compatibility in general
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EUROPEAN STANDARD

**EN 50121-3-2**

NORME EUROPÉENNE

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March 2015

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English Version

## Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus

Applications ferroviaires - Compatibilité électromagnétique -  
Partie 3-2: Matériel roulant - AppareilsBahnanwendungen - Elektromagnetische Verträglichkeit -  
Teil 3-2: Bahnfahrzeuge - Geräte

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Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

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## Foreword

This document (EN 50121-3-2:2015) has been prepared by CLC/TC 9X: "Electrical and electronic applications for railways".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-01-05
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2018-01-05

This document supersedes EN 50121-3-2:2006.

EN 50121-3-2:2015 includes the following significant technical changes with respect to EN 50121-3-2:2006:

- clarification of scope (Clause 1);
- set dated normative references (Clause 2);
- new definition of ports and clarification in Tables 1 to 6;
- emission requirement extended in the frequency range 1 GHz to 6 GHz following EN 61000-6-4;
- immunity requirement extended in the frequency range 5,1 GHz to 6 GHz;
- revision of Annex B.

This European Standard is to be read in conjunction with EN 50121-1.

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

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

This standard forms Part 3-2 of the European Standard series EN 50121, published under the general title "Railway applications - Electromagnetic compatibility". The series consists of:

- Part 1: General
- Part 2: Emission of the whole railway system to the outside world
- Part 3-1: Rolling stock - Train and complete vehicle
- Part 3-2: Rolling stock - Apparatus
- Part 4: Emission and immunity of the signalling and telecommunications apparatus
- Part 5: Emission and immunity of fixed power supply installations and apparatus

## 1 Scope

This European Standard applies to emission and immunity aspects of EMC for electrical and electronic apparatus intended for use on railway rolling stock. EN 50121-3-2 applies for the integration of apparatus on rolling stock.

The frequency range considered is from DC to 400 GHz. No measurements need to be performed at frequencies where no requirement is specified.

The application of tests shall depend on the particular apparatus, its configuration, its ports, its technology and its operating conditions.

This standard takes into account the internal environment of the railway rolling stock and the external environment of the railway, and interference to the apparatus from equipment such as hand-held radio-transmitters.

If a port is intended to transmit or receive for the purpose of radio communication (intentional radiators, e.g. transponder systems), then the radiated emission requirement in this standard is not intended to be applicable to the intentional transmission from a radio-transmitter as defined by the ITU.

Immunity limits do not apply in the exclusion bands as defined in the corresponding EMC related standard for radio equipment.

This standard does not apply to transient emissions when starting or stopping the apparatus.

The objective of this standard is to define limits and test methods for electromagnetic emissions and immunity test requirements in relation to conducted and radiated disturbances.

These limits and tests represent essential electromagnetic compatibility requirements.

Emission requirements have been selected so as to ensure that disturbances generated by the apparatus operated normally on railway rolling stock do not exceed a level which could prevent other apparatus from operating as intended. The emission limits given in this standard take precedence over emission requirements for individual apparatus on board the rolling stock given in other standards.

Likewise, the immunity requirements have been selected so as to ensure an adequate level of immunity for rolling stock apparatus.

The levels do not however cover all cases which may occur with an extremely low probability of occurrence in any location. Specific requirements which deviate from this standard shall be specified.

Test requirements are specified for each port considered.

These specific provisions are to be used in conjunction with the general provisions in EN 50121-1.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50121-1:2015, *Railway applications - Electromagnetic compatibility - Part 1: General*

EN 50121-3-1:2015, *Railway applications - Electromagnetic compatibility - Part 3-1: Rolling stock - Train and complete vehicle*

EN 50155:2007, *Railway applications - Electronic equipment used on rolling stock*

EN 55016-1-1:2010, *Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus (CISPR 16-1-1:2010)*

EN 55016-1-4:2010, *Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-4: Radio disturbance and immunity measuring apparatus - Antennas and test sites for radiated disturbance measurements (CISPR 16-1-4:2010)*

EN 55016-2-1:2009, *Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-1: Methods of measurement of disturbances and immunity - Conducted disturbance measurements (CISPR 16-2-1:2008)*

EN 55016-2-3:2010, *Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-3: Methods of measurement of disturbances and immunity - Radiated disturbance measurements (CISPR 16-2-3:2010)*

EN 55022:2010, *Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (CISPR 22:2008, mod.)*

EN 61000-4-2:2009, *Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test (IEC 61000-4-2:2008)*

EN 61000-4-3:2006, *Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3:2006)*

EN 61000-4-4:2004, *Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test (IEC 61000-4-4:2004)*

EN 61000-4-5:2006, *Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test (IEC 61000-4-5:2005)*

EN 61000-4-6:2009, *Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields (IEC 61000-4-6:2008)*

EN 61000-4-30:2009, *Electromagnetic compatibility (EMC) - Part 4-30: Testing and measurement techniques - Power quality measurement methods (IEC 61000-4-30:2008)*

EN 61000-6-4:2007, *Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments (IEC 61000-6-4:2006)*

### 3 Terms, definitions and abbreviations

#### 3.1 Terms and definitions

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

##### 3.1.1

##### **rolling stock apparatus**

a finished product with an intrinsic function intended for implementation into the rolling stock installation

##### 3.1.2

##### **port**

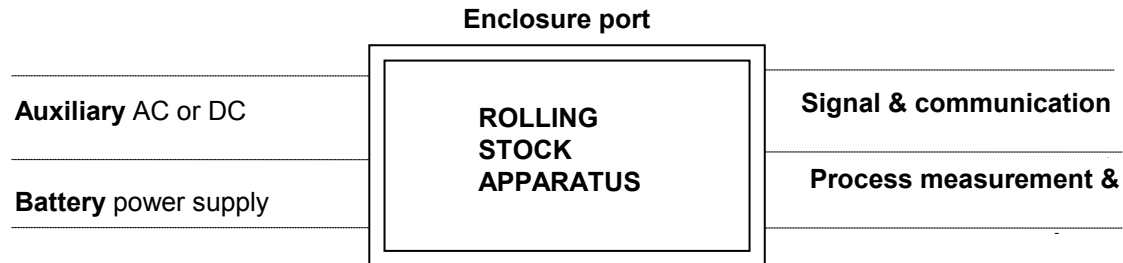
the particular interface of the specified apparatus with the external environment e.g. auxiliary AC or DC power port, I/O (input/output) port

### 3.1.3

#### enclosure port

the physical boundary of the apparatus through which electromagnetic fields may radiate or impinge

The main categories of ports for rolling stock apparatus are presented in Figure 1.



**Figure 1 – Main categories of ports**

Typical examples of rolling stock apparatus with their ports are listed in Annex A.

Traction power ports are not covered in EN 50121-3-2:2015, see Annex B.

## 3.2 Abbreviations

a.c.	Alternating current
AM	Amplitude modulation
CISPR	Comité international spécial des perturbations radioélectriques
d.c.	Direct current
EMC	Electromagnetic compatibility
EUT	Equipment under test
I/O	Input / Output
ITU	International Telegraph Union
OATS	Open area test site
PC	Personal computer
SAC	Semi-anechoic chamber
THD	Total harmonic distortion
TV	Television

## 4 Performance criteria

The variety and the diversity of the apparatus within the scope of this standard make it difficult to define precise criteria for the evaluation of the immunity test results.

A functional description and a definition of performance criteria, during or as a consequence of the EMC testing, shall be provided by the manufacturer and noted in the test report, based on the criteria A, B, C defined in EN 50121-1:2015.

## 5 Conditions during testing

It is not always possible to test every function of the apparatus. The tests shall be made at a typical operating mode considered by the manufacturer to produce the largest emission or maximum



susceptibility to noise as appropriate in the frequency band being investigated consistent with normal applications. The conditions during testing shall be defined in a test plan (see basic standard of EN 61000-4-x series).

If the apparatus is part of a system, or can be connected to auxiliary apparatus, then the apparatus shall be tested while connected to the minimum configuration of auxiliary apparatus necessary to exercise the ports in accordance e.g. with EN 55022:2010, Clause 8.

The configuration and mode of operation shall be specified in the test plan and the actual conditions, during the tests, shall be precisely noted in the test report.

If the apparatus has a large number of similar ports or ports with many similar connections, then a sufficient number shall be selected to simulate actual operating conditions and to ensure that all the different types of termination are covered (e.g. 20 % of the ports or at least four ports).

The tests shall be carried out within the specified operating range for the apparatus and at its nominal supply voltage, unless otherwise indicated.

## 6 Applicability

The measurements in this standard shall be made on the relevant ports of the apparatus.

It may be determined from consideration of the electrical characteristics, the connection and the usage of a particular apparatus that some of the tests are not applicable (e.g. radiated immunity of induction motors, transformers). In such cases, the decision not to test has to be recorded in the test plan and test report.

If not otherwise specified, the EMC tests shall be type tests.

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## 7 Emission tests and limits

The emission tests and limits for apparatus covered by this standard are given on a port by port basis.

Measurements shall be performed in well-defined and reproducible conditions for each type of disturbance.

The description of the test, the test methods and the test set-up are given in Basic Standards which are referred to in Tables 1 to 3.

The contents of these Basic Standards are not repeated here, however modifications or additional information needed for the practical application of the tests are given in this standard.

NOTE The reference to "Basic Standard" is intended to be limited to those parts of the standard that give the description of the test, the test methods and the test set-up.

Table 1 – Emission – Auxiliary AC or DC power ports (input and output)

	Port	Test specification		Basic Standard	Test set-up	Applicability note	Remarks
1.1	<b>Auxiliary supply sinusoidal AC or DC</b> (port 9 on Figures A.1, A.2 and A.4)	150 kHz to 500 kHz	99 dB $\mu$ V quasi-peak	EN 55016–2-1	EN 55016–2-1	See a, b and c	For the time being there are no limits for shore supply mode. Therefore the limits given in this table are valid. Other limits may apply if connected e.g. to the public low voltage power supply and should be specified by the train operator.
		500 kHz to 30 MHz	93 dB $\mu$ V quasi-peak				
1.2	<b>AC power outlet port for public use</b>	50 Hz to 2 kHz	THD < 8 % (THD: total harmonic distortion)	EN 61000–4-30			230 V AC power outlet ports for public use shall offer a power quality, which is sufficient for the use of intended equipment like PC and mobile telephone chargers. The harmonic distortion in differential mode shall be limited by a sine-filter to < 8 %.
<p>a Wherever applicable the method defined by EN 55016–2-1 is to be used. At present the existing method of measuring conducted emissions (EN 55016–2-1) has limitations in terms of voltage and current rating of coupling networks. In addition the method of measuring voltage has safety implications for testing high power systems. Limiting conducted emissions from apparatus connected to external cable systems will prevent excessive radiated emissions.</p> <p>b This requirement refers to the industrial limit values but considering they have been defined to protect radio and TV sets and as the objective is not the same here, the applicable limit for railway applications have been relaxed by 20 dB to be more representative of potential problems.</p> <p>c This requirement is not applicable to power ports which are connected to other dedicated, compatible ports.</p>							

Table 2 – Emission – Battery power supply (Input and output)

	Port	Test specification		Basic standard	Test set-up	Applicability note	Remarks
2.1	<b>Battery power supply</b> (port 10 on Figures A.1-A.5)	150 kHz to 500 kHz	99 dB $\mu$ V quasi-peak	EN 55016–2-1	EN 55016–2-1	See d	
		500 kHz to 30 MHz	93 dB $\mu$ V quasi-peak				

d This requirement refers to the industrial limit values but considering they have been defined to protect radio and TV sets and as the objective is not the same here, the applicable limit for railway applications have been relaxed by 20 dB to be more representative of potential problems.

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