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**Železniške naprave - Elektromagnetna združljivost - 3-2. del: Vozna sredstva -
Naprave (vsebuje popravek AC:2008)**

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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45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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EUROPEAN STANDARD
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English version

**Railway applications -
Electromagnetic compatibility
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This European Standard was approved by CENELEC on 2006-07-01. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This European Standard was prepared by Technical Committee TC 9X: Electrical and electronic applications for railways. The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50121-3-2 on 2006-07-01.

This European Standard supersedes EN 50121-3-2:2000.

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

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

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2007-07-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2009-07-01

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This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive 2004/108/EC. See Annex ZZ.

The contents of the corrigendum of May 2008 have been included in this copy.

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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 d.c. 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 emission and immunity limits in this standard at the communication frequency do not apply.

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.

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 extreme 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 referenced documents are indispensable for the application 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.

EN 50121-1	Railway applications – Electromagnetic compatibility Part 1: General
EN 50121-3-1	Railway applications – Electromagnetic compatibility Part 3-1: Rolling stock – Train and complete vehicle
EN 50155	Railway applications – Electronic equipment used on rolling stock
EN 55011	Industrial, scientific and medical (ISM) radio-frequency equipment – Radio disturbance characteristics – Limits and methods of measurement (CISPR 11, mod.)
EN 55016-1-1	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)

EN 55022	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (CISPR 22, mod.)
EN 61000-4-2	Electromagnetic compatibility (EMC) Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test (IEC 61000-4-2)
EN 61000-4-3	Electromagnetic compatibility (EMC) Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3)
EN 61000-4-4	Electromagnetic compatibility (EMC) Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test (IEC 61000-4-4)
EN 61000-4-5	Electromagnetic compatibility (EMC) Part 4-5: Testing and measurement techniques – Surge immunity test (IEC 61000-4-5)
EN 61000-4-6	Electromagnetic compatibility (EMC) Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields (IEC 61000-4-6)
EN 61000-6-1	Electromagnetic compatibility (EMC) Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1, mod.)

3 Definitions

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For the purpose of this Part 3-2 of the European Standard, the following definitions apply:

3.1

rolling stock apparatus

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

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3.2

port

the particular interface of the specified apparatus with the external environment e.g. a.c. power port, d.c. power port, I/O (input/output) port

3.3

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.

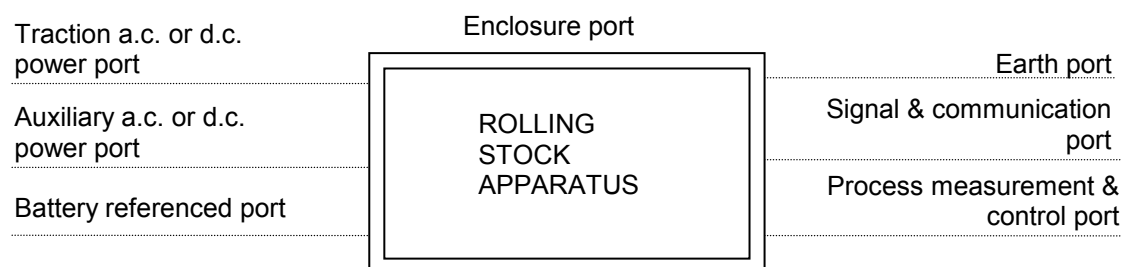


Figure 1 – Main categories of ports

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

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.

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 manufacturer shall define the conditions during testing in a test plan.

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 with EN 55022.

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 rated supply voltage, unless otherwise indicated in the Basic Standard.

6 Applicability <https://standards.iteh.ai/catalog/standards/sist/1d585c75-dad1-4e10-8e39-9b2473253645/sist-en-50121-3-2-2007>

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 or test report.

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

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 6.

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 – Traction a.c. power ports

Port	Test specification	Basic standard	Test set-up	Remarks
1.1	High voltage connection, input side before filter (port 3 on Figures A.1, A.2, A.3)	see EN 50121-3-1		
	Signalling and telecommunication frequencies			
	9 kHz ... 30 MHz	No limits		See note 1 & 2
NOTE 1 No conducted radio frequency limits are applied. The apparatus when installed with other surrounding equipment shall satisfy the radiated emission limits of EN 50121-3-1 for trains.				
NOTE 2 It is desirable but not possible to apply conducted radio frequency limits. No practical test method exists and the relationship between conducted emissions and radiated emissions is not possible to define.				

Table 2 – Emission – Traction d.c. power ports

Port	Test specification	Basic standard	Test set-up	Remarks
2.1	High voltage connection, input side before filter (port 3 on Figure A.4)	see EN 50121-3-1		
	Signalling and telecommunication frequencies			
	9 kHz ... 30 MHz	No limits		See note 1 & 2
NOTE 1 No conducted radio frequency limits are applied. The apparatus when installed with other surrounding equipment shall satisfy the radiated emission limits of EN 50121-3-1 for trains.				
NOTE 2 At present there is no agreed method or limit for conducted emissions on the traction supply from 9 kHz to 30 MHz. Limiting conducted emissions from an apparatus connected to the traction supply will prevent excessive radiated emissions from the supply system. A method for measuring conducted emissions is proposed in Annex B. Experience in this technique and the relationship between conducted and radiated emissions is necessary in order to progress this standard in the future.				

Table 3 – Emission – Auxiliary a.c. or d.c. power ports

Port	Test specification		Basic Standard	Test set-up	Remarks
	9 kHz ... 150 kHz	No limits			
3.1 Auxiliary supply sinusoidal a.c. or d.c. (port 9 on Figures A.1, A.2 and A.4)	150 kHz ... 500 kHz	99 dB μ V quasi-peak	EN 55011	EN 55011	See note 1 & 2 See note 3, 4 & 5 See note 3, 4 & 5
	500 kHz ... 30 MHz	93 dB μ V quasi-peak			
	NOTE 1 At present there are no limits for conducted emissions from 9 kHz to 150 kHz. Limiting conducted emissions from an apparatus will prevent excessive radiated emissions. Experience in this technique and the relationship between conducted and radiated emissions is necessary in order to progress this standard in the future.				
NOTE 2 230 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 and common mode shall be limited by a sine-filter to < 5 %. The burst and surge emissions of the outlet have to be limited to the levels of residential equipment according to EN 61000-6-1. AM radio receivers are not intended to be supplied by these power outlets.					
NOTE 3 Wherever applicable the method defined by EN 55011 is to be used. At present the existing method of measuring conducted emissions (EN 55011) 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.					
NOTE 4 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.					
NOTE 5 This requirement is not applicable to power ports which are connected to other dedicated, compatible ports.					

Table 4 – Emission – Battery referenced ports

Port	Test specification		Basic standard	Test set-up	Remarks
	9 kHz ... 150 kHz	No limits			
4.1 Battery power supply (port 10 on Figures A.1-A.5)	150 kHz ... 500 kHz	99 dB μ V quasi-peak	EN 55011	EN 55011	See note 1 See note 2 See note 2
	500 kHz ... 30 MHz	93 dB μ V quasi-peak			
	NOTE 1 At present there are no limits for conducted emissions from 9 kHz to 150 kHz. Limiting conducted emissions from an apparatus will prevent excessive radiated emissions. Experience in this technique and the relationship between conducted and radiated emissions is necessary in order to progress this standard in the future.				
NOTE 2 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.					

Table 5 – Emission – Process measurement and control ports

	Port	Test specification		Basic standard	Test set-up	Remarks
5.1	Electronic supply sinusoidal a.c. or d.c. (port 16 on Figure A.5)	9 kHz ... 150 kHz	No limits	EN 55011	EN 55011	See note 1
		150 kHz ... 500 kHz	99 dB μ V quasi-peak			See note 2
		500 kHz ... 30 MHz	93 dB μ V quasi-peak			See note 2
<p>NOTE 1 At present there are no limits for conducted emissions from 9 kHz to 150 kHz. Limiting conducted emissions from an apparatus will prevent excessive radiated emissions. Experience in this technique and the relationship between conducted and radiated emissions is necessary in order to progress this standard in the future.</p> <p>NOTE 2 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>						

Table 6 - Emission - Enclosure port

	Port	Test specification		Basic standard	Test set-up	Remarks
6.1	Enclosure	30 MHz ... 230 MHz	40 dB μ V/m quasi-peak	EN 55011	EN 55011	See note 1 & 2
		230 MHz ... 1 GHz	47 dB μ V/m quasi-peak			See note 1 & 2
<p>NOTE 1 Measurement distance is 10 m. A measurement distance of 3 m may be used with the limit increased by 10 dB.</p> <p>NOTE 2 Traction converters and auxiliary converters over 50 kVA need not be tested individually but when the vehicle is tested as a whole in accordance with EN 50121-3-1.</p>						