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

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

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45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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Will supersede EN 50121-3-2:2016 and all of its amendments and corrigenda (if any)

English Version

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

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

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

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2021-10-15.

It has been drawn up by CLC/TC 9X.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CENELEC 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.

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

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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European foreword

This document (prEN 50121-3-2:2021) has been prepared by CLC/TC 9X “Electrical and electronic applications for railways”.

The following dates are proposed:

• latest date by which the existence of this document has to be announced at national level	(doa)	dor + 6 months
• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	dor + 12 months
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	dor + 36 months (to be confirmed or modified when voting)

This document will supersede EN 50121-3-2:2016 and all of its amendments and corrigenda (if any).

prEN 50121-3-2:2021 includes the following significant technical changes with respect to EN 50121-3-2:2016:

— Update of scope (Clause 1);

— Update of normative references (Clause 2);

— Introduction of performance criteria (Clause 4);

— Update of Clause 5, three paragraphs from Clause 1 were introduced;

— revision of Annex ZZ.

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

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 document 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.

This document 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.

The objective of this document 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.

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 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.

EN 50121-1:2017, *Railway applications - Electromagnetic compatibility - Part 1: General*

prEN 50121-3-1:2021, *Railway applications - Electromagnetic compatibility - Part 3-1: Rolling stock - Train and complete vehicle*

EN 55016-2-1:2014, *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-:2014)*

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 61000-4-4:2012, *Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test (IEC 61000-4-4:2012)*

EN 61000-4-5:2014, *Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test (IEC 61000-4-5:2014)*

EN 61000-4-6:2014, *Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields (IEC 61000-4-5:2013)*

EN 61000-4-30:2015, *Electromagnetic compatibility (EMC) - Part 4-30: Testing and measurement techniques - Power quality measurement methods (IEC 61000-4-30:2015)*

EN IEC 61000-6-4:2019, *Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments (IEC 61000-6-4:2018)*

3 Terms, definitions and abbreviations

3.1 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:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
rolling stock apparatus
finished product with an intrinsic function intended for implementation into the rolling stock installation

3.1.2
port
particular interface of the specified apparatus with the external environment

EXAMPLE: AC power port, DC power port, I/O (input/output) port, earth port.

[SOURCE: IEC 60050-821:2015, 821-11-36]

3.1.3
enclosure port
physical boundary of the apparatus through which electromagnetic fields may radiate or impinge

Note 1 to entry: The main categories of ports for rolling stock apparatus are presented in Figure 1.

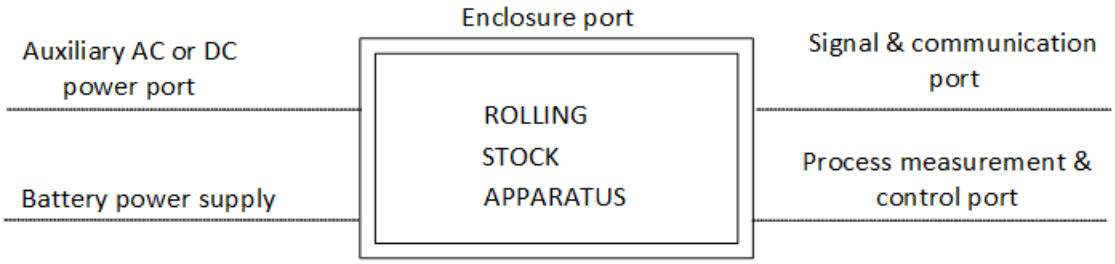

Figure 1 — Main categories of ports

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

Traction power ports are not covered in this European Standard see Annex B.

3.2 Abbreviations

AC	Alternating current
AM	Amplitude modulation
CISPR	Comité international spécial des perturbations radioélectriques
DC	Direct current
EMC	Electromagnetic compatibility
I/O	Input / Output
ITU	International Telegraph Union
PC	Personal computer
THD	Total harmonic distortion
TV	Television
U_N	Nominal input voltage

4 Performance criteria

A functional description and a definition of the specific performance criteria of the equipment under test (EUT), identifying acceptable degradation from normal performance during or as a consequence of immunity testing, shall be provided in the equipment's test specification and noted in the test report. Acceptable degradation is a deviation of performance of the equipment that a reasonable user accepts, when used as intended.

NOTE 1: Generally, the acceptable degradation of performance can be determined from an understanding of the purpose of the equipment (e.g. from its functional description, documentation or common specifications for that type of equipment).

The EUT's specific performance criteria shall be consistent with the following general criteria for each test as specified in Table 3 to Table 5:

Performance criterion A:

During and after the immunity test, the equipment shall;

— continue to operate and to remain controllable as intended within the identified acceptable degradation from normal performance,

— not unintentionally change its operating state,

— not unintentionally change any critical stored data.

Performance criterion B:

The immunity test shall not result in;

— the mode of operation after the test being different to that at the beginning of the test,

— unintentional change to critical stored data

After the immunity test, the equipment shall operate as intended.

Performance criterion C:

The immunity test may result in loss of function, provided the function is self-recoverable, or can be restored by the operation of the controls by the user. A reboot or re-start operation is allowed. The immunity test shall not result in an unintentional change to critical stored data.

NOTE 2: Critical data includes data previously saved by the user.

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 the EN 61000-4 series).

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

If the equipment is part of a system, or can be connected to auxiliary equipment, the equipment shall be tested while connected to the minimum representative configuration of auxiliary equipment necessary to exercise the ports. Auxiliary equipment may be simulated.

If the equipment has a large number of similar ports or ports with many similar connections, a sufficient number shall be selected to simulate actual operating conditions and to ensure that all the different types of termination are covered. Justification for the selection of the tested ports shall be included in the test report.

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.

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.

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 radiated emission limits defined for enclosure port in EN IEC 61000-6-4:2019, Table 3 shall be complied with. The description of the test, the test methods and the test set-up are given in Basic Standards which are referred to in EN IEC 61000-6-4.

Measurement distance is 10 m according line 3.1 in Table 3 of EN IEC 61000-6-4:2019. A measurement distance of 3 m may be used with the limit increased by 10 dB.

Traction converters and auxiliary converters over 50 kVA cannot be tested individually but when the vehicle is tested as a whole in accordance with prEN 50121-3-1:2021.

The description of the conducted emission tests, the test methods and the test set-up are given in Basic Standards which are referred to in Tables 1 and 2.

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.

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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	**Auxiliary supply sinusoidal AC or DC** (port 9 on Figures A.1, A.2 and A.4)	150 kHz to 500 kHz 500 kHz to 30 MHz	99 dBµV quasi-peak 93 dBµV 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.
1.2	**AC power outlet port for public use**	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 %.

[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.

[b] This requirement refers to the industrial limit values but considering they have been defined to protect radio and TV services 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.

[c] This requirement is not applicable to power ports which are connected to other dedicated, compatible ports.

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

	Port	Test specification		Basic standard	Test set-up	Applicability note	Remarks
2.1	**Battery power supply** (port 10 on Figures A.1-A.5)	150 kHz to 500 kHz 500 kHz to 30 MHz	99 dBµV quasi-peak 93 dBµV quasi-peak	EN 55016-2-1	EN 55016-2-1	See [a]	
[a] This requirement refers to the industrial limit values but considering they have been defined to protect radio and TV services 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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