
Železniške naprave - Elektromagnetna združljivost - 5. del: Sevanje in odpornost stabilnih močnostnih napajalnih inštalacij in naprav

Railway applications - Electromagnetic compatibility - Part 5: Emission and immunity of fixed power supply installations and apparatus

Bahnanwendungen - Elektromagnetische Verträglichkeit - Teil 5: Störaussendungen und Störfestigkeit von ortsfesten Anlagen und Einrichtungen der Bahnenergieversorgung

Applications ferroviaires - Compatibilité électromagnétique - Partie 5 : Emission et immunité des installations fixes d'alimentation de puissance et des équipements associés

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Ta slovenski standard je istoveten z: prEN 50121-5:2021

ICS:

33.100.01	Elektromagnetna združljivost na splošno	Electromagnetic compatibility in general
45.020	Železniška tehnika na splošno	Railway engineering in general

oSIST prEN 50121-5:2021

en

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 50121-5

July 2021

ICS

Will supersede EN 50121-5:2017 and all of its amendments and corrigenda (if any)

English Version

Railway applications - Electromagnetic compatibility - Part 5: Emission and immunity of fixed power supply installations and apparatus

Applications ferroviaires - Compatibilité électromagnétique -
Partie 5 : Emission et immunité des installations fixes
d'alimentation de puissance et des équipements associés

Bahnanwendungen - Elektromagnetische Verträglichkeit -
Teil 5: Störaussendungen und Störfestigkeit von ortsfesten
Anlagen und Einrichtungen der Bahnenergieversorgung

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.

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

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European foreword

This document (prEN 50121-5:2021) 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 50121-5:2017 and all of its amendments and corrigenda (if any).

EN 50121-5:2020 includes the following significant technical changes with respect to EN 50121-5:2017:

- Update of scope (Clause 1); (standards.iteh.ai)
- Update of normative references (Clause 2); ([osist prEN 50121-5:2021](https://standards.iteh.ai/catalog/standards/sist/dec255b4-d09b-4365-8c2c-318c471cabc/osist-pren-50121-5-2021))
- Introduction of performance criteria (Clause 4); (<https://standards.iteh.ai/catalog/standards/sist/dec255b4-d09b-4365-8c2c-318c471cabc/osist-pren-50121-5-2021>)
- Update of Clause 6, paragraphs from Clause 1 were introduced;
- revision of Annex ZZ.

This European Standard is to be 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 5 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

Introduction

The requirements of this standard have been specified so as to ensure a level of electromagnetic emission which will cause minimal disturbance to other equipment. The levels, however, do not cover the following cases:

- a) which may occur with an extremely low probability of occurrence in any location;
- b) where highly susceptible apparatus will be used in close proximity of the equipment covered by this standard, in which case further measures may have to be taken.

The emission limits given are on the basis that the equipment of the product family range is installed in railway substation areas.

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1 Scope

This document applies to emission and immunity aspects of EMC for electrical and electronic apparatus and systems intended for use in railway fixed installations for power supply. This includes the power feed to the apparatus, the apparatus itself with its protective control circuits, trackside items such as switching stations, power autotransformers, booster transformers, substation power switchgear and power switchgear to other longitudinal and local supplies.

Filters operating at railway system voltage (for example, for harmonic suppression or power factor correction) are not included in this document since each site has special requirements. Filters would normally have separate enclosures with separate rules for access. If electromagnetic limits are required, these will appear in the specification for the equipment.

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

Emission and immunity limits are given for items of apparatus which are situated:

- a) within the boundary of a substation which delivers electric power to a railway;
- b) beside the track for the purpose of controlling or regulating the railway power supply, including power factor correction;
- c) along the track for the purpose of supplying electrical power to the railway other than by means of the conductors used for contact current collection, and associated return conductors. Included are high voltage feeder systems within the boundary of the railway which supply substations at which the voltage is reduced to the railway system voltage;
- d) beside the track for controlling or regulating electric power supplies to ancillary railway uses. This category includes power supplies to marshalling yards, maintenance depots and stations;
- e) various other non-traction power supplies from railway sources which are shared with railway traction.

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*

EN 50121-2:2017, *Railway applications - Electromagnetic compatibility - Part 2: Emission of the whole railway system to the outside world*

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

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

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

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

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

EN 61000-4-8:2010, *Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test*

EN IEC 61000-4-18:2020, *Electromagnetic compatibility (EMC) - Part 4-18: Testing and measurement techniques - Damped oscillatory wave immunity test (IEC 61000-4-18:2019 + Cor1: 2019)*

EN IEC 61000-6-1:2019, *Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments*

EN IEC 61000-6-3:2021, *Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for equipment in residential environments*

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

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/>

<https://standards.iteh.ai/catalog/standards/sist/dec255b4-d09b-4365-8c2c-318c471cab/osit-pren-50121-5-2021>

3.1.1

apparatus

electric or electronic product with an intrinsic function intended for implementation into a fixed railway installation

3.1.2

environment

surrounding objects or region which may influence the behaviour of the system and or may be influenced by the system

3.1.3

railway substation

installation, the main function of which is to supply a contact line system at which the voltage of a primary supply system, and in some cases the frequency, is transformed to the voltage and frequency of the contact line

3.1.4

long bus

bus cables with a length of more than 30 m

3.1.5

3 m zone

area along the railway line within a distance of 3 m from the centreline of the nearest track at both sides of the track

3.1.6**10 m zone**

area along the railway line within a distance of 10 m from the centreline of the nearest track at both sides of the track

3.2 Abbreviations

For the purposes of this document, the following abbreviations apply.

AC	Alternating current
AM	Amplitude modulation
CE	Communauté Européenne
DC	Direct current
EMC	Electromagnetic compatibility
ITU	International Telecommunication Union
Rms	Root Mean Square

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. (standards.iteh.ai)

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). <https://standards.iteh.ai/catalog/standards/sist/dec255b4-d09b-4365-8c2c-318cf471cab6/osist-pren-50121-5-2021>

The EUT's specific performance criteria shall be consistent with the following general criteria for each test as specified in Table 2 to Table 6:

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 Emission tests and limits

5.1 Emission from the substation to the outside world

Limit values for this emission, over the frequency range 150 kHz to 1 GHz are given in EN 50121-2.

Guidance values are given in EN 50121-2 for emission of DC and power frequency magnetic fields.

Conductors (overhead or underground) between the substation and the railway are part of the railway installation, but because of their wide variety of positions and ampere loadings, limit values cannot be set for the magnetic fields which they produce.

No limits are set for emissions into the active space of the underground railway due to the complexities of obtaining measurements in the confined space and the lack of a precise method of relating the measured values to the degree of disturbance which other apparatus would suffer.

No measurements are necessary for total underground railway systems with no surface operation.

5.2 Emission test for apparatus operating at less than 1 000 V rms AC

The emission limits for apparatus covered by this standard which is supplied with electrical power at a voltage below 1 000 V rms are given on a port by port basis in EN IEC 61000-6-4.

5.3 Emission values within the boundary of the substation

Because there is such a wide variety of options for the design and the construction of the substation, limits are not given for emission within the general space inside the boundary of the substation. Practical measurements have been made and guidance values are given in Annex A. These are for information only and are not part of the normative content of this standard.

6 Immunity requirements

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The immunity levels given in this standard apply for: <https://standards.iteh.ai/catalog/standards/sist/dec255b4-d09b-4365-8c2c->

- vital equipment such as protection devices;
- equipment having connections to the traction power conductors;
- apparatus inside the 3 m zone;
- ports of apparatus inside the 10 m zone with connection inside the 3 m zone;
- ports of apparatus inside the 10 m zone with cable length > 30 m.

Apparatus and systems which are in an environment which can be described as residential, commercial or light industry, even when placed within the physical boundary of the railway substation, shall comply with EN IEC 61000-6-1:2019 for immunity and EN IEC 61000-6-3:2021 for emission requirements.

Excluded from the immunity requirements of this standard is power supply apparatus which is intrinsically immune to the tests defined in Tables 1 to 6.

NOTE An example is an 18 MVA 230 kV to 25 kV power supply transformer.

The immunity test requirements for apparatus covered by this standard are given on a port by port basis in Tables 1 to 6.

Tests shall be conducted in a well-defined and reproducible manner. The tests shall be carried out as single tests in sequence. The sequence of testing is optional.

The description of the tests, the test generator, the test methods, and the test set-up are given in the Basic Standards which are referred to in Tables 1 to 6. The contents of the Basic Standards are not

repeated here, however modifications or additional information needed for the practical application of the tests are given in this standard.

Where possible, the tests shall be made with a typical operating mode chosen to produce the maximum susceptibility to noise in the frequency band being investigated, consistent with normal applications.

The configuration and mode of operation during the tests shall be precisely noted in the test report. It is not always possible to test every function of the apparatus; in such cases the most critical mode of operation should be selected.

The tests shall be carried out within the specified operating range for the apparatus and at its rated supply voltage.

Some of the immunity levels are higher than those of the heavy industrial Generic Standard because this has been found necessary in practice.

Voltages induced by traction currents are not treated here. They have to be covered by the functional specification (e.g. EN 50124-1).

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