

# SLOVENSKI STANDARD

## SIST EN 50121-5:2017

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### 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

Ta slovenski standard je istoveten z: **EN 50121-5:2017**

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EUROPEAN STANDARD

**EN 50121-5**

NORME EUROPÉENNE

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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

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Europäisches Komitee für Elektrotechnische Normung

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

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## European foreword

This document (EN 50121-5:2017) 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) 2017-11-06
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2020-02-06

This document supersedes EN 50121-5:2015.

EN 50121-5:2017 includes the following significant technical changes with respect to EN 50121-5:2015:

- clarification of scope (Clause 1);
- set dated normative references (Clause 2);
- 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;
- removal of limits for radiated H-fields in the frequency range 9 kHz to 150 kHz due to the fact that:
- there are very few outside world victims;
- there is low reproducibility;
- revision of Annex ZZ.

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 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 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 European Standard 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 standard 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.

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 are not intended to be applicable to the intentional transmission from a radio-transmitter as defined by the ITU.

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.

The immunity levels given in this standard apply for:

- 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 61000-6-1:2007 for immunity and EN 61000-6-3:2007 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.

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

**EN 50121-5:2017 (E)**

This part of the standard covers requirements for both apparatus and fixed installations. The sections for fixed installations are not relevant for CE marking.

**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 50121-1:2017, *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 (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 61000-4-5:2006, *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 61000-4-8:2010, *Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test (IEC 61000-4-8:2009)*

EN 61000-4-18:2007, *Electromagnetic compatibility (EMC) - Part 4-18: Testing and measurement techniques - Damped oscillatory wave immunity test (IEC 61000-4-18:2006)*

EN 61000-6-4:2007<sup>i</sup>, *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****apparatus**

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

<sup>i</sup> As impacted by EN 61000-6-4:2007/A1:2011.



**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**

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

AC	Alternating current	<a href="https://standards.iteh.ai/catalog/standards/sist/54c5e239-5c56-42eb-90eb-89c79efb0fac/sist-en-50121-5-2017">SIST EN 50121-5:2017</a>
AM	Amplitude modulation	<a href="https://standards.iteh.ai/catalog/standards/sist/54c5e239-5c56-42eb-90eb-89c79efb0fac/sist-en-50121-5-2017">https://standards.iteh.ai/catalog/standards/sist/54c5e239-5c56-42eb-90eb-89c79efb0fac/sist-en-50121-5-2017</a>
CE	Communauté Européenne	
DC	Direct current	
EMC	Electromagnetic compatibility	
ITU	International Telecommunication Union	
Rms	Root Mean Square	

**4 Performance criteria**

The variety and diversity of the apparatus within the scope of this document make it difficult to define precise criteria for the evaluation of the immunity test results. Three general levels of performance are therefore used, as defined in EN 50121-1.

**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.

**EN 50121-5:2017 (E)**

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 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**

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 manufacturer shall define the conditions of the test in the test plan.

If the apparatus is part of a system or can be connected to auxiliary apparatus, then the apparatus should preferably be tested while connected to the minimum configuration of auxiliary apparatus necessary to exercise the test point in accordance with the general methods of EN 61000-4-x.

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).

Table 1 — Immunity – Enclosure port

	Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
1.1	<b>Radio-frequency electromagnetic field. Amplitude modulated</b>	80 MHz to 800 MHz 10 V/m (rms) 80 % AM, 1 kHz	Unmodulated carrier	EN 61000–4–3	EN 61000–4–3		The test level specified is the rms value of the unmodulated carrier	A
1.2	<b>Radio-frequency electromagnetic field</b>	800 MHz to 1 000 MHz 20 V/m (rms) 80 % AM, 1 kHz	Unmodulated carrier				The test level specified is the rms value of the unmodulated carrier	A
		1 400 MHz to 2 000 MHz 10 V/m (rms) 80 % AM, 1 kHz	Unmodulated carrier				The test level specified is the rms value of the unmodulated carrier	
		2 000 MHz to 2 700 MHz 5 V/m (rms) 80 % AM, 1 kHz	Unmodulated carrier	EN 61000–4–3	EN 61000–4–3		These tests are intended to simulate disturbances from digital communication devices	
		5 100 MHz to 6 000 MHz 3 V/m (rms) 80 % AM, 1 kHz	Unmodulated carrier					