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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

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EUROPEAN STANDARD

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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
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Störfestigkeit von ortsfesten Anlagen und
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This European Standard was approved by CENELEC on 2000-04-01. 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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

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Foreword

This European Standard was prepared by SC 9XC, Electric supply and earthing systems for public transport equipment and ancillary apparatus (fixed installations) of the Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways, in accordance with the decisions taken by TC 9X.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50121-5 on 2000-04-01.

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) 2001-04-01 |
| - | latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) 2003-04-01 |

This European Standard is to be read in conjunction with EN 50121-1:2000.

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

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given only for information.

In this standard, annexes A, B and C are informative.

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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) where the probability of an occurrence likely to produce emissions in excess of those which would normally be experienced is extremely low,
- 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.

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 associated with 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.

The limits in this standard do not apply to intentional communication signals.

The frequency range covered is from d.c. to 400 GHz. At present testing is defined only up to 1 GHz.

Limits are given for the EMC between 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 and filtering;
- 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.

NOTE 1 Examples are one conductor of a 25-0-25 kV 50 Hz system and the 110 kV 16,7 Hz supply systems.

NOTE 2 Similar conductors which are outside the railway boundary are treated as in the public area and are considered to be general overhead power lines although they feed only the railway.

- 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.

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 the relevant generic European EMC standard.

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 of this standard.

NOTE 3 An example is an 18 MVA 230 kV to 25 kV power supply transformer.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited in the appropriate places in the text and the publications are listed below. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated into it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 50081-2	1993	Electromagnetic Compatibility (EMC) - Generic emission Standard Part 2: Industrial environment
EN 50121-1		Railway applications - Electromagnetic compatibility Part 1: General
EN 50121-2		Part 2: Emission of the whole railway system to the outside world
ENV 50204		Radiated electromagnetic field from digital radio telephones - Immunity test
EN 55022		Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (CISPR 22, modified)
EN 61000-3-2		Electromagnetic Compatibility (EMC) Part 3-2: Limits - Limits for harmonic current emissions (equipment input current up to and including 16 A per phase) (IEC 61000-3-2)
EN 61000-3-3		Part 3-3: Limits - Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current up to and including 16 A (IEC 61000-3-3)
EN 61000-4-2		Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test (IEC 61000-4-2)
EN 61000-4-3		Part 4-3: Testing and measurement techniques - Radiated, radio- frequency, electromagnetic field immunity test (IEC 61000-4-3, modified)
EN 61000-4-4		Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test (IEC 61000-4-4)
EN 61000-4-5		Part 4-5: Testing and measurement techniques - Surge immunity test (IEC 61000-4-5)
EN 61000-4-6		Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields (IEC 61000-4-6)
EN 61000-4-8		Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test (IEC 61000-4-8)
EN 61000-4-12		Part 4-12: Testing and measurement techniques - Oscillatory waves immunity test (IEC 61000-4-12)

EN 61000-4-16		Part 4-16: Testing and measurement techniques - Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz (IEC 61000-4-16)
EN 61000-6-2	1999	Part 6-2: Generic Standards - Immunity for industrial environments (IEC 61000-6-2)
CISPR 16-1		Specification for radio disturbance and immunity measuring apparatus and methods -- Part 1: Radio disturbance and immunity measuring apparatus

3 Definitions

For the purpose of this part 5 of the European Standard the following definitions apply.

3.1

apparatus

an electric or electronic product with an intrinsic function intended for implementation into a fixed railway installation, which can be placed on the market as a single unit

3.2

environment

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

3.3

external interface

the boundary where a system interacts with any other or where a system interacts with its environment

3.4

railway substation

an 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

3.5

railway supply lines

conductors running within the boundary of the railway which supply power to only the railway but are not energised at railway system voltage

4 Performance criteria

The variety and diversity of the apparatus within the scope of this document makes 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 9 kHz to 1 GHz are given in EN 50121-2.

NOTE 1 Guidance values are given in EN 50121-2 for emission of d.c. 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.

For apparatus which is under ground, measurements shall be made in the frequency range 9 kHz to 150 kHz at the surface of the ground above the apparatus.

NOTE 2 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.

5.2 Emission test for apparatus operating at less than 1 000 V r.m.s. a.c.

The emission limits for apparatus covered by this standard which is supplied with electrical power at a voltage below 1000 V r.m.s. are given on a port by port basis in EN 50081-2, Table 1.

5.3 Emission values within the boundary of the substation

Because there is such a wide variety of options for 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 tests and limits

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.

NOTE 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 55022 and 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.

7 Fixed power supplies on railway property which are not used for railway traction purposes

7.1 Various other power supplies

These are used for example for signalling systems: station services, office building services, freight cranes and yard lighting.

They fall into two categories:

- a) those that are supplied from non-railway sources. Examples are supplies from the local public electricity supplier or from separate generators. These are outside the scope of this standard. For products in the scope of EN 61000-3-2 or EN 61000-3-3 the requirements of those standards apply.
- b) those that are supplied from railway sources which are shared with train traction. Examples are: supplies from tertiary windings on rectifier transformers or from the railway a.c. overhead via transformers. See 7.2.

7.2 Apparatus supplied from sources linked to the railway traction system voltage

There is such a wide variety of options for supply, under such a wide variety of disturbance conditions, that no European limits can be set at present. The supply voltage may have a substantial harmonic content, depending on the type of traction vehicle. It is the responsibility of the body which puts the apparatus into service to establish the levels of immunity and emission which will ensure EMC.

This section of this standard will be reviewed in the light of experience, with the objective of specifying limits for this case.

In the absence of specified limits, apparatus which meets the relevant parts of generic standards EN 50081-2 and EN 61000-6-2 shall be used.

Table 1: Immunity - Enclosure port

Environmental phenomena	Test specification	Units	Basic Standard	Test setup	Remarks	Performance criteria
1.1 Radio frequency electromagnetic field. Amplitude modulated	80-1000 10 80	MHz V/m unmodulated r.m.s. % AM (1 kHz)	EN 61000-4-3	EN 61000-4-3	The test level specified is prior to modulation	A
1.2 Radio frequency electromagnetic field. Pulse modulated	900 ± 5 10 50 200	MHz V/m unmodulated r.m.s. Duty cycle % Rep. frequency Hz	ENV 50204	ENV 50204	Spot frequency within the range indicated	A
1.3 Power frequency magnetic field	50 100	Hz A/m	EN 61000-4-8	EN 61000-4-8	See note	A
1.4 Electrostatic discharge	6 Contact 8 Air discharge	kV charge voltage	EN 61000-4-2	EN 61000-4-2	See Basic Standard for applicability of contact and/or air discharge test	B
NOTE Applicable only to apparatus containing devices susceptible to magnetic fields, e.g. Hall elements, electrodynamic microphones, etc.						

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