



SLOVENSKI STANDARD
SIST ENV 50121-5:1998
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Railway applications - Electromagnetic compatibility - Part 5: Fixed power supply installations

Railway applications - Electromagnetic compatibility -- Part 5: Fixed power supply installations

Bahnanwendungen - Elektromagnetische Verträglichkeit -- Teil 5: Ortsfeste Bahn-Energieversorgungsanlagen

Applications ferroviaires - Compatibilité électromagnétique -- Partie 5: Installations fixes d'énergie de traction

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EUROPEAN PRESTANDARD
PRÉNORME EUROPÉENNE
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February 1996

ICS 29.020; 29.280; 45.020

Descriptors: Railway fixed equipment, electric power supply, electric equipment, electronic components, radio disturbances, electromagnetic compatibility, tests, limits

English version

**Railway applications - Electromagnetic compatibility
Part 5: Fixed power supply installations**

Applications ferroviaires - Compatibilité
électromagnétique
Partie 5: Installations fixes d'énergie de
traction

Bahnanwendungen - Elektromagnetische
Verträglichkeit
Teil 5: Ortsfeste
Bahn-Energieversorgungsanlagen

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This European Prestandard (ENV) was approved by CENELEC on 1995-12-11 as a prospective standard for provisional application. The period of validity of this ENV is limited initially to three years. After two years the members of CENELEC will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard (EN).

CENELEC members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



REPUBLIKA SLOVENIJA
MINISTRSTVO ZA ZNANOST IN TEHNOLOGIJO
Urad RS za standardizacijo in meroslovje
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-11- 1996

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 Prestandard was prepared by Technical Committee CENELEC TC9X, Electrical and electronic applications for railways, in accordance with the decision taken by CLC/TC9X at its 11th meeting on 1995-05-12/13.

The text of the draft was submitted to the formal vote and was approved by CENELEC as ENV 50121-5 on 1995-12-11.

The following date was fixed :

- latest date by which the existence of the ENV
has to be announced at national level (doa) 1996-01-15

This European Prestandard is to be used in conjunction with one or several specific European Prestandards listed in the scope.

Annexes designated "normative" are part of the body of this Prestandard. Annexes designated "informative" are given only for information.

In this Prestandard, annex A is informative and annexes B and C are normative.

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Introduction

This European Prestandard has been prepared to provide one means of complying with the requirements of the Electromagnetic Compatibility (EMC) Directive.

The requirements of this Prestandard 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 European Prestandard, in which case further additional precautionary 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 outdoor dedicated areas and is not connected to a Low Voltage system.

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1 Scope

1.1 General

To establish European Standards for emission and immunity aspects of apparatus used in fixed railway power installations, and for the systems and installations themselves.

This European Prestandard applies to emission and immunity aspects of EMC for electrical and electronic apparatus and components 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, conductors at railway system voltage but not carrying current (e.g. overhead contact lines), trackside items such as feeder lines, switching stations, power autotransformers, booster transformers, substation power switchgear and power switchgear to other longitudinal and local supplies.

Filters are not included in this European Prestandard 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.

Tests for ports connected to cables associated with communication links used for system control and data acquisition (such as SCADA systems), are taken from ENV 50121-4.

The frequency range covered is from d.c. to 400 GHz. At present testing is defined only up to 1 000 MHz. Not treated in this Part are coupling phenomena at frequencies below 9 kHz to other parallel conductors from both Power Supply Lines inside the railway boundary, and from conductors at railway system voltage.

National variations to this European Prestandard may exist provided they fulfil all the following conditions:

- they shall only apply to minor routes or well-localised areas;
- they are not likely to give advantage to local manufacturers at the time of European tenders;
- they do not involve European traffic.

In that case, they are considered de facto as special national conditions.

The objective of this European Prestandard is to define limits and test methods for electromagnetic emissions and immunity requirements in relation to continuous and transient radiated disturbances.

These limits and tests represent essential EMC requirements. Limits are set for:

- a) the emission from the supply system at the substation and at items which are along and beside the track for the purpose of supplying, controlling or regulating the power supply.

Emission levels have been selected sufficiently low to ensure good operation of reasonably immune equipment in the vicinity of the railway and sufficiently high to be met by economically designed apparatus and components under normal service conditions.

- b) the immunity levels which need to be met by apparatus operating as part of the power supply system.

By their nature, the high power elements of fixed installations usually are immune against electromagnetic disturbances. Thus, immunity requirements have been set only for electronic apparatus in substations, control cubicles etc.

The levels do not cover extreme cases which may occur with an extremely low probability in any given location.

The immunity levels are more severe than the Industrial Generic Standard because the environment has a greater concentration of power than most industrial sites and there are a relatively high number of disconnections due to short-circuits of the railway conductor line.

1.2 Apparatus within scope

Limits related to the EMC are given 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 delivering 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 for ancillary railway uses. This category includes power supplies to marshalling yards, maintenance depots and stations.

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2 Normative references

This European Prestandard 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 Prestandard only when incorporated into it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 50081-1		Electromagnetic compatibility - Generic emission standard Part 1: Residential, commercial and light industry
EN 50081-2	1994	Part 2: Industrial environment
prEN 50082-1	1995	Electromagnetic compatibility - Generic immunity standard, Part 1: Residential, commercial and light industry
EN 50082-2		Part 2: Industrial environment
EN 55022		Limits and methods of measurement of radio interference characteristics of Information technology equipment (CISPR 22)
ENV 50121-1		Railway applications - Electromagnetic compatibility - Part 1: General
ENV 50121-4		Railway applications - Electromagnetic compatibility - Part 4: Emission and immunity of the signalling and telecommunications apparatus
CISPR 16-1		Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus
IEC 50(161)		International Electrotechnical Vocabulary - Chapter 161: Electromagnetic compatibility

3 Definitions

For the purposes of this European Prestandard the definitions related to EMC and to relevant phenomena may be found in the EEC EMC Directive 89/336/EEC, Chapter 161 of the IEC (IEC 50) and in IEC and CISPR Publications. The definitions stated in the EMC Directive take precedence.

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 feeder lines: Conductors running parallel to, and within the boundary of, the railway which supply power to only the railway but are not energised at railway system voltage.

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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 prEN 50082-1:1995. The texts of these criteria are given in ENV 50121-1.

5 Immunity tests and limits

The immunity test requirements for apparatus covered by this European Prestandard 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 except test 3.4 which is to be applied to ports for process measurement and control where the cables leave the substation boundary. This uses the Common Mode Voltage test as specified in ENV 50121-4, and annex B shows one form of circuit which may be used for this test.

This test is required for ports which are connected to conductors which run parallel to the railway installation, because power frequency voltages are induced into these conductors.

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 European Prestandard.

It is recognised that some relevant apparatus cannot be tested by this method due to considerations such as size. For this type of apparatus, tests shall be defined that reproduce an equivalent noise input to the apparatus.

The tests shall where possible be made with a typical operating mode chosen to produce the largest emission or maximum susceptibility to noise, as appropriate, in the frequency band being investigated, consistent with normal applications. The supplier 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.

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 shall be selected.

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

6 Emission tests and limits

6.1 Emission at radio frequencies from substation (graphically in figure 1)

Radio frequency noise emission to the outside environment measured according to the method defined in annex C shall not exceed the levels below when the apparatus is working at rated continuous power,

Frequency (MHz)	Field strength dB(μ A/m) quasi-peak
0,009	55
0,15 -	45
0,15 +	50
30 -	20

Frequency (MHz)	Field strength dB(μ V/m) quasi-peak Vertical polarisation
30 +	55
1,000	35

the values being the end points of straight lines on dB / log(f) plots.

If the measurements are taken at power values below the rated continuous power, the results shall be converted in accordance with the rules in annex C.

In this document, the sign - with a frequency indicates a frequency equal to or less than the given value; the sign + indicates frequencies greater than the given value. The bandwidths used for measurement are those used in CISPR 16-1 and are:

	Bandwidth
Frequencies up to 150 kHz	200 Hz
Frequencies from 150 kHz to 30 MHz	9 kHz
Frequencies above 30 MHz	120 kHz

Test apparatus is commonly available with 10 kHz bandwidth for 150 kHz to 30 MHz and results from such apparatus shall be converted to the 9 kHz equivalent.

These limits are given as quasi-peak values since the emission outwards from the boundary of the substation will mostly affect users who are concerned with the quasi-peak noise.

The distance of 3 m defined in annex C shall be measured outwards from the fence of the substation. If no fence exists, the measurements shall be taken at 10 m from the apparatus if not in a metal enclosure or from the outer surface of the metal enclosure if it is so enclosed.

Emission of trains shall not enter into the measurement.

6.2 Emission at radio frequencies from railway feeder lines

Radio frequency noise at 10 m from these lines, when they are operating at their rated voltage but not carrying load currents, shall not exceed the values

Frequency Range	Field Strength dB(μ V/m)
30 to 230 MHz	40 Vertical polarisation
230 to 1 000 MHz	47 Vertical polarisation

measured as quasi peak values with the bandwidths and characteristics according to CISPR 16-1. During the test the antenna shall be placed midway between insulator supports and traversed through the height range 1 m to 4 m and the maximum value taken as the emission value. The emission limit values in this subclause are taken from table 1.1 of EN 50081-2 because these lines are treated as part of an industrial installation.

6.3 Emission from substations at power frequencies and harmonics up to 9 kHz

Magnetic fields which enter the outside environment need to be controlled and the limits below shall apply. When measured at 3 m from the fence of the substation, at a height of 1 m above ground level, the root mean square value of the magnetic field gradient in any axis, including any effects of harmonic currents, shall not exceed 50 A/m. This value applies to rated continuous load operation. If tests are made at less than rated load, the readings shall be linearly scaled to full load for assessment purposes. Under overload and fault conditions, the limit value shall be 500 A/m.

NOTE: The operation of power supply apparatus will produce magnetic fields which both enter the environment and enter railway apparatus. Limits are required to control this emission. There is great variety in the geometry used for the power conductors in apparatus and it is not yet considered possible to set limits for magnetic fields within the substation boundary. Measurements have been made inside typical existing installations and show that the field is unlikely to exceed 1 000 A/m at distances of more than 1 m from d.c. apparatus, or 500 A/m from a.c. apparatus.

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

The emission limits for apparatus covered by this European Prestandard which are supplied with electrical power at a voltage below 1 000 V rms are given on a port by port basis in EN 50081-2, as in table 1 of that standard, except the enclosure port where the emission measured at 3 m from the apparatus shall not exceed the levels below when the apparatus is working at rated power,

Frequency (MHz)	Field strength dB(μ A/m) quasi-peak
0,009	55
0,15 -	45
0,15 +	50
30 -	20

Frequency (MHz)	Field strength dB(μ V/m) quasi-peak Vertical polarisation
30 +	55
1 000	35