



SLOVENSKI STANDARD
SIST ENV 50121-3-1:1998
01-november-1998

Railway applications - Electromagnetic compatibility - Part 3-1: Rolling stock - Train and complete vehicle

Railway applications - Electromagnetic compatibility -- Part 3-1: Rolling stock - Train and complete vehicle

Bahnanwendungen - Elektromagnetische Verträglichkeit -- Teil 3-1: Schienenfahrzeuge - Zug und gesamtes Fahrzeug

Applications ferroviaires - Compatibilité électromagnétique -- Partie 3-1: Matériel roulant - Train, matériel moteur et matériel remorqué

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ICS:

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45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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EUROPEAN PRESTANDARD
PRÉNORME EUROPÉENNE
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ENV 50121-3-1

February 1996

ICS 29.020; 29.280; 45.020

Descriptors: Railway rolling stock, complete vehicle, electric equipment, radio disturbances, electromagnetic compatibility, tests, limits

English version

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

Applications ferroviaires - Compatibilité
électromagnétique
Partie 3-1: Matériel roulant - Train,
matériel moteur et matériel remorqué

Bahnanwendungen - Elektromagnetische
Verträglichkeit
Teil 3-1: (To be completed)

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PREVZET PO METODI RAZGLASITVE

-11- 1998

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.

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CENELEC

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

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FOREWORD

This European Prestandard was prepared by Technical Committee CENELEC TC 9X Electrical and electronic applications for railways, in accordance with the decision taken by CLC/TC 9X at its 11th meeting on 12/13 May 1995.

The text of the draft was submitted to the formal vote and was approved by CENELEC as ENV 50121-3-1 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

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This European Prestandard is to be read in conjunction with ENV 50121-1:1996 - Railway applications - Electromagnetic compatibility - Part 1 : General.

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

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



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Introduction

High powered electronic equipment together with low power microcontrollers and other electronic devices are being installed on trains in great numbers. Electromagnetic compatibility has therefore become a critical issue for the design of train related apparatus as well as of the train as a whole.

This product Prestandard for rolling stock sets limits for electromagnetic emission and immunity in order to ensure a well functioning system within its intended environment.

Although immunity limits are not given for the complete vehicle, part 3-2 of this Prestandard puts great emphasis on exact test procedures for the apparatus installed in the rolling stock in order to reduce costly and often impractical tests of the complete unit. It is the prime contractor's responsibility to establish an EMC-test plan for all apparatus provided and to ensure its execution.

1 Scope

This European Prestandard specifies the emission and immunity requirements for all types of rolling stock. It covers traction stock and trainsets as well as independent hauled stock (for individual definitions see clause 3).

The frequency range considered is from d.c. to 400 GHz. At present, testing is not defined for frequencies above 1 GHz.

The limits in this Prestandard do not apply to intentional communication signals (radio communications, track/vehicle transmissions,...).

The scope of this part of the Prestandard ends at the interface of the stock with its respective energy inputs and outputs. In the case of locomotives, trainsets, trams etc., this is the sliding contact (or the third rail), in case of hauled stock this is the a.c. or d.c. auxiliary power connector. However, since the pantograph is part of the tractive stock, it is not entirely possible to exclude the effects of this interface.

The electromagnetic interference concerning the railway system as a whole is dealt with in ENV 50121-2.

These specific provisions are additional to the general provisions in ENV 50121-1.

2 Normative references

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

ENV 50121-1 Railway applications - Electromagnetic compatibility - Part 1: General

ENV 50121-2 Railway applications - Electromagnetic compatibility - Part 2: Emission of the whole railway system to the outside world

ENV 50121-3-2 Railway applications - Electromagnetic compatibility
Part 3-2: Rolling stock - Apparatus

IEC 50 (161) International Electrotechnical Vocabulary - Chapter 161 : Electromagnetic compatibility

CISPR 16-1:1993 Specification for radio interference measuring apparatus and measurement methods

CCITT Directive concerning the protection of telecommunication lines against harmful effects from electrical power and electrified railway lines - Volume VI : Danger and disturbances

3 Definitions

Definitions related to EMC and to relevant phenomena may be found in the EEC Directive, in chapter 161 of the IEV (IEC 50) and in IEC and CISPR publications. The definitions stated in the EEC Directive (89/336/EEC) take precedence.

For the purpose of this Prstandard the following definitions apply

stock : A complete railway product which is placed on the market as a single commercial unit.

traction stock : Electric and Diesel locomotives, trainsets such as ICE and TGV, motor-coach trainsets (no locomotive, each coach has its own traction) for main line vehicles, Light Railway Vehicles such as underground trainsets, trams, etc. for urban vehicles.

hailed stock : All independent passenger coaches and freight wagons (if they contain electric apparatus such as freezing equipment) which may be hauled by different types of locomotives in random combinations.

main line vehicles : Vehicles such as high speed trains, freight trains, mainly designed to operate between cities.

urban vehicles : Vehicles such as underground trainsets, trams, LRV, mainly designed to operate within the boundary of a city.

4 Applicability

Generally it is not possible to test electromagnetic compatibility invoking every function of the stock. The tests shall be made at typical operating modes considered to produce the largest emission.

The configuration and mode of operation during the tests shall be precisely noted in the test plan and in the test report.

5 Immunity tests and limits

No tests are applied to the complete vehicle but the immunity tests and limits in part 3-2 of this Prestandard were selected in the knowledge that the vehicle should be immune to a level of 20 V/m over the frequency range 0,15 MHz to 1000 MHz. It is expected that the assembly of the apparatus into a complete vehicle will give an adequate immunity, e.g. provided an EMC plan has been prepared and implemented.

6 Emission tests and limits

The emission tests and limits for rolling stock mentioned in this Prestandard cover the influences on typical installations in the vicinity of the railway system.

Measurements shall be performed in well-defined and reproducible conditions. Since it is not possible to totally separate the effects of the railway system and the stock under test (as it is the case with apparatus), the operator and the manufacturer have to define the test conditions (e.g. load conditions, speed and configuration of the units) and the test site in the contract. The contributions of other parts of the railway system (e.g. substations, signalling) and of the external environment (e.g. power lines, industrial sites, radio and television transmitters) to the measurements must be known and taken into account.

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6.1 Power frequency harmonic distortion

Under consideration

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6.2 Compatibility with signalling and train radio communications

Signalling, train radio and other railbound systems (axle counters, track circuits, train control systems, etc...) are different in every country in terms of operating frequencies and waveforms. Therefore, emission requirements shall be specified according to the type of signalling and train radio systems used.

The requirements shall need to take into account also sources of interference other than the rolling stock, including the train radio and signalling systems themselves, and the effects of transients due to bad contact, pantograph bouncing, third rail gaps, etc...

6.3 Interference on telecommunication lines

6.3.1 Digital telecommunication lines

Interference with digital systems such as PCM, ISDN, is not covered in this Prestandard.

6.3.2 Analog telecommunication lines, psophometric current

The quantitative parameter which characterises the disturbing effect of a railway vehicle on the analog telecommunication lines is the psophometric current I_{ps0} measured on the vehicle. For the definition of I_{ps0} and relationship between the current absorbed by the traction vehicle and the noise on telecommunication line, see annex A.

6.3.2.1 Limits and test conditions

It shall be the responsibility of the purchaser to specify the maximum value of the psophometric current, and the conditions under which it is defined, including duration.

The following conditions shall be covered :

- Limits of I_{ps0} under normal and under reduced performance conditions (one or more traction converters temporarily out of service)
- In the case of d.c. supply,
 - d.c. railways are normally fed by diode rectifiers from the 3-phase mains supply. Ideally, a single bridge rectifier produces a 6-pulse shape of voltage (i.e. first harmonic at 300 Hz in a 50 Hz mains) or two bridges produce a 12-pulse shape (i.e. 600 Hz). Due to dissymmetries in the mains supply, a fundamental component at 50 Hz is commonly found.
 - The presence of filters in the substation greatly reduces the effect of the substation.
 - Nevertheless in d.c. systems, the substation is the main source of perturbation.
 - Thus, to qualify a traction vehicle, the contribution of the rectifier unit and filters of the fixed installation shall be taken into account.
 - It shall also be necessary to take into account the distance between the traction vehicle and the substation which effects the line inductance.
- In the case of a.c. supply.
 - If the line voltage distortion has to be taken into consideration, the essential harmonics shall be specified. If special resonance conditions in the catenary system shall be taken into account, it shall be necessary to specify the relevant data. Otherwise the situation of the vehicle nearest to the supply station is assumed to give the highest value I_{ps0} .

6.3.2.2 Measurement of the psophometric current

During acceptance tests or investigation tests the disturbance current I_{ps0} shall be measured on-board of the traction vehicle. Existing current sensors of the vehicle may be used, if their frequency response is sufficient (at least up to 5000 Hz). In the case of an a.c. system the current shall be picked up on the high voltage side of the transformer primary winding, and not on the ground side, as the transformer may have a resonant frequency below 10 kHz.

The psophometric current shall be measured by means of a psophometer or another adequate system which uses filtering according to the psophometric weighting factor p_f .

To achieve additional information about the composition of the spectrum and the sources of disturbance, the use of a dual channel spectrum analyser, applied to vehicle input current and input voltage, is strongly recommended.

The psophometric current shall be measured in normal and in reduced operation mode (not all converters operating). The interpretation of the measurement results shall take into consideration the influence of operating conditions as well as changes in line inductance and supply voltage.

Effects due to transients (switching in the power circuits, pantograph bouncing, third rail/fourth rail gaps etc.) shall be kept out of the evaluation.