SLOVENSKI STANDARD
SIST EN 50500:2008

01-november-2008

Merilni postopki nivojev magnetnih polj, ki jih generirajo elektriļ ni aparati v ģeleznišķem okolju glede na izpostavljenost ļ loveka

Measurement procedures of magnetic field levels generated by electronic and electrical apparatus in the railway environment with respect to human exposure

Messverfahren für magnetische Felder die durch elektronische und elektrische Geräte in der Bahnumgebung erzeugt werden hinsichtlich der Exposition von Personen

Procédures de mesure des niveaux de champ magnétique générés par les appareils électriques et électroniques dans l'environnement ferroviaire en regard de l'exposition humaine

Ta slovenski standard je istoveten z: **EN 50500:2008**

ICS:

17.220.20	Merjenje elektriļ nih in magnetnih veliļ in	Measurement of electrical and magnetic quantities
45.020	Železniška tehnika na splošno	Railway engineering in general

SIST EN 50500:2008 **en,fr,de**

EUROPEAN STANDARD

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English version

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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 Standard was prepared by the Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50500 on 2008-06-01.

This European Standard is to be read in conjunction with EN 50392.

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)	2009-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2011-06-01

Contents

Introduction

The intention of this European Standard is to establish a suitable measuring/calculation method for determining the magnetic fields in the space around the equipment mentioned in the scope, to standardize operating conditions and to fix measuring/calculation distances. It offers a method to demonstrate compliance with the council recommendation 1999/519/EC (see Bibliography) and Directive 2004/40/EC (see Bibliography).

1 Scope

The scope of this product-family standard is limited to apparatus, systems and fixed installations which are intended for use in the railway environment. The frequency range covered is 0 Hz to 300 GHz.

Technical considerations and measurements are necessary for frequencies up to 20 kHz because no relevant field strengths are expected above due to the physical nature of EMF-sources in the railway environment.

The object of this standard is to provide measurement and calculation procedures of electric and magnetic field levels generated by electronic and electrical apparatus in the railway environment with respect to human exposure.

The regulations regarding the protection of human being during exposure to non-ionizing electromagnetic fields in the railway environment are different within the countries of European Community. This standard offers a procedure regarding measurement, simulation and evaluation.

At present two European documents regarding EMF have to be considered:

a) Council Recommendation 1999/519/EC of 12 July 1999 (see Bibliography);
b) Directive 2004/40/EC (see Bibliography).

The measurement procedures and points of measurement cover also the aspect of persons bearing active implantable medical devices.

NOTE 1 Not covered is the risk assessment for persons bearing active implants in magnetic field generated by electronic and electrical apparatus in the railway environment.

Not covered are personal electronic devices (e.g. mobile phones, notebooks, wireless communication systems etc.) of passengers and workers.

Not covered are intentional transmitters with frequencies higher than 20 kHz.

NOTE 2 These apparatus (with a working frequency of 9 kHz or higher) are covered by R&TTE Directive and have to comply also with LVD (Low Voltage Directive). In this view these apparatus have also limitation of EM fields or a “safety-distance” for these apparatus must be given.

2 Normative references

The following referenced documents are indispensable for the application 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 50392	Generic standard to demonstrate the compliance of electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (0 GHz – 300 GHz)
EN 50121 series	Railway applications - Electromagnetic compatibility
EN 45502-2-1	Active implantable medical devices - Part 2-1: Particular requirements for active implantable medical devices intended to treat bradyarrhythmia (cardiac pacemakers)
EN ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50121, EN 50392 and the following apply.

3.1
workers
drivers, train-staff and all people working in the railway environment

3.2
platform
place where passengers can enter, leave and change trains

3.3
fixed installation
infrastructure of railway environment without rolling stock

3.4
electric traction system
railway electric distribution network to provide energy for an electrical motive power unit.
This system may comprise
- contact line systems,
- return circuit system,
- running rails of non-electric traction systems, which are in the vicinity of, and conductively connected to the running rails of an electric traction system,
- electrical installations, which are supplied from contact lines either directly or via a transformer,
- electrical installations in power plants and substations, which are utilized solely for generation and distribution of power directly to the contact line,
- electrical installations of switching stations

3.5
main line
railway line for passenger and freight trains in regional and long-distances operation

3.6
urban transport
railway line for underground trainsets, trams, LRV (Light Rail Vehicles), trolleybuses to operate within the boundary of a city

3.7
rolling stock
smallest unit which can be operated covering all vehicles with or without motors

3.8
level crossing
crossing of railway line and public way (street or footpath) on the same level

4 Measurement procedure

4.1 General

In railways three electromagnetic sources can affect human beings: rolling stock, traction power supply and signalling equipment.

According to generic EMF standard EN 50392, there are two separate summation regimes for simultaneous exposure to fields of different frequencies. They depend of the effects of the exposure. In the frequency range from 1 Hz to 10 MHz the electrical stimulation is relevant and the underlying basic restriction is induced current density. In the frequency range from 100 kHz to 300 GHz, thermal effects are relevant.

As the detectable emission of rolling stock, traction power supply and signalling equipment is in the frequency range from d.c. up to 20 kHz, measurements, simulation and calculation are restricted to this range. Accordingly only one summation regime is applied. In this frequency range the magnetic field is dominant and the electric field can be neglected.

As power of signalling equipment is low in comparison with other sources of EMF in the railway environment, its contribution can be neglected.

The measurement procedure of the whole railway system is divided into two cases.

Case 1: Rolling stock (see 4.2)
- measurements inside rolling stock and
- measurements outside rolling stock (on platform or alternative)

Case 2: Fixed installation of existing infrastructure (see 4.3)
- measurement of existing railway infrastructure
- simulation/calculation of worst case situation (e.g. bridges, level crossing, max. possible current in overhead lines, third rails)

NOTE 1 Compliance of rolling stock can be demonstrated with the first explained case. Compliance of infrastructure can be demonstrated with the second explained case.

For the apparatus, systems and fixed installations in railway environment there are basic restrictions for general public and workers specified in 1999/519/EC, 2004/40/EC, ICNIRP Guidelines to static magnetic fields, ICNIRP guidelines to time-varying electric, magnetic and electromagnetic fields (see Bibliography).

With compliance of both cases, it can be assumed that the whole railway system is in compliance with the basic restrictions referenced in this standard.

For active medical implantable devices there is only a susceptibility limit to d.c. magnetic fields given in EN 45502-2-1.

NOTE 2 The process defined in this chapter applies also to demonstrate the compliance of railway equipment with active implantable medical devices.

Subclause 4.2 defines the measurement points in established areas inside and outside rolling stock.

Subclause 4.3 defines the measurement points in established areas in fixed installation and gives details regarding simulation/calculation.

Subclause 4.4 defines the test conditions during the measurement of the magnetic field.

Subclause 4.5 is related to the test environment.

A test plan for rolling stock and infrastructure is given in Annex A.

4.2 Rolling stock

The following measurement points are specified inside and outside rolling stock:

4.2.1 Accessible areas for workers inside rolling stock

The measurements indicate the emissions of the train equipment in standstill and dynamic condition (see 4.4.1).

Measurements shall be carried out close to the sources of emission of the train (e.g. power converters, power cables and power inductors) where workers usually can be in normal operating conditions of train and appliance and at the driver seat. The measurement heights above the floor shall be 0,9 m and 1,5 m. The horizontal measuring distance to the walls is 0,3 m or at the minimum distance (> 0,3 m) where workers can be.

Working areas are described in the scope of 2004/40/EC (see Bibliography).

4.2.2 Public areas inside rolling stock

The measurements indicate the emissions of the train equipment in standstill and dynamic condition (see 4.4.1).

Measurements shall be carried out at the closest possible position of the sources of emission of the train (e.g. power converters, power cables and power inductors), where public can be. In this case then the measurement heights above the floor of all the public areas shall be 0,3 m, 0,9 m and 1,5 m. The horizontal measuring distance to the walls is 0,3 m or at the minimum distance (> 0,3 m) where public can be.

4.2.3 Areas outside rolling stock (public and workers)

The measurements close to rolling stock indicate the emissions of the train equipment in standstill condition (see 4.4.1) in 0,3 m horizontal distance to the train enclosure at the closest possible position of the sources of emission of the train (e.g. power converters, power cables and power inductors) at 0,5 m, 1,5 m and 2,5 m height from the top of the running rails.

Measurements for public shall not be carried out at the same side of the third rail with respect to the tracks.

4.3 Fixed installation

Demonstration of compliance of the existing infrastructure shall include fixed electric traction system of railway environment.

Positions where compliance has to be demonstrated are given in 4.3.1 to 4.3.3.

Simulation/calculation can give worst case figures (see 4.3.4).

A test plan is given in Annex A.

4.3.1 Open railway route (public and worker)

Measurements and/or simulation/calculation regarding public shall be carried out in the distances from the centre of the nearest track of regarded system as given below or in higher distances within the nearest accessible area for public, 1,5 m above ground level (standing area) where people can be at the detected location.

Table 1 – Location and distances

Location	Horizontal distance from centre of track	Remark
Main line	10 m (for public)	If not regulated by legislative requirements
Urban transport	3 m (for public)	If not regulated by legislative requirements
Trams, trolley buses, etc.	0 m	
Level crossings	0 m	
Bridges	0 m	
Underpass	0 m	

NOTE 1 Combined systems (main line and urban line close together) have to be regarded individually which may lead to other distances.

NOTE 2 There may be cases where the location of maximum field strength is different from the centre of the track. In these cases the place with the maximum field strength has to be considered.

Measurements for workers on open railway routes shall be carried out at the closest possible (not restricted) position to the sources of emission where workers can be.

Short circuit conditions are excluded.

4.3.2 Areas close to fixed power supply installations (public and workers)

Measurements and/or simulation/calculation shall be carried out at the closest possible (not restricted) position to the sources of emission from substation where public and workers can be (e.g. as marked on the floor or given by fences). In this case then the consideration of all the public areas shall be at heights of 0,3 m, 0,9 m and 1,5 m and of all the worker areas shall be at heights of 0,9 m and 1,5 m. The horizontal measuring distance to the walls or fences is 0,3 m or at the minimum distance (> 0,3 m) where public and workers can be.

4.3.3 Platform (public and worker)

Measurements and/or simulation/calculation on the platform shall be carried out at heights of 0,9 m and 1,5 m above the platform level and with 0,3 m horizontal distance from the edge of the platform.

4.3.4 Simulation/calculation

If measurements cannot cover the worst case conditions, simulation/calculation with maximum expected current values (to be set by the infrastructure manager) shall be carried out. Harmonics known to be lower than a threshold value of 10 % of the limit value can be neglected.

Validation of the calculation/simulation shall be performed by comparison between calculated/simulated results and measured values for known conditions.

4.4 Test conditions

4.4.1 Test of rolling stock

Tests are to be done under normal operating conditions, only.

The condition of the rolling stock during the magnetic field measurements is described below:

- Stand still condition (S)
  The rolling stock is not moving.
  The traction circuits shall be under voltage but not operating. The auxiliary circuits shall operate and all the relevant appliances shall be active (e.g. air conditioning/heating, lights, window heater, electric generators).

- Dynamic condition (D)
  The rolling stock starts from the standstill with maximum acceleration to maximum speed, coasting and maximum electrical brake to stop.
  The traction circuits shall be under voltage and operating. The auxiliary circuits shall operate and all the appliances shall be active (e.g. air conditioning/heating, lights, window heater, electric generators).

There may be rolling stock (e.g. urban transport) which cannot accelerate with maximum line current under test condition, or supply systems that cannot be deliberately set such that the rolling stock will draw the maximum line current for the purposes of the test. In these cases the maximum emission shall be calculated based on the measurement results and monitored line current using an appropriate method (e.g. extrapolation).

NOTE 1 Attention also needs to be paid to the emissions of car borne equipment, and the emissions of the third rail or catenary. While individual fields from car borne equipment will vary as a function of the current in the device, catenary or third rail field will vary as a function of number of cars and current.