IEC/TS 62597

Edition 1.0 2011-10

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

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

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

IEC/TS 62597:2011

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX T

ICS 45.060

ISBN 978-2-88912-735-1

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MEASUREMENT PROCEDURES OF MAGNETIC FIELD LEVELS GENERATED BY ELECTRONIC AND ELECTRICAL APPARATUS IN THE RAILWAY ENVIRONMENT WITH RESPECT TO HUMAN EXPOSURE

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62597, which is a technical specification, has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This technical specification is based on EN 50500.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
9/1429/DTS	9/1499A/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The intention of this Technical Specification is to summarize existing measuring/calculation methods for determining the magnetic fields in the space around the equipment mentioned in the scope.

MEASUREMENT PROCEDURES OF MAGNETIC FIELD LEVELS GENERATED BY ELECTRONIC AND ELECTRICAL APPARATUS IN THE RAILWAY ENVIRONMENT WITH RESPECT TO HUMAN EXPOSURE

1 Scope

This Technical Specification applies 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 from d.c. to 20 kHz because no relevant field strengths are expected above due to the physical nature of EMF-sources in the railway environment.

a) The regulations regarding the protection of human beings (also bearing active implantable medical devices) during exposure to non-ionizing electromagnetic fields in the railway environment are different according to the countries worldwide.

The object of this Technical Specification is to summarize measurement and simulation/calculation procedures of magnetic field levels generated by electronic and electrical apparatus in the railway environment with respect to human exposure (also for human beings bearing active implantable medical devices).

Transient conditions, such as short circuit, earth fault and transformer inrush are excluded.

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

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

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.

IEC 61786, *Measurement of low-frequency magnetic and electric fields with regard to exposure of human beings – Special requirements for instruments and guidance for measurements*

IEC 62236 (all parts), *Railway applications – Electromagnetic compatibility*

IEC 62311, *Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz)*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62236, IEC 62311, IEC 61786 and the following apply.

3.1
workers
drivers, train-staff and all people working in the railway environment. National definition of "workers" will have a priority if any

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 / feeding system
railway electric distribution network to provide energy for an electrical motive power unit.

EXAMPLE This system may comprise

– contact line systems,
– return circuit systems,
– 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 metropolitan area

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

3.9
working area
area for workers without access for general public. National definitions of this area have priority.

3.10
the railway environment
the surrounding objects or region which may be influenced by electronic and electrical apparatus of the railway (see IEC 62236-2)

3.11
public
all people in the railway environment except workers

3.12
open railway route
railway route except station

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 IEC 62311, there are two separate summation regimes for simultaneous exposure to fields of different frequencies. They depend on the effects of the exposure. In the frequency range from 1 Hz to 10 MHz the electrical stimulation is relevant. 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. to 100 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 load within the railway system can change widely in short times. Emission is related to load.

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.

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, maximum possible current in overhead lines, third rails).

NOTE Compliance of rolling stock can be demonstrated with the first explained case. Compliance of fixed installation 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 ICNIRP and IEEE standards (see Bibliography).

With compliance of case 1 and case 2, it can be assumed that the whole railway system complies with the relevant requirements and limits.

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 fixed installation is given in Annex A.

4.2 Rolling stock

4.2.1 General

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

4.2.2 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 where workers are located when seated or accessing areas in the train during normal operation conditions of train taking into account the sources of emission within the train. This is defined as the occupied volume.

The occupied volume can be measured either by the surface method or by the volume method.

Surface method:

The enclosing surface of the volume shall be measured at a minimum distance (under the sensor restriction) and at an agreed number of measuring points (e.g. by measurement on the floor surface above emission sources and if necessary additional measurement heights above the floor may be 0,5 m, 1,0 m and 1,5 m).

Failure to satisfy the value of the limits using the surface method does not necessarily mean the occupied volume limits are exceeded.

Volume method:

The occupied volume shall be measured at typical places where workers can be located. The measurement heights above the floor shall be 1,0 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.

4.2.3 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 in areas occupied by public during normal operation conditions of train taking into account the sources of emission within the train. This is defined as the occupied volume.

The occupied volume can be measured either by the surface method or by the volume method defined in 4.2.2.

However in the case of the volume method the measurement heights above the floor shall be 0,3 m, 1,0 m and 1,5 m.

4.2.4 Areas outside rolling stock (public and workers)

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

Measurements shall be carried out where public or workers are located outside the train during normal operation conditions of train when stationary taking into account the sources of emission within the train. This is defined as the occupied volume.

The occupied volume can be measured either by the surface method or by the volume method.

The external surface of the rolling stock is defined as shown in Figure 1. The occupied volume does not consider places below or above the rolling stock.

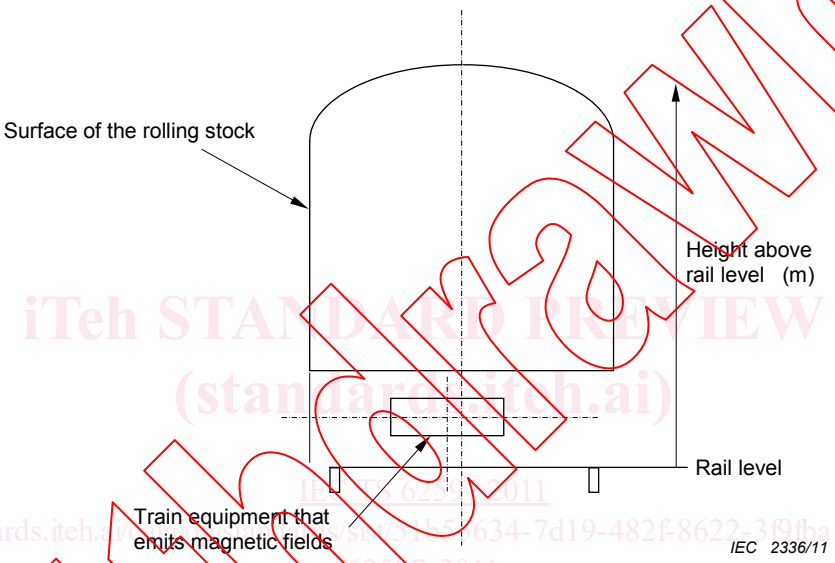

Figure 1 – External surface of the rolling stock

– Surface method:

The external surface of the train shall be measured at a minimum distance (under the sensor restriction) and at an agreed number of measuring points (e.g. by measurement at the height of the centre of the nearest side of the equipment as defined in Figure 2).

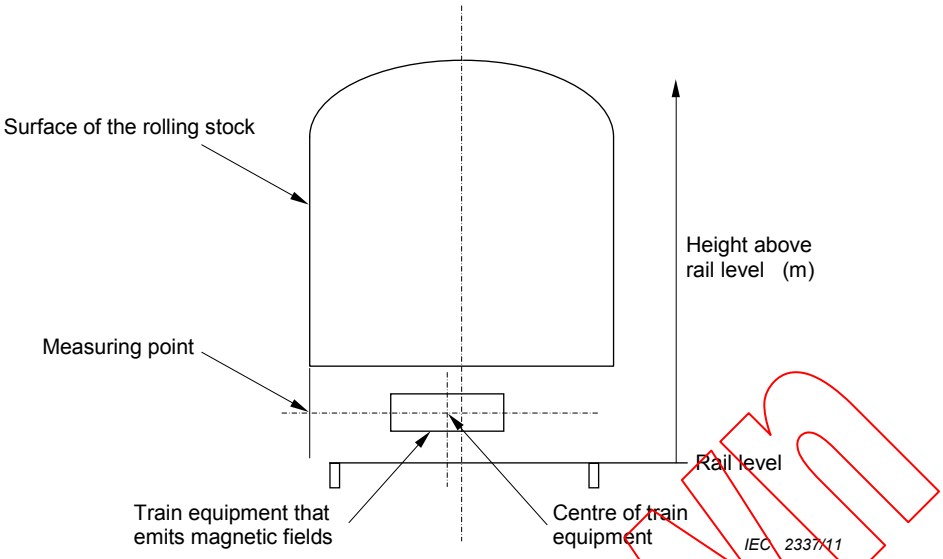

Figure 2 – Measuring point of surface method

Failure to satisfy the value of the limits using the surface method does not necessarily mean the occupied volume limits are exceeded.

– Volume method:

Measurements shall be carried out at distances of 0,3 m to the train surface taking into account the sources of emission of the rolling stock (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 (rail level).

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

4.3.1 General

Demonstration of compliance of the existing fixed installation 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.

For measurement of fixed installation, measurement should take into account coherency and compatibility with the measurement procedures for electric power systems.The international EMF standard for electric power systems IEC 62110 should be referenced.

4.3.2 Open railway route (public and workers)

Measurements and/or simulation/calculation regarding public shall be carried out at the distances measured from the centre of the nearest track of the considered system as given in Table 1, or at higher distances within the nearest accessible area for public, at 1,0 m or 1,5 m above ground level (standing area) where people can be at the detected location, see Table 1.

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 located.

NOTE 1 A measurement height of 1,0 m is a common practice for electric power systems in Japan and a measurement height of 1,5 m is common in Europe.

Table 1 – Location and distances

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

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.

4.3.3 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 fixed power supply installations where public and workers can be located (e.g. as marked on the floor or given by fences).

There are two sets of measurement heights:
0,5 m, 1,0 m and 1,5 m and
0,3 m, 0,9 m and 1,5 m.

Only one set has to be chosen.

NOTE Measurement heights of 0,5 m, 1,0 m and 1,5 m are a common practice for electric power systems in Japan and the horizontal distance is in these cases 0,2 m or at the minimum distance (> 0,2 m) where public and workers can be. If the field to be measured is considered to be uniform, measurements at heights of 0,5 m and 1,5 m can be omitted (same as single-point measurement at a height of 1,0 m).

Measurement heights of 0,3 m, 0,9 m and 1,5 m are common practice in Europe for public areas – without the height of 0,3 m for worker areas as it is not expected to have children as workers. 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.

4.3.4 Platform (public and workers)

On platforms three measurement heights above the platform level are given: 0,5 m, 1,0 m and 1,5 m.

The horizontal distance shall be 0,3 m or the closest possible horizontal distance (>0,3 m) from the edge of the platform where public and workers can be.

4.3.5 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.