

INTERNATIONAL STANDARD

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

IEC 62597:2019

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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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International Standard IEC 62597 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This first edition cancels and replaces IEC TS 62597 published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the Technical Specification:

- Annex A test plan has been converted to normative text
- New Annex B (informative) for measurement technique for lower frequency has been added
- New Annex C (informative) about consistency to IEC 62110 in some countries has been added

The text of this International Standard is based on the following documents:

FDIS	Report on voting
9/2505/FDIS	9/2517/RVD

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

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

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

The intention of this document 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.

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

1 Scope

The scope of this document 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 specified 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 document 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 beings during exposure to non-ionizing electromagnetic fields in the railway environment are different within the countries worldwide. This document offers a procedure regarding measurement, simulation/calculation and evaluation.

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

This document does not apply to the risk assessment for persons bearing active implants in magnetic field generated by electronic and electrical apparatus in the railway environment.

This document does not apply to personal electronic devices (e.g. mobile phones, laptop computers, wireless communication systems, etc.) of passengers and workers.

This document does not apply to intentional transmitters with frequencies higher than 20 kHz.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 62311, *Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz)*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1

worker

driver, train-staff and all people working in the railway environment

3.1.2

fixed installation

infrastructure of railway environment without rolling stock

3.1.3

electric traction system

railway electric distribution network used to provide energy for rolling stock

Note 1 to entry: This system includes:

- contact line systems,
- return circuit of electric traction 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,
- electric installations of switching stations.

[SOURCE: IEC 60050-811:2017, 811-36-21] **STANDARD PREVIEW**
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3.1.4

main line

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

3.1.5

urban transport

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

3.1.6

rolling stock

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

[SOURCE: IEC 60050-811:2017, 811-02-01, modified – “smallest unit which can be operated covering” has been added.]

3.1.7

level crossing

crossing of railway and a road at the same level

[SOURCE: IEC 60050-811: 2017, 811-07-01]

3.2 Abbreviated terms

AC	Alternating Current
DC	Direct Current
EMF	Electromagnetic fields
FFT	Fast Fourier transform
ICNIRP	International Commission on Non-Ionizing Radiation Protection

IEEE Institute of Electrical and Electronics Engineers

LIM Linear Induction Motor

4 Measurement procedure

4.1 General

In railways three electromagnetic sources can affect human beings: rolling stock, fixed power supply installation 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 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, fixed power supply installation and signalling equipment is in the frequency range from DC 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 (see 4.3)

- measurement of existing railway infrastructure,
- simulation/calculation of worst case situation (e.g. bridges, level crossing, maximum possible current in overhead contact line or catenary, 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 ICNIRP, IEEE and other country-specific documents (see Bibliography).

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

NOTE 2 The process defined in this subclause 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

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 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.

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 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.

4.2.4 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

4.3.1 General

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 4.3.2 to 4.3.4.

Simulation/calculation can give worst case figures (see 4.3.5).

NOTE Country specific measurement procedures can be found in Annex C.