

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Railway applications – Electromagnetic compatibility –
Part 1: General**

(standards.iteh.ai)

**Applications ferroviaires – Compatibilité électromagnétique –
Partie 1: Généralités**

<https://standards.iteh.ai/catalog/standards/sist/cee50799-8d25-4ee1-a899-605268fadf77/iec-62236-1-2018>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

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

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms, containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Railway applications – Electromagnetic compatibility –
Part 1: General**

(standards.iteh.ai)

**Applications ferroviaires – Compatibilité électromagnétique –
Partie 1: Généralités**

<https://standards.iteh.ai/catalog/standards/sist/cee50799-8d25-4ee1-a899-605268fadf77/iec-62236-1-2018>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.100; 45.060.01

ISBN 978-2-8322-5306-9

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD	3
INTRODUCTION	5
1 Scope	7
2 Normative references	7
3 Terms, definitions and abbreviated terms	7
3.1 Terms and definitions	8
3.2 Abbreviated terms	8
4 Performance criteria	8
5 Management of EMC	9
Annex A (informative) The railway system	10
A.1 General	10
A.2 General coupling mechanisms	10
A.3 Principal electromagnetic phenomena for immunity	11
A.3.1 Conducted low frequency phenomena	11
A.3.2 Radiated low frequency field phenomena	11
A.3.3 Conducted high frequency phenomena	11
A.3.4 Radiated high frequency phenomena	11
A.4 Principal electromagnetic phenomena for emission	11
A.5 Description of the different electric traction systems	11
A.6 Components of electric traction systems	11
A.7 Internal sources of electromagnetic disturbance	12
A.7.1 General	12
A.7.2 Fixed elements	12
A.7.3 Mobile elements	12
A.7.4 Onboard auxiliary power converters	13
A.7.5 Train line	13
A.7.6 Traction return current with respect to track circuits	13
A.7.7 Trackside equipment	13
A.8 Summary of main characteristics of railway systems	13
A.9 External sources of disturbance	14
Bibliography	15

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RAILWAY APPLICATIONS –
ELECTROMAGNETIC COMPATIBILITY –****Part 1: General****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62236-1 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This third edition cancels and replaces the second edition published in 2008. It constitutes a technical revision and has been developed on the basis of EN 50121-1:2015.

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

- a) Clarification in scope.
- b) Introduction of subclause Abbreviated terms.
- c) Management of EMC now based on IEC 61000 series as former reference is not adequate.

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

FDIS	Report on voting
9/2335/FDIS	9/2365/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.

A list of all parts in the IEC 62236, published under the general title *Railway applications – Electromagnetic compatibility*, can be found on the IEC website.

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

IEC 62236-1:2018

<https://standards.iteh.ai/catalog/standards/sist/cee50799-8d25-4ee1-a899-605268fadf77/iec-62236-1-2018>

INTRODUCTION

The railway system EMC series of product-specific International Standards consists of five parts described at the end of this introduction.

The series of standards provides both a framework for managing the EMC for railway systems and also specifies the limits for the electromagnetic (EM) emission of the railway system as a whole to the outside world and for the EM emission and immunity for equipment operating within the railway system. The latter is intended to be compatible with the emission limits set for the railway system as a whole and also provides for establishing confidence in equipment being fit for purpose in the railway environment. There are different stationary emission limits set for trams/trolleybuses and for metro/mainline railway systems. The frequency covered by the standards is in the range from DC to 400 GHz. No measurements need to be performed at frequencies where no requirement is specified. The limits for EMC phenomena are set so that the railway system as a whole achieves electromagnetic compatibility with the outside world, and between the various parts of the railway system. Throughout the series of standards, the immunity levels are chosen to ensure a reasonable level of EMC with other apparatus within the local railway environment and with emissions which enter the railway system from the outside world. Limits are also placed on EM emission by railway systems into the outside world.

The compatibility between railway system emissions and their external environment is based upon emission limits from the railway systems being set by considering the results from measurements. Given that the general compatibility between railway systems and their environment was satisfactory at the time these measurements were made and subsequent experience of applying the limits has confirmed their acceptability, compliance with this document has been judged to give satisfactory compatibility. The immunity and emission levels do not of themselves guarantee that the railway system will have satisfactory EMC with its neighbours. In exceptional circumstances, for instance near a “special location” which has unusually high levels of EM interference, the railway system may require additional measures to be taken to ensure proper compatibility. Particular care should be taken when in proximity to equipment such as radio transmission equipment, military or medical installations. Attention is particularly drawn to any magnetic imaging equipment in hospitals that may be near to urban transport. In all these cases, compatibility should be achieved with consultation and co-operation between the interested parties.

The immunity and emission levels do not of themselves guarantee that integration of the apparatus within the railway system will necessarily be satisfactory. The document cannot cover all the possible configurations of apparatus, but the test levels are sufficient to achieve satisfactory EMC in the majority of cases. In exceptional circumstances, for instance near a “special location” which has unusually high levels of EM interference, the system may require additional measures to be taken to ensure proper operation. The resolution of this is a matter for discussion between the equipment supplier and the project manager, infrastructure manager or equivalent.

The railway apparatus is assembled into large systems and installations, such as trains and signalling control centres. Details are given in annex A. It is not, therefore, possible to establish immunity tests and limits for these large assemblies. The immunity levels for the apparatus will normally ensure reliable operation, but it is necessary to prepare an EMC plan to deal with complex situations or to deal with specific circumstances. For example, the passage of the railway line close to a high power radio transmitter which produces abnormally high field strengths. Special conditions may be applied for railway equipment which works near such a transmitter and these will be accepted as national conditions for the specification.

The series of standards IEC 62236, *Railway applications – Electromagnetic compatibility*, contains the following parts:

- **Part 1: General.** This part gives a description of the electromagnetic behaviour of a railway system; it specifies the performance criteria for the whole series. A management process

to achieve EMC at the interface between the railway infrastructure and trains is referenced.

- *Part 2: Emission of the whole railway system to the outside world.* This part sets the emission limits from the railway system to the outside world at radio frequencies. It defines the applied test methods and gives information on typical field strength values at traction and radio frequency (cartography).
- *Part 3-1: Rolling stock – Train and complete vehicle.* This part specifies the emission and immunity requirements for all types of rolling stock. It covers traction rolling stock and trainsets, as well as independent hauled rolling stock. The scope of this part of the series ends at the interface of the rolling stock with its respective energy inputs and outputs.
- *Part 3-2: Rolling stock – Apparatus.* This part applies to emission and immunity aspects of EMC for electrical and electronic apparatus intended for use on railway rolling stock. It is also used as a means of dealing with the impracticality of immunity testing a complete vehicle.
- *Part 4: Emission and immunity of the signalling and telecommunications apparatus.* This part specifies limits for electromagnetic emission and immunity for signalling and telecommunications apparatus installed within a railway system. The EMC plan states if this part is also applicable for railway operational equipment mounted trackside or at platforms.
- *Part 5: Emission and immunity of fixed power supply installations and apparatus.* This part 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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC 62236-1:2018](https://standards.iteh.ai/catalog/standards/sist/cee50799-8d25-4ee1-a899-605268fadf77/iec-62236-1-2018)

<https://standards.iteh.ai/catalog/standards/sist/cee50799-8d25-4ee1-a899-605268fadf77/iec-62236-1-2018>

RAILWAY APPLICATIONS – ELECTROMAGNETIC COMPATIBILITY –

Part 1: General

1 Scope

This Part 1 of IEC 62236 outlines the structure and the content of the whole series.

It specifies the performance criteria applicable to the whole standards series.

Clause 5 provides information about the management of EMC.

Annex A describes the characteristics of the railway system which affect electromagnetic compatibility (EMC) behaviour.

Phenomena excluded from the series are nuclear EM pulse, abnormal operating conditions (e.g. fault conditions) and the induction effects of direct lightning strike.

Emission limits at the railway system boundary do not apply to intentional transmitters within the railway system boundaries.

Safety considerations are not covered by this series of standards.

The biological effects of non-ionising radiation as well as apparatus for medical assistance, such as pacemakers, are not considered in this series.

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 60050-161, *International Electrotechnical Vocabulary. Chapter 161: Electromagnetic compatibility*

IEC 61000 (all parts), *Electromagnetic compatibility (EMC)*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC 60050-161 and the following 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 Terms and definitions

3.1.1

intentional transmitter

transmitting equipment dedicated to radiate electromagnetic energy, such as radio, television, communication

3.2 Abbreviated terms

AC	Alternating current
DC	Direct current
E	Electric (field)
EM	Electromagnetic
EMC	Electromagnetic compatibility
GTO	Gate turnoff (thyristor)
H	Magnetic (field)
IGBT	Insulated gate bipolar transistor
MVA	Megavoltampere
RF	Radio frequency

4 Performance criteria

NOTE This clause is based on IEC 61000-6-2:2016.

The variety and the diversity of the apparatus within the scope of this set of standards makes it difficult to define precise criteria for the evaluation of the immunity test results.

A functional description and a definition of performance criteria, during or as a consequence of the EMC testing, shall be provided by the manufacturer and noted in the test report, based on the following criteria:

a) Performance criterion A

The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

b) Performance criterion B

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

c) Performance criterion C

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

5 Management of EMC

The railway system is a complex installation with moving sources of electromagnetic energy and the application of the EMC standards in the IEC 62236 series is not a guarantee of satisfactory performance. There may be cases where apparatus has to be positioned in restricted spaces or added to an existing assembly, with the possible creation of environments of unusual severity. All cases shall be considered with respect to an EMC plan. This plan should be established at as early a stage of the project as is possible.

For any new subsystem introduced within the railway systems boundary, potential sources and victims as well the coupling mechanisms between these sources and victims shall be considered.

The EMC plan shall make reference to the basic EMC phenomena described in the IEC 61000 series as applicable.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

IEC 62236-1:2018

<https://standards.iteh.ai/catalog/standards/sist/cee50799-8d25-4ee1-a899-605268fadf77/iec-62236-1-2018>

Annex A (informative)

The railway system

A.1 General

For operating purposes, railway systems use electrical systems that require very high outputs (up to several MVA) and power electronic systems that are characterised by their non-linearity (producing harmonics).

In an electric railway system, the trains are supplied by means of sliding contacts from a power supply line, called the overhead contact line, or a trackside conductor rail, which is installed along the track. The current generally returns to the substation via the rails, a separate return conductor or via the earth. The railway system is an integrated system in which electricity has many uses in addition to train propulsion including:

- heating, air conditioning, catering and lighting of passenger coaches with converters on the vehicles. This power is fed along the train by separate conductors;
- signalling and telecommunication systems along the track and between control centres, concerned with the movement of trains;
- computer installations in control centres, linked via trackside routes;
- passenger information systems on vehicles, stations and depots;
- traction within diesel-electric locomotives and multiple units;
- battery traction vehicles.

Hence, problems of EMC arise not only within the traction unit and the power supply but also in these associated systems and their subsystems. Non-electrified traction such as diesel electric traction may also be a source of EM disturbances.

The normal and disturbed working of these systems may be a source of electromagnetic disturbance which can influence all other systems.

A.2 General coupling mechanisms

The coupling between systems is by the well known physical phenomena and limits are expressed in terms of these phenomena.

Five modes of coupling are distinguished:

- electrostatic coupling, in which a charged body is discharged to a victim circuit;
- capacitive coupling, in which the varying voltage in one circuit produces voltage changes in a victim circuit via mutual capacitance;
- inductive coupling, in which a varying magnetic field produced by a current in one circuit, links with a victim circuit, inducing a voltage via mutual inductance;
- conductive coupling, in which the source and victim circuits share a common conduction path;
- electric (E) and magnetic (H) radiation, in which the circuit structures act as antennas transmitting and receiving energy.