

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Railway applications – Electromagnetic compatibility –
Part 5: Emission and immunity of fixed power supply installations and
apparatus**

**Applications ferroviaires – Compatibilité électromagnétique –
Partie 5: Emission et immunité des installations fixes d'alimentation de
puissance et des équipements associés**



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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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Email: csc@iec.ch

Tél.: +41 22 919 02 11

Fax: +41 22 919 03 00



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RAILWAY APPLICATIONS –
ELECTROMAGNETIC COMPATIBILITY –****Part 5: Emission and immunity of fixed power supply
installations and apparatus**

FOREWORD

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International Standard IEC 62236-5 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This second edition cancels and replaces the first edition published in 2003. This edition constitutes a technical revision and is based on EN 50121-5:2006.

The main changes with respect to the previous edition are listed below:

- requirements for the radiated immunity test of line 1.2 in Table 1;
- transformation of former Annex B into Bibliography;
- suppression of Annex C.

The text of this standard is based on the following documents:

FDIS	Report on voting
9/1189/FDIS	9/1217/RVD

Full information on the voting for the approval of this standard 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.

A list of all parts of IEC 62236 series, 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 publication will remain unchanged until the maintenance result 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

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INTRODUCTION

The requirements of this part of IEC 62236 have been specified so as to ensure a level of electromagnetic emission which will cause minimal disturbance to other equipment. The levels, however, do not cover the following cases:

- a) where the probability of an occurrence likely to produce emissions in excess of those which would normally be experienced is extremely low,
- b) where highly susceptible apparatus will be used in close proximity of the equipment covered by this standard, in which case further measures may have to be taken.

The emission limits given are on the basis that the equipment of the product family range is installed in railway substation areas.

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RAILWAY APPLICATIONS – ELECTROMAGNETIC COMPATIBILITY –

Part 5: Emission and immunity of fixed power supply installations and apparatus

1 Scope

This part of IEC 62236 applies to emission and immunity aspects of EMC for fixed power supply installations and electrical and electronic apparatus and systems intended to be used in these installations. This includes the power feed to the apparatus, the apparatus itself with its protective control circuits, trackside items such as switching stations, power autotransformers, booster transformers, substation power switchgear and power switchgear to other longitudinal and local supplies.

Filters operating at railway system voltage (e.g. for harmonic suppression or power factor correction) are not included in this standard since each site has special requirements. Filters would normally have separate enclosures with separate rules for access. If electromagnetic limits are required, these will appear in the specification for the equipment.

The limits in this standard do not apply to intentional communication signals.

The frequency range considered is from d.c. to 400 GHz. No measurements need to be performed at frequencies where no requirement is specified.

Emission and immunity limits are given for items of apparatus which are situated:

- a) within the boundary of a substation which delivers electric power to a railway;
- b) beside the track for the purpose of controlling or regulating the railway power supply, including power factor correction and filtering;
- c) along the track for the purpose of supplying electrical power to the railway other than by means of the conductors used for contact current collection, and associated return conductors. Included are high voltage feeder systems within the boundary of the railway which supply substations at which the voltage is reduced to the railway system voltage;

NOTE 1 Examples are one conductor of a 25-0-25 kV 50 Hz system and the 110 kV 16,7 Hz supply systems.

NOTE 2 Similar conductors which are outside the railway boundary are treated as in the public area and are considered to be general overhead power lines although they feed only the railway.

- d) beside the track for controlling or regulating electric power supplies to ancillary railway uses. This category includes power supplies to marshalling yards, maintenance depots and stations;
- e) various other non-traction power supplies from railway sources which are shared with railway traction.

Apparatus and systems which are in an environment which can be described as residential, commercial or light industry, even when placed within the physical boundary of the railway substation, shall comply with the relevant generic International EMC standard.

Excluded from the immunity requirements of this standard is power supply apparatus which is intrinsically immune to the tests defined in Tables 1 to 6 of this standard.

NOTE 3 An example is an 18 MVA 230 kV to 25 kV power supply transformer.

These specific provisions are to be used in conjunction with the general provisions in IEC 62236-1.

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 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)*

IEC 61000-3-3, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-12, *Electromagnetic compatibility (EMC) – Part 4-12: Testing and measurement techniques – Ring wave immunity test*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 62236-1, *Railway applications – Electromagnetic compatibility – Part 1: General*

IEC 62236-2, *Railway applications – Electromagnetic compatibility – Part 2: Emission of the whole railway system to the outside world*

CISPR 16-1-1, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 22, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

3 Terms and definitions

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

3.1

apparatus

electric or electronic product with an intrinsic function intended for implementation into a fixed railway installation

3.2

environment

surrounding objects or region which may influence the behaviour of the system and or may be influenced by the system

3.3

port

particular interface of the apparatus with the external environment, for example a.c. power port, d.c. power port, I/O (input/output) port, earth port (see Figure 1)

3.4

enclosure port

physical boundary of the apparatus through which electromagnetic fields may radiate or impinge

3.5

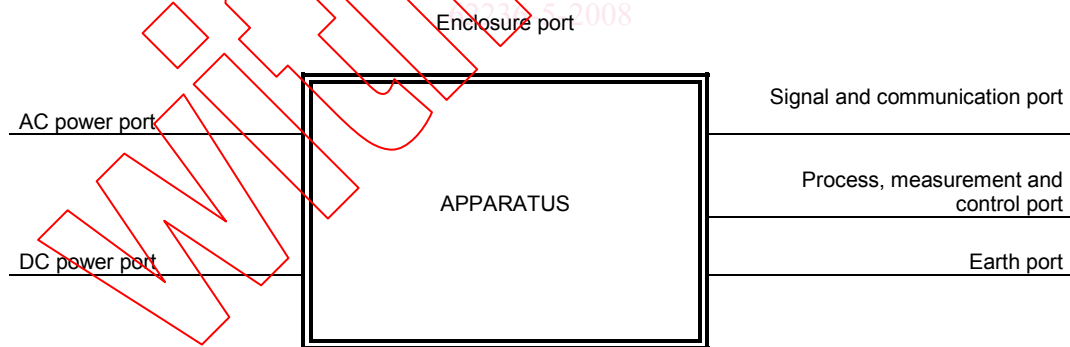
railway substation

installation, the main function of which is to supply a contact line system at which the voltage of a primary supply system, and in some cases the frequency, is transformed to the voltage and frequency of the contact line

3.6

railway supply lines

conductors running within the boundary of the railway which supply power to only the railway but are not energised at railway system voltage



IEC 2188/08

Figure 1 – Main categories of ports

4 Performance criteria

The variety and diversity of the apparatus within the scope of this standard makes it difficult to define precise criteria for the evaluation of the immunity test results. Three general levels of performance are therefore used, as defined in IEC 62236-1.

5 Emission tests and limits

5.1 Emission from the substation to the outside world

Limit values for this emission, over the frequency range 9 kHz to 1 GHz are given in IEC 62236-2.

NOTE 1 Guidance values are given in IEC 62236-2 for emission of d.c. and power frequency magnetic fields.

Conductors (overhead or underground) between the substation and the railway are part of the railway installation, but because of their wide variety of positions and ampere loadings, limit values cannot be set for the magnetic fields which they produce.

For apparatus which is under ground, measurements shall be made in the frequency range 9 kHz to 150 kHz at the surface of the ground above the apparatus.

NOTE 2 No limits are set for emissions into the active space of the underground railway due to the complexities of obtaining measurements in the confined space and the lack of a precise method of relating the measured values to the degree of disturbance which other apparatus would suffer.

5.2 Emission test for apparatus operating at less than 1 000 V r.m.s. a.c.

The emission limits for apparatus covered by this standard which is supplied with electrical power at a voltage below 1 000 V r.m.s. are given on a port by port basis in IEC 61000-6-4, Table 1.

5.3 Emission values within the boundary of the substation

Because there is such a wide variety of options for the design and the construction of the substation, limits are not given for emission within the general space inside the boundary of the substation. Practical measurements have been made and guidance values are given in Annex A. These are for information only and are not part of the normative content of this standard.

6 Immunity tests and limits

The immunity test requirements for apparatus covered by this standard are given on a port by port basis in Tables 1 to 6.

Tests shall be conducted in a well-defined and reproducible manner. The tests shall be carried out as single tests in sequence. The sequence of testing is optional.

The description of the tests, the test generator, the test methods, and the test set-up are given in the basic standards which are referred to in Tables 1 to 6. The contents of the basic standards are not repeated here, however modifications or additional information needed for the practical application of the tests are given in this standard.

Where possible, the tests shall be made with a typical operating mode chosen to produce the maximum susceptibility to noise in the frequency band being investigated, consistent with normal applications. The manufacturer shall define the conditions of the test in the test plan.

NOTE If the apparatus is part of a system or can be connected to auxiliary apparatus, then the apparatus should preferably be tested while connected to the minimum configuration of auxiliary apparatus necessary to exercise the test point in accordance with the general methods of CISPR 22 and IEC 61000-4 series.

The configuration and mode of operation during the tests shall be precisely noted in the test report. It is not always possible to test every function of the apparatus; in such cases the most critical mode of operation should be selected.

The tests shall be carried out within the specified operating range for the apparatus and at its rated supply voltage.

Some of the immunity levels are higher than those of the heavy industrial generic standard because this has been found necessary in practice.

Voltages induced by traction currents are not addressed here. They shall be covered by the functional specification.

7 Fixed power supplies on railway property which are not used for railway traction purposes

These are used for example for signalling systems: station services, office building services, freight cranes and yard lighting.

They fall into two categories:

- a) those that are supplied from non-railway sources. Examples are supplies from the local public electricity supplier or from separate generators. These are outside the scope of this standard. For products in the scope of IEC 61000-3-2 or IEC 61000-3-3, the requirements of those standards apply;
- b) those that are supplied from railway sources which are shared with train traction. The supply voltage may have a substantial harmonic content. It is the responsibility of the body which puts the apparatus into service to establish the levels of immunity and emission which will ensure EMC. Examples are: supplies from tertiary windings on rectifier transformers or from the railway a.c. overhead via transformers.

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Table 1 – Immunity – Enclosure port

Environmental phenomena	Test specification	Basic standard	Test set-up	Remarks	Performance criteria
1.1 Radio-frequency electromagnetic field, amplitude modulated	80 MHz - 1 000 MHz 10 V/m (r.m.s.) 80 % AM, 1 kHz	IEC 61000-4-3	IEC 61000-4-3	The test level specified is the r.m.s. value of the unmodulated carrier	A
1.2 Radio-frequency electromagnetic field, from digital mobile telephones	800 MHz - 1 000 MHz 20 V/m (r.m.s.) 80 % AM, 1 kHz			See Note 3	A
	1 400 MHz - 2 100 MHz 10 V/m (r.m.s.) 80 % AM, 1 kHz	IEC 61000-4-3	IEC 61000-4-3	The test level specified is the r.m.s. value of the unmodulated carrier	
	2 100 MHz - 2 500 MHz 5 V/m (r.m.s.) 80 % AM, 1 kHz				
1.3 Power - frequency magnetic field	16,7 Hz: 50/60 Hz 100 A/m (r.m.s.)	IEC 61000-4-8	IEC 61000-4-8	See Note 1 All frequencies have to be tested	A
	0 Hz 300 A/m			See Note 1	
1.4 Electrostatic discharge	± 6 kV ± 8 kV	IEC 61000-4-2	IEC 61000-4-2	See Note 2	B

NOTE 1 Test only applies to apparatus containing devices sensitive to magnetic fields, for example Hall elements, electro-dynamic microphones, etc. Unshielded CRT displays can exhibit interference effects above 1A/m (r.m.s.).

NOTE 2 See basic standard for applicability of contact and/or air discharge test.

NOTE 3 The test in 5.2 of IEC 61000-4-3 should be applied at the digital radio telephone frequencies in use in the countries in which the equipment is intended to be operated.