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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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RAILWAY APPLICATIONS – ELECTROMAGNETIC COMPATIBILITY –

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

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International Standard IEC 62236-5 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 50121-5:2015.

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

a) clarification of scope (Clause 1);
b) emission requirement extended in the frequency range 1 GHz to 6 GHz following IEC 61000-6-4;
c) immunity requirement extended in the frequency range 5,1 GHz to 6 GHz;

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d) removal of limits for radiated H-fields in the frequency range 9 kHz to 150 kHz due to the fact that:
   – there are very few outside world victims;
   – there is low reproducibility.

This Standard is to be read in conjunction with IEC 62236-1.

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

FDIS	Report on voting
9/2340/FDIS	9/2370/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 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 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- withdrawn,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
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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) which may occur with an extremely low probability of occurrence in any location;

b) where highly susceptible apparatus is used in close proximity of the equipment covered by this document, 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 traction 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 electrical and electronic apparatus and systems intended for use in railway fixed installations for power supply. 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 (for example, for harmonic suppression or power factor correction) are not included in this document 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.

If a port is intended to transmit or receive for the purpose of radio communication (intentional radiators, e.g. transponder systems), then the radiated emission requirements in this document are not intended to be applicable to the intentional transmission from a radio-transmitter as defined by the ITU.

The frequency range considered is from DC 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;

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;

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.

The immunity levels given in this document apply for:

– vital equipment such as protection devices;

– equipment having connections to the traction power conductors;

– apparatus inside the 3 m zone;

– ports of apparatus inside the 10 m zone with connection inside the 3 m zone;

– ports of apparatus inside the 10 m zone with cable length > 30 m.

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

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substation, comply with IEC 61000-6-1 for immunity and IEC 61000-6-3 for emission requirements.

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

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

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

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 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-18:2006, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

IEC 61000-6-4:2006, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*
IEC 61000-6-4:2006/AMD1:2010

IEC 62236-1:2018, *Railway applications – Electromagnetic compatibility – Part 1: General*

IEC 62236-2:2018, *Railway applications – Electromagnetic compatibility – Part 2: Emission of the whole railway system to the outside world*

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:

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

3.1.1
apparatus
device or assembly of devices which can be used as an independent unit for specific functions

[SOURCE: IEC 60050-151:2001, 151-11-22]

3.1.2
environment
surroundings in which a product or system exists, including air, water, land, natural resources, flora, fauna, humans and their interrelation

[SOURCE: IEC Guide 109:2012, 3.3]

[SOURCE: IEC 60050-901:2013, 901-07-01]

3.1.3
traction substation, <in electric traction>
substation, <in electric traction>
substation the main function of which is to supply an electric traction system

Note 1 to entry: The synonym substation is used only when the context is clear.

[SOURCE: IEC 60050-811:2017, 811-36-02]

3.1.4
long bus
bus cables with a length of more than 30 m

3.1.5
3 m zone
area along the railway line within a distance of 3 m from the centreline of the nearest track at both sides of the track

3.1.6
10 m zone
area along the railway line within a distance of 10 m from the centreline of the nearest track at both sides of the track

3.1.7
railway system voltage
railway system dedicated voltage converted from high voltage

EXAMPLE 25-0-25 kV, 50 Hz; 110 kV, 16,7 Hz.

3.2 Abbreviated terms

AC	Alternating current
AM	Amplitude modulation
DC	Direct current
EMC	Electromagnetic compatibility
ITU	International Telecommunication Union
r.m.s.	Root mean square

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4 Performance criteria

The variety and diversity of the apparatus within the scope of this document make 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 traction substation to the outside world

Limit values for this emission, over the frequency range 150 kHz to 1 GHz are given in IEC 62236-2.

Guidance values are given in IEC 62236-2 for emission of DC 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.

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.

No measurements are necessary for total underground railway systems with no surface operation.

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

The emission limits for apparatus covered by this document 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.

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 document.

6 Immunity requirements

The immunity test requirements for apparatus covered by this document are given on a port by port basis in Table 1 to Table 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 Table 1 to Table 6. The contents of the Basic Standards are not repeated herein, however, modifications or additional information needed for the practical application of the tests are given in this document.

Where possible, the tests shall be made with a typical operating mode chosen to produce the maximum susceptibility to disturbance in the frequency band being investigated, consistent

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with normal applications. The manufacturer shall define the conditions of the test in the test plan.

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 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 treated here. They have to be covered by the functional specification (e.g. IEC 62497-1).

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Table 1 – Immunity – Enclosure port

	Environmental phenomena	Test specification		Basic standard	Test set-up	Applicability note	Remarks	Performance criteria
1.1	**Radio-frequency electromagnetic field. Amplitude modulated**	80 MHz to 800 MHz 10 V/m (r.m.s.) 80 % AM, 1 kHz	Unmodulated carrier	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**	800 MHz to 1 000 MHz 20 V/m (r.m.s.) 80 % AM, 1 kHz	Unmodulated carrier	IEC 61000-4-3	IEC 61000-4-3		The test level specified is the r.m.s. value of the unmodulated carrier These tests are intended to simulate disturbances from digital communication devices	**A**
		1 400 MHz to 2 000 MHz 10 V/m (r.m.s.) 80 % AM, 1 kHz	Unmodulated carrier					
		2 000 MHz to 2 700 MHz 5 V/m (r.m.s.) 80 % AM, 1 kHz	Unmodulated carrier					
		5 100 MHz to 6 000 MHz 3 V/m (r.m.s.) 80 % AM, 1 kHz	Unmodulated carrier					

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	Environmental phenomena	Test specification		Basic standard	Test set-up	Applicability note	Remarks	Performance criteria
1.3	**Power – frequency magnetic field**	16,7 Hz 100 A/m 50 Hz / 60 Hz 100 A/m 0 Hz 300 A/m		IEC 61000-4-8	IEC 61000-4-8	See [a]	Tests only for applicable frequencies Testing time is ≥ 10 s	**A**
1.4	**Electrostatic discharge**	± 6 kV ± 8 kV	Contact discharge Air discharge	IEC 61000-4-2	IEC 61000-4-2	See [b]		**B**

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

[b] See basic standard for applicability of contact and/or air discharge test.

Table 2 – Immunity – Ports for signal lines and data buses not involved in process control

	Environmental phenomena	Test specification		Basic standard	Test set-up	Applicability note	Remarks	Performance criteria
2.1	**Radio-frequency common mode**	0,15 MHz to 80 MHz 10 V (r.m.s.) 80 % AM, 1 kHz	Unmodulated carrier	IEC 61000-4-6	IEC 61000-4-6	See [a]	The test level specified is the r.m.s. value of the unmodulated carrier	**A**
2.2	**Fast transients**	± 2 kV 5/50 ns 5 kHz	Peak T_r / T_h Repetition frequency	IEC 61000-4-4	IEC 61000-4-4	See [b]	Capacitive clamp used	**A**

[a] The test level can also be defined as the equivalent current into a 150 Ω load.

[b] Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 1 m.

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