

INTERNATIONAL STANDARD



**Railway applications – Electromagnetic compatibility –
Part 4: Emission and immunity of the signalling and telecommunications
apparatus**

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IEC 62236-4

Edition 3.0 2018-02
REDLINE VERSION

INTERNATIONAL STANDARD



**Railway applications – Electromagnetic compatibility –
Part 4: Emission and immunity of the signalling and telecommunications
apparatus**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.100; 45.060.01

ISBN 978-2-8322-5407-3

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROMAGNETIC COMPATIBILITY –****Part 4: Emission and immunity of the signalling
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International Standard IEC 62236-4 has been prepared by IEC technical committee TC 9: Electrical equipment and systems for railways.

This third edition cancels and replaces the second edition, issued in 2008. It constitutes a technical revision and has been developed on the basis of EN 50121-4:2015.

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

- a) clarification of scope (Clause 1);
- b) new definition (Clause 3);
- c) emission requirement extended in the frequency range 1 GHz to 6 GHz following IEC 61000-6-4;
- d) immunity requirement extended in the frequency range 5,1 GHz to 6 GHz.

This International 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
9/2339/FDIS	9/2369/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

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- withdrawn,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

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INTRODUCTION

This part of IEC 62236 has been prepared in the form of a Product Standard.

It defines the immunity and emission test requirements for apparatus defined in the scope in relation to the electromagnetic disturbances likely to be experienced in the railway. In particular, the test requirements represent the essential electromagnetic immunity requirements and have been selected to ensure an adequate level of immunity for apparatus installed ~~in~~ on the railway locations.

Test requirements are specified for each port considered.

Safety considerations are not covered by this document.

In ~~special~~ specific situations, where the level of disturbances may exceed the levels considered in this document, e.g. at a special location or where a hand-held transmitter is used in very close proximity to an apparatus, special mitigation measures may ~~necessary~~ have to be employed.

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RAILWAY APPLICATIONS – ELECTROMAGNETIC COMPATIBILITY –

Part 4: Emission and immunity of the signalling and telecommunications apparatus

1 Scope

This part of IEC 62236 applies to signalling and telecommunication apparatus that is installed inside the railway environment. Signalling and telecommunication apparatus mounted in vehicles is covered by IEC 62236-3-2:2018, signalling and telecommunication apparatus installed inside the substation and connected to substation equipment is covered by IEC 62236-5:2018.

This document specifies limits for emission and immunity and provides performance criteria for signalling and telecommunications (S&T) apparatus (including power supply systems belonging to S&T) which may interfere with other apparatus inside the railway environment, or increase the total emissions for the railway environment ~~beyond the limits defined in the appropriate standard~~ and so risk causing Electromagnetic Interference (EMI) to apparatus outside the railway system.

~~Apparatus which complies with the emission levels of IEC 61000-6-4 will meet the emission requirements of this standard provided that emissions from any d.c. power port are within the emissions limits specified for a.c. power ports. The immunity levels of IEC 61000-6-2 will also be adequate except for the special case of apparatus as defined in Note 1 of Table 1. This standard provides the immunity requirements for such apparatus.~~

~~The immunity levels given for the apparatus will in most cases allow the apparatus to perform as intended in the railway environment (see Note). The immunity level establishes a common reference for evaluating the performance of the apparatus when subject to interference resulting from direct exposure of the apparatus and associated cables to a radio frequency field, or by coupling of the interference from a remote source.~~

The requirements specified in this document apply for:

- vital equipment such as interlocking or command and control,
- 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.

Other apparatus not covered by at least one of these given cases is in compliance with IEC 61000-6-2.

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 and immunity limits in this standard at the communication frequency do not apply~~ requirements in this document are not intended to be applicable to the intentional transmission from a radio-transmitter as defined by the ITU.

Immunity limits do not apply in the exclusion bands as defined in the corresponding EMC related standard for radio equipment.

This document does not specify basic personal safety requirements for apparatus such as protection against electric shock, unsafe operation, insulation co-ordination and related

dielectric tests. The requirements were developed for and are applicable to this set of apparatus when operating under normal conditions. Fault conditions of the apparatus have not been taken into account.

~~The requirements and test methods also apply to telecommunications and signalling data and power lines connected to the equipment under test (EUT).~~

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

For products in the scope of IEC 61000-3-2, IEC 61000-3-3, IEC 61000-3-11 or IEC 61000-3-12, the requirements of those standards also apply.

~~Testing methods are given in the basic standards listed in Clause 2.~~

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

NOTE The immunity and emission levels do not of themselves guarantee that the integration of apparatus will necessarily be satisfactory. The document cannot cover all the possible configurations of the apparatus, but the test levels are sufficient to achieve satisfactory EMC in the majority of cases.

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 61000-3-2, 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 61000-4-2:2008, 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 61000-4-9, Electromagnetic compatibility (EMC) – Part 4-9: Testing and measurement techniques – Pulse magnetic field immunity test~~

IEC 61000-6-2:2016, Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity *standard* for industrial environments

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 62236-3-2, Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus~~

CISPR 16-2-1:2014, Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements

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

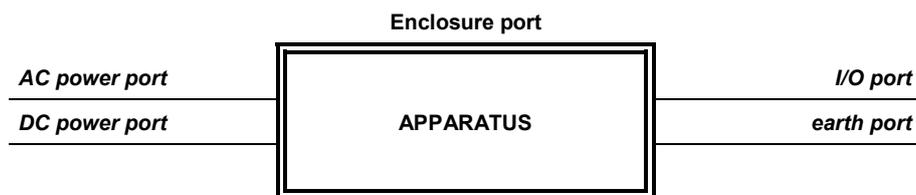
port <in electromagnetic compatibility>

particular interface of ~~the specified apparatus~~ an equipment which couples this equipment with the external electromagnetic environment (161-01-01) and through which the equipment is influenced by this environment

EXAMPLE AC power port, DC power port, I/O (input/output) port, earth port.

Note 1 to entry: The main categories of ports for signaling and telecommunication apparatus are presented in Figure 1.

[SOURCE: IEC 60050-161:1990, AMD4:2014, 161-01-27, modified]



IEC

Figure 1 – Main categories of ports

3.1.2

enclosure port

physical boundary of the apparatus through which electromagnetic fields may radiate or impinge ~~(see Figure 1)~~

3.1.3

3 m zone

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

3.1.4

10 m zone

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

3.2 Abbreviated terms

AC	Alternating current
AM	Amplitude modulation
DC	Direct current
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
I/O	Input / Output
ITU	International Telecommunication Union
r.m.s.	Root mean square
S&T	Signalling and telecommunication

4 Description of location

The railway environment is characterized as described in IEC 62236-1:2018. ~~Special consideration is given in this standard to apparatus intended to be installed within 3 m of the centreline of the nearest track and as defined in Note 1 of Table 1.~~

~~NOTE Tests covering compatibility with specific items of signalling equipment may be required.~~

5 Emission limits for apparatus

Apparatus which complies with the radiated and conducted emission levels of IEC 61000-6-4 is deemed to meet the emission requirements of this document, provided that the conducted emissions from any DC power port are within the emissions limits specified for AC power ports.

The ~~maximum emissions permitted by IEC 61000-6-4~~ limits defined in Table 1 shall be complied with. The conducted emission limits shall apply to both AC and DC power ports. ~~A measurement distance of 10 m may be used with the limits increased by 10 dB for the radiated emission of the enclosure port.~~ Where the apparatus is intended to be used in an environment other than the railway environment, then the emission limits given in the appropriate standards shall apply.

~~If the field strength measurement at 10 m or 30 m cannot be made because of high ambient noise levels, or for other reasons, measurements may be made at a closer distance, for example 3 m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance. Care should be taken in the measurement of large EUTs at 3 m at frequencies near 30 MHz, due to the near field effects.~~

Table 1 – Emission – AC or DC power ports (input and output)

	Port	Test specification		Basic Standard	Test set-up	Applicability note	Remarks
1.1	AC or DC power ports	150 kHz to 500 kHz	79 dBµV quasi-peak	CISPR 16-2-1	CISPR 16-2-1	See ^a	
		500 kHz to 30 MHz	66 dBµV average 73 dBµV quasi-peak 60 dBµV average				

^a Impulse noise (clicks) which occurs less than five times per minute is not considered. For clicks appearing more often than 30 times per minute, the limits apply. For clicks appearing between 5 and 30 times per minute, a relaxation of the limits is allowed of 20 log 30/N dB (where N is the number of clicks per minute). Criteria for separated clicks may be found in CISPR 14-1.

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6 Immunity

6.1 Performance criteria

~~It is impossible to define precise criteria for the evaluation of the apparatus within the scope of this standard, but performance criteria are as specified in IEC 62236-1, unless otherwise stated.~~

The variety and diversity of the apparatus within the scope of this document 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.

6.2 Test Immunity requirements

The immunity requirements for apparatus covered by this document are given on a port by port basis.

Test requirements are specified for each port considered.

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 test, the test generator, the test methods and the test set-up are given in the basic standards referred to in Tables 2 to 6.

If the apparatus has a large number of similar ports or ports with many similar connections, then a sufficient number shall be selected to simulate actual operating conditions and to ensure that all the different types of termination are covered (e.g. 20 % of the ports or at least four ports).

The immunity levels given for the apparatus will in most cases allow the apparatus to perform as intended inside the railway environment. The immunity level establishes a common reference for evaluating the performance of the apparatus when subject to interference resulting from direct exposure of the apparatus and associated cables to a radio frequency field, or by coupling of the interference from a remote source.

The contents of the basic standards are not repeated herein; however, additional information needed for the practical application of the tests is given where appropriate.

Voltages induced by traction currents are not treated herein. They have to be covered by the functional specification.

Table 2 – Immunity – Enclosure port

Environmental phenomena	Test specification	Test	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	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, from digital mobile telephones	800 MHz–1 000 MHz 20 V/m (r.m.s) 80 % AM, 1 kHz 1-400 MHz– 2-100 MHz 10 V/m (r.m.s) 80 % AM, 1 kHz 2-100 MHz– 2-500 MHz 5 V/m (r.m.s) 80 % AM, 1 kHz	Unmodulated carrier Unmodulated carrier Unmodulated carrier Unmodulated carrier	IEC 61000-4-3	IEC 61000-4-3	See Notes 1 and 3 The test level specified is the r.m.s. value of the unmodulated carrier	A
1.3 Power-frequency magnetic field	16,7 Hz, 50/60 Hz 100 A/m (r.m.s) 0 Hz 300 A/m	a.c. systems d.c. systems	IEC 61000-4-8	IEC 61000-4-8	See Notes 1 and 2 All frequencies have to be tested See Notes 1 and 2	A
1.4 Electrostatic discharge	± 6 kV ± 8 kV	Contact discharge Air discharge	IEC 61000-4-2	IEC 61000-4-2	See Note 4	B
1.5 Pulsed magnetic field	300 A/m		IEC 61000-4-9	IEC 61000-4-9	See Note 1	B
NOTE 1 The tests given apply to apparatus inside 3 m zone and vital equipment such as interlocking or command and control which are mounted in areas where a high risk of interference from mobile radio telephones has been identified. For other apparatus within the railway environment, requirements of IEC 61000-6-2 apply.						
NOTE 2 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 1 A/m (r.m.s.).						

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.

NOTE 4— Only applicable to equipment accessible to members of the public and operational staff (not maintenance).

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	Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
2.1	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
2.2	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							
2.3	Power – frequency magnetic field	16,7 Hz 100 A/m 50 Hz / 60 Hz 100 A/m 0 Hz 300 A/m	Unmodulated carrier	IEC 61000-4-8	IEC 61000-4-8	See ^a	Tests only for applicable frequencies Testing time is $\geq 10s$	A
2.4	Electrostatic discharge	± 6 kV ± 8 kV	Contact discharge Air discharge	IEC 61000-4-2	IEC 61000-4-2	See ^b		B

	Environmental phenomena	Test specification	Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
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.). Equipment mounted directly on the running rails is not covered, as higher field strength may occur.					Unshielded CRT displays can exhibit interference effects above 1 A/m (r.m.s.). Equipment mounted directly on the running rails is not covered, as higher field strength may occur.
b		Only applicable to equipment accessible to members of the public and operational staff (not maintenance), otherwise levels specified in IEC 61000-6-2 apply.					

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Table 3 – Immunity – I/O port

Environmental phenomena	Test specification	Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
3.1 Radio-frequency common mode	0,15 MHz to 80 MHz 10 V (r.m.s.) 80 % AM, 1 kHz	IEC 61000-4-6	IEC 61000-4-6	See ^{a, b, e}	The test level specified is the r.m.s. value of the unmodulated carrier	A
3.2 Fast transients	±2 kV 5/50 ns 5 kHz	IEC 61000-4-4	IEC 61000-4-4	See ^e	Capacitive clamp used	A
3.3 Surges	1,2 / 50 µs ± 2 kV ± 1 kV	IEC 61000-4-5	IEC 61000-4-5	See ^{c, d, e}	All severity levels below the given severity level have to be tested with 5 pulses for each severity level and a test sequence not alternating, but starting with one polarity followed by the other polarity.	B

^a Applicable only to ports interfacing with cables whose total length according to the manufacturer's specification may exceed 3 m.

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

^c An output impedance of 42 Ω (40 Ω and 2 Ω generator) and a coupling capacitance of 0,5 µF are specified.

^d For telecommunication ports and other ports intended for connection to highly balanced pairs, a line to line test is not required.

^e Ports directly connected to power ports or to the (public) low voltage network are classified as power ports also.

NOTE This test applies to I/O port connected to cable inside 3 m boundary or connected to cable longer than 30 m within 10 m boundary. I/O ports connected to cable other than above should comply with the requirements of IEC 61000-6-2 except that Note 2 of Table 2 of IEC 61000-6-2 is not applicable.

NOTE This test is intended to replicate the phenomenon known as direct coupling, hence an output impedance of 42 Ω (40 Ω and 2 Ω generator) and a coupling capacitance of 0,5 µF are recommended.

Table 4 – Immunity – DC power ports

	Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
4.1	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
4.2	Fast transients	± 2 kV 5/50 ns 5 kHz	Peak T_r / T_h Repetition frequency	IEC 61000-4-4	IEC 61000-4-4			A
4.3	Surges	1,2 / 50 µs ± 2 kV ± 1 kV	Open circuit test voltage, line to earth Open circuit test voltage, line to line	IEC 61000-4-5	IEC 61000-4-5	See ^b	All severity levels below the given severity level have to be tested with 5 pulses for each severity level and a test sequence not alternating, but starting with one polarity followed by the other polarity.	B

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

^b When the power supply is isolated from earth, an output impedance of 42 Ω (40 Ω and 2 Ω generator) and a coupling capacitance of 0,5 µF are recommended.

NOTE This test is intended to replicate the phenomena known as direct coupling. When the power supply is isolated from earth, an output impedance of 42 Ω (40 Ω and 2 Ω generator) and a coupling capacitance of 0,5 µF are recommended. When the power supply is not isolated from earth, an output impedance of 12 Ω (10 Ω and 2 Ω generator) and a coupling capacitance of 9 µF are recommended. These requirements are for cable length above 30 m.

Table 5 – Immunity – AC power ports

Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
	Radio-frequency common mode	Unmodulated carrier					
5.1	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
5.2	± 2 kV 5/50 ns 5 kHz	Peak T_r / T_h Repetition frequency	IEC 61000-4-4	IEC 61000-4-4			A
5.3	1,2 / 50 µs ± 2 kV ± 1 kV	Open circuit test voltage, line to earth Open circuit test voltage, line to line	IEC 61000-4-5	IEC 61000-4-5		All severity levels below the given severity level have to be tested with 5 pulses for each severity level and a test sequence not alternating, but starting with one polarity followed by the other polarity.	B

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

NOTE—This test is intended to replicate the phenomena known as direct coupling; hence an output impedance of 12 Ω (10 Ω and 2 Ω generator) and a coupling capacitance of 9 µF are recommended.

Table 6 – Immunity – Earth port

	Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
6.1	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		The test level specified is the r.m.s value of the u.nmodulated carrier	A
6.2	Fast transients	±1 kV 5/50 ns 5 kHz	Peak T_r / T_h Rep. frequency	IEC 61000-4-4	IEC 61000-4-4			A
<p>NOTE – The test may not be practicable with a cable length of less than 3 m.</p> <p>NOTE – The test level can also be defined as the equivalent current into a 150 Ω load.</p>								

Bibliography

~~Other standards which are relevant to the EMC behaviour of apparatus used in railway substations are listed below. Where limits are in conflict, those contained within this standard take precedence.~~

IEC 61000-3-2:2014, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)*

IEC 61000-3-3:2013, *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 61000-3-11:2017, *Electromagnetic compatibility (EMC) – Part 3-11: Limits; Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤ 75 A and subject to conditional connection*

IEC 61000-3-12:2011, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase*

IEC 62236-3-2:2018, *Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus*

~~IEC 61000-4-1, *Electromagnetic compatibility (EMC) – Part 4-1: Testing and measurement techniques – Overview of IEC 61000-4 series*~~

CISPR 14-1, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Railway applications – Electromagnetic compatibility –
Part 4: Emission and immunity of the signalling and telecommunications
apparatus**

**Applications ferroviaires – Compatibilité électromagnétique –
Partie 4: Émission et immunité des appareils de signalisation et de
télécommunication**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RAILWAY APPLICATIONS –
ELECTROMAGNETIC COMPATIBILITY –****Part 4: Emission and immunity of the signalling
and telecommunications apparatus**

FOREWORD

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International Standard IEC 62236-4 has been prepared by IEC technical committee TC 9: Electrical equipment and systems for railways.

This third edition cancels and replaces the second edition, issued in 2008. It constitutes a technical revision and has been developed on the basis of EN 50121-4:2015.

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

- a) clarification of scope (Clause 1);
- b) new definition (Clause 3);
- c) emission requirement extended in the frequency range 1 GHz to 6 GHz following IEC 61000-6-4;

d) immunity requirement extended in the frequency range 5,1 GHz to 6 GHz.

This International 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
9/2339/FDIS	9/2369/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
- amended.

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INTRODUCTION

This part of IEC 62236 has been prepared in the form of a Product Standard.

It defines the immunity and emission test requirements for apparatus defined in the scope in relation to the electromagnetic disturbances likely to be experienced in the railway. In particular, the test requirements represent the essential electromagnetic immunity requirements and have been selected to ensure an adequate level of immunity for apparatus installed on the railway locations.

Test requirements are specified for each port considered.

Safety considerations are not covered by this document.

In specific situations, where the level of disturbances may exceed the levels considered in this document, e.g. at a special location or where a hand-held transmitter is used in very close proximity to an apparatus, special mitigation measures may have to be employed.

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RAILWAY APPLICATIONS – ELECTROMAGNETIC COMPATIBILITY –

Part 4: Emission and immunity of the signalling and telecommunications apparatus

1 Scope

This part of IEC 62236 applies to signalling and telecommunication apparatus that is installed inside the railway environment. Signalling and telecommunication apparatus mounted in vehicles is covered by IEC 62236-3-2:2018, signalling and telecommunication apparatus installed inside the substation and connected to substation equipment is covered by IEC 62236-5:2018.

This document specifies limits for emission and immunity and provides performance criteria for signalling and telecommunications (S&T) apparatus (including power supply systems belonging to S&T) which may interfere with other apparatus inside the railway environment, or increase the total emissions for the railway environment and so risk causing Electromagnetic Interference (EMI) to apparatus outside the railway system.

The requirements specified in this document apply for:

- vital equipment such as interlocking or command and control,
- 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.

Other apparatus not covered by at least one of these given cases is in compliance with IEC 61000-6-2.

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.

Immunity limits do not apply in the exclusion bands as defined in the corresponding EMC related standard for radio equipment.

This document does not specify basic personal safety requirements for apparatus such as protection against electric shock, unsafe operation, insulation co-ordination and related dielectric tests. The requirements were developed for and are applicable to this set of apparatus when operating under normal conditions. Fault conditions of the apparatus have not been taken into account.

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

For products in the scope of IEC 61000-3-2, IEC 61000-3-3, IEC 61000-3-11 or IEC 61000-3-12, the requirements of those standards also apply.

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

The immunity and emission levels do not of themselves guarantee that the integration of apparatus will necessarily be satisfactory. The document cannot cover all the possible configurations of the apparatus, but the test levels are sufficient to achieve satisfactory EMC in the majority of cases.

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 61000-6-2:2016, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

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*

CISPR 16-2-1:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements*

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

port <in electromagnetic compatibility>

particular interface of an equipment which couples this equipment with the external electromagnetic environment (161-01-01) and through which the equipment is influenced by this environment

EXAMPLE AC power port, DC power port, I/O (input/output) port, earth port.

Note 1 to entry: The main categories of ports for signaling and telecommunication apparatus are presented in Figure 1.

[SOURCE: IEC 60050-161:1990, AMD4:2014, 161-01-27, modified]

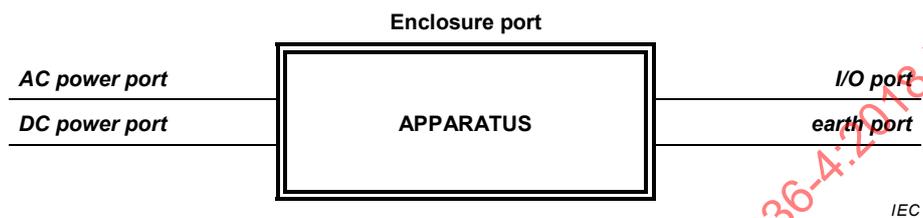


Figure 1 – Main categories of ports

3.1.2

enclosure port

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

3.1.3

3 m zone

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

3.1.4

10 m zone

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

3.2 Abbreviated terms

AC	Alternating current
AM	Amplitude modulation
DC	Direct current
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
I/O	Input / Output
ITU	International Telecommunication Union
r.m.s.	Root mean square
S&T	Signalling and telecommunication

4 Description of location

The railway environment is characterized as described in IEC 62236-1:2018.

5 Emission limits for apparatus

Apparatus which complies with the radiated and conducted emission levels of IEC 61000-6-4 is deemed to meet the emission requirements of this document, provided that the conducted emissions from any DC power port are within the emissions limits specified for AC power ports.

The emissions limits defined in Table 1 shall be complied with. The conducted emission limits shall apply to both AC and DC power ports. Where the apparatus is intended to be used in an environment other than the railway environment, then the emission limits given in the appropriate standards shall apply.

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Table 1 – Emission – AC or DC power ports (input and output)

	Port	Test specification		Basic Standard	Test set-up	Applicability note	Remarks
1.1	AC or DC power ports	150 kHz to 500 kHz	79 dBµV quasi-peak	CISPR 16-2-1	CISPR 16-2-1	See ^a	
		500 kHz to 30 MHz	66 dBµV average 73 dBµV quasi-peak 60 dBµV average				

^a Impulse noise (clicks) which occurs less than five times per minute is not considered. For clicks appearing more often than 30 times per minute, the limits apply. For clicks appearing between 5 and 30 times per minute, a relaxation of the limits is allowed of 20 log 30/N dB (where N is the number of clicks per minute). Criteria for separated clicks may be found in CISPR 14-1.

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6 Immunity

6.1 Performance criteria

The variety and diversity of the apparatus within the scope of this document 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.

6.2 Immunity requirements

The immunity requirements for apparatus covered by this document are given on a port by port basis.

Test requirements are specified for each port considered.

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 test, the test generator, the test methods and the test set-up are given in the basic standards referred to in Tables 2 to 6.

If the apparatus has a large number of similar ports or ports with many similar connections, then a sufficient number shall be selected to simulate actual operating conditions and to ensure that all the different types of termination are covered (e.g. 20 % of the ports or at least four ports).

The immunity levels given for the apparatus will in most cases allow the apparatus to perform as intended inside the railway environment. The immunity level establishes a common reference for evaluating the performance of the apparatus when subject to interference resulting from direct exposure of the apparatus and associated cables to a radio frequency field, or by coupling of the interference from a remote source.

The contents of the basic standards are not repeated herein; however, additional information needed for the practical application of the tests is given where appropriate.

Voltages induced by traction currents are not treated herein. They have to be covered by the functional specification.

Table 2 – Immunity – Enclosure port

	Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
2.1	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
2.2	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	A
		1 400 MHz to 2 000 MHz 10 V/m (r.m.s.) 80 % AM, 1 kHz	Unmodulated carrier				These tests are intended to simulate disturbances from digital communication devices	
		2 000 MHz to 2 700 MHz 5 V/m (r.m.s.) 80 % AM, 1 kHz	Unmodulated carrier					
2.3	Power – frequency magnetic field	16,7 Hz 100 A/m 50 Hz / 60 Hz 100 A/m 0 Hz 300 A/m	Unmodulated carrier	IEC 61000-4-8	IEC 61000-4-8	See ^a	Tests only for applicable frequencies Testing time is ≥ 10s	A

	Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
2.4	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.). Equipment mounted directly on the running rails is not covered, as higher field strength may occur.								
^b Only applicable to equipment accessible to members of the public and operational staff (not maintenance), otherwise levels specified in IEC 61000-6-2 apply.								

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Table 3 – Immunity – I/O port

Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
3.1 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, b, e}	The test level specified is the r.m.s. value of the unmodulated carrier	A
3.2 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 ^e	Capacitive clamp used	A
3.3 Surges	1,2 / 50 µs ± 2 kV ± 1 kV	Open circuit test voltage, line to earth Open circuit test voltage, line to line	IEC 61000-4-5	IEC 61000-4-5	See ^{c, d, e}	All severity levels below the given severity level have to be tested with 5 pulses for each severity level and a test sequence not alternating, but starting with one polarity followed by the other polarity.	B

^a Applicable only to ports interfacing with cables whose total length according to the manufacturer's specification may exceed 3 m.

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

^c An output impedance of 42 Ω (40 Ω and 2 Ω generator) and a coupling capacitance of 0,5 µF are specified.

^d For telecommunication ports and other ports intended for connection to highly balanced pairs, a line to line test is not required.

^e Ports directly connected to power ports or to the (public) low voltage network are classified as power ports also.

Table 4 – Immunity – DC power ports

Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
4.1 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
4.2 Fast transients	± 2 kV 5/50 ns 5 kHz	Peak T_r / T_h Repetition frequency	IEC 61000-4-4	IEC 61000-4-4			A
4.3 Surges	1,2 / 50 µs ± 2 kV ± 1 kV	Open circuit test voltage, line to earth Open circuit test voltage, line to line	IEC 61000-4-5	IEC 61000-4-5	See ^b	All severity levels below the given severity level have to be tested with 5 pulses for each severity level and a test sequence not alternating, but starting with one polarity followed by the other polarity.	B

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

^b When the power supply is isolated from earth, an output impedance of 42 Ω (40 Ω and 2 Ω generator) and a coupling capacitance of 0,5 µF are recommended.

Table 5 – Immunity – AC power ports

Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
	0,15 MHz to 80 MHz 10 V (r.m.s.) 80 % AM, 1 kHz	Unmodulated carrier					
5.1 Radio-frequency common mode	± 2 kV	Peak T_r / T_h	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
5.2 Fast transients	5/50 ns 5 kHz	Repetition frequency	IEC 61000-4-4	IEC 61000-4-4			A
5.3 Surges	1,2 / 50 µs ± 2 kV ± 1 kV	Open circuit test voltage, line to earth Open circuit test voltage, line to line	IEC 61000-4-5	IEC 61000-4-5		All severity levels below the given severity level have to be tested with 5 pulses for each severity level and a test sequence not alternating, but starting with one polarity followed by the other polarity.	B

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

Table 6 – Immunity – Earth port

	Environmental phenomena	Test specification		Basic Standard	Test set-up	Applicability note	Remarks	Performance criteria
6.1	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		The test level specified is the r.m.s value of the u.nmodulated carrier	A
6.2	Fast transients	±1 kV 5/50 ns 5 kHz	Peak T_r / T_h Rep. frequency	IEC 61000-4-4	IEC 61000-4-4			A

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IEC 61000-3-2:2014, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)*

IEC 61000-3-3:2013, *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 61000-3-11:2017, *Electromagnetic compatibility (EMC) – Part 3-11: Limits; Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤ 75 A and subject to conditional connection*

IEC 61000-3-12:2011, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase*

IEC 62236-3-2:2018, *Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus*

CISPR 14-1, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

**APPLICATIONS FERROVIAIRES –
COMPATIBILITÉ ÉLECTROMAGNÉTIQUE –****Partie 4: Émission et immunité des appareils
de signalisation et de télécommunication**

AVANT-PROPOS

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La Norme internationale IEC 62236-4 a été établie par le comité d'études 9 de l'IEC: Matériels et systèmes électriques ferroviaires.

Cette troisième édition annule et remplace la deuxième édition publiée en 2008. Elle constitue une révision technique et a été développée sur la base de EN 50121-4:2015.

Cette édition inclut les changements techniques significatifs suivants par rapport à l'édition précédente:

- a) clarification du domaine d'application (Article 1);
- b) nouvelles définitions (Article 3);

- c) exigences d'émissions étendues dans la plage de fréquences 1 GHz à 6 GHz, suivant l'IEC 61000-6-4;
- d) exigences d'immunité étendues dans la plage de fréquences 5,1 GHz à 6 GHz.

Cette Norme internationale doit être lue conjointement avec l'IEC 62236-1.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
9/2339/FDIS	9/2369/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 62236, publiées sous le titre général *Applications ferroviaires – Compatibilité électromagnétique*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "<http://webstore.iec.ch>" dans les données relatives au document recherché. A cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

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INTRODUCTION

La présente partie de l'IEC 62236 a été préparée sous la forme d'une Norme de Produits.

Elle définit les exigences d'essai d'immunité et d'émission pour les appareils définis dans le domaine d'application, en ce qui concerne les perturbations électromagnétiques susceptibles d'apparaître dans le domaine ferroviaire. Les exigences d'essai représentent en particulier les exigences d'immunité électromagnétique essentielles et ont été choisies pour assurer un niveau approprié d'immunité pour les appareils installés sur les systèmes ferroviaires.

Les exigences relatives aux essais sont spécifiées pour chaque accès considéré.

Les considérations de sécurité ne sont pas couvertes par le présent document.

Dans des situations particulières où le niveau de perturbation peut dépasser les niveaux de perturbation examinés dans le présent document, par exemple, à un emplacement spécial ou lorsqu'un émetteur portable est utilisé très près d'un appareil, des mesures spéciales de réduction peuvent devoir être prises.

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APPLICATIONS FERROVIAIRES – COMPATIBILITÉ ÉLECTROMAGNÉTIQUE –

Partie 4: Émission et immunité des appareils de signalisation et de télécommunication

1 Domaine d'application

La présente partie de l'IEC 62236 s'applique aux appareils de signalisation et de télécommunication qui sont installés à l'intérieur de l'environnement ferroviaire. Les appareils de signalisation et de télécommunication montés dans les véhicules sont couverts par l'IEC 62236-3-2:2018, les appareils de signalisation et de télécommunication installés en sous-station et connectés aux appareils de sous-station sont couverts par l'IEC 62236-5:2018.

Le présent document spécifie les limites d'émission et d'immunité et donne les critères d'aptitude à la fonction pour les appareils de signalisation et de télécommunication (S&T) (y compris les systèmes d'alimentation appartenant à S&T) qui peuvent perturber d'autres appareils dans l'environnement ferroviaire ou augmenter les émissions totales pour l'environnement ferroviaire et qui risquent ainsi d'être la cause d'un brouillage électromagnétique (EMI) pour des appareils à l'extérieur du système ferroviaire.

Les exigences spécifiées dans le présent document s'appliquent aux:

- équipements vitaux tels que les équipements d'interlocking ou de contrôle/commande,
- appareils situés dans la zone de 3 m,
- accès des appareils situés dans la zone de 10 m avec connexion dans la zone de 3 m,
- accès des appareils situés dans la zone de 10 m avec longueur de câble > 30 m.

Les autres appareils non couverts par au moins un des cas donnés ci-dessus sont conformes à l'IEC 61000-6-2.

Si un accès est destiné à émettre ou recevoir des communications radio (émetteurs intentionnels de rayonnement, par exemple, systèmes de balise), alors les exigences relatives aux émissions rayonnées du présent document ne s'appliquent pas à la transmission intentionnelle à partir d'un émetteur radio tel que défini par l'UIT.

Les limites d'immunité ne s'appliquent pas dans les bandes d'exclusion telles que définies dans la norme CEM correspondante pour les équipements radio.

Le présent document ne spécifie pas d'exigences fondamentales de sécurité du personnel pour les appareils telles que la protection contre les chocs électriques, le fonctionnement non sûr, la coordination de l'isolement et les essais diélectriques correspondants. Ces exigences ont été développées pour cet ensemble d'appareils et elles lui sont applicables dans des conditions normales de fonctionnement. Les conditions de défaut des appareils n'ont pas été prises en compte.

La plage de fréquences concernée va du courant continu à 400 GHz. Aucune mesure n'est nécessaire aux fréquences pour lesquelles aucune exigence n'est spécifiée.

Pour les produits du domaine d'application des normes IEC 61000-3-2, IEC 61000-3-3, IEC 61000-3-11 ou IEC 61000-3-12, les exigences de ces normes s'appliquent également.

Ces dispositions spécifiques sont utilisées avec les dispositions générales données dans l'IEC 62236-1.

L'immunité et les niveaux d'émission ne garantissent pas à eux seuls que l'intégration des appareils sera nécessairement satisfaisante. Le document ne peut pas couvrir toutes les configurations possibles des appareils, mais les niveaux d'essai sont suffisants pour obtenir une CEM satisfaisante dans la majorité des cas.

2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 61000-4-2:2008, *Compatibilité électromagnétique (CEM) – Partie 4-2: Techniques d'essai et de mesure – Essai d'immunité aux décharges électrostatiques*

IEC 61000-4-3:2006, *Compatibilité électromagnétique (CEM) – Partie 4-3: Techniques d'essai et de mesure – Essai d'immunité aux champs électromagnétiques rayonnés aux fréquences radioélectriques*

IEC 61000-4-4:2012, *Compatibilité électromagnétique (CEM) – Partie 4-4: Techniques d'essai et de mesure – Essai d'immunité aux transitoires électriques rapides en salves*

IEC 61000-4-5:2014, *Compatibilité électromagnétique (CEM) – Partie 4-5: Techniques d'essai et de mesure – Essai d'immunité aux ondes de choc*

IEC 61000-4-6:2013, *Compatibilité électromagnétique (CEM) – Partie 4-6: Techniques d'essai et de mesure – Immunité aux perturbations conduites, induites par les champs radioélectriques*

IEC 61000-4-8:2009, *Compatibilité électromagnétique (CEM) – Partie 4-8: Techniques d'essai et de mesure – Essai d'immunité au champ magnétique à la fréquence du réseau*

IEC 61000-6-2:2016, *Compatibilité électromagnétique (CEM) – Partie 6-2: Normes génériques – Norme d'immunité pour les environnements industriels*

IEC 61000-6-4:2006, *Compatibilité électromagnétique (CEM) – Partie 6-4: Normes génériques – Norme sur l'émission pour les environnements industriels*

IEC 61000-6-4:2006/AMD1:2010

IEC 62236-1:2018, *Applications ferroviaires – Compatibilité électromagnétique – Partie 1: Généralités*

CISPR 16-2-1:2014, *Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques – Partie 2-1: Méthodes de mesure des perturbations et de l'immunité – Mesures des perturbations conduites*

3 Termes, définitions et termes abrégés

3.1 Termes et définitions

Pour les besoins du présent document, les termes et définitions suivants s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse <http://www.electropedia.org/>
- ISO Online browsing platform: disponible à l'adresse <http://www.iso.org/obp>

3.1.1

Accès <en compatibilité électromagnétique>

interface particulière d'un matériel qui assure son couplage avec l'environnement électromagnétique (161-01-01) extérieur et à travers laquelle il est influencé par cet environnement

EXEMPLE Bornes d'alimentation en courant alternatif ou en courant continu, E/S (entrée/sortie), borne de terre.

Note 1 à l'article: Les principales catégories d'accès pour les appareils de signalisation et de télécommunications sont données à la Figure 1.

[SOURCE: IEC 60050-161:1990, AMD4:2014, 161-01-27, modifiée]

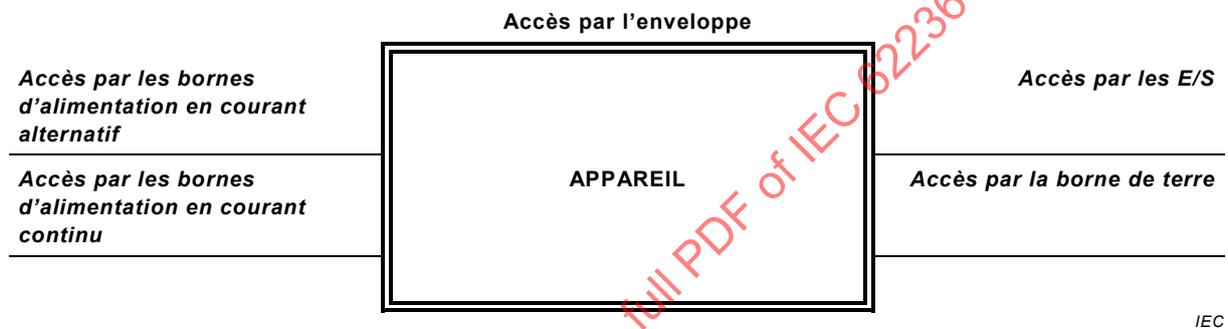


Figure 1 – Principales catégories d'accès

3.1.2

accès par l'enveloppe

frontière physique de l'appareil à travers laquelle les champs électromagnétiques peuvent rayonner ou à laquelle ils peuvent se heurter

3.1.3

zone de 3 m

zone le long de la ligne de chemin de fer située à une distance de 3 m au maximum de la ligne centrale de la voie la plus proche des deux côtés de la voie

3.1.4

zone de 10 m

zone le long de la ligne de chemin de fer située à une distance de 10 m au maximum de la ligne centrale de la voie la plus proche des deux côtés de la voie