

Railway applications — Electromagnetic compatibility —

Part 2: Emission of the whole railway system to the outside world

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Summary of pages

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

This European Standard was prepared the Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50121-2 on 2000-04-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2003-04-01

This European Standard is to be read in conjunction with EN 50121-1:2000.

This standard forms Part 2 of the European Standard series EN 50121, published under the general title Railway applications - Electromagnetic compatibility. The series consists of:

- Part 1: General;
- Part 2: Emission of the whole railway system to the outside world;
- Part 3-1: Rolling stock - Train and complete vehicle;
- Part 3-2: Rolling stock - Apparatus;
- Part 4: Emission and immunity of the signalling and telecommunications apparatus;
- Part 5: Emission and immunity of fixed power supply installations and apparatus.

Annexes designated “normative” are part of the body of the standard.

Annexes designated “informative” are given only for information.

In this standard, annex A is normative and annexes B and C are informative.

Contents

1	Scope.....	4
2	Normative references.....	4
3	Definitions.....	4
4	Emission limits.....	5
4.1	Emission from the open railway route.....	5
4.2	Emission from railway substation.....	5
4.3	Emission at radio frequencies from railway supply lines.....	6
4.4	Emission from the substation at power frequencies and harmonics to 9 kHz.....	6
5	Method of measurement of emission from moving trains.....	6
5.1	Measurement parameters.....	6
5.2	Frequency selection.....	9
5.3	Transients.....	9
5.4	Measuring conditions.....	9
5.5	Test report.....	10
5.6	Antenna positions.....	10
	Annex A (normative) Method of measurement of emission from railway substations.....	16
	Annex B (informative) Background to the method of measurement.....	17
	Annex C (informative) Cartography - Electric and magnetic fields at traction frequencies.....	22

1 Scope

This European Standard sets the emission limits from the whole railway system including urban vehicles for use in city streets, it describes the measurement method to verify the emissions, and gives the cartography values of the fields most frequently encountered.

These specific provisions are to be used in conjunction with the general provisions in EN 50121-1.

The limits refer to the particular measuring points defined in clause 5 and annex A. These emissions should be assumed to exist at all points in the vertical planes which are 10 m from the centre lines of the outer electrified railway tracks, or 3 m from the fence of the substations.

The zones above and below the railway will experience emission and particular cases shall be considered individually.

Excluded from the limits is apparatus which complies with the generic industrial emission standard EN 50081-2.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate place in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 50121-1	Railway applications - Electromagnetic compatibility - Part 1: General.
EN 50121-3-1	Part 3-1: Rolling stock - Train and complete vehicle.
EN 50121-5	Part 5: Emission and immunity of fixed power supply installations and apparatus.
EN 55013	Limits and methods of measurement of radio disturbance characteristics of broadcast receivers and associated equipment.
EN 55022	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.
CISPR 16-1	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus.
CISPR 18	Radio interference characteristics of overhead power lines and high voltage equipment.

3 Definitions

For the purpose of this Part 2 of the European Standard the following definitions apply.

3.1

apparatus

electric or electronic product with an intrinsic function intended for implementation into a fixed railway installation, which can be placed on the market as a single unit

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

external interface

boundary where a system interacts with any other or where a system interacts with its environment

3.4

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

3.5

railway supply lines

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

4 Emission limits

4.1 Emission from the open railway route

The emission limits in the frequency range 9 kHz to 1 GHz are given in Figure 1 and the measurement method is defined in clause 5. For non-electrified lines, the limits are as those given for 750 V d.c.

For urban vehicles city street transport, the emission limits given in Figure 1 for 750 V d.c. conductor rail shall not be exceeded.

NOTE 1 The emission limits for urban vehicles city street transport are under consideration.

NOTE 2 The emission limits in the frequency range d.c. to 9 kHz are under consideration.

The emission values in Figure 1 with peak detection are specified on the basis that the quasi-peak detection values are at least 20 dB below the peak values.

NOTE 3 Test results on the open electric railway mainline with moving trains have demonstrated that the emission field strength with quasi-peak detection is at least 20 dB below the values measured in peak detection.

NOTE 4 It shall be recognized however that it is not possible to undertake complete tests with quasi-peak detection due to the reasons stated in annex B.

NOTE 5 Values of electric field are for vertical polarization. Measurements at 80 MHz showed that the horizontal polarization field is smaller by about 6 dB.

Since parts of the railway system may be at distances greater than 10 m (for example substations) it is necessary to take this into account. For example Figure 2 shows a typical substation and indicates the boundaries at which the Figure 1 limit applies and at which the substation limit applies.

4.2 Emission from railway substations

Radio frequency noise emission from the railway substation to the outside environment measured according to the method defined in annex A shall not exceed the levels shown as the 25 kV line in Figure 1.

If the measurements are taken at power values below the rated continuous power, the results shall be converted in accordance with the rules in annex A.

The bandwidths used for measurement are those used in CISPR 16-1 and are:

	Bandwidth
Frequencies up to 150 kHz	200 Hz
Frequencies from 150 kHz to 30 MHz	9 kHz
Frequencies above 30 MHz	120 kHz

The distance of 3 m defined in annex A shall be measured from the fence of the substation. If no fence exists, the measurements shall be taken at 10 m from the apparatus if not in an enclosure or from the outer surface of the enclosure if it is enclosed.

Emission of trains shall not enter into the measurement.

4.3 Emission at radio frequencies from railway supply lines

Railway supply lines which are not at railway system voltage and are within the railway boundary shall comply with the requirements of CISPR 18.

NOTE Part 1 of CISPR 18 covers general information, Part 2 introduces the concept of protection distance, and Part 3 gives information concerning mitigation of emission.

4.4 Emission from the substation at power frequencies and harmonics up to 9 kHz

Magnetic fields which enter the outside environment need to be controlled and the limits below shall apply. When measured at 3 m from the fence of the substation, at a height of 1 m above ground level, the r.m.s. value of the magnetic field gradient in any axis, including any effects of harmonic currents, shall not exceed 50 A/m. This value applies to rated load operation. If tests are made at less than rated load, the readings shall be linearly scaled to full load for assessment purposes. Under overload and fault conditions, the limit value shall be 500 A/m.

NOTE 1 The operation of power supply apparatus produces magnetic and electric fields which both enter the environment and enter railway apparatus. Limits are required to control this emission. There is great variety in the geometry used for the power conductors in apparatus and it is not considered possible to set limits for magnetic fields within the substation boundary. Measurements have been made inside typical existing installations and show that the field is unlikely to exceed 1 000 A/m at distances of more than 1 m from d.c. apparatus, or 500 A/m from a.c. apparatus. Under fault conditions these values may be 10 times greater. It is intended to review this subclause and it may be possible to establish railway-specific limits for fields inside the boundary.

NOTE 2 Magnetic fields within the boundary are such that cathode ray display tubes are usually unable to work properly.

5 Method of measurement of emission from moving trains

The method of measurement is adapted from CISPR 16-1 to a railway system with moving vehicle. The background to the method of measurement is given in annex B.

The electromagnetic fields generated by rail vehicles when operating on a railway network are measured by means of field strength meters with several different set frequencies. The horizontal component of the magnetic field perpendicular to the track and the vertical component of the radiated field are measured.

5.1 Measurement parameters

5.1.1 Peak measurement method is used. Duration at selected frequency shall be sufficient to obtain an accurate reading. This is a function of the measuring set and the recommended value is 50 ms.

5.1.2 Frequency bands and bandwidths at –6 dB used for measurements are in accordance with CISPR 16-1.

These are:

Frequency bands:	9 to 150 kHz	0,15 to 30 MHz	30 to 300 MHz	300 MHz to 1 GHz
Bandwidth:	200 Hz	9 kHz	120 kHz	120 kHz

5.1.3 When connected to the antenna the error of measurement of the strength of a uniform sine-wave field shall not differ more than $\pm 4,0$ dB from CISPR 16-1 equipment.

5.1.4 Since the noise may not attain its maximum value as the traction vehicle passes the measuring point, but may occur when the vehicle is a long distance away, the measuring set shall be continuously active during the test and not triggered as the train approaches the test site.