

Railway applications — Electromagnetic compatibility —

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

ICS 29.020; 29.280; 45.020

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Committees responsible for this Draft for Development

The preparation of this Draft for Development was entrusted to Technical Committee PEL/9, Railway electrotechnical applications, upon which the following bodies were represented:

- British Cable Makers Confederation
- Confederation of Passenger Transport UK
- Docklands Light Railway
- Federation of the Electronics Industry
- Health and Safety Executive
- London Underground Ltd.
- Power Supply Manufacturers' Association — PSMA (BEAMA Ltd.)
- Railtrack
- Railway Industry Association

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National foreword

This Draft for Development has been prepared by Technical Committee PEL/9 and is the English language version of European Prestandard ENV 50121-2:1996 *Railway applications — Electromagnetic compatibility — Part 2: Emission of the whole railway system to the outside world*, published by the European Committee for Electrotechnical Standardization (CENELEC).

Cross-references

Publication referred to	Corresponding British Standard
	DD ENV 50121 <i>Railway applications — Electromagnetic compatibility</i>
ENV 50121-1:1996	DD ENV 50121-1 <i>General</i>
ENV 50121-3-1:1996	DD ENV 50121-3-1 <i>Rolling stock — Train and complete vehicle</i>
ENV 50121-4:1996	DD ENV 50121-4:1996 <i>Emission and immunity of the signalling and telecommunications apparatus</i>

This Document is being issued in the Draft for Development series of publications and is of a provisional nature. It should be applied on this provisional basis so that information and experience of its practical application may be obtained.

Comments arising from the use of this Draft for Development are requested so that UK experience can be reported to the European organization responsible for its conversion to a European Standard. A review of this publication will be initiated 2 years after its publication by the European organization so that a decision can be taken on its status at the end of its three-year life. The commencement of the review period will be notified by an announcement in *BSI News Update*.

According to the replies received by the end of the review period, the responsible BSI Committee will decide whether to support the conversion into a European Standard, to extend the life of the prestandard or to withdraw it. Comments should be sent in writing to the Secretary of BSI Technical Committee PEL/9 at 389 Chiswick High Road, London W4 4AL giving the document reference and clause number and proposing, where possible, an appropriate revision of the text.

This publication is not to be regarded as a British Standard.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ENV title page, pages 2 to 20, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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Descriptors: Railway equipment, electric equipment, electric components, railway system, radio disturbances, electromagnetic compatibility, emission

English version

Railway applications — Electromagnetic compatibility Part 2: Emission of the whole railway system to the outside world

Applications ferroviaires —
Compatibilité électromagnétique
Partie 2: Perturbations générées par un
système ferroviaire pris globalement vers
les riverains

Bahnanwendungen —
Elektromagnetische Verträglichkeit
Teil 2: *(To be completed)*

This European Prestandard (ENV) was approved by CENELEC on 1995-12-11 as a prospective standard for provisional application. The period of validity of this ENV is limited initially to three years. After two years the members of CENELEC will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard (EN).

CENELEC members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This European Prestandard was prepared by Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways, in accordance with the decision taken by CLC/TC 9X at its 11th meeting on 1995-05-12/13.

The text of the draft was submitted to the formal vote and was approved by CENELEC as ENV 50121-2 on 1995-12-11.

The following date was fixed:

- latest date by which the existence of the ENV has to be announced at national level (doa) 1996-01-15

This European Prestandard is to be used in conjunction with ENV 50121-1:1996 *Railway applications — Electromagnetic compatibility — Part 1: General*. In this Prestandard, Annex A and Annex B are informative.

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1 Scope

This Prestandard sets the emission limits from the whole railway system, 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 ENV 50121-1.

2 Normative references

This European Prestandard 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 Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ENV 50121-1:1996, *Railway Applications — Electromagnetic Compatibility — Part 1: General*.

ENV 50121-3-1:1996, *Part 3-1: Rolling stock — Train and complete vehicle*.

ENV 50121-4:1996, *Part 4: Emission and immunity of the signalling and telecommunications apparatus*.

CISPR 16-1:1993, *Specification for radio disturbance and immunity measuring apparatus and methods — Part 1: Radio disturbance and immunity measuring apparatus*.

3 Definitions

Void

4 Emission limits

The emission limits in frequency range 9 kHz to 1 GHz are given in Figure 1.

For non-electrified lines, the limits are as these for 750 V d.c.

5 Method of measurement

The method of measurement is adapted from CISPR 16-1 to railway system with moving vehicle, the background to the method of measurement is given in Annex A.

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 milliseconds.

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

Frequency bands:	9–150 kHz	0,15–30 MHz	30–300 MHz	300 MHz – 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 exceed $\pm 4,0$ dB.

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.

5.1.5 To cover the frequency range, antennae of different design are required. Typical equipment is described below:

- for 9 kHz – 30 MHz, a loop or frame antenna is used to measure H field (see Figure 2);
- for 30 MHz – 300 MHz, a biconical dipole is used to measure E field (see Figure 3);
- for 300 MHz – 1,0 GHz, a log-periodic antenna is used to measure E field (see Figure 4).

Calibrated antenna factors are used to convert the terminal voltage of the antennae to field gradient.

5.1.6 The preferred distance of the measuring antenna from the centreline of the track on which the vehicle is moving is 10 metres. In the case of the log-periodic antenna, the 10 m distance is measured to the mechanical centre of the array.

Note that it is not considered necessary to carry out two tests to examine both sides of the vehicle, even if it contains different apparatus on the two sides, since the majority of the emission is produced by the sliding contact if the train is moving.

Where the tests are carried out at a site which meets all the recommended criteria except that the antennae are not 10 metres from the track centreline, the results can be converted to an equivalent 10 metre value by using the following formula.

$$E_{10} = E_x + n \cdot 20 \cdot \log (D/10)$$

where E_{10} is the value at 10 metres
 E_x is the measured value at D metres
n is a factor taken from the table below.

Frequency Range	n
0,15 to 0,4 Mhz	1,8
0,4 to 1,6 MHz	1,65
1,6 to 110 MHz	1,2
110 to 300 Mhz	1,0

Where the physical layout of the railway totally prevents the use of reference distances, a method shall be agreed to suit the particular circumstances. For example if the railway is in tunnel, miniature antennae can be used on the wall of the tunnel. In such a case, the limits selected shall take into account the method of measurement.

5.1.7 The height above rail level of the antenna centre shall be within the range 1,0 to 2,0 m for the loop antenna, and within 2,5 to 3,5 m to the centre of dipole or log-periodic antennae. If the level of the ground at the antenna differs from the rail level by more than 0,5 metres, the actual value shall be noted in the test report.

5.1.8 The plane of the loop antenna shall be vertical and parallel to the line of the track. The dipole shall be placed in the vertical axis. The log periodic antenna shall be arranged to measure the vertical polarisation signal, with the antenna directed towards the track.

These alignments are chosen to give standard conditions and may not detect the absolute maxima at a given site. If tests for horizontal polarisation or other alignments are required, these shall be specifically requested. Figure 2, Figure 3 and Figure 4 show the positions and alignments of the antennae.

5.1.9 If tests are being done on a railway with overhead electrified supply, the measuring point shall be at the mid-point between the support masts of the overhead line and not at a discontinuity of the contact wire. It is recognised that resonances can exist in an overhead system at radio frequencies and this may require changes in the values of frequency chosen for measurement. If resonances exist, this should be noted in the test report.

The radio frequency emission will be affected by the state of the railway supply system. Switching of feeder stations and temporary works will influence the response of the system. It is therefore necessary to note the condition of the system in the test record and all similar tests should if possible be carried out within the same working day. Where the railway has a track-side conductor rail power supply, the test location should be at least 100 metres from gaps in the rail, to avoid inclusion of the transient fields associated with the make and break of collector contact. The conductor rail and the antennae shall be on the same side of the track.