

**Electromagnetic
compatibility —
Basic immunity standard —
Radiated radio-frequency
electromagnetic field —
Immunity test**

Cooperating organizations

The European Committee for Electrotechnical Standardization (CENELEC), under whose supervision this European Standard was prepared, comprises the national committees of the following countries:

Austria	Italy
Belgium	Luxembourg
Denmark	Netherlands
Finland	Norway
France	Portugal
Germany	Spain
Greece	Sweden
Iceland	Switzerland
Ireland	United Kingdom

This Draft for Development, having been prepared under the direction of the General Electrotechnical Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 May 1994

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National foreword

This Draft for Development has been prepared under the direction of the General Electrotechnical Standards Policy Committee. It is identical with European Prestandard ENV 50140 : 1993 *Electromagnetic compatibility — Basic immunity standard — Radiated radio-frequency electromagnetic field — Immunity test* published by the European Committee for Electrotechnical Standardization (CENELEC).

This publication is not to be regarded as a British Standard

It is being issued in the Draft for Development series of publications and is of a provisional nature because it is based on an IEC draft which is still subject to technical change as it has not yet reached the Draft International Standard (DIS) stage. When the DIS stage has been reached it will be submitted to the IEC/CENELEC parallel voting procedure. In the event of a positive vote and subsequent publication of the European Standard (EN), this ENV will be withdrawn. This is highly likely to occur before the normal review of an ENV which is undertaken after two years.

As a published document, normative references to this ENV can be made in European Standards (ENs).

The UK participation in the preparation of ENV 50140 is through Technical Committee GEL/110 and any observations should be sent to the Secretary of GEL/110 at 2 Park Street, London W1A 2BS for consideration by the committee.

Attention is drawn to the following.

Part 4 of Basic EMC Standard IEC 1000 will include sections corresponding to those aspects of EMC immunity presently covered by the IEC 801 series of standards, both published and in preparation. When the relevant sections of IEC 1000 : Part 4 are published, the corresponding parts of IEC 801 will be withdrawn. Until this time, CENELEC has decided to issue ENVs covering those parts of IEC 801 which are in preparation. Accordingly, the following references to parts of IEC 801 which appear in this standard should be amended as follows:

- a) replace 'IEC 801-3' by 'ENV 50140';
- b) replace 'IEC 801-6' by 'ENV 50141'.

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Descriptors: Electromagnetic compatibility, electric equipment, electromagnetic fields, radiation, tests, severity

English version

Electromagnetic compatibility — Basic immunity standard — Radiated, radio-frequency electromagnetic field — Immunity test

This European Prestandard was approved by CENELEC on 1993-05-12 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

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Foreword

This European Prestandard has been prepared by Working Group WG02 of CENELEC Technical Committee TC 110, based on the draft publication IEC CDV 65A/77B (Secretariat) 135/100, 1992-12.

The document was approved by TC 110 on 12 May 1993.

NOTE. When the corresponding DIS prepared by IEC has successfully passed the IEC/CENELEC parallel vote and has been ratified as EN, the present ENV will be immediately withdrawn.

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1 Scope

This standard is related to the immunity of electrical and electronic equipment to radiated electromagnetic energy.

The object of this standard is to establish a common reference for evaluating the performance of electrical and electronic equipment when subjected to RF electromagnetic fields.

NOTE. Test methods are defined in this section for measuring the effect that electro-magnetic radiation has on equipment concerned. The simulation and measurement of electro-magnetic radiation is not adequately exact for quantitative determination of effects. The test methods defined are structured for the primary objective of establishing adequate repeatability of results at various test facilities for qualitative analysis of effects.

This standard defines:

- recommended test levels;
- test equipment;
- test set-up;
- test procedure.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 50(161) : 1990 *International Electrotechnical Vocabulary — Chapter 161: Electromagnetic compatibility*

3 General

Most electronic equipment is in some manner affected by electromagnetic radiation. This radiation is frequently generated by such sources as the small hand-held radio transceivers that are used by operating, maintenance and security personnel, fixed station radio and television transmitters, vehicle radio transmitters, and various industrial electromagnetic sources.

In addition to electromagnetic energy deliberately generated, there is also spurious radiation caused by devices such as welders, thyristors, fluorescent lights, switches operating inductive loads, etc. For the most part, this interference manifests itself as conducted electrical interference and, as such, is dealt with in other parts of the standard. Methods employed to prevent effects from electromagnetic fields will normally also reduce the effects from these sources.

The electromagnetic environment is determined by the strength of the electromagnetic field (field strength in Volts per metre). The field strength is not easily measured without sophisticated instrumentation nor is it easily calculated by classical equations and formulae because of the effect of surrounding structures or the proximity of other equipment that will distort and/or reflect the electromagnetic waves.

4 Definitions

For the purposes of this International Standard, the following definitions, together with those in IEC 50(161) apply.

4.1 Amplitude modulation

The process by which the amplitude of a carrier wave is varied following a specified law. (IEC Multilingual dictionary of electricity).

4.2 Anechoic chamber

A shielded enclosure which is lined with radio frequency absorbers to reduce reflections from the internal surfaces. Fully lined chambers have such material on all internal surfaces. Semi-anechoic chambers have such material on all surfaces except the floor.

4.3 Antenna

A transducer which either emits radio frequency power into space from a signal source or intercepts an arriving electromagnetic field, converting it into an electrical signal.

4.4 Balun

An antenna balancing device, which facilitates use of coaxial feeds with symmetrical antennas such as a dipole.

4.5 Continuous waves (CW)

Electromagnetic waves, the successive oscillations of which are identical under steady-state conditions, which can be interrupted or modulated to convey information.

4.6 Dipole

An antenna consisting of a straight conductor (usually not more than a half-wavelength long), divided at its electrical centre for connection to a transmission line.

4.7 Electromagnetic wave

The radiant energy produced by the oscillation of an electric charge characterized by oscillation of the electric and magnetic fields.

4.8 Far field

That region where the power flux density from an antenna approximately obeys an inverse square law of the distance.

For a dipole this corresponds to distances greater than $\lambda/2\pi$ where λ is the wavelength of the radiation.

4.9 Field strength

The term 'field strength' shall be applied only to measurements made in the far field. The measurement may be of either the electric or the magnetic component of the field and may be expressed as V/m, A/m or W/m²; any one of these may be converted to the others.

NOTE. For measurements made in the near field the term 'electric field strength' or 'magnetic field strength' shall be used according to whether the resultant electric or magnetic field, respectively, is measured.

In this field region the relationship between the electric and magnetic field strength and distance is complex and difficult to predict, being dependent on the specific configuration involved. In as much as it is not generally feasible to determine the time and space phase relationship of the various components of the complex field, the power flux density of the field is similarly indeterminate.

4.10 Frequency band

A continuous range of frequencies extending between two limits.

4.11 Induction field

The predominant electric and/or magnetic field existing at a distance, $d < \lambda/2\pi$ where λ is the wavelength.

4.12 Isotropic

Having properties of equal values in all directions.

4.13 Monopole

An antenna consisting of a straight conductor (usually not more than one-quarter-wavelength long) mounted immediately above, and normal to, an imaging (ground) plane. It is connected to a transmission line at its base and behaves, with its image, like a dipole.

4.14 Polarization

A term used to describe the orientation of the electric field vector of a radiated field.

4.15 Shielded enclosure

A screened or solid metal housing designed expressly for the purpose of isolating the internal from the external electromagnetic environment.

The purpose is to prevent outside ambient electromagnetic fields from causing performance degradation and to prevent emission from causing interference to outside activities.

4.16 Stripline

Parallel plate transmission line which generates an electromagnetic field for testing purposes.

4.17 Spurious radiation

Any undesired electromagnetic emission from an electrical device.

4.18 Sweep

A continuous or incremental traverse over a range of frequencies.

4.19 Transceiver

The combination of radio transmitting and receiving equipment in a common housing.

5 Test levels

The preferential range of test levels is given in table 1.

Frequency band: 80 MHz to 1000 MHz.

Table 1	
Level	Test field strength (V/m)
1	1
2	3
3	10
x	Special

NOTE. 'x' is an open level; this level may be given in the product specification.

Table 1 gives details of the field strength of the unmodulated signal. For testing of equipment, this signal is 80 % amplitude modulated with a 1 kHz sine wave to simulate actual threats (figure 1 refers). Details of how the test is performed are given in section 8.

NOTE. IEC 801-6 also defines test methods for establishing the immunity of electrical and electronic equipment against radiated electromagnetic energy. It will cover frequencies below 80 MHz. Product committees may decide to choose a lower or higher transition frequency. (See Annex A8.)