

Guide to

Electromagnetic environment for low-frequency conducted disturbances and signalling in public power supply systems

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the General Electrotechnical Standards Policy Committee (GEL/-) to Technical Committee GEL/110, upon which the following bodies were represented:

- Association of Control Manufacturers (TACMA) (BEAMA Ltd.)
- Association of Manufacturers of Domestic Electrical Appliances
- Automated Material Handling Systems Association
- BEAMA Interactive and Mains Systems Association (BIMSA)
- BEAMA Ltd.
- British Lighting Association for the Preparation of Standards (Britlaps)
- British Radio and Electronic Equipment Manufacturers' Association
- British Telecommunications plc
- Department of Health
- Department of Transport
- EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)
- ERA Technology Ltd.
- Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
- Electricity Supply Industry in United Kingdom
- Electro Medical Trade Association Limited
- Electronic Components Industry Federation
- Engineering Equipment and Materials Users' Association
- GAMBICA (BEAMA Ltd.)
- Health and Safety Executive
- Induction and Dielectric Heating Manufacturers' Association
- Institution of Electrical Engineers
- Lighting Industry Federation Ltd.
- Ministry of Defence
- National Air Traffic Services
- National Telecommunications Ltd.
- National Transcommunications Ltd.
- Radiocommunications Agency
- Rotating Electrical Machines Association (BEAMA Ltd.)
- Society of British Gas Industries
- Society of Motor Manufacturers and Traders Limited
- Sound and Communication Industries Federation
- Transmission and Distribution Association (BEAMA Ltd.)
- United Kingdom Atomic Energy Authority

The following body was also represented in the drafting of the standard, through subcommittees and panels:

- British Steel plc

This British Standard, 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 31 October 1991

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The following BSI references relate to the work on this standard:
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Amendments issued since publication

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Publication(s) referred to	Inside back cover

National foreword

This British Standard has been prepared under the direction of the General Electrotechnical Standards Policy Committee. It is identical with IEC 1000-2-1:1990 “*Electromagnetic compatibility (EMC)*” — Part 2 “*Environment*” Section 1 “*Description of the environment — Electromagnetic environment for low-frequency conducted disturbances and signalling in public power supply systems*” which has the status of a Technical Report and is published by the International Electrotechnical Commission (IEC).

IEC 1000 will be published in separate Parts in accordance with the following structure.

Part 1: General;

General considerations (introduction, fundamental principles)

Definitions, terminology

Part 2: Environment;

Description of the environment

Classification of the environment

Compatibility levels

Part 3: Limits;

Emission limits

Immunity limits (in so far as they do not fall under the responsibility of the product committees)

Part 4: Testing and measurement techniques;

Measurement techniques

Testing techniques

Part 5: Installation and mitigation guidelines;

Installation guidelines

Mitigation methods and devices

Part 9: Miscellaneous.

Each Part will be subdivided into Sections each of which may be published as either a standard or a Technical Report.

Cross-references

International Standard	Corresponding British Standard
IEC 50 (161):1990	BS 4727 <i>Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms</i> Part 1 <i>Terms common to power, telecommunications and electronics</i> Group 09:1991 <i>Electromagnetic compatibility</i> (Identical)
IEC 555-3:1982	BS 5406 <i>Disturbances in supply systems caused by household appliances and similar electrical equipment</i> Part 3:1988 <i>Specification of voltage fluctuations</i> (Identical)
IEC 868:1986	BS 6796:1986 <i>Specification for flickermeters</i> (Identical)

The Technical Committee has reviewed the provisions of IEC 146:1985, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard. A related standard to IEC 146 is BS 4417.

IEC 38:1983 has been adopted by CENELEC as harmonized document HD 472 S1:1989 which incorporates a deviation for the low voltage public electricity supply systems in use in the UK which are 240 V and 415 V.

The provisions of IEC 1000-2-2 are currently being reviewed by CENELEC with a view to determining what common modifications are required before adoption as a European Standard (EN). This EN, when ratified, will be numbered EN 61000-2-2 and will be implemented as BS EN 61000-2-2.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 16, 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.

1 Scope

This section of IEC 1000-2 is concerned with conducted disturbances in the frequency range up to 10 kHz with an extension for mains signalling systems. Separate sections give numerical compatibility levels for different system voltage levels.

This section does not deal with the application of compatibility levels to assess, for example, the permissible interference emission from specific items of equipment or installations, because other system parameters, such as its impedance as a function of frequency, have also to be considered. Furthermore, it does not prejudice the specification of immunity levels by the product committees but merely provides a guide.

The disturbance phenomena considered are:

- harmonics;
- inter-harmonics;
- voltage fluctuations;
- voltage dips and short supply interruptions;
- voltage unbalance;
- mains signalling;
- power frequency variation;
- d.c. components.

The object of this section is to give information on the various types of disturbances that can be expected on public power supply systems. It is a reference document for those associated parts that give values of compatibility level.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this section of IEC 1000-2. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this section of IEC 1000-2 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 38:1983, *IEC standard voltages*.

IEC 50(161):1990, *International Electrotechnical Vocabulary (IEV), Chapter 161: Electromagnetic Compatibility. (Under consideration.)*.

IEC 146:1985, *Semiconductor convertors. Second impression 1985 incorporating: Supplement 146A (1974) and Amendment No. 1 (1975)*.

IEC 555-3:1982, *Disturbances in supply systems caused by household appliances and similar electrical equipment. Part 3: Voltage fluctuations*.

IEC 868:1986, *Flickermeter. Functional and design specifications*.

IEC 1000-2-2:1990, *Electromagnetic compatibility (EMC). Part 2: Environment. Section 2: Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*.

3 Definitions

The definitions are taken from IEC 50(161): International Electrotechnical Vocabulary (IEV), Chapter 161: Electromagnetic compatibility.

The relevant basic definitions are:

3.1

electromagnetic compatibility; EMC (abbreviation) (IEV 161-01-07)

the ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

3.2

(electromagnetic) compatibility level (IEV 161-03-10)

the specified maximum electromagnetic disturbance level expected to be impressed on a device, equipment or system operated in particular conditions

NOTE In practice the electromagnetic compatibility level is not an absolute maximum level, but may be exceeded with a small probability.

3.3

electromagnetic disturbance (IEV 161-01-05)

any electromagnetic phenomenon which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter

NOTE An electromagnetic disturbance may be an electromagnetic noise, an unwanted signal or a change in the propagation medium itself.

3.4

disturbance level (not defined in IEV 161)

the value of a given electromagnetic disturbance, measured in a specified way

3.5

limit of disturbance (IEV 161-03-08)

the maximum permissible electromagnetic disturbance level, as measured in a specified way

3.6

immunity level (IEV 161-03-14)

the maximum level of a given electromagnetic disturbance incident on a particular device, equipment or system for which it remains capable of operating at a required degree of performance

3.7

(Electromagnetic) susceptibility (IEV 161-01-21)

the inability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

NOTE Susceptibility is a lack of immunity.

4 Purpose of specifying electromagnetic compatibility levels

NOTE An interpretation of the basic definitions for practical application in IEC is in preparation. The main results are considered in this clause.

From the definition of electromagnetic compatibility level it can be seen that it is a reference value by means of which the disturbance level on the system and the immunity level for various equipment types can be coordinated.

For practical purposes the “limit of disturbance” is the maximum disturbance level appearing with a certain probability in the electromagnetic environment of a device, equipment or system. This is the reference value to which the other levels have to be related, in order to avoid causing interference.

In some cases, this maximum disturbance level is the result of the superposition of several sources (e.g. harmonics), in other cases it is produced by a single source (e.g. non-repetitive voltage dip).

It must be emphasized that in general, the disturbance level is not a single value, but varies with position and time. In practice, the statistical distribution of the disturbance must be considered.

The maximum disturbance level may be derived from actual network measurements or, possibly, theoretical study.

Because of this variability of the disturbance level, it is often very difficult or even impossible to determine the actual highest level of disturbance which may appear very infrequently. It is also generally not economical to define the compatibility level in terms of this highest value to which most devices would not be exposed most of the time.

It therefore seems appropriate to define the compatibility level not as the “maximum value” of a disturbance but as the level of the disturbance that would be exceeded in only a small or very small number of cases — the aim being for the compatibility level to cover at least 95 % or so of situations.

The immunity level of equipment should be equal to the compatibility level or higher.

The immunity level has to be checked by an appropriate test. Determining its value and the test procedure is the responsibility of a relevant Technical Committee (or is subject to agreement between the parties involved).

The susceptibility level of equipment is the level of disturbance which would disturb the function of the equipment. It should be equal to, or higher than, the immunity level fixed for the tests.