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Electromagnetic compatibility (EMC) - Part 3: Limits - Section 8: Signalling on low-voltage electrical installations - Emission levels, frequency bands and electromagnetic disturbance levels

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Electromagnetic compatibility (EMC) –

Part 3:
Limits –
Section 8: Signalling on low-voltage electrical installations – Emission levels, frequency bands and electromagnetic disturbance levels

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

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FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
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6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International standard IEC 61000-3-8 has been prepared by subcommittee 77B: High-frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

The text of this standard is based on the following documents:

FDIS	Report on voting
77B/187/FDIS	77B/202/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annex A forms an integral part of the standard.

Annex B is for information only.

INTRODUCTION

This standard is part of the IEC 61000 series, according to the following structure:

Part 1: General

General consideration (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 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into sections which are to be published either as international standards or as technical reports.

This section is an international standard which gives requirements related to emission levels, frequency bands and electromagnetic disturbance levels for signalling on low-voltage electrical installations.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3: Limits –

Section 8: Signalling on low-voltage electrical installations – Emission levels, frequency bands and electromagnetic disturbance levels

1 Scope

This section of IEC 61000-3 applies to electrical equipment using signals in the frequency range from 3 kHz up to 525 kHz to transmit information on low-voltage electrical installations, either on the public supply system or within customers' premises.

It specifies frequency bands allocated to different applications (where appropriate), limits for the terminal output voltage in the operating band and limits for conducted and radiated disturbance. It also gives the methods of measurement.

It specifies disturbance limits in the frequency range from 3 kHz up to 400 GHz.

It does not specify the signal modulation methods nor the coding methods, nor functional features.

Environmental requirements and tests are not included.

NOTE – Compliance with this standard does not imply permission to establish communications with locations outside the customer's installation or with other customers through the public supply system where this would otherwise not be allowed.

2 Normative references1

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 61000-3. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 61000-3 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(60): 1970, *International Electrotechnical Vocabulary (IEV) – Chapter 60: Radio-communications*

IEC 60050(161): 1990, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electro-magnetic compatibility*

CISPR 14: 1993, *Limits and methods of measurement of radio disturbance characteristics of electrical motor-operated and thermal appliances for household and similar purposes, electric tools and electric apparatus*

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

CISPR 16-2: 1996, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2: Méthods of measurement of disturbances and immunity*

CISPR 22: 1993, *Limits and methods of measurement of radio disturbance characteristics of information technology equipment*

3 General

The objects of this section are twofold:

– to prevent interference by mains signalling equipment to radiocommunications services and other equipment connected to the network;

– to limit mutual interference between differing mains signalling equipments connected to the same electrical network.

With regard to the former object and above 150 kHz, limits for maximum output terminal voltage for household equipment are given in CISPR 14, and for information technology equipment are given in CISPR 22. Neither of these specifically apply to mains signalling equipment, but they have been used as guidance for the maximum output levels specified in this section. However, it should be pointed out that the CISPR is concerned with involuntary emissions whereas mains signalling is deliberate emission and, with some methods of signalling, the signal level needs to be above the possible noise level in order to achieve signalling success.

Below 150 kHz, there is no guidance and the values specified are considered appropriate and consistent with the CISPR principles. Another factor at any frequency band is that there may be, in some countries, regulatory guidelines for maximum emission levels for signalling which must be observed.

With regard to the latter object, three classes of technique may be used to limit mutual interference between different signalling systems:

a) physical separation, separation by means of filters to limit interchange of emissions, or differential signal injection systems;

b) separation by frequency bands allocated to different types of application;

c) agreement to a common protocol, with identified and separate addressing mechanisms for different applications to avoid contention.

The general rules for the assignment and use of frequencies in the range from 9 kHz to 400 GHz by radiocommunication services and definitions of these services are specified in the ITU radio regulations which contain a table of frequency allocations. This standard takes these allocations into account where it defines frequency bands for different applications, in order to avoid disturbances to radiotelecommunications services. However, in the event of actual disturbance being caused, then additional precautions will need to be applied. The ITU regulations specify three regions, and frequency allocations vary between these regions.

Where requirements in specific regions having equipment within the scope of this section are known to differ from values stated, this is recorded by means of a note (as in clause 7). However, omission of such a note does not imply that frequency bands, output voltages, or conducted or radiated disturbance values stated are necessarily acceptable in these regions.

In ITU region 1, AM broadcasting bands begin above 148,5 kHz, and to optimise the use of the range in which mains signalling is allowed, and taking into account that there is no protocol common to electricity supplier and customer applications, the CENELEC countries have adopted the approach of b) and have agreed separate frequency bands for supplier/customer use. All clauses of this section therefore apply, and care is required with out of band emissions within the band(s) available for other equipment in order to limit the possibility of mutual interference.

In ITU regions 2 and 3, AM broadcasting begins at 525 kHz and 526,5 kHz respectively. Frequency band allocation for mains signalling is not employed and the methods used to limit mutual interference may fall outside the scope of this section, particularly where protocols need to be defined. In these regions, clause 5 will not apply and, as regards clause 7, out of band emissions within the band available for mains signalling may not be relevant in that they cannot interfere with radiocommunications services. However, consideration shall be given to possible interference with other equipment connected to the mains, and the relevant values given in clause 6 should be observed.

NOTE – In the United States, the Federal Communications Commission is to allow mains signalling at frequencies above which AM broadcasting begins (in the band 535 kHz to 1 705 kHz), albeit with restrictions on maximum output levels. This is a special case and is not covered by this section.

Common-mode injection shall not be used unless otherwise explicitly allowed in local regulations (see also clause 9).

4 Definitions

For the purpose of this section, the definitions of IEC 60050(60) and IEC 60050(161) apply.

5 Frequency bands (ITU region 1 only)

Under consideration in ITU region 3.

5.1 *Band 3 kHz up to 9 kHz*

The use of frequencies in this band shall be restricted to electricity suppliers.

However, frequencies in this band may be used for signalling in customers' installations in cases and under conditions authorized by the electricity supplier.

5.2 *Band 9 kHz up to 95 kHz*

The use of frequencies in this band shall be restricted to electricity suppliers and their licensees.

5.3 *Band above 95 kHz*

The use of frequencies in this band shall be restricted for customer use only.

6 Transmitter output signal voltage

Under consideration in ITU region 3.

6.1 *Maximum output signal levels*

6.1.1 *Band 3 kHz up to 9 kHz*

a) Differential mode equipment

134 dB(µV) when measured according to 6.2.1 a).

b) Common-mode equipment

134 dB(µV) into the customer network and 89 dB(µV) into the electricity supplier network at the signal injection system when measured according to 6.2.1 b). See also clause 9.

6.1.2 *Band 9 kHz up to 95 kHz*

The signal is considered as a narrow band signal if its bandwidth is less than 5 kHz and as a wide band signal if the bandwidth is equal to or greater than 5 kHz. The signal bandwidth shall be measured according to 6.3.

a) Narrow band signals:

134 dB(μV) at 9 kHz decreasing linearly with the logarithm of frequency to 120 dB(μV) at 95 kHz when measured according to 6.2.2.

b) Wide band signals:

134 dB(μV) when measured according to 6.2.2.

In addition, no part of the spectrum of the signal shall exceed 120 dB(μV) measured with a peak detector with 200 Hz bandwidth.

6.1.3 *Band 95 kHz up to 148,5 kHz*

The output level measured according to 6.2.2 shall be limited according to the use of the equipment as follows:

a) For general use: 116 dB(μV).

Equipment that satisfies this output level limit shall be designated as "class 116 equipment".

b) For particular application (e.g. industrial areas): 134 dB(μV).

Equipment that satisfies this output level limit shall be designated as "class 134 equipment".

NOTE – The use of class 134 equipment may require prior notification to, or consent of, appropriate authorities.

6.1.4 *Band 148,5 kHz up to 500 kHz*

Decreasing linearly with the logarithm of the frequency from 66 dB(μV) to 56 dB(μV) r.m.s. at 500 kHz.

6.1.5 *Band 500 kHz to 525 kHz*

56 dB(μV).

6.2 *Output signal measurement*

For all measurement methods, an artificial mains network is used. Details of networks suitable for various frequency bands are given in annex A.

NOTE – In the case of differential mode transmitters, the measured output for the purposes of 6.1 is 6 dB below the true differential output.

6.2.1 *Band 3 kHz up to 9 kHz*

Measurements shall be made as follows:

a) Differential mode equipment:

With the device connected as shown in figure 1 the output level shall be measured at points A and A1 with respect to earth.

b) Common-mode equipment:

With the device connected as shown in figure 2 the output level into the customer network shall be measured at points B and B1 with respect to earth, and into the electricity supplier network it shall be measured differentially between points A and A1.

6.2.2 *Bands above 9 kHz*

Measurements shall be made as follows:

a) Differential mode equipment:

For differential mode equipment operated continuously the output voltage shall be measured over a period of 1 min with a peak detection receiver on an artificial network of (50 Ω/50 µH + 5 Ω) conforming to subclause 11.2 of CISPR 16-1. A spectrum analyzer having a bandwidth equal to or larger than the output spectrum of the transmitter is suitable for this measurement.

b) Common mode equipment:

Under consideration.

6.3 *Determination of bandwidth*

The output signal spectrum referred to in 6.1.2 and 6.2.2 a) is determined by the use of a spectrum analyzer having a peak detector and a 100 Hz bandwidth.

The transmitter shall operate in such a way that the bandwidth and output signal magnitude have the greatest values permitted by the manufacturer's specification.

The spectral width (B in Hz) is defined by the length of the interval where all the frequency lines are less than 20 dB below the maximum spectral line (see figure 3).

6.4 *Marking of the output level class*

The output level class shall be marked on the equipment.

7 Disturbance and interference limits

Under consideration in ITU region 3.

The limits given below apply to frequencies outside the band, as listed in 6.1.1, 6.1.2, 6.1.3, 6.1.4 and 6.1.5, in which the signalling equipment operates. For the purpose of disturbance measurements, bands given in 6.1.1 and 6.1.2 shall be considered as one band. The test conditions shall be those given in clause 8.

NOTE – The limits have been chosen to conform with limits already agreed or under consideration by CISPR to protect radiocommunication services.

For the frequency range above 9 kHz the measuring receiver shall conform to CISPR 16-1. For the frequency band 3 kHz up to 9 kHz the measuring receiver shall be a narrow band peak detector with a bandwidth of 100 Hz.

7.1 *Limits of conducted disturbance*

The method of measurement shall be that described in CISPR 16-2. Details of suitable artificial mains networks for various frequency bands are given in annex A.

7.1.1 *Frequency range 3 kHz up to 9 kHz*

Not greater than 89 dB(µV) peak.

NOTE – For equipment in this band used on consumers' premises, this level will also apply to in-band interference measured at the point of supply to the consumers premises with the measurement carried out according to 6.2.1.