

Electromagnetic compatibility (EMC) —

**Part 4-13: Testing and measurement
techniques — Harmonics and
interharmonics including mains
signalling at a.c. power port, low
frequency immunity tests
(IEC 61000-4-13:2002)**

ICS 33.100.20

National foreword

This British Standard is the UK implementation of EN 61000-4-13:2002+A2:2016. It is identical to IEC 61000-4-13:2002, incorporating amendment 1:2009 and amendment 2:2015. It supersedes BS EN 61000-4-13:2002+A1:2009 which will be withdrawn on 18 January 2019.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by A1 A1.

The UK participation in its preparation was entrusted by Technical Committee GEL/210, EMC-Policy committee, to Subcommittee GEL/210/11, EMC - Standards Committee.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Electromagnetic compatibility (EMC)
Part 4-13: Testing and measurement techniques -
Harmonics and interharmonics including mains signalling
at a.c. power port, low frequency immunity tests
(IEC 61000-4-13:2002)

Compatibilité électromagnétique (CEM)
Partie 4-13: Techniques d'essai
et de mesure -
Essais d'immunité basse fréquence
aux harmoniques et inter-harmoniques
incluant les signaux transmis
sur le réseau électrique alternatif
(CEI 61000-4-13:2002)

Elektromagnetische Verträglichkeit (EMV)
Teil 4-13: Prüf- und Messverfahren -
Prüfungen der Störfestigkeit
am Wechselstrom-Netzanschluss
gegen Oberschwingungen
und Zwischenharmonische einschließlich
leitungsgeführter Störgrößen
aus der Signalübertragung
auf elektrischen Niederspannungsnetzen
(IEC 61000-4-13:2002)

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CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 77A/368/FDIS, future edition 1 of IEC 61000-4-13, prepared by SC 77A, Low frequency phenomena, of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61000-4-13 on 2002-05-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2003-02-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2005-05-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

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

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61000-4-13:2002 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068-1	NOTE	Harmonized as EN 60068-1:1994 (not modified).
IEC 61000-2-4	NOTE	Harmonized as EN 61000-2-4:1994 (not modified).

Foreword to amendment A1

The text of document 77A/668/CDV, future amendment 1 to IEC 61000-4-13:2002, prepared by SC 77A, Low frequency phenomena, of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 61000-4-13:2002 on 2009-07-01.

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Endorsement notice

The text of amendment 1:2009 to the International Standard IEC 61000-4-13:2002 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A2

The text of document 77A/904/FDIS, future IEC 61000-4-13:2002/A2, prepared by SC 77A, "EMC -Low-frequency phenomena", of IEC TC 77, "Electromagnetic compatibility" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61000-4-13:2002/A2:2016.

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- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2019-01-18

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61000-4-13:2002/A2:2015 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

IEC 61000 is published in separate parts according to 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 6: Generic Standards

Part 9: Miscellaneous

Each part is further subdivided into several parts, published either as International Standards or as technical specifications or technical reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and a second number identifying the subdivision (example: 61000-6-1).

This part is an EMC basic standard which gives immunity requirements and test procedures related to harmonics and interharmonics including mains signalling at a.c. power port.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests

1 Scope and object

This part of IEC 61000 defines the immunity test methods and range of recommended basic test levels for electrical and electronic equipment with rated current up to 16 A per phase at disturbance frequencies up to and including 2 kHz (for 50 Hz mains) and 2,4 kHz (for 60 Hz mains) for harmonics and interharmonics on low voltage power networks.

It does not apply to electrical and electronic equipment connected to 16 2/3 Hz, or to 400 Hz a.c. networks. Tests for these networks will be covered by future standards.

The object of this standard is to establish a common reference for evaluating the functional immunity of electrical and electronic equipment when subjected to harmonics and interharmonics and mains signalling frequencies. The test method documented in this part of IEC 61000 describes a consistent method to assess the immunity of an equipment or system against a defined phenomenon. As described in IEC guide 107, this is a basic EMC publication for use by product committees of the IEC. As also stated in Guide 107, the IEC product committees are responsible for determining whether this immunity test standard should be applied or not, and if applied, they are responsible for determining the appropriate test levels and performance criteria. TC 77 and its sub-committees are prepared to co-operate with product committees in the evaluation of the value of particular immunity tests for their products.

The verification of the reliability of electrical components (for example capacitors, filters, etc.) is not in the scope of the present standard. Long term thermal effects (greater than 15 min) are not considered in this standard.

The levels proposed are more adapted for residential, commercial and light industry environments. For heavy industrial environments the product committees are responsible for the definition of a class X with the necessary levels. They have also the possibility of defining more complex waveforms for their own need. Nevertheless, the simple waveforms proposed have been mainly observed on several networks (flat curve more often for single phase system) and also on industrial networks (overswing curve more for three phase systems).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050(161), *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

IEC 61000-2-2, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

IEC 61000-4-7, *Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques – General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto*

3 Definitions

For the purposes of this part of IEC 61000, the following definitions and terms apply as well as the definitions of IEC 60050(161):

3.1

immunity

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

[IEV 161-01-20]

3.2

harmonic (component)

component of order greater than 1 of the Fourier series of a periodic quantity

[IEV 161-02-18]

3.3

fundamental (component)

component of order 1 of the Fourier series of a periodic quantity

[IEV 161-02-17]

3.4

flat curve waveshape

waveform that follows a time related function in which each half-wave consists of three parts:

Part 1: starts from zero and follows a pure sine function up to the specified value;

Part 2: is a constant value;

Part 3: follows a pure sine function down to zero

3.5

overswing waveshape

waveform which consists of discrete values of the fundamental harmonic, the 3rd and the 5th harmonics with the specified phase shift

3.6

f_1

fundamental frequency

3.7

mains signalling frequencies

signal frequencies between harmonics for control and communication

3.8

EUT

equipment under test

4 General

4.1 Description of the phenomenon

4.1.1 Harmonics

Harmonics are sinusoidal voltages and currents with frequencies that are integer multiples of the frequency at which the supply system operates.

Harmonic disturbances are generally caused by equipment with non-linear voltage – current characteristics or by periodic and line-synchronised switching of loads. Such equipment may be regarded as sources of harmonic currents.

The harmonic currents from the different sources produce harmonic voltage drops across the impedance of the network.

As a result of cable capacitance, line inductance and the connection of power factor correction capacitors, parallel or series resonance may occur in the network and cause a harmonic voltage amplification even at a remote point from the distorting load. The waveforms proposed are the result of the summation of different harmonic orders of one or several harmonic sources.

4.1.2 Interharmonics

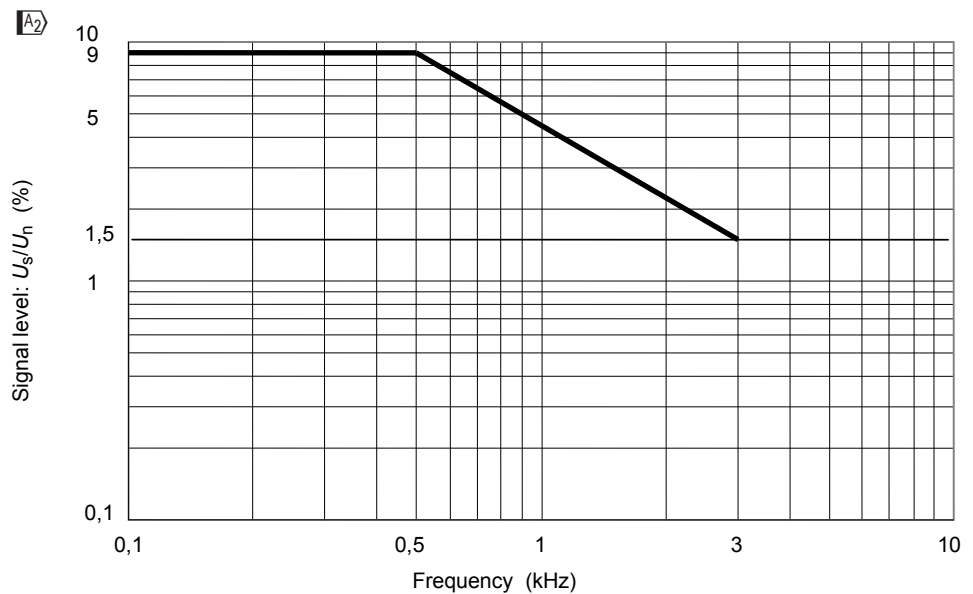
Between the harmonics of the power frequency voltage and current, further frequencies can be observed which are not an integer multiple of the fundamental. They can appear as discrete frequencies or as a wide-band spectrum. Summation of different interharmonic sources is not likely and is not taken into account in this standard.

4.1.3 Mains signalling (ripple control)

Signal frequencies ranging from A_2 100 Hz to 3 kHz A_2 used in networks or parts of them in order to transfer information from a sending point to one or more receiving points.

For the scope of this standard, the frequency range is limited to A_2 2,4 kHz A_2 (2,4 kHz/60 Hz).

A_2 For the Meister curve, see Figure 8. A_2



IEC

NOTE The figure is taken from IEC 61000-2-2:2007, Figure 3.

Figure 8 – Meister curve for ripple control systems in public networks (100 Hz to 3 000 Hz)

4.2 Sources

4.2.1 Harmonics

Harmonic currents are generated to a small extent by generation, transmission and distribution equipment and to a greater extent by industrial and residential loads. Sometimes, there are only a few sources generating significant harmonic currents in a network; the individual harmonic level of the majority of the other devices is low, nevertheless these may make a relatively high contribution to the harmonic voltage distortion, at least for low order harmonics due to their summation.

Significant harmonic currents in a network can be generated by non-linear loads, for example:

- controlled and uncontrolled rectifiers, especially with capacitive smoothing (for example used in television, indirect and direct static frequency converters, and self-ballasted lamps), because these harmonics are in approximately the same phase from different sources and there is only poor compensation in the network;
- phase controlled equipment, some types of computers and UPS equipment.

Sources may produce harmonics at a constant or varying level, depending on the method of operation.