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Edition 5.1 2020-07
CONSOLIDATED VERSION

INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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REDLINE VERSION



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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC 61000-3-2
Edition 5.0 2018-01
Amendment 1 2020-07

ELECTROMAGNETIC COMPATIBILITY (EMC) –

**Part 3-2: Limits – Limits for harmonic current emissions
(equipment input current ≤ 16 A per phase)**

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by subcommittee 77A: EMC – Low frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

The text of this interpretation sheet is based on the following documents:

DISH	Report on voting
77A/1106/DISH	77A/1114/RVDISH

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

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

Interpretation of the second set of requirements applicable to Class C equipment with a rated power ≥ 5 W and ≤ 25 W according to 7.4.3 of IEC 61000-3-2:2018 and IEC 61000-3-2:2018/AMD1:2020.

Introduction

The second set of requirements of 7.4.3 of IEC 61000-3-2:2018 and IEC 61000-3-2:2018/AMD1:2020 requires that *“the waveform of the input current shall be such that it reaches the 5 % current threshold before or at 60°, has its peak value before or at 65° and does not fall below the 5 % current threshold before 90°, referenced to any zero crossing of the fundamental supply voltage”* and that *“Components of current with frequencies above 9 kHz shall not influence this evaluation (a filter similar to the one described in 5.3 of IEC 61000-4-7:2002 and IEC 61000-4-7:2002/AMD1:2008 may be used);”*

Testing laboratories and Class C equipment manufacturers concluded that several harmonics test systems with IEC 61000-4-7 compliant measurement equipment do not completely filter out the components of current with frequencies above 9 kHz, thus resulting in a non-accurate evaluation of the phase angles (see Figure 1). One of the reasons why filters are not used is that they can alter the phase angle itself by introducing a phase delay.

Question

When applying the second set of requirements in 7.4.3, what method shall be used to measure the phase angle in order to avoid the influence of components of current with frequencies above 9 kHz?

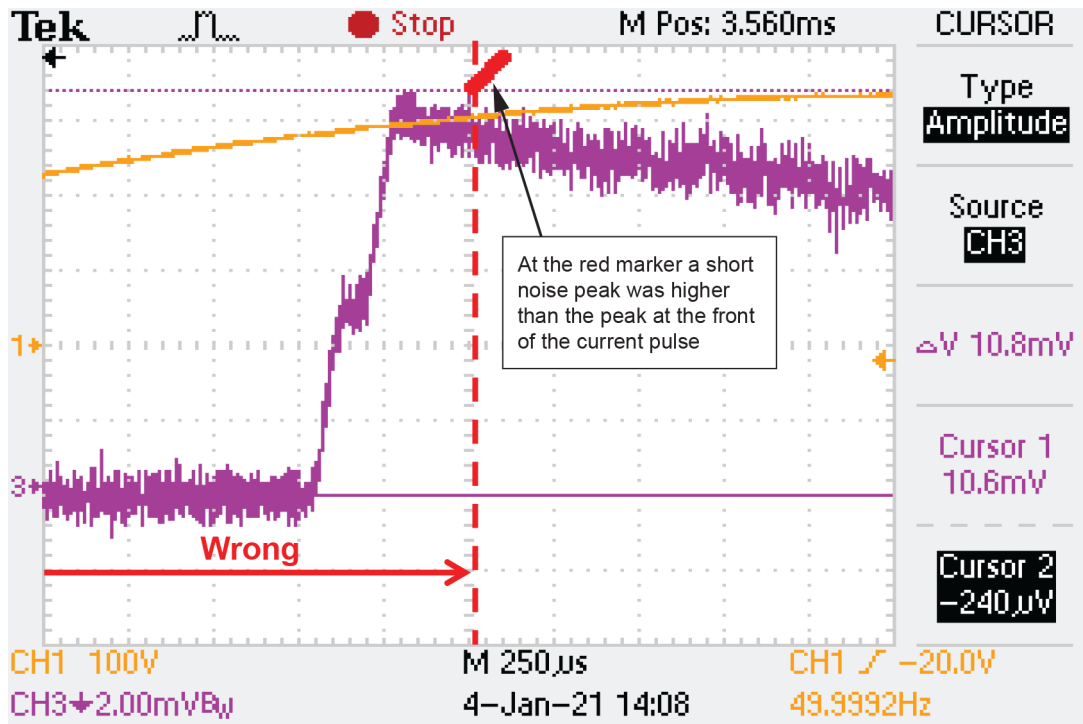
Interpretation

Given the issues reported by test laboratories, if the phase angle is measured with an IEC 61000-4-7 test system that doesn't remove the components above 9 kHz correctly, the measurements with a digital oscilloscope shall prevail, where the components above 9 kHz have been removed without affecting the phase angle at which the peak current occurs.

NOTE This can be achieved for example by using a synchronous averaging mode of the oscilloscope (see Figure 2).

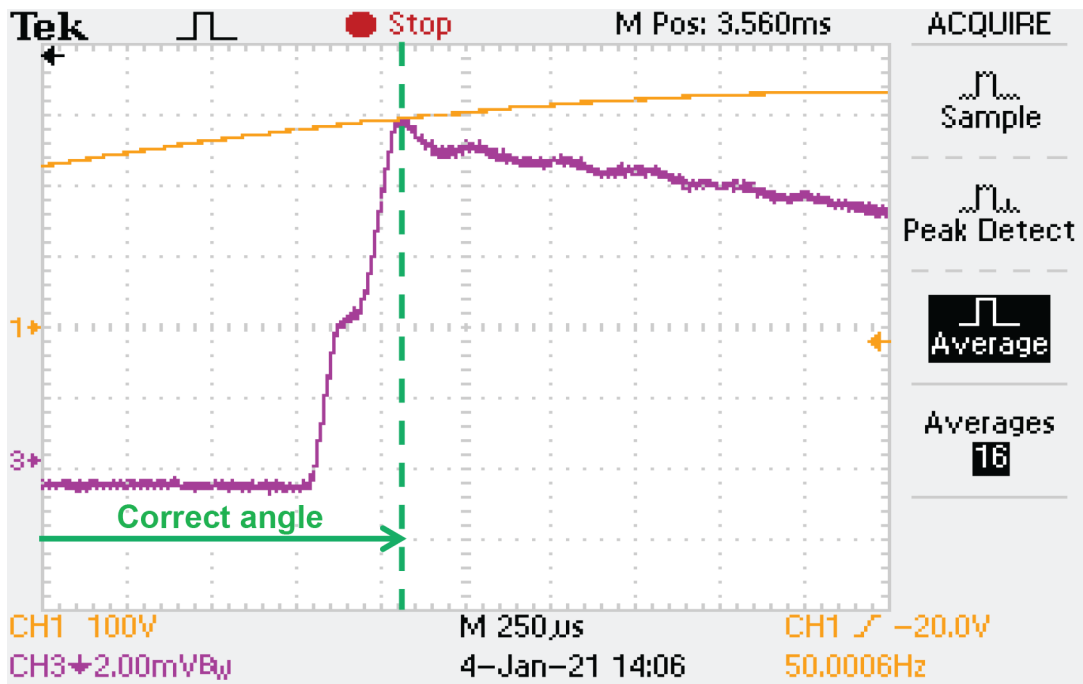
Annex

Figure 1 and Figure 2 show an incorrect and the correct evaluation of the phase angle.



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Figure 1 – Incorrect measurement



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Figure 2 – Correct measurement with averaged waveform

CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope	7
2 Normative references	7
3 Terms and definitions	8
4 General	13
5 Classification of equipment	13
5.1 General	13
5.2 Description of lighting equipment	14
5.3 External power supplies	14
6 General requirements	15
6.1 General	15
6.2 Control methods	15
6.3 Harmonic current measurement	17
6.3.1 Test configuration	17
6.3.2 Measurement procedure	17
6.3.3 General requirements	18
6.3.4 Test observation period	19
6.4 Equipment in a rack or case	19
6.5 Multifunction equipment	20
7 Harmonic current limits	20
7.1 General	20
7.2 Limits for Class A equipment	21
7.3 Limits for Class B equipment	22
7.4 Limits for Class C equipment	22
7.4.1 General	22
7.4.2 Rated power > 25 W	22
7.4.3 Rated power ≥ 5 W and ≤ 25 W	23
7.5 Limits for Class D equipment	24
8 Compliance with this document	25
Annex A (normative) Measurement circuit and supply source	26
A.1 Test circuit	26
A.2 Supply source	26
Annex B (normative) Type test conditions	29
B.1 General	29
B.2 Test conditions for Television receivers (TV)	29
B.2.1 General requirements	29
B.2.2 Measurement conditions	29
B.2.3 Test report	30
B.3 Test conditions for Audio amplifiers	30
B.3.1 Conditions	30
B.3.2 Input signals and loads	30
B.4 Test conditions for Video-cassette recorders	31
B.5 Test conditions for Lighting equipment	31
B.5.1 General conditions	31

B.5.2	Lamps Light sources.....	31
B.5.3	Luminaires.....	31
B.5.4	Lighting control gear.....	32
B.5.5	DLT control devices.....	33
B.6	Test conditions for Independent phase control dimmers for lighting equipment.....	33
B.7	Test conditions for Vacuum cleaners.....	33
B.8	Test conditions for Washing machines.....	34
B.9	Test conditions for Microwave ovens.....	34
B.10	Test conditions for Information technology equipment (ITE).....	34
B.10.1	General conditions.....	34
B.10.2	Optional conditions for measuring emissions of IT equipment with external power supplies or battery chargers	35
B.11	Test conditions for Cooking appliances.....	35
B.11.1	Induction hobs and hotplates.....	35
B.11.2	Hobs and hotplates other than induction cooking appliances.....	36
B.12	Test conditions for Air conditioners.....	36
B.13	Test conditions for Kitchen machines as defined in IEC 60335-2-14.....	36
B.14	Test conditions for Arc welding equipment which is not professional equipment.....	37
B.15	Test conditions for High pressure cleaners which are not professional equipment.....	37
B.16	Test conditions for Refrigerators and freezers.....	37
B.16.1	General.....	37
B.16.2	Refrigerators and freezers with VSD.....	38
B.16.3	Refrigerators and freezers without VSD.....	38
B.17	External power supplies (EPS).....	38
B.17.1	EPS designated for specific models of equipment.....	38
B.17.2	EPS not designated for specific models of equipment.....	38
Annex C (normative)	POHC calculation.....	40
C.1	General.....	40
C.2	Calculation of the POHC from the final values of the harmonic currents, averaged over the complete observation time.....	40
C.3	Calculation of the final POHC from single POHC values for each DFT time window.....	40
Bibliography	41
Figure 1	– Flowchart for determining conformity.....	21
Figure 2	– Illustration of the relative phase angle and current parameters described in 7.4.3.....	23
Figure A.1	– Measurement circuit for single-phase equipment.....	27
Figure A.2	– Measurement circuit for three-phase equipment.....	28
Table 1	– Limits for Class A equipment.....	24
Table 2	– Limits for Class C equipment ^a	24
Table 3	– Limits for Class D equipment.....	25
Table 4	– Test observation period.....	25
Table B.1	– Conventional load for arc welding equipment tests.....	37

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

FOREWORD

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- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 61000-3-2 edition 5.1 contains the fifth edition (2018-01) [documents 77A/986/FDIS and 77A/990/RVD] and its amendment 1 (2020-07) [documents 77A/1077/FDIS and 77A/1084/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 61000-3-2 has been prepared by sub-committee 77A: EMC – Low frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

It forms part 3-2 of the IEC 61000 series. It has the status of a product family standard.

This fifth edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) an update of the emission limits for lighting equipment with a rated power ≤ 25 W to take into account new types of lighting equipment;
- b) the addition of a threshold of 5 W under which no emission limits apply to all lighting equipment;
- c) the modification of the requirements applying to the dimmers when operating non-incandescent lamps;
- d) the addition of test conditions for digital load side transmission control devices;
- e) the removal of the use of reference lamps and reference ballasts for the tests of lighting equipment;
- f) the simplification and clarification of the terminology used for lighting equipment;
- g) the classification of professional luminaires for stage lighting and studios under Class A;
- h) a clarification about the classification of emergency lighting equipment;
- i) a clarification for lighting equipment including one control module with an active input power ≤ 2 W;
- j) an update of the test conditions for television receivers;
- k) an update of the test conditions for induction hobs, taking also into account the other types of cooking appliances;
- l) for consistency with IEC 61000-3-12, a change of the scope of IEC 61000-3-2 from equipment with an input current ≤ 16 A to equipment with a rated input current ≤ 16 A.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61000 series, published under the general title, *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The contents of the Interpretation sheet of August 2021 have been included in this copy. Apply to the English version only.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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 ~~levels~~ 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: IEC 61000-6-1).

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

1 Scope

This part of IEC 61000 deals with the limitation of harmonic currents injected into the public supply system.

It specifies limits of harmonic components of the input current which can be produced by equipment tested under specified conditions.

This part of IEC 61000 is applicable to electrical and electronic equipment having a rated input current up to and including 16 A per phase, and intended to be connected to public low-voltage distribution systems.

Arc welding equipment, which is not professional equipment, with a rated input current up to and including 16 A per phase, is included in the scope of this document. ~~Arc welding equipment intended for professional use, as specified in IEC 60974-1, is excluded from this document and can be subject to installation restrictions as indicated in IEC 61000-3-12.~~ All other arc welding equipment is excluded from the scope of this document; however, the harmonics emission can be evaluated using IEC 61000-3-12 and relevant installation restrictions.

The tests according to this document are type tests.

For systems with nominal voltages less than but not equal to 220 V (line-to-neutral), the limits have not yet been considered.

NOTE The words apparatus, appliance, device and equipment are used throughout this document. They have the same meaning for the purposes of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60050-161:1990, *International Electrotechnical Vocabulary (IEV) – Part 161: Electromagnetic compatibility* (available at www.electropedia.org)

IEC 60107-1:1997, *Methods of measurement on receivers for television broadcast transmissions – Part 1: General considerations – Measurements at radio and video frequencies*

IEC 60155:1993, *Glow-starters for fluorescent lamps*

IEC 60268-1:1985, *Sound system equipment – Part 1: General*
IEC 60268-1:1985/AMD1:1988
IEC 60268-1:1985/AMD2:1988

IEC 60268-3:2018, *Sound system equipment – Part 3: Amplifiers*

IEC 60335-2-2:2019, *Household and similar electrical appliances – Safety – Part 2-2: Particular requirements for vacuum cleaners and water-suction cleaning appliances*

IEC 60335-2-14:2016, *Household and similar electrical appliances – Safety – Part 2-14: Particular requirements for kitchen machines*

IEC 60335-2-24:2010, *Household and similar electrical appliances – Safety – Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice makers*
IEC 60335-2-24:2010/AMD1:2012
IEC 60335-2-24:2010/AMD2:2017

IEC 60335-2-79:2016, *Household and similar electrical appliances – Safety – Part 2-79: Particular requirements for high pressure cleaners and steam cleaners*

IEC 60598-2-17:2012, *Luminaires – Part 2-17: Particular requirements – Luminaires for stage lighting, television and film studios (outdoor and indoor)*
IEC 60598-2-17:2012/AMD1:2015

IEC 60974-1:2017, *Arc welding equipment – Part 1: Welding power sources*

IEC 61000-4-7:2002, *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*
IEC 61000-4-7:2002/AMD1:2008

IEC 62756-1:2015, *Digital load side transmission lighting control (DLT) – Part 1: Basic requirements*

FINAL VERSION



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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC 61000-3-2
Edition 5.0 2018-01
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Interpretation of the second set of requirements applicable to Class C equipment with a rated power ≥ 5 W and ≤ 25 W according to 7.4.3 of IEC 61000-3-2:2018 and IEC 61000-3-2:2018/AMD1:2020.

Introduction

The second set of requirements of 7.4.3 of IEC 61000-3-2:2018 and IEC 61000-3-2:2018/AMD1:2020 requires that *“the waveform of the input current shall be such that it reaches the 5 % current threshold before or at 60°, has its peak value before or at 65° and does not fall below the 5 % current threshold before 90°, referenced to any zero crossing of the fundamental supply voltage”* and that *“Components of current with frequencies above 9 kHz shall not influence this evaluation (a filter similar to the one described in 5.3 of IEC 61000-4-7:2002 and IEC 61000-4-7:2002/AMD1:2008 may be used);”*

Testing laboratories and Class C equipment manufacturers concluded that several harmonics test systems with IEC 61000-4-7 compliant measurement equipment do not completely filter out the components of current with frequencies above 9 kHz, thus resulting in a non-accurate evaluation of the phase angles (see Figure 1). One of the reasons why filters are not used is that they can alter the phase angle itself by introducing a phase delay.

Question

When applying the second set of requirements in 7.4.3, what method shall be used to measure the phase angle in order to avoid the influence of components of current with frequencies above 9 kHz?

Interpretation

Given the issues reported by test laboratories, if the phase angle is measured with an IEC 61000-4-7 test system that doesn't remove the components above 9 kHz correctly, the measurements with a digital oscilloscope shall prevail, where the components above 9 kHz have been removed without affecting the phase angle at which the peak current occurs.

NOTE This can be achieved for example by using a synchronous averaging mode of the oscilloscope (see Figure 2).

Annex

Figure 1 and Figure 2 show an incorrect and the correct evaluation of the phase angle.

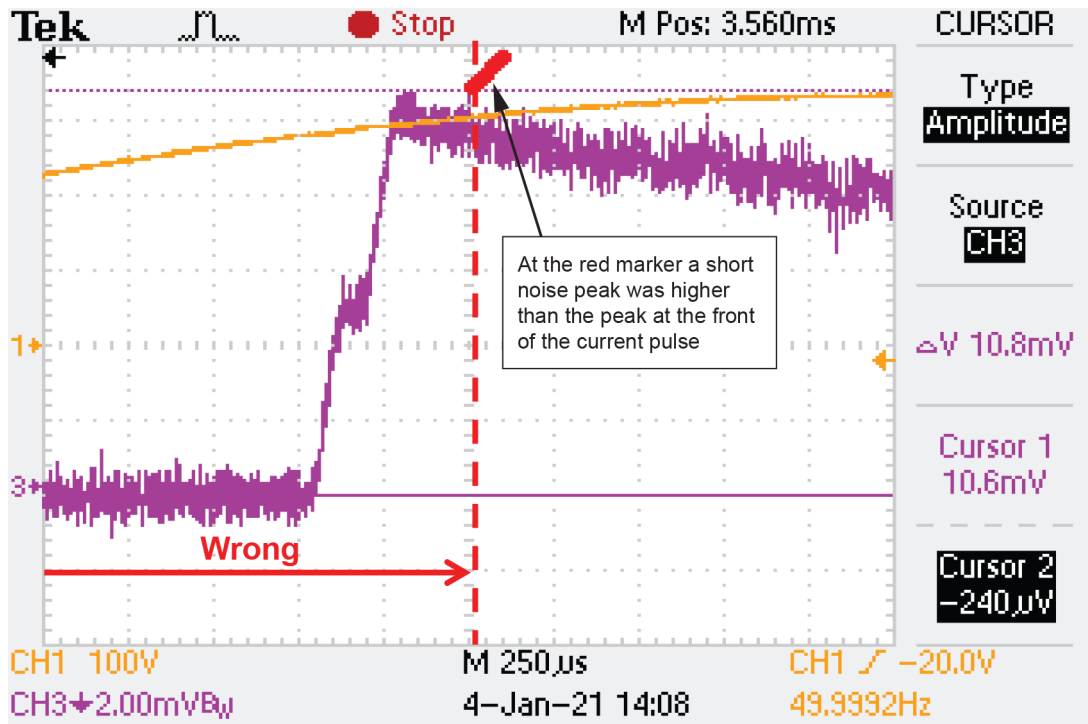


Figure 1 – Incorrect measurement

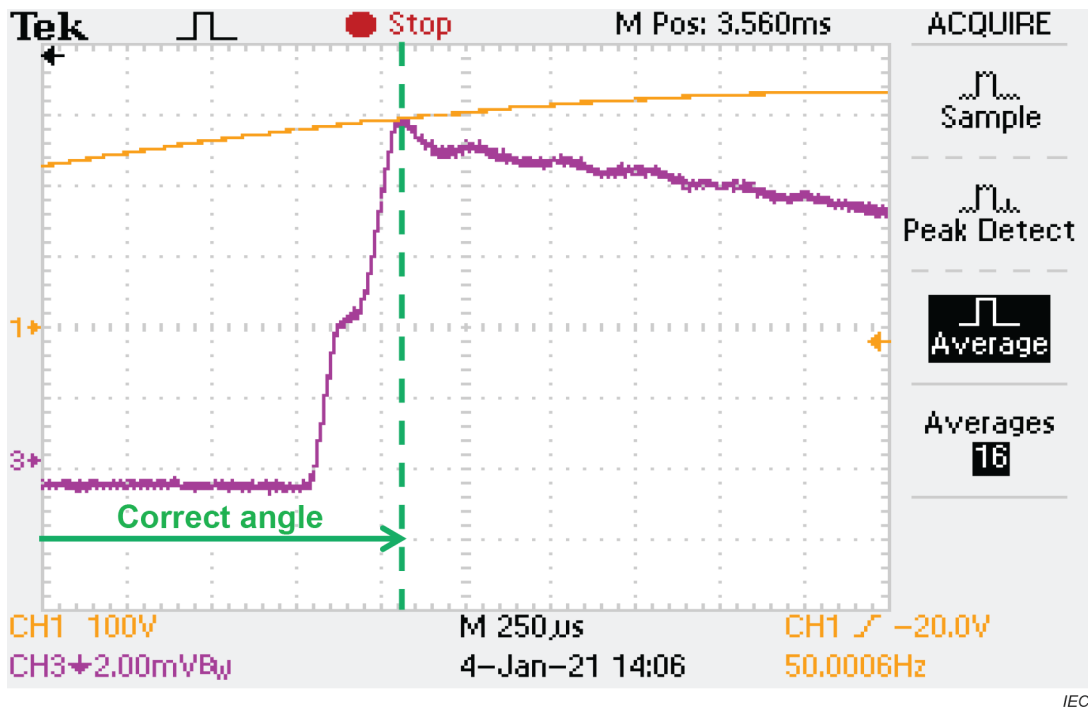


Figure 2 – Correct measurement with averaged waveform

CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope	7
2 Normative references	7
3 Terms and definitions	8
4 General	12
5 Classification of equipment	12
5.1 General	12
5.2 Description of lighting equipment	13
5.3 External power supplies	14
6 General requirements	14
6.1 General	14
6.2 Control methods	14
6.3 Harmonic current measurement	15
6.3.1 Test configuration	15
6.3.2 Measurement procedure	16
6.3.3 General requirements	16
6.3.4 Test observation period	18
6.4 Equipment in a rack or case	18
6.5 Multifunction equipment	18
7 Harmonic current limits	19
7.1 General	19
7.2 Limits for Class A equipment	20
7.3 Limits for Class B equipment	21
7.4 Limits for Class C equipment	21
7.4.1 General	21
7.4.2 Rated power > 25 W	21
7.4.3 Rated power ≥ 5 W and ≤ 25 W	22
7.5 Limits for Class D equipment	23
8 Compliance with this document	24
Annex A (normative) Measurement circuit and supply source	25
A.1 Test circuit	25
A.2 Supply source	25
Annex B (normative) Type test conditions	28
B.1 General	28
B.2 Television receivers (TV)	28
B.2.1 General requirements	28
B.2.2 Measurement conditions	28
B.2.3 Test report	29
B.3 Audio amplifiers	29
B.3.1 Conditions	29
B.3.2 Input signals and loads	29
B.4 Video-cassette recorders	30
B.5 Lighting equipment	30
B.5.1 General conditions	30

B.5.2	Light sources	30
B.5.3	Luminaires	30
B.5.4	Lighting control gear	31
B.5.5	DLT control devices	31
B.6	Independent phase control dimmers for lighting equipment	31
B.7	Vacuum cleaners	32
B.8	Washing machines	32
B.9	Microwave ovens	33
B.10	Information technology equipment (ITE).....	33
B.10.1	General conditions.....	33
B.10.2	IT equipment with external power supplies	33
B.11	Cooking appliances.....	34
B.11.1	Induction hobs and hotplates	34
B.11.2	Hobs and hotplates other than induction cooking appliances	34
B.12	Air conditioners	34
B.13	Kitchen machines as defined in IEC 60335-2-14	35
B.14	Arc welding equipment which is not professional equipment	35
B.15	High pressure cleaners which are not professional equipment	35
B.16	Refrigerators and freezers	36
B.16.1	General	36
B.16.2	Refrigerators and freezers with VSD	36
B.16.3	Refrigerators and freezers without VSD	36
B.17	External power supplies (EPS).....	37
B.17.1	EPS designated for specific models of equipment.....	37
B.17.2	EPS not designated for specific models of equipment.....	37
Annex C (normative)	POHC calculation.....	38
C.1	General.....	38
C.2	Calculation of the POHC from the final values of the harmonic currents, averaged over the complete observation time	38
C.3	Calculation of the final POHC from single POHC values for each DFT time window	38
Bibliography	39
Figure 1	– Flowchart for determining conformity.....	20
Figure 2	– Illustration of the relative phase angle and current parameters described in 7.4.3	22
Figure A.1	– Measurement circuit for single-phase equipment.....	26
Figure A.2	– Measurement circuit for three-phase equipment.....	27
Table 1	– Limits for Class A equipment	23
Table 2	– Limits for Class C equipment ^a	23
Table 3	– Limits for Class D equipment.....	24
Table 4	– Test observation period	24
Table B.1	– Conventional load for arc welding equipment tests	35

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

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This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61000 series, published under the general title, *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The contents of the Interpretation sheet of August 2021 have been included in this copy. Apply to the English version only.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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: IEC 61000-6-1).

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

1 Scope

This part of IEC 61000 deals with the limitation of harmonic currents injected into the public supply system.

It specifies limits of harmonic components of the input current which can be produced by equipment tested under specified conditions.

This part of IEC 61000 is applicable to electrical and electronic equipment having a rated input current up to and including 16 A per phase, and intended to be connected to public low-voltage distribution systems.

Arc welding equipment, which is not professional equipment, with a rated input current up to and including 16 A per phase, is included in the scope of this document. All other arc welding equipment is excluded from the scope of this document; however, the harmonics emission can be evaluated using IEC 61000-3-12 and relevant installation restrictions.

The tests according to this document are type tests.

For systems with nominal voltages less than but not equal to 220 V (line-to-neutral), the limits have not yet been considered.

NOTE The words apparatus, appliance, device and equipment are used throughout this document. They have the same meaning for the purposes of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60050-161:1990, *International Electrotechnical Vocabulary (IEV) – Part 161: Electromagnetic compatibility* (available at www.electropedia.org)

IEC 60107-1:1997, *Methods of measurement on receivers for television broadcast transmissions – Part 1: General considerations – Measurements at radio and video frequencies*

IEC 60155:1993, *Glow-starters for fluorescent lamps*

IEC 60268-1:1985, *Sound system equipment – Part 1: General*
IEC 60268-1:1985/AMD1:1988
IEC 60268-1:1985/AMD2:1988

IEC 60268-3:2018, *Sound system equipment – Part 3: Amplifiers*

IEC 60335-2-2:2019, *Household and similar electrical appliances – Safety – Part 2-2: Particular requirements for vacuum cleaners and water-suction cleaning appliances*

IEC 60335-2-14:2016, *Household and similar electrical appliances – Safety – Part 2-14: Particular requirements for kitchen machines*

IEC 60335-2-24:2010, *Household and similar electrical appliances – Safety – Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice makers*
IEC 60335-2-24:2010/AMD1:2012
IEC 60335-2-24:2010/AMD2:2017

IEC 60335-2-79:2016, *Household and similar electrical appliances – Safety – Part 2-79: Particular requirements for high pressure cleaners and steam cleaners*

IEC 60598-2-17:2012, *Luminaires – Part 2-17: Particular requirements – Luminaires for stage lighting, television and film studios (outdoor and indoor)*
IEC 60598-2-17:2012/AMD1:2015

IEC 60974-1:2017, *Arc welding equipment – Part 1: Welding power sources*

IEC 61000-4-7:2002, *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*
IEC 61000-4-7:2002/AMD1:2008

IEC 62756-1:2015, *Digital load side transmission lighting control (DLT) – Part 1: Basic requirements*