

# FINAL VERSION

# VERSION FINALE



**Electromagnetic compatibility (EMC) –  
Part 4-30: Testing and measurement techniques - Power quality measurement  
methods**

**Compatibilité électromagnétique (CEM) –  
Partie 4-30: Techniques d'essai et de mesure – Méthodes de mesure de la qualité  
de l'alimentation**

## CONTENTS

FOREWORD .....	7
INTRODUCTION .....	9
1 Scope .....	10
2 Normative references .....	10
3 Terms and definitions .....	11
4 General .....	16
4.1 Classes of measurement .....	16
4.2 Organization of the measurements .....	17
4.3 Electrical values to be measured .....	17
4.4 Measurement aggregation over time intervals .....	17
4.5 Measurement aggregation algorithm .....	18
4.5.1 Requirements .....	18
4.5.2 150/180-cycle aggregation .....	18
4.5.3 10-min aggregation .....	18
4.5.4 2-hour aggregation .....	20
4.6 Time-clock uncertainty .....	21
4.7 Flagging concept .....	21
5 Power quality parameters .....	21
5.1 Power frequency .....	21
5.1.1 Measurement method .....	21
5.1.2 Measurement uncertainty and measuring range .....	22
5.1.3 Measurement evaluation .....	22
5.1.4 Aggregation .....	22
5.2 Magnitude of the supply voltage .....	22
5.2.1 Measurement method .....	22
5.2.2 Measurement uncertainty and measuring range .....	22
5.2.3 Measurement evaluation .....	23
5.2.4 Aggregation .....	23
5.3 Flicker .....	23
5.3.1 Measurement method .....	23
5.3.2 Measurement uncertainty and measuring range .....	23
5.3.3 Measurement evaluation .....	23
5.3.4 Aggregation .....	23
5.4 Supply voltage dips and swells .....	24
5.4.1 Measurement method .....	24
5.4.2 Detection and evaluation of a voltage dip .....	24
5.4.3 Detection and evaluation of a voltage swell .....	25
5.4.4 Calculation of a sliding reference voltage .....	26
5.4.5 Measurement uncertainty and measuring range .....	26
5.5 Voltage interruptions .....	26
5.5.1 Measurement method .....	26
5.5.2 Evaluation of a voltage interruption .....	26
5.5.3 Measurement uncertainty and measuring range .....	27
5.5.4 Aggregation .....	27
5.6 Transient voltages .....	27

5.7	Supply voltage unbalance .....	27
5.7.1	Measurement method .....	27
5.7.2	Measurement uncertainty and measuring range .....	28
5.7.3	Measurement evaluation .....	29
5.7.4	Aggregation .....	29
5.8	Voltage harmonics .....	29
5.8.1	Measurement method .....	29
5.8.2	Measurement uncertainty and measuring range .....	29
5.8.3	Measurement evaluation .....	30
5.8.4	Aggregation .....	30
5.9	Voltage interharmonics .....	30
5.9.1	Measurement method .....	30
5.9.2	Measurement uncertainty and measuring range .....	30
5.9.3	Evaluation .....	30
5.9.4	Aggregation .....	30
5.10	Mains signalling voltage on the supply voltage .....	31
5.10.1	General .....	31
5.10.2	Measurement method .....	31
5.10.3	Measurement uncertainty and measuring range .....	31
5.10.4	Aggregation .....	31
5.11	Rapid voltage change (RVC) .....	31
5.11.1	General .....	31
5.11.2	RVC event detection .....	32
5.11.3	RVC event evaluation .....	33
5.11.4	Measurement uncertainty .....	34
5.12	Underdeviation and overdeviation .....	34
5.13	Current .....	34
5.13.1	General .....	34
5.13.2	Magnitude of current .....	35
5.13.3	Current recording .....	35
5.13.4	Harmonic currents .....	36
5.13.5	Interharmonic currents .....	36
5.13.6	Current unbalance .....	36
6	Performance verification .....	36
Annex A	(informative) Power quality measurements – Issues and guidelines .....	39
A.1	General .....	39
A.2	Installation precautions .....	39
A.2.1	General .....	39
A.2.2	Test leads .....	39
A.2.3	Guarding of live parts .....	40
A.2.4	Monitor placement .....	40
A.2.5	Earthing .....	41
A.2.6	Interference .....	41
A.3	Transducers .....	41
A.3.1	General .....	41
A.3.2	Signal levels .....	42
A.3.3	Frequency response of transducers .....	43
A.3.4	Transducers for measuring transients .....	43

A.4	Transient voltages and currents .....	44
A.4.1	General.....	44
A.4.2	Terms and definitions .....	44
A.4.3	Frequency and amplitude characteristics of a.c. mains transients .....	44
A.4.4	Transient voltage detection .....	45
A.4.5	Transient voltage evaluation .....	46
A.4.6	Effect of surge protective devices on transient measurements .....	46
A.5	Voltage dip characteristics .....	46
A.5.1	General.....	46
A.5.2	Rapidly updated r.m.s values .....	47
A.5.3	Phase angle/point-on-wave.....	47
A.5.4	Voltage dip unbalance .....	47
A.5.5	Phase shift during voltage dip .....	48
A.5.6	Missing voltage .....	48
A.5.7	Distortion during voltage dip .....	48
A.5.8	Other characteristics and references.....	48
Annex B (informative)	Power quality measurement – Guidance for applications .....	49
B.1	Contractual applications of power quality measurements .....	49
B.1.1	General.....	49
B.1.2	General considerations .....	49
B.1.3	Specific considerations .....	50
B.2	Statistical survey applications .....	53
B.2.1	General.....	53
B.2.2	Considerations.....	53
B.2.3	Power quality indices .....	54
B.2.4	Monitoring objectives .....	54
B.2.5	Economic aspects of power quality surveys .....	54
B.3	Locations and types of surveys .....	55
B.3.1	Monitoring locations.....	55
B.3.2	Pre-monitoring site surveys.....	56
B.3.3	Customer side site survey.....	56
B.3.4	Network side survey.....	56
B.4	Connections and quantities to measure.....	56
B.4.1	Equipment connection options .....	56
B.4.2	Priorities: Quantities to measure .....	57
B.4.3	Current monitoring .....	58
B.5	Selecting the monitoring thresholds and monitoring period.....	58
B.5.1	Monitoring thresholds .....	58
B.5.2	Monitoring period .....	58
B.6	Statistical analysis of the measured data .....	59
B.6.1	General.....	59
B.6.2	Indices.....	59
B.7	Trouble-shooting applications .....	59
B.7.1	General.....	59
B.7.2	Power quality signatures.....	59
Annex C (informative)	Conducted emissions in the 2 kHz to 150 kHz range .....	61
C.1	General.....	61
C.2	Measurement method – 2 kHz to 9 kHz .....	61

C.3	Measurement method – 9kHz to 150 kHz .....	62
C.4	Measurement range and measurement uncertainty .....	63
C.5	Aggregation .....	63
Annex D (informative)	Underdeviation and overdeviation .....	64
D.1	General.....	64
D.2	Measurement method .....	64
D.3	Measurement uncertainty and measuring range .....	64
D.4	Aggregation .....	64
Annex E (informative)	Class B Measurement Methods .....	66
E.1	Background for Class B .....	66
E.2	Class B – Measurement aggregation over time intervals .....	66
E.3	Class B – Measurement aggregation algorithm .....	66
E.4	Class B – Real time clock (RTC) uncertainty.....	66
E.4.1	General.....	66
E.4.2	Class B – Frequency – Measurement method .....	66
E.4.3	Class B – Frequency – Measurement uncertainty.....	66
E.4.4	Class B – Frequency – Measurement evaluation.....	67
E.4.5	Class B – Magnitude of the supply – Measurement method.....	67
E.4.6	Class B – Magnitude of the supply – Measurement uncertainty and measuring range.....	67
E.5	Class B – Flicker.....	67
E.5.1	General.....	67
E.5.2	Class B – Supply voltage dips and swells – Measurement method .....	67
E.6	Class B – Voltage interruptions .....	67
E.6.1	General.....	67
E.6.2	Class B – Supply voltage unbalance – Measurement method .....	67
E.6.3	Class B – Supply voltage unbalance –Uncertainty.....	67
E.6.4	Class B – Voltage harmonics – Measurement method.....	67
E.6.5	Class B –Voltage harmonics – Measurement uncertainty and range.....	67
E.6.6	Class B – Voltage interharmonics – Measurement method .....	68
E.6.7	Class B –Voltage interharmonics – Measurement uncertainty and range.....	68
E.6.8	Class B – Mains signalling voltage – Measurement method .....	68
E.6.9	Class B –Mains signalling voltage – Measurement uncertainty and range.....	68
E.6.10	Class B – Current – Measurement method .....	68
E.6.11	Class B – Current – Measurement uncertainty and range.....	68
Bibliography	.....	69
Figure 1	– Measurement chain.....	17
Figure 2	– Synchronization of aggregation intervals for Class A .....	19
Figure 3	– Synchronization of aggregation intervals for Class S: parameters for which gaps are not permitted .....	20
Figure 4	– Synchronization of aggregation intervals for Class S: parameters for which gaps are permitted (see 4.5.2) .....	20
Figure 5	– Example of supply voltage unbalance uncertainty .....	28
Figure 6	– RVC event: example of a change in r.m.s voltage that results in an RVC event .....	33

Figure 7 – Not an RVC event: example of a change in r.m.s voltage that does not result in an RVC event because the dip threshold is exceeded ..... 34

Figure A.1 – Frequency spectrum of typical representative transient test waveforms ..... 45

Table 1 – Summary of requirements (see subclauses for actual requirements) ..... 37

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

### ELECTROMAGNETIC COMPATIBILITY (EMC) –

#### Part 4-30: Testing and measurement techniques – Power quality measurement methods

#### FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). 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. 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 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 IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 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 4-30 edition 3.1 contains the third edition (2015-02) [documents 77A/873/FDIS and 77A/878/RVD] and its corrigendum (2016-12), and its amendment 1 (2021-03) [documents 77A/1080/CDV and 77A/1092/RVC].**

**This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.**

International Standard IEC 61000-4-30 has been prepared by subcommittee 77A: EMC – Low-frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

This standard forms part 4-30 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

This third edition constitutes a technical revision.

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

- a) the measurement method for current, previously informative, is now normative with some changes;
- b) the measurement method for RVC (rapid voltage change) has been added;
- c) the measurement method for conducted emissions in the 2 kHz to 150 kHz range has been added in informative Annex C;
- d) underdeviation and overdeviation parameters are moved to informative Annex D;
- e) Class A and Class S measurement methods are defined and clarified, while Class B is moved to informative Annex E and considered for future removal;
- f) measurement methods continue in this standard, but responsibility for influence quantities, performance, and test procedures are transferred to IEC 62586-2.

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.

**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 completed by a second number identifying the subdivision (example: 61000-6-1).

## ELECTROMAGNETIC COMPATIBILITY (EMC) –

### Part 4-30: Testing and measurement techniques – Power quality measurement methods

#### 1 Scope

This part of IEC 61000-4 defines the methods for measurement and interpretation of results for power quality parameters in a.c. power supply systems with a declared fundamental frequency of 50 Hz or 60 Hz.

Measurement methods are described for each relevant parameter in terms that give reliable and repeatable results, regardless of the method's implementation. This standard addresses measurement methods for in-situ measurements.

Measurement of parameters covered by this standard is limited to conducted phenomena in power systems. The power quality parameters considered in this standard are power frequency, magnitude of the supply voltage, flicker, supply voltage dips and swells, voltage interruptions, transient voltages, supply voltage unbalance, voltage harmonics and interharmonics, mains signalling on the supply voltage, rapid voltage changes, and current measurements. Emissions in the 2 kHz to 150 kHz range are considered in Annex C (informative), and over- and underdeviations are considered in Annex D (informative). Depending on the purpose of the measurement, all or a subset of the phenomena on this list may be measured.

NOTE 1 Test methods for verifying compliance with this standard can be found in IEC 62586-2.

NOTE 2 The effects of transducers inserted between the power system and the instrument are acknowledged but not addressed in detail in this standard. Guidance about effects of transducers can be found IEC TR 61869-103.

#### 2 Normative references

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

IEC 60050 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at [www.electropedia.org](http://www.electropedia.org))

IEC 61000-2-4, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

IEC 61000-3-8, *Electromagnetic compatibility (EMC) – Part 3: Limits – Section 8: Signalling on low-voltage electrical installations – Emission levels, frequency bands and electromagnetic disturbance levels*

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 61000-4-15:2010, *Electromagnetic compatibility (EMC) – Part 4-15: Testing and measurement techniques – Flickermeter – Functional and design specifications*