

TECHNICAL SPECIFICATION



Power quality management – Part 1: General guidelines



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2021 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Preview generated by EVS

TECHNICAL SPECIFICATION



Power quality management – Part 1: General guidelines

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.020

ISBN 978-2-8322-1061-4

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	8
3 Terms, definitions and abbreviated terms	10
3.1 Terms and definitions.....	10
3.2 Abbreviated terms.....	12
4 Use cases list	13
4.1 List of business use case and business roles of the domains	13
4.2 List of system use cases and system roles.....	15
5 Provisions	16
5.1 Power quality assessment.....	16
5.1.1 General	16
5.1.2 Monitoring assessment	17
5.1.3 Monitoring assessment process	17
5.1.4 Predicted assessment.....	18
5.1.5 Predicted assessment process	18
5.1.6 Background description and analysis	18
5.1.7 Disturbance anticipation	18
5.1.8 Impacts analysis	19
5.2 PQ monitoring system	19
5.2.1 General	19
5.2.2 Monitoring points	19
5.2.3 Monitoring equipment	20
5.2.4 Related information and communication system	20
5.3 Economical assessment.....	20
5.3.1 General	20
5.3.2 Economical assessment of PQ provisions.....	21
5.3.3 Economical assessment of unsatisfactory PQ objectives/results	22
5.4 PQ requirement	23
5.5 Mitigation/Trouble shooting	23
5.5.1 Total requirements.....	23
5.5.2 Power quality mitigation scheme.....	24
Annex A (normative) Use case	26
A.1 Business use cases	26
A.1.1 BUC 1: Manage power quality over the grid	26
A.1.2 BUC 2: Manage complaints on power quality over the network	28
A.1.3 BUC 3: Provide reports on network power quality	36
A.1.4 BUC 4: Take into account power quality constraints in connecting a user to the grid	42
A.2 System UCs	48
A.2.1 SUC1: Measure power quality on a specific point of the network.....	48
A.2.2 SUC2: Monitor power quality on the network.....	60
A.2.3 SUC3: Assess the emission limit related to power quality technical parameters in power system	69
Annex B (informative) Main contents and requirements of power quality monitoring assessment report	74

B.1	Overview.....	74
B.2	Basic information of the assessment object.....	74
B.3	Basic information of power grid.....	74
B.4	Basis of assessment and standard.....	74
B.5	Monitoring instructions.....	74
B.6	Analysis and conclusion.....	74
B.7	Measures and suggestions (as required).....	74
B.8	Attachments.....	74
Annex C (informative) Main contents and requirements of power quality predicted assessment report.....		75
C.1	Overview.....	75
C.2	Basic information of the assessment object.....	75
C.3	Basic situation of power grid.....	75
C.4	Basis of assessment and standard.....	75
C.5	Brief description of assessment method.....	75
C.6	Calculation and analysis.....	76
C.7	Measures and suggestions (as required).....	76
C.8	Conclusion.....	76
C.9	Attachments.....	76
Annex D (informative) Economic data of power quality.....		77
D.1	Data structure.....	77
D.2	Basic data of economic cost of power users.....	77
D.3	Basic data of economic cost of public distribution network.....	78
D.4	Power quality related monitoring data.....	78
D.5	Equipment and system parameters.....	79
Bibliography.....		80
IEC references.....		80
Non-IEC references.....		81
Figure 1 – Organisation of the use cases.....		13
Figure 2 – Overview of the power quality management main functions.....		17
Table 1 – Content of IEC TS 63222-1.....		8
Table 2 – Abbreviations of IEC TS 63222-1.....		12
Table 3 – Lists of business use cases.....		14
Table 4 – Business roles of IEC TS 63222-1.....		15
Table 5 – Lists of the system use cases.....		15
Table 6 – Lists of system roles.....		16

INTERNATIONAL ELECTROTECHNICAL COMMISSION

POWER QUALITY MANAGEMENT –**Part 1: General guidelines****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.

IEC TS 63222 has been prepared by IEC technical committee 8: System aspects of electrical energy supply. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
8/1588/DTS	8/1602/RVDTS

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

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 63222 series, published under the general title *Power quality management*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

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.

INTRODUCTION

With the development of smart grid and massive deployment of renewable energy, power quality issues have received attention not only from system operators and customers (especially with sensitive power quality loads) but also from market regulators with the demands to provide information on the actual power quality level. Power quality management of the grid is a systematic project which includes the whole process of planning, operation, assessment and mitigation. The characteristics of power supplier, load characteristics of power consumer and external environment will affect the power quality of the grid. This document focuses on the whole process management and is the general guideline for this series of standards.

Traditional electrified railways, steel mills and other non-linear loads are the main pollution sources of the power quality. In recent years, the new loads such as new energy and electric vehicles have brought new challenges to power quality management. The rapid popularization and application of high-tech precision technology has also put forward new requirements for high-quality power supply and consumption system.

Power quality is an important issue for electricity supply network operators, which needs to be handled at planning and operation stages. In order to achieve power quality target, reduce power quality impacts/losses and improve the economic efficiency of the system, power quality regulation and supervision of the operating power system is necessary, and a well-considered power quality planning before project implementation is also needed, such as system expansion, construction and grid connection of the distributed generation. Besides, the users at the end of power system should also be taken into consideration. Power quality problems can cause system instability, equipment abnormal operation and supply interruption. Power quality management is a method to avoid further power quality problems after project implementation.

The standard system in power quality management provides a technical basis for improving power management level and standardizing power quality industry and market. As the general guideline of the standard series, this specification summarizes the power quality indicators and assessment methods, and analyses the overall power quality level by monitoring assessment and predicted assessment. Monitoring system and field test are used to assess the power quality level at different nodes of the grid, and solve users' power quality complaints and other practical problems. Connection and monitoring points are reasonably selected to assess the power quality levels of the grid in operation stage, and it also contributes to the power quality mitigation. In addition, the economical assessment of power quality is regulated in the document. Power quality management use cases in different typical scenarios are shown in Annex A.

POWER QUALITY MANAGEMENT –

Part 1: General guidelines

1 Scope

This part of IEC 63222, which is a Technical Specification, is intended to provide provisions associated to the main use cases regarding recognized engineering practices applicable to power quality management in public electric power supply networks. It summarizes the operation in power quality management and investigates the current standards, for requirement of power quality assessment work, as well as to promote the development of power quality management best practices.

The power quality management domain groups use cases and associated power quality requirements common to network management, including customer support network operation, network and extension planning.

This document captures possible "common and repeated usage" of power quality management under the format of "use case". Use case implementations are given for information purpose only. This document derives the common requirement as provisions by further standardization activities, in terms of actors interacting with the given system. The interface requirement is considered for later standardization activities. The relationship of the stakeholders in power quality management, such as network operator, network user, etc., are discussed in the document. Table 1 highlights the domains and business use cases described.

Table 1 – Content of IEC TS 63222-1

Domain	Content	Scope
Power quality monitoring assessment	<p>Described with 5 business use cases</p> <ol style="list-style-type: none"> 1) Manage power quality over the grid. 2) Manage power quality through distribution or transmission grid interfaces with another network. 3) Take into account power quality constraints in network operation. 4) Provide reports on network power quality. 5) Manage complaints on power quality over the network. <p>Described with 5 system use cases</p> <ol style="list-style-type: none"> 1) Assess power quality on the network. 2) Measure power quality on a specific point of the network. 3) Monitor power quality on the network. 4) Engineer a power quality provision. 5) Assess the emission limit related to power quality technical parameters in power system. 	Continuous monitoring operation for public power grid
Power quality predicted assessment	<p>Described with 4 business use cases</p> <ol style="list-style-type: none"> 1) Manage power quality over the grid. 2) Take into account power quality constraints in connecting a user to the grid. 3) Take into account power quality constraints in network development. 4) Provide reports on network power quality. <p>Described with 7 system use cases</p> <ol style="list-style-type: none"> 1) Predict power quality impact of a construction work or maintenance. 2) Predict power quality impact of a new connection or network development. 3) Measure power quality on a specific point of the network. 4) Monitor power quality on the network. 5) Engineer a power quality provision. 6) Assess power quality on the network. 7) Assess the emission limit related to power quality technical parameters in power system. 	Power quality assessment of new construction, reconstruction or expansion projects in the grid

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 61000-3 (all parts), *Electromagnetic compatibility (EMC) – Part 3: Limits*

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

IEC 61000-3-3, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply system, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection*

IEC TS 61000-3-4, *Electromagnetic compatibility (EMC) – Part 3-4: Limits – Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 16 A*

IEC TS 61000-3-5, *Electromagnetic compatibility (EMC) – Part 3-5: Limits – Limitation of voltage fluctuations and flicker in low-voltage power supply systems for equipment with rated current greater than 75 A*

IEC TR 61000-3-6, *Electromagnetic compatibility (EMC): Limits-Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems*

IEC TR 61000-3-7, *Electromagnetic compatibility (EMC): Limits – Assessment of emission limits for the connection of fluctuating load installations to MV, HV and EHV power systems*

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 61000-3-11, *Electromagnetic compatibility (EMC) – Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤ 75 A and subject to conditional connection*

IEC 61000-3-12, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤ 75 A per phase*

IEC TR 61000-3-13, *Electromagnetic compatibility (EMC) – Limits – Assessment of emission limits for the connection of unbalanced installations to MV, HV and EHV power systems*

IEC TR 61000-3-14, *Electromagnetic compatibility (EMC) – Assessment of emission limits for harmonics, interharmonics, voltage fluctuations and unbalance for the connection of disturbing installations to LV power systems*

IEC 61000-4 (all parts), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques*

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

IEC 61000-4-30:2015, *Electromagnetic compatibility (EMC) – Part 4-30: Testing and measurement techniques – Power quality measurement methods*

IEC 61850 (all parts), *Communication networks and systems for power utility automation*

IEC TR 61850-90-17:2017, *Communication networks and systems for power utility automation – Part 90-17: Using IEC 61850 to transmit power quality data*

IEC 61968-9:2013, *Application integration at electric utilities – System interfaces for distribution management – Part 9: Interfaces for meter reading and control*

IEC TS 62749: 2020, *Assessment of power quality – Characteristics of electricity supplied by public networks*

ISO 10002:2018, *Quality management – Customer satisfaction – Guidelines for complaints handling in organizations*