BS EN IEC 62920:2017+A1:2021

BSI Standards Publication

Photovoltaic power generating systems - EMC requirements and test methods for power conversion equipment

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National foreword

This British Standard is the UK implementation of EN IEC 62920:2017+A1:2021. It is identical to IEC 62920:2017, incorporating amendment 1:2021. It supersedes BS EN 62920:2017+A11:2020, which is withdrawn.

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 to Technical Committee GEL/82, Photovoltaic Energy Systems.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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ISBN 978 0 539 06004 1

ICS 27.160

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2017.

Amendments/corrigenda issued since publication

Date	Text affected
31 March 2022	Implementation of IEC amendment A1:2021

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62920:2017+A1

October 2021

ICS 27.160

English Version

Photovoltaic power generating systems - EMC requirements and test methods for power conversion equipment (IEC 62920:2017/A1:2021)

Systèmes de production d'énergie photovoltaïque - Exigences de CEM et méthodes d'essai pour les équipements de conversion de puissance (IEC 62920:2017/A1:2021)

Photovoltaische Stromerzeugungssysteme - EMV-Anforderungen und Prüfverfahren für Leistungsumrichter (IEC 62920:2017/A1:2021)

This amendment A1 modifies the European Standard EN 62920:2017; it was approved by CENELEC on 2021-05-11. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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European foreword

The text of document 82/1835/FDIS, future IEC 62920/A1, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62920:2017/A1:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2022-04-15
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2024-10-15

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This document has been prepared under a Standardization Request given to CENELEC by the European Commission and the European Free Trade Association.

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Endorsement notice

The text of the International Standard IEC 62920:2017/A1:2021 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 62109-1:2010	NOTE	Harmonized as EN 62109-1:2010 (not modified)
IEC 62933-1:2018	NOTE	Harmonized as EN IEC 62933-1:2018 (not modified)

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PHOTOVOLTAIC POWER GENERATING SYSTEMS – EMC REQUIREMENTS AND TEST METHODS FOR POWER CONVERSION EQUIPMENT

FOREWORD

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IEC 62920 edition 1.1 contains the first edition (2017-07) [documents 82/1288/FDIS and 82/1313/RVD] and its amendment 1 (2021-04) [documents 82/1835/FDIS and 82/1874/RVD].

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.

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International Standard IEC 62920 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

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

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
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INTRODUCTION

Background

Power conversion equipment (PCE) is indispensable for solar photovoltaic power energy systems in order to convert the DC electric power energy generated by solar photovoltaic panels into AC or DC electric power, and to feed the AC power energy into the AC mains network or loads. PCE consists of DC to DC, DC to AC or AC to DC converters and forms systems with or without DC-coupled electrical energy storage devices.

Manufacturers of PCE ensure the performance and reliability of PCE. Electromagnetic compatibility (EMC) is one aspect of performance which must be ensured wherever PCE is used in or exposed to an electromagnetic environment.

IEC Guide 107 specifies that TC 77 and CISPR, which are called EMC committees, have responsibility for the development of basic, product family and generic standards on EMC requirements, and product committees must use the emission limits developed by EMC committees and must refer to basic immunity standards for the specification of test techniques.

However, when the EMC standards which are developed by TC 77 and CISPR are not considered suitable for a particular product or electromagnetic environment, product committees must seek their assistance and advice for any change in the emission limits and/or measurement requirements. Product committees are responsible for selecting the appropriate immunity test items and levels for their products as well as for defining the relevant performance criteria for the evaluation of the immunity test results. Consequently, product committees, such as TC 22, TC 26, TC 9, and TC 69, have their own EMC standard to define EMC requirements and test methods for their particular types of products.

TC 82 also has the responsibility to consider EMC requirements for PCE applying to the solar photovoltaic power energy systems, and TC 82 has taken action as follows to develop its own product EMC standards:

a) selection of the immunity test items in accordance with EMC environments for the solar photovoltaic power energy systems,

b) supplement of generic standards with a detailed description of test conditions and test set up,

c) development of the conditional limits and alternative test methods in terms of installation environmental and operational conditions, and

d) development of appropriate requirements and test method for high power equipment.

In 2017, TC82 published IEC 62920 (Ed.1.0). By taking into account the latest market needs, IEC 62920:2017 (Ed.1.0) has covered the above mentioned items and presents the minimum EMC requirements for PCE applying to solar photovoltaic power energy systems.

Purpose of the maintenance of a product EMC standard

Following the state of the art technology as well as the latest market needs, users of standards recognize the improvement of product EMC standards. The maintenance of product standards is also one of important activities for product committees.

IEC 62920:2017 (Ed.1.0) is amended to extend the scope of IEC 62920:2017 (Ed.1.0) by taking into account the following technical items.

– DC to DC power conversion equipment used in photovoltaic power energy systems.

– Electrical energy storage devices connected to DC power ports of PCE used in photovoltaic power energy systems.

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Furthermore, IEC 62920:2017 (Ed.1.0) is amended to cover the latest options of measurement distance of radiated disturbances by taking the latest updates of CISPR 16-1-4 and CISPR 16-2-3 into consideration to adapt it to different sizes of products.

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PHOTOVOLTAIC POWER GENERATING SYSTEMS – EMC REQUIREMENTS AND TEST METHODS FOR POWER CONVERSION EQUIPMENT

1 Scope

This document specifies electromagnetic compatibility (EMC) requirements for power conversion equipment (PCE) (e.g. DC to DC, DC to AC and AC to DC) for use in photovoltaic (PV) power systems with or without DC-coupled electrical energy storage devices.

The PCE covered by this document can be grid-interactive, which is termed as a grid connected power converter (GCPC), or stand-alone. It can be supplied by single or multiple photovoltaic modules grouped in various array configurations, and can be intended for use in conjunction with batteries or other forms of energy storage.

NOTE A micro inverter is an example of a GCPC supplied by a single photovoltaic module.

This document covers not only PCE connected to a public low voltage AC mains network or other low voltage AC mains installation, but also PCE connected to a medium or high voltage AC network with or without step-down power transformers. Requirements for the PCE connected to a medium or high voltage AC network are specified in this document. However, some requirements relevant to grid interconnection are addressed with other standards specifying power quality or their own grid codes in some countries.

NOTE DC/DC converters used for PV systems are not yet covered in this document. They can cause electromagnetic interference due to conducted disturbances at DC ports.

PCE is assessed with EMC requirements as a type test at a test site. This document provides test methods and test conditions for PCE as well as emission and immunity requirements, but not for photovoltaic modules and other balance of system components.

When compliance with EMC requirements at the test site cannot be shown due to technical reasons of the test site, PCE can be assessed in situ, such as at the manufacturer's premises or in the field where the PCE is assembled into a PV power system. However, only high frequency emission requirements for in situ assessment are specified in CISPR 11.

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 61000-3-2:2014, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment with input current ≤ 16 A per phase)*

IEC 61000-3-3:2013, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection*

IEC TR 61000-3-6:2008, *Electromagnetic compatibility (EMC) – Part 3-6: Limits – Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems*

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IEC 61000-3-11:2000, *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 61000-3-12:2011, *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 61000-3-14:2011, *Electromagnetic compatibility (EMC) – Part 3-14: Assessment of emission limits for harmonics, interharmonics, voltage fluctuations and unbalance for the connection of disturbing installations to LV power systems*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
IEC 61000-4-3:2006/AMD1:2007
IEC 61000-4-3:2006/AMD2:2010

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

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 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-34:2005, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current more than 16 A per phase*

CISPR 11:2015, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*
CISPR 11:2015/AMD1:2016

CISPR 16-1-2:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-2: Radio disturbance and immunity measuring apparatus – Coupling devices for conducted disturbance measurements*

CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
photovoltaic power generating system
PV system
electric power generating system which uses the photovoltaic effect to convert solar power into electricity

3.2
power conversion equipment
PCE
electrical device converting one form of electrical power to another form of electrical power with respect to voltage, current, frequency, phase and the number of phases

[SOURCE: IEC 62109-1:2010, 3.66, modified – The definition has been rephrased, and the note has been deleted.]

3.3
photovoltaic module
PV modules
complete and environmentally protected assembly of interconnected photovoltaic cells

[SOURCE: IEC TS 61836:2016, 3.1.48.7, modified – The note has been deleted.]

3.4
electrical energy storage devices
ESS
devices that are able to absorb electrical energy, to store it for a certain amount of time and to release electrical energy during which energy conversion processes may be included

[SOURCE: IEC 62933-1:2018, 3.1, modified – The example and the note have been deleted.]

3.5
port
particular interface of the PCE with the external electromagnetic environment

Note 1 to entry: See Figure 1 for examples of ports.

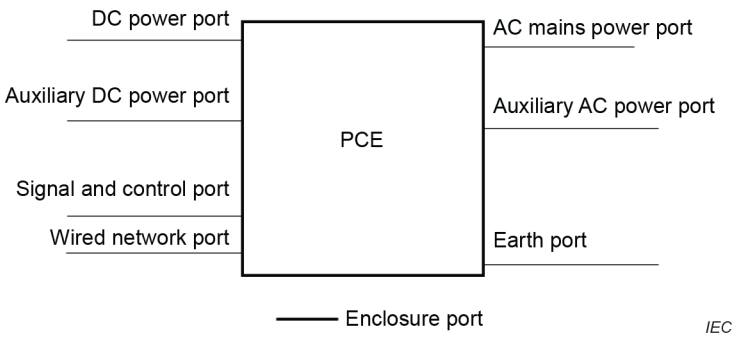

Figure 1 – Example of ports

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3.6
enclosure port
physical boundary of the PCE product which electromagnetic fields may radiate through or impinge on

3.7
AC mains power port
port used to connect to a public low voltage AC mains power distribution network or other low voltage AC mains installation

3.8
auxiliary AC power port
additional low voltage AC power port for purposes other than feeding in AC power

3.9
DC power port
port used to connect a local low voltage DC power generating system or electrical energy storage devices

3.10
auxiliary DC power port
additional low voltage DC power port for purposes other than supplying DC power for the DC to AC conversion or electrical energy storage devices

3.11
signal and control port
port intended for the interconnection of components of PCE, or between PCE and local auxiliary equipment, and used in accordance with relevant functional specifications

Note 1 to entry: Examples include RS-232, Universal Serial Bus (USB), High-Definition Multimedia Interface (HDMI), IEEE standard 1394 (“Fire Wire”) and control pilot.

3.12
wired network port
point to connection for voice, data and signalling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network

Note 1 to entry: Examples include CATV, PSTN, ISDN, xDSL, LAN and similar networks. These ports can support screened or unscreened cables and can also carry AC or DC power where this is an integral part of the telecommunication specification.

3.13
high power electronic equipment and system
one or more power conversion equipment with a combined rated power greater than 75 kVA, or a system containing such equipment

3.14
low voltage
LV
set of voltage levels used for the distribution of electricity and whose upper limit is generally accepted to be 1 000 V AC or 1 500 V DC

3.15
high voltage
HV
1) in a general sense, the set of voltage levels in excess of low voltage
2) in a restrictive sense, the set of upper voltage levels used in power system for bulk transmission of electricity

[SOURCE: IEC 60050-601:1985, 601-01-27]

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3.16
medium voltage
MV
any set of voltage levels lying between low and high voltage

[SOURCE: IEC 60050-601:1985, 601-01-28, modified – The note has been deleted.]

3.17
small equipment
equipment including its cables fits in an imaginary cylindrical test volume of 1,5 m in diameter and 1,5 m in height (to ground plane) to be measured at a measurement distance of 3 m at an OATS/SAC

3.18
medium equipment
equipment including its cables fits in an imaginary cylindrical test volume of 2 m in diameter and 2 m in height (to ground plane) to be measured at a measurement distance of 5 m at an OATS/SAC

3.19
type test
test of one or more equipment made to a certain design to show that the design meets certain specifications

3.20
residential environment
environment characterized by the fact that the product is directly (not via external transformer) connected to a public low voltage AC mains power distribution network or other low voltage AC mains installation

3.21
non-residential environment
environment characterized by a separate power network, supplied from a dedicated power transformer or a high- or medium-voltage transformer

3.22
PCE-MV
PCE including a medium voltage transformer

3.23
artificial mains network
AMN
network that provides a defined impedance to the equipment under test (EUT) at radio frequencies, couples the disturbance voltage to the measuring receiver and decouples the test circuit from the low voltage AC mains supply

3.24
artificial DC network
DC-AN
artificial network used for defined termination of the EUT's port under test also providing the necessary decoupling from conducted disturbances originating from the laboratory low voltage DC power source

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4 Classification of PCE

4.1 Category of environment

In consideration of the intended use of PCE in environments and the definition of environment in the generic EMC standards, for simplicity only two categories are defined in this document for both emission and immunity requirements; these are residential and non-residential environments.

Figure 2 shows examples of installation of PV systems in both environments. The appropriate category of environment should be confirmed according to the definition of each environment.

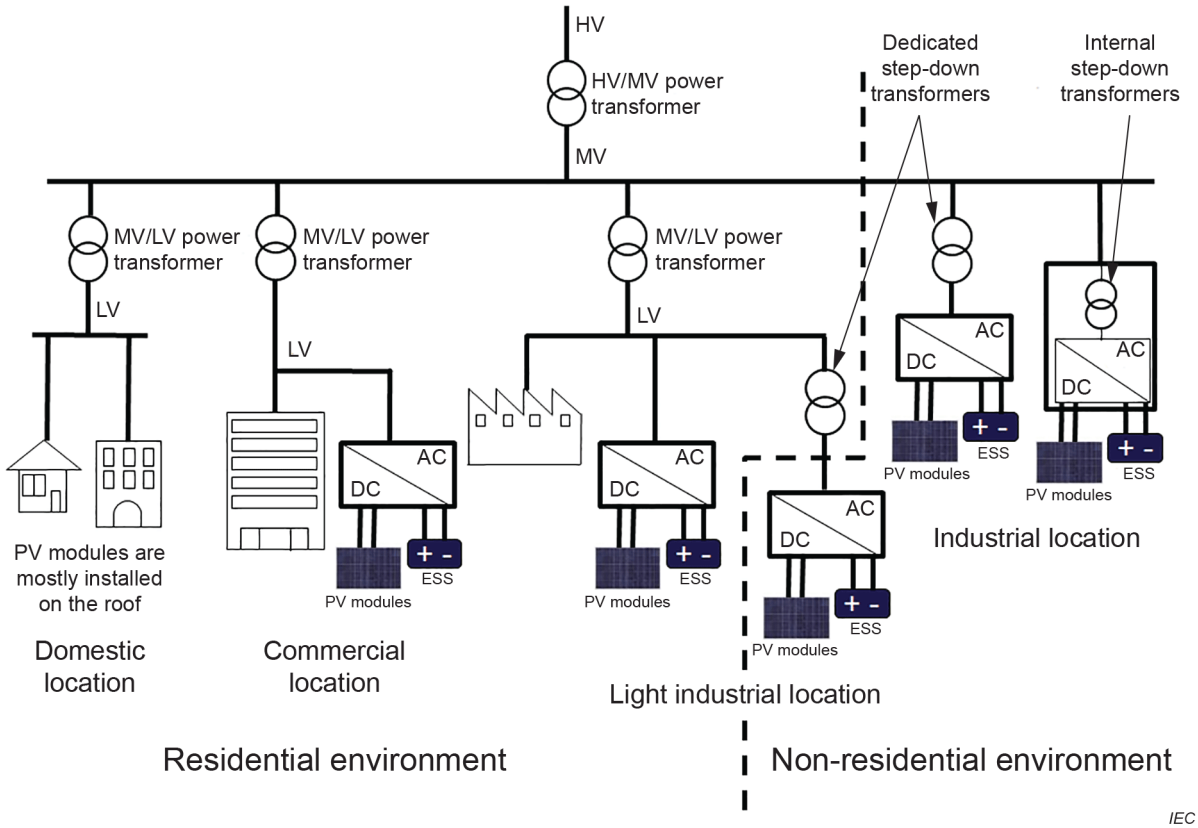

Figure 2 – Examples of installation of PV systems in both environments

4.2 Division into classes

In order to harmonize with basic, generic and product family standards, this document defines two classes of equipment in accordance with the category of environment, class A and class B as follows.

- Class A PCE is suitable for use in non-residential environments.
- Class A PCE shall meet class A requirements.
- Class B PCE is suitable for use in the residential environments.
- Class B PCE shall meet class B requirements.

PCE may fulfil the requirement of both classes. Such PCE can be classified as A and B and is suitable for use in both environments.

NOTE Such equipment would fulfil the tighter emission requirements of the residential environment as well as the severe immunity requirements of the industrial environment.

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4.3 Information for users

The manufacturer and/or supplier of PCE shall ensure that the user is informed of the class either by labelling or by the accompanying documentation.

PCE not suitable for residential environments shall include the following caution in an instruction manual.

Caution: This PCE is not intended for use in a residential environment, and this PCE may cause radio interference, in which case the user may be required to take additional mitigation measures against electromagnetic interference.

5 Test setup for type test

5.1 General

Emission and immunity testing of PCE can be conducted with or without solar photovoltaic modules or storage devices. However, only the PCE is subject to testing. Therefore, the test may be conducted with a uni- or bi-directional appropriate DC power supply to simulate a PV module and a storage device. The DC power supply shall provide a continuous and stable DC voltage, load or power during testing. In addition, this alternative DC supply shall be designed in such a manner that harmonics and electromagnetic disturbance from the DC supply do not influence test results.

Similarly, a uni- or bi-directional appropriate AC power supply should be used so that continuous and stable AC voltage and frequency for the PCE can be supplied during testing. Harmonics and electromagnetic disturbance generated by the AC power source shall not influence test results.

The uni- or bi-directional appropriate DC power supply and AC power supply are connected to the DC power port and the AC mains power port. Auxiliary power ports, if any, and if necessary to operate the PCE as intended, shall be connected to the appropriate power supply during testing.

The uni- or bi-directional AC and/or DC power supply shall support all operating modes of PCE to be tested.

5.2 Configuration of test setups

5.2.1 General

The PCE shall be placed under a condition close to an actual installation condition during testing for immunity and emission requirements. Cable arrangement shall be conducted by following installation manuals provided by manufacturers. Except at manufacturer's designation which specifies mounting of covers and access panels during testing, those covers and access panels shall be mounted under a condition close to an actual mounting condition. This does not apply when power to PCE is not applied.

The basic standards define test setups. Hence, this document supplements the basic standards and provides descriptions regarding testing arrangement for wall-mounted PCE in Annex A.

Micro inverters can be dealt with as wall-mounted PCE for EMC requirements only. Configuration examples of test setup for wall-mounted PCE can be applied to a type test for micro inverters.

The DC power ports of the PCE shall be connected to a suitable DC power supply. The DC voltage of this power supply shall be adjustable to provide a voltage level within the rated

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