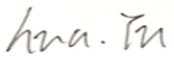
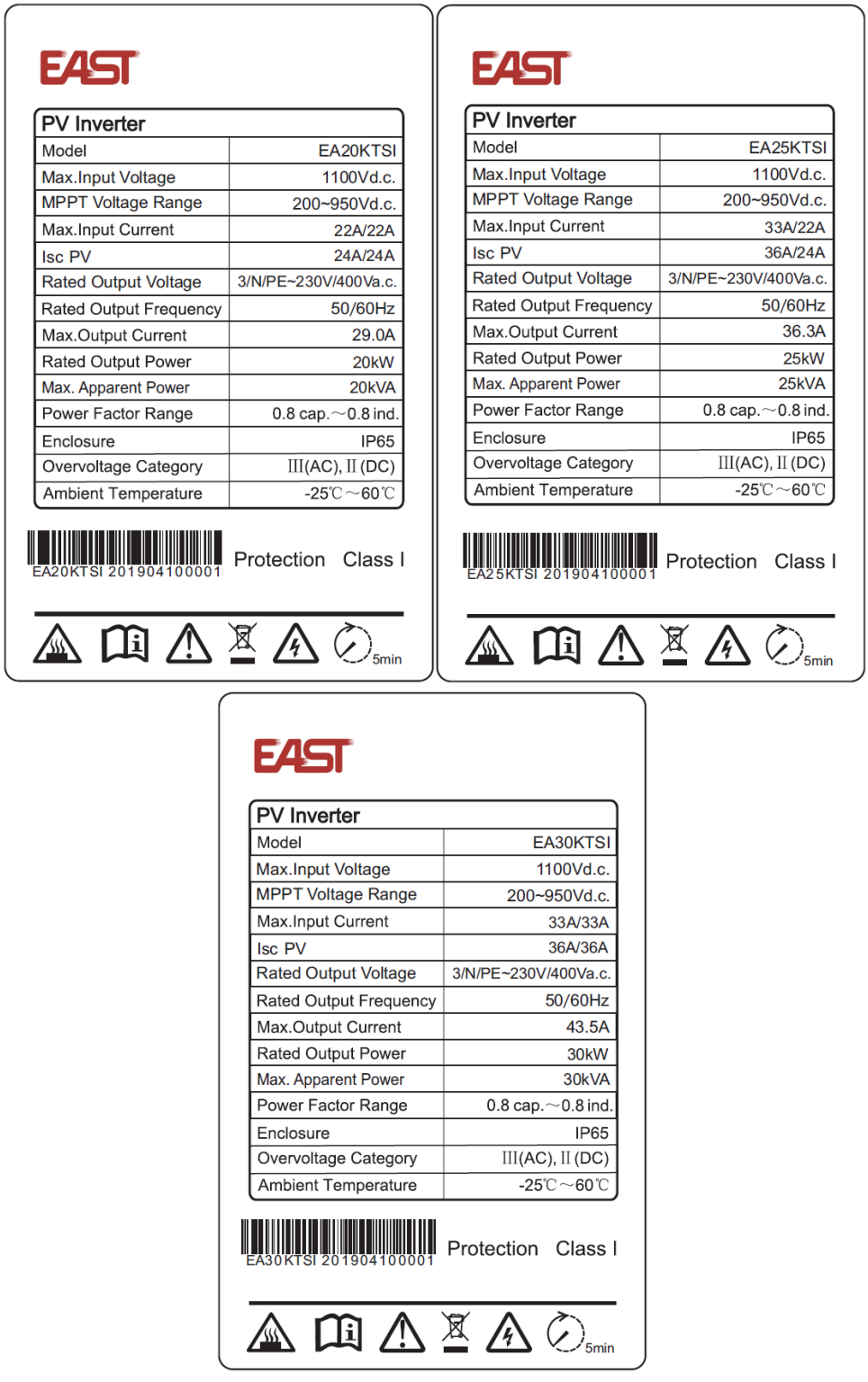
TEST REPORT
UTE C15-712-1
Photovoltaic installations connected to the public distribution network

Report	
Report Number. ..... :	6071537.50
Date of issue..... :	2020-01-19
Total number of pages.....	87 pages
Testing Laboratory ..... :	DEKRA Testing and Certification (Suzhou) Co., Ltd.
Address ..... :	No.99, Hongye Road, Suzhou Industrial Park, Suzhou, Jiangsu, P.R. China
Applicant's name ..... :	EAST Group Co., Ltd.
Address ..... :	No.6 Northern Industry Road, Songshan Lake Sci. & Tech. Industrial Park, Dongguan City, Guangdong Province, China
Test specification:	
Standard..... :	UTE C15-712-1:2013
	DIN V VDE V 0126-1-1/A1 VFR2014
	Enedis-NOI-RES_13E, Version 7, 14/12/2018
Test procedure..... :	Type test
Non-standard test method..... :	N/A
Test Report Form No. ..... :	UTE C15-712-1_V1.1
Test Report Form(s) Originator ..... :	DEKRA Testing and Certification (Shanghai) Ltd.
Master TRF..... :	Dated 2018-12
Test item description..... :	Grid-connected PV inverter
Trade Mark ..... :	EAST
Manufacturer ..... :	EAST Group Co., Ltd.
	No.6 Northern Industry Road, Songshan Lake Sci. & Tech. Industrial Park, Dongguan City, Guangdong Province, China
Model/Type reference ..... :	EA20KTSI, EA25KTSI, EA30KTSI

Ratings……..:	EA20KTSI: PV input: Max. 1100 Vdc , MPPT voltage range: 200-950 Vdc , max 22 A/22 A, Isc PV: 24 A/24 A Output: 230/400 Vac, 3/N/PE, 50/60 Hz, 20000 VA, max 29.0 A EA25KTSI: PV input: Max. 1100 Vdc , MPPT voltage range: 200-950 Vdc , max 33 A/22 A, Isc PV: 36 A/24 A Output: 230/400 Vac, 3/N/PE, 50/60 Hz, 25000 VA, max 36.3 A EA30KTSI: PV input: Max. 1100 Vdc , MPPT voltage range: 200-950 Vdc , max 33 A/33 A, Isc PV: 36 A/36 A Output: 230/400 Vac, 3/N/PE, 50/60 Hz, 30000 VA, max 43.5 A

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	Testing Laboratory:	DEKRA Testing and Certification (Suzhou) Co., Ltd.	
Testing location/ address ..... :		No.99, Hongye Road, Suzhou Industrial Park, Suzhou, Jiangsu, P.R. China	
☐	Associated Testing Laboratory:		
Testing location/ address ..... :			
Tested by (name, function, signature) ..... :		Hua Yu	
Approved by (name, function, signature)..... :		Jason Guo	
☐	~~Testing procedure: TMP/CTF Stage 1:~~		
~~Testing location/ address ..... :~~			
~~Tested by (name, function, signature) ..... :~~			
~~Approved by (name, function, signature)..... :~~			
☐	~~Testing procedure: WMT/CTF Stage 2:~~		
~~Testing location/ address ..... :~~			
~~Tested by (name + signature) ..... :~~			
~~Witnessed by (name, function, signature) ..... :~~			
~~Approved by (name, function, signature)..... :~~			
☐	~~Testing procedure: SMT/CTF Stage 3 or 4:~~		
~~Testing location/ address ..... :~~			
~~Tested by (name, function, signature) ..... :~~			
~~Witnessed by (name, function, signature) ..... :~~			
~~Approved by (name, function, signature)..... :~~			
~~Supervised by (name, function, signature) .... :~~			

Rating label:



Warning Label:

Test item particulars:				
Equipment mobility ..... :	movable fixed	hand-held transportable	stationary for building-in	
Connection to the mains ..... :	pluggable equipment permanent connection		direct plug-in for building-in	
Enviromental category ..... :	outdoor	indoor unconditional	indoor conditional	
Over voltage category Mains ..... :	OVC I	OVC II	OVC III	OVC IV
Over voltage category PV ..... :	OVC I	OVC II	OVC III	OVC IV
Mains supply tolerance (%) ..... :	-90 / +110 %			
Tested for power systems ..... :	TN			
IT testing, phase-phase voltage (V) ..... :	N/A			
Class of equipment ..... :	Class I Not classified	Class II	Class III	
Mass of equipment (kg) ..... :	43			
Pollution degree ..... :	Outside PD3; Inside PD2			
IP protection class ..... :	IP65			
Possible test case verdicts:				
- test case does not apply to the test object ..... :	N/A			
- test object does meet the requirement ..... :	P (Pass)			
- test object does not meet the requirement ..... :	F (Fail)			
- this clause is information reference for installation .:	Info.			
Testing:				
Date of receipt of test item ..... :	2019-10-27 (samples provided by applicant)			
Date (s) of performance of tests ..... :	2019-12-30 to 2020-01-16			

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.
This report is only for reference and is not used for legal proof function in China market.
The information provided by the customer in this report may affect the validity of the results, the test lab is not responsible for it.
"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Name and address of factory (ies):

EAST Group Co., Ltd.

No.6 Northern Industry Road, Songshan Lake Sci. & Tech. Industrial Park, Dongguan City, Guangdong Province, China

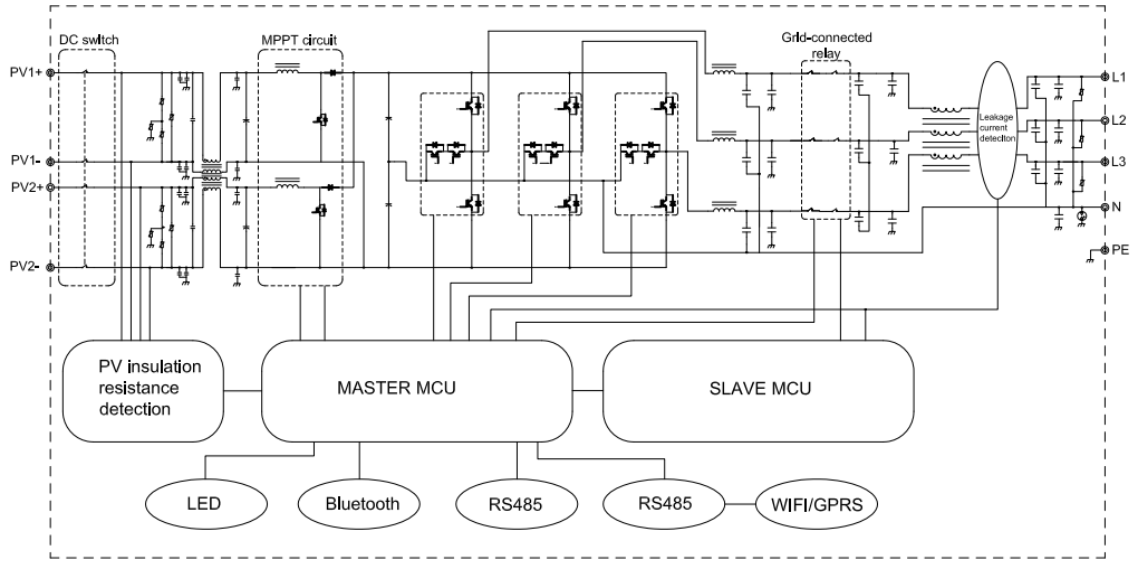
General product information:

The products are grid-connected photovoltaic inverter converts DC voltage into AC voltage, the unit is providing EMC filtering at the input and output towards mains.

The output was switched off redundant by the high power switching bridge and relay in series. This designation assures that the disconnection of the output circuit from the grid will also operate in case of one error.

The internal control is redundant built. It consists of two Microcontrollers (master DSP U1, slave DSP U22). The master DSP can control the relays; detect the PV voltage, PV current and BUS voltage, measures grid voltage, frequency, AC current with injected DC, insulation resistance to ground and residual current. The slave CPU (U22) were also detected grid voltage, injected DC current and residual current. Both microcontrollers communicate with each other. Any abnormal of those electrical parameter will trigger the disconnection of the inverter from the grid.

Block Diagram



Model difference:

1. The models EA20KTSI and EA25KTSI are similar with EA30KTSI in hardware and just power derating according to setting variations parameter in software.

2. The models EA20KTSI, EA25KTSI are identical with EA30KTSI in topological schematic circuit diagram of hardware except for the boost inductor (EA25KTSI and EA30KTSI with 889 μH*2 pcs, EA20KTSI with 650 μH*2 pcs); bus capacitor quantity (EA25KTSI and EA30KTSI with 8 bus capacitors, EA20KTSI with 6 bus capacitors); Boost diode and IGBT; current sampling resistor (EA25KTSI and EA30KTSI with 13 kΩ, EA20KTSI with 8.2 kΩ); AC relay type of output side (EA25KTSI and EA30KTSI with type HF176F/12-H3F; EA20KTSI with type HF165FD-G/12-HY1STF); Internal fan (Only model EA30KTSI designed with internal fan); the type designation and the input/output electrical rating.

The product was tested on:

Hardware version: 00

Software version: HornetV019

Unless otherwise specified, all the tests were performed on model EA30KTSI and also applicable for all other models stated in this report. According to the user manual and testing, the product was evaluated for maximum ambient temperature of 60°C and will derating the output power above 45°C.

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
1	Introduction The development of the use of photovoltaic generators makes it necessary to specify the rules of implementation which are the subject of this guide. NOTE In the rest of the text the abbreviation "PV" is used for "photovoltaic". The application of these rules does not preclude compliance with the by-laws to which certain facilities are required to comply.		–
2	Scope For photovoltaic installations connected to the public low voltage and non-storage distribution network, this guide specifies and supplements the rules of the NF C 15-100. For photovoltaic installations connected to the public high voltage distribution network and without storage, this guide specifies and supplements the rules of the NF C 15-100, for the low voltage part. The ac modules (PV module and associated inverter) are not taken into account in this guide. Their installation is subject to the rules of NF C 15-100. NOTE In the rest of the text the abbreviations "a.c." and "d.c. Are respectively used for "alternating current" and "direct current". Only operation in the presence of voltage on the public distribution network is considered in this guide.		–
3	Normative references		–
	CEI 62109-1		–
	NF EN 12101		–
	NF EN 50380 (C 57-201)		–
	NF EN 50521 (CF57-339)		–
	NF EN 50539-11 (C 61-739-11)		–
	NF EN 60269-6 (C 60-200-6)		–
	NF EN 60904-3 (C 57-323)		–
	NF EN 60947-1 (C 63-001)		–
	NF EN 60664-1 (C 20-040-1)		–
	NF EN 60904-3 (C 57-323)		–
	NF EN 60947-2 (C 63-120)		–
	NF EN 60947-3 (C 63-130)		–
	NF EN 61046 (C 71-240)		–
	NF EN 61215 (C 57-105)		–
	NF EN 61439 (C 63-421)		–
	NF EN 61557-8 (C 42-198-8)		–
	NF EN 61558-2-6 (C 52-558-2-6)		–
	NF EN 61643-11 (C 61-740)		–
	NF EN 61646 (C 57-109)		–
	NF EN 61730-1 (C 57-111-1)		–
	NF EN 61730-2 (C 57-111-2)		–

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
	NF EN 62109-2 (C 57-409-2)		–
	NF EN 62262 (C 20-015)		–
	NF EN 62305-1 (C 17-100-1)		–
	NF EN 62305-2 (C 17-100-2)		–
	NF EN 62305-3 (C 17-100-3		–
	NF C 14-100		–
	NF C 15-100		–
	NF C 17-102		–
	UTE C 15-105		–
	UTE C 15-400		–
	UTE C 15-520		–
	UTE C 32-502		–
	UTE C 61-740-52		–
	UTE C 17-108		–
	DIN VDE 0126-1-1 et amendement 1		–
4	Definitions In addition to the definitions set out in NF C 15-100, the following definitions apply to this guide		–
5	Description of PV installations	Must be taken under consideration for the installation.	N/A
6.	Earthing of the installation		P
6.1	Diagrams showing bonding of alternating current part with earth. The earthing system has been produced in accordance with the requirements of NF C 15-100.		P
6.2	Earthing of one polarity in the d.c. part In a PV installation, the protection devices against indirect contact are independent of the principle of the earthing systems. The direct current part is created in accordance with the rules for class II or equivalent isolation.		N/A
6.3	Earthing of conductive masses and elements		P
6.3.1	Direct current part To minimise the effects of induced overvoltages, the metal structures of the modules and the metal support structures (including the metal cable runs) must be connected to equipotential bonding, which in turn is connected to the earth.	Must be taken under consideration for the installation.	N/A
6.3.2	Alternating current part All chassis on the a.c. side must be connected to the earth via a protective conductor that meets the requirements of paragraph 411.3.1.2 and section 5-54 of NF C 15-100. If a transformer is installed outside the inverter (low	Must be taken under consideration for the installation.	N/A

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
	voltage/low voltage or high voltage/low voltage transformer), equipotential bonding is required between these items of equipment.		
6.3.3	Inverter The inverter body must be connected to the equipotential bonding via a conductor with a minimum cross-section of 6mm² Cu or equivalent and to the protective conductor of the a.c. part.	The PV inverter provided with PE connector itself, a minimum cross-section of the protective earthing wire of 6 mm² is required in the manual.	P
7.	Protection against electric shock		P
7.1	General points The PV equipment of the direct current part must be treated as being under voltage, even if it is disconnected from the alternating current part.		P
7.2	Protection against direct contact		P
7.2.1	General case Electrical equipment must be fitted with a form of protection either by insulation of the live parts or through a casing If the boxes or cabinets are not located in a place to which only authorised or qualified persons have access, protection against direct access must be ensured when an access door is opened by installing equipment that, by the nature of its design or installation, has a minimum degree of protection of IP2X or IPXXB.	The PV inverter is Class I product, and IP protection class is rated IP65.	P
7.2.2	Particular case of safety extra-low voltage and protective extra-low voltage If the nominal voltage of the safety extra-low voltage circuit is less than or equal to 25 V rms a.c. or 60 V d.c. without ripple, protection against direct contact through insulation of the live parts or a casing is not necessary.	The communication port of PV inverter is safety extra-low voltage according IEC 62109-1 test report.	P
7.3	Protection against indirect contact		P
7.3.1	General points The regulations for protection against indirect contact are set out in section 4-41 of NF C 15-100. The circuits covered by 411.3.3 of standard NF C 15-100 and, in particular, circuits in residential buildings must be protected with a differential device with a sensitivity of 30 mA or less.	Must be taken under consideration for the installation.	N/A
7.3.2	Direct current part For the direct current part (PV modules, junction boxes, chain cables, group cables, marshalling boxes or cabinets, etc.), protection against indirect contact must be ensured	Must be taken under consideration for the installation.	N/A
7.3.2.1	Protection with safety extra-low voltage or protective extra-low voltage The requirements of article 414 of standard NF C 15-100 must be applied. The voltage U_{ocMAX} must not exceed 120 V.	PV inverter is rated for PV voltages above 120V	N/A

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
7.3.2.2	Protection with double or reinforced insulation The requirements of article 412 of standard NF C 15-100 must be applied.	Must be taken under consideration for the installation.	N/A
7.3.3	Alternating current part Protection against indirect contact is ensured through double or reinforced insulation or by an automatic cut-out of the supply, according to one of the following measures: • In a TT system: cut-out on the first fault; • In a TN system: cut-out on the first fault; • In an IT system: cut-out on the second fault.	The unit is only intended for TN systems. The unit is rated class I. In combination with the required differential device in clause 7.3.1 no hazard can occur in single fault.	P
8	Overcurrent protection		N/A
8.1	Direct current part		N/A
8.1.1	General points See figure 6 of this standard	Must be taken under consideration for the installation.	N/A
8.1.2	Protection of PV modules In an installation with several PV module chains in parallel, the modules must be protected against the effect of reverse currents that may be generated in the chains in the event of a fault.	Must be taken under consideration for the installation.	N/A
8.1.3	Protection of PV chain cables The sizing of the PV chain cables takes into account the choice of protection device for the PV modules adopted in 8.1.2.	Must be taken under consideration for the installation.	N/A
8.1.4	Protection of PV group cables In an installation with several PV groups in parallel, the cables for the groups must be protected against the effect of reverse currents caused by a short circuit in a group.	Must be taken under consideration for the installation.	N/A
8.1.5	Protection of main PV cable The main cable of a PV generator must be dimensioned with a permissible current I_z greater than or equal to 1,25 I_{scSTC_gen}.	Must be taken under consideration for the installation.	N/A
8.1.6	Characteristics of overcurrent protection devices The overcurrent protection devices must be either fuses compliant with standard NF EN 60269-1 or circuit-breakers compliant with standard NF EN 60947-2. These devices must be implemented for both polarities, regardless of the configuration of the installation.	Must be taken under consideration for the installation.	N/A
8.2	Alternating current part		N/A
8.2.1	General points In the case of an installation connected to the network via a branch line with limited power, the minimum cross-section of the conductors connected to the terminals downstream of the general isolating and protection	Must be taken under consideration for the installation.	N/A

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
	device is 10 mm^2 Cu.		
8.2.2	Overload protection Alternating current circuits are protected against surges in accordance with the requirements of article 433 of standard NF C 15-100.	Must be taken under consideration for the installation.	N/A
8.2.3	Short-circuit protection In the case of a short circuit in an inverter or its line, the inverter is regarded as the load and the public network as the source.	Must be taken under consideration for the installation.	N/A
9.	Tripping device This protection device is designed to disconnect generators in the event of: • a fault on the public distribution network; • a failure in the supply from the public distribution network; • fluctuations in the voltage or frequency greater than those specified by the distributor. This tripping device complies with the specifications set out in guide UTE C 15-400. It is type B.1 for installations whose total inverter power does not exceed 250 kVA and type H for installations with a power greater than this. In installations whose total inverter power does not exceed 250 kVA, the tripping device is allowed to be built into the inverters. It must therefore comply with pre-standard DIN VDE 0126-1-1.	The unit provides a integral disconnection facility according to VDE 0126-1-1 an it is rated below 250 kVA	P
10	Prevention of degradation of photovoltaic installations In order to prevent the degradation of PV installations due to specific external influences and the presence of direct current, and despite the implementation of measures such as the installation of double insulation and monoconductor cables, additional measures must be implemented for the direct current part.	The inverter is applicable to be used for no galvanic insulation and PV array not earthed.	P
11	Voltage drop		N/A
11.1	General points The objective of technical and commercial optimisations is to minimise voltage drops.	Must be taken under consideration for the installation.	N/A
11.2	Direct current installation The authorised maximum drop in voltage in the direct current part of the installation is between 3% and I_{mppSTC} (STC: standard test conditions).	Must be taken under consideration for the installation.	N/A
11.3	Alternating current installation For PV installations connected directly to the LV public distribution network, the maximum authorised drop in voltage between the a.c. terminals of the inverter and the point of delivery (NF C 14-100) is 3% at the nominal power of the inverter(s). It is recommended to limit this drop in voltage to 1% in order to be able to limit energy	Must be taken under consideration for the installation.	N/A

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
	losses on the one hand and momentary disconnection of the inverter on the other, maintaining a margin between the average operating voltage of the inverter and the setting of its protection at maximum voltage.		
12.	Disconnectors and circuit-breakers		N/A
12.1	General points When choosing and installing circuit-breakers and disconnectors between the PV installation and the public distribution network, the network must be regarded as the source and the PV installation as the load.	Must be taken under consideration for the installation.	N/A
12.2	Disconnectors To facilitate maintenance of the PV inverters, disconnection mechanisms must be installed close to the inverter, on both direct current and alternating current sides.	Must be taken under consideration for the installation.	N/A
12.3	Emergency circuit-breakers	Must be taken under consideration for the installation.	N/A
12.3.1	General points To allow maintenance work on junction boxes fitted with protection devices, a circuit-breaker must be installed inside or immediately downstream of these protection devices	Must be taken under consideration for the installation.	N/A
12.3.2	Direct current part		N/A
12.3.2.1	General measures The emergency disconnection can be ensured by manual control of the circuit-breaker or via a remote control action.	Must be taken under consideration for the installation.	N/A
12.3.2.2	Measures specific to residential buildings In conformity with the regulations set down in article 771.463 of standard NF C 15-100, the emergency circuit-breakers must be tripped by a direct manual action.	Must be taken under consideration for the installation.	N/A
12.3.3	Alternating current part		N/A
12.3.3.1	General measures The emergency disconnection can be ensured by manual control of the circuit-breaker or via a remote control action.	Must be taken under consideration for the installation.	N/A
12.3.3.2	Measures specific to residential buildings If the route between the inverter and the network passes through the residential part, the emergency circuit-breaker of the PV installation must be installed in the residential service duct of the building, if there is one, in accordance with articles 771.463 and 771.558 of standard NF C 15-100.	Must be taken under consideration for the installation.	N/A
12.3.3.3	Cut-out for intervention by emergency services If a cut-out is required to allow the intervention of the emergency services, this must be triggered by one of the following events:	Must be taken under consideration for the installation.	N/A

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
13	Protection from surges emanating from the atmosphere or caused by operations		N/A
13.1	General points The information contained in this chapter refers to overvoltage protection for photovoltaic installations connected to the network and complements standard NF C 15-100 and guide UTE C 61-740-52.	Must be taken under consideration for the installation.	N/A
13.1.1	Types of protection		N/A
13.1.1.1	Protection through equipotential bonding As described in section 6.3, an equipotential bonding conductor must connect all the metal structures of the modules and the metal structures of the supports of the PV installation (including the metal cable runs) whether or not lightning conductors are present. This conductor must be connected to the earth.	Must be taken under consideration for the installation.	N/A
13.1.1.2	Protection by lightning arresters The installation conditions are described in 13.2.	Must be taken under consideration for the installation.	N/A
13.2	Installation conditions for lightning arresters		N/A
13.2.1	Installation conditions for lightning arresters on a.c. side Based on guide UTE C 61-740-52, protection by a lightning arrester is obligatory if there is a lightning conductor or if the lightning density (Ng) is greater than 2.5.	Must be taken under consideration for the installation.	N/A
13.2.2	Installation conditions for lightning arresters on d.c. side		N/A
13.2.2.1	Installation without lightning conductor The length L is the accumulated distance between the inverter(s) and the furthest points of the photovoltaic modules comprising the chain, as a sum of the lengths of the routes in accordance with the principles shown in Figure 7.	Must be taken under consideration for the installation.	N/A
13.2.2.2	Installation with lightning conductor The installation of type 2 lightning conductor(s) is obligatory on the d.c. side.	Must be taken under consideration for the installation.	N/A
13.3	Overvoltage protection for installations without lightning conductor		N/A
13.3.1	Choice and installation of lightning arresters on a.c. side If a lightning arrester is prescribed for the a.c. part of a PV installation connected to the public low-voltage distribution network, it is always installed in the panel nearest to the installation origin of the installation. If this lightning arrester is located more than 10 metres away from the inverter, a second lightning arrester must be installed near the latter.	Must be taken under consideration for the installation.	N/A
13.3.2	Choice and installation of lightning arresters on d.c. side If a lightning arrester is prescribed for the d.c. part of a PV installation, it is always installed in the panel nearest to the inverter. If one of the chains is located more than	Must be taken under consideration for the installation.	N/A

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
	10 metres away from the inverter, the installation of a second lightning arrester near the chains is recommended.		
13.3.2.1	Choice of I_n The lightning arresters are type 2 with a minimum value for the nominal discharge current In of 5 kA. A higher nominal discharge current than the required value will prolong the service life of the lightning arrester.	Must be taken under consideration for the installation.	N/A
13.3.2.2	Choice of I_{max} This parameter is used to coordinate the energy of the lightning arresters: please refer to information from the manufacturer.	Must be taken under consideration for the installation.	N/A
13.3.2.3	Choice of I_{imp} The shock current I_{imp} of the type 1 surge arresters is chosen according to the UTE C guide 61-740-52 or by default with a minimum value of 12.5 kA.	Must be taken under consideration for the installation.	N/A
13.3.2.4	Choice of U_p The value of U_p shall be less than 80% of the value of the rated impact voltage of the equipment to be protected.	Must be taken under consideration for the installation.	N/A
13.3.2.5	Choice of I_{SCWPV} and protection device associated with the lightning arrester The lightning arrester must be fitted with an external disconnection device, if specified by the manufacturer; this assembly must be sized to function regardless of the current produced by the PV modules.	Must be taken under consideration for the installation.	N/A
13.3.2.6	Choice of I_{SCPV} and protection device associated with surge arrester I_{SCPV}: keeping short circuit current of a surge arrester The surge arrester must be equipped with a disconnection device. An external disconnection device may be recommended by the manufacturer. This set must be sized to operate regardless of the current produced by the PV modules.	Must be taken under consideration for the installation.	N/A
13.4	Additional regulations for surge protection for installations with a lightning conductor The regulations are set out in guide UTE C 61-740-52.	Must be taken under consideration for the installation.	N/A
14.	Choice and installation of equipment		P
14.1	General points The rated operating voltage of all the equipment of the d.c. part must be equal to or greater than the voltage U_{OCMAX}. In the case of buildings with multiple occupation (for tertiary or residential use) with photovoltaic production in communal parts, the lines coming from the PV modules must be routed round the outside of private areas to the junction boxes for the chain/group located in the communal areas or in the buildings or the electrical service site dedicated to this purpose.	The inverter is rated IP65 and IK07. For IP see attached test report. For IK see test results below.	P

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The equipment installed outside must have a minimum degree of protection of IP44. The degree of protection against mechanical impacts must be at least IK07 in compliance with standard NF EN 62262 (C 20-015). It must be possible to carry out work on the removable equipment, devices and connections in the utmost safety. If a transformer is installed, the inverters and any general low-voltage panel must be installed close to the transformer in the same room or in adjoining rooms. The location of equipment (junction box(es), inverter(s), cabinets with protection devices and meter cabinets etc.) must comply with article 513.1 of standard NF C 15-100. Special regulations for residential buildings are given in article 771. The equipment, including the ducts etc., must be arranged so that they can be operated, inspected and serviced easily and their connections can be accessed.		
14.2	Ducts etc.		N/A
14.2.1	Choice for the d.c. part The ducts are sized in accordance with the regulations in standard NF C 15-100 on the basis of cables with reticulated polyethylene insulation.	Must be taken under consideration for the installation.	N/A
14.2.2	Installation The connections and the cables must be installed in a manner that will prevent any deterioration due to external influences. See the requirements set out in guide UTE C 15-520.	Must be taken under consideration for the installation.	N/A
14.3	PV modules The PV modules must comply with the standards in series NF EN 61730.	Must be taken under consideration for the installation.	N/A
14.4	Inverters The level of the current for the inverter must be based on I_{mppSTC}.		P
14.5	Equipment All equipment installed in the d.c. part must be adapted for operation in direct current and be selected and installed in accordance with the manufacturer's instructions. Equipment installed in the d.c. part must be of the industrial type, in other words compliant with the NF EN 60947 series of standards. • The characteristics of switches, switch-disconnectors and fuse-combination units must conform to the operating category DC21B. • The characteristics of disconnectors must conform to the operating category DC20. • The characteristics of contactors must conform to the operating category DC1.	The internal DC switch of the inverter was certified according to EN 60947 series standards.	P

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
14.6	Equipment assemblies The direct current and alternating parts of the installation can be accommodated in the same panel if there is a physical separation of these two parts. For the d.c. part, it is imperative to protect all the connections or disconnection devices against accidental or unauthorised opening when live in accordance with 536.2.3 of standard NF C 15-100. To this end, a notice "Do not operate when live" must be placed inside the boxes or cabinets near these disconnection devices. Furthermore, in premises accessible to persons other than those with the requisite authorisation or qualification (BA4 or BA5): • The design or installation must be such that it is only possible to disassemble the connection devices with the aid of a tool; • Equipment that does not have an under load circuit-breaking feature must require the either the use of a key or tool or the direct operation of a device with an under load circuit-breaking feature.	The PV input connectors cannot be removed without of a tool. In addition there is a marking adjacent the connectors with states "Do not operate when live".	P
14.7	Connectors In the d.c. part, the connectors used must comply with the standard NF EN 50521. To guarantee the quality of the connection and limit the risks of an electric arc that could spark a fire, each pair of male and female connectors to be assembled must be of the same type and the same brand.	The unit provides only one type and brand of connectors for DC with male and female plugs, which are not interchangeable. The plugs were certified according to EN 50521.	P
14.8	Lightning arresters		N/A
14.8.1	Choice of lightning arresters The lightning arresters installed in the a.c. part of the PV installation must comply with standard NF EN 61643-11. The lightning arresters installed in the d.c. part of the PV installation must meet the requirements of guide UTE C 61-740-51.	An external lightning protection must be installed.	N/A
14.8.2	Installation of lightning arresters Alternating current and direct current lightning arresters are installed in accordance with the regulations set out in guide UTE C 61-740-52.	Must be taken under consideration for the installation.	N/A
15	Markings		P
15.1	Identification of components The main components comprising the photovoltaic installations must be identified and marked with clearly visible labels fixed permanently in accordance with the installation plans and diagrams:	The inverter provides permanent marking.	P
15.2	Labelling For safety reasons and to alert the different people carrying out work in and around the building (staff tasked with maintenance work, inspectors, public distribution network operators, emergency services, etc.), it is		P

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
	imperative that the presence of a photovoltaic installation on a building is indicated.		
15.2.1	Labelling on the a.c. part	Must be taken under consideration for the installation.	N/A
15.2.2	Labelling on the d.c. part All the junction boxes (PV generator and PV groups) and d.c. ducts must carry a visible and permanent marking indicating that live parts within these boxes may remain under voltage even after the inverter has been disconnected on the direct current side.	Must be taken under consideration for the installation.	N/A
15.2.3	Labelling on the inverter All inverters must bear a marking indicating that before any work is carried out, the two sources of voltage must be isolated. Inverter label:  	The unit is provided with the applicable marking.	P
15.3	Specific Labels for Emergency Response If specific labels for the intervention of the rescue services is required, it meets the principles described below. The purpose of this signage is to provide emergency services with information that allows a decision-making approach to quickly know: • if and how secure is the area accessible to people to be rescued; • if there are cut-off devices according to paragraph 12.5 and if the cut is effective. This signage affixed next to the general control and disconnection device (or AGCP) will complete the signage dedicated to the general control and disconnecting apparatus of the consumption and production installations defined in paragraph 12.	Must be taken under consideration for the installation.	N/A
16.	Technical file The technical file must include the following items drawn up in French: • A circuit diagram of the photovoltaic system;	The required information was stated in the manual.	P

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
	• The list of installed equipment mentioning the characteristics and references to the replacement parts (fuses, lightning arrester cartridges etc.); • An installation diagram for the various photovoltaic components and modules as well as the corresponding connections (ducts); • A description of the procedure for working on the photovoltaic system and safety instructions.		
17.	Maintenance of photovoltaic installations		N/A
17.1	General points The minimal technical maintenance work must be provided for during the life cycle of a photovoltaic installation to maintain or restore the installation to a state in which it can fulfil the function for which it was designed.	Must be taken under consideration for the installation.	N/A
17.2	Levels and frequency of maintenance A distinction is made between the following three levels of maintenance comprising: • Conditional maintenance based on monitoring of the key parameters of the installation; • Precautionary maintenance carried out according to the prognoses extrapolated from the analysis and evaluation of the key parameters concerning the degradation of the asset (e.g. corrosion); • Systematic maintenance carried out at predetermined intervals and without a prior check of the state of the product or its constituent components.	Must be taken under consideration for the installation.	N/A
17.3	Technical areas covered during maintenance A distinction is made between operations relating to the safety of persons and property, and actions relating to functional reliability.	Must be taken under consideration for the installation.	N/A
Annex A Agreements between the administrator of the public distribution network and the user/produce			
A1	Provisions for limiting effects adversely affecting supply quality The study of the connection by the administrator of the public distribution network requires the communication of the characteristic data for the project, the generators and the provisions for connection to the network. The administrator of the public distribution network may disclose data sheets summarising the minimum list of data required to study the request.	Must be taken under consideration for the installation.	N/A
A2	Choice of tripping device and approval The installation or modification of a tripping device must be subject to an agreement with the administrator of the public distribution network.	Must be taken under consideration for the installation.	N/A

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
	This process must take account of the situation and the features at the point of delivery and must therefore, where necessary, be coordinated with the connection study for the site.		
A3	Start-up by the administrator of the public distribution network For installations with a power of less than 250 kVA, this step is subject to prior submission of proof of conformity stamped by CONSUEL (Comité National pour la Sécurité des Usagers de l'Electricité, the National Committee for the Safety of Users of Electricity).	Must be taken under consideration for the installation.	N/A
	Annex B Cables for photovoltaic installations - values for permissible currents (informative)		
	Specific cables for photovoltaic installations have been refined in order to meet the needs of these installations. The tables below, taken from document UTE C 32-502, give the values for the permissible currents for cables compliant with this guide.	Must be taken under consideration for the installation.	N/A
	Annex C Keraunic levels in France and in the overseas departments (informative)		
	Note – To obtain the corresponding lightning density (Ng), simply divide Nk by 10.		–
	Appendix D Calculation of U_{ocmax} and I_{scmax}		
D1	Calculation of U_{ocmax} U_{ocmax} is the maximum voltage across a PV module, PV array, PV array, or unloaded PV generator (open circuit). It is calculated with the formula: $U_{ocmax} = K_U U_{ocSTC}$	Must be taken under consideration for the installation.	N/A
D2	Calculation of I_{scmax} The maximum short-circuit current of a PV module, PV chain, PV array or PV generator is calculated by the following formula: $I_{scmax} = K_i I_{scSTC}$ K_i must be chosen at least equal to 1.25.	Must be taken under consideration for the installation.	N/A

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

14.1	**TABLE: IEC 62262 / IEC 60068-2-75 (Hammer test)**									**P**
Use method	Swing hammer			Spring hammer			Vertical hammer			
	N/A			N/A			P			
Repeats	3 Hits unless otherwise specified									
Energy (J)	0.14	0.2	0.35	0.5	0.7	1	**2**	5	10	20
Mass (kg)	0.25						**0.5**	1.7	5	5
Radius (mm)	10						**25**	25	50	50
IK code	IK01	IK02	IK03	IK04	IK05	IK06	**IK07**	IK08	IK09	IK10
Verdict	N/A	N/A	N/A	N/A	N/A	N/A	**P**	N/A	N/A	N/A

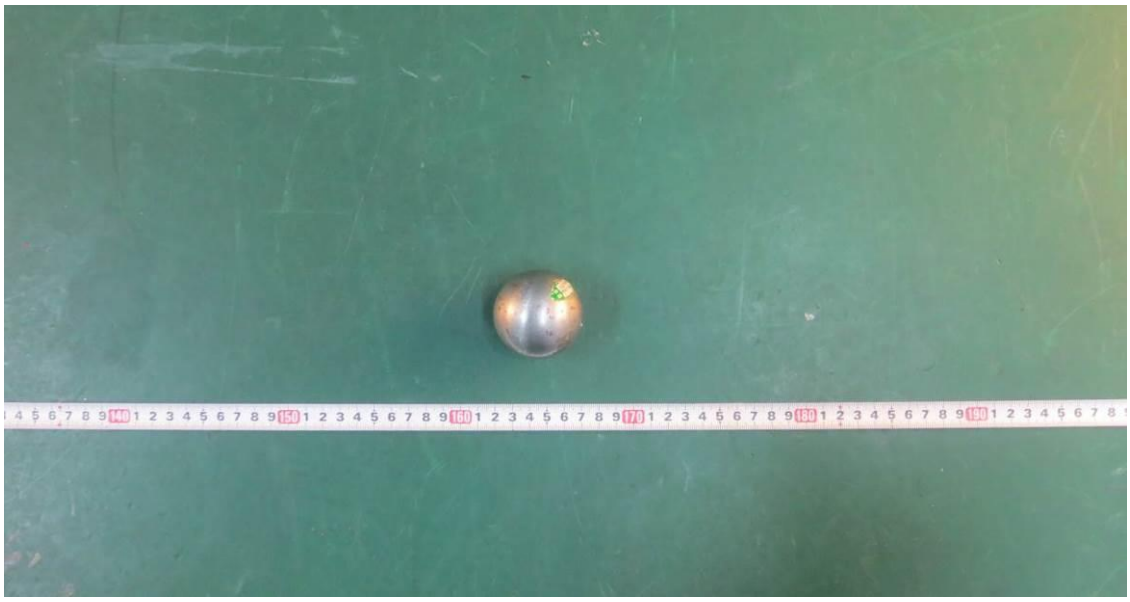
Note:
According to IEC 60068-2-75, to produce impacts of the required severity, the striking element shall be released from a height depending on the equivalent mass of the pendulum, according to below table.

Energy J	0,14	0,2		(0,3)	0,35	(0,4)	0,5		0,7	1	2	5	10	20	50
Equivalent mass kg	0,25	(0,2)	0,25	(0,2)	0,25	(0,2)	(0,2)	0,25	0,25	0,25	0,5	1,7	5	5	10
Height of fall mm ± 1 %	56	(100)	80	(150)	140	(200)	(250)	200	280	400	400	300	200	400	500

NOTE 1 Figures in brackets appear in previous IEC 60068-2 standards; although no longer recommended, they may be used for historic consistency.

NOTE 2 In this part of IEC 60068, the energy, J, is calculated taking the standard acceleration due to the earth's gravity (g_n), rounded up to the nearest whole number, that is 10 m/s^2.

The tests were performed on model EA30KTSI also applicable for all other models stated in this report.



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Appendix 1: DIN V VDE V 0126-1-1/A1 VFR2014 Test Report

DIN V VDE V 0126-1-1/A1 VFR2014			
1	Scope (Automatic disconnecting facility for photovoltaic installations)		
2	Normative references		
	DIN EN 50160:2003-03		
	DIN EN 50178 (VDE 0160):1998-04		
	DIN EN 60664-1 (VDE 0110-1)		
	E DIN VDE 0664-100:2005-05		
	DIN EN 61000-6-2		
	DIN EN61000-6-3		
	DIN EN 61008-1 (VDE 0664-10):2000-09		
	DIN VDE 0105-100:2000-06		
4	Requirements: 1. Monitoring of voltage and frequency derivation 2. Monitoring of DC-Injection 3. Monitoring of accidental anti Islanding 4. Monitoring of intended anti Islanding 5. Residual Current Monitoring Unit –RCMU (only if no galvanic separation)		
4.1	Functional safety: Automatic disconnecting facility	See appended table. The single fault safe system was reviewed. The theoretical investigation was verified by error simulation.	P
4.1.1	Single fault safety of the automatic disconnecting facility	See appended table, see block diagram, functional explanation and table 6.1 below.	P
4.1.2	Disconnection device: At least two independent disconnection devices. At least one relay and one switch with overvoltage category 2. If without galvanic seperation then two relays are necessary	Disconnection takes place redundant through two relays and the IGBT-full bridge in series. The relays and the IGBT-full bridge are able to switch the full current.	P
4.2	Monitoring of the voltage: Voltages <=80% and >=115% of V_{nom} cause a disconnection within 0,2s (reconnection after min. 5s if voltage fluctuation <=3s; min. 30s if voltage fluctuation >3s). Test voltage steps should not be below 77% and above 118% of V_{nom}. Continuous over voltage above 110% up to 115% (adjustable, default setting 110%) causes disconnection after max. 10min. Re-connection after min. 30s.	Tested with a variable AC-Power supply at the output. Inverter disconnects within the limits, see table 6.2 below.	P
4.3	Monitoring of frequency: Frequencies <=47,5Hz	Tested with an AC-Source	P

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
DIN V VDE V 0126-1-1/A1 VFR2014			
	and >=51,5Hz cause a disconnection within 0,2s	at the output, according to Enedis-NOI-RES_13E and DIN V VDE V 0126-1-1/A1 VFR2014 the frequency upper limit 50,6Hz use for this test. See table 6.3 below.	
4.4	Monitoring of DC-Injection: DC error or DC-Currents >= 1A cause disconnection within 0,2s (positive and negative polarity)	See table 6.4 below.	P
4.5	Detection of anti-islanding: anti islanding causes disconnection within 5s (for multiple installations 0,2s if triggered external). For the detection of anti-islanding is only one of the following methods necessary: -6.5.1 Measurement of impedance or -6.5.2 Resonant circuit test or -6.5.3 3-phase grid-voltage monitoring	See table 6.5.2 below.	P
4.6	Marking: In case of an automatic disconnecting facility there is a note at the type plate necessary	Marking provided on the type label.	P
4.7	Special requirements:		–
4.7.1	Photovoltaics: If without galvanic separation then a RCMU is necessary. Insulation resistance > 1kOhm/V, at least 500kOhm. Slowly increasing DC-Leaking currents up to 300mA cause disconnection within 0,3s / Surge dc-leakage currents should lead to a disconnection of: -30mA within 0,3s -60mA within 0,15s -150mA within 0,04s Before every connection to the grid, the d.c. array ground insulation has to be checked. (see 6.6.2.2.4).	For Residual Current Monitoring see table 6.6 below.	P
5	General requirements: Electromagnetic compatibility (EMC)		–
	Emitted interference DIN EN 61000-6-3 (VDE 0839-6-3)	See separated EMC test report.	P
	Interference resistance DIN EN 61000-6-2 (VDE 0839-6-2)	See separated EMC test report.	P
6	Type test:	See following test report	P
7.	Routine test:		P
8	Specification of installation:		P
	Annex A		
A.1	Additional Methods of monitoring anti islanding:		P
A.2	Frequency limits		P
	According to the specifications for power plants within the integrated network, the lower tripping threshold is set to 47.5 Hz.		P

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict
DIN V VDE V 0126-1-1/A1 VFR2014			
	This serves to prevent additional generators from being switched off in case of an output shortage in the integrated network which can be noticed because of a dip in frequency. A deviation from these specifications occurs at the upper frequency limit based on various considerations: A frequency increase in the integrated network indicates a power reserve. In this case, disconnecting the generators could mean helping the power generated adapt to demand, resulting in a more stable network. However, the tripping threshold for large-scale power plants is set at a relatively high level (51.5 Hz) because disconnecting these power plants and the "trapping of auxiliary power" required to do so as well as the subsequent start-up are not exactly problem-free. Critical network conditions could be caused if these power plants are needed again for short term demands. This operating method is neither required nor does it make sense for small generators which is why the upper frequency limit was set to 50.2 Hz.		
A.3	Operating emergency power systems		N/A
	For certain types of work to be performed in the network (e.g. replacing local network transformers), distribution network operators are required to separate sub-networks from the other network. To be able to supply customers during this time, network operators use network back-up systems (generally Diesel aggregates). In most cases, an uninterruptible supply is actually possible.	Must be taken under consideration for the installation.	N/A
A.4	Disconnection for a short period		P
	For short-term disconnections of the generator due to safety reasons (generally following an interference in the network due to a lower deviation from the voltage band lasting up to 3 s), a waiting period of 5 s is permissible. It is measured starting from the point in time when the voltage and frequency are back inside the tolerance band (unlike the aforementioned value of 30 s before the resynchronization). In this case, the generators' device-specific characteristics must be taken into account (e.g. complete shutdown of rotating systems).	If frequency fluctuation of <=3s occur, the reconnection after min. 5s is permitted.	P

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

DIN V VDE V 0126-1-1/A1 VFR2014		
Clause	Test Item	Result
6.1 (4.1)	Functional safety	P
6.2 (4.2)	Voltage monitoring	P
6.2 (4.2)	Voltage monitoring: Island 50Hz	P
6.2 (4.2)	Voltage monitoring: Island 60Hz	P
6.2(4.2.3)	Overvoltage protection according to DIN EN 50160	P
6.3 (4.3)	Frequency monitoring: DIN V VDE V 0126-1-1:2006-02	P
6.3 (4.3)	Frequency monitoring: DIN V VDE V 0126-1-1/A1 VFR2014	P
6.3 (4.3)	Frequency monitoring: Island 50Hz	P
6.3 (4.3)	Frequency monitoring: Island 60Hz	P
6.4 (4.4)	Monitoring of DC-Injection	P
6.5 (4.5)	Detection of Anti-Islanding - Resonant circuit test	P
6.6 (4.7)	Residual Current Monitoring	P
6.6.2.2.2	Test for correct disconnection in case of a continuously rising residual current	P
6.6.2.2.2	Test for correct disconnection in case of an abrupt appearing residual current >300mA	P
6.6.2.2.3	Test for correct disconnection in case of a suddenly occuring residual current	P
6.6.2.2.4	Isolation measurement before feeding in	P
14.1	IEC 60068-2-75 (Hammer test)	P

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

6.1 (4.1)	TABLE: fault condition tests						P
No.	component No.	fault	test voltage [V]	test time	fuse No.	fuse current [A]	Test result
1. 10	BUS Voltage detection (R300)	Open Circuit	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Bus Over Volt Trans Err”. No damage, no hazard, leakage
2. 11	BUS Voltage detection (R300)	short circuit	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Bus Volt Plus-Minus Unbalance Err”. No damage, no hazard
3. 14	Grid voltage detection R (R584)	Open Circuit	620Vdc/230Vac	10min	--	--	PCE NormalState. No error message. No damage, no hazard
4. 15	Grid voltage detection R (R584)	short circuit	620Vdc/230Vac	10min	--	--	PCE NormalState. No error message. No damage, no hazard
5. 19	Grid voltage detection R (R678)	Open Circuit	620Vdc/230Vac	10min	--	--	PCE NormalState. No error message. No damage, no hazard
6. 20	Grid voltage detection R (R678)	short circuit	620Vdc/230Vac	10min	--	--	PCE NormalState. No error message. No damage, no hazard
7. 21	Grid voltage detection R (R550)	Open Circuit	620Vdc/230Vac	10min	--	--	PCE NormalState. No error message. No damage, no hazard
8. 22	Grid voltage detection R (R550)	Short Circuit	620Vdc/230Vac	10min	--	--	PCE NormalState. No error message. No damage, no hazard
9. 23	Inv voltage detection R(R424)	short circuit	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Inv soft Start Fail Err”. No damage, no hazard
10.	Inv voltage detection R (R424)	Open Circuit	620Vdc/230Vac	10min	--	--	Inv soft Start Fail Err PCE shutdown and disconnected from grid immediately. Error message:“Inv soft Start Fail Err”. No damage, no hazard
11.	Inv voltage detection N(R407)	short circuit	620Vdc/230Vac	10min	--	--	PCE NormalState. No error message. No damage, no hazard
12.	Inv voltage detection N(R407)	Open Circuit	620Vdc/230Vac	10min	--	--	PCE NormalState. No error message. No damage, no hazard

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

13.	Inv voltage detection N(R144)	short circuit	620Vdc/230Vac	10min	--	--	PCE NormalState. No error message. No damage, no hazard
14.	Inv voltage detection N(R144)	Open Circuit	620Vdc/230Vac	10min	--	--	PCE NormalState. No error message. No damage, no hazard.
15.	Power supply +12V (T612-T616)	Short Circuit	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No damage, no hazard
16. \	Power supply +7V (T616-T619)	Short Circuit	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No damage, no hazard
17.	Power supply +15V (T609-T610)	Short Circuit	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No damage, no hazard
18.	Power supply +15V2 (T604-T606)	Short Circuit	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Inv soft Start Fail Err”. No damage, no hazard
19.	ISO detection relay (RY900)	Short Circuit before start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“ ISO Fail Err”. No damage, no hazard
20.	BUS Capacitor (C301)	Short Circuit before start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“ Bus Over Volt Trans Err”. No damage, no hazard
21.	PV+ to PV-	Shorted	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No error massage. No damage, no hazard
22.	PV+ to PV-	Reversed	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No error massage. No damage, no hazard.
23.	Leakage current detection (R579)	Open Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “GFCI Sensor Err”. No damage, no hazard
24.	Leakage current detection (R579)	Short Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “GFCI Sensor Err”. No damage, no hazard

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

25.	Transformer T600 (Pin 8-pin 9)	Short Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: LED off. No power output No damage, no hazard
26.	Transformer T600 (Pin10-pin 12)	Short Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: LED off. No power output No damage, no hazard
27.	Off grid voltage detection (R164)	Open Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: " Grid Over Volt Err". No damage, no hazard
28.	Off grid voltage detection (R164)	Short Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: " Grid Over Volt Err". No damage, no hazard
29.	INV Current detection (R75)	Open Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:"Inv Over Curr Trans Err". No damage, no hazard
30.	INV Current detection (R75)	Short circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:"Inv Over Curr Trans Err". No damage, no hazard
31.	Grid frequency detection (R408)	Open Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:"Grid Under Freq Err". No damage, no hazard
32.	Grid frequency detection (R408)	Open Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:"Grid Under Freq Err". No damage, no hazard
33.	Output Relay (K400)	Short Circuit before start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:"Output Relay Err". No damage, no hazard
34.	Output Relay (K400)	Short Circuit after start up	620Vdc/230Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

35.	DSP power supply loss 3.3V (C240)	Short Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SPI Comm Fail Err”. No damage, no hazard
36.	DSP power supply loss 3.3V (C240)	Open Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No error massage, No damage, no hazard.
37.	Communication defect between DSP (R36)	Open Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SPI Comm Fail Err”. No damage, no hazard
38.	Communication defect between DSP (R36)	Short Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SPI Comm Fail Err”. No damage, no hazard
39.	Communication defect between DSP (R31)	Open Circuit after start up	620Vdc/230Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
40.	Communication defect between DSP (R31)	Short Circuit after start up	620Vdc/230Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
41.	Crystal Oscillator defect (C183)	Short Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SMCU Grid Freq Err”. No damage, no hazard
42.	Crystal Oscillator defect (C183)	Open Circuit after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“SMCU Grid Freq Err”. No damage, no hazard
43.	N-PE voltage detection R678	Open Circuit	620Vdc/230Vac	10min	--	0	PCE shutdown and disconnected from grid immediately. Error message:“Ground Connection Err”. No damage, no hazard
44.	N-PE voltage detection R678	Short Circuit	620Vdc/230Vac	10min	--	0	PCE shutdown and disconnected from grid immediately. Error message:“Ground Connection Err”. No damage, no hazard

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

45.	Crystal Oscillator defect (C182)	Short Circuit	620Vdc/230Vac	10min	--	0	PCE shutdown and disconnected from grid immediately. Error message:“SMCU Grid Freq Err”. No damage, no hazard
46.	Crystal Oscillator defect (C182)	Open Circuit	620Vdc/230Vac	10min	--	0	PCE shutdown and disconnected from grid immediately. Error message:“SMCU Grid Freq Err”. No damage, no hazard
47.	Heat Dissipation Fan	locked-rotor	950Vdc/230Vac	25min	--	--	PCE output power derated to 60% No Error message, No damage, no hazard
48.	L1, N	Mis-wiring with incorrect phase sequence	950Vdc/230Vac	10min	--	--	PCE can not start up, Error message: “Grid Over Volt Err”. No damage, no hazard
49.	L1, G	Mis-wiring with incorrect phase sequence	950Vdc/230Vac	10min	--	--	PCE can not start up, Error message: “Grid Over Volt Err”. No damage, no hazard
Note:							

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Transformer short circuit tests(T600, Input 1100Vdc)								**P**
1	Pin17-18	SC	950Vmp/ Pmp:30kw	10min	--	--	EUT normal, with full load output	
2	Pin14-15	SC	950Vmp/ Pmp:30kw	10min	--	--	EUT normal, with full load output	
3	Pin10-12	SC	950Vmp/ Pmp:30kw	10min	--	--	EUT output power off, relay switched off.	
4	Pin10-11	SC	950Vmp/ Pmp:30kw	10min	--	--	EUT output power off, relay switched off.	
5	Pin8-9	SC	950Vmp/ Pmp:30kw	10min	--	--	EUT normal, with full load output	
5	Pin5-6	SC	950Vmp/ Pmp:30kw	10min	--	--	EUT normal, with full load output	
Output short circuit								**P**
1	Output L1-N	SC after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error massage: " Grid Under Volt Err2". Short current 0A. No damage, no hazard	
2	Output L2-N	SC after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error massage: " Grid Under Volt Err2". Short current 0A. No damage, no hazard	
3	Output L3-N	SC after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error massage: " Grid Under Volt Err2". Short current 0A. No damage, no hazard	
4	Output N-PE	SC after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Short current 0A. No damage, no hazard	
5	Output L1-L2	SC after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:" Grid Under Volt Err2". Short current 79.9A.	

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

6	Output L1-L3	SC after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“ Grid Under Volt Err2”. Short current 80.9A. No damage, no hazard
7	Output L2-L3	SC after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“ Grid Under Volt Err2”. Short current 79.8A. No damage, no hazard
8	Output L1-L2, L3	SC after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“ Grid Under Volt Err2”. Short current: L1 69.2A. L2 69.4A L3 69.2A No damage, no hazard
9	Output PE not connected	SC after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“PE Fail Err”. No damage, no hazard
Output overload							**P**
1	MPPT1	Backfeed current	1100Vdc/230Vac	10min	--	--	No back feed current in MPPT1, with the DC current
2	MPPT2	Backfeed current	1100Vdc/230Vac	10min	--	--	No back feed current in MPPT2
3	AC output	Backfeed current	1100Vdc/230Vac	10min	--	--	No back feed current in AC output
Output overload							**N/A**
--	--	--	--	--	--	--	--
The PCE can not working on overload mode.							

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Reverse d.c. connections								**P**
1	PV+ to PV-	RV	950Vmp/Pmp:30kw	10min	--	--	EUT could not start up.	

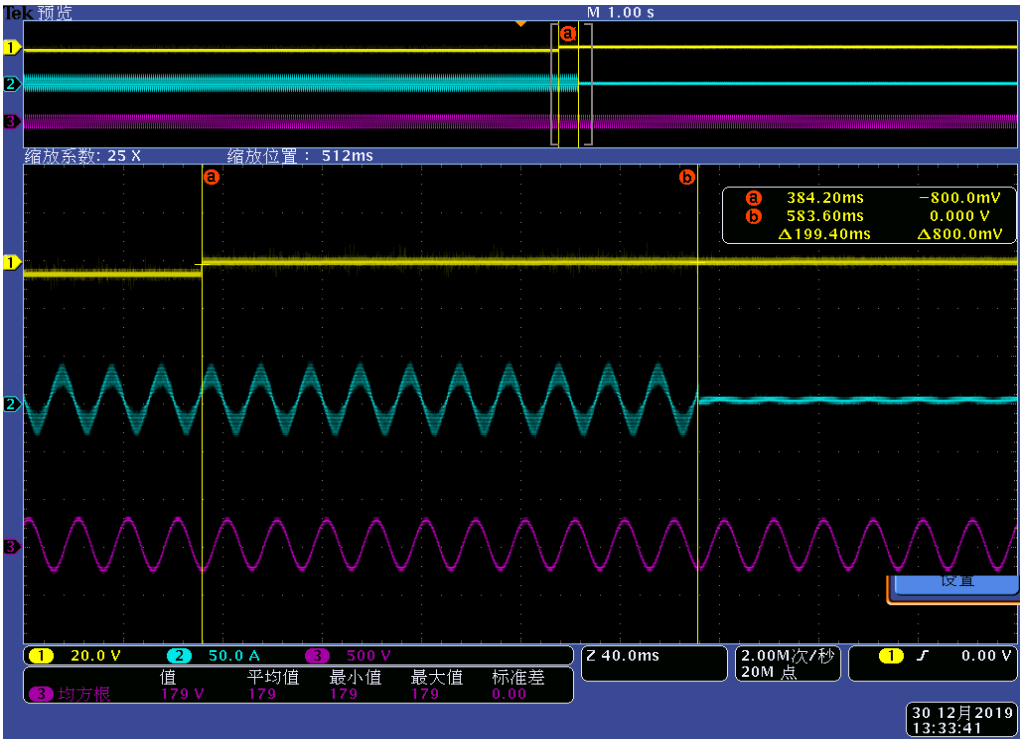
Supplementary information:
Tests performed under abnormal or fault conditions shall be tested with a source capable of 1,25 to 1,5 times the PCE rated maximum input current (Isc PV) for that input.
SC: short circuit
OC: open circuit
OL: over load
RV: reversed

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

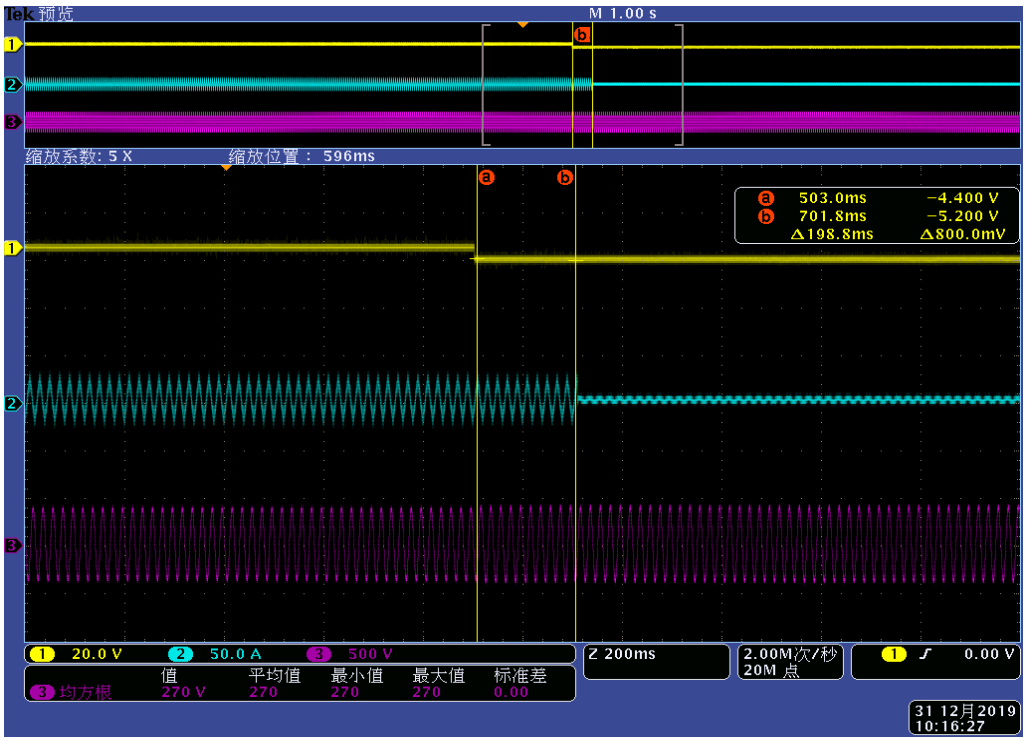
6.2 (4.2)	**TABLE: Voltage monitoring**								**P**
Phase A									
	Under Voltage				Over Voltage				
Parameter	Voltage	Trip Time [ms]			Voltage	Trip Time [ms]			
Limit	184.0V	<= 200 ms			264.5V	<= 200 ms			
Trip value	184.0V				264.5V				
Disconnection time	188V to 178V	199.4	194.6	193.0	260V to 270V	186.0	198.8	178.8	
	230V to 178V	194.6	193.4	184.2	230V to 270V	195.2	173.6	169.2	
Reconnection time (fluctuation <=3s):	>= 5s	62.79s			>= 5s	63.58s			
Reconnection time (fluctuation >3s):	>= 30s	63.19s			>= 30s	63.08s			
Note: Lower and upper threshold voltage shall not fall or rise below or above 3% of the threshold voltage itself (min. 178.4V; max. 272.4V). The measurement shall take place at nominal frequency and any power. The tests were performed on model EA30KTSI also applicable for all other models stated in this report.									

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under voltage:



Over voltage:

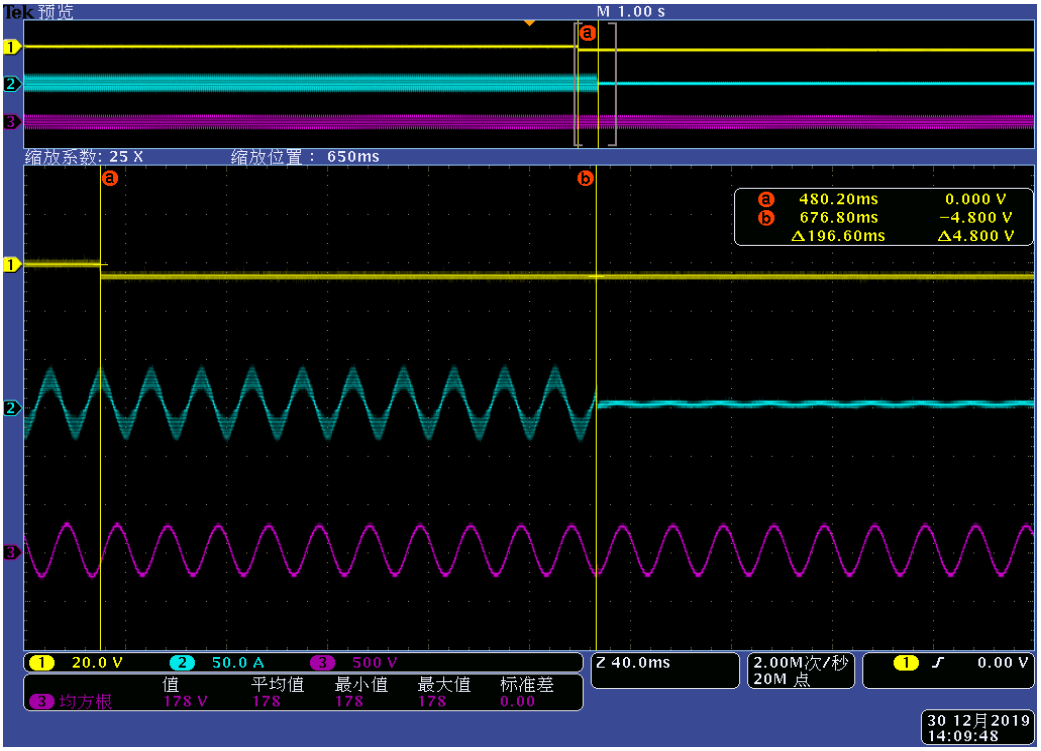


UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

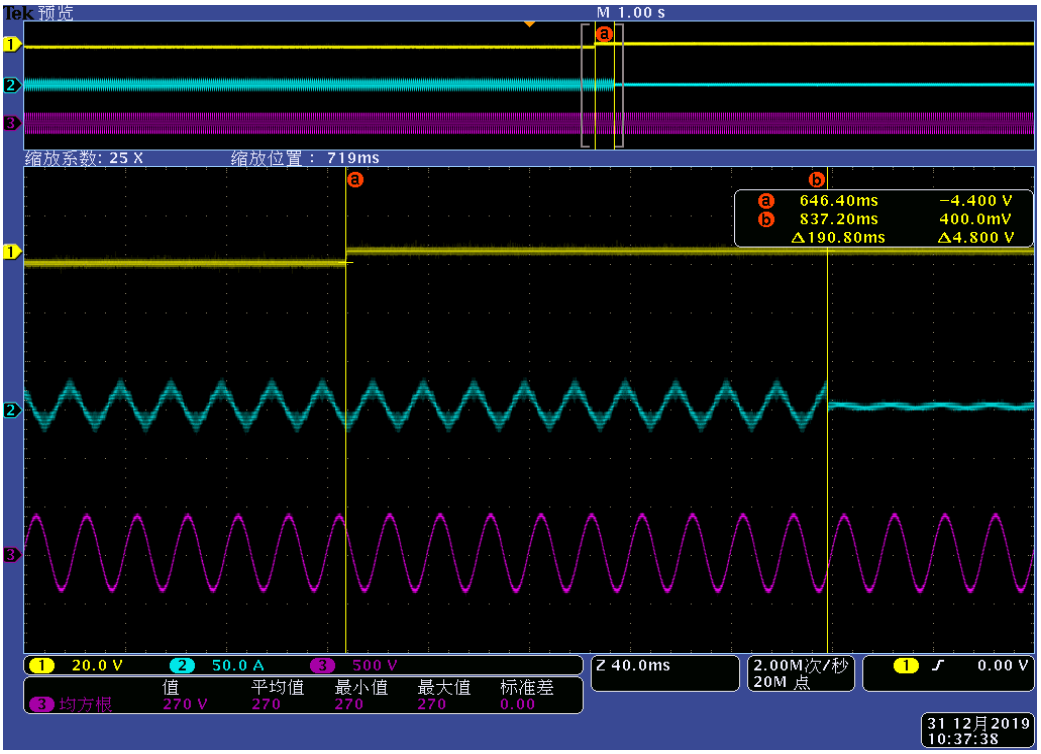
6.2 (4.2)	**TABLE: Voltage monitoring**								**P**
Phase B									
	Under Voltage				Over Voltage				
Parameter	Voltage	Trip Time [ms]			Voltage	Trip Time [ms]			
Limit	184.0V	<= 200 ms			264.5V	<= 200 ms			
Trip value	184.0V				264.5V				
Disconnection time	188V to 178V	193.0	193.8	194.6	260V to 270V	179.6	190.8	184.4	
	230V to 178V	191.8	196.6	185.4	230V to 270V	178.0	185.2	188.8	
Reconnection time (fluctuation <=3s):	>= 5s	63.49s			>= 5s	63.28s			
Reconnection time (fluctuation >3s):	>= 30s	62.99s			>= 30s	63.08s			
Note: Lower and upper threshold voltage shall not fall or rise below or above 3% of the threshold voltage itself (min. 178.4V; max. 272.4V). The measurement shall take place at nominal frequency and any power. The tests were performed on model EA30KTSI also applicable for all other models stated in this report.									

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under voltage:



Over voltage:

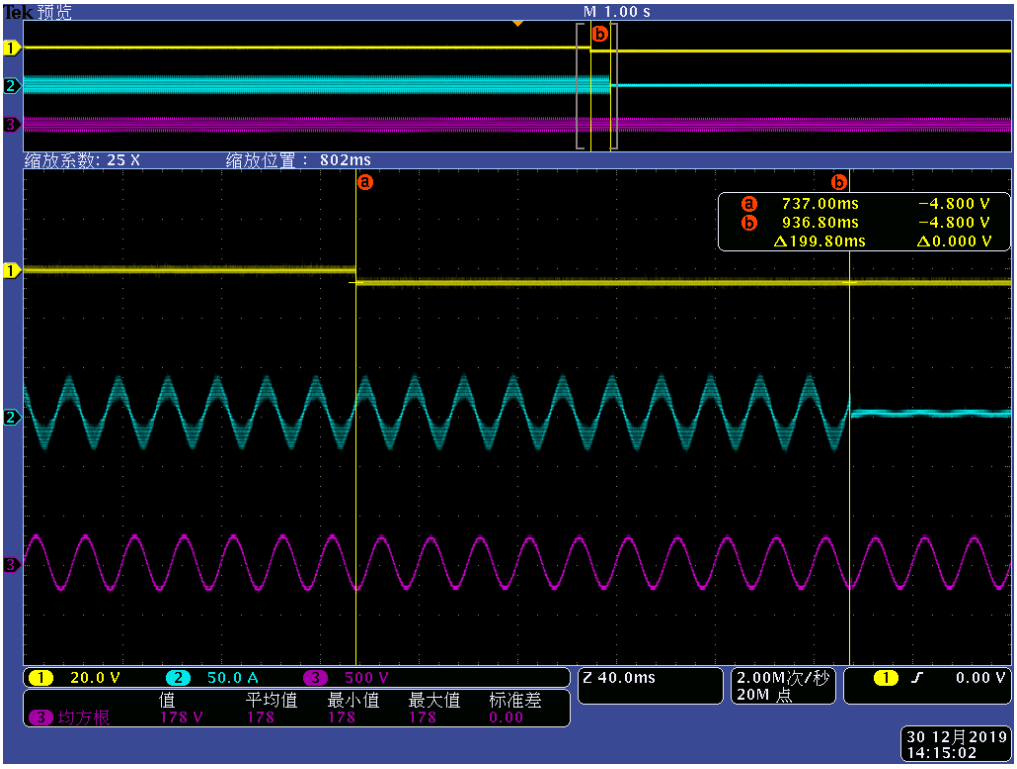


UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

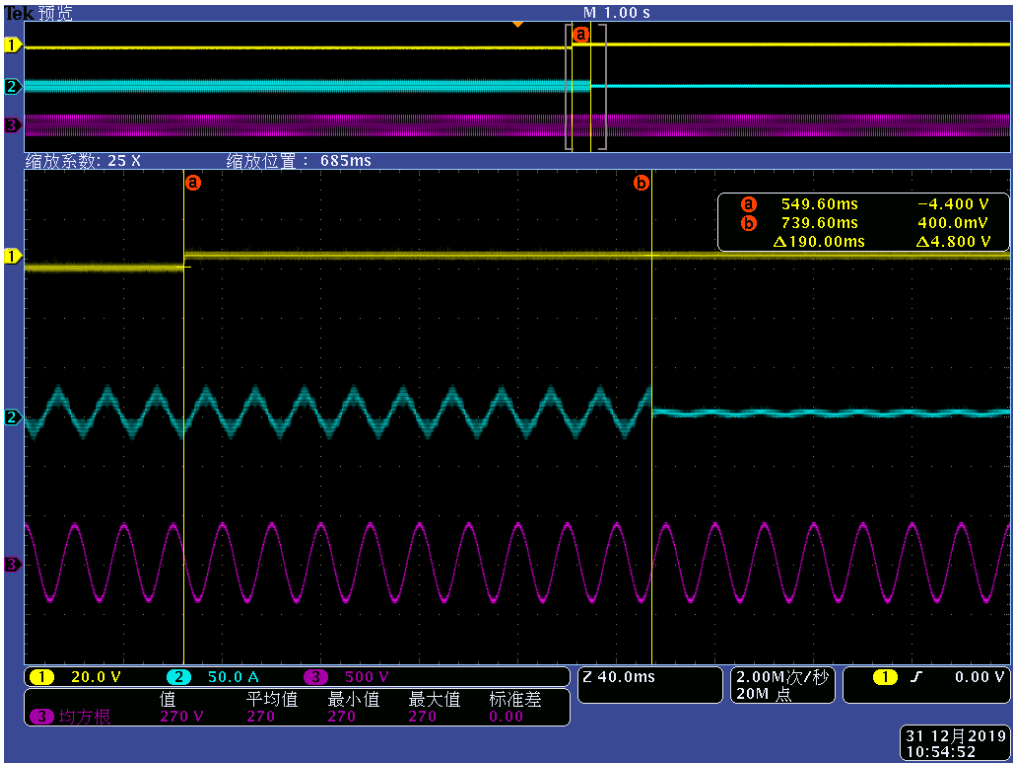
6.2 (4.2)	**TABLE: Voltage monitoring**								**P**
Phase C									
	Under Voltage				Over Voltage				
Parameter	Voltage	Trip Time [ms]			Voltage	Trip Time [ms]			
Limit	184.0V	<= 200 ms			264.5V	<= 200 ms			
Trip value	184.0V				264.5V				
Disconnection time	188V to 178V	199.8	199.8	181.8	260V to 270V	188.8	181.6	176.8	
	230V to 178V	199.0	197.8	191.4	230V to 270V	190.0	178.0	189.2	
Reconnection time (fluctuation <=3s):	>= 5s	63.29s			>= 5s	62.98s			
Reconnection time (fluctuation >3s):	>= 30s	63.49s			>= 30s	63.48s			
Note: Lower and upper threshold voltage shall not fall or rise below or above 3% of the threshold voltage itself (min. 178.4V; max. 272.4V). The measurement shall take place at nominal frequency and any power. The tests were performed on model EA30KTSI also applicable for all other models stated in this report.									

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under voltage:



Over voltage:



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Island 50Hz

6.2 (4.2) Voltage monitoring according protection de Découplage pour le Raccordement d'une production décentralisée en HTA et en BT dans les zones non interconnectées, référentiel technique – SEI REF 04, V5	**P**

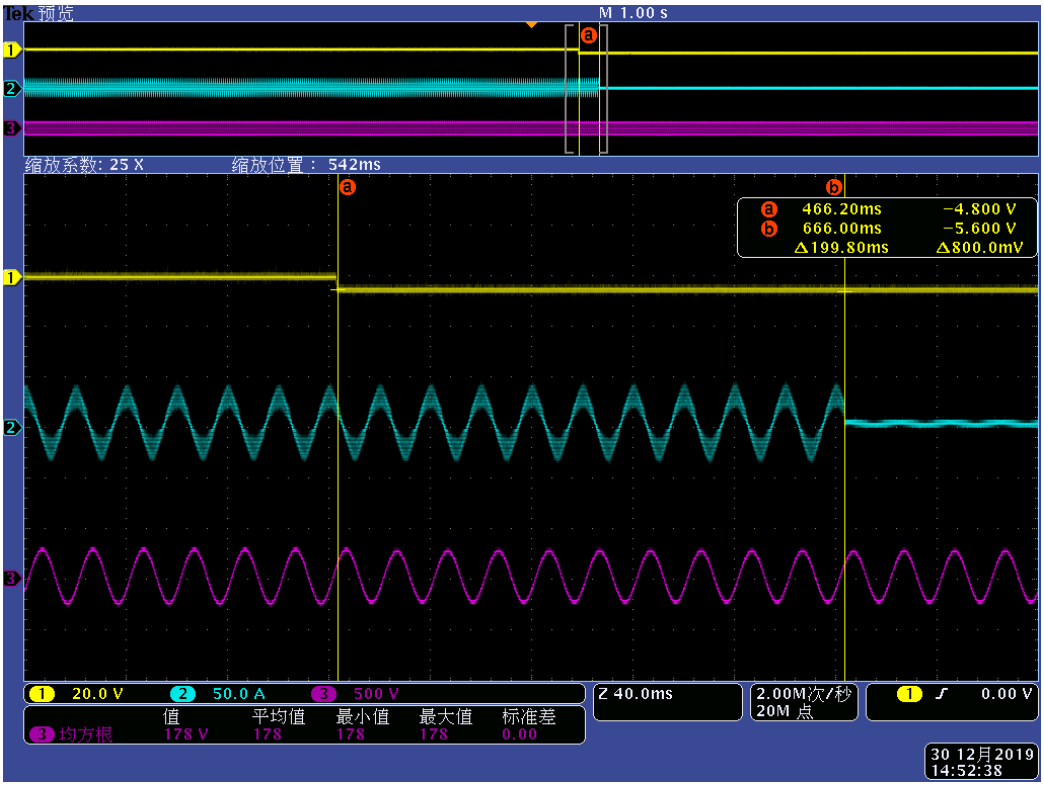
Phase A

	Under Voltage				Over Voltage			
Parameter	Voltage	Time [ms]			Voltage	Time [ms]		
Limit	184.0V	<= 200ms			255.3V	<= 200 ms		
Trip value	184.0V				255.3V			
Disconnection time	188V to 178V	193.4	199.8	195.0	250V to 260V	171.6	174.4	195.6
	230V to 178V	197.0	198.2	193.0	230V to 260V	178.8	181.2	171.2
Reconnection time (fluctuation <=3s):	>= 5s	62.69s			>= 5s	62.48s		
Reconnection time (fluctuation >3s):	>= 30s	62.79s			>= 30s	63.48s		

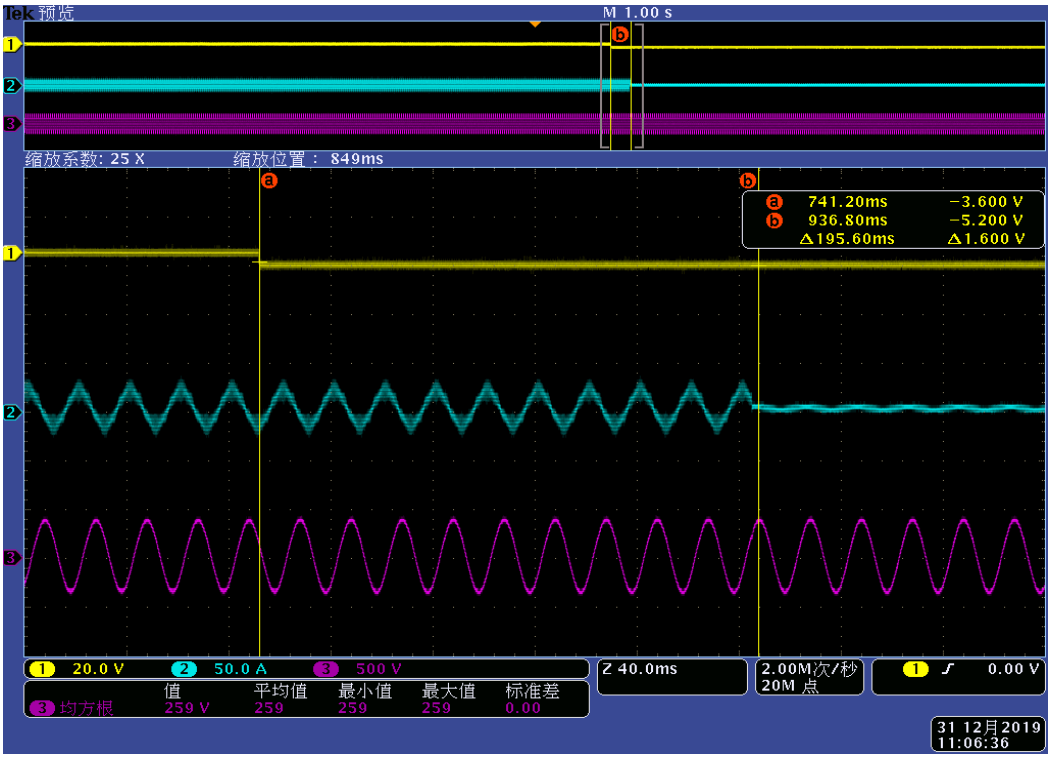
Note:
Lower and upper threshold voltage shall not fall or rise below or above 3% of the threshold voltage itself (min. 178.4V; max. 262.9V). The measurement shall take place at nominal frequency and any power.
The tests were performed on model EA30KTSI also applicable for all other models stated in this report.

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under voltage:



Over voltage:



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Island 50Hz

6.2 (4.2) Voltage monitoring according protection de Découplage pour le Raccordement d'une production décentralisée en HTA et en BT dans les zones non interconnectées, référentiel technique – SEI REF 04, V5	**P**

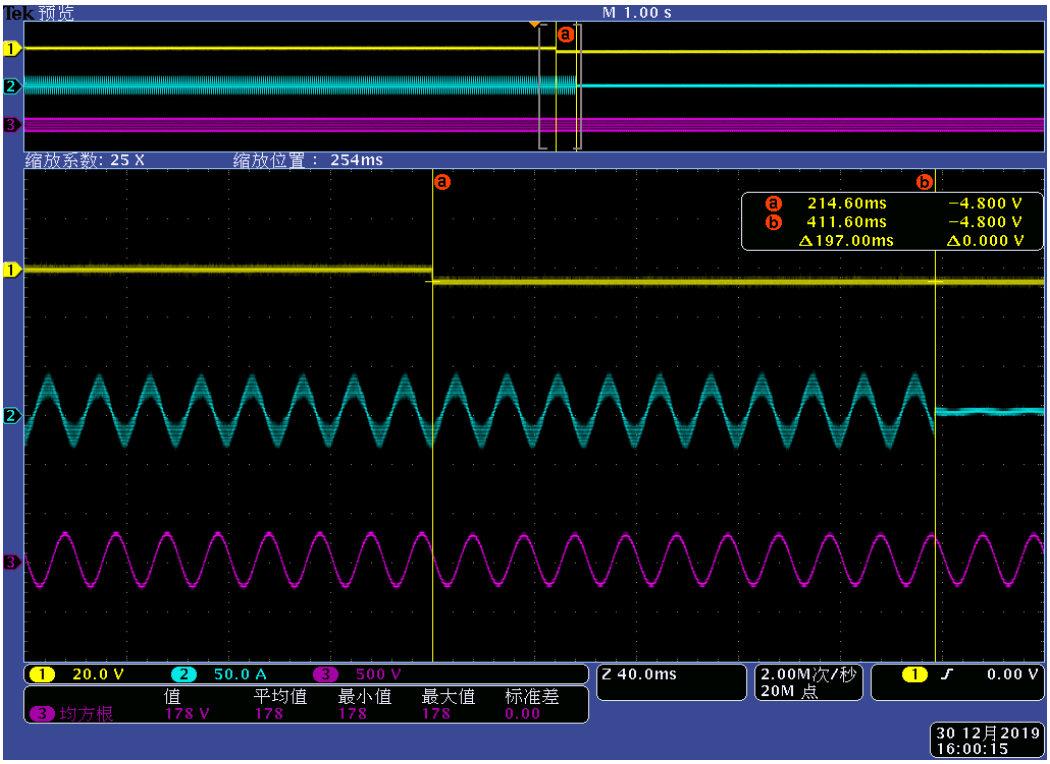
Phase B

	Under Voltage				Over Voltage			
Parameter	Voltage	Time [ms]			Voltage	Time [ms]		
Limit	184.0V	<= 200ms			255.3V	<= 200 ms		
Trip value	184.0V				255.3V			
Disconnection time	188V to 178V	190.2	191.0	190.2	250V to 260V	184.0	179.6	173.2
	230V to 178V	197.0	178.6	182.2	230V to 260V	172.4	176.8	173.6
Reconnection time (fluctuation <=3s):	>= 5s	62.94s			>= 5s	63.18s		
Reconnection time (fluctuation >3s):	>= 30s	63.14s			>= 30s	62.58s		

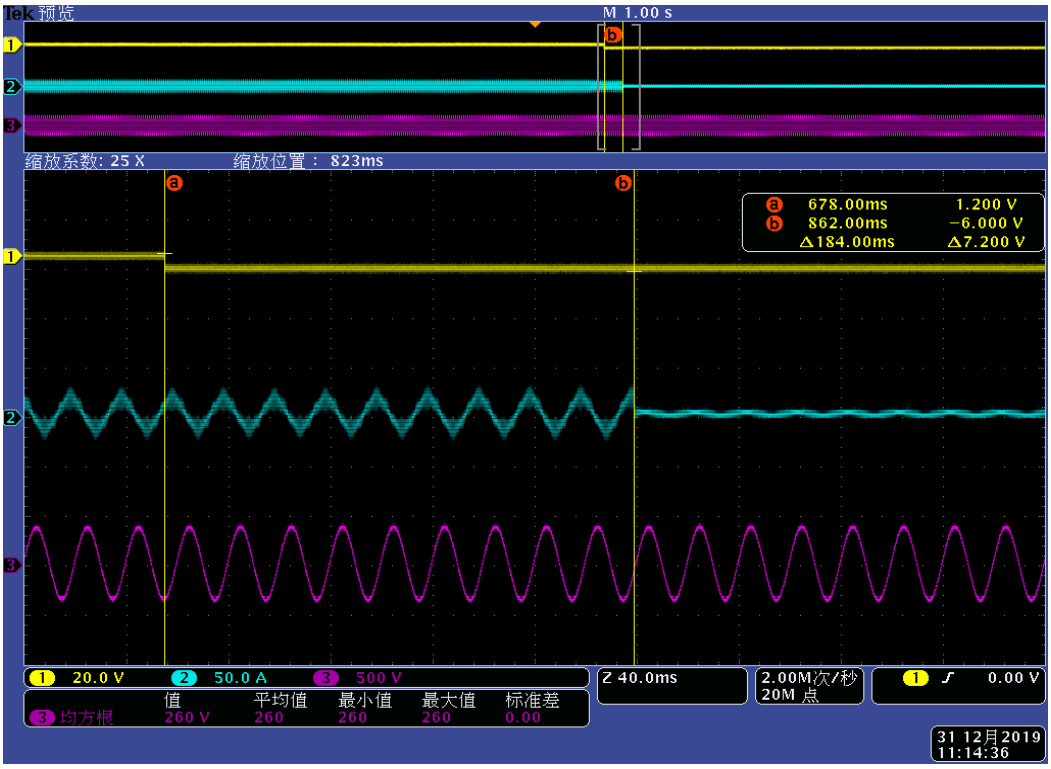
Note:
Lower and upper threshold voltage shall not fall or rise below or above 3% of the threshold voltage itself (min. 178.4V; max. 262.9V).The measurement shall take place at nominal frequency and any power.
The tests were performed on model EA30KTSI also applicable for all other models stated in this report.

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under voltage:



Over voltage:



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Island 50Hz

6.2 (4.2) Voltage monitoring according protection de Découplage pour le Raccordement d'une production décentralisée en HTA et en BT dans les zones non interconnectées, référentiel technique – SEI REF 04, V5	**P**

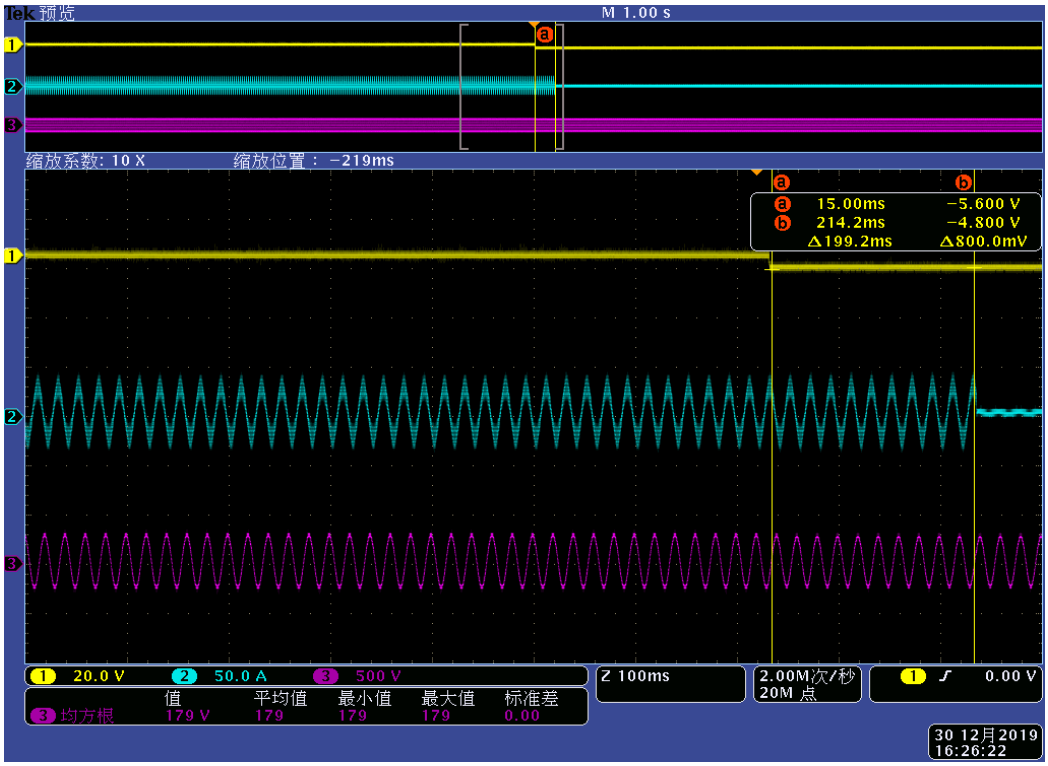
Phase C

	Under Voltage				Over Voltage			
Parameter	Voltage	Time [ms]			Voltage	Time [ms]		
Limit	184.0V	<= 200ms			255.3V	<= 200 ms		
Trip value	184.0V				255.3V			
Disconnection time	188V to 178V	193.0	194.6	199.0	250V to 260V	182.8	178.0	178.0
	230V to 178V	195.8	192.6	199.2	230V to 260V	184.0	178.8	168.4
Reconnection time (fluctuation <=3s):	>= 5s	63.14s			>= 5s	63.68s		
Reconnection time (fluctuation >3s):	>= 30s	62.84s			>= 30s	63.28s		

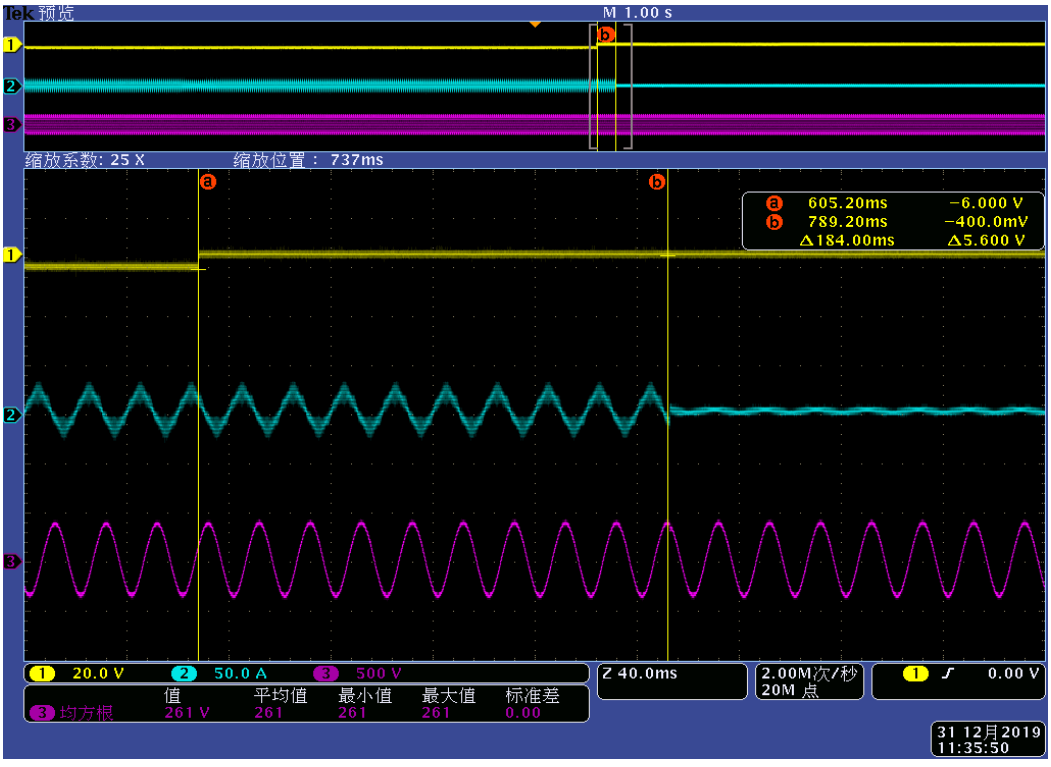
Note:
Lower and upper threshold voltage shall not fall or rise below or above 3% of the threshold voltage itself (min. 178.4V; max. 262.9V). The measurement shall take place at nominal frequency and any power.
The tests were performed on model EA30KTSI also applicable for all other models stated in this report.

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under voltage:



Over voltage:



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Island 60Hz

6.2 (4.2) Voltage monitoring according contrat de raccordement, d'accès et d'exploitation (CRAE) pour une installation de production photovoltaïque raccordée au réseau public d'électricité	**P**

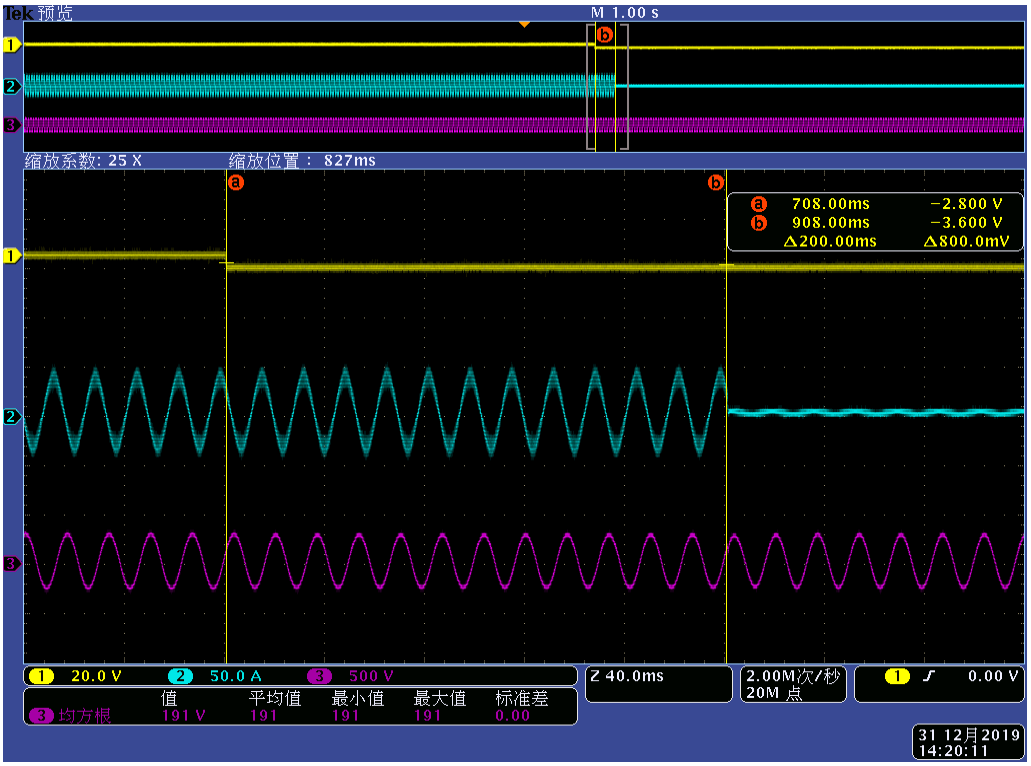
Phase A

	Under Voltage				Over Voltage			
Parameter	Voltage	Time [ms]			Voltage	Time [ms]		
Limit	195.5V	<= 200 ms			264.5V	<= 200 ms		
Trip value	195.5V				264.5V			
Disconnection time	200V to 190V	197.6	186.0	196.4	260V to 270V	199.6	190.0	195.2
	230V to 190V	195.2	196.0	200.0	230V to 270V	196.0	198.4	200.0
Reconnection time (fluctuation <=3s):	>= 5s	62.70s			>= 5s	62.97s		
Reconnection time (fluctuation >3s):	>= 30s	63.30s			>= 30s	62.77s		

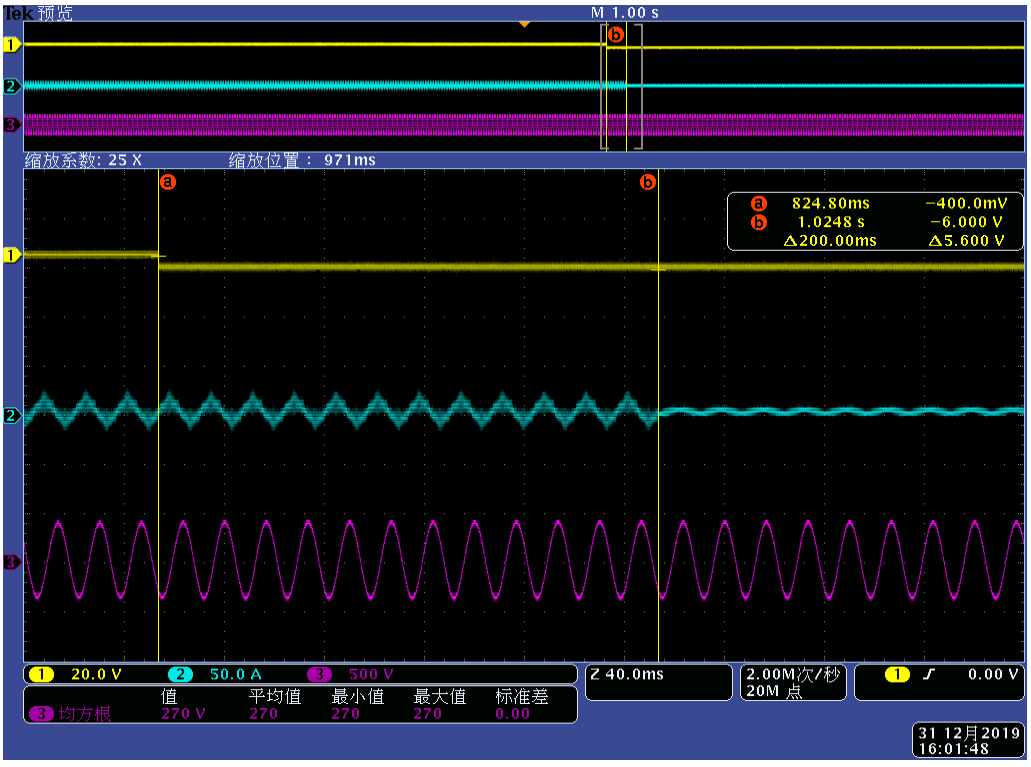
Note:
Lower and upper threshold voltage shall not fall or rise below or above 3% of the threshold voltage itself (min. 189.6V; max. 272.4V). The measurement shall take place at nominal frequency and any power.
The tests were performed on model EA30KTSI also applicable for all other models stated in this report.

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under voltage:



Over voltage:



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Island 60Hz

6.2 (4.2) Voltage monitoring according contrat de raccordement, d'accès et d'exploitation (CRAE) pour une installation de production photovoltaïque raccordée au réseau public d'électricité	**P**

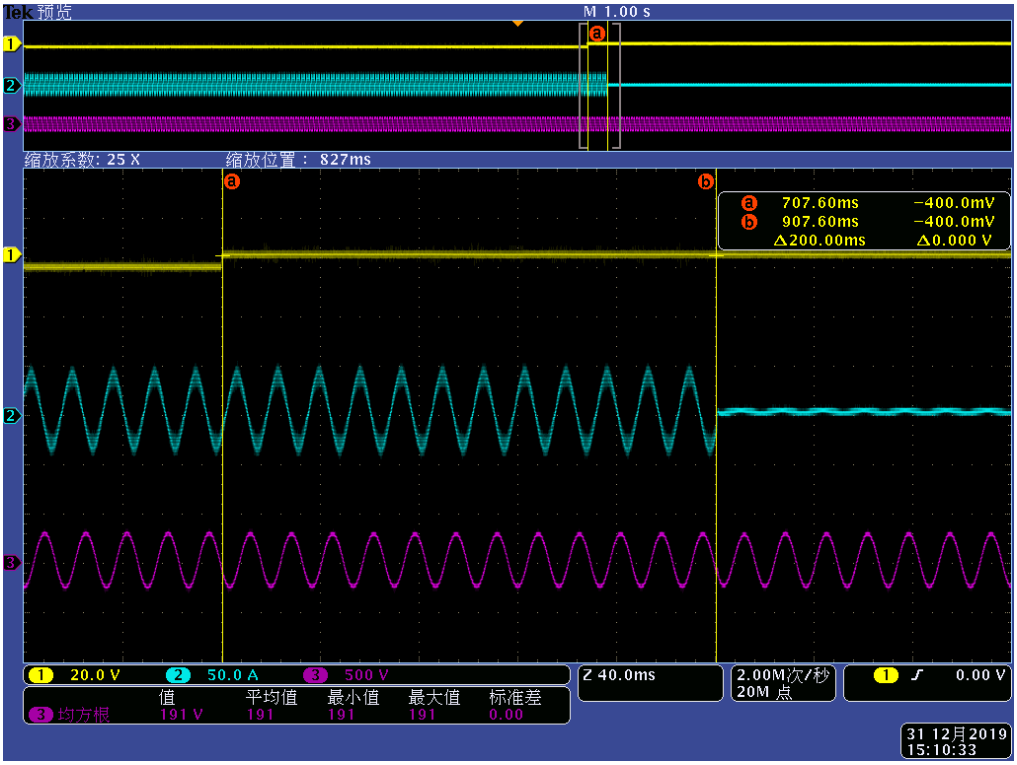
Phase B

	Under Voltage				Over Voltage			
Parameter	Voltage	Time [ms]			Voltage	Time [ms]		
Limit	195,5V	<= 200ms			264,5V	<= 200 ms		
Trip value	195,5V				264,5V			
Disconnection time	200V to 190V	187.2	186.4	192.4	260V to 270V	193.6	194.4	199.6
	230V to 190V	200.0	192.4	199.2	230V to 270V	199.6	186.4	197.2
Reconnection time (fluctuation <=3s):	>= 5s	63.70s			>= 5s	63.37s		
Reconnection time (fluctuation >3s):	>= 30s	63.70s			>= 30s	63.37s		

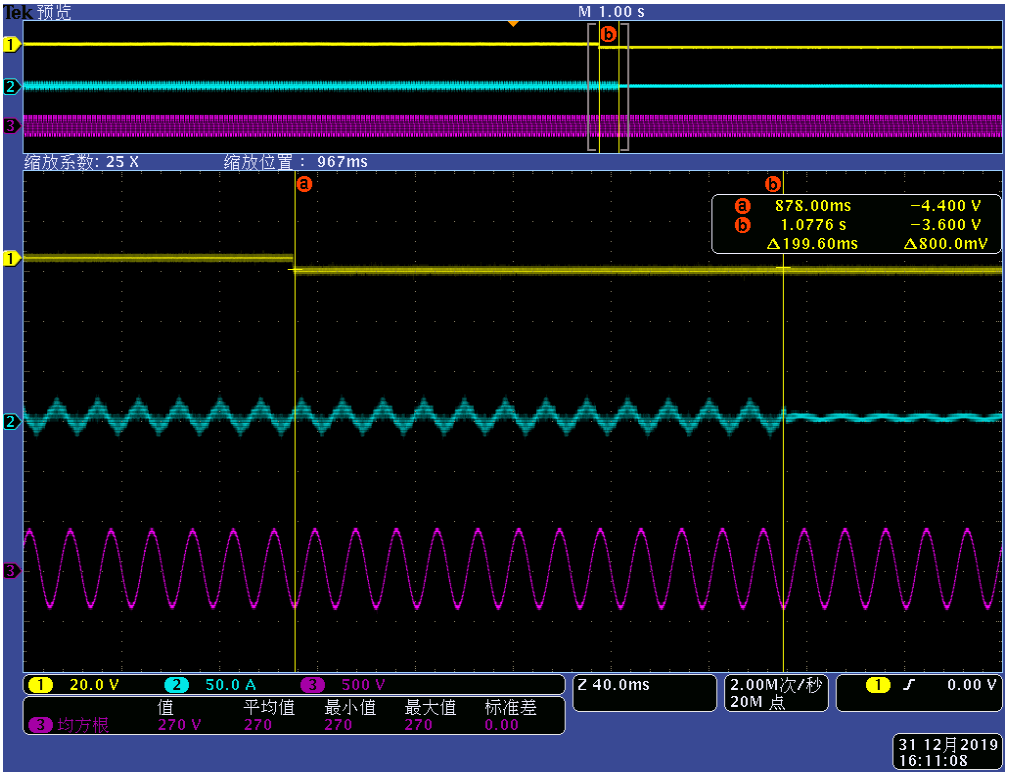
Note:
Lower and upper threshold voltage shall not fall or rise below or above 3% of the threshold voltage itself (min. 189.6V; max. 272.4V). The measurement shall take place at nominal frequency and any power.
The tests were performed on model EA30KTSI also applicable for all other models stated in this report.

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under voltage:



Over voltage:



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Island 60Hz

6.2 (4.2) Voltage monitoring according contrat de raccordement, d'accès et d'exploitation (CRAE) pour une installation de production photovoltaïque raccordée au réseau public d'électricité	**P**

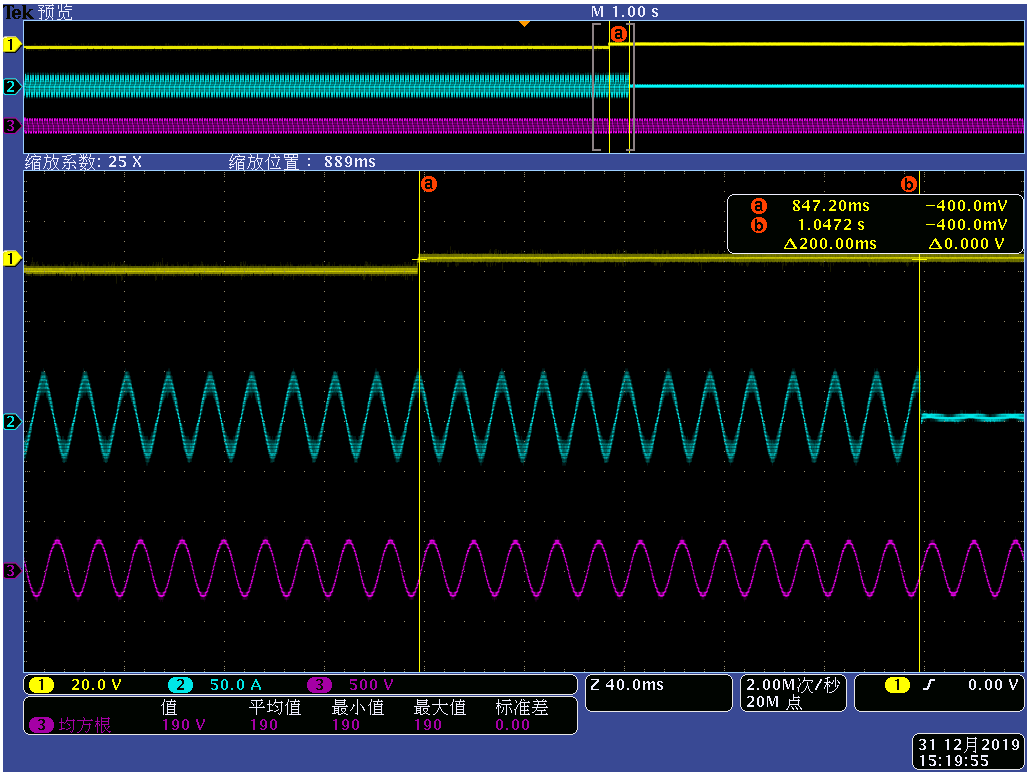
Phase C

	Under Voltage				Over Voltage			
Parameter	Voltage	Time [ms]			Voltage	Time [ms]		
Limit	195.5V	<= 200ms			264.5V	<= 200 ms		
Trip value	195.5V				264.5V			
Disconnection time	200V to 190V	197.6	200.0	193.6	260V to 270V	196.4	194.0	194.4
	230V to 190V	192.8	194.8	179.6	230V to 270V	200.0	198.0	196.8
Reconnection time (fluctuation <=3s):	>= 5s	62.80s			>= 5s	63.17s		
Reconnection time (fluctuation >3s):	>= 30s	63.30s			>= 30s	63.37s		

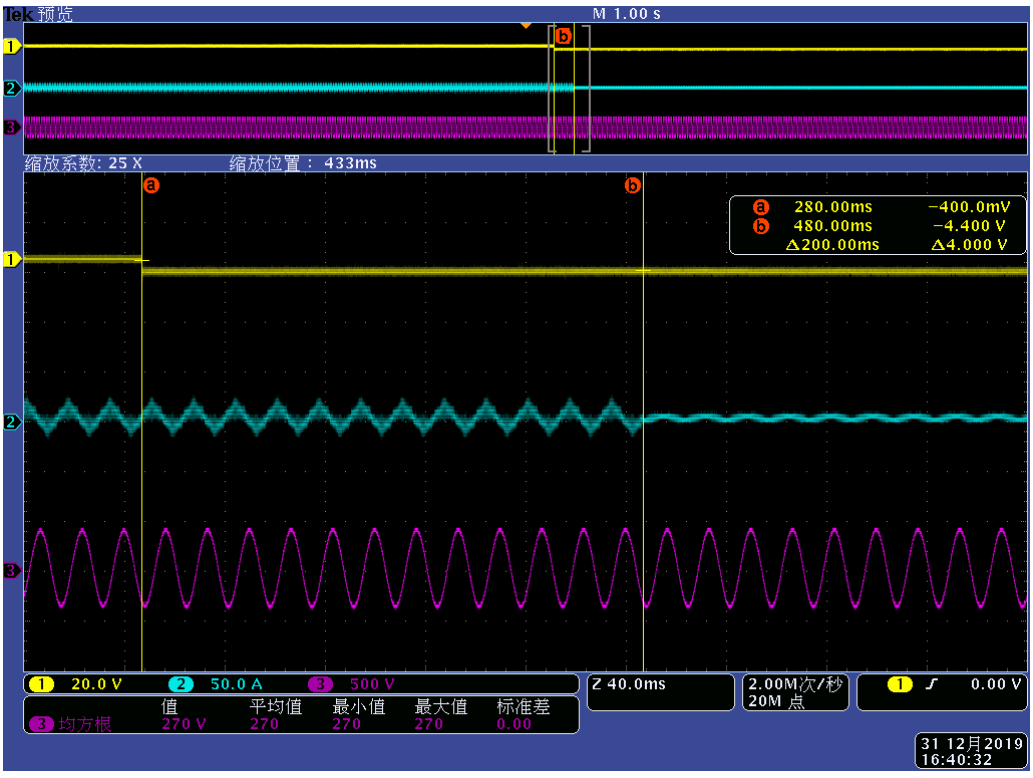
Note:
Lower and upper threshold voltage shall not fall or rise below or above 3% of the threshold voltage itself (min. 189.6V; max. 272.4V). The measurement shall take place at nominal frequency and any power.
The tests were performed on model EA30KTSI also applicable for all other models stated in this report.

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under voltage:



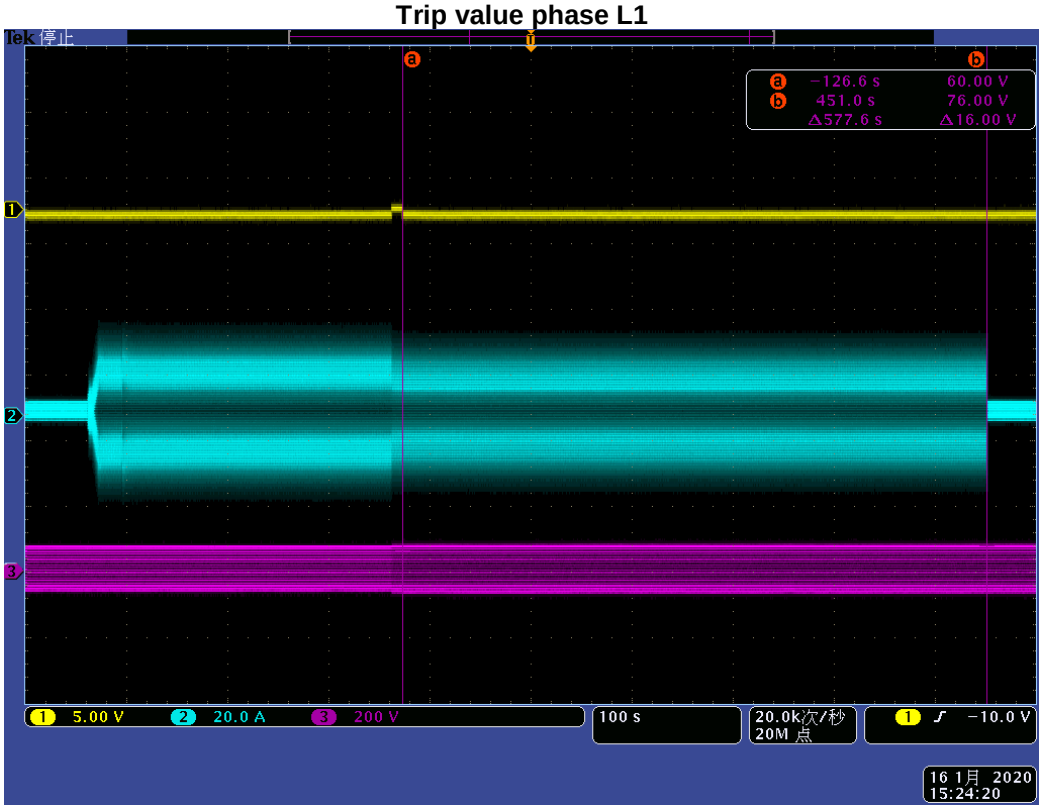
Over voltage:



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

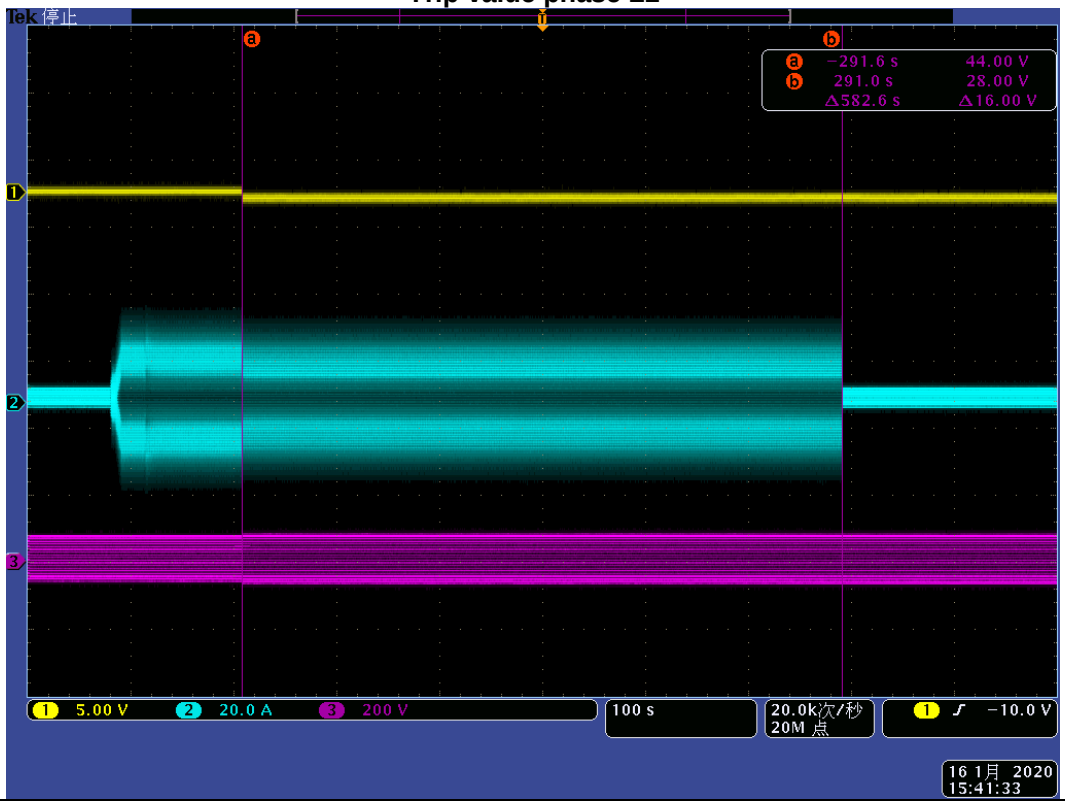
6.2 (4.2.3)	**TABLE: Overvoltage protection according to DIN EN 50160:2000-03, 2.3**		P
Limit:		From 253 V to 264,5 V	Trip time within 10 min
Trip value phase L1		254V	577.60s
Trip value phase L2		254V	582.60s
Trip value phase L3		254V	583.60s
Note: The tests were performed on model EA30KTSI also applicable for all other models stated in this report.			

Trip value phase L1

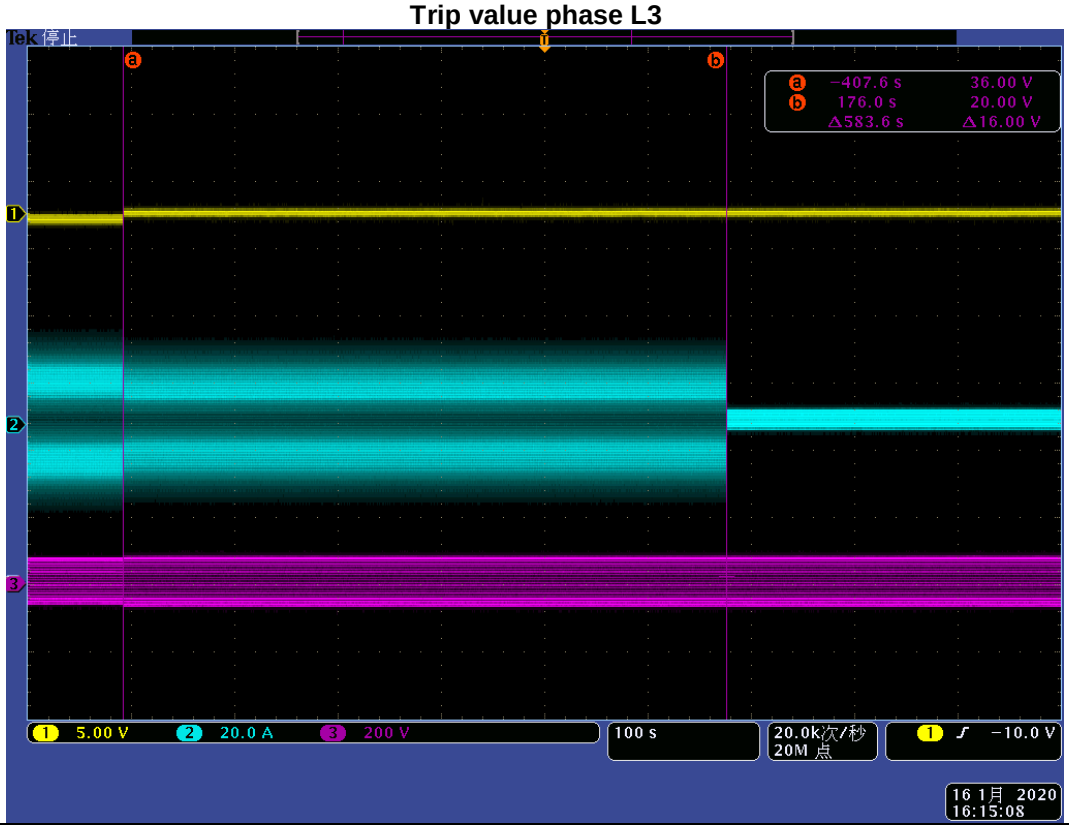


UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Trip value phase L2



Trip value phase L3

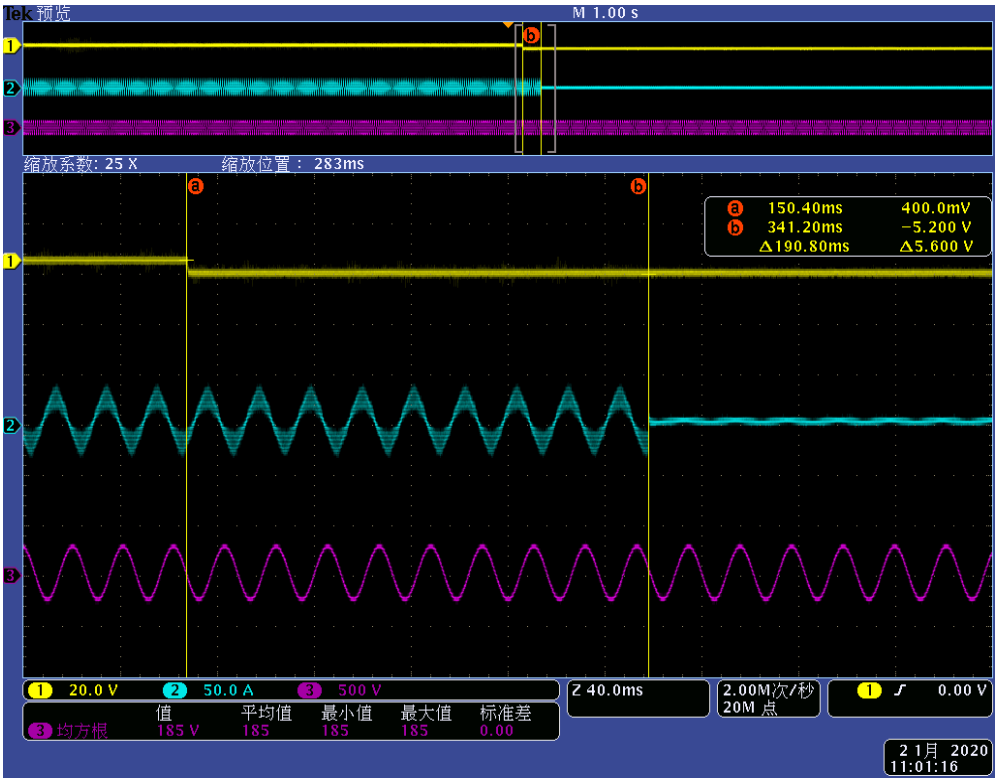


UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

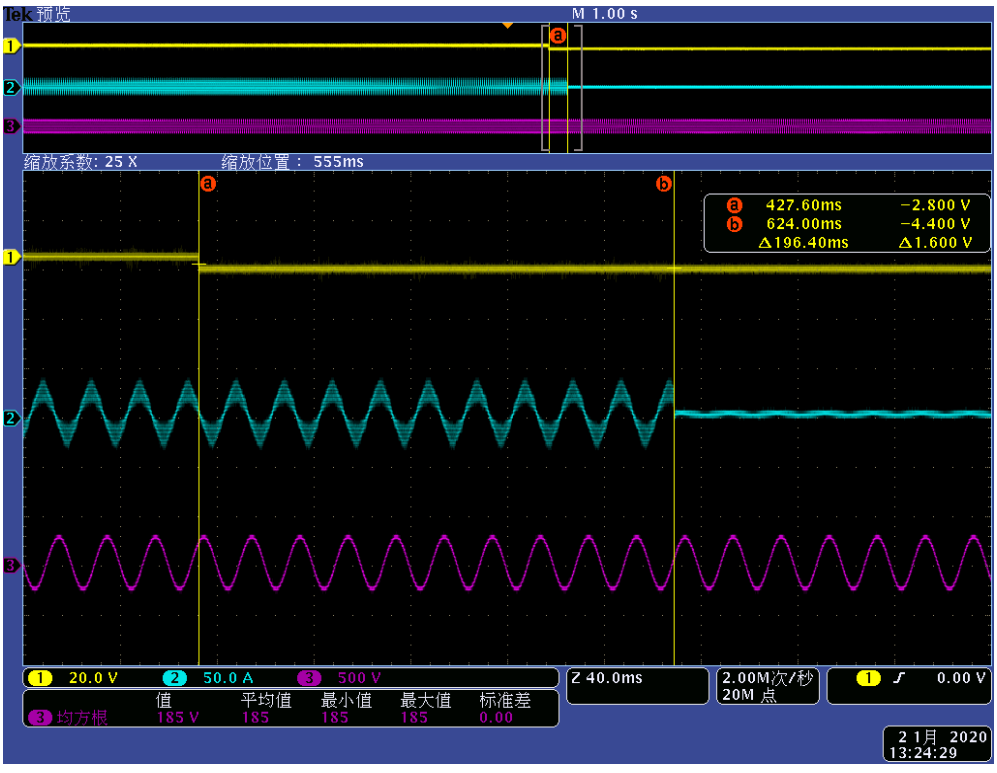
6.3 (4.3)	**Frequency monitoring DIN V VDE V 0126-1-1:2006-02**								**P**
	Under frequency				Over frequency				
Parameter	Frequency [Hz]	Time [ms]			Frequency [Hz]	Time [ms]			
Output Voltage		80%U_N	U_N	115%U_N		80%U_N	U_N	115%U_N	
Limit	47.5Hz	200ms	200ms	200ms	50.2Hz	200ms	200ms	200ms	
Trip value		47.5Hz	47.5Hz	47.5Hz		50.2Hz	50.2Hz	50.2Hz	
Disconnection time (ms)	48.00Hz to 47.00Hz	190.8	182.8	178.4	50.00Hz to 51.00Hz	196.4	178.8	183.6	
		184.8	187.6	189.2		175.6	195.6	176.0	
Reconnection time (fluctuation <=3s):	>= 5s	62.18s			>= 5s	61.96s			
Reconnection time (fluctuation >3s):	>= 30s	61.89s			>= 30s	62.16s			
Note: The tests were performed on model EA30KTSI also applicable for all other models stated in this report.									

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under frequency:



Over frequency:

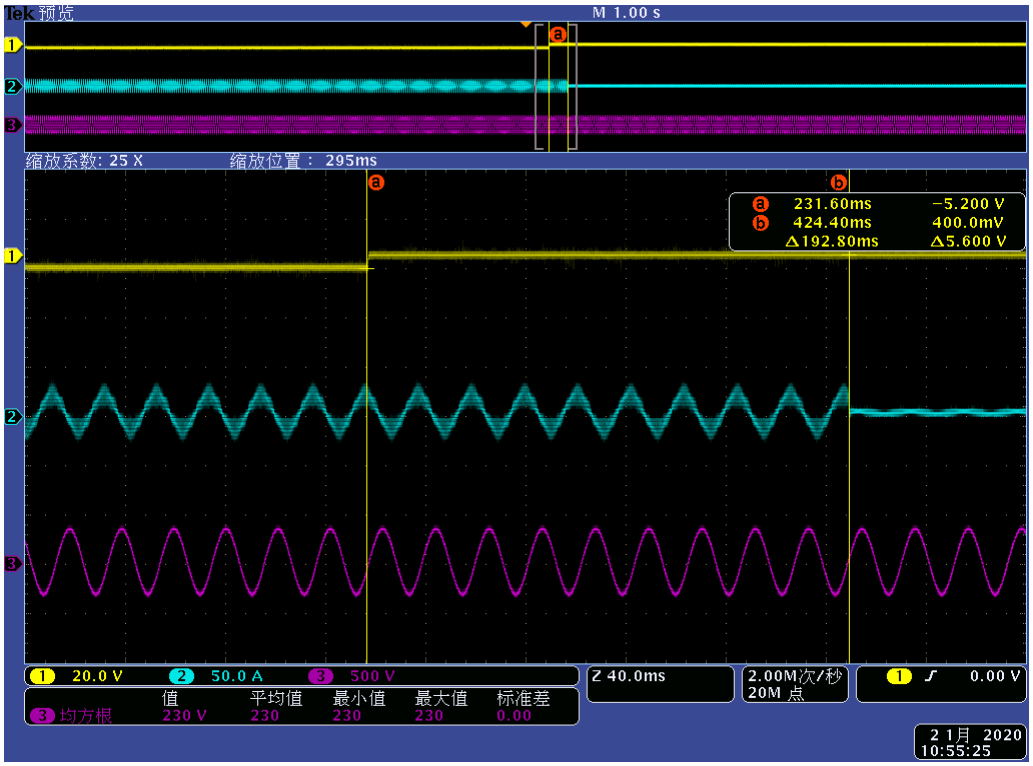


UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

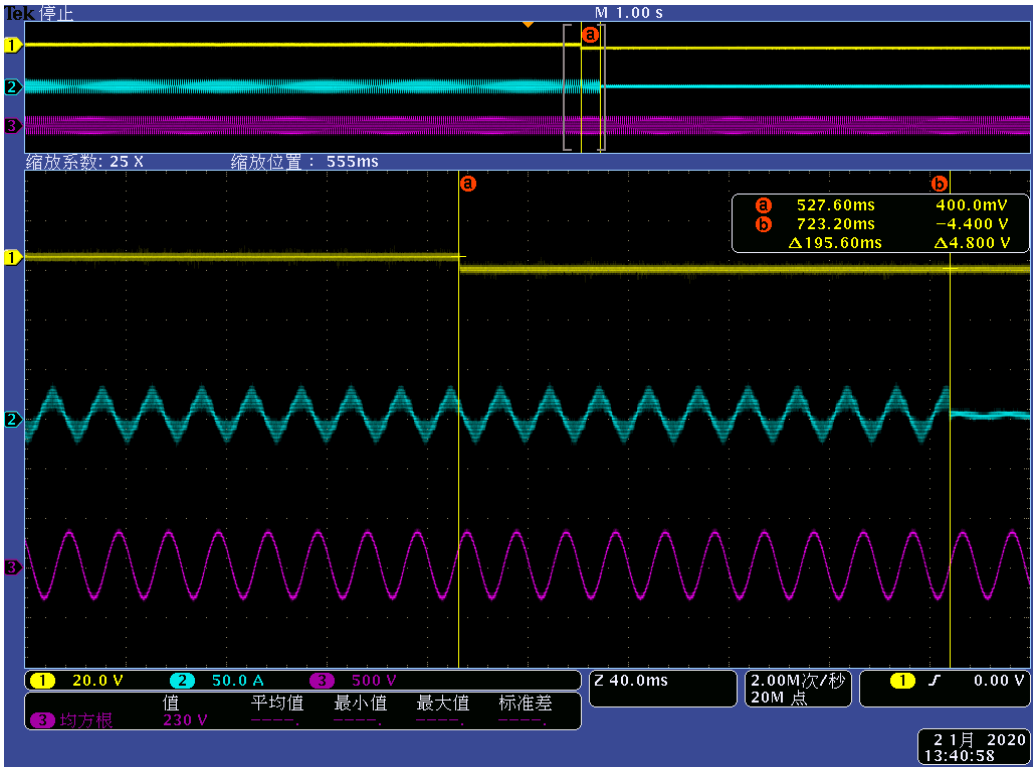
6.3 (4.3)	**Frequency monitoring DIN V VDE V 0126-1-1/A1 VFR2014**								**P**
	Under frequency				Over frequency				
Parameter	Frequency [Hz]	Time [ms]			Frequency [Hz]	Time [ms]			
Output Voltage		80%U_N	U_N	115%U_N		80%U_N	U_N	115%U_N	
Limit	47.5Hz	200ms	200ms	200ms	50.6Hz	200ms	200ms	200ms	
Trip value		47.5Hz	47.5Hz	47.5Hz		50.6Hz	50.6Hz	50.6Hz	
Disconnection time (ms)	48.00Hz to 47.00Hz	186.0	192.8	178.8	50.00Hz to 51.00Hz	170.0	195.6	182.0	
		190.4	174.4	188.4		191.2	194.0	183.6	
Reconnection time (fluctuation <=3s):	>= 5s	62.39s			>= 5s	62.14s			
Reconnection time (fluctuation >3s):	>= 30s	61.98s			>= 30s	62.04s			
Note: The tests were performed on model EA30KTSI also applicable for all other models stated in this report.									

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under frequency:



Over frequency:



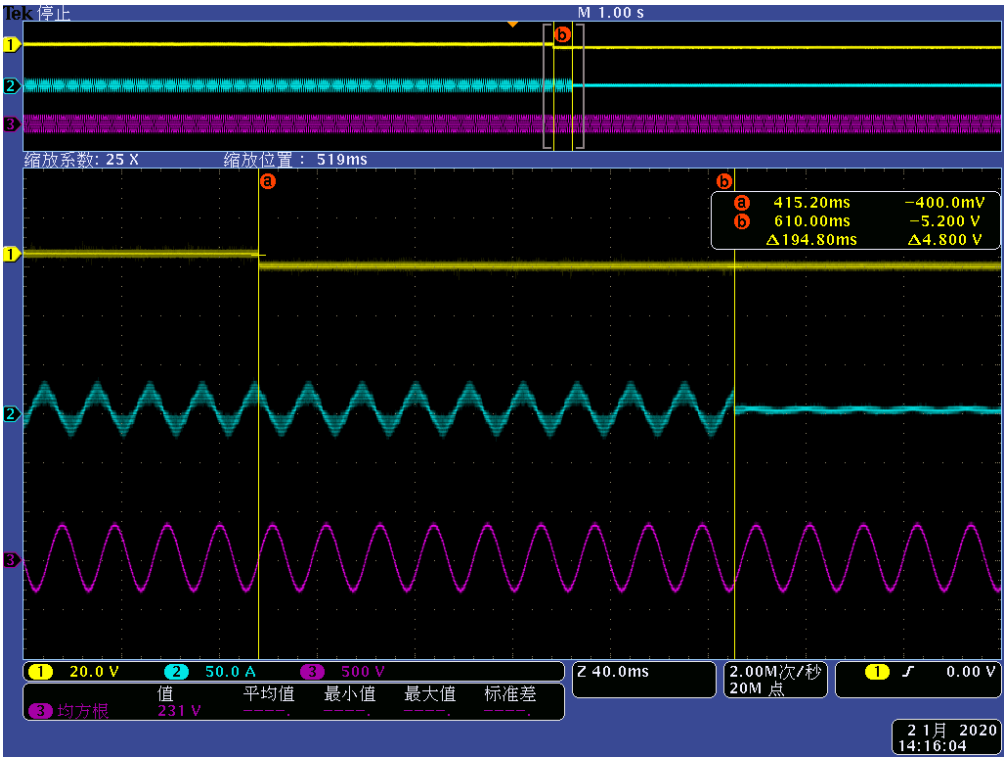
UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Island 50Hz

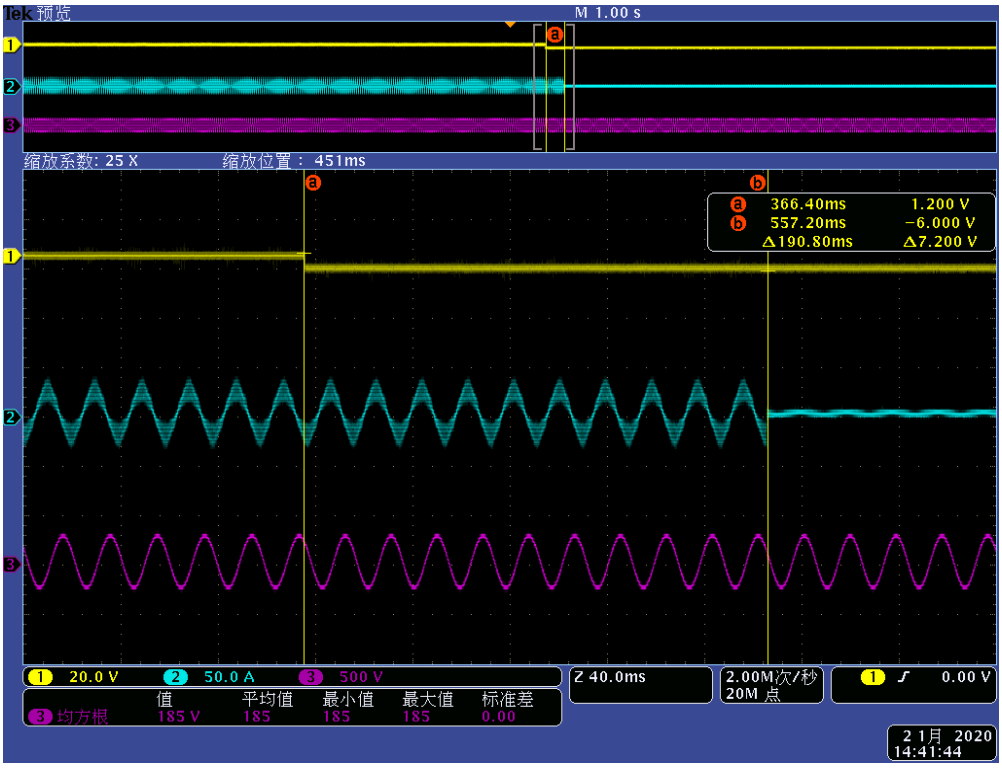
6.3 (4.3) Frequency monitoring according protection de Découplage pour le Raccordement d'une production décentralisée en HTA et en BT dans les zones non interconnectées, référentiel technique – SEI REF 04, V5									**P**
	Under frequency				Over frequency				
Parameter	Frequency [Hz]	Time [ms]			Frequency [Hz]	Time [ms]			
Output Voltage		80%U_N	U_N	111%U_N		80%U_N	U_N	111%U_N	
Limit	46.0Hz	200ms	200ms	200ms	52.0Hz	200ms	200ms	200ms	
Trip value		46.0Hz	46.0Hz	46.0Hz		52.0Hz	52.0Hz	52.0Hz	
Disconnection time (ms)	46.50Hz to 45.50Hz	177.2	194.8	183.6	51.50Hz to 52.50Hz	190.8	172.4	184.8	
		192.8	182.0	190.4		162.8	181.6	180.0	
Reconnection time (fluctuation <=3s):	>= 5s	61.80s			>= 5s	61.60s			
Reconnection time (fluctuation >3s):	>= 30s	62.10s			>= 30s	61.60s			
Note: The tests were performed on model EA30KTSI also applicable for all other models stated in this report.									

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under frequency:



Over frequency:



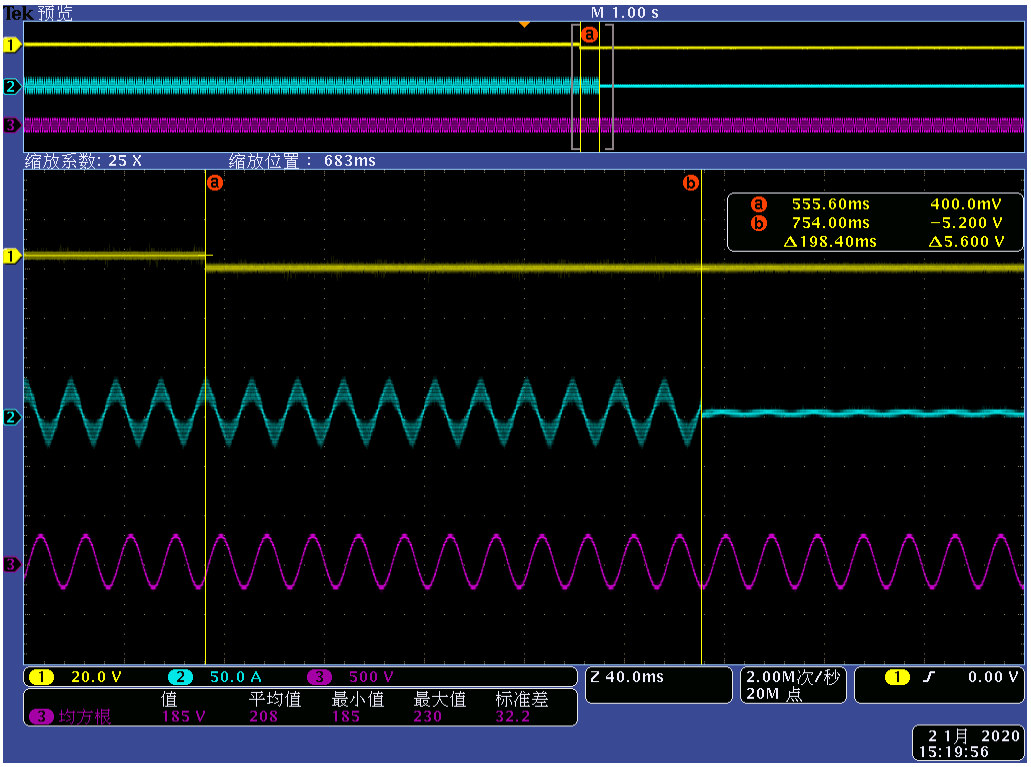
UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Island 60Hz

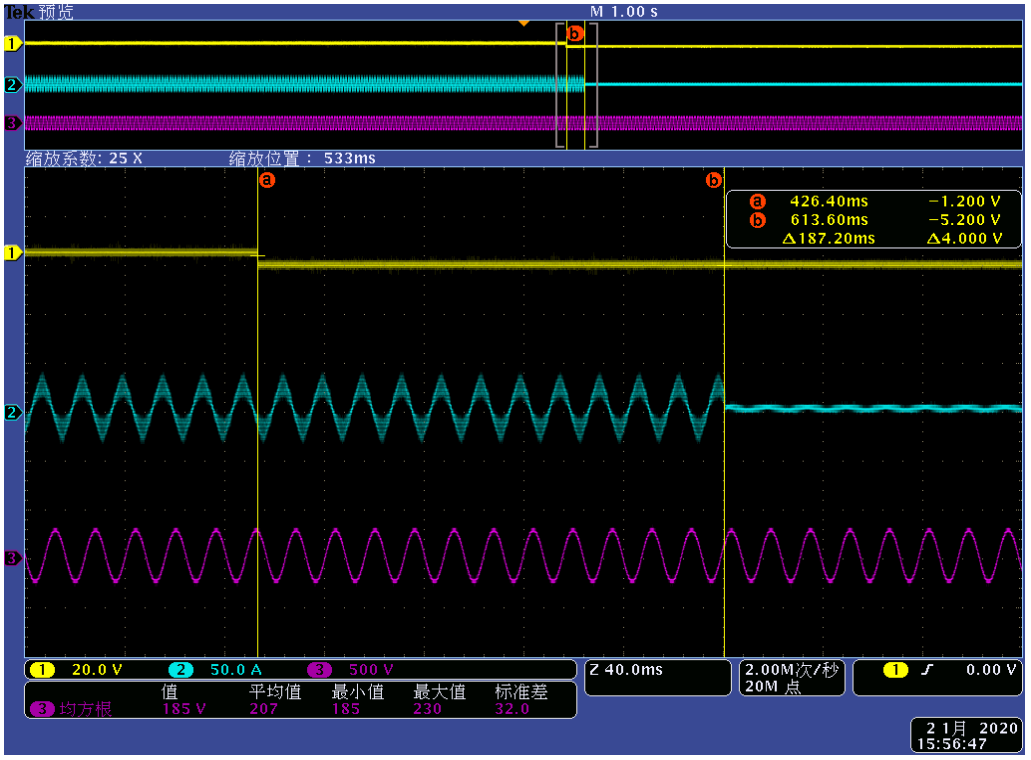
6.3 (4.3) Frequency monitoring according contrat de raccordement, d'accès et d'exploitation (CRAE) pour une installation de production photovoltaïque raccordée au réseau public d'électricité									**P**
	Under frequency				Over frequency				
Parameter	Frequency [Hz]	Time [ms]			Frequency [Hz]	Time [ms]			
Output Voltage		85%U_N	U_N	115%U_N		85%U_N	U_N	115%U_N	
Limit	55.0Hz	200ms	200ms	200ms	62.5Hz	200ms	200ms	200ms	
Trip value		55.0Hz	55.0Hz	55.0Hz		62.5Hz	62.5Hz	62.5Hz	
Disconnection time (ms)	55.50Hz to 54.50Hz	198.4	175.2	178.8	62.00Hz to 63.00Hz	187.2	185.2	169.2	
		175.6	181.2	193.6		177.2	180.0	178.8	
Reconnection time (fluctuation <=3s):	>= 5s	104.90s			>= 5s	105.00s			
Reconnection time (fluctuation >3s):	>= 30s	105.30s			>= 30s	104.00s			
Note: The tests were performed on model EA30KTSI also applicable for all other models stated in this report.									

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Under frequency:



Over frequency:

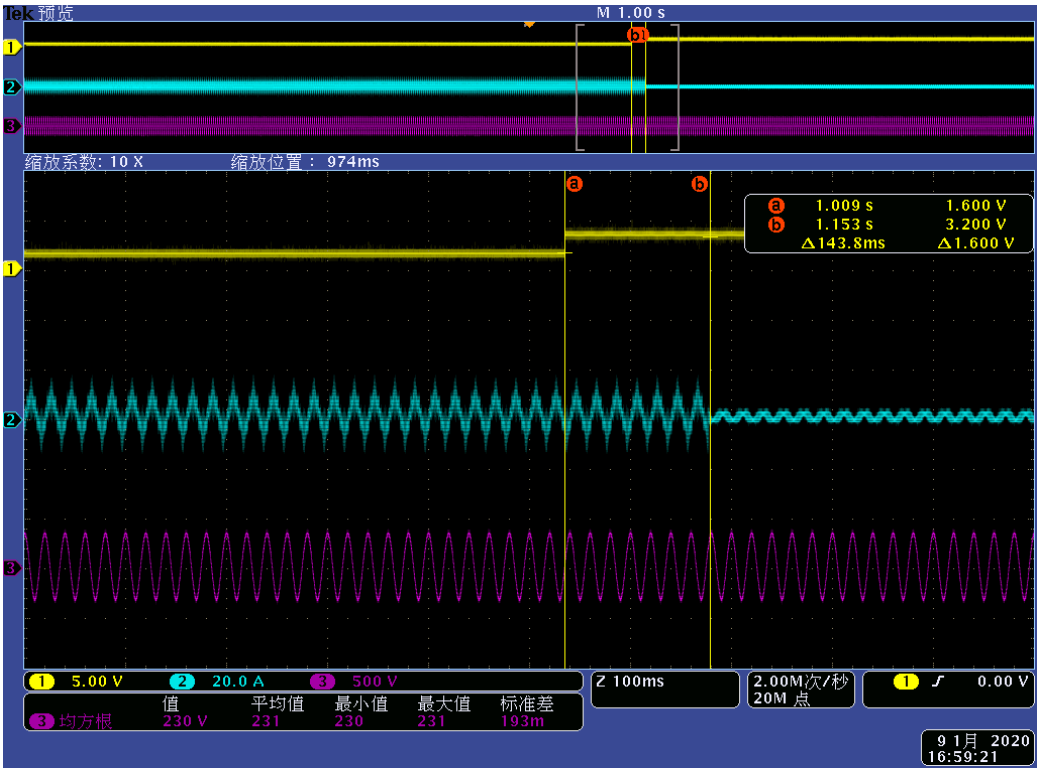


UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

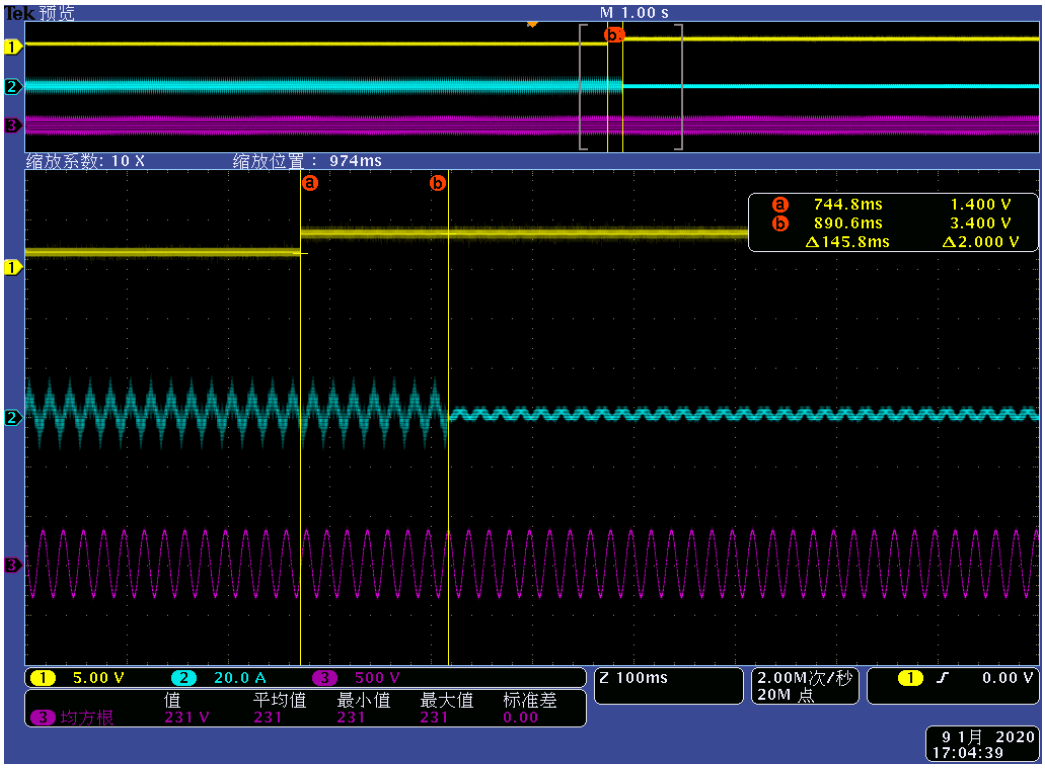
6.4 (4.4)	**Monitoring of DC-Injection**			**P**
Model: EA30KTSI				
DC Injection [A]	**Limits**	**Trip Time [ms]**		
Tested with +1.01 A	I_{DC}:>1A than disconnection within 0.2 sec	133.80	143.80	137.80
Tested with -1.01 A	I_{DC}:>1A than disconnection within 0.2 sec	145.80	140.80	138.80
Note: A dc-current of 1A is injected, disconnection time of max. 0.2s The tests were performed on model EA30KTSI also applicable for all other models stated in this report.				

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Positive DC-Injection:



Negative DC-Injection:



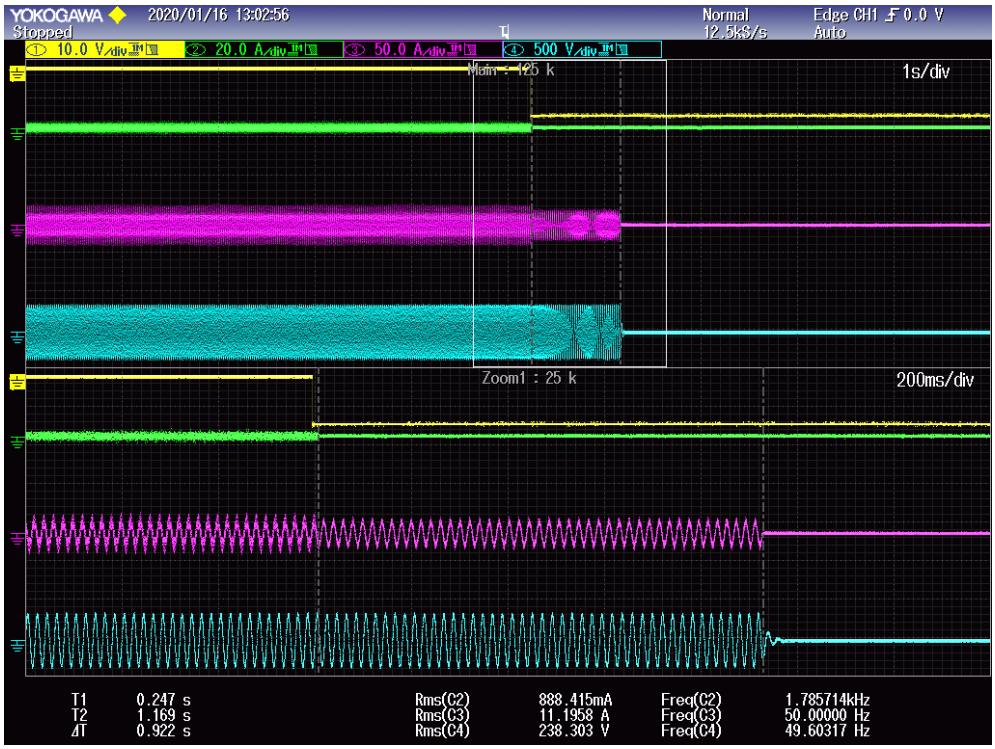
UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

6.5(4.5)	**Detection of Anti-Islanding - Resonant circuit test**		**P**
Model: EA30KTSI			
Test conditions:	Frequency: 50+/-0,2Hz U_N=230+/-3Vac Distortion factor of chokes <2% Quality Q>2		
Disconnection limit:	5s		
Output power: / Osc. Parameter	25%	50%	100%
- 5%	0.122	0.124	0.110
- 4%	0.106	0.119	0.120
- 3%	0.143	0.130	0.119
- 2%	0.108	0.128	0.123
- 1%	0.127	0.157	0.132
0 %	0.319	0.203	0.157
+1 %	0.655	0.510	0.339
+2 %	0.922	0.792	1.549
+3 %	0.804	0.588	0.845
+4 %	0.734	0.900	0.447
+5 %	0.436	0.164	0.291
Parameter at 0%	L=11.23 mH R=7.05 Ω C=903.04µF	L=5.62 mH R=3.53 Ω C=1806.08µF	L=2.81 mH R=1.76 Ω C=3612.15µF

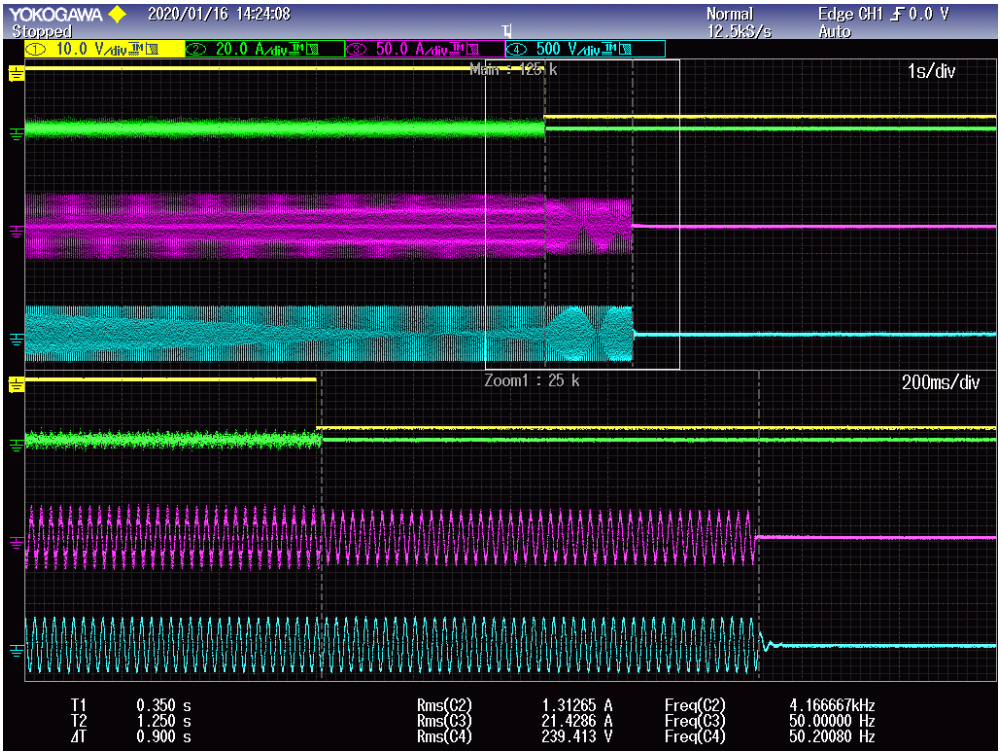
Note:
The capacitors and the Chokes of the resonant circuit were adjusted in order to reach a quality of >2. $P_{QC}+P_{QL}=-P_{Q,WR}$. The resitors of the resonant circuit consumed the real power of the inverter (P_{WR}) within +/-3%.
The tests were performed on model EA30KTSI also applicable for all other models stated in this report.

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Graph of disconnection at PAC 25% and OSC +2% nominal power

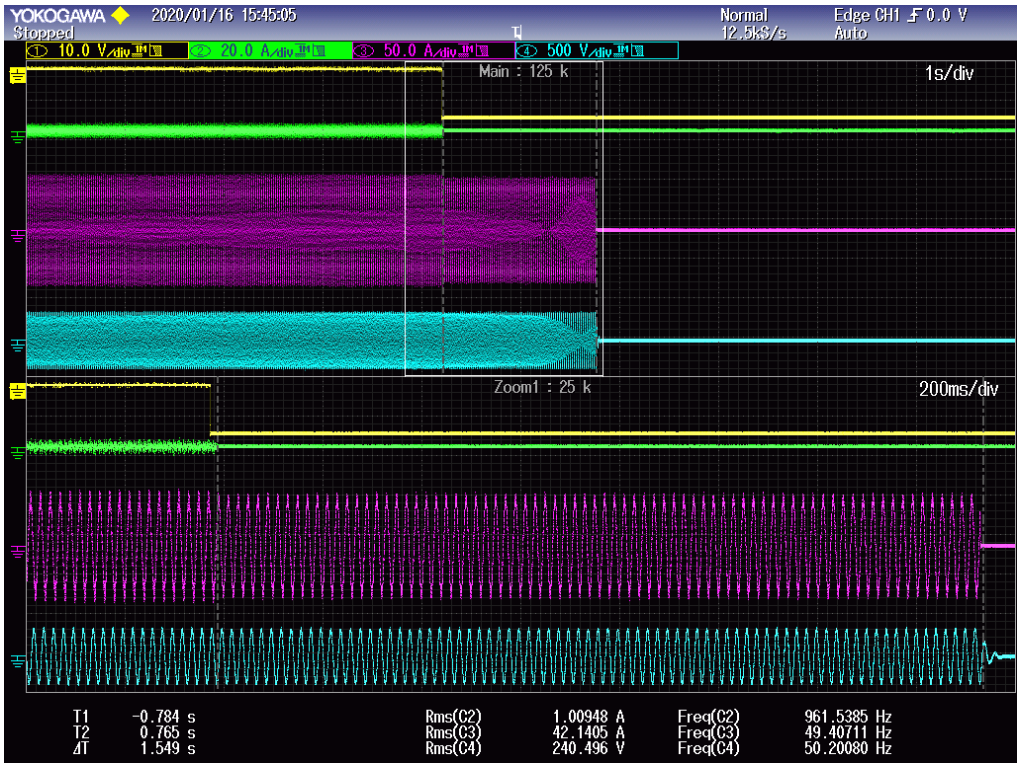


Graph of disconnection at PAC 50% and OSC +4% nominal power



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Graph of disconnection at PAC 100% and OSC +2% nominal power



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

6.6 (4.7) Residual current monitoring			**P**
6.6.2.2.2 Test for correct disconnection in case of a continuously rising residual current			
+ PV to N:			
	Fault Current [mA]		
Limit [mA]	~0.85U_N	U_N	~1.15U_N
<=300	290	296	206
<=300	292	299	195
<=300	293	298	195
<=300	295	298	203
<=300	296	300	203
- PV to N:			
	Fault Current [mA]		
Limit [mA]	~0.85U_N	U_N	~1.15U_N
<=300	300	287	203
<=300	300	290	201
<=300	297	288	202
<=300	299	289	198
<=300	298	287	199
Note: Comparing test circuit at 6.6.2.1, pic. 4. Fault current will rise up to 300mA within 30s. 5 values will be measured and listed. The tests were performed on model EA30KTSI also applicable for all other models stated in this report.			

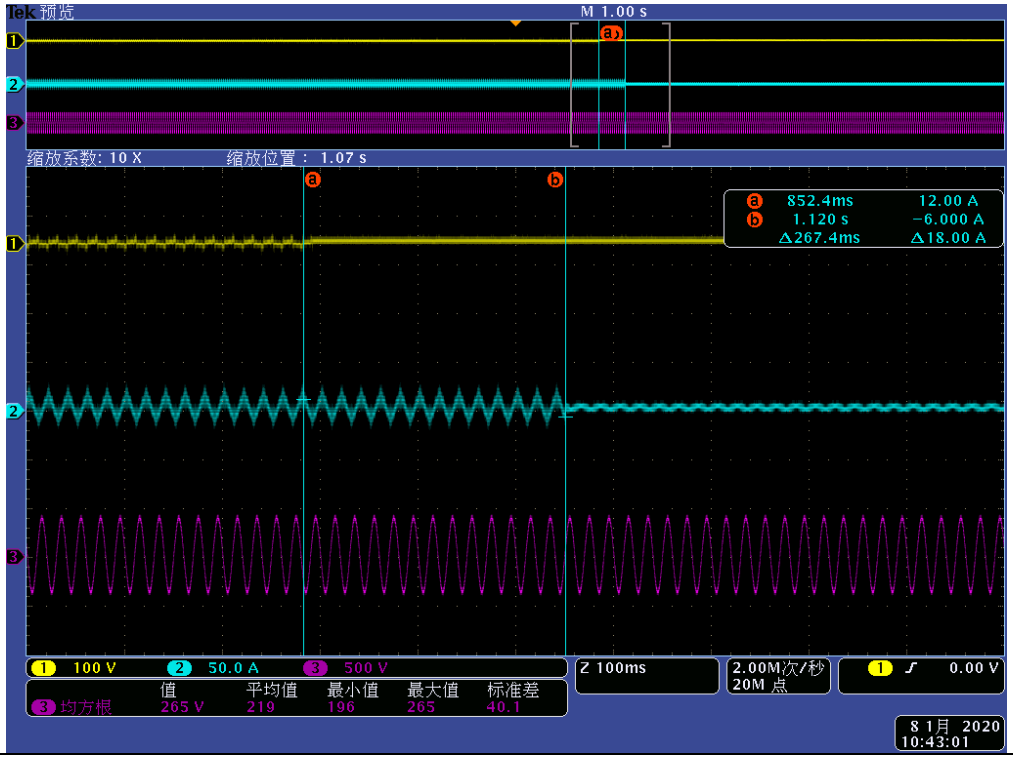
UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

6.6.2.2.2	**TABLE: Test for correct disconnection in case of an abrupt appearing residual current >300mA**		**P**
+ PV to N:			
Fault Current > 300 mA			
Limit [ms]	~0.85 U_N	U_N	~1.15 U_N
300	261.40	266.40	267.40
- PV to N:			
Fault Current > 300 mA			
Limit [ms]	~0.85 U_N	U_N	~1.15 U_N
300	250.40	262.40	255.40

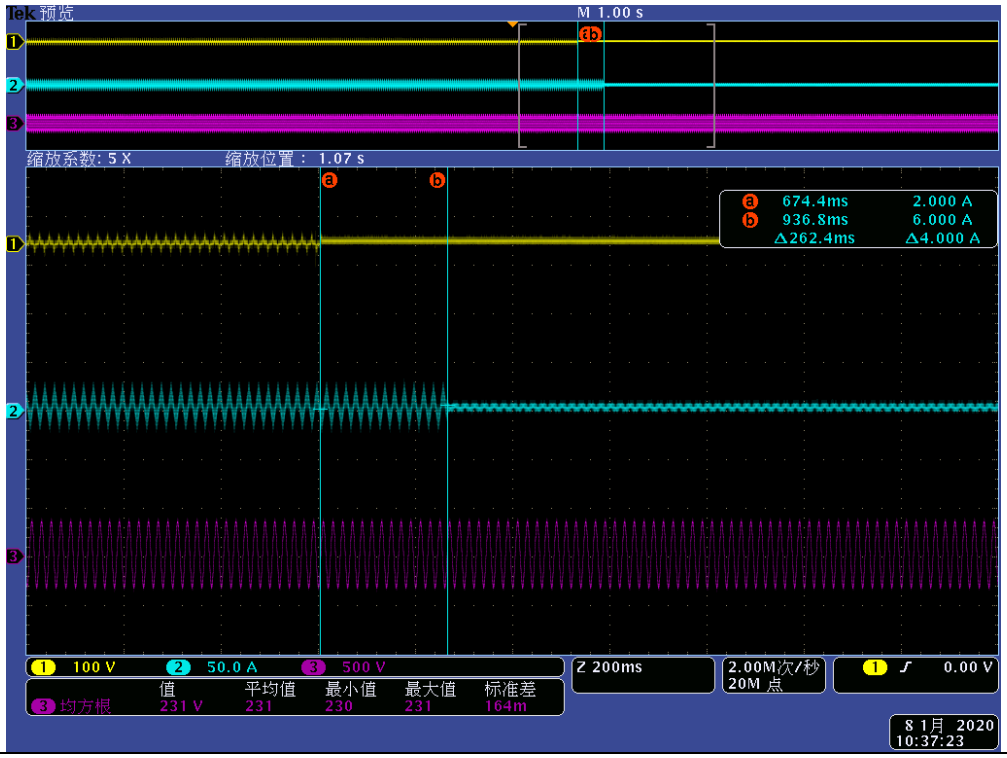
Note:
To test the trip time, the test resistance is then adjusted to set the residual current to a value approximately 10 mA below the actual trip level. A second external resistance, adjusted to cause approximately 20 mA of residual current to flow, is connected through a switch from ground to the same PV input terminal as the first resistance. The switch is closed, increasing the residual current to a level above the trip level determined above. The time shall be measured from the moment the second resistance is connected until the moment the inverter disconnects from the mains, as determined by observing the inverter output current and measuring the time until the current drops to zero.
The tests were performed on model EA30KTSI also applicable for all other models stated in this report.

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Scope picture: + PV to N



Scope picture: - PV to N



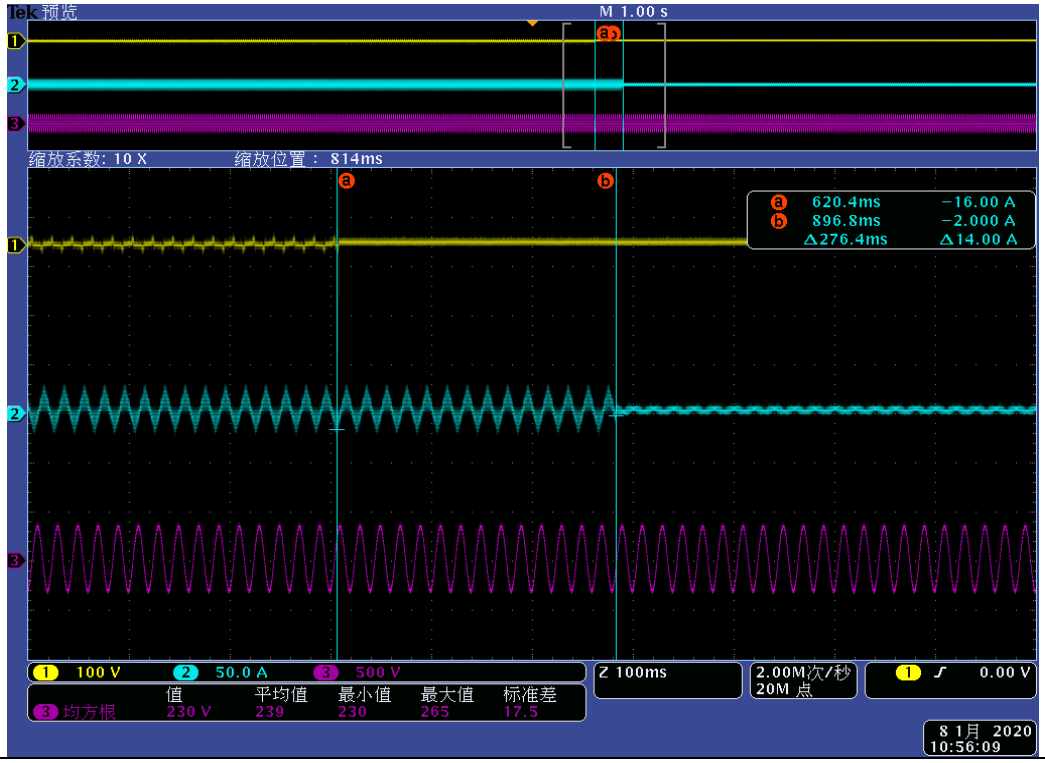
UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

6.6.2.2.3	**Test for correct disconnection in case of a suddenly occuring residual current**			**P**
+PV to N				
Limit [mA]	~0.85U_N	U_N	~1.15U_N	Limit [ms]
	Disconnection time [ms]	Disconnection time [ms]	Disconnection time [ms]	
30	272.4	261.4	249.4	300
30	258.4	259.4	228.4	300
30	266.4	276.4	264.4	300
30	256.4	258.4	205.4	300
30	221.4	272.4	255.4	300
60	90.4	97.4	97.4	150
60	107.4	77.4	107.4	150
60	113.4	107.4	95.4	150
60	98.4	99.4	101.4	150
60	98.4	101.4	105.4	150
150	14.6	12	18	40
150	25.4	26.6	8	40
150	28.8	28.2	22	40
150	22.6	11.8	24.8	40
150	9.6	9.4	8.2	40
-PV to N				
Limit [mA]	~0.85U_N	U_N	~1.15U_N	Limit [ms]
	Disconnection time [ms]	Disconnection time [ms]	Disconnection time [ms]	
30	247.4	276.4	259.4	300
30	264.4	269.4	259.4	300
30	281.4	253.4	253.4	300
30	276.4	260.4	259.4	300
30	264.4	259.4	265.4	300
60	109.4	105.4	81.4	150
60	105.4	103.4	110.4	150
60	115.4	110.4	106.4	150
60	113.4	102.4	98.4	150
60	105.4	103.4	113.4	150
150	12.6	26	24.4	40
150	25.2	11.8	15.2	40
150	15.2	24.6	10.6	40
150	21.6	14.6	17.4	40
150	14	12.2	16.4	40

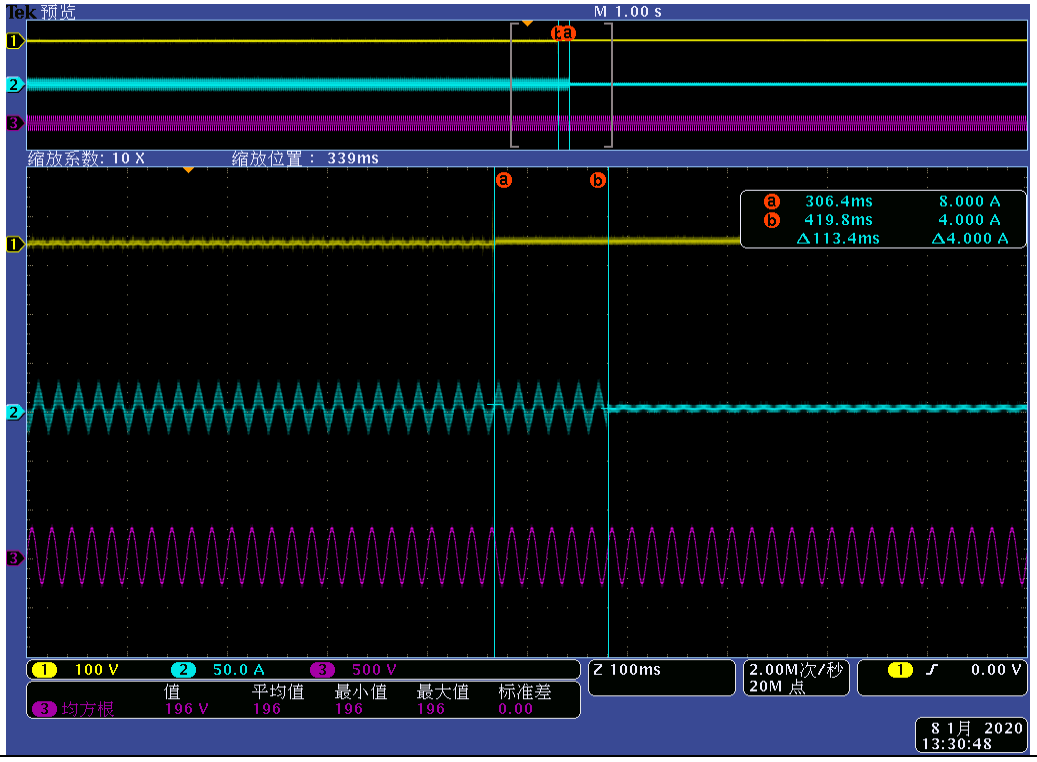
Note:
The capacitive current is risen until disconnection.
Test condition: I_c + 30/60/150mA <= I_{cmax}. R_1 is set that 30/60/150mA Flow and switch S is closed.
The tests were performed on model EA30KTSI also applicable for all other models stated in this report.

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Scope picture: + PV to N; 100%U_N; 30mA

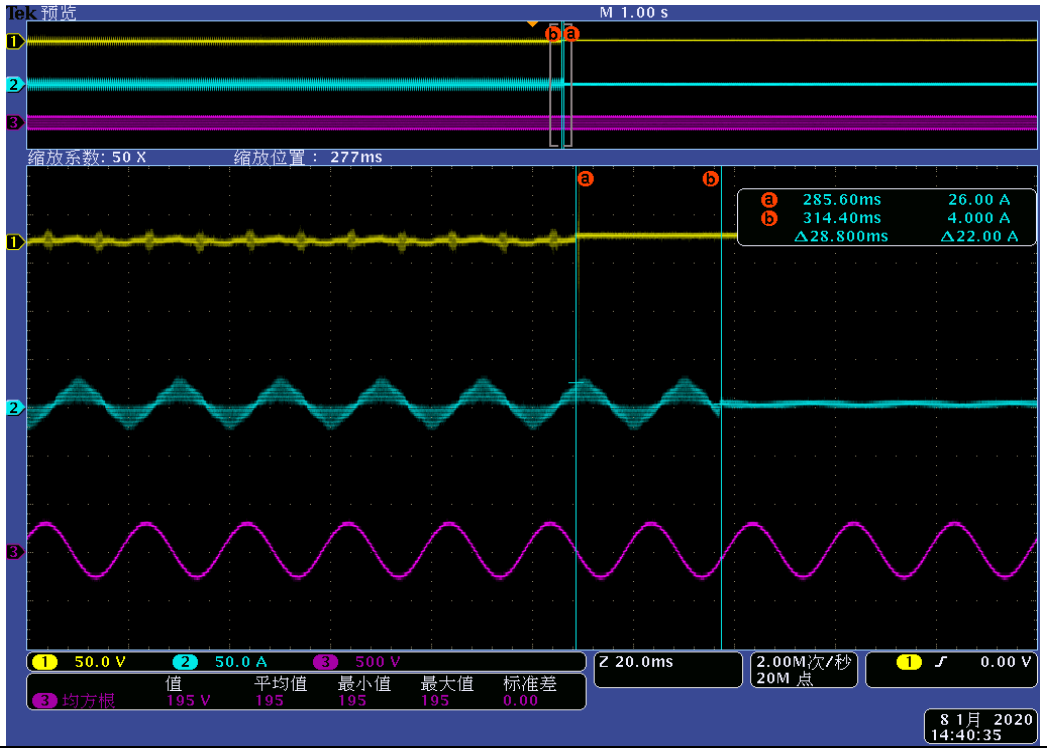


Scope picture: + PV to N; 100%U_N; 60mA



UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

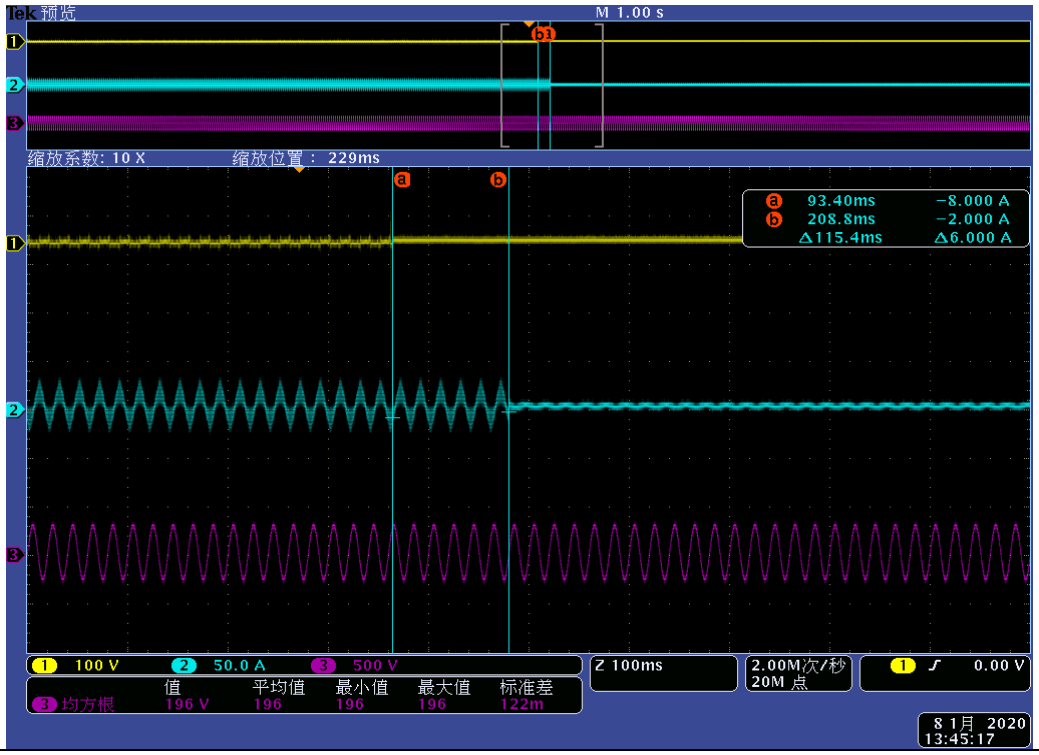
Scope picture: + PV to N; 100%U_N; 150mA



Scope picture: - PV to N; 100%U_N; 30mA

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

Scope picture: - PV to N; 100%U_N; 60mA



Scope picture: - PV to N; 100%U_N; 150mA

UTE C15-712-1			
Clause	Requirement – Test	Result – Remark	Verdict

6.6.2.2.4	**TABLE: Isolation measurement before feeding in**			**P**
Condition		DC Voltage [V]	Required Insulation resistance (kΩ)	Result
PV+				
V+, the higher array voltage		1100	1100 kΩ	More than 3276.7 kΩ
Vcritical, the voltage level analyzed to be difficult to detect		950		
Varbitrary, any voltage within the range V- and V+		640		
V-, the lower array voltage		200		
PV-				
V+, the higher array voltage		1100	1100 kΩ	More than 3276.7 kΩ
Vcritical, the voltage level analyzed to be difficult to detect		950		
Varbitrary, any voltage within the range V- and V+		640		
V-, the lower array voltage		200		
Note: The array insulation resistance to ground shall be not less than 1 kΩ/V with respect to the maximum dc input voltage as specified by the manufacturer, with a minimum of 500 kΩ The tests were performed on model EA30KTSI also applicable for all other models stated in this report.				

Appendix 2: IP65 Test Result

Summary of IP65 test results:

The test performed on EA30KTSI is valid for EA20KTSI and EA25KTSI due to that they have same metal enclosure. After test, no deposit of dust is observable inside the enclosure and no water entered into the enclosure of sample.

According to standard of IEC 60529:2013 (Edition 2.2) / IEC 60529:1989+A1:1999+A2:2013, EN 60529:1991+A1:2000+A2:2013, IEC 62109-1:2010 (clause 6.3), the test result is accepted.

The test results shown in this report relate only to the tests performed according to the test program. The test object has not been submitted to a full test program.

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Test program:

This test is according to clause 12.2, 13.4 & 13.6 (IP6X) & 14.2.5 (IPX5) & 14.3 of IEC/EN 60529.

Acceptance condition for first characteristic numeral 6:

The enclosure of the unit under test was considered as Category 1: Enclosures where the normal working cycle of the equipment causes reductions in air pressure within the enclosure below that of the surrounding air.

The protection is satisfactory if no deposit of dust is observable inside the enclosure at the end of the test.

Acceptance condition for secondary characteristic numeral 5:

It is the responsibility of the relevant technical committee to specify the amount of water which may be allowed to enter the enclosure and the details of a dielectric strength test, if any.

14.3 Acceptance conditions:

After testing in accordance with the appropriate requirements of 14.2.1 to 14.2.8 the enclosure shall be inspected for ingress of water.

It is the responsibility of the relevant technical committee to specify the amount of water which may be allowed to enter the enclosure and the details of a dielectric strength test, if any.

In general, if any water has entered, it shall not:

– be sufficient to interfere with the correct operation of the equipment or impair safety;

– deposit on insulation parts where it could lead to tracking along the creepage distances;

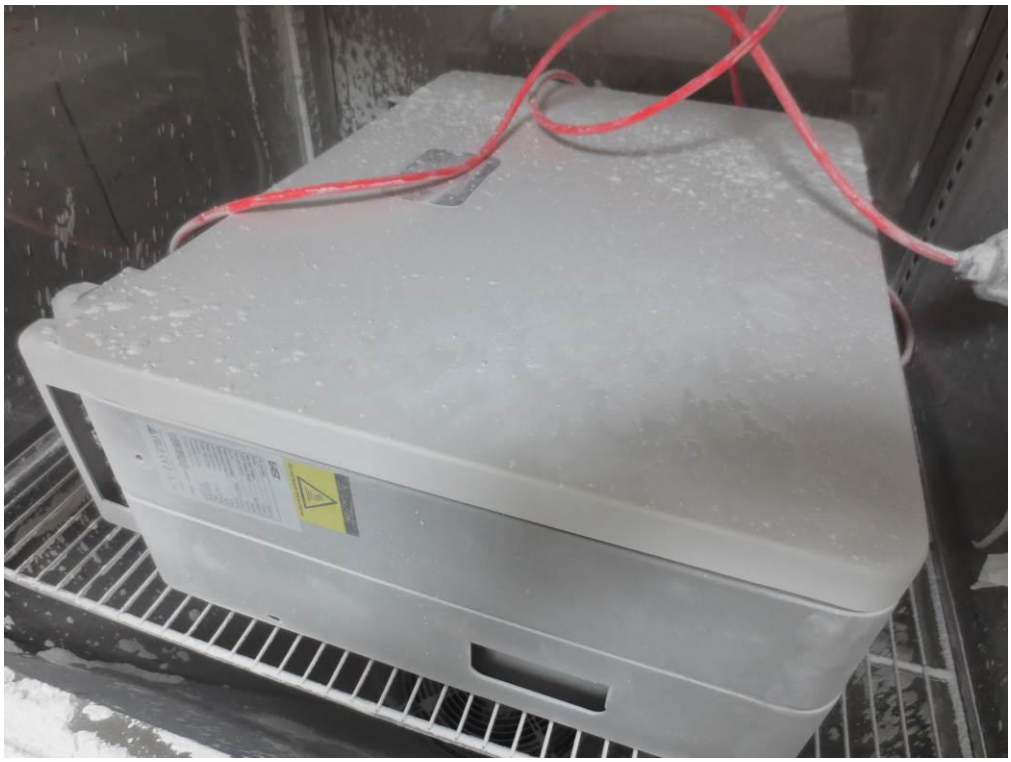
– reach live parts or windings not designed to operate when wet;

– accumulate near the cable end or enter the cable if any.

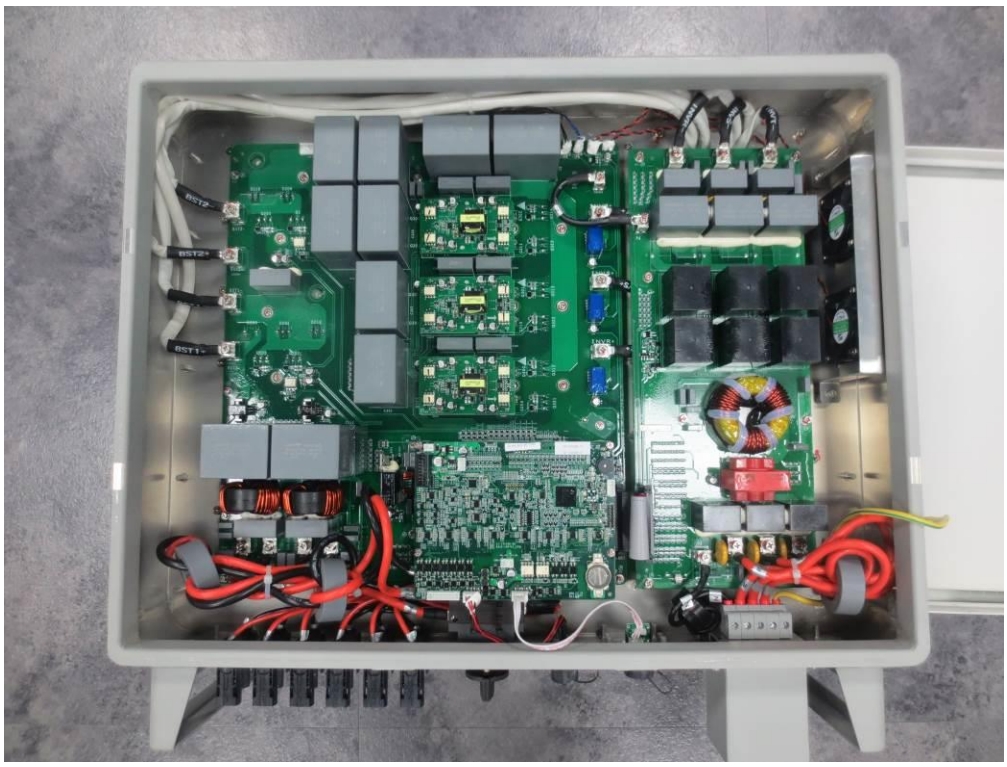
If the enclosure is provided with drain-holes, it should be proved by inspection that any water which enters does not accumulate and that it drains away without doing any harm to the equipment.

For enclosures without drain-holes, the relevant product standard shall specify the acceptance conditions if water can accumulate to reach live parts.

Pictures during IP6X test:



Pictures after IP6X test:



No dust find

Pictures during IPX5 test:

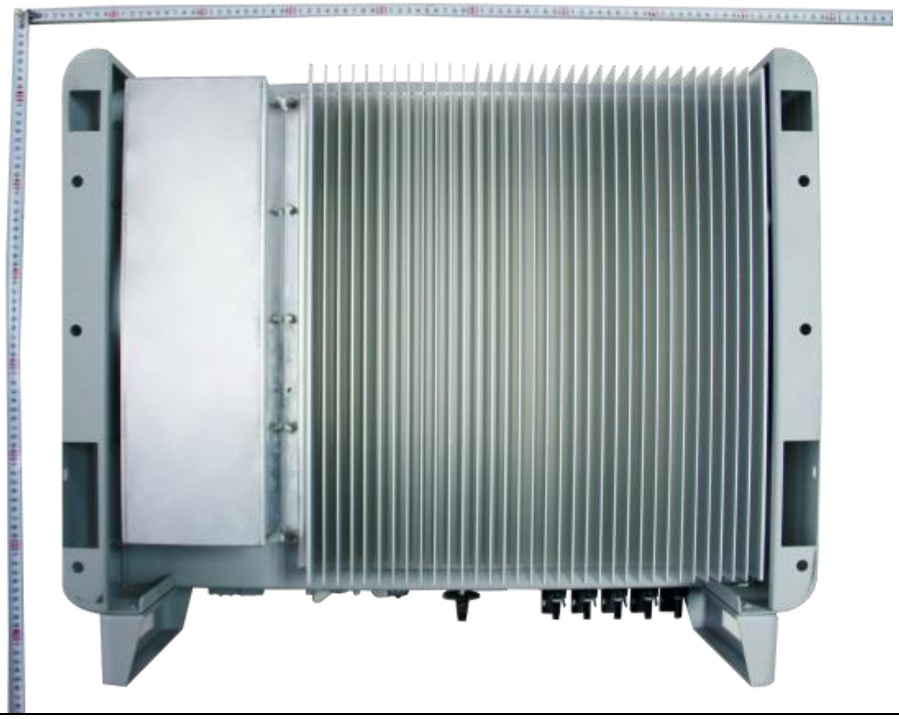
Pictures after IPX5 test:

No water find

Appendix 3: Photo documentation

EA20KTSI / EA25KTSI / EA30KTSI
Enclosure – Front View

EA20KTSI / EA25KTSI / EA30KTSI
Enclosure – Rear View



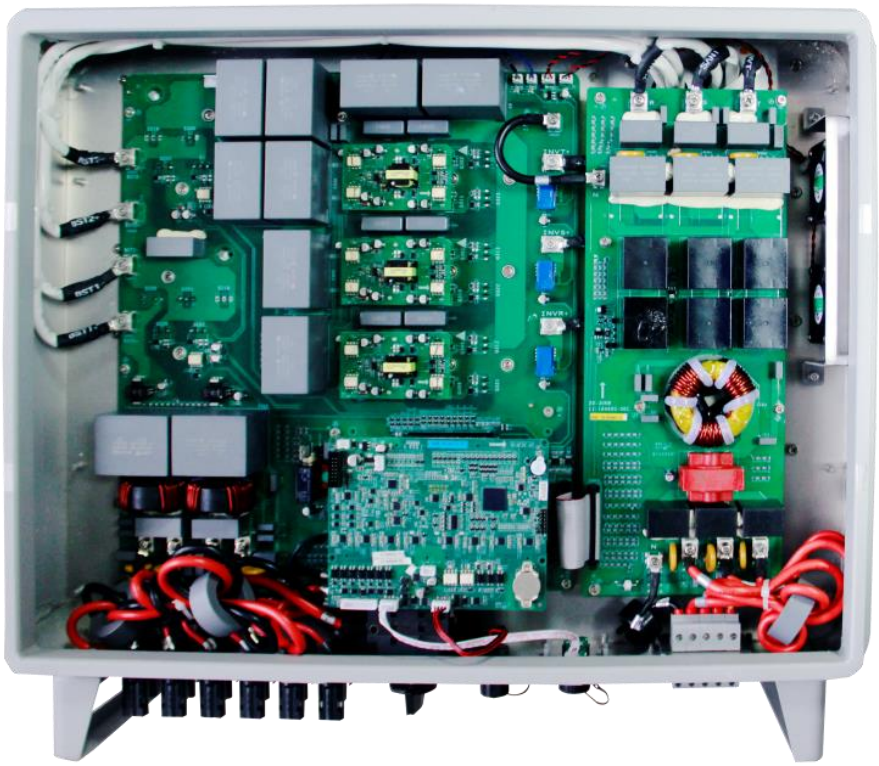
EA30KTSI
Enclosure –Bottom View

EA25KTSI
Enclosure –Bottom View

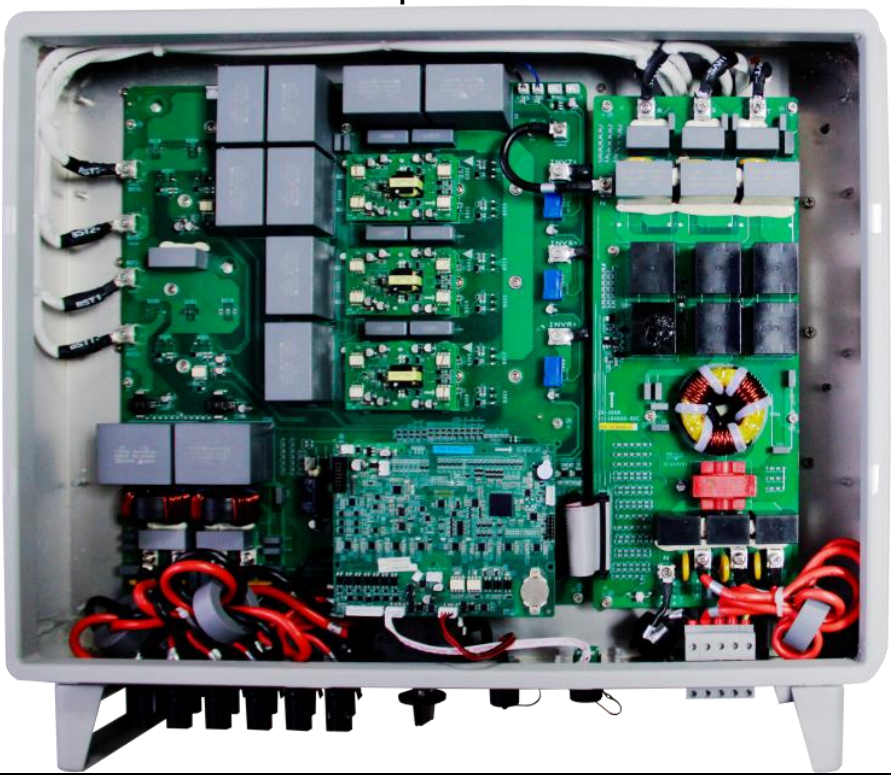
EA20KTSI
Enclosure – Bottom View

EA20KTSI / EA25KTSI / EA30KTSI
Cover

EA30KTSI
Open View

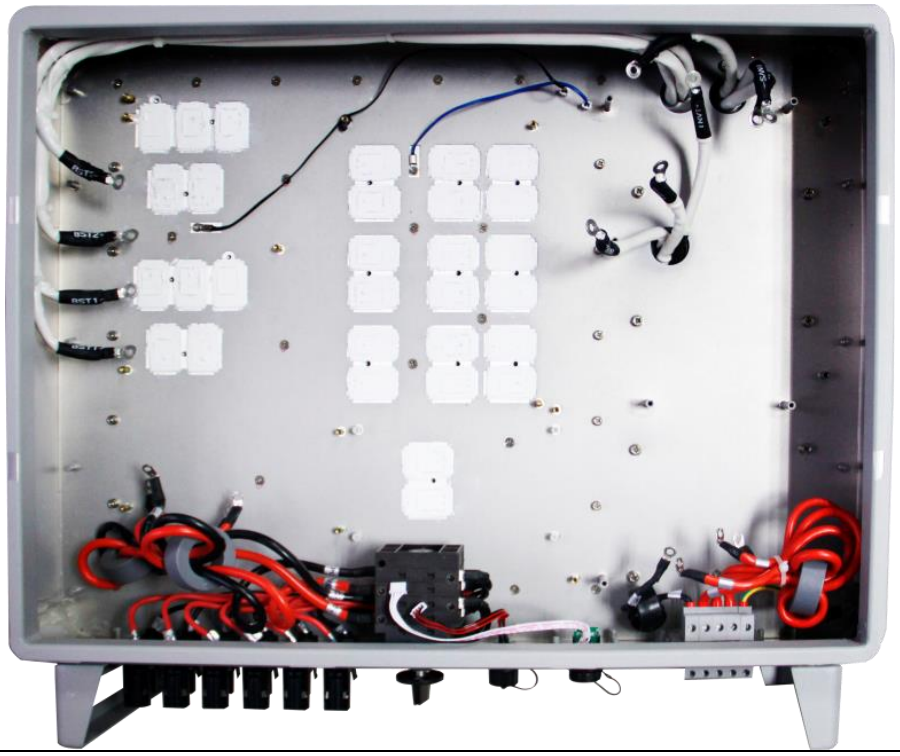


EA25KTSI
Open View

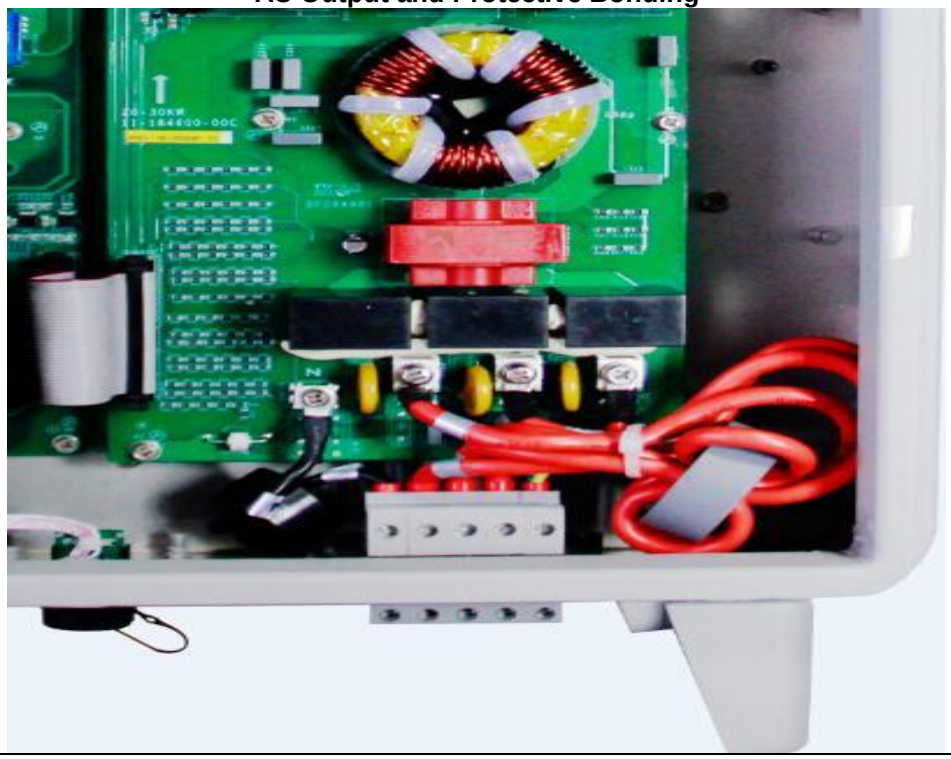


EA20KTSI
Open View

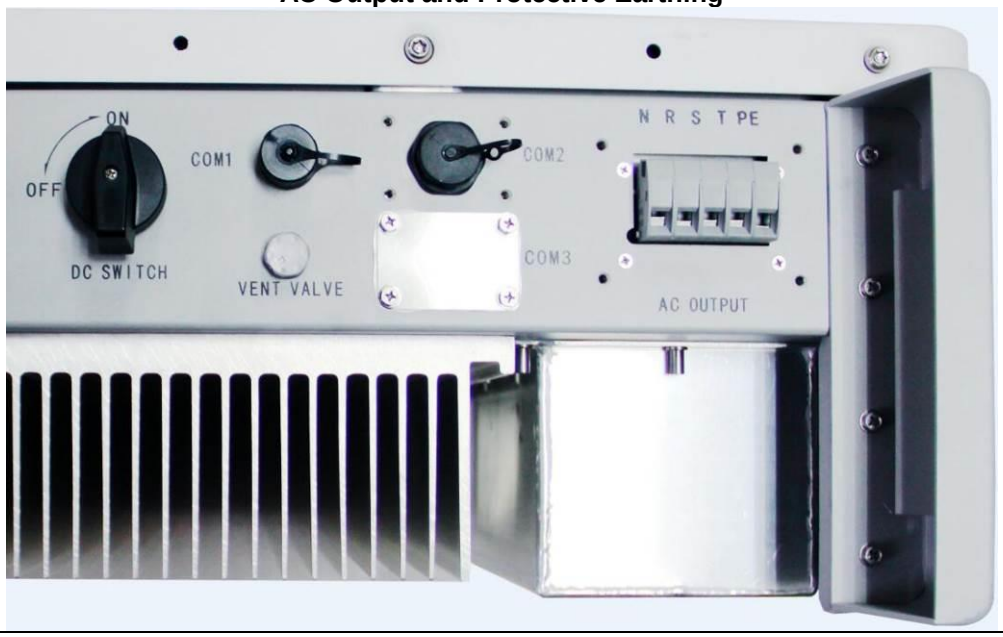
EA20KTSI / EA25KTSI / EA30KTSI
Internal Enclosure



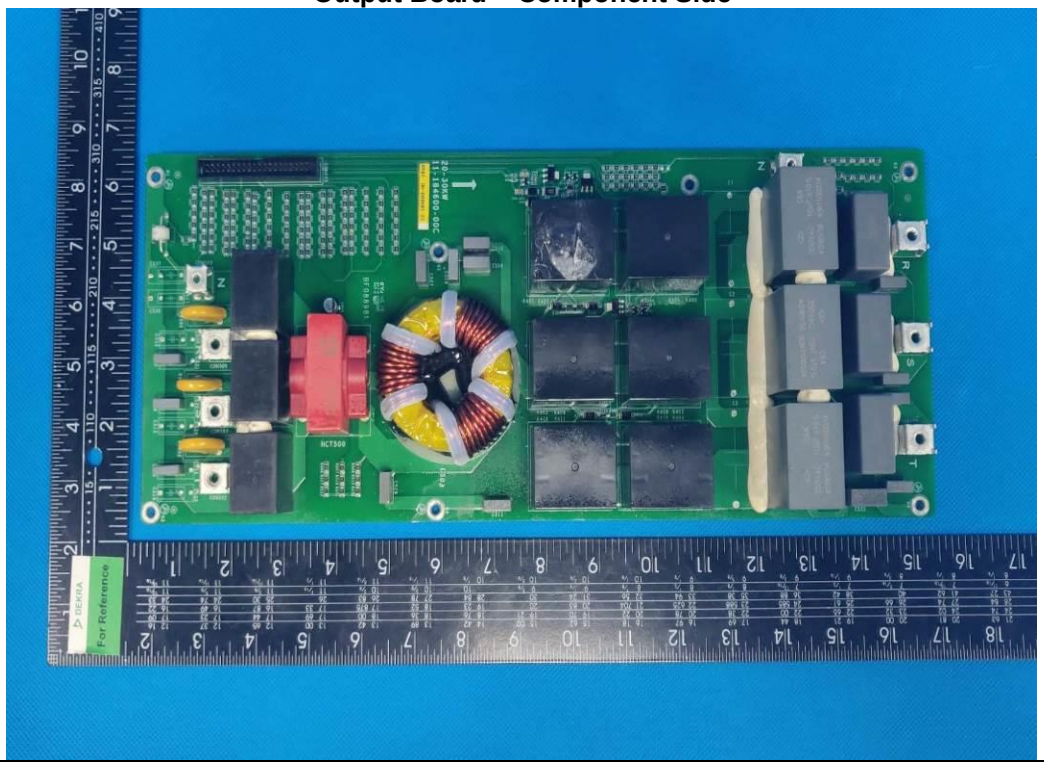
EA20KTSI / EA25KTSI / EA30KTSI
AC Output and Protective Bonding



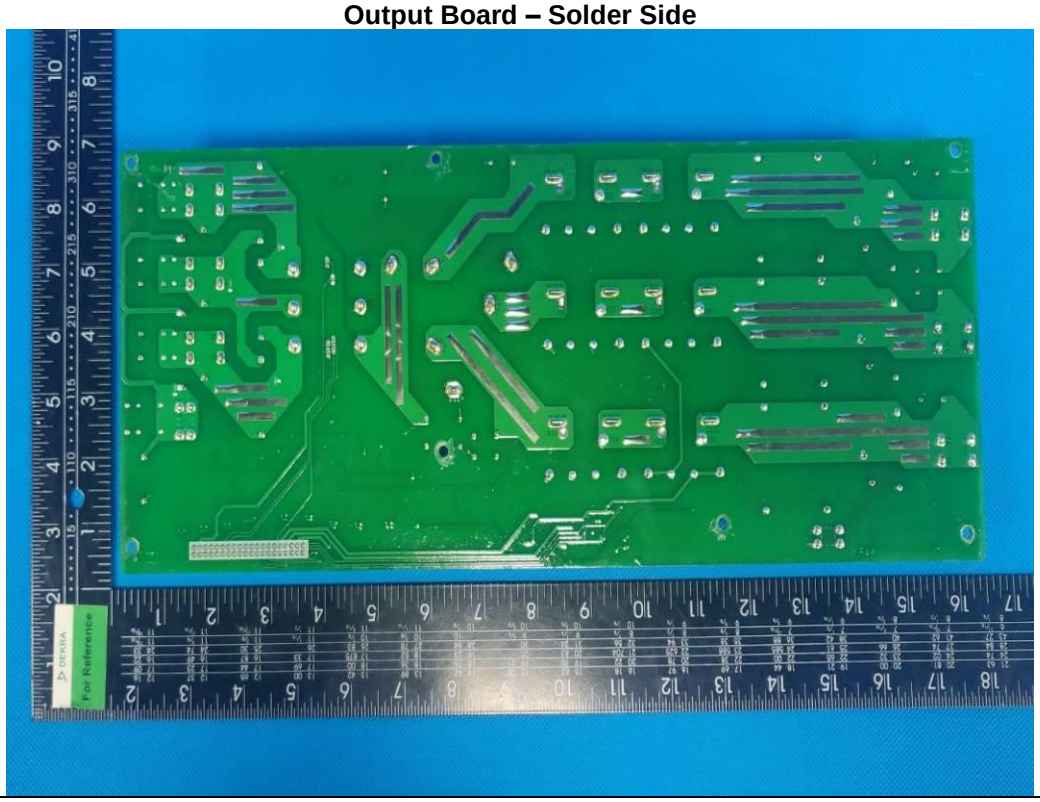
EA20KTSI / EA25KTSI / EA30KTSI
AC Output and Protective Earthing



EA25KTSI / EA30KTSI
Output Board – Component Side



Output Board – Solder Side

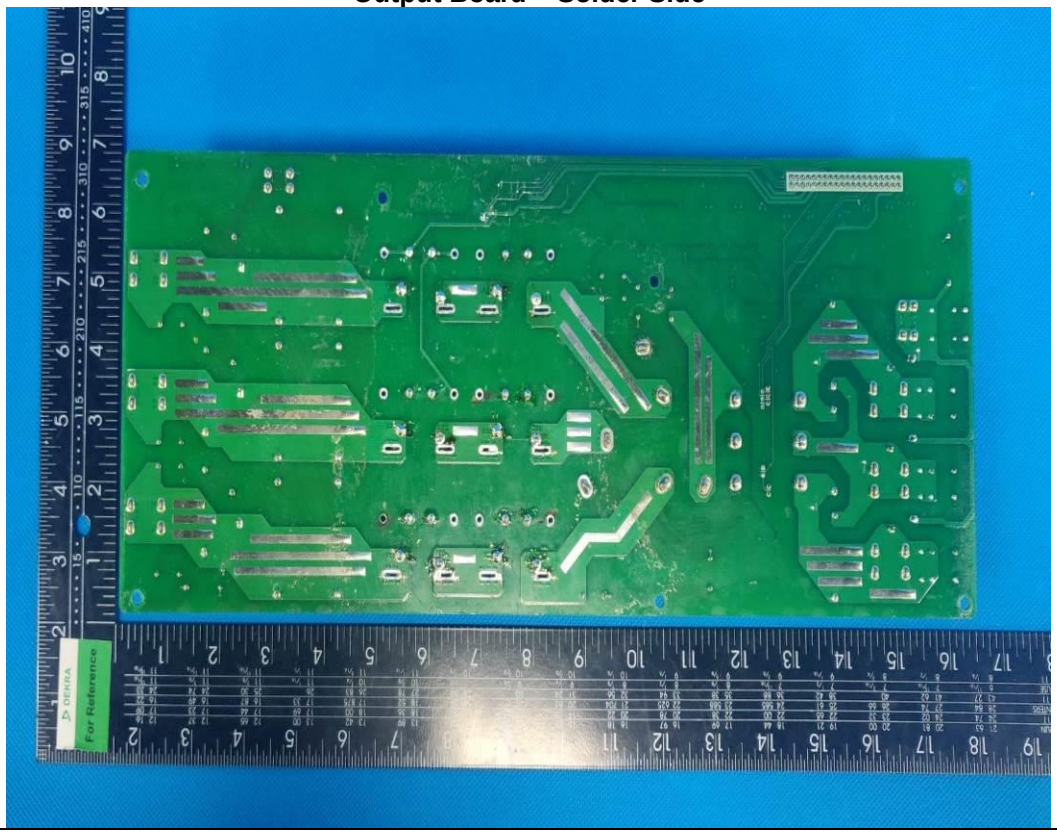


x

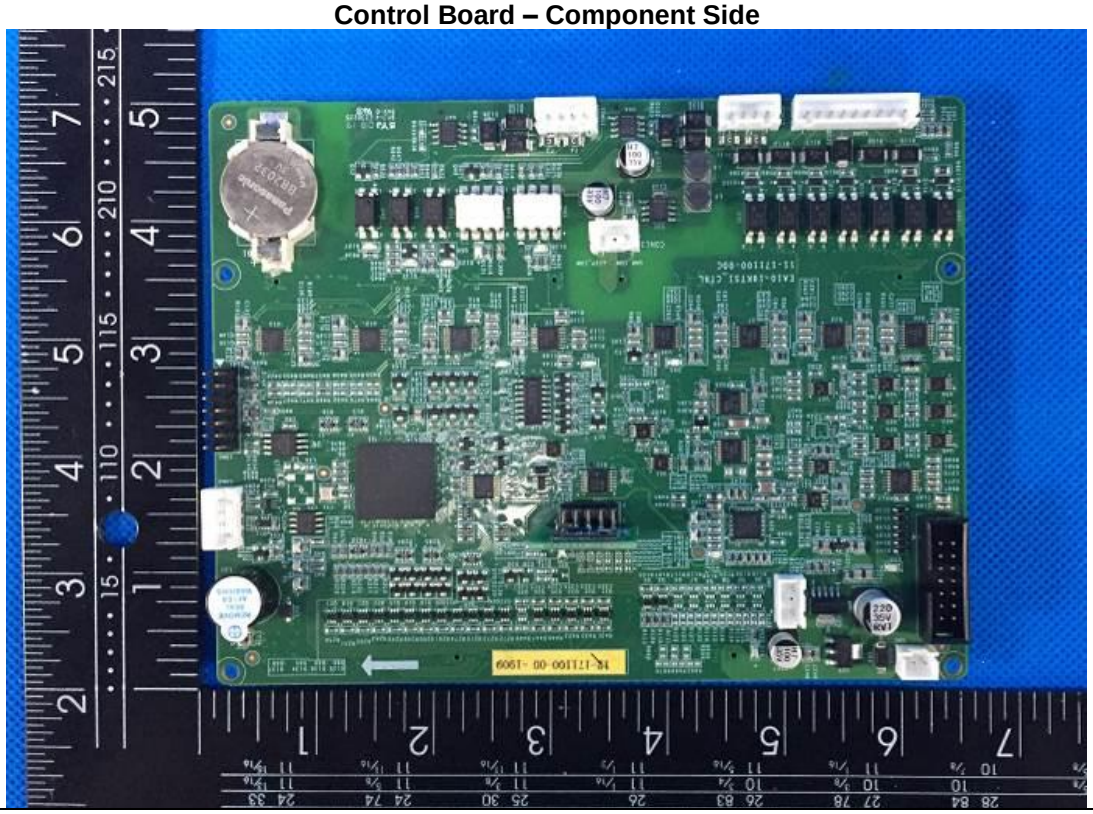
EA20KTSI

Output Board – Component Side

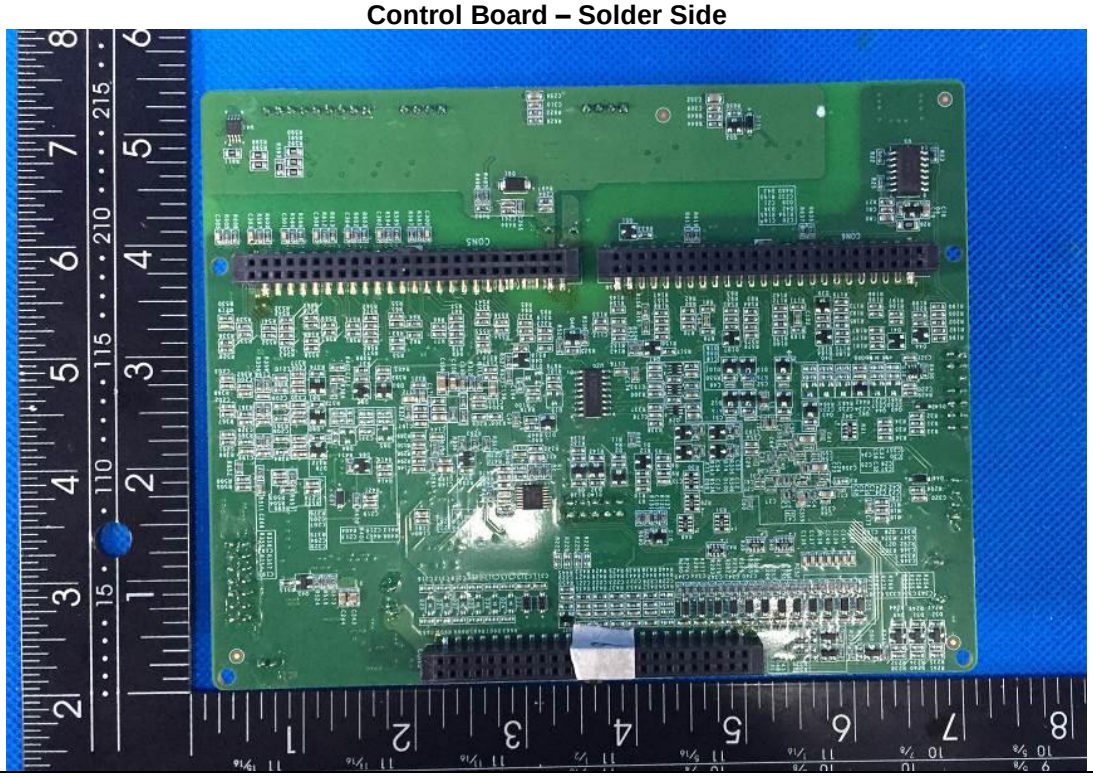
Output Board – Solder Side



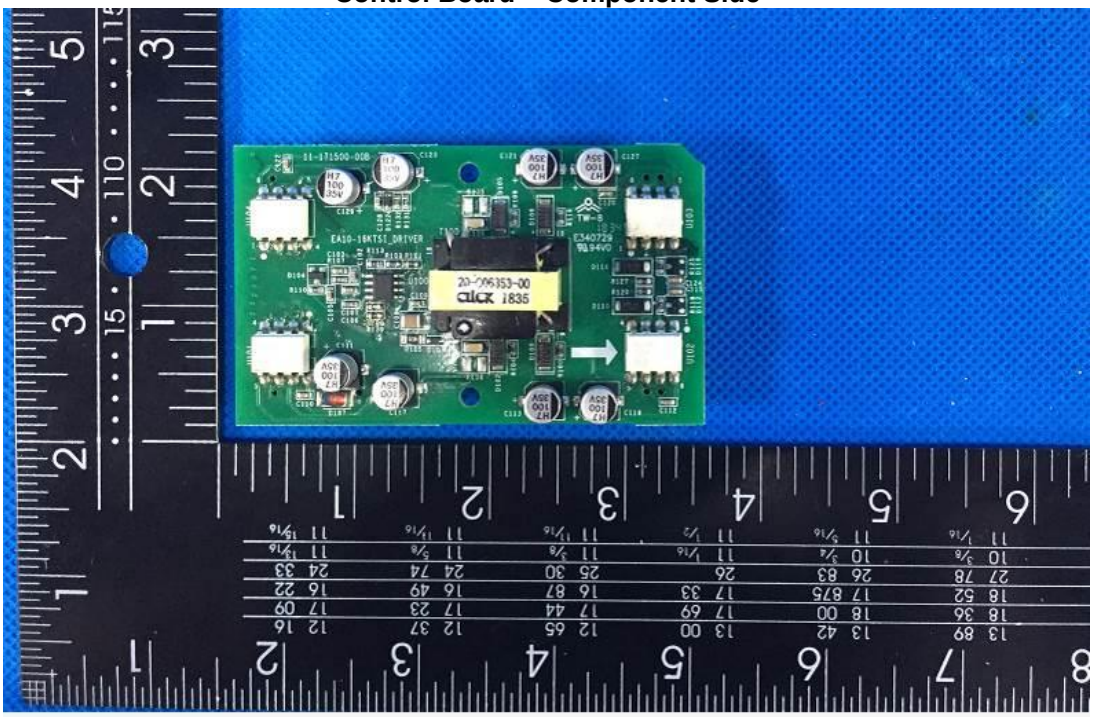
EA20KTSI / EA25KTSI / EA30KTSI
Control Board – Component Side



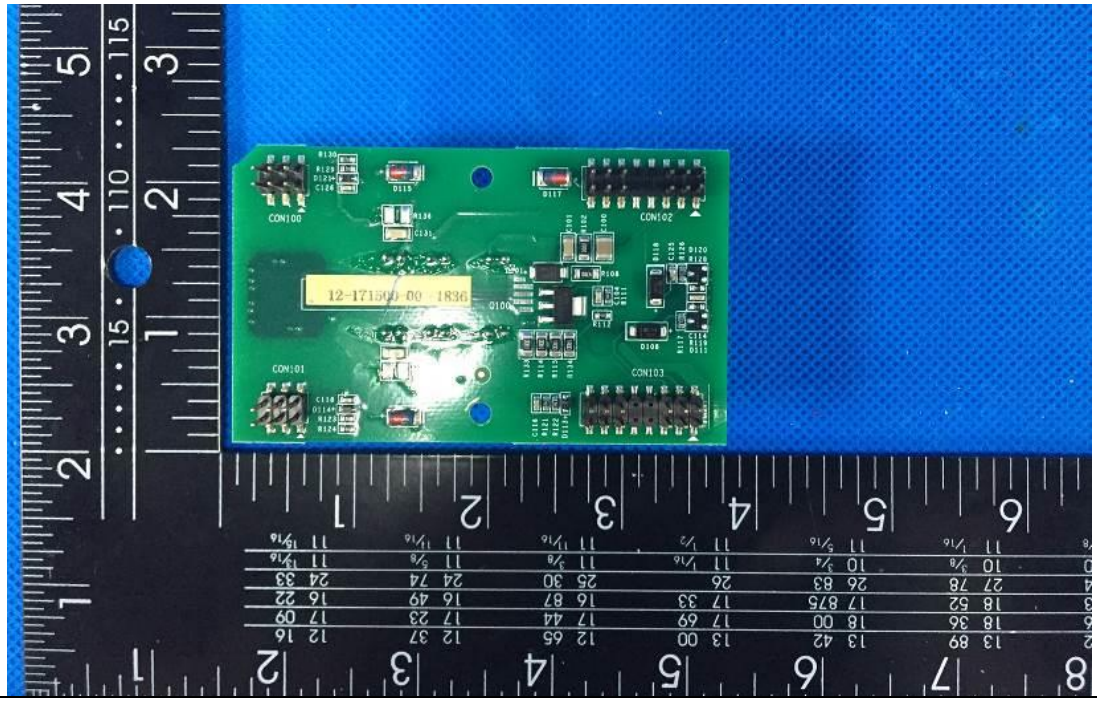
EA20KTSI / EA25KTSI / EA30KTSI
Control Board – Solder Side



EA20KTSI / EA25KTSI / EA30KTSI
Control Board – Component Side



EA20KTSI / EA25KTSI / EA30KTSI
Driver Board – Solder Side



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