TEST REPORT

AS/NZS 4777.2

Grid connection of energy systems via inverters
Part 2: Inverter requirements

Report reference number .....:	**PVAU160721N056-R3**
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Testing laboratory name .....:	**Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch**
Address .....:	No. 34, Chenwulu Section, Guantai Rd., Houjie Town, Dongguan City, Guangdong 523942, China
Applicant's name.....:	**Shenzhen SOFARSOLAR Co., Ltd.**
Address .....:	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China.
Test specification	
Standard.....:	AS/NZS 4777.2:2015
Certificate.....:	**Ce**rtificate of compliance
Test report form number .....:	AS4777_C
Master TRF .....:	Bureau Veritas Consumer Products Services Germany GmbH
Test item description .....:	**Grid connected photovoltaic inverter**
Trademark.....:	SOFAR SOLAR
Model / Type .....:	SOFAR 30000TL-Sx Series, SOFAR 33000TL-Sx Series, SOFAR 40000TL-Sx Series

Ratings .....:	**SOFAR 30000TL-Sx Series**	**SOFAR 33000TL-Sx Series**	**SOFAR 40000TL-Sx Series**
Maximum input DC voltage [V].....:	1000		
Operating input DC voltage range [V]:	250-960		
Full load MPPT input DC voltage range [V].....:	480 - 800		560-800
Input DC current [A] .....:	Max. 32,0 x 2	Max. 35,0 x 2	
Output AC voltage [V] .....:	3/N/PE, 230/400Vac, 50,0Hz		3/N/PE, 277/480Vac, 50,0Hz
Output AC current [A].....:	Max. 43,0 x 3	Max. 48,0 x 3	
Output power [VA].....:	Max. 30000	Max. 33000	Max. 40000

Testing Location .....:	**Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch**
Address .....:	No. 34, Chenwulu Section, Guantai Rd., Houjie Town, Dongguan City, Guangdong 523942, China
Tested by (name and signature) .....:	Dora Zhang 
Approved by (name and signature) .....:	James Huang 
Manufacturer's name .....:	**Shenzhen SOFARSOLAR Co., Ltd.**
Manufacturer address .....:	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China.
Factory's name .....:	**Dongguan SOFAR SOLAR Co.,Ltd.**
Factory address .....:	1F - 6F, Building E, No. 1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City

Document History

Date	Internal reference	Modification / Change / Status	Revision
2016-10-21	James Huang	Initial report was written	0
2017-08-25	James Huang	Add the test results in table 7.3	1
2018-03-07	James Huang	Update the software version to V3.00 due to add the IEC 62116 test mothod for clause 7.3.	2
2019-07-22	Dora Zhang	- Add the test result for clause 6.2. - Add the test result for clause 6.3.2.3. - Add the test result for clause 6.3.5.3.3 - Update the information of the Applicant, Manufacturer and Factory	3

Supplementary information:

Test items particulars

Equipment mobility ..... :	Permanent connection
Operating condition ..... :	Continuous
Class of equipment ..... :	Class I
Protection against ingress of water .. :	IP65 according to EN 60529
Mass of equipment [kg] ..... :	50kg

Test case verdicts

Test case does not apply to the test object ..... :	N/A
Test item does meet the requirement ..... :	P(ass)
Test item does not meet the requirement ..... :	F(ail)

Testing

Date of receipt of test item ..... :	1) 2016-07-21, 2) 2017-08-01 3) 2019-06-27
Date(s) of performance of test ..... :	1) 2016-07-21 to 2016-10-20, 2) 2017-08-01 to 2017-08-24 3) 2019-06-27 to 2019-07-20

General remarks*:*

The test result presented in this report relate only to the object(s) tested.
This report shall not be reproduced, except in full, without the written approval of the applicant.

”(see Annex #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a comma is used as the decimal separator.

The unit was reviewed to
AS 4777.2:2015 Grid connection of energy systems via inverters – Part 2: inverter requirements and the unit fulfils the requirements of the European EMC directive requirements. The EMC requirements of AS 4777.2 (flicker) refer to the same standards as the EMC directive; therefore the EMC report documents show the compliance.

For the testing product (model SOFAR 40000TL-Sx Series), there is an external isolated transformer on the ac output side in order to transfer the ac output voltage 277/480Vac to the right grid voltage 230/400Vac.

This Test Report consists of the following documents:

- Test Results
- Annex No. 1 – EMC Test Report
- Annex No. 2 – Pictures of the unit
- Annex No. 3 – Test equipment list

Copy of marking plate:

SOFAR SOLAR Solar Inverter

Model No.	SOFAR 30000TL-Sx Series
Max. DC input voltage	1000V
Operating MPPT voltage range	250-960V
Max. Input current	2x32A
Max. PV Isc	2x40A
Nominal Grid Voltage	3/N/PE, 230/400V~
Max. Output Current	3x43A
Nominal Grid Frequency	50/60Hz
Max. Output power	30000VA
Power factor	>0.99(adjustable+/-0.8)
Ingress protection	IP65
Operating Temperature Range	-25-+60°C
Protective Class	Class I
Made in China	

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.

VDE0126-1-1,VDE-AR-N4105,G59/3,IEC61727,IEC62116, C10/11,RD1699,UTE C15-712-1,AS4777

SOFAR SOLAR Solar Inverter

Model No.	SOFAR 33000TL-Sx Series
Max. DC input voltage	1000V
Operating MPPT voltage range	250-960V
Max. Input current	2x35A
Max. PV Isc	2x40A
Nominal Grid Voltage	3/N/PE, 230/400V~
Max. Output Current	3x48A
Nominal Grid Frequency	50/60Hz
Max. Output power	33000VA
Power factor	>0.99(adjustable+/-0.8)
Ingress protection	IP65
Operating Temperature Range	-25-+60°C
Protective Class	Class I
Made in China	

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.

VDE0126-1-1,VDE-AR-N4105,G59/3,IEC61727,IEC62116, C10/11,RD1699,UTE C15-712-1,AS4777

SOFAR SOLAR Solar Inverter

Model No.	SOFAR 40000TL-Sx Series
Max. DC input voltage	1000V
Operating MPPT voltage range	250-960V
Max. Input current	2x35A
Max. PV Isc	2x40A
Nominal Grid Voltage	3/PE, 480V~
Max. Output Current	3x48A
Nominal Grid Frequency	50/60Hz
Max. Output power	40000VA
Power factor	>0.99(adjustable+/-0.8)
Ingress protection	IP65
Operating Temperature Range	-25-+60°C
Protective Class	Class I
Made in China	

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.

VDE0126-1-1,VDE-AR-N4105,G59/3,IEC61727,IEC62116, C10/11,RD1699,UTE C15-712-1,AS4777

Inverter topology: Non-isolated

DRM 0 ☑	DRM 1 ☐	DRM 2 ☐
DRM 3 ☐	DRM 4 ☐	DRM 5 ☑
DRM 6 ☑	DRM 7 ☑	DRM 8 ☑

General product information:

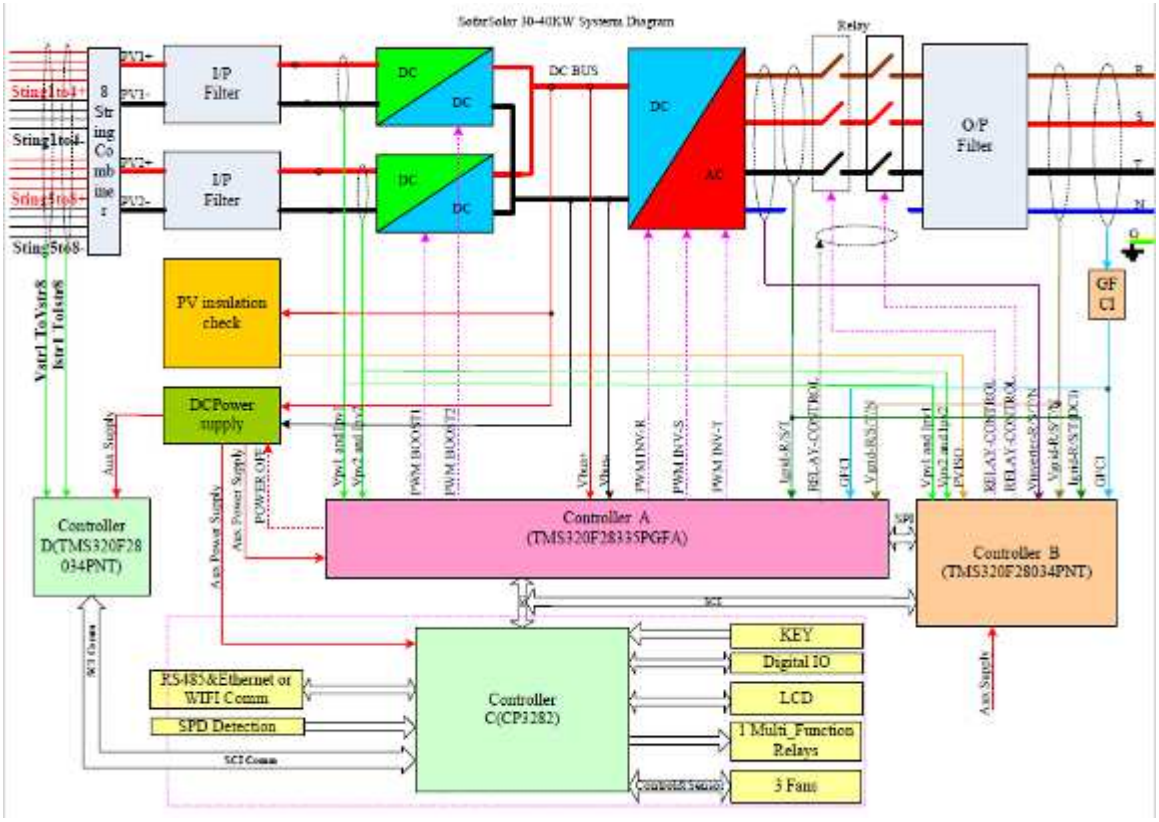
The Solar Inverter converts DC voltage into AC voltage.

The input and output are protected by Varistors to Earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundant by the high power switching bridge and two relays in series. This assures that the opening of the output circuit will also operate in case of one error.

The grid connected photovoltaic inverter has estimated Annex B only.

The grid connected photovoltaic inverter must be connected only to a circuit which provides with external interface protection system (external SPI) in accordance with the italian standard of CEI 0-21 and IEC/EN 61850.

Description of the electrical circuit



Block diagram

The internal control is redundant built. It consists of Microcontroller Controller A (UC20) and Controller B (UC73).

The Controller A (UC20) control the relays (RY1-RY3) by switching signals; measures the PV voltage, PV current, Bus voltage, grid voltage, frequency, AC current with injected DC and the array insulation resistance to ground. In addition it tests the current sensors and the RCMU circuit before each start up.

The Controller B (UC73) is measures the grid voltage, AC current, grid frequency and residual current, also can switch off the relays (RY1-RY3) independently, and communicate with Controller A (UC20) each other.

The current is measured by a current sensor. The AC current signal and the injected DC current signal are sent to the Master DSP. The Master DSP tests and calibrates before each start up all current sensors.

The unit provides two relays in series in all output conductors. When single fault applied to one relay, alarm an error code in display panel, another redundant relay provides basic insulation maintained between the PV array and the mains. All the relays are tested before each start up

Differences of the models
The models SOFAR 30000TL-Sx Series, SOFAR 33000TL-Sx Series and SOFAR 40000TL-Sx Series are completely identical in hardware except output voltage, and output power derated by software. The output of the model SOFAR 40000TL-Sx Series should be connected with isolated transformer.

The product was tested on
hardware version: V2.0
software version: V3.50

AS/NZS 4777.2 – 2015			
Clause	**Requirement – Test**	**Result - Remark**	**Verdict**
5	**GENERAL REQUIREMENTS**		**P**
5.1	Electrical safety		P
	Inverters for use in inverter energy systems with photovoltaic (PV) arrays shall comply with the appropriate electrical safety requirements of IEC 62109-1 and IEC 62109-2, and the requirements within this Standard.	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
	Inverters for use in inverter energy systems that have energy storage (batteries) as the only possible energy source shall comply with the electrical safety requirements of AS 62040.1.1, and the requirements within this Standard.	No such the energy storage system.	N/A
	Inverters for use in inverter energy systems that incorporate energy sources other than photovoltaic (PV) arrays or batteries shall comply with the applicable electrical safety requirements of IEC 62109-1 and IEC 62109-2, and the requirements within this Standard.	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
5.2	Provision for external connections	Provided in the installation manual.	P
	Inverters shall be used and installed as fixed equipment only.		P
	Inverter provisions for external connection -	See below.	P
	(a) shall be for fixed equipment only; and	Complied.	P
	(b) shall provide for safe and reliable connection to any d.c. source or load or any a.c. source or load.	Provided in the installation manual.	P
	All inverter ports (except communications ports) shall incorporate connection types for either -	See below.	P
	(i) permanently connected equipment; or		P
	(ii) pluggable type B equipment.	Permanently connected equipment	N/A
	Inverter source or load connections shall not incorporate connection types for pluggable type A equipment.		P
	Permanently connected inverters shall have suitable terminals for connection to fixed installation wiring.	Complied.	P
	Pluggable type B equipment shall have one of the following means of connection:	Permanently connected equipment	N/A
	(A) A non-detachable cord for connection to the supply by means of a connector.	Permanently connected equipment	N/A

	(B) An appliance inlet suitable for connection to a matching connector.	Permanently connected equipment	N/A
	Pluggable type B equipment shall not incorporate -	See below.	N/A
	(1) a connection by a connector or inlet complying with any of the dimensional sheets of AS/NZS 60320.1;		N/A
	(2) a connection by a plug conforming to AS/NZS 3112; or	No such plug used.	N/A
	(3) a connection by a connector or inlet where hazardous voltages are accessible by the standard test finger.	No such devices..	N/A
5.3	Photovoltaic (PV) array earth fault/earth leakage detection		P
	For inverter energy systems used with PV array systems that require earth fault detection and a residual current detection, either internal or external to the inverter, the type of detection used shall be declared in accordance with IEC 62109-1 and IEC 62109-2.	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
	If an external residual current device (RCD) is required, the manufacturer's installation instructions shall state the need for an RCD and shall specify its rating, type and required circuit location in accordance with Clause 9.		N/A
	Where the additional detection for functionally earthed PV arrays, as required by AS/NZS 5033, is present in the inverter, this additional detection shall, before start-up of the system -	See below.	P
	(a) open circuit the functional earth connection to the PV array;		P
	(b) measure the resistance to earth of each conductor of the PV array;	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
	(c) if the earth resistance is above the resistance limit (Riso limit) threshold specified in Table 1, the system shall reconnect the functional earth and shall be allowed to start; and	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
	(d) if the earth resistance is equal to or less than the resistance limit (Riso limit) threshold specified in Table 1, the inverter shall shut down and initiate an earth fault alarm in accordance with the requirements of IEC 62109-2.	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
5.4	Compatibility with electrical installation		P
	The inverter shall be compatible with wiring practices for LV electrical	Considered.	P

	installations of AS/NZS 3000 and variations as required in AS/NZS 4777.1. The inverter a.c. voltage and frequency operation shall comply with the limits specified in AS 60038 (for Australia), or IEC 60038 (for New Zealand).		
5.5	Power factor		P
	The displacement power factor of the inverter, considered as a load from the perspective of the grid, shall, for all current outputs from 25% to 100% of rated current, operate at unity power factor within the range 0.95 leading to 0.95 lagging.	See appendix table.	P
	Operation at power factor other than unity is acceptable where the inverter operates in power quality response modes.	See Clause 6.3.	P
5.6	Harmonic currents		P
	The harmonic currents of the inverter shall not exceed the limits specified in Tables 2 and 3 and the total harmonic current distortion (ITHD) to the 50th harmonic shall be less than 5%.	See appendix table 5.6 Harmonic currents.	P
5.7	Voltage fluctuations and flicker		P
	The inverter shall conform to the voltage fluctuation and flicker limits specified in AS/NZS 61000.3.3 for equipment with rated current less than or equal to 16 A per phase (a.c.).	See appendix table 5.7 Voltage Fluctuations and Flicker.	P
	For equipment with rated current greater than 16 A per phase (a.c.), The impedance shall be determined in accordance with the methods given in AS/NZS 61000.3.11.	See appendix table 5.7 Voltage Fluctuations and Flicker.	P
5.8	Transient voltage limits		P
	To prevent damage to electrical equipment connected to the same circuit as the inverter, disconnection of the inverter from the grid shall not result in transient overvoltages beyond the limits specified in Table 4.	See appendix table 5.8 Transient Voltage Limits (phase to neutral).	P
5.9	D.C. current injection		P
	In the case of a single-phase inverter, the d.c. output current of the inverter at any a.c. port including the grid-interactive and/or stand-alone port shall not exceed 0.5% of the inverter's rated current or 5 mA, whichever is the greater.	See appendix table 5.9 Direct curent injection.	P
	In the case of a three-phase inverter, the d.c. output current of the inverter at any	This is three-phase grid inverter.	P

	a.c. port, including the grid-interactive and/or stand-alone port, measured in each of the phases, shall not exceed 0.5% of the inverter's per-phase rated current or 5 mA, whichever is the greater.		
5.10	Current balance for three-phase inverters		P
	In the case of a three-phase inverter the a.c. output current shall be generated and injected into the three-phase electrical installation as a three-phase balanced current.	See appendix table 5.10.	P

6	**OPERATIONAL MODES AND MULTIPLE MODE INVERTERS**		**P**
6.1	General		P
	Unless otherwise stated, the modes in the following Clauses are for the grid-interactive port of the inverter.		P
6.2	Inverter demand response modes (DRMs)		P
6.2.1	General	See below.	P
	The inverter shall support the demand response mode DRM 0 of Table 5. The inverter should support the other demand response modes of Table 5.	See appendix table 6.2.	P
	The inverter shall detect and initiate a response to all supported demand response commands within 2 s. The inverter shall continue to respond while the mode remains asserted.	See appendix table 6.2.	P
6.2.2	Interaction with demand response enabling device (DRED)	See below.	P
	The inverter shall have a means of connecting to a DRED. This means of connection shall include a terminal block or RJ45 socket.	Considered.	P
	The terminal block or RJ45 socket shall comply with the minimum electrical specifications in Table 6.	Considered.	P
	The DRED asserts demand response modes by shorting together terminals or pins as specified in Table 7.	Considered.	P
6.3	Inverter power quality response modes		P
6.3.1	General	See below.	P
	The inverter may have the capability of operating in modes which will -		P
	(a) contribute to maintaining the power quality at the point of connection with the customer installation; or		P
	(b) provide characteristics which are		P

	outside the typical operation of an inverter for the purpose of providing support to a grid.		
6.3.2	Volt response modes		P
6.3.2.1	General	See below.	P
	The intent of including the volt response modes, which respond to voltage changes at the inverter terminals, is to increase the number of systems which can be connected at a point on the grid without adversely affecting the voltage within an electrical installation.		P
	The volt–watt and volt–var response modes specified in Clause 6.3.2.2 and Clause 6.3.2.3 shall use the volt response reference values specified in Table 9.		P
6.3.2.2	Volt–watt response mode		P
	The inverter should have the volt–watt response mode. If this mode is available, it shall be enabled by default.		P
	The response curve required for the volt–watt response mode is defined by the volt response reference values in Table 9 and corresponding power levels. The default values are listed in Table 10 and example response modes are shown in Figure 2(A) for Australia and Figure 2(B) for New Zealand.	See appendix table 6.3.2.2.	P
6.3.2.3	Volt–var response mode		P
	The inverter should have the volt–var response capability. If this mode is available, it shall be disabled by default.		P
	The response curve required for the volt–var response is defined by the volt response reference values specified in Table 9 and corresponding var levels. The default values are listed in Table 11 and shown in Figure 3.	See appendix table.	P
6.3.2.4	Voltage balance modes		P
	Three-phase inverters, or single-phase inverters used in a three-phase combination may be used for voltage balancing between phases by injecting unbalanced three-phase currents into the electrical installation.	Considered.	P
	If the voltage balance mode is available, the following requirements apply:	see below.	P
	(a) The voltage balance mode shall be disabled by default.		N/A
	(b) For single-phase inverters used in a	The EUT is three-phase type.	N/A

	three-phase combination, the requirements of Clause 8.2 apply.		
	(c) The voltage balancing mode shall be able to -	See below.	P
	(i) operate correctly with a single fault applied;		P
	(ii) detect the fault or loss of operability and cause the inverter to revert to injecting current into the three-phase electrical installation as a three-phase balanced current; or		P
	(iii) detect the fault or loss of operability and disconnect the inverter from the electrical installation.		P
6.3.3	Fixed power factor mode and reactive power mode		P
	These modes shall be disabled by default.		P
	If the inverter is capable of operating with reactive power mode, the maximum ratio of reactive power (vars) to rated apparent power should be 100%.	See appendix table 6.3.3.	P
	If the inverter is capable of operating with fixed power factor mode, the minimum range of settings should be 0.8 leading to 0.8 lagging.	See appendix table 6.3.3.	P
6.3.4	Characteristic power factor curve for cos φ (P) (Power response)		P
	If this mode is available, it shall be disabled by default.		P
	The response curve required for the cos φ (P) response should be defined within displacement power factor range of 0.9 leading to 0.9 lagging. One possible cos φ (P) curve is shown in Figure 4.	See appendix table 6.3.4.	P
6.3.5	Power rate limit		P
6.3.5.1	General	See below.	P
	The power rate limit for an inverter is a power quality response mode.		P
	The inverter shall have the capability to rate limit changes in power generation through the grid-interactive port.		P
	Inverters capable of multiple mode operation should have the capability to rate limit changes in power consumption (for example increasing/decreasing of charging rates of connected energy storage).		N/A
	The power rate limit does not apply when the inverter disconnection device is		P

	required to operate (i.e. to disconnect).		
6.3.5.2	Gradient of power rate limit		P
	The default setting for the power rate limit (WGra) for increase and decrease shall be 16.67% of rated power per minute which is a nominal ramp time of 6 min.	See appendix table 6.3.5.	P
	The power rate limit (WGra) shall be adjustable within the range 5% to 100% of rated power per minute.	See appendix table 6.3.5.	P
	It is acceptable to have two separate power rate limits for increase and decrease in output power, as follows:		N/A
	(a) To rate limit an increase in power (WGra+).	Considered.	P
	(b) To rate limit a decrease in power (WGra–).		N/A
6.3.5.3	Power rate limit modes		P
6.3.5.3.1	General		P
	The inverter power rate limit (WGra) is applicable to operate in the following modes:		P
6.3.5.3.2	Soft ramp up after connect or reconnect		P
	All inverters shall have this mode. This mode shall be enabled as per Clause 7.7 and for the increase in power required by Clause 7.5.3 after frequency decreased to the required limit.	See appendix table.	P
6.3.5.3.3	Changes in a.c. operation and control		P
	If available, this mode shall be enabled for a change in a demand response mode of Clause 6.2 (except for DRM 0).		P
	The power rate limit for changes in a.c. operation and control does not apply to those inverters that are correcting for sags and swells of less than 1 min.		P
6.3.5.3.4	Changes in energy source operation	No energy source in the EUT.	N/A
	This mode only applies to multiple mode inverters with energy storage. It operates when there is a change in the energy resource available to the inverter, which causes a change in output through the grid-interactive port.		N/A
	For this mode the power rate limit (WGra) should apply to the increase or decrease in power generation or consumption, and to the transitions between power output levels.		N/A
	For this mode, the power rate limit (WGra)		N/A

	should be able to be enabled or disabled.		
	The power rate limit shall be disabled by default.		N/A
	The increase or decrease for transitions between power output levels is contingent on external situations (such as amount of available solar energy, wind energy or discharge capacity).		N/A
	Only for increases or decreases in the output which are faster than the power rate limit (WGra) does a control action to limit the ramp rate apply.		N/A
6.3.5.4	Nonlinearity of power rate limit changes		P
	The nonlinearity (NL) of the power rate limit (WGra) in response to an increase of the inverter power output, as defined by the characteristic curve depicted in Figure 5, shall be less than 10%.		P
6.4	Multiple mode inverter operation	No multiple mode.	N/A
6.4.1	General	See below.	N/A
	When the multiple mode inverter is disconnected from the grid any stand-alone port shall ensure that all active conductors are also isolated from the grid-interactive port.		N/A
	Multiple mode inverters shall be arranged to ensure that the continuity of the neutral conductor to the load from the electrical installation is not interrupted when the inverter disconnects from the grid and supplies a load via the stand-alone port.		N/A
	When the multiple mode inverter is providing the stand-alone function and is disconnected from the grid, the stand-alone port shall comply with the requirements for d.c. current injection (refer to Clause 5.9) into the connected load circuits. The type of RCD compatible with and for use on the stand-alone function outputs shall be declared.		N/A
6.4.2	Sinusoidal output in stand-alone mode	The EUT is a Grid-tied inverter.	N/A
	The a.c. output voltage waveform of a stand-alone port of a multiple mode inverter operating in stand-alone mode, shall comply with the requirements of this Clause (6.4.2). The a.c. output voltage waveform of a stand-alone mode shall have a voltage total harmonic distortion (THD) not exceeding of 5% and no individual harmonic at a level exceeding 5%.		N/A

6.4.3	Volt–watt response mode for charging of energy storage	No energy storage system in the EUT.	N/A
	A multiple mode inverter with energy storage which can be charged from the grid shall have this volt–watt response mode.		N/A
	This volt–watt response mode is only active when power from the grid is required to charge the energy storage.		N/A
	The response curve required for the volt–watt response is defined by the volt response reference values in Table 9 and corresponding power consumption from the grid through the grid-interactive port for charging energy storage. The default values are listed in Table 12 and shown in Figure 6.		N/A
6.5	Security of operational settings		P
	The internal settings of the demand response or power quality response modes of theinverter shall be secured against inadvertent or unauthorized tampering.	Considered.	P
	Changes to the internal settings shall require the use of a tool and special instructions not provided to unauthorized personnel.	Provide in installation manual.	P

7	**PROTECTIVE FUNCTIONS FOR CONNECTION TO ELECTRICAL INSTALLATIONS AND THE GRID**		**P**
7.1	General	See below.	P
	The automatic disconnection device shall operate -	The automatic disconnection device is integral part of the inverter.	P
	(a) if supply from the grid is disrupted;	Connsidered.	P
	(b) when the grid goes outside preset parameters (e.g. undervoltage/overvoltage, under-frequency/over-frequency); or	Connsidered.	P
	(c) when the demand response mode DRM 0 (see Clause 6.2) is asserted.	Connsidered.	P
	For inverter energy systems connected to multiple phases the automatic disconnection device shall operate if any of the above conditions is met on any phase.	Connsidered.	P
7.2	Automatic disconnection device		P
	The automatic disconnection device shall provide isolation in all live conductors	The unit is switched off redundant by the high power bridge of the inverter and the relays in line and	P

		neutral.	
	The automatic disconnection device shall be capable of interrupting at least the ratedcurrent.	Considered.	P
	The settings of the automatic disconnection device shall not exceed the capability of the inverter.	Considered.	P
	A semiconductor (solid-state) device shall not be used for isolation purposes.	Considered.	P
7.3	Active anti-islanding protection	See below.	P
	The automatic disconnection device shall incorporate at least one method of active anti-islanding protection.	Considered.	P
	The method used to provide active anti-islanding protection shall be declared.	Rate of change of frequency (RoCof) detection method used.	P
	To prevent islanding, the active anti-islanding protection system shall operate the automatic disconnection device (see Clause 7.2) within 2 s of disruption to the power supply from the grid.	See appendix table . 7.3.	P
	Compliance shall be determined by type testing in accordance with the active anti-islanding tests specified in Appendix F or IEC 62116.	Considered.	P
7.4	Voltage and frequency limits (passive anti-islanding protection)	See below.	P
	The automatic disconnection device shall incorporate the following forms of passive anti-islanding protection:	Considered.	P
	(a) Undervoltage and overvoltage protection.	See appendix table7.4	P
	(b) Under-frequency and over-frequency protection.	See appendix table7.4	P
7.5	Limits for sustained operation		P
7.5.1	General	See below.	P
	The inverter or inverter energy system shall remain connected over the range of voltages and frequencies that it is required to be compatible with. Refer to Clause 5.4.	Considered.	P
7.5.2	Sustained operation for voltage variations		P
	The inverter shall operate the automatic disconnection device (see Clause 7.2) within 3 s when the average voltage for a 10 min period exceeds the Vnom_max, where Vnom-max lies in the range 244–258 V.	See appendix table7.5.2	P

	The default set-point for Vnom-max shall be as follows: (a) In Australia: 255 V. (b) In New Zealand: 248 V.	See appendix table7.5.2	P
7.5.3	Sustained operation for frequency variations		P
7.5.3.1	Response to an increase in frequency		P
	The inverter shall be capable of supplying rated power between 47 Hz and 50.25 Hz for Australia.	Considered.	P
	The inverter shall be capable of supplying rated power between 45 Hz and 50.25 Hz for New Zealand.		N/A
	The power level present at the time the frequency reaches or exceeds 50.25 Hz shall be held as the reference power level used to calculate the required response to the increasing frequency.	Considered.	P
	This is expressed in the equation below: $P_{out} = P_{ref}\left[1-\frac{(f-50.25)}{(f_{stop}-50.25)}\right]$ where P_{out} = required output for a frequency between 50.25 Hz and f_{stop} P_{ref} = reference power level when the frequency reaches or exceeds 50.25 Hz f = frequency between 50.25 Hz and f_{stop} When the frequency exceeds f_{stop} the inverter power output shall be ceased (i.e. 0 W). The default set-point for f_{stop} shall be 52 Hz.	See appendix table 7.5.3.1	P
	Unconstrained power operation may recommence 6 min after the frequency returns to and remains at less than 50.15 Hz.	See appendix table 7.5.3.1	P
7.5.3.2	Response to a decrease in grid frequency	The EUT without energy storage.	N/A
	This requirement applies only to inverters with energy storage.		N/A
	The inverter shall be capable of charging the energy storage between 49.75 Hz and 52.0 Hz.		N/A
	The power input level for charging present at the time the frequency reaches or falls below 49.75 Hz shall be held as the reference charge rate used to calculate the required response to the decreasing		N/A

	frequency.		
	This is expressed in the equation below: $P_{charge} = P_{ref}\left[1-\frac{(49.75-f)}{(49.75-f_{stop-CH})}\right]$ where P_{charge} = charge rate of the storage element for a frequency between 49.75 Hz and $f_{stop-CH}$ P_{ref-CH} = charge rate of the storage element when the frequency reaches or falls below 49.75 Hz f = frequency between 49.75 Hz and $f_{stop-CH}$ When the frequency falls below $f_{stop-CH}$, the inverter should have ceased charging the storage element (i.e. 0 W). The default set-point for fstop-CH should be 49 Hz.		N/A
	Unconstrained charging of the storage element may recommence 6 min after the frequency returns to and remains above than 49.85 Hz.		N/A
7.6	Disconnection on external signal	See below	P
	The automatic disconnection device shall incorporate the ability to disconnect on an external signal.	The automatic disconnection device is integral part of the inverter.	P
	If an external signal or demand response 'DRM 0' condition is asserted, the automatic disconnection device shall operate within 2 s.	Considered.	P
7.7	Connection and reconnection procedure	See below	P
	Only after all of the following conditions have been met shall the automatic disconnection device operate to connect or reconnect the inverter to the grid -	The unit provides monitoring of the voltage, frequency and synchronisation. If one of these conditions is not met, then the unit is not switching on.	P
	(a) the voltage of the grid has been maintained within the limits of AS 60038 (for Australia) or IEC 60038 (for New Zealand) for at least 60 s;	Considered.	P
	(b) the frequency of the grid has been maintained within the range 47.5 Hz to 50.15 Hz for at least 60 s;	Considered.	P
	(c) the inverter and the grid are synchronized and in-phase with each other; and	Considered.	P
	(d) no external signal is present or DRM 0 asserted requiring the system to be disconnected.	Considered.	P

7.8	Security of protection settings		P
	The internal settings of the automatic disconnection device shall be secured against inadvertent or unauthorized tampering. Changes to the internal settings shall require the use of a tool and special instructions not provided to unauthorized personnel.	Changes to the internal settings shall require the use of a tool and special instructions provided to authorized personnel.	P

8	**MULTIPLE INVERTER COMBINATIONS**		**N/A**
8.1	General	See below.	N/A
	If a combination is not tested, it should not be used or external devices should be used in accordance with the requirements of AS/NZS 4777.1.	This is a three-phase grid inverter, and it's not used for parallel installations.	N/A
	Possible combinations are single-phase inverters used in parallel, single-phase inverters used in multiple phase installations and three-phase inverters used in parallel.	This is a three-phase grid inverter, and it's not used for parallel installations.	N/A
8.2	Inverter current balance across multiple phases	This is a three-phase grid inverter, and it's not used for parallel installations.	N/A
	The maximum current imbalance in a three-phase inverter system comprised of individual single-phase inverters shall be no more than 21.7 A.	This is a three-phase grid inverter, and it's not used for parallel installations.	N/A
8.3	Grid disconnection		N/A
	When any inverter within the inverter energy system disconnects as required by Clause 7, all inverters within the inverter energy system shall disconnect within 2 s of the first inverter disconnecting.	No energy system in the EUT.	N/A
	This applies to all inverters used in combination for single-phase or multiple phases.	This is a three-phase grid inverter.	N/A
8.4	Grid connection and reconnection	No such installation.	N/A
	When multiple inverters are used together in a multiple phase combination, only after all the conditions of Clause 7.7 have been met on all connected phases shall the automatic disconnection device operate to connect or reconnect any inverter of the multiple phase combination to the grid.		N/A
	Where any inverter used in a multiple phase combination has a rated current exceeding 21.7 A per phase, the requirement of Clause 8.2 shall be met when connecting or reconnecting.		N/A

8.5	Testing combinations		N/A
8.5.1	Single-phase combinations	This is a three-phase grid inverter.	N/A
	Single-phase parallel combinations of inverters shall be tested for combinations with total rated current (I_{rated}) equal to or up to the maximum of 6 A per phase.	This is a three-phase grid inverter.	N/A
	To determine the number of inverters to be tested, the following equation shall be used: $N = \frac{6}{I_{rated}}$ where N = number to be tested, rounded up to next whole number I_{rated} = rating of the inverter in amperes If N ≥ 2, the minimum number of inverters to be tested shall be N. If N > 6, the maximum number of inverters to be tested in a combination shall be 6.	This is a three-phase grid inverter.	N/A
8.5.2	Single-phase inverters used in three-phase combinations	This is a three-phase grid inverter.	N/A
	For single-phase inverters with rated current (I_{rated}) greater than or equal to 5 A used in three-phase combinations, three inverters shall be tested in a three-phase arrangement [refer to Figure 8(a)].	This is a three-phase grid inverter.	N/A
	Single-phase inverters with rated current less than 5 A and to be used in three-phase combinations shall be tested in combination with at least two inverters per phase [refer to Figure 8(b).	This is a three-phase grid inverter.	N/A
8.5.3	Required tests for multiple inverter combinations	This is a three-phase grid inverter.	N/A
	Any single-phase inverter used in a multiple inverter combination shall be tested individually and meet all the requirements of this Standard. Any single-phase inverter which is to be used as part of a multiple inverter combination shall be tested in combination as specified in Clauses 8.5.1 and 8.5.2.	This is a three-phase grid inverter.	N/A
8.5.4	Multiple inverters with one automatic disconnection device	This is a three-phase grid inverter, and it's not used for parallel installations.	N/A
	Where the inverter does not have an internal automatic disconnection device, or requires an external automatic disconnection device to provide the required disconnection function, or both,	This is a three-phase grid inverter, and it's not used for parallel installations.	N/A

	testing shall be conducted with the automatic disconnection device and with either the number of inverters required by Clause 8.5.1 and 8.5.2 or with the automatic disconnection device configured with the number of inverters specified by the manufacturer's instructions.		

9	**INVERTER MARKING AND DOCUMENTATION**		**P**
9.1	General		P
	All markings and documentation shall be in the English language.	Considered.	P
9.2	Marking		P
9.2.1	General		P
9.2.2	Equipment ratings		P
	Photovoltaic		-
	Vmax PV (absolute maximum)	1000V	P
	Isc PV (absolute maximum)	2x40A	P
	Wind (a.c. or d.c.)		-
	Voltage (nominal or range)		N/A
	Rated current (maximum continuous)		N/A
	Frequency (nominal or range) (a.c. wind only)		N/A
	Energy storage ports		-
	Voltage (nominal)		N/A
	Voltage (range)		N/A
	Rated current (maximum continuous)		N/A
	Storage type		N/A
	Other energy sources or inputs (a.c. or d.c.)		-
	Voltage (nominal or range)		N/A
	Rated current (maximum continuous)		N/A
	Power factor (range)		N/A
	Frequency (nominal or range) (a.c. sources only)		N/A
	a.c. output ratings (for each port)		-
	Voltage (nominal or range)	For SOFAR 30000TL-Sx Series, SOFAR 33000TL-Sx Series: 3/N/PE, 230/400Vac; For SOFAR 40000TL-Sx Series: 3/N/PE, 277/480Vac;	P
	Rated current	43,0 x 3A for SOFAR 30000TL-Sx	P

		Series; 48,0 x 3A for SOFAR 33000TL-Sx Series, SOFAR 40000TL-Sx Series	
	Frequency (nominal or range)	50,00Hz	P
	Rated apparent power	30000VA for SOFAR 30000TL-Sx Series; 33000VA for SOFAR 33000TL-Sx Series L; 40000VA for SOFAR 40000TL-Sx Series;	P
	Power factor range	>0,99(adjustable+/-0,8)	P
	d.c. output ratings		-
	Voltage (nominal or range)		N/A
	Rated current		N/A
	Inverter topology	Non-isolated.	P
	Protective class (I, II or III)	Class I	P
	Ingress protection (IP) rating	IP65	P
9.2.3	Ports		P
	Each port shall be marked with its classification and indicate whether a.c or d.c. voltage asappropriate.	The classification marking were provided adjacent to the terminals of each port.	P
9.2.4	External and ancillary equipment	Ref to installation manual.	P
9.2.5	Residual current devices (RCDs)		N/A
	Where an external RCD is required, the inverter shall be marked with a warning along with the rating and type of RCD required. The warning shall be located in a prominent position and written in lettering at least 5 mm high. It shall contain the following or an equivalent statement: **WARNING: AN RCD IS REQUIRED ON THE [*NAME*] PORTS OF THE INVERTER**	The Residual current devices (RCDs) are integral part of inverter. An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	N/A
	If the inverter energy system requires a Type B RCD, the inverter shall be marked with a warning. The warning shall be located in a prominent position and written in lettering at least 5 mm high. It shall contain the following: **WARNING: A TYPE B RCD IS REQUIRED ON THE [*NAME*] PORTS OF THE INVERTER**	The Residual current devices (RCDs) are integral part of inverter. An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	N/A
9.2.6	Demand response modes		P
	The demand response modes supported by the inverter should be permanently	The demand response modes supported by the inverter has	P

	marked on the name plate or on a durable sticker located on or near the demand response interface port to indicate the demand response modes of which the unit is capable.	permanently marked on the name plate closed the communication terminals for DRED.	
9.3	Documentation		P
9.3.1	General		P
9.3.2	Equipment ratings		P
	Photovoltaic		-
	Vmax PV (absolute maximum)	1000V	P
	PV input operating voltage range	250-960Vdc	P
	Maximum operating PV input current	32,0 x 2A for SOFAR 30000TL-Sx Series; 35,0 x 2A for SOFAR 33000TL-Sx Series, SOFAR 40000TL-Sx Series;	P
	Isc PV (absolute maximum)	2x40A	P
	Maximum inverter backfeed current to array	No backfeed current to array.	P
	Wind (a.c. or d.c.)		-
	Voltage (nominal or range)		N/A
	Rated current (maximum continuous)		N/A
	Current (inrush)		N/A
	Frequency (nominal or range) (a.c. wind only)		N/A
	Energy storage ports		-
	Voltage (nominal or range)		N/A
	Nominal battery voltage		N/A
	Rated current (maximum continuous) input and output		N/A
	Storage type		N/A
	Other energy sources or inputs (a.c. or d.c.)		-
	Voltage (nominal or range)		N/A
	Rated current (maximum continuous)		N/A
	Power factor (range)		N/A
	Frequency (nominal or range) (a.c. sources only)		N/A
	a.c. output ratings (for each port)		-
	Voltage (nominal or range)	3/N/PE, 230/400Vac for SOFAR 30000TL-Sx Series, SOFAR 33000TL-Sx Series; 3/N/PE, 277/480Vac for SOFAR 40000TL-Sx Series;	P

	Rated current	43,0 x 3A for SOFAR 30000TL-Sx Series; 48,0 x 3A for SOFAR 33000TL-Sx Series, SOFAR 40000TL-Sx Series;	P
	Current (inrush)	0,8A/2us	P
	Frequency (nominal or range)	50,00Hz	P
	Rated apparent power	30000VA for SOFAR 30000TL-Sx Series; 33000VA for SOFAR 33000TL-Sx Series; 40000VA for SOFAR 40000TL-Sx Series;	P
	Power factor range	>0,99(adjustable+/-0,8)	P
	Maximum output fault current	200A	P
	Maximum output overcurrent protection	43,0 x 3A for SOFAR 30000TL-Sx Series; 48,0 x 3A for SOFAR 33000TL-Sx Series, SOFAR 40000TL-Sx Series;	P
	d.c. output ratings		-
	Voltage (nominal or range)		N/A
	Rated current		N/A
	Inverter topology	Non-isolated.	P
	Active anti-islanding method		P
	Protective class (I, II or III)	Class I	P
	Over voltage category	DC side: OVC II; AC side: OVC III	P
	Ingress protection (IP) rating	IP65	P
	Temperature operating range	-25° C ~ +60° C(above 45° C derating)	P
9.3.3	Ports		P
9.3.4	External and ancillary equipment	Provided in installation manual.	P
9.3.5	RCDs		P
9.3.6	Multiple mode inverters	No such mode.	N/A
9.3.7	Multiple inverter combinations	No such combinations.	N/A

APPENDIX A	**GENERAL TEST AND REPORTING REQUIREMENTS (Normative)**	**P**

APPENDIX B	**POWER FACTOR TEST (Normative)**	**P**

APPENDIX C	**HARMONIC CURRENT LIMIT TEST (Normative)**	**P**
APPENDIX D	**TRANSIENT VOLTAGE LIMIT TEST (Normative)**	**P**
APPENDIX E	**D.C. INJECTION TEST (Normative)**	**P**
APPENDIX F	**ACTIVE ANTI-ISLANDING TEST (Normative)**	**P**
APPENDIX G	**VOLTAGE AND FREQUENCY LIMITS (PASSIVE ANTI-ISLANDING PROTECTION) TESTS (Normative)**	**P**
APPENDIX H	**LIMITS FOR SUSTAINED OPERATION (Normative)**	**P**
APPENDIX I	**DEMAND AND POWER QUALITY RESPONSE MODE TESTING INCLUDING DISCONNECTION ON EXTERNAL SIGNAL (Normative)**	**P**
APPENDIX J	**MULTIPLE INVERTER TESTING (Normative)**	**N/A**
APPENDIX K	**RELATED DOCUMENTS (Informative)**	**P**

Test Results

5.5 Power factor Appendix B Power factor test						P
SOFAR 30000TL-Sx Series						
Mode	Meausrement	Rated Output Current				
		15+/-5%	25+/-5%	50+/-5%	75+/-5%	100+/-5%
Unity	Vrms (V)	230,3	230,2	230,2	230,2	230,2
	Arms (A)	6,350	11,118	21,697	32,808	43,950
	Apparent Power (kVA)	4,386	7,678	14,985	22,659	30,354
	Power (kW)	4,386	7,678	14,985	22,659	30,354
	Recative power (kVar)	-0,020	-0,025	-0,009	-0,076	-0,104
	PF cos (phi)	0,999	0,999	0,999	0,999	0,999
Lag limit	Vrms (V)	229,9	230,0	230,3	230,1	230,2
	Arms (A)	7,090	11,917	24,033	32,501	43,767
	Apparent Power (kVA)	4,889	8,223	16,607	22,330	29,909
	Power (kW)	4,429	7,434	14,967	20,091	26,849
	Recative power (kVar)	-2,069	-3,515	-7,196	-9,745	-13,178
	PF cos (phi)	0,906	0,904	0,901	0,900	0,898
Lead limit	Vrms (V)	229,9	230,0	230,4	230,2	230,1
	Arms (A)	7,243	11,874	23,680	32,606	44,060
	Apparent Power (kVA)	4,996	8,193	16,369	22,479	30,071
	Power (kW)	4,441	7,337	14,714	20,229	26,995
	Recative power (kVar)	2,288	3,646	7,173	9,802	13,248
	PF cos (phi)	0,889	0,896	0,899	0,900	0,900
SOFAR 33000TL-Sx Series						
Mode	Meausrement	Rated Output Current				
		15+/-5%	25+/-5%	50+/-5%	75+/-5%	100+/-5%
Unity	Vrms (V)	230,3	230,3	230,3	230,3	230,1
	Arms (A)	6,879	12,174	23,816	35,988	47,701
	Apparent Power (kVA)	4,751	8,408	16,449	24,856	32,943
	Power (kW)	4,751	8,408	16,449	24,856	32,943
	Recative power (kVar)	-0,030	-0,032	-0,029	-0,086	-0,112
	PF cos (phi)	0,999	0,999	0,999	0,999	0,999
Lag limit	Vrms (V)	230,1	230,3	229,9	230,2	230,1
	Arms (A)	7,927	12,939	26,489	39,167	48,203
	Apparent Power (kVA)	5,473	8,938	18,271	27,050	32,937
	Power (kW)	4,954	8,071	16,464	24,354	29,496

	Recative power (kVar)	-2,326	-3,841	-7,923	-11,772	-14,653
	PF cos (phi)	0,905	0,903	0,901	0,900	0,895
Lead limit	Vrms (V)	230,2	230,3	230,6	230,5	230,0
	Arms (A)	8,112	12,946	25,849	38,795	48,810
	Apparent Power (kVA)	5,601	8,945	17,886	26,822	33,334
	Power (kW)	4,993	8,010	16,079	24,151	29,999
	Recative power (kVar)	2,539	3,981	7,833	11,667	14,407
	PF cos (phi)	0,891	0,895	0,899	0,900	0,900
SOFAR 40000TL-Sx Series						
Mode	Meausrement	Rated Output Current				
		15+/-5%	25+/-5%	50+/-5%	75+/-5%	100+/-5%
Unity	Vrms (V)	229,9	230,1	230,6	230,0	230,2
	Arms (A)	8,268	14,054	27,933	43,352	58,192
	Apparent Power (kVA)	5,703	9,702	19,321	29,612	39,749
	Power (kW)	5,678	9,688	19,314	29,568	39,682
	Recative power (kVar)	0,073	0,077	0,089	1,581	2,273
	PF cos (phi)	0,999	0,999	0,999	0,999	0,998
Lag limit	Vrms (V)	230,2	230,4	230,8	230,2	230,0
	Arms (A)	9,274	15,645	31,425	48,202	58,878
	Apparent Power (kVA)	6,406	10,813	21,760	32,937	40,240
	Power (kW)	5,793	9,756	19,599	29,496	35,984
	Recative power (kVar)	-2,734	-4,661	-9,453	-14,653	-18,009
	PF cos (phi)	0,904	0,902	0,901	0,896	0,894
Lead limit	Vrms (V)	230,2	230,4	230,8	230,1	230,1
	Arms (A)	9,726	15,748	30,990	48,220	56,873
	Apparent Power (kVA)	4,995	10,884	21,461	32,927	38,874
	Power (kW)	6,000	9,759	19,312	29,646	35,009
	Recative power (kVar)	3,021	4,819	9,361	14,307	16,893
	PF cos (phi)	0,893	0,897	0,900	0,901	0,901

Note:

Inverter shall be connected to test circuit Figure B1 (AS/NZS 4777.2),

The required accuracy for the measurement and reporting of results is ±0.01 PF. The vars at the 15% test point are required to be the same or less than the vars at the 25% test point when operating at unity power factor.

c: capacitive / leading

i: inductive / lagging

5.6 Harmonic currents Appendix C Harmonic Current Limit Test	P

SOFAR 30000TL-Sx Series

L1 phase

Generating Unit rating per phase (rpp)				
	At 50% of rated ouput current		**100% of rated output currentA**	
	Watts	5004	Watts	10014
	VA	5004	VA	10014
	Vrms	230,4	Vrms	230,9
	Arms	21,717	Arms	43,54
	PF	1,000	PF	1,000
	Frequency	50,00	Frequency	50,00

Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
0	N/A	N/A	N/A	N/A	N/A	N/A	0,5%
1st	21,717	N/A	49,950	43,542	N/A	99,998	100%
2nd	0,020	N/A	0,047	0,163	N/A	0,375	1%
3rd	0,053	N/A	0,123	0,068	N/A	0,157	4%
4th	0,013	N/A	0,031	0,127	N/A	0,292	1%
5th	0,037	N/A	0,085	0,128	N/A	0,294	4%
6th	0,008	N/A	0,018	0,029	N/A	0,066	1%
7th	0,033	N/A	0,075	0,089	N/A	0,205	4%
8th	0,007	N/A	0,015	0,062	N/A	0,143	1%
9th	0,029	N/A	0,066	0,014	N/A	0,032	2%
10th	0,007	N/A	0,016	0,039	N/A	0,090	0,5%
11th	0,011	N/A	0,024	0,028	N/A	0,065	2%
12th	0,006	N/A	0,013	0,016	N/A	0,037	0,5%
13th	0,009	N/A	0,021	0,028	N/A	0,065	2%
14th	0,005	N/A	0,013	0,022	N/A	0,050	0,5%
15th	0,014	N/A	0,031	0,025	N/A	0,057	1%
16th	0,005	N/A	0,011	0,020	N/A	0,045	0,5%
17th	0,010	N/A	0,022	0,016	N/A	0,037	1%
18th	0,005	N/A	0,012	0,010	N/A	0,023	0,5%
19th	0,009	N/A	0,021	0,021	N/A	0,049	1%
20th	0,004	N/A	0,010	0,014	N/A	0,033	0,5%
21th	0,011	N/A	0,026	0,013	N/A	0,030	0,6%
22th	0,004	N/A	0,009	0,012	N/A	0,027	0,5%
23th	0,007	N/A	0,015	0,020	N/A	0,045	0,6%
24th	0,004	N/A	0,010	0,007	N/A	0,017	0,5%
25th	0,006	N/A	0,013	0,013	N/A	0,029	0,6%
26th	0,003	N/A	0,007	0,006	N/A	0,015	0,5%
27th	0,005	N/A	0,012	0,006	N/A	0,014	0,6%
28th	0,003	N/A	0,008	0,007	N/A	0,016	0,5%
29th	0,005	N/A	0,010	0,021	N/A	0,048	0,6%
30th	0,003	N/A	0,008	0,006	N/A	0,013	0,5%
31th	0,004	N/A	0,009	0,018	N/A	0,042	0,6%
32th	0,003	N/A	0,006	0,005	N/A	0,012	0,5%
33th	0,003	N/A	0,006	0,009	N/A	0,020	0,6%
THD (to 50th)	N/A	N/A	0,409	N/A	N/A	0,674	5%

L2 phase

Generating Unit rating per phase (rpp)				
	At 50% of rated ouput current		**100% of rated output currentA**	
	Watts	5006	Watts	10044
	VA	5006	VA	10044

	Vrms	230,4	Vrms	230,9	
	Arms	21,728	Arms	43,49	
	PF	1,000	PF	1,000	
	Frequency	50,00	Frequency	50,00	

Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
0	N/A	N/A	N/A	N/A	N/A	N/A	0,5%
1st	21,728	N/A	49,974	43,489	N/A	99,998	100%
2nd	0,016	N/A	0,037	0,126	N/A	0,289	1%
3rd	0,030	N/A	0,069	0,029	N/A	0,066	4%
4th	0,010	N/A	0,024	0,109	N/A	0,250	1%
5th	0,060	N/A	0,139	0,147	N/A	0,338	4%
6th	0,006	N/A	0,014	0,013	N/A	0,029	1%
7th	0,045	N/A	0,104	0,073	N/A	0,168	4%
8th	0,005	N/A	0,012	0,053	N/A	0,121	1%
9th	0,014	N/A	0,032	0,019	N/A	0,044	2%
10th	0,006	N/A	0,015	0,033	N/A	0,075	0,5%
11th	0,012	N/A	0,027	0,013	N/A	0,030	2%
12th	0,005	N/A	0,012	0,010	N/A	0,022	0,5%
13th	0,013	N/A	0,031	0,035	N/A	0,080	2%
14th	0,005	N/A	0,011	0,017	N/A	0,038	0,5%
15th	0,007	N/A	0,015	0,013	N/A	0,029	1%
16th	0,004	N/A	0,010	0,019	N/A	0,043	0,5%
17th	0,012	N/A	0,028	0,023	N/A	0,053	1%
18th	0,005	N/A	0,011	0,008	N/A	0,019	0,5%
19th	0,007	N/A	0,016	0,017	N/A	0,038	1%
20th	0,003	N/A	0,008	0,016	N/A	0,036	0,5%
21th	0,005	N/A	0,011	0,011	N/A	0,024	0,6%
22th	0,004	N/A	0,009	0,012	N/A	0,027	0,5%
23th	0,008	N/A	0,018	0,016	N/A	0,038	0,6%
24th	0,004	N/A	0,009	0,007	N/A	0,016	0,5%
25th	0,005	N/A	0,012	0,009	N/A	0,020	0,6%
26th	0,003	N/A	0,006	0,008	N/A	0,018	0,5%
27th	0,003	N/A	0,007	0,008	N/A	0,018	0,6%
28th	0,003	N/A	0,007	0,006	N/A	0,014	0,5%
29th	0,004	N/A	0,010	0,014	N/A	0,033	0,6%
30th	0,003	N/A	0,007	0,005	N/A	0,011	0,5%
31th	0,004	N/A	0,008	0,015	N/A	0,036	0,6%
32th	0,002	N/A	0,005	0,006	N/A	0,013	0,5%
33th	0,002	N/A	0,006	0,006	N/A	0,014	0,6%
THD (to 50th)	N/A	N/A	0,415	N/A	N/A	0,733	5%

L3 phase

Generating Unit rating per phase (rpp)				
	At 50% of rated ouput current		**100% of rated output currentA**	
	Watts	5011	Watts	9996
	VA	5011	VA	9996
	Vrms	230,4	Vrms	230,9
	Arms	21,747	Arms	43,29
	PF	1,000	PF	1,000
	Frequency	50,00	Frequency	50,00

Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
0	N/A	N/A	N/A	N/A	N/A	N/A	0,5%
1st	21,747	N/A	50,018	43,292	N/A	99,998	100%
2nd	0,017	N/A	0,039	0,114	N/A	0,263	1%

3rd	0,032	N/A	0,073	0,050	N/A	0,115	4%
4th	0,012	N/A	0,027	0,097	N/A	0,224	1%
5th	0,059	N/A	0,137	0,132	N/A	0,306	4%
6th	0,007	N/A	0,016	0,026	N/A	0,060	1%
7th	0,043	N/A	0,100	0,071	N/A	0,163	4%
8th	0,006	N/A	0,014	0,043	N/A	0,100	1%
9th	0,018	N/A	0,041	0,013	N/A	0,030	2%
10th	0,006	N/A	0,015	0,024	N/A	0,057	0,5%
11th	0,019	N/A	0,044	0,027	N/A	0,063	2%
12th	0,006	N/A	0,013	0,016	N/A	0,036	0,5%
13th	0,011	N/A	0,025	0,031	N/A	0,071	2%
14th	0,005	N/A	0,012	0,015	N/A	0,034	0,5%
15th	0,008	N/A	0,018	0,017	N/A	0,040	1%
16th	0,004	N/A	0,010	0,013	N/A	0,030	0,5%
17th	0,007	N/A	0,017	0,016	N/A	0,036	1%
18th	0,005	N/A	0,011	0,011	N/A	0,025	0,5%
19th	0,012	N/A	0,027	0,010	N/A	0,022	1%
20th	0,004	N/A	0,009	0,014	N/A	0,033	0,5%
21th	0,008	N/A	0,018	0,009	N/A	0,020	0,6%
22th	0,004	N/A	0,009	0,011	N/A	0,024	0,5%
23th	0,006	N/A	0,013	0,019	N/A	0,044	0,6%
24th	0,004	N/A	0,009	0,006	N/A	0,014	0,5%
25th	0,007	N/A	0,015	0,008	N/A	0,018	0,6%
26th	0,003	N/A	0,007	0,006	N/A	0,014	0,5%
27th	0,003	N/A	0,007	0,005	N/A	0,012	0,6%
28th	0,003	N/A	0,007	0,007	N/A	0,015	0,5%
29th	0,005	N/A	0,011	0,016	N/A	0,036	0,6%
30th	0,003	N/A	0,007	0,005	N/A	0,012	0,5%
31th	0,004	N/A	0,008	0,014	N/A	0,033	0,6%
32th	0,002	N/A	0,006	0,005	N/A	0,011	0,5%
33th	0,003	N/A	0,007	0,006	N/A	0,013	0,6%
THD (to 50th)	N/A	N/A	0,420	N/A	N/A	0,759	5%

Note:
Inverter shall be connected to test circuit Figure C1 (AS4777.2), Grid nominal voltage within +/-5%, AC-Frequency 50+/-1Hz and Phase angle between 3 phases shall be 120+/-1.5°. Via DC-input set AC-output power (VA) so that it equals to 100+/-5% of rated output. Harmonic ratios of the test voltage shall be measured. Limits based on percentage of fundamental! Total harmonic distortion to the 50th harmonic 5%.

5.6 Harmonic currents Appendix C Harmonic Current Limit Test							P
SOFAR 33000TL-Sx Series							
L1 phase							
Generating Unit rating per phase (rpp)							
	At 50% of rated ouput current			**100% of rated output currentA**			
	Watts	5413		Watts	10892		
	VA	5413		VA	10892		
	Vrms	230,8		Vrms	230,7		
	Arms	23,450		Arms	47,211		
	PF	1,000		PF	1,000		
	Frequency	50,00		Frequency	50,00		
Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
0	N/A	N/A	N/A	N/A	N/A	N/A	0,5%
1st	23,450	N/A	49,031	47,209	N/A	99,996	100%
2nd	0,019	N/A	0,040	0,032	N/A	0,067	1%
3rd	0,052	N/A	0,109	0,044	N/A	0,093	4%
4th	0,014	N/A	0,029	0,022	N/A	0,047	1%
5th	0,032	N/A	0,067	0,034	N/A	0,072	4%
6th	0,009	N/A	0,018	0,011	N/A	0,023	1%
7th	0,030	N/A	0,062	0,060	N/A	0,127	4%
8th	0,008	N/A	0,016	0,039	N/A	0,083	1%
9th	0,029	N/A	0,060	0,024	N/A	0,052	2%
10th	0,008	N/A	0,016	0,014	N/A	0,029	0,5%
11th	0,012	N/A	0,024	0,020	N/A	0,043	2%
12th	0,007	N/A	0,014	0,007	N/A	0,015	0,5%
13th	0,011	N/A	0,024	0,043	N/A	0,091	2%
14th	0,006	N/A	0,012	0,031	N/A	0,066	0,5%
15th	0,014	N/A	0,030	0,012	N/A	0,025	1%
16th	0,005	N/A	0,011	0,018	N/A	0,039	0,5%
17th	0,012	N/A	0,026	0,008	N/A	0,017	1%
18th	0,006	N/A	0,012	0,006	N/A	0,013	0,5%
19th	0,011	N/A	0,023	0,013	N/A	0,027	1%
20th	0,005	N/A	0,010	0,019	N/A	0,040	0,5%
21th	0,011	N/A	0,024	0,012	N/A	0,025	0,6%
22th	0,004	N/A	0,009	0,017	N/A	0,036	0,5%
23th	0,011	N/A	0,022	0,006	N/A	0,014	0,6%
24th	0,005	N/A	0,010	0,006	N/A	0,012	0,5%
25th	0,009	N/A	0,019	0,010	N/A	0,020	0,6%
26th	0,003	N/A	0,007	0,010	N/A	0,022	0,5%
27th	0,005	N/A	0,011	0,009	N/A	0,020	0,6%
28th	0,003	N/A	0,007	0,013	N/A	0,028	0,5%
29th	0,007	N/A	0,015	0,008	N/A	0,017	0,6%
30th	0,004	N/A	0,008	0,006	N/A	0,013	0,5%
31th	0,006	N/A	0,012	0,017	N/A	0,037	0,6%
32th	0,003	N/A	0,006	0,006	N/A	0,014	0,5%
33th	0,003	N/A	0,006	0,009	N/A	0,019	0,6%
THD (to 50th)	N/A	N/A	0,372	N/A	N/A	1,063	5%
L2 phase							
Generating Unit rating per phase (rpp)							
	At 50% of rated ouput current			**100% of rated output currentA**			
	Watts	5416		Watts	10874		
	VA	5416		VA	10874		

	Vrms	230,9	Vrms	230,7	
	Arms	23,452	Arms	47,211	
	PF	1,000	PF	1,000	
	Frequency	50,00	Frequency	50,00	

Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
0	N/A	N/A	N/A	N/A	N/A	N/A	0,5%
1st	23,452	N/A	49,035	47,160	N/A	99,993	100%
2nd	0,016	N/A	0,033	0,023	N/A	0,049	1%
3rd	0,027	N/A	0,057	0,034	N/A	0,072	4%
4th	0,011	N/A	0,024	0,022	N/A	0,047	1%
5th	0,055	N/A	0,115	0,041	N/A	0,086	4%
6th	0,007	N/A	0,015	0,014	N/A	0,029	1%
7th	0,042	N/A	0,088	0,087	N/A	0,184	4%
8th	0,006	N/A	0,013	0,040	N/A	0,085	1%
9th	0,015	N/A	0,031	0,019	N/A	0,039	2%
10th	0,007	N/A	0,014	0,017	N/A	0,036	0,5%
11th	0,011	N/A	0,024	0,013	N/A	0,029	2%
12th	0,006	N/A	0,012	0,007	N/A	0,014	0,5%
13th	0,014	N/A	0,028	0,055	N/A	0,117	2%
14th	0,005	N/A	0,011	0,032	N/A	0,068	0,5%
15th	0,007	N/A	0,014	0,008	N/A	0,017	1%
16th	0,005	N/A	0,010	0,021	N/A	0,044	0,5%
17th	0,012	N/A	0,026	0,010	N/A	0,021	1%
18th	0,005	N/A	0,011	0,005	N/A	0,011	0,5%
19th	0,007	N/A	0,015	0,019	N/A	0,039	1%
20th	0,004	N/A	0,009	0,018	N/A	0,038	0,5%
21th	0,005	N/A	0,011	0,006	N/A	0,013	0,6%
22th	0,004	N/A	0,009	0,018	N/A	0,038	0,5%
23th	0,009	N/A	0,020	0,007	N/A	0,014	0,6%
24th	0,004	N/A	0,009	0,005	N/A	0,011	0,5%
25th	0,006	N/A	0,013	0,011	N/A	0,024	0,6%
26th	0,003	N/A	0,007	0,021	N/A	0,045	0,5%
27th	0,003	N/A	0,007	0,011	N/A	0,023	0,6%
28th	0,003	N/A	0,007	0,011	N/A	0,024	0,5%
29th	0,006	N/A	0,013	0,005	N/A	0,011	0,6%
30th	0,003	N/A	0,007	0,005	N/A	0,011	0,5%
31th	0,005	N/A	0,010	0,016	N/A	0,033	0,6%
32th	0,003	N/A	0,005	0,007	N/A	0,015	0,5%
33th	0,003	N/A	0,006	0,006	N/A	0,013	0,6%
THD (to 50th)	N/A	N/A	0,364	N/A	N/A	0,875	5%

L3 phase

Generating Unit rating per phase (rpp)				
	At 50% of rated ouput current		**100% of rated output currentA**	
	Watts	5420	Watts	10,877
	VA	5420	VA	10,877
	Vrms	230,8	Vrms	231,4
	Arms	23,479	Arms	47,006
	PF	1,000	PF	0,999
	Frequency	50,00	Frequency	50,00

Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
0	N/A	N/A	N/A	N/A	N/A	N/A	0,5%
1st	23,479	N/A	49,093	47,004	N/A	99,996	100%
2nd	0,015	N/A	0,032	0,022	N/A	0,048	1%

3rd	0,024	N/A	0,051	0,042	N/A	0,090	4%
4th	0,012	N/A	0,026	0,020	N/A	0,044	1%
5th	0,053	N/A	0,110	0,043	N/A	0,092	4%
6th	0,008	N/A	0,016	0,011	N/A	0,023	1%
7th	0,041	N/A	0,085	0,077	N/A	0,164	4%
8th	0,007	N/A	0,014	0,041	N/A	0,087	1%
9th	0,017	N/A	0,037	0,013	N/A	0,027	2%
10th	0,007	N/A	0,015	0,015	N/A	0,032	0,5%
11th	0,019	N/A	0,039	0,031	N/A	0,067	2%
12th	0,006	N/A	0,013	0,007	N/A	0,014	0,5%
13th	0,010	N/A	0,021	0,053	N/A	0,112	2%
14th	0,006	N/A	0,012	0,031	N/A	0,065	0,5%
15th	0,008	N/A	0,017	0,006	N/A	0,012	1%
16th	0,005	N/A	0,010	0,020	N/A	0,042	0,5%
17th	0,007	N/A	0,014	0,015	N/A	0,033	1%
18th	0,005	N/A	0,011	0,005	N/A	0,011	0,5%
19th	0,011	N/A	0,024	0,017	N/A	0,037	1%
20th	0,005	N/A	0,010	0,015	N/A	0,032	0,5%
21th	0,008	N/A	0,016	0,007	N/A	0,016	0,6%
22th	0,005	N/A	0,009	0,017	N/A	0,036	0,5%
23th	0,006	N/A	0,012	0,010	N/A	0,021	0,6%
24th	0,004	N/A	0,009	0,006	N/A	0,012	0,5%
25th	0,008	N/A	0,017	0,011	N/A	0,023	0,6%
26th	0,003	N/A	0,007	0,015	N/A	0,031	0,5%
27th	0,003	N/A	0,007	0,009	N/A	0,020	0,6%
28th	0,003	N/A	0,007	0,015	N/A	0,032	0,5%
29th	0,005	N/A	0,011	0,008	N/A	0,016	0,6%
30th	0,004	N/A	0,008	0,005	N/A	0,011	0,5%
31th	0,006	N/A	0,012	0,016	N/A	0,033	0,6%
32th	0,003	N/A	0,006	0,006	N/A	0,013	0,5%
33th	0,003	N/A	0,006	0,004	N/A	0,009	0,6%
THD (to 50th)	N/A	N/A	0,356	N/A	N/A	1,006	5%

Note:
Inverter shall be connected to test circuit Figure C1 (AS4777.2), Grid nominal voltage within +/-5%, AC-Frequency 50+/-1Hz and Phase angle between 3 phases shall be 120+/-1.5°. Via DC-input set AC-output power (VA) so that it equals to 100+/-5% of rated output. Harmonic ratios of the test voltage shall be measured. Limits based on percentage of fundamental! Total harmonic distortion to the 50th harmonic 5%.

5.6 Harmonic currents Appendix C Harmonic Current Limit Test	P

SOFAR 40000TL-Sx Series

L1 phase

Generating Unit rating per phase (rpp)				
	At 50% of rated ouput current		**100% of rated output currentA**	
	Watts	6530	Watts	13,226
	VA	6530	VA	13,226
	Vrms	230,8	Vrms	230,7
	Arms	28,291	Arms	57,948
	PF	1,000	PF	1,000
	Frequency	50,00	Frequency	50,00

Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
0	N/A	N/A	N/A	N/A	N/A	N/A	0,5%
1st	28,291	N/A	48,802	57,947	N/A	99,996	100%
2nd	0,021	N/A	0,037	0,032	N/A	0,067	1%
3rd	0,038	N/A	0,066	0,044	N/A	0,093	4%
4th	0,016	N/A	0,027	0,022	N/A	0,047	1%
5th	0,046	N/A	0,080	0,034	N/A	0,072	4%
6th	0,008	N/A	0,014	0,011	N/A	0,023	1%
7th	0,046	N/A	0,079	0,060	N/A	0,127	4%
8th	0,006	N/A	0,011	0,039	N/A	0,083	1%
9th	0,028	N/A	0,048	0,024	N/A	0,052	2%
10th	0,007	N/A	0,012	0,014	N/A	0,029	0,5%
11th	0,008	N/A	0,014	0,020	N/A	0,043	2%
12th	0,005	N/A	0,009	0,007	N/A	0,015	0,5%
13th	0,007	N/A	0,012	0,043	N/A	0,091	2%
14th	0,006	N/A	0,010	0,031	N/A	0,066	0,5%
15th	0,013	N/A	0,023	0,012	N/A	0,025	1%
16th	0,004	N/A	0,008	0,018	N/A	0,039	0,5%
17th	0,011	N/A	0,018	0,008	N/A	0,017	1%
18th	0,004	N/A	0,008	0,006	N/A	0,013	0,5%
19th	0,010	N/A	0,017	0,013	N/A	0,027	1%
20th	0,004	N/A	0,007	0,019	N/A	0,040	0,5%
21th	0,011	N/A	0,019	0,012	N/A	0,025	0,6%
22th	0,004	N/A	0,007	0,017	N/A	0,036	0,5%
23th	0,014	N/A	0,024	0,006	N/A	0,014	0,6%
24th	0,004	N/A	0,007	0,006	N/A	0,012	0,5%
25th	0,013	N/A	0,022	0,010	N/A	0,020	0,6%
26th	0,003	N/A	0,006	0,010	N/A	0,022	0,5%
27th	0,006	N/A	0,010	0,009	N/A	0,020	0,6%
28th	0,003	N/A	0,005	0,013	N/A	0,028	0,5%
29th	0,015	N/A	0,026	0,008	N/A	0,017	0,6%
30th	0,003	N/A	0,005	0,006	N/A	0,013	0,5%
31th	0,014	N/A	0,024	0,017	N/A	0,037	0,6%
32th	0,003	N/A	0,004	0,006	N/A	0,014	0,5%
33th	0,004	N/A	0,006	0,009	N/A	0,019	0,6%
THD (to 50th)	N/A	N/A	0,341	N/A	N/A	1,063	5%

L2 phase

Generating Unit rating per phase (rpp)				
	At 50% of rated ouput current		**100% of rated output currentA**	
	Watts	6534	Watts	13,210
	VA	6534	VA	13,210

	Vrms	230,8	Vrms	230,7	
	Arms	28,305	Arms	57,434	
	PF	1,0	PF	1,000	
	Frequency	50,00	Frequency	50,00	

Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
0	N/A	N/A	N/A	N/A	N/A	N/A	0,5%
1st	28,305	N/A	48,826	57,433	N/A	99,072	100%
2nd	0,016	N/A	0,027	0,023	N/A	0,049	1%
3rd	0,016	N/A	0,027	0,034	N/A	0,072	4%
4th	0,013	N/A	0,022	0,022	N/A	0,047	1%
5th	0,070	N/A	0,120	0,041	N/A	0,086	4%
6th	0,007	N/A	0,011	0,014	N/A	0,029	1%
7th	0,054	N/A	0,092	0,087	N/A	0,184	4%
8th	0,005	N/A	0,009	0,040	N/A	0,085	1%
9th	0,014	N/A	0,025	0,019	N/A	0,039	2%
10th	0,006	N/A	0,011	0,017	N/A	0,036	0,5%
11th	0,015	N/A	0,025	0,013	N/A	0,029	2%
12th	0,005	N/A	0,009	0,007	N/A	0,014	0,5%
13th	0,014	N/A	0,025	0,055	N/A	0,117	2%
14th	0,005	N/A	0,009	0,032	N/A	0,068	0,5%
15th	0,007	N/A	0,012	0,008	N/A	0,017	1%
16th	0,004	N/A	0,007	0,021	N/A	0,044	0,5%
17th	0,009	N/A	0,016	0,010	N/A	0,021	1%
18th	0,004	N/A	0,008	0,005	N/A	0,011	0,5%
19th	0,005	N/A	0,008	0,019	N/A	0,039	1%
20th	0,004	N/A	0,006	0,018	N/A	0,038	0,5%
21th	0,005	N/A	0,009	0,006	N/A	0,013	0,6%
22th	0,004	N/A	0,008	0,018	N/A	0,038	0,5%
23th	0,010	N/A	0,017	0,007	N/A	0,014	0,6%
24th	0,004	N/A	0,006	0,005	N/A	0,011	0,5%
25th	0,009	N/A	0,015	0,011	N/A	0,024	0,6%
26th	0,003	N/A	0,005	0,021	N/A	0,045	0,5%
27th	0,003	N/A	0,005	0,011	N/A	0,023	0,6%
28th	0,003	N/A	0,005	0,011	N/A	0,024	0,5%
29th	0,012	N/A	0,021	0,005	N/A	0,011	0,6%
30th	0,003	N/A	0,005	0,005	N/A	0,011	0,5%
31th	0,012	N/A	0,020	0,016	N/A	0,033	0,6%
32th	0,002	N/A	0,004	0,007	N/A	0,015	0,5%
33th	0,003	N/A	0,004	0,006	N/A	0,013	0,6%
THD (to 50th)	N/A	N/A	0,358	N/A	N/A	0,875	5%

L3 phase

Generating Unit rating per phase (rpp)				
	At 50% of rated ouput current		**100% of rated output currentA**	
	Watts	6531	Watts	13,233
	VA	6531	VA	13,233
	Vrms	230,7	Vrms	230,4
	Arms	28,311	Arms	57,435
	PF	1,0	PF	1,000
	Frequency	50,00	Frequency	50,00

Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
0	N/A	N/A	N/A	N/A	N/A	N/A	0,5%
1st	28,311	N/A	48,837	57,434	N/A	99,074	100%
2nd	0,021	N/A	0,036	0,022	N/A	0,048	1%

3rd	0,035	N/A	0,061	0,042	N/A	0,090	4%
4th	0,014	N/A	0,025	0,020	N/A	0,044	1%
5th	0,067	N/A	0,115	0,043	N/A	0,092	4%
6th	0,007	N/A	0,012	0,011	N/A	0,023	1%
7th	0,055	N/A	0,095	0,077	N/A	0,164	4%
8th	0,006	N/A	0,010	0,041	N/A	0,087	1%
9th	0,017	N/A	0,029	0,013	N/A	0,027	2%
10th	0,006	N/A	0,011	0,015	N/A	0,032	0,5%
11th	0,021	N/A	0,036	0,031	N/A	0,067	2%
12th	0,005	N/A	0,009	0,007	N/A	0,014	0,5%
13th	0,011	N/A	0,020	0,053	N/A	0,112	2%
14th	0,005	N/A	0,009	0,031	N/A	0,065	0,5%
15th	0,007	N/A	0,013	0,006	N/A	0,012	1%
16th	0,004	N/A	0,007	0,020	N/A	0,042	0,5%
17th	0,005	N/A	0,009	0,015	N/A	0,033	1%
18th	0,004	N/A	0,007	0,005	N/A	0,011	0,5%
19th	0,009	N/A	0,015	0,017	N/A	0,037	1%
20th	0,004	N/A	0,006	0,015	N/A	0,032	0,5%
21th	0,008	N/A	0,014	0,007	N/A	0,016	0,6%
22th	0,004	N/A	0,007	0,017	N/A	0,036	0,5%
23th	0,008	N/A	0,014	0,010	N/A	0,021	0,6%
24th	0,004	N/A	0,007	0,006	N/A	0,012	0,5%
25th	0,009	N/A	0,016	0,011	N/A	0,023	0,6%
26th	0,003	N/A	0,005	0,015	N/A	0,031	0,5%
27th	0,004	N/A	0,006	0,009	N/A	0,020	0,6%
28th	0,003	N/A	0,005	0,015	N/A	0,032	0,5%
29th	0,012	N/A	0,021	0,008	N/A	0,016	0,6%
30th	0,003	N/A	0,005	0,005	N/A	0,011	0,5%
31th	0,012	N/A	0,020	0,016	N/A	0,033	0,6%
32th	0,002	N/A	0,004	0,006	N/A	0,013	0,5%
33th	0,003	N/A	0,004	0,004	N/A	0,009	0,6%
THD (to 50th)	N/A	N/A	0,379	N/A	N/A	1,006	5%

Note:
Inverter shall be connected to test circuit Figure C1 (AS4777.2), Grid nominal voltage within +/-5%, AC-Frequency 50+/-1Hz and Phase angle between 3 phases shall be 120+/-1.5°. Via DC-input set AC-output power (VA) so that it equals to 100+/-5% of rated output. Harmonic ratios of the test voltage shall be measured. Limits based on percentage of fundamental! Total harmonic distortion to the 50th harmonic 5%.

5.6 Harmonic currents Appendix C3 Harmonic Voltage Limit Test					P
Generating Unit rating per phase (rpp)					
	At 50% of rated ouput current A		100% of rated output current A		
Harmonic	Value V	% of fundamental	Value V	% of fundamental	Limit in % of fundamental
L1 phase					
2nd	0,011	0,005	0,013	0,006	0,2%
3rd	0,060	0,026	0,067	0,029	4%
4th	0,008	0,004	0,008	0,003	0,2%
5th	0,043	0,019	0,053	0,023	4%
6th	0,006	0,003	0,009	0,004	0,2%
7th	0,007	0,003	0,006	0,003	4%
8th	0,010	0,004	0,008	0,004	0,2%
9th	0,016	0,007	0,023	0,010	2%
10th	0,003	0,001	0,004	0,002	0,2%
11th	0,011	0,005	0,004	0,002	0,1%
12th	0,008	0,004	0,009	0,004	0,1%
13th	0,013	0,006	0,021	0,009	0,1%
14th	0,006	0,003	0,004	0,002	0,1%
15th	0,003	0,001	0,004	0,002	0,1%
16th	0,004	0,002	0,006	0,003	0,1%
17th	0,006	0,003	0,007	0,003	0,1%
18th	0,009	0,004	0,006	0,003	0,1%
19th	0,007	0,003	0,010	0,004	0,1%
20th	0,007	0,003	0,007	0,003	0,1%
21th	0,010	0,004	0,012	0,005	0,1%
22th	0,007	0,003	0,007	0,003	0,1%
23th	0,011	0,005	0,015	0,007	0,1%
24th	0,008	0,004	0,008	0,004	0,1%
25th	0,009	0,004	0,018	0,008	0,1%
26th	0,006	0,003	0,008	0,003	0,1%
27th	0,007	0,003	0,015	0,006	0,1%
28th	0,006	0,003	0,005	0,002	0,1%
29th	0,005	0,002	0,017	0,007	0,1%
30th	0,005	0,002	0,005	0,002	0,1%
31th	0,004	0,002	0,015	0,007	0,1%
32th	0,005	0,002	0,007	0,003	0,1%
33th	0,003	0,001	0,009	0,004	0,1%
34th	0,004	0,002	0,005	0,002	0,1%
35th	0,005	0,002	0,017	0,008	0,1%
36th	0,006	0,003	0,007	0,003	0,1%
37th	0,005	0,002	0,016	0,007	0,1%
38th	0,004	0,002	0,006	0,002	0,1%
39th	0,003	0,001	0,008	0,003	0,1%
40th	0,004	0,002	0,007	0,003	0,1%
41th	0,005	0,002	0,016	0,007	0,1%
42th	0,004	0,002	0,005	0,002	0,1%
43th	0,005	0,002	0,016	0,007	0,1%
44th	0,004	0,002	0,007	0,003	0,1%
45th	0,003	0,001	0,007	0,003	0,1%
46th	0,004	0,002	0,006	0,003	0,1%
47th	0,004	0,002	0,016	0,007	0,1%

48th	0,005	0,002	0,007	0,003	0,1%
49th	0,007	0,003	0,015	0,007	0,1%
50th	0,005	0,002	0,005	0,002	0,1%
THD	N/A	0,038	N/A	0,049	5%
L2 phase					
2nd	0,013	0,006	0,014	0,006	0,2%
3rd	0,052	0,023	0,054	0,024	4%
4th	0,008	0,004	0,007	0,003	0,2%
5th	0,044	0,019	0,056	0,024	4%
6th	0,009	0,004	0,011	0,005	0,2%
7th	0,009	0,004	0,007	0,003	4%
8th	0,011	0,005	0,009	0,004	0,2%
9th	0,027	0,012	0,033	0,014	2%
10th	0,004	0,002	0,007	0,003	0,2%
11th	0,010	0,004	0,003	0,001	0,1%
12th	0,009	0,004	0,010	0,004	0,1%
13th	0,014	0,006	0,023	0,010	0,1%
14th	0,008	0,003	0,006	0,003	0,1%
15th	0,011	0,005	0,008	0,004	0,1%
16th	0,007	0,003	0,010	0,004	0,1%
17th	0,005	0,002	0,009	0,004	0,1%
18th	0,007	0,003	0,006	0,003	0,1%
19th	0,006	0,003	0,009	0,004	0,1%
20th	0,009	0,004	0,009	0,004	0,1%
21th	0,004	0,002	0,007	0,003	0,1%
22th	0,011	0,005	0,013	0,006	0,1%
23th	0,005	0,002	0,011	0,005	0,1%
24th	0,006	0,003	0,006	0,002	0,1%
25th	0,007	0,003	0,015	0,007	0,1%
26th	0,006	0,003	0,007	0,003	0,1%
27th	0,004	0,002	0,009	0,004	0,1%
28th	0,005	0,002	0,005	0,002	0,1%
29th	0,004	0,002	0,013	0,006	0,1%
30th	0,005	0,002	0,006	0,003	0,1%
31th	0,004	0,002	0,014	0,006	0,1%
32th	0,004	0,002	0,004	0,002	0,1%
33th	0,004	0,002	0,006	0,003	0,1%
34th	0,005	0,002	0,006	0,003	0,1%
35th	0,003	0,001	0,015	0,006	0,1%
36th	0,004	0,002	0,005	0,002	0,1%
37th	0,004	0,002	0,015	0,007	0,1%
38th	0,004	0,002	0,005	0,002	0,1%
39th	0,003	0,001	0,006	0,003	0,1%
40th	0,004	0,002	0,005	0,002	0,1%
41th	0,004	0,002	0,014	0,006	0,1%
42th	0,004	0,002	0,007	0,003	0,1%
43th	0,005	0,002	0,015	0,006	0,1%
44th	0,004	0,002	0,004	0,002	0,1%
45th	0,003	0,001	0,006	0,002	0,1%
46th	0,004	0,002	0,006	0,002	0,1%
47th	0,004	0,002	0,014	0,006	0,1%
48th	0,005	0,002	0,006	0,003	0,1%
49th	0,006	0,003	0,014	0,006	0,1%
50th	0,005	0,002	0,006	0,003	0,1%
THD	N/A	0,037	N/A	0,047	5%
L3 phase					
2nd	0,014	0,006	0.014	0.006	0,2%

3rd	0,057	0,025	0.057	0.025	4%
4th	0,010	0,004	0.009	0.004	0,2%
5th	0,045	0,020	0.059	0.026	4%
6th	0,007	0,003	0.011	0.005	0,2%
7th	0,013	0,006	0.007	0.003	4%
8th	0,012	0,005	0.010	0.005	0,2%
9th	0,026	0,011	0.035	0.015	2%
10th	0,004	0,002	0.005	0.002	0,2%
11th	0,011	0,005	0.005	0.002	0,1%
12th	0,009	0,004	0.010	0.005	0,1%
13th	0,009	0,004	0.018	0.008	0,1%
14th	0,008	0,004	0.004	0.002	0,1%
15th	0,009	0,004	0.008	0.004	0,1%
16th	0,006	0,003	0.009	0.004	0,1%
17th	0,004	0,002	0.006	0.002	0,1%
18th	0,006	0,003	0.004	0.002	0,1%
19th	0,007	0,003	0.008	0.003	0,1%
20th	0,006	0,003	0.005	0.002	0,1%
21th	0,003	0,001	0.004	0.002	0,1%
22th	0,008	0,003	0.011	0.005	0,1%
23th	0,008	0,004	0.011	0.005	0,1%
24th	0,007	0,003	0.008	0.004	0,1%
25th	0,007	0,003	0.015	0.007	0,1%
26th	0,006	0,003	0.005	0.002	0,1%
27th	0,005	0,002	0.010	0.004	0,1%
28th	0,004	0,002	0.005	0.002	0,1%
29th	0,006	0,002	0.015	0.006	0,1%
30th	0,004	0,002	0.004	0.002	0,1%
31th	0,004	0,002	0.014	0.006	0,1%
32th	0,004	0,002	0.003	0.001	0,1%
33th	0,004	0,002	0.005	0.002	0,1%
34th	0,004	0,002	0.005	0.002	0,1%
35th	0,005	0,002	0.016	0.007	0,1%
36th	0,005	0,002	0.005	0.002	0,1%
37th	0,005	0,002	0.015	0.006	0,1%
38th	0,004	0,002	0.004	0.002	0,1%
39th	0,003	0,001	0.008	0.003	0,1%
40th	0,004	0,002	0.004	0.002	0,1%
41th	0,004	0,002	0.015	0.007	0,1%
42th	0,004	0,002	0.006	0.003	0,1%
43th	0,004	0,002	0.014	0.006	0,1%
44th	0,004	0,002	0.004	0.002	0,1%
45th	0,004	0,002	0.006	0.002	0,1%
46th	0,004	0,002	0.005	0.002	0,1%
47th	0,005	0,002	0.015	0.007	0,1%
48th	0,005	0,002	0.006	0.002	0,1%
49th	0,005	0,002	0.014	0.006	0,1%
50th	0,005	0,002	0.006	0.002	0,1%
THD	N/A	0,038	N/A	0,047	5%

Note:
Inverter shall be connected to test circuit Figure C1 (AS4777.2), Grid nominal voltage within +/-5%, AC-Frequency 50+/-1Hz and Phase angle between 3 phases shall be 120+/-1.5°. Via DC-input set AC-output power (VA) so that it equals to 100+/-5% of rated output. Harmonic ratios of the test voltage shall be measured. Limits based on percentage of fundamental! Total harmonic distortion to the 50th harmonic 5%.

5.7 Voltage Fluctuations and Flicker				P
SOFAR 33000TL-Sx Series				
	dc (%)	Dmax (%)	Running	
Limit	3,3	4	Pst = 1,0	Plt = 0,65
Test value	0,96	1,28	0,083	0,192
SOFAR 40000TL-Sx Series				
	dc (%)	Dmax (%)	Running	
Limit	3,3	4	Pst = 1,0	Plt = 0,65
Test value	1,18	1,30	0,086	0,196

Note:

The inverter shall conform to the voltage fluctuation and flicker limits specified in AS/NZS 61000.3.3 for equipment with rated current less than or equal to 16 A per phase (a.c.).

For equipment with rated current greater than 16 A per phase (a.c.), if the inverter cannot meet the requirements of AS/NZS 61000.3.3, the maximum permissible connection point impedance (Zmax) shall be determined such that the voltage fluctuation and flicker limits specified in AS/NZS 61000.3.3 can be met. The impedance shall be determined in accordance with the methods given in AS/NZS 61000.3.11.

The test result refer to the original test report “150715025GZU-003” issued by Intertek on Sep. 15, 2015.

The tests had been performed on the SOFAR 33000TL-Sx Series and SOFAR 40000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

5.8 Transient Voltage Limits (phase to neutral) **Appendix D Transient Voltage Limit Test** **SOFAR 33000TL-Sx Series**						**P**
L1 phase						
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0,002	580	0,002	580	0,002	580
Test value	0,002	400,3	0,002	4,0	0,002	93,5
Limit	0,006	470	0,006	470	0,006	470
Test value	0,006	288,8	0,006	118,8	0,006	93,0
Limit	0,02	420	0,02	420	0,02	420
Test value	0,02	264,8	0,02	118,5	0,02	92,7
Limit	>0,06	390	>0,06	390	>0,06	390
Test value	>0,06	259,3	>0,06	116,0	>0,06	91,2
L2 phase						
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0,002	580	0,002	580	0,002	580
Test value	0,002	295,0	0,002	300,0	0,002	356,7
Limit	0,006	470	0,006	470	0,006	470
Test value	0,006	137,2	0,006	298,9	0,006	355,8
Limit	0,02	420	0,02	420	0,02	420
Test value	0,02	165,6	0,02	297,3	0,02	353,7
Limit	>0,06	390	>0,06	390	>0,06	390
Test value	>0,06	162,0	>0,06	290,3	>0,06	345,5

L3 phase						
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0,002	580	0,002	580	0,002	580
Test value	0,002	171,7	0,002	354,4	0,002	217,1
Limit	0,006	470	0,006	470	0,006	470
Test value	0,006	195,0	0,006	354,0	0,006	216,8
Limit	0,02	420	0,02	420	0,02	420
Test value	0,02	194,1	0,02	352,3	0,02	216,0
Limit	>0,06	390	>0,06	390	>0,06	390
Test value	>0,06	189,9	>0,06	344,4	>0,06	211,5

Note:
Results shall not exceed limits in Table 4 of AS/NZS 4777.2. Test Specifications: Inverter shall be connected to test circuit AS/NZS 4777.2 Figure D1. Grid nominal voltage within +/-5%, Via DC-input set AC- output power so that it equals to 10+/-5% of rated output (VA). Switch S shall be opened and the output voltage duration (Sample frequency of at least 10kHz) of the inverter shall be recorded. Test shall be repeated at 50+/-5% and 100+/-5% of rated output power.

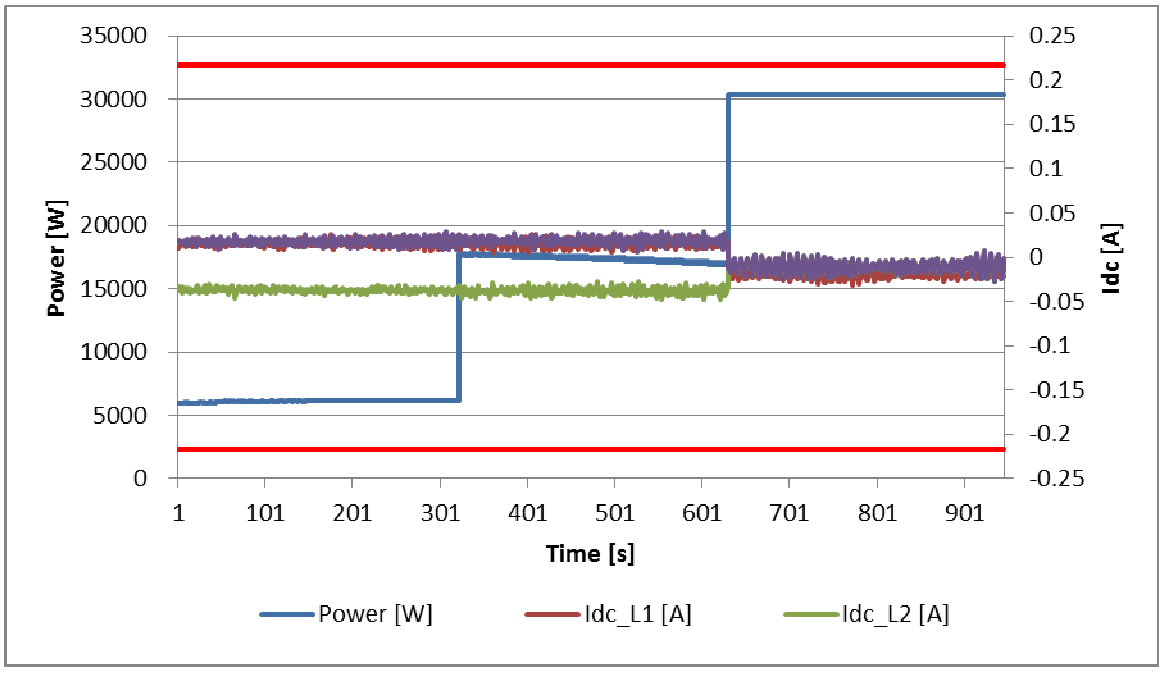
The tests had been performed on the SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

5.8 Transient Voltage Limits (phase to neutral) **Appendix D Transient Voltage Limit Test** **SOFAR 40000TL-Sx Series**						**P**
L1 phase						
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0,002	580	0,002	580	0,002	580
Test value	0,002	350,0	0,002	111,9	0,002	182,4
Limit	0,006	470	0,006	470	0,006	470
Test value	0,006	54,6	0,006	218,1	0,006	183,4
Limit	0,02	420	0,02	420	0,02	420
Test value	0,02	111,1	0,02	217,2	0,02	182,6
Limit	>0,06	390	>0,06	390	>0,06	390
Test value	>0,06	109,3	>0,06	213,0	>0,06	182,6
L2 phase						
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0,002	580	0,002	580	0,002	580
Test value	0,002	287,1	0,002	198,3	0,002	137,2
Limit	0,006	470	0,006	470	0,006	470
Test value	0,006	268,0	0,006	232,0	0,006	239,8
Limit	0,02	420	0,02	420	0,02	420
Test value	0,02	266,8	0,02	231,1	0,02	238,7
Limit	>0,06	390	>0,06	390	>0,06	390
Test value	>0,06	261,4	>0,06	227,0	>0,06	233,5

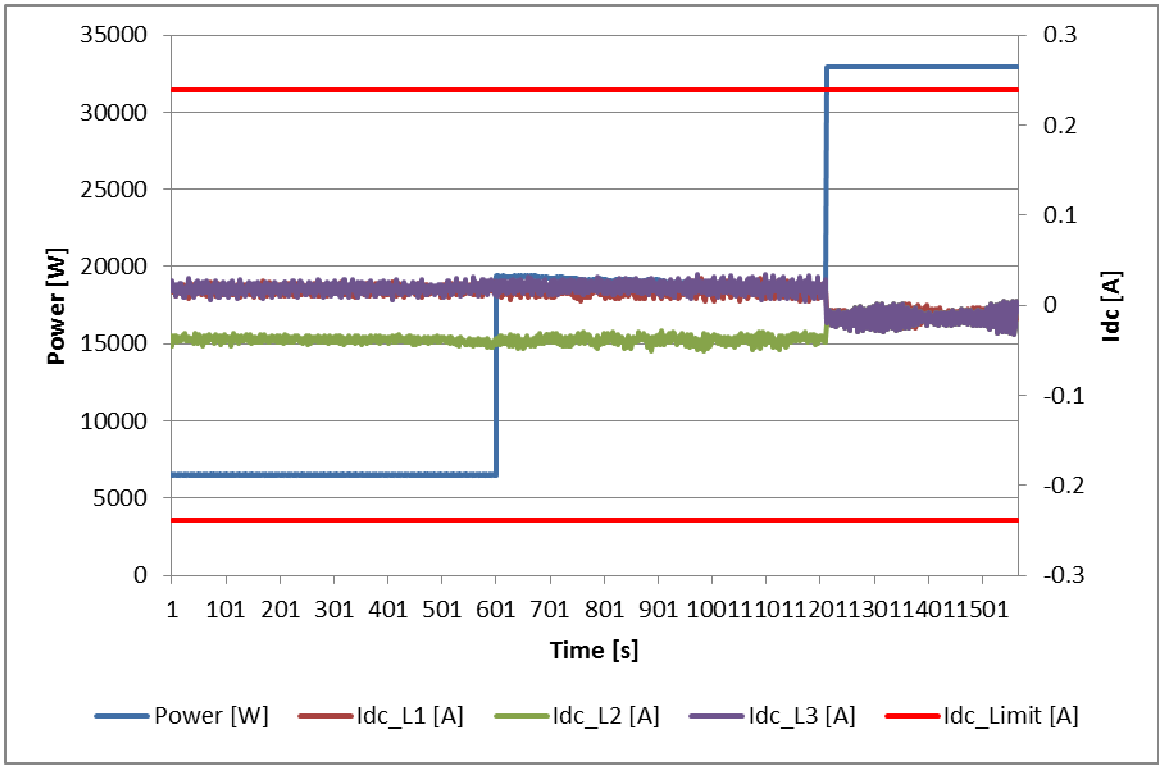
L3 phase						
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0,002	580	0,002	580	0,002	580
Test value	0,002	174,3	0,002	143,7	0,002	231,8
Limit	0,006	470	0,006	470	0,006	470
Test value	0,006	160,4	0,006	143,8	0,006	230,3
Limit	0,02	420	0,02	420	0,02	420
Test value	0,02	159,3	0,02	143,8	0,02	229,2
Limit	>0,06	390	>0,06	390	>0,06	390
Test value	>0,06	159,3	>0,06	143,6	>0,06	223,9

Note:
Results shall not exceed limits in Table 4 of AS/NZS 4777.2. Test Specifications: Inverter shall be connected to test circuit AS/NZS 4777.2 Figure D1. Grid nominal voltage within +/-5%, Via DC-input set AC- output power so that it equals to 10+/-5% of rated output (VA). Switch S shall be opened and the output voltage duration (Sample frequency of at least 10kHz) of the inverter shall be recorded. Test shall be repeated at 50+/-5% and 100+/-5% of rated output power.

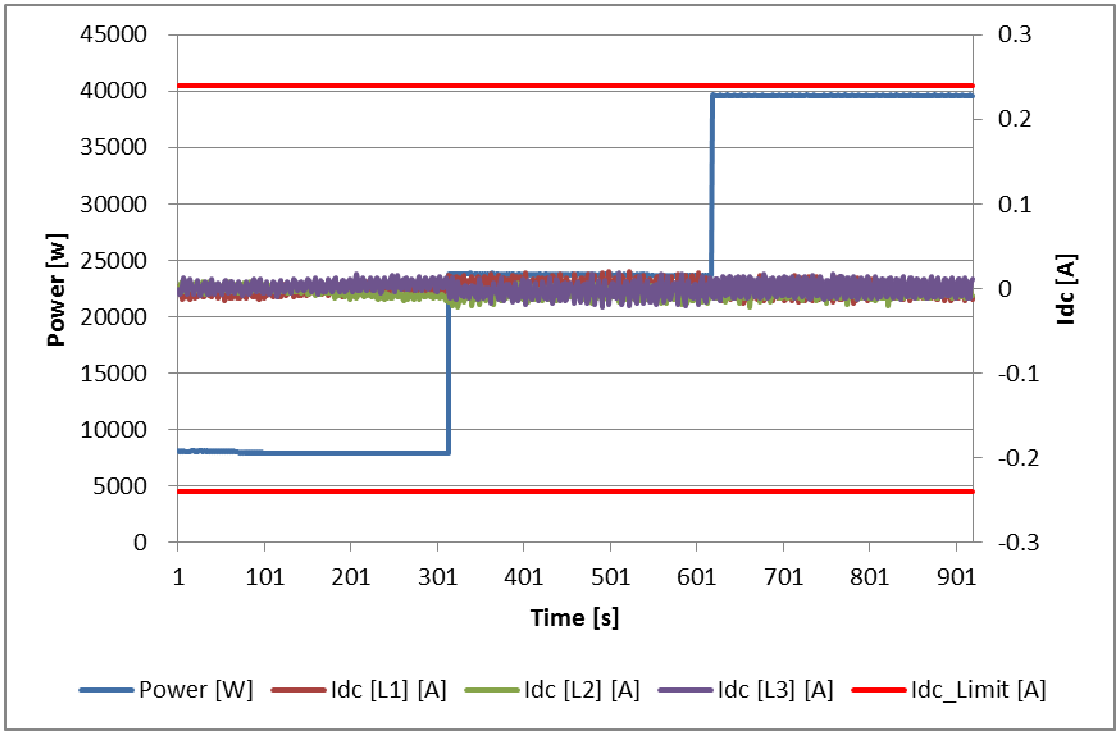
5.9 Direct current injection **Appendix E D.C. injection test**							**P**
SOFAR 30000TL-Sx Series							
	Testing at 20+/-5% Output Power						
Phases	L1-L1 (mA)	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Test value	Three phase!	Three phase!	Three phase!	Three phase!	25,4	-46,0	28,3
	Testing at 60+/-5% Output Power						
Phases	L1-L1 (mA)	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Test value	Three phase!	Three phase!	Three phase!	Three phase!	-46,5	-47,9	29,0
	Testing at 100+/-5% Output Power						
Phases	L1-L1 (mA)	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Test value	Three phase!	Three phase!	Three phase!	Three phase!	-32,0	-28,0	-28,0



SOFAR 33000TL-Sx Series							
	Testing at 20+/-5% Output Power						
Phases	L1-L1 (mA)	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Test value	Three phase!	Three phase!	Three phase!	Three phase!	26,8	-46,7	31,8
	Testing at 60+/-5% Output Power						
Phases	L1-L1 (mA)	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Test value	Three phase!	Three phase!	Three phase!	Three phase!	30,5	-51,1	34,6
	Testing at 100+/-5% Output Power						
Phases	L1-L1 (mA)	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Test value	Three phase!	Three phase!	Three phase!	Three phase!	-26,0	-33,0	-33,0



SOFAR 40000TL-Sx Series							
	Testing at 20+/-5% Output Power						
Phases	L1-L1 (mA)	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Test value	Three phase!	Three phase!	Three phase!	Three phase!	-14,1	-14,8	17,7
	Testing at 60+/-5% Output Power						
Phases	L1-L1 (mA)	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Test value	Three phase!	Three phase!	Three phase!	Three phase!	20,2	-22,2	19,5
	Testing at 100+/-5% Output Power						
Phases	L1-L1 (mA)	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Test value	Three phase!	Three phase!	Three phase!	Three phase!	-17,0	-22,0	17,0



Note:
In the case of a single-phase inverter: not exceed 0.5% of the inverter's rated current or 5 mA, whichever is the greater.
In the case of a three-phase inverter: shall not exceed 0.5% of the inverter's per-phase rated current or 5 mA, whichever is the greater.

5.10 Current balance for three-phase inverters						P
SOFAR 33000TL-Sx Series						
Setting values	PF cos φ = 1			Rated output current: 47,826 A		
Test value	L1	L2	L3	L1 – L2	L2 – L3	L3 – L1
100% of rated current	47,919	47,542	47,643	0,376	-0,100	-0,276
	47,921	47,541	47,645	0,380	-0,104	-0,276
	47,920	47,540	47,644	0,380	-0,104	-0,276
	47,921	47,540	47,645	0,381	-0,105	-0,276
	47,922	47,539	47,645	0,383	-0,106	-0,277
Limit [A]: 5% of rated current	2,391A					
SOFAR 40000TL-Sx Series						
Setting values	PF cos φ = 1			Rated output current: 57,97 A		
Test value	L1	L2	L3	L1 – L2	L2 – L3	L3 – L1
100% of rated current	57,1568	57,1437	57,4178	0,0131	-0,2741	0,2610
	56,7094	56,6973	56,9703	0,0121	-0,2730	0,2609
	55,5634	55,5560	55,8235	0,0074	-0,2675	0,2601
	55,0825	55,0757	55,3411	0,0068	-0,2654	0,2586
	54,6139	54,6087	54,8718	0,0052	-0,2631	0,2579
Limit [A]: 5% of rated current	2,4A					

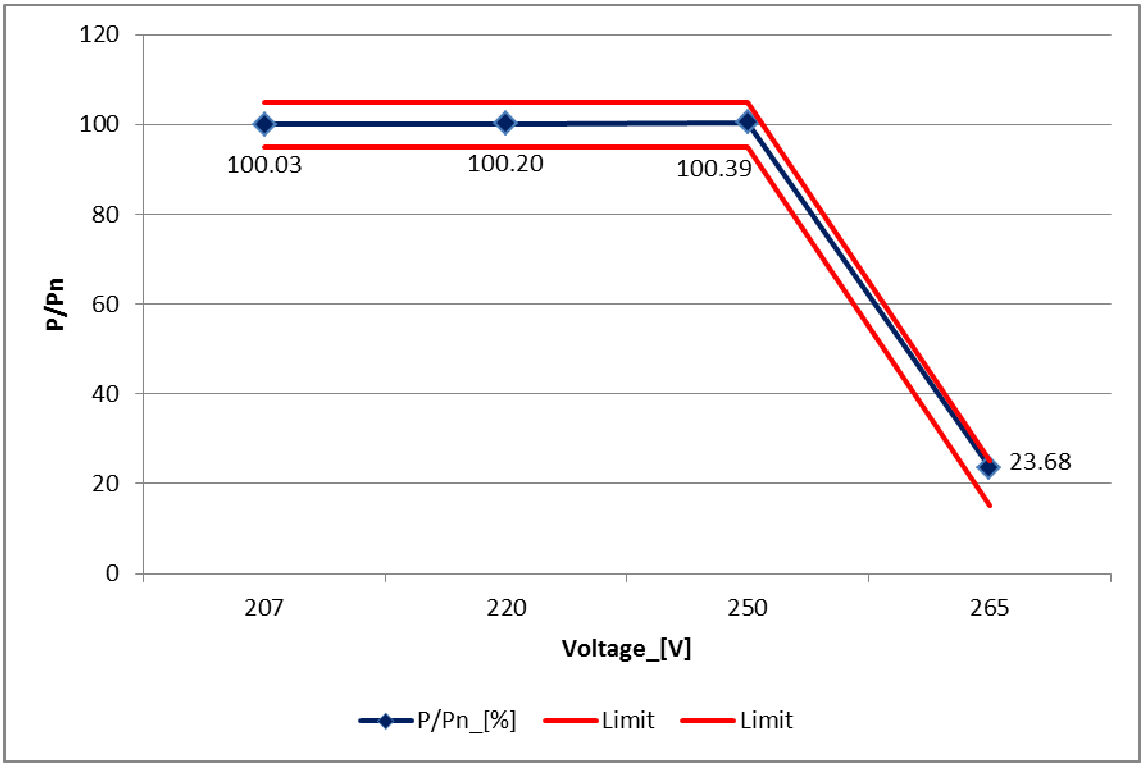
Note:
The a.c. output current for each phase for three-phase balanced current shall be within 5% of the measured value of the other phases at rated current when injected into a balanced three phase voltage.

The tests had been performed on the SOFAR 33000TL-Sx Series and SOFAR 40000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

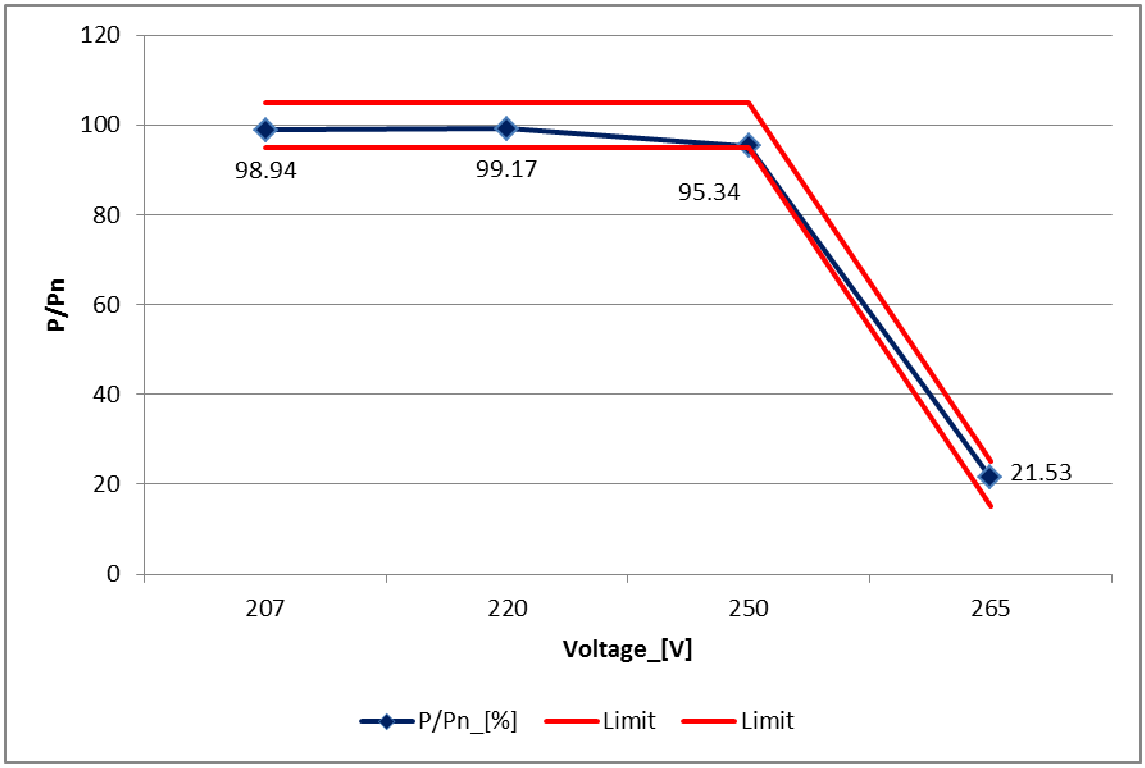
6.2 Inverter demand response modes (DRMs) **Appendix I Demand and power quality response**					**P**
SOFAR 33000TL-Sx Series					
Mode	Requirement	Measurement			Result
		Real current (A)	Reactive current (A)	Switching Time (s)	
DRM 0	Operate the disconnection device	0	0	0,326	P
DRM 1	Do not consume power	N/A	N/A	N/A	N/A
DRM 2	Do not consume at more than 50% of rated power	N/A	N/A	N/A	N/A
DRM 1 and DRM 2		N/A	N/A	N/A	N/A
DRM 3	Do not consume at more than 75% of rated power AND Source reactive power if capable	N/A	N/A	N/A	N/A
DRM 2 and DRM 3		N/A	N/A	N/A	N/A
DRM 4	Increase power consumption (subject to constraints from other active DRMs)	N/A	N/A	N/A	N/A
DRM 5	Do not generate power	1,410	0,477	0,854	P
DRM 6	Do not generate at more than 50% of rated power	23,910	0,877	0,952	P
DRM 5 and DRM 6		1,410	0,477	0,854	P
DRM 7	Do not generate at more than 75% of rated power AND Sink reactive power if capable	35,851	0,757	0,106	P
DRM 6 and DRM 7		1,410	0,477	0,854	P
DRM 8	Increase power generation (subject to constraints from other active DRMs)	47,799	0,927	1,410	P

SOFAR 40000TL-Sx Series					
Mode	Requirement	Measurement			Result
		Real current (A)	Reactive current (A)	Switching Time (s)	
DRM 0	Operate the disconnection device	0	0	0,356	P
DRM 1	Do not consume power	N/A	N/A	N/A	N/A
DRM 2	Do not consume at more than 50% of rated power	N/A	N/A	N/A	N/A
DRM 1 and DRM 2		N/A	N/A	N/A	N/A
DRM 3	Do not consume at more than 75% of rated power AND Source reactive power if capable	N/A	N/A	N/A	N/A
DRM 2 and DRM 3		N/A	N/A	N/A	N/A
DRM 4	Increase power consumption (subject to constraints from other active DRMs)	N/A	N/A	N/A	N/A
DRM 5	Do not generate power	1,417	0,784	1,108	P
DRM 6	Do not generate at more than 50% of rated power	23,994	0,956	0,356	P
DRM 5 and DRM 6		1,417	0,784	1,108	P
DRM 7	Do not generate at more than 75% of rated power AND Sink reactive power if capable	36,028	0,821	0,828	P
DRM 6 and DRM 7		23,994	0,956	0,356	P
DRM 8	Increase power generation (subject to constraints from other active DRMs)	47,643	0,549	0,570	P
Note: Switching time limit : 2s The tests had been performed on the SOFAR 40000TL-Sx Series and SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software					

6.3.2.2 Volt-watt response mode (Australia Default Setting)				P
SOFAR 33000TL-Sx Series				
Test value	a) V1	b) V2	c) V3	d) V4
Voltage (V)	206,7	219,6	249,6	265,7
P (kW)	33,011	33,067	33,130	7,815
P/P_{rated} (%)	100,032	100,202	100,393	23,683



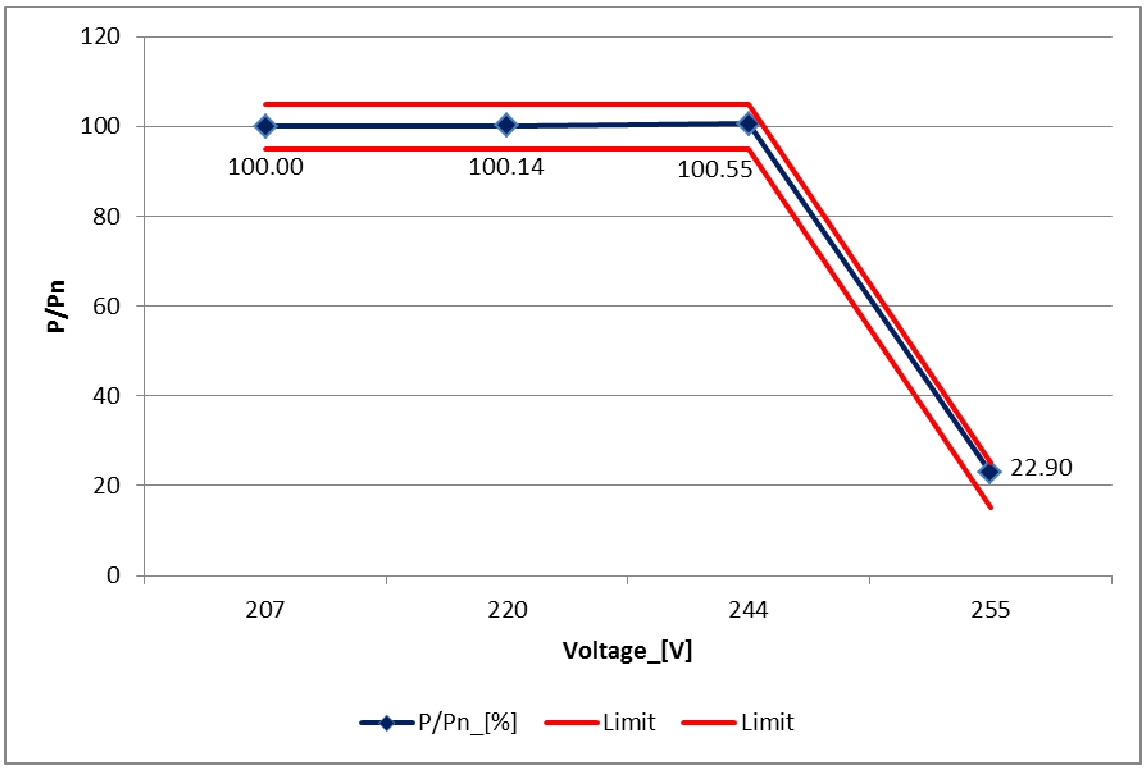
SOFAR 40000TL-Sx Series				
Test value	a) V1	b) V2	c) V3	d) V4
Voltage (V)	206,9	219,8	249,0	264,9
P (kW)	39,576	39,666	38,136	8,610
P/P_{rated} (%)	98,940	99,166	95,339	21,525



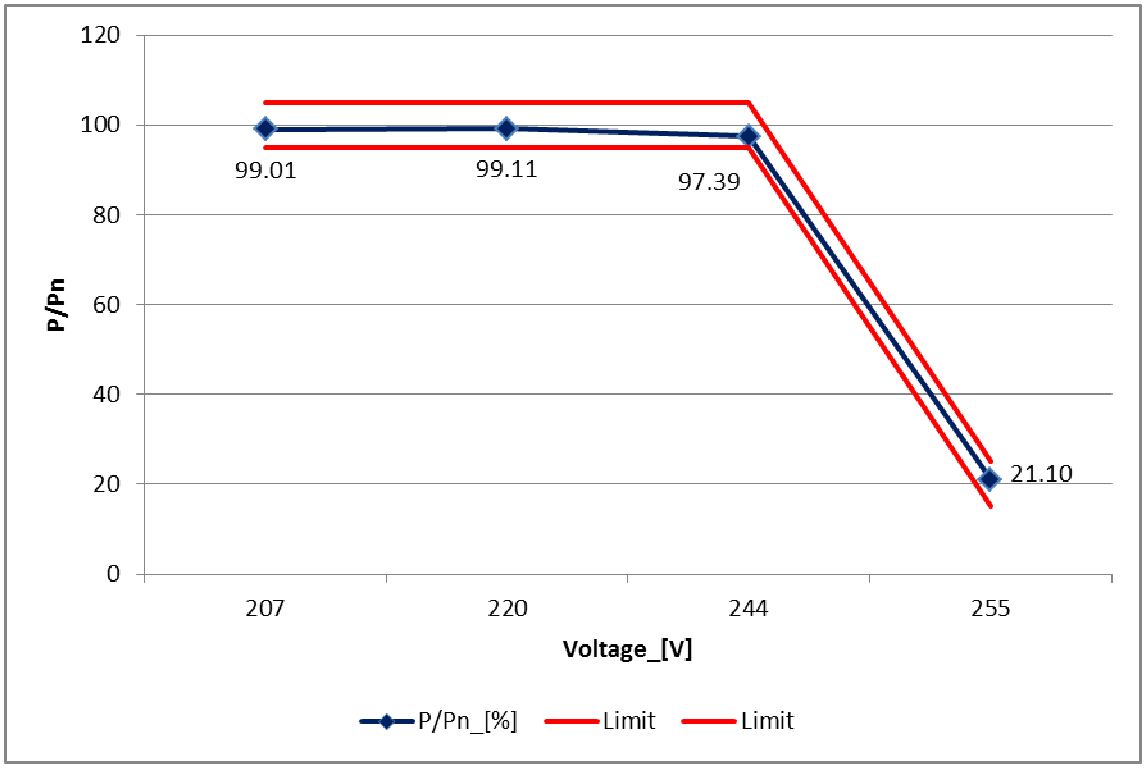
Note:

The tests had been performed on the SOFAR 40000TL-Sx Series and SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

6.3.2.2 Volt-watt response mode (New Zealand Default Setting)				P
SOFAR 40000TL-Sx Series				
Test value	a) V1	b) V2	c) V3	d) V4
Voltage (V)	206,7	219,6	243,6	255,0
P (kW)	32,999	33,045	33,180	7,557
P/P_{rated} (%)	100,00	100,14	100,55	22,90



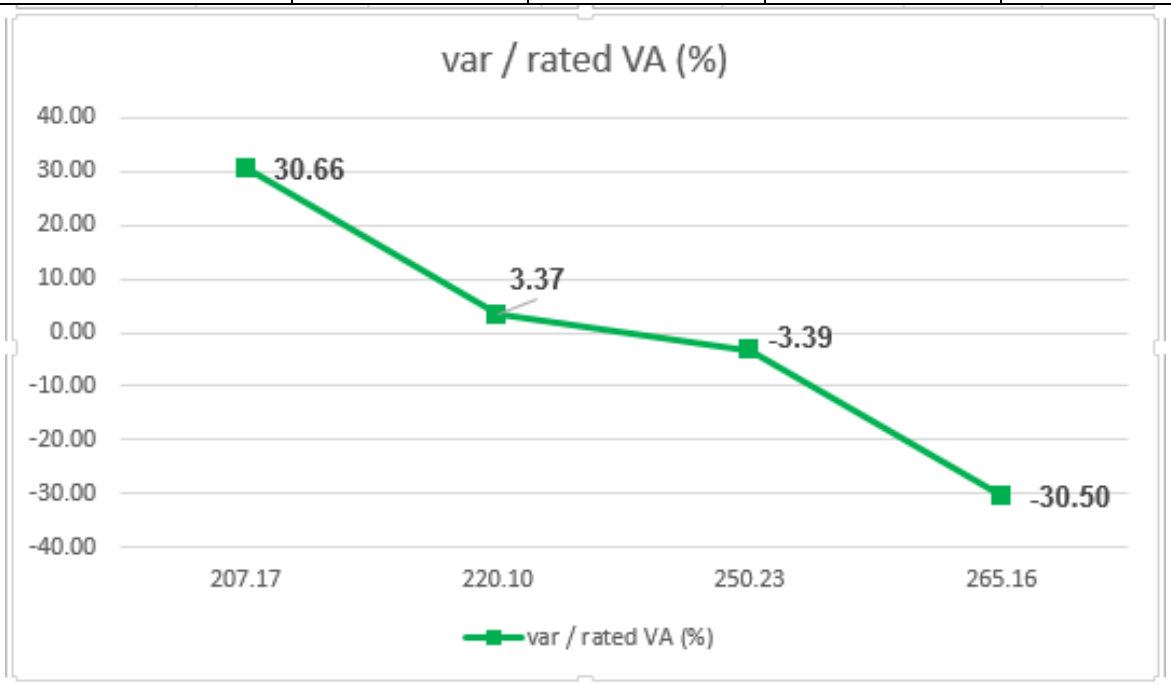
SOFAR 40000TL-Sx Series				
Test value	a) V1	b) V2	c) V3	d) V4
Voltage (V)	206,9	219,8	243,9	255,1
P (kW)	39,606	39,644	38,955	8,441
P/P_{rated} (%)	99,01	99,11	97,39	21,10



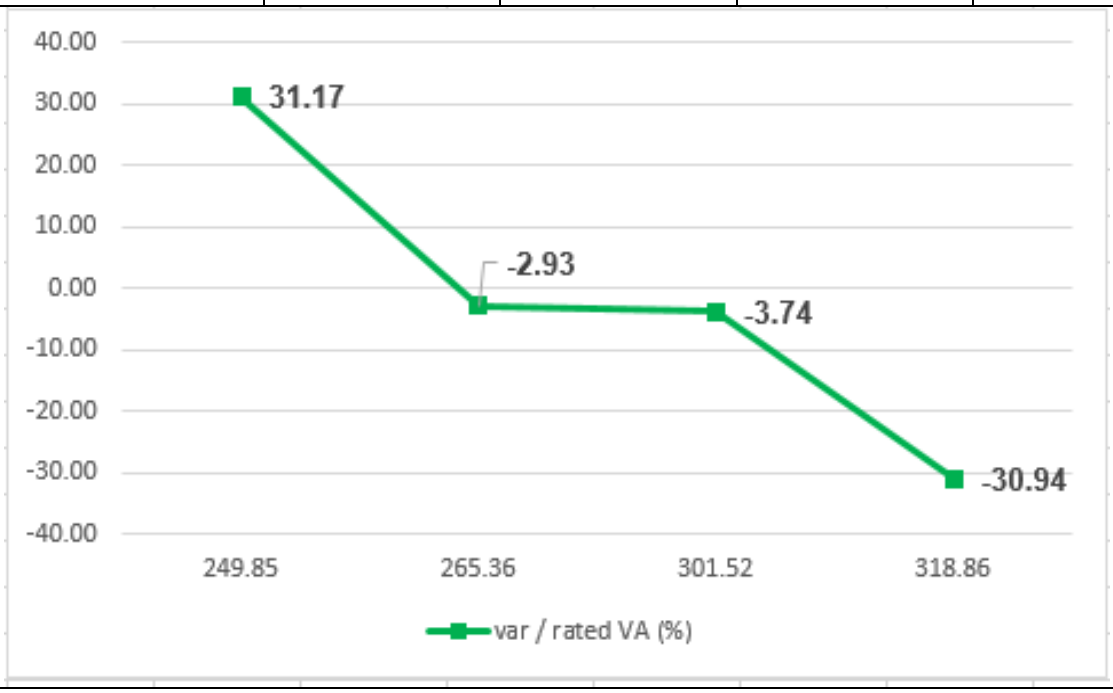
Note:

The tests had been performed on the SOFAR 40000TL-Sx Series and SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

6.3.2.3 Volt-var response mode (Australia Default Setting)				P
SOFAR 33000TL-Sx Series				
Test value	a) V1	b) V2	c) V3	d) V4
Voltage (V):	207,17	220,10	250,23	265,16
Q (kVar)	10,12	1,11	-1,12	-10,06
var / rated VA (%)	30,66	3,37	-3,39	-30,50



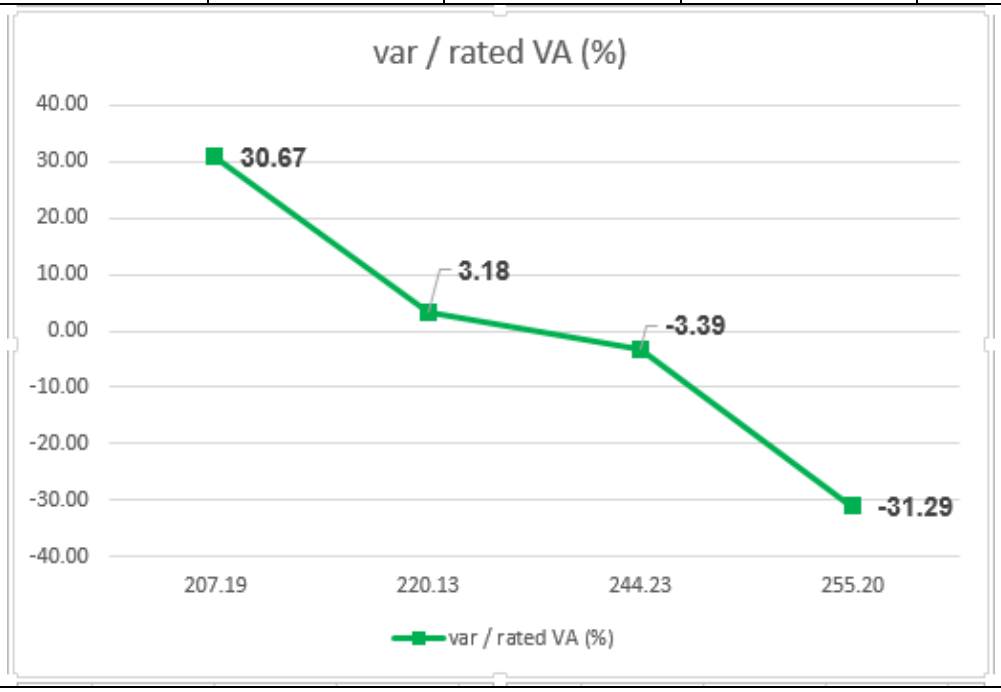
SOFAR 40000TL-Sx Series				
Test value	a) V1	b) V2	c) V3	d) V4
Voltage (V):	249,85	265,36	301,52	318,86
Q (kVar)	12,47	-1,17	-1,50	-12,37
var / rated VA (%)	31,17	-2,93	-3,74	-30,94



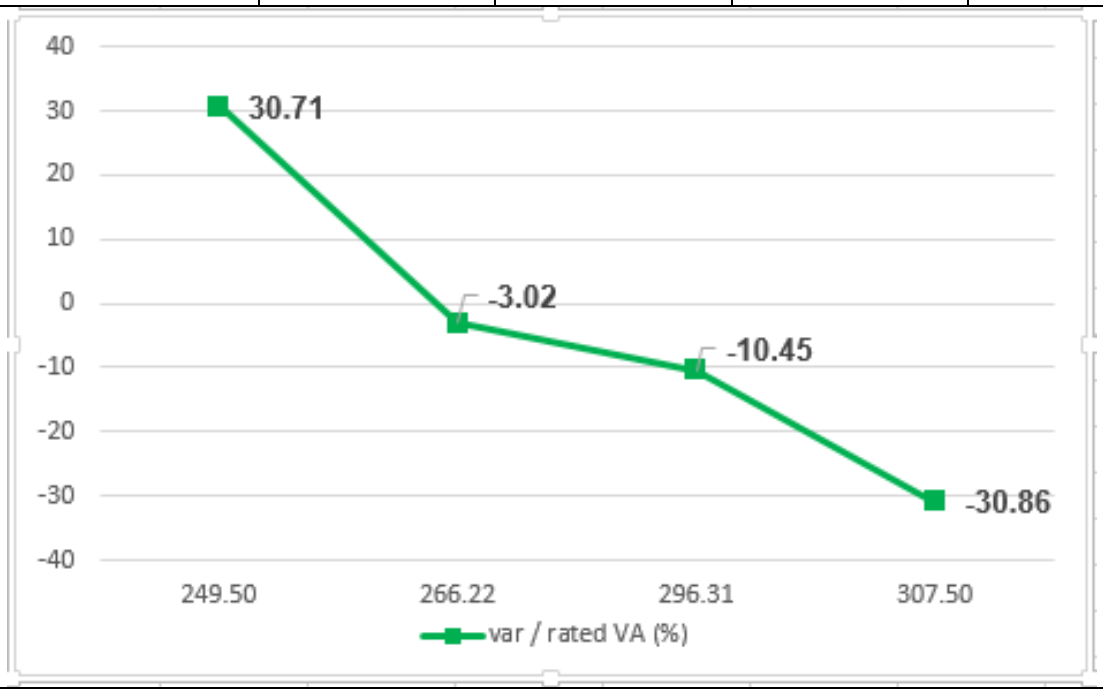
Note:
1. The percentage var/VA level leading is the inverter sourcing vars to the grid, whereas the percentage var/VA level lagging is the inverter sinking vars from the grid.
2. Inverters may provide a range up to 100% leading or lagging.
3. % of rated apparent power use for test.

The tests had been performed on the SOFAR 40000TL-Sx Series and SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

6.3.2.3 Volt-var response mode (New Zealand Default Setting)				P
SOFAR 33000TL-Sx Series				
Test value	a) V1	b) V2	c) V3	d) V4
Voltage (V):	207,19	220,13	244,23	255,20
Q (kVar)	10,12	1,05	-1,12	-10,32
var / rated VA (%)	30,67	3,18	-3,39	-31,29



SOFAR 40000TL-Sx Series				
Test value	a) V1	b) V2	c) V3	d) V4
Voltage (V):	249,50	266,22	293,74	307,50
Q (kVar)	12,28	-1,21	-1,76	-12,34
var / rated VA (%)	30,71	-3,02	-4,39	-30,86



Note:
1. The percentage var/VA level leading is the inverter sourcing vars to the grid, whereas the percentage var/VA level lagging is the inverter sinking vars from the grid.
2. Inverters may provide a range up to 100% leading or lagging.
3. % of rated apparent power use for test.

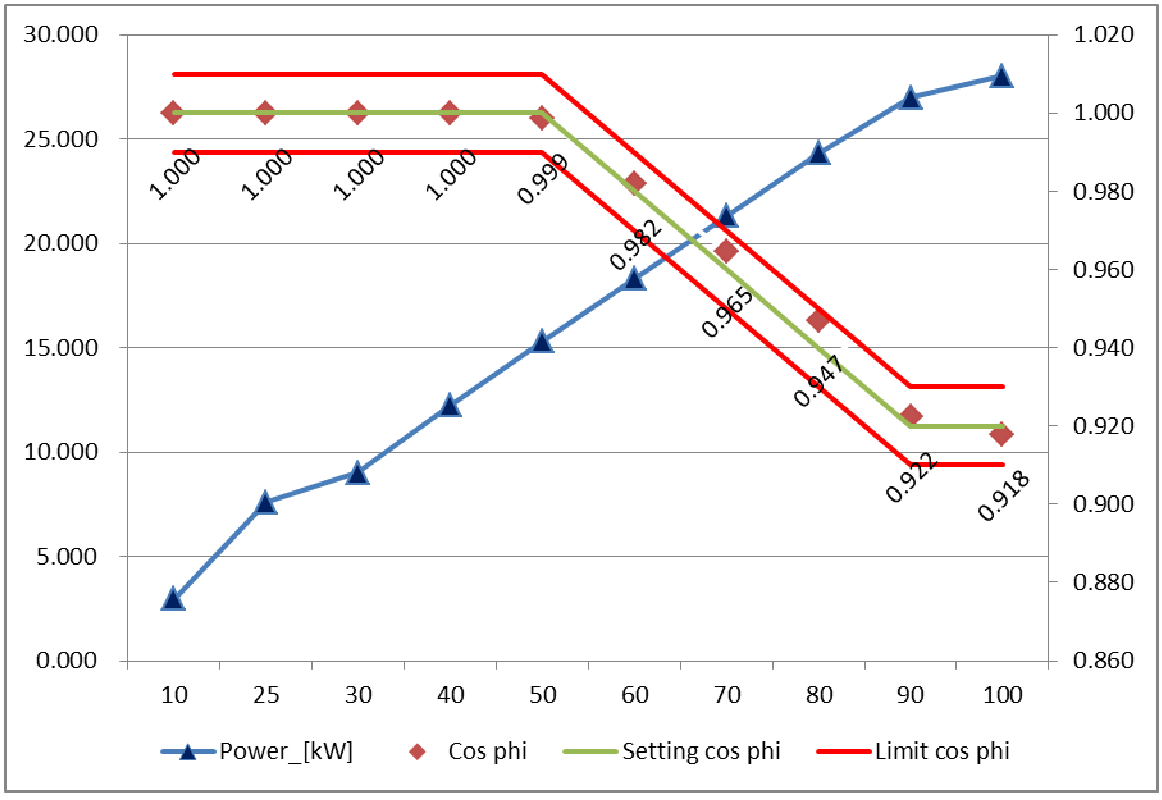
The tests had been performed on the SOFAR 40000TL-Sx Series and SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

6.3.3 Fixed power factor mode and reactive power mode										P
SOFAR 30000TL-Sx Series										
P/P_{rated} in %	10	25	30	40	50	60	70	80	90	100
Setting PF cosφ = 1										
U (V)	230,2	230,2	230,2	230,2	230,2	230,2	230,2	230,2	230,2	230,2
Power (kW)	2,223	6,251	9,176	12,103	15,025	18,315	21,237	24,155	27,080	30,007
Reactive power (kVar)	-0,013	-0,017	-0,022	-0,020	-0,022	-0,037	-0,037	-0,083	-0,104	-0,114
Power factor	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999
PF = 0,8 leading										
U (V)	230,3	230,4	230,5	230,7	229,6	229,6	229,6	229,7	229,7	229,7
Power (kW)	3,014	5,907	8,910	11,924	15,084	18,118	21,063	23,778	23,778	23,777
Reactive power (kVar)	2,352	4,466	6,662	8,873	11,261	13,525	15,292	17,282	17,281	17,273
Power factor	0,788	0,798	0,801	0,802	0,801	0,801	0,809	0,809	0,809	0,809
PF = 0,8 lagging										
U (V)	230,3	230,4	230,5	230,7	230,0	230,0	229,9	229,9	229,9	229,9
Power (kW)	2,947	5,986	8,854	11,892	14,638	17,599	21,001	23,931	23,975	23,983
Reactive power (kVar)	-2,086	-4,332	-6,460	-8,723	-10,957	-13,191	-15,850	-18,039	-18,075	-18,086
Power factor	0,816	0,810	0,808	0,806	0,801	0,800	0,798	0,799	0,798	0,798
SOFAR 33000TL-Sx Series										
P/P_{rated} in %	10	25	30	40	50	60	70	80	90	100
Setting PF cosφ = 1										
U (V)	230,3	230,3	230,3	230,3	230,3	230,3	230,3	230,3	230,3	230,3
Power (kW)	3,261	6,560	9,851	13,302	16,433	19,725	23,014	26,310	29,608	33,572
Reactive power (kVar)	-0,013	-0,020	-0,032	-0,027	-0,028	-0,044	-0,061	-0,075	-0,090	-0,104
Power factor	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999
PF = 0,8 leading										
U (V)	230,3	230,5	230,6	230,7	230,9	229,6	229,6	229,8	229,8	229,7
Power (kW)	3,179	6,523	9,739	13,071	16,360	20,023	23,139	26,086	26,524	25,074
Reactive power (kVar)	2,473	4,914	7,267	9,716	12,120	14,950	16,818	19,014	19,338	18,245
Power factor	0,789	0,799	0,801	0,803	0,804	0,801	0,809	0,808	0,808	0,809
PF = 0,8 lagging										
U (V)	230,3	230,5	230,6	230,7	230,9	229,1	229,9	229,9	229,9	229,9
Power (kW)	3,274	6,546	9,772	13,102	16,504	19,470	23,097	26,040	26,720	26,713
Reactive power (kVar)	-2,331	-4,746	-7,141	-9,621	-12,156	-14,604	-17,443	-19,608	-20,121	-20,104
Power factor	0,815	0,810	0,807	0,806	0,805	0,800	0,798	0,799	0,799	0,799

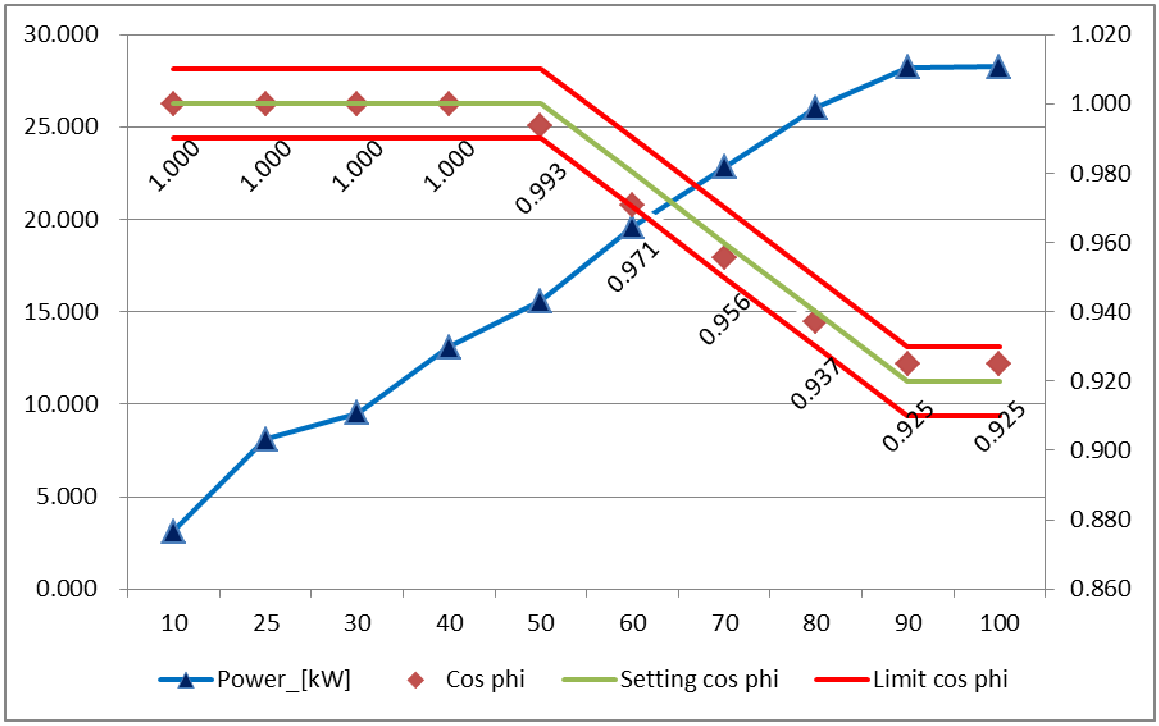
SOFAR 40000TL-Sx Series										
P/P_{rated} in %	10	25	30	40	50	60	70	80	90	100
Setting PF cosφ = 1										
U (V)	229,9	230,1	230,2	230,4	230,6	230,7	230,1	230,0	229,9	229,8
Power (kW)	3,994	7,952	11,958	15,998	19,936	23,803	27,984	31,955	35,895	39,461
Reactive power (kVar)	0,086	0,064	0,063	0,062	0,055	0,042	-1,452	-1,665	-1,898	-1,628
Power factor	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999
PF = 0,8 leading										
U (V)	230,4	230,5	230,7	230,8	231,1	229,6	229,7	229,9	229,9	229,8
Power (kW)	3,929	7,935	11,932	15,927	19,863	23,751	27,633	30,631	30,852	29,513
Reactive power (kVar)	3,030	5,952	8,885	11,809	14,703	17,629	20,874	23,120	22,836	22,240
Power factor	0,792	0,800	0,802	0,803	0,804	0,803	0,798	0,798	0,804	0,799
PF = 0,8 lagging										
U (V)	230,4	230,5	230,6	230,8	229,9	229,8	229,9	230,0	230,0	230,0
Power (kW)	3,917	7,912	11,887	15,911	19,751	23,284	27,412	31,260	32,866	32,463
Reactive power (kVar)	-2,808	-5,761	-8,718	-11,717	-14,663	-17,379	-20,546	-23,508	-23,786	-24,445
Power factor	0,813	0,808	0,806	0,805	0,803	0,801	0,800	0,799	0,810	0,799

Note:
The gird-connected inverter of power plant type shall be evaluated.
Each power-bin must be kept for at least 3 minute.
If the inverter is capable of operating with reactive power mode, the maximum ratio of reactive power (vars) to rated apparent power should be 100%.
If the inverter is capable of operating with fixed power factor mode, the minimum range of settings should be 0.8 leading to 0.8 lagging.

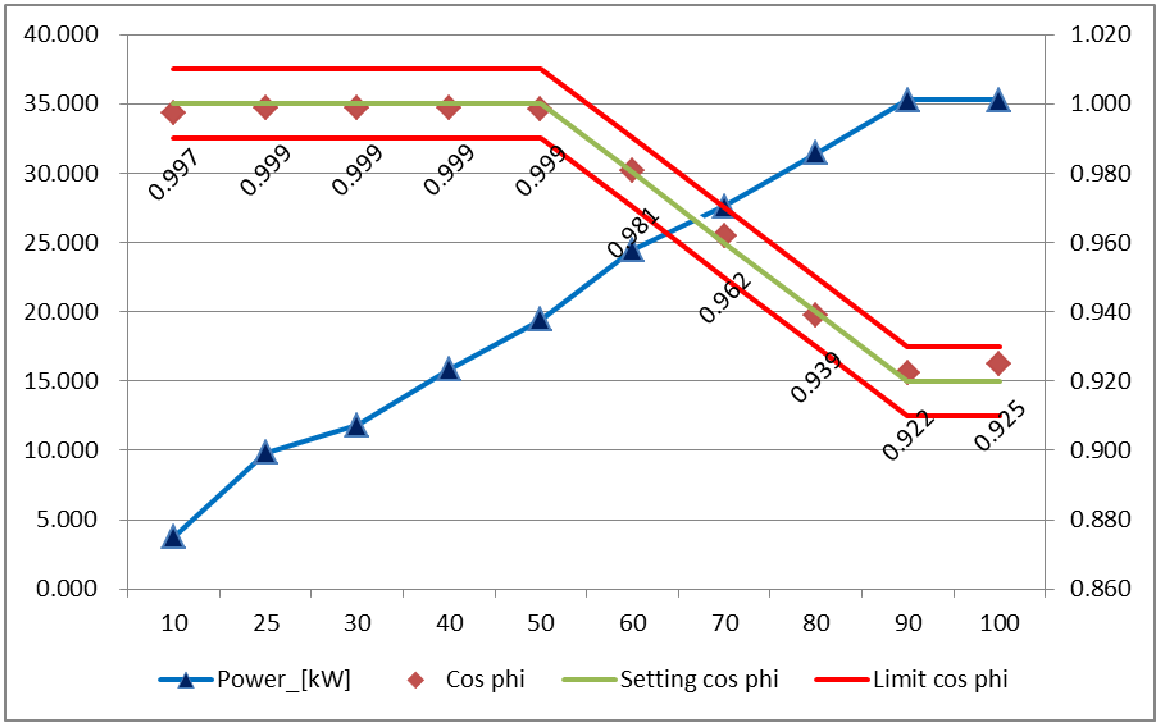
6.3.4 characteristic power factor curve for cos φ (P) (Power response)										P
SOFAR 30000TL-Sx Series										
cos φ (P):										
P/P_{rated} (%)	10	25	30	40	50	60	70	80	90	100
30 s mean value	10% to 100% P_{rated}									
U (V):	229,0	229,0	229,0	228,9	228,9	229,0	229,1	229,1	229,0	229,0
P (kW):	2,965	7,608	8,996	12,238	15,300	18,308	21,317	24,312	26,977	28,020
P / P_{rated} (%):	9,88	25,36	29,99	40,79	50,99	61,03	71,06	81,04	89,92	93,40
Q (kVar):	0,007	-0,107	-0,135	-0,193	-0,763	-3,529	-5,821	-8,249	-11,290	-12,129
cos φ:	1,000	1,000	1,000	1,000	0,999	0,982	0,965	0,947	0,922	0,918
$\cos \varphi_{setpoint}$ of P:	1	1	1	1	1	0,98	0,96	0,94	0,92	0,9
Limit cos φ :	$\cos \varphi_{setpoint} \pm 0,01$									



SOFAR 33000TL-Sx Series										
cos φ (P):										
P/P_{rated} (%)	10	25	30	40	50	60	70	80	90	100
30 s mean value	10% to 100% P_{rated}									
U (V):	229,0	229,0	229,0	228,9	228,9	229,0	229,1	229,0	229,1	229,1
P (kW):	3,122	8,116	9,533	13,091	15,583	19,596	22,838	26,055	28,231	28,270
P / P_{rated} (%):	9,46	24,59	28,89	39,67	47,22	59,38	69,21	78,95	85,55	85,67
Q (kVar):	0,003	-0,117	-0,145	-0,208	-1,685	-4,837	-7,041	-9,712	-11,615	-11,633
cos φ:	1,000	1,000	1,000	1,000	0,993	0,971	0,956	0,937	0,925	0,925
cos $\varphi_{setpoint}$ of P:	1	1	1	1	1	0,98	0,96	0,94	0,92	0,9
Limit cos φ :	cos $\varphi_{setpoint}$ ± 0,01									



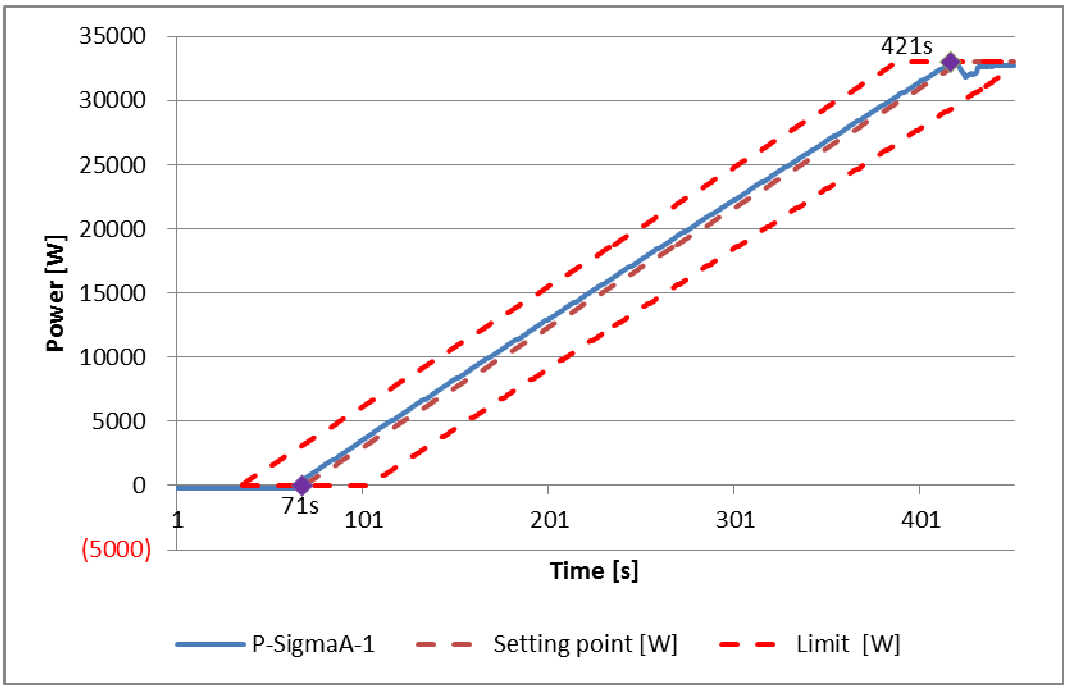
SOFAR 40000TL-Sx Series										
cos φ (P):										
P/P_{rated} (%)	10	25	30	40	50	60	70	80	90	100
30 s mean value	10% to 100% P_{rated}									
U (V):	229,1	229,0	229,0	228,9	228,9	229,0	229,0	229,1	229,1	229,1
P (kW):	3,723	9,814	11,835	15,852	19,452	24,477	27,624	31,456	35,265	35,271
P / P_{rated} (%):	9,31	24,54	29,59	39,63	48,63	61,19	69,06	78,64	88,16	88,18
Q (kVar):	-0,272	-0,503	-0,590	-0,770	-1,041	-4,873	-7,853	-11,523	-14,778	-14,495
cos φ:	0,997	0,999	0,999	0,999	0,999	0,981	0,962	0,939	0,922	0,925
cos $\varphi_{setpoint}$ of P:	1	1	1	1	1	0,98	0,96	0,94	0,92	0,9
Limit cos φ :	cos $\varphi_{setpoint}$ ± 0,01									



Note:

The response curve required for the cos φ (P) response should be defined within displacement power factor range of 0.9 leading to 0.9 lagging.

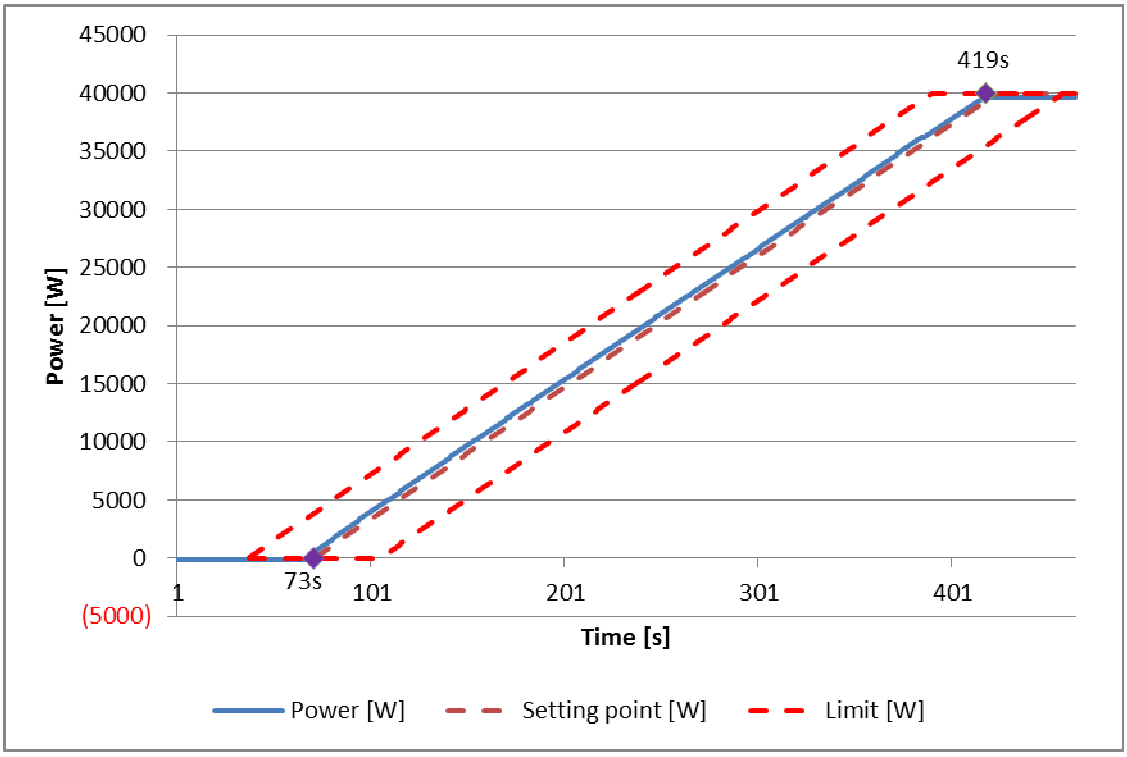
6.3.5 Power rate limit	P
SOFAR 33000TL-Sx Series	
6.3.5.3.2 Test (a): Soft ramp up after connect or reconnect	
Time measurement from 0% to 100% P_{rated} (min)	351s
W_{Gra}	93,5W
Limit W_{Gra} : (Default : 16,67%)	17%



6.3.5.3.3 Test (b): Change in a.c. operation and control (DRM control only)		
DRM mode	DRM 5, DRM 6, DRM 7, DRM 8	N/A
Power change (%)	Increase: __0__% to _100__%	N/A
Time measurement	351s	N/A
W_{Gra}	93,5W	N/A
Limit W_{Gra} : (Default : 16,67%)	17%	N/A
See table 6.3.5.3.2		

6.3.5.3.4 Test ©: Change in energy source operation (only for multiple mode inverters with energy storage)		
DRM mode	N/A	N/A
Power change	N/A	N/A
Time measurement	N/A	N/A
W_{Gra}	N/A	N/A
Limit W_{Gra} : (Default : 16,67%)	N/A	N/A
N/A		

6.3.5.4 Nonlinearity of power rate limit changes		
DRM mode	DRM 0	N/A
Power change	Increase: __0__% to _100__%	N/A
Time measurement	351s	N/A
W_{Gra}	93,5W	N/A
Limit W_{Gra} : (Default : 16,67%)	17%	N/A
See table 6.3.5.3.2		
SOFAR 40000TL-Sx Series		
6.3.5.3.2 Test (a): Soft ramp up after connect or reconnect		
Time measurement from 0% to 100% P_{rated} (min)	346s	
W_{Gra}	113,3W	
Limit W_{Gra} : (Default : 16,67%)	17%	



6.3.5.3.3 Test (b): Change in a.c. operation and control (DRM control only)		
DRM mode	DRM 5, DRM 6, DRM 7, DRM 8	N/A
Power change (%)	Increase: __0__% to _100__%	N/A
Time measurement	346s	N/A
W_{Gra}	113,3W	N/A
Limit W_{Gra} : (Default : 16,67%)	17%	N/A
See table 6.3.5.3.2		
6.3.5.3.4 Test ©: Change in energy source operation (only for multiple mode inverters with energy storage)		

DRM mode	N/A	N/A
Power change	N/A	N/A
Time measurement	N/A	N/A
W_{Gra}	N/A	N/A
Limit W_{Gra} : (Default : 16,67%)	N/A	N/A
N/A		
6.3.5.4 Nonlinearity of power rate limit changes		
DRM mode	DRM 0	N/A
Power change	Increase: __0__% to _100__%	N/A
Time measurement	346s	N/A
W_{Gra}	113,3W	N/A
Limit W_{Gra} : (Default : 16,67%)	17%	N/A
See table 6.3.5.3.2		
Note: The tests had been performed on the SOFAR 40000TL-Sx Series and SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.		

7.3 Active anti-islanding protection
Appendix F Active anti-islanding test

F3 Test under load condition A = Light Electronic Load	**P**

SOFAR 33000TL-Sx Series

Inverter output Power	Approx. Inverter power (W)	Time to trip (Average in Sec)	Disconnection Limit (in sec)
10+/-5%	3300	1,48	2s
50+/-5%	16500	1,20	2s
100+/-5%	33000	1,38	2s

Light Electronic Load:

Test circuit according to AS 4777.2 Annex F (Figure F1 and F2). Grid voltage equal to nominal load. Via dc input control ac output power so that it equals to 10+/-5% of rated output. Switch S shall be opened and time interval for the inverter being disconnected shall be recorded. Same procedure for 50+/-5% and 100+/-5%.

The load of Figure F2 is used for the inverters with rated apparent power not more than 5kVA.

For other inverters, the resistor load of Figure 2 equal to 0,1% of rated apparent power.

The test result refer to the original test report “150715025GZU-004” issued by Intertek on Sep. 15, 2015.

The tests had been performed on the SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

7.3 Active anti-islanding protection
Appendix F Active anti-islanding test

F4 Test under load condition B = Load match	**P**

SOFAR 33000TL-Sx Series

Inverter output Power	Approx. Inverter power (W)	Time to trip (Average in Sec)	Disconnection Limit (in sec)
10+/-5%	3300	0,980	2s
50+/-5%	16500	0,928	2s
100+/-5%	33000	1,170	2s

Load match:

Test circuit according to AS 4777.2 Annex F (Figure F1 and F3) Grid voltage equal to nominal load +/-5%, R shall match real power output, L and C shall draw reactive power according to Table F1. Via dc input control ac output power so that it equals to 10+/-5% of rated output. R shall be in- or decreased until resonant load matches real power output to within +/-5%.Inductive or capacitive load shall be adjusted until reactive power consumption matches the reactive power output of the inverter to within +/-5%. Switch S shall be opened and time interval of the inverter being disconnected shall be recorded. Same procedure for 50+/-5% and 100+/-5%.

The test result refer to the original test report “150715025GZU-004” issued by Intertek on Sep. 15, 2015.

The tests had been performed on the SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

7.3 Active anti-islanding protection
Appendix F Active anti-islanding test

F5 Test under load condition C = Load match + 10%	**P**

SOFAR 33000TL-Sx Series

Inverter output Power	Approx. Inverter power (W)	Time to trip (Average in Sec)	Disconnection Limit (in sec)
10+/-5%	3300	1,03	2s
50+/-5%	16500	0,94	2s
100+/-5%	33000	1,01	2s

Load match + 10%:

Test circuit according to AS 4777.2 Annex F (Figure F1 and F3) Grid voltage equal to nominal load +/-5%, R shall match real power output, L and C shall draw reactive power according to Table F1. Via dc input control ac output power so that it equals to 10+/-5% of rated output. R shall be in- or decreased until resonant load matches real power output to within +/-5%.Inductive or capacitive load shall be adjusted until reactive power consumption matches the reactive power output of the inverter to within +/-5%. Switch S shall be opened and time interval of the inverter being disconnected shall be recorded. Same procedure for 50+/-5% and 100+/-5%.

The test result refer to the original test report “150715025GZU-004” issued by Intertek on Sep. 15, 2015.

The tests had been performed on the SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

7.3 Active anti-islanding protection
Appendix F Active anti-islanding test

F3 Test under load condition A = Light Electronic Load	**P**

SOFAR 40000TL-Sx Series

Inverter output Power	Approx. Inverter power (W)	Time to trip (Average in Sec)	Disconnection Limit (in sec)
10+/-5%	4020	0,076	2s
50+/-5%	19890	0,068	2s
100+/-5%	39700	0,090	2s

Light Electronic Load:

Test circuit according to AS 4777.2 Annex F (Figure F1 and F2). Grid voltage equal to nominal load. Via dc input control ac output power so that it equals to 10+/-5% of rated output. Switch S shall be opened and time interval for the inverter being disconnected shall be recorded. Same procedure for 50+/-5% and 100+/-5%.

The load of Figure F2 is used for the inverters with rated apparent power not more than 5kVA.

For other inverters, the resistor load of Figure 2 equal to 0,1% of rated apparent power.

7.3 Active anti-islanding protection **Appendix F Active anti-islanding test**	
F4 Test under load condition B = Load match	**P**

SOFAR 40000TL-Sx Series

Inverter output Power	Approx. Inverter power (W)	Time to trip (Average in Sec)	Disconnection Limit (in sec)
10+/-5%	4005	0,084	2s
50+/-5%	20010	0,080	2s
100+/-5%	39780	0,105	2s

Load match:

Test circuit according to AS 4777.2 Annex F (Figure F1 and F3) Grid voltage equal to nominal load +/-5%, R shall match real power output, L and C shall draw reactive power according to Table F1. Via dc input control ac output power so that it equals to 10+/-5% of rated output. R shall be in- or decreased until resonant load matches real power output to within +/-5%.Inductive or capacitive load shall be adjusted until reactive power consumption matches the reactive power output of the inverter to within +/-5%. Switch S shall be opened and time interval of the inverter being disconnected shall be recorded. Same procedure for 50+/-5% and 100+/-5%.

7.3 Active anti-islanding protection
Appendix F Active anti-islanding test

F5 Test under load condition C = Load match + 10%	**P**

SOFAR 40000TL-Sx Series

Inverter output Power	Approx. Inverter power (W)	Time to trip (Average in Sec)	Disconnection Limit (in sec)
10+/-5%	4005	0,086	2s
50+/-5%	20010	0,088	2s
100+/-5%	39780	0,102	2s

Load match + 10%:

Test circuit according to AS 4777.2 Annex F (Figure F1 and F3) Grid voltage equal to nominal load +/-5%, R shall match real power output, L and C shall draw reactive power according to Table F1. Via dc input control ac output power so that it equals to 10+/-5% of rated output. R shall be in- or decreased until resonant load matches real power output to within +/-5%.Inductive or capacitive load shall be adjusted until reactive power consumption matches the reactive power output of the inverter to within +/-5%. Switch S shall be opened and time interval of the inverter being disconnected shall be recorded. Same procedure for 50+/-5% and 100+/-5%.

7.3 Active anti-islanding protection **IEC 62116 Active anti-islanding test** Load imbalance (real, reactive load) for test condition A (EUT ouput = 100%)	**P**

SOFAR 40000TL-Sx Series

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac RLC consumes inverter real power within +/- 3% Distortion factor of chokes < 3% Quality =1
Disconnection limit	2s

No	P_{EUT} 1) (% of EUT rating)	Reactive load (% of Q_L in 6.1.d) 1)	P_{AC} 2) (% of nominal)	Q_{AC} 3) (% of nominal)	Run on Time (ms)	P_{EUT} (W)	Qf	V_{DC}	Remarks4)
1	**100**	**100**	**0**	**0**	**1064**	**13333**	**1,003**	**750**	**Test A at BL**
4	100	100	-5	-5	964	13333	1,029	750	Test A at IB
5	100	100	-5	0	1012	13333	1,056	750	Test A at IB
6	100	100	-5	+5	928	13333	1,082	750	Test A at IB
7	100	100	0	-5	964	13333	0,978	750	Test A at IB
8	100	100	0	+5	988	13333	1,028	750	Test A at IB
9	100	100	+5	-5	560	13333	0,931	750	Test A at IB
10	100	100	+5	0	620	13333	0,956	750	Test A at IB
11	100	100	+5	+5	852	13333	0,979	750	Test A at IB

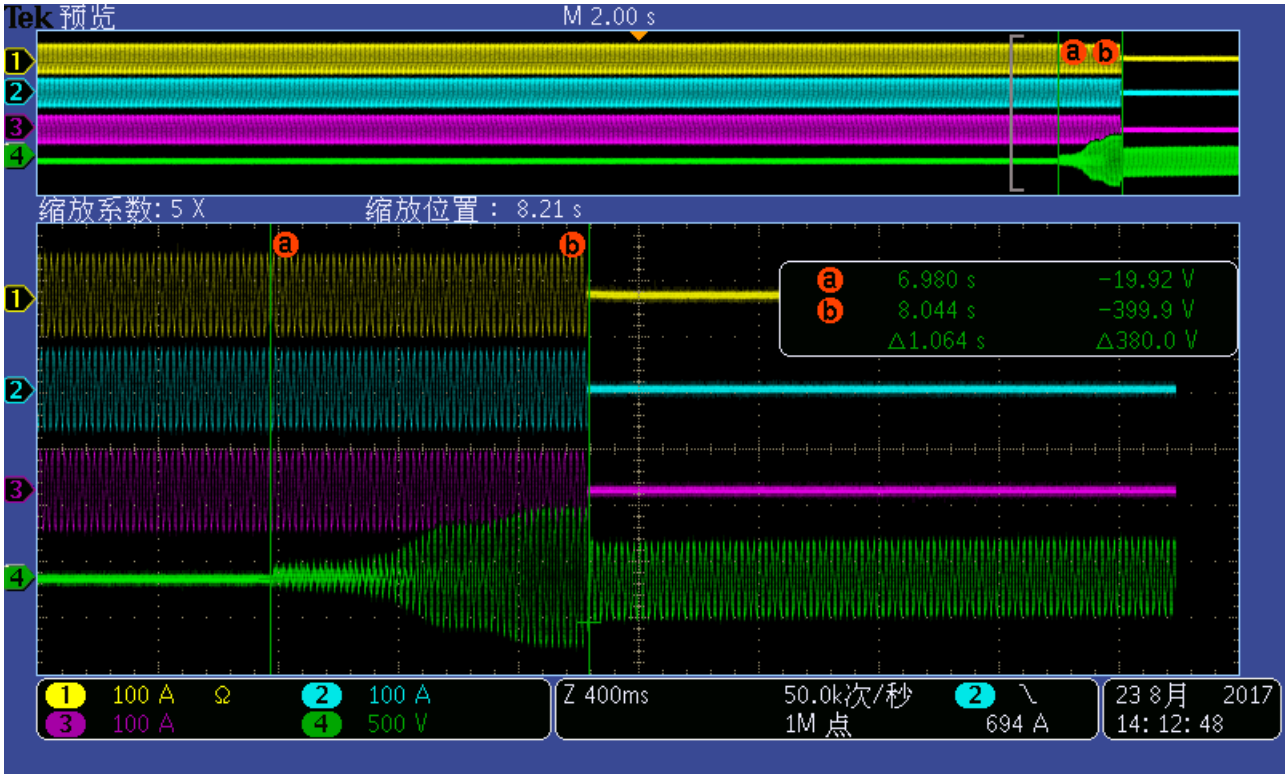
Parameter at 0%	L= 12,63 mH	R= 3,97 Ω	C= 802,27 µF

Indicate additional shut down time included in above results. (Disconnection device operation time)	20ms

Note:
Note for technologies which have a substantial shut down time this can be added to the 0.5 seconds in establishing that the trip occurred in less than 0.5s. Maximum shut down time could therefore be up to 1.0 seconds for these technologies.
RLC is adjusted to min. +/-1% of the inverter rated output power
1) P_{EUT}: EUT output power
2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.
3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.
4) BL: Balance condition, IB: Imbalance condition.
Condition A:
EUT output power PEUT = Maximum 5)
EUT input voltage 6) = >90% of rated input voltage range
5) Maximum EUT output power condition should be achieved using the maximum allowable input power. Actual output power may exceed nominal rated output.
6) Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 90 % of range =X + 0,9 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

The tests had been performed on the SOFAR 40000TL-Sx Series is valid for the SOFAR 30000TL-Sx Series, and SOFAR 33000TL-Sx Series, since it is similar in hardware and just power derated by software.

Disconnection at P_{AC} -5% and Q_{AC} 0% reactive load and 100% nominal power



7.3 Active anti-islanding protection **IEC 62116 Active anti-islanding test** Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)	**P**

SOFAR 40000TL-Sx Series

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac RLC consumes inverter real power within +/- 3% Distortion factor of chokes < 3% Quality =1
Disconnection limit	2s

No	P_{EUT} 1) (% of EUT rating)	Reactive load (% of Q_L in 6.1.d) 1)	P_{AC} 2) (% of nominal)	Q_{AC} 3) (% of nominal)	Run on Time (ms)	P_{EUT} (W)	Qf	V_{DC}	Remarks4)
12	66	66	0	-5	960	8888	0,977	525	Test B at IB
13	66	66	0	-4	964	8888	0,982	525	Test B at IB
14	66	66	0	-3	964	8888	0,988	525	Test B at IB
15	66	66	0	-2	932	8888	0,993	525	Test B at IB
16	**66**	**66**	**0**	**-1**	**1156**	**8888**	**0,998**	**525**	**Test B at IB**
2	66	66	0	0	1108	8888	1,003	525	Test B at BL
17	66	66	0	1	952	8888	1,008	525	Test B at IB
18	66	66	0	2	872	8888	1,013	525	Test B at IB
19	66	66	0	3	608	8888	1,018	525	Test B at IB
20	66	66	0	4	916	8888	1,023	525	Test B at IB
21	66	66	0	5	892	8888	1,027	525	Test B at IB

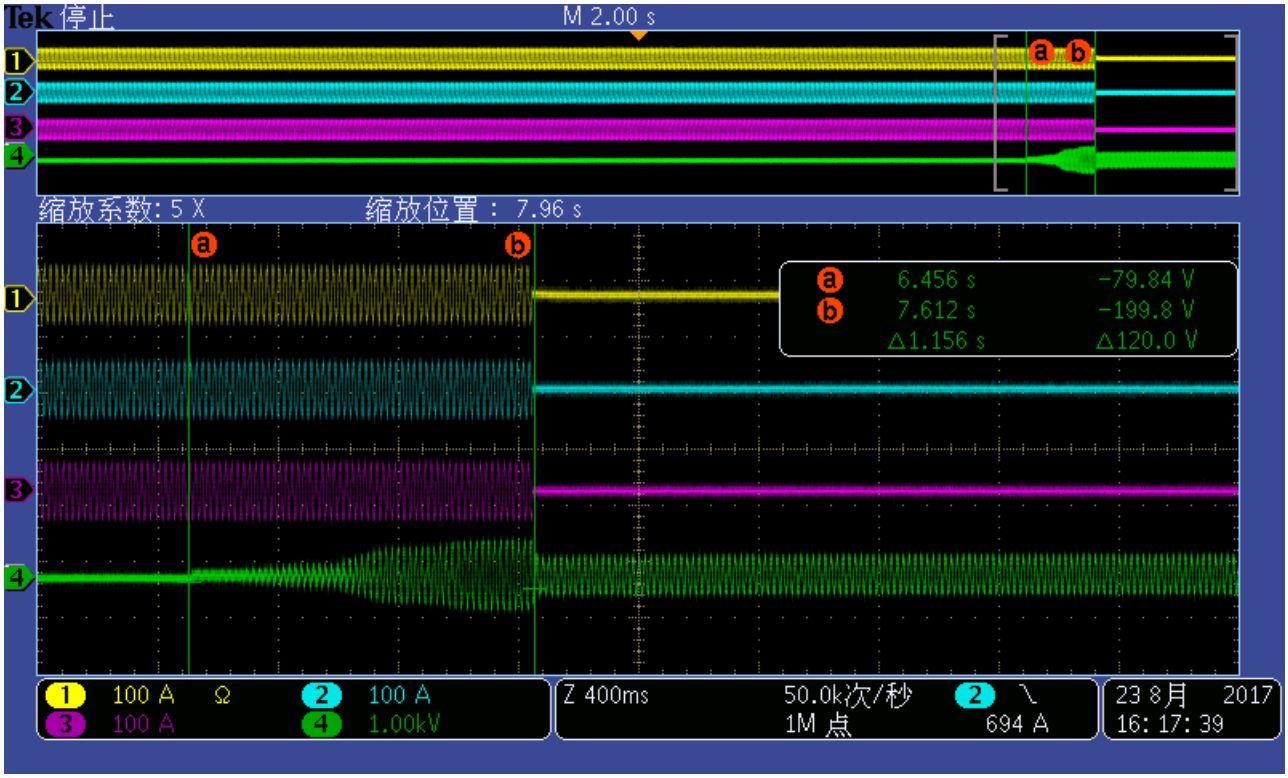
Parameter at 0%	L= 18,95mH	R= 5,95Ω	C= 534,81µF

Indicate additional shut down time included in above results. (Disconnection device operation time)	20ms

Note:
RLC is adjusted to min. +/-1% of the inverter rated output power
1) P_{EUT}: EUT output power
2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.
3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.
4) BL: Balance condition, IB: Imbalance condition.
Condition B:
EUT output power PEUT = 50 % – 66 % of maximum
EUT input voltage 5) = 50 % of rated input voltage range, ±10 %
5) Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 50 % of range =X + 0,5 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

The tests had been performed on the SOFAR 40000TL-Sx Series is valid for the SOFAR 30000TL-Sx Series, and SOFAR 33000TL-Sx Series, since it is similar in hardware and just power derated by software.

Disconnection at P_{AC} 0% and Q_{AC} -1% reactive load and 66% nominal power



7.3 Active anti-islanding protection **IEC 62116 Active anti-islanding test** Load imbalance (reactive load) for test condition C (EUT output = 25 % – 33 %)	**P**

SOFAR 40000TL-Sx Series

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac RLC consumes inverter real power within +/- 3% Distortion factor of chokes < 3% Quality =1
Disconnection limit	2s

No	P_{EUT} 1) (% of EUT rating)	Reactive load (% of Q_L in 6.1.d) 1)	P_{AC} 2) (% of nominal)	Q_{AC} 3) (% of nominal)	Run on Time (ms)	P_{EUT} (W)	Qf	V_{DC}	Remarks4)
22	33	33	0	-5	936	4444	0,980	300	Test C at IB
23	33	33	0	-4	964	4444	0,985	300	Test C at IB
24	33	33	0	-3	996	4444	0,990	300	Test C at IB
25	33	33	0	-2	972	4444	0,995	300	Test C at IB
26	33	33	0	-1	1144	4444	1,000	300	Test C at IB
3	33	33	0	0	940	4444	1,005	300	Test C at BL
27	33	33	0	1	1048	4444	1,011	300	Test C at IB
28	33	33	0	2	932	4444	1,016	300	Test C at IB
29	33	33	0	3	1072	4444	1,020	300	Test C at IB
30	**33**	**33**	**0**	**4**	**1160**	**4444**	**1,025**	**300**	**Test C at IB**
31	33	33	0	5	1028	4444	1,030	300	Test C at IB

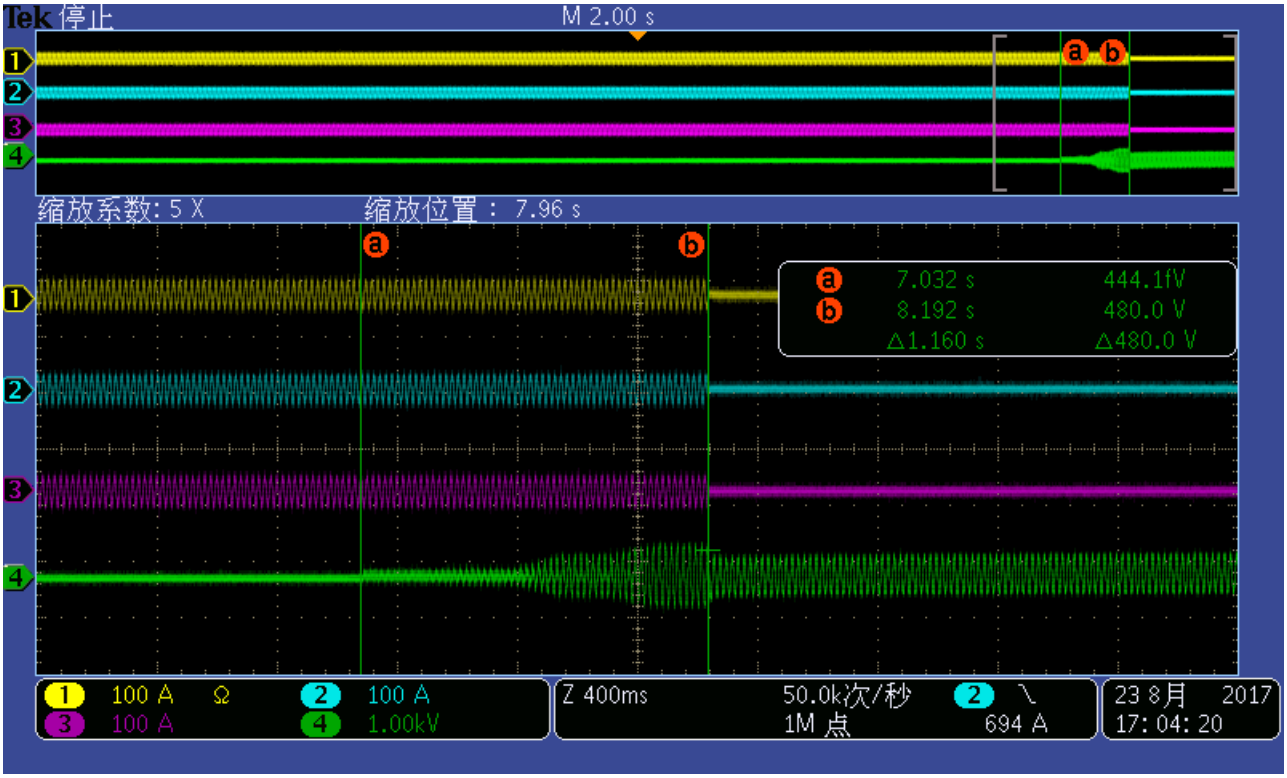
Parameter at 0%	L= 37,89mH	R= 11,90Ω	C= 267,40μF

Indicate additional shut down time included in above results. (Disconnection device operation time)	20ms

Note:
RLC is adjusted to min. +/-1% of the inverter rated output power
1) P_{EUT}: EUT output power
2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.
3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.
4) BL: Balance condition, IB: Imbalance condition.
Condition C:
EUT output power PEUT = 25 % – 33 % 5) of maximum
EUT input voltage 6) = <10 % of rated input voltage range
5) Or minimum allowable EUT output level if greater than 33 %.
6) Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 10 % of range =X + 0,1 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

The tests had been performed on the SOFAR 40000TL-Sx Series is valid for the SOFAR 30000TL-Sx Series, and SOFAR 33000TL-Sx Series, since it is similar in hardware and just power derated by software.

Disconnection at P_{AC} 0% and Q_{AC} 5% reactive load and 33% nominal power



7.4 Voltage and frequency limits (passive anti-islanding protection) Appendix G2 Under- and over-voltage trip settings and reconnection test SOFAR 33000TL-Sx Series								P
L1 phase								
	Output Current level: 50+/-5% rated current							
Test	**Under Voltage (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**	
Limit	< 180 V			<=2s			>=60s	
Actual setting	180,0			2,0			60,0	
Trip value	180,2	180,4	180,1	1,220	1,210	1,230	67,0	
Test	**Over Voltage 1 (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**	
Limit	> 260 V			<=2s			>=60s	
Actual setting	260,0			2,0			60,0	
Trip value	259,5	259,7	259,4	1,200	1,210	1,210	67,0	
Test	**Over Voltage 2 (V)**			**Time to disconnect (s)**			**Time to reconnect (s)**	
Limit	> 265 V			<=0,2s			>=60s	
Actual setting	265,0			0,2			60,0	
Trip value	264,0	264,1	264,0	0,113	0,127	0,124	67,0	
L2 phase								
	Output Current level: 50+/-5% rated current							
Test	**Under Voltage (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**	
Limit	< 180 V			<=2s			>=60s	
Actual setting	180,0			2,0			60,0	
Trip value	180,1	180,0	180,3	1,220	1,230	1,210	66,0	
Test	**Over Voltage 1 (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**	
Limit	> 260 V			<=2s			>=60s	
Actual setting	260,0			2,0			60,0	
Trip value	259,8	260,1	259,9	1,220	1,220	1,220	67,0	
Test	**Over Voltage 2 (V)**			**Time to disconnect (s)**			**Time to reconnect (s)**	
Limit	> 265 V			<=0,2s			>=60s	
Actual setting	265,0			0,2			60,0	
Trip value	264,3	264,0	264,2	0,124	0,123	0,112	67,0	

L3 phase							
	Output Current level: 50+/-5% rated current						
Test	**Under Voltage (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**
Limit	< 180 V			<=2s			>=60s
Actual setting	180,0			2,0			60,0
Trip value	180,5	180,2	180,3	1,210	1,190	1,210	67,0
Test	**Over Voltage 1 (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**
Limit	> 260 V			<=2s			>=60s
Actual setting	260,0			2,0			60,0
Trip value	260,1	259,8	260,3	1,220	1,210	1,200	67,0
Test	**Over Voltage 2 (V)**			**Time to disconnect (s)**			**Time to reconnect (s)**
Limit	> 265 V			<=0,2s			>=60s
Actual setting	265,0			0,2			60,0
Trip value	264,5	264,8	264,6	0,122	0,119	0,138	67,0

Note:
Actual settings are the settings of the inverter. The Trip value the measured value. It has to be in the range of *+/- 2V* of the actual setting.

The tests had been performed on the SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

Diagram of under-voltage protection:L1 phase

Diagram of over-voltage 1 protection:L1 phase

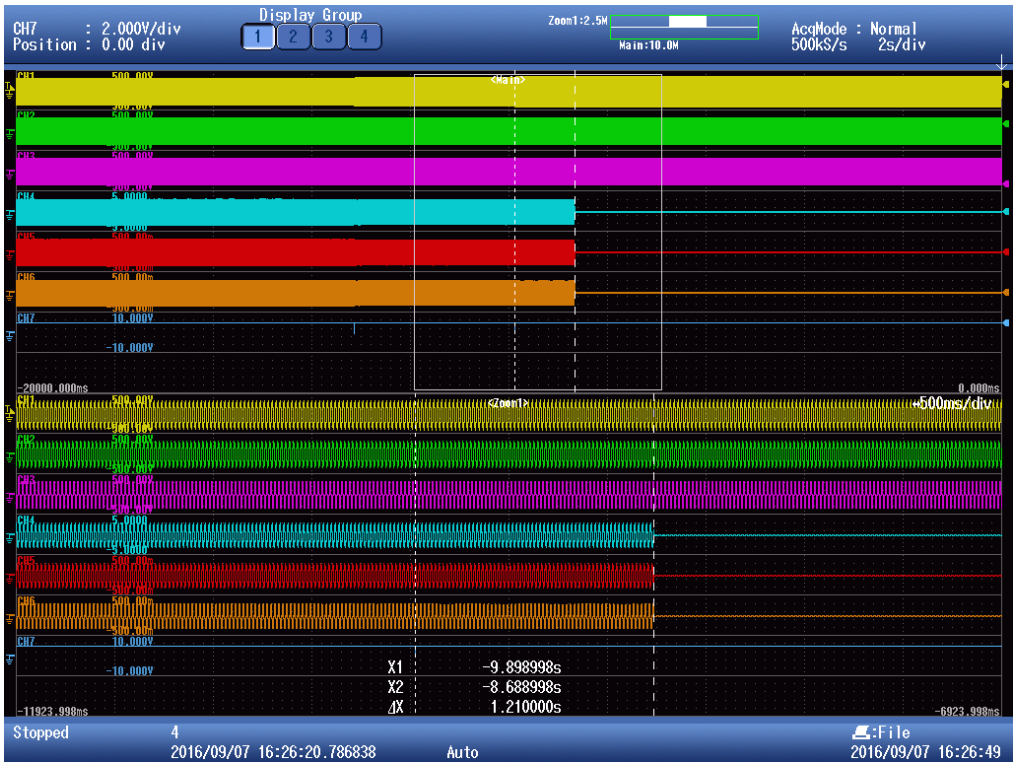


Diagram of over-voltage 2 protection:L1 phase

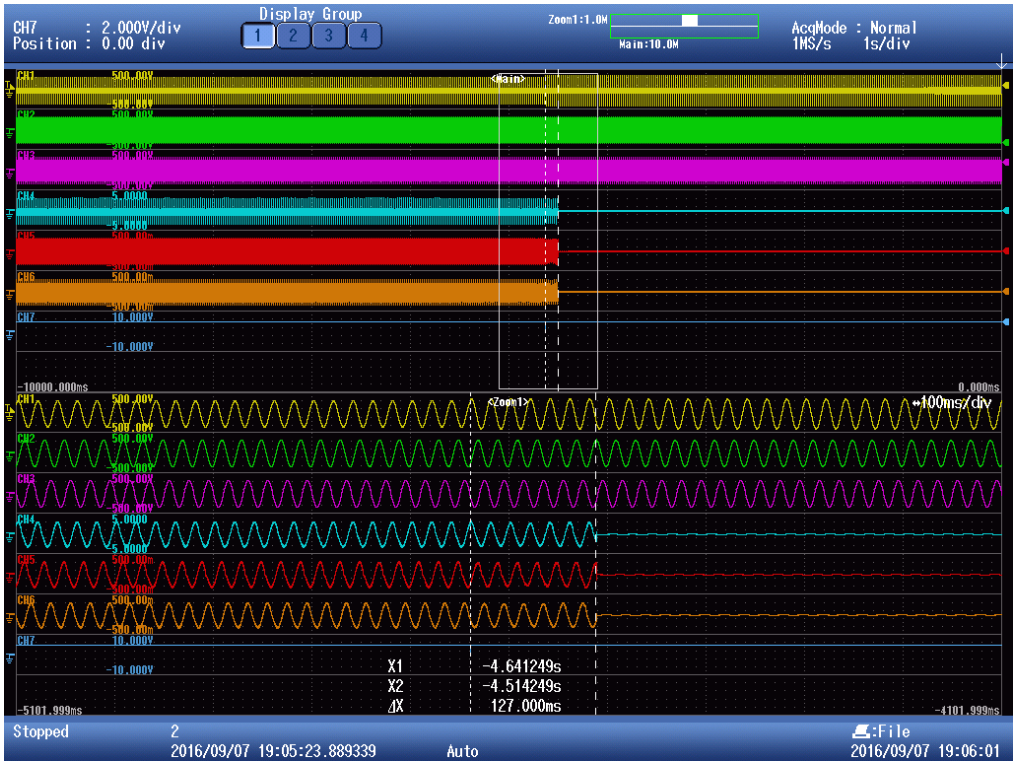


Diagram of under-voltage protection:L2 phase

Diagram of over-voltage 1 protection:L2 phase

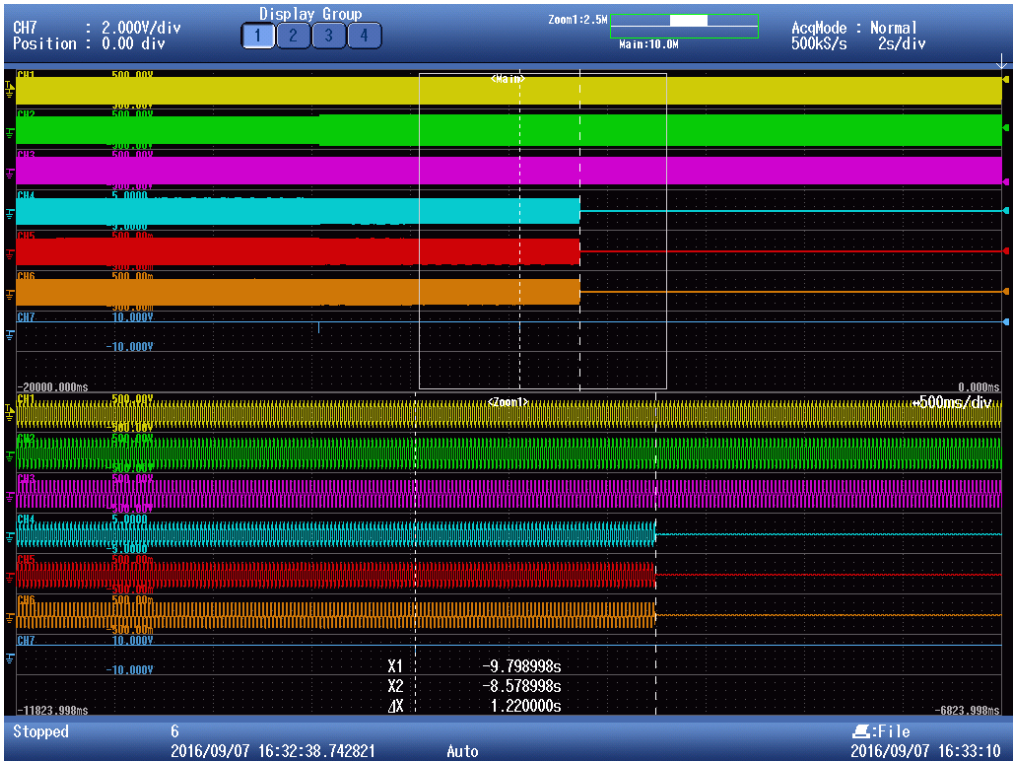


Diagram of over-voltage 2 protection:L2 phase

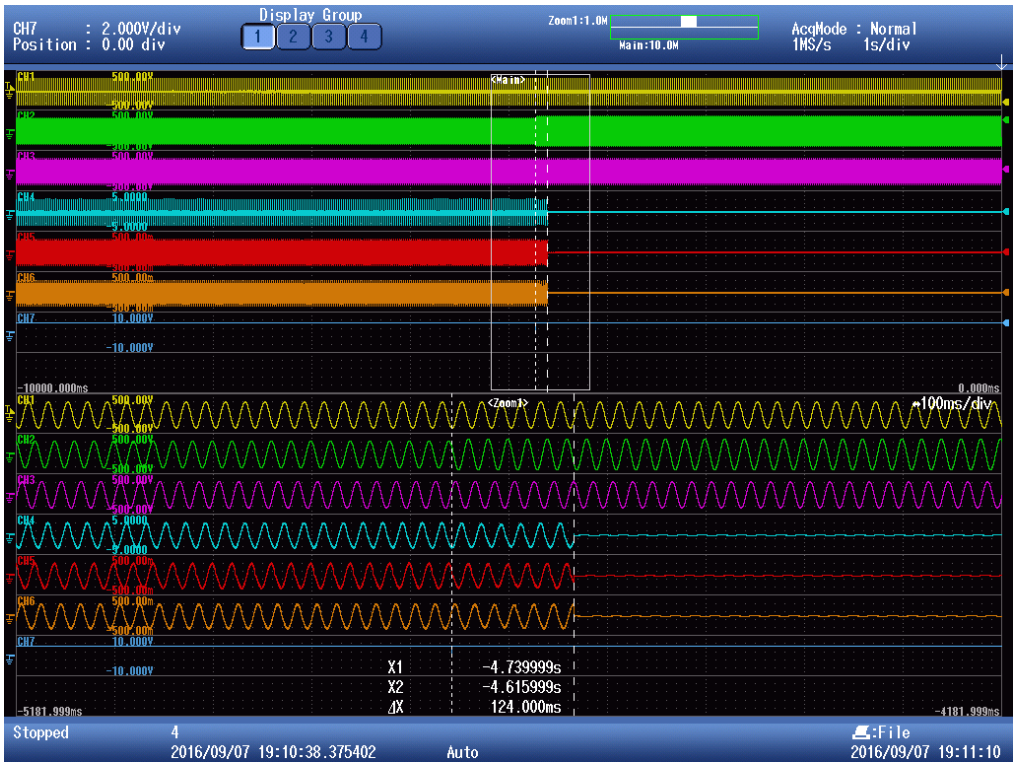


Diagram of under-voltage protection:L3 phase

Diagram of over-voltage 1 protection:L3 phase

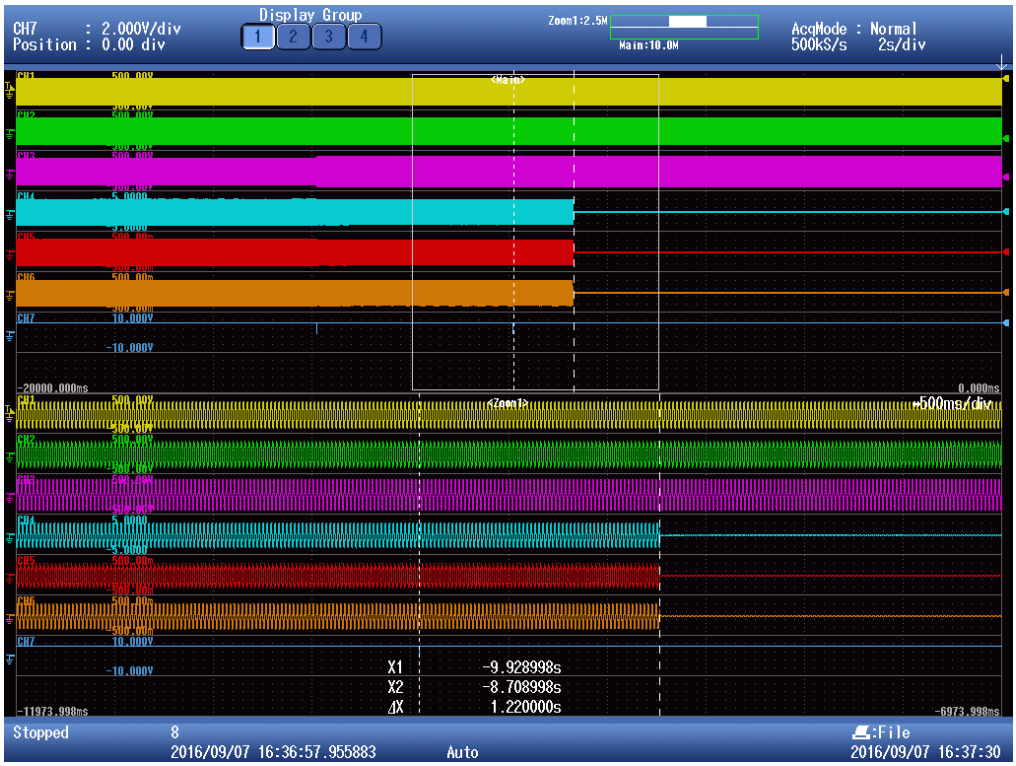
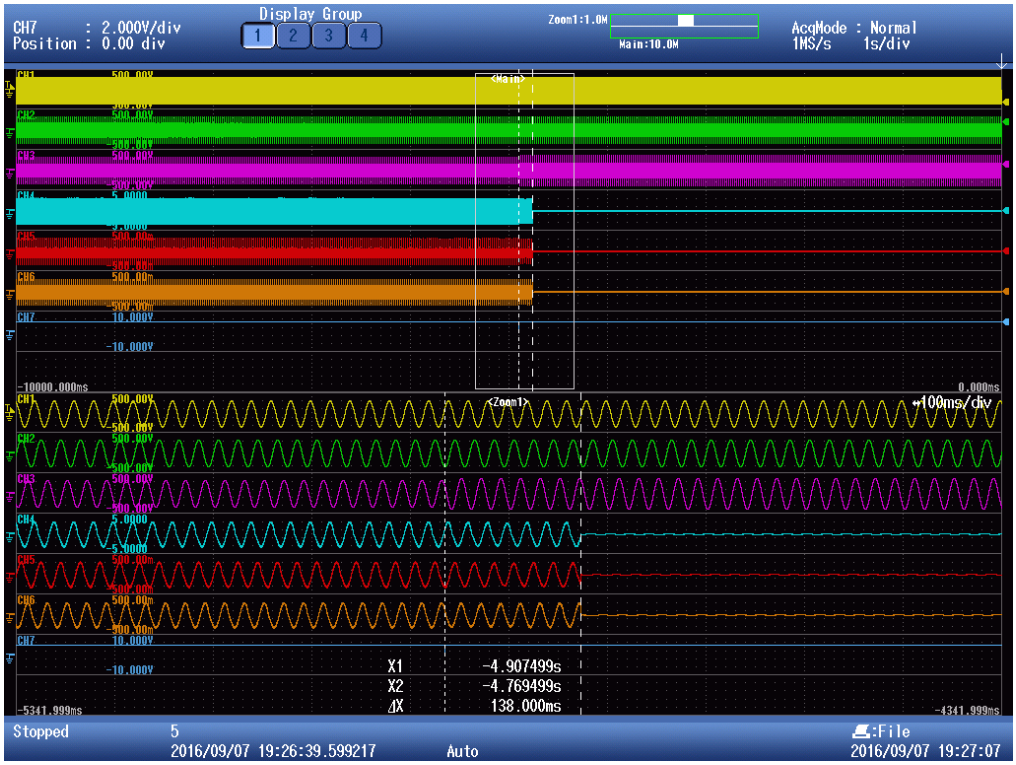


Diagram of over-voltage 2 protection:L3 phase



7.4 Voltage and frequency limits (passive anti-islanding protection) Appendix G2 Under- and over-voltage trip settings and reconnection test SOFAR 40000TL-Sx Series							P
L1 phase							
	Output Current level: 50+/-5% rated current						
Test	**Under Voltage (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**
Limit	< 180 V			<=2s			>=60s
Actual setting	180,0			2,0			60,0
Trip value	180,6	180,3	180,5	1,210	1,215	1,215	67,0
Test	**Over Voltage 1 (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**
Limit	> 260 V			<=2s			>=60s
Actual setting	260,0			2,0			60,0
Trip value	259,8	260,0	259,6	1,191	1,210	1,200	67,0
Test	**Over Voltage 2 (V)**			**Time to disconnect (s)**			**Time to reconnect (s)**
Limit	> 265 V			<=0,2s			>=60s
Actual setting	265,0			0,2			60,0
Trip value	264,7	264,1	264,5	0,122	0,109	0,117	67,0
L2 phase							
	Output Current level: 50+/-5% rated current						
Test	**Under Voltage (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**
Limit	< 180 V			<=2s			>=60s
Actual setting	180,0			2,0			60,0
Trip value	181,0	180,5	180,4	1,207	1,200	1,212	66,0
Test	**Over Voltage 1 (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**
Limit	> 260 V			<=2s			>=60s
Actual setting	260,0			2,0			60,0
Trip value	259,1	260,2	259,4	1,198	1,203	1,220	67,0
Test	**Over Voltage 2 (V)**			**Time to disconnect (s)**			**Time to reconnect (s)**
Limit	> 265 V			<=0,2s			>=60s
Actual setting	265,0			0,2			60,0
Trip value	264,9	264,1	264,3	0,119	0,117	0,114	67,0

L3 phase							
	Output Current level: 50+/-5% rated current						
Test	**Under Voltage (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**
Limit	< 180 V			<=2s			>=60s
Actual setting	180,0			2,0			60,0
Trip value	180,1	180,0	180,4	1,200	1,210	1,205	66,0
Test	**Over Voltage 1 (V)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**
Limit	> 260 V			<=2s			>=60s
Actual setting	260,0			2,0			60,0
Trip value	259,9	260,4	259,3	1,208	1,211	1,198	66,0
Test	**Over Voltage 2 (V)**			**Time to disconnect (s)**			**Time to reconnect (s)**
Limit	> 265 V			<=0,2s			>=60s
Actual setting	265,0			0,2			60,0
Trip value	264,3	264,7	264,7	0,118	0,105	0,127	67,0
Note: Actual settings are the settings of the inverter. The Trip value the measured value. It has to be in the range of *+/- 2V* of the actual setting.							

Diagram of under-voltage protection:L1 phase

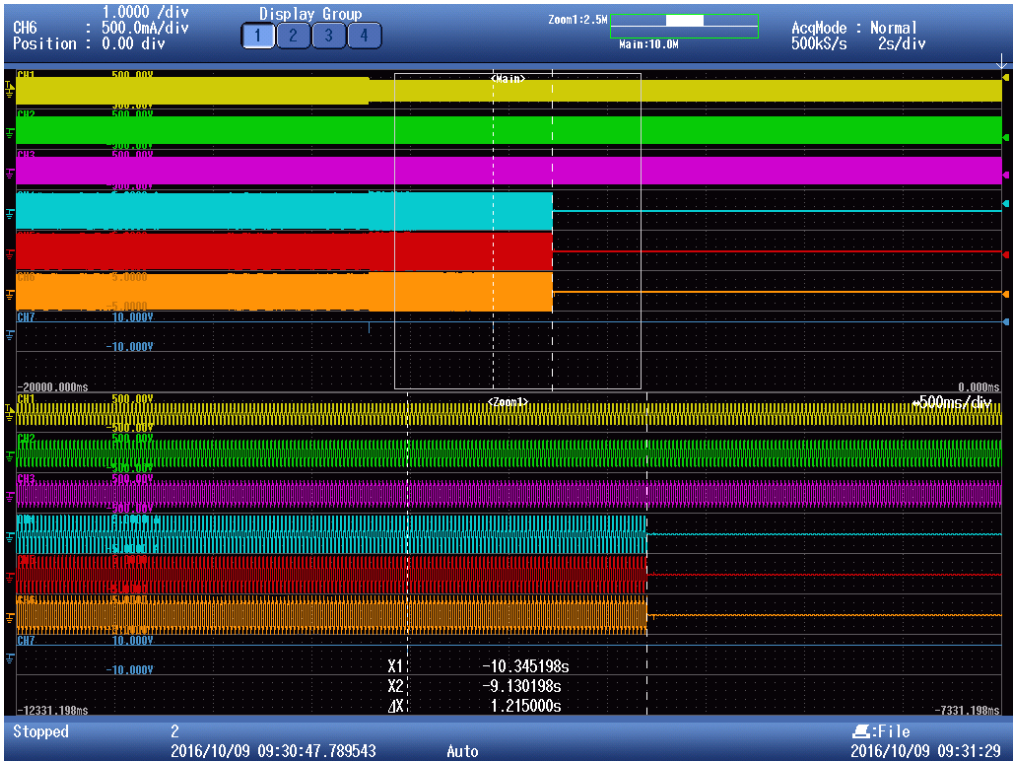


Diagram of over-voltage 1 protection:L1 phase

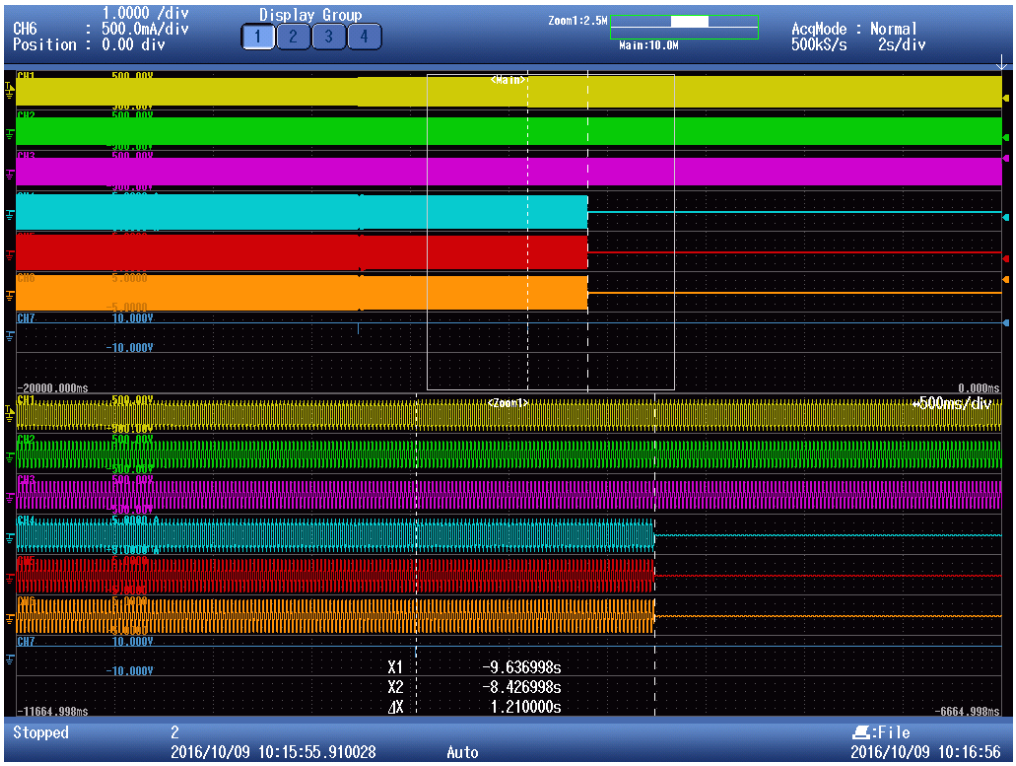


Diagram of over-voltage 2 protection:L1 phase

Diagram of under-voltage protection:L2 phase

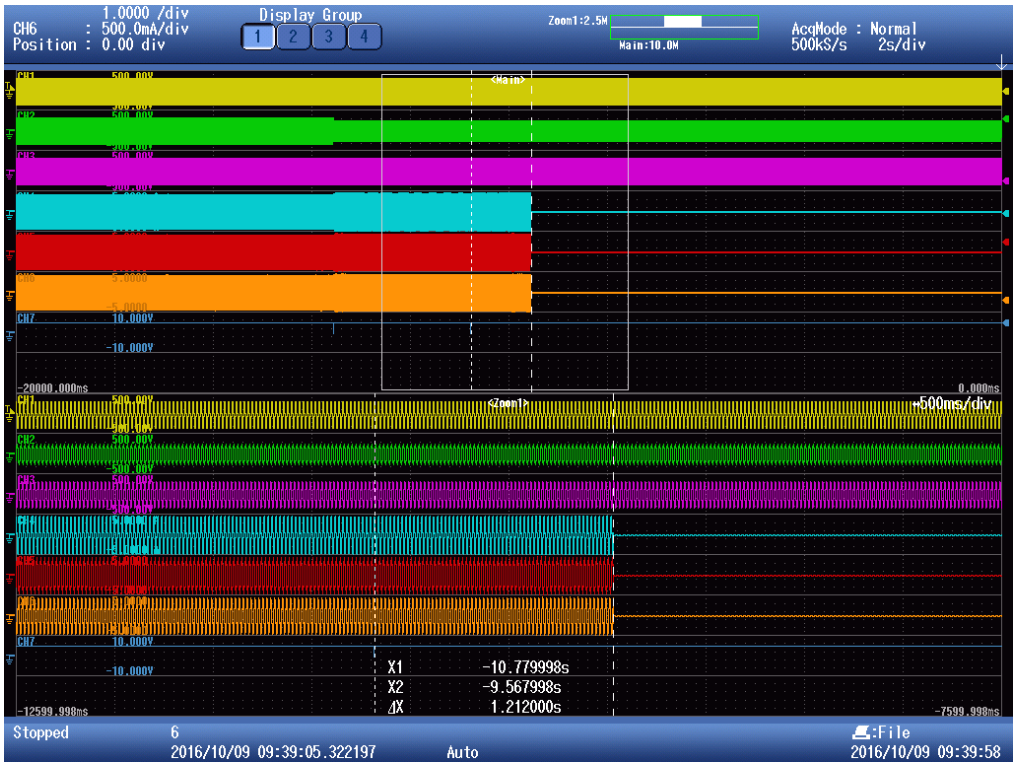


Diagram of over-voltage 1 protection:L2 phase

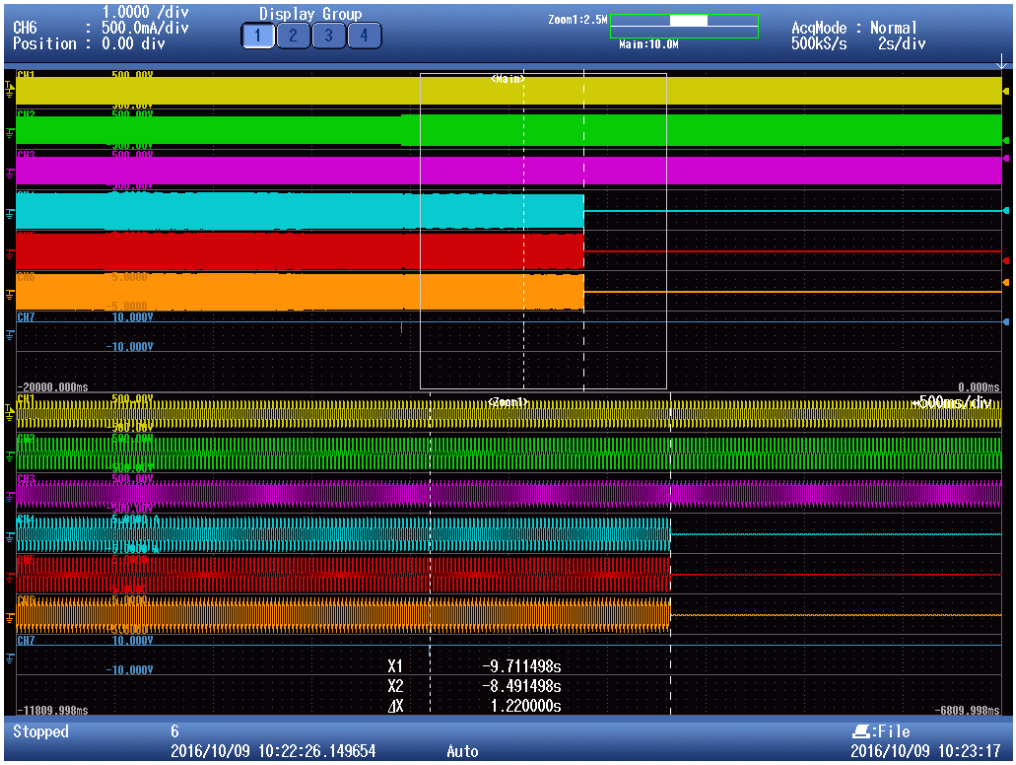


Diagram of over-voltage 2 protection:L2 phase

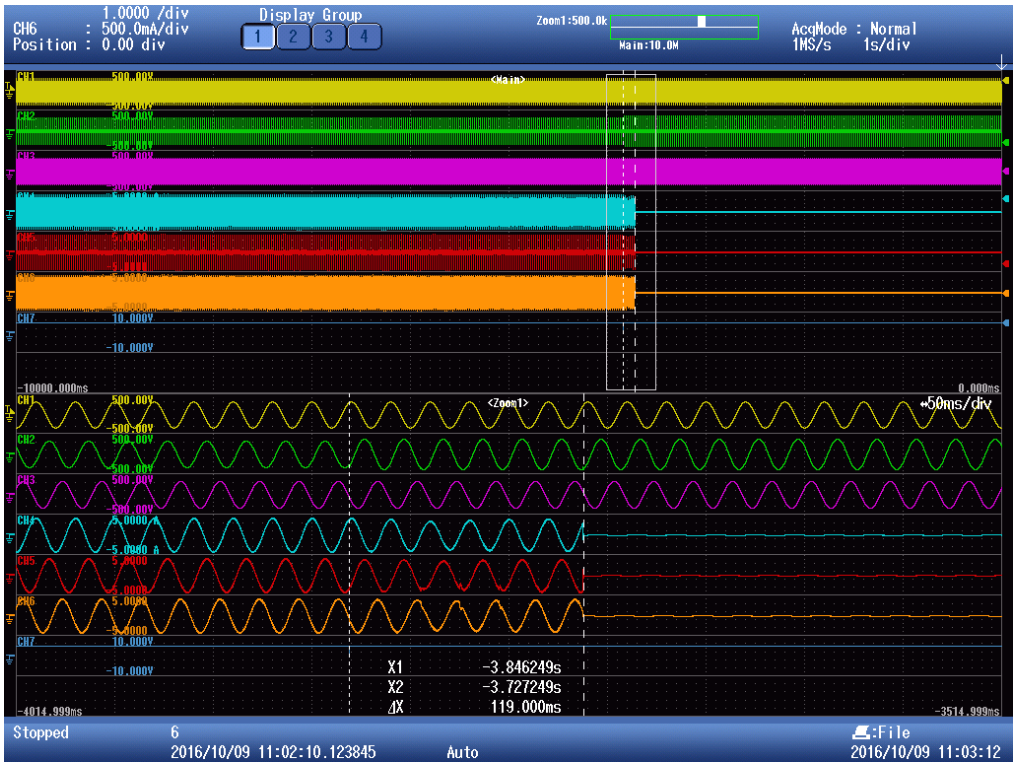


Diagram of under-voltage protection:L3 phase

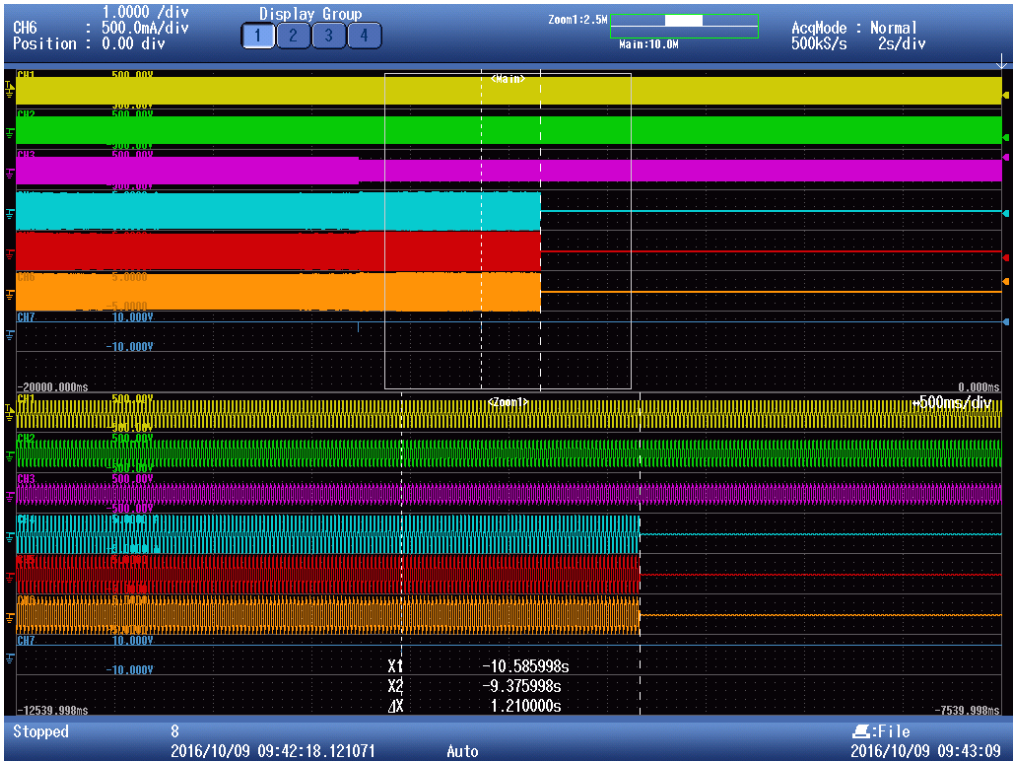


Diagram of over-voltage 1 protection:L3 phase

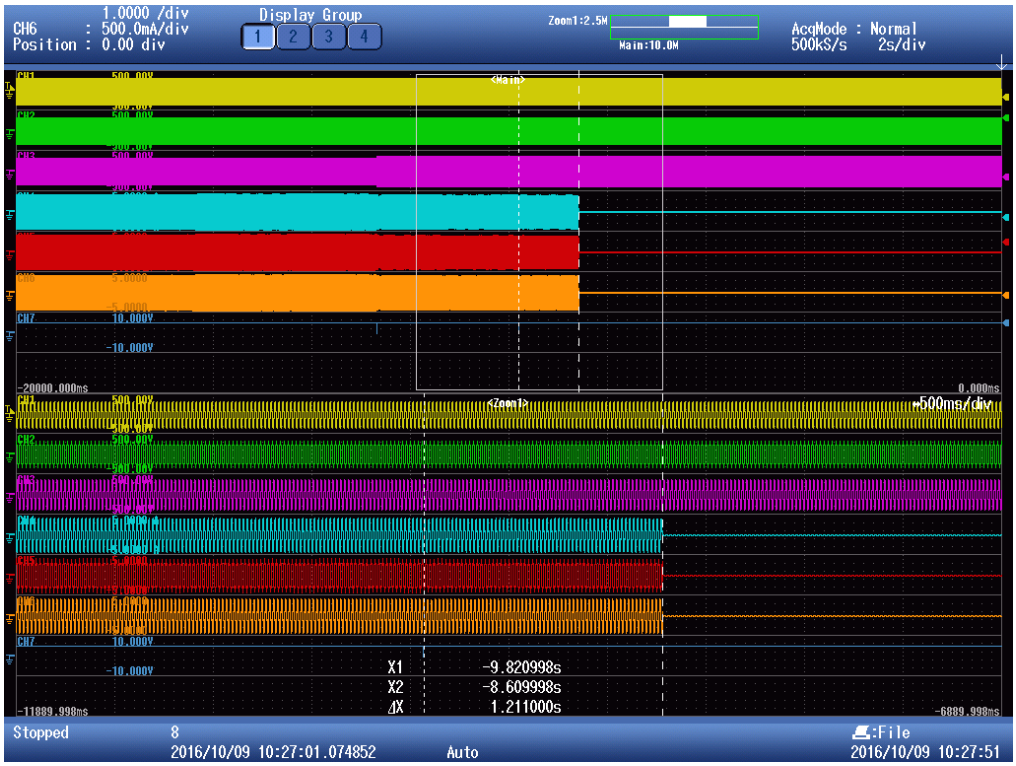
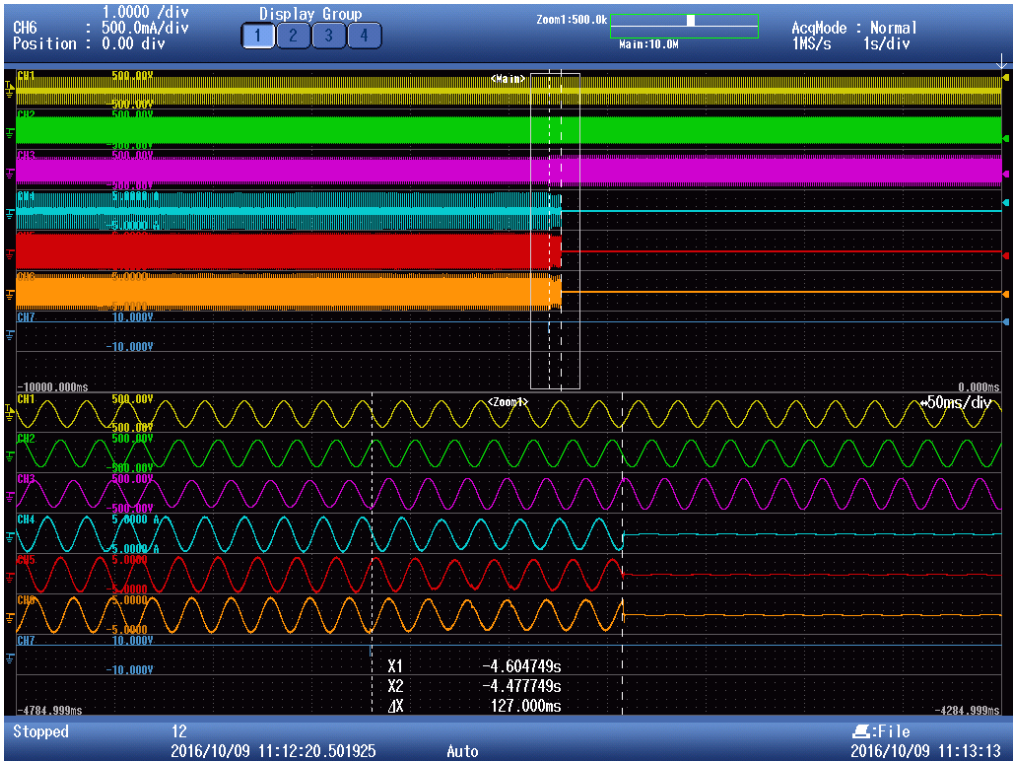


Diagram of over-voltage 2 protection:L3 phase



7.4 Voltage and frequency limits (passive anti-islanding protection) **Appendix G3 Under- and over-frequency trip settings and reconnection test**								**P**
	Output Current level: 50+/-5% rated current or 10A (whichever is the lesser)							
Test	**Under Frequency (Hz)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**	
Australia Limit	>=47Hz			<=2s			>=60s	
Actual setting	47,0			2,0			60,0	
Trip value	47,00	47,00	47,00	1,210	1,210	1,230	66,0	
Test	**Under Frequency (Hz)**			**Time to disconnect (s) (Trip delay 1s)**			**Time to reconnect (s)**	
New Zealand Limit	>=45Hz			<=2s			>=60s	
Actual setting	45,0			2,0			60,0	
Trip value	45,00	45,00	45,00	1,230	1,200	1,220	66,0	
Test	**Over Frequency (Hz)**			**Time to disconnect (s)**			**Time to reconnect (s)**	
Limit	<=52Hz			<=0,2s			>=60s	
Actual setting	52,0			0,2			60,0	
Trip value	52,01	52,00	52,01	0,094	0,091	0,100	67,0	

Note:
Actual settings are the settings of the inverter. The trip value is the measured value. It has to be in the range of *+/- 0.1Hz* of the actual setting.

The tests had been performed on the SOFAR 40000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series and SOFAR 33000TL-Sx Series, since it is similar in hardware and just power derated by software.

Diagram of under-frequency protection (for Australia)

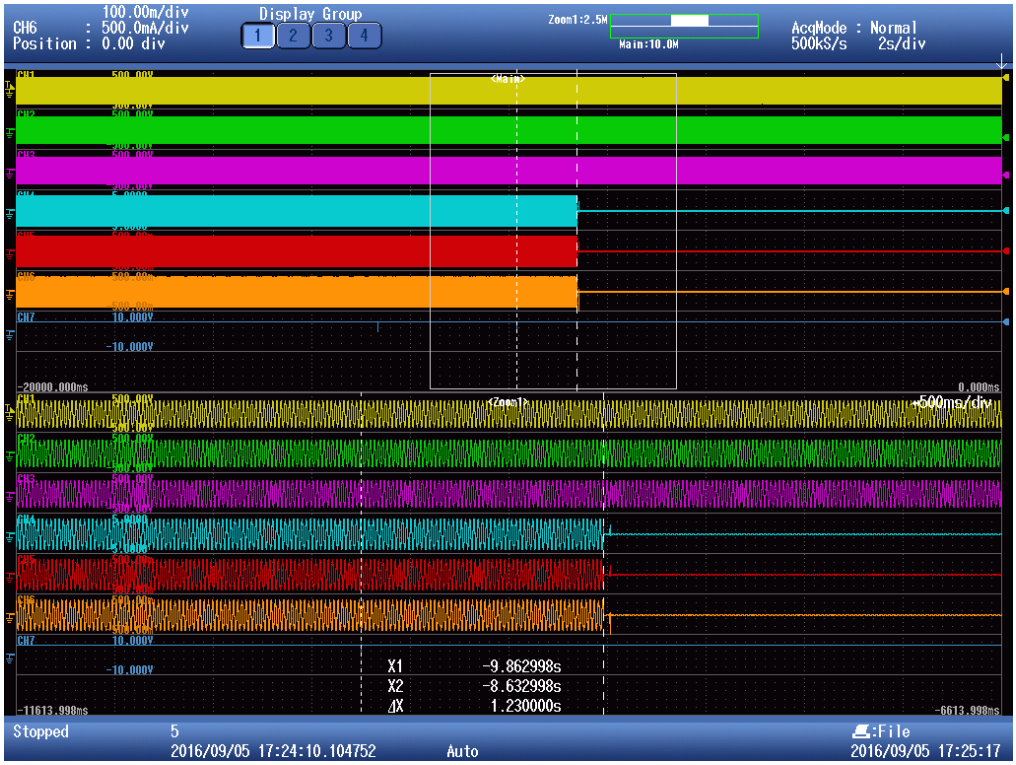


Diagram of under-frequency protection (for New Zealand)

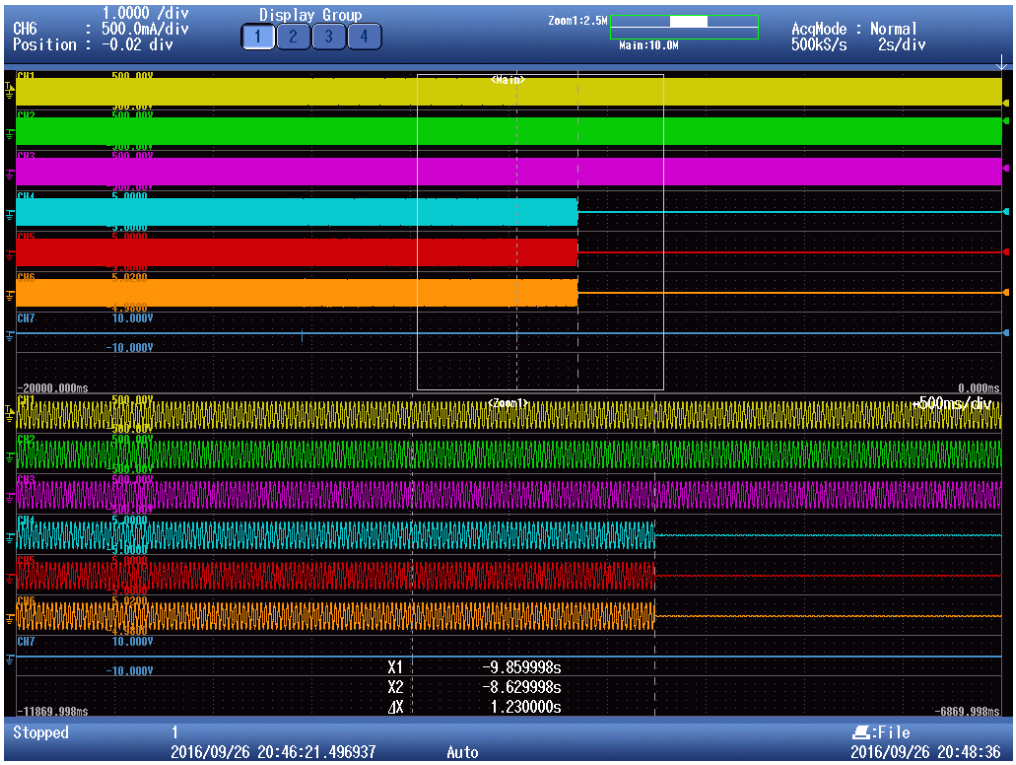
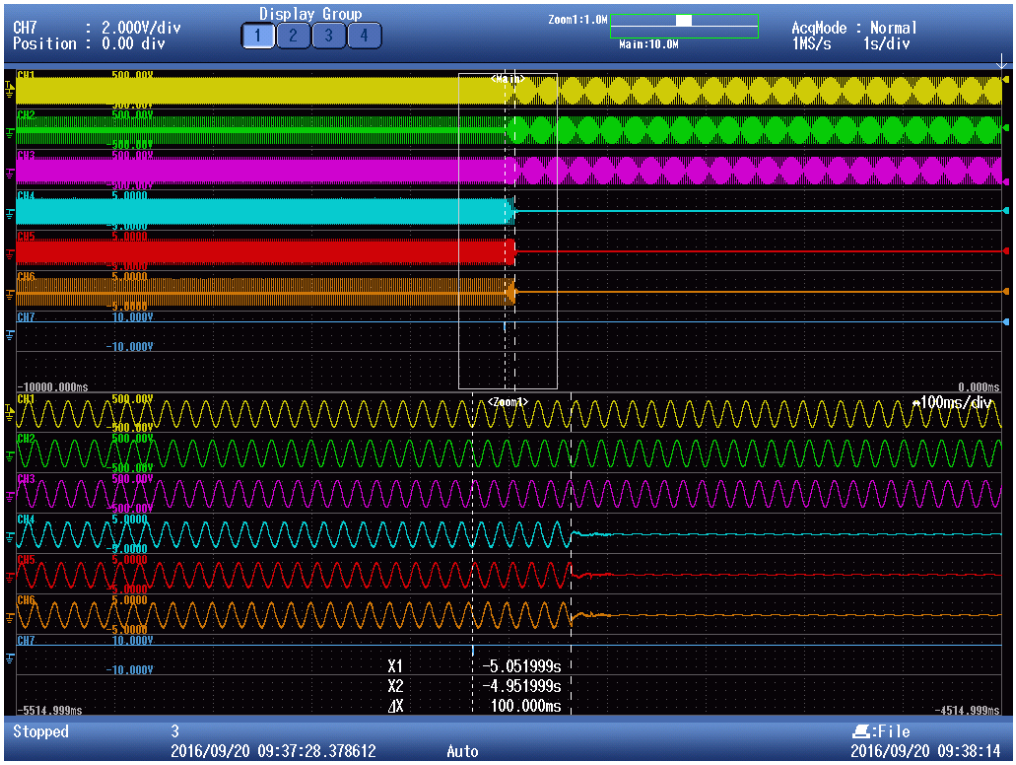


Diagram of over-frequency protection



7.5.2 Limits for sustainedoeration **Appendix H2 Sustained operation for voltage variations** **Australia** **SOFAR 33000TL-Sx Series**	**P**

	Output power level: 50+/-5% Apparent Power	
Setting values	Setting Vnom_max [V]	255,0
	Setting $T_{disconnection}$ [s]	10,0
Test:		

a)

Step 1. The voltage is set to Vnom_max – 1 V. Maintained for 5 min.
Step 2. The voltage increase to Vnom_max + 1 V and proceeding 10 min.
Step 3. The 10 min average voltage shall be recorded.

		Average Voltage (V)	Limit
Phase 1	1st time	255,3	1. Disconnection should take place. 2. Voltage within +/1 % of the set-point.
	2nd time	255,2	
	3rd time	255,2	
Phase 2	1st time	255,3	
	2nd time	255,2	
	3rd time	254,7	
Phase 3	1st time	255,2	
	2nd time	255,2	
	3rd time	255,2	

b)

Step 1. The voltage is set to Vnom_max and maintained for 10 min.
Step 2. Increase 2 V to trig the protection.
Step 3. Record the disconnection time.

	Disconnection time (s)	Limit
Phase 1	7,0	Disconnection time < 30s
Phase 2	10,0	
Phase 3	9,0	

c)

Step 1. The output voltage of variable a.c. supply decrease the voltage to gird test voltage.
Step 2. Record the reconnection time.

	Reconnection time (s)	Limit
Phase 1	75,0	Reconnection time > 60s
Phase 2	74,0	
Phase 3	75,0	

Note:
1. The default set-point for Vnom-max shall be as follows:
   (a) In Australia: 255 V.
   (b) In New Zealand: 248 V.
2. The 10 min average value shall be compared against the limit Vnom_max at least every 3 s to determine when to disconnect.
3. The inverter shall operate the automatic disconnection device (see Clause 7.2) within 3 s when the average voltage for a 10 min period exceeds the Vnom_max.

The tests had been performed on the SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

7.5.2 Limits for sustainedoeration **Appendix H2 Sustained operation for voltage variations** **Australia** **SOFAR 40000TL-Sx Series**	**P**

	Output power level: 50+/-5% Apparent Power	
Setting values	Setting Vnom_max [V]	255,0
	Setting $T_{disconnection}$ [s]	10,0

Test:

a)

Step 1. The voltage is set to Vnom_max – 1 V. Maintained for 5 min.
Step 2. The voltage increase to Vnom_max + 1 V and proceeding 10 min.
Step 3. The 10 min average voltage shall be recorded.

		Average Voltage (V)	Limit
Phase 1	1st time	255,6	1. Disconnection should take place. 2. Voltage within +/1 % of the set-point.
	2nd time	255,7	
	3rd time	255,7	
Phase 2	1st time	255,7	
	2nd time	255,6	
	3rd time	255,7	
Phase 3	1st time	255,6	
	2nd time	255,6	
	3rd time	255,8	

b)

Step 1. The voltage is set to Vnom_max and maintained for 10 min.
Step 2. Increase 2 V to trig the protection.
Step 3. Record the disconnection time.

	Disconnection time (s)	Limit
Phase 1	8,0	Disconnection time < 30s
Phase 2	11,0	
Phase 3	9,0	

c)

Step 1. The output voltage of variable a.c. supply decrease the voltage to gird test voltage.
Step 2. Record the reconnection time.

	Reconnection time (s)	Limit
Phase 1	72,0	Reconnection time > 60s
Phase 2	72,0	
Phase 3	75,0	

Note:
1. The default set-point for Vnom-max shall be as follows:
   (a) In Australia: 255 V.
   (b) In New Zealand: 248 V.
2. The 10 min average value shall be compared against the limit Vnom_max at least every 3 s to determine when to disconnect.
3. The inverter shall operate the automatic disconnection device (see Clause 7.2) within 3 s when the average voltage for a 10 min period exceeds the Vnom_max.

7.5.2 Limits for sustainedoeration **Appendix H2 Sustained operation for voltage variations** **New Zealand** **SOFAR 33000TL-Sx Series**	**P**

	Output power level: 50+/-5% Apparent Power	
Setting values	Setting Vnom_max [V]	248,0
	Setting $T_{disconnection}$ [s]	10,0

Test:

a)

Step 1. The voltage is set to Vnom_max – 1 V. Maintained for 5 min.
Step 2. The voltage increase to Vnom_max + 1 V and proceeding 10 min.
Step 3. The 10 min average voltage shall be recorded.

		Average Voltage (V)	Limit
Phase 1	1st time	248,2	1. Disconnection should take place. 2. Voltage within +/1 % of the set-point.
	2nd time	248,3	
	3rd time	248,2	
Phase 2	1st time	248,3	
	2nd time	248,3	
	3rd time	248,3	
Phase 3	1st time	248,3	
	2nd time	248,3	
	3rd time	248,4	

b)

Step 1. The voltage is set to Vnom_max and maintained for 10 min.
Step 2. Increase 2 V to trig the protection.
Step 3. Record the disconnection time.

	Disconnection time (s)	Limit
Phase 1	12,0	Disconnection time < 30s
Phase 2	8,0	
Phase 3	13,0	

c)

Step 1. The output voltage of variable a.c. supply decrease the voltage to gird test voltage.
Step 2. Record the reconnection time.

	Reconnection time (s)	Limit
Phase 1	74,0	Reconnection time > 60s
Phase 2	75,0	
Phase 3	75,0	

Note:
1. The default set-point for Vnom-max shall be as follows:
   (a) In Australia: 255 V.
   (b) In New Zealand: 248 V.
2. The 10 min average value shall be compared against the limit Vnom_max at least every 3 s to determine when to disconnect.
3. The inverter shall operate the automatic disconnection device (see Clause 7.2) within 3 s when the average voltage for a 10 min period exceeds the Vnom_max.

The tests had been performed on the SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

7.5.2 Limits for sustainedoeration **Appendix H2 Sustained operation for voltage variations** **New Zealand** **SOFAR 40000TL-Sx Series**	**P**

	Output power level: 50+/-5% Apparent Power	
Setting values	Setting Vnom_max [V]	248,0
	Setting $T_{disconnection}$ [s]	10,0

Test:

a)

Step 1. The voltage is set to Vnom_max – 1 V. Maintained for 5 min.
Step 2. The voltage increase to Vnom_max + 1 V and proceeding 10 min.
Step 3. The 10 min average voltage shall be recorded.

		Average Voltage (V)	Limit
Phase 1	1st time	248,1	1. Disconnection should take place. 2. Voltage within +/1 % of the set-point.
	2nd time	248,2	
	3rd time	248,2	
Phase 2	1st time	248,2	
	2nd time	248,2	
	3rd time	248,2	
Phase 3	1st time	248,1	
	2nd time	248,2	
	3rd time	248,1	

b)

Step 1. The voltage is set to Vnom_max and maintained for 10 min.
Step 2. Increase 2 V to trig the protection.
Step 3. Record the disconnection time.

	Disconnection time (s)	Limit
Phase 1	13,0	Disconnection time < 30s
Phase 2	15,0	
Phase 3	15,0	

c)

Step 1. The output voltage of variable a.c. supply decrease the voltage to gird test voltage.
Step 2. Record the reconnection time.

	Reconnection time (s)	Limit
Phase 1	74,0	Reconnection time > 60s
Phase 2	72,0	
Phase 3	74,0	

Note:
1. The default set-point for Vnom-max shall be as follows:
   (a) In Australia: 255 V.
   (b) In New Zealand: 248 V.
2. The 10 min average value shall be compared against the limit Vnom_max at least every 3 s to determine when to disconnect.
3. The inverter shall operate the automatic disconnection device (see Clause 7.2) within 3 s when the average voltage for a 10 min period exceeds the Vnom_max.

7.5.3.1 Response to an increase in frequency **Appendix H3.2 Test procedure** **SOFAR 33000TL-Sx Series**							**P**
1. Measurement a) to w): Power output: 50+/-5% of rated apparent power							
30s mean value	a) 50,00Hz	b) 50,25Hz	c) 50,35Hz	d) 50,45Hz	e) 50,55Hz	f) 50,65Hz	g) 50,75Hz
Frequency [Hz]:	50,00	50,25	50,35	50,45	50,55	50,65	50,75
$P_{setpoint}$ [kW]:	17,000	17,000	16,370	15,378	14,386	13,394	12,401
P [kW]:	17,359	17,362	16,495	15,229	14,210	13,240	12,253
$\Delta P/P_{Setpoint}$ [%]:	3,6	3,6	1,2	-1,5	-1,8	-1,5	-1,5
30s mean value	h) 50,85Hz	i) 50,95Hz	j) 51,05Hz	k) 51,15Hz	l) 51,25Hz	m)51,35Hz	n) 51,45Hz
Frequency [Hz]:	50,85	50,95	51,05	51,15	51,25	51,35	51,45
$P_{setpoint}$ [kW]:	11,409	10,417	9,425	8,433	7,441	6,449	5,457
P [kW]:	11,285	10,315	9,303	8,319	7,340	6,381	5,381
$\Delta P/P_{Setpoint}$ [%]:	-0,7	-0,6	-0,7	-0,7	-0,6	-0,4	-0,4
30s mean value	o) 51,55Hz	p) 51,65Hz	q) 51,75Hz	r) 51,85Hz	s) 51,95Hz	t)52,05Hz	u) 52,15Hz
Frequency [Hz]:	51,55	51,65	51,75	51,85	51,95	52,05	52,15
$P_{setpoint}$ [kW]:	4,465	3,472	2,480	1,488	0,496	0,000	0,000
P [kW]:	4,394	3,407	2,370	1,349	0,372	0,035	0,022
$\Delta P/P_{Setpoint}$ [%]:	-0,4	-0,4	-0,6	-0,8	-0,7	0,2	0,1
The frequency shall be decreased every 30 s in 0,2 Hz decrements from 52,25Hz until less than 50,15Hz. Maintained for 10 min or until the inverter reaches the maximum output power available. After frequency decreased to less than 50,15Hz, adjust output power to 100% rated power.							
30s mean value	v) 52,25Hz	->	w) 50,05Hz	N/A	N/A	N/A	N/A
Frequency [Hz]:	52,25	N/A	50,05	N/A	N/A	N/A	N/A
$P_{setpoint}$ [kW]:	0,000	N/A	0,000	N/A	N/A	N/A	N/A
P [kW]:	0,023	N/A	0,020	N/A	N/A	N/A	N/A
$\Delta P/P_{Setpoint}$ [%]:	0,1	N/A	0,1	N/A	N/A	N/A	N/A
Limit W_{Gra}:	+ 17 %						

Note:
1. The output power at grid test voltage/50,00Hz shall be maintained for 5 min and the average power shall be used as the frozen value of power (Pref)
2. The frequency increase rate: 0.1Hz/step/30s.
3. The frequency decrease rate: 0.2Hz/step/30s.
4. While the frequency decrease less than 50,15Hz, the voltage and frequency shall be maintained for 10 min or until the inverter reaches the maximum output power available.
5 After frequency decrease less than 50,15Hz, adjust output power to 100% rated power.

The tests had been performed on the SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.

Diagram of overfrequency

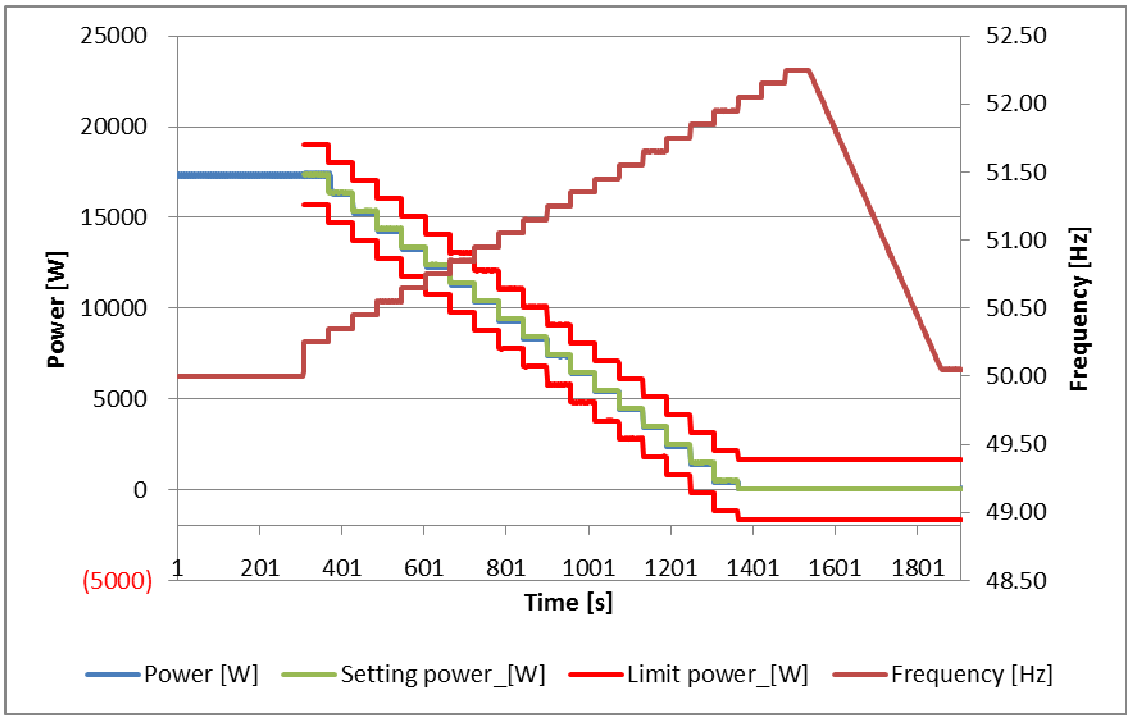
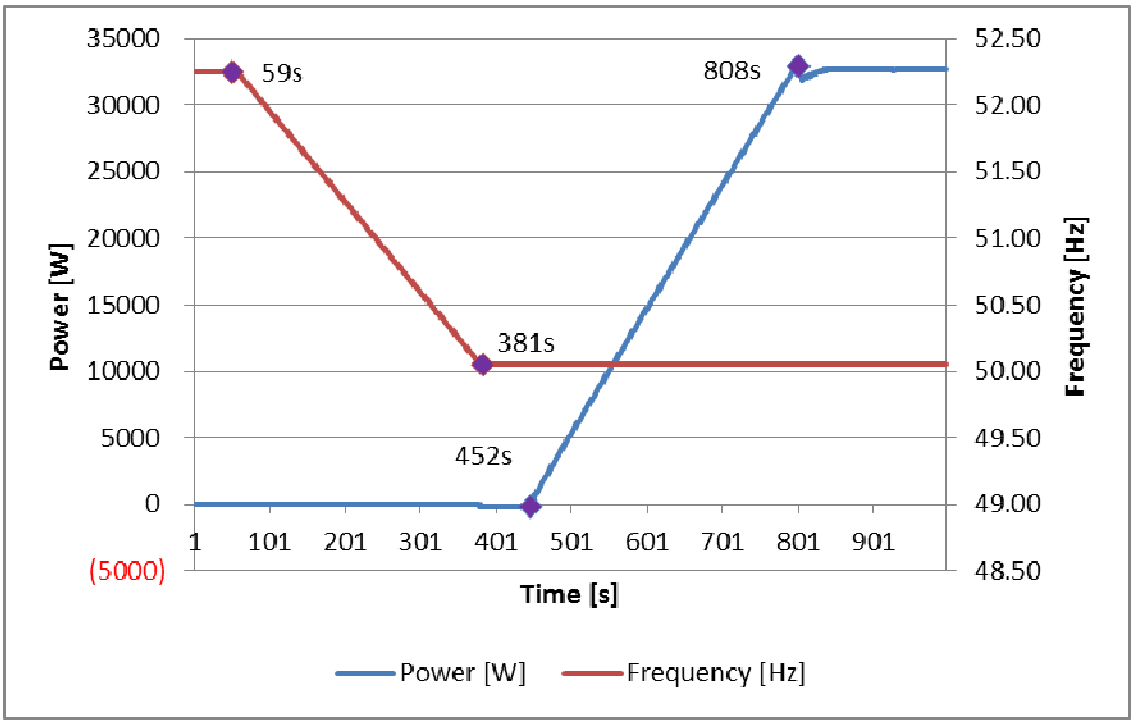


Diagram of power restore gradient line



7.5.3.1 Response to an increase in frequency **Appendix H3.2 Test procedure** **SOFAR 40000TL-Sx Series**							**P**
1. Measurement a) to w): Power output: 50+/-5% of rated apparent power							
30s mean value	a) 50,00Hz	b) 50,25Hz	c) 50,35Hz	d) 50,45Hz	e) 50,55Hz	f) 50,65Hz	g) 50,75Hz
Frequency [Hz]:	50,00	50,25	50,35	50,45	50,55	50,65	50,75
$P_{setpoint}$ [kW]:	20,000	20,000	18,194	17,092	15,989	14,886	13,784
P [kW]:	19,614	19,297	18,596	17,106	15,982	14,889	13,774
$\Delta P/P_{Setpoint}$ [%]:	-1,9	-3,5	2,0	0,1	0,1	0,1	0,1
30s mean value	h) 50,85Hz	i) 50,95Hz	j) 51,05Hz	k) 51,15Hz	l) 51,25Hz	m)51,35Hz	n) 51,45Hz
Frequency [Hz]:	50,85	50,95	51,05	51,15	51,25	51,35	51,45
$P_{setpoint}$ [kW]:	12,681	11,578	10,476	9,373	8,270	7,167	6,065
P [kW]:	12,686	11,594	10,462	9,372	8,254	7,168	6,061
$\Delta P/P_{Setpoint}$ [%]:	0,1	0,1	0,1	0,1	0,1	0,1	0,1
30s mean value	o) 51,55Hz	p) 51,65Hz	q) 51,75Hz	r) 51,85Hz	s) 51,95Hz	t)52,05Hz	u) 52,15Hz
Frequency [Hz]:	51,55	51,65	51,75	51,85	51,95	52,05	52,15
$P_{setpoint}$ [kW]:	4,962	3,859	2,757	1,654	0,551	0,000	0,000
P [kW]:	4,950	3,845	2,681	1,532	0,432	0,031	0,027
$\Delta P/P_{Setpoint}$ [%]:	-0,1	-0,1	-0,4	-0,7	-0,7	0,2	0,2
The frequency shall be decreased every 30 s in 0,2 Hz decrements from 52,25Hz until less than 50,15Hz. Maintained for 10 min or until the inverter reaches the maximum output power available. After frequency decreased to less than 50,15Hz, adjust output power to 100% rated power.							
30s mean value	v) 52,25Hz	->	w) 50,05Hz	N/A	N/A	N/A	N/A
Frequency [Hz]:	52,25	N/A	50,05	N/A	N/A	N/A	N/A
$P_{setpoint}$ [kW]:	0,000	N/A	0,000	N/A	N/A	N/A	N/A
P [kW]:	0,027	N/A	0,025	N/A	N/A	N/A	N/A
$\Delta P/P_{Setpoint}$ [%]:	0,1	N/A	0,1	N/A	N/A	N/A	N/A
Limit W_{Gra}:	+ 17 %						

Note:
1. The output power at grid test voltage/50,00Hz shall be maintained for 5 min and the average power shall be used as the frozen value of power (Pref)
2. The frequency increase rate: 0.1Hz/step/30s.
3. The frequency decrease rate: 0.2Hz/step/30s.
4. While the frequency decrease less than 50,15Hz, the voltage and frequency shall be maintained for 10 min or until the inverter reaches the maximum output power available.
5 After frequency decrease less than 50,15Hz, adjust output power to 100% rated power.

Diagram of overfrequency

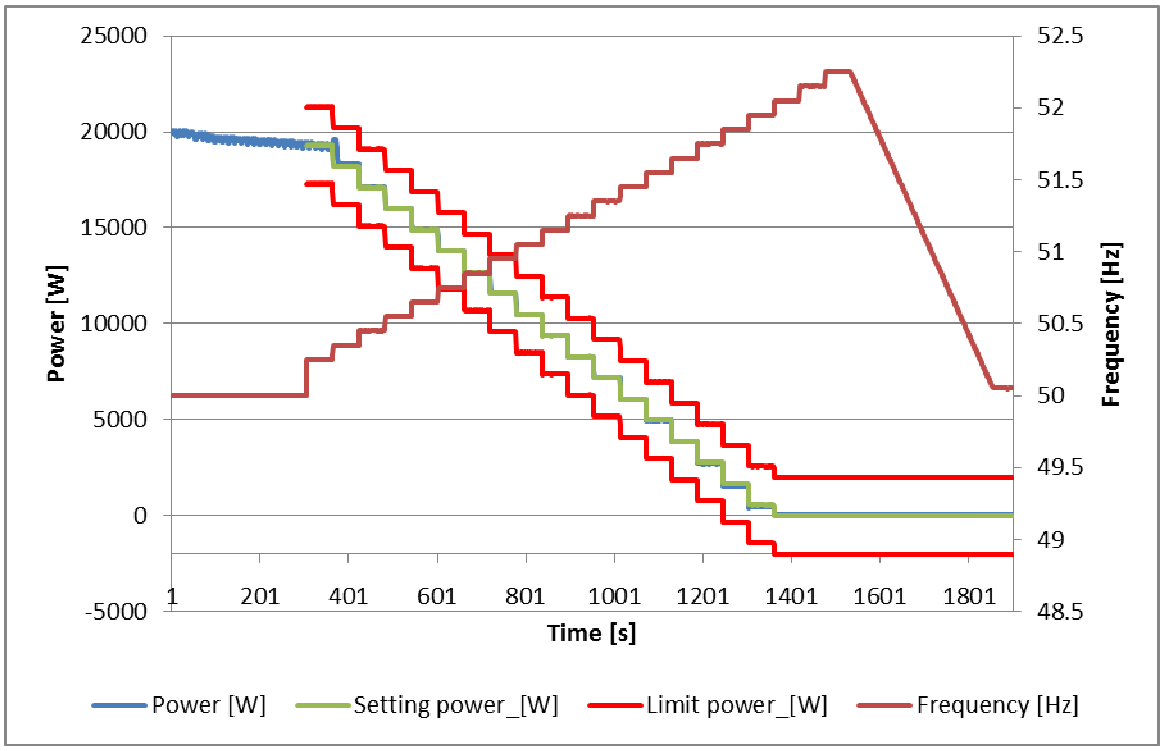
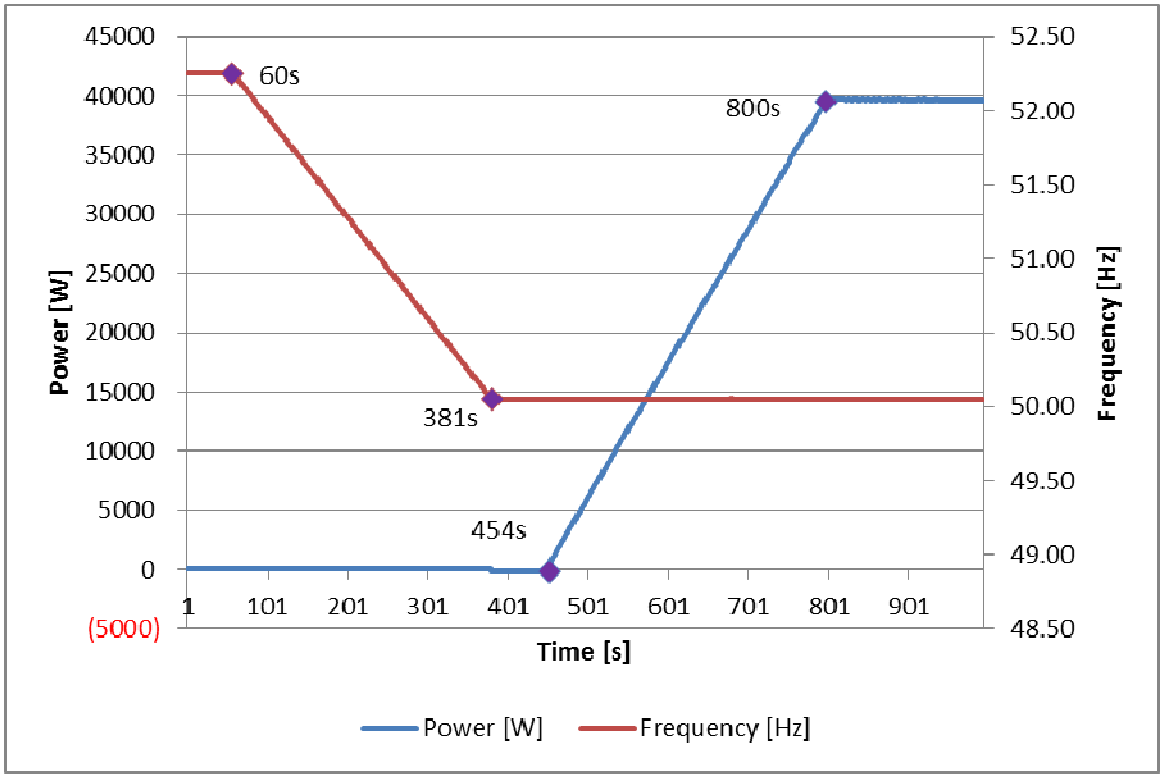


Diagram of power restore gradient line



7.5.3.1 Response to an increase in frequency (continued) **Appendix H3.2 Test procedure (continued)** **SOFAR 33000TL-Sx Series**							**P**
2. Measurement a) to o): Power output: 50+/-5% of rated apparent power							
30s mean value	a) 50,00Hz	b) 50,25Hz	c) 50,35Hz	d) 50,45Hz	e) 50,55Hz	f) 50,65Hz	g) 50,75Hz
Frequency [Hz]:	50,00	50,25	50,35	50,45	50,55	50,65	50,75
$P_{setpoint}$ [kW]:	17,000	17,000	16,253	15,268	14,283	13,298	12,313
P [kW]:	16,948	17,238	16,496	15,230	14,206	13,237	12,258
$\Delta P/P_{Setpoint}$ [%]:	-0,30	1,40	1,43	-0,22	-0,45	-0,36	-0,32
30s mean value	h) 50,85Hz	i) 50,95Hz	j) 51,05Hz	N/A	N/A	N/A	N/A
Frequency [Hz]:	50,85	50,95	51,05	N/A	N/A	N/A	N/A
$P_{setpoint}$ [kW]:	11,328	10,343	9,358	N/A	N/A	N/A	N/A
P [kW]:	11,294	10,329	9,300	N/A	N/A	N/A	N/A
$\Delta P/P_{Setpoint}$ [%]:	-0,20	-0,08	-0,34	N/A	N/A	N/A	N/A
The frequency shall be decreased every 30 s in 0,2 Hz decrements from 51,05Hz until less than 50,15Hz. Maintained for 10 min or until the inverter reaches the maximum output power available. After frequency decreased to less than 50,15Hz, adjust output power to 100% rated power.							
30s mean value	k) 50,85Hz	l) 50,65Hz	m)50,45Hz	n) 50,25Hz	o) 50,05Hz	N/A	N/A
Frequency [Hz]:	50,85	50,65	50,45	50,25	50,05	N/A	N/A
$P_{setpoint}$ [kW]:	9,358	9,358	9,358	9,358	9,358	N/A	N/A
P [kW]:	9,286	9,286	9,287	9,287	9,285	N/A	N/A
$\Delta P/P_{Setpoint}$ [%]:	-0,42	-0,42	-0,42	-0,42	-0,43	N/A	N/A
Limit W_{Gra}:	+ 17 %						
Note: 1. The output power at grid test voltage/50,00Hz shall be maintained for 5 min and the average power shall be used as the frozen value of power (Pref) 2. The frequency increase rate: 0.1Hz/step/30s. 3. The frequency decrease rate: 0.2Hz/step/30s. 4. While the frequency decrease less than 50,15Hz, the voltage and frequency shall be maintained for 10 min or until the inverter reaches the maximum output power available. 5 After frequency decrease less than 50,15Hz, adjust output power to 100% rated power. The tests had been performed on the SOFAR 33000TL-Sx Series and the results are valid for the SOFAR 30000TL-Sx Series, since it is similar in hardware and just power derated by software.							

Diagram of overfrequency

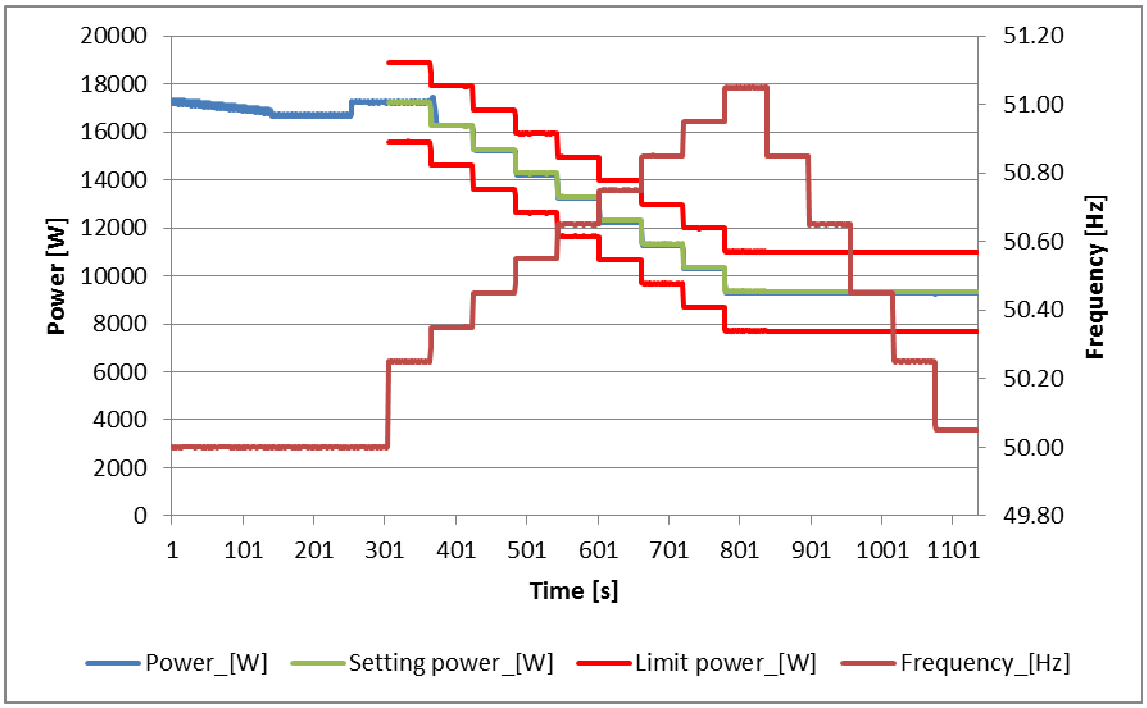
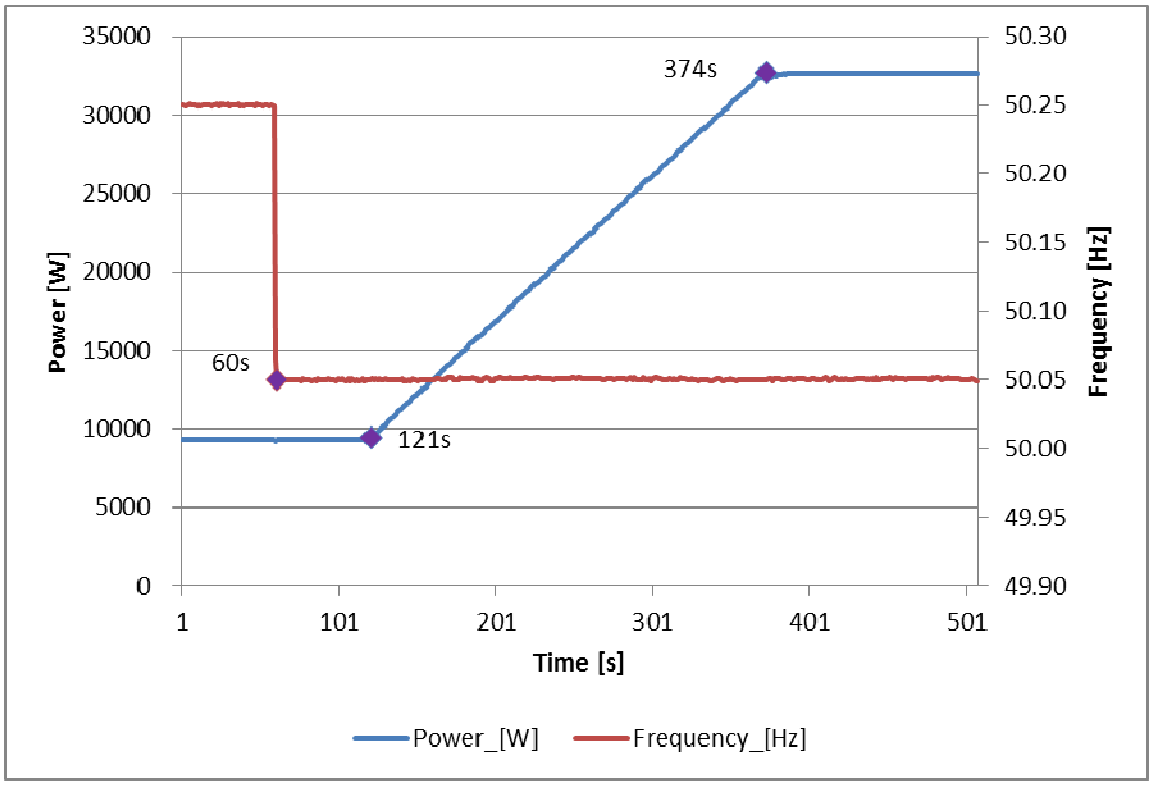


Diagram of power restore gradient line



7.5.3.1 Response to an increase in frequency (continued) **Appendix H3.2 Test procedure (continued)** **SOFAR 40000TL-Sx Series**							**P**
2. Measurement a) to o): Power output: 50+/-5% of rated apparent power							
30s mean value	a) 50,00Hz	b) 50,25Hz	c) 50,35Hz	d) 50,45Hz	e) 50,55Hz	f) 50,65Hz	g) 50,75Hz
Frequency [Hz]:	50,00	50,25	50,35	50,45	50,55	50,65	50,75
$P_{setpoint}$ [kW]:	20,000	20,000	17,597	16,531	15,464	14,398	13,331
P [kW]:	19,290	18,664	18,182	16,536	15,440	14,391	13,320
$\Delta P/P_{Setpoint}$ [%]:	-3,55	-6,68	2,92	0,03	-0,12	-0,03	-0,06
30s mean value	h) 50,85Hz	i) 50,95Hz	j) 51,05Hz	N/A	N/A	N/A	N/A
Frequency [Hz]:	50,85	50,95	51,05	N/A	N/A	N/A	N/A
$P_{setpoint}$ [kW]:	12,265	11,198	10,132	N/A	N/A	N/A	N/A
P [kW]:	12,263	11,214	10,107	N/A	N/A	N/A	N/A
$\Delta P/P_{Setpoint}$ [%]:	-0,01	0,08	-0,12	N/A	N/A	N/A	N/A
The frequency shall be decreased every 30 s in 0,2 Hz decrements from 51,05Hz until less than 50,15Hz. Maintained for 10 min or until the inverter reaches the maximum output power available. After frequency decreased to less than 50,15Hz, adjust output power to 100% rated power.							
30s mean value	k) 50,85Hz	l) 50,65Hz	m)50,45Hz	n) 50,25Hz	o) 50,05Hz	N/A	N/A
Frequency [Hz]:	50,85	50,65	50,45	50,25	50,05	N/A	N/A
$P_{setpoint}$ [kW]:	10,132	10,132	10,132	10,132	10,132	N/A	N/A
P [kW]:	10,109	10,110	10,109	10,110	10,108	N/A	N/A
$\Delta P/P_{Setpoint}$ [%]:	-0,11	-0,11	-0,11	-0,11	-0,12	N/A	N/A
Limit W_{Gra}:	+ 17 %						
Note: 1. The output power at grid test voltage/50,00Hz shall be maintained for 5 min and the average power shall be used as the frozen value of power (Pref) 2. The frequency increase rate: 0.1Hz/step/30s. 3. The frequency decrease rate: 0.2Hz/step/30s. 4. While the frequency decrease less than 50,15Hz, the voltage and frequency shall be maintained for 10 min or until the inverter reaches the maximum output power available. 5 After frequency decrease less than 50,15Hz, adjust output power to 100% rated power.							

Diagram of overfrequency

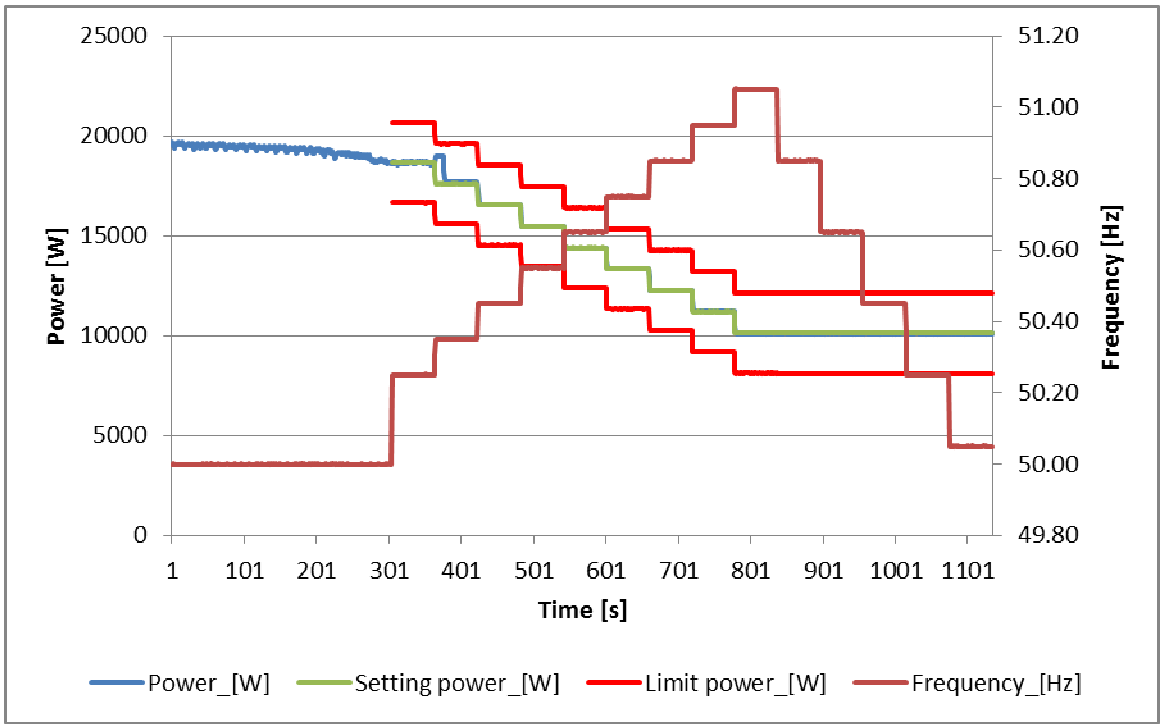
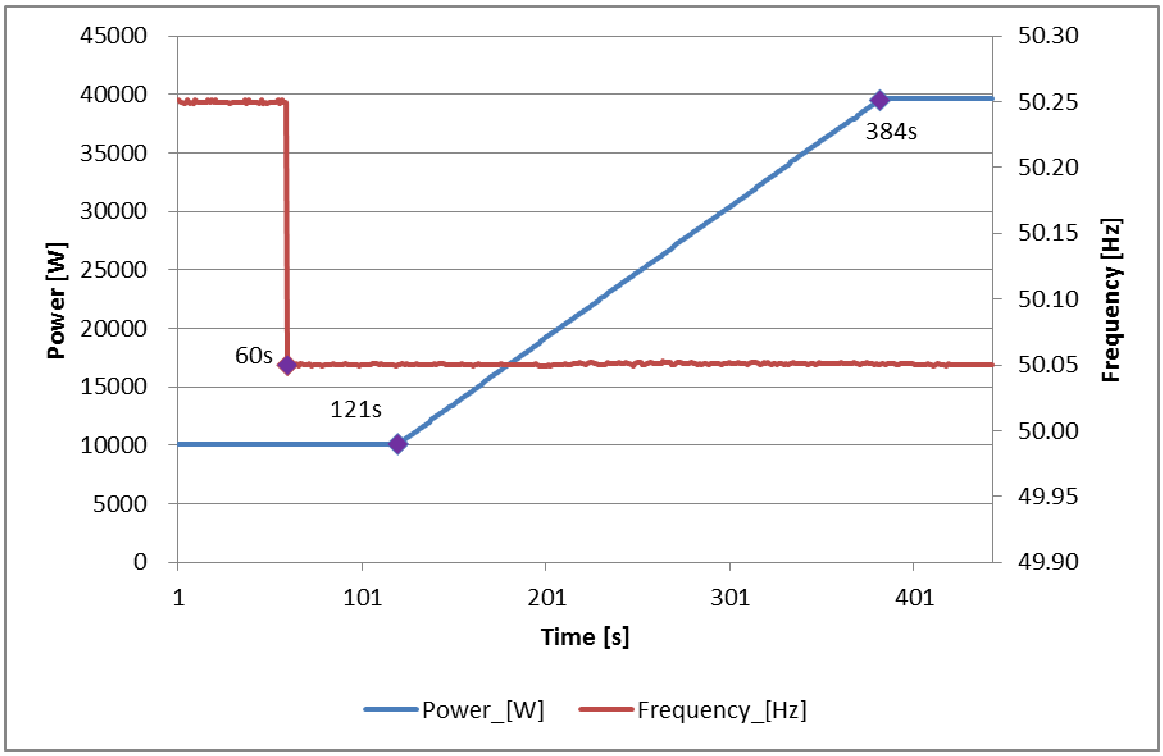


Diagram of power restore gradient line



Annex 1
EMC Test Report

Report No.: SET2016-11547

EMC TEST REPORT

Report No.:	SET2016-11547
Product:	Solar Inverter
Model No:	SOFAR 30000TL-SX, SOFAR 33000TL-SX, SOFAR 40000TL-SX (X=0-2)
Applicant:	Shenzhen SOFARSOLAR Co., Ltd.
Address:	3A-1, Huake Building, East Technology Park, Qiaoxiang Road, Nanshan District, Shenzhen, China
Issued by:	CCIC Southern Electronic Product Testing (Shenzhen)CO., Ltd.
Lab location:	Electronic Testing Building, No. 43 Shahe Road, Xili Jiedao, Nanshan District, Shenzhen, Guangdong, China
Tel:	86 755 26627338 Fax: 86 755 26627238

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Query No.: 85UHFKZE

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Report

Product	Solar Inverter
Model No.	SOFAR 30000TL-SX, SOFAR 33000TL-SX, SOFAR 40000TL-SX (X=0-2)
Brand Name	/
Applicant	Shenzhen SOFARSOLAR Co., Ltd.
Applicant Address	3A-1, Huake Building, East Technology Park, Qiaoxiang Road, Nanshan District, Shenzhen, China
Manufacturer	Suga Networks Equipment (Shenzhen) Co., Ltd.
Manufacturer Address	Suga High-tech Industrial Park, No 8, Fulong Road, Sanzhong, Qingxi Town,Dongguan, Guangdong,China
Test Standards	**AS/NZS 61000.6.3: 2012** Electromagnetic compatibility (EMC) – Part 6.3: Generic standards – Emission standard for residential, commercial and light-industrial environments
Test Result	Pass
Tested by	Chen Weichang Jul. 08, 2016
	Signature, Date
Reviewed by	Liu-Tongzhou Jul. 08, 2016
	Signature, Date
Approved by	Wu Lian Jul. 08, 2016
	Signature, Date

CCIC-SET

CCIC-SET/T-I (00)

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Table of Contents

1 General Information

1.1 Description of EUT

Product: Solar Inverter

Model No.: SOFAR 33000TL-SX, SOFAR 40000TL-SX (X=0-2)

Brand Name: /

Serial No.: /

Rating:
Maximum d.c. input voltage: 1000 V
Input voltage range: 250-960 V
MPPT voltage range: 560-800 V (for SOFAR 40000TL-Sx); 480-800 V(for SOFAR 30000TL-Sx, SOFAR 33000TL-Sx)
Max. input current: 2×32 A (for SOFAR 30000TL-Sx); 2×35 A (for SOFAR 33000TL-Sx); 2×35 A (for SOFAR 40000TL-Sx)
Max. PV Isc: 2×40 A (for SOFAR 30000TL-Sx); 2×40 A (for SOFAR 33000TL-Sx); 2×40 A (for SOFAR 40000TL-Sx)
Nominal output voltage: 3/N/PE230V/400Vac (for SOFAR 30000TL-Sx, SOFAR 33000TL-Sx); 3/PE/480Vac(for SOFAR 40000TL-Sx)
Max. output current: 3×43 A (for SOFAR 30000TL-Sx); 3×48A (for SOFAR 33000TL-Sx); 3×48 A (for SOFAR 40000TL-Sx)
Nominal frequency: 50 Hz
Max. output power: 30000 VA(for SOFAR 30000TL-Sx); 33000 VA (for SOFAR 33000TL-Sx); 40000 VA (for SOFAR 40000TL-Sx)

Accessories: /

NOTE:

1. Model SOFAR 30000TL-SX, SOFAR 33000TL-SX, SOFAR 40000TL-SX(X=0-2) was certified using 9 MP330 modules. The highest internal frequency of the EUT is less than 108 MHz, so the radiated emission measurement shall be made up to 1GHz.
2. Since all the models have identical mechanical and electrical construction except some parameter of the software architecture in order to control the max output power. And refer to the following table for details.

Model	DC surge arrester	AC surge arrester
SOFAR 30000TL-S0, SOFAR 33000TL-S0, SOFAR 40000TL-S0		
SOFAR 30000TL-S1, SOFAR 33000TL-S1, SOFAR 40000TL-S1	√	
SOFAR 30000TL-S2, SOFAR 33000TL-S2, SOFAR 40000TL-S2	√	√
√ denote incorporating this component		

Model	SOFAR 40000TL-Sx, SOFAR 33000TL-Sx	SOFAR 30000TL-Sx
Heat-dissipating methods	With two Fans	Natural cooling

Therefore we performed the tests which shown in summary table on model SOFAR 33000TL-Sx and SOFAR 40000TL-Sx.

3. For more detailed features description about the EUT, please refer to User's Manual.

1.2 Objective

Perform ElectroMagnetic Interference (EMI) tests for C-Tick Marking.

2 Test Facilities and Configuration

2.1 Environmental Conditions

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 15-35°C
- Humidity: 30-60 %
- Atmospheric pressure: 86-106 kPa

2.2 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

- Uncertainty of Conducted Emission, Uc = ±3.6dB
- Uncertainty of Radiated Emission (30MHz-1GHz), Uc = ±5.1dB

2.3 Test Facility

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is **L1659**.

The EMC chamber site No.1 (EMC12.8×6.8×6.4(m)), and the radiated and conducted Emission test equipments of CCIC-SET are constructed and calibrated to meet the FCC requirements ANSI C63.4:2001 and CISPR 22/EN 55022. The FCC Registration Number is **406086**.

The EMC chamber site No.1 (EMC12.8×6.8×6.4(m)) also complies with Canada standard RSS 212, and acceptable to Industry Canada for the performance of radiated measurements. The Industry Canada Registration Number is **11185A**.

2.4 Test Standards and Results

The EUT has been tested according to the following specifications:

EMISSION		
Standard	**Test Type**	**Result**
AS/NZS 61000.6.3: 2012	Mains terminal disturbance voltage	PASS
	Radiated disturbance	PASS

2.5 List of Equipments Used

Description	Manufacturer	Model No.	Calibration Due Date	Serial No.
Test Receiver	ROHDE&SCHWARZ	ESCI	Jun.10, 2017	A130901474
LISN	ROHDE&SCHWARZ	ESH2-Z5	Jun.10, 2017	A0304221
Shield Room	Nanbo Tech	Site 2	Nov.14, 2016	A0304210
Test Receiver	ROHDE&SCHWARZ	ESCI	Jun.10, 2017	A0902601
Broadband Ant.	SCHWARZBECK	VULB 09160	Jun.10, 2017	A0805560
Anechoic Chamber	Albatross	SAC-10MAC 19.6×11.8×8.55	Mar.10, 2017	A0802520

NOTE: Equipments above have been calibrated and are in the period of validation.

3 Emission Test

3.1 EUT Setup and Operating Conditions

The EUT was powered by 720V AC mains and continuously operated.

3.2 Mains Terminal Disturbance Voltage Measurement

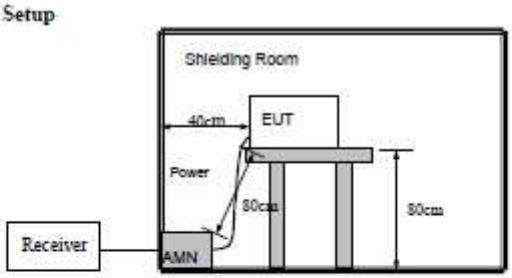
3.2.1 Limits of Mains Terminal Disturbance Voltage

Frequency range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.

3.2.2 Test Setup



3.2.3 Test Result

Environment Condition:
Temperature: 24°C; Relative Humidity: 55%; Pressure:101kPa
Test Date: 2015-08-11 to 2015-08-15
Test Engineer: Zhao Kai
Test Site: EMC Lab

No.	Freq. (MHz)	Limit Value (dBμV)		Emission Level (dBμV)	
		QP	AV	QP	AV
Model No.: SOFAR 40000TL-S0					
L1	0.1500	66	56	54.00	49.90
L1	0.5780	56	46	41.70	36.30
L1	4.0620	56	46	50.10	44.30
L2	0.1500	66	56	54.20	49.40
L2	0.5780	56	46	42.70	36.80
L2	4.0220	56	46	46.40	40.80
L3	0.1500	66	56	55.20	50.20
L3	0.5940	56	46	42.20	36.00
L3	4.0260	56	46	42.60	37.10
Model No.: SOFAR 33000TL-S0					
L1	0.1500	66	56	56.80	48.20
L1	0.5860	56	46	38.70	34.60
L1	4.0260	56	46	34.00	27.30
L2	0.1500	66	56	58.80	49.50
L2	0.5700	56	46	42.10	35.40
L2	4.0380	56	46	42.50	31.90
L3	0.1500	66	56	60.50	50.90
L3	0.5700	56	46	43.10	34.50
L3	4.0260	56	46	43.10	30.20
N	0.1780	64.6	54.6	32.40	28.20
N	0.5860	56	46	38.10	34.50
N	3.3180	56	46	29.90	23.50

NOTE:

1. QP and AV are abbreviations of the quasi-peak and average individually.
2. If the emission levels measured with QP detector are lower than AV limits, there is unnecessary to measure with AV detector.
3. The emission levels recorded above is the larger ones of both L phase and N phase.

3.3 Radiated Disturbance Measurement

3.3.1 Limits of Radiated Disturbance (30MHz ~ 1GHz)

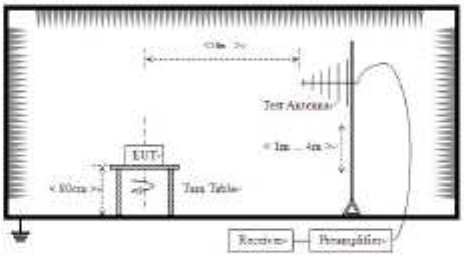
Frequency range (MHz)	Quasi peak limits(dBμV/m), at 10m measurement distance
30 – 230	30
230 – 1000	37

Notes:

(1) The lower limit shall apply at the transition frequency.

(2) Additional provisions may be required for cases where interference occurs.

3.3.2Test Setup



3.3.3 Test Result

Environment Condition:

Temperature: 24□C; Relative Humidity: 55%; Pressure:101kPa

Test Date: 2015-08-11 to 2015-08-15

Test Engineer: Zhao Kai

Test Site: EMC Lab

No.	Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	QP Limits (dBμV/m)	Emission Level (dBμV/m)
1	123.28	H	400	0	30	22.10
2	30.24	V	100	0	30	28.70
3	35.84	V	100	10	30	25.70
4	127.00	V	100	90	30	22.40

Appendix I: Photographs of the EUT

1. Appearance

Overall view of the unit for model SOFAR 40000TL-Sx and SOFAR 33000TL-Sx

Bottom view of the unit model SOFAR 40000TL-Sx and SOFAR 33000TL-Sx

2, Inside

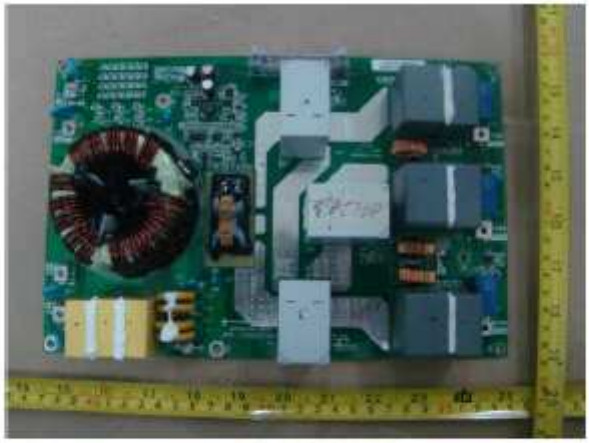
Internal view model SOFAR 40000TL-Sx and SOFAR 33000TL-Sx

Internal view of the unit model SOFAR 40000TL-Sx and SOFAR 33000TL-Sx

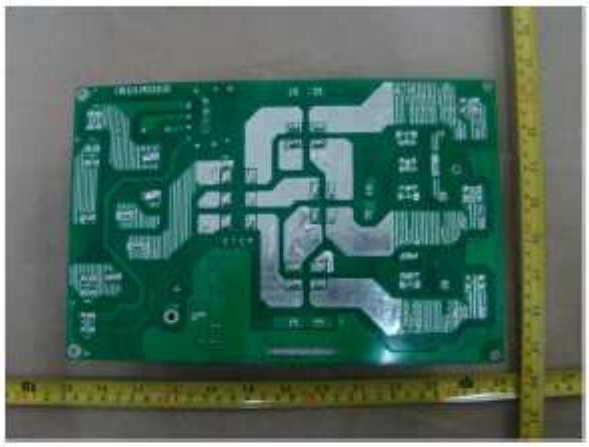
Internal view of the unit model SOFAR 40000TL-Sx and SOFAR 33000TL-Sx

Control board

PCB soldering view

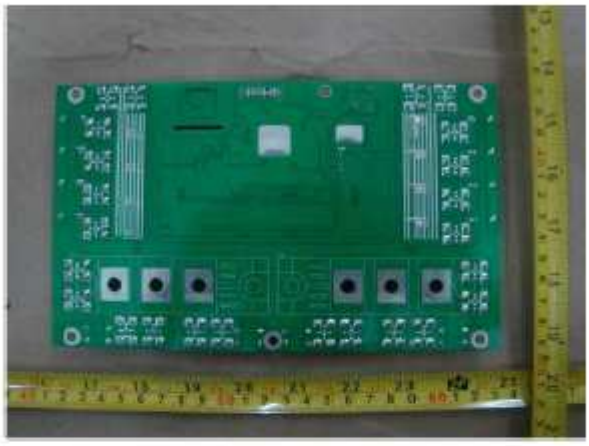


Output board

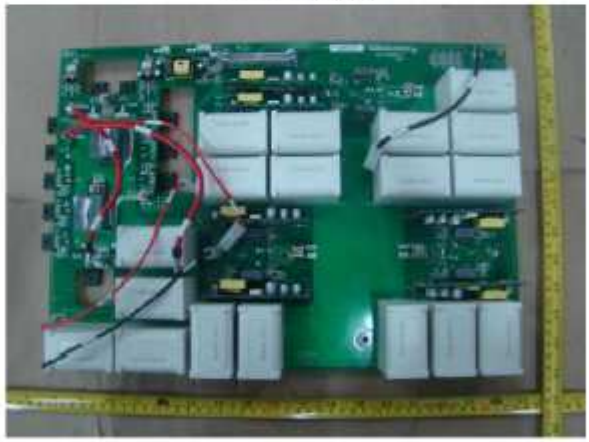


PCB soldering view

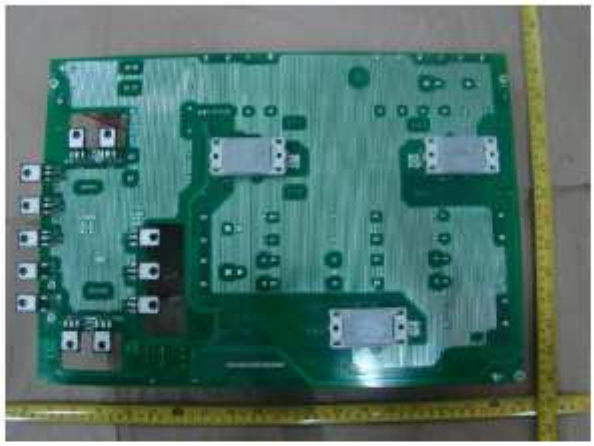
Combiner board



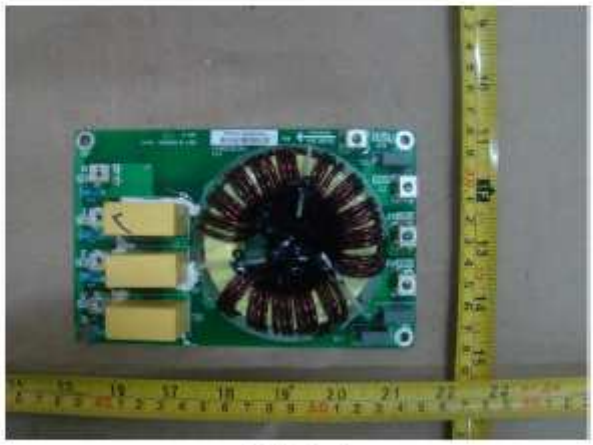
PCB soldering view



Power board



PCB soldering view



AC EMI board

PCB soldering view

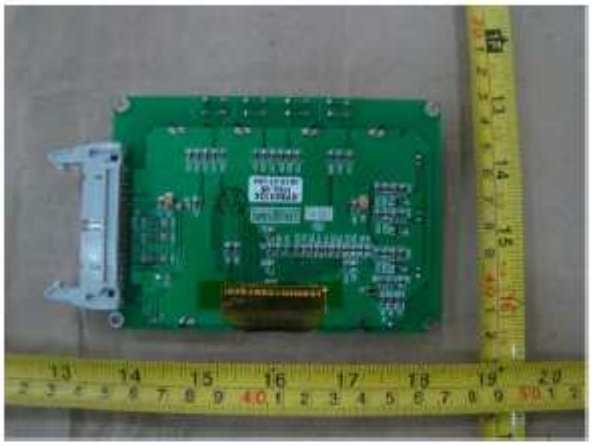
Input board

PCB soldering

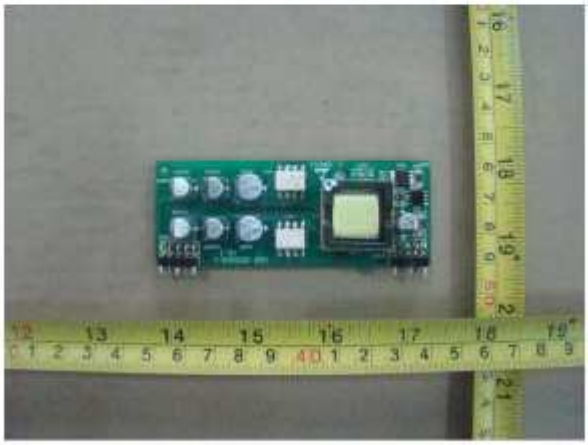
Communication board

PCB soldering view

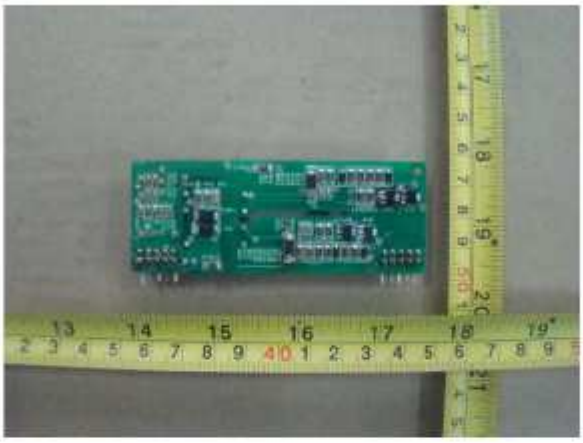
LCD display board



PCB soldering view



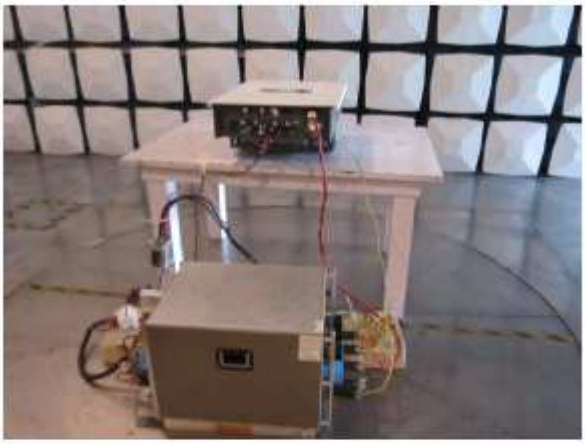
Driver board



Bottom of driver board

Appendix II: Photographs of EMC Test Configuration

1. Mains terminal disturbance voltage



2. Radiated Field Strength Measurement

STATEMENT

1. This test laboratory is accredited by CNAS, Accreditation Certificate No.L1659.
2. The test report is invalid without stamp of laboratory.
3. The test report is invalid without signature of person(s) testing and authorizing.
4. The test report is invalid if erased and corrected.
5. Test results of the report are valid to the test samples if sampling by client.
6. "☆" item cannot be Accredited by CNAS.
7. The test report shall not be reproduced except in full, without written approval of the laboratory.
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Address: Electronic Testing Building, No. 43 Shahe Road, Xili Jiedao, Nanshan District, Shenzhen, Guangdong, China
P.C.: 518055
TEL: 0755-26028093、26627338 FAX: 0755-26627238
Internet: http://www.ccic-set.com E-Mail: manager@ccic-set.com

Report No. SET2016-11548

EMC TEST REPORT

Report No.:	SET2016-11548
Product:	Solar Inverter
Model No:	SOFAR 30000TL-SX, SOFAR 33000TL-SX, SOFAR 40000TL-SX(X=0-2)
Applicant:	Shenzhen SOFARSOLAR Co., Ltd.
Address:	3A-1, Huake Building, East Technology Park, Qiaoxiang Road, Nanshan District, Shenzhen, China
Issued by:	CCIC Southern Electronic Product Testing (Shenzhen)CO., Ltd.
Lab location:	Electronic Testing Building, No. 43 Shahe Road, Xili Jiedao, Nanshan District, Shenzhen, Guangdong, China
Tel:	86 755 26627338 Fax: 86 755 26627238

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Query No.: 85UHFKZE

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Report No. SET2016-11548

Report

Product	Solar Inverter
Model No.	SOFAR 30000TL-SX, SOFAR 33000TL-SX, SOFAR 40000TL-SX(X=0-2)
Brand Name	/
Applicant	Shenzhen SOFARSOLAR Co., Ltd.
Applicant Address	3A-1, Huake Building, East Technology Park, Qiaoxiang Road, Nanshan District, Shenzhen, China
Manufacturer	Suga Networks Equipment (Shenzhen) Co., Ltd.
Manufacturer Address	Suga High-tech Industrial Park, No. 8, Fulong Road, Sanzhong, Qingxi Town, Dongguan, Guangdong, China
Test Standards	**EN 61000-6-2:2005** Electromagnetic compatibility (EMC) -- Part 6-2: Generic standards - Immunity for industrial environments **EN 61000-6-4:2007+A1:2011** Electromagnetic compatibility (EMC) -- Part 6-4: Generic standards - Emission standard for industrial environments
Test Result	Pass

Tested by ..... : Chen Weicheng Jul. 08, 2016
Signature, Date

Reviewed by ..... : Lu-Tongshou Jul. 08, 2016
Signature, Date

Approved by ..... : Wu Lian Jul. 08, 2016
Signature, Date

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Table of Contents

1 General Information

1.1 Description of EUT

Product: Solar Inverter

Model No.: SOFAR 33000TL-SX, SOFAR 40000TL-SX (X=0-2)

Brand Name: ----

Serial No.: /

Rating:
Maximum d.c. input voltage: 1000 V
Input voltage range: 250-960 V
MPPT voltage range: 560-800 V (for SOFAR 40000TL-Sx); 480-800 V(for SOFAR 30000TL-Sx, SOFAR 33000TL-Sx)
Max. input current: 2×32 A (for SOFAR 30000TL-Sx); 2×35 A (for SOFAR 33000TL-Sx); 2×35 A (for SOFAR 40000TL-Sx)
Max. PV Isc: 2×40 A (for SOFAR 30000TL-Sx); 2×40 A (for SOFAR 33000TL-Sx); 2×40 A (for SOFAR 40000TL-Sx)
Nominal output voltage: 3/N/PE230V/400Vac (for SOFAR 30000TL-Sx, SOFAR 33000TL-Sx); 3/PE/480Vac(for SOFAR 40000TL-Sx)
Max. output current: 3×43 A (for SOFAR 30000TL-Sx); 3×48A (for SOFAR 33000TL-Sx); 3×48 A (for SOFAR 40000TL-Sx)
Nominal frequency: 50 Hz
Max. output power: 30000 VA(for SOFAR 30000TL-Sx); 33000 VA (for SOFAR 33000TL-Sx); 40000 VA (for SOFAR 40000TL-Sx)

Accessories: /

NOTE:

1. Model SOFAR 30000TL-SX, SOFAR 33000TL-SX, SOFAR 40000TL-SX(X=0-2) was certified using 9 MP330 modules. The highest internal frequency of the EUT is less than 108 MHz，so the radiated emission measurement shall be made up to 1GHz.
2. Since all the models have identical mechanical and electrical construction except some parameter of the software architecture in order to control the max output power. And refer to the following table for details.

Model	DC surge arrester	AC surge arrester
SOFAR 30000TL-S0, SOFAR 33000TL-S0, SOFAR 40000TL-S0		
SOFAR 30000TL-S1, SOFAR 33000TL-S1, SOFAR 40000TL-S1	√	
SOFAR 30000TL-S2, SOFAR 33000TL-S2, SOFAR 40000TL-S2	√	√
√ denote incorporating this component		

Model	SOFAR 40000TL-Sx, SOFAR 33000TL-Sx	SOFAR 30000TL-Sx
Heat-dissipating methods	With two Fans	Natural cooling

Therefore we performed the tests which shown in summary table on model SOFAR 33000TL-Sx and SOFAR 40000TL-Sx.

3. For more detailed features description about the EUT, please refer to User's Manual.

1.2 Objective

Perform ElectroMagnetic Interference (EMI) and ElectroMagnetic Susceptibility (EMS) tests for CE Marking.

2 Test Facilities and Configuration

2.1 Environmental Conditions

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 15-25°C
- Humidity: 30-60 %
- Atmospheric pressure: 86-106 kPa

2.2 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

- Uncertainty of Conducted Emission, Uc = ±3.6dB
- Uncertainty of Radiated Emission, Uc = ±5.1dB

2.3 Test Standards and Results

The EUT has been tested according to the following specifications:

EMISSION		
Standard	**Test Type**	**Result**
EN 61000-6-4:2007+A1:2011	Mains terminal disturbance voltage	PASS
	Radiated disturbance	PASS
IMMUNITY (EN61000-6-2:2005)		
Basic Standard	**Test Type**	**Result**
IEC 61000-4-2	Electrostatic discharge immunity	PASS
IEC 61000-4-3	Radiated, radio frequency electromagnetic field immunity	PASS
IEC 61000-4-4	Electrical fast transient/burst immunity	PASS
IEC 61000-4-5	Surge immunity	PASS
IEC 61000-4-6	Immunity to conducted disturbances induced by RF fields	PASS
IEC 61000-4-8	Power frequency magnetic field immunity	PASS

NOTE: The latest versions of basic standards are applied.

2.4 List of Equipments Used

Description	Manufacturer	Model No.	Calibration Due Date	Serial No.
Test Receiver	ROHDE&SCHWARZ	ESCI	Jun.10, 2017	A0902601
LISN	SCHWARZBECK	NNLK8130	Jun.10, 2017	A131001541
Broadband Ant.	ROHDE&SCHWARZ	VULB09160	Jun.10, 2017	A0805560
Antenna	Amplifier Research	AR AT1080	Jun.10, 2017	A0304249
Antenna	Amplifier Research	AT4002A	Jun.10, 2017	A0304250
ESD Test System	EM TEST	ESD30C	Jul.03, 2016	A0712513
EFT/Surge Test System	EM TEST	UCS500N7.7	Dec.16.2016	A130201094
	EM TEST	CNI503B9.3	Dec.16.2016	A130201095
Signal Generator	ROHDE&SCHWARZ	SMR27	Jun.10, 2017	A0304219
Power Amplifier	Amplifier Research	500W1000A	/	A0804545
Power Amplifier	Amplifier Research	50S1g4AM1	/	A0804546
Signal Generator	ROHDE&SCHWARZ	SML01	Jun.10, 2017	1090.3000.11
Power Amplifier	Amplifier Research	500A100A	/	A0804544
Electromagnetic coupling clamp	ROHDE&SCHWARZ	F2031	Jun.10, 2017	A0304258
Anechoic Chamber	Albatross	EMC 19.6*11.8*8.55(m)	Mar.08, 2017	A0802520
Magnetic Field Tester	HAEFELY	MAG 100.1	Jun.10, 2017	A0103109
Power Quality Analyzer	Fluke	F435	Jun.10, 2017	--

NOTE: Equipments above have been calibrated and are in the period of validation.

3 Emission Test

3.1 EUT Setup and Operating Conditions

The EUT was powered by 720V DC mains and continuously operated.
Environment Condition:
Temperature: 24°C; Relative Humidity: 55%; Pressure:101kPa
Test Date: 2015-08-11 to 2015-08-15
Test Engineer: Zhao Kai
Test Site: EMC Lab

3.2 Mains Terminal Disturbance Voltage Measurement

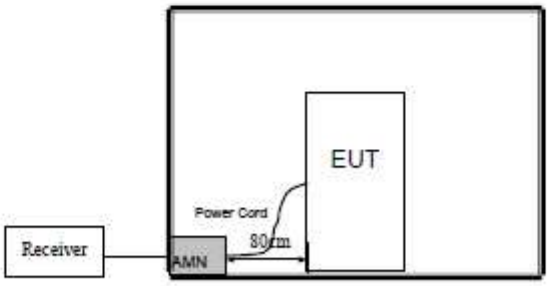
3.2.1 Limits of Mains Terminal Disturbance Voltage

Frequency range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

NOTE:

1. The lower limit shall apply at the transition frequencies.

3.2.2 Test Setup



3.2.3 Test Result

No.	Freq. (MHz)	Limit Value (dBμV)		Emission Level (dBμV)	
		QP	AV	QP	AV
Model No.: SOFAR 40000TL-S0					
L1	0.1500	66	56	54.00	49.90
L1	0.5780	56	46	41.70	36.30
L1	4.0620	56	46	50.10	44.30
L2	0.1500	66	56	54.20	49.40
L2	0.5780	56	46	42.70	36.80
L2	4.0220	56	46	46.40	40.80
L3	0.1500	66	56	55.20	50.20
L3	0.5940	56	46	42.20	36.00
L3	4.0260	56	46	42.60	37.10
Model No.: SOFAR 33000TL-S0					
L1	0.1500	66	56	56.80	48.20
L1	0.5860	56	46	38.70	34.60
L1	4.0260	56	46	34.00	27.30
L2	0.1500	66	56	58.80	49.50
L2	0.5700	56	46	42.10	35.40
L2	4.0380	56	46	42.50	31.90
L3	0.1500	66	56	60.50	50.90
L3	0.5700	56	46	43.10	34.50
L3	4.0260	56	46	43.10	30.20
N	0.1780	64.6	54.6	32.40	28.20
N	0.5860	56	46	38.10	34.50
N	3.3180	56	46	29.90	23.50

NOTE:

1. QP and AV are abbreviations of the quasi-peak and average individually.
2. If the emission levels measured with QP detector are lower than AV limits, there is unnecessary to measure with AV detector.
3. The emission levels recorded above is the larger ones of each phase.

3.3 Radiated Disturbance Measurement

3.3.1 Limits of Radiated Disturbance

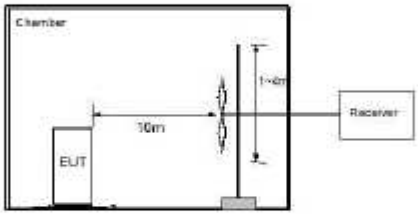
Frequency range (MHz)	Quasi peak limits(dBμV/m), at 10m measurement distance
30 – 230	30
230 – 1000	37

Notes:

(1) The lower limit shall apply at the transition frequency.

(2) Additional provisions may be required for cases where interference occurs.

3.3.2Test Setup



3.3.3 Test Result

No.	Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Table Angle (Degree)	QP Limits (dBμV/m)	Emission Level (dBμV/m)
1	123.28	H	400	0	30	22.10
2	30.24	V	100	0	30	28.70
3	35.84	V	100	10	30	25.70
4	127.00	V	100	90	30	22.40

4 Immunity Test

4.1 EUT Setup and Operating Conditions

The EUT was powered by 380V AC mains and continuously operated.
Environment Condition:
Temperature: 24°C; Relative Humidity: 55%; Pressure:101kPa
Test Date: 2015-07-06 to 2015-07-13
Test Engineer: Yang Zhicheng
Test Site: EMC Lab

4.2 Performance Criteria

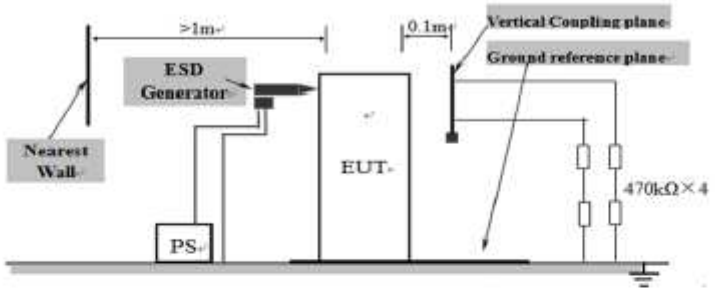
Criterion A	The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended.
Criterion B	The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended.
Criterion C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

4.3 Electrostatic Discharge Immunity Test

4.3.1 Test Specification

Basic Standard:	IEC 61000-4-2
Discharge Impedance	330Ω / 150 pF
Discharge Voltage:	Air Discharge : 8 kV Contact Discharge : 4kV
Polarity:	Positive / Negative
Number of Discharge:	Minimum 20 times at each test point
Discharge Mode:	Single discharge
Discharge Period:	1-second minimum
Criterion:	B

4.3.2 Test Setup



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

4.3.3 Test Result

Test Points	Discharge Level (kV)	Discharge Mode	Observation	Comply with Criterion
Aperture of the cover	±8	Air	Note(1)	A
Screen	±8	Air	Note(1)	A
Button	±8	Air	Note(1)	A
Metallic shell of connecters	±4	Contact	Note(1)	A
HCP	±4	Contact	Note(1)	A
VCP	±4	Contact	Note(1)	A

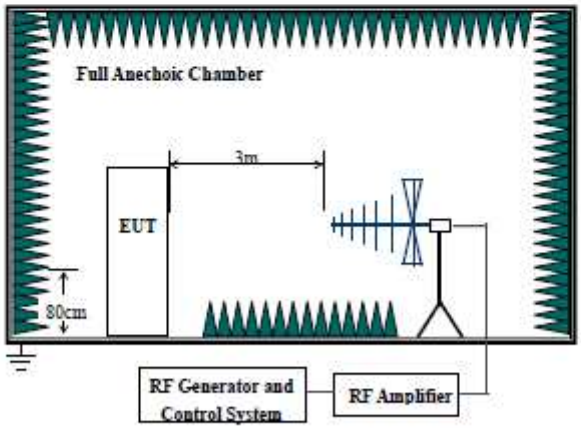
NOTE:
(1). The EUT continued to operate as intended. No degradation of performance was observed.

4.4 Radiated, Radio Frequency Electromagnetic Field Immunity Test

4.4.1 Test Specification

Basic Standard:	IEC 61000-4-3		
Frequency Range:	80 MHz – 1000MHz	1.4GHz – 2.0GHz	2.0GHz – 2.7GHz
Field Strength:	10V/m	3V/m	1V/m
Modulation:	1kHz sine wave, 80%, AM modulation		
Frequency Step:	1% of fundamental		
Polarity of Antenna	Horizontal and Vertical		
Test Distance:	3m		
Antenna Height:	1.5m		
Dwell Time:	3 seconds		
Criterion:	A		

4.4.2 Test Setup



4.4.3 Test Result

Frequency	Polarity	Azimuth	Field Strength (V/m)	Observation	Comply with Criterion
80-1000 MHz	V&H	0,90,180, 270	10	Note(1)	A
1.4-2.0GHz	V&H	0,90,180, 270	3	Note(1)	A
2.0-2.7GHz	V&H	0,90,180, 270	1	Note(1)	A

NOTE:

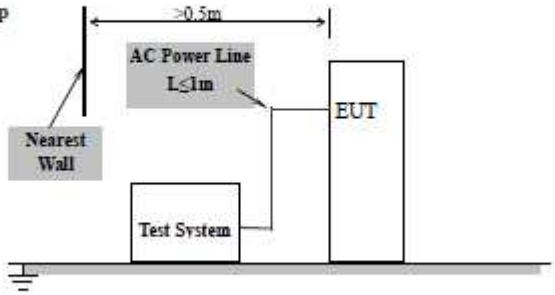
(1). The EUT continued to operate as intended. No degradation of performance was observed.

4.5 Electrical Fast Transient/Burst Immunity Test

4.5.1 Test Specification

Basic Standard:	IEC 61000-4-4
Test Voltage:	AC. power port:2 kV
Polarity:	Positive/Negative
Impulse Frequency:	5kHz
Impulse wave shape:	5/50ns
Burst Duration:	15ms
Burst Period:	300ms
Test Duration:	Not less than 1 min.
Criterion:	B

4.5.2 Test Setup



4.5.3 Test Result

Test Point	Polarity	Test Level (kV)	Observation	Comply with Criterion
AC Power Port	+/-	2	Note (1)	A

NOTE:

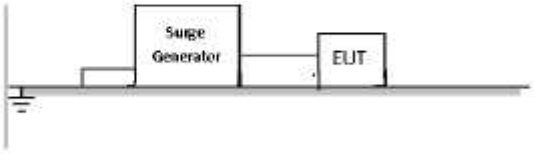
(1). The EUT continued to operate as intended. No degradation of performance was observed.

4.6 Surge Immunity Test

4.6.1 Test Specification

Basic Standard:	IEC 61000-4-5
Waveform:	Voltage 1.2/50 μs; Current 8/20 μs
Test Voltage:	a.c. power port, line to line 1 kV, line to earth 2Kv d.c. power port, line to line 0.5 kV
Polarity:	Positive/Negative
Phase Angle:	0°、90°、180°、270°
Repetition Rate:	60sec
Times:	5 time/each condition.
Criterion:	B

4.6.2 Test Setup



4.6.3 Test Result

Coupling Line	Polarity	Voltage (kV)	Observation	Comply with Criterion
AC power, Line-Line	+/-	1	Note (1)	A
AC power, Line-Earth	+/-	2	Note (1)	A
DC power, Line-Line	+/-	0.5	Note (1)	A

NOTE:

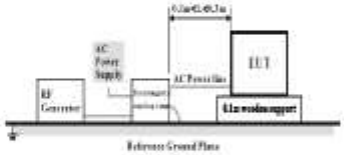
(1). The EUT continued to operate as intended. No degradation of performance was observed.

4.7 Immunity to Conducted Disturbances Induced by RF Fields

4.7.1 Test Specification

Basic Standard:	IEC 61000-4-6
Frequency Range:	0.15 MHz – 80 MHz
Field Strength:	10V
Modulation:	1 kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1% of fundamental
Coupled Cable:	AC. power line, DC power line
Coupling Device:	Electromagnetic coupling clamp
Criterion:	A

4.7.2 Test Setup



4.7.3 Test Result

Test Point	Frequency	Field Strength (Vrms)	Observation	Comply with criterion
AC. power line	0.15 – 80 MHz	10	Note(1)	A
DC. power line	0.15 – 80 MHz	10	Note(1)	A

NOTE:

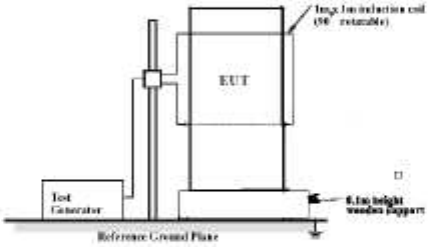
(1). The EUT continued to operate as intended. No degradation of performance was observed.

4.8 Power Frequency Magnetic Field Immunity Test

4.8.1 Test Specification

Basic Standard:	IEC 61000-4-8
Frequency Range:	50Hz
Field Strength:	30A/m
Observation Time:	2 minute
Inductance Coil:	Rectangular type, 1m×1m
Criterion:	A

4.8.2 Test Setup



4.8.3 Test Resut

Direction	Field Strength(A/m)	Observation	Comply with Criterion
X	30	Note(1)	A
Y	30	Note(1)	A
Z	30	Note(1)	A

NOTE:

(1). The EUT continued to operate as intended. No degradation of performance was observed

For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

Appendix I: Photographs of the EUT

1. Appearance

Overall view of the unit for model SOFAR 40000TL-Sx and SOFAR 33000TL-Sx

Bottom view of the unit model SOFAR 40000TL-Sx and SOFAR 33000TL-Sx

2, Inside

Internal view model SOFAR 40000TL-Sx and SOFAR 33000TL-Sx

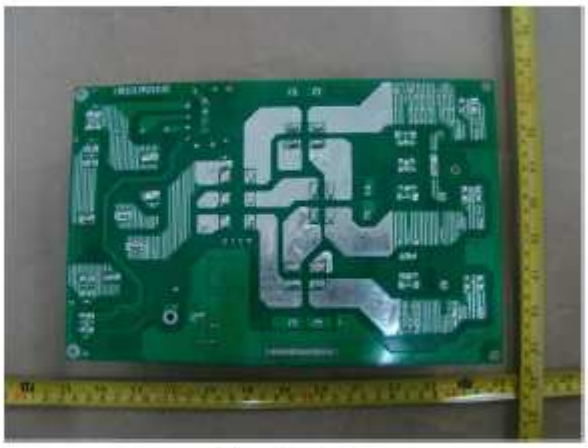
Internal view of the unit model SOFAR 40000TL-Sx and SOFAR 33000TL-Sx

Internal view of the unit model SOFAR 40000TL-Sx and SOFAR 33000TL-Sx

Control board

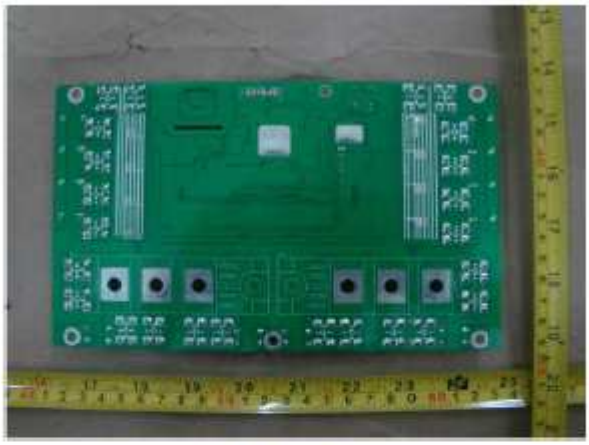
PCB soldering view

Output board

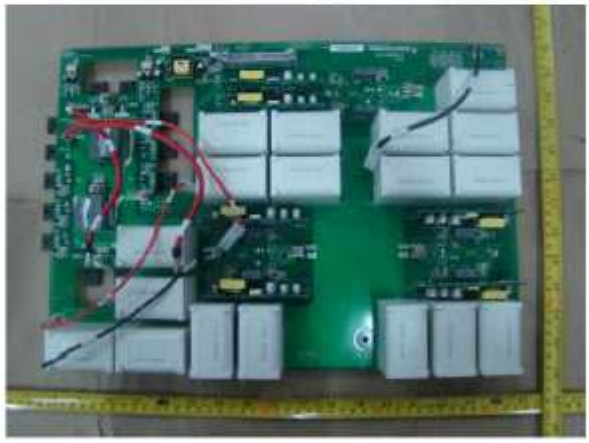


PCB soldering view

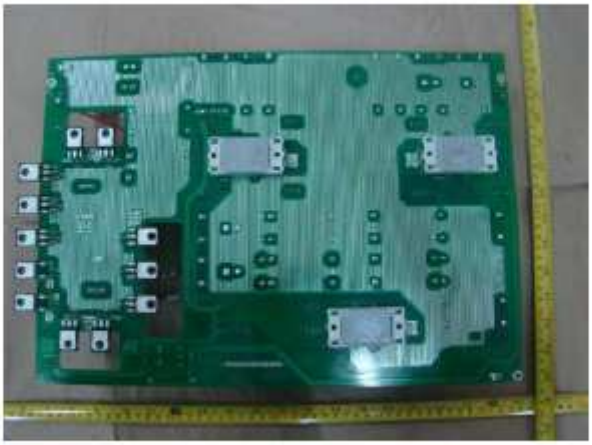
Combiner board



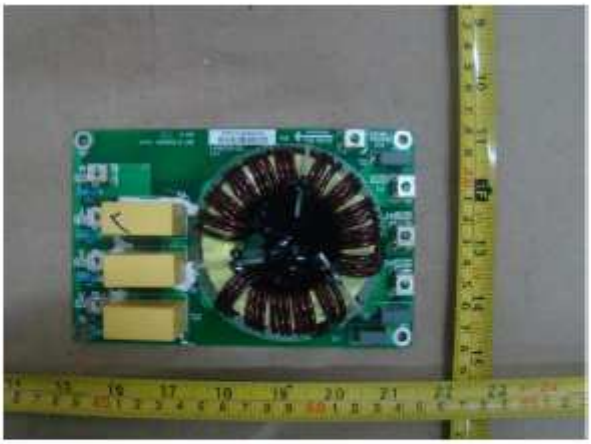
PCB soldering view



Power board



PCB soldering view



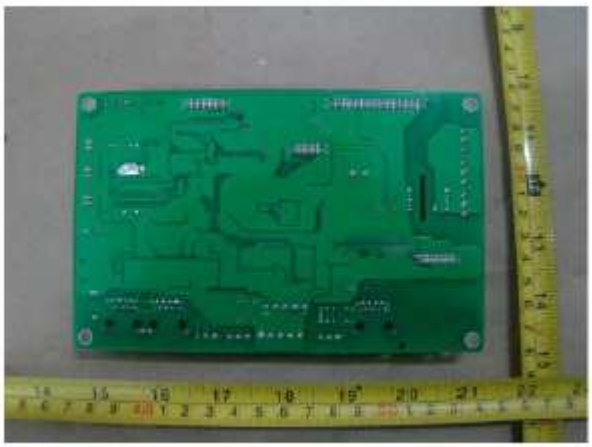
AC EMI board

PCB soldering view

Input board

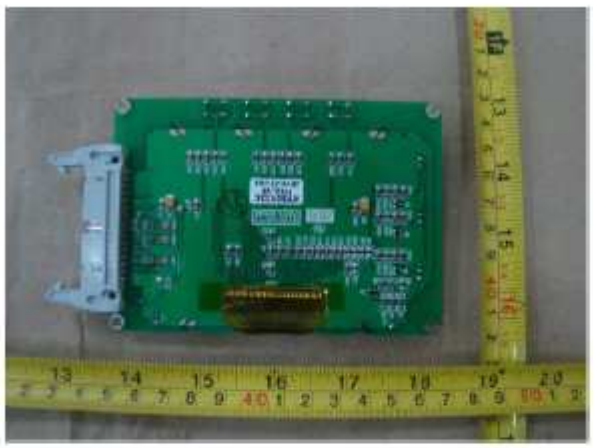
PCB soldering

Communication board

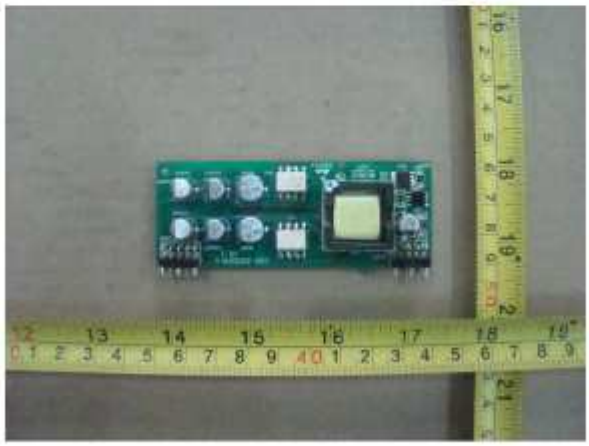


PCB soldering view

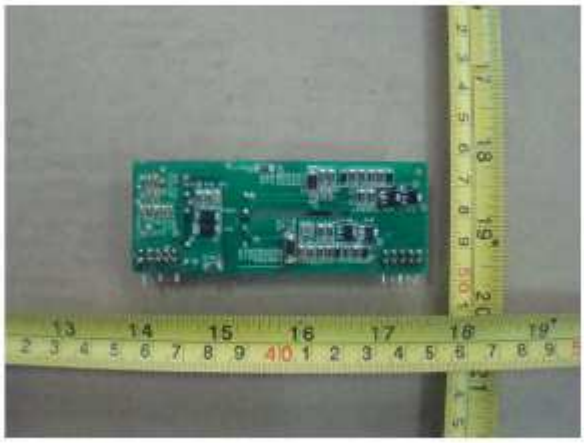
LCD display board



PCB soldering view



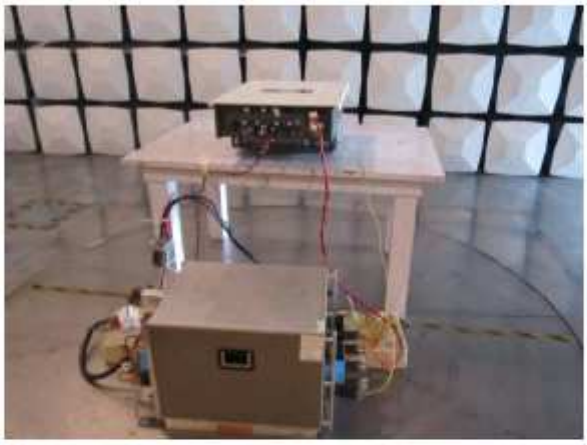
Driver board



Bottom of driver board

Appendix II: Photographs of EMC Test Configuration

1. Mains Terminal Disturbance Voltage Measurement



2. Radiated Field Strength Measurement

3. Electrostatic Discharge Immunity Test

4. Radiated, Radio Frequency Electromagnetic Field Immunity Test (below 1GHz)

5. Electrical Fast Transient/Burst Immunity Test, Surge Immunity Test

6. Immunity to Conducted Disturbances Induced by RF Fields

Bureau Veritas Shenzhen Co., Ltd.
Dongguan Branch

No. 34, Chenwulu Section, Guantai Rd.,
Houjie Town, Dongguan City, Guangdong
523942, China

Tel: +86 769 8998 2098
Fax: +86 769 8599 1080
Email: customerservice.dg@cn.bureauveritas.com

8. Power Frequency magnetic Field Immunity

Bureau Veritas Shenzhen Co., Ltd.
Dongguan Branch

No. 34, Chenwulu Section, Guantai Rd.,
Houjie Town, Dongguan City, Guangdong
523942, China

Tel: +86 769 8998 2098
Fax: +86 769 8599 1080
Email: customerservice.dg@cn.bureauveritas.com

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4. The test report is invalid if erased and corrected.
5. Test results of the report is valid to the test samples if sampling by client.
6. "☆" item to be outside the scope of authorized by CNAS.
7. The test report shall not be reproduced except in full, without written approval of the laboratory.
8. If there is any objection to report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

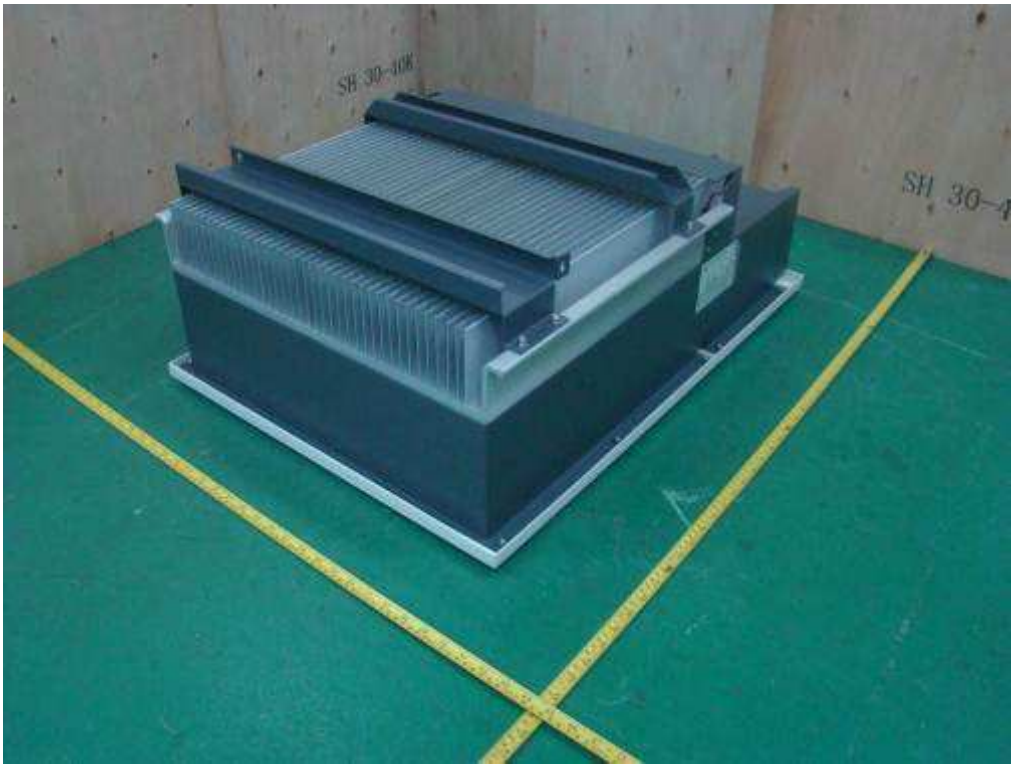
Address: Electronic Testing Building, No. 43 Shahe Road, Xili Jiedao, Nanshan District, Shenzhen, Guangdong, China
P.C.: 518055
TEL: 0755-26628093、26627338 FAX: 0755-26627238
Internet: http://www.ccic-set.com E-Mail: manager@ccic-set.com

Annex 2

Pictures of the unit

Enclosure front view

Enclosure rear view-1



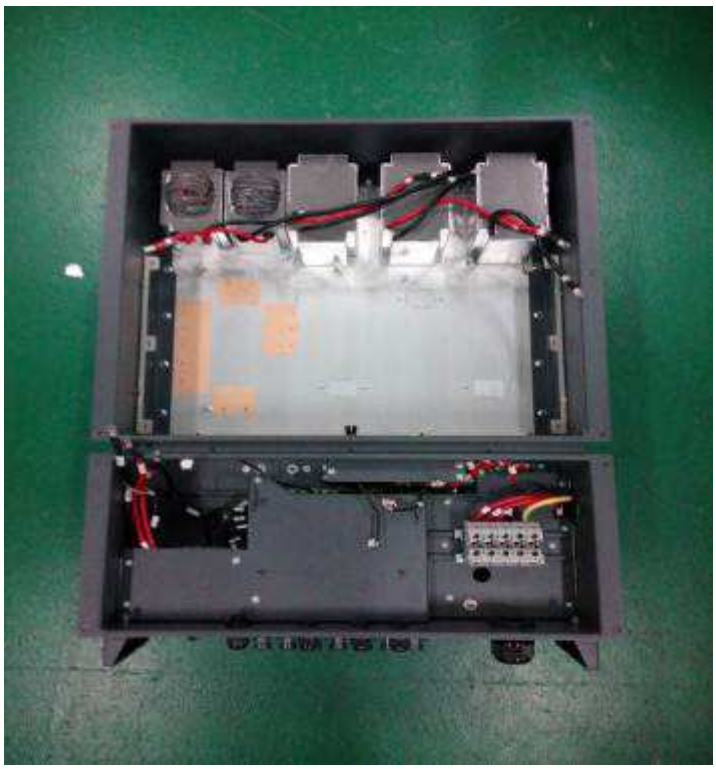
Enclosure bottom view-2

Enclosure bottom view

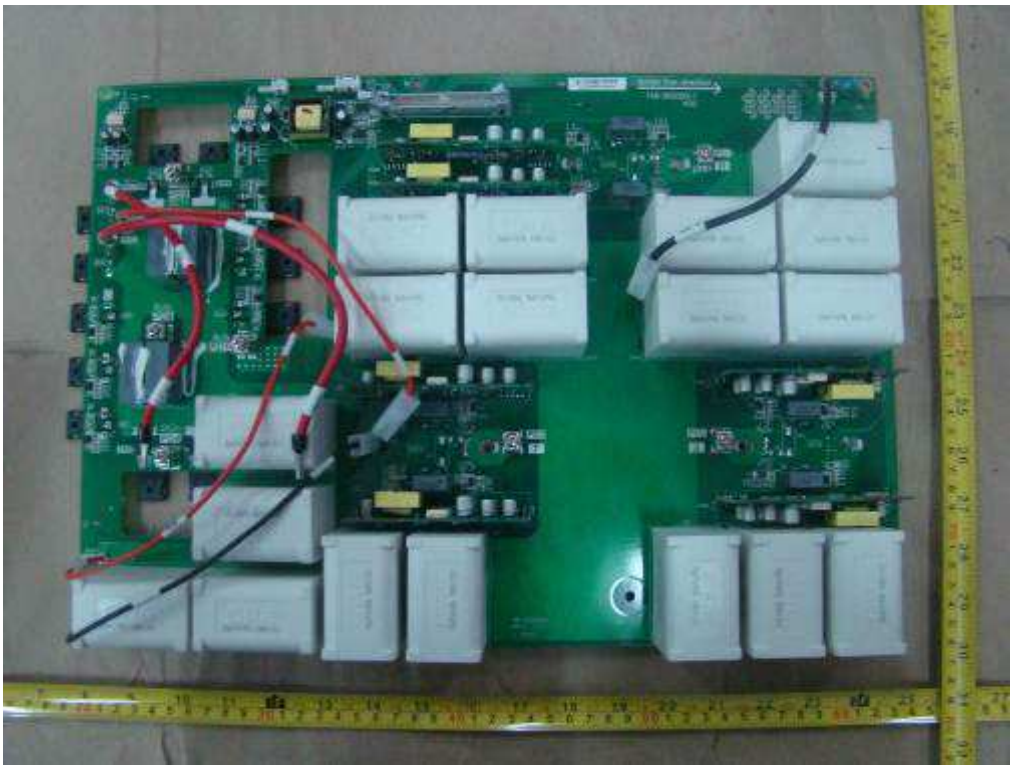
Internal view-1

Internal view-2

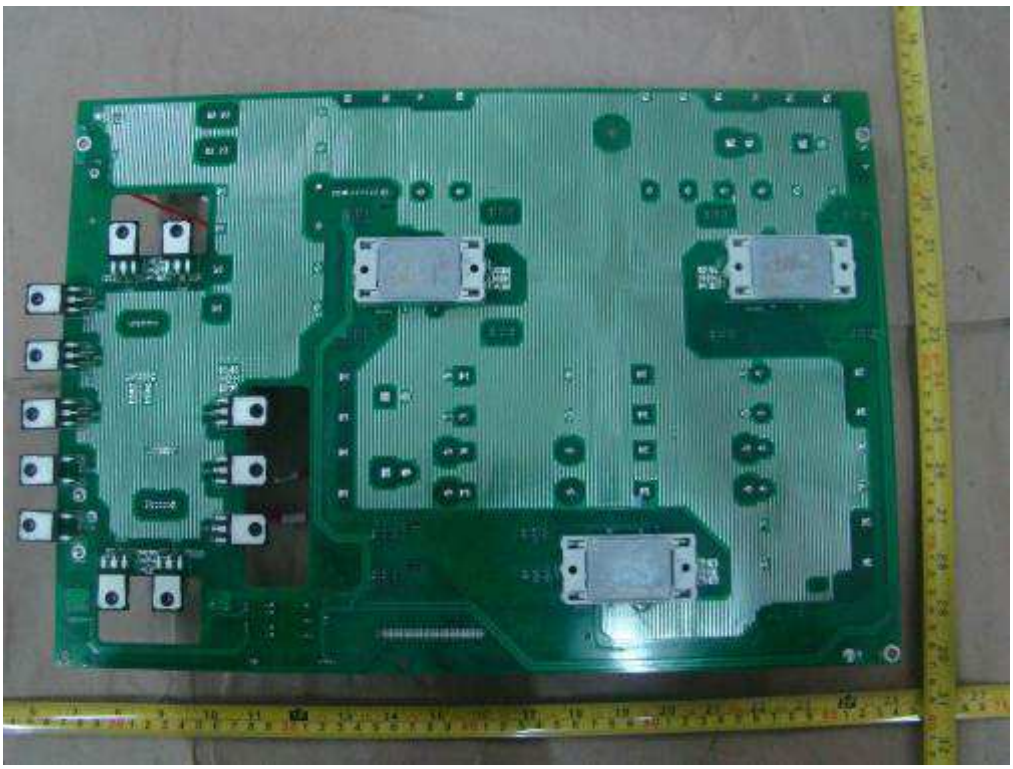
Internal view-3



Main power board component side view



Main power board solder side view

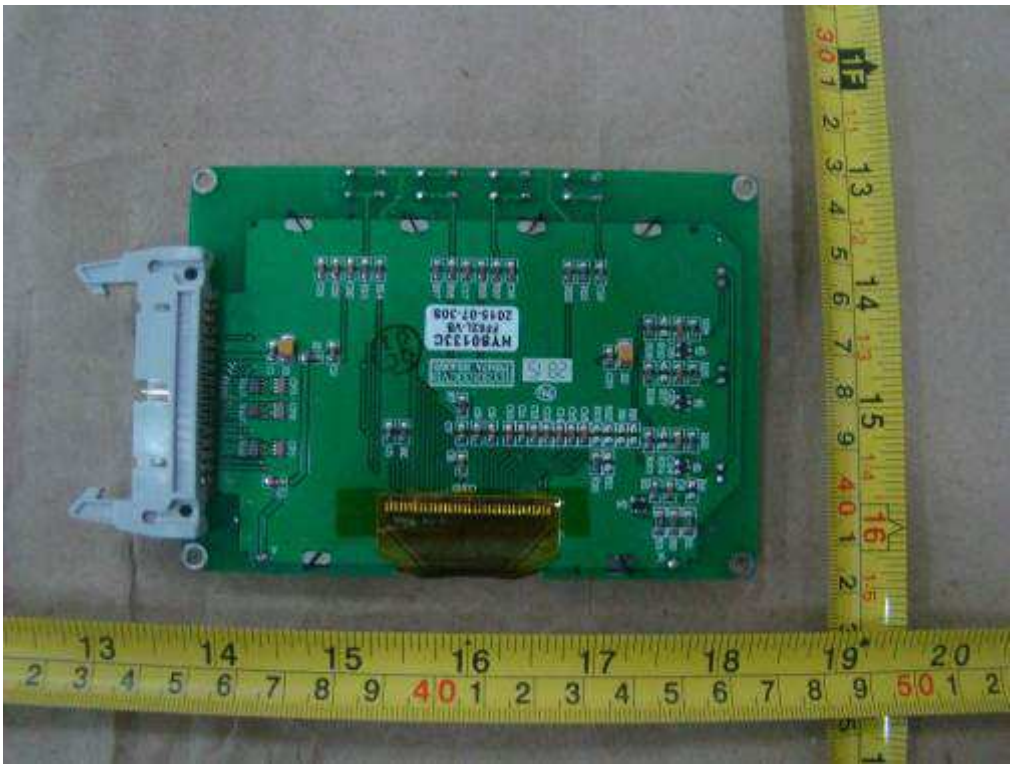


Control board component side view

Control board solder side view

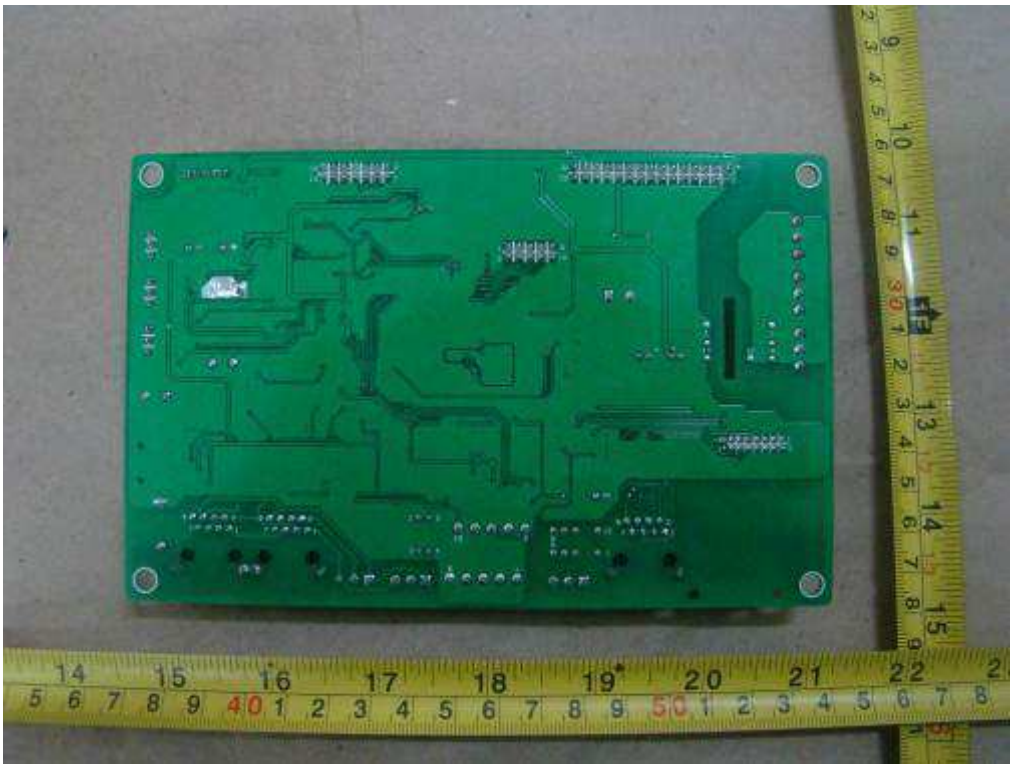
Display board component side view

Display board solder side view



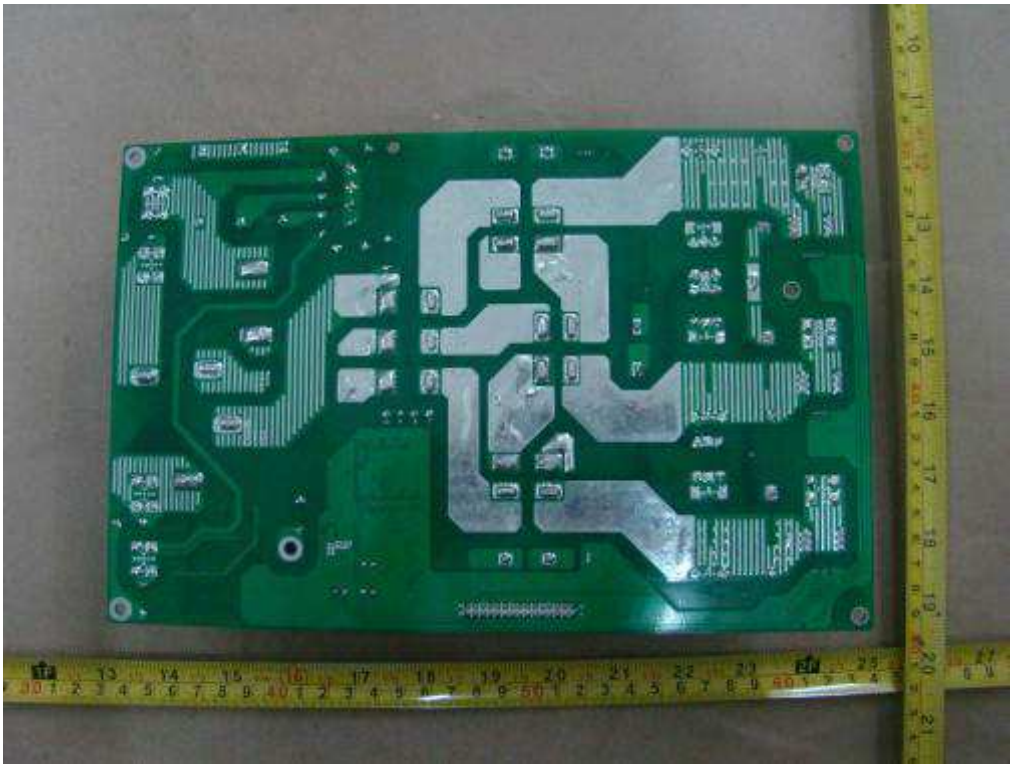
Communication board component side view

Communication board solder side view



AC output 1 board component side view

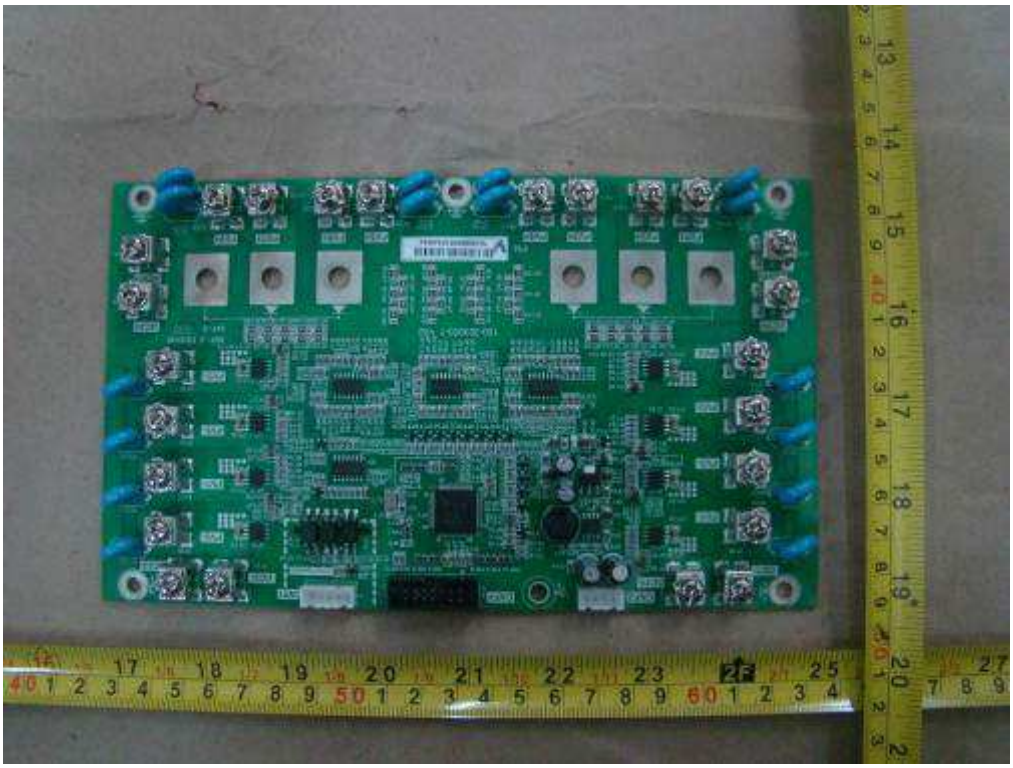
AC output 1 board solder side view



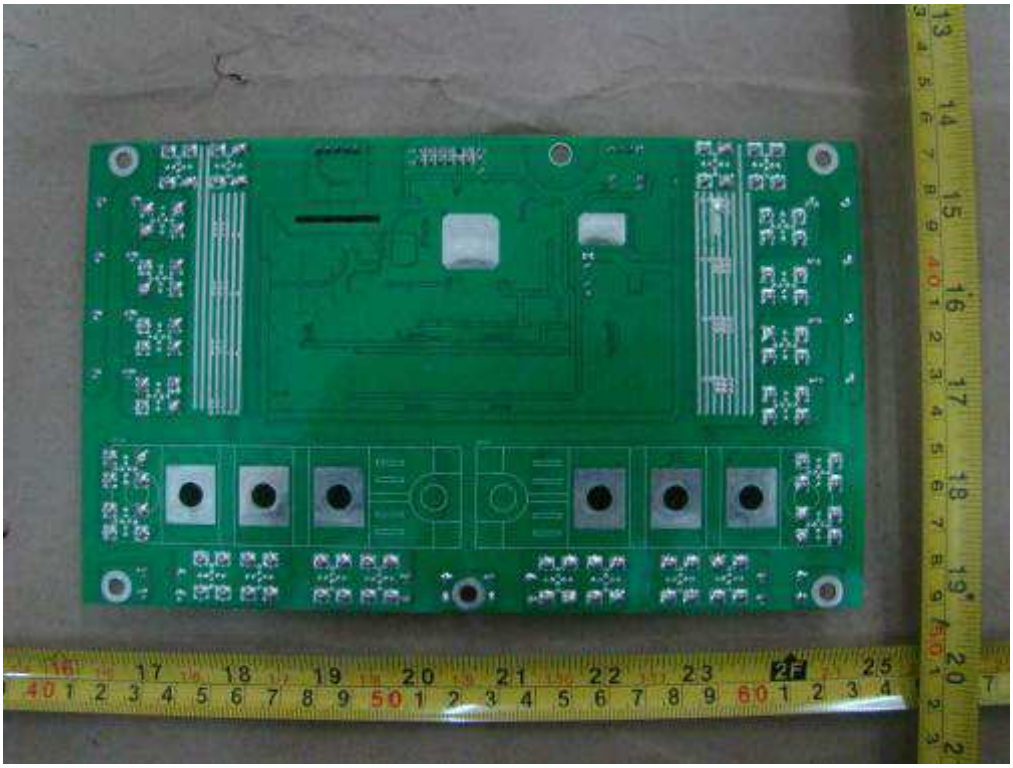
DC input board component side view

DC input board solder side view

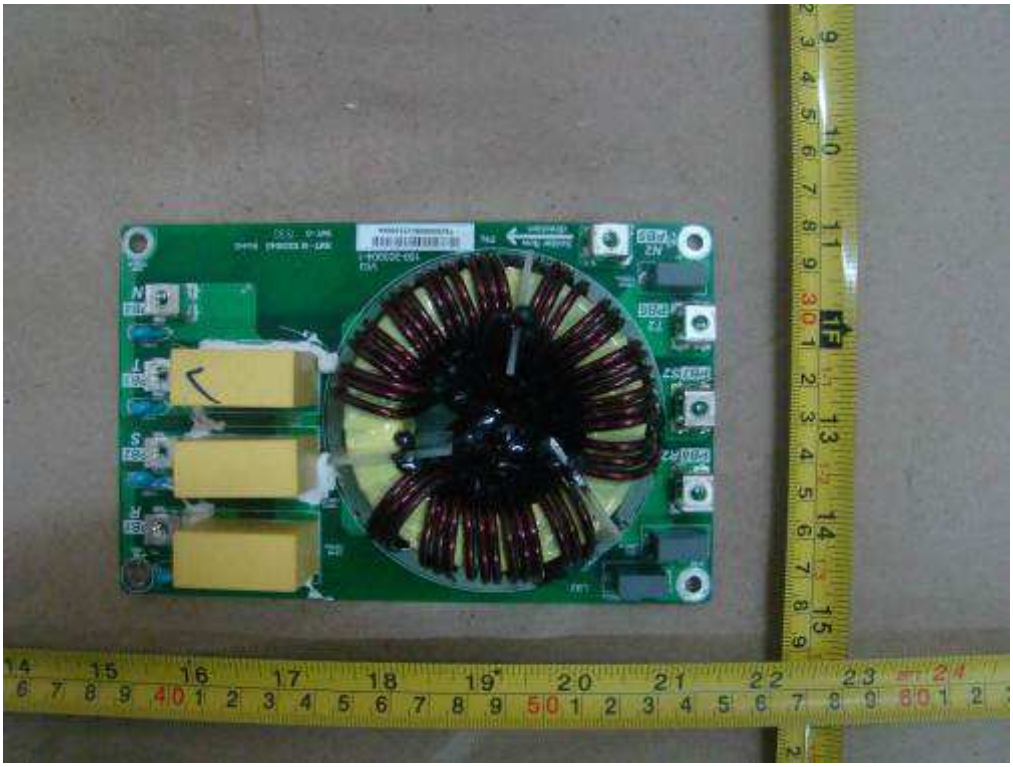
Fuse board solder side view



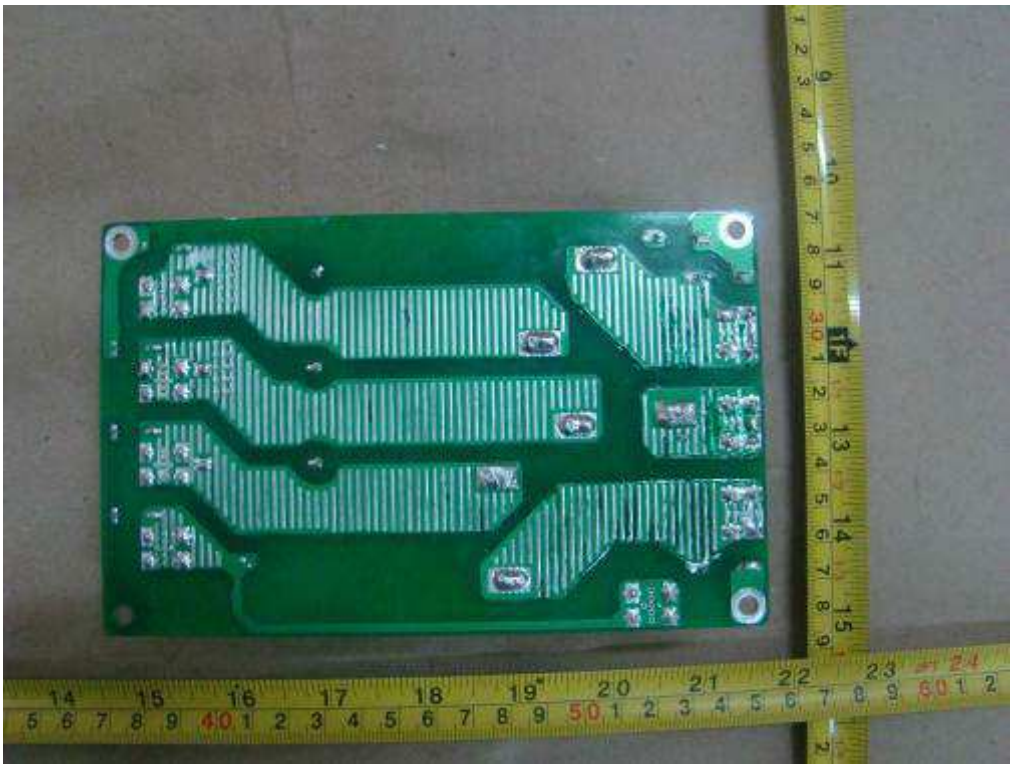
Fuse board solder side view



AC output 2 board solder side view



DC EMI board component side view



Annex 3

Test equipment list

1) Testing Location: Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch
Date(s) of performance test: 2016-07-21 to 2016-10-20

Equipment	Internal No.	Manufacturer	Type	Serial No.	Last Calibration
AC Source	A7040019DG	Chroma	61512	61512000439	Monitored by Power Analyzer
	A7040020DG	Chroma	61512	61512000438	
	A7040006DG	AC Power	ACST-S-33045T	C311120140	
DC Simulation Power Supply	A7040015DG	Chroma	62150H-1000S	62150EF00488	
	A7040016DG	Chroma	62150H-1000S	62150EF00490	
	A7040017DG	Chroma	620028	620028EF00120	
	A7040021DG	Chroma	62150H-1000S	62150EF00609	
RLC Load	A7150027DG	Qunling	ACLT-3803H	93VOO2869	
Resistive load cabinet	A7150030DG	Shenzhen Weihuaer	//	//	
	A7150029DG	Shenzhen Weihuaer	//	//	
Inductive load cabinet	A7180005DG	Shenzhen Weihuaer	//	//	
Power Analyzer	A4080002DG	YOKOGAWA	WT3000	91M210852	Mar. 07, 2016
LCR Hitester	A1060006DG	HIOKI	3535	120112505	Mar. 11, 2016
Digital Phosphor Oscilloscope	A4089017DG	YOKOGAWA	DL850-H-HC	91N726247	Sep. 08, 2016
Isolation voltage probe	A1490011DG	YOKOGAWA	701901	//	Oct. 21, 2015
	A1490012DG	YOKOGAWA	701901	//	Oct. 29, 2015
	A1490013DG	YOKOGAWA	701901	//	Oct. 21, 2015
Current transducer	A1060007DG	YOKOGAWA	CT200	1130700012	Dec. 01, 2015
	A1060008DG	YOKOGAWA	CT200	1130700017	Nov. 16, 2015
	A1060009DG	YOKOGAWA	CT200	1130700019	Nov. 16, 2015
	A1060010DG	YOKOGAWA	CT200	1130700016	Dec. 01, 2015
	A1060011DG	YOKOGAWA	CT200	1130700011	Dec. 01, 2015
	A1060012DG	YOKOGAWA	CT200	1130700018	Nov. 16, 2015

2) Testing Location: Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch
Date(s) of performance test: 2017-08-01 to 2017-08-24

Equipment	Internal no.:	Manufacturer:	Type:	Serial no.:	Last calibration
AC Source	A7040019DG	Chroma	61512	61512000439	Monitored by Power Analyzer
AC Source	A7040020DG	Chroma	61512	61512000438	
DC Simulation Power Supply	A7040016DG	Chroma	62150H-1000S	62150EF00490	
DC Simulation Power Supply	A7040021DG	Chroma	62150H-1000S	62150EF00609	
RLC Load	A7150027DG	Qunling	ACLT-3803H	93VOO2869	
Power Analyzer	A4080002DG	YOKOGAWA	WT3000	91M210852	Jan. 06, 2017
Four Channel Digital Phosphor Oscilloscope	A4089003DG	Tektronix	DPO4104B	C010624	Oct. 11, 2016
Eight Channel Digital Phosphor Oscilloscope	A4089017DG	YOKOGAWA	DL850	91N726247	Sep. 08, 2016
Oscilloscope probel	A4089008DG	Tektronix	TPP1000	C008230	Dec. 15, 2016
ScopeCorder	A4089009DG	Tektronix	TPP1000	C008231	Dec. 14, 2016
Current transducer	A1060007DG	YOKOGAWA	CT200	1130700012	Nov. 29, 2016
Current transducer	A1060008DG	YOKOGAWA	CT200	1130700017	Nov. 23, 2016
Current transducer	A1060012DG	YOKOGAWA	CT200	1130700018	Nov. 15, 2016
Impulse Test Generator	A6600004DG	COMPLIANCE WEST	10*700-7	431250	Jan. 03, 2017
Withstanding Voltage/Insulation	A6600007DG	KIKUSUI	TOS9201	SJ001948	Jan. 03, 2017
Temp. & Humi. Chamber	D1020009DG	Zhongzhi	CZ-A-3375A	Z412018	Jan. 03, 2017
Insulation Tester	A6610001DG	Qingdao YIDI	MN35B	03MN11063	Dec. 15,2016

3) Test location: Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch
Performed dates of test: 2019-06-27 to 2019-07-20

Equipment	Internal No.	Manufacturer	Type	Serial No.	Last Calibration
Power Analyzer	A4080002DG	YOKOGAWA	WT3000	91M210852	Dec, 13, 2018
AC Source	//	Chroma	61860	618603800387	Monitored by Power Analyzer
DC Simulation Power Supply	A7040015DG	Chroma	62150H-1000S	62150EF00488	
	A7040016DG	Chroma	62150H-1000S	62150EF00490	
	A7040021DG	Chroma	62150H-1000S	62150EF00609	
RLC Load	A7150027DG	Qunling	ACLT-3803H	93VOO2869	
Resistive load	A7150030DG	Shenzhen Weihuaer	//	//	
Oscilloscope probel	A1490009DG	YOKOGAWA	701901	//	Nov, 01, 2018
	A1490010DG	YOKOGAWA	701901	//	Nov, 01, 2018
	A1490011DG	YOKOGAWA	701901	//	Nov, 01, 2018
Current transducer	A1060008DG	YOKOGAWA	CT200	1130700017	Nov, 17, 2018
	A1060009DG	YOKOGAWA	CT200	1130700019	Nov, 17, 2018
	A1060009DG	YOKOGAWA	CT200	1130700019	Nov, 17, 2018