TEST REPORT

UNE206007-1/ UNE 206006

Requisitos de conexion a la red eléctrica
Parte 1: Inversores para conexion a la red de distribución
Ensayos de detección de funcionamiento en isla de múltiples inversores fotovoltaicos conectados a red en paralelo

Report reference number ..... :	**PVSP200511N080-6**
Date of issue ..... :	2021-03-12
Total number of pages ..... :	65
Testing laboratory name ..... :	**Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch**
Address ..... :	No. 96, Guantai Road (Houjie Section), Houjie Town, Dongguan City, Guangdong Province, 523942, People's Republic of China
Accrediation ..... :	ilac-MRA ACCREDITED Certificate # 2951.01
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..... :	UNE 206007-1:2013 UNE 206006:2011
Test Report Form No. ..... :	UNE 206007-1 VER.0
TRF Originator ..... :	Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch
Master TRF ..... :	Dated 2020-03-11
Test item description ..... :	**Solar Grid-tied Inverter**
Trademark..... :	SOFAR SOLAR
Model / Type ..... :	SOFAR 15KTLX-G3, SOFAR 17KTLX-G3, SOFAR 20KTLX-G3, SOFAR 22KTLX-G3, SOFAR 24KTLX-G3

Ratings .....:	SOFAR 15KTLX-G3	SOFAR 17KTLX-G3	SOFAR 20KTLX-G3	SOFAR 22KTLX-G3	SOFAR 24KTLX-G3
Input DC voltage [V] ..... :	Max. 1100Vd.c.				
MPP DC voltage range [V] ..... :	140-1000Vd.c.				
Input DC current [A] ..... :	26,0A / 26,0A				
Isc PV [A] ..... :	36,0A / 36,0A				
Output AC voltage [V] ..... :	380/400Va.c., 3W+N+PE; 50/60Hz				
Rated Output AC current [A] ..... :	21,7	24,6	29,0	31,9	34,8
Max. Output AC current [A] ..... :	23,9	27,1	31,9	35,1	38,3
Rated Output power [kW] ..... :	15,0	17,0	20,0	22,0	24,0
Max Output power [kVA] ..... :	16,5	18,7	22,0	24,2	26,4

Testing Location ..... :	**Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch**
Address ..... :	No. 96, Guantai Road (Houjie Section), Houjie Town, Dongguan City, Guangdong Province, 523942, People's Republic of China
Tested by (name and signature) ..... :	Lukes Lin 
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**
2021-03-12	Lukes Lin	Initial report was written	0
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] ..... :	Approx. 20,0 kg for SOFAR 15KTLX-G3; Approx. 22,0 kg for SOFAR 17KTLX-G3, SOFAR 20KTLX-G3; Approx. 23,0 kg for SOFAR 22KTLX-G3, SOFAR 24KTLX-G3;

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 ..... :	2020-11-20
Date(s) of performance of test ..... :	2020-11-20 to 2021-03-10

General remarks:

The test result presented in this report relate only to the object(s) tested, The report shall state compliance of the tested objects with the requirements of UNE 206007-1 (Requisitos de conexion a la red eléctrica Parte 1: Inversores para conexion a la red de distribución) and UNE 206006 (Ensayos de detección de funcionamiento en isla de múltiples inversores fotovoltaicos conectados a red en paralelo).

The test result presented in this report relate only to the object(s) tested.
This report shall not be reproduced in part or in full without the written approval of the issuing testing laboratory.

"(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.

This Test Report consists of the following documents:

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

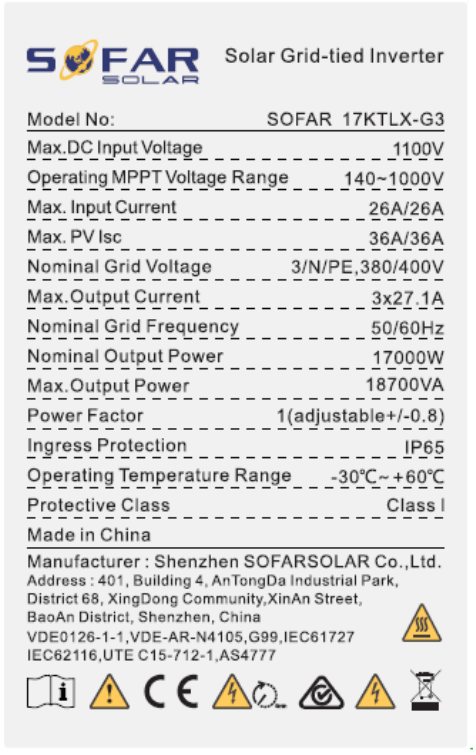
Copy of marking plate:

SOFAR SOLAR Solar Grid-tied Inverter

Model No:	SOFAR 15KTLX-G3
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	140~1000V
Max. Input Current	26A/26A
Max. PV Isc	36A/36A
Nominal Grid Voltage	3/N/PE,380/400V
Max.Output Current	3x23.9A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	15000W
Max.Output Power	16500VA
Power Factor	1(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-30℃~+60℃
Protective Class	Class I

Made in China

Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.
Address : 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community,XinAn Street, BaoAn District, Shenzhen, China
VDE0126-1-1,VDE-AR-N4105,G99,IEC61727
IEC62116,UTE C15-712-1,AS4777

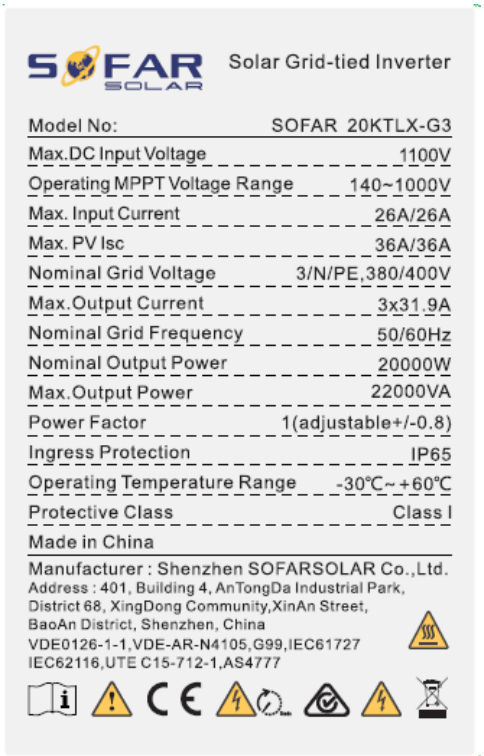


SOFAR SOLAR Solar Grid-tied Inverter

Model No:	SOFAR 17KTLX-G3
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	140~1000V
Max. Input Current	26A/26A
Max. PV Isc	36A/36A
Nominal Grid Voltage	3/N/PE,380/400V
Max.Output Current	3x27.1A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	17000W
Max.Output Power	18700VA
Power Factor	1(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-30℃~+60℃
Protective Class	Class I

Made in China

Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.
Address : 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community,XinAn Street, BaoAn District, Shenzhen, China
VDE0126-1-1,VDE-AR-N4105,G99,IEC61727
IEC62116,UTE C15-712-1,AS4777



SOFAR SOLAR Solar Grid-tied Inverter

Model No:	SOFAR 20KTLX-G3
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	140~1000V
Max. Input Current	26A/26A
Max. PV Isc	36A/36A
Nominal Grid Voltage	3/N/PE,380/400V
Max.Output Current	3x31.9A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	20000W
Max.Output Power	22000VA
Power Factor	1(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-30℃~+60℃
Protective Class	Class I

Made in China

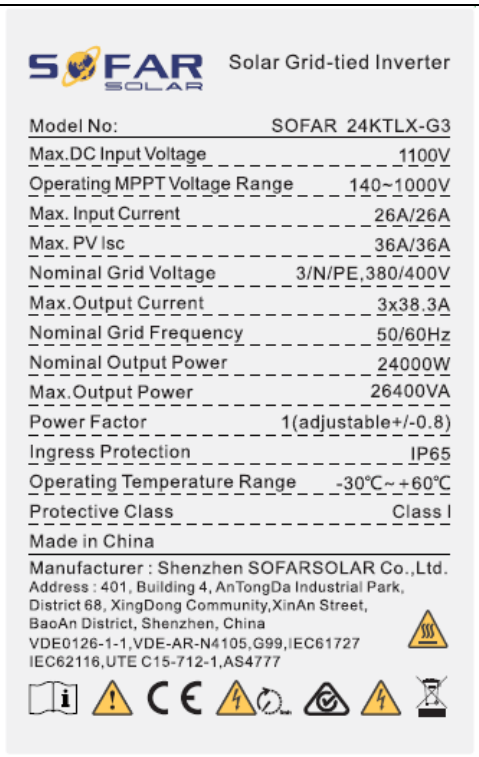
Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.
Address : 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community,XinAn Street, BaoAn District, Shenzhen, China
VDE0126-1-1,VDE-AR-N4105,G99,IEC61727
IEC62116,UTE C15-712-1,AS4777

SOFAR SOLAR Solar Grid-tied Inverter

Model No:	SOFAR 22KTLX-G3
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	140~1000V
Max. Input Current	26A/26A
Max. PV Isc	36A/36A
Nominal Grid Voltage	3/N/PE,380/400V
Max.Output Current	3x35.1A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	22000W
Max.Output Power	24200VA
Power Factor	1(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-30℃~+60℃
Protective Class	Class I

Made in China

Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.
Address : 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community,XinAn Street, BaoAn District, Shenzhen, China
VDE0126-1-1,VDE-AR-N4105,G99,IEC61727
IEC62116,UTE C15-712-1,AS4777



SOFAR SOLAR Solar Grid-tied Inverter

Model No:	SOFAR 24KTLX-G3
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	140~1000V
Max. Input Current	26A/26A
Max. PV Isc	36A/36A
Nominal Grid Voltage	3/N/PE,380/400V
Max.Output Current	3x38.3A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	24000W
Max.Output Power	26400VA
Power Factor	1(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-30℃~+60℃
Protective Class	Class I

Made in China

Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.
Address : 401, Building 4, AnTongDa Industrial Park,
District 68, XingDong Community,XinAn Street,
BaoAn District, Shenzhen, China
VDE0126-1-1,VDE-AR-N4105,G99,IEC61727
IEC62116,UTE C15-712-1,AS4777

General product information:

The Solar Grid-tied 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 a two relays. This assures that the opening of the output circuit will also operate in case of one error.

Description of the electrical circuit:

The internal control is redundant built. It consists of Microcontroller main CPU (U30) and slave DSP (U23).

The main CPU (U30) control the relays 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 slave CPU (U23) is measures the grid voltage, grid frequency, DCI and residual current, also can switch off the relays independently, and communicate with the main CPU (U30) each other.

The current is measured by a current sensor. The AC current signal and the injected DC current signal are sent to the main CPU (U30). The main CPU (U30) 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.

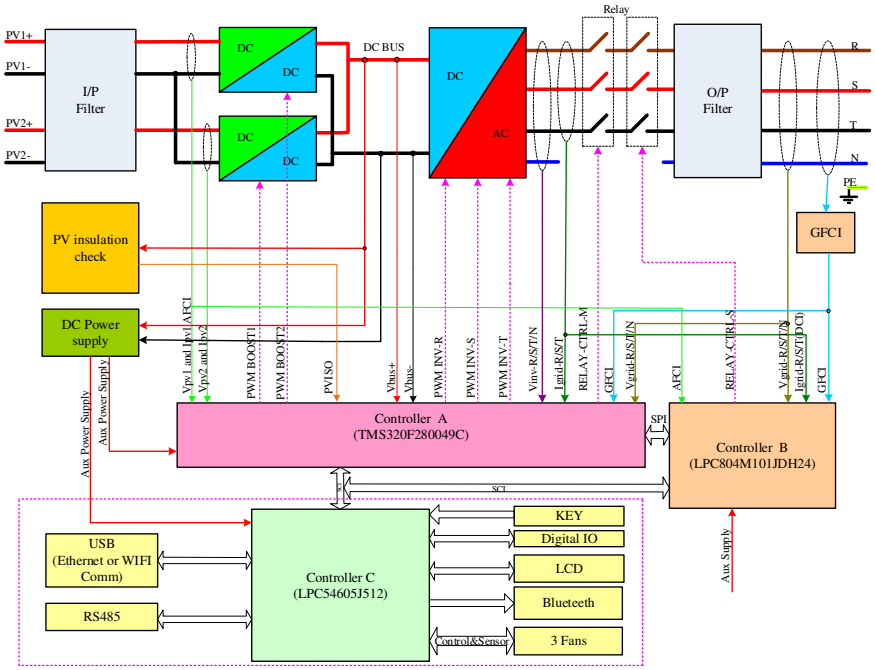


Figure 1 – Block diagram

Differences of the models:

The models SOFAR 15KTLX-G3, SOFAR 17KTLX-G3, SOFAR 20KTLX-G3, SOFAR 22KTLX-G3 and SOFAR 24KTLX-G3 are use the identical hardware platform, control unit, control system and software except the output power derated by software and in following table descripts for different.

	SOFAR 15KTLX-G3	SOFAR 17KTLX-G3	SOFAR 20KTLX-G3	SOFAR 22KTLX-G3	SOFAR 24KTLX-G3
Thin-film capacitor of BUS	4pcs (110uF, 550V)	6pcs (110uF, 550V)			
INV IGBT (Q60, Q67, Q71 Q72, Q75, Q76)	6pcs 40A, 1200V	6pcs 75A, 1200V			
External Fan	1	2			

The product was tested on:

Hardware version: V101

Software version: V010000

Test report

UNE 206007-1:2013			
Clause/§	**Requirement:**	**Remark:**	**Verdict**
5. Technical Requirements			
5.1 Direct Current Injection into the Grid			
1	The inverter shall guarantee that any direct current injected into the grid does not exceed 0,5% of rated current,		**P**
5.2 Behavior in the Event of an Insulation Fault			
1	The inverter shall measure the impedance of the PV array to ground, In transformerless inverters, this protection shall only be active before the inverter is connected to the grid, The measurement circuit shall detect an insulation resistance between the live parts of the PV array (positive and negative) and ground below the value of resistance R as defined in EN 62109-2, If the insulation resistance is below this value, the inverter shall: 1. In invertors with low or high frequency transformers, indicate an insulation fault (the inverter may connect or remain connected to the grid), 2. In transformerless inverters, indicate an insulation fault and not connect to the grid,		**P**
5.3 Detection of Fault Currents in the PV Array			
1	Inverters with low frequency transformers and inverters with high frequency transformers are not subject to this requirement, In transformerless inverters, a ground fault current detection unit is required between the grid and the PV array,	5,3,1 Maximum Current Test This shall be conducted according to the specifications of EN 62109-2, chapter 4,8,3,5,1, a) 5,3,2 Instantaneous Variations of Current Test This shall be conducted according to the specifications of EN 62109-2, chapter 4,8,3,5,1, b)	**P**
5.4 Voltage and frequency Disconnection **5.5 Automatic Reconnection**			
1	An automatic connection switch for automatic disconnection-connection of the facility in the event of a network voltage or frequency anomaly, together with a locking relay, Eventually, the function of this switch may be performed by the switch or switches of the generator equipment, Eventually, the functions of the automatic connection switch and general cut-off switch may be performed by the same device,	The unit provides an integrated automatic disconnection device which opens in case of loss of voltage and frequency. See appended table.	**P**

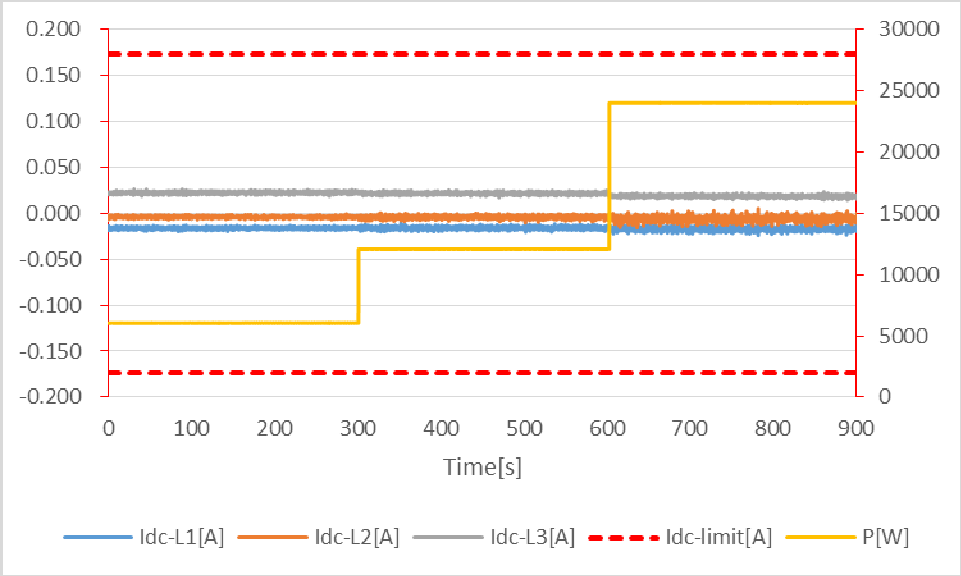
UNE 206007-1:2013			
Clause/§	**Requirement:**	**Remark:**	**Verdict**
2	Maximum and minimum frequency connection protections and maximum and minimum voltage between phases as indicated in table 1 (RD 1699/2011), where the low voltage proposal is generalised for all other levels, In insular and extra-peninsular electrical systems, the above values shall be the ones indicated in the respective operating procedures, The voltage for measuring these values shall be taken from the network side of the general automatic switch for high voltage facilities or the main switches of the generators in low voltage networks, In the event of activating the maximum frequency protection, reconnection shall only be made when the frequency reaches a value that is less than or equal to 50 Hz,	With modification according to RD413:2014 for RD1699 Upper frequency: 51,0 Hz Lower frequency: 48,0 Hz Upper voltage (stage 2): Un +15% Upper voltage (stage 1): Un +10% Lower voltage: Un -15% Automatic reconnection after at least 180s according to IEC 61727:2001 once the grid conditions are within the limits of clause d) See appended tables. Parameters are adjustable only for the installer and protected via password.	**P**
3	In addition, for voltages greater than 1 kV and up to 36 kV inclusive, the disconnection criteria for maximum homopolar voltage shall be added,	The inverter is designed for connection to the low voltage grid.	**P**
4	These protections may act on the general switch or on the switch or switches of the equipment or generators,	The unit provides an integrated automatic disconnection device which opens in case of an error.	**P**
5	The protections shall be sealed by the supply company, after the necessary checks on the switching system and on the integration of the protection functions into the generator equipment,	The values can be changed by authorised staff and are protected by password.	**P**
6	In the event that the generator or inverter equipment have the above-described protections, these shall comply with current legislation, and in particular, the Low voltage electro technical regulations, approved by Royal Decree 842/2002 of 2 August 2002, the Regulations governing technical conditions and safety assurance in electric power stations, substations and transformation stations, approved by Royal Decree 3275/1982 of 12 November 1982 and the Regulations governing technical conditions and safety assurance in high voltage electrical lines, approved by Royal Decree 223/2008 of 15 February 2008, for facilities operating parallel to the supply network, In this case, there is no need for the protections to be duplicated,	Considered.	**P**

UNE 206007-1:2013			
Clause/§	**Requirement:**	**Remark:**	**Verdict**
5.6 Island Operation Detection			
1	Inverters connected to the low voltage grid shall comply with the specifications of AENOR Report UNE 206006 IN, Inverters within installations with anti-island systems at the grid termination point are permitted to not incorporate island operation detection systems, The inverter's anti-island systems shall not prevent compliance with standards in force applicable to the power generation plant,		**P**
5.7 Overvoltage generation			
1	The inverter shall not generate overvoltages at its alternating current connection, complying with the limits set in tables 2 or 3 as applicable,	Table 2 and 3 are stated in UNE206007-1.	**P**
5.8 Grid quality			
1	Emission (EN 61000-6-3) and Immunity (EN 61000-6-2) requirements have to be conform according to the respective actual and valid standards, Harmonics have to be conform according to EN 61000-3-2 (-3-12 for >16A/phase), The voltage fluctuations due to connection/disconnection to the public grid of less than 5%, This is covered by Flicker according to EN 61000-3-3 (-3-11 for >16A/phase)	The inverter is tested according to the EMC requirements. For detailed information please see the EMC test report.	**P**
5.9 Out of Syncronism			
1	The PV inverter must be able to withstand an out-of-sync reactivation, to prepare against the possibility of a network reactivation in less time than it takes for the anti-islanding system to actuate or for the system to be disconnected, The simulator must be capable of producing a 90º and 180° phase shift in its output voltage,		**P**

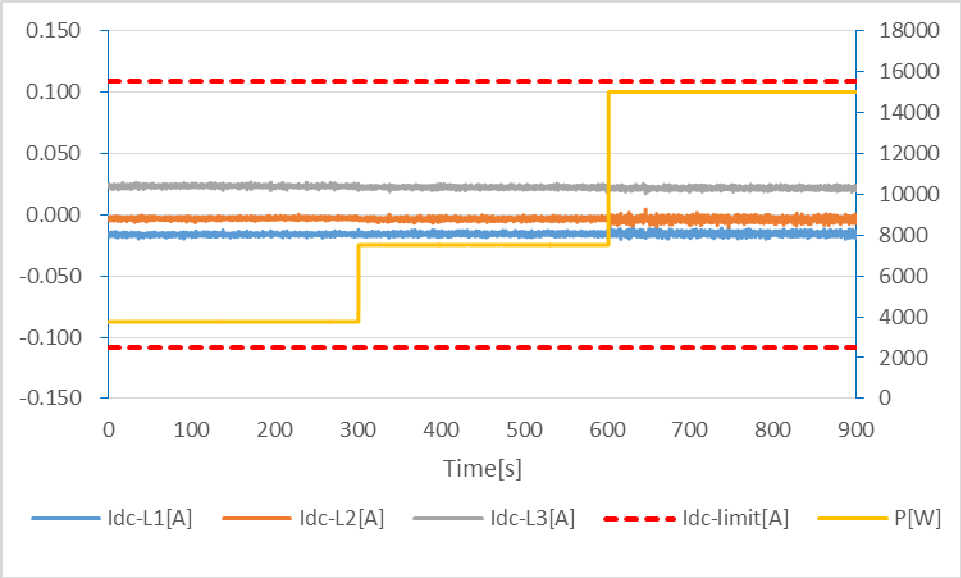
UNE 206007-1:2013		
Article	**Test**	**Result**
5. Technical Requirements		
5.1	**Direct Current Injection into the Grid**	**P**
5.2	**Behaviour in the Event of an Insulation Fault**	**P**
5.3	**Detection of Fault Currents in the PV Array**	**P**
	5.3.1 Maximum Current Test	**P**
	5.3.2 Instantaneous Variations of Current Test	**P**
5.4	**Voltage and Frequency Disconnection**	**P**
5.5	**Automatic Reconnection**	**P**
5.6	**Island Operation Detection**	**P**
5.7	**Overvoltage Generation**	**P**
5.8	**Grid Quality**	**P**
5.9	**Out of Syncronism**	**P**

Test Results

5.1 Direct current injection into grid			P
Test result: SOFAR 24KTLX-G3			
Power Level	25%	50%	100%
Watt	6046	12081	24021
Vrms	230,28	230,54	231,11
Arms	8,761	17,475	34,656
PF	0,9989	0,9995	0,9997
Cosφ	0,9989	0,9995	0,9997
Abs, Max, DC (mA)	27	25	24
Abs, Max, DC (%)	0,076	0,073	0,068
Abs, Ave, DC (mA)	16	17	19
Abs, Ave, DC (%)	0,047	0,050	0,053



Test result: SOFAR 15KTLX-G3			
Power Level	25%	50%	100%
Watt	3762	7529	15023
Vrms	230,16	230,33	230,66
Arms	5,462	10,904	21,718
PF	0,9974	0,9992	0,9996
Cosφ	0,9974	0,9992	0,9996
Abs, Max, DC (mA)	27	26	25
Abs, Max, DC (%)	0,077	0,074	0,073
Abs, Ave, DC (mA)	16	16	17
Abs, Ave, DC (%)	0,047	0,046	0,049



Note:
The inverter shall guarantee that any direct current injected into the grid does not exceed 0,5% of rated current.
Before testing, the internal temperature of the inverter has reached a steady state (less than 2ºC temperature change in 15 minutes).
The test results refer to the report PVSP200511N080-5 issued by Bureau Veritas Shenzhen Co.,Ltd.Dongguan Branch on 2020-02-19.

5.2 Behaviour in the Event of an Insulation Fault	**P**

DC Voltage below minimum operating voltage (V)	DC Voltage for inverter begin operation (V)	Resistance between ground and PV input terminal (KΩ)	Required Insulation resistance $R = (V_{MAX\ PV} / 30mA)$ (KΩ)	Result
DC+				
250	250	100K	37K	Error message:" Error:"ID56"(The insulation resistance is too low)" PV inverter does not start-up.
250	480	100K	37K	
250	850	100K	37K	
250	953	100K	37K	
DC-				
250	250	100K	37K	Error message:" Error:"ID56"(The insulation resistance is too low)" PV inverter does not start-up.
250	480	100K	37K	
250	850	100K	37K	
250	953	100K	37K	

Note:

The test procedure is defined in IEC 62109-2, For isolated inverters, shall indicate a fault in accordance with 13,9 (operation is allowed); the fault indication shall be maintained until the array insulation resistance has recovered to a value higher than the limit above

For non-isolated inverters, or inverters with isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30, shall indicate a fault in accordance with 13,9, and shall not connect to the mains; the inverter may continue to make the measurement, may stop indicating a fault and may connect to the mains if the array insulation resistance has recovered to a value higher than the limit above,

It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel,

Supplementary information:

The test results refer to the original test report LD200511N080 issued by Bureau Veritas Shenzhen Co.,Ltd.Dongguan Branch, dated on 2020-12-17.

The tests had been performed on the SOFAR 24KTLX-G3 are valid for the SOFAR 15KTLX-G3 since it is same as in hardware and just power derated by software.

5.3 Detection of Fault Currents in the PV Array	**P**
5.3.1 Maximum Current Test	**P**

Fault Current (mA)		Disconnection time (ms)	
Measured Fault Current	Limit 300mA for output power ≤ 30 kVA 10mA per kVA for output power > 30 kVA	Measured Disconnection time	Limit
+ PV to N:			
Un			
257	300	268	300
262	300	266	300
252	300	272	300
254	300	264	300
252	300	272	300
- PV to N:			
Un			
255	300	276	300
254	300	266	300
254	300	274	300
254	300	272	300
254	300	266	300

Note:
The tests are based on IEC 62109-2, chapter 4,8,3,5,1, a),
– maximum 300mA for inverters with continuous output power rating ≤30 kVA;
– maximum 10mA per kVA of rated continuous output power for inverters with continuous output power rating > 30 kVA.
This test shall be repeated 5 times, and for all 5 tests the time to disconnect shall not exceed 0,3s.
The test is repeated for each PV input terminal, It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel.

Supplementary information:

The tests had been performed on the SOFAR 24KTLX-G3 is valid for the SOFAR 15KTLX-G3,SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

The test results refer to the report LD200511N080 issued by Bureau Veritas Shenzhen Co.,Ltd.Dongguan Branch on 2020-12-17.

5.3.2 Instantaneous Variations of Current Test		P
+PV to N		
Limit (mA)	Disconnection time (ms) Un	Limit (ms)
30	220	300
30	215	300
30	223	300
30	232	300
30	234	300
60	136	150
60	128	150
60	129	150
60	111	150
60	113	150
150	36	40
150	36	40
150	29	40
150	33	40
150	34	40
-PV to N		
Limit (mA)	Disconnection time (ms) Un	Limit (ms)
30	241	300
30	237	300
30	236	300
30	231	300
30	239	300
60	132	150
60	133	150
60	120	150
60	126	150
60	117	150
150	30	40
150	32	40
150	34	40
150	35	40
150	32	40

Note:
The tests are based on IEC 62109-2, chapter 4,8,3,5,1, b),
The capacitive current is risen until disconnection,
Test condition: I_c + 30/60/150mA <= I_{cmax}, R_1 is set that 30/60/150mA Flow and switch S is closed,

Supplementary information:

The tests had been performed on the SOFAR 24KTLX-G3 is valid for the SOFAR 15KTLX-G3, SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3, since it is identical in hardware and software construction except output power derated by software.

The test results refer to the report LD200511N080 issued by Bureau Veritas Shenzhen Co.,Ltd.Dongguan Branch on 2020-12-17.

5.4 Voltage and Frequency Disconnection									**N/A**
Voltage Monitoring									
Test conditions:	**								
	under voltage				**over voltage (stage 1)**				
Parameter	Voltage	Time [ms]			Voltage	Time [ms]			
Limit	195V	**<= 1500 ms***			253V	**<= 1500 ms**			
Trip value	**				253,1				
Disconnection time	**210V to 190V**	**	**	**	**240V to 255V**	**	**	**	
	230V to 190V	**	**	**	**230V to 255V**	**	**	**	
Reconnection time:	**>=180 s**	**			**>=180 s**	**			
	--				**over voltage (stage 2)**				
Parameter	--				Voltage	Time (ms)			
Limit	--				264,5V	**<= 200 ms**			
Trip value	--				**				
Disconnection time	--				**245V to 265V**	**	**	**	
	--				**230V to 265V**	**	**	**	
Reconnection time:	--				**>=180 s**	**			

Note:
The test is based on the limits of RD1699:2011/RD413:2014.
The maximum and minimum voltage connection protection must be set to Un +10% (stage 1), Un +15% (stage 2) and Un -15%, The accuracy for the voltage measurement must be in a range of +/-2,3V (1% $U_{nom,}$).

* In case of facilities required to meet performance requirements against voltage sags, The time performance should be equal to 1,5 s.

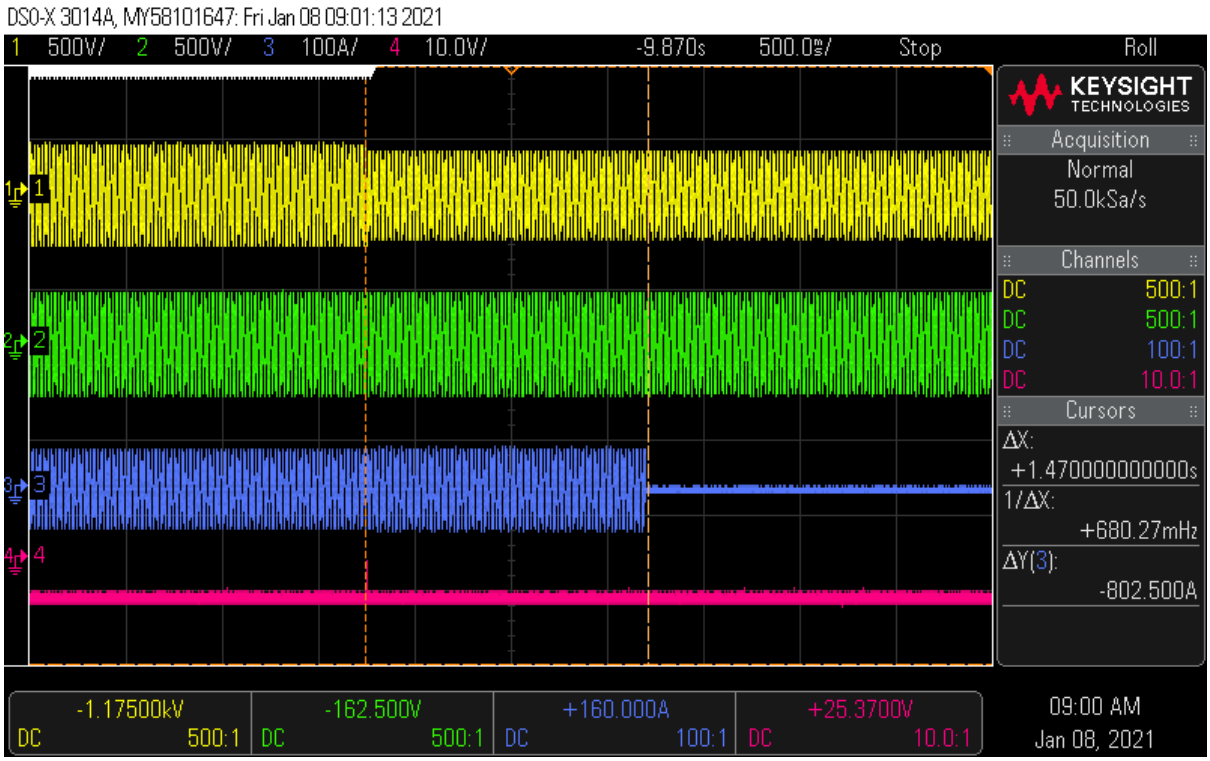
6,5,3 3-phase grid-voltage monitoring							P
Test Condition:			Frequency: 50+/-0,2Hz U_N=230Vac				
Phase	**Limit:**	**Voltage step: (to min, 184,1 or max, 281,5)**	**Trip value (V):**	**Reconnection time if <=3s (s):**	**Reconnection time if >3s (s):**	**Disconnection time (ms):**	**Limit (ms):**
L1 to N	~85% of Un	230V->190V	196,4	N/A	192	1450	**1500**
		230V->190V				1470	
	~110% of Un	230V->260V	254,5	N/A	193	1454	**1500**
		230V->260V				1454	
	~115% of Un	230V->270V	265,9	N/A	191	176	**200**
		230V->270V				185	
L2 to N	~85% of Un	230V->190V	196,5	N/A	193	1460	**1500**
		230V->190V				1450	
	~110% of Un	230V->260V	254,5	N/A	193	1444	**1500**
		230V->260V				1456	
	~115% of Un	230V->270V	266,0	N/A	194	184	**200**
		230V->270V				189	
L3 to N	~85% of Un	230V->190V	196,7	N/A	193	1452	**1500**
		230V->190V				1460	
	~110% of Un	230V->260V	254,4	N/A	191	1460	**1500**
		230V->260V				1446	
	~115% of Un	230V->270V	265,8	N/A	193	188	**200**
		230V->270V				186	

Note:

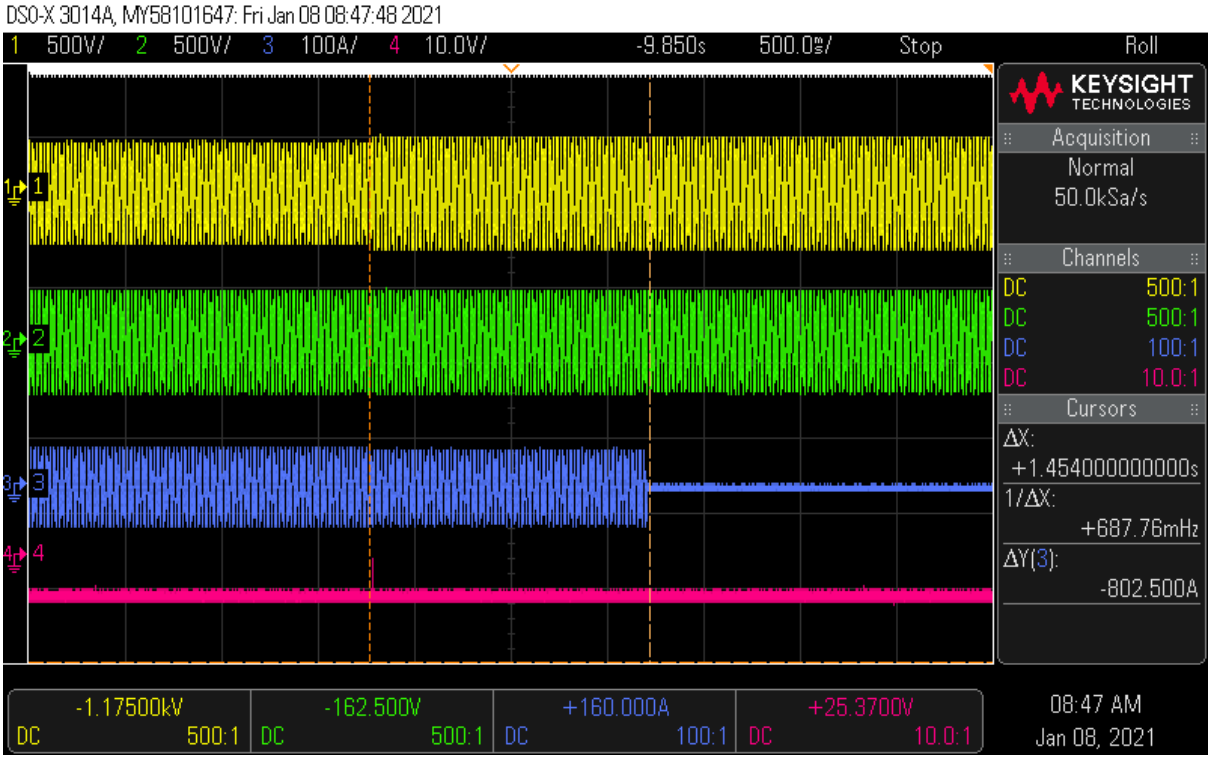
The tests had been performed on the SOFAR 24KTLX-G3 and SOFAR 15KTLX-G3 is valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3, since it is identical in hardware and software construction except output power derated by software.

The test results refer to the report PVSP200511N080-5 issued by Bureau Veritas Shenzhen Co.,Ltd.Dongguan Branch on 2020-02-19.

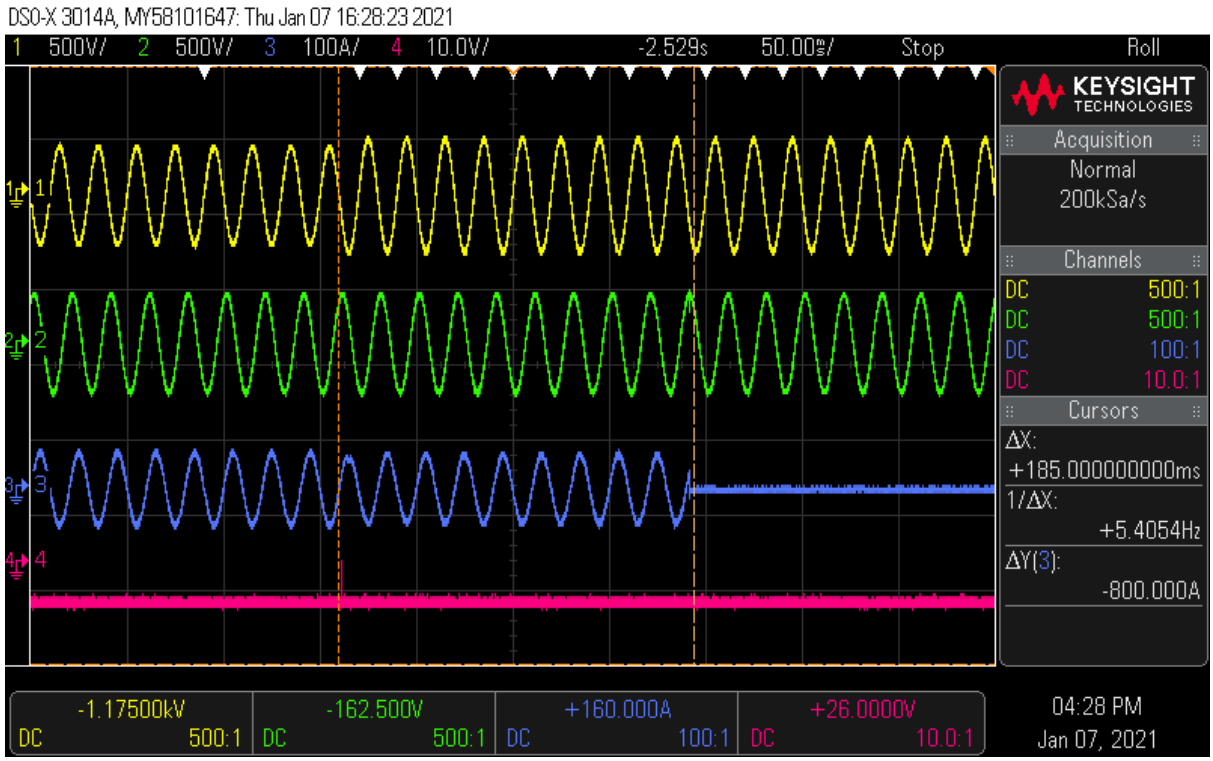
under voltage: L1 to N



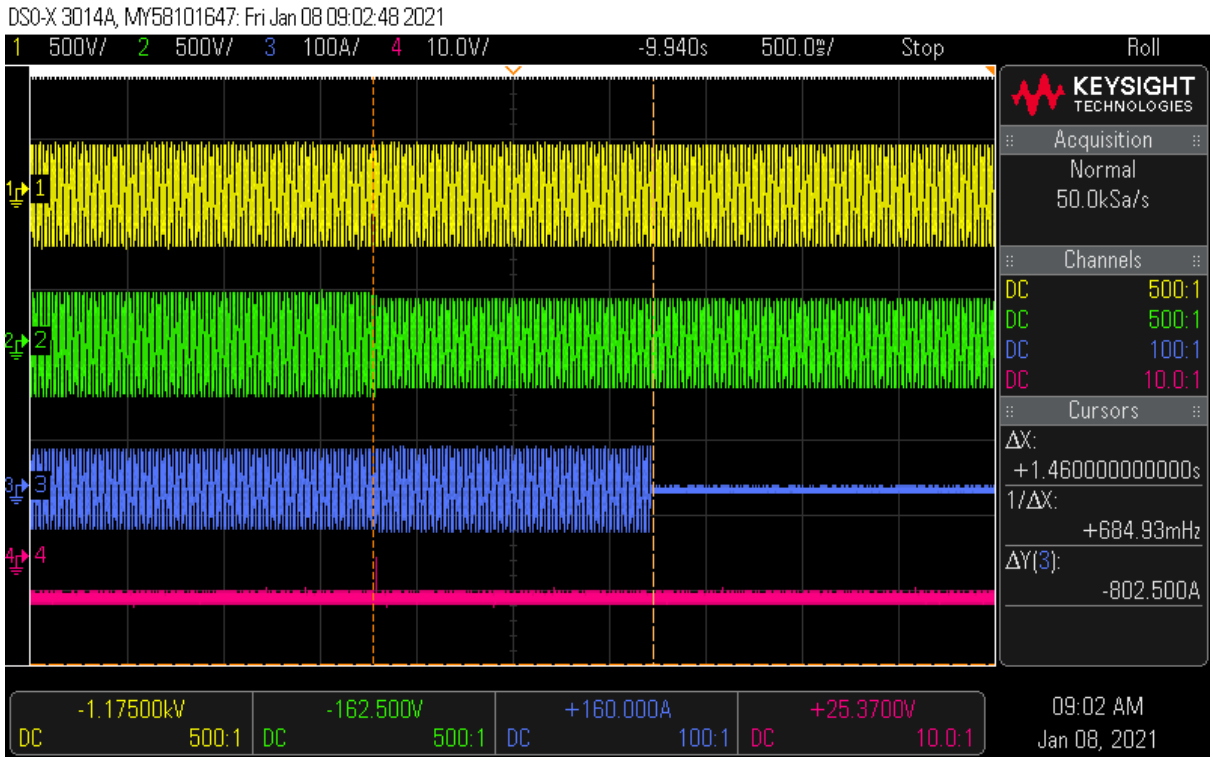
over voltage (stage 1): L1 to N



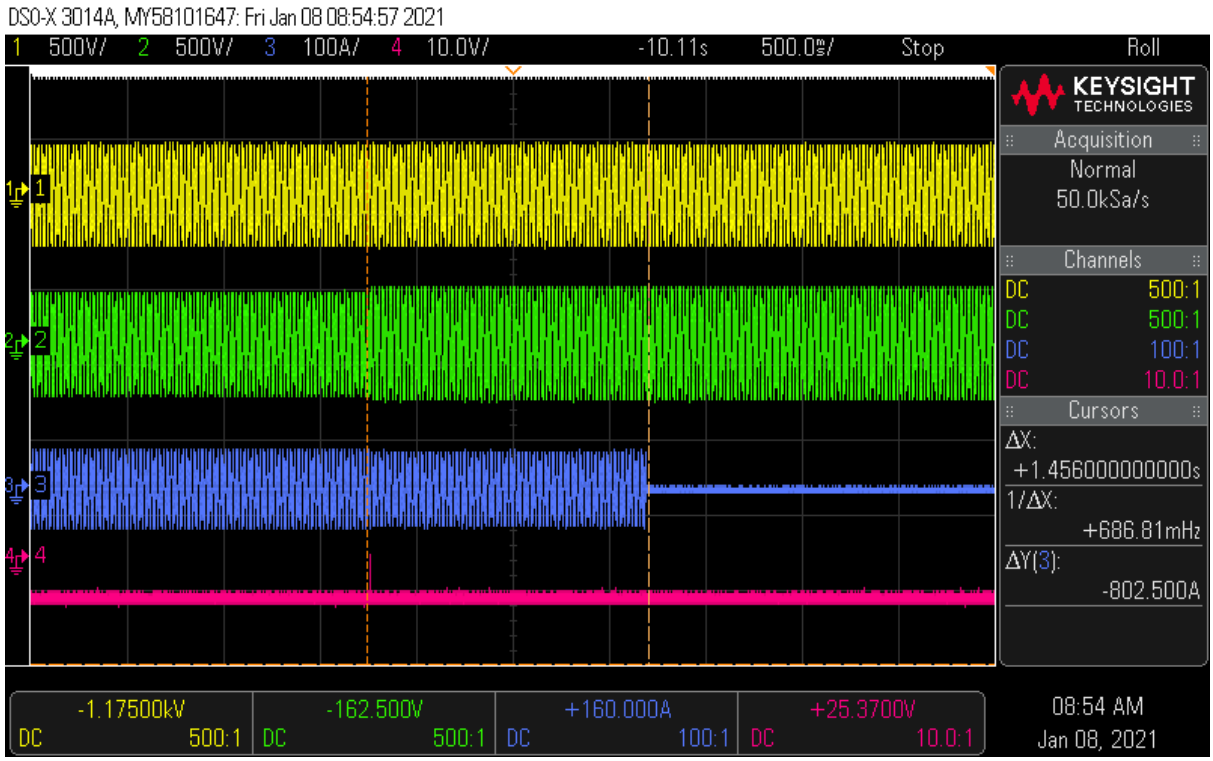
over voltage (stage 2): L1 to N



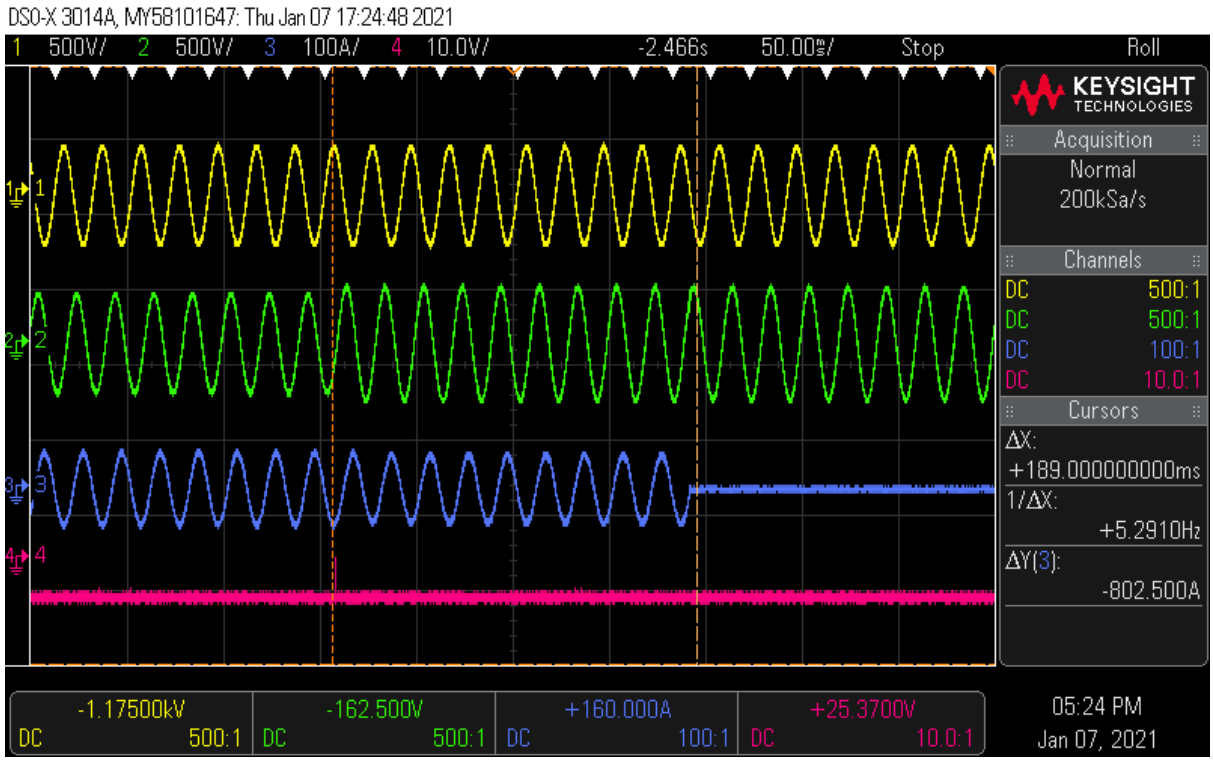
under voltage: L2 to N



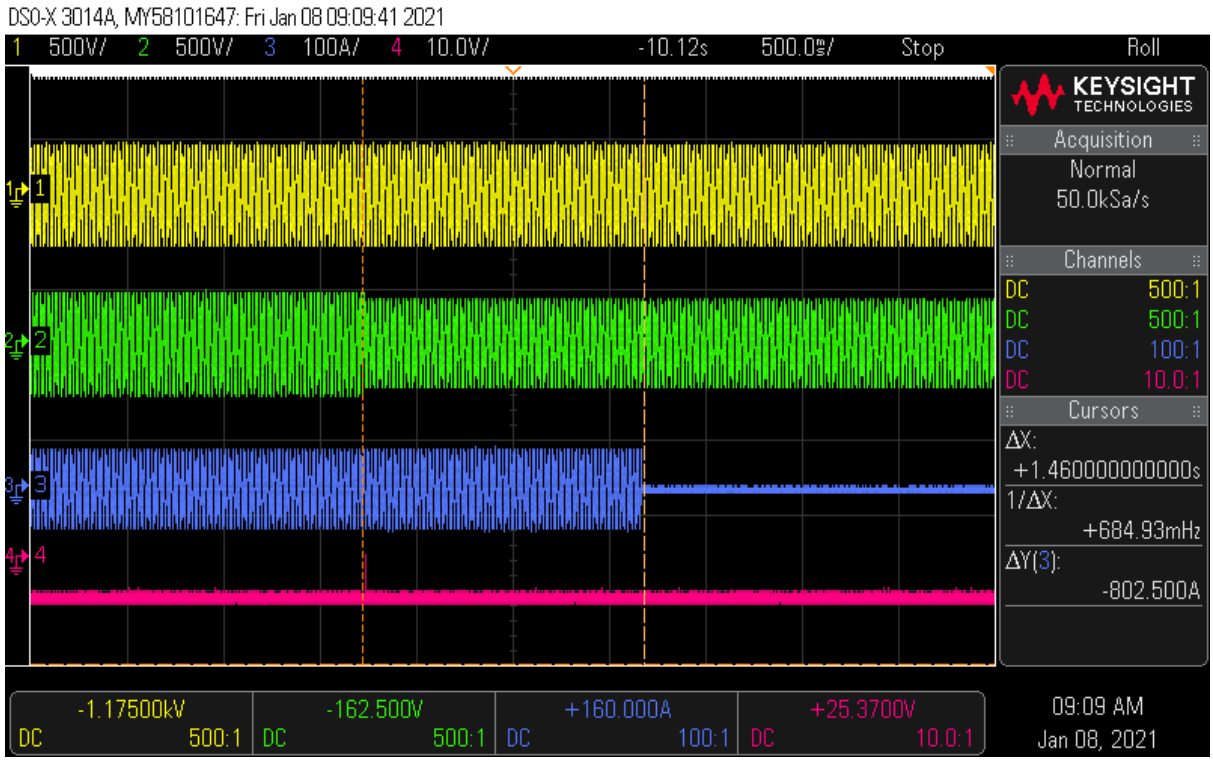
over voltage (stage 1): L2 to N



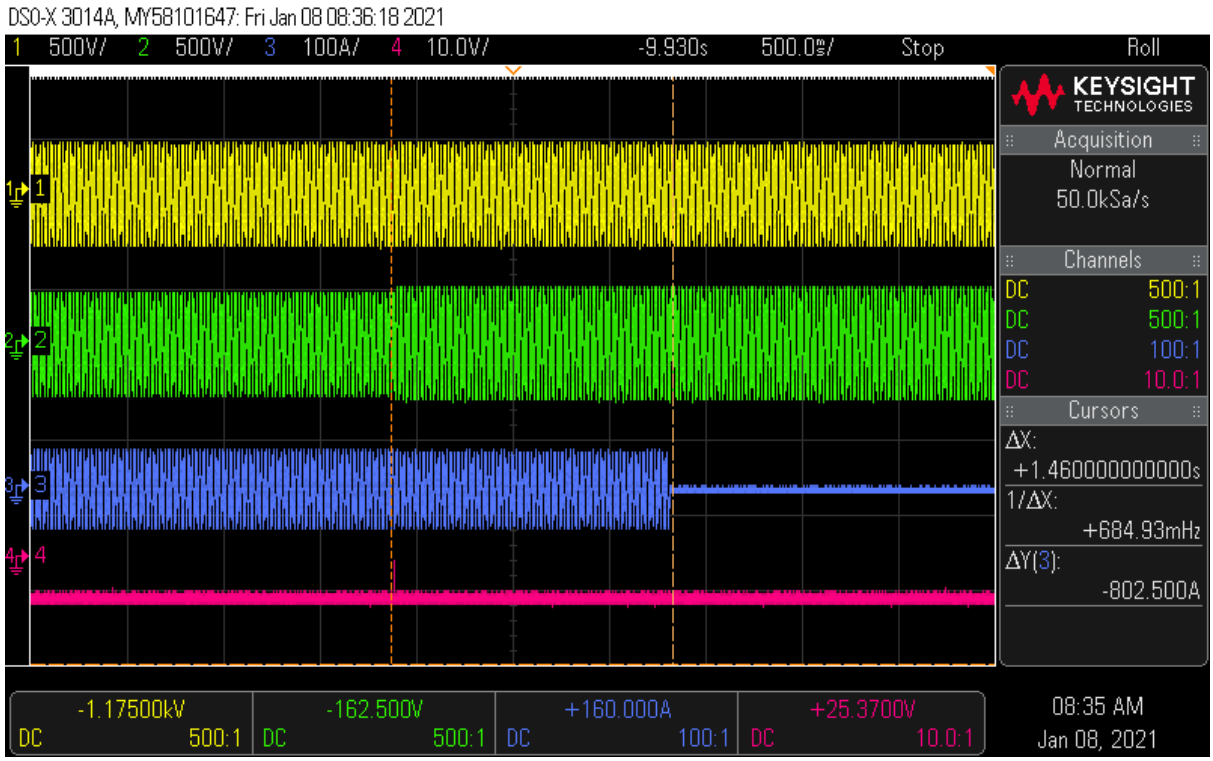
over voltage (stage 2): L2 to N



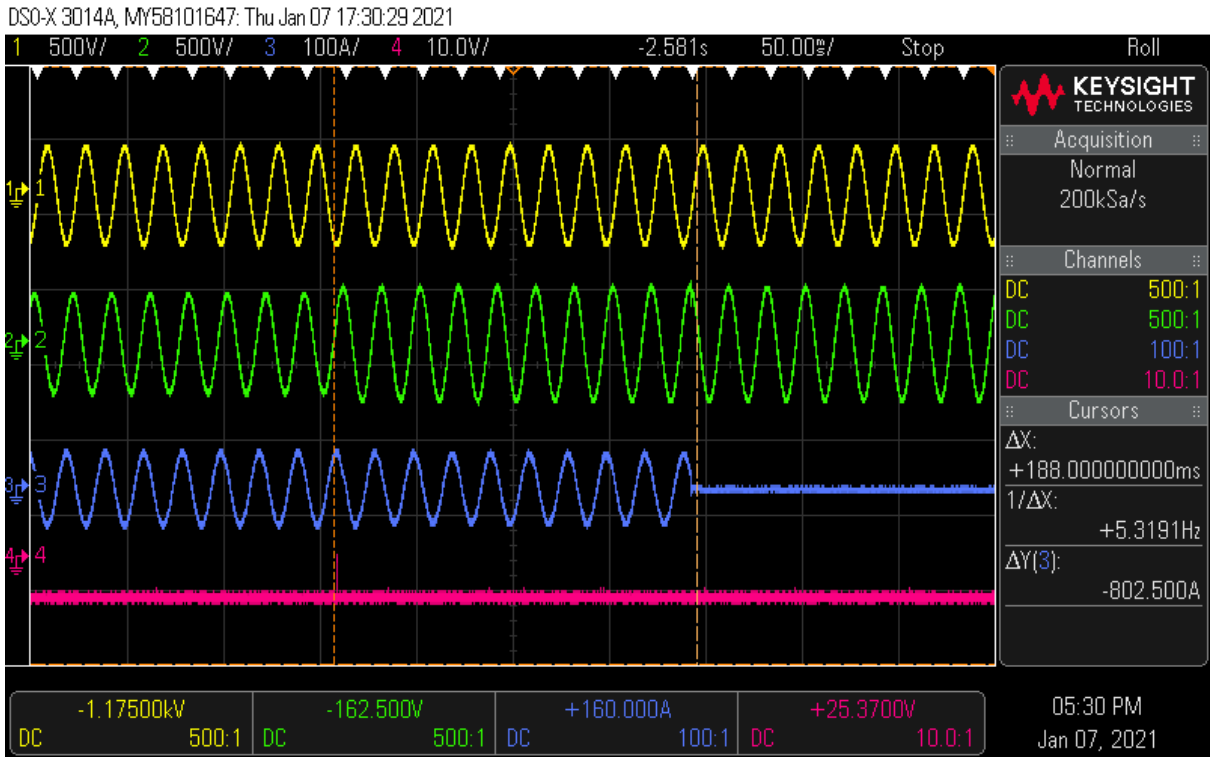
under voltage: L3 to N



over voltage (stage 1): L3 to N



over voltage (stage 2): L3 to N



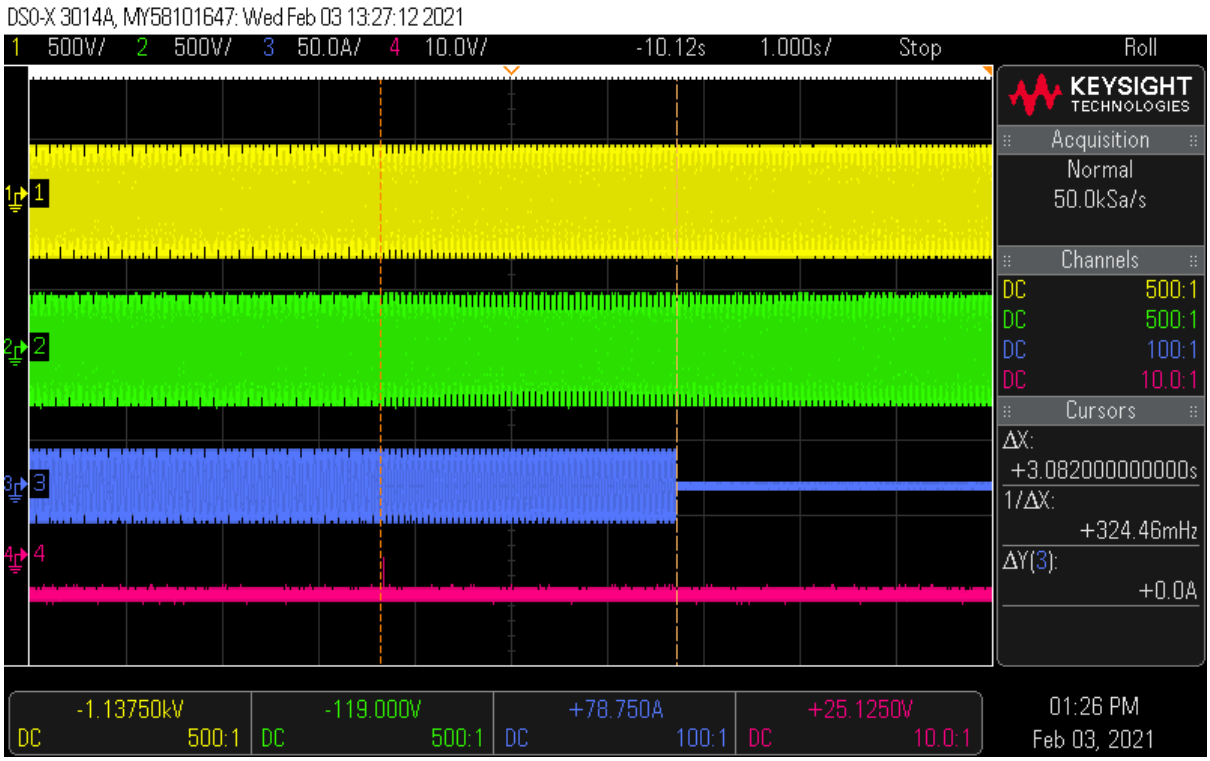
Frequency monitoring:									**P**
	under frequency				**over frequency**				
Parameter	Frequency [Hz]	Time [ms]			Frequency [Hz]	Time [ms]			
Output Voltage		**~85%U_N**	**U_N**	**~110%U_N**		**~85%U_N**	**U_N**	**~110%U_N**	
Limit	**48,0 Hz**	**at least 3 s**			**51,0 Hz**	**<= 500 ms**			
Trip value		47,99	47,98	47,98		51,00	51,00	51,00	
Disconnection time (s)	48,1Hz to 47,9Hz	3,078	3,060	3,082	50,9Hz to 51,1Hz	0,444	0,456	0,458	
		3,080	3,080	3,070		0,446	0,440	0,452	
Reconnection time:	**>=180s**	190 s			**>=180s**	189 s			

Note:
The test is based on the limits of RD1699:2011.
The maximum and minimum frequency connection protection must be set to 51,0 Hz and 48,0 Hz, For an under frequency failure the inverter has to stay connect for at least 3 s, After the 3 s the inverter has to disconnect immediately from the grid, The accuracy for the frequency measurement must be in a range of +/- 0,05 Hz.

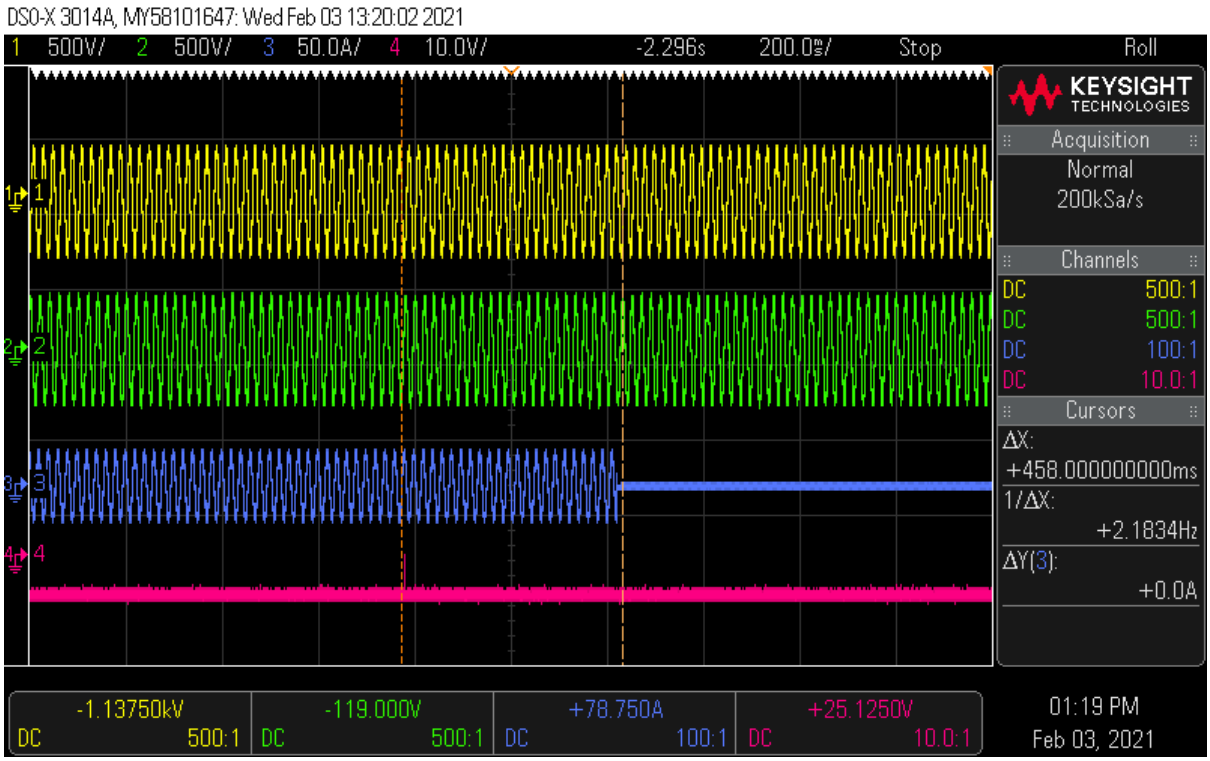
The tests had been performed on the SOFAR 24KTLX-G3 is valid for the SOFAR 15KTLX-G3,SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

The test results refer to the report PVSP200511N080-5 issued by Bureau Veritas Shenzhen Co.,Ltd.Dongguan Branch on 2020-02-19.

under frequency:



over frequency:



5.5 Automatic Reconnection			**P**
Setting values reconnection	Setting $T_{reconnection}$ ≥ 180s:	180 s	
	Setting $f_{reconnection}$ ≤ 50,00Hz:	50 Hz	

Connecting conditions for frequencies:			
a)	50,00 Hz		inverter running
	f_{ist}	**Reset time:**	**Limit:**
	Switch to b) for ≥ Setting $T_{reconnection}$:		
b)	≥ 50,50 Hz	No connection	inverter has to disconnect, no resetting allowed
	Switch to c) for ≥ Setting $T_{reconnection}$:		
c)	50,05 Hz	No connection	no resetting allowed
	Switch to d) for ≥ Setting $T_{reconnection}$:		
d)	≤ 50,00 Hz	189s	resetting allowed after ≥ Setting $T_{reconnection}$

Test:
The test is based on the limits of RD413.
see points a) to d) for the test process.
The measurement was carried out with a programmable AC source.
e,g, connecting conditions for frequencies:
a) AC source was programmed in such a way that the AC output is set to 230 V / 50 Hz
b) AC source is set for ≥ Setting $T_{reconnection}$ to 230 V / 50,5 Hz, switching on again is not permitted
c) AC source is set to 230 V / 50,05 Hz for ≥ Setting $T_{reconnection}$, reconnection is not permitted
d) AC source is set back to 230 V / 50,0 Hz, reconnection is allowed after ≥ Setting $T_{reconnection}$.

Note:
In the event of activating the maximum frequency protection, reconnection shall only be made when the frequency reaches a value that is less than or equal to 50 Hz, The accuracy for the frequency measurement must be in a range of +/-0,05 Hz (0,1% $f_{nom.}$).

The tests had been performed on the SOFAR 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

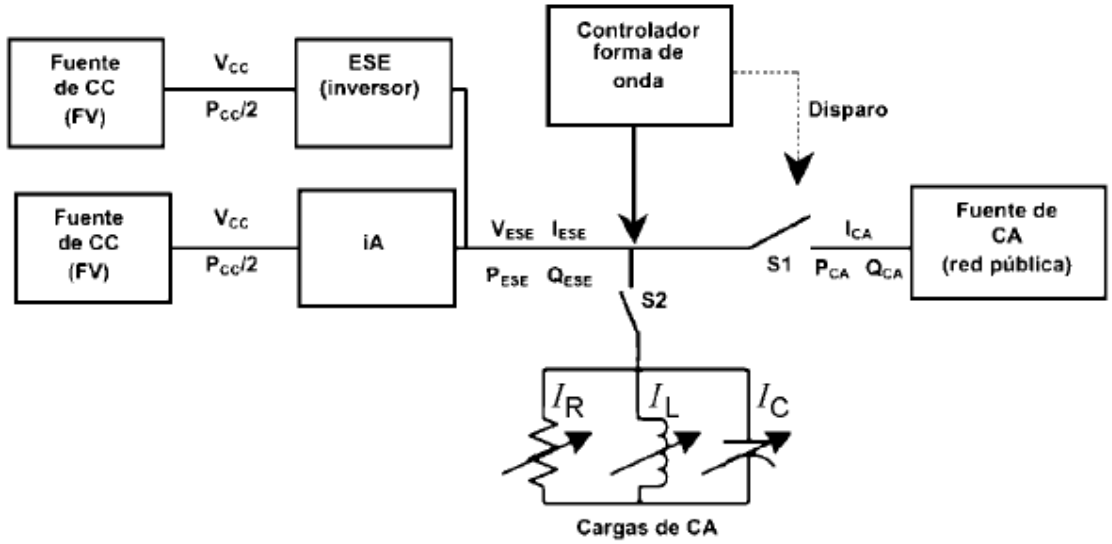
The test results refer to the report PVSP200511N080-5 issued by Bureau Veritas Shenzhen Co.,Ltd.Dongguan Branch on 2020-02-19.

5.6 Island Operation Detection	P

Test circuit and parameters

Parameter	Symbol	Units
EUT DC Input		
DC voltage	V_{DC}	V
DC Current	I_{DC}	A
DC Power	P_{DC}	W
EUT AC ouput		
AC voltage	V_{EUT}	V
AC current	I_{EUT}	A
Real power	P_{EUT}	W
Reactive power	Q_{EUT}	VAr
Test Load		
Resistive load current	I_R	A
Inductive load current	I_L	A
Capacitive load current	I_C	A
AC (utility) power source		
Utility real power	P_{AC}	W
Utility reactive power	Q_{AC}	VAr
Utility current	I_{AC}	A

Block diagram test circuit UNE 206006:2011



Note:
Test 1: Both inverters are feeding in parallel with Anti-Islanding detection activated.
Test 2: Both inverters are feeding in parallel with Anti-Islanding detection deactivated of the second inverter.

Each inverter is generating 50% of the required test-bin.

The testing is based on EN 62116.

5.6 Islanding protection according table 6 - Load imbalance (real, reactive load) for test condition A (EUT ouput = 100%)	**P**

TEST 1

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality = 1
Disconnection limit	2s (IEC 62116)

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]	I_{AC} 4) [A]	P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [ms]	Remarks 5)
1	100	100	0	0	0,074	8000	635	1,007	612	BL
2	100	100	-5	-5	1,626	8000	635	1,033	400	IB
3	100	100	-5	0	1,688	8000	635	1,060	312	IB
4	100	100	-5	+5	1,658	8000	635	1,086	338	IB
5	100	100	0	-5	0,265	8000	635	0,981	405	IB
6	100	100	0	+5	0,234	8000	635	1,032	336	IB
7	100	100	+5	-5	2,008	8000	635	0,935	369	IB
8	100	100	+5	0	1,951	8000	635	0,959	429	IB
9	100	100	+5	+5	1,979	8000	635	0,983	416	IB

Parameter at 0% per phase	L=20,74 mH	R=6,59 Ω	C=484,38 µF

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) Fundamental of I_{AC} when RLC is adjusted
5) BL: Balance condition, IB: Imbalance condition.
Condition A:
EUT output power PEUT = Maximum 6)
EUT input voltage 6) = >75% of rated input voltage range

6) Maximum EUT output power condition should be achieved using the maximum allowable input power, Actual output power may exceed nominal rated output.
7) Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 90 % of range =X + 0,75 × (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 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

Disconnection at No. 1

5.6 Islanding protection according Table 7 – Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)	**P**

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality =1
Disconnection limit	2s (IEC 62116)

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]	I_{AC} 4) [A]	P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [ms]	Remarks 5)
1	66	66	0	-5	1,006	5280	470	1,022	350	IB
2	66	66	0	-4	1,019	5280	470	1,027	407	IB
3	66	66	0	-3	1,029	5280	470	1,033	375	IB
4	66	66	0	-2	1,038	5280	470	1,038	393	IB
5	66	66	0	-1	1,043	5280	470	1,043	394	IB
6	66	66	0	0	0,048	5280	470	1,049	603	BL
7	66	66	0	1	1,048	5280	470	1,054	390	IB
8	66	66	0	2	1,047	5280	470	1,059	354	IB
9	66	66	0	3	1,043	5280	470	1,064	380	IB
10	66	66	0	4	1,037	5280	470	1,069	331	IB
11	66	66	0	5	1,028	5280	470	1,074	327	IB

Parameter at 0% per phase	L= 31,79 mH	R= 10,48 Ω	C= 318,76 µF

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) Fundamental of I_{AC} when RLC is adjusted
5) BL: Balance condition, IB: Imbalance condition.
Condition B:
EUT output power P_{EUT} = 50 % – 66 % of maximum
EUT input voltage 6) = 50 % of rated input voltage range, ±10 %
6) 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 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

Disconnection at No. 6

5.6 Islanding protection according Table 7 – Load imbalance (reactive load) for test condition C (EUT output = 25 % – 33 %)	**P**

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality =1
Disconnection limit	2s (IEC 62116)

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]	I_{AC} 4) [A]	P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [ms]	Remarks 5)
1	33	33	0	-5	0,492	2640	272	1,040	345	IB
2	33	33	0	-4	0,497	2640	272	1,046	417	IB
3	33	33	0	-3	0,500	2640	272	1,051	404	IB
4	33	33	0	-2	0,508	2640	272	1,056	401	IB
5	33	33	0	-1	0,514	2640	272	1,062	410	IB
6	33	33	0	0	0,032	2640	272	1,067	402	BL
7	33	33	0	1	0,511	2640	272	1,073	406	IB
8	33	33	0	2	0,516	2640	272	1,078	358	IB
9	33	33	0	3	0,519	2640	272	1,083	355	IB
10	33	33	0	4	0,504	2640	272	1,088	389	IB
11	33	33	0	5	0,503	2640	272	1,094	372	IB

Parameter at 0% per phase	L= 62,38 mH	R= 20,91 Ω	C= 162,43 µF

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) Fundamental of I_{AC} when RLC is adjusted
5) BL: Balance condition, IB: Imbalance condition.
Condition B:
EUT output power PEUT = 25 % – 33 % 6) of maximum
EUT input voltage 7) = <20 % of rated input voltage range
6) Or minimum allowable EUT output level if greater than 33 %.
7) Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 10 % of range =X + 0,2 × (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 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

Disconnection at No. 2

5.6 Islanding protection according table 6 - Load imbalance (real, reactive load) for test condition A (EUT ouput = 100%)	**P**

TEST 2

Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality = 1
Disconnection limit	2s (IEC 62116)

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]	I_{AC} 4) [A]	P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [ms]	Remarks 5)
1	100	100	0	0	0,023	8000	635	1,008	462	BL
2	100	100	-5	-5	1,611	8000	635	1,034	370	IB
3	100	100	-5	0	1,677	8000	635	1,061	397	IB
4	100	100	-5	+5	1,652	8000	635	1,087	374	IB
5	100	100	0	-5	0,176	8000	635	0,983	334	IB
6	100	100	0	+5	0,136	8000	635	1,033	362	IB
7	100	100	+5	-5	1,916	8000	635	0,936	397	IB
8	100	100	+5	0	1,856	8000	635	0,960	456	IB
9	100	100	+5	+5	1,879	8000	635	0,984	388	IB

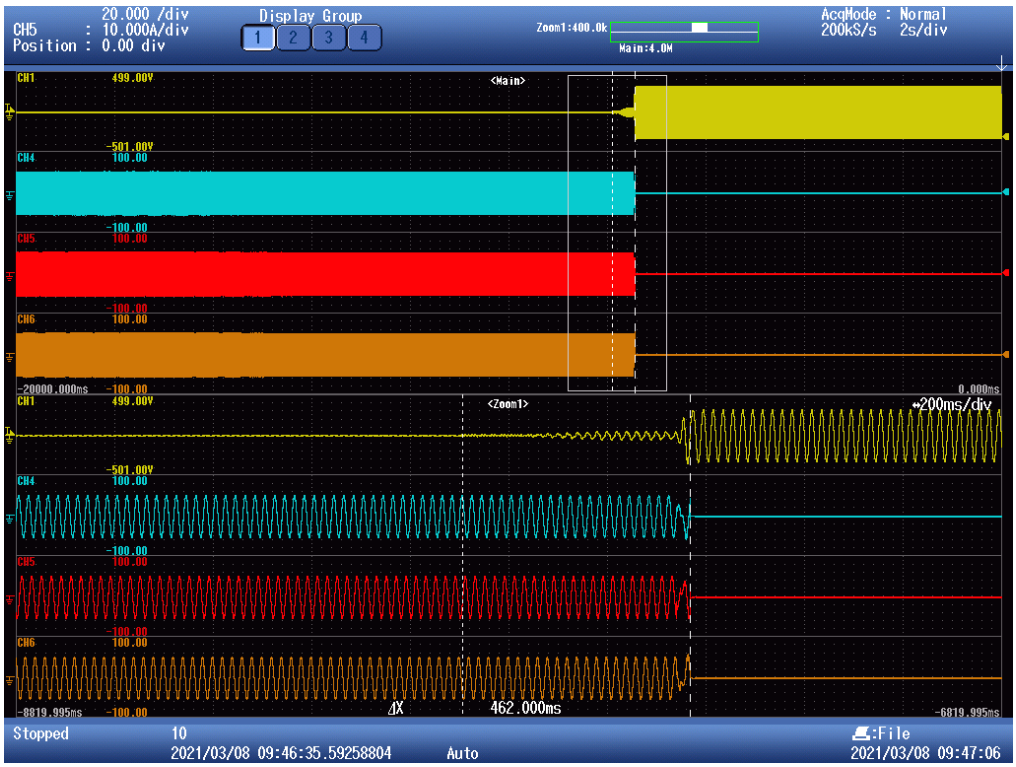
Parameter at 0% per phase	L= 20,83 mH	R= 6,60 Ω	C= 486,44 µF

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) Fundamental of I_{AC} when RLC is adjusted
5) BL: Balance condition, IB: Imbalance condition.
Condition A:
EUT output power PEUT = Maximum 6)
EUT input voltage 6) = >75% of rated input voltage range

6) Maximum EUT output power condition should be achieved using the maximum allowable input power, Actual output power may exceed nominal rated output.
7) Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 90 % of range =X + 0,75 × (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 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

Disconnection at No. 1



5.6 Islanding protection according Table 7 – Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)	**P**

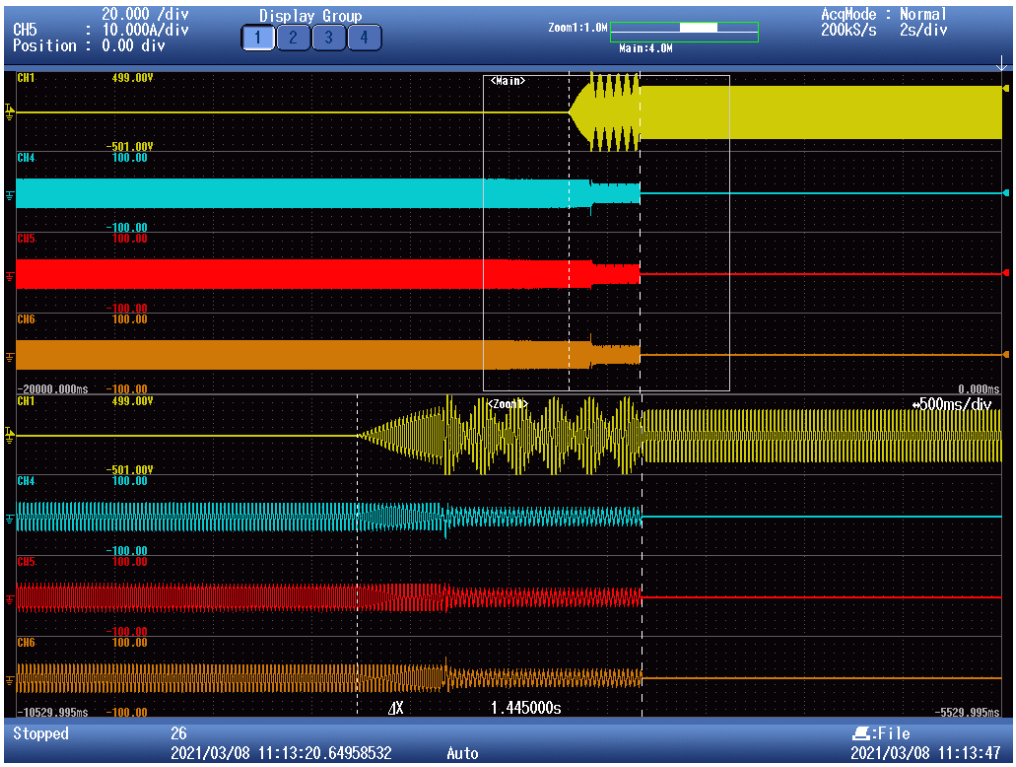
Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality =1
Disconnection limit	2s (IEC 62116)

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]	I_{AC} 4) [A]	P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [ms]	Remarks 5)
1	66	66	0	-5	0,238	5280	470	0,970	1320	IB
2	66	66	0	-4	0,226	5280	470	0,975	1375	IB
3	66	66	0	-3	0,217	5280	470	0,980	1352	IB
4	66	66	0	-2	0,210	5280	470	0,985	1445	IB
5	66	66	0	-1	0,205	5280	470	0,990	1316	IB
6	66	66	0	0	0,072	5280	470	0,995	1370	BL
7	66	66	0	1	0,203	5280	470	1,000	1304	IB
8	66	66	0	2	0,205	5280	470	1,005	1385	IB
9	66	66	0	3	0,209	5280	470	1,010	1369	IB
10	66	66	0	4	0,216	5280	470	1,015	1366	IB
11	66	66	0	5	0,225	5280	470	1,020	1350	IB

Parameter at 0% per phase	L= 31,87 mH	R= 9,96 Ω	C= 317,92 µF

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) Fundamental of I_{AC} when RLC is adjusted
5) BL: Balance condition, IB: Imbalance condition.
Condition B:
EUT output power P_{EUT} = 50 % – 66 % of maximum
EUT input voltage 6) = 50 % of rated input voltage range, ±10 %
6) 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 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

Disconnection at No. 4



5.6 Islanding protection according Table 7 – Load imbalance (reactive load) for test condition C (EUT output = 25 % – 33 %)	**P**

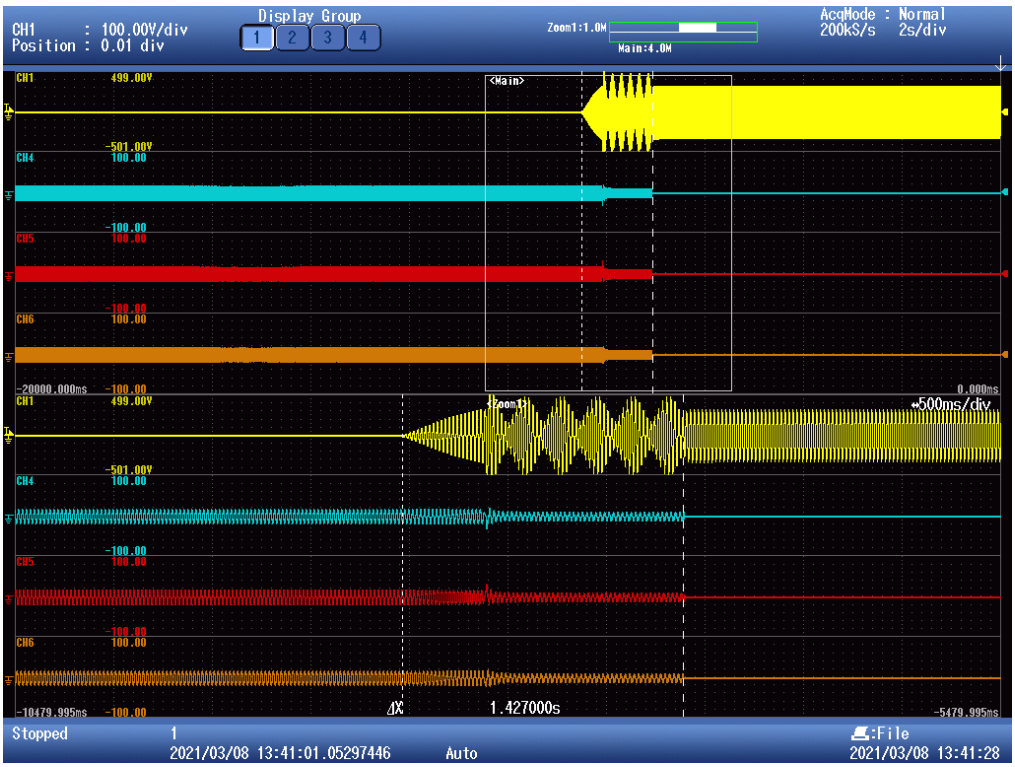
Test conditions	Frequency: 50+/-0,1Hz U_N=230+/-3Vac Distortion factor of chokes < 2% Quality =1
Disconnection limit	2s (IEC 62116)

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]	I_{AC} 4) [A]	P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [ms]	Remarks 5)
1	33	33	0	-5	0,834	2640	272	0,969	1400	IB
2	33	33	0	-4	0,828	2640	272	0,975	1412	IB
3	33	33	0	-3	0,823	2640	272	0,980	1403	IB
4	33	33	0	-2	0,820	2640	272	0,985	1415	IB
5	33	33	0	-1	0,818	2640	272	0,990	1427	IB
6	33	33	0	0	0,034	2640	272	0,995	1374	BL
7	33	33	0	1	0,817	2640	272	1,000	1418	IB
8	33	33	0	2	0,818	2640	272	1,005	1400	IB
9	33	33	0	3	0,821	2640	272	1,009	1290	IB
10	33	33	0	4	0,825	2640	272	1,014	1357	IB
11	33	33	0	5	0,830	2640	272	1,019	1349	IB

Parameter at 0% per phase	L= 60,01 mH	R= 18,76 Ω	C= 168,84 µF

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) Fundamental of I_{AC} when RLC is adjusted
5) BL: Balance condition, IB: Imbalance condition.
Condition B:
EUT output power PEUT = 25 % – 33 % 6) of maximum
EUT input voltage 7) = <20 % of rated input voltage range
6) Or minimum allowable EUT output level if greater than 33 %.
7) Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 10 % of range =X + 0,2 × (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 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

Disconnection at No. 5



5,7 Overvoltage Generation **Phase- neutral**				**P**
L1 phase to neutral	50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration(s)	Line to neutral (V)
Limit	0,0002	910	0,0002	910
Test value	0,0002	323	0,0002	278
Limit	0,0006	710	0,0006	710
Test value	0,0006	338	0,0006	275
Limit	0,002	580	0,002	580
Test value	0,002	351	0,002	166
Limit	0,006	470	0,006	470
Test value	0,006	136	0,006	333
Limit	0,02	420	0,02	420
Test value	0,02	382	0,02	333
Limit	0,06	390	0,06	390
Test value	0,06	379	0,06	301
Limit	0,2	390	0,2	390
Test value	0,2	239	0,2	191
Limit	0,6	390	0,6	390
Test value	0,6	67	0,6	53
L2 phase to neutral	50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration(s)	Line to neutral (V)
Limit	0,0002	910	0,0002	910
Test value	0,0002	332	0,0002	344
Limit	0,0006	710	0,0006	710
Test value	0,0006	220	0,0006	370
Limit	0,002	580	0,002	580
Test value	0,002	352	0,002	84
Limit	0,006	470	0,006	470
Test value	0,006	8	0,006	47
Limit	0,02	420	0,02	420

Test value	0,02	324	0,02	74
Limit	0,06	390	0,06	390
Test value	0,06	275	0,06	64
Limit	0,2	390	0,2	390
Test value	0,2	174	0,2	43
Limit	0,6	390	0,6	390
Test value	0,6	48	0,6	10
L3 phase to neutral	50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration(s)	Line to neutral (V)
Limit	0,0002	910	0,0002	910
Test value	0,0002	206	0,0002	87
Limit	0,0006	710	0,0006	710
Test value	0,0006	198	0,0006	249
Limit	0,002	580	0,002	580
Test value	0,002	16	0,002	88
Limit	0,006	470	0,006	470
Test value	0,006	331	0,006	336
Limit	0,02	420	0,02	420
Test value	0,02	331	0,02	337
Limit	0,06	390	0,06	390
Test value	0,06	332	0,06	335
Limit	0,2	390	0,2	390
Test value	0,2	236	0,2	245
Limit	0,6	390	0,6	390
Test value	0,6	68	0,6	71

Note:

The tests are based on the procedure of AS/NZS 4777,2.

The inverter shall not generate overvoltages at its alternating current connection, complying with the limits set in tables 2 or 3 of UNE206007-1 as applicable.

The tests had been performed on the SOFAR 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

5,7 Overvoltage Generation Phase-Phase				**P**
L1 phase to L2 phase	50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to line (V)	Duration(s)	Line to line (V)
Limit	0,0002	1580	0,0002	1580
Test value	0,0002	339	0,0002	189
Limit	0,0006	1240	0,0006	1240
Test value	0,0006	495	0,0006	125
Limit	0,002	1010	0,002	1010
Test value	0,002	466	0,002	94
Limit	0,006	810	0,006	810
Test value	0,006	553	0,006	93
Limit	0,02	720	0,02	720
Test value	0,02	511	0,02	88
Limit	0,06	670	0,06	670
Test value	0,06	419	0,06	75
Limit	0,2	670	0,2	670
Test value	0,2	238	0,2	42
Limit	0,6	670	0,6	670
Test value	0,6	51	0,6	9
L2 phase to L3 phase	50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to line (V)	Duration(s)	Line to line (V)
Limit	0,0002	1580	0,0002	1580
Test value	0,0002	457	0,0002	110
Limit	0,0006	1240	0,0006	1240
Test value	0,0006	463	0,0006	152
Limit	0,002	1010	0,002	1010
Test value	0,002	113	0,002	573
Limit	0,006	810	0,006	810

Test value	0,006	659	0,006	747
Limit	0,02	720	0,02	720
Test value	0,02	43	0,02	75
Limit	0,06	670	0,06	670
Test value	0,06	36	0,06	131
Limit	0,2	670	0,2	670
Test value	0,2	20	0,2	74
Limit	0,6	670	0,6	670
Test value	0,6	5	0,6	16
L3 phase to L1 phase	50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to line (V)	Duration(s)	Line to line (V)
Limit	0,0002	1580	0,0002	1580
Test value	0,0002	158	0,0002	49
Limit	0,0006	1240	0,0006	1240
Test value	0,0006	210	0,0006	92
Limit	0,002	1010	0,002	1010
Test value	0,002	588	0,002	487
Limit	0,006	810	0,006	810
Test value	0,006	649	0,006	725
Limit	0,02	720	0,02	720
Test value	0,02	43	0,02	16
Limit	0,06	670	0,06	670
Test value	0,06	563	0,06	466
Limit	0,2	670	0,2	670
Test value	0,2	321	0,2	265
Limit	0,6	670	0,6	670
Test value	0,6	69	0,6	56

Note:

The tests are based on the procedure of AS/NZS 4777,2.

The inverter shall not generate overvoltages at its alternating current connection, complying with the limits set in tables 2 or 3 of UNE206007-1 as applicable.

The test shall be performed for a power greater than 50% of rated power, Repeat the test three times, The tests had been performed on the SOFAR 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

5,8 Grid quality	P

Harmonics: SOFAR 15KTLX-G3

Normal ambient (EN 61000-3-12) Output power (33±5)%								
Watts				**1,658**			**1,713**	**1,630**
Vrms				**230,26**			**230,15**	**230,39**
Arms				**7,206**			**7,449**	**7,081**
Frequency				**50,00**				
THD* (33% output power)				**1,629**			**1,339**	**1,376**
Harmonics	**Current Magnitude (A)**			**% of Nominal current**			**Phase**	**Harmonic Current Limits (%)**
1st	7,202	7,444	7,077	-	-	-	Three Phase	N/A
2nd	0,009	0,007	0,007	0,131	0,097	0,096	Three Phase	8
3rd	0,047	0,008	0,054	0,651	0,104	0,764	Three Phase	21,6
4th	0,010	0,008	0,005	0,143	0,112	0,072	Three Phase	4
5th	0,073	0,063	0,048	1,010	0,851	0,672	Three Phase	10,7
6th	0,005	0,004	0,003	0,072	0,058	0,036	Three Phase	2,67
7th	0,052	0,050	0,036	0,717	0,675	0,506	Three Phase	7,2
8th	0,003	0,002	0,002	0,047	0,030	0,034	Three Phase	2
9th	0,010	0,004	0,015	0,137	0,056	0,212	Three Phase	3,8
10th	0,003	0,002	0,003	0,040	0,031	0,036	Three Phase	1,6
11th	0,027	0,025	0,021	0,379	0,340	0,304	Three Phase	3,1
12th	0,002	0,002	0,002	0,028	0,024	0,028	Three Phase	1,33
13th	0,016	0,015	0,013	0,222	0,201	0,184	Three Phase	2
14th	0,002	0,002	0,002	0,024	0,024	0,026	Three Phase	N/A
15th	0,005	0,003	0,003	0,065	0,044	0,040	Three Phase	N/A
16th	0,002	0,002	0,002	0,027	0,022	0,031	Three Phase	N/A
17th	0,011	0,011	0,009	0,150	0,153	0,130	Three Phase	N/A
18th	0,002	0,002	0,002	0,024	0,021	0,024	Three Phase	N/A
19th	0,006	0,004	0,003	0,090	0,057	0,049	Three Phase	N/A
20th	0,002	0,002	0,002	0,022	0,023	0,025	Three Phase	N/A
21th	0,006	0,003	0,003	0,079	0,041	0,038	Three Phase	N/A
22th	0,001	0,002	0,002	0,021	0,021	0,022	Three Phase	N/A
23th	0,016	0,015	0,014	0,218	0,202	0,204	Three Phase	N/A
24th	0,002	0,002	0,002	0,025	0,021	0,028	Three Phase	N/A
25th	0,007	0,009	0,006	0,091	0,117	0,088	Three Phase	N/A
26th	0,001	0,001	0,002	0,021	0,019	0,023	Three Phase	N/A
27th	0,003	0,002	0,003	0,041	0,032	0,048	Three Phase	N/A
28th	0,001	0,002	0,002	0,019	0,024	0,022	Three Phase	N/A
29th	0,013	0,011	0,011	0,177	0,153	0,153	Three Phase	N/A
30th	0,001	0,001	0,001	0,017	0,018	0,020	Three Phase	N/A
31th	0,015	0,018	0,016	0,201	0,236	0,227	Three Phase	N/A
32th	0,002	0,002	0,002	0,029	0,022	0,025	Three Phase	N/A
33th	0,003	0,003	0,003	0,047	0,040	0,045	Three Phase	N/A
34th	0,002	0,002	0,002	0,025	0,024	0,025	Three Phase	N/A
35th	0,016	0,015	0,015	0,221	0,201	0,208	Three Phase	N/A
36th	0,001	0,001	0,001	0,019	0,019	0,021	Three Phase	N/A
37th	0,016	0,018	0,017	0,220	0,235	0,238	Three Phase	N/A
38th	0,002	0,002	0,002	0,024	0,022	0,026	Three Phase	N/A
39th	0,004	0,004	0,003	0,051	0,048	0,043	Three Phase	N/A
40th	0,002	0,002	0,001	0,022	0,020	0,021	Three Phase	N/A
41th	0,016	0,016	0,015	0,227	0,214	0,211	Three Phase	N/A

42th	0,002	0,002	0,002	0,032	0,033	0,031	Three Phase	N/A
43th	0,012	0,013	0,012	0,161	0,171	0,167	Three Phase	N/A
44th	0,002	0,002	0,002	0,021	0,024	0,022	Three Phase	N/A
45th	0,003	0,002	0,004	0,039	0,032	0,054	Three Phase	N/A
46th	0,005	0,005	0,004	0,069	0,066	0,060	Three Phase	N/A
47th	0,014	0,013	0,013	0,187	0,179	0,190	Three Phase	N/A
48th	0,003	0,003	0,003	0,040	0,036	0,036	Three Phase	N/A
49th	0,012	0,012	0,012	0,166	0,161	0,173	Three Phase	N/A
50th	0,005	0,005	0,004	0,072	0,069	0,060	Three Phase	N/A
Normal ambient (EN 61000-3-12) Output power (66±5)%								
Watts					**3,303**		**3,412**	**3,243**
Vrms					**230,52**		**230,44**	**230,55**
Arms					**14,331**		**14,809**	**14,068**
Frequency					**50,00**			
THD* (66% output power)					**1,205**		**1,058**	**1,072**
Harmonics	**Current Magnitude (A)**			**% of Nominal current**			**Phase**	**Harmonic Current Limits (%)**
1st	14,327	14,804	14,064	-	-	-	Three Phase	N/A
2nd	0,009	0,005	0,008	0,063	0,037	0,057	Three Phase	8
3rd	0,061	0,008	0,066	0,423	0,053	0,473	Three Phase	21,6
4th	0,010	0,007	0,006	0,068	0,050	0,039	Three Phase	4
5th	0,106	0,095	0,080	0,742	0,641	0,570	Three Phase	10,7
6th	0,004	0,004	0,003	0,027	0,029	0,019	Three Phase	2,67
7th	0,080	0,077	0,065	0,557	0,522	0,465	Three Phase	7,2
8th	0,006	0,004	0,005	0,043	0,030	0,035	Three Phase	2
9th	0,010	0,005	0,017	0,070	0,032	0,124	Three Phase	3,8
10th	0,004	0,003	0,002	0,027	0,023	0,017	Three Phase	1,6
11th	0,050	0,052	0,037	0,348	0,352	0,263	Three Phase	3,1
12th	0,002	0,003	0,003	0,016	0,017	0,019	Three Phase	1,33
13th	0,020	0,020	0,020	0,137	0,132	0,139	Three Phase	2
14th	0,003	0,002	0,003	0,022	0,017	0,024	Three Phase	N/A
15th	0,007	0,004	0,004	0,050	0,028	0,032	Three Phase	N/A
16th	0,005	0,005	0,005	0,032	0,031	0,032	Three Phase	N/A
17th	0,018	0,025	0,022	0,129	0,166	0,153	Three Phase	N/A
18th	0,002	0,003	0,002	0,016	0,017	0,017	Three Phase	N/A
19th	0,020	0,026	0,027	0,140	0,178	0,191	Three Phase	N/A
20th	0,002	0,002	0,002	0,017	0,015	0,017	Three Phase	N/A
21th	0,004	0,003	0,003	0,026	0,021	0,024	Three Phase	N/A
22th	0,005	0,003	0,004	0,032	0,023	0,030	Three Phase	N/A
23th	0,010	0,011	0,013	0,073	0,074	0,093	Three Phase	N/A
24th	0,003	0,003	0,003	0,018	0,018	0,022	Three Phase	N/A
25th	0,027	0,034	0,028	0,192	0,227	0,200	Three Phase	N/A
26th	0,003	0,004	0,002	0,023	0,025	0,016	Three Phase	N/A
27th	0,004	0,004	0,005	0,030	0,030	0,033	Three Phase	N/A
28th	0,003	0,003	0,003	0,020	0,022	0,018	Three Phase	N/A
29th	0,029	0,025	0,026	0,202	0,168	0,185	Three Phase	N/A
30th	0,002	0,002	0,002	0,014	0,014	0,015	Three Phase	N/A
31th	0,032	0,036	0,032	0,222	0,243	0,230	Three Phase	N/A
32th	0,003	0,003	0,002	0,020	0,021	0,018	Three Phase	N/A
33th	0,004	0,004	0,003	0,031	0,026	0,024	Three Phase	N/A
34th	0,002	0,002	0,002	0,016	0,016	0,015	Three Phase	N/A
35th	0,024	0,023	0,020	0,168	0,154	0,143	Three Phase	N/A
36th	0,002	0,002	0,002	0,014	0,015	0,015	Three Phase	N/A
37th	0,017	0,018	0,018	0,117	0,122	0,127	Three Phase	N/A

38th	0,002	0,002	0,002	0,014	0,014	0,014	Three Phase	N/A
39th	0,005	0,005	0,004	0,034	0,031	0,026	Three Phase	N/A
40th	0,002	0,002	0,002	0,013	0,013	0,013	Three Phase	N/A
41th	0,016	0,017	0,015	0,113	0,112	0,103	Three Phase	N/A
42th	0,003	0,003	0,003	0,019	0,020	0,019	Three Phase	N/A
43th	0,009	0,010	0,009	0,060	0,064	0,062	Three Phase	N/A
44th	0,002	0,002	0,002	0,014	0,013	0,014	Three Phase	N/A
45th	0,003	0,004	0,003	0,022	0,025	0,025	Three Phase	N/A
46th	0,005	0,005	0,004	0,035	0,034	0,031	Three Phase	N/A
47th	0,007	0,008	0,007	0,048	0,052	0,047	Three Phase	N/A
48th	0,003	0,003	0,003	0,021	0,020	0,019	Three Phase	N/A
49th	0,015	0,014	0,016	0,104	0,093	0,113	Three Phase	N/A
50th	0,005	0,005	0,004	0,035	0,035	0,030	Three Phase	N/A
Normal ambient (EN 61000-3-12) Output power (100±5)%								
Watts					**4,981**		**5,145**	**4,889**
Vrms					**230,80**		**230,74**	**230,76**
Arms					**21,590**		**22,307**	**21,196**
Frequency					**50,00**			
THD* (100% output power)					**1,957**		**1,896**	**1,851**
Harmonics	**Current Magnitude (A)**			**% of Nominal current**			**Phase**	**Harmonic Current Limits (%)**
1st	21,580	22,297	21,186	-	-	-	Three Phase	N/A
2nd	0,006	0,004	0,005	0,029	0,018	0,023	Three Phase	8
3rd	0,080	0,014	0,079	0,370	0,061	0,371	Three Phase	21,6
4th	0,006	0,006	0,004	0,028	0,026	0,019	Three Phase	4
5th	0,296	0,293	0,264	1,372	1,315	1,247	Three Phase	10,7
6th	0,005	0,005	0,003	0,023	0,021	0,015	Three Phase	2,67
7th	0,172	0,173	0,165	0,797	0,775	0,781	Three Phase	7,2
8th	0,003	0,003	0,003	0,014	0,014	0,015	Three Phase	2
9th	0,009	0,007	0,019	0,044	0,030	0,087	Three Phase	3,8
10th	0,004	0,004	0,003	0,018	0,020	0,014	Three Phase	1,6
11th	0,099	0,101	0,071	0,460	0,455	0,335	Three Phase	3,1
12th	0,003	0,004	0,003	0,012	0,016	0,014	Three Phase	1,33
13th	0,044	0,047	0,038	0,204	0,210	0,181	Three Phase	2
14th	0,004	0,005	0,004	0,018	0,020	0,018	Three Phase	N/A
15th	0,009	0,005	0,006	0,041	0,024	0,029	Three Phase	N/A
16th	0,004	0,003	0,003	0,018	0,014	0,016	Three Phase	N/A
17th	0,076	0,092	0,081	0,351	0,412	0,380	Three Phase	N/A
18th	0,003	0,004	0,003	0,014	0,019	0,016	Three Phase	N/A
19th	0,123	0,134	0,126	0,568	0,599	0,597	Three Phase	N/A
20th	0,003	0,003	0,003	0,013	0,014	0,016	Three Phase	N/A
21th	0,005	0,009	0,009	0,025	0,042	0,044	Three Phase	N/A
22th	0,004	0,003	0,003	0,018	0,014	0,016	Three Phase	N/A
23th	0,028	0,021	0,025	0,130	0,093	0,116	Three Phase	N/A
24th	0,004	0,003	0,004	0,018	0,015	0,018	Three Phase	N/A
25th	0,089	0,095	0,089	0,410	0,427	0,420	Three Phase	N/A
26th	0,004	0,003	0,004	0,019	0,013	0,018	Three Phase	N/A
27th	0,006	0,010	0,008	0,028	0,045	0,040	Three Phase	N/A
28th	0,003	0,004	0,004	0,014	0,016	0,018	Three Phase	N/A
29th	0,047	0,047	0,045	0,219	0,211	0,215	Three Phase	N/A
30th	0,003	0,003	0,003	0,015	0,015	0,014	Three Phase	N/A
31th	0,071	0,079	0,073	0,329	0,353	0,345	Three Phase	N/A
32th	0,004	0,003	0,003	0,018	0,014	0,016	Three Phase	N/A
33th	0,006	0,007	0,006	0,027	0,032	0,029	Three Phase	N/A

34th	0,003	0,003	0,003	0,015	0,013	0,016	Three Phase	N/A
35th	0,054	0,053	0,048	0,250	0,239	0,227	Three Phase	N/A
36th	0,003	0,003	0,003	0,016	0,013	0,014	Three Phase	N/A
37th	0,030	0,032	0,031	0,141	0,144	0,148	Three Phase	N/A
38th	0,003	0,003	0,003	0,014	0,012	0,013	Three Phase	N/A
39th	0,006	0,006	0,005	0,026	0,027	0,026	Three Phase	N/A
40th	0,003	0,003	0,003	0,013	0,012	0,013	Three Phase	N/A
41th	0,032	0,031	0,028	0,150	0,138	0,132	Three Phase	N/A
42th	0,004	0,003	0,003	0,017	0,015	0,016	Three Phase	N/A
43th	0,008	0,009	0,010	0,037	0,041	0,045	Three Phase	N/A
44th	0,003	0,003	0,003	0,014	0,011	0,012	Three Phase	N/A
45th	0,006	0,005	0,004	0,026	0,022	0,021	Three Phase	N/A
46th	0,005	0,005	0,005	0,025	0,024	0,021	Three Phase	N/A
47th	0,022	0,020	0,019	0,101	0,091	0,092	Three Phase	N/A
48th	0,003	0,003	0,003	0,016	0,015	0,014	Three Phase	N/A
49th	0,008	0,009	0,010	0,039	0,041	0,046	Three Phase	N/A
50th	0,005	0,005	0,004	0,025	0,024	0,021	Three Phase	N/A

Harmonics: SOFAR 24KTLX-G3								
Normal ambient (EN 61000-3-12) Output power (33±5)%								
Watts				2,653			2,743	2,608
Vrms				230,25			230,34	230,37
Arms				11,528			11,914	11,329
Frequency				50,00				
THD* (33% output power)				1,621			1,335	1,374
Harmonics	Current Magnitude (A)			% of Nominal current			Phase	Harmonic Current Limits (%)
1st	11,521	11,907	11,322	-	-	-	Three Phase	N/A
2nd	0,014	0,010	0,011	0,123	0,086	0,098	Three Phase	8
3rd	0,074	0,012	0,086	0,645	0,104	0,759	Three Phase	21,6
4th	0,015	0,013	0,008	0,134	0,105	0,069	Three Phase	4
5th	0,116	0,101	0,076	1,005	0,847	0,671	Three Phase	10,7
6th	0,008	0,007	0,004	0,067	0,057	0,036	Three Phase	2,67
7th	0,082	0,080	0,057	0,716	0,675	0,505	Three Phase	7,2
8th	0,005	0,004	0,004	0,045	0,031	0,035	Three Phase	2
9th	0,016	0,007	0,024	0,136	0,055	0,209	Three Phase	3,8
10th	0,004	0,004	0,004	0,034	0,030	0,032	Three Phase	1,6
11th	0,043	0,040	0,034	0,377	0,338	0,303	Three Phase	3,1
12th	0,004	0,003	0,004	0,033	0,027	0,038	Three Phase	1,33
13th	0,026	0,024	0,021	0,222	0,201	0,184	Three Phase	2
14th	0,004	0,003	0,004	0,034	0,025	0,032	Three Phase	N/A
15th	0,008	0,005	0,005	0,067	0,044	0,042	Three Phase	N/A
16th	0,003	0,003	0,004	0,028	0,024	0,033	Three Phase	N/A
17th	0,017	0,018	0,015	0,151	0,154	0,133	Three Phase	N/A
18th	0,003	0,003	0,003	0,024	0,023	0,026	Three Phase	N/A
19th	0,011	0,007	0,006	0,092	0,062	0,053	Three Phase	N/A
20th	0,003	0,003	0,003	0,024	0,023	0,027	Three Phase	N/A
21th	0,009	0,005	0,004	0,077	0,039	0,037	Three Phase	N/A
22th	0,003	0,002	0,003	0,022	0,020	0,023	Three Phase	N/A
23th	0,025	0,024	0,023	0,218	0,200	0,205	Three Phase	N/A
24th	0,003	0,002	0,004	0,028	0,021	0,032	Three Phase	N/A
25th	0,011	0,014	0,010	0,092	0,117	0,090	Three Phase	N/A
26th	0,003	0,002	0,003	0,022	0,019	0,024	Three Phase	N/A
27th	0,005	0,004	0,006	0,043	0,032	0,050	Three Phase	N/A
28th	0,002	0,003	0,003	0,019	0,024	0,023	Three Phase	N/A
29th	0,020	0,018	0,017	0,174	0,152	0,152	Three Phase	N/A
30th	0,002	0,003	0,002	0,019	0,021	0,022	Three Phase	N/A
31th	0,023	0,028	0,026	0,198	0,236	0,227	Three Phase	N/A
32th	0,003	0,003	0,003	0,028	0,022	0,025	Three Phase	N/A
33th	0,006	0,005	0,005	0,049	0,039	0,046	Three Phase	N/A
34th	0,003	0,003	0,003	0,023	0,023	0,024	Three Phase	N/A
35th	0,025	0,024	0,023	0,221	0,199	0,205	Three Phase	N/A
36th	0,002	0,002	0,002	0,020	0,020	0,021	Three Phase	N/A
37th	0,025	0,029	0,027	0,219	0,239	0,238	Three Phase	N/A
38th	0,003	0,003	0,003	0,024	0,022	0,026	Three Phase	N/A
39th	0,006	0,006	0,005	0,049	0,047	0,045	Three Phase	N/A
40th	0,002	0,002	0,002	0,021	0,020	0,021	Three Phase	N/A
41th	0,026	0,026	0,024	0,228	0,215	0,211	Three Phase	N/A
42th	0,004	0,004	0,004	0,035	0,034	0,032	Three Phase	N/A
43th	0,019	0,020	0,019	0,163	0,172	0,166	Three Phase	N/A

44th	0,003	0,003	0,003	0,024	0,024	0,027	Three Phase	N/A
45th	0,005	0,004	0,007	0,045	0,032	0,058	Three Phase	N/A
46th	0,008	0,008	0,007	0,070	0,068	0,060	Three Phase	N/A
47th	0,022	0,021	0,022	0,190	0,175	0,193	Three Phase	N/A
48th	0,005	0,004	0,005	0,043	0,038	0,043	Three Phase	N/A
49th	0,019	0,019	0,020	0,166	0,160	0,175	Three Phase	N/A
50th	0,008	0,008	0,007	0,071	0,068	0,061	Three Phase	N/A
Normal ambient (EN 61000-3-12) Output power (66±5)%								
Watts					**5,285**		**5,460**	**5,191**
Vrms					**230,49**		**230,56**	**230,62**
Arms					**22,935**		**23,688**	**22,513**
Frequency					**50,00**			
THD* (66% output power)					**1,194**		**1,056**	**1,067**
Harmonics	**Current Magnitude (A)**			**% of Nominal current**			**Phase**	**Harmonic Current Limits (%)**
1st	22,927	23,681	22,506	-	-	-	Three Phase	N/A
2nd	0,013	0,009	0,012	0,055	0,036	0,053	Three Phase	8
3rd	0,095	0,013	0,105	0,415	0,056	0,468	Three Phase	21,6
4th	0,014	0,010	0,008	0,059	0,044	0,037	Three Phase	4
5th	0,168	0,151	0,127	0,734	0,637	0,566	Three Phase	10,7
6th	0,006	0,007	0,004	0,028	0,029	0,018	Three Phase	2,67
7th	0,127	0,125	0,104	0,556	0,526	0,461	Three Phase	7,2
8th	0,009	0,007	0,008	0,040	0,028	0,034	Three Phase	2
9th	0,015	0,008	0,028	0,064	0,034	0,122	Three Phase	3,8
10th	0,006	0,005	0,004	0,026	0,021	0,019	Three Phase	1,6
11th	0,079	0,083	0,060	0,345	0,350	0,265	Three Phase	3,1
12th	0,004	0,004	0,004	0,017	0,017	0,020	Three Phase	1,33
13th	0,032	0,032	0,032	0,141	0,135	0,142	Three Phase	2
14th	0,005	0,004	0,005	0,022	0,018	0,022	Three Phase	N/A
15th	0,012	0,007	0,007	0,050	0,029	0,032	Three Phase	N/A
16th	0,007	0,007	0,007	0,032	0,029	0,032	Three Phase	N/A
17th	0,031	0,039	0,033	0,134	0,164	0,149	Three Phase	N/A
18th	0,004	0,004	0,004	0,016	0,017	0,017	Three Phase	N/A
19th	0,032	0,042	0,043	0,142	0,177	0,190	Three Phase	N/A
20th	0,004	0,003	0,004	0,016	0,015	0,016	Three Phase	N/A
21th	0,006	0,005	0,005	0,028	0,021	0,024	Three Phase	N/A
22th	0,007	0,005	0,006	0,030	0,023	0,028	Three Phase	N/A
23th	0,016	0,018	0,021	0,071	0,075	0,095	Three Phase	N/A
24th	0,004	0,004	0,005	0,017	0,017	0,021	Three Phase	N/A
25th	0,044	0,053	0,046	0,190	0,225	0,203	Three Phase	N/A
26th	0,005	0,006	0,004	0,021	0,024	0,017	Three Phase	N/A
27th	0,007	0,007	0,008	0,030	0,030	0,035	Three Phase	N/A
28th	0,004	0,005	0,004	0,019	0,021	0,019	Three Phase	N/A
29th	0,046	0,040	0,042	0,199	0,170	0,185	Three Phase	N/A
30th	0,003	0,003	0,003	0,014	0,015	0,015	Three Phase	N/A
31th	0,051	0,058	0,052	0,221	0,243	0,231	Three Phase	N/A
32th	0,004	0,005	0,004	0,019	0,020	0,018	Three Phase	N/A
33th	0,007	0,006	0,006	0,029	0,027	0,025	Three Phase	N/A
34th	0,004	0,004	0,004	0,016	0,016	0,016	Three Phase	N/A
35th	0,038	0,036	0,032	0,165	0,153	0,143	Three Phase	N/A
36th	0,003	0,003	0,003	0,014	0,015	0,015	Three Phase	N/A
37th	0,027	0,029	0,029	0,117	0,123	0,127	Three Phase	N/A
38th	0,005	0,005	0,003	0,024	0,020	0,015	Three Phase	N/A
39th	0,007	0,007	0,006	0,032	0,029	0,025	Three Phase	N/A

40th	0,003	0,003	0,003	0,013	0,013	0,013	Three Phase	N/A
41th	0,026	0,026	0,023	0,114	0,112	0,103	Three Phase	N/A
42th	0,004	0,005	0,004	0,019	0,020	0,019	Three Phase	N/A
43th	0,014	0,015	0,014	0,061	0,063	0,063	Three Phase	N/A
44th	0,005	0,003	0,004	0,023	0,015	0,019	Three Phase	N/A
45th	0,005	0,006	0,005	0,021	0,025	0,023	Three Phase	N/A
46th	0,008	0,008	0,007	0,037	0,035	0,032	Three Phase	N/A
47th	0,011	0,013	0,010	0,049	0,053	0,046	Three Phase	N/A
48th	0,005	0,005	0,005	0,023	0,021	0,021	Three Phase	N/A
49th	0,023	0,022	0,025	0,102	0,092	0,111	Three Phase	N/A
50th	0,008	0,009	0,007	0,037	0,036	0,031	Three Phase	N/A
Normal ambient (EN 61000-3-12) Output power (100±5)%								
Watts					**7,975**		**8,234**	**7,829**
Vrms					**230,79**		**230,80**	**230,82**
Arms					**34,569**		**35,691**	**33,931**
Frequency					**50,00**			
THD* (100% output power)					**1,941**		**1,896**	**1,849**
Harmonics	**Current Magnitude (A)**			**% of Nominal current**			**Phase**	**Harmonic Current Limits (%)**
1st	34,553	35,675	33,915	-	-	-	Three Phase	N/A
2nd	0,009	0,006	0,007	0,026	0,017	0,020	Three Phase	8
3rd	0,120	0,022	0,125	0,348	0,061	0,368	Three Phase	21,6
4th	0,008	0,007	0,005	0,022	0,021	0,014	Three Phase	4
5th	0,470	0,468	0,422	1,362	1,310	1,246	Three Phase	10,7
6th	0,007	0,007	0,005	0,021	0,020	0,016	Three Phase	2,67
7th	0,276	0,281	0,264	0,798	0,788	0,777	Three Phase	7,2
8th	0,004	0,005	0,005	0,012	0,014	0,014	Three Phase	2
9th	0,012	0,012	0,027	0,034	0,033	0,081	Three Phase	3,8
10th	0,007	0,007	0,005	0,020	0,020	0,015	Three Phase	1,6
11th	0,156	0,161	0,116	0,450	0,451	0,343	Three Phase	3,1
12th	0,004	0,006	0,005	0,012	0,017	0,015	Three Phase	1,33
13th	0,069	0,075	0,061	0,198	0,211	0,180	Three Phase	2
14th	0,006	0,008	0,007	0,018	0,023	0,021	Three Phase	N/A
15th	0,014	0,008	0,009	0,040	0,024	0,026	Three Phase	N/A
16th	0,006	0,005	0,006	0,017	0,014	0,016	Three Phase	N/A
17th	0,125	0,149	0,128	0,362	0,418	0,377	Three Phase	N/A
18th	0,005	0,007	0,005	0,013	0,019	0,016	Three Phase	N/A
19th	0,196	0,214	0,205	0,567	0,600	0,603	Three Phase	N/A
20th	0,005	0,005	0,006	0,013	0,014	0,017	Three Phase	N/A
21th	0,009	0,014	0,015	0,026	0,040	0,044	Three Phase	N/A
22th	0,006	0,005	0,005	0,017	0,014	0,016	Three Phase	N/A
23th	0,044	0,029	0,040	0,127	0,082	0,117	Three Phase	N/A
24th	0,006	0,006	0,006	0,017	0,017	0,019	Three Phase	N/A
25th	0,140	0,151	0,142	0,406	0,423	0,420	Three Phase	N/A
26th	0,007	0,005	0,007	0,019	0,013	0,019	Three Phase	N/A
27th	0,010	0,015	0,014	0,029	0,043	0,040	Three Phase	N/A
28th	0,005	0,006	0,006	0,015	0,016	0,018	Three Phase	N/A
29th	0,074	0,074	0,073	0,215	0,207	0,215	Three Phase	N/A
30th	0,005	0,006	0,005	0,015	0,016	0,014	Three Phase	N/A
31th	0,113	0,125	0,117	0,327	0,350	0,344	Three Phase	N/A
32th	0,006	0,005	0,006	0,018	0,014	0,017	Three Phase	N/A
33th	0,010	0,012	0,010	0,029	0,034	0,031	Three Phase	N/A
34th	0,005	0,005	0,006	0,016	0,014	0,016	Three Phase	N/A
35th	0,085	0,084	0,075	0,245	0,235	0,222	Three Phase	N/A

36th	0,006	0,005	0,005	0,016	0,014	0,015	Three Phase	N/A
37th	0,049	0,051	0,049	0,141	0,144	0,145	Three Phase	N/A
38th	0,005	0,005	0,005	0,016	0,013	0,014	Three Phase	N/A
39th	0,010	0,011	0,010	0,028	0,031	0,029	Three Phase	N/A
40th	0,005	0,005	0,005	0,014	0,013	0,014	Three Phase	N/A
41th	0,051	0,048	0,044	0,147	0,135	0,129	Three Phase	N/A
42th	0,006	0,006	0,006	0,017	0,016	0,019	Three Phase	N/A
43th	0,013	0,014	0,015	0,039	0,040	0,043	Three Phase	N/A
44th	0,006	0,004	0,005	0,016	0,013	0,015	Three Phase	N/A
45th	0,010	0,008	0,008	0,030	0,024	0,024	Three Phase	N/A
46th	0,009	0,009	0,007	0,025	0,024	0,022	Three Phase	N/A
47th	0,034	0,032	0,030	0,098	0,090	0,088	Three Phase	N/A
48th	0,006	0,006	0,005	0,017	0,016	0,015	Three Phase	N/A
49th	0,013	0,015	0,016	0,038	0,042	0,047	Three Phase	N/A
50th	0,009	0,009	0,007	0,025	0,024	0,022	Three Phase	N/A

Note:
The tests should be based on the limits of the EN61000-3-2 for less than 16A and on EN 61000-3-12 for more than 16A.

The tests had been performed on the SOFAR 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

The test results refer to the report PVIT200511N080 issued by Bureau Veritas Shenzhen Co.,Ltd.Dongguan Branch on 2020-12-03.

5.8 Grid quality				**P**
Flicker				**P**
Normal ambient：SOFAR 15KTLX-G3				
Output power:	Flicker limits according to:	Result:		
		Plt	Pst	dc%
33%	EN 61000-3-11	0,136	0,137	0,114
66%	EN 61000-3-11	0,138	0,139	0,138
100%*	EN 61000-3-11	0,148	0,154	0,127
Normal ambient：SOFAR 24KTLX-G3				
Output power:	Flicker limits according to:	Result:		
		Plt	Pst	dc%
33%	EN 61000-3-11	0,140	0,142	0,115
66%	EN 61000-3-11	0,137	0,139	0,114
100%*	EN 61000-3-11	0,135	0,135	0,127

Note:

*The stationary deviance of dc% is bigger than the dynamic deviance of d_{max} at starting and stopping,
Mains Impedance according EN61000-3-11: **R_{max} =0,24Ω; jX_{max}=0,15Ω @50Hz (|Z_{max}| =0,625Ω)**

Bei Einphasigen Invertern Zmax sowie Rn und jxn angeben **R_n = 0,1Ω; jX_n=0,1Ω**

Calculation of the maximum permissible grid impedance at the point of common coupling based on d_c:
$Z_{max} = Z_{ref} * 3,3\% / d_c(P_n)$

The tests should be based on the limits of the EN61000-3-3 for less than 16A and on EN 61000-3-11 for more than 16A.

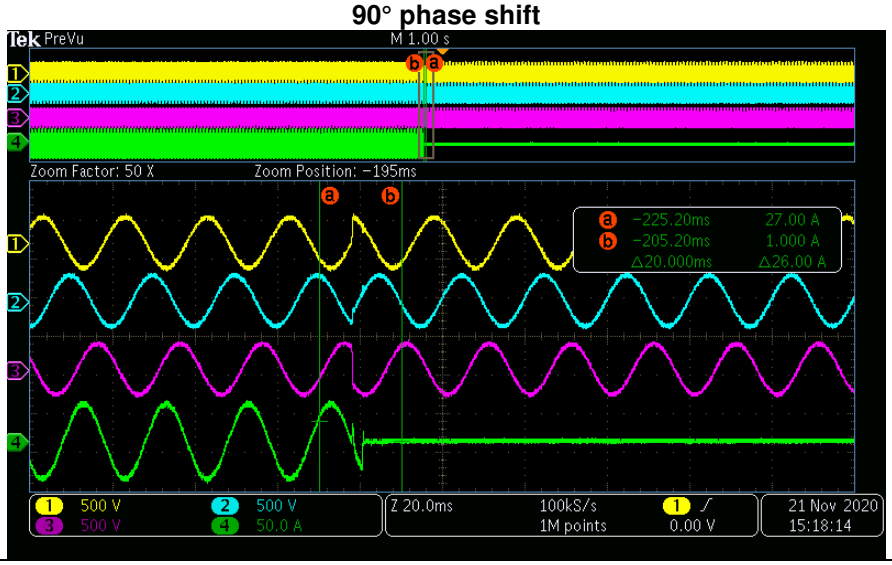
The tests had been performed on the SOFAR 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

The test results refer to the report PVIT200511N080 issued by Bureau Veritas Shenzhen Co.,Ltd.Dongguan Branch on 2020-12-03.

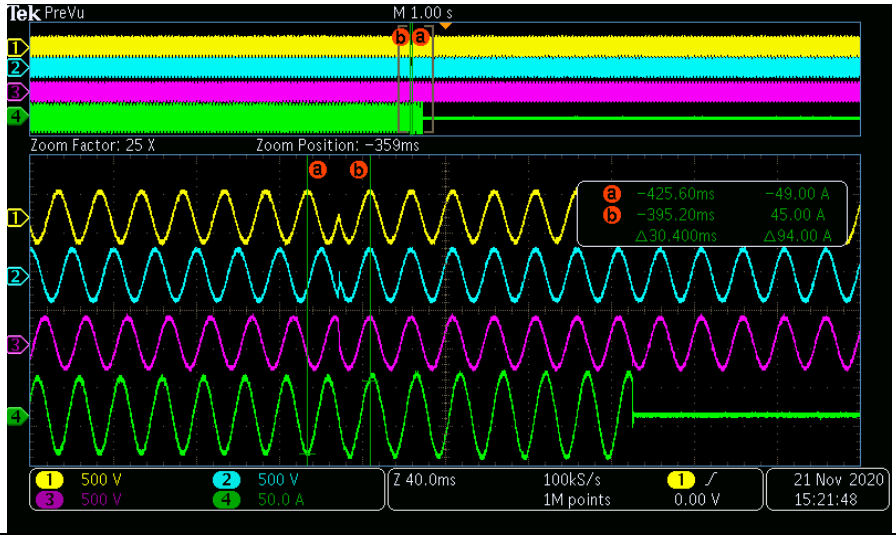
5.9 Out of Synchronism	P

Test results

90° phase shift



180° phase shift



Note:

The simulator must be capable of producing a 90º and 180° phase shift in its output voltage.
The inverter must be operating at nominal power and unity power factor for at least 5 minutes.
Once the inverter is in steady state operation, following the above step, a transient is induced to produce a 180° phase shift in the simulator voltage Vr, The process is repeated for a 90º phase shift.
The test report shall state the phase shift to a tolerance of 1° and the inverter current for the period from 20 ms before to 200 ms after the phase shift was induced.
The tests had been performed on the SOFAR 24KTLX-G3 and SOFAR 15KTLX-G3 are valid for the SOFAR 17KTLX-G3, SOFAR 20KTLX-G3 and SOFAR 22KTLX-G3 since it is same as in hardware and just power derated by software.

The test results refer to the report PVIT200511N080 issued by Bureau Veritas Shenzhen Co.,Ltd.Dongguan Branch on 2020-12-03.

Annex 1

Pictures of the unit

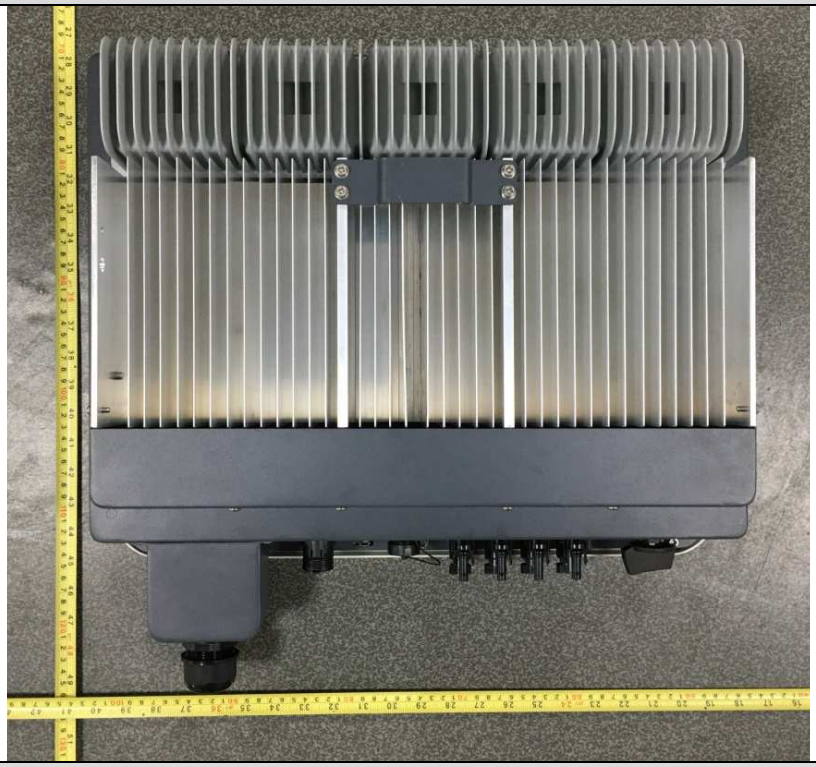
Enclosure front view

Enclosure side view

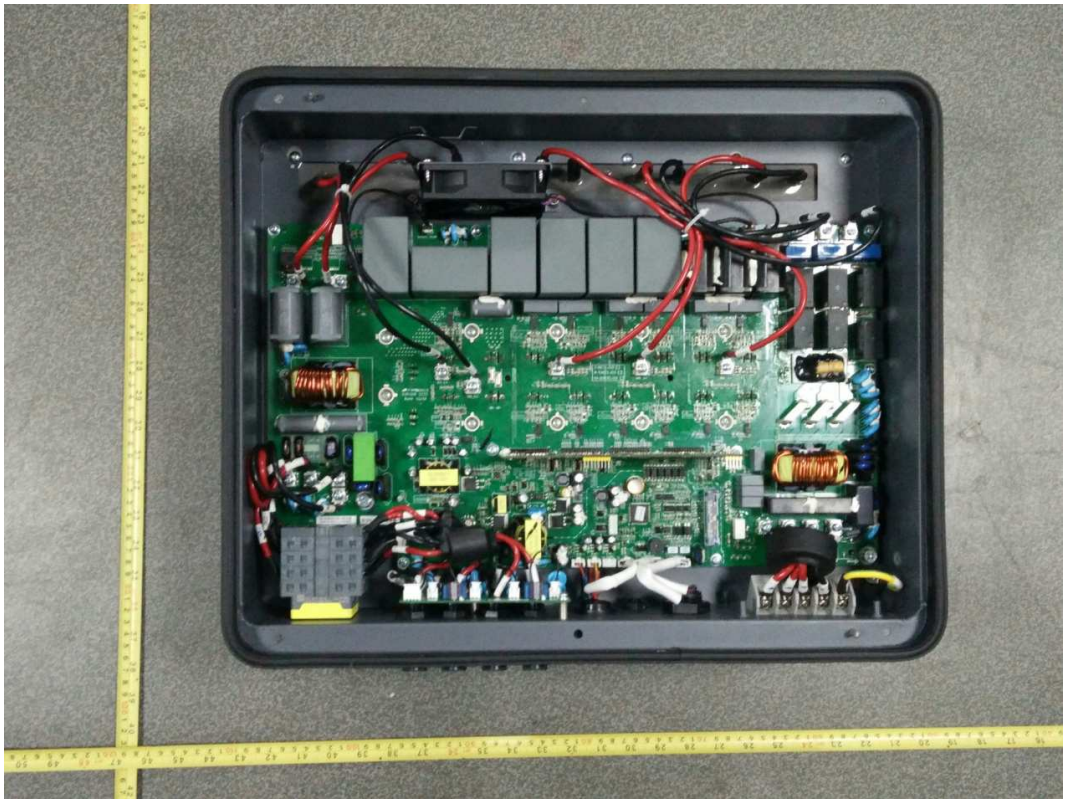
Enclosure bottom view
SOFAR 15KTLX-G3, SOFAR 17KTLX-G3

Enclosure bottom view
SOFAR 20KTLX-G3, SOFAR 22KTLX-G3, SOFAR 24KTLX-G3

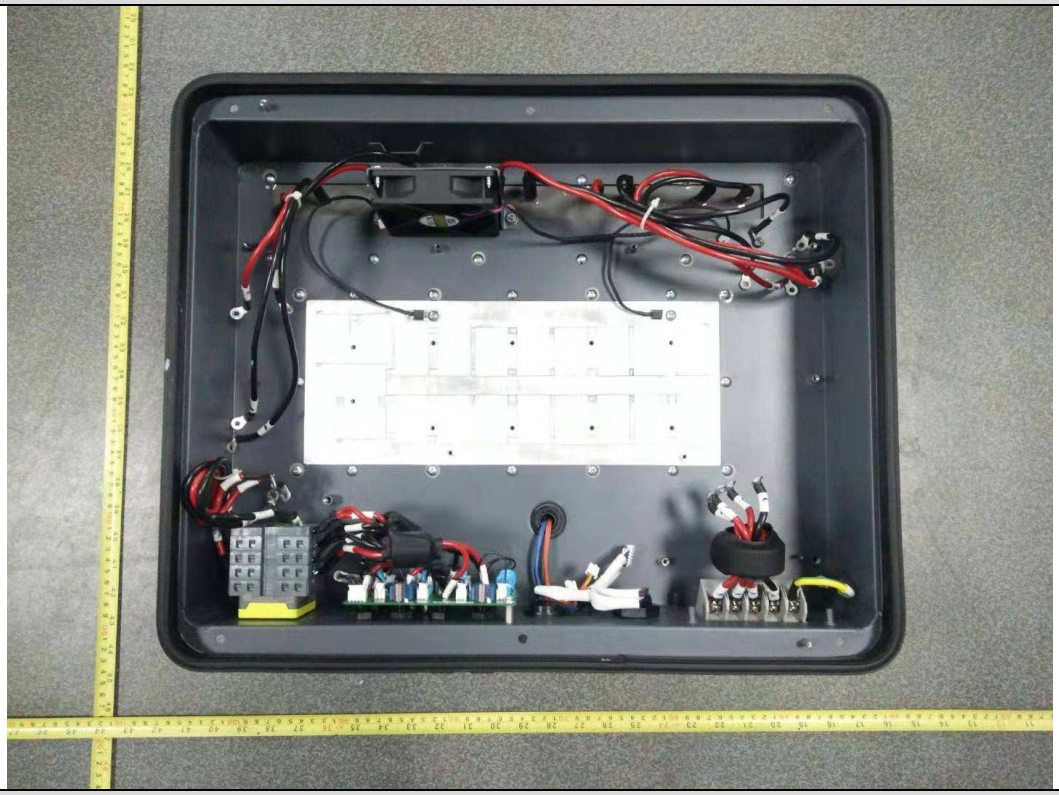
Enclosure rear view



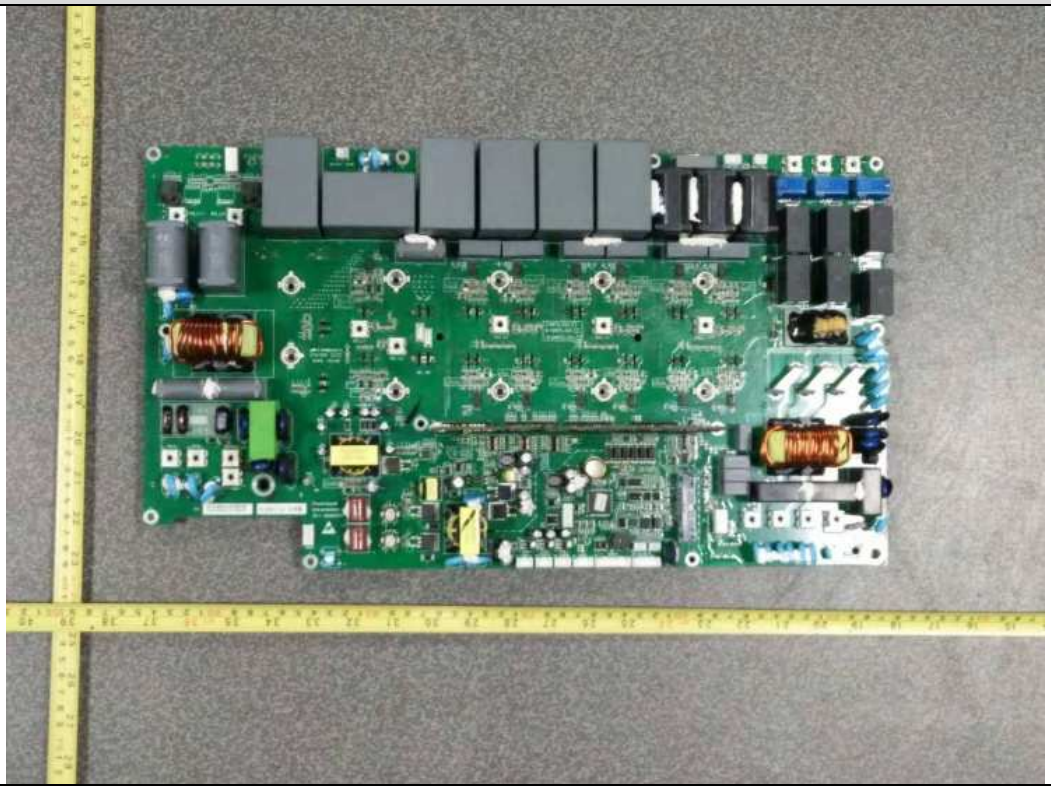
Internal view



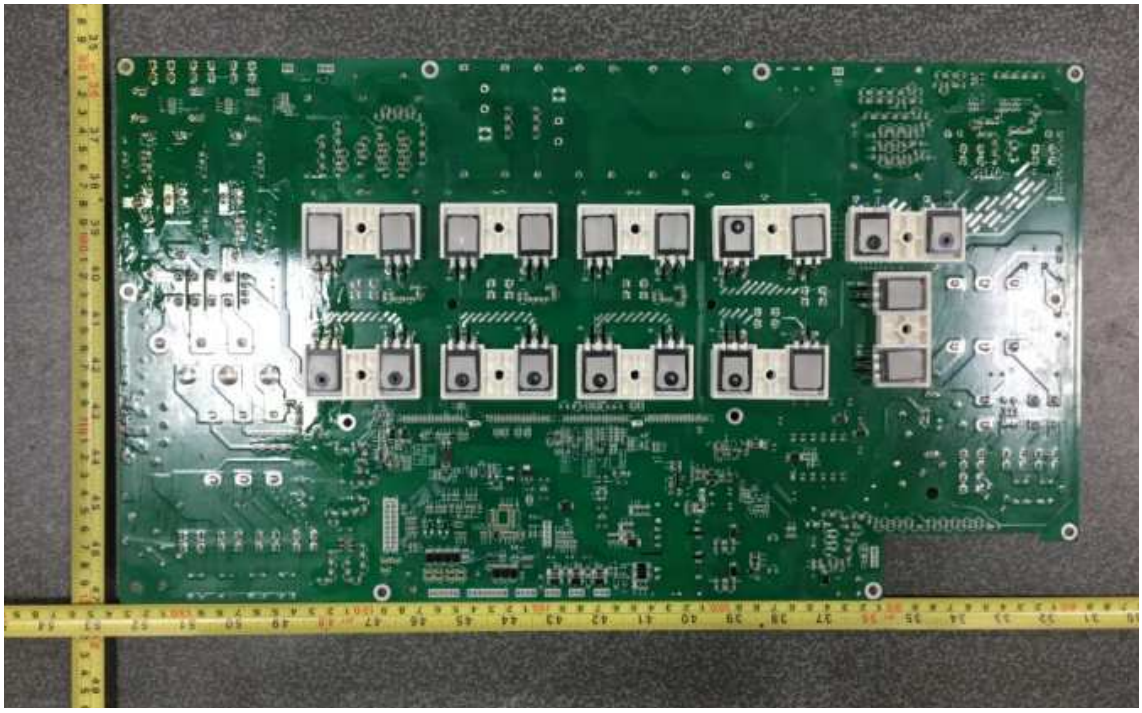
Internal view



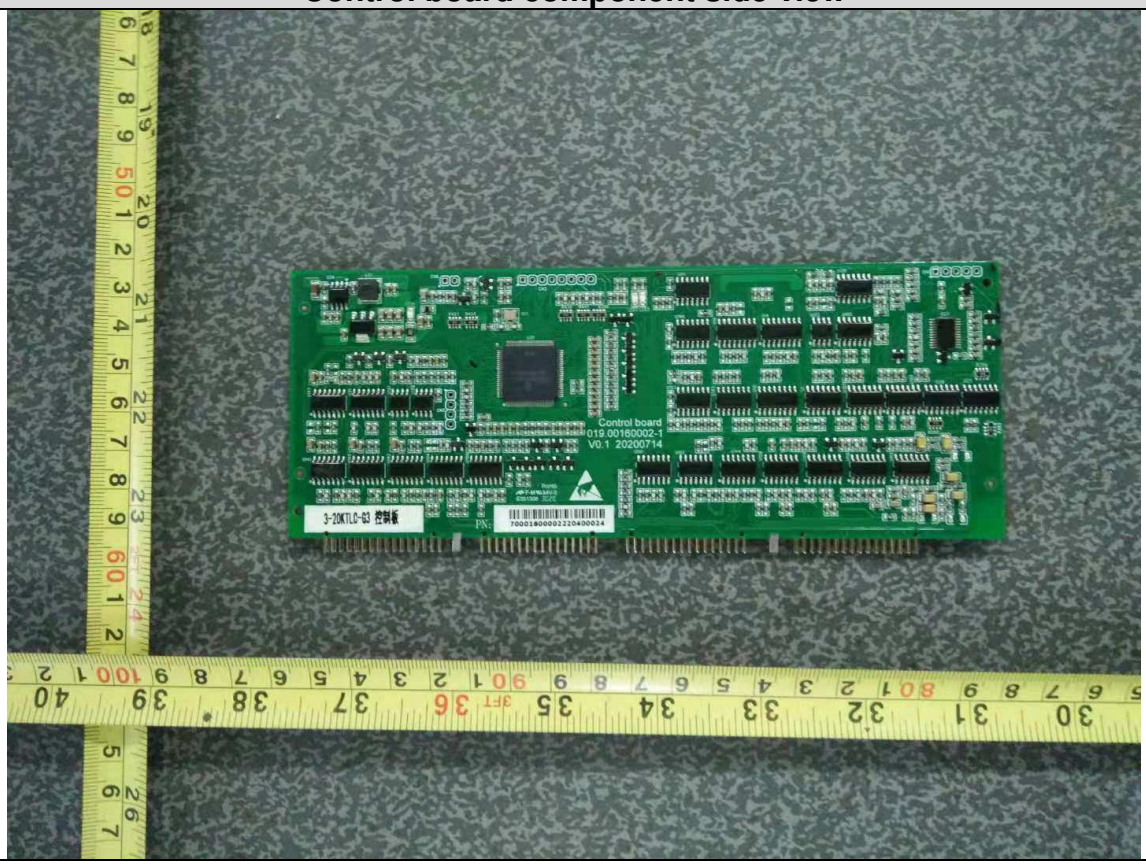
Power board component side view



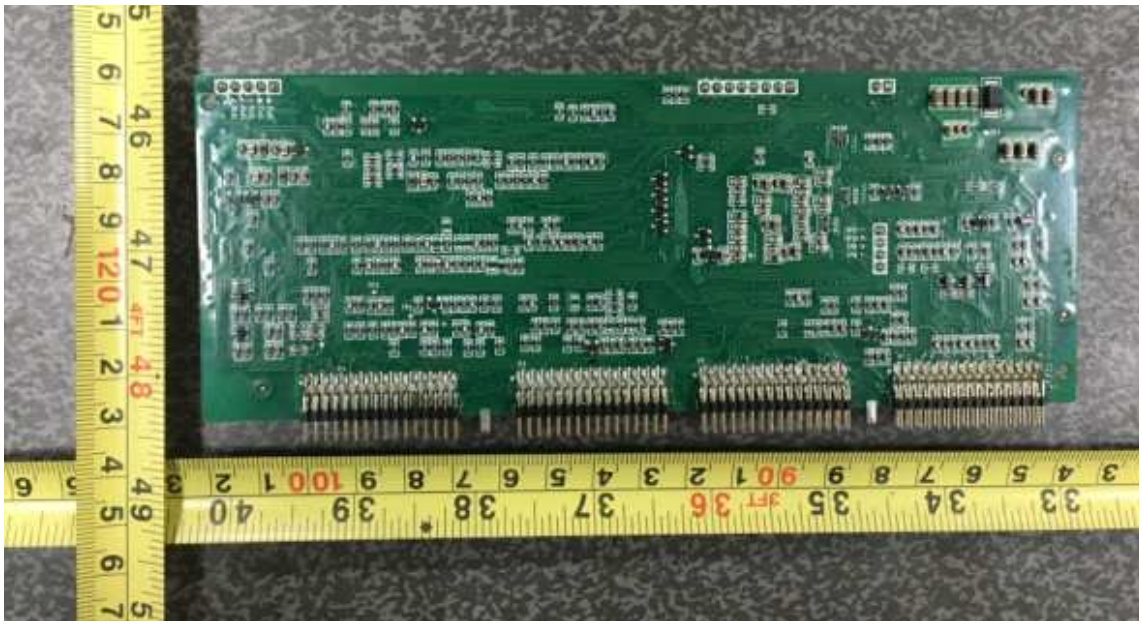
Power board solder side view



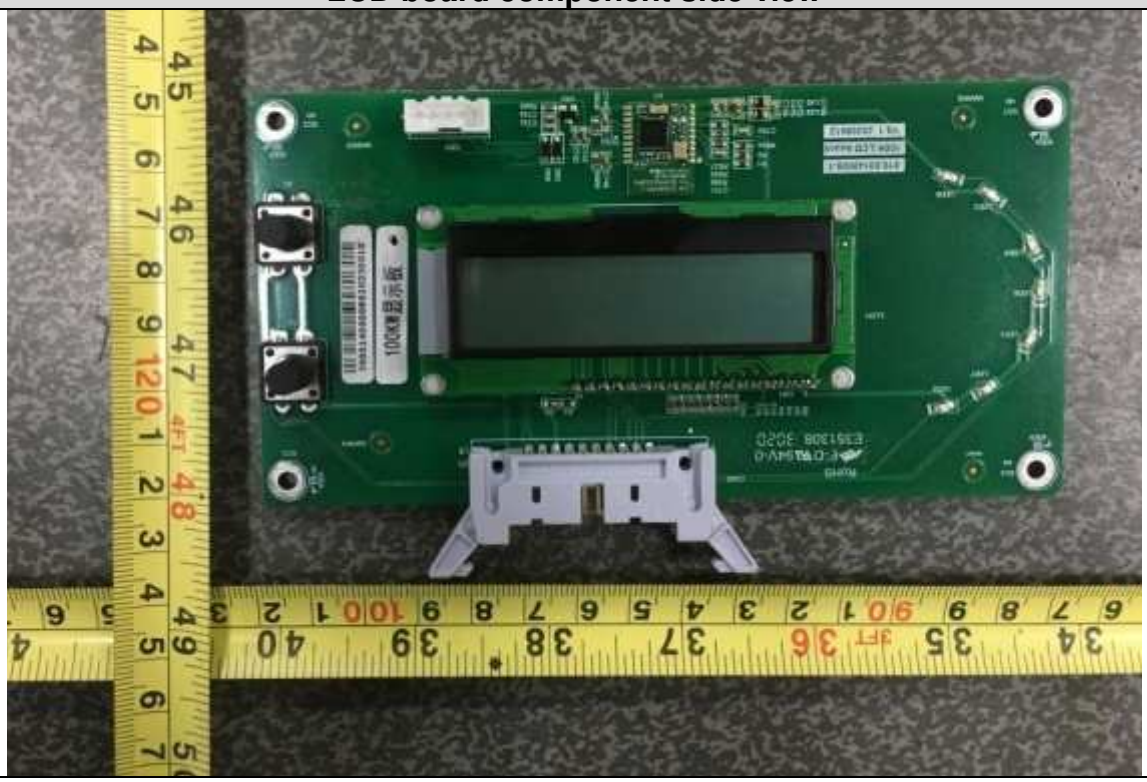
Control board component side view



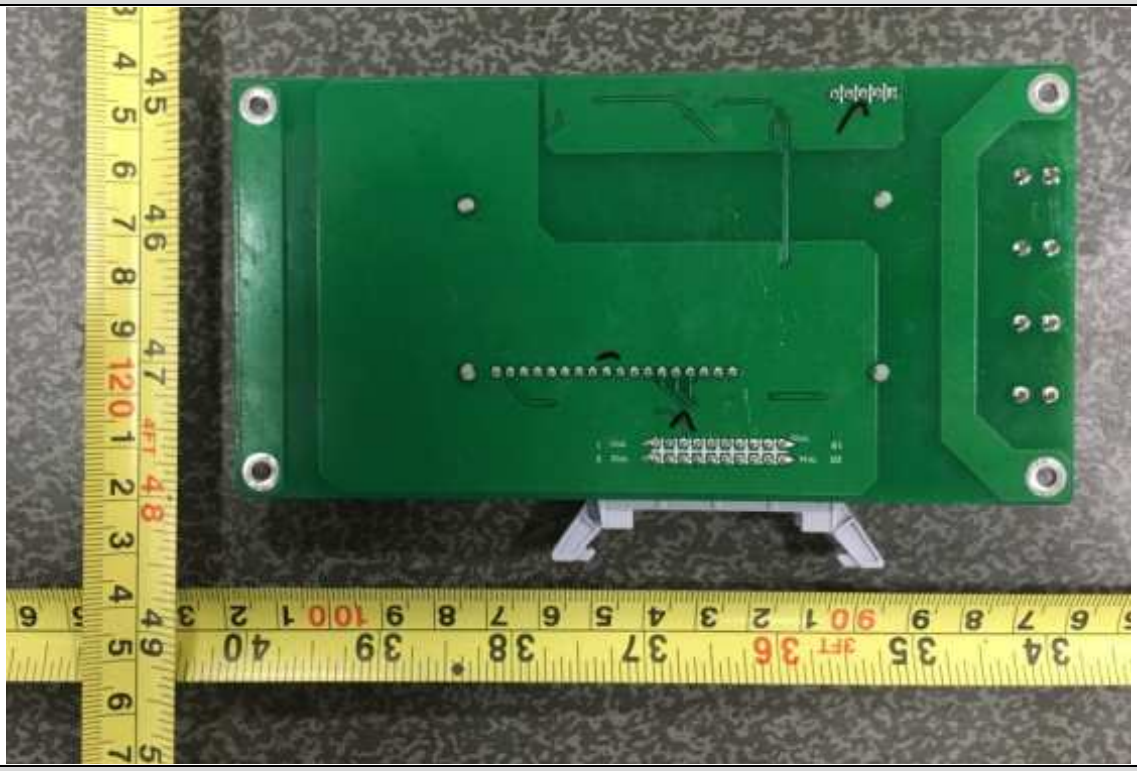
Control board solder side view



LCD board component side view



LCD board solder side view



General view of Grouding point

Annex 2

Test equipment list

Dates of performance test: 2020-11-20 to 2021-03-10

Equipment	Internal No.	Manufacturer	Type	Serial No.	Next Calibration date
Power Analyser	A4080002DG	YOKOGAWA	WT3000	91M210852	Jun. 16, 2021
AC Source	A7040019DG	Chroma	61512	61512000439	Monitored by Power Analyser
	A7040020DG	Chroma	61512	61512000438	
DC Simulation Power Supply	A7040015DG	Chroma	62150H-1000S	62150EF00488	
	A7040016DG	Chroma	62150H-1000S	62150EF00490	
	A7040017DG	Chroma	620028	620028EF00120	
RLC Load	A7150027DG	Qunling	ACLT-3803H	93VOO2869	
Eight Channel Digital Phosphor Oscilloscope	A4089017DG	YOKOGAWA	DL850	91N726247	Sep. 23, 2021
Oscilloscope probe	A4089008DG	Tektronix	TPP1000	C008230	Aug. 10, 2021
	A4089010DG	Tektronix	TPP1000	C008228	Aug. 10, 2021
	A4089011DG	Tektronix	TPP1000	C008229	Aug. 10, 2021
Current transducer	A1060007DG	YOKOGAWA	CT200	1130700012	Sep. 02, 2021
	A1060008DG	YOKOGAWA	CT200	1130700017	Sep. 02, 2021
	A1060012DG	YOKOGAWA	CT200	1130700018	Sep. 02, 2021
Oscilloscope	//	Agilent	DS05014A	MY50070266	Jan. 05, 2022
Oscilloscope current probe	//	FLUKE	i1000S	29503223	Jan. 05, 2022
	//	FLUKE	iL000S	30413448	Jan. 05, 2022
	//	CYBERTEK	CP1000A	C181000929	Jan. 05, 2022
	//	CYBERTEK	CP1000A	C181000922	Jan. 05, 2022
	//	CYBERTEK	CP1000A	C191000141	Jan. 05, 2022
Oscilloscope voltage probe	//	SANHUA	SI-9110	152655	Jan. 05, 2022
	//	SANHUA	SI-9110	111134	Jan. 05, 2022
	//	SANHUA	SI-9110	111539	Jan. 05, 2022
	//	SIGLENT	DPB5150A	D15A150052	Jan. 05, 2022
	//	SIGLENT	DPB5150A	D15A200317	Jan. 05, 2022
	//	SIGLENT	DPB5150A	D15A200314	Jan. 05, 2022
	//	SIGLENT	DPB5150A	D15A150047	Jan. 05, 2022