TEST REPORT

EN 50438

Requirements for the connection of micro-generators in parallel with public low-voltage distribution networks

Report reference number ..... :	**PV140609N058-2**
Date of issue ..... ::	2014-09-24
Total number of pages ..... ::	127
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 ..... :	3A-1, Huake Building, East Technology Park, Qiaoxiang Road, Nanshan District, Shenzhen, China.
Test specification	
Standard ..... :	EN 50438:2007 DIN EN 50438:2008 with deviations according the national network and system protection for Poland DIN V VDE V 0126-1-1:2006-02
Certificate ..... :	**Certificate of compliance**
Test report form number. ..... :	EN50438
Master TRF ..... :	Bureau Veritas Consumer Products Services Germany GmbH
Test item description ..... :	**Grid connected photovoltaic inverter**
Trademark ..... :	
Model / Type ..... :	SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM, SOFAR 4600TLM, SOFAR 5000TLM

ACCREDITED
Certificate # 2951.01

Ratings .....:	SOFAR 3000TLM	SOFAR 3680TLM	SOFAR 4000TLM	SOFAR 4600TLM	SOFAR 5000TLM
MPP DC voltage range [V].....:	160-500	165-500			175-500
Input DC voltage range [V].....:	100-550, max. 600				
Input DC current [A] .....:	10/10	12/12	13/13	15/15	
Output AC voltage [V] .....:	230, 50Hz				
Output AC current [A].....:	13	16	17,5	20	22
Output power [VA].....:	3000	3680	4000	4600	5000

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) ..... :	James Huang 
Approved by (name and signature) ..... :	Ted Wu 
Manufacturer's name ..... :	**Shenzhen SOFARSOLAR Co., Ltd.**
Factory address ..... :	No. 8, Fulong road, Qingxi town, Dongguan city, Guangdong, China.

Document History			
Date	**Internal reference**	**Modification / Change / Status**	**Revision**
2014-09-24	James Huang	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] ..... :	SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM: 18kg SOFAR 4600TLM, SOFAR 5000TLM: 19kg

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 ..... :	2014-06-09
Date(s) of performance test ..... :	2014-06-09 to 2014-09-18

General remarks:

The test result presented in this report relate only to the object(s) tested.
This report must 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 – EMC Test Report
3. Annex No. 2 – Pictures of the units
4. Annex No. 3 – Test equipment list

Copy of marking plate:

SOFAR SOLAR

PV Grid Inverter
光伏并网逆变器

Model No.(产品型号):	SOFAR 3000TLM
Vmax. DC input voltage(最大直流输入电压):	600V
DC input voltage range(输入直流电压范围):	100-550V
Imax. DC input current(最大直流输入电流):	2x10A
Isc(max.) DC current(最大直流短路电流):	2x12A
Nominal grid voltage(额定电网电压):	230V~
Nominal AC output current(额定输出电流):	13A
Nominal grid frequency(额定电网频率):	50Hz
Nominal output power(额定输出功率):	3000VA
Power factor(功率因数):	1(adjustable+/-0.8)
Ingress protection(保护等级):	IP65
Operating temperature range(工作温度):	-25-+60°C
Protective class(保护类别):	Class I

Made in China(中国制造)

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.
制造商：深圳市首航新能源有限公司

VDE0126-1-1,VDE-AR-N 4105,G83/2,EN50438,C10/11,
AS4777,RD1699,UTE C15-712-1

SOFAR SOLAR

PV Grid Inverter
光伏并网逆变器

Model No.(产品型号):	SOFAR 3680TLM
Vmax. DC input voltage(最大直流输入电压):	600V
DC input voltage range(输入直流电压范围):	100-550V
Imax. DC input current(最大直流输入电流):	2x12A
Isc(max.) DC current(最大直流短路电流):	2x14A
Nominal grid voltage(额定电网电压):	230V~
Nominal AC output current(额定输出电流):	16A
Nominal grid frequency(额定电网频率):	50Hz
Nominal output power(额定输出功率):	3680VA
Power factor(功率因数):	1(adjustable+/-0.8)
Ingress protection(保护等级):	IP65
Operating temperature range(工作温度):	-25-+60°C
Protective class(保护类别):	Class I

Made in China(中国制造)

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.
制造商：深圳市首航新能源有限公司

VDE0126-1-1,VDE-AR-N 4105,G83/2,EN50438,C10/11,
AS4777,RD1699,UTE C15-712-1

SOFAR SOLAR

PV Grid Inverter
光伏并网逆变器

Model No.(产品型号):	SOFAR 4000TLM
Vmax. DC input voltage(最大直流输入电压):	600V
DC input voltage range(输入直流电压范围):	100-550V
Imax. DC input current(最大直流输入电流):	2x13A
Isc(max.) DC current(最大直流短路电流):	2x16A
Nominal grid voltage(额定电网电压):	230V~
Nominal AC output current(额定输出电流):	17.5A
Nominal grid frequency(额定电网频率):	50Hz
Nominal output power(额定输出功率):	4000VA
Power factor(功率因数):	1(adjustable+/-0.8)
Ingress protection(保护等级):	IP65
Operating temperature range(工作温度):	-25-+60°C
Protective class(保护类别):	Class I

Made in China(中国制造)

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.
制造商：深圳市首航新能源有限公司

VDE0126-1-1,VDE-AR-N 4105,G59/3,EN50438,C10/11,
AS4777,RD1699,UTE C15-712-1

SOFAR SOLAR

PV Grid Inverter
光伏并网逆变器

Model No.(产品型号):	SOFAR 4600TLM
Vmax. DC input voltage(最大直流输入电压):	600V
DC input voltage range(输入直流电压范围):	100-550V
Imax. DC input current(最大直流输入电流):	2x15A
Isc(max.) DC current(最大直流短路电流):	2x18A
Nominal grid voltage(额定电网电压):	230V~
Nominal AC output current(额定输出电流):	20A
Nominal grid frequency(额定电网频率):	50Hz
Nominal output power(额定输出功率):	4600VA
Power factor(功率因数):	1(adjustable+/-0.8)
Ingress protection(保护等级):	IP65
Operating temperature range(工作温度):	-25-+60°C
Protective class(保护类别):	Class I

Made in China(中国制造)

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.
制造商：深圳市首航新能源有限公司

VDE0126-1-1,VDE-AR-N 4105,G59/3,EN50438,C10/11,
AS4777,RD1699,UTE C15-712-1

SOFAR SOLAR

PV Grid Inverter
光伏并网逆变器

Model No.(产品型号):	SOFAR 5000TLM
Vmax. DC input voltage(最大直流输入电压):	600V
DC input voltage range(输入直流电压范围):	100-550V
Imax. DC input current(最大直流输入电流):	2x15A
Isc(max.) DC current(最大直流短路电流):	2x18A
Nominal grid voltage(额定电网电压):	230V~
Nominal AC output current(额定输出电流):	22A
Nominal grid frequency(额定电网频率):	50Hz
Nominal output power(额定输出功率):	5000VA
Power factor(功率因数):	1(adjustable+/-0.8)
Ingress protection(保护等级):	IP65
Operating temperature range(工作温度):	-25-+60°C
Protective class(保护类别):	Class I

Made in China(中国制造)

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.
制造商：深圳市首航新能源有限公司

VDE0126-1-1,G59/3,EN50438,C10/11,AS4777,RD1699,
UTE C15-712-1

SA1ES040E88001

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 PV input and output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundantly by the high power switching bridge and two relays. This assures that the opening of the output circuit will also operate in case of a single error.

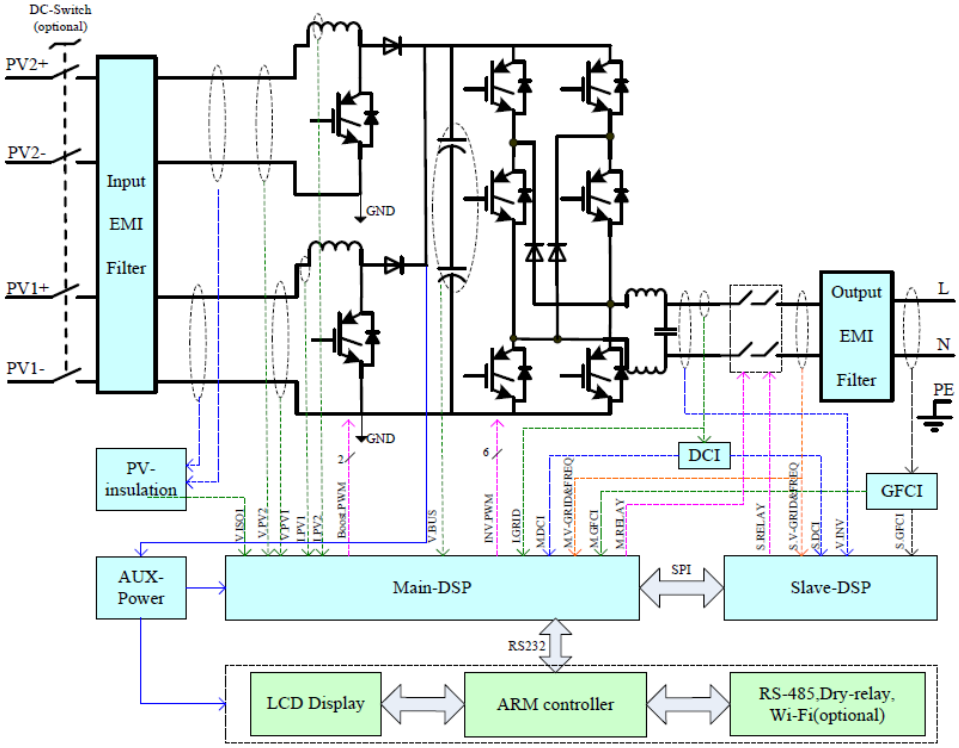


Figure 1 Block digram

The internal control is redundant built. It consists of Microcontroller Master DSP (UC34) and Slave DSP (UC35).

The Master DSP 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 DSP (UC35) is measures the grid voltage, AC current, grid frequency and residual current, also can switch off the relays independently, and communicate with Master DSP (UC34) 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(UC34). The Master DSP(UC34) 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 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM, SOFAR 4600TLM and SOFAR 5000TLM are same as in hardware except the components are in the difference table. Identical in software the output power just adjusted by software.

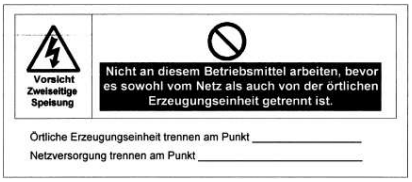
Difference table					
	SOFAR 3000TLM	SOFAR 3680TLM	SOFAR 4000TLM	SOFAR 4600TLM	SOFAR 5000TLM
Boost inductor	2,0mH	2,0mH	2,0mH	1,8mH	1,8mH
BUS capacitor	6 pcs	6 pcs	6 pcs	8 pcs	8 pcs
Inverter inductor	1035uH	1035uH	1035uH	0,75mH	0,75mH
DC switch and Wi-Fi module are optional.					

The product was tested on:
Hardware version: V1.00
Software version: V1.00

Default interface protection settings according EN 50438:2007: (Poland)		
Parameter	**Max. clearance time**	**Trip setting**
Over voltage	0,2s	230V +15% (264,5V)
Under voltage	1,5s	230V -15% (195,5V)
Over frequency	0,5s	50Hz +2% (51,0Hz)
Under frequency	0,5s	50Hz -6% (47,0Hz)
Reconnection time	>=20s	
Permanent DC-injection	0,5% of rated inverter output current	
Loss of main DIN V VDE V 0126-1-1:2006	Inverter shall detect and disconnect within 5s	
The stated currents and voltages are 'true r.m.s.'-values. The voltages in this table are - phase-to-neutral in 230 V single phase systems and 230/400 V systems, - phase-to-phase in a multiphase 230 V system.		
*Over voltage – stage1: 10min mean value corrsponding to EN 50160 Tolerances on trip values: - Voltage: +/- 1% of the nominal voltage; - Frequency: +/- 0,5% of the nominal frequency - Clearance time: +/- 10%		

EN 50438:2007			
Clause/§	**Requirement:**	**Remark:**	**Verdict**
1	**Scope (Micro-generators up to 16A on the public low-voltage grid)**		
2	**Normative references**		
	EN 50110 series		
	EN 50160		
	EN 60255-6		
	EN 60664-1		
	EN 61000-3-2		
	EN 61000-3-3		
	EN 61000-6-1		
	EN 61000-6-3:2001 + A11:2004		
	HD 384 / HD 60364 series		
	IEC 60364-5-55		
3	**Terms and definitions**		
4	**Connection requirements:**		
4.1	The electrical installation.....:	The installation shall be in compliance with HD 384 series and national and local regulation.	**P**
4.1.1	Installation instructions.....:	Maintenance in accordance with the instructions issued by the manufacturer	**P**
4.1.2	Over-current protection……..:	The manufacturer recommends an over-current protection device in the manual	**P**
4.1.3	Earthing……..:	Earthing shall be according to HD 384.5.54 / IEC 60364-5-55 and the relevant national standards.	**P**
4.2	Interface protection		**P**
4.2.1	General……..:	The interface protection, monitoring and control functions are integral part of the inverter.	**P**
4.2.1.1	Default settings versus national settings……:	Default settings of table 2 are applied	**P**
4.2.1.2	Response to protection operation……:	See table 4.2.1.2 below	**P**
4.2.1.3	Accessibility of isolation switching devices……:	The transformerless unit provides two disconnection devices in series.	**P**

EN 50438:2007			
Clause/§	**Requirement:**	**Remark:**	**Verdict**
4.2.1.4	Place of the interface protection……..:	The interface protection is integral part of the inverter and conform to EN 60255-6 or equivalent. The manufacturer declares conformity of his product to this standard within the CE declaration of conformity.	**P**
4.2.1.5	Changing settings of the interface protection……:	It is not possible for the user to alter the interface protection settings	**P**
4.2.1.6	Combined protection devices for multiple generators……:	The proper combined working of the protection is ensured	**P**
4.2.2	Interface protection settings……..:	Default interface protection settings are applied, see table 4.2.2 below	**P**
4.2.3	Loss of Mains protection……..:	Loss of mains protection is required (see Annex A)	**P**
4.2.4	Automatic reconnection after a network outage…:	>20s, see table 4.2.2 below	**P**
4.2.5	Synchronisation……..:	Automatic synchronisation of the inverter	**P**
5	Power quality:		
5.1	Electromagnetic emission / immunity……..:	The inverter complies with the requirements of the EMC directive, see attached EMC report in Annex 1	**P**
	EN 61000-6-1 (immunity)		**P**
	EN 61000-6-3 + A11 (emission)		**P**
	EN 61000-3-2 (harmonics)		**P**
	EN 61000-3-3 (voltage fluctuations and flicker)		**P**
5.2	DC injection……..:	Nearly no DC injection, see table 5.2 below	**P**
5.3	Power factor……..:	See table 5.3 below	**P**
6	**Operation and safety of the micro-generator**		
6.1	General……..:	The unit operates safely over the declared operating range	**P**
6.2	Safety……..:	This standard does not cover safety of DNO personnel.	**P**

EN 50438:2007			
Clause/§	**Requirement:**	**Remark:**	**Verdict**
6.3	Information plate……:	At least information of manufacturers name, identification, rated power, nom. voltage, nom. frequency, phases and power factor, see above marking plate.	**P**
6.4	Labelling……..:	The unit provides the following warning label: 	**P**
6.5	Maintainance and routine testing……..:	The manufacturer provides information for maintainance in the manual. The units are routine tested in the factory.	**P**
7	**Commissioning**		
7.1	General		**P**
	The micro-generator (including the interface protection) shall fulfil the requirements of this standard and the other applicable standards…….:	Noticed	**-**
	The manufacturer shall provide an installation instruction in accordance with this standard and national or regional requirements……..:	Verified, see manual.	**-**
	Access to the interface protection shall be tamper-proof……..:	Access just via password, provided by the manufacturer	**-**
	The micro-generator shall be type tested against the interface requirements of this standard……..:	Noticed, see test tables below	**-**
	The installation shall be carried out by installer with recognised and approved qualification	Not scope of investigation	**-**
7.2	Installation	Not scope of investigation	**N/A**
7.3	Notification		**N/A**
7.4	Decommissioning arrangements		**N/A**
7.5	Replacement arrangements		**N/A**
	Annex		
A (normative)	**Interface protection settings, national deviations**	No specific national settings are supplied, the default settings in 4.2.2, table 2 are applicable	**N/A**
B (informative)	**Notification sheets**		**N/A**
C (informative)	**Interface protection**	Noticed	**P**

EN 50438:2007			
Clause/§	**Requirement:**	**Remark:**	**Verdict**
D (informative)	**Type certification test results sheet**	Noticed	**P**
E (informative)	**Countries allowing extensions of the scope >16A**		**N/A**
F (informative)	**Abbreviations**	Noticed	**P**
G (informative)	**A-deviations**		**N/A**

EN 50438:2007		
Clause	**Test**	**Result**
4.2.1.2	Response to protection operation	**P**
4.2.2	Interface protection settings	**P**
4.2.3	Loss of Mains protection	**P**
4.2.4	Automatic reconnection after a network outage	**P**
5.1	Harmonic current emission	**P**
5.1	Voltage fluctuation and flicker	**N/A**
5.2	DC injection	**P**
5.3	Power factor	**P**

Test Results

4.2.1.2 Response to protection operation - fault condition tests according DIN V VDE V 0126-1-1:2006-02			**P**
	ambient temperature [°C] :	24,8	—
	model/type of power supply :	DC : 62150H-1000S AC : 61512	—
	manufacturer of power supply :	Chroma	—
	rated markings of power supply :	DC: 0-1000V, 15kW AC: 0-300V, 18kW	—

component No.	fault	test condition		test time	fuse No.	fault condition		result
		AC	DC			AC	DC	
PV voltage detect R4	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID09. (PV voltage over range)
PV voltage detect R30	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID11. (PV voltage fault)
PV voltage detect R13	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 19,94 A	500V 9,46A	PV inverter normal working.
PV voltage detect R18	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 19,94 A	500V 9,46A	PV inverter normal working.
PV current detect R85	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID10. (PV current fault)
PV current detect R100	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID10. (PV current fault)
Bus voltage detect R44	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0A	500V 0,02A	PV inverter disconnected from grid immediately, Q14, Q15, Q13, D40, C163 damaged, error message: ID02 (Grid voltage), ID04 (Grid frequency fault), ID14, ID15 (PV current fault), ID23 (BUS voltage fault).

component No.	fault	test condition		test time	fuse No.	fault condition		result
		AC	DC			AC	DC	
Bus voltage detect R75	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0A	500V 0,02A	PV inverter disconnected from grid immediately, Q14, Q15, Q13, D40 damaged, error message: ID02 (Grid voltage), ID04 (Grid frequency fault), ID14, ID15 (PV current fault), ID23 (BUS voltage fault).
ISO detect R37	Open before start	230V 0,02 A	500V 0,02 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter can not start up, error message: ID56. (ISO fault)
ISO detect R239	Open before start	230V 0,02 A	500V 0,02 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter can not start up, error message: ID56. (ISO fault)
AC current detect R170	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID15, ID16, ID70. (AC current over range)
AC current detect R172	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID15, ID16, ID70. (AC current over range)
DC current detect R108	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID28. (DC current fault).
DC current detect RC39	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID14. (DC current over range).
DC current detect R112	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID10, ID30. (DC current fault).
AC current detect RC40	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID28. (DC current over range).
DC current detect R117	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID10. (DC current fault).
DC current detect R118	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID10. (DC current fault).
DC current detect R123	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID30. (DC current over range).

component No.	fault	test condition		test time	fuse No.	fault condition		result
		AC	DC			AC	DC	
AC current detect RC21	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID15. (AC current over range).
AC current detect RC61	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID15. (AC current over range).
GFCI detect R151	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID12. (GFCI fault).
GFCI detect R161	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID12. (GFCI fault).
Relay detect RY1 Pin3-4	Short before start	230V 0,02 A	500V 0,02 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter can not start up, error message: ID55, ID77. (Relay fault).
Relay detect RY2 Pin3-4	Short before start	230V 0,02 A	500V 0,02 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter can not start up, error message: ID55, ID77. (Relay fault).
Relay detect RY3 Pin3-4	Short before start	230V 0,02 A	500V 0,02 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter can not start up, error message: ID55, ID77. (Relay fault).
Relay detect RY4 Pin3-4	Short before start	230V 0,02 A	500V 0,02 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter can not start up, error message: ID55, ID77. (Relay fault).
Grid voltage detect R179	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID02 (AC voltage under range), ID55 (Relay fault).
Grid voltage detect R179	Short	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID01 (AC voltage over range).
Grid voltage detect R189	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID02 (AC voltage under range), ID55 (Relay fault).
Grid voltage detect R189	Short	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID01 (AC voltage over range).
Grid voltage detect RC14	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID02 (AC voltage under range), ID55 (Relay fault).

component No.	fault	test condition		test time	fuse No.	fault condition		result
		AC	DC			AC	DC	
Grid voltage detect RC20	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID02 (AC voltage under range), ID55 (Relay fault).
Grid voltage detect RC16	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID01, ID02, ID04, ID49 (Grid voltage fault).
Loss of control CC100	Short	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: DSP communicate fail
Loss of control XLC	Short	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: DSP communicate fail
Communication microcontroller defect UC34 Pin 31	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID 53 (SPI Communication fault)
Communication microcontroller defect UC34 Pin 37	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID 53 (SPI Communication fault)
Communication microcontroller defect UC34 Pin 44	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID 53 (SPI Communication fault)
Communication microcontroller defect UC34 Pin 47	Open	230V 19,94 A	500V 9,46 A	2 Min.	--	230V 0,02A	500V 0,02A	PV inverter disconnected from grid immediately, error message: ID 53 (SPI Communication fault)
The errors in the control circuit simulate that the safety is even ensured during single fault. The tests had been performed on the SOFAR 5000TLM is valid for the SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM and SOFAR 4600TLM, since it is same as in hardware and just power derated by software.								
Addendum – Shutdown device								
Each active phase can be switched. (L and N)								P
If no galvanic separation between AC and DC (PV): Two relays in series on each active phase are necessary to fulfil the basic insulation or simple separation based on the PV working voltage.								P

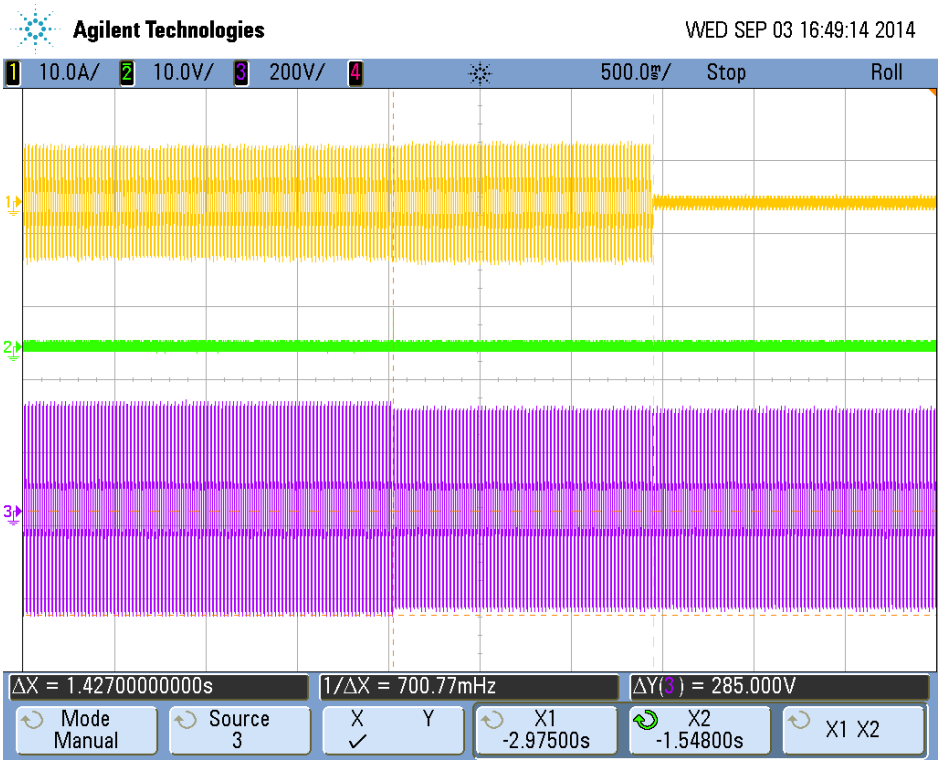
4.2.2 Interface protection settings – Over / under voltage **(4.2.3) Automatic reconnection after a network outage**						**P**
Test Condition			Output power: 960W Frequency: 50+/-0,2Hz			
Phase	Limit [V]	Trip value [V]	Voltage step [V]	Reconnection time [s]	Disconnection time [ms]	Limit [ms]
L1	85% of Un = 195,5	196,5	201V to 191V	78	1414	1500
			201V to 191V		1421	
			201V to 191V		1426	
			201V to 191V		1410	
			201V to 191V		1427	
	115% of Un = 264,5	263,5	258V to 268V	78	167	200
			258V to 268V		170	
			258V to 268V		157	
			258V to 268V		146	
			258V to 268V		149	

Note:
Lower and upper threshold voltage shall not fall or rise below or above 2,3V of the trip value itself. The measurement shall take place at nominal frequency and any power.

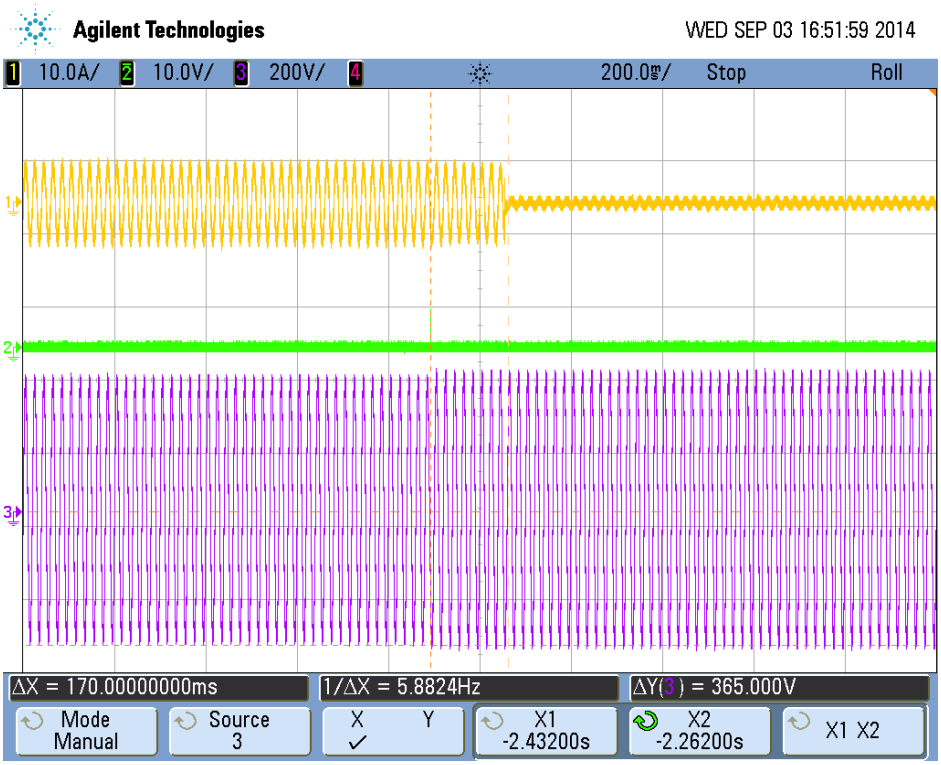
The oscilloscope pictures below show the measured worst case disconnection times.

The tests had been performed on the SOFAR 5000TLM is valid for the SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM and SOFAR 4600TLM, since it is same as in hardware and just power derated by software.

Undervoltage



Overvoltage



4.2.2 Measuring the rise-in voltage protection as a running 10-minute mean value Overvoltage protection according to DIN EN 50160:2000-03, 2.3			**P**
Setting values of the protection:	Trip value Setting [V]	264,5	
	Setting $T_{disconnection\ trip\ value}$ [s]	600	
	Setting $T_{disconnection}$ [ms]	140	
Test:			
	Disconnection time [s]	Limit [s]	
a)	The voltage is set to 100% U_n and held for 600 s. Thereafter the voltage is set to 112% U_n. Disconnection must take place within 600 s.		
	Phase 1:	487 s	600 s
	Phase 2:	N/A	
	Phase 3:	N/A	
b)	The voltage is set to U_n for 600 s and then to 108% U_n for 600 s. No disconnection should take place.		
	Phase 1:	No disconnection	Disconnection should not take place.
	Phase 2:	N/A	
	Phase 3:	N/A	
c)	The voltage is set to 106 % U_n and held for 600 s. Thereafter the voltage is set to 114 % U_n. The disconnection should last for half the period as in Point a)*		
	Phase 1:	287 s	300 s
	Phase 2:	N/A	
	Phase 3:	N/A	

Test:
a) This test serves as proof of the measurement accuracy and the maximum set time.
b) This test serves as proof of the measurement accuracy.
c) This test serves as proof of the correct formation of the 10 minute running mean value.

Assessment criterion:
The permitted tolerance between setting value and trip value of the voltage may not exceed ± 1 % of U_N.

Limit values:
Rise-in voltage protection 1,1 U_N after a max. 600 s, the switch off after 200 ms.

Note:
If only one integrated protection is used for the power generation systems, the value of the rise-in voltage protection of 1,1 U_N may not be changed.

The tests had been performed on the SOFAR 5000TLM is valid for the SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM and SOFAR 4600TLM, since it is same as in hardware and just power derated by software.

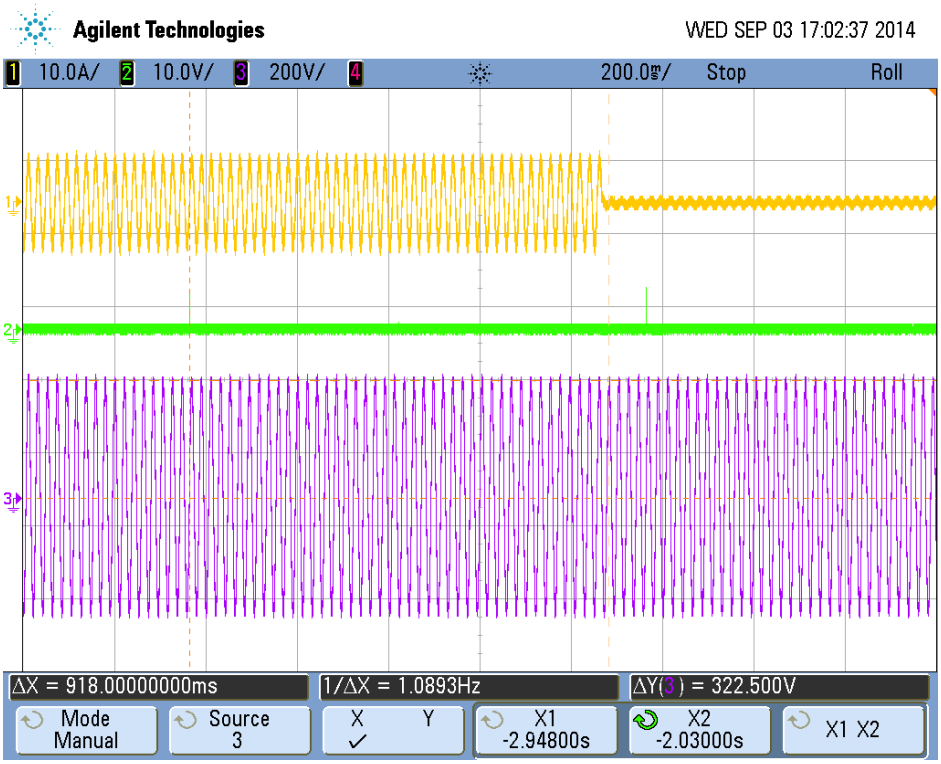
4.2.2 Interface protection settings – Over / under frequency **(4.2.4) Automatic reconnection after a network outage**									**P**
Test conditions	Output power: 960W U_N = 230Vac								
	Under frequency				**Over frequency**				
Parameter	Frequency	Time			Frequency	Time			
Output Voltage		~85% of U_N	U_N	~115% of U_N		~85% of U_N	U_N	~115% of U_N	
Limit	47,00Hz	500ms	500ms	500ms	51,00Hz	500ms	500ms	500ms	
Trip value [Hz]		47,00Hz	47,00Hz	47,00Hz		50,99Hz	50,99Hz	50,99Hz	
Disconnection time [ms]	47,5Hz to 46,5Hz	413	418	404	50,5Hz to 51,5Hz	418	432	426	
		406	418	414		428	418	424	
		402	416	416		424	426	434	
		412	412	418		430	416	433	
		413	404	412		428	430	436	
Reconnection time [s]:	>= 20	78s			>= 20	78s			

Note:
It was measured at a continuous change of frequency of 1Hz/s at lower, nominal and upper U_N and arbitary output power. The trip value was determined manually by reducing the frequency in 10mHz steps. When the trip value is known (e.g. 48,02Hz), the ac-source is programmed to run from e.g. 48,50Hz to 47,50Hz with 1Hz/s. The disconnection time is calculated by the measured time minus the 480ms from 48,50Hz to 48,02Hz.

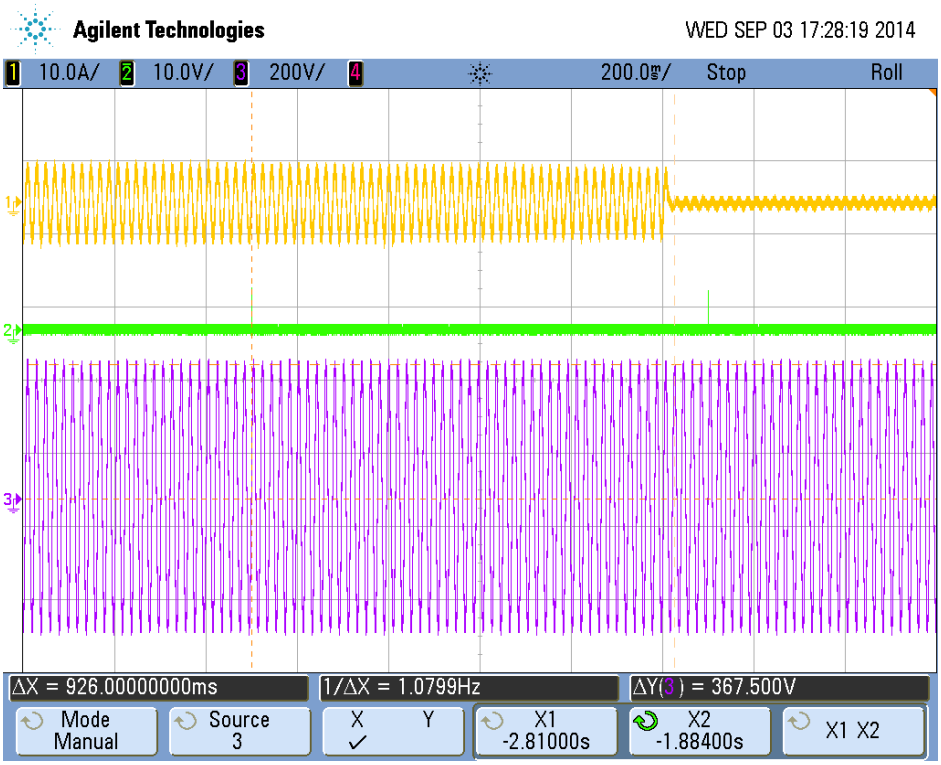
The oscilloscope pictures below show the measured worst case disconnection times.

The tests had been performed on the SOFAR 5000TLM is valid for the SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM and SOFAR 4600TLM, since it is same as in hardware and just power derated by software.

Under frequency



Over frequency



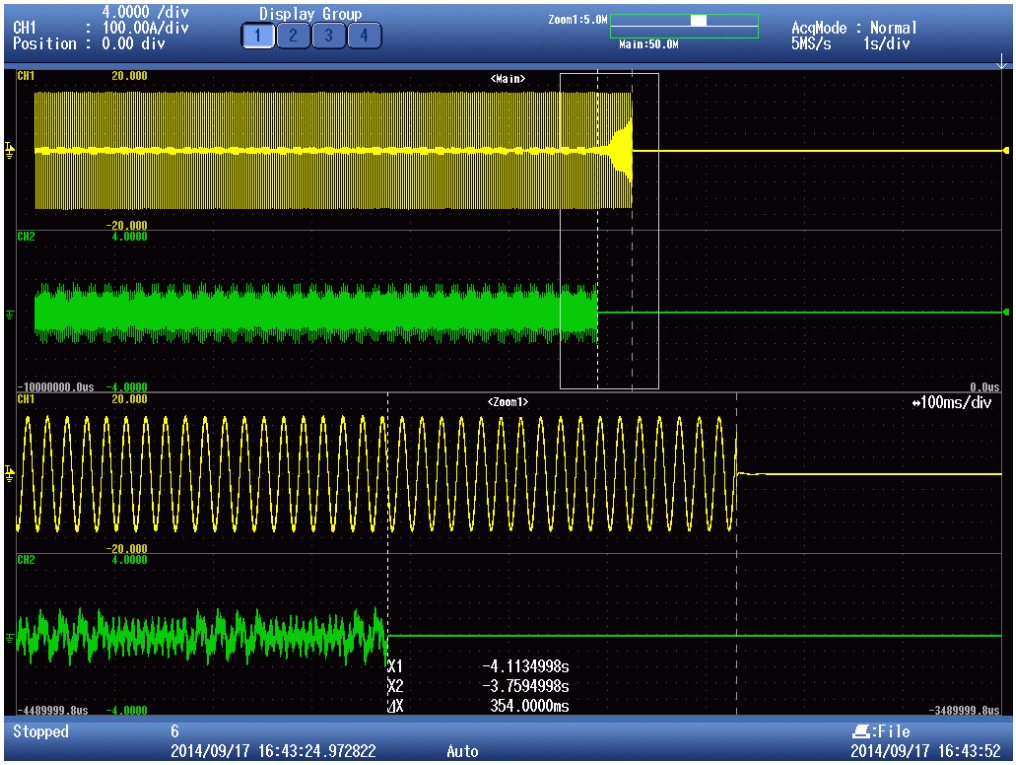
4.3.2. Loss of Mains according DIN V VDE V 0126-1-1:2006-02			**P**
Test conditions	Frequency 50+/-0,1Hz U_N = 230+/-3Vac Distortion factor of chokes <2% Quality Q>2		
Disconnection limit	5s		
Output power / Osc. Parameter	Min. ~25% disconnect time [s]	Medium ~50% disconnect time [s]	Max. ~100% disconnect time [s]
- 5%	0,402	0,230	0,208
- 4%	0,413	0,275	0,270
- 3%	0,404	0,268	0,239
- 2%	0,305	0,270	0,371
- 1%	0,364	0,354	0,377
0 %	0,304	0,295	0,286
+1 %	0,228	0,292	0,349
+2 %	0,385	0,320	0,347
+3 %	0,281	0,266	0,268
+4 %	0,274	0,260	0,226
+5 %	0,247	0,190	0,226
Parameter at 0%	L=71,20 mH R=46,28 Ω C=138,58 uF	L=35,82 mH R=23,20 Ω C= 277,15 uF	L=18,28 mH R=11,71 Ω C=545,04 uF

Note:
The oscilloscope pictures below show the measured worst case disconnection times.

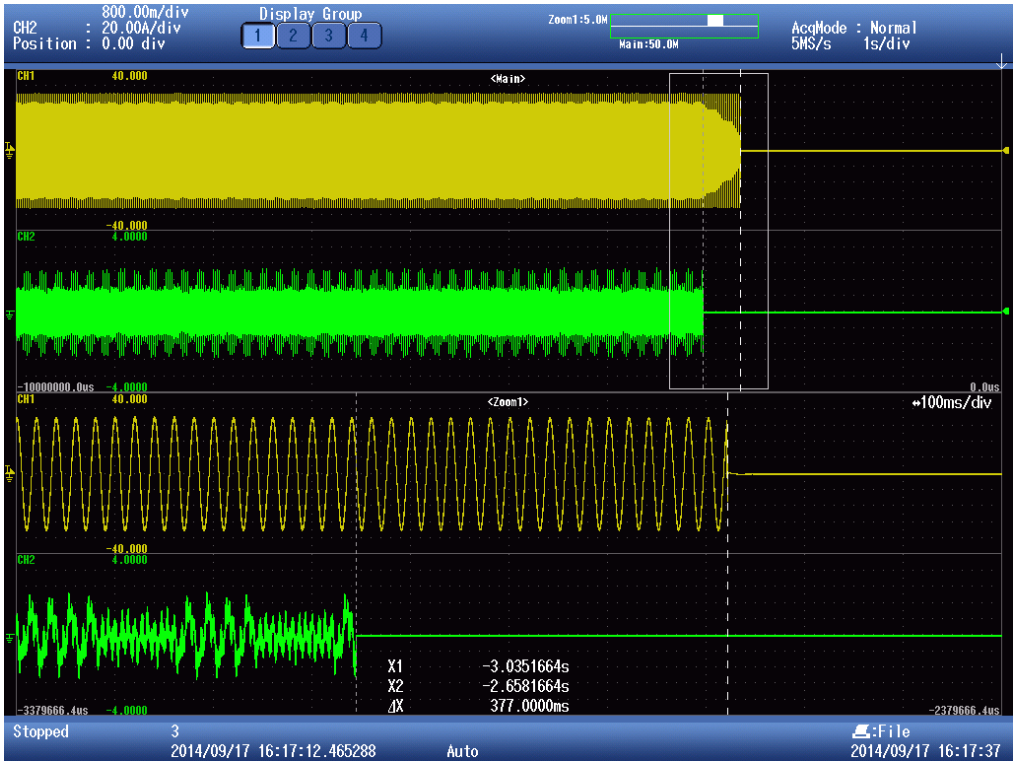
The tests had been performed on the SOFAR 5000TLM is valid for the SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM and SOFAR 4600TLM, since it is same as in hardware and just power derated by software.

25% Power

50% Power



100% Power


800.00m/div
CH2 : 20.00A/div
Position : 0.00 div
Display Group
1 2 3 4
Zoom1:5.0M
Main:50.0M
AcqMode : Normal
5MS/s 1s/div
CH1 40.000
<Main>
-40.000
CH2 4.0000
-10000000.0us -4.0000
0.0us
CH1 40.000
<Zoom1>
↔100ms/div
-40.000
CH2 4.0000
X1 -3.0351664s
X2 -2.6581664s
ΔX 377.0000ms
-3379666.4us -4.0000
-2379666.4us
Stopped 3
2014/09/17 16:17:12.465288
Auto
:File
2014/09/17 16:17:37

5.1 Harmonic current emission (EN 61000-3-2) (SOFAR 3000TLM)	P

Watts [kW]	3,004
Vrms [V]	231,0
Arms [A]	13,015
Frequency [Hz]	50,00
THD [%]	1,93

Harmonics	Current Magnitude [A]	% of Fundamental	Phase	Harmonic Current Limits [A]
1st	13,012	--	Single Phase	N/A
2nd	0,023	0,18	Single Phase	1,080
3rd	0,191	1,47	Single Phase	2,300
4th	0,020	0,15	Single Phase	0,430
5th	0,051	0,39	Single Phase	1,140
6th	0,014	0,11	Single Phase	0,300
7th	0,048	0,37	Single Phase	0,770
8th	0,010	0,08	Single Phase	0,230
9th	0,053	0,40	Single Phase	0,400
10th	0,009	0,07	Single Phase	0,184
11th	0,054	0,41	Single Phase	0,330
12th	0,008	0,06	Single Phase	0,153
13th	0,054	0,42	Single Phase	0,210
14th	0,007	0,06	Single Phase	0,131
15th	0,055	0,42	Single Phase	0,150
16th	0,007	0,06	Single Phase	0,115
17th	0,050	0,39	Single Phase	0,132
18th	0,007	0,06	Single Phase	0,102
19th	0,044	0,34	Single Phase	0,118
20th	0,006	0,05	Single Phase	0,092
21th	0,040	0,30	Single Phase	0,107
22th	0,005	0,04	Single Phase	0,084
23th	0,036	0,27	Single Phase	0,098
24th	0,006	0,05	Single Phase	0,077
25th	0,031	0,24	Single Phase	0,090
26th	0,005	0,04	Single Phase	0,071
27th	0,026	0,20	Single Phase	0,083
28th	0,005	0,04	Single Phase	0,066
29th	0,022	0,17	Single Phase	0,078
30th	0,005	0,04	Single Phase	0,061
31th	0,020	0,15	Single Phase	0,073
32th	0,004	0,03	Single Phase	0,058
33th	0,018	0,14	Single Phase	0,068
34th	0,004	0,03	Single Phase	0,054
35th	0,014	0,11	Single Phase	0,064
36th	0,007	0,06	Single Phase	0,051
37th	0,012	0,09	Single Phase	0,061
38th	0,003	0,03	Single Phase	0,048
39th	0,011	0,08	Single Phase	0,058
40th	0,004	0,03	Single Phase	0,046

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.

5.1 Harmonic current emission (EN 61000-3-2) (SOFAR 3680TLM)	P

Watts [kW]	3,570
Vrms [V]	230,9
Arms [A]	15,472
Frequency [Hz]	50,00
THD [%]	1,83

Harmonics	Current Magnitude [A]	% of Fundamental	Phase	Harmonic Current Limits [A]
1st	15,469	--	Single Phase	N/A
2nd	0,036	0,23	Single Phase	1,080
3rd	0,230	1,49	Single Phase	2,300
4th	0,027	0,18	Single Phase	0,430
5th	0,051	0,33	Single Phase	1,140
6th	0,021	0,14	Single Phase	0,300
7th	0,040	0,26	Single Phase	0,770
8th	0,024	0,15	Single Phase	0,230
9th	0,070	0,45	Single Phase	0,400
10th	0,018	0,12	Single Phase	0,184
11th	0,047	0,30	Single Phase	0,330
12th	0,010	0,07	Single Phase	0,153
13th	0,048	0,31	Single Phase	0,210
14th	0,014	0,09	Single Phase	0,131
15th	0,062	0,40	Single Phase	0,150
16th	0,016	0,10	Single Phase	0,115
17th	0,038	0,25	Single Phase	0,132
18th	0,011	0,07	Single Phase	0,102
19th	0,041	0,27	Single Phase	0,118
20th	0,007	0,05	Single Phase	0,092
21th	0,036	0,23	Single Phase	0,107
22th	0,008	0,05	Single Phase	0,084
23th	0,028	0,18	Single Phase	0,098
24th	0,009	0,06	Single Phase	0,077
25th	0,024	0,16	Single Phase	0,090
26th	0,006	0,04	Single Phase	0,071
27th	0,022	0,14	Single Phase	0,083
28th	0,006	0,04	Single Phase	0,066
29th	0,016	0,11	Single Phase	0,078
30th	0,006	0,04	Single Phase	0,061
31th	0,014	0,09	Single Phase	0,073
32th	0,004	0,03	Single Phase	0,058
33th	0,010	0,07	Single Phase	0,068
34th	0,006	0,04	Single Phase	0,054
35th	0,008	0,05	Single Phase	0,064
36th	0,004	0,03	Single Phase	0,051
37th	0,006	0,04	Single Phase	0,061
38th	0,004	0,03	Single Phase	0,048
39th	0,006	0,04	Single Phase	0,058
40th	0,003	0,02	Single Phase	0,046

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.

5.1 Harmonic current emission (EN 61000-3-12) (SOFAR 4000TLM)	P

Watts [kW]	4,027
Vrms [V]	231,0
Arms [A]	17,442
Frequency [Hz]	50,00
THD [%]	1,81
PWHD [%]	2,91

Harmonics	Current Magnitude [A]	% of Fundamental	Phase	Harmonic Current Limits [%]
1st	17,440	--	Single Phase	N/A
2nd	0,029	0,16	Single Phase	8
3rd	0,262	1,50	Single Phase	21,6
4th	0,030	0,17	Single Phase	4
5th	0,066	0,38	Single Phase	10,7
6th	0,025	0,14	Single Phase	2,67
7th	0,048	0,27	Single Phase	7,2
8th	0,013	0,07	Single Phase	2
9th	0,044	0,25	Single Phase	3,8
10th	0,024	0,14	Single Phase	1,6
11th	0,076	0,44	Single Phase	3,1
12th	0,018	0,10	Single Phase	1,33
13th	0,057	0,33	Single Phase	2
14th	0,014	0,08	Single Phase	N/A
15th	0,040	0,23	Single Phase	N/A
16th	0,018	0,10	Single Phase	N/A
17th	0,055	0,31	Single Phase	N/A
18th	0,010	0,06	Single Phase	N/A
19th	0,047	0,27	Single Phase	N/A
20th	0,012	0,07	Single Phase	N/A
21th	0,032	0,18	Single Phase	N/A
22th	0,011	0,06	Single Phase	N/A
23th	0,030	0,17	Single Phase	N/A
24th	0,008	0,05	Single Phase	N/A
25th	0,030	0,17	Single Phase	N/A
26th	0,013	0,08	Single Phase	N/A
27th	0,024	0,14	Single Phase	N/A
28th	0,007	0,04	Single Phase	N/A
29th	0,018	0,10	Single Phase	N/A
30th	0,009	0,05	Single Phase	N/A
31th	0,015	0,09	Single Phase	N/A
32th	0,008	0,05	Single Phase	N/A
33th	0,010	0,06	Single Phase	N/A
34th	0,005	0,03	Single Phase	N/A
35th	0,008	0,05	Single Phase	N/A
36th	0,007	0,04	Single Phase	N/A
37th	0,009	0,05	Single Phase	N/A
38th	0,005	0,03	Single Phase	N/A
39th	0,006	0,03	Single Phase	N/A
40th	0,005	0,03	Single 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.

5.1 Harmonic current emission (EN 61000-3-12) (SOFAR 5000TLM)	P

Watts [kW]	4,998
Vrms [V]	233,2
Arms [A]	21,450
Frequency [Hz]	50,00
THD [%]	1,69
PWHD [%]	3,16

Harmonics	Current Magnitude [A]	% of Fundamental	Phase	Harmonic Current Limits [%]
1st	21,446	--	Single Phase	N/A
2nd	0,050	0,23	Single Phase	8
3rd	0,287	1,34	Single Phase	21,6
4th	0,041	0,19	Single Phase	4
5th	0,074	0,34	Single Phase	10,7
6th	0,029	0,14	Single Phase	2,67
7th	0,057	0,26	Single Phase	7,2
8th	0,022	0,10	Single Phase	2
9th	0,051	0,24	Single Phase	3,8
10th	0,034	0,16	Single Phase	1,6
11th	0,089	0,42	Single Phase	3,1
12th	0,021	0,10	Single Phase	1,33
13th	0,072	0,33	Single Phase	2
14th	0,017	0,08	Single Phase	N/A
15th	0,047	0,22	Single Phase	N/A
16th	0,018	0,08	Single Phase	N/A
17th	0,065	0,30	Single Phase	N/A
18th	0,011	0,05	Single Phase	N/A
19th	0,065	0,30	Single Phase	N/A
20th	0,017	0,08	Single Phase	N/A
21th	0,040	0,19	Single Phase	N/A
22th	0,011	0,05	Single Phase	N/A
23th	0,041	0,19	Single Phase	N/A
24th	0,014	0,06	Single Phase	N/A
25th	0,043	0,20	Single Phase	N/A
26th	0,014	0,07	Single Phase	N/A
27th	0,029	0,14	Single Phase	N/A
28th	0,009	0,04	Single Phase	N/A
29th	0,025	0,12	Single Phase	N/A
30th	0,016	0,07	Single Phase	N/A
31th	0,025	0,12	Single Phase	N/A
32th	0,015	0,07	Single Phase	N/A
33th	0,018	0,08	Single Phase	N/A
34th	0,012	0,05	Single Phase	N/A
35th	0,016	0,08	Single Phase	N/A
36th	0,012	0,06	Single Phase	N/A
37th	0,016	0,07	Single Phase	N/A
38th	0,008	0,04	Single Phase	N/A
39th	0,011	0,05	Single Phase	N/A
40th	0,008	0,04	Single 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 5000TLM, SOFAR 4000TLM, SOFAR 3680TLM, and SOFAR 3000TLM are valid for the SOFAR 4600TLM, since it is same as in hardware and just power derated by software.

5.1 Voltage fluctuation and flicker				**N/A**
Test conditions	Maximum permissible voltage fluctuation (expressed as a percentage of nominal voltage at 100 % power) and flicker as per EN 61000-3-3/ EN61000-3-3			
	Starting	Stopping	Running	
Limit	3,3%	3,3%	P_{st}=1,0	P_{lt}=0,65
Test value	**			

Note:
*The stationary deviance of dc% is bigger than the dynamic deviance of d_{max} at starting and stopping.

Mains Impedance according EN61000-3-3 / EN61000-3-11: **R_{max} = Ω; jX_{max}= Ω @50Hz (|Z_{max}| = Ω)**
Bei Einphasigen Invertern Zmax sowie Rn und jxn angeben **R_n = Ω; jX_n= Ω**

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.

** see Annex No. 1 – EMC Test report

5.2 Monitoring of DC-Injection			P
Protection limit	tested at three power levels limit 0,5% of $I_{AC;nom}$		
Output power	~25%	~50%	~100%
SOFAR 3000TLM			
max. test value (phase L1) [mA]	19,1 mA	17,3 mA	16,4 mA
SOFAR 5000TLM			
max. test value (phase L1) [mA]	5,1 mA	5,5 mA	-7,1 mA

Diagram of permanent dc-injection: SOFAR 3000TLM

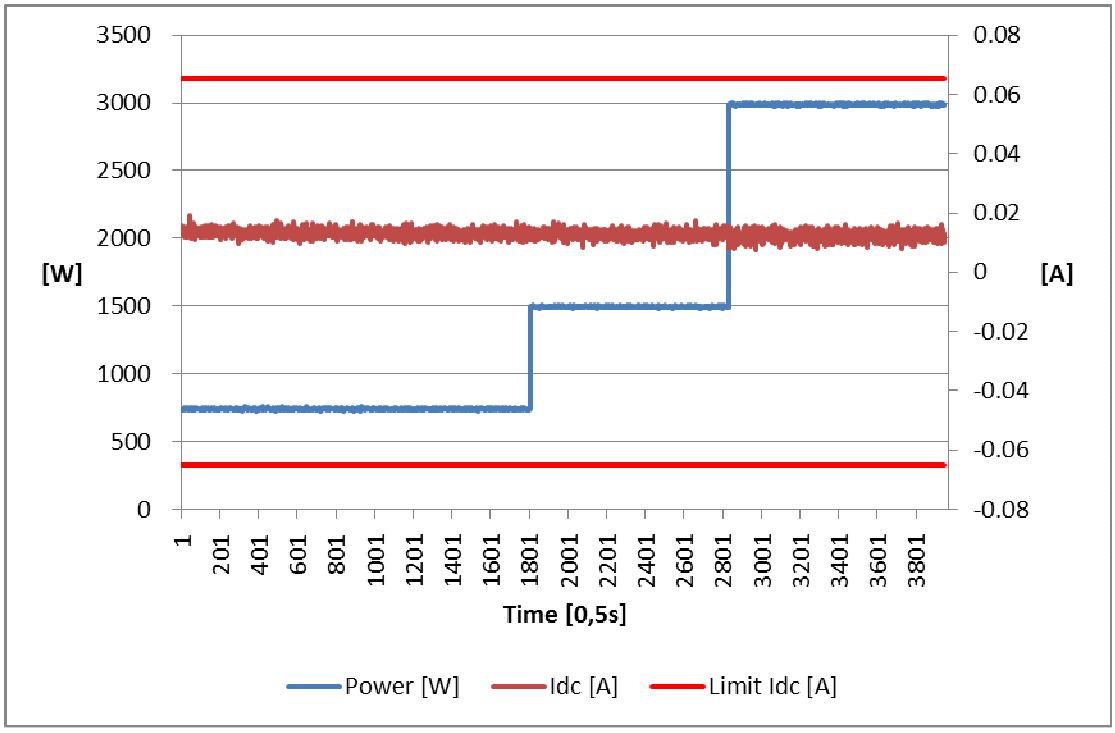
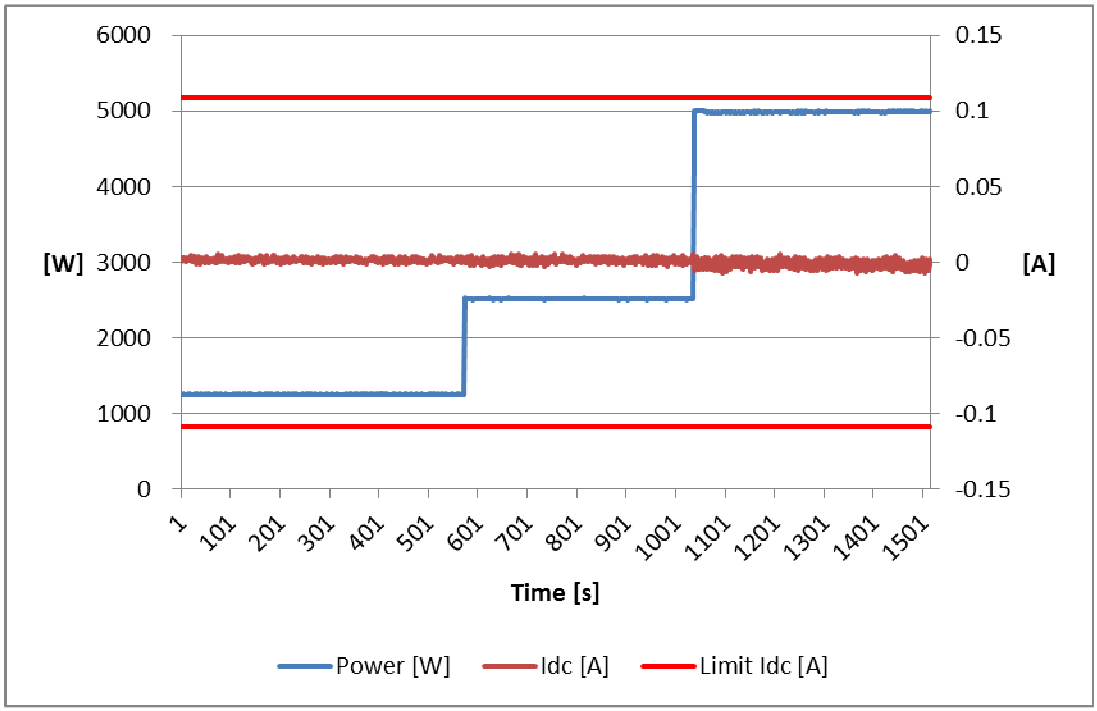


Diagram of permanent dc-injection: SOFAR 5000TLM



Note:
Testing must be performed according to WI 10.4.-03.doc rev D. The internal temperature of the EUT must be stabilized. No temperature drift of more than 2K within 1 hour is allowed.

The tests had been performed on the SOFAR 5000TLM and SOFAR 3000TLM are valid for the SOFAR 3680TLM, SOFAR 4000TLM and SOFAR 4600TLM, since it is same as in hardware and just power derated by software.

5.3 Power factor					P
SOFAR 3000TLM					
Test conditions	Uinput = 500V				
Output power / Test voltage	~20%	~40%	~60%	~80%	~100%
210V	0,994c	0,998c	0,999c	0,999c	0,999c
230V	0,991c	0,998c	0,999c	0,999c	0,999c
250V	0,987c	0,997c	0,999c	0,999c	0,999c
SOFAR 5000TLM					
Test conditions	Uinput = 500V				
Output power / Test voltage	~20%	~40%	~60%	~80%	~100%
210V	0,998c	0,999c	0,999c	0,999c	0,999c
230V	0,998c	0,999c	0,999c	0,999c	0,999c
250V	0,997c	0,999c	0,999c	0,999c	0,999c

Note:
The power factor of the micro-generator at normal steady-state operating conditions across the statuary tolerance band of normal voltage shall be between 0,95 leading and 0,95 lagging, provided the output active power of the mirco-generator is above 20% the rated output of the unit.

The tests had been performed on the SOFAR 5000TLM and SOFAR 3000TLM are valid for the SOFAR 3680TLM, SOFAR 4000TLM and SOFAR 4600TLM, since it is same as in hardware and just power derated by software.

Annex 1
EMC Test Report

ATTESTATION
of conformity with European Directives

Attestation Number: **1488AB0609N058001**
Product: **PV Grid Inverter**
Brand Name:
Model: **SOFAR 3000TLM, SOFAR 4000TLM, SOFAR 5000TLM**
Additional Model: **SOFAR 3680TLM, SOFAR 4600TLM**
Applicant: **Shenzhen SOFARSOLAR Co., Ltd.**
Address: **3A-1, Huake Building, East Technology Park, Qiaoxiang Road, Nanshan District, Shenzhen, China.**
Technical Characteristics: **DC Input: DC 100 - 550V, 10A/10A For SOFAR 3000TLM;**
DC Input: DC 100 - 550V, 12A/12A For SOFAR 3680TLM;
DC Input: DC 100 - 550V, 13A/13A For SOFAR 4000TLM;
DC Input: DC 100 - 550V, 15A/15A For SOFAR 4600TLM;
DC Input: DC 100 - 550V, 15A/15A For SOFAR 5000TLM
Output: AC 230V, 50/60Hz, Power: 3000VA / 3680VA / 4000VA / 4600VA / 5000VA
Output Voltage/Current: SOFAR 3000TLM:AC 230V/13A; SOFAR 3680TLM:AC 230V/16A; SOFAR 4000TLM: AC 230V/17.5A; SOFAR 4680TLM: AC 230V/20A; SOFAR 5000TLM:AC 230V/22A

The submitted sample of the above equipment has been tested for CE marking according to following European Directive and standards:

- **Electromagnetic Compatibility Directive 2004/108/EC**

Standards	Report Number	Report date
EN 61000-6-3:2007 + A1:2011 EN 61000-3-2:2006 + A1:2009 + A2:2009 EN 61000-3-12:2011 EN 61000-3-11:2000 EN 61000-3-3:2013 EN 61000-6-2:2005	CE140609N058	Sep. 12, 2014

The referred test report(s) show that the product complies with standard(s) recognized as giving presumption of compliance with the essential requirements in the specified European Directive.

This verification does not imply assessment of the production of the product. The CE marking may be affixed if all relevant and effective European Directives with CE are applicable.

Supervisor
EMC Department

Name: Madison Luo
Date: Sep. 12, 2014

Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch
No. 34, Chenwulu Section, Guantai Rd., Houjie Town, Dongguan City, Guangdong 523942, China
Tel.: +86 769 8593 5656
Fax: +86 769 8593 1080
Email:customerservice.dg@cn.bureauveritas.com

Test Report No.: CE140609N058

TEST REPORT

Applicant	Shenzhen SOFARSOLAR Co., Ltd.
Address	3A-1, Huake Building, East Technology Park, Qiaoxiang Road, Nanshan District, Shenzhen, China.

Manufacturer or Supplier	Shenzhen SOFARSOLAR Co., Ltd.
Address	3A-1, Huake Building, East Technology Park, Qiaoxiang Road, Nanshan District, Shenzhen, China.
Product	PV Grid Inverter
Brand Name	SOFAR SOLAR
Model	SOFAR 3000TLM, SOFAR 4000TLM, SOFAR 5000TLM
Additional Model & Model Difference	SOFAR 3680TLM, SOFAR 4600TLM; See item 2.1
Date of tests	Jun. 09, 2014 ~ Sep. 12, 2014

The submitted sample of the above equipment has been tested for according to following European Directive - Electromagnetic directive 2004/108/EC and the tests have been carried out according to the requirements of the following standards:

- ☒ **EN 61000-6-3:2007 + A1:2011**
- ☒ **EN 61000-3-2:2006 + A1:2009 + A2:2009**
- ☒ **EN 61000-3-12:2011**
- ☒ **EN 61000-3-11:2000**
- ☒ **EN 61000-3-3:2013**
- ☒ **EN 61000-6-2:2005**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Tested by Breeze Jiang Project Engineer / EMC Department	Approved by Madison Luo Supervisor / EMC Department
Breeze	Date: Sep. 12, 2014

Bureau Veritas Shenzhen Co., Ltd.
Dongguan Branch

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Test Report No.: CE140609N058

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
CE140609N058	Original release	Sep. 12, 2014

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

EMISSION			
Standard	**Test Type**	**Result**	**Remarks**
EN61000-6-3:2007+ A1:2011	Conducted test	PASS	Meets requirement limit Minimum passing margin is –5.47 dB at 16.16016MHz
	Radiated test (30MHz~1GHz)	PASS	Meets limits minimum passing margin is –3.66 dB at 54.856MHz
EN 61000-3-2:2006 + A1:2009 + A2:2009	Harmonic current emissions	PASS	Meets the requirements.
EN 61000-3-12:2011	Harmonic current emissions	PASS	Meets the requirements.
EN 61000-3-3:2013	Voltage fluctuations & flicker	PASS	Meets the requirements.
EN 61000-3-11:2000	Voltage fluctuations & flicker	PASS	Meets the requirements.

IMMUNITY (EN 61000-6-2:2005)			
Standard	**Test Type**	**Result**	**Remarks**
IEC 61000-4-2:2008	Electrostatic discharge immunity test	PASS	Electrostatic Discharge – ESD: 8kV Air discharge, 4kV Contact discharge, Performance Criterion A
IEC 61000-4-3:2005 + A1:2007+A2:2010	Radiated, radio-frequency, electromagnetic field immunity test	PASS	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80-1000 MHz, 10V/m, 80% AM (1kHz), 1400-2000 MHz, 3V/m, 80% AM (1kHz) 2000-2700 MHz, 1V/m, 80% AM (1kHz) Performance Criterion A
IEC 61000-4-4:2012	Electrical fast transient / burst immunity test.	PASS	Electrical Fast Transient/Burst - EFT AC Power line: 2kV, DC Power line: 2kV, Performance Criterion A
IEC 61000-4-5:2005	Surge immunity test	PASS	Surge Immunity Test: 1.2/50 us Open Circuit Voltage, 8 /20 us Short Circuit Current, AC Power Line: line to line 1 kV, Line to earth 2kV , DC Power Line: line to line 0.5 kV Performance Criterion B
IEC 61000-4-6:2008	Immunity to conducted disturbances, induced by radio-frequency fields	PASS	Conducted Radio Frequency Disturbances Test – CS: 0.15-80 MHz, 10Vrms, 80% AM, 1kHz, Performance Criterion A
IEC 61000-4-8:2009	Power frequency magnetic field immunity test.	PASS	Power Frequency Magnetic Field Test, 50 Hz / 60Hz, 30A/m, Performance Criterion A

1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

MEASUREMENT	FREQUENCY	UNCERTAINTY
Mains Terminal Disturbance Voltage Test	0.15MHz ~ 30MHz	+ /-2.66 dB
Radiated Disturbance Test	30MHz ~ 1000MHz	+ /-4.06 dB

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	PV Grid Inverter
MODEL NO.	SOFAR 3000TLM, SOFAR 4000TLM, SOFAR 5000TLM
ADDITIONAL MODEL	SOFAR 3680TLM, SOFAR 4600TLM;
POWER SUPPLY	DC Input: DC 100 - 550V, 10A/10A For SOFAR 3000TLM; DC Input: DC 100 - 550V, 12A/12A For SOFAR 3680TLM; DC Input: DC 100 - 550V, 13A/13A For SOFAR 4000TLM; DC Input: DC 100 - 550V, 15A/15A For SOFAR 4600TLM; DC Input: DC 100 - 550V, 15A/15A For SOFAR 5000TLM Output: AC 230V, 50/60Hz, Power: 3000VA / 3680VA / 4000VA / 4600VA / 5000VA Output Voltage/Current: SOFAR 3000TLM:AC 230V/13A; SOFAR 3680TLM:AC 230V/16A; SOFAR 4000TLM: AC 230V/17.5A; SOFAR 4680TLM: AC 230V/20A; SOFAR 5000TLM:AC 230V/22A
SOFTWARE VERSION	V1.00
HARDWARE VERSION	V1.00
THE HIGHEST OPERATING FREQUENCY	Below 108MHz
DATA CABLE SUPPLIED	DC Cable: Unshielded; Detachable 1.5m; AC Cable: Unshielded; Detachable 1.5m;

NOTE:

1. For the test results, the EUT had been tested with all conditions. But only the worst case was showed in test report.

2. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

3. All models shell include red, blue, white and other colors. All models of DC switch and WIFI module is optional accessories, optional installation according to the need of client.

4. This is a series of PV Grid Inverter with the same as in hardware except the amount of BUS capacitor, inverter inductor and Boost inductor are different. Identical in software the output power just adjusted by software; models SOFAR 3000TLM, SOFAR 4000TLM and SOFAR 5000TLM are selected to test. Full test was performed for the model SOFAR 5000TLM, and partial test for the models SOFAR 3000TLM and SOFAR 4000TLM.

Test Report No.: CE140609N058

Ratings .....:	SOFAR 3000TLM	SOFAR 3680TLM	SOFAR 4000TLM	SOFAR 4600TLM	SOFAR 5000TLM
Full Load MPP DC voltage range [V]:	160-500	165-500			175-500
Input DC voltage range [V].....:	100-550, max. 600				
Input DC current [A].....:	10A/10A	12A/12A	13A/13A	15A/15A	
Output AC voltage [V].....:	230V, 50/60Hz				
Output AC current [A] .....:	13A	16A	17.5A	20A	22A
Output power [VA] .....:	3000VA	3680VA	4000VA	4600VA	5000VA

5. Model Difference:

Difference:	SOFAR 3000TLM	SOFAR 3680TLM	SOFAR 4000TLM	SOFAR 4600TLM	SOFAR 5000TLM
Boost inductor	2.0mH	2.0mH	2.0mH	1.8mH	1.8mH
Bus capacitor	6pcs	6pcs	6pcs	8pcs	8pcs
Inverter inductor	1035uH	1035uH	1035uH	0.75mH	0.75mH

2.2 DESCRIPTION OF TEST MODES

The EUT was tested under the following modes' the final worst mode were marked in boldface and recorded in this report.

◆ For Conducted Emission Test

Test Mode	TEST VOLTAGE	Model
Grid and Full Load	DC 200V	SOFAR 3000TLM
Grid and Full Load	DC 200V	SOFAR 4000TLM
Grid and Full Load	**DC 200V**	**SOFAR 5000TLM**
Grid and Full Load	DC 360V	
Grid and Full Load	DC 500V	

◆ For Radiated Emission Test

Test Mode	TEST VOLTAGE	Model
Grid and Full Load	DC 200V	SOFAR 3000TLM
Grid and Full Load	DC 200V	SOFAR 4000TLM
Grid and Full Load	**DC 200V**	**SOFAR 5000TLM**
Grid and Full Load	DC 360V	
Grid and Full Load	DC 500V	

◆ For Harmonics and Flicker Tests

Test Mode	TEST VOLTAGE	Model
Grid and Full Load	**DC 200V**	**SOFAR 3000TLM**
Grid and Full Load	**DC 200V**	**SOFAR 5000TLM**

◆ For Immunity Test

Test Mode	TEST VOLTAGE	Model
Grid and 10% Load	**DC 200V**	**SOFAR 5000TLM**

2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT has been tested and complied with the requirements of the following standards:

EN 61000-6-3:2007 + A1:2011
EN 61000-3-2:2006 + A1:2009 + A2:2009
EN 61000-3-12:2011
EN 61000-3-3:2008
EN 61000-3-11:2000
EN 61000-6-2:2005
IEC 61000-4-2:2008
IEC 61000-4-3:2005 + A1:2007 + A2:2010
IEC 61000-4-4:2012
IEC 61000-4-5:2005
IEC 61000-4-6:2008
IEC 61000-4-8:2009

Notes: The above IEC basic standards are applied with latest version if customer has no special requirement

2.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	DC Source	Chroma	62150H-1000S	620028E00120	N/A
2	DC Source	Chroma	62150H-1000S	62150EF00488	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	AC Line: Unshielded, Detachable 2.0m, DC Line: Unshielded, Detachable 3.0m;
2	AC Line: Unshielded, Detachable 2.0m, DC Line: Unshielded, Detachable 3.0m;

3 EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

Note: (1) The lower limit shall apply at the transition frequencies.
(2) The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
(3) All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

3.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCS30	100199	May 17,14	May 16,15
Pulse Limiter	Rohde&Schwarz	ESH3-Z2	100168	Oct. 12,13	Oct. 11,14
Artificial Mains Network	Rohde&Schwarz	ESH2-Z5	100071	May 13,14	May 12,15
Test software	ADT	ADT_Cond_ V7.3.7	N/A	N/A	N/A

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in shielding room 843.

3.1.3 TEST PROCEDURE

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

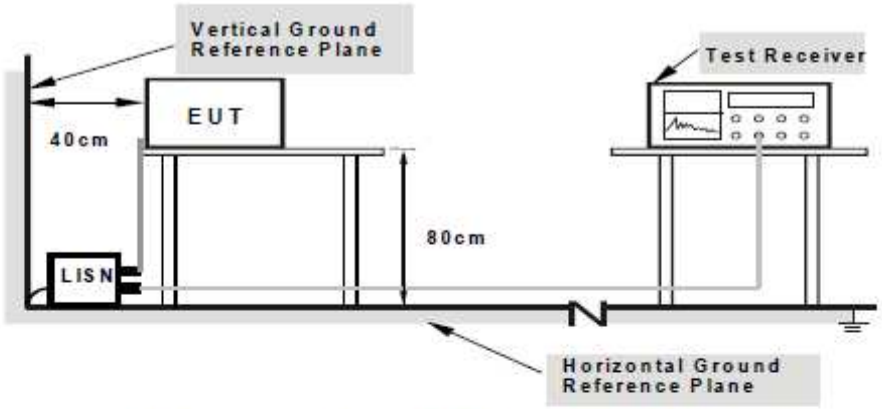
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20dB) were not recorded.

3.1.4 DEVIATION FROM TEST STANDARD

No deviation

3.1.5 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

3.1.6 EUT OPERATING CONDITIONS

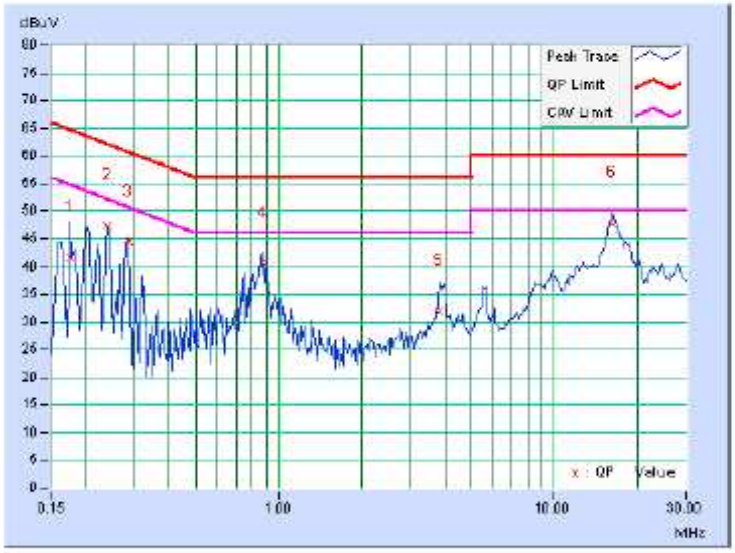
a. Turned on the power of all equipment.
b. EUT was operated according to the type description in manufacturer's specifications or the User's Manual.

3.1.7 TEST RESULTS

TEST MODE	Grid and Full Load	6dB BANDWIDTH	9 kHz
TEST VOLTAGE	DC 200V	PHASE	Line (L)
ENVIRONMENTAL CONDITIONS	25 deg. C, 55% RH	TESTED BY: Xue Wang	

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17344	6.50	35.32	22.14	41.82	28.64	64.79	54.79	-22.97	-26.15
2	0.23984	9.26	38.06	35.64	47.32	44.90	62.10	52.10	-14.78	-7.20
3	0.28281	9.35	35.12	33.14	44.47	42.49	60.73	50.73	-16.26	-8.24
4	0.88047	9.74	30.88	23.04	40.62	32.78	56.00	46.00	-15.38	-13.22
5	3.83984	9.96	22.02	16.66	31.98	26.62	56.00	46.00	-24.02	-19.38
6	**16.16016**	**10.43**	**37.46**	**34.10**	**47.89**	**44.53**	**60.00**	**50.00**	**-12.11**	**-5.47**

REMARKS: The emission levels of other frequencies were very low against the limit.

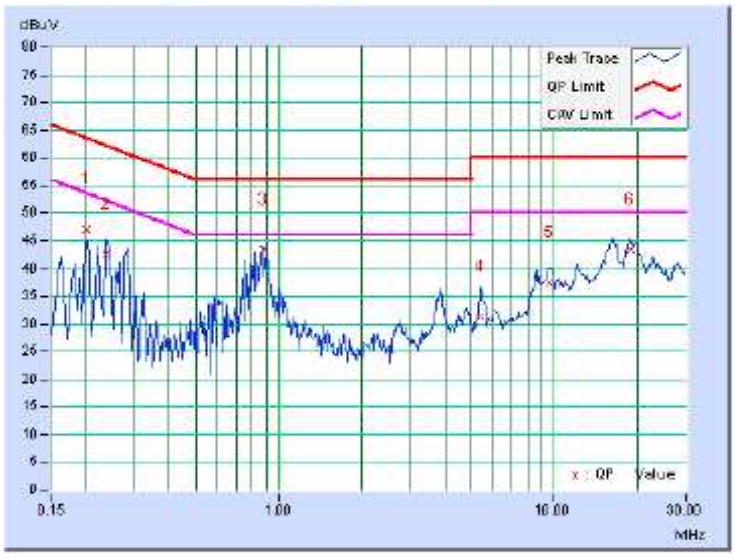


Test Report No.: CE140609N058

TEST MODE	Grid and Full Load	6dB BANDWIDTH	9 kHz
TEST VOLTAGE	DC 200V	PHASE	Neutral (N)
ENVIRONMENTAL CONDITIONS	25 deg. C, 55% RH	TESTED BY: Xue Wang	

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.20078	9.17	38.06	30.38	47.23	39.55	63.58	53.58	-16.35	-14.03
2	0.23594	9.25	33.26	28.46	42.51	37.71	62.24	52.24	-19.73	-14.53
3	0.88047	9.72	33.72	25.42	43.44	35.14	56.00	46.00	-12.56	-10.86
4	5.40234	10.03	21.28	15.10	31.31	25.13	60.00	50.00	-28.69	-24.87
5	9.55859	10.17	27.22	22.30	37.39	32.47	60.00	50.00	-22.61	-17.53
6	18.85938	10.41	32.98	28.08	43.39	38.49	60.00	50.00	-16.61	-11.51

REMARKS: The emission levels of other frequencies were very low against the limit.



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

TEST STANDARD: EN 61000-6-3

FOR FREQUENCY BELOW 1000 MHz

FREQUENCY (MHz)	Class B (at 3m)	Class B (at 10m)
	Quasi-Peak (dBuV/m)	Quasi-Peak (dBuV/m)
30 – 230	40	30
230 – 1000	47	37

FREQUENCY RANGE OF RADIATED MEASUREMENT
(For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	Up to 5 times of the highest frequency or 6 GHz, whichever is less

FOR FREQUENCY ABOVE 1000 MHz

FREQUENCY (GHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
1 to 3	76	56	70	50
3 to 6	80	60	74	54

NOTE: (1) The lower limit shall apply at the transition frequencies.
(2) Emission level (dBuV/m) = 20 log Emission level (uV/m).
(3) All emanation from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

3.2.2 TEST INSTRUMENTS

Frequency Range 30MHz-1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	100962	Mar. 06,14	Mar. 05,15
EMI Test Receiver	Rohde&Schwarz	ESU 26	100005	May 13,14	May 12,15
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-554	Dec. 03, 13	Dec. 02, 14
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-555	Dec. 03, 13	Dec. 02, 14
Signal Amplifier	Agilent	8447D	2944A10488	Jun. 25,14	Jun. 24,15
Signal Amplifier	Agilent	8447D	2944A11174	Jun. 25,14	Jun. 24,15
10m Semi-anechoic Chamber	CHANGLING	21.4m*12.1m*8.8m	NSEMC006	May 15, 14	May 14, 15
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A

Frequency Range Above1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	100962	Mar. 06,14	Mar. 05,15
EMI Test Receiver	Rohde&Schwarz	ESU 26	100005	May 13,14	May 12,15
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV40	101003	Apr. 9, 14	Apr. 8, 15
Pre-Amplifier (100MHz-26.5GHz)	EMCI	EMC 012645	980077	Jun. 16,14	Jun. 15,15
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Nov. 04,13	Nov. 03,14
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A

NOTE: 1. The test was performed in 10m Chamber.
2. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Horn Antenna	ETS-Lindgren	3117	00085519	Feb. 02,13	Feb. 01,15

NOTE: 1. The test was performed in 10m Chamber.
2. The calibration interval of the above test instruments is 24 months. And the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170242	Feb. 13,14	Feb. 12,17

NOTE: 1. The test was performed in 10m Chamber.
2. The calibration interval of the above test instruments is 36 months. And the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

3.2.3 TEST PROCEDURE

<Frequency Range below 1GHz>

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
4. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier).
5. Margin value = Emission level – Limit value.

<Frequency Range above 1GHz>

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter Semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna can be varied from one meter-to four meters, the height of adjustment depends on the EUT height and the antenna 3dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. The bore sight should be used during the test above 1GHz.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test receiver/spectrum was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

NOTE:

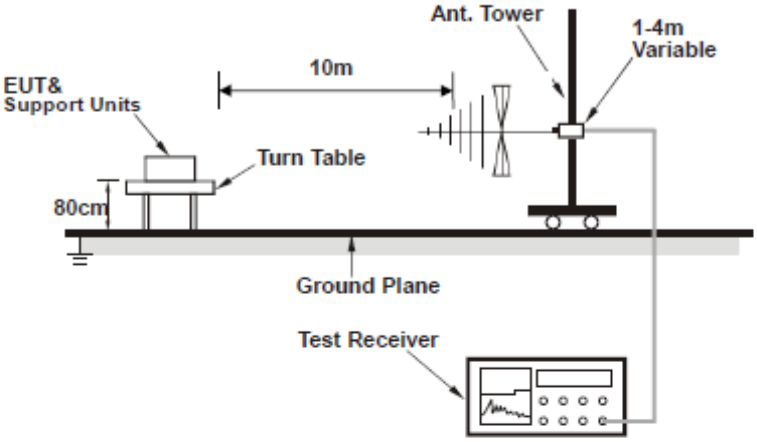
1. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.
2. For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
3. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
4. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
5. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier).
6. Margin value = Emission level – Limit value.

3.2.4 DEVIATION FROM TEST STANDARD

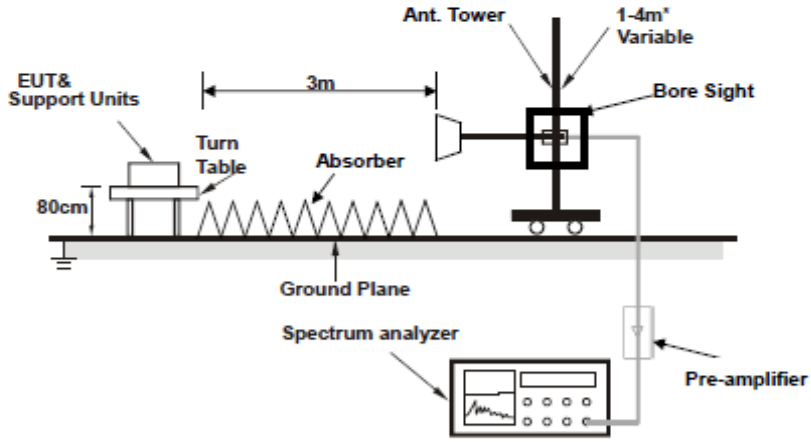
No deviation

3.2.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



* : depends on the EUT height and the antenna 3dB beamwidth both, refer to section 7.3 of CISPR 16-2-3.

3.2.6 EUT OPERATING CONDITIONS

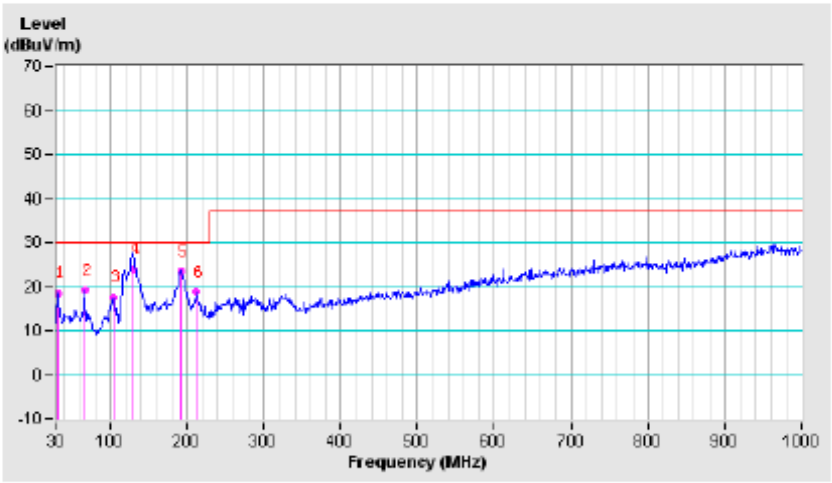
Same as item 3.1.6

3.2.7 TEST RESULTS

TEST MODE	Grid and Full Load	FREQUENCY RANGE	30-1000 MHz
TEST VOLTAGE	DC 200V	DETECTOR FUNCTION & BANDWIDTH	Quasi-Peak, 120kHz
ENVIRONMENTAL CONDITIONS	23 deg. C, 64% RH	TESTED BY: Kery He	

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 10 M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	32.304	-15.00	33.47	18.47	30.00	-11.53	400	108
2	66.981	-15.79	34.79	19.00	30.00	-11.00	400	140
3	104.205	-16.99	34.60	17.61	30.00	-12.39	400	182
4	129.789	-15.08	38.98	23.90	30.00	-6.10	400	347
5	192.111	-15.66	39.11	23.45	30.00	-6.55	400	116
6	212.118	-15.57	34.24	18.67	30.00	-11.33	400	93

REMARKS: The emission levels of other frequencies were very low against the limit.

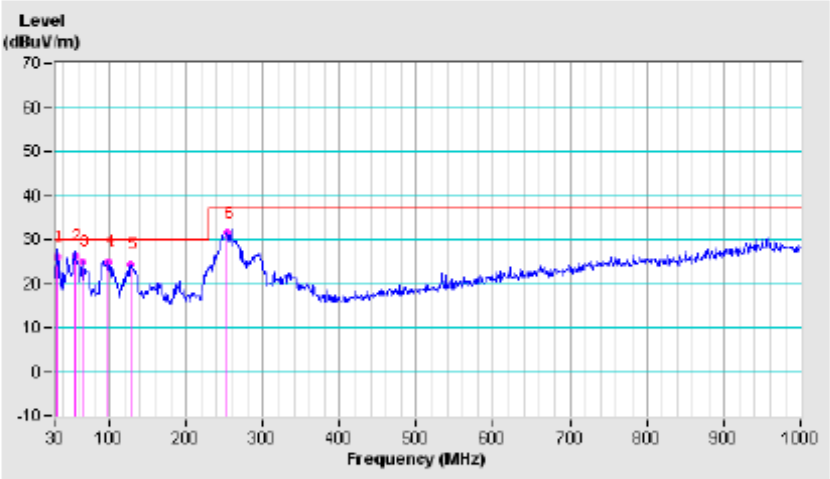


Test Report No.: CE140609N058

TEST MODE	Grid and Full Load	FREQUENCY RANGE	30-1000 MHz
TEST VOLTAGE	DC 200V	DETECTOR FUNCTION & BANDWIDTH	Quasi-Peak, 120kHz
ENVIRONMENTAL CONDITIONS	23 deg. C, 64% RH	TESTED BY: Kery He	

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 10 M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	32.789	-14.91	40.91	26.00	30.00	-4.00	100	212
2	**54.856**	**-14.43**	**40.77**	**26.34**	**30.00**	**-3.66**	**100**	**92**
3	65.647	-15.59	40.51	24.92	30.00	-5.08	100	323
4	99.234	-17.19	42.17	24.98	30.00	-5.02	100	207
5	127.606	-14.85	39.16	24.31	30.00	-5.69	100	347
6	252.494	-13.04	44.64	31.60	37.00	-5.40	100	342

REMARKS: The emission levels of other frequencies were very low against the limit.



3.3 HARMONICS CURRENT MEASUREMENT (<16A)

3.3.1 LIMITS OF HARMONICS CURRENT MEASUREMENT

TEST STANDARD: EN 61000-3-2

Limits for Class A equipment	
Harmonic Order n	Max. permissible harmonics current A
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15<=n<=39	0.15x15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8<=n<=40	0.23x8/n

Limits for Class D equipment		
Harmonic Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd Harmonics only		
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
13	0.30	0.21
15<=n<=39	3.85/n	0.15x15/n

NOTE: 1. Class A and Class D are classified according to section 5 of EN 61000-3-2.

2. According to section 7 of EN 61000-3-2, the above limits for all equipment except for lighting equipment having an active power input> 75 W and no limits apply for equipment with an active power input up to and including 75 W.

♦ **Limits for Class B equipment:**

For class B equipment, the harmonics of the input current shall not exceed the maximum permissible values given for class A equipment multiplied by a factor of 1.5.

Limits for Class C equipment	
Harmonic Order n	Max. permissible harmonics current expressed as a percentage of the input current at the fundamental frequency %
2	2
3	30· λ*
5	10
7	7
9	5
11<=n<=39 (odd harmonics only)	3
* λ is the circuit power factor	

NOTE: Discharge lighting equipment having an active TEST VOLTAGE smaller than or equal to 25W, the harmonic currents shall not exceed the power related limits of Class D.

3.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
PRECISION POWER ANALYZER	YOKOGAWA	WT3000	91M210852	Mar. 12,14	Mar. 11,15
Test Software	YOKOGAWA	IEC61000	N/A	N/A	N/A
PEFERENCE IMPEDANCE NETWORK	Voltech	EUR	3018	N/A	N/A

NOTE: 1. The test was performed in PV Room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

3.3.3 TEST PROCEDURE

a. The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

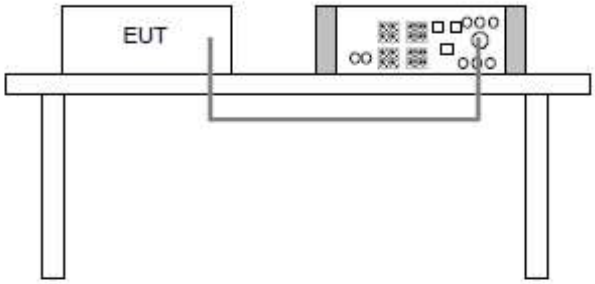
b. The classification of EUT is according to section 5 of EN 61000-3-2:2006 + A1:2009 + A2:2009.
The EUT is classified as follows:
Class A: Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.
Class B: Portable tools. ; Arc welding equipment which is not professional equipment
Class C: Lighting equipment.
Class D: Equipment having a specified power less than or equal to 600 W of the following types: Personal computers and personal computer monitors and television receivers.

c. The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.

3.3.4 DEVIATION FROM TEST STANDARD

No deviation

3.3.5 TEST SETUP



3.3.6 EUT OPERATING CONDITIONS

Same as item 3.1.6

Test Report No.: CE140609N058

3.3.7 TEST RESULTS

SOFAR 3000TLM

******** appliances (Average)**

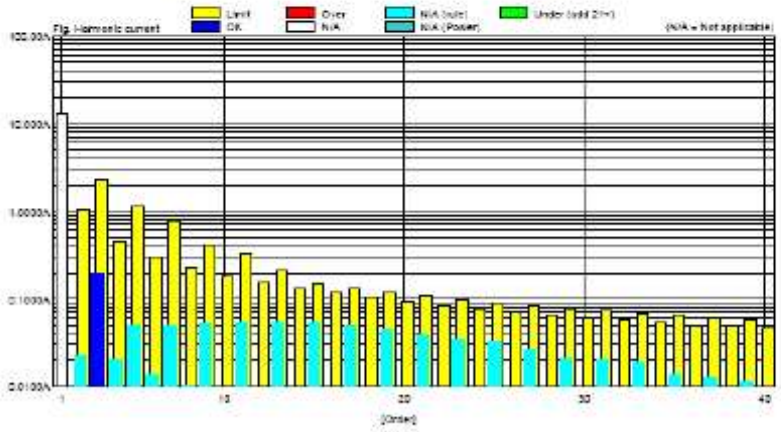
Print Date	Mon Aug 11 09:00:05 2014
MeasureDate	Mon Aug 11 09:00:40 2014
Comment	Experimental model Pattern A

Regulation	IEC61000-3-2 Ed3.0 am2 IEC61000-4-7 Ed2.0 A1
Class	CLASS A
MeasureTime	180.00sec
Mode	YOKOGAWA WT3000
Rating Voltage	230.00 V
Wiring	single-phase 2-wire
Element	1
Range	300V/50A
Current(rms)	13.0145 A
Voltage(rms)	231.00 V
Frequency	50.000 Hz
Power Factor	0.9991
POHC Limit	0.2514 A
POHC Max	0.0726 A
THC	0.2551 A

PASS

Set Fundamental I	----------
Set Power Factor	----------
Set P	----------
Sigma W Max	3006.210 W
Sigma PF	0.9991
Distortion factor(V)	0.05 %
V THD6	0.05 %
V THDG	0.05 %
Distortion factor(A)	1.90 %
A THD6	1.94 %
A THDG	1.97 %
P THD	0.00 %
Power Limit	75 W

Order	Measure[A]	Limit[A]	Margin[%]	Order	Measure[A]	Limit[A]	Margin[%]
1	13.0120			2	[illegible]	1.0800	97.9
3	0.1912	2.3000	91.7	4	[illegible]	0.4300	95.3
5	[illegible]	1.1400	95.5	6	[illegible]	0.3000	96.3
7	[illegible]	0.7700	93.7	8	[illegible]	0.2300	95.6
9	[illegible]	0.4000	95.9	10	[illegible]	0.1840	95.2
11	[illegible]	0.3300	93.8	12	[illegible]	0.1533	94.9
13	[illegible]	0.2100	74.2	14	[illegible]	0.1314	94.4
15	[illegible]	0.1500	85.3	16	[illegible]	0.1150	85.7
17	[illegible]	0.1324	61.9	18	[illegible]	0.1022	92.9
19	[illegible]	0.1184	92.9	20	[illegible]	0.0920	92.9
21	[illegible]	0.1071	63.6	22	[illegible]	0.0836	93.5
23	[illegible]	0.0978	63.5	24	[illegible]	0.0767	92.3
25	[illegible]	0.0900	65.3	26	[illegible]	0.0708	93.0
27	[illegible]	0.0833	66.3	28	[illegible]	0.0657	93.0
29	[illegible]	0.0776	72.1	30	[illegible]	0.0613	91.6
31	[illegible]	0.0726	72.8	32	[illegible]	0.0576	92.3
33	[illegible]	0.0682	73.4	34	[illegible]	0.0541	95.2
35	[illegible]	0.0643	78.4	35	[illegible]	0.0511	95.0
37	[illegible]	0.0605	79.5	38	[illegible]	0.0484	93.0
39	[illegible]	0.0577	80.9	40	[illegible]	0.0460	90.6



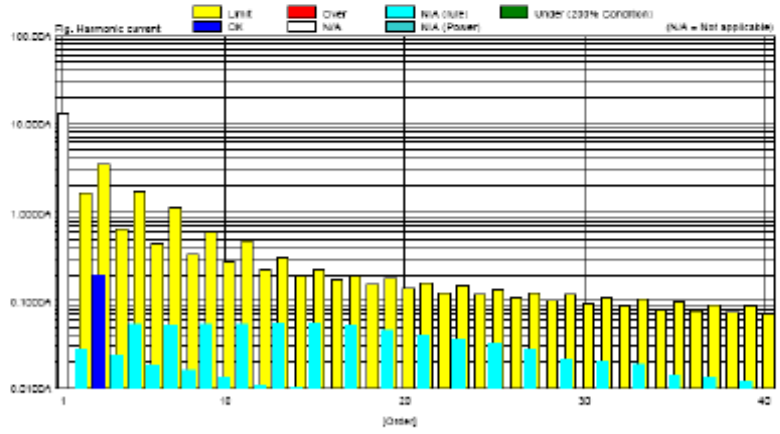
Test Report No.: CE140609N058

***** appliances (Maximum)

Print Date	:	Mon Aug 11 09:00:45 2014
Measuredate	:	Mon Aug 11 08:00:30 2014
Comment	:	Experimental model Pattern A

Regulation	:	IEC61000-3-2 Ed3.0 am2 IEC61000-3-3 Ed2.0 A1	PASS		
Class	:	CLASS A			
MeasureTime	:	150.00sec	Set Fundamental	:	--------
Model	:	YOKOGAWA WT3000	Set Power Factor	:	--------
Rating Voltage	:	230.00 V	Set P	:	--------
Wiring	:	single-phase 2-wire	Sigma W Max	:	3005.210 W
Element	:	1	Sigma PF	:	0.9992
Range	:	300V/30A	Distortion factor(V)	:	0.05 %
Current(rms)	:	13.0254 A	V THD3	:	0.05 %
Voltage(rms)	:	251.05 V	V THDG	:	0.05 %
Frequency	:	50.006 Hz	Distortion factor(A)	:	1.97 %
Power Factor	:	0.9992	A THD3	:	2.01 %
Beyond Limit Time	:	15.0000 s	A THDG	:	2.03 %
Beyond Total Time	:	0.0000 s	P THD	:	0.00 %
THC	:	0.2500 A	Power Limit	:	75 W

Order	Measure[A]	Limit[A]	Margin[%]	Order	Measure[A]	Limit[A]	Margin[%]
1	13.0220			2	0.0072	1.0200	99.3
3	0.1941	3.4500	94.4	4	0.0034	0.6450	99.4
5	0.0545	1.7100	96.8	6	0.0178	0.4500	96.0
7	0.0520	1.1550	95.5	8	0.0158	0.3450	95.4
9	0.0539	0.8000	93.0	10	0.0126	0.2750	95.4
11	0.0551	0.4950	88.9	12	0.0108	0.2300	95.3
13	0.0534	0.3150	82.4	14	0.0103	0.1971	94.8
15	0.0561	0.2250	75.1	16	0.0098	0.1725	94.3
17	0.0515	0.1686	74.0	18	0.0093	0.1533	93.9
19	0.0452	0.1776	74.6	20	0.0084	0.1300	93.5
21	0.0407	0.1607	74.7	22	0.0078	0.1255	93.8
23	0.0366	0.1467	75.1	24	0.0073	0.1150	93.7
25	0.0321	0.1350	76.2	26	0.0061	0.1062	94.2
27	0.0272	0.1250	78.2	28	0.0057	0.0986	94.2
29	0.0223	0.1164	80.8	30	0.0051	0.0920	94.4
31	0.0200	0.1089	80.9	32	0.0053	0.0862	93.8
33	0.0187	0.1023	81.7	34	0.0049	0.0812	94.0
35	0.0145	0.0964	85.0	36	0.0078	0.0767	89.8
37	0.0139	0.0912	85.9	38	0.0048	0.0726	93.5
39	0.0119	0.0866	86.4	40	0.0048	0.0690	93.0



3.4 HARMONICS CURRENT MEASUREMENT (>16A)

3.4.1 LIMITS OF HARMONICS CURRENT MEASUREMENT

TEST STANDARD: EN 61000-3-12

3.4.2 CURRENT EMISSION LIMITS FOR EQUIPMENT OTHER THAN BALANCED THREE-PHASE EQUIPMENT

Minimal R_{sce}	Admissible individual harmonic current I_n/I_1 [a] %						Admissible harmonic current distortion factors %	
	I_3	I_5	I_7	I_9	I_{11}	I_{13}	THD	$PWHD$
33	21,6	10,7	7,2	3,8	3,1	2	23	23
66	24	13	8	5	4	3	26	26
120	27	15	10	6	5	4	30	30
250	35	20	13	9	8	6	40	40
≥ 350	41	24	16	12	10	8	47	47

The relative values of even harmonics up to order 12 shall not exceed 16/n %. Even harmonics above order 12 are taken into account in THD and $PWHD$ in the same way as odd order harmonics.

NOTE Linear interpolation between successive R_{sce} values is permitted. See also Annex B.

[a] I_1 = reference fundamental current; I_n = harmonic current component.

3.4.3 CURRENT EMISSION LIMITS FOR BALANCED THREE-PHASE EQUIPMENT

Minimal R_{sce}	Admissible individual harmonic current I_n/I_1 [a] %				Admissible harmonic current distortion factors %	
	I_5	I_7	I_{11}	I_{13}	THD	$PWHD$
33	10.7	7.2	3.1	2	13	22
66	14	9	5	3	16	25
120	19	12	7	4	22	28
250	31	20	12	7	37	38
≥350	40	25	15	10	48	46

The relative values of even harmonics up to order 12 shall not exceed 16/n %. Even harmonics above order 12 are taken into account in THD and $PWHD$ in the same way as odd order harmonics.

NOTE Linear interpolation between successive R_{sce} values is permitted. See also Annex B.

[a] I_1 = reference fundamental current; I_n = harmonic current component.

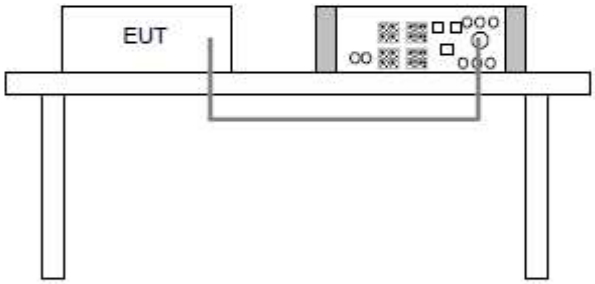
3.4.4 CURRENT EMISSION LIMITS FOR BALANCED THREE-PHASE EQUIPMENT UNDER SPECIFIED CONDITIONS

Minimal R_{sce}	Admissible individual harmonic current I_n/I_1 [a] %				Admissible harmonic current distortion factors %	
	I_5	I_7	I_{11}	I_{13}	THD	$PWHD$
33	10.7	7.2	3.1	2	13	22
≥120	40	25	15	10	48	46
The relative values of even harmonics up to order 12 shall not exceed 16/n %. Even harmonics above order 12 are taken into account in THD and $PWHD$ in the same way as odd order harmonics.						
NOTE Linear interpolation between successive R_{sce} values is permitted. See also Annex B.						
[a] I_1 = reference fundamental current; I_n = harmonic current component.						

3.4.5 DEVIATION FROM TEST STANDARD

No deviation

3.4.6 TEST SETUP



3.4.7 EUT OPERATING CONDITIONS

Same as item 3.1.6

Test Report No.: CE140609N058

3.4.8 TEST RESULTS

SOFAR 5000TLM

***** appliances

Print Date	:	Fri Aug 08 11:50:14 2014
MeasureDate	:	Fri Aug 08 11:48:53 2014
Comment	:	Experimental model Pattern A

Regulation	:	IEC61000-3-12 IEC61000-4-7 Ed2.0 A1
MeasureTime	:	150sec
Model	:	YOKOGAWA WT3000
Wiring	:	single-phase 2-wire
Element	:	1
Range	:	300V/30A
Rating Voltage	:	230 V
Iequ	:	16.0000 A
Z Impedance	:	0.1200 ohm
I1	:	21.4465 A
Power Rsce	:	127.779
Max Rsce	:	33.000

PASS

Ssc	:	341550.00
Min Rsce	:	33.0000
Apply Limit	:	equipment other than balanced 3-phase.
Situation1	:	1.35% (Pass)
Term a	:	224.46 - 241.85deg (Fail)
Term c(5)	:	0.36% (Pass)
Term c(7)	:	0.26% (Pass)

[Average]

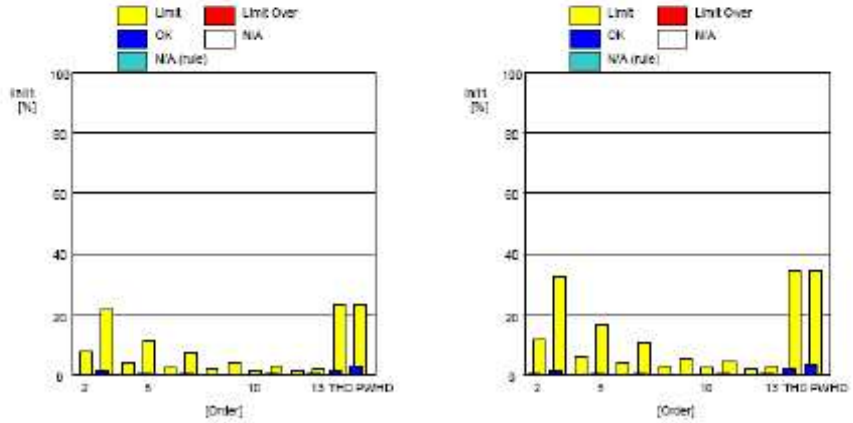
Voltage(rms)	:	233.18 V
Current(rms)	:	21.45 A
Frequency	:	50.00 Hz
Power Factor	:	1.00
Sigma W	:	4997.80 W
THC	:	0.37 A
V THD	:	0.07 %
A THD	:	1.72 %
P THD	:	0.00 %

[Maximum]

Voltage(rms)	:	234.53 V
Current(rms)	:	21.48 A
Frequency	:	50.01 Hz
Power Factor	:	0.99
Sigma W	:	5000.74 W
THC	:	0.37 A
V THD	:	0.38 %
A THD	:	1.77 %
P THD	:	0.00 %

Order	Measure[%]	Limit[%]	Margin[%]
2	0.2218	8.0000	97.1
3	1.9363	21.9600	90.9
4	0.1808	4.0000	95.3
5	0.3432	11.2000	97.0
6	0.1369	2.6667	94.9
7	0.2541	7.3250	96.4
8	0.1021	2.0000	94.9
9	0.2387	3.8250	93.8
10	0.1568	1.6000	90.1
11	0.4152	3.1000	86.6
12	0.0527	1.3333	92.8
13	0.3246	2.0600	83.8
THD	1.7141	23.4750	92.7
PWHD	3.1693	23.4750	86.5

Order	Measure[%]	Limit[%]	Margin[%]
2	0.2804	12.0000	97.8
3	1.3486	32.9700	95.9
4	0.2148	6.0000	96.4
5	0.3555	16.9800	97.9
6	0.1706	4.0000	95.7
7	0.2789	10.9875	97.5
8	0.1425	3.0000	95.3
9	0.2458	5.7375	95.7
10	0.1778	2.4000	92.6
11	0.4233	4.7400	91.1
12	0.1113	2.0000	94.4
13	0.3452	3.0600	88.8
THD	1.7556	35.2125	95.0
PWHD	3.3078	35.2125	90.4



3.5 VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

3.5.1 LIMITS OF VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

TEST STANDARD: EN 61000-3-3

TEST ITEM	LIMIT	NOTE
P_{st}	1.0	P_{st} means short-term flicker indicator.
P_{lt}	0.65	P_{lt} means long-term flicker indicator.
$T_{d(t)}$ (ms)	500	$T_{d(t)}$ means maximum time that d(t) exceeds 3.3%.
d_{max} (%)	4	dmax means maximum relative voltage change.
dc (%)	3.3	dc means relative steady-state voltage change

TEST STANDARD: EN 61000-3-11

The test conditions specified in Annex A of EN 61000-3-3 shall be applicable to equipment rated ≤16A

The test impedance Z_{test} may be lower than Z_{ref}, particularly for equipment having a rated input current >16 A. To find the optimal test impedance, two conditions shall be met.

- firstly, the voltage drop, ΔU, caused by the equipment shall be within the range 3 % to 5 % of the test supply voltage;
- secondly, the ratio of inductive to resistive components of Z_{test} given by X_{test} / R_{test} shall be within the range 0,5 to 0,75 (i.e. similar to the ratio of the components of Z_{ref}).

NOTE The 3 % to 5 % condition ensures that the relative current changes of the equipment in the real network situation will be nearly the same as those during the test.

The test shall be made with the test circuit specified in Figure 1, except that the impedance Z_{ref} is replaced with Z_{test}. Four values $d_{c\ test}$, $d_{max\ test}$, $P_{st\ test}$ and $P_{lt\ test}$ shall be measured. The definitions of d_c, d_{max}, P_{st}, and P_{lt} are given in IEC 61000-3-3.

3.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
PRECISION POWER ANALYZER	YOKOGAWA	WT3000	91M210852	Mar. 12,14	Mar. 11,15
Test Software	YOKOGAWA	IEC61000	N/A	N/A	N/A
PEFERENCE IMPEDANCE NETWORK	Voltech	EUR	3018	N/A	N/A

NOTE: 1. The test was performed in PV Room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

3.5.3 TEST PROCEDURE

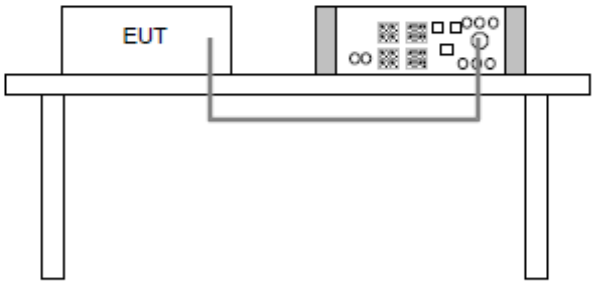
a. The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under Normal Operating conditions.

b. During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 120 minutes

3.5.4 DEVIATION FROM TEST STANDARD

No deviation

3.5.5 TEST SETUP



3.5.6 EUT OPERATING CONDITIONS

Same as item 3.1.6.

Test Report No.: CE140609N058

3.5.7 TEST RESULTS

SOFAR 3000TLM

***** appliances

Print Date	: Mon Aug 11 11:19:39 2014
MeasureDate	: Mon Aug 11 11:09:44 2014
Comment	: Experimental model Pattern A

Regulation	: IEC61000-3-3 Ed2.0 IEC61000-4-15 Ed1.1
Interval	: 10Min0Sec
Model	: YOKOGAWA WT3000
Wiring	: single-phase 2wire
Voltage Range	: 300.00V
Voltage U1	: 236.78V
Set Frequency	: 50Hz
Frequency U1	: 50.000Hz
Element	: 1
dmin	: 0.10%

PASS

Element1		: Pass
dc	(3.30%)	: Pass
dmax	(4.00%)	: Pass
d(t)	(500ms)	: Pass
Pst	(1.00)	: Pass
Plt	(0.65)	: Pass

No.	dc[%]	dmax[%]	d(t)[ms]	Pst
1	0.06	0.10	0.00	0.17
2	0.00	0.00	0.00	0.17
3	0.04	0.14	0.00	0.17
4	0.04	0.14	0.00	0.17
5	0.00	0.00	0.00	0.17
6	0.06	0.14	0.00	0.17
7	0.05	0.12	0.00	0.17
8	0.05	0.13	0.00	0.17
9	0.02	0.11	0.00	0.17
10	0.05	0.13	0.00	0.17
11	0.00	0.00	0.00	0.17
12	0.04	0.13	0.00	0.17

Plt
0.17

Test Report No.: CE140609N058

SOFAR 5000TLM

***** appliances

Print Date : Fri Aug 08 17:14:15 2014
MeasureDate : Fri Aug 08 17:14:05 2014
Comment : Experimental model Pattern A

Regulation : IEC61000-3-11 Ed1.0
IEC61000-4-15 Ed1.1
Interval : 10Min0Sec
Model : YOKOGAWA WT3000
Wiring : single-phase 2wire
Voltage Range : 300.00V
Voltage U1 : 240.84V
Set Frequency : 50Hz
Frequency U1 : 50.002Hz
Element : 1
dmin : 0.10%

PASS

Compatibility Condition		: Compliance with IEC61000-3-3
Element1		: Pass
dc	(3.30%)	: Pass
dmax	(4.00%)	: Pass
d(t)	(500ms)	: Pass
Pst	(1.00)	: Pass
Plt	(0.65)	: Pass

No.	dc[%]	dmax[%]	d(t)[ms]	Pst
1	0.14	0.27	0.00	0.26
2	0.04	0.21	0.00	0.25
3	0.02	0.21	0.00	0.26
4	0.03	0.21	0.00	0.26
5	0.03	0.20	0.00	0.26
6	0.02	0.21	0.00	0.25
7	0.02	0.20	0.00	0.25
8	0.01	0.20	0.00	0.26
9	0.00	0.00	0.00	0.25
10	0.00	0.00	0.00	0.25
11	0.00	0.00	0.00	0.26

Plt
0.26

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4 IMMUNITY TEST

4.1 GENERAL DESCRIPTION

4.1.1 GENERAL DESCRIPTION OF EN 61000-6-2

Product Standard:	EN 61000-6-2:2005	
Basic Standard, specification requirement, and Performance Criteria:	IEC 61000-4-2	Electrostatic Discharge – ESD: 4kV Contact discharge, 8kV air discharge, Performance Criterion B
	IEC 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80-1000 MHz, 10V/m, 80% AM (1kHz), 1400-2000 MHz, 3V/m, 80% AM (1kHz) 2000-2700 MHz, 1V/m, 80% AM (1kHz) Performance Criterion A
	IEC 61000-4-4	Electrical Fast Transient/Burst - EFT AC Power line: 2kV, DC Power line: 2kV Signal line: 1kV Performance Criterion B
	IEC 61000-4-5	Surge Immunity Test: 1.2/50 us Open Circuit Voltage, 8 /20 us Short Circuit Current, AC Power Line: line to line 1 kV, line to earth 2kV DC Power Line: line to line 0.5kV line to earth 0.5kV Signal line: 1kV Performance Criterion B
	IEC 61000-4-6	Conducted Radio Frequency Disturbances Test – CS: 0.15-80 MHz, 10Vrms, 80% AM, 1kHz, Performance Criterion A
	IEC 61000-4-8	Power Frequency Magnetic Field Test, 50 Hz, 30A/m, Performance Criterion A

4.1.2 PERFORMANCE CRITERIA

According to Clause 4 of EN 61000-6-2:2005 standard, the following describes the general performance criteria.

CRITERION A	The apparatus shall continue to operate as intended during and 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. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if 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. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if 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.

4.1.3 EUT OPERATING CONDITION

Same as item 3.1.6

4.2 ELECTROSTATIC DISCHARGE IMMUNITY TEST (ESD)

4.2.1 TEST SPECIFICATION

Basic Standard:	IEC 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Discharge Voltage:	Air Discharge: 8 kV (Direct) Contact Discharge: 4 kV (Indirect)
Polarity:	Positive & Negative
Number of Discharge:	20 times at each test point
Discharge Mode:	Single Discharge
Discharge Period:	1 second

4.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
ESD Generator	TESEQ	NSG 437	279	Oct. 12, 13	Oct. 11, 14
Test Software	TESEQ	V03.03	N/A	N/A	N/A
ESD Generator	EM TEST	Dito	V1211112265	Jun. 19,14	Jun. 18,15
Test Software	EM TEST	V 2.31	N/A	N/A	N/A

NOTE: 1. The test was performed in ESD Room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

4.2.3 TEST PROCEDURE

The basic test procedure was in accordance with IEC 61000-4-2:

a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.

b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

c. The time interval between two successive single discharges was at least 1 second.

d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.

e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.

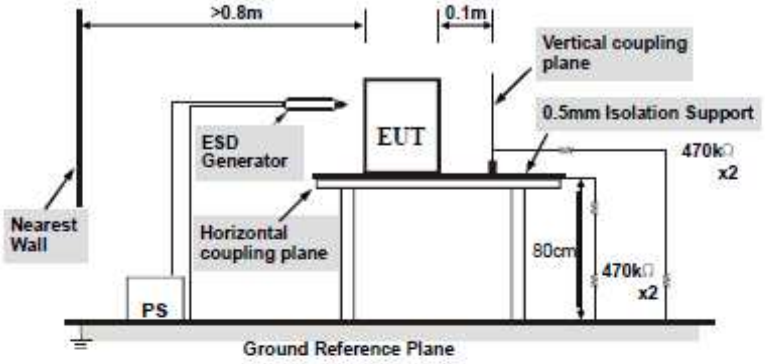
g. At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator was positioned horizontal at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.

h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.

4.2.4 DEVIATION FROM TEST STANDARD

No Deviation

4.2.5 TEST SETUP



NOTE:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A Horizontal Coupling Plane (1.6m x 0.8m) was placed on the table and attached to the GRP by means of a cable with 940kΩ total impedance. The equipment under test, was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were placed on the HCP and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

4.2.6 TEST RESULTS

TEST MODE	See item 2.2	TEST VOLTAGE	DC 200V
ENVIRONMENTAL CONDITIONS	22.8deg. C, 45.1% RH 101.3kPa	TESTED BY: Heise Chen	

Direct Discharge Application				
Test Level (kV)	Polarity	Test Point	Test Result of Contact Discharge	Test Result of Air Discharge
4	+/-	All Metal Part	A	N/A
8	+/-	All Non-metal Part	N/A	A

Indirect Discharge Application				
Discharge Level (kV)	Polarity	Test Point	Test Result of HCP	Test Result of VCP
4	+/-	HCP&VCP	A	A

NOTE: A: There was no change compared with initial operation during the test.

4.3 RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD IMMUNITY TEST (RS)

4.3.1 TEST SPECIFICATION

Basic Standard:	IEC 61000-4-3
Frequency Range:	80-1000MHz, 1400-2000MHz, 2000-2700MHz
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
Antenna Height:	1.5m
Dwell Time:	at least 3 seconds

4.3.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Signal Generator	Agilent	N5181A	MY50142530	Nov. 01,13	Oct. 31,14
Antenna Log-Periodic	CORAD	ATR80M6G	0337307	N/A	N/A
Antenna Log-Periodic	CORAD	ATS700M11G	0336821	N/A	N/A
Switch Controller	CORAD	SC1000	0337343	N/A	N/A
RF Power Meter	ESE	4242	13984	Nov. 04,13	Nov. 03,14
Power Sensor	ESE	51011EMC	35716	Nov. 04,13	Nov. 03,14
Power Sensor	ESE	51011EMC	35715	Nov. 04,13	Nov. 03,14
E-Field probe	Narda	NBM-520	2403/01B	May 07,14	May 06,15
Power Amplifier	TESEQ	CBA 1G-150	T44029	N/A	N/A
Power Amplifier	TESEQ	CBA 3G-100	T44030	N/A	N/A
Power Amplifier	TESEQ	CBA 6G-050	1041204	N/A	N/A
Dual Directional Coupler	TESEQ	C5982	95208	Dec. 23,13	Dec. 22,14
Dual Directional Coupler	TESEQ	C6187	95175	Dec. 23,13	Dec. 22,14
Dual Directional Coupler	TESEQ	CPH-274F	M251304-01	Dec. 23,13	Dec. 22,14
Test Software	ADT	BVADT_RS_V7.6.4-DG	N/A	N/A	N/A

NOTE: 1. The test was performed in RS chamber.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

4.3.3 TEST PROCEDURE

The test procedure was in accordance with IEC 61000-4-3

a. The testing was performed in a fully-anechoic chamber.

b. The frequency range is swept from 80 MHz to 1000 MHz, 1400MHz to 2000MHz, 2000MHz to 2700MHz with the signal 80% amplitude modulated with a 1kHz sine wave.

c. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0,5s.

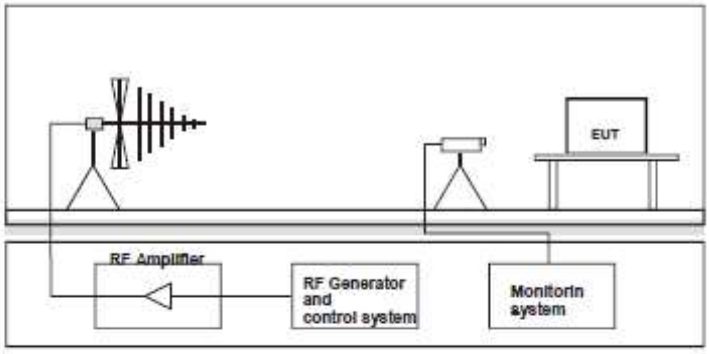
d. The field strength levels were 10V/m, 3V/m, 1V/m.

e. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

4.3.4 DEVIATION FROM TEST STANDARD

No Deviation

4.3.5 TEST SETUP



NOTE:

TABLETOP EQUIPMENT
The EUT installed in a representative system as described in section 7 of IEC 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR STANDING EQUIPMENT
The EUT installed in a representative system as described in section 7 of IEC 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

4.3.6 TEST RESULTS

TEST MODE	See item 2.2	TEST VOLTAGE	DC 200V
ENVIRONMENTAL CONDITIONS	24.5deg. C, 56.3% RH	TESTED BY: Heise Chen	

Field Strength (V/m)	Test Frequency Note#1 (MHz)	Polarization of antenna (Horizontal / Vertical)	Test Distance (m)	Test Result	Remark
10	80 - 1000	H&V	3	A	N/A
3	1400 - 2000	H&V	3	A	N/A
1	2000 - 2700	H&V	3	A	N/A

Note#1:

Tested Israel SII Frequencies 89,100,107,144,163,196,244,315,434,460,600,825,845,880 MHz

NOTE: A: There was no change compared with initial operation during the test.

4.4 ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST (EFT)

4.4.1 TEST SPECIFICATION

Basic Standard:	IEC 61000-4-4
Test Voltage:	Power Line: 2kV
Polarity:	Positive & Negative
Impulse Frequency:	5 kHz
Impulse Waveshape :	5/50 ns
Burst Duration:	15 ms
Burst Period:	300 ms
Test Duration:	1 min.

4.4.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EFT Tester	HAEFELY	PEFT4010	150546	May 17,14	May 16,15
EFT Coupling Clamp	HAEFELY	IP4A	150407	May 17,14	May 16,15
Test Software	HAEFELY	SWPE4010 1.22	N/A	N/A	N/A

NOTE: 1. The test was performed in EMS Room 1.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

4.4.3 TEST PROCEDURE

a. Both positive and negative polarity discharges were applied.

b. The length of the "hot wire" from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 0.5 meter ± 0.05 meter.

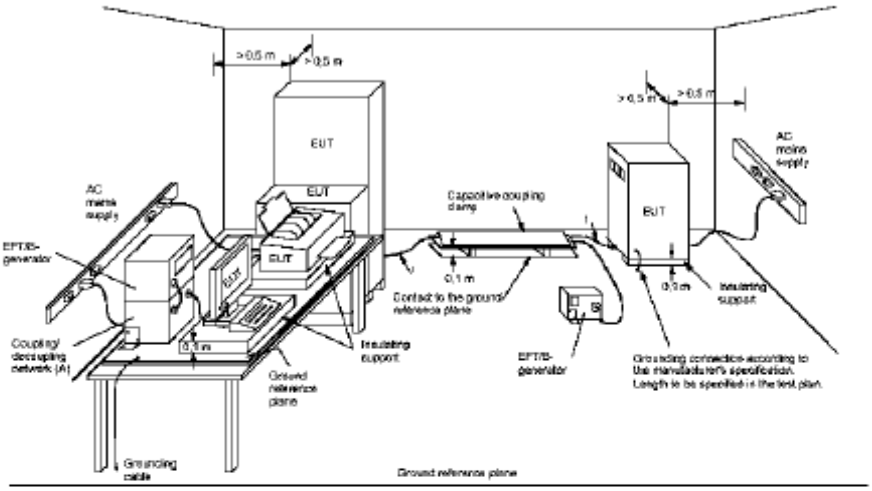
c. The duration time of each test sequential was 1 minute.

d. The transient/burst waveform was in accordance with IEC 61000-4-4, 5/50ns.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation.

4.4.5 TEST SETUP



NOTE:

TABLETOP EQUIPMENT

The configuration consisted of a wooden table standing on the Ground Reference Plane and should be located 0.1m +/- 0.01m above the Ground Reference Plane.
The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system. A minimum distance of 0.5m was provided between the EUT and the walls of the laboratory or any other metallic structure.

FLOOR STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC 61000-4-4 and its cables, were isolated from the Ground Reference Plane by an insulating support that is 0.1-meter thick. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system.

4.4.6 TEST RESULTS

TEST MODE	See item 2.2	TEST VOLTAGE	DC 200V
ENVIRONMENTAL CONDITIONS	22.6 deg. C, 53.6% RH	TESTED BY: Heise Chen	

Pulse Voltage	2.0 kV		___ kV		___ kV		___ kV	
Pulse Polarity	+	–	+	–	+	–	+	–
L	A	A	/	/	/	/	/	/
N	A	A	/	/	/	/	/	/
PE	A	A	/	/	/	/	/	/
L+N	A	A	/	/	/	/	/	/
L+PE	A	A	/	/	/	/	/	/
N+PE	A	A	/	/	/	/	/	/
L+N+PE	A	A	/	/	/	/	/	/
DC Input Line	A	A	/	/	/	/	/	/

NOTE: A: There was no change compared with initial operation during the test.

4.5 SURGE IMMUNITY TEST

4.5.1 TEST SPECIFICATION

Basic Standard:	IEC 61000-4-5
Wave-Shape:	Combination Wave 1.2/50 us Open Circuit Voltage 8 /20 us Short Circuit Current
Test Voltage:	AC Power Line: Line to Line:1kV Line to PE:2kV Signal Line: 1kV DC Power Line: Line to Line:0.5kV Line to PE:0.5kV
Surge Input/Output:	L-N&L-PE&N-PE, RJ 45 Line
Generator Source Impedance:	2 ohm between networks 12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	0° /90°/180°/270°
Pulse Repetition Rate:	1 time / 60 sec.
Number of Tests:	5 positive and 5 negative at selected points

4.5.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Combination wave Module	TESEQ AG	CDN 3061	1361	Feb. 17,14	Feb. 16,15
Telecom Surge Module	TESEQ AG	NSG 3060 Mainframe	1404	Feb. 17,14	Feb. 16,15
CDN	TESEQ	CDN HSS-2	34275	Nov.06, 13	Nov.05, 14
CDN	TESEQ	CDN 118	30741	Nov.06, 13	Nov.05, 14
Test Software	TESEQ	CDM 3061_0002.30	1361	N/A	N/A
Test Software	TESEQ	HVM 3060_0002.30	293	N/A	N/A

NOTE: 1. The test was performed in EMS Room 1.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

4.5.3 TEST PROCEDURE

a. For EUT power supply:

The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

b. For test applied to unshielded unsymmetrically operated interconnection lines of EUT:

The surge is applied to the lines via the capacitive coupling. The coupling / decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

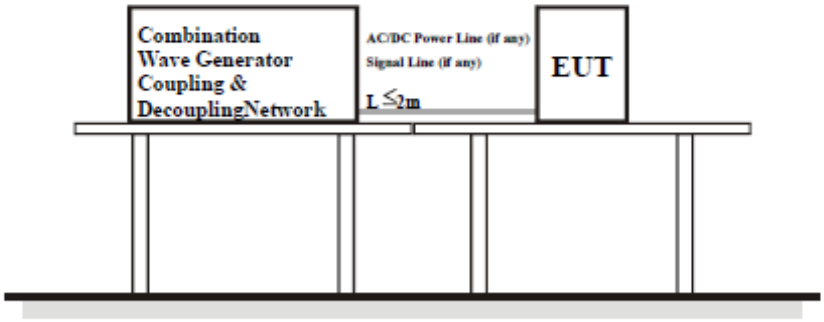
c. For test applied to unshielded symmetrically operated interconnection / telecommunication lines of EUT:

The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

4.5.4 DEVIATION FROM TEST STANDARD

No deviation.

4.5.5 TEST SETUP



4.5.6 TEST RESULTS

TEST MODE	See item 2.2	TEST VOLTAGE	DC 200V
ENVIRONMENTAL CONDITIONS	21.5deg. C, 59.2% RH	TESTED BY: Heise Chen	

AC/DC Power port:

\Phase angle \ Test result \Voltage (kV) \ Test point\ Polarity			0°	90°	180°	270°	DC Power Port
1	L-N	+	A	A	B	B	N/A
		−	A	A	B	B	N/A
2	L-PE	+	B	B	B	B	N/A
		−	B	B	B	B	N/A
2	N-PE	+	B	B	B	B	N/A
		−	B	B	B	B	N/A

Signal ports and telecommunication ports:

Voltage (kV)	Test Point	Polarity	Test result	Voltage (kV)	Test Point	Polarity	Test result
/	/	+/-	/	/	/	+/-	/

NOTE: A: There was no change compared with initial operation during the test.
B: During test, EUT stopped grid, and could automatically return to normal after test.

4.6 IMMUNITY TO CONDUCTED DISTURBANCES INDUCED BY RF FIELDS (CS)

4.6.1 TEST SPECIFICATION

Basic Standard:	IEC 61000-4-6
Frequency Range:	0.15 MHz - 80 MHz
Field Strength:	$10V_{r.m.s}$
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of fundamental
Coupled Cable:	Power Mains & DC Power Line
Coupling Device:	CDN-M3(3 wires) & Clamp

4.6.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Signal Generator	Rohde&Schwarz	SME06	829498/006	Oct.15,13	Oct.14, 14
CDN	Luthi	L-801M2/M3	2015	Oct.18,13	Oct. 17,14
CDN(AUX)	TESEQ	CDN M016	27452	Nov. 20,13	Nov. 19,14
CDN	TESEQ	T200A	26944	Apr. 08,14	Apr. 07,15
CDN	TESEQ	T400A	26536	Apr. 08,14	Apr. 07,15
CDN	TESEQ	ST08A	32256	Apr. 08,14	Apr. 07,15
6dB 50Watt Attenuator	HUBER+SUHNER	5906.17.0005	303688	Oct.15,13	Oct.14,14
Signal Amplifier	HAEFELY	PAMP250	149594	NA	NA
Electromagnetic Injection Clamp	Luthi	EM101	35640	Oct.16,13	Oct.15,14
C/S Test System	HAEFELY	WinPAMP	NSEMC002	N/A	N/A
Test Software	ADT	BVADT_CS_V7.5.1	N/A	N/A	N/A

NOTE: 1. The test was performed in CS test room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

4.6.3 TEST PROCEDURE

a. The EUT shall be tested within its intended operating and climatic conditions.

b. An artificial hand was placed on the hand-held accessory and connected to the ground reference plane.

c. The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.

d. The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. Where the frequency is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value.

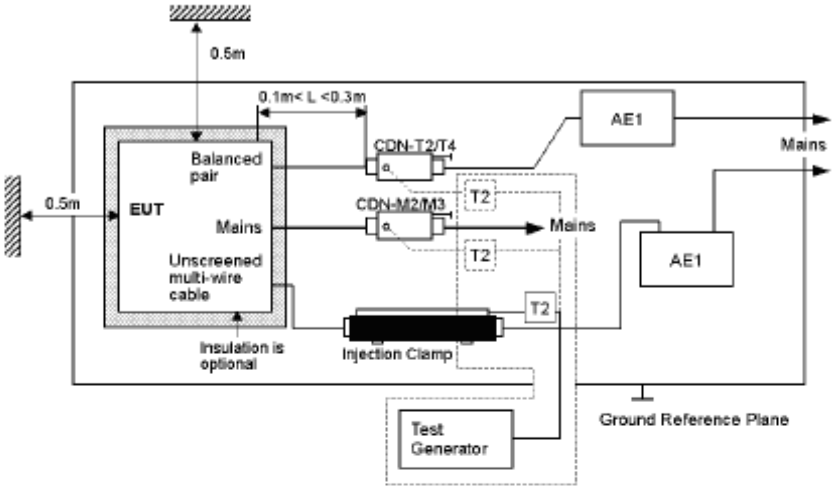
e. The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0,5 s. The sensitive frequencies (e.g. clock frequencies) shall be analyzed separately.

f. Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.

4.6.4 DEVIATION FROM TEST STANDARD

No deviation.

4.6.5 TEST SETUP



NOTE: The EUT clearance from any metallic obstacles shall be at least 0.5m.
All non-excited input ports of the CDNs shall be terminated by 50Ω loads.

NOTE:

FLOOR-STANDING EQUIPMENT
The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

4.6.6 TEST RESULTS

TEST MODE	See Item 2.2	TEST VOLTAGE	DC 200V
ENVIRONMENTAL CONDITIONS	23.7deg. C, 56.5% RH	TESTED BY: Heise Chen	

Voltage (V)	Test Frequency Note#1 (MHz)	Tested Line	Injection Method.	Test Result	Remark
10	0.15 – 80	AC Mains	CDN-M3	A	N/A
10	0.15 – 80	DC Input line	Clamp	A	N/A

Note#1: Tested Israel SII Frequencies 0.2,0.53,1,1.5,7.1,13.56,21,27.12,40.68,65,68 MHz

NOTE: A: There was no change compared with initial operation during the test.

4.7 POWER FREQUENCY MAGNETIC FIELD IMMUNITY TEST

4.7.1 TEST SPECIFICATION

Basic Standard:	IEC 61000-4-8
Frequency Range:	50Hz, 60Hz
Field Strength:	30A/m
Observation Time:	5 minute
Inductance Coil:	Rectangular type, 1mx1m

4.7.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Magnetic Field Tester	HAEFELY	MAG100.1	150579	Oct.18,13	Oct.17,14
Test Software	N/A	N/A	N/A	N/A	N/A

NOTE: 1. The test was performed in Shielding Room 843.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

4.7.3 TEST PROCEDURE

a. The equipment is configured and connected to satisfy its functional requirements.

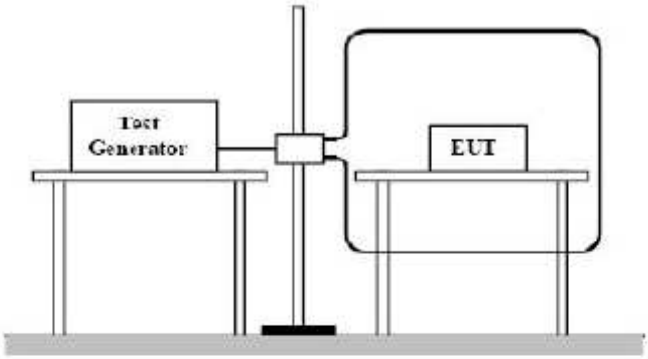
b. The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.

c. The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.

4.7.4 DEVIATION FROM TEST STANDARD

No Deviation

4.7.5 TEST SETUP



NOTE:

TABLETOP EQUIPMENT
The equipment shall be subjected to the test magnetic field by using the induction coil of standard dimension (1 m x 1 m). The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

FLOOR-STANDING EQUIPMENT
The equipment shall be subjected to the test magnetic field by using induction coils of suitable dimensions. The test shall be repeated by moving and shifting the induction coils, in order to test the whole volume of the EUT for each orthogonal direction. The test shall be repeated with the coil shifted to different positions along the side of the EUT, in steps corresponding to 50 % of the shortest side of the coil. The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

4.7.6 TEST RESULTS

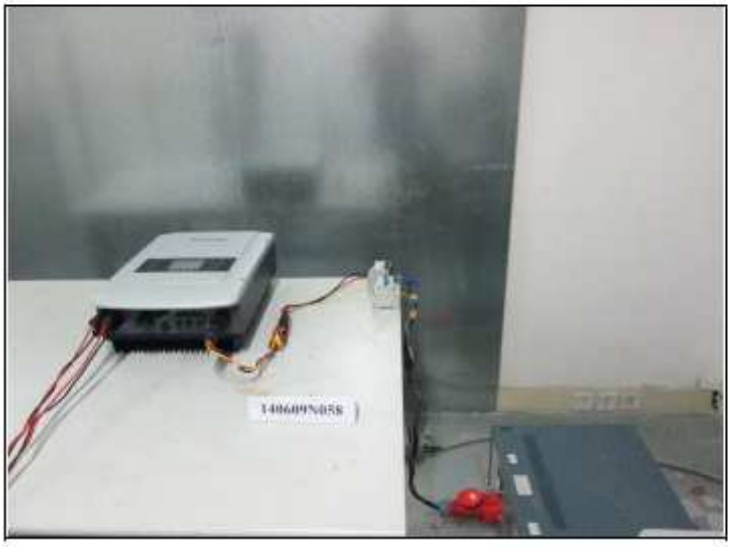
TEST MODE	See Item 2.2	TEST VOLTAGE	DC 200V
ENVIRONMENTAL CONDITIONS	22.6deg. C, 57% RH	TESTED BY: Heise Chen	

MAGNETIC FIELD DIRECTION	TESTING RESULT	REMARK
X - Axis	A	30A/ m
Y - Axis	A	30A/ m
Z - Axis	A	30A/ m

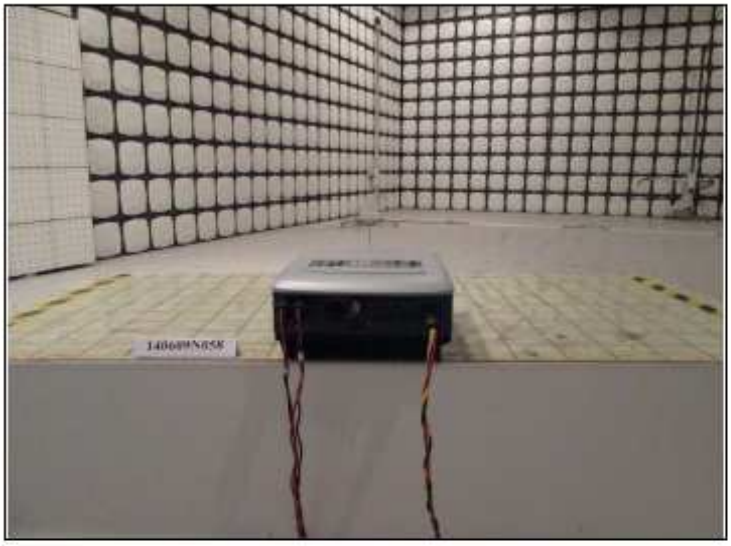
NOTE: A: There is no change compared with the initial operation during the test.

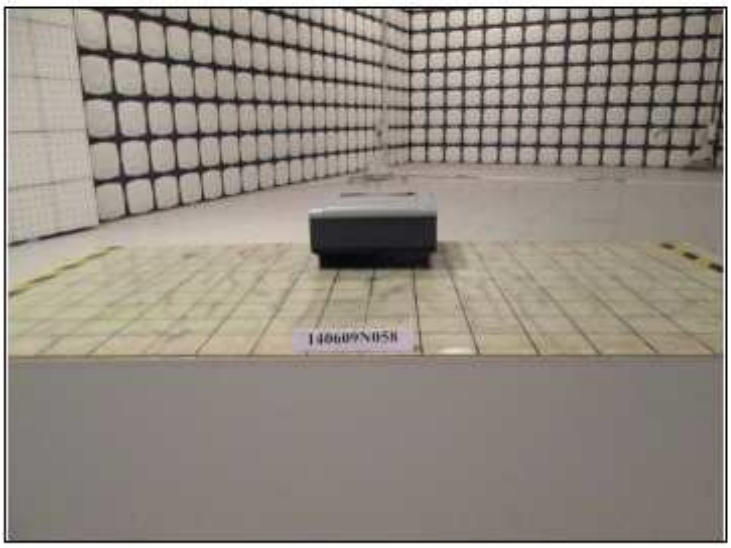
5 PHOTOGRAPHS OF THE TEST CONFIGURATION

CONDUCTED EMISSION TEST



RADIATED EMISSION TEST

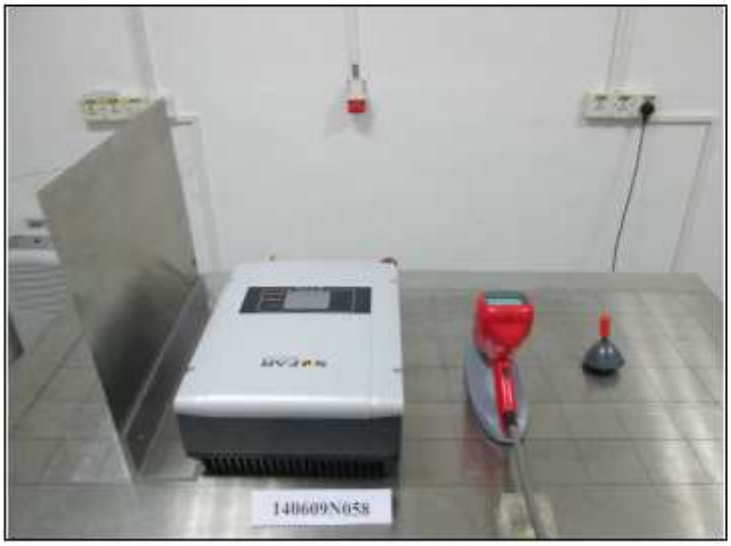




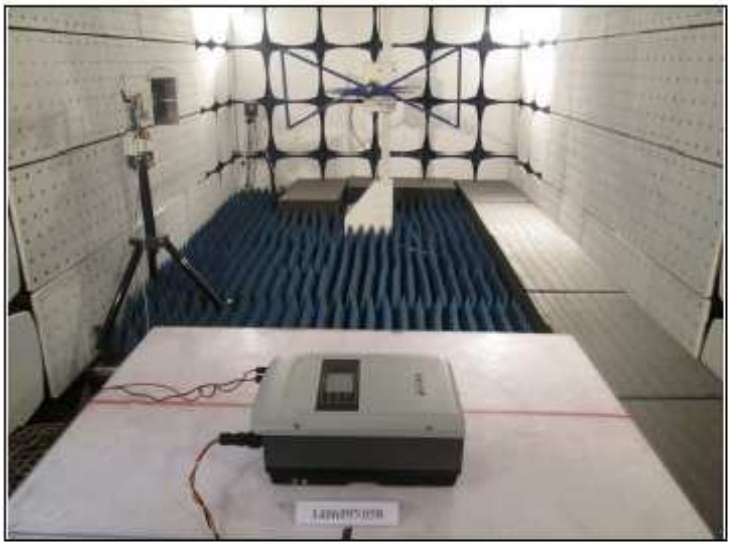
Test Report No.: CE140609N058

HARMONICS EMISSION TEST &
VOLTAGE FLUCTUATIONS AND FLICKER TEST

ESD TEST



RS TEST

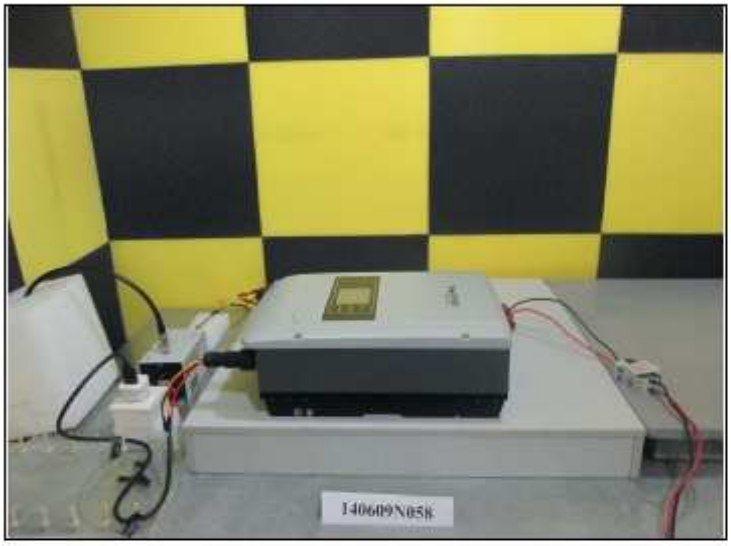


EFT TEST(AC Mains)

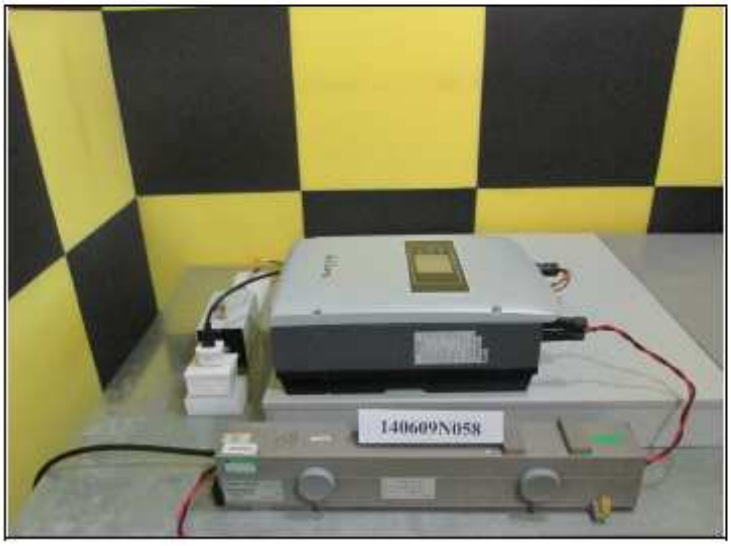
EFT TEST (DC Cable)

SURGE TEST

CONDUCTED SUSCEPTIBILITY TEST (AC Mains)



CONDUCTED SUSCEPTIBILITY TEST (DC Cable)



Test Report No.: CE140609N058

POWER-FREQUENCY MAGNETIC FIELDS TEST

Bureau Veritas Shenzhen Co., Ltd.
Dongguan Branch

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

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Email: customerservice.dg@cn.bureauveritas.com

6 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications were made to the EUT by the lab during the test.

---END---

Bureau Veritas Shenzhen Co., Ltd.
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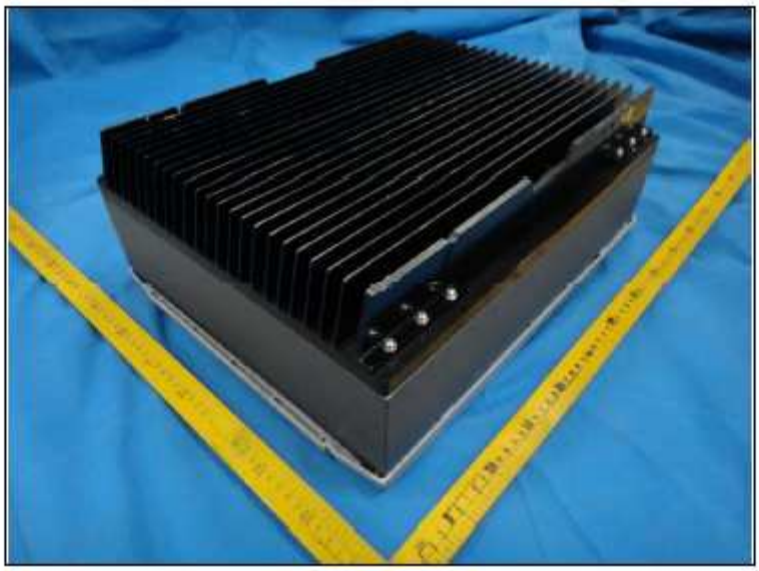
Email: customerservice.dg@cn.bureauveritas.com

Reference No.: 140609N058

PHOTOGRAPHS OF THE EUT

SOFAR 4600TLM、SOFAR 5000TLM:



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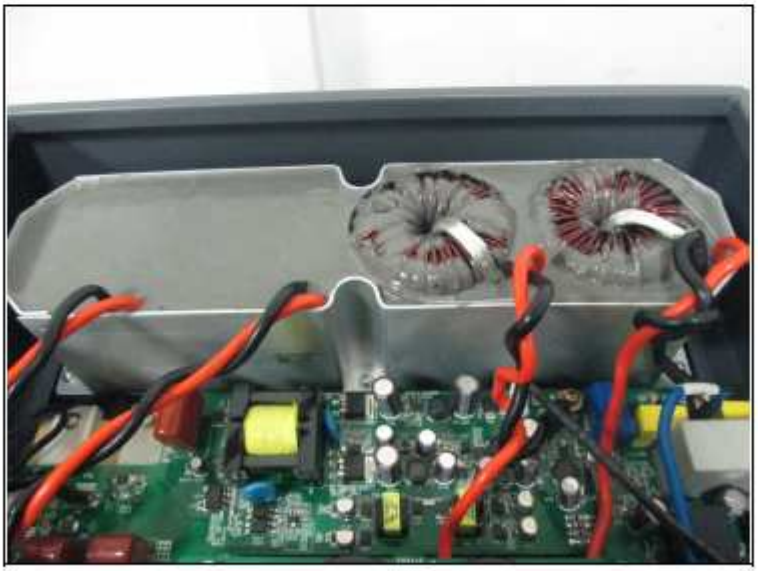

Reference No.: 140609N058

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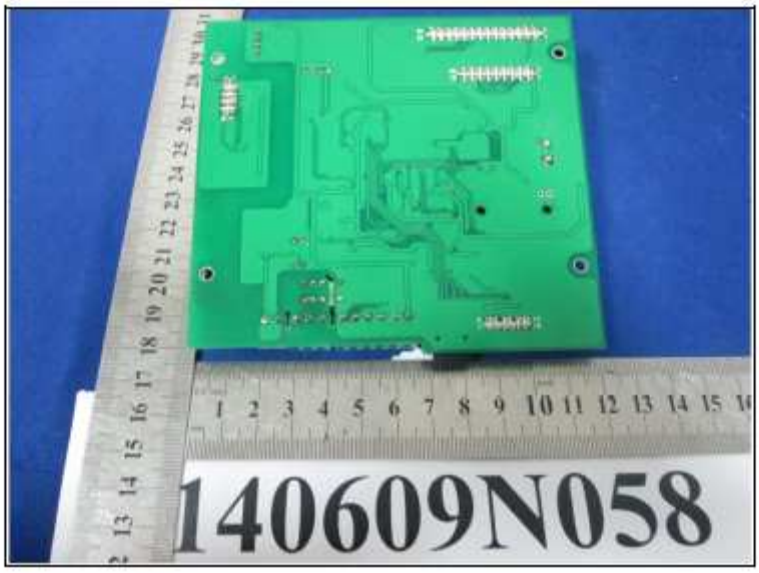
Reference No.: 140609N058



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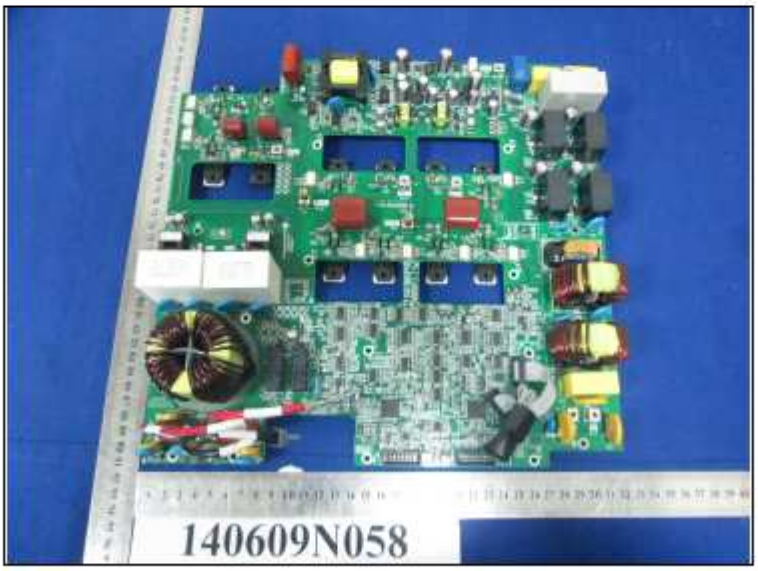
Reference No.: 140609N058



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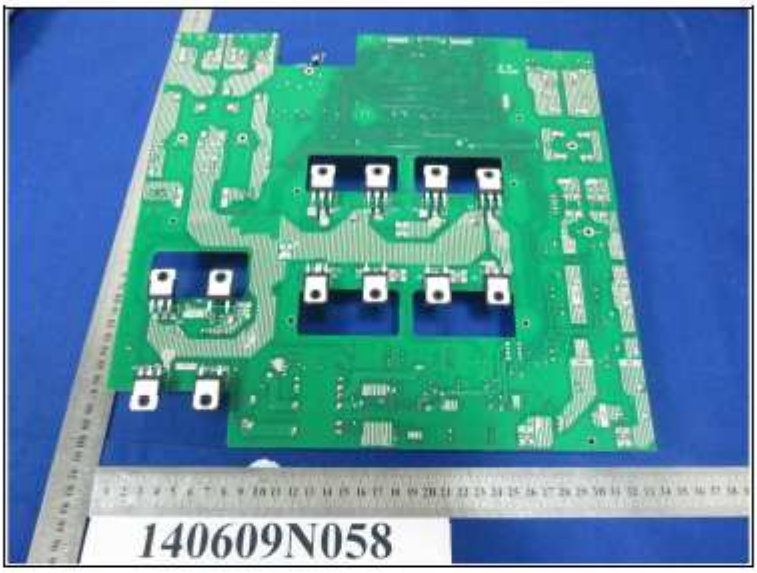
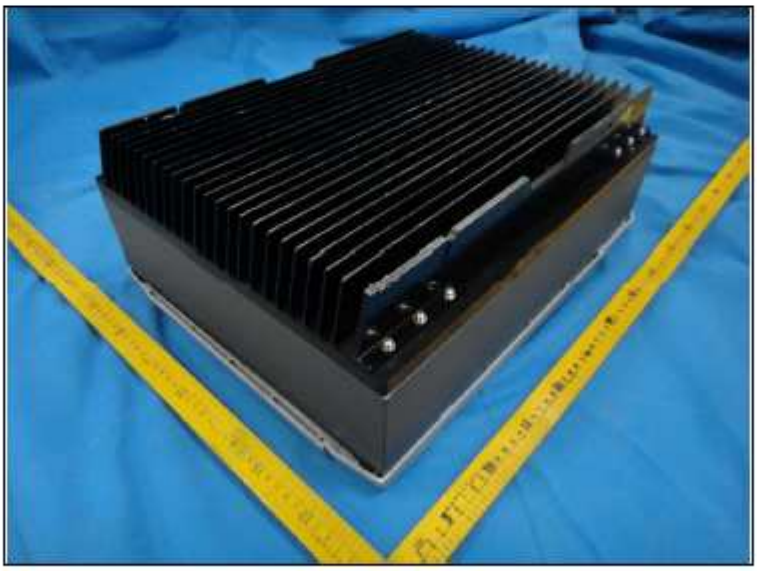


Reference No.: 140609N058

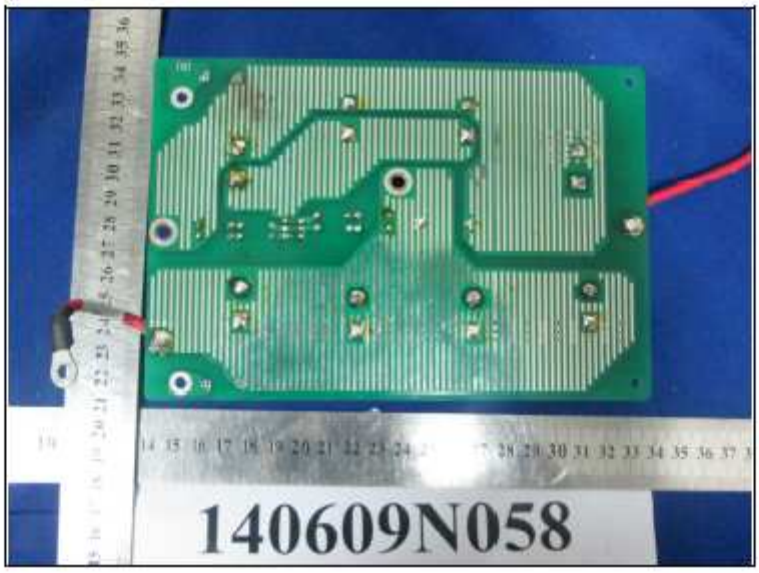
SOFAR 3000TLM、SOFAR3680TLM、SOFAR4000TLM:



Reference No.: 140609N058

Reference No.: 140609N058

Reference No.: 140609N058

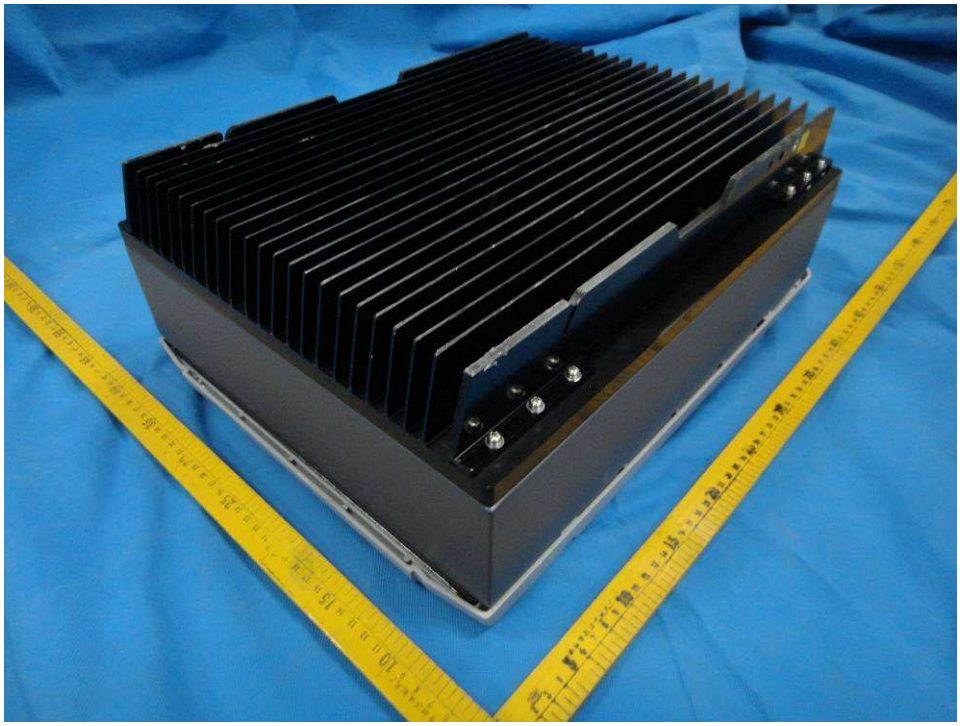


Annex 2

Pictures of the unit

Enclosure front view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM, SOFAR 4600TLM, SOFAR 5000TLM

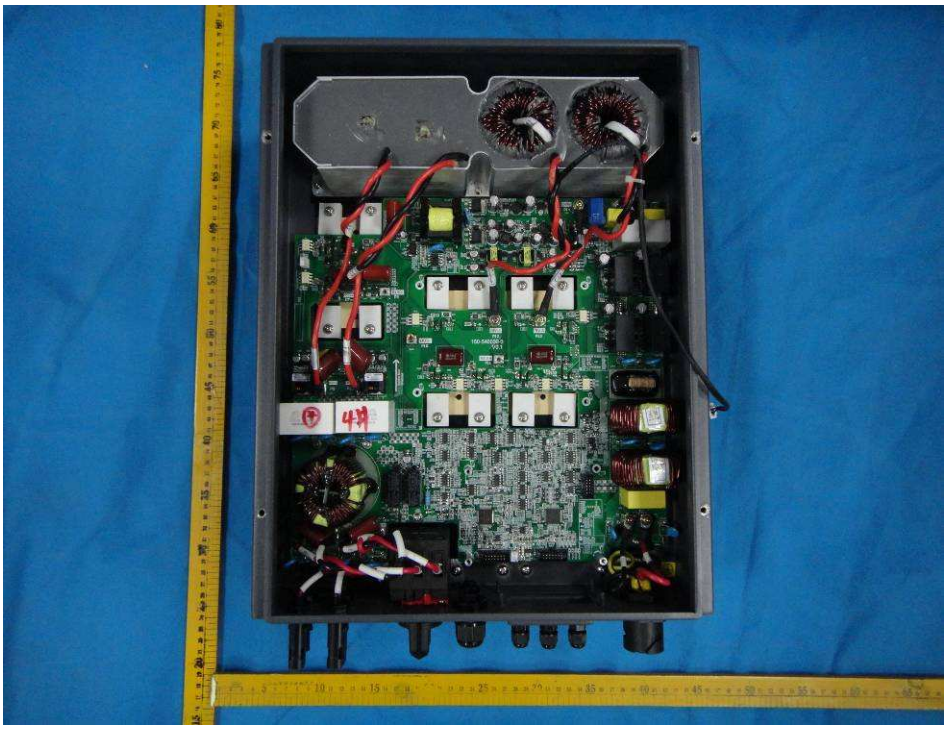
Enclosure rear view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM, SOFAR 4600TLM, SOFAR 5000TLM



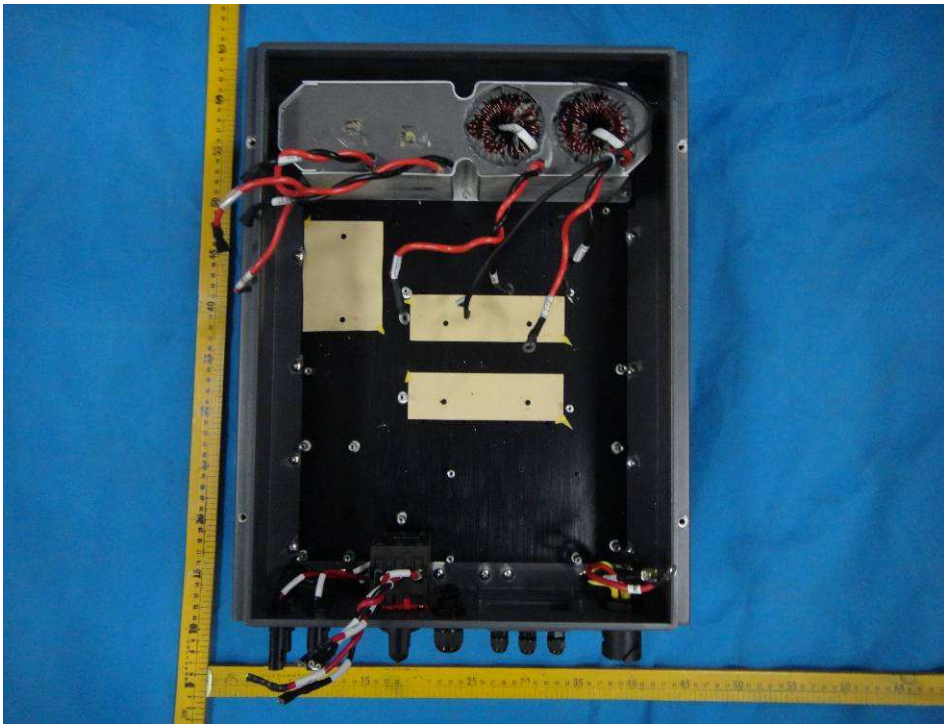
Enclosure bottom view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM,
SOFAR 4600TLM, SOFAR 5000TLM

Internal view-1
SOFAR 4600TLM, SOFAR 5000TLM

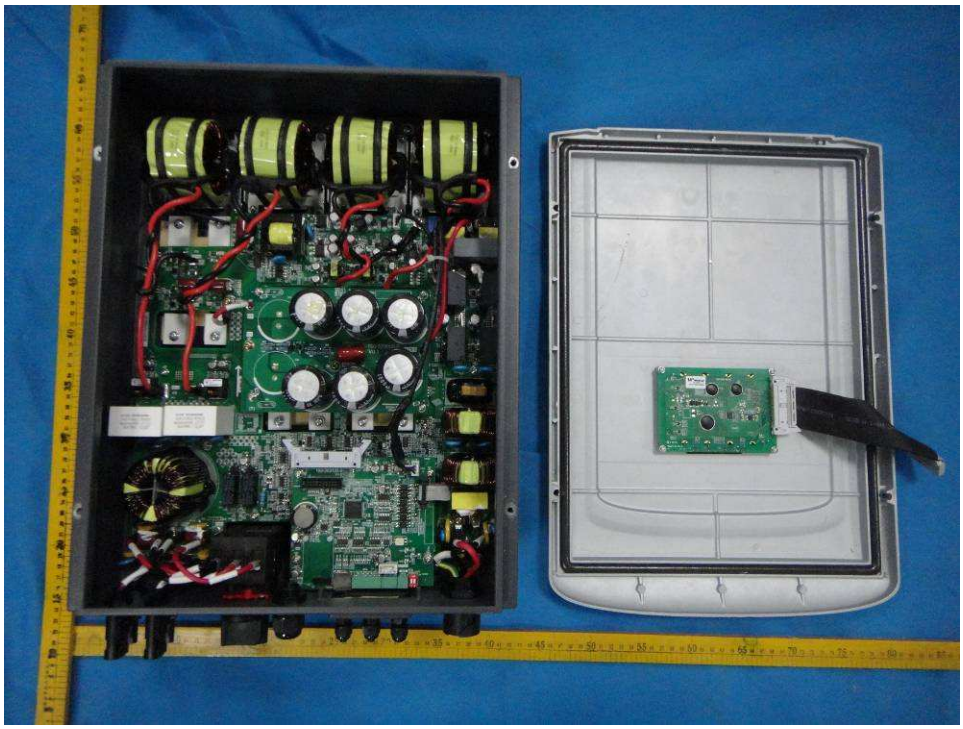
Internal view-2
SOFAR 4600TLM, SOFAR 5000TLM



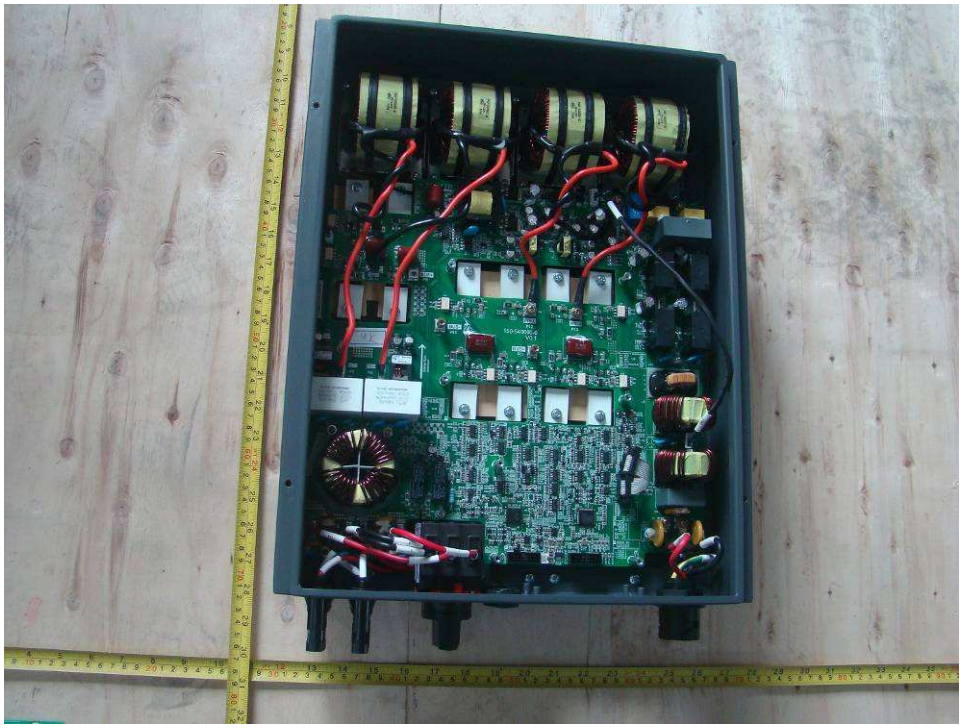
Internal view-3
SOFAR 4600TLM, SOFAR 5000TLM



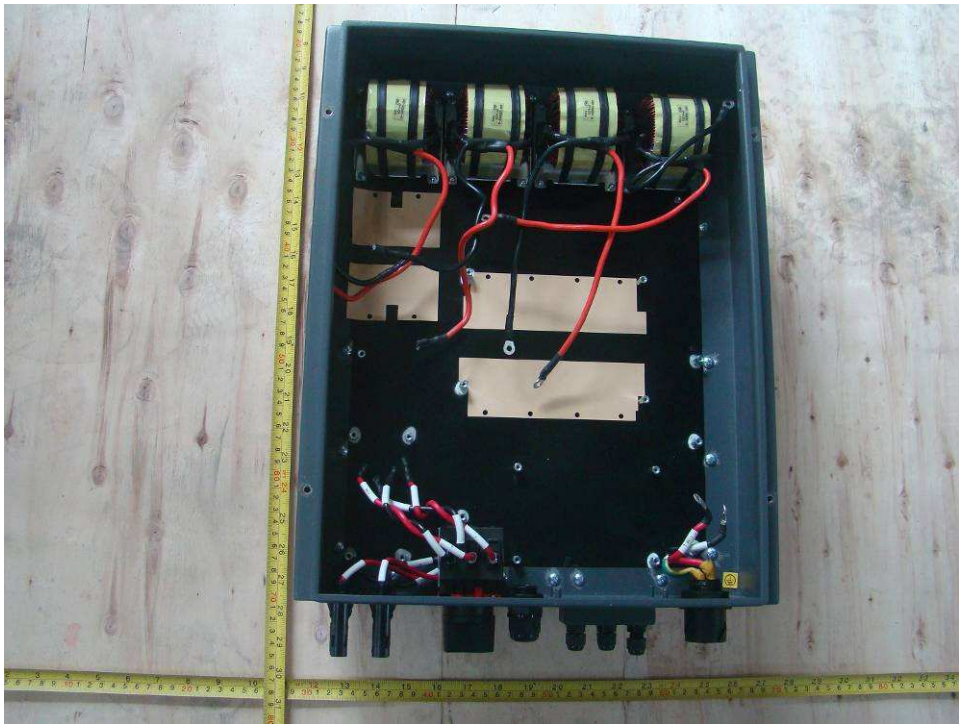
Internal view-4
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM



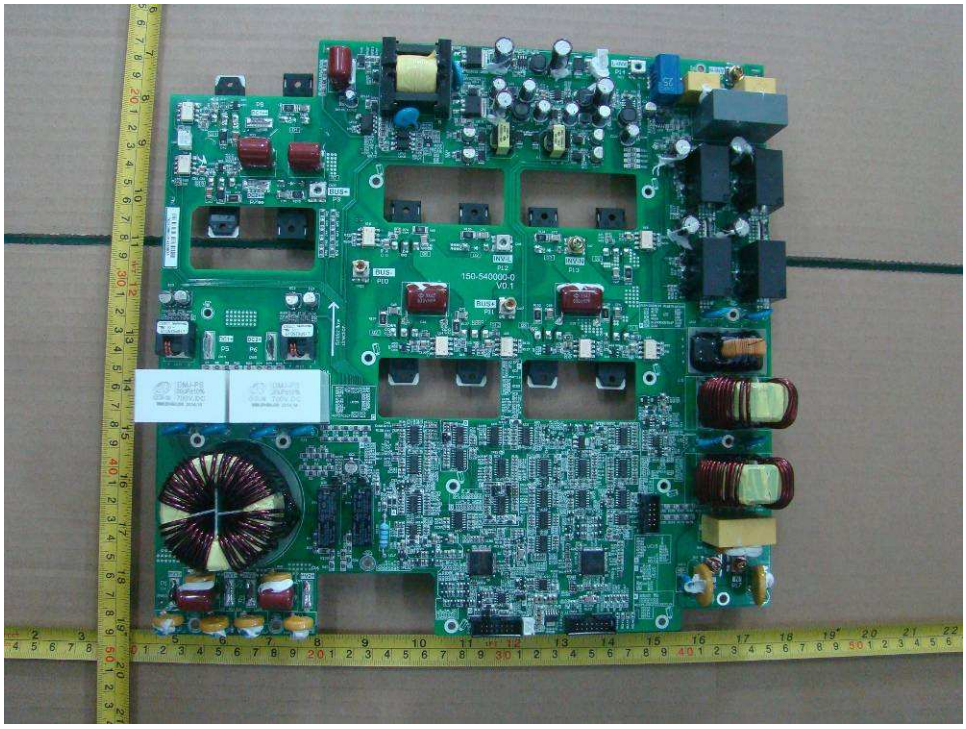
Internal view-5
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM



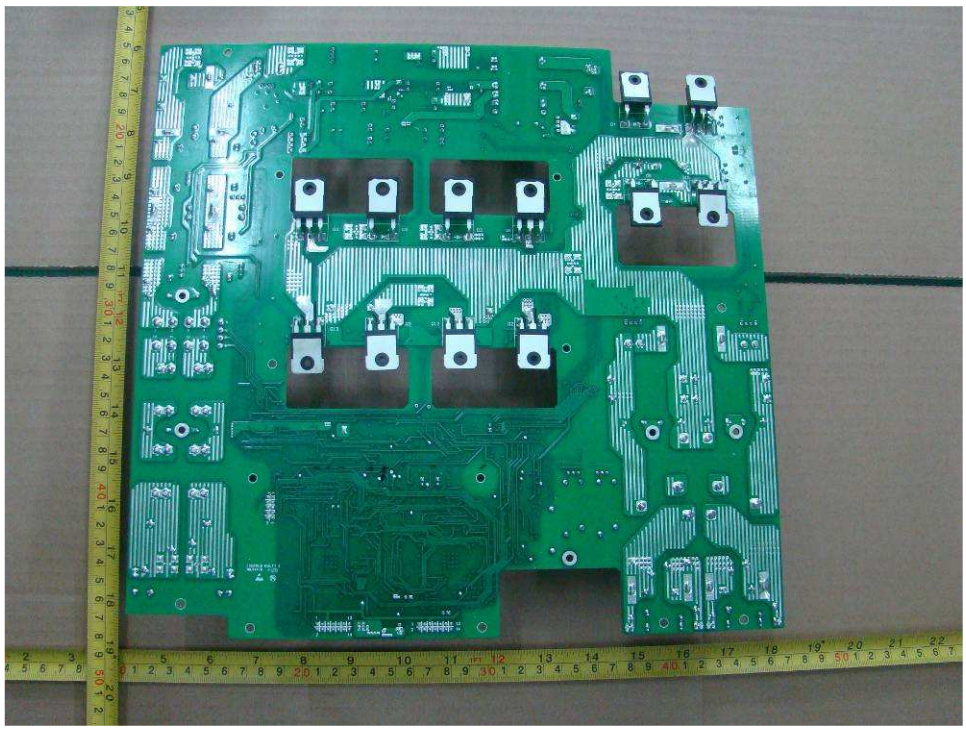
Internal view-6
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM



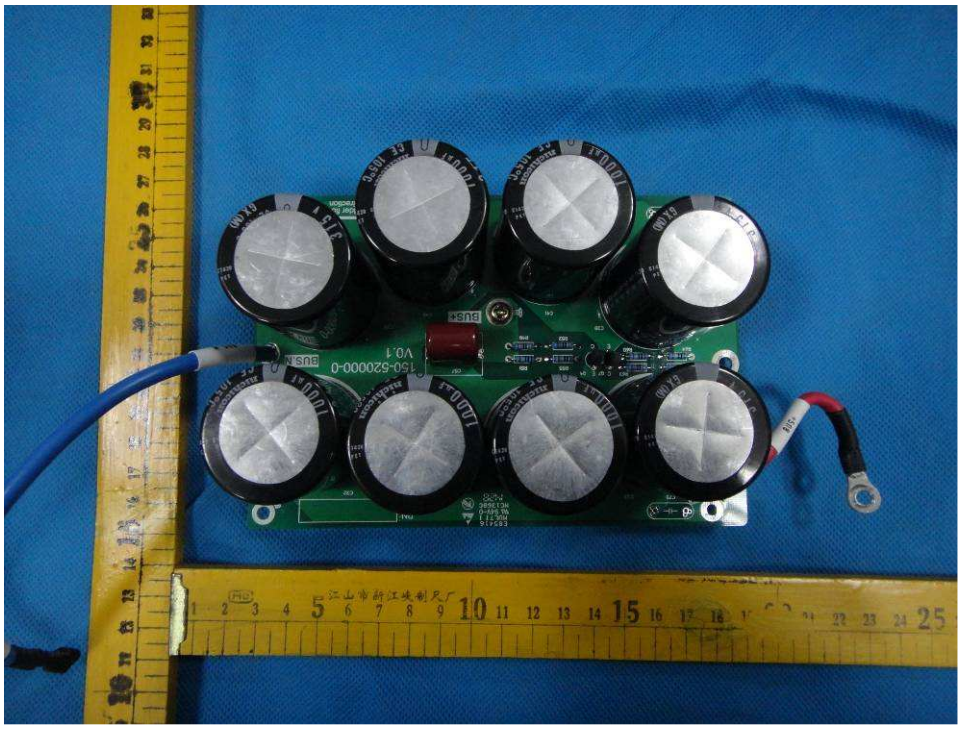
Main power board component side view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM,
SOFAR 4600TLM, SOFAR 5000TLM



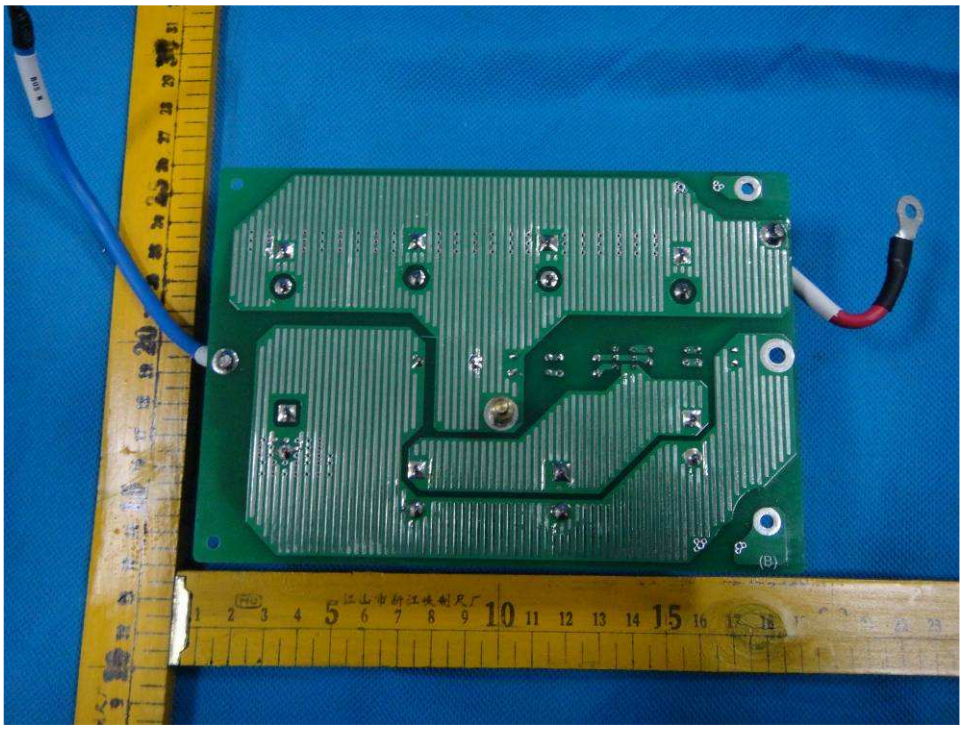
Main power board solder side view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM,
SOFAR 4600TLM, SOFAR 5000TLM



Cap board component side view
SOFAR 4600TLM, SOFAR 5000TLM

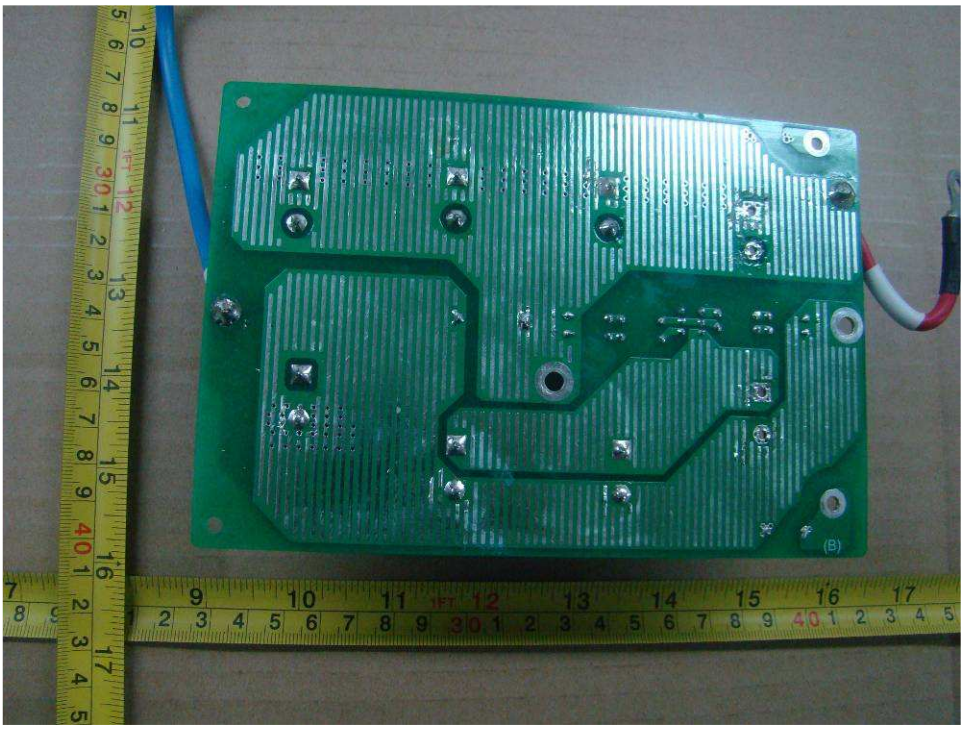


Cap board solder side view
SOFAR 4600TLM, SOFAR 5000TLM

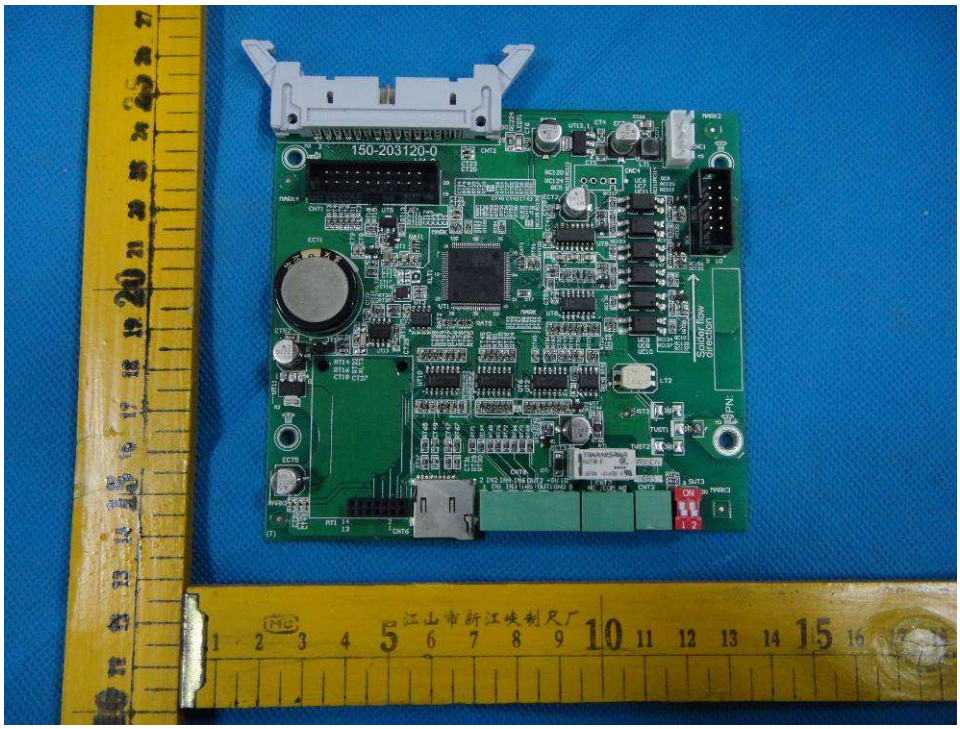


Cap board component side view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM

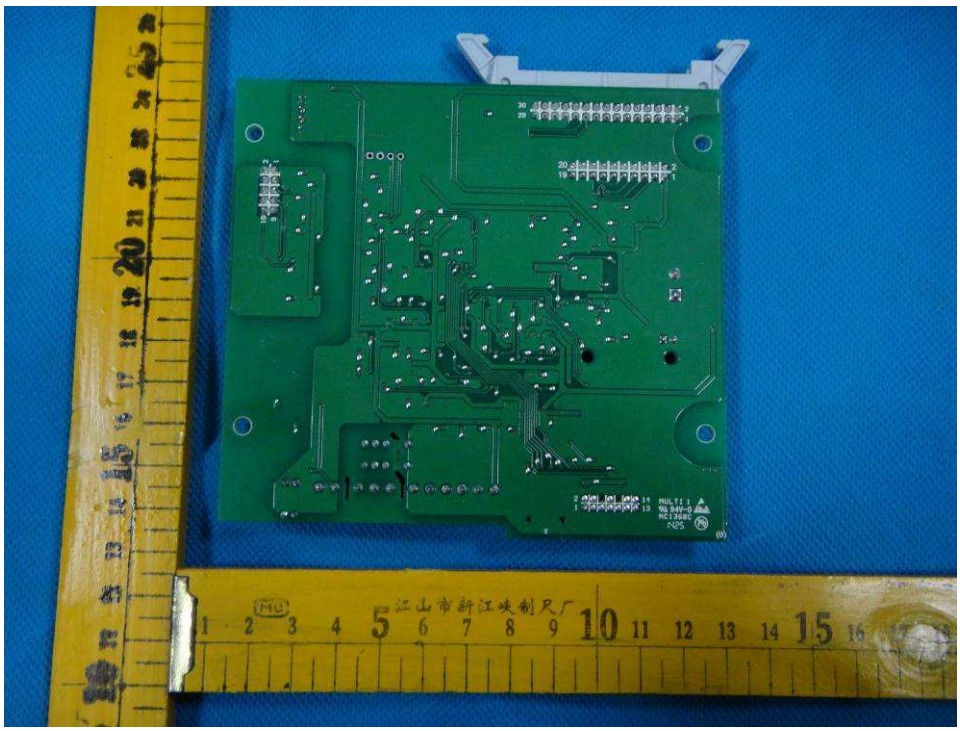
Cap board solder side view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM



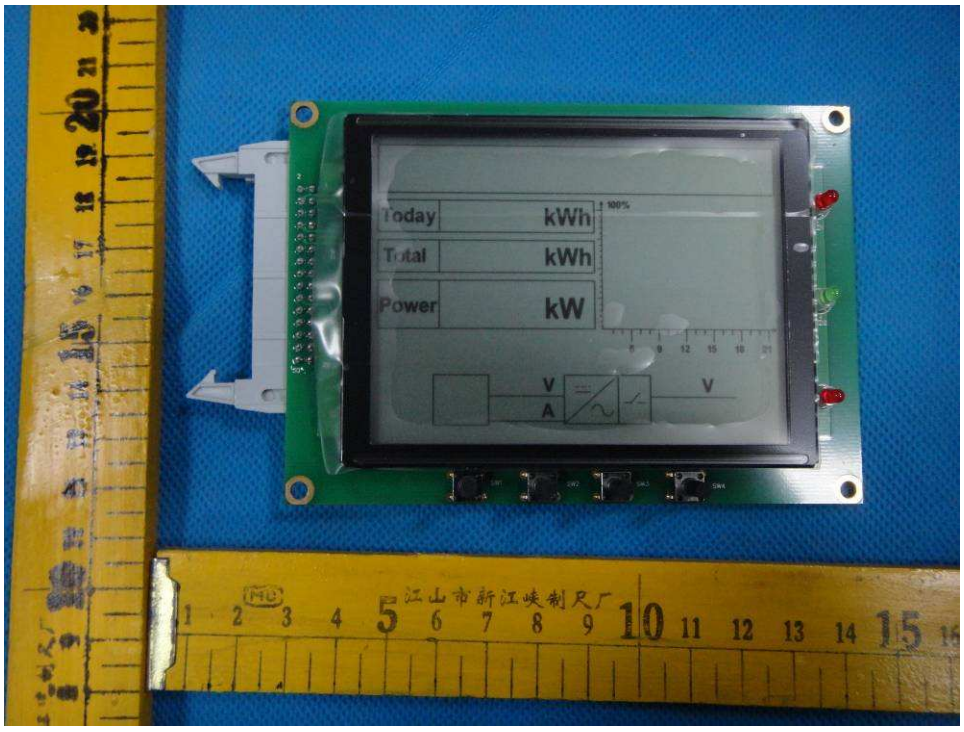
Control board component side view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM,
SOFAR 4600TLM, SOFAR 5000TLM



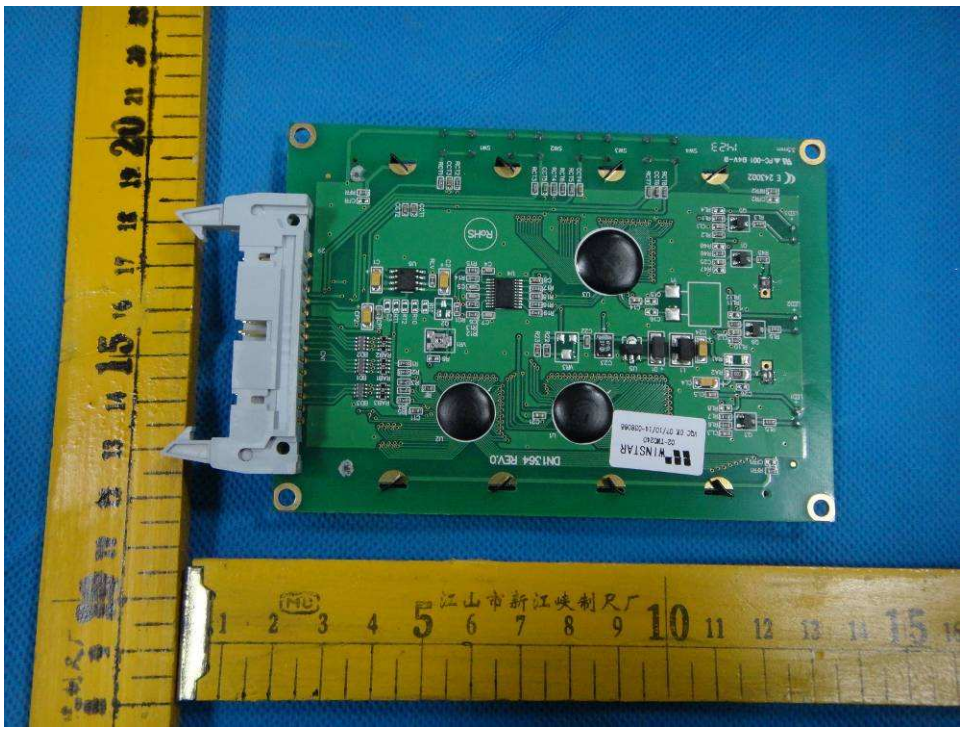
Control board solder side view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM, SOFAR 4600TLM, SOFAR 5000TLM



Display board component side view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM, SOFAR 4600TLM, SOFAR 5000TLM



Display board solder side view
SOFAR 3000TLM, SOFAR 3680TLM, SOFAR 4000TLM,
SOFAR 4600TLM, SOFAR 5000TLM



Annex 3

Test equipment list

Equipment	Internal No.	Manufacturer	Type	Serial No.	Last Calibration
Power Analyzer	A4080002DG	YOKOGAWA	WT3000	91M210852	Mar. 12, 2014
AC Source	A7040019DG	Chroma	61512	61512000439	Monitored by Power Analyzer
AC Source	A7040020DG	Chroma	61512	61512000438	Monitored by Power Analyzer
DC Simulation Power Supply	A7040015DG	Chroma	62150H-1000S	62150EF00488	Monitored by Power Analyzer
DC Simulation Power Supply	A7040016DG	Chroma	62150H-1000S	62150EF00490	Monitored by Power Analyzer
Four Channel Digital Phosphor Oscilloscope	A4089003DG	Tektronix	DPO4104B	C010624	Oct. 17, 2013
Current transducer	A1060007DG	YOKOGAWA	CT200	1130700012	Jan 20, 2014
RLC Load	A7150027DG	Qunling	ACLT-3803H	93VOO2869	Monitored by Power Analyzer
Oscilloscope probel	A4089010DG	Tektronix	TPP1000	C008228	Dec. 20, 2013
Oscilloscope probel	A4089011DG	Tektronix	TPP1000	C008229	Dec. 20, 2013
LCR Hitester	A1060006DG	HIOKI	3535	120112505	Mar. 06, 2014