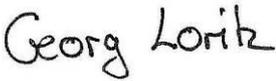


TEST REPORT

Engineering recommendation G59/2

Recommendation for the connection of generating plant to the distribution systems of licensed distribution network operators.

Report reference No	12TH0124-G59/2_0			
Tested by (printed name and signature)	Ted Wu			
Approved by (printed name and signature)	Georg Loritz			
Date of issue	2012-03-13			
Testing Laboratory Name	Bureau Veritas Consumer Products Services Germany GmbH	 DAkKS Deutsche Akkreditierungsstelle D-PL-12024-03-01		
Address	Businesspark A96, 86842 Türkheim, Germany			
Testing location	Growatt New Energy Co., Ltd.			
Address	No. 12 Building, Xicheng Industrial Zone, Bao'an District, Shenzhen, P.R. China			
Applicant's Name	Growatt New Energy Co., Ltd.			
Address	No. 12 Building, Xicheng Industrial Zone, Bao'an District, Shenzhen, P.R. China			
Test specification				
Standard	G59/2 August 2010			
Test Report Form No.	G59/2 A			
TRF originator	Bureau Veritas			
Master TRF	Bureau Veritas Consumer Products Services Germany GmbH			
Copyright © Bureau Veritas Consumer Products Services Germany GmbH				
Test item description	Solar Inverter			
Trademark				
Manufacturer	Growatt New Energy Co., Ltd.			
Model and/or type reference	Growatt 10000UE, Growatt 12000UE, Growatt 18000UE, Growatt 20000UE			
Hardware Version	Growatt 10000UE, Growatt 12000UE: V1.01 Growatt 18000UE, Growatt 20000UE: V1.02			
Software Version.....	Communication board: C.0.9 Control board: D.0.9			
Ratings.....	Growatt 10000UE	Growatt 12000UE	Growatt 18000UE	Growatt 20000UE
Input Voltage:	300-1000V _{DC}			
Input current:	2x15A	2x17A	2x23A	2x26A
Output Voltage:	230V/400V, 3/N/PE, 50Hz			
Output current:	Nom. 14,4A, Max. 16A	Nom. 17,5A Max. 19A	Nom. 26A Max.28,6A	Nom. 29A Max. 32A
Output power:	10KW	12KW	18KW	20KW

Copy of marking plate:

GROWATT PV Grid Inverter	
Model Name	Growatt 10000UE
U_{DC max}	1000V
I_{DC max}	2 * 15A
U_{DC range}	300V - 1000V
V_{AC norm}	3/N/PE 230V/400V
f_{AC norm}	50/60Hz
P_{AC norm}	10kW
I_{AC norm}	14.4A
I_{AC max}	16A
Protection Degree	IP65
Operation Ambient Temperature	-25°C - +60°C
RD 1663, G59, ENEL-Guide	
CE VDE 0126-1-1, IEC 62109 AS/NZS 3100, AS4777	

GROWATT PV Grid Inverter	
Model Name	Growatt 12000UE
U_{DC max}	1000V
I_{DC max}	2 * 17A
U_{DC range}	300V - 1000V
V_{AC norm}	3/N/PE 230V/400V
f_{AC norm}	50/60Hz
P_{AC norm}	12kW
I_{AC norm}	17.5A
I_{AC max}	19A
Protection Degree	IP65
Operation Ambient Temperature	-25°C - +60°C
RD 1663, G59, ENEL-Guide	
CE VDE 0126-1-1, IEC 62109 AS/NZS 3100, AS4777	

GROWATT PV Grid Inverter	
Model Name	Growatt 18000UE
U_{DC max}	1000V
I_{DC max}	2 * 23A
U_{DC range}	300V - 1000V
V_{AC norm}	3/N/PE 230V/400V
f_{AC norm}	50/60Hz
P_{AC norm}	18kW
I_{AC norm}	26A
I_{AC max}	28.6A
Protection Degree	IP65
Operation Ambient Temperature	-25°C - +60°C
RD 1663, G59, ENEL-Guide	
CE VDE 0126-1-1, IEC 62109 AS/NZS 3100, AS4777	

GROWATT PV Grid Inverter	
Model Name	Growatt 20000UE
U_{DC max}	1000V
I_{DC max}	2 * 26A
U_{DC range}	300V - 1000V
V_{AC norm}	3/N/PE 230V/400V
f_{AC norm}	50/60Hz
P_{AC norm}	20kW
I_{AC norm}	29A
I_{AC max}	32A
Protection Degree	IP65
Operation Ambient Temperature	-25°C - +60°C
RD 1663, G59, ENEL-Guide	
CE VDE 0126-1-1, IEC 62109 AS/NZS 3100, AS4777	

History Sheet:

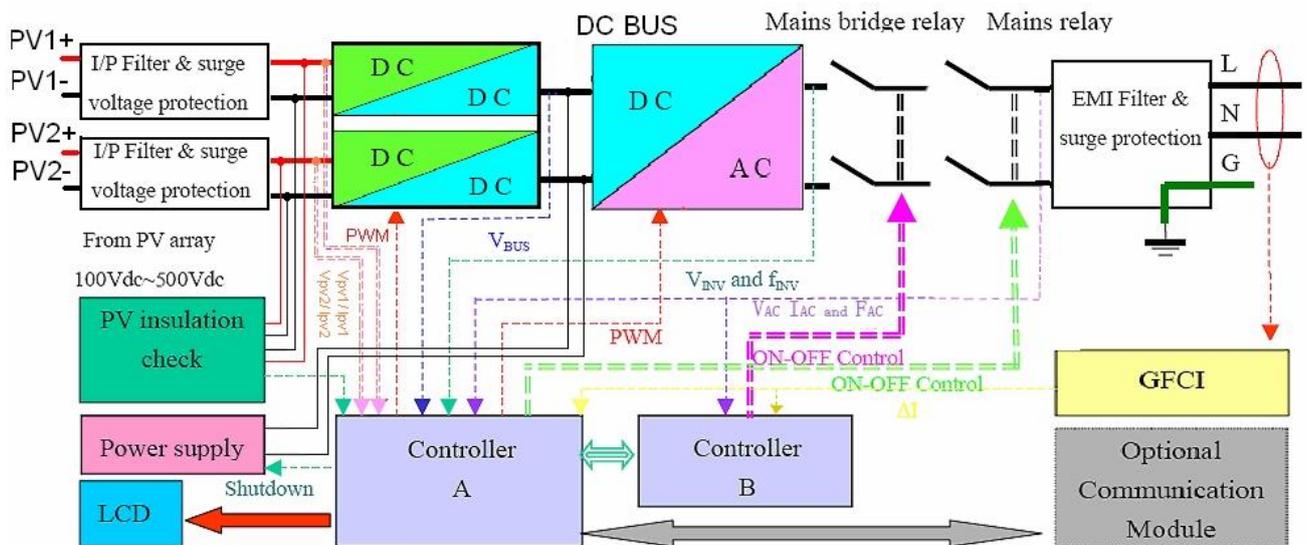
Ted Wu	2012-03-13	Initial report was written	Rev.0
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Address of the manufacturer sites:

**SUGA Network Equipment(Shenzhen) Co., Ltd.
Block 12, Xi Cheng Industrial District,
Xi Xiang Town, Bao An, Shenzhen City,
Guangdong Province.
P.R. China**

General product information:

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



The internal control is redundant built. It consists of Microcontrollers DSP (U1) and MCU (U309).

The DSP control the relays by switching signals; sample the PV voltage, current and voltage, measures 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 MCU (U309) measures the grid voltage and residual current measuring, also can switch off the relays independently, and communicate with DSP (U1) each other.

The unit provides two relays in series in all three line 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.

The models Growatt 10000UE, Growatt 12000UE, Growatt 18000UE are similar in hardware and software with Growatt 20000UE except for electrical ratings and appearance size.

Rate of change of frequency (RoCoF) detection was used for LOM protection.

The product was tested on:

Hardware version:

Growatt 10000UE/Growatt 12000UE: V1.01

Growatt 18000UE/Growatt 20000UE: V1.02

Software version:

Communication board: C.0.9

Control board: D.0.9

Particulars: Test requirements:	
Equipment mobility	Permanent connection
Operating condition	Continuous
Mains supply tolerance	Input (Solar): 300-1000V _{DC} Output (mains): 230/400 V _{AC} , 3PH/N/PE, 50Hz
Class of equipment	Class I
Mass of equipment	Growatt 10000UE, Growatt 12000UE: 41Kg. Growatt 18000UE, Growatt 20000UE: 60Kg.
Protection against ingress of water	IP44 according to EN 60529
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	2012-01-16
Date(s) of performance of test	2012-01-16 to 2012-03-12
General remarks:	
<p>The test result presented in this report relate only to the object(s) tested. The report shall state compliance of the tested objects with the requirements of G59/2. This report shall not be reproduced, except in full, without the written approval of the applicant.</p> <p>"(see Annex #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report.</p> <p>Throughout this report a comma is used as the decimal separator.</p>	
This Test Report consists of the following documents:	
<ol style="list-style-type: none"> 1. Test Report 2. EMC Test Report – Annex No. 1 3. Pictures of the unit – Annex No. 2 4. Test equipment list – Annex No. 3 	

SUMMARY OF TESTING: Continue			
Engineering recommendation G59/2			
Clause	Requirement – Test	Result – Remark	Verdict
13.7.1	General arrangements		
13.7.2	CE Marking and Certification		
13.7.3	Type Verification Functional Testing of the Interface Protection		
13.7.3.2	Over / Under Voltage Tests	see Table 13.7.3.2	P
13.7.3.3	Over / Under Frequency Tests	see Table 13.7.3.3	P
13.7.3.4	Loss of Mains Test	see Table 13.7.3.4	P
13.7.3.5	Reconnection Times	see Table 13.7.3.5	P
13.7.6	Power quality		
13.7.6.1	Harmonics	Covered by EMC Report 13.7.6.8	P
13.7.6.2	Power Factor	see Table 13.7.6.2	P
13.7.6.3	Voltage Fluctuations and Flicker	Covered by EMC Report 13.7.6.8	P
13.7.6.4	DC Injection	see Table 13.7.6.4	P
13.7.6.5	Over Current Protection	see Table 13.7.6.5	P
13.7.6.6	Short Circuit Current Contribution	see Table 13.7.6.6	P
13.7.6.7	SELF Monitoring – Solid State Switching	see Table 13.7.6.7	N/A
13.7.6.8	Electromagnetic Compatibility	see Table 13.7.6.8	P
13.7.6.9	Generating Unit Electrical Installation	see Table 13.7.6.9	N/A

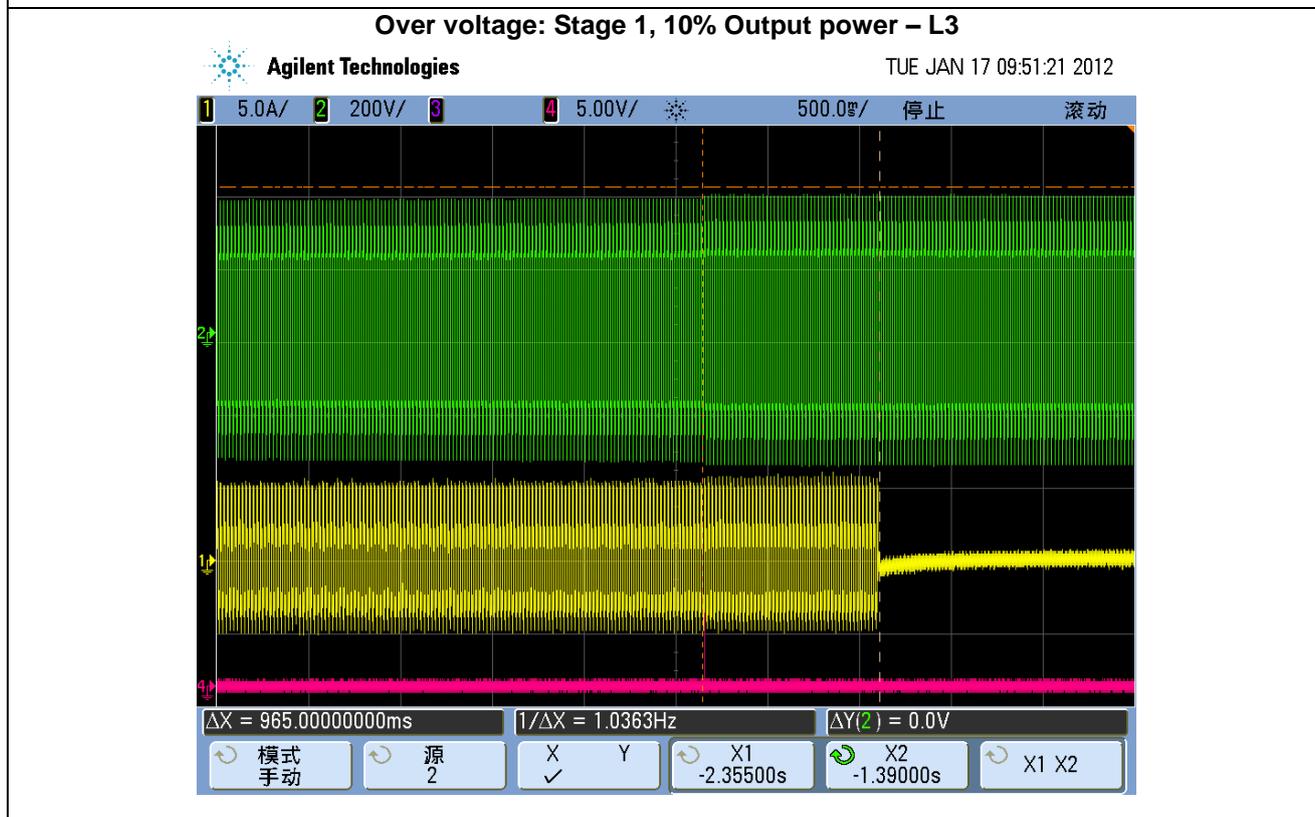
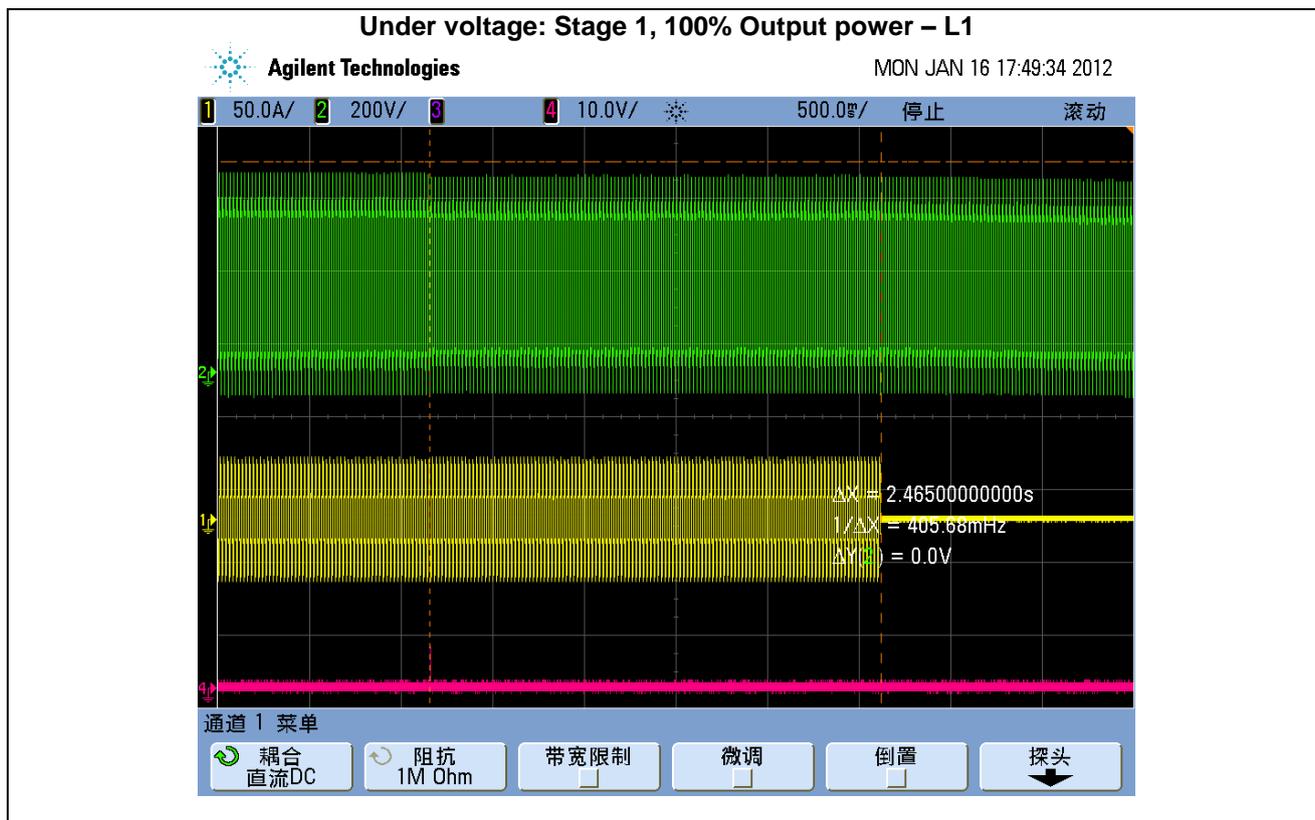
G59/2 TEST SHEET:

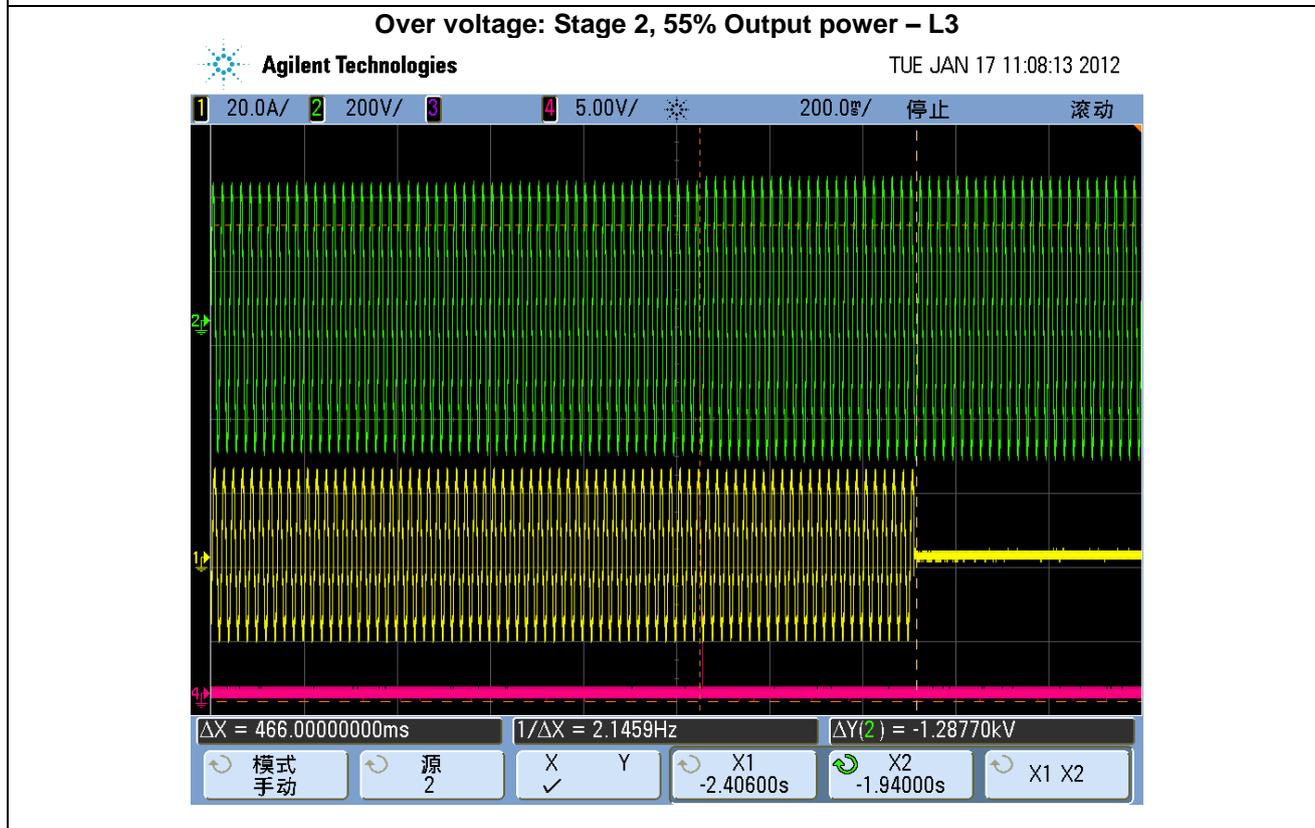
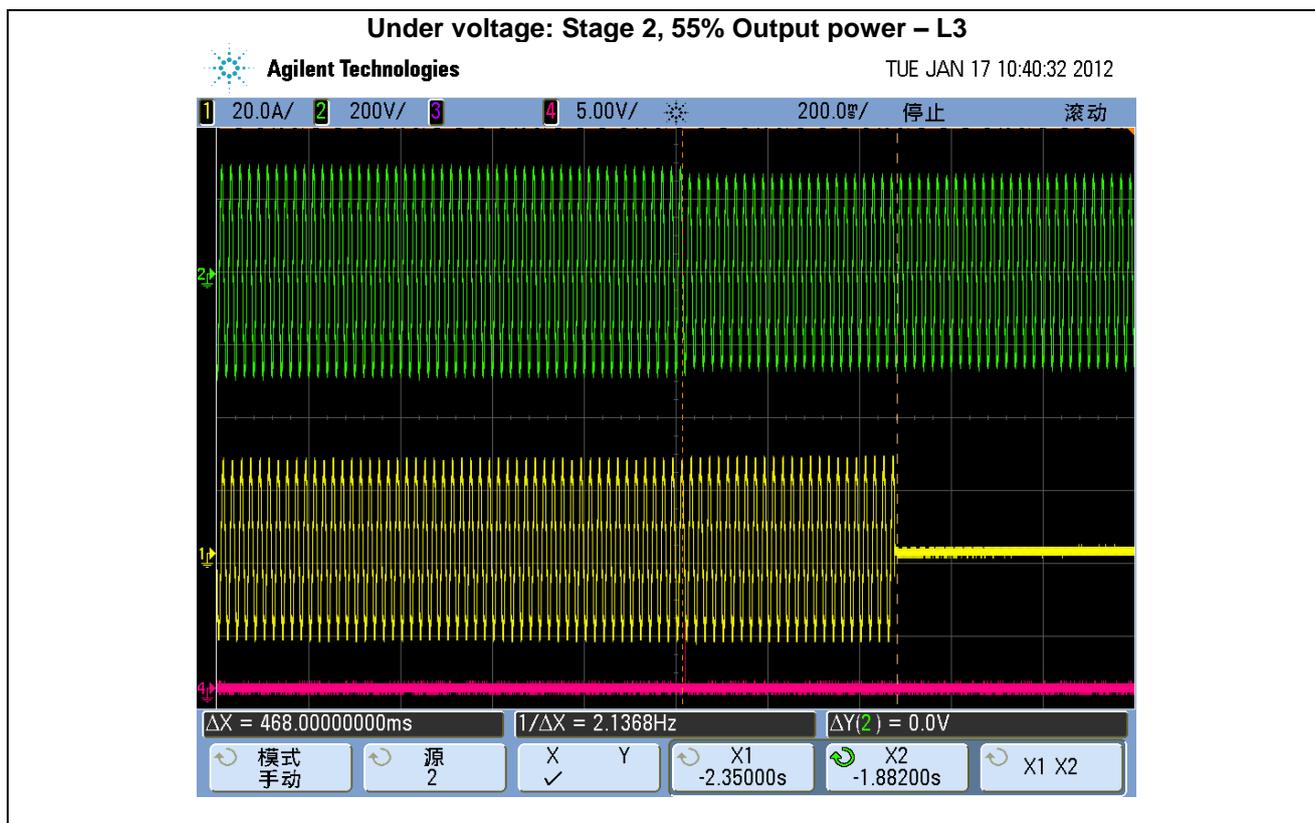
13.7.3 Type verification functional testing of the interface protection

13.7.3.2 UNDER / OVER VOLTAGE TESTS								P
Parameter	Under Voltage				Over Voltage			
	L1 phase							
Parameter	Voltage	Time (sec)			Voltage	Time (sec)		
Output power level		10%	55%	100%		10%	55%	100%
G59/2 Limit: stage 1	-13%Un	2,5 s			+10%Un	1,0 s		
Actual setting	201,3V	201,4V	200,8V	201,5V	250V	252,2V	251,5V	250,3V
Trip value	204V to 198V	2,264	2,450	2,445	248V to 255V	0,944	0,946	0,946
		2,265	2,455	2,445		0,940	0,944	0,948
		2,250	2,425	2,445		0,948	0,942	0,936
		2,435	2,445	2,450		0,938	0,938	0,946
		2,430	2,445	2,465		0,944	0,944	0,948
G59/2 Limit: stage 2	-20%Un	0,5 s			+15%Un	0,5 s		
Actual setting	185V	186,2V	185,3V	184,0V	263V	263,8V	263,2V	262,3V
Trip value	204V to 184V	0,452	0,454	0,456	248V to 264V	0,450	0,462	0,456
		0,460	0,458	0,460		0,460	0,456	0,460
		0,448	0,458	0,460		0,452	0,454	0,450
		0,446	0,460	0,460		0,446	0,456	0,456
		0,450	0,454	0,458		0,454	0,452	0,448
Parameter	Under Voltage				Over Voltage			
	L2 phase							
Parameter	Voltage	Time (sec)			Voltage	Time (sec)		
Output power level		10%	55%	100%		10%	55%	100%
G59/2 Limit: stage 1	-13%Un	2,5 s			+10%Un	1,0 s		
Actual setting	201,3V	202,8V	201,7V	200,7V	250V	251,6V	250,5V	249,6V
Trip value	205V to 198V	2,440	2,460	2,440	247V to 254V	0,954	0,942	0,945
		2,435	2,450	2,450		0,948	0,938	0,936
		2,450	2,455	2,450		0,952	0,934	0,938
		2,435	2,440	2,460		0,940	0,942	0,944
		2,440	2,440	2,440		0,946	0,940	0,946
G59/2 Limit: stage 2	-20%Un	0,5 s			+15%Un	0,5 s		
Actual setting	185V	186,7V	185,8V	184,9V	263V	263,5V	262,5V	261,5V
Trip value	205V to 184V	0,444	0,446	0,456	247V to 264.6V	0,444	0,454	0,444
		0,442	0,448	0,458		0,454	0,442	0,448
		0,452	0,452	0,446		0,460	0,452	0,450
		0,448	0,446	0,454		0,454	0,444	0,448
		0,442	0,452	0,446		0,448	0,450	0,446

Parameter	Under Voltage				Over Voltage			
	L3 phase							
Parameter	Voltage	Time (sec)			Voltage	Time (sec)		
Output power level		10%	55%	100%		10%	55%	100%
G59/2 Limit: stage 1	-13%Un	2,5 s			+10%Un	1,0 s		
Actual setting	201,3V	201,7V	201,0V	199,6V	250V	252,6V	251,6V	250,8V
Trip value	204V to 198V	2,440	2,440	2,460	248V to 255V	0,944	0,953	0,940
		2,440	2,450	2,450		0,952	0,940	0,935
		2,450	2,440	2,455		0,938	0,945	0,935
		2,430	2,450	2,440		0,965	0,950	0,950
		2,450	2,460	2,450		0,960	0,955	0,940
G59/2 Limit: stage 2	-20%Un	0,5 s			+15%Un	0,5 s		
Actual setting	185V	186,4V	185,4V	184,2V	263V	264,2V	263,6V	262,9V
Trip value	204V to 184V	0,466	0,446	0,456	248V to 264V	0,460	0,464	0,450
		0,454	0,452	0,458		0,460	0,448	0,452
		0,458	0,468	0,462		0,458	0,454	0,446
		0,464	0,458	0,458		0,448	0,450	0,458
		0,460	0,454	0,468		0,454	0,466	0,460

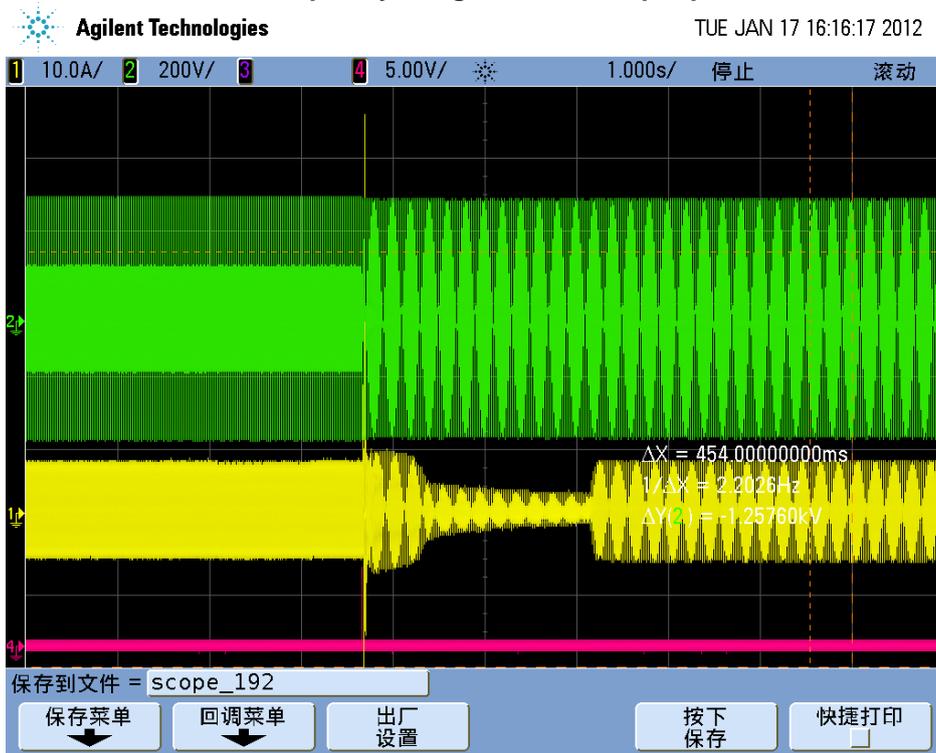
Note:
The Interface Protection should operate within the specified trip times of Table 10.5.7.1 when the voltage is at or within 1.5% of the trip setting of the inverter. The measurement shall take place at nominal frequency, 10%, 55% and 100% power.
The tests had been performed on the model Growatt 20000UE is valid for Growatt 10000UE, Growatt 12000UE, Growatt 18000UE,, since they are identical in hardware and just power derated by software.



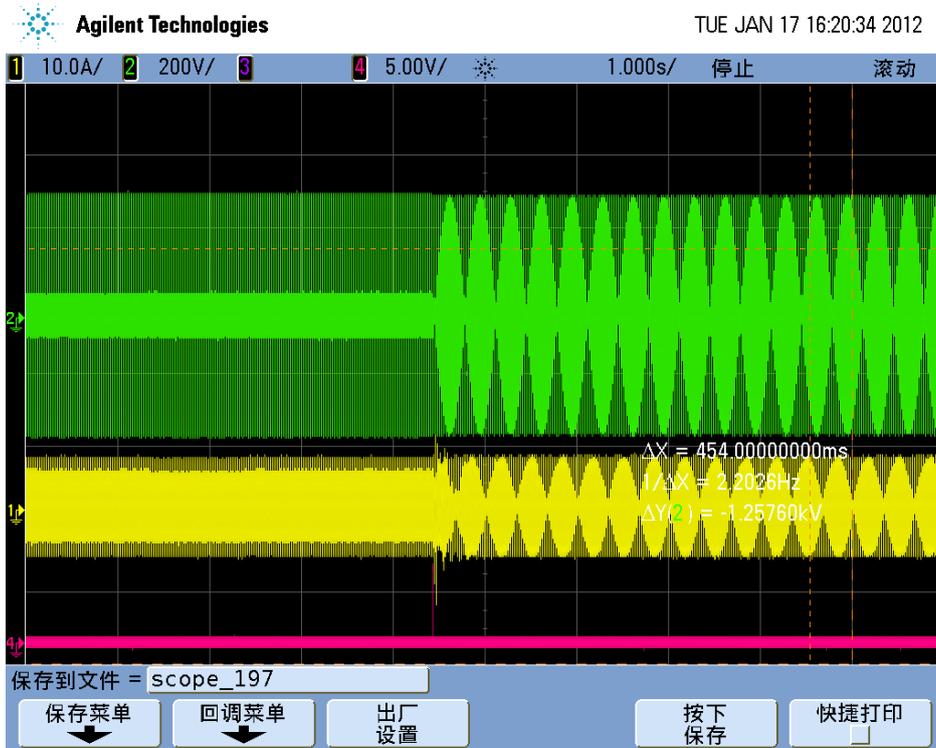


13.7.3.3 UNDER / OVER FREQUENCY TESTS					P
Under frequency			Over frequency		
Load condition:					
1) Full rating for an inverter of up to 5kW rating 2) No less than 10% of the rating for larger inverters up to 50KW.					
Parameter	Frequency	Time	Frequency	Time	
Output power level		100%		100%	
G59/2 Limit: stage 1	47,5Hz	at least 20s	51,5Hz	at least 90s	
Actual setting	--	--	--	--	
Trip value	50,0Hz to 47,5Hz	No disconnection	50,5Hz to 51,5Hz	No disconnection	
		No disconnection		No disconnection	
		No disconnection		No disconnection	
		No disconnection		No disconnection	
		No disconnection		No disconnection	
G59/2 Limit: stage 2	47,0Hz	max. 0,5s	52,0Hz	max. 0,5s	
Actual setting	47,03Hz	47,03Hz	51,97Hz	51,97Hz	
Trip value	47,23Hz to 46,76Hz	0,480	51,74Hz to 52,26Hz	0,408	
		0,436		0,412	
		0,456		0,414	
		0,444		0,414	
		0,438		0,408	
Note:					
Under abnormal conditions automatic low-frequency load-shedding provides for load reduction down to 47Hz. In exceptional circumstances, the frequency of the DNO's Distribution System could rise above 50,5Hz. Therefore all embedded Small Power Stations should be capable to continuing to operate in parallel with the Distribution System in accordance with the following:					
<ul style="list-style-type: none"> - Disconnection by over-frequency or under-frequency protection is not permitted in the range of 47,5Hz till 51,5Hz. - Operation for a period of at least 20 seconds is required each time the frequency is within the range of 47,0Hz till 47,5Hz. - Operation for a period of at least 90 seconds is required each time the frequency is within the range of 51,5Hz till 52Hz. 					
Operation of the under/over frequency protection will be demonstrated for an increase or decrease of frequency within $\pm 0.5\%$ of the trip settings, e.g. for an Over Frequency setting of 50.5 Hz the permissible operating range is 50.5 ± 0.2525 Hz. The test frequency should be applied in steps of $\pm 0.5\%$ of setting for a duration that is longer than the trip time delay, for example 1 second in the case of a delay setting of 0.5 second.					
The tests had been performed on the model Growatt 20000UE is valid for Growatt 10000UE, Growatt 12000UE, Growatt 18000UE,, since they are identical in hardware and just power derated by software.					

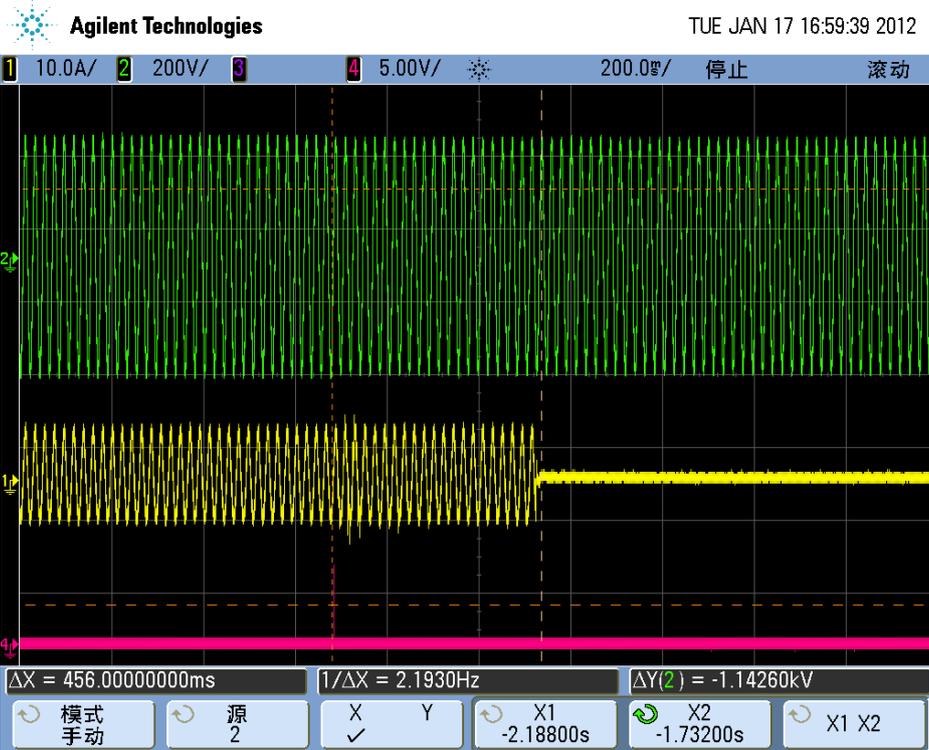
Under frequency: Stage 1, 100% Output power



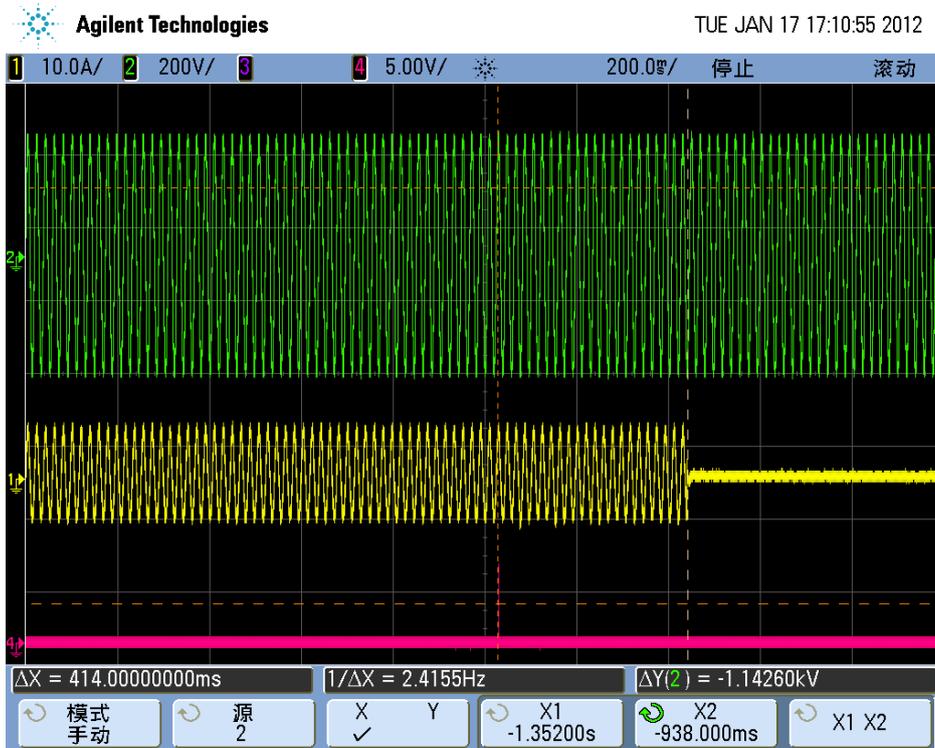
Over frequency: Stage 1, 100% Output power



Under frequency: Stage 2, 100% Output power



Over frequency: Stage 2, 100% Output power



C3.4 LOSS OF MAINS TEST			P
Test conditions:	Frequency: 50+/-0,2Hz $U_N=230\pm 3V_{ac}$ RLC consumes inverter real power within +/- 5% Quality >2 @ 55% load		
Output power level:	10%	55%	100%
G59/2 Limit:	5s		
Actual setting (sec):	1,5s	1,5s	1,5s
L1 phase			
Trip value (sec):	0,132	0,161	0,261
	0,134	0,157	0,295
	0,135	0,164	0,288
	0,132	0,153	0,420
	0,134	0,154	0,283
Parameter	L= 22,86H	L= 22,87mH	L= 22,87mH
	R=79.58Ω	R=14,4Ω	R=7,925Ω
	C=442,2F	C=442,2F	C=442,2F
L2 phase			
Trip value (sec):	0,136	0,942	0,394
	0,141	0,838	0,430
	0,124	1,080	0,402
	0,118	1,074	0,310
	0,117	1,088	0,301
Parameter	L= 22,86H	L= 22,87mH	L= 22,87mH
	R=79.58Ω	R=14,4Ω	R=7,925Ω
	C=442,2F	C=442,2F	C=442,2F

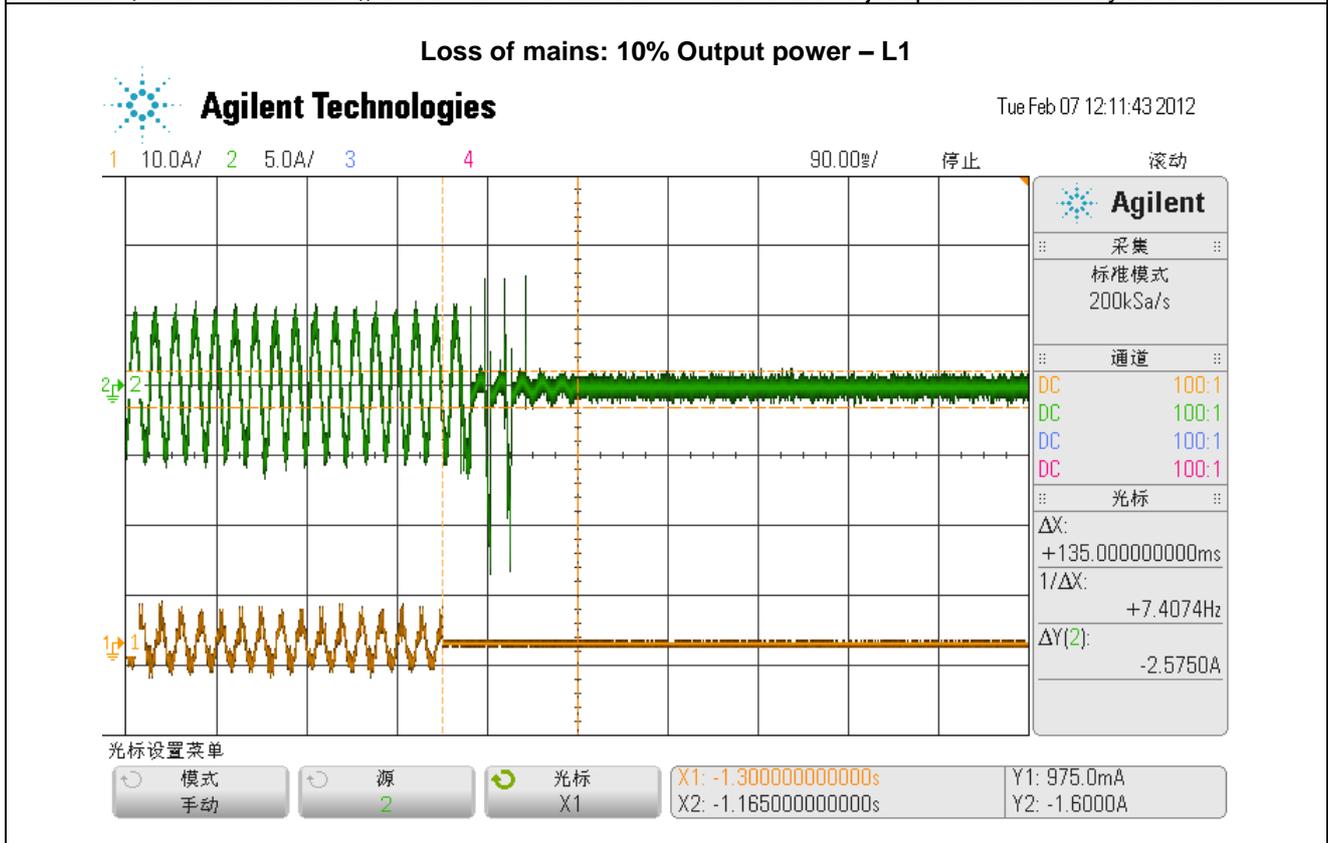
	L3 phase		
Trip value (sec):	0,338	0,231	0,524
	0,280	0,265	0,513
	0,279	0,289	0,510
	0,304	0,296	0,585
	0,319	0,299	0,495
Parameter	L= 22,86H	L= 22,87mH	L= 22,87mH
	R=79.58Ω	R=14,4Ω	R=7,925Ω
	C=442,2F	C=442,2F	C=442,2F

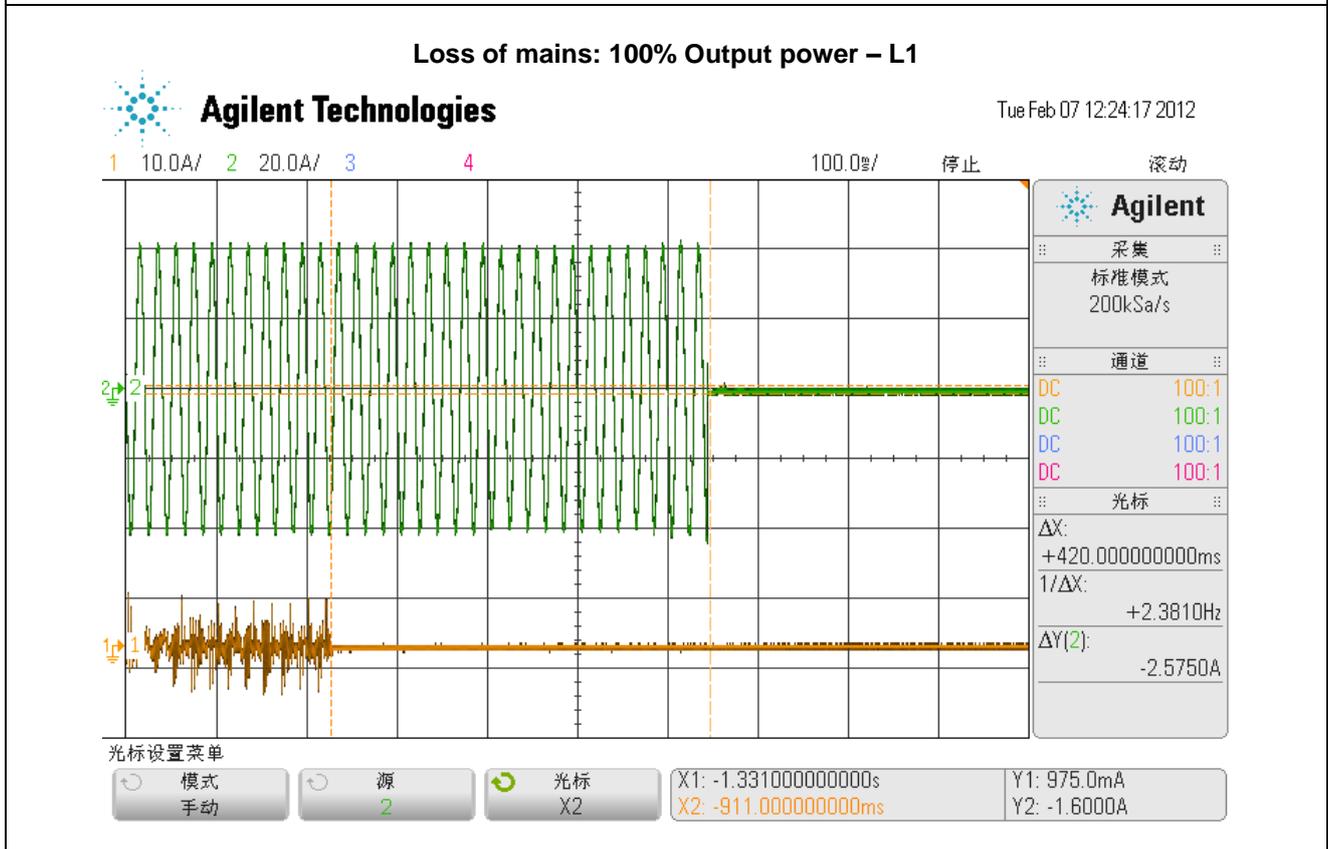
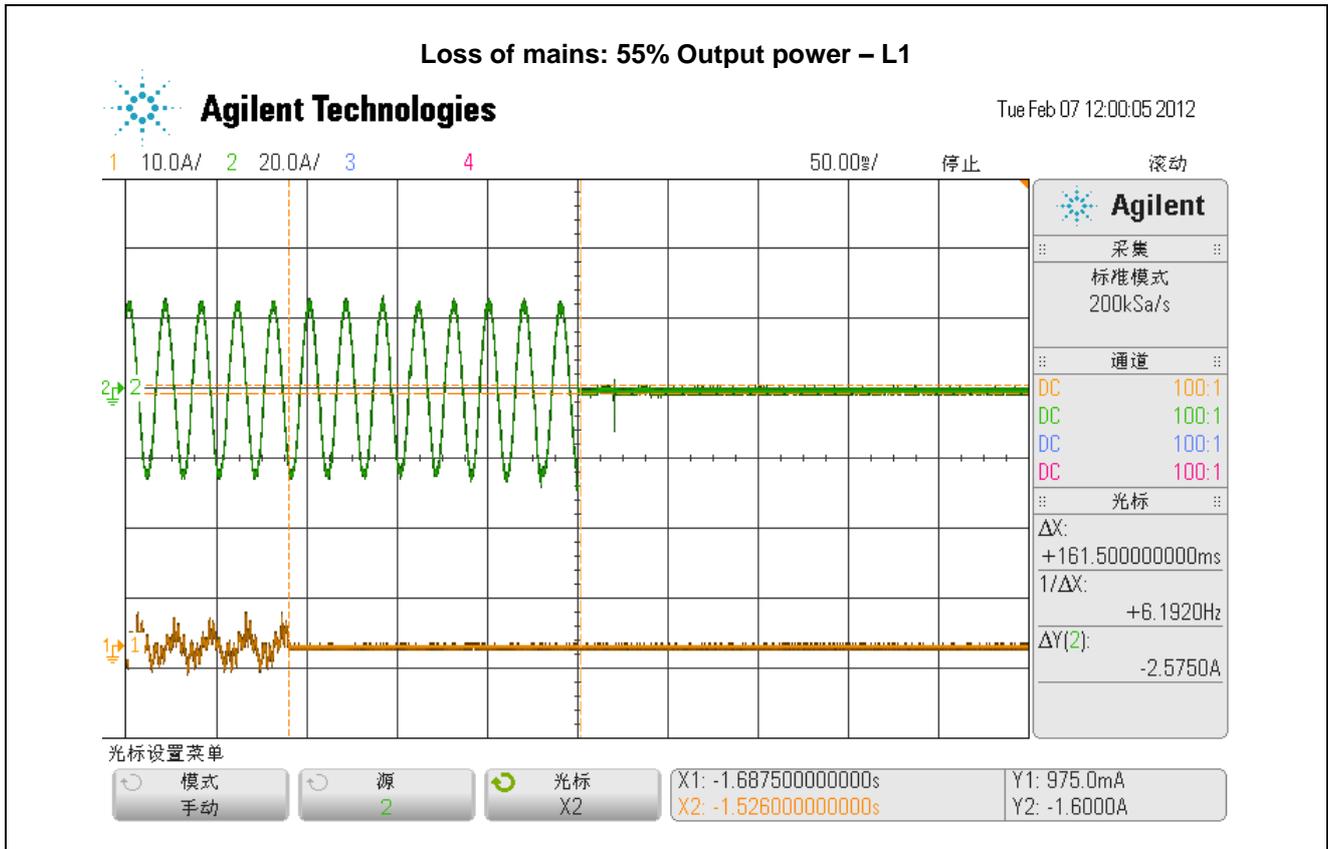
Note:

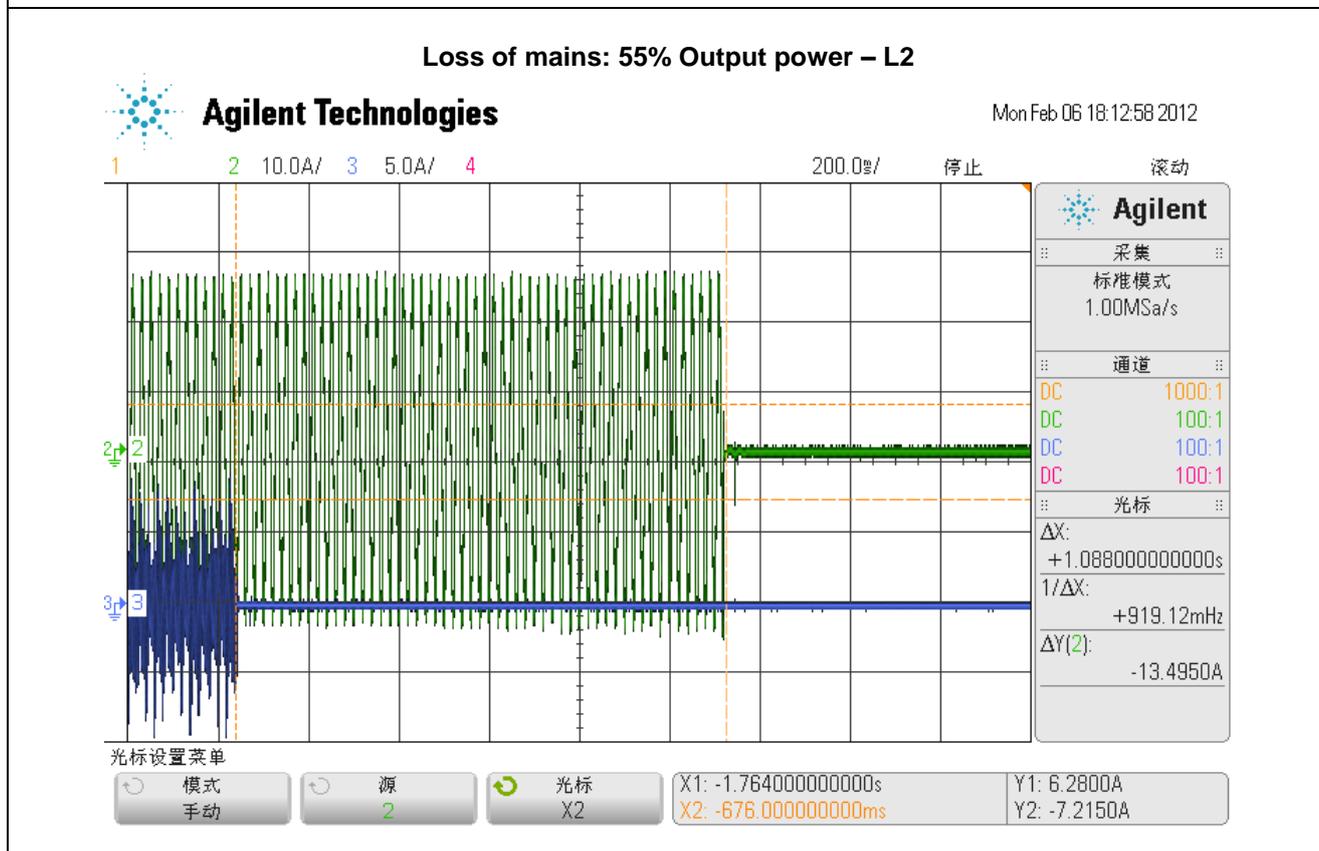
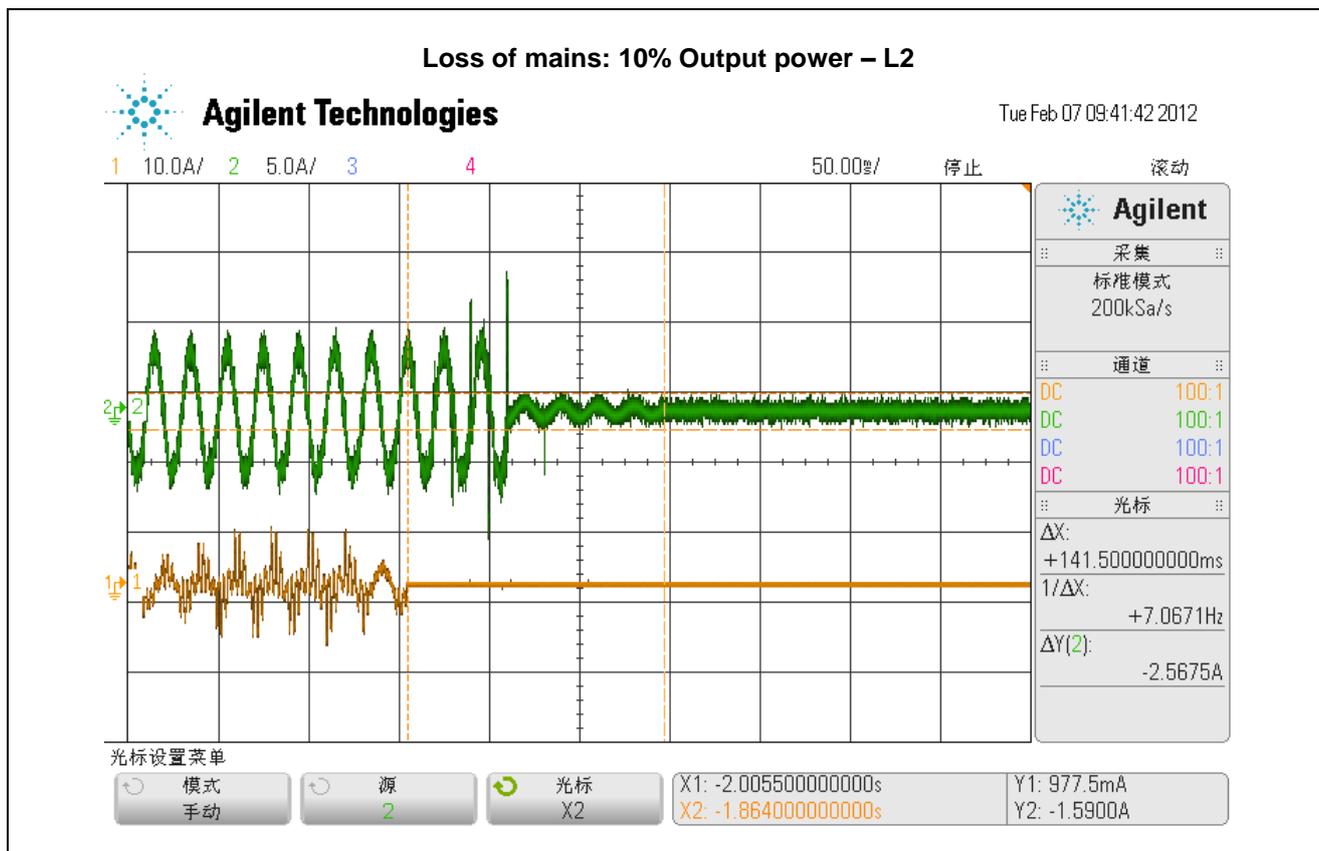
Inverter connected to a network combining a resonant circuit with a Q factor >2 (at 55% output power and the values of L and C are fixed for 10% and 100% tests) and a variable load; the value of the load is to match the inverter output to within +/-5%. A switch is placed between inverter/load and distribution system.

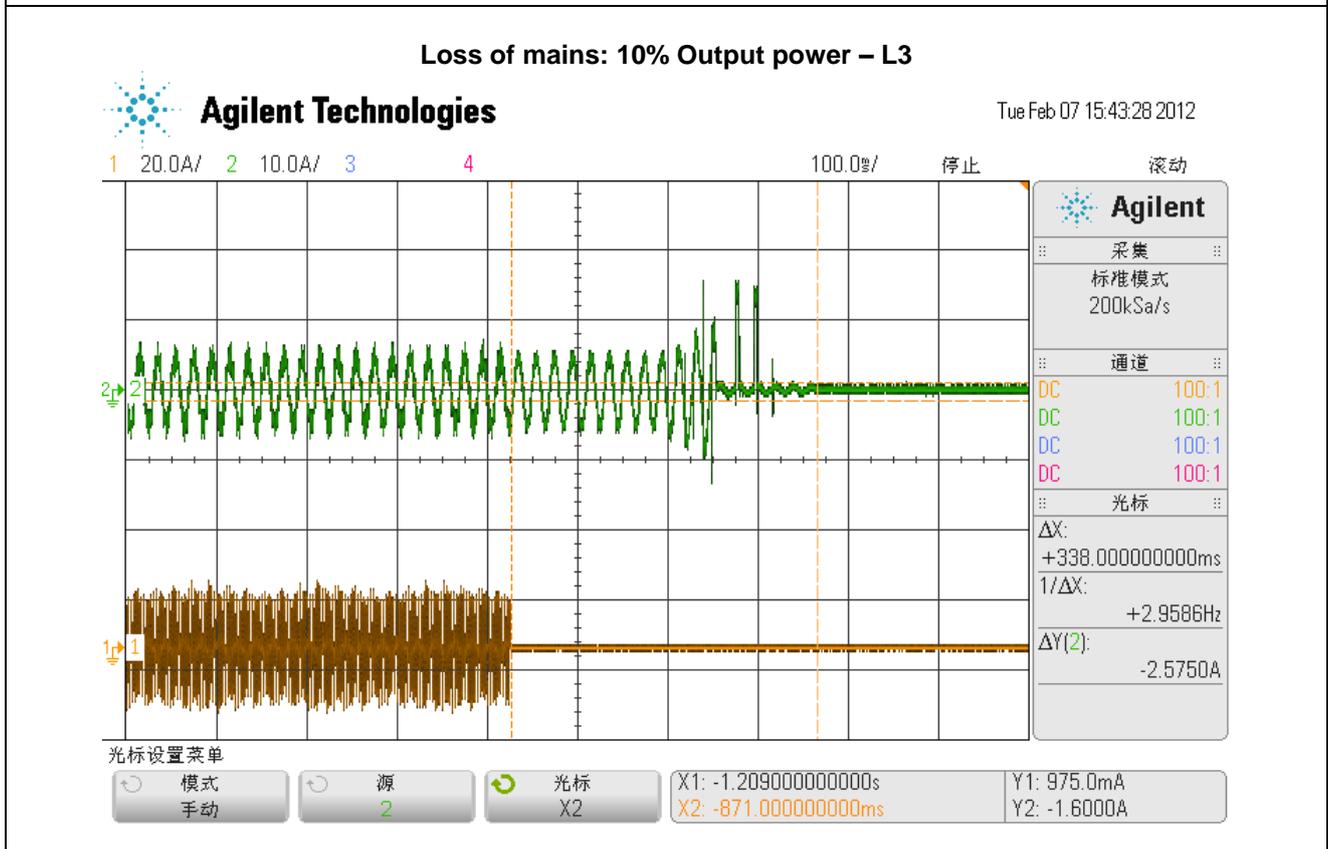
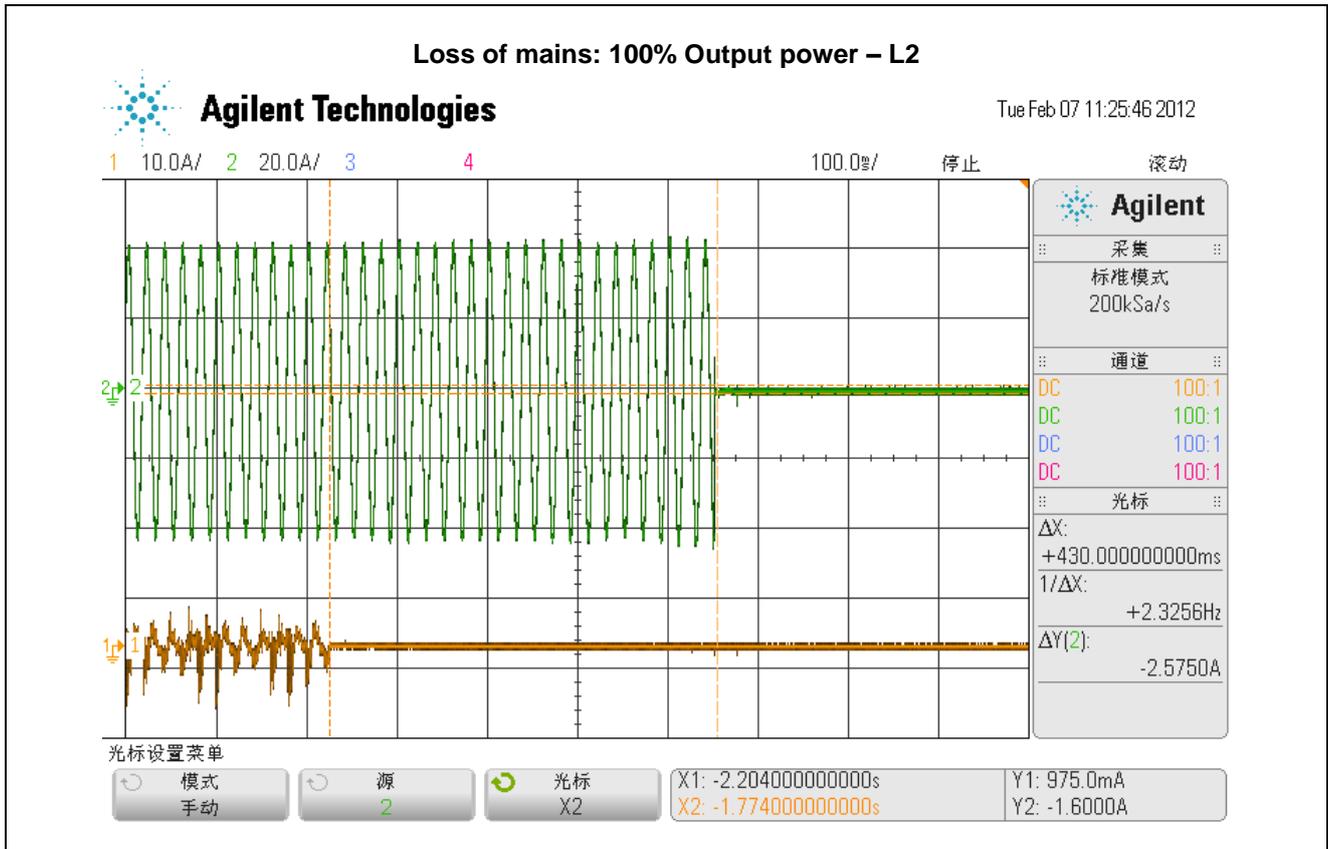
Rate of change of frequency (RoCoF) detection was used for LOM protection.

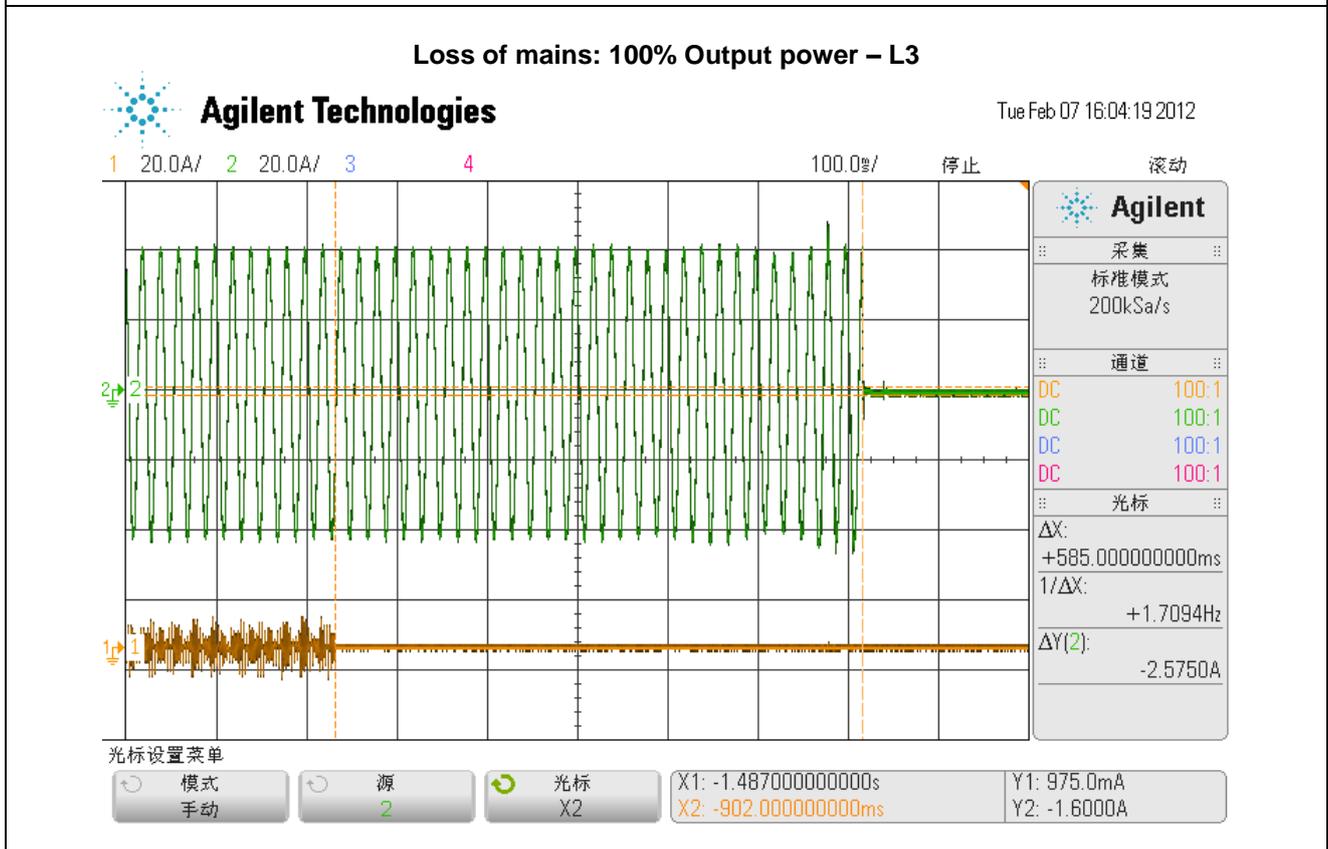
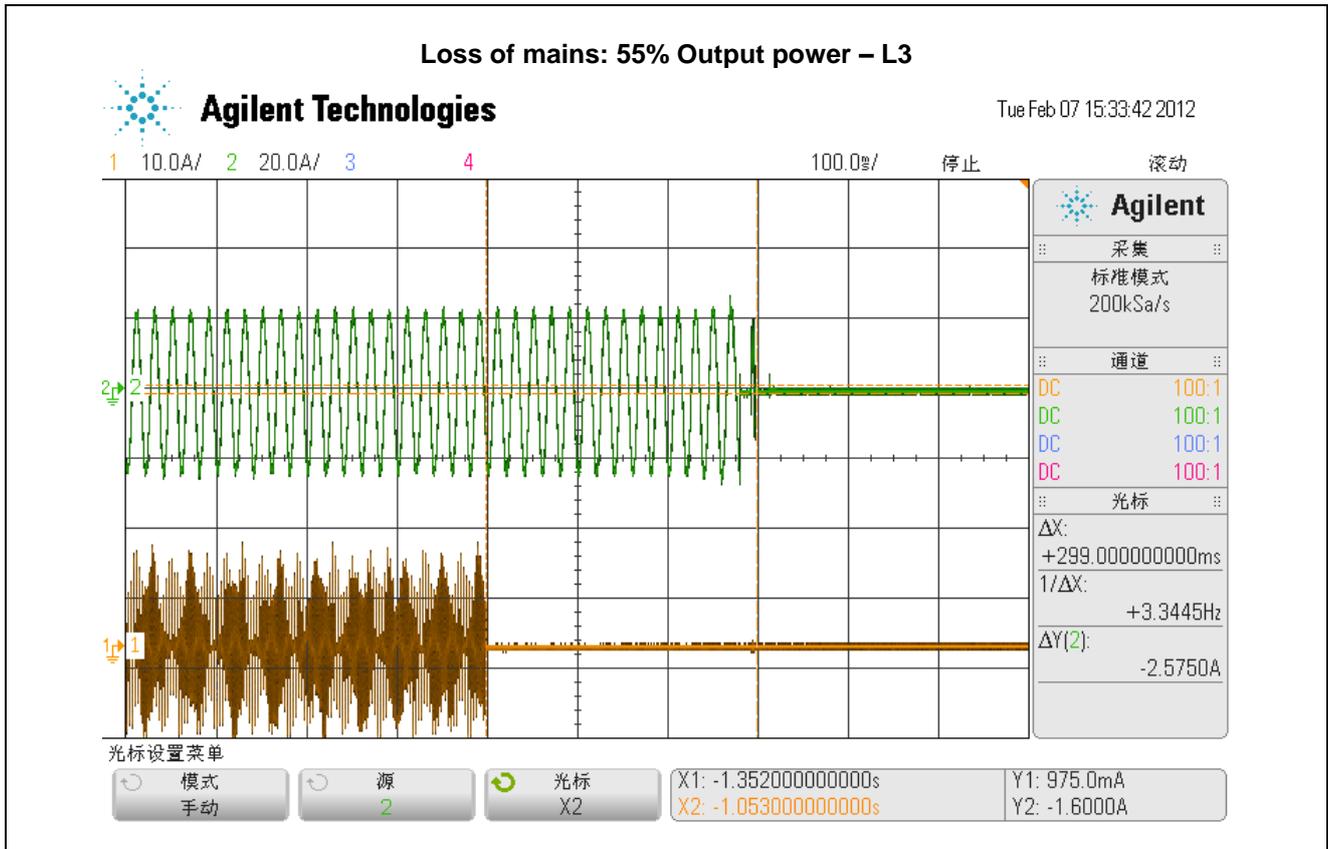
The tests had been performed on the model Growatt 20000UE is valid for Growatt 10000UE, Growatt 12000UE, Growatt 18000UE,, since they are identical in hardware and just power derated by software.











13.7.5 RE-CONNECTION TIMES				P
Reconnection Time	Under/Over voltage	Under/over frequency	Loss of mains	
Minimum value	180 seconds			
Actual settings (sec)	200	200	200	
Recorded value (sec)	201/201	201/201	200	
Note: The tests had been performed on the model Growatt 20000UE is valid for Growatt 10000UE, Growatt 12000UE, Growatt 18000UE,, since they are identical in hardware and just power derated by software.				

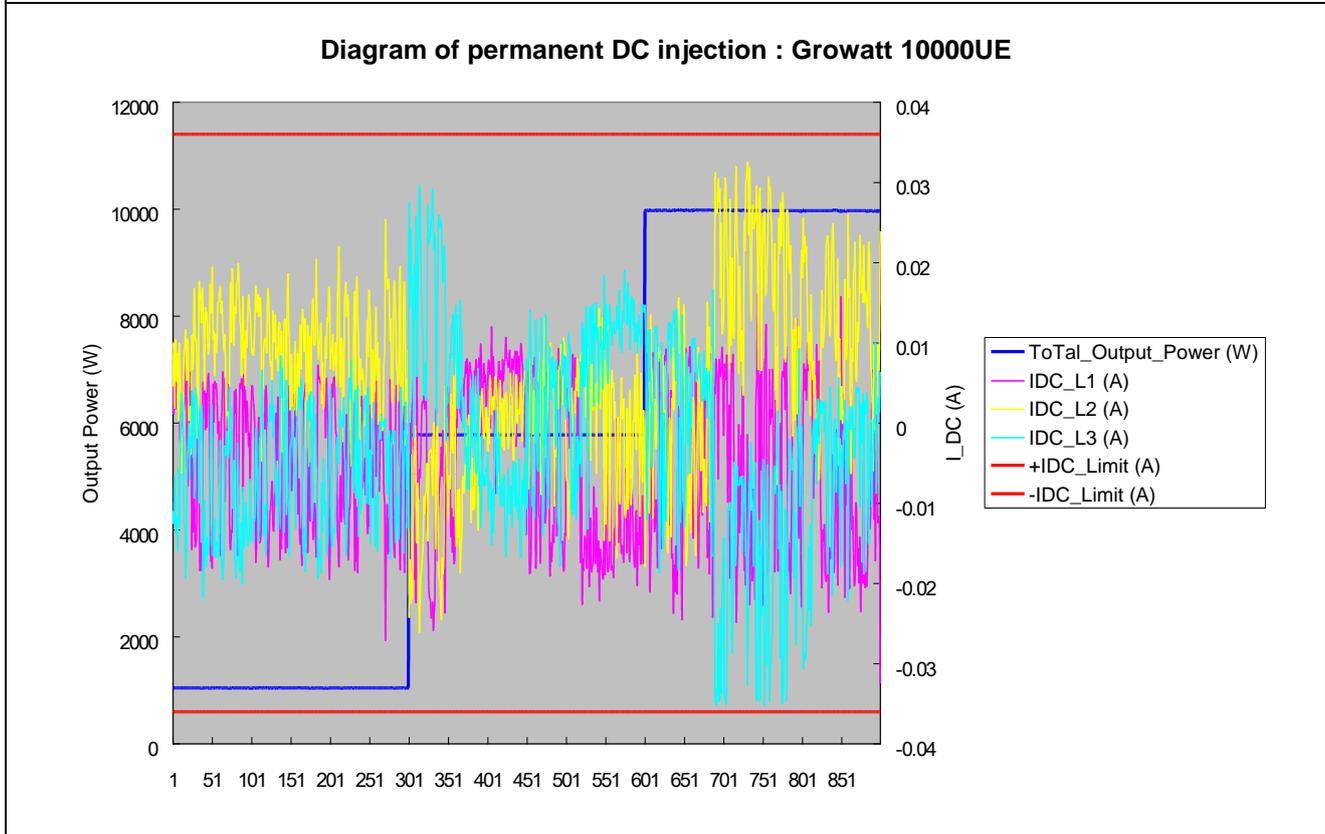
13.7.6 Power quality

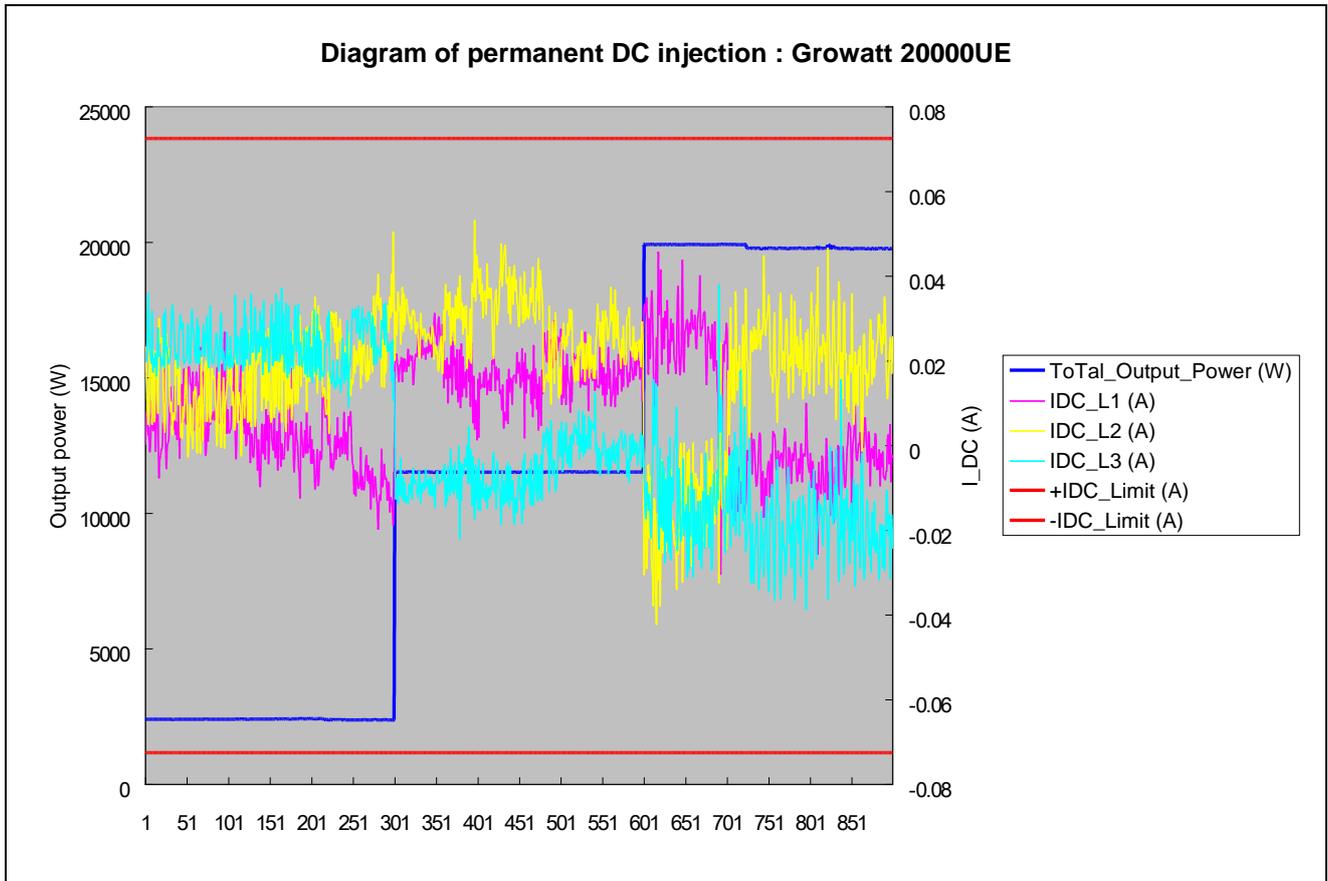
13.7.6.1 Harmonic Current Emissions											P	
Growatt 20000UE												
Maximum permissible harmonic current as per EN 61000-3-12												
Harmonic	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th	13 th
Limit [%] 3phasig	8,00	N/A	4,00	10,70	2,67	7,20	2,00	N/A	1,60	3,10	1,33	2,00
Test value [%]	1,108	0,202	0,828	0,960	0,097	0,558	0,281	0,254	0,145	0,023	0,047	0,127
THD						PWHD						
Limit [%] 3phasig	13						22					
Test value [%]	1,902%						2,27%					
Growatt 10000UE												
Maximum permissible harmonic current as per EN 61000-3-12												
Harmonic	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th	13 th
Limit [%] 3phasig	8,00	N/A	4,00	10,70	2,67	7,20	2,00	N/A	1,60	3,10	1,33	2,00
Test value [%]	0,439	8,192	0,684	2,227	1,960	0,673	0,865	2,474	0,283	0,298	0,123	0,145
THD						PWHD						
Limit [%] 3phasig	13						22					
Test value [%]	9,557 %						12,197%					
Note: The tests are based on the limits of the EN 61000-3-12 for more than 16A. Covered by EMC Report 13.7.6.8												

13.7.6.2 Power factor			P
G 59/2 Limit	+/- 0,95pf		
Output Voltage:	212V (U _N -8%)	230V	248V (U _N +12.7%)
Test Value Growatt 20000UE	0,9990	0,9991	0,9991
Test Value Growatt 18000UE	0,9990	0,9992	0,9992
Test Value Growatt 12000UE	0,9991	0,9991	0,9992
Test Value Growatt 10000UE	0,9991	0,9992	0,9993
Note: The power factor test shall be such that the inverter supplies full load to the DNO system.			

13.7.6.3 Voltage Flicker			P	
U _N =230V Output power: 100%				
Test conditions:	Maximum permissible voltage fluctuation (expressed as a percentage of nominal voltage at 100 % power) and flicker as per EN 61000-3-3			
	Starting	Stopping	Running	
Limit	3,3%	3,3%	P _{st} =1,0	P _{lt} =0,65
Test value	*	*	*	*
Limit	dc% = 3,3		P _{st} =1,0	P _{lt} =0,65
Test value	0,221		0,365	0,324
Note:				
* see Annex No. 1 – EMC Test report				
*The stationary deviance of dc% is bigger than the dynamic deviance of d _{max} at starting and stopping.				
Mains Impedance according EN61000-3-11: R_{max} = 0,24Ω; jX_{max} = 0,15Ω @50Hz (Z_{max} = 0,283Ω)				
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.				
Covered by EMC Report 13.7.6.8				

13.7.6.4 DC injection			P
G 59/2 Limit	20mA till 2kW, 0,25% for inverter over 2kW		
Output power:	10%	55%	100%
Growatt 10000UE			
Test Value: L1 Phase	-27,0mA	-25,8mA	-32,5mA
Test Value: L2 Phase	25,1mA	-26,0mA	32,6mA
Test Value: L3 Phase	-21,4mA	29,6mA	-35,2mA
Growatt 20000UE			
Test Value: L1 Phase	26,5mA	31,2mA	45,3mA
Test Value: L2 Phase	50,4mA	53,3mA	46,4mA
Test Value: L3 Phase	37,3mA	-22,1mA	-38,7mA
Note:			
The level of dc injection may be measured during tests 13.7.3.2, 13.7.3.3, 13.7.3.4 and 13.7.6.2.			
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 model Growatt 20000UE and Growatt 10000UE, the results are valid for Growatt 12000UE, Growatt 18000UE, since they are identical in hardware and just power derated by software.			





13.7.6.5 Over Current Protection	P
The products have to be installed with appropriate protection according to BS7671	
Note: See installation manual	

13.7.6.6 Short circuit Current Contribution	P
As Photovoltaic SSEGs are inverter connected, they are deemed to automatically comply with regulations and no further tests are required.	

13.7.6.7 Self Monitoring – Solid state Disconnection	N/A
Units do not provide solid state switching relays. In case the semiconductor bridge is switched off, then the voltage on the output drops to 0. In this case the relays on the output will also open.	

13.7.6.8 Electromagnetic Compatibility (EMC)	P
Note: The whole report is stored at Bureau Veritas Consumer Product Services GmbH, Türkheim	

13.7.6.9 Generating Unit Electrical Installation	N/A

Annex No. 1
EMC test report
**(The whole report is stored at Bureau Veritas Consumer
Product Services GmbH, Türkheim)**



Shenzhen EMTEK Co., Ltd.
Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China
www.emtek.com.cn Tel:+86-755-2695 4280 Fax:+86-755-2695 4282



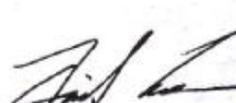
Certificate of Conformity

NO.: ES110616085E-1

The following product has been tested by us with the listed standards and found in conformity with the council EMC directive 2004/108/EC. It is possible to use CE marking to demonstrate the conformity with this EMC Directive.

Applicant : SHENZHEN GROWATT NEW ENERGY CO., LTD.
Address : NO.12 Building, Xicheng Industrial Zone, Bao'an District, Shenzhen, China
Manufacturer : SHENZHEN GROWATT NEW ENERGY CO., LTD.
Address : NO.12 Building, Xicheng Industrial Zone, Bao'an District, Shenzhen, China
Trade Mark : Growatt
EUT : Solar Inverter
M/N : Growatt 18000UE, Growatt 20000UE
Test Standards : EN 61000-6-3:2007
EN 61000-6-2:2005




(Manager)
October 25, 2011


The certificate is based on a single evaluation of one sample of above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab. logo.

SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1



EMC TEST REPORT
For

SHENZHEN GROWATT NEW ENERGY CO., LTD.

Solar Inverter

Model No.: Growatt 18000UE, Growatt 20000UE

Prepared for : SHENZHEN GROWATT NEW ENERGY CO., LTD.
Address : NO.12 Building, Xicheng Industrial Zone, Bao' an District,
Shenzhen, China

Prepared by : SHENZHEN EMTEK CO., LTD.
Address : Bldg 69, Majialong Industry Zone,
Nanshan District, Shenzhen, Guangdong, China

Tel: (0755) 26954280

Fax: (0755) 26954282

Report Number : ES110616085E-1
Date of Test : October 20, 2011 to October 25, 2011
Date of Report : October 25, 2011

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APPENDIX I (Photos of EUT) (2 Pages)

SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1

TEST REPORT DESCRIPTION

Applicant : SHENZHEN GROWATT NEW ENERGY CO., LTD.
Manufacturer : SHENZHEN GROWATT NEW ENERGY CO., LTD.
Trademark : Growatt
EUT : Solar Inverter
Model No. : Growatt 18000UE, Growatt 20000UE
Power Supply : Growatt 18000UE:
Input: 300-1000VDC;
Output: three phases, 230VAC, 26A, 18000W
Growatt 20000UE:
Input: 300-1000VDC;
Output: three phases, 230VAC, 29A, 20000W

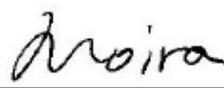
Measurement Procedure Used:

EN 61000-6-3:2007
EN 61000-6-2:2005
(EN 61000-4-2:2009, EN 61000-4-3:2006+A1:2008+A2:2010,
EN 61000-4-4:2004+A1:2010, EN 61000-4-5:2006, EN 61000-4-6:2009, EN 61000-4-8:2010)

The device described above is tested by SHENZHEN EMTEK CO., LTD. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and SHENZHEN EMTEK CO., LTD. is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the EN 61000-6-3 and EN 61000-6-2 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of SHENZHEN EMTEK CO., LTD.

Date of Test : October 20, 2011 to October 25, 2011

Prepared by : 
(Engineer)

Reviewer : 
(Quality Manager)

Approved & Authorized Signer : 
(Manager)



1. SUMMARY OF TEST RESULT

EMISSION			
Description of Test Item	Standard	Limits	Results
Conducted Disturbance	EN 61000-6-3:2007	--	Pass
Radiated Disturbance	EN 61000-6-3:2007	--	Pass
IMMUNITY (EN 61000-6-2:2005)			
Description of Test Item	Basic Standard	Performance Criteria	Results
Electrostatic Discharge (ESD)	EN 61000-4-2:2009	B	Pass
Radio-Frequency, Continuous Radiated Disturbance	EN 61000-4-3:2006 +A1:2008+A2:2010	A	Pass
EFT/B Immunity	EN 61000-4-4:2004 +A1:2010	B	Pass
Surge Immunity	EN 61000-4-5:2006	B	Pass
Conducted RF Immunity	EN 61000-4-6:2009	A	Pass
Power Frequency Magnetic Field	EN 61000-4-8:2010	A	Pass
Note: N/A is an abbreviation for Not Applicable.			

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

EUT	: Solar Inverter
Model Number	: Growatt 18000UE, Growatt 20000UE (Note: All models have same circuit diagram and PCB layout except their output rating. We prepare Growatt 18000UE for test.)
Input Voltage	: DC 480V
Output Voltage	: AC 380V/50Hz
Applicant	: SHENZHEN GROWATT NEW ENERGY CO., LTD.
Address	: NO.12 Building, Xicheng Industrial Zone, Bao' an District, Shenzhen, China
Manufacturer	: SHENZHEN GROWATT NEW ENERGY CO., LTD.
Address	: NO.12 Building, Xicheng Industrial Zone, Bao' an District, Shenzhen, China
Date of Received	: October 20, 2011
Date of Test	: October 20, 2011 to October 25, 2011

2.2. Description of Test Facility

Site Description	
EMC Lab.	: Accredited by CNAS, 2010.10.29 The certificate is valid until 2013.10.28 The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005) The Certificate Registration Number is L2291. Accredited by TUV Rheinland Shenzhen 2010.5 The Laboratory has been assessed according to the requirements ISO/IEC 17025. Accredited by FCC, October 28, 2010 The Certificate Registration Number is 406365. Accredited by Industry Canada, March 5, 2010 The Certificate Registration Number is 46405-4480.
Name of Firm	: SHENZHEN EMTEK CO., LTD.
Site Location	: Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1

2.3. Description of Support Device

N/A

2.4. Measurement Uncertainty

Conducted Emission Uncertainty : 2.8dB

Radiated Emission Uncertainty : 4.2dB (10m Chamber)

3. MEASURING DEVICE AND TEST EQUIPMENT

3.1. For Conducted Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCS30	828985/018	May 29, 2011	1 Year
2.	L.I.S.N.	Schwarzbeck	NNLK8129	8129-203	May 29, 2011	1 Year
4.	L.I.S.N.	Rohde & Schwarz	ESH3-Z6	100011	May 29, 2011	1 Year
5.	L.I.S.N.	Rohde & Schwarz	ESH3-Z6	100253	May 29, 2011	1 Year
6.	L.I.S.N.	Rohde & Schwarz	ESH3-Z5	100191	May 29, 2011	1 Year
7.	50Ω Coaxial Switch	Anritsu	MP59B	M20531	N/A	N/A
8.	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100006	May 29, 2011	1 Year
9.	Voltage Probe	Rohde & Schwarz	TK9416	N/A	May 29, 2011	1 Year
10.	I.S.N	Rohde & Schwarz	ENY22	1109.9508.02	May 29, 2011	1 Year

3.2. For Radiated Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Test Receiver	Rohde & Schwarz	ESCI	101045	May 29, 2011	1 Year
2.	Pre-Amplifier	CD	PAP-0203	22013	May 29, 2011	1 Year
3.	Bilog Antenna	Schwarzbeck	VULB9163	141	May 29, 2011	1 Year
4.	Cable	H+B	CBL3-NN-0.5m	100319-2140500-1	May 29, 2011	1 Year
5.	Cable	H+B	CBL3-NN-3m	100319-2143000-1	May 29, 2011	1 Year
6.	Cable	H+B	CBL3-NN-6.5m	100319-2146500-1	May 29, 2011	1 Year
7.	Cable	H+B	CBL3-NN-10.5m	100319-21410500	May 29, 2011	1 Year
8.	Cable	H+B	CBL3-NN-12.5m	100319-21412500	May 29, 2011	1 Year

3.3. For Electrostatic Discharge Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	ESD Tester	TESEQAG	NSG 437	000409	May 29, 2011	1 Year

3.4. For RF Strength Susceptibility Test (Below 2GHz)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	RF Power Meter. Dual Channel	BOONTON	4232A	10539	May 29, 2011	1 Year
2.	50ohm Diode Power Sensor	BOONTON	51011EMC	34236/34238	May 29, 2011	1 Year
3.	Broad-Band Horn Antenna	SCHWARZB ECK	BBHA 9120 L3F	332	May 29, 2011	1 Year
4.	Power Amplifier	PRANA	AP32MT215	N/A	May 29, 2011	1 Year
5.	Power Amplifier	MILMEGA	AS0102-55	N/A	May 29, 2011	1 Year
6.	Signal Generator	AEROFLEX	2023B	N/A	May 29, 2011	1 Year

SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1

7.	Field Strength Meter	HOLADAY	HI-6005	N/A	May 29, 2011	1 Year
8.	RS232 Fiber Optic Modem	HOLADAY	HI-4413P	N/A	May 29, 2011	1 Year
9.	Log.-Per. Antenna	SCHWARZB ECK	VULP 9118E	N/A	May 29, 2011	1 Year

3.5. For RF Strength Susceptibility Test in Huatongwei (Above 2GHz)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Signal Generator	IFR-Aeroflex	2032	203002/100	2010/10	1 Year
2.	Power Amplifier	AR	150W 1000	301584	2010/10	1 Year
3.	Antenna	AR	AT1080	28570	2010/10	1 Year
4.	Field Monitor	AR	FM5004	N/A	2010/10	1 Year
5.	Power Head	AR	PH2000	301193	2010/10	1 Year
6.	Power Meter	AR	PH2002	302799	2010/10	1 Year
7.	Dual Directional Coupler	AR	DC6080	301508	2010/10	1 Year

3.6. For Electrical Fast Transient / Burst Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Burst Tester	HAEFELY	PEFT4010	080981-16	May 29, 2011	1 Year
2.	Coupling Clamp	HAEFELY	IP-4A	147147	May 29, 2011	1 Year

3.7. For Surge Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Surge Controller	HAEFELY	Psurge 8000	174031	May 29, 2011	1 Year
2.	Impulse Module	HAEFELY	PIM 100	174124	May 29, 2011	1 Year
3.	Coupling Decoupling Filter	HAEFELY	PCD 130	172181	May 29, 2011	1 Year
4.	Coupling Module	HAEFELY	PCD122	174354	May 29, 2011	1 Year
5.	Surge Impulse Module	HAEFELY	PIM 120	174435	May 29, 2011	1 Year
6.	Coupling Module	HAEFELY	PCD 126A	174387	May 29, 2011	1 Year
7.	Impulse Module	HAEFELY	PIM 110	174391	May 29, 2011	1 Year

3.8. For Injected Current Susceptibility Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Simulator	EMTEST	CWS500C	0900-12	May 29, 2011	1 Year
2.	CDN	EMTEST	CDN-M2	5100100100	May 29, 2011	1 Year
3.	CDN	EMTEST	CDN-M3	0900-11	May 29, 2011	1 Year
4.	Injection Clamp	EMTEST	F-2031-23M M	368	May 29, 2011	1 Year
5.	Attenuator	EMTEST	ATT6	0010222A	May 29, 2011	1 Year

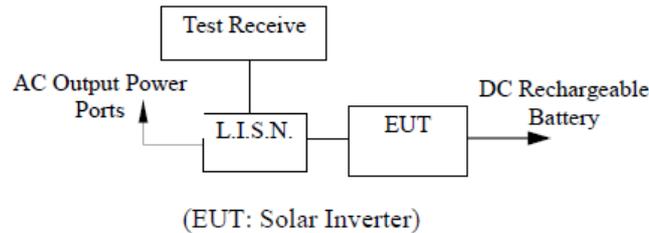
SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1

3.9. For Magnetic Field Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Magnetic Field Tester	HAEFELY	MAG100	250040.1	May 29, 2011	1 Year

4. CONDUCTED EMISSION MEASUREMENT

4.1. Block Diagram of Test Setup



4.2. Measuring Standard

EN 61000-6-3:2007

4.3. Conducted Emission Limits

Frequency (MHz)	Limit (dB μ V)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66.0 ~ 56.0 *	56.0 ~ 46.0 *
0.50 ~ 5.00	56.0	46.0
5.00 ~ 30.00	60.0	50.0

NOTE1-The lower limit shall apply at the transition frequencies.
NOTE2-The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.

4.4. EUT Configuration on Measurement

The following equipments are installed on Conducted Emission Measurement to meet EN 61000-6-3 requirements and operating in a manner which tends to maximize its emission characteristics in a normal application.

EUT : Solar Inverter
Model Number : Growatt 18000UE

4.5. Operating Condition of EUT

- 4.5.1. Setup the EUT as shown on Section 4.1.
- 4.5.2. Turn on the power of all equipments.
- 4.5.3. Let the EUT work in measuring mode (Full Load) and measure it.

4.6. Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and the AC Output Power Ports connected to the AC mains through Line Impedance Stability Network (L.I.S.N). This provided a 50ohm coupling impedance for the tested equipments. All of the output lines are investigated to find out the maximum conducted emission according to the EN 61000-6-3 regulations during conducted emission measurement.

The bandwidth of the field strength meter (R&S Test Receiver ESCS30) is set at 9kHz in 150kHz~30MHz and 200Hz in 9kHz~150kHz.

The frequency range from 150kHz to 30MHz is investigated.

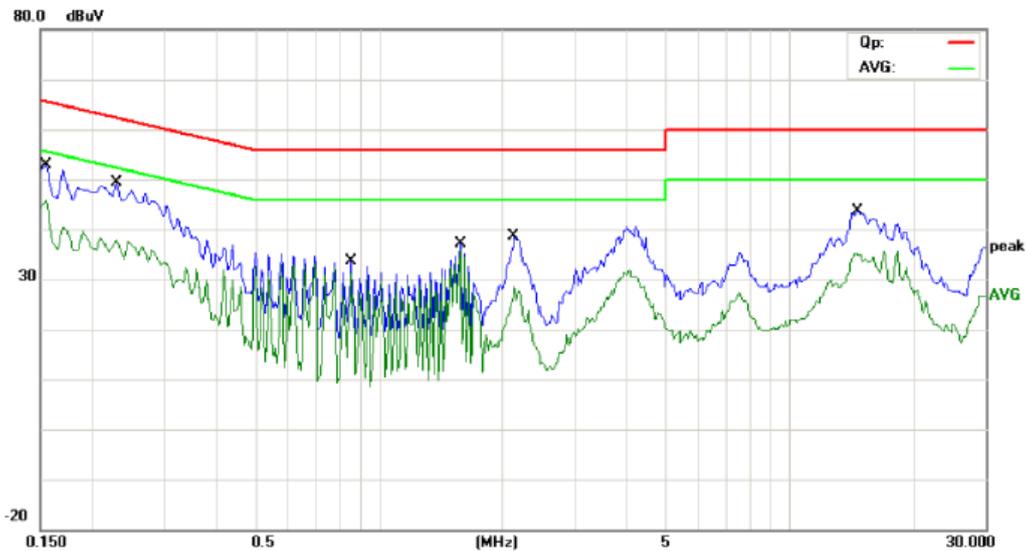
All the scanning waveform is put in Appendix I.

4.7. Measuring Results

PASS.

Please see the attached pages.

SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1



Site Conduction #2

Phase: L1

Temperature: 26

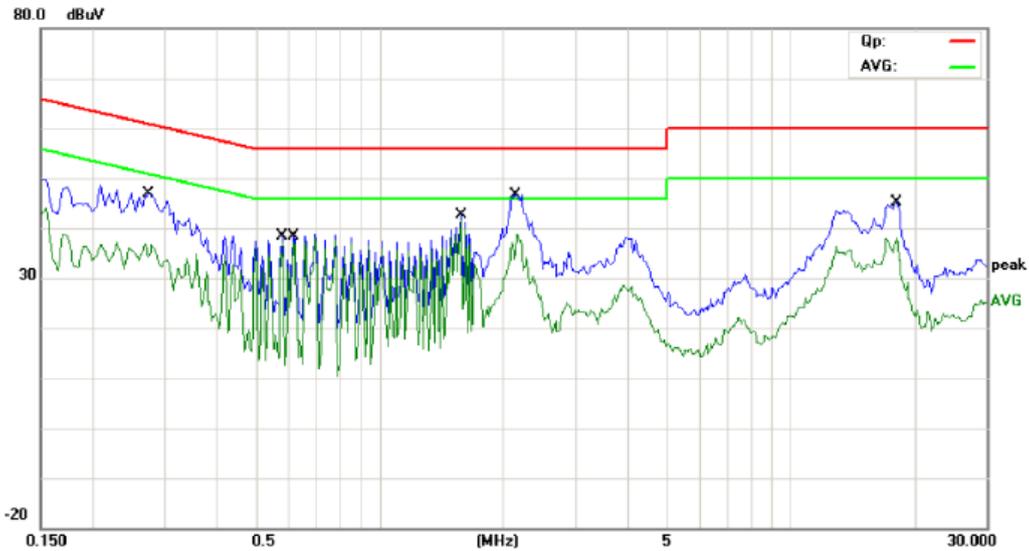
Mode: FULL LOAD

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1550	52.87	0.00	52.87	65.73	-12.86	QP	
2	*	0.1550	45.94	0.00	45.94	55.73	-9.79	AVG	
3		0.2303	49.12	0.00	49.12	62.44	-13.32	QP	
4		0.2303	37.72	0.00	37.72	52.44	-14.72	AVG	
5		0.8600	33.58	0.00	33.58	56.00	-22.42	QP	
6		0.8600	31.16	0.00	31.16	46.00	-14.84	AVG	
7		1.5800	37.07	0.00	37.07	56.00	-18.93	QP	
8		1.5800	36.00	0.00	36.00	46.00	-10.00	AVG	
9		2.1400	38.67	0.00	38.67	56.00	-17.33	QP	
10		2.1400	28.74	0.00	28.74	46.00	-17.26	AVG	
11		14.5171	43.20	0.00	43.20	60.00	-16.80	QP	
12		14.5171	35.17	0.00	35.17	50.00	-14.83	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WOLF

SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1



Site Conduction #2
Mode: FULL LOAD
Note:

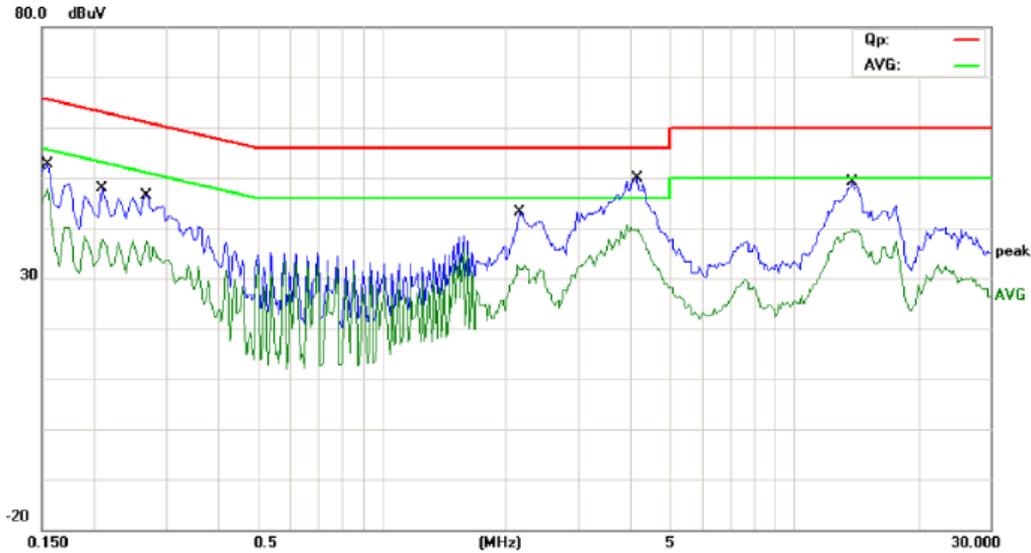
Phase: **L2**

Temperature: 26

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	0.2750	46.89	0.00	46.89	60.97	-14.08	QP	
2	0.2750	34.06	0.00	34.06	50.97	-16.91	AVG	
3	0.5800	38.46	0.00	38.46	56.00	-17.54	QP	
4	0.5800	37.09	0.00	37.09	46.00	-8.91	AVG	
5	0.6200	38.45	0.00	38.45	56.00	-17.55	QP	
6	0.6200	37.24	0.00	37.24	46.00	-8.76	AVG	
7	1.5800	42.63	0.00	42.63	56.00	-13.37	QP	
8 *	1.5800	41.65	0.00	41.65	46.00	-4.35	AVG	
9	2.1600	46.54	0.00	46.54	56.00	-9.46	QP	
10	2.1600	38.76	0.00	38.76	46.00	-7.24	AVG	
11	18.2316	44.75	0.00	44.75	60.00	-15.25	QP	
12	18.2316	37.11	0.00	37.11	50.00	-12.89	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WOLF

SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1



Site Conduction #2

Phase: L3

Temperature: 26

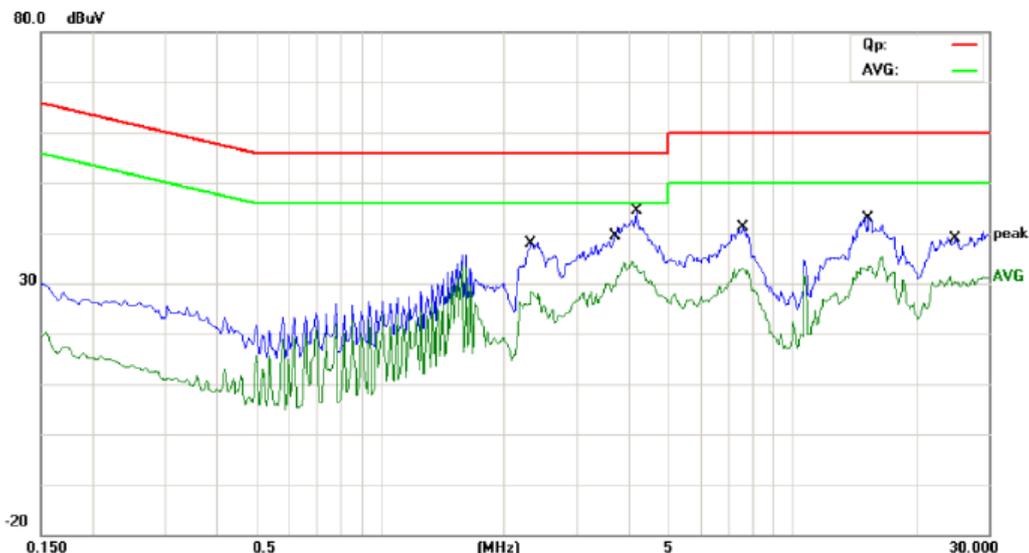
Mode: FULL LOAD

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1540	52.39	0.00	52.39	65.78	-13.39	QP	
2		0.1540	47.25	0.00	47.25	55.78	-8.53	AVG	
3		0.2100	47.82	0.00	47.82	63.21	-15.39	QP	
4		0.2100	37.76	0.00	37.76	53.21	-15.45	AVG	
5		0.2671	46.23	0.00	46.23	61.21	-14.98	QP	
6		0.2671	36.07	0.00	36.07	51.21	-15.14	AVG	
7		2.1783	42.89	0.00	42.89	56.00	-13.11	QP	
8		2.1783	31.82	0.00	31.82	46.00	-14.18	AVG	
9	*	4.1600	49.93	0.00	49.93	56.00	-6.07	QP	
10		4.1600	39.59	0.00	39.59	46.00	-6.41	AVG	
11		13.8500	49.24	0.00	49.24	60.00	-10.76	QP	
12		13.8500	39.91	0.00	39.91	50.00	-10.09	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WOLF

SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1



Site Conduction #2

Phase: N

Temperature: 26

Mode: FULL LOAD

Note:

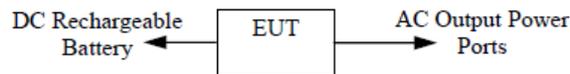
No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	2.2968	36.89	0.00	36.89	56.00	-19.11	QP	
2	2.2968	25.83	0.00	25.83	46.00	-20.17	AVG	
3	3.6700	38.00	0.00	38.00	56.00	-18.00	QP	
4	3.6700	29.59	0.00	29.59	46.00	-16.41	AVG	
5	4.2241	42.24	0.00	42.24	56.00	-13.76	QP	
6 *	4.2241	32.89	0.00	32.89	46.00	-13.31	AVG	
7	7.6200	41.10	0.00	41.10	60.00	-18.90	QP	
8	7.6200	32.93	0.00	32.93	50.00	-17.07	AVG	
9	15.4701	42.62	0.00	42.62	60.00	-17.38	QP	
10	15.4701	33.29	0.00	33.29	50.00	-16.71	AVG	
11	24.6594	38.07	0.00	38.07	60.00	-21.93	QP	
12	24.6594	30.04	0.00	30.04	50.00	-19.96	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WOLF

5. RADIATED EMISSION MEASUREMENT

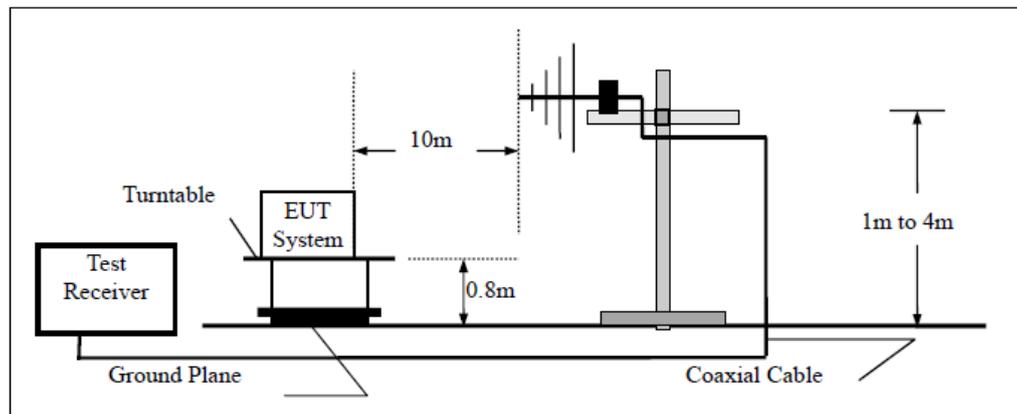
5.1. Block Diagram of Test Setup

5.1.1. Block diagram of EUT System



(EUT: Solar Inverter)

5.1.2. Block diagram of test setup (In chamber)



(EUT: Solar Inverter)

5.2. Measuring Standard

EN 61000-6-3:2007

5.3. Radiated Emission Limits

FREQUENCY (MHz)	DISTANCE (Meters)	FIELD STRENGTHS LIMIT (dB μ V/m)
30 ~ 230	10	30
230 ~ 1000	10	37

- Note:
- (1) The smaller limit shall apply at the combination point between two frequency bands.
 - (2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the EUT.

5.4.EUT Configuration on Measurement

The EN 61000-6-3 regulations test method must be used to find the maximum emission during radiated emission measurement.

EUT : Solar Inverter
Model Number : Growatt 18000UE

5.5.Operating Condition of EUT

5.5.1.Setup the EUT as shown on Section 5.1.

5.5.2.Turn on the power of all equipments.

5.5.3.Let the EUT work in measuring mode (Full Load) and measure it.

5.6.Test Procedure

The EUT is placed on a turntable which is 0.8 meter high above the ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 10 meters away from the receiving antenna that is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Bilog antenna (calibrated by Dipole Antenna) is used as a receiving antenna. Both horizontal and vertical polarization of the antenna is set on test.

The bandwidth of the Receiver is set at 120kHz.

5.7.Measuring Results

PASS.

The frequency range from 30MHz to 1000MHz is investigated.

Please see the attached pages.

SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1



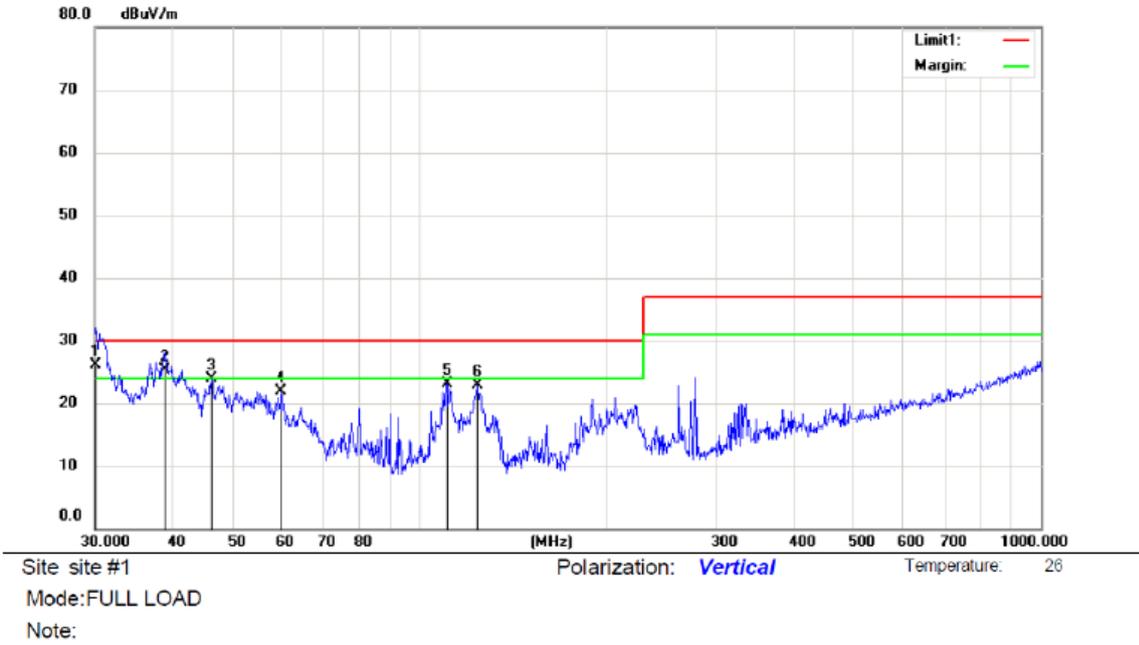
Site site #1
 Mode: FULL LOAD
 Note:
 Polarization: *Horizontal*
 Temperature: 26

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	30.3173	47.68	-22.05	25.63	30.00	-4.37	QP		
2		37.5480	44.41	-21.35	23.06	30.00	-6.94	QP		
3		109.7960	40.17	-21.31	18.86	30.00	-11.14	QP		
4		121.9755	42.61	-23.28	19.33	30.00	-10.67	QP		
5		210.7860	41.72	-20.93	20.79	30.00	-9.21	QP		
6		324.4561	38.77	-16.82	21.95	37.00	-15.05	QP		

*:Maximum data x:Over limit !:over margin

Operator: Ricky

SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	30.0000	48.15	-22.05	26.10	30.00	-3.90			QP
2	!	38.8878	46.39	-20.99	25.40	30.00	-4.60			QP
3		46.1780	44.58	-20.70	23.88	30.00	-6.12			QP
4		59.8588	43.28	-21.33	21.95	30.00	-8.05			QP
5		110.5686	44.51	-21.41	23.10	30.00	-6.90			QP
6		123.6984	46.37	-23.51	22.86	30.00	-7.14			QP

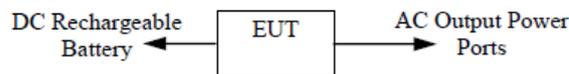
*:Maximum data x:Over limit !:over margin

Operator: Ricky

6. ELECTROSTATIC DISCHARGE IMMUNITY TEST

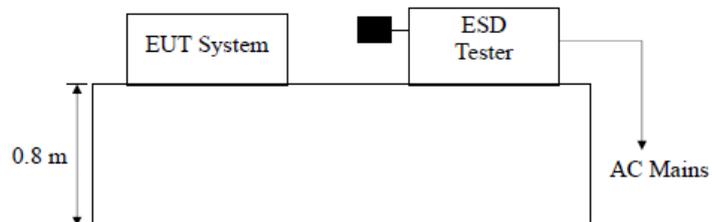
6.1. Block Diagram of Test Setup

6.1.1. Block diagram of EUT System



(EUT: Solar Inverter)

6.1.2. Block diagram of ESD test setup



(EUT: Solar Inverter)

6.2. Test Standard

EN 61000-6-2:2005

(EN 61000-4-2:2009 Severity Level: 3 / Air Discharge: $\pm 8\text{kV}$;

Level: 2 / Contact Discharge: $\pm 4\text{kV}$)

6.3. Severity Levels and Performance Criterion

6.3.1. Severity level

Level	Test Voltage Contact Discharge (kV)	Test Voltage Air Discharge (kV)
1	± 2	± 2
2	± 4	± 4
3	± 6	± 8
4	± 8	± 15
X	Special	Special

6.3.2. Performance criterion: B

6.4. Operating Condition of EUT

- 6.4.1. Setup the EUT as shown on Section 6.1.
- 6.4.2. Turn on the power of all equipments.
- 6.4.3. Let the EUT work in test mode (Full Load) and test it.

6.5. Test Procedure

6.5.1. Air Discharge:

This test is done on a non-conductive surface. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

6.5.2. Contact Discharge:

All the procedure shall be same as Section 6.5.1. Except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

6.5.3. Indirect discharge for horizontal coupling plane

At least 10 single discharges (in the most sensitive polarity) shall be applied at the front edge of each HCP opposite the center point of each unit (if applicable) of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge.

6.5.4. Indirect discharge for vertical coupling plane

At least 10 singles discharge (in the most sensitive polarity) shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m×0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

6.6. Test Results

PASS.

Please refer to the following pages.

Electrostatic Discharge Test Results

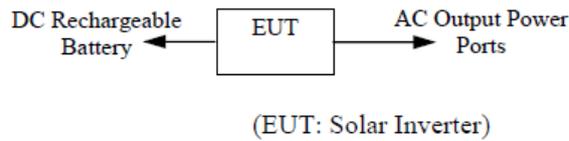
SHENZHEN EMTEK CO., LTD.

Applicant	: SHENZHEN GROWATT NEW ENERGY CO., LTD.	
EUT	: Solar Inverter	Test Date : October 24, 2011
M/N	: Growatt 18000UE	Temperature : 22°C
Power Supply	: DC 480V	Humidity : 50%
Air discharge	: ± 8.0kV	Test Mode : Full Load
Contact discharge:	± 4.0kV	Criterion : B
	Location	Kind A-Air Discharge C-Contact Discharge
	Slot	A PASS
	LCD	A PASS
	Metal	C PASS
	Port	C PASS
	Screw	C PASS
	HCP	C PASS
	VCP of front	C PASS
	VCP of rear	C PASS
	VCP of left	C PASS
	VCP of right	C PASS
Note:		

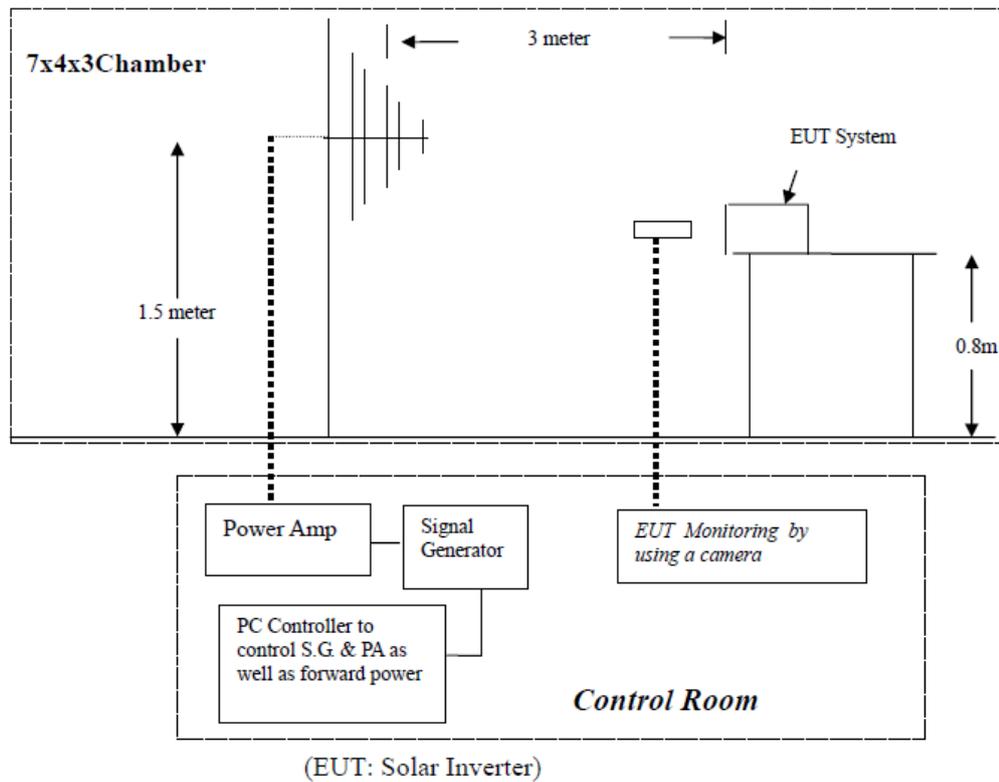
7. RF FIELD STRENGTH SUSCEPTIBILITY TEST

7.1. Block Diagram of Test Setup

7.1.1. Block diagram of EUT System



7.1.2. Block diagram of RS test setup



7.2. Test Standard

EN 61000-6-2:2005 (EN 61000-4-3:2006+A1:2008+A2:2010,
Severity Level: 1 V/m, 3 V/m, 10 V/m)

7.3. Severity Levels and Performance Criterion

7.3.1. Severity Levels

Level	Field Strength V/m
1.	1
2.	3
3.	10
X	Special

7.3.2. Performance Criterion: A

7.4. Operating Condition of EUT

7.4.1. Setup the EUT as shown on Section 7.1.

7.4.2. Turn on the power of all equipments.

7.4.3. Let the EUT work in test mode (Full Load) and test it.

7.5. Test Procedure

The EUT are placed on a table that is 0.8 meter high above the ground. The EUT is set 3 meters away from the transmitting antenna that is mounted on an antenna tower. Both horizontal and vertical polarization of the antenna is set on test. Each of the four sides of the EUT must be faced this transmitting antenna and measured individually.

In order to judge the EUT performance, a CCD camera and a multimeter are used to monitor it.

All the scanning conditions are as following:

Condition of Test	Remark
1. Fielded Strength	1V/m (Severity Level 1) 3V/m (Severity Level 2) 10V/m (Severity Level 3)
2. Radiated Signal	Modulated
3. Scanning Frequency	80-2700MHz
4. Sweep time of radiated	0.0015 Decade/s
5. Dwell Time	1 Sec.

7.6. Test Results

PASS.

Please refer to the following page.

RF Field Strength Susceptibility Test Results

SHENZHEN EMTEK CO., LTD.

Applicant : SHENZHEN GROWATT NEW ENERGY CO., LTD.				
EUT	: Solar Inverter		Test Date	: October 24, 2011
M/N	: Growatt 18000UE		Temperature	: 22°C
Field Strength	: 10 V/m		Humidity	: 50%
Power Supply	: DC 480V		Criterion	: A
Test Mode	: Full Load		Frequency Range	: 80MHz to 1000MHz
Modulation: <input type="checkbox"/> None <input type="checkbox"/> Pulse <input checked="" type="checkbox"/> AM 1kHz 80%				
Frequency Rang 1: 80~ 1000MHz			Frequency Rang 2: N/A	
Steps	1%			
	Horizontal	Vertical	Horizontal	Vertical
Front	PASS	PASS		
Right	PASS	PASS		
Rear	PASS	PASS		
Left	PASS	PASS		
Test Equipment: 1. Signal Generator: 2023B (AEROFLEX) 2. Power Amplifier: AS0102-55 (MILMEGA) & AP32MT215 (PRANA) 3. Log.-Per. Antenna: VULP9118E (SCHWARZBECK) 4. Broad-Band Horn Antenna: BBHA 9120L3F (SCHWARZBECK) 5. RF Power Meter: Dual Channel: 4232A (BOONTON) 6. Field Strength Meter: HI-6005 (HOLADAY)				
Note:				

RF Field Strength Susceptibility Test Results

SHENZHEN EMTEK CO., LTD.

Applicant : SHENZHEN GROWATT NEW ENERGY CO., LTD.				
EUT : Solar Inverter		Test Date : October 24, 2011		
M/N : Growatt 18000UE		Temperature : 22°C		
Field Strength : 3 V/m		Humidity : 50%		
Power Supply : DC 480V		Criterion : A		
Test Mode : Full Load		Frequency Range: 1.4GHz to 2GHz		
Modulation: <input type="checkbox"/> None <input type="checkbox"/> Pulse <input checked="" type="checkbox"/> AM 1kHz 80%				
Frequency Rang 1: 1.4GHz to 2GHz		Frequency Rang 2: N/A		
Steps	1%			
	Horizontal	Vertical	Horizontal	Vertical
Front	PASS	PASS		
Right	PASS	PASS		
Rear	PASS	PASS		
Left	PASS	PASS		
<p>Test Equipment:</p> <ol style="list-style-type: none"> 1. Signal Generator: 2023B (AEROFLEX) 2. Power Amplifier: AS0102-55 (MILMEGA) & AP32MT215 (PRANA) 3. Log.-Per. Antenna: VULP9118E (SCHWARZBECK) 4. Broad-Band Horn Antenna: BBHA 9120L3F (SCHWARZBECK) 5. RF Power Meter. Dual Channel: 4232A (BOONTON) 6. Field Strength Meter: HI-6005 (HOLADAY) 				
Note:				

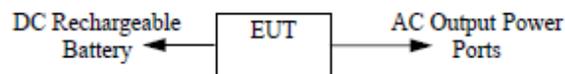
RF Field Strength Susceptibility Test Results

Applicant : SHENZHEN GROWATT NEW ENERGY CO., LTD.				
EUT : Solar Inverter		Test Date : October 24, 2011		
M/N : Growatt 18000UE		Temperature : 22°C		
Field Strength : 1 V/m		Humidity : 50%		
Power Supply : DC 480V		Criterion : A		
Test Mode : Full Load		Frequency Range: 2GHz to 2.7GHz		
Modulation: <input type="checkbox"/> None <input type="checkbox"/> Pulse <input checked="" type="checkbox"/> AM 1kHz 80%				
		Frequency Rang 1: 2GHz to 2.7GHz		Frequency Rang 2: N/A
Steps	1%			
	Horizontal	Vertical	Horizontal	Vertical
Front	PASS	PASS		
Right	PASS	PASS		
Rear	PASS	PASS		
Left	PASS	PASS		
Note:				

8. ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST

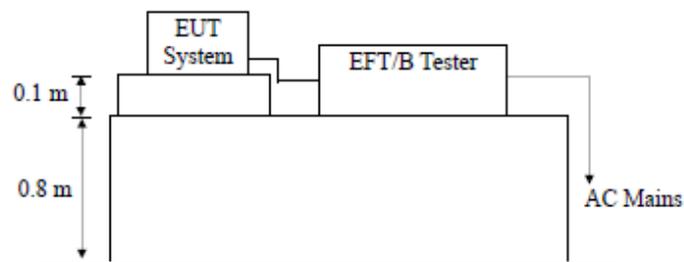
8.1. Block Diagram of Test Setup

8.1.1. Block Diagram of EUT System



(EUT: Solar Inverter)

8.1.2. EFT Test Setup



(EUT: Solar Inverter)

8.2. Test Standard

EN 61000-6-2:2005 (EN 61000-4-4:2004+A1:2010, Severity Level:
AC Output Power Ports: 2kV; DC Power Lines 2kV)

8.3. Severity Levels and Performance Criterion

8.3.1. Severity level

Level	Open Circuit Output Test Voltage $\pm 10\%$	
	On Power Supply Lines	On I/O (Input/Output) Signal data and control lines
1	0.5 kV	0.25 kV
2	1 kV	0.5 kV
3	2 kV	1 kV
4	4 kV	2 kV
X	Special	Special

8.3.2. Performance criterion: B

8.4. Operating Condition of EUT

- 8.4.1. Setup the EUT as shown on Section 10.1.
- 8.4.2. Turn on the power of all equipments.
- 8.4.3. Let the EUT work in test mode (Full Load) and test it.

8.5. Test Procedure

The EUT is put on the table that is 0.8 meter high above the ground. This reference ground plane shall project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane beneath the EUT, shall be more than 0.5m.

8.5.1. For input and output DC power ports:

The EUT is connected to the power mains by using a coupling device that couples the EFT interference signal to DC power lines. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 mins.

8.5.2. For signal lines and control lines ports:

No I/O ports. It's unnecessary to test.

8.5.3. For AC output line ports:

The AC Output Power Ports of EUT are connected to the AC power mains by using a coupling device that couples the EFT interference signal to AC power lines (AC Output Power Ports). All of the test voltage should be applied during compliance test and the duration of the test is 2 mins.

8.6. Test Results

PASS.

Please refer to the following page.



Electrical Fast Transient/Burst Test Results

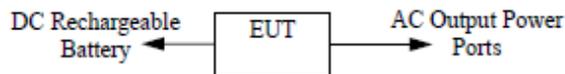
SHENZHEN EMTEK CO., LTD.

Standard: <input checked="" type="checkbox"/> EN 61000-4-4		Result: <input checked="" type="checkbox"/> PASS / <input type="checkbox"/> FAIL	
Applicant : <u>SHENZHEN GROWATT NEW ENERGY CO., LTD.</u>			
EUT : <u>Solar Inverter</u>			
M/N : <u>Growatt 18000UE</u>			
Input Voltage: <u>DC 480V</u>		Output Voltage: <u>AC 380V/50Hz</u>	
Criterion : B			
Ambient Condition : <u>22 °C</u>		<u>50% RH</u>	
Operation Mode: Full Load			
Line : <input checked="" type="checkbox"/> DC Mains <input checked="" type="checkbox"/> AC Power Port		Line : <input type="checkbox"/> Signal <input type="checkbox"/> I/O Cable	
Coupling : <input checked="" type="checkbox"/> Direct		Coupling : <input type="checkbox"/> Capacitive	
Test Time : 120s			
Line	Test Voltage	Result(+)	Result(-)
L1, L2, L3, N, PE	2kV	PASS	PASS
L1-L2, L1-L3, L2-L3, L1-N, L2-N, L3-N	2kV	PASS	PASS
L1-PE, L2-PE, L3-PE, N-PE	2kV	PASS	PASS
L1-L2-PE, L1-L3-PE, L2-L3-PE, L1-L2-L3, L1-L2-N, L1-L3-N, L2-L3-N, L1-N-PE, L2-N-PE, L3-N-PE	2kV	PASS	PASS
L1-L2-L3-PE, L1-L2-L3-N, L1-L2-N-PE, L1-L3-N-PE, L2-L3-N-PE	2kV	PASS	PASS
DC Line	2kV	PASS	PASS
Note:			

9. SURGE IMMUNITY TEST

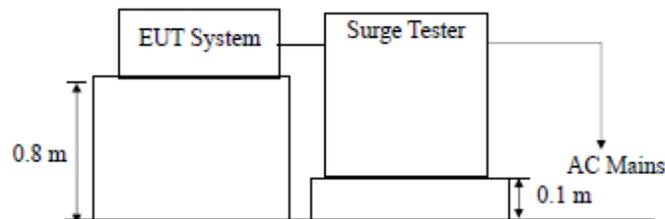
9.1. Block Diagram of Test Setup

9.1.1. Block Diagram of EUT System



(EUT: Solar Inverter)

9.1.2. Surge Test Setup



(EUT: Solar Inverter)

9.2. Test Standard

EN 61000-6-2:2005

(EN 61000-4-5:2006, Severity Level: AC Output Power Ports:

Line to Line: Level 2, 1.0kV; Line to earth, Level 3, 2.0kV,

DC Power Line 0.5kV)

9.3. Severity Levels and Performance Criterion

9.3.1. Severity level

Severity Level	Open-Circuit Test Voltage kV
1	0.5
2	1.0
3	2.0
4	4.0
*	Special

9.3.2. Performance criterion: B

9.4. Operating Condition of EUT

- 9.4.1. Setup the EUT as shown on Section 9.1.
- 9.4.2. Turn on the power of all equipments.
- 9.4.3. Let the EUT work in test mode (Full Load) and test it.

9.5. Test Procedure

- 1) Set up the EUT and test generator as shown on Section 9.1.2.
- 2) For AC Output Power Ports: For line to line coupling mode, provide a 1.0 kV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points. For line to Earth coupling mode, provide a 2.0 kV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points. DC line: For line to line coupling mode, provide a 0.5 kV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points.
- 3) At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are conducted during test.
- 4) Different phase angles are done individually.
- 5) Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

9.6. Test Results

PASS.

Please refer to the following page.

Surge Immunity Test Results

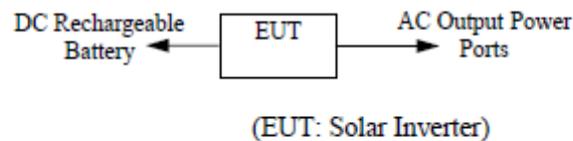
SHENZHEN EMTEK CO., LTD.

Applicant : <u>SHENZHEN GROWATT NEW ENERGY CO., LTD.</u>					
EUT : <u>Solar Inverter</u>			Test Date : <u>October 24, 2011</u>		
M/N : <u>Growatt 18000UE</u>			Temperature : <u>22°C</u>		
Power Supply : <u>DC 480V</u>		Output Voltage: <u>AC 380V/50Hz</u>		Humidity : <u>50%</u>	
Test Mode : <u>Full Load</u>			Criterion : <u>B</u>		
Location	Polarity	Phase Angle	Number of Pulse	Pulse Voltage (kV)	Result
L1-L2, L1-L3, L2-L3	+	0°, 90°, 180°, 270°	5	1.0	PASS
	-	0°, 90°, 180°, 270°	5	1.0	PASS
L1-N, L2-N, L3-N	+	0°, 90°, 180°, 270°	5	1.0	PASS
	-	0°, 90°, 180°, 270°	5	1.0	PASS
L1-PE, L2-PE, L3-PE	+	0°, 90°, 180°, 270°	5	2.0	PASS
	-	0°, 90°, 180°, 270°	5	2.0	PASS
N-PE	+	0°, 90°, 180°, 270°	5	2.0	PASS
	-	0°, 90°, 180°, 270°	5	2.0	PASS
DC Line	+	0°	5	0.5	PASS
	-	0°	5	0.5	PASS
Remark:					

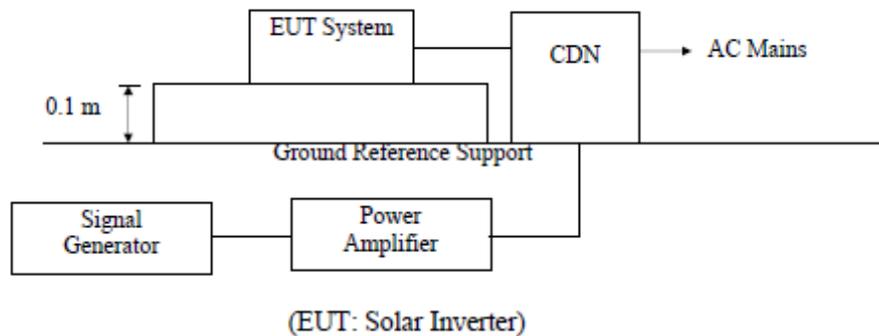
10. INJECTED CURRENTS SUSCEPTIBILITY TEST

10.1. Block Diagram of Test Setup

10.1.1. Block Diagram of EUT System



10.1.2. Block Diagram of Test Setup



10.2. Test Standard

EN 61000-6-2:2005

(EN 61000-4-6:2009, Severity Level: Level 3, 10V (r.m.s.), 0.15MHz ~ 80MHz)

10.3. Severity Levels and Performance Criterion

10.3.1. Severity level

Level	Field Strength V
1	1
2	3
3	10
X	Special

10.3.2. Performance criterion: A

10.4. Operating Condition of EUT

10.4.1. Setup the EUT as shown on Section 12.1.

10.4.2. Turn on the power of all equipments.

10.4.3. Let the EUT work in test mode (Full Load) and test it.

10.5. Test Procedure

- 1) Set up the EUT, CDN and test generators as shown on Section 11.1.2.
- 2) Let the EUT work in test mode and measure it.
- 3) The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).
- 4) The EUT are placed on an insulating support 0.1m high above a ground reference plane. EM-Clamp is placed on the ground plane about 0.3m from EUT.
- 5) The disturbance signal described below is injected to EUT through CDN.
- 6) The EUT operates within its operational mode(s) under intended climatic conditions after power on.
- 7) The frequency range is swept from 150kHz to 80MHz using 10V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave.
- 8) The rate of sweep shall not exceed $1.5 \cdot 10^{-3}$ decades/s. Where the frequency is swept incrementally, the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.
- 9) Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

10.6. Test Results

PASS.

Please refer to the following page.

Injected Currents Susceptibility Test Results

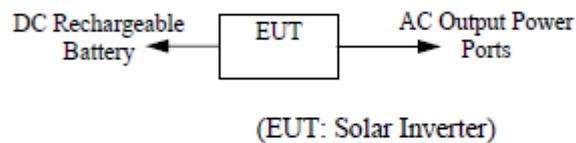
SHENZHEN EMTEK CO., LTD.

Applicant : <u>SHENZHEN GROWATT NEW ENERGY CO., LTD.</u>				
EUT : <u>Solar Inverter</u>		Test Date: <u>October 24, 2011</u>		
M/N : <u>Growatt 18000UE</u>		Temperature : <u>22°C</u>		
Power Supply : <u>DC 480V</u>		Output Voltage: <u>AC 380V/50Hz</u>		Humidity : <u>58%</u>
Test Engineer : <u>ANDY</u>				
Test Mode: Full Load				
Frequency Range (MHz)	Injected Position	Strength (Unmodulated)	Criterion	Result
0.15 ~ 80	AC Output Power Ports	10V	A	PASS
0.15 ~ 80	DC line	10V	A	PASS
Test Mode : <u>N/A</u>				
Frequency Range (MHz)	Injected Position	Strength (Unmodulated)	Criterion	Result
Remark : 1. Modulation Signal:1kHz 80% AM Measurement Equipment : Simulator: CWS 500 (SWITZERLAND EMTEST) CDN : <input checked="" type="checkbox"/> CDN-M2 (SWITZERLAND EMTEST) <input checked="" type="checkbox"/> CDN-M3 (SWITZERLAND EMTEST) <input type="checkbox"/> EM-Clamp (SWITZERLAND EMTEST)		Note:		

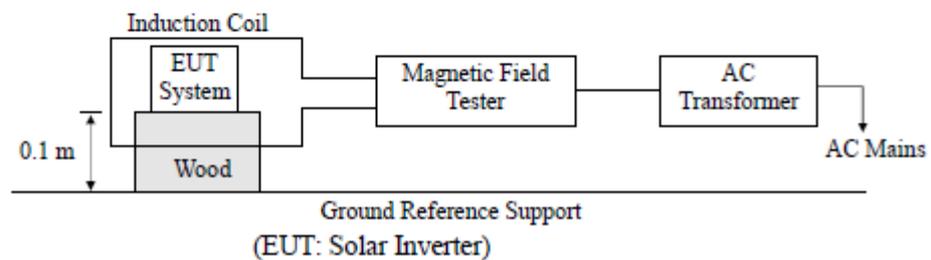
11. MAGNETIC FIELD SUSCEPTIBILITY TEST

11.1. Block Diagram of Test Setup

11.1.1. Block diagram of EUT System



11.1.2. Magnetic field test setup



11.2. Test Standard

EN 61000-6-2:2005

(EN 61000-4-8:2010, Severity Level: Level 4, 30 A/m)

11.3. Severity Levels and Performance Criterion

11.3.1. Severity Levels

Level	Field Strength A/m
1	1
2	3
3	10
4	30
5	100
X	Special

11.3.2. Performance Criterion: A

11.4. Operating Condition of EUT

11.4.1. Setup the EUT as shown on Section 13.1.

11.4.2. Turn on the power of all equipments.

11.4.3. Let the EUT work in test mode (Full Load) and test it.

11.5. Test Procedure

The EUT is placed in the middle of a induction coil (1*1m), under which is a 1*1*0.1m (high) table, this small table is also placed on a larger table, 0.8 m above the ground. Both horizontal and vertical polarization of the induction coil is set on test, so that each side of the EUT is affected by the magnetic field. Also can reach the same aim by change the position of the EUT.

11.6. Test Results

PASS.

Please refer to the following page.

Magnetic Field Immunity Test Results

SHENZHEN EMTEK CO., LTD.

Standard: <input checked="" type="checkbox"/> EN 61000-4-8		Result: <input checked="" type="checkbox"/> PASS / <input type="checkbox"/> FAIL		
Applicant : <u>SHENZHEN GROWATT NEW ENERGY CO., LTD.</u> EUT : <u>Solar Inverter</u> M/N : <u>Growatt 18000UE</u> Input Voltage : <u>DC 480V</u> Date of Test : <u>October 24, 2011</u> Test Engineer: <u>ANDY</u> Ambient Condition : Temp : <u>22°C</u> Humid: <u>55%</u> Criterion: A				
Operation Mode: Full Load				
Test Level (A/m)	Testing Duration	Coil Orientation	Criterion	Result
30	5 mins	X	A	PASS
30	5 mins	Y	A	PASS
30	5 mins	Z	A	PASS
Operation Mode: N/A				
Test Level (A/m)	Testing Duration	Coil Orientation	Criterion	Result
Test Equipment	Magnetic Field Test: HEAFELY MAG 100.1			
Note:				



Shenzhen EMTEK Co., Ltd.
Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China
www.emtek.com.cn Tel:+86-755-2695 4280 Fax:+86-755-2695 4282

EMTEK
Access to the World

Certificate of Conformity

NO.: ES110921099E

The following product has been tested by us with the listed standards and found in conformity with the council EMC directive 2004/108/EC. It is possible to use CE marking to demonstrate the conformity with this EMC Directive.

Applicant : SHENZHEN GROWATT NEW ENERGY CO., LTD.
Address : Building No. 12, Xicheng Industrial Zone, Bao'an District,
Shenzhen, China
Manufacturer : SHENZHEN GROWATT NEW ENERGY CO., LTD.
Address : Building No. 12, Xicheng Industrial Zone, Bao'an District,
Shenzhen, China
Trade Mark : Growatt
EUT : Solar Inverter
M/N : Growatt 10000UE, Growatt 12000UE
Test Standards : EN 61000-6-3:2007
EN 61000-6-2:2005





(Manager)
September 28, 2011



SHENZHEN EMTEK CO., LTD.
CERTIFICATE

The certificate is based on a single evaluation of one sample of above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab. logo.

SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E



EMC TEST REPORT
For

SHENZHEN GROWATT NEW ENERGY CO., LTD.

Solar Inverter

Model No.: Growatt 10000UE, Growatt 12000UE

Prepared for : SHENZHEN GROWATT NEW ENERGY CO., LTD.
Address : Building No. 12, Xicheng Industrial Zone, Bao'an District,
Shenzhen, China

Prepared by : SHENZHEN EMTEK CO., LTD.
Address : Bldg 69, Majialong Industry Zone,
Nanshan District, Shenzhen, Guangdong, China

Tel: (0755) 26954280
Fax: (0755) 26954282

Report Number : ES110921099E
Date of Test : September 21, 2011 to September 28, 2011
Date of Report : September 28, 2011

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APPENDIX I (Photos of EUT) (2 Pages)

TEST REPORT DESCRIPTION

Applicant : SHENZHEN GROWATT NEW ENERGY CO., LTD.
Manufacturer : SHENZHEN GROWATT NEW ENERGY CO., LTD.
Trademark : Growatt
EUT : Solar Inverter
Model No. : Growatt 10000UE, Growatt 12000UE
Power Supply : Growatt 10000UE:
Input: 300V-1000VDC,
Output: three phases, 230VAC, 14.4A, 10000W;
Growatt 12000UE:
Input: 300V-1000VDC,
Output: three phases, 230VAC, 17.5A, 12000W

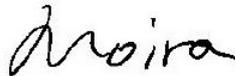
Measurement Procedure Used:

EN 61000-6-3:2007
EN 61000-6-2:2005
(EN 61000-4-2:2009, EN 61000-4-3:2006+A1:2008+A2:2010,
EN 61000-4-4:2004+A1:2010, EN 61000-4-5:2006, EN 61000-4-6:2009, EN 61000-4-8:2010)

The device described above is tested by SHENZHEN EMTEK CO., LTD. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and SHENZHEN EMTEK CO., LTD. is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the EN 61000-6-3 and EN 61000-6-2 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of SHENZHEN EMTEK CO., LTD.

Date of Test : September 21, 2011 to September 28, 2011

Prepared by : 
(Engineer)

Reviewer : 
(Quality Manager)

Approved & Authorized Signer : 
(Manager)



1. SUMMARY OF TEST RESULT

EMISSION			
Description of Test Item	Standard	Limits	Results
Conducted Disturbance	EN 61000-6-3:2007	--	Pass
Radiated Disturbance	EN 61000-6-3:2007	--	Pass
IMMUNITY (EN 61000-6-2:2005)			
Description of Test Item	Basic Standard	Performance Criteria	Results
Electrostatic Discharge (ESD)	EN 61000-4-2:2009	B	Pass
Radio-Frequency, Continuous Radiated Disturbance	EN 61000-4-3:2006 +A1:2008+A2:2010	A	Pass
EFT/B Immunity	EN 61000-4-4:2004 +A1:2010	B	Pass
Surge Immunity	EN 61000-4-5:2006	B	Pass
Conducted RF Immunity	EN 61000-4-6:2009	A	Pass
Power Frequency Magnetic Field	EN 61000-4-8:2010	A	Pass
Note: N/A is an abbreviation for Not Applicable.			

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

EUT	:	Solar Inverter
Model Number	:	Growatt 10000UE, Growatt 12000UE (Note: All models have same circuit diagram and PCB layout except their output rating. We prepare Growatt 12000UE for test.)
Input Voltage	:	DC 480V
Output Voltage	:	AC 380V/50Hz
Applicant	:	SHENZHEN GROWATT NEW ENERGY CO., LTD.
Address	:	Building No. 12, Xicheng Industrial Zone, Bao'an District, Shenzhen, China
Manufacturer	:	SHENZHEN GROWATT NEW ENERGY CO., LTD.
Address	:	Building No. 12, Xicheng Industrial Zone, Bao'an District, Shenzhen, China
Date of Received	:	September 21, 2011
Date of Test	:	September 21, 2011 to September 28, 2011

2.2. Description of Test Facility

Site Description	:	
EMC Lab.	:	Accredited by CNAS, 2010.10.29 The certificate is valid until 2013.10.28 The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005) The Certificate Registration Number is L2291. Accredited by TUV Rheinland Shenzhen 2010.5 The Laboratory has been assessed according to the requirements ISO/IEC 17025. Accredited by FCC, October 28, 2010 The Certificate Registration Number is 406365. Accredited by Industry Canada, March 5, 2010 The Certificate Registration Number is 46405-4480.
Name of Firm	:	SHENZHEN EMTEK CO., LTD.
Site Location	:	Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

2.3. Description of Support Device

N/A

2.4. Measurement Uncertainty

Conducted Emission Uncertainty : 2.8dB

Radiated Emission Uncertainty : 4.2dB (10m Chamber)

3. MEASURING DEVICE AND TEST EQUIPMENT

3.1. For Conducted Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCS30	828985/018	May 29, 2011	1 Year
2.	L.I.S.N.	Schwarzbeck	NNLK8129	8129-203	May 29, 2011	1 Year
4.	L.I.S.N.	Rohde & Schwarz	ESH3-Z6	100011	May 29, 2011	1 Year
5.	L.I.S.N.	Rohde & Schwarz	ESH3-Z6	100253	May 29, 2011	1 Year
6.	L.I.S.N.	Rohde & Schwarz	ESH3-Z5	100191	May 29, 2011	1 Year
7.	50Ω Coaxial Switch	Anritsu	MP59B	M20531	N/A	N/A
8.	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100006	May 29, 2011	1 Year
9.	Voltage Probe	Rohde & Schwarz	TK9416	N/A	May 29, 2011	1 Year
10.	I.S.N	Rohde & Schwarz	ENY22	1109.9508.02	May 29, 2011	1 Year

3.2. For Radiated Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Test Receiver	Rohde & Schwarz	ESCI	101045	May 29, 2011	1 Year
2.	Pre-Amplifier	CD	PAP-0203	22013	May 29, 2011	1 Year
3.	Bilog Antenna	Schwarzbeck	VULB9163	141	May 29, 2011	1 Year
4.	Cable	H+B	CBL3-NN-0.5m	100319-2140500-1	May 29, 2011	1 Year
5.	Cable	H+B	CBL3-NN-3m	100319-2143000-1	May 29, 2011	1 Year
6.	Cable	H+B	CBL3-NN-6.5m	100319-2146500-1	May 29, 2011	1 Year
7.	Cable	H+B	CBL3-NN-10.5m	100319-21410500	May 29, 2011	1 Year
8.	Cable	H+B	CBL3-NN-12.5m	100319-21412500	May 29, 2011	1 Year

3.3. For Electrostatic Discharge Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	ESD Tester	TESEQAG	NSG 437	000409	May 29, 2011	1 Year

3.4. For RF Strength Susceptibility Test (Below 2GHz)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	RF Power Meter. Dual Channel	BOONTON	4232A	10539	May 29, 2011	1 Year
2.	50ohm Diode Power Sensor	BOONTON	51011EMC	34236/34238	May 29, 2011	1 Year
3.	Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9120 L3F	332	May 29, 2011	1 Year
4.	Power Amplifier	PRANA	AP32MT215	N/A	May 29, 2011	1 Year
5.	Power Amplifier	MILMEGA	AS0102-55	N/A	May 29, 2011	1 Year
6.	Signal Generator	AEROFLEX	2023B	N/A	May 29, 2011	1 Year

SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E

7.	Field Strength Meter	HOLADAY	HI-6005	N/A	May 29, 2011	1 Year
8.	RS232 Fiber Optic Modem	HOLADAY	HI-4413P	N/A	May 29, 2011	1 Year
9.	Log.-Per. Antenna	SCHWARZBECK	VULP 9118E	N/A	May 29, 2011	1 Year

3.5. For RF Strength Susceptibility Test in Huatongwei (Above 2GHz)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Signal Generator	IFR-Aeroflex	2032	203002/100	2010/10	1 Year
2.	Power Amplifier	AR	150W 1000	301584	2010/10	1 Year
3.	Antenna	AR	AT1080	28570	2010/10	1 Year
4.	Field Monitor	AR	FM5004	N/A	2010/10	1 Year
5.	Power Head	AR	PH2000	301193	2010/10	1 Year
6.	Power Meter	AR	PH2002	302799	2010/10	1 Year
7.	Dual Directional Coupler	AR	DC6080	301508	2010/10	1 Year

3.6. For Electrical Fast Transient / Burst Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Burst Tester	HAEFELY	PEFT4010	080981-16	May 29, 2011	1 Year
2.	Coupling Clamp	HAEFELY	IP-4A	147147	May 29, 2011	1 Year

3.7. For Surge Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Surge Controller	HAEFELY	Psurge 8000	174031	May 29, 2011	1 Year
2.	Impulse Module	HAEFELY	PIM 100	174124	May 29, 2011	1 Year
3.	Coupling Decoupling Filter	HAEFELY	PCD 130	172181	May 29, 2011	1 Year
4.	Coupling Module	HAEFELY	PCD122	174354	May 29, 2011	1 Year
5.	Surge Impulse Module	HAEFELY	PIM 120	174435	May 29, 2011	1 Year
6.	Coupling Module	HAEFELY	PCD 126A	174387	May 29, 2011	1 Year
7.	Impulse Module	HAEFELY	PIM 110	174391	May 29, 2011	1 Year

3.8. For Injected Current Susceptibility Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Simulator	EMTEST	CWS500C	0900-12	May 29, 2011	1 Year
2.	CDN	EMTEST	CDN-M2	5100100100	May 29, 2011	1 Year
3.	CDN	EMTEST	CDN-M3	0900-11	May 29, 2011	1 Year
4.	Injection Clamp	EMTEST	F-2031-23M M	368	May 29, 2011	1 Year
5.	Attenuator	EMTEST	ATT6	0010222A	May 29, 2011	1 Year

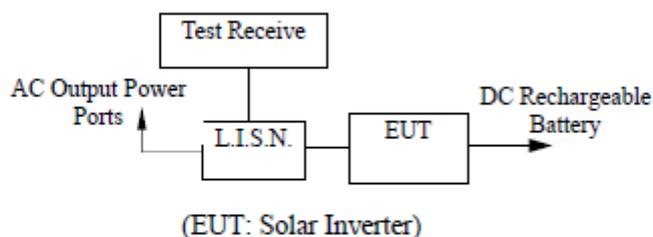
SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E

3.9. For Magnetic Field Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Magnetic Field Tester	HAEFELY	MAG100	250040.1	May 29, 2011	1 Year

4. CONDUCTED EMISSION MEASUREMENT

4.1. Block Diagram of Test Setup



4.2. Measuring Standard

EN 61000-6-3:2007

4.3. Conducted Emission Limits

Frequency (MHz)	Limit (dB μ V)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66.0 ~ 56.0 *	56.0 ~ 46.0 *
0.50 ~ 5.00	56.0	46.0
5.00 ~ 30.00	60.0	50.0

NOTE1-The lower limit shall apply at the transition frequencies.
NOTE2-The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.

4.4. EUT Configuration on Measurement

The following equipments are installed on Conducted Emission Measurement to meet EN 61000-6-3 requirements and operating in a manner which tends to maximize its emission characteristics in a normal application.

EUT : Solar Inverter
Model Number : Growatt 12000UE

4.5. Operating Condition of EUT

4.5.1. Setup the EUT as shown on Section 4.1.

4.5.2. Turn on the power of all equipments.

4.5.3. Let the EUT work in measuring mode (Full Load) and measure it.

4.6. Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and the AC Output Power Ports connected to the AC mains through Line Impedance Stability Network (L.I.S.N). This provided a 50ohm coupling impedance for the tested equipments. All of the output lines are investigated to find out the maximum conducted emission according to the EN 61000-6-3 regulations during conducted emission measurement.

The bandwidth of the field strength meter (R&S Test Receiver ESCS30) is set at 9kHz in 150kHz~30MHz and 200Hz in 9kHz~150kHz.

The frequency range from 150kHz to 30MHz is investigated.

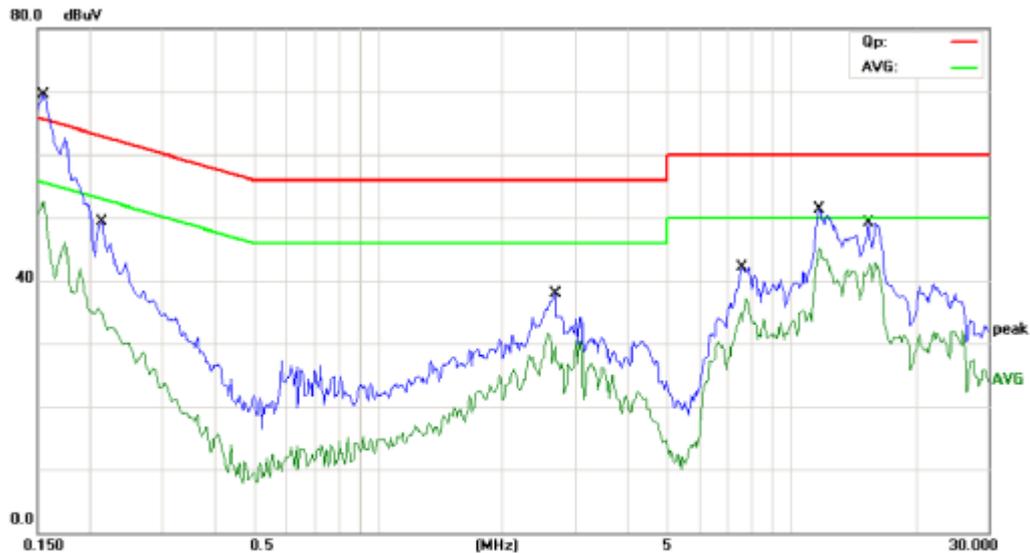
All the scanning waveform is put in Appendix I.

4.7. Measuring Results

PASS.

Please see the attached pages.

SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E



Site Conduction #2

Limit: (CE)EN61000-6-3_QP

Mode: FULL LOAD

Note:

Phase: L1

Temperature: 22

Power: AC 380V/50Hz

Humidity: 50 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1550	60.20	0.00	60.20	65.73	-5.53	QP	
2	*	0.1550	52.42	0.00	52.42	55.73	-3.31	AVG	
3		0.2150	49.25	0.00	49.25	63.01	-13.76	QP	
4		0.2150	35.68	0.00	35.68	53.01	-17.33	AVG	
5		2.6800	37.97	0.00	37.97	56.00	-18.03	QP	
6		2.6800	31.75	0.00	31.75	46.00	-14.25	AVG	
7		7.6000	42.18	0.00	42.18	60.00	-17.82	QP	
8		7.6000	37.08	0.00	37.08	50.00	-12.92	AVG	
9		11.7250	51.35	0.00	51.35	60.00	-8.65	QP	
10		11.7250	45.05	0.00	45.05	50.00	-4.95	AVG	
11		15.5000	49.19	0.00	49.19	60.00	-10.81	QP	
12		15.5000	42.70	0.00	42.70	50.00	-7.30	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WOLF

SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E



Site Conduction #2
 Limit: (CE)EN61000-6-3_QP
 Mode: FULL LOAD
 Note:

Phase: L2
 Power: AC 380V/50Hz
 Temperature: 22
 Humidity: 50 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1550	59.10	0.00	59.10	65.73	-6.63	QP	
2	*	0.1550	51.20	0.00	51.20	55.73	-4.53	AVG	
3		2.6300	42.28	0.00	42.28	56.00	-13.72	QP	
4		2.6300	39.61	0.00	39.61	46.00	-6.39	AVG	
5		4.4800	40.48	0.00	40.48	56.00	-15.52	QP	
6		4.4800	33.62	0.00	33.62	46.00	-12.38	AVG	
7		7.4700	46.24	0.00	46.24	60.00	-13.76	QP	
8		7.4700	41.51	0.00	41.51	50.00	-8.49	AVG	
9		11.9000	52.57	0.00	52.57	60.00	-7.43	QP	
10		11.9000	44.54	0.00	44.54	50.00	-5.46	AVG	
11		16.2750	48.06	0.00	48.06	60.00	-11.94	QP	
12		16.4000	42.24	0.00	42.24	50.00	-7.76	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WOLF

SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E



Site Conduction #2

Phase: **L3**

Temperature: 22

Limit: (CE)EN61000-6-3_QP

Power: AC 380V/50Hz

Humidity: 50 %

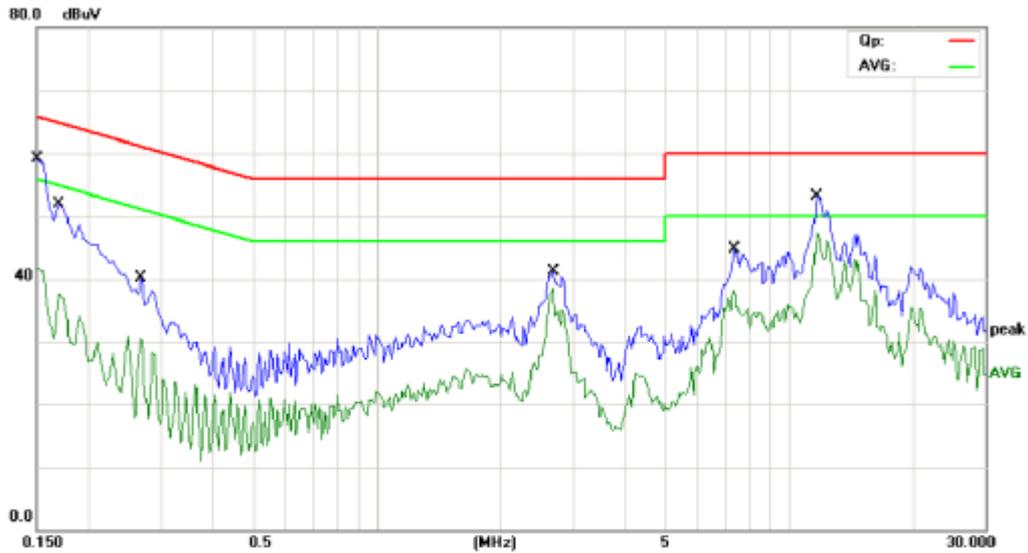
Mode: FULL LOAD

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1500	51.46	0.00	51.46	56.00	-4.54	AVG	
2		0.1550	59.40	0.00	59.40	65.73	-6.33	QP	
3		2.8200	40.58	0.00	40.58	56.00	-15.42	QP	
4		2.8200	38.16	0.00	38.16	46.00	-7.84	AVG	
5		4.3600	45.70	0.00	45.70	56.00	-10.30	QP	
6		4.3600	36.98	0.00	36.98	46.00	-9.02	AVG	
7		7.1200	39.66	0.00	39.66	60.00	-20.34	QP	
8		7.1200	33.82	0.00	33.82	50.00	-16.18	AVG	
9		11.9750	45.20	0.00	45.20	60.00	-14.80	QP	
10		11.9750	38.68	0.00	38.68	50.00	-11.32	AVG	
11		15.8000	45.22	0.00	45.22	60.00	-14.78	QP	
12		15.9000	40.33	0.00	40.33	50.00	-9.67	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WOLF

SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E



Site Conduction #2

Phase: **N**

Temperature: 22

Limit: (CE)EN61000-6-3_QP

Power: AC 380V/50Hz

Humidity: 50 %

Mode: FULL LOAD

Note:

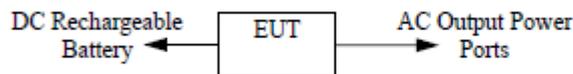
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1500	59.08	0.00	59.08	66.00	-6.92	QP	
2		0.1500	41.53	0.00	41.53	56.00	-14.47	AVG	
3		0.1700	51.85	0.00	51.85	64.96	-13.11	QP	
4		0.1700	37.58	0.00	37.58	54.96	-17.38	AVG	
5		0.2700	40.05	0.00	40.05	61.12	-21.07	QP	
6		0.2700	30.53	0.00	30.53	51.12	-20.59	AVG	
7		2.6900	41.13	0.00	41.13	56.00	-14.87	QP	
8		2.6900	38.41	0.00	38.41	46.00	-7.59	AVG	
9		7.3700	44.72	0.00	44.72	60.00	-15.28	QP	
10		7.3700	38.05	0.00	38.05	50.00	-11.95	AVG	
11		11.7250	53.10	0.00	53.10	60.00	-6.90	QP	
12	*	11.7250	47.30	0.00	47.30	50.00	-2.70	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: WOLF

5. RADIATED EMISSION MEASUREMENT

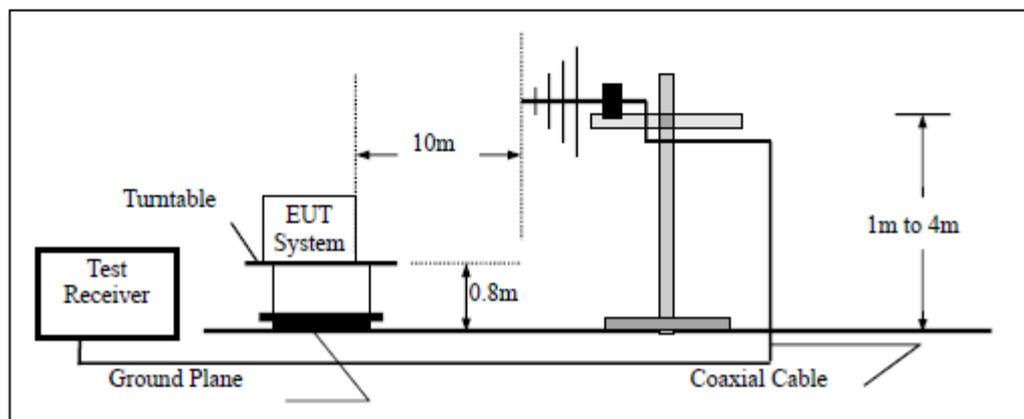
5.1. Block Diagram of Test Setup

5.1.1. Block diagram of EUT System



(EUT: Solar Inverter)

5.1.2. Block diagram of test setup (In chamber)



(EUT: Solar Inverter)

5.2. Measuring Standard

EN 61000-6-3:2007

5.3. Radiated Emission Limits

FREQUENCY (MHz)	DISTANCE (Meters)	FIELD STRENGTHS LIMIT (dB μ V/m)
30 ~ 230	10	30
230 ~ 1000	10	37

- Note:
- (1) The smaller limit shall apply at the combination point between two frequency bands.
 - (2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the EUT.

5.4. EUT Configuration on Measurement

The EN 61000-6-3 regulations test method must be used to find the maximum emission during radiated emission measurement.

EUT : Solar Inverter
Model Number : Growatt 12000UE

5.5. Operating Condition of EUT

5.5.1. Setup the EUT as shown on Section 5.1.

5.5.2. Turn on the power of all equipments.

5.5.3. Let the EUT work in measuring mode (Full Load) and measure it.

5.6. Test Procedure

The EUT is placed on a turntable which is 0.8 meter high above the ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 10 meters away from the receiving antenna that is mounted on an antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Bilog antenna (calibrated by Dipole Antenna) is used as a receiving antenna. Both horizontal and vertical polarization of the antenna is set on test.

The bandwidth of the Receiver is set at 120kHz.

5.7. Measuring Results

PASS.

The frequency range from 30MHz to 1000MHz is investigated.

Please see the attached pages.

SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E



Site site #1 Polarization: *Vertical* Temperature: 26
 Limit: EN61000-6-3 10m Radiation Power: DC 480V Humidity: 50 %
 Mode: FULL LOAD
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	38.7518	46.73	-21.03	25.70	30.00	-4.30	QP		
2	!	41.5670	45.69	-20.69	25.00	30.00	-5.00	QP		
3		60.7044	41.61	-21.61	20.00	30.00	-10.00	QP		
4		86.8068	46.23	-22.93	23.30	30.00	-6.70	QP		
5		154.2785	40.27	-24.29	15.98	30.00	-14.02	QP		
6		216.0240	44.20	-20.68	23.52	30.00	-6.48	QP		

*: Maximum data x: Over limit !: over margin

Operator: Ricky

SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E



Site site #1 Polarization: *Horizontal* Temperature: 26
 Limit: EN61000-6-3 10m Radiation Power: DC 480V Humidity: 50 %
 Mode:FULL LOAD
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		33.5624	44.12	-22.03	22.09	30.00	-7.91	QP		
2	*	37.9450	43.35	-21.25	22.10	30.00	-7.90	QP		
3		51.1210	40.16	-20.90	19.26	30.00	-10.74	QP		
4		91.1746	43.66	-21.66	22.00	30.00	-8.00	QP		
5		153.2004	44.80	-24.35	20.45	30.00	-9.55	QP		
6		219.8448	41.05	-20.51	20.54	30.00	-9.46	QP		

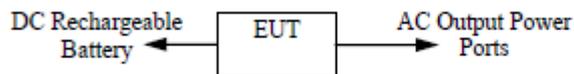
*:Maximum data x:Over limit l:over margin

Operator: Ricky

6. ELECTROSTATIC DISCHARGE IMMUNITY TEST

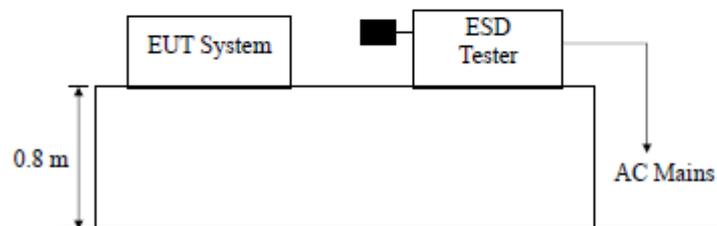
6.1. Block Diagram of Test Setup

6.1.1. Block diagram of EUT System



(EUT: Solar Inverter)

6.1.2. Block diagram of ESD test setup



(EUT: Solar Inverter)

6.2. Test Standard

EN 61000-6-2:2005

(EN 61000-4-2:2009 Severity Level: 3 / Air Discharge: ± 8 kV;

Level: 2 / Contact Discharge: ± 4 kV)

6.3. Severity Levels and Performance Criterion

6.3.1. Severity level

Level	Test Voltage Contact Discharge (kV)	Test Voltage Air Discharge (kV)
1	± 2	± 2
2	± 4	± 4
3	± 6	± 8
4	± 8	± 15
X	Special	Special

6.3.2. Performance criterion: B

6.4. Operating Condition of EUT

- 6.4.1. Setup the EUT as shown on Section 6.1.
- 6.4.2. Turn on the power of all equipments.
- 6.4.3. Let the EUT work in test mode (Full Load) and test it.

6.5. Test Procedure

6.5.1. Air Discharge:

This test is done on a non-conductive surface. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

6.5.2. Contact Discharge:

All the procedure shall be same as Section 6.5.1. Except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

6.5.3. Indirect discharge for horizontal coupling plane

At least 10 single discharges (in the most sensitive polarity) shall be applied at the front edge of each HCP opposite the center point of each unit (if applicable) of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge.

6.5.4. Indirect discharge for vertical coupling plane

At least 10 singles discharge (in the most sensitive polarity) shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m×0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

6.6. Test Results

PASS.

Please refer to the following pages.

Electrostatic Discharge Test Results

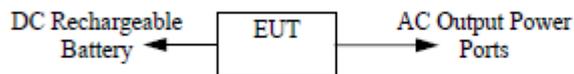
SHENZHEN EMTEK CO., LTD.

Applicant	: SHENZHEN GROWATT NEW ENERGY CO., LTD.	
EUT	: Solar Inverter	Test Date : September 24, 2011
M/N	: Growatt 12000UE	Temperature : 22°C
Power Supply	: DC 480V	Humidity : 50%
Air discharge	: ± 8.0kV	Test Mode : Full Load
Contact discharge	: ± 4.0kV	Criterion : B
Location	Kind A-Air Discharge C-Contact Discharge	Result
Slot	A	PASS
LCD	A	PASS
Metal	C	PASS
Port	C	PASS
Screw	C	PASS
HCP	C	PASS
VCP of front	C	PASS
VCP of rear	C	PASS
VCP of left	C	PASS
VCP of right	C	PASS
Note:		

7. RF FIELD STRENGTH SUSCEPTIBILITY TEST

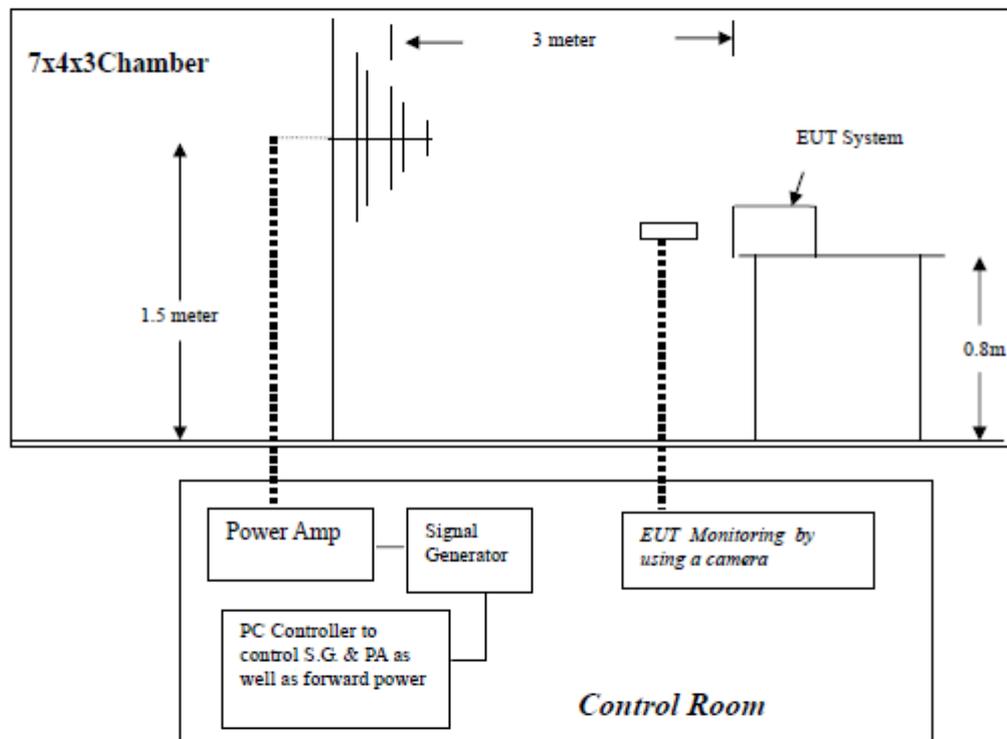
7.1. Block Diagram of Test Setup

7.1.1. Block diagram of EUT System



(EUT: Solar Inverter)

7.1.2. Block diagram of RS test setup



(EUT: Solar Inverter)

7.2. Test Standard

EN 61000-6-2:2005 (EN 61000-4-3:2006+A1:2008+A2:2010,
Severity Level: 1 V/m, 3 V/m, 10 V/m)

7.3. Severity Levels and Performance Criterion

7.3.1. Severity Levels

Level	Field Strength V/m
1.	1
2.	3
3.	10
X	Special

7.3.2. Performance Criterion: A

7.4. Operating Condition of EUT

7.4.1. Setup the EUT as shown on Section 7.1.

7.4.2. Turn on the power of all equipments.

7.4.3. Let the EUT work in test mode (Full Load) and test it.

7.5. Test Procedure

The EUT are placed on a table that is 0.8 meter high above the ground. The EUT is set 3 meters away from the transmitting antenna that is mounted on an antenna tower. Both horizontal and vertical polarization of the antenna is set on test. Each of the four sides of the EUT must be faced this transmitting antenna and measured individually. In order to judge the EUT performance, a CCD camera and a multimeter are used to monitor it.

All the scanning conditions are as following:

Condition of Test	Remark
1. Fielded Strength	1V/m (Severity Level 1) 3V/m (Severity Level 2) 10V/m (Severity Level 3)
2. Radiated Signal	Modulated
3. Scanning Frequency	80-2700MHz
4. Sweep time of radiated	0.0015 Decade/s
5. Dwell Time	1 Sec.

7.6. Test Results

PASS.

Please refer to the following page.

RF Field Strength Susceptibility Test Results

SHENZHEN EMTEK CO., LTD.

Applicant : SHENZHEN GROWATT NEW ENERGY CO., LTD.				
EUT : Solar Inverter		Test Date : September 24, 2011		
M/N : Growatt 12000UE		Temperature : 22°C		
Field Strength : 10 V/m		Humidity : 50%		
Power Supply : DC 480V		Criterion : A		
Test Mode : Full Load		Frequency Range: 80MHz to 1000MHz		
Modulation: <input type="checkbox"/> None <input type="checkbox"/> Pulse <input checked="" type="checkbox"/> AM 1kHz 80%				
Frequency Rang 1: 80~ 1000MHz		Frequency Rang 2: N/A		
Steps	1%			
	Horizontal	Vertical	Horizontal	Vertical
Front	PASS	PASS		
Right	PASS	PASS		
Rear	PASS	PASS		
Left	PASS	PASS		
<p>Test Equipment:</p> <ol style="list-style-type: none"> 1. Signal Generator: 2023B (AEROFLEX) 2. Power Amplifier: AS0102-55 (MILMEGA) & AP32MT215 (PRANA) 3. Log.-Per. Antenna: VULP9118E (SCHWARZBECK) 4. Broad-Band Horn Antenna: BBHA 9120L3F (SCHWARZBECK) 5. RF Power Meter. Dual Channel: 4232A (BOONTON) 6. Field Strength Meter: HI-6005 (HOLADAY) 				
Note:				

RF Field Strength Susceptibility Test Results

SHENZHEN EMTEK CO., LTD.

Applicant : SHENZHEN GROWATT NEW ENERGY CO., LTD.				
EUT : Solar Inverter		Test Date : September 24, 2011		
M/N : Growatt 12000UE		Temperature : 22°C		
Field Strength : 3 V/m		Humidity : 50%		
Power Supply : DC 480V		Criterion : A		
Test Mode : Full Load		Frequency Range: 1.4GHz to 2GHz		
Modulation: <input type="checkbox"/> None <input type="checkbox"/> Pulse <input checked="" type="checkbox"/> AM 1kHz 80%				
Frequency Rang 1: 1.4GHz to 2GHz		Frequency Rang 2: N/A		
Steps	1%			
	Horizontal	Vertical	Horizontal	Vertical
Front	PASS	PASS		
Right	PASS	PASS		
Rear	PASS	PASS		
Left	PASS	PASS		
<p>Test Equipment:</p> <ol style="list-style-type: none"> 1. Signal Generator: 2023B (AEROFLEX) 2. Power Amplifier: AS0102-55 (MILMEGA) & AP32MT215 (PRANA) 3. Log.-Per. Antenna: VULP9118E (SCHWARZBECK) 4. Broad-Band Horn Antenna: BBHA 9120L3F (SCHWARZBECK) 5. RF Power Meter. Dual Channel: 4232A (BOONTON) 6. Field Strength Meter: HI-6005 (HOLADAY) 				
Note:				

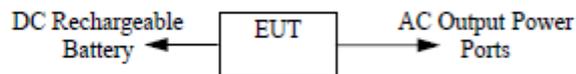
RF Field Strength Susceptibility Test Results

Applicant : SHENZHEN GROWATT NEW ENERGY CO., LTD.				
EUT : Solar Inverter		Test Date : September 24, 2011		
M/N : Growatt 12000UE		Temperature : 22°C		
Field Strength : 1 V/m		Humidity : 50%		
Power Supply : DC 480V		Criterion : A		
Test Mode : Full Load		Frequency Range: 2GHz to 2.7GHz		
Modulation: <input type="checkbox"/> None <input type="checkbox"/> Pulse <input checked="" type="checkbox"/> AM 1kHz 80%				
		Frequency Rang 1: 2GHz to 2.7GHz		Frequency Rang 2: N/A
Steps	1%			
	Horizontal	Vertical	Horizontal	Vertical
Front	PASS	PASS		
Right	PASS	PASS		
Rear	PASS	PASS		
Left	PASS	PASS		
Note:				

8. ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST

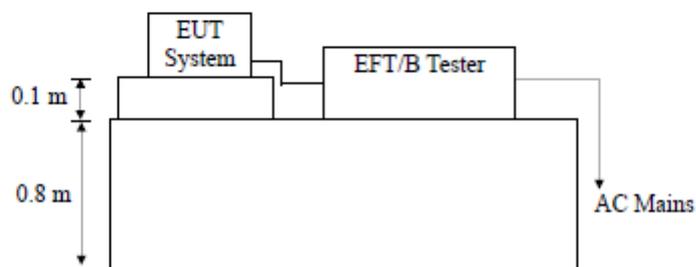
8.1. Block Diagram of Test Setup

8.1.1. Block Diagram of EUT System



(EUT: Solar Inverter)

8.1.2. EFT Test Setup



(EUT: Solar Inverter)

8.2. Test Standard

EN 61000-6-2:2005 (EN 61000-4-4:2004+A1:2010, Severity Level:
AC Output Power Ports: 2kV; DC Power Lines 2kV)

8.3. Severity Levels and Performance Criterion

8.3.1. Severity level

Level	Open Circuit Output Test Voltage $\pm 10\%$	
	On Power Supply Lines	On I/O (Input/Output) Signal data and control lines
1	0.5 kV	0.25 kV
2	1 kV	0.5 kV
3	2 kV	1 kV
4	4 kV	2 kV
X	Special	Special

8.3.2. Performance criterion: B

8.4. Operating Condition of EUT

- 8.4.1. Setup the EUT as shown on Section 10.1.
- 8.4.2. Turn on the power of all equipments.
- 8.4.3. Let the EUT work in test mode (Full Load) and test it.

8.5. Test Procedure

The EUT is put on the table that is 0.8 meter high above the ground. This reference ground plane shall project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane beneath the EUT, shall be more than 0.5m.

8.5.1. For input and output DC power ports:

The EUT is connected to the power mains by using a coupling device that couples the EFT interference signal to DC power lines. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 mins.

8.5.2. For signal lines and control lines ports:

No I/O ports. It's unnecessary to test.

8.5.3. For AC output line ports:

The AC Output Power Ports of EUT are connected to the AC power mains by using a coupling device that couples the EFT interference signal to AC power lines (AC Output Power Ports). All of the test voltage should be applied during compliance test and the duration of the test is 2 mins.

8.6. Test Results

PASS.

Please refer to the following page.

Electrical Fast Transient/Burst Test Results

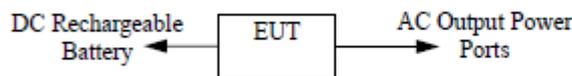
SHENZHEN EMTEK CO., LTD.

Standard: <input checked="" type="checkbox"/> EN 61000-4-4		Result: <input checked="" type="checkbox"/> PASS / <input type="checkbox"/> FAIL	
Applicant : <u>SHENZHEN GROWATT NEW ENERGY CO., LTD.</u>			
EUT : <u>Solar Inverter</u>			
M/N : <u>Growatt 12000UE</u>			
Input Voltage: <u>DC 480V</u>		Output Voltage: <u>AC 380V/50Hz</u>	
Criterion : B			
Ambient Condition : <u>22 °C</u>		<u>50% RH</u>	
Operation Mode: Full Load			
Line : <input checked="" type="checkbox"/> DC Mains <input checked="" type="checkbox"/> AC Power Port		Line : <input type="checkbox"/> Signal <input type="checkbox"/> I/O Cable	
Coupling : <input checked="" type="checkbox"/> Direct		Coupling : <input type="checkbox"/> Capacitive	
Test Time : 120s			
Line	Test Voltage	Result(+)	Result(-)
L1, L2, L3, N, PE	2kV	PASS	PASS
L1-L2, L1-L3, L2-L3, L1-N, L2-N, L3-N	2kV	PASS	PASS
L1-PE, L2-PE, L3-PE, N-PE	2kV	PASS	PASS
L1-L2-PE, L1-L3-PE, L2-L3-PE, L1-L2-L3, L1-L2-N, L1-L3-N, L2-L3-N, L1-N-PE, L2-N-PE, L3-N-PE	2kV	PASS	PASS
L1-L2-L3-PE, L1-L2-L3-N, L1-L2-N-PE, L1-L3-N-PE, L2-L3-N-PE	2kV	PASS	PASS
DC Line	2kV	PASS	PASS
Note:			

9. SURGE IMMUNITY TEST

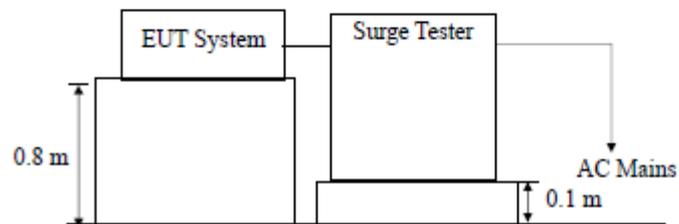
9.1. Block Diagram of Test Setup

9.1.1. Block Diagram of EUT System



(EUT: Solar Inverter)

9.1.2. Surge Test Setup



(EUT: Solar Inverter)

9.2. Test Standard

EN 61000-6-2:2005

(EN 61000-4-5:2006, Severity Level: AC Output Power Ports:
Line to Line: Level 2, 1.0kV; Line to earth, Level 3, 2.0kV,
DC Power Line 0.5kV)

9.3. Severity Levels and Performance Criterion

9.3.1. Severity level

Severity Level	Open-Circuit Test Voltage kV
1	0.5
2	1.0
3	2.0
4	4.0
*	Special

9.3.2. Performance criterion: B

9.4. Operating Condition of EUT

- 9.4.1. Setup the EUT as shown on Section 9.1.
- 9.4.2. Turn on the power of all equipments.
- 9.4.3. Let the EUT work in test mode (Full Load) and test it.

9.5. Test Procedure

- 1) Set up the EUT and test generator as shown on Section 9.1.2.
- 2) For AC Output Power Ports: For line to line coupling mode, provide a 1.0 kV 1.2/50 μ s voltage surge (at open-circuit condition) and 8/20 μ s current surge to EUT selected points. For line to Earth coupling mode, provide a 2.0 kV 1.2/50 μ s voltage surge (at open-circuit condition) and 8/20 μ s current surge to EUT selected points. DC line: For line to line coupling mode, provide a 0.5 kV 1.2/50 μ s voltage surge (at open-circuit condition) and 8/20 μ s current surge to EUT selected points.
- 3) At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are conducted during test.
- 4) Different phase angles are done individually.
- 5) Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

9.6. Test Results

PASS.

Please refer to the following page.

Surge Immunity Test Results

SHENZHEN EMTEK CO., LTD.

Applicant : <u>SHENZHEN GROWATT NEW ENERGY CO., LTD.</u>					
EUT : <u>Solar Inverter</u>			Test Date : <u>September 24, 2011</u>		
M/N : <u>Growatt 12000UE</u>			Temperature : <u>22°C</u>		
Power Supply : <u>DC 480V</u>		Output Voltage: <u>AC 380V/50Hz</u>		Humidity : <u>50%</u>	
Test Mode : <u>Full Load</u>			Criterion : <u>B</u>		
Location	Polarity	Phase Angle	Number of Pulse	Pulse Voltage (kV)	Result
L1-L2, L1-L3, L2-L3	+	0°, 90°, 180°, 270°	5	1.0	PASS
	-	0°, 90°, 180°, 270°	5	1.0	PASS
L1-N, L2-N, L3-N	+	0°, 90°, 180°, 270°	5	1.0	PASS
	-	0°, 90°, 180°, 270°	5	1.0	PASS
L1-PE, L2-PE, L3-PE	+	0°, 90°, 180°, 270°	5	2.0	PASS
	-	0°, 90°, 180°, 270°	5	2.0	PASS
N-PE	+	0°, 90°, 180°, 270°	5	2.0	PASS
	-	0°, 90°, 180°, 270°	5	2.0	PASS
DC Line	+	0°	5	0.5	PASS
	-	0°	5	0.5	PASS
Remark:					

10.4. Operating Condition of EUT

- 10.4.1. Setup the EUT as shown on Section 12.1.
- 10.4.2. Turn on the power of all equipments.
- 10.4.3. Let the EUT work in test mode (Full Load) and test it.

10.5. Test Procedure

- 1) Set up the EUT, CDN and test generators as shown on Section 11.1.2.
- 2) Let the EUT work in test mode and measure it.
- 3) The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).
- 4) The EUT are placed on an insulating support 0.1m high above a ground reference plane. EM-Clamp is placed on the ground plane about 0.3m from EUT.
- 5) The disturbance signal described below is injected to EUT through CDN.
- 6) The EUT operates within its operational mode(s) under intended climatic conditions after power on.
- 7) The frequency range is swept from 150kHz to 80MHz using 10V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave.
- 8) The rate of sweep shall not exceed 1.5×10^{-3} decades/s. Where the frequency is swept incrementally, the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.
- 9) Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

10.6. Test Results

PASS.

Please refer to the following page.

Injected Currents Susceptibility Test Results

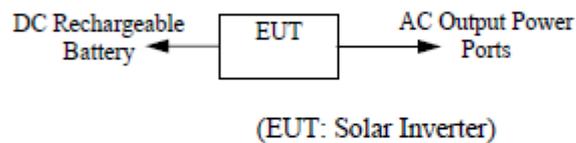
SHENZHEN EMTEK CO., LTD.

Applicant : <u>SHENZHEN GROWATT NEW ENERGY CO., LTD.</u>				
EUT : <u>Solar Inverter</u>		Test Date: <u>September 24, 2011</u>		
M/N : <u>Growatt 12000UE</u>		Temperature : <u>22°C</u>		
Power Supply : <u>DC 480V</u>		Output Voltage: <u>AC 380V/50Hz</u>		Humidity : <u>58%</u>
Test Engineer : <u>ANDY</u>				
Test Mode: Full Load				
Frequency Range (MHz)	Injected Position	Strength (Unmodulated)	Criterion	Result
0.15 ~ 80	AC Output Power Ports	10V	A	PASS
0.15 ~ 80	DC line	10V	A	PASS
Test Mode : <u>N/A</u>				
Frequency Range (MHz)	Injected Position	Strength (Unmodulated)	Criterion	Result
Remark : 1. Modulation Signal:1kHz 80% AM Measurement Equipment : Simulator: CWS 500 (SWITZERLAND EMTEST) CDN : <input checked="" type="checkbox"/> CDN-M2 (SWITZERLAND EMTEST) <input checked="" type="checkbox"/> CDN-M3 (SWITZERLAND EMTEST) <input type="checkbox"/> EM-Clamp (SWITZERLAND EMTEST)		Note:		

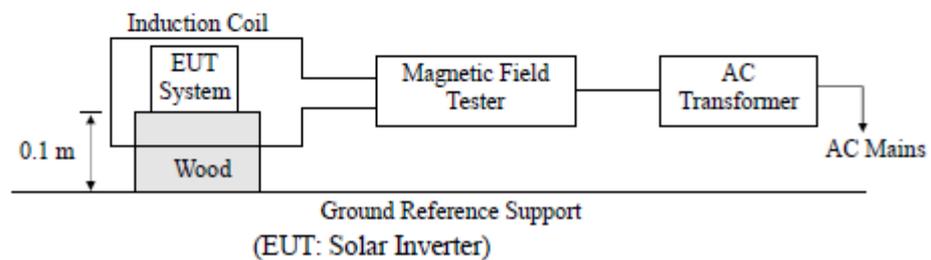
11. MAGNETIC FIELD SUSCEPTIBILITY TEST

11.1. Block Diagram of Test Setup

11.1.1. Block diagram of EUT System



11.1.2. Magnetic field test setup



11.2. Test Standard

EN 61000-6-2:2005

(EN 61000-4-8:2010, Severity Level: Level 4, 30 A/m)

11.3. Severity Levels and Performance Criterion

11.3.1. Severity Levels

Level	Field Strength A/m
1	1
2	3
3	10
4	30
5	100
X	Special

11.3.2. Performance Criterion: A

11.4. Operating Condition of EUT

11.4.1. Setup the EUT as shown on Section 13.1.

11.4.2. Turn on the power of all equipments.

11.4.3. Let the EUT work in test mode (Full Load) and test it.

11.5. Test Procedure

The EUT is placed in the middle of a induction coil (1*1m), under which is a 1*1*0.1m (high) table, this small table is also placed on a larger table, 0.8 m above the ground. Both horizontal and vertical polarization of the induction coil is set on test, so that each side of the EUT is affected by the magnetic field. Also can reach the same aim by change the position of the EUT.

11.6. Test Results

PASS.

Please refer to the following page.

Magnetic Field Immunity Test Results

SHENZHEN EMTEK CO., LTD.

Standard: <input checked="" type="checkbox"/> EN 61000-4-8		Result: <input checked="" type="checkbox"/> PASS / <input type="checkbox"/> FAIL		
Applicant : <u>SHENZHEN GROWATT NEW ENERGY CO., LTD.</u> EUT : <u>Solar Inverter</u> M/N : <u>Growatt 12000UE</u> Input Voltage : <u>DC 480V</u> Date of Test : <u>September 24, 2011</u> Test Engineer: <u>ANDY</u> Ambient Condition : Temp : <u>22°C</u> Humid: <u>55%</u> Criterion: A				
Operation Mode: Full Load				
Test Level (A/m)	Testing Duration	Coil Orientation	Criterion	Result
30	5 mins	X	A	PASS
30	5 mins	Y	A	PASS
30	5 mins	Z	A	PASS
Operation Mode: N/A				
Test Level (A/m)	Testing Duration	Coil Orientation	Criterion	Result
Test Equipment	Magnetic Field Test: HEAFELY MAG 100.1			
Note:				

Annex No. 2

Pictures of the unit

Model: Growatt 20000UE, Growatt 18000UE

Enclosure – Front



Enclosure – Rear



Model: Growatt 20000UE, Growatt 18000UE

Interior view – 1

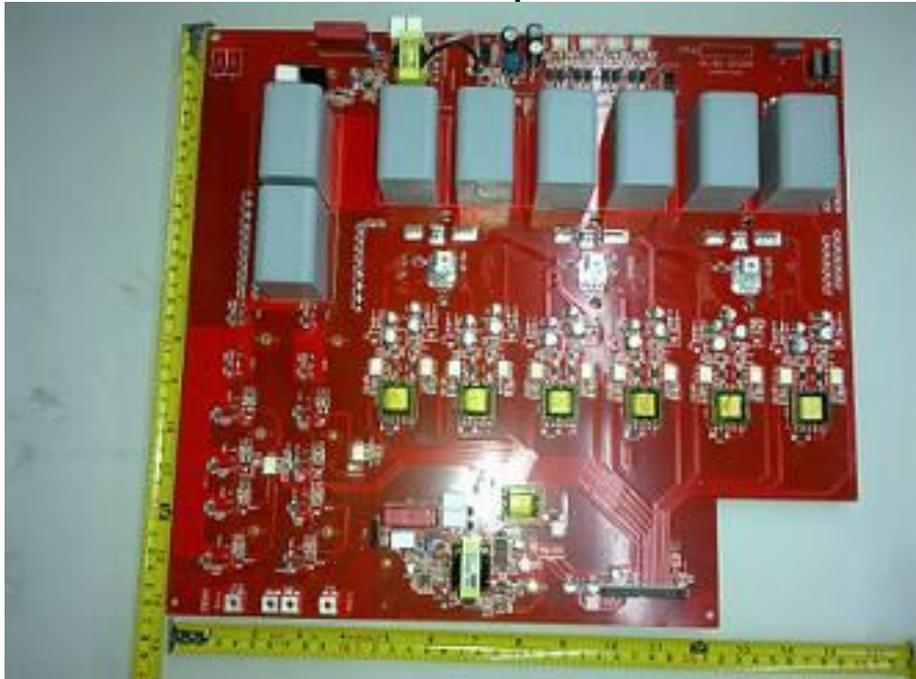


Interior view – 2

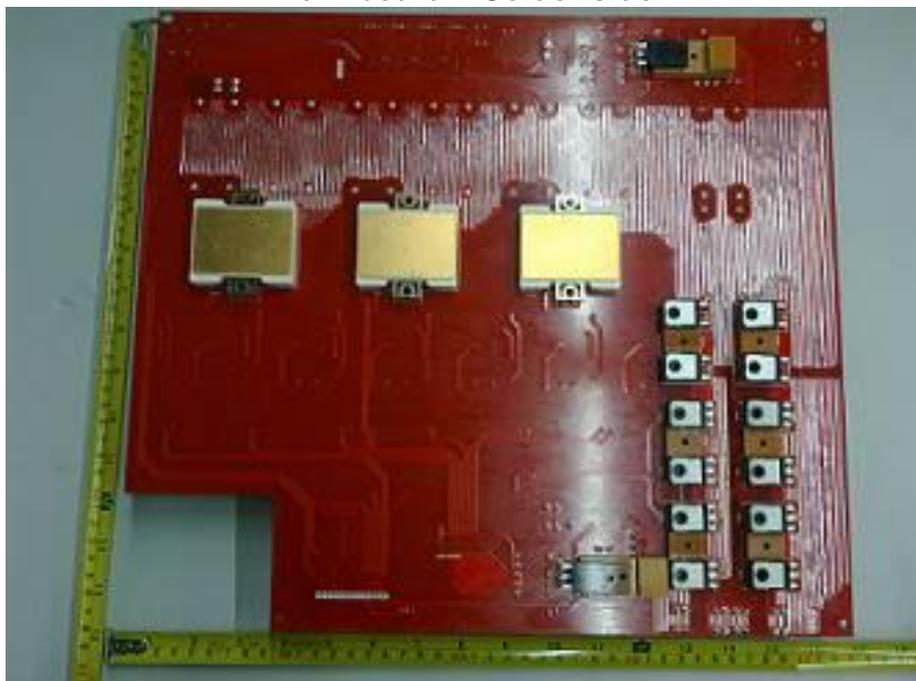


Model: Growatt 20000UE, Growatt 18000UE

Main board – Component side

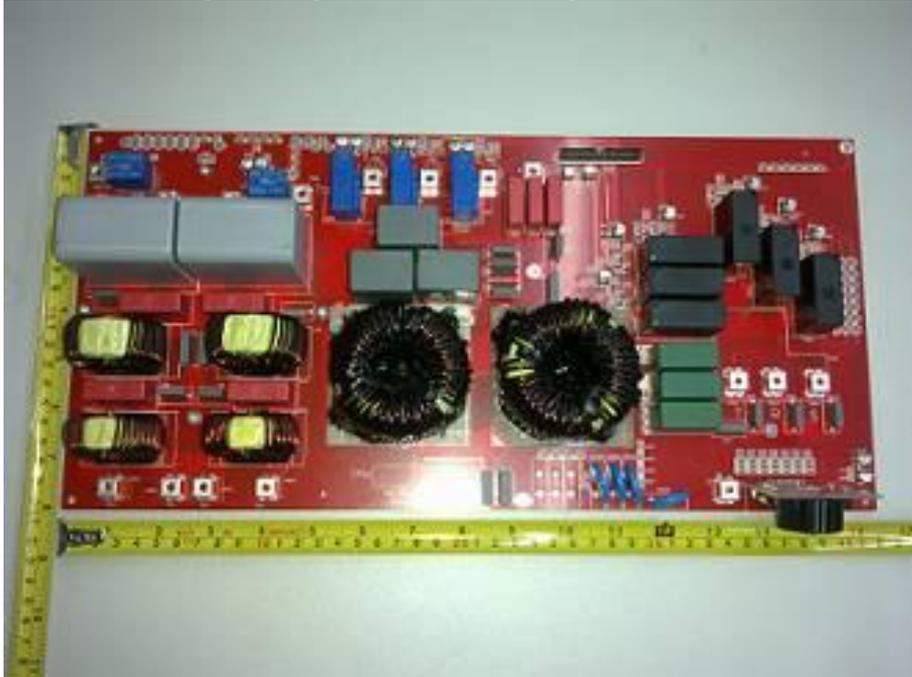


Main board – Solder side

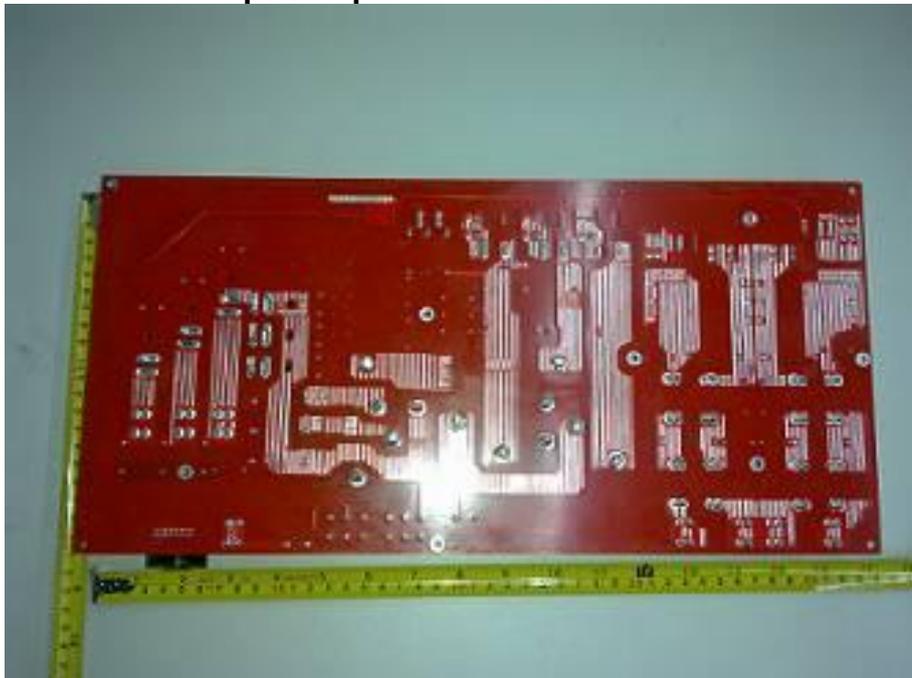


Model: Growatt 20000UE, Growatt 18000UE

Input/output board – Component side



Input/output board – Solder side

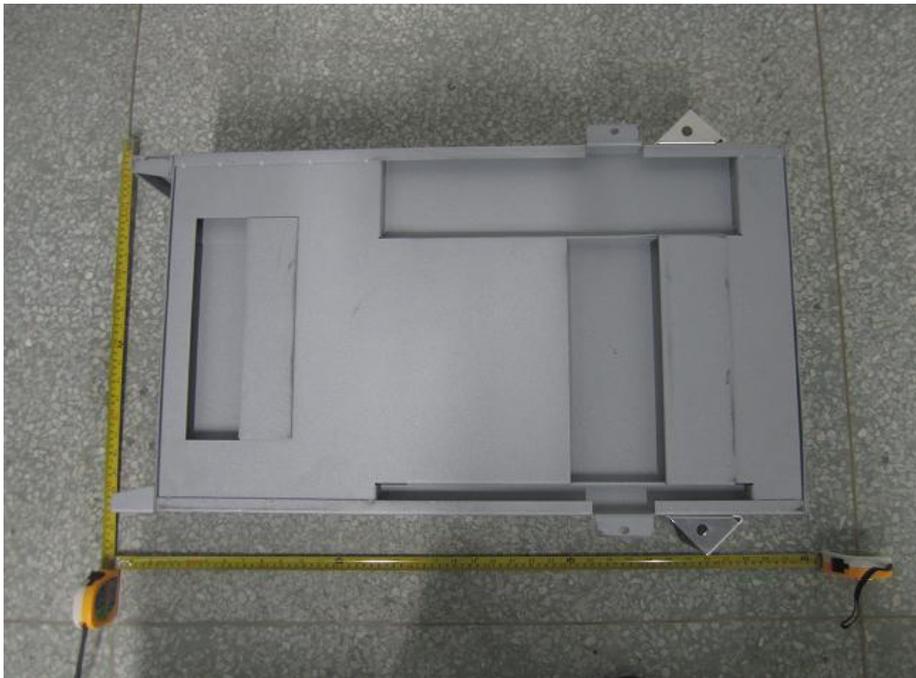


Model: Growatt 12000UE, Growatt 10000UE

Enclosure – Front

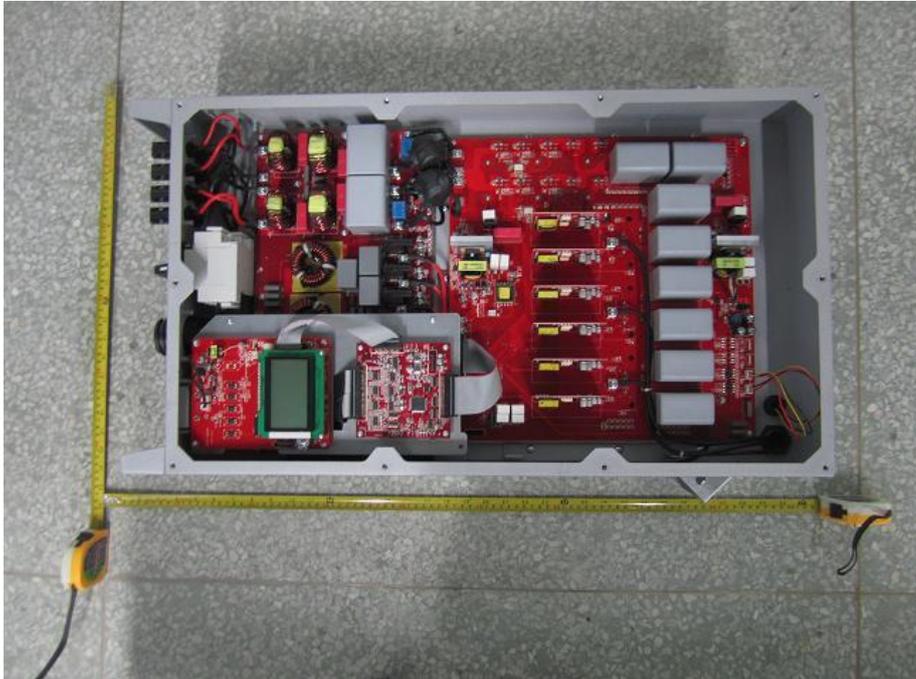


Enclosure – Rear

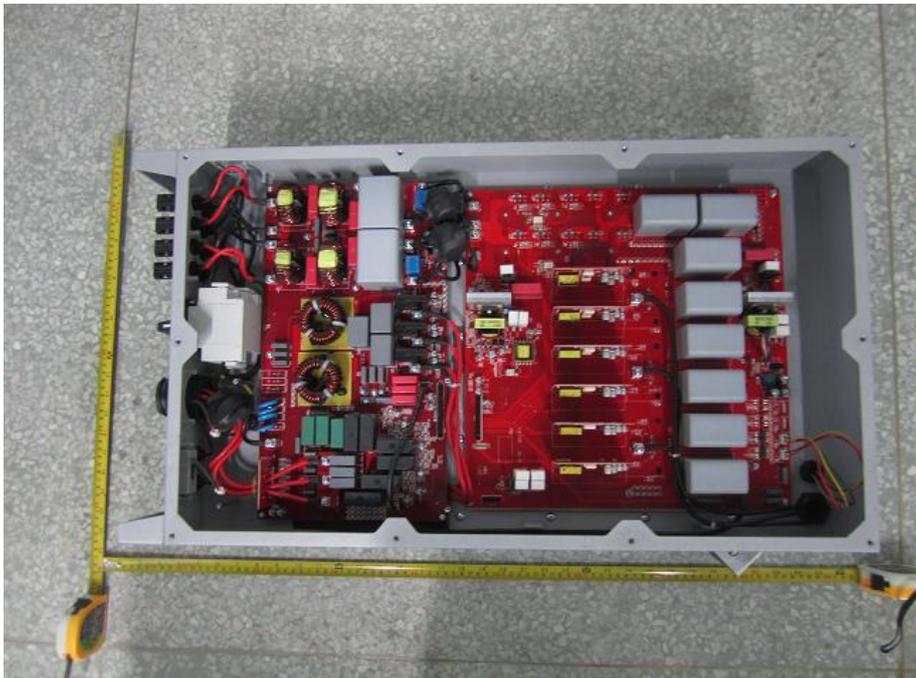


Model: Growatt 12000UE, Growatt 10000UE

Interior view – 1



Interior view – 2

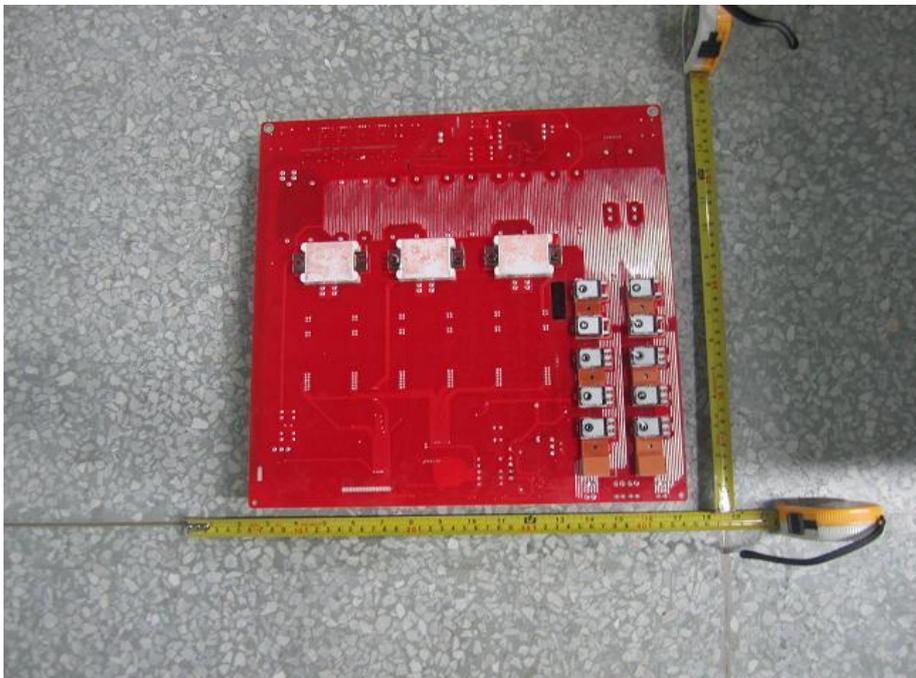


Model: Growatt 12000UE, Growatt 10000UE

Main board – Component side

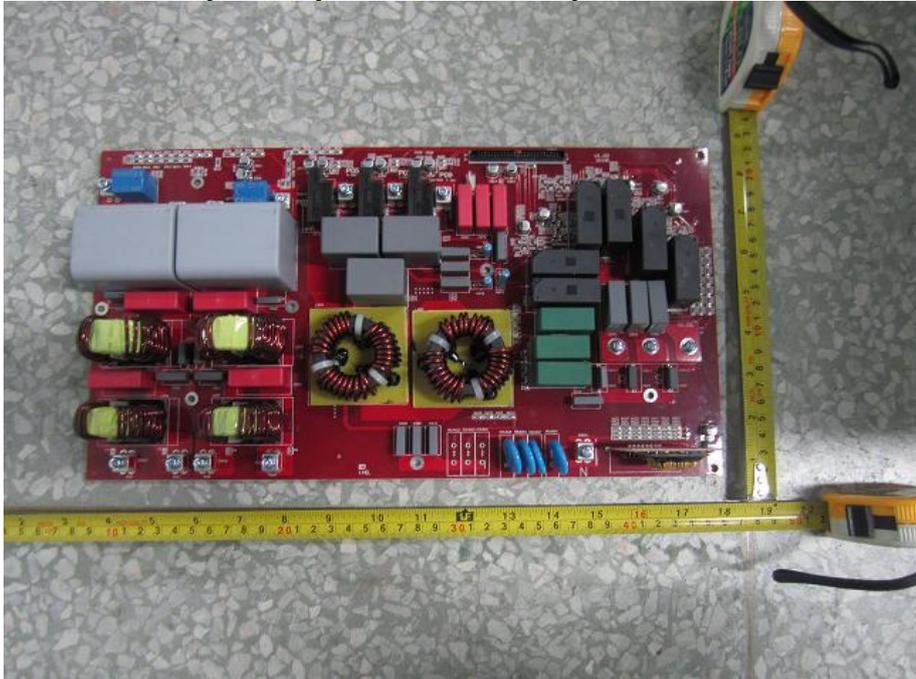


Main board – Solder side

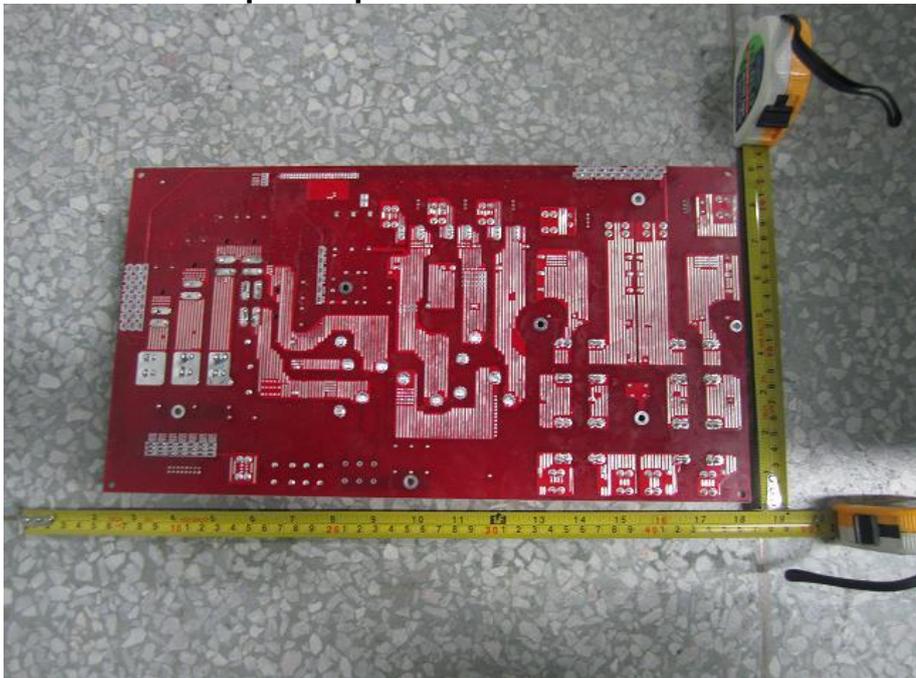


Model: Growatt 12000UE, Growatt 10000UE

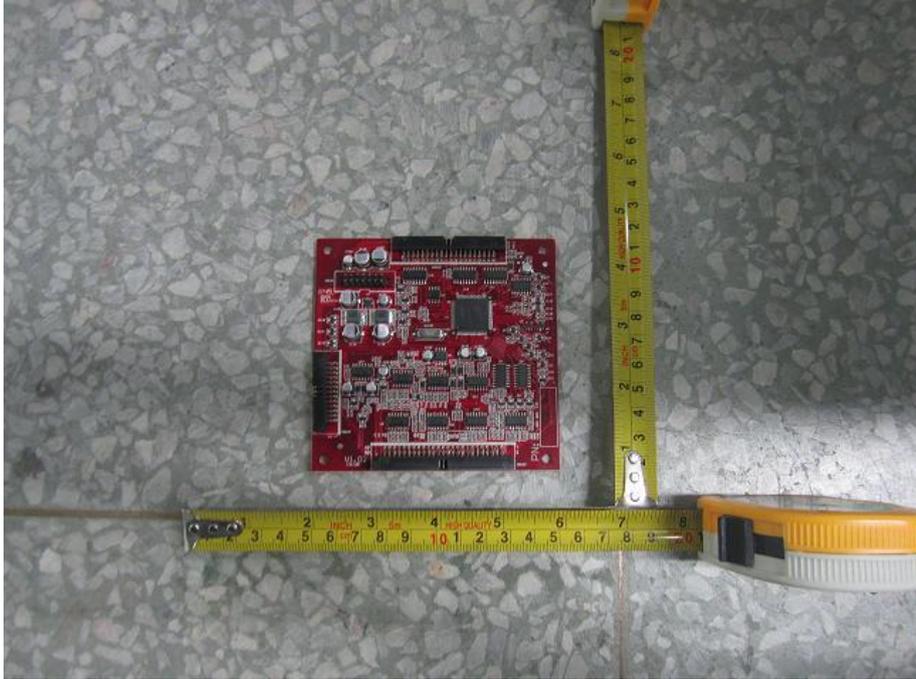
Input/output board – Component side



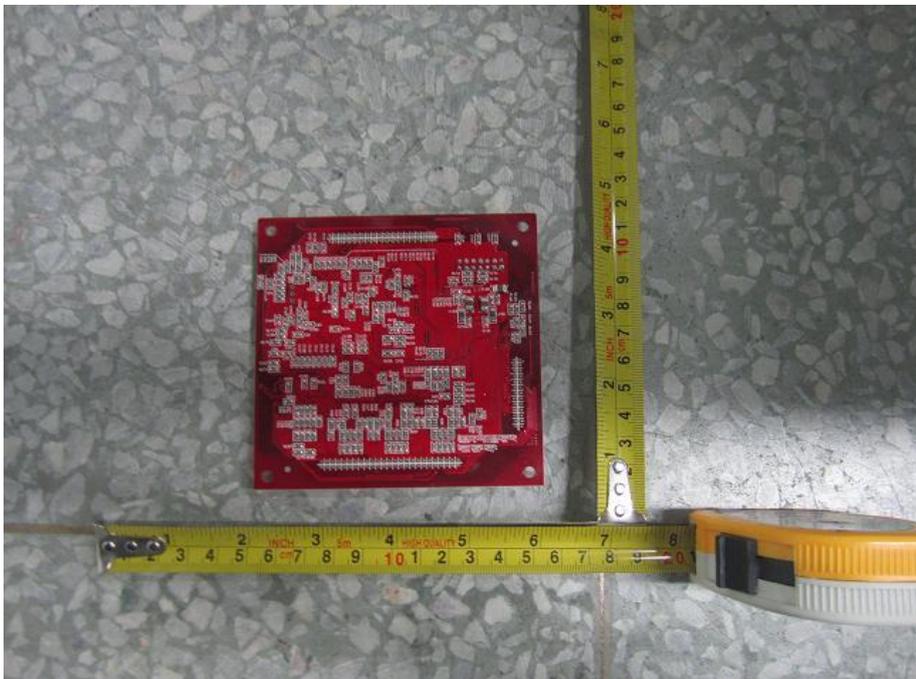
Input/output board – Solder side



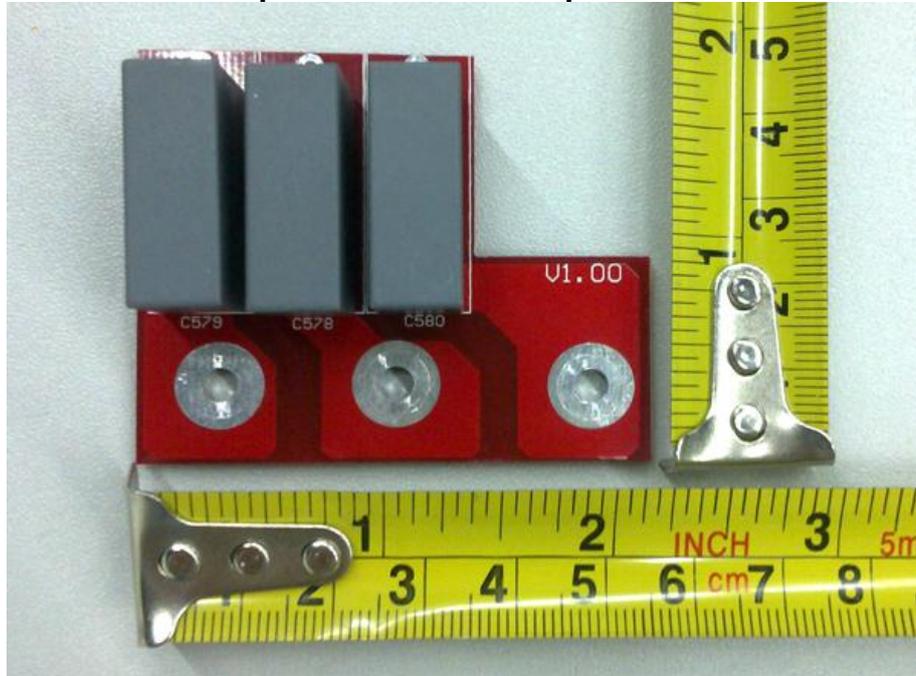
Control board - Component side



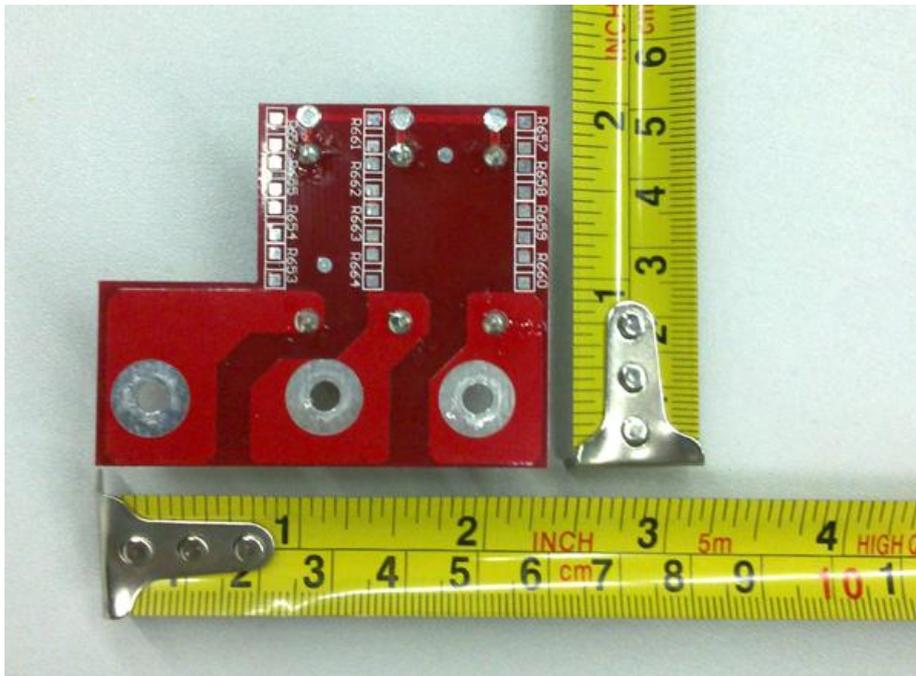
LCD display board - Solder side



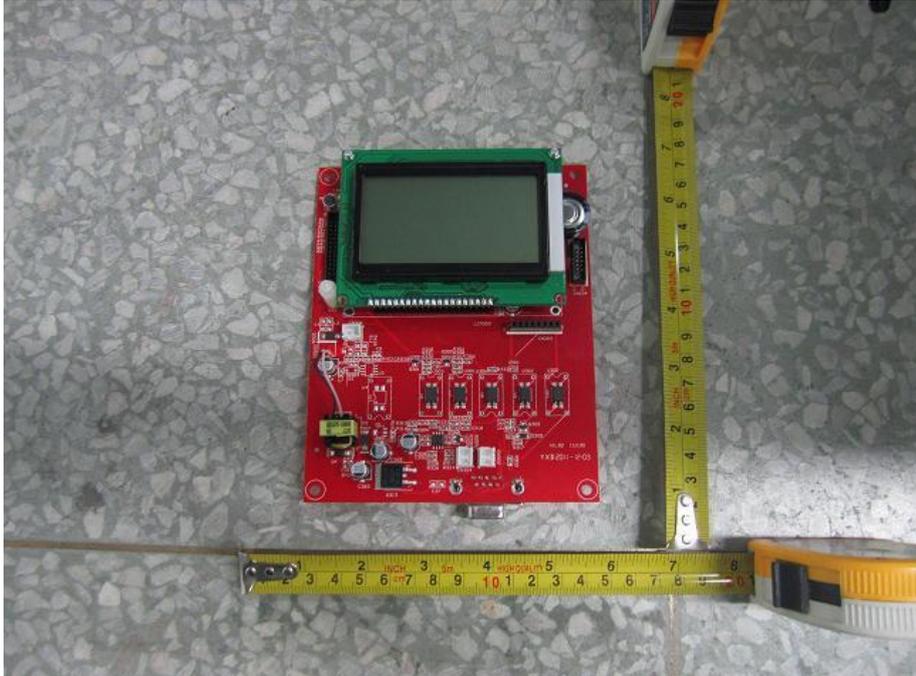
X Capacitor board - Component side



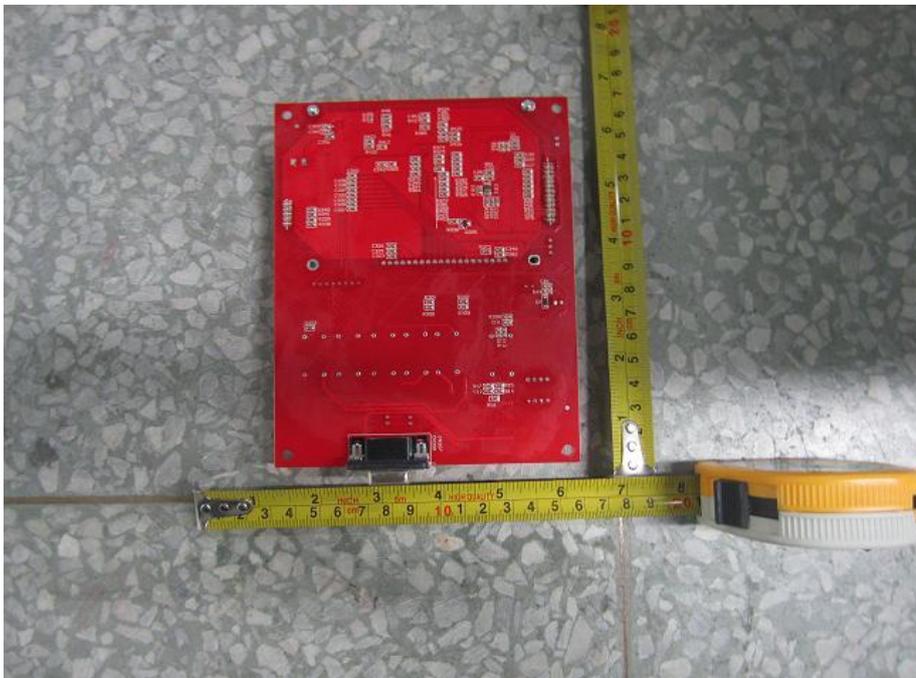
X Capacitor board - Solder side



Communication board - Component side



Communication board - Solder side



Groundingkit board - Component side



Groundingkit board - Solder side



Annex No. 3

Test Equipment list

Equipment	Manufacturer	Type	Serial No.	Last Calibration	Next Calibration
DC Source	REGATRON	TC.P.16.800.400. PV.HMI	1020CC696	2011-08-11	2012-08-10
AC Source	Chroma	Chroma 6560	SB0136	2011-08-11	2012-08-10
Power analyzer	YOKOGAWA	WT3000	SB0055	2011-08-11	2012-08-10
RLC load	Weirkeji	VR116	1011899 (SB0133)	2011-08-11	2012-08-10
Oscilloscope	Agilent	DS05014A	MY50200199	2011-08-11	2012-08-10
Oscilloscope	Agilent	DS05014A	MY50340287	2011-08-11	2012-08-10
Oscilloscope	Agilent	DS05014A	MY5020018	2011-08-11	2012-08-10
Current Probe	PINTECH	PT-710	239029	2011-08-11	2012-08-10
Current Probe	PINTECH	PT-710	239029	2011-08-11	2012-08-10
Current Probe	Tektronix	A621	01JJ27275DV	2011-08-11	2012-08-10
Voltage Probe	Sapphire	SI-9110	SB0059	2011-08-11	2012-08-10
Voltage Probe	Sapphire	SI-9110	111158 (SB0002)	2011-08-11	2012-08-10
Voltage Probe	Sapphire	SI-9110	105075	2011-08-11	2012-08-10
High Voltage Different Probe	TEK	P5200	C030444	2011-08-11	2012-08-10
Multi function meter	FLUKE	289	119801979(SB0012)	2011-08-11	2012-08-10