

| 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

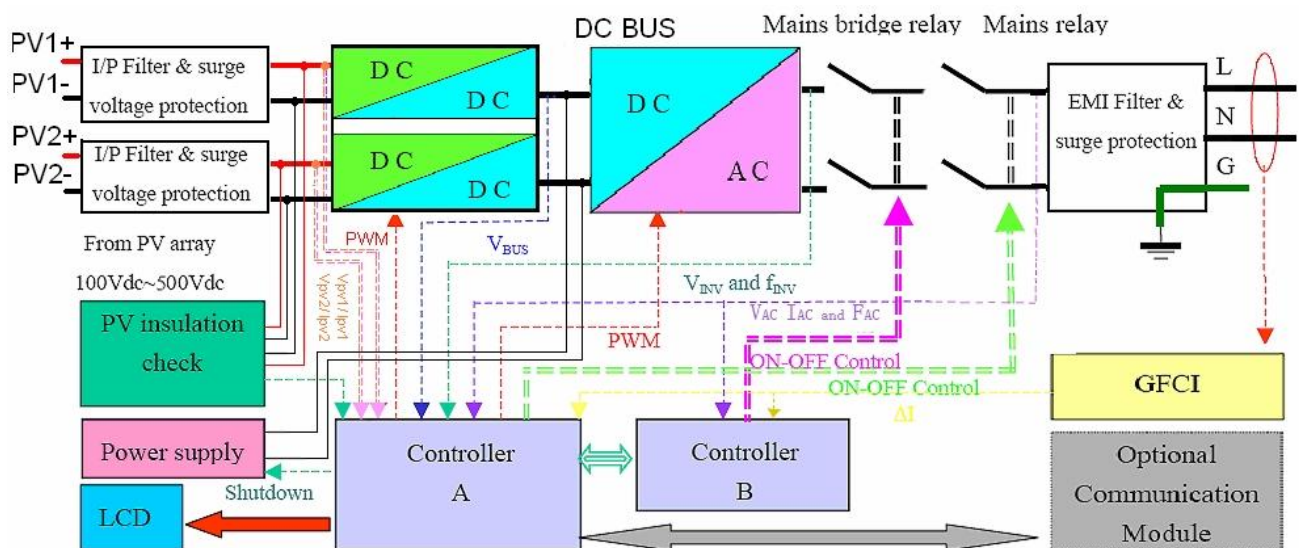
Address of the manufacturer sites:

**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 |
| <p>General remarks:</p> <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> <p>This Test Report consists of the following documents:</p> <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 |

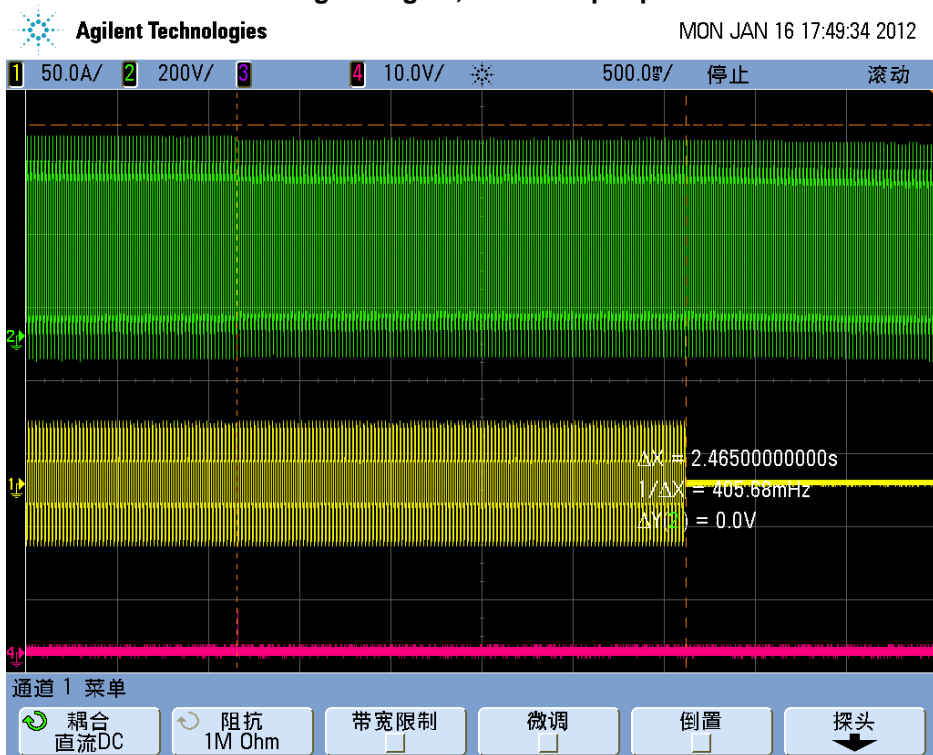
G59/2 TEST SHEET:

13.7.3 Type verification functional testing of the interface protection

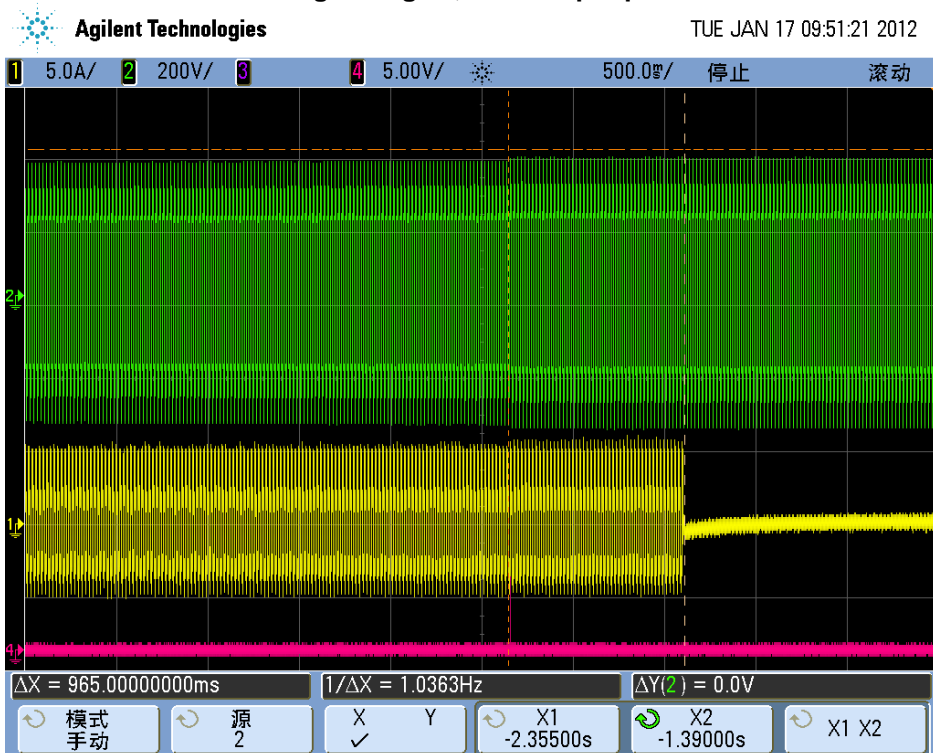
| 13.7.3.2 UNDER / OVER VOLTAGE TESTS | | | | | | | | P |
|-------------------------------------|---------------|------------|--------|--------|----------------|------------|--------|--------|
| | Under Voltage | | | | Over Voltage | | | |
| | L1 phase | | | | | | | |
| Parameter | Voltage | Time (sec) | | | 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 |
| | 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 |

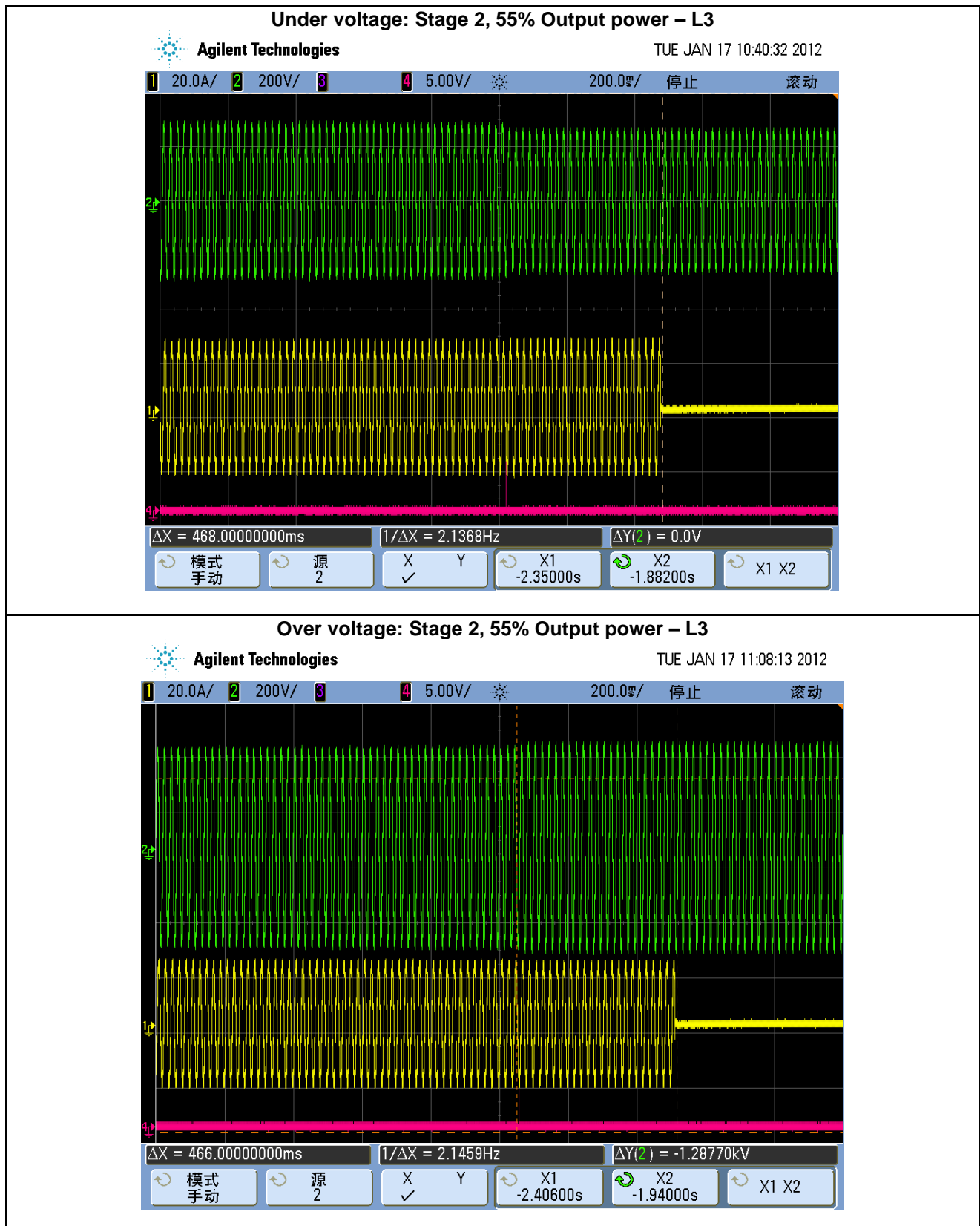
| | Under Voltage | | | | Over Voltage | | | |
|---|---------------|------------|--------|--------|--------------|------------|--------|--------|
| | L3 phase | | | | | | | |
| Parameter | Voltage | Time (sec) | | | Voltage | Time (sec) | | |
| Output power level | | 10% | 55% | 100% | | 10% | 55% | 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. | | | | | | | | |

Under voltage: Stage 1, 100% Output power – L1



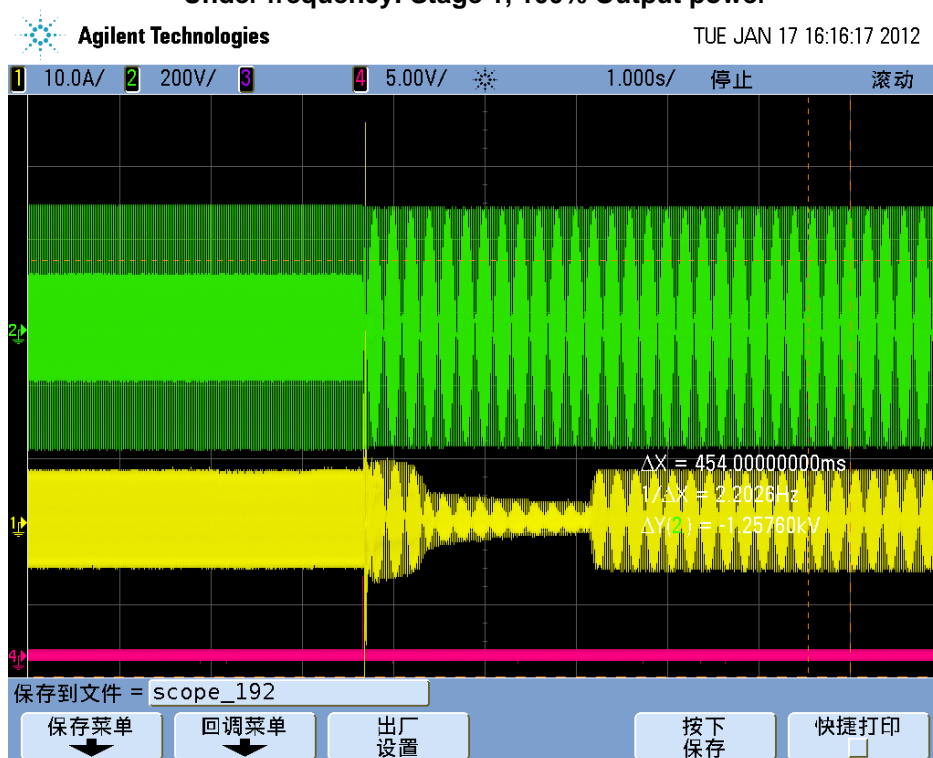
Over voltage: Stage 1, 10% Output power – L3



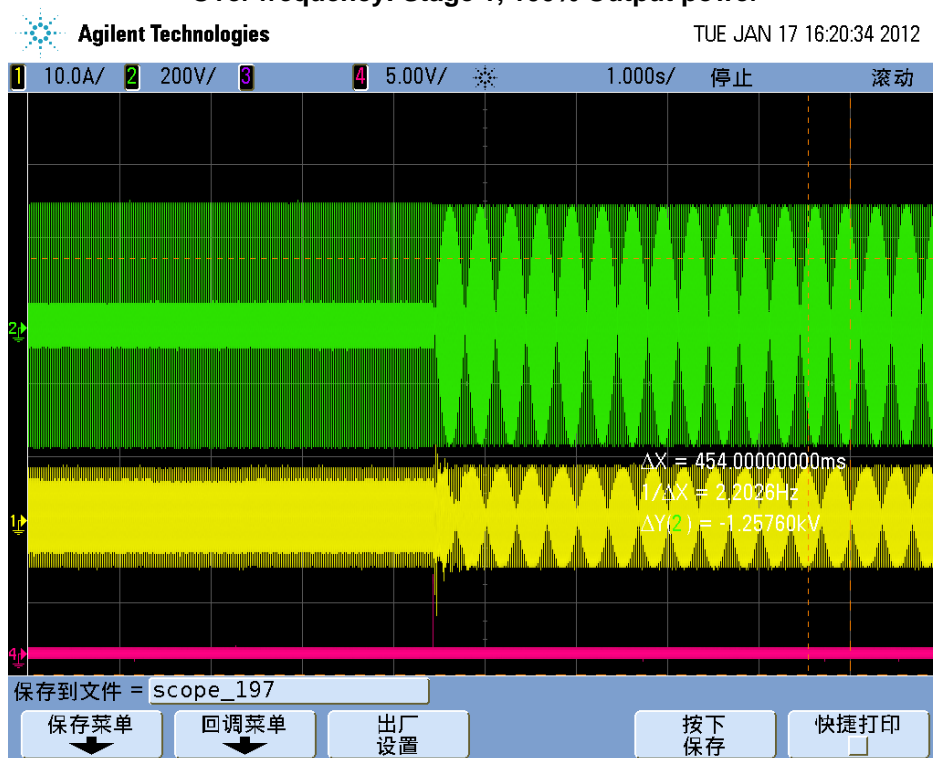


| 13.7.3.3 UNDER / OVER FREQUENCY TESTS | | | | | P |
|---|---|------------------|--------------------|------------------|---|
| | Under frequency | | | Over frequency | |
| | Load condition: 1) Full rating for an inverter of up to 5kW rating 2) No less than 10% of the rating for larger inverters up 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 ± 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 ± 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. | | | | | |

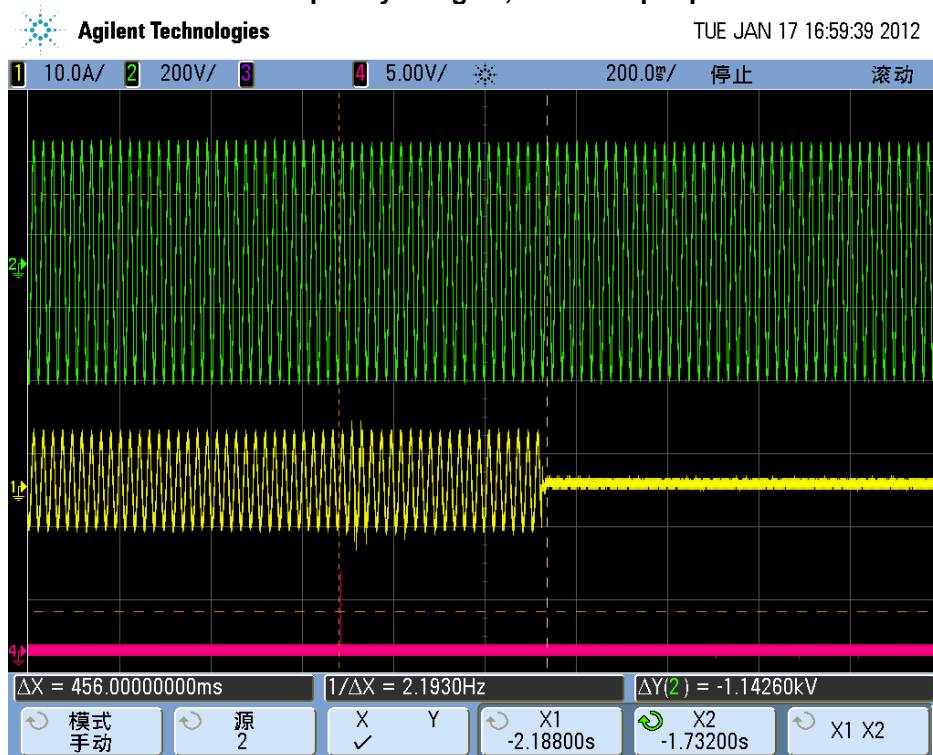
Under frequency: Stage 1, 100% Output power



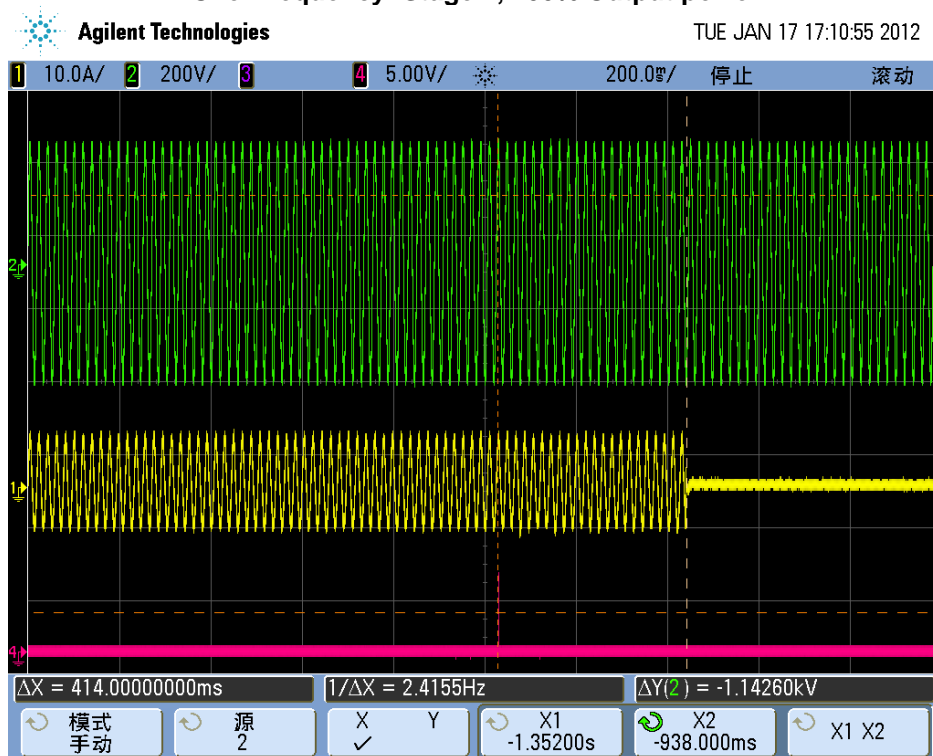
Over frequency: Stage 1, 100% Output power



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 |

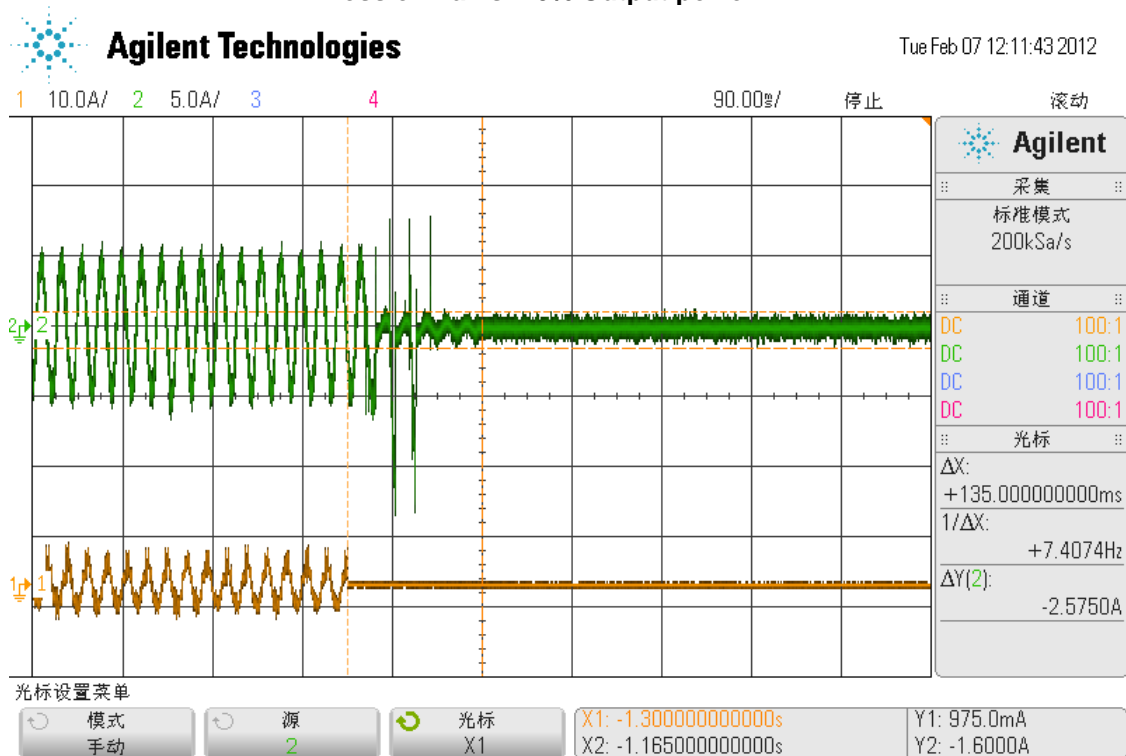
| | L3 phase | | |
|-------------------|-----------|------------|------------|
| Trip value (sec): | 0,338 | 0,231 | 0,524 |
| | 0,280 | 0,265 | 0,513 |
| | 0,279 | 0,289 | 0,510 |
| | 0,304 | 0,296 | 0,585 |
| | 0,319 | 0,299 | 0,495 |
| Parameter | L= 22,86H | L= 22,87mH | L= 22,87mH |
| | R=79.58Ω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

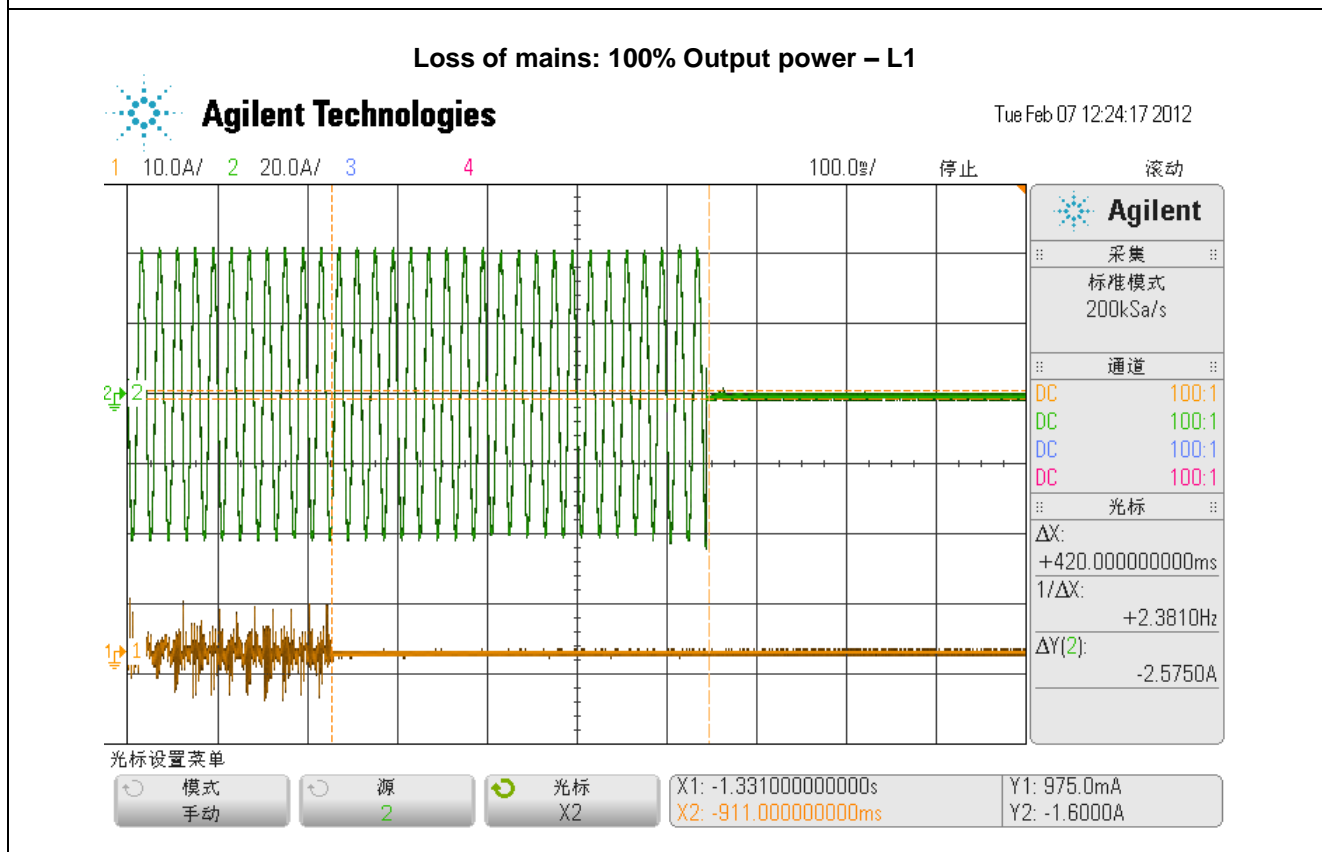
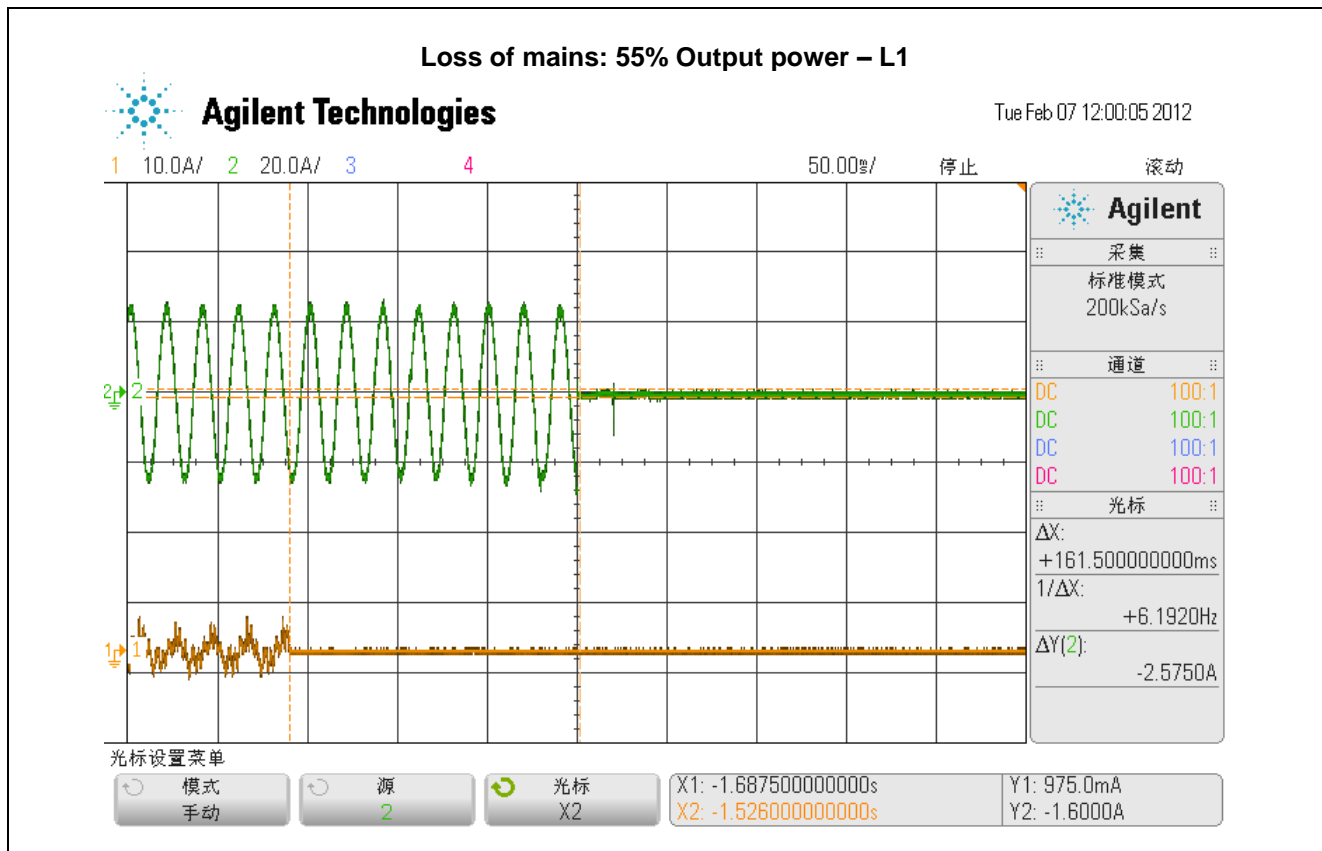
Note:

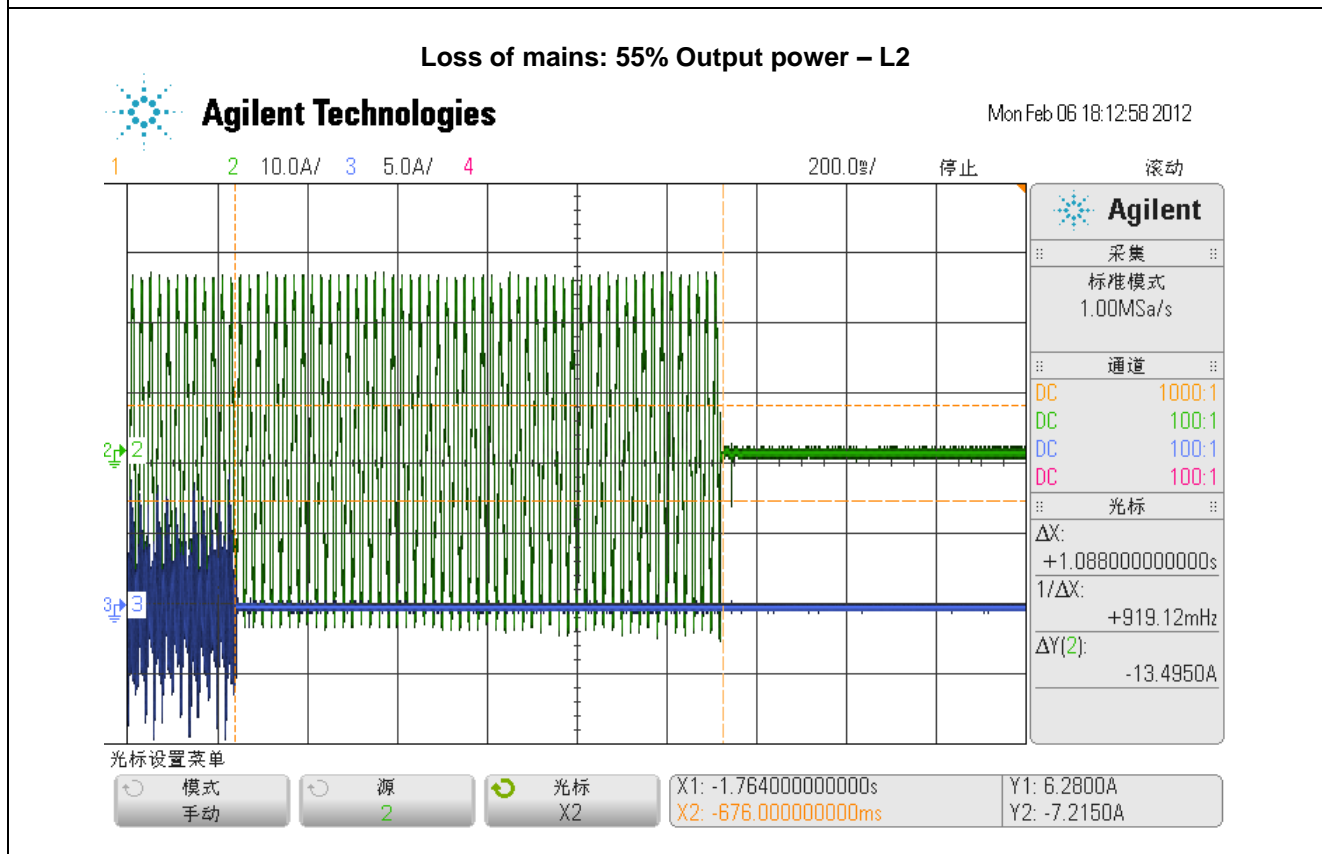
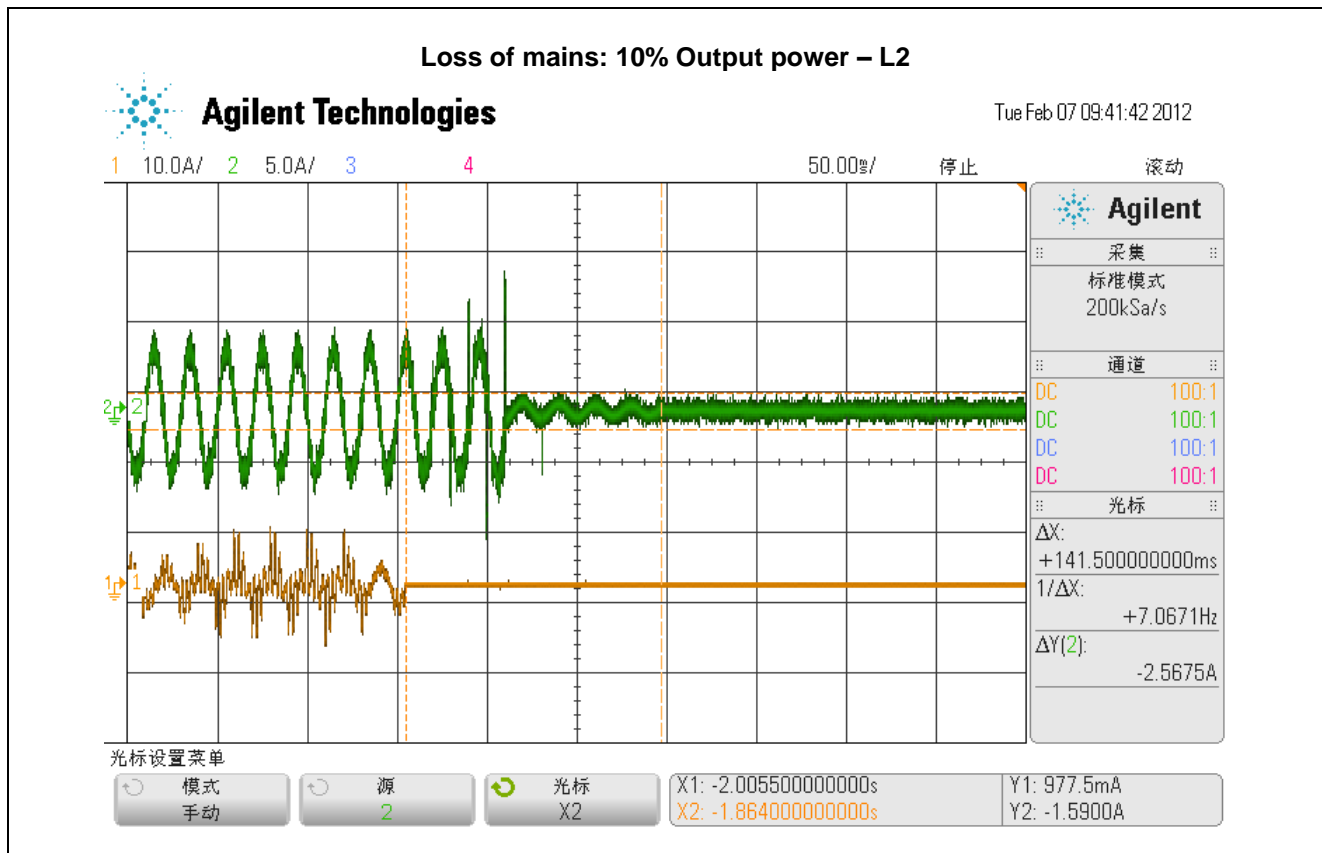
Inverter connected to a network combining a resonant circuit with a Q factor >2 (at 55% output power and the values of L and C are fixed for 10% and 100% tests) and a variable load; the value of the load is to match the inverter output to within +/-5%. A switch is placed between inverter/load and distribution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

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

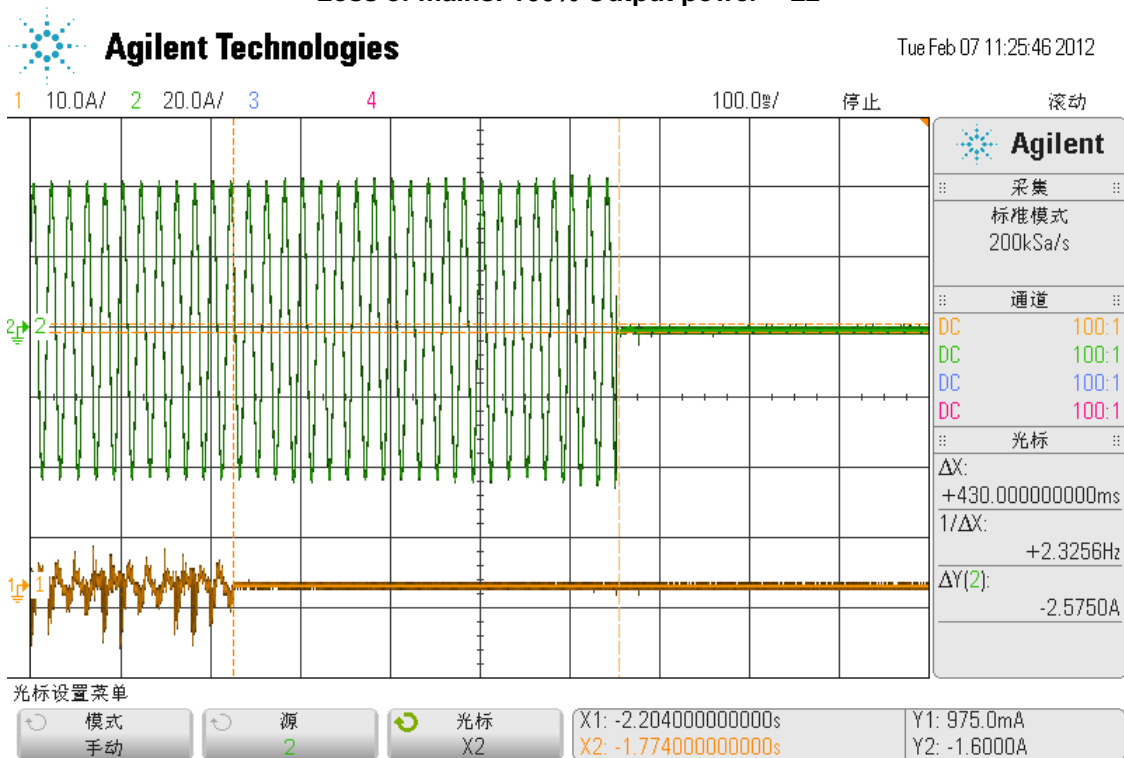
The tests had been performed on the model Growatt 20000UE is valid for Growatt 10000UE, Growatt 12000UE, Growatt 18000UE,, since they are identical in hardware and just power derated by software.

Loss of mains: 10% Output power – L1


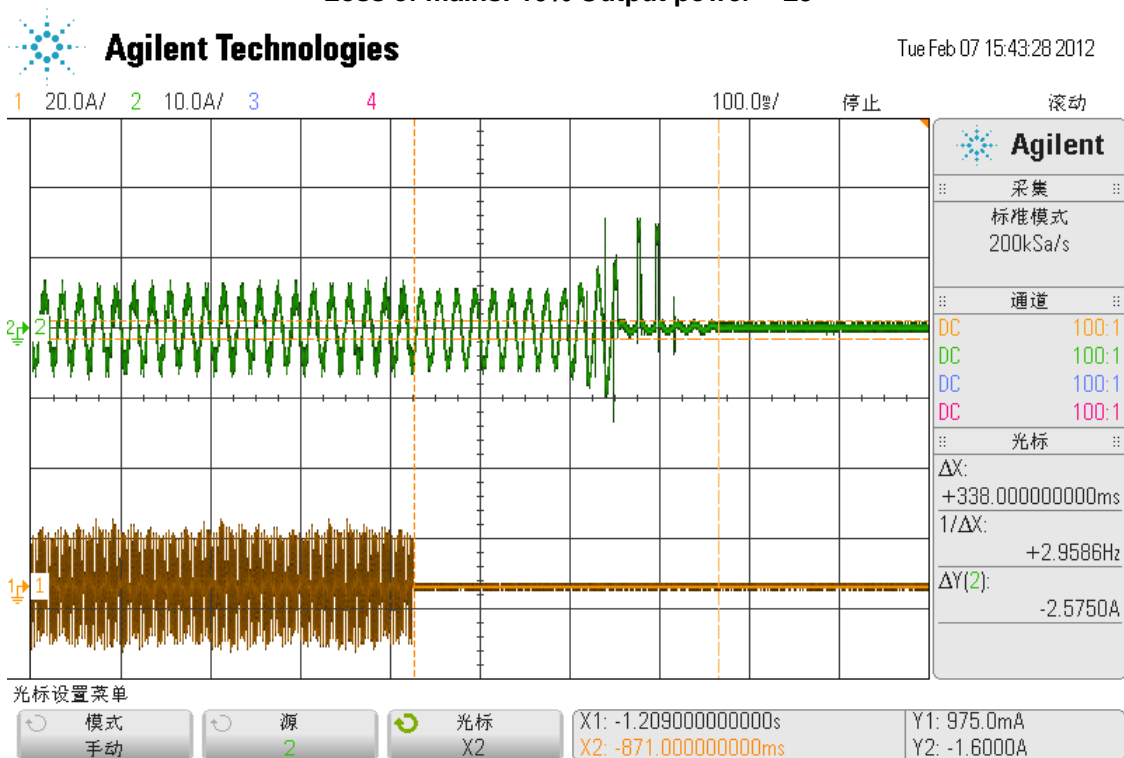




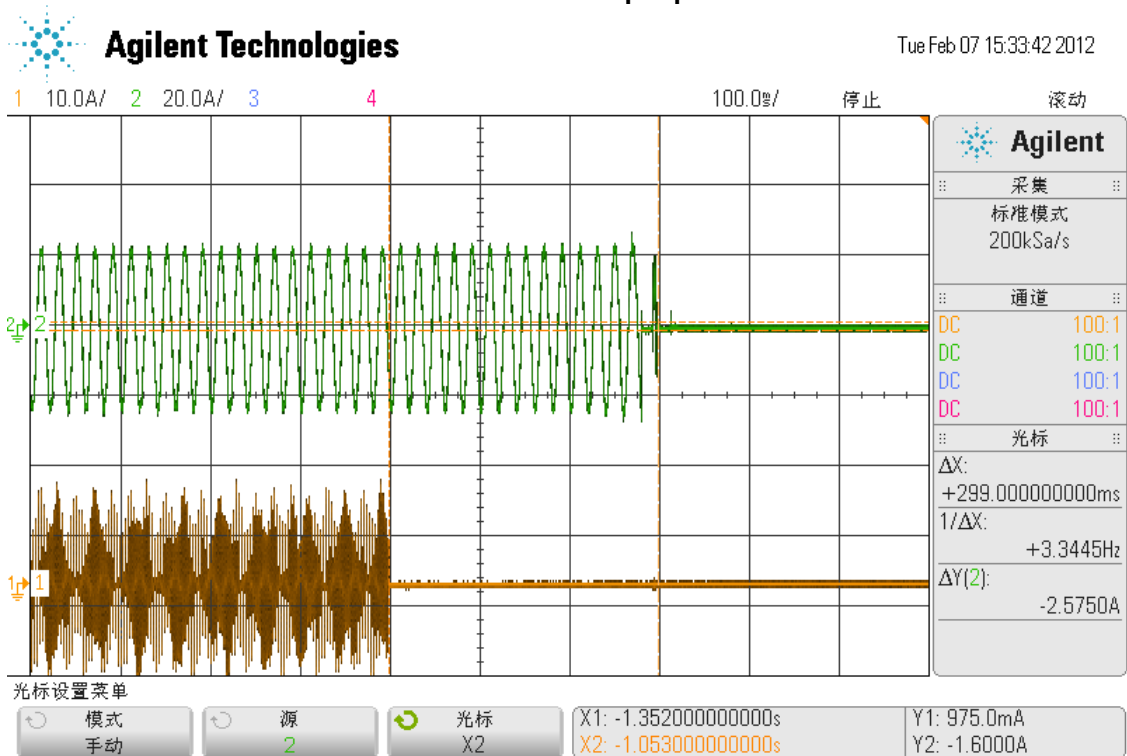
Loss of mains: 100% Output power – L2



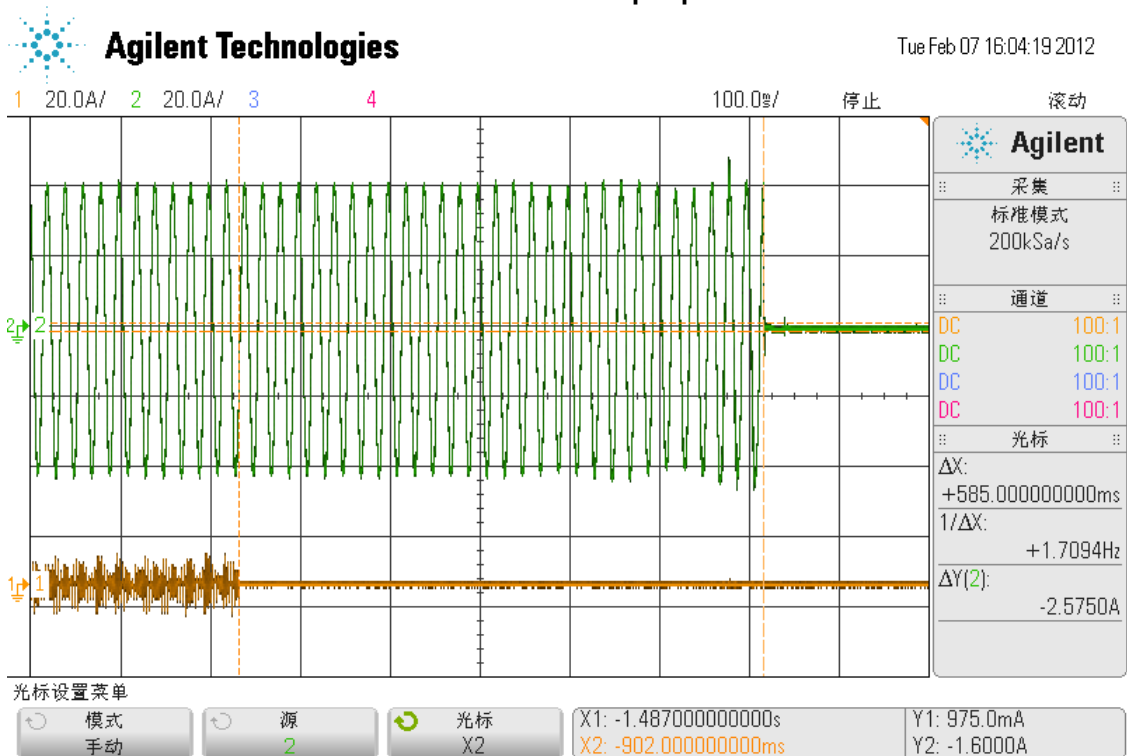
Loss of mains: 10% Output power – L3



Loss of mains: 55% Output power – L3



Loss of mains: 100% Output power – L3



| 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

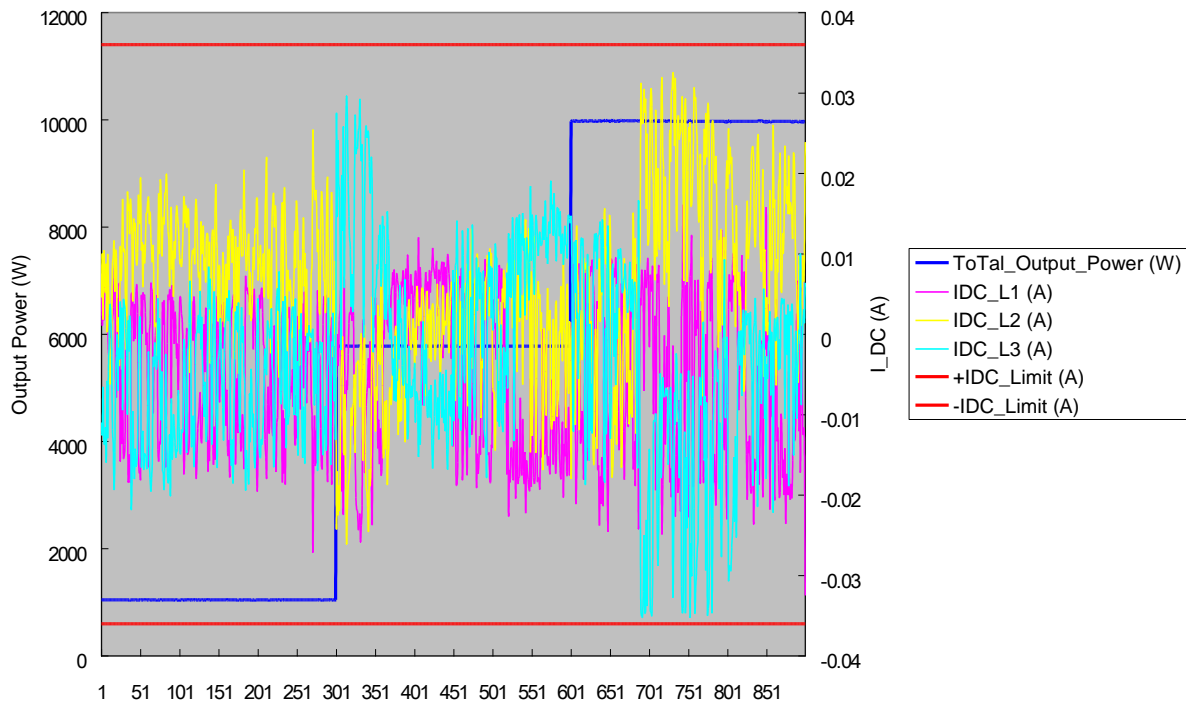
| 13.7.6.1 Harmonic Current Emissions | | | | | | | | | | | P | |
|--|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|
| Growatt 20000UE | | | | | | | | | | | | |
| | 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 | | | | | | | | | | | | |

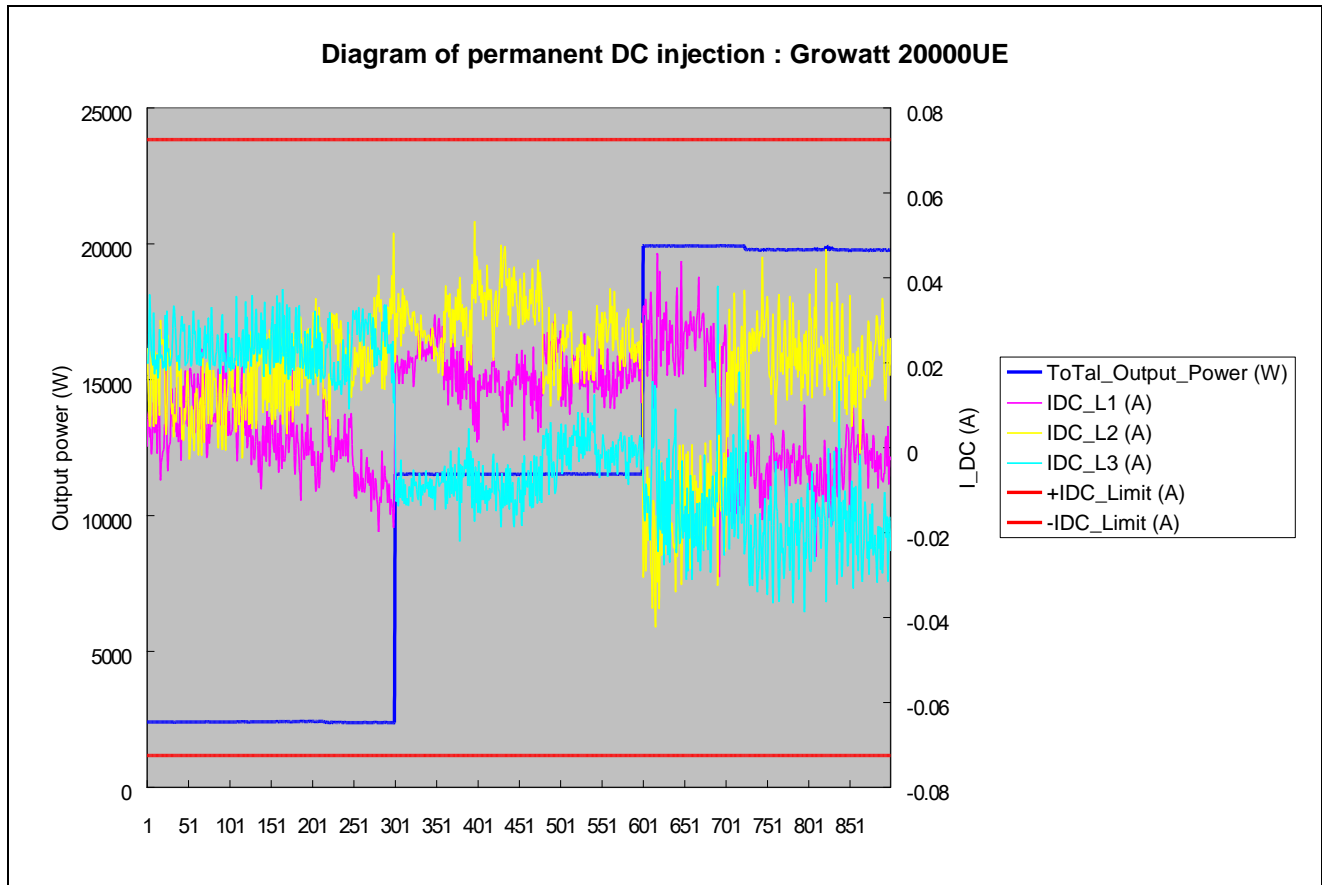
| 13.7.6.2 Power factor | | | | P |
|---|---------------------------|--------|------------------------------|---|
| G 59/2 Limit | +/- 0,95pf | | | |
| Output Voltage: | 212V (U _N -8%) | 230V | 248V (U _N +12.7%) | |
| Test Value Growatt 20000UE | 0,9990 | 0,9991 | 0,9991 | |
| Test Value Growatt 18000UE | 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. | | | |

Diagram of permanent DC injection : Growatt 10000UE





| | |
|---|----------|
| 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



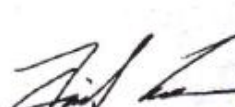
Certificate of Conformity


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)



SHENZHEN EMTEK CO., LTD. Report No.: ES110616035E-1

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. | | | |

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

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 | SCHWARZBECK 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 |

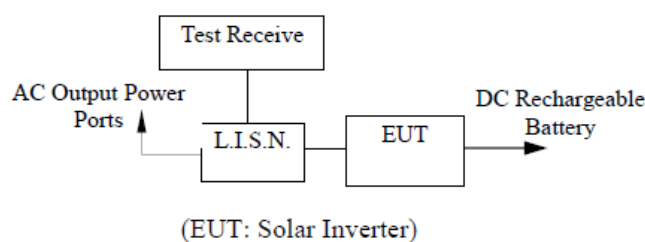
SHENZHEN EMTEK CO., LTD. Report No.: ES110616085E-1

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 (dBμV) | |
|--------------------|------------------|---------------|
| | 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.

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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.

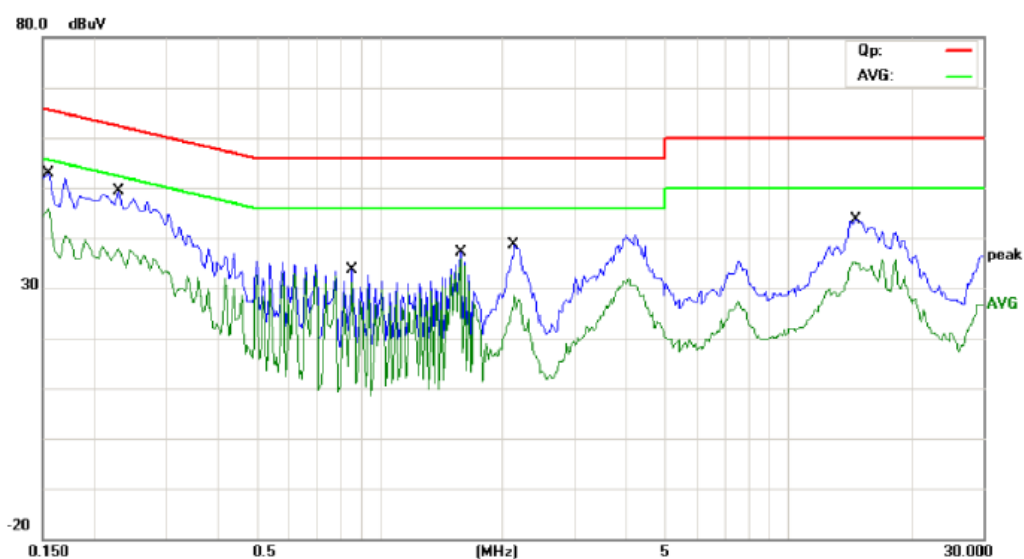
All the scanning waveform is put in Appendix I.

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

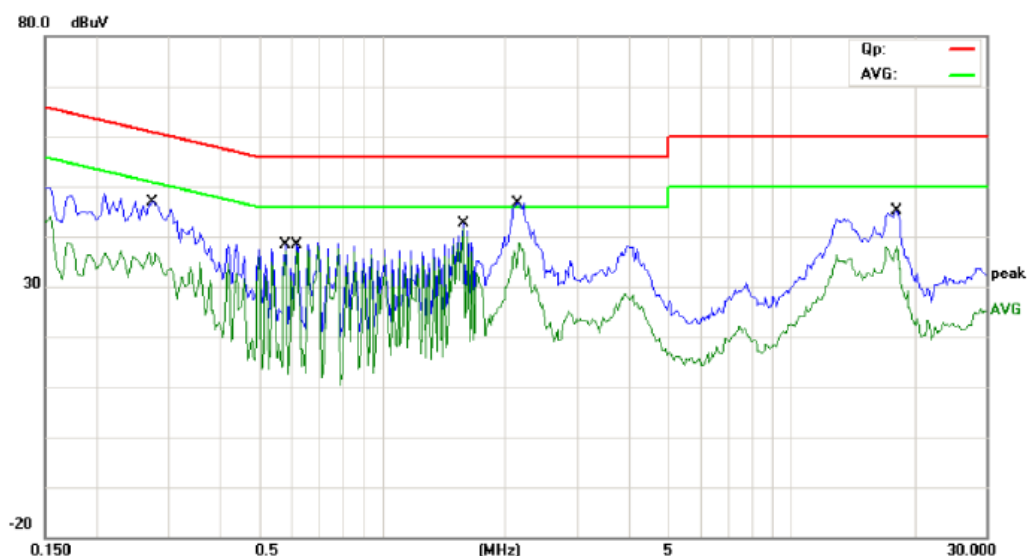
Mode: FULL LOAD

Note:

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measurement | Limit | Over | | |
|-----|-----|---------|---------------|----------------|-------------|-------|--------|----------|---------|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector | Comment |
| 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

Phase: L2

Temperature: 26

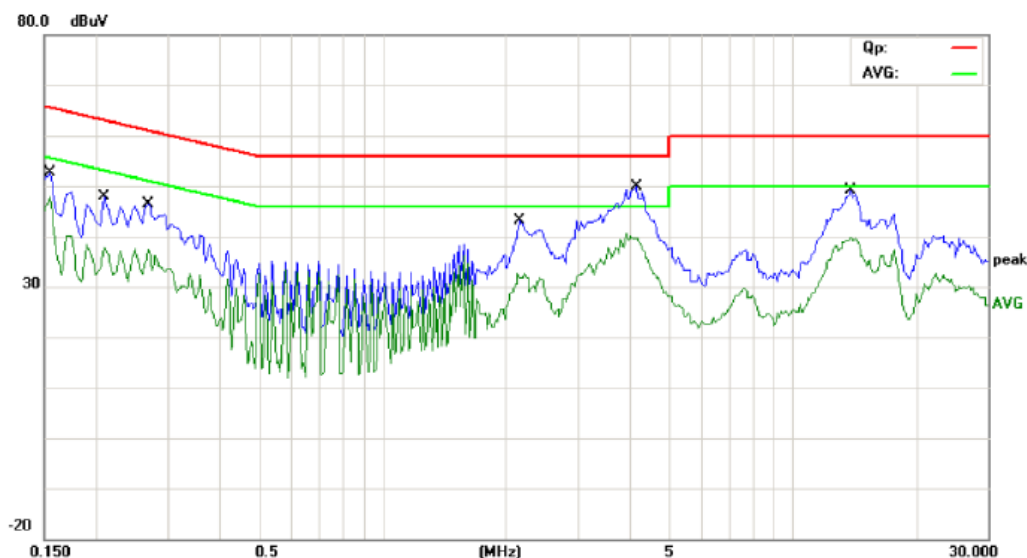
Mode: FULL LOAD

Note:

| No. Mk. | Freq. MHz | Reading Level dBuV | Correct Factor dB | Measure- ment dBuV | Limit dBuV | Over dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|---------|
| 1 | 0.2750 | 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

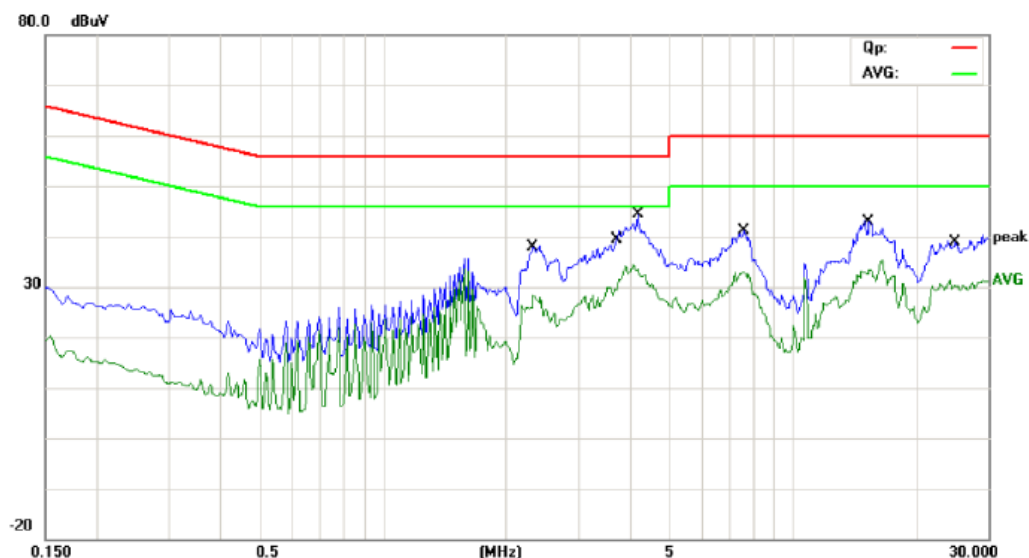
Mode: FULL LOAD

Note:

| No. Mk. | Freq. | Reading Level | Correct Factor | Measurement | Limit | Over | | |
|---------|---------|---------------|----------------|-------------|-------|--------|----------|---------|
| | MHz | dBuV | dB | dBuV | dBuV | 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:

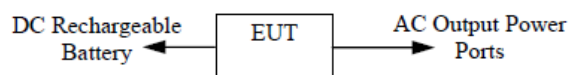
| No. | Mk. | Freq. MHz | Reading Level dBuV | Correct Factor dB | Measure- ment dBuV | Limit dBuV | Over dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|---------|
| 1 | | 2.2968 | 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 | 32.69 | 0.00 | 32.69 | 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

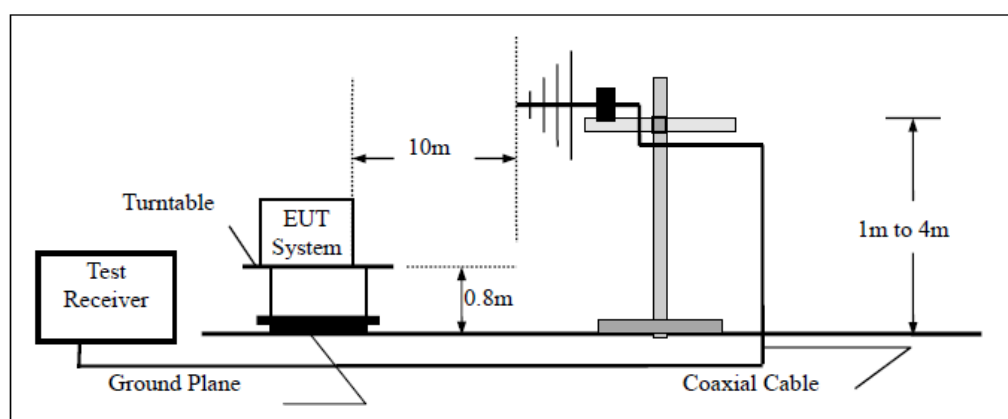
5.1. Block Diagram of Test Setup

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.

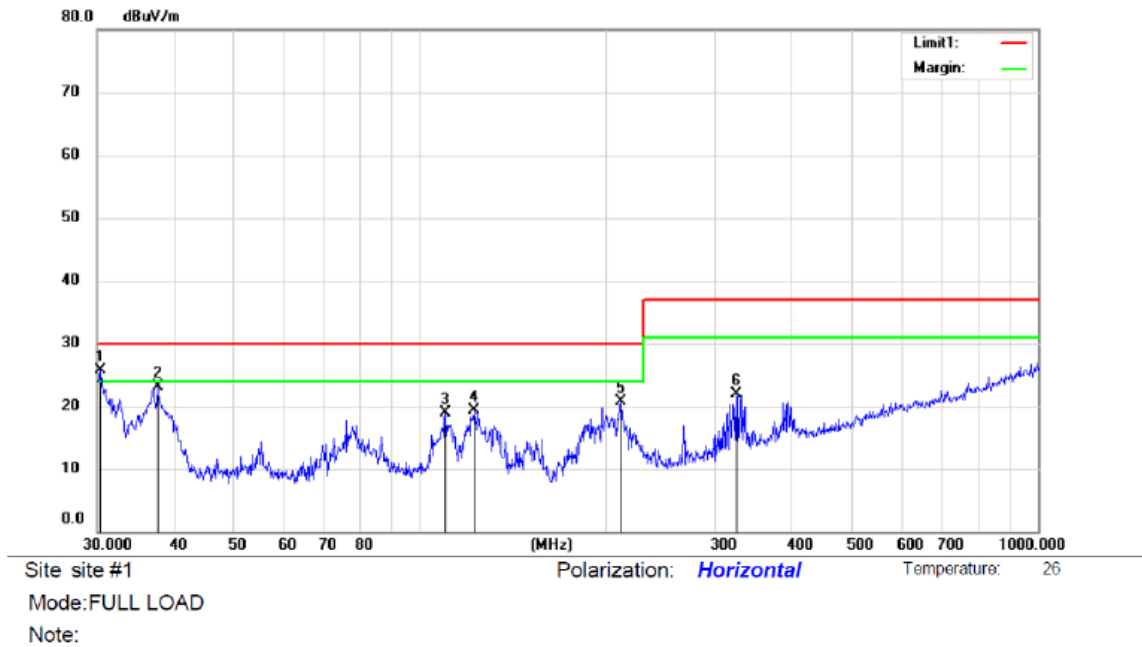
5.7.Measuring Results

PASS.

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

Please see the attached pages.

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

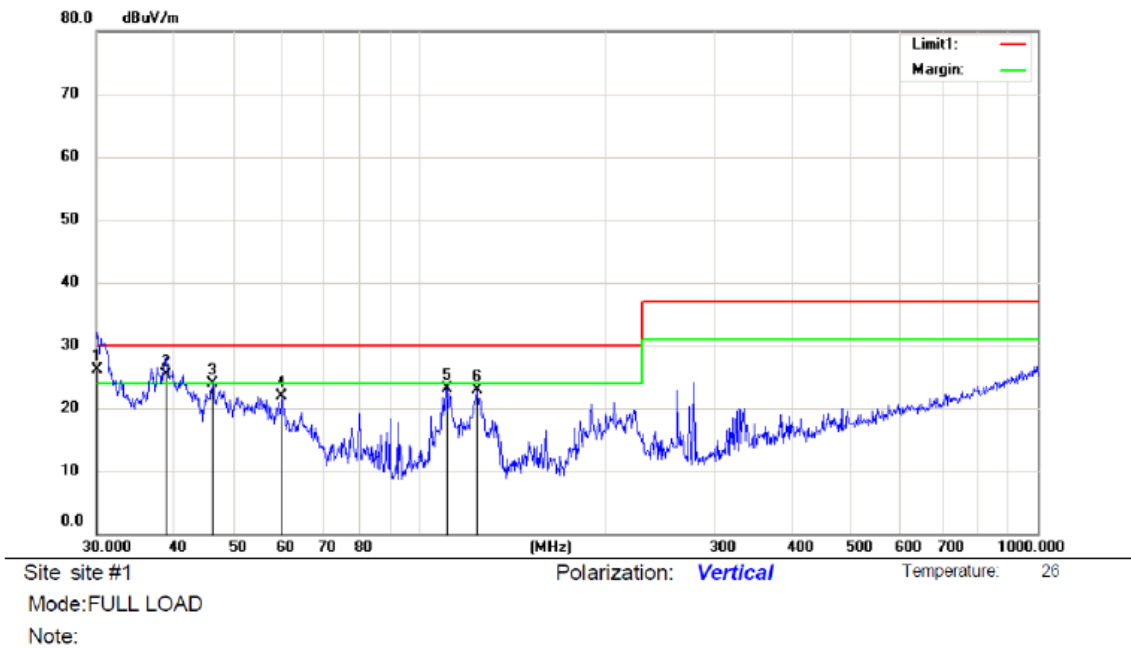


| No. | Mk. | Freq. | Reading Level | Correct Factor | Measurement | Limit | Over | Antenna Height | Table Degree | |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------------|--------------|--------|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | cm | degree |
| 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 | Measure-ment | 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 | | |

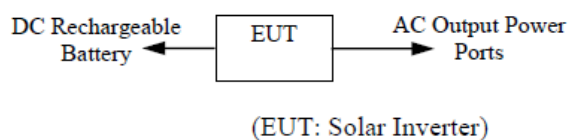
*:Maximum data x:Over limit !:over margin

Operator: Ricky

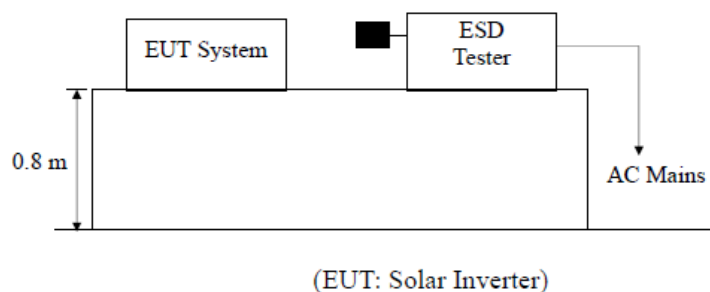
6. ELECTROSTATIC DISCHARGE IMMUNITY TEST

6.1. Block Diagram of Test Setup

6.1.1. Block diagram of EUT System



6.1.2. Block diagram of ESD test setup



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.

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

Electrostatic Discharge Test Results

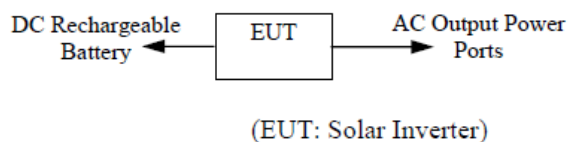
SHENZHEN EMTEK CO., LTD.

| 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 | : $\pm 8.0\text{kV}$ | Test Mode : Full Load |
| Contact discharge: | $\pm 4.0\text{kV}$ | 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: | | |

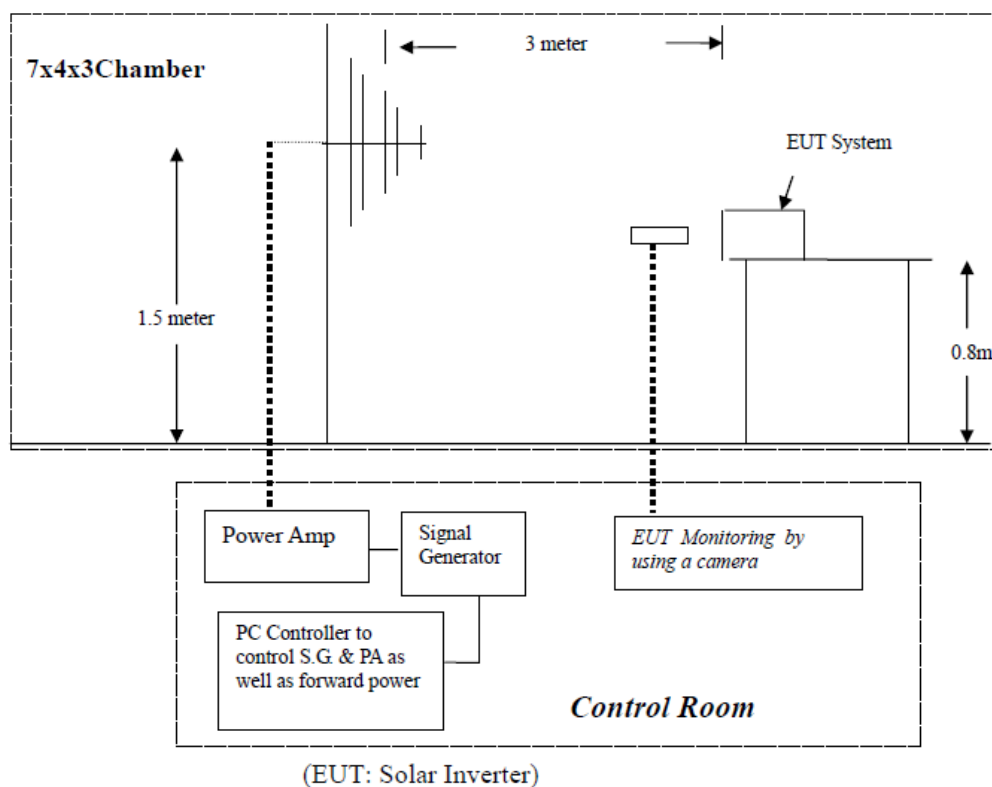
7. RF FIELD STRENGTH SUSCEPTIBILITY TEST

7.1. Block Diagram of Test Setup

7.1.1. Block diagram of EUT System



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.

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

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: | | | | |

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

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 | | |
| 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: | | | | |

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

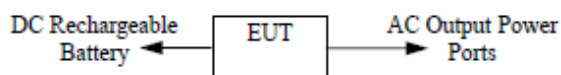
RF Field Strength Susceptibility Test Results

| | | | | |
|--|------------|-------------------------------------|------------|-----------------------|
| 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

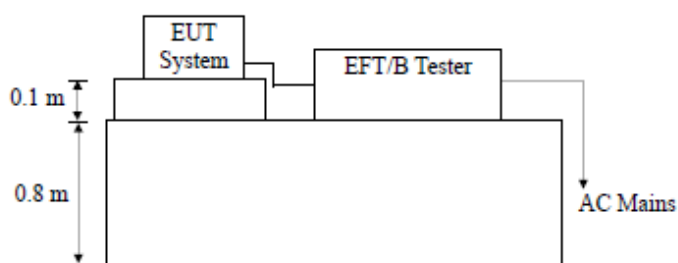
8.1. Block Diagram of Test Setup

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

| Open Circuit Output Test Voltage $\pm 10\%$ | | |
|---|-----------------------|---|
| Level | 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

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

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

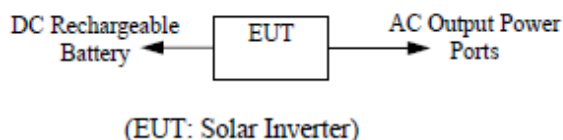
SHENZHEN EMTEK CO., LTD.

| | | | |
|--|--------------|--|-----------|
| 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: | | | |

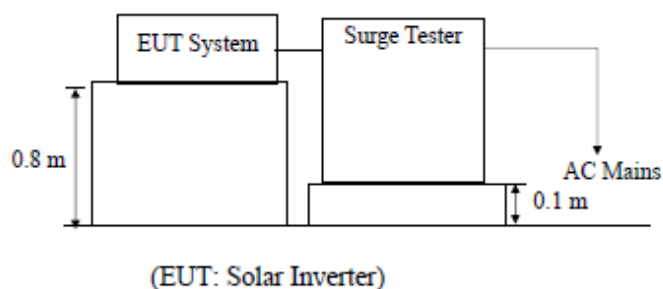
9. SURGE IMMUNITY TEST

9.1. Block Diagram of Test Setup

9.1.1. Block Diagram of EUT System



9.1.2. Surge Test Setup



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.

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

Surge Immunity Test Results

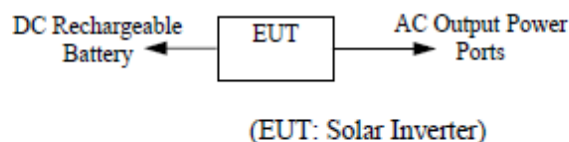
SHENZHEN EMTEK CO., LTD.

| 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: | | | | | |

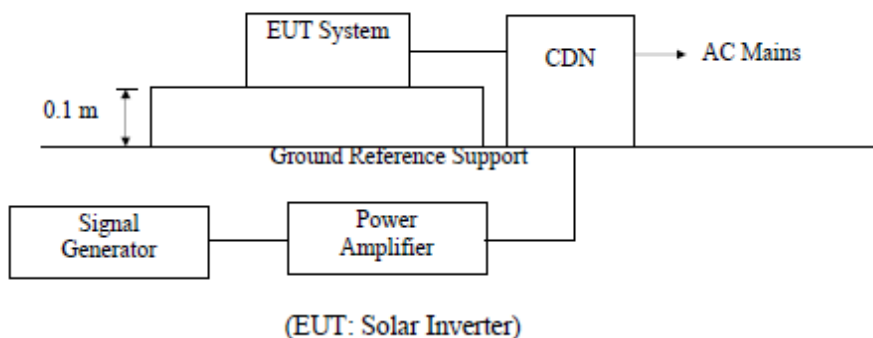
10. INJECTED CURRENTS SUSCEPTIBILITY TEST

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 1.5×10^{-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.

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

Injected Currents Susceptibility Test Results

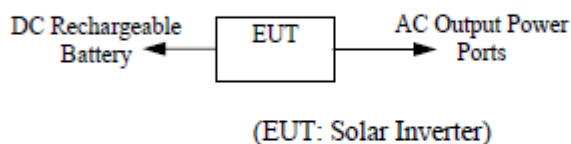
SHENZHEN EMTEK CO., LTD.

| 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: | | |

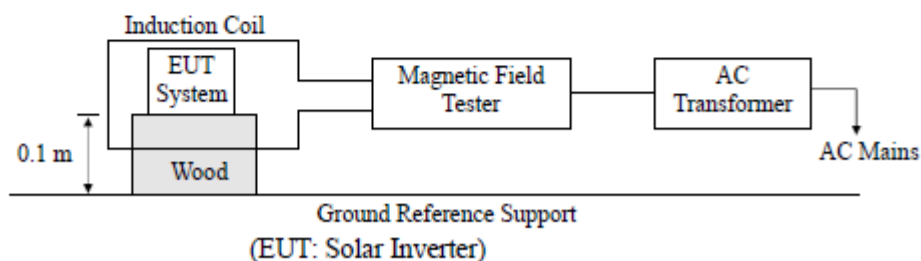
11. MAGNETIC FIELD SUSCEPTIBILITY TEST

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

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

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.

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

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: | | | | |



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www.emtek.com.cn Tel:+86-755-2695 4280 Fax:+86-755-2695 4282

EMTEK
Access to the World

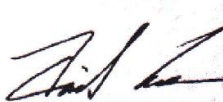

Certificate of Conformity

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


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

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APPENDIX I (Photos of EUT) (2 Pages)

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

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

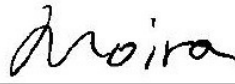

EN 61000-6-2:2005

(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, 2011Prepared 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 |

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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 | 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 |

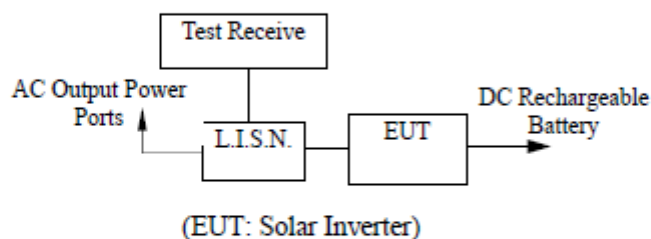
SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E

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 (dBμV) | |
|--------------------|------------------|---------------|
| | 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.

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

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

Power: AC 380V/50Hz

Temperature: 22

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

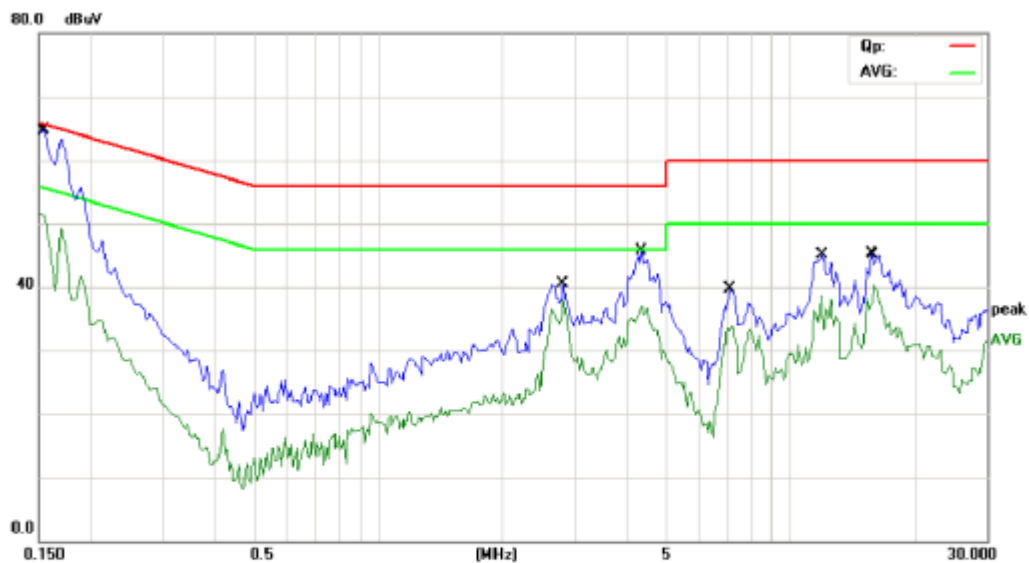
Temperature: 22

Humidity: 50 %

| No. | Mk. | Freq. | Reading | Correct | Measure- | Limit | Over | | |
|-----|-----|---------|---------|---------|----------|-------|--------|----------|---------|
| | | MHz | Level | Factor | ment | | | Detector | Comment |
| | | | 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 %

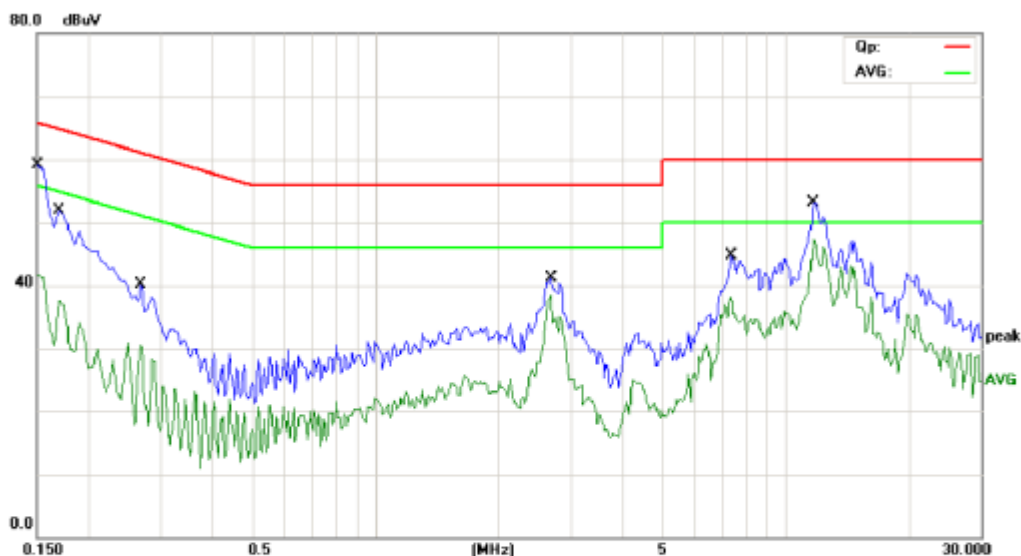
Mode: FULL LOAD

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

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Site Conduction #2

Limit: (CE)EN61000-6-3_QP

Mode: FULL LOAD

Note:

Phase: N

Power: AC 380V/50Hz

Temperature: 22

Humidity: 50 %

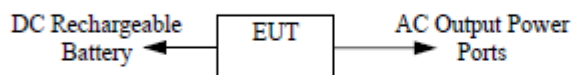
| No. | Mk. | Freq. | Reading Level | Correct Factor | Measurement | Limit | Over | | |
|-----|-----|---------|---------------|----------------|-------------|-------|--------|----------|---------|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector | Comment |
| 1 | | 0.1500 | 59.08 | 0.00 | 59.08 | 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

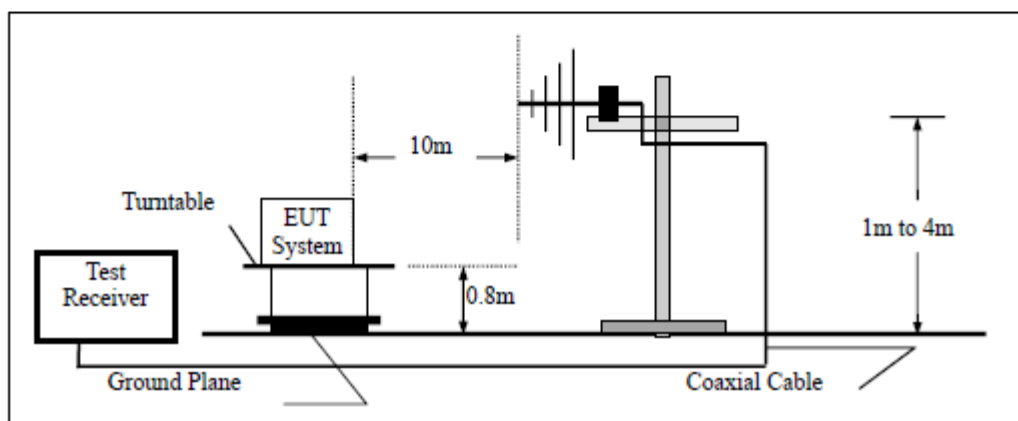
5.1. Block Diagram of Test Setup

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 (dBμV/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 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.

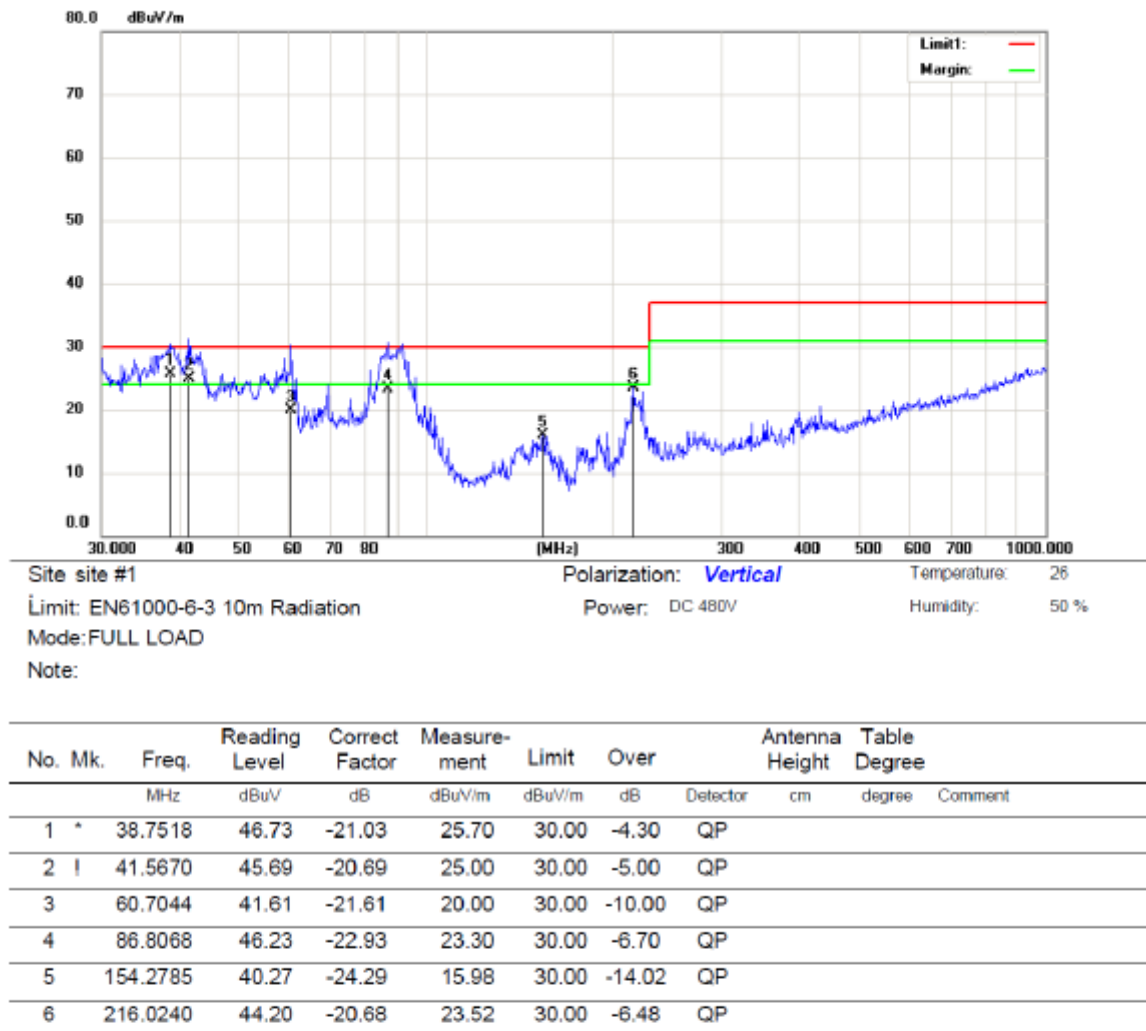
5.7.Measuring Results

PASS.

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

Please see the attached pages.

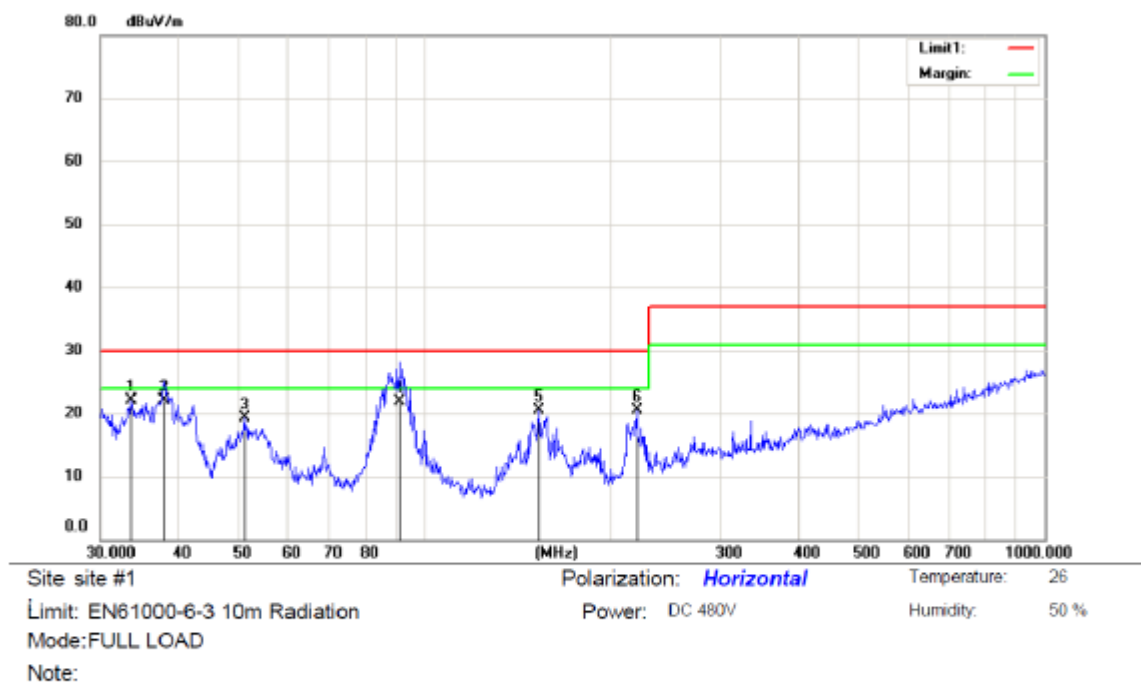
SHENZHEN EMTEK CO., LTD. Report No.: ES110921099E



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

Operator: Ricky

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



| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | Antenna Height | Table Degree |
|-----|-----|----------|---------------|----------------|--------------|--------|--------|----------------|--------------|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | cm | degree |
| 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 | |

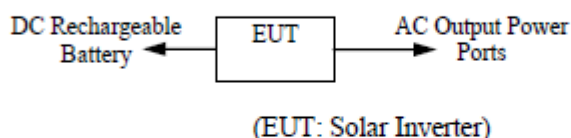
*:Maximum data x:Over limit l:over margin

Operator: Ricky

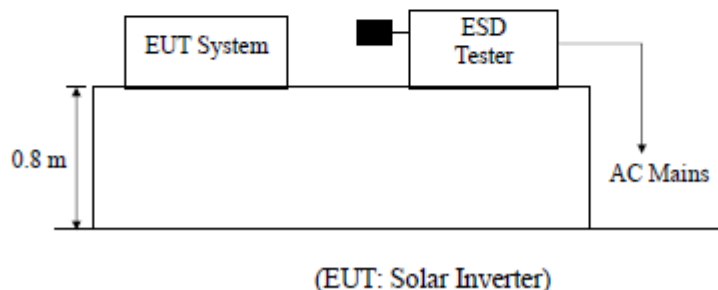
6. ELECTROSTATIC DISCHARGE IMMUNITY TEST

6.1. Block Diagram of Test Setup

6.1.1. Block diagram of EUT System



6.1.2. Block diagram of ESD test setup



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.

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

Electrostatic Discharge Test Results

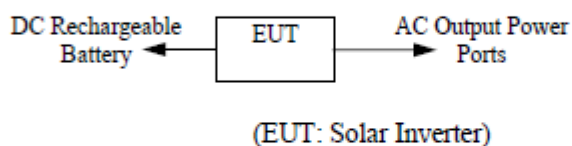
SHENZHEN EMTEK CO., LTD.

| 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 | : $\pm 8.0\text{kV}$ | Test Mode : Full Load |
| Contact discharge | : $\pm 4.0\text{kV}$ | 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: | | |

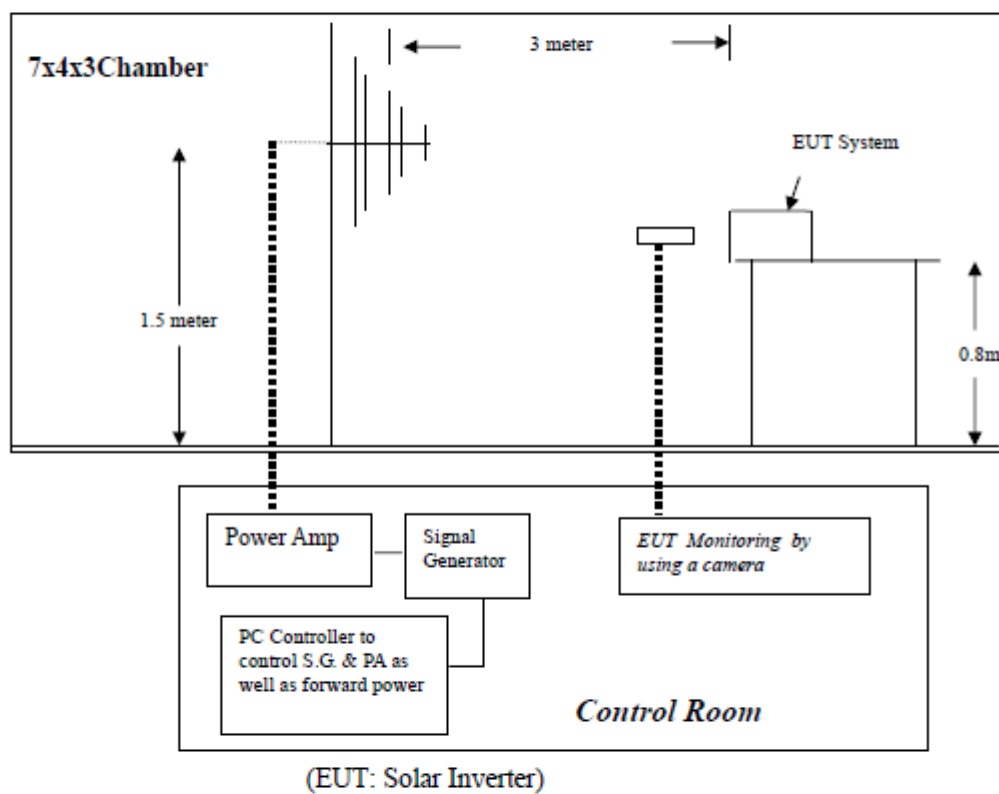
7. RF FIELD STRENGTH SUSCEPTIBILITY TEST

7.1. Block Diagram of Test Setup

7.1.1. Block diagram of EUT System



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.

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

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: | | | | |

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

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 | | |
| 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: | | | | |

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

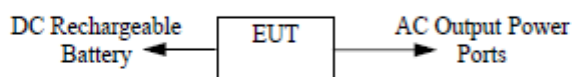
RF Field Strength Susceptibility Test Results

| | | | | |
|--|------------|-------------------------------------|------------|-----------------------|
| 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

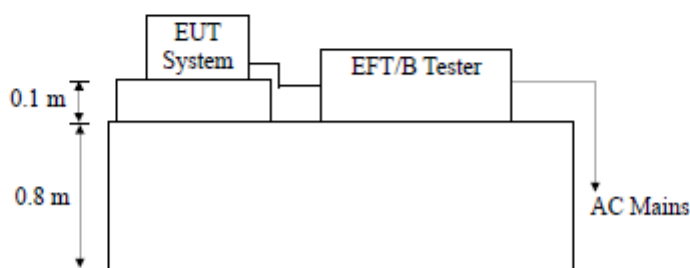
8.1. Block Diagram of Test Setup

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.

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

Electrical Fast Transient/Burst Test Results

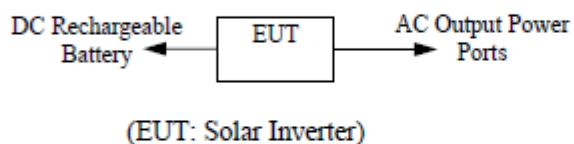
SHENZHEN EMTEK CO., LTD.

| | | | |
|--|--------------|--|-----------|
| 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: | | | |

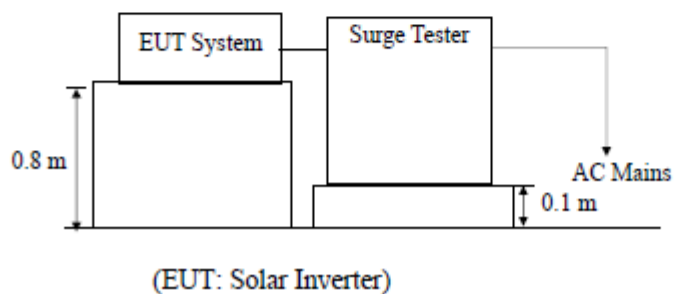
9. SURGE IMMUNITY TEST

9.1. Block Diagram of Test Setup

9.1.1. Block Diagram of EUT System



9.1.2. Surge Test Setup



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.

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

Surge Immunity Test Results

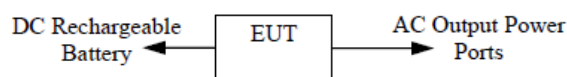
SHENZHEN EMTEK CO., LTD.

| 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. INJECTED CURRENTS SUSCEPTIBILITY TEST

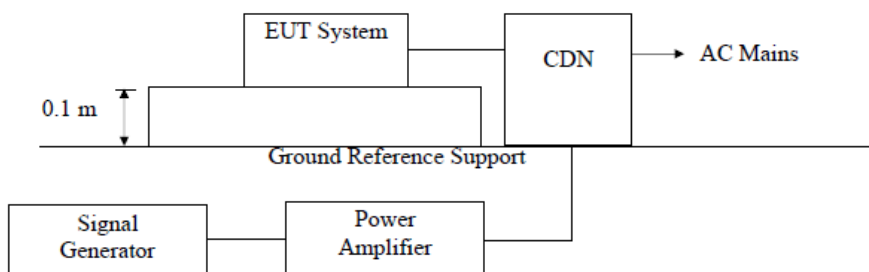
10.1. Block Diagram of Test Setup

10.1.1. Block Diagram of EUT System



(EUT: Solar Inverter)

10.1.2. Block Diagram of Test Setup



(EUT: Solar Inverter)

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 1.5×10^{-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.

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

Injected Currents Susceptibility Test Results

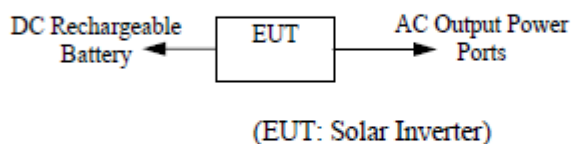
SHENZHEN EMTEK CO., LTD.

| 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: | | |

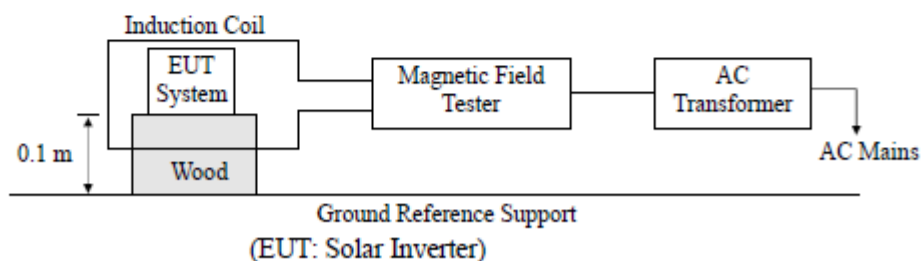
11. MAGNETIC FIELD SUSCEPTIBILITY TEST

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

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

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.

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

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

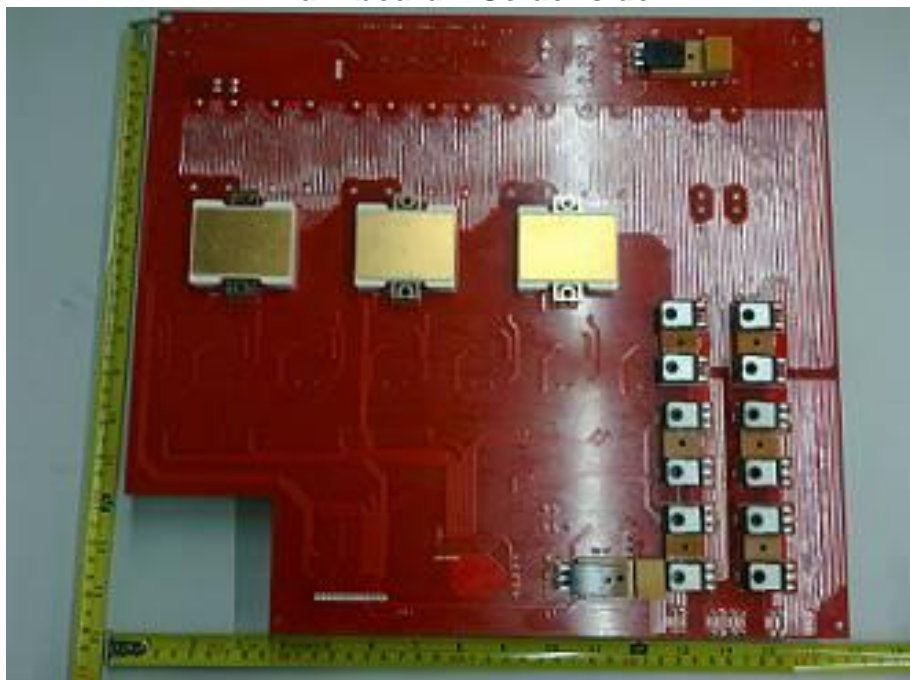


Model: Growatt 20000UE, Growatt 18000UE

Main board – Component side



Main board – Solder side

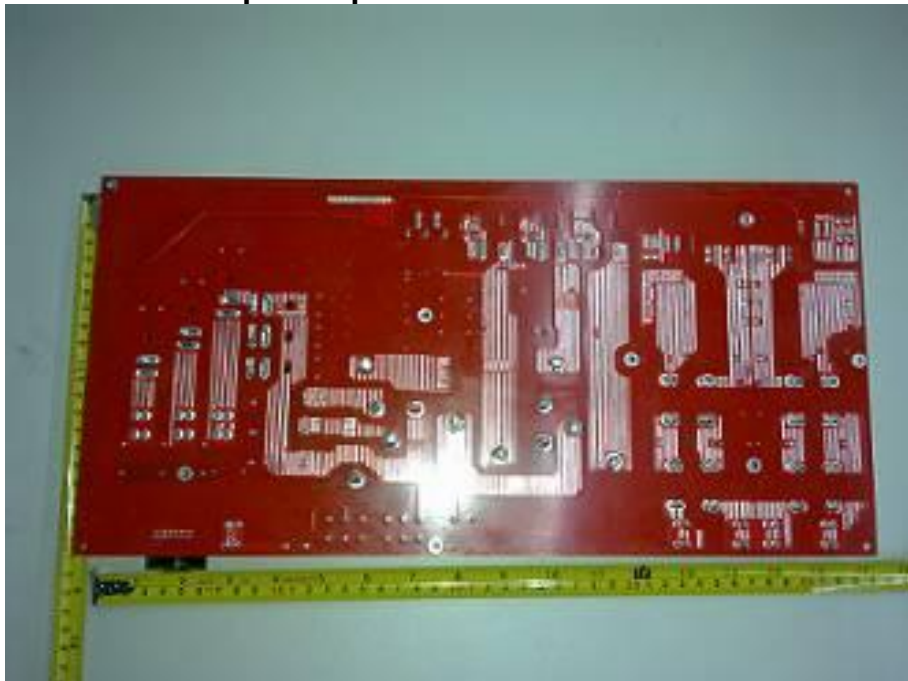


Model: Growatt 20000UE, Growatt 18000UE

Input/output board – Component side



Input/output board – Solder side

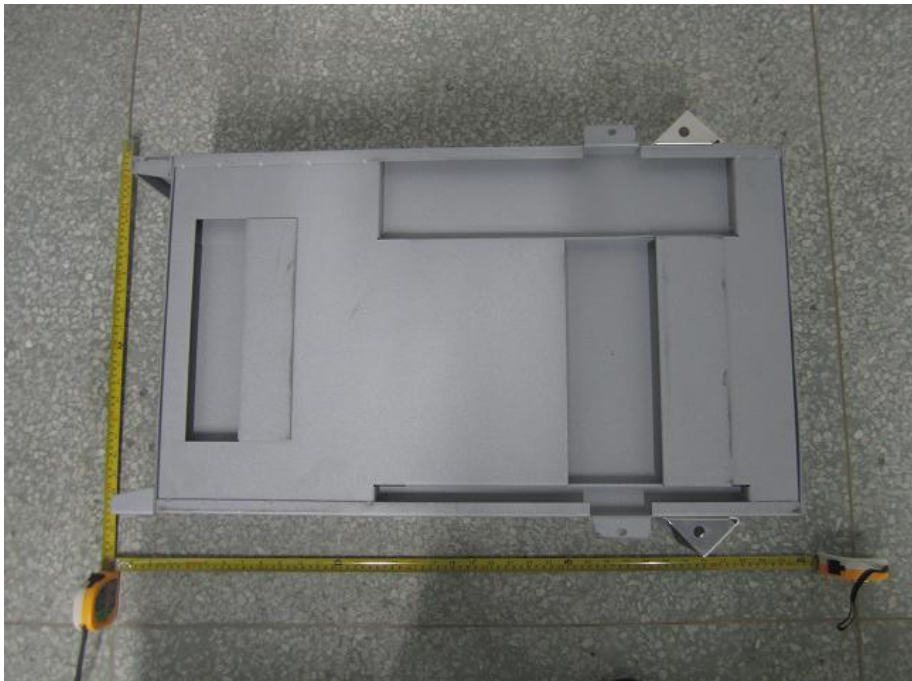


Model: Growatt 12000UE, Growatt 10000UE

Enclosure – Front

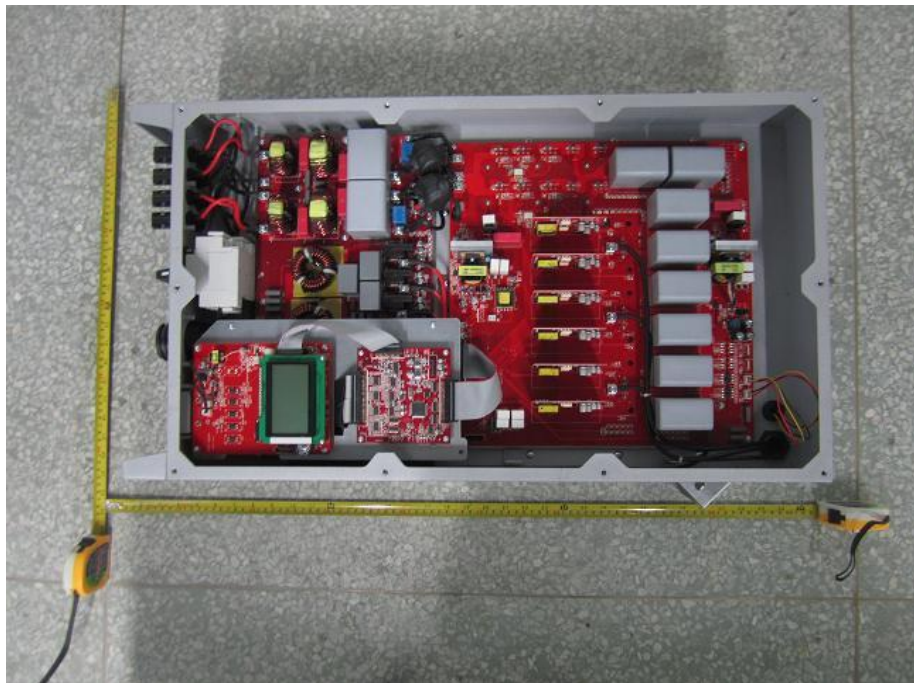


Enclosure – Rear

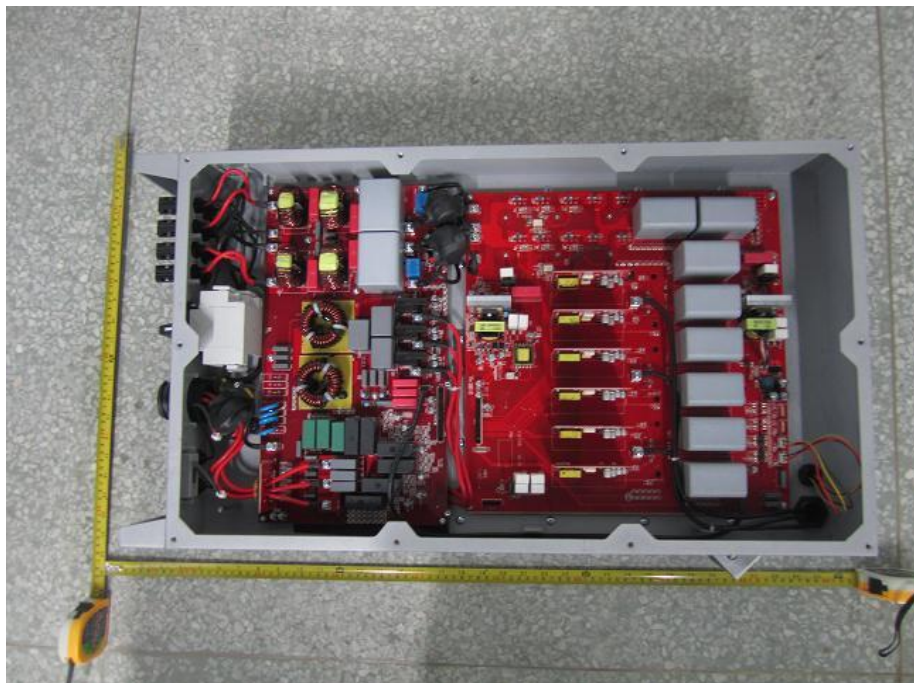


Model: Growatt 12000UE, Growatt 10000UE

Interior view – 1



Interior view – 2

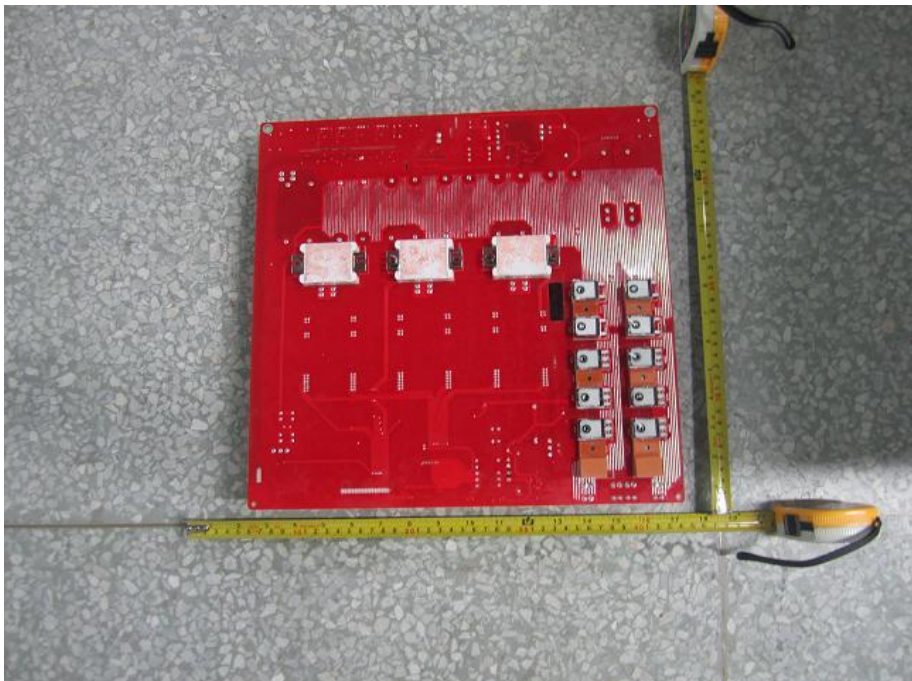


Model: Growatt 12000UE, Growatt 10000UE

Main board – Component side

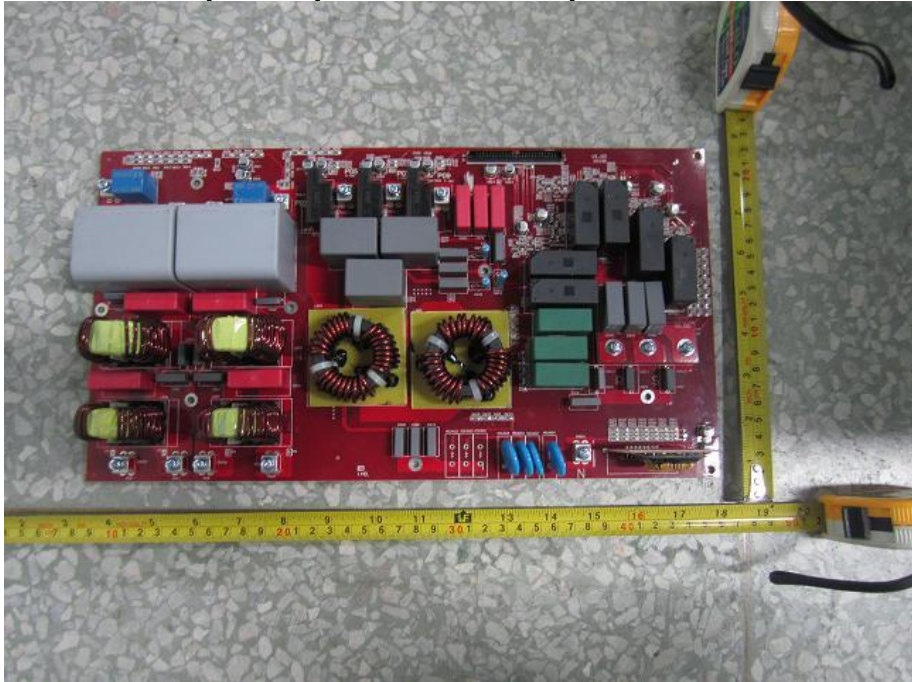


Main board – Solder side

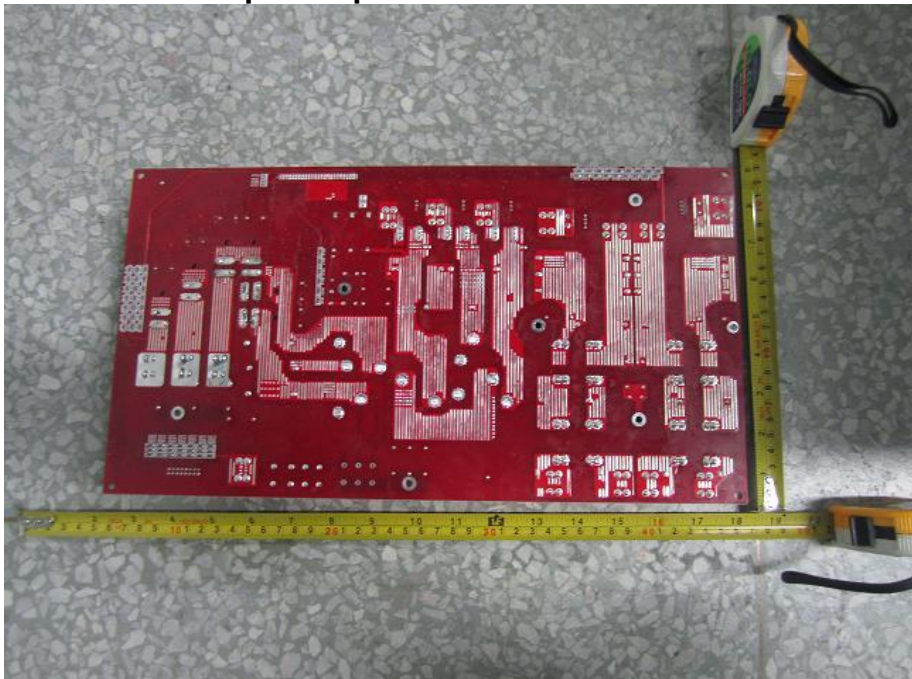


Model: Growatt 12000UE, Growatt 10000UE

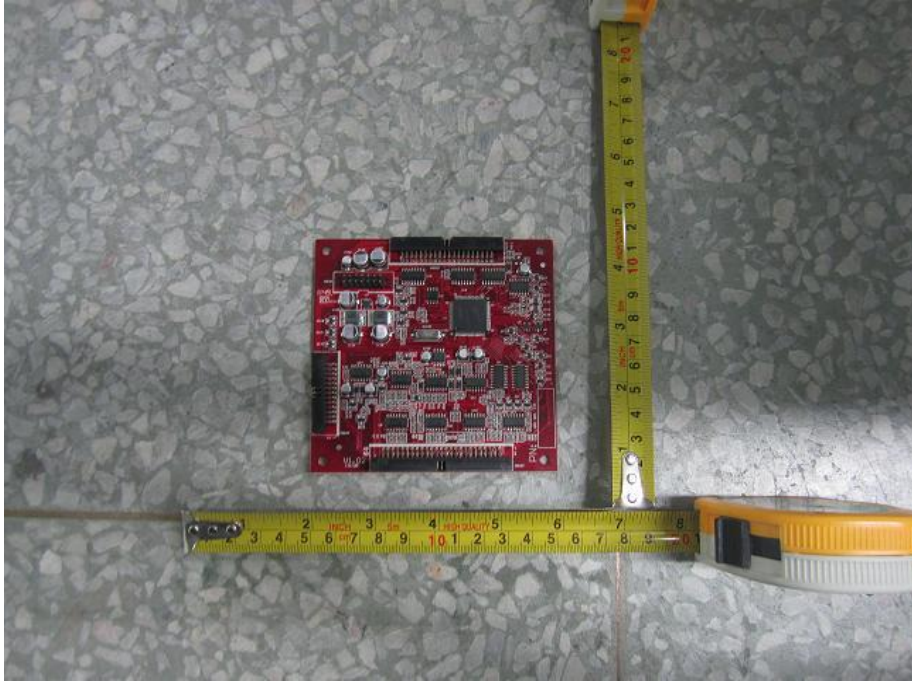
Input/output board – Component side



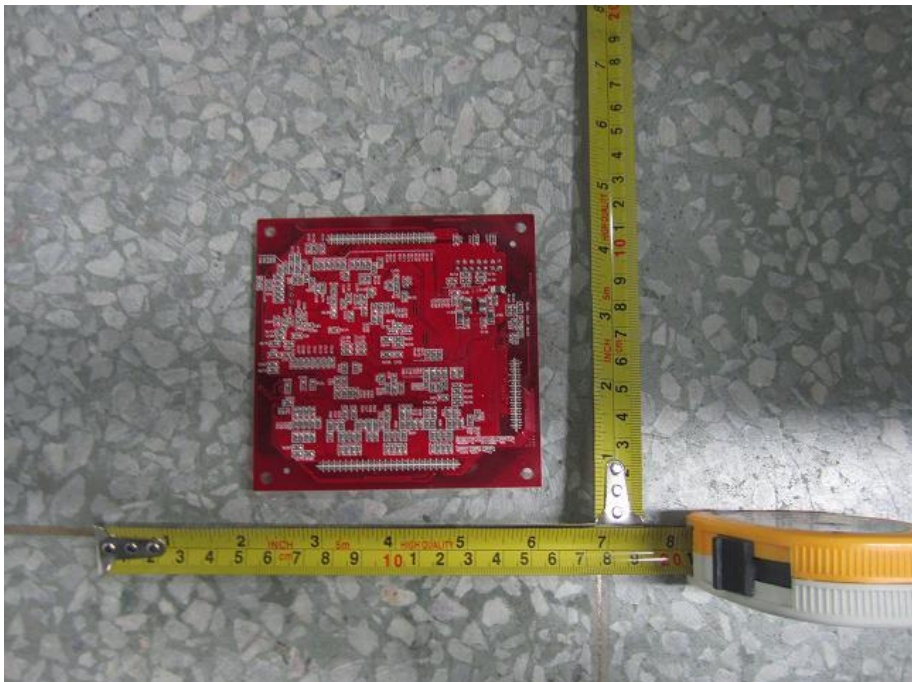
Input/output board – Solder side



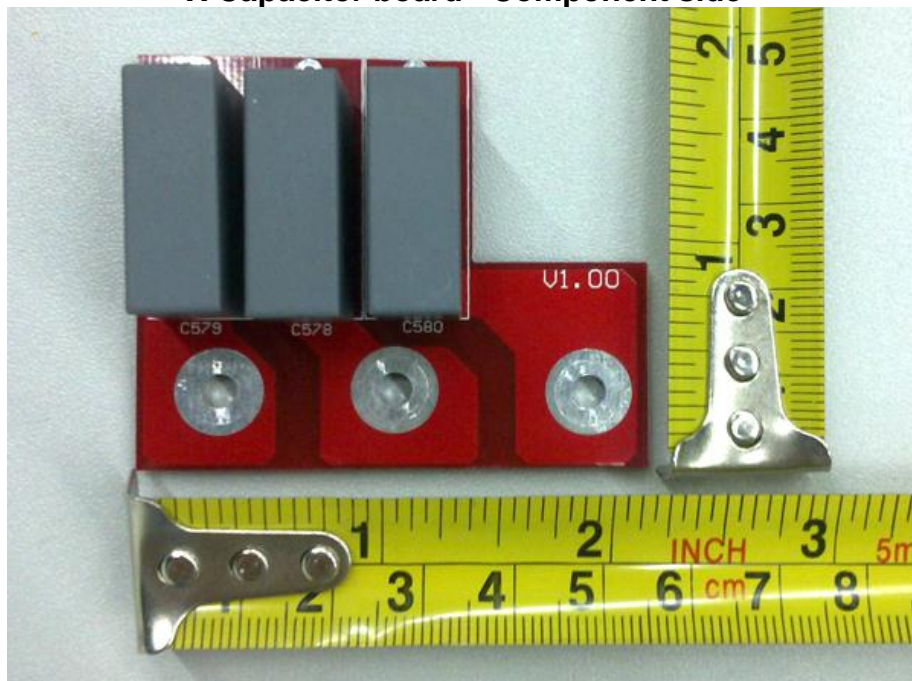
Control board - Component side



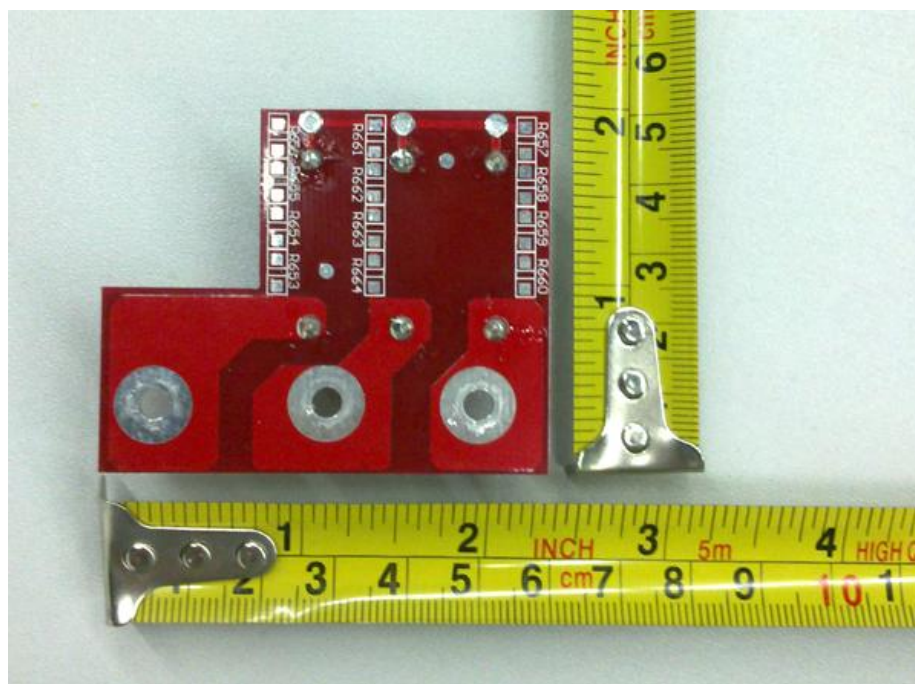
LCD display board - Solder side



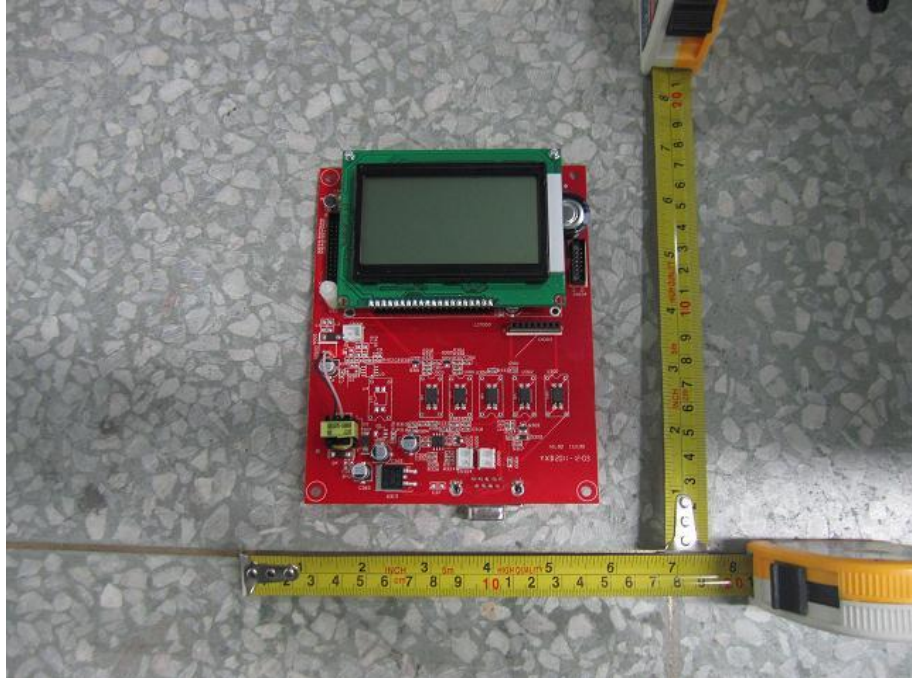
X Capacitor board - Component side



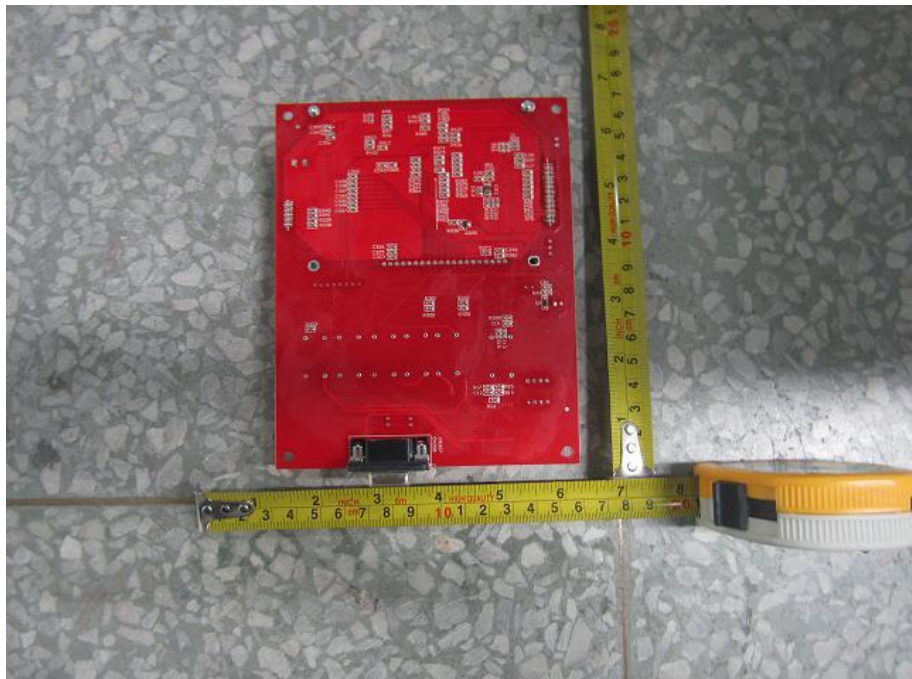
X Capacitor board - Solder side



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(SB0 012) | 2011-08-11 | 2012-08-10 |