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# EMC TEST REPORT
# For

## SHENZHEN SUNRAY POWER CO., LTD

## Inverter

## Model No.: MPS-V-3200-24, MPS-V-5000-48

| | | |
|---|---|---|
| Prepared for | : | SHENZHEN SUNRAY POWER CO., LTD |
| Address | : | B16, Rd No.1, the 1st industry park, Guangming, Shenzhen, Guangdong, China., 518107 |
| Prepared by | : | EMTEK (SHENZHEN) CO., LTD. |
| Address | : | Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China |
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| | | Fax: (0755) 26954282 |

| | | |
|---|---|---|
| Report Number | : | ES190523009E-1 |
| Date of Test | : | May 24, 2018 to June 01, 2018 |
| Date of Report | : | June 24, 2018 |

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APPENDIX (Photos of EUT)

# TEST REPORT DESCRIPTION

| | | |
|---|---|---|
| Applicant | : | SHENZHEN SUNRAY POWER CO., LTD |
| Manufacturer | : | SHENZHEN NEXT POWER TECHNOLOGY CO., LTD |
| Trade Mark | : | Sumry |
| EUT | : | Inverter |
| Model No. | : | MPS-V-3200-24, MPS-V-5000-48 |
| Power Supply | : | DC 360V for PV port, DC 24V for battery(MPS-V-3200-24), DC 48V for battery(MPS-V-5000-48), AC 230V/50Hz |

**Measurement Procedure Used:**

EN 61000-6-3:2007+A1:2011+ AC:2012,
EN 61000-3-11: 2000,
EN 61000-3-12: 2011,
EN 61000-6-1:2007
(IEC 61000-4-2:2008, IEC 61000-4-3:2006+A1:2007+A2:2010, IEC61000-4-4:2012,
IEC 61000-4-5:2014, IEC 61000-4-6:2013, IEC 61000-4-8:2009, IEC 61000-4-11:2004)

The device described above is tested by EMTEK (SHENZHEN) 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 EMTEK (SHENZHEN) 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 EN61000-6-3, EN61000-3-2, EN61000-3-3 and EN61000-6-1 requirements.

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

| | | |
|---|---|---|
| Date of Test | : | May 23, 2019 to June 21, 2019 |
| Prepared by | : | Winmy Huang/Editor |
| Reviewer | : | Jessie Hu /Supervisor |
| Approved & Authorized Signer | : | Lisa Wang/Manager |

EMTEK (SHENZHEN) CO., LTD. TESTING

# Modified Information

| Version | Report No. | Revision Date | Summary |
|---|---|---|---|
| Ver.1.0 | ES190523009E | / | Original Report |
| Ver.1.1 | ES190523009E-1 | / | Change Applicant to SHENZHEN SUNRAY POWER CO., LTD<br>Change model No. to MPS-V-3200-24, MPS-V-5000-48<br>Change trade mark to Sumry |

# 1. SUMMARY OF TEST RESULTS

| EMISSION | | | |
|---|---|---|---|
| Description of Test Item | Standard | Limits | Results |
| Conducted Disturbance at Mains Terminals | EN 61000-6-3:2007+A1:2011 + AC:2012 | -- | Pass |
| Radiated Disturbance | EN 61000-6-3:2007+A1:2011 + AC:2012 | -- | Pass |
| Voltage Fluctuation and Flicker | EN 61000-3-11: 2000 | Section 5 | Pass |
| Harmonic Current Emissions | EN 61000-3-12: 2011 | Table 2 | Pass |
| **IMMUNITY (EN 61000-6-1:2007)** | | | |
| Description of Test Item | Basic Standard | Performance Criteria | Results |
| Electrostatic Discharge (ESD) | IEC 61000-4-2:2008 | B | Pass |
| Radio-Frequency, Continuous Radiated Disturbance | IEC 61000-4-3:2006+A1:2007 +A2:2010 | A | Pass |
| EFT/B Immunity | IEC61000-4-4:2012 | B | Pass |
| Surge Immunity | IEC 61000-4-5:2014 | B | Pass |
| Conducted RF Immunity | IEC 61000-4-6:2013 | A | Pass |
| Power Frequency Magnetic Field | IEC 61000-4-8:2009 | A | Pass |
| Voltage Dips, >95% Reduction | IEC 61000-4-11:2004 | B | Pass |
| Voltage Dips, 30% Reduction | | C | Pass |
| Voltage Interruptions | | C | Pass |
| Note: N/A is an abbreviation for Not Applicable. | | | |

# 2. GENERAL INFORMATION

## 2.1. Description of Device (EUT)

| | |
|---|---|
| EUT | : Inverter |
| Model Number | : MPS-V-3200-24, MPS-V-5000-48<br>(Note: Two models are identical in circuitry and electrical, mechanical and physical construction; the only difference is the power derating of MPS-V-3200-24. We prepare MPS-V-3200-24, MPS-V-5000-48 for emission test, MPS-V-5000-48 for immunity test) |
| Test Voltage | : DC 360V for PV port, DC 24V for battery(MPS-V-3200-24), DC 48V for battery(MPS-V-5000-48), AC 230V/50Hz |
| Applicant | : SHENZHEN SUNRAY POWER CO., LTD |
| Address | : B16, Rd No.1, the 1st industry park, Guangming, Shenzhen, Guangdong, China., 518107 |
| Manufacturer | : SHENZHEN NEXT POWER TECHNOLOGY CO., LTD |
| Address | : 13/F, Block B, Dadan Industrial Park, No. 503, JiHua Rd, LongGang District, Shenzhen, China, 518129 |
| Date of Received | : May 23, 2019 |
| Date of Test | : May 23, 2019 to June 21, 2019 |

## 2.2. Description of Test Facility

Site Description

EMC Lab. : Accredited by CNAS, 2016.10.24
The certificate is valid until 2022.10.28
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 2018.3.30
The Laboratory has been assessed according to the requirements ISO/IEC 17025.

Accredited by FCC, August 06, 2018
Designation Number: CN1204
Test Firm Registration Number: 882943

Accredited by Industry Canada, November 09, 2018
The Certificate Registration Number is CN0008.

Accredited by A2LA, August 08, 2018
The Certificate Number is 4321.01

Name of Firm : EMTEK (SHENZHEN) CO., LTD.
Site Location : Bldg 69, Majialong Industry Zone,
Nanshan District, Shenzhen, Guangdong, China

## 2.3. Description of Support Device

N/A : N/A

## 2.4. Measurement Uncertainty

| Test Item | | Uncertainty |
|---|---|---|
| Conducted Emission Uncertainty | : | 3.16dB(9k~150kHz Conduction 2#)<br>2.90dB(150k-30MHz Conduction 2#) |
| Radiated Emission Uncertainty (3m Chamber) | : | 3.78dB (30M~1GHz Polarize: H)<br>4.27dB (30M~1GHz Polarize: V) |
| Uncertainty for Flicker test | : | 0.07% |
| Uncertainty for Harmonic test | : | 1.8% |
| Uncertainty for C/S Test | : | 1.45(Using CDN Test) |
| Uncertainty for R/S Test | : | 2.10dB(80MHz-200MHz) |
| Uncertainty for test site temperature and humidity | : | 0.6℃<br>4% |

# 3. MEASURING DEVICE AND TEST EQUIPMENT

## 3.1. For Power Line Conducted Emission Measurement

| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| ☑ | Test Receiver | Rohde & Schwarz | ESCS30 | 828985/018 | May 20, 2019 | 1 Year |
| ☑ | L.I.S.N. | ROHDE & SCHWARZ | ESH3-Z5 | 100191 | May 19, 2019 | 1 Year |
| ☑ | 50Ω Coaxial Switch | Anritsu | MP59B | M20531 | May 20, 2019 | 1 Year |
| ☑ | Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100006 | May 19, 2019 | 1 Year |

## 3.2. For Radiated Emission Measurement

| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| ☑ | EMI Test Receiver | Rohde & Schwarz | ESCI | 101414 | May 19, 2019 | 1 Year |
| ☑ | Pre-Amplifier | LUNAR-EM | LNA30M3G-25 | J10100000071 | May 19, 2019 | 1 Year |
| ☑ | Bilog Antenna | Schwarzbeck | VULB9163 | 660 | May 20, 2019 | 1 Year |
| ☑ | Cable | H+B | NmSm-05-C15052 | N/A | May 20, 2019 | 1 Year |
| ☑ | Cable | H+B | NmSm-2-C15201 | N/A | May 20, 2019 | 1 Year |
| ☑ | Cable | H+B | NmNm-7-C15702 | N/A | May 20, 2019 | 1 Year |

## 3.3. For Harmonic Current / Flicker Measurement

| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| ☑ | 45KVA AC Power source | Teseq | NSG 1007-45/45KVA | 1305A02873 | May 19, 2019 | 1 Year |
| ☑ | Signal conditioning Unit | Teseq | CCN 1000-3 | 1305A02873 | May 19, 2019 | 1 Year |
| ☑ | Three phase impedance network | Teseq/Germany | INA2197/37A | 1305A02873 | N/A | N/A |
| ☑ | Three phase impedance network | Teseq/Germany | INA 2196/75A | 1305A02874 | N/A | N/A |
| ☐ | Profline 2100 AC Switching Unit | Teseq/Germany | NSG2200-3 | A22714 | N/A | N/A |

## 3.4. For Electrostatic Discharge Immunity Test

| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| ☑ | ESD Tester | TESEQ AG | NSG 438A | 130 | May 20, 2019 | 1 Year |
| ☑ | Impulse Module | TESEQ AG | INA 4380-150pF/330Ohm | 403-550/1712 | May 20, 2019 | 1 Year |

## 3.5. For RF Strength Susceptibility Test

| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| ☑ | Signal Generator | Agilent | N5181A | MY50145187 | May 19, 2019 | 1 Year |
| ☑ | RF Power Meter. Dual Channel | BOONTON | 4232A | 10539 | May 20, 2019 | 1 Year |
| ☑ | 50ohm Diode Power Sensor | BOONTON | 51011EMC | 34236/34238 | May 20, 2019 | 1 Year |
| ☑ | Field Strength Meter | DARE | RSS1006A | 10I00037SO22 | May 20, 2019 | 1 Year |
| ☑ | 50ohm Diode Power Sensor | BOONTON | 51011EMC | 36164 | May 20, 2019 | 1 Year |
| ☑ | Power Amplifier | MILMEGA | 80RF1000-175 | 1059345 | May 19, 2019 | 1 Year |
| ☑ | Power Amplifier | MILMEGA | AS0102-55 | 1018770 | May 19, 2019 | 1 Year |
| ☑ | Power Amplifier | MILMEGA | AS1860-50 | 1059346 | May 19, 2019 | 1 Year |
| ☑ | Log.-Per. Antenna | SCHWARZBECK | VULP 9118E | 811 | May 20, 2019 | 1 Year |
| ☑ | Broad-Band Horn Antenna | SCHWARZBECK | STLP 9149 | 9149-227 | May 20, 2019 | 1 Year |
| ☑ | Multi-function interface system | DARE | CTR1009B | 12I00250SNO72 | N/A | N/A |
| ☑ | Automatic switch group | DARE | RSW1004A | N/A | N/A | N/A |

## 3.6. For Electrical Fast Transient / Burst Immunity Test

| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| ☑ | Burst Tester | HAEFELY | PEFT4010 | 080981-16 | May 20, 2019 | 1 Year |
| ☐ | Coupling Clamp | HAEFELY | IP-4A | 147147 | May 20, 2019 | 1 Year |

## 3.7. For Surge Immunity Test

| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| ☑ | Surge Controller | HAEFELY | Psurge 8000 | 174031 | May 20, 2019 | 1 Year |
| ☑ | Impulse Module | HAEFELY | PIM 100 | 174124 | May 20, 2019 | 1 Year |
| ☑ | Coupling Decoupling Filter | HAEFELY | PCD 130 | 172181 | May 20, 2019 | 1 Year |
| ☐ | Coupling Module | HAEFELY | PCD122 | 174354 | May 20, 2019 | 1 Year |
| ☐ | Surge Impulse Module | HAEFELY | PIM 120 | 174435 | May 20, 2019 | 1 Year |
| ☐ | Coupling Module | HAEFELY | PCD 126A | 174387 | May 20, 2019 | 1 Year |
| ☐ | Impulse Module | HAEFELY | PIM 110 | 174391 | May 20, 2019 | 1 Year |

## 3.8. For Injected Current Susceptibility Test

| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| ☑ | Simulator | EMTEST | CWS500C | 0900-12 | May 20, 2019 | 1 Year |
| ☑ | CDN | EMTEST | CDN-M2 | 5100100100 | May 20, 2019 | 1 Year |
| ☐ | CDN | EMTEST | CDN-M3 | 0900-11 | May 20, 2019 | 1 Year |
| ☐ | Injection Clamp | EMTEST | F-2031-23MM | 368 | May 20, 2019 | 1 Year |
| ☑ | Attenuator | EMTEST | ATT6 | 0010222A | May 20, 2019 | 1 Year |

## 3.9. For Magnetic Field Immunity Test

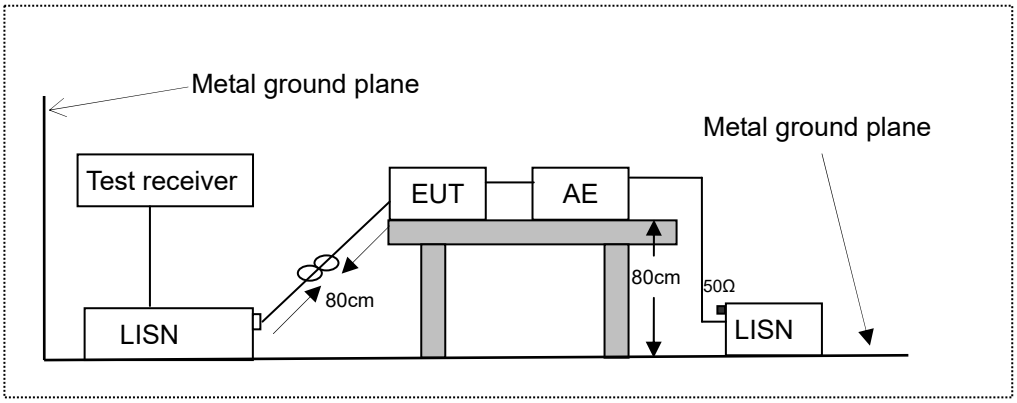
| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| ☑ | Magnetic Field Tester | HAEFELY | MAG100 | 250040.1 | May 19, 2019 | 1 Year |

## 3.10. For Voltage Dips and Interruptions Test

| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| ☑ | 45KVA AC Power source | Teseq | NSG 1007-45/45KVA | 1305A02873 | May 19, 2019 | 1 Year |
| ☐ | Signal conditioning Unit | Teseq | CCN 1000-3 | 1305A02873 | May 19, 2019 | 1 Year |
| ☐ | Three phase impedance network | Teseq/Germany | INA2197/37A | 1305A02873 | N/A | N/A |
| ☐ | Three phase impedance network | Teseq/Germany | INA 2196/75A | 1305A02874 | N/A | N/A |
| ☑ | Profline 2100 AC Switching Unit | Teseq/Germany | NSG2200-3 | A22714 | N/A | N/A |

# 4. POWER LINE CONDUCTED EMISSION MEASUREMENT

## 4.1. Block Diagram of Test Setup




LISN: Artificial Mains Network
AE: Associated equipment
EUT: Equipment under test

## 4.2. Measuring Standard

EN 61000-6-3:2007+A1:2011+ AC:2012

## 4.3. Power Line 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.<br>NOTE2-The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz. | | |

## 4.4. EUT Configuration of 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 : Inverter
Model Number : MPS-V-3200-24, MPS-V-5000-48

## 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 equipment.

4.5.3. Let the EUT work in measuring mode (AC Charge Mode) and measure it.

## 4.6. Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and connected to the AC mains through Line Impedance Stability Network (L.I.S.N). This provided a 50ohm coupling impedance for the tested equipments. Both sides of AC line are investigated to find out the maximum conducted emission according to the EN61000-6-3 regulations during conducted emission measurement.
The bandwidth of the field strength meter (R&S Test Receiver) 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 the following pages.

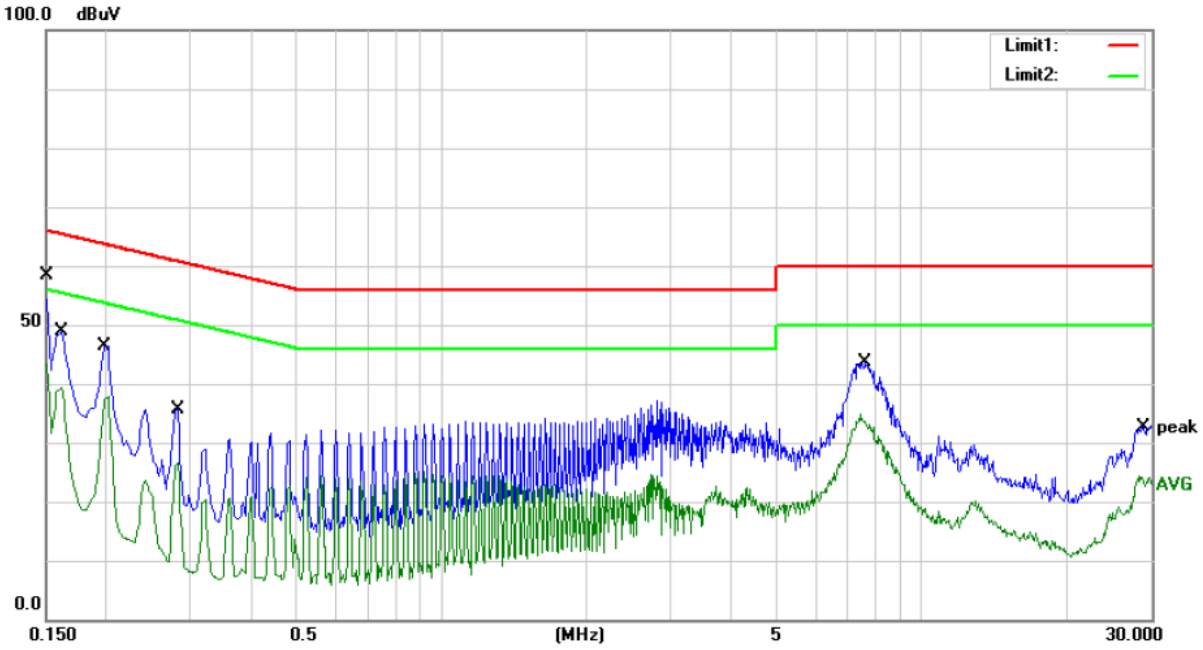
## 4.7. Measuring Results

**PASS.**

Please reference to the following pages.

## Conducted Emission Measurement

File :naisite Data :#25 Date: 2019/06/14 Time: 16:46:47




Site Conduction #2 Phase: L1 Temperature: 23.7

Limit: (CE)EN61000-6-3_QP Power: AC 230V/50Hz Humidity: 41 %

Mode: AC Charge Mode

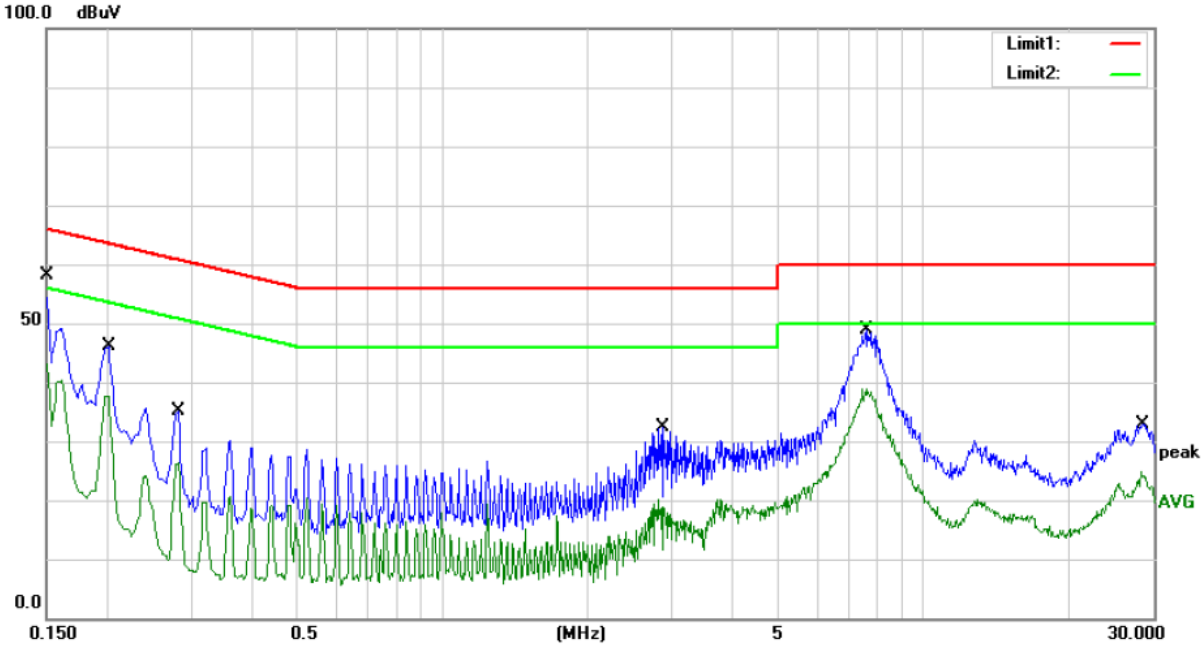
Note:

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector | Comment |
| 1 | * | 0.1500 | 48.56 | 9.89 | 58.45 | 66.00 | -7.55 | QP | |
| 2 | | 0.1500 | 36.29 | 9.89 | 46.18 | 56.00 | -9.82 | AVG | |
| 3 | | 0.1620 | 39.00 | 9.90 | 48.90 | 65.36 | -16.46 | QP | |
| 4 | | 0.1620 | 29.58 | 9.90 | 39.48 | 55.36 | -15.88 | AVG | |
| 5 | | 0.1980 | 36.46 | 9.90 | 46.36 | 63.69 | -17.33 | QP | |
| 6 | | 0.1980 | 28.01 | 9.90 | 37.91 | 53.69 | -15.78 | AVG | |
| 7 | | 0.2820 | 25.76 | 9.91 | 35.67 | 60.76 | -25.09 | QP | |
| 8 | | 0.2820 | 16.80 | 9.91 | 26.71 | 50.76 | -24.05 | AVG | |
| 9 | | 7.6460 | 33.70 | 9.99 | 43.69 | 60.00 | -16.31 | QP | |
| 10 | | 7.6460 | 24.84 | 9.99 | 34.83 | 50.00 | -15.17 | AVG | |
| 11 | | 28.8860 | 22.35 | 10.30 | 32.65 | 60.00 | -27.35 | QP | |
| 12 | | 28.8860 | 14.06 | 10.30 | 24.36 | 50.00 | -25.64 | AVG | |

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

## Conducted Emission Measurement

File :naisite Data :#24 Date: 2019/06/14 Time: 16:45:06




Site Conduction #2 Phase: N Temperature: 23.7

Limit: (CE)EN61000-6-3_QP Power: AC 230V/50Hz Humidity: 41 %

Mode:AC Charge Mode

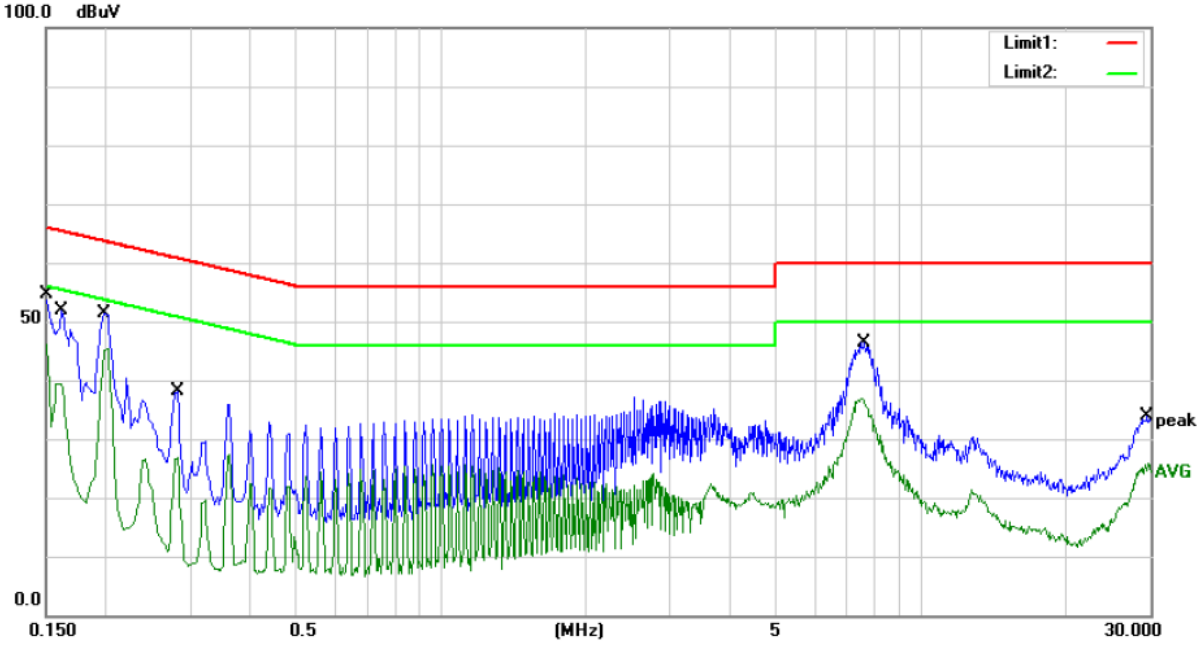
Note:

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector | Comment |
| 1 | * | 0.1500 | 48.31 | 9.89 | 58.20 | 66.00 | -7.80 | QP | |
| 2 | | 0.1500 | 35.82 | 9.89 | 45.71 | 56.00 | -10.29 | AVG | |
| 3 | | 0.2020 | 36.28 | 9.90 | 46.18 | 63.53 | -17.35 | QP | |
| 4 | | 0.2020 | 27.72 | 9.90 | 37.62 | 53.53 | -15.91 | AVG | |
| 5 | | 0.2820 | 25.15 | 9.91 | 35.06 | 60.76 | -25.70 | QP | |
| 6 | | 0.2820 | 16.45 | 9.91 | 26.36 | 50.76 | -24.40 | AVG | |
| 7 | | 2.8820 | 22.39 | 9.94 | 32.33 | 56.00 | -23.67 | QP | |
| 8 | | 2.8820 | 10.16 | 9.94 | 20.10 | 46.00 | -25.90 | AVG | |
| 9 | | 7.6020 | 38.88 | 9.99 | 48.87 | 60.00 | -11.13 | QP | |
| 10 | | 7.6020 | 28.93 | 9.99 | 38.92 | 50.00 | -11.08 | AVG | |
| 11 | | 28.5980 | 22.66 | 10.30 | 32.96 | 60.00 | -27.04 | QP | |
| 12 | | 28.5980 | 14.47 | 10.30 | 24.77 | 50.00 | -25.23 | AVG | |

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

## Conducted Emission Measurement

File :naisite Data :#26 Date: 2019/06/14 Time: 16:50:45




Site Conduction #2 Phase: L1 Temperature: 23.7

Limit: (CE)EN61000-6-3_QP Power: AC 230V/50Hz Humidity: 41 %

Mode:AC Charge Mode

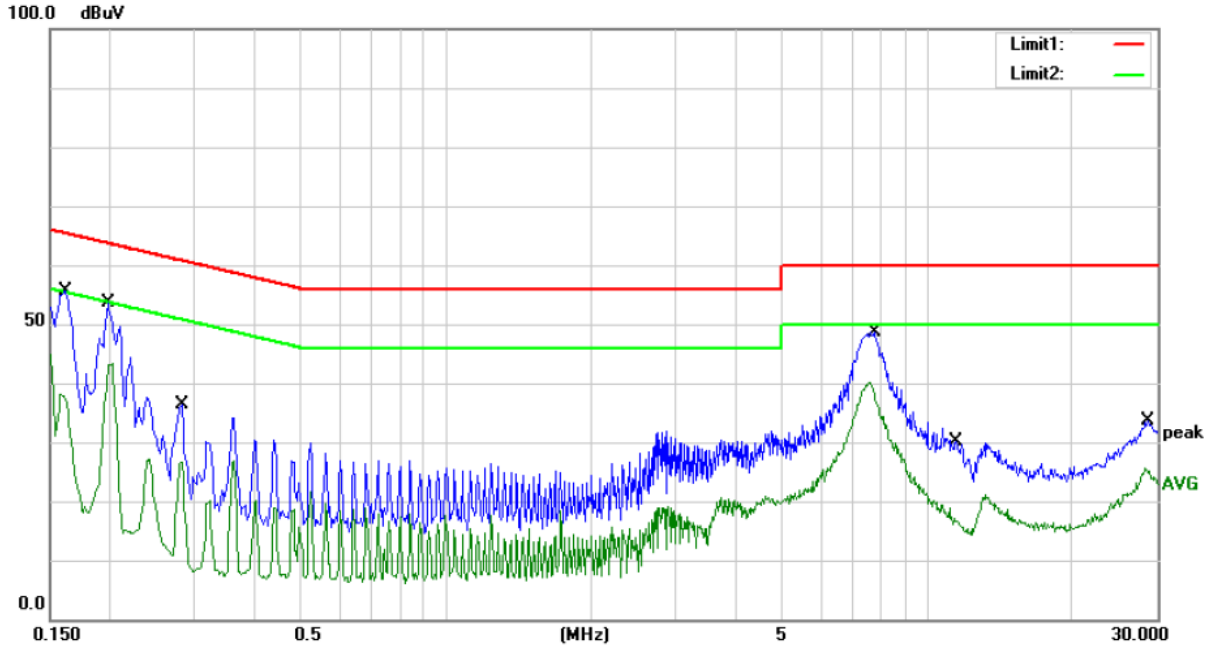
Note:

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector | Comment |
| 1 | | 0.1500 | 44.79 | 9.89 | 54.68 | 66.00 | -11.32 | QP | |
| 2 | * | 0.1500 | 39.86 | 9.89 | 49.75 | 56.00 | -6.25 | AVG | |
| 3 | | 0.1620 | 41.92 | 9.90 | 51.82 | 65.36 | -13.54 | QP | |
| 4 | | 0.1620 | 29.52 | 9.90 | 39.42 | 55.36 | -15.94 | AVG | |
| 5 | | 0.1980 | 41.51 | 9.90 | 51.41 | 63.69 | -12.28 | QP | |
| 6 | | 0.1980 | 35.45 | 9.90 | 45.35 | 53.69 | -8.34 | AVG | |
| 7 | | 0.2820 | 28.16 | 9.91 | 38.07 | 60.76 | -22.69 | QP | |
| 8 | | 0.2820 | 16.88 | 9.91 | 26.79 | 50.76 | -23.97 | AVG | |
| 9 | | 7.6420 | 36.42 | 9.99 | 46.41 | 60.00 | -13.59 | QP | |
| 10 | | 7.6420 | 26.94 | 9.99 | 36.93 | 50.00 | -13.07 | AVG | |
| 11 | | 29.6060 | 23.67 | 10.31 | 33.98 | 60.00 | -26.02 | QP | |
| 12 | | 29.6060 | 15.53 | 10.31 | 25.84 | 50.00 | -24.16 | AVG | |

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

## Conducted Emission Measurement

File :naisite Data :#27 Date: 2019/06/14 Time: 16:52:56




Site Conduction #2 Phase: N Temperature: 23.7

Limit: (CE)EN61000-6-3_QP Power: AC 230V/50Hz Humidity: 41 %

Mode:AC Charge Mode

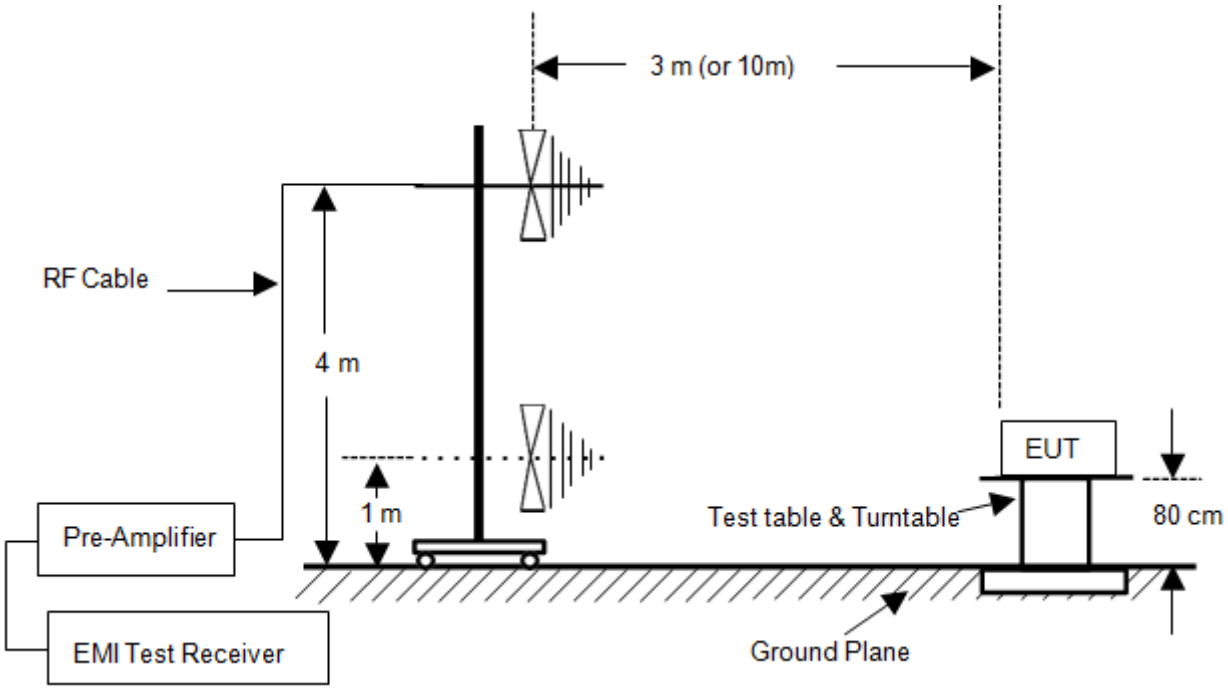
Note:

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector | Comment |
| 1 | | 0.1620 | 45.80 | 9.90 | 55.70 | 65.36 | -9.66 | QP | |
| 2 | * | 0.1620 | 38.40 | 9.90 | 48.30 | 55.36 | -7.06 | AVG | |
| 3 | | 0.1980 | 43.82 | 9.90 | 53.72 | 63.69 | -9.97 | QP | |
| 4 | | 0.1980 | 33.42 | 9.90 | 43.32 | 53.69 | -10.37 | AVG | |
| 5 | | 0.2820 | 26.51 | 9.91 | 36.42 | 60.76 | -24.34 | QP | |
| 6 | | 0.2820 | 16.71 | 9.91 | 26.62 | 50.76 | -24.14 | AVG | |
| 7 | | 7.7580 | 38.66 | 10.00 | 48.66 | 60.00 | -11.34 | QP | |
| 8 | | 7.7580 | 30.20 | 10.00 | 40.20 | 50.00 | -9.80 | AVG | |
| 9 | | 11.4820 | 20.19 | 10.02 | 30.21 | 60.00 | -29.79 | QP | |
| 10 | | 11.4820 | 12.18 | 10.02 | 22.20 | 50.00 | -27.80 | AVG | |
| 11 | | 28.6860 | 23.23 | 10.30 | 33.53 | 60.00 | -26.47 | QP | |
| 12 | | 28.6860 | 15.29 | 10.30 | 25.59 | 50.00 | -24.41 | AVG | |

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

# 5. RADIATED EMISSION MEASUREMENT

## 5.1. Block Diagram of Test Setup




## 5.2. Measuring Standard

EN 61000-6-3:2007+A1:2011+ AC:2012

## 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 of Measurement

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

EUT : Inverter
Model Number : MPS-V-3200-24, MPS-V-5000-48

## 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 equipment.

5.5.3.Let the EUT work in measuring mode (Inverter Mode, AC Charge Mode, Solar Charge Mode) 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 (ESCI) is set at 120kHz.

## 5.7. Measuring Results

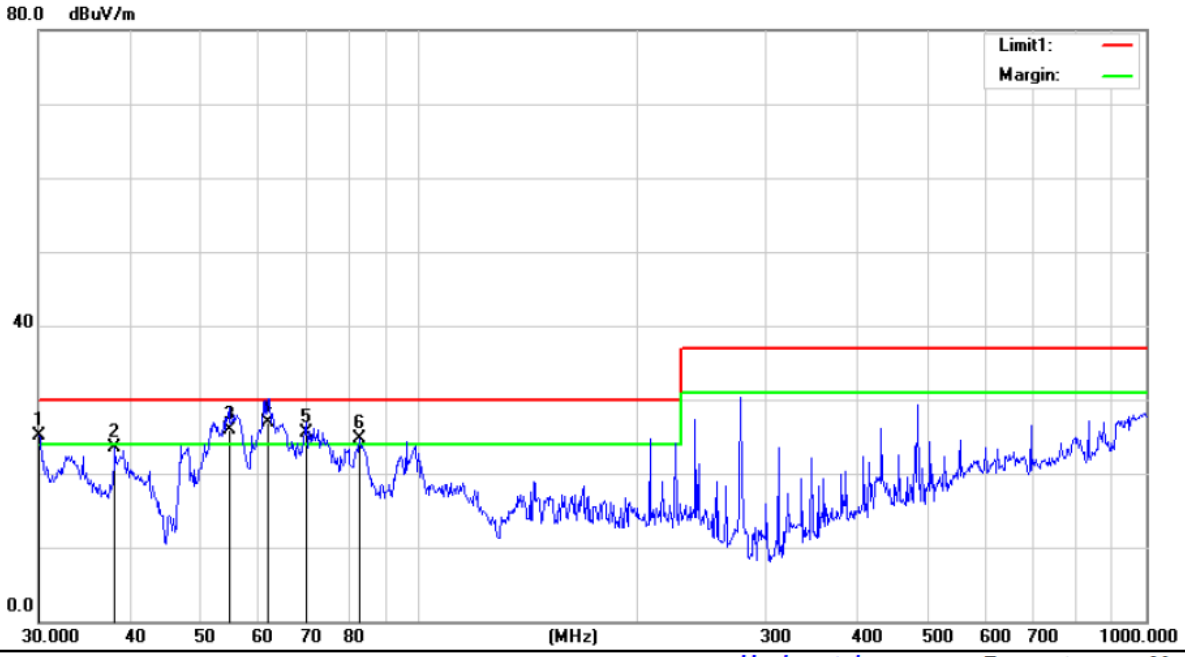
**PASS.**
All of the mode were tested, the data of the worst case are recorded in the following pages.

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

Please reference to the following pages.

## Radiated Emission Measurement

File :NAISITE Data :#24 Date: 2019/6/1 Time: 11:36:47




Site 10m Chamber 1# Polarization: *Horizontal* Temperature: 26

Limit: (RE10M)EN61000-6-3 Power: 230V/50Hz Humidity: 60 %

Mode:AC Charge Mode

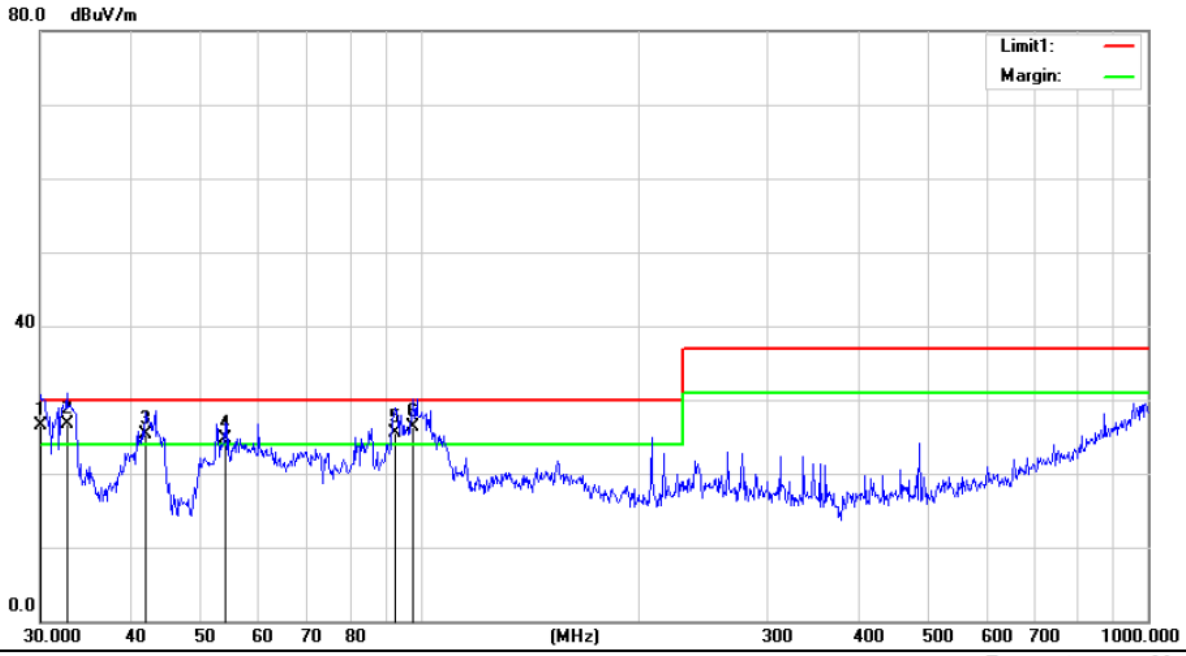
Note:

| No. | Mk. | Freq. | Reading Level | Ant. Factor | Pre Amp Gain | Cable loss | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | ! | 30.1051 | 56.49 | 11.18 | 43.29 | 0.8 | 25.18 | 30.00 | -4.82 | QP | |
| 2 | | 38.2120 | 53.60 | 12.45 | 43.33 | 0.78 | 23.50 | 30.00 | -6.50 | QP | |
| 3 | ! | 54.8348 | 55.12 | 13.46 | 43.4 | 0.82 | 26.00 | 30.00 | -4.00 | QP | |
| 4 | * | 61.9951 | 57.40 | 12.02 | 43.43 | 0.91 | 26.90 | 30.00 | -3.10 | QP | |
| 5 | ! | 70.0901 | 58.39 | 9.57 | 43.47 | 1.01 | 25.50 | 30.00 | -4.50 | QP | |
| 6 | ! | 82.9385 | 59.02 | 8.01 | 43.52 | 1.18 | 24.69 | 30.00 | -5.31 | QP | |

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

## Radiated Emission Measurement

File :NAISITE Data :#25 Date: 2019/6/1 Time: 11:36:47




Site 10m Chamber 1# Polarization: *Vertical* Temperature: 26

Limit: (RE10M)EN61000-6-3 Power: 230V/50Hz Humidity: 60 %

Mode:AC Charge Mode

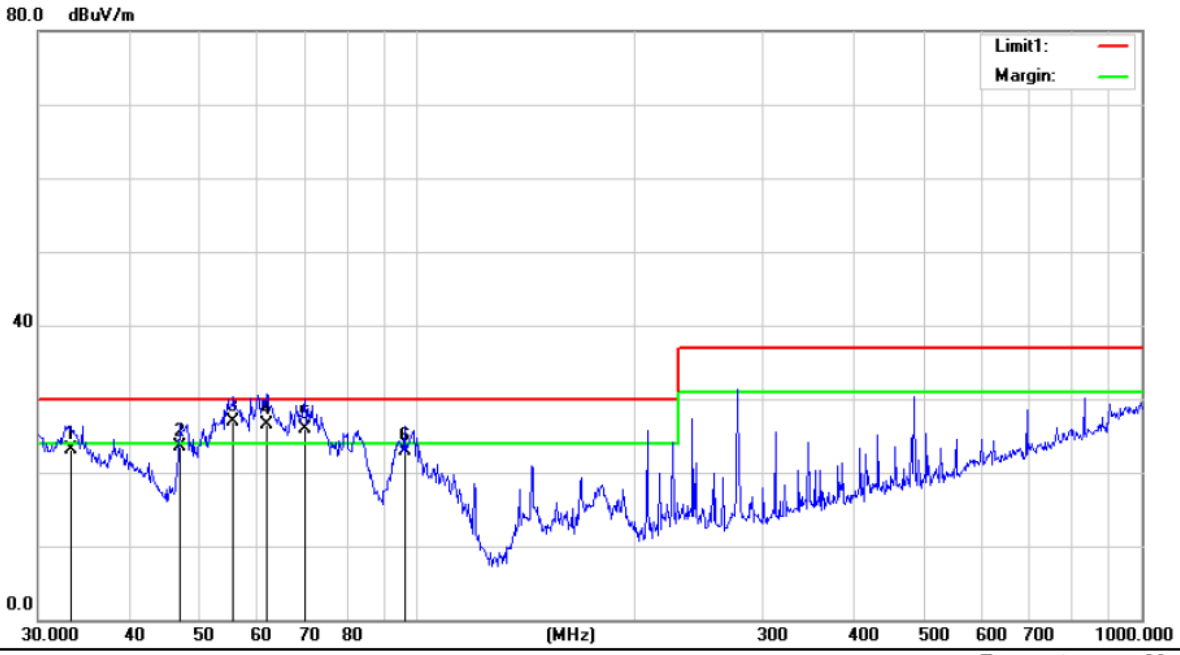
Note:

| No. | Mk. | Freq. | Reading Level | Ant. Factor | Pre Amp Gain | Cable loss | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | ! | 30.1051 | 57.53 | 10.99 | 43.01 | 0.99 | 26.50 | 30.00 | -3.50 | QP | |
| 2 | * | 32.6340 | 58.00 | 10.83 | 43.03 | 1 | 26.80 | 30.00 | -3.20 | QP | |
| 3 | ! | 41.8596 | 54.00 | 13.45 | 43.08 | 1.03 | 25.40 | 30.00 | -4.60 | QP | |
| 4 | ! | 53.8817 | 53.01 | 13.71 | 43.14 | 1.12 | 24.70 | 30.00 | -5.30 | QP | |
| 5 | ! | 92.4624 | 57.01 | 10.19 | 43.36 | 1.76 | 25.60 | 30.00 | -4.40 | QP | |
| 6 | ! | 97.7980 | 56.65 | 11.19 | 43.39 | 1.85 | 26.30 | 30.00 | -3.70 | QP | |

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

## Radiated Emission Measurement

File :NAISITE Data :#18 Date: 2019/6/1 Time: 11:06:59




Site 10m Chamber 1# Polarization: *Horizontal* Temperature: 26

Limit: (RE10M)EN61000-6-3 Power: 230V/50Hz Humidity: 60 %

Mode:AC Charge Mode

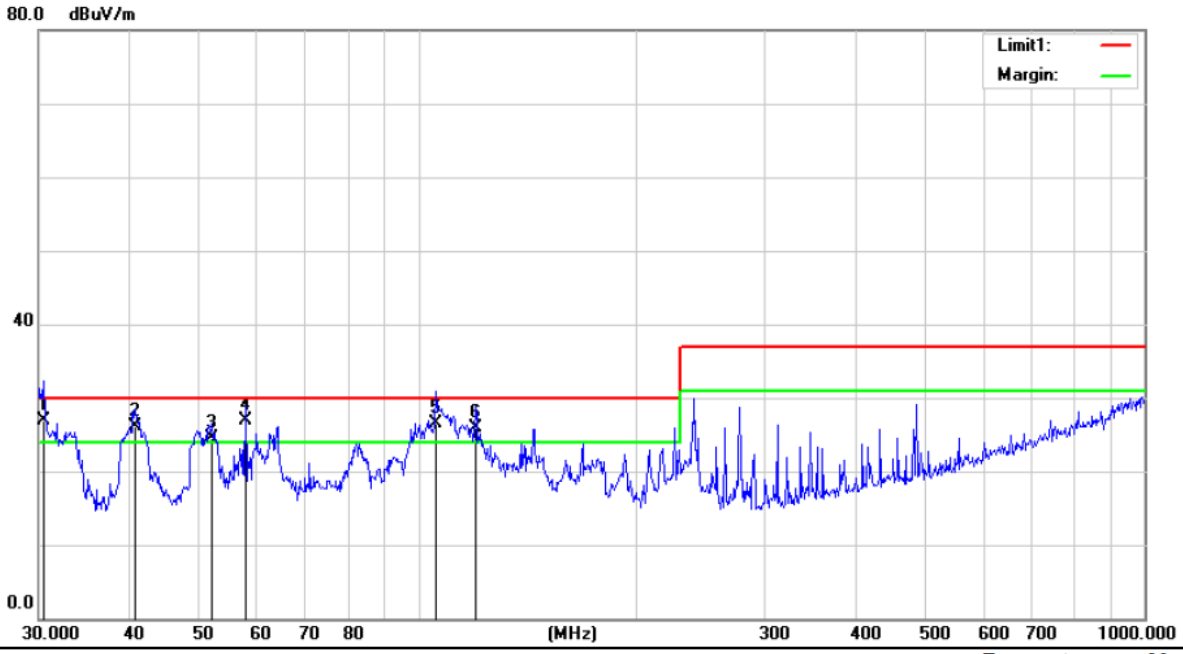
Note:

| No. | Mk. | Freq. | Reading Level | Ant. Factor | Pre Amp Gain | Cable loss | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | | 33.3280 | 54.21 | 11.5 | 43.3 | 0.79 | 23.20 | 30.00 | -6.80 | QP | |
| 2 | | 46.9948 | 52.39 | 13.7 | 43.36 | 0.77 | 23.50 | 30.00 | -6.50 | QP | |
| 3 | * | 55.8046 | 56.06 | 13.41 | 43.4 | 0.83 | 26.90 | 30.00 | -3.10 | QP | |
| 4 | ! | 61.9951 | 57.10 | 12.02 | 43.43 | 0.91 | 26.60 | 30.00 | -3.40 | QP | |
| 5 | ! | 70.0903 | 58.89 | 9.57 | 43.47 | 1.01 | 26.00 | 30.00 | -4.00 | QP | |
| 6 | | 96.0986 | 54.02 | 11.22 | 43.58 | 1.34 | 23.00 | 30.00 | -7.00 | QP | |

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

## Radiated Emission Measurement

File :NAISITE Data :#19 Date: 2019/6/1 Time: 11:07:00




Site 10m Chamber 1# Polarization: *Vertical* Temperature: 26

Limit: (RE10M)EN61000-6-3 Power: 230V/50Hz Humidity: 60 %

Mode:AC Charge Mode

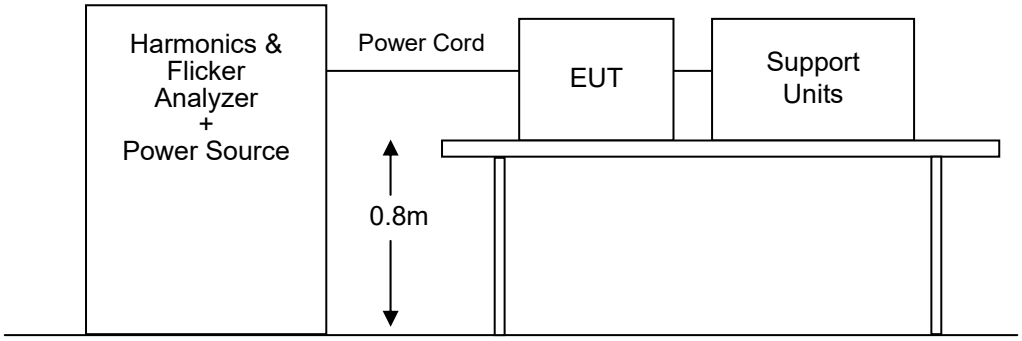
Note:

| No. | Mk. | Freq. | Reading Level | Ant. Factor | Pre Amp Gain | Cable loss | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | * | 30.4237 | 58.06 | 10.96 | 43.01 | 0.99 | 27.00 | 30.00 | -3.00 | QP | |
| 2 | ! | 40.7014 | 55.13 | 13.05 | 43.07 | 1.03 | 26.14 | 30.00 | -3.86 | QP | |
| 3 | ! | 52.0251 | 52.74 | 13.8 | 43.13 | 1.09 | 24.50 | 30.00 | -5.50 | QP | |
| 4 | ! | 57.7961 | 56.41 | 12.47 | 43.17 | 1.19 | 26.90 | 30.00 | -3.10 | QP | |
| 5 | ! | 105.6414 | 56.39 | 11.56 | 43.39 | 1.94 | 26.50 | 30.00 | -3.50 | QP | |
| 6 | ! | 119.8555 | 57.35 | 9.83 | 43.36 | 2.08 | 25.90 | 30.00 | -4.10 | QP | |

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

# 6. HARMONIC CURRENT EMISSION MEASUREMENT

## 6.1. Block Diagram of Test Setup




## 6.2. Measuring Standard

EN 61000-3-12: 2011 Table 2

## 6.3. Operation Condition of EUT

6.3.1. Setup the EUT as shown on Section 6.1.

6.3.2. Turn on the power of all equipment.

6.3.3. Let the EUT work in measuring mode (AC Charge Mode) and measure it.

## 6.4. Measuring Results

**PASS.**

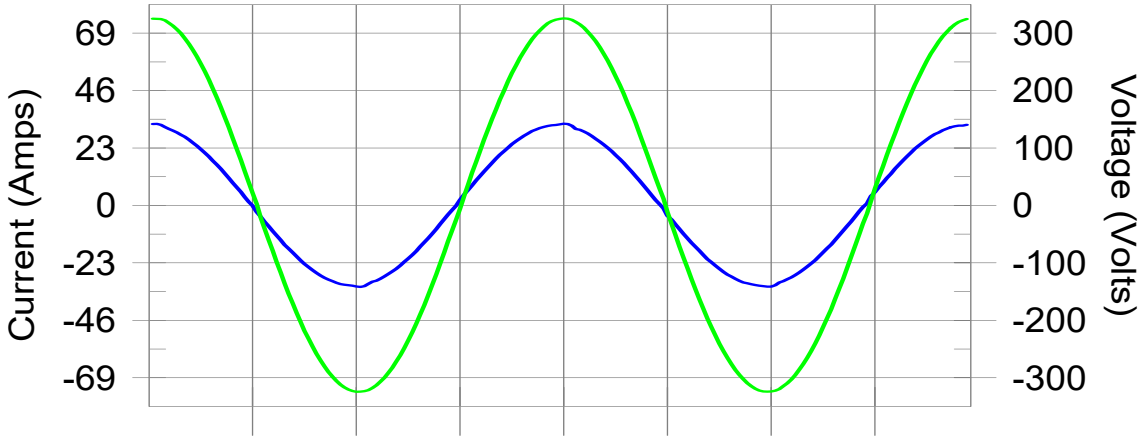
Please see the attached page.

## Harmonics – Per EN/IEC61000-3-12(Run time)

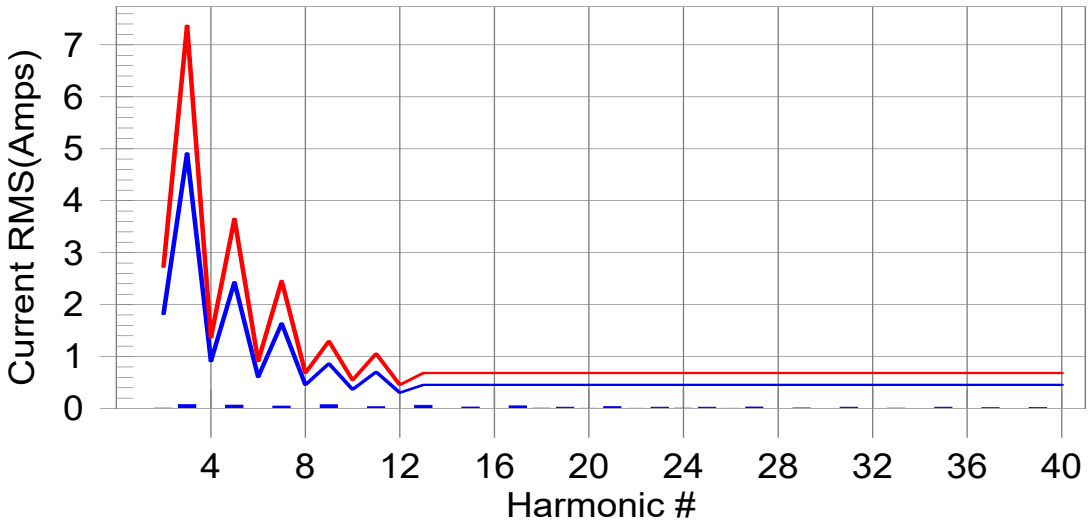
**EUT: Inverter** **Tested by: LJX**
**Test category: Table:2, Rsce=33, Inter-Harm, Test Margin: 100**
**Test date: 2019/6/6 Start time: 9:53:13 End time: 9:56:06**
**Test duration (min): 2.5 Data file name: WIN2106_H-000004.cts_data**
**Comment: AC CHARGER MODE**
**Customer: SHENZHEN SUNRAY POWER CO., LTD**

**Test Result: Pass** **Source qualification: Normal**

**Current & voltage waveforms**




**Harmonics and Class 2 limit line** **European Limits**




**Test result: Pass** **Worst harmonic was #13 with 14.25 % of the limit.**

## Current Test Result Summary (Run time)

**EUT: Inverter** **Tested by: LJX**
**Test category: Table:2, Rsce=33, Inter-Harm,** **Test Margin: 100**
**Test date: 2019/6/6** **Start time: 9:53:13** **End time: 9:56:06**
**Test duration (min): 2.5** **Data file name: WIN2106_H-000004.cts_data**
**Comment: AC CHARGER MODE**
**Customer: SHENZHEN SUNRAY POWER CO., LTD**

**Test Result: Pass** **Measured I-ref: 22.746 Amp rms** **Source: Normal**
**I-THC(%): 0.8** **Limit(%): 23.0** **PWHC(%): 2.2** **PWHC Limit(%): 23.0**

**Highest parameter values during test:**

| | | | |
|---|---|---|---|
| **V_RMS (Volts):** | **230.00** | **Frequency(Hz):** | **50.00** |
| **I_Peak (Amps):** | **33.020** | **I_RMS (Amps):** | **22.762** |
| **I_Fund (Amps):** | **22.746** | **Crest Factor:** | **1.452** |
| **Power (Watts):** | **5218** | **Power Factor:** | **0.997** |

| Harm# | Harms(avg) | 100%Limit | %of Limit | Harms(max) | 150%Limit | %of Limit | Status |
|---|---|---|---|---|---|---|---|
| 2 | 0.008 | 1.820 | 0.4 | 0.011 | 2.730 | 0.4 | Pass |
| 3 | 0.076 | 4.913 | 1.5 | 0.085 | 7.370 | 1.2 | Pass |
| 4 | 0.004 | 0.910 | N/A | 0.005 | 1.365 | N/A | Pass |
| 5 | 0.068 | 2.434 | 2.8 | 0.071 | 3.651 | 1.9 | Pass |
| 6 | 0.003 | 0.607 | N/A | 0.004 | 0.910 | N/A | Pass |
| 7 | 0.047 | 1.638 | 2.9 | 0.049 | 2.457 | 2.0 | Pass |
| 8 | 0.003 | 0.455 | N/A | 0.004 | 0.682 | N/A | Pass |
| 9 | 0.073 | 0.864 | 8.5 | 0.075 | 1.297 | 5.8 | Pass |
| 10 | 0.003 | 0.364 | N/A | 0.003 | 0.546 | N/A | Pass |
| 11 | 0.037 | 0.705 | 5.3 | 0.039 | 1.058 | 3.7 | Pass |
| 12 | 0.003 | 0.303 | N/A | 0.004 | 0.455 | N/A | Pass |
| 13 | 0.064 | 0.455 | 14.2 | 0.065 | 0.682 | 9.6 | Pass |
| 14 | 0.003 | N/A | N/A | 0.003 | N/A | N/A | N/A |
| 15 | 0.029 | N/A | N/A | 0.030 | N/A | N/A | N/A |
| 16 | 0.004 | N/A | N/A | 0.005 | N/A | N/A | N/A |
| 17 | 0.053 | N/A | N/A | 0.053 | N/A | N/A | N/A |
| 18 | 0.007 | N/A | N/A | 0.007 | N/A | N/A | N/A |
| 19 | 0.027 | N/A | N/A | 0.029 | N/A | N/A | N/A |
| 20 | 0.005 | N/A | N/A | 0.006 | N/A | N/A | N/A |
| 21 | 0.039 | N/A | N/A | 0.040 | N/A | N/A | N/A |
| 22 | 0.005 | N/A | N/A | 0.006 | N/A | N/A | N/A |
| 23 | 0.027 | N/A | N/A | 0.028 | N/A | N/A | N/A |
| 24 | 0.007 | N/A | N/A | 0.008 | N/A | N/A | N/A |
| 25 | 0.025 | N/A | N/A | 0.026 | N/A | N/A | N/A |
| 26 | 0.005 | N/A | N/A | 0.005 | N/A | N/A | N/A |
| 27 | 0.030 | N/A | N/A | 0.030 | N/A | N/A | N/A |
| 28 | 0.004 | N/A | N/A | 0.004 | N/A | N/A | N/A |
| 29 | 0.012 | N/A | N/A | 0.013 | N/A | N/A | N/A |
| 30 | 0.003 | N/A | N/A | 0.004 | N/A | N/A | N/A |
| 31 | 0.028 | N/A | N/A | 0.029 | N/A | N/A | N/A |
| 32 | 0.003 | N/A | N/A | 0.004 | N/A | N/A | N/A |
| 33 | 0.009 | N/A | N/A | 0.010 | N/A | N/A | N/A |
| 34 | 0.004 | N/A | N/A | 0.004 | N/A | N/A | N/A |
| 35 | 0.025 | N/A | N/A | 0.025 | N/A | N/A | N/A |
| 36 | 0.004 | N/A | N/A | 0.004 | N/A | N/A | N/A |
| 37 | 0.017 | N/A | N/A | 0.018 | N/A | N/A | N/A |
| 38 | 0.003 | N/A | N/A | 0.004 | N/A | N/A | N/A |
| 39 | 0.020 | N/A | N/A | 0.021 | N/A | N/A | N/A |
| 40 | 0.004 | N/A | N/A | 0.005 | N/A | N/A | N/A |

***Note: Measured I-ref was applied for this test.***

# Voltage Source Verification Data (Run time)

**EUT: Inverter** **Tested by: LJX**
**Test category: Table:2, Rsce=33, Inter-Harm, Test Margin: 100**
**Test date: 2019/6/6 Start time: 9:53:13 End time: 9:56:06**
**Test duration (min): 2.5 Data file name: WIN2106_H-000004.cts_data**
**Comment: AC CHARGER MODE**
**Customer: SHENZHEN SUNRAY POWER CO., LTD**

**Test Result: Pass** **Source qualification: Normal**
**Measured source distortion is within the requirements of the standards**
**Measurements are compliant with IEC/EN61000-3-12 Ed.2 (2011) & IEC/EN61000-4-7**

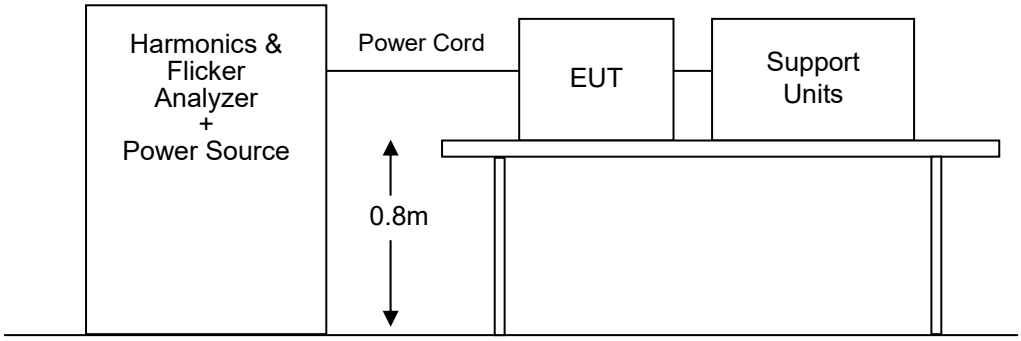
**Highest parameter values during test:**

| | | | |
|---|---|---|---|
| **Voltage (Vrms):** | **230.00** | **Frequency(Hz):** | **50.00** |
| **I_Peak (Amps):** | **33.020** | **I_RMS (Amps):** | **22.762** |
| **I_Fund (Amps):** | **22.746** | **Crest Factor:** | **1.452** |
| **Power (Watts):** | **5218** | **Power Factor:** | **0.997** |

| Harm# | Harmonics V-rms | Limit V-rms | % of Limit | Status |
|---|---|---|---|---|
| 2 | 0.097 | 0.920 | 10.51 | OK |
| 3 | 0.163 | 2.875 | 5.66 | OK |
| 4 | 0.038 | 0.920 | 4.11 | OK |
| 5 | 0.115 | 3.449 | 3.33 | OK |
| 6 | 0.018 | 0.920 | 2.00 | OK |
| 7 | 0.139 | 2.875 | 4.85 | OK |
| 8 | 0.021 | 0.920 | 2.25 | OK |
| 9 | 0.177 | 1.380 | 12.84 | OK |
| 10 | 0.021 | 0.920 | 2.28 | OK |
| 11 | 0.141 | 1.610 | 8.75 | OK |
| 12 | 0.022 | 0.690 | 3.16 | OK |
| 13 | 0.154 | 1.380 | 11.16 | OK |
| 14 | 0.022 | 0.690 | 3.18 | OK |
| 15 | 0.143 | 0.690 | 20.73 | OK |
| 16 | 0.020 | 0.690 | 2.93 | OK |
| 17 | 0.129 | 0.690 | 18.69 | OK |
| 18 | 0.027 | 0.690 | 3.90 | OK |
| 19 | 0.122 | 0.690 | 17.74 | OK |
| 20 | 0.027 | 0.690 | 3.92 | OK |
| 21 | 0.108 | 0.690 | 15.63 | OK |
| 22 | 0.021 | 0.690 | 3.04 | OK |
| 23 | 0.126 | 0.690 | 18.23 | OK |
| 24 | 0.026 | 0.690 | 3.75 | OK |
| 25 | 0.085 | 0.690 | 12.27 | OK |
| 26 | 0.023 | 0.690 | 3.30 | OK |
| 27 | 0.110 | 0.690 | 15.96 | OK |
| 28 | 0.023 | 0.690 | 3.34 | OK |
| 29 | 0.076 | 0.690 | 11.02 | OK |
| 30 | 0.018 | 0.690 | 2.60 | OK |
| 31 | 0.090 | 0.690 | 13.08 | OK |
| 32 | 0.018 | 0.690 | 2.62 | OK |
| 33 | 0.069 | 0.690 | 9.97 | OK |
| 34 | 0.022 | 0.690 | 3.14 | OK |
| 35 | 0.073 | 0.690 | 10.52 | OK |
| 36 | 0.022 | 0.690 | 3.24 | OK |
| 37 | 0.075 | 0.690 | 10.92 | OK |
| 38 | 0.017 | 0.690 | 2.41 | OK |
| 39 | 0.059 | 0.690 | 8.50 | OK |
| 40 | 0.025 | 0.690 | 3.58 | OK |

# 7. VOLTAGE FLUCTUATION AND FLICKER MEASUREMENT

## 7.1. Block Diagram of Test Setup




## 7.2. Measuring Standard

EN 61000-3-11: 2000 Section 5

## 7.3. Operation Condition of EUT

7.3.1.Me Setup the EUT as shown on Section 7.1.

7.3.2.Turn on the power of all equipment.

7.3.3.Let the EUT work in measuring mode (AC Charge Mode) and measure it.

## 7.4. Measuring Results

**PASS.**

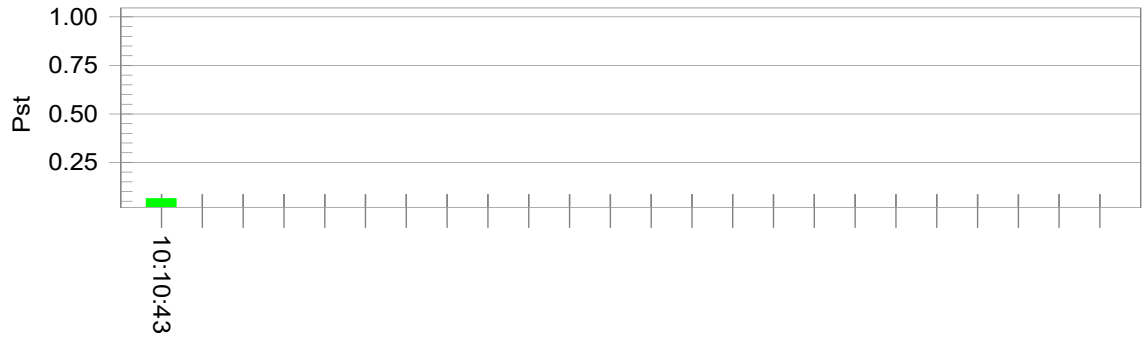
Please see the attached page.

# Flicker Test Summary (Run time) per EN/IEC61000-3-11

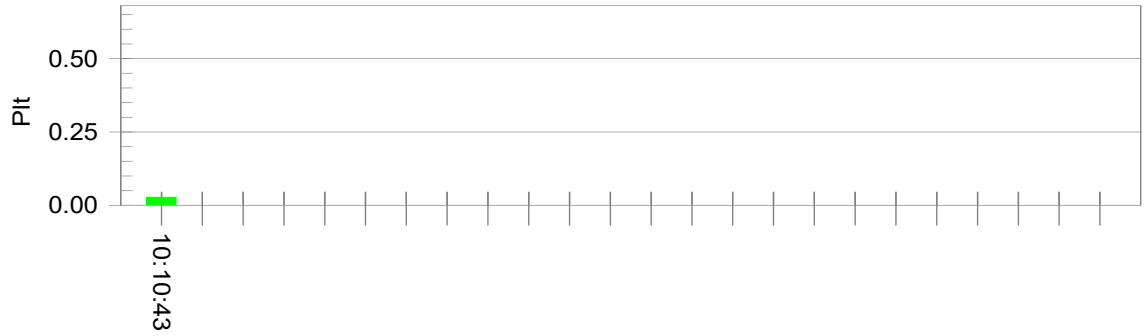
**EUT: Inverter** **Tested by: LJX**
**Test category: All parameters** **Test Margin: 100**
**Test date: 2019/6/6** **Start time: 10:00:13** **End time: 10:10:44**
**Test duration (min): 10** **Data file name: WIN2106_F-000005.cts_data**
**Comment: AC CHARGING MODE**
**Customer: SHENZHEN SUNRAY POWER CO., LTD**
**Z-test = (0.400 + j 0.250 Ohm)**

**Test Result: Pass**
**Status: Test Completed**

**$Pst_i$ and limit line**




**Plt and limit line**




**Parameter values recorded during the test:**

**Vrms at the end of test (Volt): 224.68**

| | | | | |
|---|---|---|---|---|
| **T-max (mS):** | **0.0** | **Test limit (mS):** | **500.0** | **Pass** |
| **Highest dc (%):** | **0.00** | **Test limit (%):** | **3.30** | **Pass** |
| **Highest dmax (%):** | **0.09** | **Test limit (%):** | **4.00** | **Pass** |
| **Highest Pst (10 min. period):** | **0.064** | **Test limit:** | **1.000** | **Pass** |
| **Highest Plt (2 hr. period):** | **0.028** | **Test limit:** | **0.650** | **Pass** |

**Calculated dmax(%): 0.000**
**Calculated dc(%): 0.000**
**Calculated Pst : 0.064**
**Calculated Plt : 0.028**

# 8. IMMUNITY PERFORMANCE CRITERIA DESCRIPTION

Performance Level

The test results shall be classified in terms of the loss of function or degradation of performance of the equipment under test, relative to a performance level by its manufacturer or the requestor of the test, or the agreed between the manufacturer and the purchaser of the product.

Definition related to the performance level:
1. Based on the used product standard
2. Based on the declaration of the manufacturer, requestor or purchaser

Criterion A:

The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Criterion B:

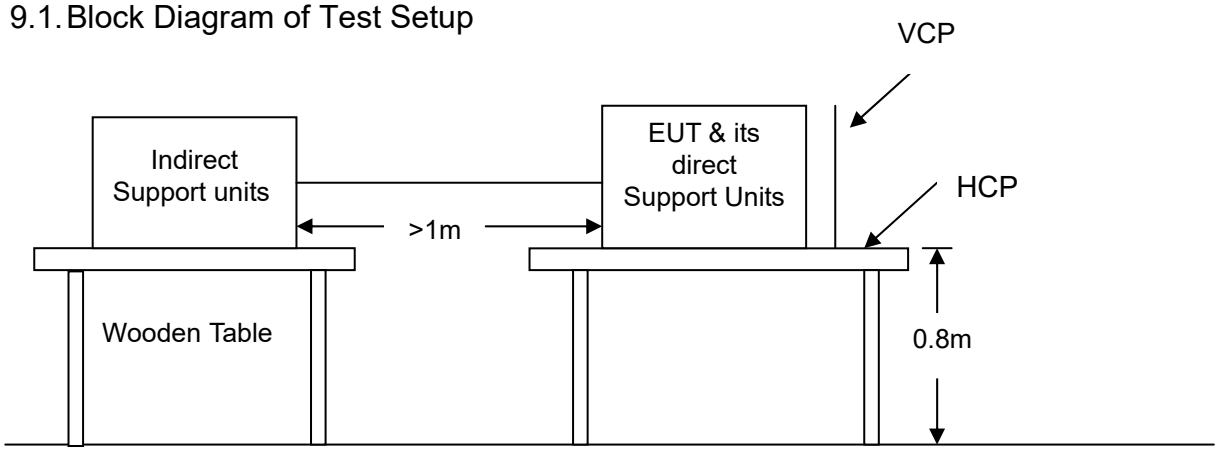
The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance.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

Criterion C:

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

# 9. ELECTROSTATIC DISCHARGE IMMUNITY TEST

## 9.1. Block Diagram of Test Setup




Ground Reference Plane

## 9.2. Test Standard

EN 61000-6-1:2007
(IEC 61000-4-2:2008 Severity Level: 3 / Air Discharge: ±8kV
Level: 2 / Contact Discharge: ±4kV)

## 9.3. Severity Levels and Performance Criterion

9.3.1.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 |

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 equipment.

9.4.3.Let the EUT work in test mode (Inverter Mode, AC Charge Mode, Solar Charge Mode) and test it.

## 9.5. Test Procedure

### 9.5.1. 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.

### 9.5.2. Contact Discharge:

All procedure shall be the same as Section 9.5.1. except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

### 9.5.3. 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.

### 9.5.4. 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.

## 9.6. Test Results

**PASS.**

Please refer to the following page.

# Electrostatic Discharge Test Result

EMTEK (SHENZHEN) CO., LTD.

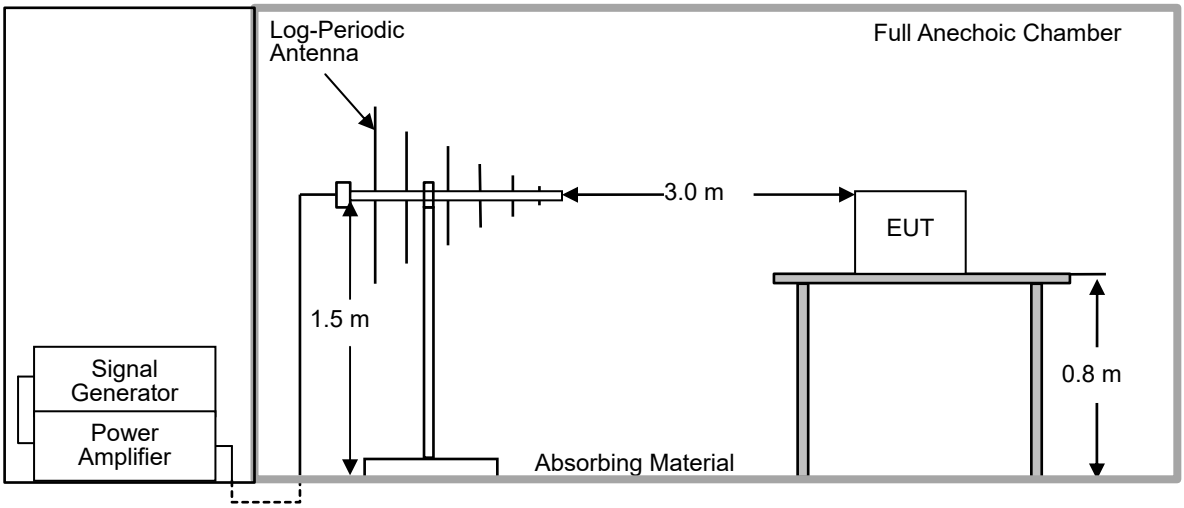
| | | | |
|---|---|---|---|
| Applicant : | SHENZHEN SUNRAY POWER CO., LTD | | |
| EUT : | Inverter | Test Date : | June 06, 2019 |
| M/N : | MPS-V-5000-48 | Temperature : | 24.9℃ |
| Power Supply : | DC 360V, DC 48V for battery, AC 230V/50Hz | Humidity : | 48% |
| Air discharge : | ± 8.0kV | Test ode : | Inverter Mode, AC Charge Mode, Solar Charge Mode |
| Contact discharge: | ± 4.0kV | Criterion : | B |

| **Location** | **Kind** A-Air Discharge C-Contact Discharge | **Result** |
|---|---|---|
| Screw | C | A |
| Metal | C | A |
| Button | A | A |
| Screen | A | A |
| Slot | A | A |
| USB | A | A |
| HCP | C | A |
| VCP of front | C | A |
| VCP of rear | C | A |
| VCP of left | C | A |
| VCP of right | C | A |
| | | |
| | | |

Note:

# 10. RF FIELD STRENGTH SUSCEPTIBILITY TEST

## 10.1.Block Diagram of Test Setup




## 10.2.Test Standard

EN 61000-6-1:2007
(IEC 61000-4-3:2006+A1:2007+A2:2010, Severity Level: 1V/m, 3V/m)

## 10.3.Severity Levels and Performance Criterion

10.3.1.Severity Levels

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

10.3.2.Performance Criterion: A

## 10.4.Operating Condition of EUT

10.4.1.Me Setup the EUT as shown on Section 10.1.

10.4.2.Turn on the power of all equipment.

10.4.3.Let the EUT work in test mode (Inverter Mode, AC Charge Mode, Solar Charge Mode) and test it.

## 10.5.Test Procedure

The EUT is 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 is used to monitor it.
All the scanning conditions are as following:

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

## 10.6.Test Results

**PASS.**

Please refer to the following pages.

# RF Field Strength Susceptibility Test Results

EMTEK (SHENZHEN) CO., LTD.

| | | | |
|---|---|---|---|
| Applicant | : SHENZHEN SUNRAY POWER CO., LTD | | |
| EUT | : Inverter | Test Date | : June 06, 2019 |
| M/N | : MPS-V-5000-48 | Temperature | : 26.5℃ |
| Field Strength | : 3 V/m | Humidity | : 47% |
| Power Supply | : DC 360V, DC 48V for battery, AC 230V/50Hz | Criterion | : A |
| Test Mode | : Inverter Mode, AC Charge Mode, Solar Charge Mode | Frequency Range | : 80 MHz to 1000 MHz<br>1400 MHz to 2000 MHz |

Modulation: ☐ None ☐ Pulse ☒ AM 1kHz 80%

| | Frequency Rang 1: 80~ 1000MHz | | Frequency Rang 2: 1400~ 2000 MHz | |
|---|---|---|---|---|
| Steps | 1% | | | |
| | Horizontal | Vertical | Horizontal | Vertical |
| Front | A | A | A | A |
| Right | A | A | A | A |
| Rear | A | A | A | A |
| Left | A | A | A | A |

Test Equipment **:**
1. Signal Generator : N5181A (Agilent)
2. Power Amplifier : AS0102-55 (MILMEGA) & 80RF1000-175 (MILMEGA) & AS1860-50 (MILMEGA)
3. Log.-Per.Antenna: VULP9118E (SCHWARZBECK)
4. Broad-Band Horn Antenna: STLP 9149 (Schwarzbeck)
5. RF Power Meter. Dual Channel: 4232A (BOONTON)
6. Field Strength Meter: RSS1006A (DARE)

Note:

# RF Field Strength Susceptibility Test Results

EMTEK (SHENZHEN) CO., LTD.

| | | | |
|---|---|---|---|
| Applicant | : SHENZHEN SUNRAY POWER CO., LTD | | |
| EUT | : Inverter | Test Date | : June 06, 2019 |
| M/N | : MPS-V-5000-48 | Temperature | : 26.5℃ |
| Field Strength | : 1 V/m | Humidity | : 47% |
| Power Supply | : DC 360V, DC 48V for battery, AC 230V/50Hz | Criterion | : A |
| Test Mode | : Inverter Mode, AC Charge Mode, Solar Charge Mode | Frequency Range | : 2000 MHz to 2700 MHz |

Modulation: ☐ None ☐ Pulse ☒ AM 1kHz 80%

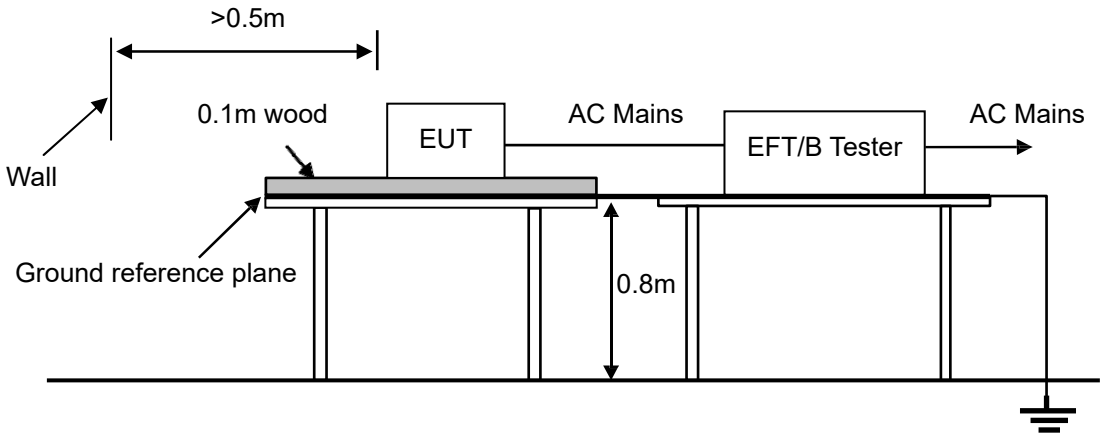
| | Frequency Rang 1: 2000~ 2700 MHz | | Frequency Rang 2: N/A | |
|---|---|---|---|---|
| Steps | 1% | | | |
| | Horizontal | Vertical | Horizontal | Vertical |
| Front | A | A | | |
| Right | A | A | | |
| Rear | A | A | | |
| Left | A | A | | |

Test Equipment **:**
1. Signal Generator : N5181A (Agilent)
2. Power Amplifier : AS0102-55 (MILMEGA) & 80RF1000-175 (MILMEGA) & AS1860-50 (MILMEGA)
3. Log.-Per.Antenna: VULP9118E (SCHWARZBECK)
4. Broad-Band Horn Antenna: STLP 9149 (Schwarzbeck)
5. RF Power Meter. Dual Channel: 4232A (BOONTON)
6. Field Strength Meter: RSS1006A (DARE)

Note:

# 11. ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST

## 11.1.Block Diagram of Test Setup




## 11.2.Test Standard

EN 61000-6-1:2007
(IEC61000-4-4:2012, Severity Level: 2: 1kV, Severity Level: 1: 0.5kV)

## 11.3.Severity Levels and Performance Criterion

11.3.1.Severity level

| Open Circuit Output Test Voltage ±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 |

11.3.2.Performance criterion: B

## 11.4.Operating Condition of EUT

11.4.1.Me Setup the EUT as shown on Section 11.1.

11.4.2.Turn on the power of all equipment.

11.4.3.Let the EUT work in test mode (AC Charge Mode, Solar Charge Mode) and test it.

## 11.5.Test Procedure

The EUT is put on the table that is 0.8meter 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.

11.5.1.For input and output AC power ports:

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

11.5.2.For signal lines and control lines ports:

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

11.5.3.For DC output line ports:

It's unnecessary to test.

## 11.6.Test Results

**PASS.**

Please refer to the following page.

# Electrical Fast Transient/Burst Test Results

EMTEK (SHENZHEN) CO., LTD.

| Standard: ☒ IEC 61000-4-4 | Result: ☒ PASS / ☐ FAIL |
|---|---|

Applicant : SHENZHEN SUNRAY POWER CO., LTD

EUT : Inverter

M/N : MPS-V-5000-48

Input Voltage: DC 360V, AC 230V/50Hz

Criterion : B

Ambient Condition : 25.7 ℃ 49% RH

Operation Mode: AC Charge Mode, Solar Charge Mode

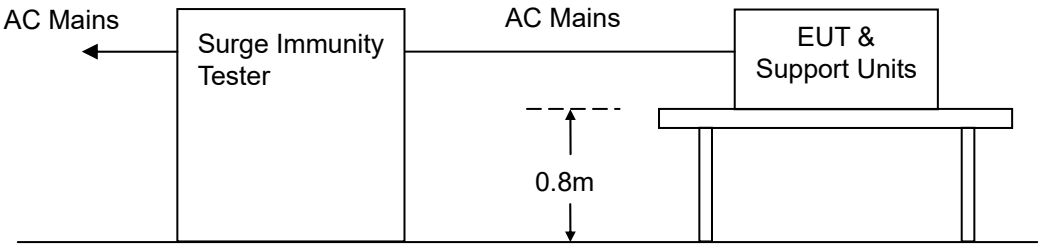
| Line : ☒ AC Mains ☒ DC Mains | Line : ☐ Signal ☐ I/O Cable |
|---|---|
| Coupling : ☒ Direct | Coupling : ☐ Capacitive |
| Test Time : 120s | |

| Line | Test Voltage | Result(+) | Result(-) |
|---|---|---|---|
| L | 1kV | A | A |
| N | 1kV | A | A |
| PE | 1kV | A | A |
| L、N | 1kV | A | A |
| L、PE | 1kV | A | A |
| N、PE | 1kV | A | A |
| L、N、PE | 1kV | A | A |
| Signal Line | | | |
| DC Line | 0.5kV | A | A |

Note:

# 12. SURGE IMMUNITY TEST

## 12.1.Block Diagram of Test Setup




## 12.2.Test Standard

EN 61000-6-1:2007
(IEC 61000-4-5:2014, Severity Level**:** Line to Line: 1.0KV/0.5KV, Line to GND: 2.0KV/1.0KV)

## 12.3.Severity Levels and Performance Criterion

12.3.1.Severity level

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

12.3.2.Performance criterion: B

## 12.4.Operating Condition of EUT

12.4.1.Me Setup the EUT as shown on Section 12.1.

12.4.2.Turn on the power of all equipment.

12.4.3.Let the EUT work in test mode (AC Charge Mode, Solar Charge Mode) and test it.

## 12.5.Test Procedure

1) Set up the EUT and test generator as shown on Section 12.1.2.
2) 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.

## 12.6.Test Results

**PASS.**

Please refer to the following page.

# Surge Immunity Test Result

EMTEK (SHENZHEN) CO., LTD.

Applicant : SHENZHEN SUNRAY POWER CO., LTD

EUT : Inverter

M/N : MPS-V-5000-48

Power Supply : DC 360V, AC 230V/50Hz

Test Mode : AC Charge Mode, Solar Charge Mode

Test Date : June 06, 2019

Temperature : 25.7℃

Humidity : 49%

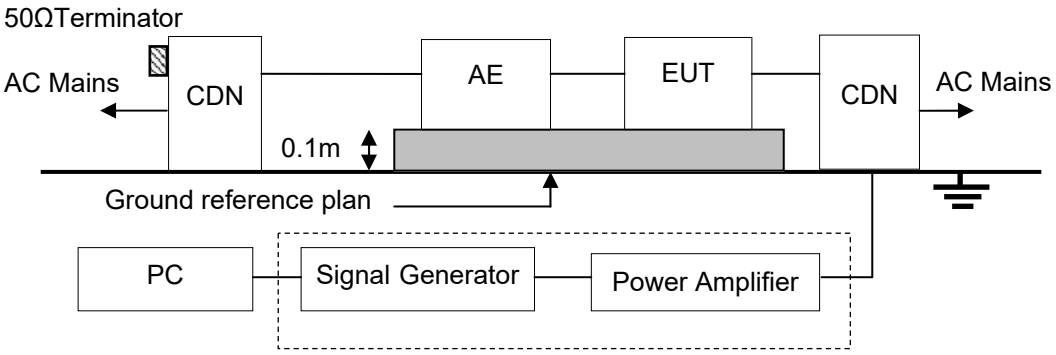
Criterion : B

| Location | Polarity | Phase Angle | Number of Pulse | Pulse Voltage (kV) | Result |
|---|---|---|---|---|---|
| L-N | + | 0˚/90˚ | 5 | 1.0 | A |
| | + | 180˚/270˚ | 5 | 1.0 | A |
| | - | 0˚/90˚ | 5 | 1.0 | A |
| | - | 180˚/270˚ | 5 | 1.0 | A |
| L-PE | + | 0˚/90˚ | 5 | 2.0 | A |
| | + | 180˚/270˚ | 5 | 2.0 | A |
| | - | 0˚/90˚ | 5 | 2.0 | A |
| | - | 180˚/270˚ | 5 | 2.0 | A |
| N-PE | + | 0˚/90˚ | 5 | 2.0 | A |
| | + | 180˚/270˚ | 5 | 2.0 | A |
| | - | 0˚/90˚ | 5 | 2.0 | A |
| | - | 180˚/270˚ | 5 | 2.0 | A |
| P-N | + | | 5 | 0.5 | A |
| | - | | 5 | 0.5 | A |
| P-PE | + | | 5 | 1.0 | A |
| | - | | 5 | 1.0 | A |
| N-PE | + | | 5 | 1.0 | A |
| | - | | 5 | 1.0 | A |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Remark:

# 13. INJECTED CURRENTS SUSCEPTIBILITY TEST

## 13.1.Block Diagram of Test Setup




## 13.2.Test Standard

EN 61000-6-1:2007
(IEC 61000-4-6:2013, Severity Level: Level 2, 3V (r.m.s.), 0.15MHz ~ 80MHz)

## 13.3.Severity Levels and Performance Criterion

13.3.1.Severity level

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

13.3.2.Performance criterion: A

## 13.4.Operating Condition of EUT

13.4.1.Me Setup the EUT as shown on Section 13.1.

13.4.2.Turn on the power of all equipment.

13.4.3.Let the EUT work in test mode (AC Charge Mode, Solar Charge Mode) and test it.

## 13.5.Test Procedure

1) Set up the EUT, CDN and test generators as shown on Section 13.1.2.
2) Let the EUT work in test mode and measure it.
3) The EUT are placed on an insulating support 0.1 m 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 disturbance signal described below is injected to EUT through CDN.
5) The EUT operates within its operational mode(s) under intended climatic conditions after power on.
6) The frequency range is swept from 150kHz to80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave.
7) 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.
8) Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

## 13.6.Test Results

**PASS.**

Please refer to the following page.

# Injected Currents Susceptibility Test Results

EMTEK (SHENZHEN) CO., LTD.

Applicant : SHENZHEN SUNRAY POWER CO., LTD

EUT : Inverter

Test Date: June 06, 2019

M/N : MPS-V-5000-48

Temperature : 25.7℃

Power Supply : DC 360V, AC 230V/50Hz

Humidity : 49%

Test Engineer : LZY

Test Mode: AC Charge Mode, Solar Charge Mode

| Frequency Range (MHz) | Injected Position | Strength (Unmodulated) | Criterion | Result |
|---|---|---|---|---|
| 0.15 ~ 80 | AC Mains | 3V | A | A |
| 0.15 ~ 80 | DC Mains | 3V | A | A |

Test Mode : N/A

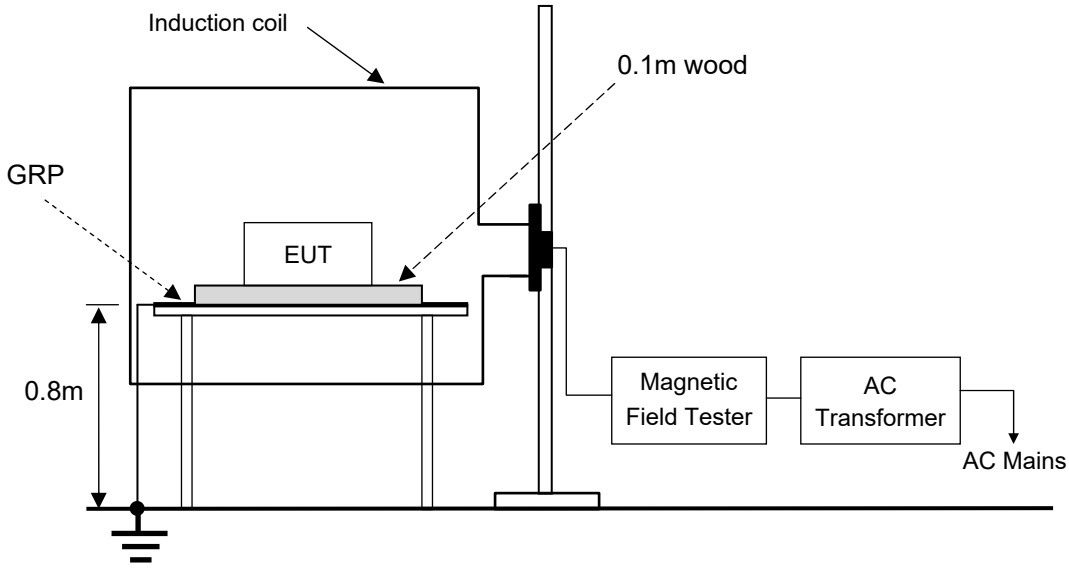
| Frequency Range (MHz) | Injected Position | Strength (Unmodulated) | Criterion | Result |
|---|---|---|---|---|
| | | | | |
| | | | | |

Remark : 1. Modulation Signal:1kHz 80% AM
Measurement Equipment :
Simulator: CWS 500C (SWITZERLAND EMTEST)
CDN : ☐ CDN-M2 (SWITZERLAND EMTEST)
☒ CDN-M3 (SWITZERLAND EMTEST)

Note:

# 14. MAGNETIC FIELD SUSCEPTIBILITY TEST

## 14.1.Block Diagram of Test Setup




GRP: Ground reference plane
EUT: Equipment under test

## 14.2.Test Standard

EN 61000-6-1:2007
(IEC 61000-4-8:2009, Severity Level: Level 2, 3A / m)

## 14.3.Severity Levels and Performance Criterion

### 14.3.1.Severity Levels

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

### 14.3.2.Performance Criterion: A

## 14.4.Operating Condition of EUT

14.4.1.Me Setup the EUT as shown on Section 14.1.

14.4.2.Turn on the power of all equipment.

14.4.3.Let the EUT work in test mode (Inverter Mode, AC Charge Mode, Solar Charge Mode) and test it.

## 14.5.Test Procedure

The EUT is placed in the middle of a induction coil (1*1m), under which is a 1*1*0.8m (high) table, this small table is also placed on a larger table, 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.

## 14.6.Test Results

**PASS.**

Please refer to the following page.

# Magnetic Field Immunity Test Result

EMTEK (SHENZHEN) CO., LTD.

| Standard: ☒ IEC 61000-4-8 | Result: ☒ PASS / ☐ FAIL |
|---|---|

Applicant : SHENZHEN SUNRAY POWER CO., LTD
EUT : Inverter
M/N : MPS-V-5000-48
Input Voltage : DC 360V, DC 48V for battery, AC 230V/50Hz

Date of Test : June 06, 2019 Test Engineer: LZY

Ambient Condition : Temp : 25.7℃ Humid: 49%

Criterion: A

Operation Mode: Inverter Mode, AC Charge Mode, Solar Charge Mode

| Test Level (A/m) | Testing Duration | Coil Orientation | Criterion | Result |
|---|---|---|---|---|
| 3 | 5 mins | X | A | A |
| 3 | 5 mins | Y | A | A |
| 3 | 5 mins | Z | A | A |

Operation Mode: N/A

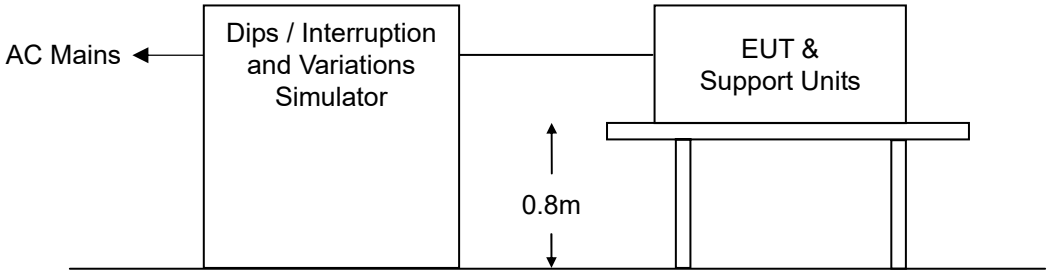
| Test Level (A/m) | Testing Duration | Coil Orientation | Criterion | Result |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

| Test Equipment | Magnetic Field Test: HEAFELY MAG 100.1 |
|---|---|

Note:

# 15. VOLTAGE DIPS AND INTERRUPTIONS TEST

## 15.1.Block Diagram of Test Setup




## 15.2.Test Standard

EN 61000-6-1:2007 (IEC 61000-4-11:2004)

## 15.3.Severity Levels and Performance Criterion

15.3.1.Severity level

| Test Level %UT | Voltage dip and short interruptions %UT | Duration (in period) |
|---|---|---|
| 0 | 100 | 0.5<br>1<br>5<br>10<br>25<br>50<br>* |
| 70 | 30 | |
| 0 | 100 | |

15.3.2.Performance criterion: B&C

## 15.4.Operating Condition of EUT

15.4.1.Me Setup the EUT as shown on Section 15.1.

15.4.2.Turn on the power of all equipment.

15.4.3.Let the EUT work in test mode (AC Charge Mode) and test it.

## 15.5.Test Procedure

1) Set up the EUT and test generator as shown on Section 15.1.2.
2) The interruption is introduced at selected phase angles with specified duration.
3) Record any degradation of performance.

## 15.6.Test Results

**PASS.**

Please refer to the following page.

# Voltage Dips and Interruptions Test Results

EMTEK (SHENZHEN) CO., LTD.

Applicant : SHENZHEN SUNRAY POWER CO., LTD

EUT : Inverter

M/N : MPS-V-5000-48

Power Supply : AC 230V/50Hz

Test Date : June 06, 2019

Temperature : 25.7℃

Humidity : 49%

Test Mode: AC Charge Mode

| Test Level % $U_T$ | Voltage Dips & Short Interruptions % $U_T$ | Duration (in periods) | Criterion ☐A ☒B ☒C ☐D | Result |
|---|---|---|---|---|
| 0 | 100 | 0.5P | B | A |
| 0 | 100 | 1P | B | A |
| 70 | 30 | 25P | C | A |
| 0 | 100 | 250P | C | B |

Test Mode : N/A

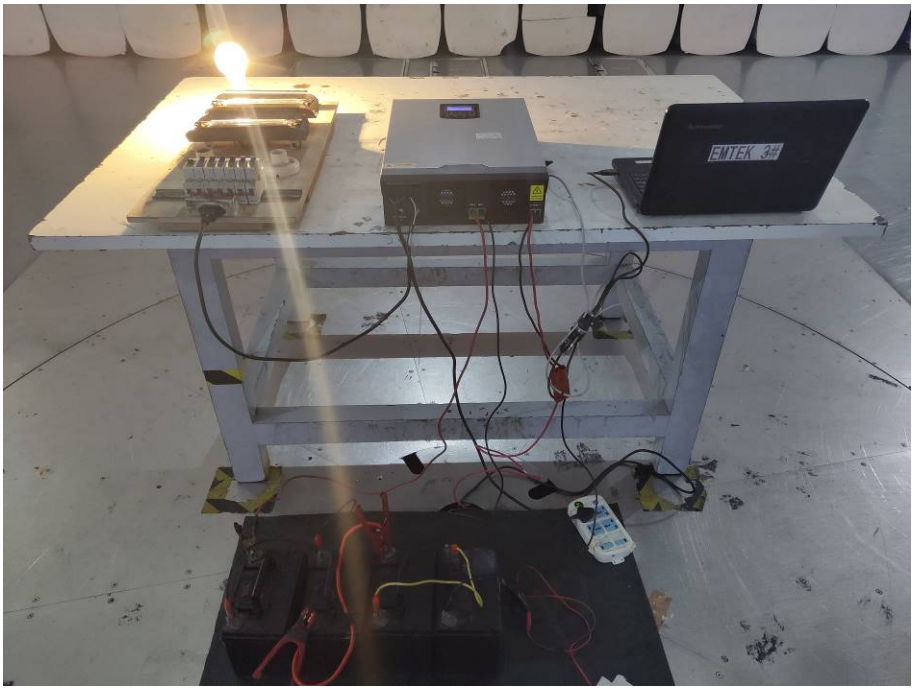
| Test Level % $U_T$ | Voltage Dips & Short Interruptions % $U_T$ | Duration (in periods) | Criterion ☐A ☐B ☐C ☐D | Result |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

Note: Dips to 0%, Duration 250P, EUT stopped operation, but it can be resumed by itself after test.

# 16. PHOTOGRAPHS

## 16.1.Photos of Conducted Emission Measurement

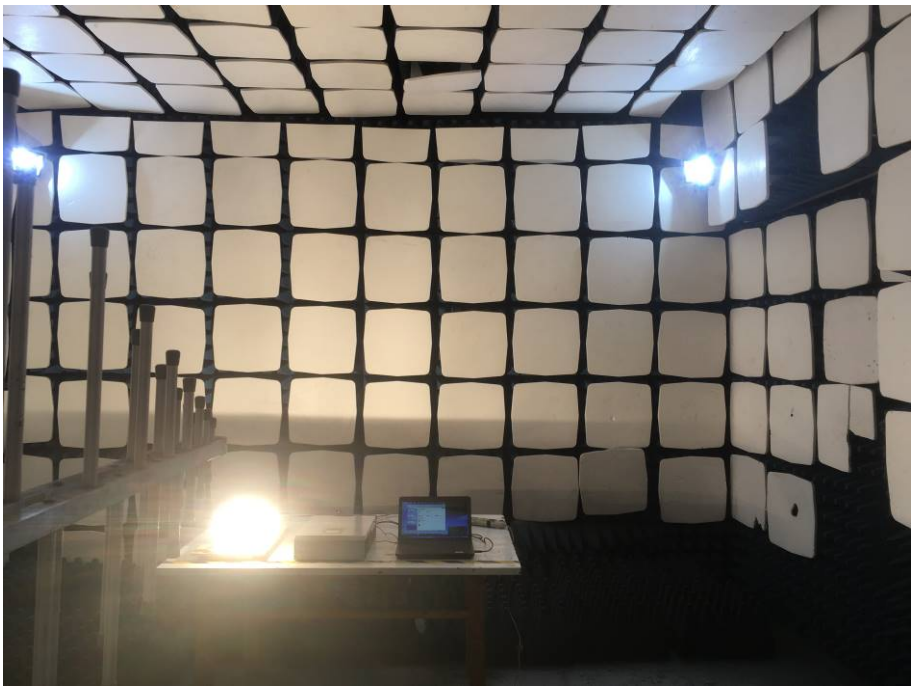

## 16.2.Photos of Radiation Emission Measurement

## 16.3.Photo of Harmonic / Flicker Measurement

## 16.4.Photo of Electrostatic Discharge Test

## 16.5.Photo of RF Field Strength Susceptibility Test



## 16.6.Photo of Electrical Fast Transient / Burst Test

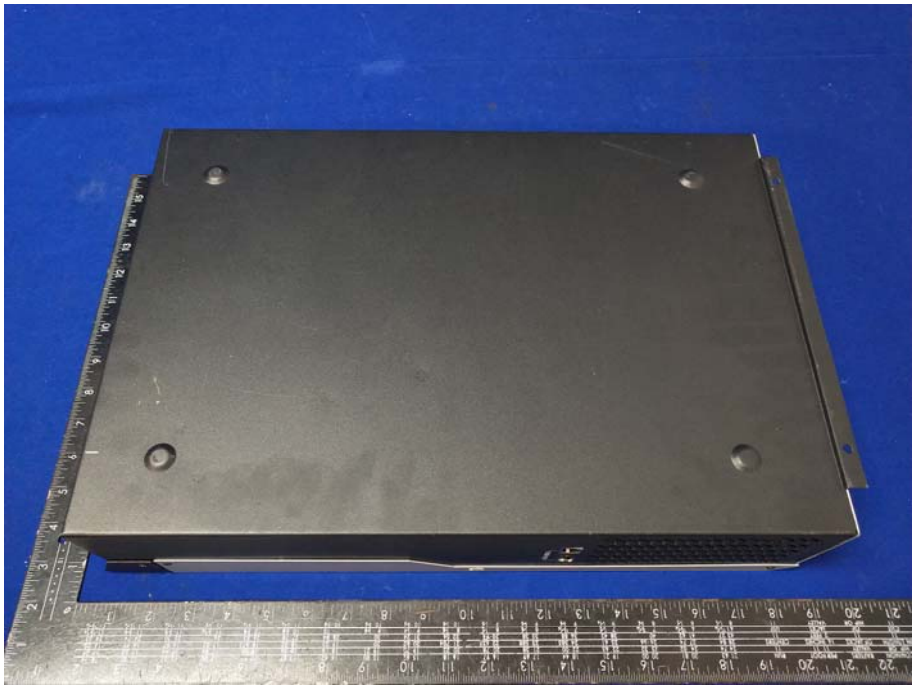
## 16.7.Photo of Surge Test


## 16.8.Photo of Injected Currents Susceptibility Test

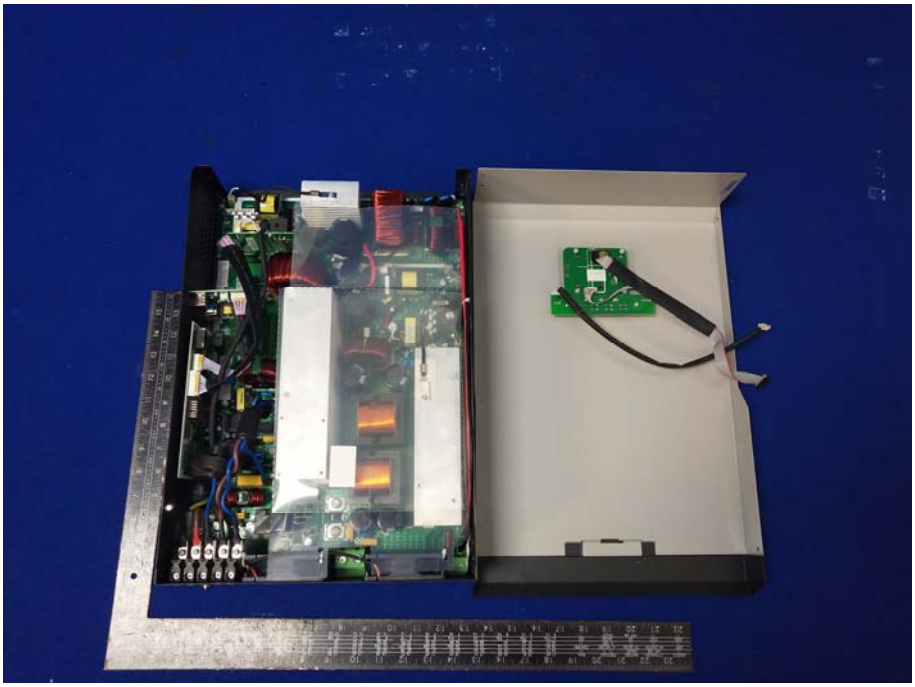
## 16.9.Photo of Magnetic Field Immunity Test

## 16.10.Photo of Voltage Dips and Interruption Immunity Test

# APPENDIX
# (Photos of EUT)




INPUT BREAKER
230VAC~
AC OUT
AC IN



----------The end----------