



# EMC TEST REPORT

Applicant : Shenzhen Lvyou Energy Technology Co., Ltd  
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Manufacturer : Shenzhen Lvyou Energy Technology Co., Ltd  
Address : 103-104, Building 12, Dawangshan 2nd Industrial Zone, Shajing, Baoan District, Shenzhen, Guangdong, China

Factory : Jing Lin Communication Technology Co., Ltd  
Address : No. 8, Pingxiang village Shengping road, Shuibian management district, Hengli town, Dongguan city, Guangdong, China

E.U.T. : PV Microinverter

Brand Name : EFFiSolax

Model No. : ES-800

Standard : EN IEC 61000-6-1: 2019  
EN IEC 61000-6-2: 2019  
EN IEC 61000-6-3: 2021  
EN IEC 61000-6-4: 2019  
EN IEC 61000-3-2: 2019+A1: 2021  
EN 61000-3-3: 2013+A2: 2021

Date of Receiving Samples : Refer to page 4 of the report

Date of Test : Refer to page 4 of the report

Date of Report : October 07, 2023

This Test Report is Issued Under the Authority of :

Prepared by

Fancy Yang / Engineer

Approved & Authorized Signer



Evan Yang / Authorized Signatory

This report shows that above equipment is technically compliant with the requirements of the standards above. All test results in this report apply only to the tested sample(s). Without prior written approval of Shenzhen Nore Testing Center Co., Ltd, this report shall not be reproduced except in full.

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Revision History of This Test Report

| Report Number    | Description        | Issued Date |
|------------------|--------------------|-------------|
| SZNTC2306017EV00 | Initial Issue      | 2023-06-10  |
| SZNTC2309108EV00 | Derivative Version | 2023-09-18  |
| SZNTC2309209EV00 | Derivative Version | 2023-10-07  |
| ---              | ---                | ---         |
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| ---              | ---                | ---         |

Remark:

1. This report is an additional version with original report number SZNTC2309108EV00. Compared with the original report, Change applicant and model.

2. Through evaluation of the above difference, no test is needed, all test data and photos are from the original report.

3. This report is based on report of SZNTC2309108EV00.



## 1.SUMMARY OF TEST RESULTS

The E.U.T. has been tested according to the following specifications:

| EMISSION                                  |                                               |        |                                                            |
|-------------------------------------------|-----------------------------------------------|--------|------------------------------------------------------------|
| Standard                                  | Test Type                                     | Result | Remarks                                                    |
| EN IEC 61000-6-3: 2021                    | Conducted Emission Measurement                | PASS   | Meet the requirements of the Residential Environment Limit |
|                                           | Radiated Emission Measurement                 | PASS   | Meet the requirements of the Residential Environment Limit |
| EN IEC 61000-3-2: 2019+A1: 2021           | Harmonic current emission Measurement         | PASS   | Meets the Class A requirements                             |
| EN 61000-3-3: 2013+A2: 2021               | Voltage Fluctuations & Flicker Measurement    | PASS   | Meets the requirements                                     |
| IMMUNITY (EN IEC 61000-6-2: 2019)         |                                               |        |                                                            |
| Basic Standard                            | Test Type                                     | Result | Results<br>(Performance Criterion)                         |
| IEC 61000-4-2: 2008                       | Electrostatic Discharge Test                  | PASS   | A                                                          |
| IEC 61000-4-3: 2006/<br>A1:2007/ A2: 2010 | Radio-Frequency<br>Electromagnetic Field Test | PASS   | A                                                          |
| IEC 61000-4-4: 2012                       | Fast transients test                          | PASS   | B                                                          |
| IEC 61000-4-5: 2014                       | Surge Test                                    | PASS   | B                                                          |
| IEC 61000-4-6: 2013                       | Radio-Frequency Common<br>Mode Test           | PASS   | A                                                          |
| IEC 61000-4-8: 2009                       | Power-Frequency Magnetic<br>Field Test        | N/A    | See note                                                   |
| IEC 61000-4-11: 2004                      | Voltage dips and interruptions                | PASS   | B                                                          |

Note: Applicable only to equipment containing devices susceptible to magnetic fields.

## 2.TEST UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

| Test item                                                                                                                                                                                                                                                                                                                                        | Uncertainty        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Conducted Emission Measurement                                                                                                                                                                                                                                                                                                                   | $\pm 2.3\text{dB}$ |
| Radiated Emission Measurement<br>(30-1000MHz)                                                                                                                                                                                                                                                                                                    | $\pm 3.9\text{dB}$ |
| <p>Note: As <math>U_{\text{lab}}</math> in all applicable tests listed above are less than <math>U_{\text{CISPR}}</math> according to CISPR 16-4-2.<br/>Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit; non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.</p> |                    |

### 3.GENERAL INFORMATION

#### 3.1.Product Information

|                             |                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E.U.T.:                     | PV Microinverter                                                                                                                                                                                                                                                                                                                                                                                 |
| Main Model No.:             | ES-800                                                                                                                                                                                                                                                                                                                                                                                           |
| E.U.T Type:                 | Industrial Environment & Residential Environment                                                                                                                                                                                                                                                                                                                                                 |
| Typical arrangement:        | Table top                                                                                                                                                                                                                                                                                                                                                                                        |
| Highest Internal Frequency: | Highest internal frequency below 108MHz, radiation test frequency range 30MHz-1000MHz.                                                                                                                                                                                                                                                                                                           |
| Rating:                     | Max. Input Voltage(DC): 55V<br>PV Operating Voltage(DC): 18V-55V<br>Max. Continuous Input Current (DC): 2x14A<br>Nominal Output Voltage (AC): 230V<br>Max. Continuous Output Current (AC): 3.47A<br>Max. Continuous Output Power: 800W<br>Nominal Output Frequency: 50Hz<br>Peak Efficiency: 92%<br>Type of Enclosure: IP67<br>Protective Class: Class I<br>Operating Ambient Temp.: -40°C~+65°C |
| Sample No.:                 | SZNTC2306017EV00-001                                                                                                                                                                                                                                                                                                                                                                             |
| Remark:                     | All the information above are provided by the manufacturer. More detailed feature of the EUT please refers to the user manual.                                                                                                                                                                                                                                                                   |

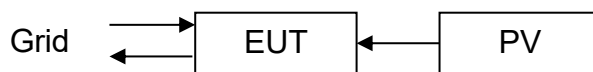
### 3.2.Description of Support Device

| No. | Equipment                       | Manufacturer | M/N     | S/N |
|-----|---------------------------------|--------------|---------|-----|
| 1.  | Photovoltaic simulator software | ACTION       | PRD2006 | /   |

Note: Provided by the laboratory for testing

### 3.3.Block Diagram of Test Setup

(1) Operating mode



Remark: Operating mode to feed into AC grid and/or to discharge from electrical energy storage devices: The PCE shall operate at a rated operation point

### 3.4.Test Mode

| No. | Test Mode      | Remark                                                                        |
|-----|----------------|-------------------------------------------------------------------------------|
| 1.  | Operating mode | After the EUT has PV power supply, the AC output is integrated into the grid. |



### 3.5.Test Conditions

| No. | Test Item                                                          | Test Mode | Test Voltage           | Tested by | Remarks        |
|-----|--------------------------------------------------------------------|-----------|------------------------|-----------|----------------|
| 1.  | Conducted Emission - AC power input port                           | 1         | AC 230V/50Hz<br>PV 36V | LXJ       | See note 1&4   |
| 2.  | Conducted Emission - AC power output port                          | ---       | ---                    | ---       | ---            |
| 3   | Conducted Disturbances - Wired network port or signal/control port | ---       | ---                    | ---       | ---            |
| 4.  | Radiated Emission                                                  | 1         | AC 230V/50Hz<br>PV 36V | PH        | See note 1&4   |
| 5.  | Harmonic Current Emission                                          | 1         | AC 230V/50Hz<br>PV 36V | CRB       | See note 1     |
| 6.  | Voltage Fluctuations & Flicker                                     | 1         | AC 230V/50Hz<br>PV 36V | CRB       | See note 1     |
| 7.  | Electrostatic Discharges (ESD)                                     | 1         | AC 230V/50Hz<br>PV 36V | CRB       | See note 2&3&4 |
| 8.  | Radio-Frequency Electromagnetic Field                              | 1         | AC 230V/50Hz<br>PV 36V | Enpot     | See note 1&3&4 |
| 9.  | Fast transients test                                               | 1         | AC 230V/50Hz<br>PV 36V | CRB       | See note 1&3&4 |
| 10. | Surges                                                             | 1         | AC 230V/50Hz<br>PV 36V | CRB       | See note 1&3&4 |
| 11. | Radio-Frequency Common Mode Test                                   | 1         | AC 230V/50Hz<br>PV 36V | Enpot     | See note 1&3&4 |
| 12. | Power Frequency Magnetic Field                                     | ---       | ---                    | ---       | ---            |
| 13. | Voltage dips and interruptions                                     | 1         | AC 230V/50Hz<br>PV 36V | CRB       | See note 1&3&4 |

**Note:**

1. The testing climatic conditions for temperature, humidity, and atmospheric pressure are within: 15~35°C, 30~70%, 86~106kPa.
  2. The testing climatic conditions for temperature, humidity, and atmospheric pressure are within: 15~35°C, 30~60%, 86~106kPa.
  3. Only the worst data were recorded on the report.
  4. Only the most stringent limits were recorded on the report.
- ( This product is suitable for industrial environment, also suitable for residential environment, we use most stringent standards EN IEC 61000-6-2 and EN IEC 61000-6-3 for testing. )

### 3.6.Sample Calculations

| Conducted Emission                                                                                                                                                                                                                                                                                                             |                  |                   |                 |                 |                |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------|-----------------|-----------------|----------------|----------|
| Freq.<br>(MHz)                                                                                                                                                                                                                                                                                                                 | Factor<br>(dB/m) | Reading<br>(dBuV) | Level<br>(dBuV) | Limit<br>(dBuV) | Margin<br>(dB) | Detector |
| 0.2260                                                                                                                                                                                                                                                                                                                         | 11.56            | 12.50             | 24.06           | 66.00           | -41.94         | AVG      |
| <p>Where,</p> <p>Freq. = Emission frequency in MHz</p> <p>Reading = Spectrum Analyzer/Receiver Reading</p> <p>Factor = Insertion loss of LISN + Cable Loss</p> <p>Level = Reading + Factor</p> <p>Limit = Limit stated in standard</p> <p>Margin = Level - Limit</p> <p>Detector = Reading for Quasi-Peak / Average / Peak</p> |                  |                   |                 |                 |                |          |

| Radiated Emission                                                                                                                                                                                                                                                                                                                                                  |                  |                   |                   |                   |                |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------|-------------------|-------------------|----------------|----------|
| Freq.<br>(MHz)                                                                                                                                                                                                                                                                                                                                                     | Factor<br>(dB/m) | Reading<br>(dBuV) | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Detector |
| 75.9773                                                                                                                                                                                                                                                                                                                                                            | -17.06           | 59.36             | 42.30             | 49.00             | -6.70          | QP       |
| <p>Where,</p> <p>Freq. = Emission frequency in MHz</p> <p>Reading = Spectrum Analyzer/Receiver Reading</p> <p>Factor = Antenna Factor + Cable Loss - Pre-amplifier</p> <p>Level = Reading + Factor</p> <p>Limit = Limit stated in standard</p> <p>Margin = Margin, which calculated by Level - Limit</p> <p>Detector = Reading for Quasi-Peak / Average / Peak</p> |                  |                   |                   |                   |                |          |

3.7.Test Facility

|                                    |                                                                                                                                                                                                                 |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Site:                         | Shenzhen Nore Testing Center Co., Ltd.                                                                                                                                                                          |
| Accreditations and Authorizations: | Listed by CNAS, May 18, 2018<br>The certificate is valid until May 17, 2024<br>The Laboratory has been assessed and proved to be in compliance with CNAS/CL01<br>The Certificate Registration Number is L11038. |
| Test Site Location:                | South, No. 1, Building 10, Maqueling Industrial Zone, Nanshan<br>Shenzhen, Guangdong, 518057, China                                                                                                             |
| Subcontractor:                     | Dongguan Nore Testing Center Co.,Ltd.                                                                                                                                                                           |
| Test Site Location:                | Building D, Gaosheng Science and Technology Park, Hongtu Road,<br>Nancheng District, Dongguan City, Guangdong Province, China                                                                                   |
| Test Items:                        | Radio-Frequency Electromagnetic Field<br>Conducted Radio-Frequency Common Mode Test                                                                                                                             |

3.8.Abnormalities from Standard Conditions

None

## 4.MEASURING DEVICES AND TEST EQUIPMENT

### 4.1.For Conducted Emission Measurement

| Item | Equipment     | Manufacturer    | Model No.               | Serial No. | Last Cal.     | Cal. Interval |
|------|---------------|-----------------|-------------------------|------------|---------------|---------------|
| 1.   | Test Receiver | Rohde & Schwarz | ESCI-3                  | 100120     | Mar. 24, 2023 | 1 Year        |
| 2.   | L.I.S.N       | Rohde & Schwarz | ESH3-Z5                 | 100157     | Mar. 24, 2023 | 1 Year        |
| 3.   | L.I.S.N       | SCHWARZBECK     | NNLK8129                | 8129-212   | Mar. 24, 2023 | 1 Year        |
| 4.   | L.I.S.N       | SCHWARZBECK     | PVDC 8301               | 8301-0083  | Jun. 01, 2023 | 1 Year        |
| 5.   | PULSE LIMITER | SCHWARZBECK     | VTSD9561-F              | 443        | Mar. 24, 2023 | 1 Year        |
| 6.   | Test Software | EZ              | EZ-EMC<br>(Ver. CT3A11) | N/A        | N/A           | N/A           |

### 4.2.For Radiated Emission Measurement

| Item | Equipment                     | Manufacturer    | Model No.               | Serial No. | Last Cal.     | Cal. Interval |
|------|-------------------------------|-----------------|-------------------------|------------|---------------|---------------|
| 1.   | Test Receiver                 | Rohde & Schwarz | ESPI-7                  | 100006     | Mar. 24, 2023 | 1 Year        |
| 2.   | Loop Antenna                  | ZHINAN          | ZN30900C                | 16036      | Apr. 09, 2022 | 2 Year        |
| 3.   | Composite logarithmic antenna | SCHAFFNER       | CBL6112B                | 2625       | Apr. 09, 2022 | 2 Year        |
| 4.   | Horn Antenna                  | SCHWARZBECK     | BBHA 9120 D             | 01884      | Apr. 09, 2022 | 2 Year        |
| 5.   | Power Amplifier               | HP              | HP 8447D                | 2443A04646 | Mar. 24, 2023 | 1 Year        |
| 6.   | Power Amplifier               | KSYET           | PAM-118                 | 443007     | Mar. 24, 2023 | 1 Year        |
| 7.   | Test Software                 | EZ              | EZ-EMC<br>(Ver. CT3A11) | N/A        | N/A           | N/A           |

### 4.3.For Harmonic Current/ Flicker Measurement

| Item | Equipment                        | Manufacturer            | Model No.     | Serial No. | Last Cal.     | Cal. Interval |
|------|----------------------------------|-------------------------|---------------|------------|---------------|---------------|
| 1.   | Harmonics Flicker Power Analyser | LAPLACE INSTRUMENTS LTD | AS 2000A      | N/A        | Mar. 24, 2023 | 1 Year        |
| 2.   | AC Power Source                  | Sophpower               | HHF 5010      | N/A        | Mar. 24, 2023 | 1 Year        |
| 3.   | Software                         | HTEC                    | Harmonic V1.2 | N/A        | N/A           | N/A           |

### 4.4.For Electrostatic Discharge Test

| Item | Equipment  | Manufacturer | Model No. | Serial No. | Last Cal.     | Cal. Interval |
|------|------------|--------------|-----------|------------|---------------|---------------|
| 1.   | ESD Tester | HAEFELY      | ONYX16    | 1811981    | Mar. 27, 2023 | 1 Year        |

#### 4.5.For Voltage Dips and Interruptions Test

| Item | Equipment      | Manufacturer | Model No.        | Serial No. | Last Cal.     | Cal. Interval |
|------|----------------|--------------|------------------|------------|---------------|---------------|
| 1.   | Dips Tester    | HAEFELY      | AXOS5            | 177723     | Mar. 24, 2023 | 1 Year        |
| 2.   | Dips Modulator | N/A          | N/A              | N/A        | N/A           | N/A           |
| 3.   | Test Soft      | VNC          | VNC Viewer 5.0.5 | N/A        | N/A           | N/A           |

#### 4.6.For Radio-Frequency Electromagnetic Field Test (Dongguan Nore Testing Center Co., Ltd.)

| Item | Equipment        | Manufacturer    | Model No.       | Serial No. | Last Cal.     | Cal. Interval |
|------|------------------|-----------------|-----------------|------------|---------------|---------------|
| 1.   | Signal Generator | Agilent         | N5181A          | MY47070160 | Mar. 13, 2023 | 1 Year        |
| 2.   | RF Switch        | SKET            | N/A             | N/A        | N/A           | N/A           |
| 3.   | Power Amplifier  | SKET            | HAP801000M_250W | 201804008  | N/A           | N/A           |
| 4.   | Power Amplifier  | SKET            | HAP0103G_75W    | 201804009  | N/A           | N/A           |
| 5.   | Power Amplifier  | SKET            | HAP0306G_50W    | 201804010  | N/A           | N/A           |
| 6.   | Power Meter      | Agilent         | E4419B          | GB40201469 | Mar. 13, 2023 | 1 Year        |
| 7.   | Power Sensor     | Agilent         | E9304A          | MY41498919 | Mar. 13, 2023 | 1 Year        |
| 8.   | Power Sensor     | Agilent         | E9300A          | US39211259 | Mar. 13, 2023 | 1 Year        |
| 9.   | E-Field Probe    | Narda           | EP-601          | N/A        | Mar. 23, 2023 | 1 Year        |
| 10.  | Antenna          | Schwarzbeck     | STLP 9129       | 9129071    | N/A           | N/A           |
| 11.  | Audio Analyzer   | Rohde & Schwarz | UPV             | 100894     | Mar. 13, 2023 | 1 Year        |
| 12.  | Test Software    | SKET            | SKET_RS         | N/A        | N/A           | N/A           |

#### 4.7.For Electrical Fast Transient-Burst Test

| Item | Equipment      | Manufacturer | Model No.        | Serial No. | Last Cal.     | Cal. Interval |
|------|----------------|--------------|------------------|------------|---------------|---------------|
| 1.   | Burst Tester   | HAEFELY      | AXOS5            | 177723     | Mar. 24, 2023 | 1 Year        |
| 2.   | Coupling Clamp | HAEFELY      | N/A              | N/A        | Mar. 24, 2023 | 1 Year        |
| 3.   | Test Software  | VNC          | VNC Viewer 5.0.5 | N/A        | N/A           | N/A           |

#### 4.8.For Surge Test

| Item | Equipment     | Manufacturer | Model No.        | Serial No. | Last Cal.     | Cal. Interval |
|------|---------------|--------------|------------------|------------|---------------|---------------|
| 1.   | Surge Tester  | HAEFELY      | AXOS5            | 177723     | Mar. 24, 2023 | 1 Year        |
| 2.   | Test Software | VNC          | VNC Viewer 5.0.5 | N/A        | N/A           | N/A           |

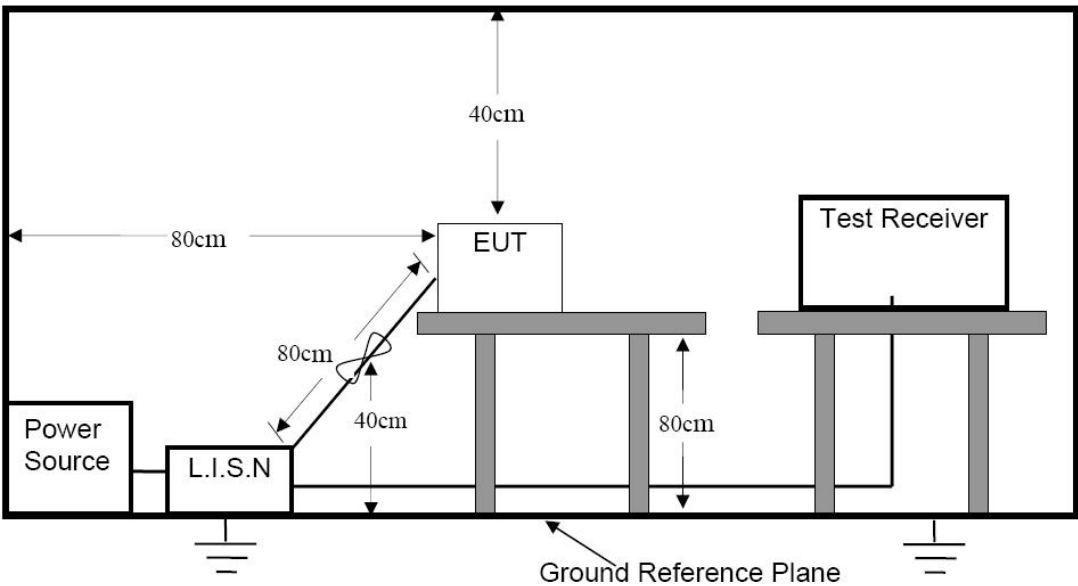
#### 4.9.For Conducted Radio-Frequency Common Mode Test (Dongguan Nore Testing Center Co., Ltd.)

| Item | Equipment             | Manufacturer    | Model No.  | Serial No. | Last Cal.     | Cal. Interval |
|------|-----------------------|-----------------|------------|------------|---------------|---------------|
| 1.   | Signal generator      | IFR             | 2023A      | 2023051280 | Mar. 13, 2023 | 1 Year        |
| 2.   | Power Amplifier       | SCHAFFNER       | CBA9425    | 1022       | Mar. 13, 2023 | 1 Year        |
| 3.   | 6dB 50Watt Attenuator | SCHAFFNER       | ATN6025    | N/A        | Mar. 13, 2023 | 1 Year        |
| 4.   | CDN                   | Lioncel         | CDN-M3-16  | 0170703    | Mar. 13, 2023 | 1 Year        |
| 5.   | CDN                   | Lioncel         | CDN-M2-16  | 0170708    | Mar. 13, 2023 | 1 Year        |
| 6.   | CDN                   | CDSI            | ADN-M5/AF5 | 8105001    | Mar. 13, 2023 | 1 Year        |
| 7.   | EM Clamp              | CDSI            | EMCL-22    | 8192007    | Mar. 13, 2023 | 1 Year        |
| 8.   | Directional Coupler   | SCHAFFNER       | 255        | 19184      | Mar. 13, 2023 | 1 Year        |
| 9.   | Audio Analyzer        | Rohde & Schwarz | UPV        | 100894     | Mar. 13, 2023 | 1 Year        |
| 10.  | Test Software         | EZ              | EZ_CS      | N/A        | N/A           | N/A           |



## 5.CONDUCTED EMISSION MEASUREMENT

### 5.1.Block Diagram of Test Setup



### 5.2.Limit of Conducted Emission Measurement

#### ☒ Residential Environment Limit

| Frequency range<br><br>MHz                                          | Limits dB (µV)                                    |                       |                                                   |         |                                          |                       | Detector<br>type<br>/<br>bandwidth |
|---------------------------------------------------------------------|---------------------------------------------------|-----------------------|---------------------------------------------------|---------|------------------------------------------|-----------------------|------------------------------------|
|                                                                     | <input checked="" type="checkbox"/> AC Mains Port |                       | <input checked="" type="checkbox"/> DC Power Port |         | <input type="checkbox"/> Other Wire Port |                       |                                    |
|                                                                     | Quasi-peak                                        | Average               | Quasi-peak                                        | Average | Quasi-peak                               | Average               |                                    |
| 0,15 to 0,50 <sup>b</sup>                                           | 66 to 56 <sup>a</sup>                             | 56 to 46 <sup>a</sup> | 79                                                | 66      | 84 to 74 <sup>a</sup>                    | 74 to 64 <sup>a</sup> | 9 kHz                              |
| 0,50 to 5,0 <sup>b</sup>                                            | 56                                                | 46                    | 73                                                | 60      | 74                                       | 64                    |                                    |
| 5,0 to 30,0                                                         | 60                                                | 50                    |                                                   |         |                                          |                       |                                    |
| a The limits decrease linearly with the logarithm of the frequency. |                                                   |                       |                                                   |         |                                          |                       |                                    |
| b The lower limit shall apply at the transition frequency.          |                                                   |                       |                                                   |         |                                          |                       |                                    |

#### ☐ Industrial Environment Limit

| Frequency range<br><br>MHz                                          | Limits dB (µV)                         |         |                                        |         |                                          |                       |                                    |
|---------------------------------------------------------------------|----------------------------------------|---------|----------------------------------------|---------|------------------------------------------|-----------------------|------------------------------------|
|                                                                     | <input type="checkbox"/> AC Mains Port |         | <input type="checkbox"/> DC Power Port |         | <input type="checkbox"/> Other Wire Port |                       | Detector<br>type<br>/<br>bandwidth |
|                                                                     | Quasi-peak                             | Average | Quasi-peak                             | Average | Quasi-peak                               | Average               |                                    |
| 0,15 to 0,50 <sup>b</sup>                                           | 79                                     | 66      | 89                                     | 76      | 97 to 87 <sup>a</sup>                    | 84 to 74 <sup>a</sup> | 9 kHz                              |
| 0,50 to 30,0                                                        | 73                                     | 60      | 83                                     | 70      | 87                                       | 74                    |                                    |
| a The limits decrease linearly with the logarithm of the frequency. |                                        |         |                                        |         |                                          |                       |                                    |
| b The lower limit shall apply at the transition frequency.          |                                        |         |                                        |         |                                          |                       |                                    |

---

### 5.3.Test Procedure

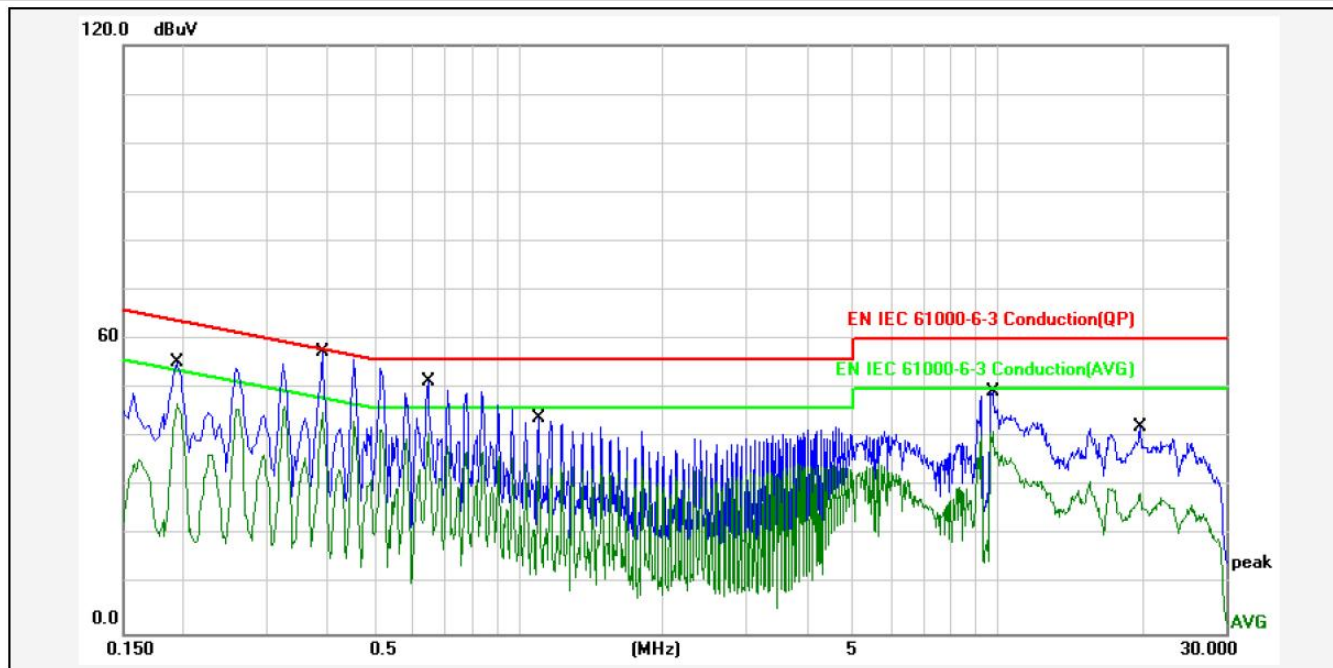
- a. The EUT was placed on a wooden table 0.8m height from the metal ground plan and 0.4m from the conducting wall of the shielding room and it was kept at 0.8m from any other grounded conducting surface.
- b. Configure the EUT and support devices as per section 5.1.
- c. All cables and support devices were positioned as per EN IEC 61000-6-3.
- d. Connect mains power port of the EUT to a line impedance stabilization network (LISN). Wired network port to Asymmetric Artificial Network (AAN).
- e. Connect all support devices to the other LISN and AAN, if needed.
- f. Turn on the EUT and all support devices, and make it run stably.
- g. Set the detector and measurement bandwidth of test-receiver system as per EN IEC 61000-6-3.
- h. Scan the frequency range from 150KHz to 30MHz at each side of AC line for conducted interference checking
- i. Repeat the above scans in each mode and record the test data.

### 5.4.Test Results

**PASS.**

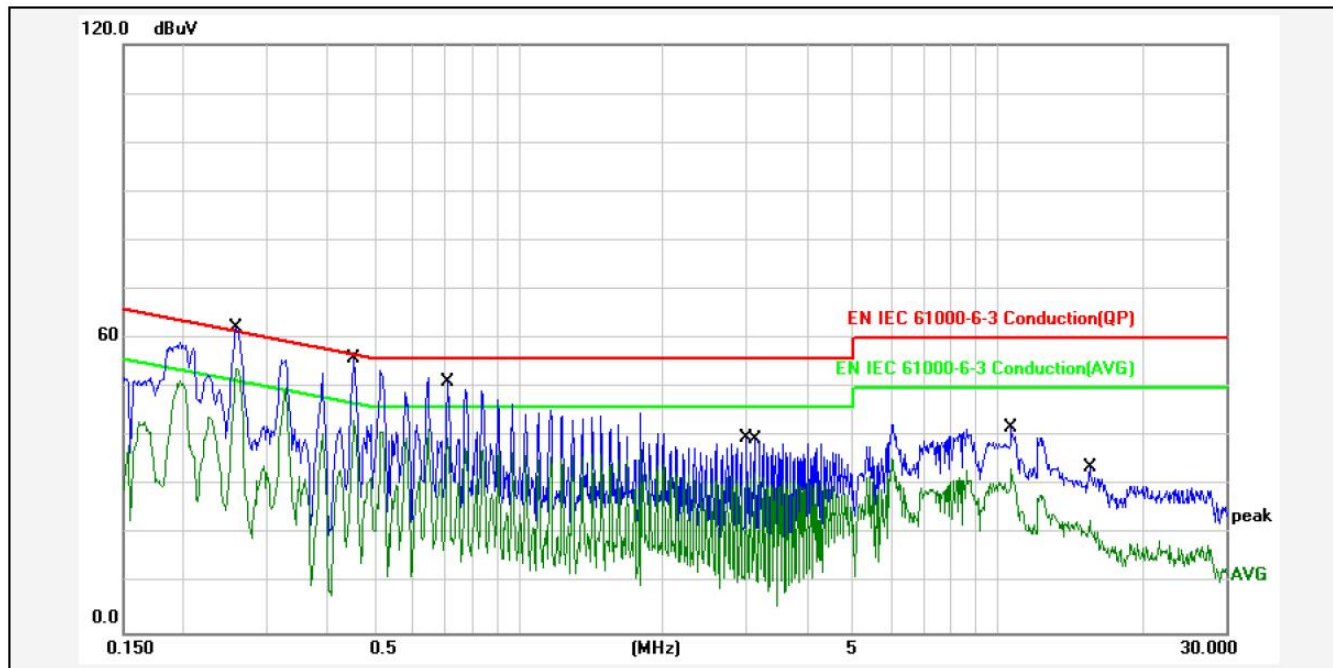
Please refer to the following pages.

|              |                  |                    |              |
|--------------|------------------|--------------------|--------------|
| E.U.T:       | PV Microinverter | Model Name :       | ES-800       |
| Temperature: | 26℃              | Relative Humidity: | 60%          |
| Pressure:    | 1011hPa          | Test Voltage:      | AC 230V/50Hz |
| Test Mode:   | Operating mode   | Phase:             | Line 1       |
| Remark:      | AC Port          | Test Date:         | 2023-06-06   |



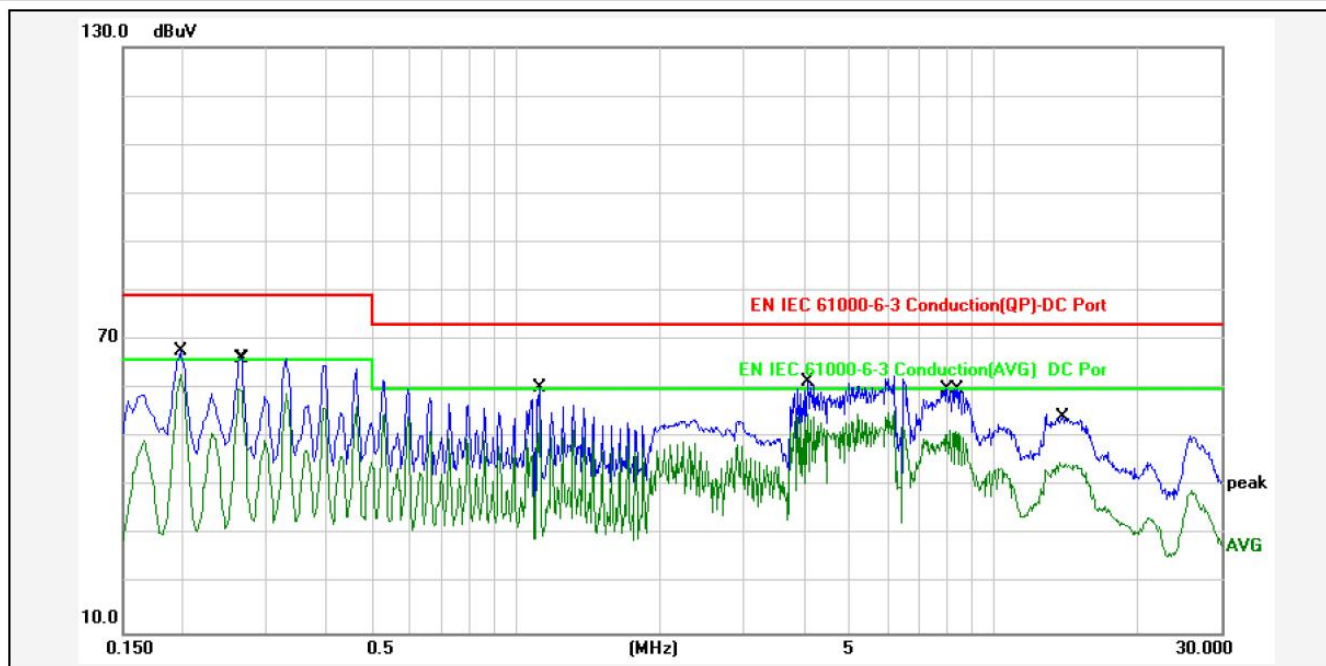
| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F | Remark |
|-----|-----------------|-------------|----------------|--------------|--------------|-------------|----------|-----|--------|
| 1   | 0.1932          | 11.39       | 41.81          | 53.20        | 63.89        | -10.69      | QP       | P   |        |
| 2   | 0.1932          | 11.39       | 34.81          | 46.20        | 53.89        | -7.69       | AVG      | P   |        |
| 3   | 0.3891          | 11.52       | 44.08          | 55.60        | 58.08        | -2.48       | QP       | P   |        |
| 4   | 0.3891          | 11.52       | 31.48          | 43.00        | 48.08        | -5.08       | AVG      | P   |        |
| 5   | 0.6471          | 11.55       | 40.35          | 51.90        | 56.00        | -4.10       | QP       | P   |        |
| 6   | 0.6471          | 11.55       | 27.95          | 39.50        | 46.00        | -6.50       | AVG      | P   |        |
| 7   | 1.1052          | 11.62       | 29.58          | 41.20        | 56.00        | -14.80      | QP       | P   |        |
| 8   | 1.1052          | 11.62       | 20.88          | 32.50        | 46.00        | -13.50      | AVG      | P   |        |
| 9   | 9.7566          | 11.83       | 35.77          | 47.60        | 60.00        | -12.40      | QP       | P   |        |
| 10  | 9.7566          | 11.83       | 30.07          | 41.90        | 50.00        | -8.10       | AVG      | P   |        |
| 11  | 19.8445         | 11.96       | 27.54          | 39.50        | 60.00        | -20.50      | QP       | P   |        |
| 12  | 19.8445         | 11.96       | 15.94          | 27.90        | 50.00        | -22.10      | AVG      | P   |        |

|              |                  |                    |              |
|--------------|------------------|--------------------|--------------|
| E.U.T:       | PV Microinverter | Model Name :       | ES-800       |
| Temperature: | 26℃              | Relative Humidity: | 60%          |
| Pressure:    | 1011hPa          | Test Voltage:      | AC 230V/50Hz |
| Test Mode:   | Operating mode   | Phase:             | Neutral      |
| Remark:      | AC Port          | Test Date:         | 2023-06-06   |



| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F | Remark |
|-----|-----------------|-------------|----------------|--------------|--------------|-------------|----------|-----|--------|
| 1   | 0.2575          | 11.46       | 47.14          | 58.60        | 61.51        | -2.91       | QP       | P   |        |
| 2   | 0.2575          | 11.46       | 37.44          | 48.90        | 51.51        | -2.61       | AVG      | P   |        |
| 3   | 0.4539          | 11.52       | 41.88          | 53.40        | 56.80        | -3.40       | QP       | P   |        |
| 4   | 0.4539          | 11.52       | 29.78          | 41.30        | 46.80        | -5.50       | AVG      | P   |        |
| 5   | 0.7118          | 11.57       | 39.63          | 51.20        | 56.00        | -4.80       | QP       | P   |        |
| 6   | 0.7118          | 11.57       | 28.23          | 39.80        | 46.00        | -6.20       | AVG      | P   |        |
| 7   | 2.9933          | 11.70       | 27.90          | 39.60        | 56.00        | -16.40      | QP       | P   |        |
| 8   | 3.1065          | 11.71       | 20.69          | 32.40        | 46.00        | -13.60      | AVG      | P   |        |
| 9   | 10.6760         | 11.84       | 29.86          | 41.70        | 60.00        | -18.30      | QP       | P   |        |
| 10  | 10.6760         | 11.84       | 21.56          | 33.40        | 50.00        | -16.60      | AVG      | P   |        |
| 11  | 15.5519         | 11.89       | 21.91          | 33.80        | 60.00        | -26.20      | QP       | P   |        |
| 12  | 15.5519         | 11.89       | 11.01          | 22.90        | 50.00        | -27.10      | AVG      | P   |        |

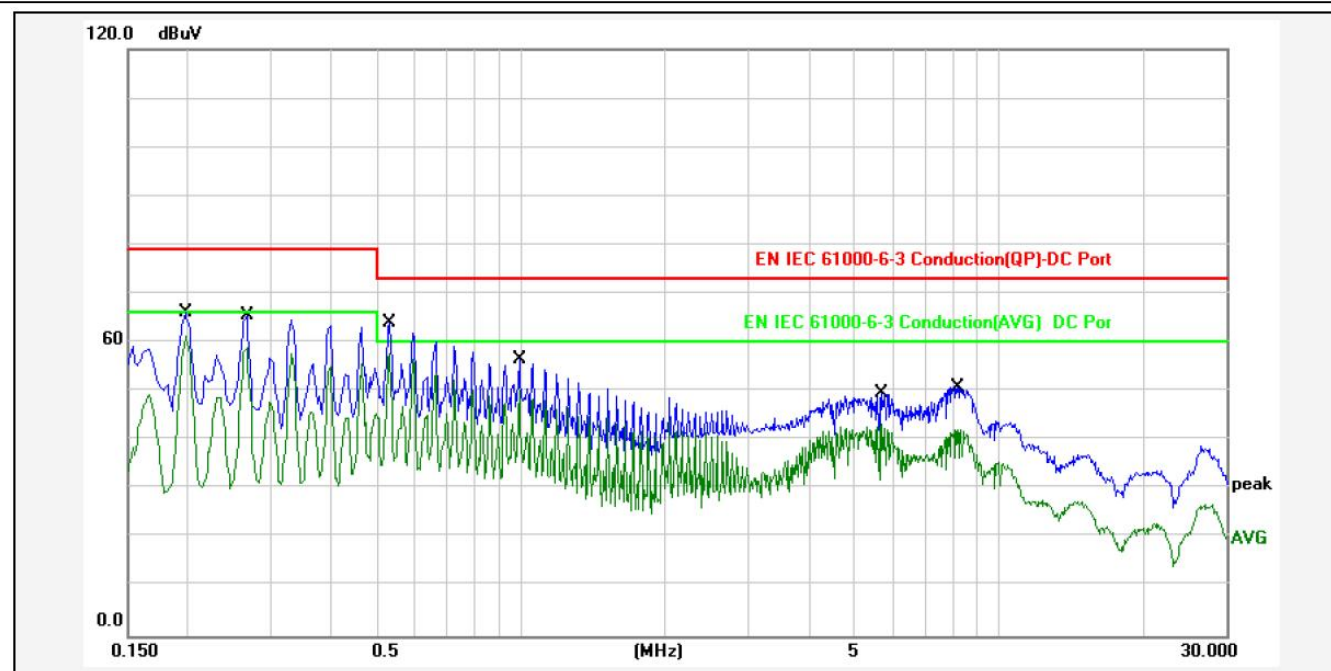
|              |                  |                    |               |
|--------------|------------------|--------------------|---------------|
| E.U.T:       | PV Microinverter | Model Name :       | ES-800        |
| Temperature: | 26℃              | Relative Humidity: | 60%           |
| Pressure:    | 1011hPa          | Test Voltage:      | PV 36V        |
| Test Mode:   | Operating mode   | Phase:             | Positive pole |
| Remark:      | PV Port          | Test Date:         | 2023-06-06    |



| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F | Remark |
|-----|-----------------|-------------|----------------|--------------|--------------|-------------|----------|-----|--------|
| 1   | 0.1980          | 28.99       | 38.61          | 67.60        | 79.00        | -11.40      | QP       | P   |        |
| 2   | 0.1980          | 28.99       | 33.91          | 62.90        | 66.00        | -3.10       | AVG      | P   |        |
| 3   | 0.2620          | 28.88       | 31.02          | 59.90        | 66.00        | -6.10       | AVG      | P   |        |
| 4   | 0.2660          | 28.88       | 37.52          | 66.40        | 79.00        | -12.60      | QP       | P   |        |
| 5   | 1.1220          | 28.82       | 31.28          | 60.10        | 73.00        | -12.90      | QP       | P   |        |
| 6   | 1.1220          | 28.82       | 24.78          | 53.60        | 60.00        | -6.40       | AVG      | P   |        |
| 7   | 4.0858          | 28.99       | 32.41          | 61.40        | 73.00        | -11.60      | QP       | P   |        |
| 8   | 4.0858          | 28.99       | 25.71          | 54.70        | 60.00        | -5.30       | AVG      | P   |        |
| 9   | 8.0739          | 29.32       | 22.08          | 51.40        | 60.00        | -8.60       | AVG      | P   |        |
| 10  | 8.4059          | 29.35       | 30.65          | 60.00        | 73.00        | -13.00      | QP       | P   |        |
| 11  | 13.7099         | 29.96       | 14.94          | 44.90        | 60.00        | -15.10      | AVG      | P   |        |
| 12  | 13.9699         | 29.99       | 24.11          | 54.10        | 73.00        | -18.90      | QP       | P   |        |



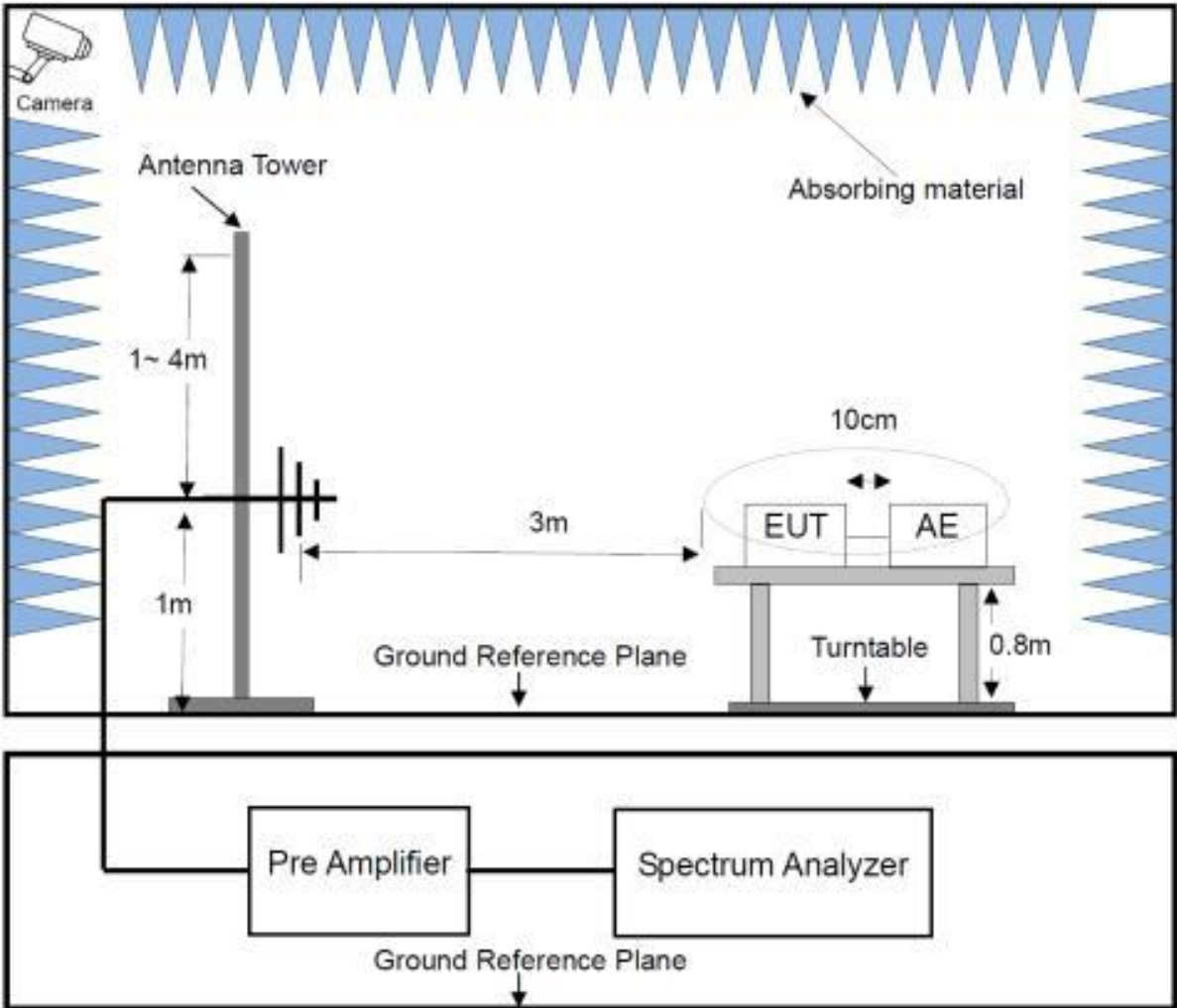
|              |                  |                    |                    |
|--------------|------------------|--------------------|--------------------|
| E.U.T:       | PV Microinverter | Model Name :       | ES-800             |
| Temperature: | 26℃              | Relative Humidity: | 60%                |
| Pressure:    | 1011hPa          | Test Voltage:      | PV 36V             |
| Test Mode:   | Operating mode   | Phase:             | Negative electrode |
| Remark:      | PV Port          | Test Date:         | 2023-06-06         |



| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F | Remark |
|-----|-----------------|-------------|----------------|--------------|--------------|-------------|----------|-----|--------|
| 1   | 0.1980          | 28.99       | 37.11          | 66.10        | 79.00        | -12.90      | QP       | P   |        |
| 2   | 0.1980          | 28.99       | 32.31          | 61.30        | 66.00        | -4.70       | AVG      | P   |        |
| 3   | 0.2660          | 28.88       | 36.52          | 65.40        | 79.00        | -13.60      | QP       | P   |        |
| 4   | 0.2660          | 28.88       | 30.02          | 58.90        | 66.00        | -7.10       | AVG      | P   |        |
| 5   | 0.5299          | 28.83       | 35.17          | 64.00        | 73.00        | -9.00       | QP       | P   |        |
| 6   | 0.5299          | 28.83       | 27.37          | 56.20        | 60.00        | -3.80       | AVG      | P   |        |
| 7   | 0.9899          | 28.82       | 27.58          | 56.40        | 73.00        | -16.60      | QP       | P   |        |
| 8   | 0.9899          | 28.82       | 21.28          | 50.10        | 60.00        | -9.90       | AVG      | P   |        |
| 9   | 5.7099          | 29.12       | 20.38          | 49.50        | 73.00        | -23.50      | QP       | P   |        |
| 10  | 5.7099          | 29.12       | 14.18          | 43.30        | 60.00        | -16.70      | AVG      | P   |        |
| 11  | 8.2179          | 29.34       | 21.46          | 50.80        | 73.00        | -22.20      | QP       | P   |        |
| 12  | 8.2179          | 29.34       | 12.76          | 42.10        | 60.00        | -17.90      | AVG      | P   |        |

## 6.RADIATED EMISSION MEASUREMENT

### 6.1.Block Diagram of Test Setup



### 6.2.Limit of Radiated Emission Measurement

☒ Below 1 GHz:

| Frequency range<br>MHz | Quasi-peak limits<br>dB(μV/m)                                  |                                                    | Distance<br>m | Detector type<br>/<br>Bandwidth |
|------------------------|----------------------------------------------------------------|----------------------------------------------------|---------------|---------------------------------|
|                        | <input checked="" type="checkbox"/> Residential<br>Environment | <input type="checkbox"/> Industrial<br>Environment |               |                                 |
| 30 to 230              | 40                                                             | 50                                                 | 3             | 120 KHz                         |
| 230 to 1000            | 47                                                             | 57                                                 | 3             | 120 KHz                         |

Note: The lower limit shall apply at the transition frequency.



☐ Above 1 GHz:

| Frequency range<br>MHz | <input type="checkbox"/> Residential Environment |                | <input type="checkbox"/> Industrial Environment |                | Distance<br>m | Detector type<br>/<br>Bandwidth |
|------------------------|--------------------------------------------------|----------------|-------------------------------------------------|----------------|---------------|---------------------------------|
|                        | Peak limits                                      | Average limits | Peak limits                                     | Average limits |               |                                 |
|                        | dB(μV/m)                                         | dB(μV/m)       | dB(μV/m)                                        | dB(μV/m)       |               |                                 |
| 1000 to 3000           | 76                                               | 56             | 70                                              | 50             | 3             | 1MHz                            |
| 3000 to 6000           | 80                                               | 60             | 74                                              | 54             | 3             | 1MHz                            |

Required highest frequency for radiated measurement

| Highest internal frequency* ( $F_x$ )        |                                                                                                                       | Highest measured frequency              |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| $F_x \leq 108 \text{ MHz}$                   |                                                                                                                       | 1 GHz                                   |
| $108 \text{ MHz} < F_x \leq 500 \text{ MHz}$ |                                                                                                                       | 2 GHz                                   |
| $500 \text{ MHz} < F_x \leq 1 \text{ GHz}$   |                                                                                                                       | 5 GHz                                   |
| $F_x > 1 \text{ GHz}$                        |                                                                                                                       | $5 \times F_x$ up to a maximum of 6 GHz |
| Note                                         | 1. $F_x$ is highest fundamental frequency generated or used within the EUT or highest frequency at which it operates. |                                         |
|                                              | 2. Where the $F_x$ is not known, tests are performed up to 6 GHz.                                                     |                                         |

### 6.3.Test Procedure

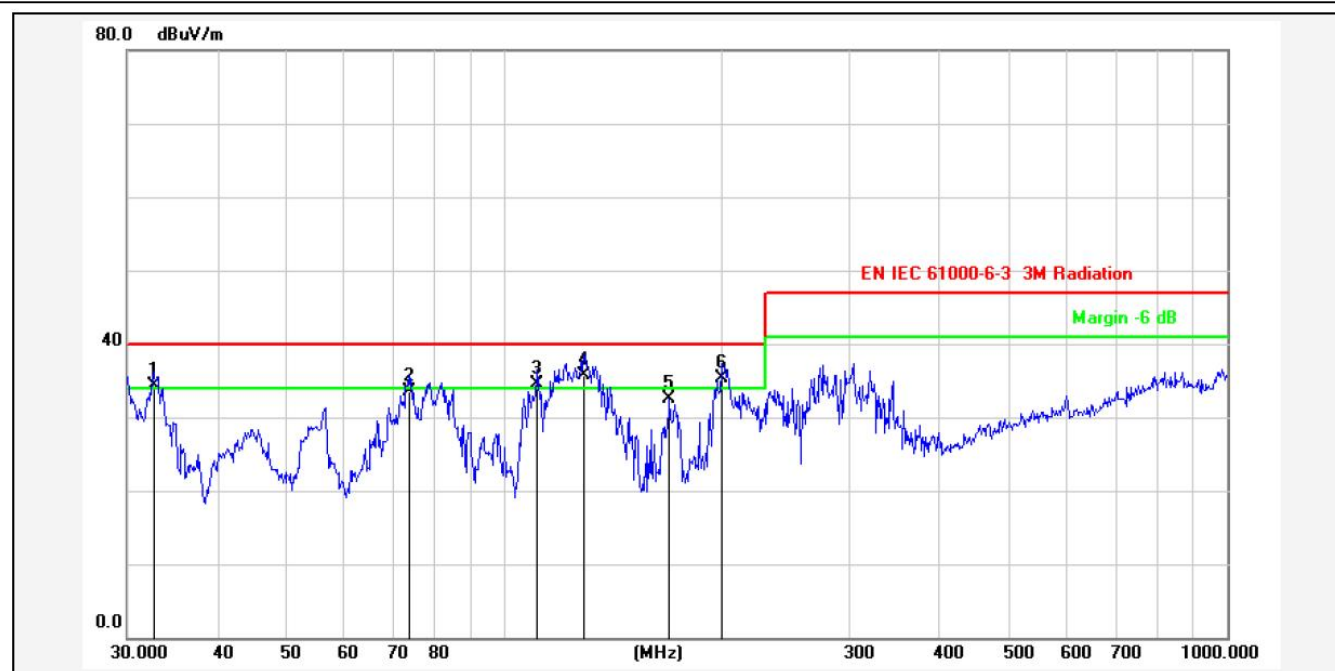
- a. The EUT was placed on a rotatable wooden table top 0.8m above ground.
- b. The EUT was set 3m away from the receiving antenna which was mounted on the top of a variable height antenna tower.
- c. Configure the EUT and support devices as per section 6.1.
- d. All cables and support devices were positioned as per EN IEC 61000-6-3.
- e. Connect mains power port of the EUT to the outlet socket under the turntable and connect all other support devices to other outlet socket under the turntable.
- f. Turn on the EUT and all support devices, and make it run stably.
- g. Set the detector and measurement bandwidth of test-receiver system as per EN IEC 61000-6-3.
- h. Scan the frequency range from 30MHz to 1000MHz for radiation emissions checking.
- i. Emissions were scanned and measured rotating the EUT from 0 to 360 degrees and positioning the antenna from 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- j. Repeat the above scans in each mode and channel and record the test data.

### 6.4.Test Results

**PASS.**

Please refer to the following pages.

|              |                  |                    |                        |
|--------------|------------------|--------------------|------------------------|
| E.U.T:       | PV Microinverter | Model Name :       | ES-800                 |
| Temperature: | 23.5℃            | Relative Humidity: | 58%                    |
| Pressure:    | 1011hPa          | Test Voltage:      | AC 230V/50Hz<br>PV 36V |
| Test Mode:   | Operating mode   | Polarization:      | Horizontal             |
| Test Date:   | 2023-06-07       |                    |                        |



| No. | Frequency (MHz) | Factor (dB/m) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|-----|-----------------|---------------|----------------|----------------|----------------|-------------|----------|-------------|----------------|-----|--------|
| 1   | 32.6340         | -9.84         | 44.14          | 34.30          | 40.00          | -5.70       | QP       |             |                | P   |        |
| 2   | 73.6170         | -17.91        | 51.51          | 33.60          | 40.00          | -6.40       | QP       |             |                | P   |        |
| 3   | 110.9569        | -9.55         | 44.05          | 34.50          | 40.00          | -5.50       | QP       |             |                | P   |        |
| 4   | 128.5629        | -9.63         | 45.33          | 35.70          | 40.00          | -4.30       | QP       |             |                | P   |        |
| 5   | 169.0053        | -9.72         | 42.20          | 32.48          | 40.00          | -7.52       | peak     |             |                | P   |        |
| 6   | 199.9855        | -11.99        | 47.29          | 35.30          | 40.00          | -4.70       | QP       |             |                | P   |        |

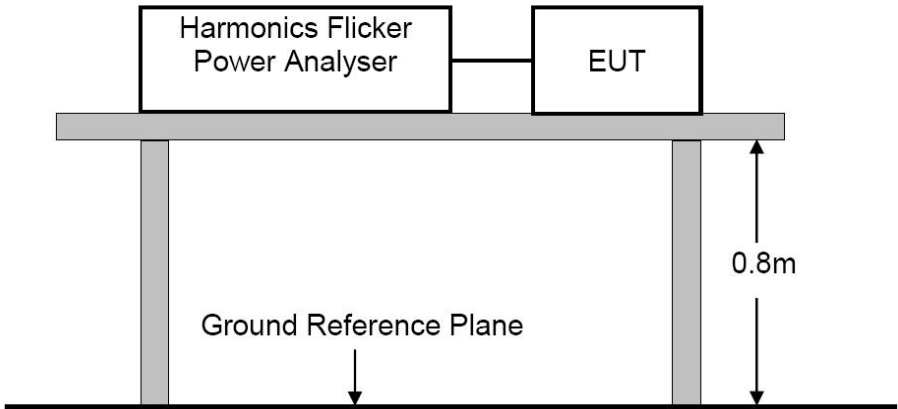
|              |                  |                    |                        |
|--------------|------------------|--------------------|------------------------|
| E.U.T:       | PV Microinverter | Model Name :       | ES-800                 |
| Temperature: | 23.5℃            | Relative Humidity: | 58%                    |
| Pressure:    | 1011hPa          | Test Voltage:      | AC 230V/50Hz<br>PV 36V |
| Test Mode:   | Operating mode   | Polarization:      | Vertical               |
| Test Date:   | 2023-06-07       |                    |                        |



| No. | Frequency (MHz) | Factor (dB/m) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|-----|-----------------|---------------|----------------|----------------|----------------|-------------|----------|-------------|----------------|-----|--------|
| 1   | 30.1051         | -9.74         | 45.44          | 35.70          | 40.00          | -4.30       | QP       |             |                | P   |        |
| 2   | 56.3947         | -17.55        | 53.45          | 35.90          | 40.00          | -4.10       | QP       |             |                | P   |        |
| 3   | 82.3588         | -15.34        | 51.74          | 36.40          | 40.00          | -3.60       | QP       |             |                | P   |        |
| 4   | 116.9492        | -8.53         | 45.23          | 36.70          | 40.00          | -3.30       | QP       |             |                | P   |        |
| 5   | 199.9855        | -11.89        | 47.99          | 36.10          | 40.00          | -3.90       | QP       |             |                | P   |        |
| 6   | 216.7828        | -11.70        | 47.00          | 35.30          | 40.00          | -4.70       | QP       |             |                | P   |        |

## 7.HARMONIC CURRENT EMISSION MEASUREMENT

### 7.1.Block Diagram of Test Setup



### 7.2.Test Limits

☒ **Limits for Class A equipment**

| Harmonics Order     | Max. permissible harmonics current |
|---------------------|------------------------------------|
| $h$                 | A                                  |
| Odd harmonics       |                                    |
| 3                   | 2.30                               |
| 5                   | 1.14                               |
| 7                   | 0.77                               |
| 9                   | 0.40                               |
| 11                  | 0.33                               |
| 13                  | 0.21                               |
| $15 \leq h \leq 39$ | $0.15 \times 15/h$                 |
| Even harmonics      |                                    |
| 2                   | 1.08                               |
| 4                   | 0.43                               |
| 6                   | 0.30                               |
| $8 \leq h \leq 40$  | $0.23 \times 8/h$                  |

☐ **For Class B equipment:**

The harmonics of the input current shall not exceed the values given in Class A equipment multiplied by a factor of 1,5.

☐ **Limits for Class C equipment<sup>a</sup>**

| Harmonics Order<br>$h$                                                                                                                                                                                      | Maximum permissible harmonic current<br>expressed as a percentage of the input<br>current at the fundamental frequency<br>% |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Odd harmonics                                                                                                                                                                                               |                                                                                                                             |
| 2                                                                                                                                                                                                           | 2                                                                                                                           |
| 3                                                                                                                                                                                                           | 27 <sup>b</sup>                                                                                                             |
| 5                                                                                                                                                                                                           | 10                                                                                                                          |
| 7                                                                                                                                                                                                           | 7                                                                                                                           |
| 9                                                                                                                                                                                                           | 5                                                                                                                           |
| $11 \leq h \leq 39$<br>(odd harmonics only)                                                                                                                                                                 | 3                                                                                                                           |
| <p>a For some Class C products, other emission limits apply (see 7.4).</p> <p>b The limit is determined based on the assumption of modern lighting technologies having power factors of 0,90 or higher.</p> |                                                                                                                             |

☐ **Limits for Class D equipment**

| Harmonics Order<br>$h$                      | Max. permissible<br>harmonics current per watt<br>mA/W | Max. permissible<br>harmonics current<br>A |
|---------------------------------------------|--------------------------------------------------------|--------------------------------------------|
| 3                                           | 3.4                                                    | 2.30                                       |
| 5                                           | 1.9                                                    | 1.14                                       |
| 7                                           | 1.0                                                    | 0.77                                       |
| 9                                           | 0.5                                                    | 0.40                                       |
| 11                                          | 0.35                                                   | 0.33                                       |
| 13                                          | 0.30                                                   | 0.21                                       |
| $15 \leq h \leq 39$<br>(Odd harmonics only) | $3.85/h$                                               | $0.15 \times 15/h$                         |

For the following categories of equipment limits are not specified in this edition of the standard.

Note: Equipment with a rated power of 75W or less, other than lighting equipment.

The E.U.T. is classified as follows:

**Class A:**

Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.

**Class B:**

Portable tools; Arc welding equipment which is not professional equipment.

**Class C:**

Lighting equipment.

**Class D:**

Equipment having a specified power less than or equal to 600W of the following types:  
Personal computers and personal computer monitors and television receivers.



---

### 7.3.Test Procedure

- a. The EUT was placed on a wooden table 0.8m above ground.
- b. Configure the EUT and support devices as per section 7.1.
- c. Turn on the EUT and all support devices, and make it run stably.
- d. Set the EUT to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.
- e. Set correspondent test program and measurement time of the test system to measure the current harmonics emanated from EUT, and then record the test data.

### 7.4.Test Results

**PASS.**

Please refer to the following pages.

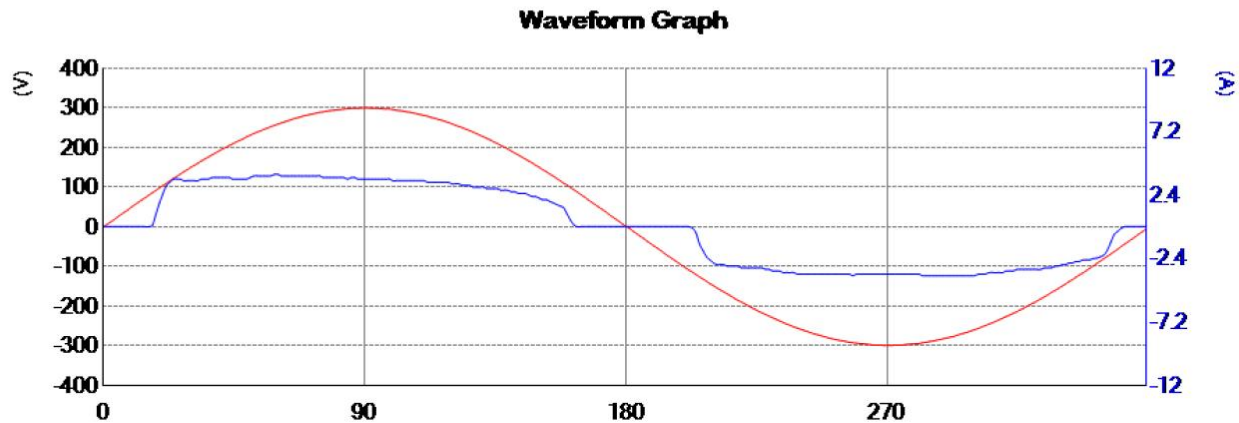
## Test Report

EUT: PV Microinverter  
Test category: IEC/EN 61000-3-2:2019+A1:2021 Class A  
Measurement standard: IEC 61000-4-7 Ed2:1:2009  
Test date:2023-06-07  
Test duration (sec):150  
Describe: Operation mode

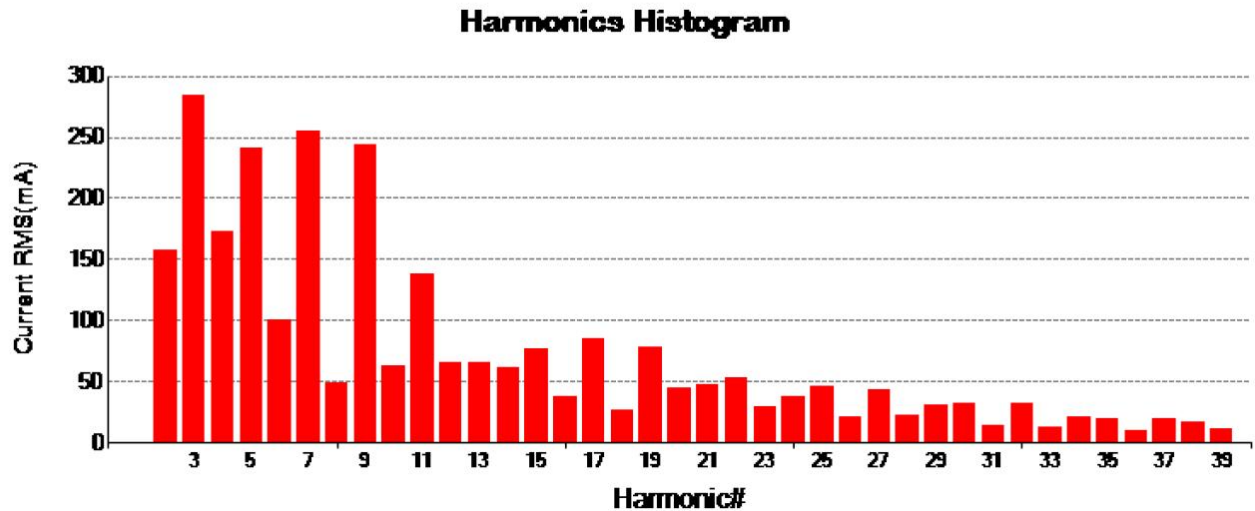
Operator: CRB  
Model/Type: ES-800  
Serial number:  
End time: 11:40:35

Test Result: **Pass**      Source qualification(Power On Load): **Idle - Pass**

### Current & voltage waveforms



### Harmonics and Class A



## Harmonics Test Summary

EUT: PV Microinverter Operator: CRB  
Test category: IEC/EN 61000-3-2:2019+A1:2021 Class A Model/Type: ES-800  
Measurement standard: IEC 61000-4-7 Ed2:1:2009 Serial number:  
Test date:2023-06-07 Start time: 11:38:05 End time: 11:40:35  
Test duration (sec):150  
Describe: Operation mode  
Test Result: **Pass** Source qualification(Power On Load): **Idle - Pass**

THC(mA): 671.800 I - THD(%): 23.3 POHC(mA):101.000 POHC Limit(mA):251.353

Parameter values during test:

V\_RMS (Volts): 217.4

I\_RMS (A): 3.0

Power (Watts): 628.3

Frequency(Hz): 50.0

Crest Factor: 1.348

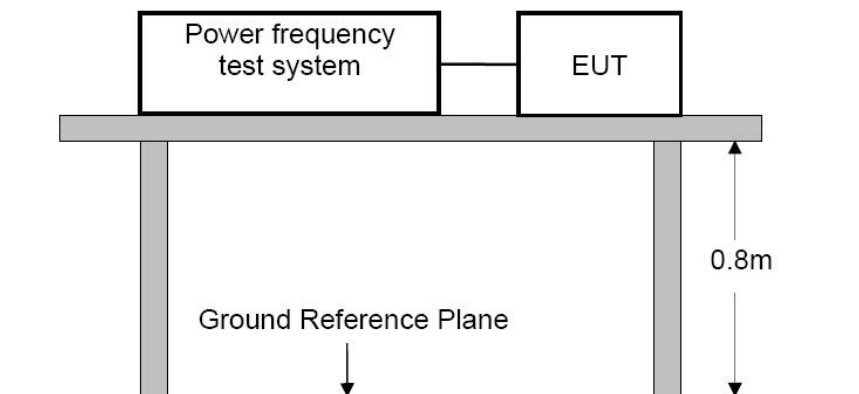
Power Factor: 0.974

| Harm#  | Harms(filtered)<br>(mA) | Limit<br>(mA) | Harms(avg)<br>(mA) | 100%Limit | Harms(max)<br>(mA) | 150%Limit | Status |
|--------|-------------------------|---------------|--------------------|-----------|--------------------|-----------|--------|
| I_Fund | 2888.300                |               |                    |           |                    |           |        |
| 2      | 266.100                 | 1080.000      | 201.500            | 18.657    | 274.000            | 16.914    | Pass   |
| 3      | 288.000                 | 2300.000      | 278.400            | 12.104    | 296.700            | 8.600     | Pass   |
| 4      | 235.900                 | 430.000       | 190.300            | 44.256    | 235.900            | 36.574    | Pass   |
| 5      | 195.600                 | 1140.000      | 223.300            | 19.588    | 244.900            | 14.322    | Pass   |
| 6      | 132.300                 | 300.000       | 110.000            | 36.667    | 135.900            | 30.200    | Pass   |
| 7      | 216.800                 | 770.000       | 238.600            | 30.987    | 257.800            | 22.320    | Pass   |
| 8      | 49.900                  | 230.000       | 50.300             | 21.870    | 53.900             | 15.623    | Pass   |
| 9      | 212.500                 | 400.000       | 229.900            | 57.475    | 253.500            | 42.250    | Pass   |
| 10     | 85.200                  | 184.000       | 72.000             | 39.130    | 86.600             | 31.377    | Pass   |
| 11     | 130.500                 | 330.000       | 135.800            | 41.152    | 140.600            | 28.404    | Pass   |
| 12     | 115.400                 | 153.300       | 88.400             | 57.665    | 116.100            | 50.489    | Pass   |
| 13     | 64.700                  | 210.000       | 63.400             | 30.190    | 67.600             | 21.460    | Pass   |
| 14     | 112.500                 | 131.400       | 83.600             | 63.623    | 113.200            | 57.433    | Pass   |
| 15     | 41.300                  | 150.000       | 59.800             | 39.867    | 77.300             | 34.356    | Pass   |
| 16     | 71.900                  | 115.000       | 50.100             | 43.565    | 71.900             | 41.681    | Pass   |
| 17     | 44.900                  | 132.400       | 69.400             | 52.417    | 85.900             | 43.253    | Pass   |
| 18     | 28.000                  | 102.200       | 28.000             | 27.397    | 30.900             | 20.157    | Pass   |
| 19     | 43.500                  | 118.400       | 66.000             | 55.743    | 77.600             | 43.694    | Pass   |
| 20     | 57.500                  | 92.000        | 53.200             | 57.826    | 59.300             | 42.971    | Pass   |
| 21     | 38.400                  | 107.100       | 45.600             | 42.577    | 50.700             | 31.559    | Pass   |
| 22     | 82.700                  | 83.600        | 68.200             | 81.579    | 82.700             | 65.949    | Pass   |
| 23     | 28.000                  | 97.800        | 26.200             | 26.789    | 30.500             | 20.791    | Pass   |
| 24     | 66.500                  | 76.700        | 51.300             | 66.884    | 66.800             | 58.062    | Pass   |
| 25     | 24.000                  | 90.000        | 32.800             | 36.444    | 47.100             | 34.889    | Pass   |
| 26     | 36.300                  | 70.800        | 26.500             | 37.429    | 36.300             | 34.181    | Pass   |
| 27     | 20.500                  | 83.300        | 30.500             | 36.615    | 43.100             | 34.494    | Pass   |
| 28     | 19.400                  | 65.700        | 21.600             | 32.877    | 23.700             | 24.049    | Pass   |
| 29     | 14.300                  | 77.600        | 24.000             | 30.928    | 32.000             | 27.491    | Pass   |
| 30     | 34.500                  | 61.300        | 37.000             | 60.359    | 39.500             | 42.958    | Pass   |
| 31     | 11.800                  | 72.600        | 13.900             | 19.146    | 15.400             | 14.141    | Pass   |
| 32     | 40.600                  | 57.500        | 39.500             | 68.696    | 42.700             | 49.507    | Pass   |
| 33     | 14.700                  | 68.200        | 11.600             | 17.009    | 15.100             | 14.761    | Pass   |
| 34     | 30.500                  | 54.100        | 26.800             | 49.538    | 32.000             | 39.433    | Pass   |
| 35     | 19.400                  | 64.300        | 14.600             | 22.706    | 20.800             | 21.566    | Pass   |
| 36     | 16.900                  | 51.100        | 12.500             | 24.462    | 17.200             | 22.440    | Pass   |
| 37     | 19.700                  | 60.800        | 14.500             | 23.849    | 20.500             | 22.478    | Pass   |
| 38     | 12.200                  | 48.400        | 15.600             | 32.231    | 17.900             | 24.656    | Pass   |
| 39     | 12.900                  | 57.700        | 10.000             | 17.331    | 13.300             | 15.367    | Pass   |
| 40     | 15.100                  | 46.000        | 21.000             | 45.652    | 23.000             | 33.333    | Pass   |

Note: All harmonics are below the minimum limits and are ignored.

## 8.VOLTAGE FLUCTUATIONS & FLICKER MEASUREMENT

### 8.1.Block Diagram of Test Setup



### 8.2.Test Limits

| Test Item                                                | Limit |
|----------------------------------------------------------|-------|
| $P_{st}$ (Short-term flicker indicator.)                 | 1.0   |
| $P_{lt}$ (Long-term flicker indicator.)                  | 0.65  |
| $T_{d(t)}$ (ms) ( Maximum time that $d(t)$ exceeds 3.3%) | 500   |
| $d_{max}(\%)$ (Maximum relative voltage change.)         | 4     |
| $d_c(\%)$ (Relative steady-state voltage change)         | 3.3   |

### 8.3.Test Procedure

- The EUT was placed on a wooden table 0.8m above ground.
- Configure the EUT and support devices as per section 8.1.
- Turn on the EUT and all support devices, and make it run stably.
- Set the EUT to produce the most unfavorable sequence of voltage changes under normal operating conditions.
- Set correspondent test program and measurement time of the test system to measure the most unfavorable sequence of voltage changes from EUT, and then record the test data.

### 8.4.Test Results

**PASS.**

Please refer to the following pages.

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## 9.PERFORMANCE CRITERIA FOR IMMUNITY

The performance criteria are referred to the test standard: EN IEC 61000-6-2

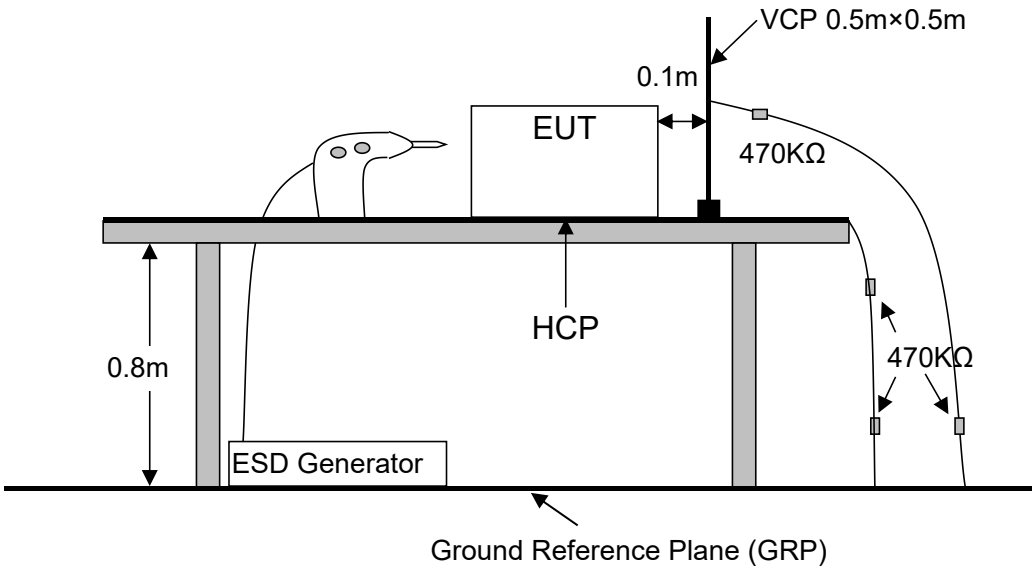
A functional description and a definition of specific performance criteria, during or as a consequence of immunity testing of equipment under test (EUT), shall be provided by the manufacturer and noted in the test report.

- a)** Performance criterion A: The EUT 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 EUT is used as intended. If the performance level is not specified by the manufacturer, this may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.
- b)** Performance criterion B: The EUT 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 EUT is used as intended. The performance level may be replaced by a permissible loss of performance. However, during the test degradation of performance is allowed but 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 equipment if used as intended.
- c)** Performance criterion C: Temporary loss of function is allowed during the test, provided the function is self-recoverable or can be restored by the operation of the controls. If, as a result of the application of the tests defined in this standard, the EUT becomes dangerous or unsafe, it shall be deemed to have failed the test.



# 10.ELECTROSTATIC DISCHARGE TEST

## 10.1.Block Diagram of Test Setup



## 10.2.Test Standard and Severity Levels

### a. Test Standard:

|                       |                  |
|-----------------------|------------------|
| Product standard      | EN IEC 61000-6-2 |
| Basic standard        | IEC 61000-4-2    |
| Performance criterion | B                |

### b. Severity Levels:

| Level | Test Voltage<br>Contact Discharge (KV) | Test Voltage<br>Air Discharge (KV) |
|-------|----------------------------------------|------------------------------------|
| 1.    | ±2                                     | ±2                                 |
| 2.    | ±4                                     | ±4                                 |
| 3.    | ±6                                     | ±8                                 |
| 4.    | ±8                                     | ±15                                |
| X     | Special                                | Special                            |



### 10.3.Test Procedure

#### **Air Discharge:**

Air discharges at slots and apertures and insulating surfaces. On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those are normally handled by the user. A minimum of 10 single air discharges shall be applied to the selected test point for each such area.

#### **Contact Discharge:**

Contact discharges to the conductive surfaces and coupling planes. The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 20 indirect discharges to the center of the front edge of the Horizontal Coupling Plane (HCP). The remaining three test points shall each receive at least 20 direct contact discharges. If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.

- a. The EUT was placed on a wooden table 0.8m height from the ground.
- b. The EUT was located 0.1m minimum from all side of the HCP (dimensions 1.6m x0.8m).
- c. Configure the EUT and support devices as per section 10.1.
- d. The support units were located 30cm away from the EUT, but direct support unit was/were located at same location as EUT on the HCP and keep at a distance of 10cm with EUT.
- e. Turn on the EUT and all support devices, and make it run stably.
- f. The time interval between two successive single discharges was at least 1 second. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- g. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.

- 
- h. At least ten single discharges (in the most sensitive polarity) were applied at the front edge of each HCP opposite the center point of each unit of the EUT and 0.1 meters from the front of the EUT. The long axis of the discharge electrode was in the plane of the HCP and perpendicular to its front edge during the discharges.
  - i. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane (VCP) in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.
  - j. Repeat the above steps in each mode and record the test result.

#### 10.4.Test Results

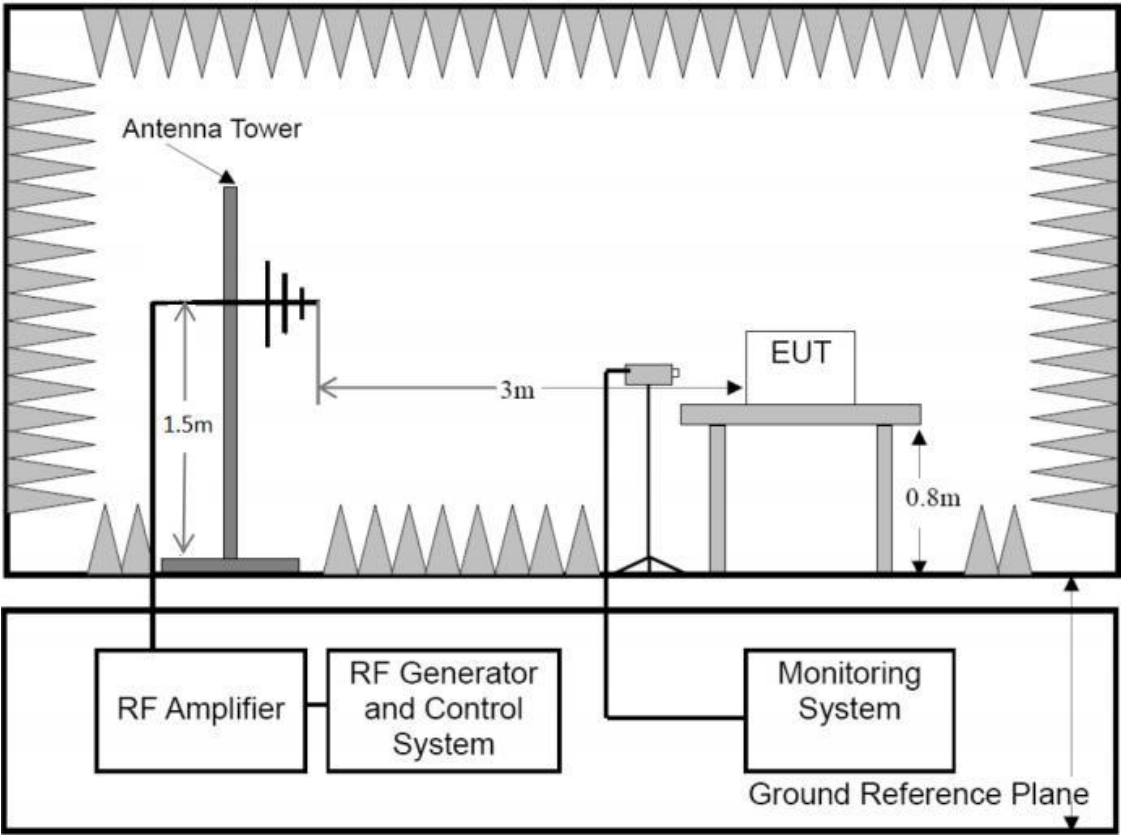
**PASS.**

Please refer to the following page.

| Electrostatic Discharge Test Results                                                     |                              |                                                          |                                   |
|------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------|-----------------------------------|
| Ambient Condition:                                                                       | Temp.: 27°C                  | R.H.: 50%                                                | Air Pressure : 101kPa             |
| Test Specifications                                                                      | Test level:                  | ± 4 KV for Contact Discharge<br>± 8 KV for Air Discharge |                                   |
|                                                                                          | Discharge impedance:         | 330ohm / 150pF                                           |                                   |
|                                                                                          | No. of discharges:           | 10 times at each test point for each polarity at least   |                                   |
|                                                                                          | Polarity:                    | Positive / Negative                                      |                                   |
|                                                                                          | Discharge mode:              | Single                                                   |                                   |
|                                                                                          | Interval time of discharges: | ≥1s                                                      |                                   |
| Required Performance Criterion                                                           | B                            |                                                          |                                   |
| Tested Mode                                                                              | Operating mode               |                                                          |                                   |
| Test model:                                                                              | ES-800                       |                                                          |                                   |
| Test Point                                                                               |                              | Kind<br>A-Air Discharge<br>C-Contact Discharge           | Result<br>(Performance Criterion) |
| Metal shell                                                                              |                              | C                                                        | A                                 |
| Screw                                                                                    |                              | C                                                        | A                                 |
| PV Input /AC Grid Port                                                                   |                              | A                                                        | A                                 |
| Photovoltaic switch                                                                      |                              | A                                                        | A                                 |
| Pilot lamp                                                                               |                              | A                                                        | A                                 |
| Push-button                                                                              |                              | A                                                        | A                                 |
| Indirect Discharge (VCP)                                                                 |                              | C                                                        | A                                 |
| Indirect Discharge (HCP)                                                                 |                              | C                                                        | A                                 |
| Note: No performance degradation or other exceptions occurred during and after the test. |                              |                                                          |                                   |

## 11.RADIO-FREQUENCY ELECTROMAGNETIC FIELD TEST

### 11.1.Block Diagram of Test Setup



### 11.2.Test Standard and Severity Levels

a. Test Standard

|                       |                  |
|-----------------------|------------------|
| Product standard      | EN IEC 61000-6-2 |
| Basic standard        | IEC 61000-4-3    |
| Performance criterion | A                |

b. Severity Levels

| Level | Field Strength (V/m) |
|-------|----------------------|
| 1.    | 1                    |
| 2.    | 3                    |
| 3.    | 10                   |
| 4.    | 30                   |
| X     | Special              |

---

### 11.3.Test Procedure

- a. The testing was performed in a fully anechoic chamber.
- b. The EUT and necessary support devices were placed on a turn table which is 0.8 meter above ground.
- c. EUT was set 3 meter away from the transmitting antenna which is mounted on an antenna tower.
- d. Configure the EUT and support devices as per section 11.1.
- e. Turn on the EUT and all support devices, and make it run stably.
- f. Set horizontal and vertical polarization of the antenna to test. Each of the four sides of EUT must be faced this transmitting antenna and measured individually.
- g. Repeat the above steps in each mode and record the test result.

### 11.4.Test Results

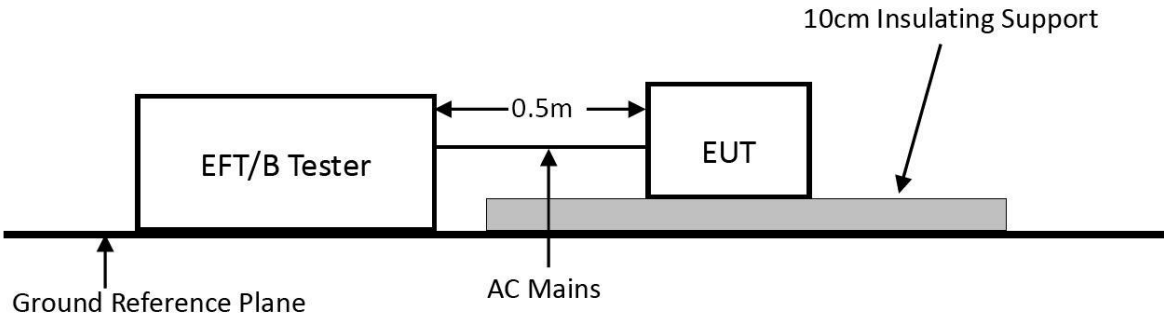
**PASS.**

Please refer to the following page.

| Radio-Frequency Electromagnetic Field Test Results                                       |                   |                        |                                 |                                |
|------------------------------------------------------------------------------------------|-------------------|------------------------|---------------------------------|--------------------------------|
| Ambient Condition                                                                        | Temp.: 28℃        |                        | R.H.: 55%                       | Air Pressure: 101 kPa          |
| Test Specifications                                                                      | Fielded Strength: |                        | 10V/m, 3V/m                     |                                |
|                                                                                          | Modulation:       |                        | 1kHz sine wave, 80%AM           |                                |
|                                                                                          | Frequency Size:   |                        | 1% of preceding frequency value |                                |
|                                                                                          | Dwell Time:       |                        | 1s                              |                                |
|                                                                                          | Mode:             |                        | Swept test                      |                                |
| Required Performance Criterion                                                           | A                 |                        |                                 |                                |
| Tested mode                                                                              | Operating mode    |                        |                                 |                                |
| Test model:                                                                              | ES-800            |                        |                                 |                                |
| Frequency (MHz)                                                                          | Level (V/m)       | Antenna polarity       | Side                            | Result (Performance Criterion) |
| 80-1000                                                                                  | 10                | Horizontal<br>Vertical | Front                           | A                              |
|                                                                                          |                   |                        | Left                            | A                              |
|                                                                                          |                   |                        | Right                           | A                              |
|                                                                                          |                   |                        | Back                            | A                              |
| 1400-6000                                                                                | 3                 | Horizontal<br>Vertical | Front                           | A                              |
|                                                                                          |                   |                        | Left                            | A                              |
|                                                                                          |                   |                        | Right                           | A                              |
|                                                                                          |                   |                        | Back                            | A                              |
| Note: No performance degradation or other exceptions occurred during and after the test. |                   |                        |                                 |                                |

## 12.FAST TRANSIENTS TEST

### 12.1.Block Diagram of Test Setup



### 12.2.Test Standard and Severity Levels

#### a. Test Standard

|                       |                  |
|-----------------------|------------------|
| Product standard      | EN IEC 61000-6-2 |
| Basic standard        | IEC 61000-4-4    |
| Performance criterion | B                |

#### b. Severity level

| Open circuit output test voltage and repetition rate of the impulses |                                                                                                                                                                                                     |                          |                               |                          |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------|--------------------------|
| Level                                                                | Power ports, earth port (PE)                                                                                                                                                                        |                          | Signal data and control ports |                          |
|                                                                      | Voltage peak kV                                                                                                                                                                                     | Repetition frequency kHz | Voltage peak kV               | Repetition frequency kHz |
| 1.                                                                   | 0.5                                                                                                                                                                                                 | 5 or 100                 | 0.25                          | 5 or 100                 |
| 2.                                                                   | 1.0                                                                                                                                                                                                 | 5 or 100                 | 0.5                           | 5 or 100                 |
| 3.                                                                   | 2.0                                                                                                                                                                                                 | 5 or 100                 | 1.0                           | 5 or 100                 |
| 4.                                                                   | 4.0                                                                                                                                                                                                 | 5 or 100                 | 2.0                           | 5 or 100                 |
| X                                                                    | Special                                                                                                                                                                                             | Special                  | Special                       | Special                  |
| Note 1                                                               | The use of 5 kHz repetition rates is traditional, however, 100 kHz is closer to reality. Product committees should determine which frequencies are relevant for specific products or product types. |                          |                               |                          |
| Note 2                                                               | With some products, there may be no clear distinction between power ports and signal ports, in which case it is up to product committees to make this determination for test purposes.              |                          |                               |                          |
| Note 3                                                               | “X” can be any level, above, below or in between the others. The level shall be specified in the dedicated equipment specification.                                                                 |                          |                               |                          |



---

### 12.3.Test Procedure

- a. The EUT was placed on the insulating support 0.1m above the reference ground plane.
- b. Configure the EUT and support devices as per section 12.1.
- c. Turn on the EUT and all support devices, and make it run stably.
- d. For input and output AC power port of the EUT, the EUT was connected to the power mains by using a coupling device which couples the EFT interference signal to AC power lines. The coaxial output of the EFT generator to the terminals on the EUT should not exceed 0.5 meter. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 minutes.
- e. For signal ports of the EUT, the EUT was connected to the power mains, and the signal line through a coupling device which couples the EUT interference signal to signal line. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 minutes.
- f. Repeat the above steps in each mode and record the test result.

### 12.4.Test Result

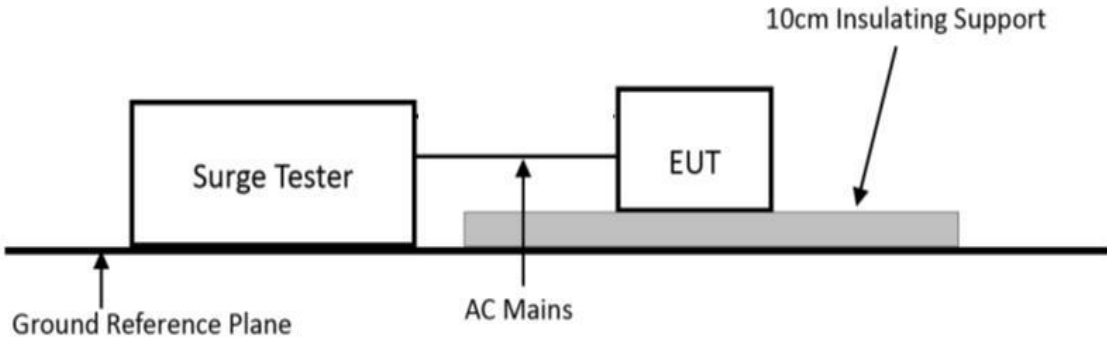
**PASS.**

Please refer to the following page.

| Fast transients test Results                                                                                                                |                                                                                                                                                                                                                 |                                                |                       |
|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------|
| Ambient Condition                                                                                                                           | Temp.: 27.4°C                                                                                                                                                                                                   | R.H.:50%                                       | Air Pressure: 101 kPa |
| Test Specifications                                                                                                                         | Test Level:                                                                                                                                                                                                     | 2kV for AC power port<br>1kV for PV power port |                       |
|                                                                                                                                             | Repetition Frequency:                                                                                                                                                                                           | 5kHz                                           |                       |
|                                                                                                                                             | Duration:                                                                                                                                                                                                       | 15ms                                           |                       |
|                                                                                                                                             | Period:                                                                                                                                                                                                         | 300ms                                          |                       |
|                                                                                                                                             | Impulse wave shape:                                                                                                                                                                                             | 5/50ns (Tr/Th)                                 |                       |
|                                                                                                                                             | Test Duration:                                                                                                                                                                                                  | ≥1min                                          |                       |
| Required Performance Criterion                                                                                                              | B                                                                                                                                                                                                               |                                                |                       |
| Test mode                                                                                                                                   | Operating mode                                                                                                                                                                                                  |                                                |                       |
| Test model:                                                                                                                                 | ES-800                                                                                                                                                                                                          |                                                |                       |
| Coupling mode and port                                                                                                                      | <input checked="" type="checkbox"/> AC Power <input checked="" type="checkbox"/> DC port <input type="checkbox"/> Signal line<br><input checked="" type="checkbox"/> Direct <input type="checkbox"/> Capacitive |                                                |                       |
| Test Line                                                                                                                                   | Test Voltage                                                                                                                                                                                                    | Result<br>(Performance Criterion)              |                       |
| AC Grid Port                                                                                                                                | ±2KV                                                                                                                                                                                                            | B                                              |                       |
| PV Input Port                                                                                                                               | ±1KV                                                                                                                                                                                                            | B                                              |                       |
| Note : During the testing process, the EUT grid connected output was unstable, and it automatically recovered after the test was completed. |                                                                                                                                                                                                                 |                                                |                       |

## 13.SURGE TEST

### 13.1.Block Diagram of Test Setup



### 13.2.Test Standard and Severity Levels

#### a. Test Standard

|                       |                  |
|-----------------------|------------------|
| Product standard      | EN IEC 61000-6-2 |
| Basic standard        | IEC 61000-4-5    |
| Performance criterion | B                |

#### b. Severity level

| Level | Open-Circuit Test Voltage<br>KV |
|-------|---------------------------------|
| 1.    | 0.5                             |
| 2.    | 1.0                             |
| 3.    | 2.0                             |
| 4.    | 4.0                             |
| *     | Special                         |

### 13.3.Test Procedure

- a. The EUT was placed on the wooden table 0.1m above the ground.
- b. Configure the EUT and support devices as per section 13.1.
- c. Turn on the EUT and all support devices, and make it run stably.
- d. The surge is applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.
- e. For test applied to unshielded un-symmetrically operated interconnection lines of EUT, the surge was applied to the lines via the capacitive coupling. The coupling / decoupling networks didn't influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.
- f. For test applied to unshielded symmetrically operated interconnection / telecommunication lines of EUT, the surge was applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor were not specified. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.
- g. Five positive and five negative (polarity) pulses at specified phase angles with a 1min repetition rate are conducted during test.
- h. Repeat the above steps in each mode and record the test result.

### 13.4.Test Result

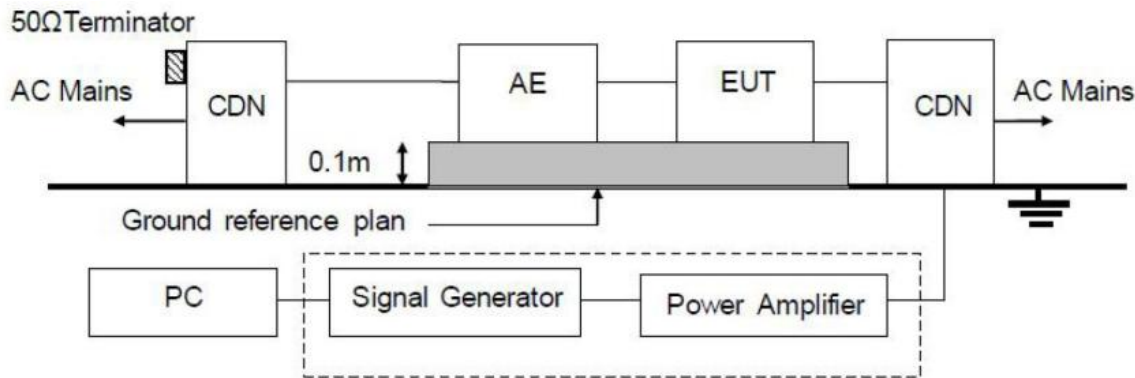
**PASS.**

Please refer to the following page.

| Surge Test Results                                                                                                                         |               |                             |                                                                                                                                                                  |                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Ambient Condition                                                                                                                          |               | Temp.: 27.6°C               | R.H.:54%                                                                                                                                                         | Air Pressure: 101 kPa             |
| Test Specifications                                                                                                                        |               | Wave-shape:                 | 1.2/50 us (Tr/Th) / 8/20 us (Tr/Th) for power port                                                                                                               |                                   |
|                                                                                                                                            |               | Test Level:                 | ±1.0kV for AC power port Line to Line<br>±2.0kV for AC power port Line to Earth<br>±0.5kV for PV power port Line to Line<br>±1kV for PV power port Line to Earth |                                   |
|                                                                                                                                            |               | Phase angle:                | 0°, 90°, 180° and 270°                                                                                                                                           |                                   |
|                                                                                                                                            |               | Polarity:                   | Positive / Negative                                                                                                                                              |                                   |
|                                                                                                                                            |               | NO. of pulse:               | 5 positive / 5 negative                                                                                                                                          |                                   |
|                                                                                                                                            |               | Pulse repetition rate:      | 1 time per minute / maximum                                                                                                                                      |                                   |
|                                                                                                                                            |               | Generator source impedance: | 2 ohm / power supply network<br>12 ohm / power supply network to ground                                                                                          |                                   |
| Required Performance Criterion                                                                                                             |               | B                           |                                                                                                                                                                  |                                   |
| Test mode                                                                                                                                  |               | Operating mode              |                                                                                                                                                                  |                                   |
| Test model:                                                                                                                                |               | ES-800                      |                                                                                                                                                                  |                                   |
| Test Line                                                                                                                                  |               | Phase Angle                 | Test Voltage                                                                                                                                                     | Result<br>(Performance Criterion) |
| AC Grid Port                                                                                                                               | Line to line  | 0°, 90°, 180°, 270°         | ±1KV                                                                                                                                                             | B                                 |
|                                                                                                                                            | Line to earth | 0°, 90°, 180°, 270°         | ±2KV                                                                                                                                                             | B                                 |
| PV Input Port                                                                                                                              | Line to line  | ---                         | ±0.5KV                                                                                                                                                           | A                                 |
|                                                                                                                                            | Line to earth | ---                         | ±1KV                                                                                                                                                             | A                                 |
| Note: During the testing process, the EUT grid connected output was unstable, and it automatically recovered after the test was completed. |               |                             |                                                                                                                                                                  |                                   |

## 14.CONDUCTED RADIO-FREQUENCY COMMON MODE TEST

### 14.1.Block Diagram of Test Setup



### 14.2.Test Standard and Severity Levels

#### a. Test Standard

|                       |                  |
|-----------------------|------------------|
| Product standard      | EN IEC 61000-6-2 |
| Basic standard        | IEC 61000-4-6    |
| Performance criterion | A                |

#### b. Severity level

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

### 14.3.Test Procedure

- a. The EUT was placed on the insulating support 0.1m above the ground reference plane. CDN (coupling and decoupling device) or EM clamp is placed on the ground plane about 0.3m from EUT. Cables between CDN or EM clamp and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).
- b. Configure the EUT and support devices as per section 14.1.
- c. Turn on the EUT and all support devices, and make it run stably.
- d. The disturbance signal described below is injected to EUT through CDN or EM clamp.
- e. The frequency range is swept from 150 KHz to 80 MHz using 10V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave. The rate of sweep shall not exceed  $1.5 \times 10^{-3}$  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.
- f. Repeat the above steps in each mode and record the test result.

### 14.4.Test Result

**PASS.**

Please refer to the following page.

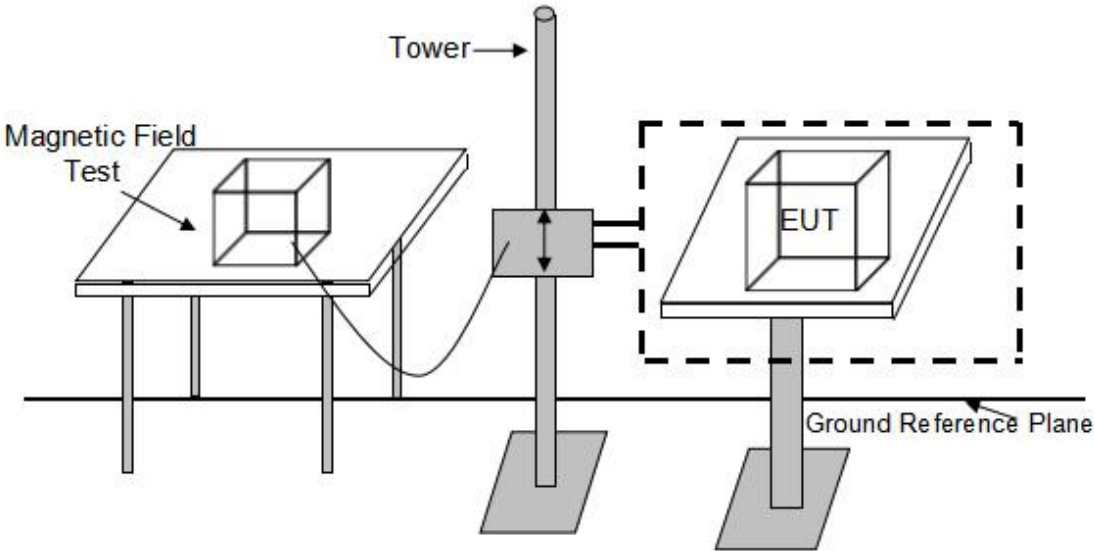


### Conducted RF Common Mode Test Results

|                                                                                           |                 |                                 |                                |
|-------------------------------------------------------------------------------------------|-----------------|---------------------------------|--------------------------------|
| Ambient Condition                                                                         | Temp.: 28°C     | R.H.: 55%                       | Air Pressure:101 kPa           |
| Test Specifications                                                                       | Test Level:     | 10V (r.m.s)                     |                                |
|                                                                                           | Modulation:     | 1kHz sine wave, 80%AM           |                                |
|                                                                                           | Step Size:      | 1% of preceding frequency value |                                |
|                                                                                           | Dwell Time:     | 1s                              |                                |
|                                                                                           | Mode:           | Swept test                      |                                |
| Required Performance Criterion                                                            | A               |                                 |                                |
| Test mode                                                                                 | Operating mode  |                                 |                                |
| Test model:                                                                               | ES-800          |                                 |                                |
| Test Port                                                                                 | Frequency (MHz) | Level(V)                        | Result (Performance Criterion) |
| AC Grid Power                                                                             | 0.15~80         | 10                              | A                              |
| PV Input Power                                                                            | 0.15~80         | 10                              | A                              |
| Note : No performance degradation or other exceptions occurred during and after the test. |                 |                                 |                                |

## 15.POWER-FREQUENCY MAGNETIC FIELD TEST

### 15.1.Block Diagram of Test Setup



### 15.2.Test Standard and Severity Levels

#### a. Test Standard

|                       |                  |
|-----------------------|------------------|
| Product standard      | EN IEC 61000-6-2 |
| Basic standard        | IEC 61000-4-8    |
| Performance criterion | A                |

#### b. Severity level

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

---

### 15.3.Test Procedure

- a. The EUT was placed on the middle of an induction coil(1\*1m), under which is a 0.1m-thick insulating support.
- b. Configure the EUT and support devices as per section 15.1.
- c. All cables of the EUT were exposed to the magnetic field for 1m of their length.
- d. X, Y and Z polarization of the induction coil are set on test, so that each side of the E.U.T. is affected by the magnetic field. If not possible as the EUT size, change the position of the EUT is permitted.
- e. Repeat the above steps in each mode and record the test result.

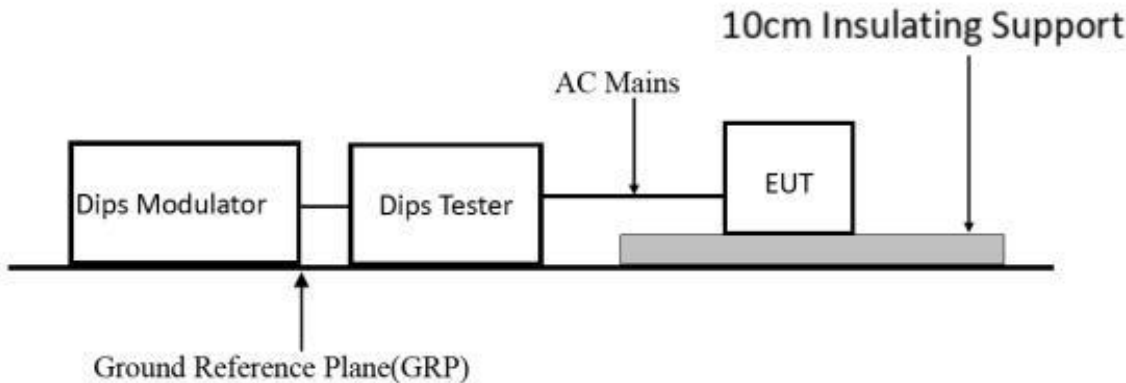
### 15.4.Test Result

**N/A**

Applicable only to equipment containing devices susceptible to magnetic fields.

## 16.VOLTAGE DIPS AND INTERRUPTIONS TEST

### 16.1.Block Diagram of Test Setup



### 16.2.Test Standard and Severity Levels

#### a. Test Standard

|                       |                  |
|-----------------------|------------------|
| Product standard      | EN IEC 61000-6-2 |
| Basic standard        | IEC 61000-4-34   |
| Performance criterion | B&C              |

#### b. Severity level

| Class                | Test level and durations for voltage dips ( $t_s$ )(50Hz/60Hz) |                       |                                                       |                                          |                                            |
|----------------------|----------------------------------------------------------------|-----------------------|-------------------------------------------------------|------------------------------------------|--------------------------------------------|
| Class 1              | Case-by-case according to the equipment requirements           |                       |                                                       |                                          |                                            |
| Class 2              | 0 % during<br>$1/2$ cycle                                      | 0 % during<br>1 cycle | 70 % during 25/30 <sup>b</sup> cycles                 |                                          |                                            |
| Class 3              | 0 % during<br>$1/2$ cycle                                      | 0 % during<br>1 cycle | 40 % <sup>c</sup> during<br>10/12 <sup>b</sup> cycles | 70 % during<br>25/30 <sup>b</sup> cycles | 80 % during<br>250/300 <sup>b</sup> cycles |
| Class X <sup>a</sup> | X                                                              | X                     | X                                                     | X                                        | X                                          |

Note: a. To be defined by product committee. For equipment connected directly or indirectly to the public network, the levels must not be less severe than Class 2.

b. "25/30 cycles" means "25 cycles for 50 Hz test" and "30 cycles for 60 Hz test", "10/12 cycles" means "10 cycles for 50 Hz test" and "12 cycles for 60 Hz test" and "250/300 cycles" means "250 cycles for 50 Hz test" and "300 cycles for 60 Hz test".

c. May be replaced by product committee with a test level of 50 % for equipment that is intended primarily for 200 V or 208V nominal operation.

| Class                                                                                                                                                                                                                                                         | Test level and durations for short interruptions ( $t_s$ ) (50 Hz/60 Hz) |   |   |   |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---|---|---|---|
| Class 1                                                                                                                                                                                                                                                       | Case-by-case according to the equipment requirements                     |   |   |   |   |
| Class 2                                                                                                                                                                                                                                                       | 0 % during 250/300 <sup>b</sup> cycles                                   |   |   |   |   |
| Class 3                                                                                                                                                                                                                                                       | 0 % during 250/300 <sup>b</sup> cycles                                   |   |   |   |   |
| Class X <sup>a</sup>                                                                                                                                                                                                                                          | X                                                                        | X | X | X | X |
| Note: a. To be defined by product committee. For equipment connected directly or indirectly to the public network, the levels must not be less severe than Class 2.<br>b. "250/300 cycles" means "250 cycles for 50 Hz test" and "300 cycles for 60 Hz test". |                                                                          |   |   |   |   |

### 16.3.Test Procedure

- The EUT was placed on the wooded table 0.1m above the ground.
- Configure the EUT and support devices as per section 16.1.
- Setting the parameter of tests and then perform the test software of test simulator.
- Conditions changes to occur at 0 and 180 degree crossover point of the voltage waveform.
- Repeat the above steps in each mode and record the test result.

### 16.4.Test Result

**PASS.**

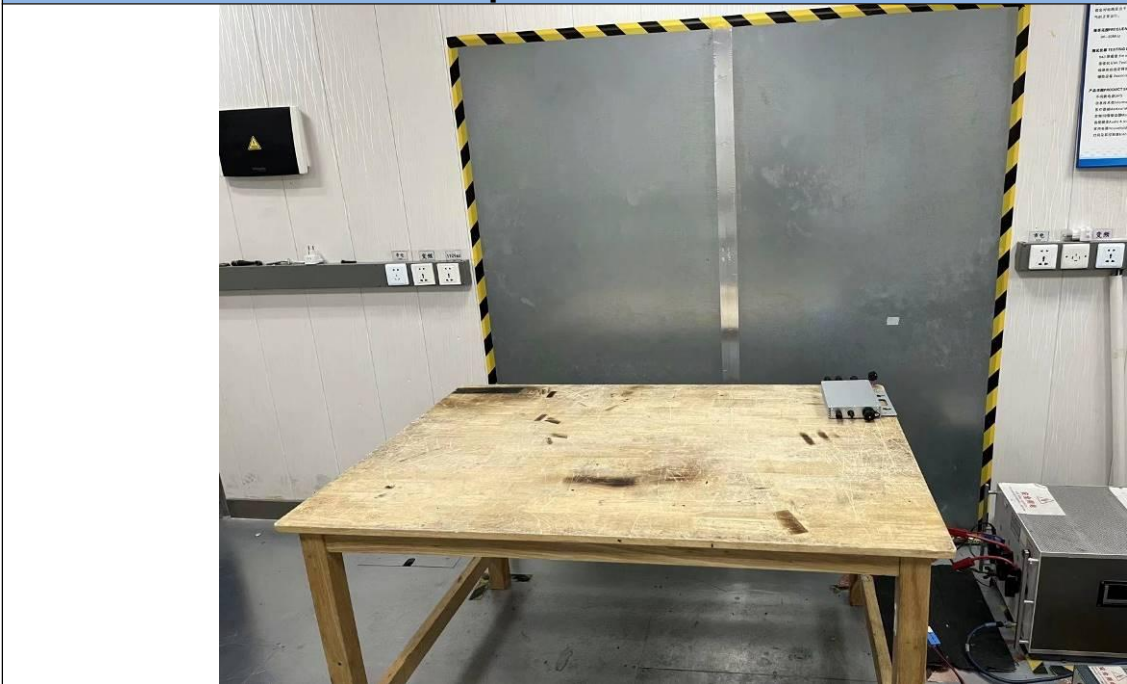
Please refer to the following page.

| Voltage Dips and Interruptions Test Results                                                                            |                                                                    |                                                  |                                                   |
|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------|
| Ambient Condition:                                                                                                     | Temp.: 27.6°C                                                      | R.H.:56%                                         | Air Pressure: 101 kPa                             |
| Test Specifications:                                                                                                   | Residual voltage:                                                  | 0%, 40%, 70%, 0%                                 |                                                   |
|                                                                                                                        | Duration (periods):                                                | <input type="checkbox"/> 0.5 for 50/60Hz         | <input checked="" type="checkbox"/> 1 for 50/60Hz |
|                                                                                                                        |                                                                    | <input checked="" type="checkbox"/> 10 for 50Hz  | <input checked="" type="checkbox"/> 12 for 60Hz   |
|                                                                                                                        |                                                                    | <input checked="" type="checkbox"/> 25 for 50Hz  | <input checked="" type="checkbox"/> 30 for 60Hz   |
|                                                                                                                        |                                                                    | <input checked="" type="checkbox"/> 250 for 50Hz | <input checked="" type="checkbox"/> 300 for 60Hz  |
|                                                                                                                        | Phase angle:                                                       | 0° and 180°                                      |                                                   |
|                                                                                                                        | Interval between tests:                                            | 10s                                              |                                                   |
|                                                                                                                        | NO. of tests:                                                      | 3 times                                          |                                                   |
| Required Performance Criterion                                                                                         | B for voltage dips<br>C for voltage dips and voltage interruptions |                                                  |                                                   |
| Test mode:                                                                                                             | Operating mode                                                     |                                                  |                                                   |
| Test model:                                                                                                            | ES-800                                                             |                                                  |                                                   |
| Test Level<br>(% Residual voltage)                                                                                     | Duration (periods)                                                 |                                                  | Result<br>(Performance Criterion)                 |
|                                                                                                                        | 50Hz                                                               | 60Hz                                             |                                                   |
| 0                                                                                                                      | 1P                                                                 | 1P                                               | B <sup>note</sup>                                 |
| 40                                                                                                                     | 10P                                                                | 12P                                              | B <sup>note</sup>                                 |
| 70                                                                                                                     | 25P                                                                | 30P                                              | B <sup>note</sup>                                 |
| 0                                                                                                                      | 250P                                                               | 300P                                             | B <sup>note</sup>                                 |
| Note : During the testing process, the EUT output was interrupted and returned to normal after the test was completed. |                                                                    |                                                  |                                                   |

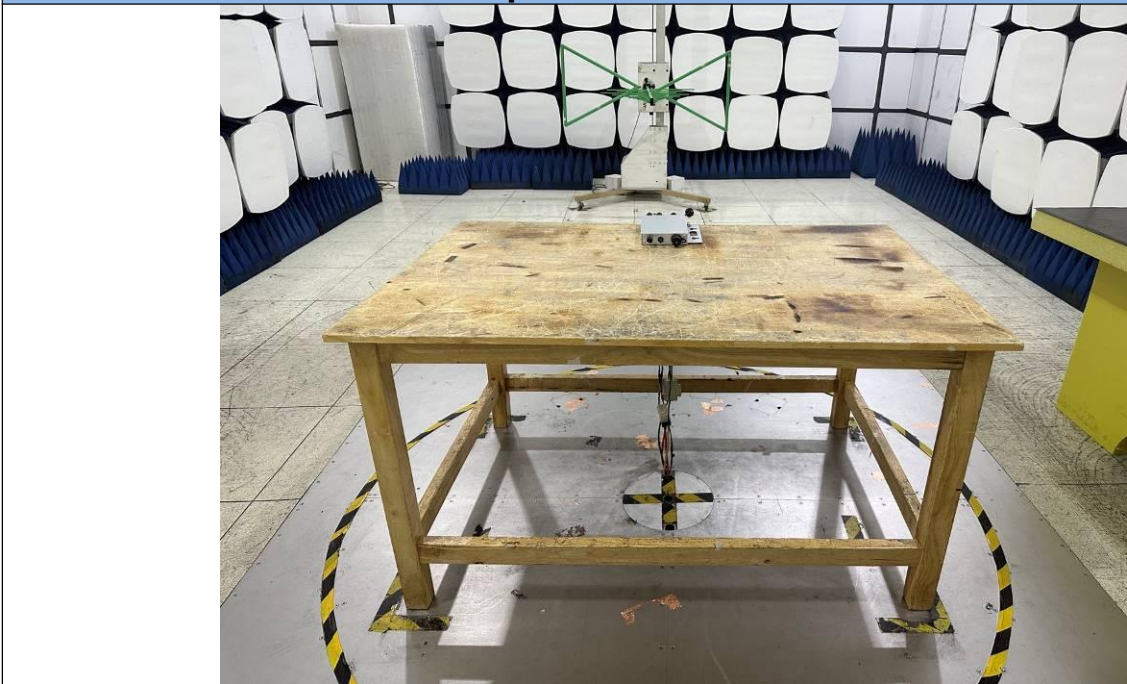
# APPENDIX I (Photos of Test Setup)

**Photos of Test Setup**

**Set-up for Conducted Emission**



**Set-up for Radiated Emission**



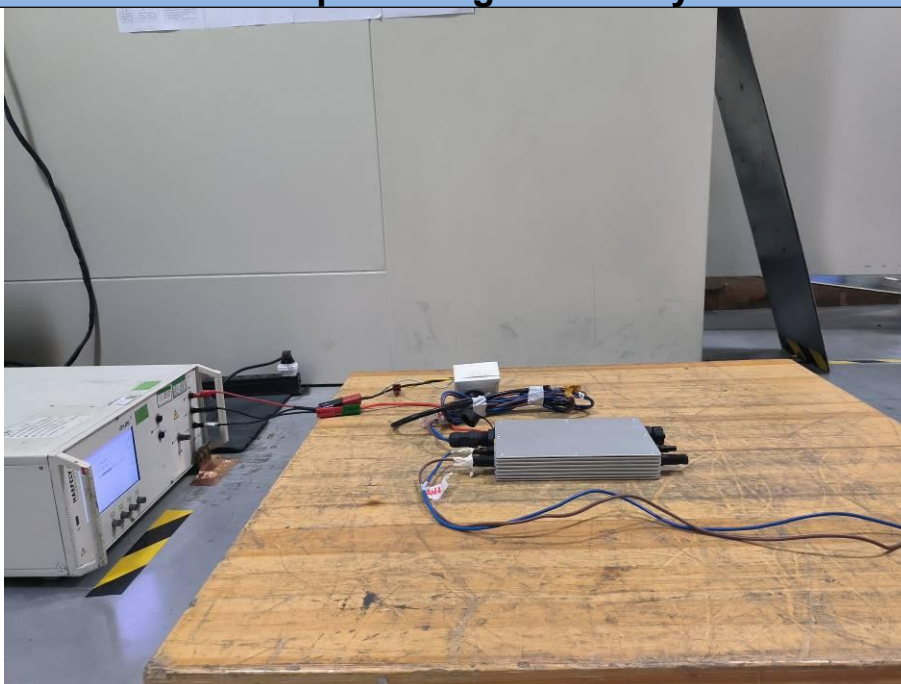


The photograph shows a laboratory environment. In the foreground, a wooden workbench holds a power supply module connected to a larger unit. The larger unit is a Laplace Instruments LTD power supply, which has a laptop on top displaying a software interface. The background features a wall with safety posters and a wooden workbench.

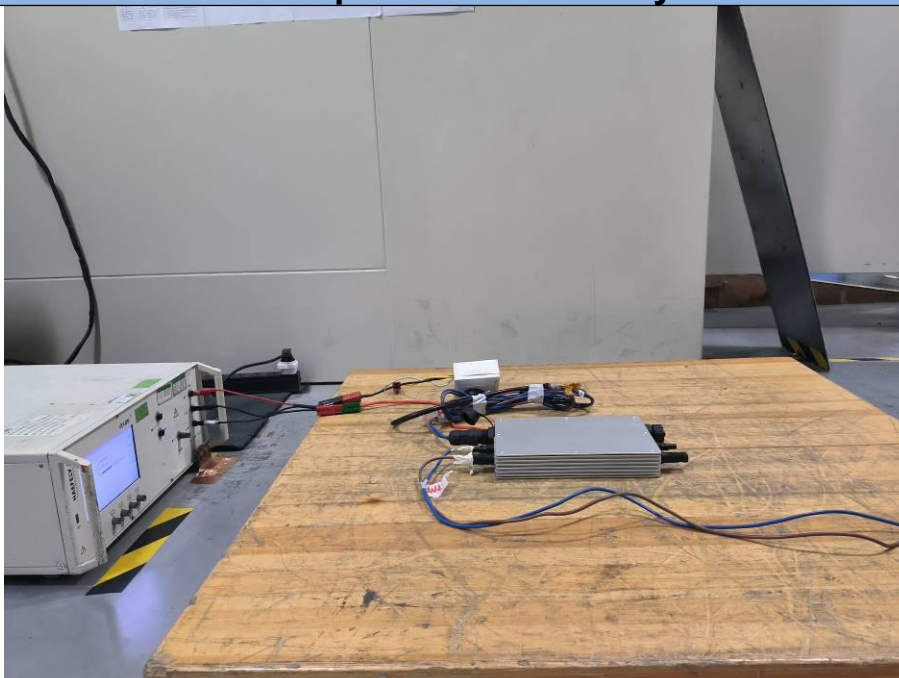
### Set-up for Radio-Frequency Electromagnetic Field



### Set-up for Surge Immunity



### Set-up for EFT Immunity

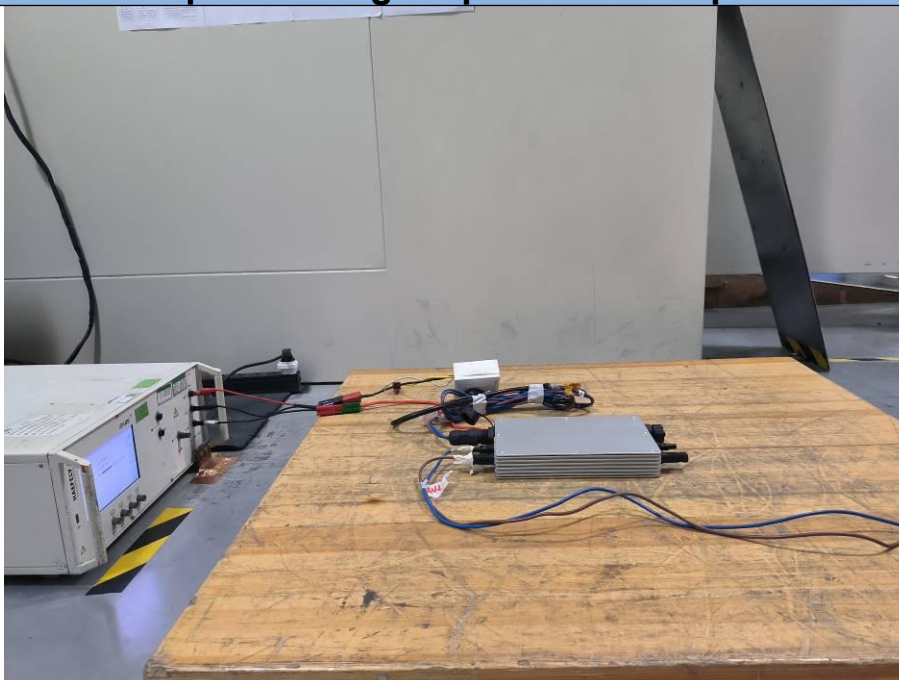


### Set-up for Conducted RF Common Mode





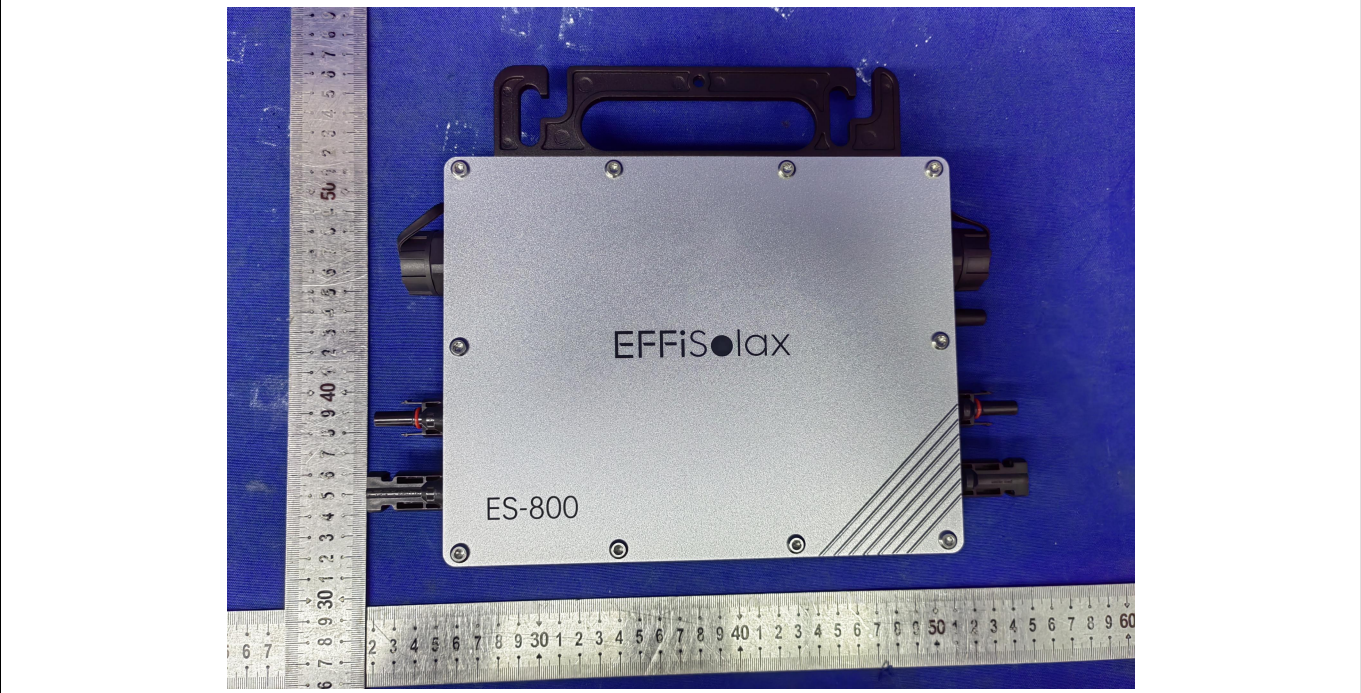
### Set-up for Voltage Dips and Interruptions



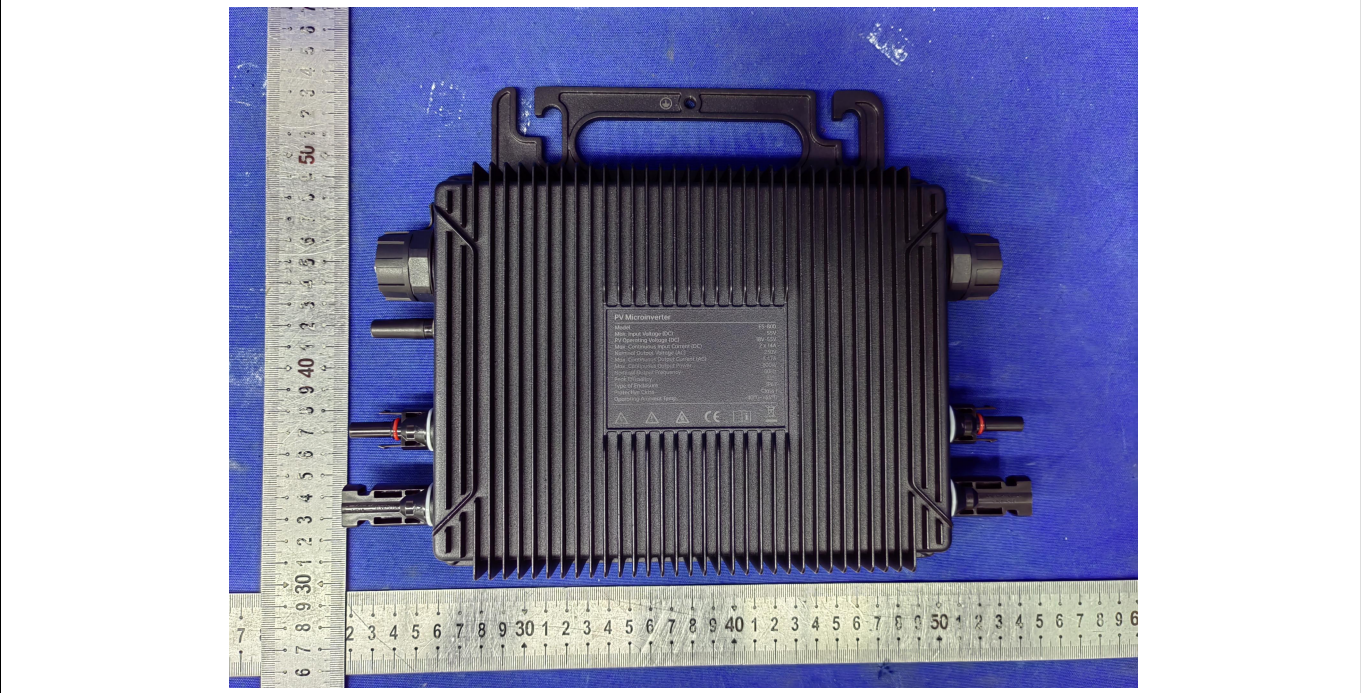
# APPENDIX II (Photos of E.U.T)

Photos of the EUT

Over View -1

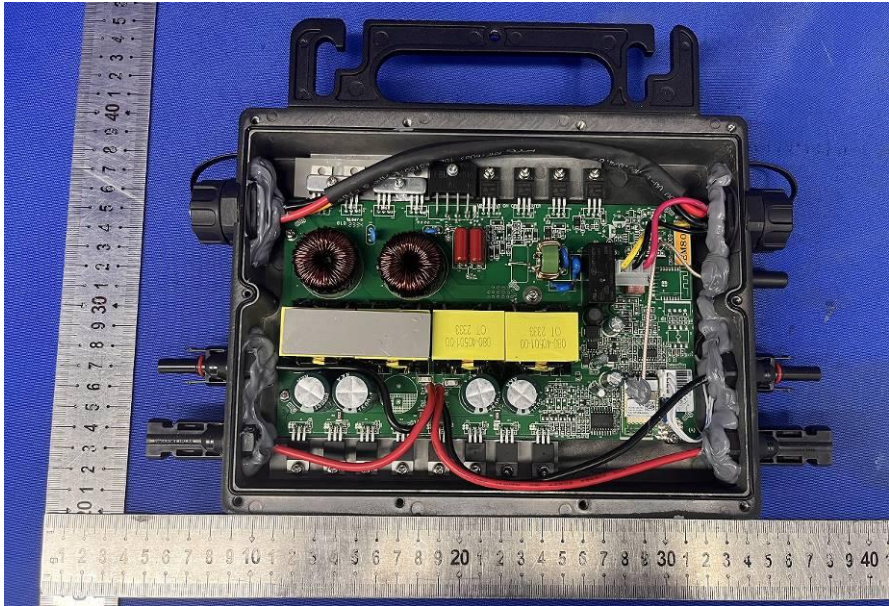


Over View -2

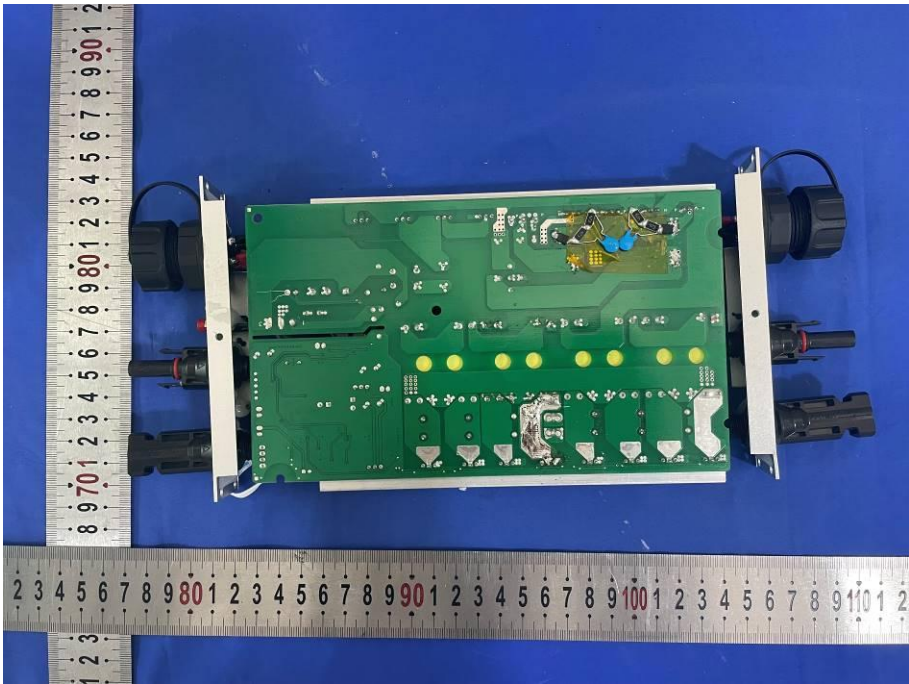




PCB View -1



PCB View -2



---End ---