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TEST REPORT


Applicant: Shenzhen LEMAX New Energy Co., Ltd

Address: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China

EUT Name: Grid-connected PV Inverter

Mode Name Under Test: SUN-60K-G03

Series Model Name: SUN-30K-G03, SUN-33K-G03, SUN-35K-G03, SUN-40K-G03, SUN-50K-G03, SUN-60K-G03

Brand Name:  LEMAX

Test Standard: EN IEC 61000-6-2:2019, EN IEC 61000-6-4:2019, IEC 61000-6-2:2016, IEC 61000-6-4:2018, IEC 61000-3-11:2017, IEC 61000-3-12:2011, EN IEC 61000-3-11:2019, EN 61000-3-12:2011

Sample Arrival Date: Jan. 19, 2021

Test Date: Jan. 19, 2021 ~ Feb. 06, 2021

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ISSUED BY:

Dongguan BALUN Testing Technology Co., Ltd.

Tested by: Yongqing Chen



Checked by: Tao Zheng



Approved by: Simon Qi





Revision History

| Version | Issue Date | Revisions Content |
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| <u>Rev. 01</u> | <u>Feb. 07, 2023</u> | <u>Initial Issue</u> |

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1. GENERAL INFORMATION

1.1. Test Laboratory

| | |
|---------|--|
| Name | Dongguan BALUN Testing Technology Co., Ltd. |
| Address | Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong Province, P. R. China 523808 |

1.2. Test Location

| | |
|----------|--|
| Name | Dongguan BALUN Testing Technology Co., Ltd. |
| Location | Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong Province, P. R. China 523808 |



2. PRODUCT INFORMATION

2.1. Applicant Information

| | |
|-----------|---|
| Applicant | Shenzhen LEMAX New Energy Co., Ltd |
| Address | A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China |

2.2. Manufacturer Information

| | |
|--------------|---|
| Manufacturer | Shenzhen LEMAX New Energy Co., Ltd |
| Address | A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China |

2.3. Factory Information

| | |
|---------|---|
| Factory | NingBo Deye Inverter Technology Co.,Ltd. |
| Address | No. 26 South YongJiang Road, Daqi, Beilun, NingBo, China. |

2.4. General Description for Equipment under Test (EUT)

| | |
|---|---|
| EUT Name | Grid-connected PV Inverter |
| Mode Name Under Test | SUN-60K-G03 |
| Series Model Name | SUN-30K-G03, SUN-33K-G03, SUN-35K-G03, SUN-40K-G03, SUN-50K-G03, SUN-60K-G03 |
| Description of Model name differentiation | The variants models have the same appearance, topology, PCB board and software. The number of MPPT will be differentiated according to different power levels. The output power and input power are different which controlled by software. Dongguan BALUN Testing Technology Co., Ltd. is not responsible for the authenticity of the above statements. |
| Hardware Version | N/A |
| Software Version | DSP: 0179 CPLD: 2185 |

Parameters Table:

| Model | SUN-30K-G03 | SUN-33K-G03 |
|---------------------------------|---|-------------|
| Input Side | | |
| Max.DC Power(kW) | 39 | 42.9 |
| Max.DC Input Voltage(V) | 1000 | |
| Start-up DC Input Voltage(V) | 250 | |
| MPPT Operating Range(V) | 200~850 | |
| Max.DC Input Current(A) | 40*2 | 40*3 |
| Number of MPPT/Strings per MPPT | 2/3 | 3/3 |
| Output Side | | |
| Rated Output Power(kW) | 30 | 33 |
| Max.Active Power(kW) | 33 | 36.3 |
| Rated AC Grid Voltage(V) | 230/400 | |
| AC Grid Voltage Range(V) | 277~460 | |
| Rated Grid Frequency(Hz) | 50/60(Optional) | |
| Operating Phase | Three phase | |
| Rated AC Grid Output Current(A) | 43.5 | 48 |
| Max.AC Output Current(A) | 47.8 | 52.8 |
| Output Power Factor | 0.8 leading to 0.8 lagging | |
| Grid Current THD | <2% | |
| DC Injection Current(mA) | <0.5% | |
| Grid Frequency Range | 47-52 or 57-62 (optional) | |
| Efficiency | | |
| Max.Efficiency | 98.7% | |
| Euro Efficiency | 98% | |
| MPPT Efficiency | >99% | |
| General Data | | |
| Size(mm, W×H×D) | 647.5×537×303.5 | |
| Weight(kg) | 44.5 | |
| Topology | Transformerless | |
| Internal consumption | <1W(Night) | |
| Operating temperature | -25 ~ 65℃ | |
| Ingress protection | IP65 | |
| Max. operation altitude | 2000m | |
| Cooling Concept | Smart cooling | |
| Noise Emission(Typical) | <55dB | |
| Designed Lifetime | >20 Years | |
| Grid Connection Standard | EN50549, IEC61727, VDE 0126-1-1, IEC62109-1-2 | |
| Operation surrounding humidity | 0~100% | |
| Stafty EMC / Standard | IEC62109-1/-2, AS3100, EN61000-6-4 | |
| DC Connection | MC-4 mateable | |
| AC Connection | IP65 rated plug | |

| Model | SUN-35K-G03 | SUN-40K-G03 | SUN-50K-G03 | SUN-60K-G03 |
|---------------------------------|---|-------------|-------------|-------------|
| Input Side | | | | |
| Max.DC Power(kW) | 45.5 | 52 | 65 | 78 |
| Max.DC Input Voltage(V) | 1000 | | | |
| Start-up DC Input Voltage(V) | 250 | | | |
| MPPT Operating Range(V) | 200~850 | | | |
| Max.DC Input Current(A) | 40*3 | | 40*4 | |
| Number of MPPT/Strings per MPPT | 3/3 | | 4/3 | |
| Output Side | | | | |
| Rated Output Power(kW) | 35 | 40 | 50 | 60 |
| Max.Active Power(kW) | 38.5 | 44 | 55 | 66 |
| Rated AC Grid Voltage(V) | 230/400 | | | |
| AC Grid Voltage Range(V) | 277~460 | | | |
| Rated Grid Frequency(Hz) | 50/60(Optional) | | | |
| Operating Phase | Three phase | | | |
| Rated AC Grid Output Current(A) | 50.7 | 58 | 72.4 | 87 |
| Max.AC Output Current(A) | 55.8 | 63.8 | 79.7 | 95.7 |
| Output Power Factor | 0.8 leading to 0.8 lagging | | | |
| Grid Current THD | <2% | | | |
| DC Injection Current(mA) | <0.5% | | | |
| Grid Frequency Range | 47-52 or 57-62（optional） | | | |
| Efficiency | | | | |
| Max.Efficiency | 98.7% | | | |
| Euro Efficiency | 98% | | | |
| MPPT Efficiency | >99% | | | |
| General Data | | | | |
| Size(mm, W×H×D) | 647.5×537×303.5 | | | |
| Weight(kg) | 44.5 | | | |
| Topology | Transformerless | | | |
| Internal consumption | <1W(Night) | | | |
| Operating temperature | -25 ~ 65℃ | | | |
| Ingress protection | IP65 | | | |
| Max. operation altitude | 2000m | | | |
| Cooling Concept | Smart cooling | | | |
| Noise Emission(Typical) | <55dB | | | |
| Designed Lifetime | >20 Years | | | |
| Grid Connection Standard | EN50549, IEC61727, VDE 0126-1-1, IEC62109-1-2 | | | |
| Operation surrounding humidity | 0~100% | | | |
| Stafty EMC / Standard | IEC62109-1/-2, AS3100, EN61000-6-4 | | | |
| DC Connection | MC-4 mateable | | | |
| AC Connection | IP65 rated plug | | | |
| Display | LCD 240×160 | | | |

2.5. Ancillary Equipment

Note: not applicable.

2.6. Technical Information

| | | |
|-------------------------------|--------------|---|
| Interfaces present on the EUT | AC Ports | From mains to AC power adapter. |
| | DC Ports | From DC power supply to EUT. |
| | Telecom Port | No Telecom Ports. |
| | Signal Ports | RS-485, which cable length is less than 3m. |
| About the Product | | The equipment is Grid-connected PV Inverter, the above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual. |

Labels:



LEMAX


| | |
|----------------------------------|----------------------------|
| Product Name | Grid-connected PV Inverter |
| Model | SUN-30K-G03 |
| Max. DC Input Power | 39kW |
| Max. DC Input Voltage | 1000Vdc |
| MPPT Voltage Range | 200-850Vdc |
| Max.DC Input Current | 2x40Adc |
| Max. short circuit input current | 2x64Adc |
| Rated AC Grid Voltage | 3L/N/PE 230/400V |
| Rated AC Grid Frequency | 50/60Hz |
| Rated AC Output Power | 30kW |
| Max. Active Power | 33kW |
| Max. Apparent Output Power | 33kVA |
| Max. AC Output Current | 47.8Aac |
| Power Factor | -0.8~+0.8 |
| Operating Temperature Range | -25℃~+65℃ |
| Ingress Protection | IP65 |
| Protection Level | Class I |


Standard IEC/EN 62109-1,
IEC/EN 62109-2


Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China


Safety Warning

  The AC and DC circuits must be disconnected separately, 5min and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.

 It is strictly forbidden for users to open the casing. Professional maintenance is required for internal maintenance of the inverter.

 Surface high temperature , Please do not touch the inverter case.

 The DC input terminals of the inverter must not be grounded.

 Please read the instructions carefully before use.



LEMAX


| | |
|----------------------------------|----------------------------|
| Product Name | Grid-connected PV Inverter |
| Model | SUN-33K-G03 |
| Max. DC Input Power | 42.9kW |
| Max. DC Input Voltage | 1000Vdc |
| MPPT Voltage Range | 200-850Vdc |
| Max.DC Input Current | 3x40Adc |
| Max. short circuit input current | 3x64Adc |
| Rated AC Grid Voltage | 3L/N/PE 230/400V |
| Rated AC Grid Frequency | 50/60Hz |
| Rated AC Output Power | 33kW |
| Max. Active Power | 36.3kW |
| Max. Apparent Output Power | 36.3kVA |
| Max. AC Output Current | 52.8Aac |
| Power Factor | -0.8~+0.8 |
| Operating Temperature Range | -25℃~+65℃ |
| Ingress Protection | IP65 |
| Protection Level | Class I |


Standard IEC/EN 62109-1,
IEC/EN 62109-2


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Safety Warning

  The AC and DC circuits must be disconnected separately, 5min and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.

 It is strictly forbidden for users to open the casing. Professional maintenance is required for internal maintenance of the inverter.

 Surface high temperature , Please do not touch the inverter case.

 The DC input terminals of the inverter must not be grounded.

 Please read the instructions carefully before use.



LEMAX


| | |
|----------------------------------|----------------------------|
| Product Name | Grid-connected PV Inverter |
| Model | SUN-35K-G03 |
| Max. DC Input Power | 45.5kW |
| Max. DC Input Voltage | 1000Vdc |
| MPPT Voltage Range | 200-850Vdc |
| Max.DC Input Current | 3x40Adc |
| Max. short circuit input current | 3x64Adc |
| Rated AC Grid Voltage | 3L/N/PE 230/400V |
| Rated AC Grid Frequency | 50/60Hz |
| Rated AC Output Power | 35kW |
| Max. Active Power | 38.5kW |
| Max. Apparent Output Power | 38.5kVA |
| Max. AC Output Current | 55.8Aac |
| Power Factor | -0.8~+0.8 |
| Operating Temperature Range | -25℃~+65℃ |
| Ingress Protection | IP65 |
| Protection Level | Class I |


Standard IEC/EN 62109-1,
IEC/EN 62109-2


Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China


Safety Warning

  The AC and DC circuits must be disconnected separately, 5min and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.

 It is strictly forbidden for users to open the casing. Professional maintenance is required for internal maintenance of the inverter.

 Surface high temperature , Please do not touch the inverter case.

 The DC input terminals of the inverter must not be grounded.

 Please read the instructions carefully before use.



LEMAX


| | |
|----------------------------------|----------------------------|
| Product Name | Grid-connected PV Inverter |
| Model | SUN-40K-G03 |
| Max. DC Input Power | 52kW |
| Max. DC Input Voltage | 1000Vdc |
| MPPT Voltage Range | 200-850Vdc |
| Max.DC Input Current | 3x40Adc |
| Max. short circuit input current | 3x64Adc |
| Rated AC Grid Voltage | 3L/N/PE 230/400V |
| Rated AC Grid Frequency | 50/60Hz |
| Rated AC Output Power | 40kW |
| Max. Active Power | 44kW |
| Max. Apparent Output Power | 44kVA |
| Max. AC Output Current | 63.8Aac |
| Power Factor | -0.8~+0.8 |
| Operating Temperature Range | -25℃~+65℃ |
| Ingress Protection | IP65 |
| Protection Level | Class I |


Standard IEC/EN 62109-1,
IEC/EN 62109-2


Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China


Safety Warning

  The AC and DC circuits must be disconnected separately, 5min and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.

 It is strictly forbidden for users to open the casing. Professional maintenance is required for internal maintenance of the inverter.

 Surface high temperature , Please do not touch the inverter case.

 The DC input terminals of the inverter must not be grounded.

 Please read the instructions carefully before use.



LEMAX


| | |
|----------------------------------|----------------------------|
| Product Name | Grid-connected PV Inverter |
| Model | SUN-50K-G03 |
| Max. DC Input Power | 65kW |
| Max. DC Input Voltage | 1000Vdc |
| MPPT Voltage Range | 200-850Vdc |
| Max.DC Input Current | 4x40Adc |
| Max. short circuit input current | 4x64Adc |
| Rated AC Grid Voltage | 3L/N/PE 230/400V |
| Rated AC Grid Frequency | 50/60Hz |
| Rated AC Output Power | 50kW |
| Max. Active Power | 55kW |
| Max. Apparent Output Power | 55kVA |
| Max. AC Output Current | 79.7Aac |
| Power Factor | -0.8~+0.8 |
| Operating Temperature Range | -25℃~+65℃ |
| Ingress Protection | IP65 |
| Protection Level | Class I |


Standard IEC/EN 62109-1,
IEC/EN 62109-2


Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China


Safety Warning

  The AC and DC circuits must be disconnected separately, 5min and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.

 It is strictly forbidden for users to open the casing. Professional maintenance is required for internal maintenance of the inverter.

 Surface high temperature , Please do not touch the inverter case.

 The DC input terminals of the inverter must not be grounded.

 Please read the instructions carefully before use.



LEMAX


| | |
|----------------------------------|----------------------------|
| Product Name | Grid-connected PV Inverter |
| Model | SUN-60K-G03 |
| Max. DC Input Power | 78kW |
| Max. DC Input Voltage | 1000Vdc |
| MPPT Voltage Range | 200-850Vdc |
| Max.DC Input Current | 4x40Adc |
| Max. short circuit input current | 4x64Adc |
| Rated AC Grid Voltage | 3L/N/PE 230/400V |
| Rated AC Grid Frequency | 50/60Hz |
| Rated AC Output Power | 60kW |
| Max. Active Power | 66kW |
| Max. Apparent Output Power | 66kVA |
| Max. AC Output Current | 95.7Aac |
| Power Factor | -0.8~+0.8 |
| Operating Temperature Range | -25℃~+65℃ |
| Ingress Protection | IP65 |
| Protection Level | Class I |


Standard IEC/EN 62109-1,
IEC/EN 62109-2


Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China


Safety Warning

  The AC and DC circuits must be disconnected separately, 5min and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.

 It is strictly forbidden for users to open the casing. Professional maintenance is required for internal maintenance of the inverter.

 Surface high temperature , Please do not touch the inverter case.

 The DC input terminals of the inverter must not be grounded.

 Please read the instructions carefully before use.

3. SUMMARY OF TEST RESULTS

3.1. Test Standards

| No. | Identity | Document Title |
|-----|------------------------|---|
| 1 | EN IEC 61000-6-2:2019 | Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments |
| 2 | EN IEC 61000-6-4:2019 | Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments |
| 3 | EN IEC 61000-3-11:2019 | Electromagnetic compatibility (EMC) - Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current ≤ 75 A and subject to conditional connection |
| 4 | EN 61000-3-12:2011 | Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase |
| 5 | IEC 61000-6-2:2016 | Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments |
| 6 | IEC 61000-6-4:2018 | Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments |
| 7 | IEC 61000-3-11:2017 | Electromagnetic compatibility (EMC) — Part 3-11: Limits — Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems — Equipment with rated current ≤ 75 A and subject to conditional connection |
| 8 | IEC 61000-3-12:2011 | Electromagnetic compatibility (EMC) — Part 3-12: Limits — Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase |

3.2. Verdict

| No. | Base Standard | Description | | Test Verdict | Result | Remark |
|----------|---|---|---------------|--------------|------------|--------|
| Emission | | | | | | |
| 1 | EN IEC 61000-6-4:2019, IEC 61000-6-4:2018 | Radiated Emission | Below 1 GHz | P | Annex A.1 | -- |
| | | | Above 1 GHz | N | | Note 1 |
| 2 | EN IEC 61000-6-4:2019, IEC 61000-6-4:2018 | Conducted Emission | AC Ports | P | Annex A.2 | -- |
| | | | Telecom Ports | N | | Note 2 |
| 3 | EN 61000-3-12:2011, IEC 61000-3-12:2011 | Harmonic Current Emissions | | P | Annex A.3 | -- |
| 4 | IEC 61000-3-11:2017, EN IEC61000-3-11:2019 | Voltage Fluctuations & Flicker | | P | Annex A.4 | -- |
| Immunity | | | | | | |
| 5 | IEC 61000-4-2:2008 | Electrostatic Discharge Immunity | | P | Annex A.5 | -- |
| 6 | IEC 61000-4-3:2006 +A1:2007+A2:2010 | Radiated RF Electromagnetic Field Immunity | | P | Annex A.6 | -- |
| 7 | IEC 61000-4-4:2012 | Electrical Fast Transient/Burst Immunity | AC Ports | P | Annex A.7 | -- |
| | | | DC Ports | P | | -- |
| | | | Signal Ports | N | | Note 3 |
| 8 | IEC 61000-4-5:2014 | Surge Immunity | AC Ports | P | Annex A.8 | -- |
| | | | DC Ports | P | | -- |
| | | | Signal Ports | N | | Note 4 |
| 9 | IEC 61000-4-6:2013 | Immunity to Conducted Disturbances Induced by RF Fields | AC Ports | P | Annex A.9 | -- |
| | | | DC Ports | P | | -- |
| | | | Signal Ports | N | | Note 3 |
| 10 | IEC 61000-4-8:2009 | Power-frequency magnetic field | | P | Annex A.10 | -- |
| 11 | IEC 61000-4-34:2005 +A1:2009 | Voltage Dips and Short Interruptions Immunity | AC Ports | P | Annex A.11 | -- |

Note 1: The highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall be made below 1 GHz.

Note 2: Telecommunications/network port is a point of connection for voice, data and signaling transfers intended to interconnect widely dispersed systems via such means as direct connection to multi-user telecommunications networks, local area networks and similar networks. A port generally intended for interconnection of components of an ITE system under test and used in accordance with its functional specifications, is not considered to be a telecommunication port. The EUT does not have telecommunication port according to above definition.

Note 3: Signal/control port is a port at which a conductor or cable intended to carry signals is connected to the equipment. Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m. The signal ports cable length of EUT is less than

2m.

Note 4: Signal/control port is a port at which a conductor or cable intended to carry signals is connected to the equipment. Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 30 m. The signal ports cable length of EUT is less than 2m.

Note 5: The differences between this report and the report No.BL-DG20C0913-401, which was issued by Shenzhen BALUN Technology Co., Ltd. on Feb. 26, 2021 is that :

a: Change the applicant information, manufacturer information, EUT name and series model.

b: Update the labels and EUT external photos.

The sample under test is the same. All test result please refer to report BL-DG20C0913-401, which was issued by Shenzhen BALUN Technology Co., Ltd. on Feb. 26, 2021.

This report judges the test conclusions:

| | |
|--|---|
| ——Not applicable for this test product | N |
| ——Meet requirements | P |
| ——Does not meet the requirements | F |

3.3. Test Uncertainty

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

| Measurement | Value |
|-----------------------------------|---------|
| Conducted emissions (Mains port) | 3.77 dB |
| Radiated emissions (30 MHz-1 GHz) | 4.81 dB |

4. GENERAL TEST CONFIGURATIONS

4.1. Test Environments

| Environment Parameter | Selected Values During Tests | | | |
|---|------------------------------|--------------------------------|-------------------|-------------------|
| | Temperature | Voltage | Relative Humidity | Ambient Pressure |
| Normal Temperature, Normal Voltage (NTNV) | 20°C ~ 27°C | AC 400V 50Hz MPPT 200V~850V | 50% ~ 57% | 100kPa ~ 100.6kPa |

4.2. Test Equipment List

| Radiated Emission Test For Frequency Below 1 GHz | | | | | | |
|--|----------------------|---------------------|------------|------------|------------|-----|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due | Use |
| EMI Receiver | Keysight | N9038A | MY55330115 | 2020.03.16 | 2021.03.15 | ✓ |
| Test Antenna- Bi-Log | SCHWARZBECK | VULB 9163 | 9163-1202 | 2018.12.20 | 2021.12.19 | ✓ |
| Anechoic Chamber | YIHENG ELECTRONIC | 12.0m*7.0 m*7.5m | YHEMC018 | 2019.03.05 | 2022.03.04 | ✓ |
| Description | Manufacturer | Name | | Version | | |
| Test Software | BALUN | BL410-E | | V19.319 | | |

| Conducted Emission | | | | | | |
|--------------------|----------------------|---------------------|------------|------------|------------|-----|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due | Use |
| EMI Receiver | Keysight | N9038A | MY55330115 | 2020.03.16 | 2021.03.15 | ✓ |
| LISN | SCHWARZBECK | NNLK 8129 | 8129-462 | 2020.11.10 | 2021.11.09 | ✓ |
| Anechoic Chamber | YIHENG ELECTRONIC | 12.0m*7.0m *7.5m | YHEMC018 | 2019.03.05 | 2022.03.04 | ✓ |
| Description | Manufacturer | Name | | Version | | |
| Test Software | BALUN | BL410-E | | V19.319 | | |

| Voltage Fluctuations & Flicker and Harmonic Current Emissions Test | | | | | | |
|--|--------------|--------|------------|------------|------------|-----|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due | Use |
| Power Analyzer | FULKE | 435II | 37143115 | 2020.03.04 | 2021.03.03 | ✓ |
| Three-phase Flicker Impedance | HTEC | FI-75A | 172101 | 2020.09.21 | 2021.09.20 | ✓ |

| Electrostatic Discharge Immunity Test | | | | | | |
|---------------------------------------|--------------|------------|------------|------------|------------|-----|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due | Use |
| ESD Test System | SCHLODER | SESD 30000 | 607339 | 2020.05.13 | 2021.05.12 | ✓ |

| Radiated RF Electromagnetic Field Immunity Test | | | | | | |
|---|-------------------|------------------|------------|------------|------------|-----|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due | Use |
| Anechoic Chamber | YIHENG ELECTRONIC | 12.0m*7.0m*7.5m | YHEMC018 | 2019.03.05 | 2022.03.04 | ✓ |
| Signal Generator | ROHDE&SCHWARZ | N5181A | MY50141978 | 2020.03.16 | 2021.03.15 | ✓ |
| Power Amplifier | rflight | NTWPA-008 10200E | 18093198 | 2020.03.16 | 2021.03.15 | ✓ |
| Power Amplifier | rflight | NTWPA-106 0100E | 18093195 | 2020.03.16 | 2021.03.15 | ✓ |
| Power Meter | Agilent | E4417A | GB41292042 | 2020.03.18 | 2021.03.17 | ✓ |
| Feld Strength Meter | Narda | EP601 | 511WX51129 | 2020.03.18 | 2021.03.17 | ✓ |
| Test Antenna-Bi-Log | SCHWARZBECK | VULB 9163 | 9163-1202 | 2018.12.20 | 2021.12.19 | ✓ |
| Test Antenna-Horn | SCHWARZBECK | BBHA 9120D | 9120D-1986 | 2018.12.20 | 2021.12.19 | ✓ |
| Description | Manufacturer | Name | | Version | | |
| Test Software | BALUN | BL410-E | | V19.319 | | |

| Electrical Fast Transient/Burst Immunity Test | | | | | | |
|---|--------------|---------|------------|------------|------------|-----|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due | Use |
| EFT Test System | HTEC | HEFT 51 | 1331011 | 2020.03.16 | 2021.03.15 | ✓ |
| EFT coupling network | HTEC | ECDN 51 | 150601 | 2020.03.16 | 2021.03.15 | ✓ |

| Transients and Surges Test | | | | | | |
|--------------------------------------|--------------|-----------|------------|------------|------------|-----|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due | Use |
| SURGE Generator (AC/DC Ports) | HTEC | HCWG 70 | 151601 | 2020.03.16 | 2021.03.15 | ✓ |
| SURGE coupling network (AC/DC Ports) | HTEC | SCDN303P7 | 151602 | 2020.03.16 | 2021.03.15 | ✓ |

| Immunity to Conducted Disturbances Induced by RF Fields | | | | | | |
|---|---------------|-------------|---------------|------------|------------|-----|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due | Use |
| Conducted Disturbances Test System | Schloder GmbH | CDG 6000 | 18901932-0101 | 2020.09.21 | 2021.09.20 | ✓ |
| CDN-M2+3 | Schloder GmbH | CDN M2+3-32 | 18901802-0110 | 2020.09.21 | 2021.09.20 | ✓ |
| CDN-M5 | TESEQ | CDN-M5-100 | A2560005/2016 | 2020.09.21 | 2021.09.20 | ✓ |

| Voltage Dips and Short Interruptions Immunity Test | | | | | | |
|--|--------------|----------|------------|------------|------------|-----|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due | Use |
| Voltage Fault Simulating Generator | HTEC | HPFS303P | 152301 | 2020.03.16 | 2021.03.15 | √ |
| Voltage Fault Coupling Network | HTEC | HV3P30 | 152302 | 2020.03.16 | 2021.03.15 | √ |

| Power Frequency Magnetic Fields Immunity | | | | | | |
|--|--------------|------------|------------|------------|------------|-----|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due | Use |
| Magnetic Field Tester | HEAFELY | HPFMF 1000 | 183102 | 2020.05.13 | 2021.05.12 | √ |

4.3. Test Enclosure list

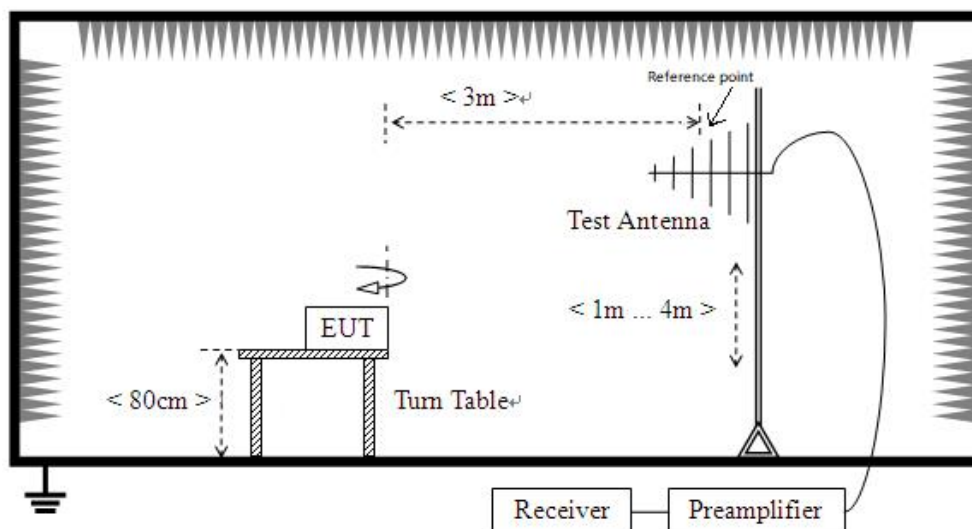
| Name | Manufacturer | Model | Serial No. | Length | Description |
|-----------|--------------|---------------|--------------|--------|-------------|
| DC Source | WKDY | WPLA-150W | W20180626011 | N/A | N/A |
| AC Source | WKDY | WPLA-33075KVA | N/A | N/A | N/A |

4.4. Test Configurations

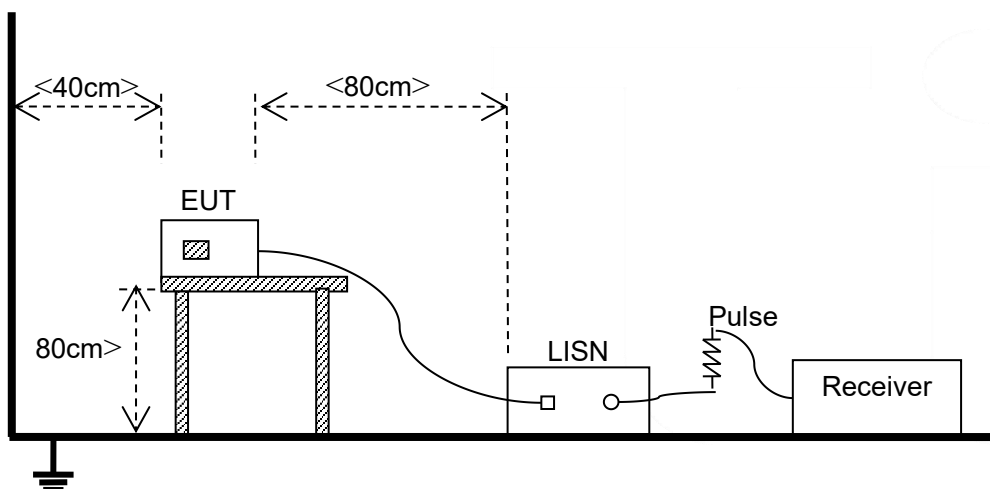
| Test Configurations (TC) No. | Description |
|------------------------------|---|
| TC01 | <u>Grid-connected(100% Load)</u> <u>EUT+ DC Source+AC Grid</u> |
| TC02 | <u>Grid-connected(86% Load)</u> <u>EUT+ DC Source+AC Grid</u> |
| TC03 | <u>Grid-connected(50% Load)</u> <u>EUT+ DC Source+AC Grid</u> |
| TC04 | <u>Grid-connected(10% Load)</u> <u>EUT+ DC Source+AC Grid</u> |
| TC05 | <u>Standby</u> <u>EUT+AC Grid</u> |

4.5. Description of Test Setup

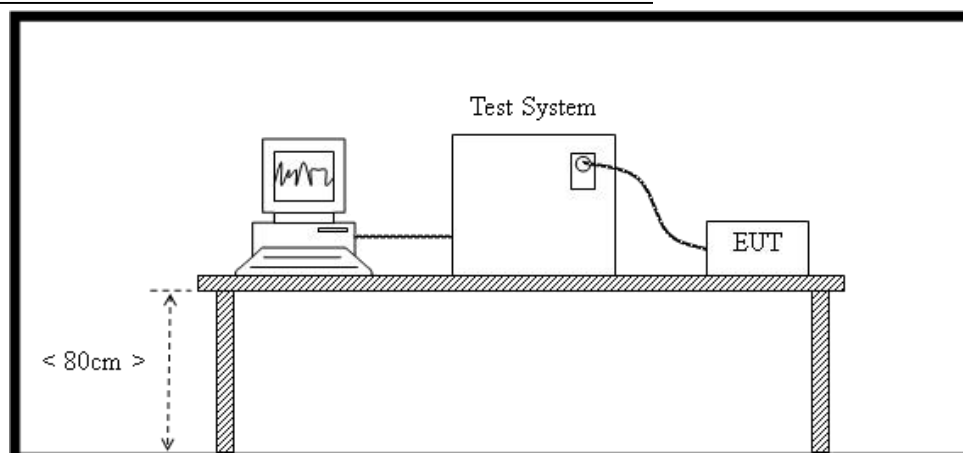
Test Setup 1 For Radiated Emission Test (30 MHz-1 GHz)



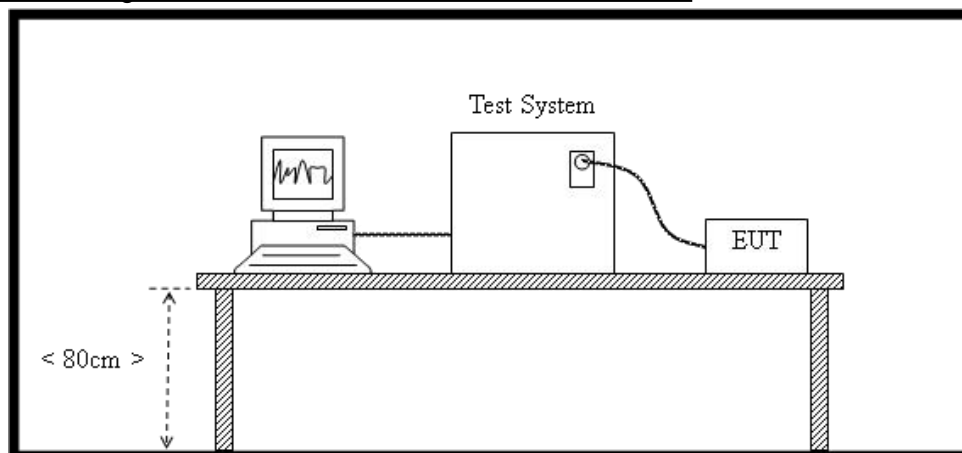
Test Setup 2 For Conducted disturbance voltage at mains terminals Test



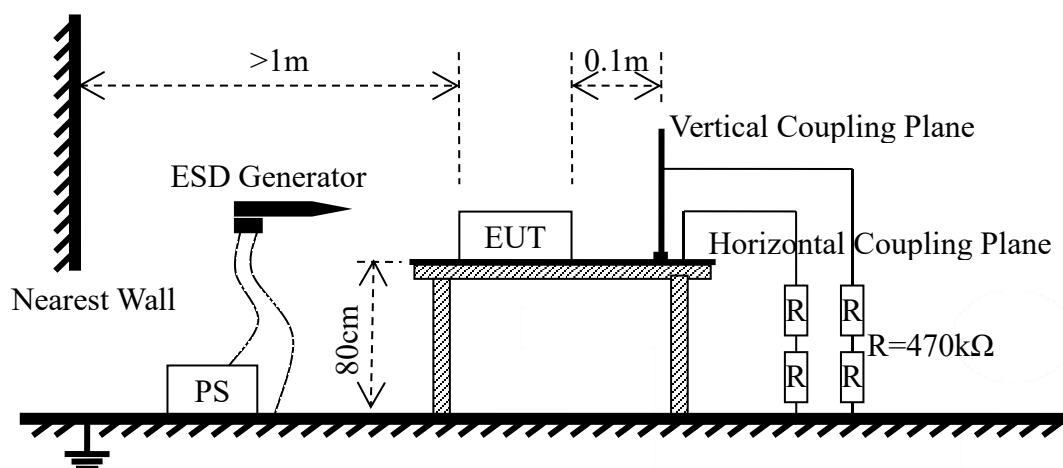
Test Setup 3 For Harmonic Current Emissions Measurement Test



Test Setup 4 For Voltage Fluctuations and Flicker Measurement Test

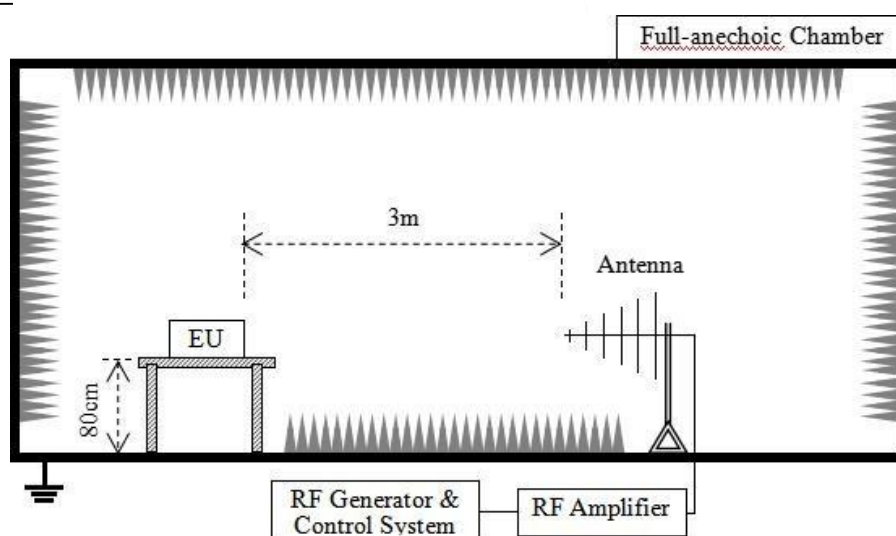


Test Setup 5 For Electrostatic Discharge Immunity Test

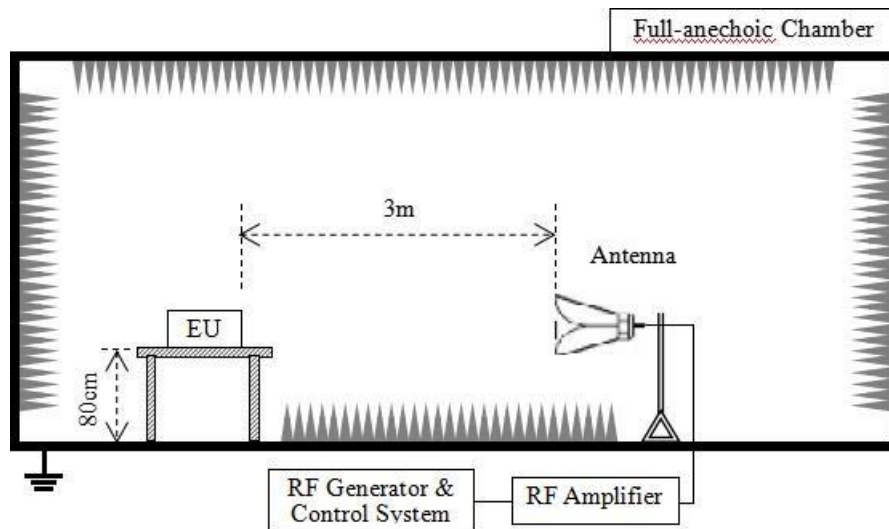


Test Setup 6 For Radiated Immunity Test

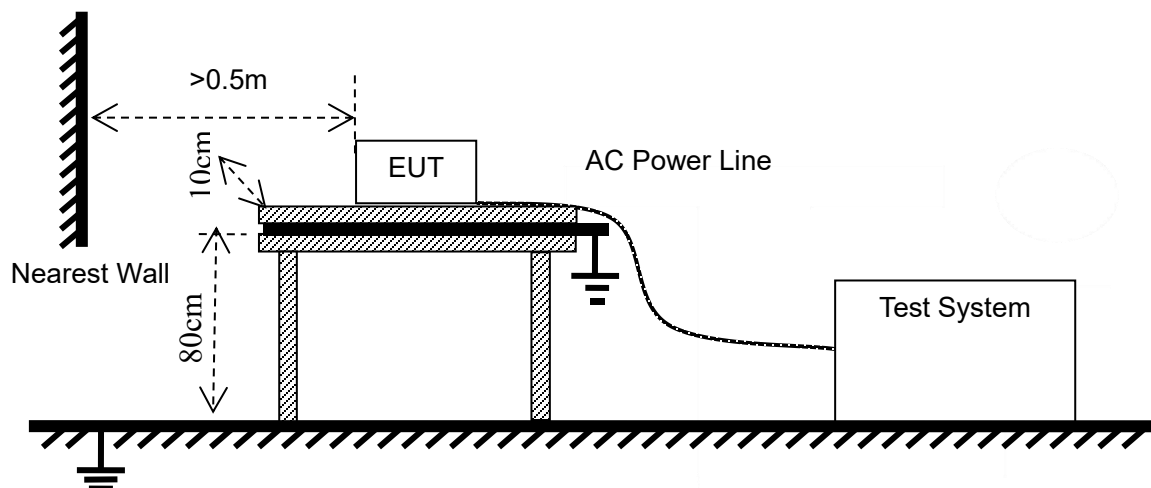
For below 1GHz



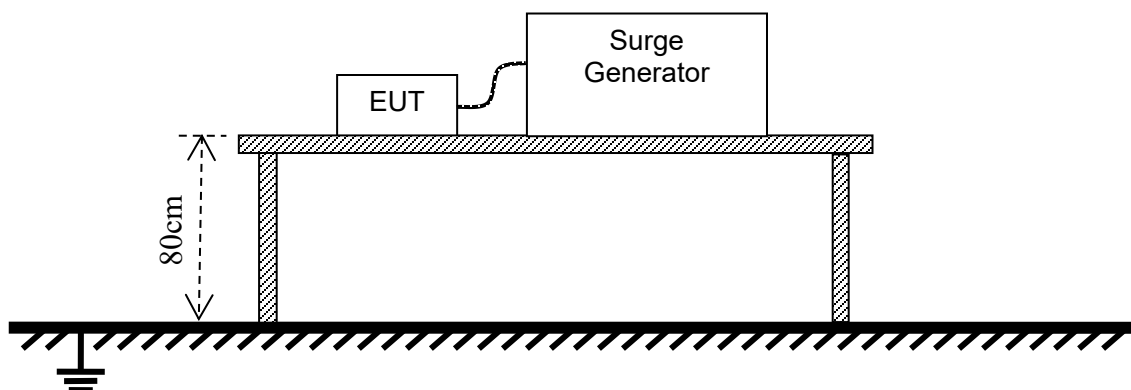
For above 1GHz



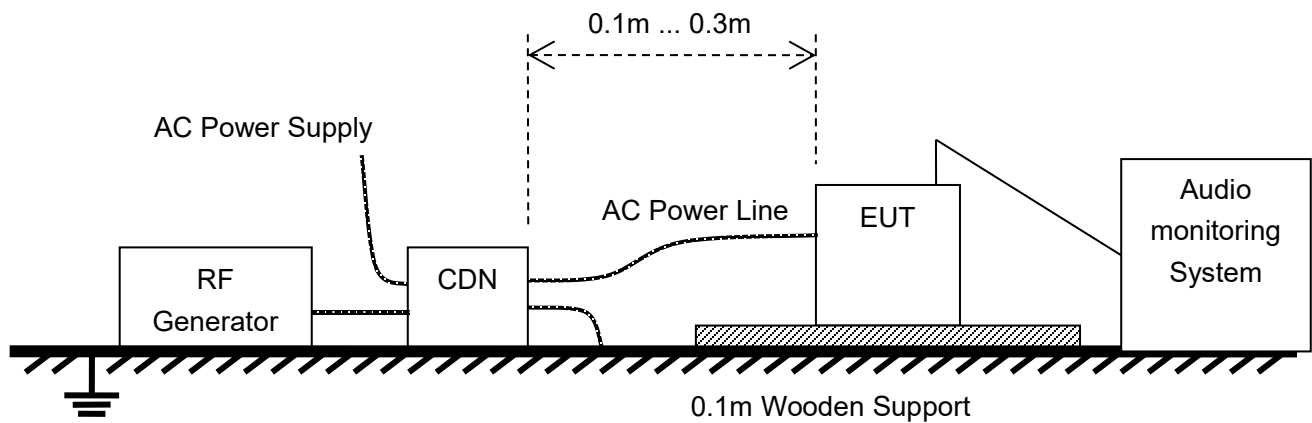
Test Setup 7 For Electrical Fast Transient / Burst Immunity Test



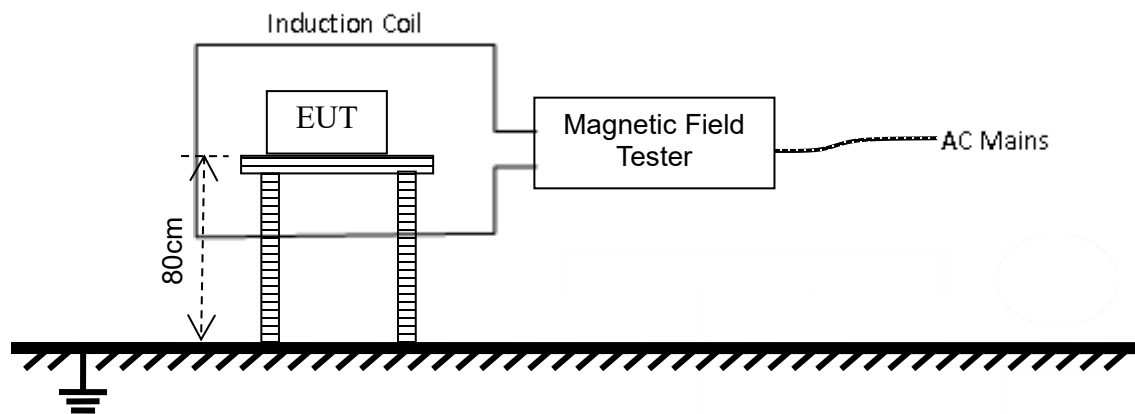
Test Setup 8 For Surge Immunity Test



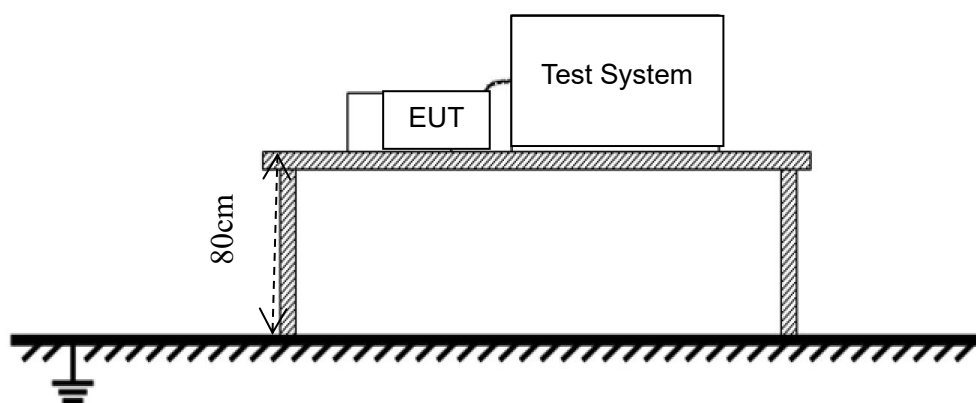
Test Setup 9 For Immunity to Conducted Disturbances Induced By RF Fields Test



Test Setup 10 Power Frequency Magnetic Fields



Test Setup 11 For Voltage Dips and Short Interruptions Immunity Test



4.6. Test Conditions

| Test Case | Test Conditions | |
|--|--------------------|------------------|
| Radiated Emission | Test Env. | NTNV |
| | Test Setup | Test Setup 1 |
| | Test Configuration | TC01, TC03, TC05 |
| Conducted Emission | Test Env. | NTNV |
| | Test Setup | Test Setup 2 |
| | Test Configuration | TC01, TC03, TC05 |
| Harmonic Current Emissions | Test Env. | NTNV |
| | Test Setup | Test Setup 3 |
| | Test Configuration | TC02 |
| Voltage Fluctuations & Flicker | Test Env. | NTNV |
| | Test Setup | Test Setup 4 |
| | Test Configuration | TC02 |
| Electrostatic Discharge Immunity | Test Env. | NTNV |
| | Test Setup | Test Setup 5 |
| | Test Configuration | TC04 |
| Radiated RF Electromagnetic Field Immunity | Test Env. | NTNV |
| | Test Setup | Test Setup 6 |
| | Test Configuration | TC04 |
| Electrical Fast Transient/Burst Immunity | Test Env. | NTNV |
| | Test Setup | Test Setup 7 |
| | Test Configuration | TC04 |
| Surge Immunity | Test Env. | NTNV |
| | Test Setup | Test Setup 8 |
| | Test Configuration | TC04 |
| Immunity to Conducted Disturbances Induced by RF Fields | Test Env. | NTNV |
| | Test Setup | Test Setup 9 |
| | Test Configuration | TC04 |
| Power-frequency magnetic field | Test Env. | NTNV |
| | Test Setup | Test Setup 10 |
| | Test Configuration | TC04 |
| Voltage Dips and Short Interruptions Immunity | Test Env. | NTNV |
| | Test Setup | Test Setup 11 |
| | Test Configuration | TC04 |
| Note: Based on client request, all normal using modes of the normal function were tested but only the worst test data of the worst mode is reported by this report. The grid-connected(100% Load) is the worst test mode in this report. | | |

5. TEST ITEMS

5.1. Emission Tests

5.1.1. Radiated Emission

5.1.1.1. Limit

| Frequency range (MHz) | Distance (at 3 m) | Distance (at 10 m) |
|--------------------------|---------------------------------|---------------------------------|
| | Quasi-Peak Limit (dB μ V/m) | Quasi-Peak Limit (dB μ V/m) |
| 30 - 230 | 50 | 40 |
| 230 - 1000 | 57 | 47 |

| Frequency range (MHz) | Distance (at 3 m) | |
|--------------------------|---------------------------|------------------------------|
| | Peak Limit (dB μ V/m) | Average Limit (dB μ V/m) |
| 1000-3000 | 76 | 56 |
| 3000-6000 | 80 | 60 |

NOTE:

- 1) If the highest internal frequency of the EUT is less than 108MHz, the measurement shall only be made up to 1GHz; If the highest internal frequency of the EUT is between 108MHz and 500MHz, the measurement shall only be made up to 2GHz; If the highest internal frequency of the EUT is between 500MHz and 1GHz, the measurement shall only be made up to 5GHz; If the highest internal frequency of the EUT is above 1GHz, the measurement shall be made up to 6GHz; Where the highest internal frequency is not known, tests shall be performed up to 6GHz.
- 2) At transitional frequencies the lower limit applies.

5.1.1.2. Test Procedure

All Radiated Emission tests were performed in the azimuth plane. And test data and plots are recorded in this test report.

An initial pre-scan was performed in the chamber using the EMI Receiver in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by Bi-Log antenna with 2 orthogonal polarities.

5.1.2. Conducted Emission

5.1.2.1. Test Limit

AC Port

| Frequency range (MHz) | Quasi-peak (dBuV) | Average (dBuV) |
|-----------------------|-------------------|----------------|
| 0.15 - 0.50 | 79 | 66 |
| 0.50 - 30 | 73 | 60 |

NOTE:

- 1) The lower limit shall apply at the band edges.

Telecom Port

| Frequency range (MHz) | Quasi-peak (dBuV) | Average (dBuV) |
|-----------------------|-------------------|----------------|
| 0.15 - 0.50 | 97-87 | 84-74 |
| 0.50 - 30 | 87 | 74 |

NOTE:

- 1) The lower limit shall apply at the band edges.
- 2) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50 MHz.
- 3) The current and voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 150 Ω to telecommunication port under test.

Discontinuous disturbances

The click limit L_q is calculated by increasing the relevant quasi-peak limit L for continuous disturbances (as given in AC Port quasi-peak limit) by:

| Frequency (MHz) | Click rate N | |
|-----------------|-------------------------------------|---|
| | Click limit L_q (dB) $N < 0,2$ | Click limit L_q (dB) $0,2 \leq N < 30$ |
| 0.15 - 30 | AC Port quasi-peak limit + 44 | AC Port quasi-peak limit + $20 \lg (30/N)$ |

5.1.2.2. Test Procedure

The EUT is connected to the power mains through a LISN which provides 50 Ω /50 μ H or 150 Ω of coupling impedance for the measuring instrument. The test frequency range is from 150 kHz to 30 MHz. The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels that are more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Telecommunication port was checked to find out the maximum conducted emission.

5.1.3. Harmonic Current Emissions ($\leq 16A$)

5.1.3.1. Limit

For each harmonic order, all 1.5s smoothed r.m.s. harmonic current values, as defined as follows, shall be either:

- a) Less than or equal to 150% of the applicable limits, or
- b) Less than or equal to 200% of the applicable limits under the following conditions, which apply all together:
 - 1) The EUT belongs to Class A for harmonics;
 - 2) The excursion beyond 150% of the applicable limits lasts less than 10% of the test observation period or in total 10min (within the test observation period), whichever is smaller, and
 - 3) The average value of the harmonic current, taken over the entire test observation period, is less than 90% of the applicable limits.

Harmonic currents less than 0.6% of the input current measured under the test conditions, or less than 5mA, whichever is greater, are disregarded.

For the 21st and higher odd order harmonics, the average value obtained for each individual odd harmonic over the full observation period, calculated from the 1.5s smoothed r.m.s., may exceed the applicable limits by 50% provided that the following conditions are met:

- The measured partial odd harmonic current does not exceed the partial odd harmonic current which can be calculated from the applicable limits;
- All 1.5s smoothed r.m.s. individual harmonic current values shall be less than or equal to 150% of the applicable limits.

Note: These exemptions (the use of the partial odd harmonic current for the average values and the 200% short term limit for single 1.5s smoothed values) are mutually exclusive and cannot be together.

| Limits for Class A equipment | | | | Limits for Class D equipment | | |
|--|--|--------------------|--|---------------------------------|--|--|
| odd harmonic | | Even harmonics | | Harmonic order (n) | Maximum permissible harmonic current per watt mA/W | Maximum permissible harmonic current A |
| Harmonic order (n) | Maximum permissible harmonic current A | Harmonic order (n) | Maximum permissible harmonic current A | | | |
| 3 | 2.30 | 2 | 1.08 | 3 | 3.4 | 2.30 |
| 5 | 1.14 | 4 | 0.43 | 5 | 1.9 | 1.14 |
| 7 | 0.77 | 6 | 0.30 | 7 | 1.0 | 0.77 |
| 9 | 0.40 | 8≤n≤40 | 0.23*(8/n) | 9 | 0.5 | 0.40 |
| 11 | 0.33 | | | 11 | 0.35 | 0.33 |
| 13 | 0.21 | | | 15≤n≤39 (odd harmonics only) | 3.85/n | 0.15*(15/n) |
| 15≤n≤39 | 0.15*(15/n) | | | | | |
| Note: For Class B equipment, the harmonics of the input current shall not exceed the values given in Table “limits for Class A equipment” multiplied by a factor of 1.5. | | | | | | |

For the purpose of harmonic current limitation, equipment is classified as follows:(Note: Class C equipment requirement not include in this standard.)

Class A:

- balanced three-phase equipment;
- household appliances, excluding equipment identified as class D;
- tools, excluding portable tools;
- dimmers for incandescent lamps;
- audio equipment.

Equipment not specified in one of the three other classes shall be considered as class A equipment.

Class B:

- portable tools;
- arc welding equipment which is not professional equipment.

Class C:

- lighting equipment.

Class D:

Equipment having a specified power according to 6.2.2 less than or equal to 600 W, of the following types:

- personal computers and personal computer monitors;
- television receivers.

5.1.3.2. Test Procedure

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

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

5.1.4. Harmonic Current Emissions (>16A)

5.1.4.1. Limit

S_{SC}

value of the three-phase short-circuit power calculated from the nominal interphase system voltage $U_{nominal}$ and the line impedance Z of the system at the PCC:

$$S_{SC} = U_{nominal}^2 / Z$$

where Z is the system impedance at the power frequency

S_{equ}

value calculated from the rated current I_{equ} of the piece of equipment stated by the manufacturer and the rated voltage U_p (single phase) or U_i (interphase) as follows:

$$S_{equ} = U_p I_{equ} \quad \text{for single-phase equipment and the single-phase part of hybrid equipment}$$

$$S_{equ} = U_i I_{equ} \quad \text{for interphase equipment}$$

$$S_{equ} = \sqrt{3} U_i I_{equ} \quad \text{for balanced three-phase equipment and the three-phase part of hybrid equipment}$$

$$S_{equ} = \sqrt{3} U_i I_{equ \max} \quad \text{for unbalanced three-phase equipment}$$

S_{sce}

characteristic value of a piece of equipment defined as follows:

$$R_{sce} = S_{SC} / (3 S_{equ}) \quad \text{for single-phase equipment and the single-phase part of hybrid equipment}$$

$$R_{sce} = S_{SC} / (2 S_{equ}) \quad \text{for interphase equipment}$$

$$R_{sce} = S_{SC} / (S_{equ}) \quad \text{for all three-phase equipment and the three-phase part of hybrid equipment}$$

The limits given apply to 230/400 V, 50 Hz systems. The limits for the other systems will be added in a future edition of this standard.

NOTE 1 In some non-European countries, the proposed methodology cannot be applied because the short-circuit power data is not always available.

The harmonic current limits specified in the tables apply to each of the line currents and not to current in the neutral conductor.

For equipment with multiple rated currents, an assessment is made for each current.

As an example (for the same equipment):

Rated voltage: 230 V single phase, rated current: x A per phase, assessment and test at 230 V.

Rated voltage: 400 V three phase, rated current: y A per phase, assessment and test at 400 V.

The harmonic current limits are specified in Tables 2 to 5

Equipment complying with the harmonic current emission limits corresponding to $R_{sce} = 33$ is suitable for connection at any point of the supply system.

NOTE 2 Values are based on a minimum value of $R_{sce} = 33$. Short-circuit ratios less than 33 are not considered.

NOTE 3 In order to reduce the depth of commutation notches of converters, a short-circuit ratio higher than 33 may be necessary.

For equipment not complying with the harmonic current emission limits corresponding to $R_{sce} = 33$, higher emission values are allowed, under the assumption that the short-circuit ratio R_{sce} is greater than 33. It is

expected that this will apply to the majority of equipment with input current above 16 A per phase. See requirement for product documentation in Clause 6.

Table 2 is applied to equipment other than balanced three-phase equipment and Tables 3, 4 and 5 are applied to balanced three-phase equipment.

Table 3 may be used for any balanced three-phase piece of equipment.

Table 4 may be used with balanced three-phase equipment if any one of these conditions is met.

- a) The 5th and 7th harmonic currents are each less than 5 % of the reference current during the whole test observation period.
- b) The design of the piece of equipment is such that the phase angle of the 5th harmonic current has no preferential value over time and can take any value in the whole interval $[0^\circ, 360^\circ]$
- c) The phase angle of the 5th harmonic current related to the fundamental phase-to-neutral voltage (see 3.16) is in the range of 90° to 150° during the whole test observation period.

Table 5 may be used with balanced three-phase equipment if any one of these conditions is met:

- d) The 5th and 7th harmonic currents are each less than 3 % of the reference current during the whole test observation period.
- e) The design of the piece of equipment is such that the phase angle of the 5th harmonic current has no preferential value over time and can take any value in the whole interval $[0^\circ, 360^\circ]$.
- f) The phase angle of the 5th harmonic current related to the fundamental phase-to-neutral voltage (see 3.16) is in the range of 150° to 210° during the whole test observation period.

Table 3, Table 4 or Table 5 can be applied to hybrid equipment in one of the following circumstances:

- a) hybrid equipment having a maximum 3rd harmonic current of less than 5 % of the reference current, or
- b) there is provision in the construction of hybrid equipment to separate the balanced three- phase and the single-phase or interphase loads for the measurement of supply currents, and when the current is being measured, the part of the equipment being measured draws the same current as under normal operating conditions. In that case, the relevant limits shall be applied separately to the single-phase or interphase part and to the balanced three-phase part. Table 3, Table 4 or Table 5 applies to the current of the balanced three- phase part, even if the rated current of the balanced three-phase part is less than or equal to 16 A per phase. Table 2 applies to the current of the single-phase or interphase part, but if the rated current of the single-phase or interphase part is less than or equal to 16 A, the manufacturer may apply the relevant limits of IEC 61000-3-2 to the single-phase or interphase part instead of the limits stated in Table 2.

For verification purposes, when circumstance b) above applies, the manufacturer shall state in the product documentation the rated current and give in the test report the measured and specified values of the input current as defined in 4.1, for each separate load. The value of R_{sce} for this type of hybrid equipment is determined as follows:

- the minimum R_{sce} value is first determined for each of the two loads, using the reference current of the considered part for the calculation of the harmonic current emissions to be compared to the limit values given in Tables 2 to 5; in case IEC 61000-3-2 is applied to the single-phase or interphase part instead of Table 2 limits, the minimum R_{sce} value for this part is deemed to be equal to 33;
- then, for each of the two parts, the minimum value of S_{sc} is calculated from its minimum R_{sce} value and its rated current (see 3.11 and 3.14);
- finally, the value of R_{sce} for the hybrid equipment is determined from the highest of both minimum values

of S_{sc} and the rated apparent power of the whole hybrid equipment.

Table 2 Current emission limits for equipment other than balanced three-phase equipment

| Minimum R_{sce} | Admissible individual harmonic current I_h/I_{ref}^a % | | | | | | Admissible harmonic parameters % | |
|----------------------|--|-------|-------|-------|----------|----------|--|-----------------|
| | I_3 | I_5 | I_7 | I_9 | I_{11} | I_{13} | THC/ I_{ref} | PWHC/ I_{ref} |
| 33 | 21.6 | 10.7 | 7.2 | 3.8 | 3.1 | 2 | 23 | 23 |
| 66 | 24 | 13 | 8 | 5 | 4 | 3 | 26 | 26 |
| 120 | 27 | 15 | 10 | 6 | 5 | 4 | 30 | 30 |
| 250 | 35 | 20 | 13 | 9 | 8 | 6 | 40 | 40 |
| ≥ 350 | 41 | 24 | 15 | 12 | 10 | 8 | 47 | 47 |

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

Linear interpolation between successive R_{sce} values is permitted.

a: I_{ref} =reference current; I_h =harmonica current component.

Table 3 Current emission limits for balanced three-phase equipment

| Minimum R_{sce} | Admissible individual harmonic current I_h/I_{ref}^a % | | | | Admissible harmonic parameters % | |
|----------------------|--|-------|----------|----------|--|-----------------|
| | I_5 | I_7 | I_{11} | I_{13} | THC/ I_{ref} | PWHC/ I_{ref} |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| 66 | 14 | 9 | 5 | 3 | 16 | 25 |
| 120 | 19 | 12 | 7 | 4 | 22 | 28 |
| 250 | 31 | 20 | 12 | 7 | 37 | 38 |
| ≥ 350 | 40 | 25 | 15 | 10 | 48 | 46 |

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

Linear interpolation between successive R_{sce} values is permitted.

a: I_{ref} =reference current; I_h =harmonica current component.

Table 4 Current emission for balanced three-phase equipment under specified conditions(a,b,c)

| Minimum R_{sce} | Admissible individual harmonic current I_h/I_{ref} ^a % | | | | Admissible harmonic parameters % | |
|----------------------|---|-------|----------|----------|--|-----------------|
| | I_5 | I_7 | I_{11} | I_{13} | THC/ I_{ref} | PWHC/ I_{ref} |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| ≥ 120 | 40 | 25 | 15 | 10 | 48 | 46 |

The relative values of even harmonics up to order 12 shall not exceed 16/h %. Even harmonics above order 12 are taken into account in THC and PWHC in the same way as odd order harmonics.
Linear interpolation between successive R_{sce} values is permitted.
a: I_{ref} =reference current; I_h =harmonica current component.

Table 5 Current emission for balanced three-phase equipment under specified conditions(d,e,f)

| Minimum $R_{sce} = 33$ | Admissible individual harmonic current I_h/I_{ref} ^a % | | | | | | | | | | | | Admissible harmonic parameters % | |
|---------------------------|---|-------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--|-----------------|
| | I_5 | I_7 | I_{11} | I_{13} | I_{17} | I_{19} | I_{23} | I_{25} | I_{29} | I_{31} | I_{35} | I_{37} | THC/ I_{ref} | PWHC/ I_{ref} |
| -- | | | | | | | | | | | | | | |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 2 | 1.5 | 1.5 | 1.5 | 1 | 1 | 1 | 1 | 13 | 22 |
| ≥ 250 | 25 | 17.3 | 12.1 | 10.7 | 8.4 | 7.8 | 6.8 | 6.5 | 5.4 | 5.2 | 4.9 | 4.7 | 35 | 70 |

For R_{sce} equal to 33, the relative values of even harmonics up to order 12 shall not exceed 16/h %. The relative values of all harmonics from I_{14} to I_{40} not listed above shall not exceed 1% of I_{ref} .
For $R_{sce} \geq 250$, the relative values of even harmonics up to order 12 shall not exceed 16/h %. The relative values of all harmonics from I_{14} to I_{40} not listed above shall not exceed 3% of I_{ref} .
Linear interpolation between both R_{sce} values is permitted.
a: I_{ref} =reference current; I_h =harmonica current component.

5.1.5. Voltage Fluctuations and Flicker

5.1.5.1. Limit

The following limits apply:

- The value of P_{st} shall not be greater than 1.0;
- The value of P_{lt} shall not be greater than 0.65;
- T_{max} , the accumulated time value of $d(t)$ with a deviation exceeding 3.3% during a single voltage change at the EUT terminals, shall not exceed 500ms;
- The maximum relative steady-state voltage change, dc , shall not exceed 3.3%;
- The maximum relative voltage change d_{max} , shall not exceed:
 - a) 4% without additional conditions;
 - b) 6% for equipment which is:
 - switched manually, or
 - switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.
 - c) 7% for equipment which is:
 - attended whilst in use, or
 - switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

Note: The cycling frequency is further limited by the P_{st} and P_{lt} limits.

In the case of equipment having several separately controlled circuits with limits b) and c) shall apply only if there is delayed or manual restart after a power supply interruption; for all equipment with automatic switching which is energized immediately on restoration of supply after a power supply interruption, limits a) shall apply; for all equipment with manual switching, limits b) or c) shall apply depending on the rate of switching.

P_{st} and P_{lt} requirement shall not be applied to voltage changes caused by manual switching.

The limits shall not be applied to voltage changes associated with emergency switching or emergency interruptions.

5.1.5.2. Test Procedure

During the Flicker measurement, the measure time shall include that part of whole operation changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours. The test specifications refer the next table.

| No. | Specification | Value |
|-----|----------------|--|
| 1 | Test Frequency | 50 Hz |
| 2 | Test Voltage | 230 VAC |
| 3 | Waveform | Sine |
| 4 | Test Time | 10 minutes for P_{st} ; 2 hours for P_{lt} |

5.2. Immunity Tests

5.2.1. Test Performance Criteria for Immunity Test

5.2.1.1. General Performance Criteria

| Type | Description |
|-------------|---|
| Criterion A | The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended. |
| Criterion B | The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended. |
| Criterion C | Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls. |

5.2.2. Electrostatic Discharge Immunity

5.2.2.1. Test Specification

| Specification | Value |
|---------------------|--|
| Basic Standard | IEC 61000-4-2:2008 |
| Discharge Impedance | 330 Ohm / 150 pF |
| Discharge Voltage | Air Discharge: 2 kV; 4 kV; 8 kV; Contact Discharge: 2 kV; 4 kV |
| Polarity | Positive / Negative |
| Number of Discharge | Minimum 20 times at each test point |
| Discharge Mode | Single discharge |
| Discharge Period | 1 second minimum |

5.2.2.2. Test Procedure

1. Electrostatic discharges are applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
2. The test is performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
3. The time interval between two successive single discharges is at least 1 second.
4. The ESD generator is held perpendicularly to the surface to which the discharge is applied and the return cable is at least 0.2 meters from the EUT.
5. Contact discharges are applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
6. Air discharges are 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 is removed from the EUT and re-triggered for a new single discharge. The test is repeated until all discharges were completed.
7. At least ten single discharges (in the most sensitive polarity) are applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator is positioned vertically at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.
8. At least ten single discharges (in the most sensitive polarity) are applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5 m*0.5 m) is placed vertically to and 0.1 meters from the EUT.

5.2.3. Radio Frequency Electromagnetic Field Immunity

5.2.3.1. Test Specification

| Specification | Value | |
|---------------------|-------------------------------------|----------------------------|
| Basic Standard | IEC 61000-4-3:2006+A1:2007+A2:2010 | |
| Frequency Range | 80 MHz to 1000 MHz | 1.4 GHz to 6.0 GHz |
| Field Strength | 10 V/m (unmodulated, r.m.s) | 3 V/m (unmodulated, r.m.s) |
| Modulation | 1 kHz sine wave, 80%, AM modulation | |
| Frequency Step | 1% of fundamental | |
| Polarity of Antenna | Horizontal and Vertical | |
| Test Distance | 3 m | |
| Antenna Height | 1.5 m | |
| Dwell Time | 3 seconds | |

5.2.3.2. Test Procedure

1. The testing is performed in a fully anechoic chamber. The transmit antenna is located at a distance of 3 meters from the EUT.
2. The test signal is 80% amplitude modulated with a 1 kHz sine wave.
3. The frequency range is swept from 80 MHz to 1000 MHz and 1400 MHz to 6000 MHz with the exception of the exclusion band for transmitters, receivers and duplex transceivers. The rate of sweep does not exceed 1.5×10^{-3} decade/s. Where the frequency range is swept incrementally, the step size is 1% of fundamental.
4. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
5. The field strength level is 10 V/m for 80 MHz to 1000MHz, 3 V/m for 1400 MHz to 6000 MHz.
6. The test is performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides, but only the worst side data is reported in this report.

5.2.4. Electrical Fast Transient / Burst Immunity

5.2.4.1. Test Specification

| Specification | Value | |
|--------------------|----------------------|---------|
| Basic Standard | IEC 61000-4-4:2012 | |
| Test Voltage | AC Power Port: 2 kV. | |
| | DC Power Port: 1 kV. | |
| | Signal Port: 1 kV. | |
| Polarity | Positive / Negative | |
| Impulse Frequency | 5 kHz | 100 kHz |
| Impulse Wave Shape | 5/50 ns | |
| Burst Duration | 15 ms | 0.75 ms |
| Burst Period | 300 ms | |
| Test Duration | > 1 min | |

NOTE:

- 1) The signal ports tests apply only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m.
- 2) The DC ports test not applicable to input ports intended for connection to a battery or a rechargeable battery which must be removed or disconnected from the apparatus for recharging.
- 3) The EUT with a DC power input port intended for use with an AC-DC power adaptor shall be tested on the AC power input of the AC-DC power adaptor specified by the manufacturer or where none is so specified, using a typical AC-DC power adaptor.
- 4) The test applicable to DC power input ports and signal ports intended to be connected permanently to cables longer than 3 m.

5.2.4.2. Test Procedure

1. The EUT is tested with 2000 V discharges to the AC power input leads, 1000 V for signal port and DC port.
2. Both positive and negative polarity discharges are applied.
3. The length of the "hot wire" from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1 m.
4. The duration time of each test sequential is 1min.
5. The transient / burst waveform is in accordance with IEC 61000-4-4:2012, 5/50 ns.

5.2.5. Surge Immunity

5.2.5.1. Test Specification

| Specification | | Value | | |
|-----------------|----------------|--------------------------------------|---------------|--------------|
| Ports class | | AC Power Port | DC Power Port | Signal Port |
| Basic Standard | | IEC 61000-4-5:2014 | | |
| Waveform | | Voltage: 1.2/50 μs; Current: 8/20 μs | | |
| Test Voltage | line to ground | 0.5 kV, 1 kV, 2 kV; | 0.5 kV, 1 kV | 0.5 kV, 1 kV |
| | line to line | 0.5 kV, 1 kV | 0.5 kV | / |
| Polarity | | Positive / Negative | | |
| Phase Angle | | 0°, 90°, 180°, 270° | N/A | |
| Repetition Rate | | 60 seconds | | |
| Times | | 5 times per condition | | |

NOTE:

- 1) The Signal ports test not applicable to ports interfacing with long distance lines which inside a building is longer than 30 m, or which leaves the building (including a line installed outdoors).
- 2) Signal ports directly connected to AC power network shall be treated as AC power ports.
- 3) The DC ports test not applicable to input ports intended for connection to a battery or a rechargeable battery which must be removed or disconnected from the apparatus for recharging.
- 4) The EUT with a DC power input port intended for use with an AC-DC power adaptor shall be tested on the AC power input of the AC-DC power adaptor specified by the manufacturer or where none is so specified, using a typical AC-DC power adaptor.

5.2.5.2. Test Procedure

The EUT and the auxiliary equipment are placed on a table of 0.8 m heights above a metal ground reference plane. The size of ground plane is greater than 1 m*1 m and project beyond the EUT by at least 0.1 m on all sides. The ground plane is connected to the protective earth. The length of power cord between the coupling device and the EUT is less than 2 meters (provided by the manufacturer).

The EUT is connected to the power mains through a coupling device that directly couples the surge interference signal. The surge noise is applied synchronized to the voltage phase at the zero crossing and the peak value of the AC voltage wave (positive and negative).

The surges are applied line to line and line(s) to earth. When testing line to earth the test voltage is applied successively between each of the lines and earth. Set up to the test level specified increased the test voltage. All lower levels including the selected test level are tested. The polarity of each surge level included positive and negative test pulses.

5.2.6. Immunity to Conducted Disturbances Induced by RF Fields

5.2.6.1. Test Specification

| Specification | Value | | |
|-----------------|----------------------------------|---------------|-------------|
| Basic Standard | IEC 61000-4-6:2013 | | |
| Frequency Range | 0.15 MHz – 80 MHz | | |
| Test Voltage | 10 V (unmodulated, r.m.s) | | |
| Modulation | 1 kHz sine wave, 80% AM | | |
| Frequency Step | 1% of fundamental | | |
| Coupled Cable | AC Power Line | DC Power Line | Signal Line |
| Coupling Device | CDN-M1/2/3/4/5, Capacitive clamp | | |

NOTE:

- 1) The DC port and Signal port only apply to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 3 m.
- 2) The test level can also be defined as the equivalent current into a 150 Ω load at signal ports.

5.2.6.2. Test Procedure

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

The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 150 Ohm load resistor.

The test signal is 80% amplitude modulated with a 1 kHz sine wave.

The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80% amplitude. The sweep rate shall not exceed 1.5×10^{-3} decades/s. The step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value where the frequency is swept incrementally.

The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequencies and harmonics or frequencies of dominant interest, shall be analyzed separately.

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

5.2.7. Power Frequency Magnetic Fields Immunity

5.2.7.1. Test Specification

| Specification | Value |
|-----------------|-------------------------|
| Basic Standard | IEC 61000-4-8:2009 |
| Field Frequency | 50/60 Hz |
| Test Level | 30 A/m |
| Polarity | Horizontal and Vertical |
| Test Duration | 5 min |

NOTE:

- 1) The test shall be carried out at the frequencies appropriate to the power supply frequency. Equipment intended for use in areas supplied only at one of these frequencies need only be tested at that frequency.
- 2) Applicable only to apparatus containing devices susceptible to magnetic fields.

5.2.7.2. Test Procedure

The EUT shall be subjected to the test magnetic field by using the induction coil of standard dimensions (1 m*1 m) and shown in Section 15.1. The induction coil shall then be rotated by 90° in order to expose the EUT to the test field with different orientations.



5.2.8. Voltage Dips and Short Interruptions Immunity

5.2.8.1. Test Specification

AC Ports

| Specification | Value |
|-----------------------|---|
| Basic Standard | IEC 61000-4-34:2005+A1:2009 |
| Frequency | 50/60Hz |
| Voltage Dips | 100% reduction: 20 ms 60% reduction: 200/240 ms 30% reduction: 500/600 ms |
| Voltage Interruptions | 100% reduction: 5000/6000 ms |
| Voltage Phase Angle | 0° |

NOTE:

- 1) Applicable only to AC input ports.

5.2.8.2. Test Procedure

The power cord is used as supplied by the manufacturer. The EUT was connected to the line output of the Voltage Dips and Interruption Generator.

The EUT is tested for a) 100% voltage dip of supplied voltage with duration of 20 ms; b) 60% voltage dip of supplied voltage with duration of 200 or 240 ms; c) 30% voltage dip of supplied voltage and duration 500 or 600 ms. Both of the dip tests are carried out for a sequence of three voltage dips with intervals of 10 seconds.

100% voltage interruption of supplied voltage with duration of 5000 or 6000 ms is followed, which is a sequence of three voltage interruptions with intervals of 10 seconds.

Voltage reductions occur at 0 degrees crossover point of the voltage waveform. The performance of the EUT is checked after the voltage dip or interruption.

ANNEX A TEST RESULTS

A.1 Radiated Emission

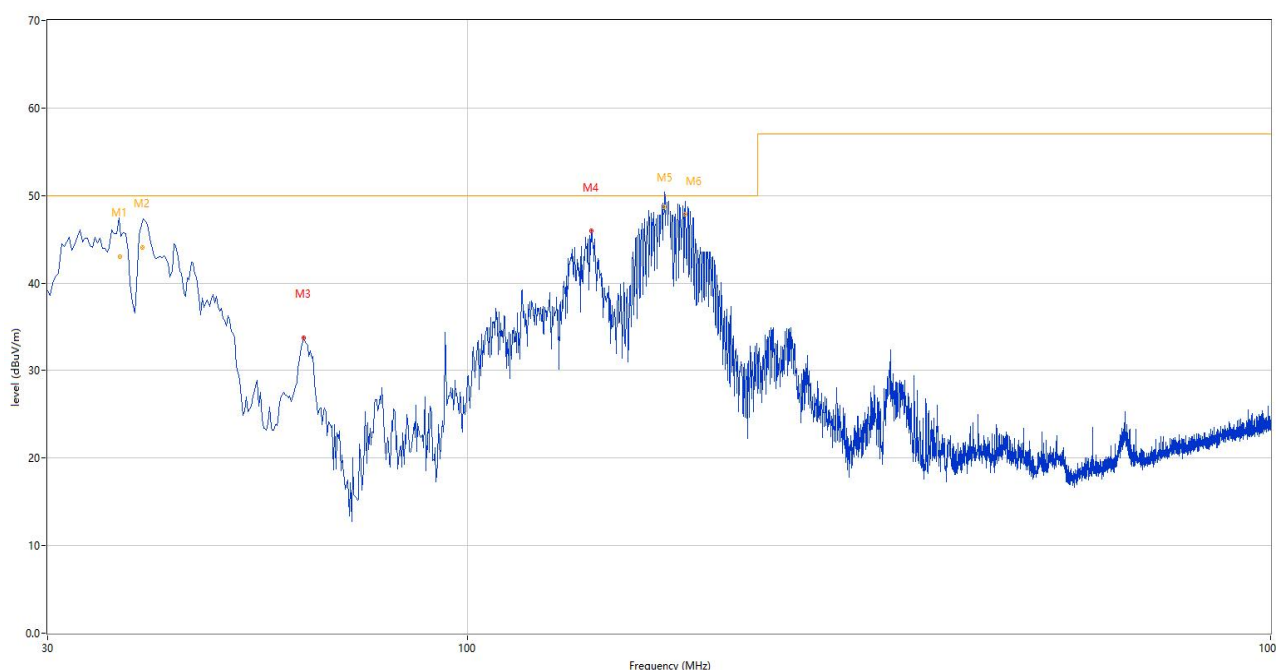
Note 1: The symbol of "--" in the table which means not application.

Note 2: Measurements shall be made with a quasi-peak measuring receiver in the frequency range 30 MHz to 1000 MHz. To reduce the testing time, a peak measuring receiver may be used instead of a quasi-peak measuring receiver. In case of dispute, measurement with a quasi-peak measuring receiver will take precedence.

Test Data and Plots- (Below 1 GHz)

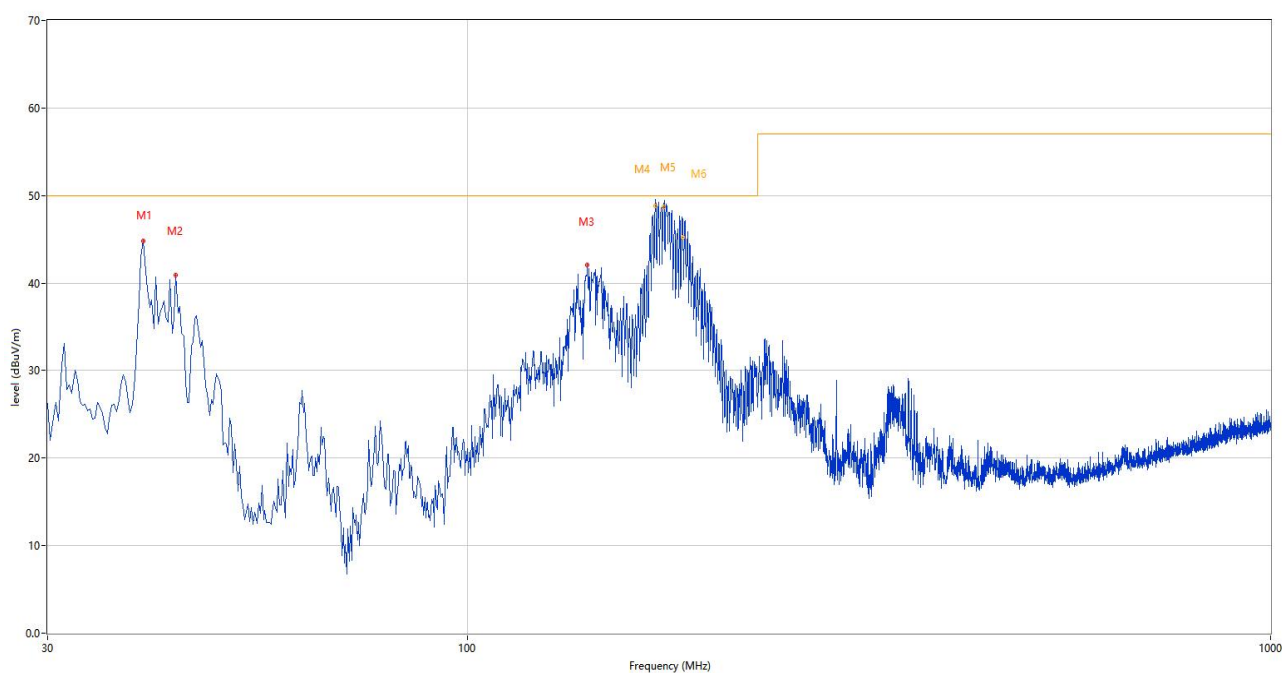
The worst test mode: Grid-connected (100% Load)

A.1.1 Test Antenna Vertical, 30 MHz – 1 GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|----------|---------|
| 1* | 36.875 | 42.97 | -28.13 | 50.0 | -7.03 | QP | 143.00 | 120 | Vertical | P |
| 2* | 39.370 | 44.08 | -27.22 | 50.0 | -5.92 | QP | 360.00 | 106 | Vertical | P |
| 3 | 62.495 | 33.75 | -27.58 | 50.0 | -16.25 | Peak | 240.00 | 100 | Vertical | P |
| 4 | 142.762 | 45.92 | -31.08 | 50.0 | -4.08 | Peak | 236.00 | 100 | Vertical | P |
| 5* | 175.630 | 48.24 | -29.47 | 50.0 | -1.76 | QP | 165.00 | 102 | Vertical | P |
| 6* | 186.648 | 47.84 | -28.46 | 50.0 | -2.16 | QP | 202.00 | 100 | Vertical | P |

A.1.2 Test Antenna Horizontal, 30 MHz – 1 GHz



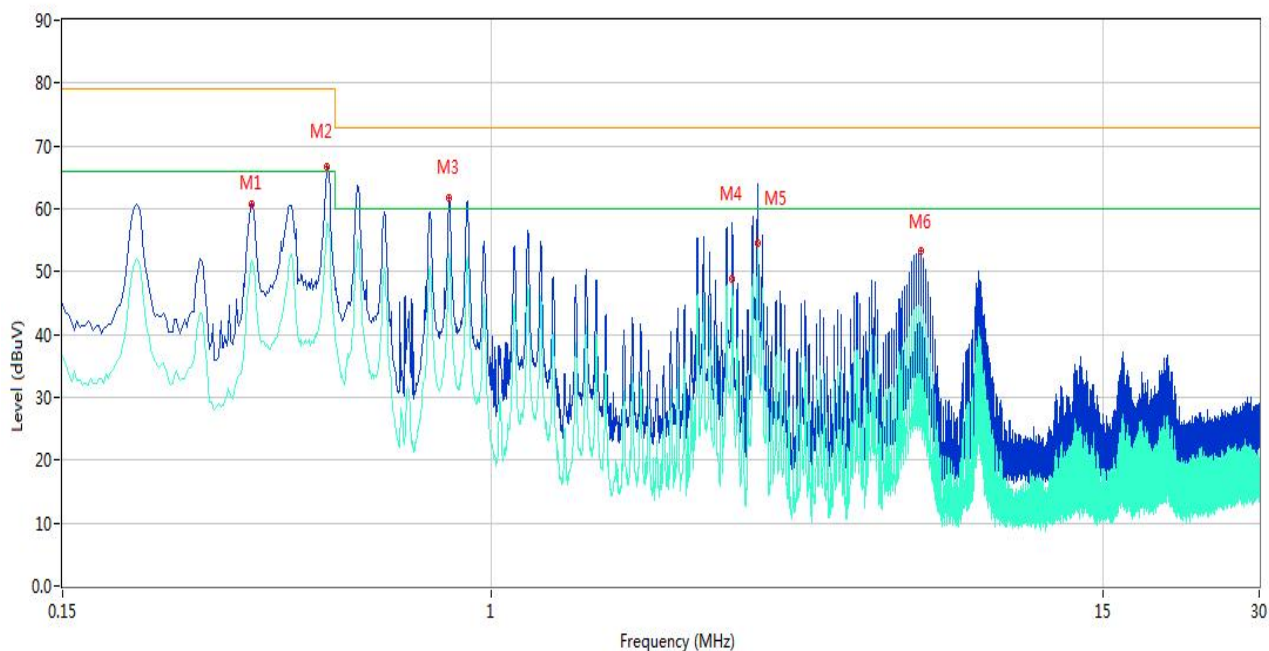
| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|------------|---------|
| 1 | 39.458 | 44.78 | -27.22 | 50.0 | -5.22 | Peak | 360.00 | 100 | Horizontal | P |
| 2 | 43.337 | 40.94 | -26.22 | 50.0 | -9.06 | Peak | 360.00 | 100 | Horizontal | P |
| 3 | 141.065 | 42.01 | -31.08 | 50.0 | -7.99 | Peak | 154.00 | 300 | Horizontal | P |
| 4* | 171.480 | 48.85 | -29.65 | 50.0 | -1.15 | QP | 146.00 | 230 | Horizontal | P |
| 5* | 175.559 | 48.54 | -29.47 | 50.0 | -1.46 | QP | 146.00 | 213 | Horizontal | P |
| 6* | 185.173 | 45.25 | -28.67 | 50.0 | -4.75 | QP | 154.00 | 204 | Horizontal | P |

A.2 Conducted Emission

Test Data and Plots-AC Port

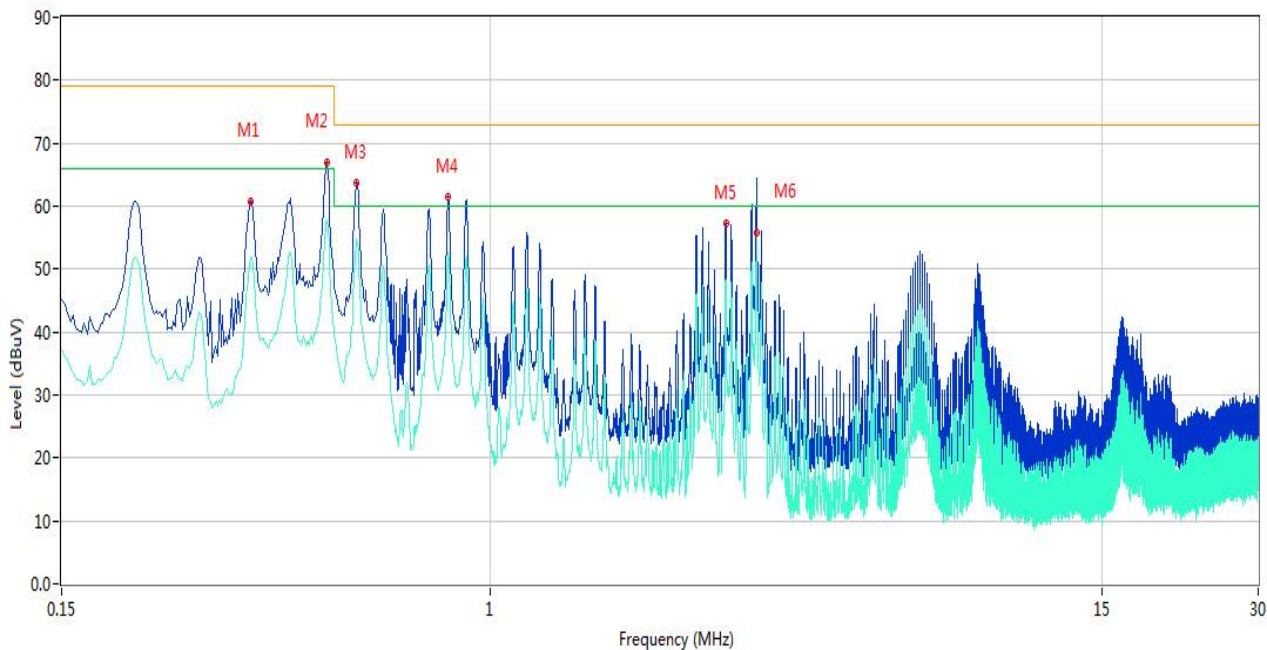
The worst test mode: Grid-connected (100% Load)

A.2.1 L1 Phase



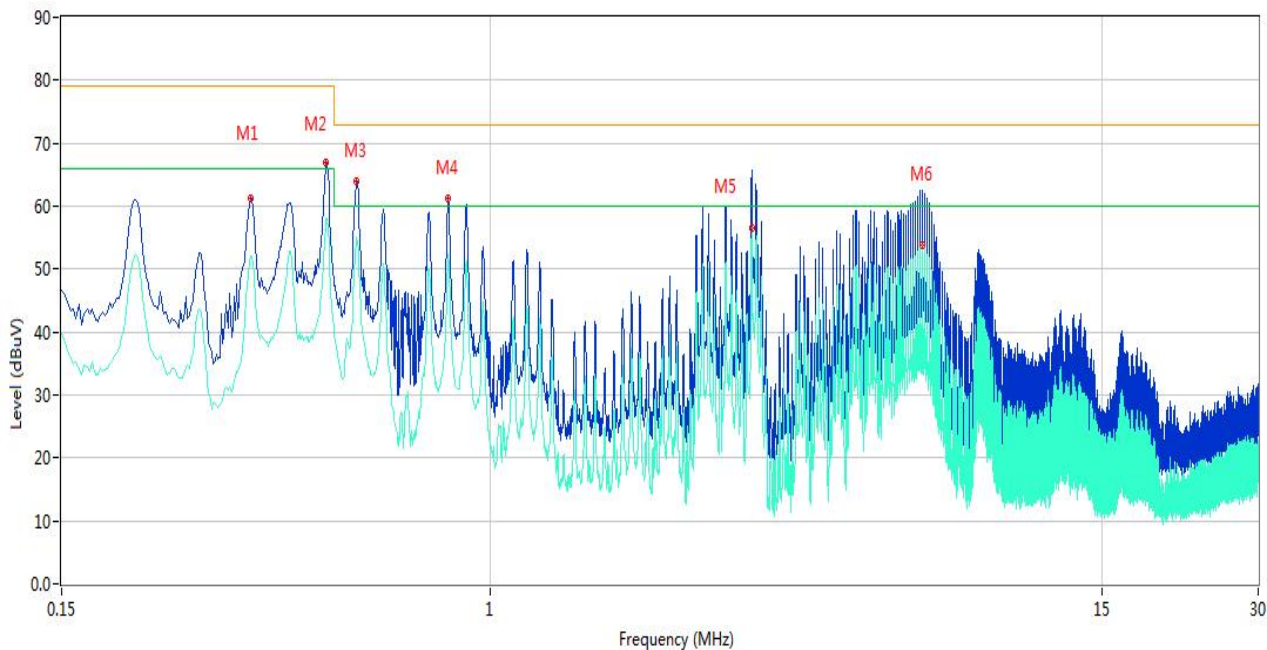
| No. | Frequency (MHz) | Results (dBuV) | Factor (dB) | Limit (dBuV) | Over Limit (dB) | Detector | Line | Verdict |
|-----|-----------------|----------------|-------------|--------------|-----------------|----------|------|---------|
| 1 | 0.346 | 60.72 | 10.41 | 79.00 | -18.28 | Peak | L1 | P |
| 1** | 0.346 | 51.91 | 10.41 | 66.00 | -14.09 | AV | L1 | P |
| 2 | 0.484 | 66.76 | 10.33 | 79.00 | -12.24 | Peak | L1 | P |
| 2** | 0.484 | 57.80 | 10.33 | 66.00 | -8.20 | AV | L1 | P |
| 3 | 0.832 | 61.68 | 10.24 | 73.00 | -11.32 | Peak | L1 | P |
| 3** | 0.832 | 52.72 | 10.24 | 60.00 | -7.28 | AV | L1 | P |
| 4 | 2.910 | 57.69 | 10.24 | 73.00 | -15.31 | Peak | L1 | P |
| 4** | 2.910 | 48.78 | 10.24 | 60.00 | -11.22 | AV | L1 | P |
| 5 | 3.254 | 63.88 | 10.27 | 73.00 | -9.12 | Peak | L1 | P |
| 5** | 3.254 | 54.56 | 10.27 | 60.00 | -5.44 | AV | L1 | P |
| 6 | 6.716 | 53.23 | 10.17 | 73.00 | -19.77 | Peak | L1 | P |
| 6** | 6.716 | 43.76 | 10.17 | 60.00 | -16.24 | AV | L1 | P |

A.2.2 L2 Phase



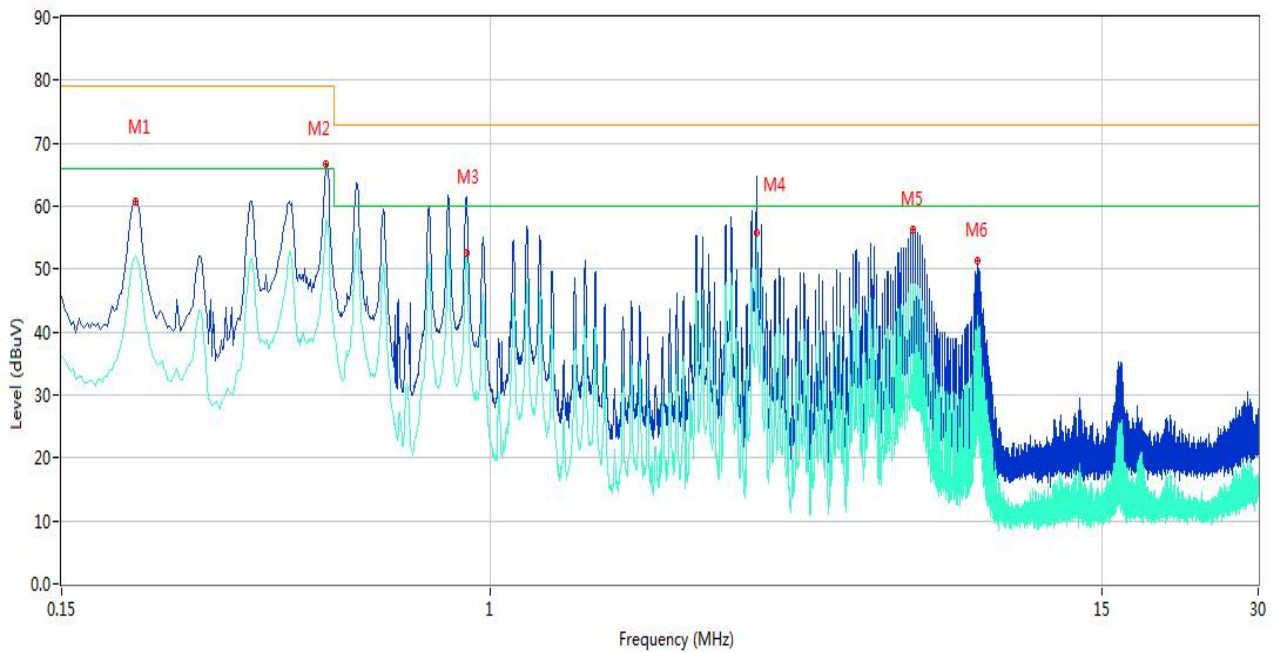
| No. | Frequency (MHz) | Results (dBuV) | Factor (dB) | Limit (dBuV) | Over Limit (dB) | Detector | Line | Verdict |
|-----|-----------------|----------------|-------------|--------------|-----------------|----------|------|---------|
| 1 | 0.346 | 60.83 | 10.41 | 79.00 | -18.17 | Peak | L2 | P |
| 1** | 0.346 | 51.73 | 10.41 | 66.00 | -14.27 | AV | L2 | P |
| 2 | 0.486 | 66.82 | 10.31 | 79.00 | -12.18 | Peak | L2 | P |
| 2** | 0.486 | 57.72 | 10.31 | 66.00 | -8.28 | AV | L2 | P |
| 3 | 0.554 | 63.71 | 10.26 | 73.00 | -9.29 | Peak | L2 | P |
| 3** | 0.554 | 54.83 | 10.26 | 60.00 | -5.17 | AV | L2 | P |
| 4 | 0.830 | 61.46 | 10.26 | 73.00 | -11.54 | Peak | L2 | P |
| 4** | 0.830 | 52.55 | 10.26 | 60.00 | -7.45 | AV | L2 | P |
| 5 | 2.840 | 57.30 | 10.25 | 73.00 | -15.70 | Peak | L2 | P |
| 5** | 2.840 | 48.31 | 10.25 | 60.00 | -11.69 | AV | L2 | P |
| 6 | 3.254 | 64.53 | 10.27 | 73.00 | -8.47 | Peak | L2 | P |
| 6** | 3.254 | 55.72 | 10.27 | 60.00 | -4.28 | AV | L2 | P |

A.2.3 L3 Phase



| No. | Frequency (MHz) | Results (dBuV) | Factor (dB) | Limit (dBuV) | Over Limit (dB) | Detector | Line | Verdict |
|-----|-----------------|----------------|-------------|--------------|-----------------|----------|------|---------|
| 1 | 0.346 | 61.24 | 10.41 | 79.00 | -17.76 | Peak | L3 | P |
| 1** | 0.346 | 52.03 | 10.41 | 66.00 | -13.97 | AV | L3 | P |
| 2 | 0.484 | 66.94 | 10.33 | 79.00 | -12.06 | Peak | L3 | P |
| 2** | 0.484 | 57.94 | 10.33 | 66.00 | -8.06 | AV | L3 | P |
| 3 | 0.554 | 63.97 | 10.26 | 73.00 | -9.03 | Peak | L3 | P |
| 3** | 0.554 | 55.03 | 10.26 | 60.00 | -4.97 | AV | L3 | P |
| 4 | 0.832 | 61.17 | 10.24 | 73.00 | -11.83 | Peak | L3 | P |
| 4** | 0.832 | 52.21 | 10.24 | 60.00 | -7.79 | AV | L3 | P |
| 5 | 3.186 | 65.75 | 10.25 | 73.00 | -7.25 | Peak | L3 | P |
| 5** | 3.186 | 56.41 | 10.25 | 60.00 | -3.59 | AV | L3 | P |
| 6 | 6.788 | 62.56 | 10.18 | 73.00 | -10.44 | Peak | L3 | P |
| 6** | 6.788 | 53.91 | 10.18 | 60.00 | -6.09 | AV | L3 | P |

A.2.4 N Phase



| No. | Frequency (MHz) | Results (dBuV) | Factor (dB) | Limit (dBuV) | Over Limit (dB) | Detector | Line | Verdict |
|-----|-----------------|----------------|-------------|--------------|-----------------|----------|------|---------|
| 1 | 0.208 | 60.77 | 10.24 | 79.00 | -18.23 | Peak | N | P |
| 1** | 0.208 | 51.99 | 10.24 | 66.00 | -14.01 | AV | N | P |
| 2 | 0.484 | 66.70 | 10.33 | 79.00 | -12.30 | Peak | N | P |
| 2** | 0.484 | 57.80 | 10.33 | 66.00 | -8.20 | AV | N | P |
| 3 | 0.900 | 61.40 | 10.26 | 73.00 | -11.60 | Peak | N | P |
| 3** | 0.900 | 52.51 | 10.26 | 60.00 | -7.49 | AV | N | P |
| 4 | 3.256 | 64.44 | 10.26 | 73.00 | -8.56 | Peak | N | P |
| 4** | 3.256 | 55.70 | 10.26 | 60.00 | -4.30 | AV | N | P |
| 5 | 6.510 | 56.28 | 10.16 | 73.00 | -16.72 | Peak | N | P |
| 5** | 6.510 | 47.45 | 10.16 | 60.00 | -12.55 | AV | N | P |
| 6 | 8.656 | 51.37 | 10.10 | 73.00 | -21.63 | Peak | N | P |
| 6** | 8.656 | 41.54 | 10.10 | 60.00 | -18.46 | AV | N | P |

A.3 Harmonic Current Emissions

| | | | |
|---|--------------------------------|-----------------|----------|
| Power R_{sce} | 33 | Active power(W) | 17320.71 |
| Voltage(V): | 230.8 | Frequency(Hz) | 50 |
| Reference current $I_{ref}(r.m.s.)(A)$ | 74.86 | | |
| Equipment category | Balanced three-phase equipment | | |

| | | | | | | |
|------------------------|--|-------|----------|----------|----------------------------------|-----------------|
| Equipment category: | Balanced three-phase equipment | | | | | |
| Minimum $R_{sce} = 33$ | Admissible individual harmonic current I_h/I_{ref} % | | | | Admissible harmonic parameters % | |
| -- | I_5 | I_7 | I_{11} | I_{13} | THC/ I_{ref} | PWHC/ I_{ref} |
| limit | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| L1 | 1.705 | 0.862 | 0.448 | 0.332 | 2.073 | 2.593 |
| L2 | 1.679 | 0.933 | 0.529 | 0.330 | 2.128 | 2.667 |
| L3 | 1.617 | 0.857 | 0.417 | 0.342 | 2.035 | 2.552 |
| Verdict | P | P | P | P | P | P |

| | | | | | | | | |
|------------------------|--|-------|-------|-------|----------|----------|----------------------------------|-----------------|
| Minimum $R_{sce} = 33$ | Admissible individual harmonic current I_h/I_{ref} % | | | | | | Admissible harmonic parameters % | |
| -- | I_2 | I_4 | I_6 | I_8 | I_{10} | I_{12} | THC/ I_{ref} | PWHC/ I_{ref} |
| limit | 8 | 4 | 2.66 | 2 | 1.6 | 1.3 | 13 | 22 |
| L1 | 0.036 | 0.056 | 0.056 | 0.077 | 0.082 | 0.039 | 2.073 | 2.593 |
| L2 | 0.304 | 0.097 | 0.220 | 0.028 | 0.062 | 0.034 | 2.128 | 2.667 |
| L3 | 0.365 | 0.073 | 0.130 | 0.059 | 0.059 | 0.041 | 2.035 | 2.552 |
| Verdict | P | P | P | P | P | P | P | P |

A.4 Voltage Fluctuations & Flicker

| | | | |
|----------------------|-------|-------------------|---------|
| Voltage(V) | 231.4 | Frequency(Hz) | 50 |
| Current (A) | 74.86 | Coupling Line | L1 |
| Test Parameter | Limit | Measurement Value | Verdict |
| P _{st} | 1.0 | 0.097 | P |
| P _{lt} | 0.65 | 0.072 | P |
| T _{dt} | 0.5 | 0 | P |
| d _{max} (%) | 4 | 0.545 | P |
| d _c (%) | 3.3 | 0.069 | P |

| | | | |
|----------------------|-------|-------------------|---------|
| Voltage(V) | 230.5 | Frequency(Hz) | 50 |
| Current (A) | 74.89 | Coupling Line | L2 |
| Test Parameter | Limit | Measurement Value | Verdict |
| P _{st} | 1.0 | 0.087 | P |
| P _{lt} | 0.65 | 0.076 | P |
| T _{dt} | 0.5 | 0 | P |
| d _{max} (%) | 4 | 0.560 | P |
| d _c (%) | 3.3 | 0.079 | P |

| | | | |
|----------------------|-------|-------------------|---------|
| Voltage(V) | 230.7 | Frequency(Hz) | 50 |
| Current (A) | 75.04 | Coupling Line | L3 |
| Test Parameter | Limit | Measurement Value | Verdict |
| P _{st} | 1.0 | 0.092 | P |
| P _{lt} | 0.65 | 0.074 | P |
| T _{dt} | 0.5 | 0 | P |
| d _{max} (%) | 4 | 0.628 | P |
| d _c (%) | 3.3 | 0.065 | P |

A.5 Electrostatic Discharge Immunity

| Test Points | Discharge Level (kV) | Discharge Mode | Number of Discharge | Met Criteria | Required Criteria | Verdict |
|----------------|----------------------|-------------------|---------------------|--------------|-------------------|---------|
| HCP | ±2, ±4 | Contact Discharge | 100 | A | B | P |
| VCP | ±2, ±4 | Contact Discharge | 100 | A | B | P |
| Metal screw | ±2, 4 | Connect discharge | 160 | A | B | P |
| Heat sink | ±2, 4 | Connect discharge | 160 | A | B | P |
| Display screen | ±2, 4, 8 | Air discharge | 160 | A | B | P |
| Gap | ±2, 4, 8 | Air discharge | 160 | A | B | P |

A.6 Radio Frequency Electromagnetic Field Immunity

| Antenna Polarity | Frequency (MHz) | Side | Field Strength (V/m) | Met Criteria | Required Criteria | Verdict |
|------------------|-----------------|--------------------------|----------------------|--------------|-------------------|---------|
| Vertical | 80 - 1000 | Front, Back, Left, Right | 10 | A | A | P |
| Horizontal | 80 - 1000 | Front, Back, Left, Right | 10 | A | A | P |
| Vertical | 1400 - 6000 | Front, Back, Left, Right | 3 | A | A | P |
| Horizontal | 1400 - 6000 | Front, Back, Left, Right | 3 | A | A | P |

A.7 Electrical Fast Transient/Burst Immunity

Test Data (AC Output Port)

| Burst Parameters | 5/50ns | Pulse Frequency | 5kHz | Pulse group action time | 15ms | | Burst interval | 300ms |
|------------------|---------------|-----------------|--------|-------------------------|-----------------|--------------|-------------------|---------|
| | | | 100kHz | | 0.75ms | | | |
| Test Port | Coupling Line | | | Polarity | Test Level (kV) | Met Criteria | Required Criteria | Verdict |
| AC Output Port | L1+L2+L3+N+PE | | | + / - | 0.5, 1, 2 | A | B | P |

Test Data (PV Input Port)

| Burst Parameters | 5/50ns | Pulse Frequency | 5kHz | Pulse group action time | 15ms | | Burst interval | 300ms |
|------------------|---------------|--------------------|--------|----------------------------|--------|-----------------|----------------------|---------|
| | | | 100kHz | | 0.75ms | | | |
| Test Port | Coupling Line | | | Polarity | 100kHz | Met Criteria | Required Criteria | Verdict |
| PV Input Port | P+&P-&PE | | | + / - | 0.5, 1 | A | B | P |

A.8 Surge Immunity

Test Data (AC Output Port)

| Times | 5 times for positive and negative | | Time interval | | 60s | | |
|----------------|---------------------------------------|----------|---------------|---------------|--------------|-------------------|---------|
| Test Port | Coupling Line | Polarity | Voltage (kV) | Test Waveform | Met Criteria | Required Criteria | Verdict |
| AC Output Port | L1-N, L2-N, L3-N, L1-L2, L1-L3, L2-L3 | + / - | 0.5, 1 | 1.2/50us | A | B | P |
| AC Output Port | L1-PE, L2-PE, L3-PE, N-PE | + / - | 0.5, 1, 2 | 1.2/50us | B | B | P |

Test Data (PV Input Port)

| Times | 5 times for positive and negative | | Time interval | | 60s | | |
|---------------|-----------------------------------|----------|---------------|---------------|--------------|-------------------|---------|
| Test Port | Coupling Line | Polarity | Voltage (kV) | Test Waveform | Met Criteria | Required Criteria | Verdict |
| PV Input Port | P+ to P- | + / - | 0.5 | 1.2/50us | A | B | P |
| PV Input Port | P+ to PE, P- to PE | + / - | 0.5, 1 | 1.2/50us | B | B | P |

A.9 Immunity to Conducted Disturbances Induced by RF Fields

Test Data (AC Output Port)

| Test Port | Frequency (MHz) | Test Voltage(V) | Met Criteria | Required Criteria | Verdict |
|----------------|-----------------|-----------------|--------------|-------------------|---------|
| AC Output Port | 0.15 - 80 | 10 | A | A | P |

Test Data (PV Input Port)

| Test Port | Frequency (MHz) | Test Voltage(V) | Met Criteria | Required Criteria | Verdict |
|---------------|-----------------|-----------------|--------------|-------------------|---------|
| PV Input Port | 0.15 - 80 | 10 | A | A | P |

A.10 Power Frequency Magnetic Fields Immunity

| Test direction | Test level(A/m) | Met Criteria | Required Criteria | Verdict |
|----------------|-----------------|--------------|-------------------|---------|
| X, Y, Z | 30 | A | A | P |

A.11 Voltage Dips and Short Interruptions Immunity

| Test Mode | Residual voltage (%) | Duration (ms) | Times | Interval (sec) | Met Criteria | Required Criteria | Verdict |
|-----------------------|----------------------|---------------|-------|----------------|--------------|-------------------|---------|
| Voltage Dips | 0 | 20 | 3 | 10 | A | B | P |
| Voltage Dips | 40 | 200 | 3 | 10 | A | C | P |
| Voltage Dips | 70 | 500 | 3 | 10 | A | C | P |
| Voltage Interruptions | 0 | 5000 | 3 | 10 | B | C | P |

ANNEX B TEST SETUP PHOTOS

Note: TEST SETUP PHOTOS please refer to original test report BL-DG20C0913-401, which was issued by Shenzhen BALUN Technology Co., Ltd. on Feb. 26, 2021 section ANNEX B TEST SETUP PHOTOS.

ANNEX C EUT EXTERNAL PHOTOS

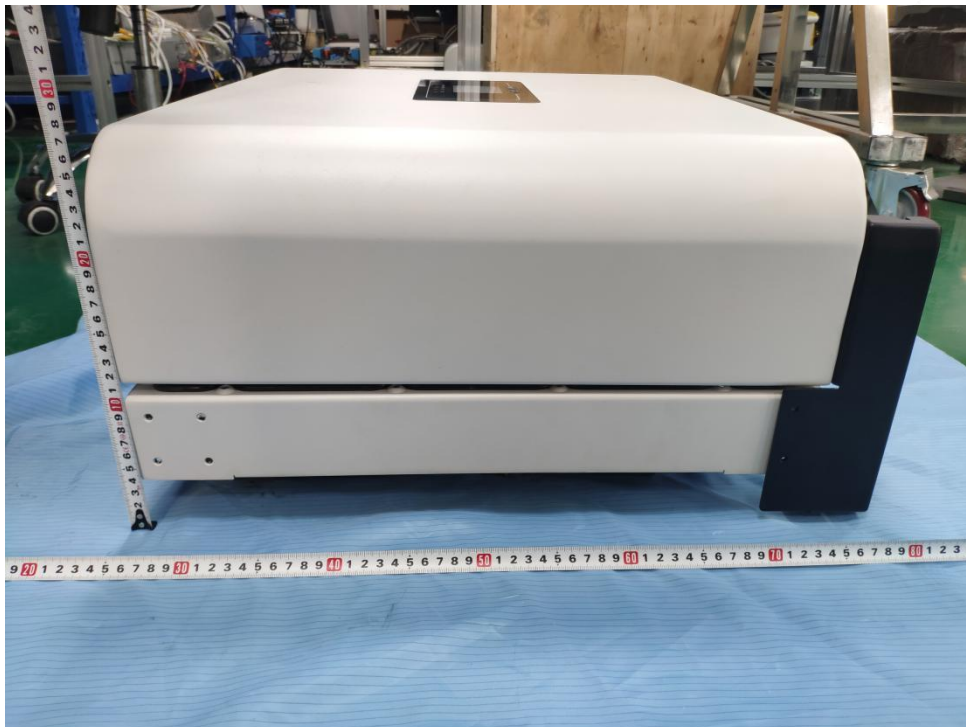
Front



Back



Left



Right



Top

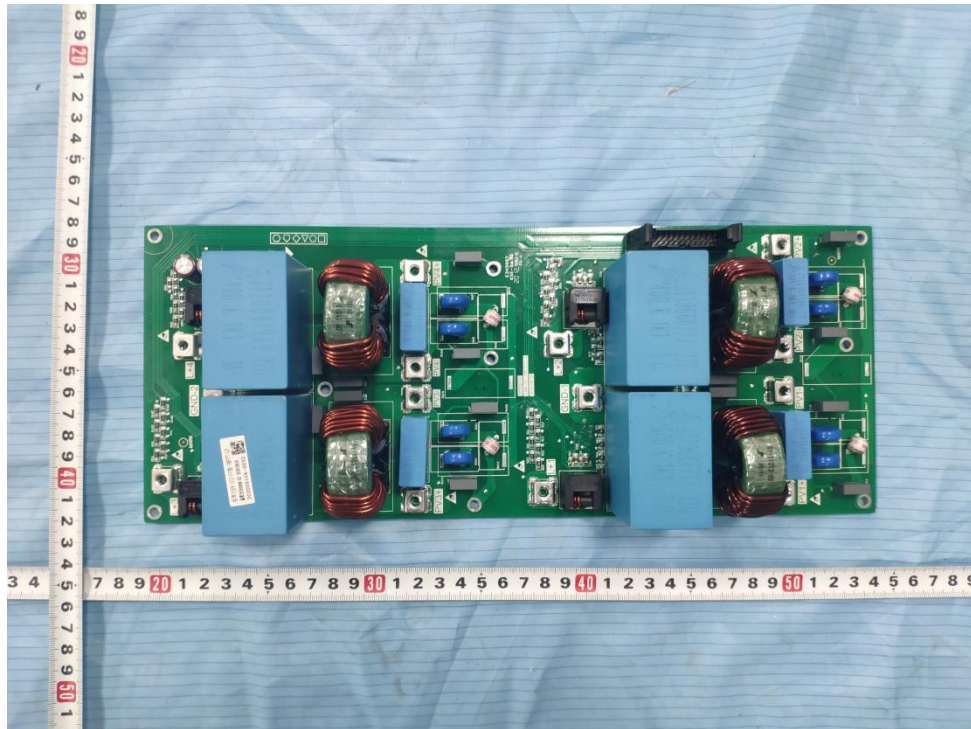


Interface

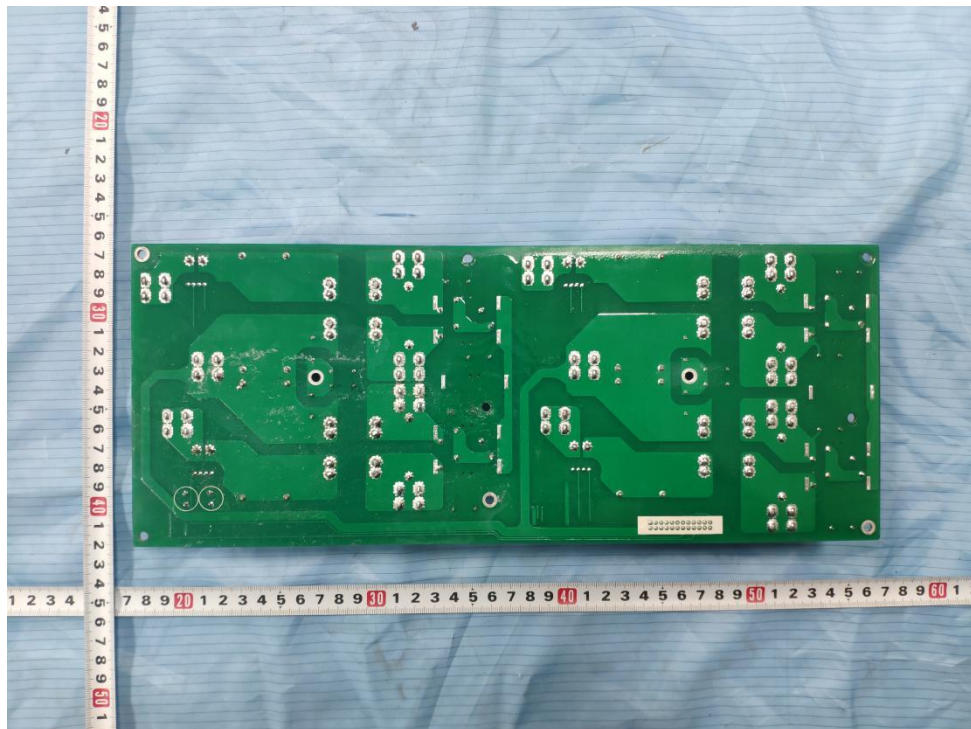


ANNEX D EUT INTERNAL PHOTOS

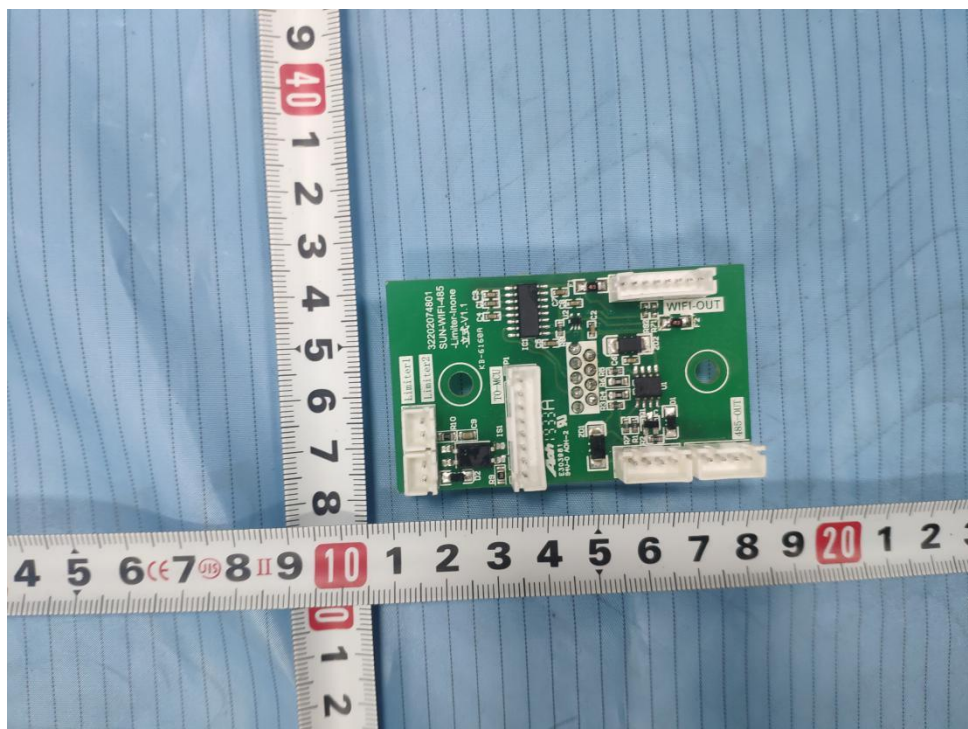
The front view of PV board



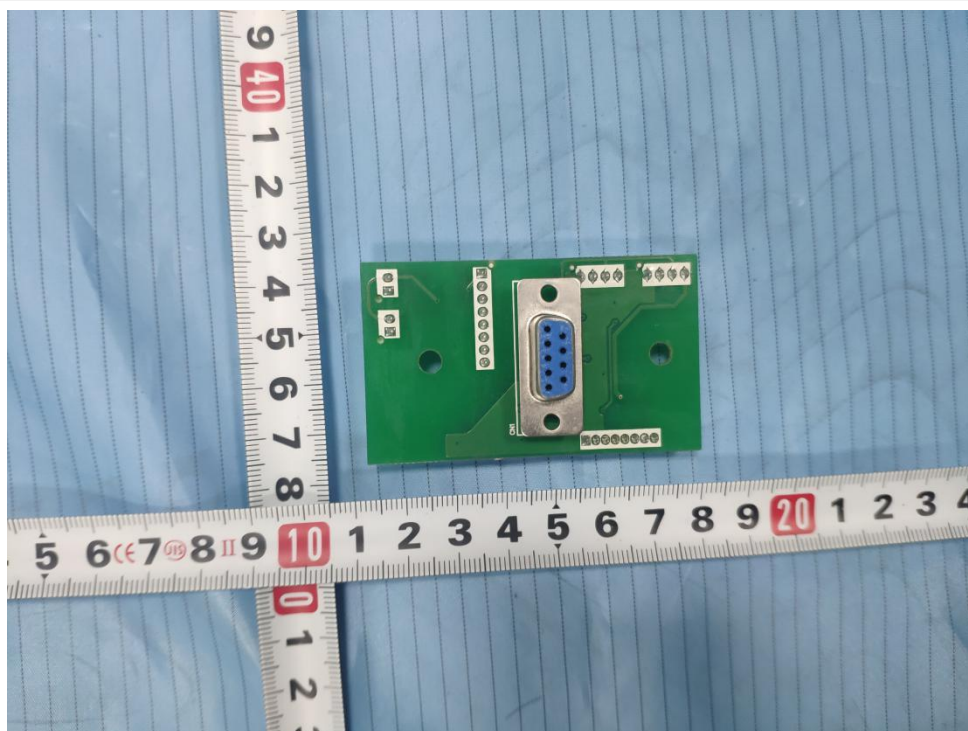
The back view of PV board



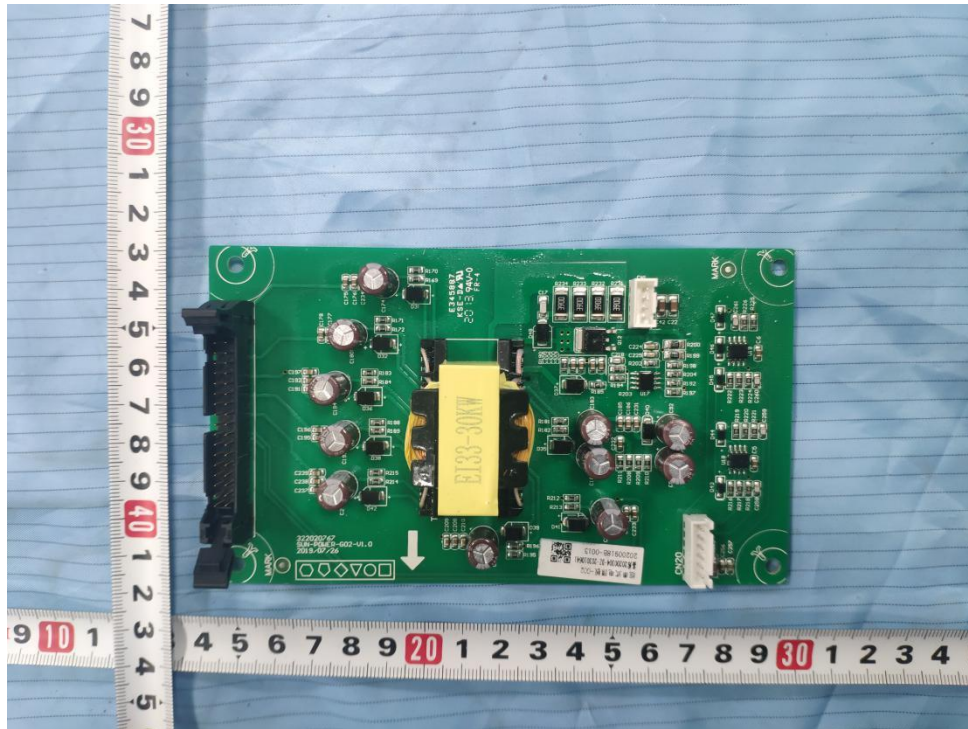
The front view of Wi-Fi board



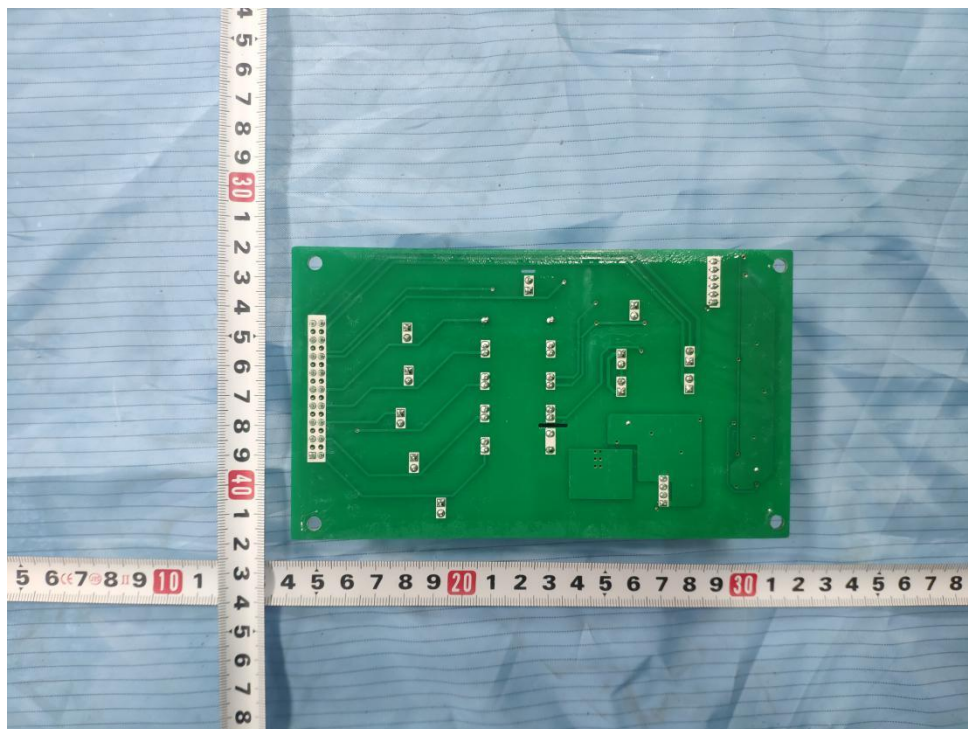
The back view of Wi-Fi board



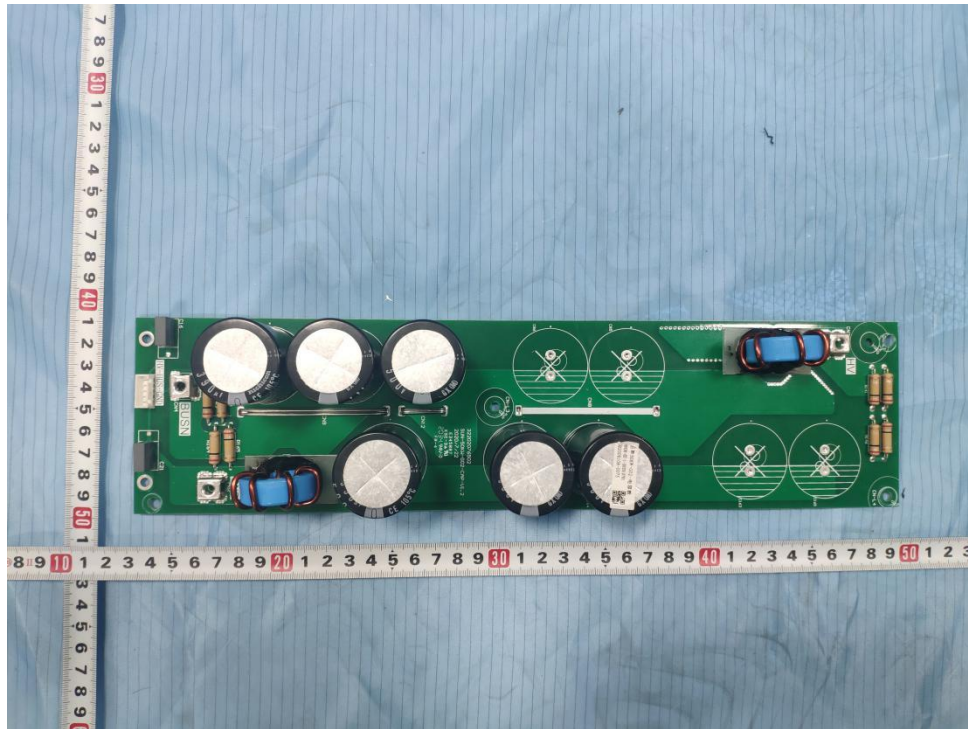
The front view of bottom power board



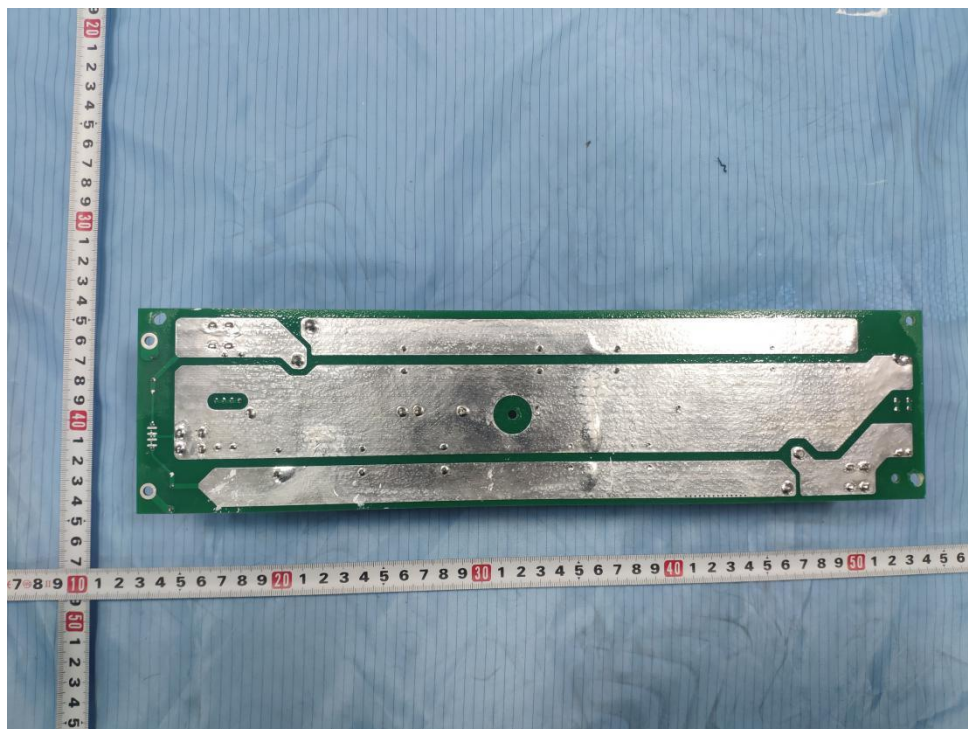
The back view of bottom power board



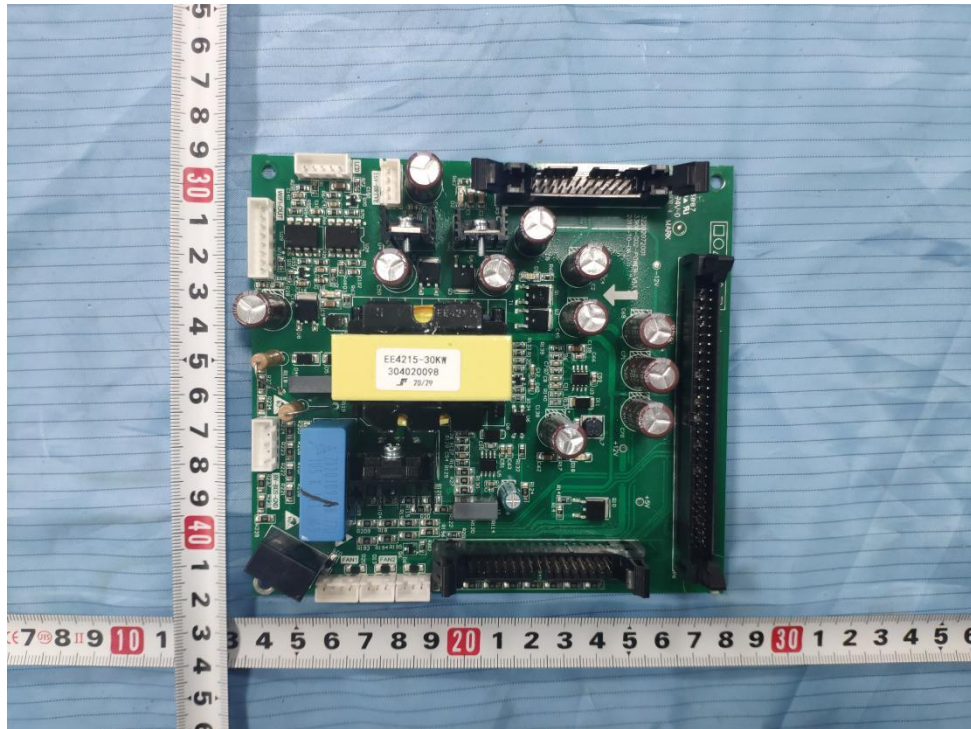
The front view of capacitance board



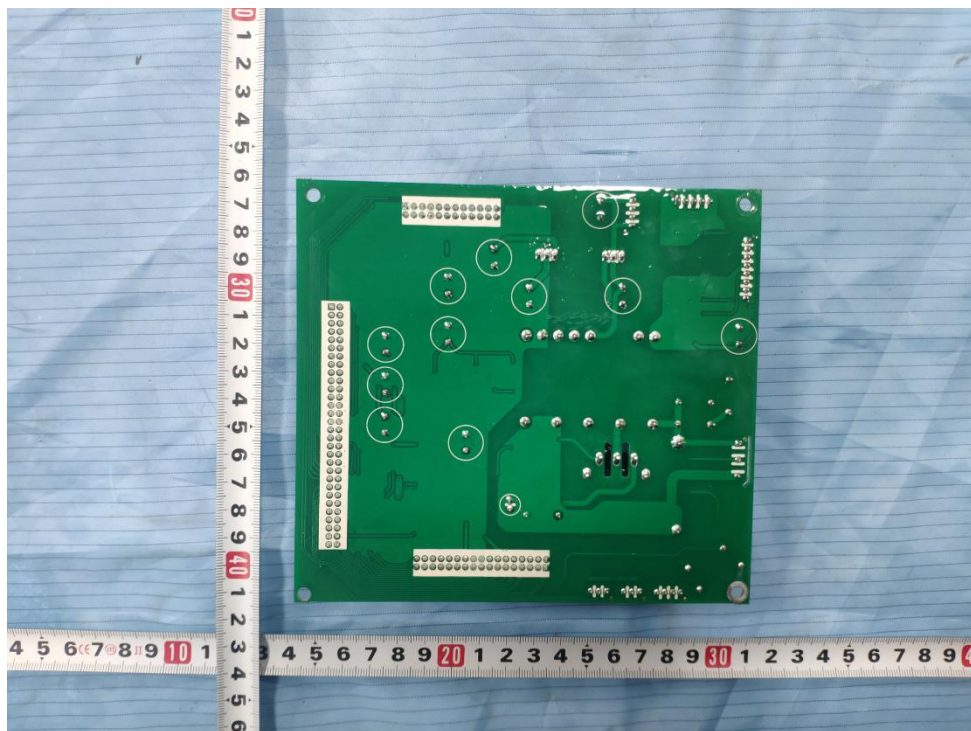
The back view of capacitance board



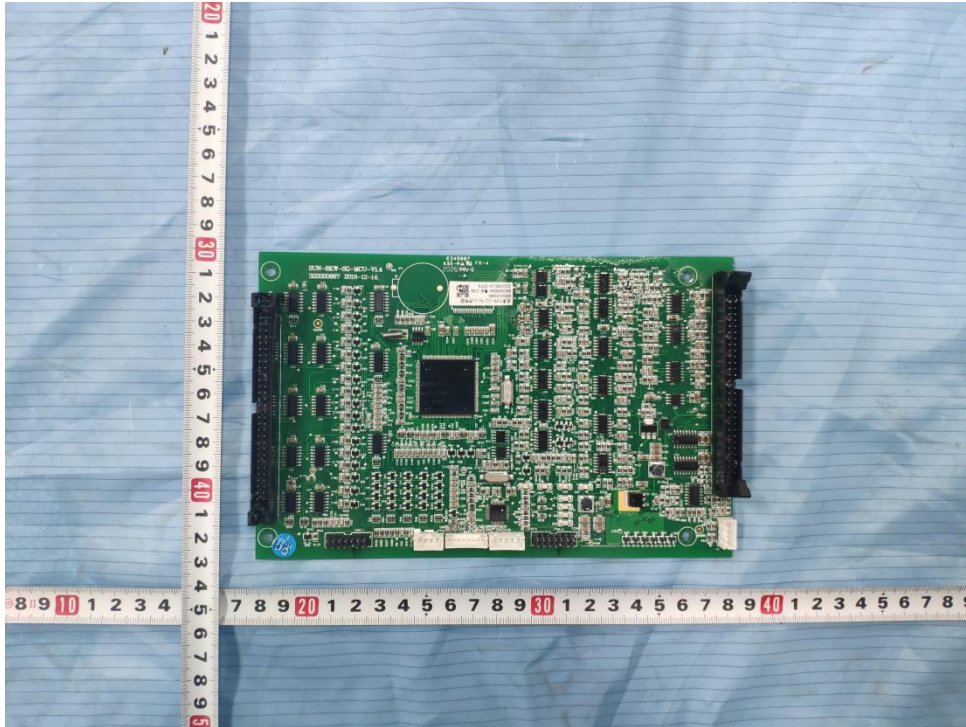
The front view of top power board



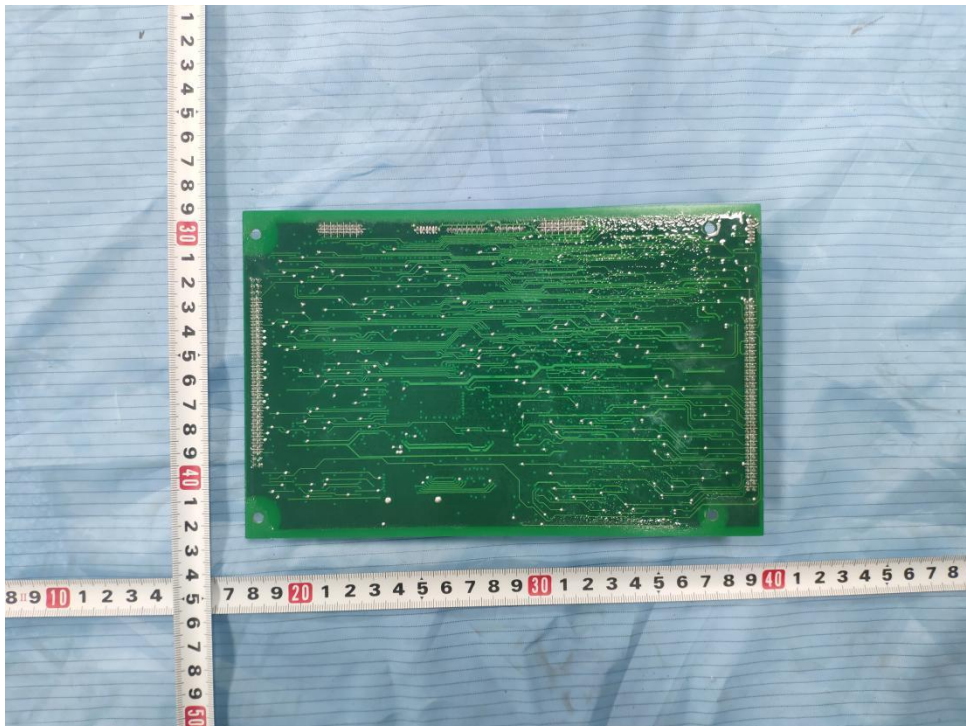
The back view of top power board



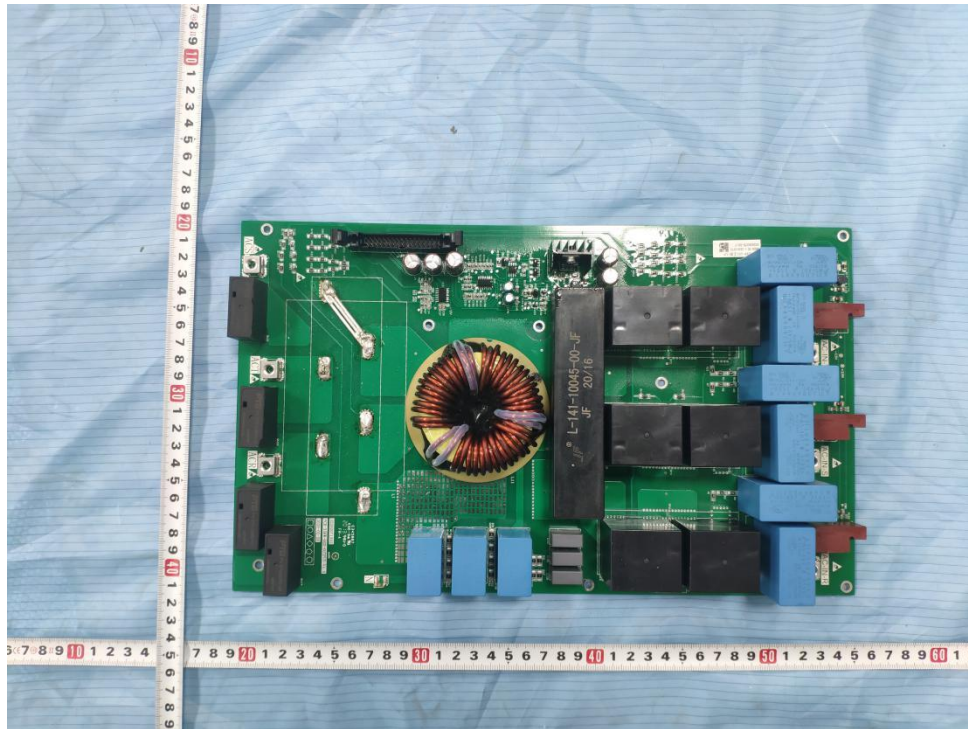
The front view of driver board



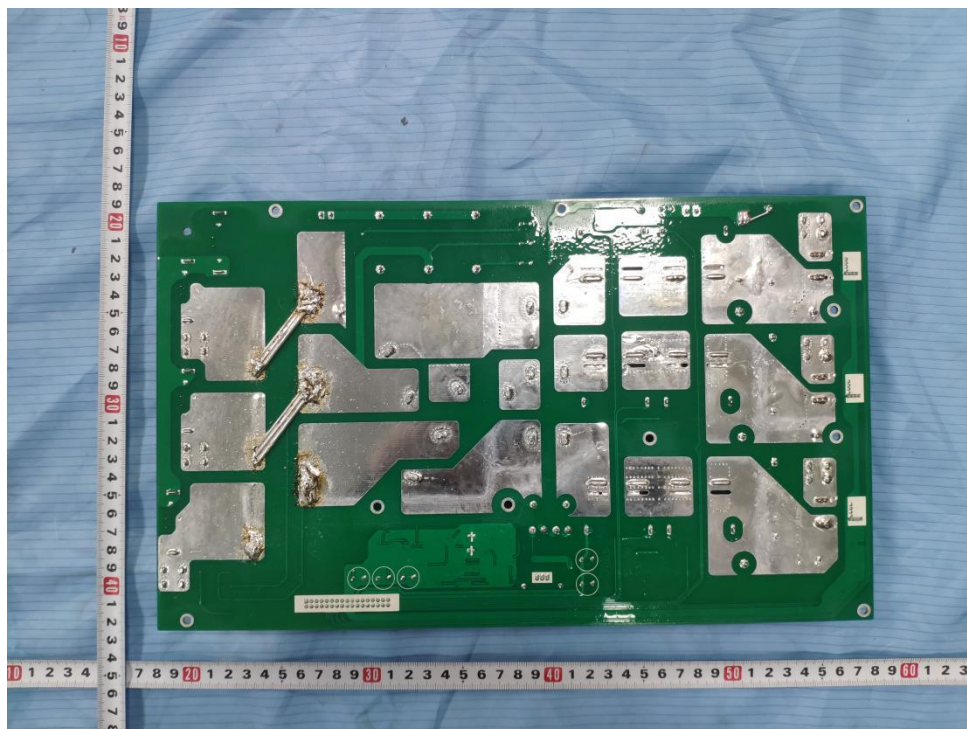
The back view of driver board



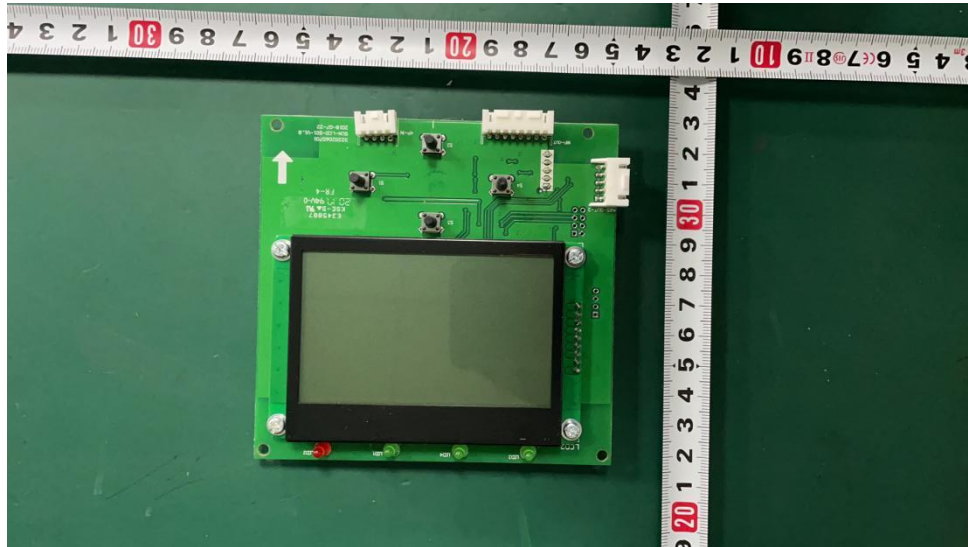
The front view of main control board



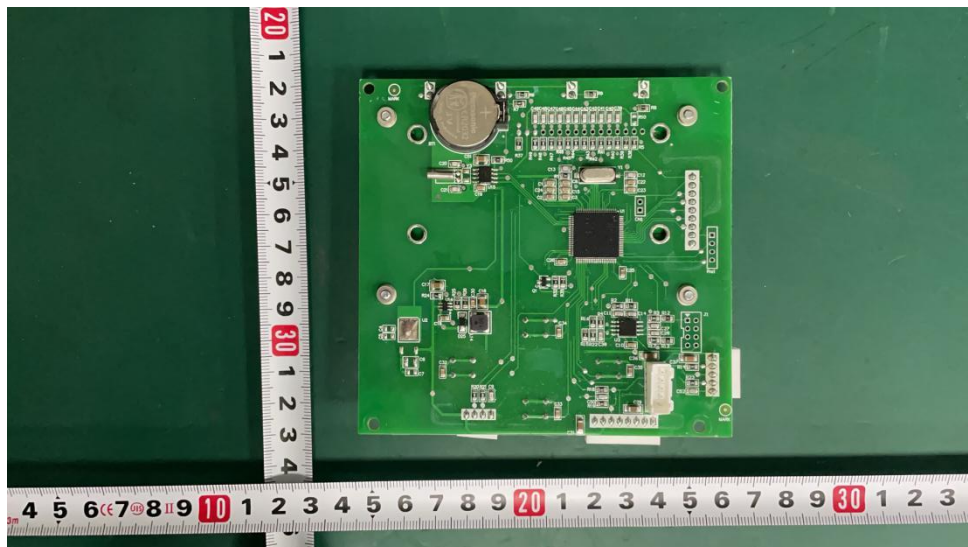
The back view of main control board



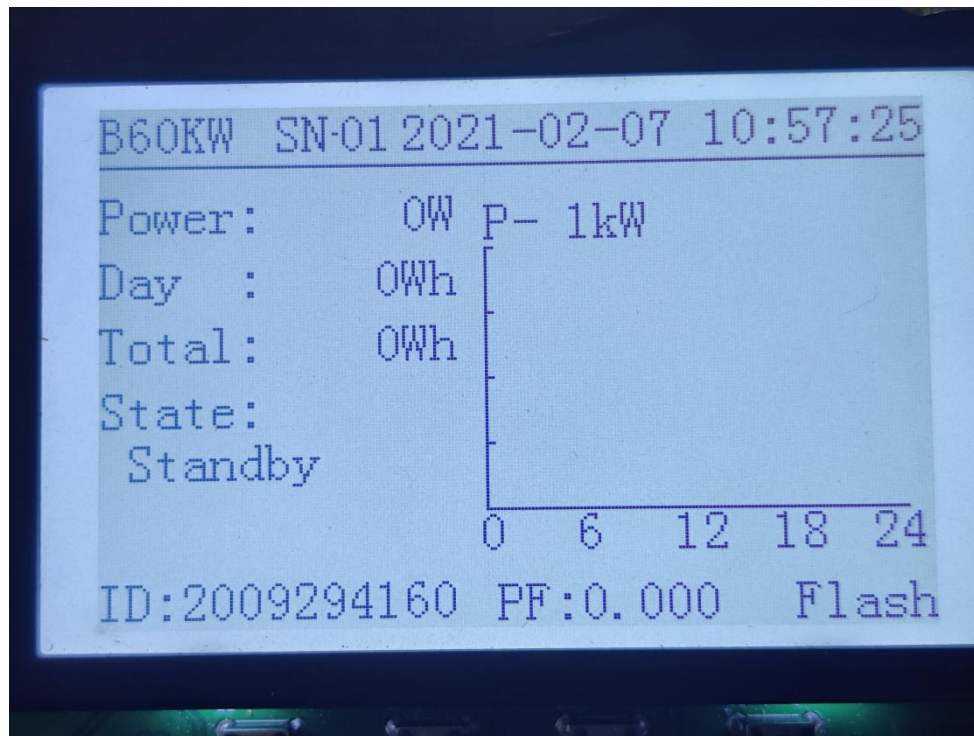
The front view of LCD board



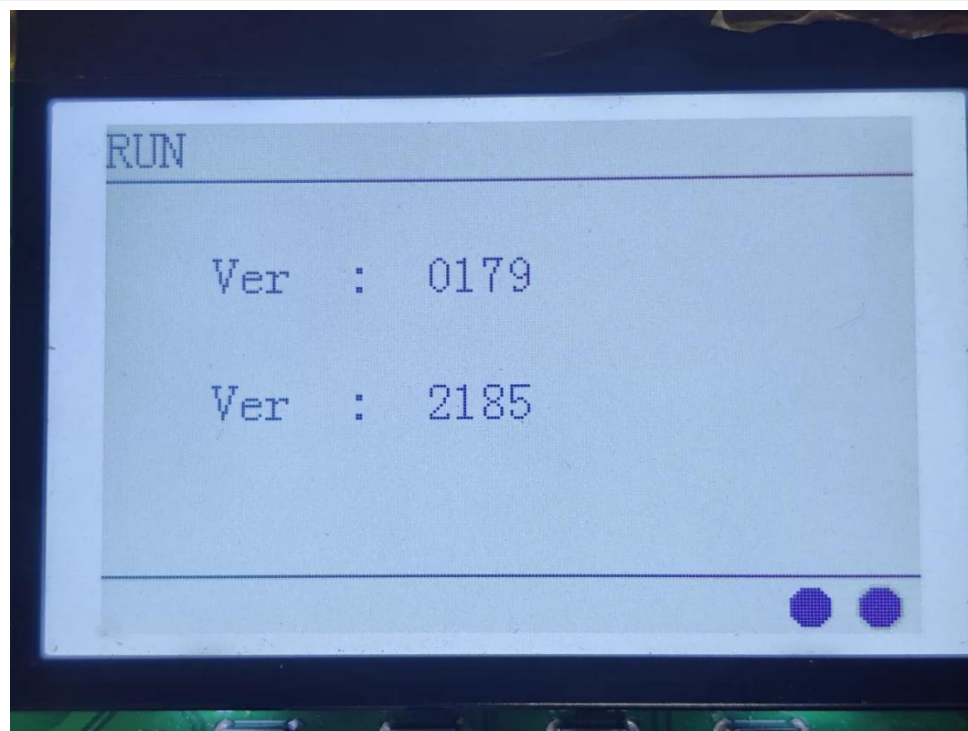
The back view of LCD board



Serial number



Software version



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--END OF REPORT--