


| | | | | |
|---|---|---|--------------------------|--------------------------------|
| Prüfbericht-Nr.: <i>Test report no.:</i> | CN23WEUS 001 | Auftrags-Nr.: <i>Order no.:</i> | 190147720 | Seite 1 von 33 Page 1 of 33 |
| Kunden-Referenz-Nr.: <i>Client reference no.:</i> | N/A | Auftragsdatum: <i>Order date:</i> | 2023-04-26 | |
| Auftraggeber: <i>Client:</i> | Beijing IN-Power Electric Co.,Ltd. No.118, Podium, 1/F, No.69, Zizhuyuan Road, Haidian District, 100080 Beijing, P.R.China | | | |
| Prüfgegenstand: <i>Test item:</i> | Power Conversion System | | | |
| Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i> | INPPCS-100/0.4-W-14-C1-OS, INPPCS-100/0.4-W-24-C1-OS | | | |
| Auftrags-Inhalt: <i>Order content:</i> | CE EMC | | | |
| Prüfgrundlage: <i>Test specification:</i> | EN IEC 61000-6-2:2019 EN IEC 61000-6-4:2019 | | | |
| Wareneingangsdatum: <i>Date of sample receipt:</i> | 2023-08-19 |  | | |
| Prüfmuster-Nr.: <i>Test sample no.:</i> | A003562855-001 | | | |
| Prüfzeitraum: <i>Testing period:</i> | 2023-08-23 to 2023-08-25 | | | |
| Ort der Prüfung: <i>Place of testing:</i> | Refer to section 1.1 | | | |
| Prüflaboratorium: <i>Testing laboratory:</i> | Refer to section 1.1 | | | |
| Prüfergebnis*: <i>Test result*:</i> | Pass | | | |
| geprüft von: <i>tested by:</i> | Yunfei Xue | | | |
| Datum: <i>Date:</i> | 2023-10-17 | Ausstellungsdatum: <i>Issue date:</i> | 2023-10-17 | |
| Stellung / Position: | Projektingenieur/PE | Stellung / Position: | Autorisierung/Authorizer | |
| Sonstiges / Other: Manufacturer or/and his importer shall ensure product bears label requirements in article 7 and article 9 of the 2014/30/EU relate to name, batch number, post address prior place the product into EU market | | | | |
| Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i> | | Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i> | | |
| * Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested | | | | |
| Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugswise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i> | | | | |

v05

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Anmerkungen
Remarks

| | |
|---|--|
| 1 | <p>Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhäuses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</p> <p><i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i></p> |
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| 3 | <p>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</p> <p><i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report. Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i></p> |
| 4 | <p>Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019.</p> <p><i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i></p> |

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TEST SUMMARY

4.1.1 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE

Result:

Pass

4.2.1 RADIATED EMISSION

Result:

Pass

5.1.1 ELECTROSTATIC DISCHARGE

Result:

Pass

5.1.2 RADIO FREQUENCY ELECTROMAGNETIC FIELD

Result:

Pass

5.1.3 POWER FREQUENCY MAGNETIC FIELD

Result:

Pass

5.2.1 ELECTRICAL FAST TRANSIENTS/BURST IMMUNITY TEST

Result:

Pass

5.2.2 RADIO FREQUENCY CONDUCTED IMMUNITY TEST

Result:

Pass

5.2.3 SURGES TO DC POWER PORT, AC OUTPUT PORT AND SIGNAL PORT

Result:

Pass

5.2.4 VOLTAGE DIPS AND INTERRUPTIONS TO AC POWER PORT

Result:

N/A

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1 Test Sites

1.1 Test Facilities

Laboratory : Xuchang KETOP Testing Research Institute Co., Ltd.
Address: No.17, Shangde Road, Xuchang, Henan, China. (CNAS No.: L0685)

1.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Lab: (Whole EMC tests were performed in Xuchang KETOP Testing Research Institute Co., Ltd.)

| Equipment | Manufacturer | M/N | S/N | Calibrated until |
|-------------------------------------|--------------|---------------------|------------------------|------------------|
| EMI Test Receiver | R&S | ESR7 | 101954 | 2024-05-14 |
| Receiving antenna | R&S | HL562E | 100959 | 2027-12-06 |
| EMC32 test software | R&S | EMC32(Ver.10.35.02) | N/A | N/A |
| EMI Test Receiver | R&S | ESR3 | 1316.3003k03-102062-av | 2024-01-08 |
| AMN | R&S | PVDC 8301 | PVDC8301#38 | 2024-05-14 |
| AMN | R&S | ENV 4200 | 100302 | 2024-01-11 |
| EMC32 test software | R&S | EMC32(Ver.8.54.0) | N/A | N/A |
| ESD testing equipment | Haefly | ONYX 30 | 186828 | 2024-01-11 |
| RF signal generator | R&S | SMB100A | 114720 | 2024-08-30 |
| Power amplifier | R&S | BBA150-BC1000 | 102430 | 2024-01-08 |
| Power amplifier | R&S | BBA150-D400E100 | 102424 | 2023-11-10 |
| log-periodic antenna | R&S | HL046E | 100255 | 2028-05-14 |
| Stacked double log-periodic antenna | SCHWARZBECK | STLP 9149 | 00521 | 2028-05-14 |
| EMC32 test software | R&S | EMC32(Ver.10.35.02) | N/A | N/A |
| PFMF testing system | Haefly | MAG 1000 | R150001-140-08 | 2024-01-09 |
| RF generator | TESEQ | NSG4070-75 | 31437 | 2024-01-08 |
| CIP | FCC | F-130A-1 | 190750 | 2024-09-05 |

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| Equipment | Manufacturer | M/N | S/N | Calibrated until |
|------------------|--------------|-----------|----------------------|------------------|
| CCI | Lioncel | EFTC | EFTC 021062218 | 2023-11-10 |
| Control system | Lioncel | SCU-614A | SCU-614A 0211103 | 2023-11-10 |
| Signal generator | Lioncel | EFT-407CB | EFT-407CB 0211102 | 2023-11-10 |
| CDN | Lioncel | CDN-4320P | CDN-4320P 0211101 | 2023-11-10 |
| Control system | Lioncel | SCU-614A | SCU-614A 0211101 | 2023-11-10 |
| Signal generator | Lioncel | LSG-510CB | LSG-510CB 0210201 | 2023-11-10 |
| CDN | Lioncel | CDN-5320P | CDN-5320P 0211101 | 2023-11-10 |

1.3 Measurement Uncertainty

Table 2: Measurement Uncertainty levels of lab

| Test | Parameters | Expanded uncertainty (U_{lab}) |
|--------------------|--|------------------------------------|
| Conducted Emission | Level accuracy (150kHz to 30MHz) | ± 1.92 dB |
| Radiated Emission | Level accuracy (30MHz to 200MHz) (200MHz to 1000MHz) | ± 2.50 dB |

2 General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is a Power Conversion System. For the further information, refer to the user's manual.

2.2 Ratings and System Details

| | | |
|-------------------------------------|---|---|
| Model number: | INPPCS-100/0.4-W-14-C1-OS, INPPCS-100/0.4-W-24-C1-OS | |
| DC side | | |
| Max. DC voltage | 900V | / |
| Min. DC voltage | 630V | / |
| DC voltage range | 630-900V | / |
| Max. DC current | 190A | / |
| No. of DC inputs | 1 | / |
| AC side(grid) | | |
| AC output rated power | 100kW | / |
| Max. AC output current | 173A | / |
| Nominal AC voltage | 400V | / |
| AC voltage range | 340-460V | / |
| Nominal frequency / Frequency range | 50Hz/60Hz±2.5Hz | / |
| AC access mode | 3P4W | / |

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| AC side(off-Grid) | | |
|-------------------------------------|----------------------|-------------|
| Nominal AC voltage | 400V | |
| AC voltage range | 340-460V | |
| Harmonic THDu | ≤3% | Linear load |
| DC voltage component | < 0.5 % | Linear load |
| Unbalance load Capacity | 100% | |
| Nominal frequency / Frequency range | 50Hz/60Hz±2.5Hz | |
| Communication | RS485, CAN, Ethernet | |

Remark: Two models are identical in circuit design and PCB layout except for model name and AC side circuit breaker used or not. Tests were performed on model INPPCS-100/0.4-W-14-C1-OS which has more complex construction.

2.3 Independent Operation Modes

The basic operation modes are:

“On”: Mode 1: Continuously operating at 80% load mode

mode 2: Continuously operating at 20% load mode

“Off”.

2.4 Noise Generating and Noise Suppressing Parts

Refer to the circuit diagram for further information.

2.5 Submitted Documents

User’s manual, Nameplate, BOM, PCB.

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test conditions were adapted accordingly in reference to the instructions for use.

Immunity: The equipment under test (EUT) was configured to have its highest possible susceptibility against the tested phenomena. The test conditions were adapted accordingly in reference to the instructions for use.

For Emission tests, tests were performed on EUT at 80% load mode and 20% load mode. For Immunity tests, tests were performed on EUT at 20% load mode. For more details, Refer to the related paragraph of this report.

Remark: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

3.2 Physical Configuration for Testing

All tests were performed at 700V DC input and 400VAC 50Hz output voltage mode.

3.3 Test Operation and Test Software

Refer to the related paragraph of this report.

3.4 Special Accessories and Auxiliary Equipment

| No. | Equipment | Model | Amount |
|-----|------------------|----------------------|--------|
| 1 | Power Supply | CP5.241 | 3 |
| 2 | Fluke multimeter | Fluke 753 | 3 |
| 3 | Laptop | K41-80 | 1 |
| 4 | USB Port | USB TO RS232/485/TTL | 1 |
| 5 | Electric relay | MY2N-GS DC24 | 2 |
| 6 | Switch | S5120-28P-WiNet | 3 |

3.5 Countermeasures to achieve EMC Compliance

Added nickel zinc magnetic rings and amorphous magnetic rings on the AC output port to Pass the Radiated emission tests.

4 Test Results EMISSION

4.1 Emission in the Frequency Range up to 30 MHz

4.1.1 Mains Terminal Continuous Disturbance Voltage

| | |
|----------------|-------------|
| Result: | Pass |
|----------------|-------------|

| | |
|-------------------|---|
| Date of testing | : 2023-08-24 |
| Test procedure | : EN IEC 61000-6-4:2019 and CISPR 16-1 series standards |
| Frequency range | : 0.15-30MHz |
| Limits | : For DC input port: Quasi-peak: 0.15-0.5MHz, 89dB μ V; 0.5-30MHz, 76dB μ V Average: 0.15-0.5MHz, 83dB μ V; 0.5-30MHz, 70dB μ V For AC output port: Quasi-peak: 0.15-0.5MHz, 79dB μ V; 0.5-30MHz, 73dB μ V Average: 0.15-0.5MHz, 66dB μ V; 0.5-30MHz, 60dB μ V |
| Kind of test site | : Shielding room |

Test Setup

| | |
|-----------------|---------------------|
| Input voltage | : DC 700V |
| Output voltage | : AC 400V, 50Hz |
| Operation mode | : Mode 1 and mode 2 |
| Artificial hand | : N/A |

The measurement equipment like test receivers, quasi-peak detector and Artificial Mains Network (AMN) are in compliance with CISPR 16-1. The tested object was operated under its input voltage and its input frequency.

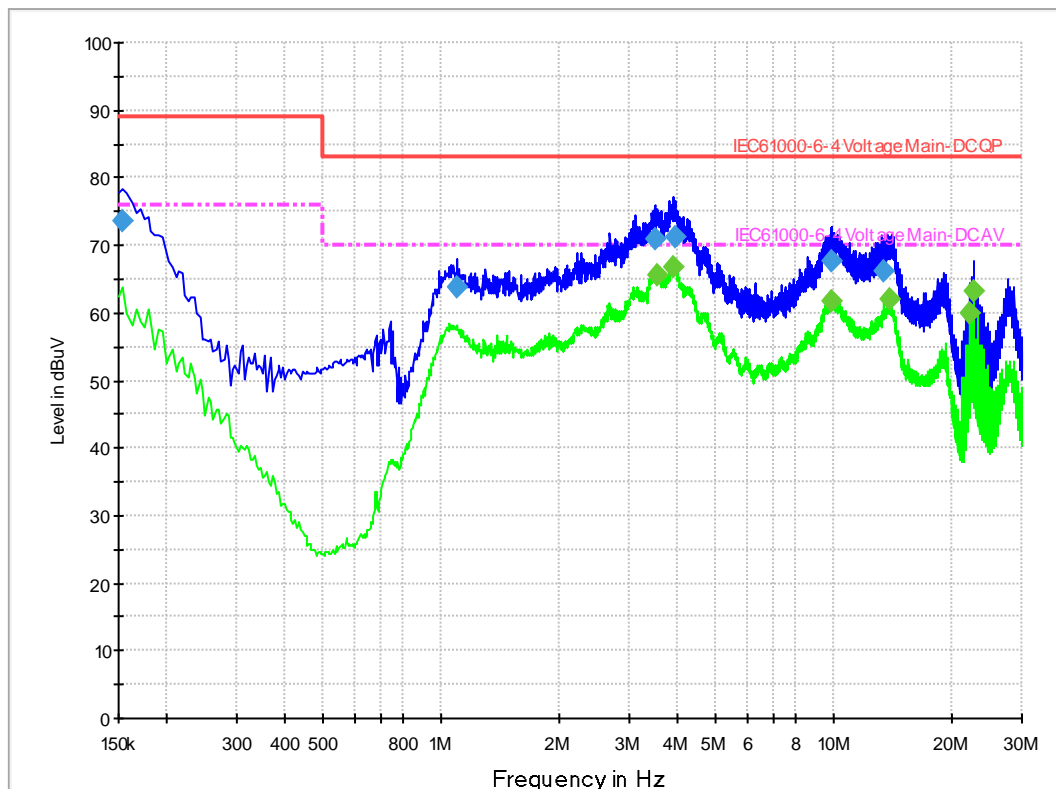
Furthermore an internal calibration with the test receiver was conducted prior to each measurement.

The EUT was set 0.8m away from the AMN. The cord longer than necessary to be connected to the AMN was folded forth and back parallel so as to form a bundle with a length between 0.3m and 0.4m.

The following figures and tables were those measured by an automatic measuring system.

Figure 1: Spectral Diagrams, Conducted Emission, 150kHz - 30MHz, DC input port

For positive line with 20% output load

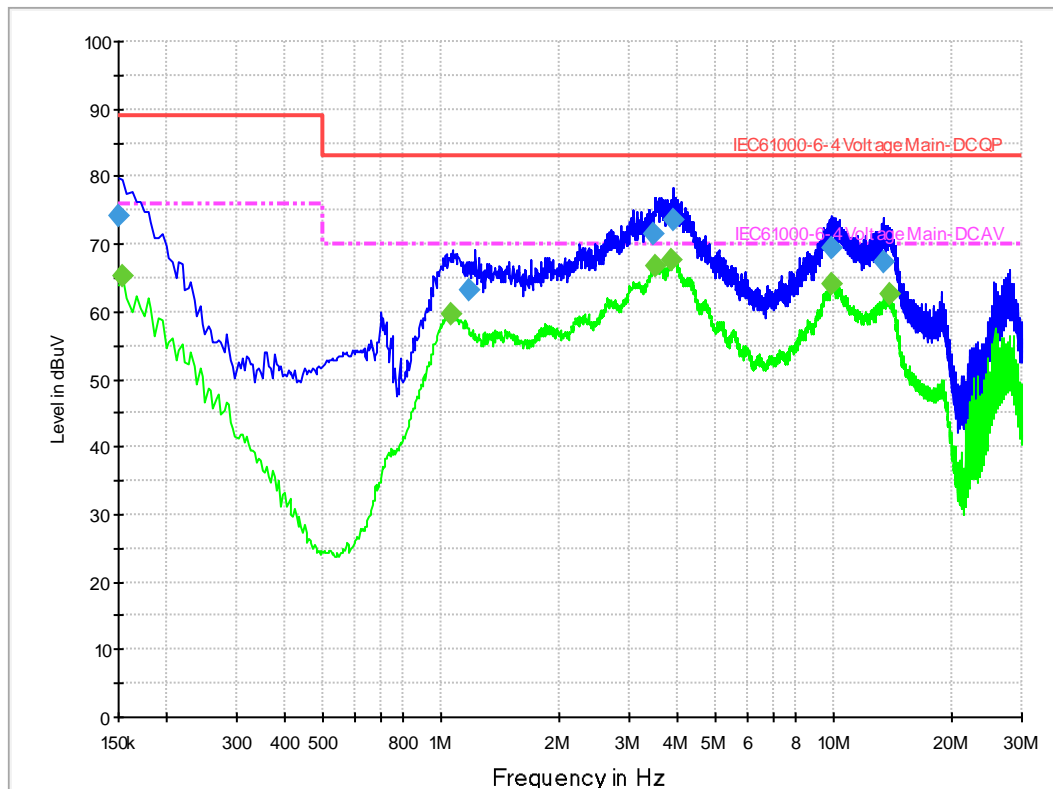


Final quasi-peak measurement results:

| Frequency (MHz) | QuasiPeak (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|------------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 0.154000 | 73.5 | 1000.0 | 9.000 | GN | DC+ | 30.1 | 15.5 | 89.0 |
| 1.093000 | 63.8 | 1000.0 | 9.000 | GN | DC+ | 28.5 | 19.2 | 83.0 |
| 3.493000 | 70.9 | 1000.0 | 9.000 | GN | DC+ | 28.7 | 12.1 | 83.0 |
| 3.913000 | 71.4 | 1000.0 | 9.000 | GN | DC+ | 28.7 | 11.6 | 83.0 |
| 9.855000 | 67.7 | 1000.0 | 9.000 | GN | DC+ | 28.8 | 15.3 | 83.0 |
| 13.281000 | 66.0 | 1000.0 | 9.000 | GN | DC+ | 29.0 | 17.0 | 83.0 |

| Frequency (MHz) | CAverage (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|-----------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 3.549000 | 65.7 | 1000.0 | 9.000 | GN | DC+ | 28.7 | 4.3 | 70.0 |
| 3.889000 | 66.8 | 1000.0 | 9.000 | GN | DC+ | 28.7 | 3.2 | 70.0 |
| 9.857000 | 61.9 | 1000.0 | 9.000 | GN | DC+ | 28.8 | 8.1 | 70.0 |
| 13.817000 | 62.2 | 1000.0 | 9.000 | GN | DC+ | 29.0 | 7.8 | 70.0 |
| 21.997000 | 60.0 | 1000.0 | 9.000 | GN | DC+ | 29.6 | 10.0 | 70.0 |
| 22.561000 | 63.1 | 1000.0 | 9.000 | GN | DC+ | 29.6 | 6.9 | 70.0 |

For negative line with 20% output load

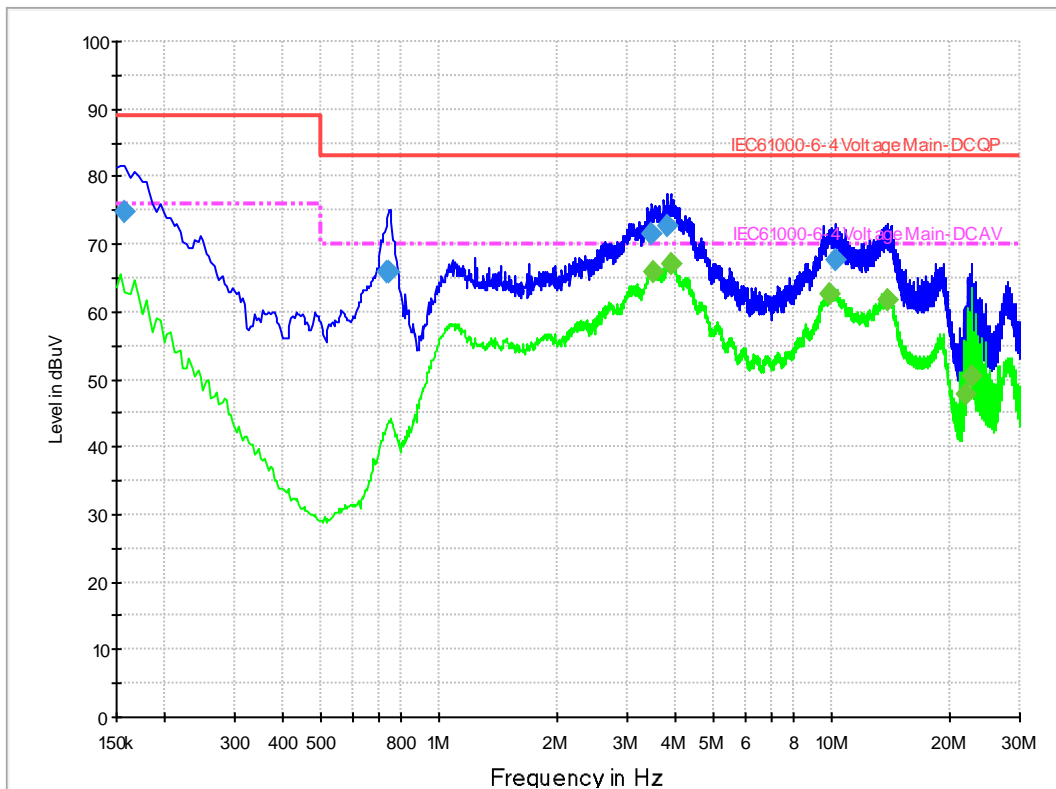


Final quasi-peak measurement results:

| Frequency (MHz) | QuasiPeak (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|------------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 0.150000 | 74.3 | 1000.0 | 9.000 | GN | DC- | 30.2 | 14.7 | 89.0 |
| 1.169000 | 63.1 | 1000.0 | 9.000 | GN | DC- | 28.5 | 19.9 | 83.0 |
| 3.465000 | 71.5 | 1000.0 | 9.000 | GN | DC- | 28.7 | 11.5 | 83.0 |
| 3.877000 | 73.5 | 1000.0 | 9.000 | GN | DC- | 28.7 | 9.5 | 83.0 |
| 9.837000 | 69.4 | 1000.0 | 9.000 | GN | DC- | 28.8 | 13.6 | 83.0 |
| 13.365000 | 67.4 | 1000.0 | 9.000 | GN | DC- | 29.0 | 15.6 | 83.0 |

| Frequency (MHz) | CAverage (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|-----------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 0.154000 | 65.2 | 1000.0 | 9.000 | GN | DC- | 30.1 | 10.8 | 76.0 |
| 1.053000 | 59.7 | 1000.0 | 9.000 | GN | DC- | 28.5 | 10.3 | 70.0 |
| 3.505000 | 66.7 | 1000.0 | 9.000 | GN | DC- | 28.7 | 3.3 | 70.0 |
| 3.853000 | 67.5 | 1000.0 | 9.000 | GN | DC- | 28.7 | 2.5 | 70.0 |
| 9.857000 | 64.0 | 1000.0 | 9.000 | GN | DC- | 28.8 | 6.0 | 70.0 |
| 13.825000 | 62.7 | 1000.0 | 9.000 | GN | DC- | 29.0 | 7.3 | 70.0 |

For positive line with 80% output load

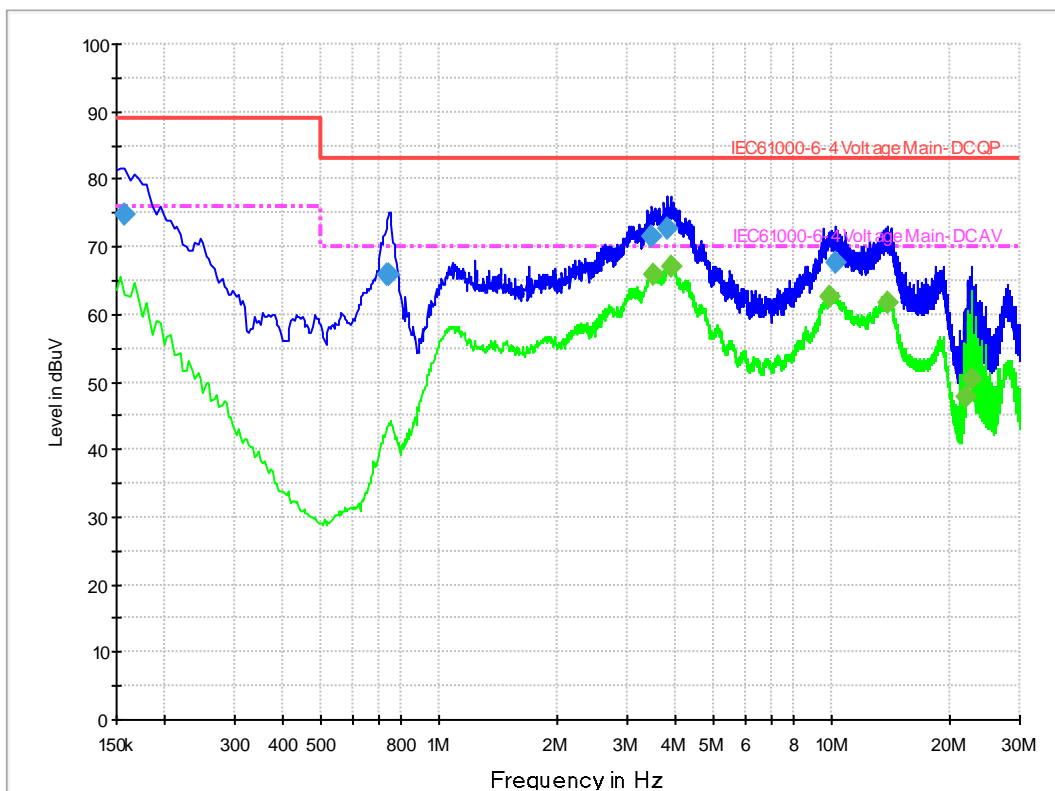


Final quasi-peak measurement results:

| Frequency (MHz) | QuasiPeak (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|------------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 0.158000 | 74.8 | 1000.0 | 9.000 | GN | DC+ | 30.1 | 14.2 | 89.0 |
| 0.733000 | 65.8 | 1000.0 | 9.000 | GN | DC+ | 28.5 | 17.2 | 83.0 |
| 0.737000 | 65.7 | 1000.0 | 9.000 | GN | DC+ | 28.5 | 17.3 | 83.0 |
| 3.469000 | 71.6 | 1000.0 | 9.000 | GN | DC+ | 28.7 | 11.5 | 83.0 |
| 3.801000 | 72.6 | 1000.0 | 9.000 | GN | DC+ | 28.7 | 10.4 | 83.0 |
| 10.205000 | 67.5 | 1000.0 | 9.000 | GN | DC+ | 28.8 | 15.5 | 83.0 |

| Frequency (MHz) | CAverage (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|-----------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 3.497000 | 66.0 | 1000.0 | 9.000 | GN | DC+ | 28.7 | 4.0 | 70.0 |
| 3.869000 | 67.0 | 1000.0 | 9.000 | GN | DC+ | 28.7 | 3.0 | 70.0 |
| 9.861000 | 62.7 | 1000.0 | 9.000 | GN | DC+ | 28.8 | 7.3 | 70.0 |
| 13.869000 | 61.6 | 1000.0 | 9.000 | GN | DC+ | 29.0 | 8.4 | 70.0 |
| 21.965000 | 47.8 | 1000.0 | 9.000 | GN | DC+ | 29.6 | 22.2 | 70.0 |
| 22.529000 | 50.5 | 1000.0 | 9.000 | GN | DC+ | 29.6 | 19.5 | 70.0 |

For negative line with 80% output load



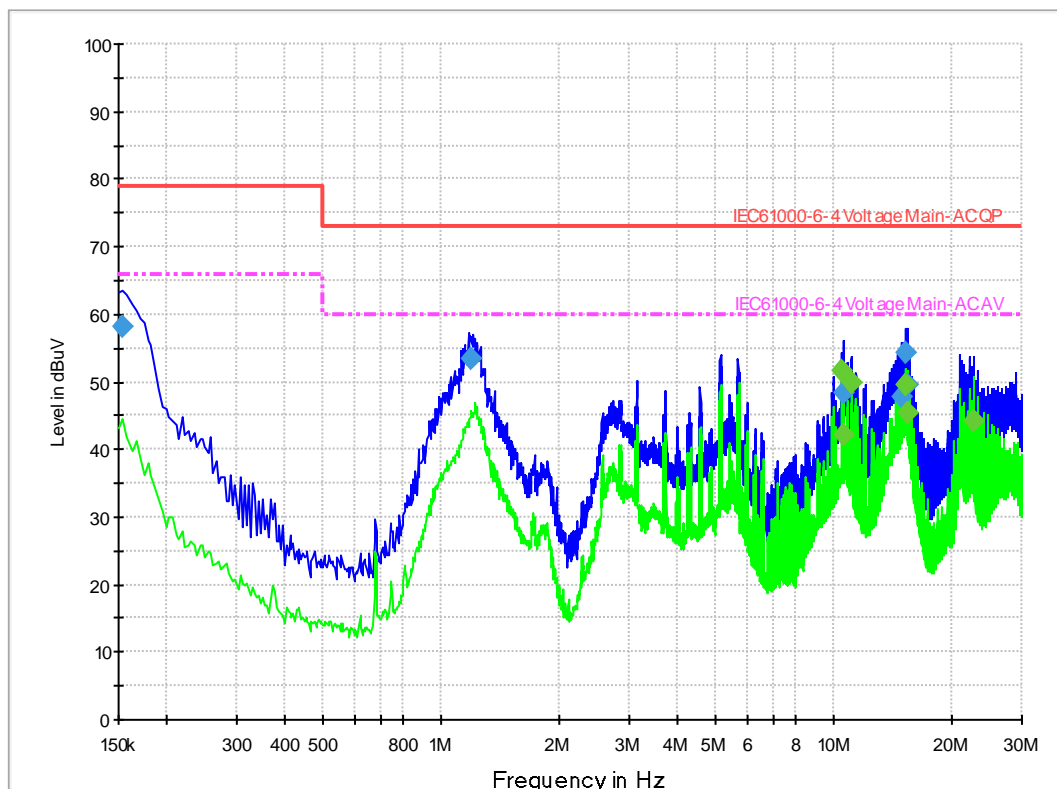
Final quasi-peak measurement results:

| Frequency (MHz) | QuasiPeak (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|------------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 0.154000 | 76.4 | 1000.0 | 9.000 | GN | DC- | 30.1 | 12.6 | 89.0 |
| 0.745000 | 67.0 | 1000.0 | 9.000 | GN | DC- | 28.5 | 16.0 | 83.0 |
| 3.481000 | 73.0 | 1000.0 | 9.000 | GN | DC- | 28.7 | 10.0 | 83.0 |
| 3.917000 | 73.9 | 1000.0 | 9.000 | GN | DC- | 28.7 | 9.1 | 83.0 |
| 9.853000 | 69.7 | 1000.0 | 9.000 | GN | DC- | 28.8 | 13.3 | 83.0 |
| 13.729000 | 68.8 | 1000.0 | 9.000 | GN | DC- | 29.0 | 14.2 | 83.0 |

| Frequency (MHz) | CAverage (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|-----------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 0.154000 | 67.6 | 1000.0 | 9.000 | GN | DC- | 30.1 | 8.4 | 76.0 |
| 1.101000 | 59.6 | 1000.0 | 9.000 | GN | DC- | 28.5 | 10.4 | 70.0 |
| 3.509000 | 66.9 | 1000.0 | 9.000 | GN | DC- | 28.7 | 3.1 | 70.0 |
| 3.877000 | 67.9 | 1000.0 | 9.000 | GN | DC- | 28.7 | 2.1 | 70.0 |
| 9.941000 | 64.4 | 1000.0 | 9.000 | GN | DC- | 28.8 | 5.6 | 70.0 |
| 10.381000 | 63.9 | 1000.0 | 9.000 | GN | DC- | 28.8 | 6.1 | 70.0 |

Figure 2: Spectral Diagrams, Conducted Emission, 150kHz - 30MHz, AC output port

For positive line with 20% output load

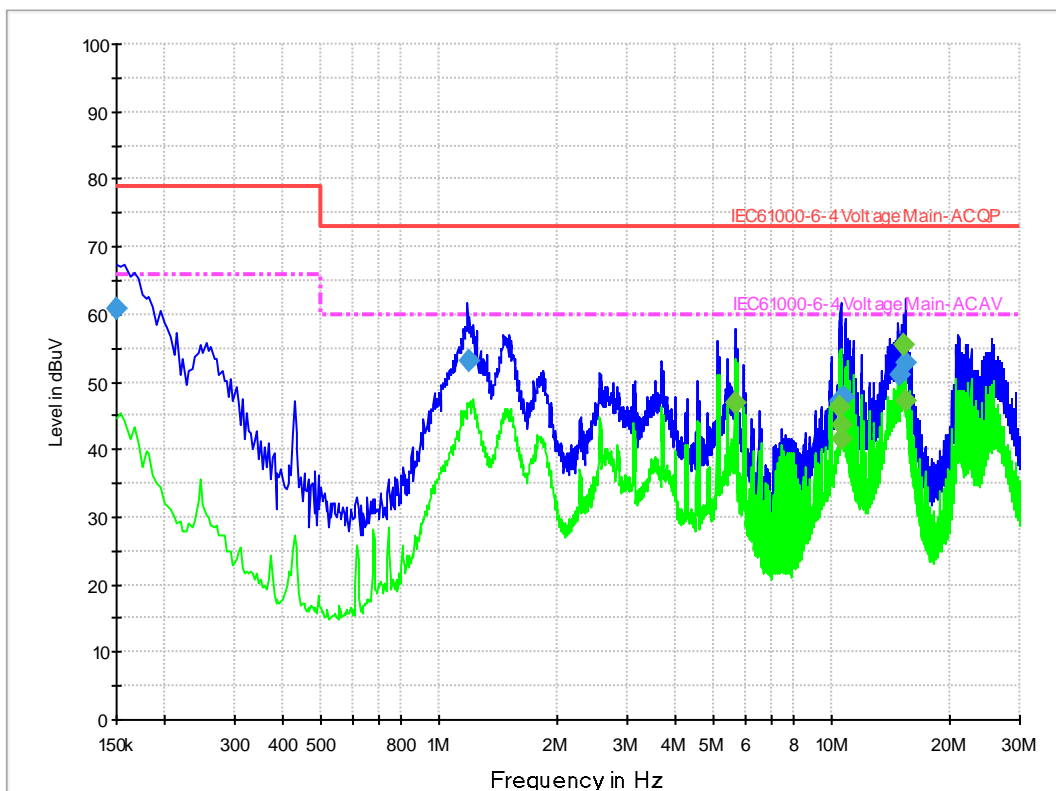


Final quasi-peak measurement results:

| Frequency (MHz) | QuasiPeak (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|------------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 0.154000 | 58.2 | 1000.0 | 9.000 | GN | L1 | 20.3 | 20.8 | 79.0 |
| 1.191000 | 53.5 | 1000.0 | 9.000 | GN | L3 | 20.0 | 19.5 | 73.0 |
| 10.507000 | 48.4 | 1000.0 | 9.000 | GN | L3 | 20.2 | 24.6 | 73.0 |
| 14.771000 | 47.9 | 1000.0 | 9.000 | GN | L3 | 20.2 | 25.1 | 73.0 |
| 15.219000 | 54.2 | 1000.0 | 9.000 | GN | L3 | 20.2 | 18.8 | 73.0 |
| 15.335000 | 49.6 | 1000.0 | 9.000 | GN | L3 | 20.3 | 23.4 | 73.0 |

| Frequency (MHz) | CAverage (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|-----------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 10.427000 | 51.7 | 1000.0 | 9.000 | GN | L3 | 20.2 | 8.3 | 60.0 |
| 10.507000 | 42.0 | 1000.0 | 9.000 | GN | L3 | 20.2 | 18.0 | 60.0 |
| 10.991000 | 49.8 | 1000.0 | 9.000 | GN | L3 | 20.2 | 10.2 | 60.0 |
| 15.219000 | 49.7 | 1000.0 | 9.000 | GN | L3 | 20.2 | 10.3 | 60.0 |
| 15.331000 | 45.3 | 1000.0 | 9.000 | GN | L3 | 20.3 | 14.7 | 60.0 |
| 22.547000 | 44.1 | 1000.0 | 9.000 | GN | L3 | 20.5 | 15.9 | 60.0 |

For ngative line with 80% output load



Final quasi-peak measurement results:

| Frequency (MHz) | QuasiPeak (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|------------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 0.150000 | 60.9 | 1000.0 | 9.000 | GN | N | 20.4 | 18.1 | 79.0 |
| 1.179000 | 53.0 | 1000.0 | 9.000 | GN | L3 | 20.0 | 20.0 | 73.0 |
| 10.471000 | 47.0 | 1000.0 | 9.000 | GN | L3 | 20.2 | 26.0 | 73.0 |
| 10.731000 | 47.8 | 1000.0 | 9.000 | GN | L3 | 20.2 | 25.2 | 73.0 |
| 14.739000 | 51.0 | 1000.0 | 9.000 | GN | L3 | 20.2 | 22.0 | 73.0 |
| 15.279000 | 52.9 | 1000.0 | 9.000 | GN | L3 | 20.3 | 20.1 | 73.0 |

| Frequency (MHz) | CAverage (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|-----------------|-----------------|-----------------|-----------------|----|------|------------|-------------|--------------|
| 5.647000 | 46.8 | 1000.0 | 9.000 | GN | L3 | 20.1 | 13.2 | 60.0 |
| 10.395000 | 46.2 | 1000.0 | 9.000 | GN | L3 | 20.2 | 13.8 | 60.0 |
| 10.513000 | 41.5 | 1000.0 | 9.000 | GN | L3 | 20.2 | 18.5 | 60.0 |
| 10.531000 | 43.7 | 1000.0 | 9.000 | GN | L3 | 20.2 | 16.3 | 60.0 |
| 15.233000 | 55.4 | 1000.0 | 9.000 | GN | L3 | 20.3 | 4.6 | 60.0 |
| 15.279000 | 47.2 | 1000.0 | 9.000 | GN | L3 | 20.3 | 12.8 | 60.0 |

4.2 Emission in the Frequency Range above 30 MHz

4.2.1 Radiated Emission

| | |
|----------------|-------------|
| Result: | Pass |
|----------------|-------------|

| | |
|-------------------|--|
| Date of testing | : 2023-08-25 |
| Test procedure | : EN IEC 61000-6-4:2019 and CISPR 16-1 series standards |
| Frequency range | : 30-1000MHz |
| Limits | : 30-230MHz, 50dB μ V/m with 3m test distance; 230-1000MHz, 57dB μ V/m with 3m test distance. |
| Kind of test site | : Semi-anechoic chamber |
| Operation mode | : Mode 1 and mode 2 |

Measuring configuration and description

The radiated disturbance test was carried out in a 3m semi-anechoic chamber with a test distance of 3m. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid.

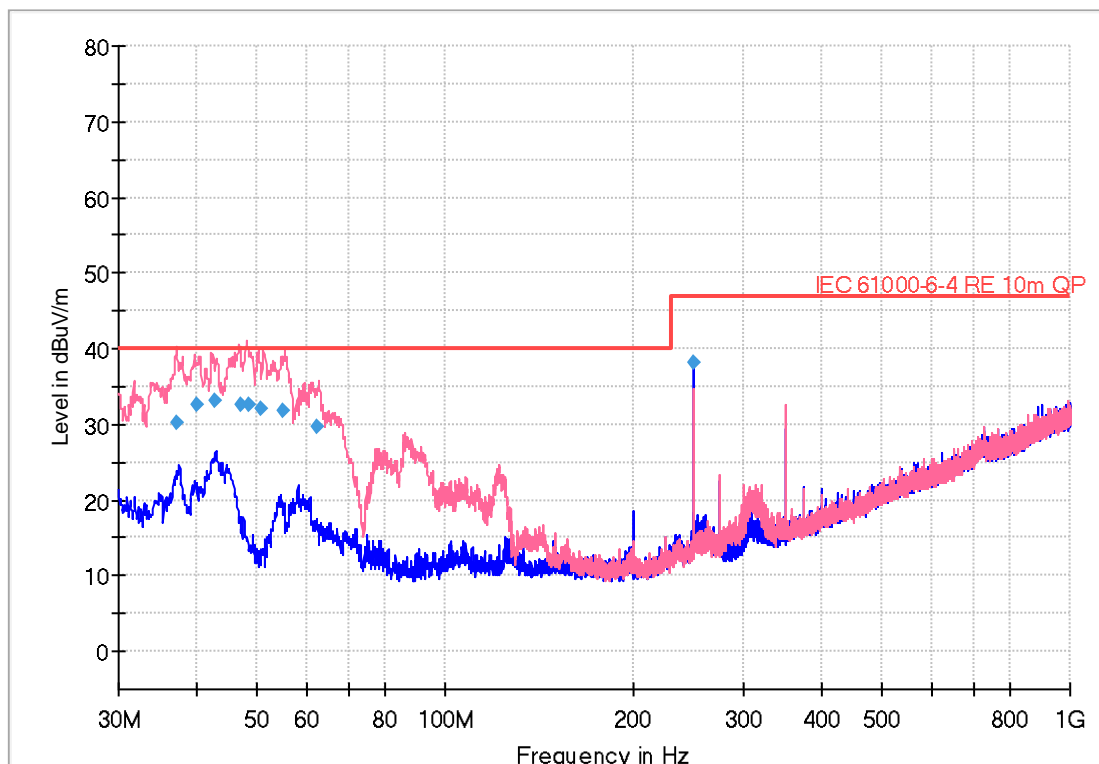
During the test, the EUT was set-up on a wooden table. The sample was rotated 360° around and the height of the antenna was varied from 1m to 4m to find the maximum disturbance. The test was performed with the antenna both in its horizontal and vertical polarizations.

The following figures and tables were those measured by an automatic measurement system. A preview test was firstly performed with peak detector. The final test was performed with quasi-peak detector at those critical frequencies found during the preview test.

Figure 3: Spectral diagrams and measurement results Horizontal and Vertical polarization,

For 20% output load

Full Spectrum

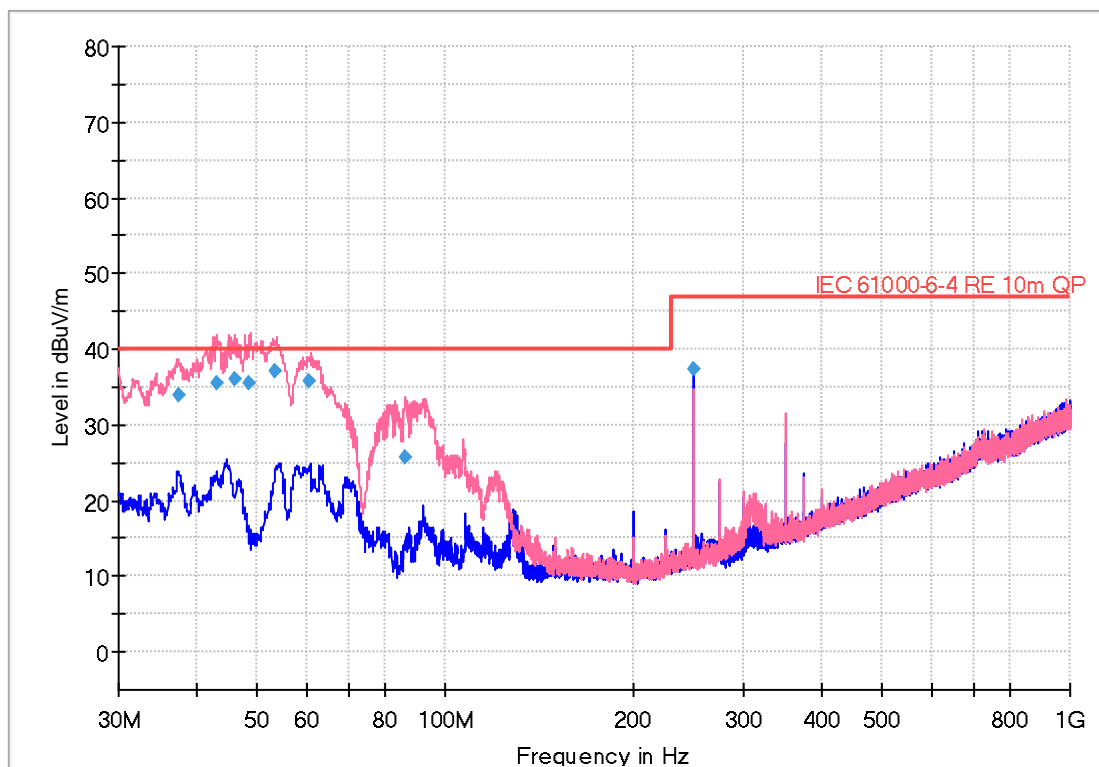


Final measurement results:

| Frequency (MHz) | QuasiPeak (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 37.273750 | 30.26 | 40.00 | 9.74 | 1000.0 | 120.000 | 153.0 | V |
| 39.880000 | 32.58 | 40.00 | 7.42 | 1000.0 | 120.000 | 108.0 | V |
| 42.848750 | 33.02 | 40.00 | 6.98 | 1000.0 | 120.000 | 175.0 | V |
| 46.912500 | 32.63 | 40.00 | 7.37 | 1000.0 | 120.000 | 142.0 | V |
| 48.606250 | 32.50 | 40.00 | 7.50 | 1000.0 | 120.000 | 112.0 | V |
| 50.677500 | 31.95 | 40.00 | 8.05 | 1000.0 | 120.000 | 125.0 | V |
| 54.921250 | 31.71 | 40.00 | 8.29 | 1000.0 | 120.000 | 198.0 | V |
| 62.496875 | 29.78 | 40.00 | 10.22 | 1000.0 | 120.000 | 217.0 | V |
| 250.007500 | 38.13 | 47.00 | 8.87 | 1000.0 | 120.000 | 275.0 | H |

Test report no.:

For 80% output load
 Full Spectrum



Final measurement results:

| Frequency (MHz) | QuasiPeak (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 37.395625 | 33.85 | 40.00 | 6.15 | 1000.0 | 120.000 | 125.0 | V |
| 42.969375 | 35.48 | 40.00 | 4.52 | 1000.0 | 120.000 | 100.0 | V |
| 45.940000 | 36.09 | 40.00 | 3.91 | 1000.0 | 120.000 | 139.0 | V |
| 48.434375 | 35.53 | 40.00 | 4.47 | 1000.0 | 120.000 | 216.0 | V |
| 53.464375 | 37.00 | 40.00 | 3.00 | 1000.0 | 120.000 | 169.0 | V |
| 60.560625 | 35.67 | 40.00 | 4.33 | 1000.0 | 120.000 | 204.0 | V |
| 86.201250 | 25.82 | 40.00 | 14.18 | 1000.0 | 120.000 | 157.0 | V |
| 250.007500 | 37.29 | 47.00 | 9.71 | 1000.0 | 120.000 | 265.0 | H |

5 Test Results IMMUNITY

As the applicant claimed, the EUT is intended to be used in a basic electromagnetic environment.

During the immunity tests, the EUT was operated under conditions specified by clause 2.3 of this report.

Performance criterion according to EN IEC 61000-6-4:2019.

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.

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.

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.

5.1 Enclosure

5.1.1 Electrostatic Discharge

| | |
|----------------|-------------|
| Result: | Pass |
|----------------|-------------|

During the test, the EUT was placed on 0.8m wooden table above the ground plane. The minimum distance between the EUT and all other conductive structures except the ground plane beneath the EUT is more than 0.5m. The size of the reference ground plane is more than 2m by 2m.

| | |
|----------------------|---|
| Date of testing | : 2023-08-23 |
| Basic standard | : IEC 61000-4-2:2008 |
| Test level | : Table 1 of EN IEC 61000-6-2:2019 ±4.0kV (contact discharge) ± 2 kV, ± 4 kV, ± 8 kV(air discharge) |
| Polarity | : Positive / Negative |
| Number of discharges | : 10 at each point |
| Performance criteria | : B |
| Ambient condition | : Temperature: 24.6°C, Relative humidity: 55.7% |

Table 3: Electrostatic discharge immunity test results

| Position | Kind of Discharge | Result | Remarks |
|---------------------------------|-------------------|--------|--|
| Nonmetallic part of enclosure | Air discharge | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| Power line | Air discharge | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| Screws, Metal part of enclosure | Contact discharge | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| HCP&VCP | Indirect Contact | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |

Test report no.:

5.1.2 Radio Frequency Electromagnetic Field

| | |
|----------------|-------------|
| Result: | Pass |
|----------------|-------------|

The test was performed inside a modified semi-anechoic chamber with a test distance of 3m. The field uniformity of the modified semi-anechoic chamber is regularly calibrated to ensure the 0-6dB field uniformity criterion as specified by IEC 61000-4-3:2006+A1+A2 is met, which is specified by EN IEC 61000-6-2:2019.

| | | |
|----------------------|---|---|
| Date of testing | : | 2023-08-23 |
| Basic standard | : | IEC 61000-4-3:2006+A1+A2 |
| Test level | : | 10V/m |
| Frequency range | : | Table 1 of EN IEC 61000-6-2:2019 10V/m: 80MHz-6GHz |
| Modulation | : | 80% AM, 1kHz |
| Dwell time | : | 3s |
| Step size | : | 1% |
| Performance criteria | : | A |
| Ambient conditions | : | Temperature: 24.3°C; Relative humidity: 55.4% |

Table 4: RF electromagnetic field immunity test results

| Polarization | Result | Remarks |
|--------------|--------|--|
| Horizontal | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| Vertical | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |

Test report no.:

5.1.3 Power frequency magnetic field

| | |
|----------------|-------------|
| Result: | Pass |
|----------------|-------------|

The immunity against Power frequency magnetic field immunity test was tested according IEC 61000-4-8:2009.

The test magnetic field is obtained by a current flowing in an induction coil; the application of the test field to the EUT is by the immersion method. The test equipment includes the current source (test generator), the induction coil and auxiliary test instrumentation. The equipment shall be subjected to the test magnetic field by using the induction coil of the standard dimensions (1m x 1m). The induction coil shall be positioned in three orthogonal orientations in order to expose the EUT to the test field with different orientations.

Date of testing : 2023-08-23
 Basic standard : IEC 61000-4-8:2009
 Test level : Table 1 of EN IEC 61000-6-2:2019
 30A/m 50Hz
 Performance criteria : A
 Ambient conditions : Temperature: 24.4 °C; Relative humidity: 56.6 %

Table 5: Power frequency magnetic field immunity test results

| Polarization | Result | Remarks |
|--------------|--------|--|
| X | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| Y | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| Z | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |

5.2 DC input Port, AC output port and Signal Port

5.2.1 Electrical fast transients/burst immunity test

| | |
|----------------|-------------|
| Result: | Pass |
|----------------|-------------|

The immunity against fast transients signal was tested in accordance to IEC 61000-4-4:2012. Test setup and the fast transient noise generator were according to IEC 61000-4-4:2012, which is specified by EN IEC 61000-6-2:2019.

During the test, the EUT was placed on a 0.1m high wooden support above the reference ground plane. The minimum distance between the EUT and all other conductive structures except the reference ground plane beneath the EUT is more than 0.5m.

The length between the coupling device and the EUT is $0.5m \pm 0.05m$. The cord length is more than 0.5m; the excess length of this cable shall be folded to avoid a flat coil and situated at a distance of 0.1m above the ground reference plane.

The reference ground plane is an aluminum sheet of 0.25mm minimum thickness. The reference ground plane is connected to the protective earth. The size of the ground plane is 2m x 2m.

| | |
|----------------------|---|
| Date of testing | : 2023-08-23 |
| Basic standard | : IEC 61000-4-4:2012 |
| Test level | : Table 2, 3, 4 of EN IEC 61000-6-2:2019 ±2kV for AC mains port ±1kV for 100kHz DC port and signal port |
| Polarity | : Negative/positive |
| Repetition frequency | : 100kHz, 5kHz |
| Test duration | : 1 min for each coupling mode |
| T_r/T_n | : 5ns/50ns |
| Performance criteria | : B |
| Ambient conditions | : Temperature: 24.4°C; Relative humidity: 56.3% |

Table 6: Electrical fast transient/burst immunity test results

| Coupling mode | Result | Remarks |
|----------------|--------|--|
| DC input port | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| AC output port | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| Signal port | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |

5.2.2 Radio frequency conducted immunity test

| | |
|----------------|-------------|
| Result: | Pass |
|----------------|-------------|

The immunity against injected current into signal port was tested according to IEC 61000-4-6:2003 in a shielded room. The Test setup and the test generator were according to IEC 61000-4-6:2003 which is specified by EN IEC 61000-6-2:2019.

During the test, the sample was placed on a 0.1m wooden support above the reference ground plane. The minimum distance between the sample and all other conductive structures except the reference ground plane beneath the EUT is more than 0.5m.

| | |
|----------------------|--|
| Date of testing | : 2023-08-23 |
| Basic standard | : IEC 61000-4-6:2013 |
| Test level | : Table 2, 3, 4 of EN IEC 61000-6-2:2019 10V for AC output port 3V for DC mains port and signal port |
| Frequency range | : 0.15-80 MHz |
| Modulation | : 80%AM, 1KHz |
| Frequency scan speed | : Frequency step: 1%; Dwell time: 1s |
| Performance criteria | : A |
| Ambient conditions | : Temperature: 24.6°C, Relative humidity: 55.6% |

Table 7: Conducted disturbances induced by RF fields, AC power port

| Port | Result | Remarks |
|----------------|--------|--|
| AC output port | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| DC output port | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| Signal port | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |

5.2.3 Surges to DC Power Port, AC output port and Signal port

| | |
|----------------|-------------|
| Result: | Pass |
|----------------|-------------|

The immunity against surges to DC Power Port, AC output port and Signal port were tested in accordance to IEC 61000-4-5:2014+A1. Test setup and the Combination Wave Generator (CWG) were according to IEC 61000-4-5:2014+A1 which is specified by EN IEC 61000-6-2:2019.

During the test, the EUT was placed on a 0.1m high wooden support.

| | |
|----------------------|---|
| Date of testing | : 2023-08-23 |
| Basic standard | : IEC 61000-4-5:2014+A1 |
| Test level | : Table 4 of EN IEC 61000-6-2:2019 ±2kV (Line to ground) for AC output port ±1kV (Line to line) for AC output port ±1kV (Line to line) for DC input port and signal port |
| T_r/T_n | : 1.2/50µs (open-circuit voltage) 8/20µs (short-circuit current) |
| Polarity | : Positive / Negative |
| Pulse number | : 5 pulses for each polarity |
| Coupling phase | : 0°, 90°, 180° and 270° |
| Repetition rate | : 1 pulse/min |
| Performance criteria | : B |
| Ambient conditions | : Temperature: 24.6°C, Relative humidity: 55.7% |

Table 8: Surge immunity test results

| Coupling mode | Result | Remarks |
|----------------|--------|--|
| AC output port | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| DC input port | Pass | During the test, the sample can meet the requirements of performance criterion A as described in clause 5. |
| signal port | N/A | The signal line is not exceed 30 meters, so no need to be test. |

5.2.4 Voltage dips and interruptions to AC Power Port

Result:

N/A

The immunity against voltage dips and interruptions to AC input power port was tested in accordance to IEC 61000-4-11:2020. Test setup and the test generator were according to IEC 61000-4-11:2020 which is specified by EN IEC 61000-6-2:2019.

| | | |
|---|---|--|
| Date of testing | : | / |
| Basic standard | : | IEC 61000-4-11:2020 |
| Test level (in % UT) and duration (in periods of the rated frequency) | : | Table 4 of EN IEC 61000-6-2:2019 0 10ms 0 20ms 70 500ms 0 5000ms |
| Performance criteria | : | B+C |
| Ambient conditions | : | Temperature: / °C, Relative humidity: / % |

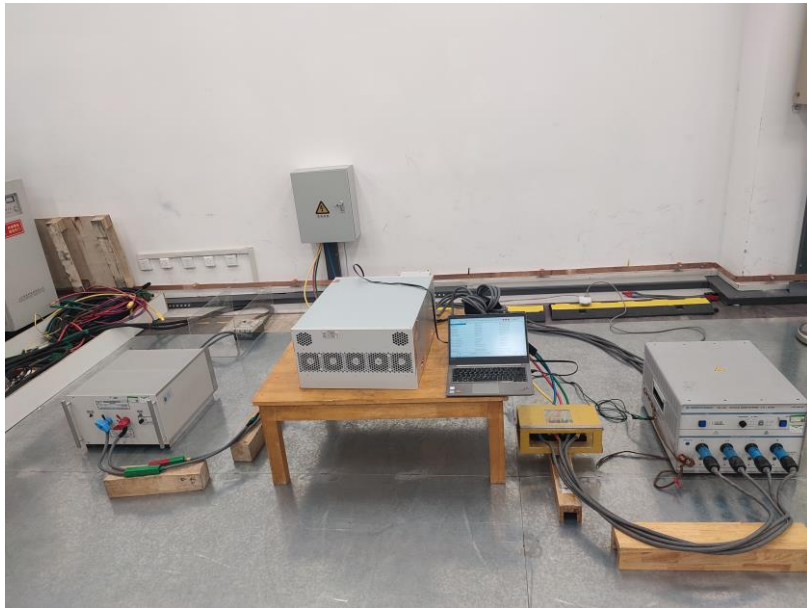
Remark: the EUT was input by DC power system, this test item was not applicable.

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6 Photographs of the Test Set-Up

Photograph 1: Set-up for measurement of disturbance voltage on AC mains



Photograph 2: Set-up for measurement of radiated emission



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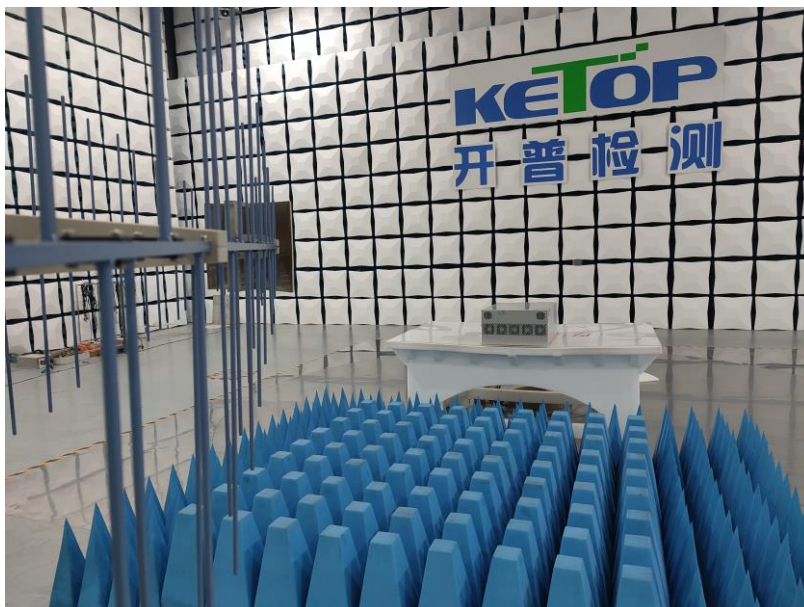
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Photograph 3: Set-up for immunity test of electrostatic discharge



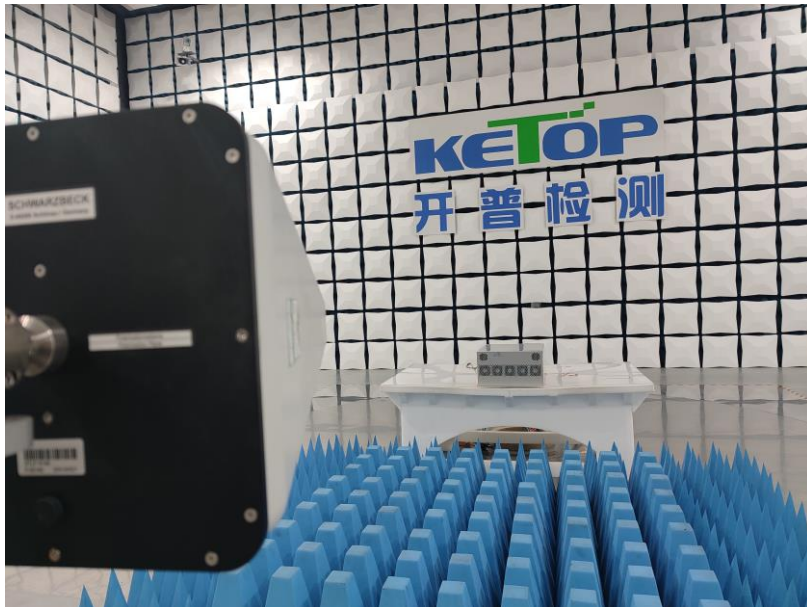
Photograph 4: Set-up for immunity test of RF electromagnetic field, 80M-1GHz



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Photograph 5: Set-up for immunity test of RF electromagnetic field, 1GHz-6GHz



Photograph 6: Set-up for immunity test of fast transient/burst

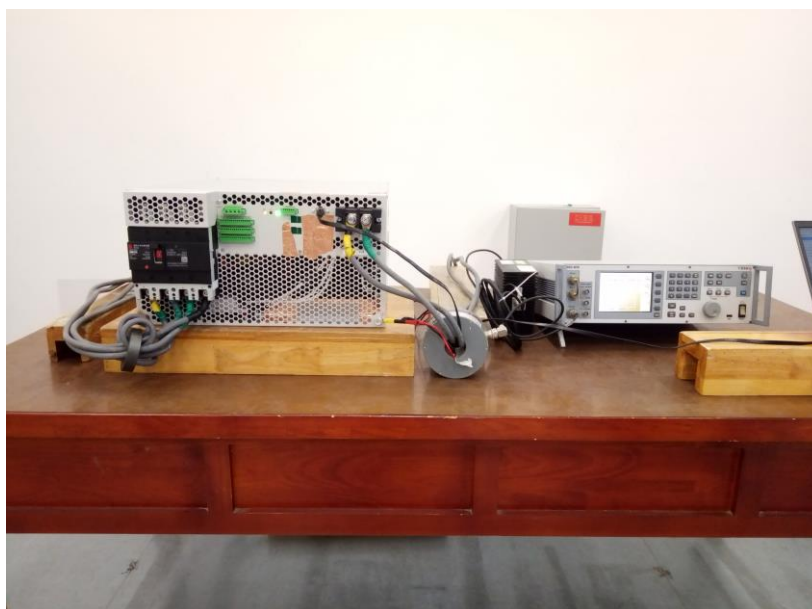
For DC input port and AC output port



For signal port



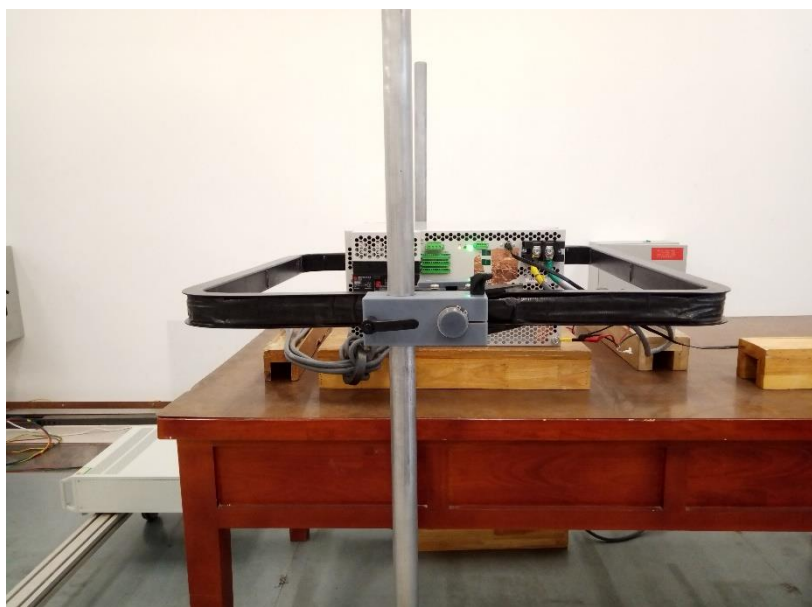
Photograph 7: Set-up for immunity test of Conducted disturbances induced by RF fields



Photograph 8: Set-up for immunity test of surge



Photograph 9: Set-up for Power frequency magnetic field



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