

EMC Test Report

Report No.: AGC01978190501EE02

PRODUCT DESIGNATION : Air Mousepad with 5W wireless charging, black
BRAND NAME : N/A
MODEL NAME : P308.251
CLIENT :
DATE OF ISSUE : May 24, 2019
STANDARD(S) : Final Draft EN 301 489-1 V2.2.1 (2019-03)
Final Draft EN 301 489-3 V2.1.1 (2017-03)
REPORT VERSION V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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Report Revise Record

| Report Version | Revise Time | Issued Date | Valid Version | Notes |
|----------------|-------------|--------------|---------------|-----------------|
| V1.0 | / | May 24, 2019 | Valid | Initial Release |

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TABLE OF CONTENTS

| | |
|---|-----------|
| 1. TEST REPORT CERTIFICATION..... | 4 |
| 2. GENERAL INFORMATION | 5 |
| 2.1. DESCRIPTION OF EUT | 5 |
| 2.2. OBJECTIVE | 5 |
| 2.3. TEST STANDARDS AND RESULTS | 5 |
| 2.4. ENVIRONMENTAL CONDITIONS | 5 |
| 3. TEST MODE DESCRIPTION | 6 |
| 4. MEASUREMENT UNCERTAINTY..... | 7 |
| 5. SUPPORT EQUIPMENT..... | 8 |
| 6. IDENTIFICATION OF THE RESPONSIBLE TESTING LOCATION..... | 9 |
| 7. TEST CONDITIONS AND RESULT..... | 11 |
| 7.1. LINE CONDUCTED EMISSION TEST | 11 |
| 7.2. RADIATED DISTURBANCE MEASUREMENT..... | 15 |
| 7.3. HARMONIC CURRENT MEASUREMENT | 19 |
| 7.4. VOLTAGE FLUCTUATIONS AND FLICK MEASUREMENT..... | 21 |
| 8. IMMUNITY TEST | 22 |
| 8.1. EUT SETUP AND OPERATING CONDITIONS | 22 |
| 8.2. GENERAL PERFORMANCE CRITERIA..... | 22 |
| 8.3. ELECTROSTATIC DISCHARGE IMMUNITY TEST | 24 |
| 8.4. RADIATED, RADIO FREQUENCY ELECTROMAGNETIC FIELD IMMUNITY TEST..... | 26 |
| 8.5. ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST | 29 |
| 8.6. SURGE IMMUNITY TEST | 31 |
| 8.7. IMMUNITY TO CONDUCTED DISTURBANCES INDUCED BY RF FIELDS | 34 |
| 8.8. VOLTAGE DIPS AND SHORT INTERRUPTIONS IMMUNITY TEST | 36 |
| APPENDIX A: PHOTOGRAPHS OF TEST SETUP | 38 |

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1. TEST REPORT CERTIFICATION

| | |
|--------------------------|---|
| Applicant | |
| Address | |
| Manufacturer | |
| Address | |
| Factory | |
| Address | |
| Product Designation | Air Mousepad with 5W wireless charging, black |
| Brand Name | N/A |
| Test Model | P308.251 |
| Date of test | May 13, 2019 to May 23, 2019 |
| Deviation | None |
| Condition of Test Sample | Normal |
| Test Result | Pass |
| Report Template | AGCRT-EC-EMC |

We, Attestation of Global Compliance (Shenzhen) Co., Ltd., hereby certify that the submitted samples of the above item, as detailed in chapter 2.1 of this report, has been tested in our facility. The test record, data evaluation and test configuration represented herein are true and accurate accounts of measurements of the sample's EMC characteristics under the conditions herein specified.

Tested By



Erik Yang(Yang Jianmin)

May 23, 2019

Reviewed By



Max Zhang(Zhang Yi)

May 24, 2019

Approved By



 Forrest Lei(Lei Yonggang)
 Authorized Officer

May 24, 2019

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2. GENERAL INFORMATION

2.1. DESCRIPTION OF EUT

The EUT is a short range, WIRELESS CHARGER device.

Details of technical specification refer to the description in follows:

| | |
|---------------------------|-----------------------|
| Hardware Version | V1.0 |
| Software Version | V1.0 |
| Operation Frequency range | 110-205kHz |
| Test Frequency | 115.3KHz |
| Number of Channels | 1 Channel |
| Antenna Type | Integral antenna |
| Power Supply | DC 5V 1A by Micro-USB |

2.2. OBJECTIVE

Perform Electro Magnetic Interference (EMI) and Electro Magnetic Susceptibility (EMS) tests for CE Marking.

2.3. TEST STANDARDS AND RESULTS

The EUT has been tested according to ETSI EN 301 489-1 V2.2.1 (2019-03) and ETSI EN 301 489-3 V2.1.1 (2017-03).

| | |
|-------------------|---|
| ETSI EN 301 489-1 | ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility |
| ETSI EN 301 489-3 | ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU |

2.4. ENVIRONMENTAL CONDITIONS

During the measurement the environmental conditions were within the listed ranges:

- Temperature: -20-55°C
- Humidity: 30-60 %
- Atmospheric pressure: 86-106 kPa

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3. TEST MODE DESCRIPTION

| NO. | TEST MODE DESCRIPTION | WORST |
|-----|------------------------------------|-------|
| 1 | Charging with adaptor at full load | V |
| 2 | Charging with adaptor at half load | -- |
| 3 | Charging with adaptor at null load | -- |

Note: 1. V means EMI worst mode. Only the data of worst case are recorded in this report.
 2. All the modes are tested, but only the worst case is recorded in this report.

I/O Port Information (☒ Applicable ☐ Not Applicable)

| I/O Port of EUT | | | |
|-----------------|--------|-------------------|-------------|
| I/O Port Type | Number | Cable Description | Tested With |
| USB | 1 | -- | 1 |
| Micro-USB | 1 | -- | 1 |

Note:

1. All the above "--" means that EUT has no cable.
2. All the cables were provided by AGC Lab.

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4. MEASUREMENT UNCERTAINTY

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in measurement" (GUM) published by CISPR and ANSI.

- Uncertainty of Conducted Emission, $U_c = \pm 3.2$ dB
- Uncertainty of Radiated Emission below 1GHz, $U_c = \pm 3.9$ dB
- Uncertainty of Radiated Emission above 1GHz, $U_c = \pm 4.8$ dB

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5. SUPPORT EQUIPMENT

| Device Type | Manufacturer | Model Name | Serial No. | specification |
|-------------------------|--------------|-------------|------------|---------------|
| Multimeter | Sanwa | CD751 | -- | -- |
| Load | -- | -- | -- | 5W |
| USB and Micro-USB cable | -- | -- | -- | 1m unshielded |
| Adaptor | KUANTEN | KT05W050100 | -- | -- |

Note:

1 All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.

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6. IDENTIFICATION OF THE RESPONSIBLE TESTING LOCATION

| | |
|-----------------|--|
| Site | Attestation of Global Compliance (Shenzhen) Co., Ltd |
| Location | 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China |

TEST EQUIPMENT OF CONDUCTED EMISSION TEST

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|---------------|--------------|---------|--------|--------------|--------------|
| TEST RECEIVER | R&S | ESPI | 101206 | Jun.12, 2018 | Jun.11, 2019 |
| LISN | R&S | ESH2-Z5 | 100086 | Aug.28, 2018 | Aug.27, 2019 |

TEST EQUIPMENT OF RADIATED EMISSION TEST

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|---------------|--------------|----------|--------|--------------|--------------|
| TEST RECEIVER | R&S | ESCI | 10096 | Jun.12, 2018 | Jun.11, 2019 |
| ANTENNA | SCHWARZBECK | VULB9168 | D69250 | Sep.28, 2018 | Sep.27, 2019 |

TEST EQUIPMENT OF POWER HARMONICS / VOLTAGE FLUCTUATION / FLICKER TEST

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|--------------------------|--------------|-----------|-------|--------------|--------------|
| Signal Conditioning Unit | Schaffner | CCN1000-1 | 72431 | Aug.28, 2018 | Aug.27, 2019 |
| AC Source | Schaffner | NSG1007 | 56825 | Aug.28, 2018 | Aug.27, 2019 |

TEST EQUIPMENT OF SURGE/EFT/DIPSTEST

| Description | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|---------------------|--------------|-------------|-------|--------------|--------------|
| EFT、Surge Generator | Schaffner | Modula 6150 | 34437 | Aug.28, 2018 | Aug.27, 2019 |

TEST EQUIPMENT OF ESD TEST

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|---------------|--------------|---------|-----|--------------|--------------|
| ESD Simulator | Schaffner | NSG 438 | 782 | Oct.25, 2018 | Oct.24, 2019 |

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TEST EQUIPMENT OF RS IMMUNITY TEST

| Description | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|------------------|--------------|------------------|---------------------|--------------|--------------|
| SIGNAL GENERATOR | R&S | E4421B | MY4335160 3 | May.13, 2019 | May.12, 2020 |
| ANTENNA | SCHWARZBCK | VULB9168 | D69250 | Aug.28, 2018 | Aug.27, 2019 |
| POWER SENSOR | R&S | URV5-Z4 | 100124 | May.13, 2019 | May.12, 2020 |
| POWER METER | R&S | NRVD | 8323781027 | May.13, 2019 | May.12, 2020 |
| POWER AMPLIFIER | KALMUS | 7100LC | 04-02/17-06 -001 | Jun.12, 2018 | Jun.11, 2019 |
| RF AMPLIFIER | Milmega | AS0104-55_5 5 | 1004793 | Jun.12, 2018 | Jun.11, 2019 |
| HORN ANTENNA | ETS LINDGREN | 3117 | 00034609 | May.26, 2018 | May.25, 2019 |

TEST EQUIPMENT OF CS IMMUNITY TEST

| Description | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|---------------------------------|--------------|------------------|----------------|--------------|--------------|
| Power Amplifier | AR | 75A250 | 18464 | Jun.12, 2018 | Jun.11, 2019 |
| CDN | ZHINAN | ZN3751 | 15004 | Aug.28, 2018 | Aug.27, 2019 |
| 6dB attenuator | JWF | 50FHC-006-5 0 | N/A | Jun.12, 2018 | Jun.11, 2019 |
| Electromagnetic Injection Clamp | Luthi | EM101 | 35773 | Aug.28, 2018 | Aug.27, 2019 |
| Power Sensor | R&S | URV5-Z4 | 100124 | May.13, 2019 | May.12, 2020 |
| Power Meter | R&S | NRVD | 8323781027 | May.13, 2019 | May.12, 2020 |
| SIGNAL GENERATOR | R&S | E4421B | MY4335160 3 | May.13, 2019 | May.12, 2020 |

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7. TEST CONDITIONS AND RESULT

7.1. LINE CONDUCTED EMISSION TEST

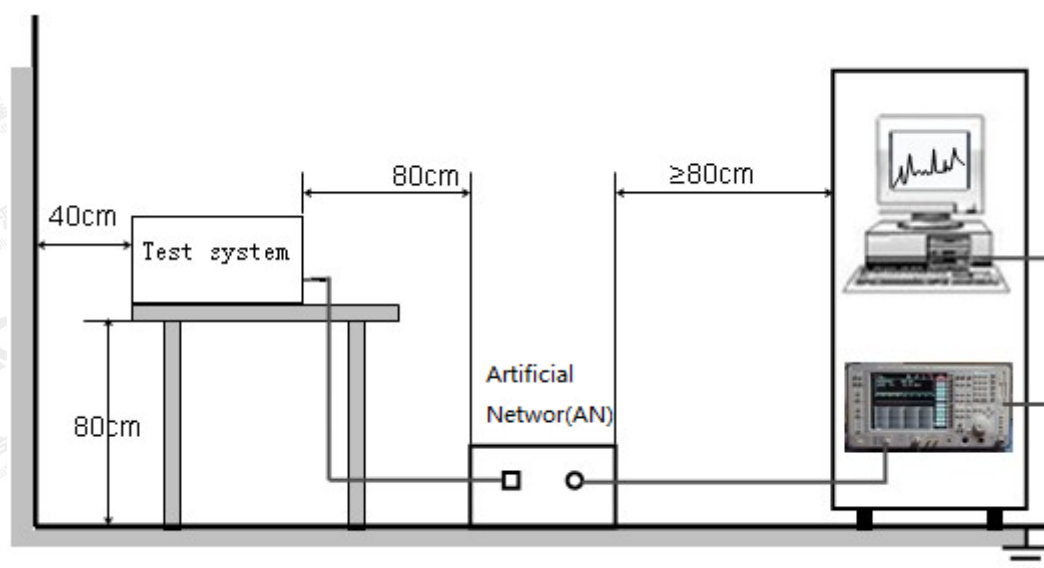
7.1.1 LIMITS OF LINE CONDUCTED EMISSION TEST

| Frequency | Maximum RF Line Voltage | |
|---------------|-------------------------|----------------|
| | Q.P.(dBuV) | Average(dBuV) |
| 150kHz-500kHz | 66-56 | 56-46 |
| 500kHz-5MHz | 56 | 46 |
| 5MHz-30MHz | 60 | 50 |

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50MHz.

7.1.2. BLOCK DIAGRAM OF TEST SETUP



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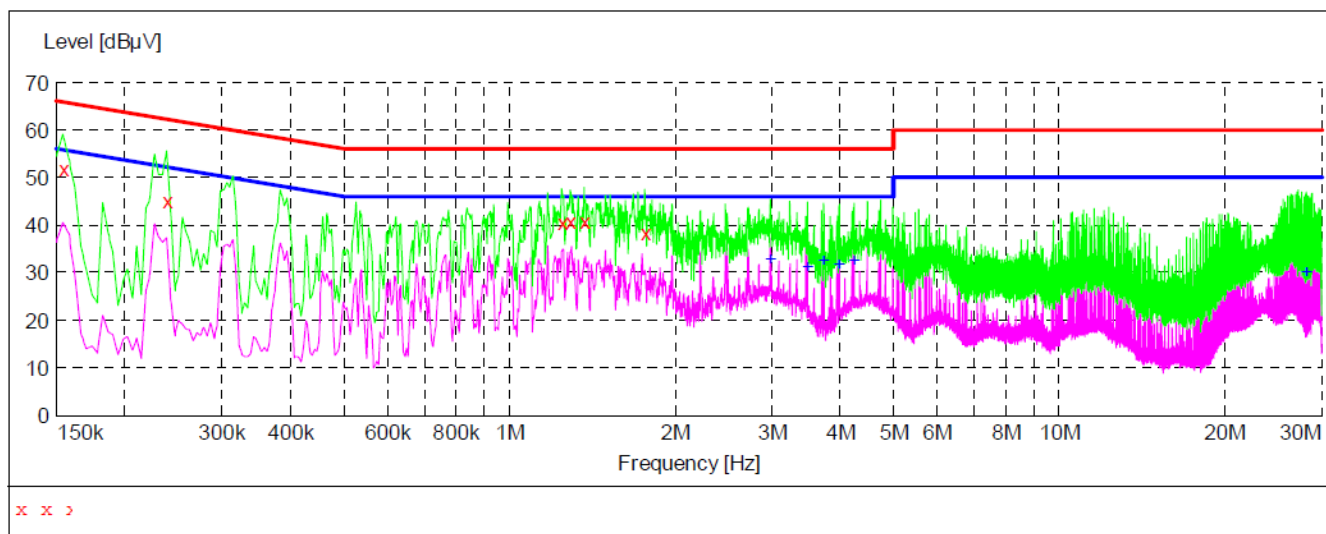
7.1.3. PROCEDURE OF LINE CONDUCTED EMISSION TEST

- (1) The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per EN 55032 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- (2) Support equipment, if needed, was placed as per EN 55032.
- (3) All I/O cables were positioned to simulate typical actual usage as per EN 55032.
- (4) The EUT received DC power from adaptor which received AC 230V power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- (5) The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the AN powering the EUT. The AN has two monitoring points: Line 1 (Positive) and Line 2 (Negative). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- (6) Analyzer / Receiver scanned from 150 kHz to 30 MHz for emissions in each of the test modes.
- (7) During the above scans, the emissions were maximized by cable manipulation.
- (8) A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions.
- (9) Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less -2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.

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7.1.4. TEST RESULT

LINE CONDUCTED EMISSION TEST-L



MEASUREMENT RESULT

| Frequency MHz | Level dBμV | Transd dB | Limit dBμV | Margin dB | Detector | Line |
|------------------|---------------|--------------|---------------|--------------|----------|------|
| 0.154000 | 51.80 | 10.8 | 66 | 14.0 | QP | L1 |
| 0.238000 | 45.10 | 10.9 | 62 | 17.1 | QP | L1 |
| 1.246000 | 40.60 | 11.5 | 56 | 15.4 | QP | L1 |
| 1.290000 | 40.90 | 11.5 | 56 | 15.1 | QP | L1 |
| 1.366000 | 40.80 | 11.5 | 56 | 15.2 | QP | L1 |
| 1.762000 | 38.60 | 11.5 | 56 | 17.4 | QP | L1 |

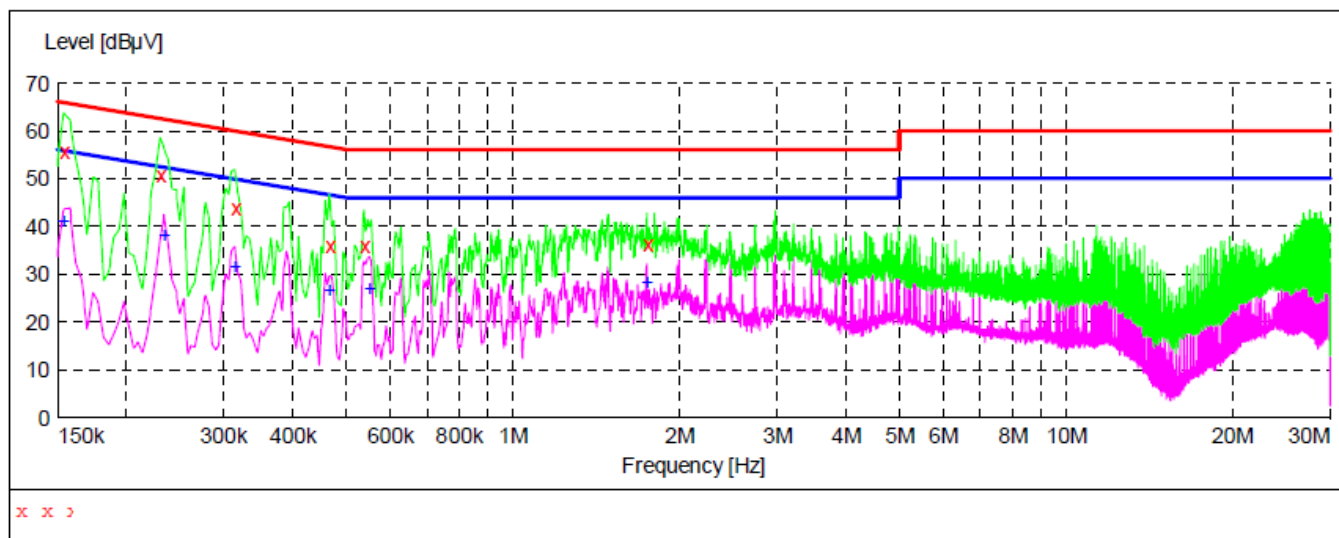
MEASUREMENT RESULT

| Frequency MHz | Level dBμV | Transd dB | Limit dBμV | Margin dB | Detector | Line |
|------------------|---------------|--------------|---------------|--------------|----------|------|
| 2.986000 | 32.70 | 11.5 | 46 | 13.3 | AV | L1 |
| 3.486000 | 31.30 | 11.6 | 46 | 14.7 | AV | L1 |
| 3.734000 | 32.40 | 11.6 | 46 | 13.6 | AV | L1 |
| 3.982000 | 31.70 | 11.6 | 46 | 14.3 | AV | L1 |
| 4.234000 | 32.50 | 11.6 | 46 | 13.5 | AV | L1 |
| 28.138000 | 30.10 | 12.8 | 50 | 19.9 | AV | L1 |

RESULT: PASS

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LINE CONDUCTED EMISSION TEST-N



MEASUREMENT RESULT

| Frequency MHz | Level dBμV | Transd dB | Limit dBμV | Margin dB | Detector | Line |
|------------------|---------------|--------------|---------------|--------------|----------|------|
| 0.154000 | 55.60 | 10.8 | 66 | 10.2 | QP | N |
| 0.230000 | 50.70 | 10.9 | 62 | 11.7 | QP | N |
| 0.314000 | 44.00 | 10.8 | 60 | 15.9 | QP | N |
| 0.466000 | 35.90 | 10.9 | 57 | 20.7 | QP | N |
| 0.538000 | 35.90 | 11.0 | 56 | 20.1 | QP | N |
| 1.746000 | 36.30 | 11.5 | 56 | 19.7 | QP | N |

MEASUREMENT RESULT

| Frequency MHz | Level dBμV | Transd dB | Limit dBμV | Margin dB | Detector | Line |
|------------------|---------------|--------------|---------------|--------------|----------|------|
| 0.154000 | 41.30 | 10.8 | 56 | 14.5 | AV | N |
| 0.234000 | 38.30 | 10.9 | 52 | 14.0 | AV | N |
| 0.314000 | 31.90 | 10.8 | 50 | 18.0 | AV | N |
| 0.466000 | 26.70 | 10.9 | 47 | 19.9 | AV | N |
| 0.550000 | 27.30 | 11.0 | 46 | 18.7 | AV | N |
| 1.746000 | 28.40 | 11.5 | 46 | 17.6 | AV | N |

RESULT: PASS

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7.2. RADIATED DISTURBANCE MEASUREMENT

7.2.1. LIMITS OF RADIATED DISTURBANCES

Limits for radiated disturbance 30M to1 GHz at a measurement distance of 3 m

| Frequency range (MHz) | Quasi peak limits(dBuV/m), for Class B ITE, at 3m measurement distance |
|-----------------------|---|
| 30 - 230 | 40 |
| 230 - 1000 | 47 |

Limits for radiated disturbance above 1 GHz at a measurement distance of 3 m

| Frequency range (MHz) | Limits (dBuV/m), Class B ITE | |
|-----------------------|------------------------------|---------|
| | Peak | Average |
| 1000-3000MHz | 70 | 50 |
| 3000-6000MHz | 74 | 54 |

Notes:

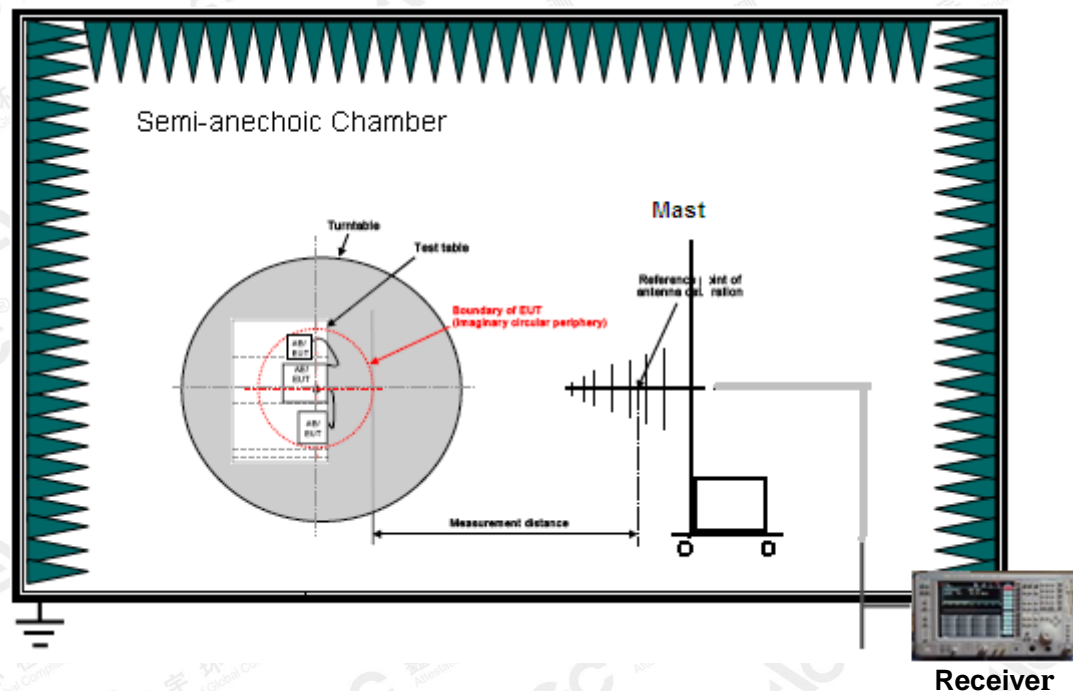
1. The lower limit shall apply at the transition frequency.
2. Additional provisions may be required for cases where interference occurs.

7.2.2. TEST PROCEDURE

- (1). The EUT was placed on the top of an insulating table 0.8 meters above the ground at a semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- (2). The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- (3).The antenna is a broadband antenna, and its height is varied from 1 to 4 meter above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- (4). For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the heights from 1 to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- (5).The test-receiver system was set to Peak Detector Function and Specified Bandwidth with Maximum Hold Mode. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emission that did not have 10dB margin would be retested one by one using the quasi-peak method.

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7.2.3. BLOCK DIAGRAM OF TEST SETUP



For the actual test configuration, please refer to the related item-Photographs of the Test Configuration.

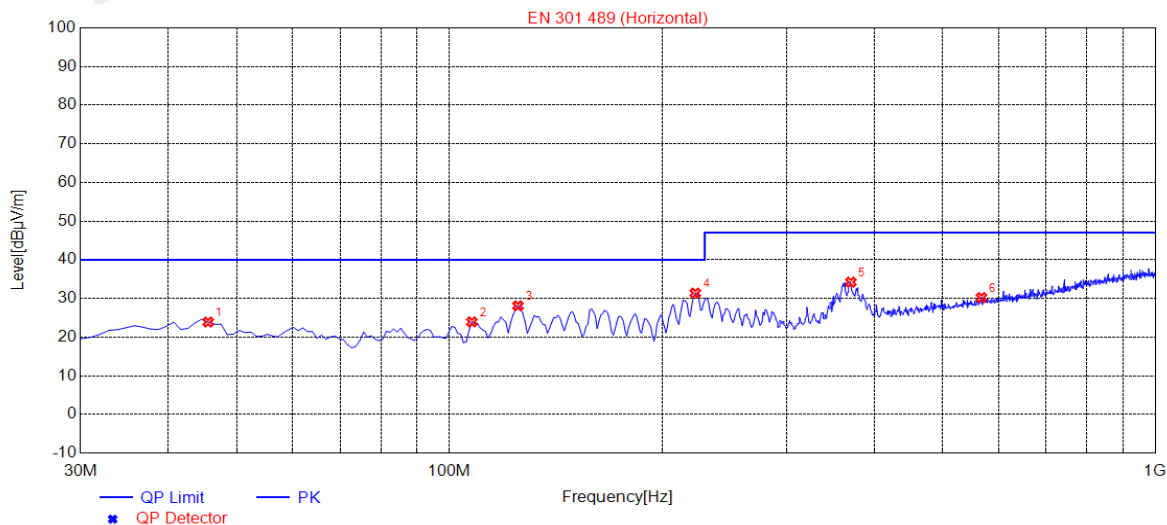
7.2.4 TEST RESULT

The test modes were carried out for all modes.

The worst test mode of the EUT was Mode 1, and its test data was showed as the follow:

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RADIATED EMISSION BELOW 1GHZ- HORIZONTAL

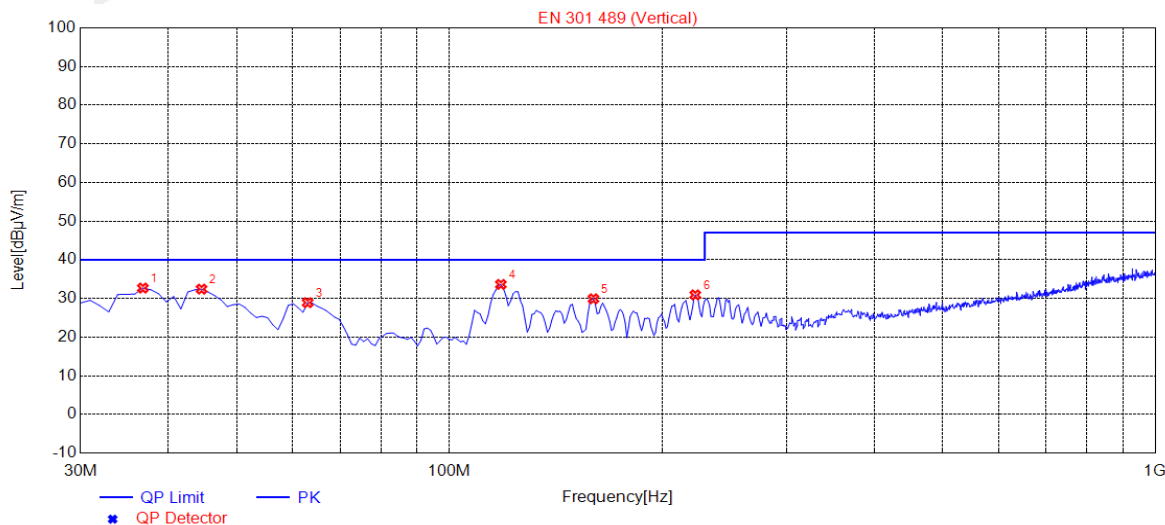


| NO. | Freq. [MHz] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
|-----|-------------|----------------|-------------|----------------|-------------|-------------|-----------|------------|
| 1 | 45.5200 | 23.88 | 14.80 | 40.00 | 16.12 | 100 | 349 | Horizontal |
| 2 | 107.6000 | 23.93 | 12.17 | 40.00 | 16.07 | 200 | 265 | Horizontal |
| 3 | 125.0600 | 28.09 | 13.81 | 40.00 | 11.91 | 200 | 254 | Horizontal |
| 4 | 223.0300 | 31.37 | 13.51 | 40.00 | 8.63 | 150 | 272 | Horizontal |
| 5 | 370.4700 | 34.21 | 18.63 | 47.00 | 12.79 | 100 | 88 | Horizontal |
| 6 | 567.3800 | 30.22 | 23.62 | 47.00 | 16.78 | 200 | 2 | Horizontal |

RESULT: PASS

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RADIATED EMISSION BELOW 1GHZ- VERTICAL



| NO. | Freq. [MHz] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
|-----|-------------|----------------|-------------|----------------|-------------|-------------|-----------|----------|
| 1 | 36.7900 | 32.68 | 14.16 | 40.00 | 7.32 | 100 | 286 | Vertical |
| 2 | 44.5500 | 32.41 | 14.82 | 40.00 | 7.59 | 100 | 86 | Vertical |
| 3 | 62.9800 | 28.90 | 13.42 | 40.00 | 11.10 | 100 | 115 | Vertical |
| 4 | 118.2700 | 33.62 | 13.29 | 40.00 | 6.38 | 100 | 46 | Vertical |
| 5 | 159.9800 | 29.90 | 14.94 | 40.00 | 10.10 | 100 | 155 | Vertical |
| 6 | 223.0300 | 30.91 | 13.51 | 40.00 | 9.09 | 100 | 175 | Vertical |

RESULT: PASS

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7.3. HARMONIC CURRENT MEASUREMENT

7.3.1 LIMITS OF HARMONIC CURRENT

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

Note:

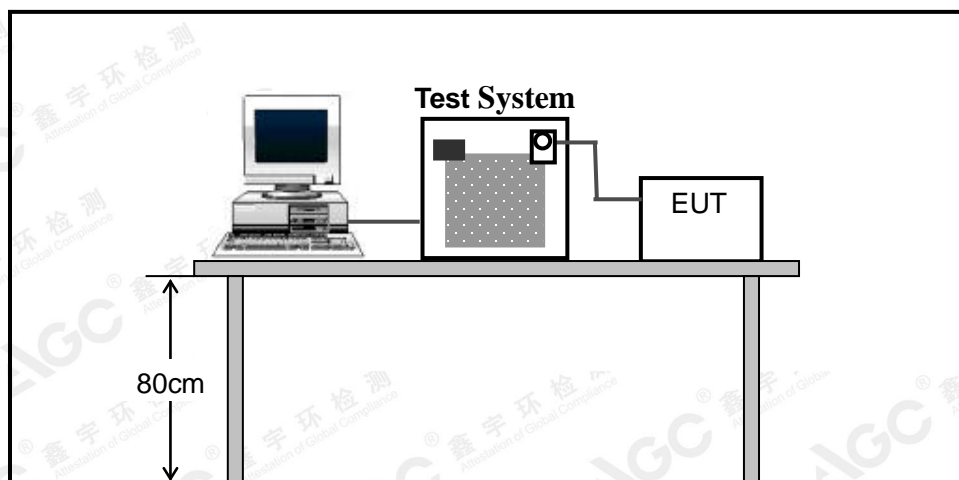
1. According to section 5 of EN61000-3-2: 2014, the EUT is Class A equipment.
2. The above limits are for all applications having an active input power > 75W. No limits apply for equipment with an active input power up to and including 75W.

7.3.2 TEST PROCEDURE

1. The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.
2. 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.

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7.3.3 TEST SETUP



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

7.3.4 TEST RESULT

No limits apply for equipment with an active input power up to and including 75W.

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7.4. VOLTAGE FLUCTUATIONS AND FLICK MEASUREMENT

7.4.1 LIMITS OF VOLTAGE FLUCTUATIONS AND FLICK

| Test Item | Limit | Note |
|---------------|-------|---|
| P_{st} | 1.0 | P_{st} means Short-term flicker indicator |
| P_{lt} | 0.65 | P_{lt} means long-term flicker indicator |
| T_{dt} | 0.5 | T_{dt} means maximum time that d_t exceeds 3% |
| $d_{max}(\%)$ | 4% | d_{max} means maximum relative voltage change. |
| $d_c(\%)$ | 3.3% | d_c means relative steady-state voltage change. |

7.4.2 TEST PROCEDURE

- The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal conditions
- During the flick 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.

7.4.3 TEST SETUP

Same as 3.4.3

7.4.4 TEST RESULT

Test Specification

| | | | |
|----------------|------|--------------|--|
| Test Frequency | 50Hz | Test Voltage | AC 230V |
| Waveform | Sine | Test Time | 10 minutes(P_{st}); 2 hours (P_{lt}) |

Test Result

☒ MODE 1 ☒ MODE 2 ☒ MODE 3

| Test Parameter | Measurement Value | Limit | Remarks |
|----------------|-------------------|-------|---------|
| P_{st} | 0.160 | 1.0 | Pass |
| P_{lt} | 0.070 | 0.65 | Pass |
| $T_{dt(s)}$ | 0.00 | 500.0 | Pass |
| $d_{max}(\%)$ | 0.00 | 4.00 | Pass |
| $d_c(\%)$ | 0.00 | 3.30 | Pass |

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8. IMMUNITY TEST

8.1. EUT SETUP AND OPERATING CONDITIONS

The battery was in full voltage and the charger was connected to the EUT to keep the voltage constant during the tests.

Each immunity test was performed according to the requirements of the standard.

8.2. GENERAL PERFORMANCE CRITERIA

1. Performance criteria for Continuous phenomena applied to Transmitter (CT)

For equipment of type II or type III that requires a communication link that is maintained during the test, it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained during each individual exposure in the test sequence.

Where the EUT is a transmitter, tests shall be repeated with the EUT in standby mode to ensure that any unintentional transmission does not occur.

2. Performance criteria for Transient phenomena applied to Transmitter (TT)

For equipment of type II or type III that requires a communication link that is maintained during the test, this shall be verified by appropriate means supplied by the manufacturer during each individual exposure in the test sequence. Where the EUT is a transmitter, tests shall be repeated with the EUT in standby mode to ensure that any unintentional transmission does not occur.

3. Performance criteria for Continuous phenomena applied to Receiver (CR)

For equipment of type II or III that requires a communication link that is maintained during the test, it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained during each individual exposure in the test sequence. Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

4. Performance criteria for Transient phenomena applied to Receiver (TR)

For equipment of type II or type III that requires a communication link that is maintained during the test, this shall be verified by appropriate means supplied by the manufacturer during each individual exposure in the test sequence. Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

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5. Performance Table

| Performance criteria | | |
|----------------------|--|--|
| Criteria | During Test | After Test |
| A | Shall operate as intended. May show degradation of performance. Shall be no loss of function. Shall be no unintentional transmissions. | Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of stored data or user programmable functions. |
| B | May show loss of function (one or more). May show degradation of performance. No unintentional transmissions. | Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance. Shall be no loss of stored data or user programmable functions. |
| C | May be loss of function (one or more). | Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance. |

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8.3. ELECTROSTATIC DISCHARGE IMMUNITY TEST

8.3.1 TEST SPECIFICATION

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

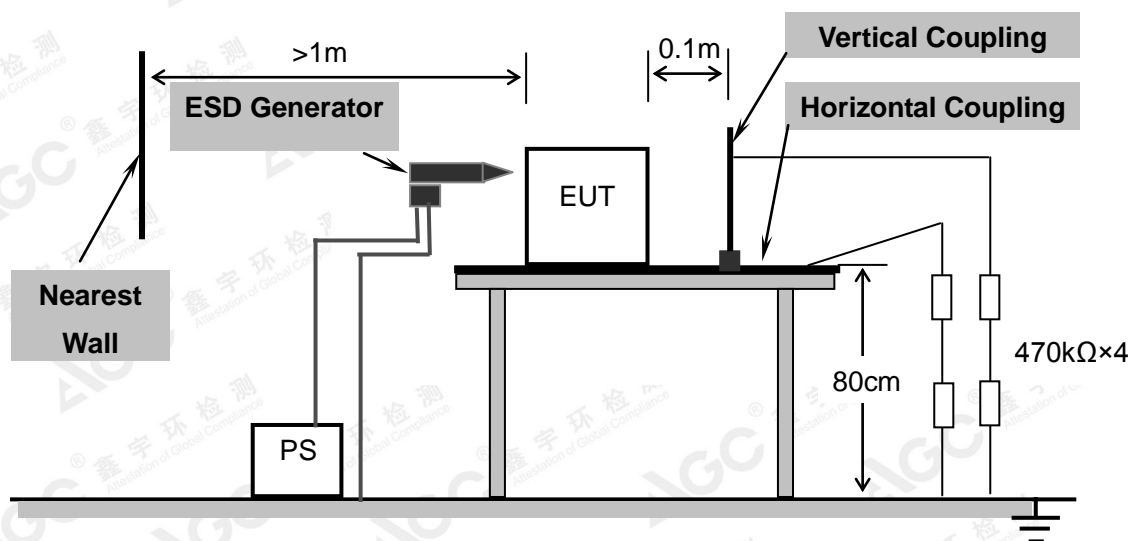
8.3.2 TEST PROCEDURE

The test procedure was in accordance with EN 61000-4-2:

- Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
- The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
- The time interval between two successive single discharges was at least 1 second.
- The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.
- Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were completed.
- At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator was positioned vertically at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.
- At least ten single discharges (in the most sensitive polarity) were 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 0.5m×0.5m) was placed vertically to and 0.1 meters from the EUT.

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8.3.3 TEST SETUP



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

8.3.4 TEST RESULT TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.3.2 and EN 61000-4-2 for the measurement methods.

☒ **MODE 1** ☒ **MODE 2** ☒ **MODE 3**

| Amount of Discharges | Voltage | Coupling | Observation | Result (Criteria meet) |
|----------------------|----------------|------------------------|-------------|---------------------------|
| Mini 20 / Point | ±2kV;±4kV | contact discharge | TR, TT | A |
| Mini 20 / Point | ±2kV;±4kV;±8kV | Air Discharge | TR, TT | A |
| Mini 20 / Point | ±4kV | Indirect Discharge HCP | TR, TT | A |
| Mini 20 / Point | ±4kV | Indirect Discharge VCP | TR, TT | A |

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8.4. RADIATED, RADIO FREQUENCY ELECTROMAGNETIC FIELD IMMUNITY TEST

8.4.1 TEST SPECIFICATION

| | |
|---------------------|-------------------------------------|
| Basic Standard | EN 61000-4-3 |
| Frequency Range | 80 MHz – 6000MHz |
| Field Strength | 3V/m |
| Modulation | 1 kHz sine wave, 80%, AM modulation |
| Frequency Step | 1% of fundamental |
| Polarity of Antenna | Horizontal and Vertical |
| Test Distance | 3m |
| Antenna Height | 1.55m |
| Dwell Time | 3 seconds |

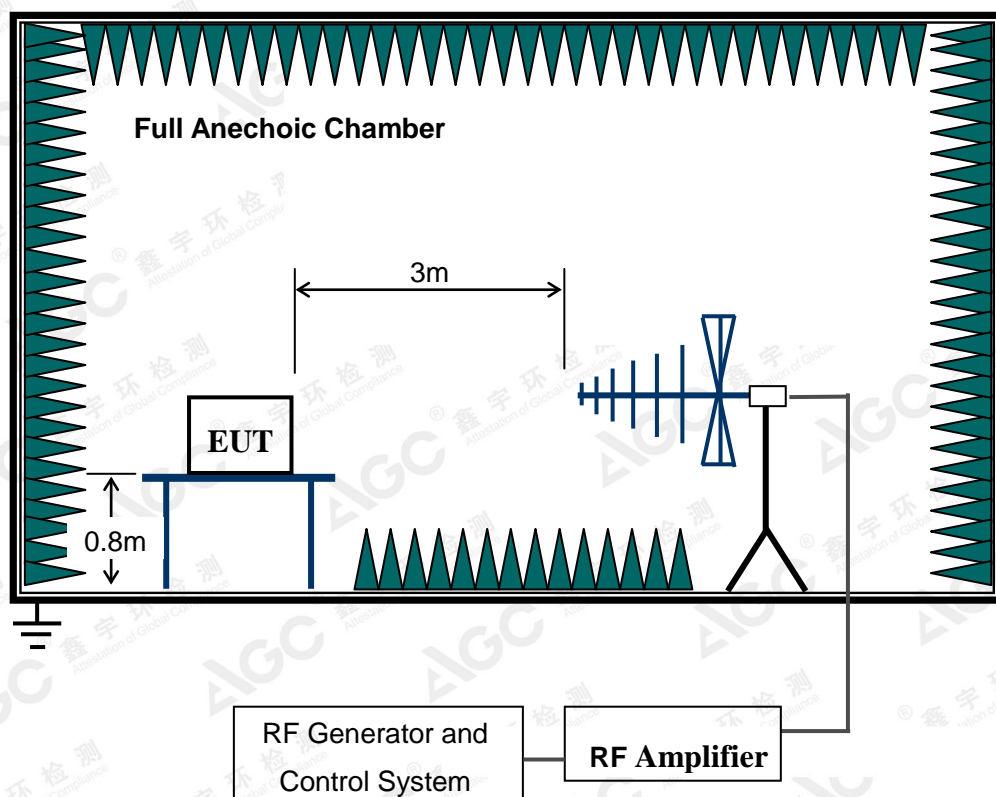
8.4.2 TEST PROCEDURE

The test procedure was in accordance with EN 61000-4-3.

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

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8.4.3 TEST SETUP



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

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8.4.4 TEST RESULT

TEST PROCEDURE

Please refer to ETSI EN 301 489-1 Clause 9.2.2, ETSI EN 301 489-3 and EN 61000-4-3 for the measurement methods.

☒ **MODE 1** ☒ **MODE 2** ☒ **MODE 3**

| Freq. Range (MHz) | Field | Modulation | Polarity | Position | Observation | Result (Criteria meet) |
|-------------------|-------|------------|----------|----------|-------------|------------------------|
| 80-6000 | 3V/m | Yes | H | Front | CR, CT | A |
| 80-6000 | 3V/m | Yes | H | Back | CR, CT | A |
| 80-6000 | 3V/m | Yes | H | Left | CR, CT | A |
| 80-6000 | 3V/m | Yes | H | Right | CR, CT | A |
| 80-6000 | 3V/m | Yes | V | Front | CR, CT | A |
| 80-6000 | 3V/m | Yes | V | Back | CR, CT | A |
| 80-6000 | 3V/m | Yes | V | Left | CR, CT | A |
| 80-6000 | 3V/m | Yes | V | Right | CR, CT | A |

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8.5. ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST

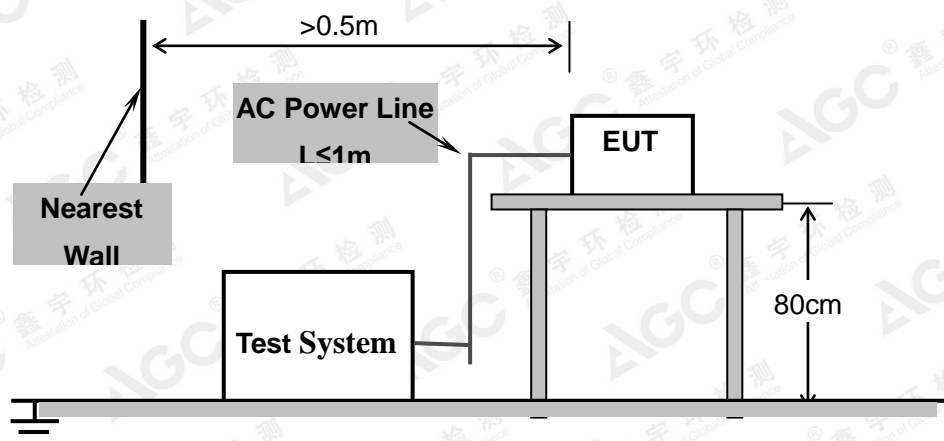
8.5.1 TEST SPECIFICATION

| | |
|--------------------|-----------------------|
| Basic Standard | EN 61000-4-4 |
| Test Voltage | a.c. power port :1 kV |
| Polarity | Positive/Negative |
| Impulse Frequency | 5kHz |
| Impulse wave shape | 5/50ns |
| Burst Duration | 15ms |
| Burst Period | 300ms |
| Test Duration | Not less than 1 min. |

8.5.2 TEST PROCEDURE

- The EUT was tested with 1000 volt discharges to the AC power input leads.
- Both positive and negative polarity discharges were applied.
- The length of the "hot wire" from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1 meter.
- The duration time of each test sequential was 1 minute.
- The transient/burst waveform was in accordance with EN 61000-4-4, 5/50ns.

8.5.3 TEST SETUP



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

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8.5.4 TEST RESULT

☒ **MODE 1** ☒ **MODE 2** ☒ **MODE 3**

| Test Point | Polarity | Test Level (kV) | Observation | Conclusion |
|----------------|----------|-----------------|-------------|------------|
| a.c. port, L | +/- | 1 | TT,TR | A |
| a.c. port, N | +/- | 1 | TT,TR | A |
| a.c. port, L-N | +/- | 1 | TT,TR | A |
| a.c. port, L-N | +/- | 1 | TT,TR | A |

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8.6. SURGE IMMUNITY TEST

8.6.1 TEST SPECIFICATION

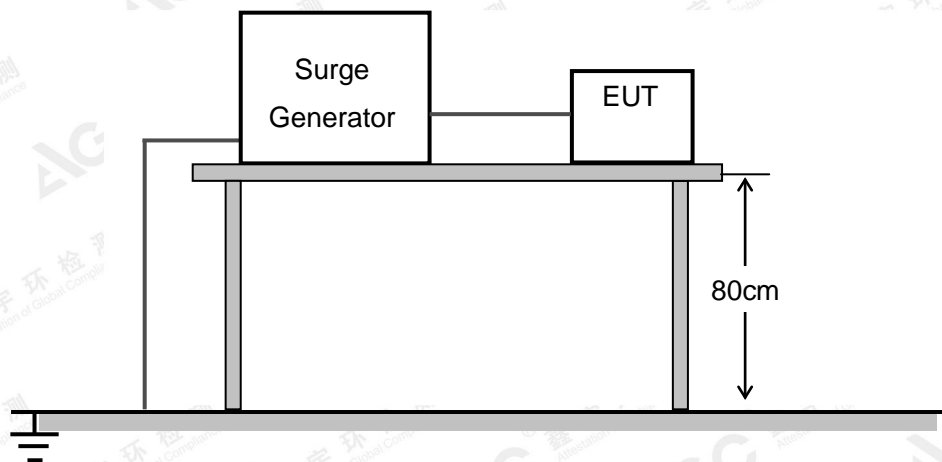
| | |
|-----------------|---|
| Basic Standard | EN 61000-4-5 |
| Waveform | Voltage 1.2/50 μ s; Current 8/20 μ s |
| Test Voltage | a.c. power port, line to ground 2 kV, line to line 1.0 kV |
| Polarity | Positive/Negative |
| Phase Angle | 0°, 90°, 180°, 270° |
| Repetition Rate | 60sec |
| Times | 5 time/each condition. |

8.6.2 TEST PROCEDURE

- The EUT and the auxiliary equipment were placed on a table of 0.8m heights above a metal ground reference plane. The size of ground plane is greater than 1m×1m and project beyond the EUT by at least 0.1m on all sides. The ground plane is connected to the protective earth. The length of power cord between the coupling device and the EUT was less than 2 meters (provided by the manufacturer).
- The EUT was connected to the power mains through a coupling device that directly couples the surge interference signal. The surge noise was applied synchronized to the voltage phase at the zero crossing and the peak value of the AC voltage wave (positive and negative).
- The surges were applied line to line and line(s) to earth. When testing line to earth the test voltage was applied successively between each of the lines and earth. Steps up to the test level specified increased the test voltage. All lower levels including the selected test level were tested. The polarity of each surge level included positive and negative test pulses.

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8.6.3 TEST SETUP



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

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8.6.4 TEST RESULT

☒ **MODE 1** ☒ **MODE 2** ☒ **MODE 3**

| Coupling Line | Polarity | Voltage (kV) | Observation | Conclusion |
|-----------------|----------|--------------|-------------|------------|
| a.c. power, L-N | +/- | 1.0 | TT,TR | A |

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8.7. IMMUNITY TO CONDUCTED DISTURBANCES INDUCED BY RF FIELDS

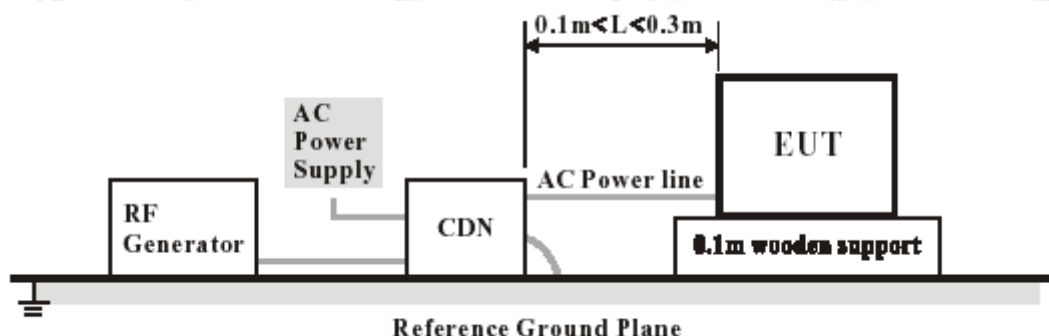
8.7.1 TEST SPECIFICATION

| | |
|-----------------|-------------------------|
| Basic Standard | EN 61000-4-6 |
| Frequency Range | 0.15 MHz – 80 MHz |
| Field Strength | 3Vrms |
| Modulation | 1 kHz Sine Wave, 80% AM |
| Frequency Step | 1% of fundamental |
| Coupled Cable | a.c. power line |
| Coupling Device | CDN-M2 |

8.7.2 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 50-ohm load resistor.
- The test signal was 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.

8.7.3 TEST SETUP



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

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8.7.4 TEST RESULT

☒ **MODE 1** ☒ **MODE 2** ☒ **MODE 3**

| Test Point | Frequency (MHz) | Field Strength (Vrms) | Observation | Conclusion |
|------------|-----------------|-----------------------|-------------|------------|
| a.c. port | 0.15 – 80 | 3 | CT,CR | A |

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8.8. VOLTAGE DIPS AND SHORT INTERRUPTIONS IMMUNITY TEST

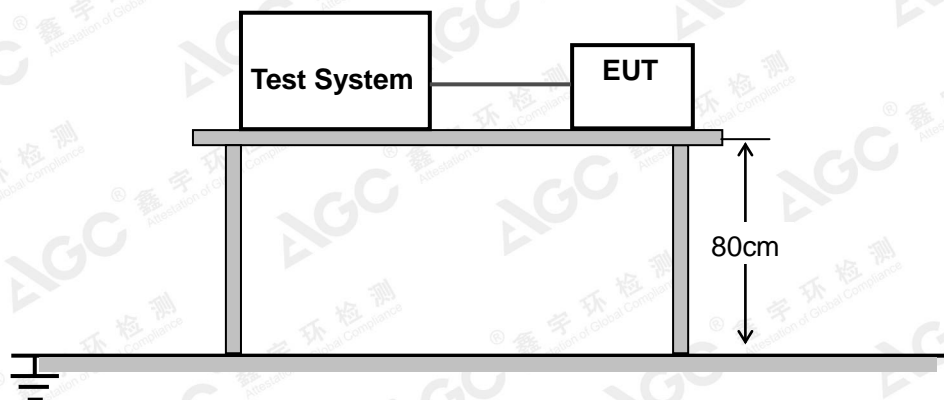
8.8.1 TEST SPECIFICATION

| | |
|------------------------------|--|
| Basic Standard | EN 61000-4-11 |
| Voltage Dips | 100% reduction, 0.5 Cycle 100% reduction, 1.0 Cycle 30% reduction, 25 Cycles |
| Voltage Interruptions | 100% reduction, 250 Cycles |
| Voltage Phase Angle | 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° |

8.8.2 TEST PROCEDURE

- The power cord was used as supplied by the manufacturer. The EUT was connected to the line output of the Voltage Dips and Interruption Generator.
- The EUT was tested for (1) 100% voltage dip of supplied voltage with duration of 0.5 cycles, (2) 100% voltage dip of supplied voltage and duration 1.0 cycle. (3) 30% voltage dip of supplied voltage and duration 25 cycles. (4) 100% voltage interruption of supplied voltage with duration of 250 Cycles was followed,
- Voltage reductions occur at 0 degree crossover point of the voltage waveform. The performance of the EUT was checked after the voltage dip or interruption.

8.8.3 TEST SETUP



For the actual test configuration, please refer to Appendix II: Photographs of the Test Configuration.

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8.8.4 TEST RESULT

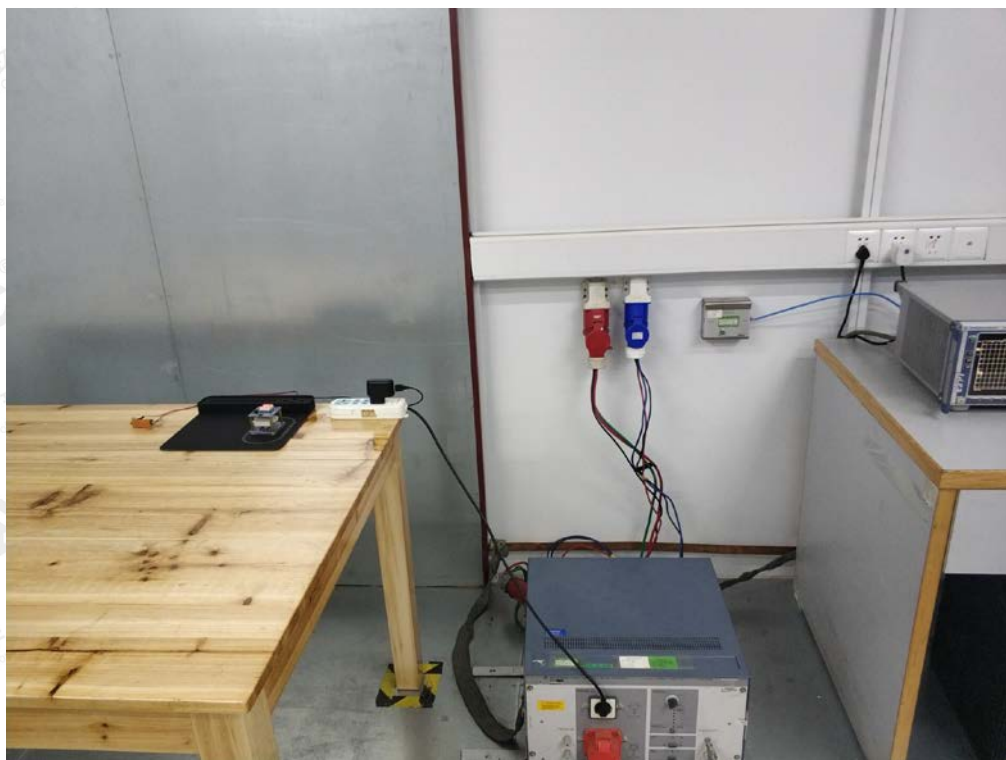
☒ **MODE 1** ☒ **MODE 2** ☒ **MODE 3**

| Test Mode | Voltage Reduction | Duration (cycle) | Times | Interval (Sec) | Observation | Conclusion |
|-----------------------|-------------------|------------------|-------|----------------|-------------|------------|
| Voltage dips | 100% | 0.5 | 3 | 10 | TT,TR | A |
| | 100% | 1 | 3 | 10 | TT,TR | A |
| | 30% | 25 | 3 | 10 | TT,TR | A |
| Voltage interruptions | 100% | 250 | 3 | 10 | TT,TR | A |

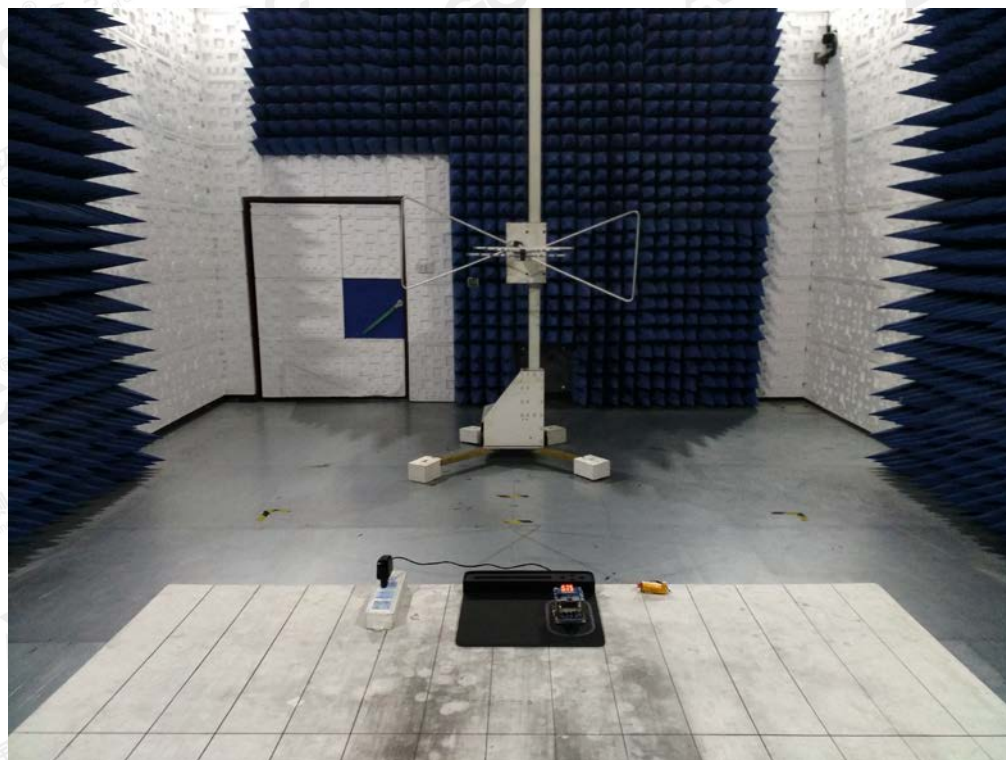
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APPENDIX A: PHOTOGRAPHS OF TEST SETUP

LINE CONDUCTED EMISSION TEST SETUP



RADIATED EMISSION TEST SETUP



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EN 61000-4-2 ESD TEST SETUP

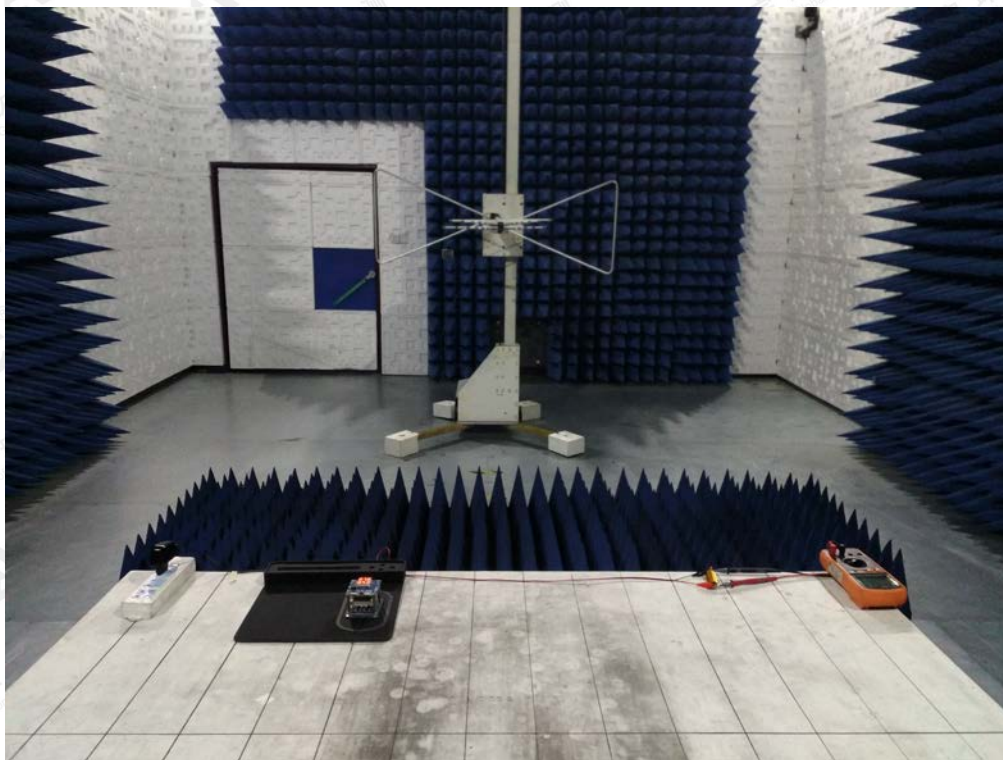


EN61000-3-3 VOLTAGE FLUCTUATION / FLICKER TEST SETUP

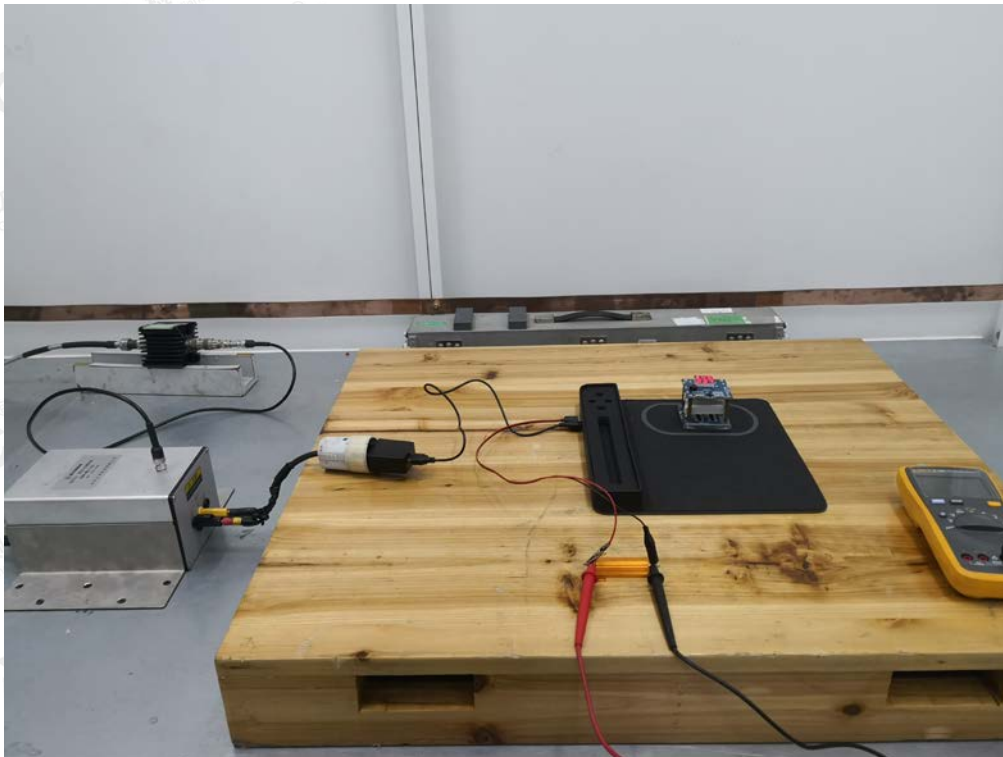


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EN 61000-4-3 RS TEST SETUP

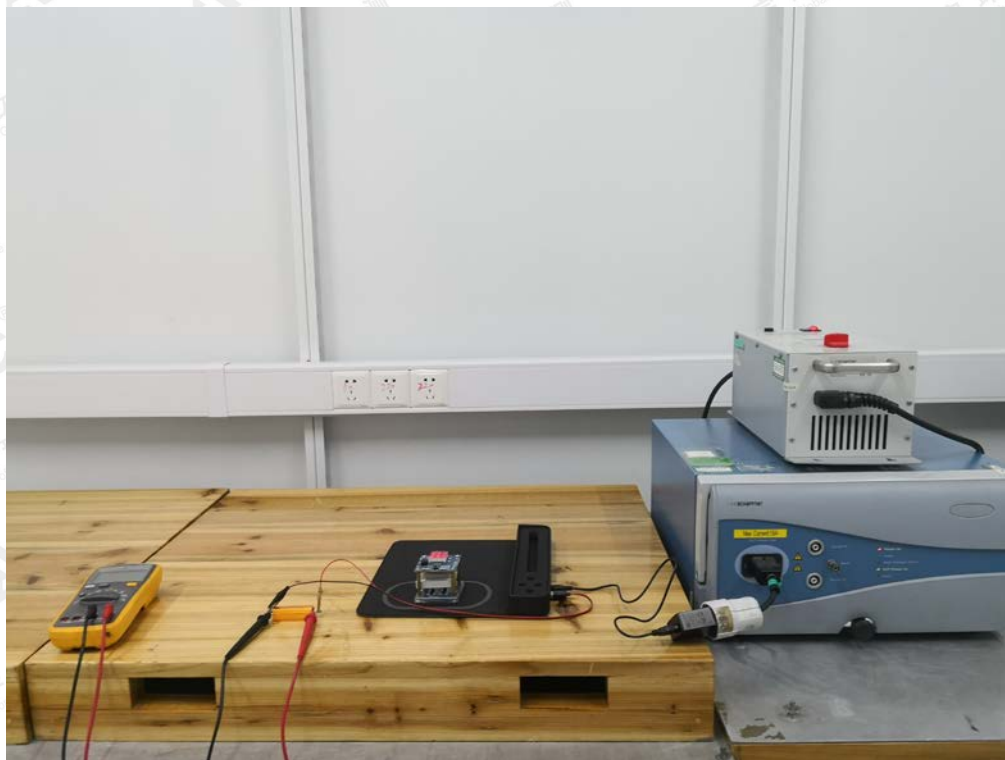


EN 61000-4-6 CS IMMUNITY TEST SETUP



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EN 61000-4-4/-5/-11 EFT/SURGE/DIPS TEST SETUP



----END OF REPORT----

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