



TEST REPORT

Product Name: LoRa Module

Trademark:   安信可科技
AI-Thinker

Model Number: Ra-01SC-P

Prepared For: Shenzhen Ai-Thinker Technology Co., Ltd

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Manufacturer: Shenzhen Ai-Thinker Technology Co., Ltd

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Sample Received Date: Oct. 29, 2024

Sample tested Date: Oct. 29, 2024 to Nov. 15, 2024

Issue Date: Nov. 15, 2024

Report No.: CTB24102904805RE02

Test Standards: ETSI EN 301 489-1 V2.2.3 (2019-11)
ETSI EN 301 489-3 V2.3.2 (2023-01)

Test Results: PASS

Remark: This is EMC test report.

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Note: If there is any objection to the inspection results in this report, please submit a written report to the company within 15 days from the date of receiving the report. The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client. "*" indicates the testing items were fulfilled by subcontracted lab. "#" indicates the items are not in CNAS accreditation scope.

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(NOTE: N/A MEANS NOT APPLICABLE)



1. VERSION

| Report No. | Issue Date | Description | Approved |
|--------------------|---------------|-------------|----------|
| CTB24102904805RE02 | Nov. 15, 2024 | Original | Valid |

2. TEST SUMMARY

The Product has been tested according to the following specifications:

| EMISSION | | |
|--------------|---|------------------|
| Standard | Test Item | Test result |
| EN 55032 | Conducted emissions from the AC mains power ports | Pass |
| EN 55032 | Asymmetric mode conducted emissions | N/A ¹ |
| EN 55032 | Conducted differential voltage emissions | N/A ² |
| EN 55032 | Radiated emissions | Pass |
| EN 61000-3-2 | Harmonic current emission(H) | N/A ³ |
| EN 61000-3-3 | Voltage fluctuations & flicker(F) | N/A ⁴ |

| IMMUNITY | | |
|----------------|--|------------------|
| Standard | Test Item | Test result |
| IEC 61000-4-2 | Electrostatic discharge (ESD) | Pass |
| IEC 61000-4-3 | Continuous RF electromagnetic field disturbances(RS) | Pass |
| IEC 61000-4-4 | Electrical fast transients/burst (EFT) | N/A ⁴ |
| IEC 61000-4-5 | Surges | N/A ⁴ |
| IEC 61000-4-6 | Radio frequency, common mode | N/A ⁴ |
| IEC 61000-4-11 | Voltage dips and interruptions (DIPS) | N/A ⁴ |

Remark:

1. Applicable to ports listed above and intended to connect to cables longer than 3 m.
2. The Product has no antenna port.
3. The Product belongs to Class A, and its power is less than 75W, so it deems to fulfil this standard without testing.
4. The EUT is powered by the DC battery, the test item is not applicable.

3. MEASUREMENT UNCERTAINTY

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

| Test item | Value (dB) |
|-----------------------------------|------------|
| Conducted Emission (150KHz-30MHz) | 3.2 |
| Radiated Emission(30MHz ~1000MHz) | 4.8 |
| Radiated Emission(1GHz ~6GHz) | 4.9 |

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

| | |
|-----------------------|--------------------------|
| Model(s): | Ra-01SC-P |
| Model Description: | N/A |
| SRD: | 433.050MHz-434.790MHz |
| Receiver Category: | 2 |
| Hardware Version: | V1.0 |
| Software Version: | V1.0 |
| Max. RF output power: | 9.180dBm |
| Type of Modulation: | FSK |
| Antenna installation: | Internal antenna |
| Ratings: | DC 3.3V powering from PC |

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Note |
|------|-----------|-----------|----------------|------------|------|
| 1. | Laptop | DELL | Vostro 5490 | N/A | AE |

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Test Mode

| Test Mode | Description | Remark |
|-----------|-------------|--------------------------------|
| Mode 1 | SRD | TR, CR, TT, CT for EMS testing |

NOTE: 1 The test modes were carried out for all operation modes. The final test mode of the EUT was the worst test mode for EMI, and its test data was showed.

2 "Link" is the connect horn alarm mode.

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at 1&2F., Building A, No. 26, Xinhe Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

| Continuous disturbance | | | | | | |
|------------------------|------------------------|---------------|--------------|------------|----------------------|------------------|
| No. | Equipment | Manufacturer | Model No. | Serial No. | Firmware version | Calibrated until |
| 1 | 843 Shield Room | C/ R/ T | 843 | / | / | 2027/6/21 |
| 2 | AMN | ROHDE&SCHWARZ | ESH3-Z5 | 831551852 | / | 2025/6/30 |
| 3 | Pulse limiter | ROHDE&SCHWARZ | ESH3Z2 | 357881052 | / | 2025/6/28 |
| 4 | EMI TEST RECEIVER | ROHDE&SCHWARZ | ESCI | 100428 | V4.42.SP3 | 2025/6/30 |
| 5 | Coaxial cable | ZDECL | Z302S | 18091904 | / | 2025/6/30 |
| 6 | ISN | Schwarzbeck | NTFM8158 | 183 | / | 2025/6/30 |
| 7 | Voltage sensor | Schwarzbeck | TK 9420 | 01189 | / | 2024/11/16 |
| 8 | EZ-EMC | Frad | EMC-con3A1.1 | / | / | / |
| 9 | Current Probe | FCC | F-52B | 199453 | / | 2025/5/27 |
| 10 | Communication test set | R&S | CMW500 | 108058 | B.19.07 (E1962B) | 2025/6/28 |
| 11 | Communication test set | Agilent | E5515C | MY50102567 | V3.5.80 | 2025/6/28 |

| Radiated emission(No.2 Chamber) | | | | | | |
|---------------------------------|--------------------------------------|--------------|-------------|------------|------------------|------------------|
| No. | Equipment | Manufacturer | Model No. | Serial No. | Firmware version | Calibrated until |
| 1 | 966 Chamber | C/ R/ T | 966 | / | / | 2026/11/14 |
| 2 | Double Ridged Broadband Horn Antenna | Schwarzbeck | BBHA 9120 D | 01911 | / | 2026/7/07 |
| 3 | Broadband Antenna | Schwarzbeck | VULB 9168 | 1471 | / | 2025/7/06 |
| 4 | Amplifier | Agilent | 8449B | 3008A01838 | / | 2025/6/30 |
| 5 | Preamplifier | Schwarzbeck | BBV 9743 B | 00500 | / | 2025/5/23 |
| 6 | EMI TEST RECEIVER | R&S | ESCI7 | 100861 | / | 2024/11/27 |
| 7 | Spectrum Analyzer | KEYSIGHT | N9020A | MY51289897 | A.14.16 | 2025/6/28 |
| 8 | EMI test software | Farad | EZ-EMC | / | Ver. FARAD-3A1+ | / |
| 9 | Coaxial cable | Rosenberg | 8m | / | / | 2024/11/27 |

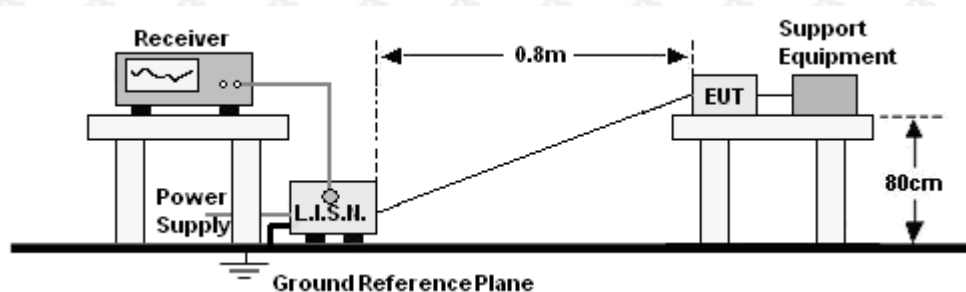
| | | | | | | |
|----|------------------------|-------------|------------|------------|---------------------|------------|
| 10 | Coaxial cable | Times | 2m | / | / | 2024/11/27 |
| 11 | Coaxial cable | Times | 2m | / | / | 2024/11/27 |
| 12 | Coaxial cable | Times | 1m | / | / | 2024/11/27 |
| 13 | loop antenna | Schwarzbeck | FMZB 1519B | 1519B-224 | / | 2025/6/29 |
| 14 | Communication test set | R&S | CMW500 | 108058 | B.19.07 (E1962B) | 2025/6/28 |
| 15 | Communication test set | Agilent | E5515C | MY50102567 | V3.5.80 | 2025/6/28 |

| Electrostatic discharges | | | | | | |
|--------------------------|------------------------|--------------|-----------|------------|----------------------|------------------|
| No. | Equipment | Manufacturer | Model No. | Serial No. | Firmware Version | Calibrated until |
| 1 | ESD Simulator | TESTQ | NSG437 | 329 | V01.00 | 2025/6/29 |
| 2 | Communication test set | R&S | CMW500 | 108058 | Version 2.0 | 2025/6/28 |
| 3 | Communication test set | Agilent | E5515C | MY50102567 | B.19.07 (E1962B) | 2025/6/28 |

| Radio frequency electromagnetic field | | | | | | |
|---------------------------------------|----------------------------------|--------------|-----------------|-------------|----------------------|------------------|
| No. | Equipment | Manufacturer | Type No. | Serial No. | Firmware Version | Calibrated until |
| 1 | 966 Chamber | C/ R/ T | 966 | / | / | 2027/6/21 |
| 2 | Signal Generator | Agilent | N5181A | MY49060920 | A.01.60 | 2025/6/28 |
| 3 | Stacked Double Log.-Per. Antenna | SKET | STLP 9129 Plus | 2106070106 | / | / |
| 4 | Switch Controller | SKET | RFSU-DC18G-4C | 2106070105 | / | / |
| 5 | RF Power Meter | Agilent | E9304A | MY41490462 | / | 2025/6/28 |
| 6 | RF Power Meter | Agilent | E9301A | MY41495675 | / | 2025/6/28 |
| 7 | E-Field Probe | Narda | EP-601 | 811ZX10305 | / | 2025/7/06 |
| 8 | Power Amplifier | SKET | HAP-80M01G-250W | 2106070103 | / | 2025/6/28 |
| 9 | Power Amplifier | SKET | HAP-01G 06G-75W | 2106070104 | / | 2025/6/28 |
| 10 | Audio Analysis | R&S | ATS-1 | ATS 1-41152 | / | 2025/7/01 |
| 11 | Audio Output Matching Network | SKET | RCO Network | / | / | 2025/7/01 |
| 12 | RS test software | SKET | V2.0.0.19 | / | / | / |
| 13 | 966 Chamber | C/ R/ T | 966 | / | / | 2026/11/14 |
| 14 | Communication test set | R&S | CMW500 | 108058 | Version 2.0 | 2025/6/28 |
| 15 | Communication test set | Agilent | E5515C | MY50102567 | B.19.07 (E1962B) | 2025/6/28 |

6. CONDUCTED EMISSIONS

6.1 Block Diagram Of Test Setup



6.2 Limit

Limits for Conducted emissions at the mains ports of Class B MME

| Frequency range (MHz) | Limits dB(μV) | |
|--------------------------|------------------|-----------|
| | Quasi-peak | Average |
| 0,15 to 0,50 | 66 to 56* | 56 to 46* |
| 0,50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

Notes: 1. *Decreasing linearly with logarithm of frequency.

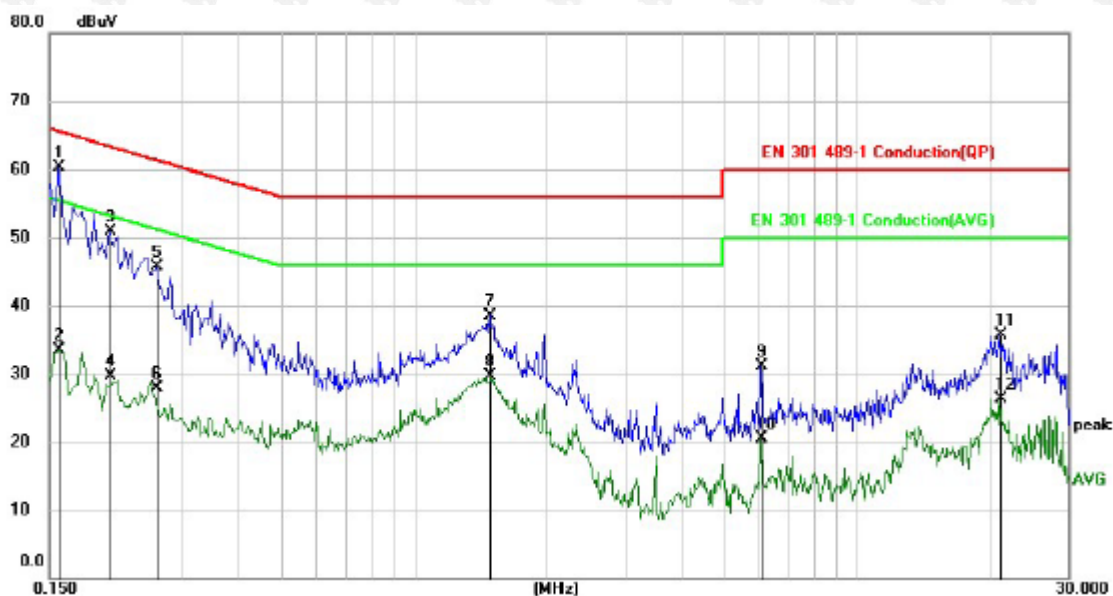
2. The lower limit shall apply at the transition frequencies.

6.3 Test procedure

- The Product was placed on a nonconductive table 0.8m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).
- The RBW of the receiver was set at 9 kHz in 150 kHz ~30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.
- For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

6.4 Test Result

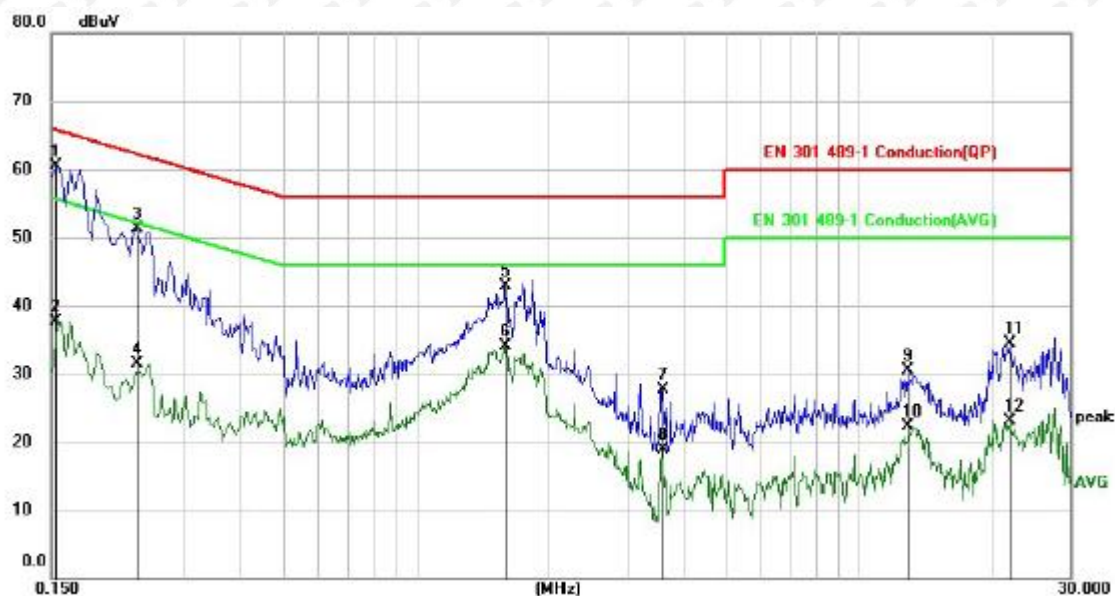
| | | | |
|--------------|-------------------|--------------------|-----|
| Temperature: | 23℃ | Relative Humidity: | 54% |
| Pressure: | 101kPa | Phase : | L |
| Test Mode | 1(the worst data) | Remark: | N/A |



| No. | Mk. | Freq. MHz | Reading Level dBuV | Correct Factor dB | Measure- ment dBuV | Limit dBuV | Over dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1 | * | 0.1580 | 49.37 | 10.86 | 60.23 | 65.57 | -5.34 | QP |
| 2 | | 0.1580 | 22.59 | 10.86 | 33.45 | 55.57 | -22.12 | AVG |
| 3 | | 0.2060 | 40.21 | 10.71 | 50.92 | 63.37 | -12.45 | QP |
| 4 | | 0.2060 | 19.07 | 10.71 | 29.78 | 53.37 | -23.59 | AVG |
| 5 | | 0.2620 | 35.02 | 10.67 | 45.69 | 61.37 | -15.68 | QP |
| 6 | | 0.2620 | 17.27 | 10.67 | 27.94 | 51.37 | -23.43 | AVG |
| 7 | | 1.4819 | 27.35 | 11.25 | 38.60 | 56.00 | -17.40 | QP |
| 8 | | 1.4819 | 18.47 | 11.25 | 29.72 | 46.00 | -16.28 | AVG |
| 9 | | 6.0700 | 18.59 | 12.61 | 31.20 | 60.00 | -28.80 | QP |
| 10 | | 6.0700 | 7.90 | 12.61 | 20.51 | 50.00 | -29.49 | AVG |
| 11 | | 21.0540 | 22.09 | 13.68 | 35.77 | 60.00 | -24.23 | QP |
| 12 | | 21.0540 | 12.65 | 13.68 | 26.33 | 50.00 | -23.67 | AVG |

Remark: Result=Reading +Factor
Over Limit=Result -Limit

| | | | |
|--------------|-------------------|--------------------|-----|
| Temperature: | 23 °C | Relative Humidity: | 54% |
| Pressure: | 101kPa | Phase : | N |
| Test Mode | 1(the worst data) | Remark: | N/A |



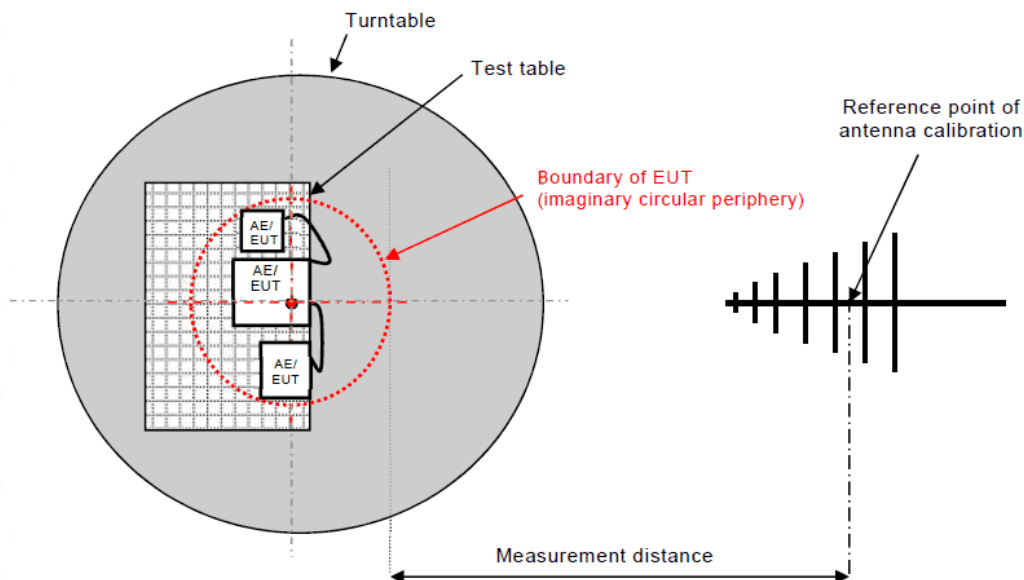
| No. | Mk. | Freq. MHz | Reading Level dBuV | Correct Factor dB | Measure- ment dBuV | Limit dBuV | Over dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1 | * | 0.1539 | 49.62 | 10.88 | 60.50 | 65.79 | -5.29 | QP |
| 2 | | 0.1539 | 26.81 | 10.88 | 37.69 | 55.79 | -18.10 | AVG |
| 3 | | 0.2340 | 40.59 | 10.69 | 51.28 | 62.31 | -11.03 | QP |
| 4 | | 0.2340 | 20.76 | 10.69 | 31.45 | 52.31 | -20.86 | AVG |
| 5 | | 1.5859 | 31.50 | 11.32 | 42.82 | 56.00 | -13.18 | QP |
| 6 | | 1.5859 | 22.74 | 11.32 | 34.06 | 46.00 | -11.94 | AVG |
| 7 | | 3.5860 | 15.82 | 11.93 | 27.75 | 56.00 | -28.25 | QP |
| 8 | | 3.5860 | 6.90 | 11.93 | 18.83 | 46.00 | -27.17 | AVG |
| 9 | | 12.8979 | 17.12 | 13.30 | 30.42 | 60.00 | -29.58 | QP |
| 10 | | 12.8979 | 9.01 | 13.30 | 22.31 | 50.00 | -27.69 | AVG |
| 11 | | 21.8740 | 20.75 | 13.75 | 34.50 | 60.00 | -25.50 | QP |
| 12 | | 21.8740 | 9.45 | 13.75 | 23.20 | 50.00 | -26.80 | AVG |

Remark: Result=Reading +Factor
Over Limit=Result -Limit

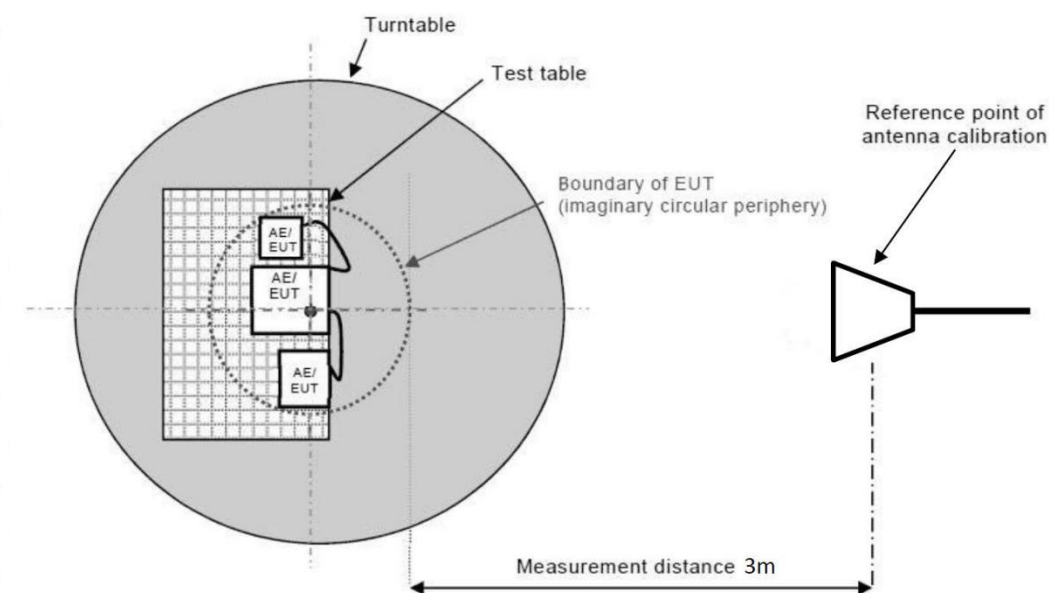
7. RADIATEDEMISSIONS TEST

7.1 Block Diagram Of Test Setup

30MHz ~ 1GHz:



Above 1GHz:



7.2 Limits

Limits for radiated disturbance of Class B MME

| Frequency (MHz) | Quasi-peak limits at 3m dB(μ V/m) |
|-----------------|---|
| 30-230 | 40 |
| 230-1000 | 47 |

| Frequency (GHz) | limit above 1G at 3m dB(μ V/m) | |
|-----------------|--|------|
| | Average | peak |
| 1-3 | 50 | 70 |
| 3-6 | 54 | 74 |

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

7.3 Test Procedure

30MHz ~ 1GHz:

- The Product was placed on the nonconductive turntable 0.8m above the ground in a semi anechoic chamber.
- Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
- For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.

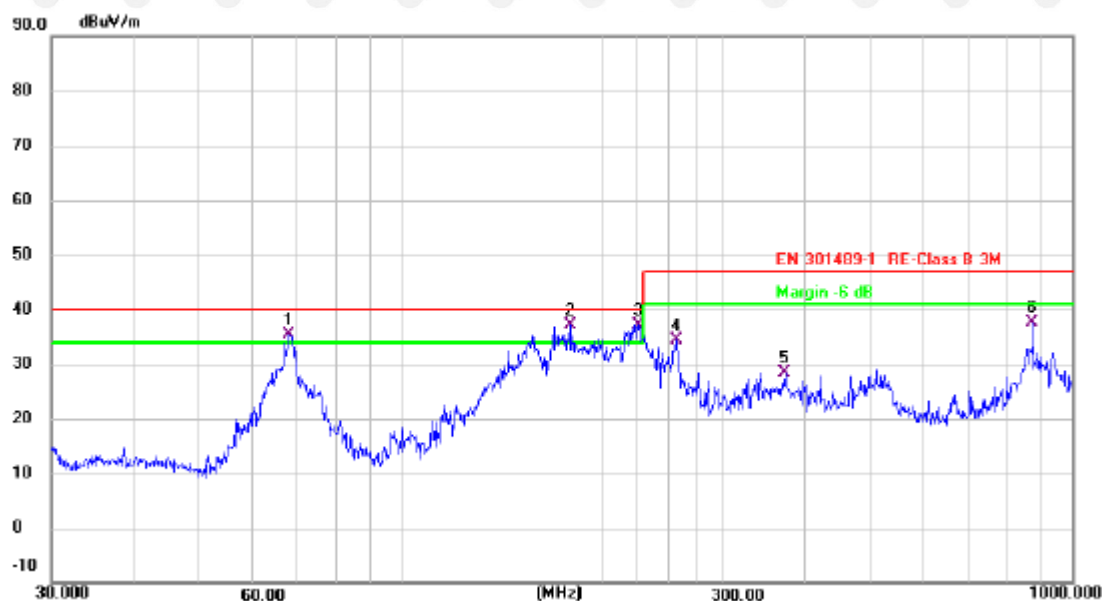
Above 1GHz:

- The Product was placed on the non-conductive turntable 0.8m above the ground in a full anechoic chamber..
- Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
- For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

7.4 Test Results

Below 1GHz

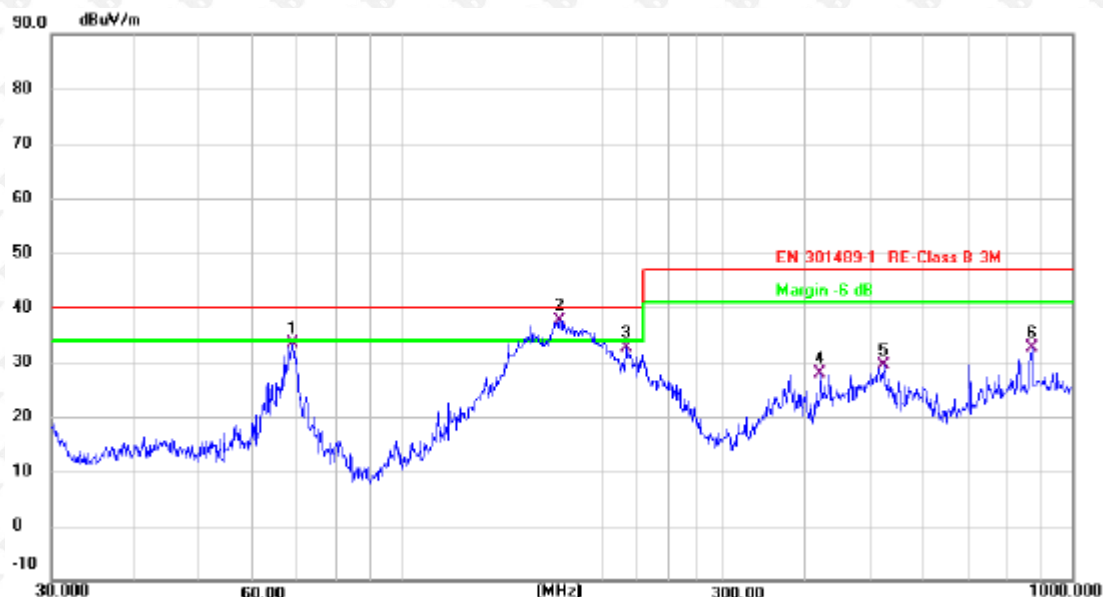
| | | | |
|--------------|-------------------|--------------------|------------|
| Temperature: | 23 °C | Relative Humidity: | 54% |
| Pressure: | 101kPa | Polarization : | Horizontal |
| Test Mode | 1(the worst data) | Remark: | N/A |



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|
| 1 ! | 67.9128 | 52.58 | -17.15 | 35.43 | 40.00 | -4.57 | QP |
| 2 ! | 178.1326 | 52.72 | -15.61 | 37.11 | 40.00 | -2.89 | QP |
| 3 * | 225.3080 | 53.95 | -16.72 | 37.23 | 40.00 | -2.77 | QP |
| 4 | 256.5210 | 50.48 | -16.07 | 34.41 | 47.00 | -12.59 | QP |
| 5 | 373.3110 | 41.09 | -12.78 | 28.31 | 47.00 | -18.69 | QP |
| 6 | 872.1832 | 38.71 | -0.99 | 37.72 | 47.00 | -9.28 | QP |

Remark: Result=Reading +Factor
Over Limit=Result -Limit

| | | | |
|--------------|-------------------|--------------------|----------|
| Temperature: | 23 °C | Relative Humidity: | 54% |
| Pressure: | 101kPa | Polarization : | Vertical |
| Test Mode | 1(the worst data) | Remark: | N/A |



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|
| 1 | 68.8721 | 50.86 | -17.46 | 33.40 | 40.00 | -6.60 | QP |
| 2 * | 171.9945 | 52.37 | -14.67 | 37.70 | 40.00 | -2.30 | QP |
| 3 | 216.0240 | 49.50 | -16.84 | 32.66 | 40.00 | -7.34 | QP |
| 4 | 420.5803 | 39.61 | -11.77 | 27.84 | 47.00 | -19.16 | QP |
| 5 | 522.7180 | 37.92 | -8.63 | 29.29 | 47.00 | -17.71 | QP |
| 6 | 869.1301 | 33.63 | -1.05 | 32.58 | 47.00 | -14.42 | QP |

Remark: Result=Reading +Factor
Over Limit=Result -Limit

Above 1GHz

| | | | |
|--------------|-------------------|--------------------|------------|
| Temperature: | 23 °C | Relative Humidity: | 54% |
| Pressure: | 101kPa | Polarization : | Horizontal |
| Test Mode | 1(the worst data) | Remark: | N/A |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|------|
| 1 | 1966.46 | 46.40 | 1.51 | 47.91 | 70.00 | -22.09 | peak |
| 2 | 1967.74 | 27.88 | 1.51 | 29.39 | 50.00 | -20.61 | AVG |
| 3 | 3773.28 | 42.96 | 5.73 | 48.69 | 74.00 | -25.31 | peak |
| 4 | 3772.50 | 26.19 | 5.73 | 31.93 | 54.00 | -22.07 | AVG |
| 5 | 4842.67 | 41.58 | 9.56 | 51.14 | 74.00 | -22.86 | peak |
| 6 | 4841.79 | 24.88 | 9.56 | 34.44 | 54.00 | -19.56 | AVG |

Remark: Result=Reading +Factor
Over Limit=Result -Limit

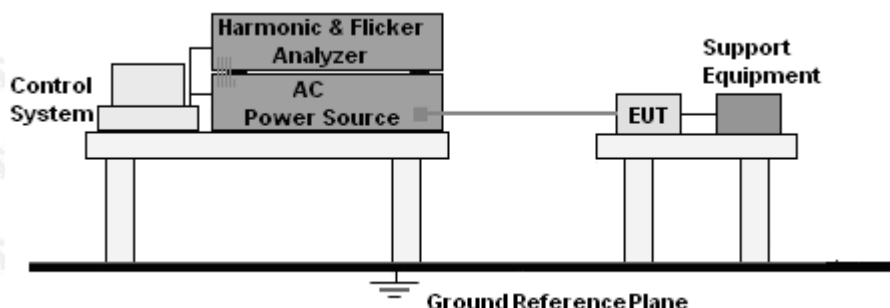
| | | | |
|--------------|-------------------|--------------------|----------|
| Temperature: | 23 °C | Relative Humidity: | 54% |
| Pressure: | 101kPa | Polarization : | Vertical |
| Test Mode | 1(the worst data) | Remark: | N/A |

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Det. |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|------|
| 1 | 1997.34 | 46.34 | 1.48 | 47.83 | 70.00 | -22.17 | peak |
| 2 | 1995.05 | 29.57 | 1.48 | 31.06 | 50.00 | -18.94 | AVG |
| 3 | 3810.59 | 46.59 | 5.91 | 52.50 | 74.00 | -21.50 | peak |
| 4 | 3808.23 | 28.76 | 5.91 | 34.67 | 54.00 | -19.33 | AVG |
| 5 | 4773.00 | 44.52 | 9.35 | 53.86 | 74.00 | -20.14 | peak |
| 6 | 4775.00 | 27.78 | 9.35 | 37.13 | 54.00 | -16.87 | AVG |

Remark: Result=Reading +Factor
Over Limit=Result -Limit

8. HARMONIC CURRENT EMISSION(H)

8.1 Block Diagram of Test Setup



8.2 Limit

EN IEC 61000-3-2:2019 Clause 7.

8.3 Test Procedure

- The Product was placed on the top of a non-conductive table 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 Product was chosen. The measure time shall be not less than the time necessary for the Product to be exercised.

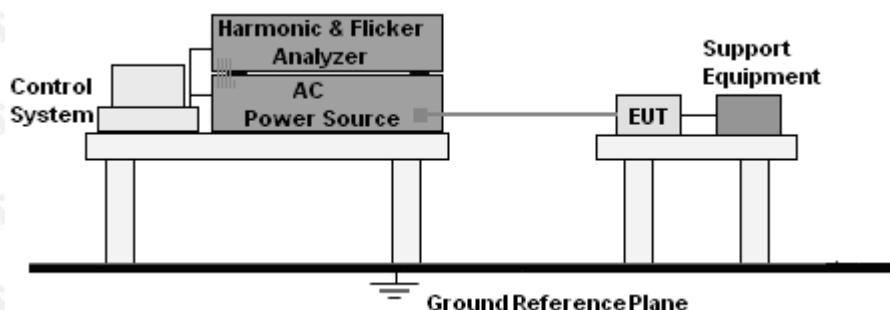
8.4 Test Results

| | | | |
|--------------|--------|--------------------|-------------------|
| Temperature: | 23 °C | Relative Humidity: | 54% |
| Pressure: | 101kPa | Test Mode | 1(the worst data) |
| Remark: | N/A | Test results | N/A |

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

9. VOLTAGE FLUCTUATIONS & FLICKER(F)

9.1 Block Diagram of Test Setup



9.2 Limit

EN 61000-3-3:2013/A1:2019 Clause 5.

9.3 Test Procedure

- The Product was placed on the top of a non-conductive table above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.
- During the flick test, the measure time shall include that part of whole operation cycle in which the Product produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

9.4 Test Results

| | | | |
|--------------|--------|--------------------|-------------------|
| Temperature: | 23 °C | Relative Humidity: | 54% |
| Pressure: | 101kPa | Test Mode | 1(the worst data) |
| Remark: | N/A | Test results | N/A |

Remark: Due to the maximum r.m.s input current (including inrush current) does not exceed 20A, and the supply current after inrush in within a variation band of 1.5A, it's not applicable to test the manual switching. Since the EUT is working in steady state with very low supply current, it will not cause any fluctuations and flicker on the supply system. Considering this, no flicker and voltage fluctuation test had been performed on the EUT, and the EUT can be deemed to comply with the standard accordingly without testing.

10. IMMUNITY TEST OF GENERAL THE PERFORMANCE CRITERIA

| Product Standard | ETSI EN 301 489-1 |
|--|--|
| <p>The performance criteria are used to take a decision on whether a radio equipment passes or fails immunity tests.</p> <p>For the purpose of the present document two categories of performance criteria apply:</p> <ul style="list-style-type: none"> •Performance criteria for continuous phenomena. •Performance criteria for transient phenomena. <p>NOTE: Normally, the performance criteria depends upon the type of radio equipment and/or its intended application. Thus, the present document only contains general performance criteria commonly used for the assessment of radio equipment.</p> | |
| Performance criteria for continuous phenomena | <p>During the test, the equipment shall:</p> <ul style="list-style-type: none"> •continue to operate as intended; •not unintentionally transmit; •not unintentionally change its operating state; •not unintentionally change critical stored data. |
| Performance criteria for transient phenomena | <p>For all ports and transient phenomena with the exception described below, the following applies:</p> <ul style="list-style-type: none"> •The application of the transient phenomena shall not result in a change of the mode of operation (e.g. unintended transmission) or the loss of critical stored data. •After application of the transient phenomena, the equipment shall operate as intended. <p>For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:</p> <ul style="list-style-type: none"> •For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be otherwise restored. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost. •For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost. |

According To EN 301489 -3 standard, The General Performance Criteria As Following:

Table 1: Performance criteria

| Criteria | During the test | After test (i.e. as a result of the application of the test) |
|----------|--|---|
| A | Operate as intended No loss of function No unintentional responses | Operate as intended No loss of function No degradation of performance No loss of stored data or user programmable functions |
| B | May show loss of function No unintentional responses | Operate as intended Lost function(s) shall be self-recoverable No degradation of performance No loss of stored data or user programmable functions |

NOTE: Whether a phenomenon is considered transient, continuous or otherwise is indicated in the test procedures for the phenomenon in ETSI EN 301 489-1 [1], clause 9.

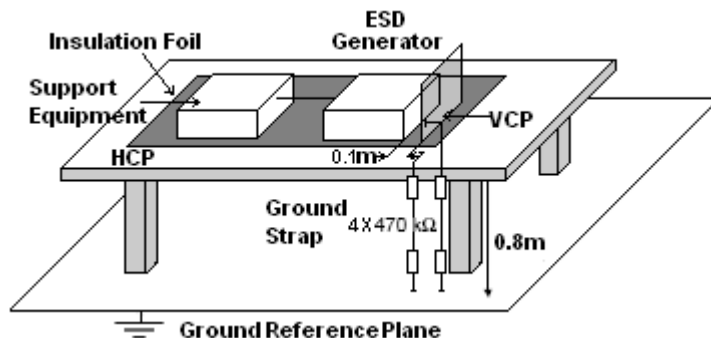
- performance criterion A applies for immunity tests with phenomena of a continuous nature;
- performance criterion B applies for immunity tests with phenomena of a transient nature.

11. ELECTROSTATIC DISCHARGE (ESD)

11.1 Test Specification

| | |
|----------------------------|-------------------------------------|
| Test Port | : Enclosure port |
| Discharge Impedance | : 330 ohm / 150 pF |
| Discharge Mode | : Single Discharge |
| Discharge Period | : one second between each discharge |

11.2 Block Diagram of Test Setup



11.3 Test Procedure

- Electrostatic discharges were applied only to those points and surfaces of the Product 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 Product.
- 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 Product as fast as possible (without causing mechanical damage) to touch the Product. After each discharge, the ESD generator was removed from the Product and re-triggered for a new single discharge. The test was repeated until all discharges were complete.
- At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the Product. The ESD generator was positioned vertically at a distance of 0.1 meters from the Product 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 Product were completely illuminated. The VCP (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the Product.

11.4 Test Results

| | | | |
|---------------|--------|---------------------|-------|
| Temperature : | 23℃ | Relative Humidity : | 54% |
| Pressure : | 101kPa | Test Mode : | Mode1 |

| Discharge Method | Discharge Position | Voltage (±kV) | Min. No. of Discharge per polarity (Each Point) | Performance Criterion |
|-------------------|---|---------------|---|-----------------------|
| Contact Discharge | Conductive Surfaces | 4 | 10 | A |
| | Indirect Discharge HCP | 4 | 10 | A |
| | Indirect Discharge VCP | 4 | 10 | A |
| Air Discharge | Slots, Apertures, and Insulating Surfaces | 8 | 10 | A |

Note: A: No performance degradation during test.

B: During the test, the EUT shut down, after the test, it reset by itself.

C: During the test, the EUT shut down, after the test, it reset by user.

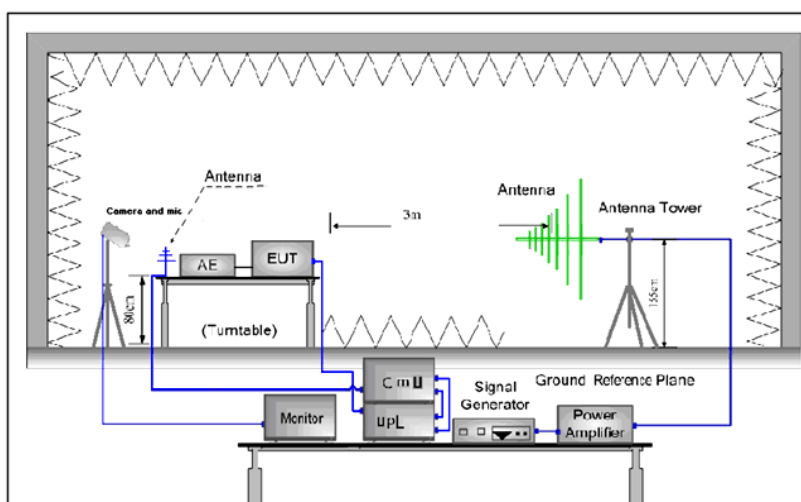
12. CONTINUOUS RF ELECTROMAGNETIC FIELD DISTURBANCES(RS)

12.1 Test Specification

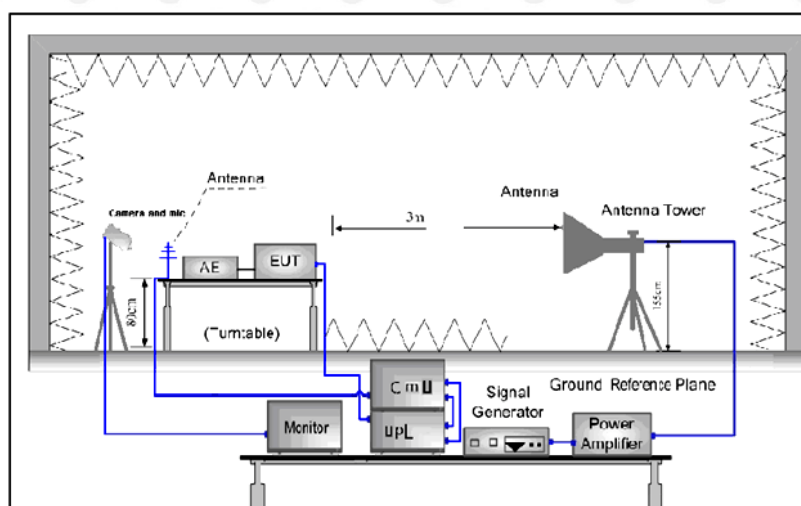
| | |
|---------------------|-------------------------|
| Test Port | : Enclosure port |
| Step Size | : 1% |
| Modulation | : 1kHz, 80% AM |
| Dwell Time | : 1 second |
| Polarization | : Horizontal & Vertical |

12.2 Block Diagram of Test Setup

Below 1GHz:



Above 1GHz:



12.3 Test Procedure

- The testing was performed in a fully-anechoic chamber. The transmit antenna was located at a distance of 3 meters from the Product.
- The frequency range is swept from 80MHz to 6000MHz, with the signal 80% amplitude modulated with a 1 kHz sine wave, and the step size was 1%.
- The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond, but should not exceed 5 s at each of the frequencies during the scan.
- The test was performed with the Product exposed to both vertically and horizontally polarized fields on each of the four sides.
- For Broadcast reception function: Group 2 not apply in this test.

12.4 Test Results

| | | | |
|---------------|--------|---------------------|-------|
| Temperature : | 23℃ | Relative Humidity : | 54% |
| Pressure : | 101kPa | Test Mode : | Mode1 |

| Frequency | Position | Field Strength (V/m) | Performance Criterion |
|--|--|----------------------|-----------------------|
| 80 - 6000MHz | Front, Right, Back, Left, Up, Down | 3 | A |
| Note: A: No performance degradation during test. | | | |

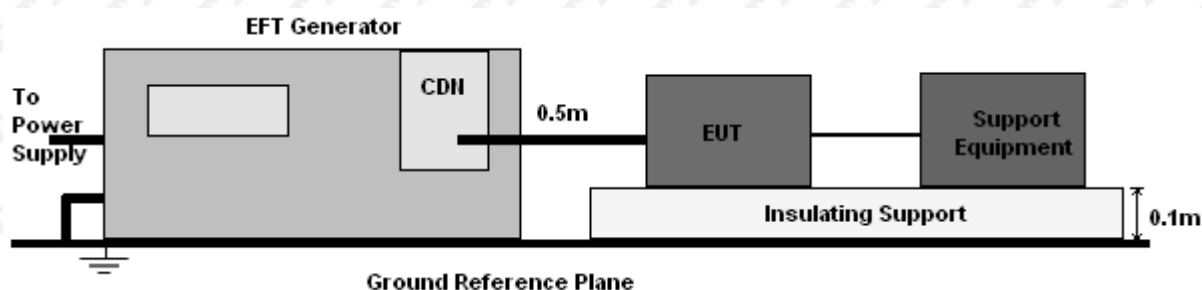
13. ELECTRICAL FAST TRANSIENTS/BURST (EFT)

13.1 Test Specification

| | |
|---------------------------|--------------------------|
| Test Port | : input a.c. power port |
| Impulse Frequency | : 5 kHz |
| Impulse Wave-shape | : 5/50 ns |
| Burst Duration | : 15 ms |
| Burst Period | : 300 ms |
| Test Duration | : 2 minutes per polarity |

13.2 Block Diagram of EUT Test Setup

For input a.c.power port:



13.3 Test Procedure

- The Product and support units were located on a non-conductive table above ground reference plane.
- A 0.5m-long power cord was attached to Product during the test.

13.4 Test Results

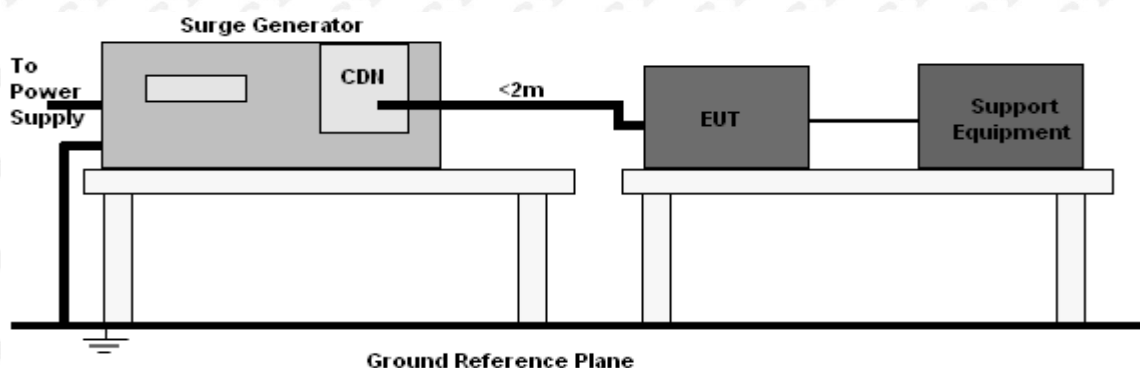
N/A

14. SURGES IMMUNITY TEST

14.1 Test Specification

| | |
|------------------------------|---|
| Test Port | : input a.c. power port |
| Wave-Shape | : Open Circuit Voltage - 1.2 / 50 us Short Circuit Current - 8 / 20 us |
| Pulse Repetition Rate | : 1 pulse / min. |
| Phase Angle | : 0° / 90° / 180° / 270° |
| Test Events | : 5 pulses (positive & negative) for each polarity |

14.2 Block Diagram of EUT Test Setup



14.3 Test Procedure

- The surge is to be applied to the Product power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave.
- The power cord between the Product and the coupling/decoupling networks shall be 2 meters in length (or shorter). Interconnection line between the Product and the coupling/decoupling networks shall be 2 meters in length (or shorter).

14.4 Test Result

N/A

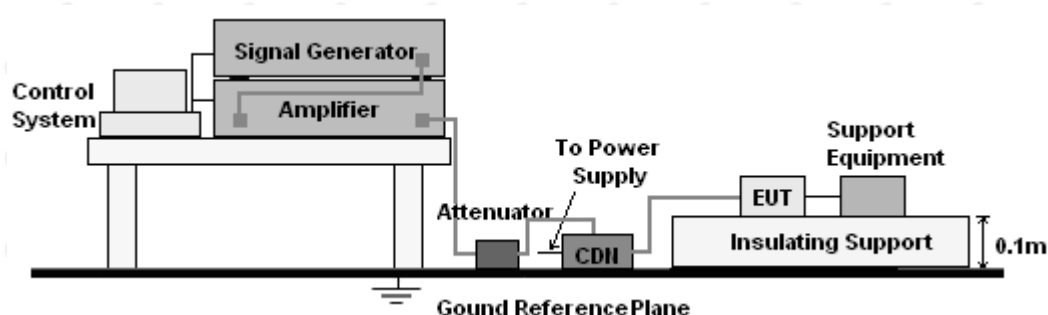
15. CONTINUOUS INDUCED RF DISTURBANCES (CS)

15.1 Test Specification

| | |
|-------------------|------------------------|
| Test Port | : input a.c.power port |
| Step Size | : 1% |
| Modulation | : 1kHz, 80% AM |
| Dwell Time | : 1 second |

15.2 Block Diagram of EUT Test Setup

For input a.c. power port:



15.3 Test Procedure

For input a.c.power port:

- The Product and support units were located at a ground reference plane with the interposition of a 0.1 m thickness insulating support and the CDN was located on GRP directly.
- The frequency range is swept from 150 kHz to 10MHz, 10MHz to 30MHz, 30MHz to 80MHz with the signal 80% amplitude modulated with a 1 kHz sine wave, and the step size was 1% of fundamental.
- The dwell time at each frequency shall be not less than the time necessary for the Product to be able to respond.

15.4 Test Result

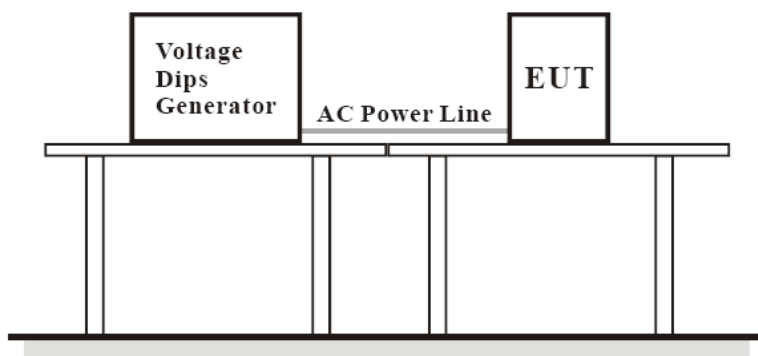
N/A

16. VOLTAGE DIPS AND INTERRUPTIONS (DIPS)

16.1 Test Specification

| | |
|--------------------|-------------------------|
| Test Port | : input a.c. power port |
| Phase Angle | : 0°, 180° |
| Test cycle | : 3 times |

16.2 Block Diagram of EUT Test Setup

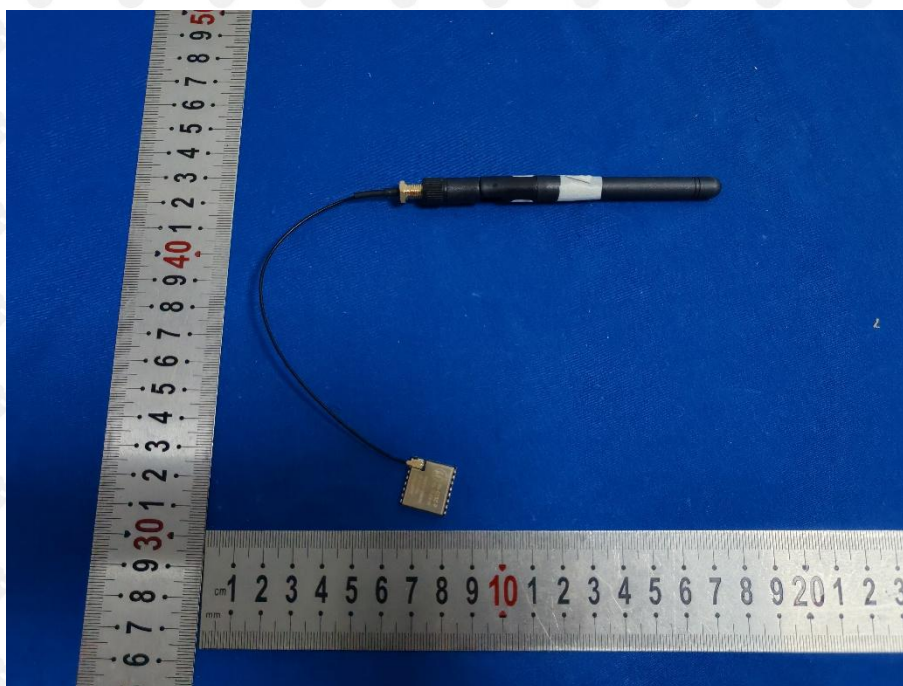
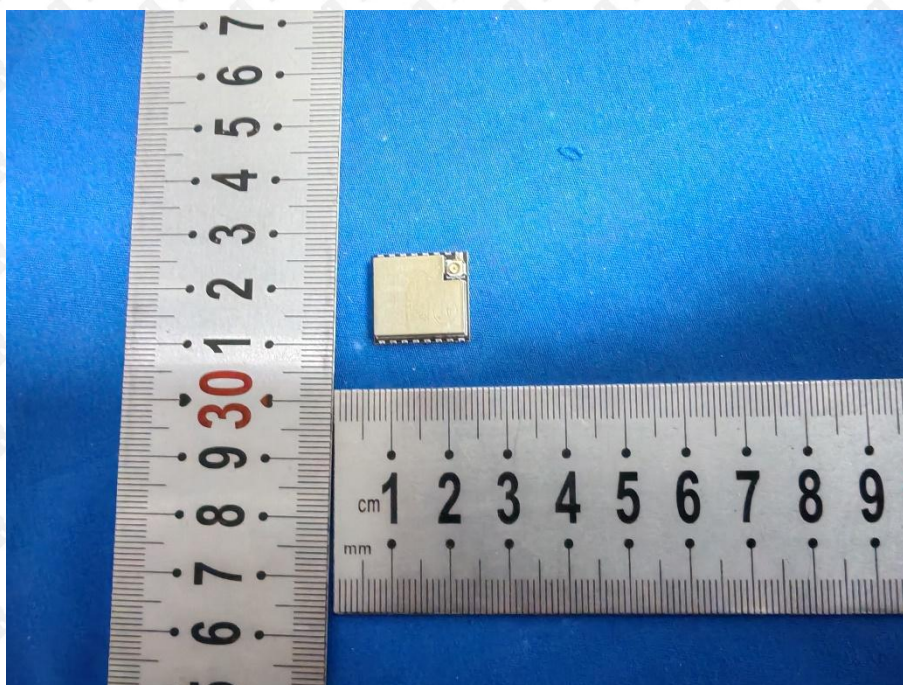


16.3 Test Procedure

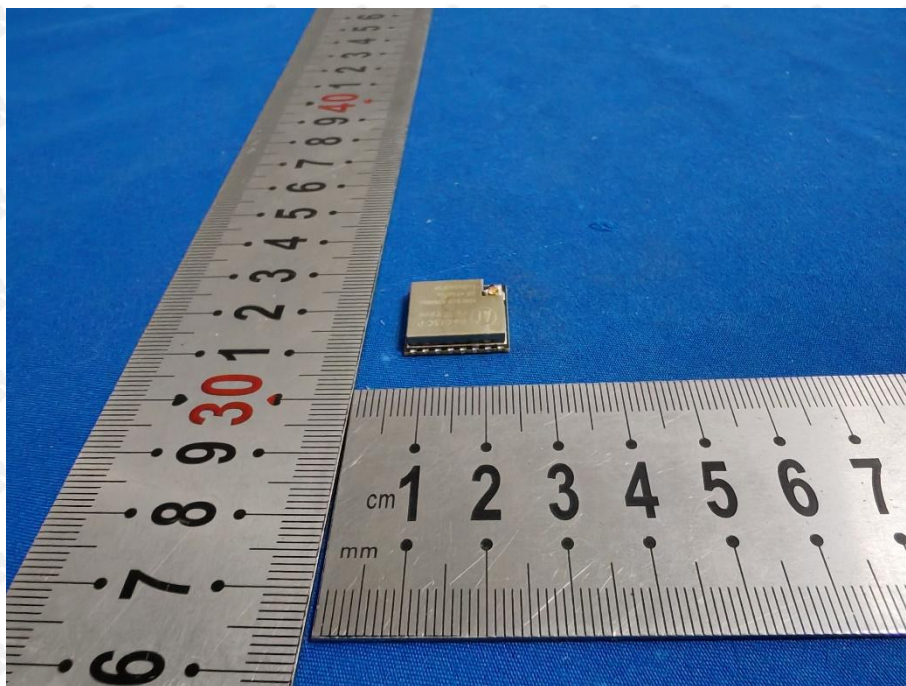
- The Product and support units were located on a non-conductive table above ground floor.
- Set the parameter of tests and then perform the test software of test simulator.
- Conditions changes to occur at 0 degree crossover point of the voltage waveform.

16.4 Test Result

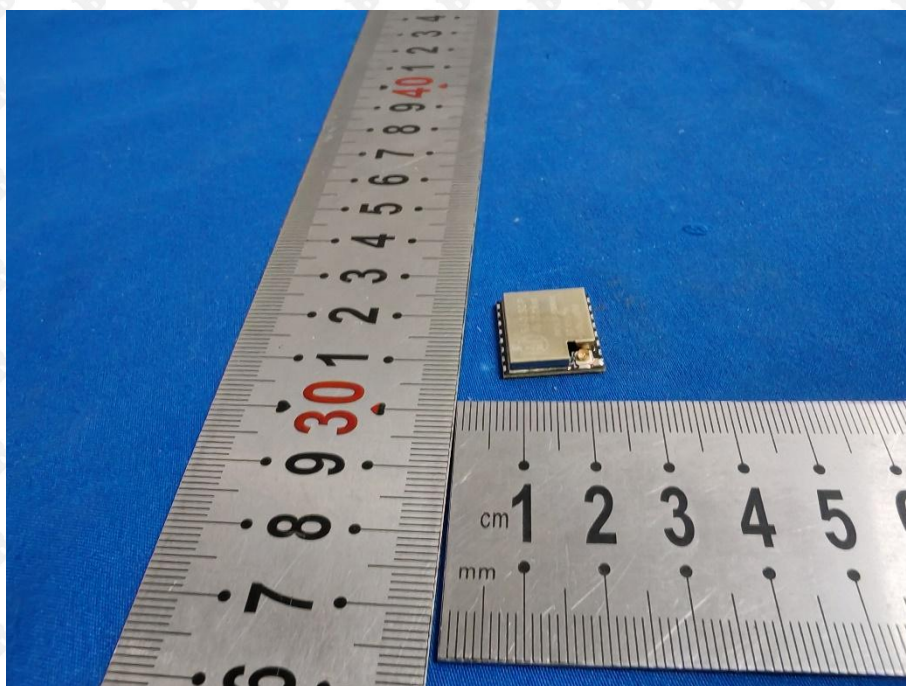
N/A

17. EUT PHOTOGRAPHS**External Photos****EUT Photo 1****EUT Photo 2**

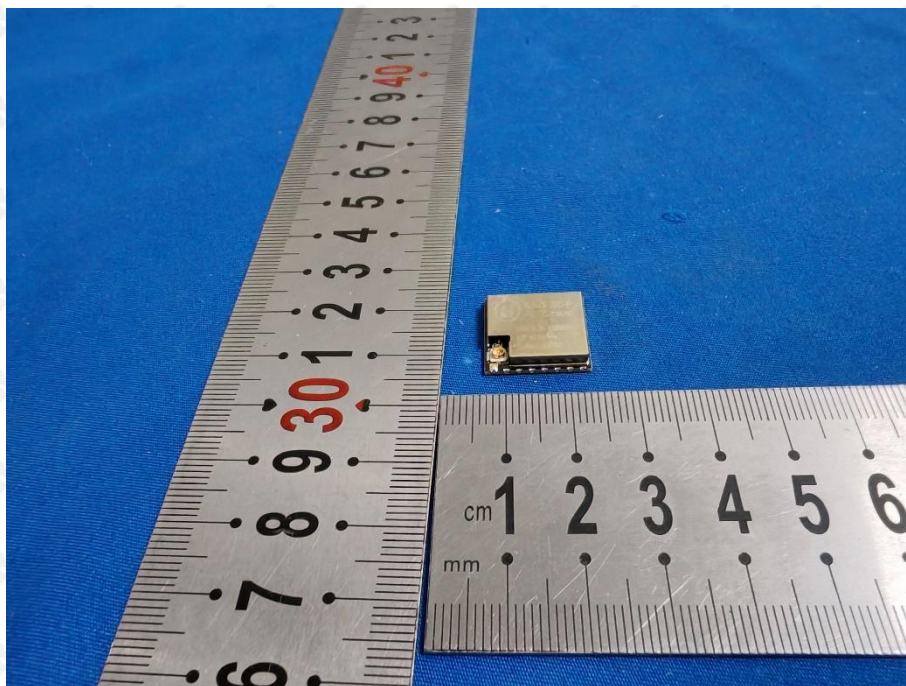
EUT Photo 3



EUT Photo 4



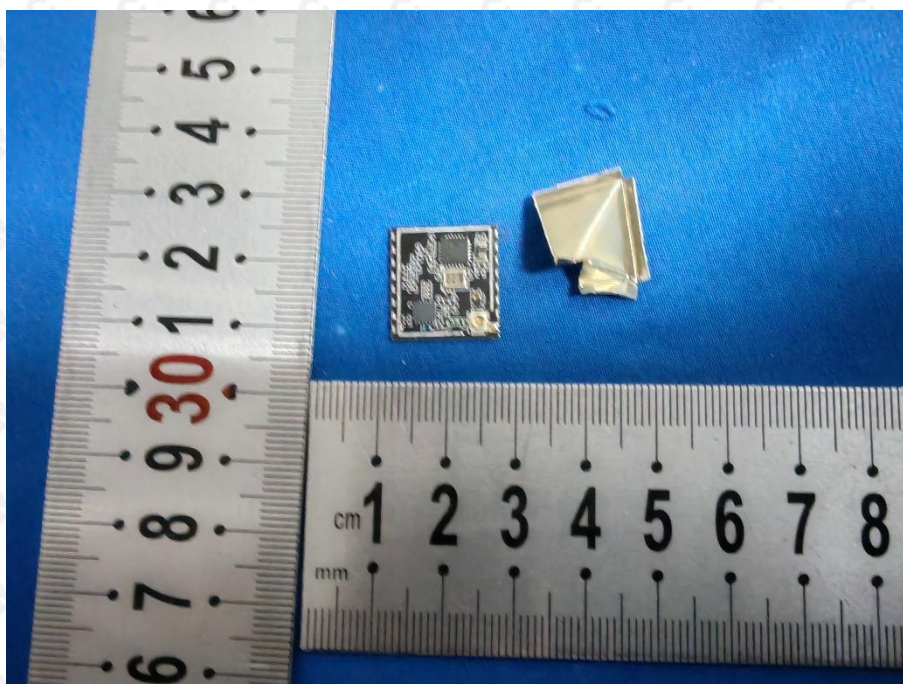
EUT Photo 5



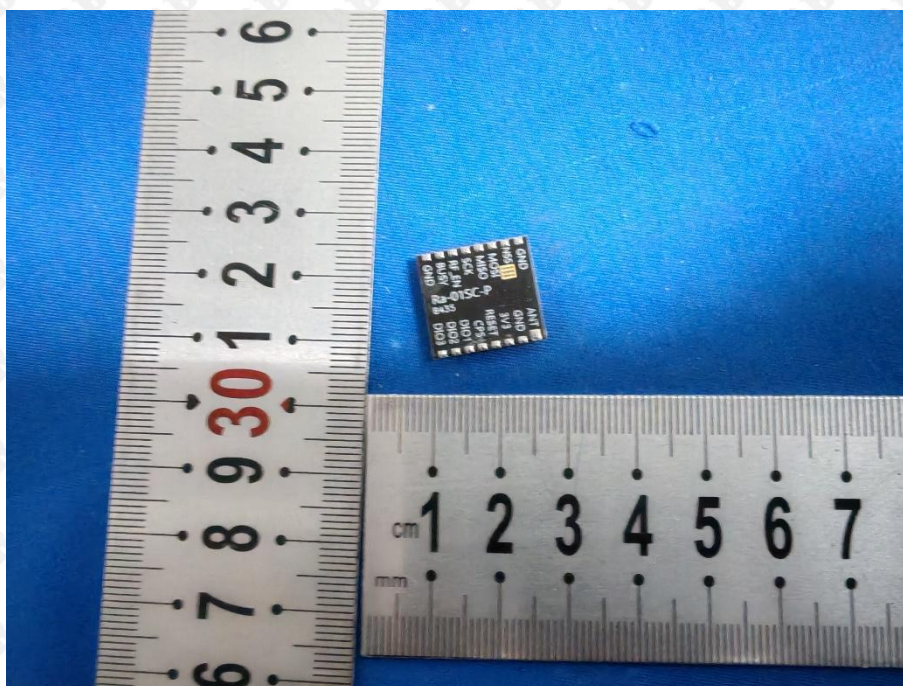
EUT Photo 6



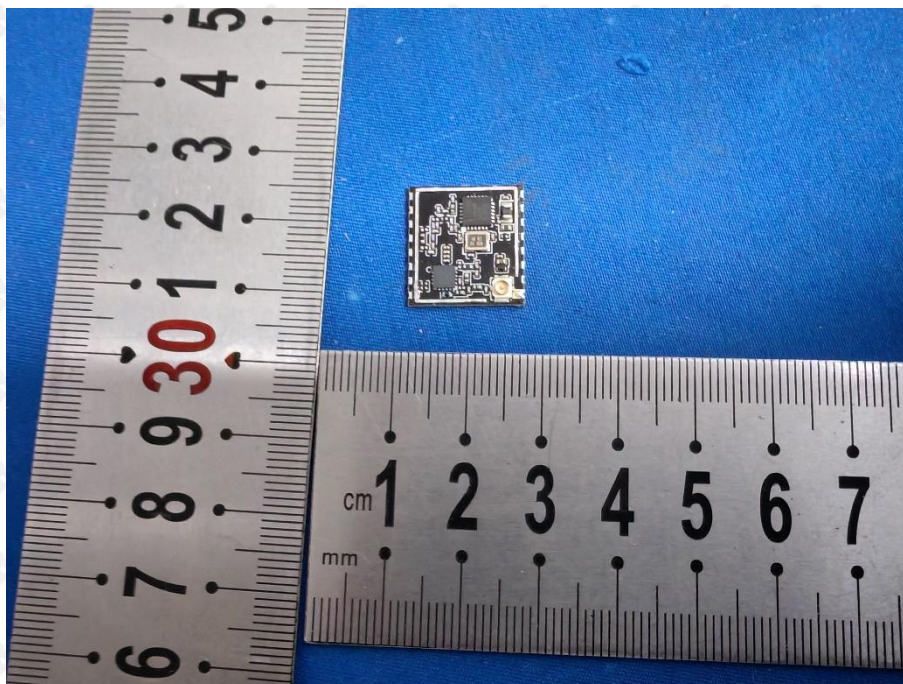
Internal Photos EUT Photo 1



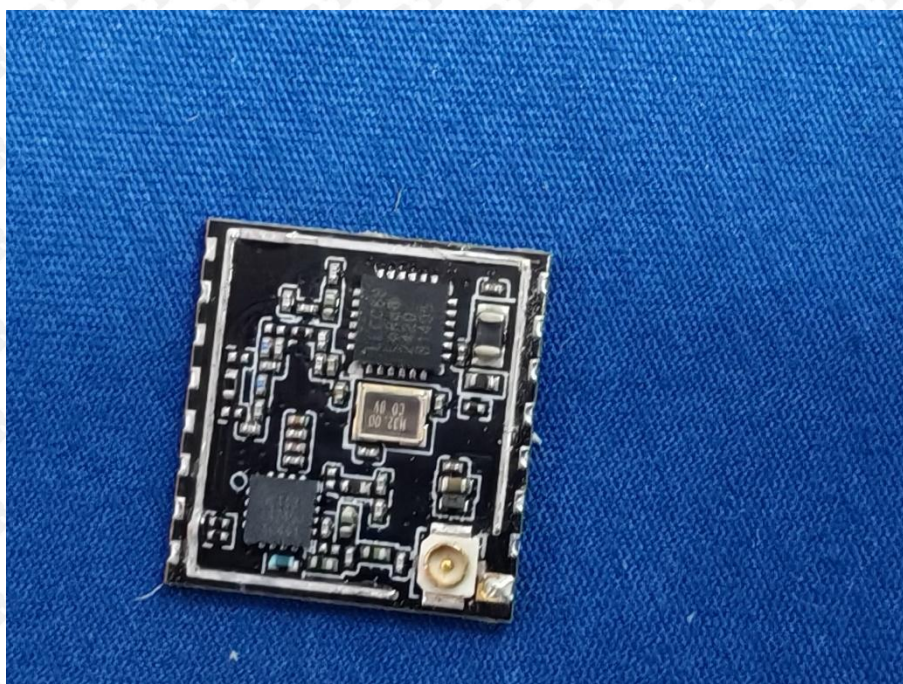
EUT Photo 2



EUT Photo 3



EUT Photo 4

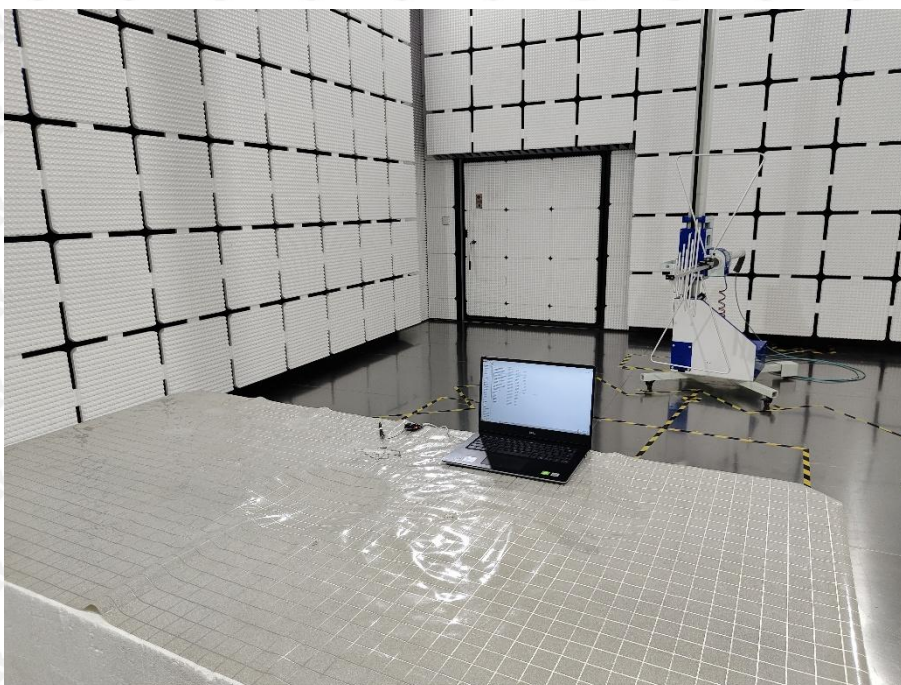


18. EUT TEST SETUP PHOTOGRAPHS

Conducted emissions



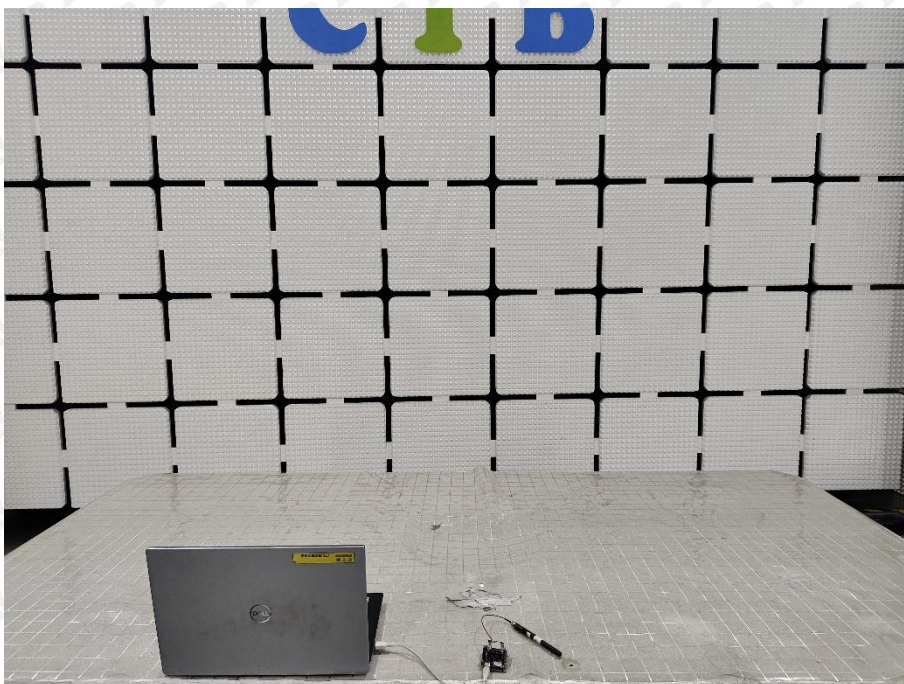
Radiated emissions below 1G



ESD



RS



***** END OF REPORT*****