# FCC RADIO TEST REPORT

## FCC ID: Y8E-VM-LORA

**Product**： LoRa SX-1276 1W module

**Trade Name**： N/A

**Model Name**： A-00700-HBT-HP

**Serial Model**： N/A

**Report No.**： UNIA19062011FR-01

### Prepared for

Vision Metering, LLC

7 Ross Cannon Street, York, SC 29745, USA

### Prepared by

Shenzhen United Testing Technology Co., Ltd.

2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

# TEST RESULT CERTIFICATION

| | |
|---|---|
| **Applicant's name**..... : | Vision Metering, LLC |
| Address..... : | 7 Ross Cannon Street, York, SC 29745, USA |
| **Manufacture's Name**..... : | Hunbil Technology (HBT) Trading Limited |
| Address..... : | FLAT/RM B 5/F, GAYLORD COMM, BLDG 114-118 LOCKHART RD, HONG KONG |

**Product description**

| | |
|---|---|
| Product name..... : | LoRa SX-1276 1W module |
| Trade Mark..... : | N/A |
| Model and/or type reference . : | A-00700-HBT-HP |
| **Standards**..... : | FCC Rules and Regulations Part 15 Subpart C Section 15.247<br>ANSI C63.10: 2013 |

This device described above has been tested by Shenzhen United Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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| | |
|---|---|
| **Date of Test**..... : | |
| Date (s) of performance of tests..... : | Jun. 12 ~ 25, 2019 |
| Date of Issue..... : | Jun. 26, 2019 |
| Test Result..... : | Pass |

Prepared by: Kaln.Yang

Kalin yang/Editor

Reviewer: Sherwin Qian

Sherwin Qian/Supervisor

Approved & Authorized Signer: liuze

Liuze/Manager

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# 1. TEST SUMMARY

## 1.1 TEST PROCEDURES AND RESULTS

| DESCRIPTION OF TEST | RESULT |
|---|---|
| CONDUCTED EMISSIONS TEST | COMPLIANT |
| RADIATED EMISSION TEST | COMPLIANT |
| BAND EDGE | COMPLIANT |
| OCCUPIED BANDWIDTH MEASUREMENT | COMPLIANT |
| MAXIMUM PEAK OUTPUT POWER | COMPLIANT |
| FREQUENCY SEPARATION | COMPLIANT |
| CONDUCTED BANDEGE MEASUREMENT | COMPLIANT |
| SPURIOUS RF CONDUCTED EMISSION | COMPLIANT |
| NUMBER OF HOPPING FREQUENCY | COMPLIANT |
| TIME OF OCCUPANCY(DWELL TIME) | COMPLIANT |
| ANTENNA REQUIREMENT | COMPLIANT |

## 1.2 TEST FACILITY

Test Firm : Shenzhen United Testing Technology Co., Ltd.

Address : 2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAS-LAB Code: L6494

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of testing Laboratories.

Designation Number: CN1227

Test Firm Registration Number: 674885

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files.

## 1.3 MEASUREMENT UNCERTAINTY

Measurement Uncertainty

| | | |
|---|---|---|
| Conducted Emission Expanded Uncertainty | = | 2.23dB, k=2 |
| Radiated emission expanded uncertainty(9kHz-30MHz) | = | 3.08dB, k=2 |
| Radiated emission expanded uncertainty(30MHz-1000MHz) | = | 4.42dB, k=2 |
| Radiated emission expanded uncertainty(Above 1GHz) | = | 4.06dB, k=2 |

# 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF EUT

| | |
|---|---|
| Equipment | LoRa SX-1276 1W module |
| Trade Mark | N/A |
| Model Name | A-00700-HBT-HP |
| Serial No. | N/A |
| Model Difference | N/A |
| FCC ID | Y8E-VM-LORA |
| Antenna Type | IPEX Connector |
| Antenna Gain | 1.5dBi |
| Frequency Range | 902-928MHz |
| Modulation Type | FSK |
| Power Source | DC 3.5V On PCB from Adapter Input AC 120V/60Hz |

Table for auxiliary equipment:

| Equipment Description | Manufacturer | Model |
|---|---|---|
| Adapter | sunshine | XS-1201000SCN |

2.2 Carrier Frequency of Channels

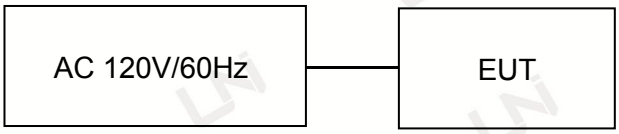
| Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---|---|---|---|---|---|---|---|
| 0 | 902.3 | 16 | 905.5 | 32 | 908.7 | 48 | 911.9 |
| 1 | 902.5 | 17 | 905.7 | 33 | 908.9 | 49 | 912.1 |
| 2 | 902.7 | 18 | 905.9 | 34 | 909.1 | 50 | 912.3 |
| 3 | 902.9 | 19 | 906.1 | 35 | 909.3 | 51 | 912.5 |
| 4 | 903.1 | 20 | 906.3 | 36 | 909.5 | 52 | 912.7 |
| 5 | 903.3 | 21 | 906.5 | 37 | 909.7 | 53 | 912.9 |
| 6 | 903.5 | 22 | 906.7 | 38 | 909.9 | 54 | 913.1 |
| 7 | 903.7 | 23 | 906.9 | 39 | 910.1 | 55 | 913.3 |
| 8 | 903.9 | 24 | 907.1 | 40 | 910.3 | 56 | 913.5 |
| 9 | 904.1 | 25 | 907.3 | 41 | 910.5 | 57 | 913.7 |
| 10 | 904.3 | 26 | 907.5 | 42 | 910.7 | 58 | 913.9 |
| 11 | 904.5 | 27 | 907.7 | 43 | 910.9 | 59 | 914.1 |
| 12 | 904.7 | 28 | 907.9 | 44 | 911.1 | 60 | 914.3 |
| 13 | 904.9 | 29 | 908.1 | 45 | 911.3 | 61 | 914.5 |
| 14 | 905.1 | 30 | 908.3 | 46 | 911.5 | 62 | 914.7 |
| 15 | 905.3 | 31 | 908.5 | 47 | 911.7 | 63 | 914.9 |

2.3 Operation of EUT during testing

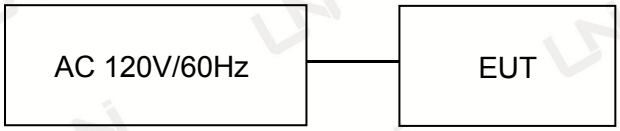
Operating Mode
The mode is used: Transmitting mode
Low Channel: 902.3MHz
Middle Channel: 908.7MHz
High Channel: 914.9MHz

2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:




Operation of EUT during Radiation testing:



## 2.5 MEASUREMENT INSTRUMENTS LIST

| Item | Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
|---|---|---|---|---|---|
| CONDUCTED EMISSIONS TEST | | | | | |
| 1 | AMN | Schwarzbeck | NNLK8121 | 8121370 | 2019.9.9 |
| 2 | AMN | ETS | 3810/2 | 00020199 | 2019.9.9 |
| 3 | EMI TEST RECEIVER | Rohde&Schwarz | ESCI | 101210 | 2019.9.9 |
| 4 | AAN | TESEQ | T8-Cat6 | 38888 | 2019.9.9 |
| RADIATED EMISSION TEST | | | | | |
| 1 | Horn Antenna | Sunol | DRH-118 | A101415 | 2019.9.29 |
| 2 | BicoNILog Antenna | Sunol | JB1 Antenna | A090215 | 2019.9.29 |
| 3 | PREAMP | HP | 8449B | 3008A00160 | 2019.9.9 |
| 4 | PREAMP | HP | 8447D | 2944A07999 | 2019.9.9 |
| 5 | EMI TEST RECEIVER | Rohde&Schwarz | ESR3 | 101891 | 2019.9.9 |
| 6 | VECTOR Signal Generator | Rohde&Schwarz | SMU200A | 101521 | 2019.9.28 |
| 7 | Signal Generator | Agilent | E4421B | MY4335105 | 2019.9.28 |
| 8 | MXA Signal Analyzer | Agilent | N9020A | MY50510140 | 2019.9.28 |
| 9 | MXA Signal Analyzer | Agilent | N9020A | MY51110104 | 2019.9.9 |
| 10 | ANT Tower&Turn table Controller | Champro | EM 1000 | 60764 | 2019.9.28 |
| 11 | Anechoic Chamber | Taihe Maorui | 9m*6m*6m | 966A0001 | 2019.9.9 |
| 12 | Shielding Room | Taihe Maorui | 6.4m*4m*3m | 643A0001 | 2019.9.9 |
| 13 | RF Power sensor | DARE | RPR3006W | 15I00041SNO88 | 2020.3.13 |
| 14 | RF Power sensor | DARE | RPR3006W | 15I00041SNO89 | 2020.3.13 |
| 15 | RF power divider | Anritsu | K241B | 992289 | 2019.9.28 |
| 16 | Wideband radio communication tester | Rohde&Schwarz | CMW500 | 154987 | 2019.9.28 |
| 17 | Biconical antenna | Schwarzbeck | VHA 9103 | 91032360 | 2019.9.8 |
| 18 | Biconical antenna | Schwarzbeck | VHA 9103 | 91032361 | 2019.9.8 |
| 19 | Broadband Hybrid Antennas | Schwarzbeck | VULB9163 | VULB9163#958 | 2019.9.8 |
| 20 | Horn Antenna | Schwarzbeck | BBHA9120D | 9120D-1680 | 2020.1.11 |
| 21 | Active Receive Loop Antenna | Schwarzbeck | FMZB 1919B | 00023 | 2019.11.02 |
| 22 | Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170651 | 2020.3.13 |
| 23 | Microwave Broadband Preamplifier | Schwarzbeck | BBV 9721 | 100472 | 2019.10.24 |
| 24 | Active Loop Antenna | Com-Power | AL-130R | 10160009 | 2020.5.10 |
| 25 | Power Meter | KEYSIGHT | N1911A | MY50520168 | 2020.5.10 |
| 26 | Frequency Meter | VICTOR | VC2000 | 997406086 | 2020.5.10 |
| 27 | DC Power Source | HYELEC | HY5020E | 055161818 | 2020.5.10 |
| Test software | | | | | |
| 1 | E3 | Audix | 6.101223a | N/A | N/A |

# 3. CONDUCTED EMISSIONS TEST

## 3.1 Conducted Power Line Emission Limit

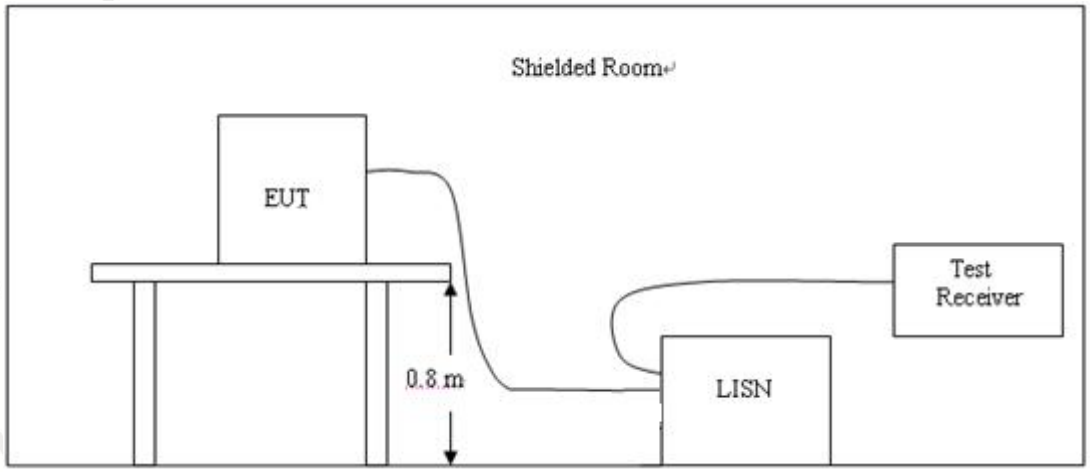
For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

| Frequency (MHz) | Maximum RF Line Voltage(dBμV) | | | |
|---|---|---|---|---|
| | CLASS A | | CLASS B | |
| | Q.P. | Ave. | Q.P. | Ave. |
| 0.15~0.50 | 79 | 66 | 66~56* | 56~46* |
| 0.50~5.00 | 73 | 60 | 56 | 46 |
| 5.00~30.0 | 73 | 60 | 60 | 50 |

* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

## 3.2 Test Setup




## 3.3 Test Procedure

1, The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. 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 ANSI C63.10.
2, Support equipment, if needed, was placed as per ANSI C63.10.
3, All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4, If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5, All support equipments received AC power from a second LISN, if any.
6, 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 LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). 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.
7, Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

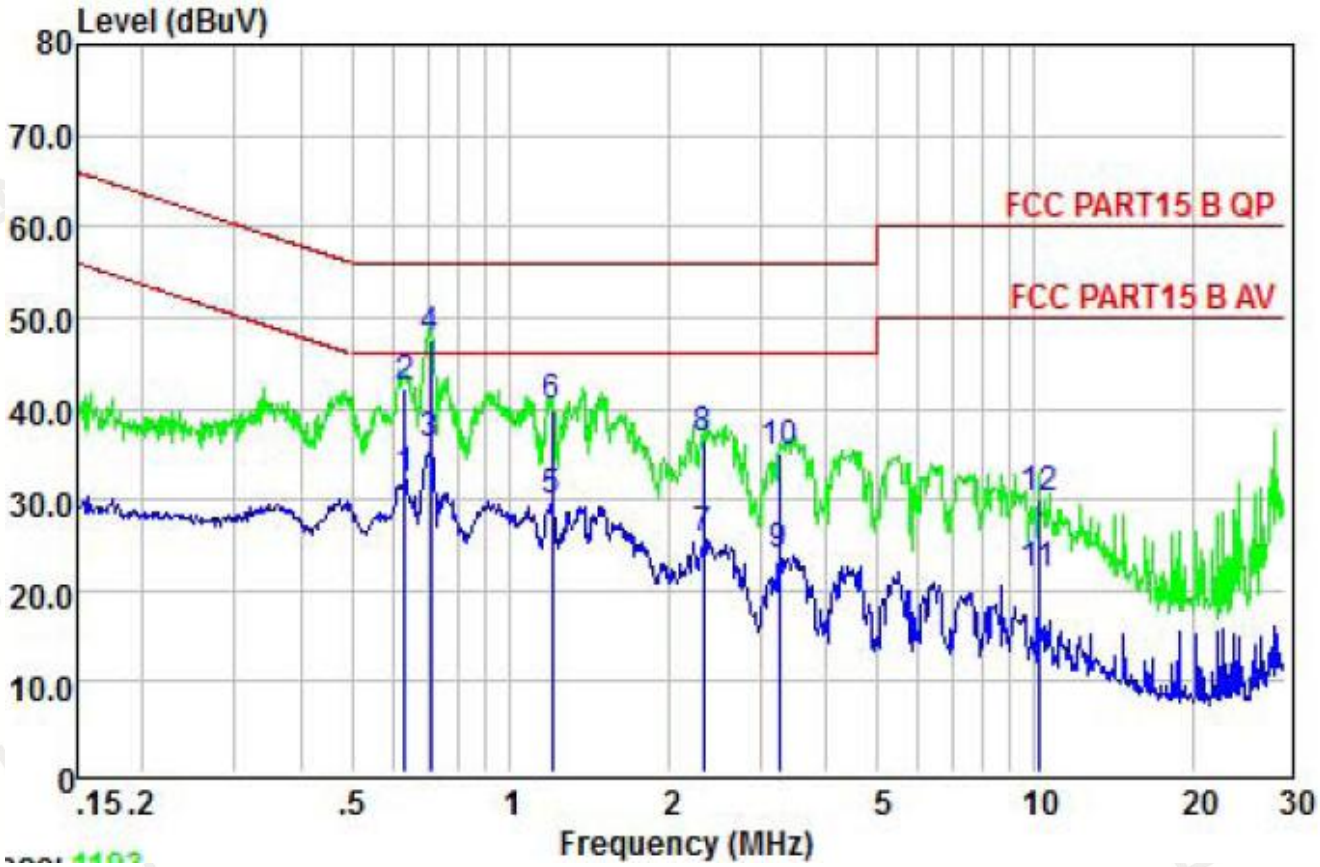
## 3.4 Test Result

Pass

Remark:

1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
2. All modes of Low, Middle, and High channel were tested, only the worst result of Middle Channel was reported as below:

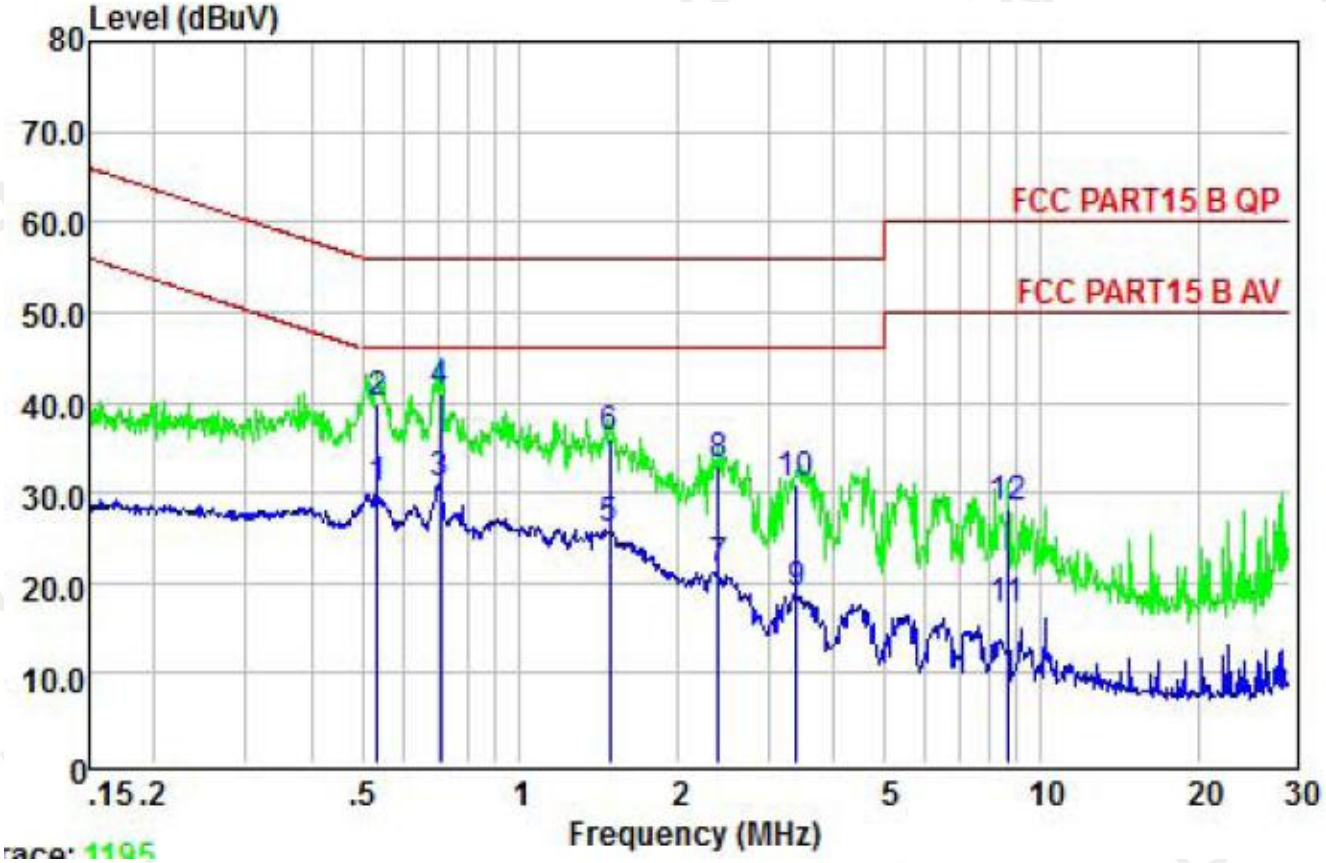
| Temperature: | 26℃ | Relative Humidity: | 48% |
|---|---|---|---|
| Test Date: | Jun. 18, 2019 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Phase: | Line |
| Test Mode: | Transmitting mode 908.7MHz (worst mode) | | |




| | Freq | Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dBuV | dB | |
| 1 | 0.63 | 32.19 | 9.60 | 0.25 | 46.00 | -13.81 | Average |
| 2 | 0.63 | 42.36 | 9.60 | 0.25 | 56.00 | -13.64 | QP |
| 3 | 0.71 | 35.85 | 9.61 | 0.26 | 46.00 | -10.15 | Average |
| 4 | 0.71 | 47.47 | 9.61 | 0.26 | 56.00 | -8.53 | QP |
| 5 | 1.20 | 29.60 | 9.60 | 0.27 | 46.00 | -16.40 | Average |
| 6 | 1.20 | 40.00 | 9.60 | 0.27 | 56.00 | -16.00 | QP |
| 7 | 2.35 | 25.61 | 9.62 | 0.28 | 46.00 | -20.39 | Average |
| 8 | 2.35 | 36.69 | 9.62 | 0.28 | 56.00 | -19.31 | QP |
| 9 | 3.26 | 23.76 | 9.63 | 0.29 | 46.00 | -22.24 | Average |
| 10 | 3.26 | 35.15 | 9.63 | 0.29 | 56.00 | -20.85 | QP |
| 11 | 10.18 | 21.58 | 9.68 | 0.39 | 50.00 | -28.42 | Average |
| 12 | 10.18 | 30.00 | 9.68 | 0.39 | 60.00 | -30.00 | QP |

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

| Temperature: | 26℃ | Relative Humidity: | 48% |
|---|---|---|---|
| Test Date: | Jun. 18, 2019 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Phase: | Neutral |
| Test Mode: | Transmitting mode 908.7MHz (worst mode) | | |




| | Freq | Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dBuV | dB | |
| 1 | 0.53 | 30.33 | 9.59 | 0.25 | 46.00 | -15.67 | Average |
| 2 | 0.53 | 39.84 | 9.59 | 0.25 | 56.00 | -16.16 | QP |
| 3 | 0.70 | 30.92 | 9.60 | 0.26 | 46.00 | -15.08 | Average |
| 4 | 0.70 | 40.92 | 9.60 | 0.26 | 56.00 | -15.08 | QP |
| 5 | 1.49 | 25.90 | 9.58 | 0.27 | 46.00 | -20.10 | Average |
| 6 | 1.49 | 35.99 | 9.58 | 0.27 | 56.00 | -20.01 | QP |
| 7 | 2.41 | 21.31 | 9.59 | 0.28 | 46.00 | -24.69 | Average |
| 8 | 2.41 | 33.12 | 9.59 | 0.28 | 56.00 | -22.88 | QP |
| 9 | 3.40 | 18.76 | 9.63 | 0.29 | 46.00 | -27.24 | Average |
| 10 | 3.40 | 30.92 | 9.63 | 0.29 | 56.00 | -25.08 | QP |
| 11 | 8.64 | 17.06 | 9.67 | 0.37 | 50.00 | -32.94 | Average |
| 12 | 8.64 | 28.19 | 9.67 | 0.37 | 60.00 | -31.81 | QP |

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

# 4. RADIATED EMISSION TEST

## 4.1 Radiation Limit

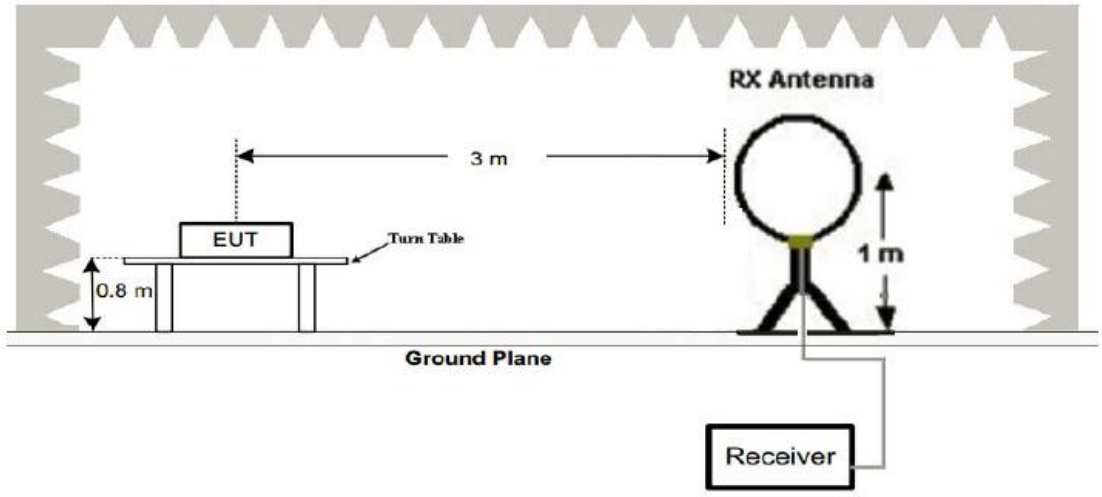
For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

| Frequency (MHz) | Distance (Meters) | Radiated (dBμV/m) | Radiated (μV/m) |
|---|---|---|---|
| 30-88 | 3 | 40 | 100 |
| 88-216 | 3 | 43.5 | 150 |
| 216-960 | 3 | 46 | 200 |
| Above 960 | 3 | 54 | 500 |

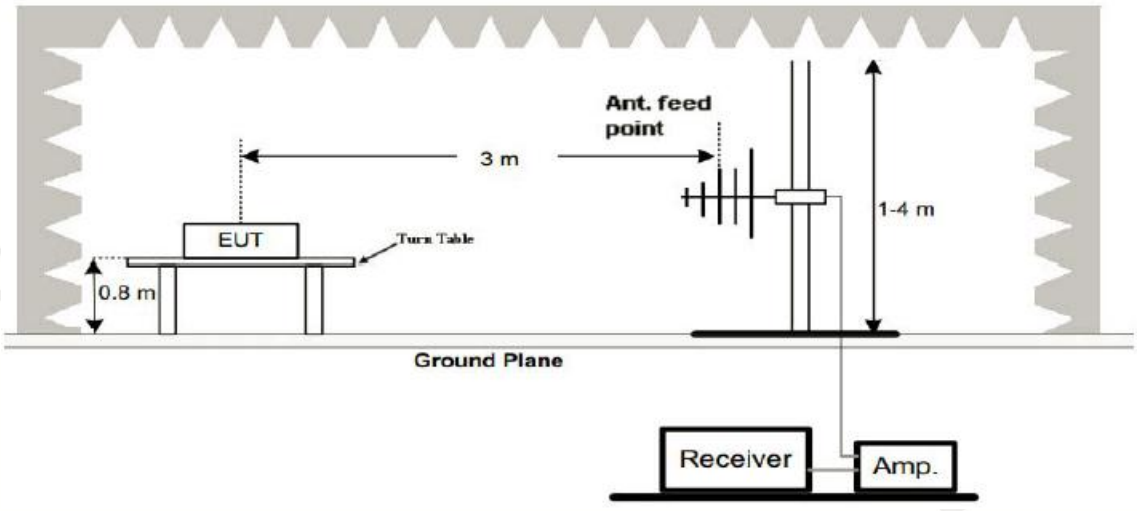
For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

## 4.2 Test Setup

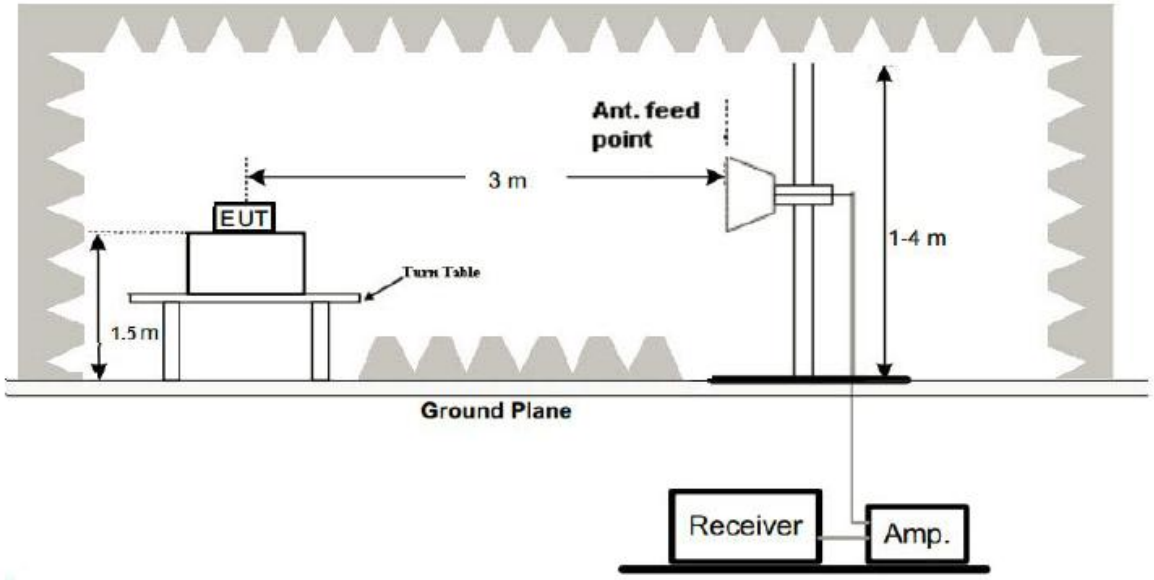
1. Radiated Emission Test-Up Frequency Below 30MHz




2. Radiated Emission Test-Up Frequency 30MHz~1GHz



3. Radiated Emission Test-Up Frequency Above 1GHz




## 4.3 Test Procedure

1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The test frequency range from 9KHz to 25GHz per FCC PART 15.33(a).
8. The distance between test antenna and EUT as following table states:

| Test Frequency range | Test Antenna Type | Test Distance |
|---|---|---|
| 9KHz-30MHz | Active Loop Antenna | 3 |
| 30MHz-1GHz | Bilog Antenna | 3 |
| 1GHz-18GHz | Horn Antenna | 3 |
| 18GHz-25GHz | Horn Anternna | 1 |

Note:
For battery operated equipment, the equipment tests shall be performed using a new battery.

## 4.4 Test Result

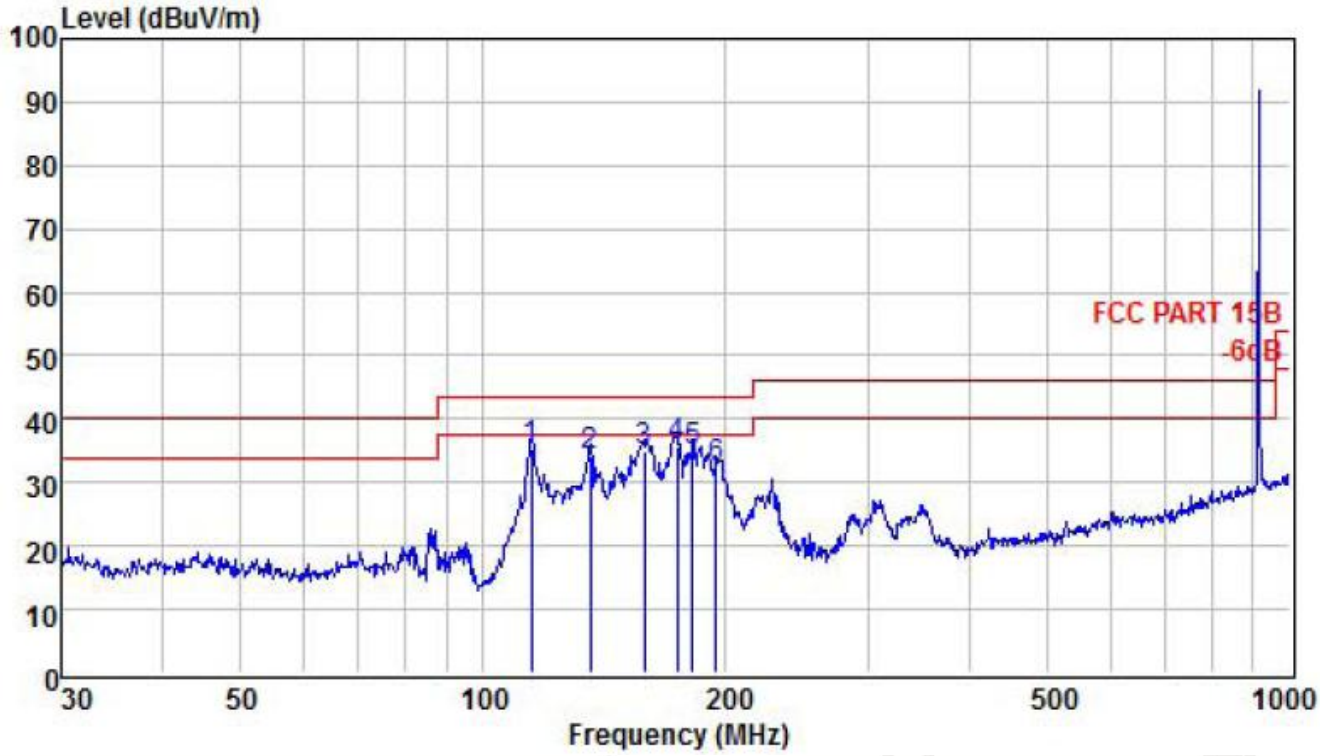
PASS

Remark:

1. All modes of Low, Middle, and High channel were tested, only the worst result of Middle Channel was reported as below:
3. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, and test data recorded in this report.
4. Radiated emission test from 9KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9KHz to 30MHz and not recorded in this report.

Below 1GHz Test Results:

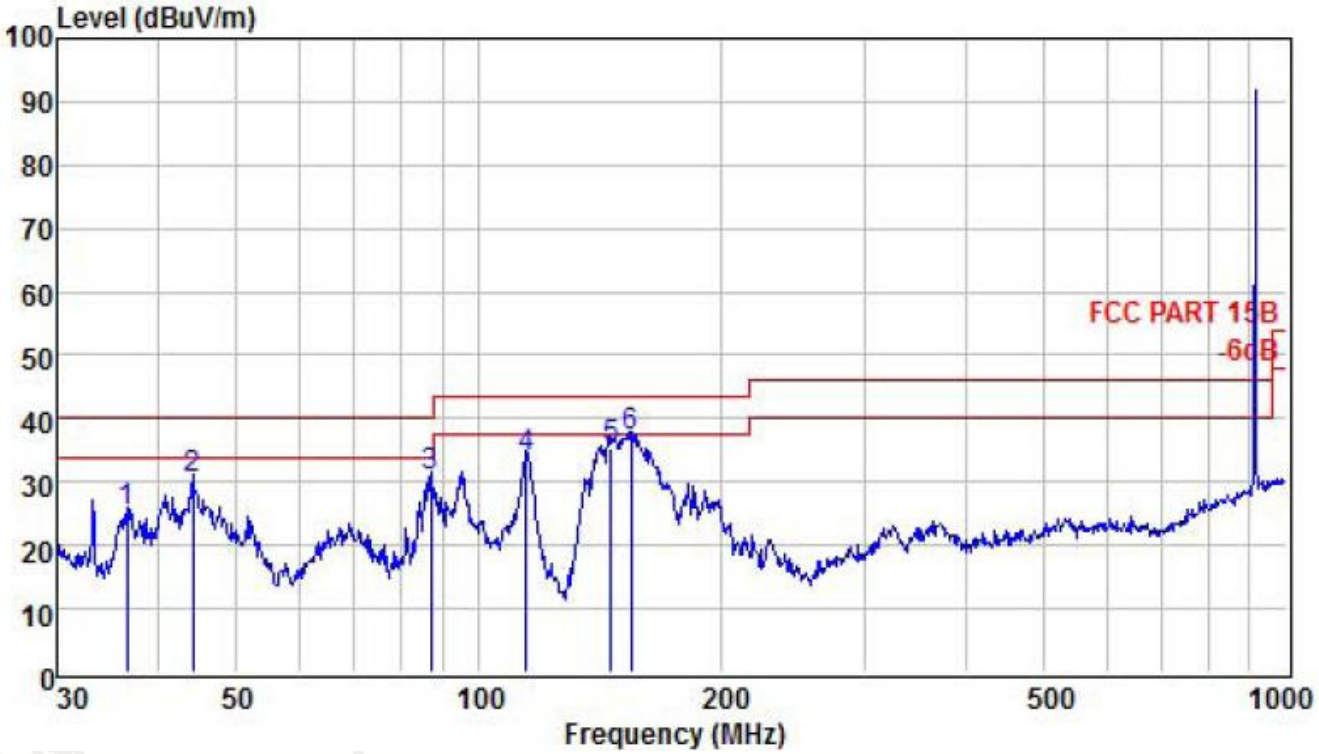
| Temperature: | 22℃ | Relative Humidity: | 48% |
|---|---|---|---|
| Test Date: | Jun. 18, 2019 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Polarization: | Horizontal |
| Test Mode: | Transmitting mode 908.7MHz (worst mode) | | |




| | Freq | Level | Antenna Factor | Cable Loss | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB/m | dB | dBuV/m | dB | |
| 1 | 114.92 | 35.33 | 12.05 | 0.20 | 43.50 | -8.17 | QP |
| 2 | 135.98 | 34.05 | 14.67 | 0.23 | 43.50 | -9.45 | QP |
| 3 | 158.67 | 34.91 | 15.67 | 0.23 | 43.50 | -8.59 | QP |
| 4 | 173.81 | 35.70 | 13.58 | 0.24 | 43.50 | -7.80 | QP |
| 5 | 181.92 | 34.83 | 12.57 | 0.24 | 43.50 | -8.67 | QP |
| 6 | 194.45 | 32.26 | 11.75 | 0.30 | 43.50 | -11.24 | QP |

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss

| Temperature: | 22℃ | Relative Humidity: | 48% |
|---|---|---|---|
| Test Date: | Jun. 18, 2019 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Polarization: | Vertical |
| Test Mode: | Transmitting mode 908.7MHz (worst mode) | | |



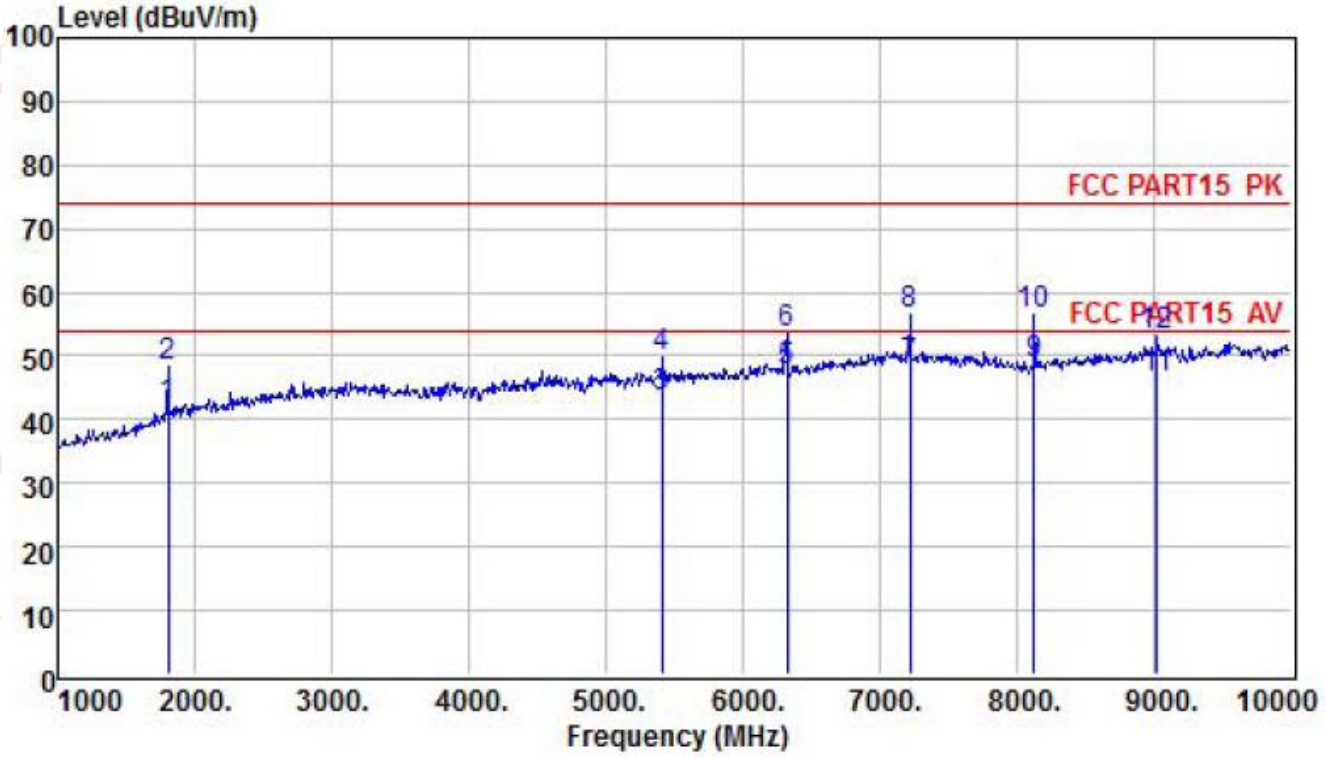

| | Freq | Level | Antenna Factor | Cable Loss | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB/m | dB | dBuV/m | dB | |
| 1 | 36.64 | 25.17 | 13.04 | 0.20 | 40.00 | -14.83 | QP |
| 2 | 44.28 | 30.32 | 13.27 | 0.13 | 40.00 | -9.68 | QP |
| 3 | 87.11 | 30.73 | 11.32 | 0.16 | 40.00 | -9.27 | QP |
| 4 | 114.51 | 33.81 | 12.02 | 0.20 | 43.50 | -9.69 | QP |
| 5 | 145.86 | 35.33 | 15.36 | 0.23 | 43.50 | -8.17 | QP |
| 6 | 154.28 | 37.04 | 15.57 | 0.23 | 43.50 | -6.46 | QP |

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss

Remark：
(1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.
(2) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

Above 1 GHz Test Results:

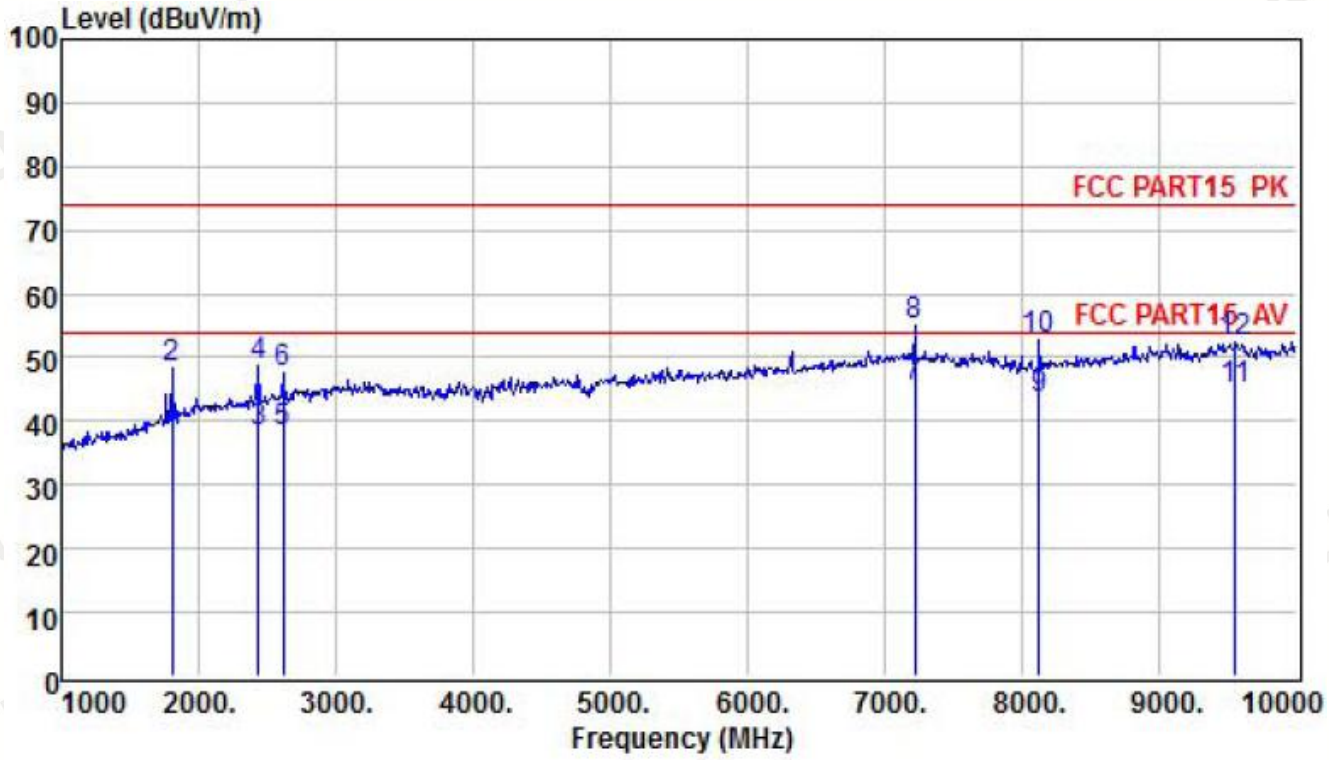
| Temperature: | 22℃ | Relative Humidity: | 48% |
|---|---|---|---|
| Test Date: | Jun. 18, 2019 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Polarization: | Vertical |
| Test Mode: | Transmitting mode 908.7MHz (worst mode) | | |




| | Freq | Read Level | Antenna Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dB | |
| 1 | 1802.800 | 38.25 | 27.16 | 2.65 | 41.90 | 54.00 | -12.10 | Average |
| 2 | 1802.800 | 44.56 | 27.16 | 2.65 | 48.21 | 74.00 | -25.79 | Peak |
| 3 | 5409.200 | 32.58 | 33.96 | 4.43 | 43.33 | 54.00 | -10.67 | Average |
| 4 | 5409.200 | 38.97 | 33.96 | 4.43 | 49.72 | 74.00 | -24.28 | Peak |
| 5 | 6320.000 | 34.69 | 35.64 | 4.98 | 47.55 | 54.00 | -6.45 | Average |
| 6 | 6320.000 | 40.57 | 35.64 | 4.98 | 53.43 | 74.00 | -20.57 | Peak |
| 7 | 7221.600 | 33.57 | 37.29 | 5.51 | 48.43 | 54.00 | -5.57 | Average |
| 8 | 7221.600 | 41.78 | 37.29 | 5.51 | 56.64 | 74.00 | -17.36 | Peak |
| 9 | 8123.200 | 34.17 | 36.50 | 6.16 | 48.69 | 54.00 | -5.31 | Average |
| 10 | 8123.200 | 41.86 | 36.50 | 6.16 | 56.38 | 74.00 | -17.62 | Peak |
| 11 | 9024.800 | 30.57 | 37.42 | 6.89 | 46.47 | 54.00 | -7.53 | Average |
| 12 | 9024.800 | 37.19 | 37.42 | 6.89 | 53.09 | 74.00 | -20.91 | Peak |

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss

| Temperature: | 22℃ | Relative Humidity: | 48% |
|---|---|---|---|
| Test Date: | Jun. 18, 2019 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Polarization: | Horizontal |
| Test Mode: | Transmitting mode 908.7MHz (worst mode) | | |




| | Freq | Read Level | Antenna Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dB | |
| 1 | 1802.800 | 34.00 | 27.16 | 2.65 | 37.65 | 54.00 | -16.35 | Average |
| 2 | 1802.800 | 44.60 | 27.16 | 2.65 | 48.25 | 74.00 | -25.75 | Peak |
| 3 | 2437.600 | 32.28 | 28.76 | 3.42 | 38.13 | 54.00 | -15.87 | Average |
| 4 | 2437.600 | 42.85 | 28.76 | 3.42 | 48.70 | 74.00 | -25.30 | Peak |
| 5 | 2612.400 | 31.99 | 29.08 | 3.65 | 38.34 | 54.00 | -15.66 | Average |
| 6 | 2612.400 | 41.18 | 29.08 | 3.65 | 47.53 | 74.00 | -26.47 | Peak |
| 7 | 7221.600 | 30.57 | 37.29 | 5.51 | 45.43 | 54.00 | -8.57 | Average |
| 8 | 7221.600 | 39.98 | 37.29 | 5.51 | 54.84 | 74.00 | -19.16 | Peak |
| 9 | 8123.200 | 29.15 | 36.50 | 6.16 | 43.67 | 54.00 | -10.33 | Average |
| 10 | 8123.200 | 38.18 | 36.50 | 6.16 | 52.70 | 74.00 | -21.30 | Peak |
| 11 | 9558.399 | 28.25 | 38.04 | 7.45 | 45.12 | 54.00 | -8.88 | Average |
| 12 | 9558.399 | 35.70 | 38.04 | 7.45 | 52.57 | 74.00 | -21.43 | Peak |

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss

# 5. BAND EDGE

## 5.1 Limits

FCC PART 15.247 Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

## 5.2 Test Procedure

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW to 1MHz and VBM to 3MHz to measure the peak field strength and set RBW to 1MHz and VBW to 10kHz to measure the average radiated field strength. The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capture the highest in-band emission and the emission at the band edge. Set RBW to 100 KHz and VBW to 300 KHz, to measure the conducted peak band edge.

## 5.3 Test Result

PASS

Radiated Band Edge Test:

Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 902 | 56.24 | -5.81 | 50.43 | 74.00 | -23.57 | PK |
| 902 | 53.14 | -5.81 | 47.33 | 54.00 | -6.67 | AV |
| 928 | 57.05 | -5.84 | 51.21 | 74.00 | -22.79 | PK |
| 928 | 53.25 | -5.84 | 47.41 | 54.00 | -6.59 | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 902 | 56.85 | -5.81 | 51.04 | 74.00 | -22.96 | PK |
| 902 | 53.47 | -5.81 | 47.66 | 54.00 | -6.34 | AV |
| 928 | 57.12 | -5.84 | 51.28 | 74.00 | -22.72 | PK |
| 928 | 53.26 | -5.84 | 47.42 | 54.00 | -6.58 | AV |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

# 6. OCCUPIED BANDWIDTH MEASUREMENT

## 6.1 Test Setup

Same as Radiated Emission Measurement

## 6.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Spectrum Setting : RBW= 1KHz, VBW=3KHz, Sweep time = Auto.
4. The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector.

## 6.3 Measurement Equipment Used

Same as Radiated Emission Measurement

## 6.4 Test Result

PASS

GFSK Modulation:

| Frequency (MHz) | 20dB Bandwidth (kHz) | Result |
|---|---|---|
| 902.3 | 148.4 | PASS |
| 908.7 | 145.2 | PASS |
| 914.9 | 145.4 | PASS |

CH: 902.3MHz

CH: 908.7MHz


CH: 914.9MHz

# 7. MAXIMUM PEAK OUTPUT POWER

## 7.1 Test Setup


## 7.2 Test Procedure

According to ANSI C63.10:2013 Maximum peak conducted output power for HFSS devices:
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.
The maximum Average conducted output power may be measured using a wideband RF power meter with a thermocouple derector or equivalent. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

## 7.3 Limit

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

## 7.4 Test Result

PASS

| Frequency | Peak Output power (dBm) | Limit (dBm) | Result |
|---|---|---|---|
| 902.3 | 29.579 | 30 | Pass |
| 908.7 | 29.655 | | |
| 914.9 | 29.479 | | |

# 8. FREQUENCY SEPARATION

## 8.1 Test Setup


## 8.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30KHz and VBW=100KHz.

## 8.3 Limit

According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

## 8.4 Test Result

PASS

| Frequency | CH Separation (kHz) | Limit (MHz) | Result |
|---|---|---|---|
| 902.3 | 559.0 | 148.4 | pass |
| 908.7 | 612.5 | 145.2 | pass |
| 914.9 | 581.2 | 145.4 | pass |

CH: 902.3MHz

CH: 908.7MHz


CH: 914.9MHz

# 9. CONDUCTED SPURIOUS & BAND EDGE EMISSION

## 9.1 Test Setup


## 9.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as TX operation and connect directly to the spectrum analyzer.
3. Based on FCC Part15 C Section 15.247: RBW=100KHz, VBW=300KHz.
4. Set detected by the spectrum analyzer with peak detector.

## 9.3 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20dB.

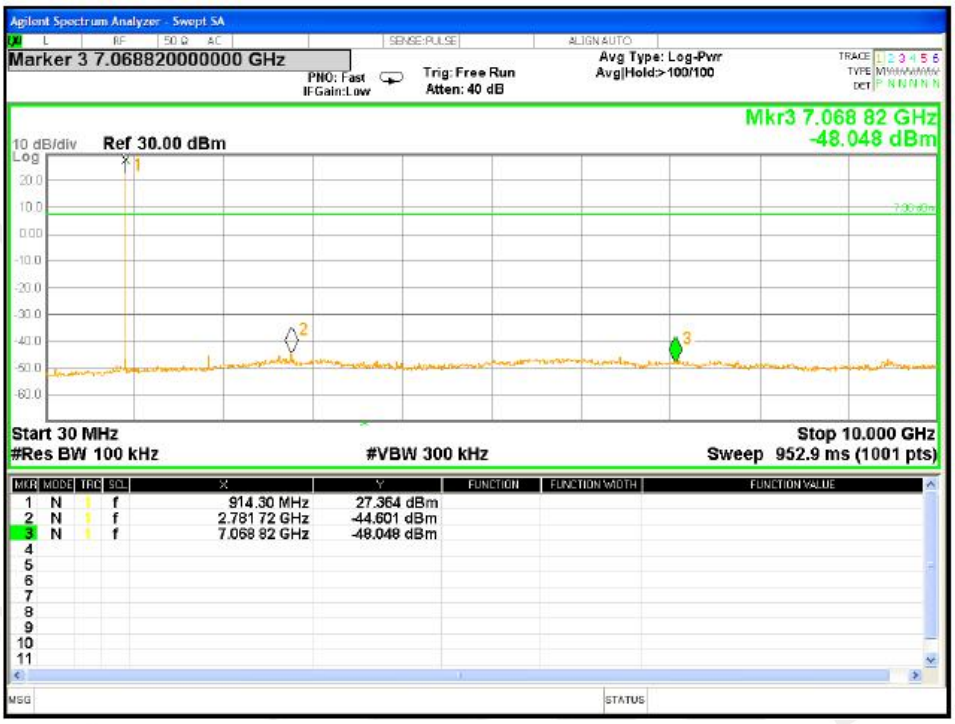
## 9.4 Test Result

PASS

CH: 902.3MHz


CH: 908.7MHz

CH: 914.9MHz




For Band edge

CH: 902.3MHz

CH: 914.9MHz


For Hopping Band edge

CH: 902.3MHz

CH: 914.9MHz


Agilent Spectrum Analyzer - Swept SA
Marker 3 955.540000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr3 955.540 MHz
-51.962 dBm
10 dB/div
Ref 30.00 dBm
Log
Start 900.00 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.00000 GHz
Sweep 7.267 ms (1001 pts)
1 N 1 f 914.280 MHz 24.902 dBm
2 N 1 f 928.104 MHz -29.033 dBm
3 N 1 f 955.540 MHz -51.962 dBm

# 10. NUMBER OF HOPPING FREQUENCY

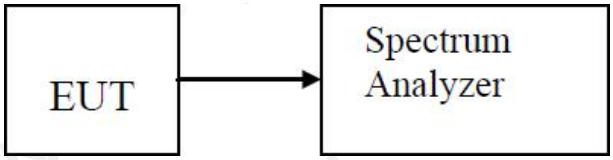
## 10.1 Test Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

## 10.2 Test Procedure

The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below, Spectrum Setting : RBW= 100KHz, VBW=300KHz, Sweep time = Auto.

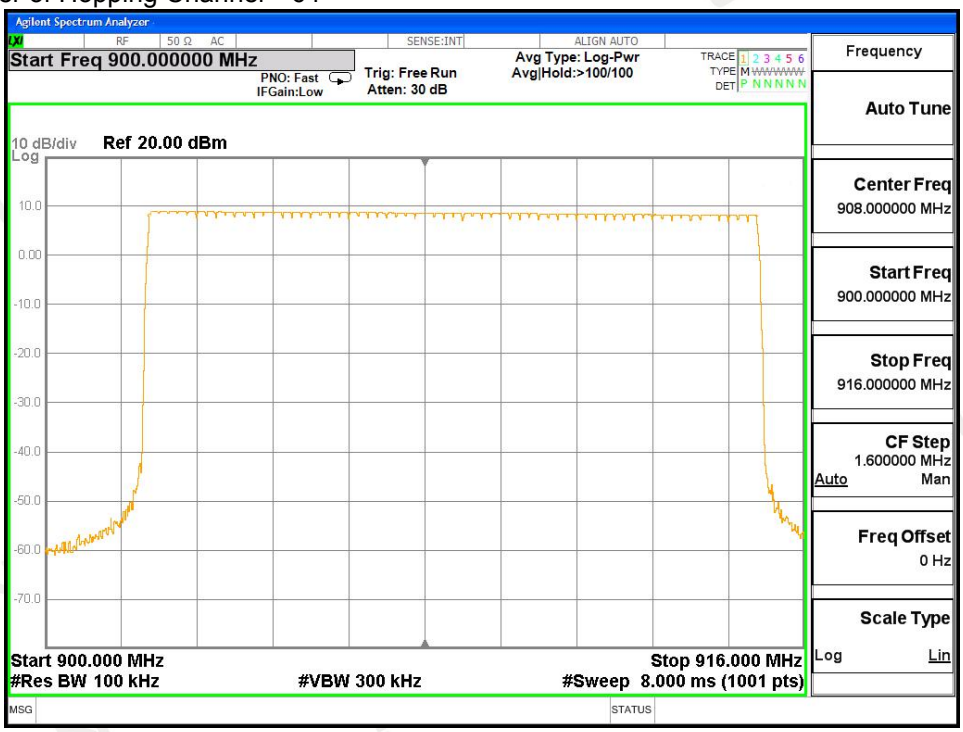
## 10.3 Test Setup




## 10.4 Test Result

PASS

Number of Hopping Channel 64



# 11. TIME OF OCCUPANCY(DWELL TIME)

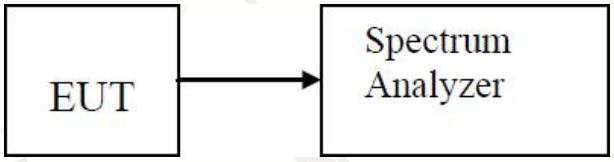
## 11.1 Test Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

## 11.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator.
Set center frequency of spectrum analyzer=operating frequency with RBW=1MHz and VBW=3MHz,Span=0Hz.
Sweep Time is 20 second.
Set the center frequency on any frequency would be measure and set the frequency span to zero span.

## 11.3 Test Setup



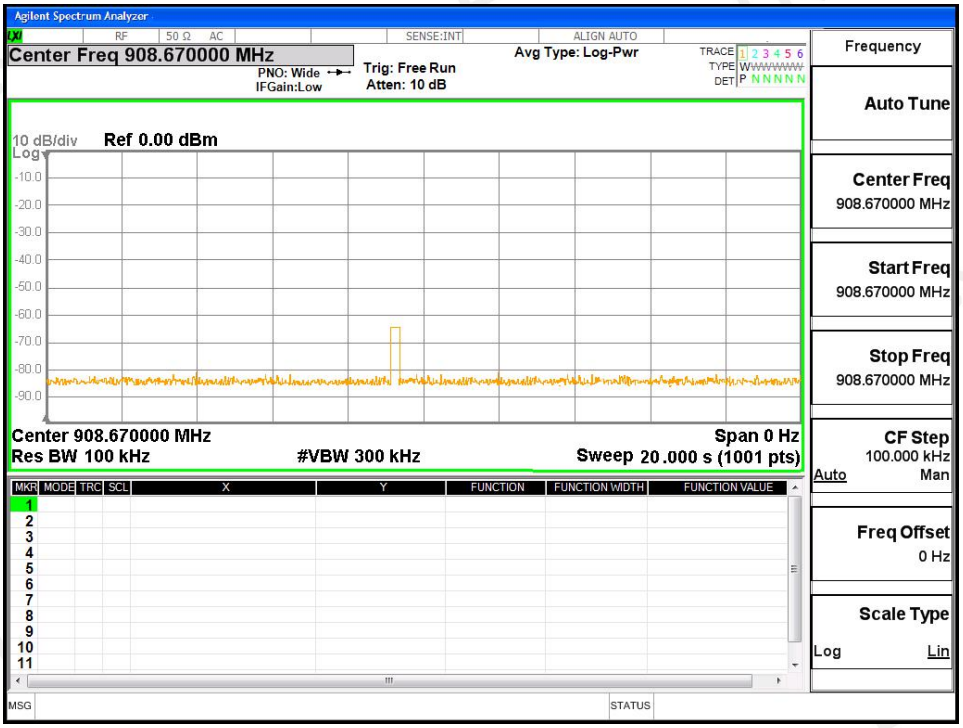

## 11.4 Test Result

PASS

| Frequency | Dwell Time(ms) | Limit(ms) | Result |
|---|---|---|---|
| 902.3 | 375.0 | 400 | Pass |
| 908.7 | 372.9 | 400 | Pass |
| 914.9 | 372.9 | 400 | Pass |

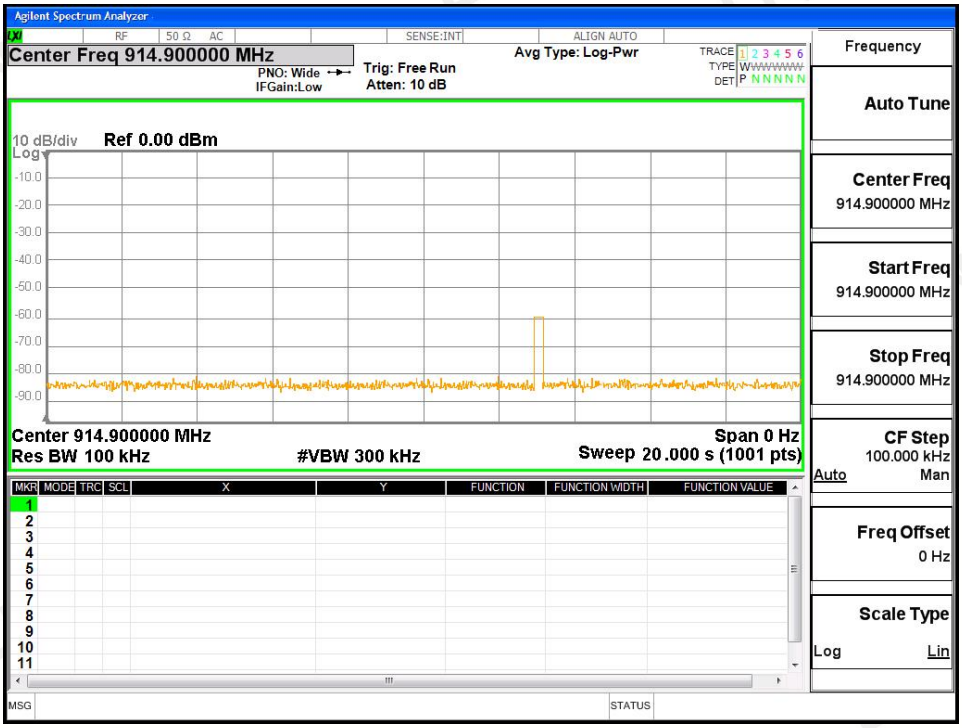
CH: 902.3MHz


CH: 908.7MHz


Agilent Spectrum Analyzer
Center Freq 908.670000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Frequency
Auto Tune
10 dB/div
Ref 0.00 dBm
Center Freq 908.670000 MHz
Start Freq 908.670000 MHz
Stop Freq 908.670000 MHz
Center 908.670000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 20.000 s (1001 pts)
CF Step 100.000 kHz
Auto
Man
Freq Offset 0 Hz
Scale Type
Log
Lin
MSG
STATUS


Agilent Spectrum Analyzer
Center Freq 908.670000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Frequency
Auto Tune
ΔMkr1 372.9 ms
-0.30 dB
10 dB/div
Ref 0.00 dBm
Center Freq 908.670000 MHz
Start Freq 908.670000 MHz
Stop Freq 908.670000 MHz
Center 908.670000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 1.000 s (1001 pts)
CF Step 100.000 kHz
Auto
Man
Freq Offset 0 Hz
Scale Type
Log
Lin
1 Δ2 1 t (Δ) 372.9 ms (Δ) -0.30 dB
2 F 1 t 66.77 ms -83.77 dBm
MSG
STATUS

CH: 914.9MHz


Agilent Spectrum Analyzer
Center Freq 914.900000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
10 dB/div
Ref 0.00 dBm
Center 914.900000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 20.000 s (1001 pts)
Frequency
Auto Tune
Center Freq
914.900000 MHz
Start Freq
914.900000 MHz
Stop Freq
914.900000 MHz
CF Step
100.000 kHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

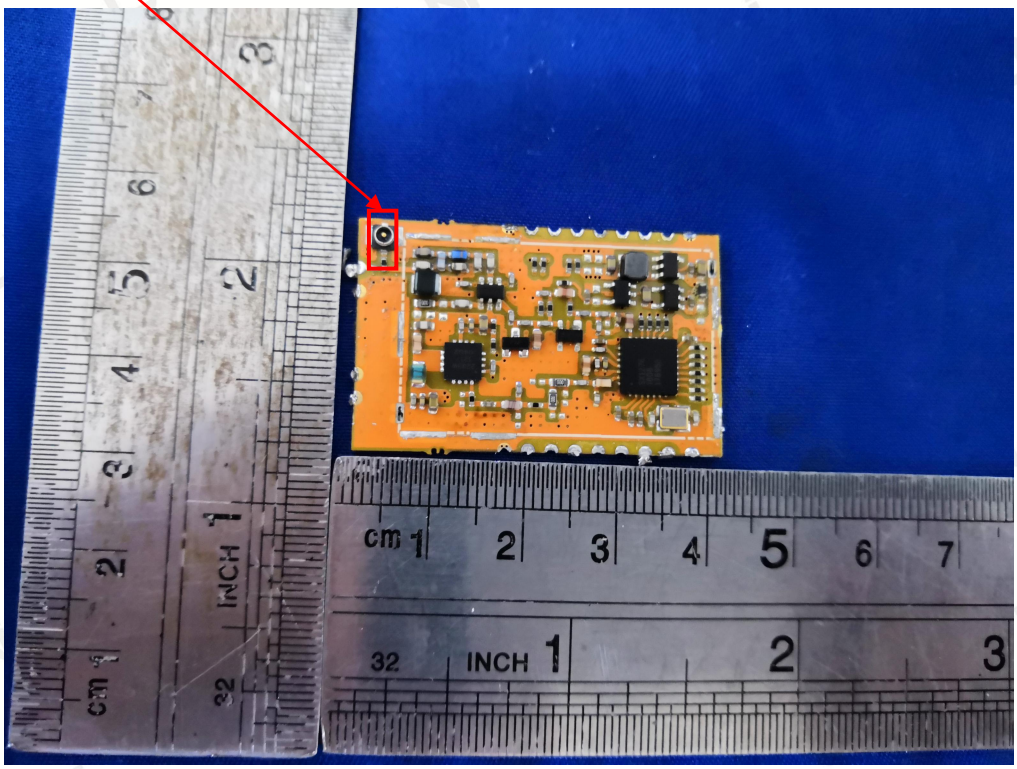

Agilent Spectrum Analyzer
Center Freq 914.900000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
ΔMkr1 372.9 ms
0.48 dB
10 dB/div
Ref 0.00 dBm
1Δ2
Center 914.900000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 1.000 s (1001 pts)
1 Δ2 1 t (Δ) 372.9 ms (Δ) 0.48 dB
2 F 1 t 345.5 ms -84.69 dBm
Frequency
Auto Tune
Center Freq
914.900000 MHz
Start Freq
914.900000 MHz
Stop Freq
914.900000 MHz
CF Step
100.000 kHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

## 12. ANTENNA REQUIREMENT

Standard Applicable:
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

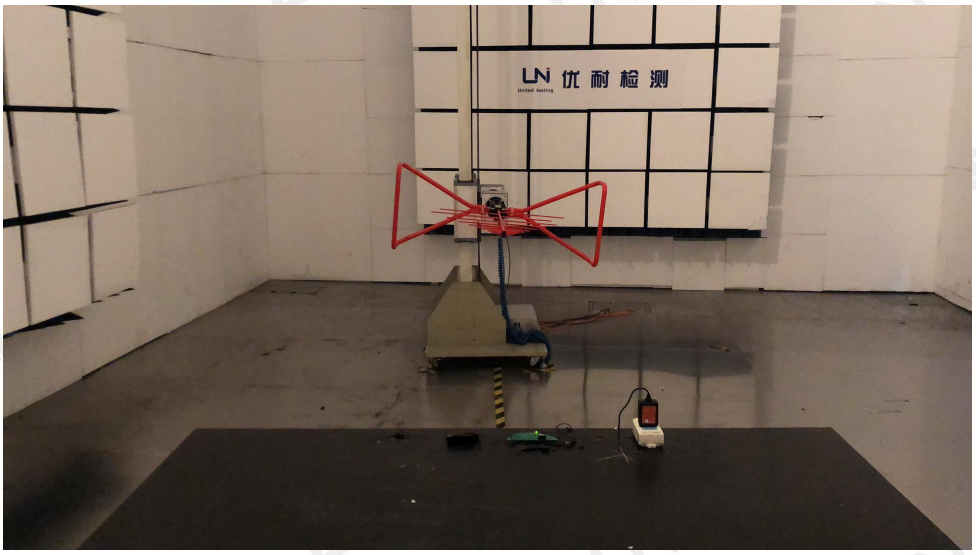
Antenna Connected Construction
The antenna used in this product is an Extenal antenna, The directional gains of antenna used for transmitting is 1.5dBi.

BT ANTENNA:



## 13. PHOTOGRAPH OF TEST

**Radiated Emission**
**(Below 1G)**




**Radiated Emission**
**(Above 1G)**


**Conducted Emission**

***End of Report***