# RF Test Report

## For

## Globe Electric Company Inc.

| | |
|---|---|
| **Test Standards:** | Part 15C Subpart C §15.247<br>IC RSS-247 Issue 2 |
| **Product Name:** | 2-outlet wifi smart socket |
| **Tested Model:** | 50155 |
| **Brand Name:** | Globe |
| **FCC ID:** | 2AQUQGE50155 |
| **IC:** | 8290A-GE50155 |
| **Classification** | (DTS) Digital Transmission System |
| **Report No.:** | EC2101014RF02 |
| **Tested Date:** | 2021-01-08 to 2021-01-21 |
| **Issued Date:** | 2021-01-21 |
| **Prepared By:** | Jack Liu / Engineer |
| **Approved By:** | Tiny Yang / RF Manager |


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# Report Revise Record

| Report Version | Revise Time | Issued Date | Valid Version | Notes |
|---|---|---|---|---|
| V1.0 | / | 2021.01.21 | Valid | Original Report |

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# Summary of Test RESULT

| FCC Rule | IC Rule | Description | Limit | Result | Remark |
|---|---|---|---|---|---|
| 15.247(a)(2) | RSS-247 5.2(a) | 6dB Bandwidth | ≥ 0.5MHz | Pass | - |
| - | RSS-Gen 6.7 | 99% Bandwidth | - | Pass | - |
| 15.247(b)(3) | RSS-247 5.4(d) | Peak Output Power | ≤ 30dBm | Pass | - |
| 15.247(e) | RSS-247 5.2(b) | Power Spectral Density | ≤ 8dBm/3kHz | Pass | - |
| 15.247(d) | RSS-247 5.5 | Conducted Band Edges and Spurious Emission | ≤ 20dBc | Pass | - |
| 15.247(d) | RSS-247 5.5 | Radiated Band Edges and Spurious Emission | 15.209(a) & 15.247(d) RSS-247 5.5 & RSS-Gen Table 5 , Table 6 | Pass | Under limit 6.02 dB at 926.280 MHz |
| 15.207 | RSS-GEN 8.8 | AC Conducted Emission | 15.207(a) RSS-GEN 8.8 Table 4 | Pass | Under limit 20.92 dB at 0.705 MHz |
| 15.203 & 15.247(b) | RSS-GEN 6.8 | Antenna Requirement | 15.203 & 15.247(b) RSS-GEN 6.8 | Pass | - |

# 1. Test Laboratory

## 1.1 Test facility

### CNAS ( accreditation number:L11138 )

Hunan Ecloud Testing Technology Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

### FCC (Designation number:CN1244 , Test Firm Registration Number:793308 )

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

### ISED(CAB identifier: CN0012, ISED# :24347)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the Wireless Device Testing Laboratories list of innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.

### A2LA (Certificate Number:4895.01)

Hunan Ecloud Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

# 2. General Description

## 2.1 Applicant

**Globe Electric Company Inc.**
150, Oneida, Montreal, Quebec, Canada, H9R 1A8

## 2.2 Manufacturer

**Globe Electric Company Inc.**
150, Oneida, Montreal, Quebec, Canada, H9R 1A8

## 2.3 General Description Of EUT

| | |
|---|---|
| **Product** | 2-outlet wifi smart socket |
| **Model No.** | 50155 |
| **Brand Name** | Globe |
| **Additional No.** | N/A |
| **Difference Description** | N/A |
| **FCC ID** | 2AQUQGE50155 |
| **IC** | 8290A-GE50155 |
| **Power Supply** | 125Vac |
| **Modulation Technology** | BLE |
| **Modulation Type** | GFSK |
| **Operating Frequency** | 2402MHz~2480MHz |
| **Number Of Channel** | 40 |
| **Max. Output Power** | 4.07 dBm (0.0026 W) |
| **Max. e.i.r.p.** | 3.07 dBm (0.0020W) |
| **Antenna Type** | PCB Antenna type with -1dBi gain |
| **HW Version** | SK521WU-P1 200717 |
| **SW Version** | 1.1.0 |
| **I/O Ports** | Refer to user's manual |

**NOTE:**

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

3. *: Pre-test AC120V and AC125V, only the worst AC125V test data is recorded in the report

## 2.4 Modification of EUT

No modifications are made to the EUT during all test items.

## 2.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- ANSI C63.10-2013
- KDB 558074 D01 15.247 Meas Guidance v05r02
- IC RSS-247 Issue 2
- IC RSS-Gen Issue 5

**Remark:**

1. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B&ICES-003, recorded in a separate test report.

# 3. Test Configuration of Equipment Under Test

## 3.1 Descriptions of Test Mode

The transmitter has a maximum peak conducted output power as follows:

| Channel | Frequency | Mode | Bluetooth RF Output Power |
|---|---|---|---|
| Ch00 | 2402MHz | GFSK | 4.07 |
| Ch19 | 2440MHz | GFSK | 3.85 |
| Ch39 | 2480MHz | GFSK | 3.71 |

a. Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

## 3.2 Test Mode

### 3.2.1 Antenna Port Conducted Measurement

| Summary table of Test Cases | |
|---|---|
| Test Item | Data Rate / Modulation |
| | Bluetooth 4.2 – LE GFSK |
| Conducted Test Cases | Mode 1: CH00_2402 MHz<br>Mode 2: CH19_2440 MHz<br>Mode 3: CH39_2480 MHz |

### 3.2.2 Radiated Emission Test (Below 1GHz)

| Radiated Test Cases | Bluetooth 4.2 – LE GFSK |
|---|---|
| | Mode 1: CH00_2402 MHz |

Note : 1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type. Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

2. Following channel(s) was (were) selected for the final test as listed above

### 3.2.3 Radiated Emission Test (Above 1GHz)

| Radiated Test Cases | Bluetooth 4.2 – LE GFSK |
|---|---|
| | Mode 1: CH00_2402 MHz<br>Mode 2: CH19_2440 MHz |

| | |
|---|---|
| | Mode 3: CH39_2480 MHz |

Note : 1. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

2. Following channel(s) was (were) selected for the final test as listed above

3. For frequency above 18GHz, the measured value is much lower than the limit, therefore, it is not reflected in the report.

### 3.2.4 Power Line Conducted Emission Test:

| | |
|---|---|
| **AC Conducted Emission** | Mode 1 : Bluetooth Link + Switch On+ Charging |

## 3.3 Support Equipment

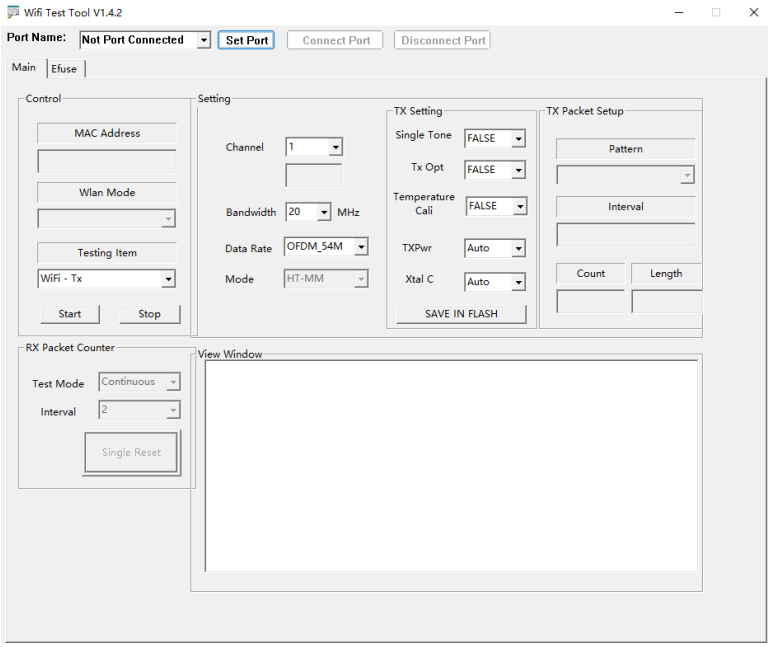
| Item | Equipment | Trade Name | Model Name | FCC ID | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1. | WLAN AP | NETGARE | R7800 | PY315100319 | N/A | unshielded AC I/P cable1.2 m |
| 2. | Notebook | Lenovo | E470C | FCC DoC | N/A | shielded cable DC O/P 1.8 m unshielded AC I/P cable1.2 m |
| 3. | Huawei | Cell Phone | ELE-AL00 | N/A | N/A | N/A |

## 3.4 Test Setup

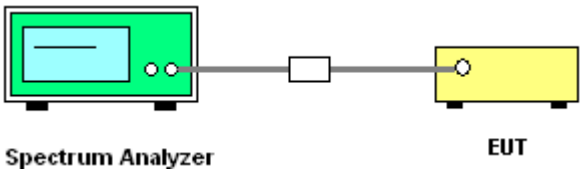
The EUT is continuously communicating to the Bluetooth tester during the tests.

EUT was set in the Hidden menu mode to enable BT communications.

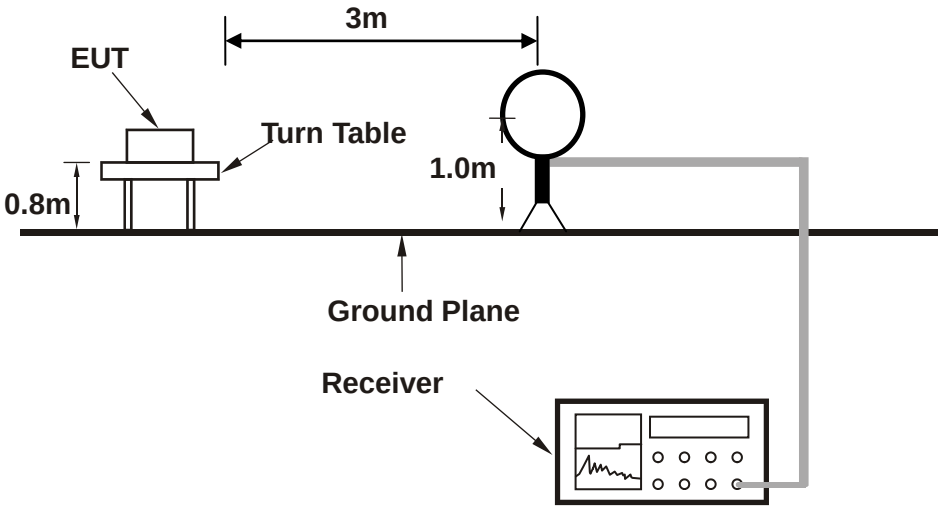
The following picture is a screenshot of the test software



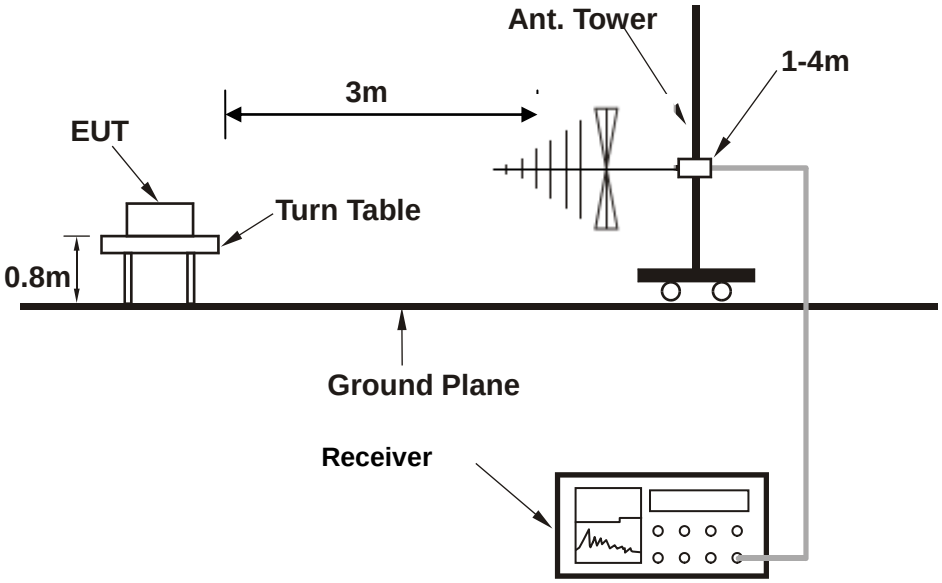

**Setup diagram for Conducted Test**



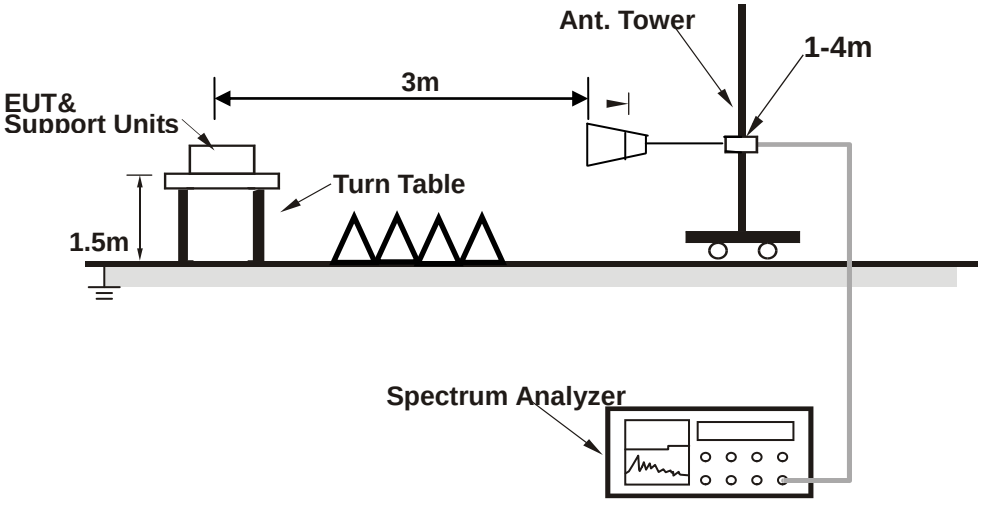

**Setup diagram for Radiation(9KHz~30MHz) Test**



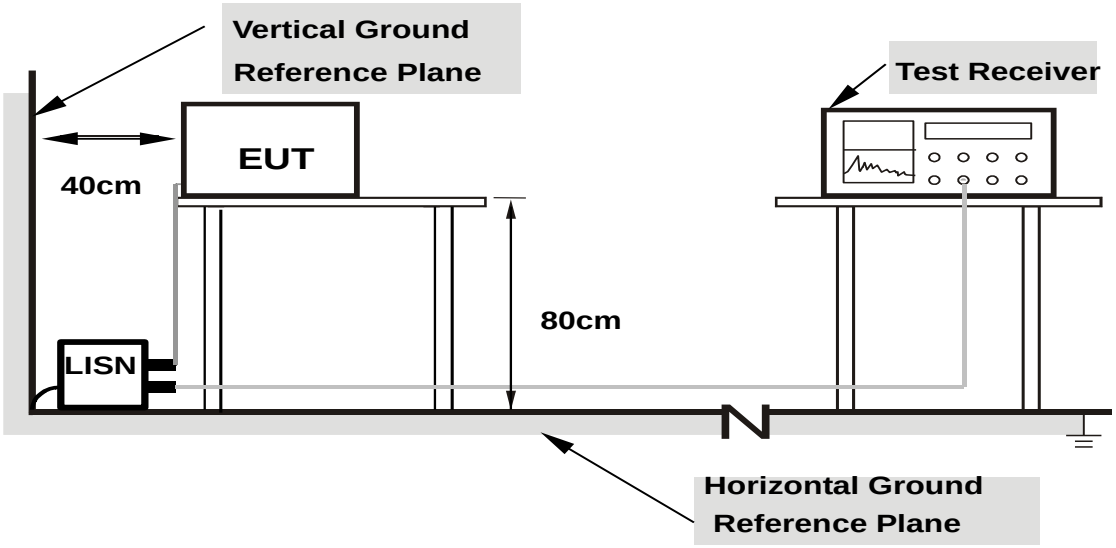
**Setup diagram for Radiation(Below 1G) Test**




**Setup diagram for Radiation (Above1G) Test**



**Setup diagram for AC Conducted Emission Test**




**Note: 1.Support units were connected to second LISN.**
**2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes**

## 3.5 Measurement Results Explanation Example

**For all conducted test items:**

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 5 dB and 10dB attenuator.

*Offset(dB) = RF cable loss(dB) + attenuator factor(dB).*

= 5 + 10 = 15 (dB)

**For all radiated test items:**

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

Over Limit (dB μ V/m) = Level(dB μ V/m) - Limit Level (dB μ V/m)

# 4. Test Result

## 4.1 6dB and 99% Bandwidth Measurement

### 4.1.1 Limit of 6dB and 99% Bandwidth

FCC §15.247 (a) (2)

IC RSS-247 5.2(a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

### 4.1.2 Test Procedures

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. Set to the maximum power setting and enable the EUT transmit continuously
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 30kHz and set the Video bandwidth (VBW) = 100kHz.

### 4.1.3 Test Result of 6dB Bandwidth

Refer to Appendix A of this test report.

### 4.1.4 Test Result of 99% Bandwidth

Refer to Appendix B of this test report.

## 4.2 Peak Output Power Measurement

### 4.2.1 Limit of Peak Output Power

FCC §15.247 (b)(3)

For systems using digital modulation in the 2400-2483.5 MHz bands: 30dBm.

IC RSS-247 A5.4(d)

For DTSs employing digital modulation techniques operating in the bands 902-928MHz and 2400-2483.5MHz, the maximum peak conducted output power shall not exceed 1 W.

The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e)

### 4.2.2 Test Procedures

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to spectrum analyzer.
3. Set to the maximum power setting and enable the EUT transmit continuously
4. Set the RBW≥DTS Bandwidth,VBW≥3*RBW,Span≥1.5*DTS Bandwidth,Detector=Peak,Sweep time=auto couple,Trace mode=max holde.
5. Allow trace to fully stabilize, Use peak marker function to determine the peak amplitude level.
6. Measure the conducted output power

### 4.2.3 Test Result of Peak Output Power

Refer to Appendix C of this test report.

# 4.3 Power Spectral Density Measurement

## 4.3.1 Limits of Power Spectral Density

FCC§15.247(e)

IC RSS-247 5.2(b)

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

## 4.3.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
4. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
5. Measure and record the results in the test report.
6. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

## 4.3.3 Test Result of Power Spectral Density

Refer to Appendix D of this test report.

# 4.4 Conducted Band Edges and Spurious Emission Measurement

## 4.4.1 Limit of Conducted Band Edges and Spurious Emission

FCC §15.247 (d)

IC RSS-247 5.5

Maximum conducted (average) output power was used to determine compliance, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

## 4.4.2 Test Procedures

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

## 4.4.3 Test Result of Conducted Band Edges

Refer to Appendix E of this test report.

## 4.4.4 Test Result of Conducted Spurious Emission

Refer to Appendix F of this test report.

## 4.5 Radiated Band Edges and Spurious Emission Measurement

### 4.5.1 Limit of Radiated Band Edges and Spurious Emission

FCC §15.247 (d)

IC RSS-247 5.5

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

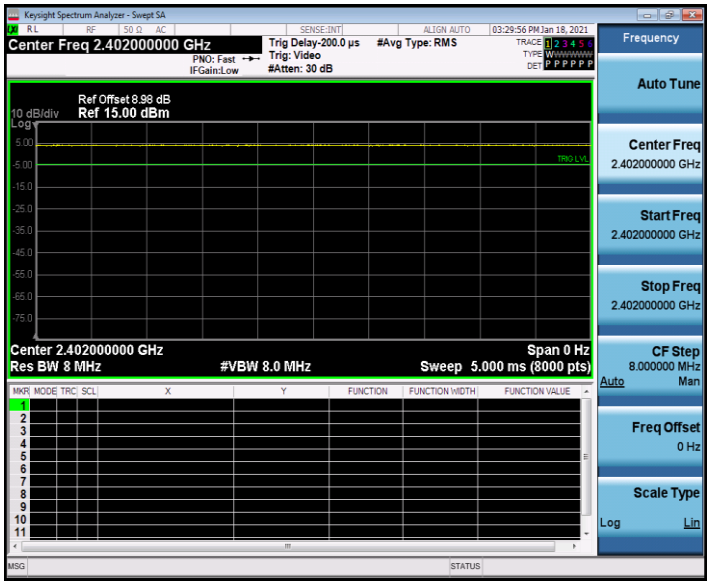
| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100 | 3 |
| 88 – 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 4.5.2 Test Procedures

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The measurement distance is 3 meter.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement:
   VBW = 10 Hz, when duty cycle is no less than 98 percent.
   VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission

duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

| Band | Duty Cycle(%) | T(ms) | 1/T(kHz) | VBW Setting |
|---|---|---|---|---|
| Bluetooth 4.2 - LE | 100 | | | 10Hz |



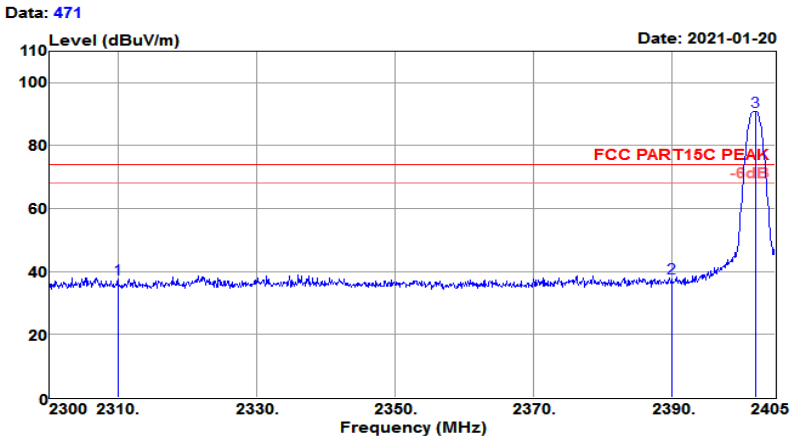

## 4.5.3 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

### 4.5.4 Test Result of Radiated Spurious at Band Edges

| Test Mode : | BLE CH00 (2402 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 2.3GHz~2.405GHz | Polarization : | Horizontal |

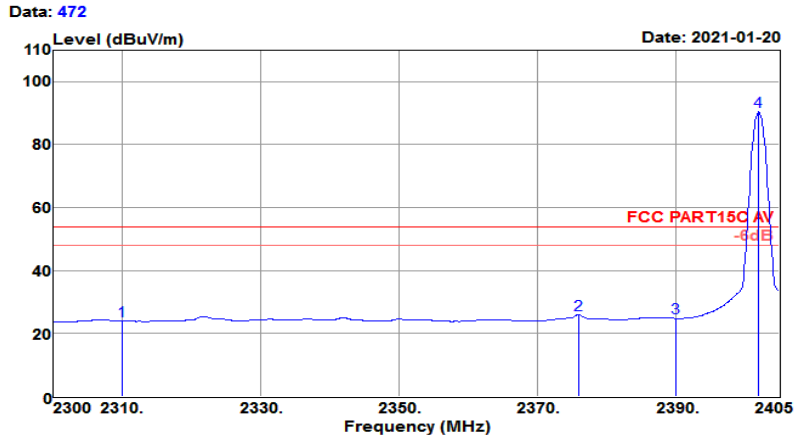
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                ----------------
Tested by    : Jack                      Pol/Phase    : HORIZONTAL
               --------------------------                ----------------
Test Mode    : Ble CH00(2402MHz)         Power rating: 125VAc
               --------------------------                ----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2310.000 | 41.65 | 27.38 | 4.11 | 35.61 | 37.53 | 74.00 | -36.47 | Peak |
| 2390.000 | 42.05 | 27.56 | 4.18 | 35.79 | 38.00 | 74.00 | -36.00 | Peak |
| 2402.270 | 94.86 | 27.58 | 4.19 | 35.82 | 90.81 | 74.00 | 16.81 | Peak |

| Test Mode : | BLE CH00 (2402 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 2.3GHz~2.405GHz | Polarization : | Horizontal |

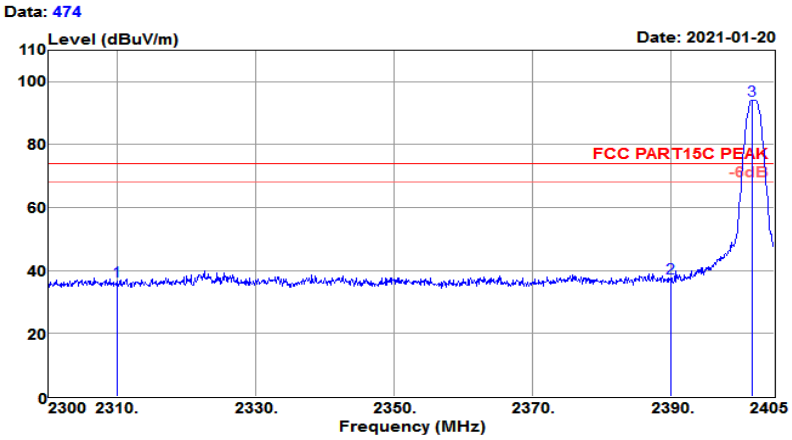
Test Site : 3m Chamber  Temp/Humi : 25℃/64%
Tested by : Jack  Pol/Phase : HORIZONTAL
Test Mode : Ble CH00(2402MHz)  Power rating: 125VAc




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2310.000 | 28.18 | 27.38 | 4.11 | 35.61 | 24.06 | 54.00 | -29.94 | Average |
| 2376.020 | 30.11 | 27.53 | 4.17 | 35.76 | 26.05 | 54.00 | -27.95 | Average |
| 2390.000 | 28.90 | 27.56 | 4.18 | 35.79 | 24.85 | 54.00 | -29.15 | Average |
| 2402.060 | 94.45 | 27.58 | 4.19 | 35.82 | 90.40 | 54.00 | 36.40 | Average |

| Test Mode : | BLE CH00 (2402 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 2.3GHz~2.405GHz | Polarization : | Vertical |

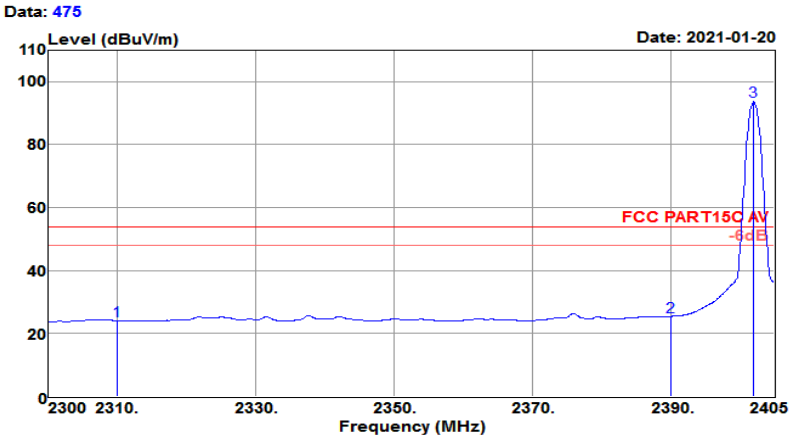
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                -----------------
Tested by    : Jack                      Pol/Phase    : VERTICAL
               --------------------------                -----------------
Test Mode    : Ble CH00(2402MHz)         Power rating: 125VAc
               --------------------------                -----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2310.000 | 40.94 | 27.38 | 4.11 | 35.61 | 36.82 | 74.00 | -37.18 | Peak |
| 2390.000 | 41.84 | 27.56 | 4.18 | 35.79 | 37.79 | 74.00 | -36.21 | Peak |
| 2401.850 | 98.21 | 27.58 | 4.19 | 35.82 | 94.16 | 74.00 | 20.16 | Peak |

| Test Mode : | BLE CH00 (2402 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 2.3GHz~2.405GHz | Polarization : | Vertical |

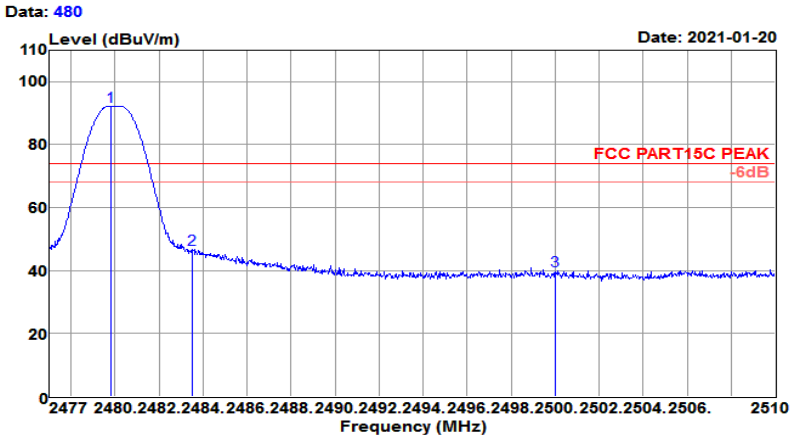
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                -----------------
Tested by    : Jack                      Pol/Phase    : VERTICAL
               --------------------------                -----------------
Test Mode    : Ble CH00(2402MHz)         Power rating: 125VAc
               --------------------------                -----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2310.000 | 28.23 | 27.38 | 4.11 | 35.61 | 24.11 | 54.00 | -29.89 | Average |
| 2390.000 | 29.52 | 27.56 | 4.18 | 35.79 | 25.47 | 54.00 | -28.53 | Average |
| 2402.060 | 97.71 | 27.58 | 4.19 | 35.82 | 93.66 | 54.00 | 39.66 | Average |

| Test Mode : | BLE CH39 (2480 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 2.477GHz~2.51GHz | Polarization : | Horizontal |

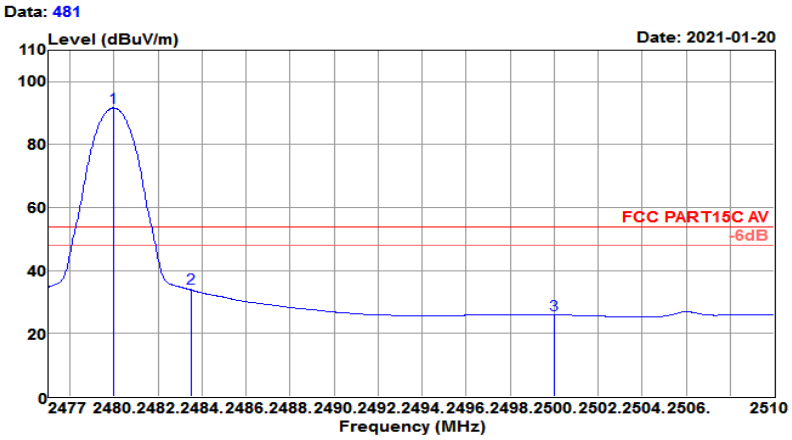
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                ----------------
Tested by    : Jack                      Pol/Phase    : HORIZONTAL
               --------------------------                ----------------
Test Mode    : Ble CH39(2480MHz)         Power rating: 125VAc
               --------------------------                ----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2479.838 | 96.27 | 27.76 | 4.26 | 35.99 | 92.30 | 74.00 | 18.30 | Peak |
| 2483.500 | 50.73 | 27.76 | 4.26 | 36.00 | 46.75 | 74.00 | -27.25 | Peak |
| 2500.000 | 43.79 | 27.80 | 4.28 | 36.04 | 39.83 | 74.00 | -34.17 | Peak |

| Test Mode : | BLE CH39 (2480 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 2.477GHz~2.51GHz | Polarization : | Horizontal |

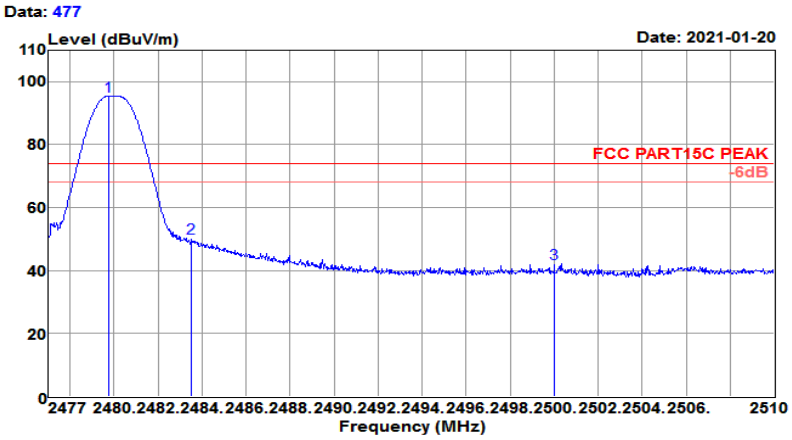
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                ----------------
Tested by    : Jack                      Pol/Phase    : HORIZONTAL
               --------------------------                ----------------
Test Mode    : Ble CH39(2480MHz)         Power rating: 125VAc
               --------------------------                ----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2479.970 | 95.67 | 27.76 | 4.26 | 35.99 | 91.70 | 54.00 | 37.70 | Average |
| 2483.500 | 38.41 | 27.76 | 4.26 | 36.00 | 34.43 | 54.00 | -19.57 | Average |
| 2500.000 | 30.01 | 27.80 | 4.28 | 36.04 | 26.05 | 54.00 | -27.95 | Average |

| Test Mode : | BLE CH39 (2480 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 2.477GHz~2.51GHz | Polarization : | Vertical |

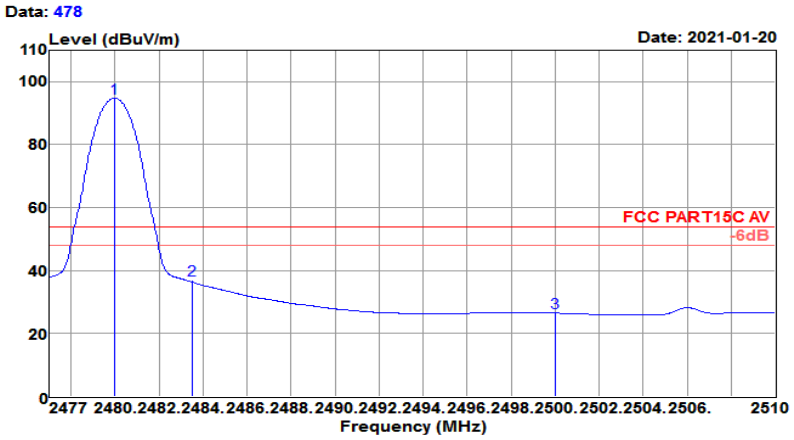
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                -----------------
Tested by    : Jack                      Pol/Phase    : VERTICAL
               --------------------------                -----------------
Test Mode    : Ble CH39(2480MHz)         Power rating: 125VAc
               --------------------------                -----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2479.739 | 99.37 | 27.76 | 4.26 | 35.99 | 95.40 | 74.00 | 21.40 | Peak |
| 2483.500 | 54.43 | 27.76 | 4.26 | 36.00 | 50.45 | 74.00 | -23.55 | Peak |
| 2500.000 | 46.11 | 27.80 | 4.28 | 36.04 | 42.15 | 74.00 | -31.85 | Peak |

| Test Mode : | BLE CH39 (2480 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 2.477GHz~2.51GHz | Polarization : | Vertical |

| | | | |
|---|---|---|---|
| Test Site | : 3m Chamber | Temp/Humi | : 25℃/64% |
| Tested by | : Jack | Pol/Phase | : VERTICAL |
| Test Mode | : Ble CH39(2480MHz) | Power rating | : 125VAc |

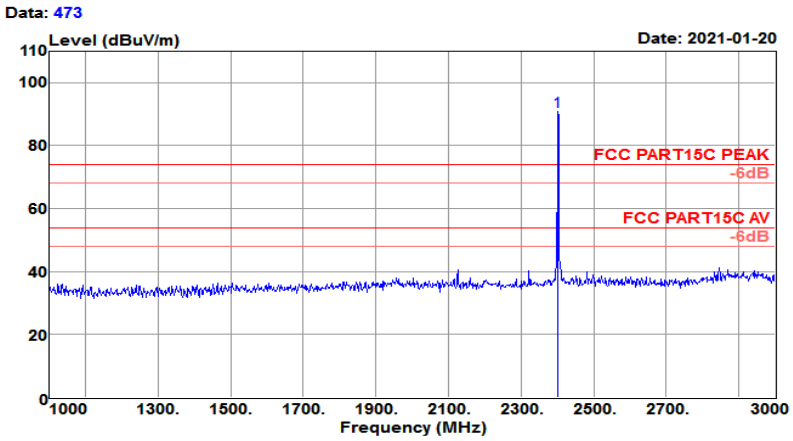



| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2479.970 | 98.78 | 27.76 | 4.26 | 35.99 | 94.81 | 54.00 | 40.81 | Average |
| 2483.500 | 40.94 | 27.76 | 4.26 | 36.00 | 36.96 | 54.00 | -17.04 | Average |
| 2500.000 | 30.47 | 27.80 | 4.28 | 36.04 | 26.51 | 54.00 | -27.49 | Average |

### 4.5.5 Test Result of Radiated Spurious Emission (1GHz ~ 10th Harmonic)

| Test Mode : | BLE CH00 (2402 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 1GHz~3GHz | Polarization : | Horizontal |

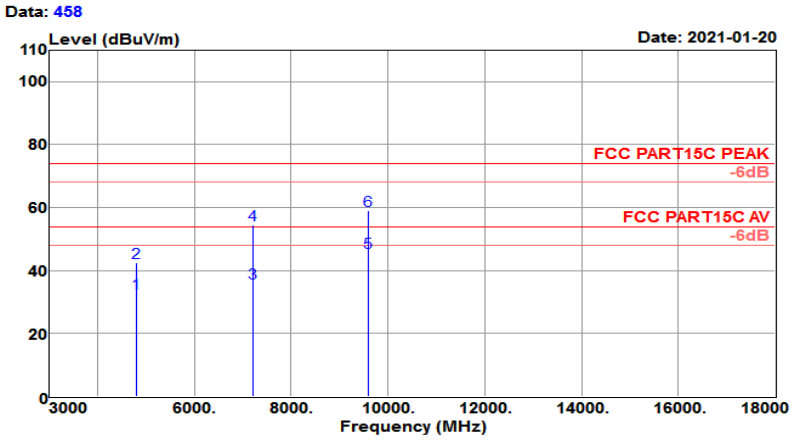
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                ----------------
Tested by    : Jack                      Pol/Phase    : HORIZONTAL
               --------------------------                ----------------
Test Mode    : Ble CH00(2402MHz)         Power rating: 125VAc
               --------------------------                ----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2402.000 | 94.94 | 27.58 | 4.19 | 35.82 | 90.89 | 74.00 | 16.89 | Peak |

| Test Mode : | BLE CH00 (2402 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 3GHz~18GHz | Polarization : | Horizontal |

```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                ----------------
Tested by    : Jack                      Pol/Phase    : HORIZONTAL
               --------------------------                ----------------
Test Mode    : Ble CH00(2402MHz)         Power rating: 125VAc
               --------------------------                ----------------
```

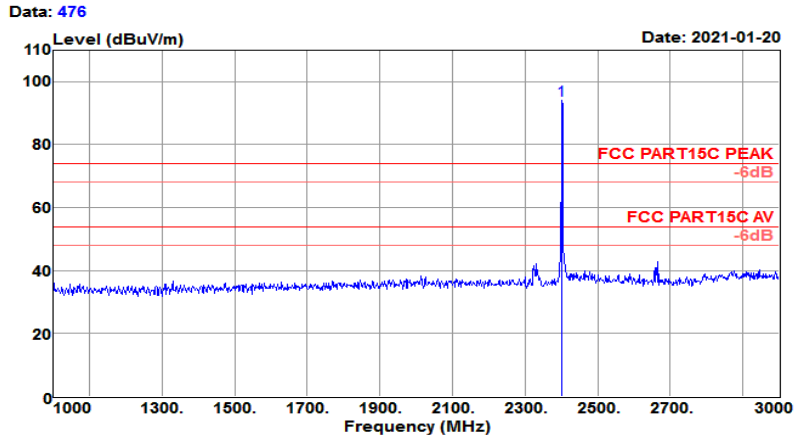



| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 4804.000 | 31.85 | 30.93 | 6.09 | 36.03 | 32.84 | 54.00 | -21.16 | Average |
| 4804.000 | 41.67 | 30.93 | 6.09 | 36.03 | 42.66 | 74.00 | -31.34 | Peak |
| 7206.000 | 25.77 | 35.39 | 9.22 | 34.25 | 36.13 | 54.00 | -17.87 | Average |
| 7206.000 | 44.15 | 35.39 | 9.22 | 34.25 | 54.51 | 74.00 | -19.49 | Peak |
| 9608.000 | 27.23 | 38.39 | 12.26 | 32.19 | 45.69 | 54.00 | -8.31 | Average |
| 9608.000 | 40.71 | 38.39 | 12.26 | 32.19 | 59.17 | 74.00 | -14.83 | Peak |

Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

| Test Mode : | BLE CH00 (2402 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 1GHz~3GHz | Polarization : | Vertical |

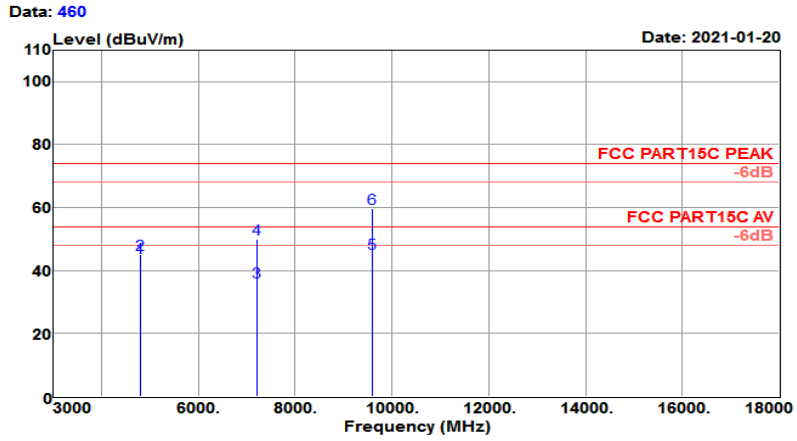
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                -----------------
Tested by    : Jack                      Pol/Phase    : VERTICAL
               --------------------------                -----------------
Test Mode    : Ble CH00(2402MHz)         Power rating: 125VAc
               --------------------------                -----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2402.000 | 98.18 | 27.58 | 4.19 | 35.82 | 94.13 | 74.00 | 20.13 | Peak |

| Test Mode : | BLE CH00 (2402 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 3GHz~18GHz | Polarization : | Vertical |

| | | | |
|---|---|---|---|
| Test Site | : 3m Chamber | Temp/Humi | : 25℃/64% |
| Tested by | : Jack | Pol/Phase | : VERTICAL |
| Test Mode | : Ble CH00(2402MHz) | Power rating | : 125VAc |

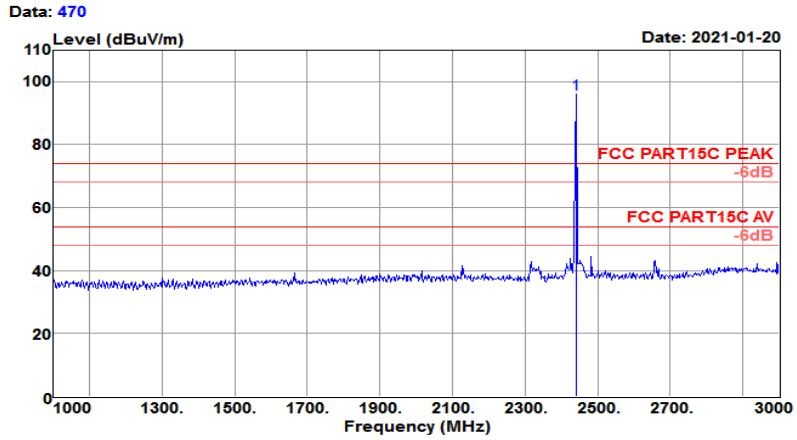



| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 4804.000 | 43.25 | 30.93 | 6.09 | 36.03 | 44.24 | 54.00 | -9.76 | Average |
| 4804.000 | 44.18 | 30.93 | 6.09 | 36.03 | 45.17 | 74.00 | -28.83 | Peak |
| 7206.000 | 25.98 | 35.39 | 9.22 | 34.25 | 36.34 | 54.00 | -17.66 | Average |
| 7206.000 | 39.51 | 35.39 | 9.22 | 34.25 | 49.87 | 74.00 | -24.13 | Peak |
| 9608.000 | 26.84 | 38.39 | 12.26 | 32.19 | 45.30 | 54.00 | -8.70 | Average |
| 9608.000 | 41.30 | 38.39 | 12.26 | 32.19 | 59.76 | 74.00 | -14.24 | Peak |

Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

| Test Mode : | BLE CH19 (2440 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 1GHz~3GHz | Polarization : | Horizontal |

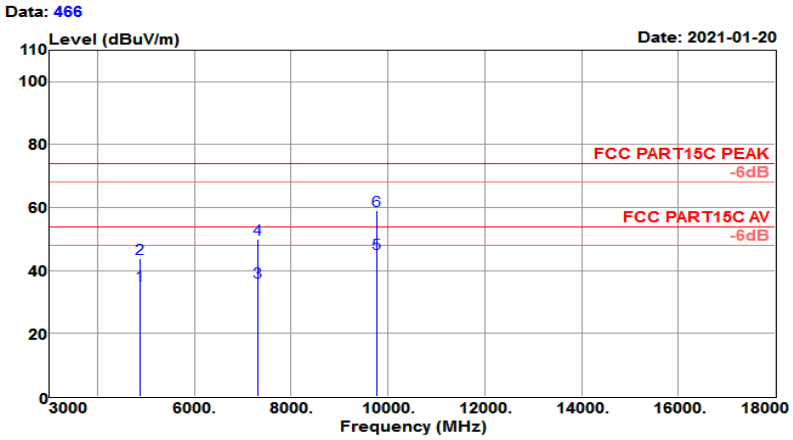
| | | | |
|---|---|---|---|
| Test Site | : 3m Chamber | Temp/Humi | : 25℃/64% |
| Tested by | : Jack | Pol/Phase | : HORIZONTAL |
| Test Mode | : Ble CH19(2440MHz) | Power rating | : 125VAc |




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2440.000 | 99.98 | 27.67 | 4.22 | 35.90 | 95.97 | 74.00 | 21.97 | Peak |

| Test Mode : | BLE CH19 (2440 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 3GHz~18GHz | Polarization : | Horizontal |

```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                ----------------
Tested by    : Jack                      Pol/Phase    : HORIZONTAL
               --------------------------                ----------------
Test Mode    : Ble CH19(2440MHz)         Power rating: 125VAc
               --------------------------                ----------------
```

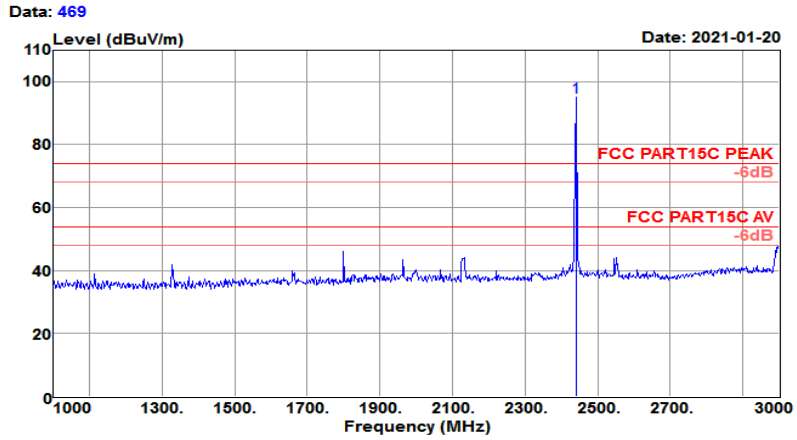



| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 4880.000 | 34.15 | 31.03 | 6.08 | 35.98 | 35.28 | 54.00 | -18.72 | Average |
| 4880.000 | 42.54 | 31.03 | 6.08 | 35.98 | 43.67 | 74.00 | -30.33 | Peak |
| 7320.000 | 25.88 | 35.67 | 9.20 | 34.29 | 36.46 | 54.00 | -17.54 | Average |
| 7320.000 | 39.48 | 35.67 | 9.20 | 34.29 | 50.06 | 74.00 | -23.94 | Peak |
| 9760.000 | 26.59 | 38.51 | 12.50 | 32.03 | 45.57 | 54.00 | -8.43 | Average |
| 9760.000 | 40.06 | 38.51 | 12.50 | 32.03 | 59.04 | 74.00 | -14.96 | Peak |

Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

| Test Mode : | BLE CH19 (2440 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 1GHz~3GHz | Polarization : | Vertical |

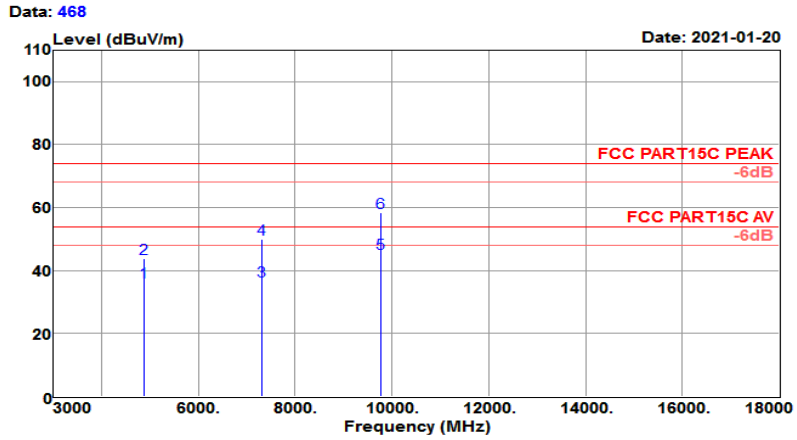
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                -----------------
Tested by    : Jack                      Pol/Phase    : VERTICAL
               --------------------------                -----------------
Test Mode    : Ble CH19(2440MHz)         Power rating: 125VAc
               --------------------------                -----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2440.000 | 99.14 | 27.67 | 4.22 | 35.90 | 95.13 | 74.00 | 21.13 | Peak |

| Test Mode : | BLE CH19 (2440 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 3GHz~18GHz | Polarization : | Vertical |

```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                ----------------
Tested by    : Jack                      Pol/Phase    : VERTICAL
               --------------------------                ----------------
Test Mode    : Ble CH19(2440MHz)         Power rating: 125VAc
               --------------------------                ----------------
```

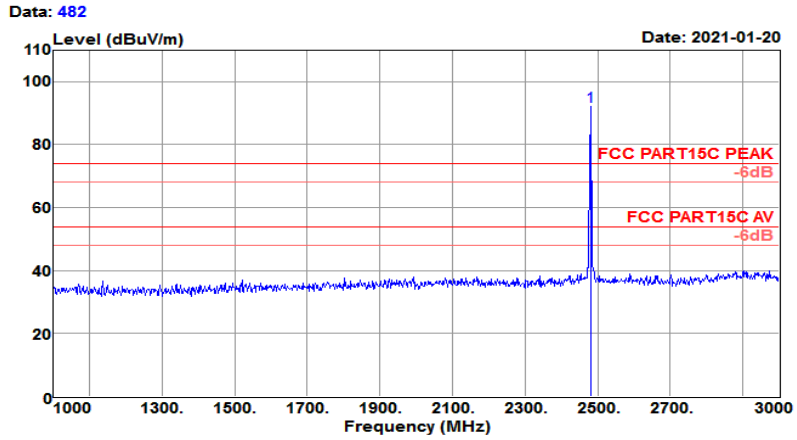



| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 4880.000 | 35.21 | 31.03 | 6.08 | 35.98 | 36.34 | 54.00 | -17.66 | Average |
| 4880.000 | 42.83 | 31.03 | 6.08 | 35.98 | 43.96 | 74.00 | -30.04 | Peak |
| 7320.000 | 25.94 | 35.67 | 9.20 | 34.29 | 36.52 | 54.00 | -17.48 | Average |
| 7320.000 | 39.25 | 35.67 | 9.20 | 34.29 | 49.83 | 74.00 | -24.17 | Peak |
| 9760.000 | 26.57 | 38.51 | 12.50 | 32.03 | 45.55 | 54.00 | -8.45 | Average |
| 9760.000 | 39.46 | 38.51 | 12.50 | 32.03 | 58.44 | 74.00 | -15.56 | Peak |

Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

| Test Mode : | BLE CH39 (2480 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 1GHz~3GHz | Polarization : | Horizontal |

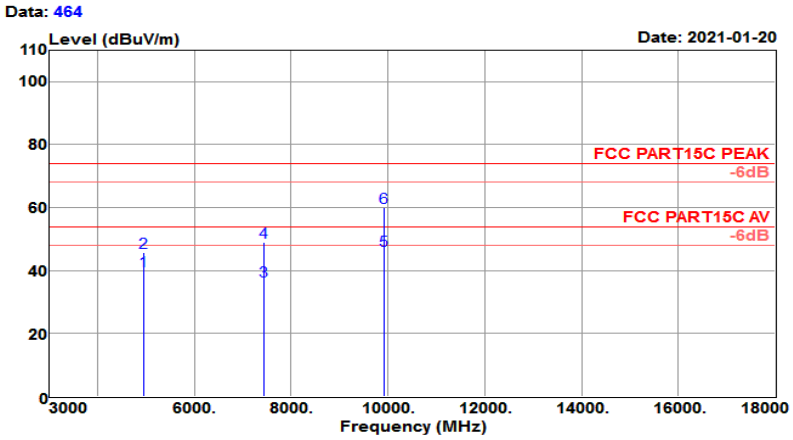
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                -----------------
Tested by    : Jack                      Pol/Phase    : HORIZONTAL
               --------------------------                -----------------
Test Mode    : Ble CH39(2480MHz)         Power rating: 125VAc
               --------------------------                -----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2480.000 | 96.23 | 27.76 | 4.26 | 35.99 | 92.26 | 74.00 | 18.26 | Peak |

| Test Mode : | BLE CH39 (2480 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 3GHz~18GHz | Polarization : | Horizontal |

```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                ----------------
Tested by    : Jack                      Pol/Phase    : HORIZONTAL
               --------------------------                ----------------
Test Mode    : Ble CH39(2480MHz)         Power rating: 125VAc
               --------------------------                ----------------
```

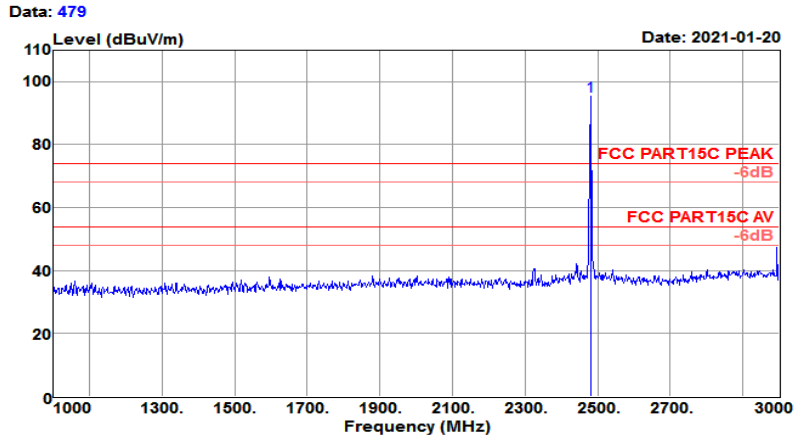



| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 4960.000 | 38.51 | 31.14 | 6.07 | 35.93 | 39.79 | 54.00 | -14.21 | Average |
| 4960.000 | 44.50 | 31.14 | 6.07 | 35.93 | 45.78 | 74.00 | -28.22 | Peak |
| 7440.000 | 25.92 | 35.96 | 9.04 | 34.32 | 36.60 | 54.00 | -17.40 | Average |
| 7440.000 | 38.32 | 35.96 | 9.04 | 34.32 | 49.00 | 74.00 | -25.00 | Peak |
| 9920.000 | 26.51 | 38.64 | 13.24 | 31.87 | 46.52 | 54.00 | -7.48 | Average |
| 9920.000 | 40.05 | 38.64 | 13.24 | 31.87 | 60.06 | 74.00 | -13.94 | Peak |

Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

| Test Mode : | BLE CH39 (2480 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 1GHz~3GHz | Polarization : | Vertical |

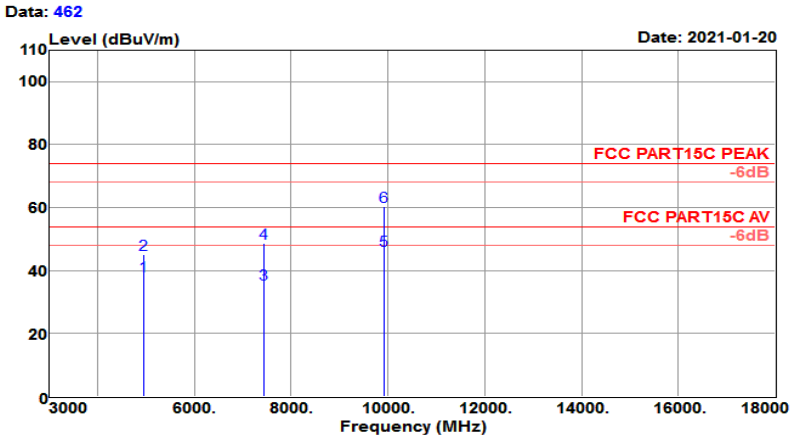
```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                -----------------
Tested by    : Jack                      Pol/Phase    : VERTICAL
               --------------------------                -----------------
Test Mode    : Ble CH39(2480MHz)         Power rating: 125VAc
               --------------------------                -----------------
```




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 2480.000 | 99.33 | 27.76 | 4.26 | 35.99 | 95.36 | 74.00 | 21.36 | Peak |

| Test Mode : | BLE CH39 (2480 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 3GHz~18GHz | Polarization : | Vertical |

```
Test Site    : 3m Chamber                Temp/Humi    : 25℃/64%
               --------------------------                ----------------
Tested by    : Jack                      Pol/Phase    : VERTICAL
               --------------------------                ----------------
Test Mode    : Ble CH39(2480MHz)         Power rating: 125VAc
               --------------------------                ----------------
```

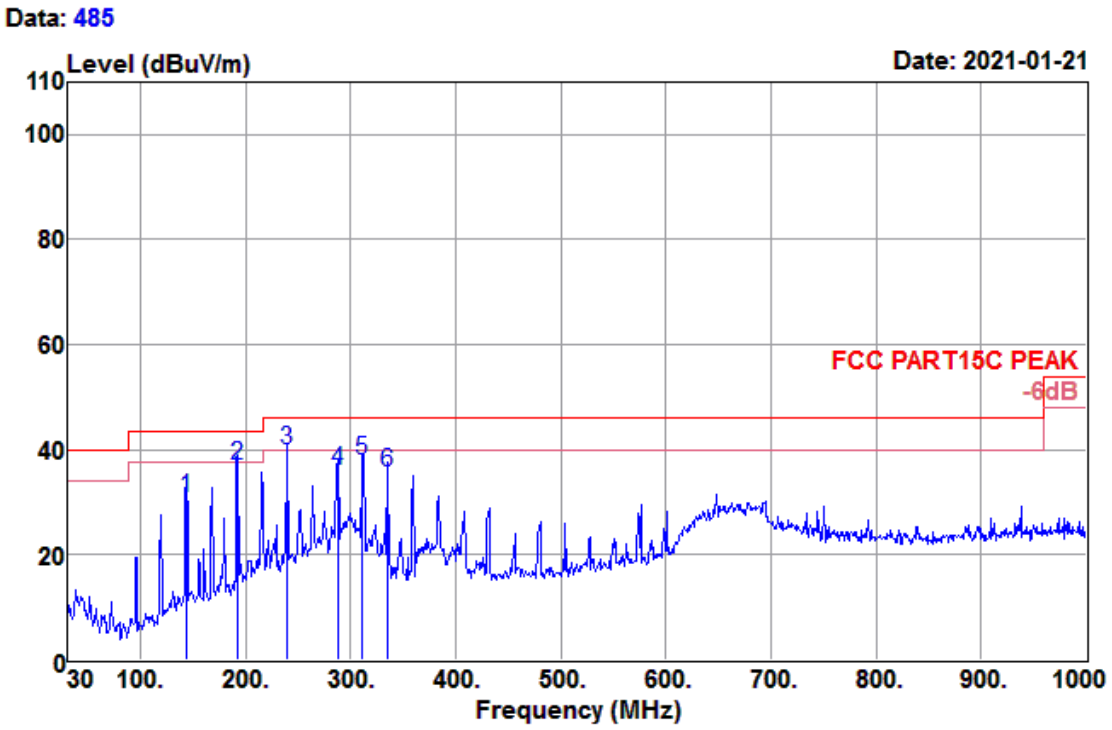



| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 4960.000 | 37.08 | 31.14 | 6.07 | 35.93 | 38.36 | 54.00 | -15.64 | Average |
| 4960.000 | 43.82 | 31.14 | 6.07 | 35.93 | 45.10 | 74.00 | -28.90 | Peak |
| 7440.000 | 25.00 | 35.96 | 9.04 | 34.32 | 35.68 | 54.00 | -18.32 | Average |
| 7440.000 | 37.91 | 35.96 | 9.04 | 34.32 | 48.59 | 74.00 | -25.41 | Peak |
| 9920.000 | 26.44 | 38.64 | 13.24 | 31.87 | 46.45 | 54.00 | -7.55 | Average |
| 9920.000 | 40.43 | 38.64 | 13.24 | 31.87 | 60.44 | 74.00 | -13.56 | Peak |

Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

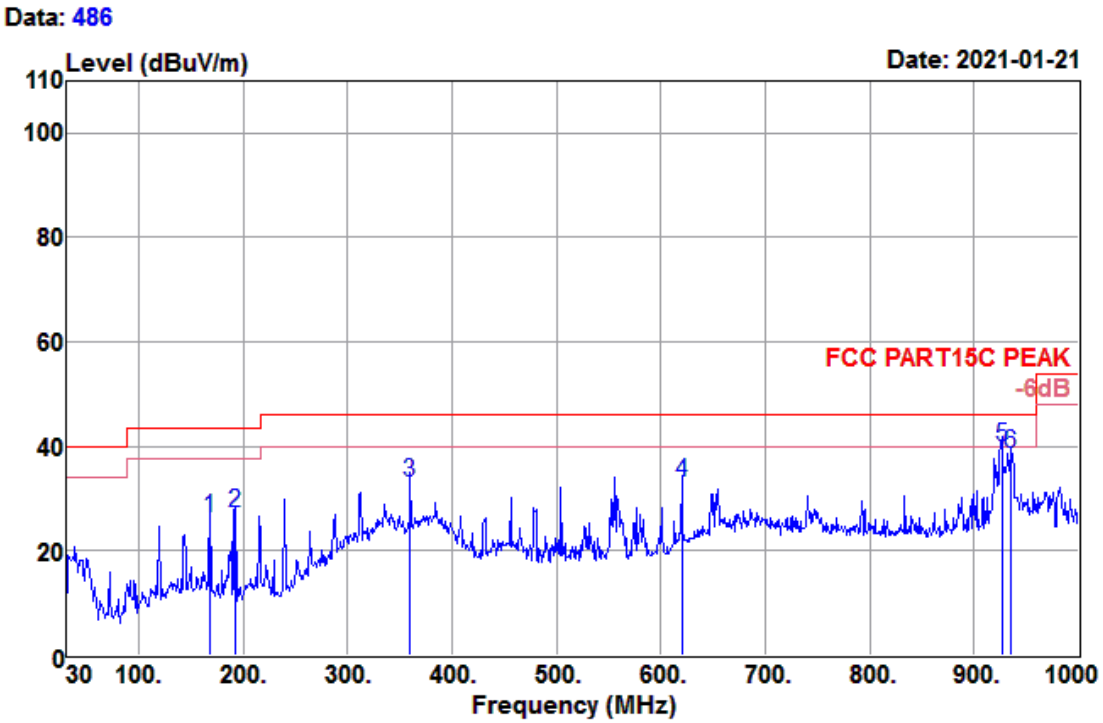
### 4.5.6 Test Result of Radiated Spurious Emission (30MHz ~ 1GHz)

| | | | |
|---|---|---|---|
| **Test Mode :** | BLE CH00 (2402 MHz) | **Temperature :** | 23~25℃ |
| **Test Engineer :** | Jack Liu | **Relative Humidity :** | 63~65% |
| **Frequencey Range** | 30MHz~1GHz | **Polarization :** | Horizontal |




| Freq MHz | Reading level dBuV | Antenna factor dB/m | Cable loss dB | Preamp factor dB | level dBuV/m | Limit level dBuV/m | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 143.490 | 46.82 | 14.17 | 2.32 | 32.48 | 30.83 | 43.50 | -12.67 | QP |
| 191.990 | 55.72 | 11.00 | 2.68 | 32.47 | 36.93 | 43.50 | -6.57 | QP |
| 239.520 | 56.72 | 12.58 | 3.02 | 32.48 | 39.84 | 46.00 | -6.16 | QP |
| 288.020 | 51.22 | 13.94 | 3.32 | 32.49 | 35.99 | 46.00 | -10.01 | QP |
| 311.300 | 52.66 | 14.34 | 3.46 | 32.50 | 37.96 | 46.00 | -8.04 | QP |
| 334.580 | 49.85 | 14.61 | 3.60 | 32.51 | 35.55 | 46.00 | -10.45 | QP |

| Test Mode : | BLE CH00 (2402 MHz) | Temperature : | 23~25℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 63~65% |
| Frequencey Range | 30MHz~1GHz | Polarization : | Vertical |




| Freq | Reading level | Antenna factor | Cable loss | Preamp factor | level | Limit level | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|
| MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | |
| 167.740 | 42.91 | 13.41 | 2.51 | 32.48 | 26.35 | 43.50 | -17.15 | QP |
| 191.990 | 45.94 | 11.00 | 2.68 | 32.47 | 27.15 | 43.50 | -16.35 | QP |
| 359.800 | 46.83 | 15.00 | 3.74 | 32.53 | 33.04 | 46.00 | -12.96 | QP |
| 619.760 | 40.72 | 20.28 | 4.95 | 32.68 | 33.27 | 46.00 | -12.73 | QP |
| 926.280 | 42.04 | 23.97 | 6.13 | 32.16 | 39.98 | 46.00 | -6.02 | QP |
| 935.010 | 40.35 | 24.13 | 6.14 | 32.15 | 38.47 | 46.00 | -7.53 | QP |

# 4.6 AC Conducted Emission Measurement

## 4.6.1 Limit of AC Conducted Emission

FCC §15.207

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

| Frequency of emission (MHz) | Conducted limit (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

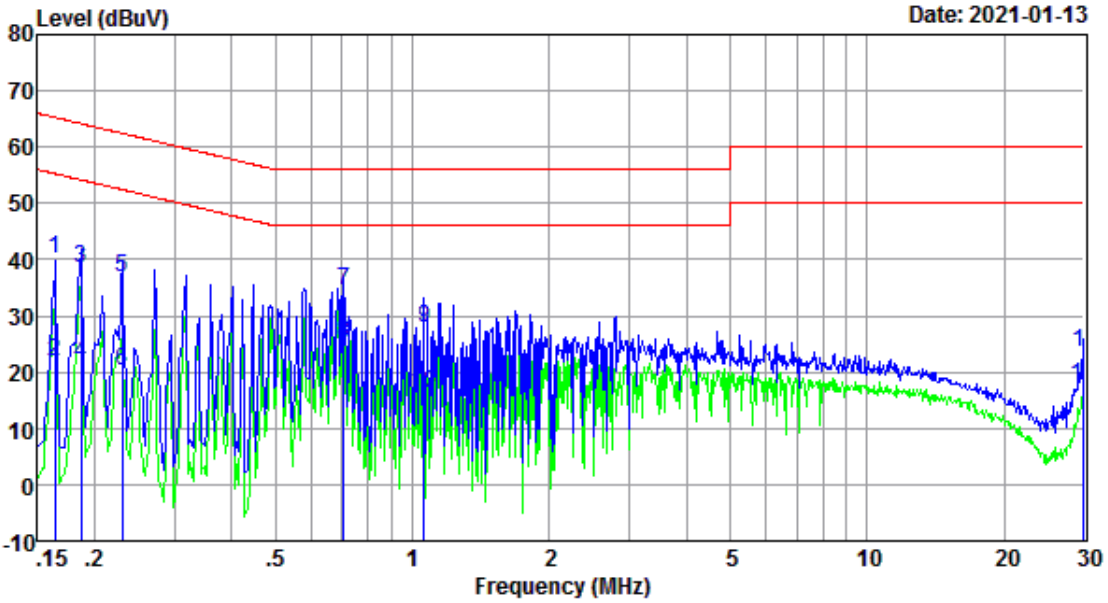
*Decreases with the logarithm of the frequency.

## 4.6.2 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

### 4.6.3 Test Result of AC Conducted Emission

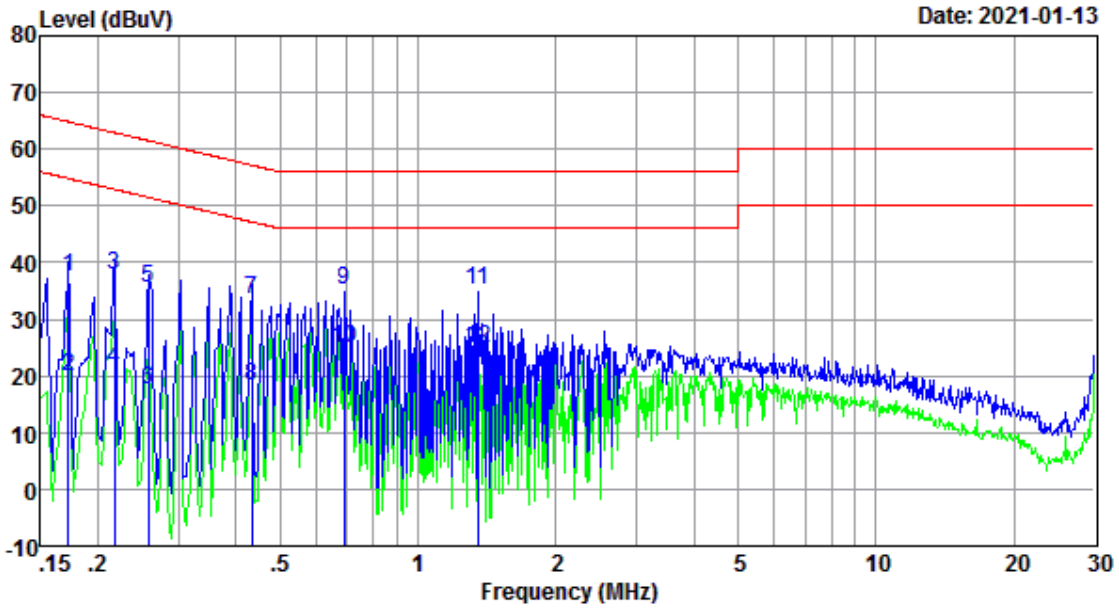
| Test Mode : | Mode 1 | Temperature : | 24℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 52% |
| Test Voltage : | 125Vac / 60Hz | Phase : | Line |
| Function Type : | Bluetooth Link + Switch On+ Charging | | |




| Freq MHz | Reading level dBuV | LISN/ISN factor dB | Cable loss dB | Result level dBuV | Limit level dBuV | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|
| 0.163 | 30.51 | 9.54 | 0.02 | 40.07 | 65.30 | -25.23 | QP |
| 0.163 | 12.41 | 9.54 | 0.02 | 21.97 | 55.30 | -33.33 | Average |
| 0.186 | 28.89 | 9.55 | 0.03 | 38.47 | 64.20 | -25.73 | QP |
| 0.186 | 11.89 | 9.55 | 0.03 | 21.47 | 54.20 | -32.73 | Average |
| 0.230 | 27.40 | 9.55 | 0.03 | 36.98 | 62.44 | -25.46 | QP |
| 0.230 | 10.60 | 9.55 | 0.03 | 20.18 | 52.44 | -32.26 | Average |
| 0.705 | 25.00 | 9.57 | 0.01 | 34.58 | 56.00 | -21.42 | QP |
| 0.705 | 15.50 | 9.57 | 0.01 | 25.08 | 46.00 | -20.92 | Average |
| 1.060 | 18.30 | 9.57 | 0.01 | 27.88 | 56.00 | -28.12 | QP |
| 1.060 | 6.80 | 9.57 | 0.01 | 16.38 | 46.00 | -29.62 | Average |
| 30.000 | 12.60 | 10.77 | 0.16 | 23.53 | 60.00 | -36.47 | QP |
| 30.000 | 6.80 | 10.77 | 0.16 | 17.73 | 50.00 | -32.27 | Average |

Result Level= Reading Level + LISN Factor + Cable Loss

| Test Mode : | Mode 1 | Temperature : | 24℃ |
|---|---|---|---|
| Test Engineer : | Jack Liu | Relative Humidity : | 52% |
| Test Voltage : | 125Vac / 60Hz | Phase : | NEUTRAL |
| Function Type : | Bluetooth Link + Switch On+ Charging | | |




| Freq MHz | Reading level dBuV | LISN/ISN factor dB | Cable loss dB | Result level dBuV | Limit level dBuV | Over limit dB | Remark |
|---|---|---|---|---|---|---|---|
| 0.172 | 27.80 | 9.56 | 0.02 | 37.38 | 64.86 | -27.48 | QP |
| 0.172 | 10.40 | 9.56 | 0.02 | 19.98 | 54.86 | -34.88 | Average |
| 0.217 | 28.10 | 9.56 | 0.03 | 37.69 | 62.92 | -25.23 | QP |
| 0.217 | 11.60 | 9.56 | 0.03 | 21.19 | 52.92 | -31.73 | Average |
| 0.258 | 26.00 | 9.57 | 0.03 | 35.60 | 61.51 | -25.91 | QP |
| 0.258 | 7.90 | 9.57 | 0.03 | 17.50 | 51.51 | -34.01 | Average |
| 0.433 | 23.80 | 9.58 | 0.02 | 33.40 | 57.20 | -23.80 | QP |
| 0.433 | 8.50 | 9.58 | 0.02 | 18.10 | 47.20 | -29.10 | Average |
| 0.690 | 25.40 | 9.59 | 0.01 | 35.00 | 56.00 | -21.00 | QP |
| 0.690 | 15.30 | 9.59 | 0.01 | 24.90 | 46.00 | -21.10 | Average |
| 1.352 | 25.41 | 9.60 | 0.01 | 35.02 | 56.00 | -20.98 | QP |
| 1.352 | 15.31 | 9.60 | 0.01 | 24.92 | 46.00 | -21.08 | Average |

Result Level= Reading Level + LISN Factor + Cable Loss

# 4.7 Antenna Requirements

## 4.7.1 Standard Applicable

According to antenna requirement of §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded..

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

## 4.7.2 Antenna Connected Construction

An PCB antenna design is used.

## 4.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

# 5. List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Calibration Date | Due Date | Remark |
|---|---|---|---|---|---|---|
| Spectrum Analyzer | Keysight | N9010A | MY56070788 | 2021-01-05 | 2022-01-04 | Conducted |
| Power Sensor | Keysight | U2021XA | MY56510025 | 2021-01-05 | 2022-01-04 | Conducted |
| Power Sensor | Keysight | U2021XA | MY57030005 | 2021-01-05 | 2022-01-04 | Conducted |
| Power Sensor | Keysight | U2021XA | MY56510018 | 2021-01-05 | 2022-01-04 | Conducted |
| Power Sensor | Keysight | U2021XA | MY56480002 | 2021-01-05 | 2022-01-04 | Conducted |
| Thermal Chamber | Howkin | UHL-34 | 19111801 | 2020-05-09 | 2021-05-08 | Conducted |
| Base Station | R&S | CMW 270 | 101231 | 2021-01-05 | 2022-01-04 | Conducted |
| Signal Generator (Interferer) | Keysight | N5182B | MY56200384 | 2021-01-05 | 2022-01-04 | Conducted |
| Signal Generator (Blocker) | Keysight | N5171B | MY56200661 | 2021-01-05 | 2022-01-04 | Conducted |

| Instrument | Manufacturer | Model No. | Serial No. | Calibration Date | Due Date | Remark |
|---|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSV 40 | 101433 | 2021-01-05 | 2022-01-04 | Radiation |
| Amplifier | Sonoma | 310 | 363917 | 2021-01-06 | 2022-01-05 | Radiation |
| Amplifier | Schwarzbeck | BBV 9718 | 327 | 2021-01-06 | 2022-01-05 | Radiation |
| Amplifier | Narda | TTA1840-35-HG | 2034380 | 2020-05-14 | 2021-05-15 | Radiation |
| Loop Antenna | Schwarzbeck | FMZB 1519B | 1519B-051 | 2020-02-14 | 2023-02-13 | Radiation |
| Broadband Antenna | Schwarzbeck | VULB 9168 | 9168-757 | 2020-09-27 | 2023-09-26 | Radiation |
| Horn Antenna | Schwarzbeck | BBHA 9120 D | 1677 | 2020-02-14 | 2023-02-13 | Radiation |
| Horn Antenna | COM-POWER | AH-1840 | 101117 | 2018-06-20 | 2021-06-19 | Radiation |
| Test Software | Audix | E3 | 6.111221a | N/A | N/A | Radiation |
| Filter | Micro-Tronics | BRM 50702 | G266 | N/A | N/A | Radiation |

| Instrument | Manufacturer | Model No. | Serial No. | Calibration Date | Due Date | Remark |
|---|---|---|---|---|---|---|
| LISN | R&S | ENV216 | 102125 | 2021-01-05 | 2022-01-04 | Conducted |
| LISN | R&S | ENV432 | 101327 | 2021-01-06 | 2022-01-05 | Conducted |
| EMI Test Receiver | R&S | ESR3 | 102143 | 2021-01-06 | 2022-01-05 | Conducted |
| EMI Test Software | Audix | E3 | N/A | N/A | N/A | Conducted |

N/A: No Calibration Required

# 6. Uncertainty of Evaluation

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| MEASUREMENT | FREQUENCY | UNCERTAINTY |
|---|---|---|
| Conducted emissions | 9kHz~30MHz | 2.42dB |
| Radiated emission | 30MHz ~ 1GMHz | 2.50dB |
| | 1GHz ~ 18GHz | 3.51dB |
| | 18GHz ~ 40GHz | 3.96dB |

| MEASUREMENT | UNCERTAINTY |
|---|---|
| Occupied Channel Bandwidth | ±196.4Hz |
| RF output power, conducted | ±2.31dB |
| Power density, conducted | ±2.31dB |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

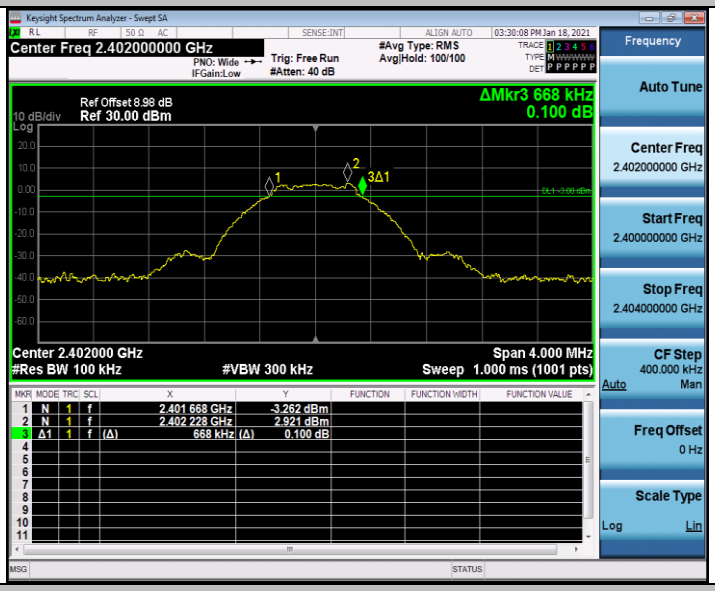
# Appendix A: DTS Bandwidth

## Test Result

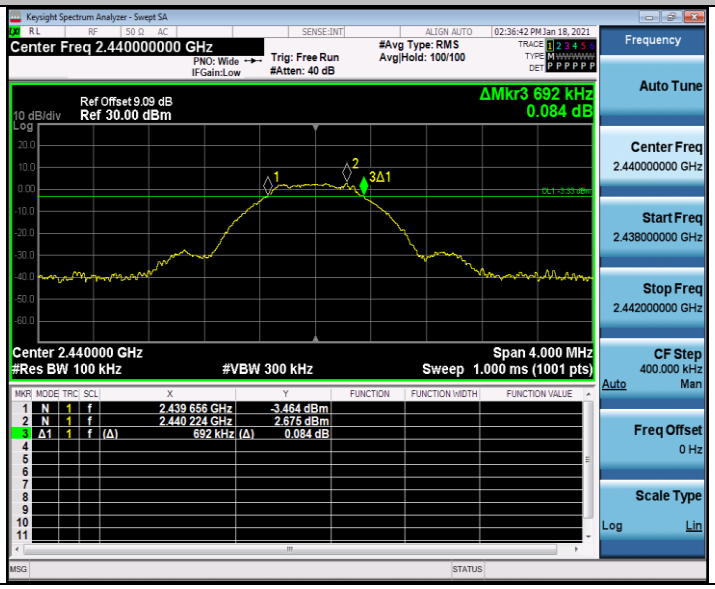
| TestMode | Antenna | Channel | DTS BW [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| BLE_BT4.2 | Ant1 | 2402 | 0.668 | 2401.668 | 2402.336 | 0.5 | PASS |
| | | 2440 | 0.692 | 2439.656 | 2440.348 | 0.5 | PASS |
| | | 2480 | 0.692 | 2479.644 | 2480.336 | 0.5 | PASS |

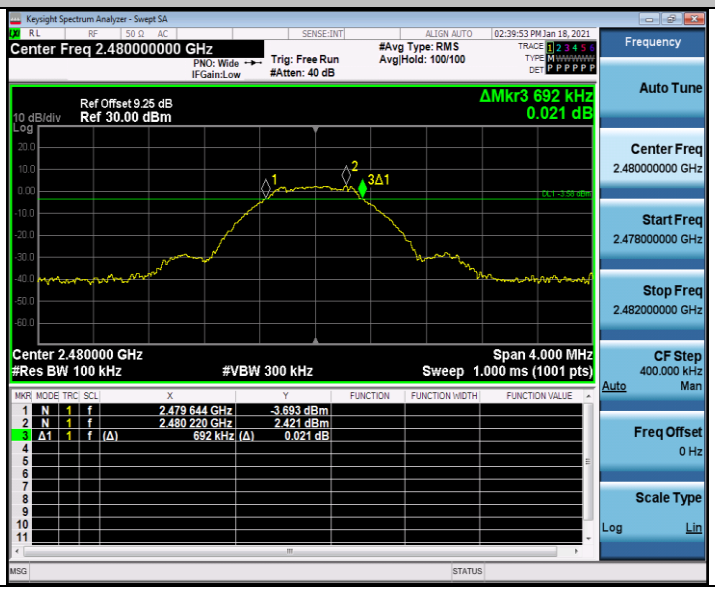
## Test Graphs

BLE_BT4.2_Ant1_2402




BLE_BT4.2_Ant1_2440



| BLE_BT4.2_Ant1_2480 |
| --- |
|  |

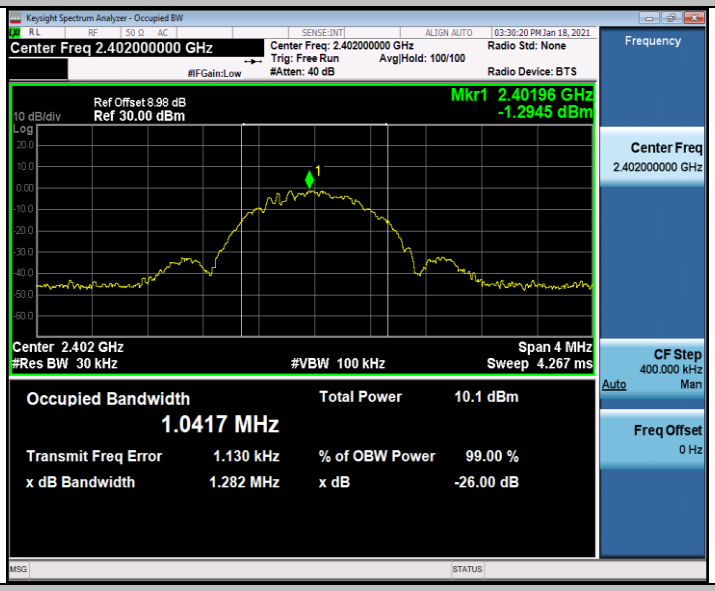
# Appendix B: Occupied Channel Bandwidth

## Test Result

| TestMode | Antenna | Channel | OCB [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| BLE_BT4.2 | Ant1 | 2402 | 1.0417 | 2401.480 | 2402.522 | --- | PASS |
| | | 2440 | 1.0367 | 2439.483 | 2440.520 | --- | PASS |
| | | 2480 | 1.0368 | 2479.484 | 2480.520 | --- | PASS |

## Test Graphs

BLE_BT4.2_Ant1_2402




BLE_BT4.2_Ant1_2440

| BLE_BT4.2_Ant1_2480 |
| --- |
|  |

# Appendix C: Maximum conducted output power

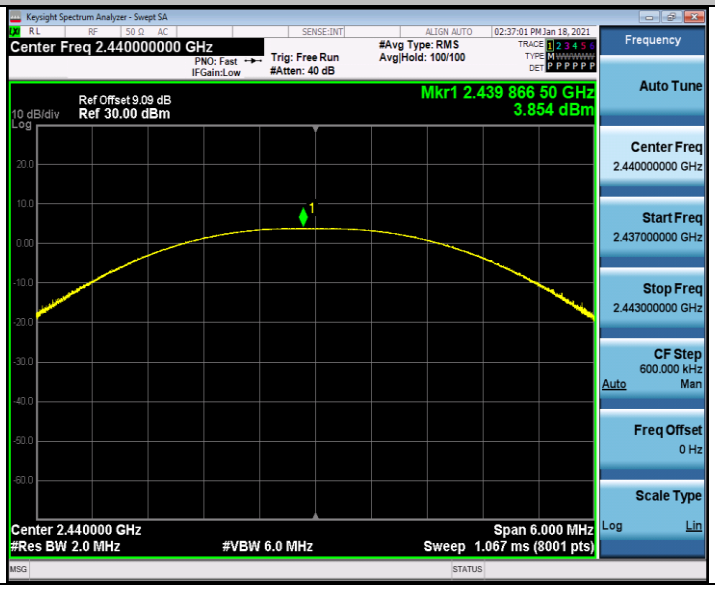
## Test Result

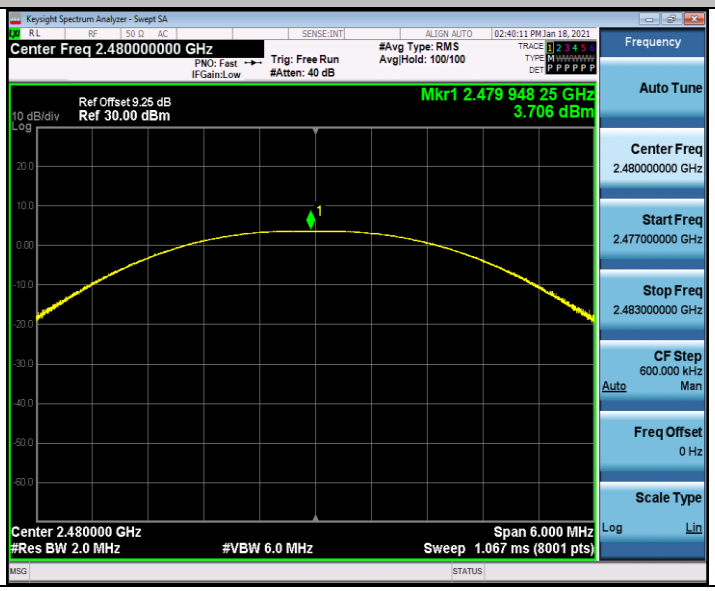
| TestMode | Antenna | Channel | Result[dBm] | EIRP[dBm] | Limit[dBm] | Verdict |
|---|---|---|---|---|---|---|
| BLE_BT4.2 | Ant1 | 2402 | 4.07 | 3.07 | <=30 | PASS |
| | | 2440 | 3.85 | 2.85 | <=30 | PASS |
| | | 2480 | 3.71 | 2.71 | <=30 | PASS |

## Test Graphs

BLE_BT4.2_Ant1_2402


BLE_BT4.2_Ant1_2440



| BLE_BT4.2_Ant1_2480 |
| --- |
|  |

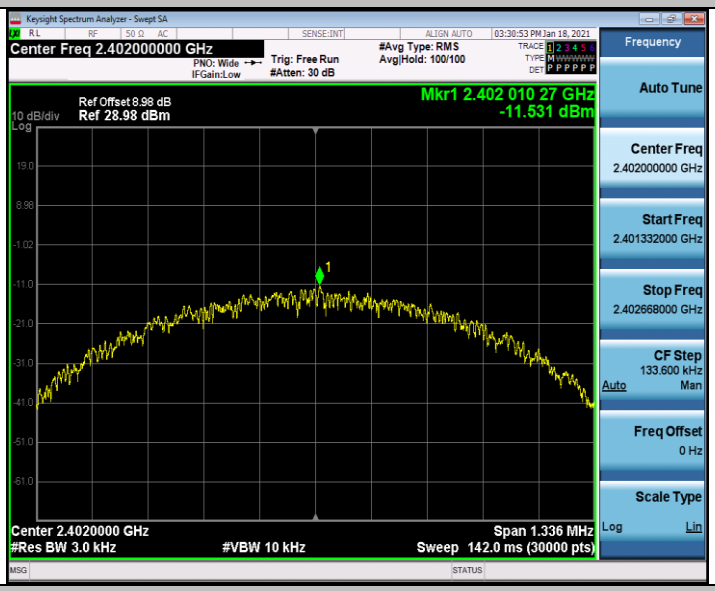
# Appendix D: Maximum power spectral density

## Test Result

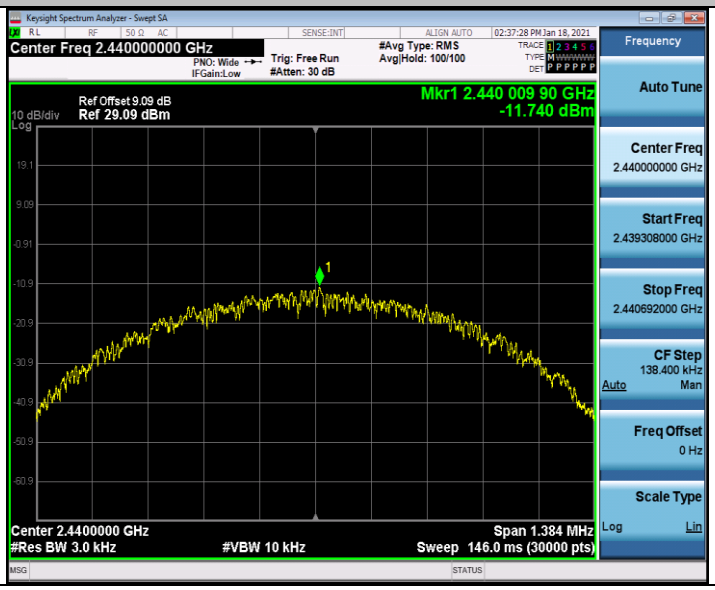
| TestMode | Antenna | Channel | Result[dBm/3-100kHz] | Limit[dBm/3kHz] | Verdict |
|---|---|---|---|---|---|
| BLE_BT4.2 | Ant1 | 2402 | -11.53 | <=8 | PASS |
| | | 2440 | -11.74 | <=8 | PASS |
| | | 2480 | -11.76 | <=8 | PASS |

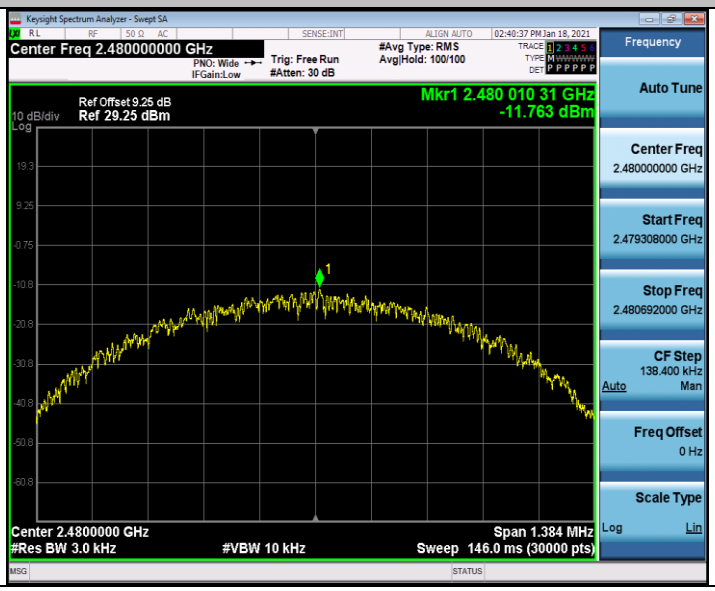
## Test Graphs

BLE_BT4.2_Ant1_2402




BLE_BT4.2_Ant1_2440



| BLE_BT4.2_Ant1_2480 |
| --- |
|  |

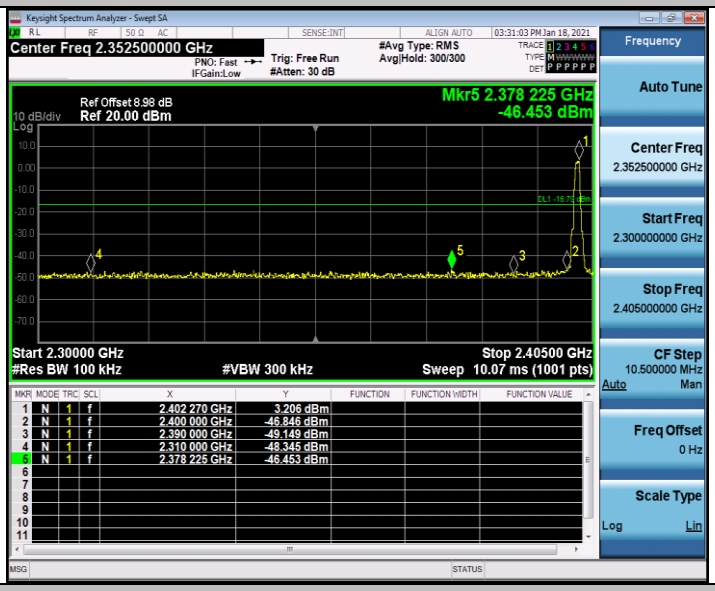
# Appendix E: Band edge measurements

## Test Result

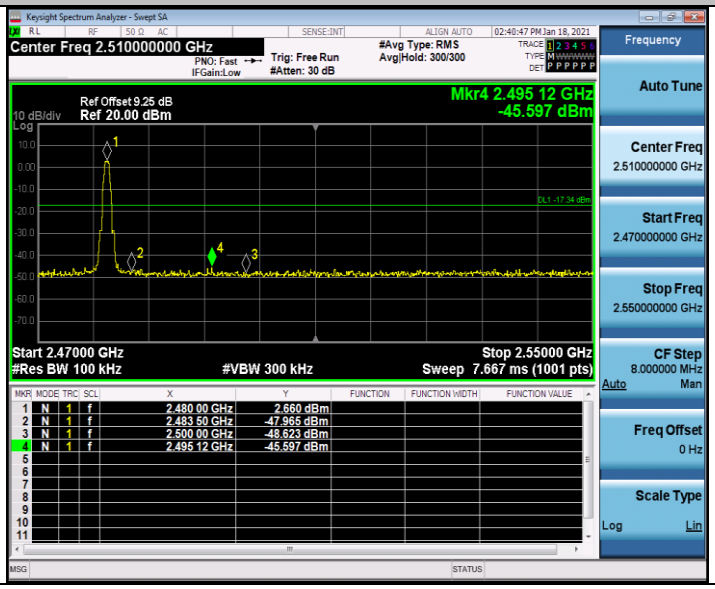
| TestMode | Antenna | ChName | Channel | RefLevel[dBm] | Result[dBm] | Limit[dBm] | Verdict |
|---|---|---|---|---|---|---|---|
| BLE_BT4.2 | Ant1 | Low | 2402 | 3.21 | -46.45 | <=-16.79 | PASS |
| | | High | 2480 | 2.66 | -45.6 | <=-17.34 | PASS |

## Test Graphs

BLE_BT4.2_Ant1_Low_2402




BLE_BT4.2_Ant1_High_2480

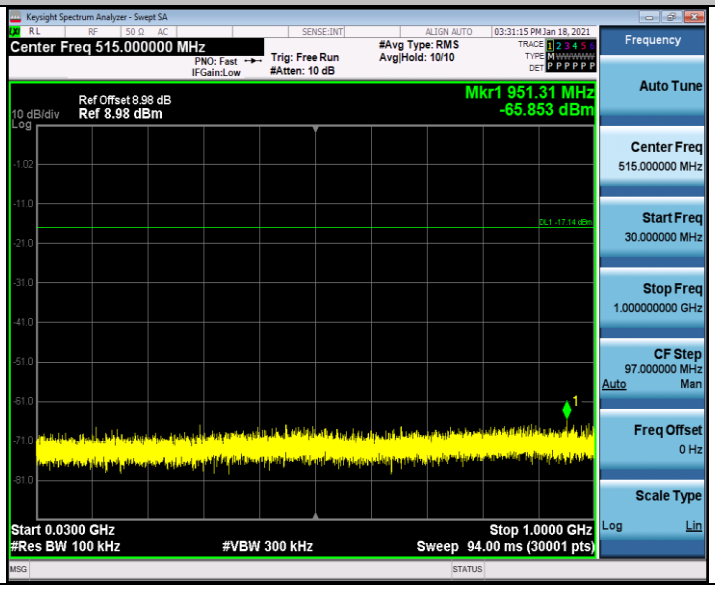


# Appendix F: Conducted Spurious Emission

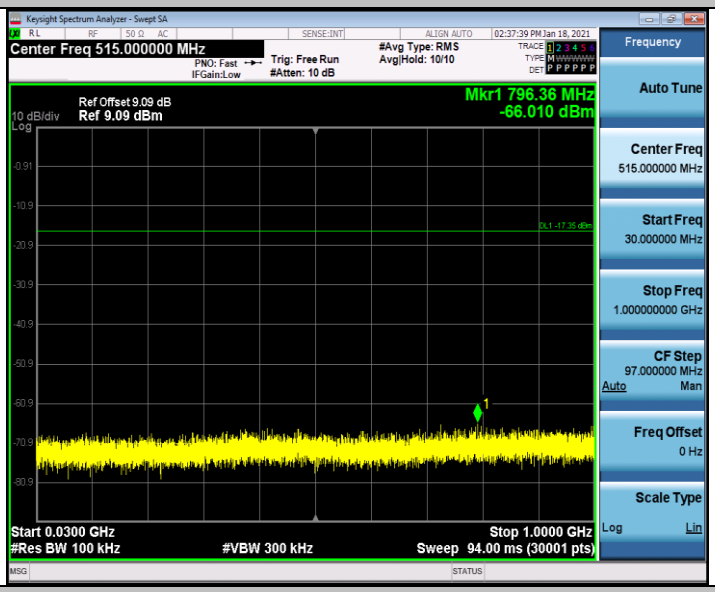
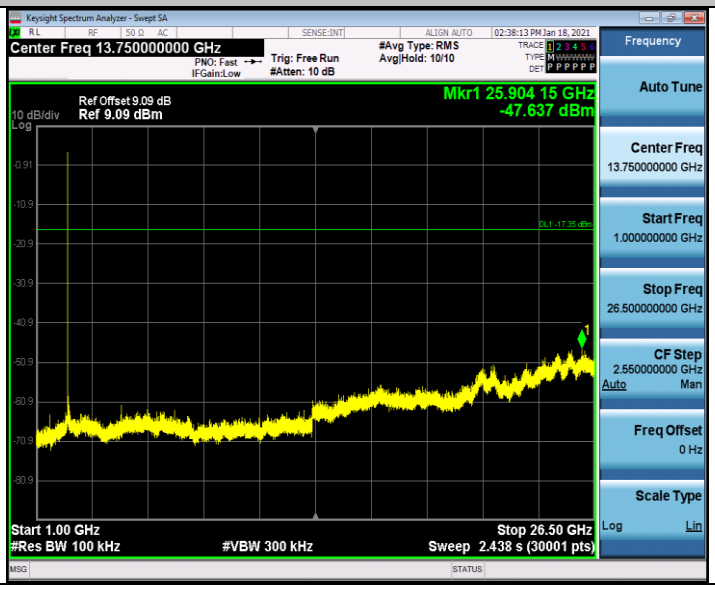
## Test Result

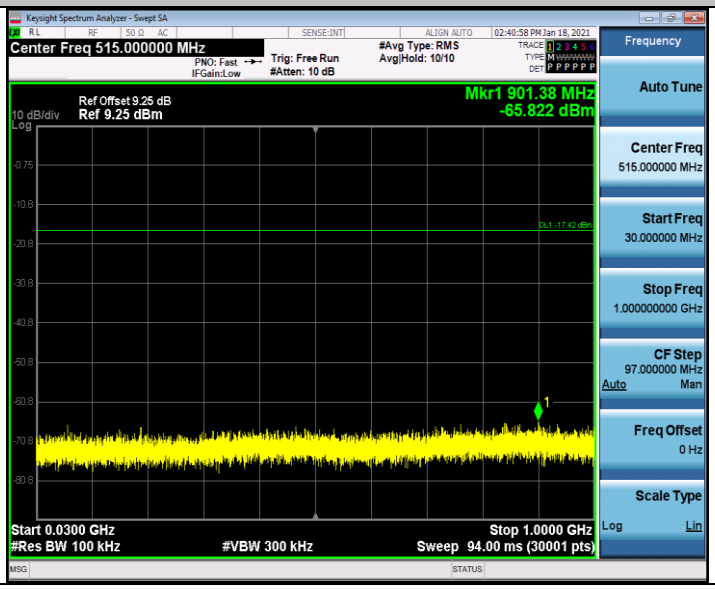
| TestMode | Antenna | Channel | FreqRange [MHz] | RefLevel [dBm] | Result[dBm] | Limit[dBm] | Verdict |
|---|---|---|---|---|---|---|---|
| BLE_BT4.2 | Ant1 | 2402 | Reference | 2.86 | 2.86 | --- | PASS |
| | | | 30~1000 | 30~1000 | -65.853 | <=-17.139 | PASS |
| | | | 1000~26500 | 1000~26500 | -47.879 | <=-17.139 | PASS |
| | | 2440 | Reference | 2.65 | 2.65 | --- | PASS |
| | | | 30~1000 | 30~1000 | -66.01 | <=-17.354 | PASS |
| | | | 1000~26500 | 1000~26500 | -47.637 | <=-17.354 | PASS |
| | | 2480 | Reference | 2.58 | 2.58 | --- | PASS |
| | | | 30~1000 | 30~1000 | -65.822 | <=-17.421 | PASS |
| | | | 1000~26500 | 1000~26500 | -47.951 | <=-17.421 | PASS |

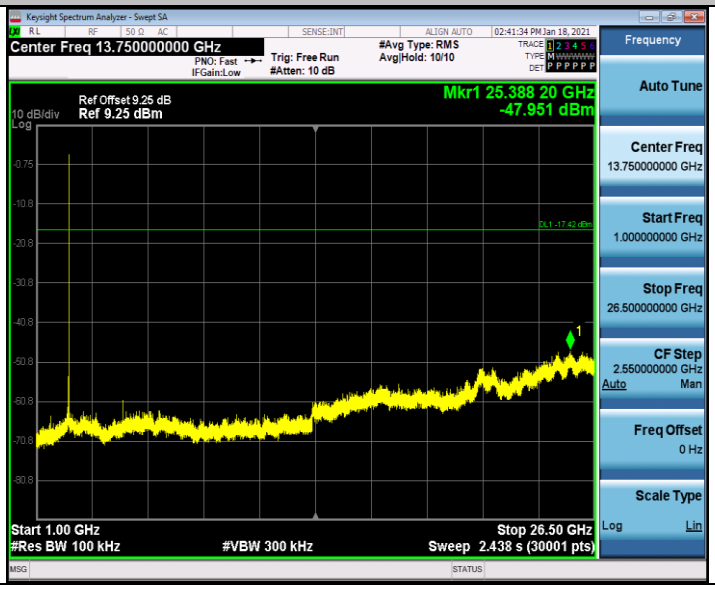
## Test Graphs

| BLE_BT4.2_Ant1_2402_0~Reference |
| --- |
|  |
| BLE_BT4.2_Ant1_2402_30~1000 |
|  |

| BLE_BT4.2_Ant1_2402_1000~26500 |
| --- |
|  |
| BLE_BT4.2_Ant1_2440_0~Reference |
|  |

| BLE_BT4.2_Ant1_2440_30~1000 |
| --- |
|  |
| BLE_BT4.2_Ant1_2440_1000~26500 |
|  |

| BLE_BT4.2_Ant1_2480_0~Reference |
| --- |
|  |
| BLE_BT4.2_Ant1_2480_30~1000 |
|  |

| BLE_BT4.2_Ant1_2480_1000~26500 |
| --- |
|  |

# Appendix G: Setup Photographs

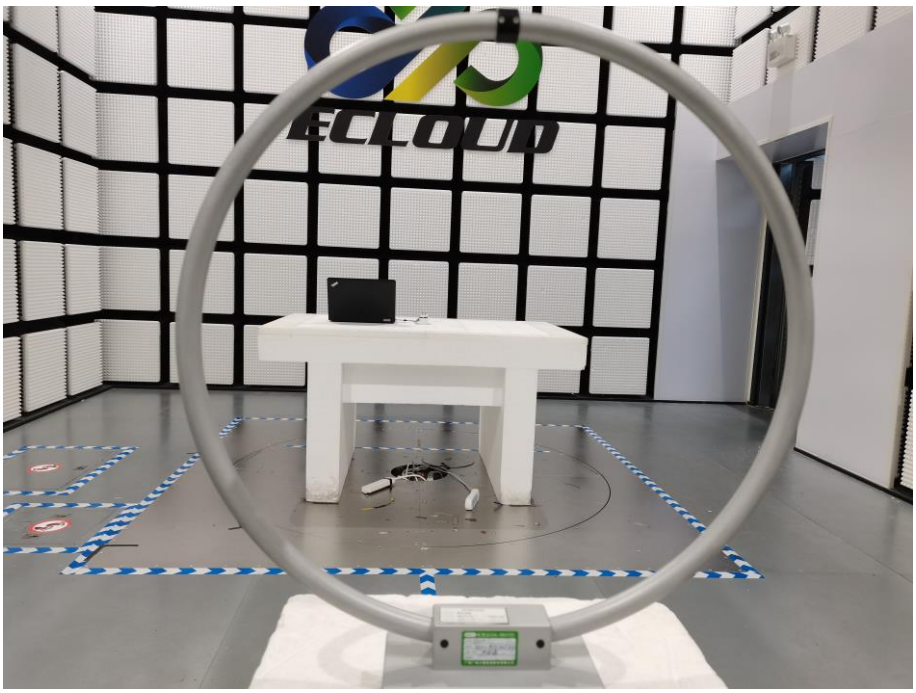


Fig. 1 Radiated emission setup photo(Below 30MHz)

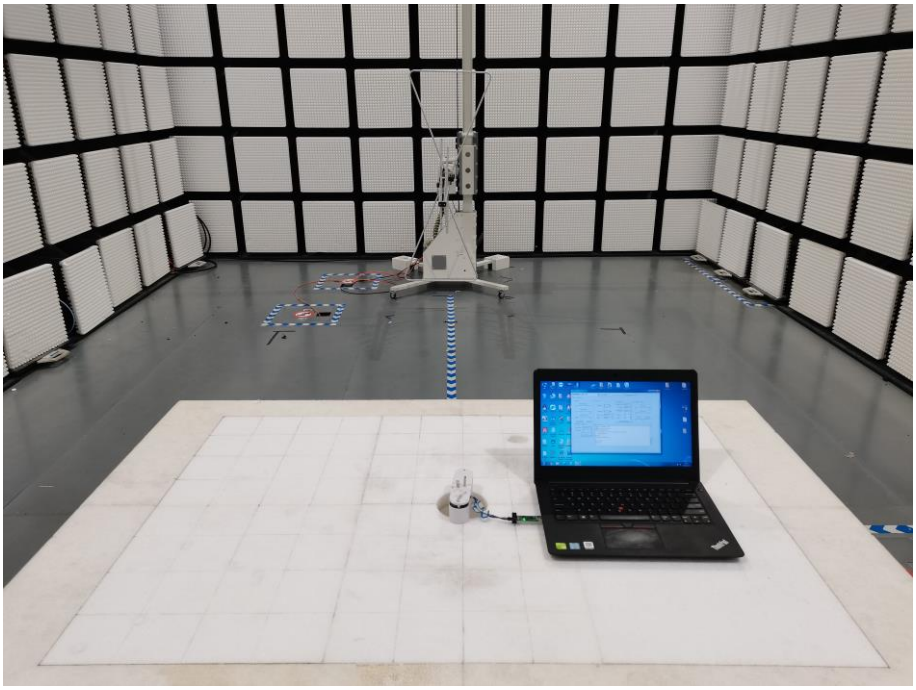


Fig. 2 Radiated emission setup photo(30MHz-1GHz)

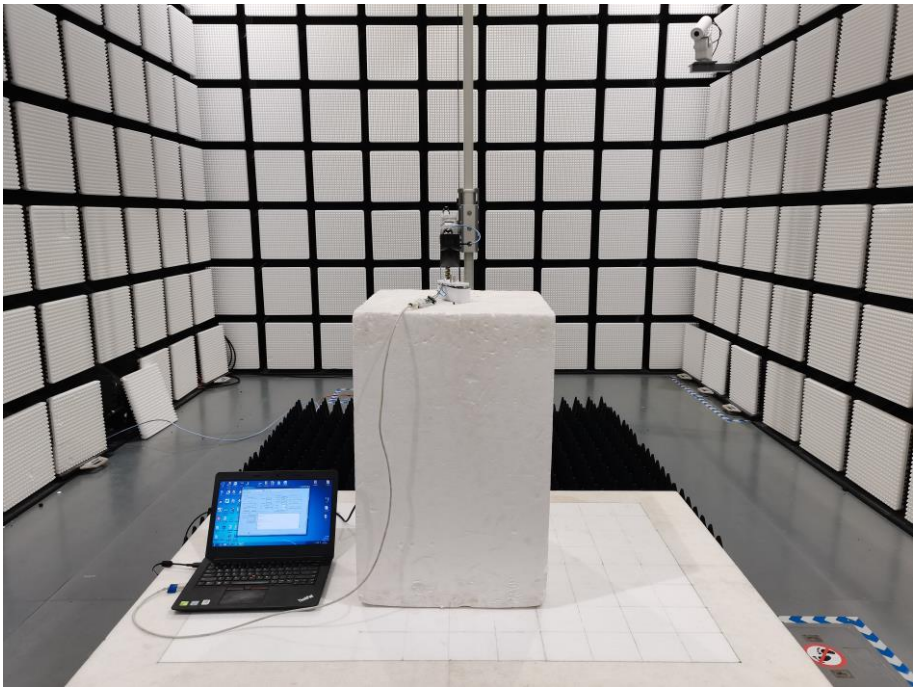


Fig. 3 Radiated emission setup photo(Above 1GHz)

Fig. 4 Power line conducted emission setup photo

----------End of the report----------