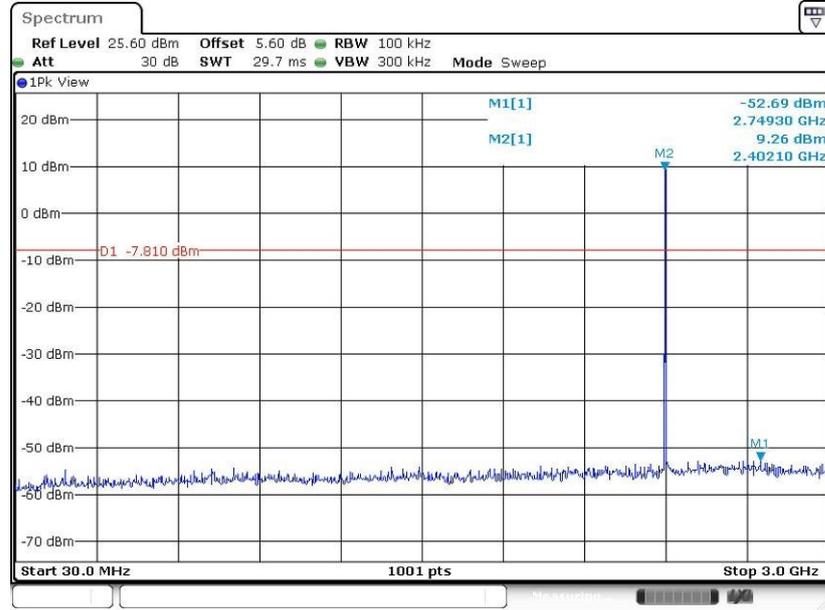


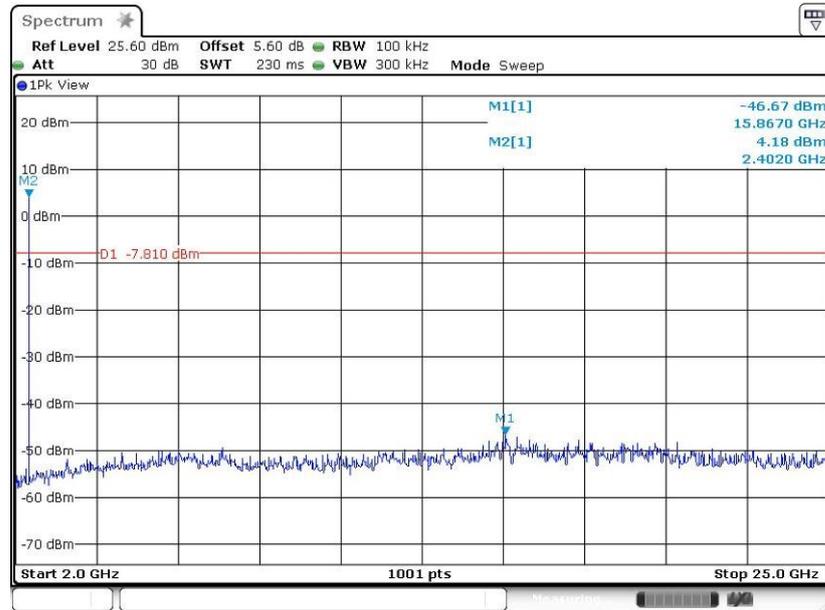


Bluetooth v5.1 LE

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps  
GFSK Channel 00

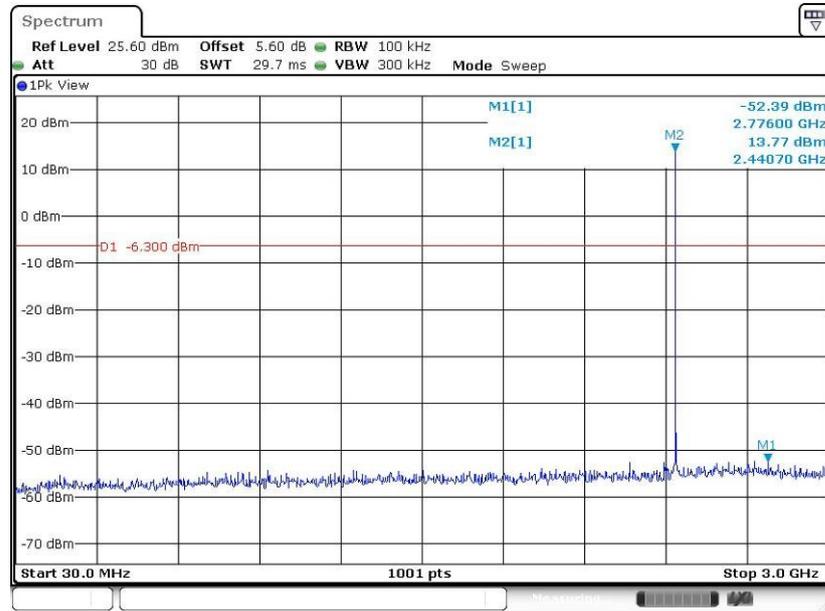


Conducted Spurious Emission Plot on Bluetooth LE 2Mbps  
GFSK Channel 00



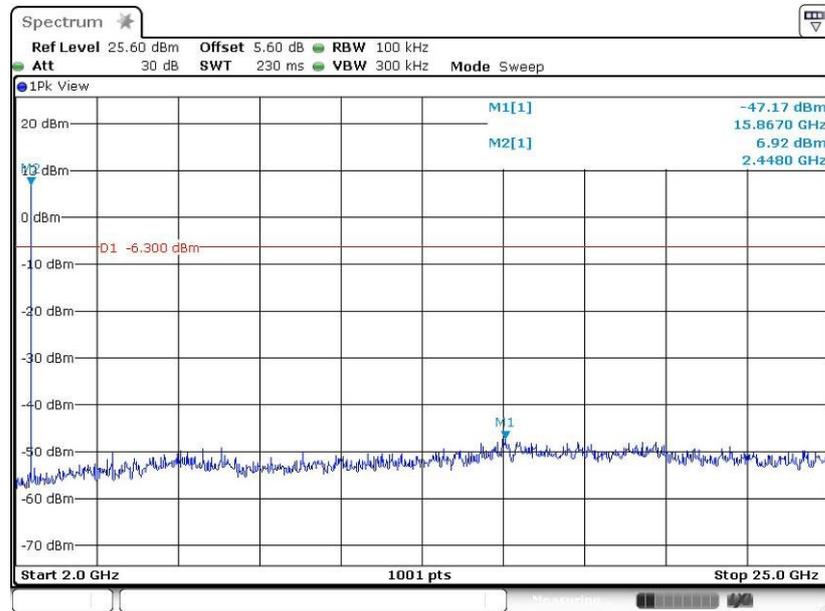


Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 19



Date: 16.NOV.2020 21:59:17

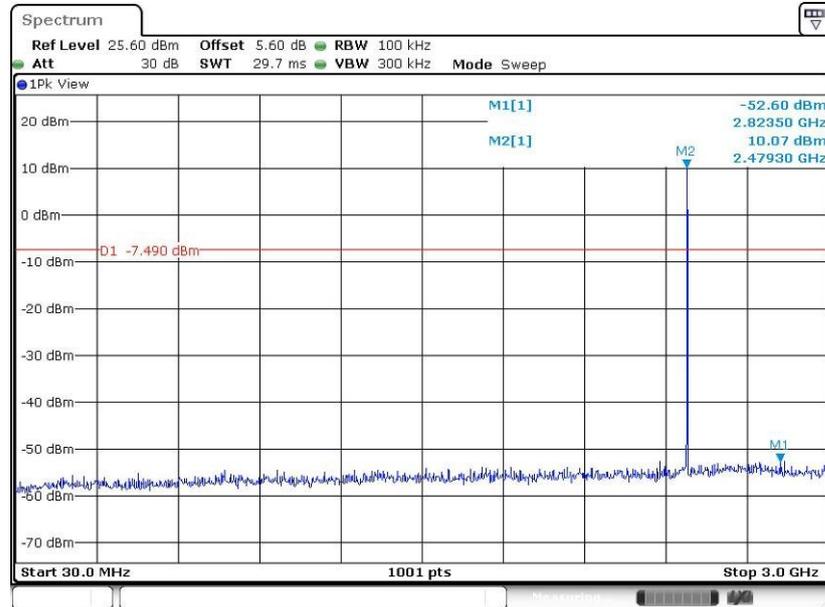
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 19



Date: 16.NOV.2020 21:59:26

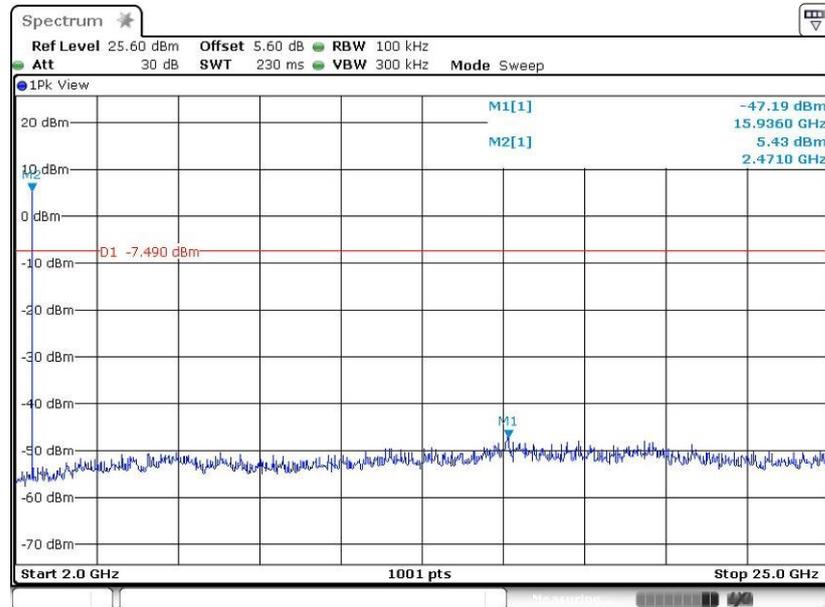


### Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39



Date: 16.NOV.2020 22:02:32

### Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39



Date: 16.NOV.2020 22:02:41



### 3.5 Radiated Band Edges and Spurious Emission Measurement

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

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. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the 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                             |

#### 3.5.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

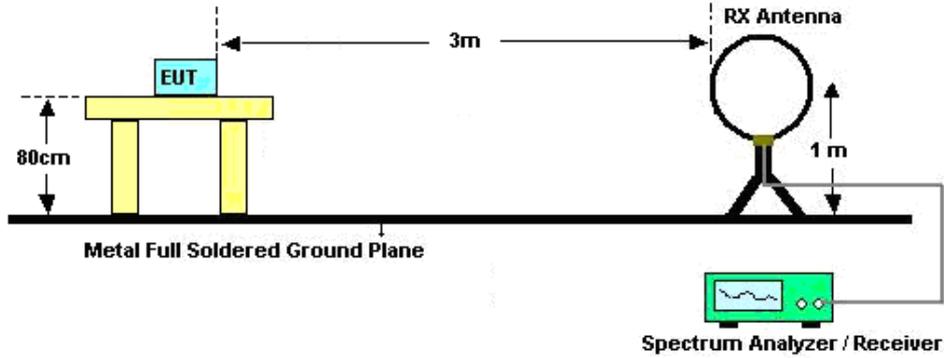


**3.5.3 Test Procedures**

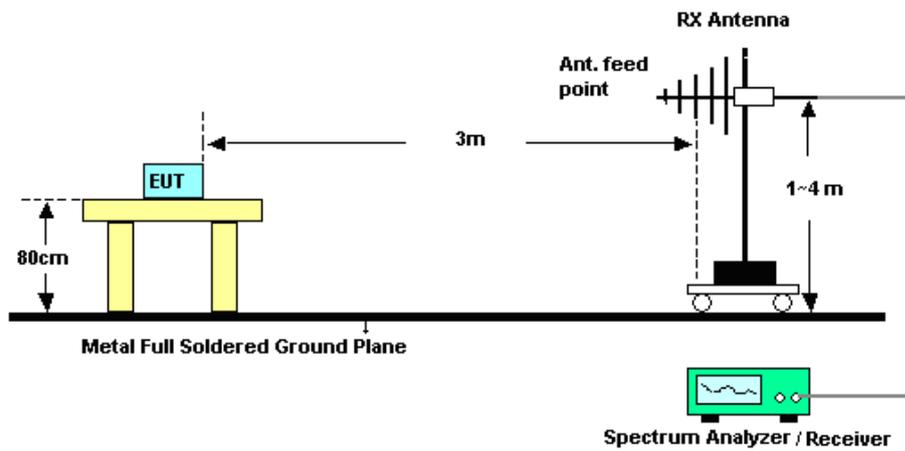
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. 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.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. 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;  $VBW \geq RBW$ ; Sweep = auto; Detector function = peak; Trace = max hold;
  - (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \geq 1$  GHz for peak measurement.  
For average measurement:
    - $VBW = 10$  Hz, when duty cycle is no less than 98 percent.
    - $VBW \geq 1/T$ , 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.

### 3.5.4 Test Setup

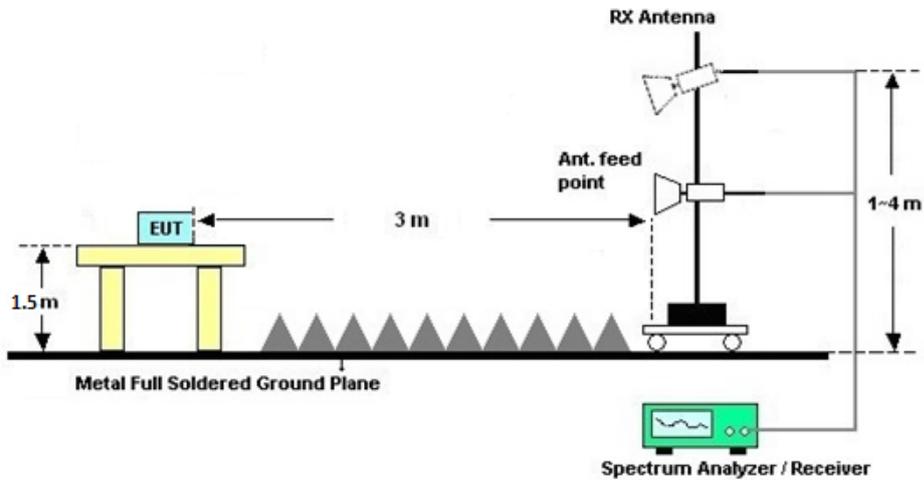
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





### **3.5.5 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 was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

### **3.5.6 Test Result of Radiated Spurious at Band Edges**

Please refer to Appendix C.

### **3.5.7 Duty Cycle**

Please refer to Appendix D.

### **3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)**

Please refer to Appendix C.



### 3.6 AC Conducted Emission Measurement

#### 3.6.1 Limit of AC Conducted Emission

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.

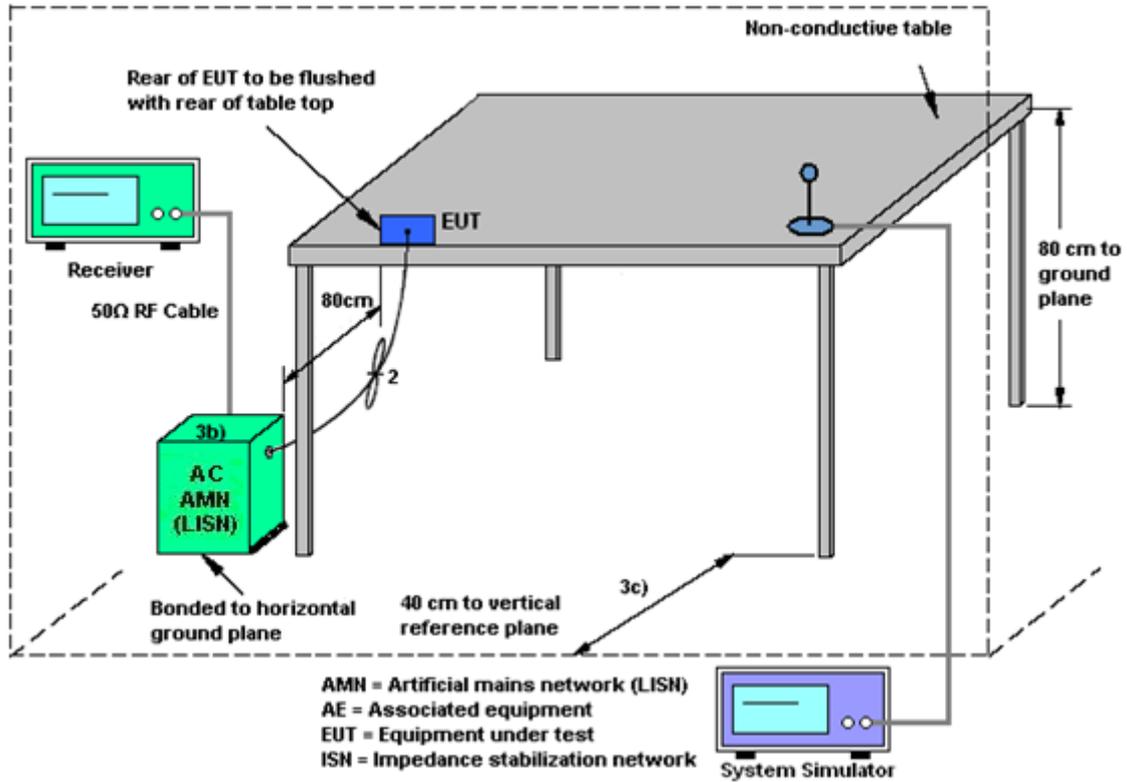
#### 3.6.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

#### 3.6.3 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.

### 3.6.4 Test Setup



### 3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



## **3.7 Antenna Requirements**

### **3.7.1 Standard Applicable**

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 rule.

### **3.7.2 Antenna Anti-Replacement Construction**

An embedded-in antenna design is used.

### **3.7.3 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.



## 4 List of Measuring Equipment

| Instrument                        | Manufacturer | Model No.              | Serial No.   | Characteristics         | Calibration Date | Test Date                   | Due Date      | Remark                |
|-----------------------------------|--------------|------------------------|--------------|-------------------------|------------------|-----------------------------|---------------|-----------------------|
| Spectrum Analyzer                 | R&S          | FSV40                  | 101040       | 10Hz~40GHz              | Nov. 02, 2020    | Nov. 16, 2020               | Nov. 01, 2021 | Conducted (TH01-KS)   |
| Pulse Power Sensor                | Anritsu      | MA2411B                | 0917070      | 300MHz~40GHz            | Jan. 13, 2020    | Nov. 16, 2020               | Jan. 12, 2021 | Conducted (TH01-KS)   |
| Power Meter                       | Anritsu      | ML2495A                | 1005002      | 50MHz Bandwidth         | Jan. 13, 2020    | Nov. 16, 2020               | Jan. 12, 2021 | Conducted (TH01-KS)   |
| EMI Test Receiver                 | Keysight     | N9038A                 | MY56400004   | 3Hz~8.5GHz; Max 30dBm   | Oct. 17, 2020    | Nov. 22, 2020~Dec. 08, 2020 | Oct. 16, 2021 | Radiation (03CH06-KS) |
| EXA Spectrum Analyzer             | Keysight     | N9010A                 | MY55150208   | 10Hz~44GHz              | Apr. 14, 2020    | Nov. 22, 2020~Dec. 08, 2020 | Apr. 13, 2021 | Radiation (03CH06-KS) |
| Loop Antenna                      | R&S          | HFH2-Z2                | 100321       | 9kHz~30MHz              | Nov. 01, 2020    | Nov. 22, 2020~Dec. 08, 2020 | Oct. 31, 2021 | Radiation (03CH06-KS) |
| Bilog Antenna                     | TeseQ        | CBL6111D               | 49921        | 30MHz~1GHz              | May 29, 2020     | Nov. 22, 2020~Dec. 08, 2020 | May 28, 2021  | Radiation (03CH06-KS) |
| Double Ridge Horn Antenna         | ETS-Lindgren | 3117                   | 00218652     | 1GHz~18GHz              | Apr. 27, 2020    | Nov. 22, 2020~Dec. 08, 2020 | Apr. 26, 2021 | Radiation (03CH06-KS) |
| SHF-EHF Horn                      | Com-power    | AH-840                 | 101115       | 18GHz~40GHz             | Nov. 09, 2020    | Nov. 22, 2020~Dec. 08, 2020 | Nov. 08, 2021 | Radiation (03CH06-KS) |
| Amplifier                         | SONOMA       | 310N                   | 187289       | 9KHz ~1GHZ              | Apr. 14, 2020    | Nov. 22, 2020~Dec. 08, 2020 | Apr. 13, 2021 | Radiation (03CH06-KS) |
| Amplifier                         | MITEQ        | EM18G40GGA             | 060728       | 18~40GHz                | Jan. 08, 2020    | Nov. 22, 2020~Dec. 08, 2020 | Jan. 07, 2021 | Radiation (03CH06-KS) |
| high gain Amplifier               | MITEQ        | AMF-7D-00101800-30-10P | 2025788      | 1Ghz-18Ghz              | Jan. 03, 2020    | Nov. 22, 2020~Dec. 08, 2020 | Jan. 02, 2021 | Radiation (03CH06-KS) |
| Amplifier                         | Keysight     | 83017A                 | MY53270203   | 500MHz~26.5GHz          | Apr. 15, 2020    | Nov. 22, 2020~Dec. 08, 2020 | Apr. 14, 2021 | Radiation (03CH06-KS) |
| AC Power Source                   | Chroma       | 61601                  | F104090004   | N/A                     | NCR              | Nov. 22, 2020~Dec. 08, 2020 | NCR           | Radiation (03CH06-KS) |
| Turn Table                        | ChamPro      | EM 1000-T              | 060762-T     | 0~360 degree            | NCR              | Nov. 22, 2020~Dec. 08, 2020 | NCR           | Radiation (03CH06-KS) |
| Antenna Mast                      | ChamPro      | EM 1000-A              | 060762-A     | 1 m~4 m                 | NCR              | Nov. 22, 2020~Dec. 08, 2020 | NCR           | Radiation (03CH06-KS) |
| EMI Receiver                      | R&S          | ESCI7                  | 100768       | 9kHz~7GHz;              | Apr. 14, 2020    | Nov. 12, 2020               | Apr. 13, 2021 | Conduction (CO01-KS)  |
| AC LISN (for auxiliary equipment) | MessTec      | AN3016                 | 060103       | 9kHz~30MHz              | Oct. 17, 2020    | Nov. 12, 2020               | Oct. 16, 2021 | Conduction (CO01-KS)  |
| AC LISN                           | MessTec      | AN3016                 | 060105       | 9kHz~30MHz              | Oct. 27, 2020    | Nov. 12, 2020               | Oct. 26, 2021 | Conduction (CO01-KS)  |
| AC Power Source                   | Chroma       | 61602                  | ABP000000811 | AC 0V~300V, 45Hz~1000Hz | Oct. 17, 2020    | Nov. 12, 2020               | Oct. 16, 2021 | Conduction (CO01-KS)  |

NCR: No Calibration Required



## 5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

|   |        |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 2.9 dB |
|---|--------|

### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

|   |        |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 5.0 dB |
|---|--------|

### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

|   |        |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 5.0 dB |
|---|--------|

### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

|   |        |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 5.0 dB |
|---|--------|



## **Appendix A. Conducted Test Results**

**Bluetooth v4.2 Low Energy**

|                |            |                    |       |    |
|----------------|------------|--------------------|-------|----|
| Test Engineer: | Rise liu   | Temperature:       | 20~26 | °C |
| Test Date:     | 2020/11/16 | Relative Humidity: | 40~51 | %  |

**TEST RESULTS DATA**  
**6dB and 99% Occupied Bandwidth**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|-----------------------|--------------|--------------------|-----------|
| BLE  | 1Mbps     | 1   | 0   | 2402        | 1.02                  | 0.67         | 0.50               | Pass      |
| BLE  | 1Mbps     | 1   | 19  | 2440        | 1.01                  | 0.67         | 0.50               | Pass      |
| BLE  | 1Mbps     | 1   | 39  | 2480        | 1.01                  | 0.67         | 0.50               | Pass      |

**TEST RESULTS DATA**  
**Peak Power Table**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Peak Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
|------|-----------|-----|-----|-------------|----------------------------|-----------------------------|----------|------------------|------------------------|------------|
| BLE  | 1Mbps     | 1   | 0   | 2402        | 7.63                       | 30.00                       | -4.60    | 3.03             | 36.00                  | Pass       |
| BLE  | 1Mbps     | 1   | 19  | 2440        | 9.21                       | 30.00                       | -4.60    | 4.61             | 36.00                  | Pass       |
| BLE  | 1Mbps     | 1   | 39  | 2480        | 8.27                       | 30.00                       | -4.60    | 3.67             | 36.00                  | Pass       |

**TEST RESULTS DATA**  
**Average Power Table**  
**(Reporting Only)**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Duty Factor (dB) | Average Conducted Power (dBm) |
|------|-----------|-----|-----|-------------|------------------|-------------------------------|
| BLE  | 1Mbps     | 1   | 0   | 2402        | 2.07             | 7.51                          |
| BLE  | 1Mbps     | 1   | 19  | 2440        | 2.07             | 9.01                          |
| BLE  | 1Mbps     | 1   | 39  | 2480        | 2.07             | 8.10                          |

**TEST RESULTS DATA**  
**Peak Power Density**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Peak PSD (dBm /3kHz) | DG (dBi) | Peak PSD Limit (dBm /3kHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|------------------------|----------------------|----------|----------------------------|-----------|
| BLE  | 1Mbps     | 1   | 0   | 2402        | 12.17                  | -2.23                | -4.60    | 8.00                       | Pass      |
| BLE  | 1Mbps     | 1   | 19  | 2440        | 13.68                  | -0.71                | -4.60    | 8.00                       | Pass      |
| BLE  | 1Mbps     | 1   | 39  | 2480        | 12.44                  | -1.88                | -4.60    | 8.00                       | Pass      |

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.

**Bluetooth v5.1 Low Energy**

|                |            |                    |       |    |
|----------------|------------|--------------------|-------|----|
| Test Engineer: | Rise liu   | Temperature:       | 20~26 | °C |
| Test Date:     | 2020/11/16 | Relative Humidity: | 40~51 | %  |

**TEST RESULTS DATA**  
**6dB and 99% Occupied Bandwidth**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|-----------------------|--------------|--------------------|-----------|
| BLE  | 2Mbps     | 1   | 0   | 1000        | 1.99                  | 1.15         | 0.50               | Pass      |
| BLE  | 2Mbps     | 1   | 19  | 2440        | 1.99                  | 1.14         | 0.50               | Pass      |
| BLE  | 2Mbps     | 1   | 39  | 2480        | 1.98                  | 1.15         | 0.50               | Pass      |

**TEST RESULTS DATA**  
**Peak Power Table**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Peak Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
|------|-----------|-----|-----|-------------|----------------------------|-----------------------------|----------|------------------|------------------------|------------|
| BLE  | 2Mbps     | 1   | 0   | 2402        | 7.17                       | 30.00                       | -4.60    | 2.57             | 36.00                  | Pass       |
| BLE  | 2Mbps     | 1   | 19  | 2440        | 8.71                       | 30.00                       | -4.60    | 4.11             | 36.00                  | Pass       |
| BLE  | 2Mbps     | 1   | 39  | 2480        | 7.52                       | 30.00                       | -4.60    | 2.92             | 36.00                  | Pass       |

**TEST RESULTS DATA**  
**Average Power Table**  
**(Reporting Only)**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Duty Factor (dB) | Average Conducted Power (dBm) |
|------|-----------|-----|-----|-------------|------------------|-------------------------------|
| BLE  | 2Mbps     | 1   | 0   | 2402        | 4.83             | 6.45                          |
| BLE  | 2Mbps     | 1   | 19  | 2440        | 4.83             | 8.19                          |
| BLE  | 2Mbps     | 1   | 39  | 2480        | 4.83             | 6.88                          |

**TEST RESULTS DATA**  
**Peak Power Density**

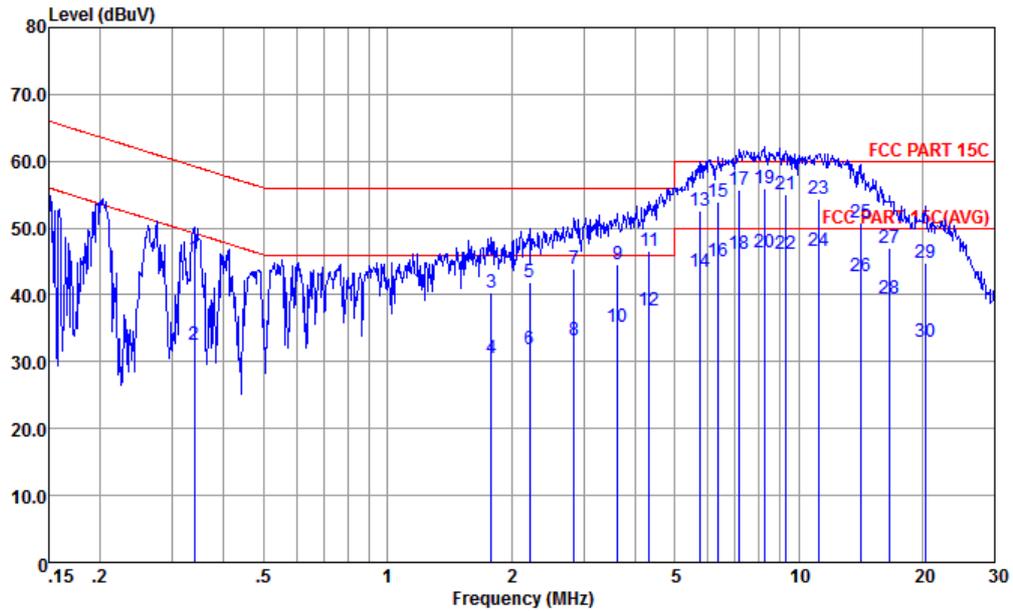
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Peak PSD (dBm /3kHz) | DG (dBi) | Peak PSD Limit (dBm /3kHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|------------------------|----------------------|----------|----------------------------|-----------|
| BLE  | 2Mbps     | 1   | 0   | 2402        | 12.19                  | -5.14                | -4.60    | 8.00                       | Pass      |
| BLE  | 2Mbps     | 1   | 19  | 2440        | 13.70                  | -3.61                | -4.60    | 8.00                       | Pass      |
| BLE  | 2Mbps     | 1   | 39  | 2480        | 12.51                  | -4.76                | -4.60    | 8.00                       | Pass      |

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.



## Appendix B. AC Conducted Emission Test Results

|                 |   |                     |             |
|-----------------|---|---------------------|-------------|
| Test Engineer : | Amos Zhang  | Temperature :       | 25.3~26.2°C |
|                 |   | Relative Humidity : | 38~40%      |
| Test Voltage :  | 120Vac / 60Hz   | Phase :             | Line        |
| Remark :        | All emissions not reported here are more than 10 dB below the prescribed limit. |                     |             |

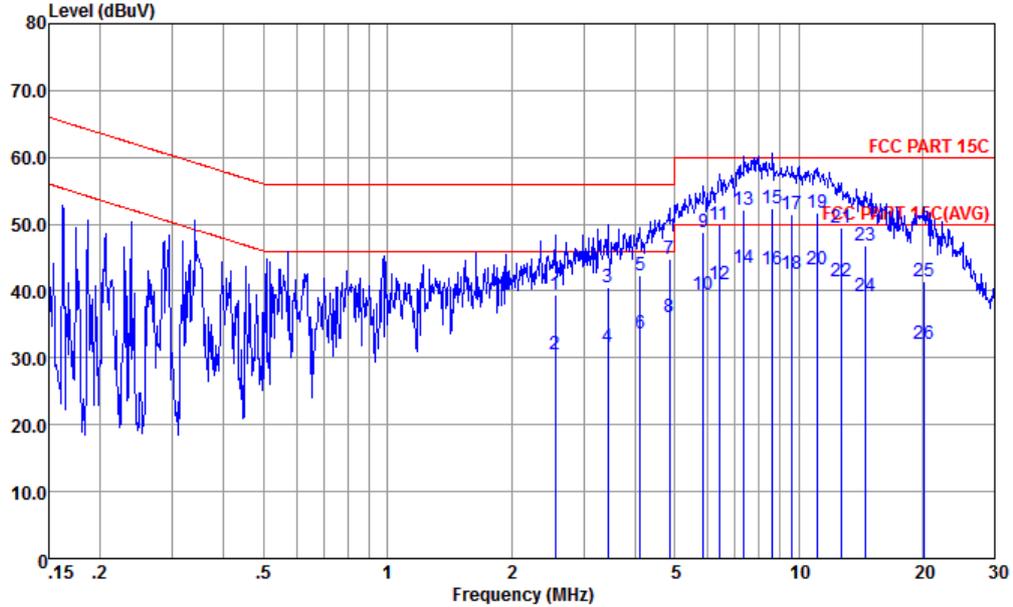


Site : CO01-KS  
Condition : FCC PART 15C TWO-LISN-CN02-L LINE

|      | Freq   | Level | Over   | Limit | Read  | LISN   | Cable | Remark  |
|------|--------|-------|--------|-------|-------|--------|-------|---------|
|      | MHz    | dBuV  | Limit  | Line  | Level | Factor | Loss  |         |
|      |        |       | dB     | dBuV  | dBuV  | dB     | dB    |         |
| 1    | 0.339  | 45.53 | -13.69 | 59.22 | 25.60 | 9.64   | 10.29 | QP      |
| 2    | 0.339  | 32.43 | -16.79 | 49.22 | 12.50 | 9.64   | 10.29 | Average |
| 3    | 1.790  | 40.33 | -15.67 | 56.00 | 20.20 | 9.90   | 10.23 | QP      |
| 4    | 1.790  | 30.43 | -15.57 | 46.00 | 10.30 | 9.90   | 10.23 | Average |
| 5    | 2.213  | 42.00 | -14.00 | 56.00 | 21.80 | 9.97   | 10.23 | QP      |
| 6    | 2.213  | 31.80 | -14.20 | 46.00 | 11.60 | 9.97   | 10.23 | Average |
| 7    | 2.839  | 43.88 | -12.12 | 56.00 | 23.60 | 10.04  | 10.24 | QP      |
| 8    | 2.839  | 33.18 | -12.82 | 46.00 | 12.90 | 10.04  | 10.24 | Average |
| 9    | 3.623  | 44.48 | -11.52 | 56.00 | 24.10 | 10.13  | 10.25 | QP      |
| 10   | 3.623  | 35.18 | -10.82 | 46.00 | 14.80 | 10.13  | 10.25 | Average |
| 11   | 4.338  | 46.65 | -9.35  | 56.00 | 26.20 | 10.19  | 10.26 | QP      |
| 12   | 4.338  | 37.65 | -8.35  | 46.00 | 17.20 | 10.19  | 10.26 | Average |
| 13   | 5.774  | 52.49 | -7.51  | 60.00 | 31.91 | 10.30  | 10.28 | QP      |
| 14   | 5.774  | 43.49 | -6.51  | 50.00 | 22.91 | 10.30  | 10.28 | Average |
| 15   | 6.386  | 53.84 | -6.16  | 60.00 | 33.20 | 10.35  | 10.29 | QP      |
| 16   | 6.386  | 44.94 | -5.06  | 50.00 | 24.30 | 10.35  | 10.29 | Average |
| 17   | 7.175  | 55.60 | -4.40  | 60.00 | 34.89 | 10.40  | 10.31 | QP      |
| 18   | 7.175  | 46.20 | -3.80  | 50.00 | 25.49 | 10.40  | 10.31 | Average |
| 19   | 8.235  | 55.96 | -4.04  | 60.00 | 35.20 | 10.44  | 10.32 | QP      |
| 20   | 8.235  | 46.26 | -3.74  | 50.00 | 25.50 | 10.44  | 10.32 | Average |
| 21   | 9.302  | 55.01 | -4.99  | 60.00 | 34.20 | 10.48  | 10.33 | QP      |
| 22   | 9.302  | 46.21 | -3.79  | 50.00 | 25.40 | 10.48  | 10.33 | Average |
| 23   | 11.198 | 54.47 | -5.53  | 60.00 | 33.50 | 10.61  | 10.36 | QP      |
| 24 * | 11.198 | 46.57 | -3.43  | 50.00 | 25.60 | 10.61  | 10.36 | Average |
| 25   | 14.213 | 50.86 | -9.14  | 60.00 | 29.63 | 10.84  | 10.39 | QP      |
| 26   | 14.213 | 42.83 | -7.17  | 50.00 | 21.60 | 10.84  | 10.39 | Average |
| 27   | 16.661 | 47.02 | -12.98 | 60.00 | 25.60 | 10.99  | 10.43 | QP      |
| 28   | 16.661 | 39.52 | -10.48 | 50.00 | 18.10 | 10.99  | 10.43 | Average |
| 29   | 20.377 | 44.88 | -15.12 | 60.00 | 23.20 | 11.18  | 10.50 | QP      |
| 30   | 20.377 | 32.98 | -17.02 | 50.00 | 11.30 | 11.18  | 10.50 | Average |



|                 |   |                     |             |
|-----------------|---|---------------------|-------------|
| Test Engineer : | Amos Zhang  | Temperature :       | 25.3~26.2°C |
|                 |   | Relative Humidity : | 38~40%      |
| Test Voltage :  | 120Vac / 60Hz   | Phase :             | Neutral     |
| Remark :        | All emissions not reported here are more than 10 dB below the prescribed limit. |                     |             |



Site : CO01-KS  
 Condition : FCC PART 15C TWO-LISN-CN02-N NEUTRAL

|      | Freq   | Level | Over   | Limit | Read  | LISN   | Cable | Remark  |
|------|--------|-------|--------|-------|-------|--------|-------|---------|
|      | MHz    | dBuV  | Limit  | Line  | Level | Factor | Loss  |         |
|      |        |       | dB     | dBuV  | dBuV  | dB     | dB    |         |
| 1    | 2.554  | 39.45 | -16.55 | 56.00 | 19.20 | 10.01  | 10.24 | QP      |
| 2    | 2.554  | 30.55 | -15.45 | 46.00 | 10.30 | 10.01  | 10.24 | Average |
| 3    | 3.436  | 40.67 | -15.33 | 56.00 | 20.30 | 10.12  | 10.25 | QP      |
| 4    | 3.436  | 31.67 | -14.33 | 46.00 | 11.30 | 10.12  | 10.25 | Average |
| 5    | 4.114  | 42.24 | -13.76 | 56.00 | 21.81 | 10.18  | 10.25 | QP      |
| 6    | 4.114  | 33.74 | -12.26 | 46.00 | 13.31 | 10.18  | 10.25 | Average |
| 7    | 4.848  | 44.71 | -11.29 | 56.00 | 24.20 | 10.24  | 10.27 | QP      |
| 8    | 4.848  | 36.01 | -9.99  | 46.00 | 15.50 | 10.24  | 10.27 | Average |
| 9    | 5.867  | 48.82 | -11.18 | 60.00 | 28.21 | 10.33  | 10.28 | QP      |
| 10   | 5.867  | 39.52 | -10.48 | 50.00 | 18.91 | 10.33  | 10.28 | Average |
| 11   | 6.420  | 49.87 | -10.13 | 60.00 | 29.21 | 10.37  | 10.29 | QP      |
| 12   | 6.420  | 40.97 | -9.03  | 50.00 | 20.31 | 10.37  | 10.29 | Average |
| 13   | 7.368  | 52.04 | -7.96  | 60.00 | 31.29 | 10.44  | 10.31 | QP      |
| 14 * | 7.368  | 43.34 | -6.66  | 50.00 | 22.59 | 10.44  | 10.31 | Average |
| 15   | 8.637  | 52.32 | -7.68  | 60.00 | 31.49 | 10.50  | 10.33 | QP      |
| 16   | 8.637  | 43.12 | -6.88  | 50.00 | 22.29 | 10.50  | 10.33 | Average |
| 17   | 9.654  | 51.47 | -8.53  | 60.00 | 30.59 | 10.54  | 10.34 | QP      |
| 18   | 9.654  | 42.47 | -7.53  | 50.00 | 21.59 | 10.54  | 10.34 | Average |
| 19   | 11.139 | 51.64 | -8.36  | 60.00 | 30.60 | 10.68  | 10.36 | QP      |
| 20   | 11.139 | 43.34 | -6.66  | 50.00 | 22.30 | 10.68  | 10.36 | Average |
| 21   | 12.716 | 49.42 | -10.58 | 60.00 | 28.21 | 10.84  | 10.37 | QP      |
| 22   | 12.716 | 41.52 | -8.48  | 50.00 | 20.31 | 10.84  | 10.37 | Average |
| 23   | 14.594 | 46.91 | -13.09 | 60.00 | 25.51 | 11.01  | 10.39 | QP      |
| 24   | 14.594 | 39.21 | -10.79 | 50.00 | 17.81 | 11.01  | 10.39 | Average |
| 25   | 20.270 | 41.55 | -18.45 | 60.00 | 19.60 | 11.45  | 10.50 | QP      |
| 26   | 20.270 | 32.15 | -17.85 | 50.00 | 10.20 | 11.45  | 10.50 | Average |

Note:

- Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
- Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)



## Appendix C. Radiated Spurious Emission

For Bluetooth LE v4.2:

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

| BLE                     | Note  | Frequency | Level      | Over Limit | Limit Line | Read Level | Antenna Factor | Path Loss | Preamp Factor | Ant Pos | Table Pos | Peak Avg. | Pol.    |
|-------------------------|---|-----------|------------|------------|------------|------------|----------------|-----------|---------------|---------|-----------|-----------|---------|
|                         |   | ( MHz )   | ( dBμV/m ) | ( dB )     | ( dBμV/m ) | ( dBμV )   | ( dB/m )       | ( dB )    | ( dB )        | ( cm )  | ( deg )   | ( P/A )   | ( H/V ) |
| BLE<br>CH 00<br>2402MHz |   | 2387.74   | 54.84      | -19.16     | 74         | 49.2       | 32.2           | 7.43      | 33.99         | 100     | 229       | P         | H       |
|                         |   | 2385.92   | 44.52      | -9.48      | 54         | 38.88      | 32.2           | 7.43      | 33.99         | 100     | 229       | A         | H       |
|                         | *   | 2402      | 106.64     | -          | -          | 100.99     | 32.2           | 7.43      | 33.98         | 100     | 229       | P         | H       |
|                         | *   | 2402      | 105.26     | -          | -          | 99.61      | 32.2           | 7.43      | 33.98         | 100     | 229       | A         | H       |
|                         |   | 2383.32   | 54.34      | -19.66     | 74         | 48.83      | 32.1           | 7.4       | 33.99         | 331     | 121       | P         | V       |
|                         |   | 2367.72   | 44.35      | -9.65      | 54         | 38.98      | 32             | 7.37      | 34            | 331     | 121       | A         | V       |
|                         | *   | 2402      | 104.27     | -          | -          | 98.62      | 32.2           | 7.43      | 33.98         | 331     | 121       | P         | V       |
|                         | *   | 2402      | 103.58     | -          | -          | 97.93      | 32.2           | 7.43      | 33.98         | 331     | 121       | A         | V       |
| BLE<br>CH 39<br>2480MHz |   | 2486.62   | 54.51      | -19.49     | 74         | 48.89      | 31.99          | 7.56      | 33.93         | 141     | 90        | P         | H       |
|                         |   | 2483.5    | 46.87      | -7.13      | 54         | 41.26      | 31.99          | 7.56      | 33.94         | 141     | 90        | A         | H       |
|                         | *   | 2480      | 102.36     | -          | -          | 96.75      | 31.99          | 7.56      | 33.94         | 141     | 90        | P         | H       |
|                         | *   | 2480      | 101.61     | -          | -          | 96         | 31.99          | 7.56      | 33.94         | 141     | 90        | A         | H       |
|                         |   | 2489.8    | 54.37      | -19.63     | 74         | 48.77      | 31.94          | 7.59      | 33.93         | 400     | 118       | P         | V       |
|                         |   | 2483.5    | 45.53      | -8.47      | 54         | 39.92      | 31.99          | 7.56      | 33.94         | 400     | 118       | A         | V       |
|                         | *   | 2480      | 99.03      | -          | -          | 93.42      | 31.99          | 7.56      | 33.94         | 400     | 118       | P         | V       |
|                         | *   | 2480      | 98.96      | -          | -          | 93.35      | 31.99          | 7.56      | 33.94         | 400     | 118       | A         | V       |
| Remark                  | <ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol> |           |            |            |            |            |                |           |               |         |           |           |         |



2.4GHz 2400~2483.5MHz
BLE (Harmonic @ 3m)

Table with 14 columns: BLE, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Path Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include BLE CH 00 (2402MHz), BLE CH 19 (2440MHz), and BLE CH 39 (2480MHz) with multiple frequency entries.

Remark

- 1. No other spurious found.
2. All results are PASS against Peak and Average limit line.



Emission below 1GHz

2.4GHz BLE (LF)

| BLE                 | Note   | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Path   | Preamp | Ant    | Table   | Peak    | Pol.    |
|---------------------|--|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
|                     |  | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |
| 2.4GHz<br>BLE<br>LF |  | 30.97     | 19.05      | -20.95 | 40         | 25.84    | 24.57    | 0.84   | 32.2   | -      | -       | P       | H       |
|                     |  | 128.94    | 17.47      | -26.03 | 43.5       | 30.03    | 17.6     | 1.98   | 32.14  | -      | -       | P       | H       |
|                     |  | 171.62    | 21.11      | -22.39 | 43.5       | 35.34    | 15.59    | 2.28   | 32.1   | -      | -       | P       | H       |
|                     |  | 222.06    | 23.98      | -22.02 | 46         | 38       | 15.52    | 2.6    | 32.14  | -      | -       | P       | H       |
|                     |  | 308.39    | 25.88      | -20.12 | 46         | 35.44    | 19.49    | 3.07   | 32.12  | 100    | 360     | P       | H       |
|                     |  | 588.72    | 24.9       | -21.1  | 46         | 27.27    | 25.71    | 4.22   | 32.3   | -      | -       | P       | H       |
|                     |  | 32.91     | 30.6       | -9.4   | 40         | 38.4     | 23.51    | 0.89   | 32.2   | 100    | 0       | P       | V       |
|                     |  | 54.25     | 26.2       | -13.8  | 40         | 43.73    | 13.4     | 1.27   | 32.2   | -      | -       | P       | V       |
|                     |  | 206.54    | 21.75      | -21.75 | 43.5       | 36.18    | 15.17    | 2.51   | 32.11  | -      | -       | P       | V       |
|                     |  | 436.43    | 19.92      | -26.08 | 46         | 25.72    | 22.78    | 3.65   | 32.23  | -      | -       | P       | V       |
|                     |  | 734.22    | 26.22      | -19.78 | 46         | 26.05    | 27.73    | 4.71   | 32.27  | -      | -       | P       | V       |
|                     |  | 912.7     | 28.06      | -17.94 | 46         | 25.43    | 29.58    | 5.25   | 32.2   | -      | -       | P       | V       |
| Remark              | <ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against limit line.</li> </ol> |           |            |        |            |          |          |        |        |        |         |         |         |



For Bluetooth LE v5.1:

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

| BLE                     | Note  | Frequency | Level      | Over Limit | Limit Line | Read Level | Antenna Factor | Path Loss | Preamp Factor | Ant Pos | Table Pos | Peak Avg. | Pol.    |
|-------------------------|---|-----------|------------|------------|------------|------------|----------------|-----------|---------------|---------|-----------|-----------|---------|
|                         |   | ( MHz )   | ( dBμV/m ) | ( dB )     | ( dBμV/m ) | ( dBμV )   | ( dB/m )       | ( dB )    | ( dB )        | ( cm )  | ( deg )   | ( P/A )   | ( H/V ) |
| BLE<br>CH 00<br>2402MHz |   | 2381.11   | 53.95      | -20.05     | 74         | 48.45      | 32.1           | 7.4       | 34            | 190     | 234       | P         | H       |
|                         |   | 2386.7    | 44.69      | -9.31      | 54         | 39.05      | 32.2           | 7.43      | 33.99         | 190     | 234       | A         | H       |
|                         | *   | 2402      | 106.34     | -          | -          | 100.69     | 32.2           | 7.43      | 33.98         | 190     | 234       | P         | H       |
|                         | *   | 2402      | 104.92     | -          | -          | 99.27      | 32.2           | 7.43      | 33.98         | 190     | 234       | A         | H       |
|                         |   | 2389.69   | 54.75      | -19.25     | 74         | 49.11      | 32.2           | 7.43      | 33.99         | 345     | 122       | P         | V       |
|                         |   | 2386.44   | 44.91      | -9.09      | 54         | 39.27      | 32.2           | 7.43      | 33.99         | 345     | 122       | A         | V       |
|                         | *   | 2402      | 104.08     | -          | -          | 98.43      | 32.2           | 7.43      | 33.98         | 345     | 122       | P         | V       |
|                         | *   | 2402      | 102.67     | -          | -          | 97.02      | 32.2           | 7.43      | 33.98         | 345     | 122       | A         | V       |
| BLE<br>CH 39<br>2480MHz |   | 2483.5    | 54.59      | -19.41     | 74         | 48.98      | 31.99          | 7.56      | 33.94         | 123     | 86        | P         | H       |
|                         |   | 2483.5    | 49.32      | -4.68      | 54         | 43.71      | 31.99          | 7.56      | 33.94         | 123     | 86        | A         | H       |
|                         | *   | 2480      | 101.79     | -          | -          | 96.18      | 31.99          | 7.56      | 33.94         | 123     | 86        | P         | H       |
|                         | *   | 2480      | 100.38     | -          | -          | 94.77      | 31.99          | 7.56      | 33.94         | 123     | 86        | A         | H       |
|                         |   | 2484.82   | 53.93      | -20.07     | 74         | 48.32      | 31.99          | 7.56      | 33.94         | 400     | 123       | P         | V       |
|                         |   | 2483.5    | 47.69      | -6.31      | 54         | 42.08      | 31.99          | 7.56      | 33.94         | 400     | 123       | A         | V       |
|                         | *   | 2480      | 99.61      | -          | -          | 94         | 31.99          | 7.56      | 33.94         | 400     | 123       | P         | V       |
|                         | *   | 2480      | 97.92      | -          | -          | 92.31      | 31.99          | 7.56      | 33.94         | 400     | 123       | A         | V       |
| Remark                  | <ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol> |           |            |            |            |            |                |           |               |         |           |           |         |



2.4GHz 2400~2483.5MHz
BLE (Harmonic @ 3m)

Table with 14 columns: BLE, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Path Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include BLE CH 00 (2402MHz) and BLE CH 19 (2440MHz) and BLE CH 39 (2480MHz) with multiple frequency entries.

Remark

- 1. No other spurious found.
2. All results are PASS against Peak and Average limit line.



Emission below 1GHz

2.4GHz BLE (LF)

| BLE                 | Note   | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Path   | Preamp | Ant    | Table   | Peak    | Pol.    |
|---------------------|--|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
|                     |  | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |
| 2.4GHz<br>BLE<br>LF |  | 30.97     | 18.91      | -21.09 | 40         | 25.7     | 24.57    | 0.84   | 32.2   | -      | -       | P       | H       |
|                     |  | 157.07    | 19.14      | -24.36 | 43.5       | 32.37    | 16.68    | 2.19   | 32.1   | -      | -       | P       | H       |
|                     |  | 234.67    | 23.44      | -22.56 | 46         | 35.99    | 16.95    | 2.67   | 32.17  | -      | -       | P       | H       |
|                     |  | 309.36    | 26.13      | -19.87 | 46         | 35.68    | 19.5     | 3.07   | 32.12  | -      | -       | P       | H       |
|                     |  | 620.73    | 24.38      | -21.62 | 46         | 26.22    | 26.09    | 4.33   | 32.26  | -      | -       | P       | H       |
|                     |  | 936.95    | 27.74      | -18.26 | 46         | 24.1     | 30.52    | 5.32   | 32.2   | 100    | 360     | P       | H       |
|                     |  | 31.94     | 29.72      | -10.28 | 40         | 37.02    | 24.04    | 0.86   | 32.2   | 100    | 0       | P       | V       |
|                     |  | 54.25     | 24.72      | -15.28 | 40         | 42.25    | 13.4     | 1.27   | 32.2   | -      | -       | P       | V       |
|                     |  | 159.01    | 17.1       | -26.4  | 43.5       | 30.44    | 16.56    | 2.2    | 32.1   | -      | -       | P       | V       |
|                     |  | 210.42    | 21.29      | -22.21 | 43.5       | 35.68    | 15.2     | 2.53   | 32.12  | -      | -       | P       | V       |
|                     |  | 464.56    | 20.84      | -25.16 | 46         | 25.97    | 23.36    | 3.77   | 32.26  | -      | -       | P       | V       |
|                     | 806  | 25.54     | -20.46     | 46     | 24.58      | 28.33    | 4.94     | 32.31  | -      | -      | P       | V       |         |
| Remark              | <ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against limit line.</li> </ol> |           |            |        |            |          |          |        |        |        |         |         |         |



**Note symbol**

|     |  |
|-----|--|
| *   | <b>Fundamental Frequency</b> which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. |
| !   | Test result is <b>over limit</b> line.   |
| P/A | <b>Peak</b> or <b>Average</b>  |
| H/V | <b>Horizontal</b> or <b>Vertical</b>   |



A calculation example for radiated spurious emission is shown as below:

| BLE                     | Note | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Path   | Preamp | Ant    | Table   | Peak    | Pol.    |
|-------------------------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
|                         |      | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |
| BLE<br>CH 00<br>2402MHz |      | 2390      | 55.45      | -18.55 | 74         | 54.51    | 32.22    | 4.58   | 35.86  | 103    | 308     | P       | H       |
|                         |      | 2390      | 43.54      | -10.46 | 54         | 42.6     | 32.22    | 4.58   | 35.86  | 103    | 308     | A       | H       |

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =  
Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

1. Level(dBμV/m)  
= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)  
= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)  
= 55.45 (dBμV/m)
2. Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 55.45(dBμV/m) – 74(dBμV/m)  
= -18.55(dB)

**For Average Limit @ 2390MHz:**

1. Level(dBμV/m)  
= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)  
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)  
= 43.54 (dBμV/m)
2. Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 43.54(dBμV/m) – 54(dBμV/m)  
= -10.46(dB)

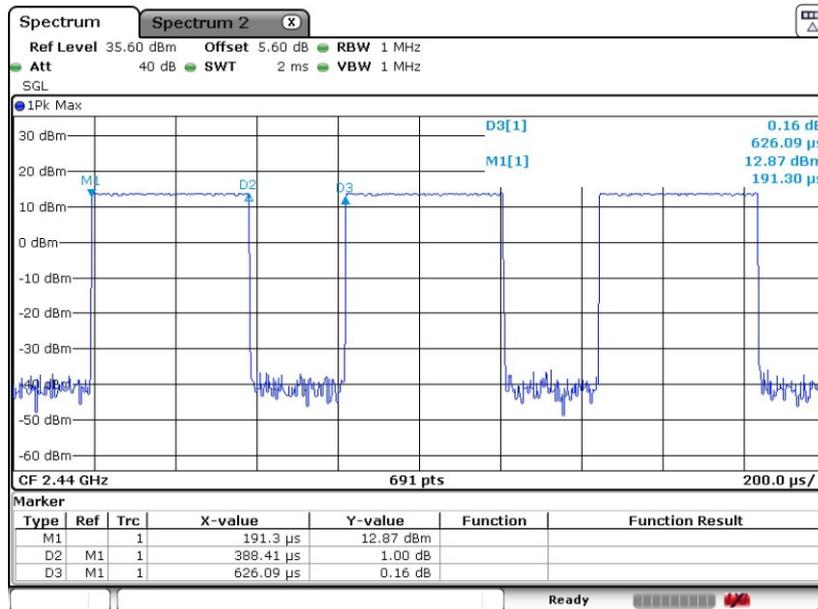
Both peak and average measured complies with the limit line, so test result is “PASS”.



## Appendix D. Duty Cycle Plots

| Band              | Duty Cycle(%) | T(ms) | 1/T(kHz) | VBW Setting |
|-------------------|---------------|-------|----------|-------------|
| Bluetooth LE v4.2 | 62.04         | 0.388 | 2.575    | 2.7KHz      |
| Bluetooth LE v5.1 | 32.87         | 0.206 | 4.859    | 5.1KHz      |

### Bluetooth LE v4.2





Bluetooth LE v5.1

