

**FCC Part 15C**  
**Measurement and Test Report**  
**For**  
**RVLOCK & CO, LLC**

**FCC ID: 2BDX6-R100V**

**FCC Rule(s):** FCC Part 15.247

**Product Description:** TREK KEYLESS ENTRY HANDLE

**Tested Model:** R100V

**Report No.:** BSL240161089608RF

**Tested Date:** Jan.5~Mar.27, 2024

**Issued Date:** Mar. 27, 2024

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## 1. GENERAL INFORMATION

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### 1.1 Product Description for Equipment Under Test (EUT)

**Client Information**

Applicant: RVLOCK & CO, LLC  
Address of applicant: 1770 WEST 2690 SOUTH WELLSVILLE, UT 84339 USA

Manufacturer: RVLOCK & CO, LLC  
Address of manufacturer: 1770 WEST 2690 SOUTH WELLSVILLE, UT 84339 USA

| General Description of EUT                                                                    |                           |
|-----------------------------------------------------------------------------------------------|---------------------------|
| Product Name:                                                                                 | TREK KEYLESS ENTRY HANDLE |
| Brand Name:                                                                                   | N/A                       |
| Models No.:                                                                                   | R100V                     |
| Rated Voltage:                                                                                | DC 3.7V by battery        |
| <i>Note: The test data is gathered from a production sample provided by the manufacturer.</i> |                           |

| Technical Characteristics of EUT |              |
|----------------------------------|--------------|
| Bluetooth Version:               | V5.3         |
| Frequency Range:                 | 2402-2480MHz |
| Modulation:                      | GFSK         |
| Quantity of Channels:            | 40           |
| Channel Separation:              | 2MHz         |
| Type of Antenna:                 | Chip Antenna |
| Antenna Gain:                    | 1.49dBi      |

## 1.2 Test Standards

The following report is prepared on behalf of the RVLOCK & CO, LLC in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 558074 D01 v05 for digital transmission systems shall be performed also.

## 1.4 Test Facility

BSL Testing Co.,LTD.

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FCC Test Firm Registration Number: 562200

Designation Number: CN1338

Tel: 400-882-9628

Fax: 86-755-26508703

### 1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

| Test Mode List |             |                           |
|----------------|-------------|---------------------------|
| Test Mode      | Description | Remark                    |
| TM1            | GFSK(BLE)   | 2402MHz, 2440MHz, 2480MHz |

| EUT Cable List and Details |            |                     |                        |
|----------------------------|------------|---------------------|------------------------|
| Cable Description          | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| /                          | /          | /                   | /                      |

| Special Cable List and Details |            |                     |                        |
|--------------------------------|------------|---------------------|------------------------|
| Cable Description              | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| /                              | /          | /                   | /                      |

| Auxiliary Equipment List and Details |              |       |               |
|--------------------------------------|--------------|-------|---------------|
| Description                          | Manufacturer | Model | Serial Number |
|                                      |              |       |               |
|                                      |              |       |               |
|                                      |              |       |               |

### 1.6 Measurement Uncertainty

| Measurement uncertainty        |            |                     |
|--------------------------------|------------|---------------------|
| Parameter                      | Conditions | Uncertainty         |
| RF Output Power                | Conducted  | $\pm 0.42\text{dB}$ |
| Occupied Bandwidth             | Conducted  | $\pm 1.5\%$         |
| Power Spectral Density         | Conducted  | $\pm 1.8\text{dB}$  |
| Conducted Spurious Emission    | Conducted  | $\pm 2.17\text{dB}$ |
| Conducted Emissions            | Conducted  | $\pm 2.88\text{dB}$ |
| Transmitter Spurious Emissions | Radiated   | $\pm 5.1\text{dB}$  |

**1.7 Test Equipment List and Details**

| Description                         | Manufacturer     | Model                 | Serial No.        | Cal Date   | Due. Date  |
|-------------------------------------|------------------|-----------------------|-------------------|------------|------------|
| Communication Tester                | Rohde & Schwarz  | CMW500                | 100358            | 2023-10-27 | 2024-10-26 |
| Spectrum Analyzer                   | R&S              | FSP40                 | 100550            | 2023-10-27 | 2024-10-26 |
| Test Receiver                       | R&S              | ESC17                 | US47140102        | 2023-10-27 | 2024-10-26 |
| Signal Generator                    | HP               | 83630B                | 3844A01028        | 2023-10-27 | 2024-10-26 |
| Test Receiver                       | R&S              | ESPI-3                | 100180            | 2023-10-27 | 2024-10-26 |
| Amplifier                           | Agilent          | 8449B                 | 4035A00116        | 2023-10-27 | 2024-10-26 |
| Amplifier                           | HP               | 8447E                 | 2945A02770        | 2023-10-27 | 2024-10-26 |
| Signal Generator                    | IFR              | 2023A                 | 202307/242        | 2023-10-27 | 2024-10-26 |
| Broadband Antenna                   | SCHAFFNER        | 2774                  | 2774              | 2023-10-27 | 2024-10-26 |
| Biconical and log periodic antennas | ELECTRO-METRIC   | EM-6917B-1            | 171               | 2023-10-27 | 2024-10-26 |
| Horn Antenna                        | R&S              | HF906                 | 100253            | 2023-10-27 | 2024-10-26 |
| Horn Antenna                        | EM               | EM-6961               | 6462              | 2023-10-27 | 2024-10-26 |
| LISN                                | R&S              | ESH3-Z5               | 100196            | 2023-10-27 | 2024-10-26 |
| LISN                                | COM-POWER        | LI-115                | 02027             | 2023-10-27 | 2024-10-26 |
| 3m Semi-Anechoic Chamber            | Chengyu Electron | 9 (L)*6 (W)*<br>6 (H) | BSL086            | 2023-10-27 | 2024-10-26 |
| Horn Antenna                        | A-INFOMW         | LB-180400KF           | BSL088            | 2023-10-27 | 2024-10-26 |
| 20dB Attenuator                     | ICPROBING        | IATS1                 | BSL1003           | 2023-10-27 | 2024-10-26 |
| POWER DIVIDER                       | Mini-circuits    | PD-2SF-0010           | N/A               | 2023-10-27 | 2024-10-26 |
| Power Meter                         | DARE             | RPR3006W              | 15I00041SN<br>O03 | 2023-10-27 | 2024-10-26 |
| Loop Antenna                        | Schwarz beck     | FMZB 1516             | 9773              | 2023-10-27 | 2024-10-26 |
| Antenna Tower                       | SKET             | BK-4AT-BS             | N/A               | N/A        | N/A        |

## 2. SUMMARY OF TEST RESULTS

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| FCC Rules                   | Description of Test Item          | Result |
|-----------------------------|-----------------------------------|--------|
| § 2.1093                    | RF Exposure                       | PASS   |
| § 15.203; § 15.247(b)(4)(i) | Antenna Requirement               | PASS   |
| §15.205                     | Restricted Band of Operation      | PASS   |
| § 15.207(a)                 | Conducted Emission                | N/A    |
| § 15.247(e)                 | Power Spectral Density            | PASS   |
| § 15.247(a)(2)              | 6 dB Bandwidth                    | PASS   |
| § 15.247(b)(3)              | RF Output Power                   | PASS   |
| § 15.209(a)                 | Radiated Emission                 | PASS   |
| § 15.247(d)                 | Band Edge (Out of Band Emissions) | PASS   |

Note: PASS: applicable, N/A: not applicable.

### **3. RF Exposure**

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#### **3.1 Standard Applicable**

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

#### **3.2 Test Result**

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

## **4. Antenna Requirement**

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### **4.1 Standard Applicable**

According to FCC Part 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.

### **4.2 Evaluation Information**

This product has a Chip antenna(1.49dBi), fulfill the requirement of this section.

## 5. Power Spectral Density

### 5.1 Standard Applicable

According to 15.247(a)(1)(iii), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 5.2 Test Procedure

According to the KDB 558074 D01 v05, the test method of power spectral density as below:

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set the VBW  $\geq 3 \times \text{RBW}$ .
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 5.3 Environmental Conditions

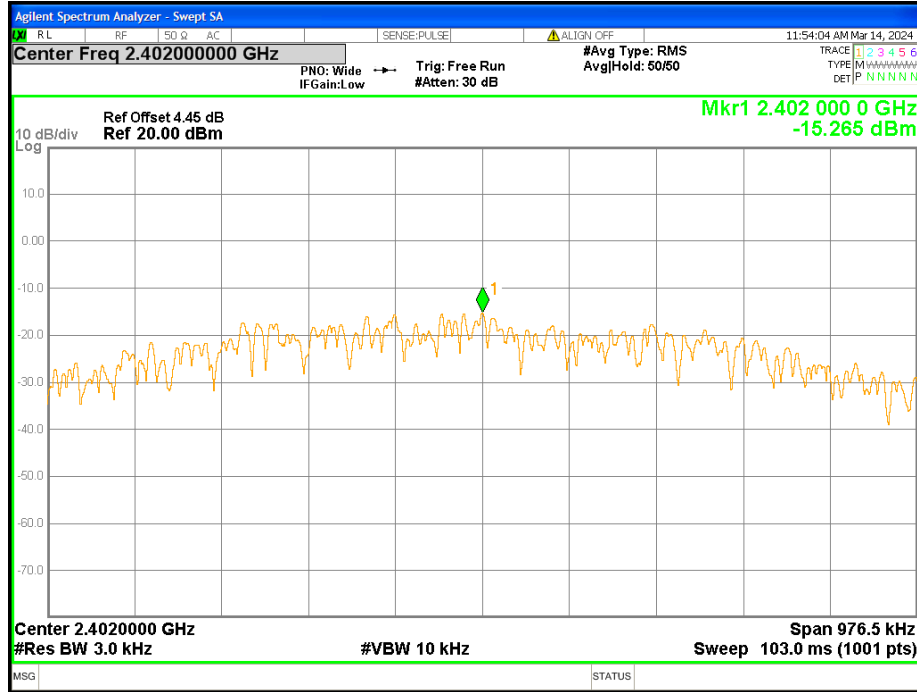
|                    |           |
|--------------------|-----------|
| Temperature:       | 26° C     |
| Relative Humidity: | 54%       |
| ATM Pressure:      | 1011 mbar |

### 5.4 Summary of Test Results/Plots

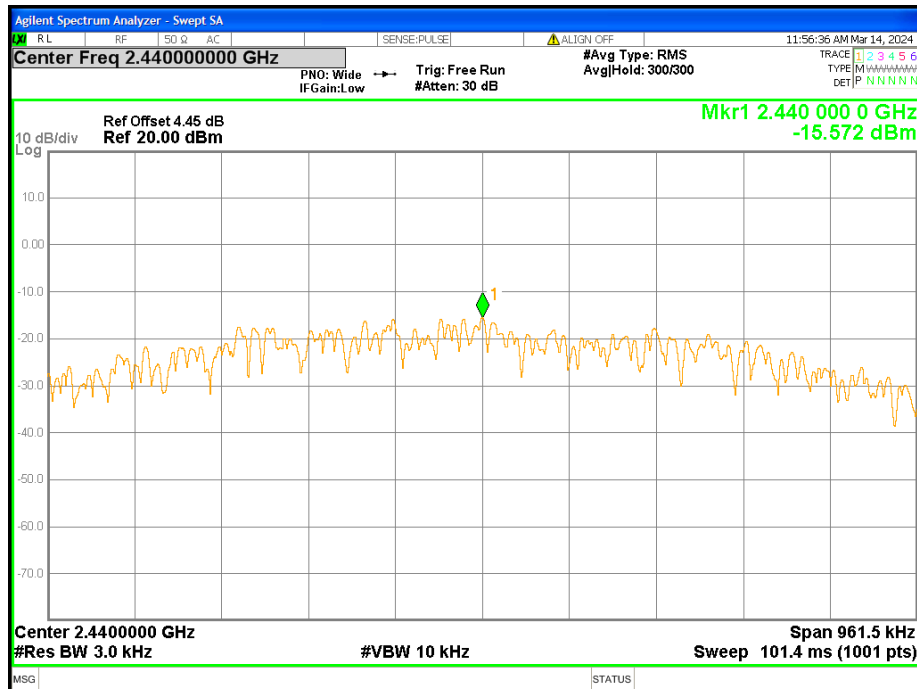
| Test Mode | Test Channel<br>MHz | Power Spectral Density<br>dBm/3kHz | Limit<br>dBm/3kHz |
|-----------|---------------------|------------------------------------|-------------------|
| GFSK(BLE) | 2402                | -15.27                             | 8                 |
|           | 2440                | -15.57                             | 8                 |
|           | 2480                | -16.7                              | 8                 |

Please refer to the following test plots:

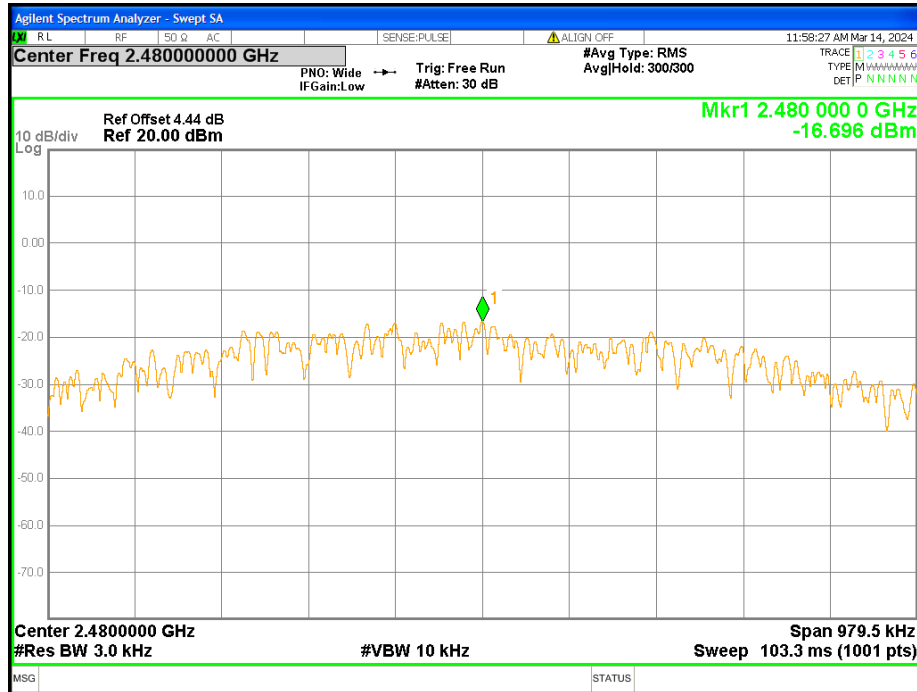
## Low Channel



## Middle Channel



High Channel



## 6. 6dB Bandwidth

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### 6.1 Standard Applicable

According to 15.247(a)(2). Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### 6.2 Test Procedure

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 6.3 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25° C     |
| Relative Humidity: | 53%       |
| ATM Pressure:      | 1018 mbar |

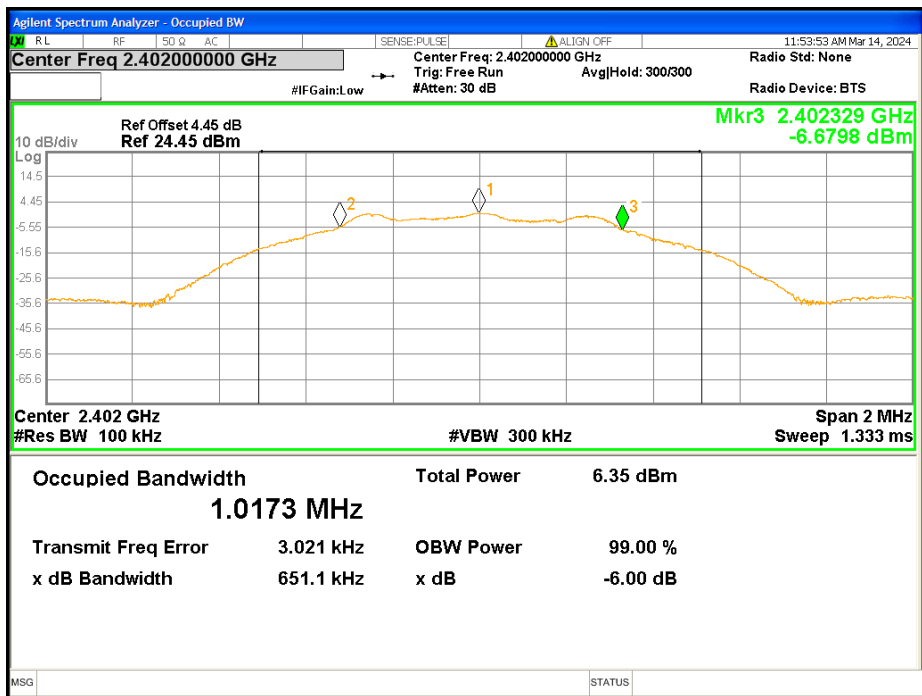
### 6.4 Summary of Test Results/Plots

| Test Mode | Test Channel<br>MHz | 6 dB Bandwidth<br>kHz | Limit<br>kHz |
|-----------|---------------------|-----------------------|--------------|
| GFSK(BLE) | 2402                | 651                   | $\geq 500$   |
|           | 2440                | 641                   | $\geq 500$   |
|           | 2480                | 653                   | $\geq 500$   |

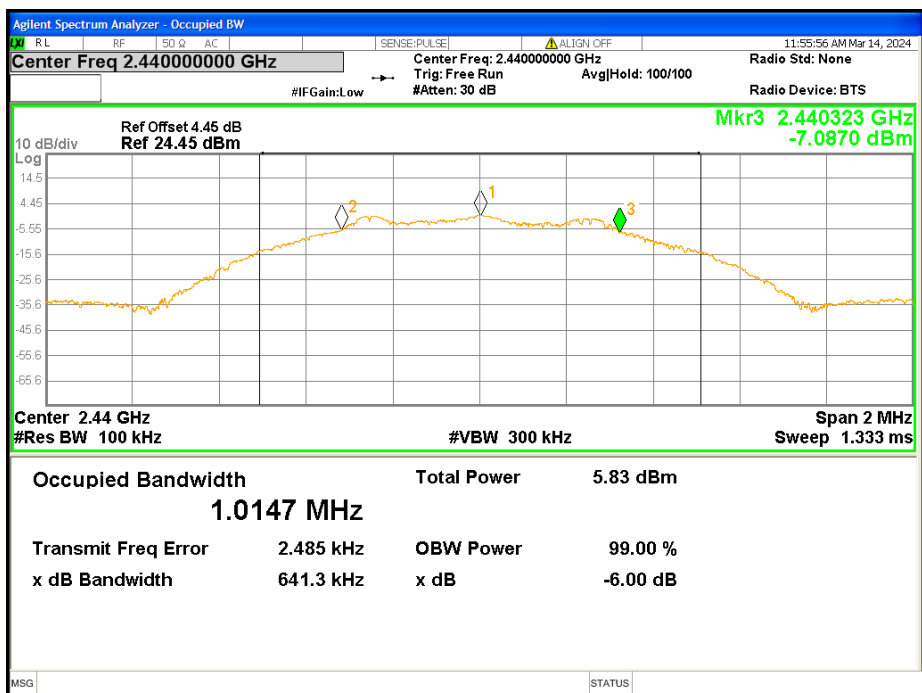
Please refer to the following test plots:

For BLE

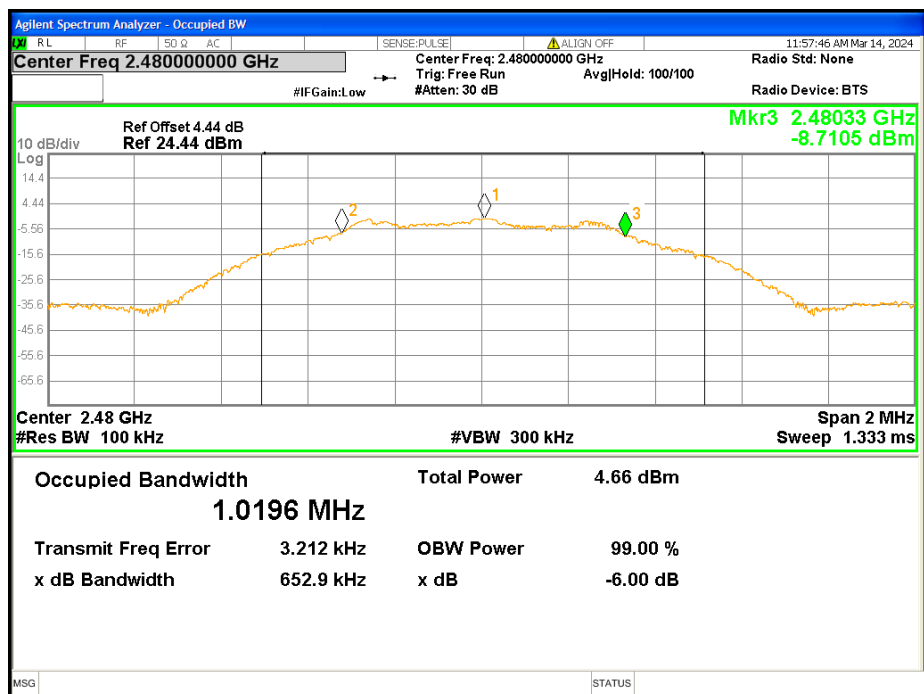
Low Channel:



Middle Channel:



High Channel:



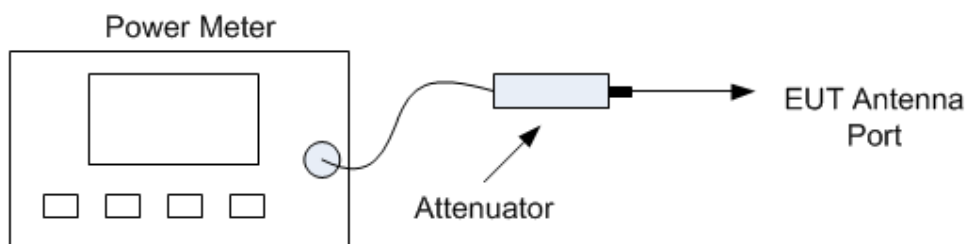
## 7. RF Output Power

### 7.1 Standard Applicable

According to 15.247(b)(3). For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

### 7.2 Test Procedure

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.



### 7.3 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 26° C     |
| Relative Humidity: | 57%       |
| ATM Pressure:      | 1011 mbar |

### 7.4 Summary of Test Results/Plots

| Test Mode | Frequency<br>MHz | Reading<br>dBm | Output Power<br>mW | Limit<br>mW |
|-----------|------------------|----------------|--------------------|-------------|
| GFSK(BLE) | 2402             | 0.35           | 1.08               | 1000        |
|           | 2440             | 0.1            | 1.02               | 1000        |
|           | 2480             | -1.02          | 0.79               | 1000        |

*Note: the antenna gain of 1.49dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.*

## 8. Field Strength of Spurious Emissions

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### 8.1 Standard Applicable

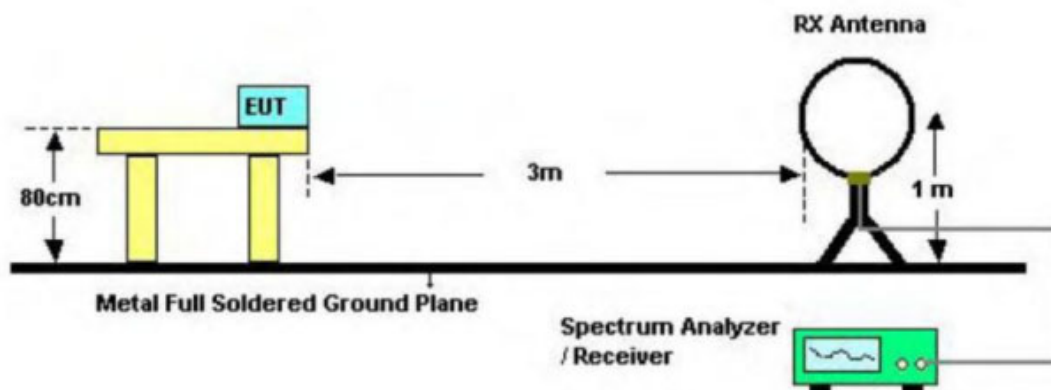
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

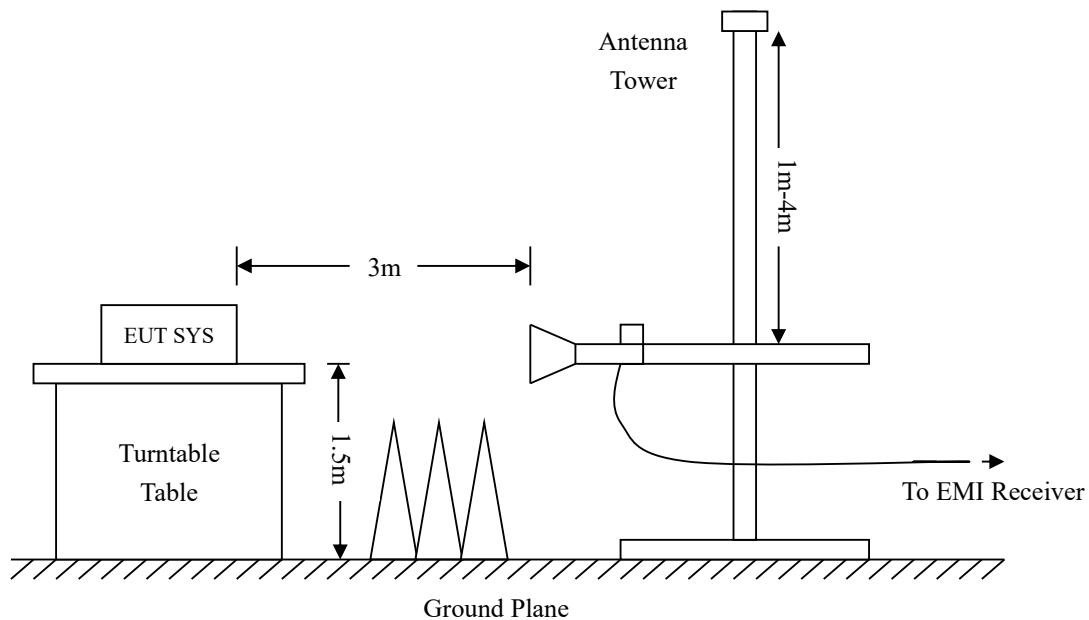
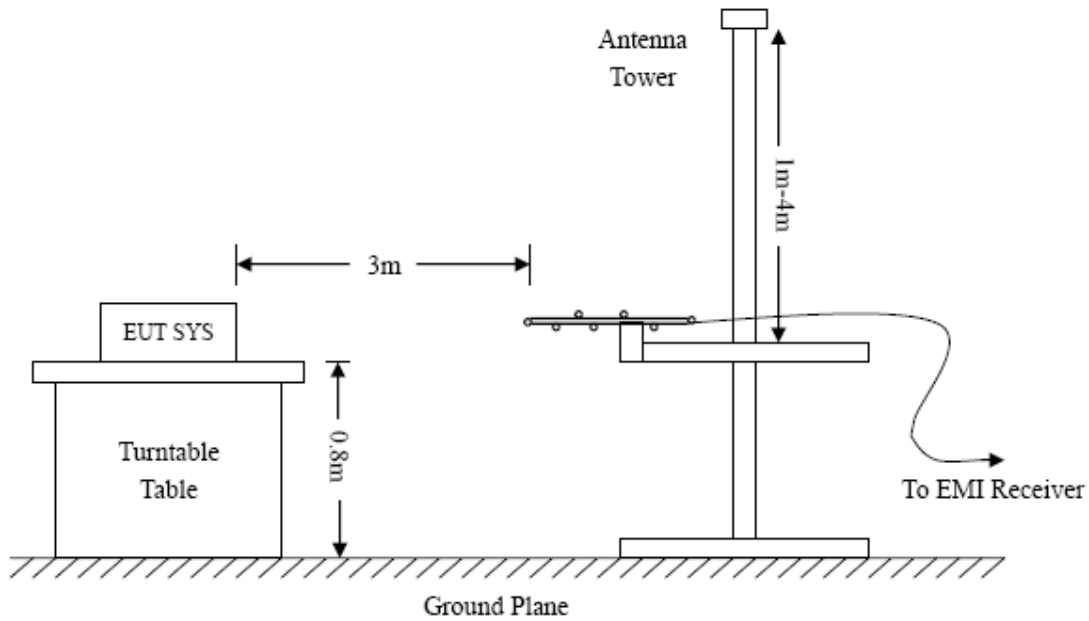
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

### 8.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz

RBW=10KHz,

VBW =30KHz

Sweep time= Auto

Trace = max hold

Detector function = peak

Frequency :30MHz-1GHz

RBW=120KHz,

VBW=300KHz

Sweep time= Auto

Trace = max hold

Detector function = peak, QP

Frequency :Above 1GHz

RBW=1MHz,

VBW=3MHz(Peak), 10Hz(AV)

Sweep time= Auto

Trace = max hold

Detector function = peak, AV

### 8.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

### 8.4 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 52%       |
| ATM Pressure:      | 1012 mbar |

### 8.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

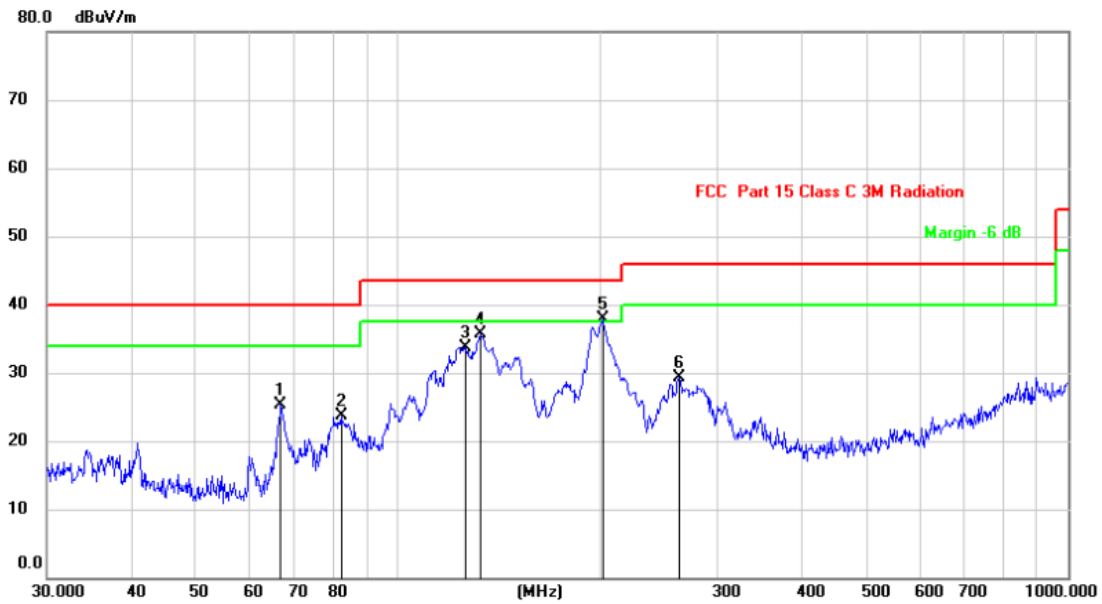
*Note:*

- 1. Worst-case radiated emission below 1GHz is GFSK (CH High) mode.*
- 2. Worst-case radiated emission above 1GHz is GFSK (CH Low, Middle, High) mode.*

The Worst Test Data Below 1GHz GFSK (CH High) mode:

### Plot of Radiated Emissions

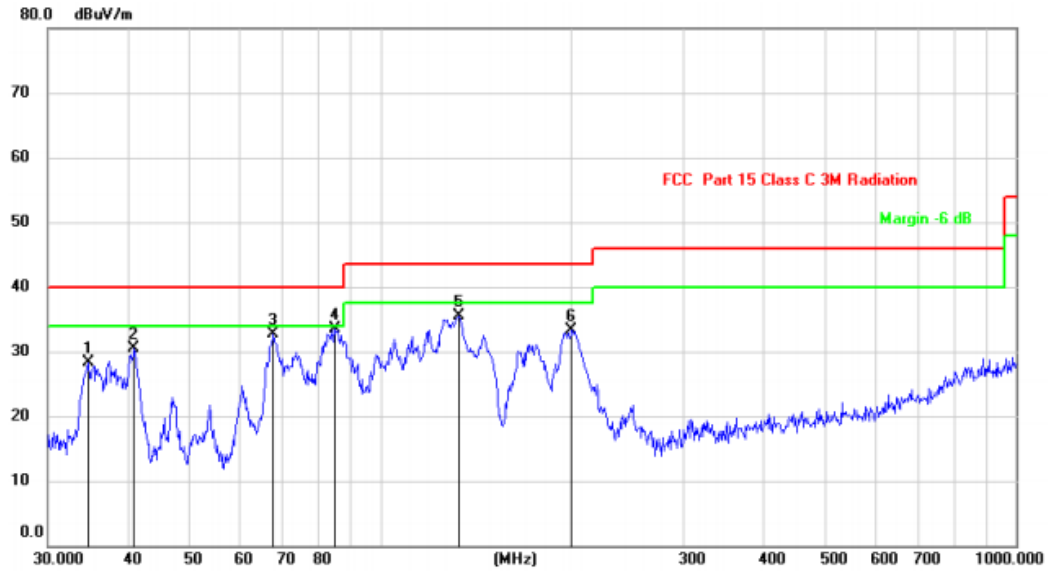
Test Specification: Horizontal



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Over   |          |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|
|     |     | MHz      | dBuV          | dBuV/m         | dBuV/m      | dBuV/m | dB     | Detector |
| 1   |     | 66.9668  | 25.41         | -0.05          | 25.36       | 40.00  | -14.64 | QP       |
| 2   |     | 82.3588  | 23.99         | -0.27          | 23.72       | 40.00  | -16.28 | QP       |
| 3   |     | 126.3285 | 31.60         | 2.19           | 33.79       | 43.50  | -9.71  | QP       |
| 4   |     | 132.6850 | 33.85         | 1.82           | 35.67       | 43.50  | -7.83  | QP       |
| 5   | *   | 202.1005 | 36.42         | 1.50           | 37.92       | 43.50  | -5.58  | QP       |
| 6   |     | 262.8955 | 26.17         | 3.07           | 29.24       | 46.00  | -16.76 | QP       |

\*:Maximum data    x:Over limit    !:over margin

Test Specification: Vertical



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measure-ment | Limit  | Over   |          |
|-----|-----|----------|---------------|----------------|--------------|--------|--------|----------|
|     |     | MHz      | dBuV          | dBuV/m         | dBuV/m       | dBuV/m | dB     | Detector |
| 1   |     | 34.7601  | 24.48         | 3.73           | 28.21        | 40.00  | -11.79 | QP       |
| 2   |     | 40.9881  | 28.24         | 2.26           | 30.50        | 40.00  | -9.50  | QP       |
| 3   |     | 67.9128  | 32.74         | -0.10          | 32.64        | 40.00  | -7.36  | QP       |
| 4   | *   | 84.7018  | 33.89         | -0.34          | 33.55        | 40.00  | -6.45  | QP       |
| 5   |     | 132.6850 | 33.65         | 1.82           | 35.47        | 43.50  | -8.03  | QP       |
| 6   |     | 199.9856 | 31.71         | 1.50           | 33.21        | 43.50  | -10.29 | QP       |

\*:Maximum data x:Over limit !:over margin

*The Worst Spurious Emissions Above 1GHz**Transmitting: BLE mode:*

|               |        |
|---------------|--------|
| Test channel: | Lowest |
|---------------|--------|

**Peak value:**

| Frequency (MHz) | Level (dBUV/m) | Limit Line (dBUV/m) | Over Limit (dB) | Polarization |
|-----------------|----------------|---------------------|-----------------|--------------|
| 2402            | 87.65          | -                   | -               | Vertical     |
| 4804            | 41.05          | 74.00               | -32.95          | Vertical     |
| 7206            | 35.14          | 74.00               | -38.86          | Vertical     |
| 9608            | 31.28          | 74.00               | -42.72          | Vertical     |
| 2402            | 85.69          | -                   | -               | Horizontal   |
| 4804            | 38.41          | 74.00               | -35.59          | Horizontal   |
| 7206            | 34.21          | 74.00               | -39.79          | Horizontal   |
| 9608            | 30.67          | 74.00               | -43.33          | Horizontal   |

**Average value:**

| Frequency (MHz) | Level (dBUV/m) | Limit Line (dBUV/m) | Over Limit (dB) | Polarization |
|-----------------|----------------|---------------------|-----------------|--------------|
| 2402            | 85.96          | -                   | -               | Vertical     |
| 4804            | 39.63          | 54.00               | -14.37          | Vertical     |
| 7206            | 33.92          | 54.00               | -20.08          | Vertical     |
| 9608            | 31.04          | 54.00               | -22.96          | Vertical     |
| 2402            | 85.20          | -                   | -               | Horizontal   |
| 4804            | 38.41          | 54.00               | -15.59          | Horizontal   |
| 7206            | 33.05          | 54.00               | -20.95          | Horizontal   |
| 9608            | 30.27          | 54.00               | -23.73          | Horizontal   |

**Remark:**

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *“\*” , means this data is the too weak instrument of signal is unable to test.*
3. *The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.*
4. *In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.*

|               |        |
|---------------|--------|
| Test channel: | Middle |
|---------------|--------|

**Peak value:**

| Frequency (MHz) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|----------------|---------------------|-----------------|--------------|
| 2442            | 87.39          | -                   | -               | Vertical     |
| 4882            | 39.52          | 74.00               | -34.48          | Vertical     |
| 7323            | 35.41          | 74.00               | -38.59          | Vertical     |
| 9764            | 31.62          | 74.00               | -42.38          | Vertical     |
| 2442            | 86.27          | -                   | -               | Horizontal   |
| 4882            | 38.20          | 74.00               | -35.8           | Horizontal   |
| 7323            | 36.02          | 74.00               | -37.98          | Horizontal   |
| 9764            | 31.51          | 74.00               | -42.49          | Horizontal   |

**Average value:**

| Frequency (MHz) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|----------------|---------------------|-----------------|--------------|
| 2442            | 85.31          | -                   | -               | Vertical     |
| 4882            | 39.24          | 54.00               | -14.76          | Vertical     |
| 7323            | 33.27          | 54.00               | -20.73          | Vertical     |
| 9764            | 30.28          | 54.00               | -23.72          | Vertical     |
| 2442            | 85.67          | -                   | -               | Horizontal   |
| 4882            | 35.69          | 54.00               | -18.31          | Horizontal   |
| 7323            | 33.27          | 54.00               | -20.73          | Horizontal   |
| 9764            | 30.16          | 54.00               | -23.84          | Horizontal   |

**Remark:**

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *"\*", means this data is the too weak instrument of signal is unable to test.*
3. *The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.*
4. *In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.*

Test channel:

Highest

**Peak value:**

| Frequency (MHz) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|----------------|---------------------|-----------------|--------------|
| 2480            | 86.37          | -                   | -               | Vertical     |
| 4960            | 41.25          | 74.00               | -32.75          | Vertical     |
| 7440            | 36.27          | 74.00               | -37.73          | Vertical     |
| 9920            | 31.91          | 74.00               | -42.09          | Vertical     |
| 2480            | 85.29          | -                   | -               | Horizontal   |
| 4960            | 39.24          | 74.00               | -34.76          | Horizontal   |
| 7440            | 34.15          | 74.00               | -39.85          | Horizontal   |
| 9920            | 31.02          | 74.00               | -42.98          | Horizontal   |

**Average value:**

| Frequency (MHz) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|----------------|---------------------|-----------------|--------------|
| 2480            | 85.64          | -                   | -               | Vertical     |
| 4960            | 39.3           | 54.00               | -14.7           | Vertical     |
| 7440            | 35.08          | 54.00               | -18.92          | Vertical     |
| 9920            | 31.04          | 54.00               | -22.96          | Vertical     |
| 2480            | 85.31          | -                   | -               | Horizontal   |
| 4960            | 39.25          | 54.00               | -14.75          | Horizontal   |
| 7440            | 33.60          | 54.00               | -20.4           | Horizontal   |
| 9920            | 31.58          | 54.00               | -22.42          | Horizontal   |

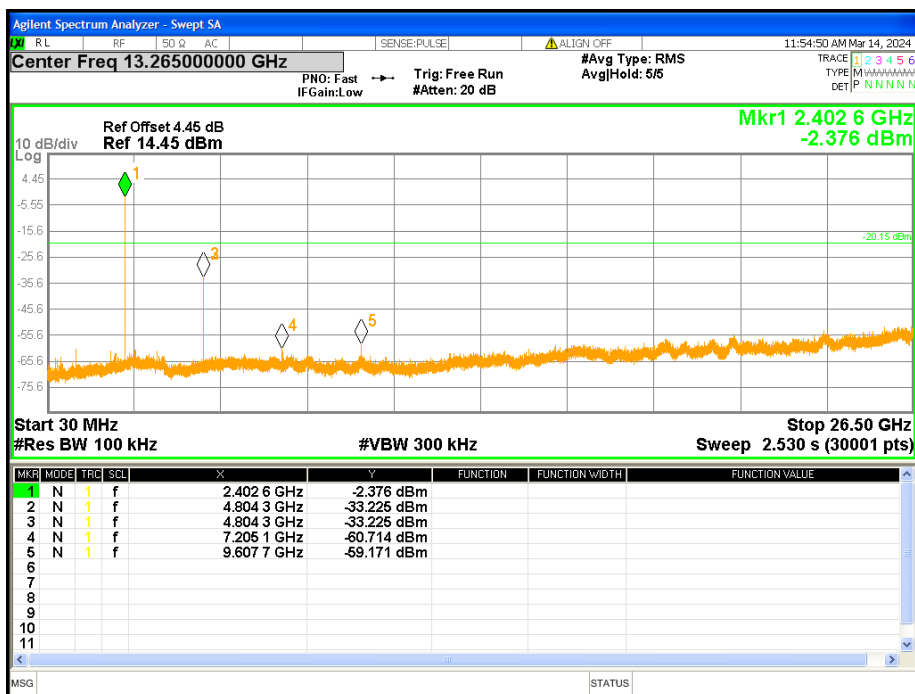
**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “\*”, means this data is the too weak instrument of signal is unable to test.
3. The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.
4. In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

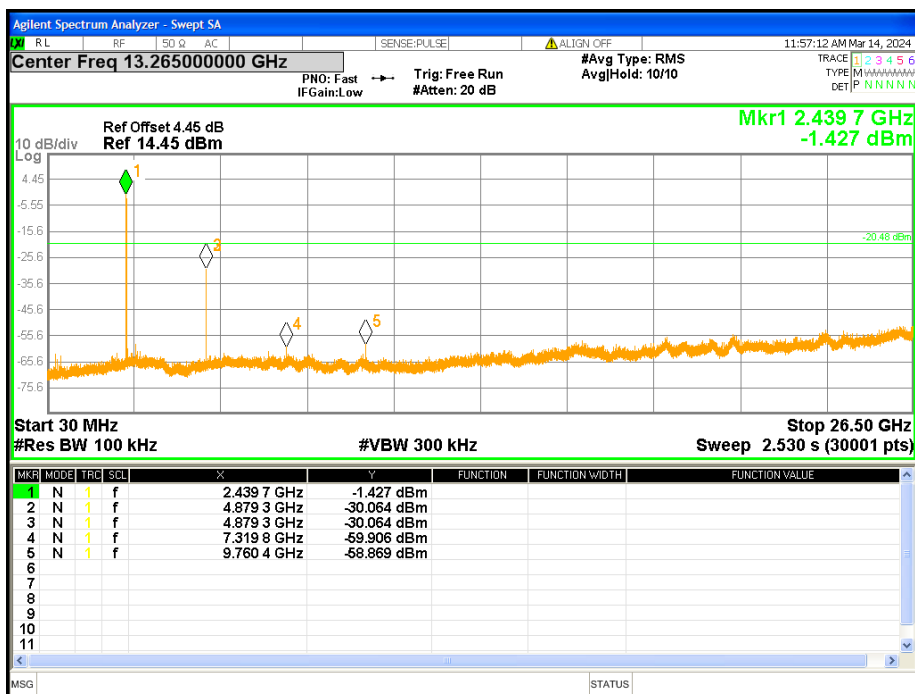
Spurious Emission(Conducted)

For BLE

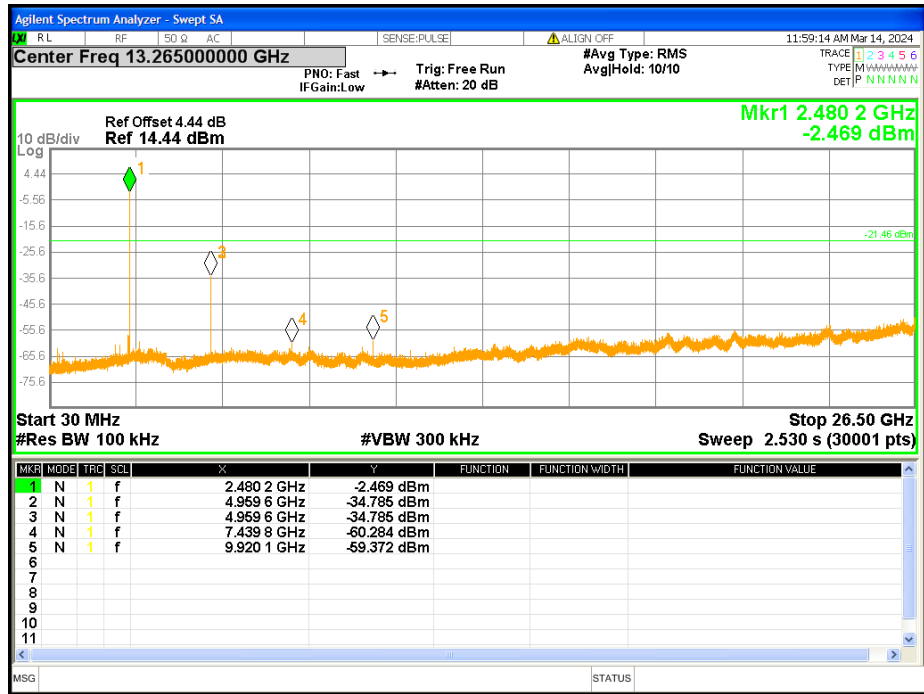
Low channel:



Middle channel:



High channel:



## 9. Out of Band Emissions

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### 9.1 Standard Applicable

According to §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

### 9.2 Test Procedure

According to the KDB 558074 D01 v05r02, the Marker-delta method as follows:

for Antenna-port conducted measurement.

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

- 1). Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2). Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to an EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
- 3). Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=1/B for AV detector.
- 4). Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- 5). Repeat above procedures until all measured frequencies were complete.
- 6). Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
- 7). Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
- 8). Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies  $\leq 30$  MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies  $> 1000$  MHz).
- 9). For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
- 10). Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

$$E = \text{EIRP} - 20 \log D + 104.77 = \text{EIRP} + 95.23$$

Where:

E = electric field strength in dBμV/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

11). Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.

12). Compare the resultant electric field strength level to the applicable regulatory limit.

13). Perform radiated spurious emission test duress until all measured frequencies were complete.

### 9.3 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 23°C      |
| Relative Humidity: | 54%       |
| ATM Pressure:      | 1011 mbar |

### 9.4 Summary of Test Results/Plots

Bandedge (Radiated)

GFSK(BLE)

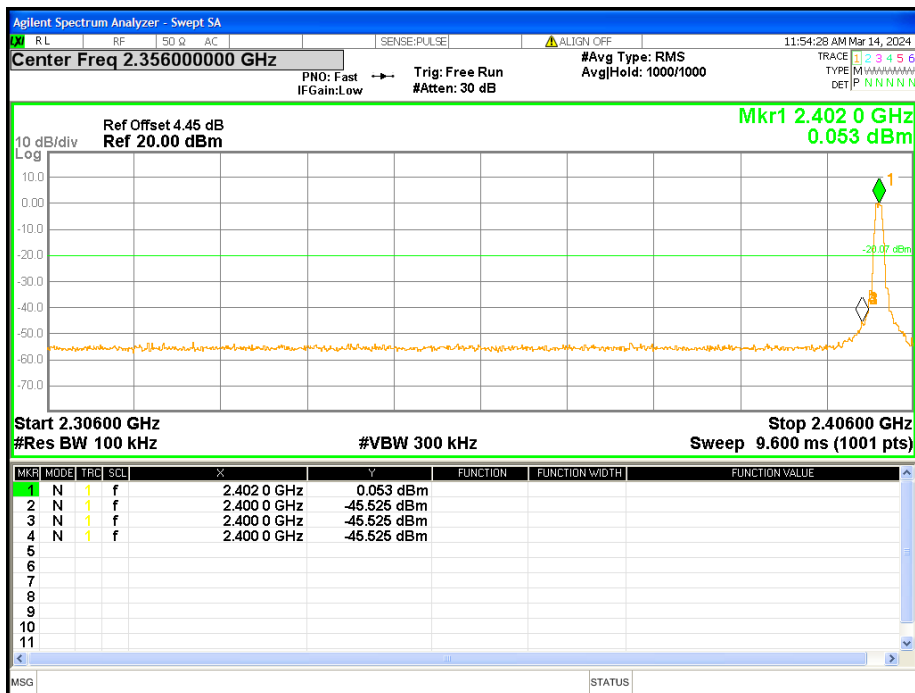
| Channel           | Freq.(MHz) | Power(dBm) | Gain(dBi) | Level(dBuV) | Limit(dBuV) | Margin(dB) | Detector |
|-------------------|------------|------------|-----------|-------------|-------------|------------|----------|
| LOW<br>(2402MHz)  | 2400.0     | -45.53     | 2.00      | 51.70       | 74.00       | -22.30     | Peak     |
| HIGH<br>(2480MHz) | 2483.5     | -55.77     | 2.00      | 41.46       | 74.00       | -32.54     | Peak     |
|                   | 2500.0     | -56.07     | 2.00      | 41.16       | 74.00       | -32.84     | Peak     |
|                   | 2484.5     | -53.18     | 2.00      | 44.05       | 74.00       | -29.95     | Peak     |

Remark: 1. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

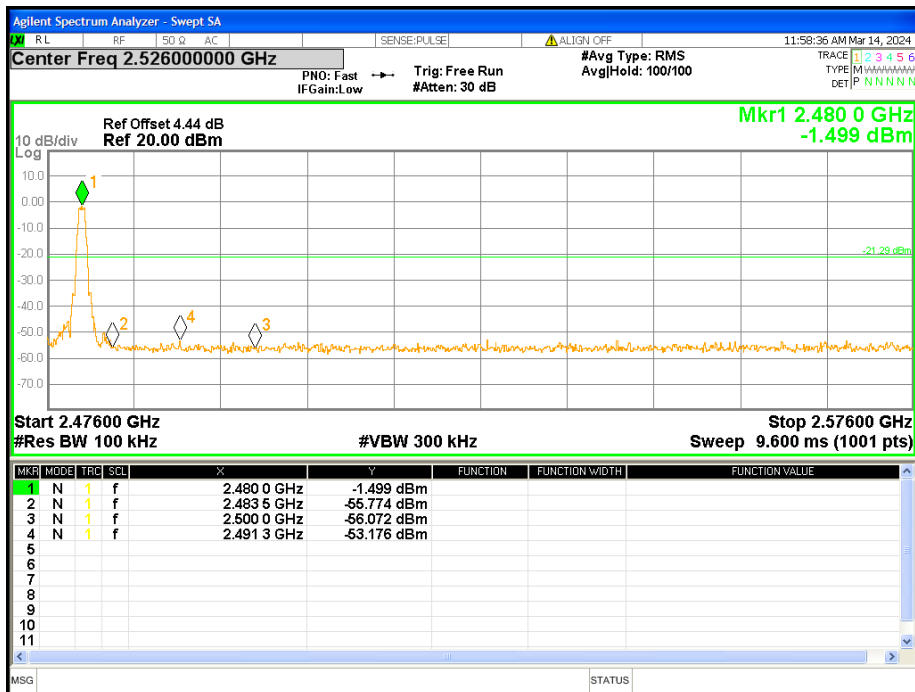
2. Maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater.

Bandedge (Conducted)

Lowest



High Channel:



## 10. Conducted Emissions

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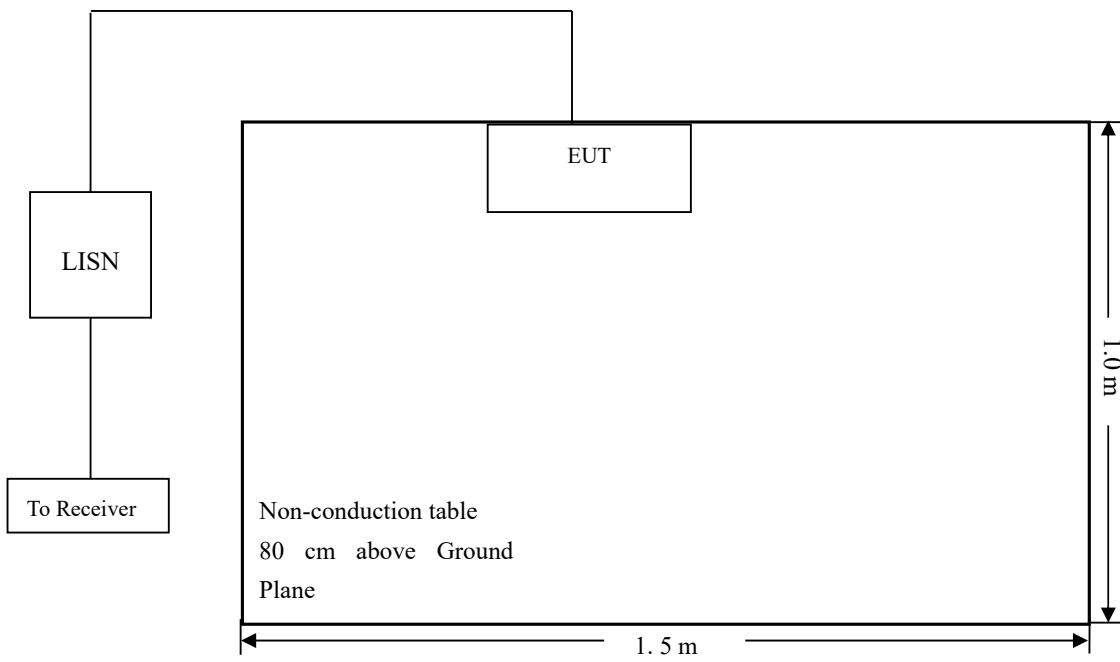
### 10.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

### 10.2 Basic Test Setup Block Diagram



### 10.3 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 52%       |
| ATM Pressure:      | 1012 mbar |

#### 10.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz  
Stop Frequency ..... 30 MHz  
Sweep Speed ..... Auto  
IF Bandwidth..... 10 kHz  
Quasi-Peak Adapter Bandwidth ..... 9 kHz  
Quasi-Peak Adapter Mode ..... Normal

#### 10.5 Summary of Test Results/Plots

According to the data in section 10.6, the EUT complied with the FCC Part 15.207 Conducted margin for this device

#### 10.6 Conducted Emissions Test Data

The equipment is battery powered, so do not test this item

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