

# FCC TEST REPORT

Applicant Name : ONESOFTDIGM. Co., Ltd.  
Brand Name : N/A  
Applicant Address : Jigok Research Bldg., 64, Jigok-ro, Nam-gu, Pohang-si,  
Gyeongsangbuk-do, 37666, Republic of Korea  
FCC ID : 2AKLA-FRA-W10  
Products Name : Body Component Meter  
Model No. : FRA-W10  
Variant Model No. : Fitrus\_A  
Products Manufacturer : BYMTECH  
Test Standard : FCC CFR 47 Part 15 Subpart C  
Test Method : KDB 558074 D01 v05 and ANSI C63.10:2013  
Test Result : PASS  
Dates of Test : DEC 11, 2019 to DEC 12, 2019  
Date of Issue : JAN 07, 2020  
Test Laboratory : Korea Standard Testlab  
FCC Registration No. : 829397

Tested by



Seungho Baek  
Test Engineer

Approved by



Dongin Youn  
Technical Manager

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## **1. General Information**

### **1.1. Client Information**

Applicant : ONESOFTDIGM. Co., Ltd.  
Address of Applicant : Jigok Research Bldg., 64, Jigok-ro, Nam-gu, Pohang-si,  
Gyeongsangbuk-do, 37666, Republic of Korea

### **1.2. General Description of E.U.T.**

Product Name : Body Component Meter  
Model No. : FRA-W10

### **1.3. Details of E.U.T.**

Operating Frequency : 2402 MHz to 2480 MHz  
Type of Modulation : GFSK  
Number of Channels : 40 Channels  
Channel Separation : 2 MHz  
Duty Cycle : Continuous operation possible for testing purposes  
Antenna Type : Chip Antenna  
Antenna gain : 0.5 dBi  
Speciality : Bluetooth specification version 4.0 (BLE)  
Power Supply : Working voltage  
Normal Test Voltage : DC 3.7 V

#### **1.4. Test Facility**

Korea Standard Testlab has been accredited as a designated testing laboratory by National Radio Research Agency in Korea under ISO/IEC 17025.

##### **-. Address**

Korea Standard Testlab

#107-27, Jangdeokdong-gil, Namyang-eup, Hwaseong-si, Gyeonggi-do, Korea

Tel : +82-31-356-7333

FAX : +82-31-356-7303

##### **-. Laboratory Accreditations and Listings**

KC Designation No. : KR0155

FCC Registration No. : 0028220721

## 2. Test Equipment and Ancillaries used for Tests

| No. | Test Equipment           | Manufacturer       | Model No.    | Serial No.  | Next Cal. Data | Used equipment |
|-----|--------------------------|--------------------|--------------|-------------|----------------|----------------|
| 1   | Spectrum Analyzer        | Agilent            | E4440A       | MY45304715  | 20.10.01       | ■              |
| 2   | Frequency Counter        | HP                 | 5350B        | 3049A05530  | 20.05.30       | □              |
| 3   | DC Power Supply          | KEYSIGHT           | U8002A       | MY5813082   | 20.02.25       | ■              |
| 4   | Signal Generator         | Leader Electronics | 3220         | 137231      | 20.05.28       | ■              |
| 5   | Synthesized CW Generator | HP                 | 83711B       | US34490158  | 20.05.28       | ■              |
| 6   | SYNTHESIZED SWEEPER      | HP                 | 8340B        | 2804A00830  | 20.05.28       | □              |
| 7   | Function Generator       | IWATSU             | SG-4105      | 62372780    | 20.05.27       | □              |
| 8   | Modulation Analyzer      | Agilent            | 8901B        | 3438A05099  | 20.05.28       | □              |
| 9   | Audio Analyser           | Agilent            | 8903B        | 3279A18576  | 20.05.27       | □              |
| 10  | Power Meter              | Agilent            | E4418B       | GB43312894  | 20.05.27       | □              |
| 11  | Power Sensor             | HP                 | 8485A        | 3316A14708  | 20.05.27       | □              |
| 12  | Power Sensor             | Agilent            | 8482B        | 2703703543  | 20.05.27       | □              |
| 13  | Pre Amplifier            | GTC                | GA-1825A     | GT0929/003  | 20.02.22       | □              |
| 14  | Pre Amplifier            | 8449B              | HP           | 3008A00224  | 20.06.18       | ■              |
| 15  | Attenuator               | Weinsche           | 53-30-33     | MG906       | 20.05.27       | □              |
| 16  | Step Attenuator          | Agilent            | 8494B        | MY41110204  | 20.05.27       | □              |
| 17  | Step Attenuator          | Agilent            | 8495B        | 3308A17660  | 20.05.27       | □              |
| 18  | Step Attenuator          | Agilent            | 8496B        | US40152183  | 20.05.27       | □              |
| 19  | Attenuator               | HP                 | 30dB         | N/A         | 20.05.27       | □              |
| 20  | Attenuator               | TAE SUNG           | SMA-1        | N/A         | 20.05.27       | □              |
| 21  | Attenuator               | TAE SUNG           | SMA-2        | N/A         | 20.05.27       | □              |
| 22  | Termination              | KWANG YEOK         | KYTE-NJ-150W | 2040004     | 20.05.27       | □              |
| 23  | Bluetooth Tester         | TESCOM             | TC-3000A     | 3000A590236 | 20.05.27       | □              |
| 24  | Loop ANT.                | Com-Power          | AL-130       | 121010      | 21.06.10       | ■              |

|    |                         |               |                |                |          |   |
|----|-------------------------|---------------|----------------|----------------|----------|---|
| 25 | Horn ANT.               | SCHWARZBECK   | BBHA 9120D     | 831            | 20.07.23 | ■ |
| 26 | Temp & Humidity Chamber | Seoksan Tech  | SE-CT-02       | S7400JD5340618 | 20.05.27 | □ |
| 27 | Test Receiver           | LIG Nex1      | LSA-265        | L07098033      | 20.10.01 | □ |
| 28 | Test Receiver           | ROHDE&SCHWARZ | ESPI           | 101014         | 20.05.28 | □ |
| 29 | Bi-log Antenna          | SCHWARZBECK   | VULB9163       | 760            | 21.04.09 | ■ |
| 30 | EMI TEST Receiver       | ESI           | ROHD & SCHWARZ | 838786         | 20.02.20 | ■ |

### 3. Summary of Test Results

| No | Test                                | Standard Sub-Class        | Result    |
|----|-------------------------------------|---------------------------|-----------|
| 0  | Antenna Requirement                 | §15.203, §15.247(c)       | Compliant |
| 1  | Maximum Peak Output Power           | §15.247(b)                | Compliant |
| 2  | Peak Power Spectral Density         | §15.247(e)                | Compliant |
| 3  | Occupied 6dB Bandwidth              | §15.247(a)                | Compliant |
| 4  | Band Edges Compliance               | §15.247(d)                | Compliant |
| 5  | Conducted Spurious Emission         | §15.247(d)                | Compliant |
| 6  | Radiated Spurious Emission          | §15.247, §15.205, §15.209 | Compliant |
| 7  | Radio Frequency Exposure Procedures | §2.1093                   | Compliant |

## 4. Test Results

### 4.1. E.U.T. test conditions

|                                       |                                                                                                                                                                  |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Voltage:                         | DC 3.7 V (Battery)                                                                                                                                               |
| Temperature:                          | 25 °C                                                                                                                                                            |
| Humidity:                             | 50 % RH                                                                                                                                                          |
| Atmospheric Pressure:                 | 1 006 mbar                                                                                                                                                       |
| Test frequencies and frequency range: | Test frequencies are 2 402 MHz to 2 480 MHz.<br>Low channel is 2 402 MHz, Middle channel is 2 440 MHz, High channel is 2 480 MHz, BLE Mode, Total channel is 40. |

#### 4.1.1. EUT channels and frequencies list

| Channel | Frequency<br>(MHz) | Channel | Frequency<br>(MHz) |
|---------|--------------------|---------|--------------------|
| 0       | 2 402              | 20      | 2 442              |
| 1       | 2 404              | 21      | 2 444              |
| 2       | 2 406              | 22      | 2 446              |
| 3       | 2 408              | 23      | 2 448              |
| 4       | 2 410              | 24      | 2 450              |
| 5       | 2 412              | 25      | 2 452              |
| 6       | 2 414              | 26      | 2 454              |
| 7       | 2 416              | 27      | 2 456              |
| 8       | 2 418              | 28      | 2 458              |
| 9       | 2 420              | 29      | 2 460              |
| 10      | 2 422              | 30      | 2 462              |
| 11      | 2 424              | 31      | 2 464              |
| 12      | 2 426              | 32      | 2 466              |
| 13      | 2 428              | 33      | 2 468              |
| 14      | 2 430              | 34      | 2 470              |
| 15      | 2 432              | 35      | 2 472              |
| 16      | 2 434              | 36      | 2 474              |
| 17      | 2 436              | 37      | 2 476              |
| 18      | 2 438              | 38      | 2 478              |
| 19      | 2 440              | 39      | 2 480              |

#### 4.1.2. Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

| Test mode    | Low channel | Middle channel | High channel |
|--------------|-------------|----------------|--------------|
| Transmitting | 2 402 MHz   | 2 440 MHz      | 2 480 MHz    |

## 4.2. Antenna

### 4.2.1. Requirement

FCC Part 15 C section 15.203

For intentional device. According to 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.

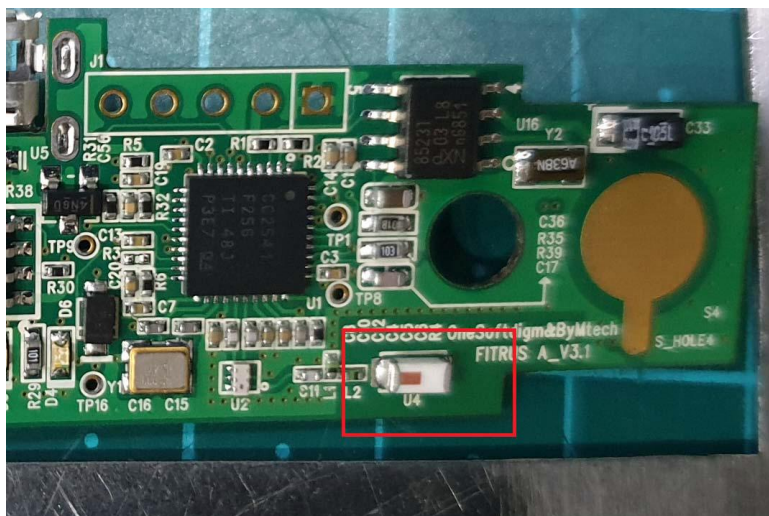
FCC Part 15 C section 15.247(c) (1)(i)

(i) Systems operating in the 2 400 ~ 2 483.5 MHz bands that are used exclusively for fixed.

Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

### 4.2.2. Test Result

The antenna is Chip antenna and no consideration of replacement. The directional gain of the antenna is 0.5 dBi. Please refer to the EUT internal photos.



Test result : The unit does meet the FCC requirements.

### 4.3. Occupied 6 dB Bandwidth

#### 4.3.1. Requirement

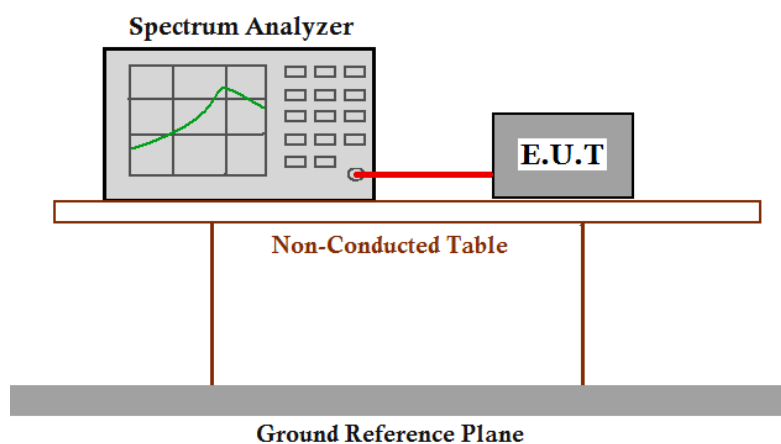
FCC Part 15 C section 15.247

(a)(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2 400 ~ 2 483.5 MHz, and 5 725 ~ 5 850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

#### 4.3.2. Test method

KDB 558074 D01 v05 and ANSI C63.10

#### 4.3.3. Test Configuration



#### 4.3.4. Test Procedure

- 1) Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
- 2) Set the spectrum analyzer :
  - 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.

#### 4.3.5. Test result

##### BLE mode

| Test Channel | Frequency (MHz) | 6 dB Bandwidth (kHz) | Limit (kHz) | Result |
|--------------|-----------------|----------------------|-------------|--------|
| Low          | 2 402           | 812.03               | $\geq 500$  | Pass   |
| Middle       | 2 440           | 807.33               | $\geq 500$  | Pass   |
| High         | 2 480           | 778.59               | $\geq 500$  | Pass   |

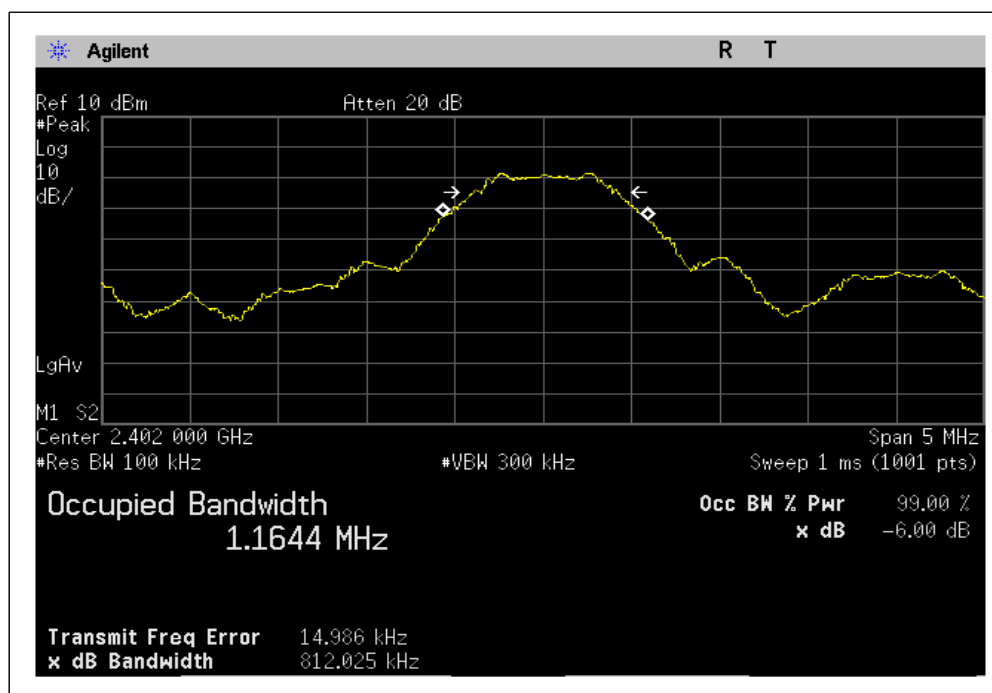
| Test Channel | Frequency (MHz) | 99% Bandwidth (kHz) | Limit (kHz) | Result |
|--------------|-----------------|---------------------|-------------|--------|
| Low          | 2 402           | 1 164.40            | N/A         | N/A    |
| Middle       | 2 440           | 1 157.60            | N/A         | N/A    |
| High         | 2 480           | 1 133.80            | N/A         | N/A    |

Test result : The unit does meet the FCC requirements.

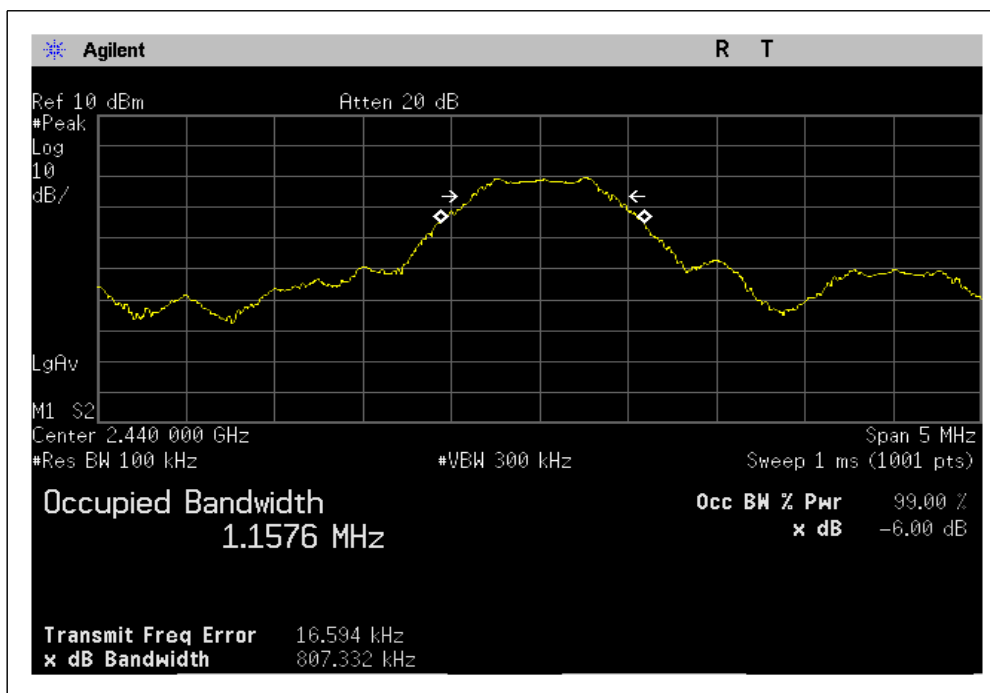
Please refer to the following test plots:

For BLE

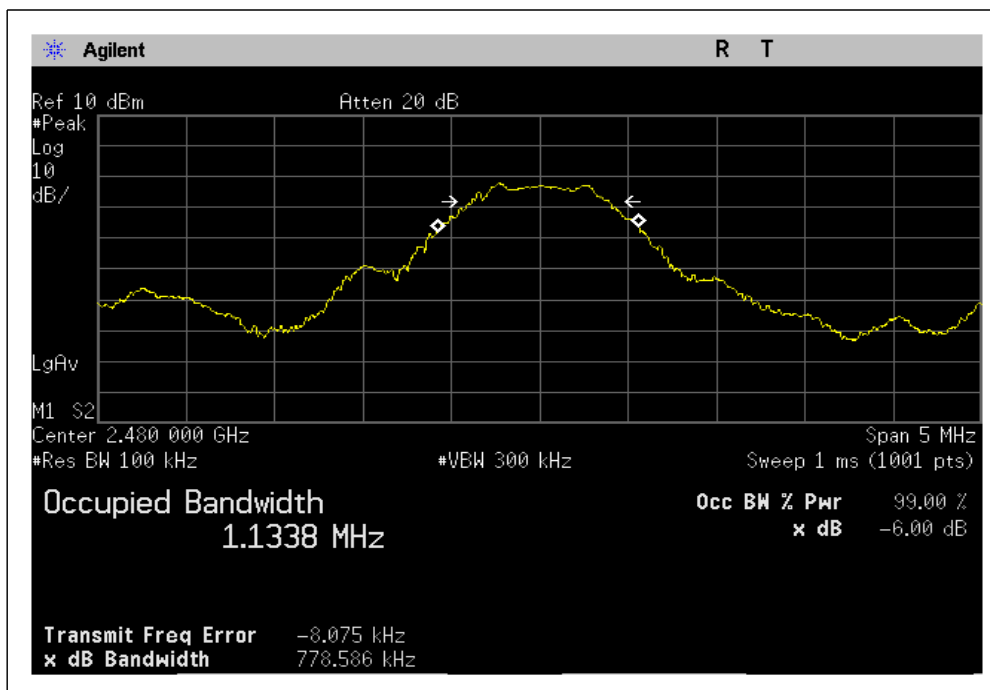
Low Channel(2 402 MHz):



Middle Channel(2 440 MHz):



High Channel(2 480 MHz):



#### 4.4. Maximum Peak Output Power

##### 4.4.1. Requirement

FCC Part 15 C section 15.247

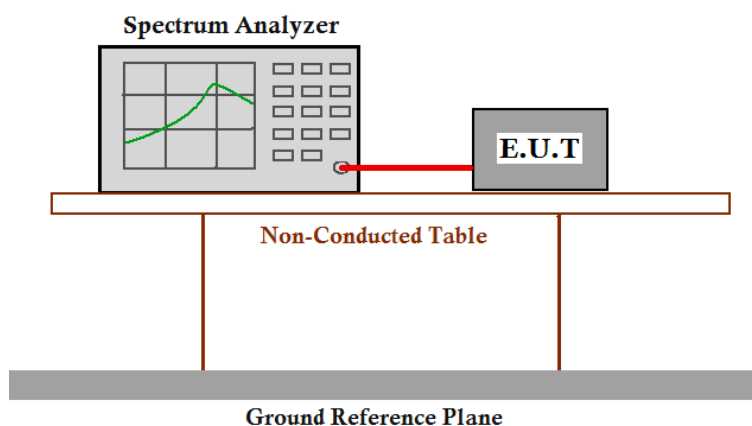
(b)(3) For systems using digital modulation in the 902 ~ 928 MHz, 2 400 ~ 2 483.5 MHz, and 5 725 ~ 5 850 MHz bands: 1 Watt.

Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraph (b) (1), (b) (2), and (b) (3) of section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

##### 4.4.2. Test Method

KDB 558074 D01 v05 and ANSI C63.10

##### 4.4.3. Test Configuration



##### 4.4.4. Test Procedure

- 1) Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
- 2) Set the spectrum analyzer:
  - a) Set  $RBW \geq DTS \text{ bandwidth}$
  - b) Set the video bandwidth (VBW)  $\geq 3 \times RBW$ .
  - c) Set span  $\geq 3 \times RBW$ .
  - d) Sweep time = auto couple.
  - e) Detector = Peak.
  - f) Trace mode = max hold.
  - g) Allow the trace to stabilize.
  - h) Use peak marker function to determine the peak amplitude level.

#### 4.4.5. Test result

##### BLE mode

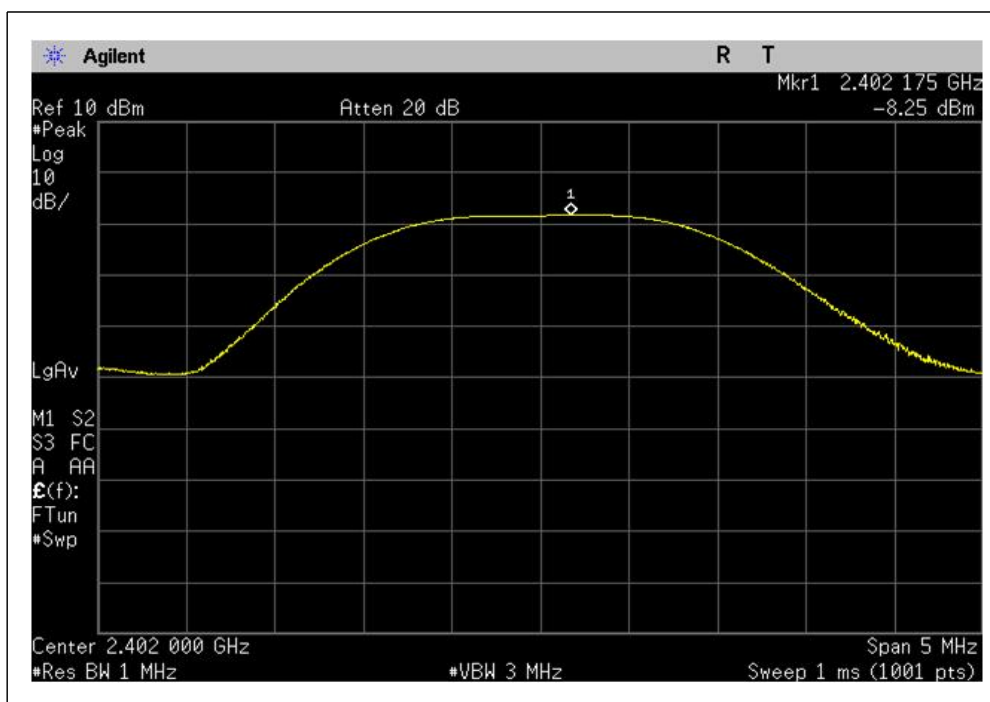
| Test Channel | Frequency (MHz) | Measured Channel Power (dBm) | Measured Channel Power (mW) | Limit (mW) | Result |
|--------------|-----------------|------------------------------|-----------------------------|------------|--------|
| Low          | 2 402           | -8.25                        | 0.15                        | 1000.00    | Pass   |
| Middle       | 2 440           | -10.09                       | 0.10                        | 1000.00    | Pass   |
| High         | 2 480           | -12.00                       | 0.06                        | 1000.00    | Pass   |

This unit does meet the FCC requirements.

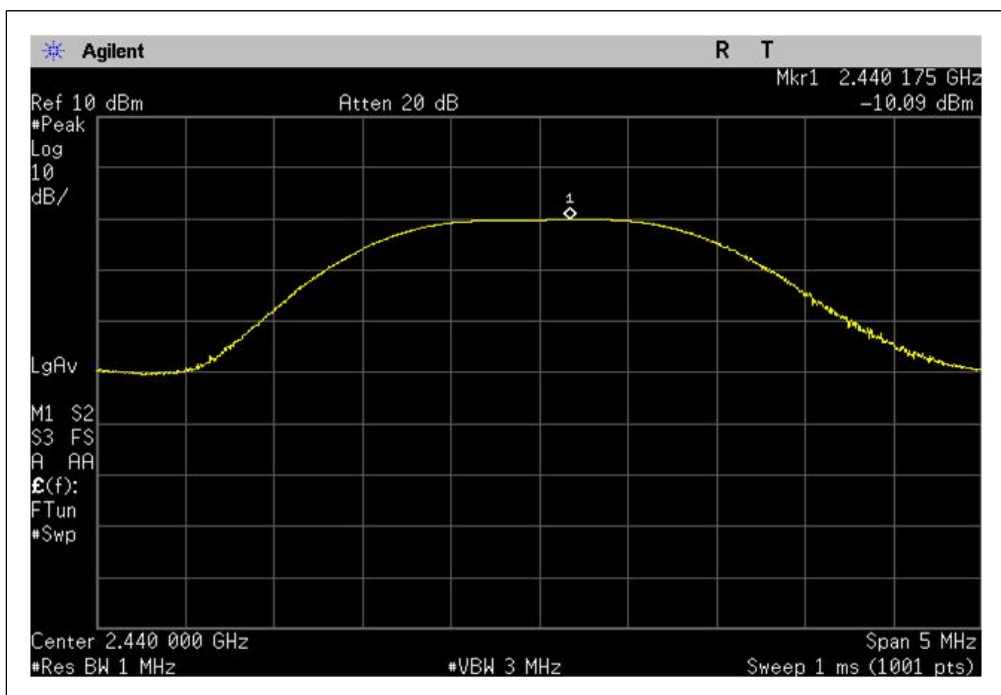
Please refer to the following test plots:

For BLE

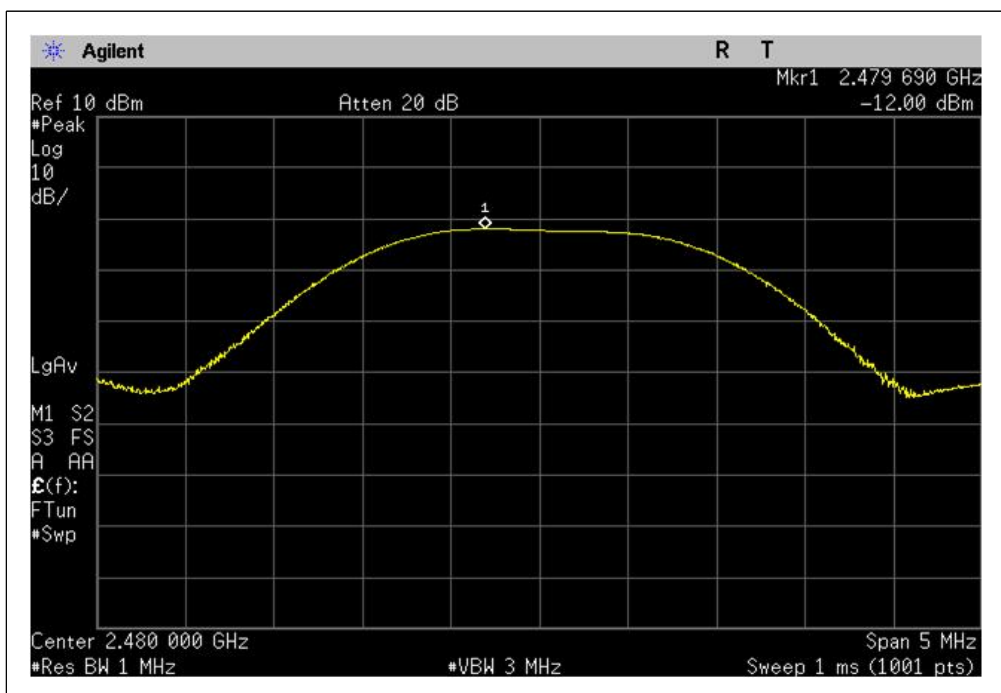
Low Channel(2 402 MHz):



Middle Channel(2 440 MHz):



High Channel(2 480 MHz):



## 4.5. Peak Power Spectral Density

### 4.5.1. Requirement

FCC Part 15 C section 15.247

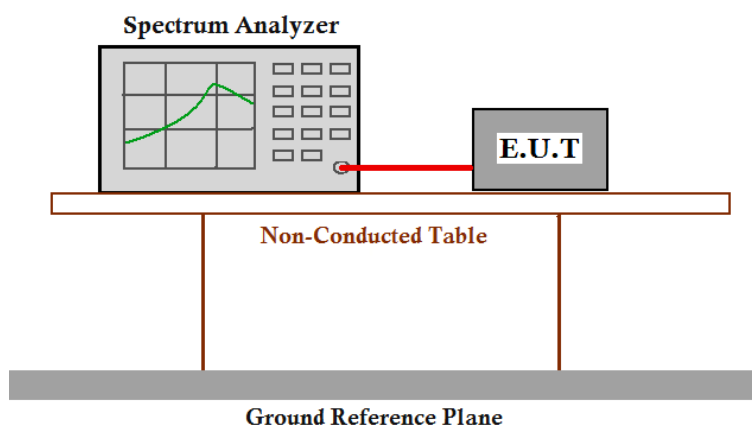
(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### 4.5.2. Test Method

KDB 558074 D01 v05 and ANSI C63.10

### 4.5.3. Test Configuration



### 4.5.4. Test Procedure

- 1) Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
- 2) Set the spectrum analyzer:
  - 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.

#### 4.5.5. Test result

BLE mode:

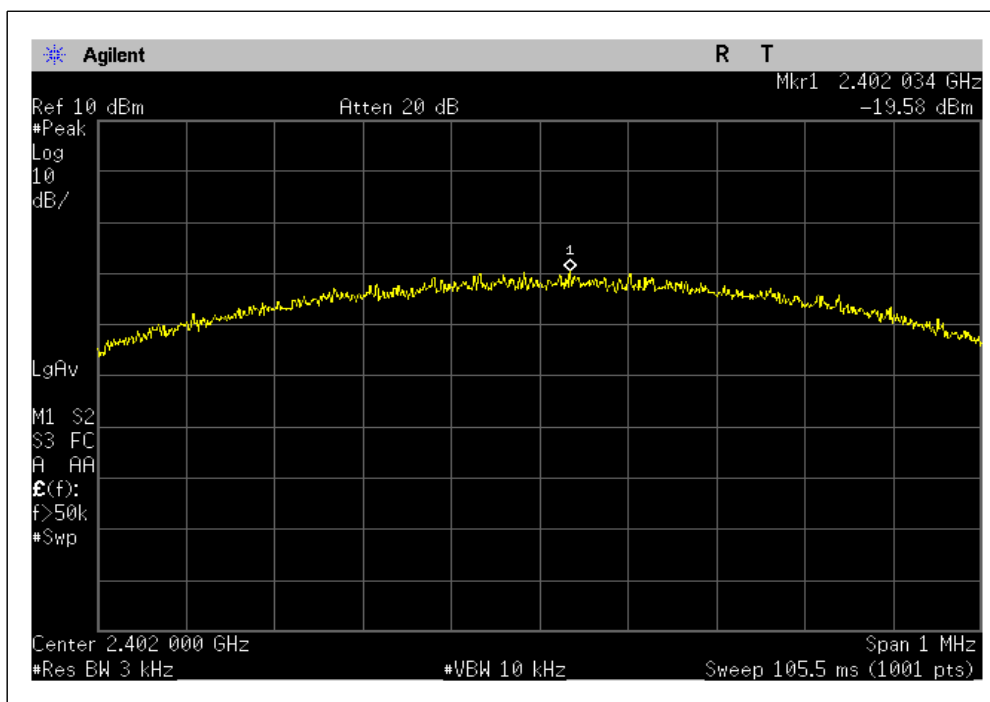
| Test Channel | Frequency (MHz) | Measured Peak Power Spectral Density (dBm/3 kHz) | Limit (dBm/3 kHz) | Result |
|--------------|-----------------|--------------------------------------------------|-------------------|--------|
| Low          | 2 402           | -19.58                                           | 8                 | Pass   |
| Middle       | 2 441           | -21.44                                           | 8                 | Pass   |
| High         | 2 480           | -23.54                                           | 8                 | Pass   |

This unit does meet the FCC requirements.

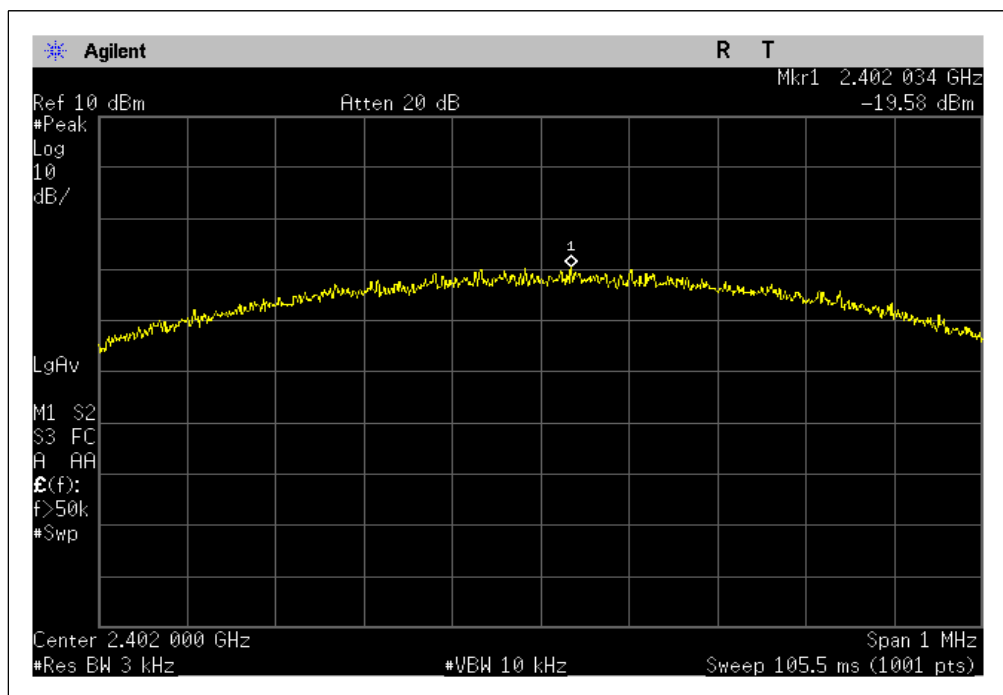
Please refer to the following test plots:

For BLE

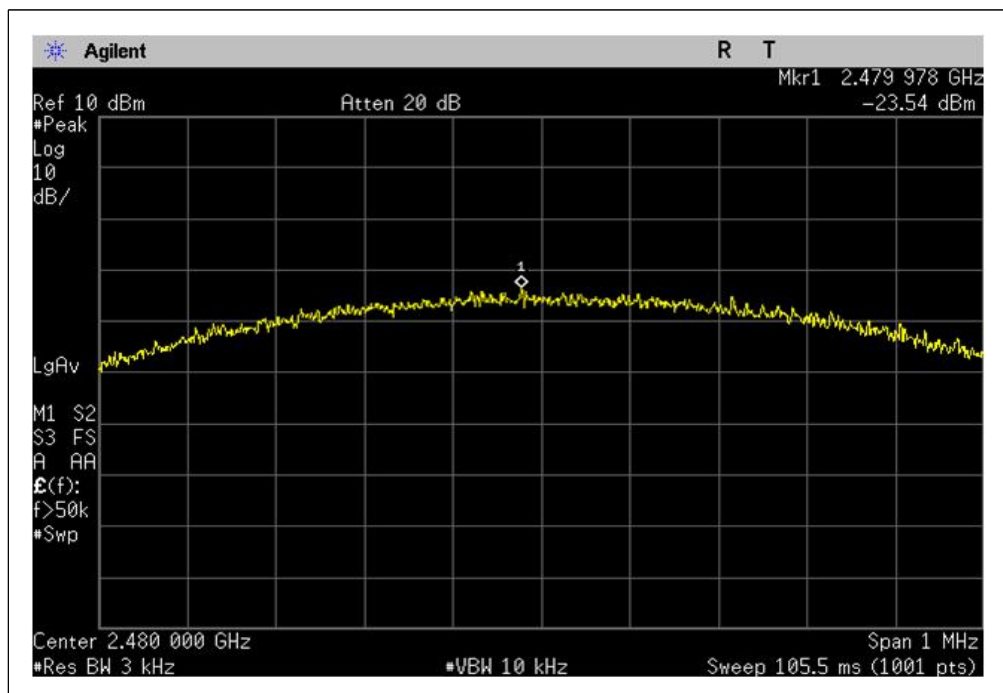
Low Channel(2 402 MHz):



Middle Channel(2 440 MHz):



High Channel(2 480 MHz):



#### 4.6. Conducted Spurious Emissions

##### 4.6.1. Requirement

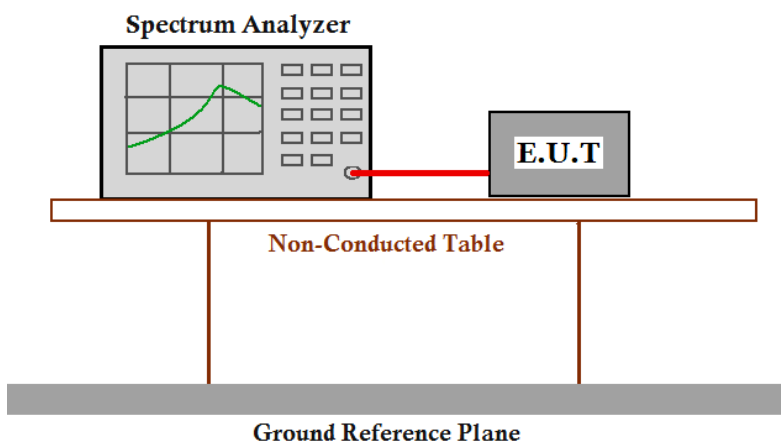
FCC Part15 C section 15.247

(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.

##### 4.6.2. Test Method

KDB 558074 D01 v03r05 and ANSI C63.10

##### 4.6.3. Test Configuration

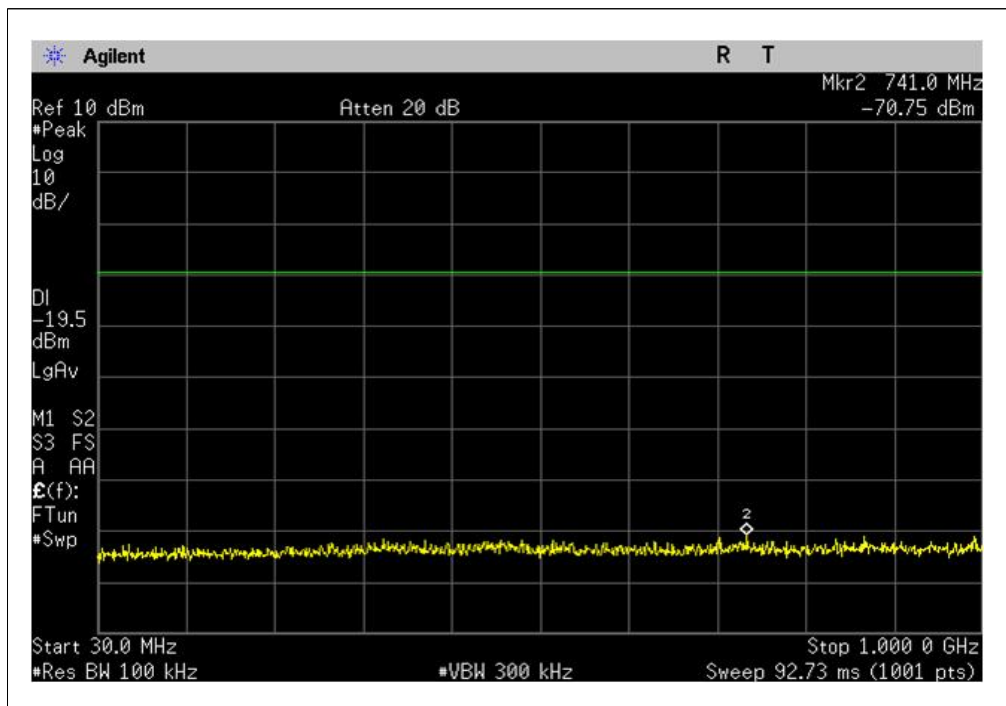


##### 4.6.4. Test Procedure

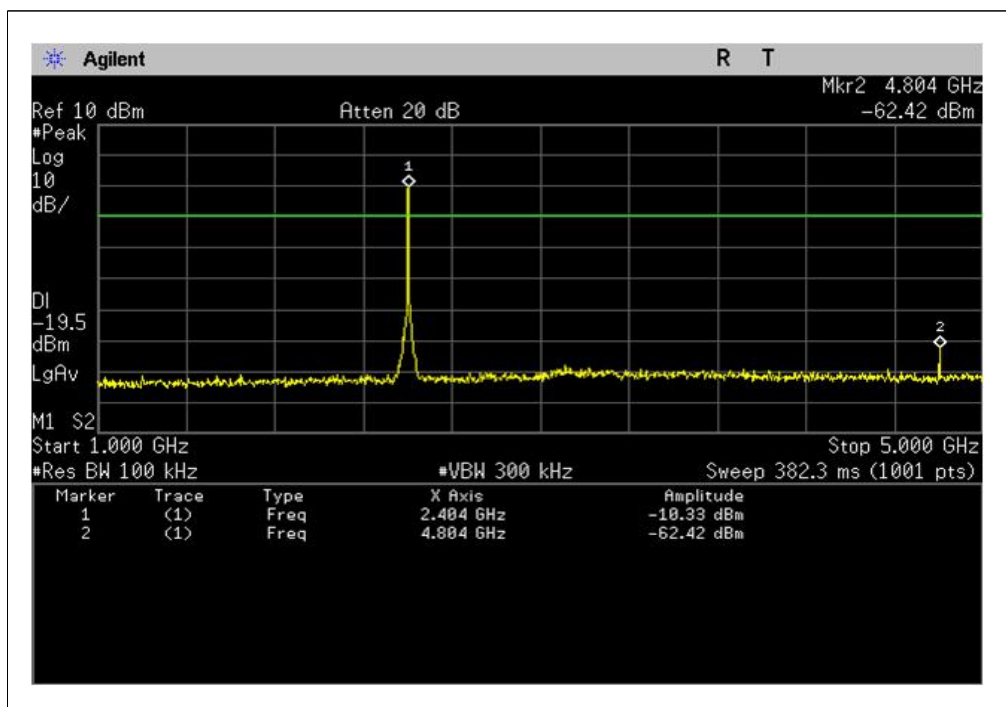
- 1) Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
- 2) Set the spectrum analyzer:
  - a) Set the RBW = 100 kHz.
  - b) Set the VBW = 300 kHz.
  - c) Detector = peak.
  - d) Sweep time = auto couple.
  - e) Trace mode = max hold.
  - f) Scan up through 10th harmonic.

#### 4.6.5. Test result

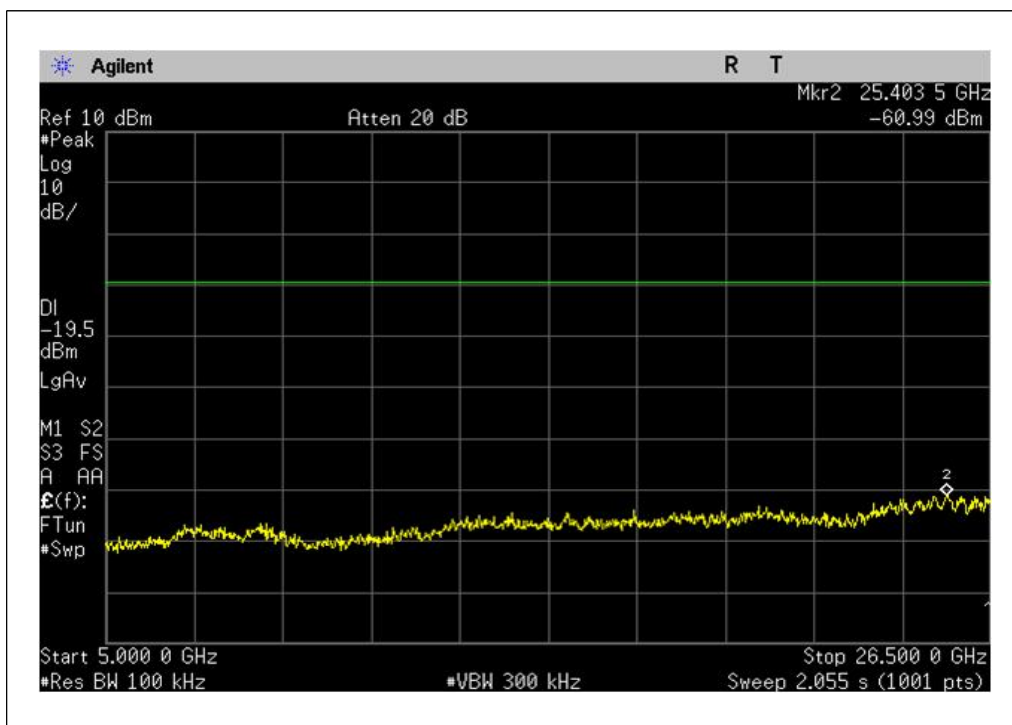
Low Channel(2 402 MHz) : 30 MHz to 1 GHz



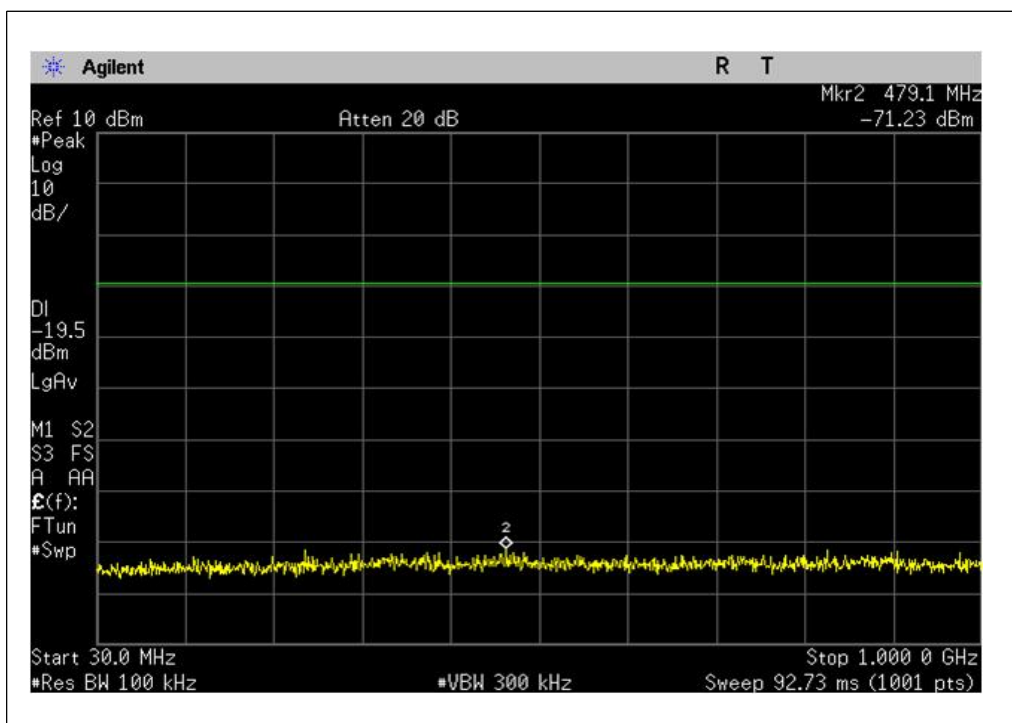
Low Channel(2 402 MHz) : 1 GHz to 5 GHz



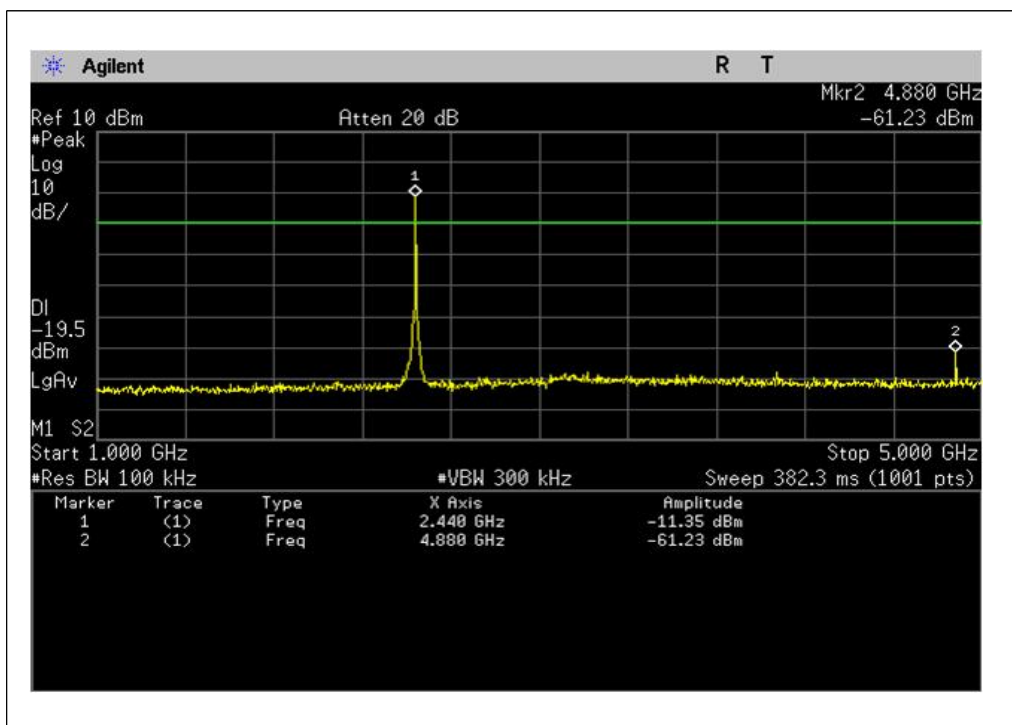
Low Channel(2 402 MHz) : 5 GHz to 26.5 GHz



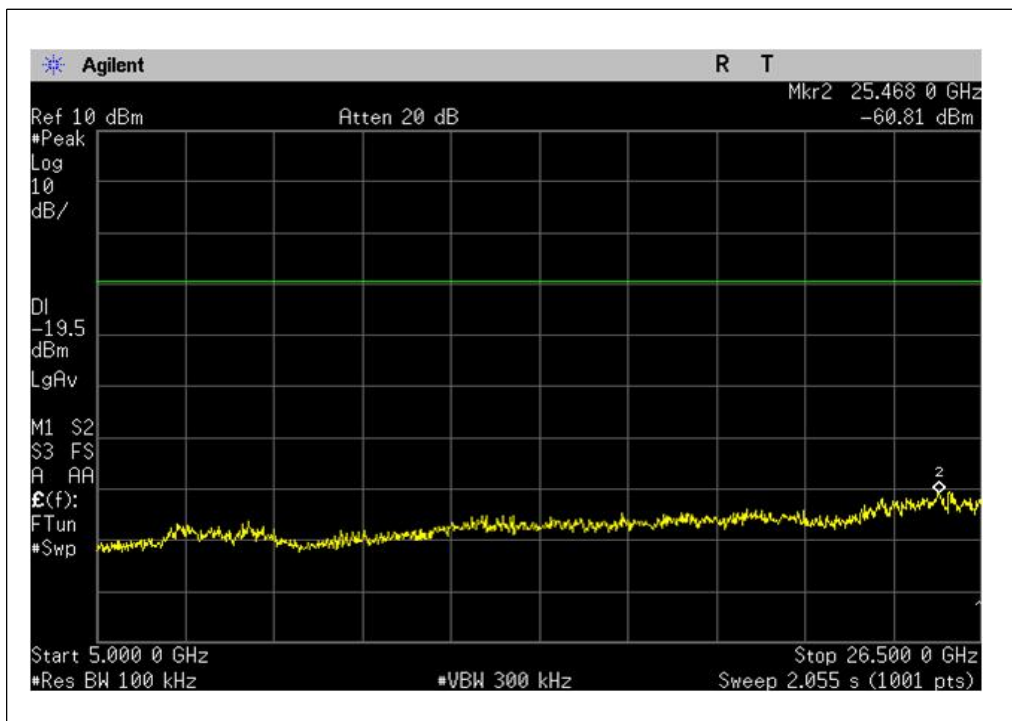
Middle Channel(2 440 MHz) : 30 MHz to 1 GHz



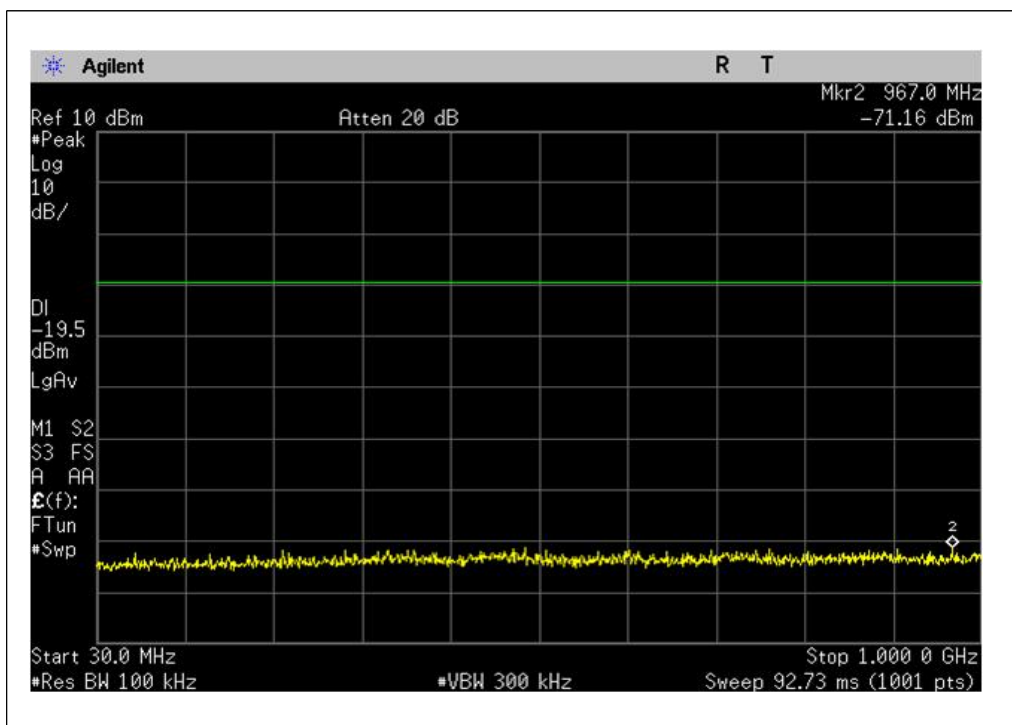
Middle Channel(2 440 MHz) : 1 GHz to 5 GHz



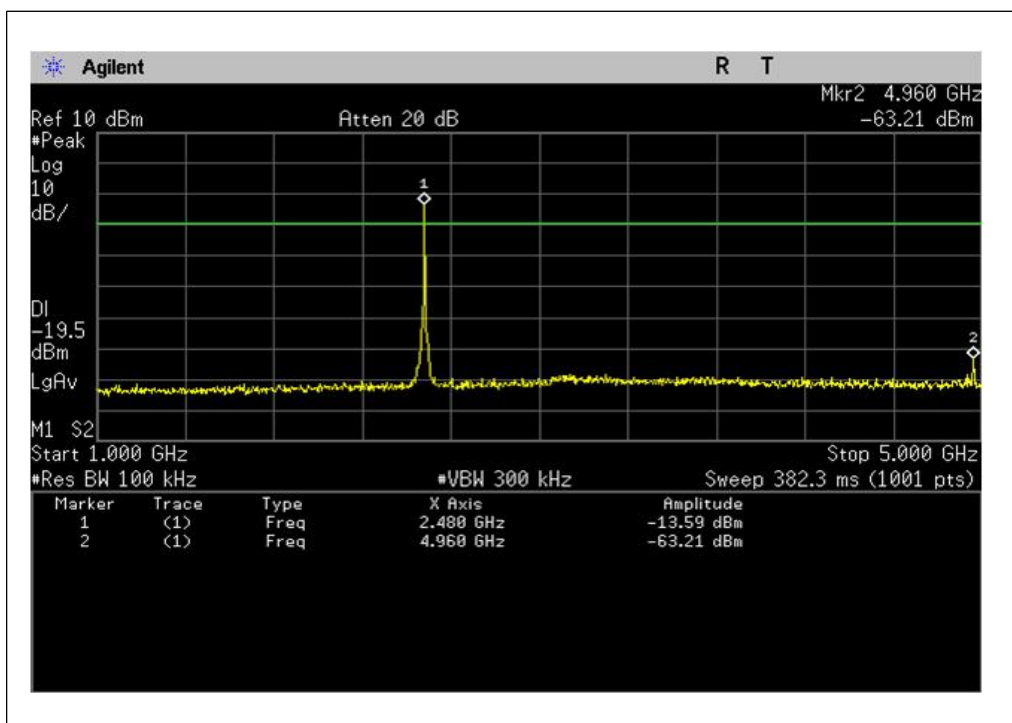
Middle Channel(2 440 MHz) : 5 GHz to 26.5 GHz



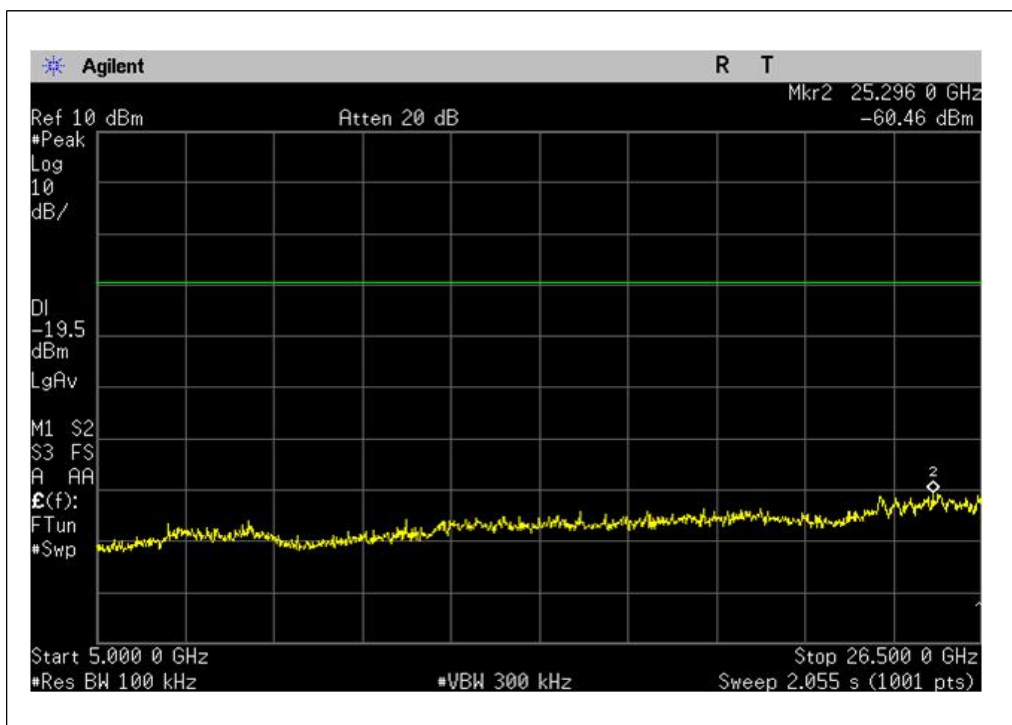
High Channel(2 480 MHz) : 30 MHz to 1 GHz



High Channel(2 480 MHz) : 1 GHz to 5 GHz



High Channel(2 480 MHz) : 5 GHz to 26.5 GHz



#### 4.7. Radiated Spurious Emission

##### 4.7.1. Requirement

FCC Part15 C section 15.247

(d) In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limited specified in Section 15.209(a) (see Section 15.205(c)).

##### 4.7.2. Test Method

ANSI C63.10

###### 1) Test site

Measurement Distance : 3 m (Semi-Anechoic Chamber)

###### 2) Receiver setup

| Frequency    | Detector   | RBW     | VBW     | Remark           |
|--------------|------------|---------|---------|------------------|
| 30 MHz~1 GHz | Quasi-peak | 120 KHz | 300 KHz | Quasi-peak Value |
| Above 1 GHz  | Peak       | 1 MHz   | 3 MHz   | Peak Value       |
|              | RMS        | 1 MHz   | 3 MHz   | Average Value    |

###### 3) Limit

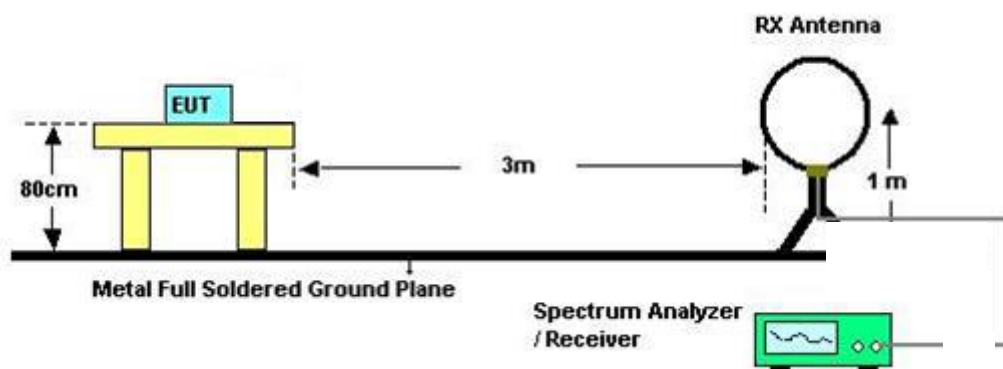
| Frequency         | Limit(dB $\mu$ V/m @ 3m) | Remark           |
|-------------------|--------------------------|------------------|
| 30 MHz ~ 88 MHz   | 40.0                     | Quasi-peak Value |
| 88 MHz ~ 216 MHz  | 43.5                     | Quasi-peak Value |
| 216 MHz ~ 960 MHz | 46.0                     | Quasi-peak Value |
| 960 MHz ~ 1 GHz   | 54.0                     | Quasi-peak Value |
| Above 1 GHz       | 54.0                     | Average Value    |
|                   | 74.0                     | Peak Value       |

###### 4) Test Frequency Range

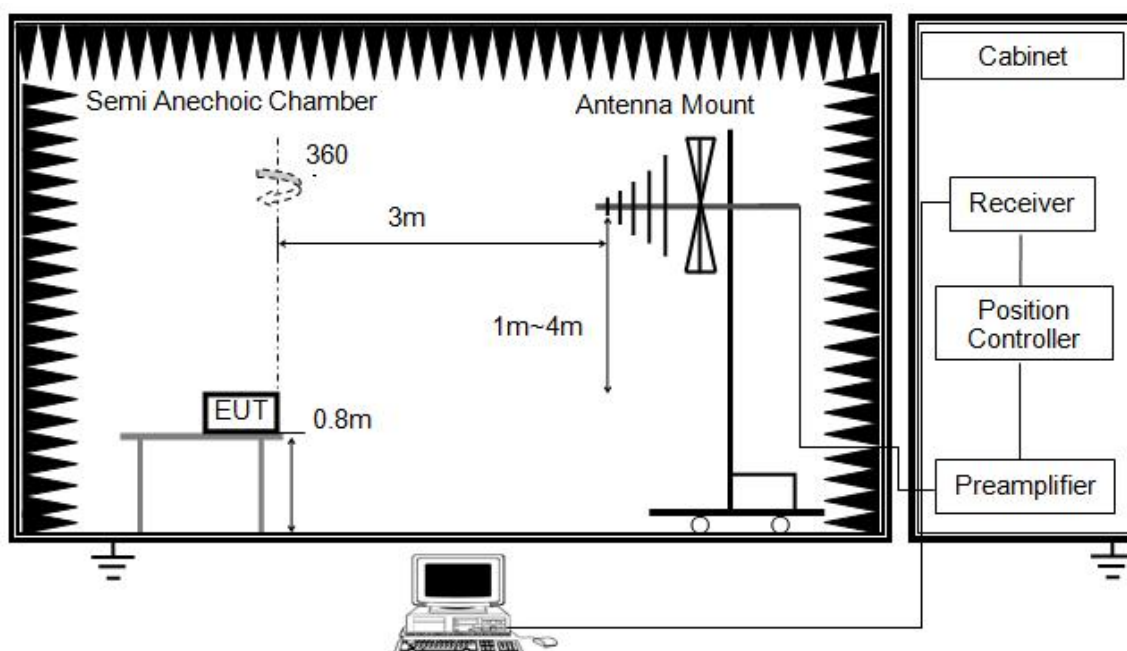
30 MHz ~ 26.5 GHz

#### 4.7.3. Test Configuration

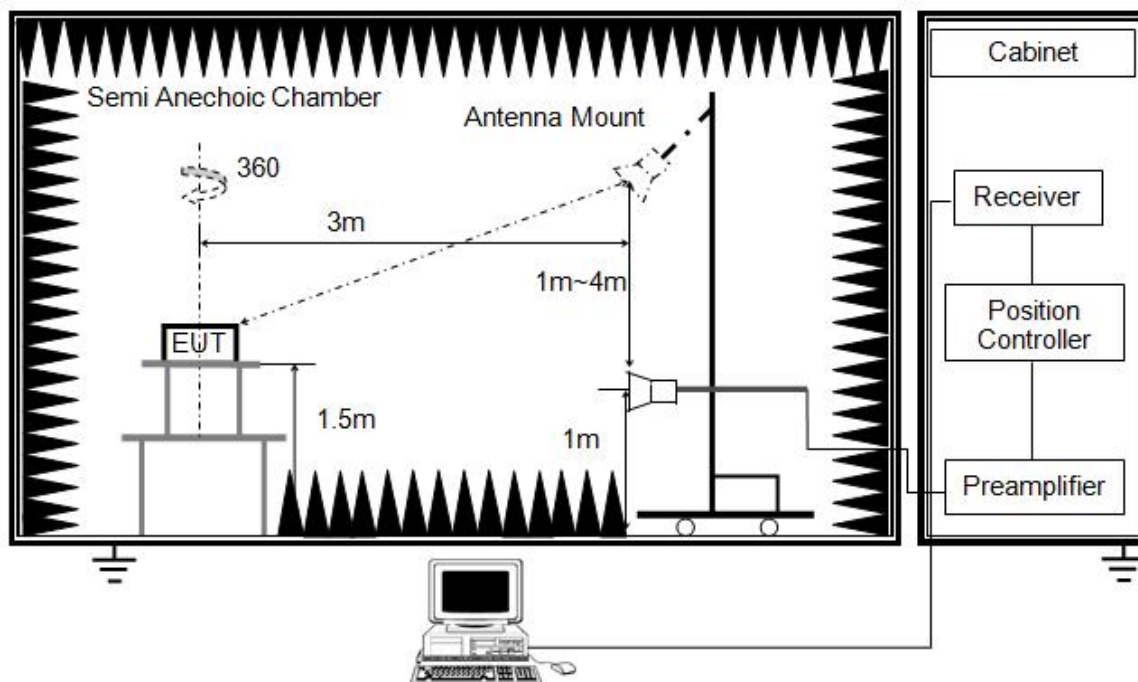
##### 1) 9 kHz to 30 MHz emissions:



##### 2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 26.5 GHz emissions:



4.7.4. Test Procedure

- 1) The EUT is placed on a turntable. For below 1 GHz, the EUT is 0.8 m above ground plane; For above 1 GHz, the EUT is 1.5m above ground plane.
- 2) The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3) EUT is set 3 m away from the receiving antenna, which is move from 1m to 4 m to find out the maximum emissions. The spectrum was investigated from the lowest radio highest fundamental frequency or to 40 GHz, whichever is lower.
- 4) Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5) And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6) Repeat above procedures until the measurements for all frequencies are complete.

#### 4.7.5. Test result

##### 1) Test at low Channel (2 402 MHz) in transmitting status

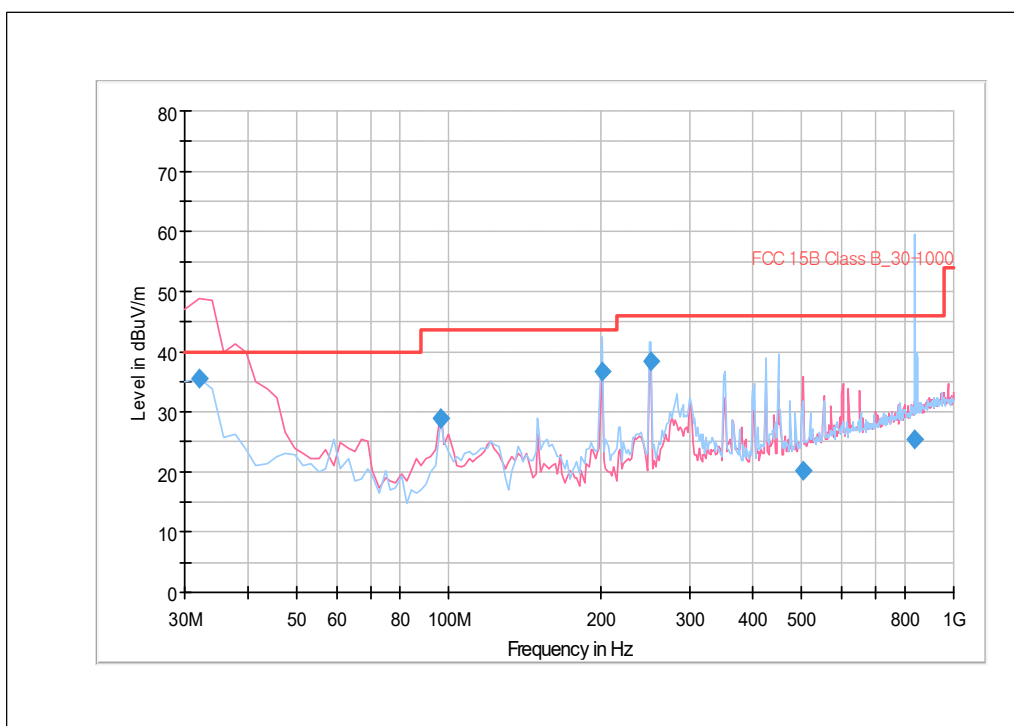
##### a) 9 kHz ~ 30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20 dB below the limit, so the test data were not recorded in the test report.

##### b) 30 MHz~1 GHz Spurious Emissions. Quasi-Peak Measurement

Horizontal and Vertical:

Level (dB $\mu$ V/m)



#### Quasi-peak measurement

| Frequency (MHz) | Detect Mode | Polarization (V/H) | Emission Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|-------------|--------------------|-------------------------------|----------------------|-------------|
| 31.94           | QP          | V                  | 35.65                         | 40.00                | 4.35        |
| 96.09           | QP          | V                  | 28.86                         | 43.50                | 14.64       |
| 201.06          | QP          | H                  | 36.62                         | 43.50                | 6.88        |
| 251.60          | QP          | H                  | 38.35                         | 46.00                | 7.65        |
| 504.31          | QP          | V                  | 20.25                         | 46.00                | 25.75       |
| 838.66          | QP          | H                  | 25.41                         | 46.00                | 20.59       |

\* Remark:

- 1) The Emission Level values are included "Correction Factor"
- 2) Correction Factor = "Antenna Factor" + "Cable Loss" - "Amp. Gain"

### c) 1~26.5 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

#### Peak Measurement:

| Frequency (MHz) | Polarization (V/H) | Emission Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|--------------------|-------------------------------|----------------------|-------------|
| 1 579.16        | H                  | 41.79                         | 74.00                | 32.21       |
| 1 715.43        | V                  | 42.13                         | 74.00                | 31.87       |
| 4 815.63        | H                  | 49.96                         | 74.00                | 24.04       |
| 4 917.84        | V                  | 50.70                         | 74.00                | 23.30       |
| 14 695.39       | H                  | 54.12                         | 74.00                | 19.88       |
| 15 002.00       | V                  | 53.82                         | 74.00                | 20.18       |

\* Remark:

- 1) The Emission Level values are included "Correction Factor"
- 2) Correction Factor = "Antenna Factor" + "Cable Loss" - "Amp. Gain"
- 3) As shown in Section, for frequencies above 1 000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.
- 4) The test only perform the EUT in transmitting status since the test frequencies were over 1 GHz only required transmitting status.

#### Average Measurement:

| Frequency (MHz) | Polarization (V/H) | Emission Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|--------------------|-------------------------------|----------------------|-------------|
| 1 579.16        | H                  | 29.03                         | 54.00                | 24.97       |
| 1 715.43        | V                  | 29.62                         | 54.00                | 24.38       |
| 4 815.63        | H                  | 37.11                         | 54.00                | 16.89       |
| 4 917.84        | V                  | 40.07                         | 54.00                | 13.93       |
| 14 695.39       | H                  | 41.25                         | 54.00                | 12.75       |
| 15 002.00       | V                  | 41.71                         | 54.00                | 12.29       |

\* Remark:

- 1) The Emission Level values are included "Correction Factor"
- 2) Correction Factor = "Antenna Factor" + "Cable Loss" - "Amp. Gain"
- 3) As shown in Section, for frequencies above 1 000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.
- 4) The test only perform the EUT in transmitting status since the test frequencies were over 1 GHz only required transmitting status.

2) Test at middle Channel (2 440 MHz) in transmitting status

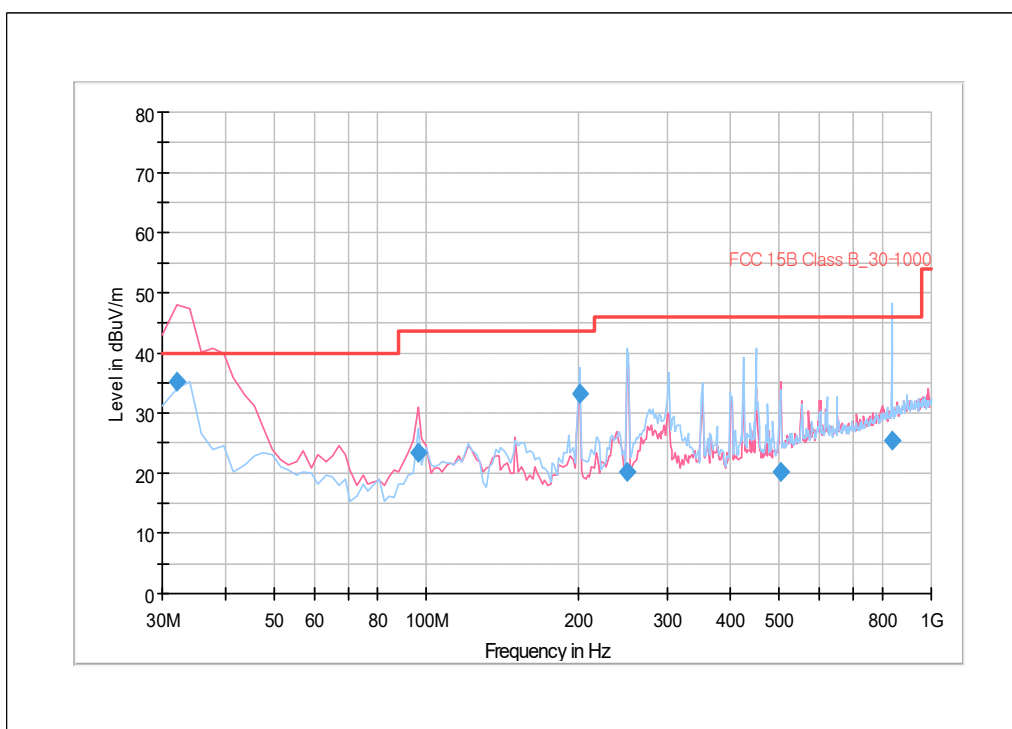
a) 9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20 dB below the limit, so the test data were not recorded in the test report.

b) 30 MHz ~ 1 GHz Spurious Emissions. Quasi-Peak Measurement

Horizontal and Vertical:

Level (dB $\mu$ V/m)



Quasi-peak measurement

| Frequency (MHz) | Detect Mode | Polarization (V/H) | Emission Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|-------------|--------------------|-------------------------------|----------------------|-------------|
| 31.94           | QP          | V                  | 35.37                         | 40.00                | 4.63        |
| 96.09           | QP          | V                  | 23.53                         | 43.50                | 19.97       |
| 201.06          | QP          | H                  | 33.08                         | 43.50                | 10.42       |
| 249.66          | QP          | H                  | 20.12                         | 46.00                | 25.88       |
| 504.31          | QP          | V                  | 20.20                         | 46.00                | 25.80       |
| 838.66          | QP          | H                  | 25.41                         | 46.00                | 20.59       |

\* Remark:

- 1) The Emission Level values are included "Correction Factor"
- 2) Correction Factor = "Antenna Factor" + "Cable Loss" - "Amp. Gain".

### c) 1~26.5 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

#### Peak Measurement:

| Frequency (MHz) | Polarization (V/H) | Emission Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|--------------------|-------------------------------|----------------------|-------------|
| 1 613.23        | H                  | 41.95                         | 74.00                | 32.05       |
| 1 681.36        | V                  | 42.39                         | 74.00                | 31.61       |
| 11 152.30       | H                  | 53.30                         | 74.00                | 20.71       |
| 11 424.85       | V                  | 53.04                         | 74.00                | 20.96       |
| 14 422.85       | V                  | 53.42                         | 74.00                | 20.58       |
| 14 831.66       | H                  | 53.59                         | 74.00                | 20.41       |

\* Remark:

- 1) The Emission Level values are included "Correction Factor"
- 2) Correction Factor = "Antenna Factor" + "Cable Loss" - "Amp. Gain"
- 3) As shown in Section, for frequencies above 1 000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.
- 4) The test only perform the EUT in transmitting status since the test frequencies were over 1 GHz only required transmitting status.

#### Average Measurement:

| Frequency (MHz) | Polarization (V/H) | Emission Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|--------------------|-------------------------------|----------------------|-------------|
| 1 613.23        | H                  | 28.92                         | 54.00                | 25.08       |
| 1 681.36        | V                  | 29.27                         | 54.00                | 24.73       |
| 11 152.30       | H                  | 39.65                         | 54.00                | 14.35       |
| 11 424.85       | V                  | 42.51                         | 54.00                | 11.49       |
| 14 422.85       | V                  | 41.93                         | 54.00                | 12.07       |
| 14 831.66       | H                  | 41.40                         | 54.00                | 12.60       |

\* Remark:

- 1) The Emission Level values are included "Correction Factor"
- 2) Correction Factor = "Antenna Factor" + "Cable Loss" - "Amp. Gain"
- 3) As shown in Section, for frequencies above 1 000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.
- 4) The test only perform the EUT in transmitting status since the test frequencies were over 1 GHz only required transmitting status.

3) Test at high Channel (2 480 MHz) in transmitting status

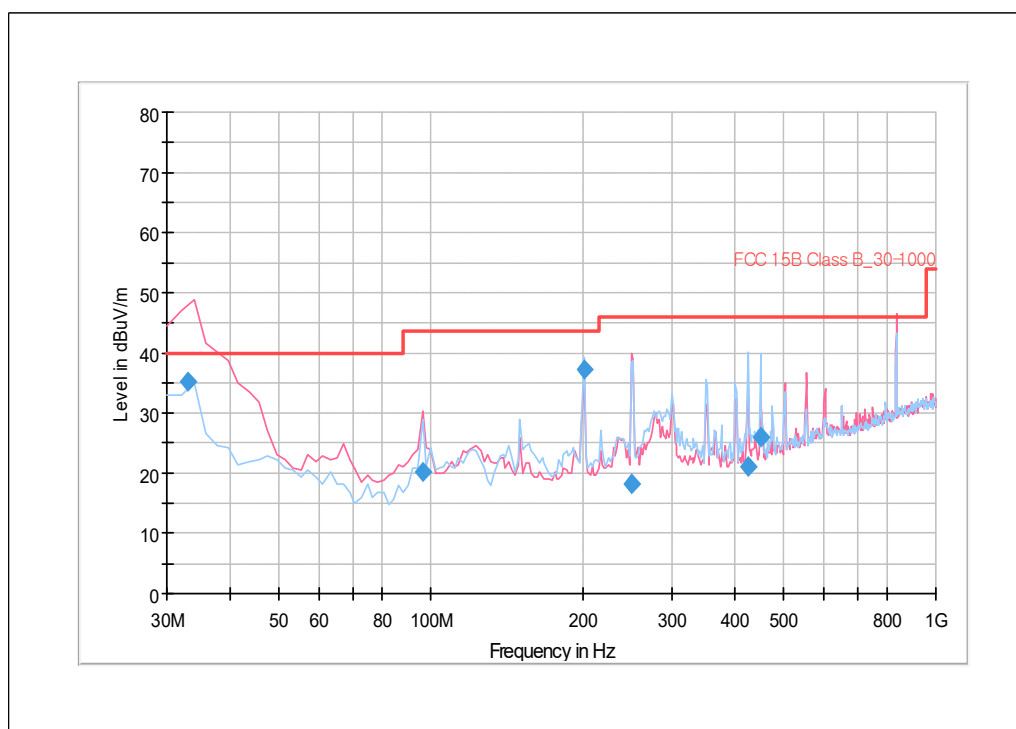
a) 9 kHz ~ 30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with active loop antenna were greater than 20 dB below the limit, so the test data were not recorded in the test report.

b) 30 MHz ~ 1 GHz Spurious Emissions. Quasi-Peak Measurement

Horizontal and Vertical:

Level (dB $\mu$ V/m)



Quasi-peak measurement

| Frequency (MHz) | Detect Mode | Polarization (V/H) | Emission Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|-------------|--------------------|-------------------------------|----------------------|-------------|
| 33.00           | QP          | V                  | 35.11                         | 40.00                | 4.89        |
| 96.09           | QP          | V                  | 20.27                         | 43.50                | 23.23       |
| 201.06          | QP          | H                  | 37.15                         | 43.50                | 6.35        |
| 249.66          | QP          | V                  | 18.08                         | 46.00                | 27.92       |
| 424.61          | QP          | H                  | 21.15                         | 46.00                | 24.85       |
| 449.88          | QP          | H                  | 26.03                         | 46.00                | 19.97       |

\* Remark:

- 1) The Emission Level values are included "Correction Factor"
- 2) Correction Factor = "Antenna Factor" + "Cable Loss" - "Amp. Gain".

### c) 1~26.5 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

#### Peak Measurement:

| Frequency (MHz) | Polarization (V/H) | Emission Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|--------------------|-------------------------------|----------------------|-------------|
| 1 579.16        | H                  | 41.24                         | 74.00                | 32.76       |
| 1 647.29        | V                  | 42.51                         | 74.00                | 31.49       |
| 10 300.60       | H                  | 52.41                         | 74.00                | 21.59       |
| 10 913.83       | V                  | 53.23                         | 74.00                | 20.77       |
| 13 877.76       | V                  | 53.44                         | 74.00                | 20.56       |
| 14 831.66       | H                  | 53.22                         | 74.00                | 20.78       |

\* Remark:

- 1) The Emission Level values are included "Correction Factor"
- 2) Correction Factor = "Antenna Factor" + "Cable Loss" - "Amp. Gain"
- 3) As shown in Section, for frequencies above 1 000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.
- 4) The test only perform the EUT in transmitting status since the test frequencies were over 1 GHz only required transmitting status.

#### Average Measurement:

| Frequency (MHz) | Polarization (V/H) | Emission Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|--------------------|-------------------------------|----------------------|-------------|
| 1 579.16        | H                  | 28.70                         | 54.00                | 25.30       |
| 1 647.29        | V                  | 29.41                         | 54.00                | 24.59       |
| 10 300.60       | H                  | 41.60                         | 54.00                | 12.40       |
| 10 913.83       | V                  | 40.20                         | 54.00                | 13.80       |
| 13 877.76       | V                  | 40.78                         | 54.00                | 13.22       |
| 14 831.66       | H                  | 41.98                         | 54.00                | 12.02       |

\* Remark:

- 1) The Emission Level values are included "Correction Factor"
- 2) Correction Factor = "Antenna Factor" + "Cable Loss" - "Amp. Gain"
- 3) As shown in Section, for frequencies above 1 000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.
- 4) The test only perform the EUT in transmitting status since the test frequencies were over 1 GHz only required transmitting status.

## 4.8. Band Edges Compliance

### 4.8.1. Requirement

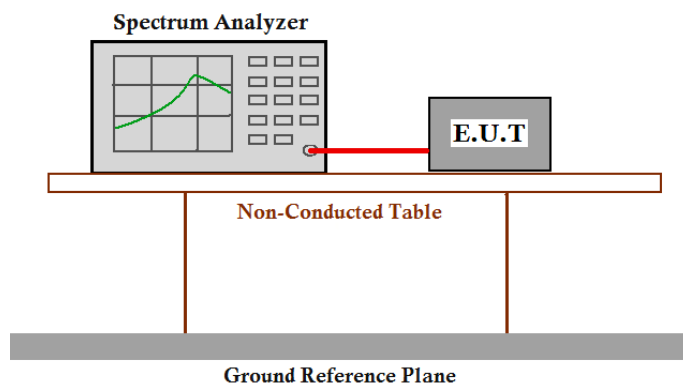
FCC Part15 C section 15.247

(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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

### 4.8.2. Test Method

KDB 558074 D01 v03r05 and ANSI C63.10

### 4.8.3. Test Configuration



### 4.8.4. Test Procedure

- 1) Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
- 2) Set the spectrum analyzer:
  - a) Set start frequency to DTS channel edge frequency.
  - b) Set stop frequency so as to encompass the spectrum to be examined.
  - c) Set RBW = 100 kHz.
  - d) Set VBW  $\geq$  300 kHz.
  - e) Detector = peak.
  - f) Trace Mode = max hold.

- g) Sweep = auto couple.
- h) Allow the trace to stabilize (this may take some time, depending on the extent of the span).
- i) Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

#### 4.8.5. Test result

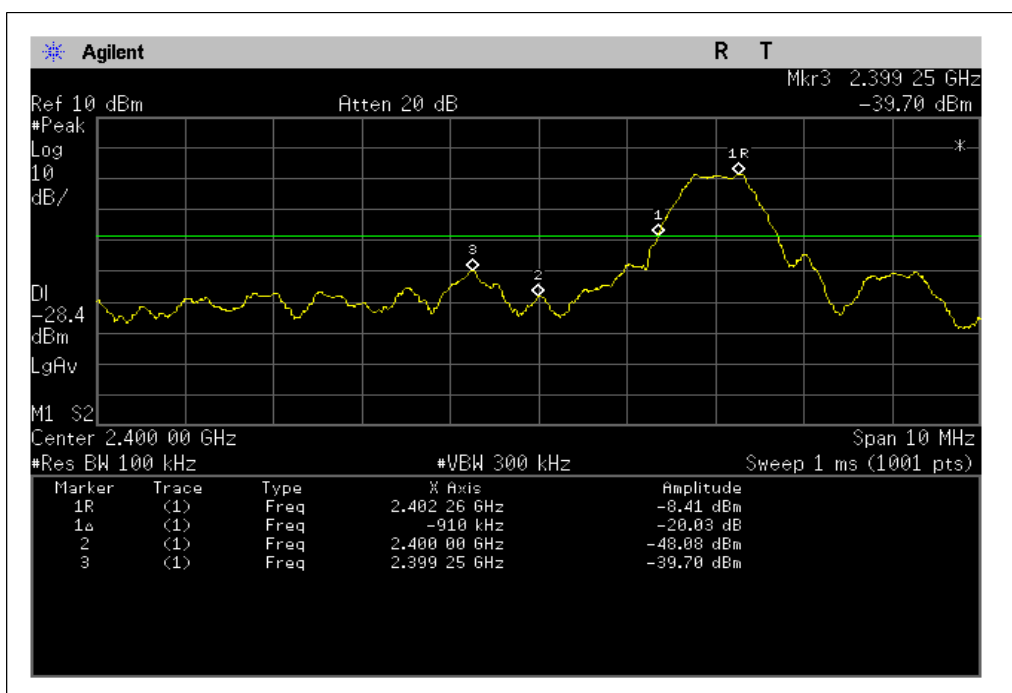
Compare with the output power of the lowest frequency, the Lower Edges attenuated more than 20 dB.

Compare with the output power of the highest frequency, the Upper Edges attenuated more than 20 dB.

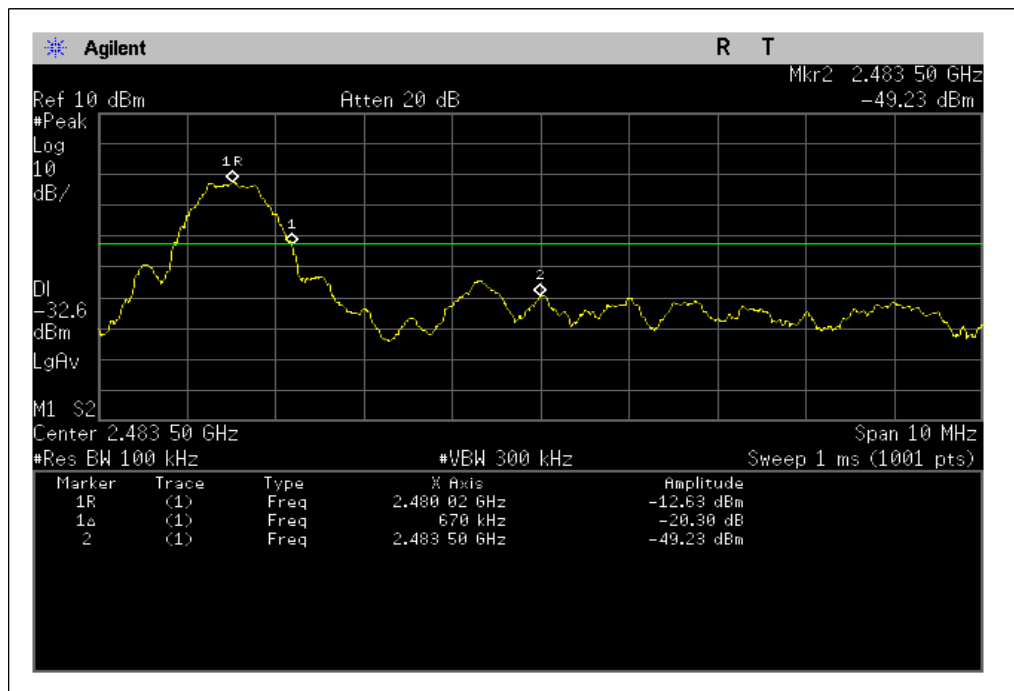
Result plot as follows:

BLE mode:

Low Channel(2 402 MHz):



Highest Channel(2 480 MHz):



## 4.9. Radio Frequency Exposure Procedures

### 4.9.1. Requirement

According to §15.247(i) and § 1.1307(b)(1) , systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

KDB 447498 D01: Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table:

| MHz   | 5  | 10 | 15  | 20  | 25  | mm                                         |
|-------|----|----|-----|-----|-----|--------------------------------------------|
| 150   | 39 | 77 | 116 | 155 | 194 | SAR Test<br>Exclusion<br>Threshold<br>(mW) |
| 300   | 27 | 55 | 82  | 110 | 137 |                                            |
| 450   | 22 | 45 | 67  | 89  | 112 |                                            |
| 835   | 16 | 33 | 49  | 66  | 82  |                                            |
| 900   | 16 | 32 | 47  | 63  | 79  |                                            |
| 1 500 | 12 | 24 | 37  | 49  | 61  |                                            |
| 1 900 | 11 | 22 | 33  | 44  | 54  |                                            |
| 2 450 | 10 | 19 | 29  | 38  | 48  |                                            |
| 3 600 | 8  | 16 | 24  | 32  | 40  |                                            |
| 5 200 | 7  | 13 | 20  | 26  | 33  |                                            |
| 5 400 | 6  | 13 | 19  | 26  | 32  |                                            |
| 5 800 | 6  | 12 | 19  | 25  | 31  |                                            |

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:  $[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.

#### 4.9.2. Conclusion

##### 1) Maximum Measured Transmitter Power:

| Channel Frequency (MHz) | Maximum Peak Conducted Output Power |      | Max Antenna Gain (dBi) | Numeric antenna gain (mW) |
|-------------------------|-------------------------------------|------|------------------------|---------------------------|
|                         | (dBm)                               | (mW) |                        |                           |
| 2 402                   | -8.25                               | 0.15 | 0.5                    | 1.12                      |

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] = 0.15/25 \cdot \sqrt{2.402} = 0.009 \leq 3.0$$

Threshold at which no SAR required is 48 mW and  $\leq 3.0$  for 1-g SAR, Separation distance is 25 mm.

2) Conclusion : The SAR measurement is exempt.

## APPENDIX A : Photographs of Test Setup

### 1. Radiated Spurious Emission



## APPENDIX B : Photographs of EUT

### 1. EUT photo

