

# FCC Radio Test Report

## FCC ID: 2APBP-CS30

### Original Grant

**Report No.** : TB-FCC179351  
**Applicant** : Ciontek Technology Corp.  
**Equipment Under Test (EUT)**  
**EUT Name** : Handheld Smart POS  
**Model No.** : CS30  
**Series Model No.** : CS30PRO, CS30LITE, CS30S, CS30V, CS30MINI, CS30A, CS30C, CS31, CS32  
**Brand Name** : Ciontek  
**Sample ID** : 20200916-08-01#& 20200916-08-02#  
**Receipt Date** : 2021-03-22  
**Test Date** : 2021-03-23 to 2021-05-25  
**Issue Date** : 2021-05-28  
**Standards** : FCC Part 15, Subpart C 15.247  
**Test Method** : ANSI C63.10: 2013  
KDB 558074 D01 15.247 Meas Guidance v05r02  
**Conclusions** : **PASS**

In the configuration tested, the EUT complied with the standards specified above,

**Test/Witness Engineer** :

Rebecca

**Engineer Supervisor** :

IVAN SU

**Engineer Manager** :

Ray Lai



This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.



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## Revision History

| Report No.   | Version | Description             | Issued Date |
|--------------|---------|-------------------------|-------------|
| TB-FCC179351 | Rev.01  | Initial issue of report | 2021-05-28  |
|              |         |                         |             |
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|              |         |                         |             |
|              |         |                         |             |



## 1. General Information about EUT

### 1.1 Client Information

|                     |   |                                                                                                                        |
|---------------------|---|------------------------------------------------------------------------------------------------------------------------|
| <b>Applicant</b>    | : | Ciontek Technology Corp.                                                                                               |
| <b>Address</b>      | : | B501, Chanxueyan Building Wuhan University, No.6 Of Yuexing 2nd Road, Yuehai Street, Nanshan District, Shenzhen, China |
| <b>Manufacturer</b> | : | Ciontek Technology Corp.                                                                                               |
| <b>Address</b>      | : | B501, Chanxueyan Building Wuhan University, No.6 Of Yuexing 2nd Road, Yuehai Street, Nanshan District, Shenzhen, China |

### 1.2 General Description of EUT (Equipment Under Test)

|                               |   |                                                                                                                            |                                             |
|-------------------------------|---|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| <b>EUT Name</b>               | : | Handheld Smart POS                                                                                                         |                                             |
| <b>Model(s) No.</b>           | : | CS30, CS30PRO, CS30LITE, CS30S, CS30V, CS30MINI, CS30A, CS30C, CS31, CS32                                                  |                                             |
| <b>Model Different</b>        | : | All these models are identical in the same PCB, layout and electrical circuit, The only difference is appearance color.    |                                             |
| <b>Product Description</b>    | : | Operation Frequency:                                                                                                       | Bluetooth 4.2(BLE): 2402MHz~2480MHz         |
|                               |   | Number of Channel:                                                                                                         | Bluetooth 4.2(BLE): 40 channels see note(3) |
|                               |   | Antenna Gain:                                                                                                              | 0.8dBi PIFA Antenna                         |
|                               |   | Modulation Type:                                                                                                           | GFSK                                        |
|                               |   | Bit Rate of Transmitter:                                                                                                   | 1Mbps                                       |
| <b>Power Rating</b>           | : | Adapter(XS12-050200U)<br>Input: 100-240V~, 50/60Hz, 0.5A<br>Output: DC5V2A                                                 |                                             |
| <b>Li-ion Polymer Battery</b> | : | 7.6V, 2600mAh, 19.76Wh                                                                                                     |                                             |
| <b>Software Version</b>       | : | a51_v0.01_20210316c                                                                                                        |                                             |
| <b>Hardware Version</b>       | : | CS30HWV2.0                                                                                                                 |                                             |
| <b>Remark</b>                 | : | The antenna gain and adapter provided by the applicant, the verified for the RF conduction test provided by TOBY test lab. |                                             |

**Note:**

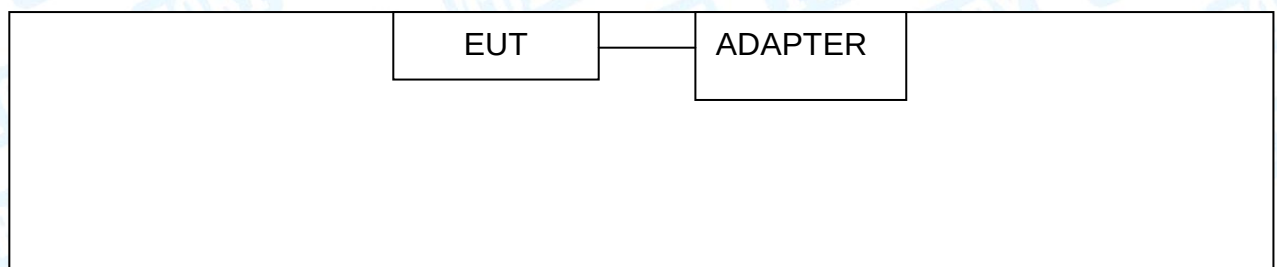
- (1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
- (2) Antenna information provided by the applicant.



(3) Channel List:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|
| 00      | 2402            | 14      | 2430            | 28      | 2458            |
| 01      | 2404            | 15      | 2432            | 29      | 2460            |
| 02      | 2406            | 16      | 2434            | 30      | 2462            |
| 03      | 2408            | 17      | 2436            | 31      | 2464            |
| 04      | 2410            | 18      | 2438            | 32      | 2466            |
| 05      | 2412            | 19      | 2440            | 33      | 2468            |
| 06      | 2414            | 20      | 2442            | 34      | 2470            |
| 07      | 2416            | 21      | 2444            | 35      | 2472            |
| 08      | 2418            | 22      | 2446            | 36      | 2474            |
| 09      | 2420            | 23      | 2448            | 37      | 2476            |
| 10      | 2422            | 24      | 2450            | 38      | 2478            |
| 11      | 2424            | 25      | 2452            | 39      | 2480            |
| 12      | 2426            | 26      | 2454            |         |                 |
| 13      | 2428            | 27      | 2456            |         |                 |

1.3 Block Diagram Showing the Configuration of System Tested



1.4 Description of Support Units

| Equipment Information |               |              |              |           |
|-----------------------|---------------|--------------|--------------|-----------|
| Name                  | Model         | FCC ID/VOC   | Manufacturer | Used “√”  |
| ---                   | ----          | ----         | ---          | ---       |
| Cable Information     |               |              |              |           |
| Number                | Shielded Type | Ferrite Core | Length       | Note      |
| Cable 1               | Yes           | NO           | 1.0M         | Accessory |



## 1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

| For Conducted Test |                                  |
|--------------------|----------------------------------|
| Final Test Mode    | Description                      |
| Mode 1             | Charging+TX Mode                 |
| For Radiated Test  |                                  |
| Final Test Mode    | Description                      |
| Mode 2             | TX Mode                          |
| Mode 3             | TX 1Mbps Mode (Channel 00/20/39) |

**Note:**

- (1) For all test, we have verified the construction and function in typical operation. And all the test modes were carried out with the EUT in transmitting operation in maximum power with all kinds of data rate.  
According to ANSI C63.10 standards, the measurements are performed at the highest, middle, lowest available channels, and the worst case data rate as follows:  
BLE Mode: GFSK Modulation Transmitting mode.
- (2) During the testing procedure, the continuously transmitting with the maximum power mode was programmed by the customer.
- (3) The EUT is considered a portable unit; in normal use it was positioned on X-plane. The worst case was found positioned on X-plane. Therefore only the test data of this X-plane was used for radiated emission measurement test.



## 1.6 Description of Test Software Setting

During testing channel& Power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of RF setting.

| Test Software Version | QRCT     |         |          |
|-----------------------|----------|---------|----------|
| Frequency             | 2402 MHz | 2442MHz | 2480 MHz |
| BLE GFSK              | DEF      | DEF     | DEF      |

## 1.7 Measurement Uncertainty

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95 %.

| Test Item          | Parameters                                        | Expanded Uncertainty ( $U_{Lab}$ ) |
|--------------------|---------------------------------------------------|------------------------------------|
| Conducted Emission | Level Accuracy:<br>9kHz~150kHz<br>150kHz to 30MHz | $\pm 3.50$ dB<br>$\pm 3.10$ dB     |
| Radiated Emission  | Level Accuracy:<br>9kHz to 30 MHz                 | $\pm 4.60$ dB                      |
| Radiated Emission  | Level Accuracy:<br>30MHz to 1000 MHz              | $\pm 4.50$ dB                      |
| Radiated Emission  | Level Accuracy:<br>Above 1000MHz                  | $\pm 4.20$ dB                      |



## 1.8 Test Facility

The testing was performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at: 1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China.

At the time of testing, the following bodies accredited the Laboratory:

### **CNAS (L5813)**

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

### **A2LA Certificate No.: 4750.01**

The laboratory has been accredited by American Association for Laboratory Accreditation (A2LA) to ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01.FCC Accredited Test Site Number: 854351. Designation Number: CN1223.

### **IC Registration No.: (11950A)**

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A. CAB identifier: CN0056.



## 2. Test Summary

| FCC Part 15 Subpart C(15.247)                           |                                                                              |                                    |          |        |
|---------------------------------------------------------|------------------------------------------------------------------------------|------------------------------------|----------|--------|
| Standard Section                                        | Test Item                                                                    | Test Sample(s)                     | Judgment | Remark |
| 15.203                                                  | Antenna Requirement                                                          | 20200916-08-01#                    | PASS     | N/A    |
| 15.207(a)                                               | Conducted Emission                                                           | 20200916-08-02#                    | PASS     | N/A    |
| 15.205&15.247(d)                                        | Band-Edge & Unwanted Emissions into Restricted Frequency                     | 20200916-08-01#                    | PASS     | N/A    |
| 15.247(a)(2)                                            | 6dB Bandwidth                                                                | 20200916-08-01#                    | PASS     | N/A    |
| 15.247(b)(3)                                            | Conducted Max Output Power                                                   | 20200916-08-01#                    | PASS     | N/A    |
| 15.247(e)                                               | Power Spectral Density                                                       | 20200916-08-01#                    | PASS     | N/A    |
| 15.205, 15.209&15.247(d)                                | Transmitter Radiated Spurious & Unwanted Emissions into Restricted Frequency | 20200916-08-01#<br>20200916-08-02# | PASS     | N/A    |
| <b>Note:</b> N/A is an abbreviation for Not Applicable. |                                                                              |                                    |          |        |

## 3. Test Software

| Test Item                | Test Software | Manufacturer | Version No. |
|--------------------------|---------------|--------------|-------------|
| Conducted Emission       | EZ-EMC        | EZ           | CDI-03A2    |
| Radiation Emission       | EZ-EMC        | EZ           | FA-03A2RE   |
| RF Conducted Measurement | MTS-8310      | MWRFtest     | V2.0.0.0    |



## 4. Test Equipment

| Conducted Emission Test    |                                        |                   |               |               |               |
|----------------------------|----------------------------------------|-------------------|---------------|---------------|---------------|
| Equipment                  | Manufacturer                           | Model No.         | Serial No.    | Last Cal.     | Cal. Due Date |
| EMI Test Receiver          | Rohde & Schwarz                        | ESCI              | 100321        | Jul. 06, 2020 | Jul. 05, 2021 |
| RF Switching Unit          | Compliance<br>Direction Systems<br>Inc | RSU-A4            | 34403         | Jul. 06, 2020 | Jul. 05, 2021 |
| AMN                        | SCHWARZBECK                            | NNBL 8226-2       | 8226-2/164    | Jul. 06, 2020 | Jul. 05, 2021 |
| LISN                       | Rohde & Schwarz                        | ENV216            | 101131        | Jul. 06, 2020 | Jul. 05, 2021 |
| Radiation Emission Test    |                                        |                   |               |               |               |
| Equipment                  | Manufacturer                           | Model No.         | Serial No.    | Last Cal.     | Cal. Due Date |
| Spectrum Analyzer          | Agilent                                | E4407B            | MY45106456    | Jul. 06, 2020 | Jul. 05, 2021 |
| EMI Test Receiver          | Rohde & Schwarz                        | ESPI              | 100010/007    | Jul. 06, 2020 | Jul. 05, 2021 |
| Spectrum Analyzer          | Rohde & Schwarz                        | FSV40-N           | 102197        | Jul. 06, 2020 | Jul. 05, 2021 |
| Bilog Antenna              | ETS-LINDGREN                           | 3142E             | 00117537      | Mar.01, 2020  | Feb. 28, 2022 |
| Horn Antenna               | ETS-LINDGREN                           | 3117              | 00143207      | Mar.01, 2020  | Feb. 28, 2022 |
| Horn Antenna               | ETS-LINDGREN                           | BBHA 9170         | BBHA9170582   | Mar.01, 2020  | Feb. 28, 2022 |
| Loop Antenna               | SCHWARZBECK                            | FMZB 1519 B       | 1519B-059     | Jul. 07, 2020 | Jul. 06, 2021 |
| Pre-amplifier              | Sonoma                                 | 310N              | 185903        | Feb. 25, 2021 | Feb. 24, 2022 |
| Pre-amplifier              | HP                                     | 8449B             | 3008A00849    | Feb. 25, 2021 | Feb. 24, 2022 |
| Pre-amplifier              | SKET                                   | LNPA_1840G-50     | SK201904032   | Feb. 25, 2021 | Feb. 24, 2022 |
| Cable                      | HUBER+SUHNER                           | 100               | SUCOFLEX      | Feb. 25, 2021 | Feb. 24, 2022 |
| Positioning Controller     | ETS-LINDGREN                           | 2090              | N/A           | N/A           | N/A           |
| Antenna Conducted Emission |                                        |                   |               |               |               |
| Equipment                  | Manufacturer                           | Model No.         | Serial No.    | Last Cal.     | Cal. Due Date |
| Spectrum Analyzer          | Agilent                                | E4407B            | MY45106456    | Jul. 06, 2020 | Jul. 05, 2021 |
| Spectrum Analyzer          | Rohde & Schwarz                        | ESPI              | 100010/007    | Jul. 06, 2020 | Jul. 05, 2021 |
| MXA Signal Analyzer        | Agilent                                | N9020A            | MY49100060    | Sep. 11, 2020 | Sep. 10, 2021 |
| Vector Signal Generator    | Agilent                                | N5182A            | MY50141294    | Sep. 11, 2020 | Sep. 10, 2021 |
| Analog Signal Generator    | Agilent                                | N5181A            | MY50141953    | Sep. 11, 2020 | Sep. 10, 2021 |
| RF Power Sensor            | DARE!! Instruments                     | RadiPowerRPR3006W | 17I00015SNO26 | Sep. 11, 2020 | Sep. 10, 2021 |
|                            | DARE!! Instruments                     | RadiPowerRPR3006W | 17I00015SNO29 | Sep. 11, 2020 | Sep. 10, 2021 |
|                            | DARE!! Instruments                     | RadiPowerRPR3006W | 17I00015SNO31 | Sep. 11, 2020 | Sep. 10, 2021 |
|                            | DARE!! Instruments                     | RadiPowerRPR3006W | 17I00015SNO33 | Sep. 11, 2020 | Sep. 10, 2021 |



## 5. Conducted Emission Test

### 5.1 Test Standard and Limit

#### 5.1.1 Test Standard

FCC Part 15.207

#### 5.1.2 Test Limit

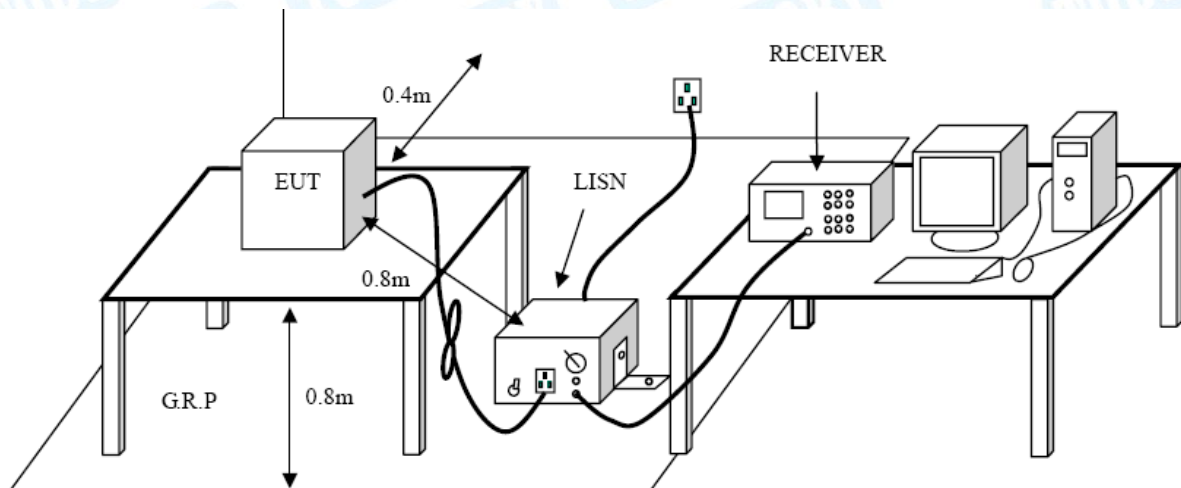
Conducted Emission Test Limit

| Frequency     | Maximum RF Line Voltage (dB $\mu$ V) |               |
|---------------|--------------------------------------|---------------|
|               | Quasi-peak Level                     | Average Level |
| 150kHz~500kHz | 66 ~ 56 *                            | 56 ~ 46 *     |
| 500kHz~5MHz   | 56                                   | 46            |
| 5MHz~30MHz    | 60                                   | 50            |

Notes:

- (1) \*Decreasing linearly with logarithm of the frequency.
- (2) The lower limit shall apply at the transition frequencies.
- (3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### 5.2 Test Setup





### 5.3 Test Procedure

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

LISN at least 80 cm from nearest part of EUT chassis.

The bandwidth of EMI test receiver is set at 9 kHz, and the test frequency band is from 0.15MHz to 30MHz.

### 5.4 Deviation From Test Standard

No deviation

### 5.5 EUT Operating Mode

Please refer to the description of test mode.

### 5.6 Test Data

Please refer to the Attachment A.



## 6. Radiated and Conducted Unwanted Emissions

### 6.1 Test Standard and Limit

#### 6.1.1 Test Standard

FCC Part 15.247(d)

#### 6.1.2 Test Limit

#### Radiated Emission Limits (9kHz~1000MHz)

| Frequency (MHz) | Field Strength (microvolt/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                             |

#### Radiated Emission Limit (Above 1000MHz)

| Frequency (MHz) | Distance Meters(at 3m) |                  |
|-----------------|------------------------|------------------|
|                 | Peak (dBuV/m)          | Average (dBuV/m) |
| Above 1000      | 74                     | 54               |

**Note:**

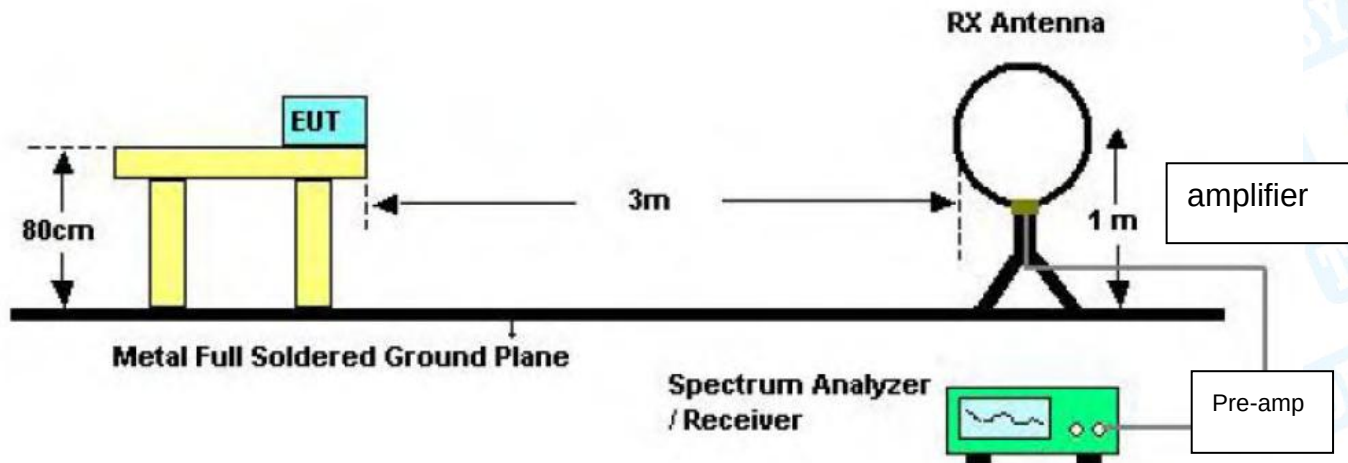
- (1) The tighter limit applies at the band edges.
- (2) Emission Level (dBuV/m)=20log Emission Level (uV/m)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB.

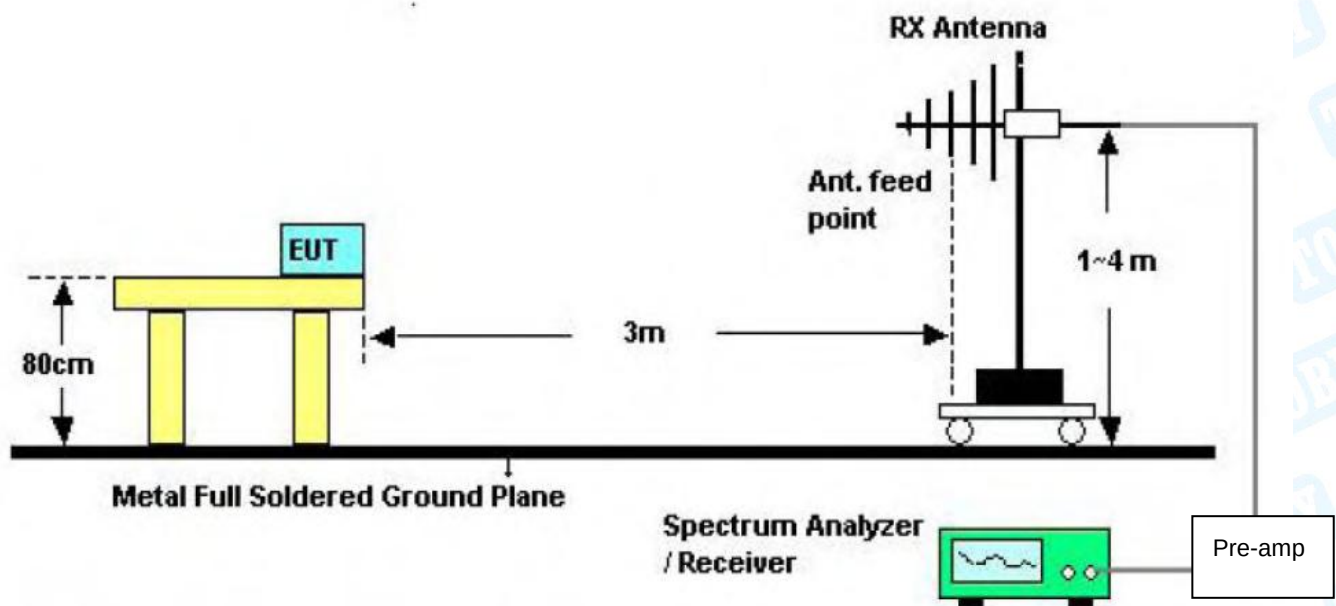


## 6.2 Test Setup

## Radiated measurement

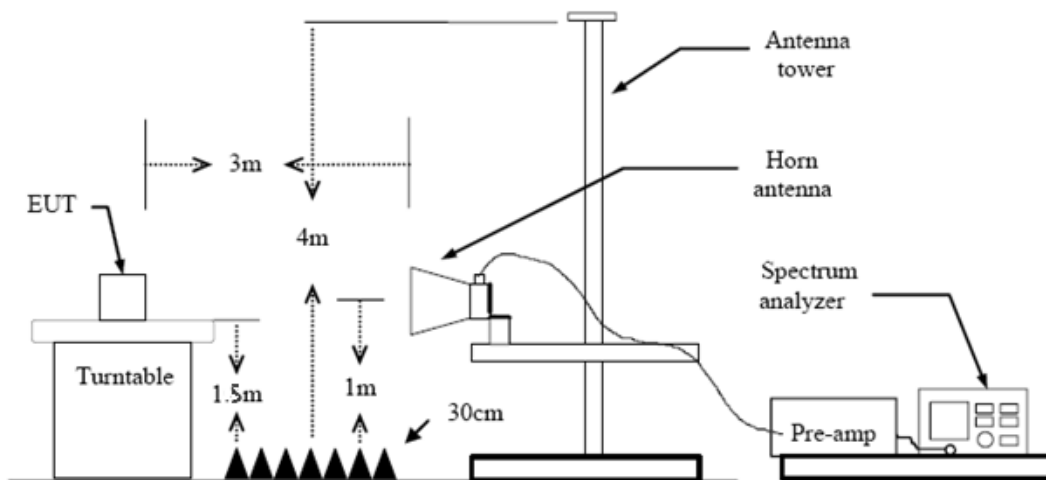


## Below 30MHz Test Setup



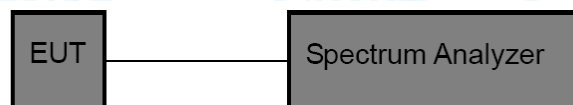
## Below 1000MHz Test Setup





Above 1GHz Test Setup

### Conducted measurement



## 6.3 Test Procedure

### Radiated measurement

- (1) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.
- (2) Measurements at frequency Below 1GHz. The EUT was placed on a rotating 0.8m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.
- (3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
- (4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- (5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional



QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.

- (6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
- (7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.
- (8) For the actual test configuration, please see the test setup photo.

### **Conducted measurement**

Testing shall be done on a laboratory bench in a shielded room or in another suitable location. The active antenna port of the unlicensed wireless device shall be connected to the spectrum analyzer after applying appropriate precautions to protect the instrumentation. If a second antenna port is available, then it shall be tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port. (See also 7.8.8, 11.12.2, and 12.1.2.)

For the actual test configuration, please see the test setup photo.

#### **6.4 Deviation From Test Standard**

No deviation

#### **6.5 EUT Operating Condition**

The Equipment Under Test was set to Continual Transmitting in maximum power.

#### **6.6 Test Data**

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

Please refer to the Attachment B.



## 7. Restricted Bands Requirement

## 7.1 Test Standard and Limit

### 7.1.1 Test Standard

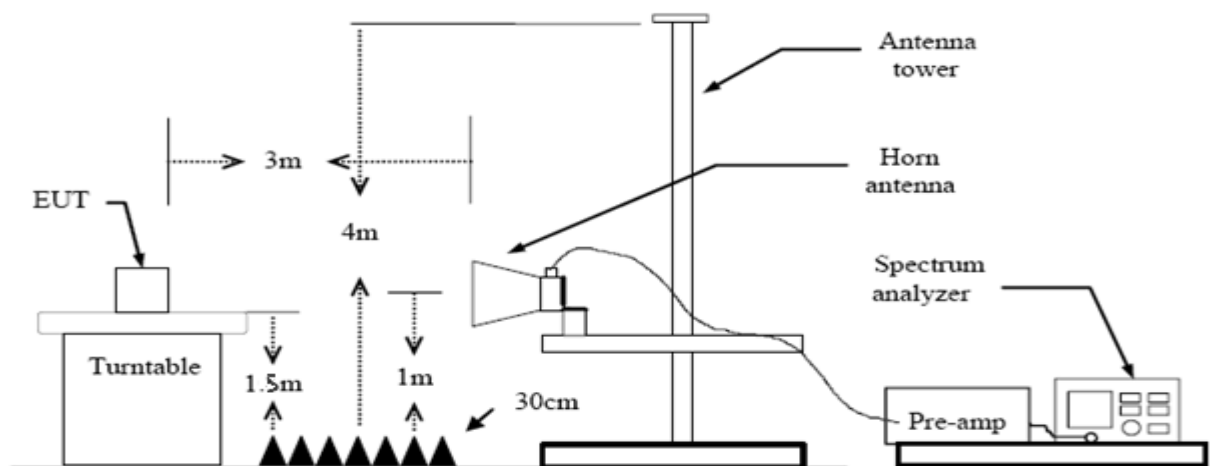
FCC Part 15.247(d)

## FCC Part 15.205

### 7.1.2 Test Limit

| Restricted Frequency Band (MHz) | Distance Meters(at 3m) |                  |
|---------------------------------|------------------------|------------------|
|                                 | Peak (dBuV/m)          | Average (dBuV/m) |
| 2310 ~2390                      | 74                     | 54               |
| 2483.5 ~2500                    | 74                     | 54               |

## 7.2 Test Setup



### 7.3 Test Procedure

- (1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.
- (2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.
- (3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
- (4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked



and then Quasi Peak detector mode re-measured.

- (5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.
- (6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
- (7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.
- (8) For the actual test configuration, please see the test setup photo.

#### 7.4 Deviation From Test Standard

No deviation

#### 7.5 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

#### 7.6 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

Please refer to the Attachment C.



## 8. Bandwidth Test

### 8.1 Test Standard and Limit

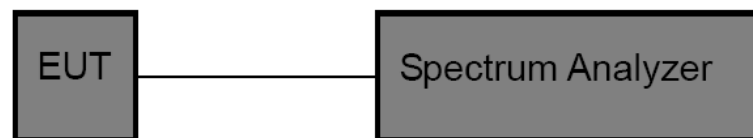
#### 8.1.1 Test Standard

FCC Part 15.247 (a)(2)

#### 8.1.2 Test Limit

| FCC Part 15 Subpart C(15.247)/RSS-247 |                                   |                      |
|---------------------------------------|-----------------------------------|----------------------|
| Test Item                             | Limit                             | Frequency Range(MHz) |
| Bandwidth                             | $\geq 500$ KHz<br>(6dB bandwidth) | 2400~2483.5          |

### 8.2 Test Setup



### 8.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) The bandwidth is measured at an amplitude level reduced 6dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst –case (i.e the widest) bandwidth.
- (3)Measure the channel separation the spectrum analyzer was set to Resolution Bandwidth:100 kHz, and Video Bandwidth:300 kHz, Detector: Peak, Sweep Time set auto.

### 8.4 Deviation From Test Standard

No deviation

### 8.5 EUT Operating Condition

The EUT was set to continuously transmitting in each mode and low, middle and high channel for the test.

### 8.6 Test Data

Please refer to the Attachment D.



## 9. Peak Output Power Test

### 9.1 Test Standard and Limit

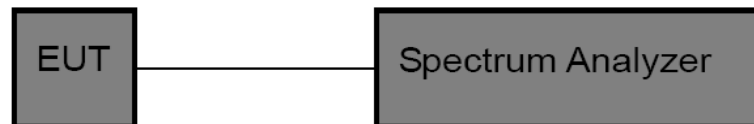
#### 9.1.1 Test Standard

FCC Part 15.247 (b)(3)

#### 9.1.2 Test Limit

| FCC Part 15 Subpart C(15.247) |                  |                      |
|-------------------------------|------------------|----------------------|
| Test Item                     | Limit            | Frequency Range(MHz) |
| Peak Output Power             | 1 Watt or 30 dBm | 2400~2483.5          |

### 9.2 Test Setup



### 9.3 Test Procedure

The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement is according to section 9.1.1 of KDB 558074 D01 Meas Guidance v05r02.

- (1) Set the RBW  $\geq$  DTS Bandwidth
- (2) Set VBW  $\geq$  3\*RBW
- (3) Set Span  $\geq$  3\*RBW
- (4) Sweep time=auto
- (5) Detector= peak
- (6) Trace mode= maxhold.
- (7) Allow trace to fully stabilize, and then use peak marker function to determine the peak amplitude level.

### 9.4 Deviation From Test Standard

No deviation

### 9.5 EUT Operating Condition

The EUT was set to continuously transmitting in the max power during the test.

### 9.6 Test Data

Please refer to the Attachment E.



## 10. Power Spectral Density Test

### 10.1 Test Standard and Limit

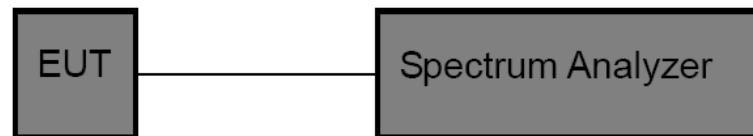
#### 10.1.1 Test Standard

FCC Part 15.247 (e)

#### 10.1.2 Test Limit

| FCC Part 15 Subpart C(15.247) |                    |                      |
|-------------------------------|--------------------|----------------------|
| Test Item                     | Limit              | Frequency Range(MHz) |
| Power Spectral Density        | 8dBm(in any 3 kHz) | 2400~2483.5          |

### 10.2 Test Setup



### 10.3 Test Procedure

The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 Meas Guidance v05r02.

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Set analyser centre frequency to DTS channel centre frequency.
- (3) Set the span to 1.5 times the DTS bandwidth.
- (4) Set the RBW to: 3 kHz
- (5) Set the VBW to: 10 kHz
- (6) Detector: peak
- (7) Sweep time: auto
- (8) Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

### 10.4 Deviation From Test Standard

No deviation

### 10.5 EUT Operating Condition

The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

### 10.6 Test Data

Please refer to the Attachment F.



## 11. Antenna Requirement

### 11.1 Standard Requirement

#### 10.1.1 Standard

FCC Part 15.203

#### 10.1.2 Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

### 11.2 Deviation From Test Standard

No deviation

### 11.3 Antenna Connected Construction

The gains of the antenna used for transmitting is 0.8dBi, and the antenna de-signed with permanent attachment and no consideration of replacement. Please see the EUT photo for details.

### 11.4 Result

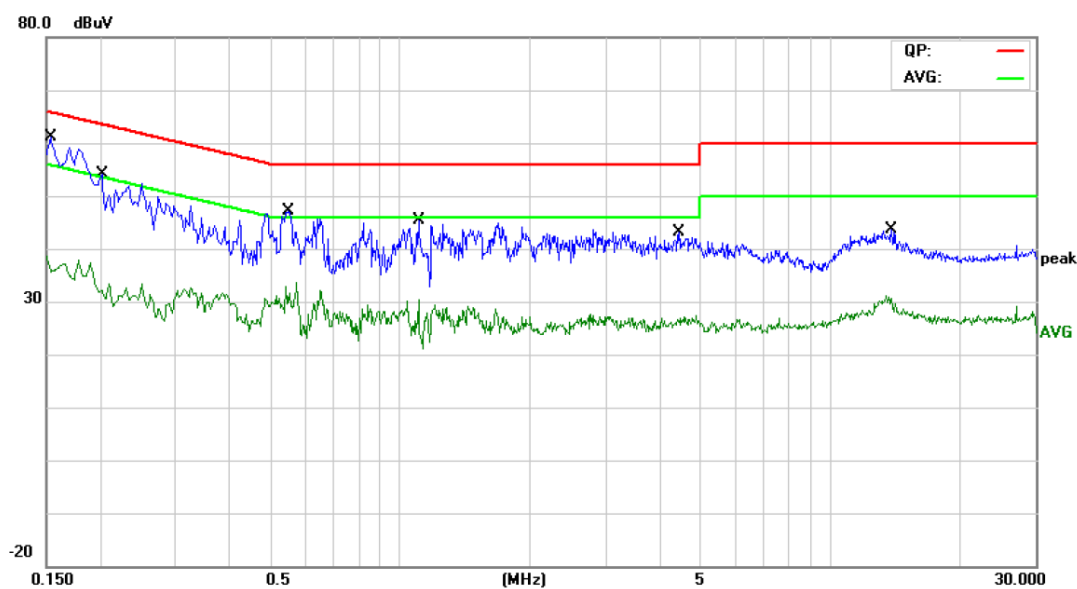
The EUT antenna is a PIFA Antenna. It complies with the standard requirement.

| Antenna Type                                                 |
|--------------------------------------------------------------|
| <input type="checkbox"/> Permanent attached antenna          |
| <input checked="" type="checkbox"/> Unique connector antenna |
| <input type="checkbox"/> Professional installation antenna   |



## Attachment A-- Conducted Emission Test Data

|               |                              |                    |     |
|---------------|------------------------------|--------------------|-----|
| Temperature:  | 23.6°C                       | Relative Humidity: | 43% |
| Test Voltage: | AC 120V 60Hz                 |                    |     |
| Terminal:     | Line                         |                    |     |
| Test Mode:    | Mode 1                       |                    |     |
| Remark:       | Only worse case is reported. |                    |     |



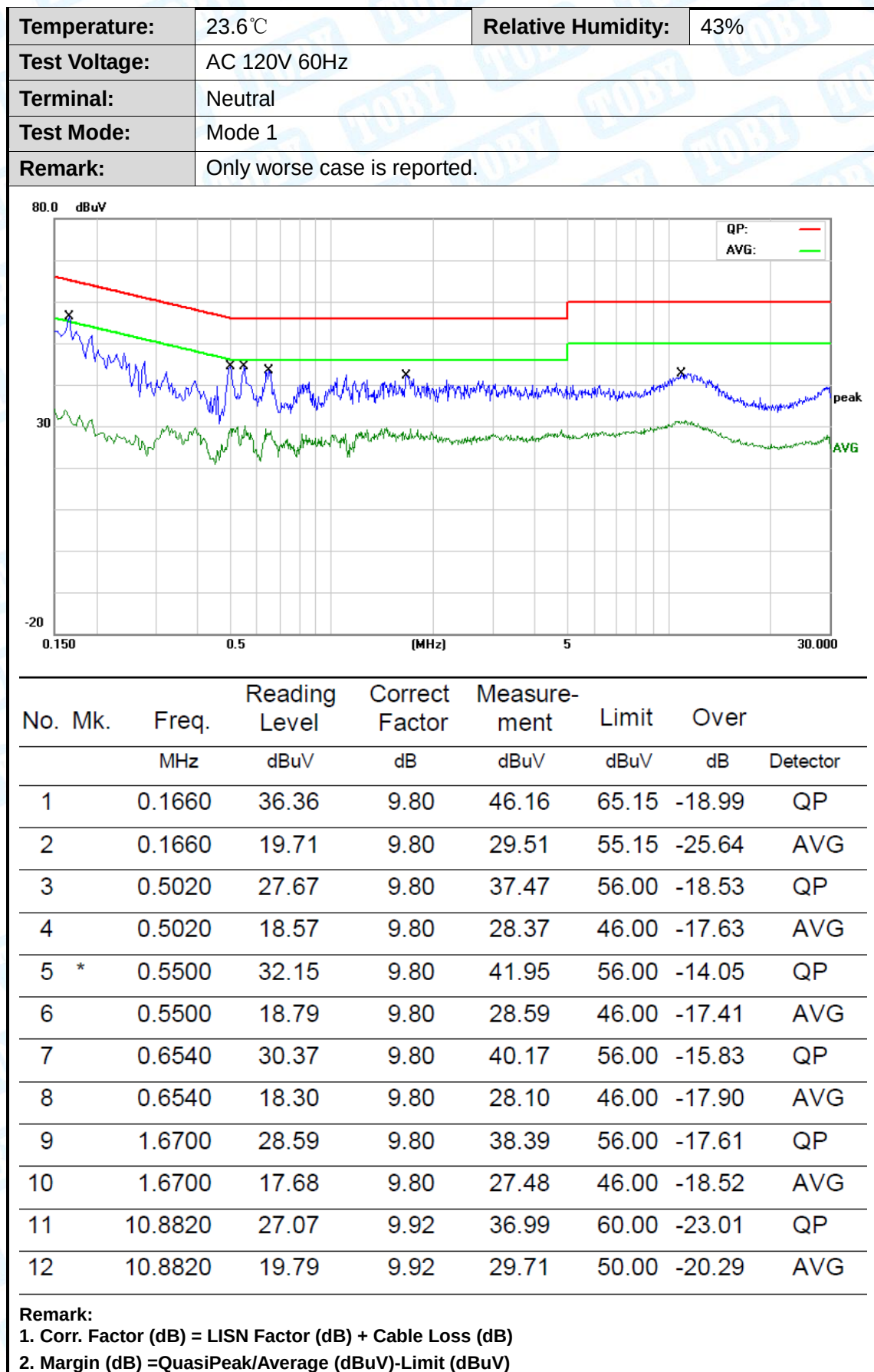
| No. | Mk. | Freq.   | Reading Level | Correct Factor | Measurement | Limit | Over   |          |
|-----|-----|---------|---------------|----------------|-------------|-------|--------|----------|
|     |     | MHz     | dBuV          | dB             | dBuV        | dBuV  | dB     | Detector |
| 1   |     | 0.1539  | 39.95         | 9.70           | 49.65       | 65.78 | -16.13 | QP       |
| 2   |     | 0.1539  | 23.31         | 9.70           | 33.01       | 55.78 | -22.77 | AVG      |
| 3   |     | 0.2020  | 34.59         | 9.70           | 44.29       | 63.52 | -19.23 | QP       |
| 4   |     | 0.2020  | 20.07         | 9.70           | 29.77       | 53.52 | -23.75 | AVG      |
| 5   | *   | 0.5500  | 32.80         | 9.70           | 42.50       | 56.00 | -13.50 | QP       |
| 6   |     | 0.5500  | 19.06         | 9.70           | 28.76       | 46.00 | -17.24 | AVG      |
| 7   |     | 1.1019  | 32.50         | 9.79           | 42.29       | 56.00 | -13.71 | QP       |
| 8   |     | 1.1019  | 17.77         | 9.79           | 27.56       | 46.00 | -18.44 | AVG      |
| 9   |     | 4.4420  | 26.39         | 9.90           | 36.29       | 56.00 | -19.71 | QP       |
| 10  |     | 4.4420  | 16.00         | 9.90           | 25.90       | 46.00 | -20.10 | AVG      |
| 11  |     | 13.8780 | 26.19         | 9.96           | 36.15       | 60.00 | -23.85 | QP       |
| 12  |     | 13.8780 | 16.33         | 9.96           | 26.29       | 50.00 | -23.71 | AVG      |

## Remark:

1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)

2. Margin (dB) = QuasiPeak/Average (dBuV)-Limit (dBuV)







## Attachment B--Unwanted Emissions Data

### ---Radiated Unwanted Emissions

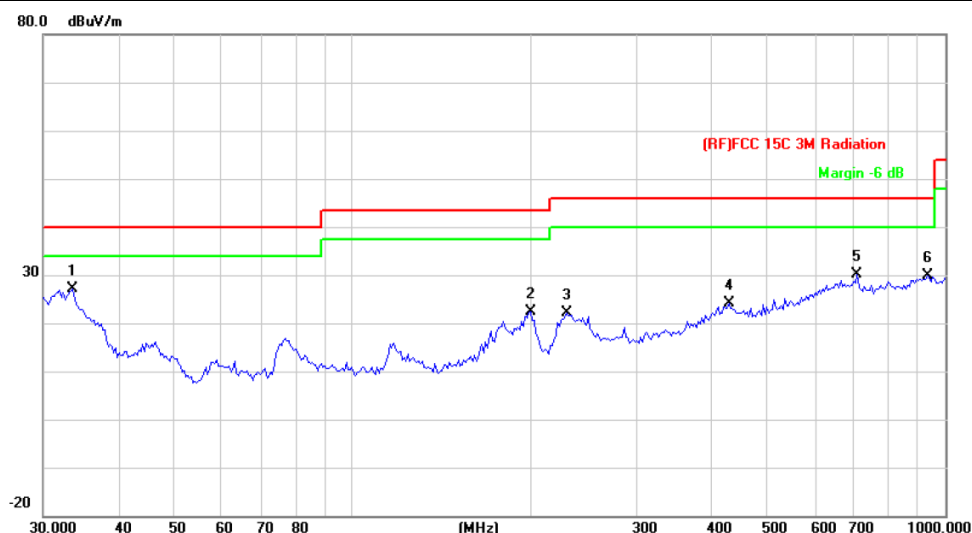
#### 9 KHz~30 MHz

From 9 KHz to 30 MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB  
Below the permissible value has no need to be reported.

#### 30MHz~1GHz

|               |                              |                    |     |
|---------------|------------------------------|--------------------|-----|
| Temperature:  | 23.7℃                        | Relative Humidity: | 46% |
| Test Voltage: | AC 120V 60Hz                 |                    |     |
| Ant. Pol.     | Horizontal                   |                    |     |
| Test Mode:    | Mode 2                       |                    |     |
| Remark:       | Only worse case is reported. |                    |     |



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB/m | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|---------------------------|----------------------------|-----------------|------------|----------|
| 1   | *   | 33.5624      | 42.84                    | -15.60                    | 27.24                      | 40.00           | -12.76     | peak     |
| 2   |     | 199.2855     | 42.40                    | -19.94                    | 22.46                      | 43.50           | -21.04     | peak     |
| 3   |     | 229.2931     | 40.36                    | -18.35                    | 22.01                      | 46.00           | -23.99     | peak     |
| 4   |     | 431.0316     | 36.13                    | -12.07                    | 24.06                      | 46.00           | -21.94     | peak     |
| 5   |     | 709.1823     | 36.84                    | -6.73                     | 30.11                      | 46.00           | -15.89     | peak     |
| 6   |     | 932.2715     | 34.15                    | -4.26                     | 29.89                      | 46.00           | -16.11     | peak     |

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

#### Remark:

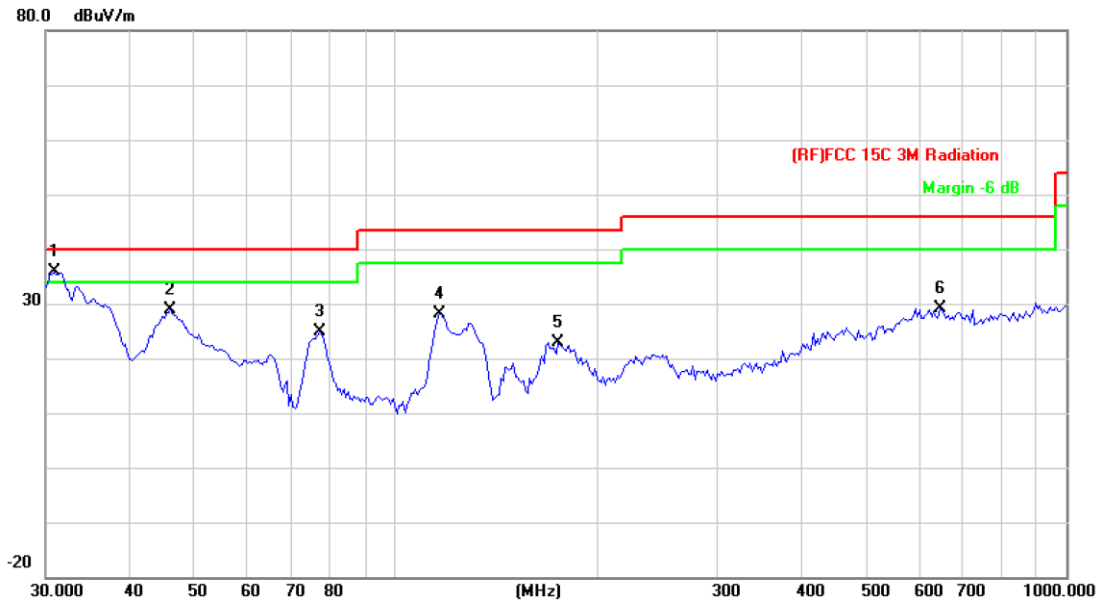
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)

3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)



|               |                              |                    |     |
|---------------|------------------------------|--------------------|-----|
| Temperature:  | 23.7°C                       | Relative Humidity: | 46% |
| Test Voltage: | AC 120V 60Hz                 |                    |     |
| Ant. Pol.     | Vertical                     |                    |     |
| Test Mode:    | Mode 2                       |                    |     |
| Remark:       | Only worse case is reported. |                    |     |



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Over   |          |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|
|     |     | MHz      | dBuV          | dB/m           | dBuV/m      | dBuV/m | dB     | Detector |
| 1   | *   | 30.8535  | 49.55         | -13.58         | 35.97       | 40.00  | -4.03  | peak     |
| 2   |     | 46.0164  | 50.52         | -21.76         | 28.76       | 40.00  | -11.24 | peak     |
| 3   |     | 76.7808  | 47.55         | -22.76         | 24.79       | 40.00  | -15.21 | peak     |
| 4   |     | 116.1321 | 50.38         | -22.22         | 28.16       | 43.50  | -15.34 | peak     |
| 5   |     | 174.4241 | 43.12         | -20.32         | 22.80       | 43.50  | -20.70 | peak     |
| 6   |     | 647.3856 | 37.17         | -7.99          | 29.18       | 46.00  | -16.82 | peak     |

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

**Remark:**

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)

3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)



**Above 1GHz**

|                      |                                                                              |                           |     |
|----------------------|------------------------------------------------------------------------------|---------------------------|-----|
| <b>Temperature:</b>  | 23.9℃                                                                        | <b>Relative Humidity:</b> | 41% |
| <b>Test Voltage:</b> | DC 7.6V                                                                      |                           |     |
| <b>Ant. Pol.</b>     | Horizontal                                                                   |                           |     |
| <b>Test Mode:</b>    | BLE(1Mbps) Mode TX 2402 MHz                                                  |                           |     |
| <b>Remark:</b>       | No report for the emission which more than 10 dB below the prescribed limit. |                           |     |

| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measure-ment | Limit  | Over   |          |
|-----|-----|----------|---------------|----------------|--------------|--------|--------|----------|
|     |     | MHz      | dBuV          | dB/m           | dBuV/m       | dBuV/m | dB     | Detector |
| 1   |     | 4803.696 | 41.03         | 13.01          | 54.04        | 74.00  | -19.96 | peak     |
| 2   | *   | 4804.262 | 27.53         | 13.02          | 40.55        | 54.00  | -13.45 | AVG      |

**Remark:**

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.

|                      |                                                                              |                           |     |
|----------------------|------------------------------------------------------------------------------|---------------------------|-----|
| <b>Temperature:</b>  | 23.9℃                                                                        | <b>Relative Humidity:</b> | 41% |
| <b>Test Voltage:</b> | DC 7.6V                                                                      |                           |     |
| <b>Ant. Pol.</b>     | Vertical                                                                     |                           |     |
| <b>Test Mode:</b>    | BLE(1Mbps) Mode TX 2402 MHz                                                  |                           |     |
| <b>Remark:</b>       | No report for the emission which more than 10 dB below the prescribed limit. |                           |     |

| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measure-ment | Limit  | Over   |          |
|-----|-----|----------|---------------|----------------|--------------|--------|--------|----------|
|     |     | MHz      | dBuV          | dB/m           | dBuV/m       | dBuV/m | dB     | Detector |
| 1   | *   | 4803.634 | 27.40         | 13.01          | 40.41        | 54.00  | -13.59 | AVG      |
| 2   |     | 4804.034 | 41.96         | 13.01          | 54.97        | 74.00  | -19.03 | peak     |

**Remark:**

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.



|               |                             |                    |     |
|---------------|-----------------------------|--------------------|-----|
| Temperature:  | 23.9℃                       | Relative Humidity: | 41% |
| Test Voltage: | DC 7.6V                     |                    |     |
| Ant. Pol.     | Horizontal                  |                    |     |
| Test Mode:    | BLE(1Mbps) Mode TX 2442 MHz |                    |     |

| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Over   |          |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|
|     |     | MHz      | dBuV          | dB/m           | dBuV/m      | dBuV/m | dB     | Detector |
| 1   | *   | 4884.034 | 28.25         | 13.60          | 41.85       | 54.00  | -12.15 | AVG      |
| 2   |     | 4884.390 | 41.66         | 13.61          | 55.27       | 74.00  | -18.73 | peak     |

Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)

3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.

5. No report for the emission which more than 20dB below the prescribed limit.

|               |                             |                    |               |                |             |        |        |          |
|---------------|-----------------------------|--------------------|---------------|----------------|-------------|--------|--------|----------|
| Temperature:  | 23.9℃                       | Relative Humidity: | 41%           |                |             |        |        |          |
| Test Voltage: | DC 7.6V                     |                    |               |                |             |        |        |          |
| Ant. Pol.     | Vertical                    |                    |               |                |             |        |        |          |
| Test Mode:    | BLE(1Mbps) Mode TX 2442 MHz |                    |               |                |             |        |        |          |
|               |                             |                    |               |                |             |        |        |          |
| No.           | Mk.                         | Freq.              | Reading Level | Correct Factor | Measurement | Limit  | Over   |          |
|               |                             | MHz                | dBuV          | dB/m           | dBuV/m      | dBuV/m | dB     | Detector |
| 1             |                             | 4883.638           | 42.00         | 13.59          | 55.59       | 74.00  | -18.41 | peak     |
| 2             | *                           | 4884.290           | 28.41         | 13.61          | 42.02       | 54.00  | -11.98 | AVG      |

Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)

3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.

5. No report for the emission which more than 20dB below the prescribed limit.



|               |                             |                    |     |
|---------------|-----------------------------|--------------------|-----|
| Temperature:  | 23.9℃                       | Relative Humidity: | 41% |
| Test Voltage: | DC 7.6V                     |                    |     |
| Ant. Pol.     | Horizontal                  |                    |     |
| Test Mode:    | BLE(1Mbps) Mode TX 2480 MHz |                    |     |

| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measure-ment | Limit  | Over   |          |
|-----|-----|----------|---------------|----------------|--------------|--------|--------|----------|
|     |     | MHz      | dBuV          | dB/m           | dBuV/m       | dBuV/m | dB     | Detector |
| 1   | *   | 4959.910 | 27.63         | 14.15          | 41.78        | 54.00  | -12.22 | AVG      |
| 2   |     | 4960.412 | 40.83         | 14.16          | 54.99        | 74.00  | -19.01 | peak     |

Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)

3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.

5. No report for the emission which more than 20dB below the prescribed limit.

|               |                             |                    |     |
|---------------|-----------------------------|--------------------|-----|
| Temperature:  | 23.9℃                       | Relative Humidity: | 41% |
| Test Voltage: | DC 7.6V                     |                    |     |
| Ant. Pol.     | Vertical                    |                    |     |
| Test Mode:    | BLE(1Mbps) Mode TX 2480 MHz |                    |     |

| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measure-ment | Limit  | Over   |          |
|-----|-----|----------|---------------|----------------|--------------|--------|--------|----------|
|     |     | MHz      | dBuV          | dB/m           | dBuV/m       | dBuV/m | dB     | Detector |
| 1   | *   | 4960.020 | 27.80         | 14.15          | 41.95        | 54.00  | -12.05 | AVG      |
| 2   |     | 4960.062 | 41.07         | 14.15          | 55.22        | 74.00  | -18.78 | peak     |

Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)

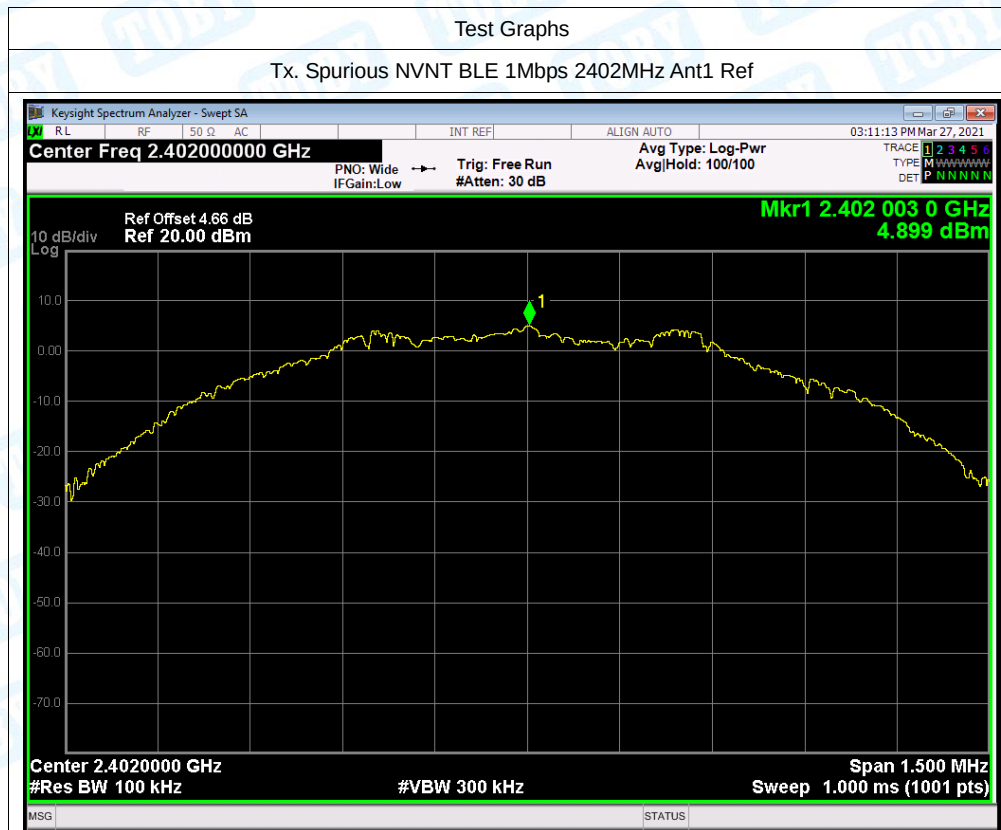
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.

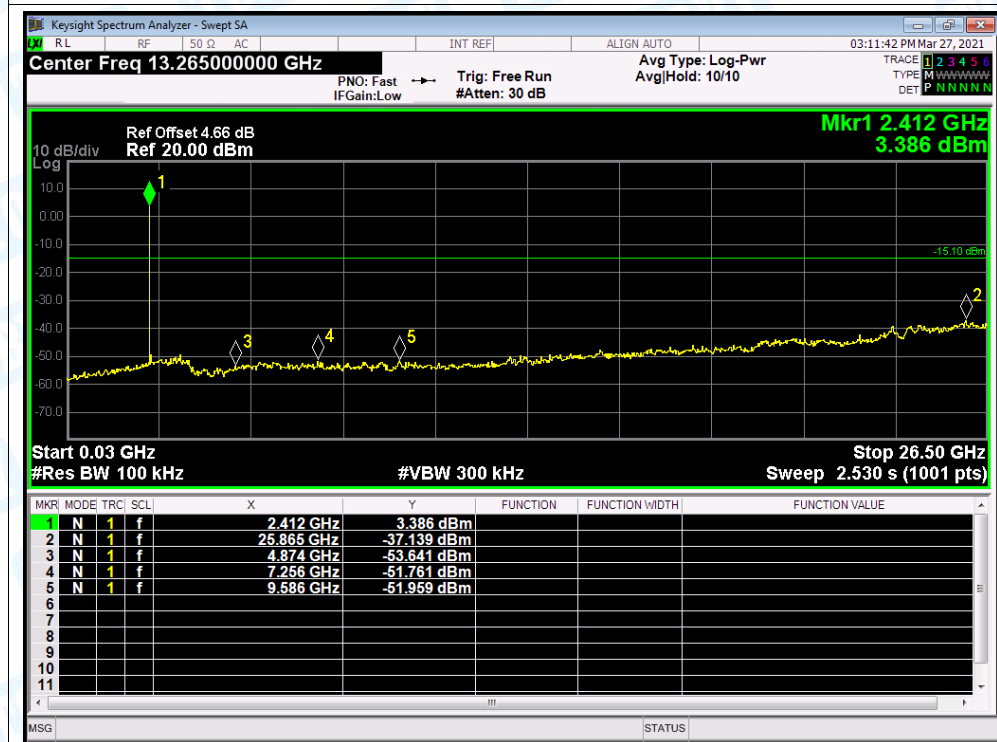
5. No report for the emission which more than 20dB below the prescribed limit.



## ---Conducted Unwanted Emissions

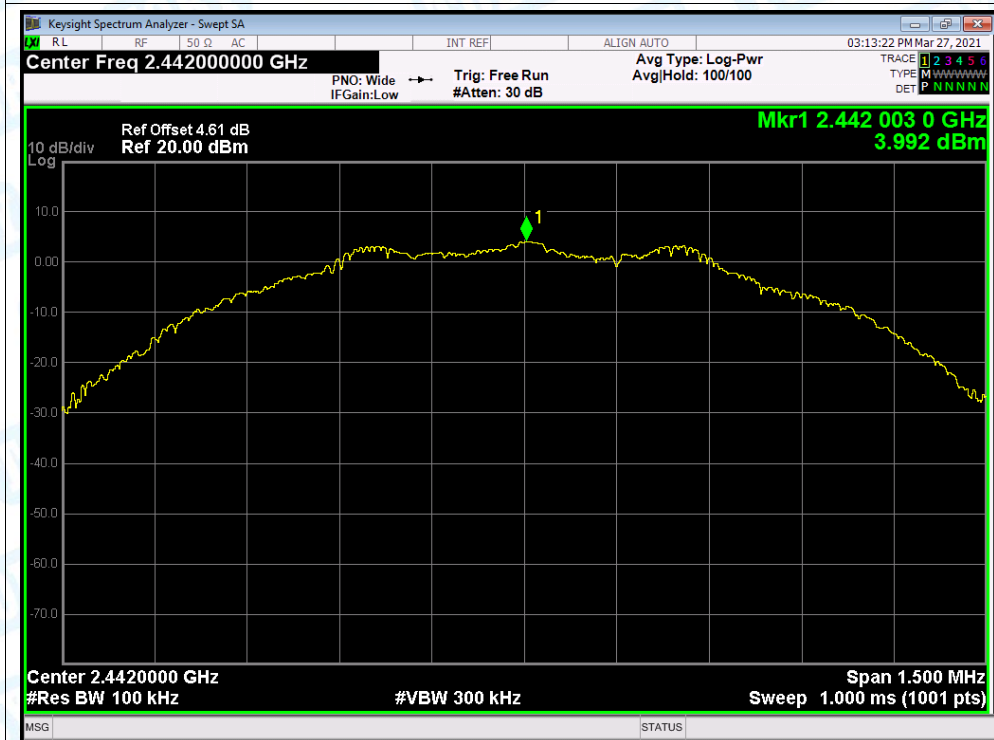


## Tx. Spurious NVNT BLE 1Mbps 2402MHz Ant1 Emission

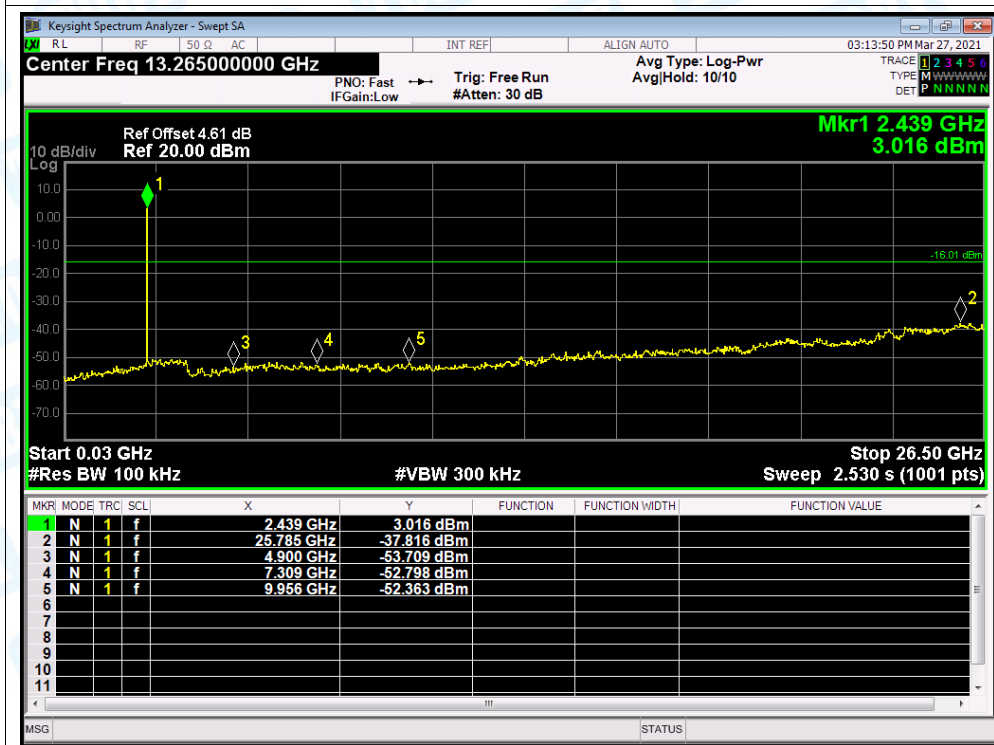




## Tx. Spurious NVNT BLE 1Mbps 2442MHz Ant1 Ref

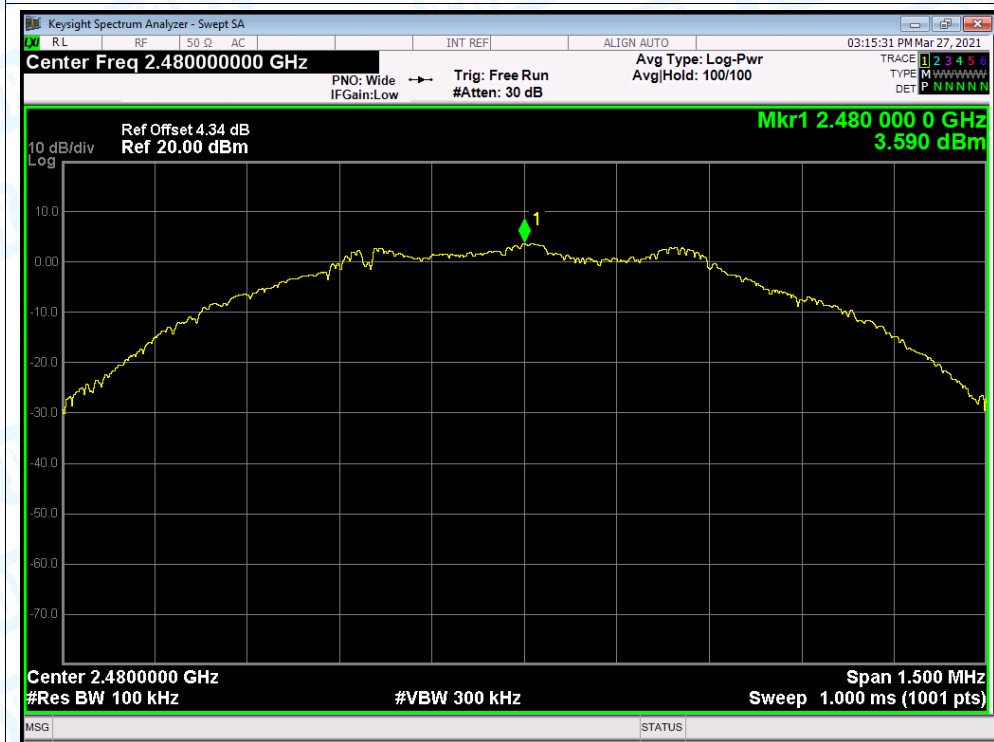


## Tx. Spurious NVNT BLE 1Mbps 2442MHz Ant1 Emission

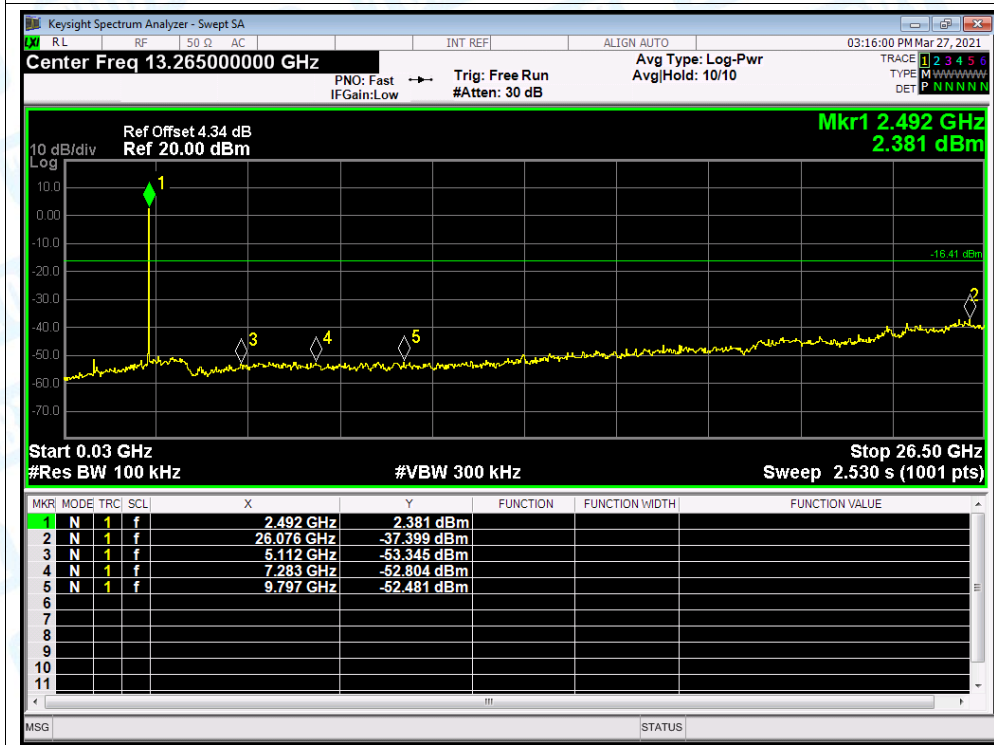




## Tx. Spurious NVNT BLE 1Mbps 2480MHz Ant1 Ref



## Tx. Spurious NVNT BLE 1Mbps 2480MHz Ant1 Emission

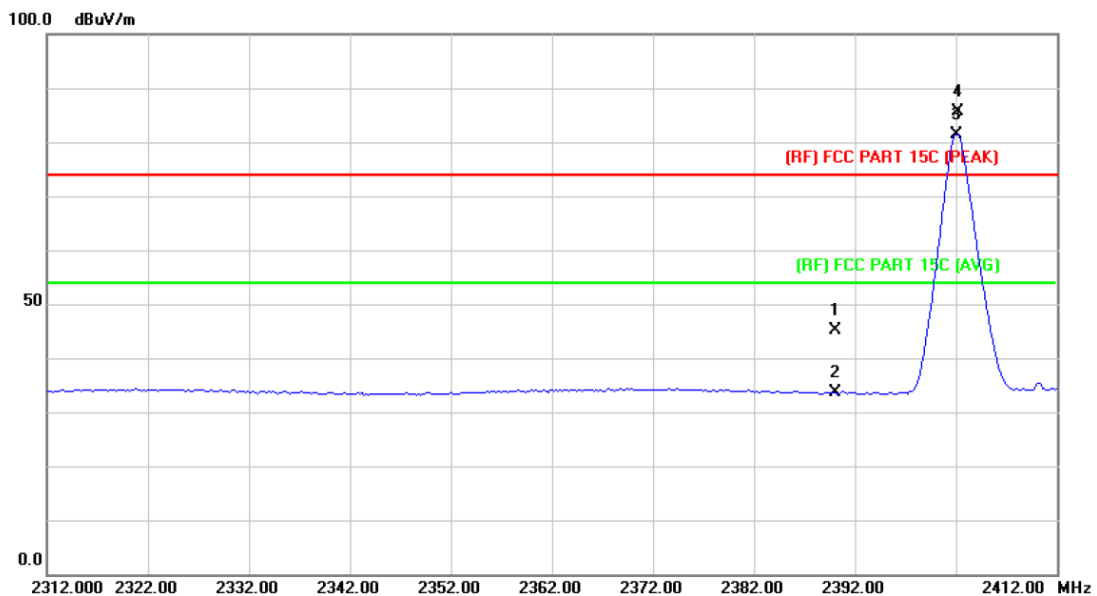




# Attachment C-- Restricted Bands Requirement and Band Edge Test Data

## (1) Radiation Test

|               |                              |                    |     |
|---------------|------------------------------|--------------------|-----|
| Temperature:  | 23.9°C                       | Relative Humidity: | 41% |
| Test Voltage: | DC 7.6V                      |                    |     |
| Ant. Pol.     | Horizontal                   |                    |     |
| Test Mode:    | BLE Mode TX 2402 MHz (1Mbps) |                    |     |
| Remark:       | N/A                          |                    |     |



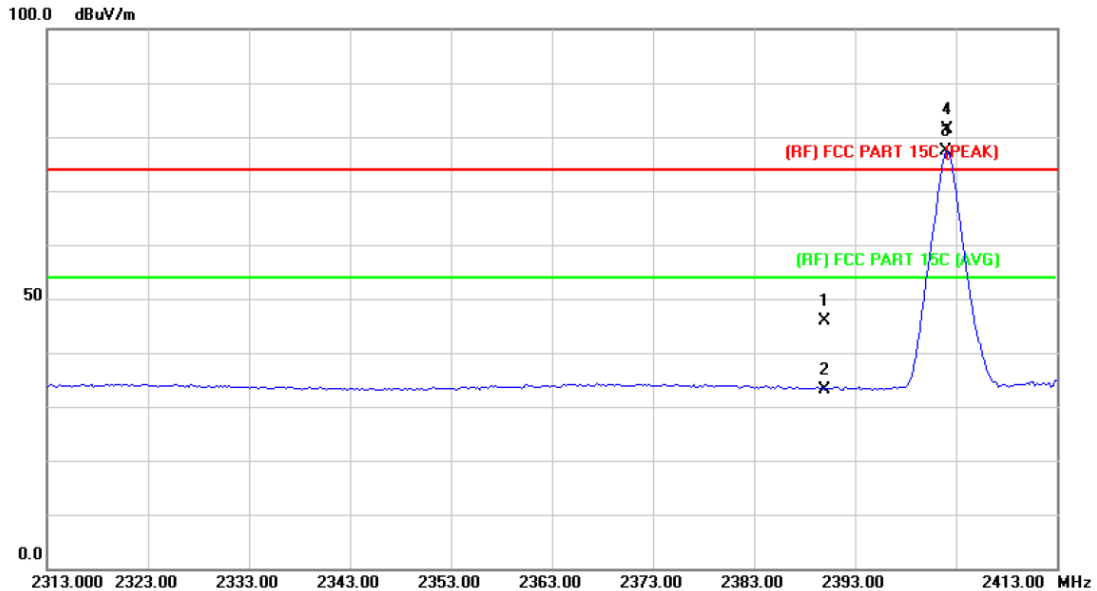
| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB/m | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m       | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|---------------------------|----------------------------|-----------------------|------------|----------|
| 1   |     | 2390.000     | 43.86                    | 1.28                      | 45.14                      | 74.00                 | -28.86     | peak     |
| 2   |     | 2390.000     | 32.37                    | 1.28                      | 33.65                      | 54.00                 | -20.35     | AVG      |
| 3   | *   | 2402.000     | 80.14                    | 1.33                      | 81.47                      | Fundamental Frequency |            | AVG      |
| 4   | X   | 2402.200     | 84.34                    | 1.33                      | 85.67                      | Fundamental Frequency |            | peak     |

### Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBuV/m) = Corr. (dB/m) + Read Level (dBuV)
3. Margin (dB) = Peak/AVG (dBuV/m) - Limit PK/AVG (dBuV/m)



|               |                             |                    |     |
|---------------|-----------------------------|--------------------|-----|
| Temperature:  | 23.9℃                       | Relative Humidity: | 41% |
| Test Voltage: | DC 7.6V                     |                    |     |
| Ant. Pol.     | Vertical                    |                    |     |
| Test Mode:    | BLE Mode TX 2402 MHz(1Mbps) |                    |     |
| Remark:       | N/A                         |                    |     |



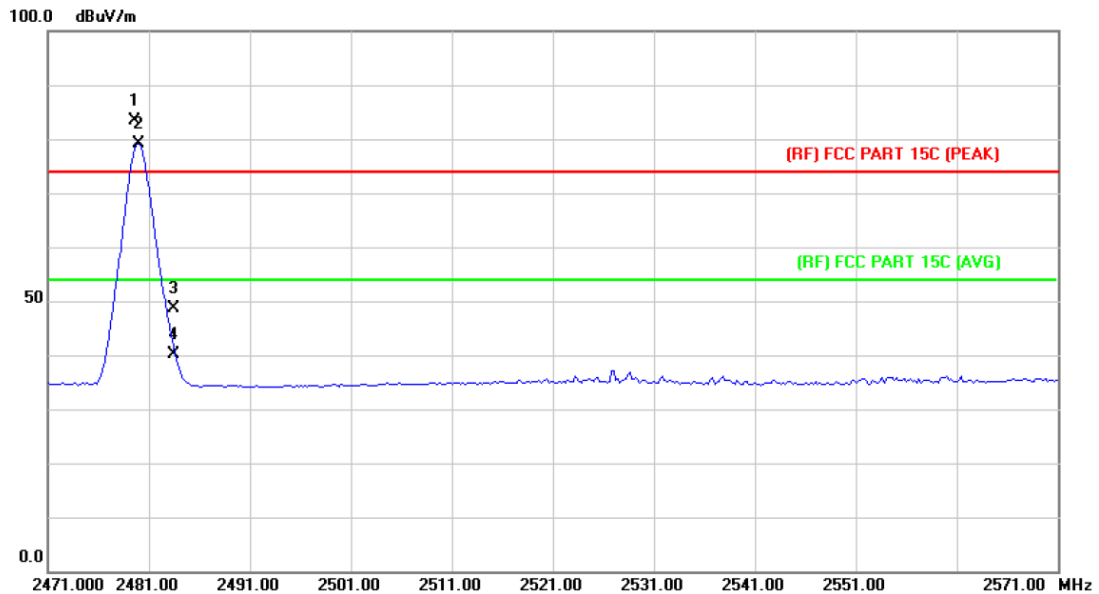
| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB/m | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m       | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|---------------------------|----------------------------|-----------------------|------------|----------|
| 1   |     | 2390.000     | 44.63                    | 1.28                      | 45.91                      | 74.00                 | -28.09     | peak     |
| 2   |     | 2390.000     | 31.94                    | 1.28                      | 33.22                      | 54.00                 | -20.78     | AVG      |
| 3   | *   | 2402.000     | 75.94                    | 1.33                      | 77.27                      | Fundamental Frequency |            | AVG      |
| 4   | X   | 2402.200     | 80.12                    | 1.33                      | 81.45                      | Fundamental Frequency |            | peak     |

**Remark:**

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)



|               |                              |                    |     |
|---------------|------------------------------|--------------------|-----|
| Temperature:  | 23.9℃                        | Relative Humidity: | 41% |
| Test Voltage: | DC 7.6V                      |                    |     |
| Ant. Pol.     | Horizontal                   |                    |     |
| Test Mode:    | BLE Mode TX 2480 MHz (1Mbps) |                    |     |
| Remark:       | N/A                          |                    |     |



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB/m | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m       | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|---------------------------|----------------------------|-----------------------|------------|----------|
| 1   | X   | 2479.600     | 81.42                    | 1.85                      | 83.27                      | Fundamental Frequency |            | peak     |
| 2   | *   | 2480.000     | 77.37                    | 1.85                      | 79.22                      | Fundamental Frequency |            | AVG      |
| 3   |     | 2483.500     | 46.69                    | 1.88                      | 48.57                      | 74.00                 | -25.43     | peak     |
| 4   |     | 2483.500     | 38.23                    | 1.88                      | 40.11                      | 54.00                 | -13.89     | AVG      |

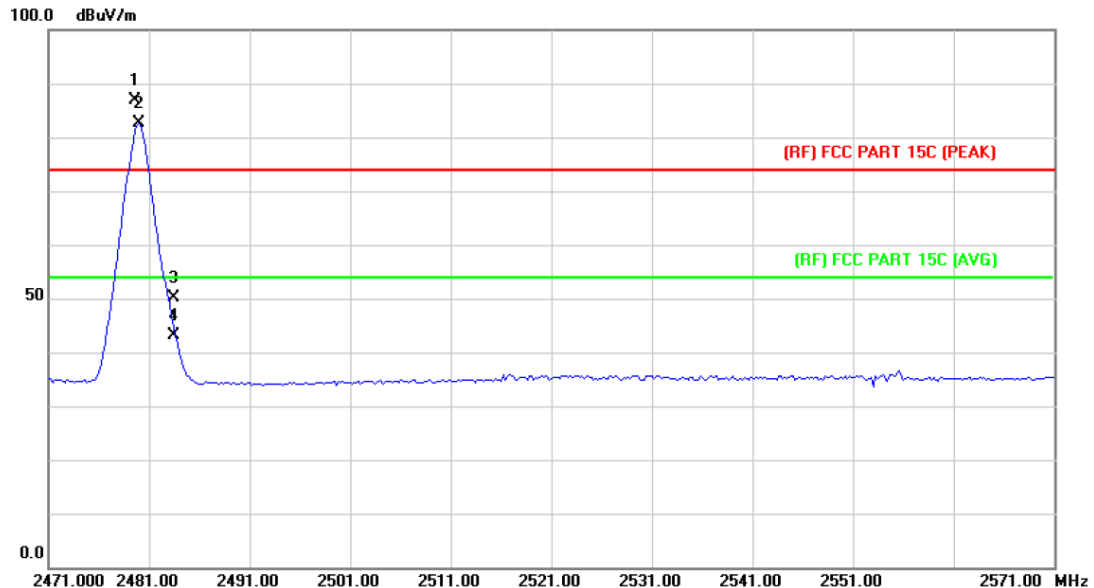
**Remark:**

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)

2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)

3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)

|               |                              |                    |     |
|---------------|------------------------------|--------------------|-----|
| Temperature:  | 23.9°C                       | Relative Humidity: | 41% |
| Test Voltage: | DC 7.6V                      |                    |     |
| Ant. Pol.     | Vertical                     |                    |     |
| Test Mode:    | BLE Mode TX 2480 MHz (1Mbps) |                    |     |
| Remark:       | N/A                          |                    |     |



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB/m | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m       | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|---------------------------|----------------------------|-----------------------|------------|----------|
| 1   | X   | 2479.600     | 85.14                    | 1.85                      | 86.99                      | Fundamental Frequency |            | peak     |
| 2   | *   | 2480.000     | 80.75                    | 1.85                      | 82.60                      | Fundamental Frequency |            | AVG      |
| 3   |     | 2483.500     | 48.25                    | 1.88                      | 50.13                      | 74.00                 | -23.87     | peak     |
| 4   |     | 2483.500     | 41.22                    | 1.88                      | 43.10                      | 54.00                 | -10.90     | AVG      |

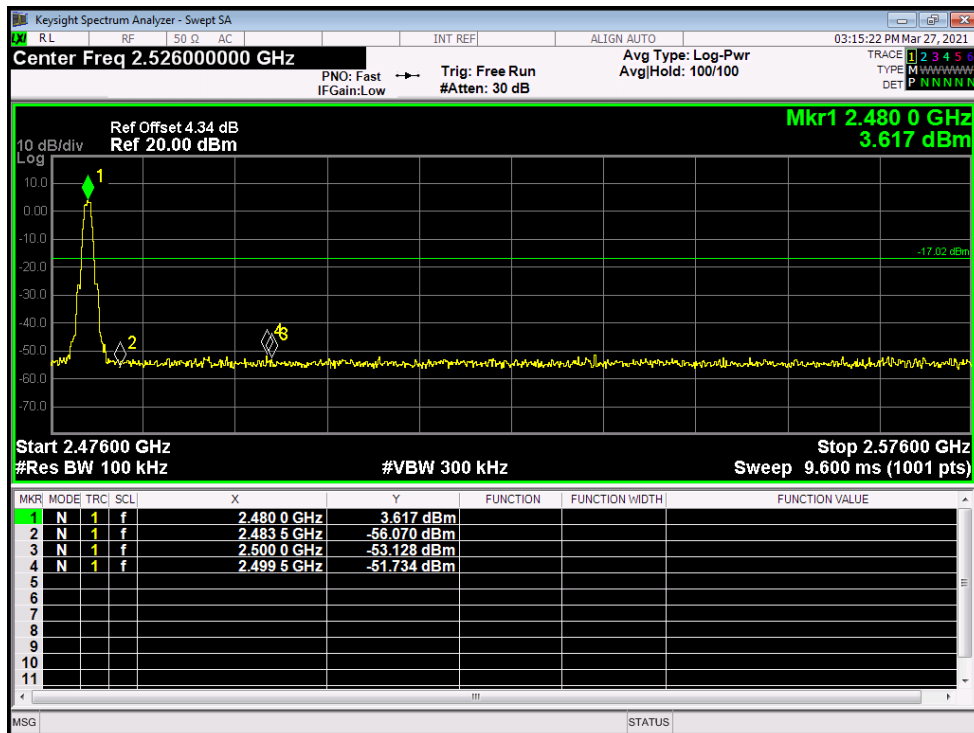
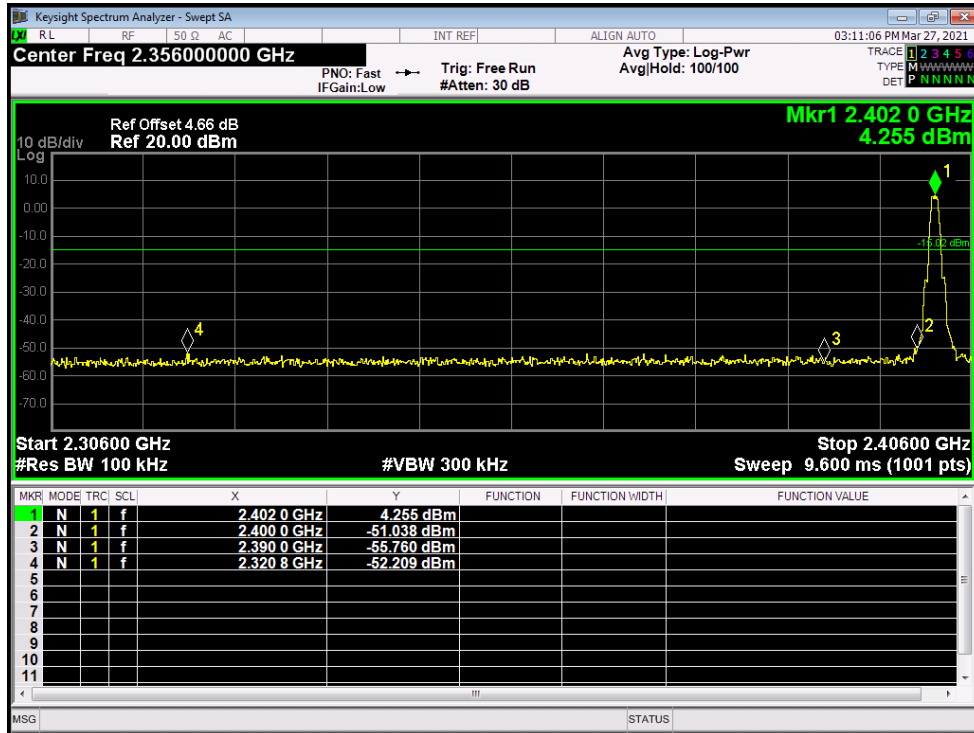
**Remark:**

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m) = Corr. (dB/m) + Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m) - Limit PK/AVG (dBμV/m)



## (2) Conducted Test

|               |                                                         |                    |     |
|---------------|---------------------------------------------------------|--------------------|-----|
| Temperature:  | 25°C                                                    | Relative Humidity: | 55% |
| Test Voltage: | DC 7.6V                                                 |                    |     |
| Test Mode:    | BLE Mode TX 2402MHz / BLE Mode TX 2480MHz(1Mbps)        |                    |     |
| Remark:       | The EUT is programmed in continuously transmitting mode |                    |     |



## Attachment D-- Bandwidth Test Data

|                         |                     |                     |             |
|-------------------------|---------------------|---------------------|-------------|
| Temperature:            | 25℃                 | Relative Humidity:  | 55%         |
| Test Voltage:           | DC 7.6V             |                     |             |
| Test Mode:              | BLE TX Mode(1 Mbps) |                     |             |
| Channel frequency (MHz) | 6dB Bandwidth (kHz) | 99% Bandwidth (kHz) | Limit (kHz) |
| 2402                    | 662.3               | 1086.4              | >=500       |
| 2442                    | 659.6               | 1079.1              |             |
| 2480                    | 660.6               | 1078.9              |             |

BLE Mode

2402 MHz

Keysight Spectrum Analyzer - Occupied BW

RLRF50ΩAC

INT REF

ALIGN AUTO

03:10:14 PM Mar 27, 2021

Center Freq 2.402000000 GHz

Center Freq: 2.402000000 GHz

Trig: Free Run

Avg/Hold: 100/100

Radio Std: None

#IF Gain: Low

#Atten: 30 dB

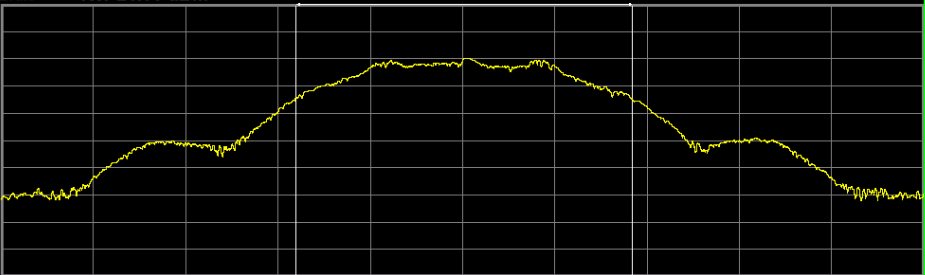
Radio Device: BTS

10 dB/div

Log

Ref Offset 4.66 dB

Ref 24.66 dBm



Center 2.402 GHz

#Res BW 100 kHz

#VBW 300 kHz

Span 3 MHz

Sweep 1.333 ms

Occupied Bandwidth

1.0864 MHz

Total Power

11.0 dBm

Transmit Freq Error

6.965 kHz

% of OBW Power

99.00 %

x dB Bandwidth

662.3 kHz

x dB

-6.00 dB

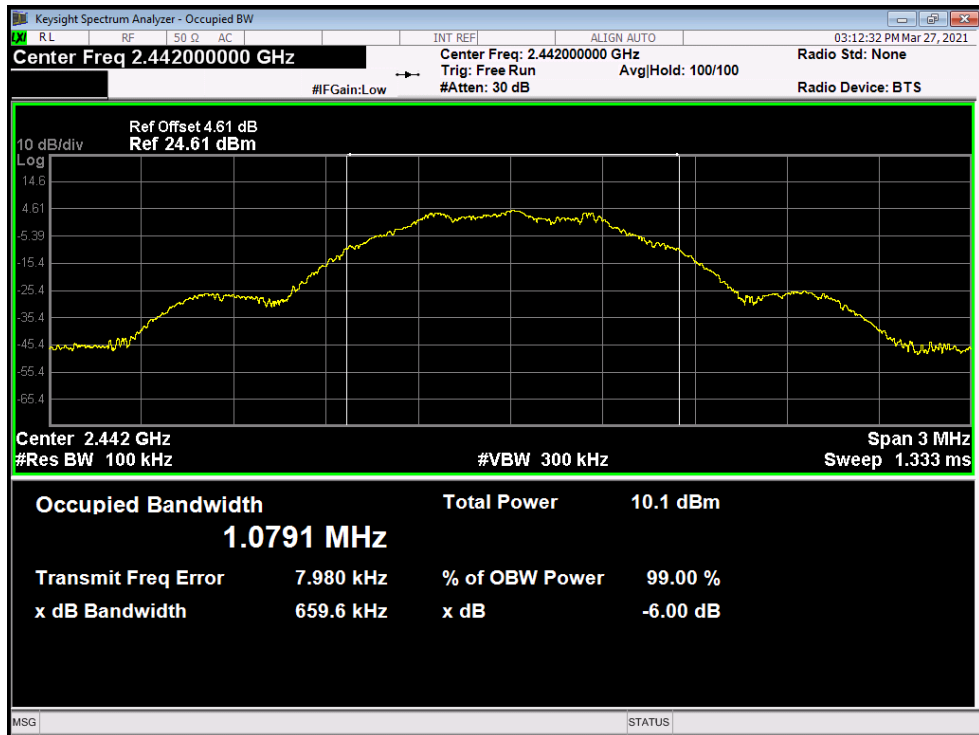
MSG

STATUS



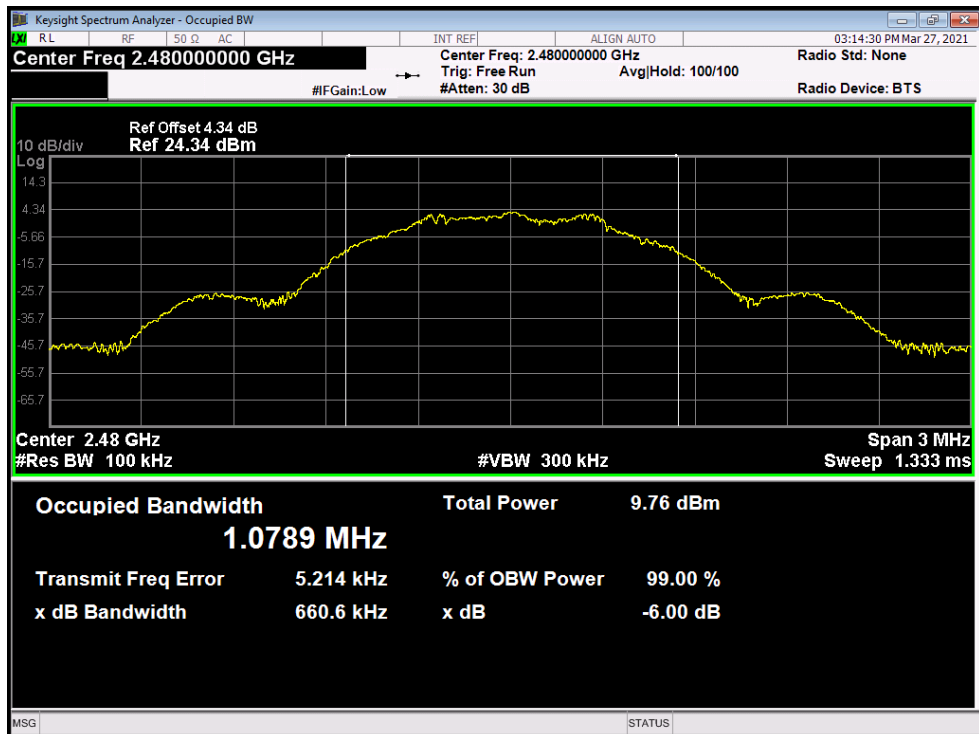
## BLE Mode

2442 MHz



## BLE Mode

2480 MHz

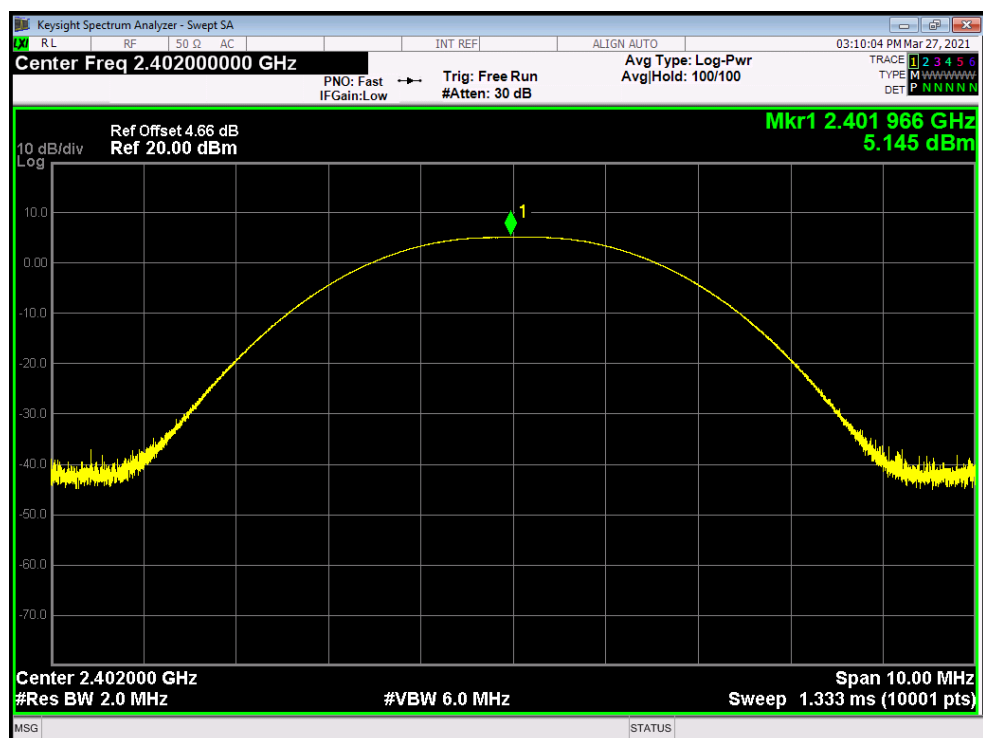


## Attachment E-- Peak Output Power Test Data

|                         |                     |                    |     |
|-------------------------|---------------------|--------------------|-----|
| Temperature:            | 25°C                | Relative Humidity: | 55% |
| Test Voltage:           | DC 7.6V             |                    |     |
| Test Mode:              | BLE TX Mode (1Mbps) |                    |     |
| Channel frequency (MHz) | Test Result (dBm)   | Limit (dBm)        |     |
| 2402                    | 5.145               | 30                 |     |
| 2442                    | 4.212               |                    |     |
| 2480                    | 3.853               |                    |     |

## BLE Mode

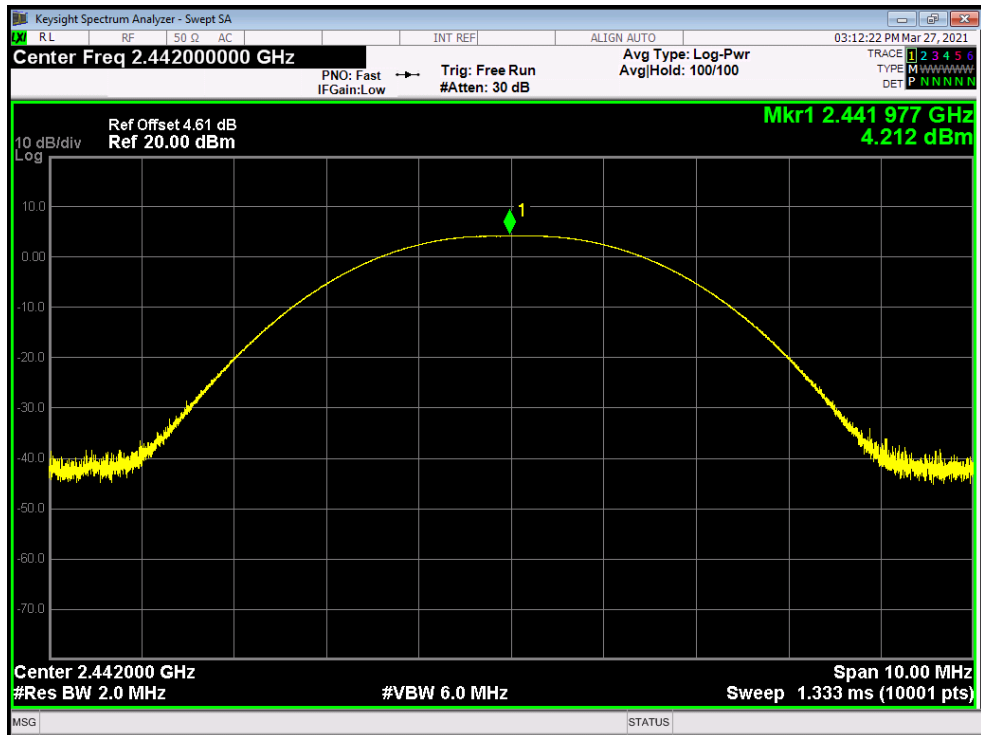
2402 MHz





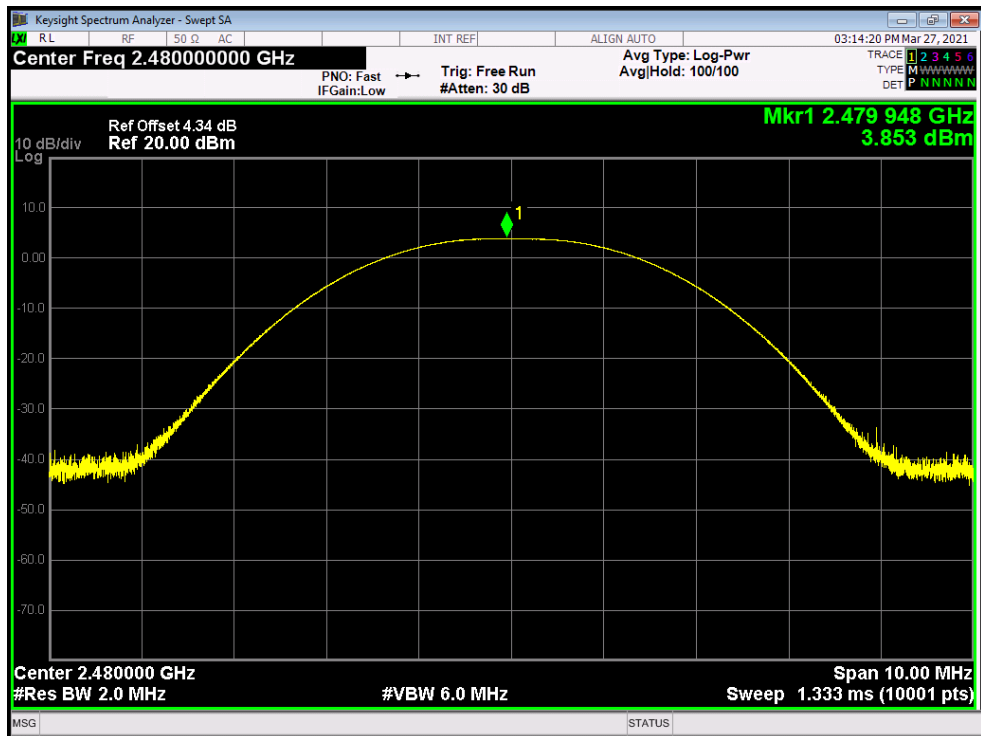
# BLE Mode

2442 MHz



# BLE Mode

2480 MHz



## Attachment F-- Power Spectral Density Test Data

|                         |                          |                    |        |
|-------------------------|--------------------------|--------------------|--------|
| Temperature:            | 25℃                      | Relative Humidity: | 55%    |
| Test Voltage:           | DC 7.6V                  |                    |        |
| Test Mode:              | BLE TX Mode(1Mbps)       |                    |        |
| Channel Frequency (MHz) | Power Density (dBm/3kHz) | Limit (dBm/3kHz)   | Result |
| 2402                    | -10.052                  | 8                  | PASS   |
| 2442                    | -10.976                  |                    |        |
| 2480                    | -11.325                  |                    |        |
| BLE Mode                |                          |                    |        |
| 2402 MHz                |                          |                    |        |

Keysight Spectrum Analyzer - Swept SA

RL

RF

50 Ω

AC

INT REF

ALIGN AUTO

Center Freq 2.402000000 GHz

PNO: Wide

IFGain: Low

Trig: Free Run

#Atten: 30 dB

Avg Type: Log-Pwr

Avg/Hold: 100/100

03:10:55 PM Mar 27, 2021

TRACE 1 2 3 4 5 6

TYPE M W W W W W W W

DET P N N N N N

10 dB/div

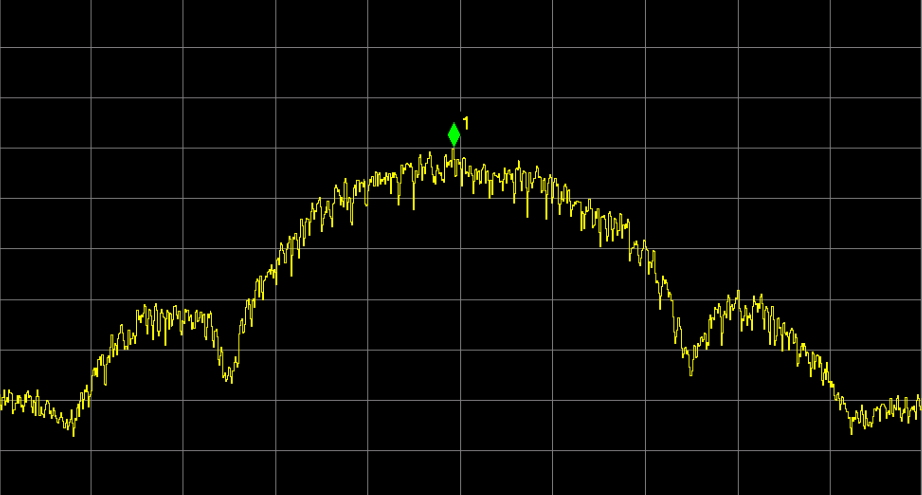
Log

Ref Offset 4.66 dB

Ref 20.00 dBm

Mkr1 2.401 979 GHz

-10.052 dBm



Center 2.402000 GHz

#Res BW 3.0 kHz

#VBW 10 kHz

Span 3.000 MHz

Sweep 316.3 ms (1001 pts)

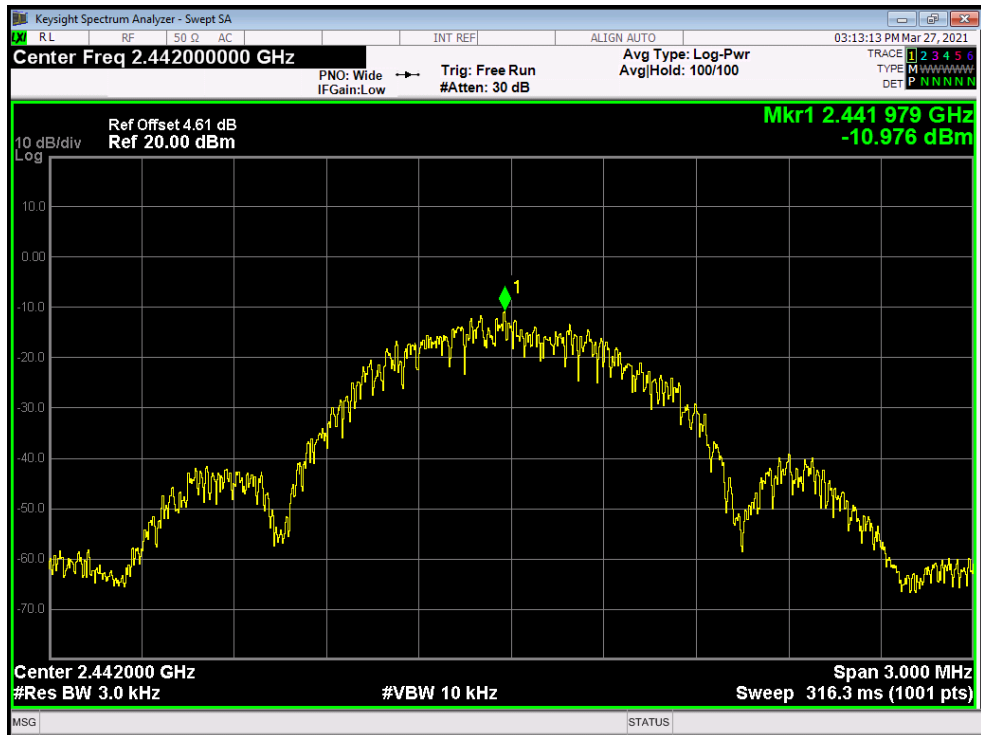
MSG

STATUS



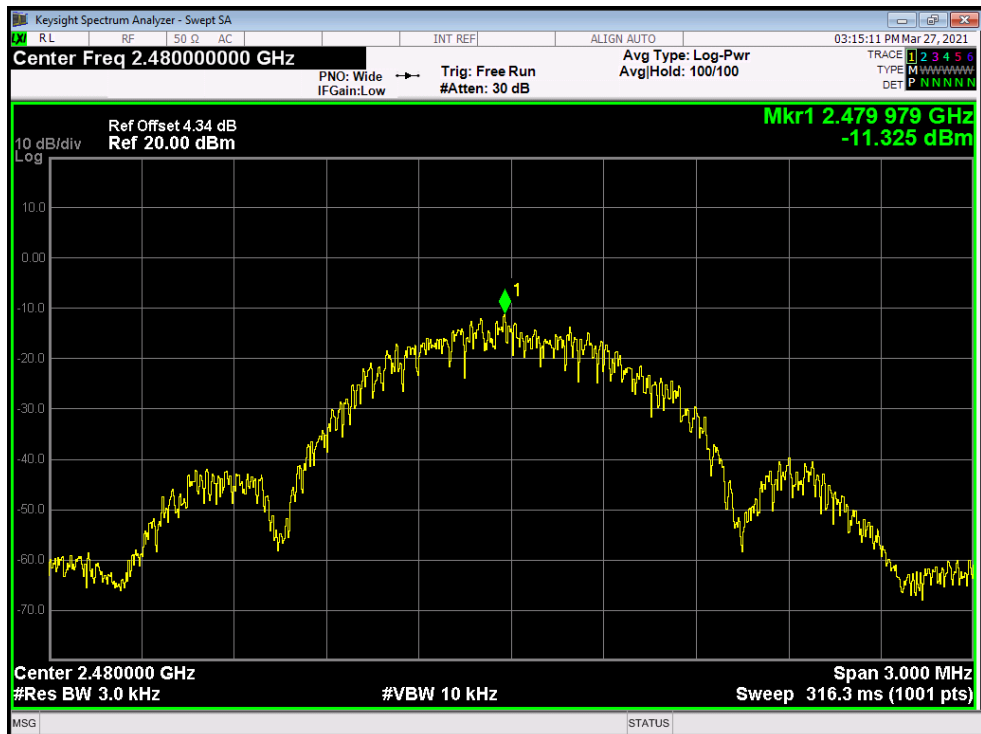
# BLE Mode

2442 MHz



# BLE Mode

2480 MHz



-----END OF REPORT-----