

# TEST REPORT

of

## FCC Part 15 Subpart C

☒ New Application; ☐ Class I PC; ☐ Class II PC

**Product :** Aristotle Hub  
**Brand:** MATTEL  
**Model:** FMT67  
**Model Difference:** N/A  
**FCC ID:** PU5FMT67  
**FCC Rule Part:** §15.247, Cat: DTS  
**Applicant:** Wistron Corporation  
**Address:** 21F., No. 88, Sec. 1, HsinTai 5th Rd., Hsichih Dist, New Taipei City 221

**Test Performed by:**  
**International Standards Laboratory**

<Lung-Tan LAB>

\*Site Registration No.

BSMI: SL2-IN-E-0013; MRA TW1036; TAF: 0997; IC: IC4067B-4;

\*Address:

No. 120, Lane 180, San Ho Tsuen, Hsin Ho Rd.

Lung-Tan Hsiang, Tao Yuan County 325, Taiwan

\*Tel : 886-3-407-1718; Fax: 886-3-407-1738

**Report No.: ISL-16LR332FCDS**

**Issue Date : 2017/01/05**

Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

This report MUST not be used to claim product endorsement by TAF, NVLAP or any agency of the Government.

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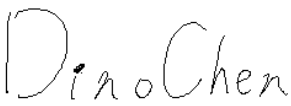
## VERIFICATION OF COMPLIANCE

**Applicant:** Wistron Corporation  
**Product Description:** Aristotle Hub  
**Brand Name:** MATTEL  
**Model No.:** FMT67  
**Model Difference:** N/A  
**FCC ID:** PU5FMT67  
**Date of test:** 2016/12/08 ~ 2017/01/04  
**Date of EUT Received:** 2016/12/08

### We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

|                     |                                                                                                                                       |              |                     |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------|
| <b>Test By:</b>     | <br>_____<br><i>Dino Chen / Engineer</i>           | <b>Date:</b> | 2017/01/05<br>_____ |
| <b>Prepared By:</b> | <br>_____<br><i>Gigi Yeh / Specialist</i>          | <b>Date:</b> | 2017/01/05<br>_____ |
| <b>Approved By:</b> | <br>_____<br><i>Vincent Su / Technical Manager</i> | <b>Date:</b> | 2017/01/05<br>_____ |

## Version

| Version No. | Date       | Description                  |
|-------------|------------|------------------------------|
| 00          | 2017/01/05 | Initial creation of document |
|             |            |                              |
|             |            |                              |

## Uncertainty of Measurement

| Description Of Test                   | Uncertainty                                              |
|---------------------------------------|----------------------------------------------------------|
| Conducted Emission<br>(AC power line) | 2.586 dB                                                 |
| Field Strength of Spurious Radiation  | <=30MHz: 2.96dB<br>30-1GHz: 4.22 dB<br>1-40 GHz: 4.08 dB |
| Conducted Power                       | 2.412 GHz: 1.30 dB<br>5.805 GHz: 1.55 dB                 |
| Power Density                         | 2.412 GHz: 1.30 dB<br>5.805 GHz: 1.67 dB                 |
| Frequency                             | 0.0032%                                                  |
| Time                                  | 0.01%                                                    |
| DC Voltage                            | 1%                                                       |

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## 1 GENERAL INFORMATION

General:

|                  |                       |                       |
|------------------|-----------------------|-----------------------|
| Product Name     | Aristotle Hub         |                       |
| Brand Name       | MATTEL                |                       |
| Model Name       | FMT67                 |                       |
| Model Difference | N/A                   |                       |
| HDMI Port:       | One                   |                       |
| Micro sd card    | One                   |                       |
| Power Supply     | 12Vdc from AC adapter |                       |
|                  | Adapter:              | Model No.: WA-30J12FU |

WLAN: 1TX/1RX

| Wi-Fi               | Frequency Range (MHz) | Channels                                                               | Peak / Average Power | Modulation Technology |
|---------------------|-----------------------|------------------------------------------------------------------------|----------------------|-----------------------|
| 802.11b             | 2412 – 2462           | 11                                                                     | 18.00dBm (PK)        | DSSS                  |
| 802.11g             | 2412 – 2462           | 11                                                                     | 21.00dBm (PK)        | OFDM                  |
| 802.11n             | HT20<br>2412 – 2462   | 11                                                                     | 20.00dBm (PK)        |                       |
| Modulation type     |                       | CCK, DQPSK, DBPSK for DSSS<br>256QAM.64QAM. 16QAM, QPSK, BPSK for OFDM |                      |                       |
| Antenna Designation |                       | Chip Antenna 4.9 dBi                                                   |                      |                       |
| Tune up power       |                       | +/- 1 dB                                                               |                      |                       |

Bluetooth: 1TX/1RX

|                    |               |                 |
|--------------------|---------------|-----------------|
| Frequency Range:   | 2402– 2480MHz |                 |
| Bluetooth Version: | BT2.1+BT3.0   | BT BLE 4.0+ 4.1 |
| Channel number:    | 79 channels   | 40 channels     |
| Modulation type    | GFSK +        |                 |

### **1.1 Related Submittal(s) / Grant (s)**

This submittal(s) (test report) is intended for **FCC ID: PU5FMT67** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

### **1.2 Test Methodology**

Both conducted and radiated testing were performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at an antenna to EUT distance 3 meters.

KDB Document: 558074 D01 DTS Meas Guidance v03r05

### **1.3 Test Facility**

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory** <Lung-Tan LAB> No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2014. FCC Registration Number is: 872200; Designation Number is: TW1036, Canada Registration Number: 4067B-4.

### **1.4 Special Accessories**

Not available for this EUT intended for grant.

### **1.5 Equipment Modifications**

Not available for this EUT intended for grant.

## **2 SYSTEM TEST CONFIGURATION**

### **2.1 EUT Configuration**

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### **2.2 EUT Exercise**

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

### **2.3 Test Procedure**

#### **2.3.1 Conducted Emissions**

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 6 of ANSI C63.10: 2013. Con-ducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR 16-1-1 Quasi-Peak and Average detector mode.

#### **2.3.2 Radiated Emissions**

The EUT is a placed on as turn table which is 0.8 m/1.5m(Frequency above 1GHz) above ground plane. The turn table shall rotate 360 degrees to determine the position of maxi-mum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 6 and 11 of ANSI C63.10: 2013.

## 2.4 Configuration of Tested System

Fig. 2-1 AC Power line and Radiated Emission Configuration



Table 2-1 Equipment Used in Tested System

| Item | Equipment | Mfr/Brand | Model/<br>Type No. | Series No. | Data Cable | Power Cord    |
|------|-----------|-----------|--------------------|------------|------------|---------------|
| 1    | NB        | HP        | 440i               | N/A        | N/A        | No- Shielding |

### 3 SUMMARY OF TEST RESULTS

| FCC Rules | Description Of Test | Result |
|-----------|---------------------|--------|
|-----------|---------------------|--------|

## 5 CONDUCTED EMISSION TEST

### 5.1 Standard Applicable:

According to §15.207, frequency range within 150KHz to 30MHz shall not exceed the Limit table as below.

| Frequency range<br>MHz                                                                                | Limits<br>dB(uV) |          |
|-------------------------------------------------------------------------------------------------------|------------------|----------|
|                                                                                                       | Quasi-peak       | Average  |
| 0.15 to 0.50                                                                                          | 66 to 56         | 56 to 46 |
| 0.50 to 5                                                                                             | 56               | 46       |
| 5 to 30                                                                                               | 60               | 50       |
| Note                                                                                                  |                  |          |
| 1.The lower limit shall apply at the transition frequencies                                           |                  |          |
| 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. |                  |          |

### 5.2 Measurement Equipment Used:

| AC Power Line Test Site  |                    |                       |                     |              |            |
|--------------------------|--------------------|-----------------------|---------------------|--------------|------------|
| EQUIPMENT<br>TYPE        | MFR                | MODEL<br>NUMBER       | SERIAL<br>NUMBER    | LAST<br>CAL. | CAL DUE.   |
| Conduction 04-3<br>Cable | WOKEN              | CFD 300-NL            | Conduction 04<br>-3 | 07/27/2016   | 07/26/2017 |
| EMI Receiver 17          | Rohde &<br>Schwarz | ESCI 7                | 100887              | 09/08/2016   | 09/07/2017 |
| LISN 18                  | ROHDE &<br>SCHWARZ | ENV216                | 101424              | 02/11/2016   | 02/10/2017 |
| LISN 19                  | ROHDE &<br>SCHWARZ | ENV216                | 101425              | 03/12/2016   | 03/11/2017 |
| Test Software            | Farad              | EZEMC<br>Ver:ISL-03A2 | N/A                 | N/A          | N/A        |

### 5.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4: 2014..
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

#### **5.4 Measurement Procedure:**

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

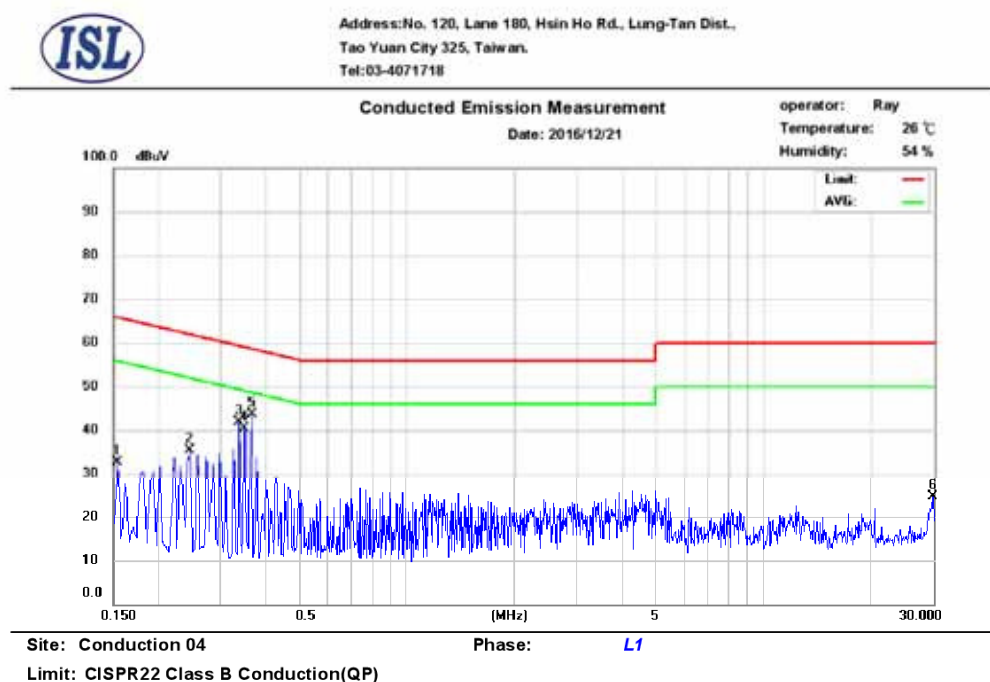
#### **5.5 Measurement Result:**

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Note: Refer to next page for measurement data and plots.

## AC POWER LINE CONDUCTED EMISSION TEST DATA

|                 |                |            |            |
|-----------------|----------------|------------|------------|
| Operation Mode: | Operation Mode | Test Date: | 2016/12/21 |
|-----------------|----------------|------------|------------|



| No. | Frequency<br>(MHz) | QP_R<br>(dBuV) | AVG_R<br>(dBuV) | Correct<br>Factor<br>(dB) | QP<br>Emission<br>(dBuV) | QP<br>Limit<br>(dBuV) | QP<br>Margin<br>(dB) | AVG<br>Emission<br>(dBuV) | AVG<br>Limit<br>(dBuV) | AVG<br>Margin<br>(dB) |
|-----|--------------------|----------------|-----------------|---------------------------|--------------------------|-----------------------|----------------------|---------------------------|------------------------|-----------------------|
| 1   | 0.154              | 24.23          | 2.03            | 9.69                      | 33.92                    | 65.78                 | -31.86               | 11.72                     | 55.78                  | -44.06                |
| 2   | 0.246              | 21.51          | 0.87            | 9.69                      | 31.20                    | 61.89                 | -30.69               | 10.56                     | 51.89                  | -41.33                |
| 3   | 0.338              | 26.91          | 3.86            | 9.69                      | 36.60                    | 59.25                 | -22.65               | 13.55                     | 49.25                  | -35.70                |
| 4   | 0.350              | 29.28          | 5.06            | 9.69                      | 38.97                    | 58.96                 | -19.99               | 14.75                     | 48.96                  | -34.21                |
| 5   | 0.366              | 28.07          | 4.53            | 9.69                      | 37.76                    | 58.59                 | -20.83               | 14.22                     | 48.59                  | -34.37                |
| 6   | 29.878             | 7.63           | 0.12            | 10.14                     | 17.77                    | 60.00                 | -42.23               | 10.26                     | 50.00                  | -39.74                |

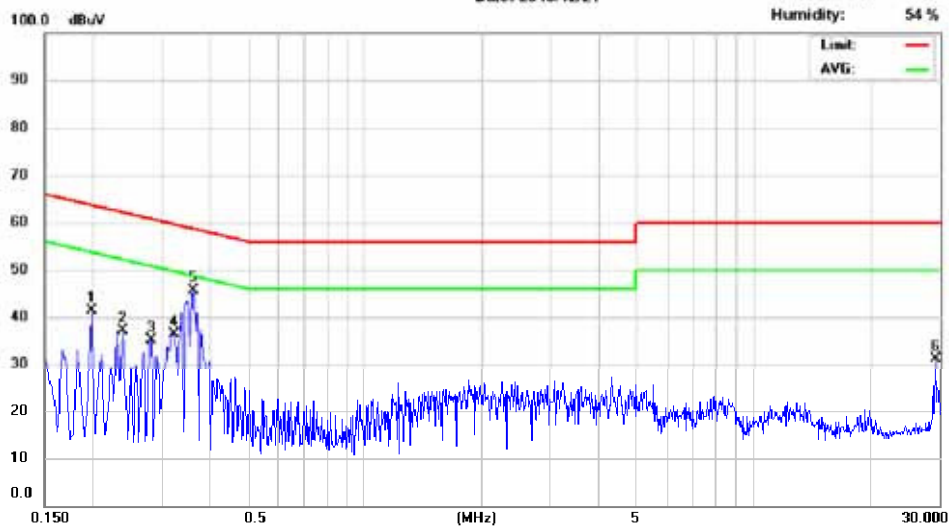


Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,  
Tao Yuan City 325, Taiwan.  
Tel: 03-4071718

### Conducted Emission Measurement

Date: 2016/12/21

operator: Ray  
Temperature: 26 °C  
Humidity: 54 %



Site: Conduction 04

Phase: N

Limit: CISPR22 Class B Conduction(QP)

| No. | Frequency<br>(MHz) | QP_R<br>(dBuV) | AVG_R<br>(dBuV) | Correct<br>Factor<br>(dB) | QP<br>Emission<br>(dBuV) | QP<br>Limit<br>(dBuV) | QP<br>Margin<br>(dB) | AVG<br>Emission<br>(dBuV) | AVG<br>Limit<br>(dBuV) | AVG<br>Margin<br>(dB) |
|-----|--------------------|----------------|-----------------|---------------------------|--------------------------|-----------------------|----------------------|---------------------------|------------------------|-----------------------|
| 1   | 0.198              | 21.58          | 1.02            | 9.68                      | 31.26                    | 63.69                 | -32.43               | 10.70                     | 53.69                  | -42.99                |
| 2   | 0.238              | 22.65          | 1.38            | 9.68                      | 32.33                    | 62.17                 | -29.84               | 11.06                     | 52.17                  | -41.11                |
| 3   | 0.282              | 19.66          | 0.23            | 9.69                      | 29.35                    | 60.76                 | -31.41               | 9.92                      | 50.76                  | -40.84                |
| 4   | 0.322              | 21.93          | 1.77            | 9.68                      | 31.61                    | 59.66                 | -28.05               | 11.45                     | 49.66                  | -38.21                |
| 5   | 0.362              | 31.52          | 7.12            | 9.68                      | 41.20                    | 58.68                 | -17.48               | 16.80                     | 48.68                  | -31.88                |
| 6   | 29.294             | 9.95           | -0.51           | 10.30                     | 20.25                    | 60.00                 | -39.75               | 9.79                      | 50.00                  | -40.21                |

## **6 PEAK OUTPUT POWER/ERIP MEASUREMENT**

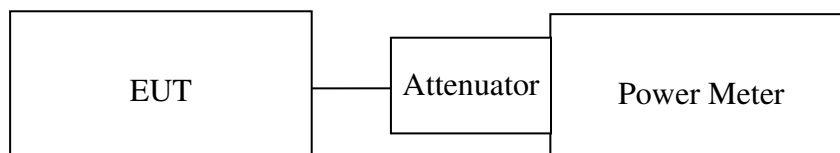
### **6.1 Standard Applicable:**

According to

## 6.2 Measurement Equipment Used:

| Conducted Emission Test Site |          |                             |                   |            |            |
|------------------------------|----------|-----------------------------|-------------------|------------|------------|
| EQUIPMENT TYPE               | MFR      | MODEL NUMBER                | SERIAL NUMBER     | LAST CAL.  | CAL DUE.   |
| Power Meter 05               | Anritsu  | ML2495A                     | 1116010           | 07/28/2016 | 07/27/2017 |
| Power Sensor 05              | Anritsu  | MA2411B                     | 34NKF50           | 07/28/2016 | 07/27/2017 |
| Power Sensor 06              | DARE     | RPR3006W                    | 13I00030SNO3<br>3 | 11/03/2016 | 11/02/2017 |
| Power Sensor 07              | DARE     | RPR3006W                    | 13I00030SNO3<br>4 | 11/03/2016 | 11/02/2017 |
| Temperature Chamber          | KSON     | THS-B4H100                  | 2287              | 06/28/2016 | 06/27/2017 |
| DC Power supply              | ABM      | 8185D                       | N/A               | 10/06/2016 | 10/05/2017 |
| AC Power supply              | EXTECH   | CFC105W                     | NA                | 12/25/2016 | 12/24/2017 |
| Attenuator                   | Woken    | Watt-65m3502                | 11051601          | NA         | NA         |
| Splitter                     | MCLI     | PS4-199                     | 12465             | 12/26/2015 | 12/25/2017 |
| Spectrum analyzer            | keysight | N9010A                      | MY56070257        | 05/31/2016 | 05/30/2017 |
| Spectrum analyzer            | R&S      | FSP40                       | 100143            | 08/07/2016 | 08/06/2017 |
| Test Software                | DARE     | Radimation<br>Ver:2013.1.23 | NA                | NA         | NA         |

## 6.3 Test Set-up:



## 6.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

## 6.5 Measurement Result:

WIFI 1TX

|                |              |                |
|----------------|--------------|----------------|
| 802.11b        |              |                |
| Cable loss = 0 | Output Power | Limit<br>(dBm) |
| CH             | Detector     |                |
|                | PK           | AV             |

**BLE Mode**

| <b>Frequency<br/>(MHz)</b> | <b>Peak Reading<br/>Power<br/>(dBm)</b> | <b>Cable Loss</b> | <b>Output Power<br/>(dBm)</b> | <b>Output Power<br/>(W)</b> | <b>Limit<br/>(W)</b> |
|----------------------------|-----------------------------------------|-------------------|-------------------------------|-----------------------------|----------------------|
| 2402.00                    | 0.95                                    | 0.00              | 0.95                          | 0.00124                     | 1                    |
| 2442.00                    | 1.23                                    | 0.00              | 1.23                          | 0.00133                     | 1                    |
| 2480.00                    | -0.98                                   | 0.00              | -0.98                         | 0.00080                     | 1                    |

offset: 1

## **7 6dB Bandwidth & 99% Bandwidth**

### **7.1 Standard Applicable:**

According to

## 7.5 Measurement Result:

### 802.11b

| Frequency<br>(MHz) | 6dB Bandwidth<br>(MHz) | 99% Band-<br>width<br>(MHz) | Limit<br>(KHz) | Result |
|--------------------|------------------------|-----------------------------|----------------|--------|
| Low                | 7.133                  | 11.928                      | > 500          | PASS   |
| Mid                | 7.15                   | 11.937                      | > 500          | PASS   |
| High               | 7.194                  | 12.127                      | > 500          | PASS   |

### 802.11g

| Frequency<br>(MHz) | 6dB Bandwidth<br>(MHz) | 99% Band-<br>width<br>(MHz) | Limit<br>(KHz) | Result |
|--------------------|------------------------|-----------------------------|----------------|--------|
| Low                | 16.37                  | 17.011                      | > 500          | PASS   |
| Mid                | 16.46                  | 17.494                      | > 500          | PASS   |
| High               | 16.42                  | 17.39                       | > 500          | PASS   |

### 802.11n HT20

| Frequency<br>(MHz) | 6dB Bandwidth<br>(MHz) | 99% Band-<br>width<br>(MHz) | Limit<br>(KHz) | Result |
|--------------------|------------------------|-----------------------------|----------------|--------|
| Low                | 17.59                  | 18.028                      | > 500          | PASS   |
| Mid                | 17.62                  | 18.348                      | > 500          | PASS   |
| High               | 17.31                  | 18.107                      | > 500          | PASS   |

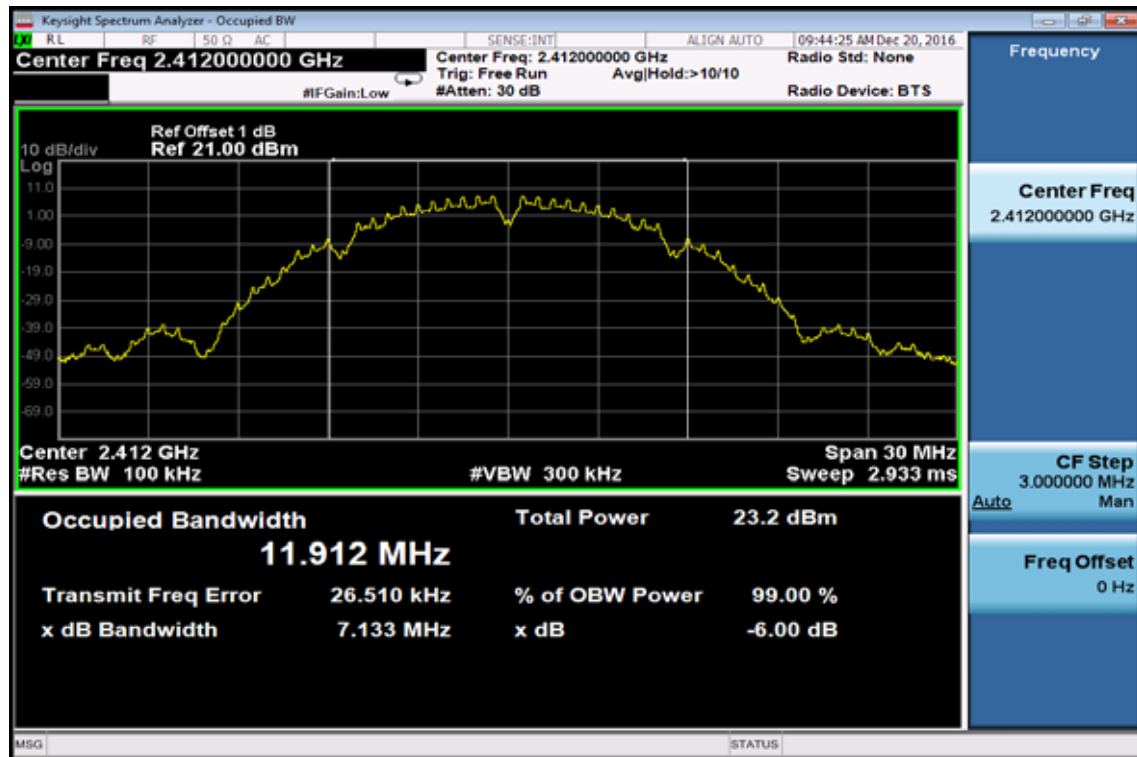
### LE Mode

| Frequency<br>(MHz) | 6dB Bandwidth<br>(MHz) | 99% Band-<br>width<br>(MHz) | Limit<br>(KHz) | Result |
|--------------------|------------------------|-----------------------------|----------------|--------|
| Low                | 0.695                  | 1.088                       | > 500          | PASS   |
| Mid                | 0.683                  | 1.094                       | > 500          | PASS   |
| High               | 0.699                  | 1.093                       | > 500          | PASS   |

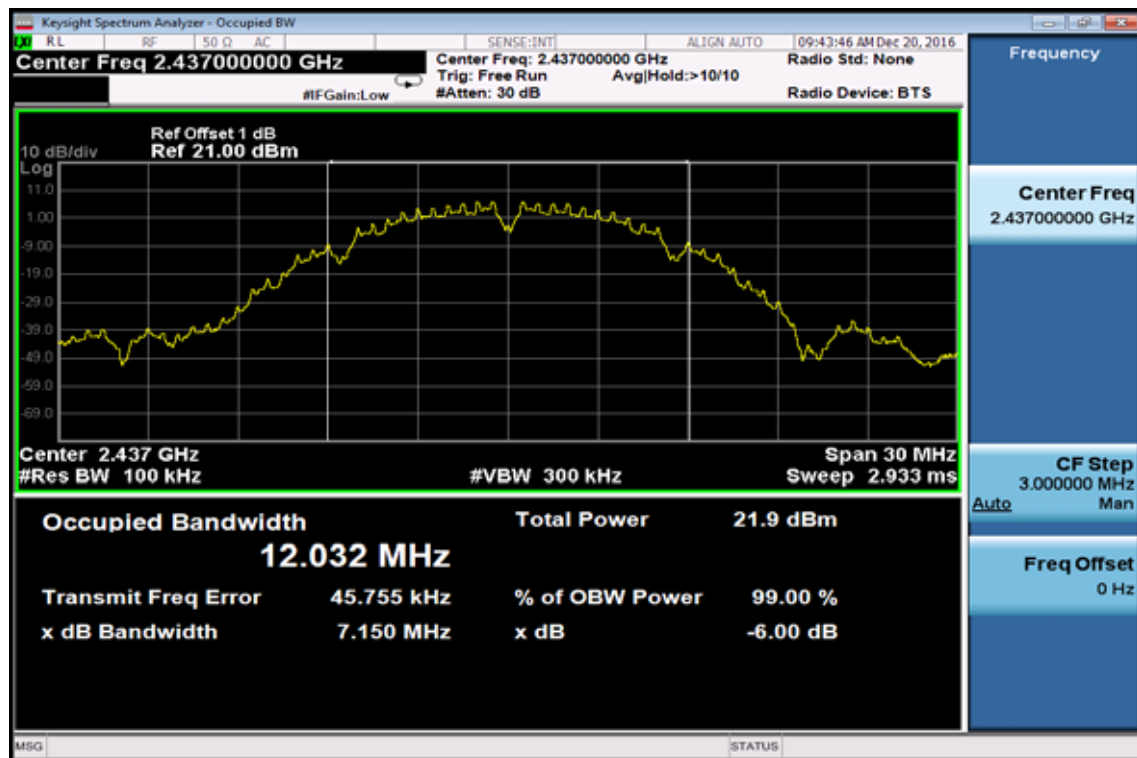
Note: Refer to next page for plots.

802.11b

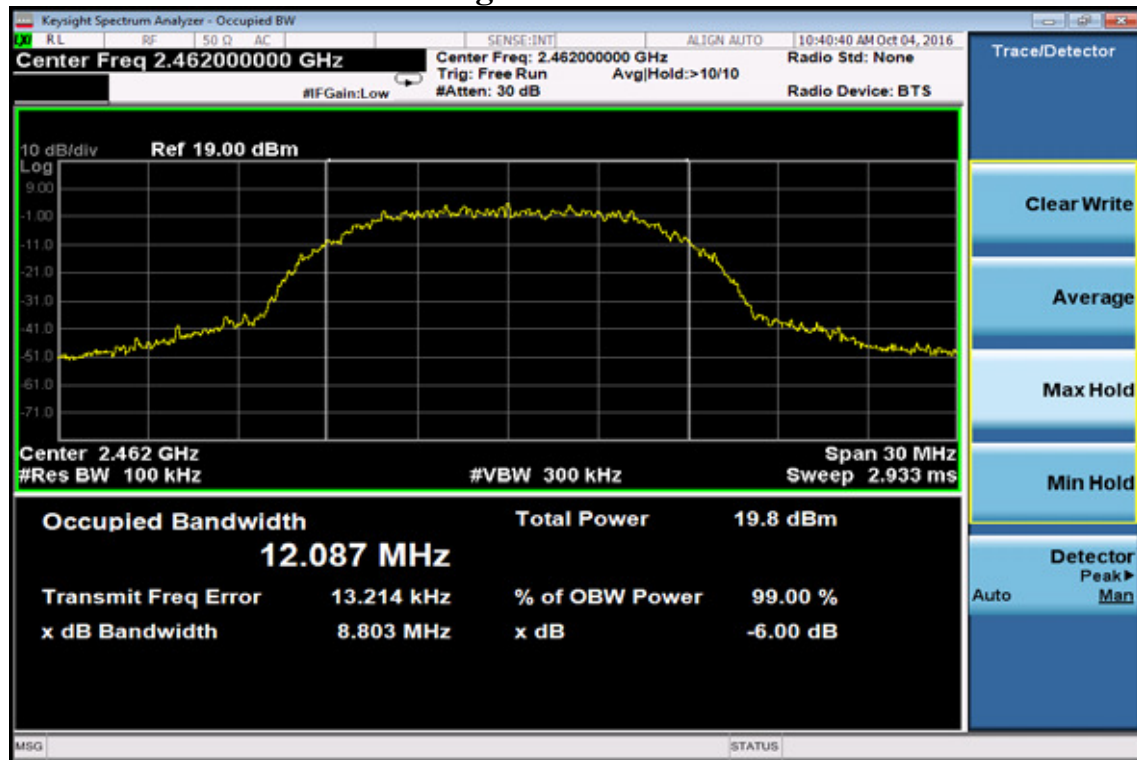
### 6dB Band Width Test Data CH-Low



### 6dB Band Width Test Data CH-Mid

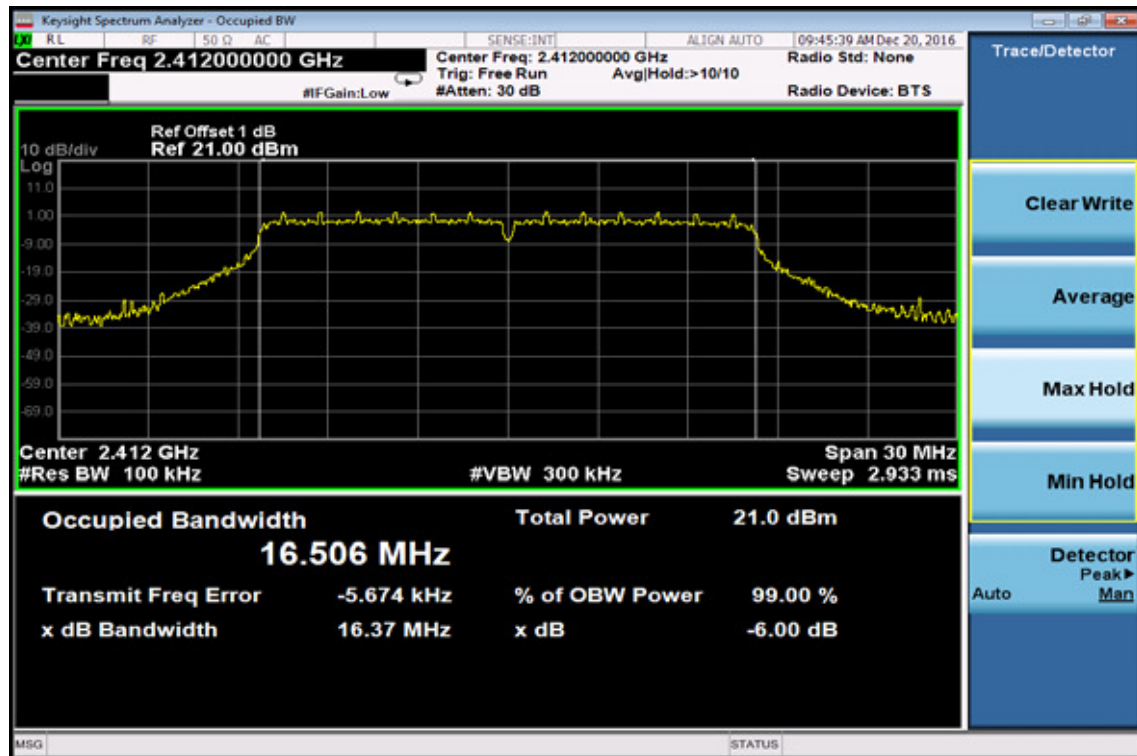


## 6dB Band Width Test Data CH-High

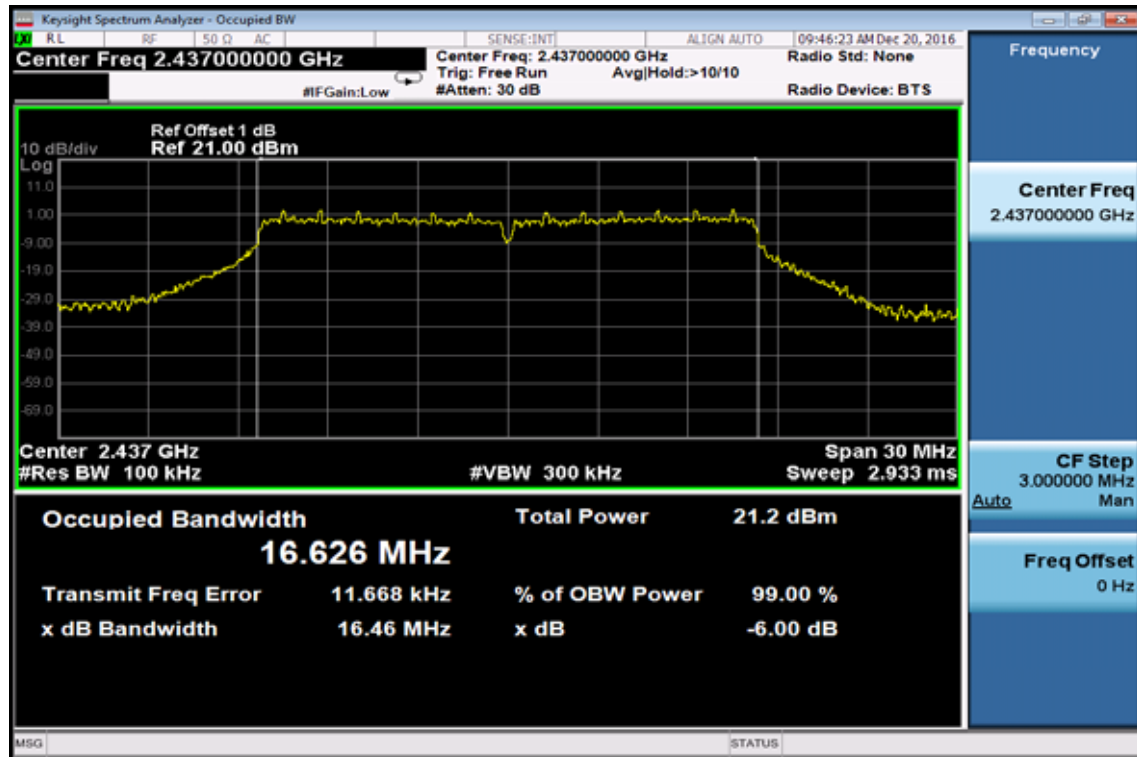


802.11g

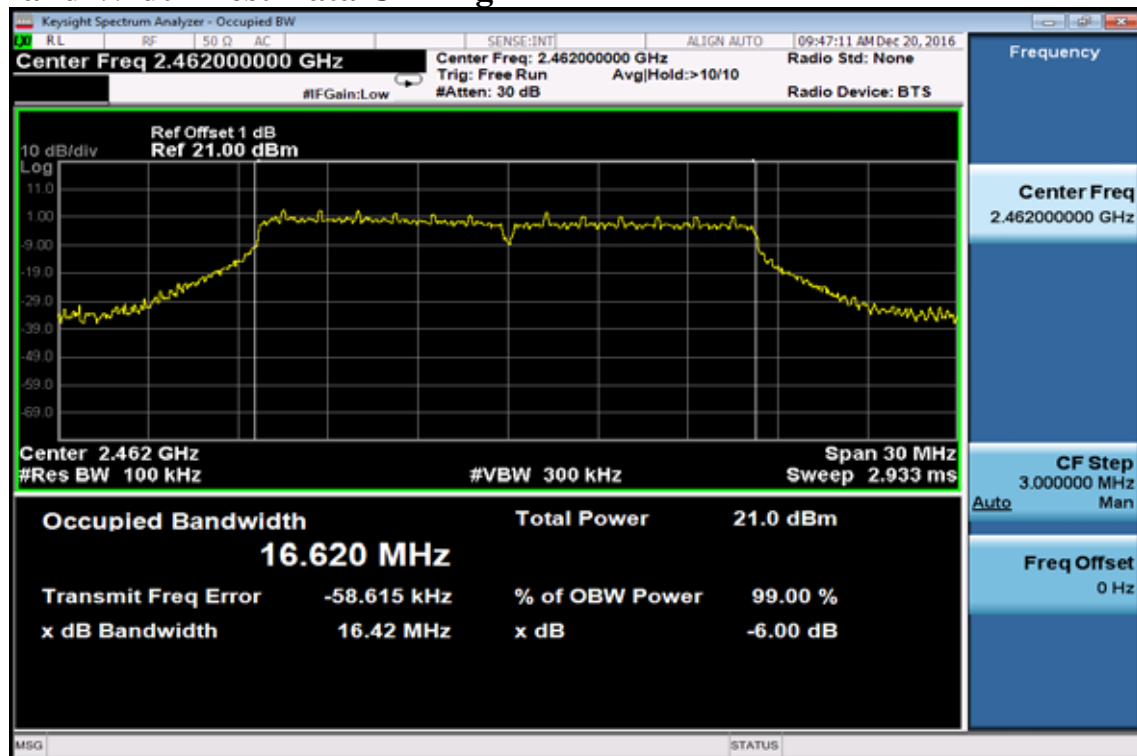
## 6dB Band Width Test Data CH-Low



## 6dB Band Width Test Data CH-Mid

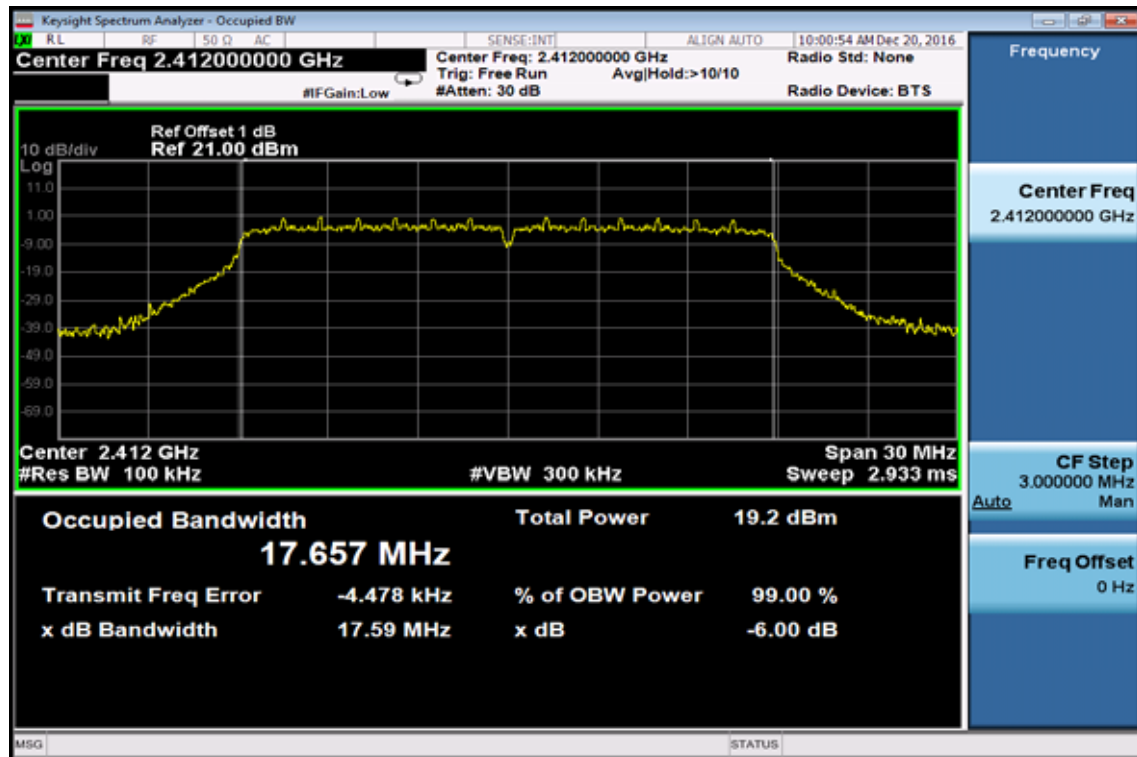


## 6dB Band Width Test Data CH-High

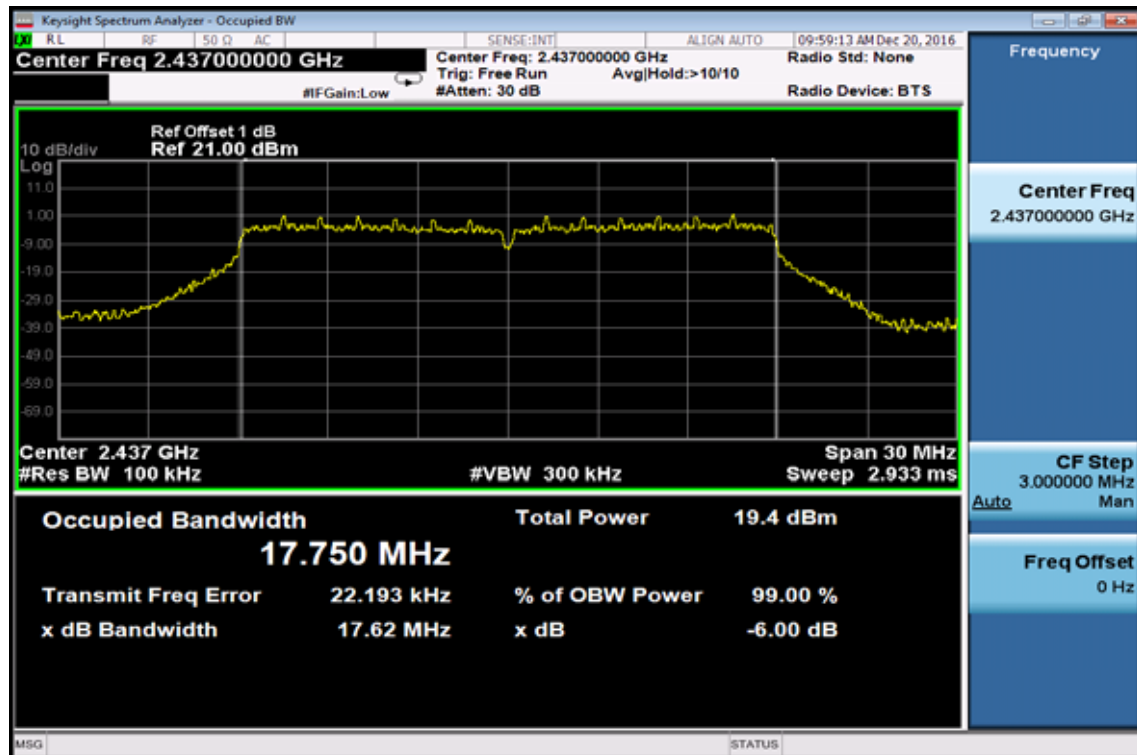


802.11n\_20M

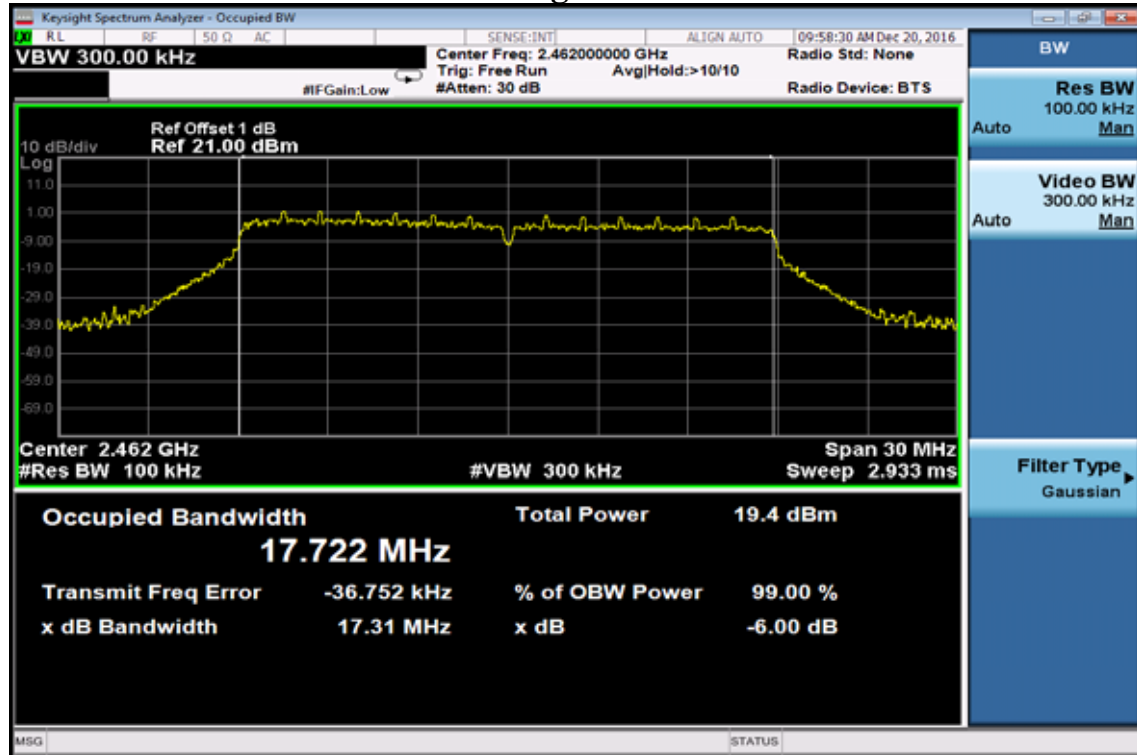
6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid

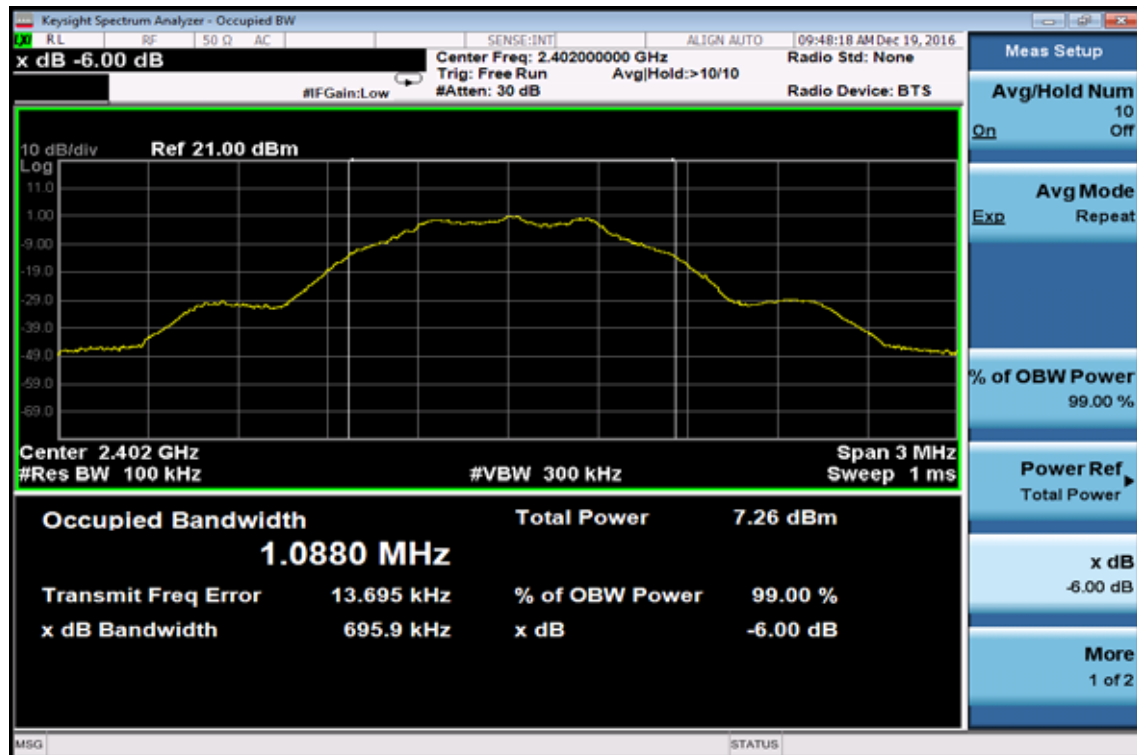


## 6dB Band Width Test Data CH-High

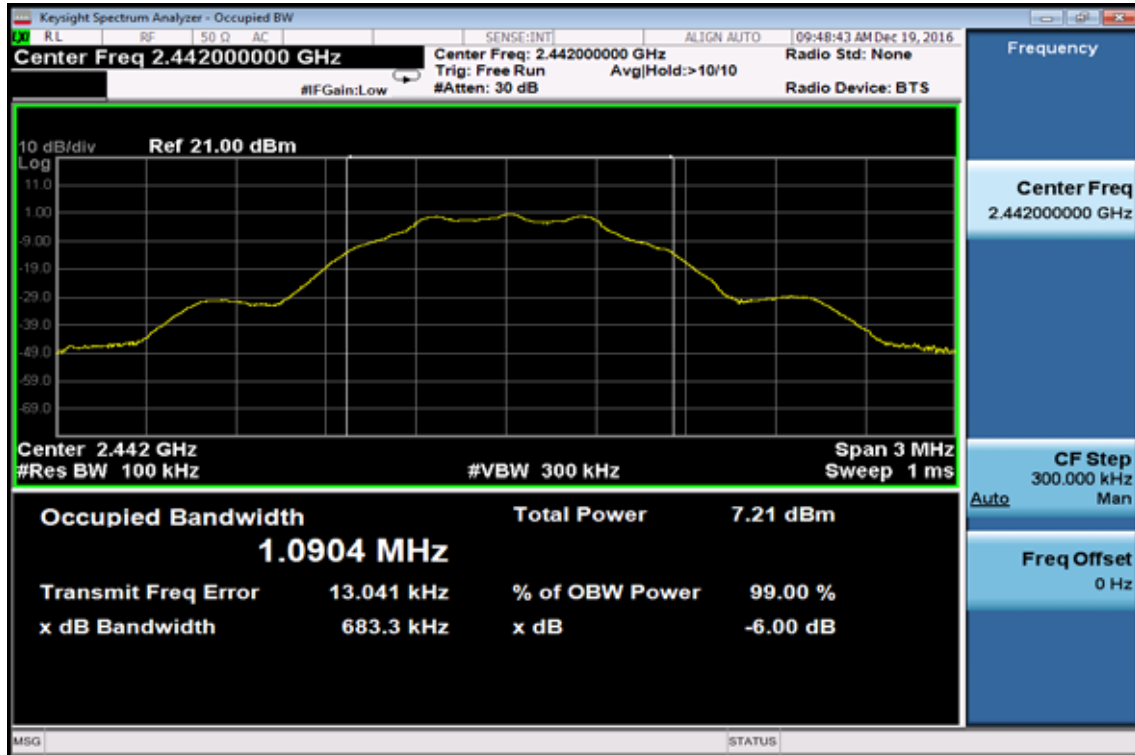


## LE Mode

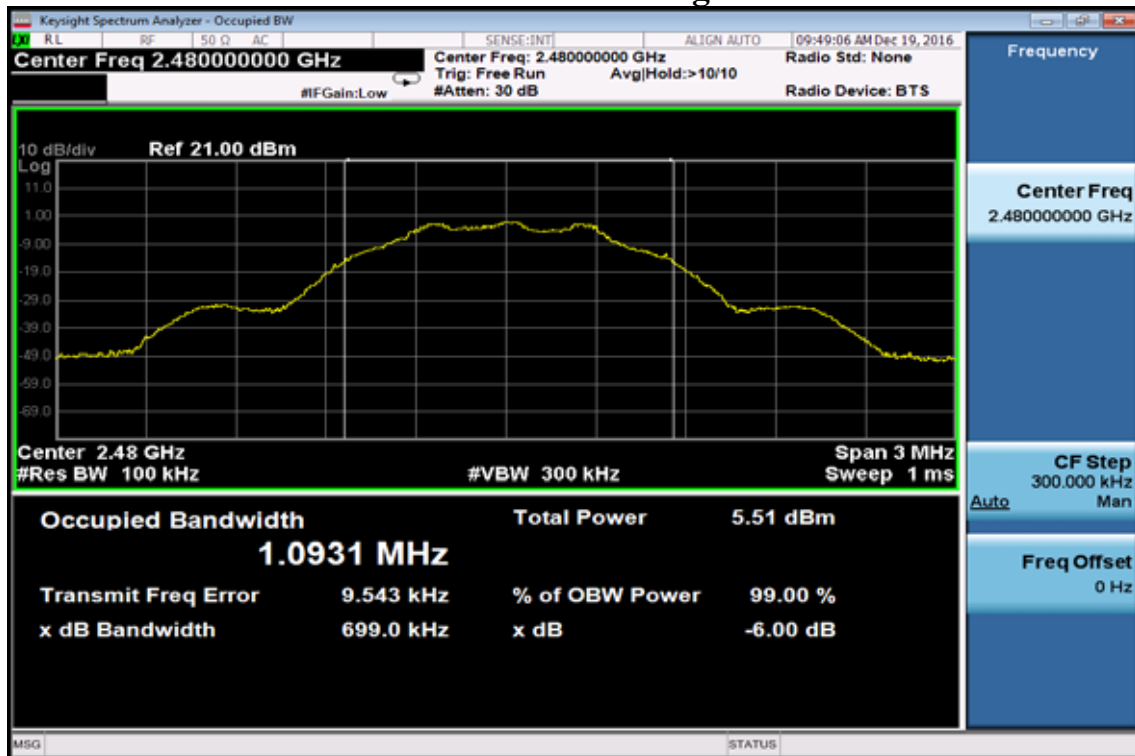
## 6dB & 99% Band Width Test Data CH-Low



### 6dB & 99% Band Width Test Data CH-Mid

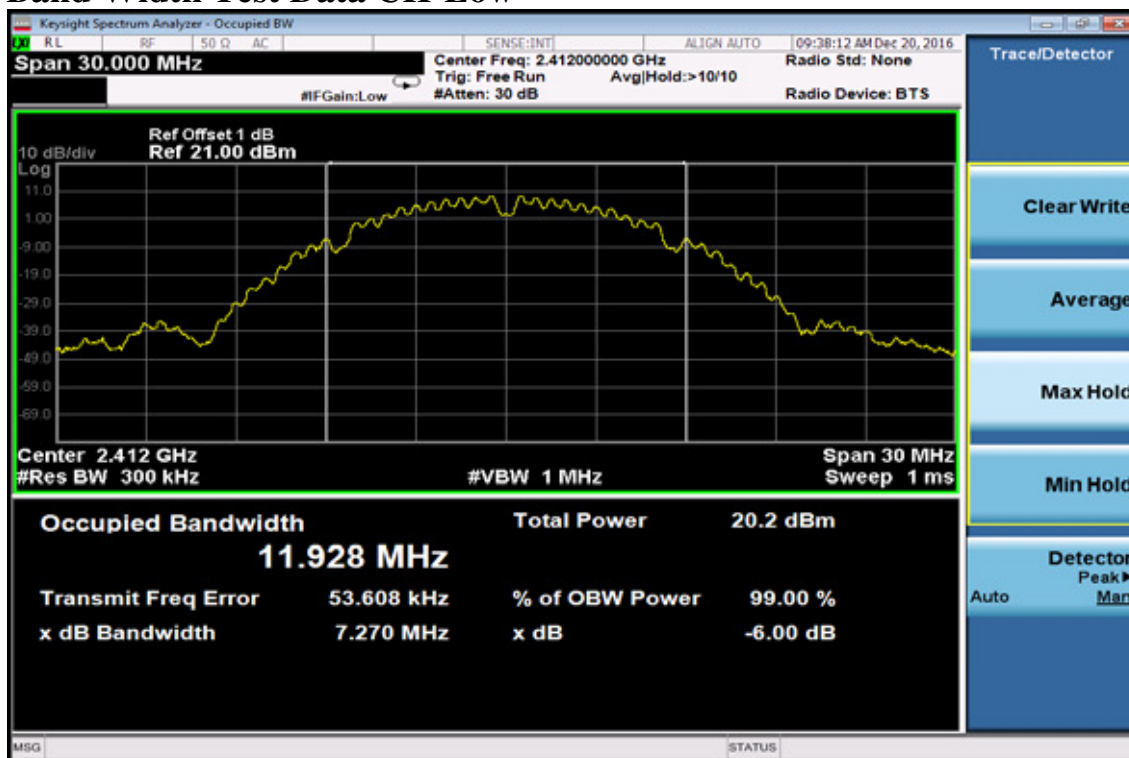


### 6dB & 99% Band Width Test Data CH-High

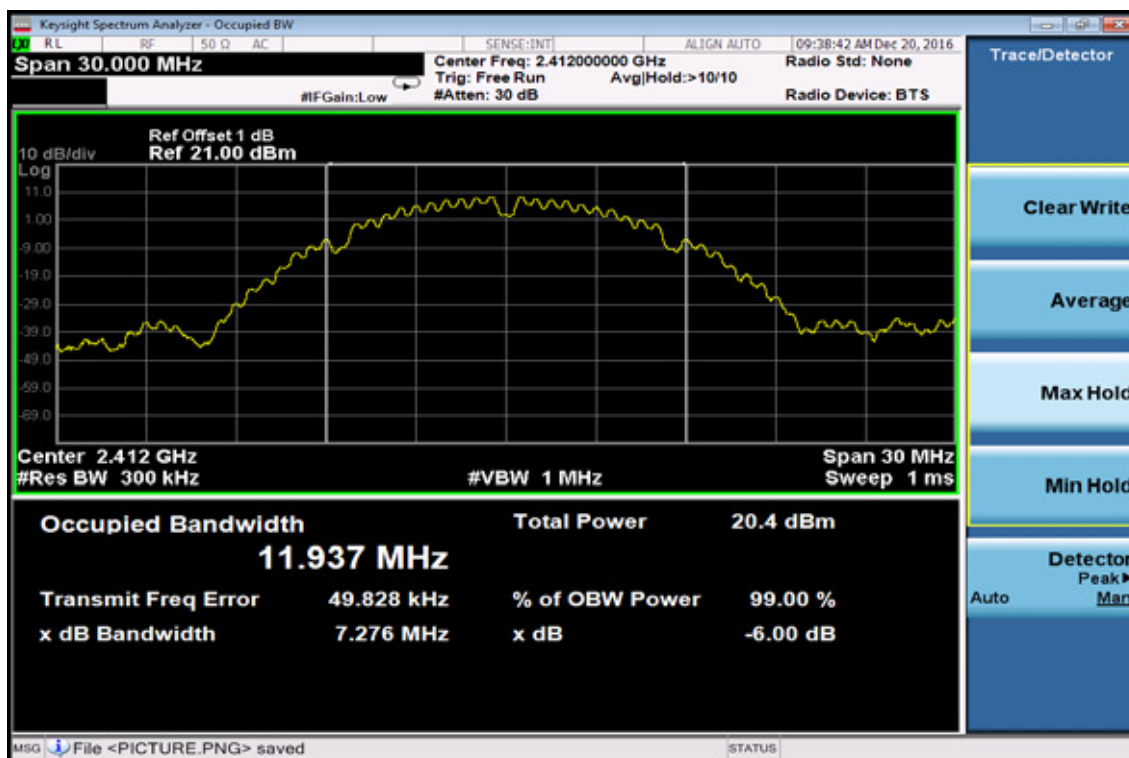


802.11b

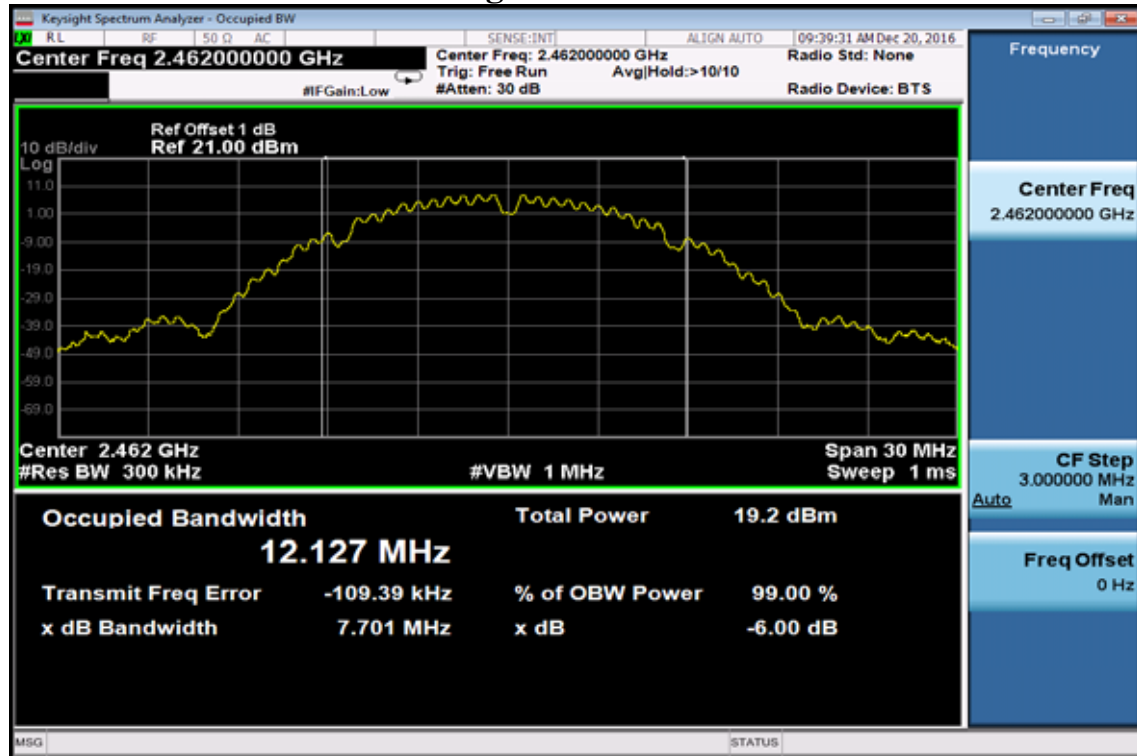
99% Band Width Test Data CH-Low



99% Band Width Test Data CH-Mid

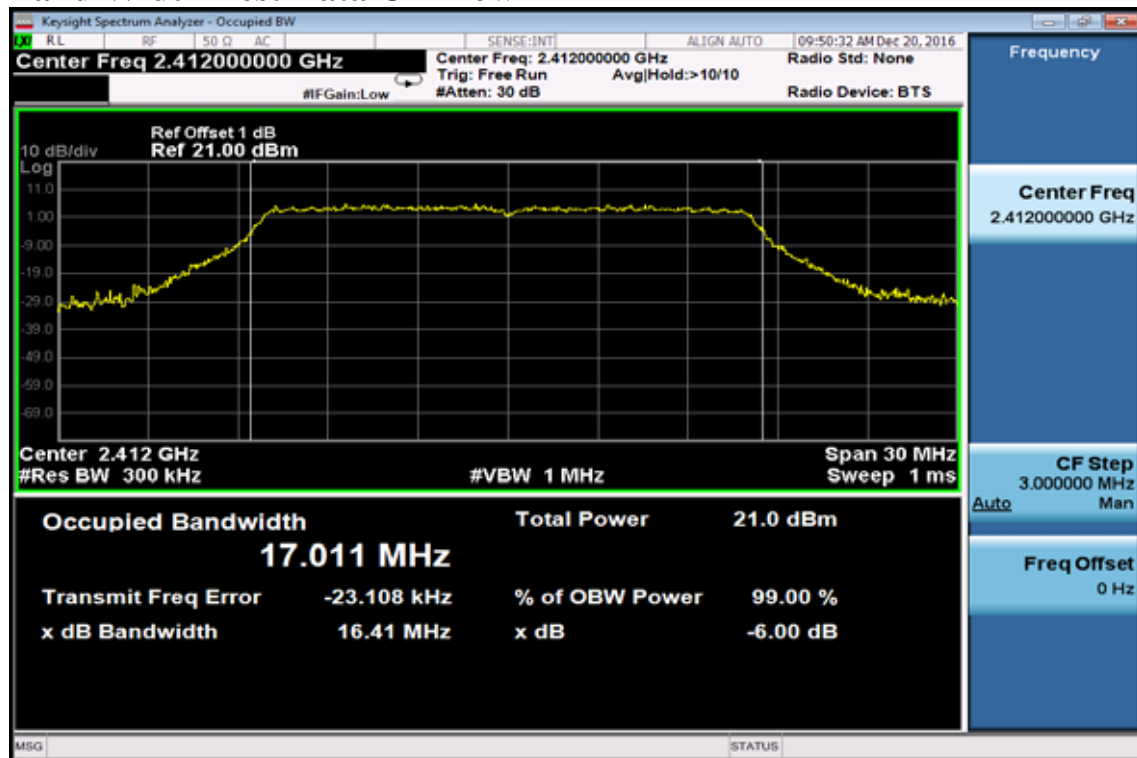


## 99% Band Width Test Data CH-High

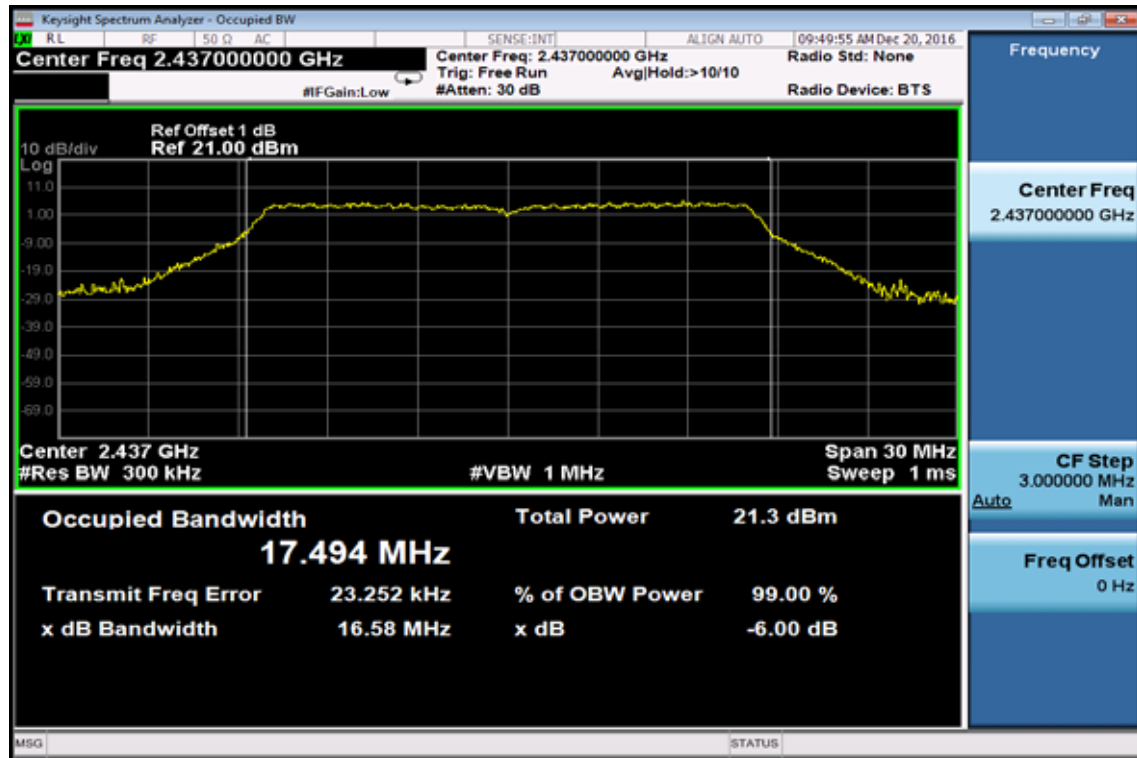


802.11g

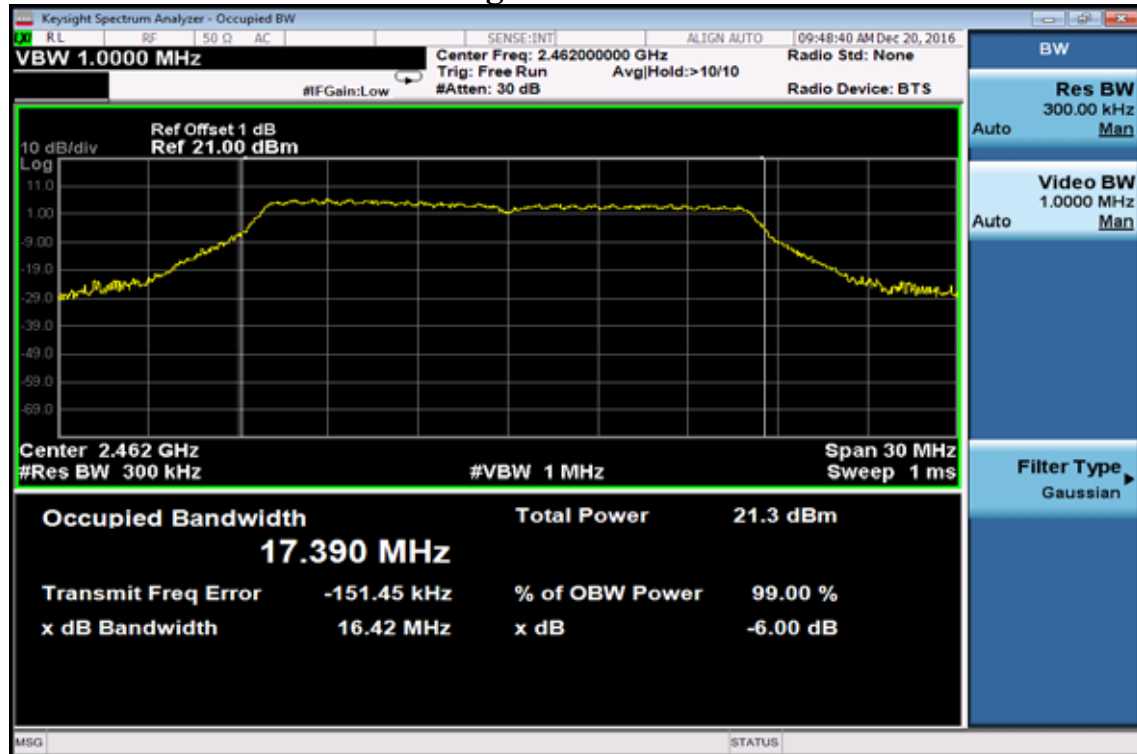
## 99% Band Width Test Data CH-Low



## 99% Band Width Test Data CH-Mid

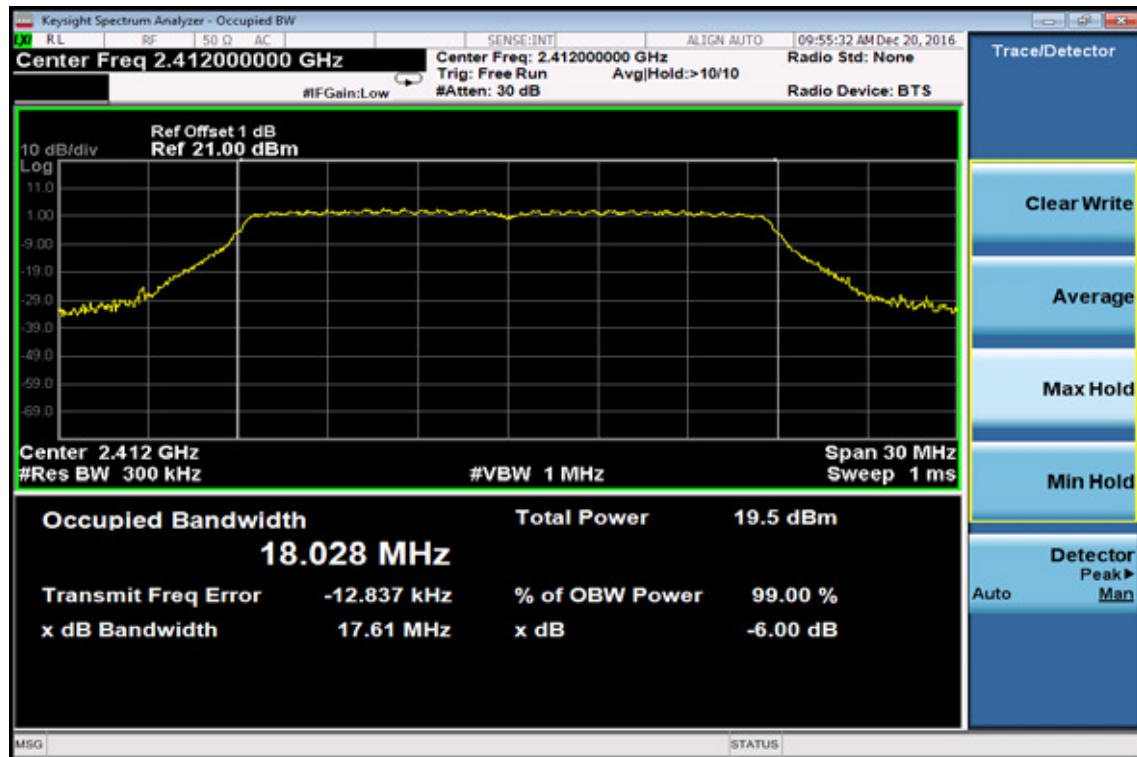


## 99% Band Width Test Data CH-High

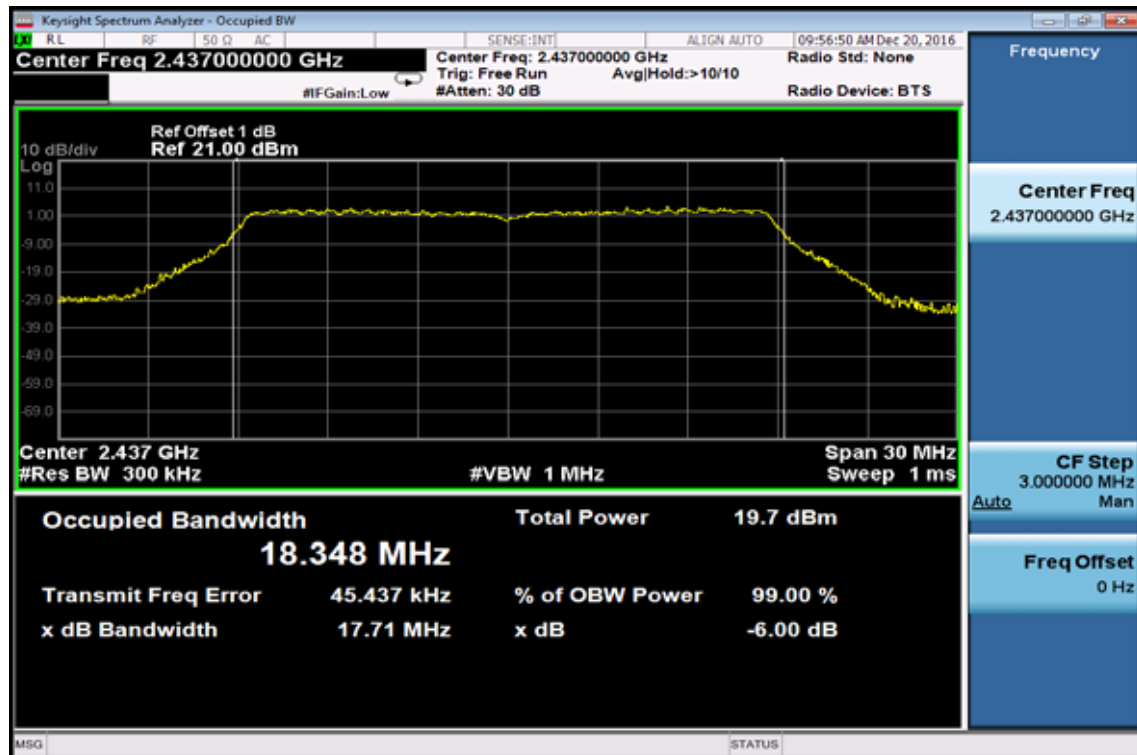


802.11n\_20M

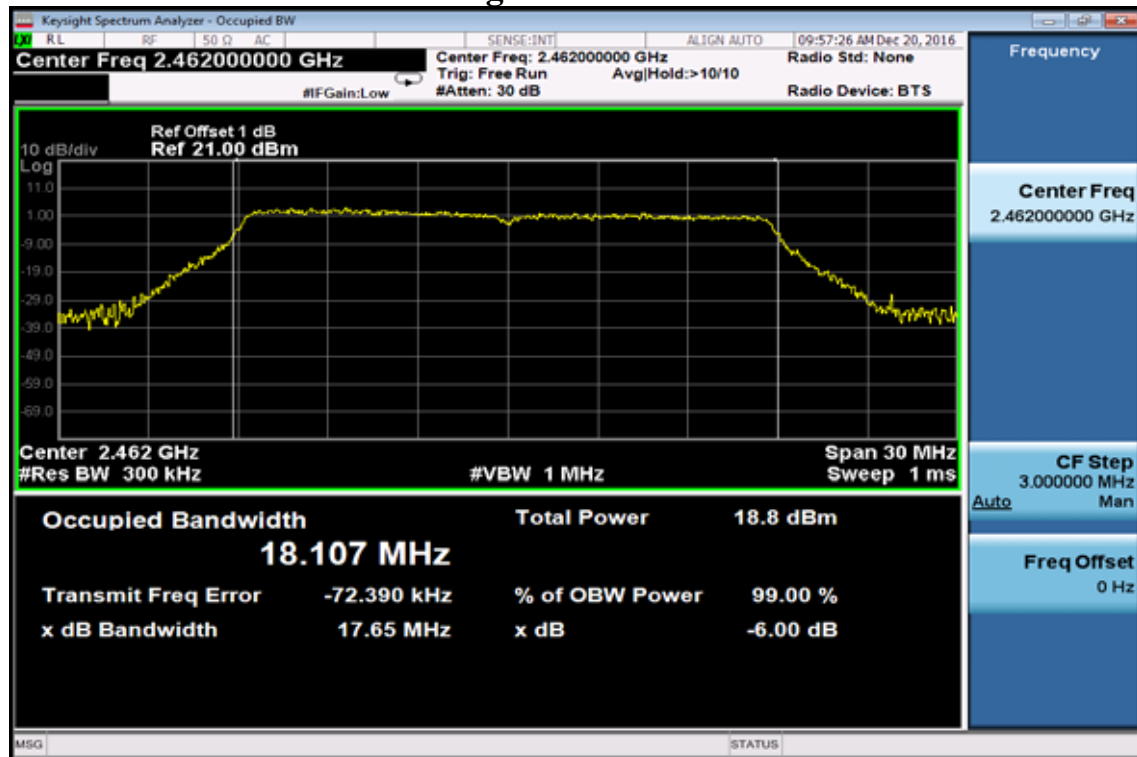
99% Band Width Test Data CH-Low



99% Band Width Test Data CH-Mid



## 99% Band Width Test Data CH-High



## **8 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT**

### **8.1 Standard Applicable:**

According to

## 8.2.2 Radiated emission:

| Chamber 14(966)               |               |                              |                     |            |            |
|-------------------------------|---------------|------------------------------|---------------------|------------|------------|
| EQUIPMENT TYPE                | MFR           | MODEL NUMBER                 | SERIAL NUMBER       | LAST CAL.  | CAL DUE.   |
| Spectrum Analyzer 21(26.5GHz) | Agilent       | N9010A                       | MY49060537          | 11/14/2016 | 11/13/2017 |
| Spectrum Analyzer 20(6.5GHz)  | Agilent       | E4443A                       | MY48250315          | 05/20/2016 | 05/19/2017 |
| Spectrum Analyzer 22(43GHz)   | R&S           | FSU43                        | 100143              | 05/22/2016 | 05/21/2017 |
| Loop Antenna9K-30M            | A.H.SYSTEM    | SAS-564                      | 294                 | 06/17/2015 | 06/16/2017 |
| Bilog Antenna30-1G            | Schaffner     | CBL 6112D                    | 37873               | 07/22/2016 | 07/21/2017 |
| Horn antenna1-18G             | ETS           | 3117                         | 00066665            | 07/22/2016 | 07/21/2017 |
| Horn antenna26-40G(05)        | Com-power     | AH-640                       | 100A                | 01/21/2015 | 01/20/2017 |
| Horn antenna18-26G(04)        | Com-power     | AH-826                       | 081001              | 07/24/2015 | 07/23/2017 |
| Preamplifier9-1000M           | HP            | 8447D                        | NA                  | 03/09/2016 | 03/08/2017 |
| Preamplifier1-18G             | MITEQ         | AFS44-001018<br>00-25-10P-44 | 1329256             | 07/27/2016 | 07/26/2017 |
| Preamplifier1-26G             | EM            | EM01M26G                     | NA                  | 03/10/2016 | 03/09/2017 |
| Preamplifier26-40G            | MITEQ         | JS-26004000-2<br>7-5A        | 818471              | 07/23/2015 | 07/22/2017 |
| Cable1-18G                    | HUBER SUHNER  | Sucoflex 106                 | NA                  | 11/25/2016 | 11/24/2017 |
| Cable UP to 1G                | HUBER SUHNER  | RG 214/U                     | NA                  | 10/02/2016 | 10/01/2017 |
| SUCOFLEX<br>1GHz~40GHz cable  | HUBER SUHNER  | Sucoflex 102                 | 27963/2&3742<br>1/2 | 11/03/2015 | 11/02/2017 |
| 2.4G Filter                   | Micro-Tronics | Brm50702                     | 76                  | 12/25/2016 | 12/24/2017 |
| Test Software                 | Audix         | E3<br>Ver:6.12023            | N/A                 | N/A        | N/A        |
| Test Software                 | Farad         | EZEMC<br>Ver:ISL-03A2        | N/A                 | N/A        | N/A        |

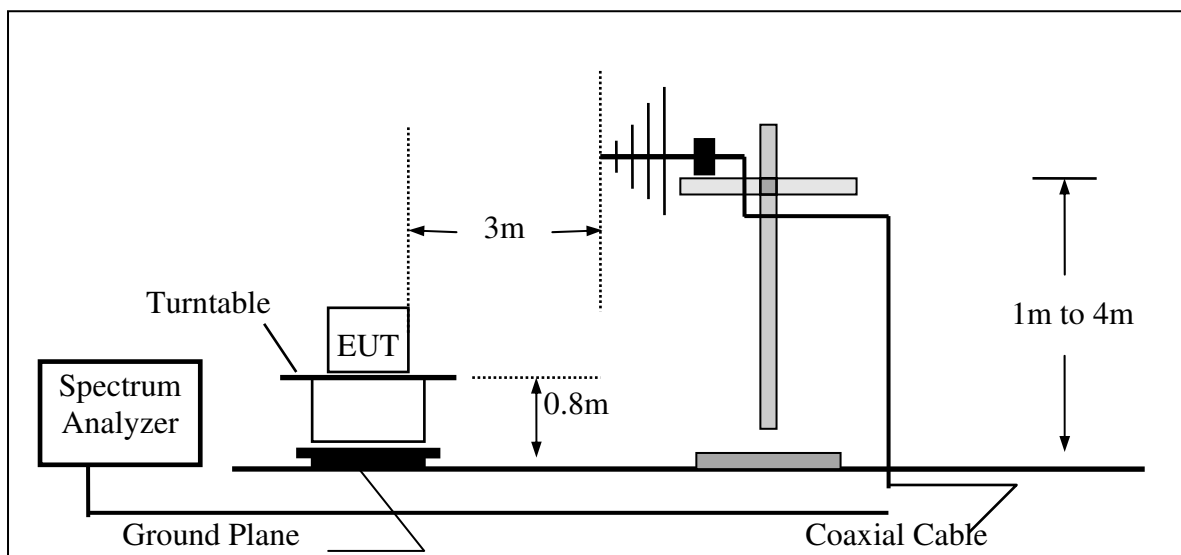
### 8.3 Test SET-UP:

#### 8.3.1 Conducted Emission at antenna port:

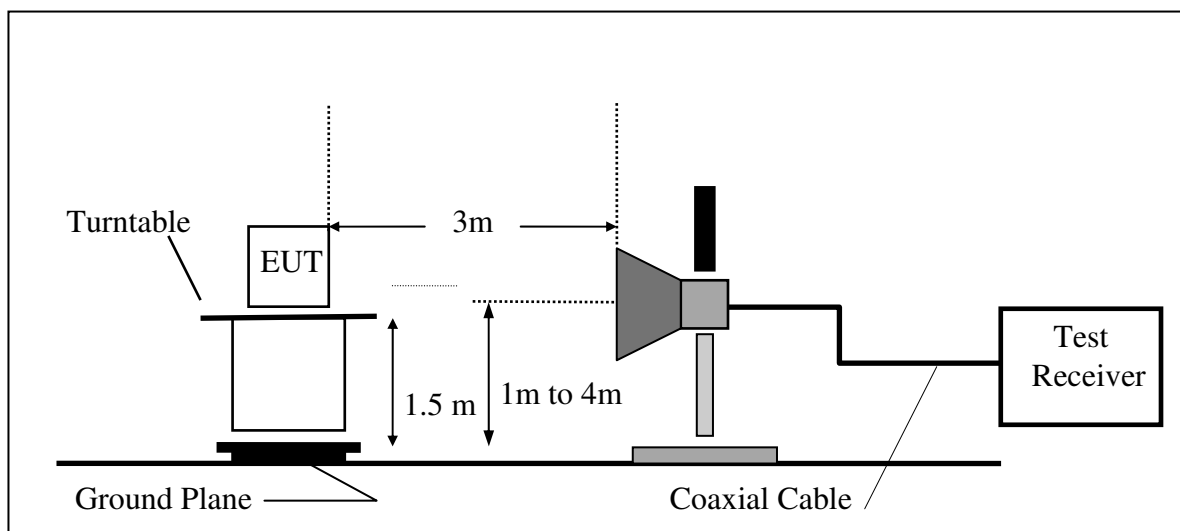
Refer to section 6.3 for details.

#### 8.3.2 Radiated emission:

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



#### 8.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span=25MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.

#### 8.5 Field Strength Calculation:

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

|       |                        |                                            |
|-------|------------------------|--------------------------------------------|
| Where | FS = Field Strength    | CL = Cable Attenuation Factor (Cable Loss) |
|       | RA = Reading Amplitude | AG = Amplifier Gain                        |
|       | AF = Antenna Factor    |                                            |

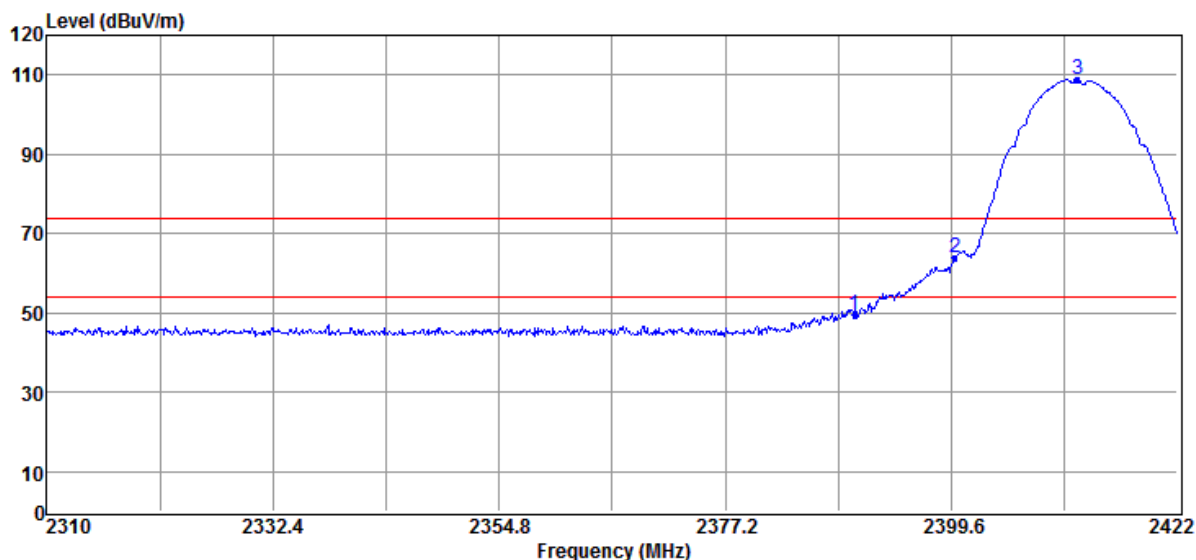
#### 8.6 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

**Radiated Emission: 802.11 b mode**

Operation Mode TX CH Low  
Fundamental Frequency 2412 MHz  
Temperature 25

Test Date 2016/12/21  
Test By Dino



| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB/m | Level<br>dBuV/m | Limit<br>dBuV/m | Over Li<br>mit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|

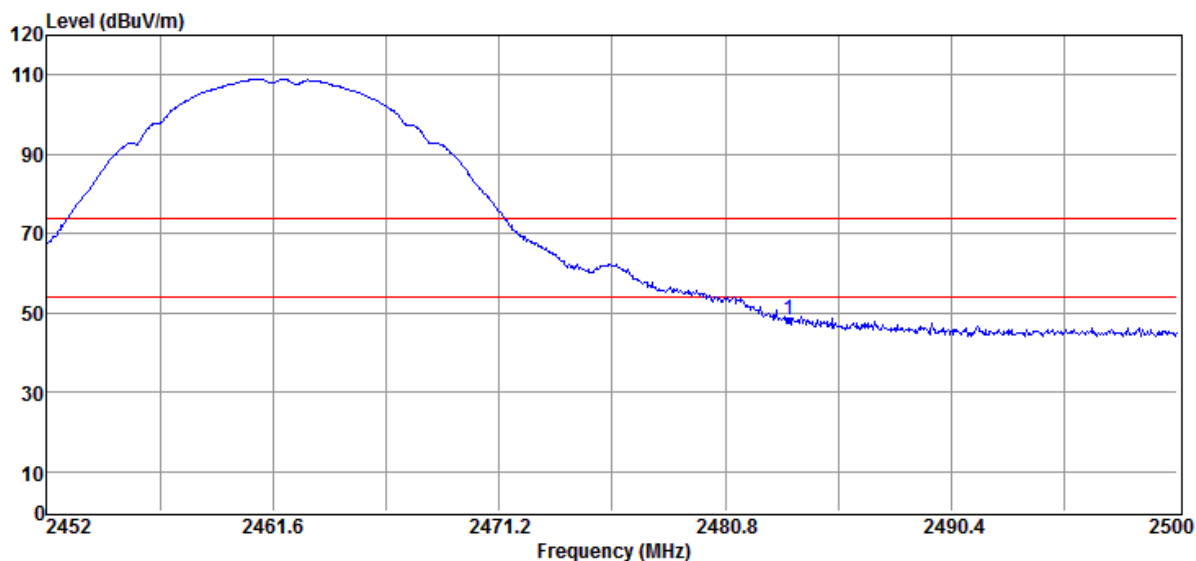
|   |         |        |       |        |       |        |      |            |
|---|---------|--------|-------|--------|-------|--------|------|------------|
| 1 | 2390.00 | 52.49  | -3.15 | 49.34  | 74.00 | -24.66 | Peak | HORIZONTAL |
| 2 | 2400.00 | 67.08  | -3.16 | 63.92  | 88.84 | -24.92 | Peak | HORIZONTAL |
| 3 | 2412.14 | 111.99 | -3.15 | 108.84 | 74.00 | 34.84  | Peak | HORIZONTAL |

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

|                       |            |
|-----------------------|------------|
| Operation Mode        | TX CH High |
| Fundamental Frequency | 2462 MHz   |
| Temperature           | 25         |

|           |            |
|-----------|------------|
| Test Date | 2016/12/21 |
| Test By   | Dino       |



| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB/m | Level<br>dBuV/m | Limit<br>dBuV/m | Over Li<br>mit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|

|   |         |       |       |       |       |        |      |            |
|---|---------|-------|-------|-------|-------|--------|------|------------|
| 1 | 2483.50 | 51.37 | -3.11 | 48.26 | 74.00 | -25.74 | Peak | HORIZONTAL |
|---|---------|-------|-------|-------|-------|--------|------|------------|

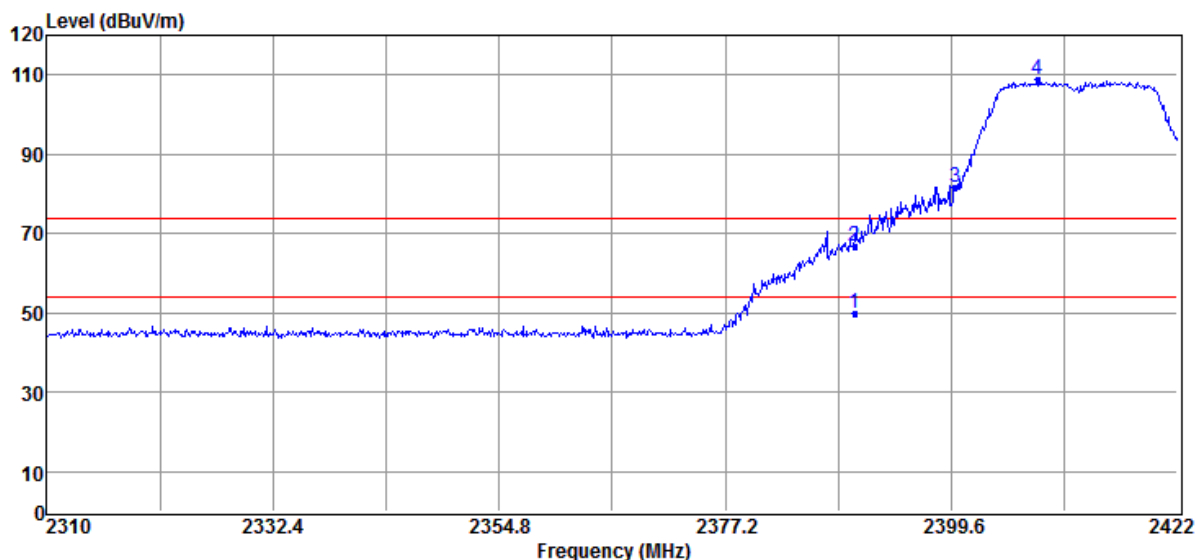
Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

**Radiated Emission: 802.11 g mode**

|                       |           |
|-----------------------|-----------|
| Operation Mode        | TX CH Low |
| Fundamental Frequency | 2412 MHz  |
| Temperature           | 25        |

|           |            |
|-----------|------------|
| Test Date | 2016/12/21 |
| Test By   | Dino       |



| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB/m | Level<br>dBuV/m | Limit<br>dBuV/m | Over L<br>imit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|

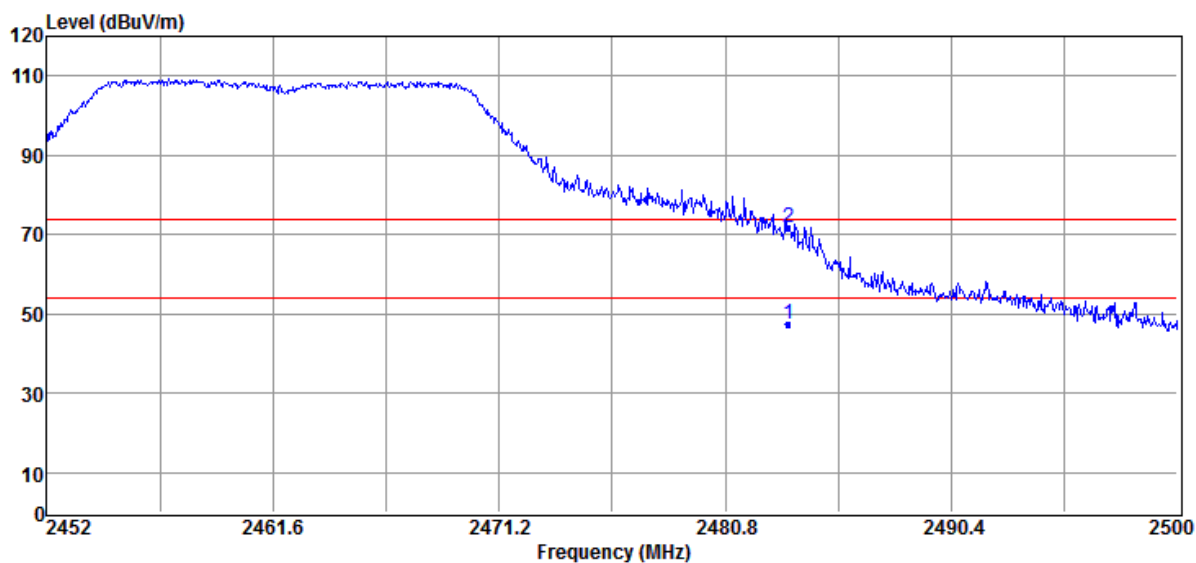
|   |         |        |       |        |       |       |         |            |
|---|---------|--------|-------|--------|-------|-------|---------|------------|
| 1 | 2390.00 | 52.99  | -3.15 | 49.84  | 54.00 | -4.16 | Average | HORIZONTAL |
| 2 | 2390.00 | 69.93  | -3.15 | 66.78  | 74.00 | -7.22 | Peak    | HORIZONTAL |
| 3 | 2400.00 | 84.84  | -3.16 | 81.68  | 88.96 | -7.28 | Peak    | HORIZONTAL |
| 4 | 2408.11 | 112.11 | -3.15 | 108.96 | 74.00 | 34.96 | Peak    | HORIZONTAL |

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

|                       |            |
|-----------------------|------------|
| Operation Mode        | TX CH High |
| Fundamental Frequency | 2462 MHz   |
| Temperature           | 25         |

|           |            |
|-----------|------------|
| Test Date | 2016/12/21 |
| Test By   | Dino       |



| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB/m | Level<br>dBuV/m | Limit<br>dBuV/m | Over L<br>imit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|

|   |         |       |       |       |       |       |         |            |
|---|---------|-------|-------|-------|-------|-------|---------|------------|
| 1 | 2483.50 | 50.57 | -3.11 | 47.46 | 54.00 | -6.54 | Average | HORIZONTAL |
| 2 | 2483.50 | 75.06 | -3.11 | 71.95 | 74.00 | -2.05 | Peak    | HORIZONTAL |

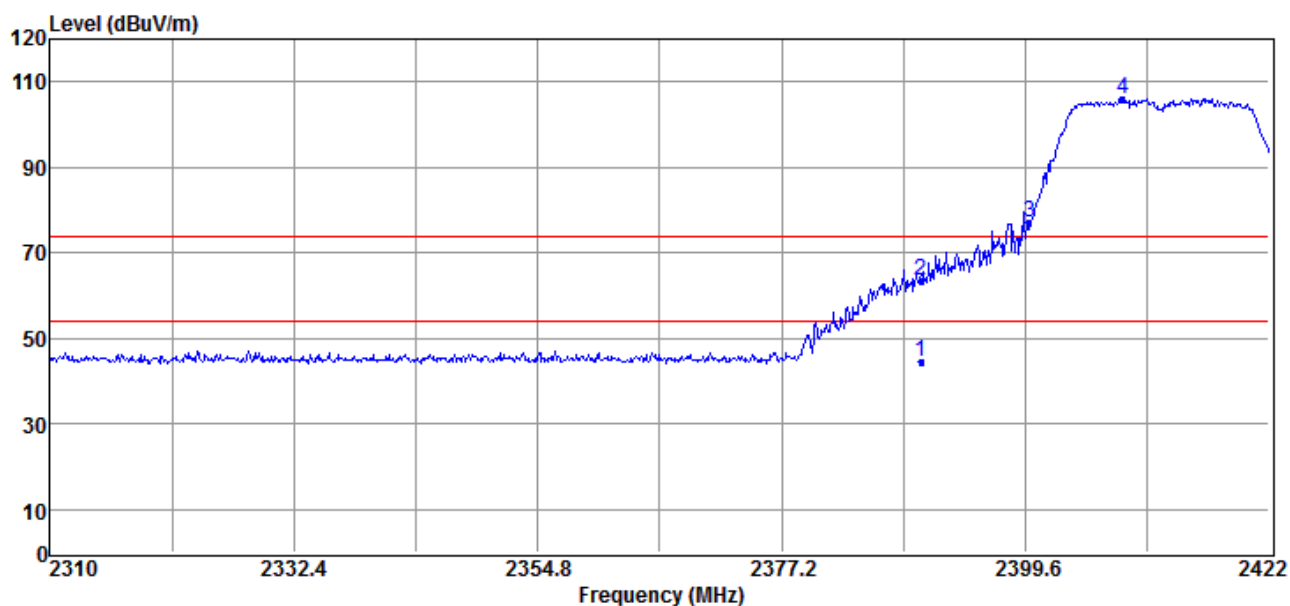
Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

**Radiated Emission: 802.11 n20 mode**

Operation Mode TX CH Low  
Fundamental Frequency 2412 MHz  
Temperature 25

Test Date 2016/12/21  
Test By Dino



| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB/m | Level<br>dBuV/m | Limit<br>dBuV/m | Over Li<br>mit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|

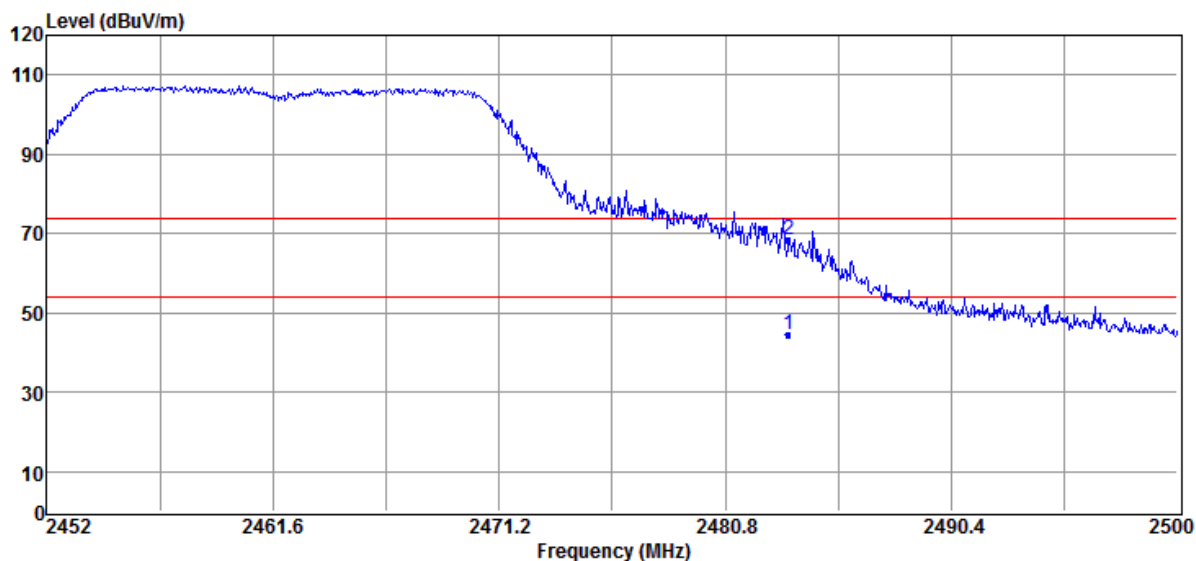
|   |         |        |       |        |       |        |         |            |
|---|---------|--------|-------|--------|-------|--------|---------|------------|
| 1 | 2390.00 | 47.89  | -3.15 | 44.74  | 54.00 | -9.26  | Average | HORIZONTAL |
| 2 | 2390.00 | 66.49  | -3.15 | 63.34  | 74.00 | -10.66 | Peak    | HORIZONTAL |
| 3 | 2400.00 | 80.27  | -3.16 | 77.11  | 86.01 | -8.90  | Peak    | HORIZONTAL |
| 4 | 2408.56 | 109.16 | -3.15 | 106.01 | 74.00 | 32.01  | Peak    | HORIZONTAL |

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

|                       |            |
|-----------------------|------------|
| Operation Mode        | TX CH High |
| Fundamental Frequency | 2462 MHz   |
| Temperature           | 25         |

|           |            |
|-----------|------------|
| Test Date | 2016/12/21 |
| Test By   | Dino       |



| No | Freq<br>MHz | Reading<br>dBUV | Factor<br>dB/m | Level<br>dBUV/m | Limit<br>dBUV/m | Over L<br>imit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|

|   |         |       |       |       |       |       |         |            |
|---|---------|-------|-------|-------|-------|-------|---------|------------|
| 1 | 2483.50 | 47.47 | -3.11 | 44.36 | 54.00 | -9.64 | Average | HORIZONTAL |
| 2 | 2483.50 | 71.73 | -3.11 | 68.62 | 74.00 | -5.38 | Peak    | HORIZONTAL |

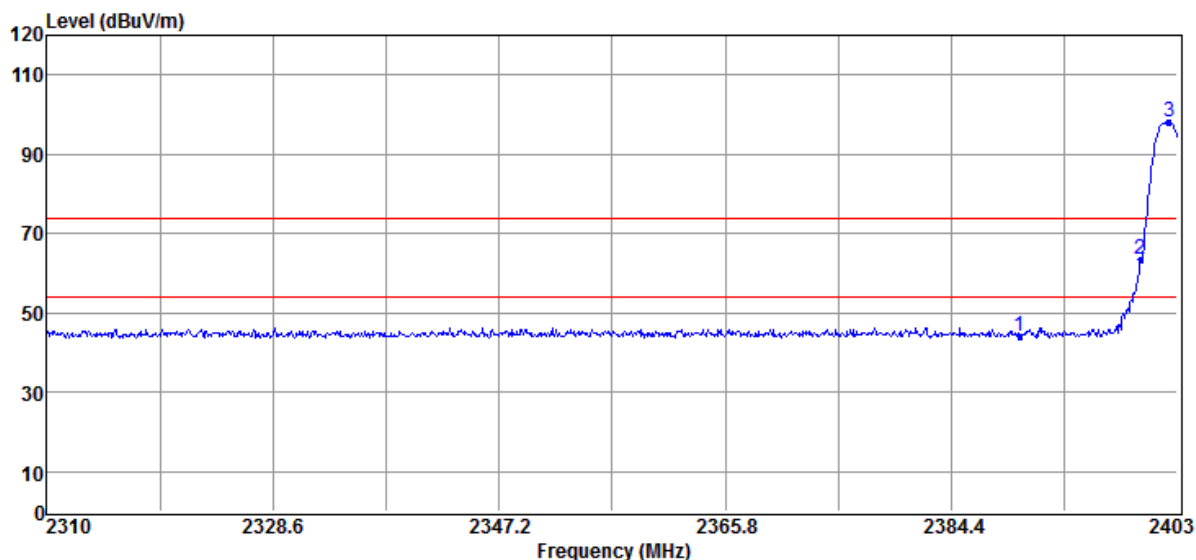
Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

**Radiated Emission: BLE mode**

Operation Mode TX CH Low  
Fundamental Frequency 2412 MHz  
Temperature 25

Test Date 2016/12/21  
Test By Dino



| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB/m | Level<br>dBuV/m | Limit<br>dBuV/m | Over Li<br>mit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|

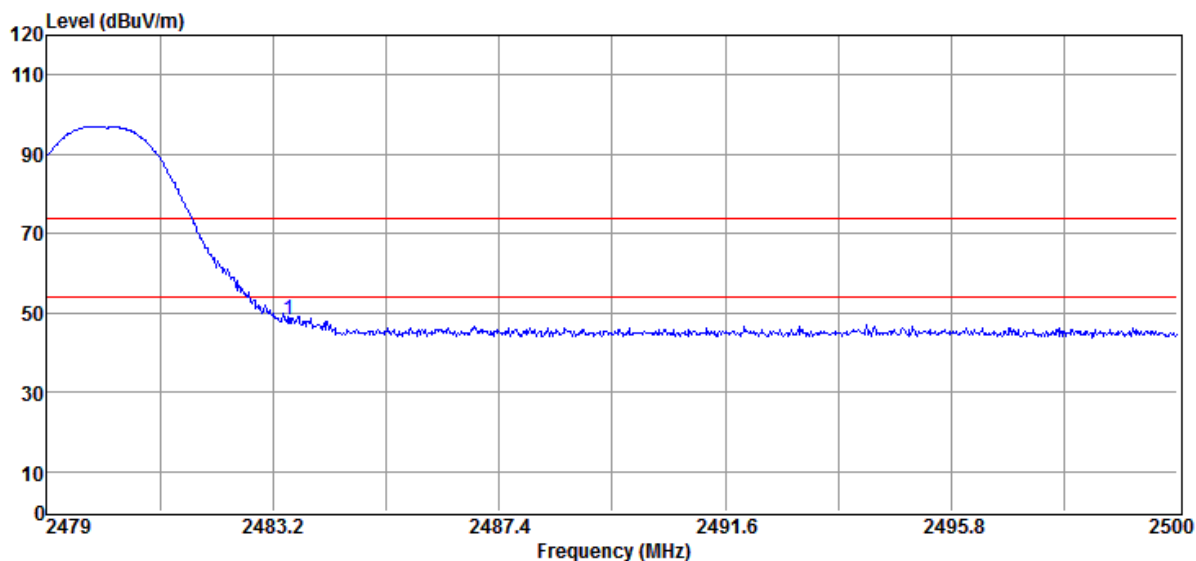
|   |         |        |       |       |       |        |      |            |
|---|---------|--------|-------|-------|-------|--------|------|------------|
| 1 | 2390.00 | 47.42  | -3.15 | 44.27 | 74.00 | -29.73 | Peak | HORIZONTAL |
| 2 | 2400.00 | 66.58  | -3.16 | 63.42 | 77.99 | -14.57 | Peak | HORIZONTAL |
| 3 | 2402.35 | 101.15 | -3.16 | 97.99 | 74.00 | 23.99  | Peak | HORIZONTAL |

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

|                       |            |
|-----------------------|------------|
| Operation Mode        | TX CH High |
| Fundamental Frequency | 2462 MHz   |
| Temperature           | 25         |

|           |            |
|-----------|------------|
| Test Date | 2016/12/21 |
| Test By   | Dino       |



| No | Freq<br>MHz | Reading<br>dBUV | Factor<br>dB/m | Level<br>dBUV/m | Limit<br>dBUV/m | Over Li<br>mit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|
|----|-------------|-----------------|----------------|-----------------|-----------------|----------------------|--------|------------|

|   |         |       |       |       |       |        |      |            |
|---|---------|-------|-------|-------|-------|--------|------|------------|
| 1 | 2483.50 | 51.20 | -3.11 | 48.09 | 74.00 | -25.91 | Peak | HORIZONTAL |
|---|---------|-------|-------|-------|-------|--------|------|------------|

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

## **9 SPURIOUS RADIATED EMISSION TEST**

### **9.1 Standard Applicable**

According to

#### 9.4 Measurement Procedure:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all frequency measured were complete.

#### 9.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

|       |                        |                                            |
|-------|------------------------|--------------------------------------------|
| Where | FS = Field Strength    | CL = Cable Attenuation Factor (Cable Loss) |
|       | RA = Reading Amplitude | AG = Amplifier Gain                        |
|       | AF = Antenna Factor    |                                            |

#### 9.6 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

**Radiated Spurious Emission Measurement Result (below 1GHz)**

|                       |                    |           |            |
|-----------------------|--------------------|-----------|------------|
| Operation Mode        | 802.11 g TX CH Low | Test Date | 2016/12/21 |
| Fundamental Frequency | 2412MHz            | Test By   | Dino       |
| Temperature           | 25                 |           |            |

**Radiated Spurious Emission Measurement Result (below 1GHz)**

|                       |                    |           |            |
|-----------------------|--------------------|-----------|------------|
| Operation Mode        | 802.11 g TX CH Mid | Test Date | 2016/12/21 |
| Fundamental Frequency | 2437MHz            | Test By   | Dino       |
| Temperature           | 25                 |           |            |

**Radiated Spurious Emission Measurement Result (below 1GHz)**

|                       |                     |           |            |
|-----------------------|---------------------|-----------|------------|
| Operation Mode        | 802.11 g TX CH High | Test Date | 2016/12/21 |
| Fundamental Frequency | 2462MHz             | Test By   | Dino       |
| Temperature           | 25                  |           |            |

**Radiated Spurious Emission Measurement Result (above 1GHz)**

|                       |                   |           |            |
|-----------------------|-------------------|-----------|------------|
| Operation Mode        | 802.11g TX CH Low | Test Date | 2016/12/21 |
| Fundamental Frequency | 2412MHz           | Test By   | Dino       |
| Temperature           | 25                |           |            |

**Radiated Spurious Emission Measurement Result (above 1GHz)**

|                       |                   |           |            |
|-----------------------|-------------------|-----------|------------|
| Operation Mode        | 802.11g TX CH Mid | Test Date | 2016/12/21 |
| Fundamental Frequency | 2437MHz           | Test By   | Dino       |
| Temperature           | 25                |           |            |

**Radiated Spurious Emission Measurement Result (above 1GHz)**

|                       |                    |           |            |
|-----------------------|--------------------|-----------|------------|
| Operation Mode        | 802.11g TX CH High | Test Date | 2016/12/21 |
| Fundamental Frequency | 2462MHz            | Test By   | Dino       |
| Temperature           | 25                 |           |            |

## **10 Peak Power Spectral Density**

### **10.1 Standard Applicable:**

According to

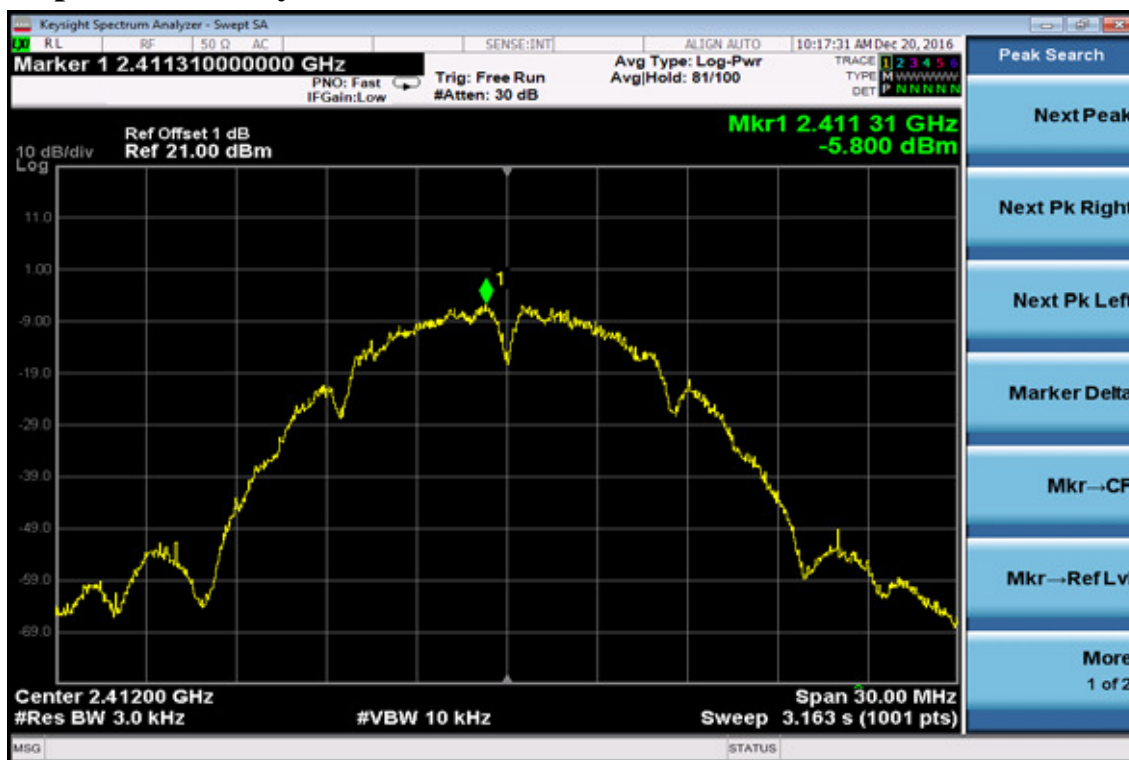
## 10.5 Measurement Result:

### 802.11b Mode

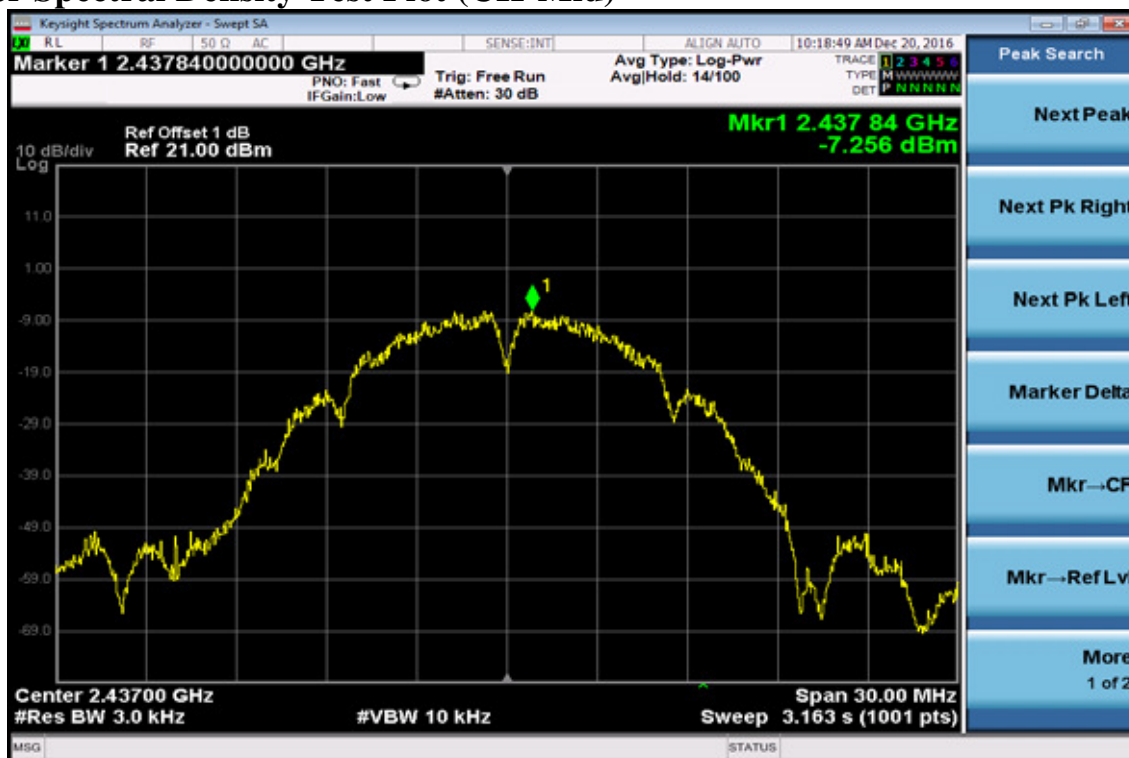
| CH   | Power Density<br>Level dBm/3KHz | Maximum Limit<br>(dBm) |
|------|---------------------------------|------------------------|
| Low  | -5.8                            | 8                      |
| Mid  | -7.256                          | 8                      |
| High | -6.973                          | 8                      |

802.11b

### Power Spectral Density Test Plot (CH-Low)



### Power Spectral Density Test Plot (CH-Mid)

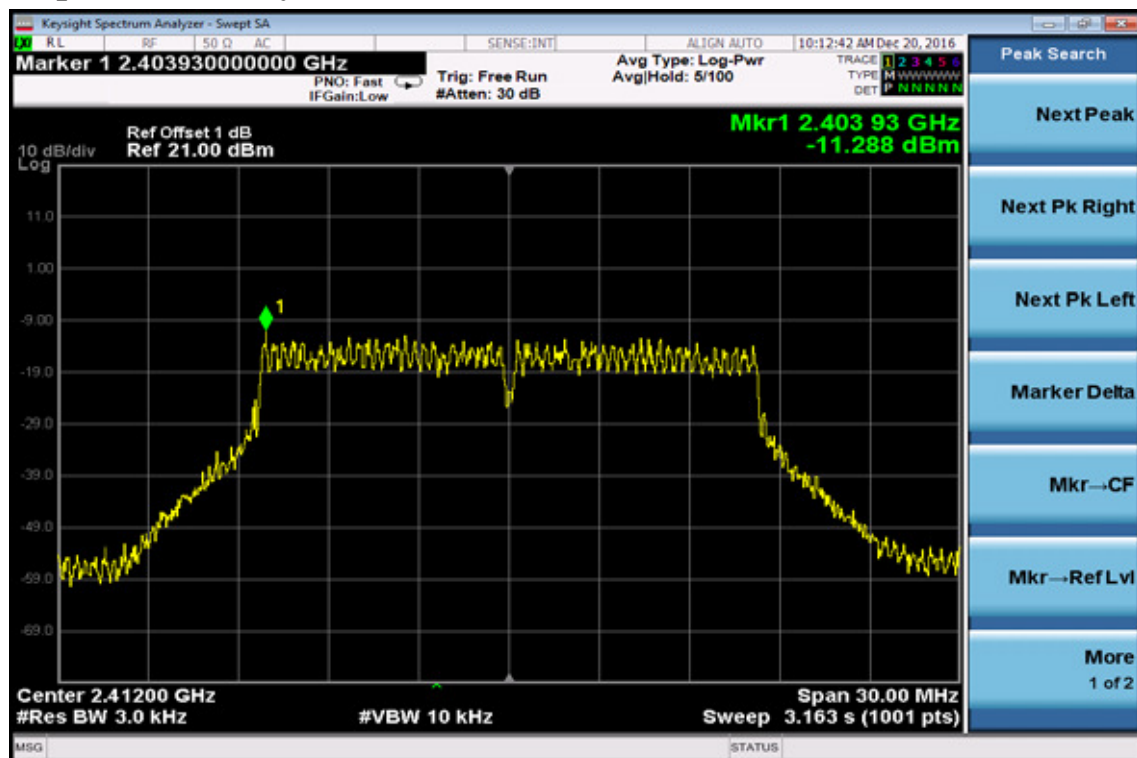


## Power Spectral Density Test Plot (CH-High)

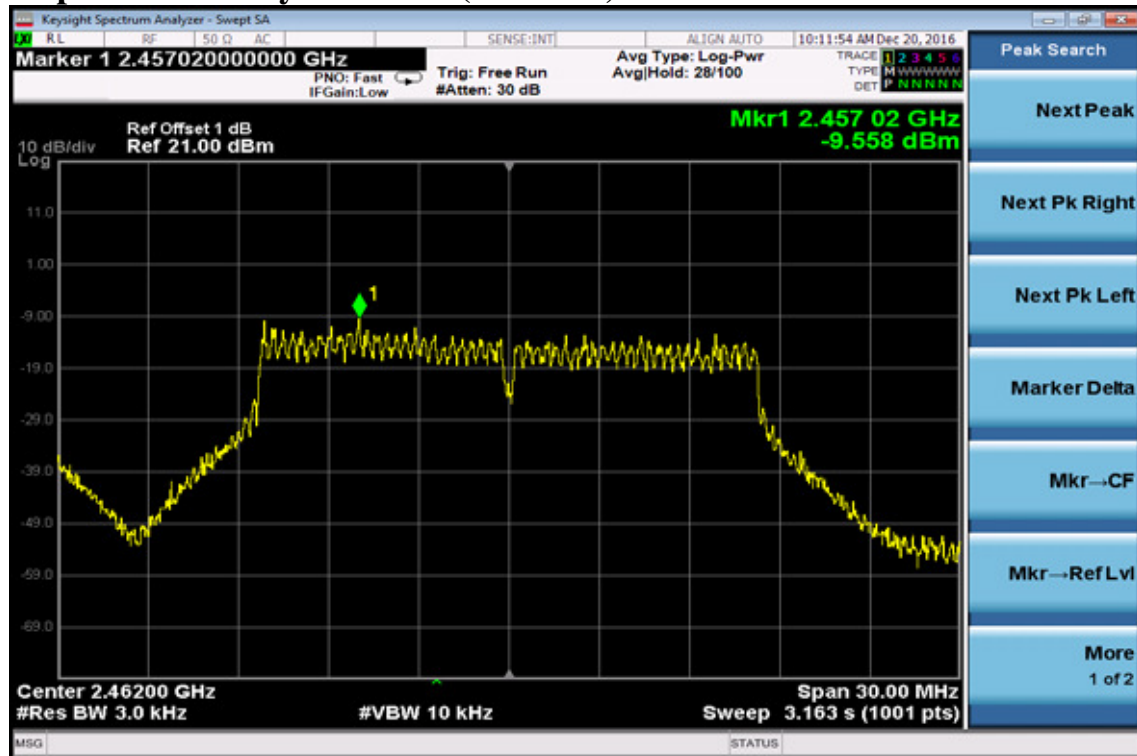


802.11g

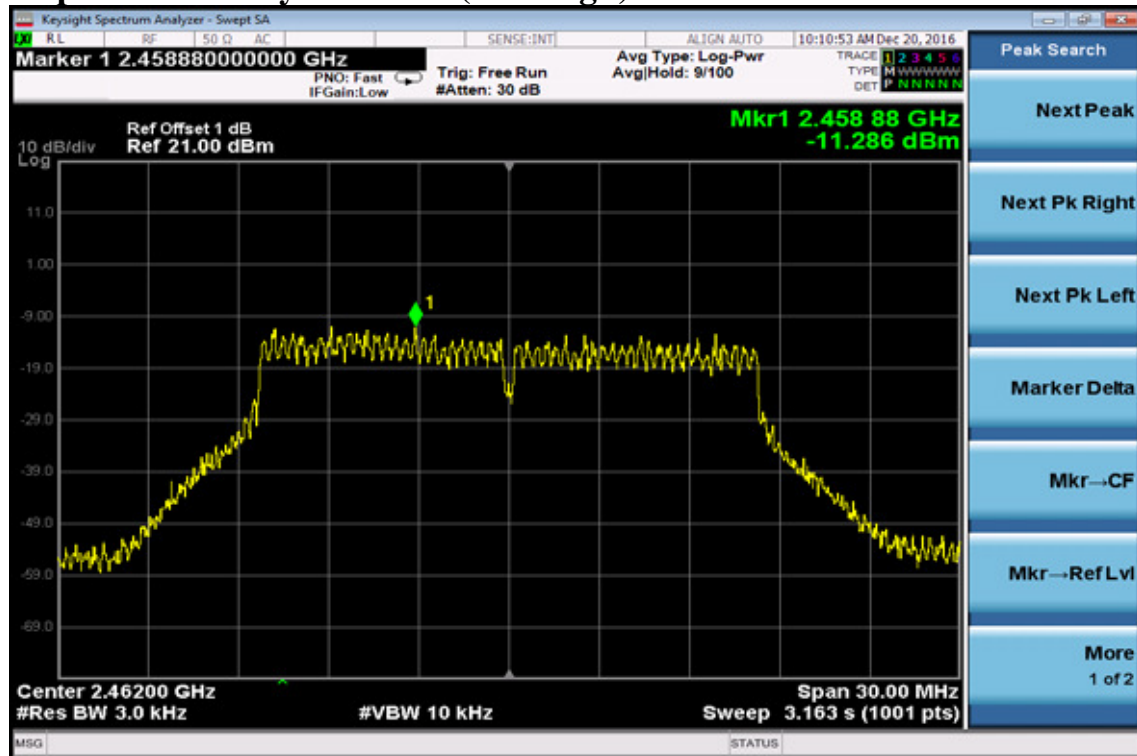
## Power Spectral Density Test Plot (CH-Low)



## Power Spectral Density Test Plot (CH-Mid)

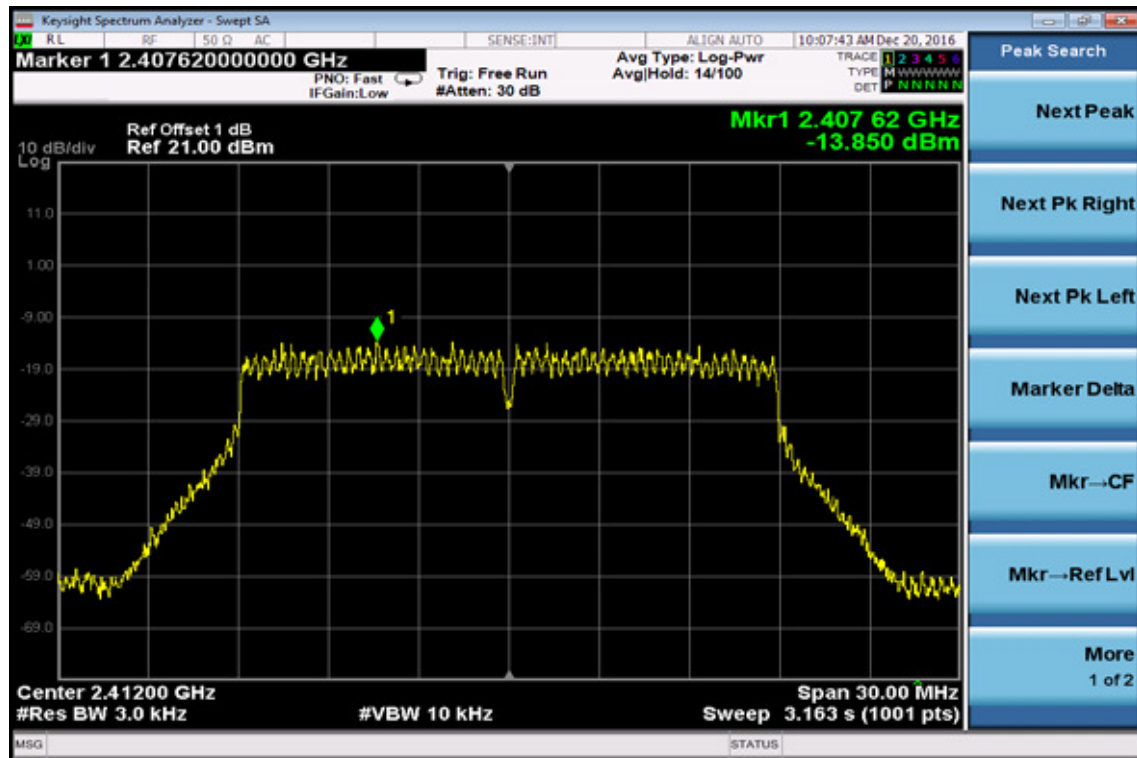


## Power Spectral Density Test Plot (CH-High)

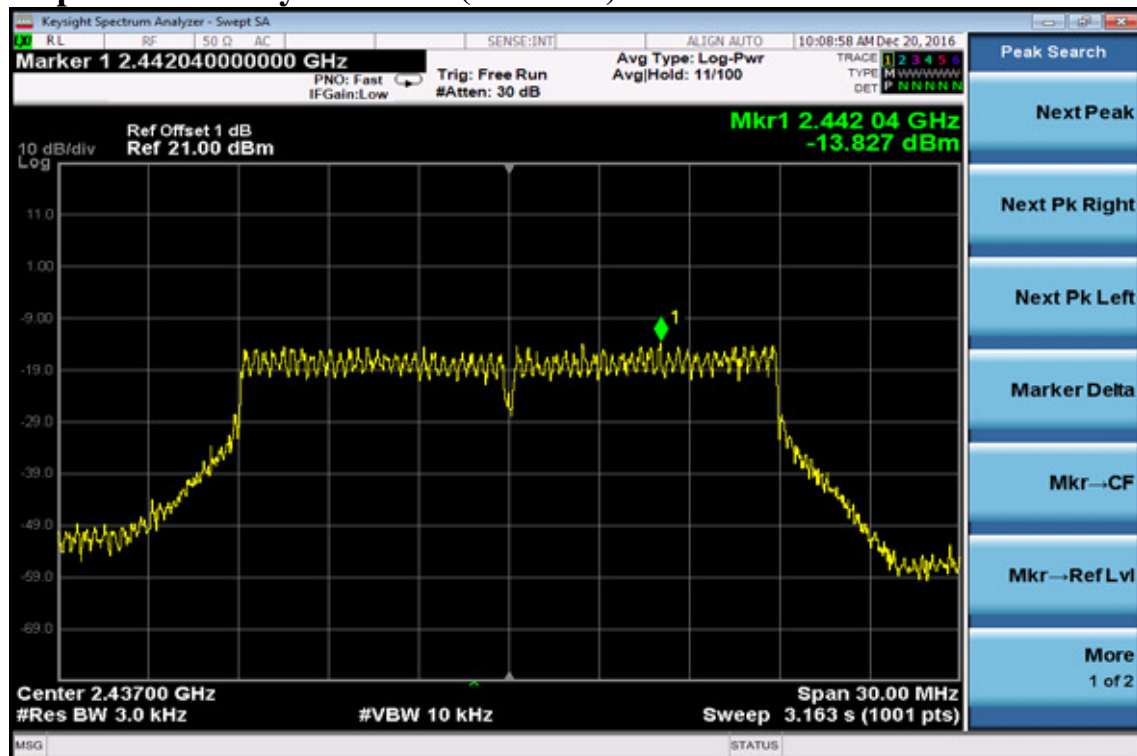


802.11n\_20M

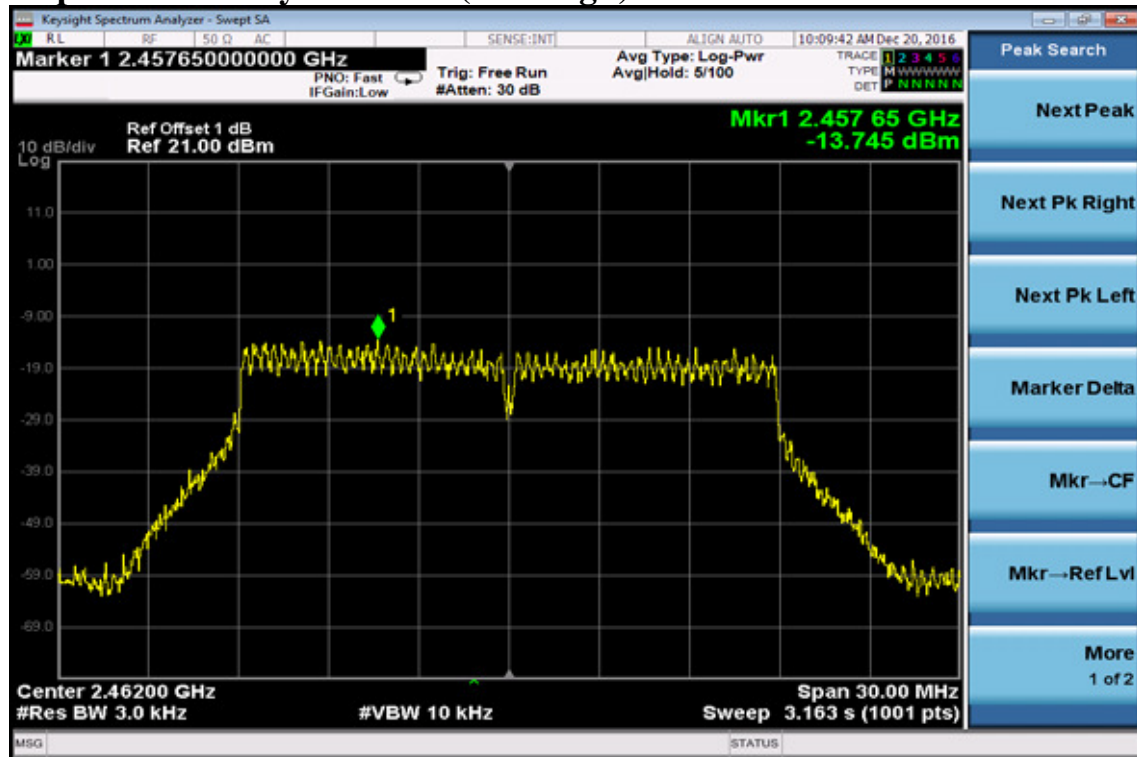
Power Spectral Density Test Plot (CH-Low)



Power Spectral Density Test Plot (CH-Mid)



## Power Spectral Density Test Plot (CH-High)

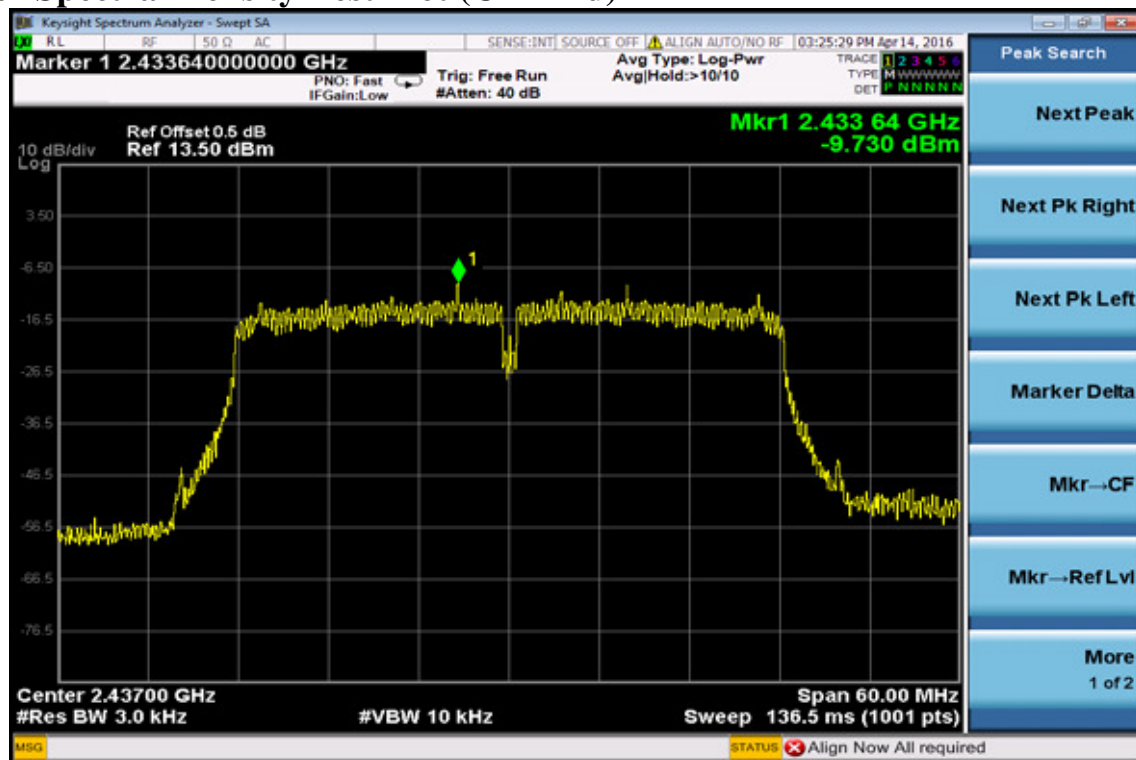


## LE Mode

## Power Spectral Density Test Plot (CH-Low)



## Power Spectral Density Test Plot (CH-Mid)



## Power Spectral Density Test Plot (CH-High)



## **11 ANTENNA REQUIREMENT**

### **11.1 Standard Applicable:**

According to