

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

**Applicant:** MCBP Technologies, LLC  
103 Foulk Road, Suite 202, Wilmington, DE 19803

**Product Name:** FIORANO

**Model No.:** B81AA1xxxx ("x" can be 0 to 9, A to Z, a to z, "/", "-" or blank)

**Model Difference:** For Marketing Purpose

**FCC ID:** 2A09Z-A5232

**Report Number:** ER/2017/C0003

**FCC Rule Part:** §15.247, Cat: DTS

**Issue Date:** Apr. 30, 2018

**Date of Test:** Dec. 01, 2017 ~ Apr. 23, 2018

**Date of EUT Received:** Dec. 01, 2017

### We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Tested By:

*Marcus Tseng*  
\_\_\_\_\_  
Marcus Tseng / Sr. Engineer

Approved By:

*Jim Chang*  
\_\_\_\_\_  
Jim Chang / Manager



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## Revision History

| Report Number | Revision | Description                  | Effected Page | Issue Date    | Revised By |
|---------------|----------|------------------------------|---------------|---------------|------------|
| ER/2017/C0003 | Rev.00   | Initial creation of document | All           | Apr. 30, 2018 | Yuri Tsai  |

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# 1 GENERAL INFORMATION

## 1.1 Product description

### General:

|                   |                                                                   |
|-------------------|-------------------------------------------------------------------|
| Product Name:     | FIORANO                                                           |
| Model No.:        | B81AA1xxxx ("x" can be 0 to 9, A to Z, a to z, "/", "-" or blank) |
| Model Difference: | For Marketing Purpose                                             |
| Power Supply:     | 100-240V AV, 50-60Hz, 1.7A                                        |

### WLAN 2.4GHz:

| Wi-Fi 802.11         | Frequency Range | Channels                                                                                             | Rated Power (dBm) | Modulation Technology |
|----------------------|-----------------|------------------------------------------------------------------------------------------------------|-------------------|-----------------------|
| b                    | 2412-2462       | 11                                                                                                   | 27.53             | DSSS,                 |
| g                    |                 |                                                                                                      | 27.81             | OFDM                  |
| n_HT20               |                 |                                                                                                      | 27.79             |                       |
| Modulation type:     |                 | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM                                      |                   |                       |
| Antenna Designation: |                 | PIFA Antenna, Gain: 1.71dBi (Main), 1.94dBi(Aux)                                                     |                   |                       |
| Transition Rate:     |                 | 802.11 b: 1/2/5.5/11 Mbps<br>802.11 g: 6/9/12/18/24/36/48/54 Mbps<br>802.11 n_20MHz: 6.5 – 144.4Mbps |                   |                       |

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## 1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance v04

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards.

## 1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803

(TAF code 0513)

FCC Registration Numbers are: 509634 / TW0001

## 1.4 Special Accessories

There are no special accessories used while test was conducted.

## 1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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## 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

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum 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 transmitter (EUT) was rotated through three orthogonal axes and 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.

### 2.4 Measurement Results Explanation Example

#### For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

#### Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

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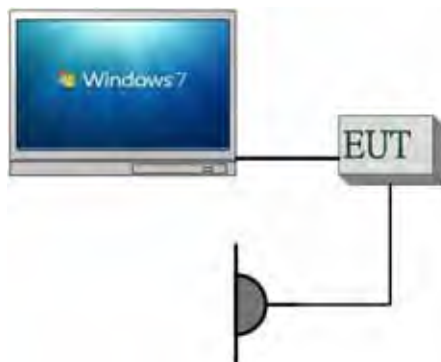
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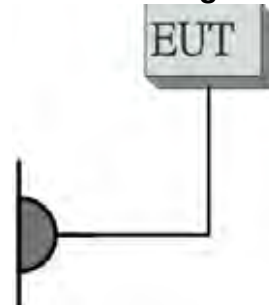
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## 2.5 Configuration of Tested System

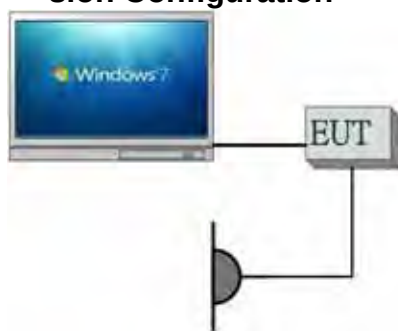
**Fig. 2-1 Radiated Emission Configuration**



**Fig. 2-3 Conducted (AC powerline) Emission Configuration**



**Fig. 2-2 Conducted (Antenna Port) Emission Configuration**



**Table 2-1 Equipment Used in Tested System**

| Item | Equipment          | Mfr/Brand | Model/Type No. | Series No. | Data Cable | Power Cord |
|------|--------------------|-----------|----------------|------------|------------|------------|
| 1.   | WLAN Test Software | N/A       | N/A            | N/A        | N/A        | N/A        |
| 2.   | Notebook           | Lenovo    | L412           | LR-957X7   | Shielded   | Unshielded |

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### 3 SUMMARY OF TEST RESULTS

| FCC Rules / IC Rules  | Description Of Test                       | Result    |
|-----------------------|-------------------------------------------|-----------|
| §15.207(a)            | AC Power Line Conducted Emission          | Compliant |
| §15.247(b) (3)        | Peak Output Power                         | Compliant |
| §15.247(a)(2)         | 6dB & 99% Emission Bandwidth              | Compliant |
| §15.247(d)            | Conducted Band Edge and Spurious Emission | Compliant |
| §15.247(d)            | Radiated Band Edge and Spurious Emission  | Compliant |
| §15.247(e)            | Power Spectral Density                    | Compliant |
| §15.203<br>§15.247(b) | Antenna Requirement                       | Compliant |

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## 4 DESCRIPTION OF TEST MODES

### 4.1 Operated in 2400 ~ 2483.5MHz Band

13 channels are provided for 802.11b, 802.11g and 802.11n HT20

| CHANNEL | FREQUENCY | CHANNEL | FREQUENCY |
|---------|-----------|---------|-----------|
| 1       | 2412 MHz  | 8       | 2447 MHz  |
| 2       | 2417 MHz  | 9       | 2452 MHz  |
| 3       | 2422 MHz  | 10      | 2457 MHz  |
| 4       | 2427 MHz  | 11      | 2462 MHz  |
| 5       | 2432 MHz  |         |           |
| 6       | 2437 MHz  |         |           |
| 7       | 2442 MHz  |         |           |

### 4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
3. Investigation has been done on all the possible configurations for searching the worst case.
4. The screen of the EUT can be rotated at 0 degree and 90 degree, when the screen be placed at 0 degree (upright), it is defined as "Portrait Mode" or "H-Plane" and when it be placed at 90 degree ( horizontal ), it is defined as "Landscape Mode" or "E2-Plane"

### RADIATED EMISSION TEST:

| MODE                                        | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) | ANTENNA PORT |
|---------------------------------------------|-------------------|----------------|------------|------------------|--------------|
| <b>RADIATED EMISSION TEST (BELOW 1 GHz)</b> |                   |                |            |                  |              |
| 802.11g                                     | 1 to 11           | 1,6,11         | OFDM       | 54               | 2TX          |
| <b>RADIATED EMISSION TEST (ABOVE 1 GHz)</b> |                   |                |            |                  |              |
| 802.11b                                     | 1 to 11           | 1,6,11         | DSSS       | 11               | 2TX          |
| 802.11g                                     | 1 to 11           | 1,6,11         | OFDM       | 54               | 2TX          |
| 802.11n (HT20)                              | 1 to 11           | 1,6,11         | OFDM       | MCS 15           | MIMO         |

#### Note:

The field strength of radiation emission was measured as EUT Portrait Mode and Landscap Mode for 802.11b/g/n WLAN Transmitter for channel Low, Mid and High, the worst case Lanscape was reported.

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# ANTENNA PORT CONDUCTED MEASUREMENT:

| CONDUCTED TEST |                   |                |            |                  |              |
|----------------|-------------------|----------------|------------|------------------|--------------|
| MODE           | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) | ANTENNA PORT |
| 802.11b        | 1 to 11           | 1,6,11         | DSSS       | 1                | 2TX          |
| 802.11g        | 1 to 11           | 1,6,11         | OFDM       | 6                | 2TX          |
| 802.11n (HT20) | 1 to 11           | 1,6,11         | OFDM       | MCS 8            | MIMO         |

## Directional gain

The Tx transmission to construct MIMO operation is cyclic delay diversity, and the following deduction to obtain the array gain of MIMO operation is based on the approach given by KDB 662911 D01.

Gain that is combined with different magnitude of two antennas:

- (i) If transmit signals are *correlated*, then

Directional gain =  $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{\text{ANT}}]$  dBi [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

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## 5 MEASUREMENT UNCERTAINTY

| Test Items                                | Uncertainty                 |
|-------------------------------------------|-----------------------------|
| AC Power Line Conducted Emission          | +/- 2.586 dB                |
| Peak Output Power                         | +/- 0.84 dB                 |
| 6dB Bandwidth                             | +/- 51.33 Hz                |
| 100 KHz Bandwidth Of Frequency Band Edges | +/- 0.84 dB                 |
| Peak Power Density                        | +/- 1.3 dB                  |
| Temperature                               | +/- 0.65 °C                 |
| Humidity                                  | +/- 4.6 %                   |
| DC / AC Power Source                      | DC= +/- 0.13%, AC= +/- 0.2% |

Radiated Spurious Emission:

|                                                              |                            |
|--------------------------------------------------------------|----------------------------|
| Measurement uncertainty<br>(Polarization : <b>Vertical</b> ) | 9kHz-30MHz: +/-2.87dB      |
|                                                              | 30MHz - 180MHz: +/- 3.37dB |
|                                                              | 180MHz -417MHz: +/- 3.19dB |
|                                                              | 0.417GHz-1GHz: +/- 3.19dB  |
|                                                              | 1GHz - 18GHz: +/- 4.04dB   |
|                                                              | 18GHz - 40GHz: +/- 4.04dB  |

|                                                                |                            |
|----------------------------------------------------------------|----------------------------|
| Measurement uncertainty<br>(Polarization : <b>Horizontal</b> ) | 9kHz-30MHz: +/-2.87dB      |
|                                                                | 30MHz - 167MHz: +/- 4.22dB |
|                                                                | 167MHz -500MHz: +/- 3.44dB |
|                                                                | 0.5GHz-1GHz: +/- 3.39dB    |
|                                                                | 1GHz - 18GHz: +/- 4.08dB   |
|                                                                | 18GHz - 40GHz: +/- 4.08dB  |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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## 6 CONDUCTED EMISSION TEST

### 6.1 Standard Applicable

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

| Frequency range<br>MHz                                                                                                                                                       | Limits<br>dB(μV) |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|
|                                                                                                                                                                              | 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<br>1.The lower limit shall apply at the transition frequencies<br>2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. |                  |          |

### 6.2 Measurement Equipment Used

| Conducted Emission Test Site |              |              |               |            |            |
|------------------------------|--------------|--------------|---------------|------------|------------|
| EQUIPMENT TYPE               | MFR          | MODEL NUMBER | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| EMI Test Receiver            | R&S          | ESCI7        | 100760        | 2017/06/06 | 2018/06/05 |
| LISN                         | SCHWARZ-BECK | NSLK 8127    | 8127-649      | 2017/05/22 | 2018/05/21 |
| Coaxial Cables               | N/A          | WK CE Cable  | N/A           | 2017/01/03 | 2018/01/02 |
| Coaxial Cables               | N/A          | WK CE Cable  | N/A           | 2018/01/02 | 2019/01/01 |

### 6.3 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
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.

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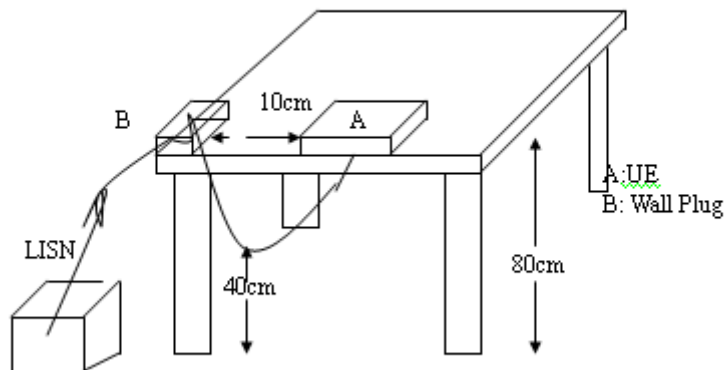
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## 6.4 Test SET-UP (Block Diagram of Configuration)



## 6.5 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 phases of power being supplied by given UE are completed

## 6.6 Measurement Result

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

Note2: The \* reveals the worst-case results that closet to the limit

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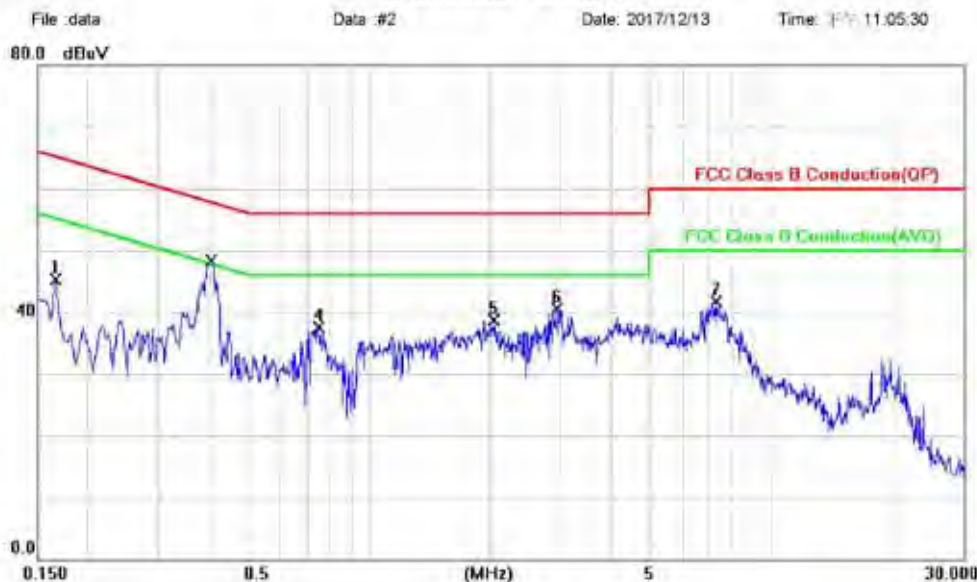
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## AC POWER LINE CONDUCTED EMISSION TEST DATA

|                                   |                     |                    |
|-----------------------------------|---------------------|--------------------|
| Site: Conduction Room             | Phase: L1           | Temperature: 20 °C |
| Limit: FCC Class B Conduction(QP) | Power: AC 120V/60Hz | Humidity: 58 %     |
| Mode: Operation                   |                     |                    |
| Note:                             |                     |                    |

## Conducted Emission



| No. | Mk. | Freq.  | Reading Level | Correct Factor | Measurement | Limit | Over   | Detector | Comment |
|-----|-----|--------|---------------|----------------|-------------|-------|--------|----------|---------|
|     |     | MHz    | dBuV          | dB             | dBuV        | dBuV  | dB     |          |         |
| 1   |     | 0.1660 | 45.33         | 0.07           | 45.40       | 65.16 | -19.76 | peak     |         |
| 2   |     | 0.4060 | 47.80         | 0.08           | 47.88       | 57.73 | -9.85  | QP       |         |
| 3 * |     | 0.4060 | 40.60         | 0.08           | 40.68       | 47.73 | -7.05  | AVG      |         |
| 4   |     | 0.7500 | 37.33         | 0.09           | 37.42       | 56.00 | -18.58 | peak     |         |
| 5   |     | 2.0460 | 38.53         | 0.11           | 38.64       | 56.00 | -17.36 | peak     |         |
| 6   |     | 2.9460 | 40.33         | 0.15           | 40.48       | 56.00 | -15.52 | peak     |         |
| 7   |     | 7.2700 | 41.39         | 0.30           | 41.69       | 60.00 | -18.31 | peak     |         |

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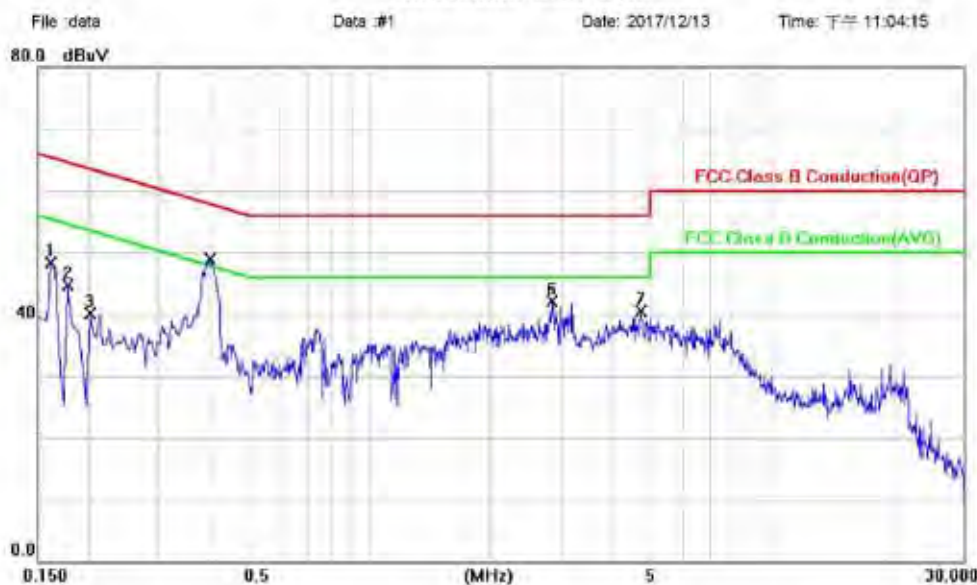
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Site: Conduction Room  
 Limit: FCC Class B Conduction(QP)  
 Mode: Operation  
 Note:

Phase: N  
 Power: AC 120V/60Hz  
 Temperature: 20 °C  
 Humidity: 58 %

## Conducted Emission



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|---------|
| 1   |     | 0.1620       | 48.21                    | 0.07                    | 48.28                    | 65.36         | -17.08     | peak     |         |
| 2   |     | 0.1780       | 44.58                    | 0.07                    | 44.65                    | 64.58         | -19.93     | peak     |         |
| 3   |     | 0.2020       | 40.09                    | 0.07                    | 40.16                    | 63.53         | -23.37     | peak     |         |
| 4   |     | 0.4020       | 48.20                    | 0.08                    | 48.28                    | 57.81         | -9.53      | QP       |         |
| 5 * |     | 0.4020       | 41.50                    | 0.08                    | 41.58                    | 47.81         | -6.23      | AVG      |         |
| 6   |     | 2.8420       | 41.87                    | 0.15                    | 42.02                    | 56.00         | -13.98     | peak     |         |
| 7   |     | 4.7220       | 40.27                    | 0.24                    | 40.51                    | 56.00         | -15.49     | peak     |         |

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## 7 DUTY CYCLE OF TEST SIGNAL

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

### Formula:

Duty Cycle =  $T_{on} / (T_{on} + T_{off})$

### Measurement Procedure:

1. Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

### Duty Cycle:

|            | Duty Cycle (%) | Duty Factor (dB) | 1/T (kHz) | VBW setting (kHz) |
|------------|----------------|------------------|-----------|-------------------|
| 802.11b    | 91.89          | 0.37             | 0.77      | 1.00              |
| 802.11g    | 91.46          | 0.39             | 0.83      | 1.00              |
| 802.11n_20 | 89.22          | 0.50             | 0.97      | 1.00              |

$b = 91.89\%$ ,  $g = 91.46\%$ ,  $n_{ht\_20} = 89.22\%$

Duty Cycle Factor:  $10 * \log(1/0.9189) = 0.37$

Duty Cycle Factor:  $10 * \log(1/0.9146) = 0.39$

Duty Cycle Factor:  $10 * \log(1/0.8922) = 0.5$

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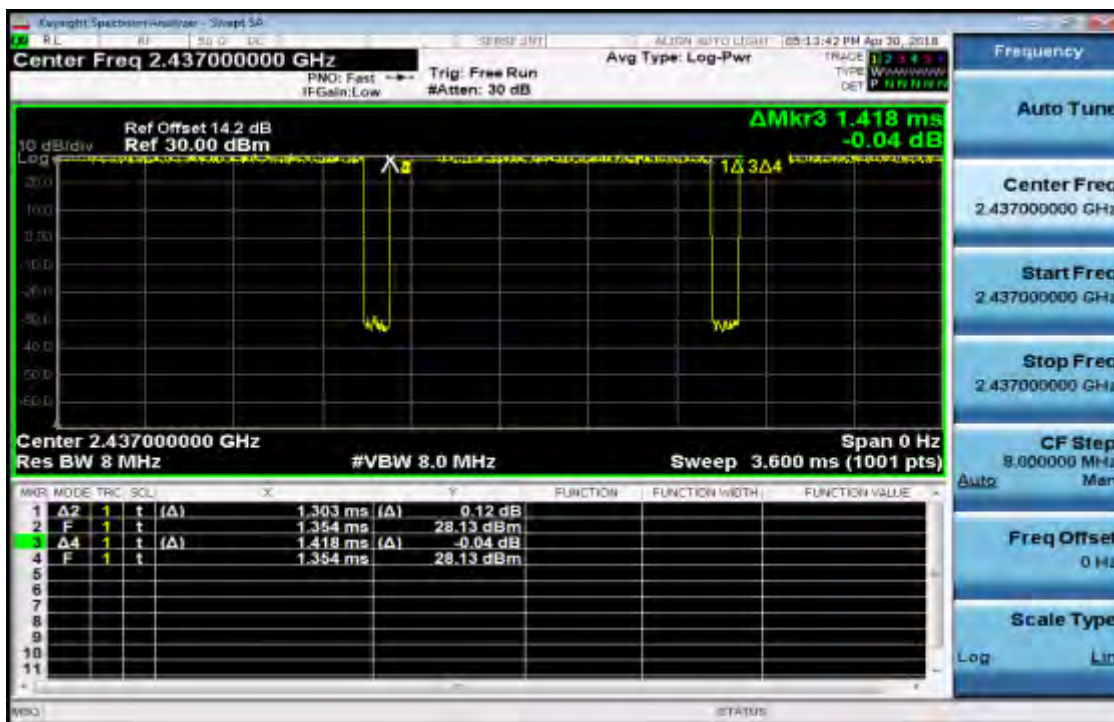
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## 7.1 DUTY CYCLE TEST SIGNAL Measurement Result 802.11 b



802.11 g



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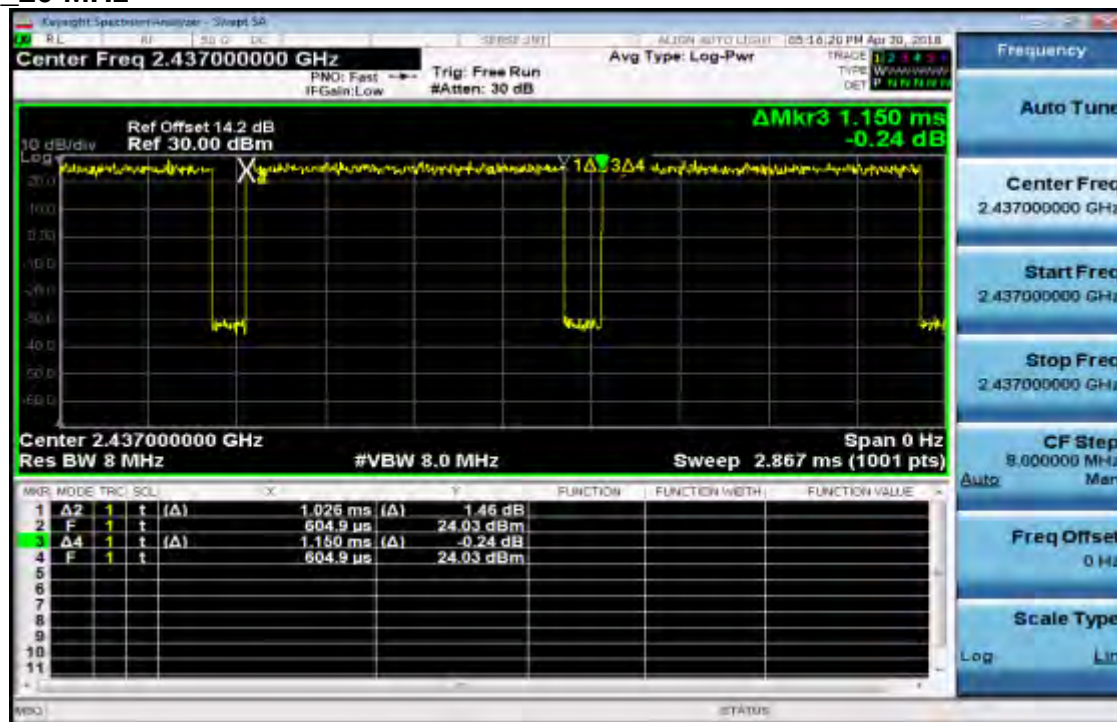
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802.11 n 20 MHz



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## 8 PEAK OUTPUT POWER MEASUREMENT

### 8.1 Standard Applicable

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

If the transmitting antenna of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

**Note:**

|                    |          |
|--------------------|----------|
| Main Antenna Gain: | 1.71 dBi |
| Aux1 Antenna Gain: | 1.94 dBi |
| Limit:             | 30 dBm   |

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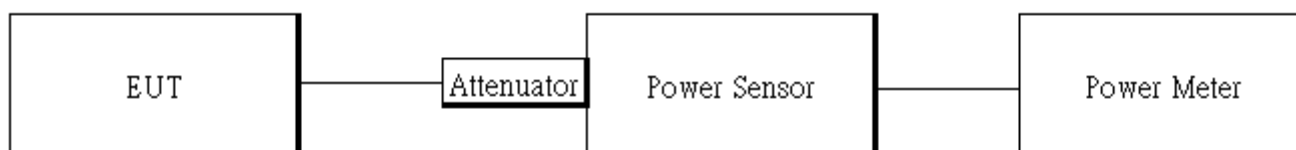
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## 8.2 Measurement Equipment Used

| Conducted Emission Test Site |              |              |               |            |            |
|------------------------------|--------------|--------------|---------------|------------|------------|
| EQUIPMENT TYPE               | MFR          | MODEL NUMBER | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Power Meter                  | Anritsu      | ML2496A      | 1242004       | 2017/10/16 | 2018/10/15 |
| Attenuator                   | Mini-Circuit | BW-S10W2+    | 2             | 2018/01/02 | 2019/01/01 |
| Notebook                     | Lenovo       | L430         | R9-X11BG      | N/A        | N/A        |

## 8.3 Test Set-up

Power Meter:



## 8.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.

### Power Meter:

It is used as the auxiliary test equipment to conduct the output power measurement.

4. Record the max. Reading as observed from Spectrum or Power Meter.

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## 8.5 Measurement Result

| 802.11b_2TX |             |           |                         |       |                                                        |                                                       |                    |        |
|-------------|-------------|-----------|-------------------------|-------|--------------------------------------------------------|-------------------------------------------------------|--------------------|--------|
| CH          | Freq. (MHz) | Data Rate | Peak Output Power (dBm) |       | Total Peak Output Power (dBm)                          | Total Peak Output Power (mW)                          | Limit              | RESULT |
|             |             |           | CH 0                    | CH 1  |                                                        |                                                       |                    |        |
| 1           | 2412        | 1         | 21.89                   | 21.64 | 24.78                                                  | 300.41                                                | 1 Watt = 30.00 dBm | PASS   |
| 6           | 2437        | 1         | 24.40                   | 23.92 | 27.18                                                  | 522.03                                                | 1 Watt = 30.00 dBm | PASS   |
| 11          | 2462        | 1         | 24.98                   | 25.06 | <b>28.03</b>                                           | 635.40                                                | 1 Watt = 30.00 dBm | PASS   |
| 802.11b_2TX |             |           |                         |       |                                                        |                                                       |                    |        |
| CH          | Freq. (MHz) | Data Rate | Avg. Output Power (dBm) |       | Max. Avg. Output include tune up tolerance Power (dBm) | Max. Avg. Output include tune up tolerance Power (mW) | Limit              | RESULT |
|             |             |           | CH 0                    | CH 1  |                                                        |                                                       |                    |        |
| 1           | 2412        | 1         | 20.70                   | 20.06 | 23.45                                                  | 221.09                                                | 1 Watt = 30.00 dBm | PASS   |
| 6           | 2437        | 1         | 22.35                   | 21.92 | <b>25.19</b>                                           | 330.69                                                | 1 Watt = 30.00 dBm | PASS   |
| 11          | 2462        | 1         | 21.85                   | 21.67 | 24.81                                                  | 303.03                                                | 1 Watt = 30.00 dBm | PASS   |
| 802.11g_2TX |             |           |                         |       |                                                        |                                                       |                    |        |
| CH          | Freq. (MHz) | Data Rate | Peak Output Power (dBm) |       | Total Peak Output Power (dBm)                          | Total Peak Output Power (mW)                          | Limit              | RESULT |
|             |             |           | CH 0                    | CH 1  |                                                        |                                                       |                    |        |
| 1           | 2412        | 6         | 18.28                   | 18.26 | 21.28                                                  | 134.29                                                | 1 Watt = 30.00 dBm | PASS   |
| 6           | 2437        | 6         | 23.78                   | 23.64 | <b>26.72</b>                                           | 469.99                                                | 1 Watt = 30.00 dBm | PASS   |
| 11          | 2462        | 6         | 19.29                   | 19.12 | 22.22                                                  | 166.58                                                | 1 Watt = 30.00 dBm | PASS   |
| 802.11g_2TX |             |           |                         |       |                                                        |                                                       |                    |        |
| CH          | Freq. (MHz) | Data Rate | Avg. Output Power (dBm) |       | Max. Avg. Output include tune up tolerance Power (dBm) | Max. Avg. Output include tune up tolerance Power (mW) | Limit              | RESULT |
|             |             |           | CH 0                    | CH 1  |                                                        |                                                       |                    |        |
| 1           | 2412        | 6         | 14.33                   | 14.04 | 17.46                                                  | 55.67                                                 | 1 Watt = 30.00 dBm | PASS   |
| 6           | 2437        | 6         | 18.61                   | 18.52 | <b>21.83</b>                                           | 152.55                                                | 1 Watt = 30.00 dBm | PASS   |
| 11          | 2462        | 6         | 14.93                   | 14.76 | 18.11                                                  | 64.78                                                 | 1 Watt = 30.00 dBm | PASS   |

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## 802.11n\_HT20M MIMO

| CH | Freq.<br>(MHz) | Data<br>Rate | Peak Output<br>Power<br>(dBm) |       | Total Peak<br>Output Power<br>(dBm) | Total Peak<br>Output Power<br>(mW) | Limit              | RESULT |
|----|----------------|--------------|-------------------------------|-------|-------------------------------------|------------------------------------|--------------------|--------|
|    |                |              | CH 0                          | CH 1  |                                     |                                    |                    |        |
| 1  | 2412           | MCS8         | 18.88                         | 18.93 | 21.92                               | 155.43                             | 1 Watt = 30.00 dBm | PASS   |
| 6  | 2437           | MCS8         | 24.17                         | 24.05 | <b>27.12</b>                        | 515.31                             | 1 Watt = 30.00 dBm | PASS   |
| 11 | 2462           | MCS8         | 19.27                         | 19.24 | 22.27                               | 168.47                             | 1 Watt = 30.00 dBm | PASS   |

## 802.11n\_HT20M MIMO

| CH | Freq.<br>(MHz) | Data<br>Rate | Avg. Output<br>Power<br>(dBm) |       | Max. Avg. Output<br>include tune up<br>tolerance Power<br>(dBm) | Max. Avg. Output<br>include tune up<br>tolerance Power<br>(mW) | Limit              | RESULT |
|----|----------------|--------------|-------------------------------|-------|-----------------------------------------------------------------|----------------------------------------------------------------|--------------------|--------|
|    |                |              | CH 0                          | CH 1  |                                                                 |                                                                |                    |        |
| 1  | 2412           | MCS8         | 13.70                         | 14.09 | 17.30                                                           | 53.68                                                          | 1 Watt = 30.00 dBm | PASS   |
| 6  | 2437           | MCS8         | 18.81                         | 18.75 | <b>22.18</b>                                                    | 165.14                                                         | 1 Watt = 30.00 dBm | PASS   |
| 11 | 2462           | MCS8         | 13.88                         | 13.90 | 17.29                                                           | 53.56                                                          | 1 Watt = 30.00 dBm | PASS   |

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| 802.11b_2TX |             |           |                         |       |                               |                              |                    |        |
|-------------|-------------|-----------|-------------------------|-------|-------------------------------|------------------------------|--------------------|--------|
| CH          | Freq. (MHz) | Data Rate | Peak Output Power (dBm) |       | Total Peak Output Power (dBm) | Total Peak Output Power (mW) | Limit              | RESULT |
|             |             |           | CH 0                    | CH 1  |                               |                              |                    |        |
| 1           | 2412        | 11        | 23.16                   | 23.23 | 26.21                         | 417.39                       | 1 Watt = 30.00 dBm | PASS   |
| 6           | 2437        | 11        | 24.52                   | 24.50 | 27.52                         | 564.98                       | 1 Watt = 30.00 dBm | PASS   |
| 11          | 2462        | 11        | 24.51                   | 24.53 | <b>27.53</b>                  | 566.28                       | 1 Watt = 30.00 dBm | PASS   |

| 802.11b_2TX |             |           |                         |       |                                                        |                                                       |                    |        |
|-------------|-------------|-----------|-------------------------|-------|--------------------------------------------------------|-------------------------------------------------------|--------------------|--------|
| CH          | Freq. (MHz) | Data Rate | Avg. Output Power (dBm) |       | Max. Avg. Output include tune up tolerance Power (dBm) | Max. Avg. Output include tune up tolerance Power (mW) | Limit              | RESULT |
|             |             |           | CH 0                    | CH 1  |                                                        |                                                       |                    |        |
| 1           | 2412        | 11        | 20.13                   | 19.89 | 23.37                                                  | 217.24                                                | 1 Watt = 30.00 dBm | PASS   |
| 6           | 2437        | 11        | 21.64                   | 21.53 | <b>24.94</b>                                           | 312.12                                                | 1 Watt = 30.00 dBm | PASS   |
| 11          | 2462        | 11        | 21.30                   | 21.43 | 24.72                                                  | 296.71                                                | 1 Watt = 30.00 dBm | PASS   |

| 802.11g_2TX |             |           |                         |       |                               |                              |                    |        |
|-------------|-------------|-----------|-------------------------|-------|-------------------------------|------------------------------|--------------------|--------|
| CH          | Freq. (MHz) | Data Rate | Peak Output Power (dBm) |       | Total Peak Output Power (dBm) | Total Peak Output Power (mW) | Limit              | RESULT |
|             |             |           | CH 0                    | CH 1  |                               |                              |                    |        |
| 1           | 2412        | 54        | 24.52                   | 24.36 | 27.45                         | 556.04                       | 1 Watt = 30.00 dBm | PASS   |
| 6           | 2437        | 54        | 24.81                   | 24.79 | <b>27.81</b>                  | 603.99                       | 1 Watt = 30.00 dBm | PASS   |
| 11          | 2462        | 54        | 23.23                   | 24.56 | 26.96                         | 496.14                       | 1 Watt = 30.00 dBm | PASS   |

| 802.11g_2TX |             |           |                         |       |                                                        |                                                       |                    |        |
|-------------|-------------|-----------|-------------------------|-------|--------------------------------------------------------|-------------------------------------------------------|--------------------|--------|
| CH          | Freq. (MHz) | Data Rate | Avg. Output Power (dBm) |       | Max. Avg. Output include tune up tolerance Power (dBm) | Max. Avg. Output include tune up tolerance Power (mW) | Limit              | RESULT |
|             |             |           | CH 0                    | CH 1  |                                                        |                                                       |                    |        |
| 1           | 2412        | 54        | 14.15                   | 13.90 | 17.43                                                  | 55.30                                                 | 1 Watt = 30.00 dBm | PASS   |
| 6           | 2437        | 54        | 18.45                   | 18.35 | <b>21.80</b>                                           | 151.40                                                | 1 Watt = 30.00 dBm | PASS   |
| 11          | 2462        | 54        | 14.83                   | 14.54 | 18.09                                                  | 64.39                                                 | 1 Watt = 30.00 dBm | PASS   |

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## 802.11n\_HT20M MIMO

| CH | Freq.<br>(MHz) | Data<br>Rate | Peak Output<br>Power<br>(dBm) |       | Total Peak<br>Output Power<br>(dBm) | Total Peak<br>Output Power<br>(mW) | Limit              | RESULT |
|----|----------------|--------------|-------------------------------|-------|-------------------------------------|------------------------------------|--------------------|--------|
|    |                |              | CH 0                          | CH 1  |                                     |                                    |                    |        |
| 1  | 2412           | MCS15        | 24.44                         | 24.38 | 27.42                               | 552.13                             | 1 Watt = 30.00 dBm | PASS   |
| 6  | 2437           | MCS15        | 24.78                         | 24.77 | 27.79                               | 600.52                             | 1 Watt = 30.00 dBm | PASS   |
| 11 | 2462           | MCS15        | 24.30                         | 24.15 | 27.24                               | 529.17                             | 1 Watt = 30.00 dBm | PASS   |

## 802.11n\_HT20M MIMO

| CH | Freq.<br>(MHz) | Data<br>Rate | Avg. Output<br>Power<br>(dBm) |       | Max. Avg. Output<br>include tune up<br>tolerance Power<br>(dBm) | Max. Avg. Output<br>include tune up<br>tolerance Power<br>(mW) | Limit              | RESULT |
|----|----------------|--------------|-------------------------------|-------|-----------------------------------------------------------------|----------------------------------------------------------------|--------------------|--------|
|    |                |              | CH 0                          | CH 1  |                                                                 |                                                                |                    |        |
| 1  | 2412           | MCS15        | 13.81                         | 13.44 | 17.13                                                           | 51.66                                                          | 1 Watt = 30.00 dBm | PASS   |
| 6  | 2437           | MCS15        | 18.69                         | 18.61 | 22.15                                                           | 164.15                                                         | 1 Watt = 30.00 dBm | PASS   |
| 11 | 2462           | MCS15        | 13.71                         | 13.73 | 17.22                                                           | 52.75                                                          | 1 Watt = 30.00 dBm | PASS   |

Offset: 11.20db

**\* Note: The duty cycle factor is compensated to obtain the maximum value of measurement in average.**

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## 9 6DB BANDWIDTH MEASUREMENT

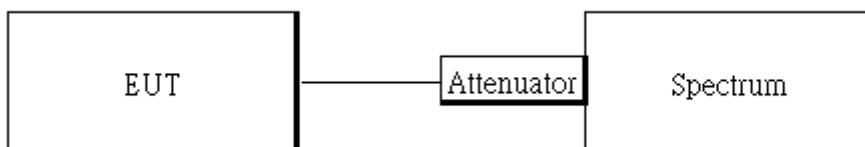
### 9.1 Standard Applicable

The minimum 6 dB bandwidth shall be at least 500 kHz.

### 9.2 Measurement Equipment Used

| Conducted Emission Test Site |              |              |               |            |            |
|------------------------------|--------------|--------------|---------------|------------|------------|
| EQUIPMENT TYPE               | MFR          | MODEL NUMBER | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| EXA Spectrum Analyzer        | Agilent      | N9010A       | MY54200716    | 2017/10/16 | 2018/10/15 |
| Attenuator                   | Mini-Circuit | BW-S10W2+    | 2             | 2017/01/03 | 2018/01/02 |
| Attenuator                   | Mini-Circuit | BW-S10W2+    | 2             | 2018/01/02 | 2019/01/01 |
| Notebook                     | Lenovo       | L430         | R9-X11BG      | N/A        | N/A        |

### 9.3 Test Set-up



### 9.4 Measurement Procedure

- Place the EUT on the table and set it in transmitting mode.
- The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
- Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- For 6dB Bandwidth:  
Set the spectrum analyzer as RBW = 100 kHz, VBW = 3\*RBW, Span = 30M/50MHz, Detector=peak, Sweep=auto.
- Mark the peak frequency and –6dB (upper and lower) frequency.
- For 99% Bandwidth:  
Set the spectrum analyzer as RBW=1%, VBW = 3\*RBW, Span = 30M/50MHz, Detector=Sample, Sweep=auto.
- Turn on the 99% bandwidth function, max reading.
- Repeat above procedures until all frequency of interest measured was complete.

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## 9.5 Measurement Result

802.11b Main

| Freq. (MHz) | 6dB BW (kHz) | Limit (kHz) | Result |
|-------------|--------------|-------------|--------|
| 2412        | <b>9095</b>  | > 500       | PASS   |
| 2437        | 9088         | > 500       | PASS   |
| 2462        | 9060         | > 500       | PASS   |

802.11b Aux1

| Freq. (MHz) | 6dB BW (kHz) | Limit (kHz) | Result |
|-------------|--------------|-------------|--------|
| 2412        | <b>9094</b>  | > 500       | PASS   |
| 2437        | 9065         | > 500       | PASS   |
| 2462        | 9081         | > 500       | PASS   |

802.11g Main

| Freq. (MHz) | 6dB BW (kHz) | Limit (kHz) | Result |
|-------------|--------------|-------------|--------|
| 2412        | <b>15390</b> | > 500       | PASS   |
| 2437        | <b>15732</b> | > 500       | PASS   |
| 2462        | 15170        | > 500       | PASS   |

802.11g Aux1

| Freq. (MHz) | 6dB BW (kHz) | Limit (kHz) | Result |
|-------------|--------------|-------------|--------|
| 2412        | <b>15665</b> | > 500       | PASS   |
| 2437        | 15340        | > 500       | PASS   |
| 2462        | 15178        | > 500       | PASS   |

802.11\_n HT20 Main

| Freq. (MHz) | 6dB BW (kHz) | Limit (kHz) | Result |
|-------------|--------------|-------------|--------|
| 2412        | <b>15975</b> | > 500       | PASS   |
| 2437        | 15744        | > 500       | PASS   |
| 2462        | 15954        | > 500       | PASS   |

802.11\_n HT20 Aux1

| Freq. (MHz) | 6dB BW (kHz) | Limit (kHz) | Result |
|-------------|--------------|-------------|--------|
| 2412        | <b>16571</b> | > 500       | PASS   |
| 2437        | 15749        | > 500       | PASS   |
| 2462        | 15470        | > 500       | PASS   |

\*Refer to next page for plots

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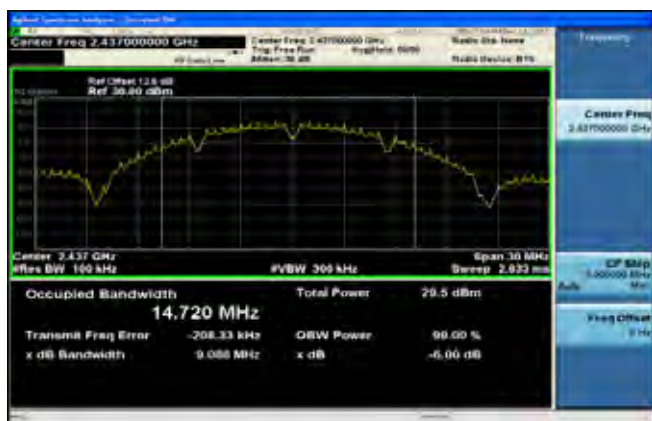
802.11b (Main) CH-Low



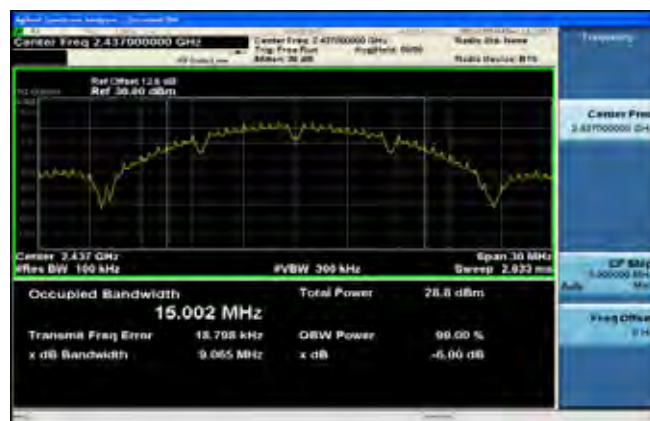
802.11b (AUX1) CH-Low



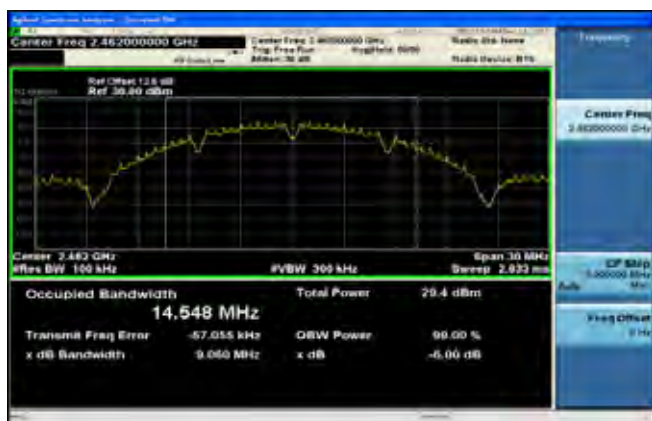
802.11b (Main) CH-Mid



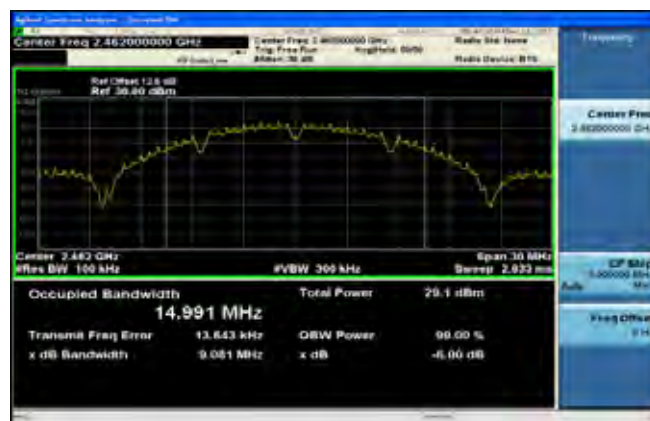
802.11b (AUX1) CH-Mid



802.11b (Main) CH-High



802.11b (AUX1) CH-High



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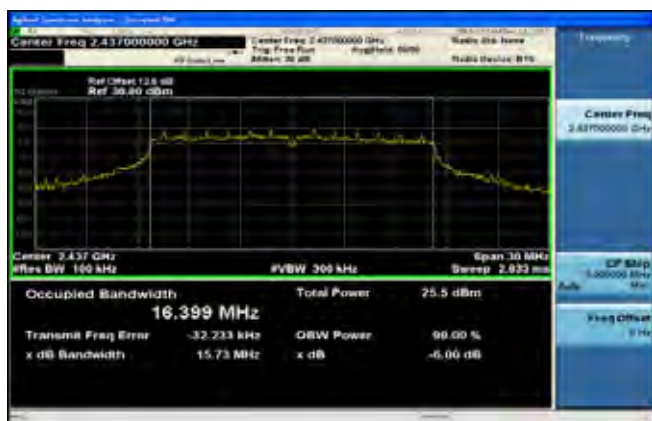
802.11g (Main) CH-Low



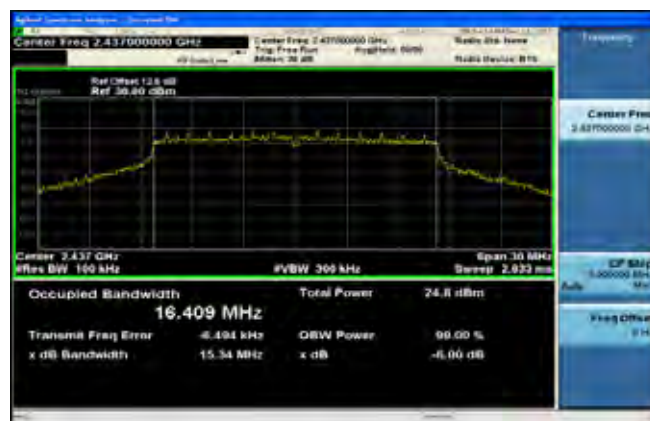
802.11g (AUX1) CH-Low



802.11g (Main) CH-Mid



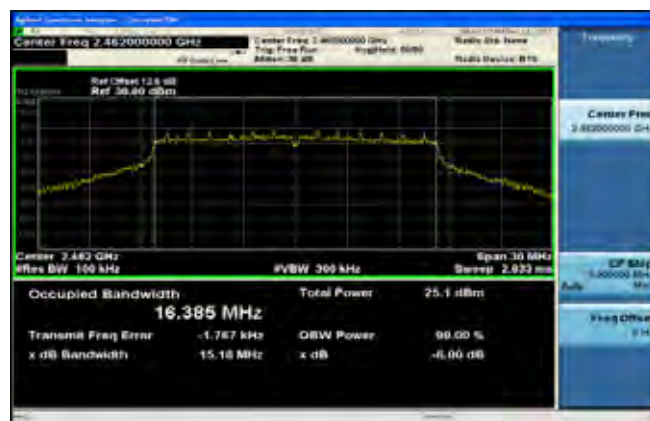
802.11g (AUX1) CH-Mid



802.11g (Main) CH-High



802.11g (AUX1) CH-High



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11n\_20M (Main) CH-Low



802.11n\_20M (AUX1) CH-Low



802.11n\_20M (Main) CH-Mid



802.11n\_20M (AUX1) CH-Mid



802.11n\_20M (Main) CH-High



802.11n\_20M (AUX1) CH-High



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## 10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

### 10.1 Standard Applicable

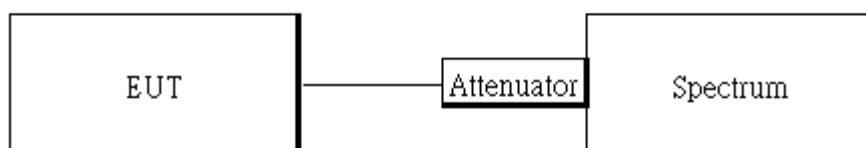
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

### 10.2 Measurement Equipment Used

| Conducted Emission Test Site |              |              |               |            |            |
|------------------------------|--------------|--------------|---------------|------------|------------|
| EQUIPMENT TYPE               | MFR          | MODEL NUMBER | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| EXA Spectrum Analyzer        | Agilent      | N9010A       | MY54200716    | 2017/10/16 | 2018/10/15 |
| Attenuator                   | Mini-Circuit | BW-S10W2+    | 2             | 2018/01/02 | 2019/01/01 |
| Notebook                     | Lenovo       | L430         | R9-X11BG      | N/A        | N/A        |

### 10.3 Test SET-UP



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## 10.4 Measurement Procedure

### Reference Level of Emission Calculation:

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 100kHz & VBW = 300 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.  
Use the peak marker function to determine the maximum amplitude level.
9. 2TX / MIMO mode: offset is set following “measure and add 10 Log (N)” on spectrum to measure the PSD for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna. N=2 for this given application.

### Conducted Band Edge:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Mark the highest reading of the emission as the reference level measurement.
7. Set DL as the limit = reading on marker 1 – 20dBm
8. Marker on frequency, 2.3999GHz and 2.4836GHz, and examine shall 100 kHz immediately outside the authorized (2400~2483.5) be attenuated by 20dB at least relative to the maximum emission of power.
9. 2TX / MIMO mode: offset is set following “measure and add 10 Log (N)” on spectrum to measure the PSD for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna. N=2 for this given application.
10. Repeat above procedures until all default test channel (low, middle, and high) was complete.

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### Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set RBW = 100 kHz & VBW= 300 kHz, Detector =Peak, Sweep = Auto.
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.
7. 2TX / MIMO mode: offset is set following “measure and add 10 Log (N)” on spectrum to measure the PSD for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna. N=2 for this given application.

### 10.5 Measurement Result

| Reference Level of Limit 802.11b mode |           |                                |
|---------------------------------------|-----------|--------------------------------|
| Freq. (MHz)                           | PSD (dBm) | Reference Level of Limit (dBm) |
| 2412                                  | 15.13     | -4.87                          |
| 2462                                  | 16.71     | -3.29                          |

| Reference Level of Limit 802.11g mode |           |                                |
|---------------------------------------|-----------|--------------------------------|
| Freq. (MHz)                           | PSD (dBm) | Reference Level of Limit (dBm) |
| 2412                                  | 9.13      | -10.87                         |
| 2462                                  | 9.81      | -10.19                         |

| Reference Level of Limit 802.11n20 mode |           |                                |
|-----------------------------------------|-----------|--------------------------------|
| Freq. (MHz)                             | PSD (dBm) | Reference Level of Limit (dBm) |
| 2412                                    | 8.53      | -11.47                         |
| 2462                                    | 8.75      | -11.25                         |

Offset: 14.21 dB

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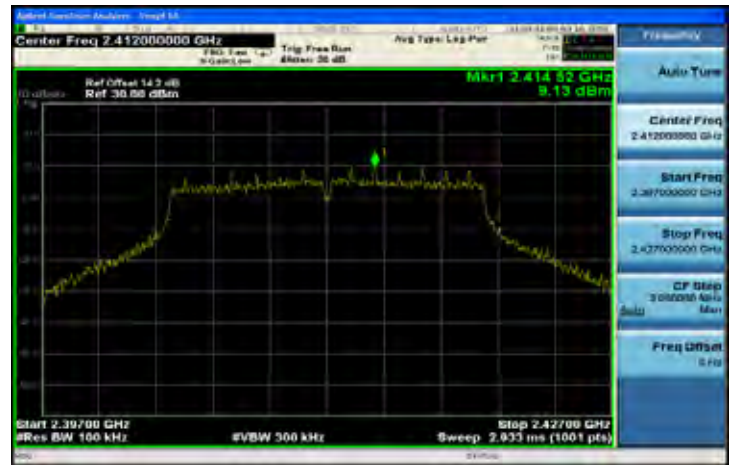
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802.11b Reference Level of Emission Limit (CH-Low)



802.11g Reference Level of Emission Limit(CH-Low)



802.11b Reference Level of Emission Limit(CH-High)



802.11g Reference Level of Emission Limit(CH-High)



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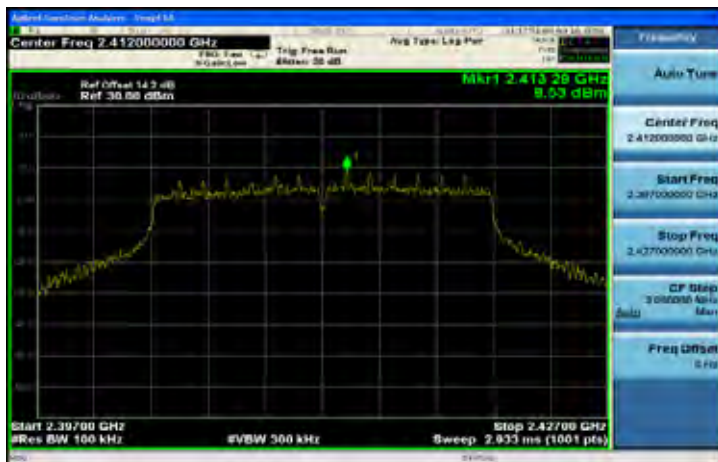
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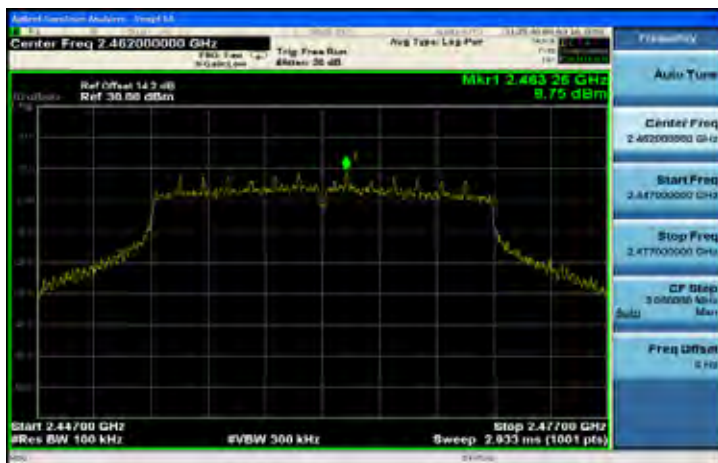
802.11n\_HT20 Reference Level of Emission Limit(CH-Low)



802.11b: Band Edges Test Data CH-Low



802.11n\_HT20 Reference Level of Emission Limit(CH-High)



802.11b: Band Edges Test Data CH-High



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802.11g: Band Edges Test Data CH-Low



802.11n\_HT20: Band Edges Test Data CH-Low



802.11g: Band Edges Test Data CH-High



802.11n\_HT20: Band Edges Test Data CH-High



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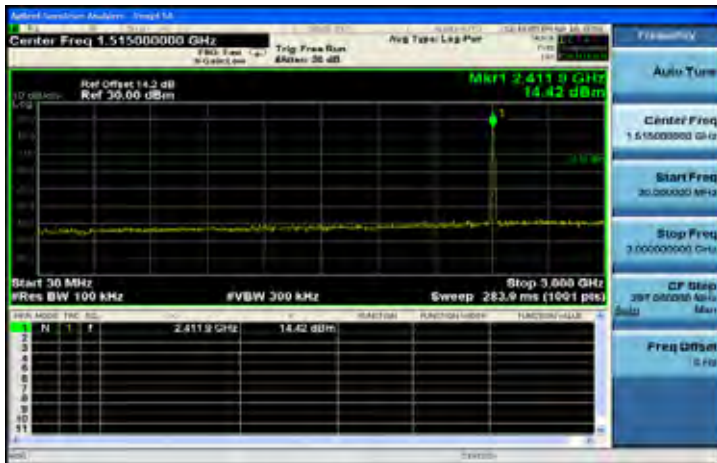
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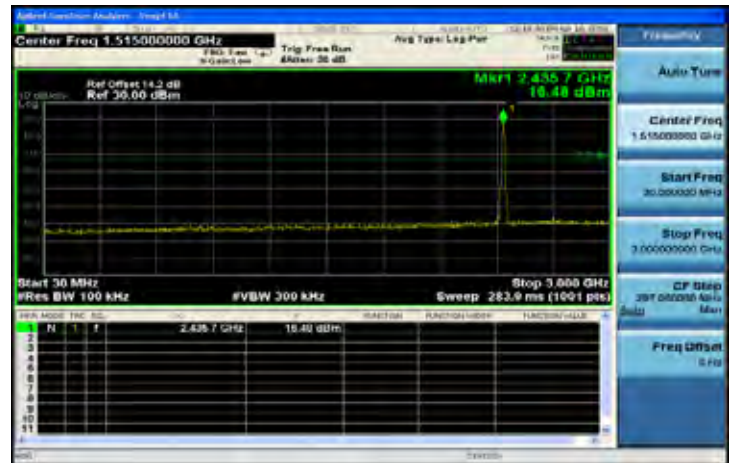
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802.11b: Spurious Emission Test Data CH-Low



802.11b: Spurious Emission Test Data CH-Mid



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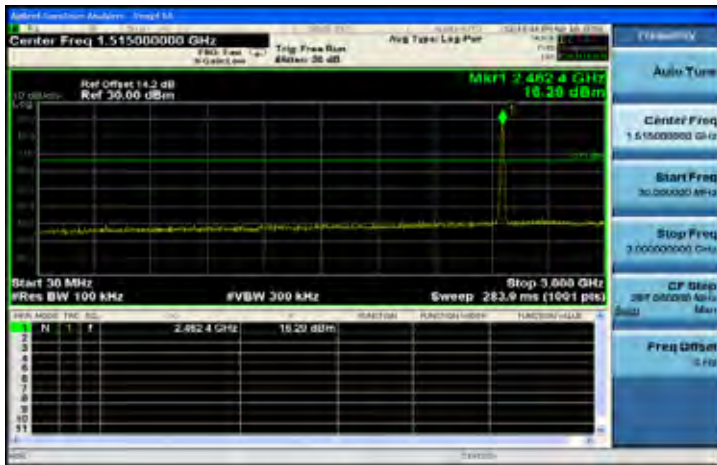
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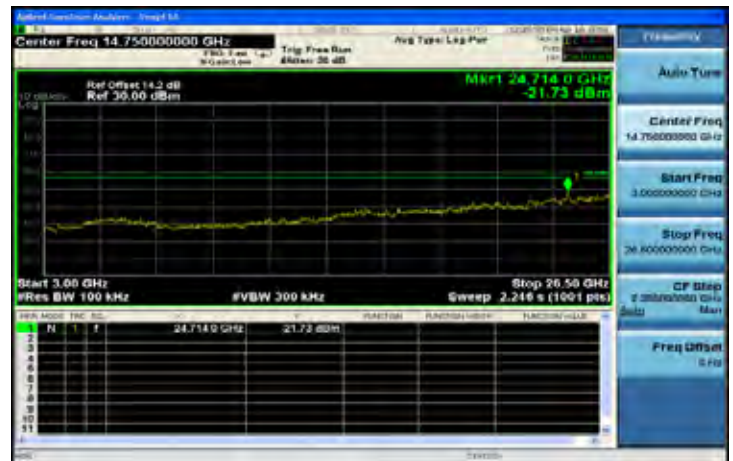
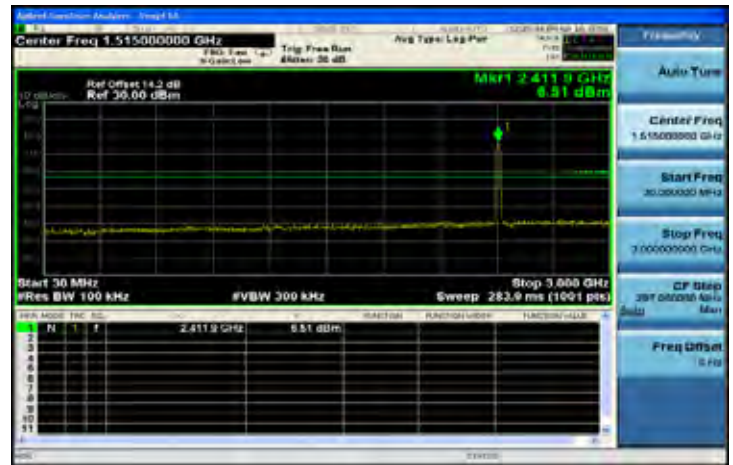
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802.11b: Spurious Emission Test Data CH-High



802.11g: Spurious Emission Test Data CH-Low



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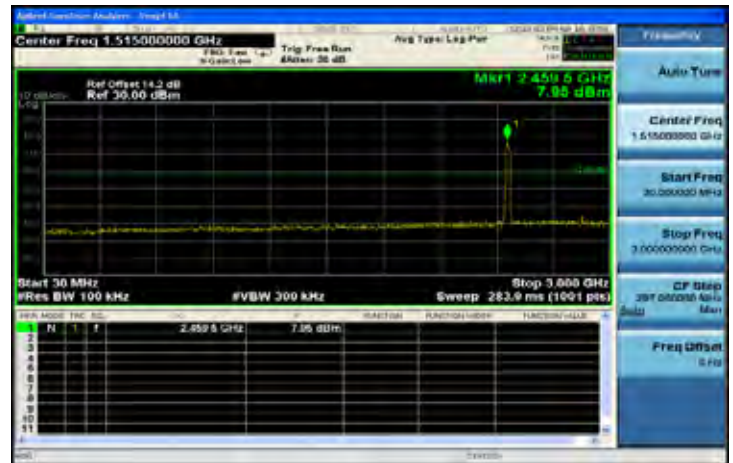
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802.11g: Spurious Emission Test Data CH-Mid



802.11g: Spurious Emission Test Data CH-High



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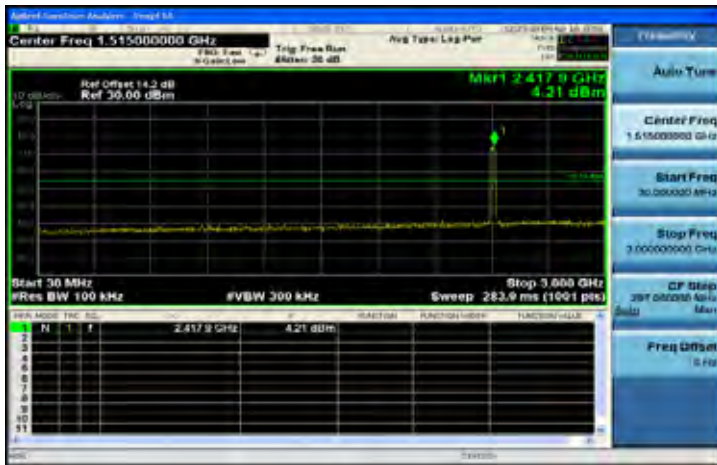
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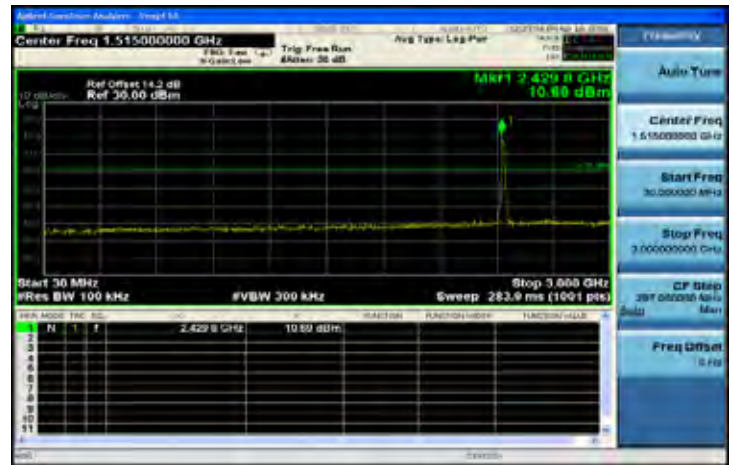
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802.11n\_HT20: Spurious Emission Test Data CH-Low



802.11n\_HT20: Spurious Emission Test Data CH-Mid



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## 802.11n\_HT20: Spurious Emission Test Data CH-High



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## 11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

### 11.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 limit as below.

And according to §15.33(a) (1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

| Frequency (MHz) | Field strength (microvolts/meter) | Distance (meters) |
|-----------------|-----------------------------------|-------------------|
| 0.009-0.490     | 2400/F(kHz)                       | 300               |
| 0.490-1.705     | 24000/F(kHz)                      | 30                |
| 1.705-30        | 30                                | 30                |
| 30-88           | 100                               | 3                 |
| 88-216          | 150                               | 3                 |
| 216-960         | 200                               | 3                 |
| Above 960       | 500                               | 3                 |

**Note:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (dBμV/m)

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## 11.2 Measurement Equipment Used:

| 966 Chamber            |                       |              |               |            |            |
|------------------------|-----------------------|--------------|---------------|------------|------------|
| EQUIPMENT TYPE         | MFR                   | MODEL NUMBER | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Bi-log Antenna         | SCHWAZBECK            | VULB9168     | 378           | 2017/12/29 | 2018/12/28 |
| Horn Antenna           | Schwarzbeck           | BBHA9120D    | 1441          | 2017/08/04 | 2018/8/3   |
| Horn Antenna           | Schwarzbeck           | BBHA9170     | 184           | 2017/12/12 | 2018/12/11 |
| Loop Antenna           | ETS.LINDGREN          | 6502         | 148045        | 2017/09/26 | 2018/09/25 |
| Spectrum Analyzer      | Agilent               | E4446A       | MY51100003    | 2017/05/10 | 2018/05/09 |
| EMI Test Receiver      | R&S                   | ESCI7        | 100760        | 2017/06/06 | 2018/06/05 |
| Pre-Amplifier          | HP                    | 8449B        | 3008A00578    | 2018/01/02 | 2019/01/01 |
| Pre-Amplifier          | HP                    | 8447D        | 2944A07676    | 2018/01/02 | 2019/01/01 |
| Pre-Amplifier          | EMC Instruments Corp. | EMC0126530   | 980038        | 2018/01/02 | 2019/01/01 |
| Attenuator             | Mini-Circuit          | BW-S10W2+    |               | 2018/01/02 | 2019/01/01 |
| Filter 2400-2483.5 MHz | EWT                   | EWT-14-0166  | M1            | 2018/01/02 | 2019/01/01 |
| Low Loss Cable         | Huber Suhner          | 966_RX       | 9             | 2018/01/02 | 2019/01/01 |
| Notebook               | Lenovo                | L430         | R9-X11BG      | N/A        | N/A        |

NOTE: N.C.R refers to Not Calibrated Required.

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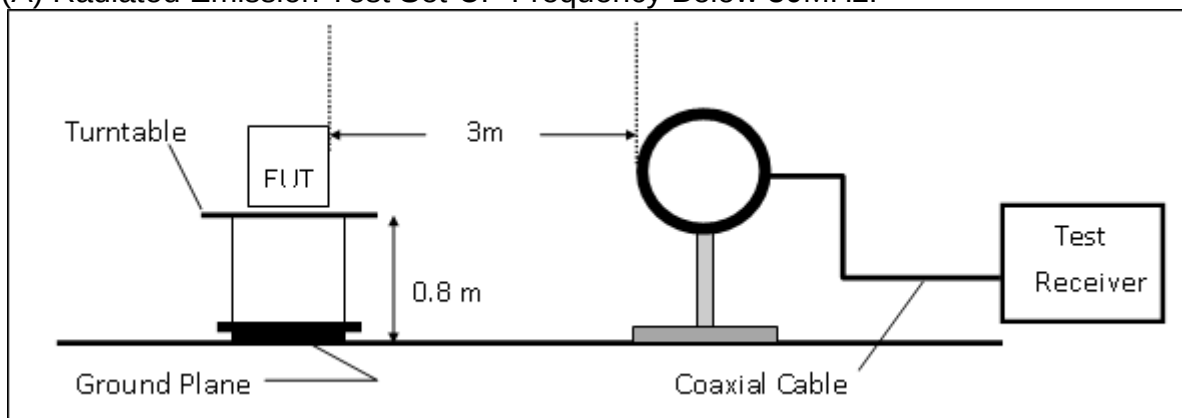
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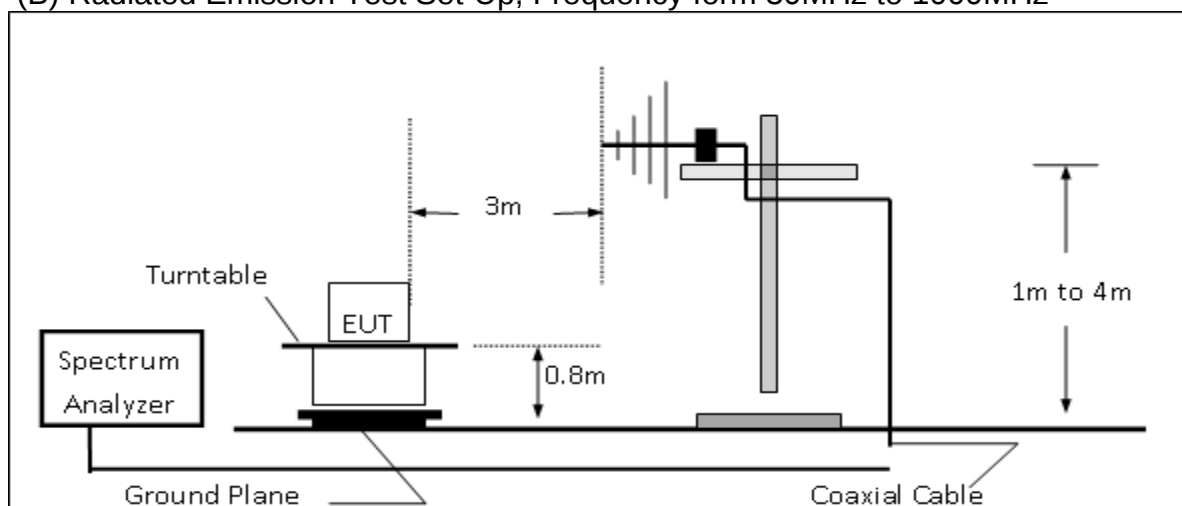
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### 11.3 Test SET-UP

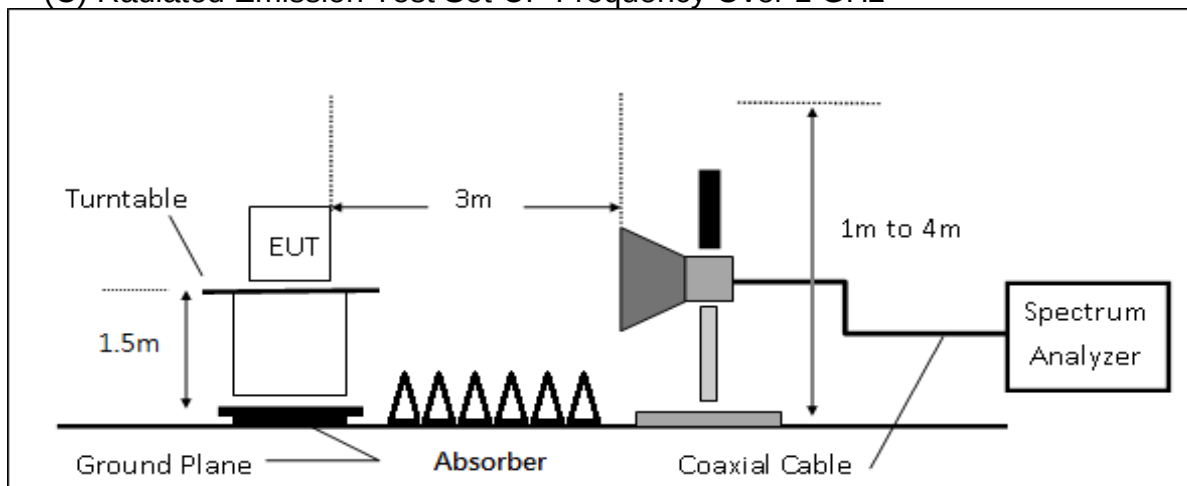
#### (A) Radiated Emission Test Set-UP Frequency Below 30MHz.



#### (B) Radiated Emission Test Set-UP, Frequency form 30MHz to 1000MHz



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



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#### 11.4 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. 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.
6. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
9. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
12. Repeat above procedures until all default test channel measured were complete.

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### 11.5 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       |                                            |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

#### Note :

“F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

### 11.6 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

### 11.7 Measurement Result

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

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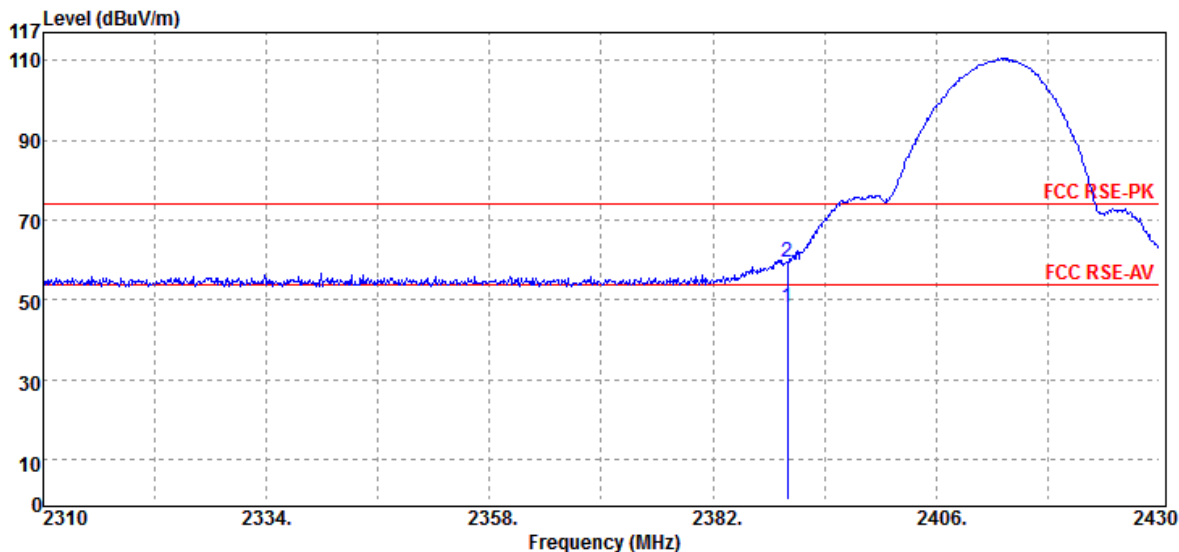
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## Radiated Band Edge Measurement Result (802.11b)

Operation Band :802.11b  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :E2 Plane

Test Date :2018-03-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2390.00 | E       | Average       | 49.84                  | -1.74  | 48.10     | 54.00     | -5.90  |
| 2390.00 | E       | Peak          | 61.36                  | -1.74  | 59.62     | 74.00     | -14.38 |

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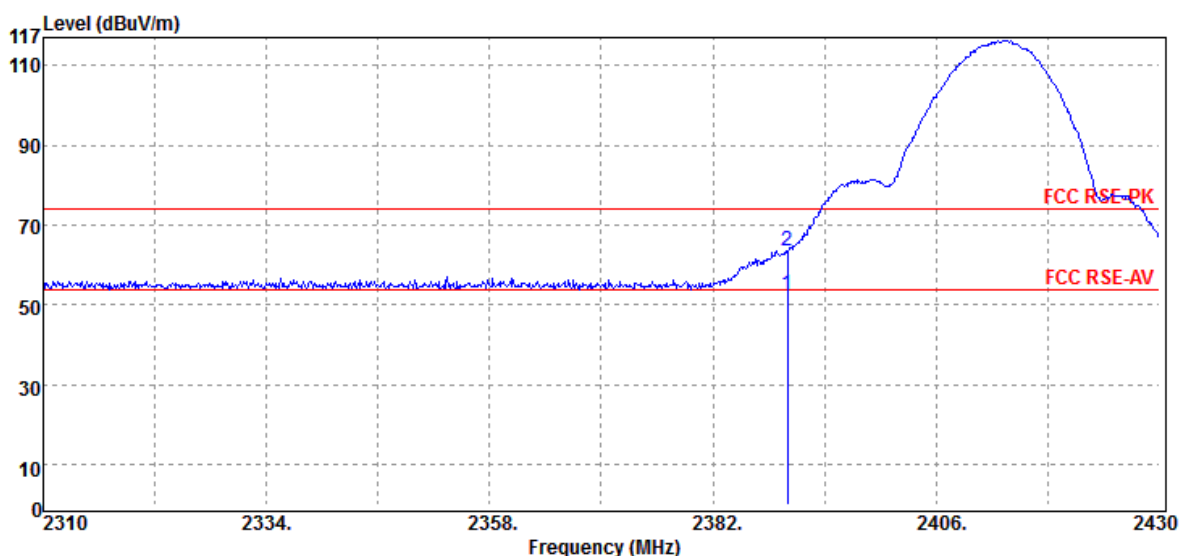
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Operation Band :802.11b  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :E2 Plane

Test Date :2018-03-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2390.00 | E       | Average       | 54.45                  | -1.74  | 52.71     | 54.00     | -1.29  |
| 2390.00 | E       | Peak          | 65.27                  | -1.74  | 63.53     | 74.00     | -10.47 |

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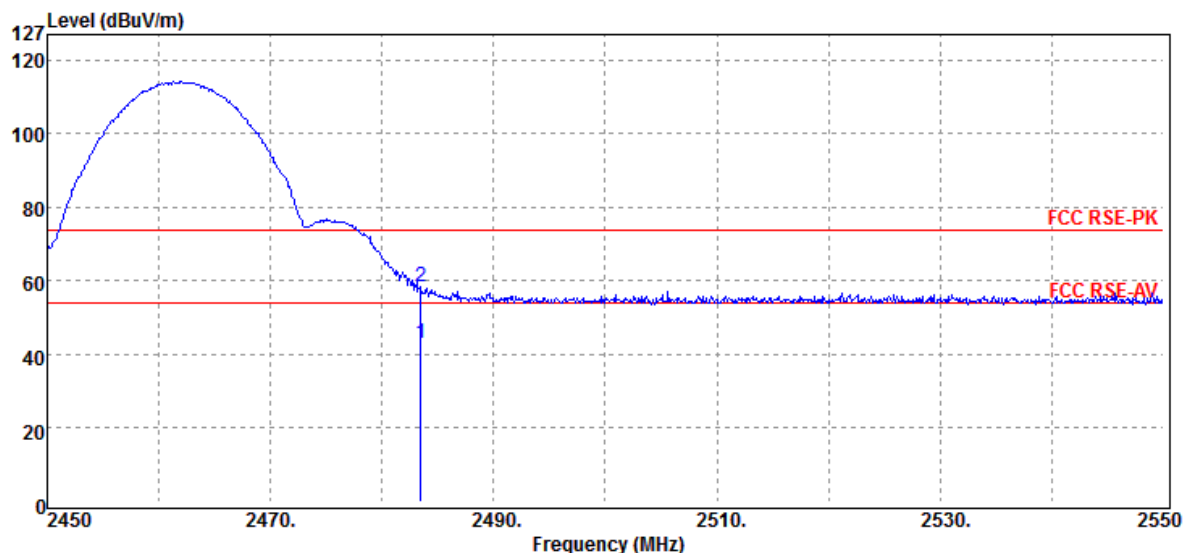
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Operation Band :802.11b  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :E2 Plane

Test Date :2018-03-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2483.50 | E       | Average       | 44.68                  | -1.62  | 43.06     | 54.00     | -10.94 |
| 2483.50 | E       | Peak          | 60.03                  | -1.62  | 58.41     | 74.00     | -15.59 |

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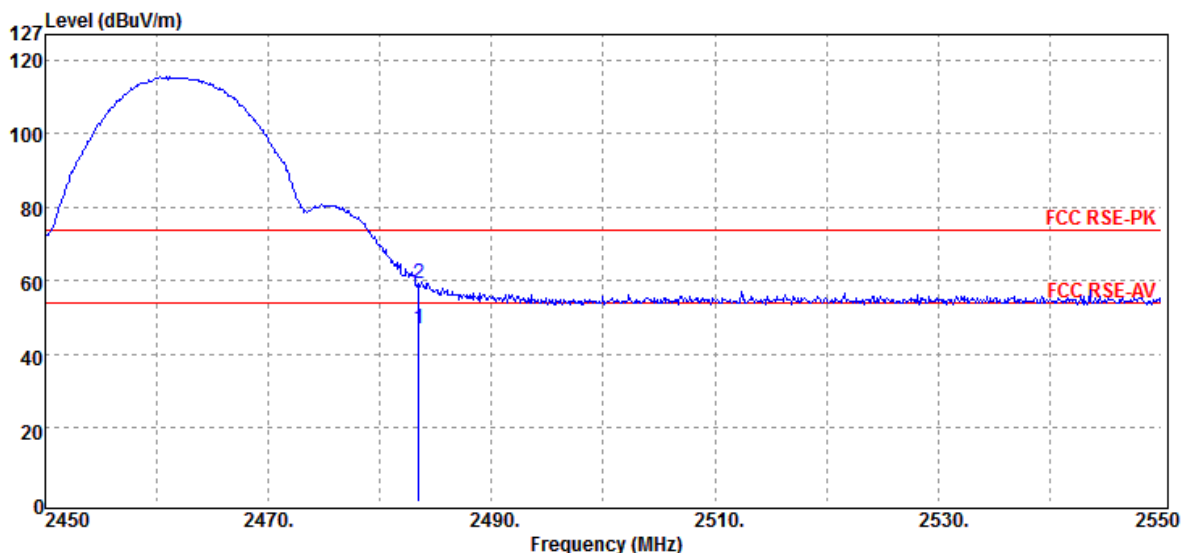
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Operation Band :802.11b  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :E2 Plane

Test Date :2018-03-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2483.50 | E       | Average       | 48.71                  | -1.62  | 47.09     | 54.00     | -6.91  |
| 2483.50 | E       | Peak          | 60.85                  | -1.62  | 59.23     | 74.00     | -14.77 |

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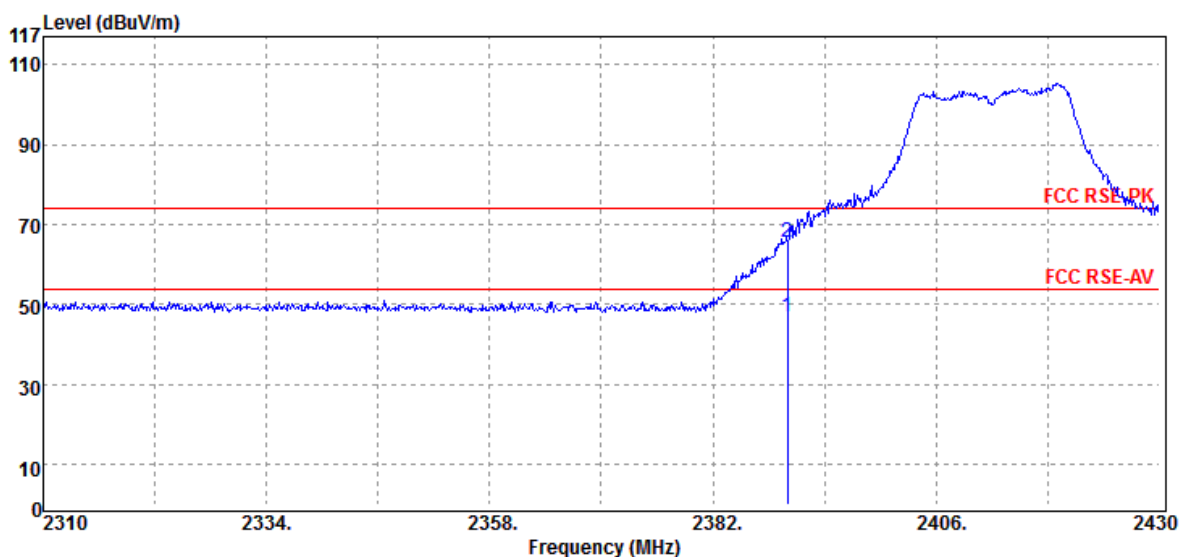
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## Radiated Band Edge Measurement Result (802.11g)

Operation Band :802.11g  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :E2 Plane

Test Date :2018-04-19  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2390.00 | E       | Average       | 48.62                  | -1.74  | 46.88     | 54.00     | -7.12  |
| 2390.00 | E       | Peak          | 67.41                  | -1.74  | 65.67     | 74.00     | -8.33  |

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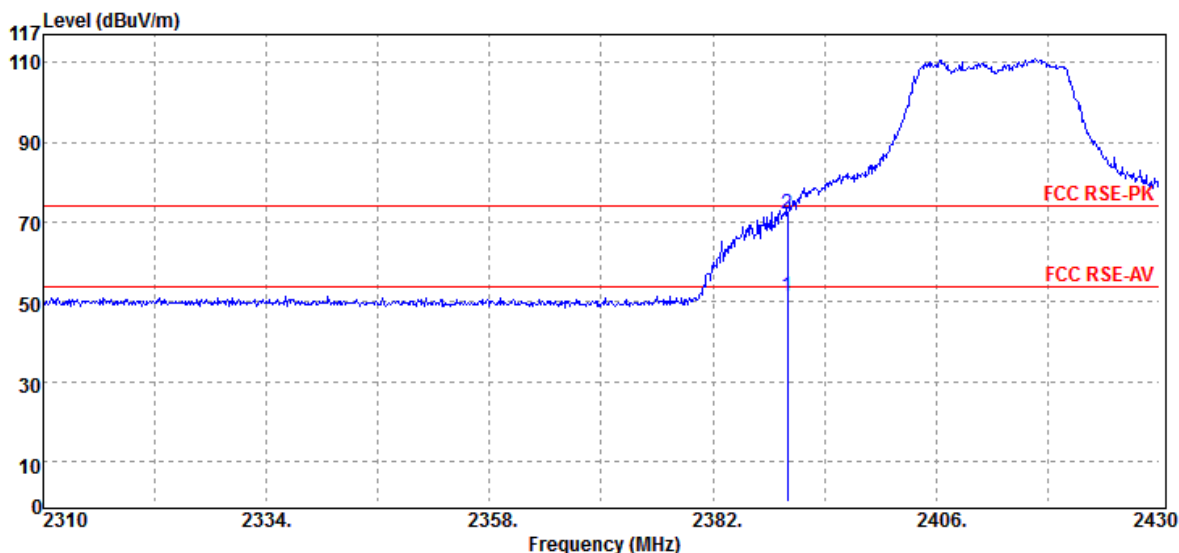
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Operation Band :802.11g  
 Fundamental Frequency :2412 MHz  
 Operation Mode :Bandedge CH LOW  
 EUT Pol. :E2 Plane

Test Date :2018-04-19  
 Temp./Humi. :21 deg\_C / 62 RH  
 Engineer :Kane  
 Measurement Antenna Pol. :HORIZONTAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBuV                   | dB     | dBuV/m    | dBuV/m    | dB     |
| 2390.00 | E       | Average       | 53.32                  | -1.74  | 51.58     | 54.00     | -2.42  |
| 2390.00 | E       | Peak          | 73.98                  | -1.74  | 72.24     | 74.00     | -1.76  |

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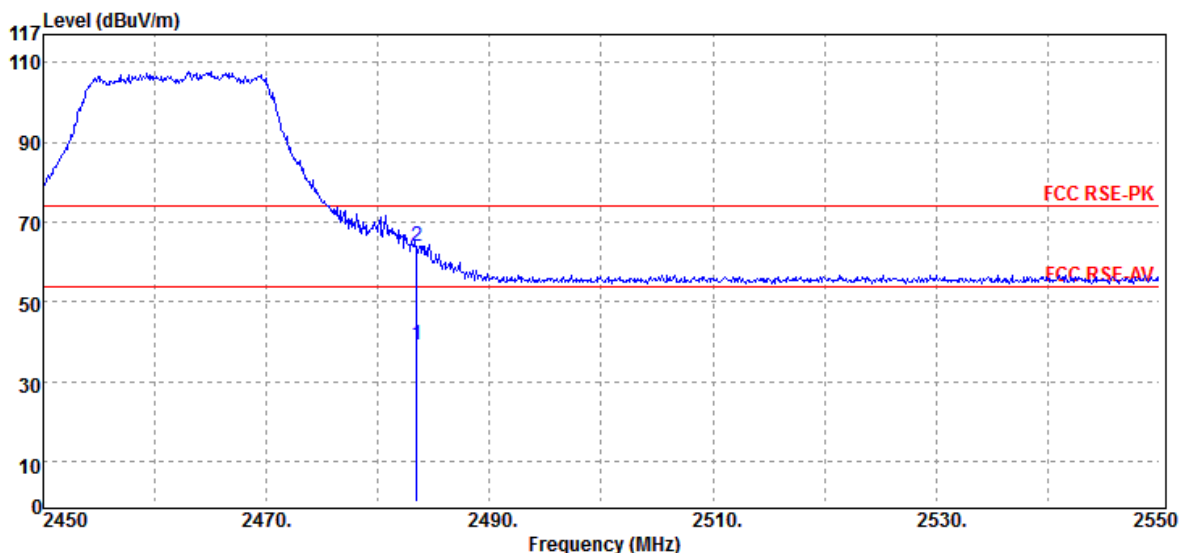
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Operation Band :802.11g  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :E2 Plane

Test Date :2018-04-19  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2483.50 | E       | Average       | 41.03                  | -1.62  | 39.41     | 54.00     | -14.59 |
| 2483.50 | E       | Peak          | 65.65                  | -1.62  | 64.03     | 74.00     | -9.97  |

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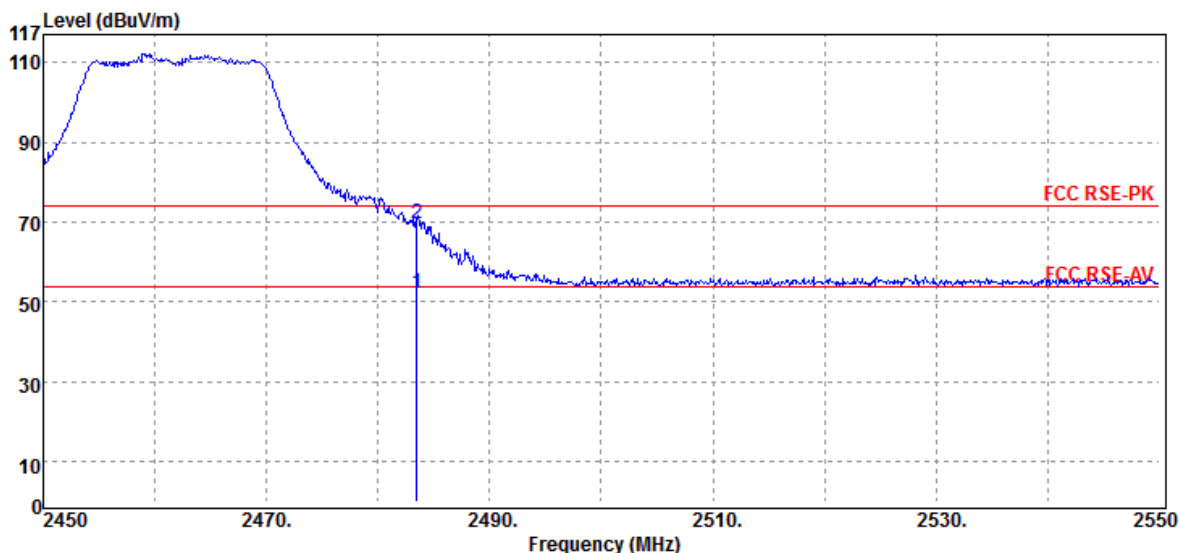
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Operation Band :802.11g  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :E2 Plane

Test Date :2018-04-19  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2483.50 | E       | Average       | 53.82                  | -1.62  | 52.20     | 54.00     | -1.80  |
| 2483.50 | E       | Peak          | 71.35                  | -1.62  | 69.73     | 74.00     | -4.27  |

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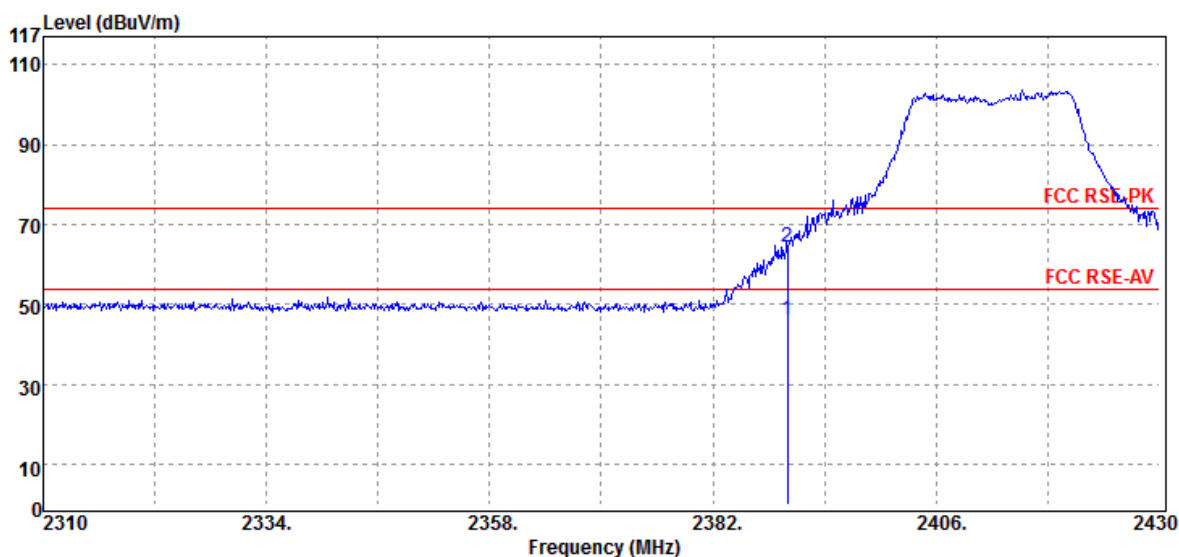
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## Radiated Band Edge Measurement Result (802.11\_HT20)

|                       |                  |                          |                   |
|-----------------------|------------------|--------------------------|-------------------|
| Operation Band        | :802.11n20       | Test Date                | :2018-04-19       |
| Fundamental Frequency | :2412 MHz        | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Bandedge CH LOW | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane        | Measurement Antenna Pol. | :VERTICAL         |



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2390.00 | E       | Average       | 47.74                  | -1.74  | 46.00     | 54.00     | -8.00  |
| 2390.00 | E       | Peak          | 66.17                  | -1.74  | 64.43     | 74.00     | -9.57  |

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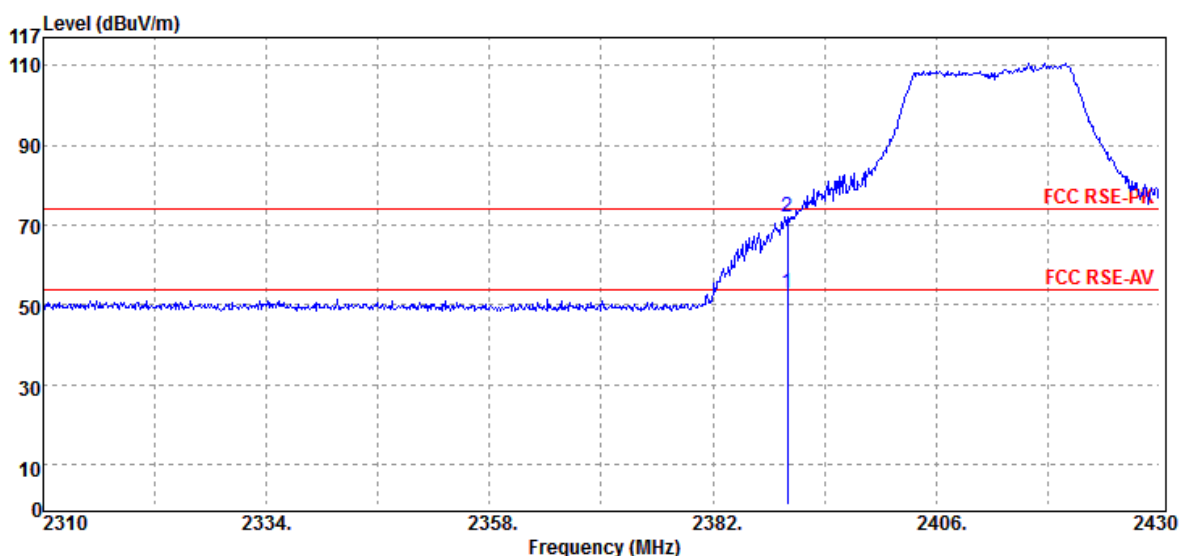
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Operation Band :802.11n20  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :E2 Plane

Test Date :2018-04-19  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2390.00 | E       | Average       | 54.71                  | -1.74  | 52.97     | 54.00     | -1.03  |
| 2390.00 | E       | Peak          | 73.63                  | -1.74  | 71.89     | 74.00     | -2.11  |

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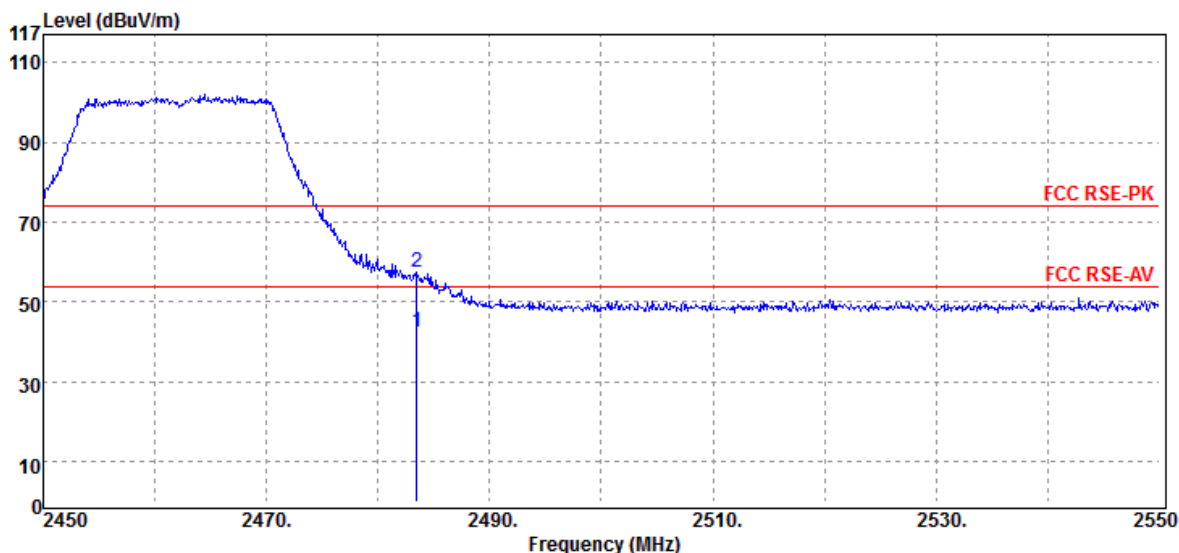
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Operation Band :802.11n20  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :E2 Plane

Test Date :2018-04-19  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2483.50 | E       | Average       | 44.11                  | -1.62  | 42.49     | 54.00     | -11.51 |
| 2483.50 | E       | Peak          | 58.96                  | -1.62  | 57.34     | 74.00     | -16.66 |

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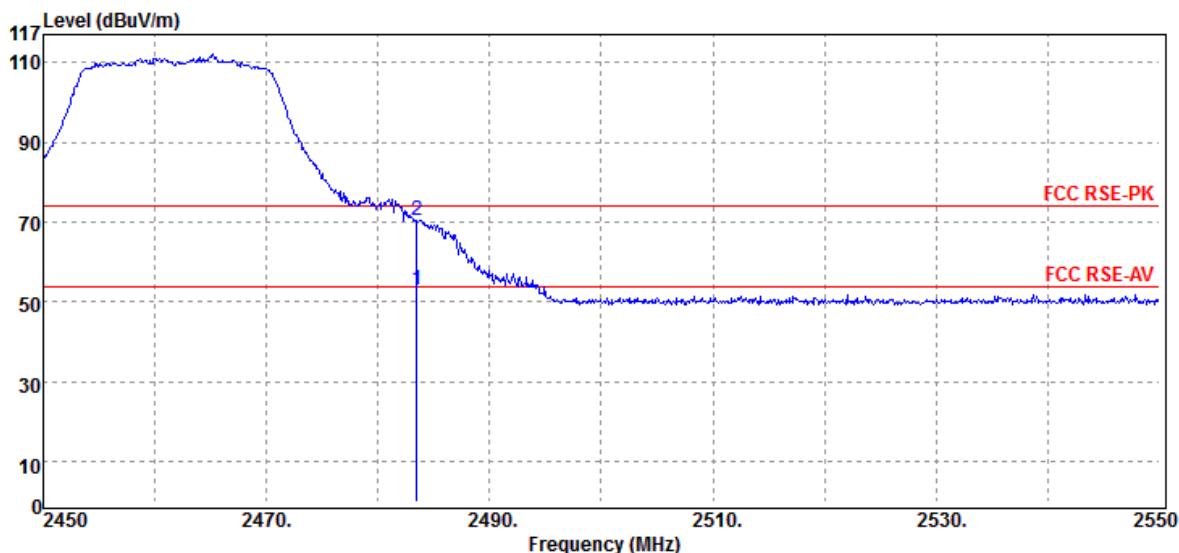
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Operation Band :802.11n20  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :E2 Plane

Test Date :2018-04-19  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



| Freq.   | Note    | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|---------|---------------|------------------------|--------|-----------|-----------|--------|
| MHz     | F/H/E/S | PK/QP/AV      | dBμV                   | dB     | dBμV/m    | dBμV/m    | dB     |
| 2483.50 | E       | Average       | 54.57                  | -1.62  | 52.95     | 54.00     | -1.05  |
| 2483.50 | E       | Peak          | 71.91                  | -1.62  | 70.29     | 74.00     | -3.71  |

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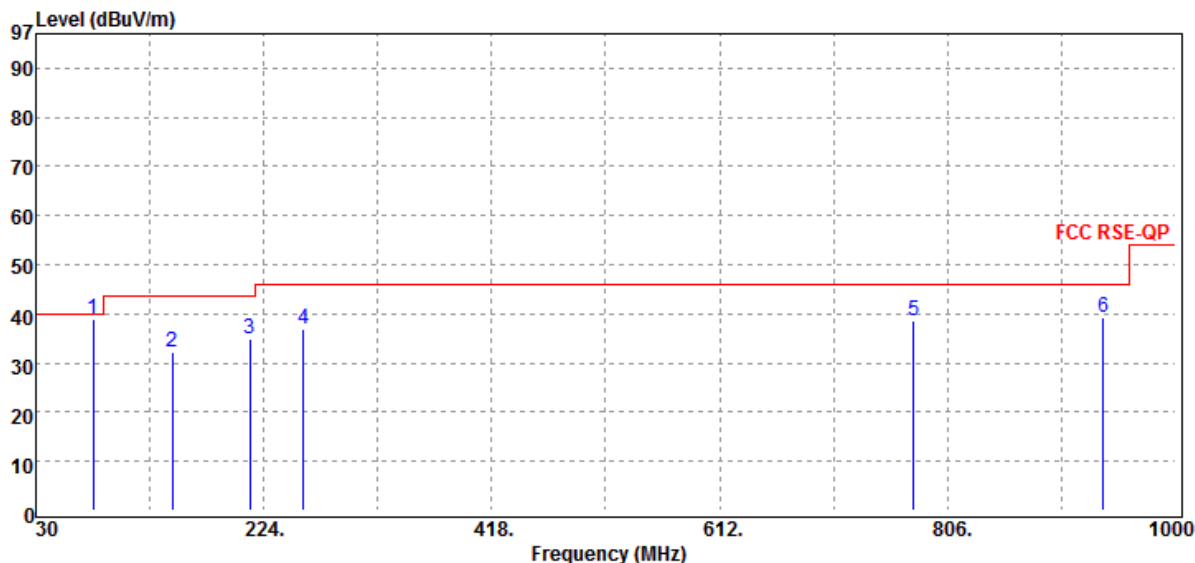
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# Below 1GHz Worst-Case Data:

## Radiated Spurious Emission Measurement Result (802.11 g)

|                       |            |                          |                   |
|-----------------------|------------|--------------------------|-------------------|
| Operation Band        | :802.11g   | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2437 MHz  | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH MID | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane  | Measurement Antenna Pol. | :VERTICAL         |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 78.50        | S               | QP                           | 50.90                             | -12.02       | 38.88                  | 40.00                  | -1.12        |
| 146.40       | S               | Peak                         | 40.27                             | -8.05        | 32.22                  | 43.50                  | -11.28       |
| 212.36       | S               | Peak                         | 44.68                             | -9.65        | 35.03                  | 43.50                  | -8.47        |
| 257.95       | S               | Peak                         | 44.36                             | -7.37        | 36.99                  | 46.00                  | -9.01        |
| 776.90       | S               | Peak                         | 36.06                             | 2.54         | 38.60                  | 46.00                  | -7.40        |
| 938.89       | S               | Peak                         | 33.88                             | 5.30         | 39.18                  | 46.00                  | -6.82        |

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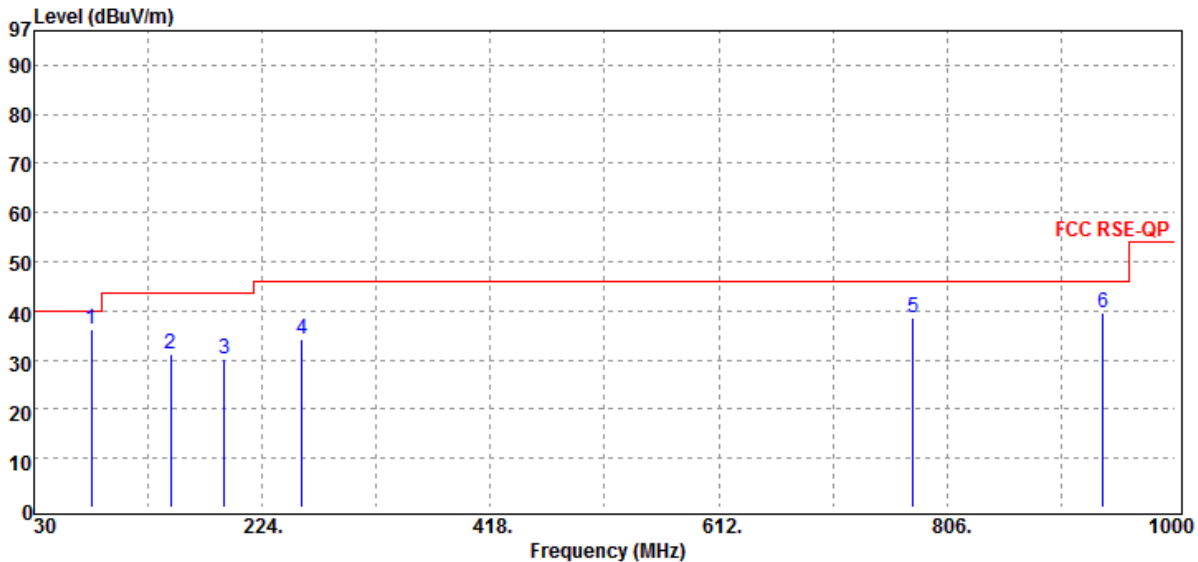
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Operation Band :802.11g  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :E2 Plane

Test Date :2018-04-23  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 78.50        | S               | Peak                         | 48.41                             | -12.02       | 36.39                  | 40.00                  | -3.61        |
| 146.40       | S               | Peak                         | 39.21                             | -8.05        | 31.16                  | 43.50                  | -12.34       |
| 191.99       | S               | Peak                         | 39.79                             | -9.42        | 30.37                  | 43.50                  | -13.13       |
| 257.95       | S               | Peak                         | 41.56                             | -7.37        | 34.19                  | 46.00                  | -11.81       |
| 776.90       | S               | Peak                         | 36.11                             | 2.54         | 38.65                  | 46.00                  | -7.35        |
| 938.89       | S               | Peak                         | 34.20                             | 5.30         | 39.50                  | 46.00                  | -6.50        |

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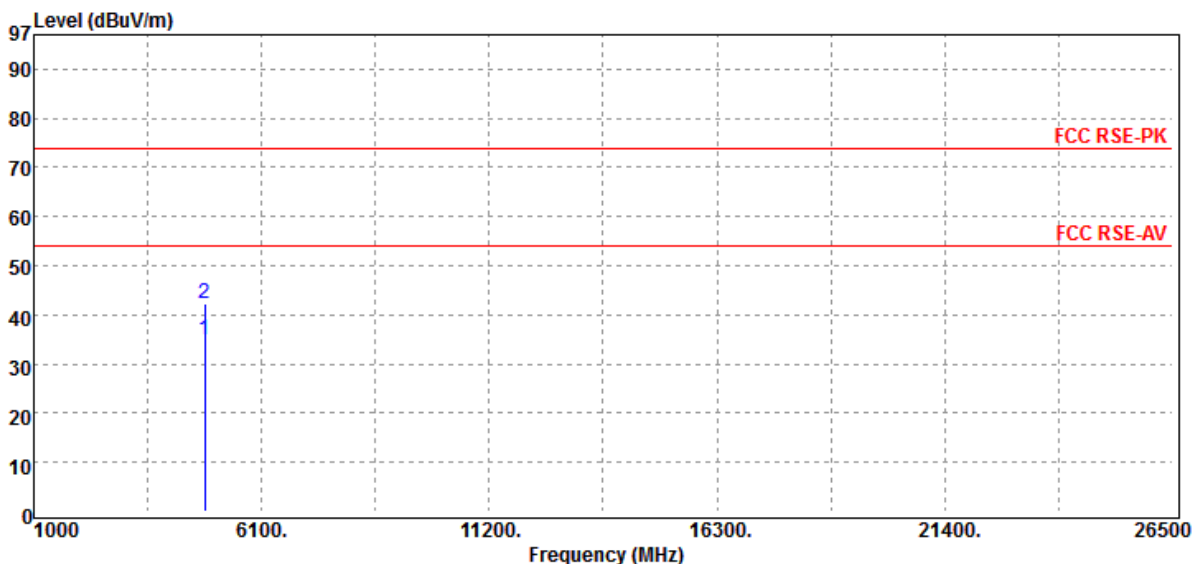
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## Above 1GHz Data:

### Radiated Spurious Emission Measurement Result (802.11 b)

|                       |            |                          |                   |
|-----------------------|------------|--------------------------|-------------------|
| Operation Band        | :802.11b   | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2412 MHz  | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH LOW | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane  | Measurement Antenna Pol. | :VERTICAL         |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4824.00      | H               | Average                      | 30.08                             | 4.93         | 35.01                  | 54.00                  | -18.99               |
| 4824.00      | H               | Peak                         | 37.38                             | 4.93         | 42.31                  | 74.00                  | -31.69               |

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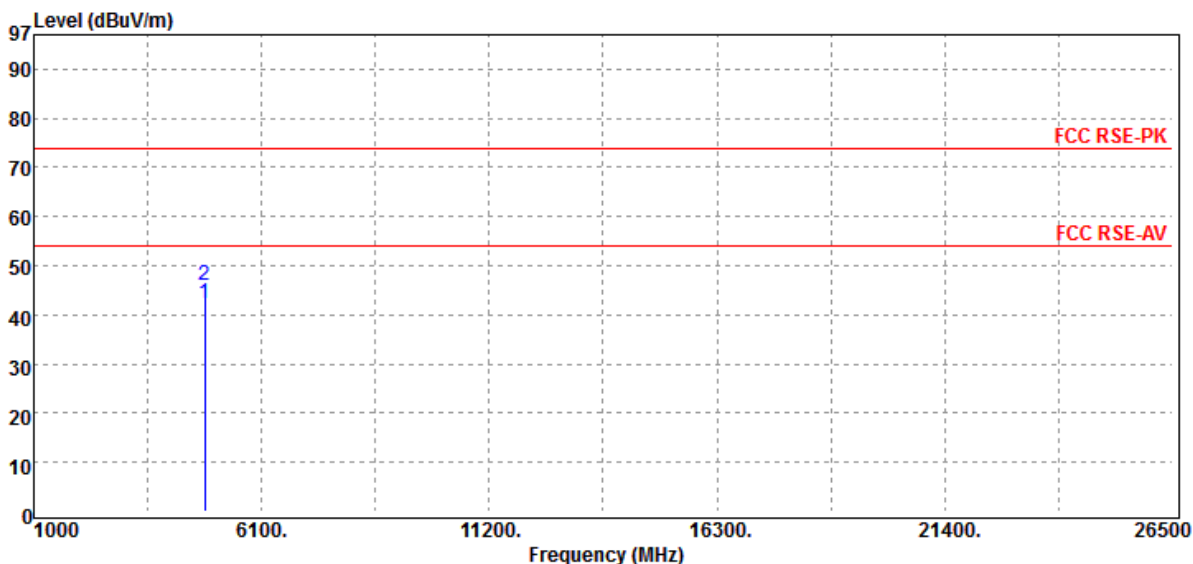
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|                       |            |                          |                   |
|-----------------------|------------|--------------------------|-------------------|
| Operation Band        | :802.11b   | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2412 MHz  | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH LOW | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane  | Measurement Antenna Pol. | :HORIZONTAL       |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4824.00      | H               | Average                      | 37.39                             | 4.93         | 42.32                  | 54.00                  | -11.68               |
| 4824.00      | H               | Peak                         | 41.05                             | 4.93         | 45.98                  | 74.00                  | -28.02               |

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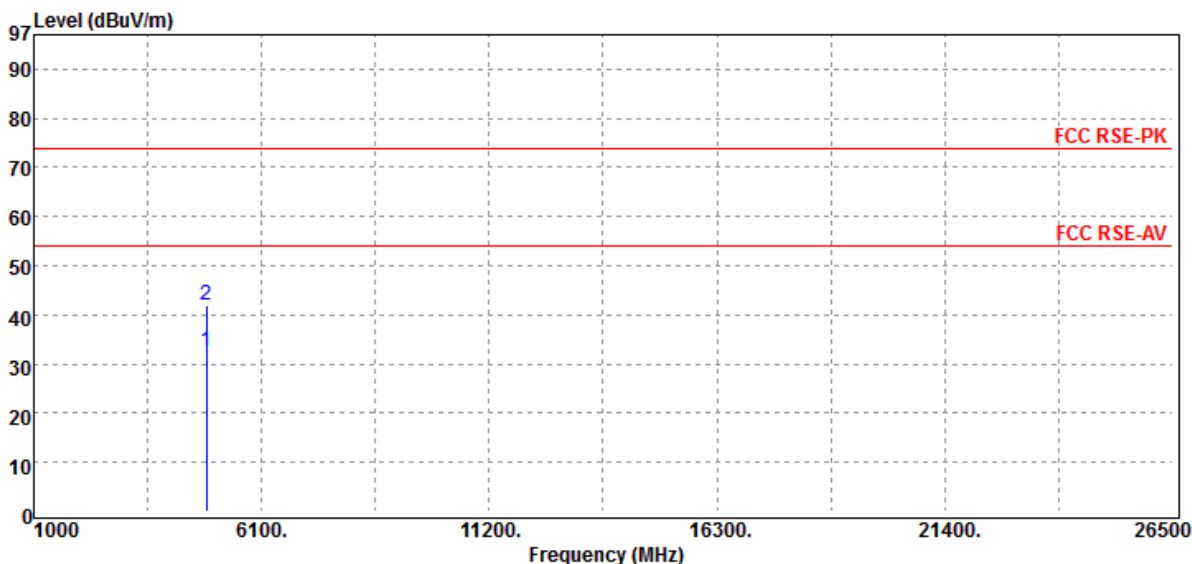
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|                       |            |                          |                   |
|-----------------------|------------|--------------------------|-------------------|
| Operation Band        | :802.11b   | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2437 MHz  | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH MID | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane  | Measurement Antenna Pol. | :VERTICAL         |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4874.00      | H               | Average                      | 27.55                             | 5.13         | 32.68                  | 54.00                  | -21.32               |
| 4874.00      | H               | Peak                         | 36.99                             | 5.13         | 42.12                  | 74.00                  | -31.88               |

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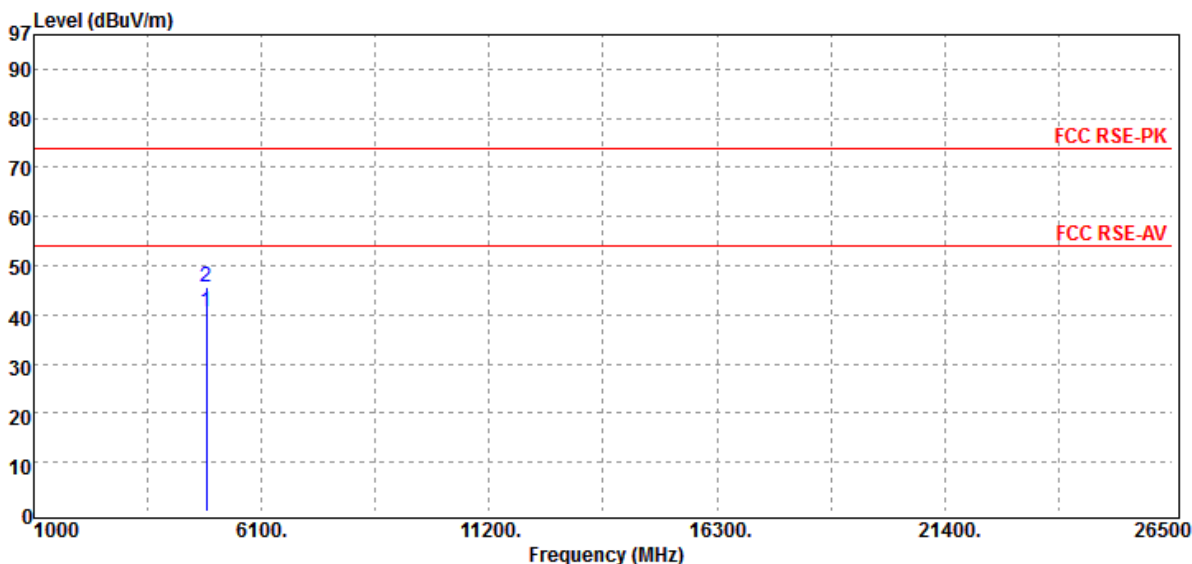
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|                       |            |                          |                   |
|-----------------------|------------|--------------------------|-------------------|
| Operation Band        | :802.11b   | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2437 MHz  | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH MID | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane  | Measurement Antenna Pol. | :HORIZONTAL       |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4874.00      | H               | Average                      | 35.52                             | 5.13         | 40.65                  | 54.00                  | -13.35               |
| 4874.00      | H               | Peak                         | 40.36                             | 5.13         | 45.49                  | 74.00                  | -28.51               |

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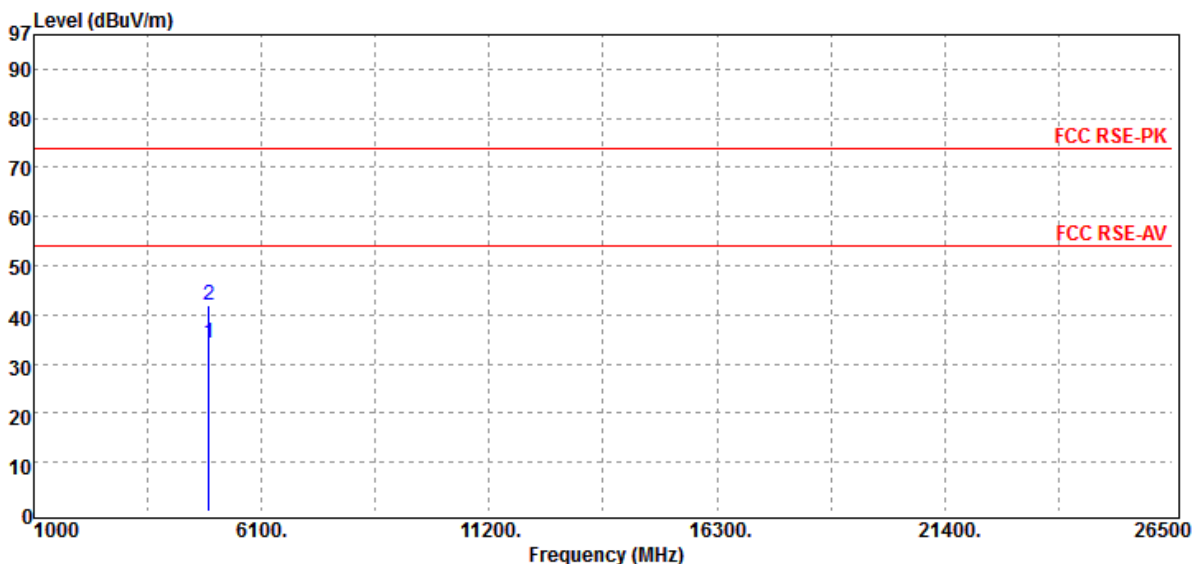
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|                       |             |                          |                   |
|-----------------------|-------------|--------------------------|-------------------|
| Operation Band        | :802.11b    | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2462 MHz   | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH HIGH | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane   | Measurement Antenna Pol. | :VERTICAL         |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4924.00      | H               | Average                      | 29.01                             | 5.25         | 34.26                  | 54.00                  | -19.74               |
| 4924.00      | H               | Peak                         | 36.74                             | 5.25         | 41.99                  | 74.00                  | -32.01               |

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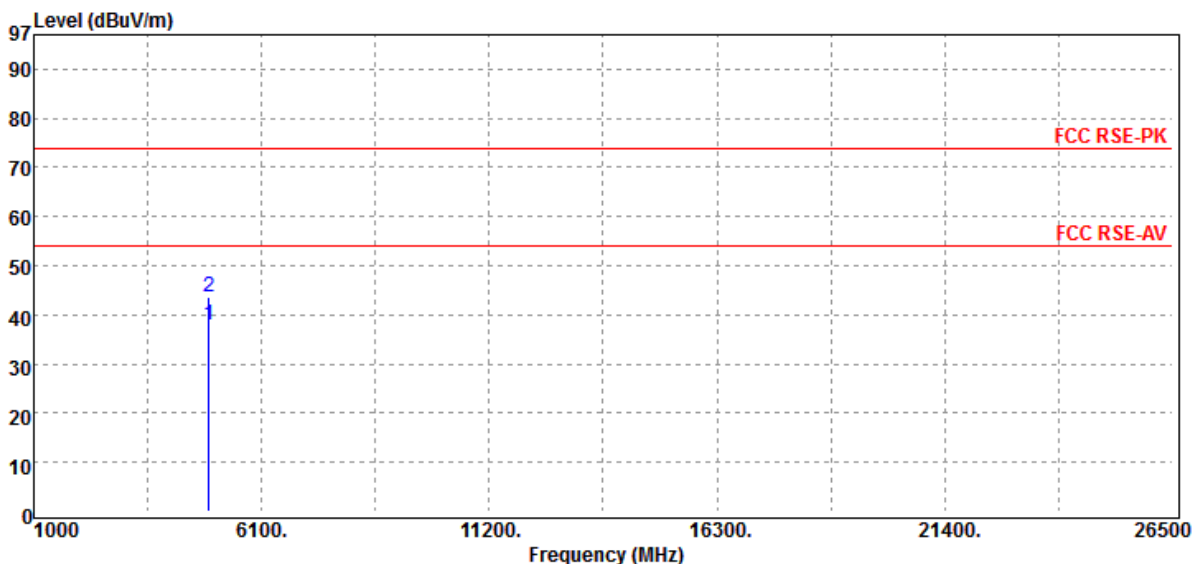
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|                       |             |                          |                   |
|-----------------------|-------------|--------------------------|-------------------|
| Operation Band        | :802.11b    | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2462 MHz   | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH HIGH | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane   | Measurement Antenna Pol. | :HORIZONTAL       |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4924.00      | H               | Average                      | 32.78                             | 5.25         | 38.03                  | 54.00                  | -15.97               |
| 4924.00      | H               | Peak                         | 38.41                             | 5.25         | 43.66                  | 74.00                  | -30.34               |

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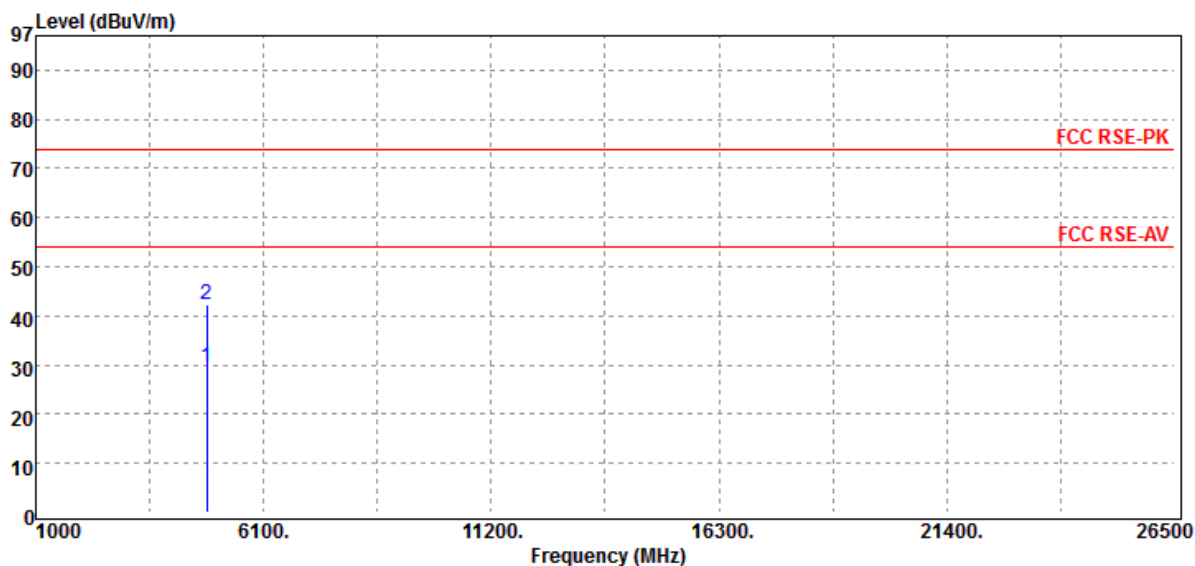
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## Radiated Spurious Emission Measurement Result (802.11 g)

|                       |            |                          |                   |
|-----------------------|------------|--------------------------|-------------------|
| Operation Band        | :802.11g   | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2412 MHz  | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH LOW | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane  | Measurement Antenna Pol. | :VERTICAL         |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4824.00      | H               | Average                      | 24.75                             | 4.93         | 29.68                  | 54.00                  | -24.32               |
| 4824.00      | H               | Peak                         | 37.20                             | 4.93         | 42.13                  | 74.00                  | -31.87               |

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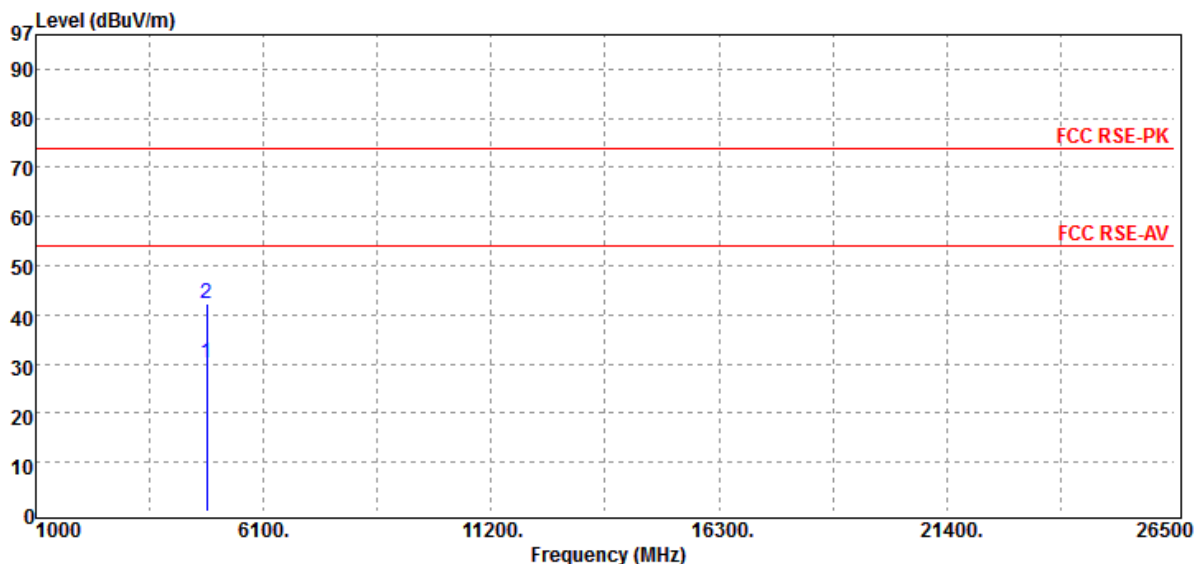
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Operation Band :802.11g  
Fundamental Frequency :2412 MHz  
Operation Mode :Tx CH LOW  
EUT Pol. :E2 Plane

Test Date :2018-04-23  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4824.00      | H               | Average                      | 25.24                             | 4.93         | 30.17                  | 54.00                  | -23.83               |
| 4824.00      | H               | Peak                         | 37.41                             | 4.93         | 42.34                  | 74.00                  | -31.66               |

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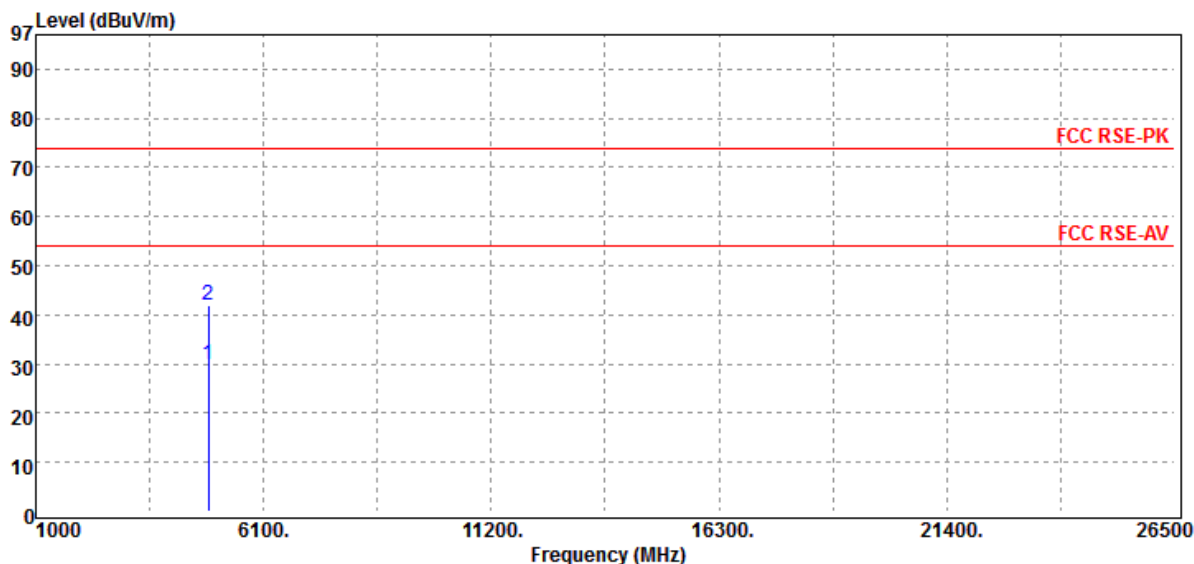
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Operation Band :802.11g  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :E2 Plane

Test Date :2018-04-23  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------------|--------------|------------------------------|------------------------------|----------------------|
| 4874.00      | H               | Average                      | 24.58                                   | 5.13         | 29.71                        | 54.00                        | -24.29               |
| 4874.00      | H               | Peak                         | 36.91                                   | 5.13         | 42.04                        | 74.00                        | -31.96               |

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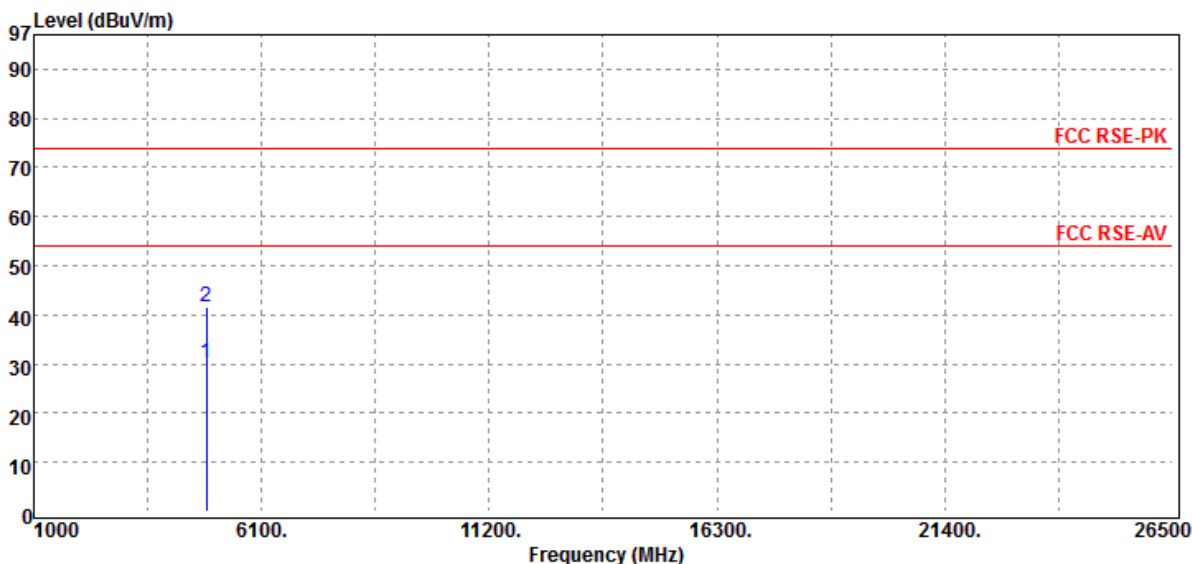
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|                       |            |                          |                   |
|-----------------------|------------|--------------------------|-------------------|
| Operation Band        | :802.11g   | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2437 MHz  | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH MID | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane  | Measurement Antenna Pol. | :HORIZONTAL       |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4874.00      | H               | Average                      | 24.91                             | 5.13         | 30.04                  | 54.00                  | -23.96               |
| 4874.00      | H               | Peak                         | 36.53                             | 5.13         | 41.66                  | 74.00                  | -32.34               |

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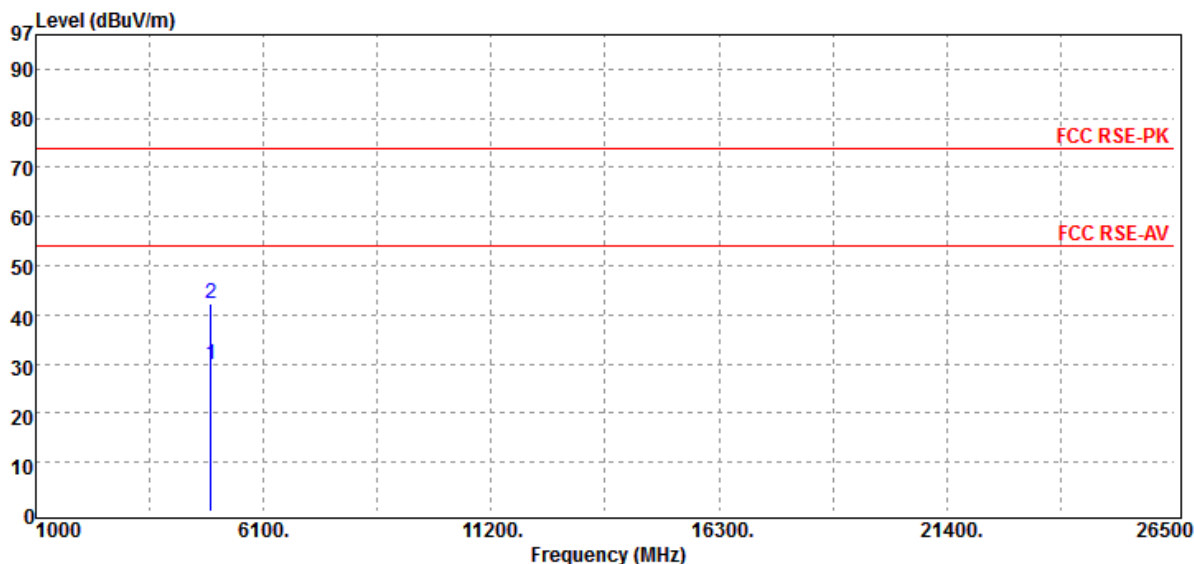
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|-----------------------|-------------|--------------------------|-------------------|
| Operation Band        | :802.11g    | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2462 MHz   | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH HIGH | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane   | Measurement Antenna Pol. | :VERTICAL         |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4924.00      | H               | Average                      | 24.56                             | 5.25         | 29.81                  | 54.00                  | -24.19               |
| 4924.00      | H               | Peak                         | 36.95                             | 5.25         | 42.20                  | 74.00                  | -31.80               |

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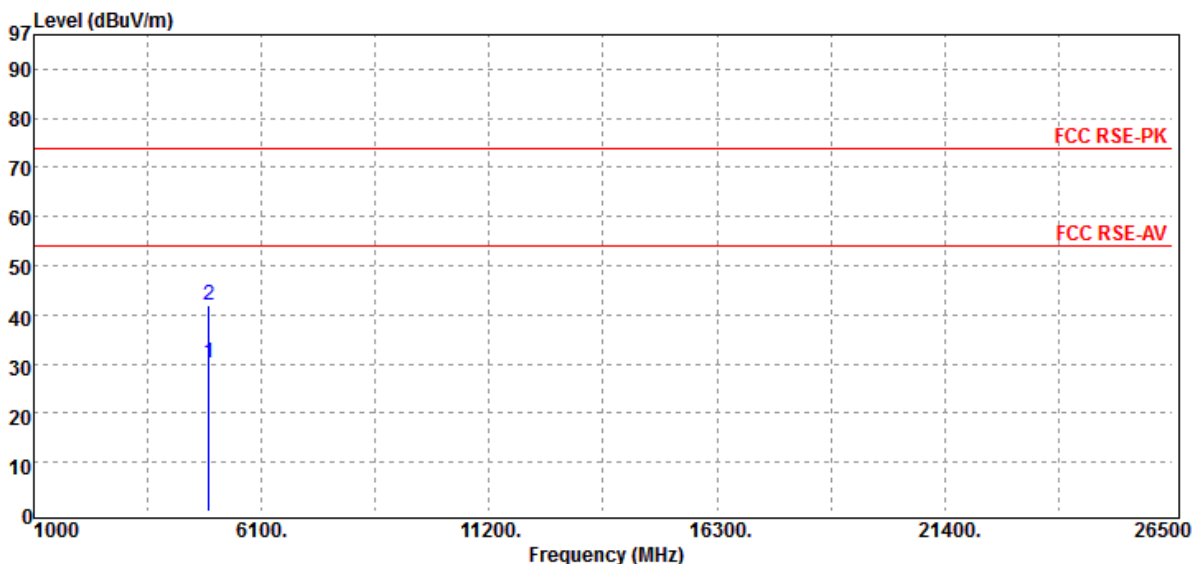
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|-----------------------|-------------|--------------------------|-------------------|
| Operation Band        | :802.11g    | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2462 MHz   | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH HIGH | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane   | Measurement Antenna Pol. | :HORIZONTAL       |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4924.00      | H               | Average                      | 24.82                             | 5.25         | 30.07                  | 54.00                  | -23.93               |
| 4924.00      | H               | Peak                         | 36.79                             | 5.25         | 42.04                  | 74.00                  | -31.96               |

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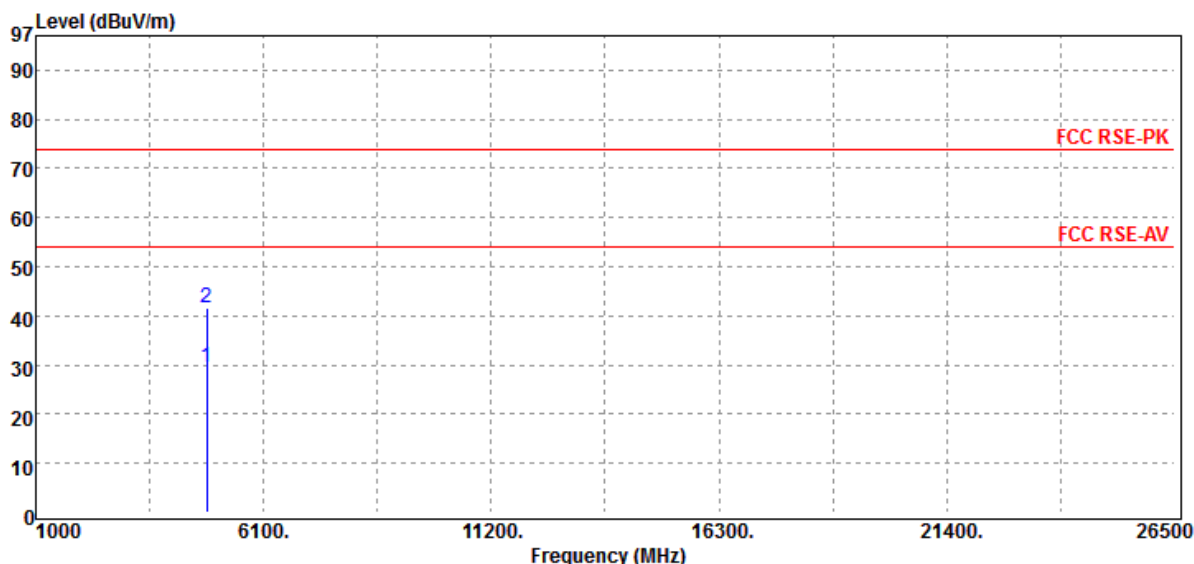
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## Radiated Spurious Emission Measurement Result (802.11\_HT20)

|                       |            |                          |                   |
|-----------------------|------------|--------------------------|-------------------|
| Operation Band        | :802.11n20 | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2412 MHz  | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH LOW | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane  | Measurement Antenna Pol. | :VERTICAL         |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4824.00      | H               | Average                      | 24.64                             | 4.93         | 29.57                  | 54.00                  | -24.43               |
| 4824.00      | H               | Peak                         | 36.76                             | 4.93         | 41.69                  | 74.00                  | -32.31               |

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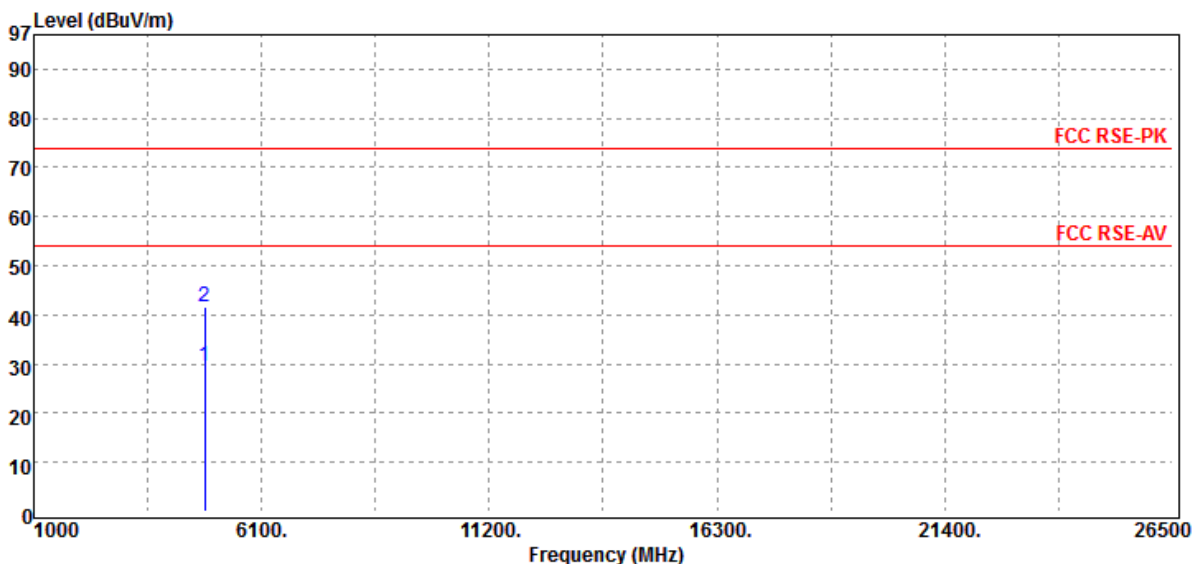
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|                       |            |                          |                   |
|-----------------------|------------|--------------------------|-------------------|
| Operation Band        | :802.11n20 | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2412 MHz  | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH LOW | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane  | Measurement Antenna Pol. | :HORIZONTAL       |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4824.00      | H               | Average                      | 24.70                             | 4.93         | 29.63                  | 54.00                  | -24.37               |
| 4824.00      | H               | Peak                         | 36.71                             | 4.93         | 41.64                  | 74.00                  | -32.36               |

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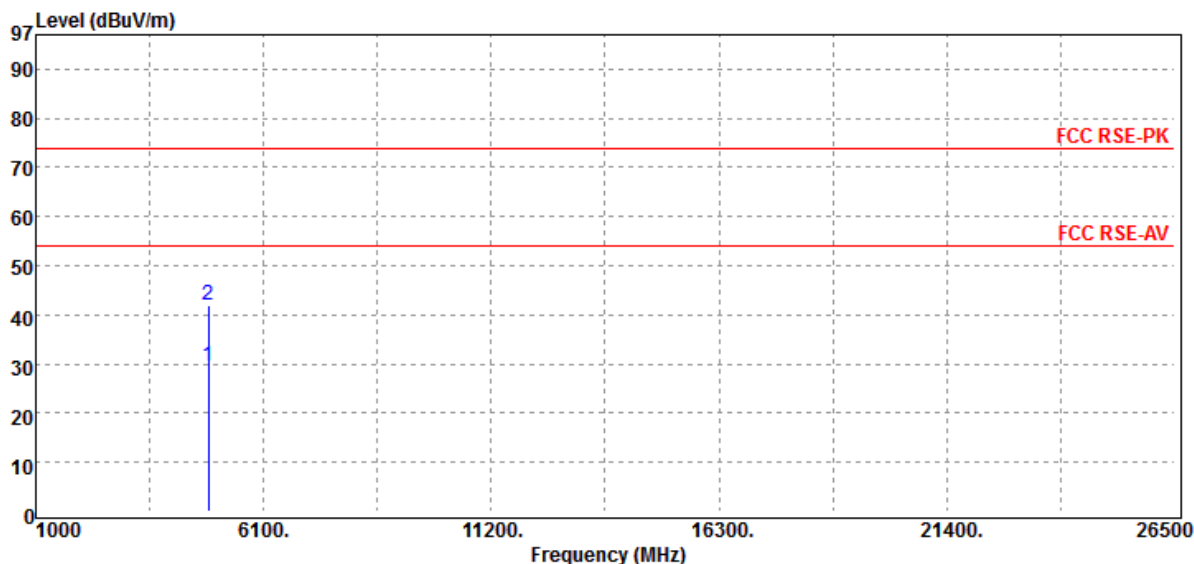
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Operation Band :802.11n20  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :E2 Plane

Test Date :2018-04-23  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4874.00      | H               | Average                      | 24.53                             | 5.13         | 29.66                  | 54.00                  | -24.34               |
| 4874.00      | H               | Peak                         | 36.69                             | 5.13         | 41.82                  | 74.00                  | -32.18               |

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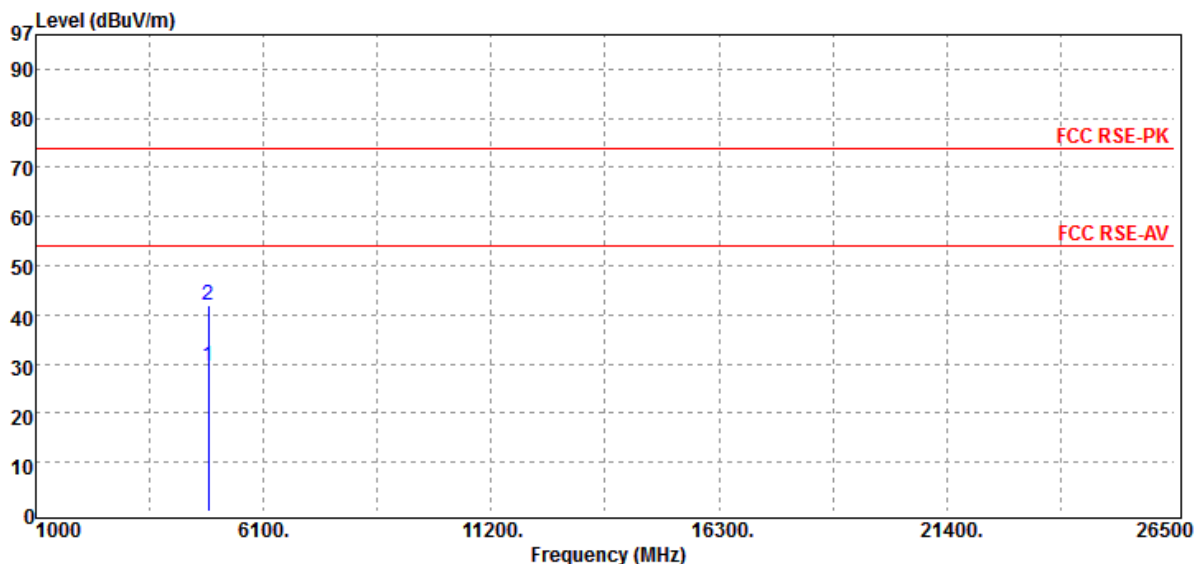
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|                       |            |                          |                   |
|-----------------------|------------|--------------------------|-------------------|
| Operation Band        | :802.11n20 | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2437 MHz  | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH MID | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane  | Measurement Antenna Pol. | :HORIZONTAL       |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4874.00      | H               | Average                      | 24.55                             | 5.13         | 29.68                  | 54.00                  | -24.32               |
| 4874.00      | H               | Peak                         | 36.83                             | 5.13         | 41.96                  | 74.00                  | -32.04               |

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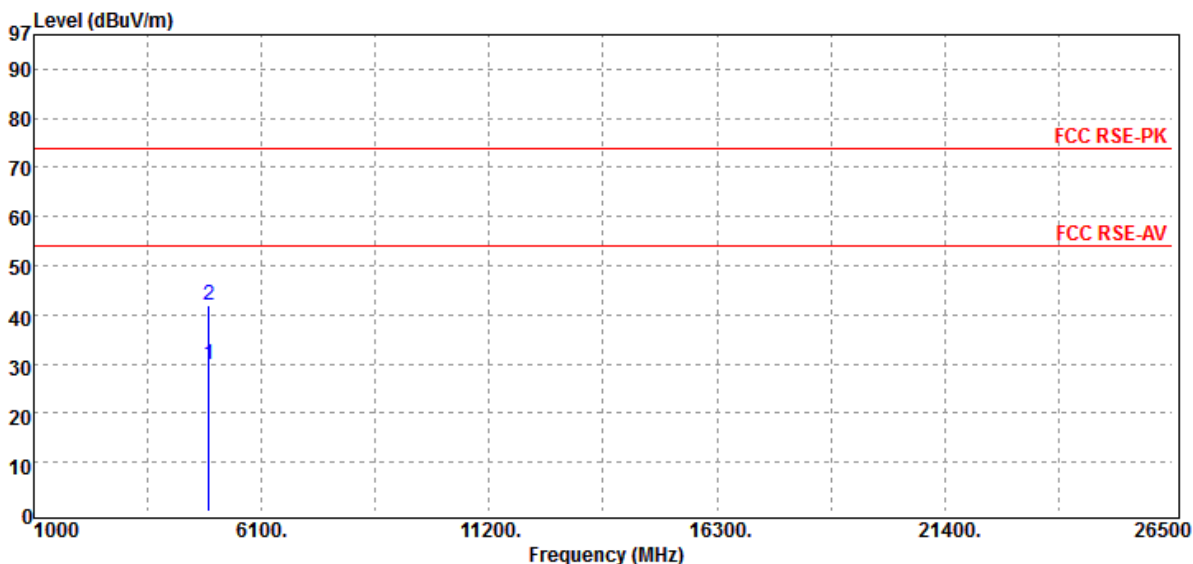
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|                       |             |                          |                   |
|-----------------------|-------------|--------------------------|-------------------|
| Operation Band        | :802.11n20  | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2462 MHz   | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH HIGH | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane   | Measurement Antenna Pol. | :VERTICAL         |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4924.00      | H               | Average                      | 24.48                             | 5.25         | 29.73                  | 54.00                  | -24.27               |
| 4924.00      | H               | Peak                         | 36.57                             | 5.25         | 41.82                  | 74.00                  | -32.18               |

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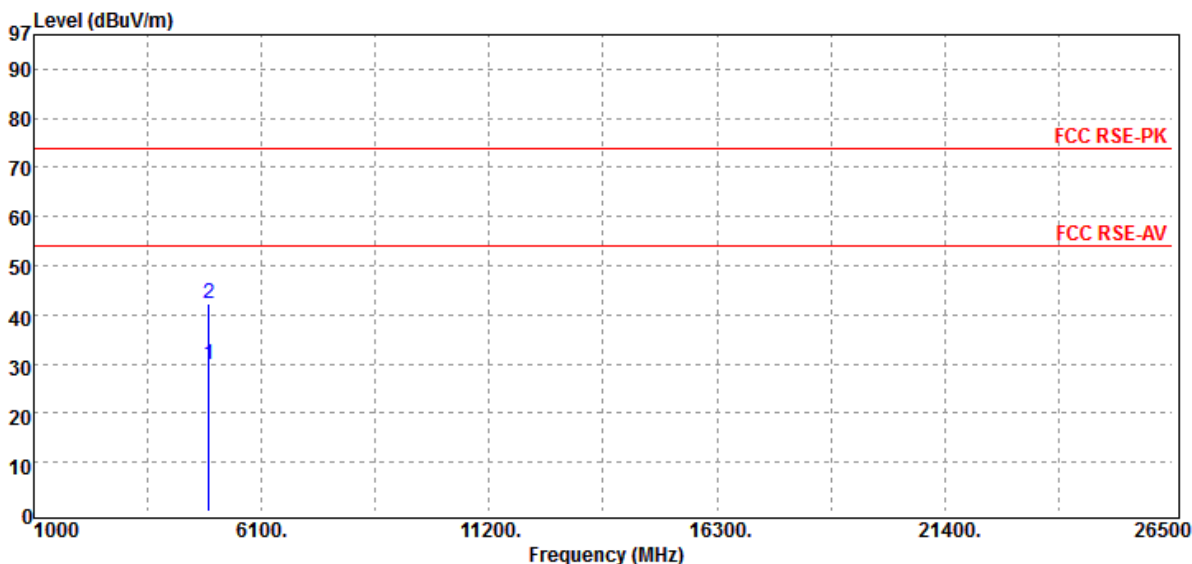
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|                       |             |                          |                   |
|-----------------------|-------------|--------------------------|-------------------|
| Operation Band        | :802.11n20  | Test Date                | :2018-04-23       |
| Fundamental Frequency | :2462 MHz   | Temp./Humi.              | :21 deg_C / 62 RH |
| Operation Mode        | :Tx CH HIGH | Engineer                 | :Kane             |
| EUT Pol.              | :E2 Plane   | Measurement Antenna Pol. | :HORIZONTAL       |



| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Safe<br>Margin<br>dB |
|--------------|-----------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|----------------------|
| 4924.00      | H               | Average                      | 24.58                             | 5.25         | 29.83                  | 54.00                  | -24.17               |
| 4924.00      | H               | Peak                         | 37.09                             | 5.25         | 42.34                  | 74.00                  | -31.66               |

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## 12 PEAK POWER SPECTRAL DENSITY

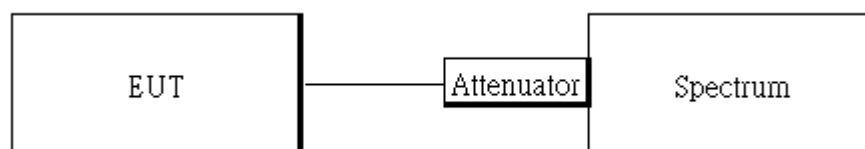
### 12.1 Standard Applicable

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

### 12.2 Measurement Equipment Used

| Conducted Emission Test Site |              |              |               |            |            |
|------------------------------|--------------|--------------|---------------|------------|------------|
| EQUIPMENT TYPE               | MFR          | MODEL NUMBER | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| EXA Spectrum Analyzer        | Agilent      | N9010A       | MY54200716    | 2017/10/16 | 2018/10/15 |
| Attenuator                   | Mini-Circuit | BW-S10W2+    | 2             | 2018/01/02 | 2019/01/01 |
| Notebook                     | Lenovo       | L430         | R9-X11BG      | N/A        | N/A        |

### 12.3 Test Set-up



### 12.4 Measurement Procedure

Set analyzer center frequency to DTS channel center frequency.

The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.

Set the span to 1.5 times the DTS channel bandwidth.

Set the RBW = 3 kHz & VBW = 10 kHz.

For defining Restricted Band Edge Limit:

Set the RBW = 100kHz & VBW = 300 kHz

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

2TX / MIMO mode: offset is set following "measure and add 10 Log (N)" on spectrum to measure the PSD for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna. N=2 for this given application.

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## 12.5 Measurement Result

| POWER DENSITY 802.11b |                               |                |                                   |                |        |
|-----------------------|-------------------------------|----------------|-----------------------------------|----------------|--------|
| Freq.<br>(MHz)        | PPSD W/O Duty Factor<br>(dBm) | Duty<br>Factor | PPSD With<br>Duty Factor<br>(dBm) | Limit<br>(dBm) | Result |
| 2412                  | 0.58                          | 0.37           | 0.95                              | 8.00           | PASS   |
| 2437                  | 2.61                          | 0.37           | 2.98                              | 8.00           | PASS   |
| 2462                  | 1.26                          | 0.37           | 1.63                              | 8.00           | PASS   |

| POWER DENSITY 802.11g |                               |                |                                   |                |        |
|-----------------------|-------------------------------|----------------|-----------------------------------|----------------|--------|
| Freq.<br>(MHz)        | PPSD W/O Duty Factor<br>(dBm) | Duty<br>Factor | PPSD With<br>Duty Factor<br>(dBm) | Limit<br>(dBm) | Result |
| 2412                  | -7.57                         | 0.39           | -7.18                             | 8.00           | PASS   |
| 2437                  | -3.96                         | 0.39           | -3.57                             | 8.00           | PASS   |
| 2462                  | -5.74                         | 0.39           | -5.35                             | 8.00           | PASS   |

| POWER DENSITY 802.11n HT20 |                               |                |                                   |                |        |
|----------------------------|-------------------------------|----------------|-----------------------------------|----------------|--------|
| Freq.<br>(MHz)             | PPSD W/O Duty Factor<br>(dBm) | Duty<br>Factor | PPSD With<br>Duty Factor<br>(dBm) | Limit<br>(dBm) | Result |
| 2412                       | -8.81                         | 0.50           | -8.31                             | 8.00           | PASS   |
| 2437                       | -3.74                         | 0.50           | -3.24                             | 8.00           | PASS   |
| 2462                       | -7.97                         | 0.50           | -7.47                             | 8.00           | PASS   |

Offset: 14.21 dB

\*Refer to next page for plots

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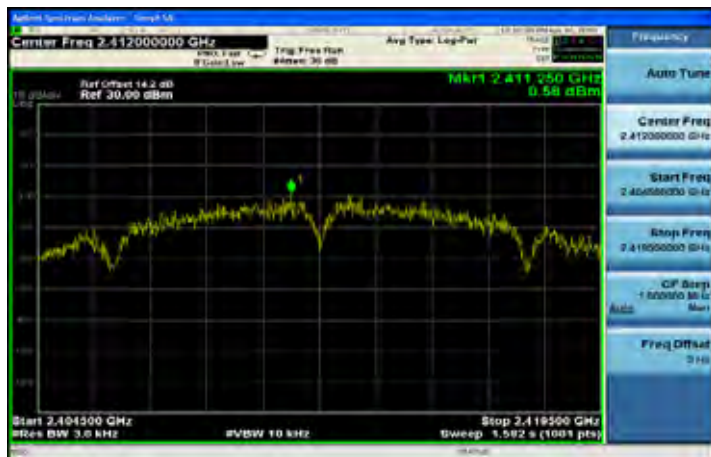
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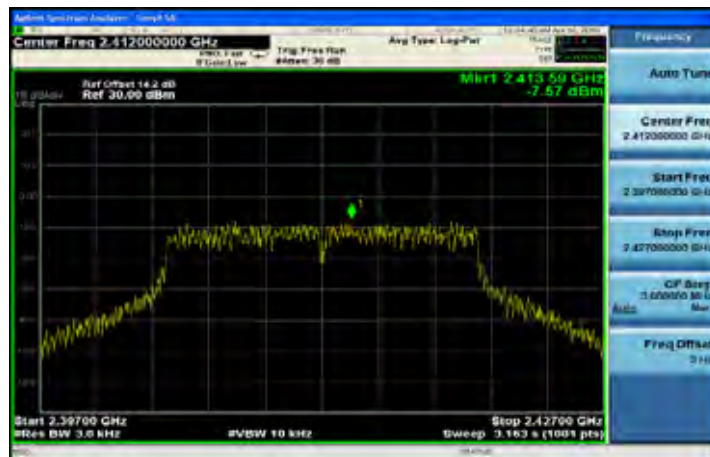
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802.11b PSD(CH-Low)



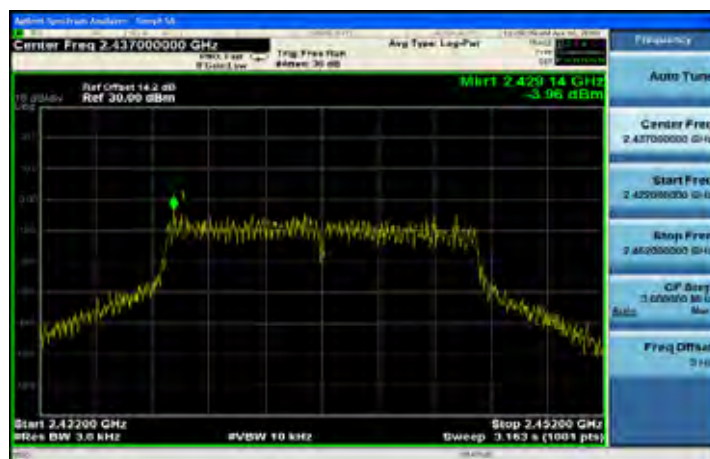
802.11g PSD(CH-Low)



802.11b PSD (CH-Mid)



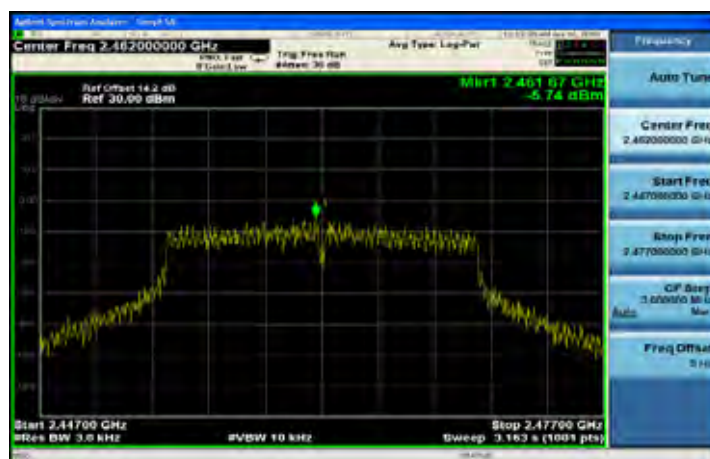
802.11g PSD (CH-Mid)



802.11b PSD (CH-High)



P802.11g PSD (CH-High)



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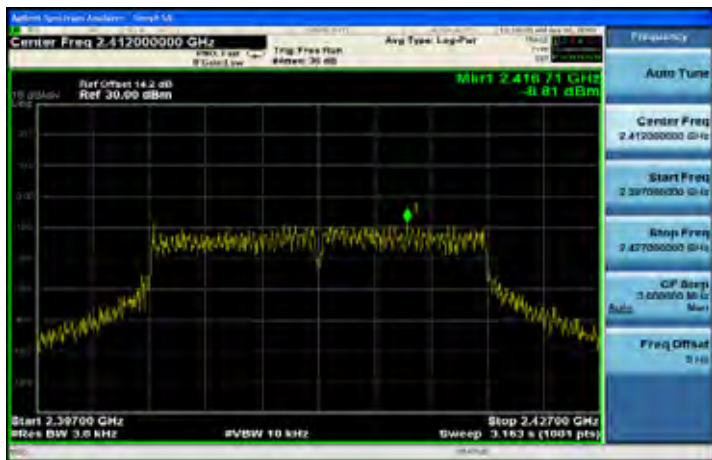
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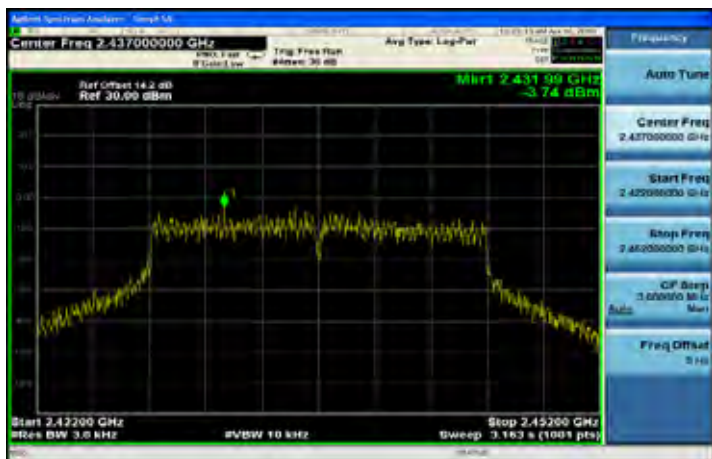
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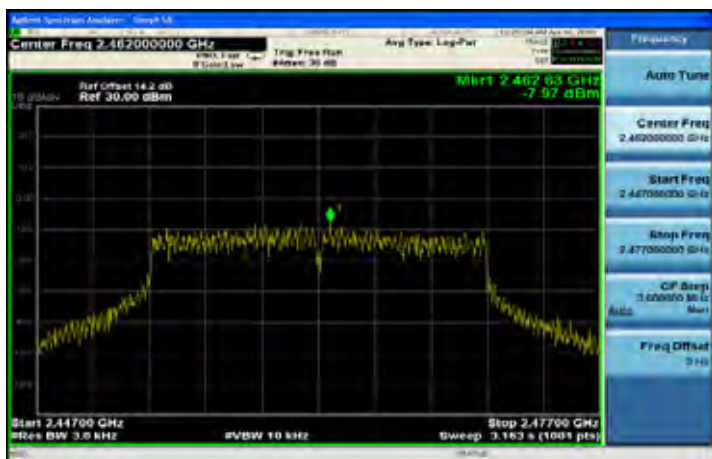
### 802.11n\_HT20 PSD (CH-Low)



### 802.11n\_HT20 PSD (CH-Mid)



### 802.11n\_HT20 PSD (CH-High)



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## 13 ANTENNA REQUIREMENT

### 13.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

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

### 13.2 Antenna Connected Construction

An embedded-in antenna design is used.

The antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

~ End of Report ~

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