

## ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

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

OF

**Product Name:** JUMPY Plus

**Brand Name:** JUMPY

**Marketing Name:** JUMPY Plus

**Model No.:** JR-02-W

**Model Difference:** N/A

**FCC ID:** 2ADZ9-JR-02-W

**Report No.:** ER/2016/10074-01

**Issue Date:** Sep. 02, 2019

**FCC Rule Part:** §15.247, Cat: DTS

**Prepared for:** JOYRAY TECHNOLOGY CO., LTD.  
Rm. 4, 4F., No.162, Sec. 4, Zhongxiao E. Rd.,  
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10688

**Prepared by:** SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
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## VERIFICATION OF COMPLIANCE

**Applicant:** JOYRAY TECHNOLOGY CO., LTD.  
Rm. 4, 4F., No.162, Sec. 4, Zhongxiao E. Rd., Da'an Dist.,  
Taipei City 106, Taiwan (R.O.C.) 10688

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**Model No.:** JR-02-W

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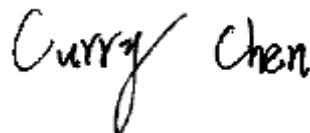
**Date of test:** Jan. 28, 2016 ~ Feb. 15, 2016

**Date of EUT Received:** Jan. 28, 2016

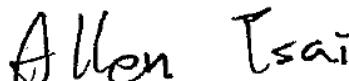
**We hereby certify that:**

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.

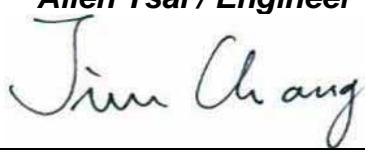
The test results of this report relate only to the tested sample identified in this report.

**Test By:****Date:**

Sep. 02, 2019

**Curry Chen / Engineer****Prepared By:****Date:**

Sep. 02, 2019

**Allen Tsai / Engineer****Approved By:****Date:**

Sep. 02, 2019

**Jim Chang / Asst. Manager**

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## Revision History

Report Number	Revision	Description	Effectuated Page	Issue Date	Revised By
ER/2016/10074	Rev.00	Initial creation of document	All	Feb. 19, 2016	Allen Tsai
ER/2016/10074-01	Rev.01	Add section 1.7 remark and conduction data updated	Page 8, 17~18	Sep. 02, 2019	Allen Tsai

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## Table of Contents

<b>1 GENERAL INFORMATION.....</b>	<b>6</b>
1.1 Product description .....	6
1.2 Product Feature of Equipment Under Test .....	7
1.3 Test Methodology of Applied Standards.....	8
1.4 Test Facility .....	8
1.5 Special Accessories .....	8
1.6 Equipment Modifications .....	8
1.7 Remarks .....	8
<b>2 SYSTEM TEST CONFIGURATION .....</b>	<b>9</b>
2.1 EUT Configuration .....	9
2.2 EUT Exercise.....	9
2.3 Test Procedure.....	9
2.4 Measurement Results Explanation Example .....	9
2.5 Configuration of Tested System.....	10
<b>3 SUMMARY OF TEST RESULTS .....</b>	<b>11</b>
<b>4 DESCRIPTION OF TEST MODES.....</b>	<b>12</b>
4.1 Operated in 2400 ~ 2483.5MHz Band .....	12
4.2 The Worst Test Modes and Channel Details.....	12
<b>5 MEASUREMENT UNCERTAINTY.....</b>	<b>14</b>
<b>6 CONDUCTED EMISSION TEST.....</b>	<b>15</b>
6.1 Standard Applicable .....	15
6.2 Measurement Equipment Used .....	15
6.3 EUT Setup .....	15
6.4 Test SET-UP (Block Diagram of Configuration) .....	16
6.5 Measurement Procedure .....	16
6.6 Measurement Result .....	16
<b>7 DUTY CYCLE OF TEST SIGNAL.....</b>	<b>19</b>
7.1 DUTY CYCLE TEST SIGNAL Measurement Result.....	20
<b>8 PEAK OUTPUT POWER MEASUREMENT .....</b>	<b>22</b>
8.1 Standard Applicable .....	22
8.2 Measurement Equipment Used .....	22
8.3 Test Set-up.....	22
8.4 Measurement Procedure .....	23

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8.5 Measurement Result .....	23
<b>9 6dB BANDWIDTH MEASUREMENT .....</b>	<b>25</b>
9.1 Standard Applicable .....	25
9.2 Measurement Equipment Used .....	25
9.3 Test Set-up.....	25
9.4 Measurement Procedure .....	25
9.5 Measurement Result .....	26
<b>10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT .....</b>	<b>32</b>
10.1 Standard Applicable .....	32
10.2 Measurement Equipment Used .....	32
10.3 Test SET-UP .....	32
10.4 Measurement Procedure .....	33
10.5 Measurement Result .....	33
<b>11 RADIATED BANDEdge AND SPURIOUS EMISSION MEASUREMENT.....</b>	<b>46</b>
11.1 Standard Applicable .....	46
11.2 Measurement Equipment Used: .....	47
11.3 Test SET-UP .....	48
11.4 Measurement Procedure .....	49
11.5 Field Strength Calculation.....	50
11.6 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz.....	50
11.7 Measurement Result.....	50
<b>12 PEAK POWER SPECTRAL DENSITY .....</b>	<b>81</b>
12.1 Standard Applicable .....	81
12.2 Measurement Equipment Used .....	81
12.3 Test Set-up.....	81
12.4 Measurement Procedure .....	81
12.5 Measurement Result .....	82
<b>13 ANTENNA REQUIREMENT .....</b>	<b>88</b>
13.1 Standard Applicable .....	88
13.2 Antenna Connected Construction.....	88

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## 1 GENERAL INFORMATION

### 1.1 Product description

#### General:

Product Name:	JUMPY Plus		
Brand Name:	JUMPY		
Marketing Name:	JUMPY Plus		
Model No.:	JR-02-W		
Model Difference:	N/A		
Software version:	000C		
Hardware version:	DVT		
USB Cable	Model No.: C-01-W Supplier: Foxlink		
Power Supply:	3.7Vdc from Li-ion Polymer rechargeable battery		
	Battery:	Model No.: 443031 Supplier: Highpower	

#### WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power	Type of Emission	Modulation Technology
11b/g	2412-2462	11	b: 18.00dBm g: 22.39dBm	b: 9M01G1D g:16M4D1D	DSSS, OFDM
11n	HT20 2412-2462	11	HT20:22.38dBm	HT20:17M6D1D	OFDM
Antenna Designation:		PIFA Antenna Gain: 0.67dBi			
Modulation type:		CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM			
Transition Rate:		802.11 b: 1/2/5.5/11 Mbps 802.11 g: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 72.2Mbps			

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## 1.2 Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is supporting WCDMA, Wi-Fi 802.11b/g/n and Bluetooth features, and below is details of information.

Product Feature	
Product Name:	JUMPY Plus
Brand Name:	JUMPY
Marketing Name:	JUMPY Plus
Model No.:	JR-02-W
Model Difference:	N/A
FCC ID:	2ADZ9-JR-02-W
WCDMA Operating Band(s)	FDD Band II
Wi-Fi Specification	802.11b/g/n
Bluetooth Version	V4.1 Single mode

**Note:** The above EUT information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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### 1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance V03r04

ANSI C63.10:2013

Note:

1. All test items have been performed and record as per the above standards.
2. The composite system is compliance with FCC Subpart B is authorized under a DoC procedure.

### 1.4 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 Designation number: TW0001

### 1.5 Special Accessories

There are no special accessories used while test was conducted.

### 1.6 Equipment Modifications

There was no modification incorporated into the EUT.

### 1.7 Remarks

The original test report ER/2016/10074 will be withdrawn with this test report ER/2016/10074-01 and is no longer valid when the withdrawal occurred.

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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 30MHz,. 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 hand-held 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. Following shows an offset computation example with cable loss 1dB and 10dB attenuator.

$$\text{offset} = \text{RF cable loss (dB)} + \text{attenuation factor(dB)} = 11\text{dB}$$

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## 2.5 Configuration of Tested System

Fig. 2-1 Radiated & Conducted Emission



Fig. 2-2 Conducted (Antenna Port)

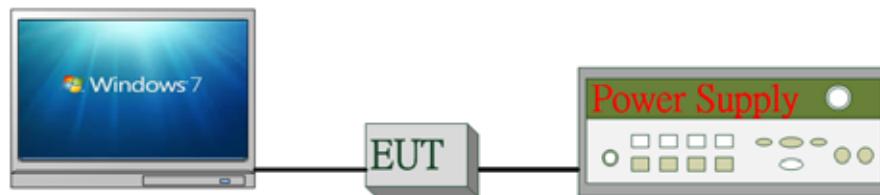


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Test Software	DRTU	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L420	LR-7HXZA	Shielded	Un-Shielded
3.	DC Power Supply	HP	E3640A	KR93300208	N/A	Un-Shielded

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### 3 SUMMARY OF TEST RESULTS

FCC 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 §15.247(b)	Antenna Requirement	Compliant

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## 4 DESCRIPTION OF TEST MODES

### 4.1 Operated in 2400 ~ 2483.5MHz Band

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

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

#### RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
802.11g	1 to 11	1,6,11	OFDM	6

RADIATED EMISSION TEST (ABOVE 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
802.11b	1 to 11	1, 6, 11	DSSS	1
802.11g	1 to 11	1, 6, 11	OFDM	6
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS 0

#### Note:

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 802.11b/g/n WLAN Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

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## ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
802.11b	1 to 11	1, 6, 11	DSSS	1
802.11g	1 to 11	1, 6, 11	OFDM	6
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS 0

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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 (Polarization : <b>Vertical</b> )	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : <b>Horizontal</b> )	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 MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

#### Note

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### 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	05/04/2015	05/03/2016
LISN	SCHWARZ BECK	NSLK 8127	8127-649	05/15/2015	05/14/2016
LISN	FCC	FCC-LISN-50/250-2 5-2-01	04034	03/13/2015	03/12/2016
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2015	11/25/2016

### 6.3 EUT Setup

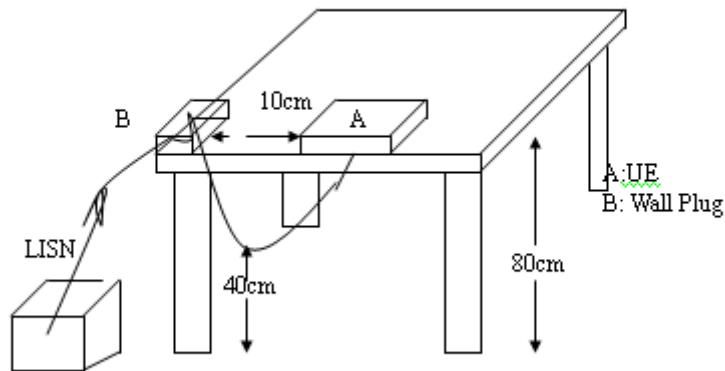
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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## 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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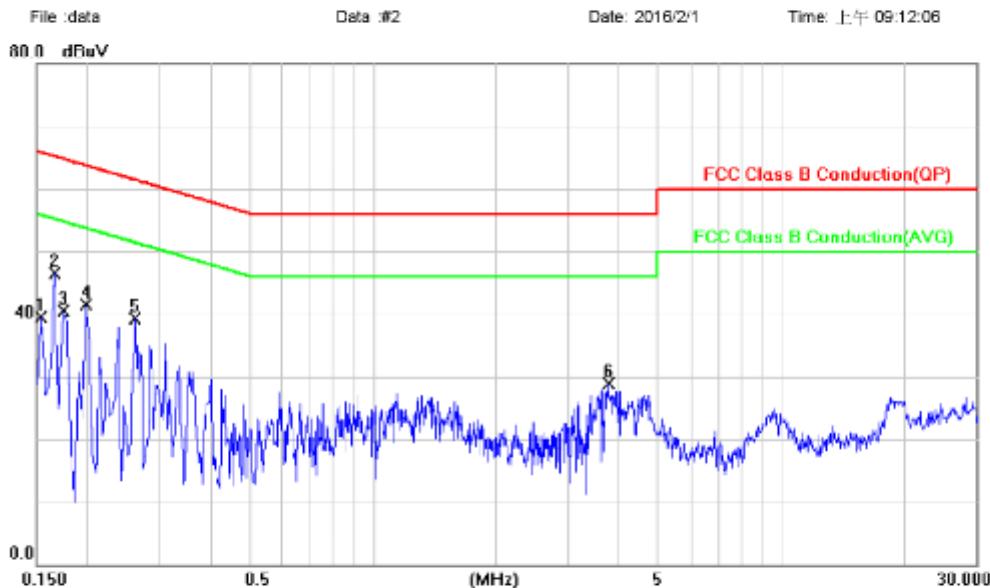
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Operation Mode:	operation mode			Test Date:	2016/02/01
Temperature:	25	Humidity:	85%	Test By:	Tin
Model No.:	N/A			Probe:	L1 / N

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

Phase: **L1** Temperature: 25 °C  
 Power: AC 120V/60Hz Humidity: 85 %

### Conducted Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level	Factor	ment				
1		0.1540	39.45	0.03	39.48	65.78	-26.30	peak	
2 *		0.1660	46.47	0.03	46.50	65.16	-18.66	peak	
3		0.1740	40.55	0.03	40.58	64.77	-24.19	peak	
4		0.1980	41.56	0.03	41.59	63.69	-22.10	peak	
5		0.2620	39.36	0.03	39.39	61.37	-21.98	peak	
6		3.7700	28.79	0.15	28.94	56.00	-27.06	peak	

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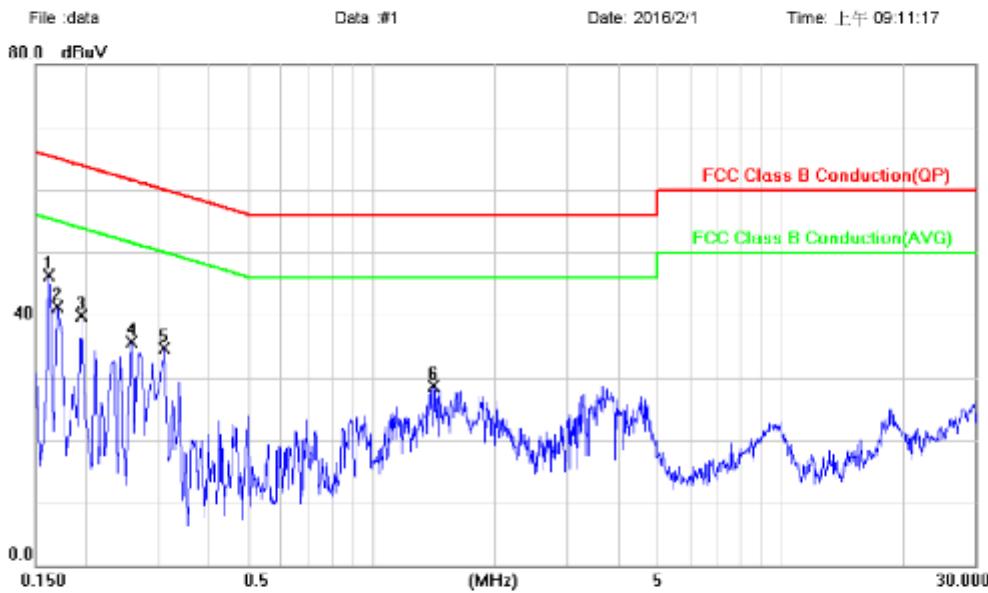
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Site: Conduction Room  
 Limit: FCC Class B Conduction(QP)  
 Mode: Operation mode  
 Note:

Phase: **N**  
 Power: AC 120V/60Hz

Temperature: 25 °C  
 Humidity: 85 %

### Conducted Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level	Factor	ment				
		MHz	dBuV	dB	dBuV	dB			
1	*	0.1620	46.36	0.03	46.39	65.36	-18.97	peak	
2		0.1700	41.32	0.03	41.35	64.96	-23.61	peak	
3		0.1940	39.82	0.03	39.85	63.86	-24.01	peak	
4		0.2580	35.67	0.03	35.70	61.50	-25.80	peak	
5		0.3100	34.73	0.03	34.76	59.97	-25.21	peak	
6		1.4180	28.70	0.05	28.75	56.00	-27.25	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:

$$\text{Duty Cycle} = \text{Ton} / (\text{Ton} + \text{Toff})$$

### Measurement Procedure:

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

### Duty Cycle:

	Duty Cycle (%)	Duty Factor (dB)
802.11b	97.60	0.11
802.11g	87.02	0.60
802.11n_20	86.73	0.62

Duty Cycle Factor:  $10 * \log(1/0.976) = 0.11$

Duty Cycle Factor:  $10 * \log(1/0.8702) = 0.6$

Duty Cycle Factor:  $10 * \log(1/0.8673) = 0.62$

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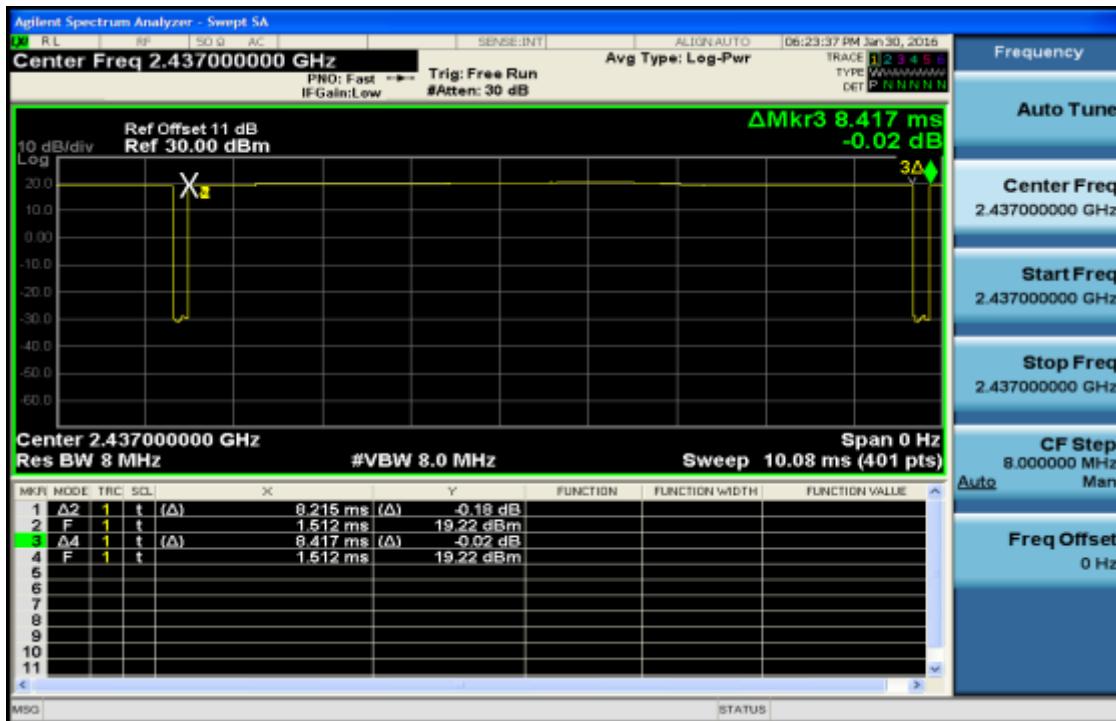
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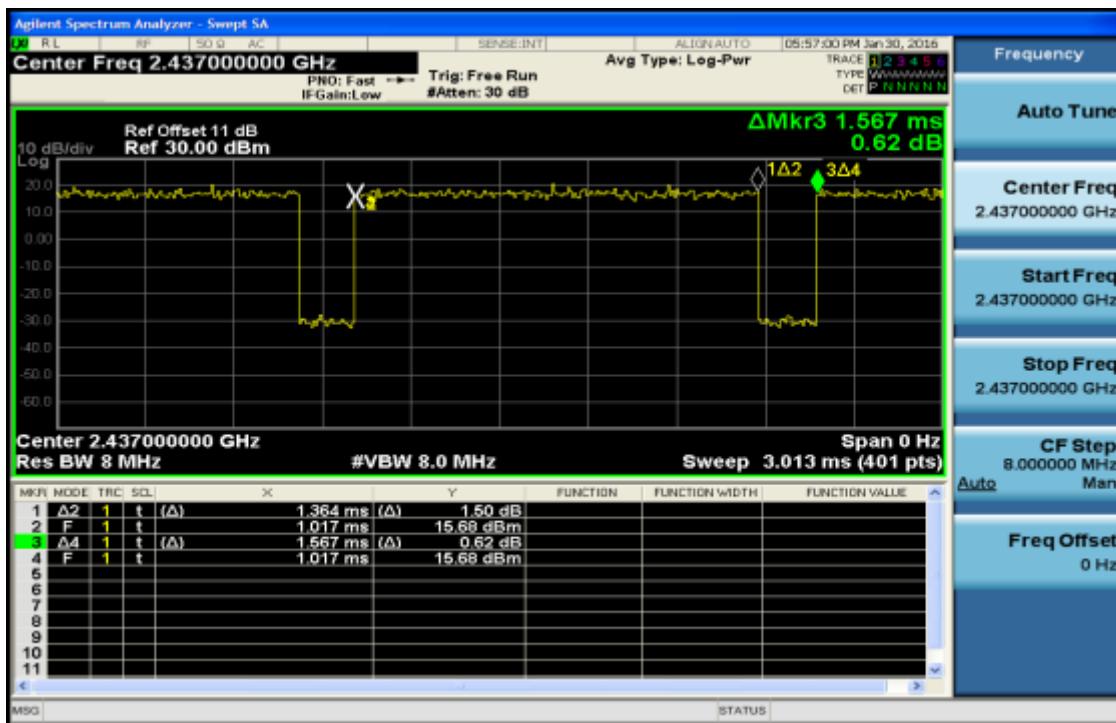
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## 7.1 DUTY CYCLE TEST SIGNAL Measurement Result

### 802.11 b



### 802.11 g

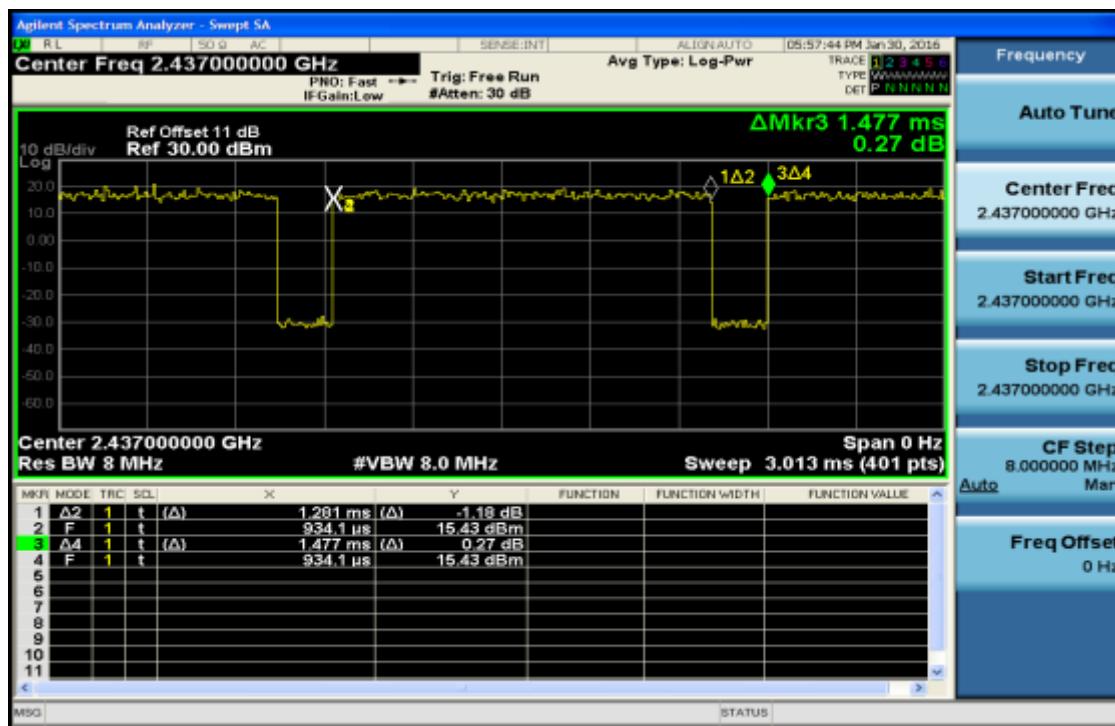


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## 802.11 n\_20 MHz



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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.

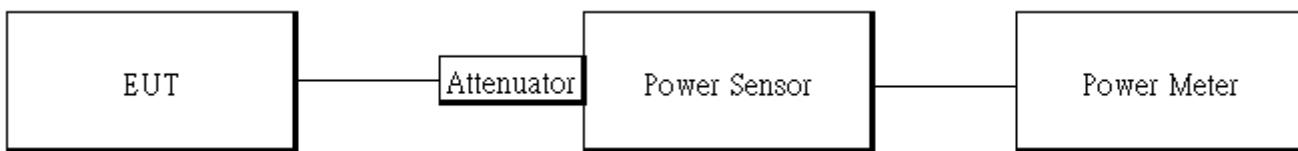
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

### 8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	12/09/2015	12/08/2016
Power Sensor	Anritsu	MA2411B	917032	12/09/2015	12/08/2016
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017

### 8.3 Test Set-up

Power Meter:



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## 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 V03r04.
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.

## 8.5 Measurement Result

802.11b Main						
CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	1	17.61	57.68	1 Watt = 30.00 dBm	PASS
6	2437	1	<b>18.00</b>	<b>63.10</b>	1 Watt = 30.00 dBm	PASS
11	2462	1	17.57	57.15	1 Watt = 30.00 dBm	PASS

802.11b Main						
CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	1	14.69	29.44	1 Watt = 30.00 dBm	PASS
6	2437	1	<b>15.22</b>	<b>33.27</b>	1 Watt = 30.00 dBm	PASS
11	2462	1	14.62	28.97	1 Watt = 30.00 dBm	PASS

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## 802.11g Main

CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	6	22.15	164.06	1 Watt = 30.00 dBm	PASS
6	2437	6	21.40	138.04	1 Watt = 30.00 dBm	PASS
11	2462	6	<b>22.39</b>	<b>173.38</b>	1 Watt = 30.00 dBm	PASS

## 802.11g Main

CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	6	13.22	20.99	1 Watt = 30.00 dBm	PASS
6	2437	6	12.81	19.10	1 Watt = 30.00 dBm	PASS
11	2462	6	<b>13.32</b>	<b>21.48</b>	1 Watt = 30.00 dBm	PASS

## 802.11n\_20M Main

CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	MCS0	22.02	159.22	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	21.32	135.52	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	<b>22.38</b>	<b>172.98</b>	1 Watt = 30.00 dBm	PASS

## 802.11n\_20M Main

CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	MCS0	13.09	20.37	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	12.73	18.75	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	<b>13.24</b>	<b>21.09</b>	1 Watt = 30.00 dBm	PASS

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

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## 9 6DB BANDWIDTH MEASUREMENT

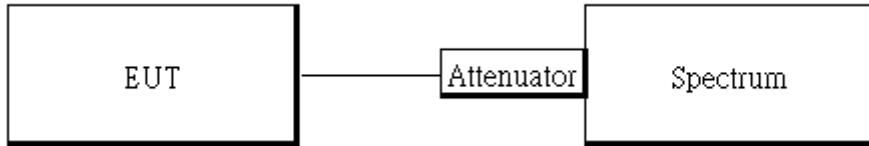
### 9.1 Standard Applicable

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.
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017

### 9.3 Test Set-up



### 9.4 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 V03r04.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. For 6dB Bandwidth:  
Set the spectrum analyzer as RBW = 100 kHz, VBW = 3\*RBW, Span = 30M/50MHz, Detector=peak, Sweep=auto.
5. Mark the peak frequency and -6dB (upper and lower) frequency.
6. For 99% Bandwidth:  
Set the spectrum analyzer as RBW=1%, VBW = 3\*RBW, Span = 30M/50MHz, Detector=Sample, Sweep=auto.
7. Turn on the 99% bandwidth function, max reading.
8. Repeat above procedures until all frequency of interest measured was complete.

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## 9.5 Measurement Result

### 6dB Bandwidth

#### 802.11b Main

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2412	9008	> 500	PASS
2437	8586	> 500	PASS
2462	8104	> 500	PASS

#### 802.11g Main

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2412	16410	> 500	PASS
2437	16380	> 500	PASS
2462	16420	> 500	PASS

#### 802.11\_n20 Main

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2412	17620	> 500	PASS
2437	17590	> 500	PASS
2462	17630	> 500	PASS

\*Refer to next page for plots

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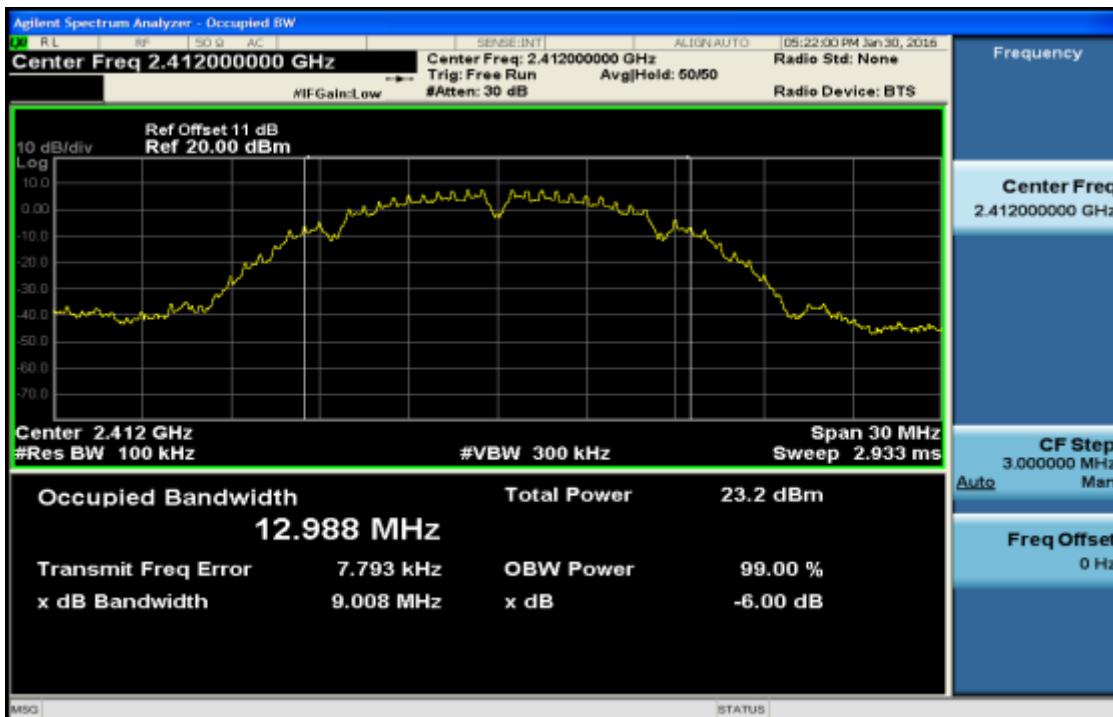
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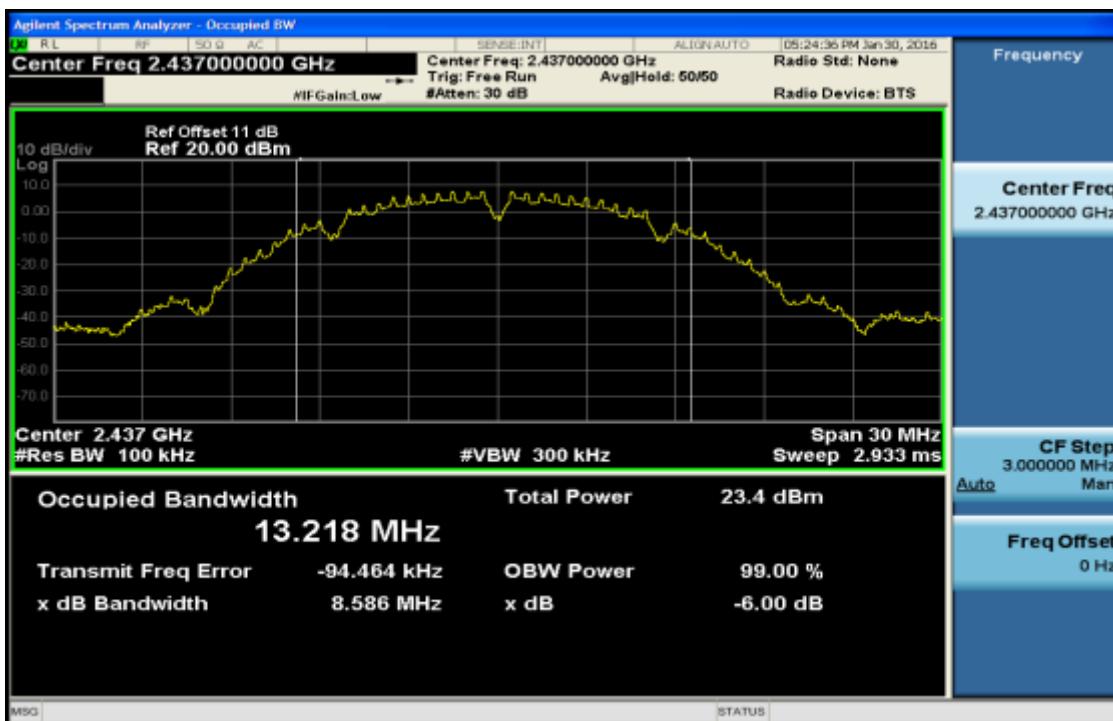
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## 802.11b

## 6dB Band Width Test Data CH-Low



## 6dB Band Width Test Data CH-Mid

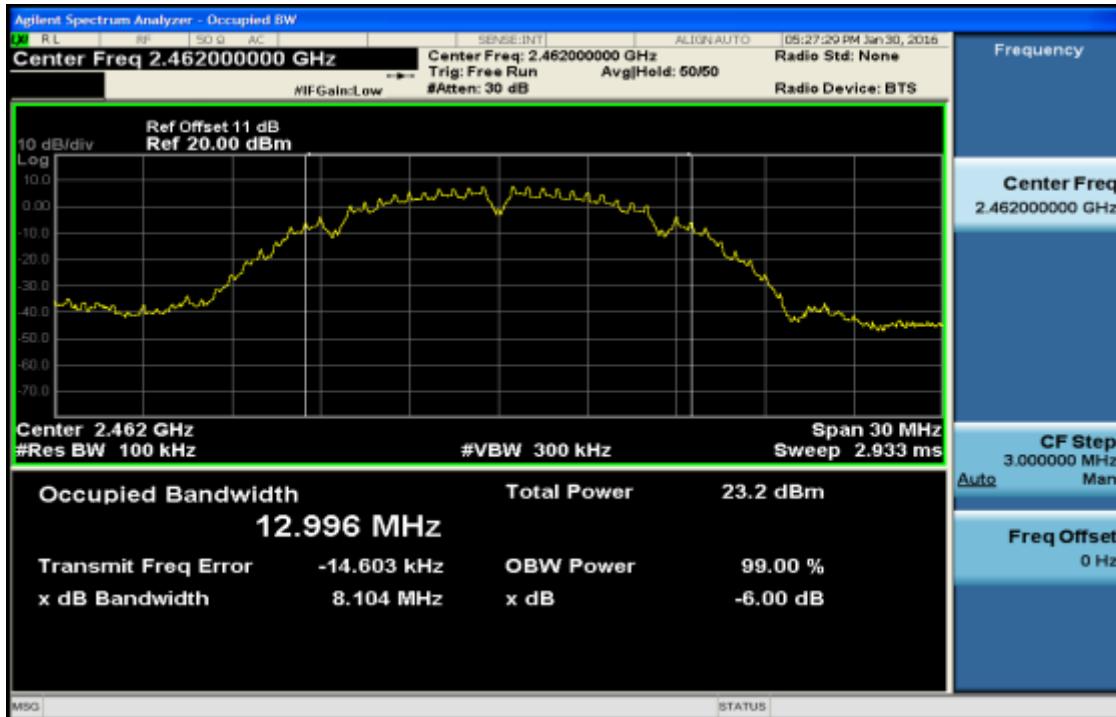


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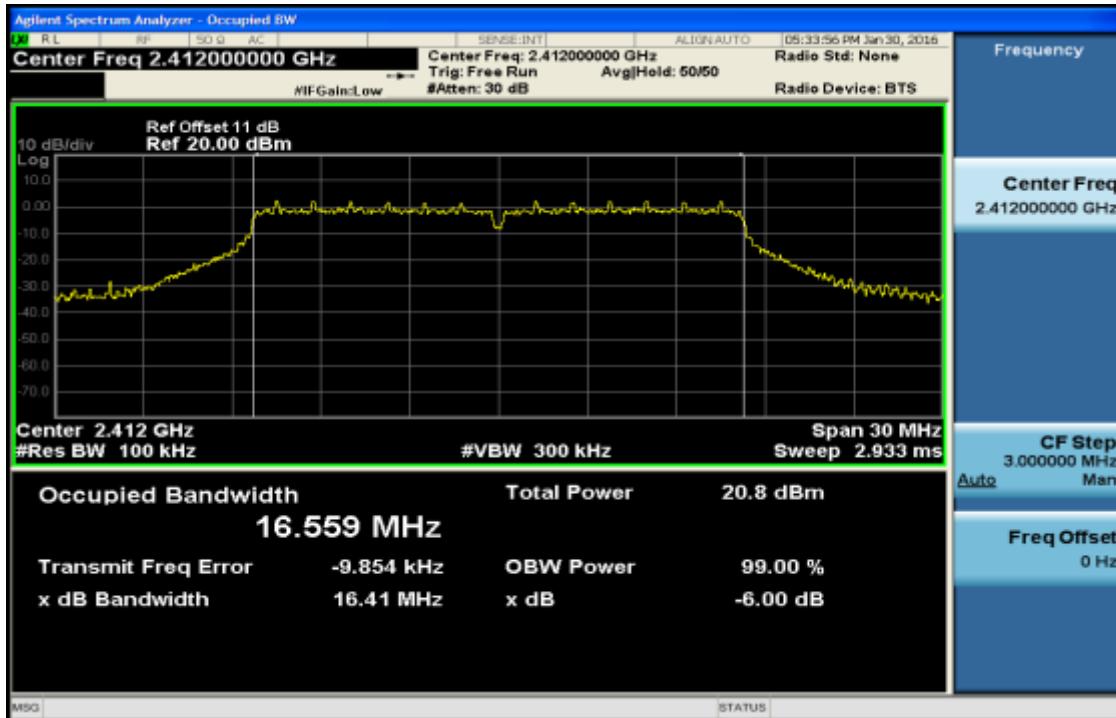
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## 6dB Band Width Test Data CH-High



## 802.11g

## 6dB Band Width Test Data CH-Low

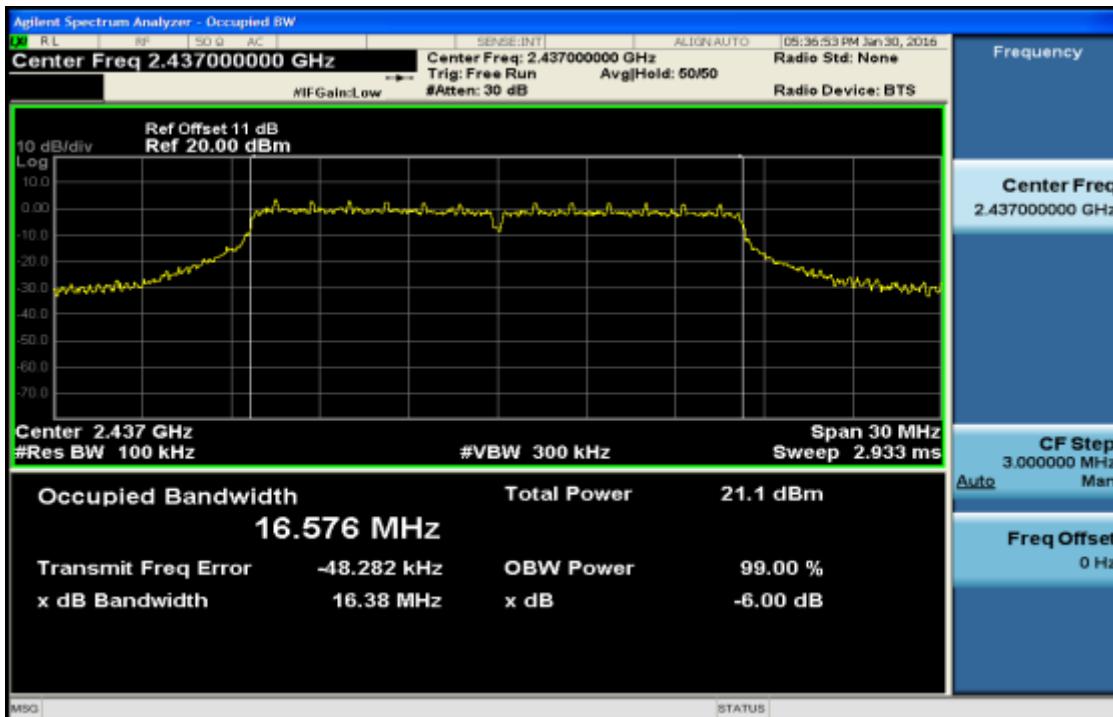


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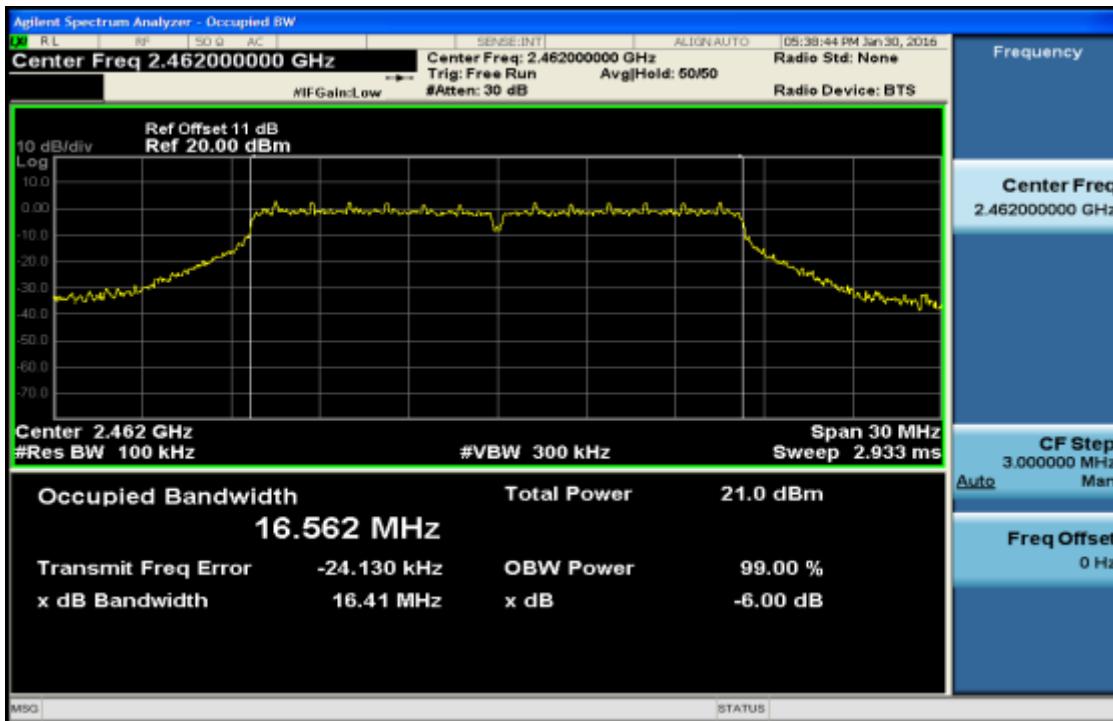
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## 6dB Band Width Test Data CH-Mid



## 6dB Band Width Test Data CH-High



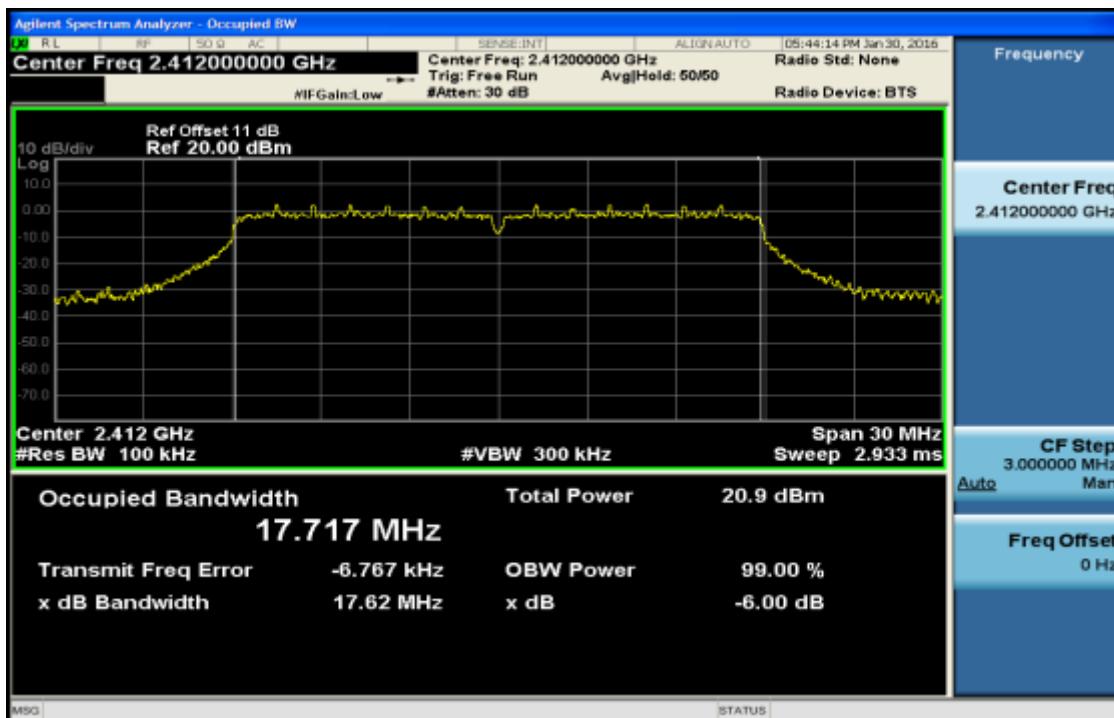
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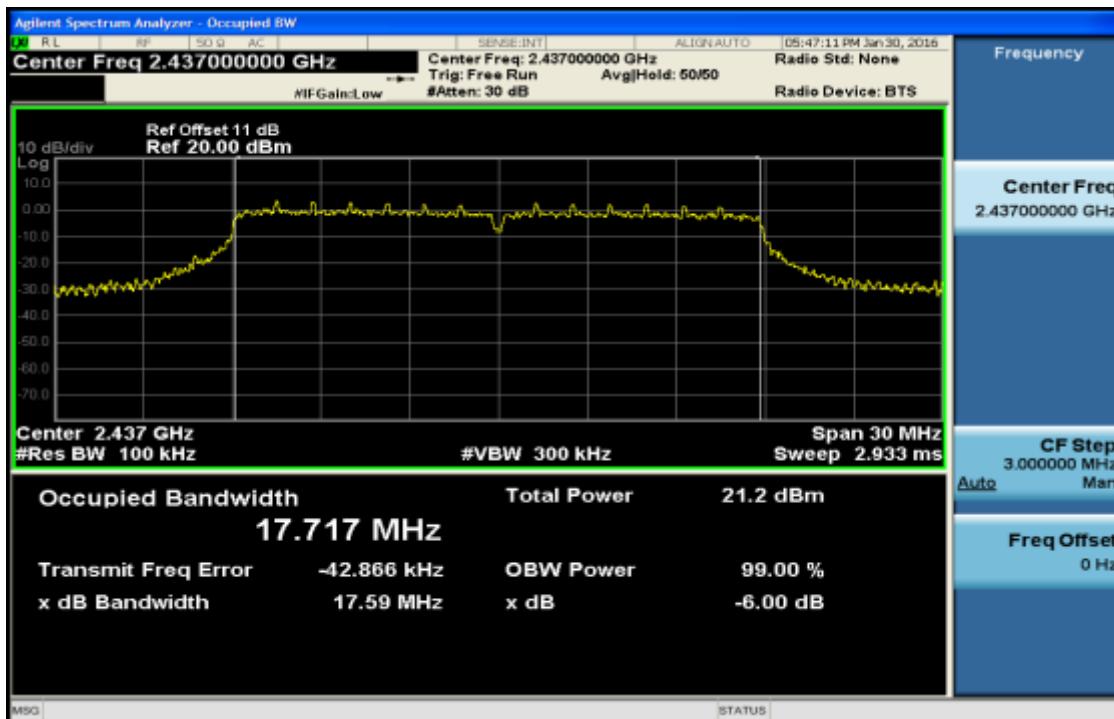
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## 802.11n\_20M

## 6dB Band Width Test Data CH-Low



## 6dB Band Width Test Data CH-Mid



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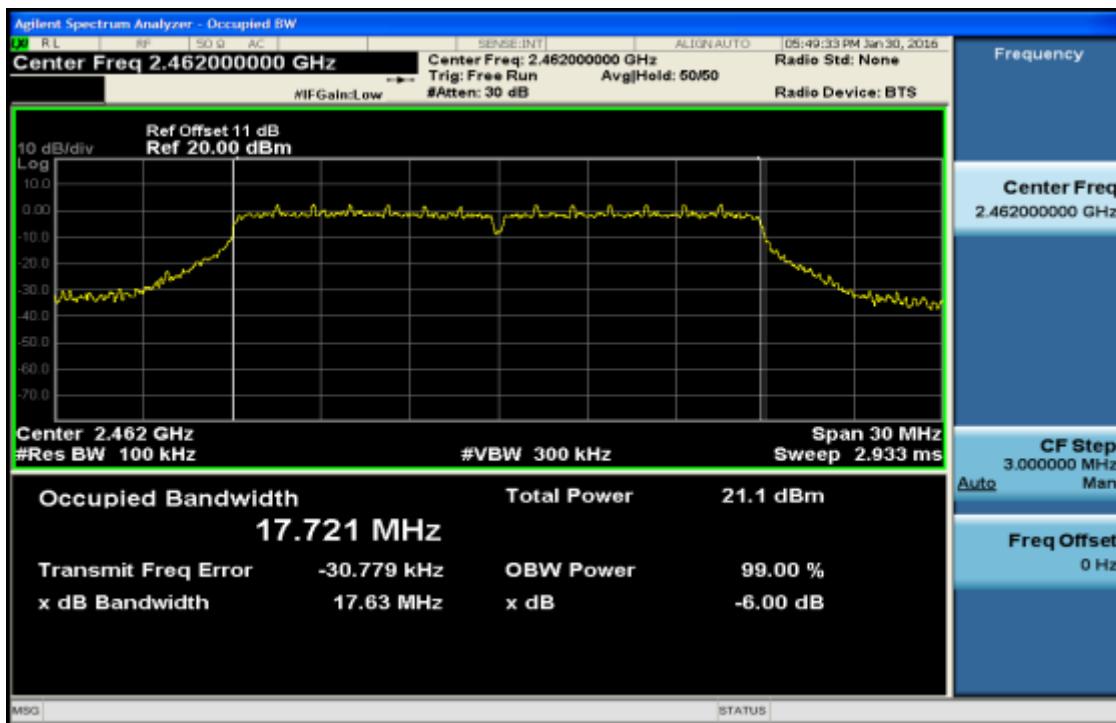
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## 6dB Band Width Test Data CH-High



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## 10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

### 10.1 Standard Applicable

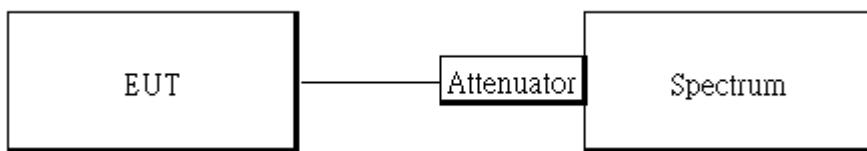
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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).

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

### 10.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017

### 10.3 Test SET-UP



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## 10.4 Measurement Procedure

### 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 V03r04.
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. Repeat above procedures until all default test channel (low, middle, and high) was complete.

### 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 V03r04.
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.

## 10.5 Measurement Result

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

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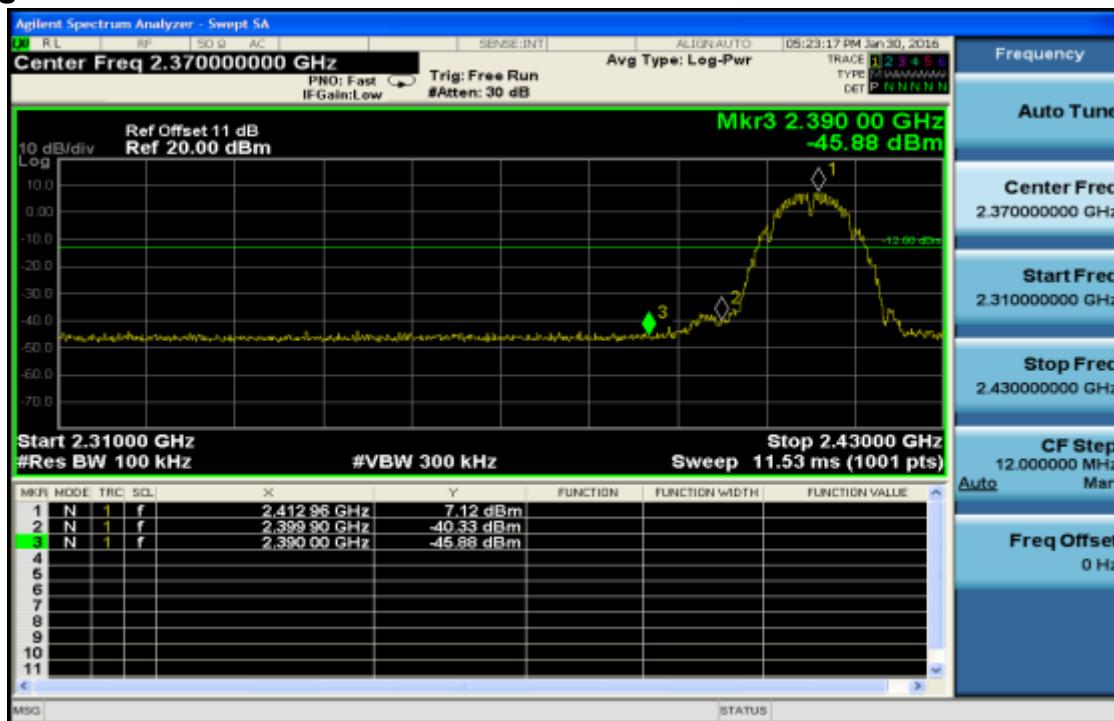
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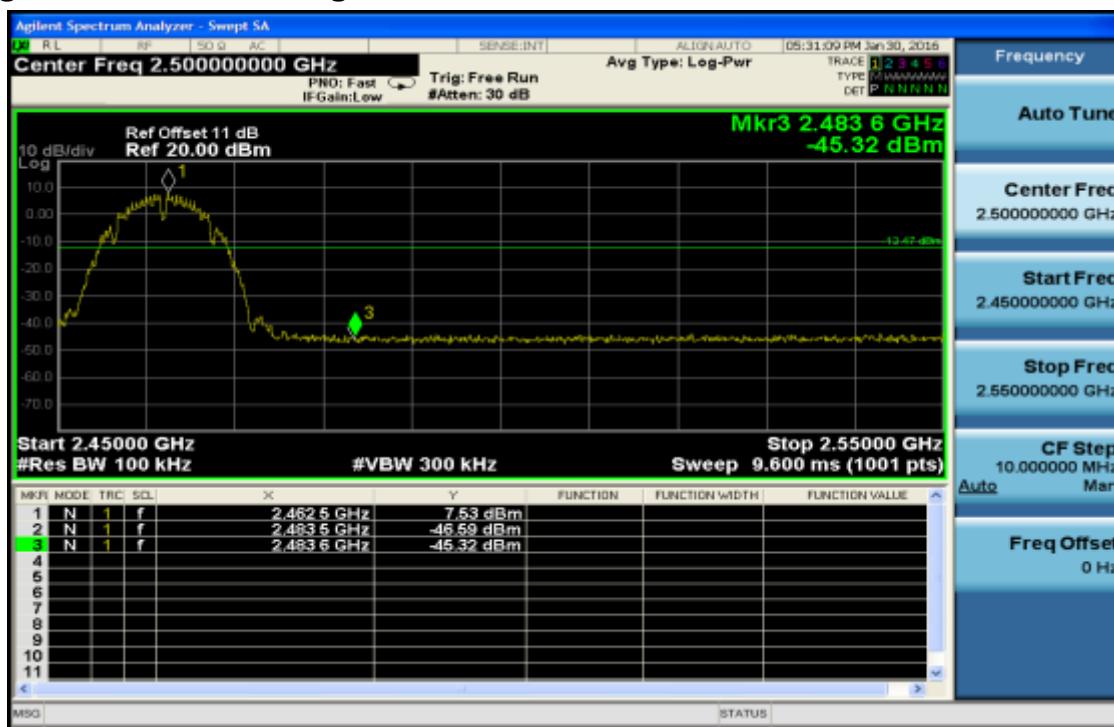
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## 802.11b

### Band Edges Test Data CH-Low



### Band Edges Test Data CH-High



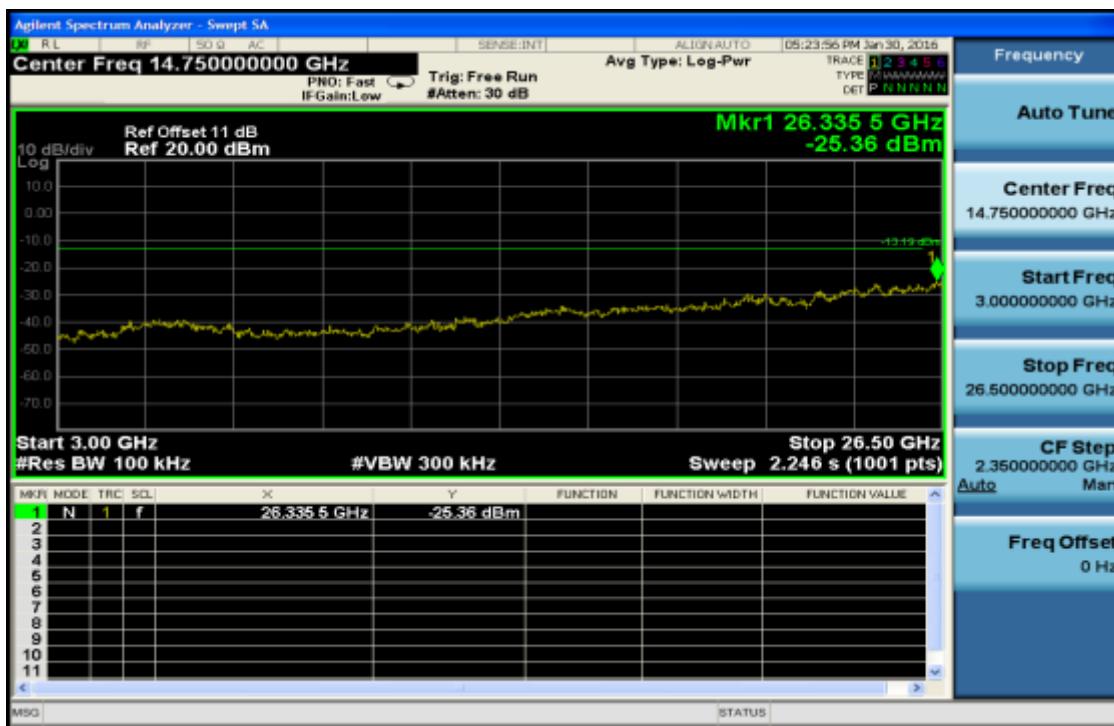
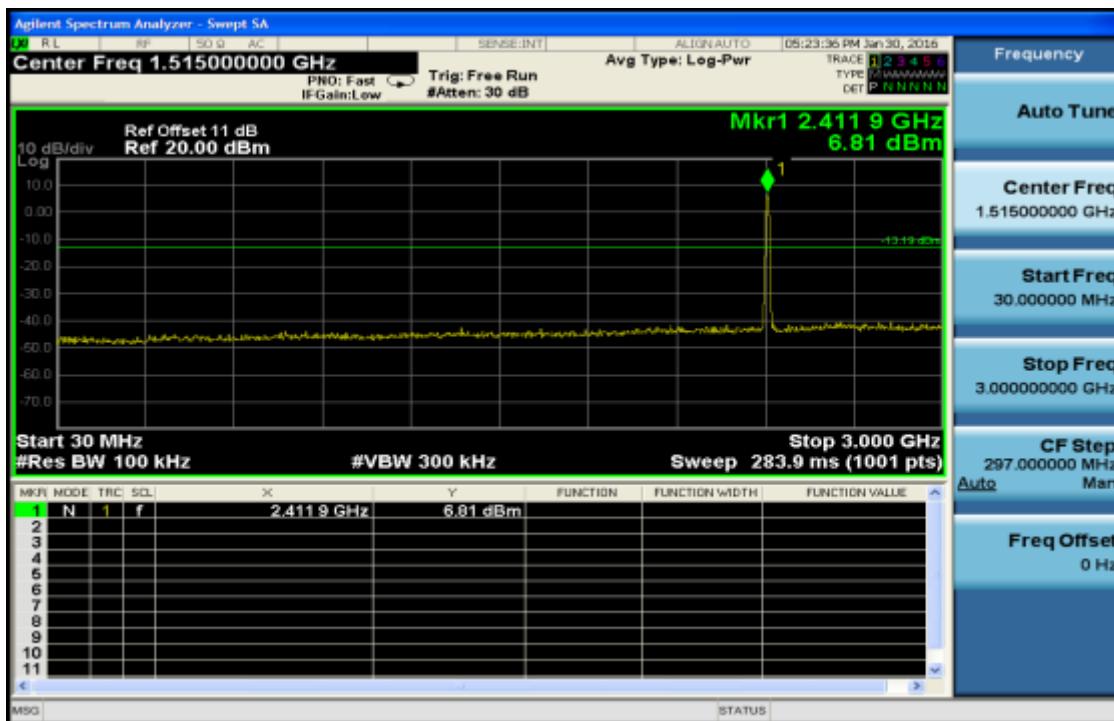
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## 802.11b

## Spurious Emission Test Data CH-Low



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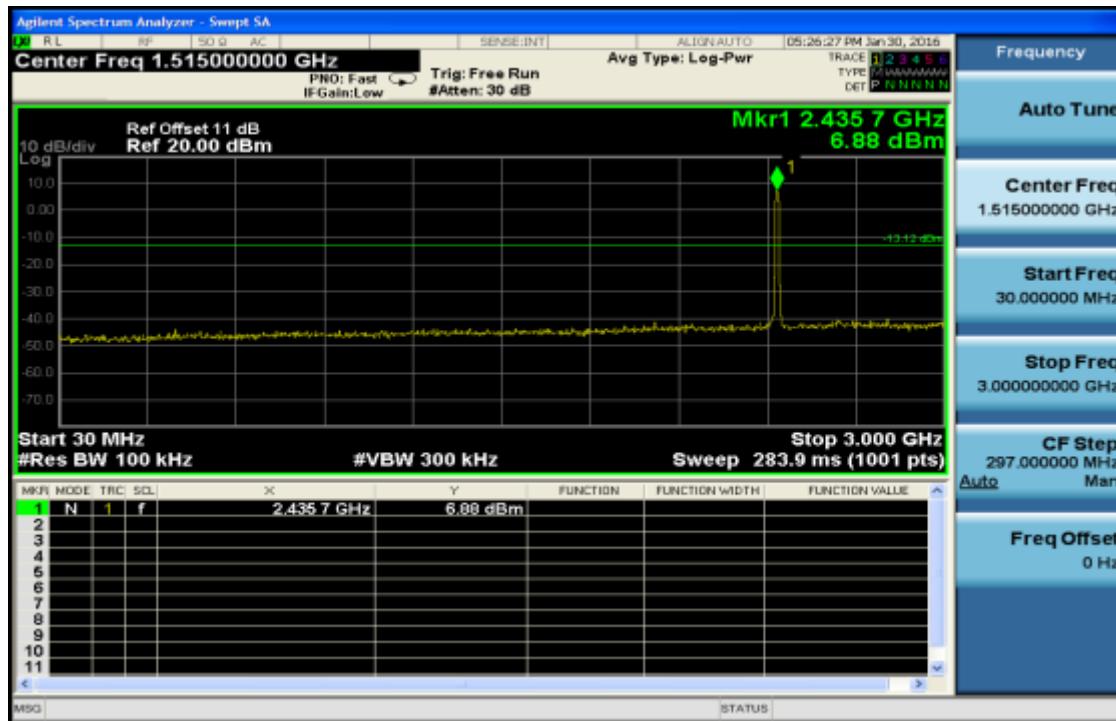
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## Spurious Emission Test Data CH-Mid

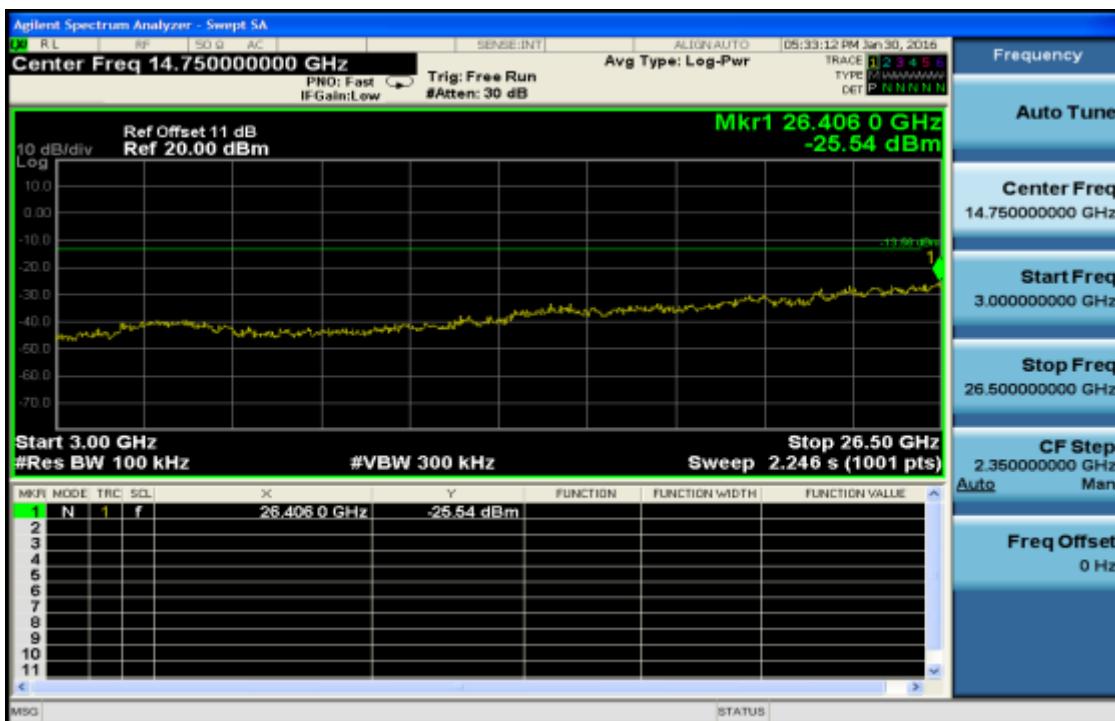
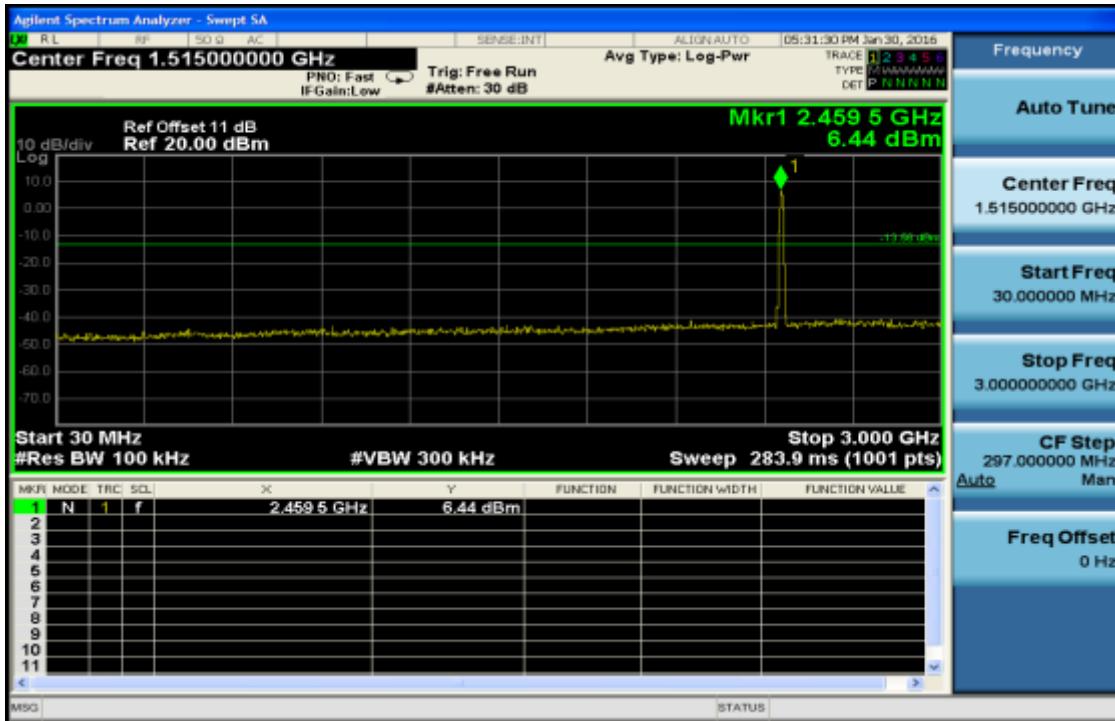


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## Spurious Emission Test Data CH-High



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## 802.11g

## Band Edges Test Data CH-Low



## Band Edges Test Data CH-High



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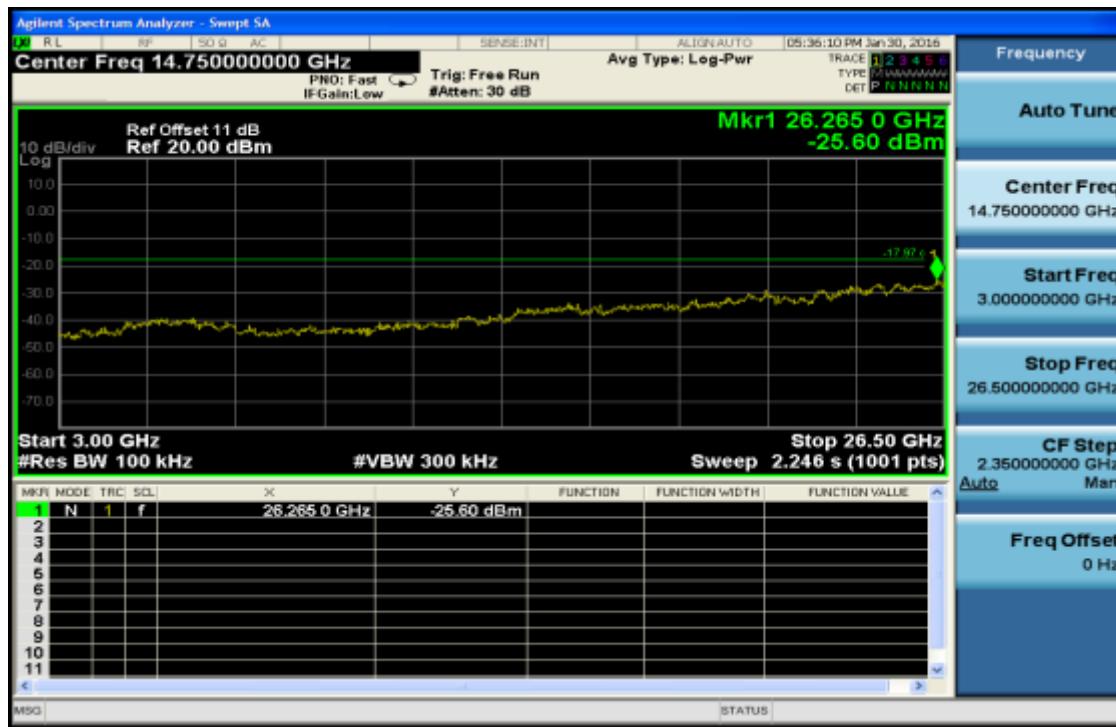
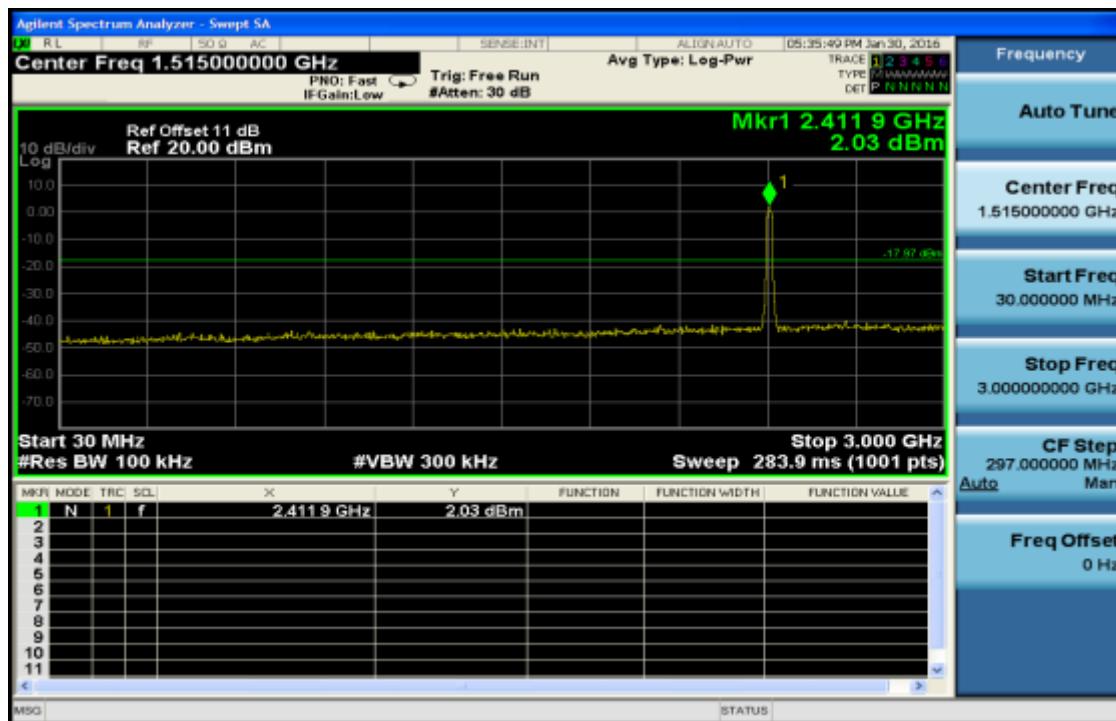
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## 802.11g

## Spurious Emission Test Data CH-Low

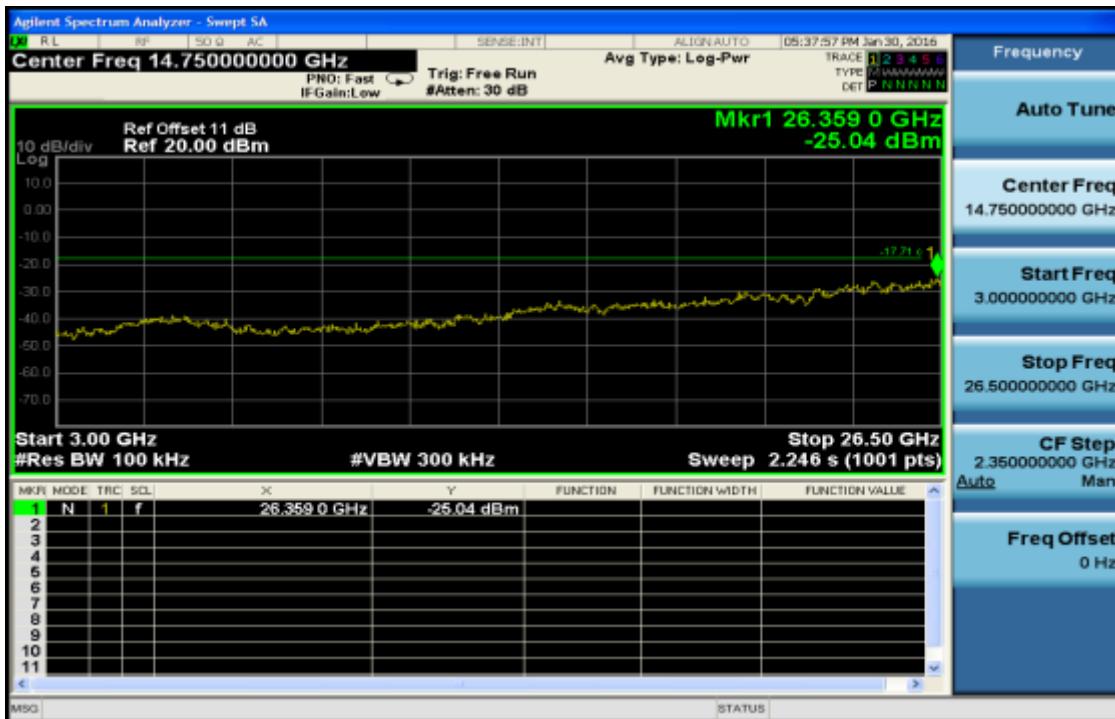
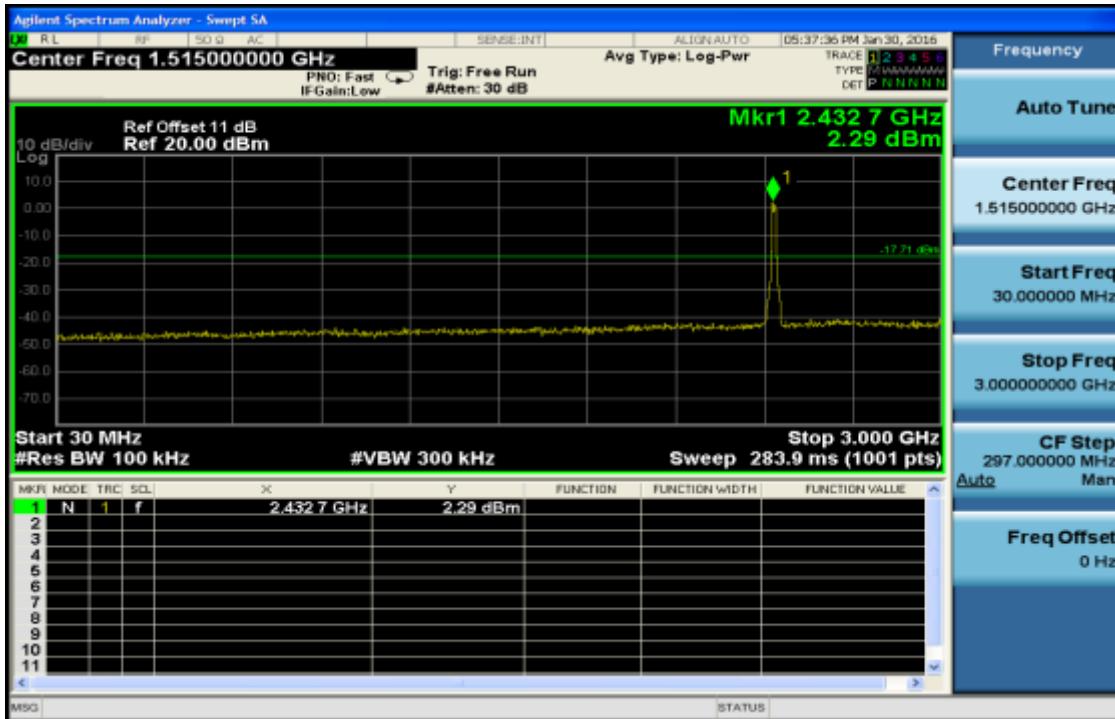


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## Spurious Emission Test Data CH-Mid

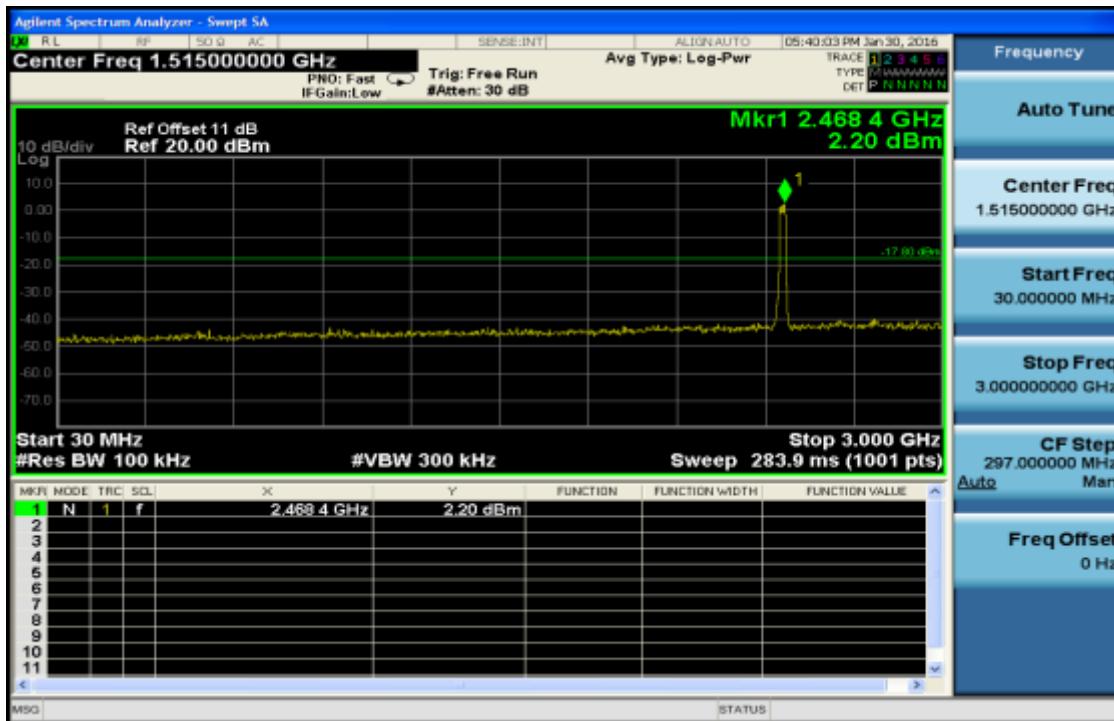


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## Spurious Emission Test Data CH-High



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## 802.11n\_HT20

### Band Edges Test Data CH-Low



### Band Edges Test Data CH-High



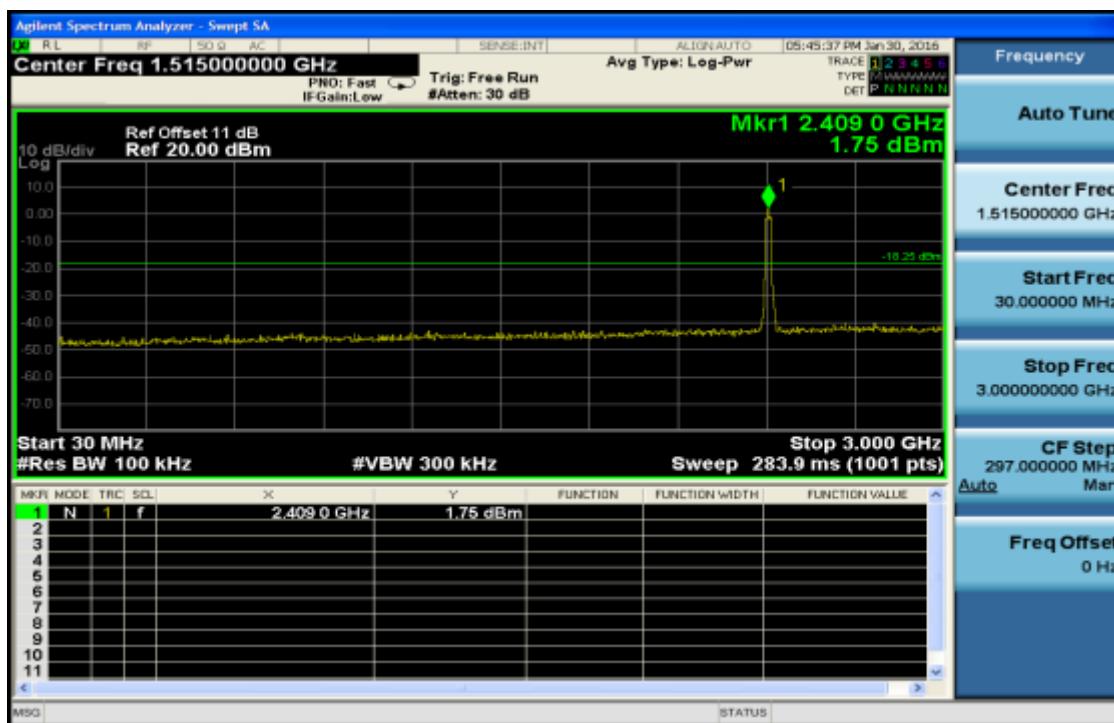
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## 802.11n\_HT20

### Spurious Emission Test Data CH-Low

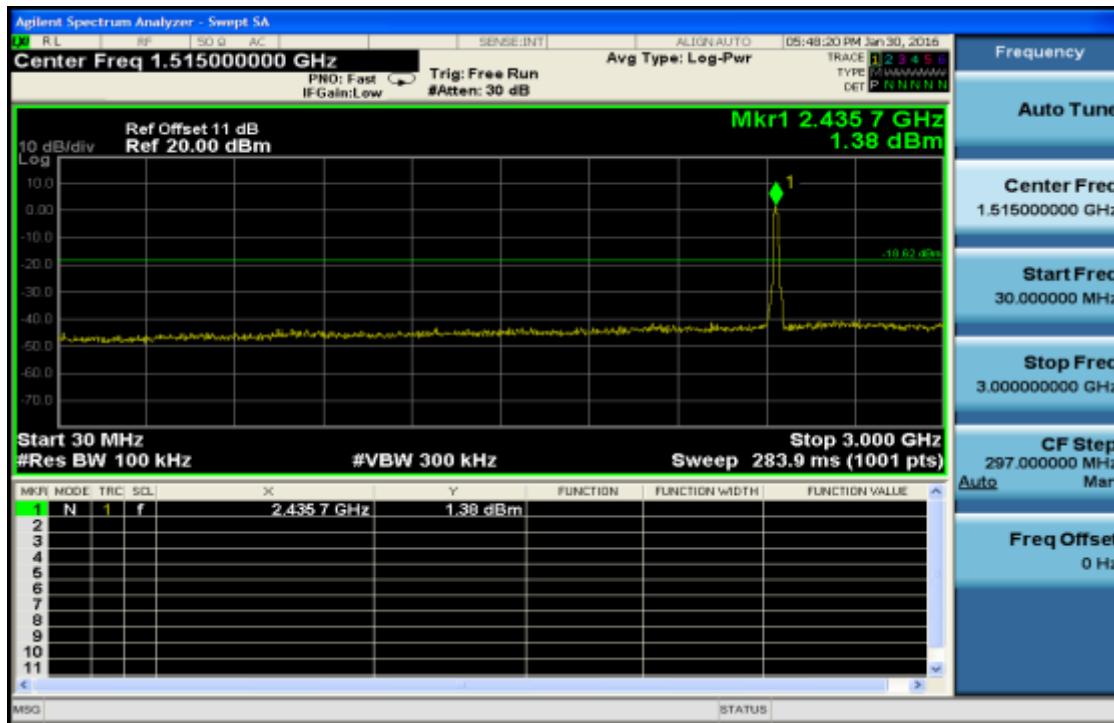


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## Spurious Emission Test Data CH-Mid

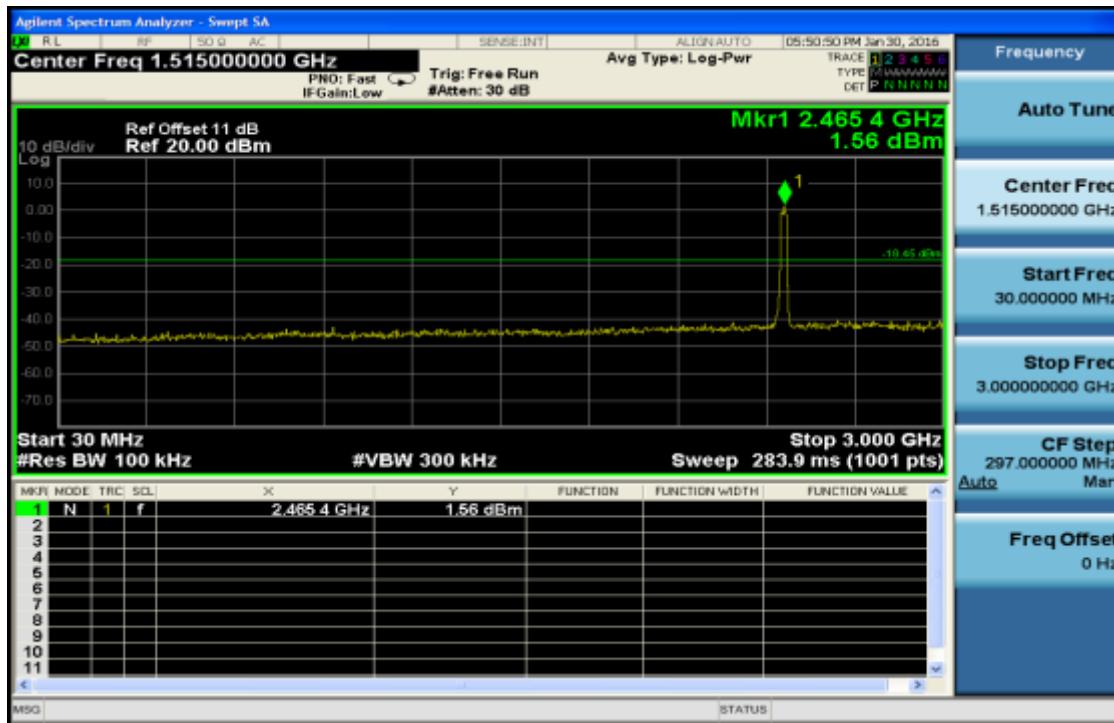


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## Spurious Emission Test Data CH-High



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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 (dB $\mu$ V/m) = 20 log Emission level (dB $\mu$ V/m)

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## 11.2 Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/04/2015	05/03/2016
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/28/2016	01/27/2017
Loop Antenna	ETS.LINDGREN	6502	148045	09/07/2015	09/06/2016
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/14/2015	12/13/2016
Horn antenna	ETS.LINDGREN	3117	123995	05/05/2015	05/04/2016
Pre-Amplifier	Agilent	8447D	2944A07676	01/02/2016	01/01/2017
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/02/2016	01/01/2017
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_RX	9	01/02/2016	01/01/2017
3m Site NSA	SGS	966 chamber	N/A	07/02/2015	07/01/2016

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

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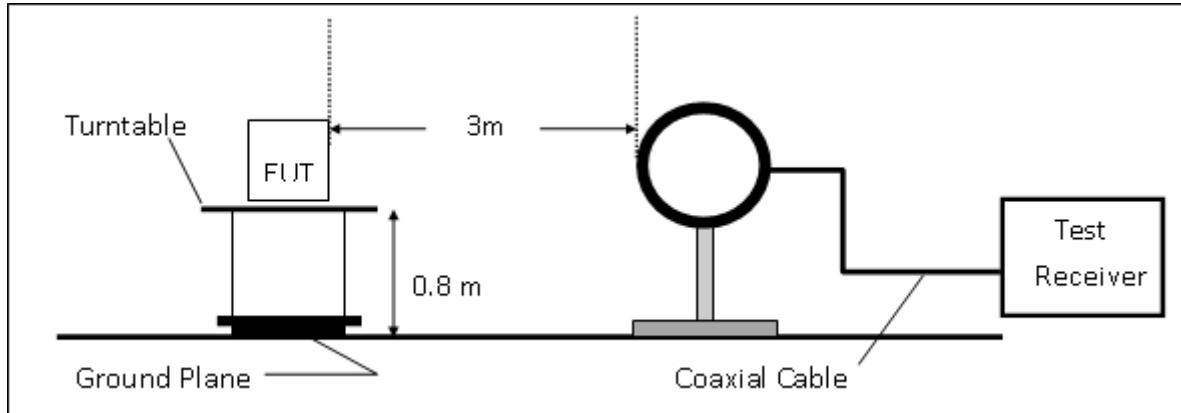
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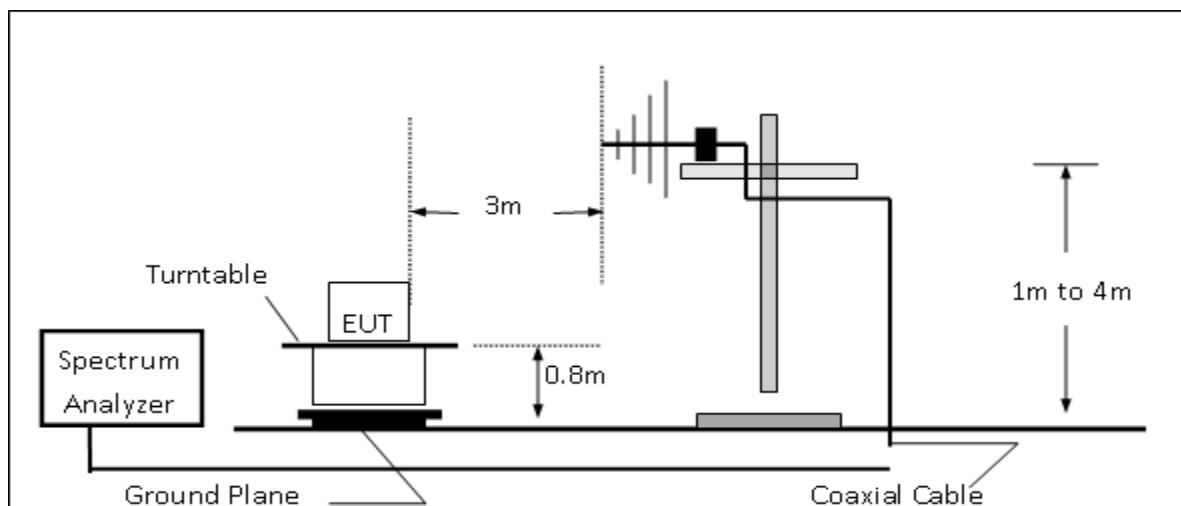
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### 11.3 Test SET-UP

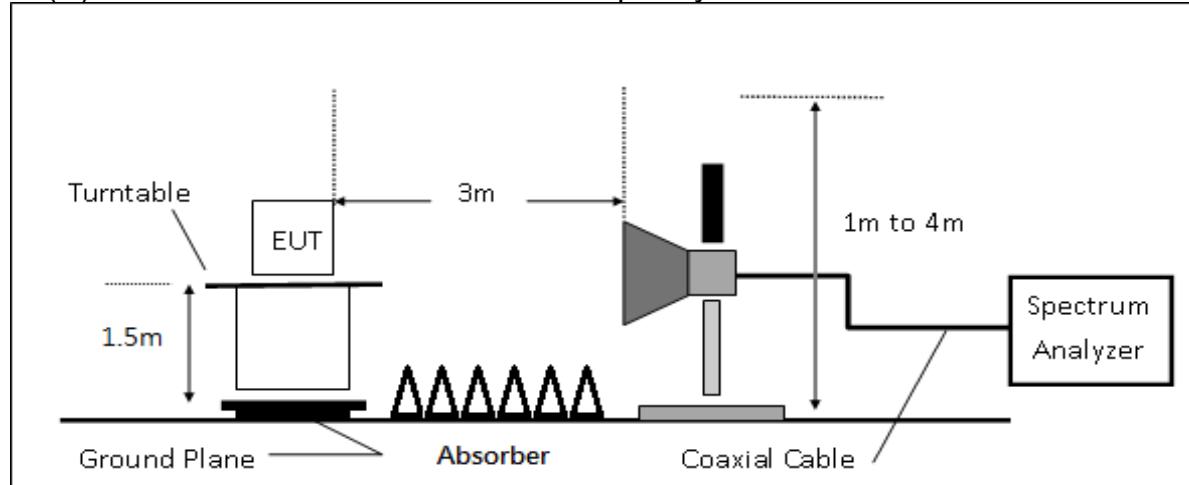
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(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 V03r04.
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  $\geq$  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(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/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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**Radiated Band Edge Measurement Result (802.11b)**

Operation Mode : 802.11 b Test Date : 02/04/2016 11:39:53  
Fundamental Frequency : 2412 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
Operation Band : Bandedge CH LOW Test Engineer : Tin  
EUT Pol. : H Plane Measurement Antenna Pol. : VERTICAL

Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum		Factor dB	Limit @3m dBuV/m	Margin dB
			Reading	Level dBuV			
2390.00	E	34.92	36.67	-1.74	54.00	-19.08	
2390.00	E	48.33	50.08	-1.74	74.00	-25.67	

Operation Mode : 802.11 b Test Date : 02/01/2016 20:06:38  
Fundamental Frequency : 2412 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
Operation Band : Bandedge CH LOW Test Engineer : Tin  
EUT Pol. : H Plane Measurement Antenna Pol. : HORIZONTAL

Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum		Factor dB	Limit @3m dBuV/m	Margin dB
			Reading	Level dBuV			
2390.00	E	32.08	33.82	-1.74	54.00	-21.92	
2390.00	E	45.99	47.74	-1.74	74.00	-28.01	

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Operation Mode : 802.11 b Test Date : 02/01/2016 20:11:56  
 Fundamental Frequency : 2462 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Bandedge CH HIGH Test Engineer : Tin  
 EUT Pol. : H Plane Measurement Antenna Pol. : VERTICAL

Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum		Factor dB	Limit @3m dBuV/m	Margin dB
			Reading	Level dBuV			
2483.50	E	31.24	32.86	-1.62	54.00	54.00	-22.76
2483.50	E	44.96	46.58	-1.62	74.00	74.00	-29.04

Operation Mode : 802.11 b Test Date : 02/01/2016 20:19:54  
 Fundamental Frequency : 2462 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Bandedge CH HIGH Test Engineer : Tin  
 EUT Pol. : H Plane Measurement Antenna Pol. : HORIZONTAL

Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum		Factor dB	Limit @3m dBuV/m	Margin dB
			Reading	Level dBuV			
2483.50	E	29.39	31.01	-1.62	54.00	54.00	-24.61
2483.50	E	46.04	47.66	-1.62	74.00	74.00	-27.96

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### Radiated Band Edge Measurement Result (802.11g)

Operation Mode : 802.11 g Test Date : 02/01/2016 20:24:50  
 Fundamental Frequency : 2412 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Bandedge CH LOW Test Engineer : Tin  
 EUT Pol. : H Plane Measurement Antenna Pol. : VERTICAL

Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum		Factor dB	Limit @3m dBuV/m	Margin dB
			Reading	Level dBuV			
2390.00	E	43.04	44.78	-1.74	54.00	54.00	-10.96
2390.00	E	66.56	68.30	-1.74	74.00	74.00	-7.44

Operation Mode : 802.11 g Test Date : 02/01/2016 20:28:29  
 Fundamental Frequency : 2412 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Bandedge CH LOW Test Engineer : Tin  
 EUT Pol. : H Plane Measurement Antenna Pol. : HORIZONTAL

Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum		Factor dB	Limit @3m dBuV/m	Margin dB
			Reading	Level dBuV			
2390.00	E	39.49	41.24	-1.74	54.00	54.00	-14.51
2390.00	E	62.87	64.62	-1.74	74.00	74.00	-11.13

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Operation Mode : 802.11 g Test Date : 02/01/2016 20:33:32  
Fundamental Frequency : 2462 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
Operation Band : Bandedge CH HIGH Test Engineer : Tin  
EUT Pol. : H Plane Measurement Antenna Pol. : VERTICAL

Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV	Factor dB	Limit @3m dBuV/m	Margin dB
2483.50	E	40.95	42.57	-1.62	54.00	-13.05
2483.50	E	65.86	67.47	-1.62	74.00	-8.14

Operation Mode : 802.11 g Test Date : 02/01/2016 20:37:57  
Fundamental Frequency : 2462 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
Operation Band : Bandedge CH HIGH Test Engineer : Tin  
EUT Pol. : H Plane Measurement Antenna Pol. : HORIZONTAL

Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV	Factor dB	Limit @3m dBuV/m	Margin dB
2483.50	E	37.08	38.69	-1.62	54.00	-16.92
2483.50	E	63.65	65.27	-1.62	74.00	-10.35

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

Operation Mode : 802.11 n20 Test Date : 02/01/2016 21:41:29  
 Fundamental Frequency : 2412 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Bandedge CH LOW Test Engineer : Tin  
 EUT Pol. : H Plane Measurement Antenna Pol. : VERTICAL

Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum		Factor dB	Limit @3m dBuV/m	Margin dB
			Reading	Level dBuV			
2390.00	E	47.01	48.76	-1.74	54.00	-6.99	
2390.00	E	69.57	71.31	-1.74	74.00	-4.43	

Operation Mode : 802.11 n20 Test Date : 02/01/2016 21:45:26  
 Fundamental Frequency : 2412 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Bandedge CH LOW Test Engineer : Tin  
 EUT Pol. : H Plane Measurement Antenna Pol. : HORIZONTAL

Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum		Factor dB	Limit @3m dBuV/m	Margin dB
			Reading	Level dBuV			
2390.00	E	38.17	39.92	-1.74	54.00	-15.83	
2390.00	E	63.04	64.78	-1.74	74.00	-10.96	

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Operation Mode : 802.11 n20 Test Date : 02/01/2016 21:50:06  
Fundamental Frequency : 2462 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
Operation Band : Bandedge CH HIGH Test Engineer : Tin  
EUT Pol. : H Plane Measurement Antenna Pol. : VERTICAL

Freq. MHz	Note F/H/E/S	Emission Level	Spectrum Reading Level	Factor	Limit @3m	Margin
		dBuV/m	dBuV	dB	dBuV/m	dB
2483.50	E	43.98	45.60	-1.62	54.00	-10.02
2483.50	E	70.92	72.54	-1.62	74.00	-3.08

Operation Mode : 802.11 n20 Test Date : 02/01/2016 21:53:21  
Fundamental Frequency : 2462 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
Operation Band : Bandedge CH HIGH Test Engineer : Tin  
EUT Pol. : H Plane Measurement Antenna Pol. : HORIZONTAL

Freq. MHz	Note F/H/E/S	Emission Level	Spectrum Reading Level	Factor	Limit @3m	Margin
		dBuV/m	dBuV	dB	dBuV/m	dB
2483.50	E	36.91	38.53	-1.62	54.00	-17.09
2483.50	E	62.38	63.99	-1.62	74.00	-11.62

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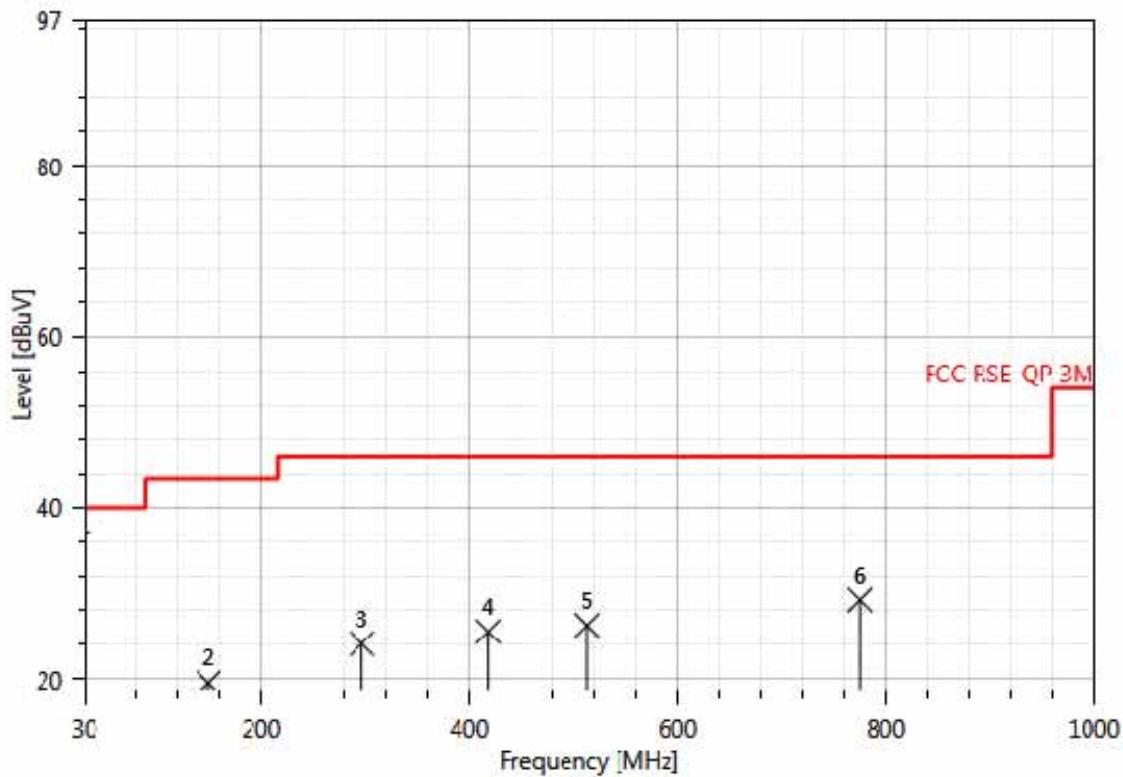
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**Below 1GHz Worst-Case Data:**

**Radiated Spurious Emission Measurement Result (802.11 g)**

Operation Mode :	802.11 g	Test Date :	02/02/2016 00:06:59
Fundamental Frequency :	2412 MHz	Temp. / Humi. :	21 deg_C / 61 RH
Operation Band :	Tx CH LOW	Test Engineer :	Tin
EUT Pol. :	H Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level	Reading Level			
30.00	S	35.16	44.35	44.35	-9.19	40.00	-4.84
149.31	S	19.58	27.39	27.39	-7.82	43.50	-23.92
296.75	S	24.14	30.12	30.12	-5.98	46.00	-21.86
418.00	S	25.54	28.92	28.92	-3.38	46.00	-20.46
513.06	S	26.25	28.15	28.15	-1.90	46.00	-19.75
774.96	S	29.19	26.42	26.42	2.76	46.00	-16.81

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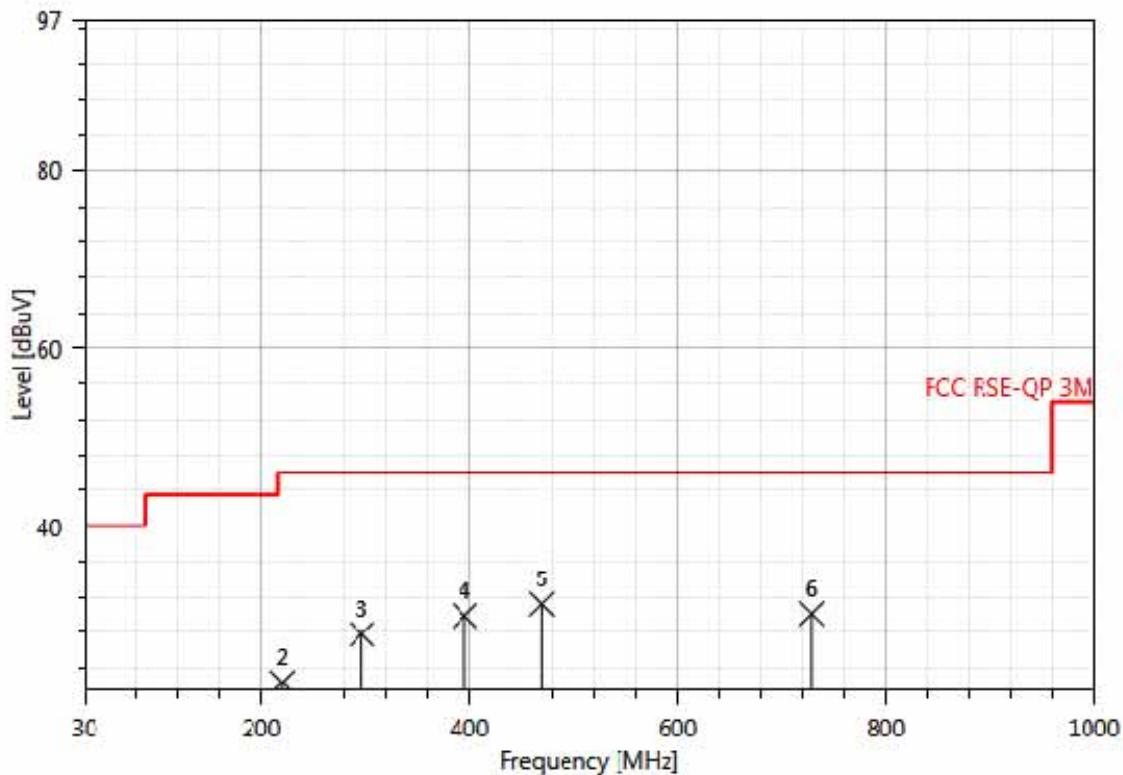
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Operation Mode : 802.11 g  
 Fundamental Frequency : 2412 MHz  
 Operation Band : Tx CH LOW  
 EUT Pol. : H Plane

Test Date : 02/02/2016 00:07:00  
 Temp. / Humi. : 21 deg\_C / 61 RH  
 Test Engineer : Tin  
 Measurement Antenna Pol. : HORIZONTAL



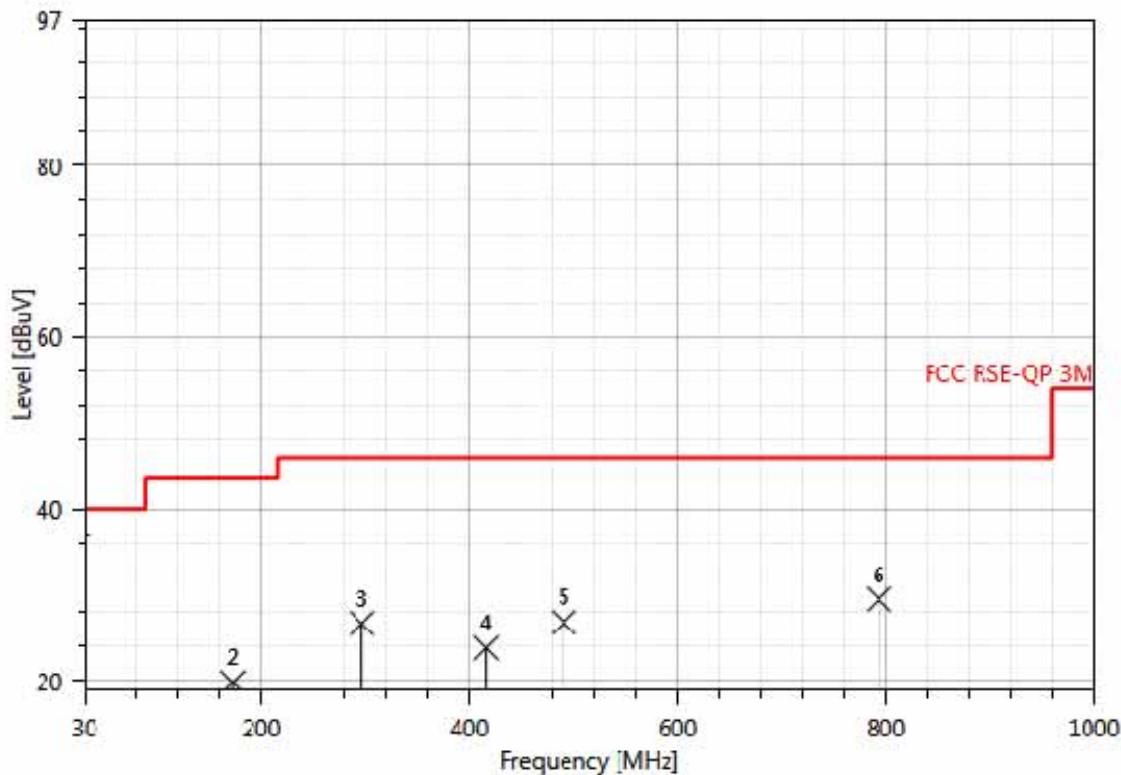
Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level dBuV/m	Reading Level dBuV			
30.00	S	26.26	35.45	35.45	-9.19	40.00	-13.74
220.12	S	22.37	31.61	31.61	-9.24	46.00	-23.63
296.75	S	27.80	33.78	33.78	-5.98	46.00	-18.20
395.69	S	29.89	34.04	34.04	-4.15	46.00	-16.11
469.41	S	31.19	33.78	33.78	-2.59	46.00	-14.81
728.40	S	30.12	28.47	28.47	1.65	46.00	-15.88

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Operation Mode : 802.11 g      Test Date : 02/02/2016 00:07:01  
 Fundamental Frequency : 2437 MHz      Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Tx CH MID      Test Engineer : Tin  
 EUT Pol. : H Plane      Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level dBuV/m	Reading Level dBuV			
30.00	S	34.83	44.02		-9.19	40.00	-5.17
172.59	S	19.78	27.64		-7.86	43.50	-23.72
296.75	S	26.65	32.63		-5.98	46.00	-19.35
416.06	S	23.79	27.06		-3.27	46.00	-22.21
490.75	S	26.79	29.31		-2.53	46.00	-19.21
793.39	S	29.46	26.60		2.86	46.00	-16.54

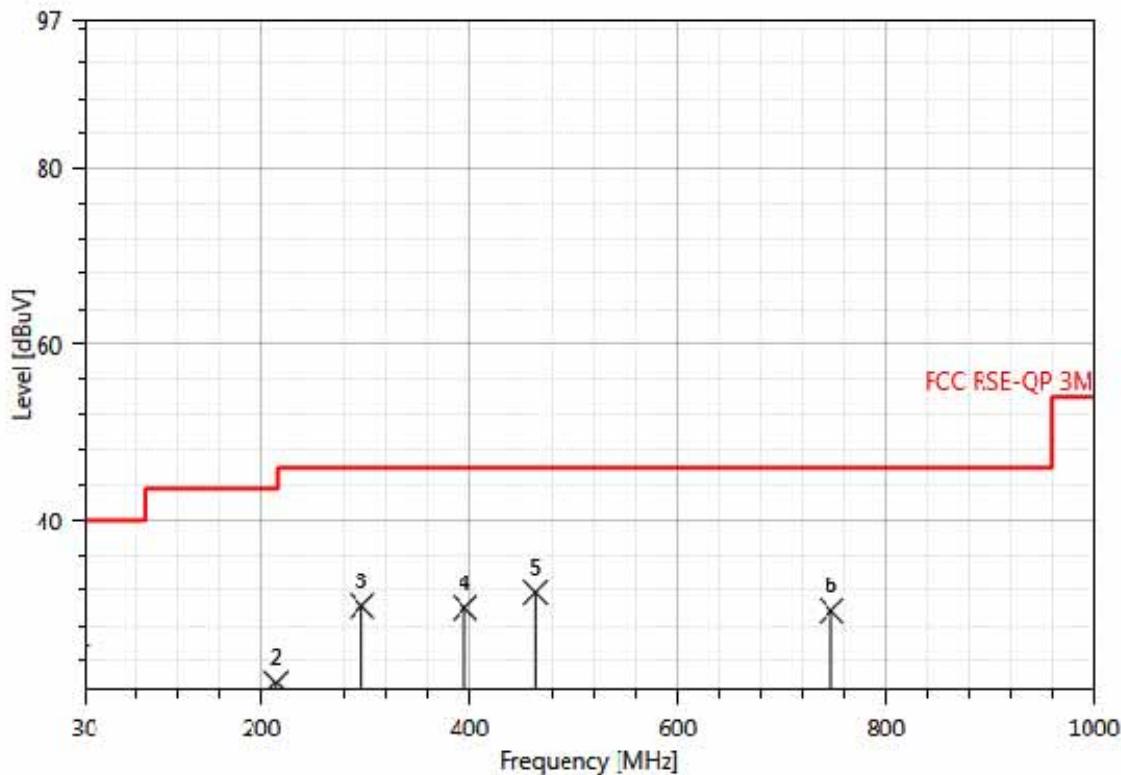
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Operation Mode : 802.11 g  
 Fundamental Frequency : 2437 MHz  
 Operation Band : Tx CH MID  
 EUT Pol. : H Plane

Test Date : 02/02/2016 00:07:02  
 Temp. / Humi. : 21 deg\_C / 61 RH  
 Test Engineer : Tin  
 Measurement Antenna Pol. : HORIZONTAL



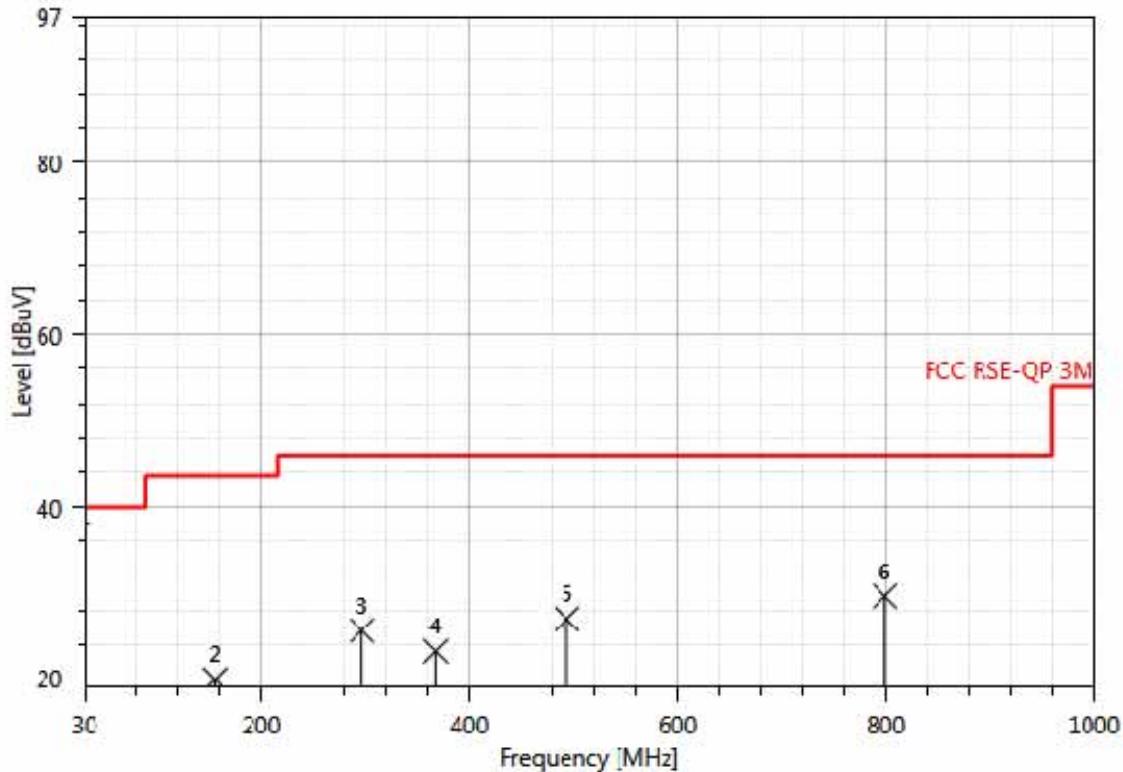
Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum		Factor dB	Limit @3m dBuV/m	Margin dB
			Reading	Level dBuV			
30.00	S	23.59	32.78		-9.19	40.00	-16.41
214.30	S	21.46	31.00		-9.54	43.50	-22.04
296.75	S	30.19	36.17		-5.98	46.00	-15.81
395.69	S	29.97	34.12		-4.15	46.00	-16.03
463.59	S	31.67	34.23		-2.55	46.00	-14.33
747.80	S	29.65	27.15		2.50	46.00	-16.35

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Operation Mode : 802.11 g      Test Date : 02/02/2016 00:07:03  
 Fundamental Frequency : 2462 MHz      Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Tx CH HIGH      Test Engineer : Tin  
 EUT Pol. : H Plane      Measurement Antenna Pol. : VERTICAL



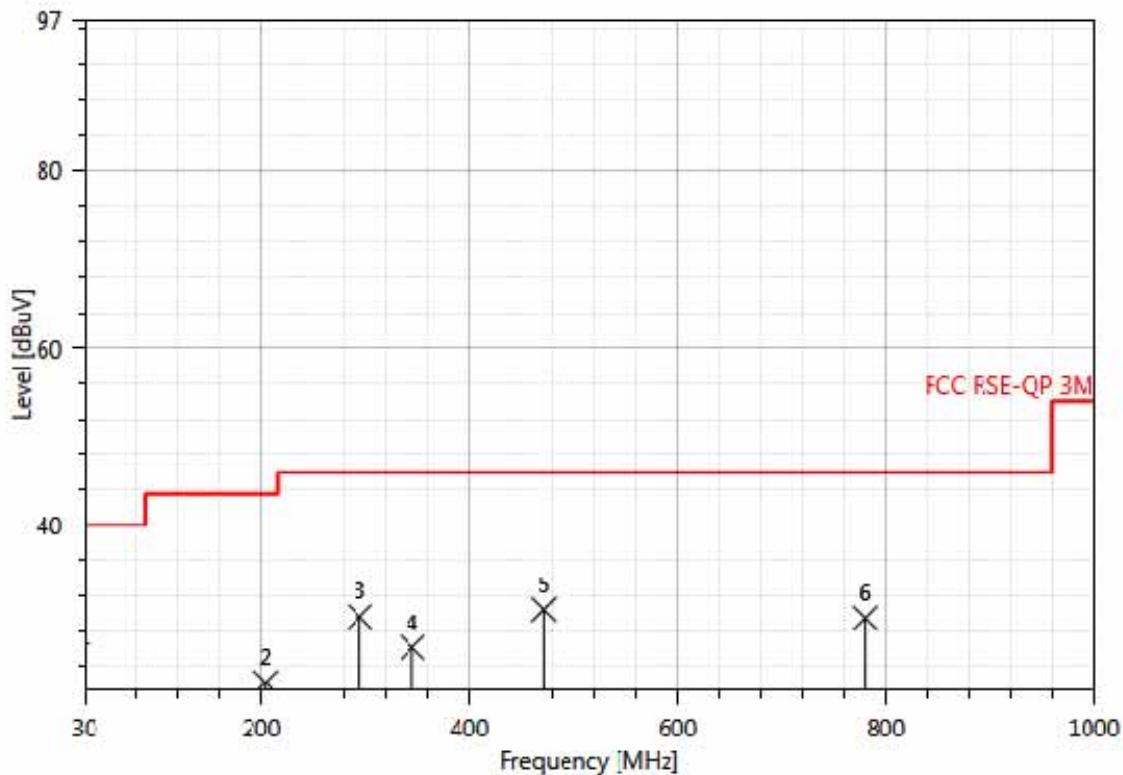
Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level dBuV/m	Reading Level dBuV			
30.00	S	35.69	44.88		-9.19	40.00	-4.31
156.10	S	19.92	27.52		-7.60	43.50	-23.58
296.75	S	25.60	31.58		-5.98	46.00	-20.40
367.56	S	23.20	27.92		-4.73	46.00	-22.80
493.66	S	26.94	29.52		-2.58	46.00	-19.06
799.21	S	29.58	26.44		3.14	46.00	-16.42

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Operation Mode : 802.11 g      Test Date : 02/02/2016 00:07:04  
 Fundamental Frequency : 2462 MHz      Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Tx CH HIGH      Test Engineer : Tin  
 EUT Pol. : H Plane      Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Emission		Spectrum		Factor	Limit @3m dBuV/m	Margin dB
		Level dBuV/m	Reading Level dBuV	Level dBuV	Reading Level dBuV			
30.00	S	24.67	33.86	-9.19	40.00	-15.33		
204.60	S	22.26	31.96	-9.70	43.50	-21.24		
294.81	S	29.69	35.71	-6.02	46.00	-16.31		
345.25	S	26.19	31.27	-5.09	46.00	-19.81		
471.35	S	30.49	33.04	-2.55	46.00	-15.51		
779.81	S	29.54	26.97	2.58	46.00	-16.46		

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

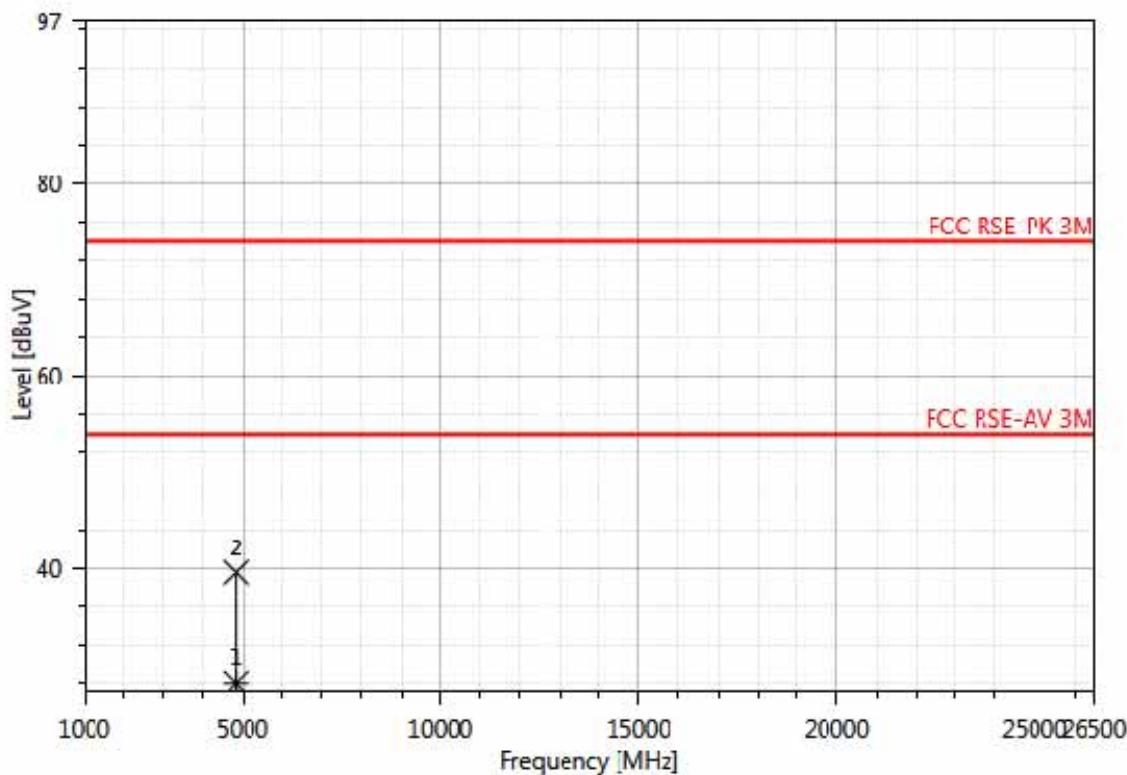
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**Above 1GHz Data:****Radiated Spurious Emission Measurement Result (802.11 b)**

Operation Mode : 802.11 b Test Date : 02/01/2016 22:09:41  
Fundamental Frequency : 2412 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
Operation Band : Tx CH LOW Test Engineer : Tin  
EUT Pol. : H Plane Measurement Antenna Pol. : VERTICAL



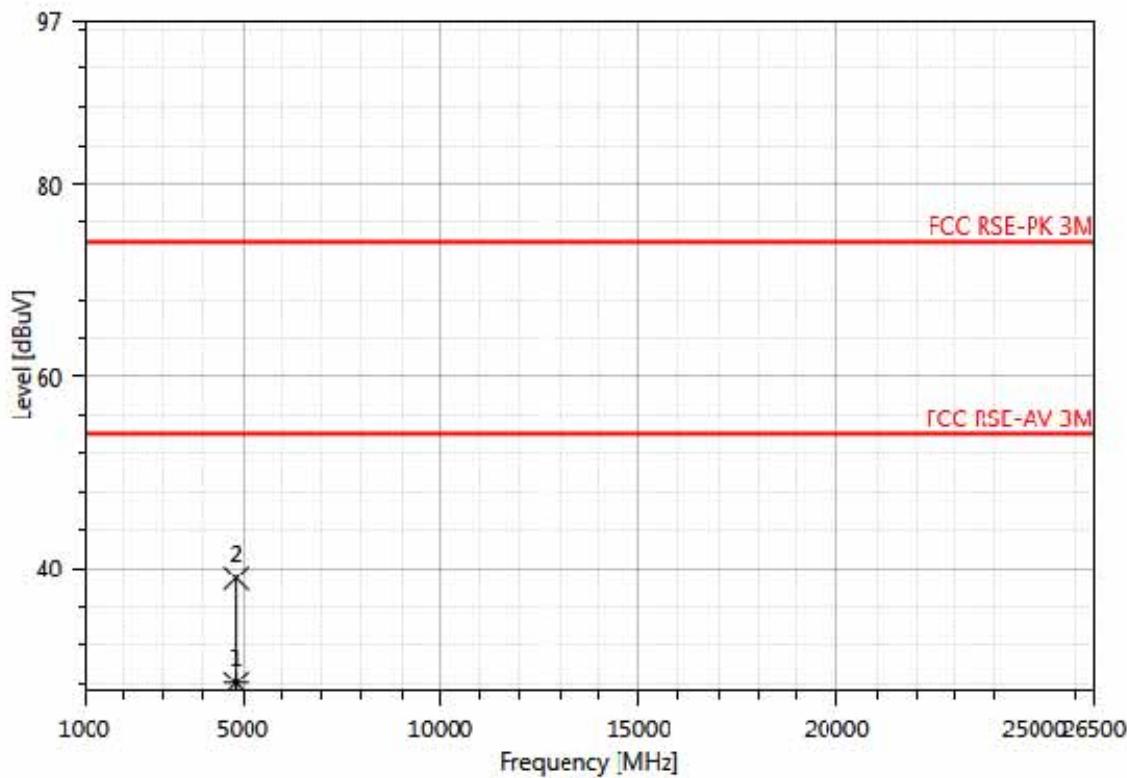
Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level dBuV/m	Reading Level dBuV			
4824.00	H	28.03	23.09	23.09	4.94	54.00	-25.97
4824.00	H	39.57	34.63	34.63	4.94	74.00	-34.43

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Operation Mode : 802.11 b      Test Date : 02/01/2016 22:09:54  
Fundamental Frequency : 2412 MHz      Temp. / Humi. : 21 deg\_C / 61 RH  
Operation Band : Tx CH LOW      Test Engineer : Tin  
EUT Pol. : H Plane      Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m		Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
		Emission Level dBuV/m	Spectrum Reading Level dBuV					
4824.00	H	28.08	23.14	4.94	54.00	4.94	54.00	-25.92
4824.00	H	39.00	34.05	4.94	74.00	4.94	74.00	-35.00

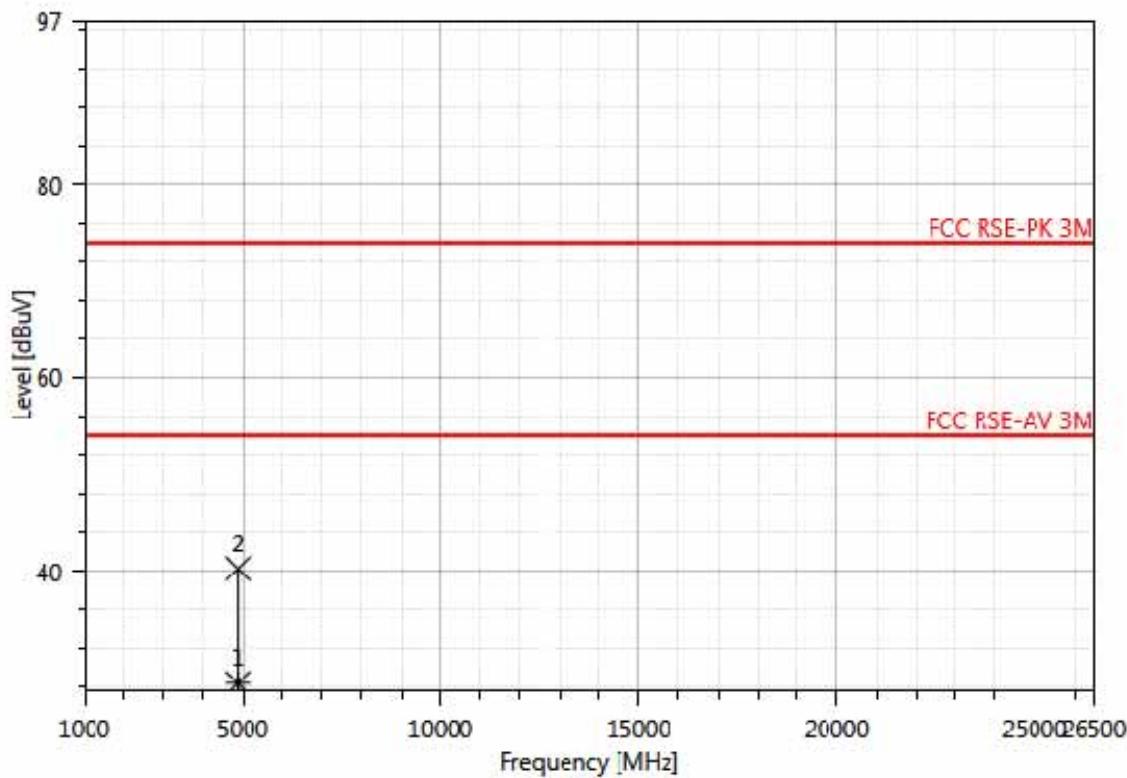
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Operation Mode : 802.11 b  
Fundamental Frequency : 2437 MHz  
Operation Band : Tx CH MID  
EUT Pol. : H Plane

Test Date : 02/01/2016 22:11:44  
Temp. / Humi. : 21 deg\_C / 61 RH  
Test Engineer : Tin  
Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level	Reading Level			
4874.00	H	28.34	23.21	23.21	5.13	54.00	-25.66
4874.00	H	40.23	35.09	35.09	5.13	74.00	-33.77

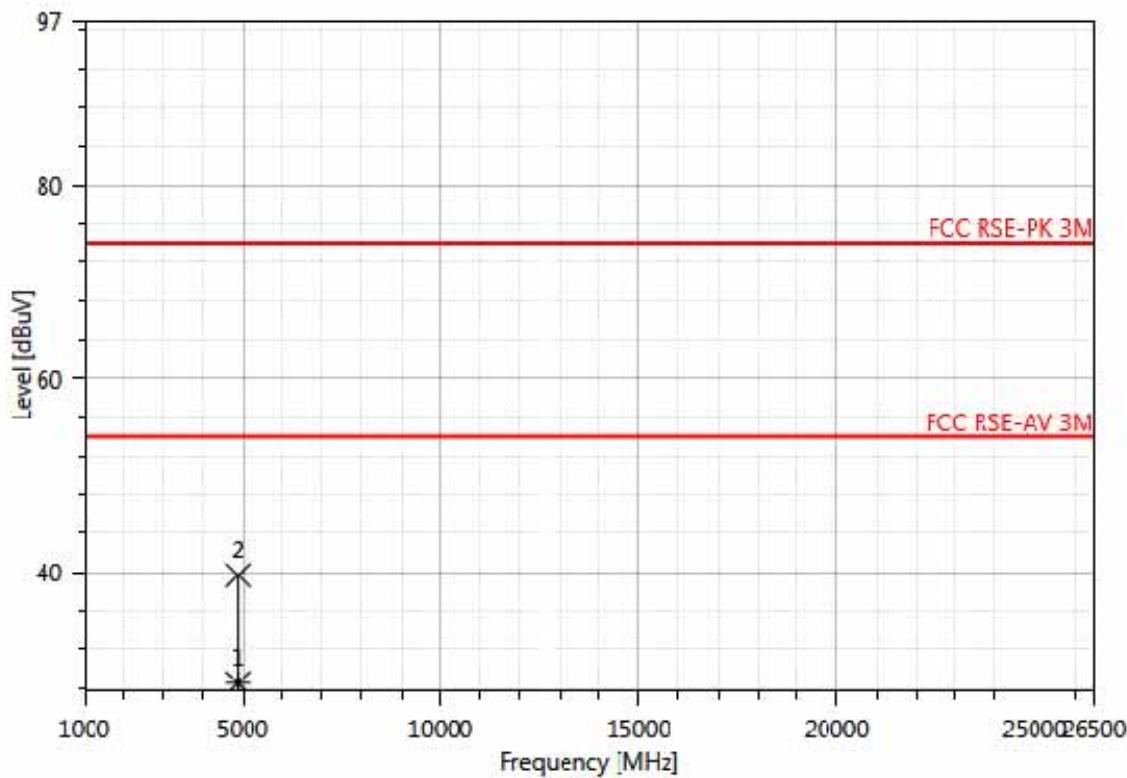
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Operation Mode : 802.11 b  
 Fundamental Frequency : 2437 MHz  
 Operation Band : Tx CH MID  
 EUT Pol. : H Plane

Test Date : 02/01/2016 22:11:54  
 Temp. / Humi. : 21 deg\_C / 61 RH  
 Test Engineer : Tin  
 Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Emission Level		Spectrum Reading Level		Factor dB	Limit @3m dBuV/m	Margin dB
		MHz	dBuV/m	dBuV				
4874.00	H	28.48	28.48	23.35	23.35	5.13	54.00	-25.52
4874.00	H	39.65	39.65	34.52	34.52	5.13	74.00	-34.35

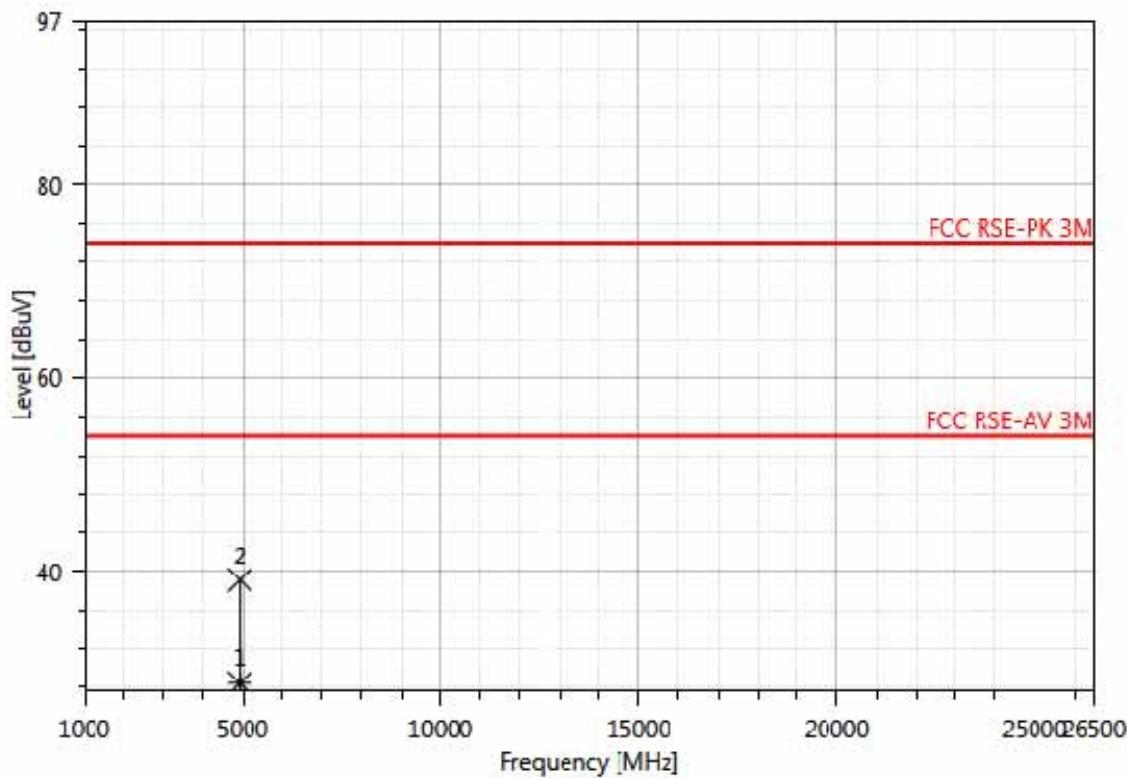
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Operation Mode : 802.11 b  
 Fundamental Frequency : 2462 MHz  
 Operation Band : Tx CH HIGH  
 EUT Pol. : H Plane

Test Date : 02/01/2016 22:14:02  
 Temp. / Humi. : 21 deg\_C / 61 RH  
 Test Engineer : Tin  
 Measurement Antenna Pol. : VERTICAL



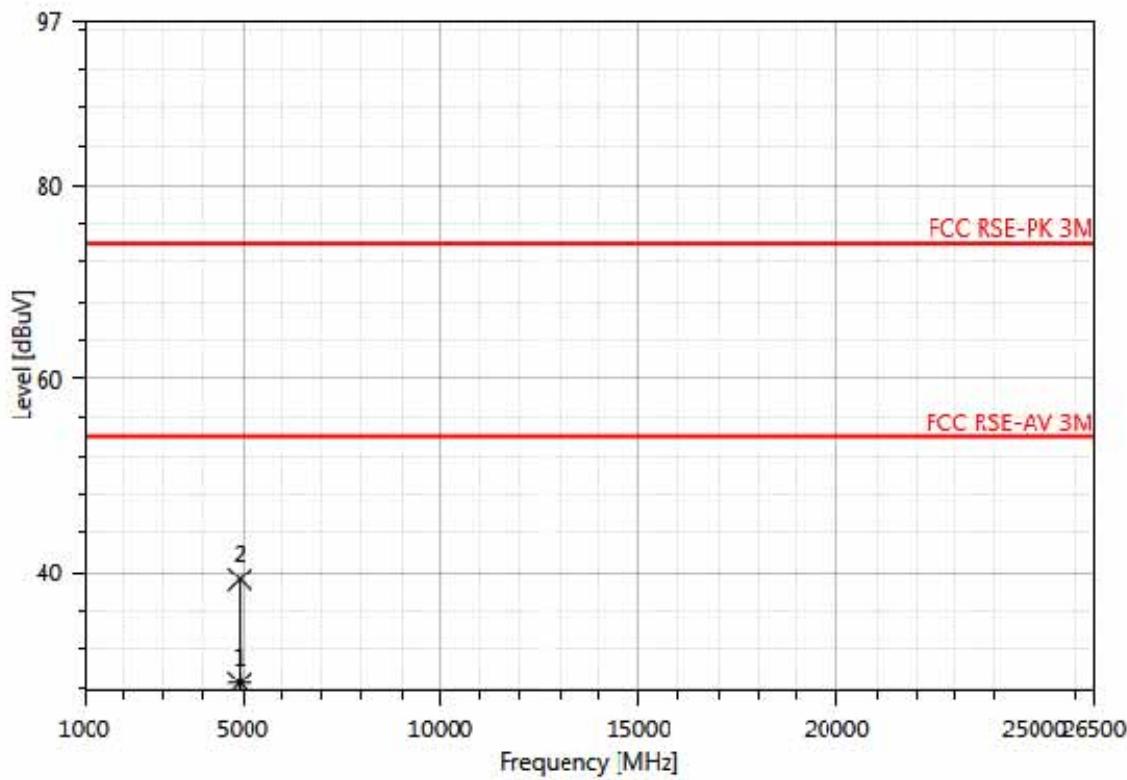
Freq. MHz	Note F/H/E/S	Emission		Spectrum		Factor dB	Limit @3m dBuV/m	Margin dB
		Level dBuV/m	Reading Level dBuV	Level dBuV/m	Reading Level dBuV			
4924.00	H	28.43	23.18	5.25	54.00	-25.57		
4924.00	H	39.12	33.87	5.25	74.00	-34.88		

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Operation Mode : 802.11 b      Test Date : 02/01/2016 22:14:27  
 Fundamental Frequency : 2462 MHz      Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Tx CH HIGH      Test Engineer : Tin  
 EUT Pol. : H Plane      Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Emission Level		Spectrum Reading Level		Factor dB	Limit @3m dBuV/m	Margin dB
		MHz	Level dBuV/m	Reading Level dBuV	Factor dB			
4924.00	H	28.50	23.25	5.25	54.00	-25.50		
4924.00	H	39.23	33.97	5.25	74.00	-34.77		

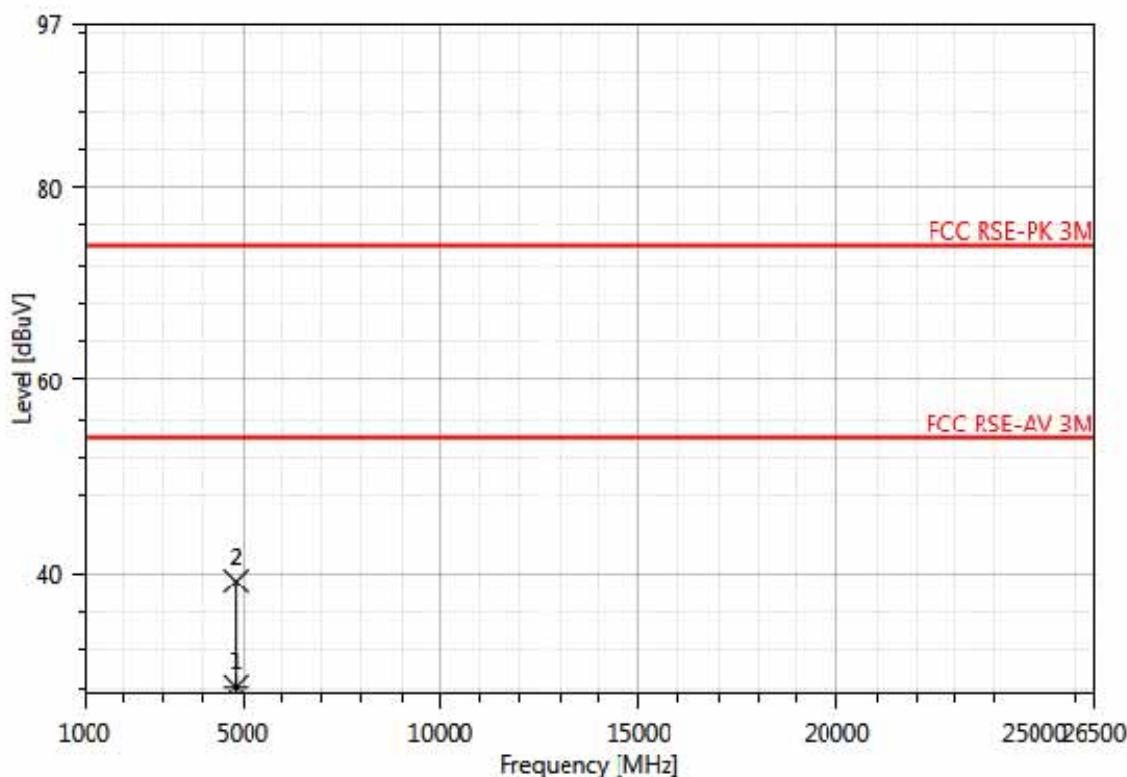
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## Radiated Spurious Emission Measurement Result (802.11 g)

Operation Mode : 802.11 g Test Date : 02/01/2016 22:16:59  
Fundamental Frequency : 2412 MHz Temp. / Humi. : 21 deg\_C / 61 RH  
Operation Band : Tx CH LOW Test Engineer : Tin  
EUT Pol. : H Plane Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Reading Level dBuV	Factor dB			
4824.00	H	28.21	23.27	4.94	54.00	-25.79	
4824.00	H	39.15	34.20	4.94	74.00	-34.85	

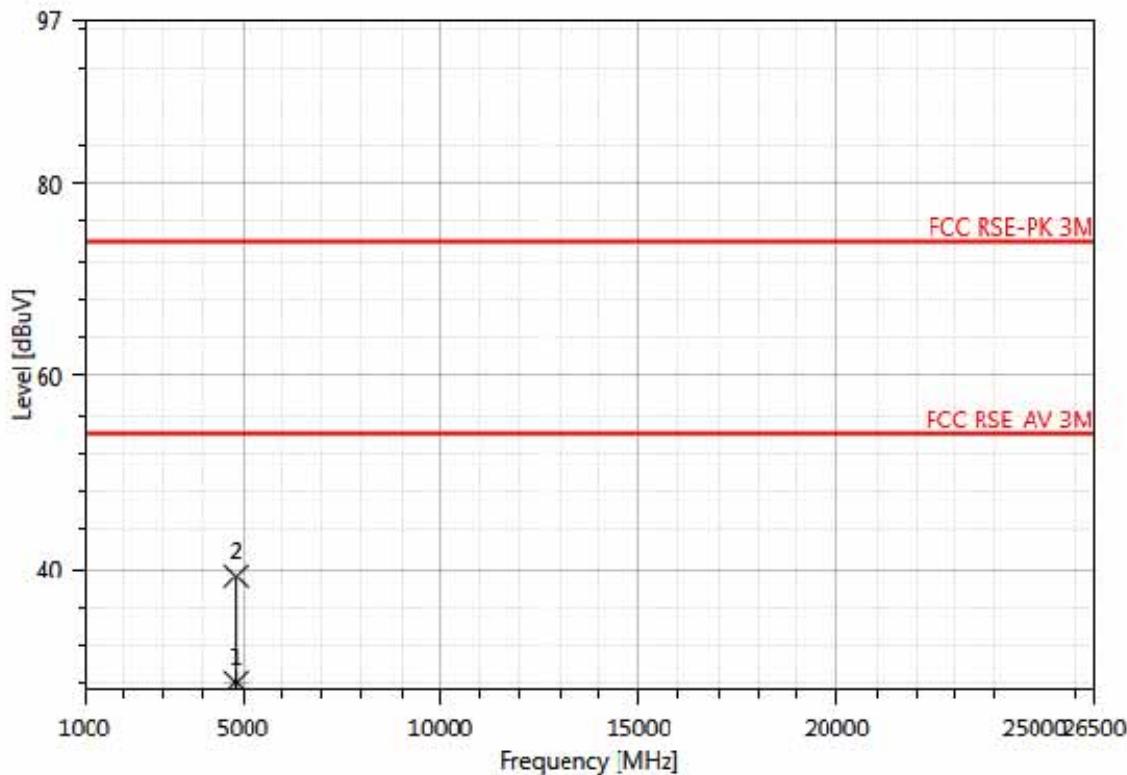
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Operation Mode : 802.11 g  
 Fundamental Frequency : 2412 MHz  
 Operation Band : Tx CH LOW  
 EUT Pol. : H Plane

Test Date : 02/01/2016 22:17:11  
 Temp. / Humi. : 21 deg\_C / 61 RH  
 Test Engineer : Tin  
 Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level	Reading Level			
4824.00	H	28.23	23.29	23.29	4.94	54.00	-25.77
4824.00	H	39.25	34.31	34.31	4.94	74.00	-34.75

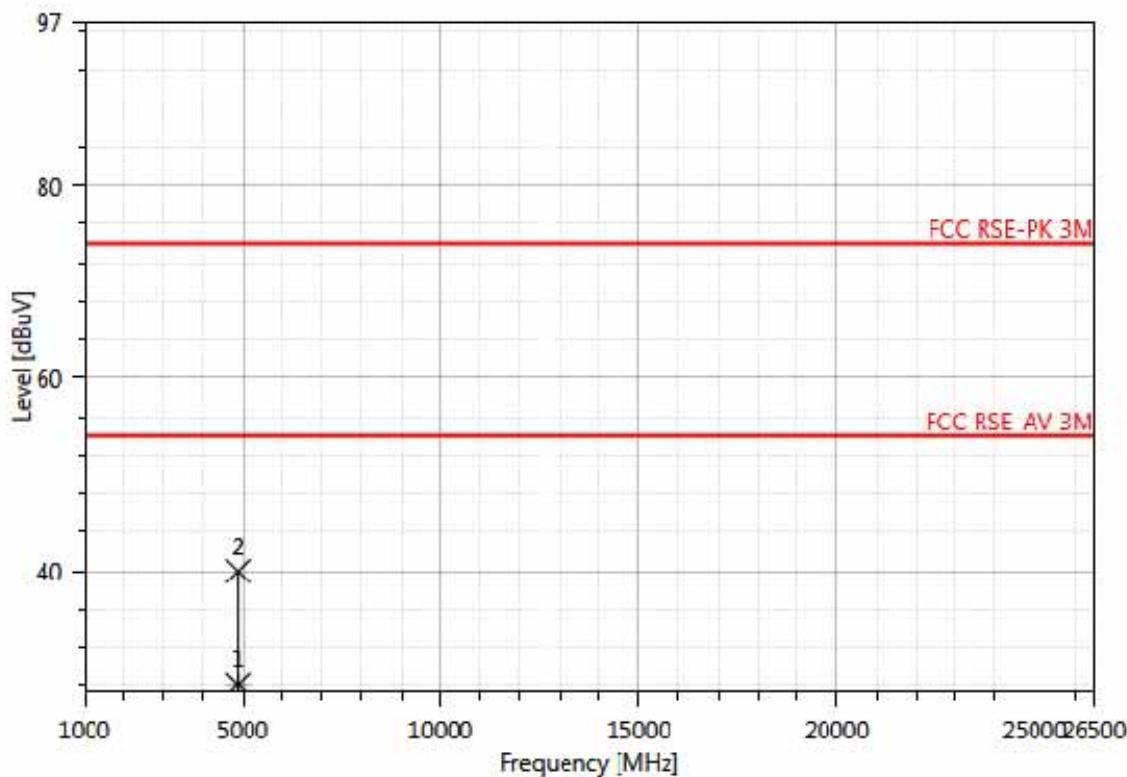
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Operation Mode : 802.11 g  
Fundamental Frequency : 2437 MHz  
Operation Band : Tx CH MID  
EUT Pol. : H Plane

Test Date : 02/01/2016 22:21:26  
Temp. / Humi. : 21 deg\_C / 61 RH  
Test Engineer : Tin  
Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level	Reading Level			
4874.00	H	28.21		23.08	5.13	54.00	-25.79
4874.00	H	39.98		34.84	5.13	74.00	-34.02

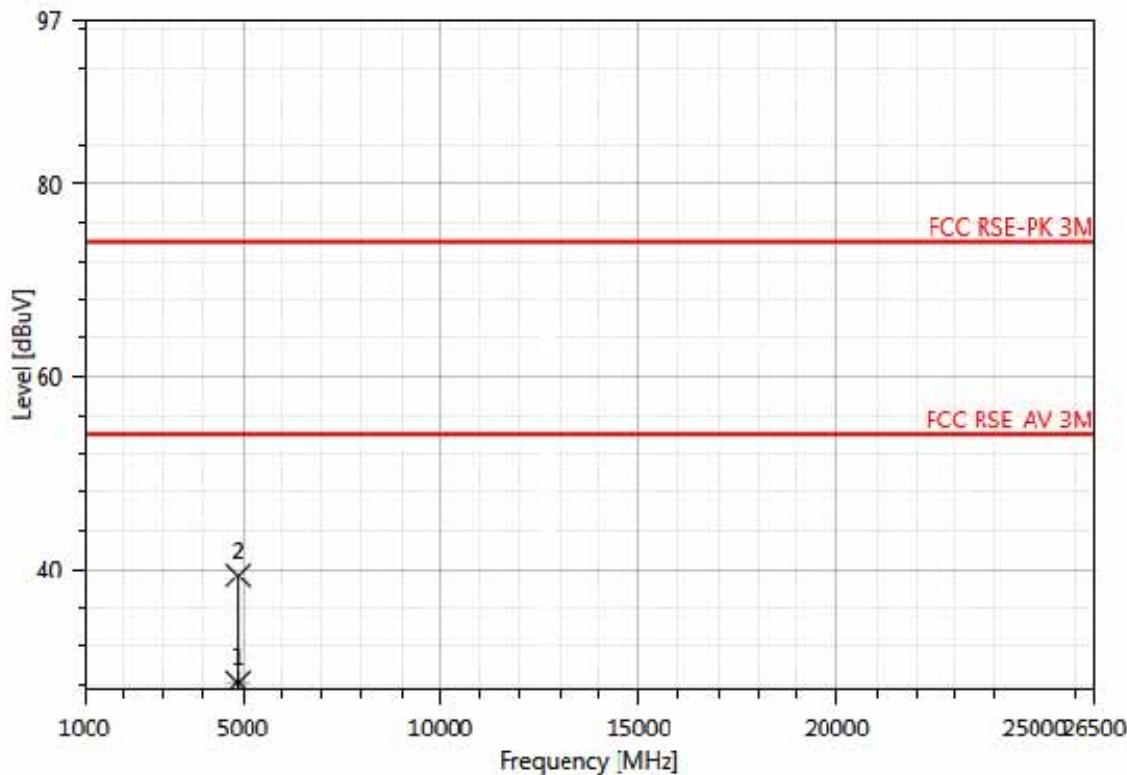
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Operation Mode : 802.11 g  
 Fundamental Frequency : 2437 MHz  
 Operation Band : Tx CH MID  
 EUT Pol. : H Plane

Test Date : 02/01/2016 22:21:35  
 Temp. / Humi. : 21 deg\_C / 61 RH  
 Test Engineer : Tin  
 Measurement Antenna Pol. : HORIZONTAL



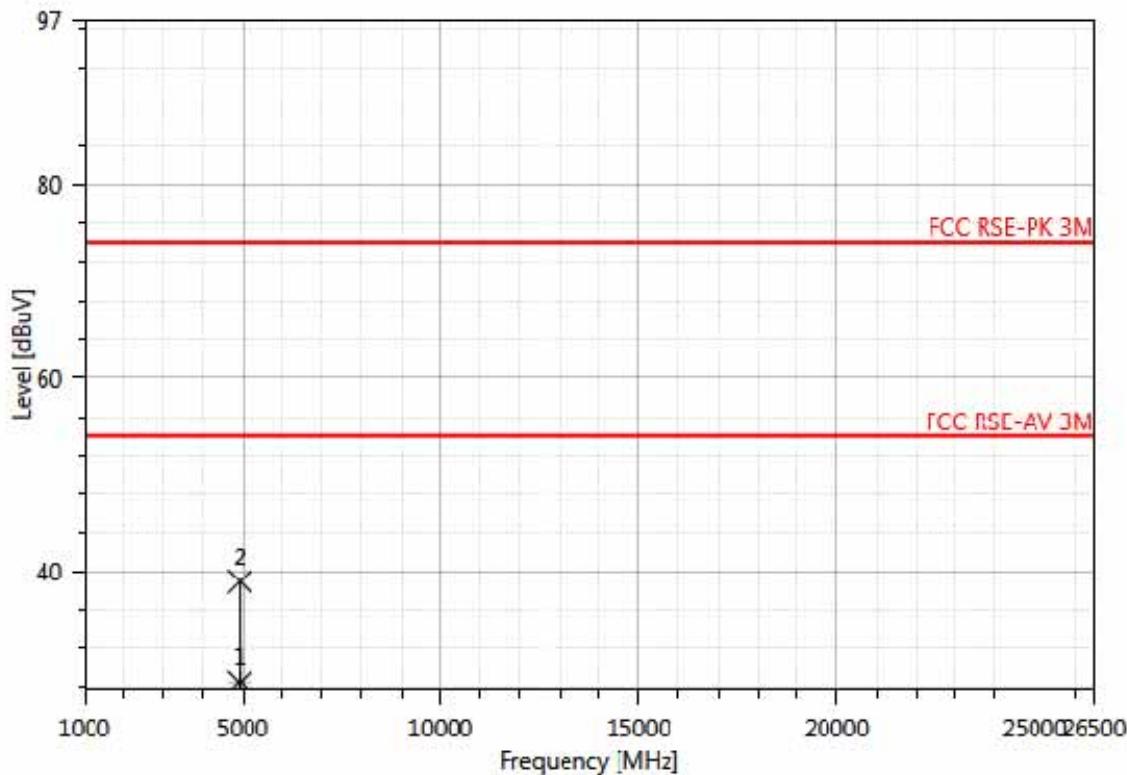
Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level	Reading Level			
4874.00	H	28.32	23.19	23.19	5.13	54.00	-25.68
4874.00	H	39.40	34.27	34.27	5.13	74.00	-34.60

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Operation Mode : 802.11 g      Test Date : 02/01/2016 22:23:28  
 Fundamental Frequency : 2462 MHz      Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Tx CH HIGH      Test Engineer : Tin  
 EUT Pol. : H Plane      Measurement Antenna Pol. : VERTICAL



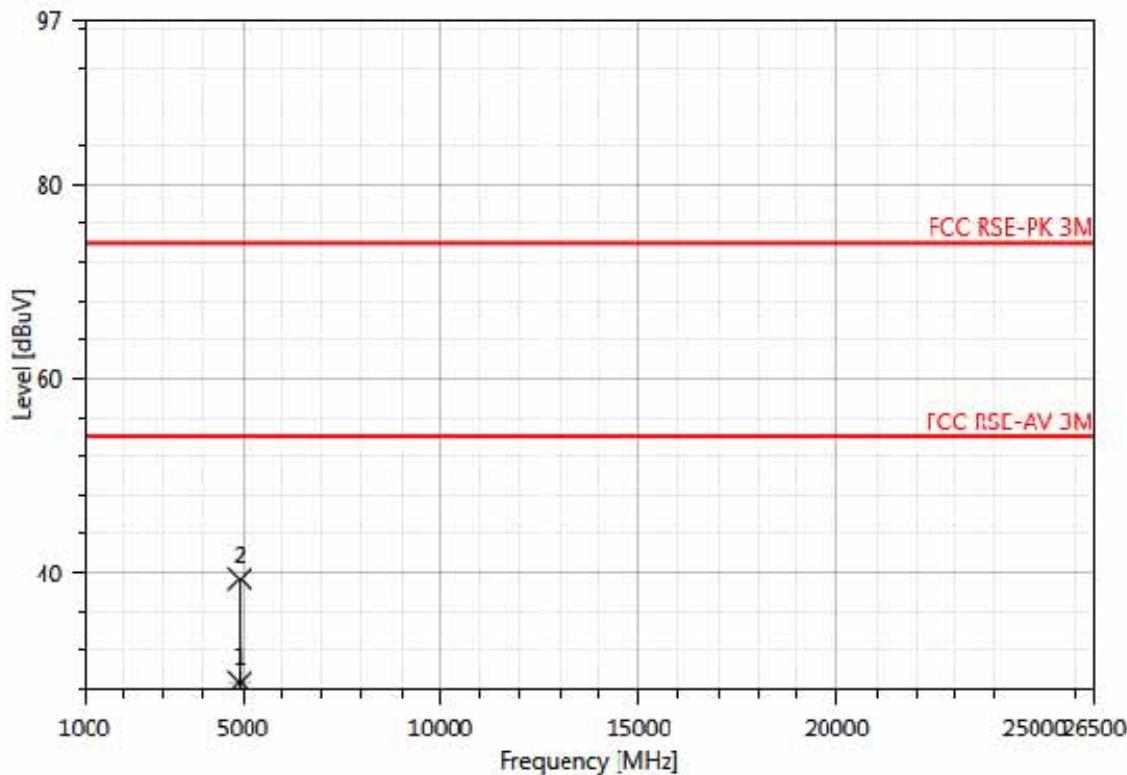
Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level	Reading Level			
4924.00	H	28.54	23.29	23.29	5.25	54.00	-25.46
4924.00	H	38.96	33.71	33.71	5.25	74.00	-35.04

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Operation Mode : 802.11 g      Test Date : 02/01/2016 22:23:51  
 Fundamental Frequency : 2462 MHz      Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Tx CH HIGH      Test Engineer : Tin  
 EUT Pol. : H Plane      Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Factor	Limit @3m dBuV/m			
4924.00	H	28.66	23.41	5.25	54.00	54.00	-25.34
4924.00	H	39.33	34.08	5.25	74.00	74.00	-34.67

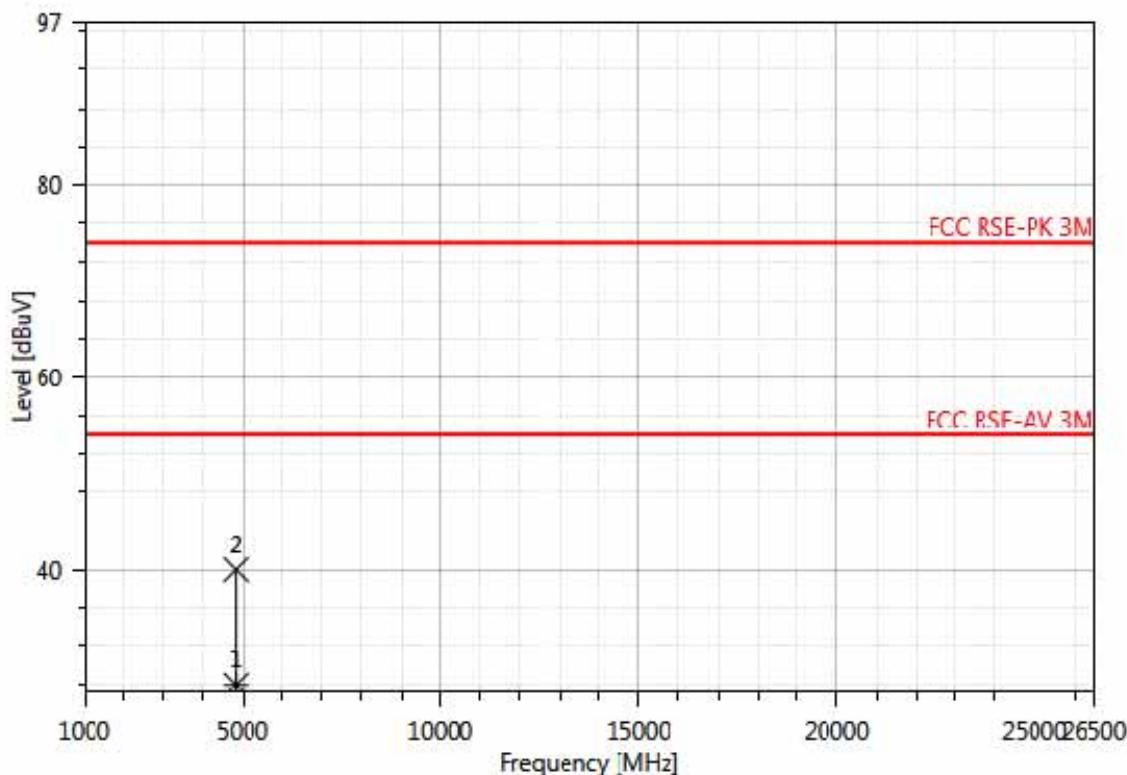
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## Radiated Spurious Emission Measurement Result (802.11\_HT20)

Operation Mode : 802.11 n20      Test Date : 02/01/2016 22:03:07  
Fundamental Frequency : 2412 MHz      Temp. / Humi. : 21 deg\_C / 61 RH  
Operation Band : Tx CH LOW      Test Engineer : Tin  
EUT Pol. : H Plane      Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level		Factor dB	Limit @3m dBuV/m	Margin dB
			Level dBuV	Reading Level dBuV			
4824.00	H	28.02	23.08	23.08	4.94	54.00	-25.98
4824.00	H	40.04	35.09	35.09	4.94	74.00	-33.96

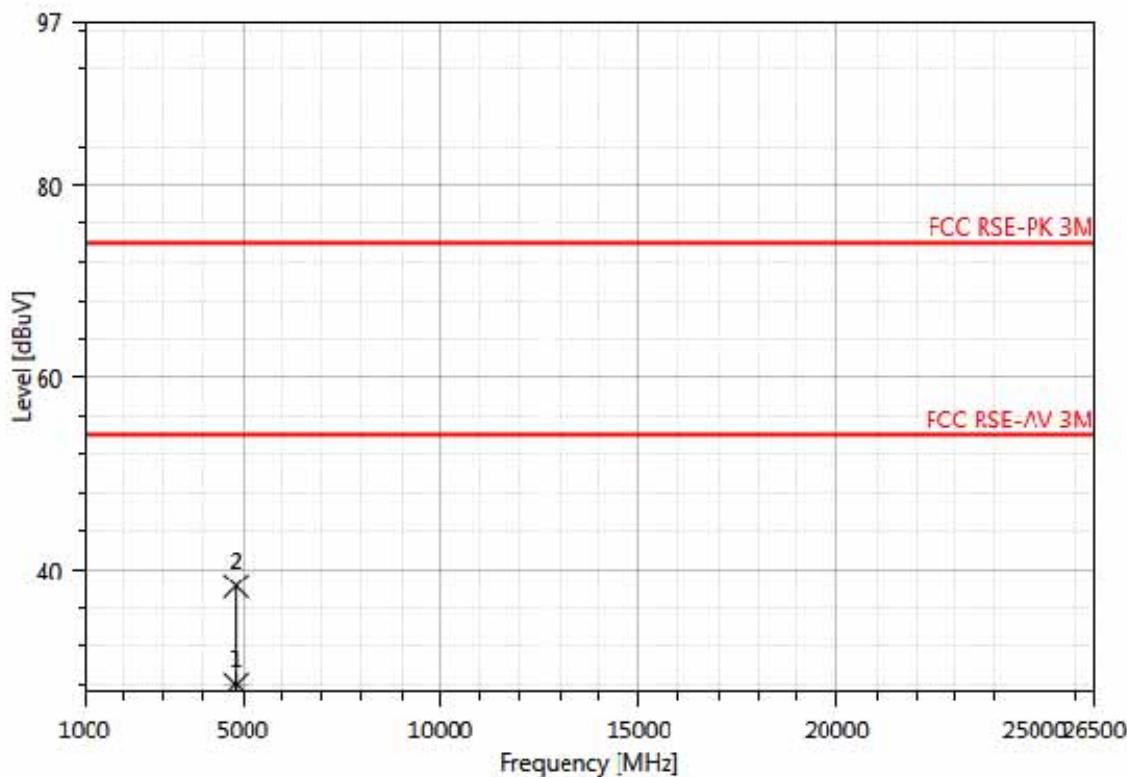
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Operation Mode : 802.11 n20  
 Fundamental Frequency : 2412 MHz  
 Operation Band : Tx CH LOW  
 EUT Pol. : H Plane

Test Date : 02/01/2016 22:03:16  
 Temp. / Humi. : 21 deg\_C / 61 RH  
 Test Engineer : Tin  
 Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Factor	Margin			
4824.00	H	28.09	23.15	4.94	54.00	54.00	-25.91
4824.00	H	38.31	33.37	4.94	74.00	74.00	-35.69

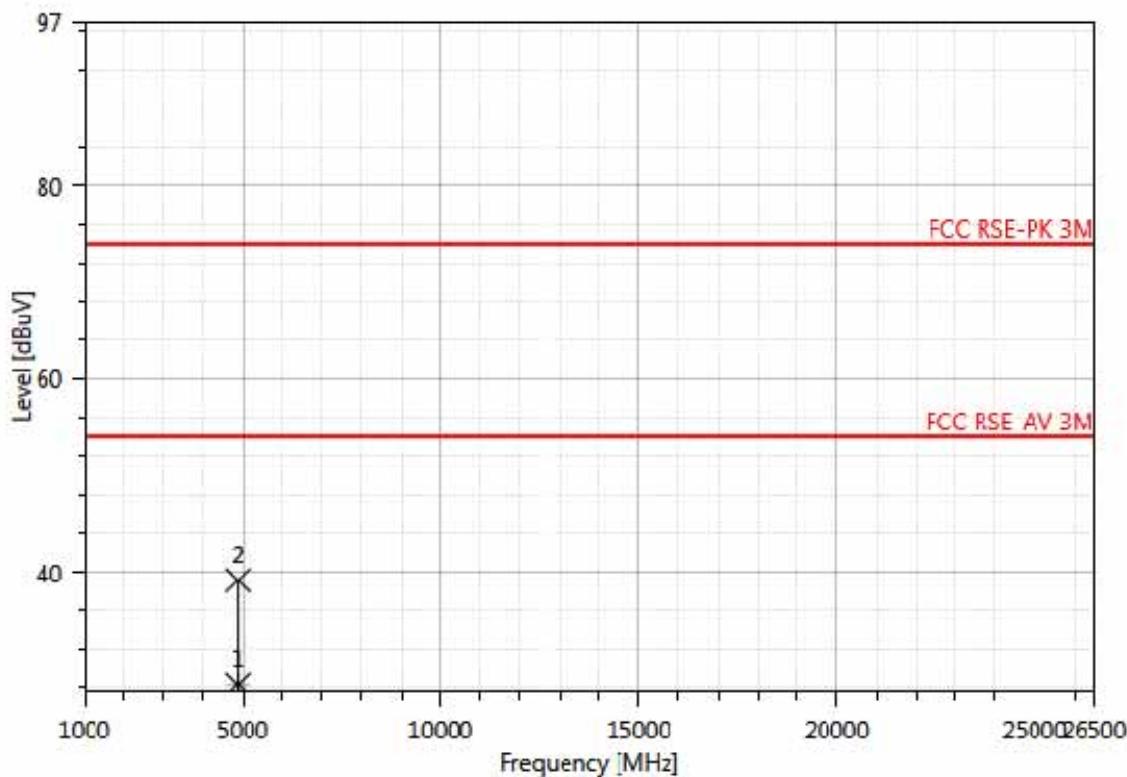
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Operation Mode : 802.11 n20  
 Fundamental Frequency : 2437 MHz  
 Operation Band : Tx CH MID  
 EUT Pol. : H Plane

Test Date : 02/01/2016 22:05:08  
 Temp. / Humi. : 21 deg\_C / 61 RH  
 Test Engineer : Tin  
 Measurement Antenna Pol. : VERTICAL



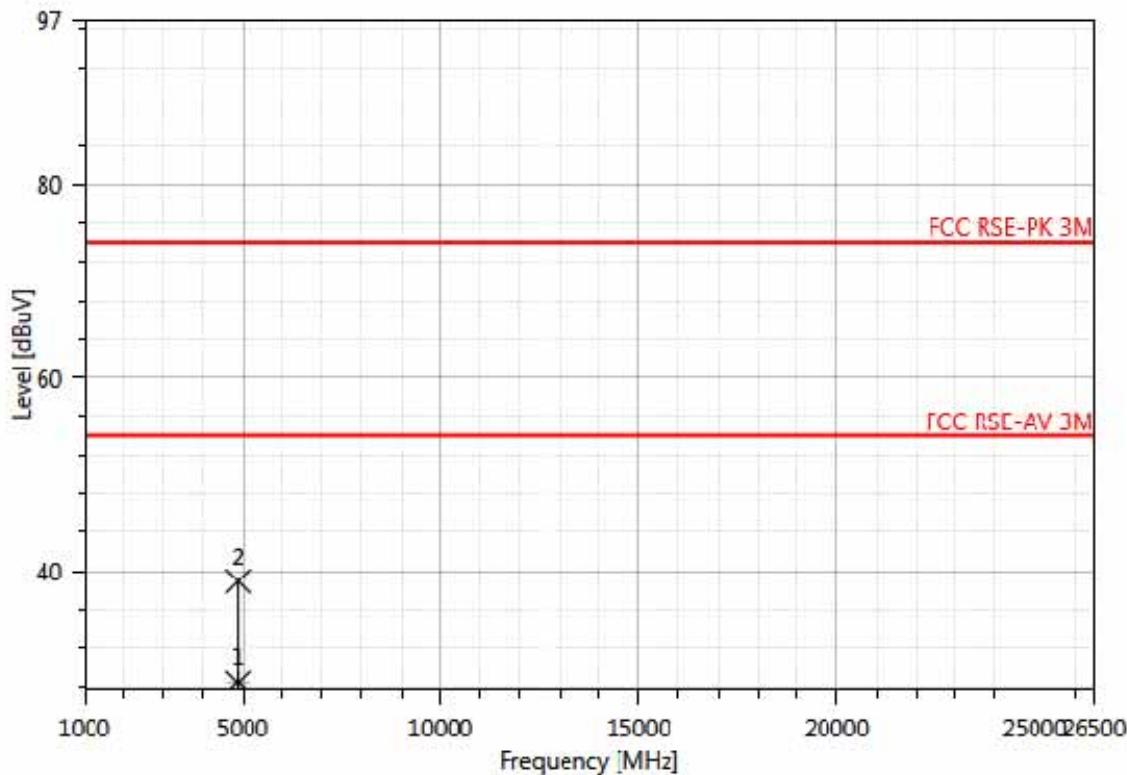
Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV	Factor dB	Limit @3m dBuV/m	Margin dB
4874.00	H	28.35	23.22	5.13	54.00	-25.65
4874.00	H	39.14	34.01	5.13	74.00	-34.86

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Operation Mode : 802.11 n20      Test Date : 02/01/2016 22:05:22  
 Fundamental Frequency : 2437 MHz      Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Tx CH MID      Test Engineer : Tin  
 EUT Pol. : H Plane      Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Factor	Limit @3m dBuV/m			
4874.00	H	28.51	23.38	5.13	54.00	54.00	-25.49
4874.00	H	38.96	33.83	5.13	74.00	74.00	-35.04

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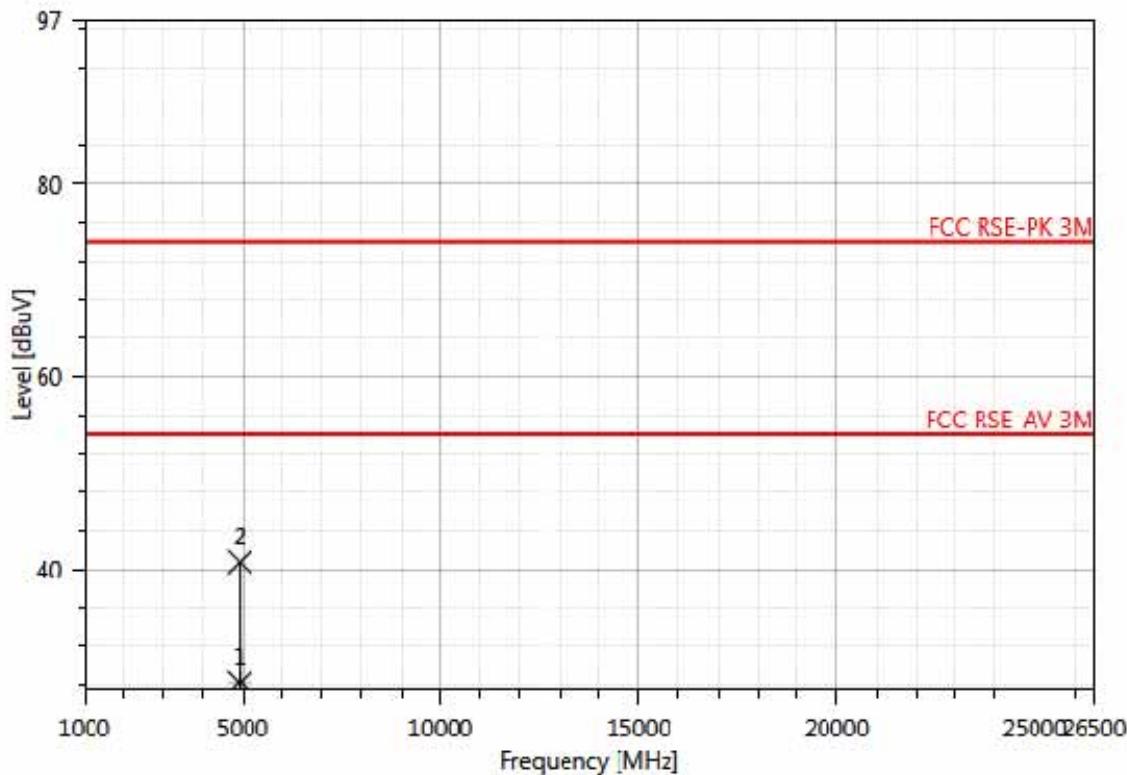
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Operation Mode : 802.11 n20      Test Date : 02/01/2016 22:00:26  
 Fundamental Frequency : 2462 MHz      Temp. / Humi. : 21 deg\_C / 61 RH  
 Operation Band : Tx CH HIGH      Test Engineer : Tin  
 EUT Pol. : H Plane      Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level	Reading Level			
4924.00	H	28.30	23.05	23.05	5.25	54.00	-25.70
4924.00	H	40.80	35.54	35.54	5.25	74.00	-33.20

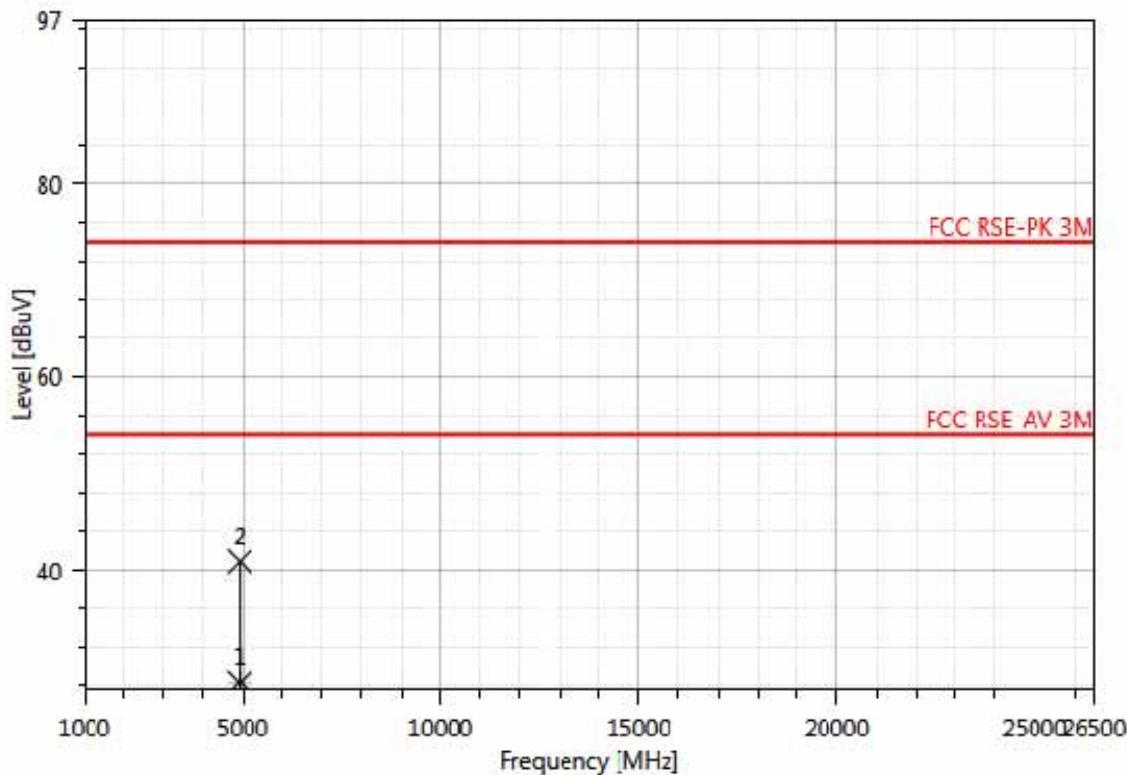
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Operation Mode : 802.11 n20  
 Fundamental Frequency : 2462 MHz  
 Operation Band : Tx CH HIGH  
 EUT Pol. : H Plane

Test Date : 02/01/2016 22:00:37  
 Temp. / Humi. : 21 deg\_C / 61 RH  
 Test Engineer : Tin  
 Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Emission Level dBuV/m	Spectrum Reading Level dBuV		Factor dB	Limit @3m dBuV/m	Margin dB
			Level	Reading Level			
4924.00	H	28.36	23.11	23.11	5.25	54.00	-25.64
4924.00	H	40.91	35.66	35.66	5.25	74.00	-33.09

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## 12 PEAK POWER SPECTRAL DENSITY

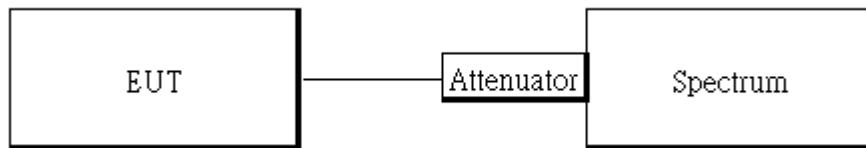
### 12.1 Standard Applicable

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.
Spectrum Analyzer	Agilent	N9010A	MY50420195	12/21/2015	12/20/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017

### 12.3 Test Set-up



### 12.4 Measurement Procedure

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 V03r04.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz.
5. Set the VBW = 10 kHz.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level.

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## 12.5 Measurement Result

POWER DENSITY 802.11b MODE			
Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2412	-6.36	8	PASS
2437	-6.23	8	PASS
2462	-6.44	8	PASS

POWER DENSITY 802.11g MODE			
Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2412	-12.45	8	PASS
2437	-11.74	8	PASS
2462	-10.77	8	PASS

POWER DENSITY 802.11n HT20 MODE			
Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2412	-11.38	8	PASS
2437	-11.42	8	PASS
2462	-10.51	8	PASS

\*Refer to next page for plots

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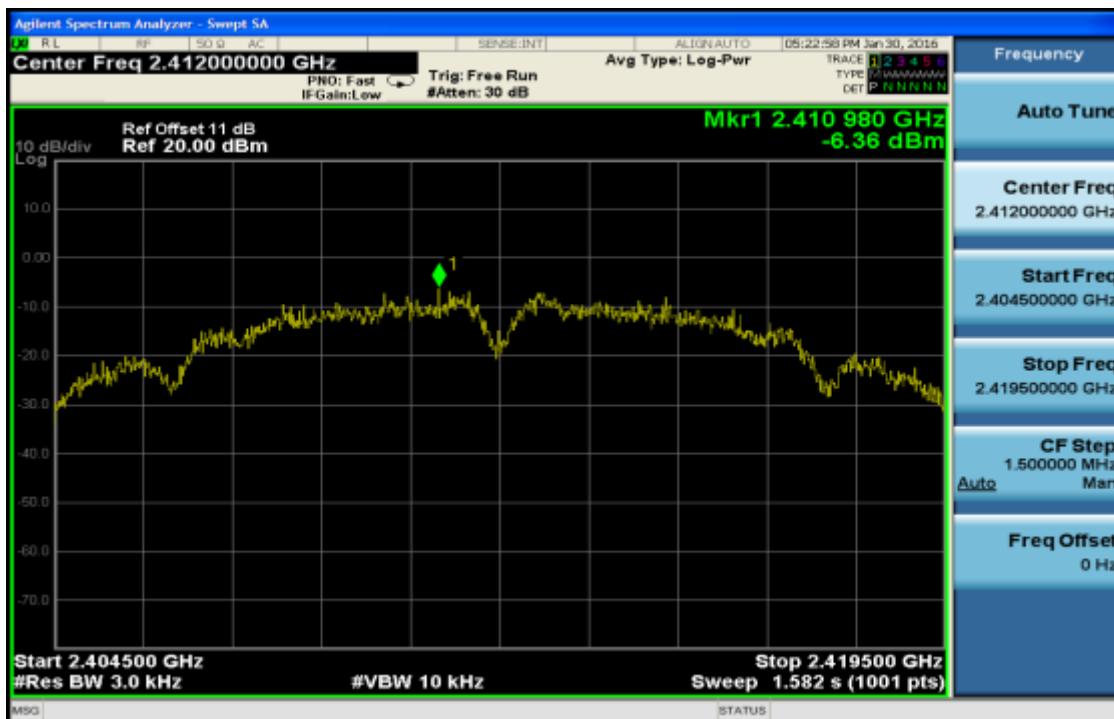
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## 802.11b

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



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

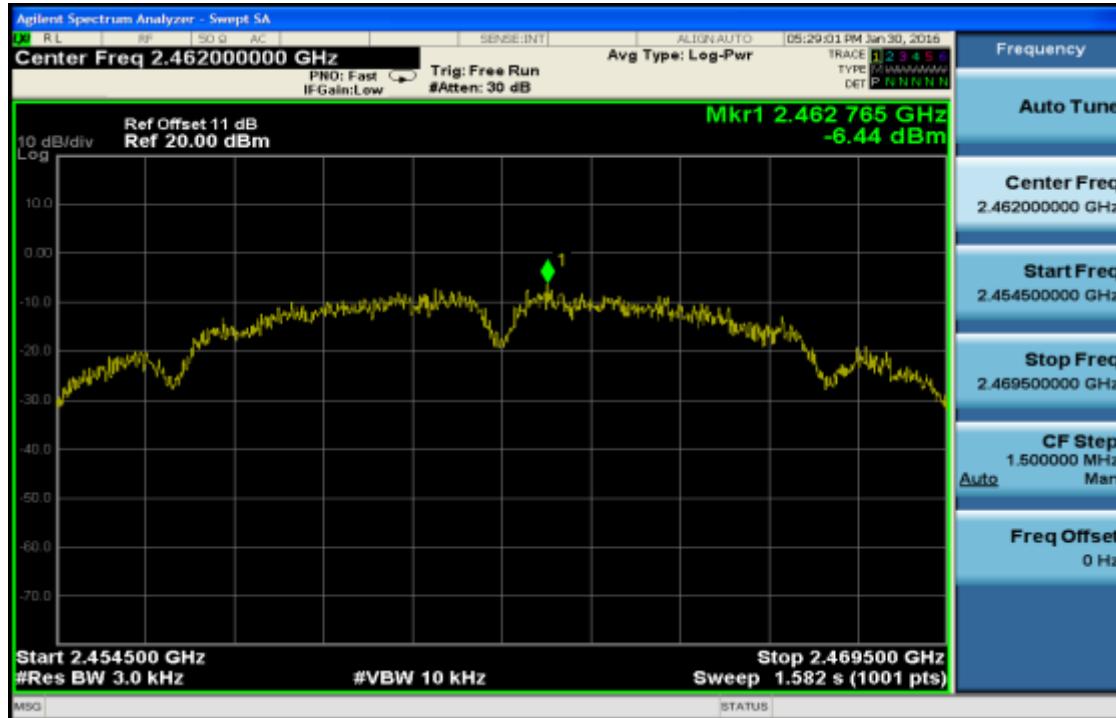


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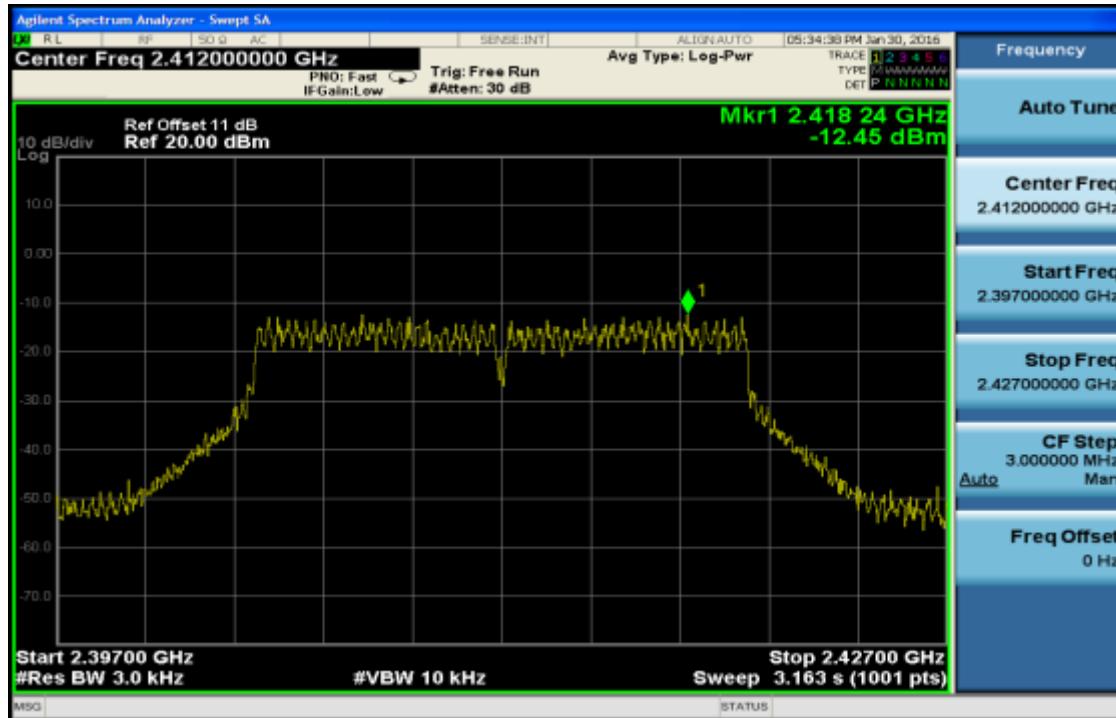
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## Power Spectral Density Test Plot (CH-High)



## 802.11g

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

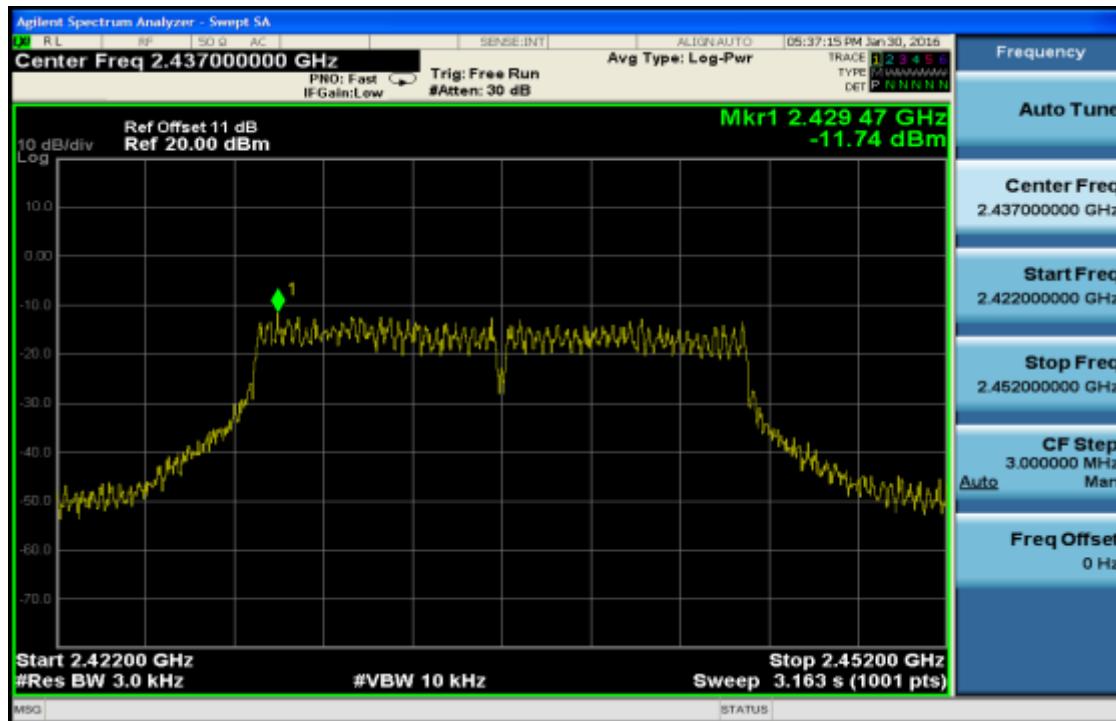


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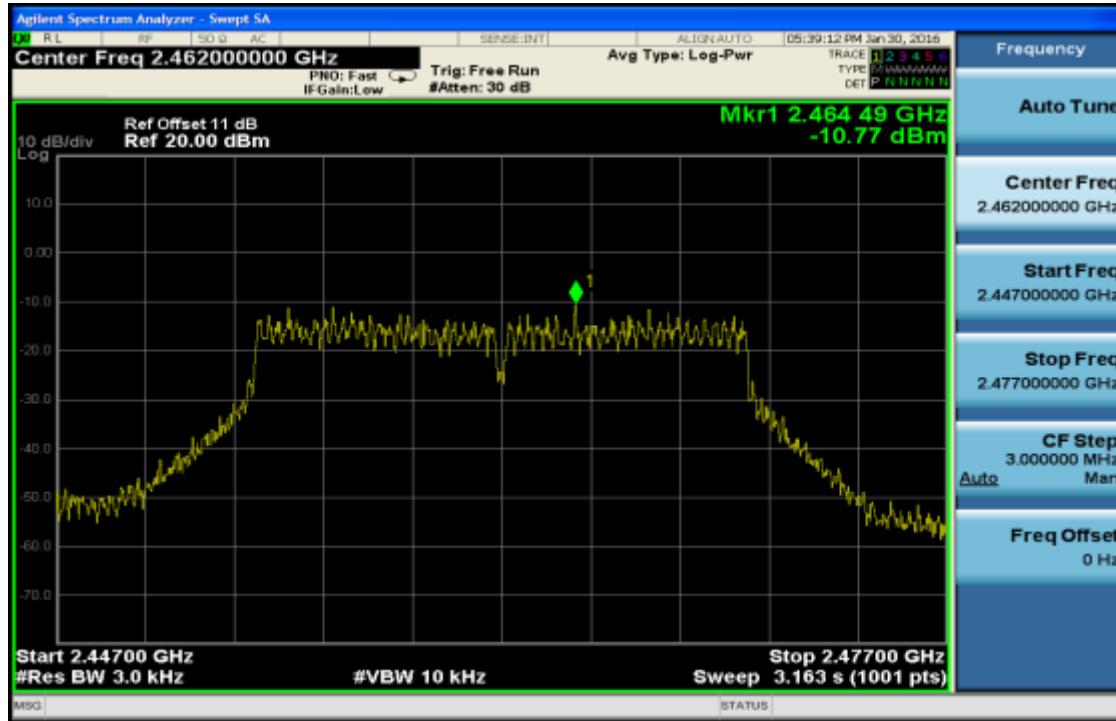
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## Power Spectral Density Test Plot (CH-Mid)



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



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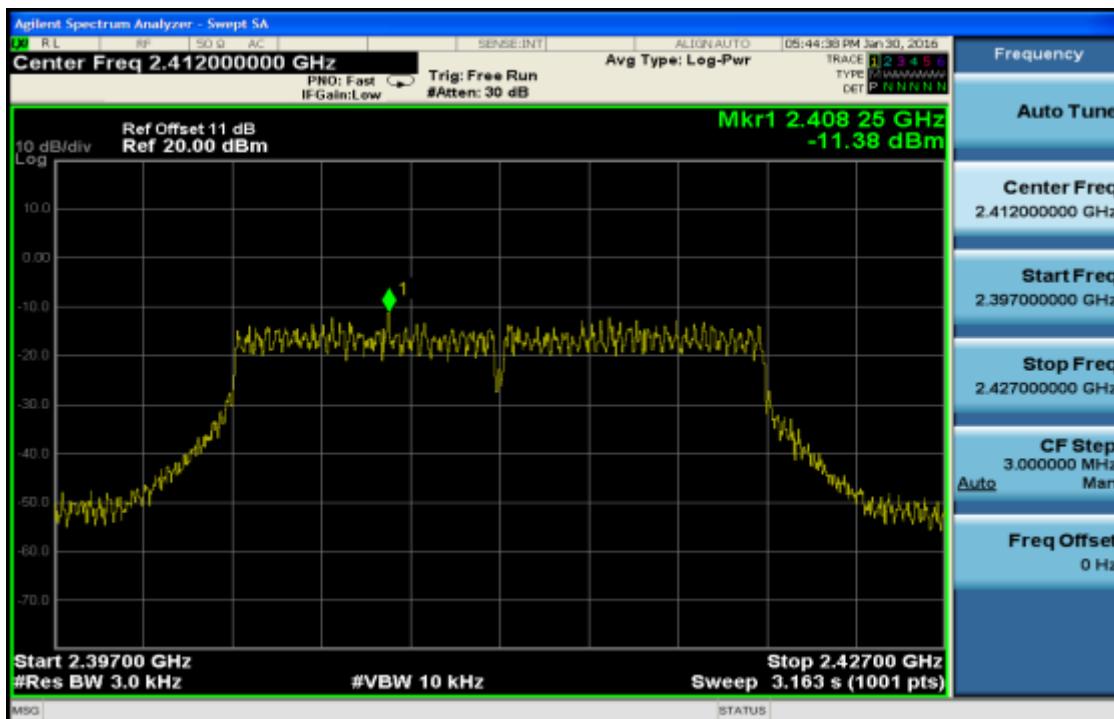
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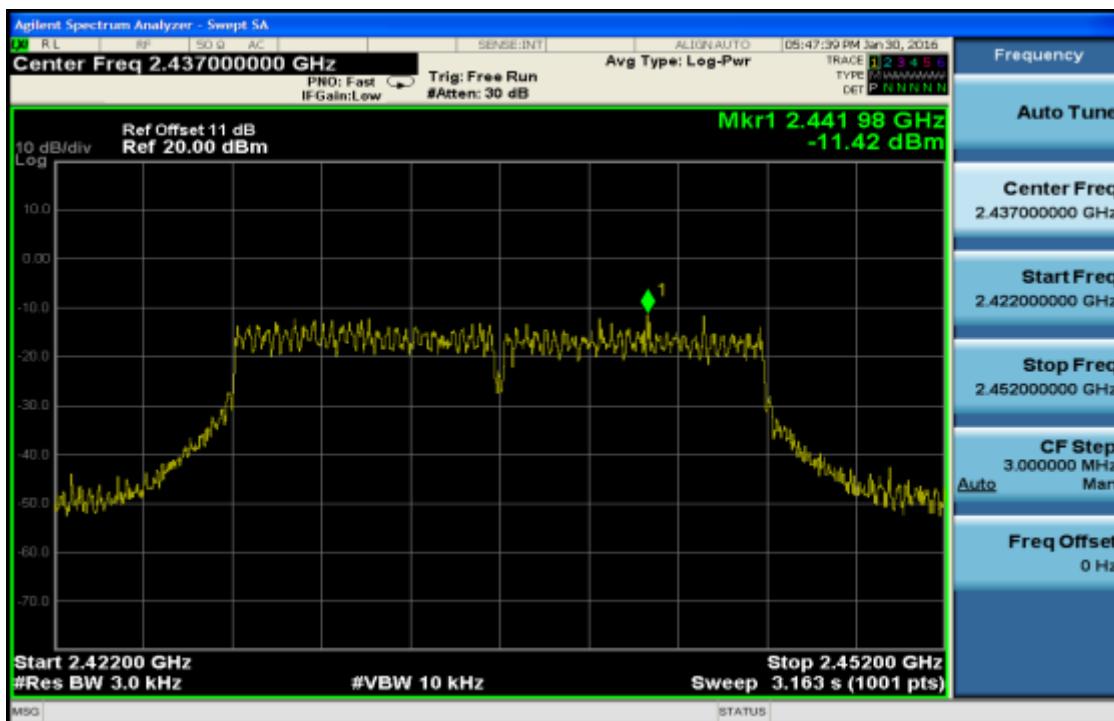
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## 802.11n\_HT20

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



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



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## Power Spectral Density Test Plot (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 is designed as permanently attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

The antenna gain is less than 6dBi. Therefore, it is not necessary to reduce maximum output power limit.

*~ End of Report ~*

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