

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT CLASS II PC REPORT

OF

**Product Name:** Frey  
**Brand Name:** Bitatek  
**Model No.:** Frey M1-0000, Frey M1-0010  
**Model Difference:** N/A  
**FCC ID:** SPYIM0002  
**Report No.:** ER/2017/70091  
**Issue Date:** Aug. 04, 2017  
**FCC Rule Part:** §15.247, Cat: DTS  
Bitatek Co.,Ltd.  
**Prepared for:** 6F.,No.115,Wugong 3rd Rd., Wugu Dist., New Taipei City 248, Taiwan  
**Prepared by:** SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803



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## VERIFICATION OF COMPLIANCE

**Applicant:** Bitatek Co.,Ltd.  
6F.,No.115,Wugong 3rd Rd., Wugu Dist., New Taipei City 248,  
Taiwan

**Product Name:** Frey

**Brand Name:** Bitatek

**Model No.:** Frey M1-0000, Frey M1-0010

**Model Difference:** N/A

**FCC ID:** SPYIM0002

**File Number:** ER/2017/70091

**Date of test:** Jul. 18, 2017 ~ Jul. 28, 2017

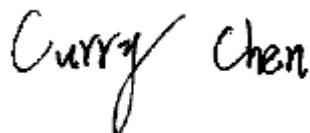
**Date of EUT Received:** Jul. 18, 2017

**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.

**Test By:**

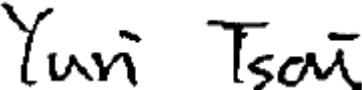


**Date:**

Aug. 04, 2016

*Curry Chen / Engineer*

**Prepared By:**

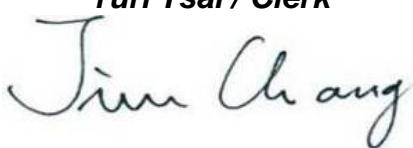


**Date:**

Aug. 04, 2016

*Yuri Tsai / Clerk*

**Approved  
By:**



**Date:**

Aug. 04, 2016

*Jim Chang / Asst. Manager*

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## Revision History

Report Number	Revision	Description	Issue Date
ER/2017/70091	Rev.00	Initial creation of document	Aug. 04, 2016

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## 1 GENERAL INFORMATION

### 1.1 Product description

General Information of Host:

Product Name of Host:	Rugged Handheld Computer	
Brand Name:	unitech	
Model No. of Host:	PA730	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Model No. of BT/WLAN Module:	Frey M1-0000, Frey M1-0010	
Scope:	The test report covers the radiated emissions requirements of the standards referenced in the report to allow system level approval of the module in this specific host.	
Class II Permissive change:	Frey INSTALLED IN Rugged Handheld Computer	
USB Cable:	Model No.: 3C10-00000790, Supplier: Bitatek	
Power Supply:	3.7Vdc from Rechargeable Li-polymer Battery or 5V from AC/DC Adapter	
	Battery:	1. Model No.: BTBAT2, Supplier: Leung's Communication & Electric Products (Guangzhou) LTD. 2. Model No.: BTBAT1, Supplier: Leung's Communication & Electric Products (Guangzhou) LTD.
	Adapter:	Model No.: S018BDU0900200, Supplier: Ten Pao Industrial Co., Ltd.

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## WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Modulation Technology
11b/g	2412-2462	11	DSSS OFDM
11n (2.4GHz)	HT20 2412-2462	11	OFDM
11n (2.4GHz)	HT40 2422-2452	11	OFDM
Antenna Designation:		IFA Antenna, Gain: 2dBi	
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 HT20: 6.5 – 72.5Mbps 802.11 HT40: 13.5 – 150Mbps	

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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

FCC KDB 662911 D01 Multiple Transmitter Output

ANSI C63.10:2013

Note:

1. All test items have been performed and record as per the above standards.
2. The EUT was placed 1.5m height for frequency above 1GHz in accordance with ANSI C63. 10 :2013

## 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

Canada Registration Number: 4620A-4

## 1.4 Special Accessories

There is no special accessory 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 plan. 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. 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 plan. 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.

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## 2.5 Configuration of Tested System

**Fig. 2-1 Configuration of Tested System**



**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

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### 3 SUMMARY OF TEST RESULTS

FCC / IC Rules	Description Of Test	Result
§15.247(d)	Spurious Emission	Compliant
§15.203	Antenna Requirement	Compliant

### 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		

7 channels are provided for 802.11n HT40,

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
3	2422 MHz	7	2442 MHz
4	2427 MHz	8	2447 MHz
5	2432 MHz	9	2452 MHz
6	2437 MHz		

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**RADIATED EMISSION TEST:**

<b>RADIATED EMISSION TEST (ABOVE 1 GHz)</b>					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	6	DSSS	1	Main
<b>RADIATED BAND EDGE EMISSION TEST</b>					
MODE	MODE	MODE	MODE	MODE	MODE
802.11b	1 to 11	1, 6, 11	DSSS	1	Main
802.11g	1 to 11	1, 6, 11	OFDM	6	Main
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS0	Main
802.11n (HT40)	3 to 9	3, 6, 9	OFDM	MCS0	Main

**Note:**

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

**ANTENNA PORT CONDUCTED MEASUREMENT:**

<b>CONDUCTED TEST</b>					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1, 6, 11	DSSS	1	Main
802.11g	1 to 11	1, 6, 11	OFDM	6	Main
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS0	Main
802.11n (HT40)	3 to 9	3, 6, 9	OFDM	MCS0	Main

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## 5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 1.55dB (for Spectrum) +/- 1.42 dB (for Power Meter)
6dB Bandwidth	+/- 123.36 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.55 dB
Peak Power Density	+/- 1.55 dB
99% Power Bandwidth	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC=+/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (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 (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 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

### 6.1 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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## 6.2 Measurement Equipment Used:

SGS 966 Chamber No.C					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI7	100760	05/11/2017	05/10/2018
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/25/2017	04/24/2018
Loop Antenna	ETS.LINDGREN	6502	148045	09/20/2016	09/19/2017
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/19/2016	12/18/2017
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/01/2016	07/31/2017
Pre-Amplifier	Agilent	8447D	2944A07676	01/05/2017	01/04/2018
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/05/2017	01/04/2018
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	01/05/2017	01/04/2018
3m Site NSA	SGS	966 chamber	N/A	07/01/2017	06/30/2018
Low Loss Cable	Huber Suhner	966 TX	1	01/05/2017	01/04/2018
Horn Antenna	Schwarzbeck	BBHA9170	184	12/12/2016	12/11/2017
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/05/2017	01/04/2018

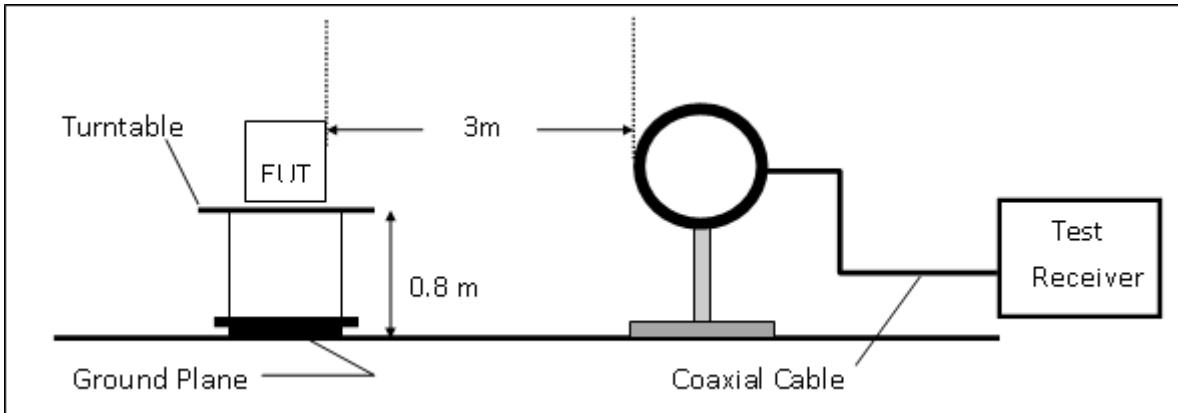
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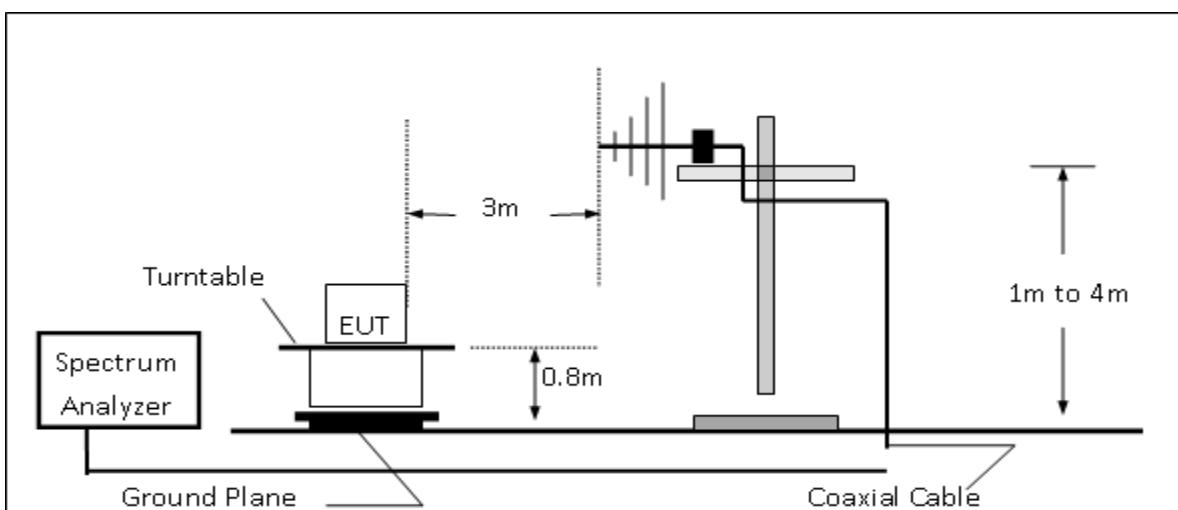
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### 6.3 Test SET-UP:

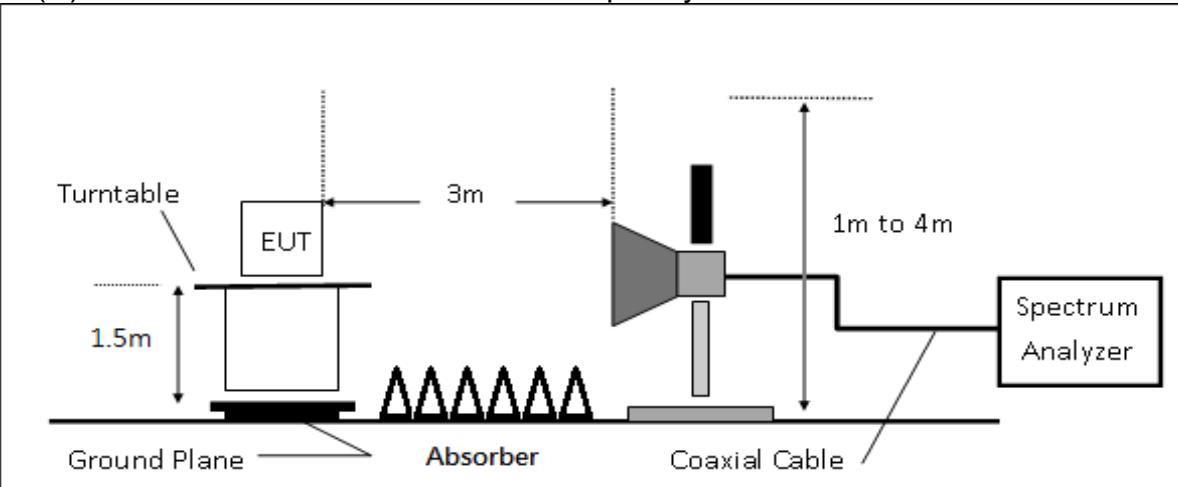
#### (A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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## 6.4 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  $\geq$  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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台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

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## 6.5 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.

## 6.6 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.

## 6.7 Measurement Result:

Note: Refer to next page tabular data sheets.

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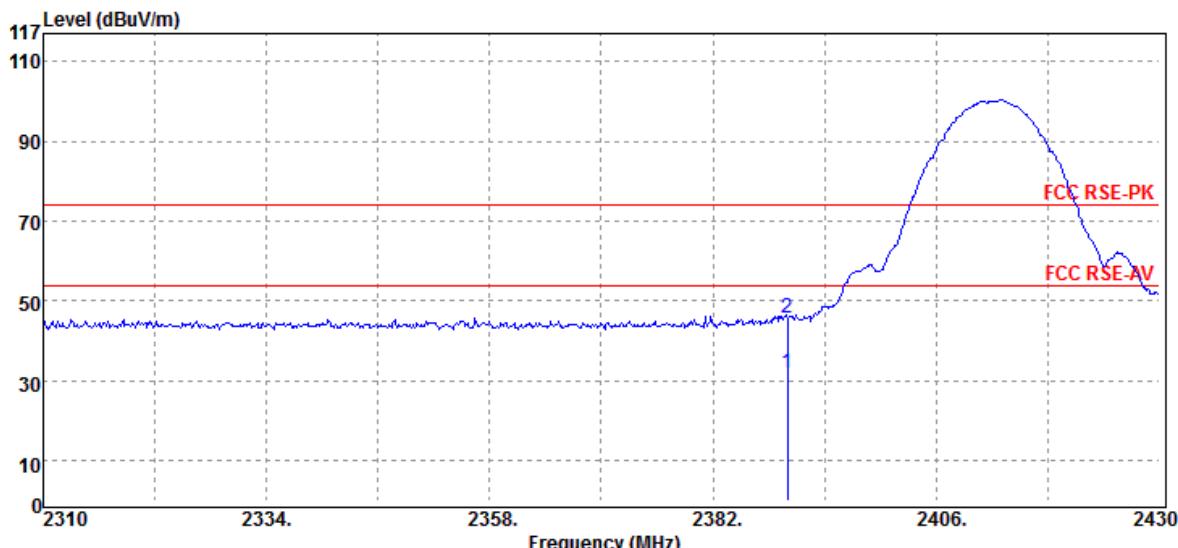
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## Radiated Band Edge Measurement Result: 802.11 b mode

Operation Band	:802.11b	Test Date	:2017-07-20
Fundamental Frequency	:2412 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2390.00	E	Average	33.87	33.87	-1.74	32.13	54.00	-21.87
2390.00	E	Peak	47.34	47.34	-1.74	45.60	74.00	-28.40

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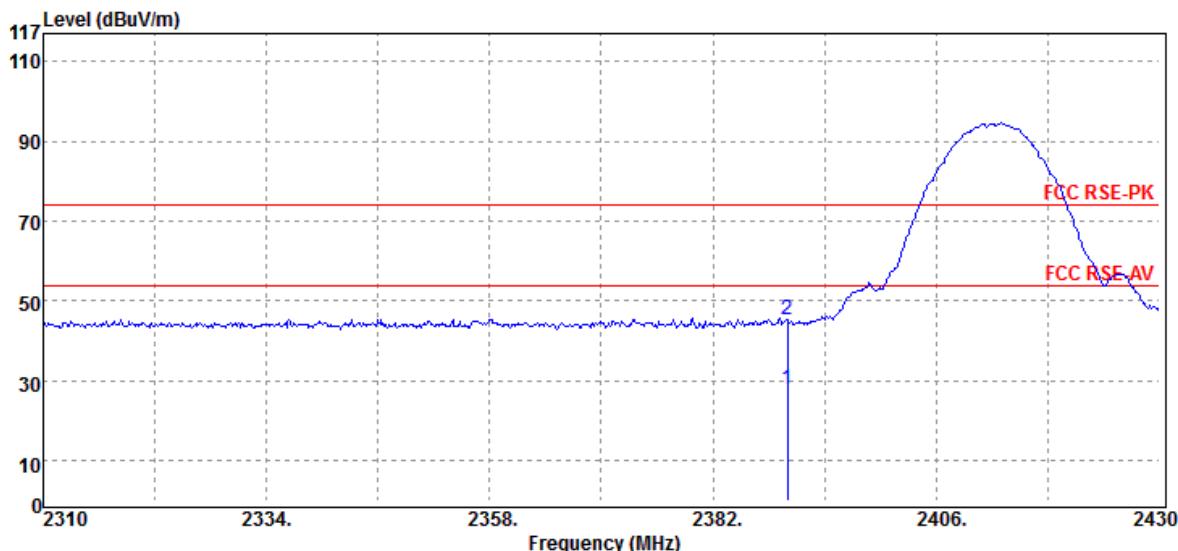
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Operation Band :802.11b  
 Fundamental Frequency :2412 MHz  
 Operation Mode :Bandedge CH LOW  
 EUT Pol. :H Plane

Test Date :2017-07-20  
 Temp./Humi. :22 deg\_C / 61 RH  
 Engineer :Mike  
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor	Actual FS	Limit @3m	Margin
			PK/QP/AV	dB $\mu$ V				
2390.00	E	Average	29.78	29.78	-1.74	28.04	54.00	-25.96
2390.00	E	Peak	47.16	47.16	-1.74	45.42	74.00	-28.58

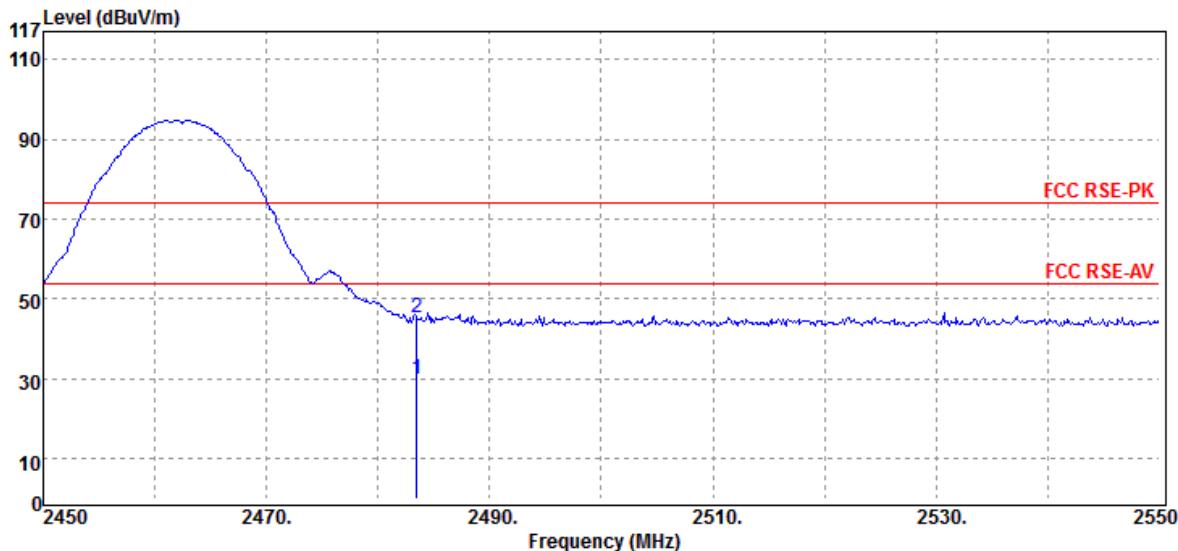
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Operation Band :802.11b  
 Fundamental Frequency :2462 MHz  
 Operation Mode :Bandedge CH HIGH  
 EUT Pol. :H Plane

Test Date :2017-07-20  
 Temp./Humi. :22 deg\_C / 61 RH  
 Engineer :Mike  
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2483.50	E	Average		31.56	-1.62	29.94	54.00	-24.06
2483.50	E	Peak		46.88	-1.62	45.26	74.00	-28.74

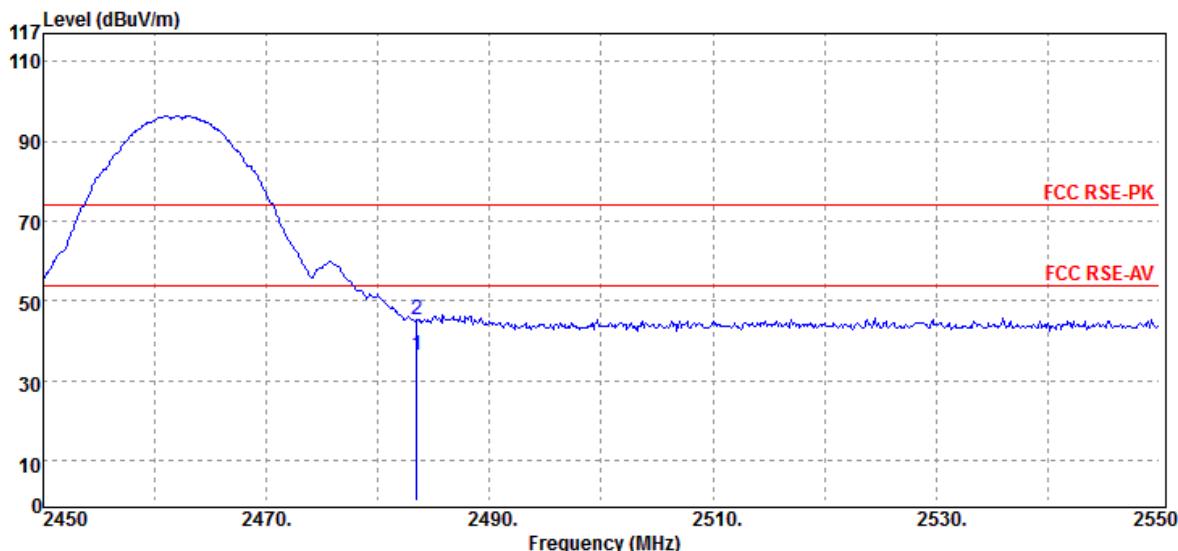
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Operation Band :802.11b  
 Fundamental Frequency :2462 MHz  
 Operation Mode :Bandedge CH HIGH  
 EUT Pol. :H Plane

Test Date :2017-07-20  
 Temp./Humi. :22 deg\_C / 61 RH  
 Engineer :Mike  
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
2483.50	E	Average	37.96	37.96	-1.62	36.34	54.00	-17.66
2483.50	E	Peak	47.06	47.06	-1.62	45.44	74.00	-28.56

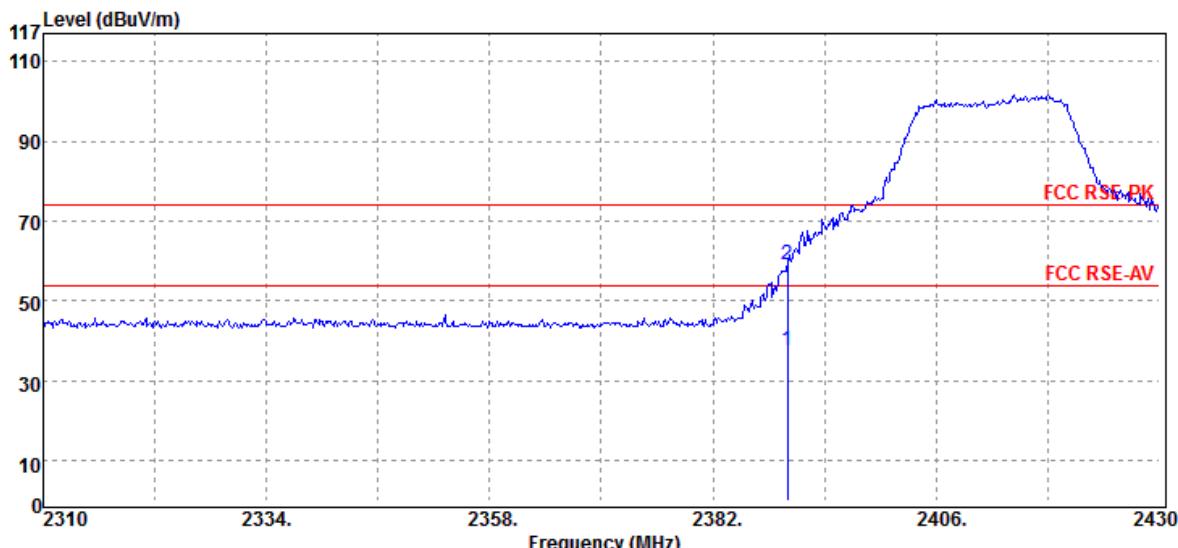
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## Radiated Band Edge Measurement Result: 802.11 g mode

Operation Band	:802.11g	Test Date	:2017-07-20
Fundamental Frequency	:2412 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2390.00	E	Average	39.26	39.26	-1.74	37.52	54.00	-16.48
2390.00	E	Peak	60.93	60.93	-1.74	59.19	74.00	-14.81

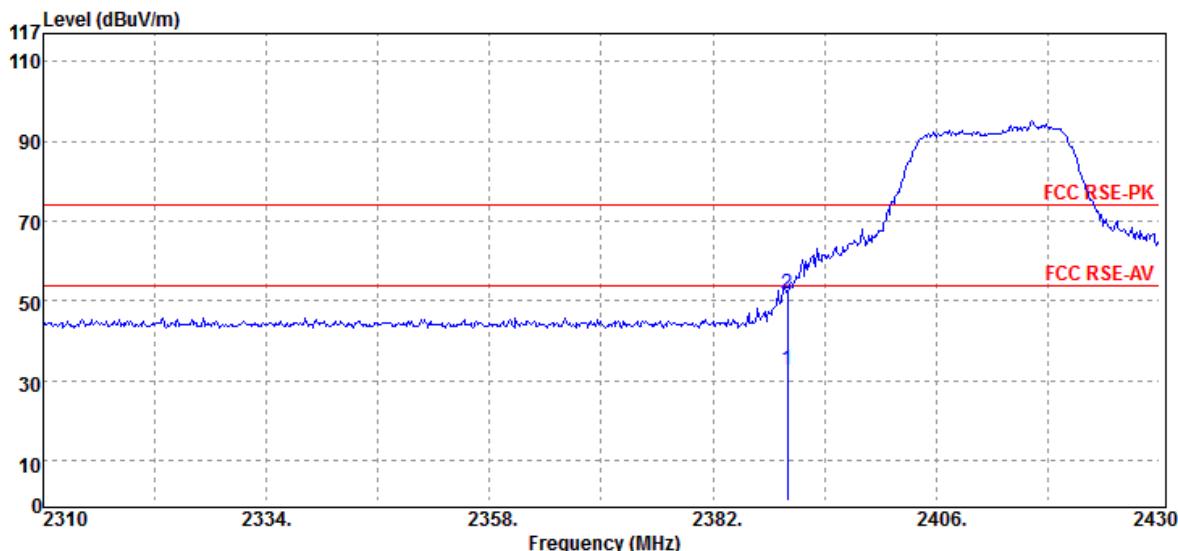
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Operation Band :802.11g  
 Fundamental Frequency :2412 MHz  
 Operation Mode :Bandedge CH LOW  
 EUT Pol. :H Plane

Test Date :2017-07-20  
 Temp./Humi. :22 deg\_C / 61 RH  
 Engineer :Mike  
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2390.00	E	Average	34.69	34.69	-1.74	32.95	54.00	-21.05
2390.00	E	Peak	53.56	53.56	-1.74	51.82	74.00	-22.18

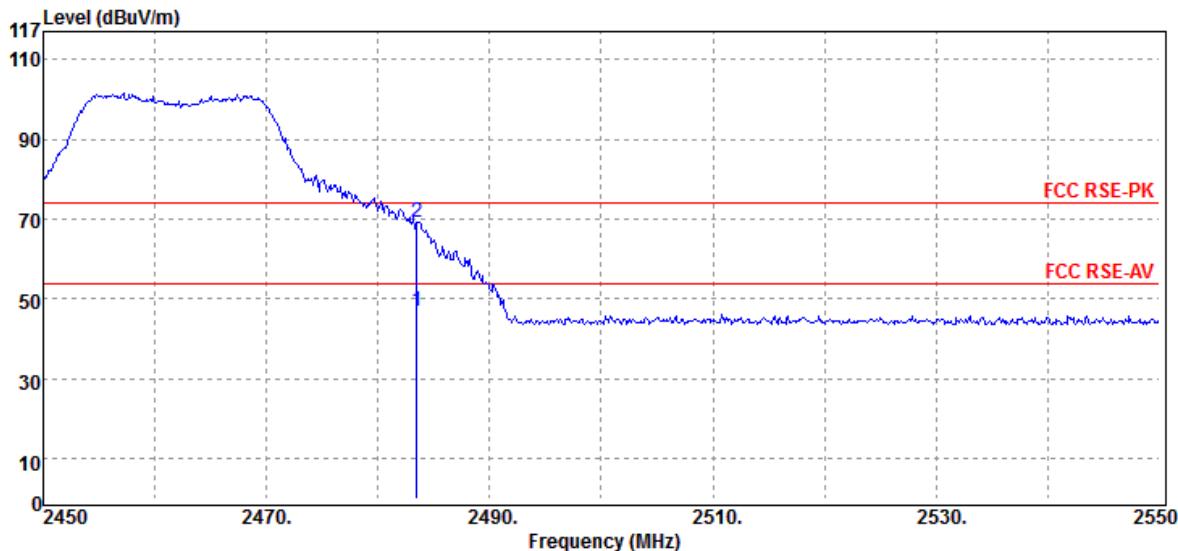
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Operation Band :802.11g  
 Fundamental Frequency :2462 MHz  
 Operation Mode :Bandedge CH HIGH  
 EUT Pol. :H Plane

Test Date :2017-07-20  
 Temp./Humi. :22 deg\_C / 61 RH  
 Engineer :Mike  
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2483.50	E	Average	48.77	48.77	-1.62	47.15	54.00	-6.85
2483.50	E	Peak	70.97	70.97	-1.62	69.35	74.00	-4.65

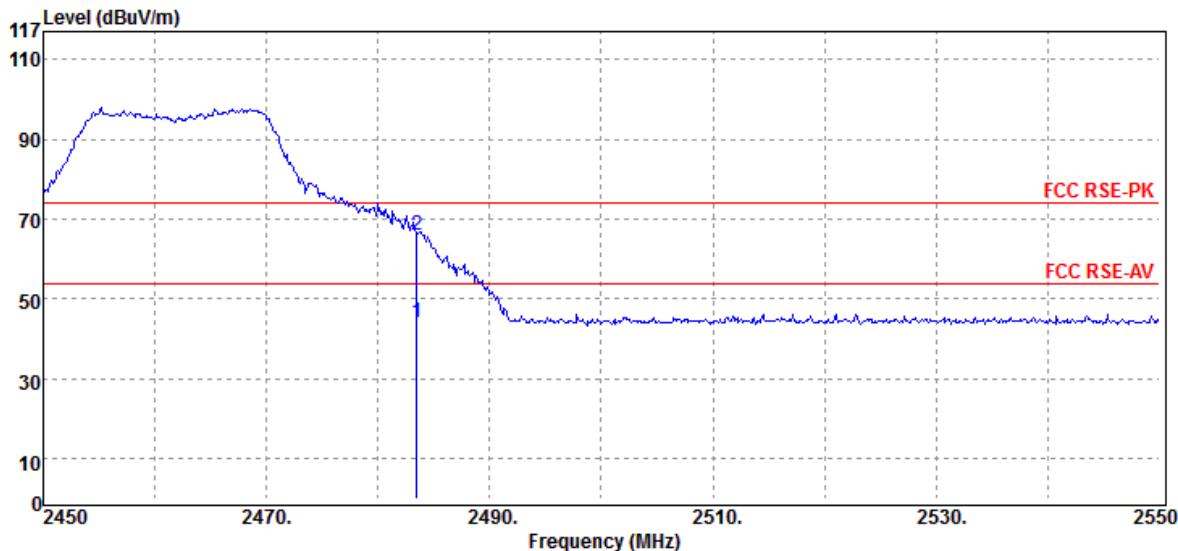
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Operation Band :802.11g  
 Fundamental Frequency :2462 MHz  
 Operation Mode :Bandedge CH HIGH  
 EUT Pol. :H Plane

Test Date :2017-07-20  
 Temp./Humi. :22 deg\_C / 61 RH  
 Engineer :Mike  
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor	Actual FS	Limit @3m	Margin
			PK/QP/AV	dB $\mu$ V				
2483.50	E	Average	45.89	45.89	-1.62	44.27	54.00	-9.73
2483.50	E	Peak	67.48	67.48	-1.62	65.86	74.00	-8.14

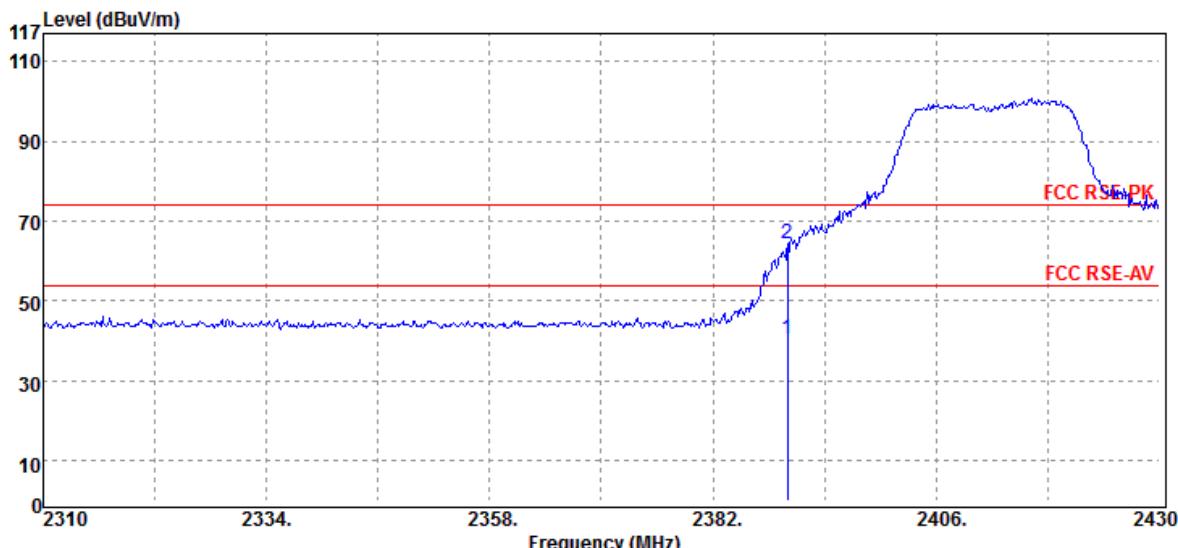
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**Radiated Band Edge Measurement Result (802.11n\_HT20)**

Operation Band	:802.11n20	Test Date	:2017-07-20
Fundamental Frequency	:2412 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2390.00	E	Average	42.15	42.15	-1.74	40.41	54.00	-13.59
2390.00	E	Peak	66.04	66.04	-1.74	64.30	74.00	-9.70

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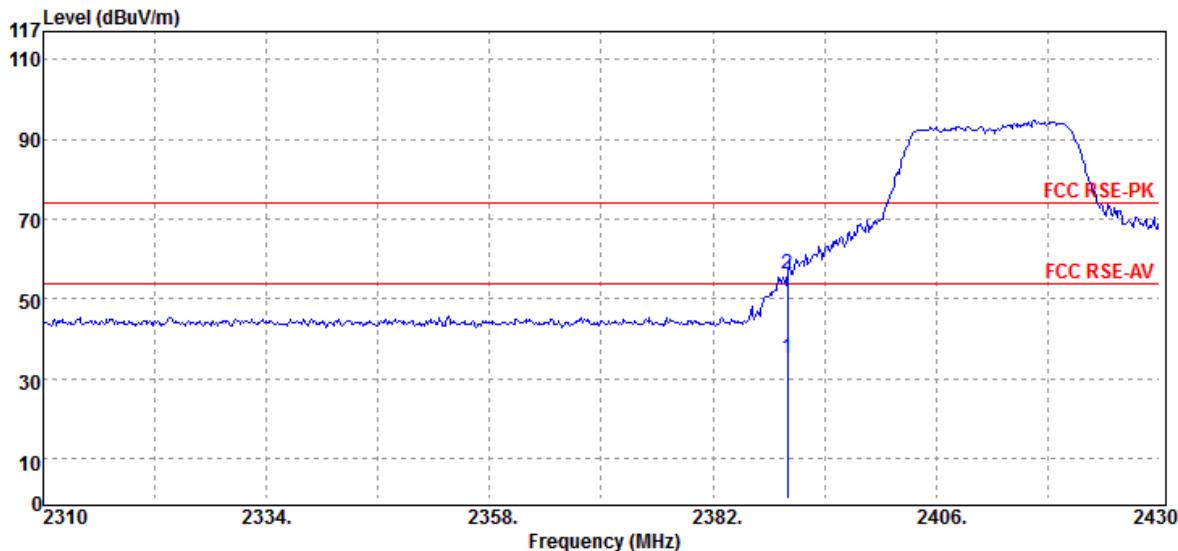
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Operation Band :802.11n20  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :H Plane

Test Date :2017-07-20  
Temp./Humi. :22 deg\_C / 61 RH  
Engineer :Mike  
Measurement Antenna Pol. :HORIZONTAL



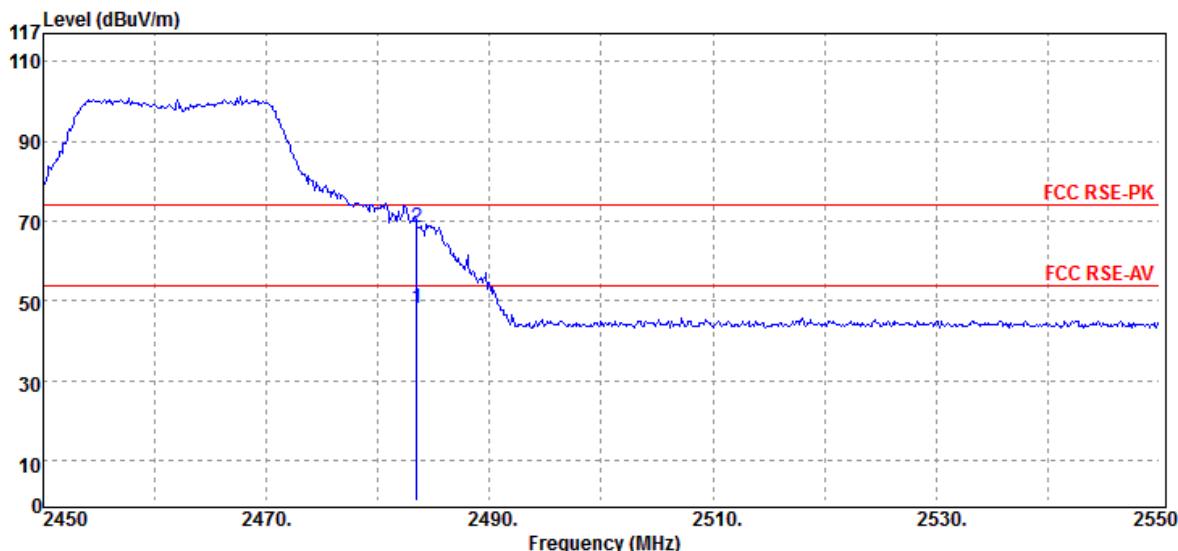
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
2390.00	E	Average	36.88	36.88	-1.74	35.14	54.00	-18.86
2390.00	E	Peak	58.03	58.03	-1.74	56.29	74.00	-17.71

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Operation Band	:802.11n20	Test Date	:2017-07-20
Fundamental Frequency	:2462 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



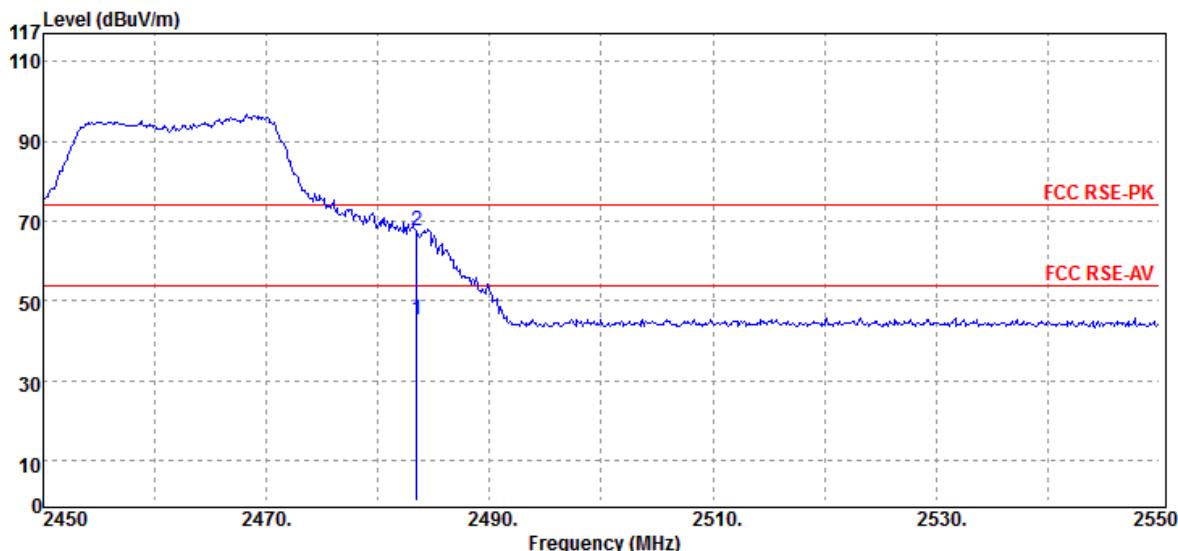
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2483.50	E	Average	49.67	49.67	-1.62	48.05	54.00	-5.95
2483.50	E	Peak	70.02	70.02	-1.62	68.40	74.00	-5.60

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Operation Band	:802.11n20	Test Date	:2017-07-20
Fundamental Frequency	:2462 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2483.50	E	Average	46.82	46.82	-1.62	45.20	54.00	-8.80
2483.50	E	Peak	69.32	69.32	-1.62	67.70	74.00	-6.30

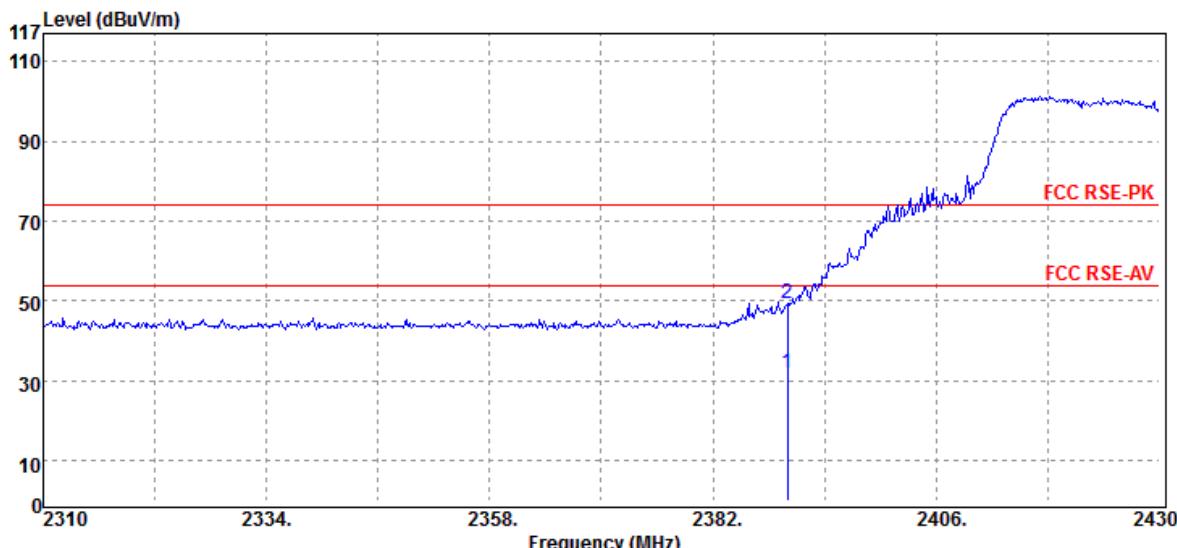
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**Radiated Band Edge Measurement Result (802.11n\_HT40)**

Operation Band	:802.11n40	Test Date	:2017-07-20
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2390.00	E	Average	33.89	33.89	-1.74	32.15	54.00	-21.85
2390.00	E	Peak	50.96	50.96	-1.74	49.22	74.00	-24.78

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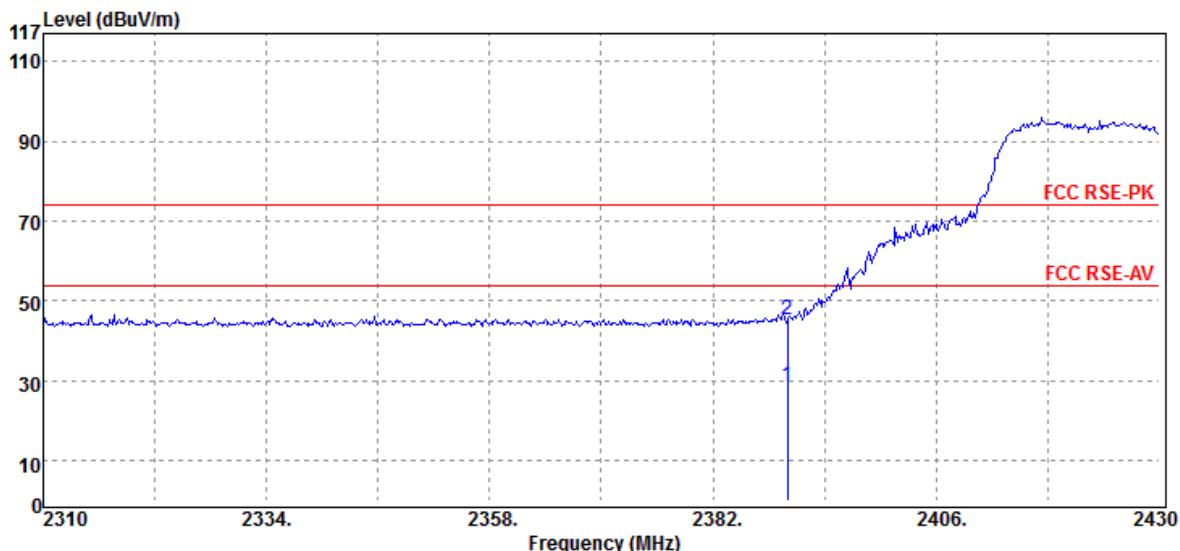
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Operation Band :802.11n40  
 Fundamental Frequency :2422 MHz  
 Operation Mode :Bandedge CH LOW  
 EUT Pol. :H Plane

Test Date :2017-07-20  
 Temp./Humi. :21 deg\_C / 62 RH  
 Engineer :Mike  
 Measurement Antenna Pol. :HORIZONTAL



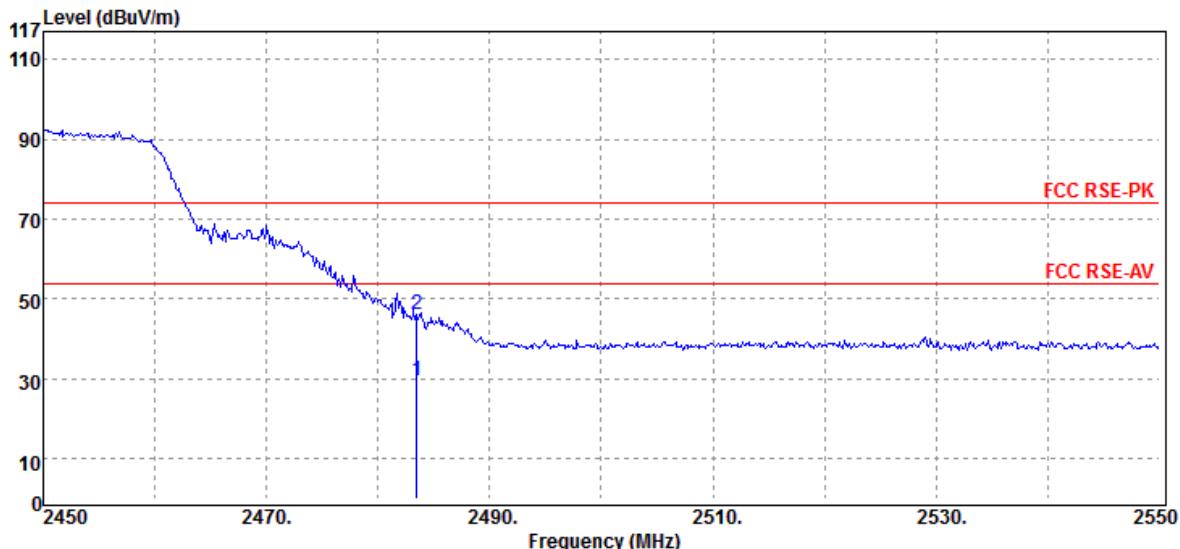
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2390.00	E	Average	30.36	30.36	-1.74	28.62	54.00	-25.38
2390.00	E	Peak	47.06	47.06	-1.74	45.32	74.00	-28.68

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Operation Band	:802.11n40	Test Date	:2017-07-20
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
			PK/QP/AV	dB $\mu$ V				
2483.50	E	Average	31.21	31.21	-1.62	29.59	54.00	-24.41
2483.50	E	Peak	47.72	47.72	-1.62	46.10	74.00	-27.90

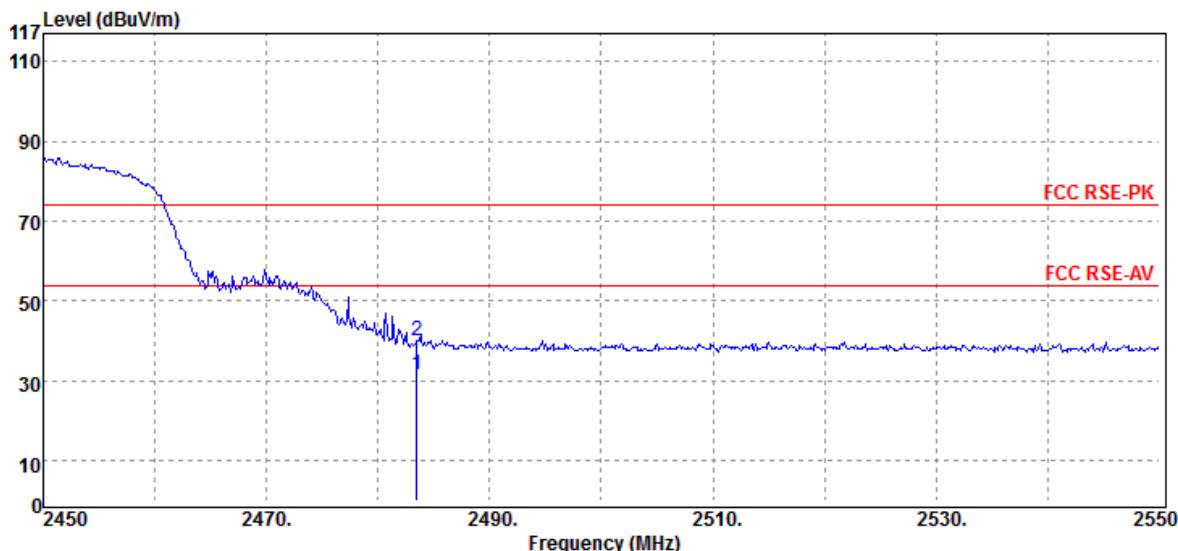
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Operation Band :802.11n40  
 Fundamental Frequency :2422 MHz  
 Operation Mode :Bandedge CH HIGH  
 EUT Pol. :H Plane

Test Date :2017-07-20  
 Temp./Humi. :21 deg\_C / 62 RH  
 Engineer :Mike  
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor	Actual FS	Limit @3m	Margin
			PK/QP/AV	dB $\mu$ V				
2483.50	E	Average		33.08	-1.62	31.46	54.00	-22.54
2483.50	E	Peak		41.50	-1.62	39.88	74.00	-34.12

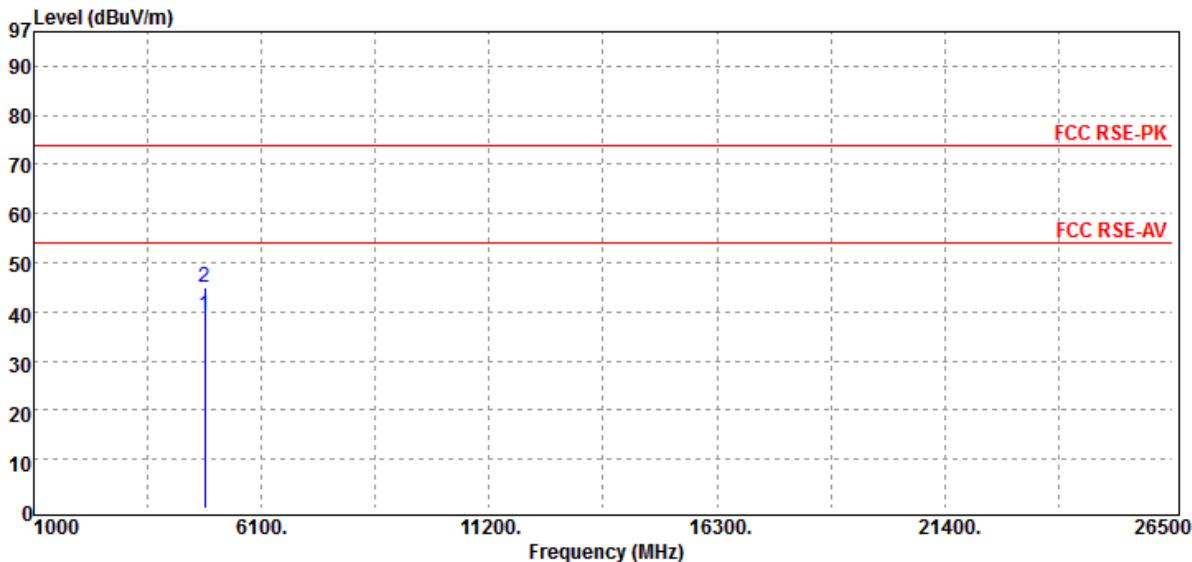
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**Above 1GHz Data:**
**Radiated Spurious Emission Measurement Result (802.11 b)**

Operation Band	:802.11b	Test Date	:2017-07-21
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



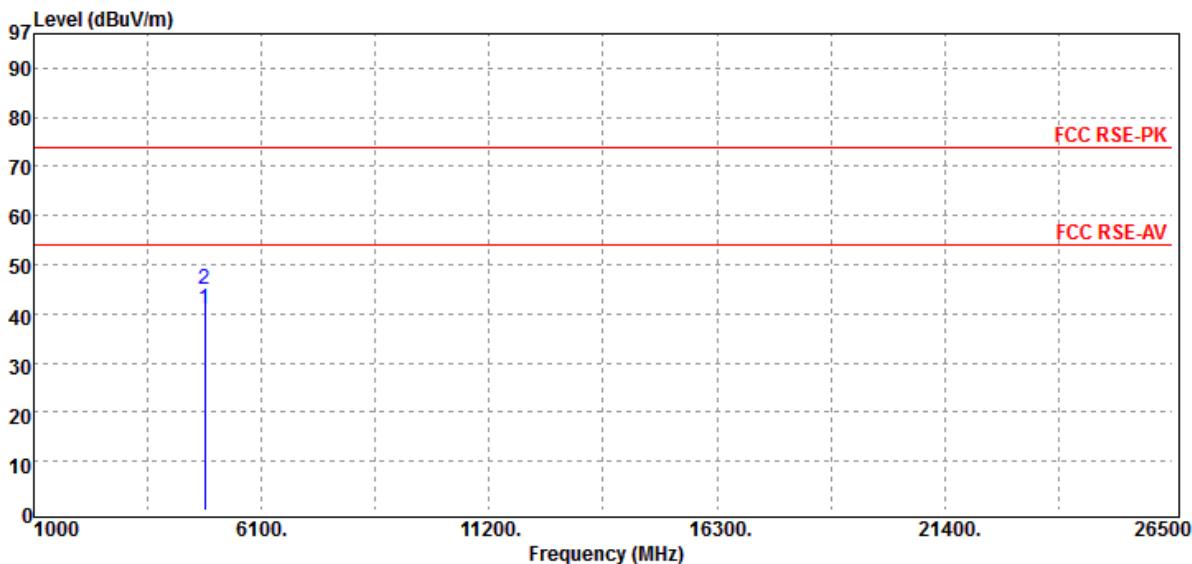
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
						dB $\mu$ V/m	dB
4824.00	H	Average	34.50	4.93	39.43	54.00	-14.57
4824.00	H	Peak	40.00	4.93	44.93	74.00	-29.07

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Operation Band	:802.11b	Test Date	:2017-07-21
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



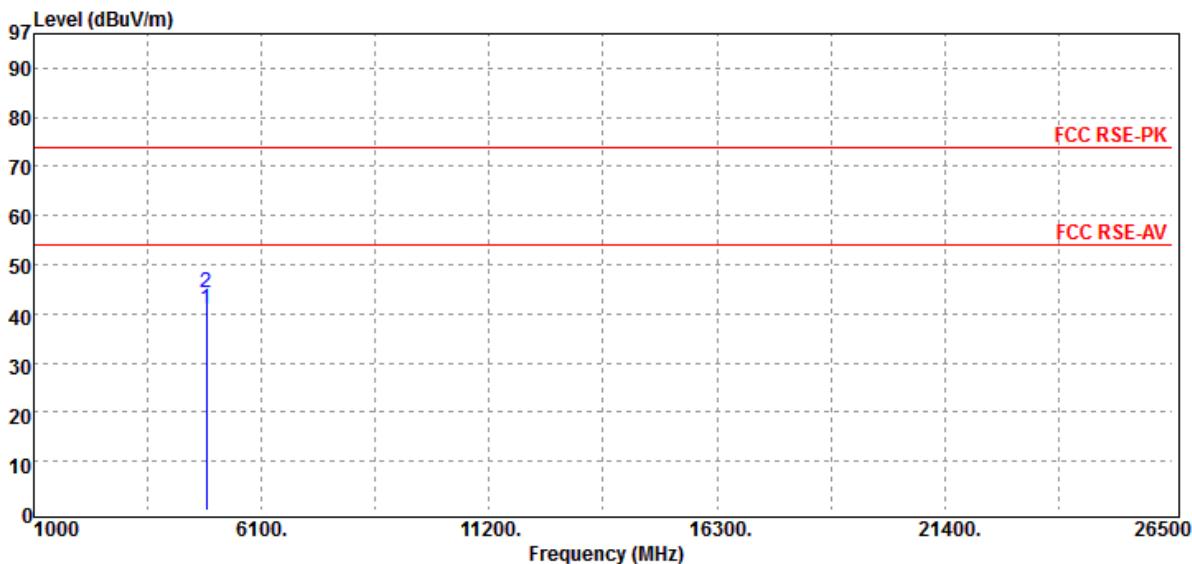
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
4824.00	H	Average		35.91	4.93	40.84	54.00	-13.16
4824.00	H	Peak		39.92	4.93	44.85	74.00	-29.15

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Operation Band	:802.11b	Test Date	:2017-07-21
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



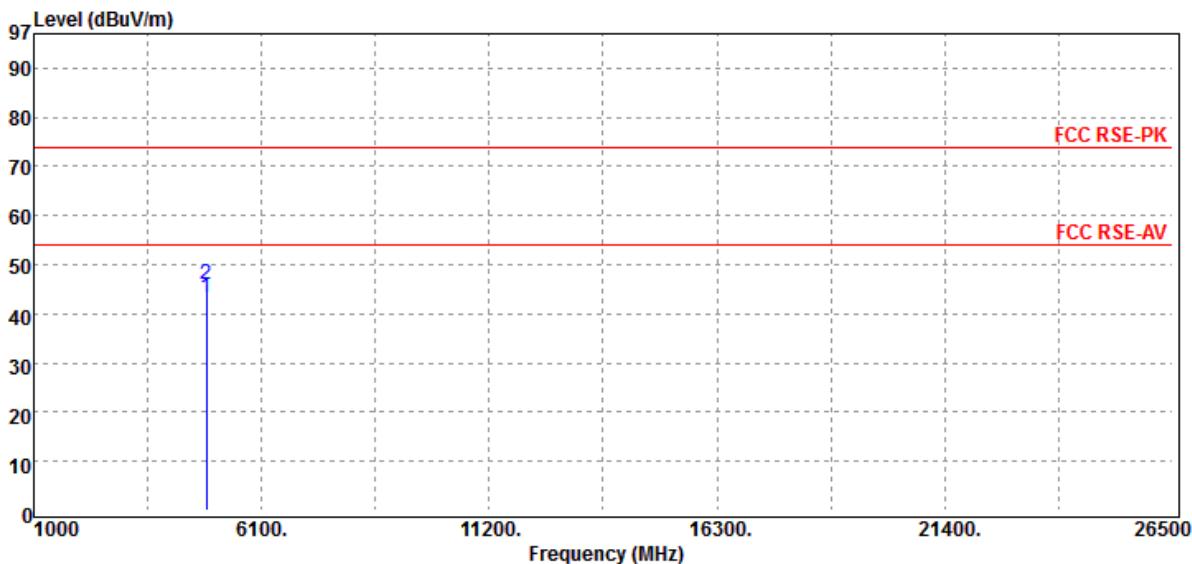
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dBμV				
4874.00	H	Average		35.88	5.13	41.01	54.00	-12.99
4874.00	H	Peak		39.01	5.13	44.14	74.00	-29.86

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Operation Band	:802.11b	Test Date	:2017-07-21
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
4874.00	H	Average		38.29	5.13	43.42	54.00	-10.58
4874.00	H	Peak		40.90	5.13	46.03	74.00	-27.97

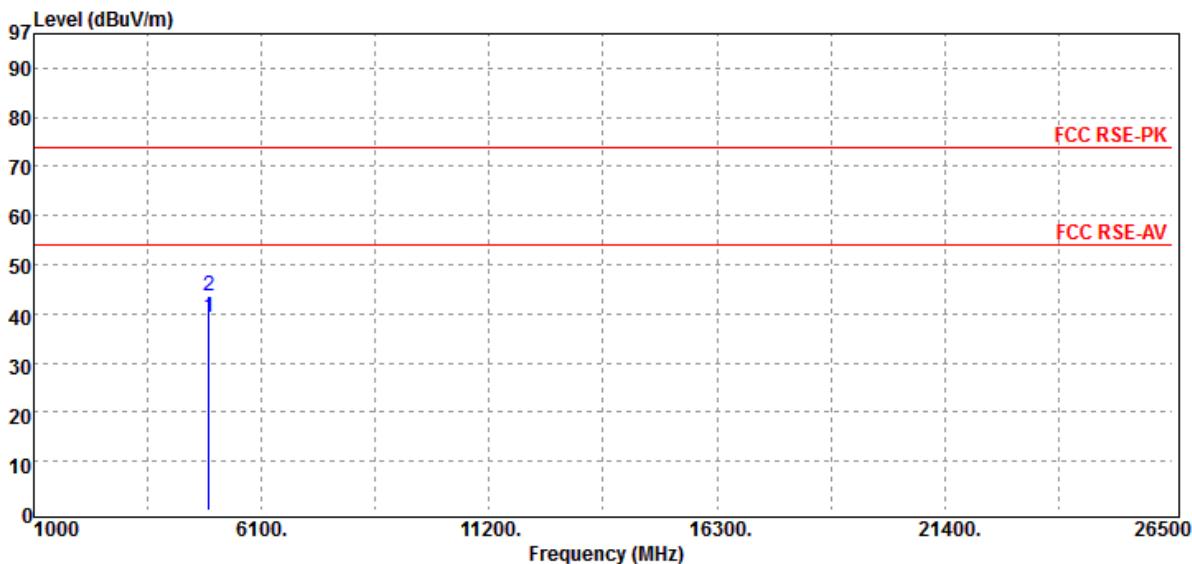
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Operation Band :802.11b  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2017-07-21  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Mike  
Measurement Antenna Pol. :VERTICAL



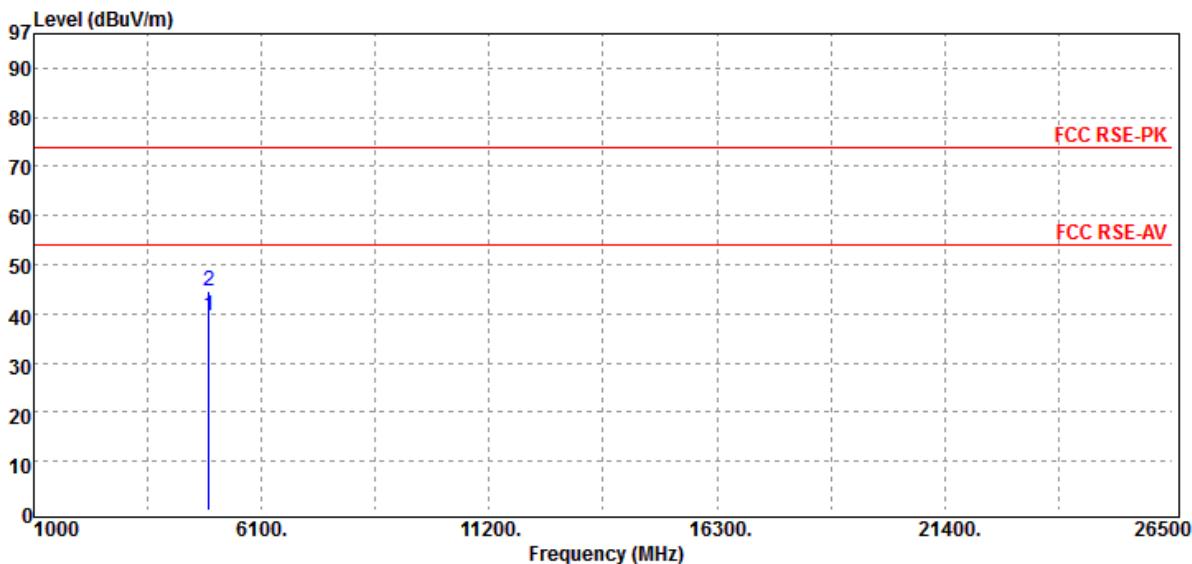
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
4924.00	H	Average		34.11	5.25	39.36	54.00	-14.64
4924.00	H	Peak		38.40	5.25	43.65	74.00	-30.35

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Operation Band	:802.11b	Test Date	:2017-07-21
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dBμV				
4924.00	H	Average		34.33	5.25	39.58	54.00	-14.42
4924.00	H	Peak		39.40	5.25	44.65	74.00	-29.35

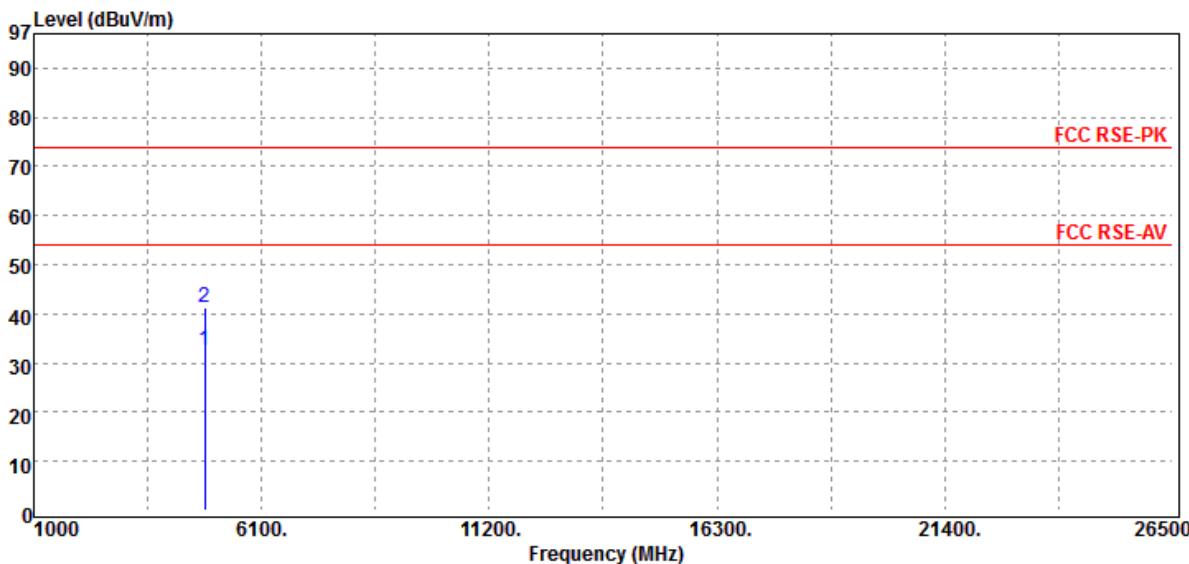
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**Radiated Spurious Emission Measurement Result (802.11 g)**

Operation Band :802.11g Test Date :2017-07-21  
Fundamental Frequency :2412 MHz Temp./Humi. :21 deg\_C / 62 RH  
Operation Mode :Tx CH LOW Engineer :Mike  
EUT Pol. :H Plane Measurement Antenna Pol. :VERTICAL



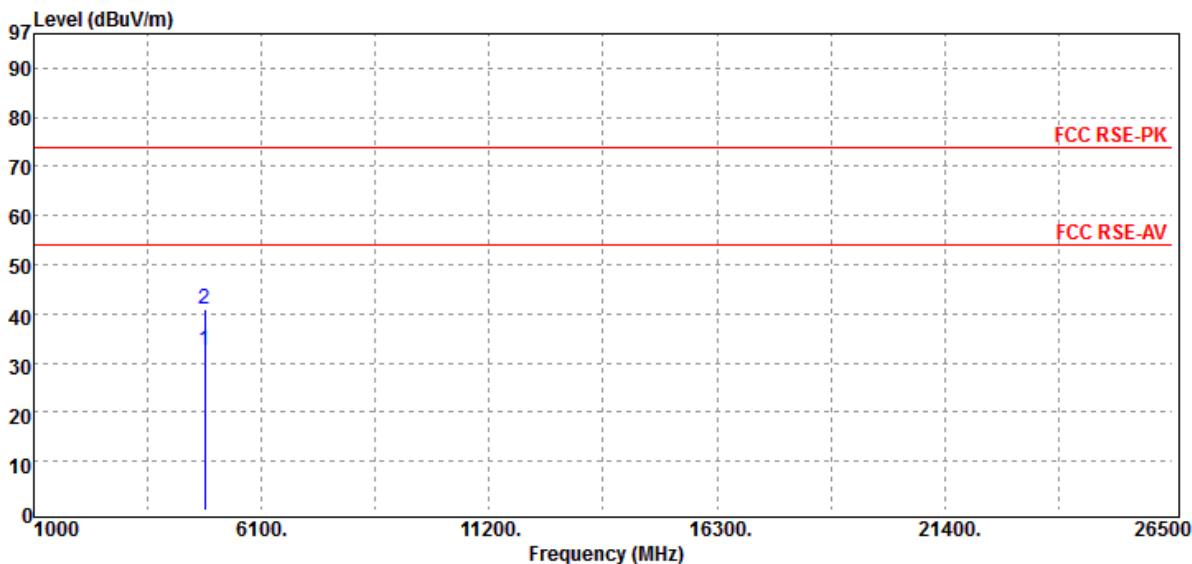
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
						dB $\mu$ V/m	dB
4824.00	H	Average	27.60	4.93	32.53	54.00	-21.47
4824.00	H	Peak	36.22	4.93	41.15	74.00	-32.85

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Operation Band	:802.11g	Test Date	:2017-07-21
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



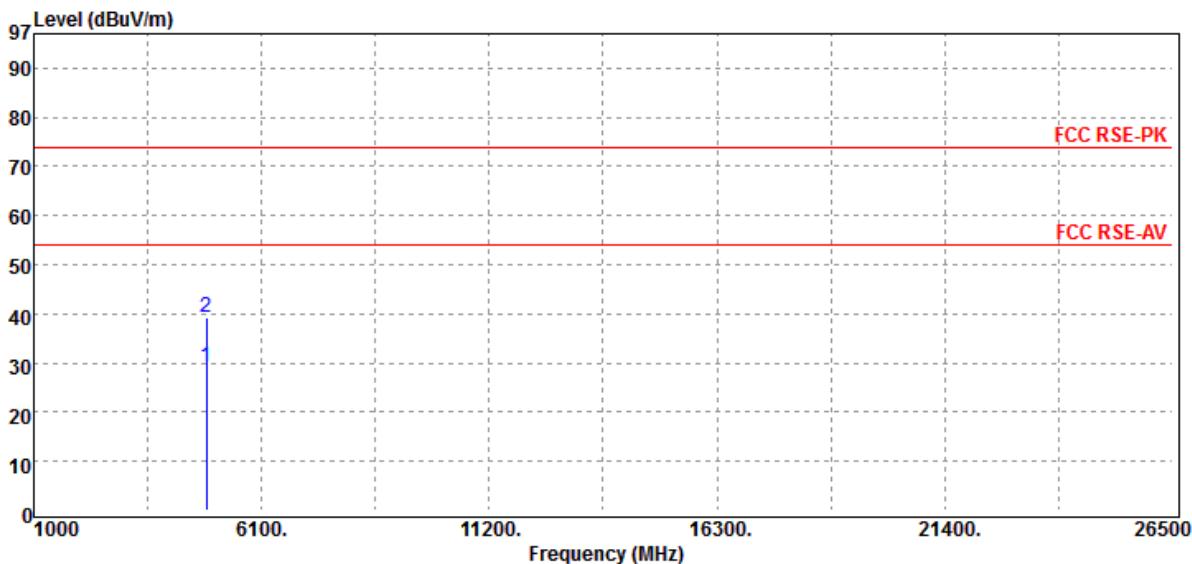
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
4824.00	H	Average	27.64		4.93	32.57	54.00	-21.43
4824.00	H	Peak	36.02		4.93	40.95	74.00	-33.05

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Operation Band	:802.11g	Test Date	:2017-07-21
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



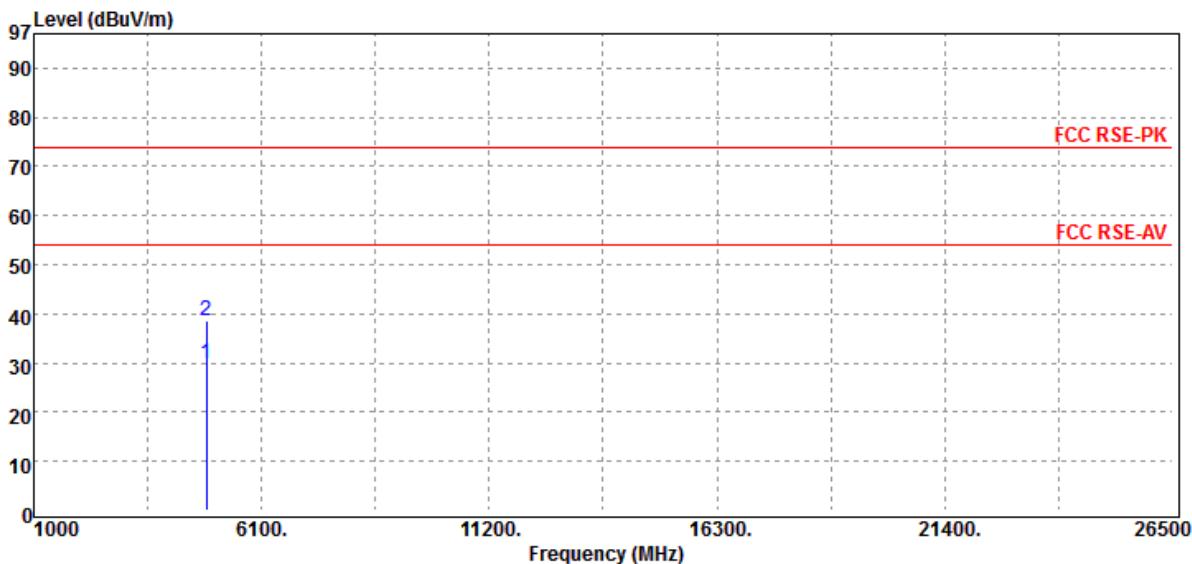
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
4874.00	H	Average		24.13	5.13	29.26	54.00	-24.74
4874.00	H	Peak		34.23	5.13	39.36	74.00	-34.64

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Operation Band	:802.11g	Test Date	:2017-07-21
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



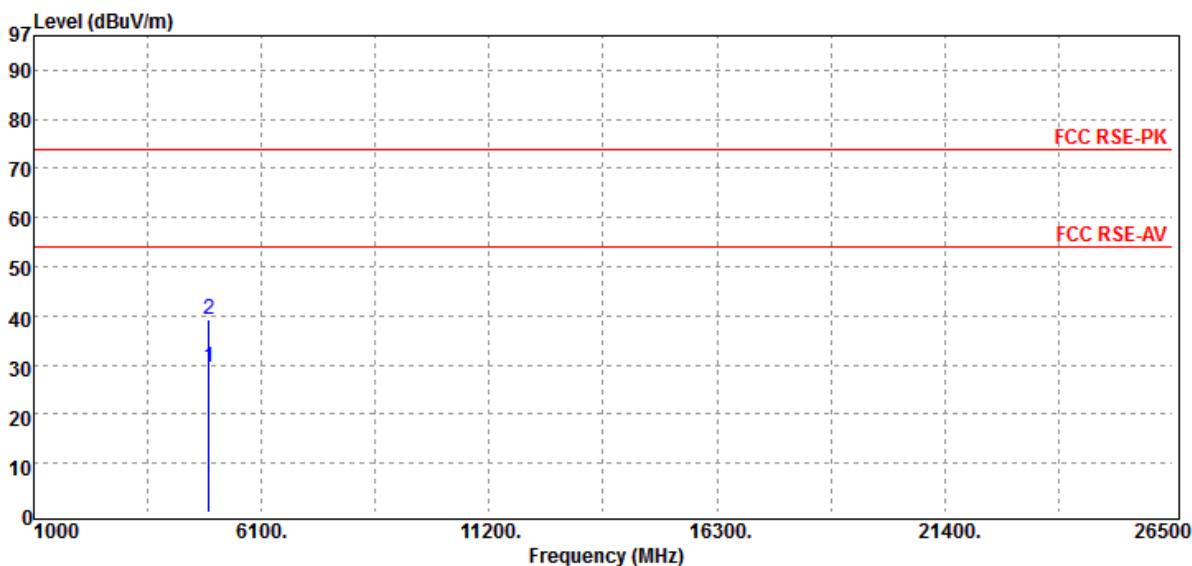
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
			PK/QP/AV	Reading Level dB $\mu$ V				
4874.00	H	Average	24.69	5.13	29.82	54.00	-24.18	
4874.00	H	Peak	33.64	5.13	38.77	74.00	-35.23	

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Operation Band	:802.11g	Test Date	:2017-07-21
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS dB	Limit @3m dBuV/m	Safe Margin dB
			PK/QP/AV	Reading Level dB $\mu$ V				
4924.00	H	Average	24.29	24.29	5.25	29.54	54.00	-24.46
4924.00	H	Peak	34.06	34.06	5.25	39.31	74.00	-34.69

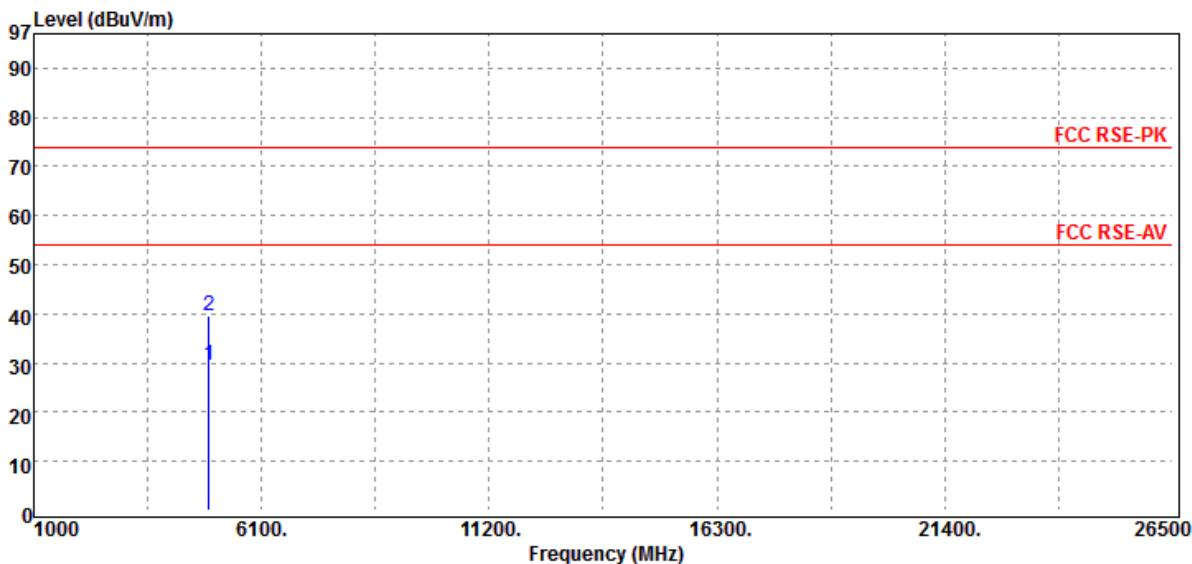
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Operation Band :802.11g  
 Fundamental Frequency :2462 MHz  
 Operation Mode :Tx CH HIGH  
 EUT Pol. :H Plane

Test Date :2017-07-21  
 Temp./Humi. :21 deg\_C / 62 RH  
 Engineer :Mike  
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
			PK/QP/AV	Reading Level dB $\mu$ V				
4924.00	H	Average		24.17	5.25	29.42	54.00	-24.58
4924.00	H	Peak		34.43	5.25	39.68	74.00	-34.32

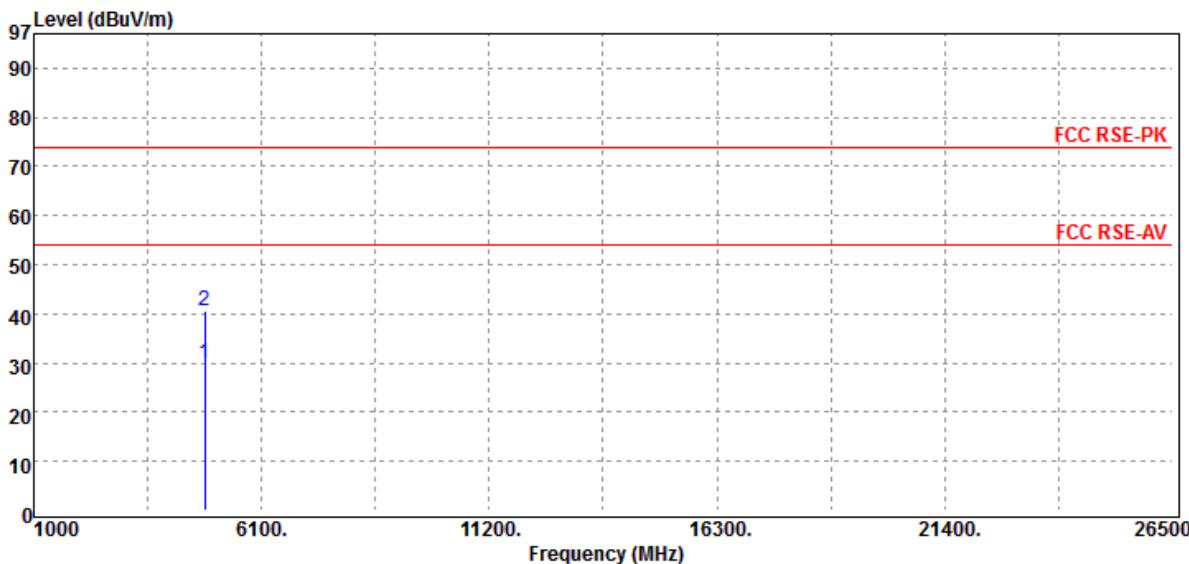
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**Radiated Spurious Emission Measurement Result (802.11 n HT20)**

Operation Band :802.11n20 Test Date :2017-07-21  
Fundamental Frequency :2412 MHz Temp./Humi. :21 deg\_C / 62 RH  
Operation Mode :Tx CH LOW Engineer :Mike  
EUT Pol. :H Plane Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
						dB $\mu$ V/m	dB
4824.00	H	Average	24.80	4.93	29.73	54.00	-24.27
4824.00	H	Peak	35.78	4.93	40.71	74.00	-33.29

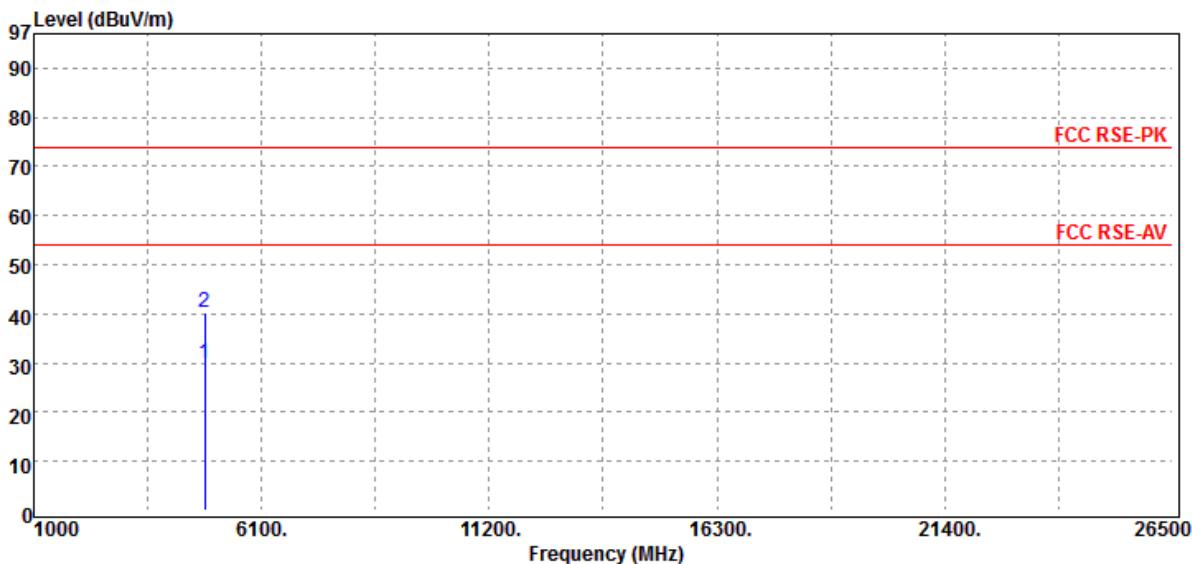
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Operation Band :802.11n20  
Fundamental Frequency :2412 MHz  
Operation Mode :Tx CH LOW  
EUT Pol. :H Plane

Test Date :2017-07-21  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Mike  
Measurement Antenna Pol. :HORIZONTAL



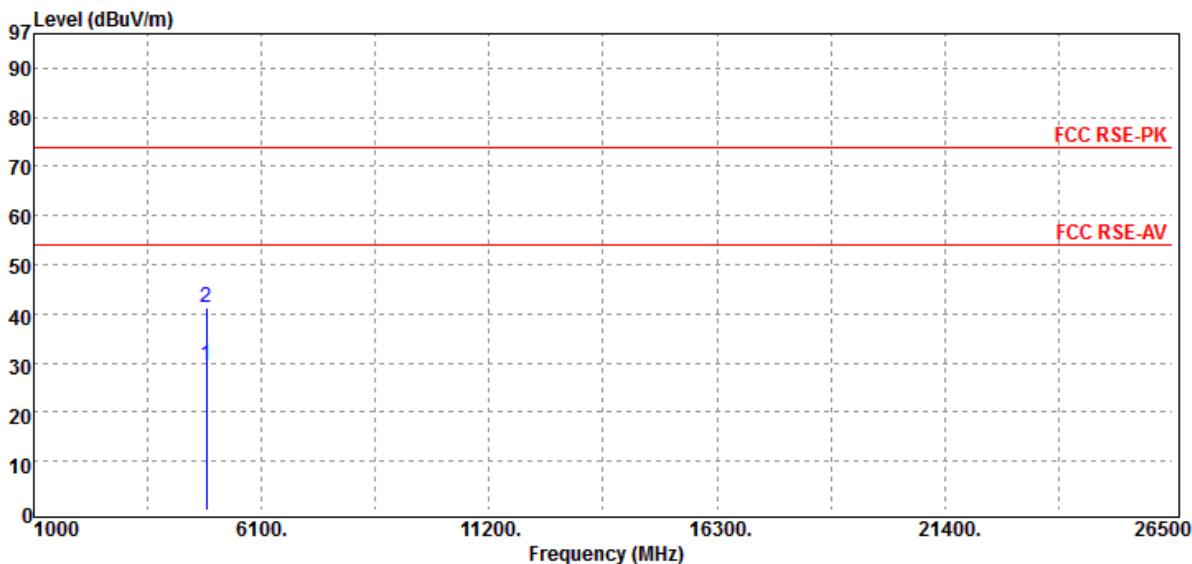
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
4824.00	H	Average		24.85	4.93	29.78	54.00	-24.22
4824.00	H	Peak		35.27	4.93	40.20	74.00	-33.80

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Operation Band	:802.11n20	Test Date	:2017-07-21
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



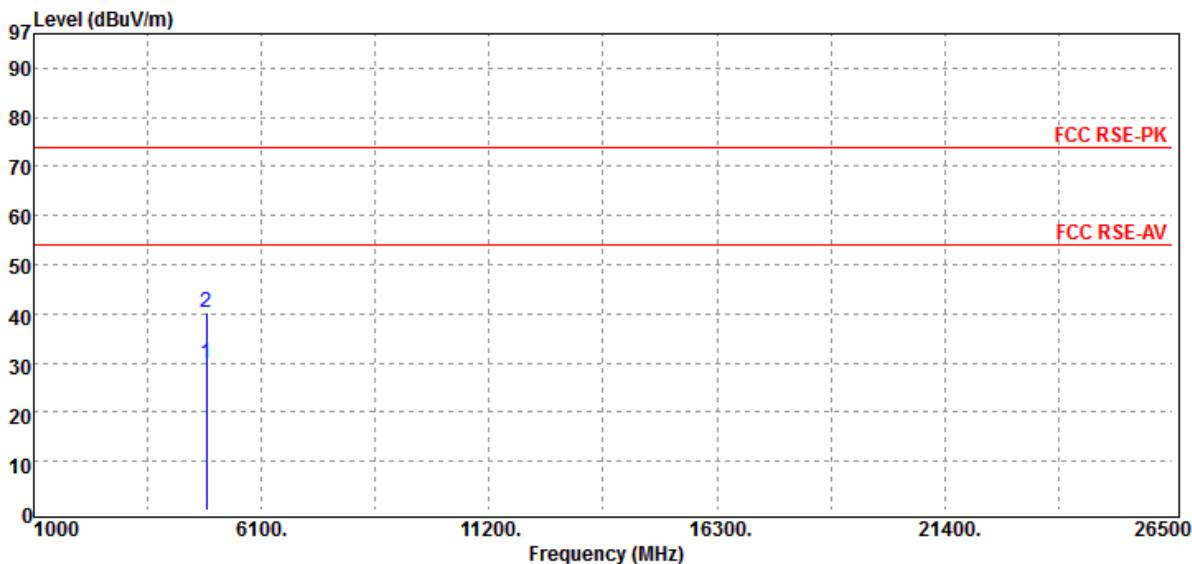
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
			PK/QP/AV	Reading Level dB $\mu$ V				
4874.00	H	Average	24.32	5.13	29.45	54.00	-24.55	
4874.00	H	Peak	36.30	5.13	41.43	74.00	-32.57	

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Operation Band	:802.11n20	Test Date	:2017-07-21
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



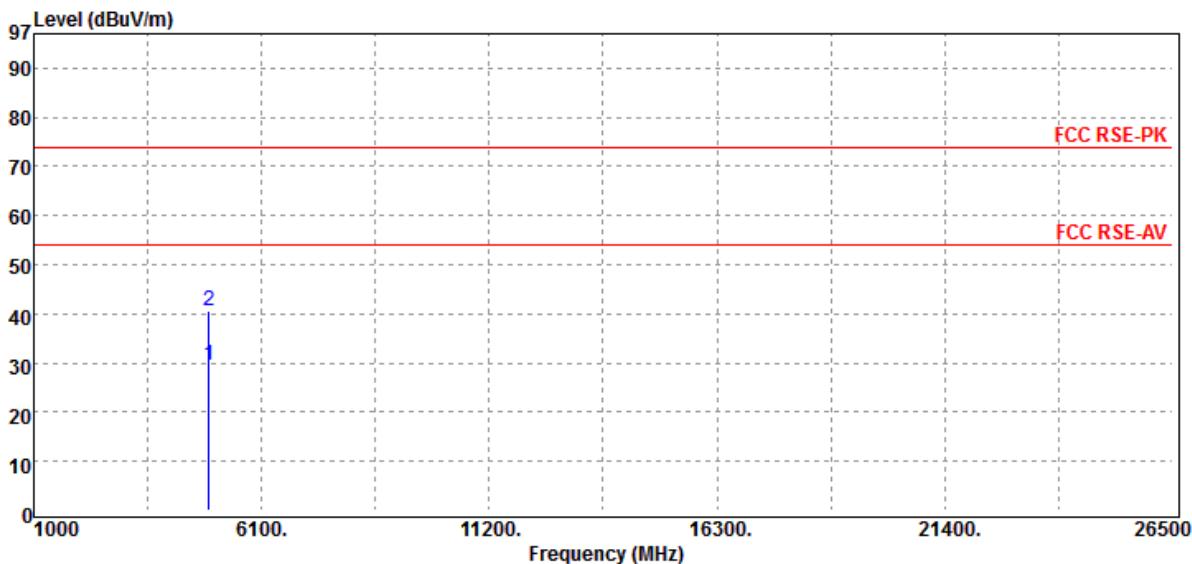
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
			PK/QP/AV	Reading Level dB $\mu$ V				
4874.00	H	Average		24.61	5.13	29.74	54.00	-24.26
4874.00	H	Peak		35.07	5.13	40.20	74.00	-33.80

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Operation Band	:802.11n20	Test Date	:2017-07-21
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



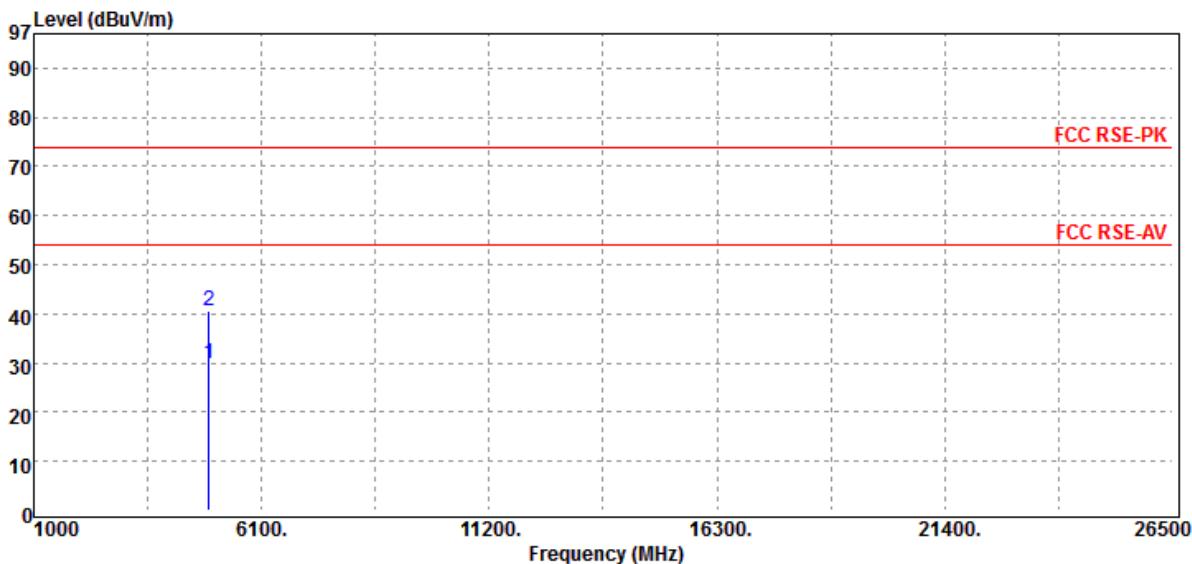
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
4924.00	H	Average	24.37	5.25	29.62	54.00	-24.38	
4924.00	H	Peak	35.48	5.25	40.73	74.00	-33.27	

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Operation Band	:802.11n20	Test Date	:2017-07-21
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
4924.00	H	Average	24.60	5.25	29.85	54.00	-24.15	
4924.00	H	Peak	35.51	5.25	40.76	74.00	-33.24	

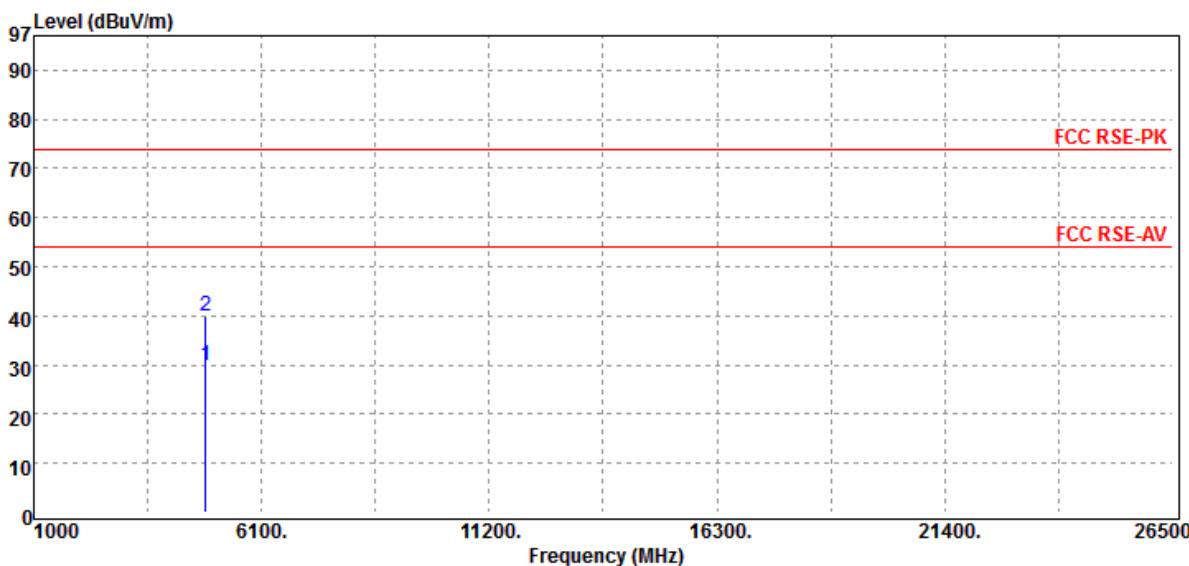
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## Radiated Spurious Emission Measurement Result (802.11 n HT40)

Operation Band	:802.11n40	Test Date	:2017-07-21
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



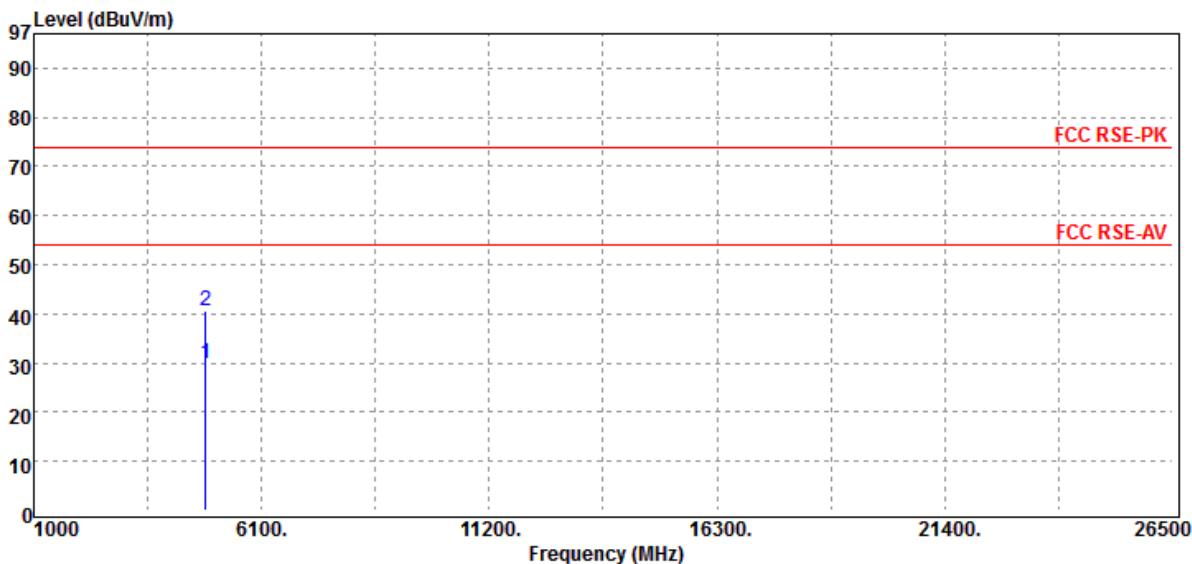
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
						dB $\mu$ V/m	
4844.00	H	Average	24.79	4.97	29.76	54.00	-24.24
4844.00	H	Peak	35.13	4.97	40.10	74.00	-33.90

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Operation Band	:802.11n40	Test Date	:2017-07-21
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



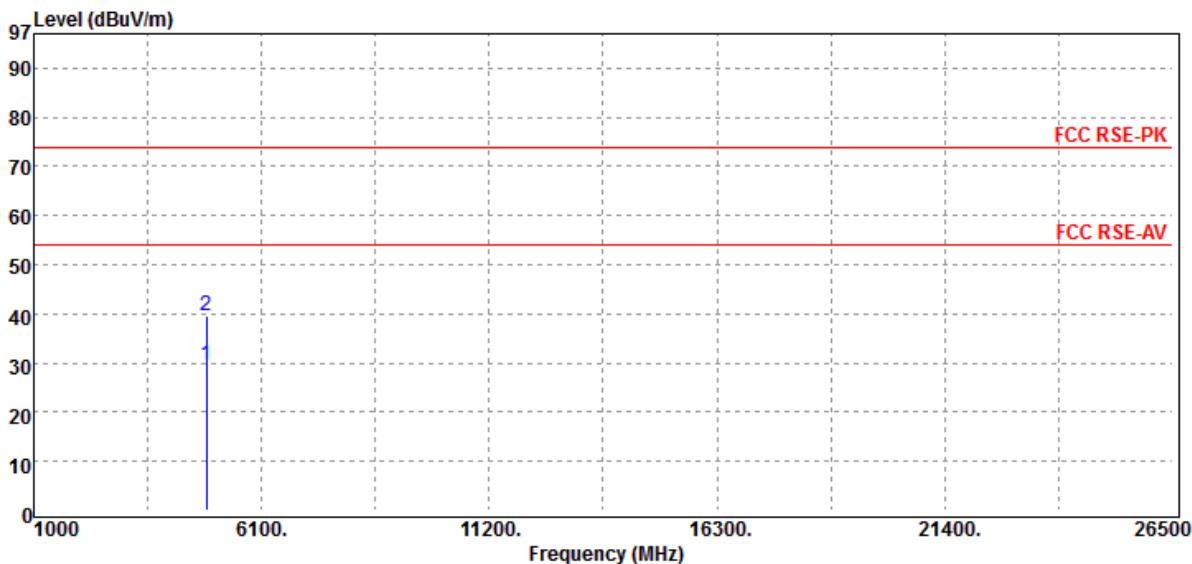
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
			PK/QP/AV	Reading Level dB $\mu$ V				
4844.00	H	Average	24.82	4.97	29.79	54.00	-24.21	
4844.00	H	Peak	35.49	4.97	40.46	74.00	-33.54	

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Operation Band	:802.11n40	Test Date	:2017-07-21
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



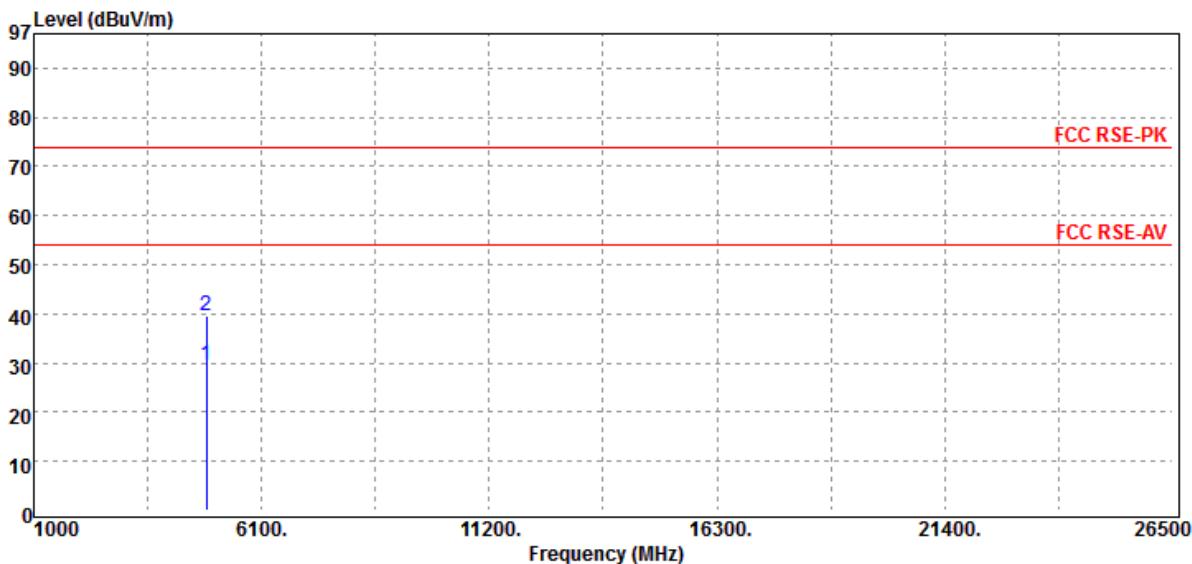
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
			PK/QP/AV	Reading Level dB $\mu$ V				
4874.00	H	Average		24.39	5.13	29.52	54.00	-24.48
4874.00	H	Peak		34.41	5.13	39.54	74.00	-34.46

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Operation Band	:802.11n40	Test Date	:2017-07-21
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



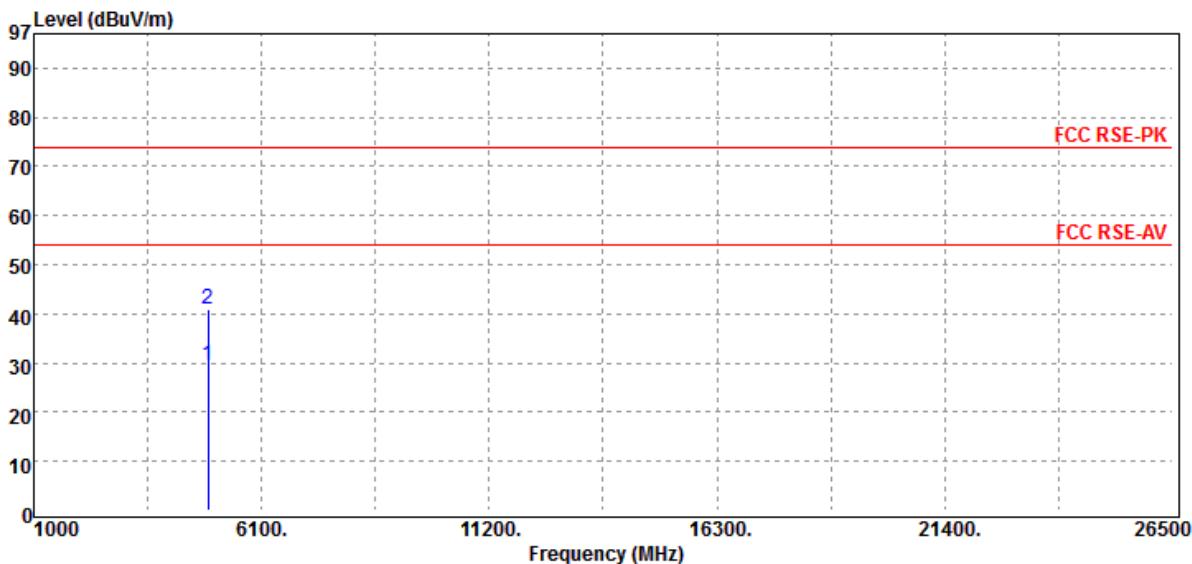
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS	Limit @3m	Safe Margin
			PK/QP/AV	Reading Level dB $\mu$ V				
4874.00	H	Average	24.46	5.13	29.59	54.00	-24.41	
4874.00	H	Peak	34.36	5.13	39.49	74.00	-34.51	

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Operation Band	:802.11n40	Test Date	:2017-07-21
Fundamental Frequency	:2452 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



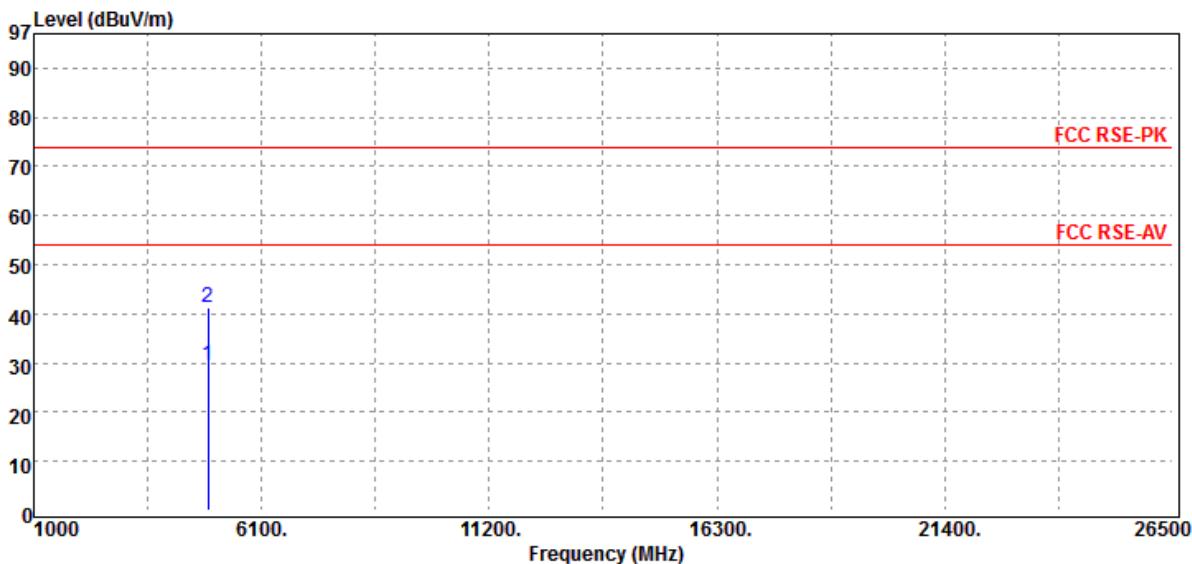
Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
			PK/QP/AV	dB $\mu$ V				
4904.00	H	Average		24.35	5.24	29.59	54.00	-24.41
4904.00	H	Peak		35.69	5.24	40.93	74.00	-33.07

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Operation Band	:802.11n40	Test Date	:2017-07-21
Fundamental Frequency	:2452 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
			PK/QP/AV	Reading Level dB $\mu$ V				
4904.00	H	Average	24.44	24.44	5.24	29.68	54.00	-24.32
4904.00	H	Peak	36.14	36.14	5.24	41.38	74.00	-32.62

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## 7 ANTENNA REQUIREMENT

### 7.1 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.

According to RSS-GEN 8.3

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.<sup>9</sup> When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

### 7.2 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.

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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SGS Taiwan Ltd. | No.134,WuKungRoad,NewTaipeiIndustrialPark,WukuDistrict,NewTaipeiCity,Taiwan24803/新北市五股區新北產業園區五工路134號

台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

[www.tw.sgs.com](http://www.tw.sgs.com)

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