

# FVELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C AND INDUSTRY CANADA RSS 247 REQUIREMENT

OF

**Applicant:** WWZN Information Technology Company Limited  
Room 901, 9th Floor, No.19, Zhong Guancun Street, Haidian  
District, Beijing, 100080 China

**Product Name:** Smart Watch

**Brand Name:** TicWatch

**Model No.:** WG12026, WG12016

**Model Difference:** Enclosure difference

**FCC ID:** 2AP42-WG12026

**IC:** 24006-WG12026

**Report Number:** ER/2018/60014

**FCC Rule Part:** §15.247, Cat: DTS

**IC Rule Part:** RSS-247 issue 2 Feb 2017

**Issue Date:** Jul. 09, 2018

**Date of Test:** Jun. 05, 2018~ Jun. 29, 2018

**Date of EUT Received:** Jun. 05, 2018

**We hereby certify that:**

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

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

**Tested By:**

*Louis Chen*

**Louis Chen / Engineer**

**Approved By:**

*Jim Chang*

**Jim Chang / Manager**



Testing Laboratory  
0513

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## Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
ER/2018/60014	Rev.00	Initial creation of document	All	Jul. 09, 2018	Stefanie Yu / Clerk

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# 1 GENERAL INFORMATION

## 1.1 Product description

General:

Product Name:	Smart Watch	
Brand Name:	TicWatch	
Model No.:	WG12026, WG12016	
Model difference:	Enclosure difference	
Product SW/HW version:	OWDT.180612.001 / 1000	
Radio SW/HW version:	OWDT.180612.001 / 1000	
Power Supply:	3.85Vdc Rechargeable Li-ion Battery or 5Vdc from USB port	
	Battery:	Model No.: SP452929SF Supplier: TianJin Lishen Battery Joint-Stock CO., LTD

WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power in dBm (Peak)	Rated Power in dBm (EIRP)	Type of Emission	Modulation Technology
802.11b	2412-2462	11	17.75	14.93	13M3G1D	DSSS,
802.11g			19.24	9.97	17M2D1D	OFDM
802.11n HT20			19.36	9.98	18M2D1D	
Antenna Designation:		PIFA Antenna, Antenna Gain: -1.78dBi				
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 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance v05

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

RSS-247 issue 2 Feb. 2017

RSS-Gen. issue 5 Apr. 2018

ANSI C63.10:2013

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

## 1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Registration Number and Designation are: 509634 / TW0001

## 1.4 Special Accessories

There are no special accessories used while test was conducted.

## 1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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## 2 SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

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

### 2.2 EUT Exercise

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

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207 & RSS-Gen §8.8. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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## 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 and attenuator.

### Offset:

= RF cable loss (dB)+ attenuation factor(dB) dB =11 (dB)

## 2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration



Fig.2-3 Conducted Emission (Antenna Port) Configuration

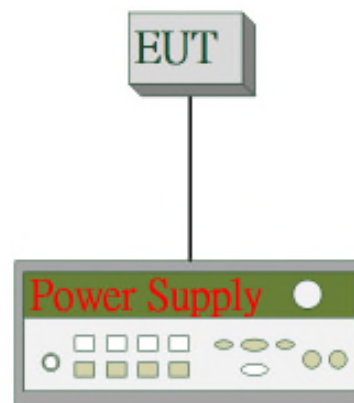


Fig. 2-2 Conducted Emission (AC Power Line) Configuration



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L420	LR-7HXZA	N/A	N/A
3.	DC Power Supply	Anritsu	E3640A	MY40000811	2017/12/18	2018/12/17

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### 3 SUMMARY OF TEST RESULTS

FCC Rules	IC Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	RSS-247 §5.4(4)	Peak Output Power	Compliant
§15.247(a)(2)	RSS-247 §5.2 (1) RSS-Gen §6.6	6dB & 99% Emission Bandwidth	Compliant
§15.247(d)	RSS-247 §5.5	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	RSS-247 §5.5	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e)	RSS-247 §5.2(2)	Power Spectral Density	Compliant
§15.203 §15.247(b)	RSS- Gen §6.8	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		

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## 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)	ANTENNA PORT
802.11g	1 to 11	6	OFDM	6	Main

RADIATED EMISSION TEST (ABOVE 1 GHz)					
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	MCS 0	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 802.11b/g/n WLAN Transmitter for channel Low, Mid and High, the worst case H position was reported.

### ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1, 6, 11	DSSS	11	Main
802.11g	1 to 11	1, 6, 11	OFDM	54	Main
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS 0	Main

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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 Edge	+/- 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> )	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 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(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
<b>Note</b> 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.
EXA Spectrum Analyzer	Agilent	N9010A	MY57120290	2018/02/14	2019/02/13
Attenuator	Mini-Circuit	BW-S10W2+	2	2018/01/02	2019/01/01
DC Power Supply	Anritsu	E3640A	MY40000811	2017/12/18	2018/12/17

### 6.3 EUT Setup

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

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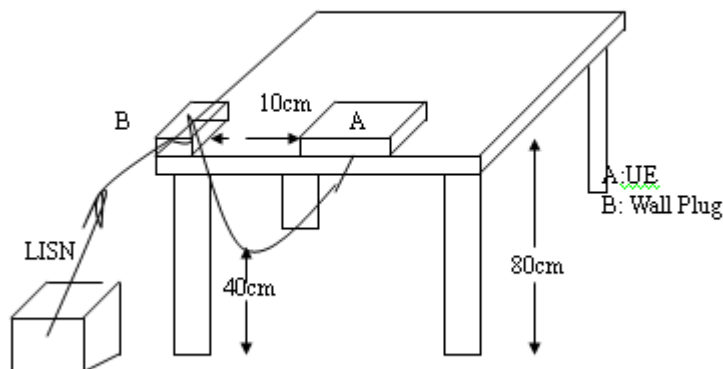
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## 6.4 Test SET-UP (Block Diagram of Configuration)



## 6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed

## 6.6 Measurement Result

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

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

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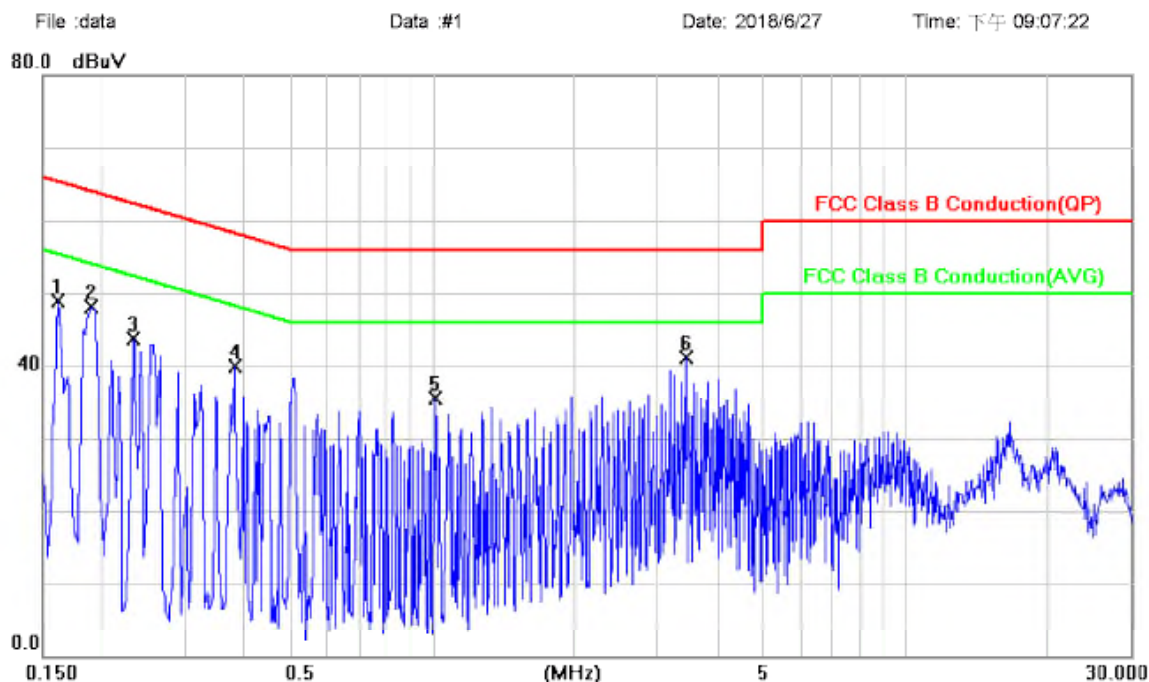
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Operation Mode:	operation mode	Test By:	Louis
-----------------	----------------	----------	-------

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

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

## Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1620	48.79	0.03	48.82	65.36	-16.54	peak	
2		0.1900	48.01	0.03	48.04	64.04	-16.00	peak	
3		0.2340	43.71	0.03	43.74	62.31	-18.57	peak	
4		0.3820	39.81	0.04	39.85	58.24	-18.39	peak	
5		1.0180	35.52	0.05	35.57	56.00	-20.43	peak	
6	*	3.4420	41.01	0.13	41.14	56.00	-14.86	peak	

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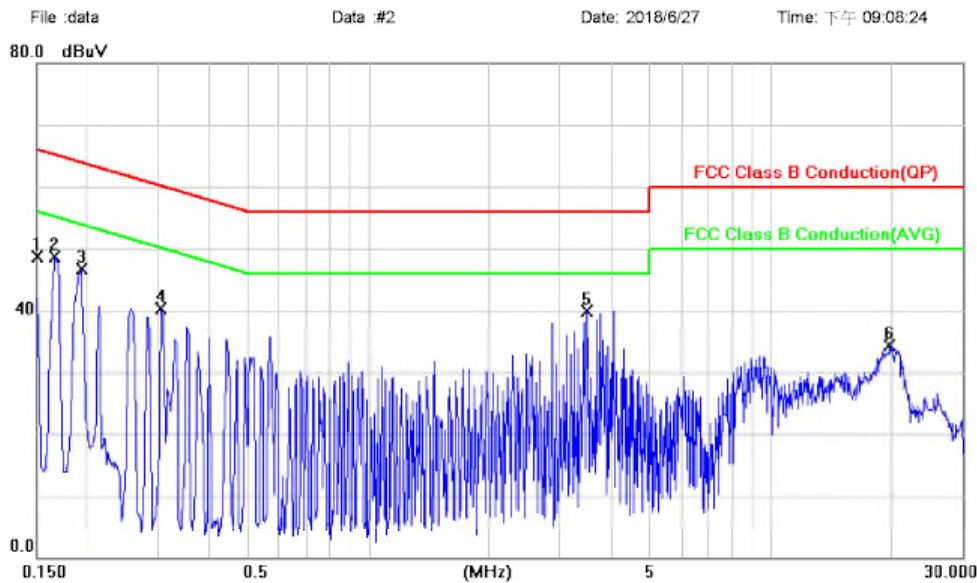
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Site: Conduction Room Phase: **N** Temperature: 25 °C  
 Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 85 %  
 Mode: Operation  
 Note:

## Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1500	48.60	0.03	48.63	66.00	-17.37	peak	
2		0.1660	48.69	0.03	48.72	65.16	-16.44	peak	
3		0.1940	46.69	0.03	46.72	63.86	-17.14	peak	
4		0.3060	40.26	0.04	40.30	60.08	-19.78	peak	
5	*	3.5060	39.77	0.13	39.90	56.00	-16.10	peak	
6		19.7540	33.85	0.40	34.25	60.00	-25.75	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)	1/T (kHz)	VBW setting (kHz)
802.11b	97.51	0.11	0.12	1.00
802.11g	87.41	0.58	0.73	1.00
802.11n_20	86.57	0.63	0.78	1.00

$$b = 97.51\%, g = 87.41\%, n\_ht\_20 = 86.57\%$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.9751) = 0.11$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.8741) = 0.58$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.8657) = 0.63$$

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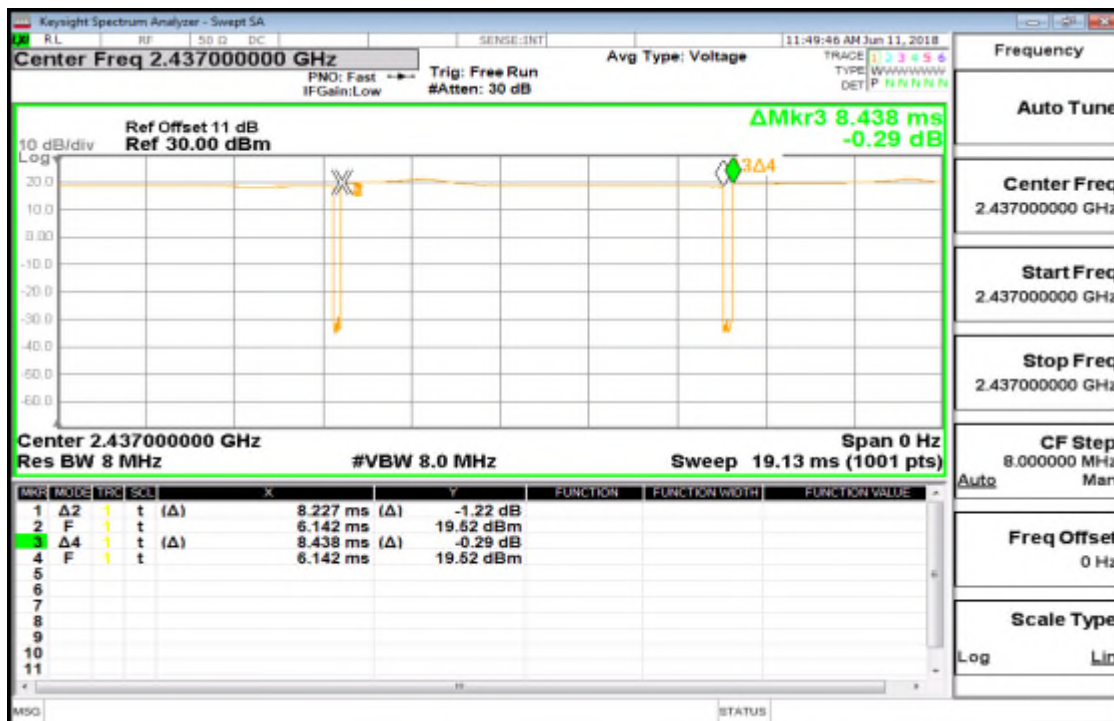
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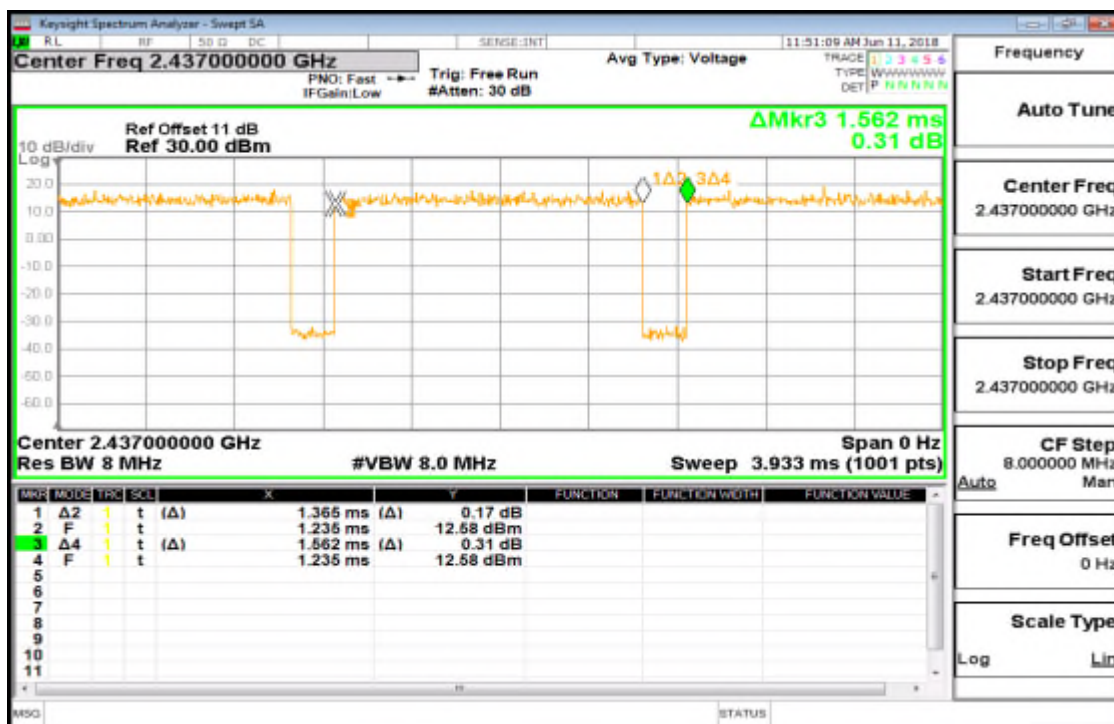


## 7.1 DUTY CYCLE TEST SIGNAL Measurement Result

802.11 b



802.11 g



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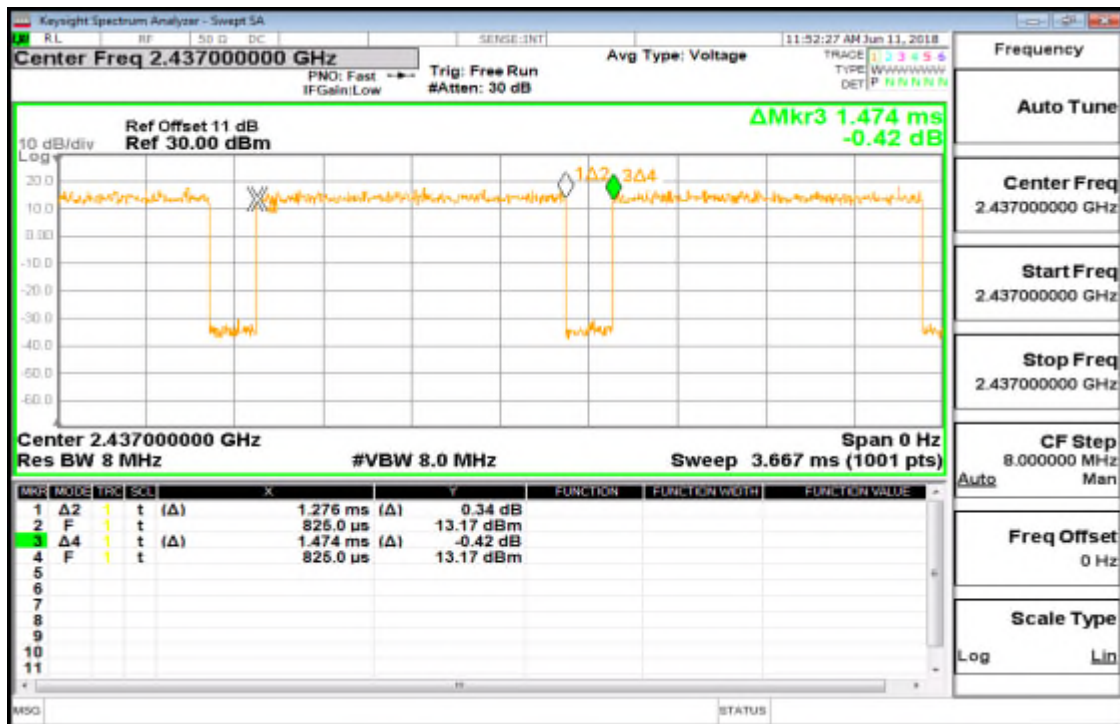
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802.11 n\_20 MHz



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## 8 PEAK OUTPUT POWER MEASUREMENT

### 8.1 Standard Applicable

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

Per RSS-247 §5.4(4)

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

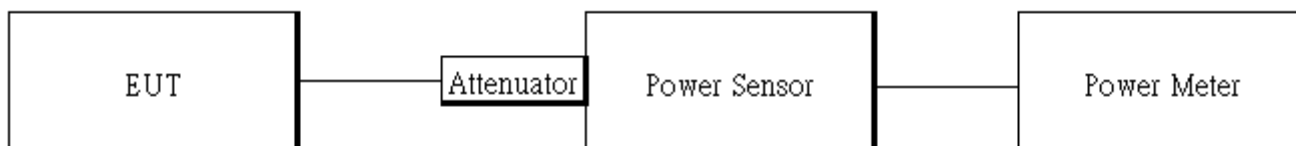
Frequency (MHz)	Effective Legacy Gain (dBi)	Conducted Power Limit (dBm)
2412~2462	-6.76	42.76

### 8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1804001	2018/02/01	2019/01/31
Attenuator	Mini-Circuit	BW-S10W2+	2	2018/01/02	2019/01/01
Power Sensor	Anritsu	MA2411B	1726104	2018/02/01	2019/01/31
DC Power Supply	Anritsu	E3640A	MY40000811	2017/12/18	2018/12/17

### 8.3 Test Set-up

Power Meter:



### 8.4 Measurement Procedure

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

#### Power Meter:

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

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

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## 8.5 Measurement Result

802.11b Main					
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit	RESULT
1	2412	1	17.75	1 Watt = 30.00 dBm	PASS
6	2437	1	17.20	1 Watt = 30.00 dBm	PASS
11	2462	1	17.54	1 Watt = 30.00 dBm	PASS
802.11b Main					
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit	RESULT
1	2412	1	14.85	1 Watt = 30.00 dBm	PASS
6	2437	1	14.67	1 Watt = 30.00 dBm	PASS
11	2462	1	14.93	1 Watt = 30.00 dBm	PASS
802.11g Main					
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit	RESULT
1	2412	6	19.09	1 Watt = 30.00 dBm	PASS
6	2437	6	19.24	1 Watt = 30.00 dBm	PASS
11	2462	6	19.01	1 Watt = 30.00 dBm	PASS
802.11g Main					
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit	RESULT
1	2412	6	9.51	1 Watt = 30.00 dBm	PASS
6	2437	6	9.97	1 Watt = 30.00 dBm	PASS
11	2462	6	9.59	1 Watt = 30.00 dBm	PASS

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802.11n_HT20M Main					
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit	RESULT
1	2412	MCS0	19.12	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	<b>19.36</b>	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	19.05	1 Watt = 30.00 dBm	PASS
802.11n_HT20M Main					
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit	RESULT
1	2412	MCS0	9.61	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	<b>9.98</b>	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	9.69	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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## EIRP

802.11b Main							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit	RESULT
1	2412	1	14.85	0.00	14.85	4W= 36 dBm	PASS
6	2437	1	14.67	0.00	14.67	4W= 36 dBm	PASS
11	2462	1	14.93	0.00	14.93	4W= 36 dBm	PASS

802.11g Main							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit	RESULT
1	2412	6	9.51	0.00	9.51	4W= 36 dBm	PASS
6	2437	6	9.97	0.00	9.97	4W= 36 dBm	PASS
11	2462	6	9.59	0.00	9.59	4W= 36 dBm	PASS

802.11n_HT20M Main							
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit	RESULT
1	2412	MCS0	9.61	0.00	9.61	4W= 36 dBm	PASS
6	2437	MCS0	9.98	0.00	9.98	4W= 36 dBm	PASS
11	2462	MCS0	9.69	0.00	9.69	4W= 36 dBm	PASS

\* **Note:** EIRP = Average Power + Gain

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## 9 6DB & 99% BANDWIDTH MEASUREMENT

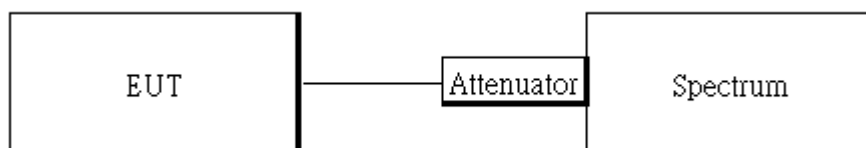
### 9.1 Standard Applicable

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

### 9.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY57120290	2018/02/14	2019/02/13
Attenuator	Mini-Circuit	BW-S10W 2+	2	2018/01/02	2019/01/01
DC Power Supply	Anritsu	E3640A	MY40000811	2017/12/18	2018/12/17

### 9.3 Test Set-up



### 9.4 Measurement Procedure

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

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## 9.5 Measurement Result

### 6dB Bandwidth

#### 802.11b Main

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	<b>8581</b>	> 500	PASS
2437	8577	> 500	PASS
2462	8111	> 500	PASS

#### 802.11g Main

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	16399	> 500	PASS
2437	<b>16451</b>	> 500	PASS
2462	16427	> 500	PASS

#### 802.11n HT20 Main

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	17619	> 500	PASS
2437	<b>17637</b>	> 500	PASS
2462	17636	> 500	PASS

### 99% Bandwidth

802.11b Main	
Freq. (MHz)	99% BW (MHz)
2412	13.274
2437	13.265
2462	<b>13.331</b>

802.11g Main	
Freq. (MHz)	99% BW (MHz)
2412	17.122
2437	17.128
2462	<b>17.153</b>

802.11n HT20M Main	
Freq. (MHz)	99% BW (MHz)
2412	18.139
2437	<b>18.162</b>
2462	18.116

\*Refer to next page for plots

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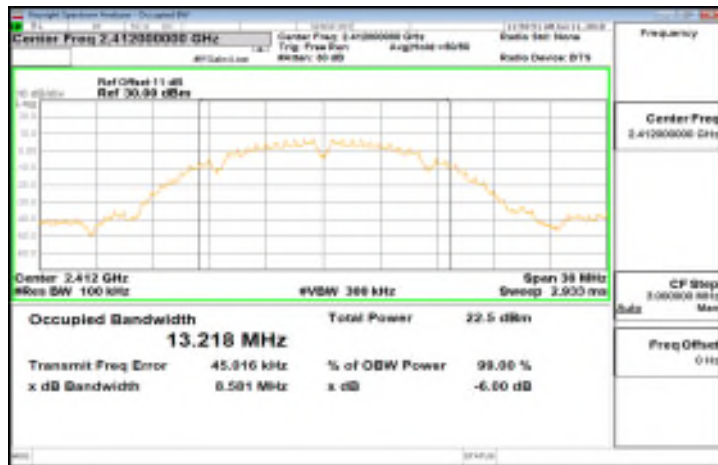
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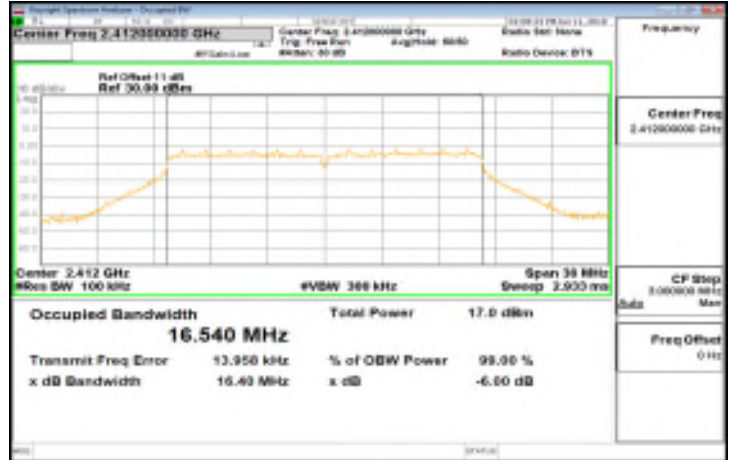
## 802.11b (Main)

## 6dB Band Width Test Data CH-Low

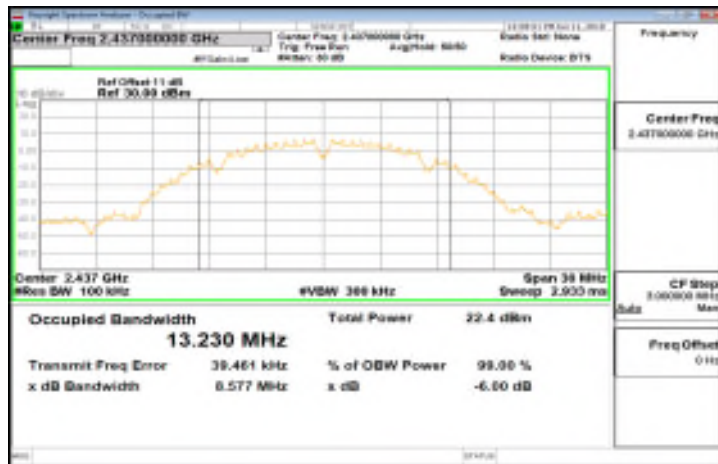


## 802.11g (Main)

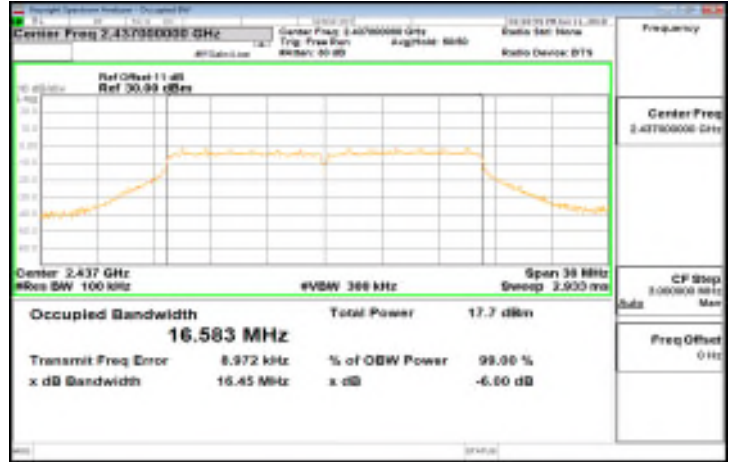
## 6dB Band Width Test Data CH-Low



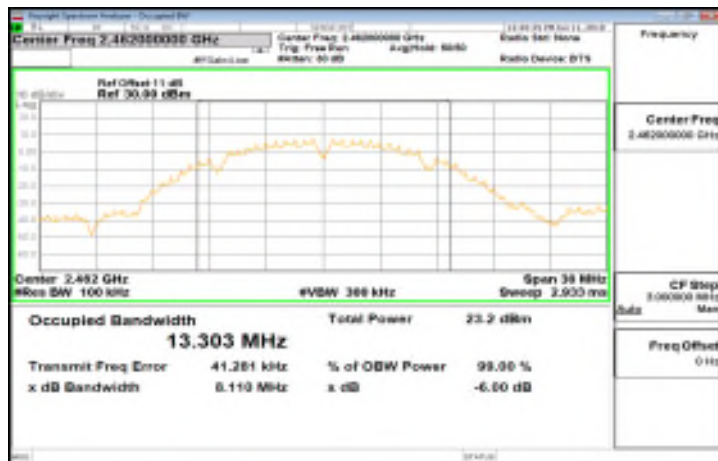
## 6dB Band Width Test Data CH-Mid



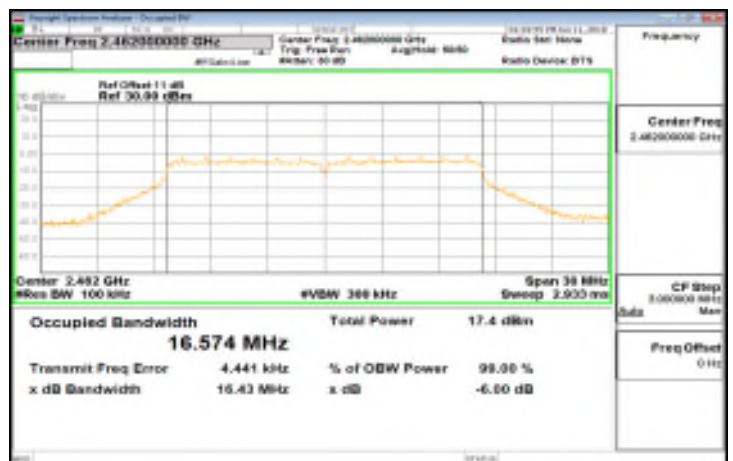
## 6dB Band Width Test Data CH-Mid



## 6dB Band Width Test Data CH-High



## 6dB Band Width Test Data CH-High



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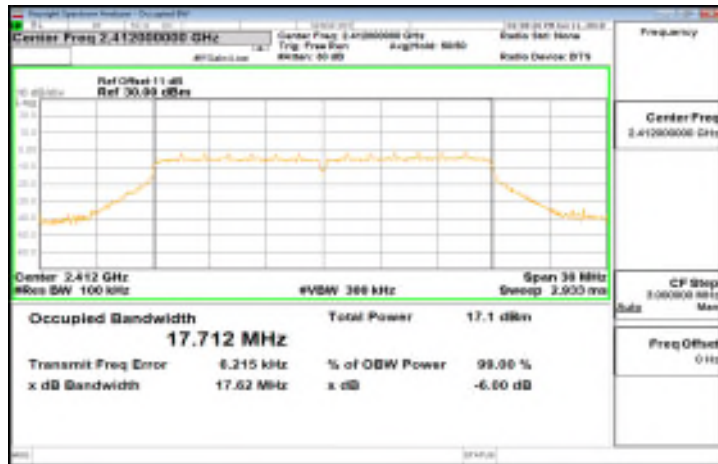
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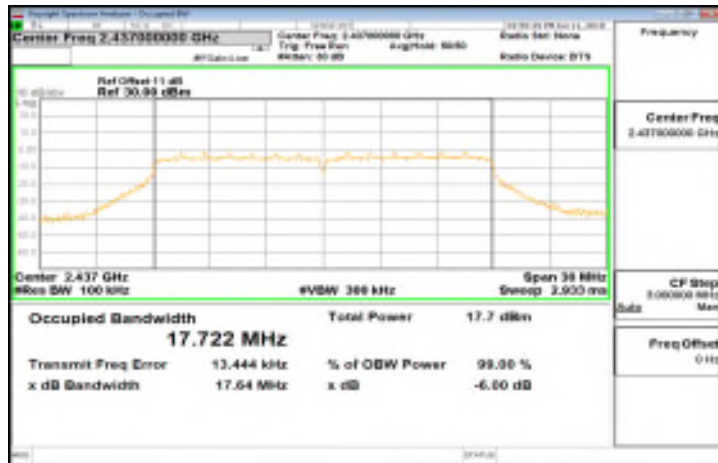


## 802.11n\_20M (Main)

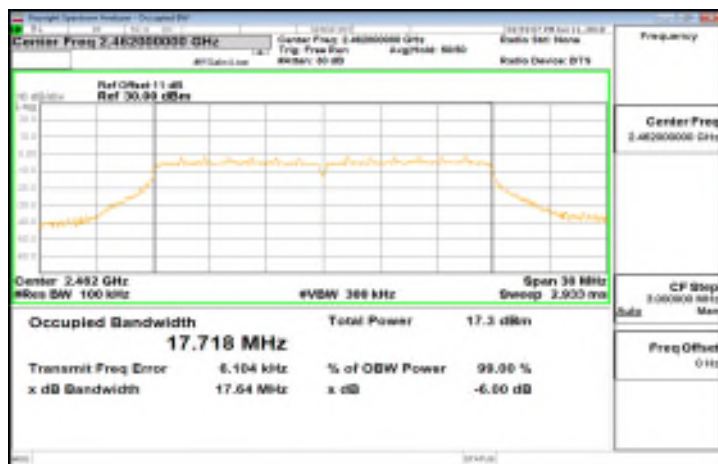
## 6dB Band Width Test Data CH-Low



## 6dB Band Width Test Data CH-Mid



## 6dB Band Width Test Data CH-High



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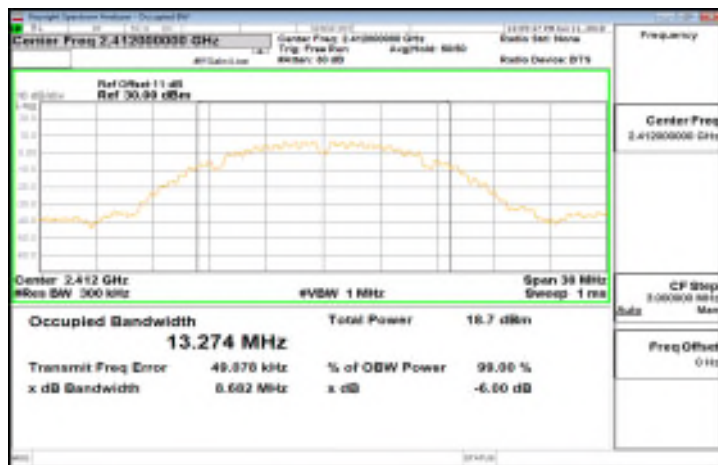
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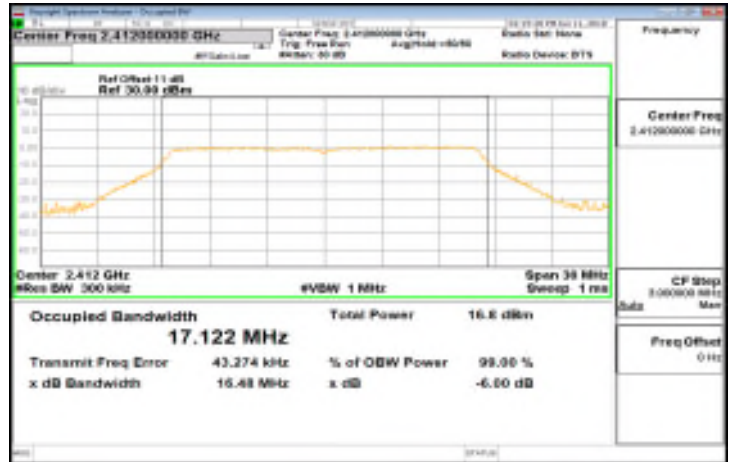
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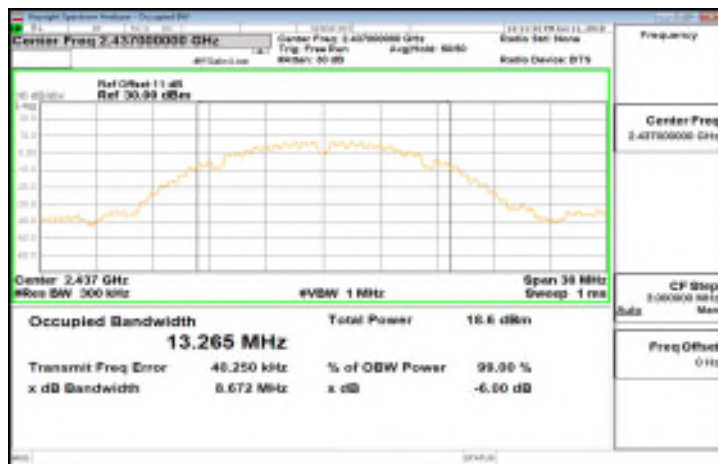
802.11b (Main)  
99% Band Width Test Data CH-Low



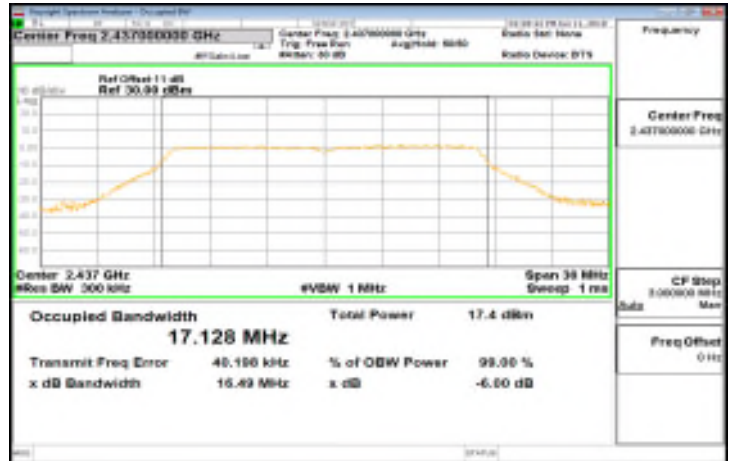
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99% Band Width Test Data CH-Low



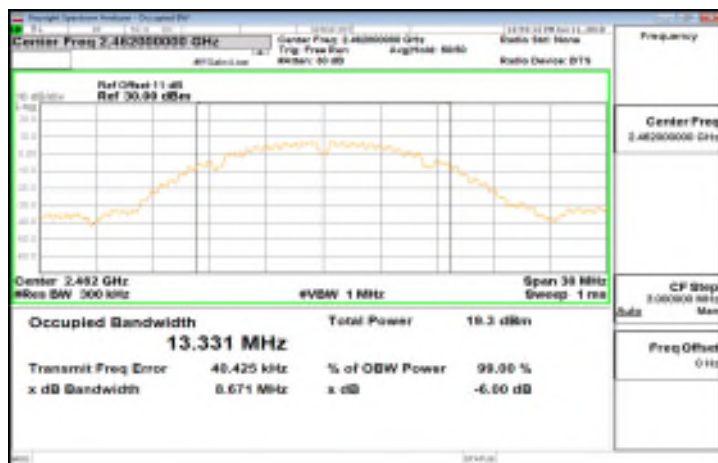
99% Band Width Test Data CH-Mid



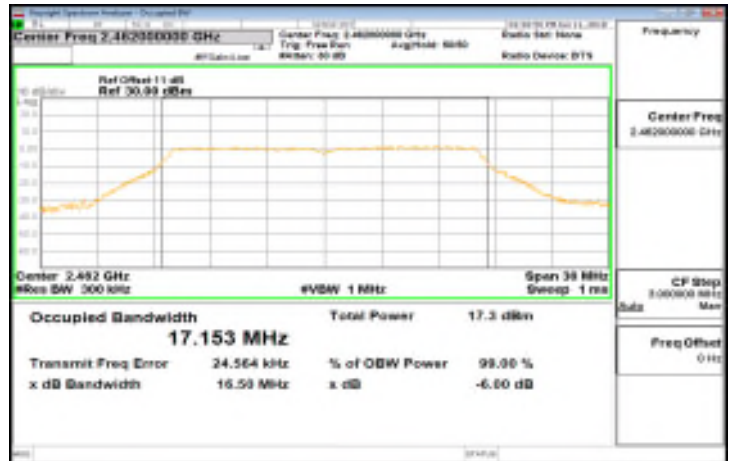
99% Band Width Test Data CH-Mid



99% Band Width Test Data CH-High



99% Band Width Test Data CH-High



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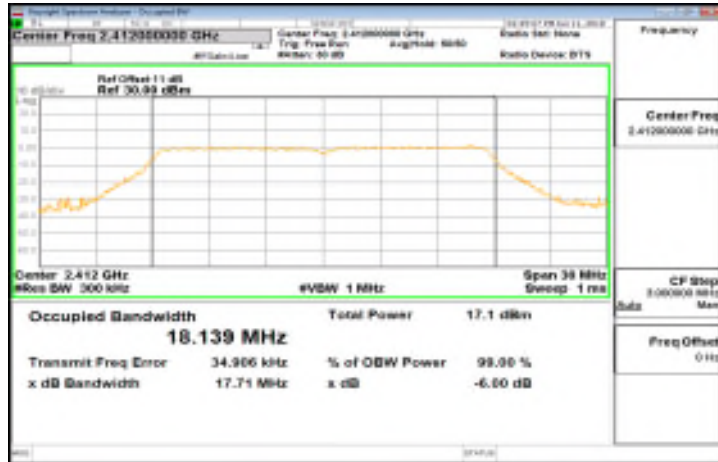
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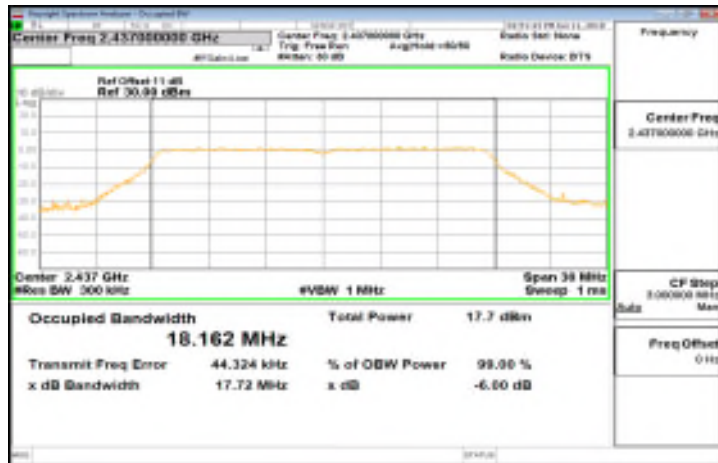
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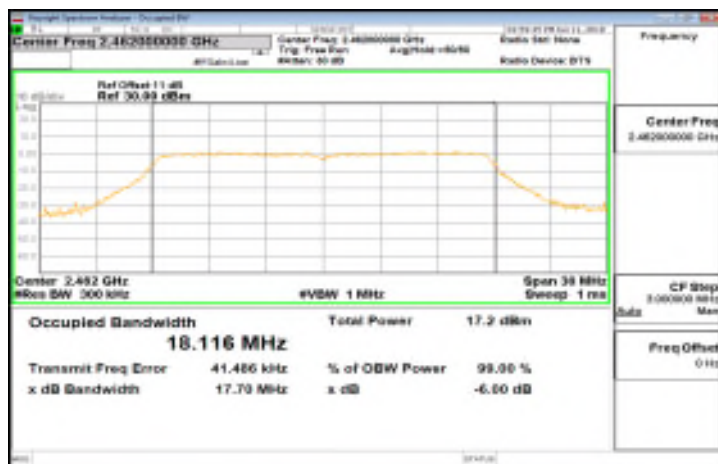
## 99% Band Width Test Data CH-Low



## 99% Band Width Test Data CH-Mid



## 99% Band Width Test Data CH-High



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## 10 CONDUCTED BAND EDGE 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.

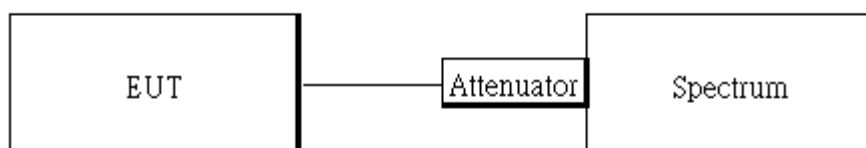
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) & RSS-Gen §8.10, must also comply with the radiated emission limits specified in §15.209(a) & RSS-Gen §8.8.

If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

### 10.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY57120290	2018/02/14	2019/02/13
Attenuator	Mini-Circuit	BW-S10W2+	2	2018/01/02	2019/01/01
DC Power Supply	Anritsu	E3640A	MY40000811	2017/12/18	2018/12/17

### 10.3 Test SET-UP



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## 10.4 Measurement Procedure

### Conducted Band Edge Limit

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 & ANSI C63.10.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 100kHz & VBW = 300 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

### 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 & ANSI C63.10.
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 & ANSI C63.10.
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.

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## 10.5 Measurement Result

Reference Level of Limit 802.11b mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	6.75	-13.25
2462	7.46	-12.54

Reference Level of Limit 802.11g mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	-1.32	-21.32
2462	-1.38	-21.38

Reference Level of Limit 802.11n20 mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	-1.44	-21.44
2462	-1.43	-21.43

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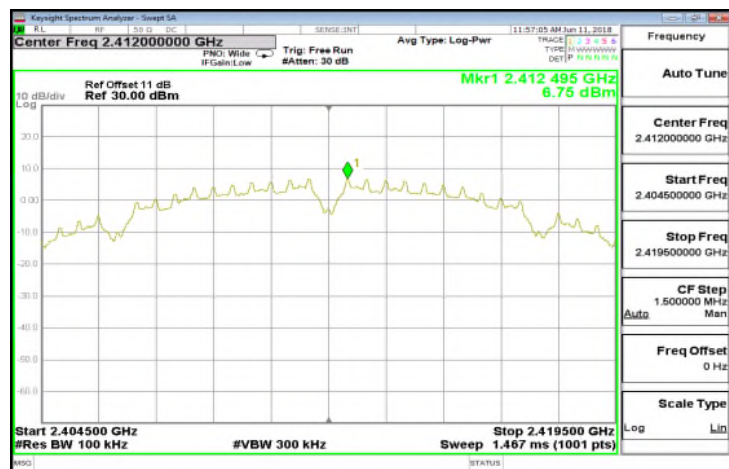
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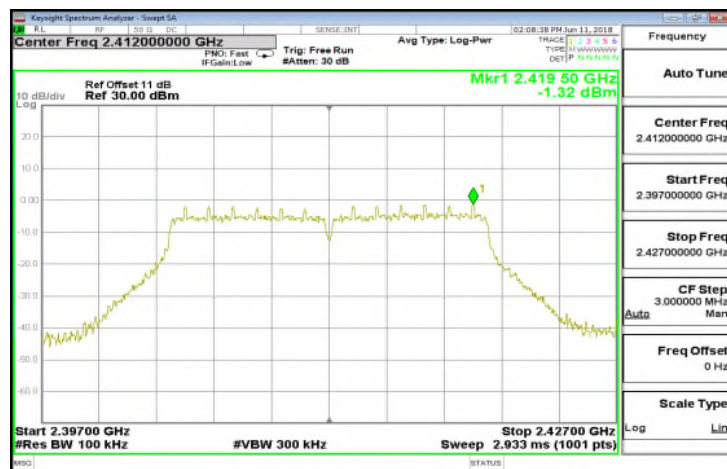
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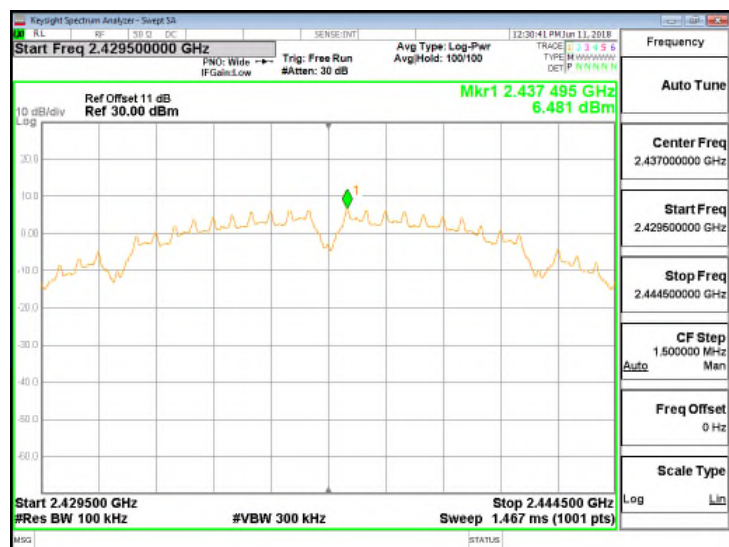
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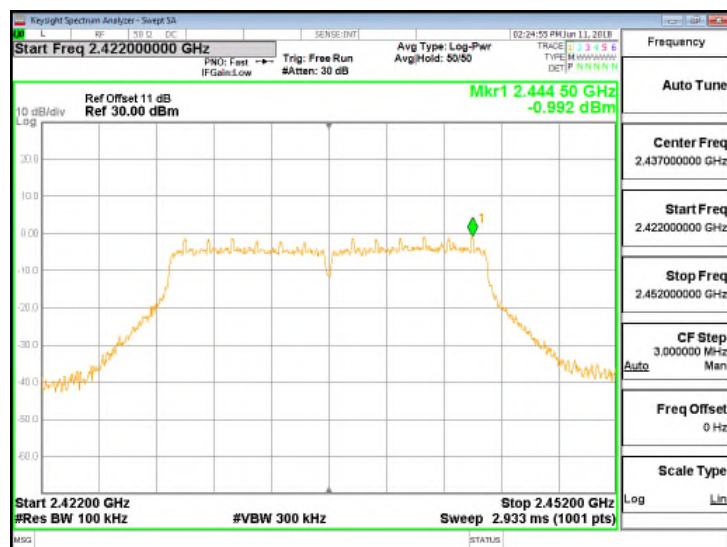
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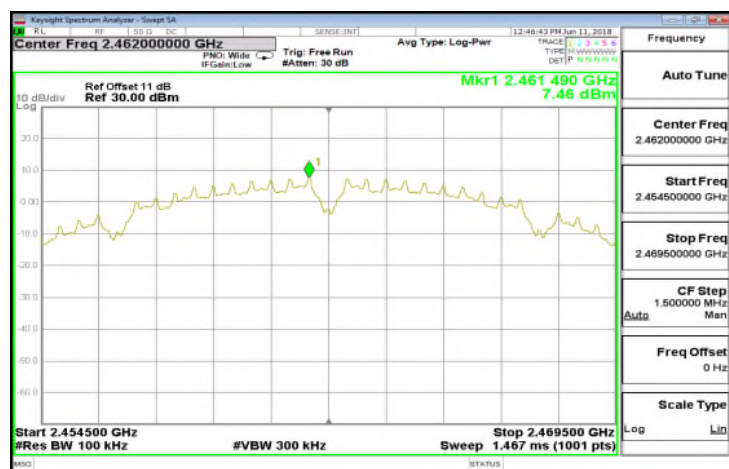
## 802.11b Band Edge Limit Test Data CH-Mid



## 802.11g Band Edge Limit Test Data CH-Mid



## 802.11b Band Edge Limit Test Data CH-High



## 802.11g Band Edge Limit Test Data CH-High



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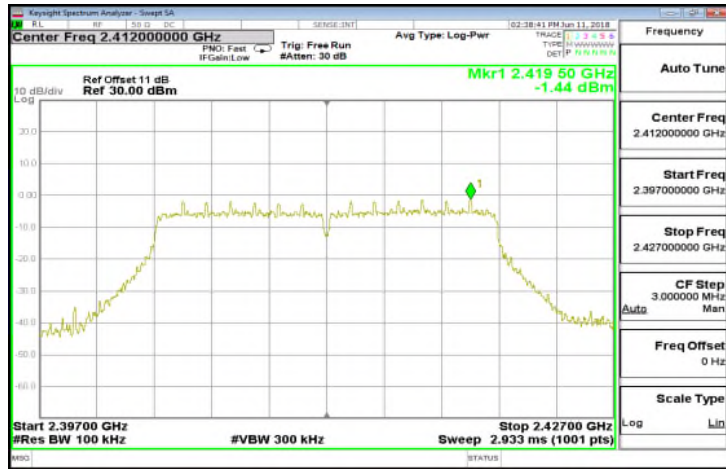
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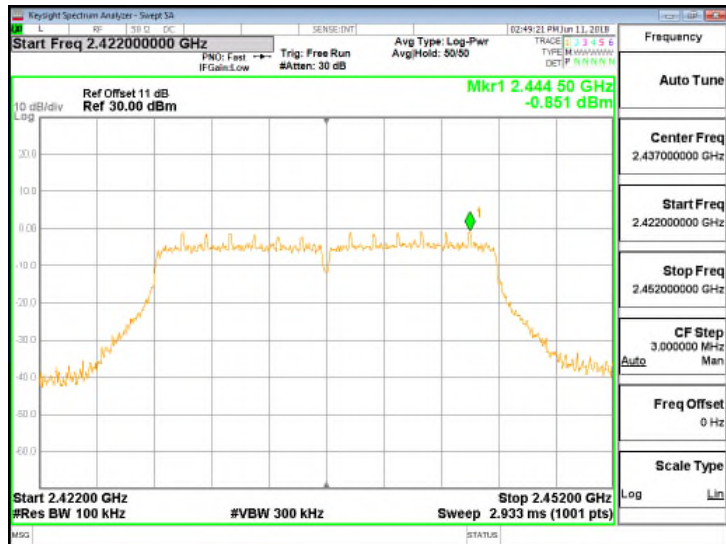
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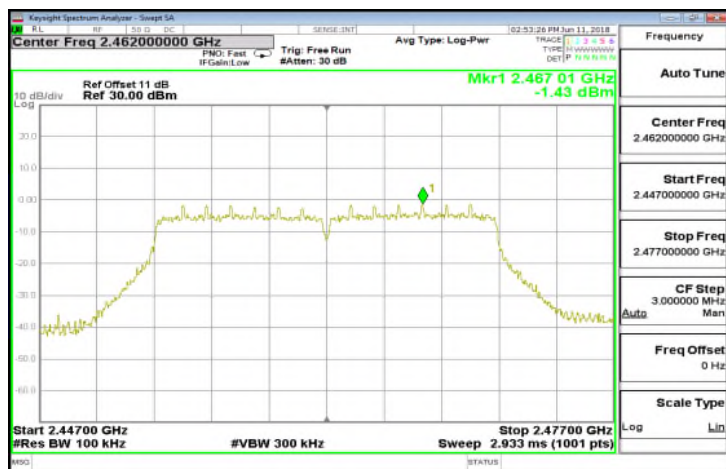
## 802.11n\_HT20 Band Edge Limit Test Data CH-Low



## 802.11n\_HT20 Band Edge Limit Test Data CH-Mid



## 802.11n\_HT20 Band Edge Limit Test Data CH-High



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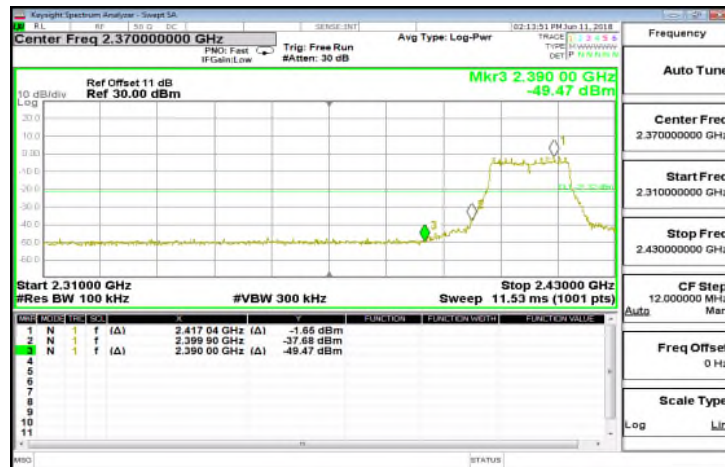
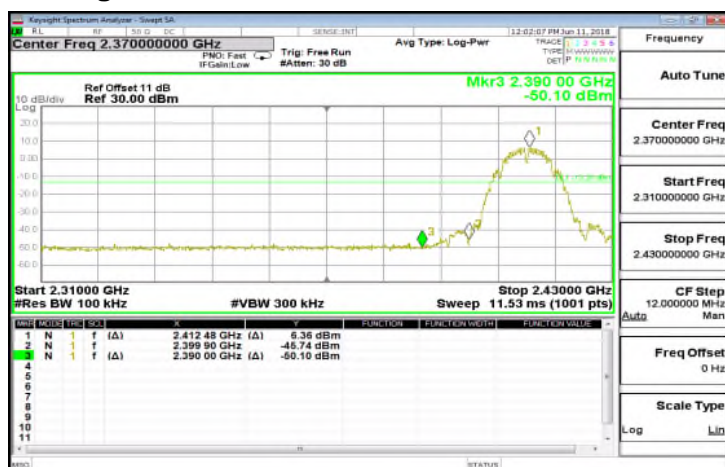


802.11b

Band Edge Test Data CH-Low

802.11g

Band Edge Test Data CH-Low



Band Edge Test Data CH-High

Band Edge Test Data CH-High



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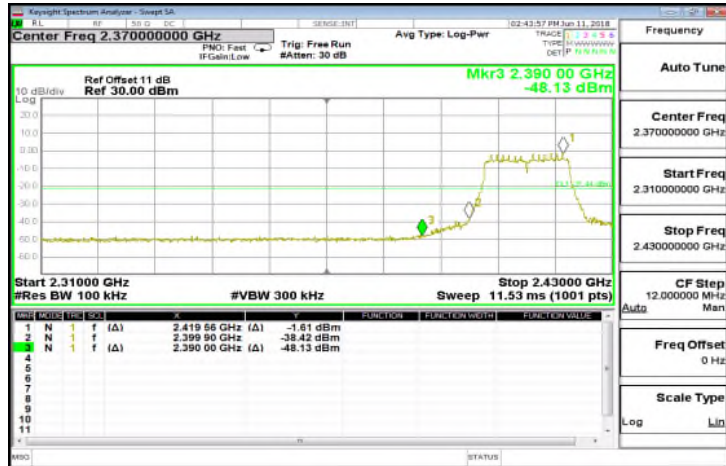
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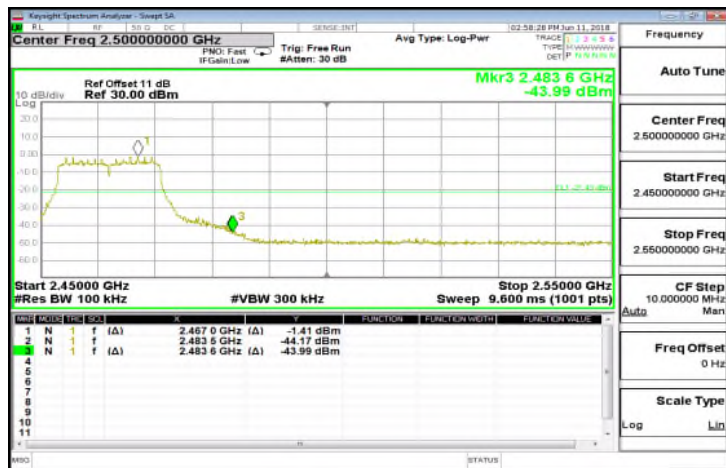
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## 802.11n\_HT20

### Band Edge Test Data CH-Low



### Band Edge Test Data CH-High



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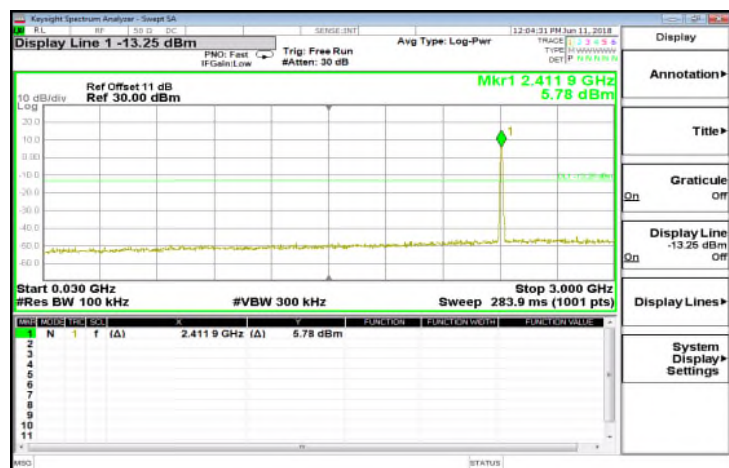
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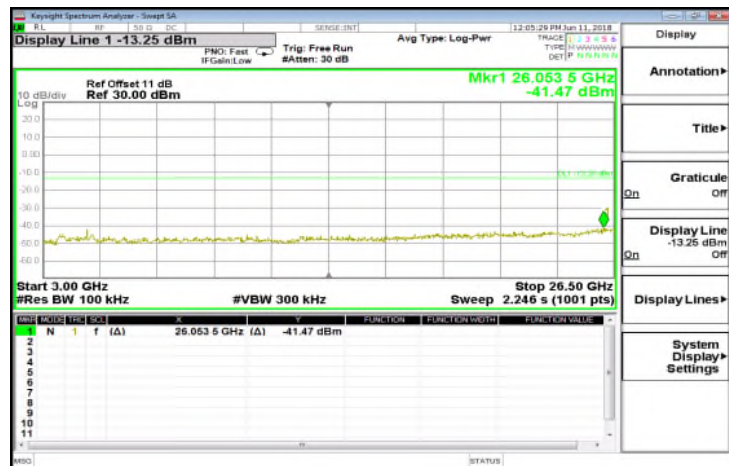


802.11b

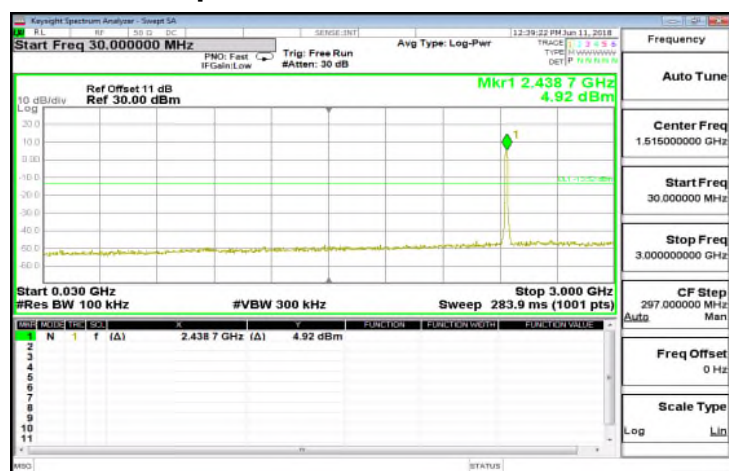
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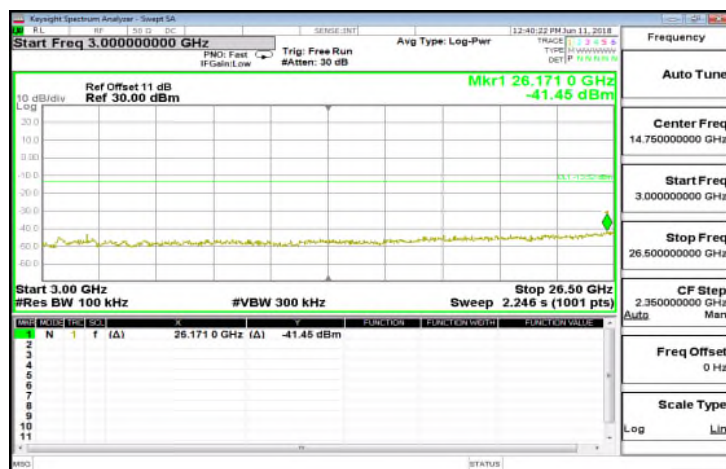
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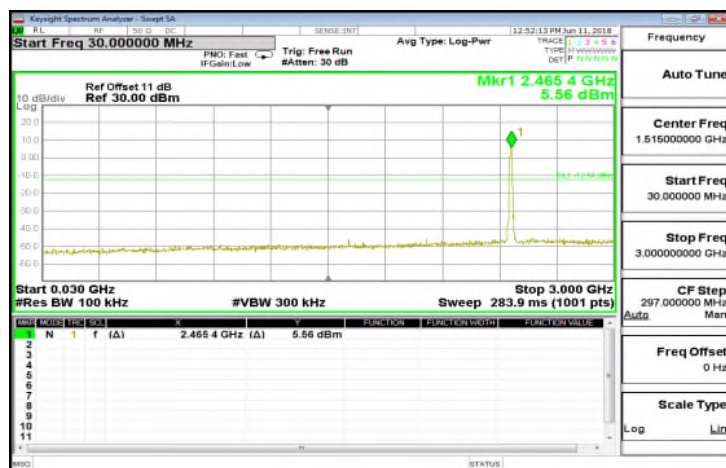
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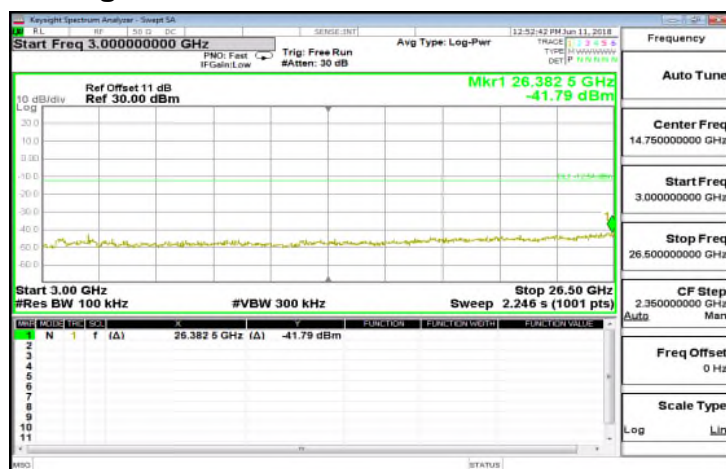
## 3G-26.5GHz Spurious Emission Test Data CH-Mid



## 30M-3GHz Spurious Emission Test Data CH-High



## 3G-26.5GHz Spurious Emission Test Data CH-High



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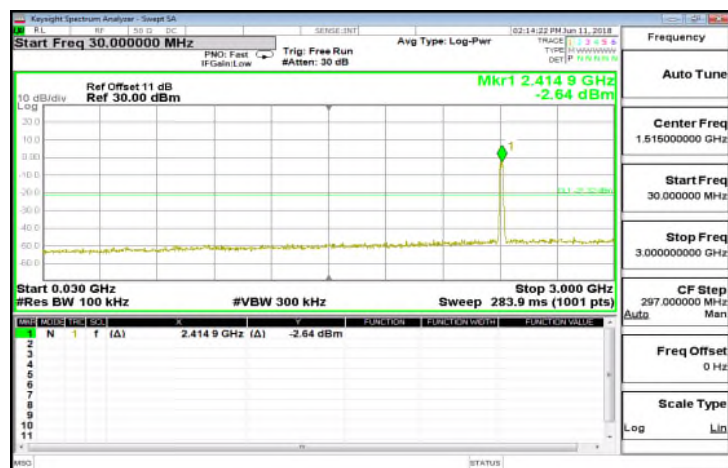
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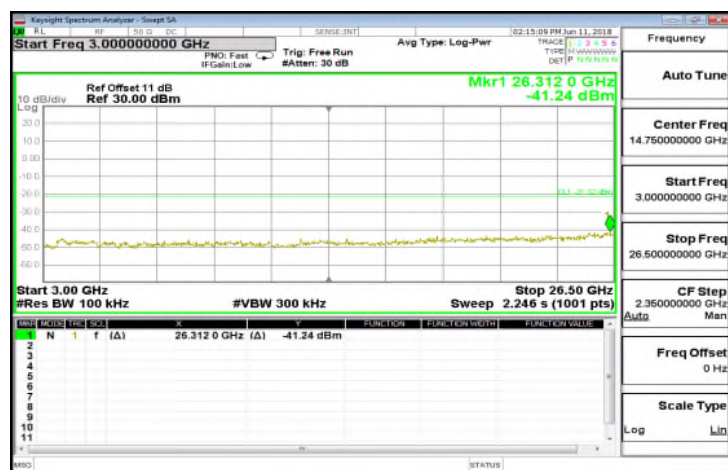
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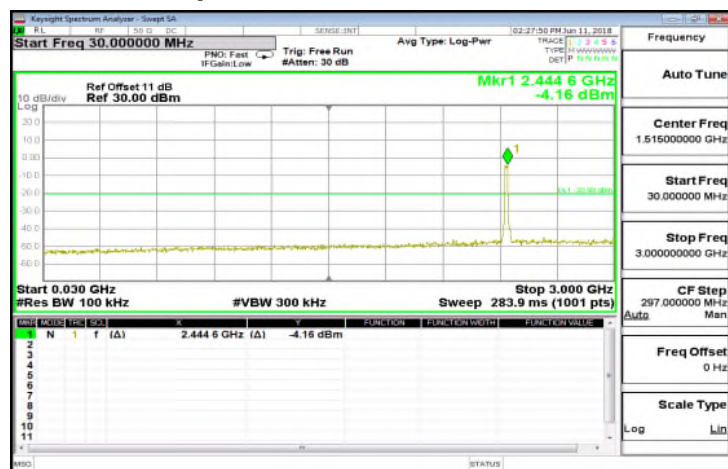
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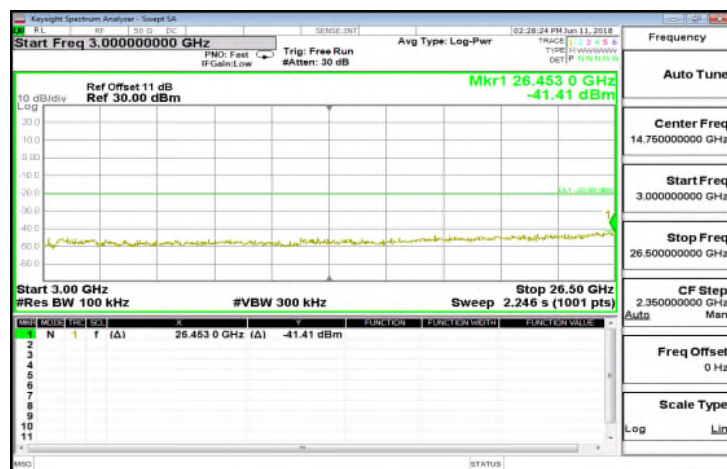
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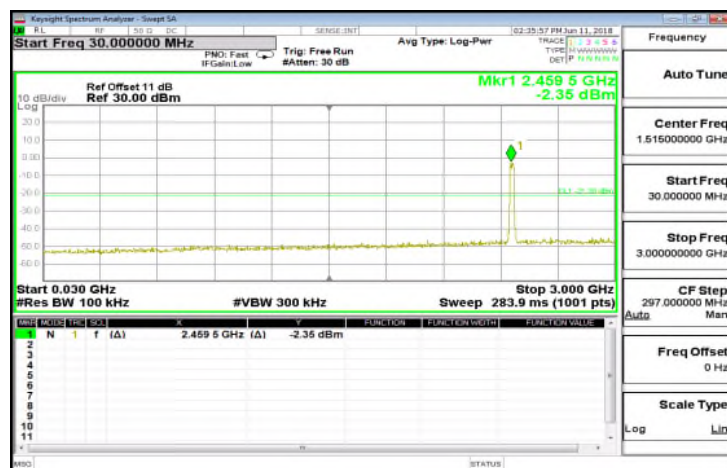
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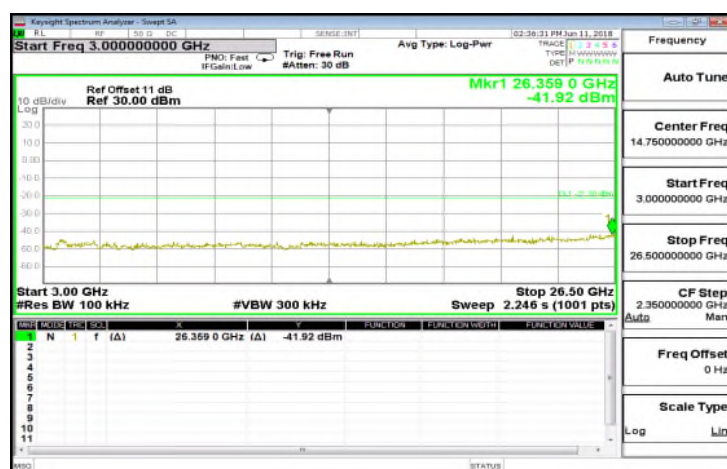
## 3G-26.5GHz Spurious Emission Test Data CH-Mid



## 30M-3GHz Spurious Emission Test Data CH-High



## 3G-26.5GHz Spurious Emission Test Data CH-High



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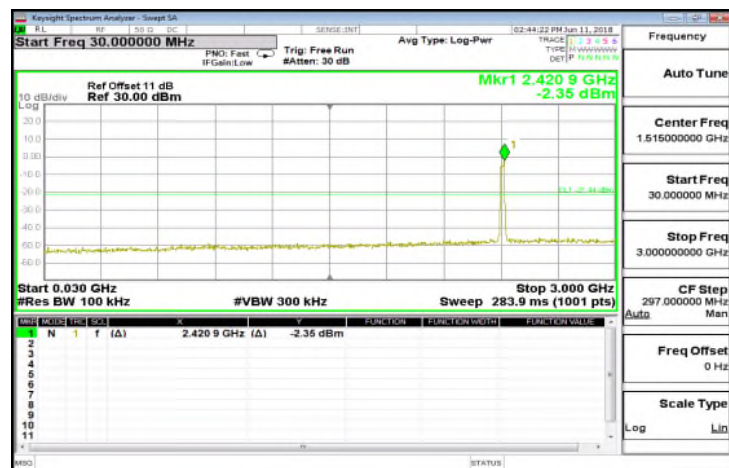
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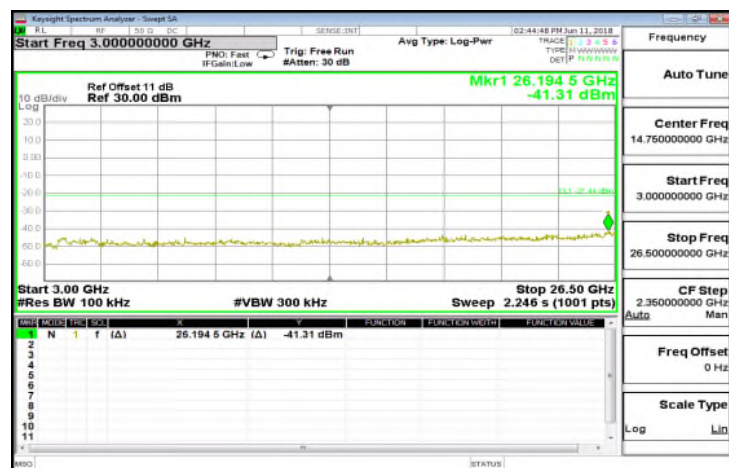


## 802.11n\_HT20

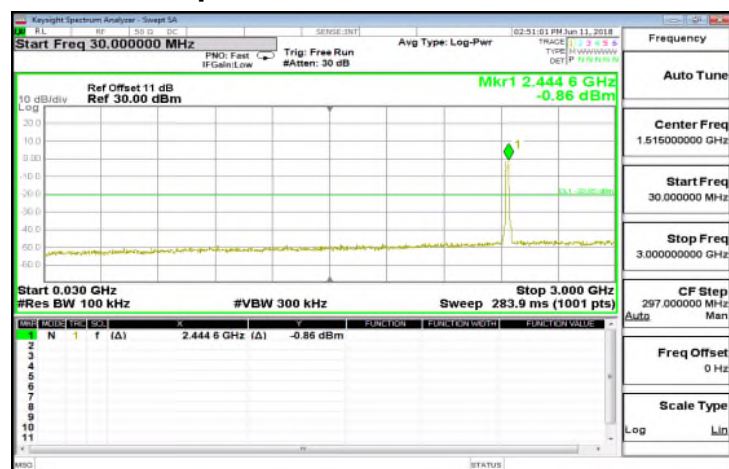
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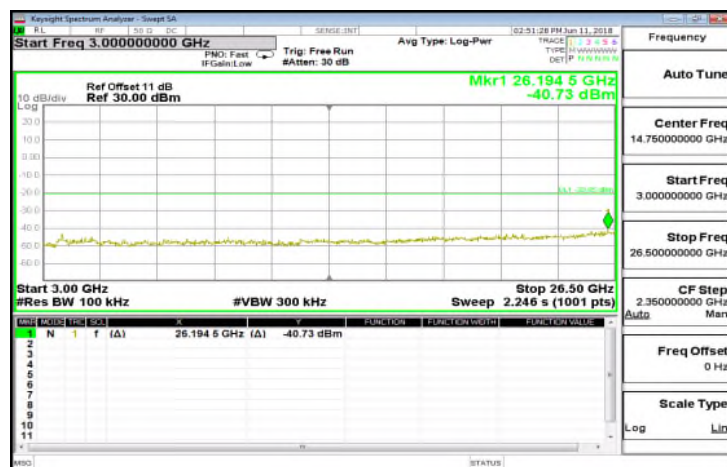
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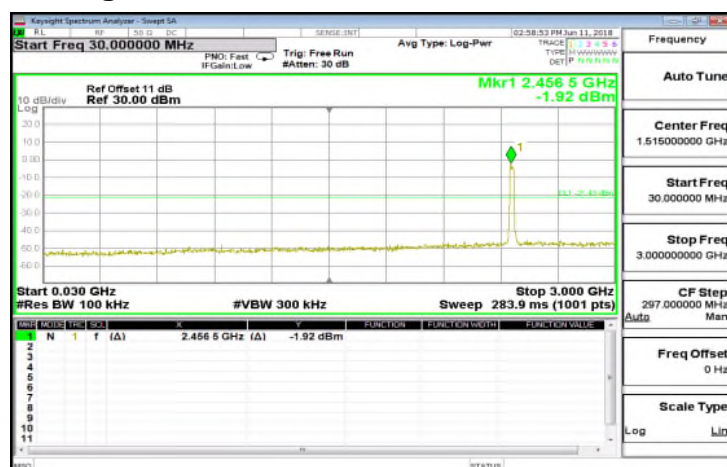
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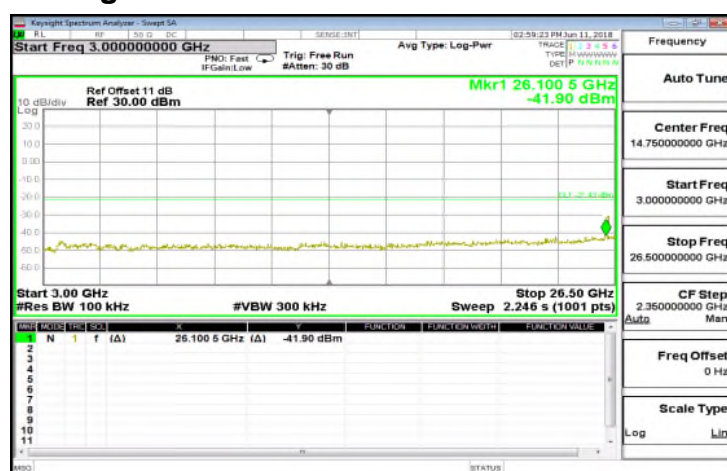
### 3G-26.5GHz Spurious Emission Test Data CH-Mid



### 30M-3GHz Spurious Emission Test Data CH-High



### 3G-26.5GHz 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 & RSS-Gen §8.8, 8.9 limit as below.

And according to §15.33(a) (1) & RSS-Gen §6.13(a), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

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

#### Note:

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

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## 11.2 Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Bi-log Antenna	SCHWAZBECK	VULB9168	378	2017/12/29	2018/12/28
Horn Antenna	Schwarzbeck	BBHA9120D	1441	2017/08/04	2018/08/03
Horn Antenna	Schwarzbeck	BBHA9170	184	2017/12/12	2018/12/11
Loop Antenna	ETS.LINDGREN	6502	148045	2017/09/26	2018/09/25
3m Site NSA	SGS	966 chamber	N/A	2018/01/02	2019/01/01
Spectrum Analyzer	Agilent	E4446A	MY51100003	2018/05/15	2019/05/14
EMI Test Receiver	R&S	ESCI7	100335	2018/02/02	2019/02/01
Pre-Amplifier	HP	8449B	3008A00578	2018/01/02	2019/01/01
Pre-Amplifier	HP	8447D	2944A07676	2018/01/02	2019/01/01
Pre-Amplifier	EMC Instruments	EMC184045B	980135	2017/10/27	2018/10/26
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M1	2018/01/02	2019/01/01
Low Loss Cable	Huber Suhner	966_RX	9	2018/01/02	2019/01/01

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

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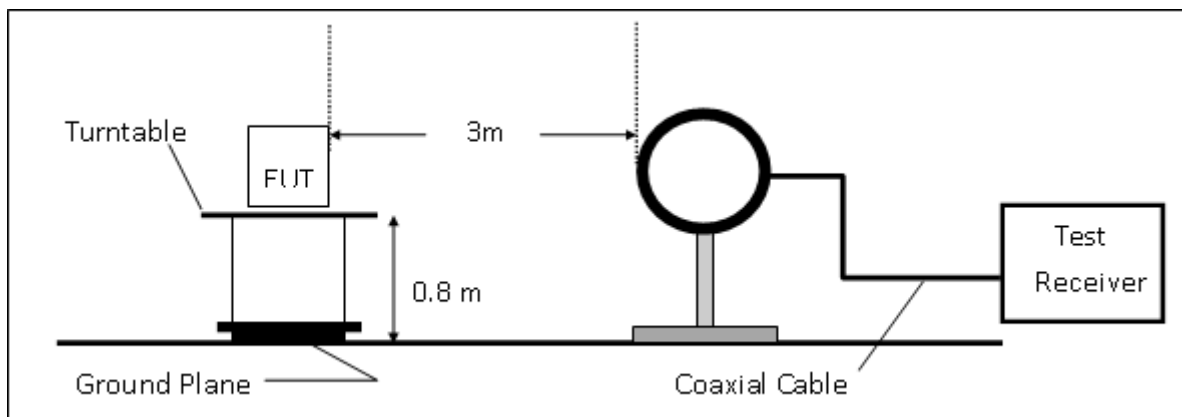
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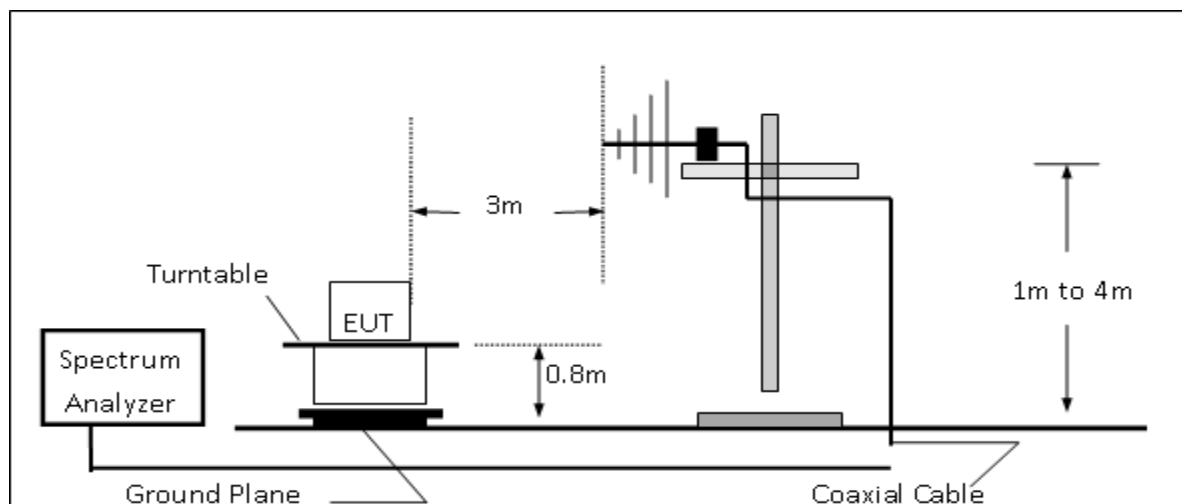
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### 11.3 Test SET-UP

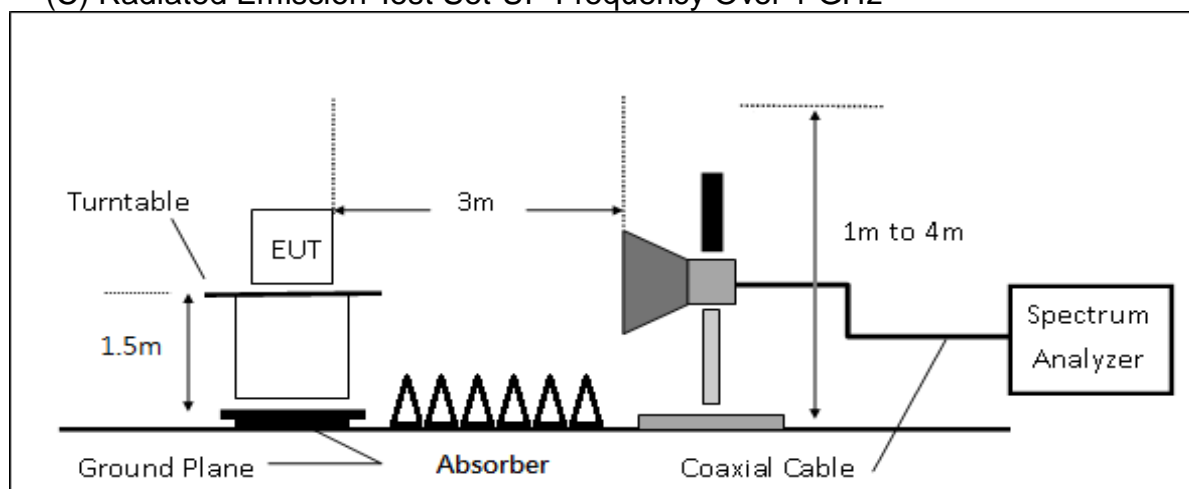
#### (A) Radiated Emission Test Set-UP Frequency Below 30MHz.



#### (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 & ANSI C63.10.
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
6. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
9. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
12. Repeat above procedures until all default test channel measured were complete.

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## 11.5 Field Strength Calculation

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

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

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

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

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

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

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

## 11.7 Measurement Result

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

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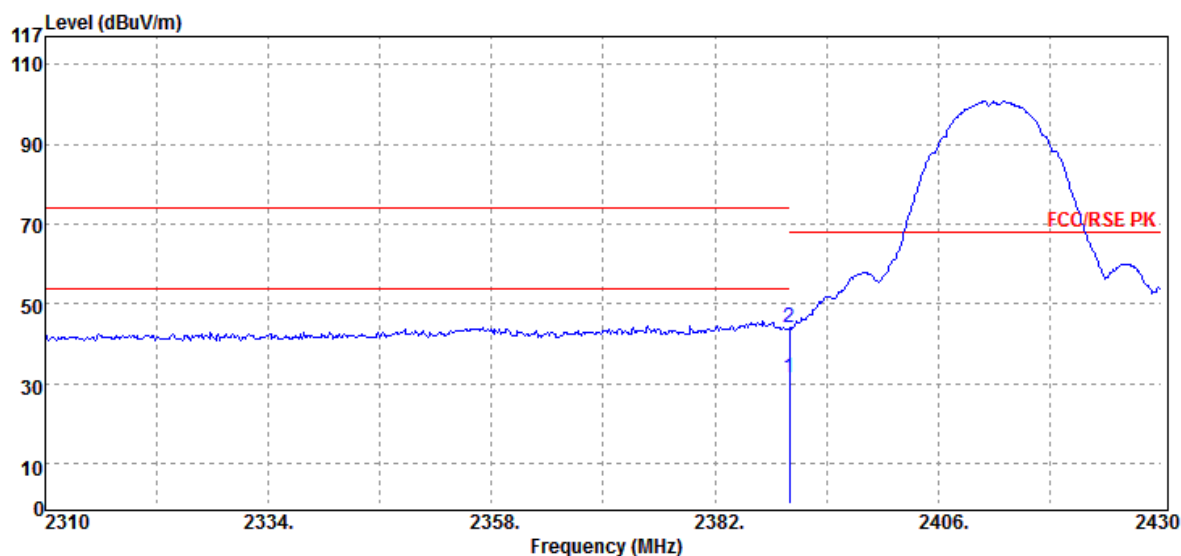
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## Radiated Band Edge Measurement Result (802.11b)

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

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2390.00	Average	31.53	0.20	31.73	54.00	-22.27
2390.00	Peak	43.87	0.20	44.07	74.00	-29.93

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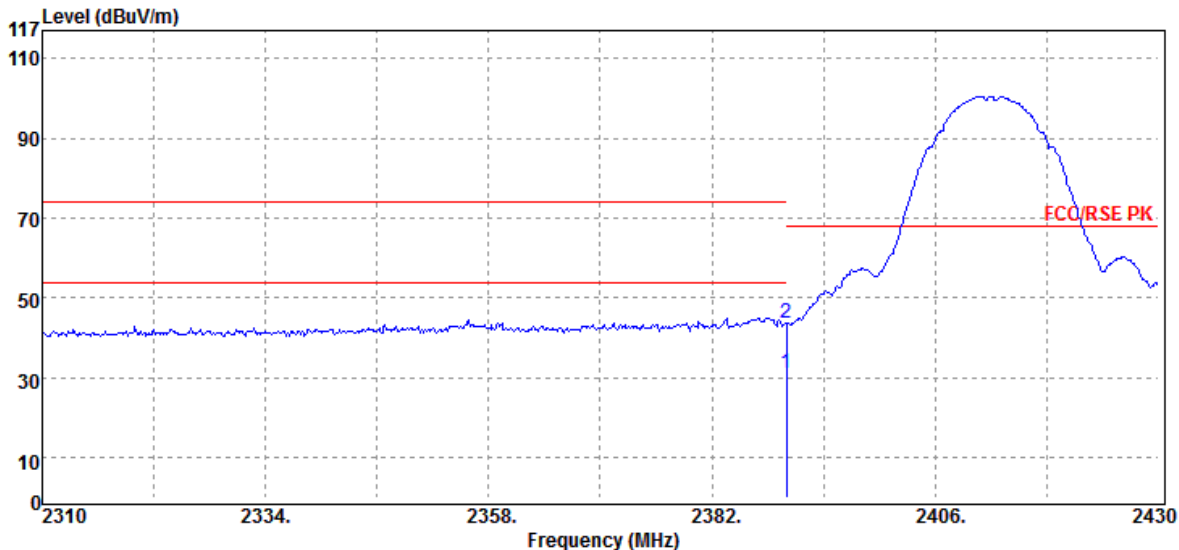
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Operation Band :802.11b  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2390.00	Average	31.07	0.20	31.27	54.00	-22.73
2390.00	Peak	43.44	0.20	43.64	74.00	-30.36

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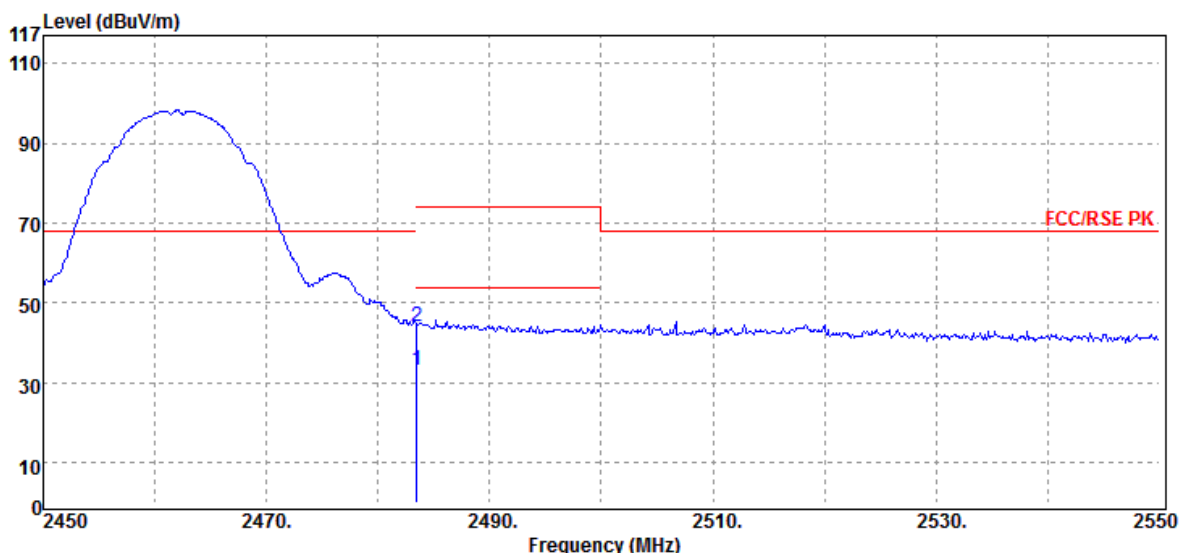
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Operation Band :802.11b  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.50	Average	32.52	0.53	33.05	54.00	-20.95
2483.50	Peak	43.64	0.53	44.17	74.00	-29.83

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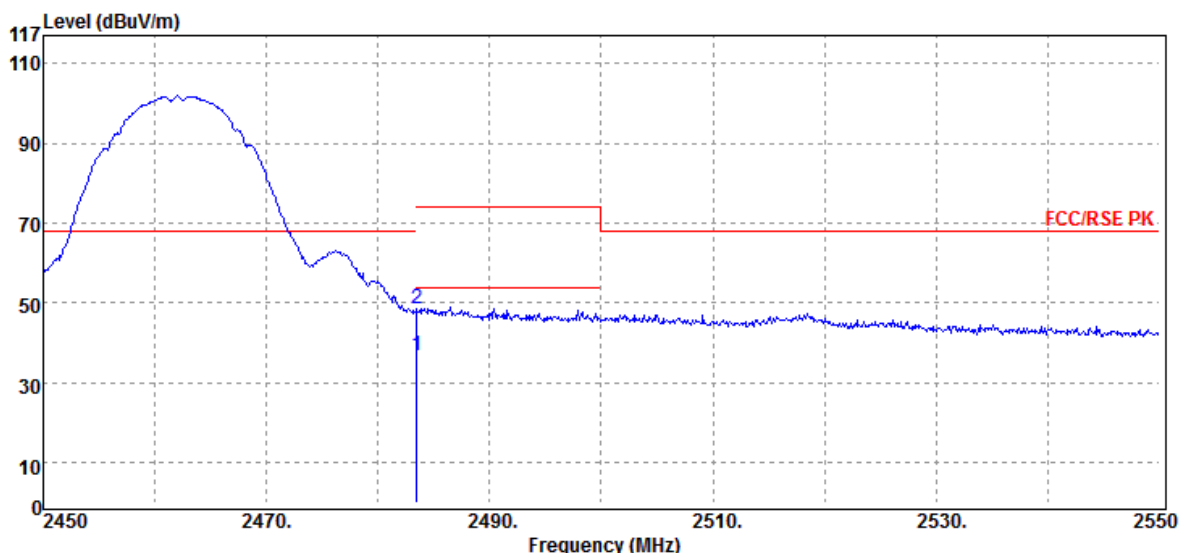
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Operation Band :802.11b  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.50	Average	36.12	0.53	36.65	54.00	-17.35
2483.50	Peak	47.98	0.53	48.51	74.00	-25.49

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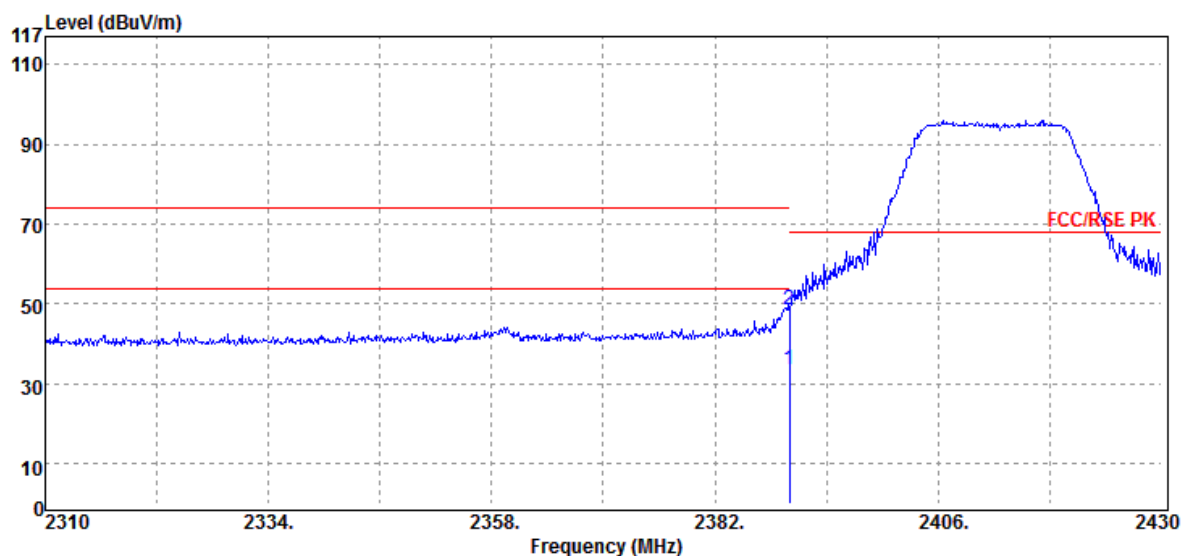
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## Radiated Band Edge Measurement Result (802.11g)

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

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2390.00	Average	33.41	0.20	33.61	54.00	-20.39
2390.00	Peak	48.30	0.20	48.50	74.00	-25.50

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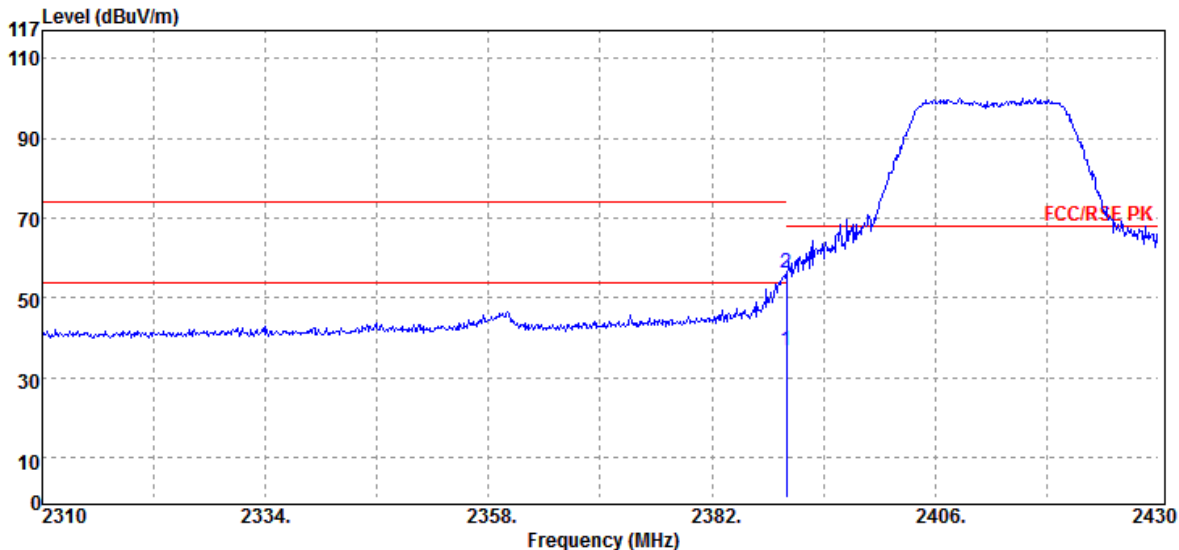
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Operation Band :802.11g  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
2390.00	Average	36.77	0.20	36.97	54.00	-17.03
2390.00	Peak	56.11	0.20	56.31	74.00	-17.69

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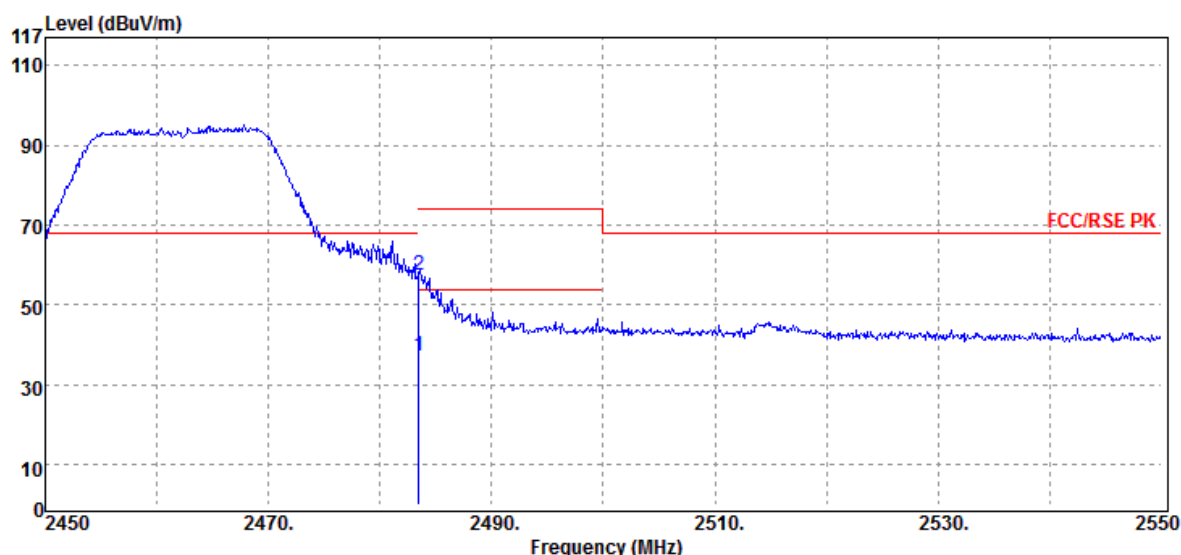
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Operation Band :802.11g  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.50	Average	36.85	0.53	37.38	54.00	-16.62
2483.50	Peak	57.07	0.53	57.60	74.00	-16.40

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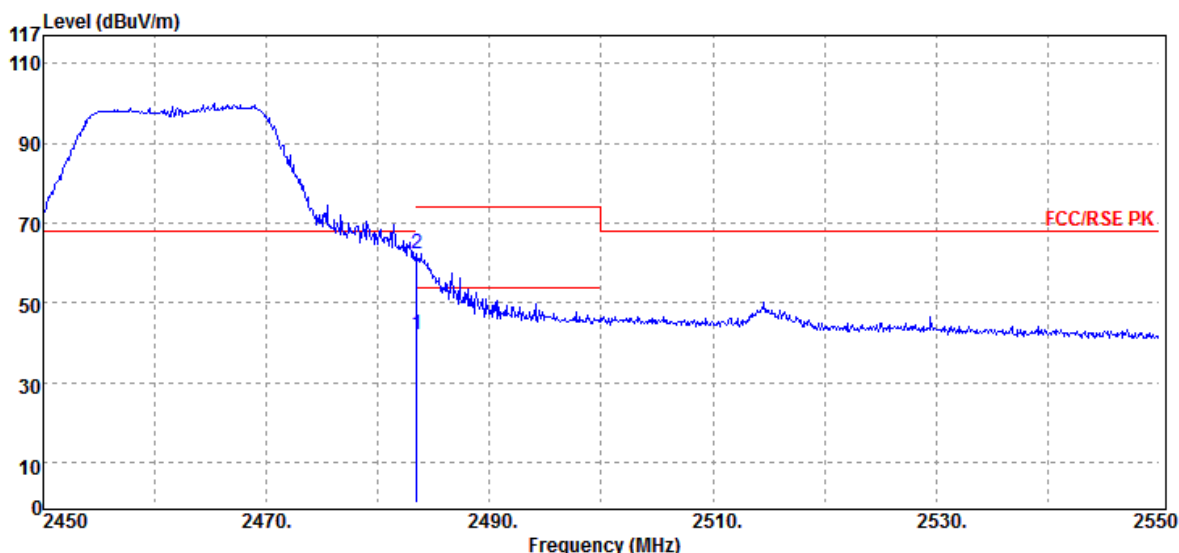
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Operation Band :802.11g  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.50	Average	41.53	0.53	42.06	54.00	-11.94
2483.50	Peak	61.82	0.53	62.35	74.00	-11.65

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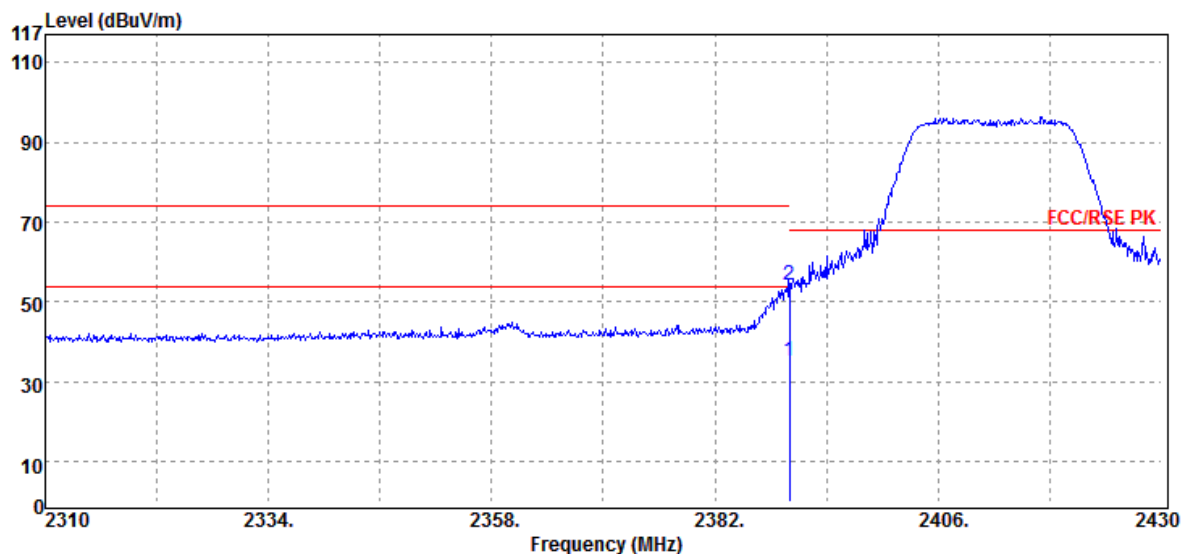
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## Radiated Band Edge Measurement Result (802.11\_HT20)

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

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2390.00	Average	34.83	0.20	35.03	54.00	-18.97
2390.00	Peak	54.21	0.20	54.41	74.00	-19.59

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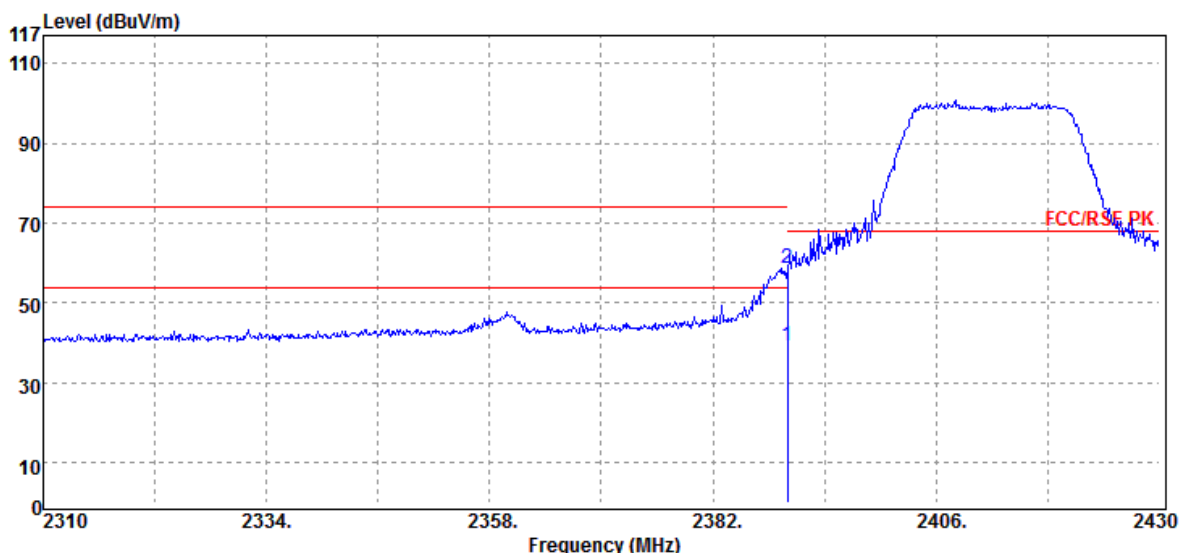
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Operation Band :802.11n20  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2390.00	Average	39.04	0.20	39.24	54.00	-14.76
2390.00	Peak	58.58	0.20	58.78	74.00	-15.22

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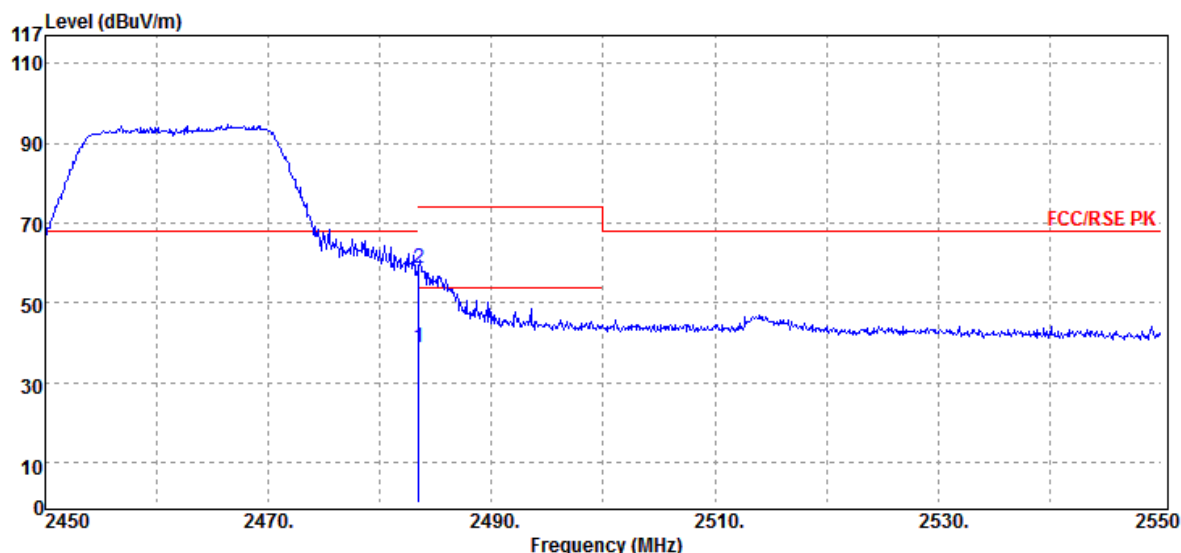
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Operation Band :802.11n20  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.50	Average	38.35	0.53	38.88	54.00	-15.12
2483.50	Peak	58.26	0.53	58.79	74.00	-15.21

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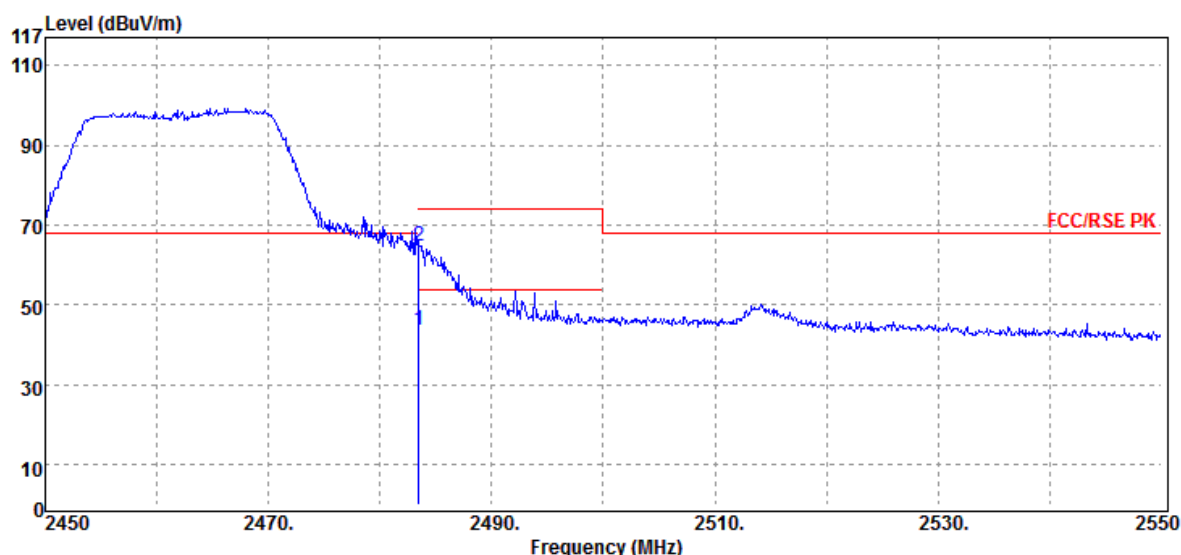
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Operation Band :802.11n20  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
2483.50	Average	43.30	0.53	43.83	54.00	-10.17
2483.50	Peak	64.27	0.53	64.80	74.00	-9.20

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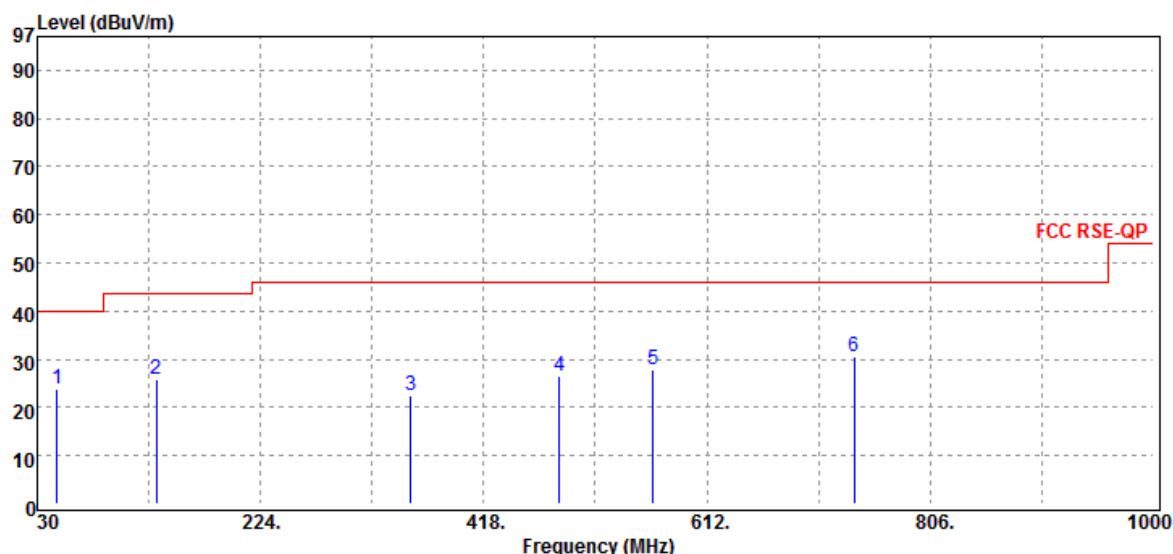
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# Below 1GHz Worst-Case Data:

## Radiated Spurious Emission Measurement Result (802.11 g)

Operation Band	:802.11g	Test Date	:2018-06-26
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
47.46	Peak	31.56	-7.64	23.92	40.00	-16.08
133.79	Peak	34.57	-8.67	25.90	43.50	-17.60
354.95	Peak	26.78	-4.18	22.60	46.00	-23.40
483.96	Peak	29.38	-2.70	26.68	46.00	-19.32
565.44	Peak	28.31	-0.50	27.81	46.00	-18.19
740.04	Peak	26.96	3.56	30.52	46.00	-15.48

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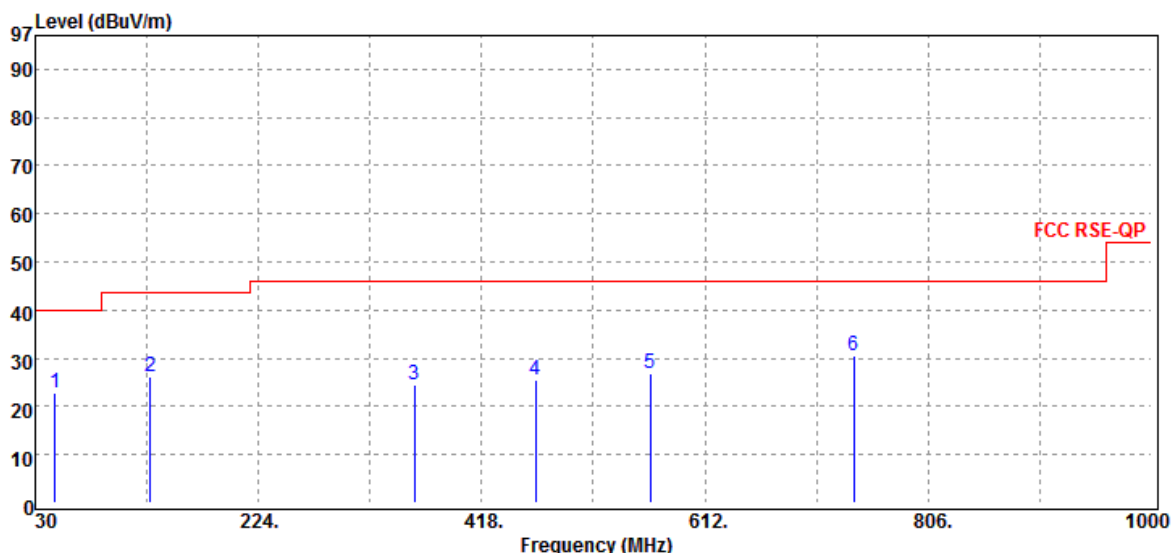
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Operation Band :802.11g  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
47.46	Peak	30.39	-7.64	22.75	40.00	-17.25
129.91	Peak	35.29	-9.19	26.10	43.50	-17.40
359.80	Peak	28.90	-4.26	24.64	46.00	-21.36
464.56	Peak	27.52	-2.08	25.44	46.00	-20.56
564.47	Peak	27.55	-0.56	26.99	46.00	-19.01
741.01	Peak	27.31	3.35	30.66	46.00	-15.34

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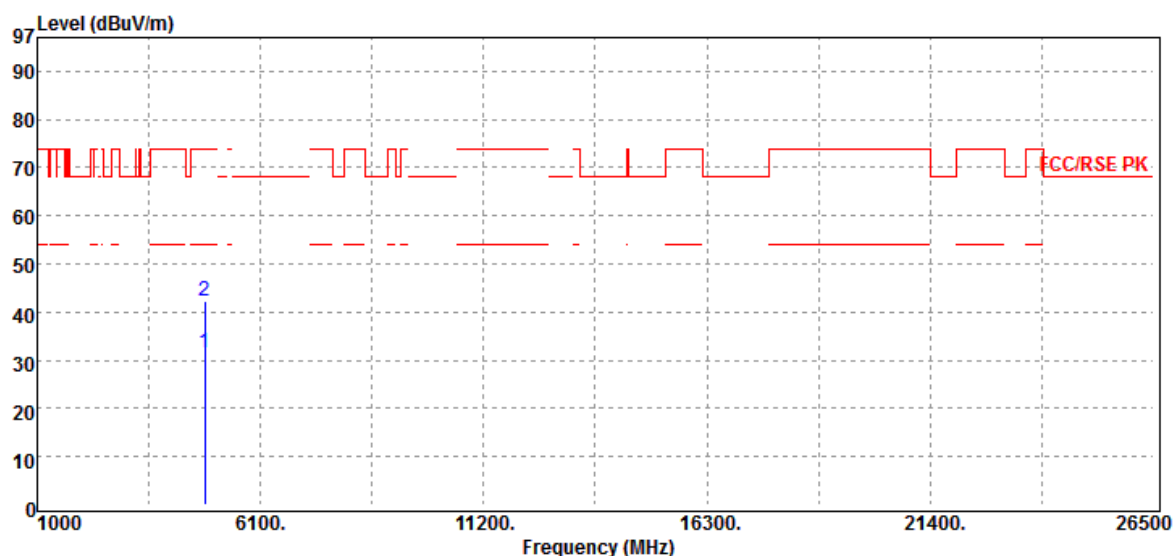
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# Above 1GHz Data:

## Radiated Spurious Emission Measurement Result (802.11 b)

Operation Band	:802.11b	Test Date	:2018-06-26
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4824.00	Average	25.96	5.61	31.57	54.00	-22.43
4824.00	Peak	36.72	5.61	42.33	74.00	-31.67

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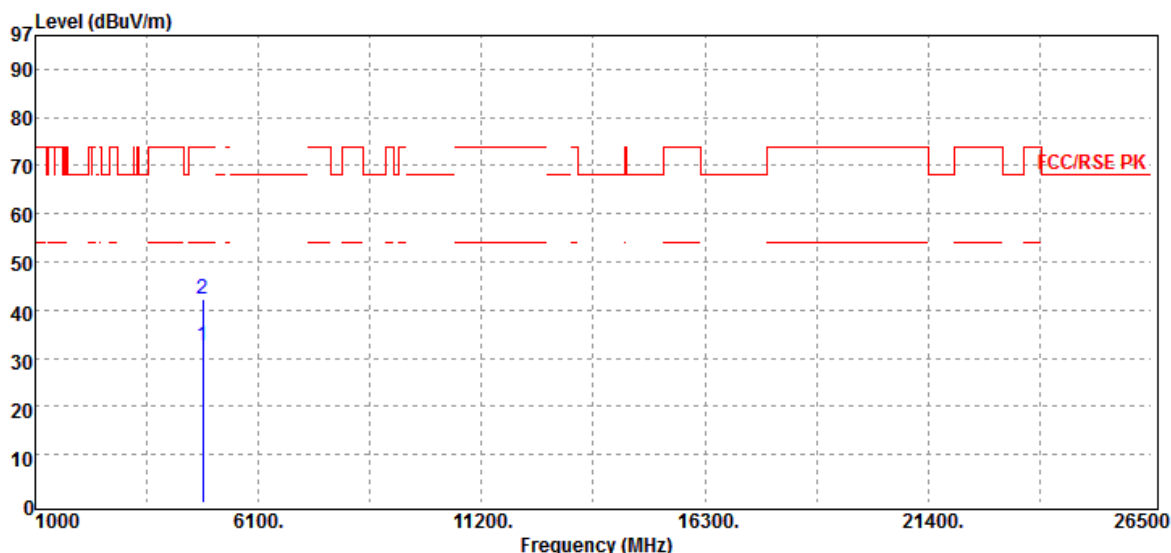
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Operation Band :802.11b  
Fundamental Frequency :2412 MHz  
Operation Mode :Tx CH LOW  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4824.00	Average	26.86	5.61	32.47	54.00	-21.53
4824.00	Peak	36.64	5.61	42.25	74.00	-31.75

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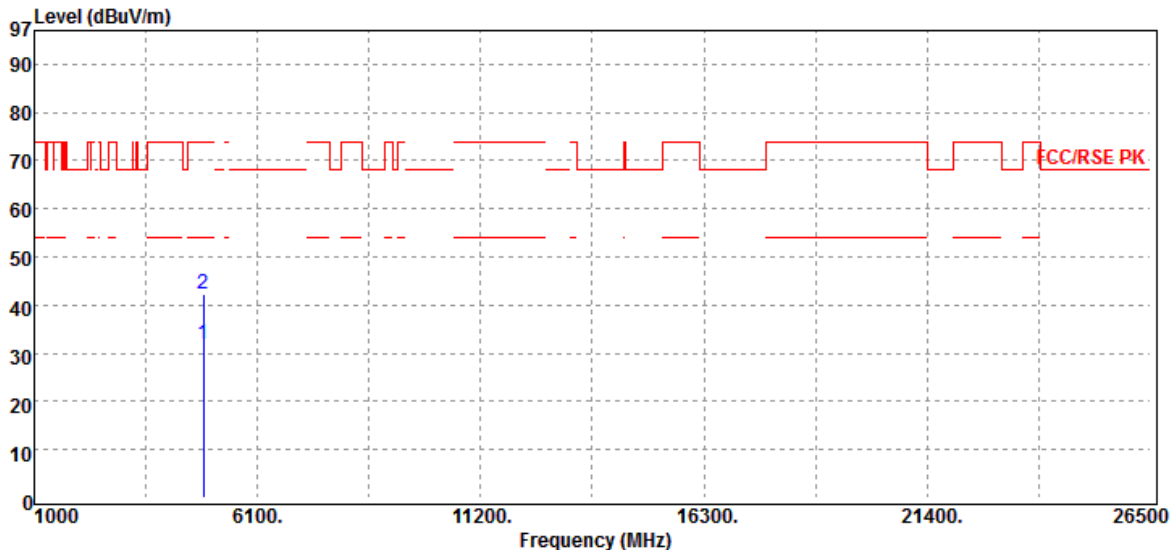
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Operation Band :802.11b  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4874.00	Average	26.11	5.85	31.96	54.00	-22.04
4874.00	Peak	36.54	5.85	42.39	74.00	-31.61

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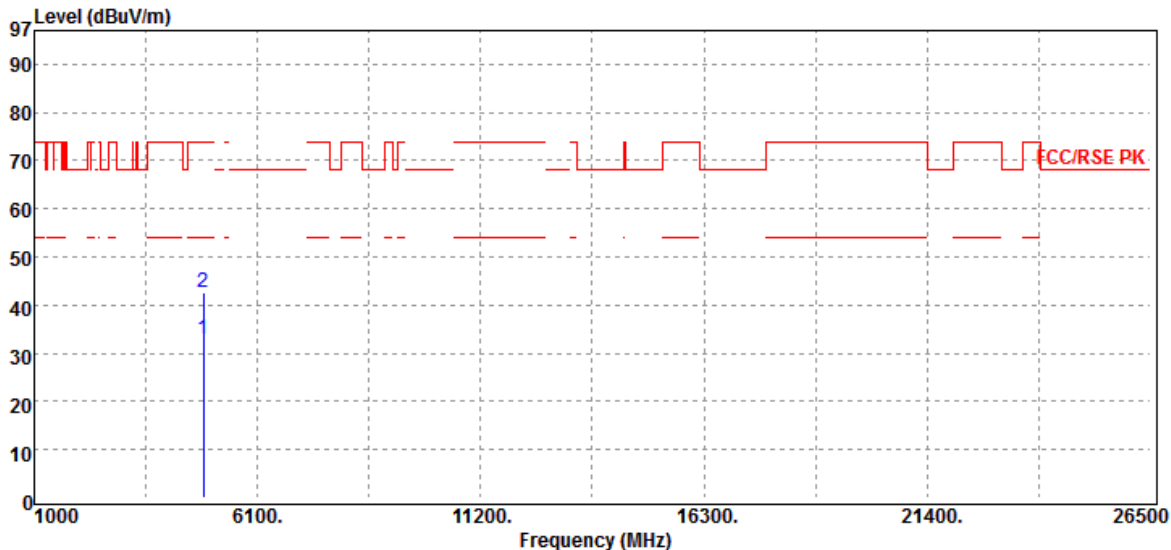
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Operation Band :802.11b  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
4874.00	Average	26.93	5.85	32.78	54.00	-21.22
4874.00	Peak	36.70	5.85	42.55	74.00	-31.45

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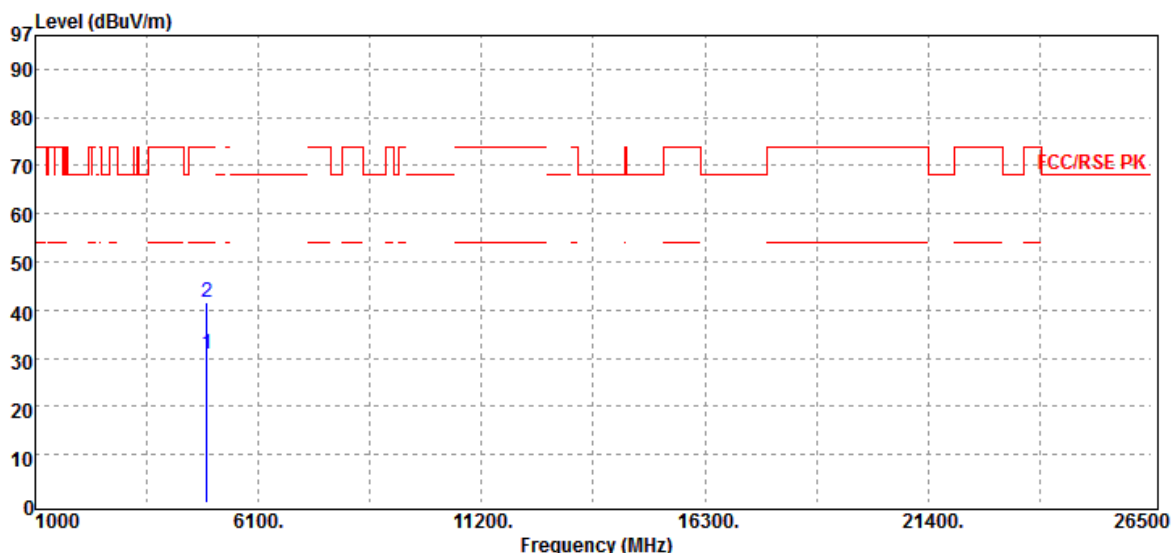
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Operation Band :802.11b  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4924.00	Average	25.21	5.82	31.03	54.00	-22.97
4924.00	Peak	35.92	5.82	41.74	74.00	-32.26

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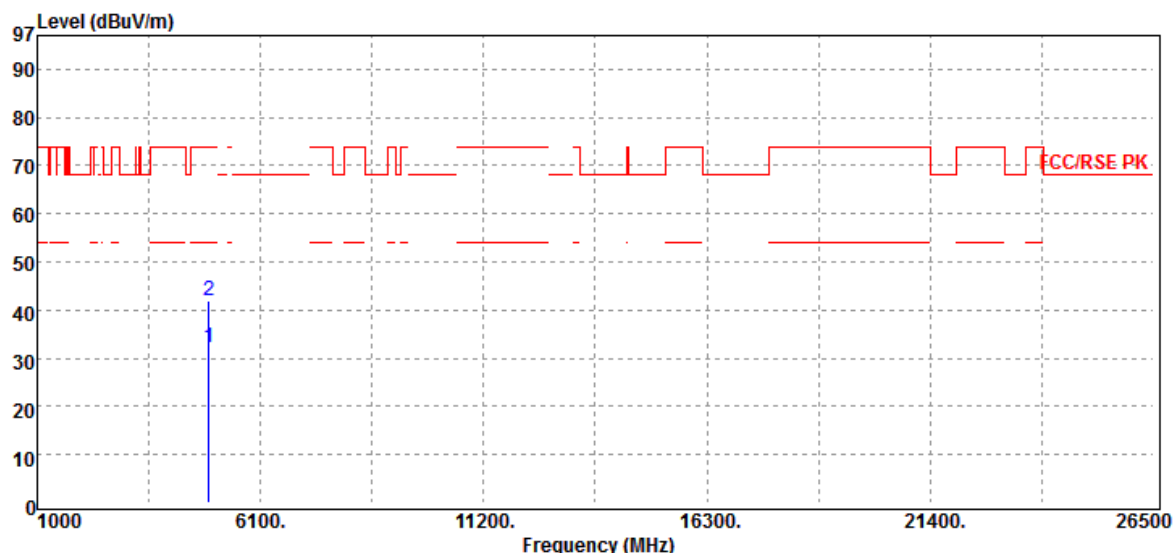
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Operation Band :802.11b  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4924.00	Average	26.29	5.82	32.11	54.00	-21.89
4924.00	Peak	36.04	5.82	41.86	74.00	-32.14

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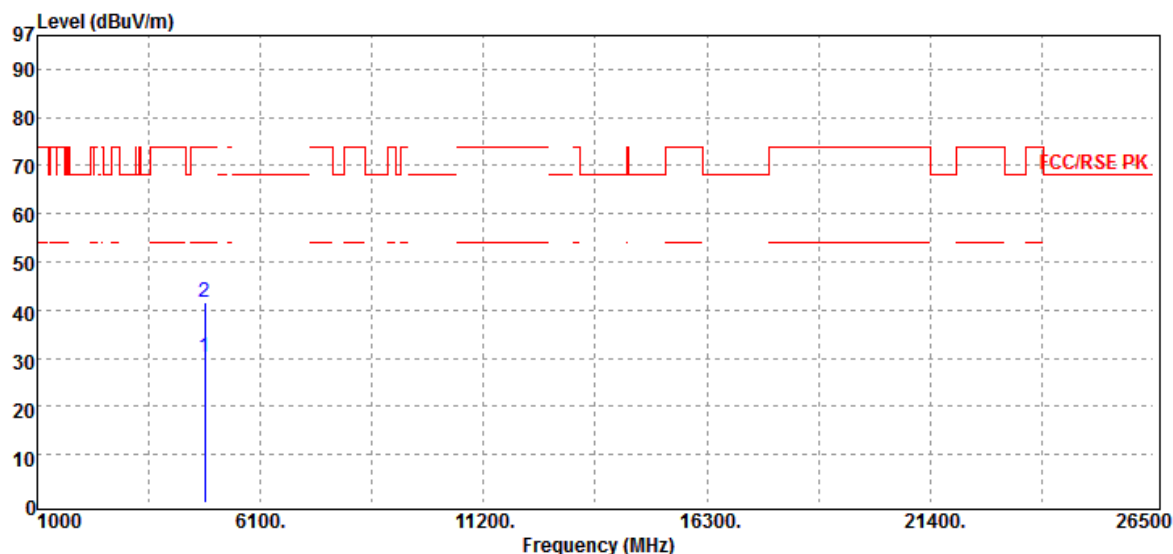
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## Radiated Spurious Emission Measurement Result (802.11 g)

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

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4824.00	Average	24.60	5.61	30.21	54.00	-23.79
4824.00	Peak	35.90	5.61	41.51	74.00	-32.49

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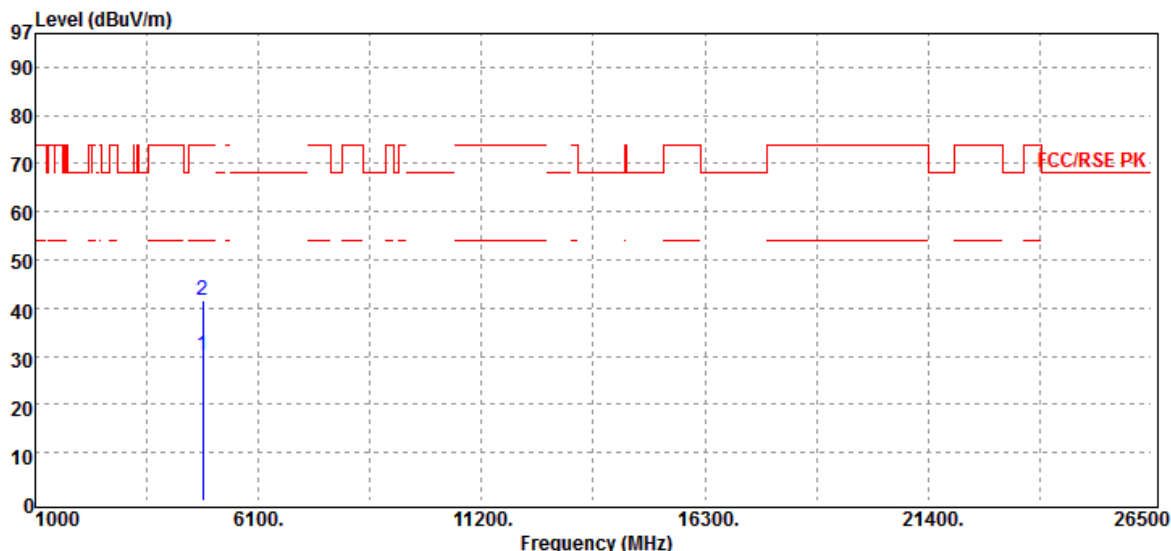
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Operation Band :802.11g  
Fundamental Frequency :2412 MHz  
Operation Mode :Tx CH LOW  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4824.00	Average	24.71	5.61	30.32	54.00	-23.68
4824.00	Peak	35.99	5.61	41.60	74.00	-32.40

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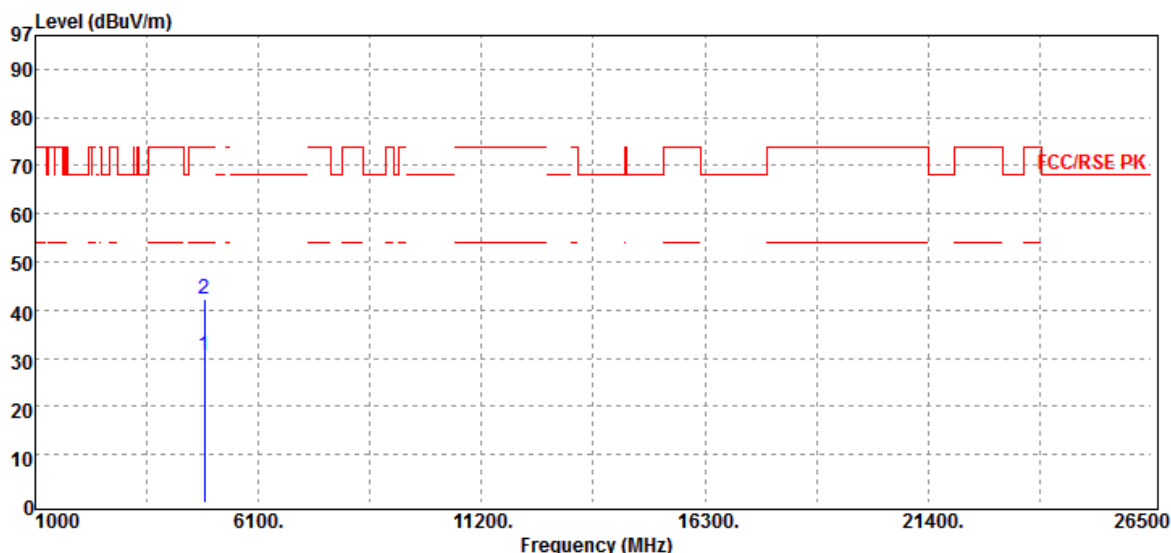
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Operation Band :802.11g  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
4874.00	Average	24.77	5.85	30.62	54.00	-23.38
4874.00	Peak	36.28	5.85	42.13	74.00	-31.87

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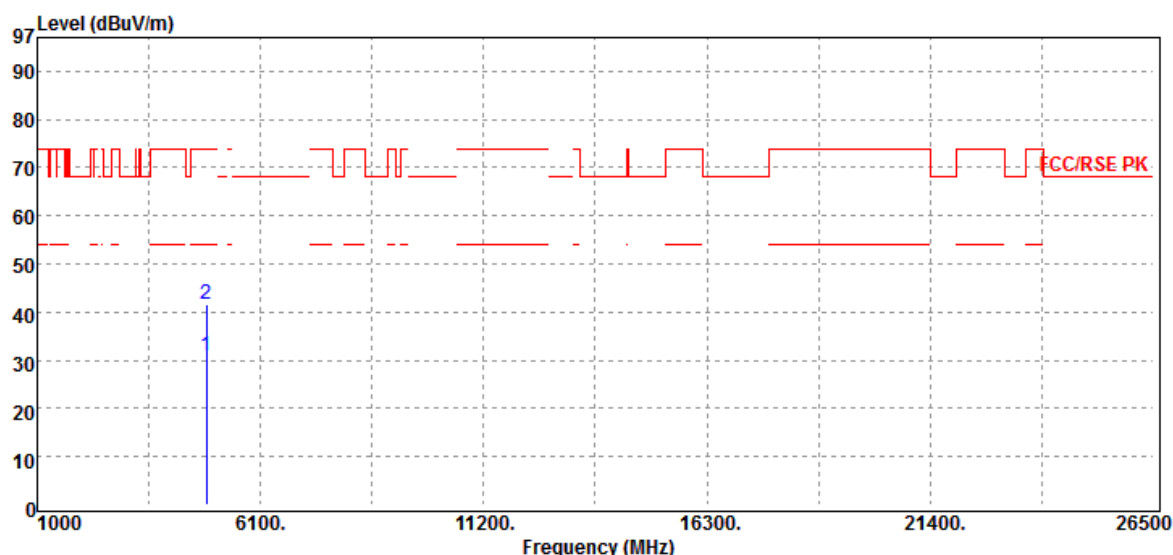
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Operation Band :802.11g  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4874.00	Average	24.94	5.85	30.79	54.00	-23.21
4874.00	Peak	35.92	5.85	41.77	74.00	-32.23

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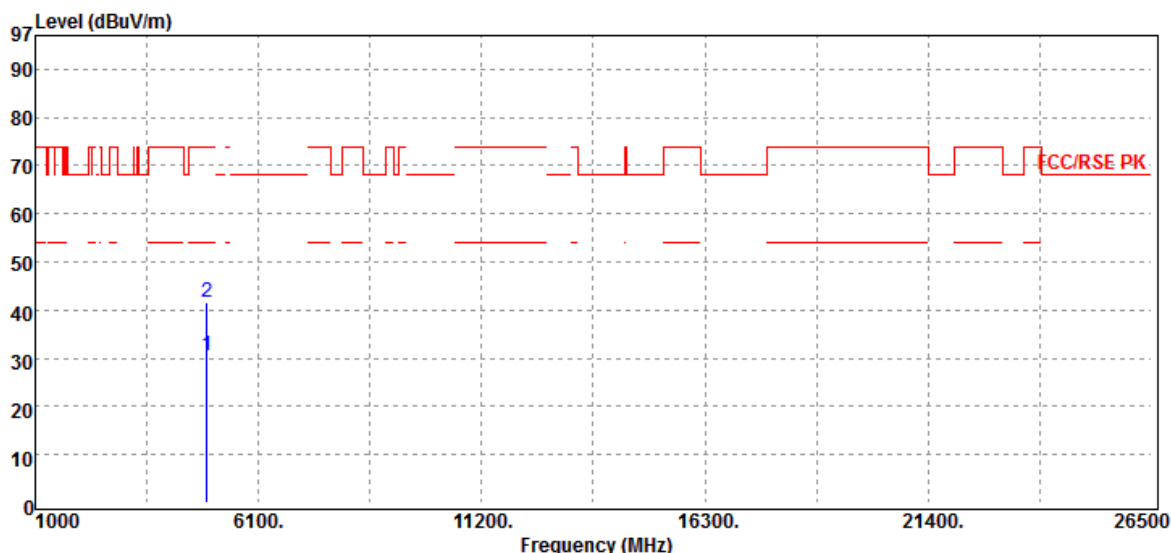
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Operation Band :802.11g  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4924.00	Average	24.71	5.82	30.53	54.00	-23.47
4924.00	Peak	35.65	5.82	41.47	74.00	-32.53

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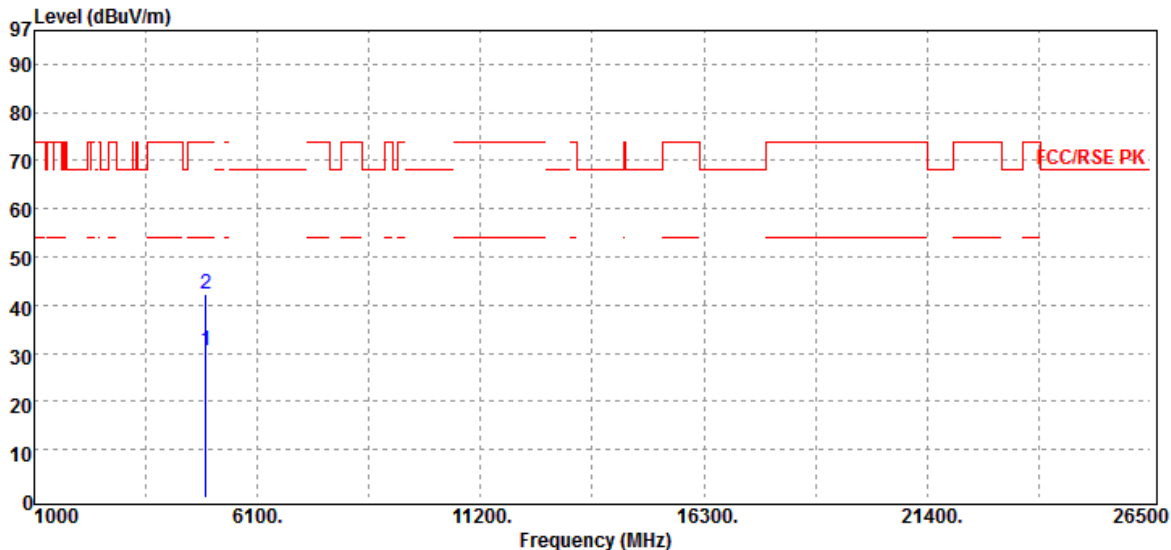
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Operation Band :802.11g  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4924.00	Average	24.83	5.82	30.65	54.00	-23.35
4924.00	Peak	36.39	5.82	42.21	74.00	-31.79

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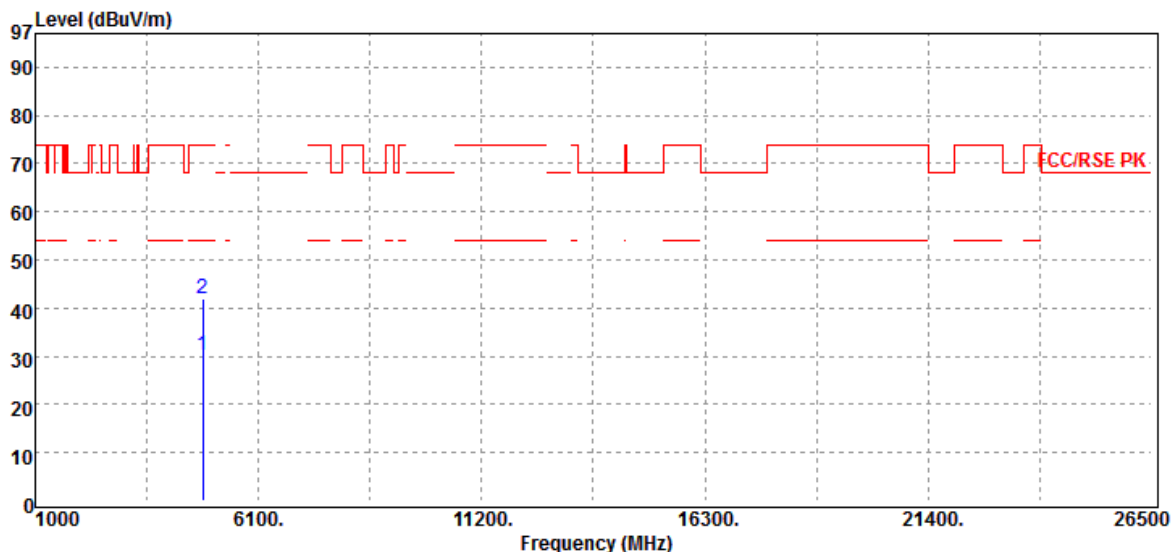
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## Radiated Spurious Emission Measurement Result (802.11n\_HT20)

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

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4824.00	Average	24.60	5.61	30.21	54.00	-23.79
4824.00	Peak	36.22	5.61	41.83	74.00	-32.17

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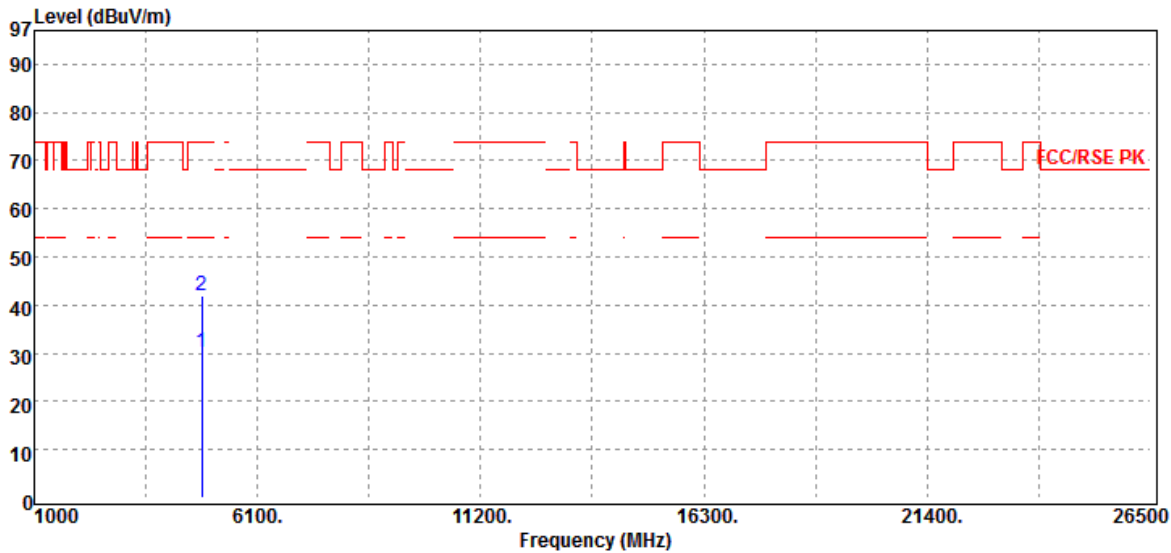
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Operation Band :802.11n20  
Fundamental Frequency :2412 MHz  
Operation Mode :Tx CH LOW  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4824.00	Average	24.76	5.61	30.37	54.00	-23.63
4824.00	Peak	36.37	5.61	41.98	74.00	-32.02

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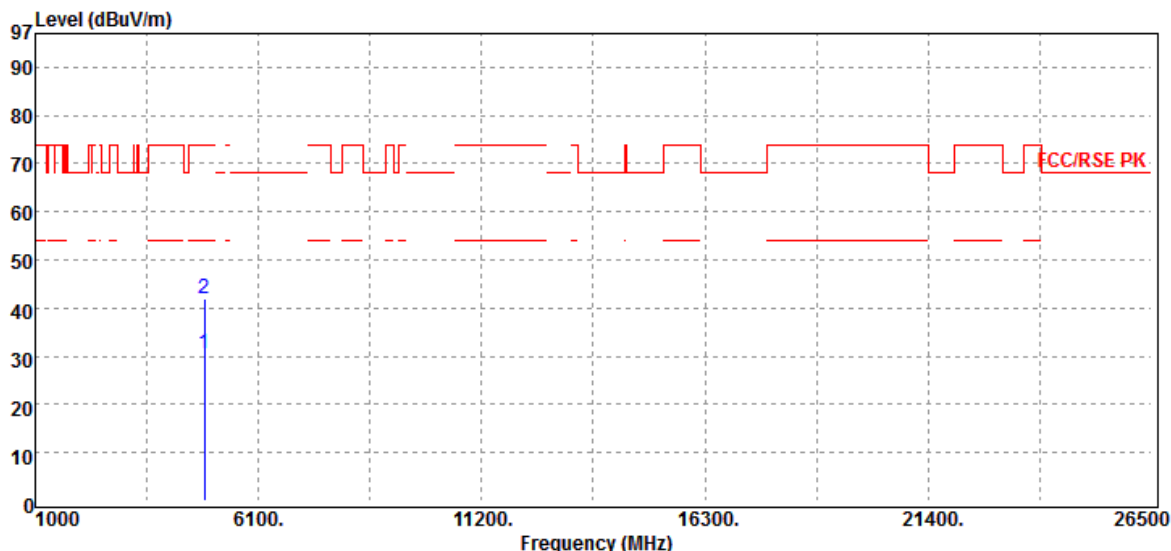
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Operation Band :802.11n20  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4874.00	Average	24.79	5.85	30.64	54.00	-23.36
4874.00	Peak	36.03	5.85	41.88	74.00	-32.12

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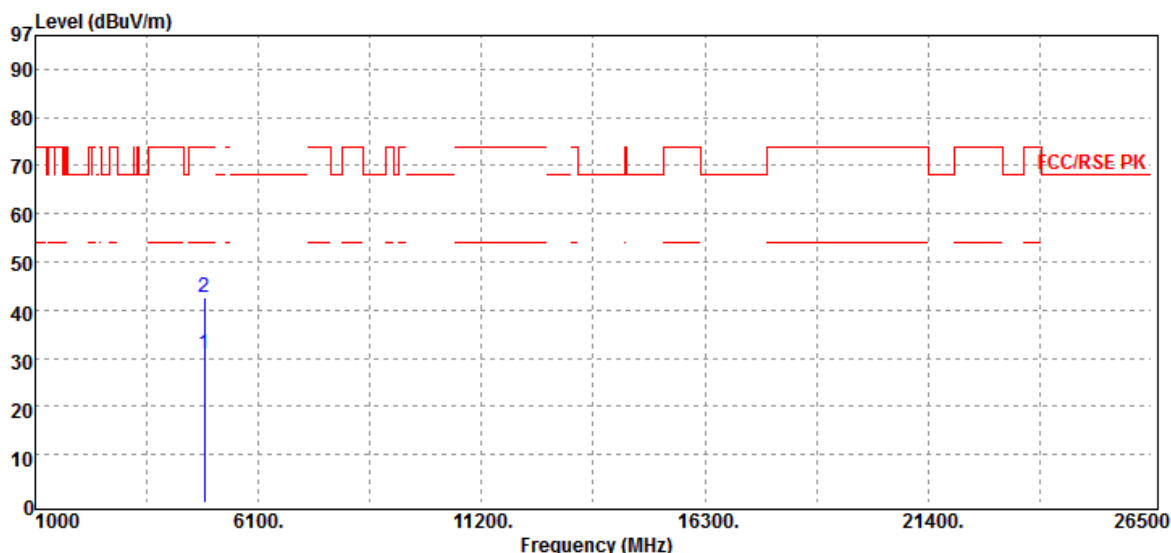
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Operation Band :802.11n20  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
4874.00	Average	24.93	5.85	30.78	54.00	-23.22
4874.00	Peak	36.75	5.85	42.60	74.00	-31.40

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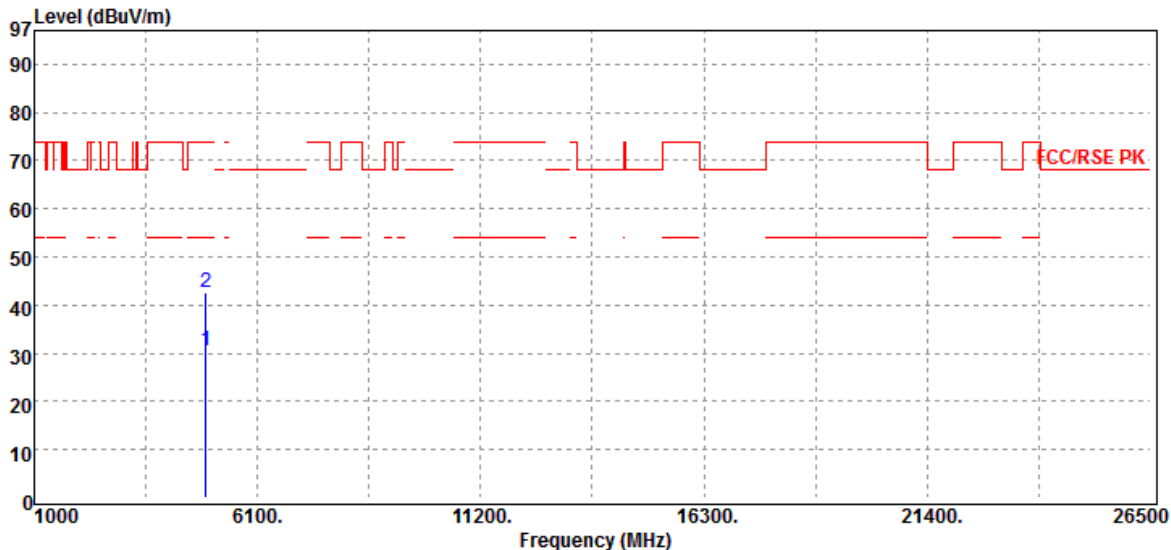
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Operation Band :802.11n20  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4924.00	Average	24.63	5.82	30.45	54.00	-23.55
4924.00	Peak	36.83	5.82	42.65	74.00	-31.35

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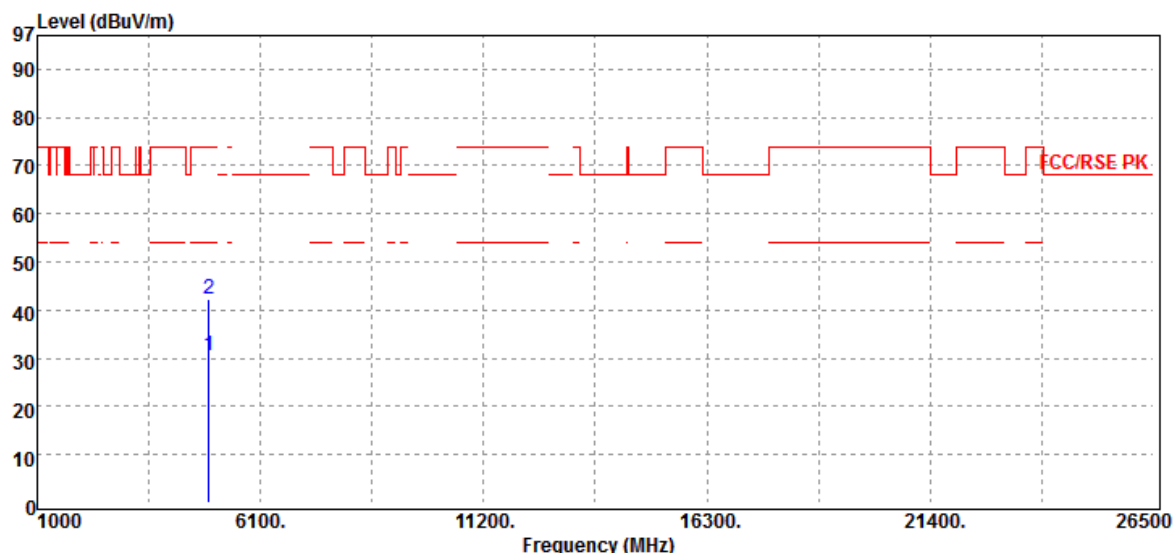
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Operation Band :802.11n20  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-06-26  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Kane  
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4924.00	Average	24.79	5.82	30.61	54.00	-23.39
4924.00	Peak	36.56	5.82	42.38	74.00	-31.62

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## 12 PEAK POWER SPECTRAL DENSITY

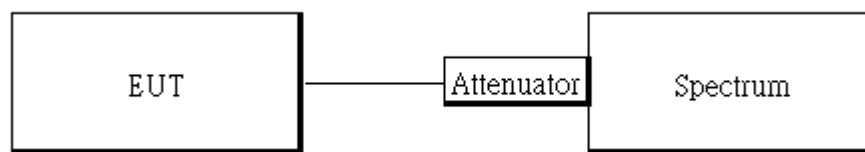
### 12.1 Standard Applicable

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

### 12.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY57120290	2018/02/14	2019/02/13
Attenuator	Mini-Circuit	BW-S10W2+	2	2018/01/02	2019/01/01
DC Power Supply	Anritsu	E3640A	MY40000811	2017/12/18	2018/12/17

### 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 & ANSI C63.10.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz. & the VBW = 10 kHz
5. For defining Restricted Band Edge Limit:  
Set the RBW = 100kHz & VBW = 300 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				POWER DENSITY 802.11g			
Freq. (MHz)	PPSD (dBm)	Limit (dBm)	Result	Freq. (MHz)	PPSD (dBm)	Limit (dBm)	Result
2412	-7.36	8.00	PASS	2412	-16.09	8.00	PASS
2437	-7.57	8.00	PASS	2437	-15.48	8.00	PASS
2462	-7.16	8.00	PASS	2462	-15.24	8.00	PASS

POWER DENSITY 802.11n HT20			
Freq. (MHz)	PPSD (dBm)	Limit (dBm)	Result
2412	-16.71	8.00	PASS
2437	-15.30	8.00	PASS
2462	-14.28	8.00	PASS

offset 11.00 dB for SISO mode  
offset dB for MIMO mode

*\*Refer to next page for plots*

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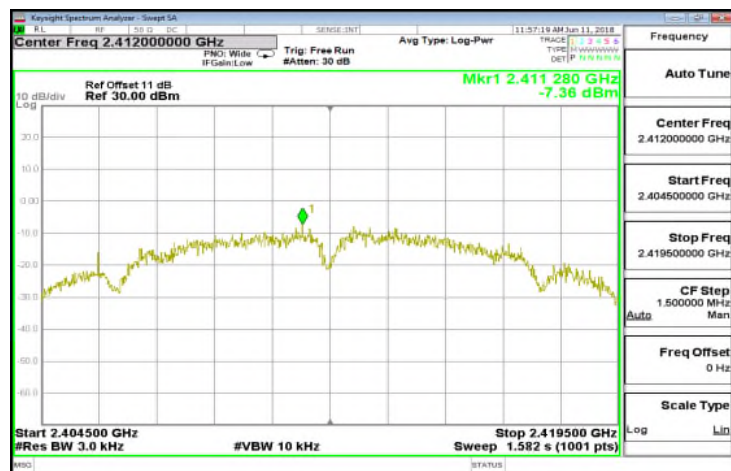
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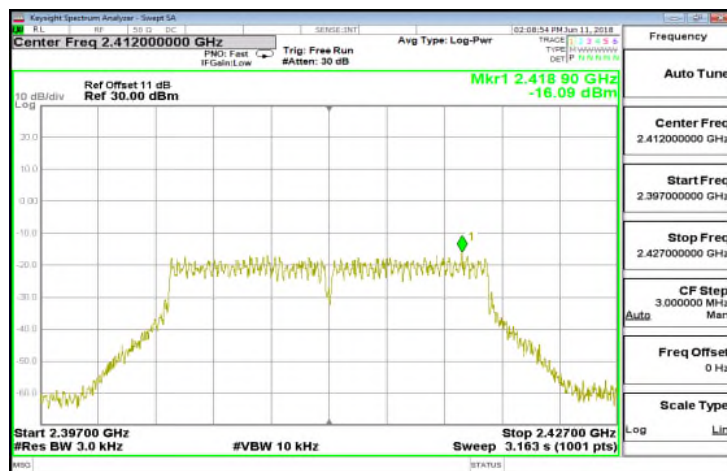
802.11b

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

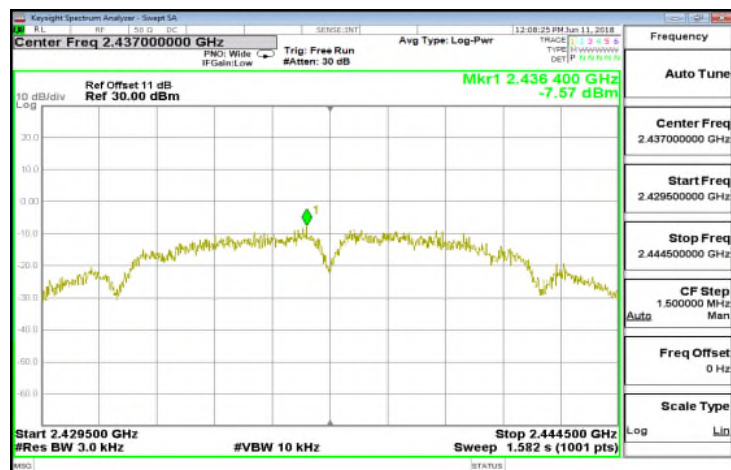


802.11g

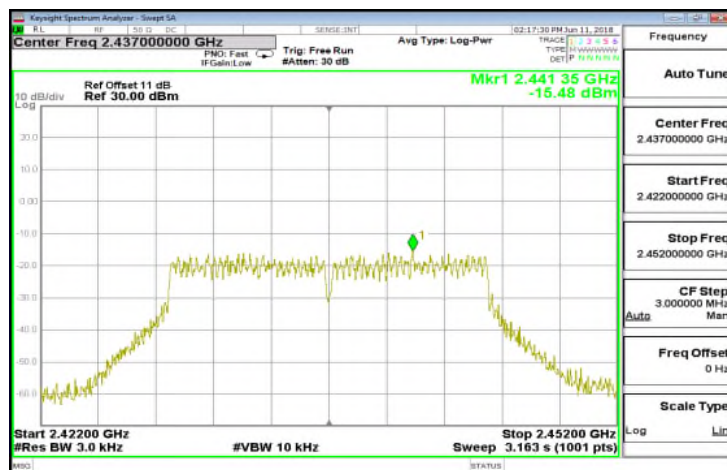
## Power Spectral Density Test Plot (CH-Low)



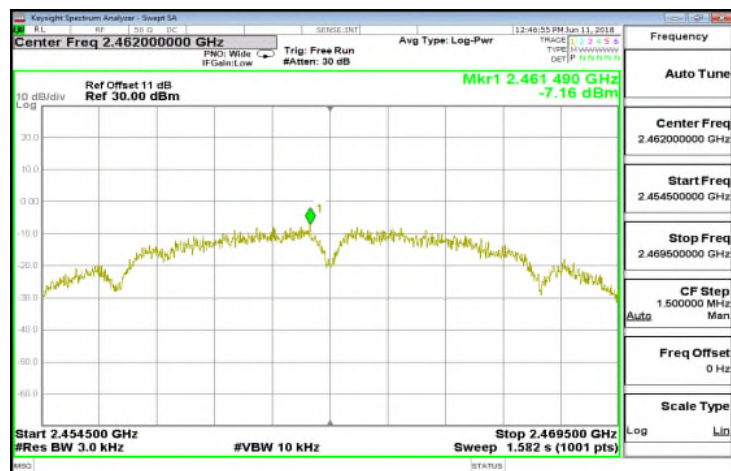
## Power Spectral Density Test Plot (CH-Mid)



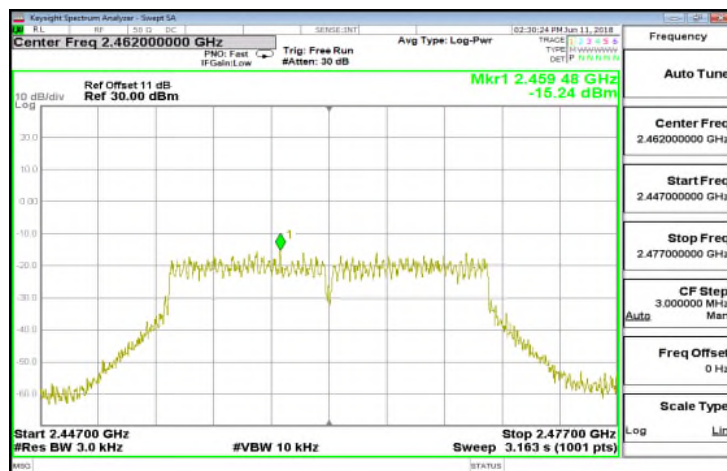
## Power Spectral Density Test Plot (CH-Mid)



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



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



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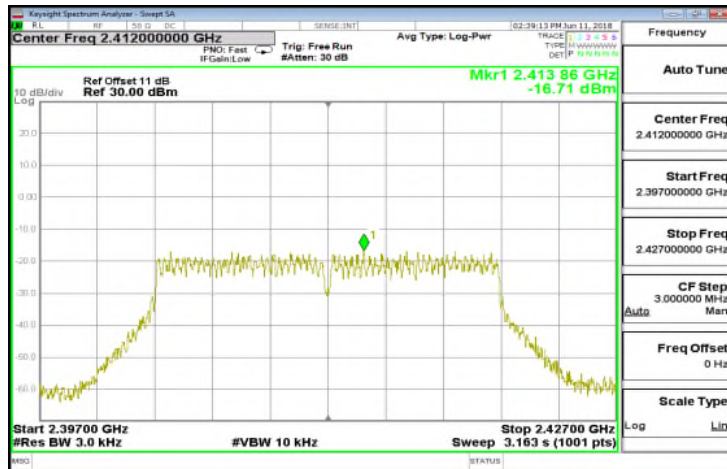
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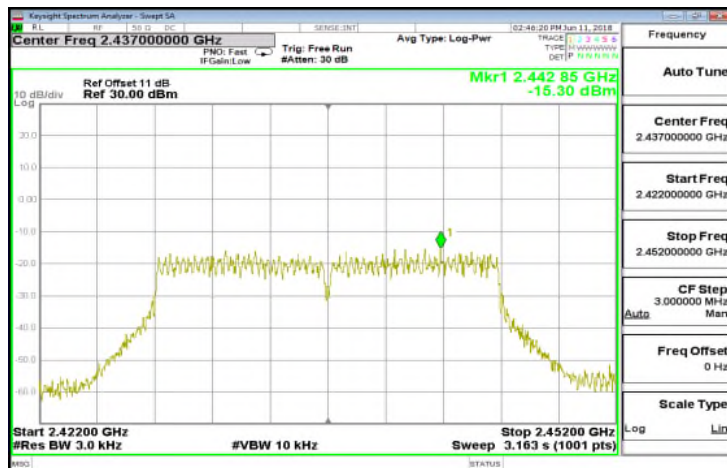
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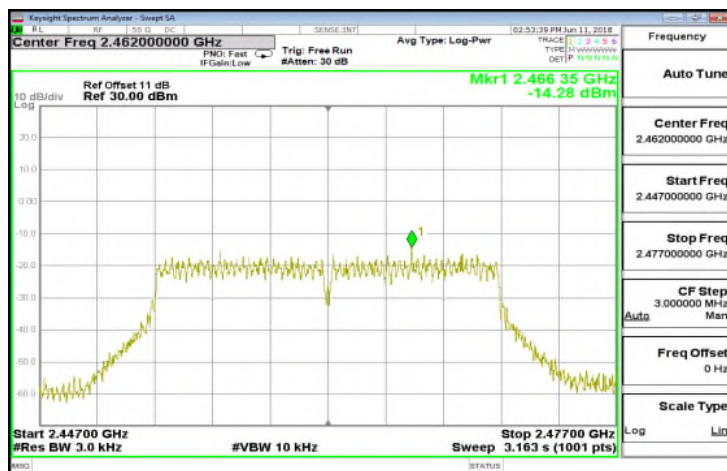
### Power Spectral Density Test Plot (CH-Low)



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



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

*~ End of Report ~*

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