

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

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

OF

**Applicant:** FUJITSU CONNECTED TECHNOLOGIES Ltd.  
1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki 211-8588,  
Japan

**Product Name:** Smart Phone

**Brand Name:** FUJITSU

**Model No.:** F-01L

**Model Difference:** N/A

**FCC ID:** 2AQYEFMP167

**Report Number:** ER/2018/70059

**FCC Rule Part:** §15.247, Cat: DTS

**Issue Date:** Nov. 8th, 2018

**Date of Test:** Aug. 28th, 2018 ~ Sep.14th, 2018

**Date of EUT Re-** Aug. 28th, 2018

**ceived:**

### We hereby certify that:

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

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

**Tested By:**

*Marcus Tseng*

**Marcus Tseng / Engineer**

**Approved By:**

*Blue Yang*

**Blue Yang / Supervisor**



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## Revision History

Report Number	Revision	Description	Effectuated Page	Issue Date	Revised By
ER/2018/70059	Rev.00	Initial creation of document	All	Sep. 20th, 2018	Stefanie Yu / Clerk
ER/2018/70059	Rev.01	Revised section 1.1	All	Nov. 8th, 2018	Stefanie Yu / Clerk

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# 1 GENERAL INFORMATION

## 1.1 Product description

General:

Product Name:	Smart Phone		
Brand Name:	FUJITSU		
Marketing Name:	N/A		
Model No.:	F-01L		
Model Difference:	N/A		
Software version:	V01R028Ae		
Hardware version:	V2.1.0		
Power Supply:	3.8Vdc from Rechargeable Li-ion Battery or 5Vdc /9Vdc / 12Vdc from AC/DC Adapter		
	Battery:	Model No.: CA54310-0075-A1, Supplier: FUJITSU CONNECTED TECHNOLOGIES LIMITED	
	Adapter:	Model No.: AC Adapter 06 Supplier: NTT docomo	

## WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power	Modulation Technology
11b/g	2412-2462	11	b: 18.02dBm g: 23.11dBm	DSSS, OFDM
11n	HT20 2412-2462	11	HT20:22.88dBm	OFDM
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		
Antenna Designation:		λ/4 Monopole Antenna, Peak Gain: -3.9 dBi		

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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

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.

## 1.6 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m\*9m\*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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## 2 SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

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

### 2.2 EUT Exercise

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

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50 uH 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 Configuration of Tested System

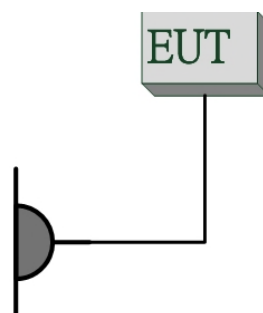
**Fig. 2-1 Conducted (Antenna Port) Emission Configuration**



**Fig 2-2 Radiated Emission**



**Fig 2-3 Conduction (AC Power Line) Radiated Emission**



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

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	Notebook	Lenovo	L430	R9-WR6X4	Shielded	Unshielded
2	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A

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### 3 SUMMARY OF TEST RESULTS

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

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## 4 DESCRIPTION OF TEST MODES

### 4.1 Operated in 2400 ~ 2483.5MHz Band

11 channels are provided for 802.11b, 802.11g and 802.11n\_HT20

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

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		

### 4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
3. Investigation has been done on all the possible configurations for searching the worst case.

#### RADIATED EMISSION TEST:

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

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

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**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)
802.11b	1 to 11	1, 6, 11	DSSS	1
802.11g	1 to 11	1, 6, 11	OFDM	6
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS 0

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## 5 MEASUREMENT UNCERTAINTY

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

Radiated Spurious Emission:

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

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

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## 6 CONDUCTED EMISSION TEST

### 6.1 Standard Applicable

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

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

### 6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100335	Feb. 2nd, 2018	Feb. 1st, 2019
LISN	SCHWARZBECK	NSLK 8127	8127-649	May 18th, 2018	May 17th, 2019

### 6.3 EUT Setup

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

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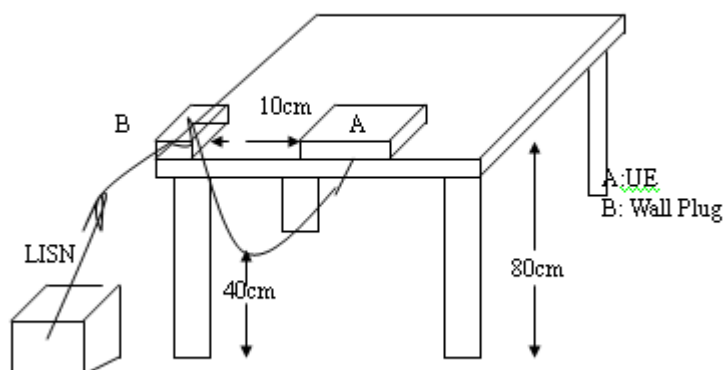
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## 6.4 Test SET-UP (Block Diagram of Configuration)



## 6.5 Measurement Procedure

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

## 6.6 Measurement Result

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

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

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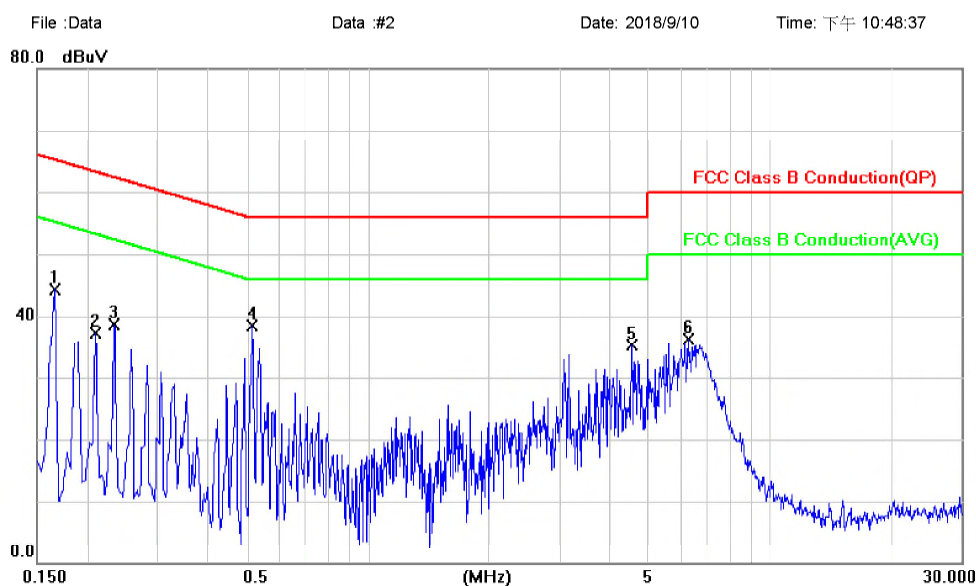
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## AC POWER LINE CONDUCTED EMISSION TEST DATA

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

Site: Conduction Room	Phase: L1	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		0.1660	44.17	0.04	44.21	65.16	-20.95	peak	
2		0.2100	37.19	0.04	37.23	63.21	-25.98	peak	
3		0.2340	38.62	0.04	38.66	62.31	-23.65	peak	
4	*	0.5140	38.38	0.04	38.42	56.00	-17.58	peak	
5		4.5300	35.08	0.18	35.26	56.00	-20.74	peak	
6		6.2540	36.04	0.23	36.27	60.00	-23.73	peak	

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Site: Conduction Room

Phase: **N**

Temperature: 25 °C

Limit: FCC Class B Conduction(QP)

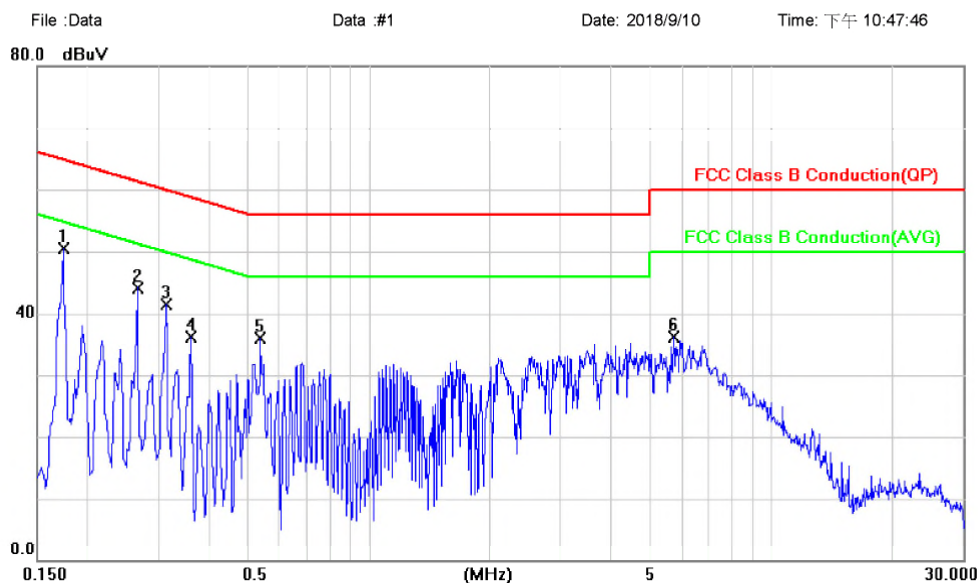
Power: AC 120V/60Hz

Humidity: 65 %

Mode: Operation

Note:

## Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1740	50.47	0.04	50.51	64.77	-14.26	peak	
2		0.2660	44.16	0.04	44.20	61.24	-17.04	peak	
3		0.3140	41.54	0.04	41.58	59.86	-18.28	peak	
4		0.3620	36.31	0.04	36.35	58.68	-22.33	peak	
5		0.5380	36.13	0.04	36.17	56.00	-19.83	peak	
6		5.7220	36.09	0.22	36.31	60.00	-23.69	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	100.00	0.00	0.00	0.01
802.11g	99.85	0.01	0.18	1.00
802.11n_20	99.82	0.01	0.20	1.00

$$\text{Duty Cycle Factor: } 10 * \log(1/0.9925) = 0.03$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.9524) = 0.21$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.952) = 0.21$$

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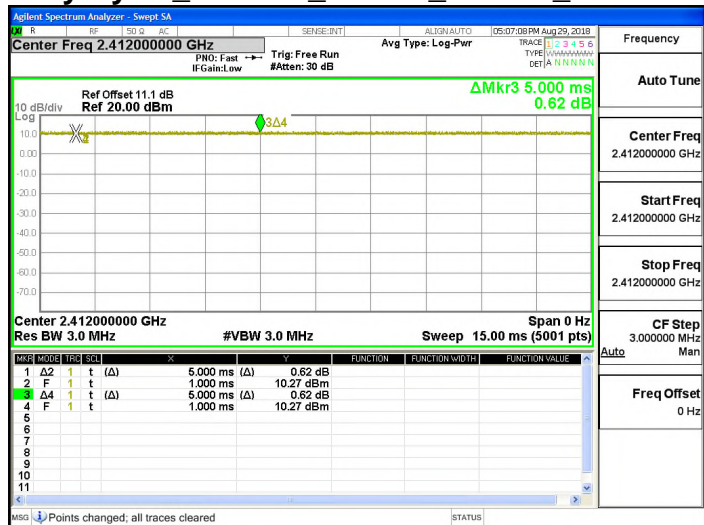
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## 7.1 DUTY CYCLE TEST SIGNAL Measurement Result

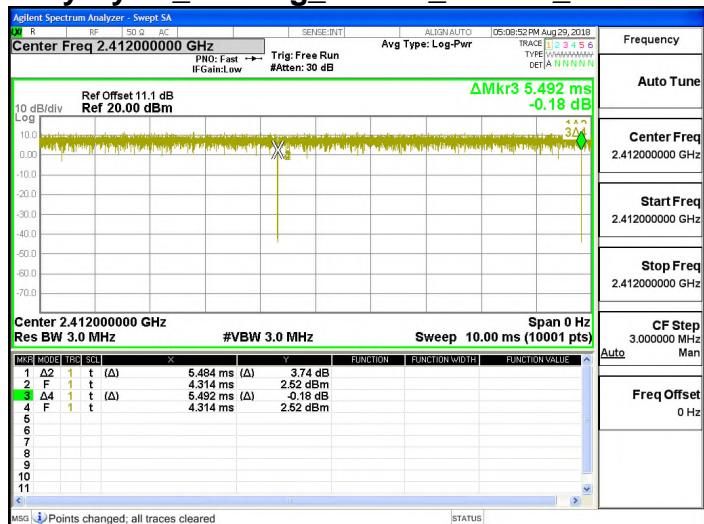
### Duty Cycle 802.11b 20MHz Chain0 2412MHz



### Duty Cycle 802.11n 20MHz Chain0 2412MHz



### Duty Cycle 802.11g 20MHz Chain0 2412MHz



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## 8 PEAK OUTPUT POWER MEASUREMENT

### 8.1 Standard Applicable

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

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

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

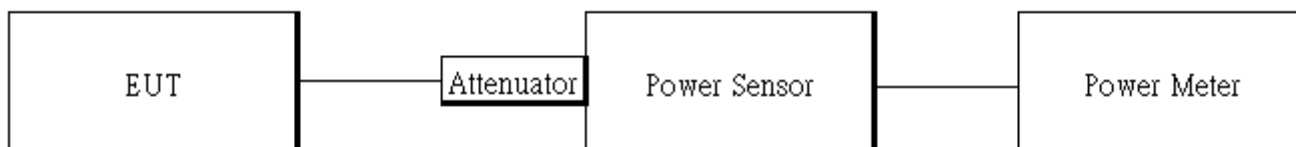
The antenna gain is not greater than 6 dBi. Therefore, reduction of power is not required.

### 8.2 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2496A	1804001	Feb. 01st, 2018	Jan. 31th, 2019
Power Sensor	Anritsu	MA2411B	1726104	Feb. 01st, 2018	Jan. 31th, 2019
Power Sensor	Anritsu	MA2411B	1726107	Feb. 01st, 2018	Jan. 31th, 2019
DC Power Supply	Anritsu	E3640A	MY52410006	Nov. 28tg, 2017	Nov. 27th, 2018
Attenuator	Mini-Circuit	BW-S10W2+	2	Jan. 02nd, 2018	Jan. 01st, 2019
DC Block	Mini-Circuits	BLK-18-S+	1	Jan. 02nd, 2018	Jan. 01st, 2019
Coaxial Cables	N/A	WK CE Cable	N/A	Jan. 02nd, 2018	Jan. 01st, 2019
Notebook	Lenovo	L430	R9-WGNK5	N/A	N/A

### 8.3 Test Set-up

Power Meter:



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## 8.4 Measurement Procedure

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

### Power Meter:

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

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

## 8.5 Measurement Result

802.11b Ch0					
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit	RESULT
1	2412	1	17.50	1 Watt = 30.00 dBm	PASS
6	2437	1	18.02	1 Watt = 30.00 dBm	PASS
11	2462	1	17.41	1 Watt = 30.00 dBm	PASS
802.11b Ch0					
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit	RESULT
1	2412	1	15.09	1 Watt = 30.00 dBm	PASS
6	2437	1	15.05	1 Watt = 30.00 dBm	PASS
11	2462	1	15.07	1 Watt = 30.00 dBm	PASS

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802.11g Ch0					
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit	RESULT
1	2412	6	23.11	1 Watt = 30.00 dBm	PASS
6	2437	6	22.98	1 Watt = 30.00 dBm	PASS
11	2462	6	22.48	1 Watt = 30.00 dBm	PASS
802.11g Ch0					
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit	RESULT
1	2412	6	15.43	1 Watt = 30.00 dBm	PASS
6	2437	6	15.37	1 Watt = 30.00 dBm	PASS
11	2462	6	15.39	1 Watt = 30.00 dBm	PASS

802.11n_HT20M Ch0					
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit	RESULT
1	2412	MCS0	22.88	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	22.86	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	22.59	1 Watt = 30.00 dBm	PASS
802.11n_HT20M Ch0					
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit	RESULT
1	2412	MCS0	15.39	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	15.27	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	15.35	1 Watt = 30.00 dBm	PASS

offset 11.60 dB for SISO mode

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

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## 9 6DB BANDWIDTH MEASUREMENT

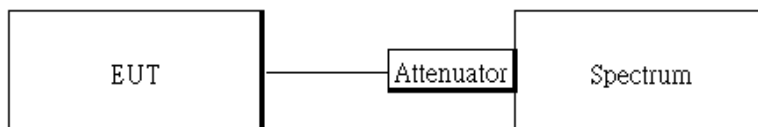
### 9.1 Standard Applicable

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

### 9.2 Measurement Equipment Used

SGS Conducted Room					
Name of Equip-ment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	R&S	FSV-30	101398	Oct. 19th, 2017	Oct. 18th, 2018
DC Power Supply	Anritsu	E3640A	MY52410006	Nov. 28th, 2017	Nov. 27th, 2018
Attenuator	Mini-Circuit	BW-S10W2+	2	Jan. 02nd, 2018	Jan. 01st, 2019
DC Block	Mini-Circuits	BLK-18-S+	1	Jan. 02nd, 2018	Jan. 01st, 2019
Coaxial Cables	N/A	WK CE Cable	N/A	Jan. 02nd, 2018	Jan. 01st, 2019
Notebook	Lenovo	L430	R9-WGNK5	N/A	N/A

### 9.3 Test Set-up



### 9.4 Measurement Procedure

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

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## 9.5 Measurement Result

### 6dB Bandwidth

802.11b Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	8094.00	> 500	PASS
2437	<b>8108.00</b>	> 500	PASS
2462	8107.00	> 500	PASS

802.11g Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	<b>16430.00</b>	> 500	PASS
2437	16420.00	> 500	PASS
2462	16410.00	> 500	PASS

802.11\_n\_HT20 Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	<b>17640.00</b>	> 500	PASS
2437	<b>17640.00</b>	> 500	PASS
2462	17610.00	> 500	PASS

*\*Refer to next page for plots*

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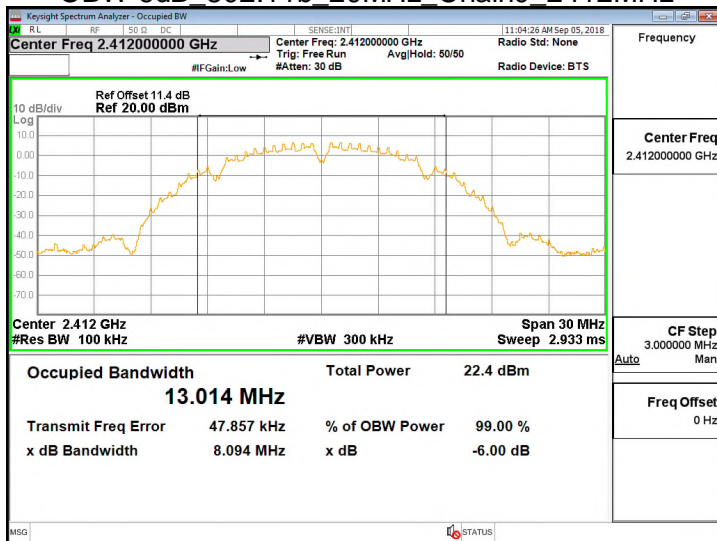
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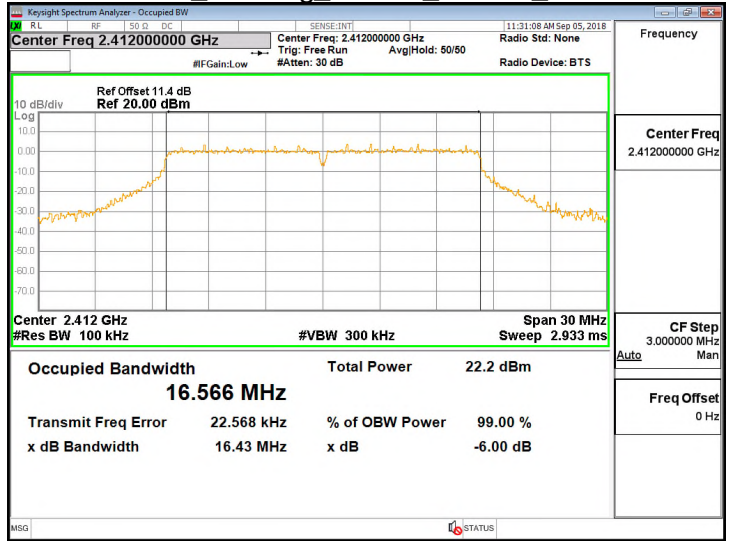
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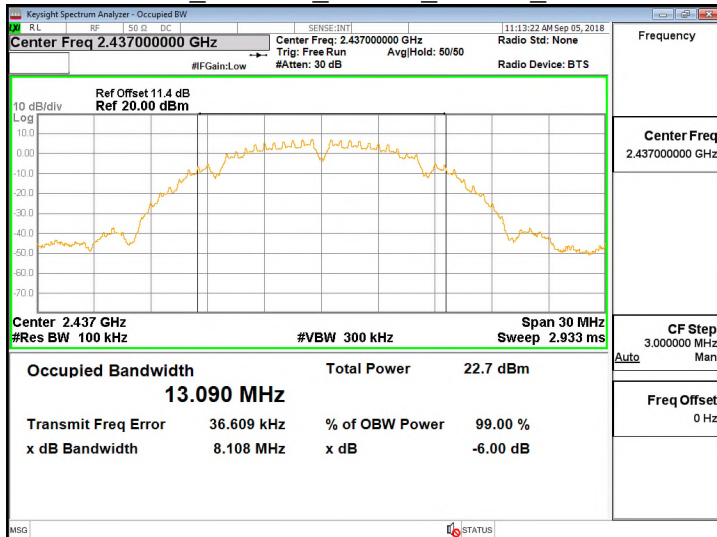
OBW 6dB 802.11b 20MHz Chain0 2412MHz



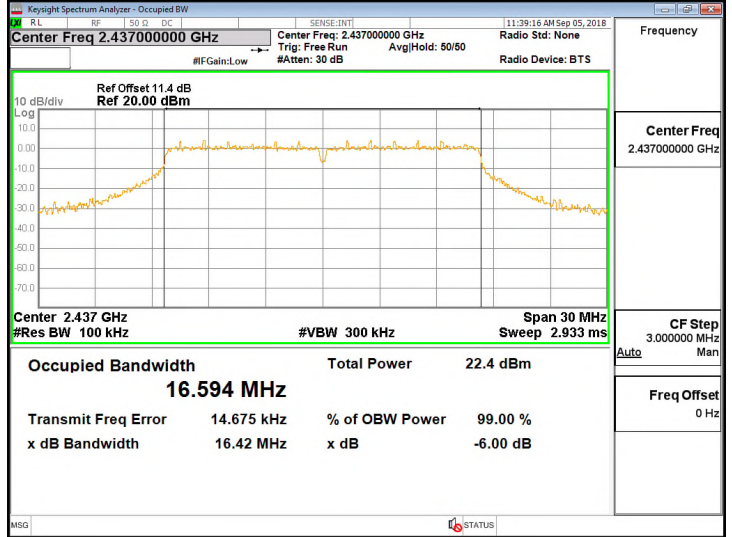
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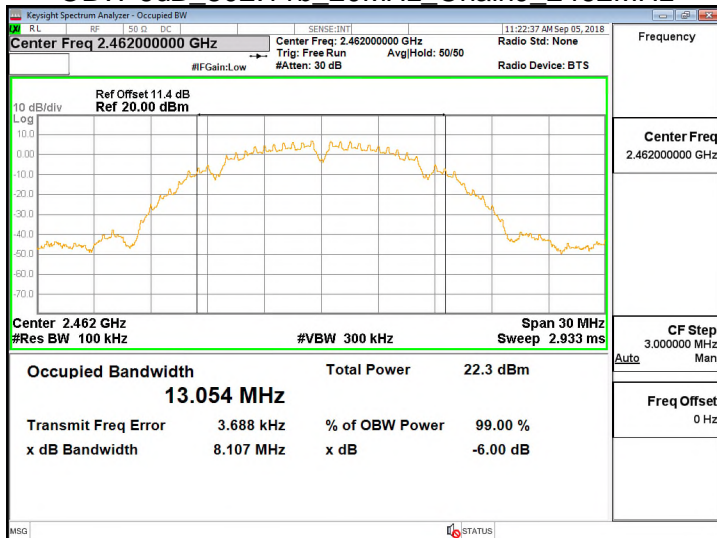
OBW 6dB 802.11b 20MHz Chain0 2437MHz



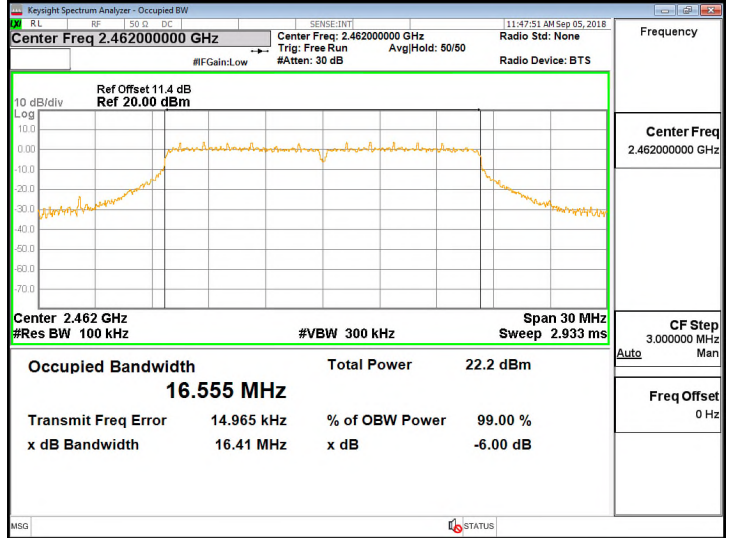
OBW 6dB 802.11g 20MHz Chain0 2437MHz



OBW 6dB 802.11b 20MHz Chain0 2462MHz



OBW 6dB 802.11g 20MHz Chain0 2462MHz



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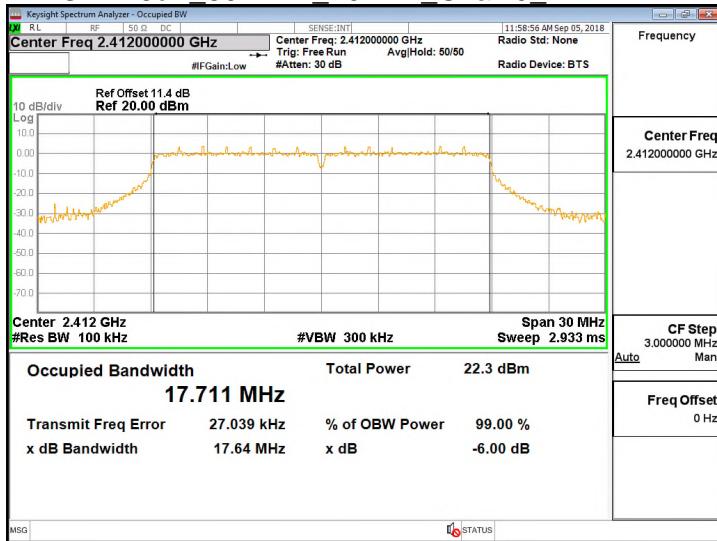
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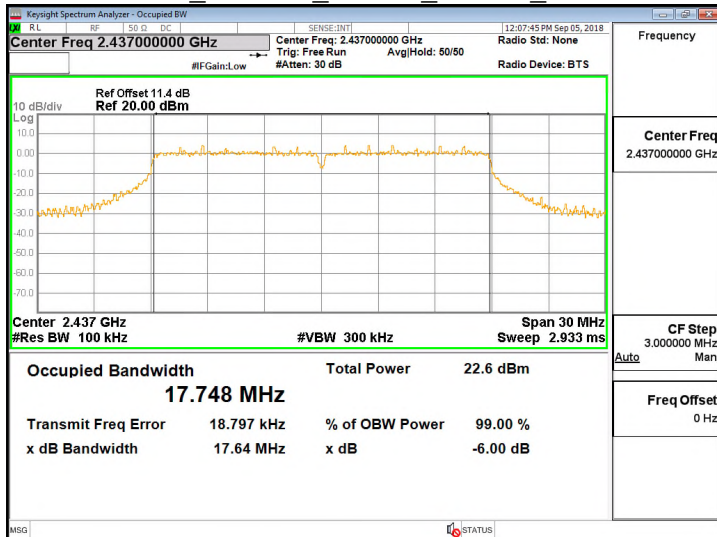
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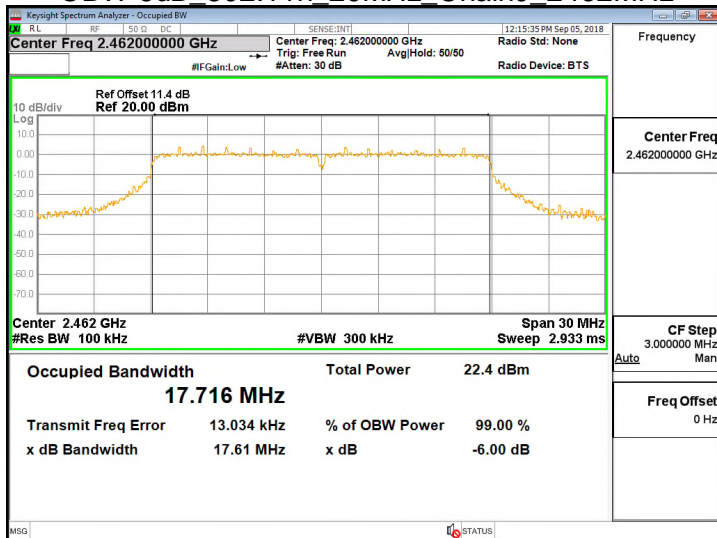
## OBW 6dB 802.11n 20MHz Chain0 2412MHz



## OBW 6dB 802.11n 20MHz Chain0 2437MHz



## OBW 6dB 802.11n 20MHz Chain0 2462MHz



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## 10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

### 10.1 Standard Applicable

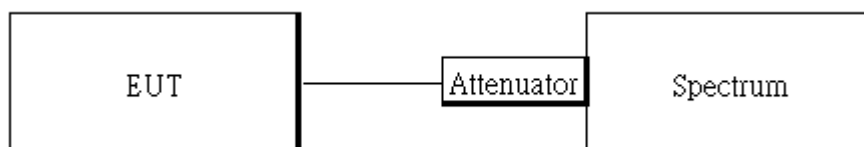
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

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

### 10.2 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	R&S	FSV-30	101398	Oct. 19th, 2017	Oct. 18th, 2018
DC Power Supply	Anritsu	E3640A	MY52410006	Nov. 28th, 2017	Nov. 27th, 2018
Attenuator	Mini-Circuit	BW-S10W2+	2	Jan. 02nd, 2018	Jan. 01st, 2019
DC Block	Mini-Circuits	BLK-18-S+	1	Jan. 02nd, 2018	Jan. 01st, 2019
Coaxial Cables	N/A	WK CE Cable	N/A	Jan. 02nd, 2018	Jan. 01st, 2019
Notebook	Lenovo	L430	R9-WGNK5	N/A	N/A

### 10.3 Test SET-UP



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## 10.4 Measurement Procedure

### Reference Level of Emission 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 .
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 .
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 .
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	6.89	-13.11
2437	6.66	-13.34
2462	6.54	-13.46

Reference Level of Limit 802.11g mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	3.91	-16.09
2437	4.38	-15.62
2462	3.98	-16.02

Reference Level of Limit 802.11n20 mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	3.89	-16.11
2437	4.47	-15.53
2462	3.71	-16.29

*offset 11.60 dB for SISO mode*

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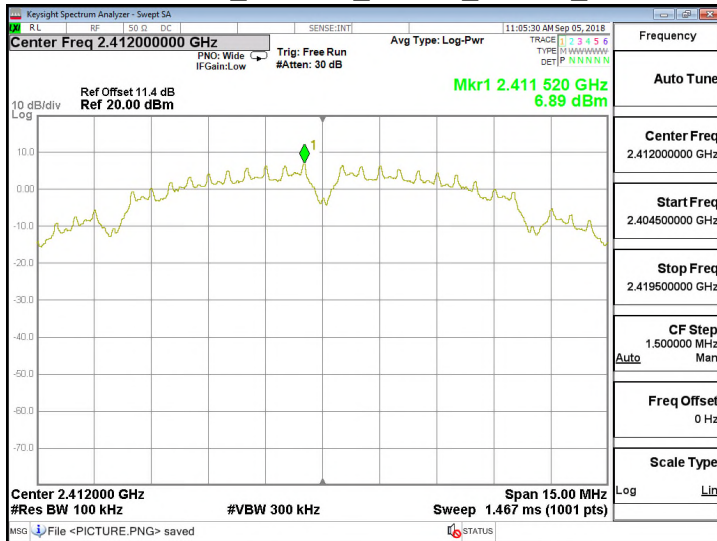
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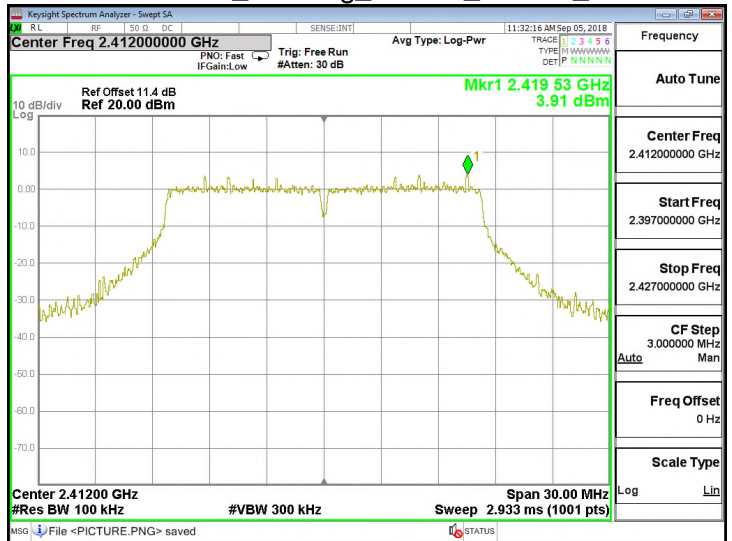
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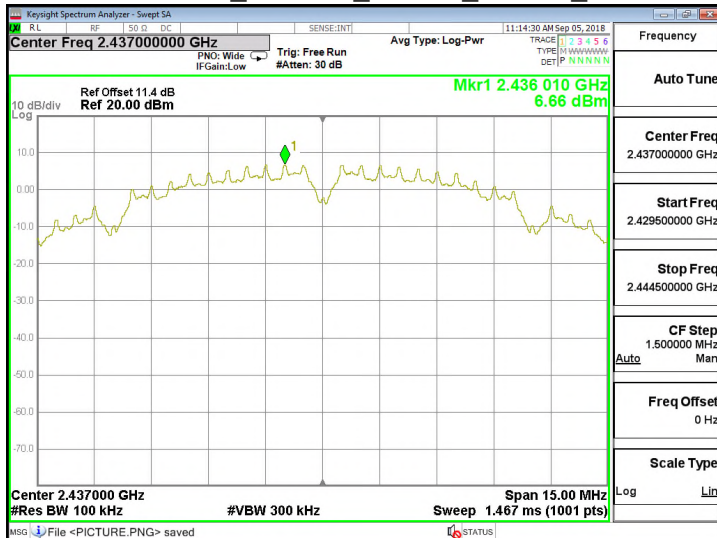
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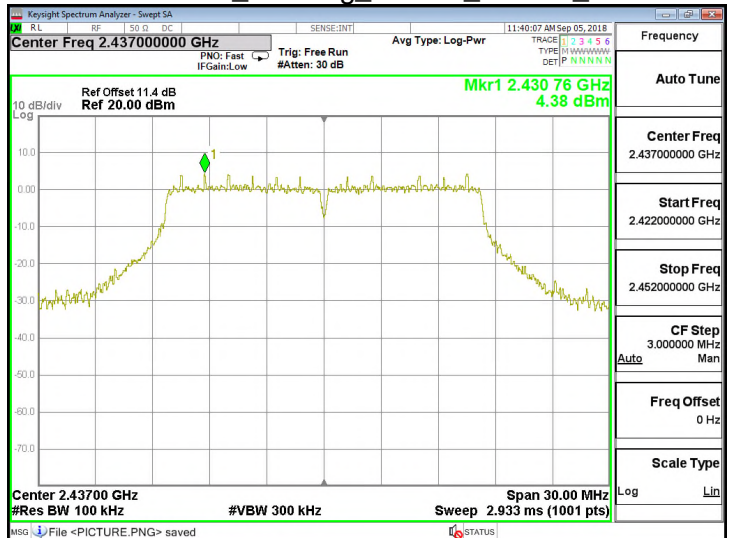
## Reference Level\_802.11g\_20MHz\_Chain0\_2412MHz



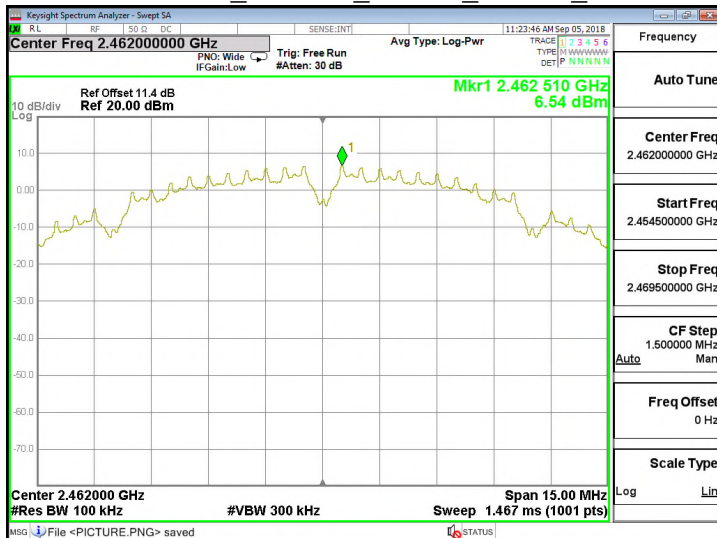
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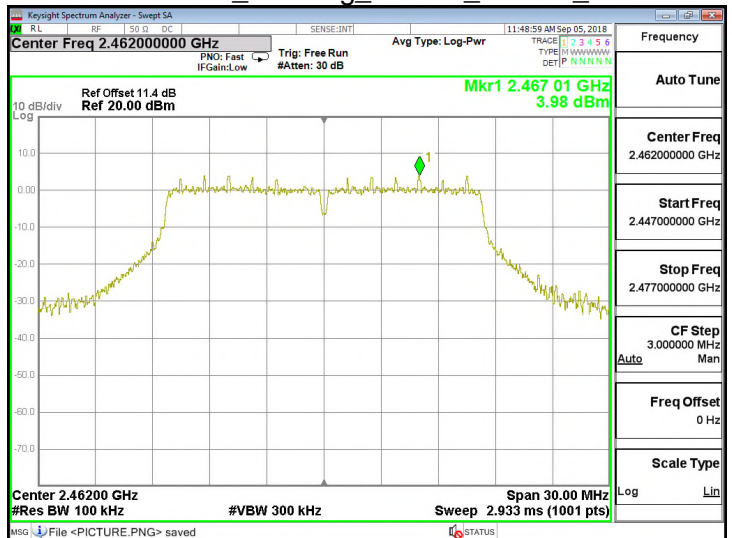
## Reference Level\_802.11g\_20MHz\_Chain0\_2437MHz



## Reference Level\_802.11b\_20MHz\_Chain0\_2462MHz



## Reference Level\_802.11g\_20MHz\_Chain0\_2462MHz



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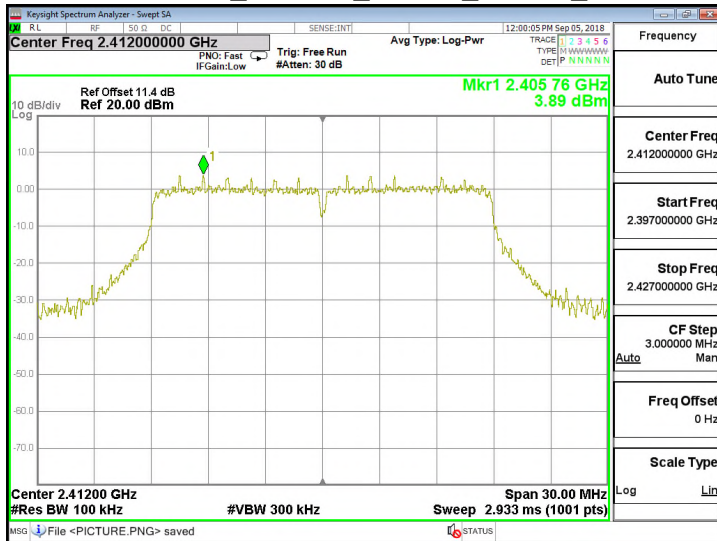
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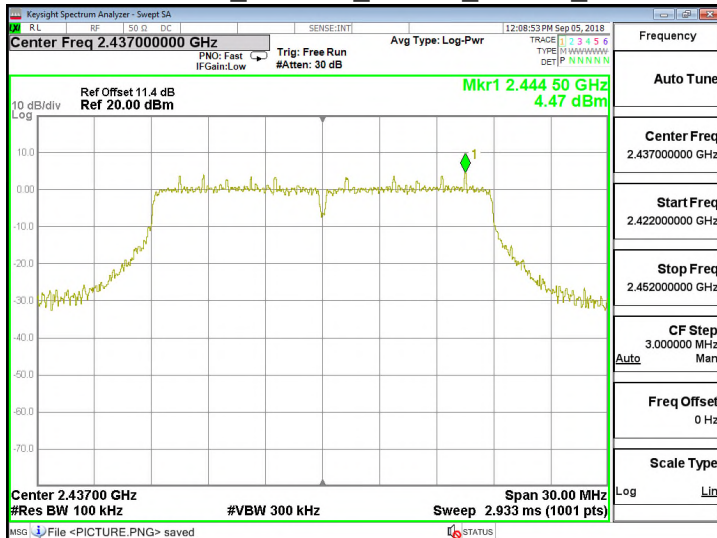
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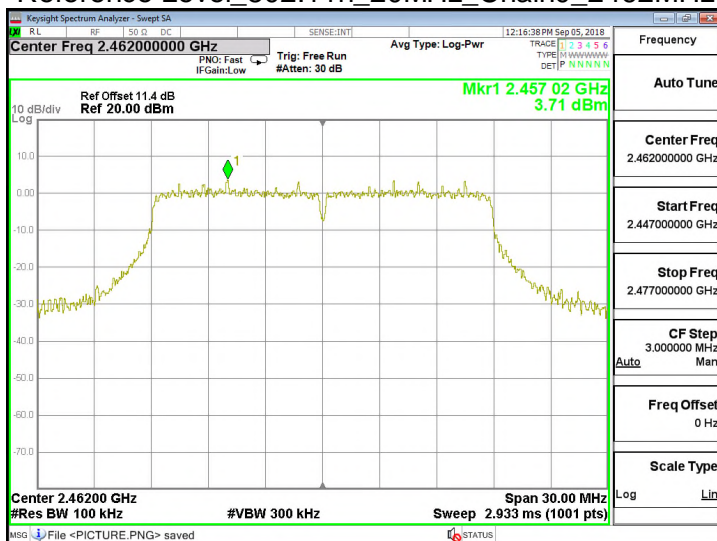
## Reference Level\_802.11n\_20MHz\_Chain0\_2412MHz



## Reference Level\_802.11n\_20MHz\_Chain0\_2437MHz



## Reference Level\_802.11n\_20MHz\_Chain0\_2462MHz



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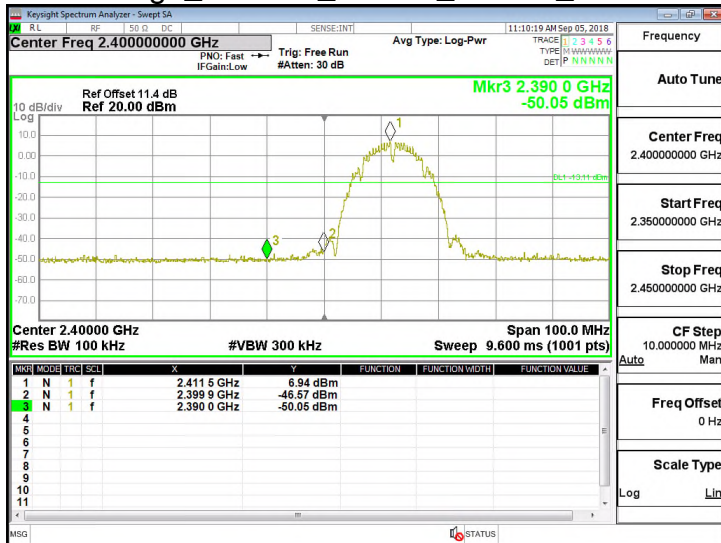
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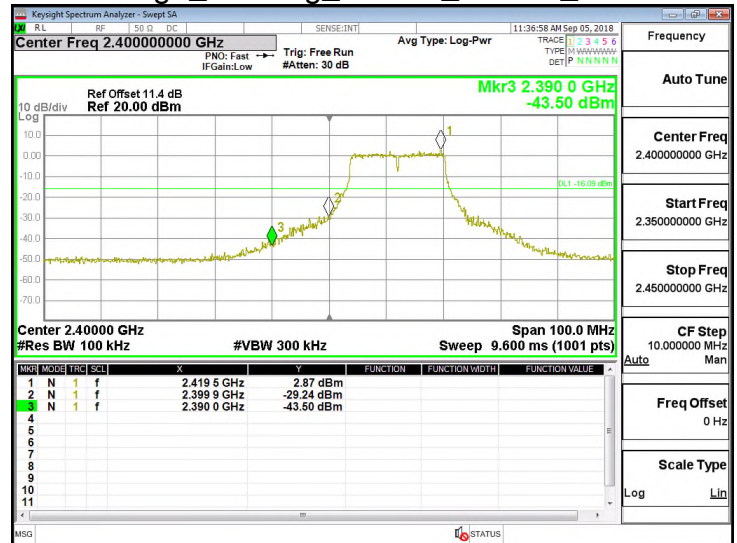
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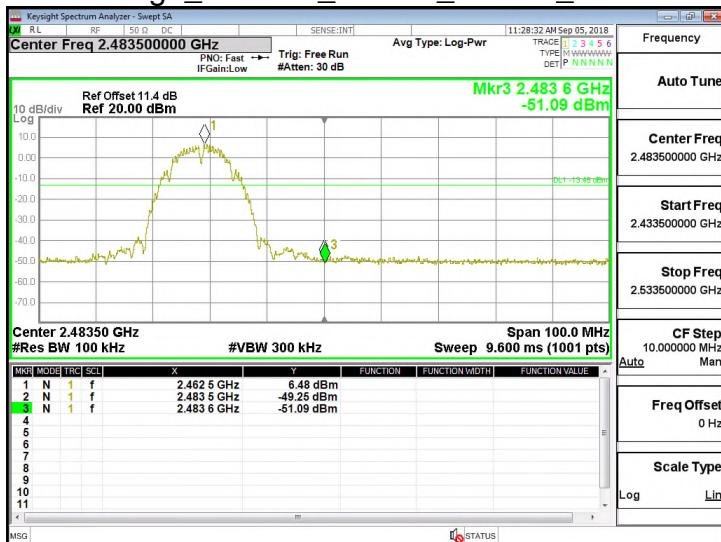
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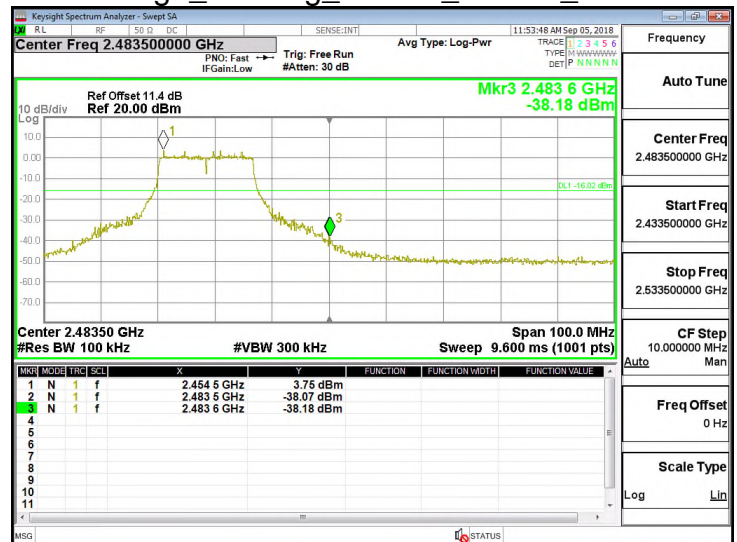
## Band Edge\_802.11g\_20MHz\_Chain0\_2412MHz



## Band Edge\_802.11b\_20MHz\_Chain0\_2462MHz



## Band Edge\_802.11g\_20MHz\_Chain0\_2462MHz



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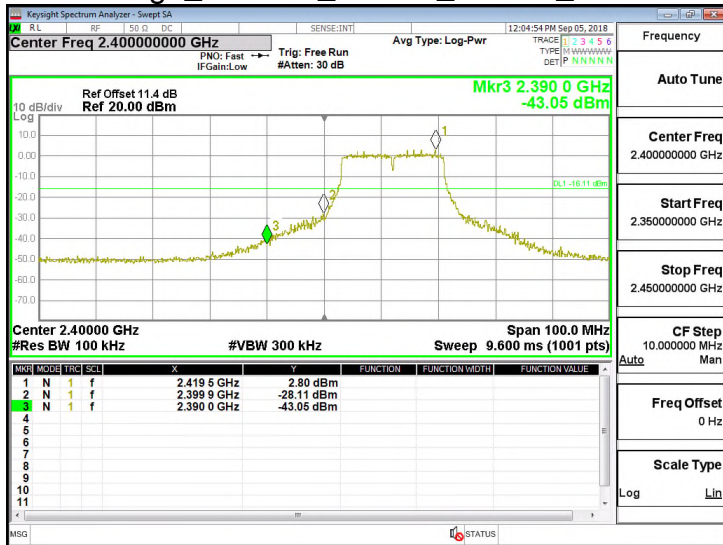
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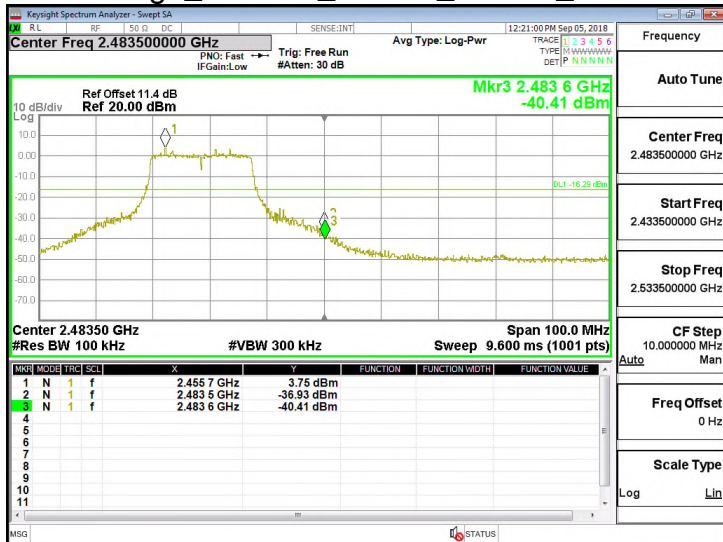
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## Band Edge\_802.11n\_20MHz\_Chain0\_2412MHz



## Band Edge\_802.11n\_20MHz\_Chain0\_2462MHz



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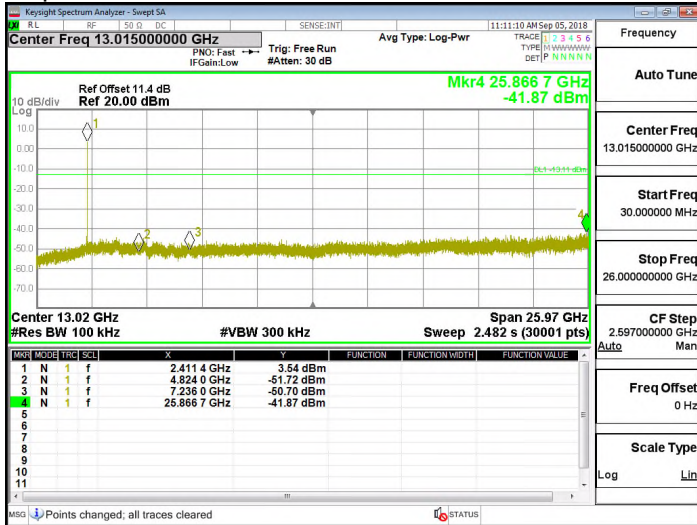
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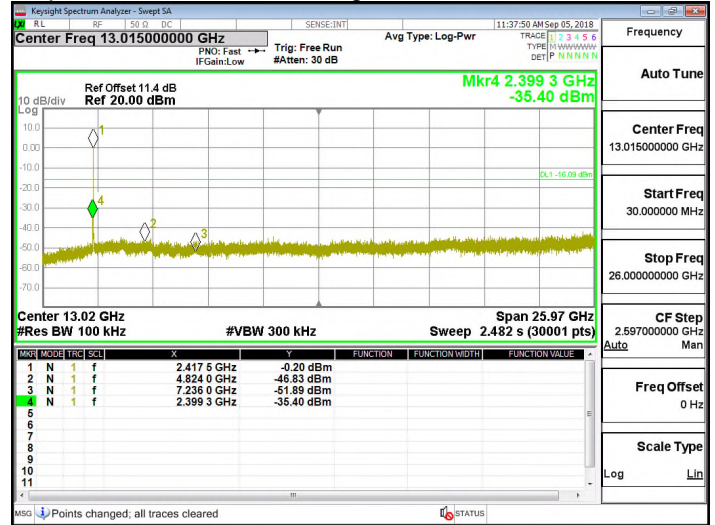
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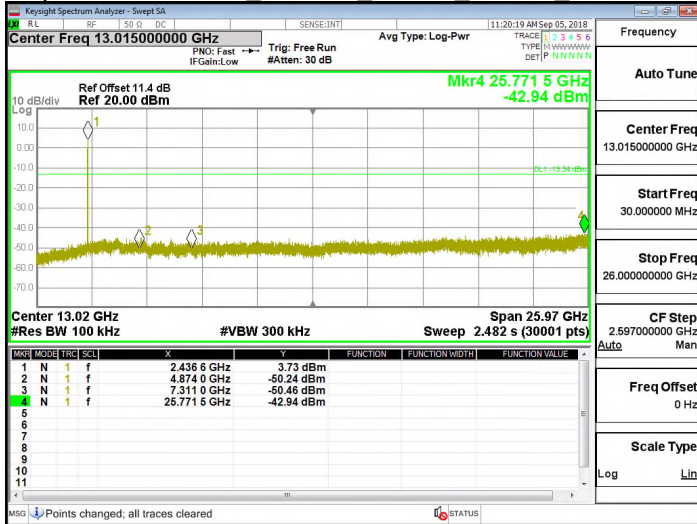
## Spurious Emission\_802.11b\_20MHz\_Chain0\_2412MHz



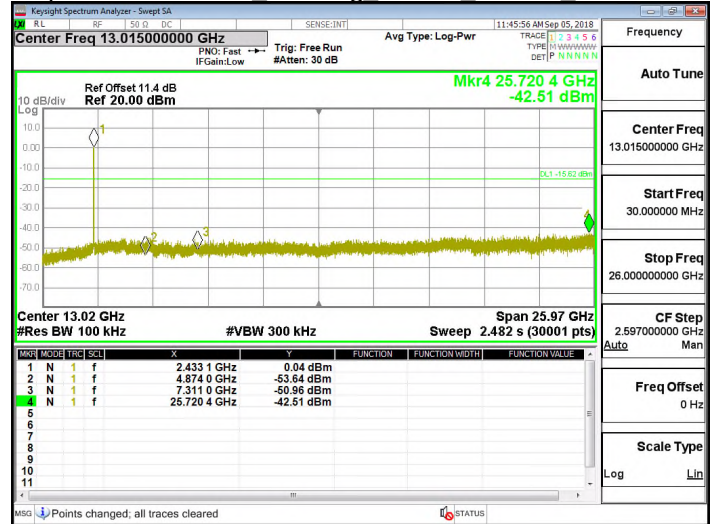
## Spurious Emission\_802.11g\_20MHz\_Chain0\_2412MHz



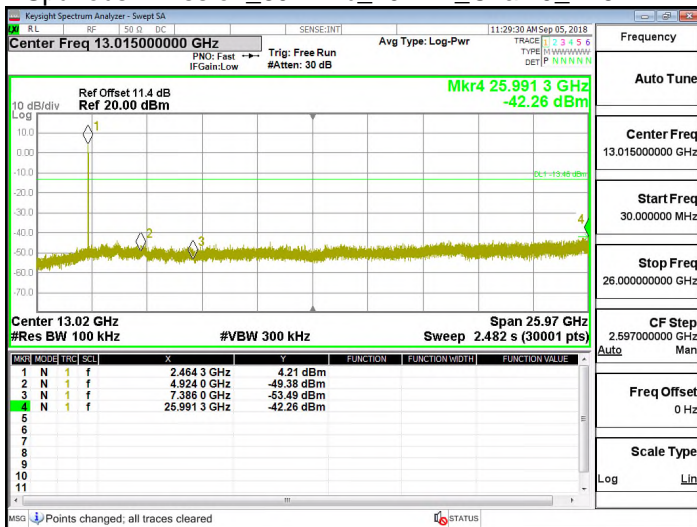
## Spurious Emission\_802.11b\_20MHz\_Chain0\_2437MHz



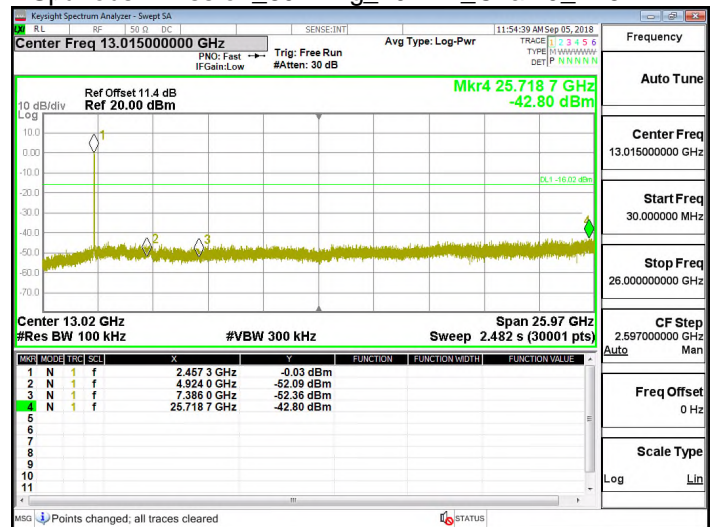
## Spurious Emission\_802.11g\_20MHz\_Chain0\_2437MHz



## Spurious Emission\_802.11b\_20MHz\_Chain0\_2462MHz



## Spurious Emission\_802.11g\_20MHz\_Chain0\_2462MHz



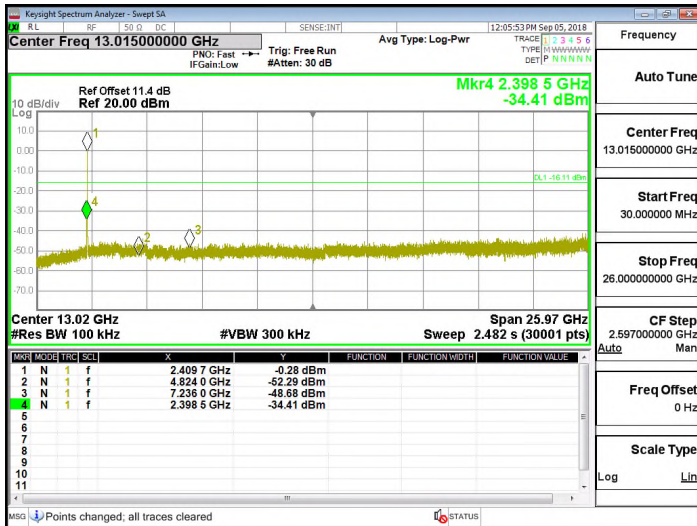
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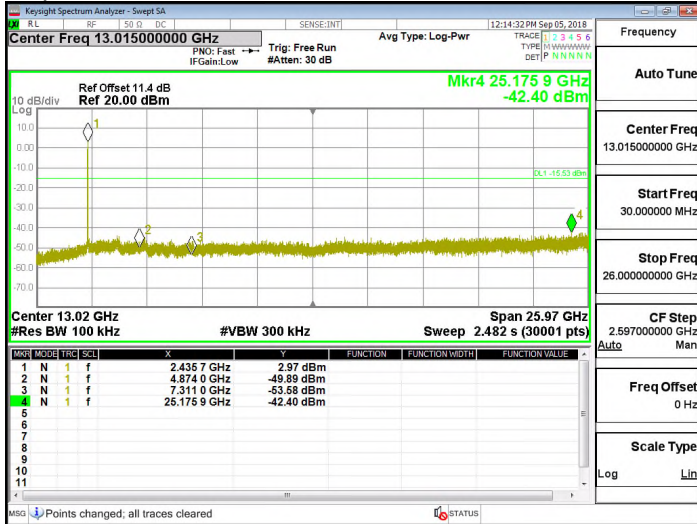
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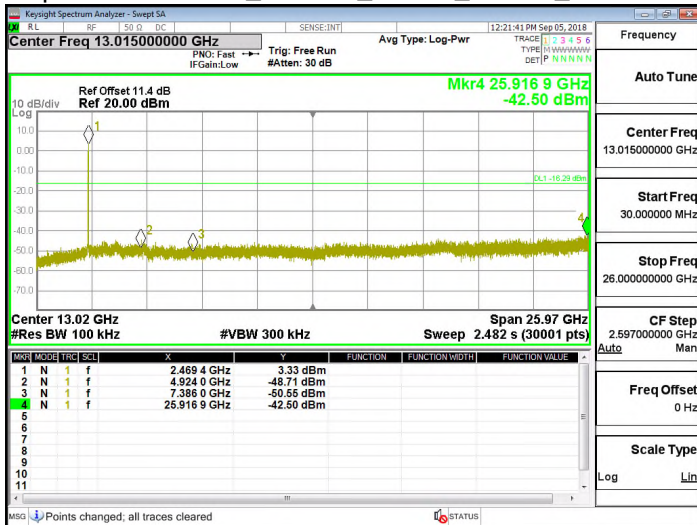




## Spurious Emission\_802.11n\_20MHz\_Chain0\_2437MHz



## Spurious Emission\_802.11n\_20MHz\_Chain0\_2462MHz



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## 11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

### 11.1 Standard Applicable

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

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

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

**Note:**

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

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## 11.2 Measurement Equipment Used:

SGS SAC-III					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Bi-log Antenna	SCHWAZBECK	VULB9168	378	Dec. 29th, 2017	Dec. 28th, 2018
Horn Antenna	Schwarzbeck	BBHA9120D	1441	Aug. 16th, 2018	Aug. 15th, 2019
Horn Antenna	Schwarzbeck	BBHA9170	184	Dec. 12th, 2017	Dec. 11th, 2018
Loop Antenna	ETS.LINDGREN	6502	148045	Sep. 26th, 2017	Sep. 25th, 2018
3m Site NSA	SGS	966 chamber	N/A	Jan. 02nd, 2018	Jan. 01st, 2019
Spectrum Analyzer	Agilent	E4446A	MY51100003	May 15th, 2018	May 14th, 2019
EMI Test Receiver	R&S	ESCI7	100335	Feb. 02nd, 2018	Feb. 01st, 2019
Pre-Amplifier	HP	8449B	3008A00578	Jan. 02nd, 2018	Jan. 01st, 2019
Pre-Amplifier	HP	8447D	2944A07676	Jan. 02nd, 2018	Jan. 01st, 2019
Pre-Amplifier	EMC Instruments	EMC184045B	980135	Oct. 27th, 2017	Oct. 26th, 2018
Attenuator	Mini-Circuit	BW-S10W2+	2	Jan. 02nd, 2018	Jan. 01st, 2019
2GHz High Pass Filter	Micro-Tronics	HPM50110	36	Jan. 02nd, 2018	Jan. 01st, 2019
Filter 5150-5350 MHz	Micro-Tronics	BRM50703	1	Jan. 02nd, 2018	Jan. 01st, 2019
Low Loss Cable	Huber Suhner	966_RX	9	Jan. 02nd, 2018	Jan. 01st, 2019
Notebook	Lenovo	L430	R9-X11BG	N/A	N/A

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

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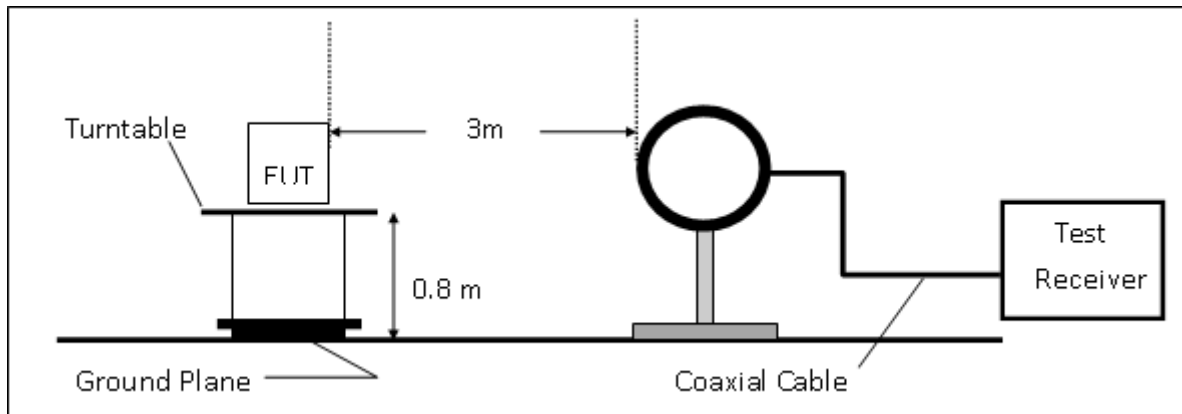
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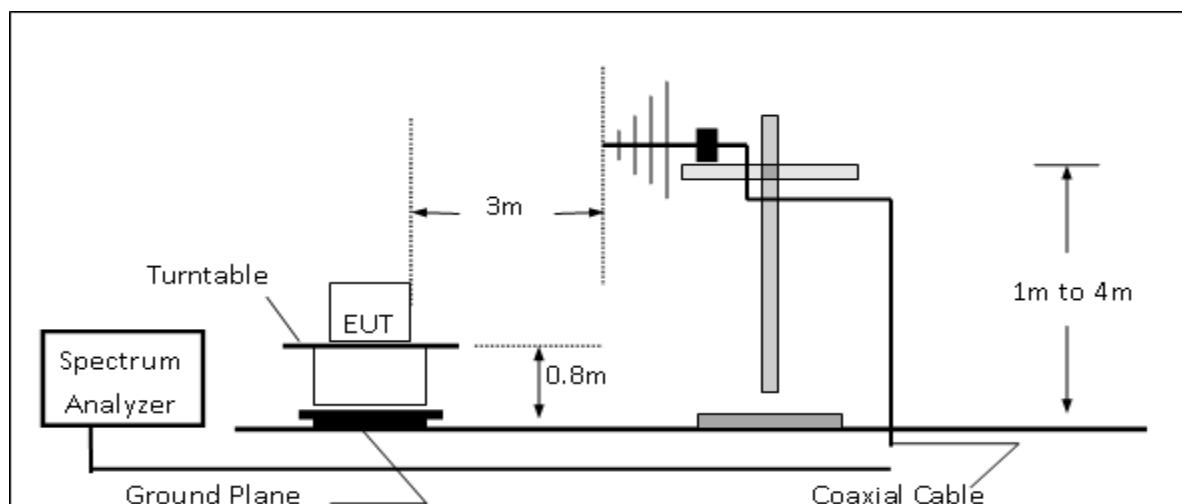
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### 11.3 Test SET-UP

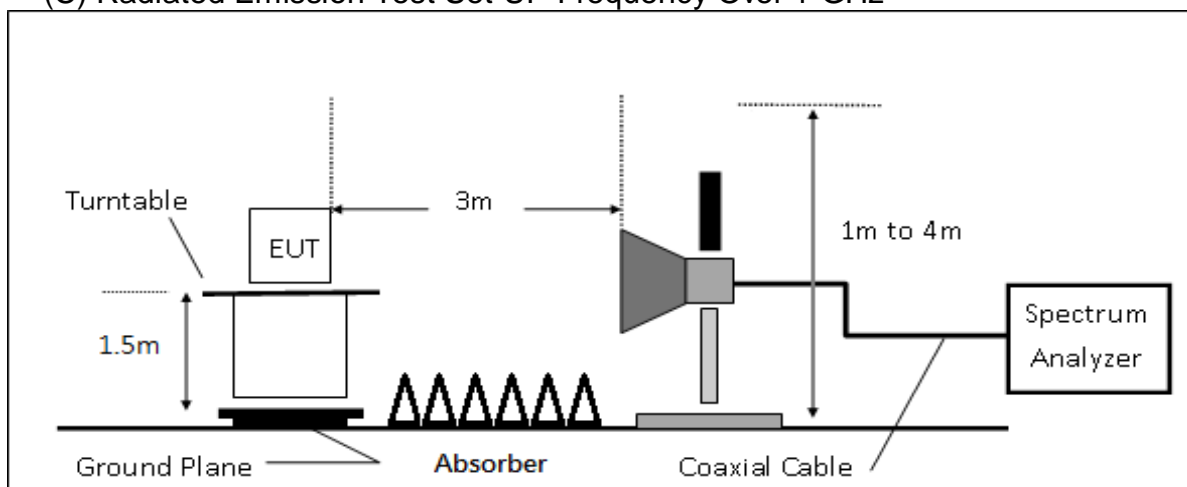
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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## 11.4 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
6. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
9. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
12. Repeat above procedures until all default test channel measured were complete.

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### 11.5 Field Strength Calculation

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

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

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

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

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

### 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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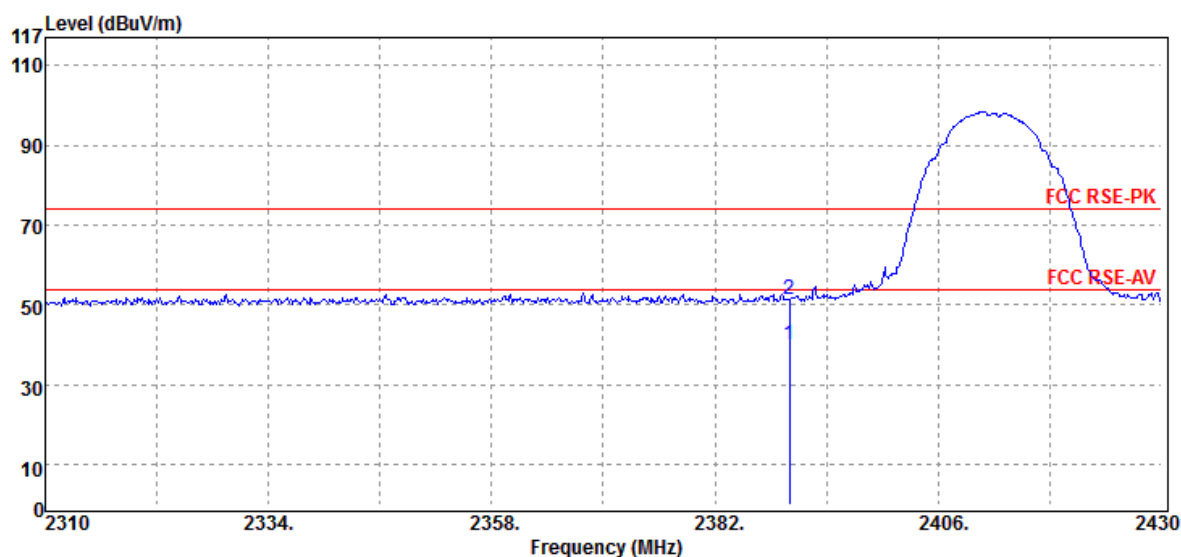
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## Radiated Band Edge Measurement Result

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

Test Date :2018-08-28  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	39.84	0.20	40.04	54.00	-13.96
2390.00	Peak	51.33	0.20	51.53	74.00	-22.47

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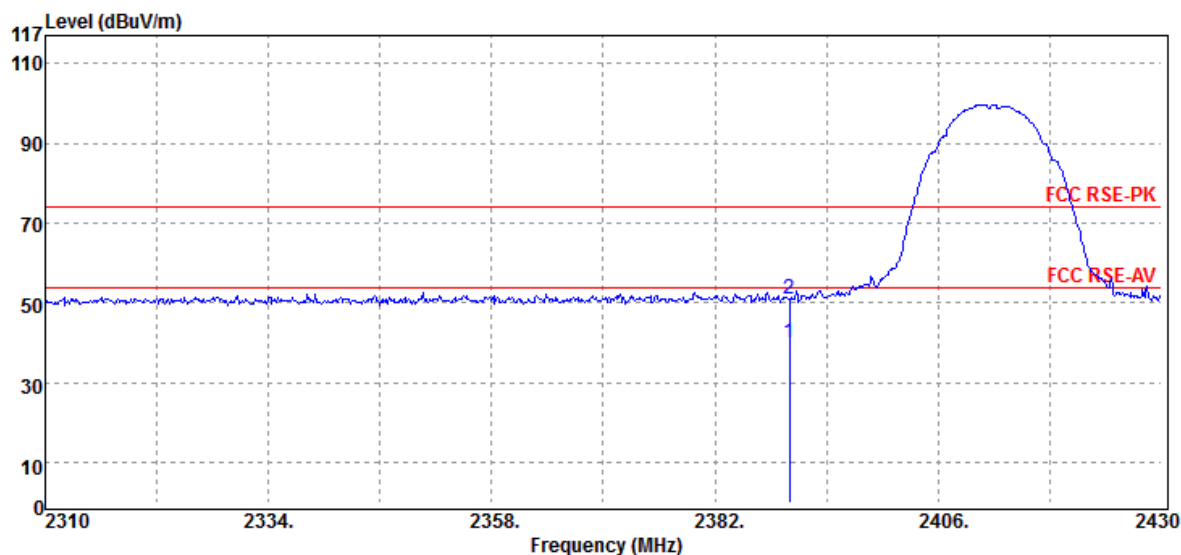
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Operation Band :802.11b  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :H Plane

Test Date :2018-08-28  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	39.79	0.20	39.99	54.00	-14.01
2390.00	Peak	50.98	0.20	51.18	74.00	-22.82

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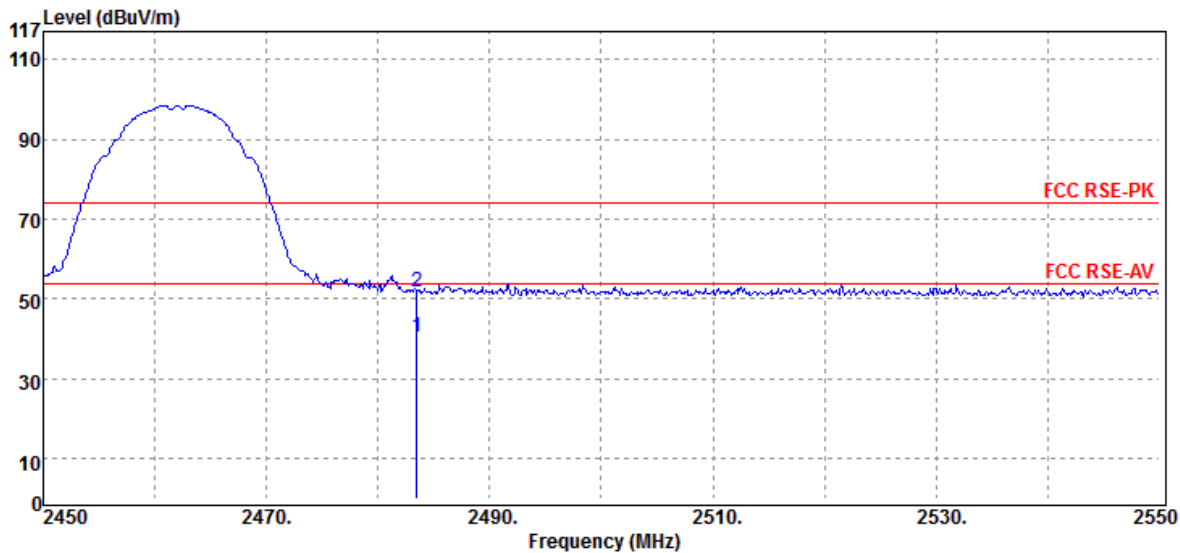
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Operation Band :802.11b  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-28  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	39.94	0.53	40.47	54.00	-13.53
2483.50	Peak	51.33	0.53	51.86	74.00	-22.14

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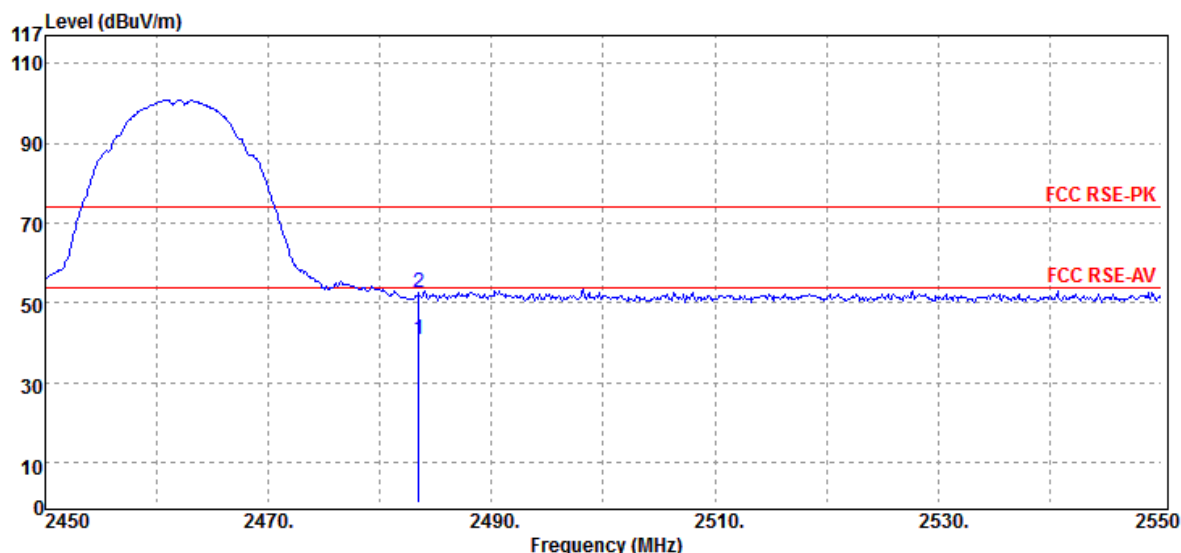
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Operation Band :802.11b  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-28  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	40.22	0.53	40.75	54.00	-13.25
2483.50	Peak	52.11	0.53	52.64	74.00	-21.36

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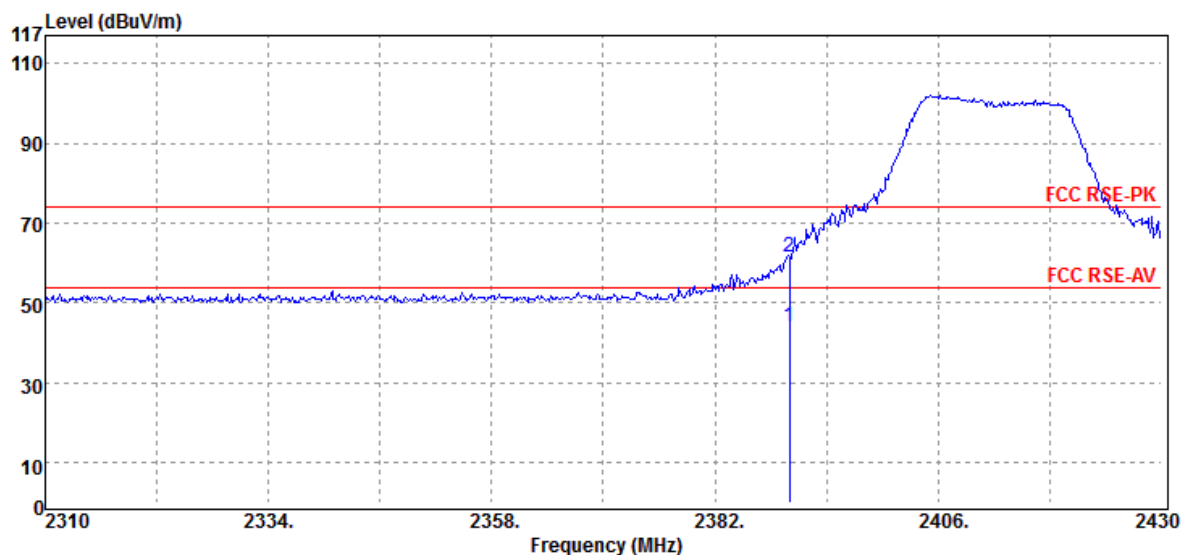
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Operation Band :802.11g  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :H Plane

Test Date :2018-08-28  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	44.00	0.20	44.20	54.00	-9.80
2390.00	Peak	61.49	0.20	61.69	74.00	-12.31

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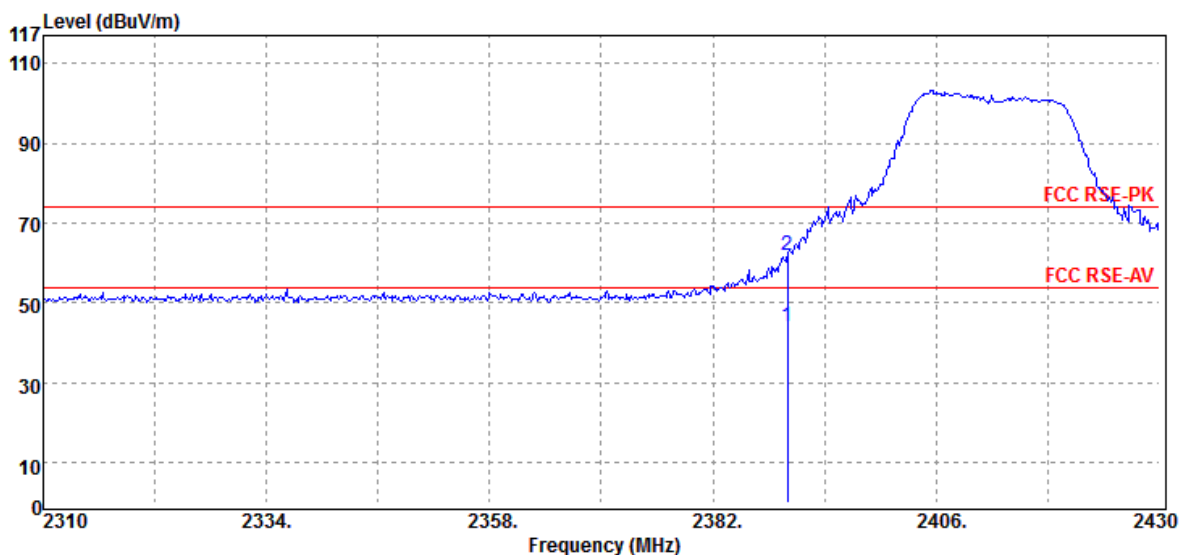
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Operation Band :802.11g  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedged CH LOW  
EUT Pol. :H Plane

Test Date :2018-08-28  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	43.99	0.20	44.19	54.00	-9.81
2390.00	Peak	61.64	0.20	61.84	74.00	-12.16

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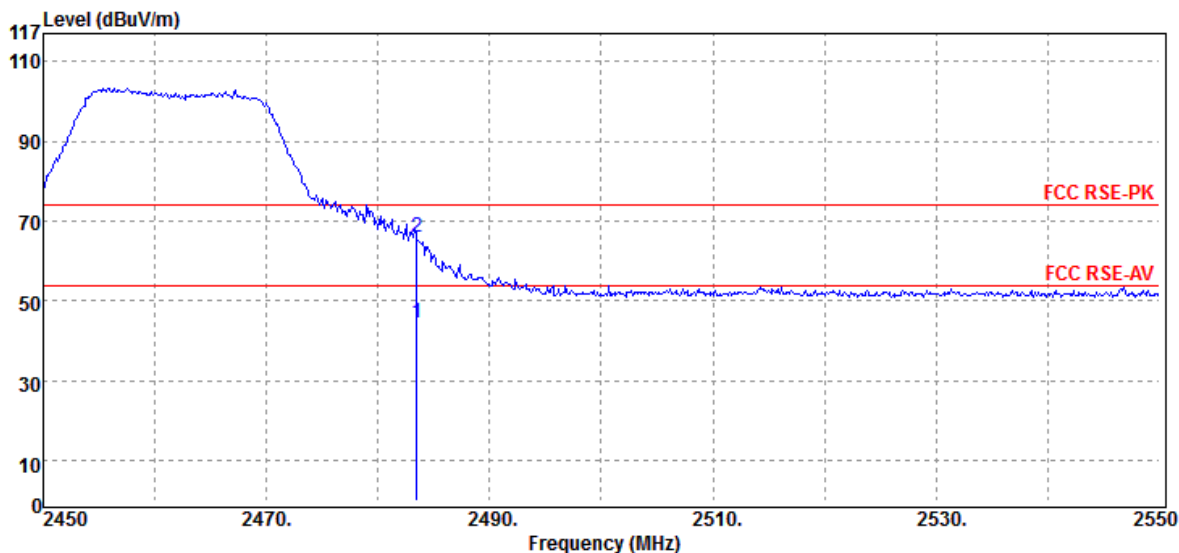
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Operation Band :802.11g  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-28  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	44.06	0.53	44.59	54.00	-9.41
2483.50	Peak	65.28	0.53	65.81	74.00	-8.19

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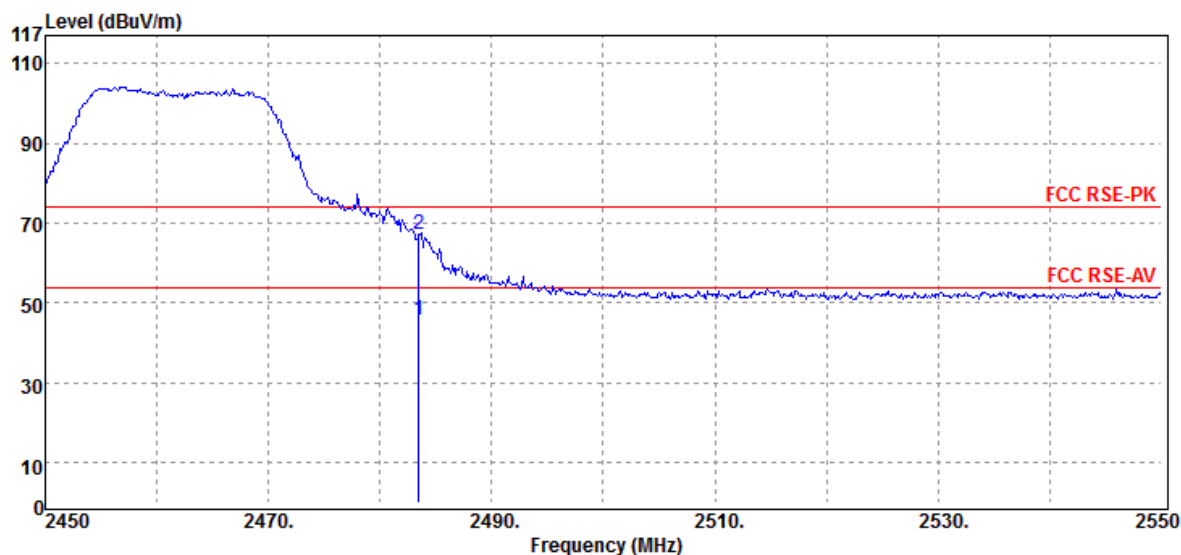
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Operation Band :802.11g  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-28  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	45.38	0.53	45.91	54.00	-8.09
2483.50	Peak	66.77	0.53	67.30	74.00	-6.70

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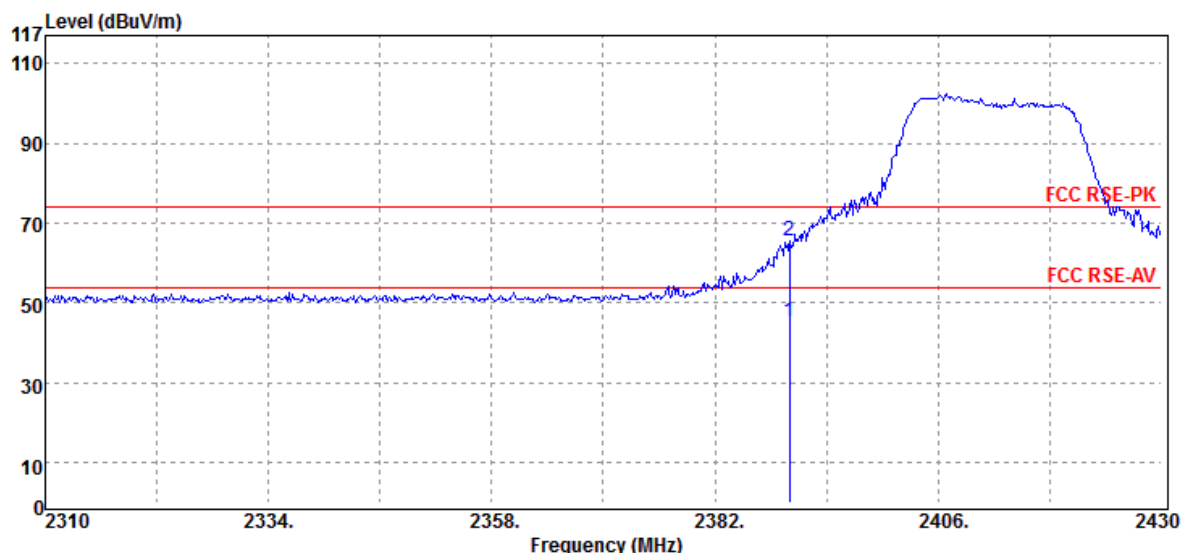
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Operation Band :802.11n20  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :H Plane

Test Date :2018-08-29  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	45.28	0.20	45.48	54.00	-8.52
2390.00	Peak	65.19	0.20	65.39	74.00	-8.61

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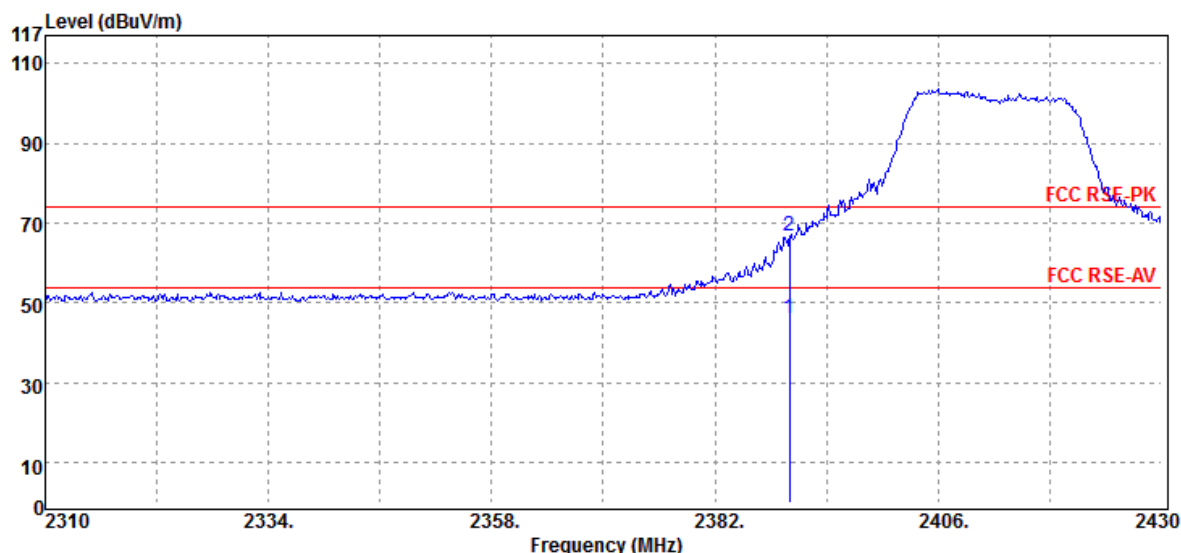
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Operation Band :802.11n20  
Fundamental Frequency :2412 MHz  
Operation Mode :Bandedge CH LOW  
EUT Pol. :H Plane

Test Date :2018-08-29  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	46.11	0.20	46.31	54.00	-7.69
2390.00	Peak	66.41	0.20	66.61	74.00	-7.39

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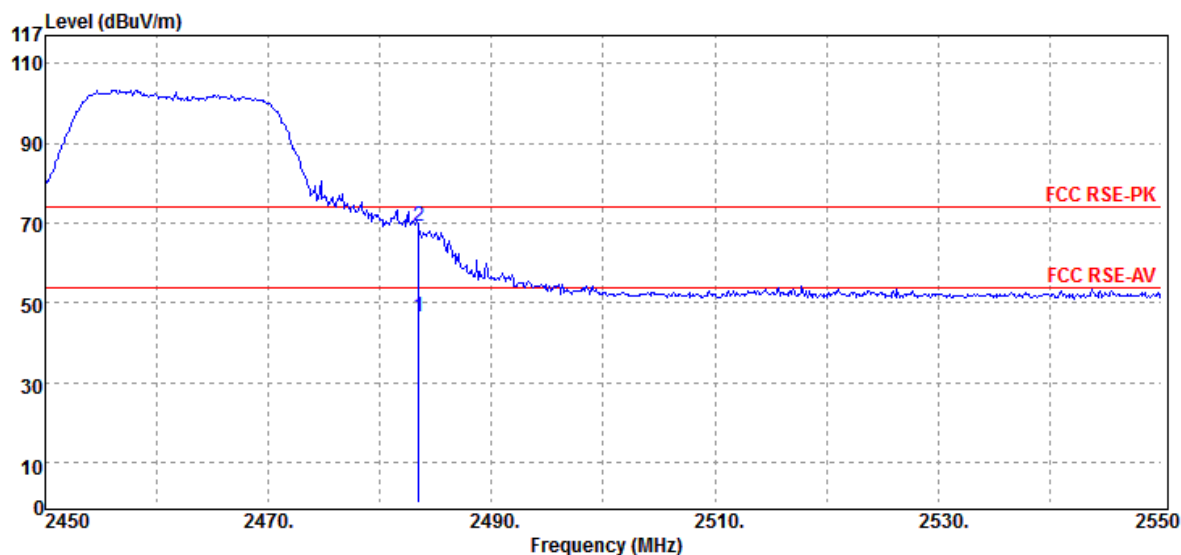
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Operation Band :802.11n20  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-29  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	45.87	0.53	46.40	54.00	-7.60
2483.50	Peak	68.58	0.53	69.11	74.00	-4.89

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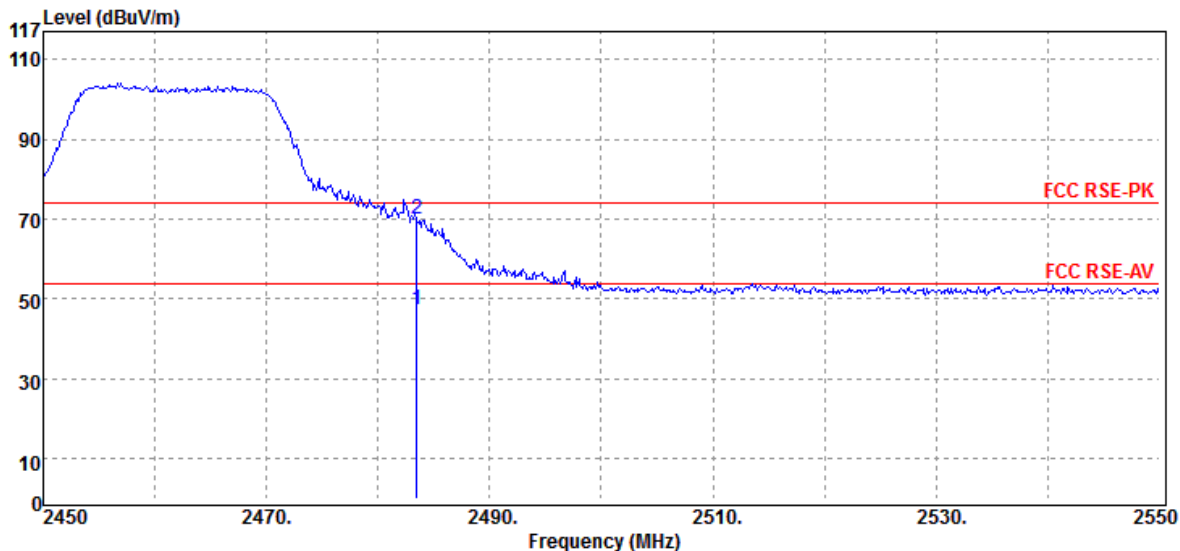
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Operation Band :802.11n20  
Fundamental Frequency :2462 MHz  
Operation Mode :Bandedge CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-29  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	46.92	0.53	47.45	54.00	-6.55
2483.50	Peak	69.40	0.53	69.93	74.00	-4.07

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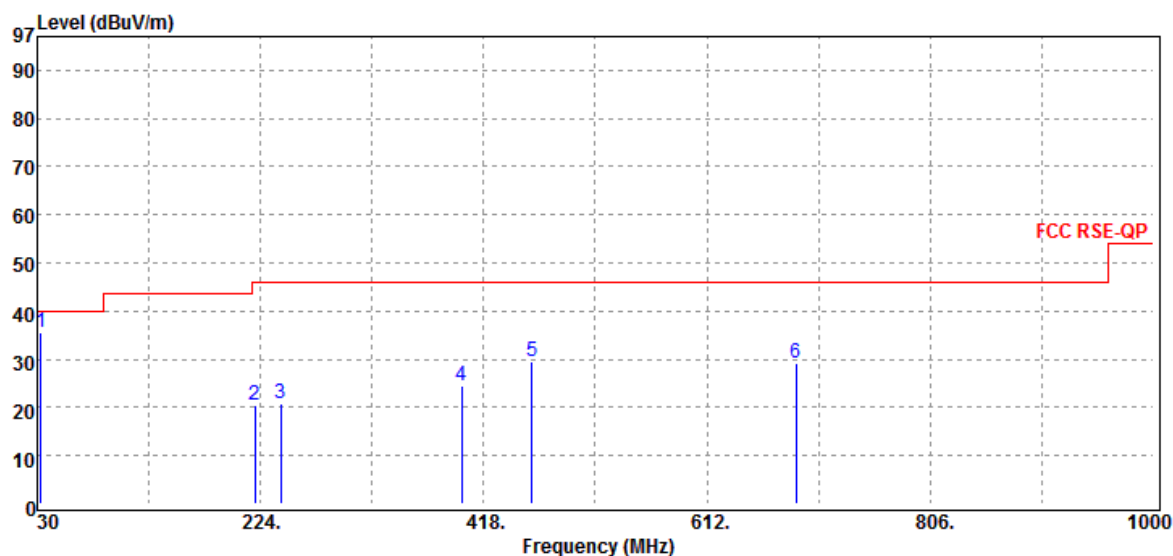
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## Below 1GHz Worst-Case Data:

### Radiated Spurious Emission Measurement Result

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

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
32.91	Peak	44.35	-8.82	35.53	40.00	-4.47
219.15	Peak	29.64	-9.08	20.56	46.00	-25.44
241.46	Peak	28.68	-7.72	20.96	46.00	-25.04
398.60	Peak	27.91	-3.41	24.50	46.00	-21.50
459.71	Peak	32.10	-2.46	29.64	46.00	-16.36
689.60	Peak	27.17	1.88	29.05	46.00	-16.95

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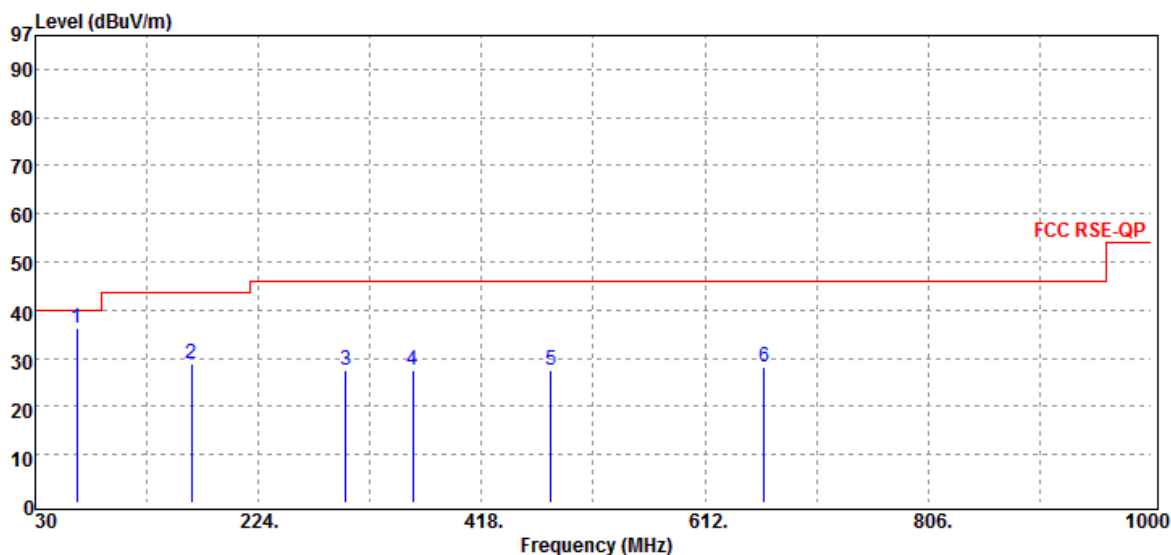
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Operation Band :802.11g  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
65.89	Peak	45.51	-9.20	36.31	40.00	-3.69
165.80	Peak	36.19	-7.32	28.87	43.50	-14.63
299.66	Peak	32.92	-5.52	27.40	46.00	-18.60
357.86	Peak	31.85	-4.22	27.63	46.00	-18.37
478.14	Peak	29.75	-2.17	27.58	46.00	-18.42
663.41	Peak	27.90	0.37	28.27	46.00	-17.73

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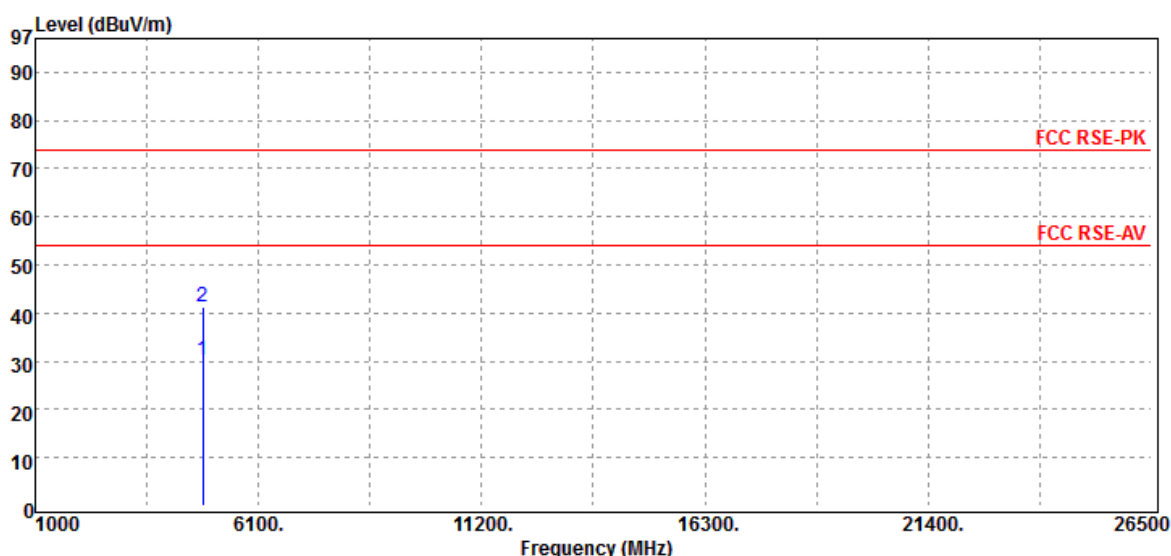
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## Above 1GHz Data:

### Radiated Spurious Emission Measurement Result

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

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4824.00	Average	24.51	5.61	30.12	54.00	-23.88
4824.00	Peak	35.63	5.61	41.24	74.00	-32.76

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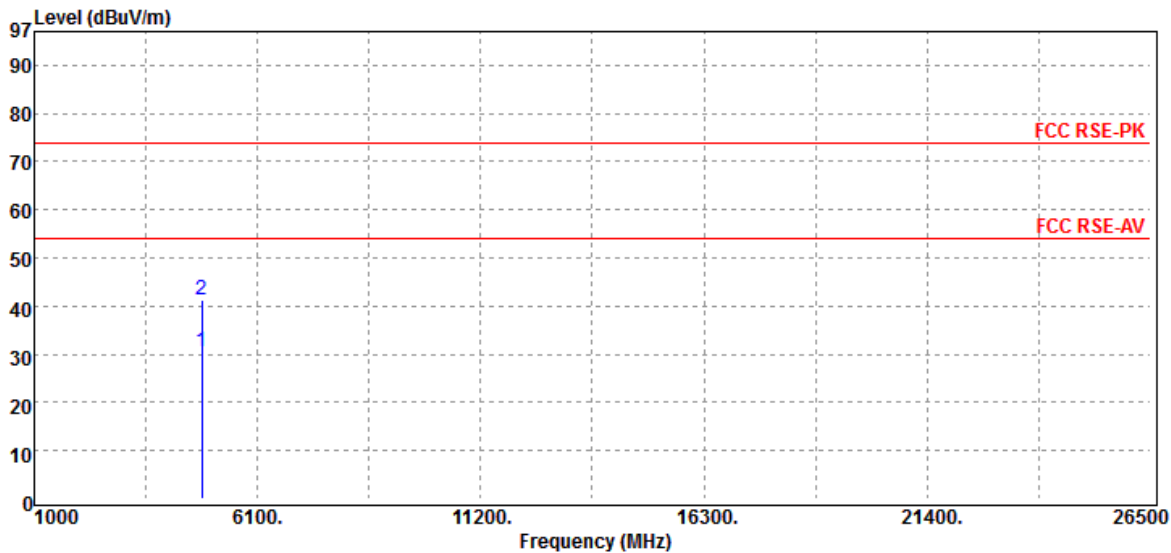
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Operation Band :802.11b  
Fundamental Frequency :2412 MHz  
Operation Mode :Tx CH LOW  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4824.00	Average	24.93	5.61	30.54	54.00	-23.46
4824.00	Peak	35.69	5.61	41.30	74.00	-32.70

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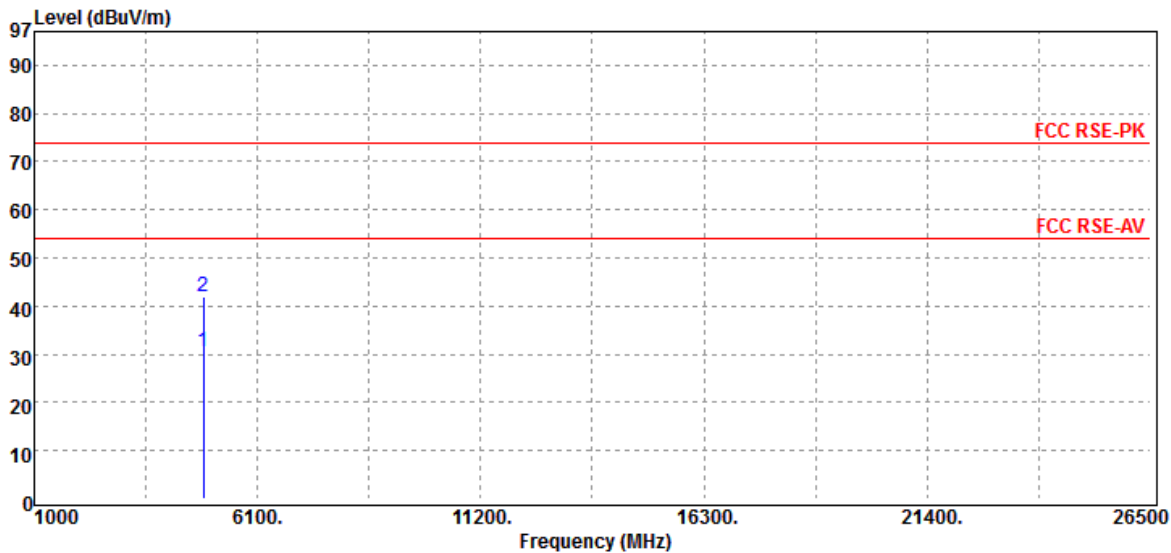
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Operation Band :802.11b  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4874.00	Average	24.55	5.85	30.40	54.00	-23.60
4874.00	Peak	36.23	5.85	42.08	74.00	-31.92

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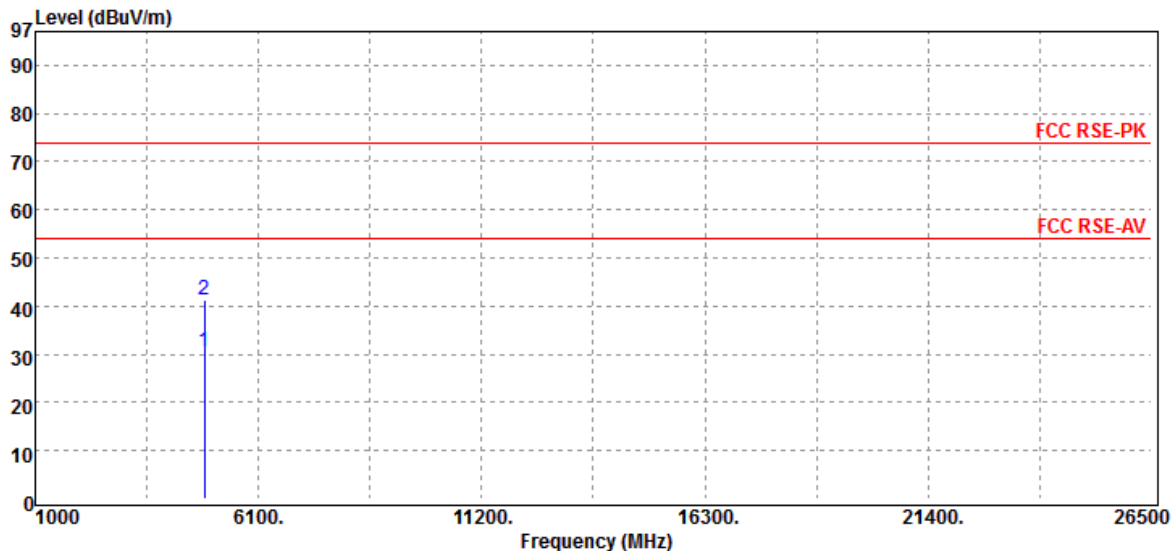
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Operation Band :802.11b  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4874.00	Average	24.71	5.85	30.56	54.00	-23.44
4874.00	Peak	35.43	5.85	41.28	74.00	-32.72

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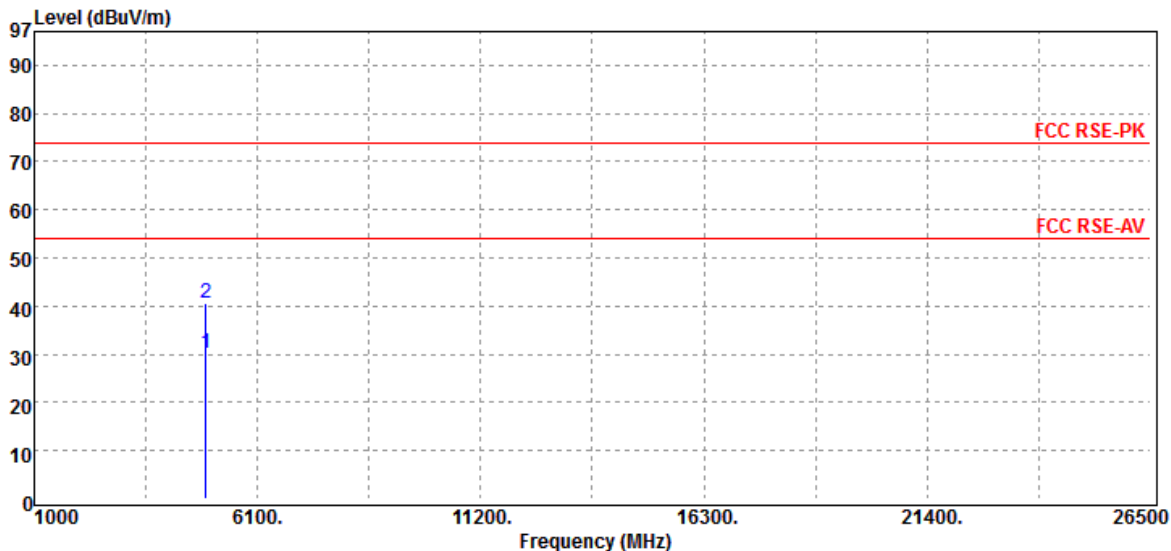
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Operation Band :802.11b  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4924.00	Average	24.48	5.82	30.30	54.00	-23.70
4924.00	Peak	34.86	5.82	40.68	74.00	-33.32

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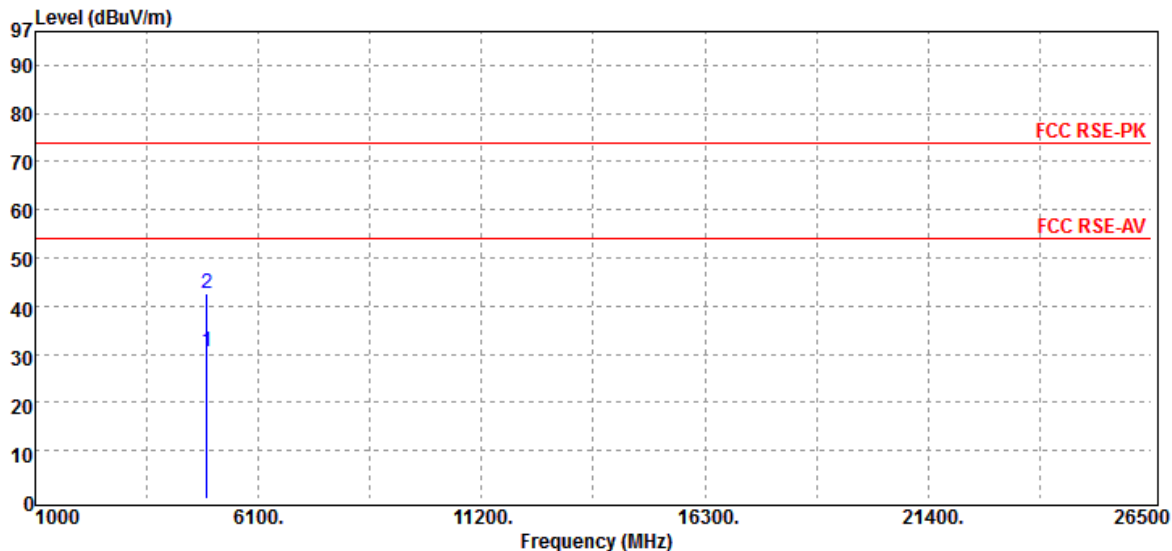
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Member of SGS Group

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

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4924.00	Average	24.75	5.82	30.57	54.00	-23.43
4924.00	Peak	36.85	5.82	42.67	74.00	-31.33

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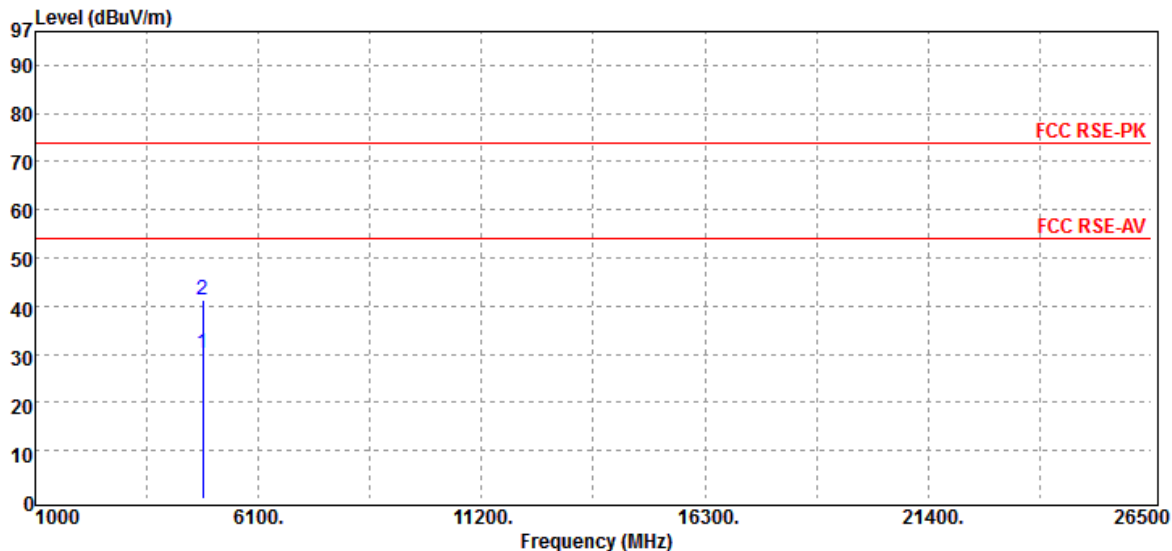
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Member of SGS Group

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

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4824.00	Average	24.76	5.61	30.37	54.00	-23.63
4824.00	Peak	35.63	5.61	41.24	74.00	-32.76

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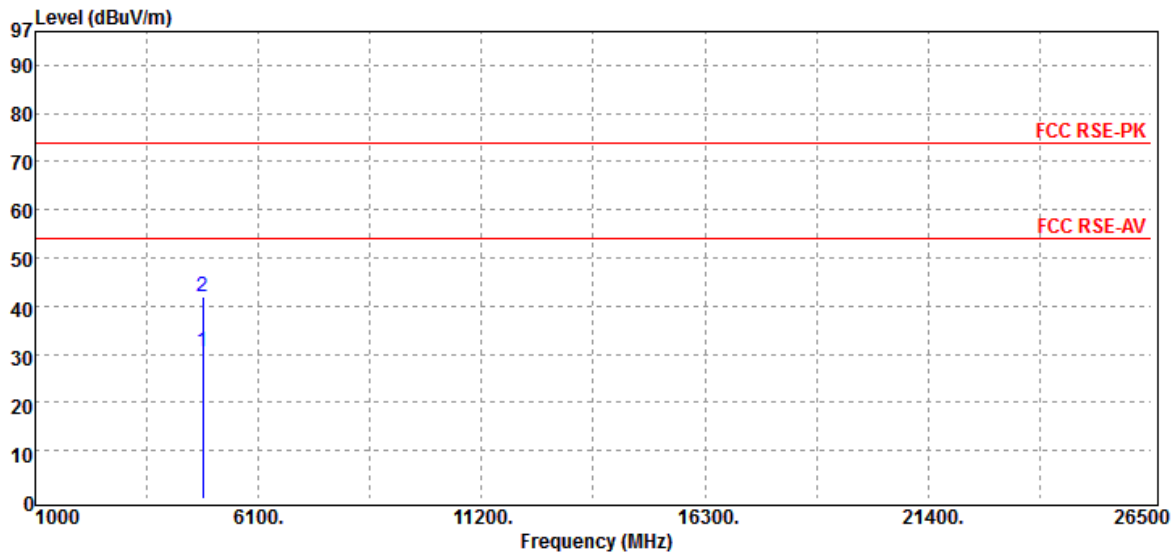
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Member of SGS Group

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

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4824.00	Average	24.84	5.61	30.45	54.00	-23.55
4824.00	Peak	36.32	5.61	41.93	74.00	-32.07

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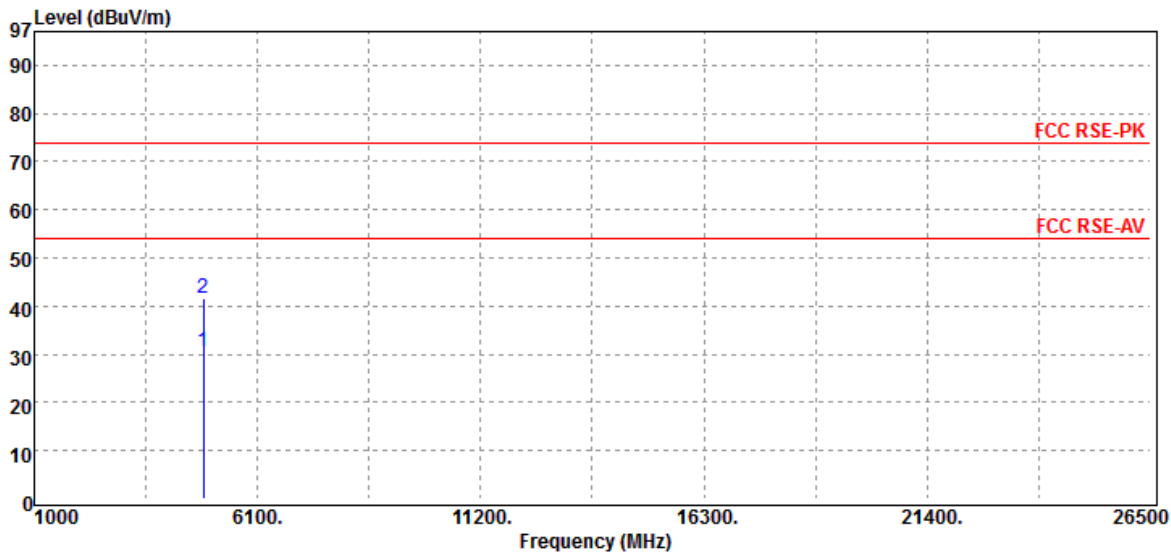
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Member of SGS Group

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

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4874.00	Average	24.61	5.85	30.46	54.00	-23.54
4874.00	Peak	35.79	5.85	41.64	74.00	-32.36

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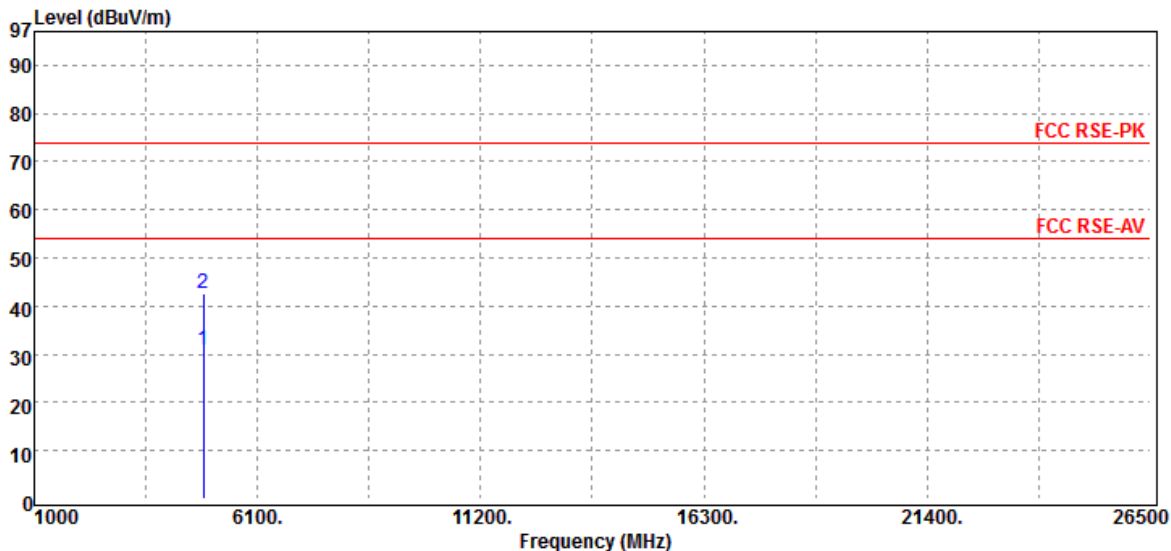
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Member of SGS Group



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

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	Average	25.01	5.85	30.86	54.00	-23.14
4874.00	Peak	36.77	5.85	42.62	74.00	-31.38

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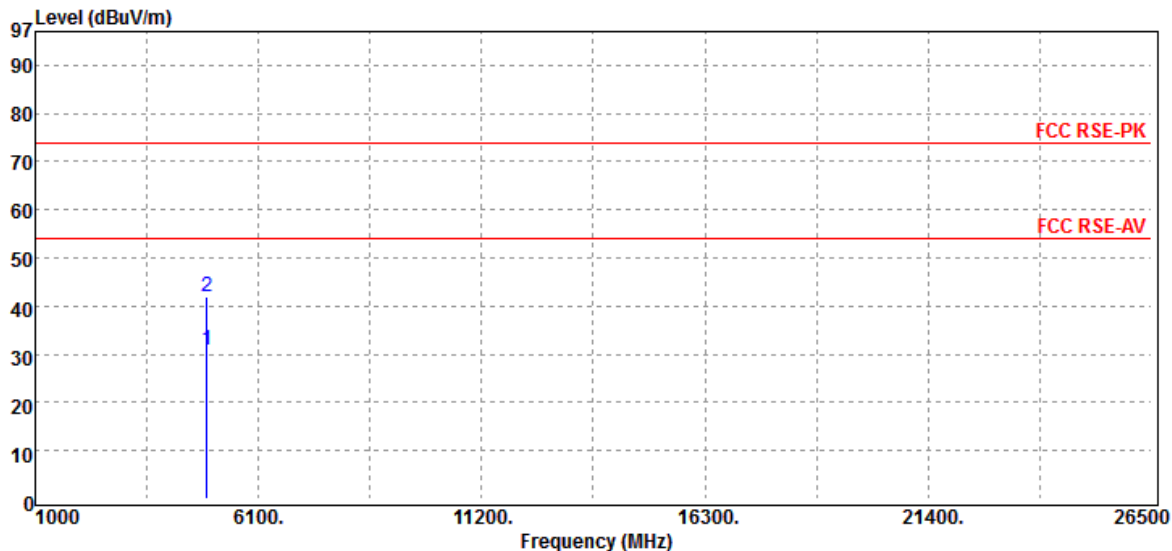
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Operation Band :802.11g  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4924.00	Average	25.12	5.82	30.94	54.00	-23.06
4924.00	Peak	36.22	5.82	42.04	74.00	-31.96

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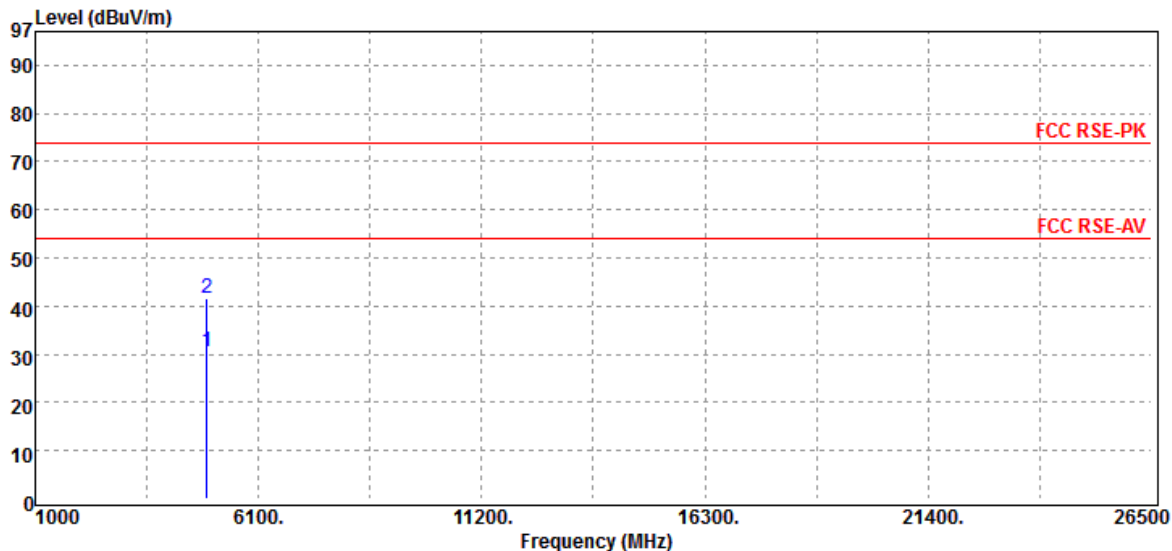
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Operation Band :802.11g  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	Average	24.80	5.82	30.62	54.00	-23.38
4924.00	Peak	35.75	5.82	41.57	74.00	-32.43

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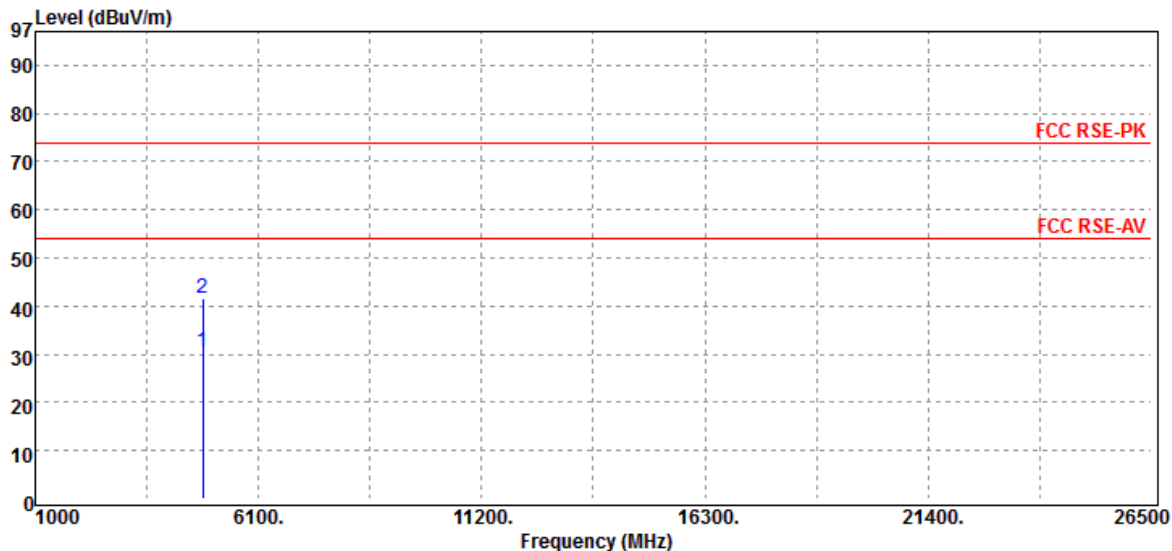
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Operation Band :802.11n20  
Fundamental Frequency :2412 MHz  
Operation Mode :Tx CH LOW  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4824.00	Average	25.00	5.61	30.61	54.00	-23.39
4824.00	Peak	36.11	5.61	41.72	74.00	-32.28

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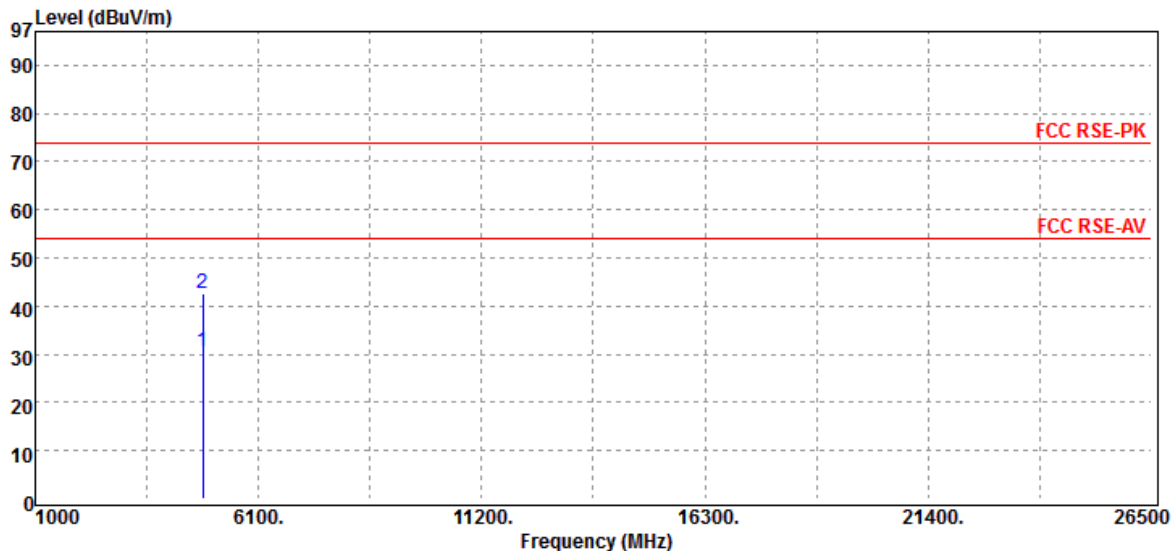
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Operation Band :802.11n20  
Fundamental Frequency :2412 MHz  
Operation Mode :Tx CH LOW  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4824.00	Average	25.07	5.61	30.68	54.00	-23.32
4824.00	Peak	36.88	5.61	42.49	74.00	-31.51

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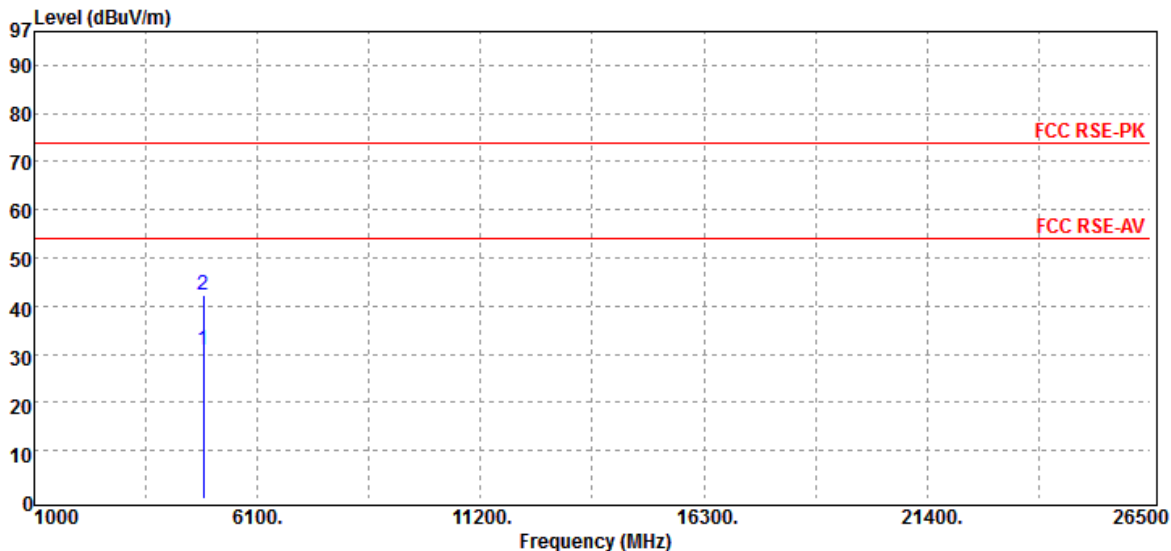
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Member of SGS Group

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

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4874.00	Average	24.93	5.85	30.78	54.00	-23.22
4874.00	Peak	36.55	5.85	42.40	74.00	-31.60

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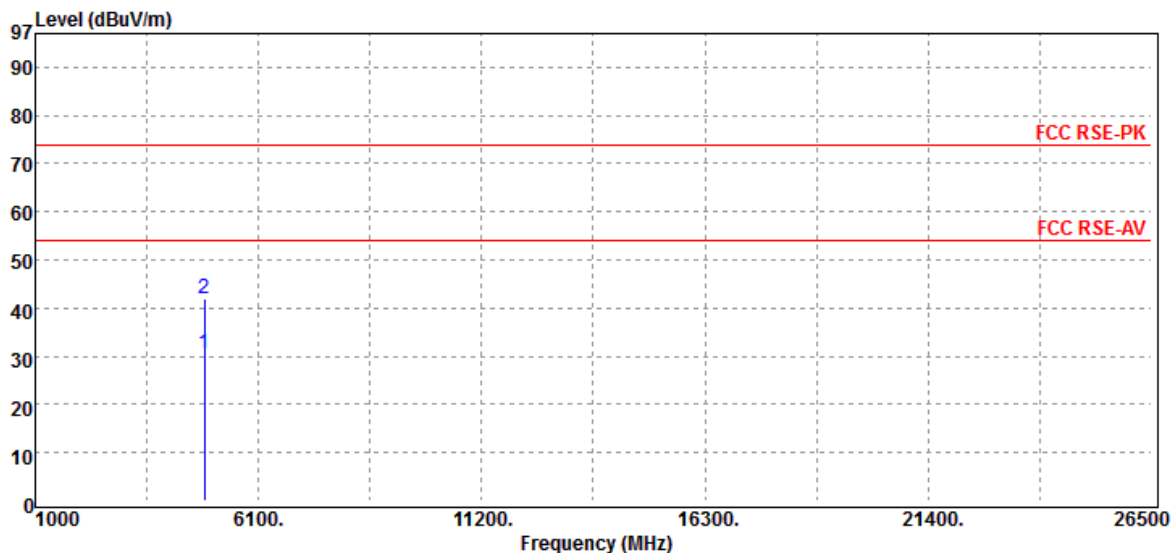
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Operation Band :802.11n20  
Fundamental Frequency :2437 MHz  
Operation Mode :Tx CH MID  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dB $\mu$ V	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB
4874.00	Average	24.79	5.85	30.64	54.00	-23.36
4874.00	Peak	36.21	5.85	42.06	74.00	-31.94

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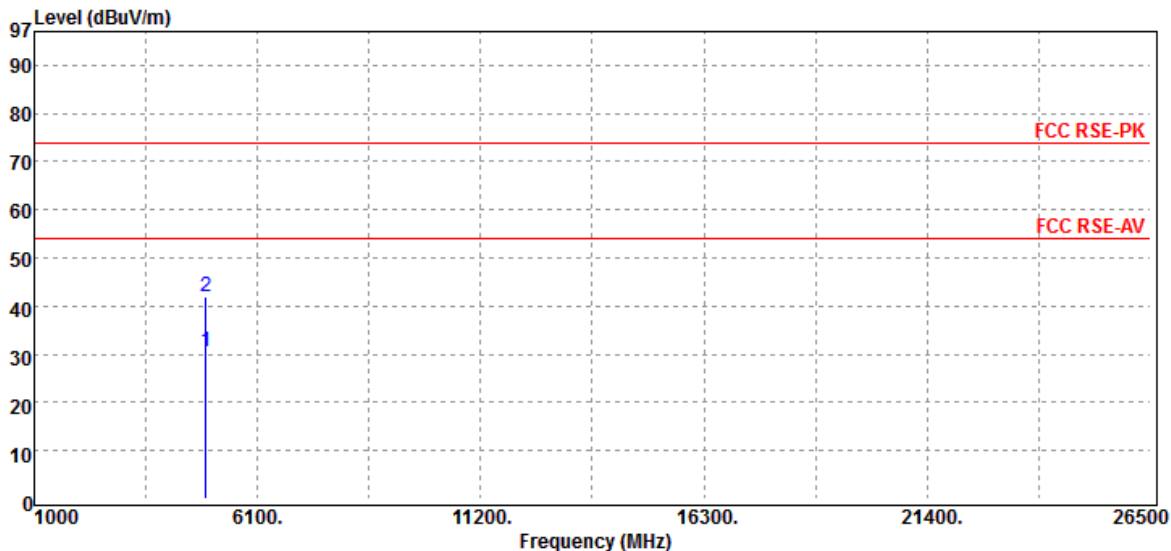
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Operation Band :802.11n20  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	Average	24.60	5.82	30.42	54.00	-23.58
4924.00	Peak	36.18	5.82	42.00	74.00	-32.00

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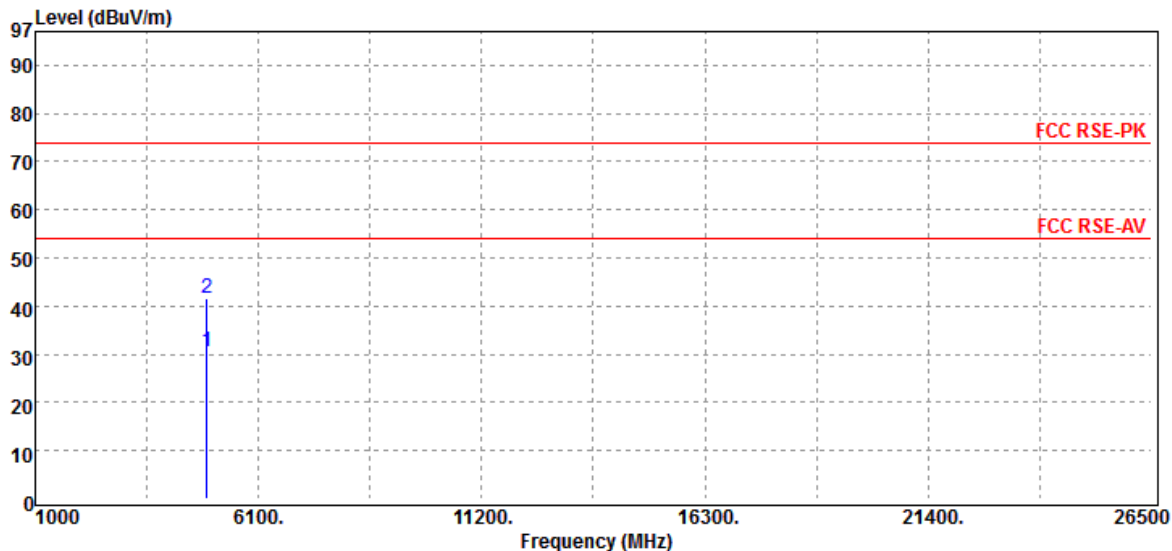
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Operation Band :802.11n20  
Fundamental Frequency :2462 MHz  
Operation Mode :Tx CH HIGH  
EUT Pol. :H Plane

Test Date :2018-08-30  
Temp./Humi. :21 deg\_C / 62 RH  
Engineer :Tin  
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
Mode	Reading Level			FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	Average	24.75	5.82	30.57	54.00	-23.43
4924.00	Peak	35.96	5.82	41.78	74.00	-32.22

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## 12 POWER SPECTRAL DENSITY

### 12.1 Standard Applicable

Per Part 15.247 (e)

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.

This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

The antenna gain is not greater than 6 dBi. Therefore, reduction of power is not required.

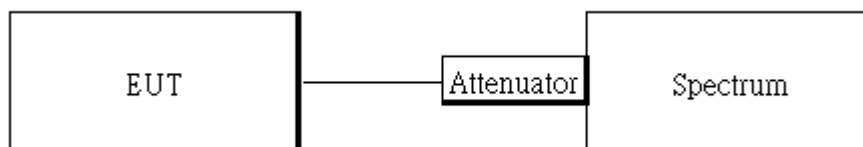
Per RSS-247 section 5.4 d

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 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

### 12.2 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	R&S	FSV-30	101398	Oct. 19th, 2017	Oct. 18th, 2018
DC Power Supply	Anritsu	E3640A	MY52410006	Nov. 28th, 2017	Nov. 27th, 2018
Attenuator	Mini-Circuit	BW-S10W2+	2	Jan. 02nd, 2018	Jan. 01st, 2019
DC Block	Mini-Circuits	BLK-18-S+	1	Jan. 02nd, 2018	Jan. 01st, 2019
Coaxial Cables	N/A	WK CE Cable	N/A	Jan. 02nd, 2018	Jan. 01st, 2019
Notebook	Lenovo	L430	R9-WGNK5	N/A	N/A

### 12.3 Test Set-up



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## 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 .
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz & 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.

## 12.5 Measurement Result

POWER DENSITY 802.11b			
Freq. (MHz)	PPSD (dBm)	Limit (dBm)	Result
2412	-8.24	8.00	PASS
2437	-7.67	8.00	PASS
2462	-8.26	8.00	PASS

POWER DENSITY 802.11g			
Freq. (MHz)	PPSD (dBm)	Limit (dBm)	Result
2412	-10.47	8.00	PASS
2437	-9.88	8.00	PASS
2462	-9.99	8.00	PASS

POWER DENSITY 802.11n HT20			
Freq. (MHz)	PPSD (dBm)	Limit (dBm)	Result
2412	-10.63	8.00	PASS
2437	-10.09	8.00	PASS
2462	-10.81	8.00	PASS

offset 11.60 dB for SISO mode

*\*Refer to next page for plots*

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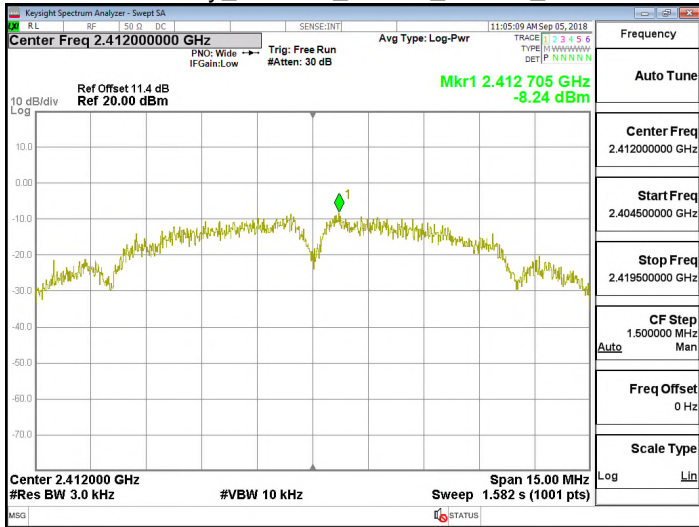
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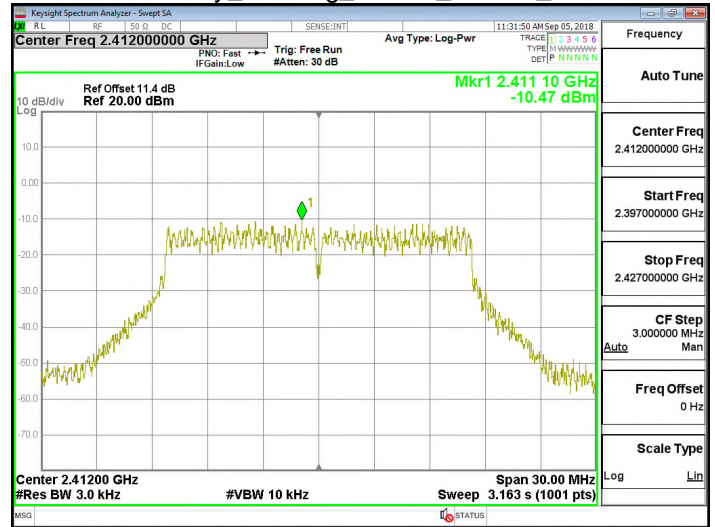
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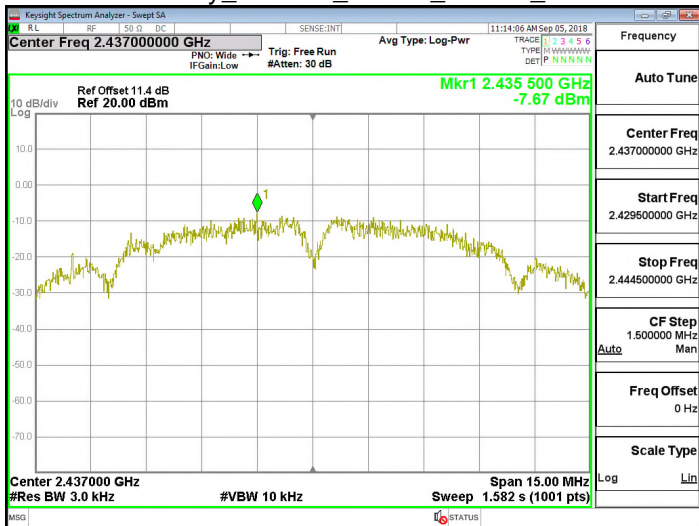
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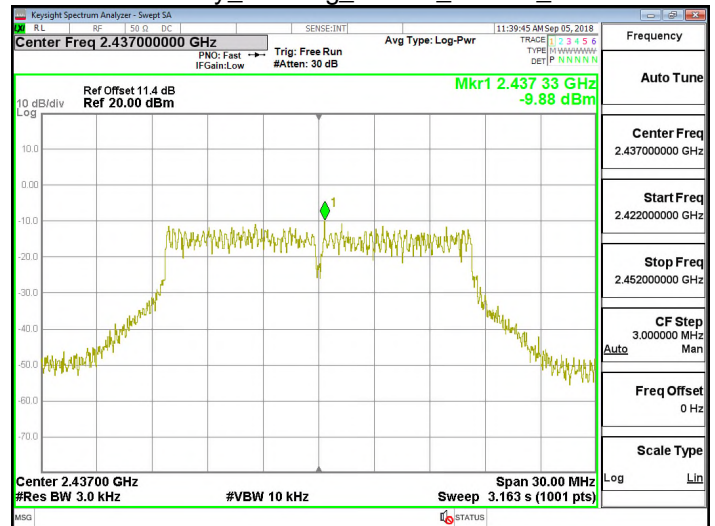
Power Density\_802.11g\_20MHz\_Chain0\_2412MHz



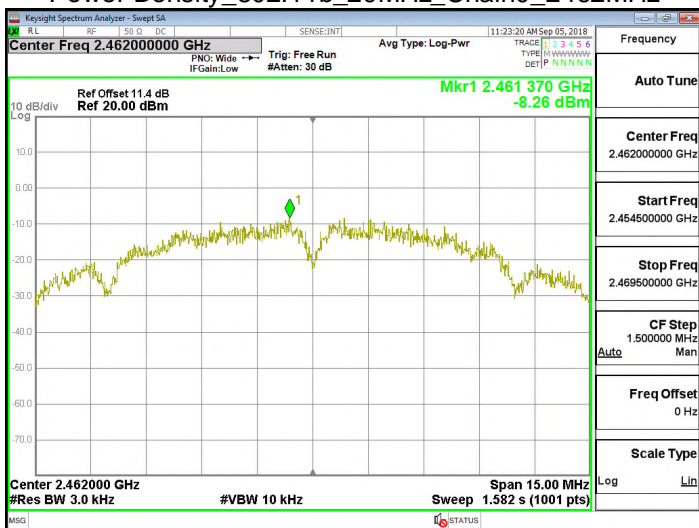
Power Density\_802.11b\_20MHz\_Chain0\_2437MHz



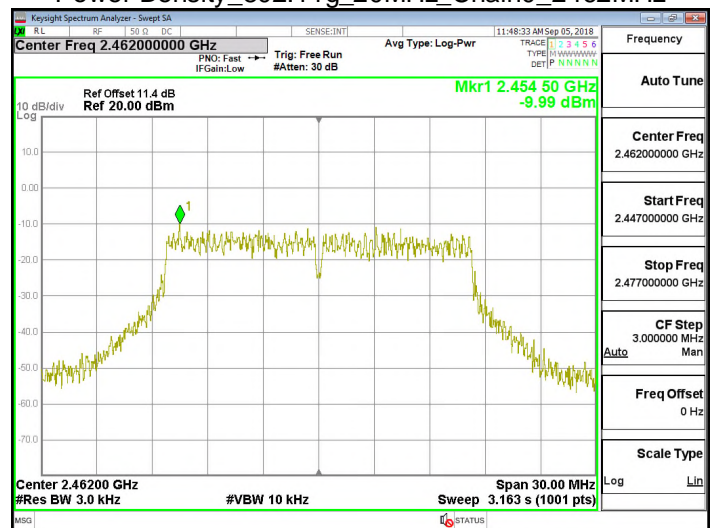
Power Density\_802.11g\_20MHz\_Chain0\_2437MHz



Power Density\_802.11b\_20MHz\_Chain0\_2462MHz



Power Density\_802.11g\_20MHz\_Chain0\_2462MHz



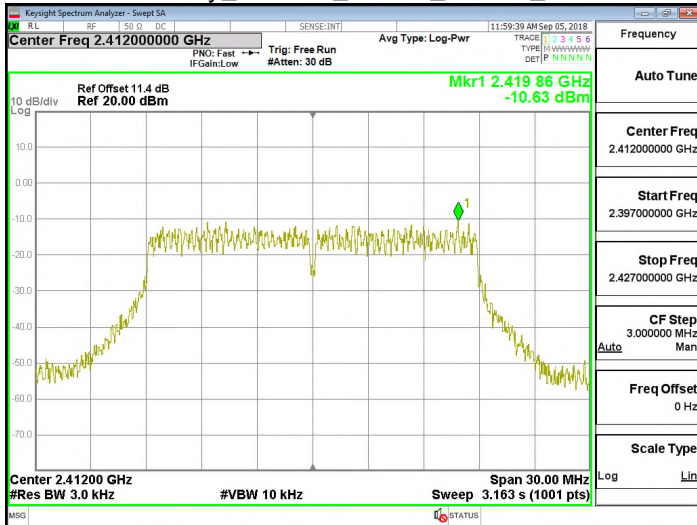
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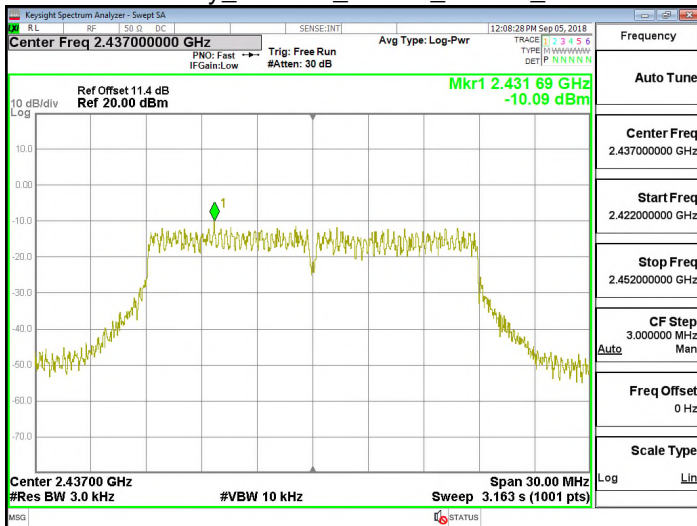
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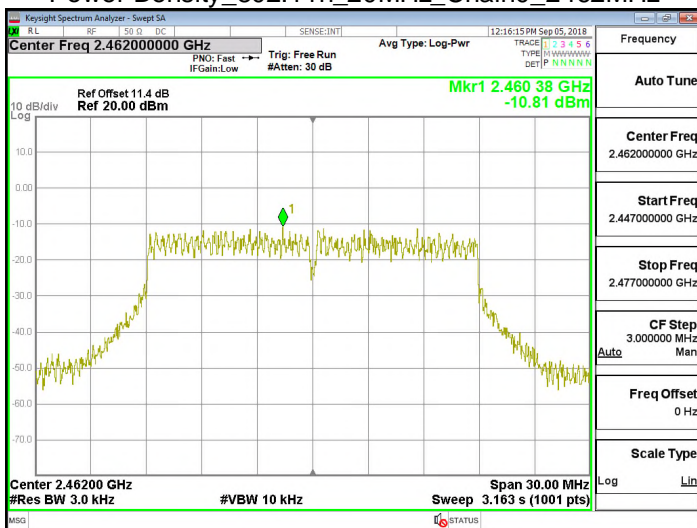
## Power Density\_802.11n\_20MHz\_Chain0\_2412MHz



## Power Density\_802.11n\_20MHz\_Chain0\_2437MHz



## Power Density\_802.11n\_20MHz\_Chain0\_2462MHz



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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

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

*~ End of Report ~*

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