

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name: USB module

Brand Name: REALTEK

Model No.: RTL8812BU

Model Difference: N/A

FCC ID: TX2-RTL8812BU

Report No.: ER/2017/70015

Issue Date: Jul. 21, 2017

FCC Rule Part: §15.247, Cat: DTS

Prepared for: REALTEK SEMICONDUCTOR CORP.
NO. 2, INNOVATION ROAD II, SCIENCE
PARK, HSINCHU 300, TAIWAN
SGS Taiwan Ltd.

Prepared by: Electronics & Communication Laboratory
No.134, Wu Kung Road, New Taipei Industrial
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VERIFICATION OF COMPLIANCE

Applicant for: REALTEK SEMICONDUCTOR CORP.
NO. 2, INNOVATION ROAD II, SCIENCE PARK, HSINCHU 300,
TAIWAN

Product Name: USB module

Brand Name: REALTEK

Model No.: RTL8812BU

Model Difference: N/A

FCC ID: TX2-RTL8812BU

Report Number: ER/2017/70015

Date of Test: Jul. 03, 2017 ~ Jul. 17, 2017

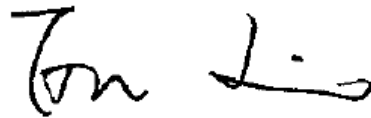
Date of EUT Received: Jul. 03, 2017

We hereby certify that:

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

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

Test By:

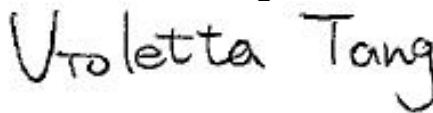


Date:

Jul. 21, 2017

Tin Lin / Engineer

Prepared By:

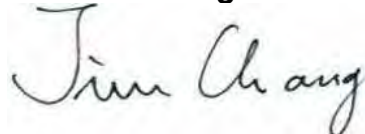


Date:

Jul. 21, 2017

Violetta Tang / Clerk

Approved By:



Date:

Jul. 21, 2017

Jim Chang / Asst. Manager

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Revision History

Report Number	Revision	Description	Issue Date
ER/2017/70015	Rev.00	Initial creation of document	Jul. 21, 2017

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1 GENERAL INFORMATION

1.1 Product description

General:

Product Name:	USB module
Brand Name:	REALTEK
FCC Model No.:	RTL8812BU
Model Difference:	N/A
Software Version:	V0.6
Hardware Version:	0V8
Power Supply:	5V from USB Port

WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power	Modulation Technology
11b/g	2412-2462	11	b: 25.18dBm g: 27.45dBm (MIMO)	DSSS, OFDM
11n	HT20 2412-2462	11	27.69dBm (MIMO)	OFDM
11n	HT40 2422-2452	7	29.34dBm (MIMO)	OFDM
Antenna Designation:	Printed Antenna, Main Antenna Gain: -1.5dBi, Part No.: RTK-ANT-0002, Supplier: REALTEK Aux Antenna Gain: -0.1dBi, Part No.: RTK-ANT-0002, Supplier: REALTEK			
Modulation type:	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM			
Transition Rate:	802.11 b: up to 11 Mbps; 802.11 g: up to 54 Mbps 802.11 n_20MHz: up to 144Mbps 802.11 n_40MHz: up to 300Mbps			

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Host Information:

MB/NB/add-in card model name	OS	USB Host
Acer-Aspire VN7 719G-55MB(NB)	WIN8.1	Intel USB3.0
ASUS-(P7H55-M/USB3)	WIN7	NEC USB3.0
ASUS-(M5A87) (PC)	WIN7	Asmedia USB3.0
ASUS(NB)-(U36J)	WIN7	Fresco USB3.0
ASUS-(P8Z77-V LX)	WIN7	Intel USB3.0
DELL Vostro 270S (PC)	WIN7	Intel USB3.0
GIGABYTE-(GA-880GMA-UD2H)	WIN7	NEC USB3.0
GIGABYTE-(GA-F2A85X-UP4)	WIN7	AMD USB3.0
GIGABYTE-(GA-H61M-USB3(B3))	WIN7	ETRON USB3.0
HP 14-R017TU(NB)	WIN8	Intel USB3.0
Lenovo T430(NB)	WIN7	Intel USB3.0
MSI-(H67MA-E35(B3))	WIN7	NEC USB3.0
TOSHIBA(NB)-(R830)	WIN7	Renesas USB3.0
TOSHIBA(NB)-(R930)	WIN7	Intel USB3.0
UTB222	WIN7	Renesas USB3.0
UTB242	WIN7	TI USB3.0
UTB245	WIN7	Fresco USB3.0
VLI-805 add-in card	WIN7	VLI USB3.0

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance

FCC KDB 662911 D01 Multiple Transmitter Output

ANSI C63.10:2013

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

1.3 Test Facility

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

FCC Registration Numbers are: 509634

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

2.3.2 Radiated Emissions

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

2.4 Measurement Results Explanation Example

For all conducted test items:

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

Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor. Following shows an offset computation example with cable loss 1.8dB, and 10dB attenuator (SISO) and cable loss 4.8dB, and 10dB attenuator (MIMO).

Offset:

SISO mode offset = RF cable loss (dB)+ attenuation factor(dB) =11.8(dB)

MIMO mode offset = RF cable loss (dB)+ attenuation factor(dB)+ 10 log(N_{ANT}) dB =14.8(dB)

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2.5 Configuration of Tested System

Fig. 2-1 Radiated & AC Power Line & Conducted (Antenna Port) Emission



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	Shielded	Un-shielded

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	6dB 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	8	2447 MHz
2	2417 MHz	9	2452 MHz
3	2422 MHz	10	2457 MHz
4	2427 MHz	11	2462 MHz
5	2432 MHz		
6	2437 MHz		
7	2442 MHz		

7 channels are provided for 802.11n_HT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
3	2422 MHz	8	2447 MHz
4	2427 MHz	9	2452 MHz
5	2432 MHz		
6	2437 MHz		
7	2442 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	1, 6, 11	OFDM	6	MIMO
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	AUX
802.11g	1 to 11	1, 6, 11	OFDM	6	MIMO
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS 8	MIMO
802.11n (HT40)	3 to 9	3, 6, 9	OFDM	MCS 8	MIMO

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.

Pre-scanned was done on Main antenna and Aux antenna. The Aux antenna results higher emission at 2.4GHz. Therefore, the completed set of radiated measurement was done on Aux antenna to be presented on this test report.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1, 6, 11	DSSS	1	AUX
802.11g	1 to 11	1, 6, 11	OFDM	6	MIMO
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS 8	MIMO
802.11n (HT40)	3 to 9	3, 6, 9	OFDM	MCS 8	MIMO

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Directional gain (MIMO)

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

Array gain = 3.01dBi (peak spectral density, conducted spurious emission)

Gain that is combined with different magnitude of two antennas:

(ii) If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream:

- Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain; or,

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

N_{SS} = the number of independent spatial streams of data;

N_{ANT} = the total number of antennas

$g_{j,k} = 10^{G_k/20}$ if the k th antenna is being fed by spatial stream j , or zero if it is not;
 G_k is the gain in dBi of the k th antenna.

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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 : Vertical)	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 : Horizontal)	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(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	ESC17	100760	05/11/2017	05/10/2018
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/22/2017	05/21/2018
LISN	MESS TEC	FCC-LISN-50/250 -25-2-01	4034	03/19/2017	03/18/2018
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2016	11/25/2017

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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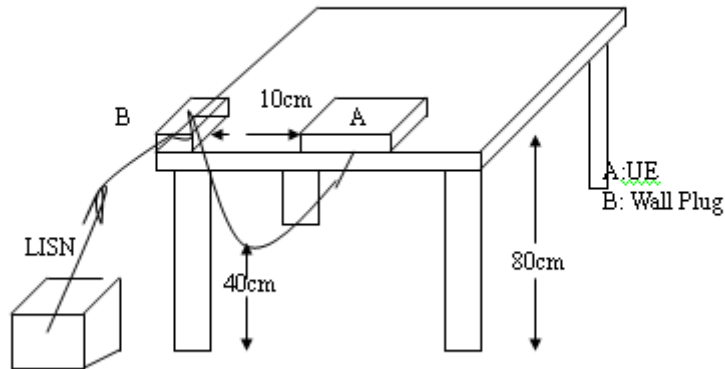
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6.4 Test SET-UP (Block Diagram of Configuration)



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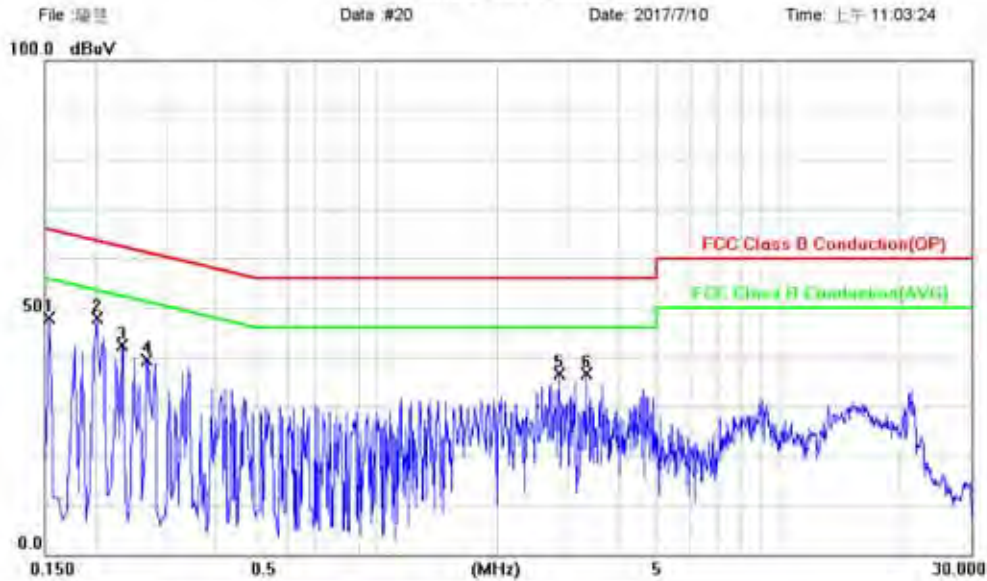
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Site: Conduction Room
 Limit: FCC Class B Conduction(QP)
 Mode: Operation mode
 Note:

Phase: N
 Power: AC 120V/60Hz

Temperature: 20 °C
 Humidity: 58 %

Conducted Emission



No.	MK	Freq MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1540	47.87	0.07	47.94	65.78	-17.84	peak	
2	*	0.2020	47.70	0.07	47.77	63.53	-15.76	peak	
3		0.2340	42.29	0.07	42.36	62.31	-19.95	peak	
4		0.2700	39.33	0.07	39.40	61.12	-21.72	peak	
5		2.8500	36.57	0.15	36.72	56.00	-19.28	peak	
6		3.3140	36.41	0.17	36.58	56.00	-19.42	peak	

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7 DUTY CYCLE OF TEST SIGNAL

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

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

Formula:

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

Measurement Procedure:

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

Duty Cycle:

	Duty Cycle (%)	Duty Factor (dB)
802.11b	99.63	0.02
802.11g	96.24	0.17
802.11n_20	92.84	0.32
802.11n_40	86.51	0.63

$$b = 99.63\%, g = 96.24\%, n_{ht_20} = 92.84\%, n_{ht_40} = 86.51\%$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.9963) = 0.02$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.9624) = 0.17$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.9284) = 0.32$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.8651) = 0.63$$

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7.1 DUTY CYCLE TEST SIGNAL Measurement Result 802.11 b



802.11 g



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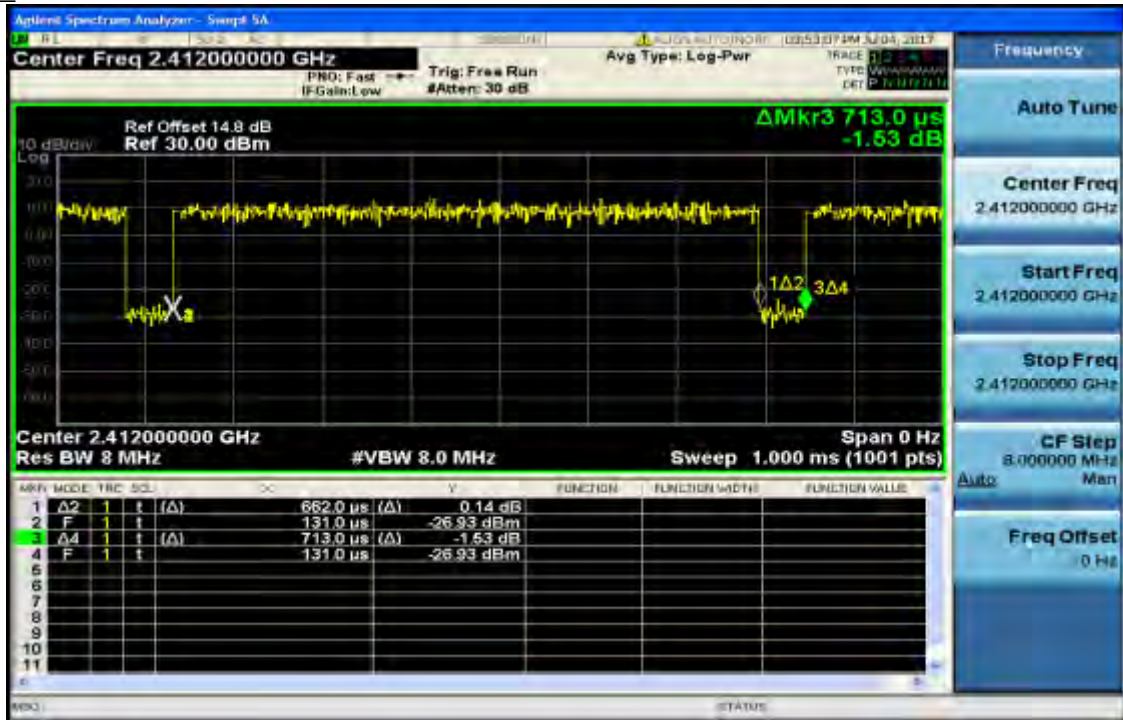
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802.11 n 20 MHz



802.11 n 40 MHz



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8 PEAK OUTPUT POWER MEASUREMENT

8.1 Standard Applicable

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

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

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

Main Antenna Gain: -1.50 dBi

Aux1 Antenna Gain: -0.10 dBi

Number Antenna: 2 pcs

Limit: 30 dBm

The antenna gain is grater than 6dBi in MIMO mode the limit reduce as below:

Directional gain = gain of antenna element + 10 log (# of TX antenna elements)

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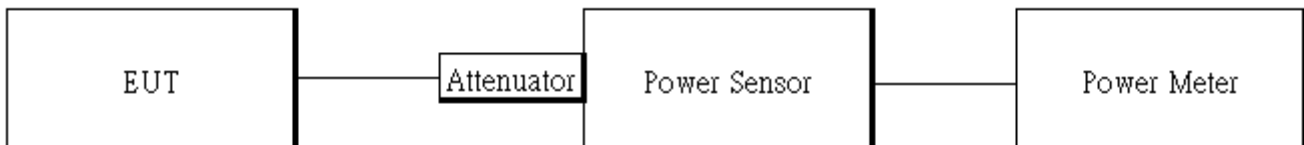
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8.2 Measurement Equipment Used

SGS Conducted Room					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018

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 Aux1						
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit		RESULT
1	2412	1	24.92	1 Watt 30.00 dBm		PASS
6	2437	1	25.18	1 Watt 30.00 dBm		PASS
11	2462	1	24.94	1 Watt 30.00 dBm		PASS
802.11b Aux1						
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Limit		RESULT
1	2412	1	22.76	1 Watt 30.00 dBm		PASS
6	2437	1	23.06	1 Watt 30.00 dBm		PASS
11	2462	1	22.81	1 Watt 30.00 dBm		PASS

802.11g_MIMO								
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)		Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CH 0	CH 1				
1	2412	6	24.26	24.61	27.45	555.75	1 Watt = 30.00 dBm	PASS
6	2437	6	24.25	24.53	27.40	549.86	1 Watt = 30.00 dBm	PASS
11	2462	6	23.78	24.41	27.12	514.84	1 Watt = 30.00 dBm	PASS
802.11g_MIMO								
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)		Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
			CH 0	CH 1				
1	2412	6	16.94	17.45	20.38	105.02	1 Watt = 30.00 dBm	PASS
6	2437	6	16.75	17.36	20.24	101.77	1 Watt = 30.00 dBm	PASS
11	2462	6	16.39	17.14	19.96	95.31	1 Watt = 30.00 dBm	PASS

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802.11n_HT20M MIMO								
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)		Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CH 0	CH 1				
1	2412	MCS8	24.03	24.18	27.12	514.75	1 Watt = 30.00 dBm	PASS
6	2437	MCS8	24.64	24.72	27.69	587.55	1 Watt = 30.00 dBm	PASS
11	2462	MCS8	23.56	23.96	26.77	475.87	1 Watt = 30.00 dBm	PASS
802.11n_HT20M MIMO								
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)		Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
			CH 0	CH 1				
1	2412	MCS8	14.76	15.09	18.26	62.21	1 Watt = 30.00 dBm	PASS
6	2437	MCS8	17.32	17.91	20.96	115.75	1 Watt = 30.00 dBm	PASS
11	2462	MCS8	14.58	15.36	18.32	63.06	1 Watt = 30.00 dBm	PASS

802.11n_HT40M MIMO								
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)		Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CH 0	CH 1				
3	2422	MCS8	23.54	23.94	26.75	473.69	1 Watt = 30.00 dBm	PASS
6	2437	MCS8	24.29	27.71	29.34	858.74	1 Watt = 30.00 dBm	PASS
9	2452	MCS8	22.75	23.23	26.01	398.74	1 Watt = 30.00 dBm	PASS
802.11n_HT40M MIMO								
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)		Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
			CH 0	CH 1				
3	2422	MCS8	13.71	14.34	17.68	50.66	1 Watt = 30.00 dBm	PASS
6	2437	MCS8	16.73	17.36	20.70	101.55	1 Watt = 30.00 dBm	PASS
9	2452	MCS8	13.19	13.96	17.23	45.73	1 Watt = 30.00 dBm	PASS

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

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9 6DB BANDWIDTH MEASUREMENT

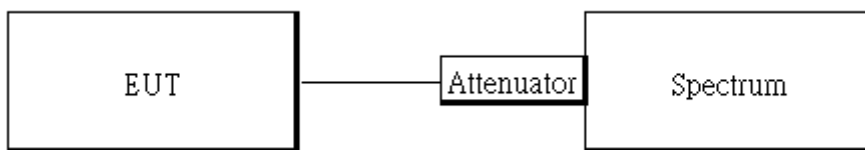
9.1 Standard Applicable

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

9.2 Measurement Equipment Used

SGS Conducted Room					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018

9.3 Test Set-up



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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 Aux1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	10063	> 500	PASS
2437	10068	> 500	PASS
2462	10057	> 500	PASS

802.11g Main

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	16360	> 500	PASS
2437	16370	> 500	PASS
2462	16330	> 500	PASS

802.11g Aux1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	16360	> 500	PASS
2437	16370	> 500	PASS
2462	16370	> 500	PASS

802.11_n_HT20 Main

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	17580	> 500	PASS
2437	17560	> 500	PASS
2462	17590	> 500	PASS

802.11_n_HT20 Aux1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	17600	> 500	PASS
2437	17590	> 500	PASS
2462	17580	> 500	PASS

802.11_n_HT40 Main

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2422	36380	> 500	PASS
2437	36520	> 500	PASS
2452	36350	> 500	PASS

802.11_n_HT40 Aux1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2422	36330	> 500	PASS
2437	36420	> 500	PASS
2452	36390	> 500	PASS

**Refer to next page for plots*

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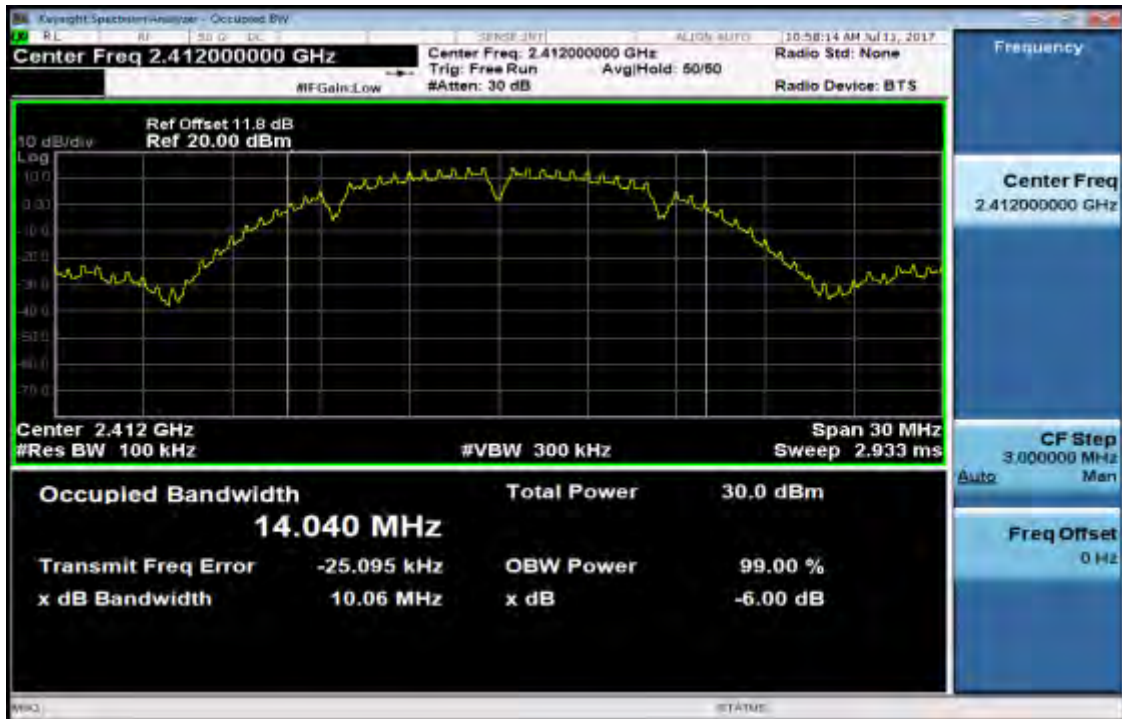
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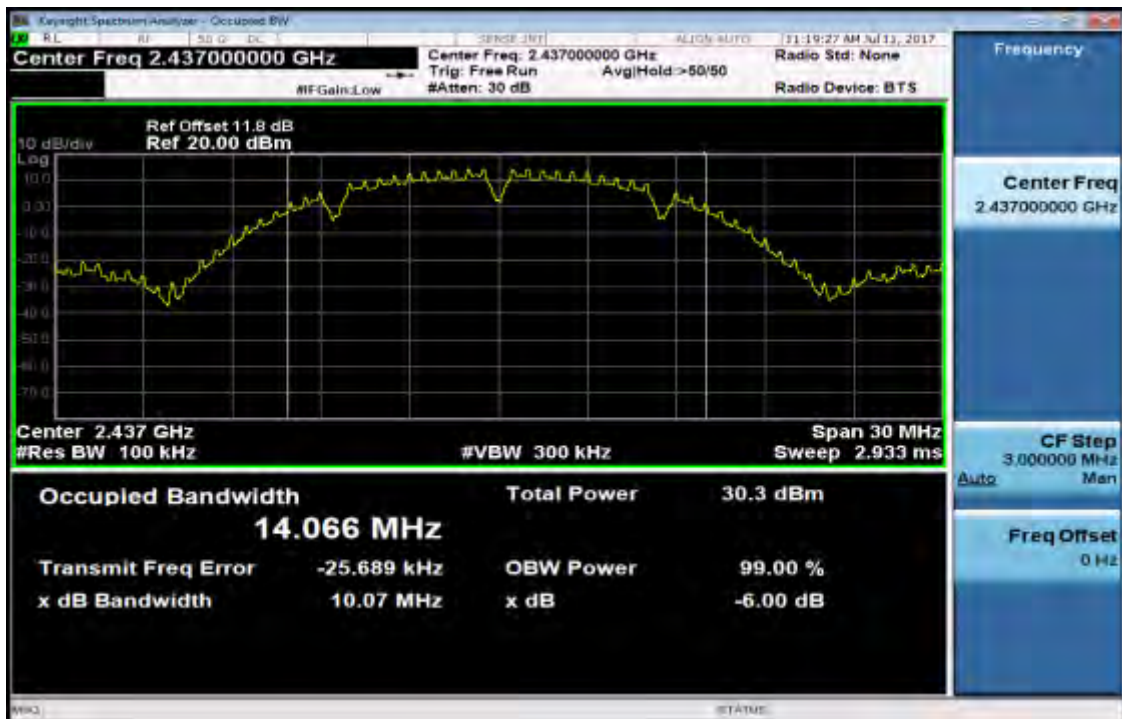
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802.11b (Aux) 6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid



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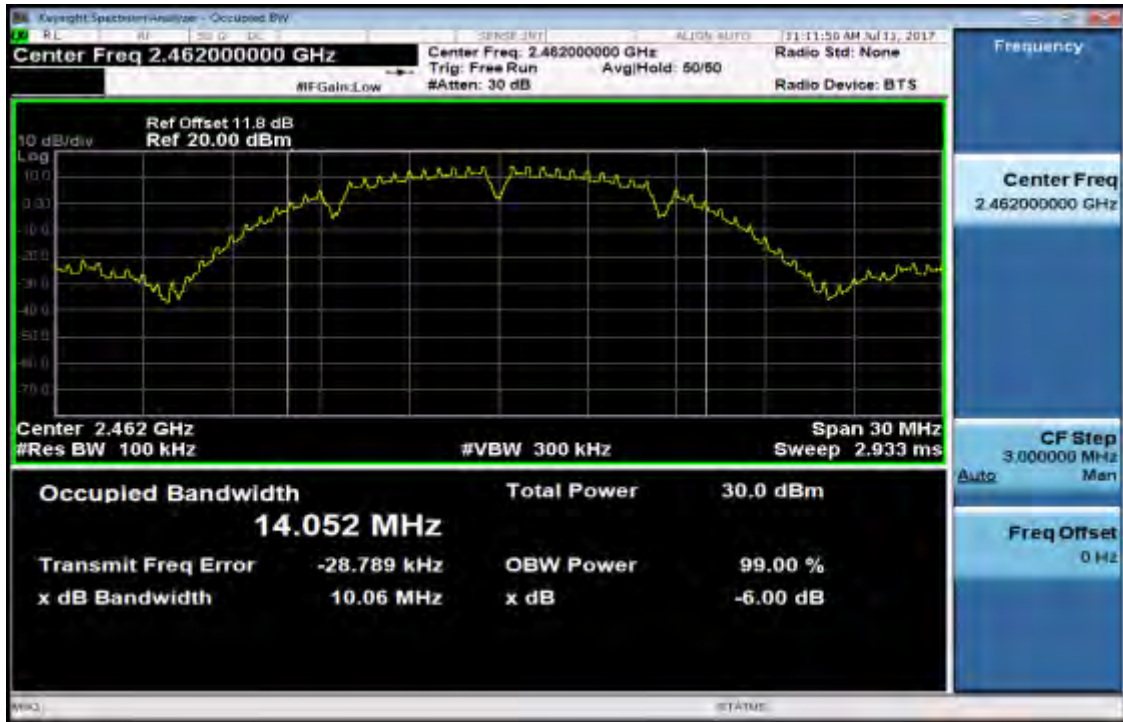
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6dB Band Width Test Data CH-High



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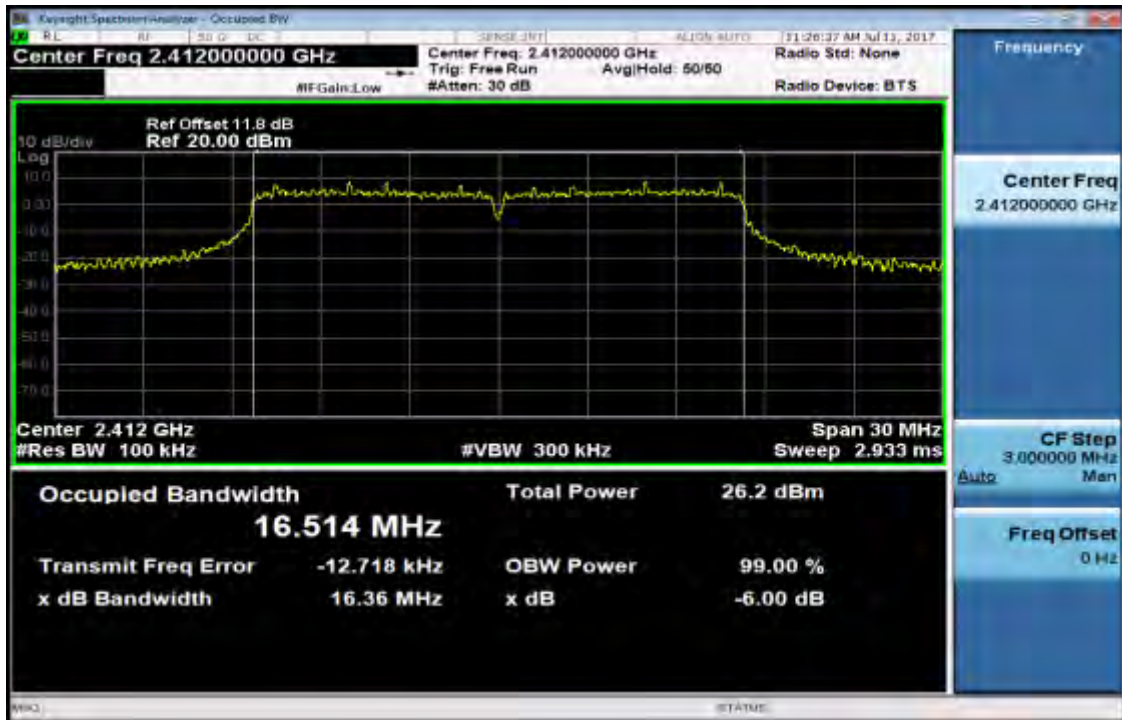
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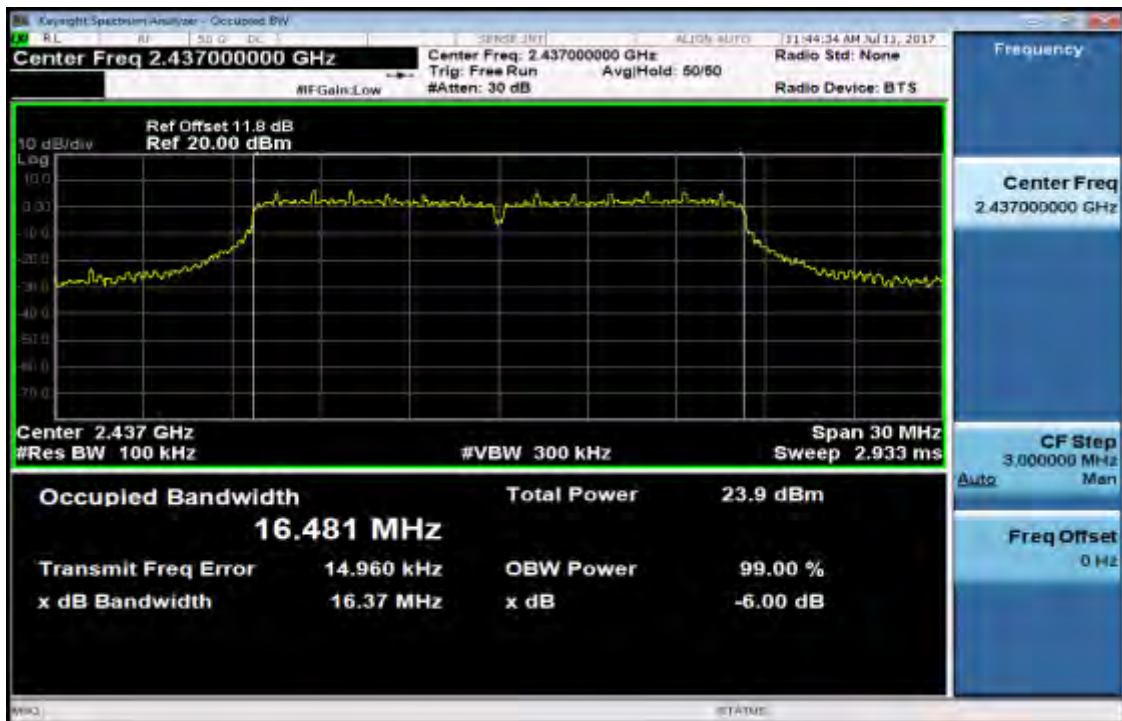
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802.11g (Main)
6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid



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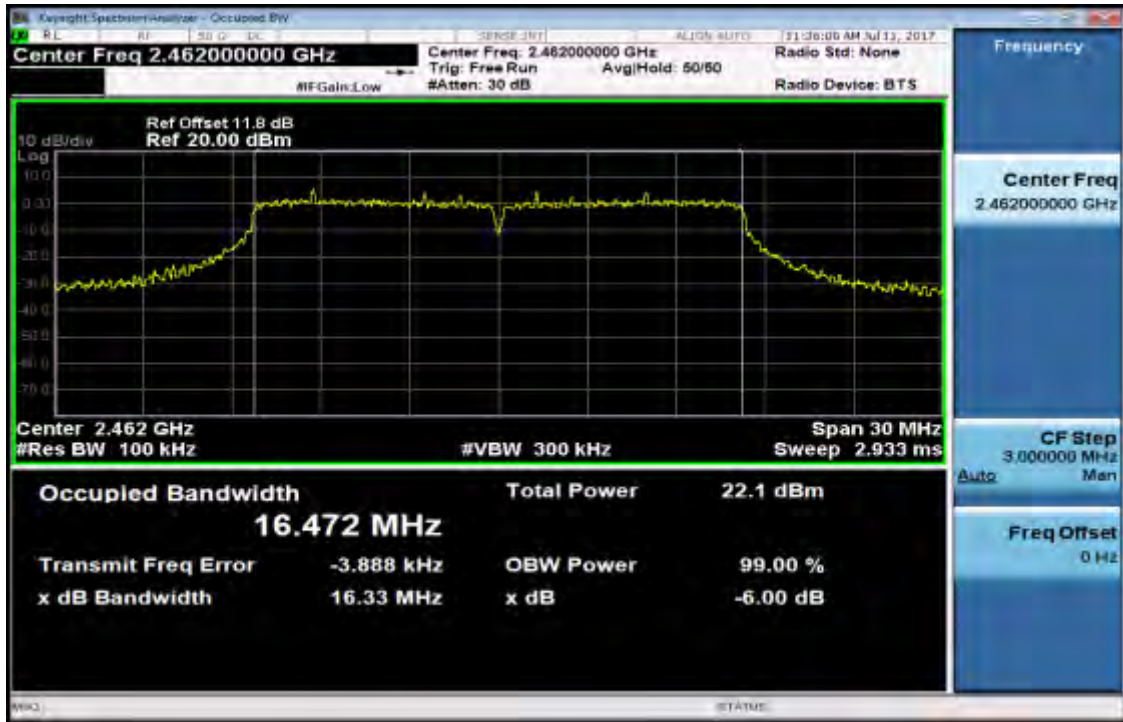
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6dB Band Width Test Data CH-High



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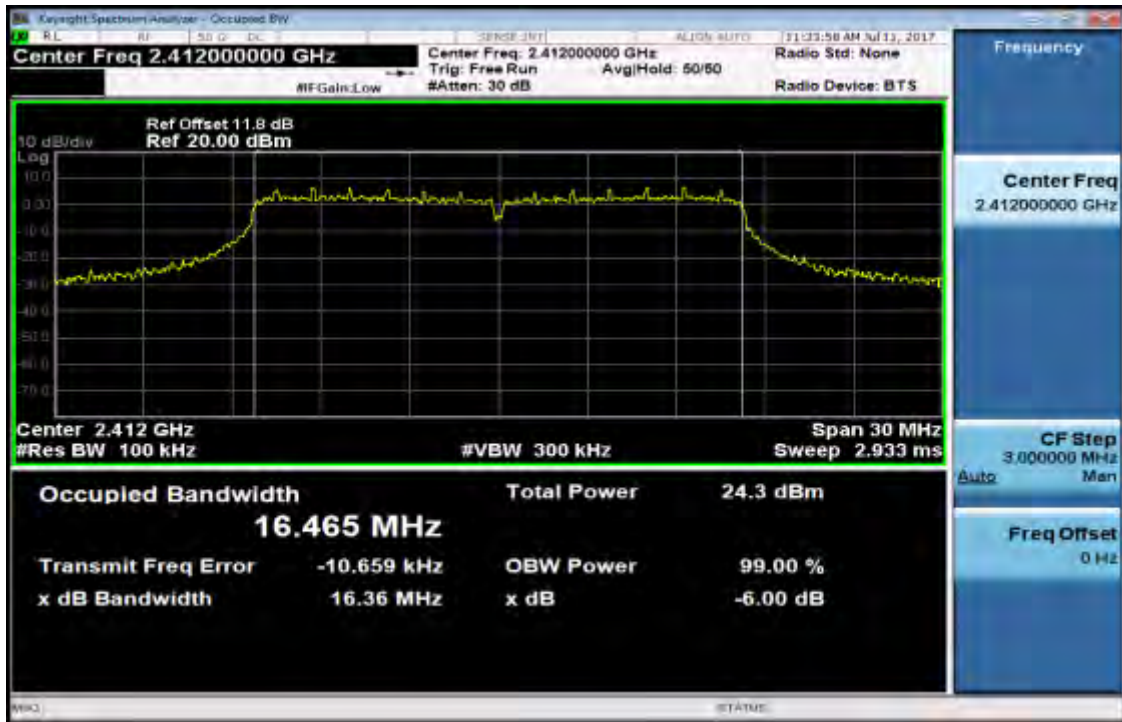
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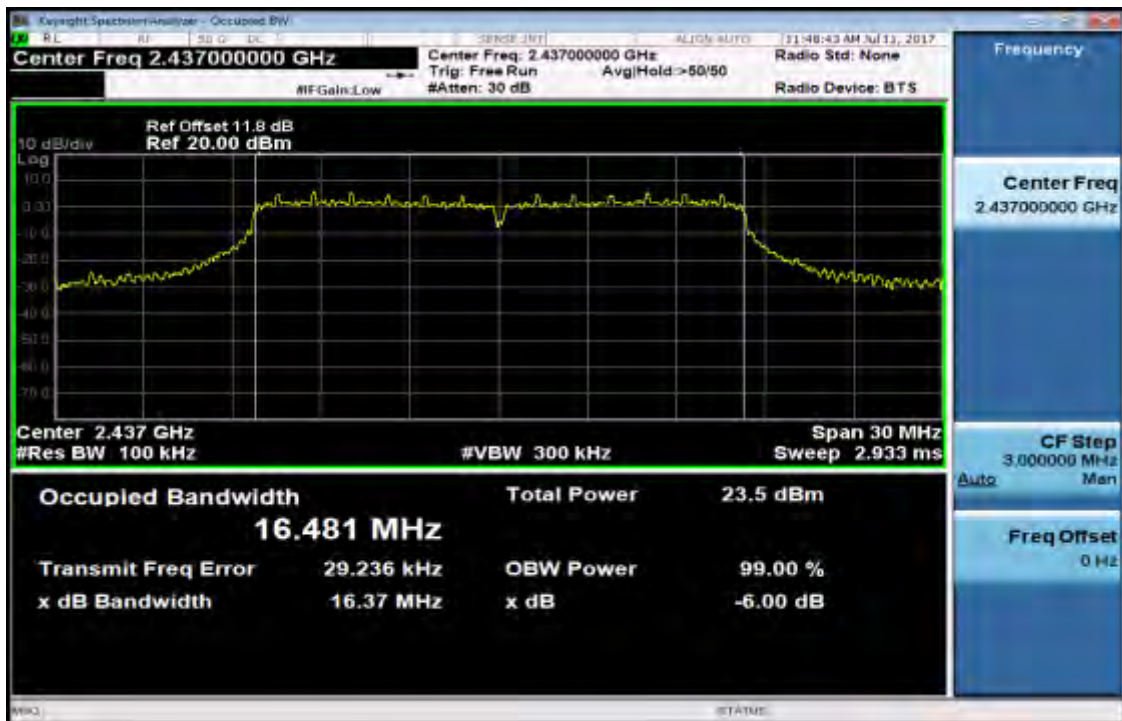
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802.11g (Aux) 6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid



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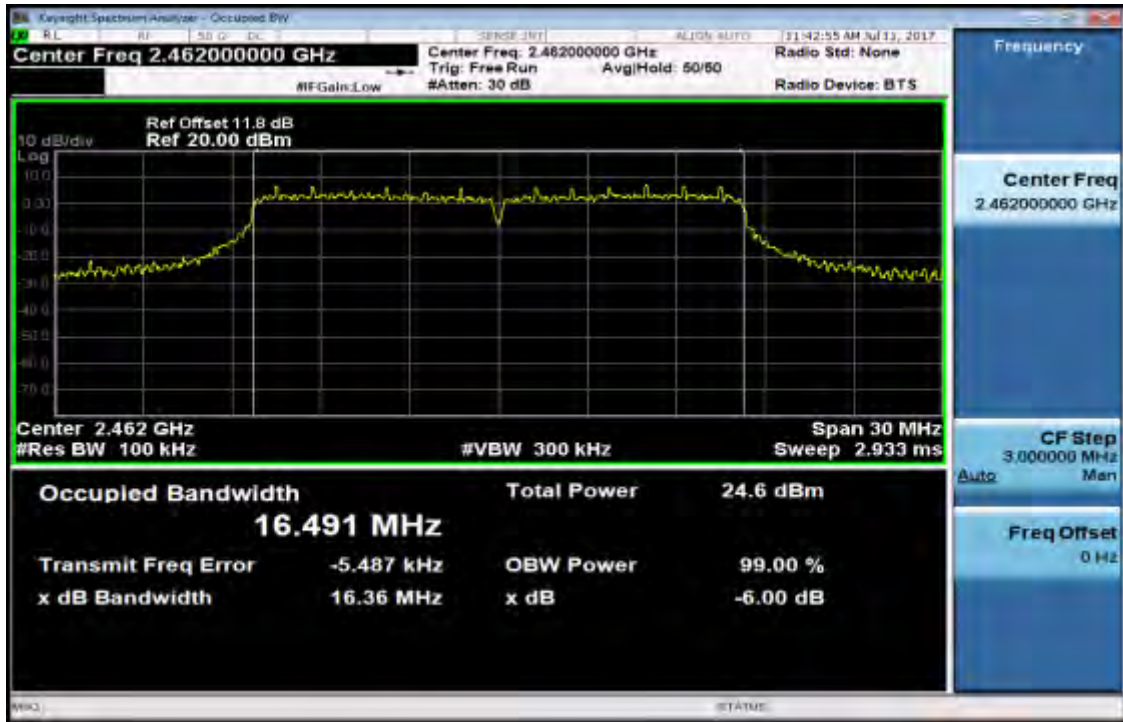
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6dB Band Width Test Data CH-High



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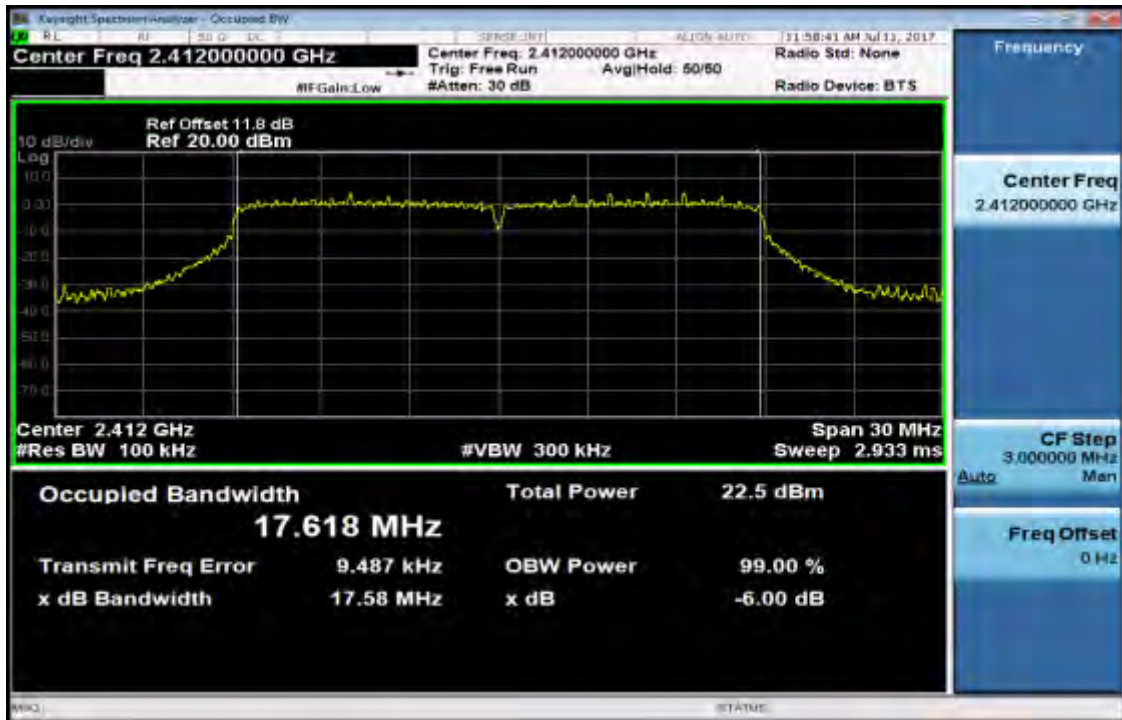
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f (886-2) 2298-0488

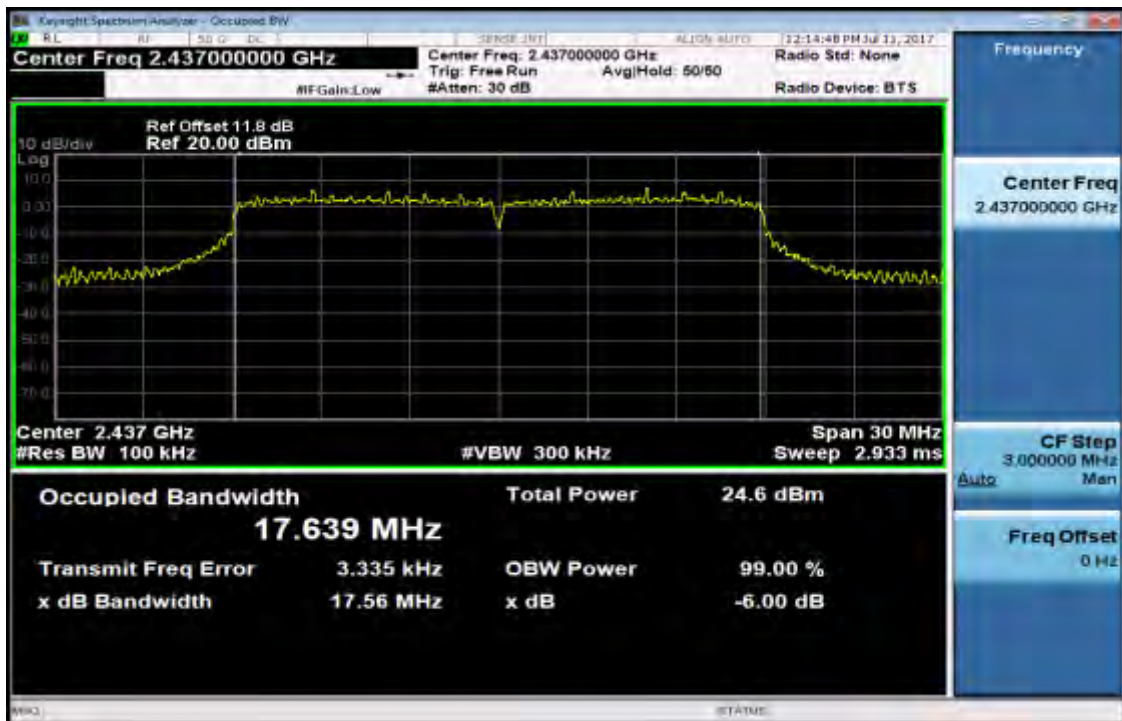
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802.11n_20M (Main)
6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid



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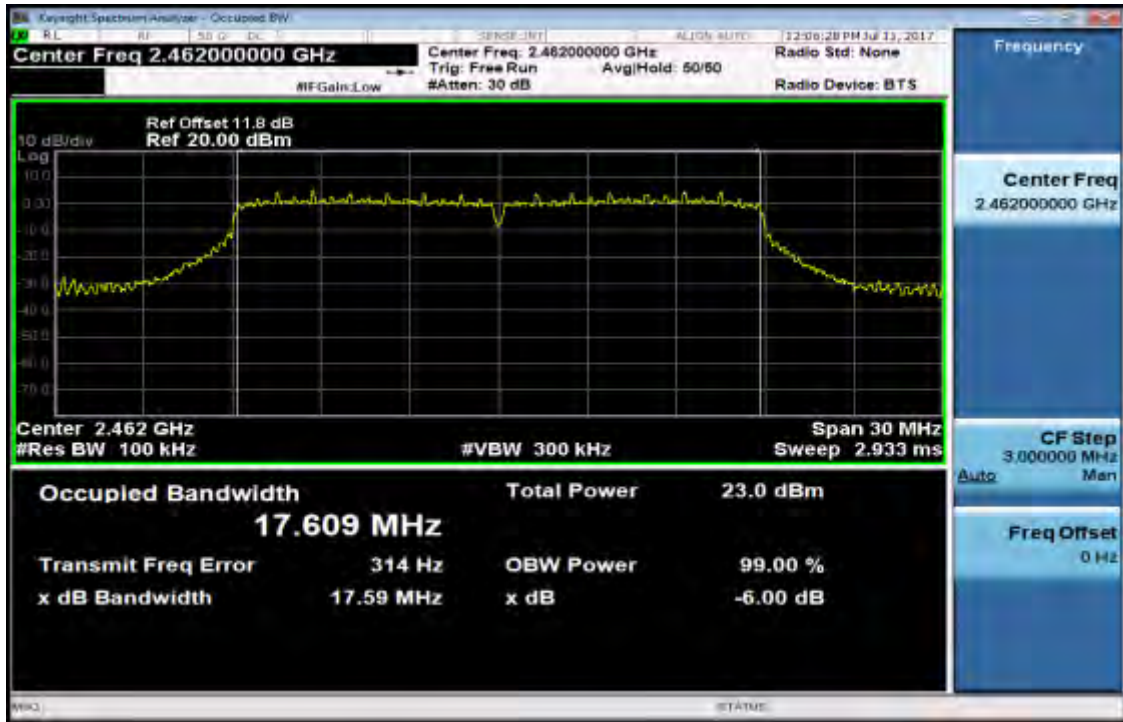
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6dB Band Width Test Data CH-High



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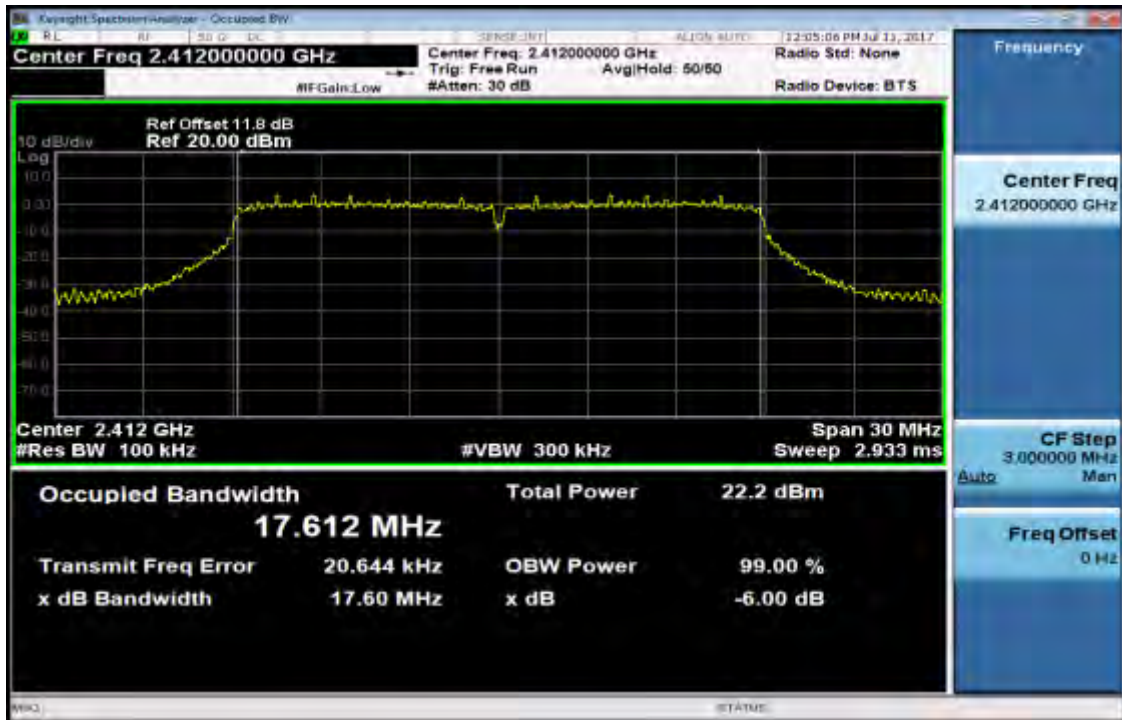
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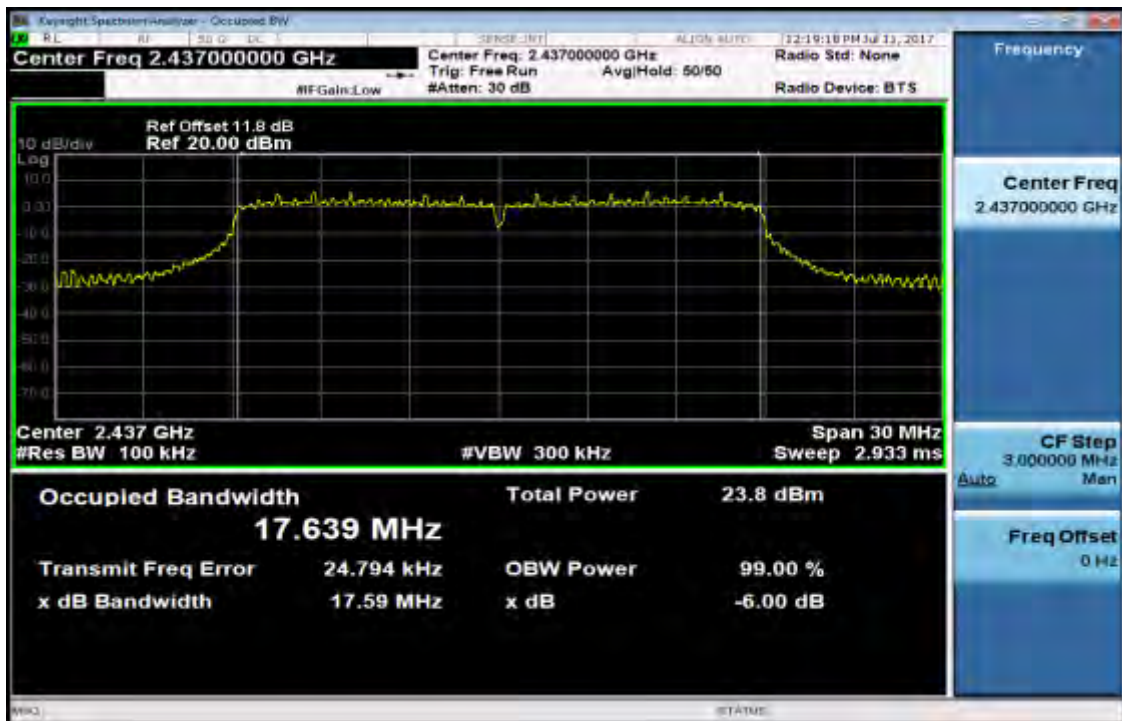
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802.11n_20M (Aux)
6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid

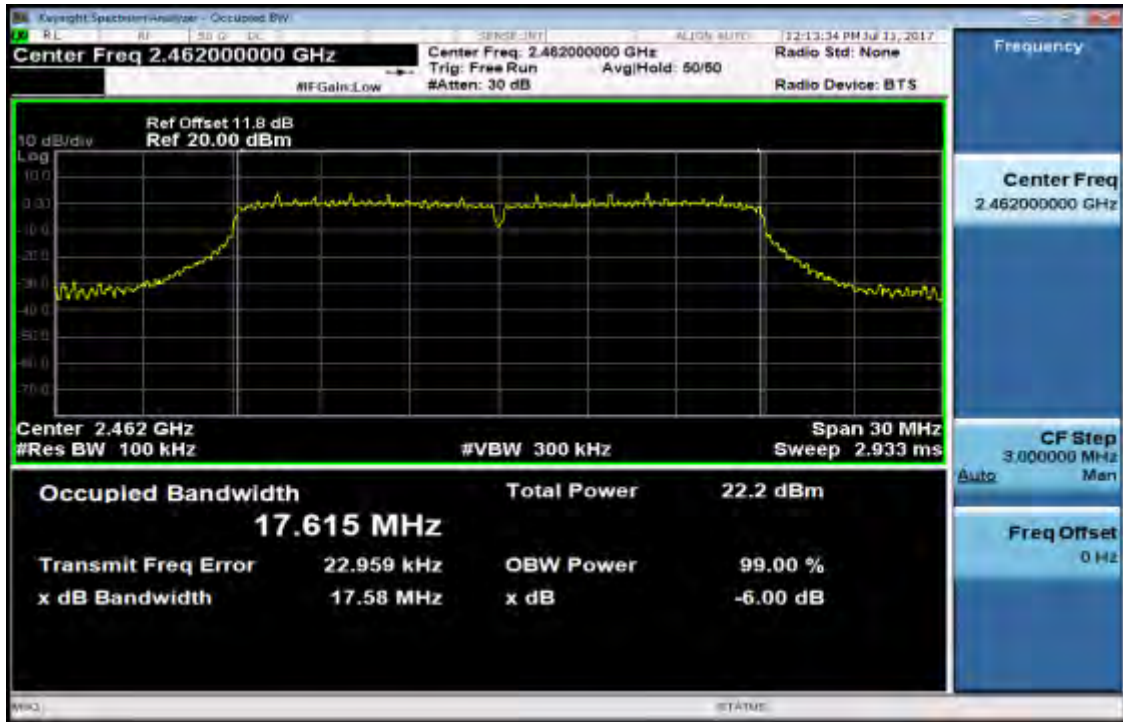


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6dB Band Width Test Data CH-High



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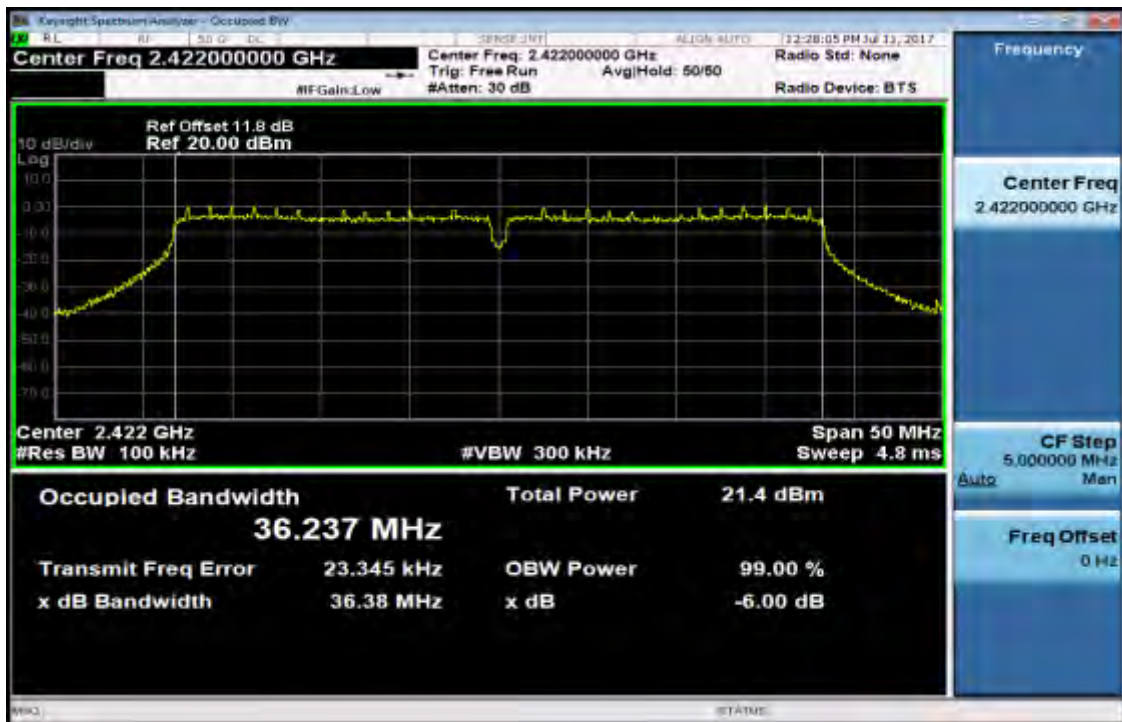
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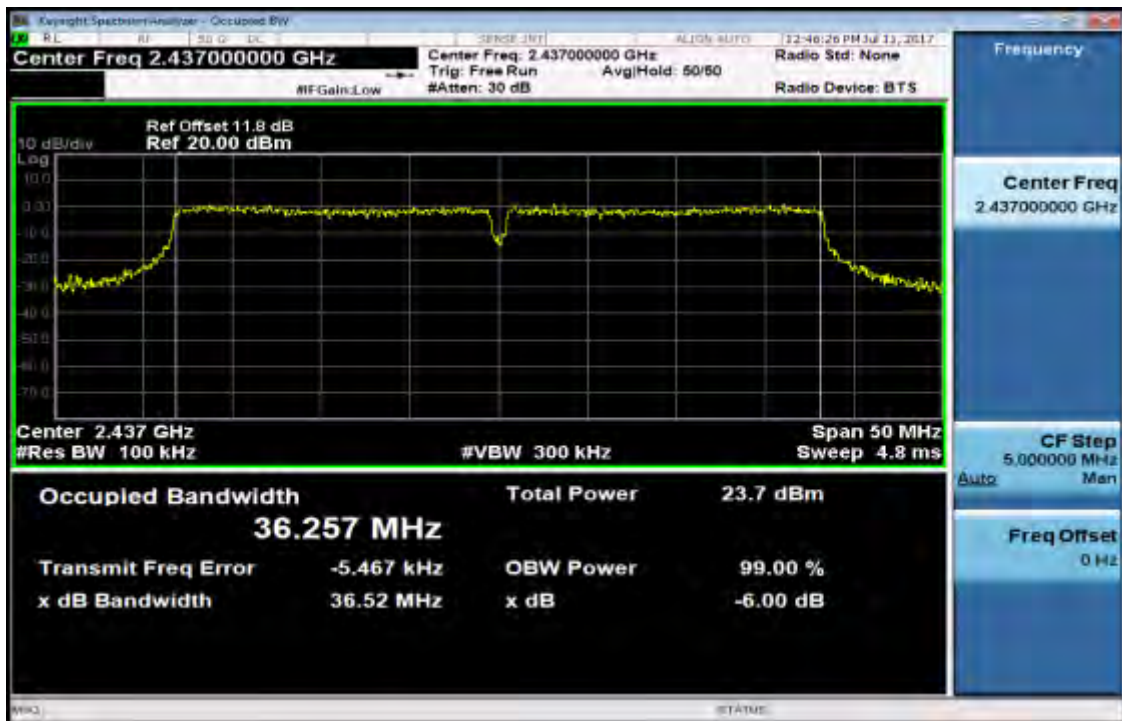
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802.11n_40M (Main) 6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid



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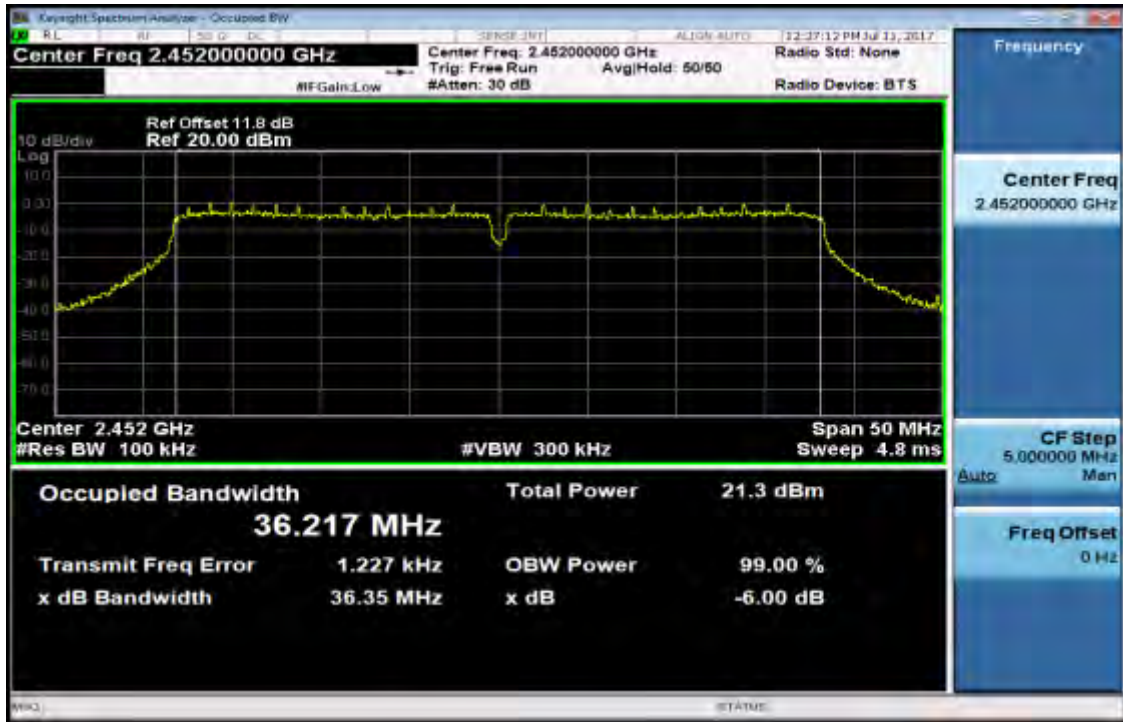
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6dB Band Width Test Data CH-High



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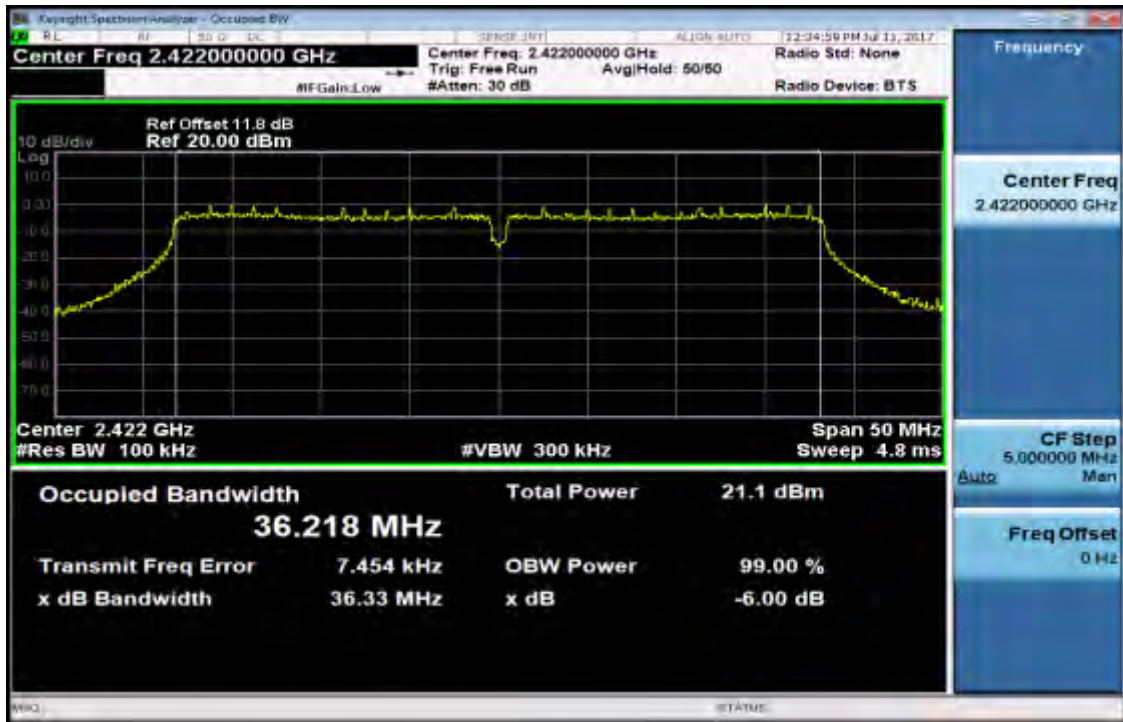
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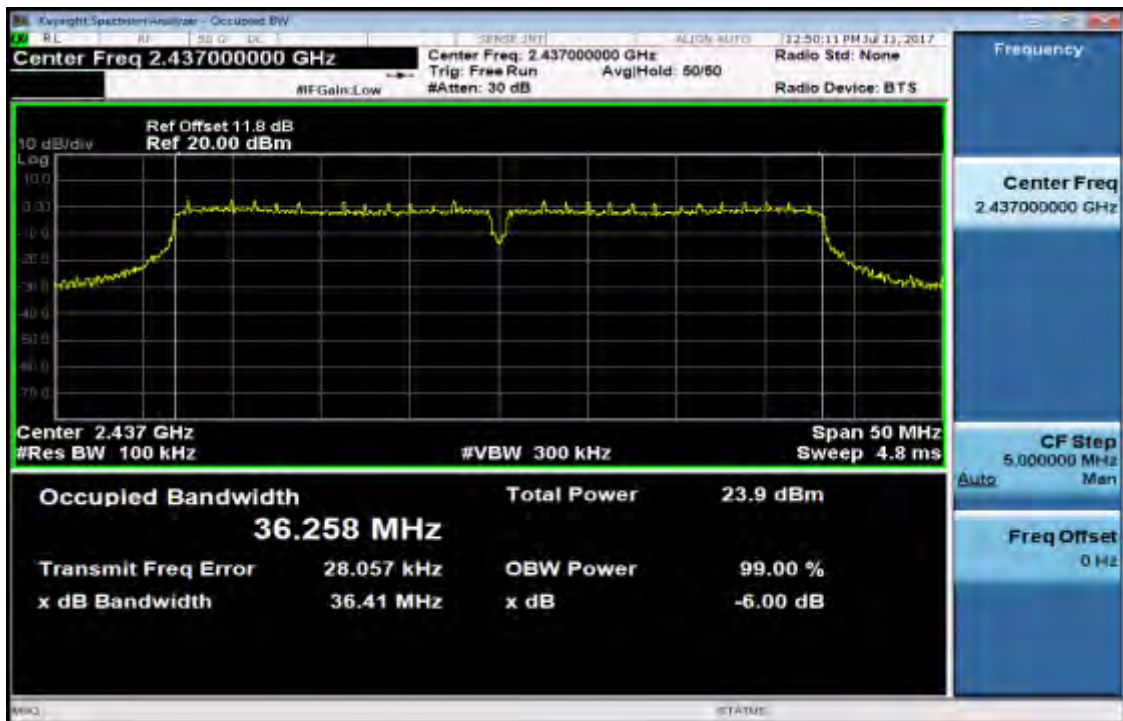
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802.11n_40M (Aux)
6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid



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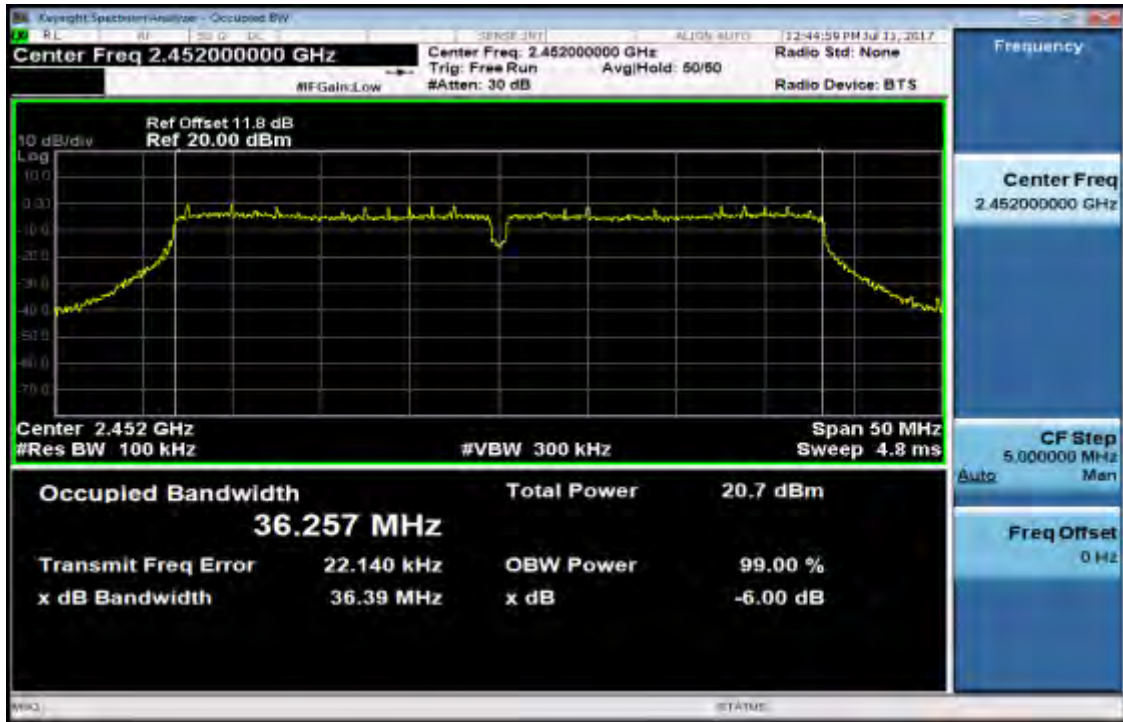
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6dB Band Width Test Data CH-High



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10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

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

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

If the transmitter complies with the conducted power limits based on the use of 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.

10.2 Measurement Equipment Used

SGS Conducted Room					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018

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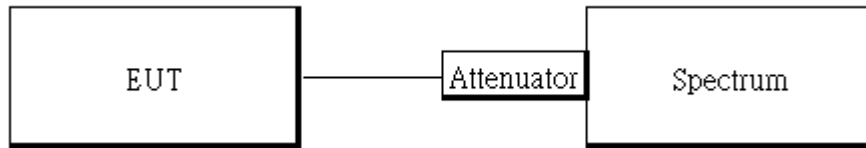
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10.3 Test SET-UP



10.4 Measurement Procedure

Conducted Band Edge:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
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.

10.5 Measurement Result

1. Refer to next page spectrum analyzer data chart and tabular data sheets.
2. For restricted Band Edge Limit, please refer to section 12.5 of this report for measurement result.

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802.11b Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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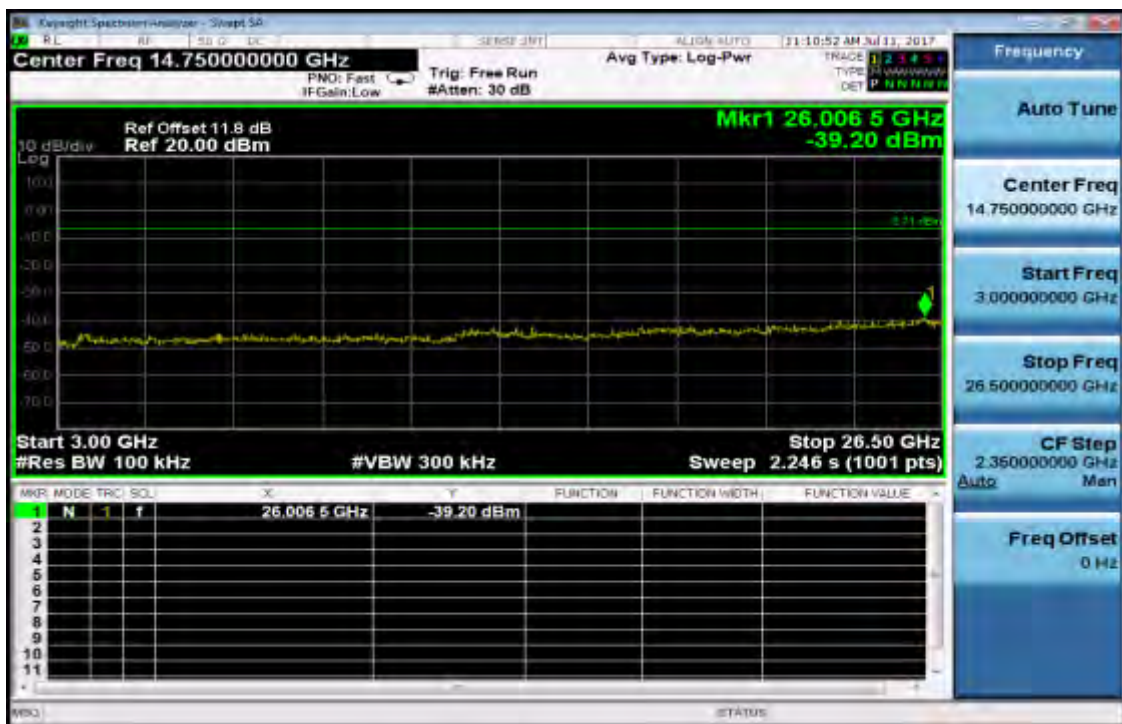
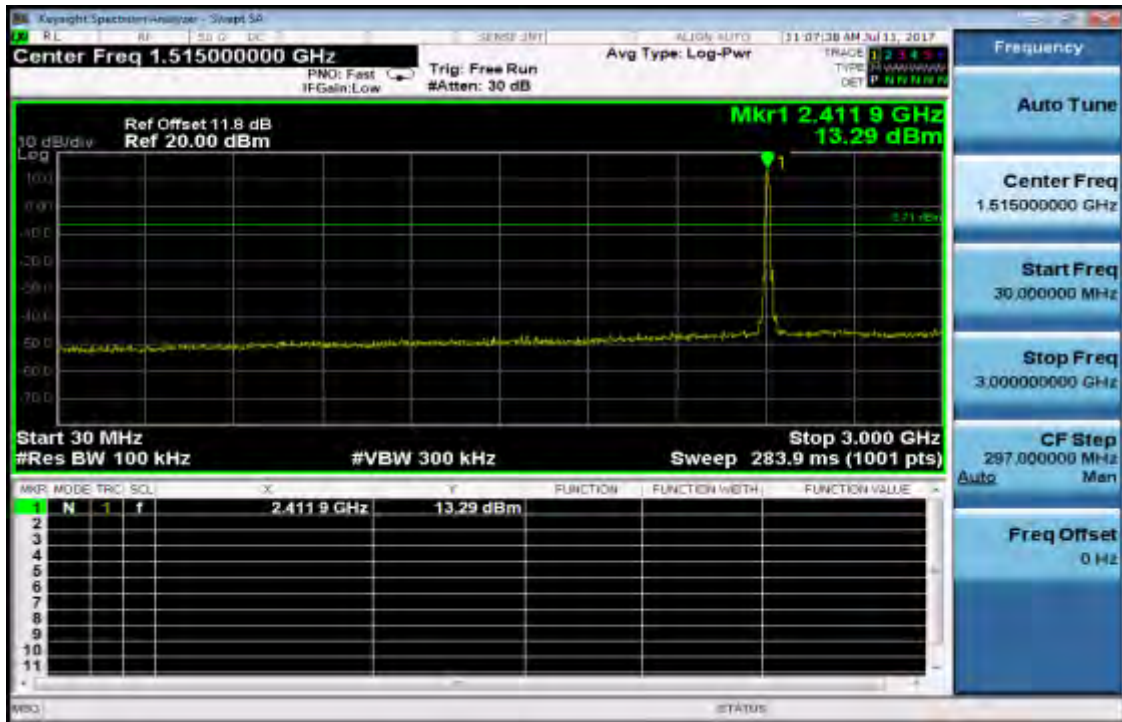
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802.11b
Spurious Emission Test Data CH-Low

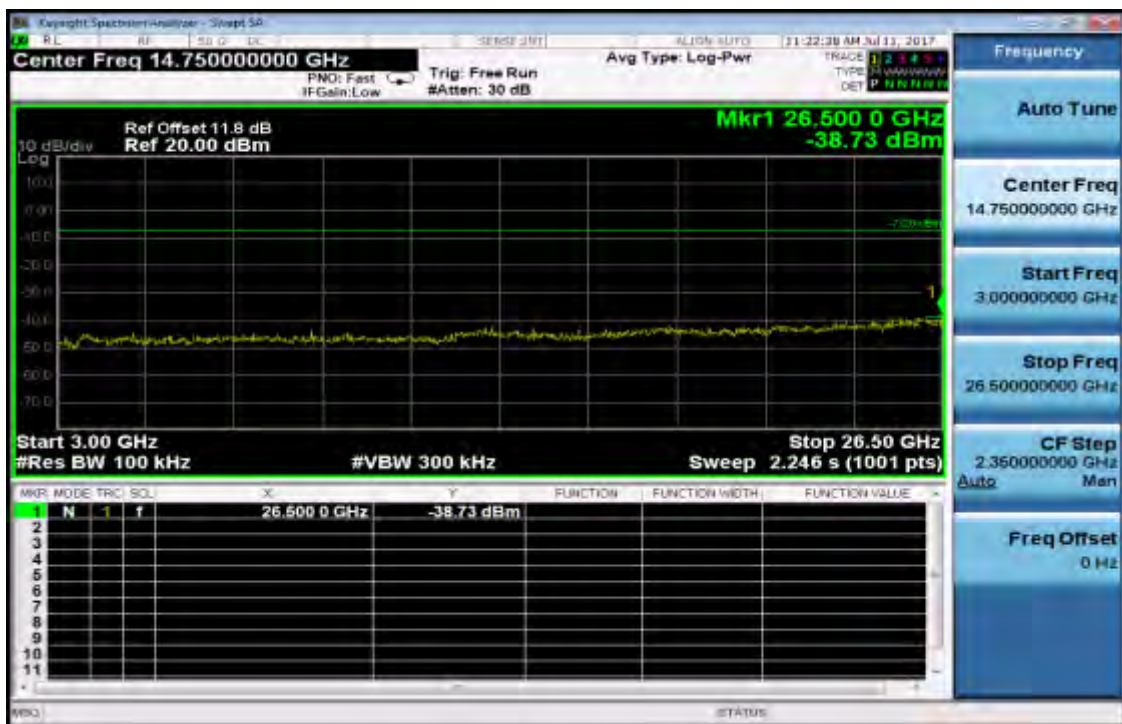
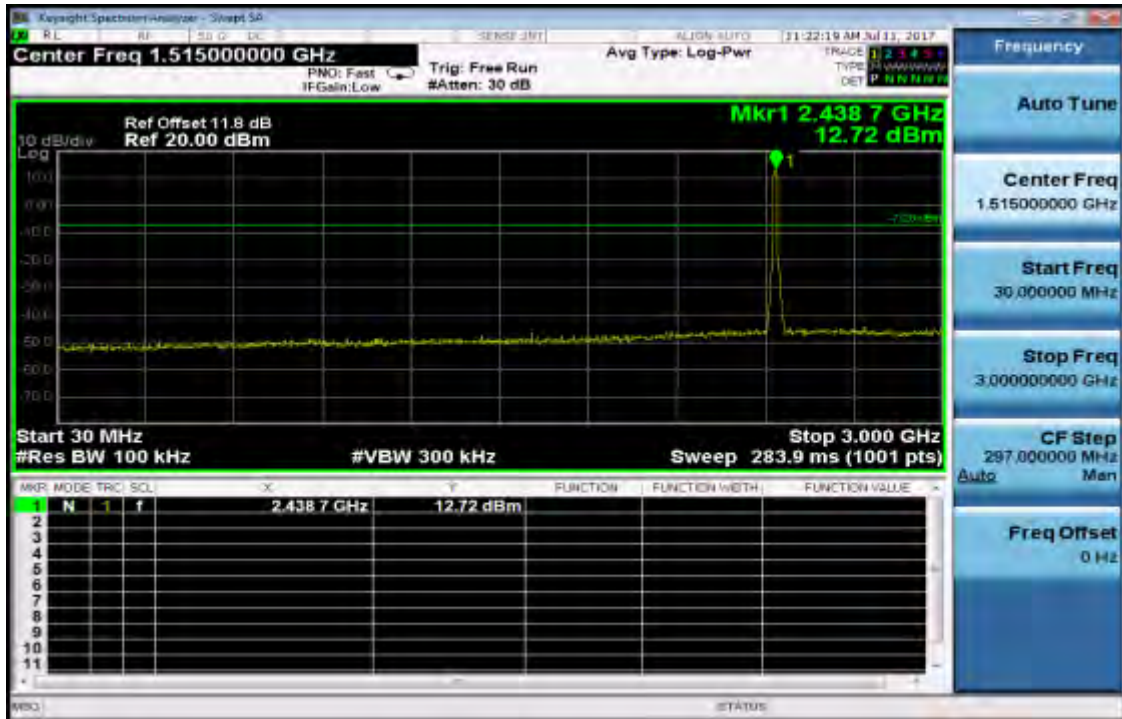


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Spurious Emission Test Data CH-Mid



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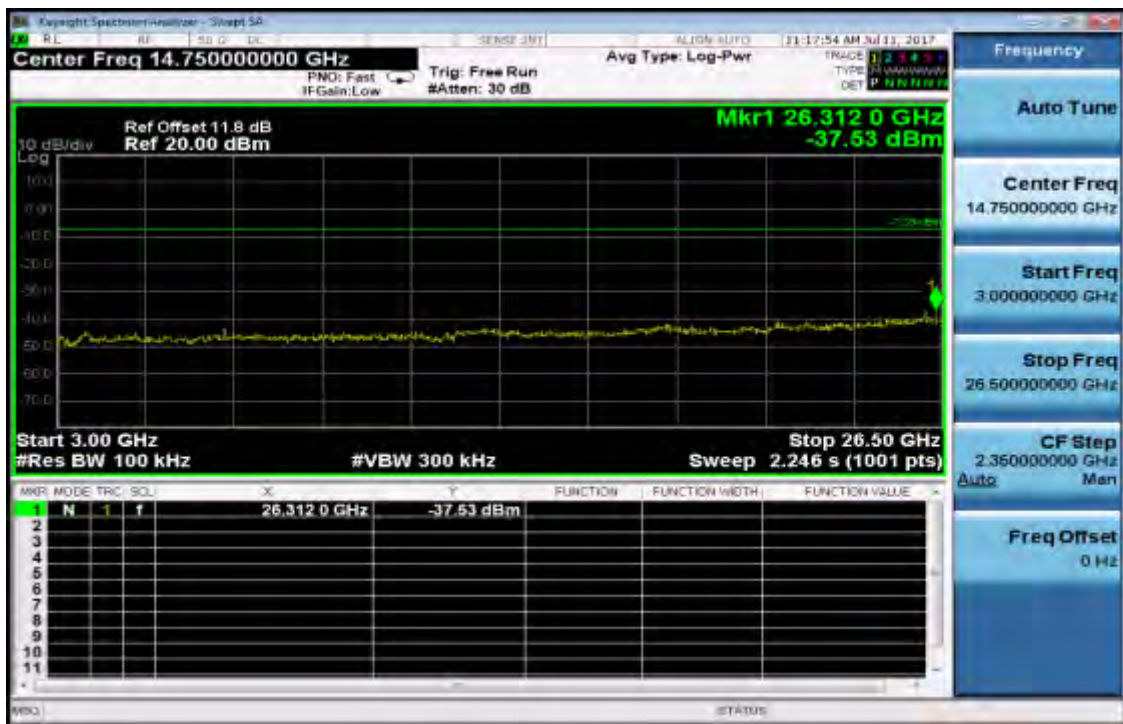
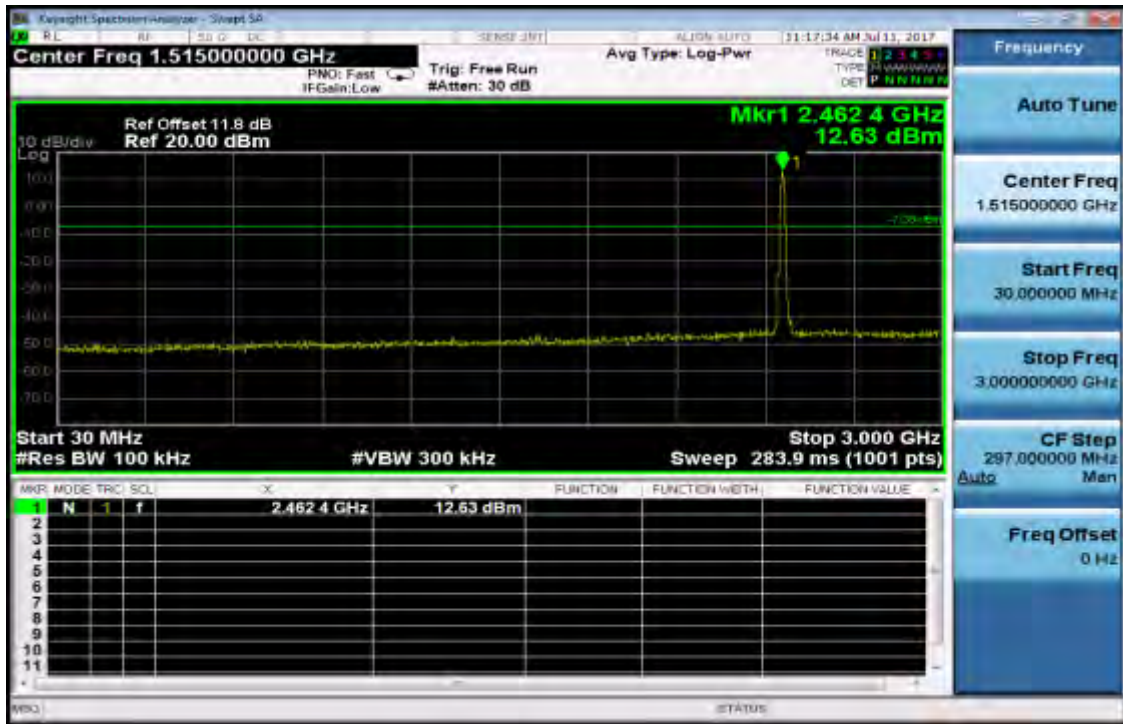
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Spurious Emission Test Data CH-High



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802.11g Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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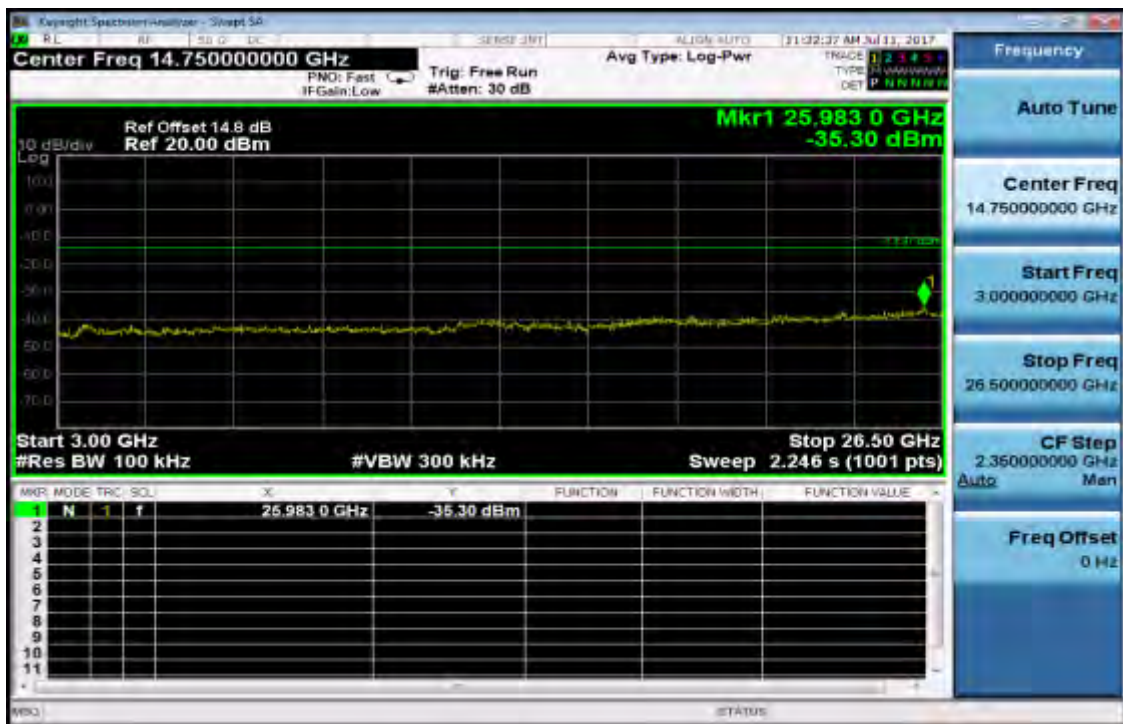
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802.11g
Spurious Emission Test Data CH-Low



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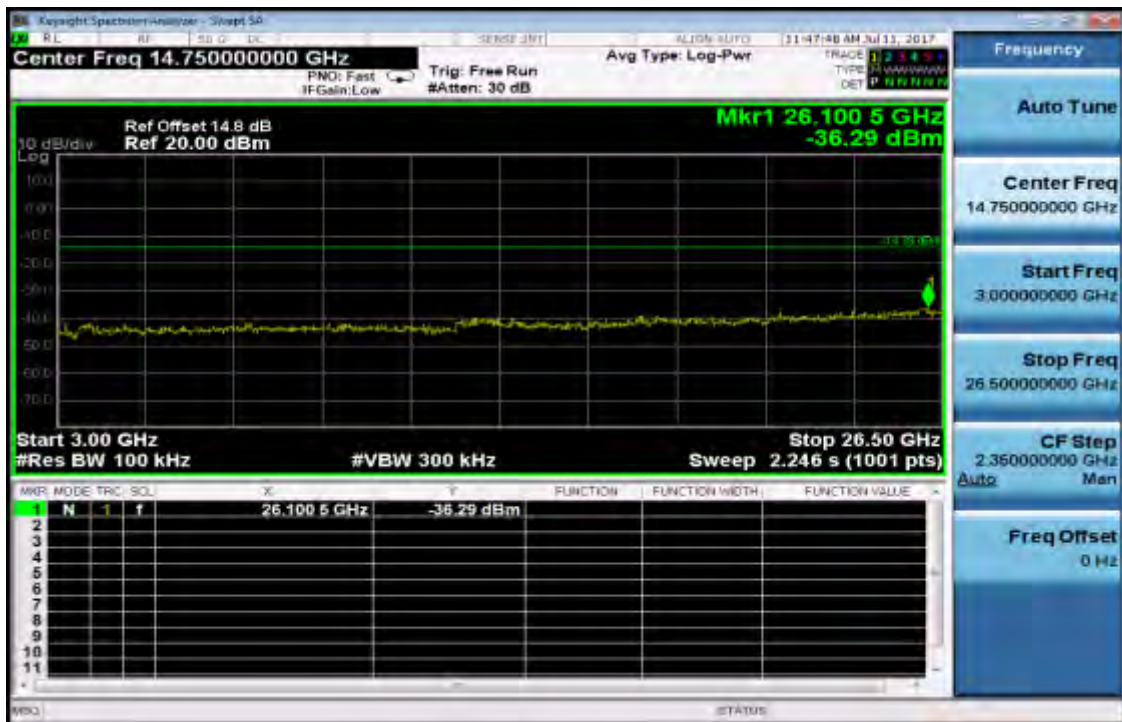
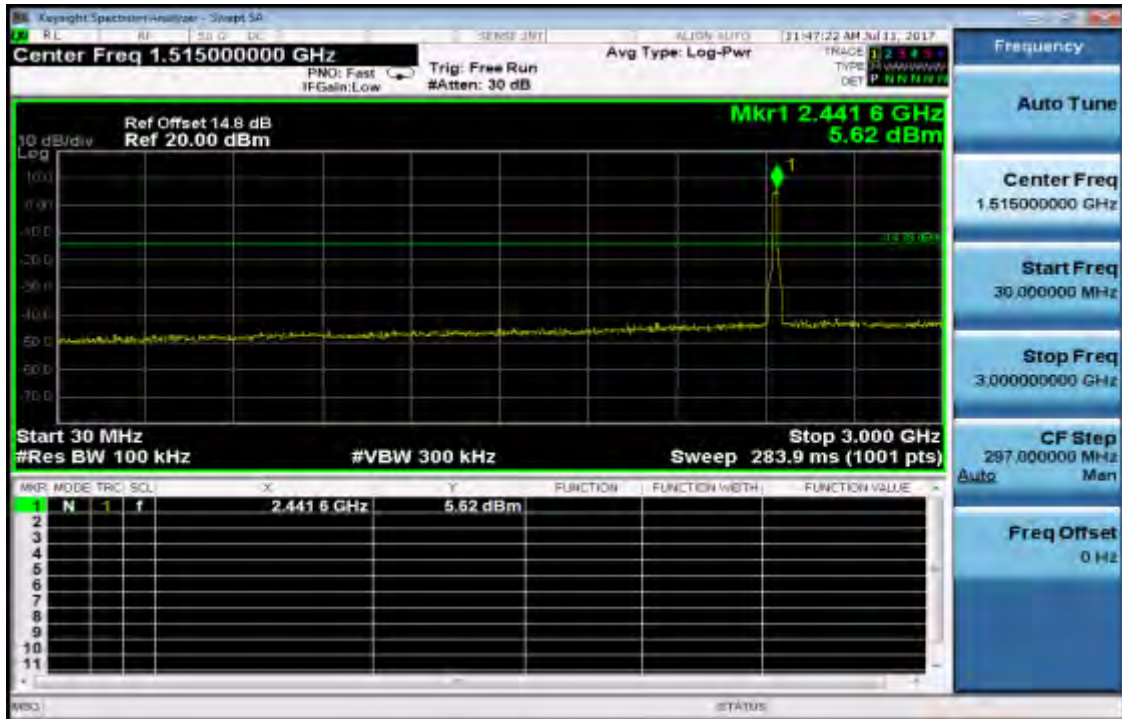
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Spurious Emission Test Data CH-Mid



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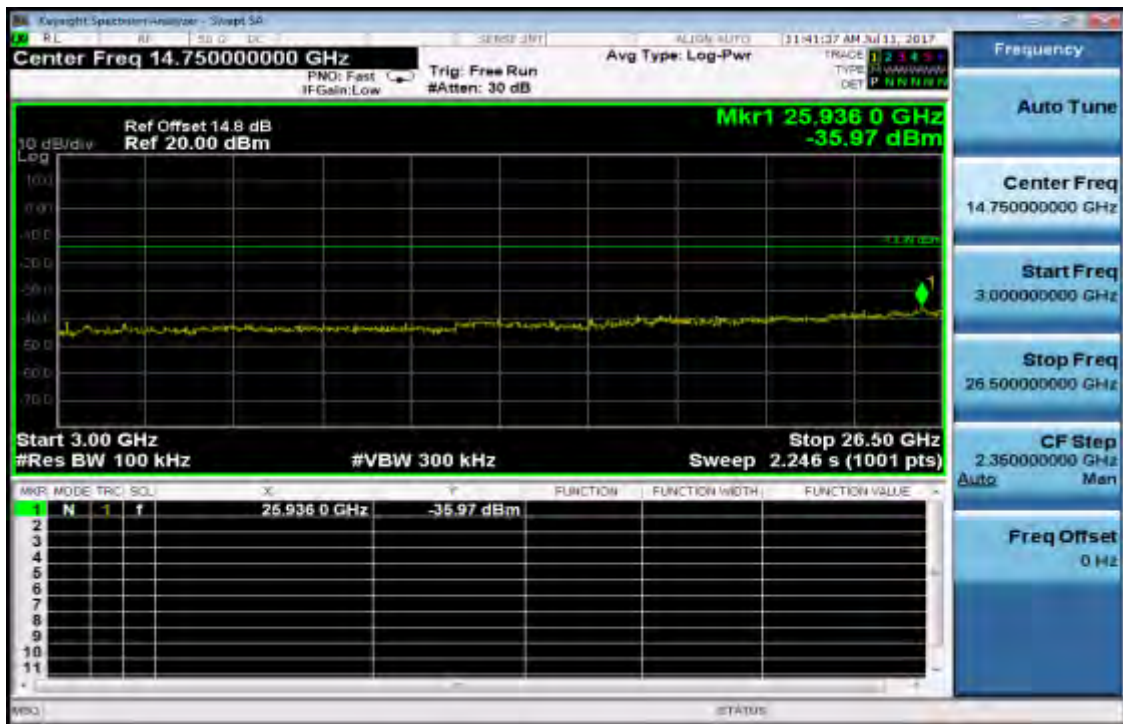
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Spurious Emission Test Data CH-High



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802.11n_HT20
Band Edges Test Data CH-Low



Band Edges Test Data CH-High

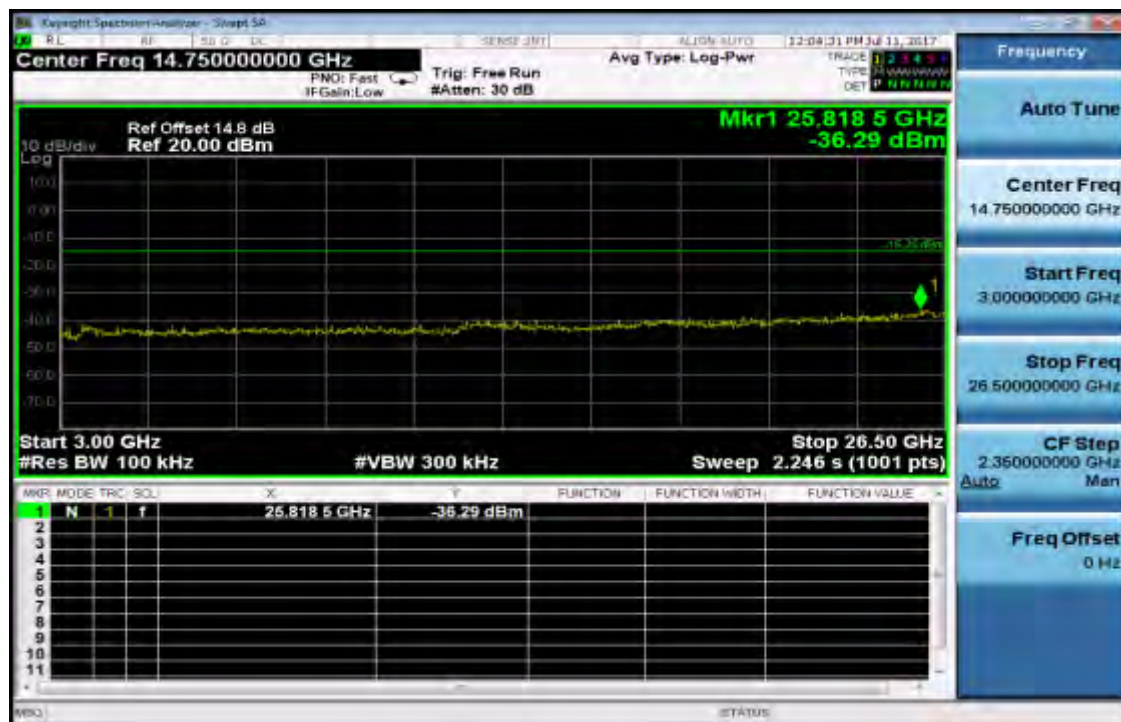
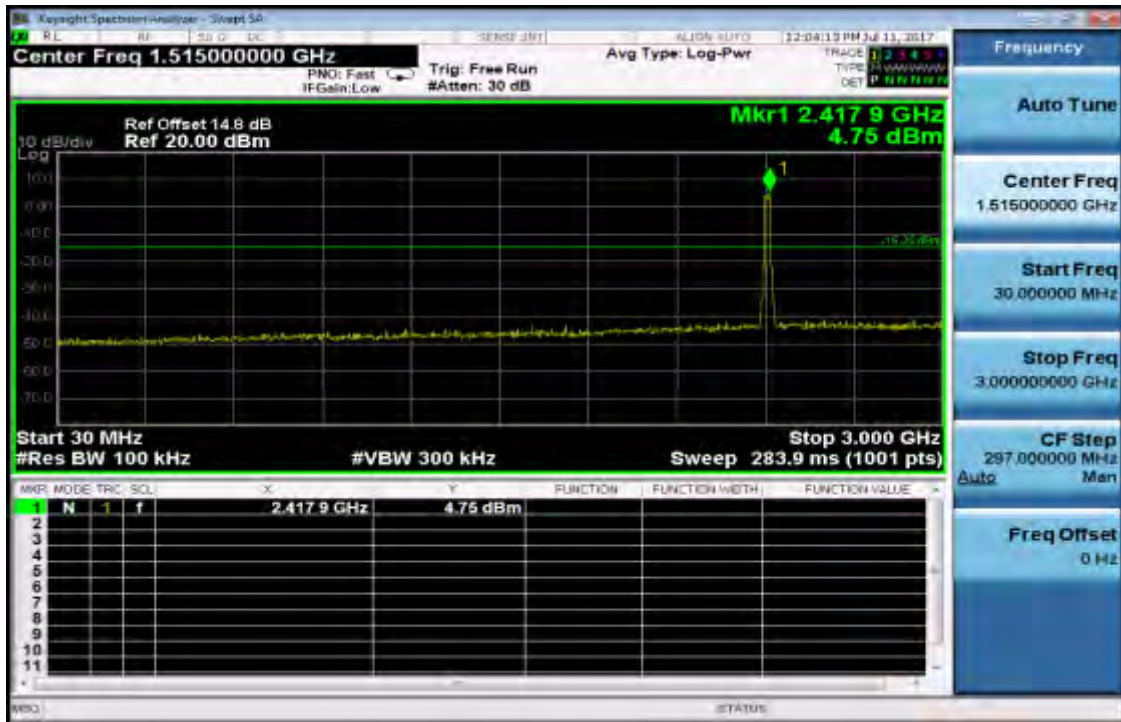


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802.11n_HT20
Spurious Emission Test Data CH-Low



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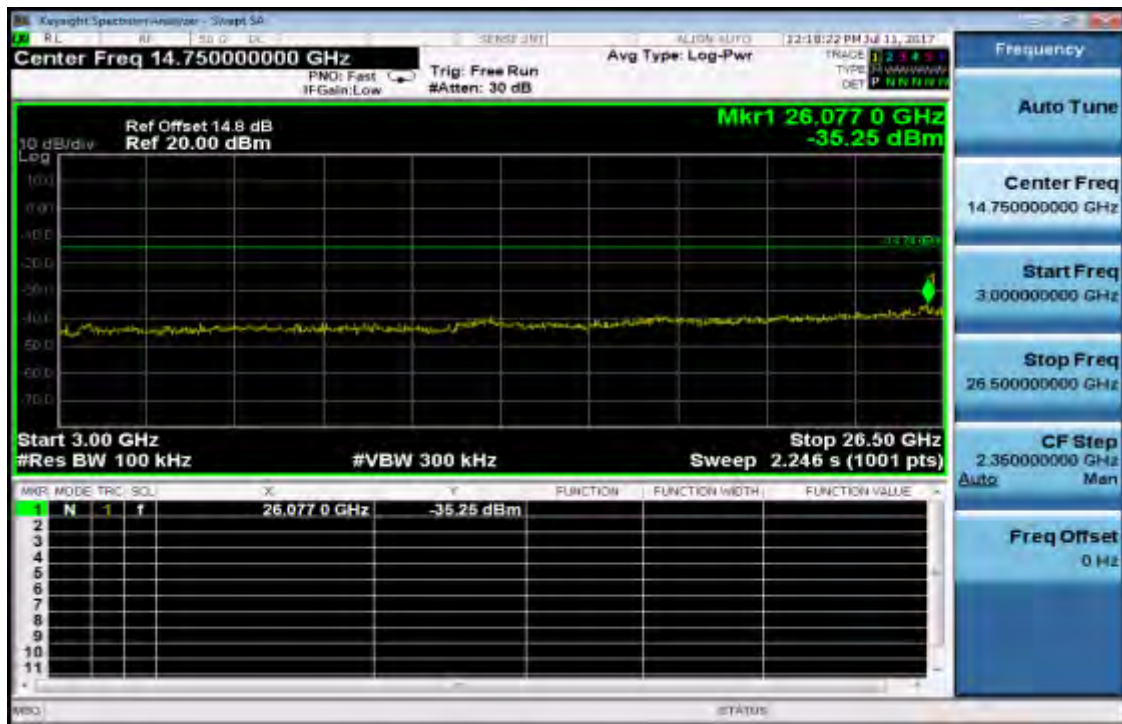
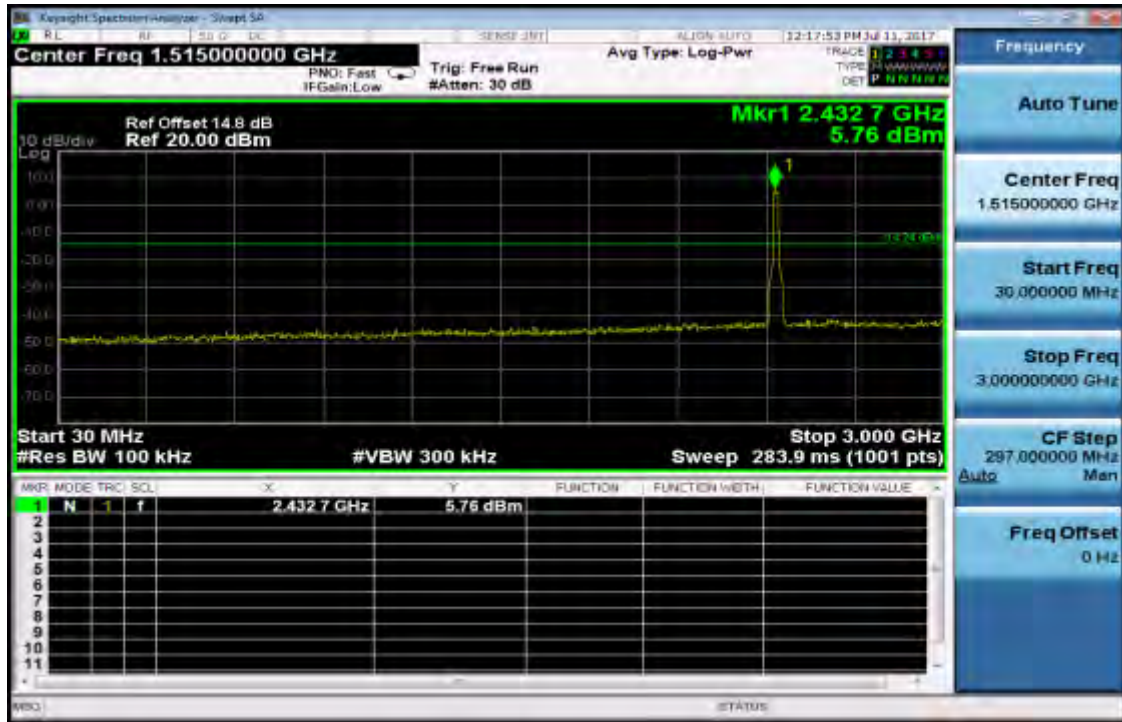
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Spurious Emission Test Data CH-Mid



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802.11n_HT40 Band Edges Test Data CH-Low



Band Edges Test Data CH-High

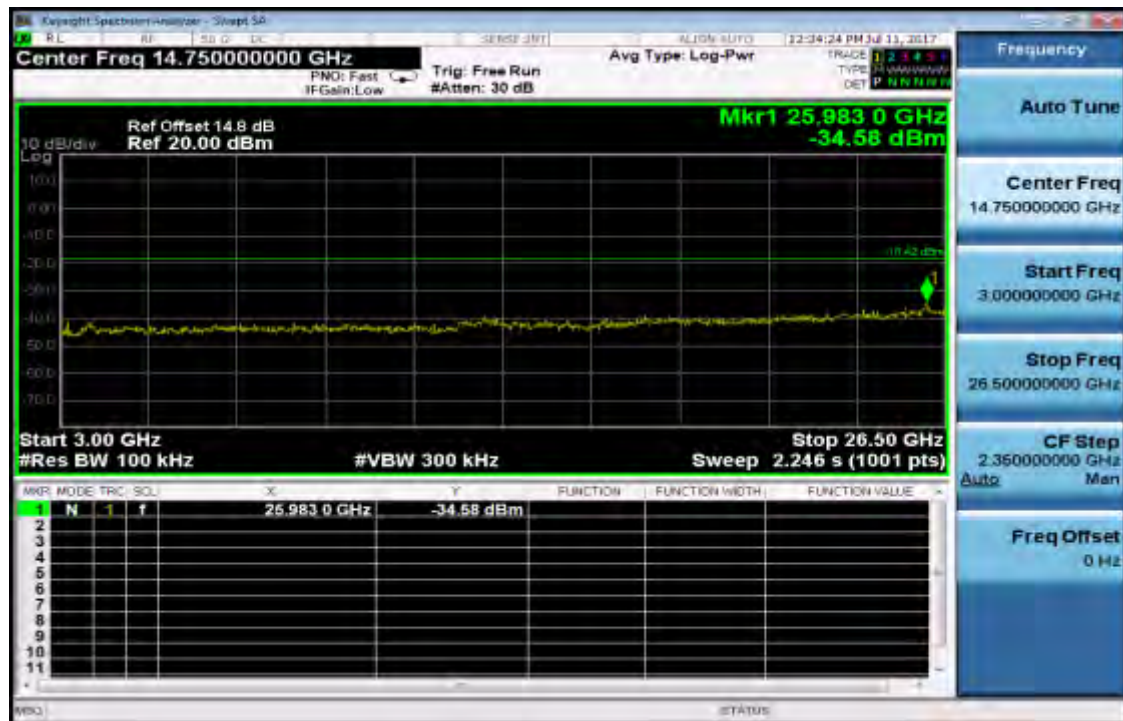
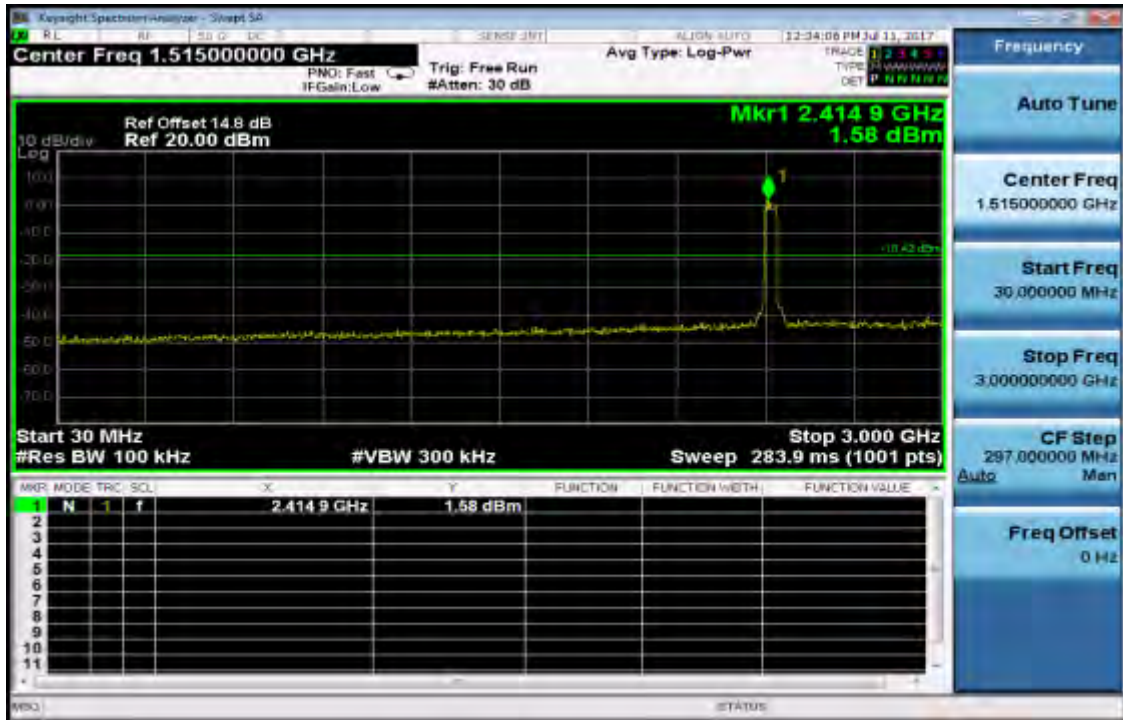


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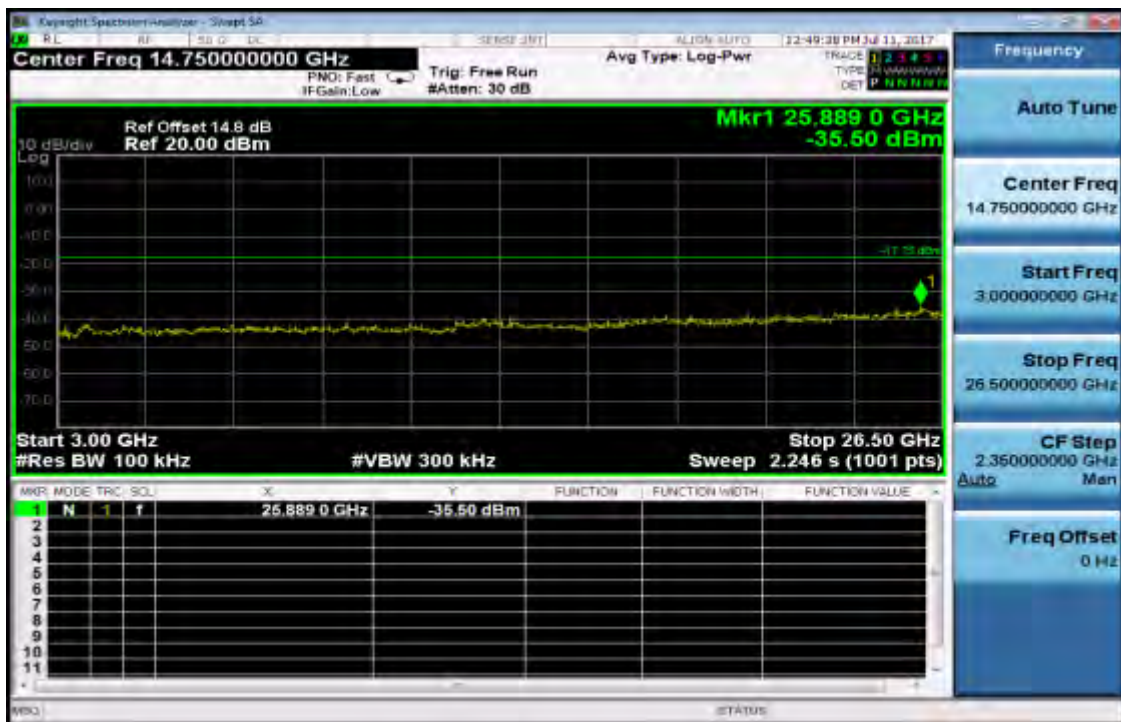
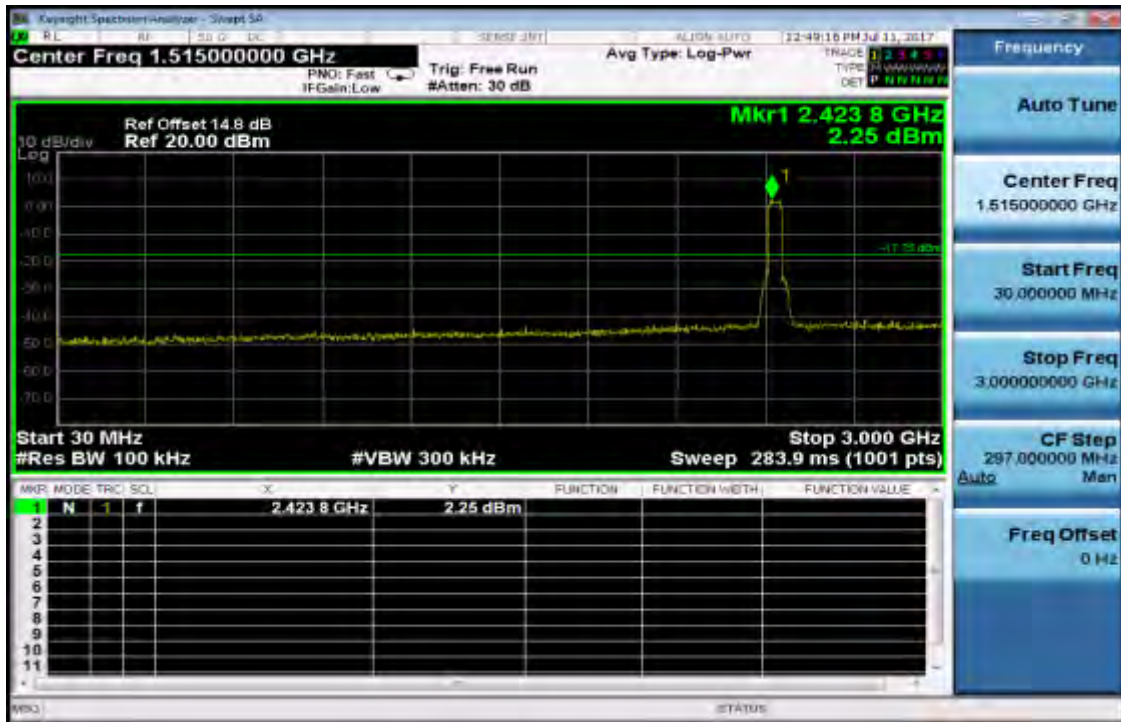
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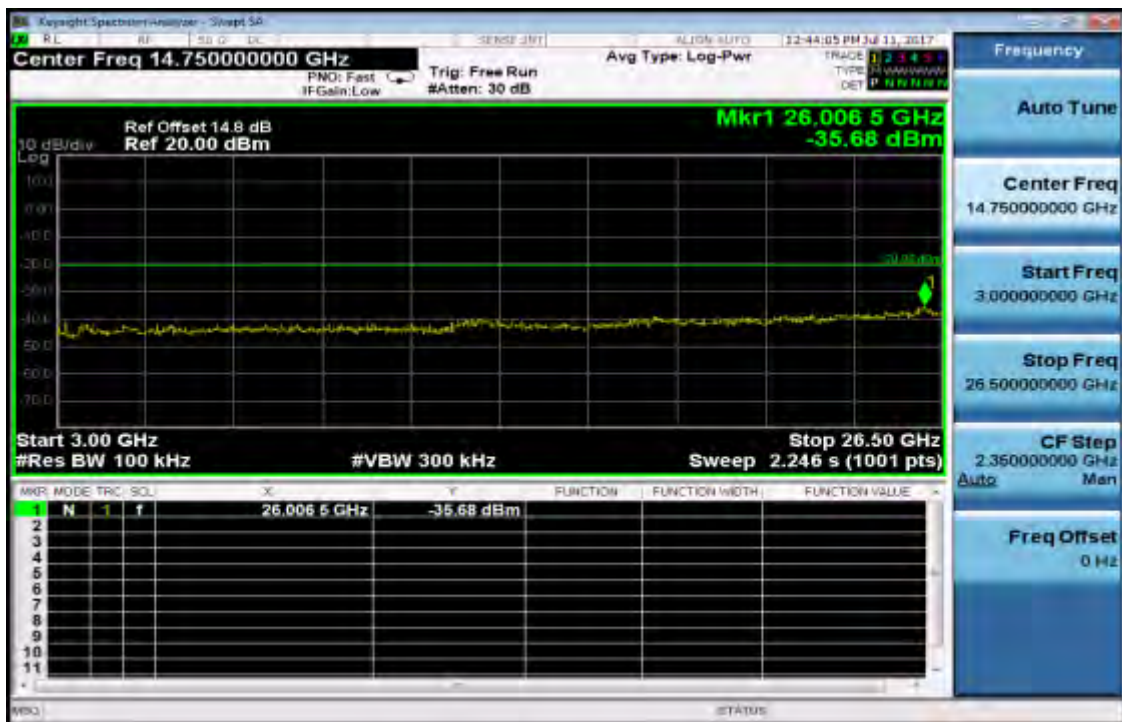
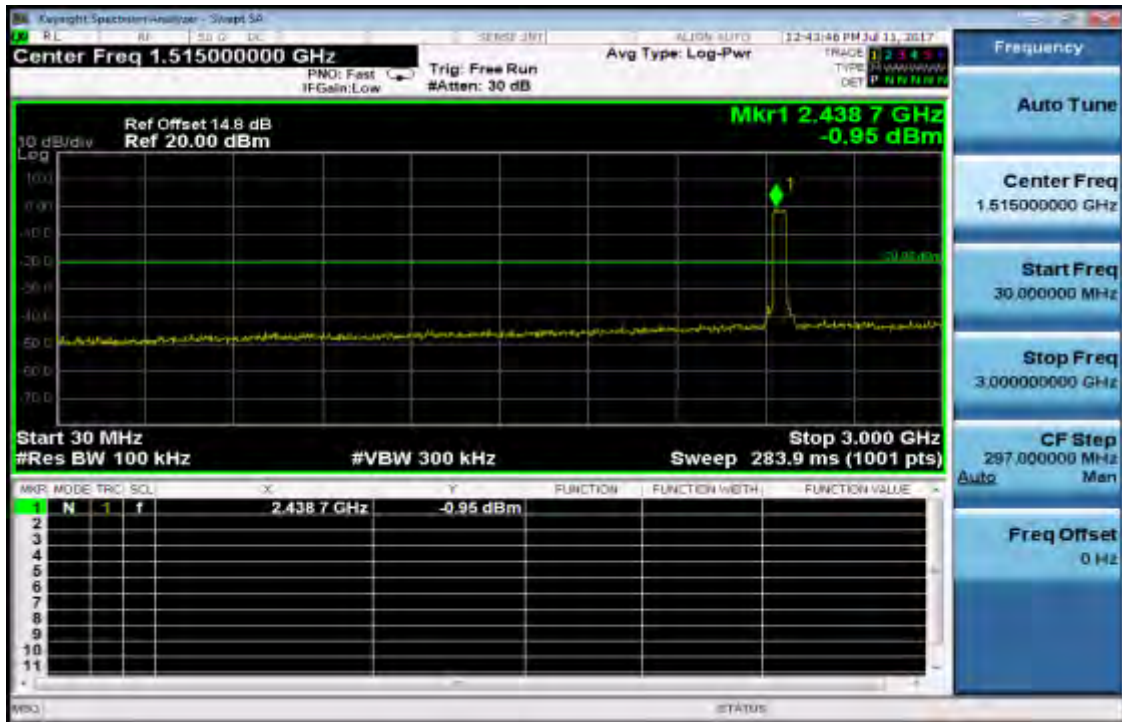
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11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

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					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100760	05/11/2017	05/10/2018
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/25/2017	04/24/2018
Loop Antenna	ETS-Lindgren	6502	148045	09/20/2016	09/19/2017
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/19/2016	12/18/2017
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/01/2016	07/31/2017
Pre-Amplifier	Agilent	8447D	2944A07676	01/05/2017	01/04/2018
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/05/2017	01/04/2018
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_RX	9	01/05/2017	01/04/2018
3m Site NSA	SGS	966 chamber	N/A	07/01/2017	06/30/2018
Low Loss Cable	Huber Suhner	966 TX	1	01/05/2017	01/04/2018
Horn Antenna	Schwarzbeck	BBHA9170	184	12/12/2016	12/11/2017
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/05/2017	01/04/2018

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

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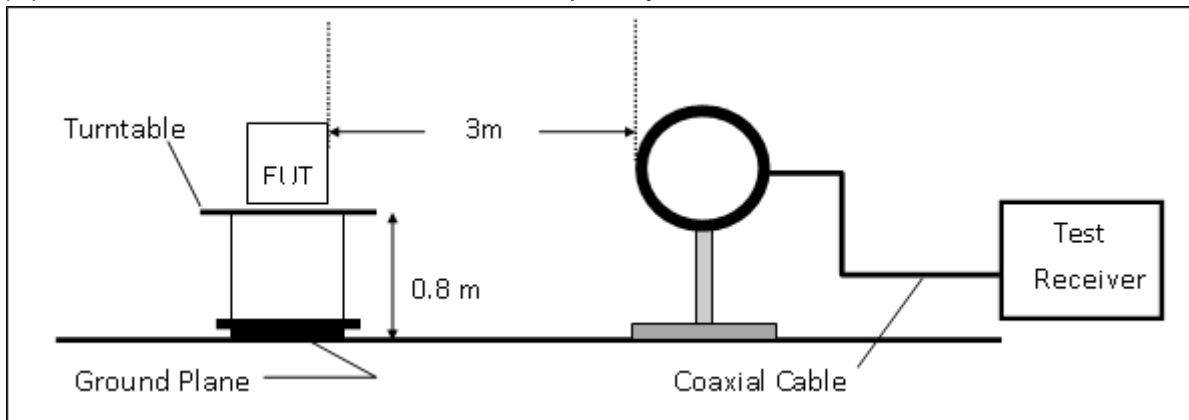
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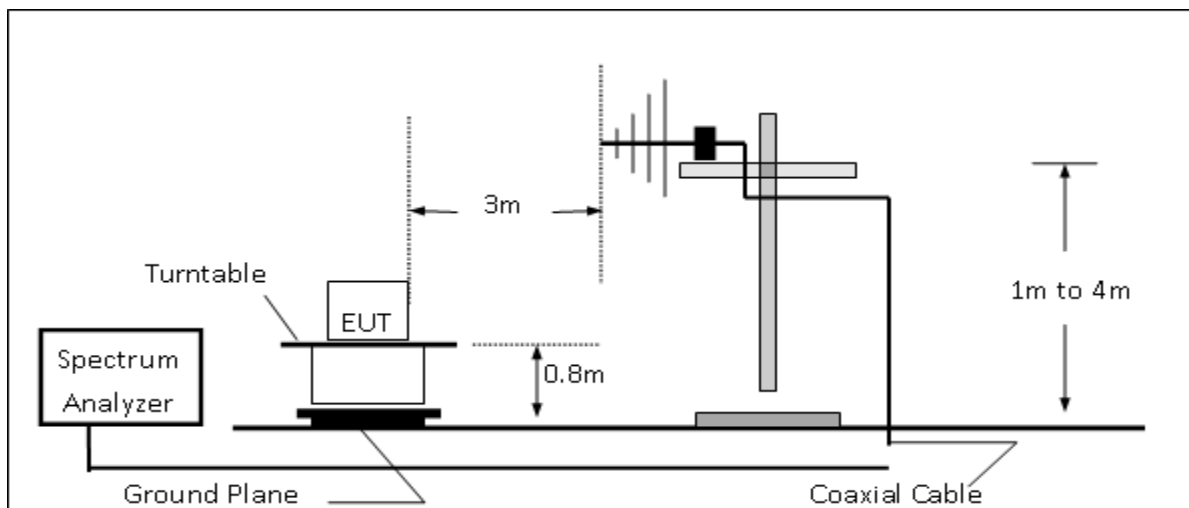
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11.3 Test SET-UP

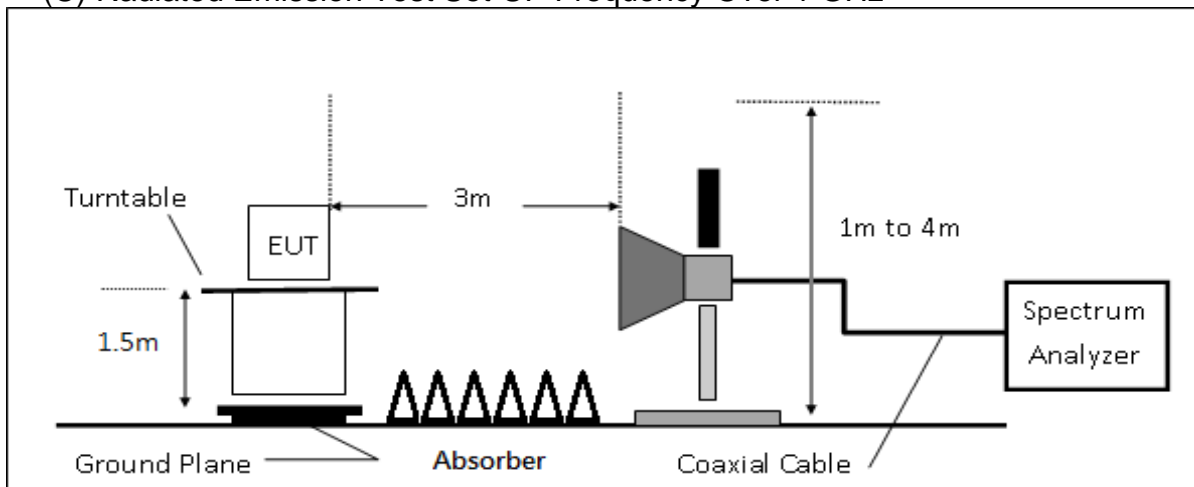
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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11.4 Measurement Procedure

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

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11.5 Field Strength Calculation

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

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

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

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

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note :

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

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

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

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

11.7 Measurement Result

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

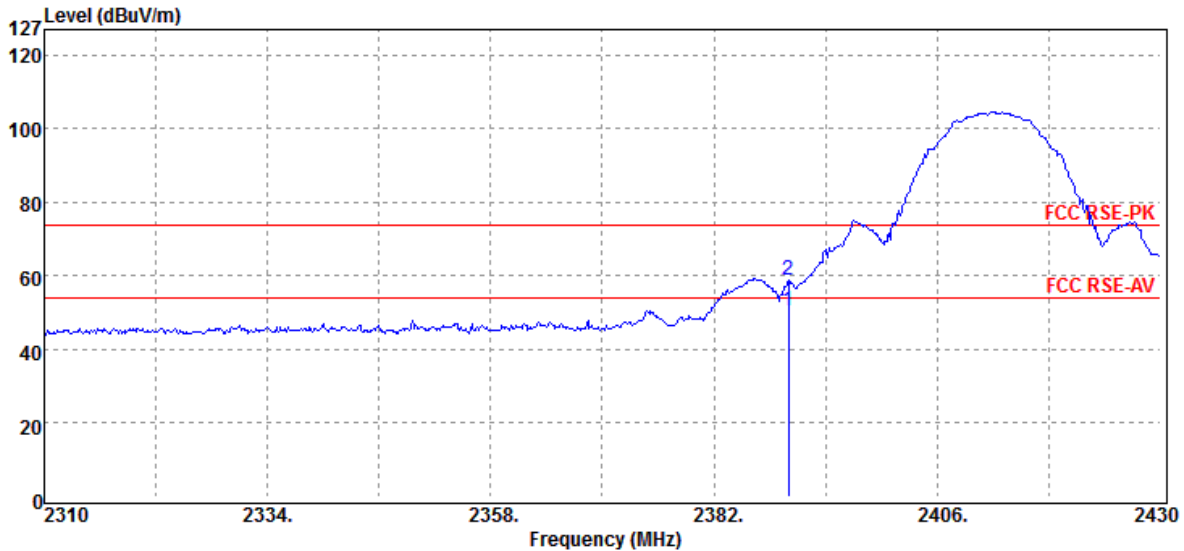
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Radiated Band Edge Measurement Result (802.11b)

Operation Band	:802.11b	Test Date	:2017-07-06
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	52.23	-1.74	50.49	54.00	-3.51
2390.00	E	Peak	60.46	-1.74	58.72	74.00	-15.28

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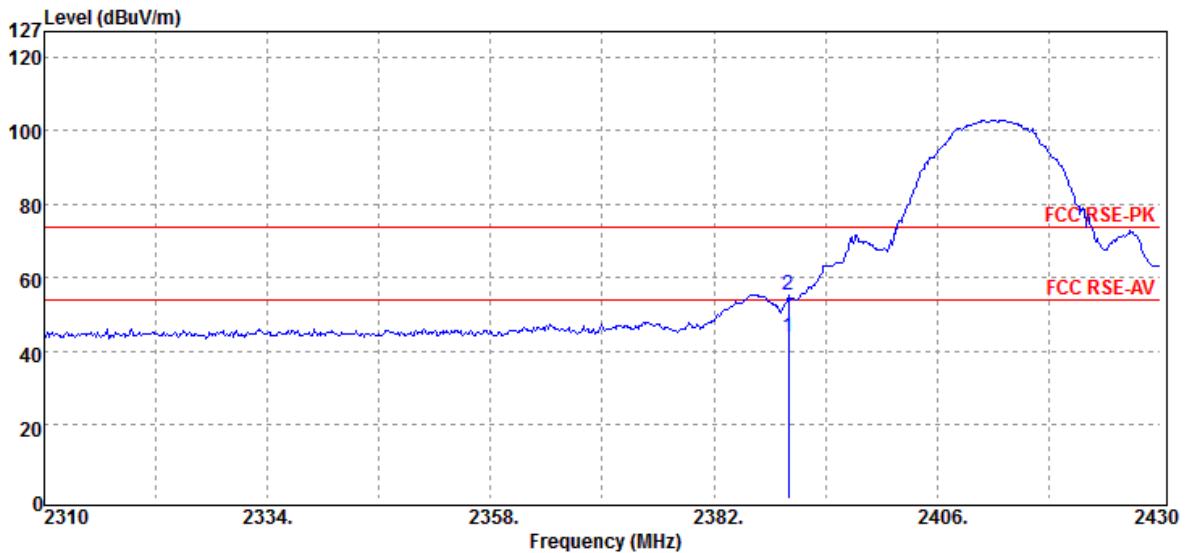
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Operation Band	:802.11b	Test Date	:2017-07-06
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	45.59	-1.74	43.85	54.00	-10.15
2390.00	E	Peak	57.07	-1.74	55.33	74.00	-18.67

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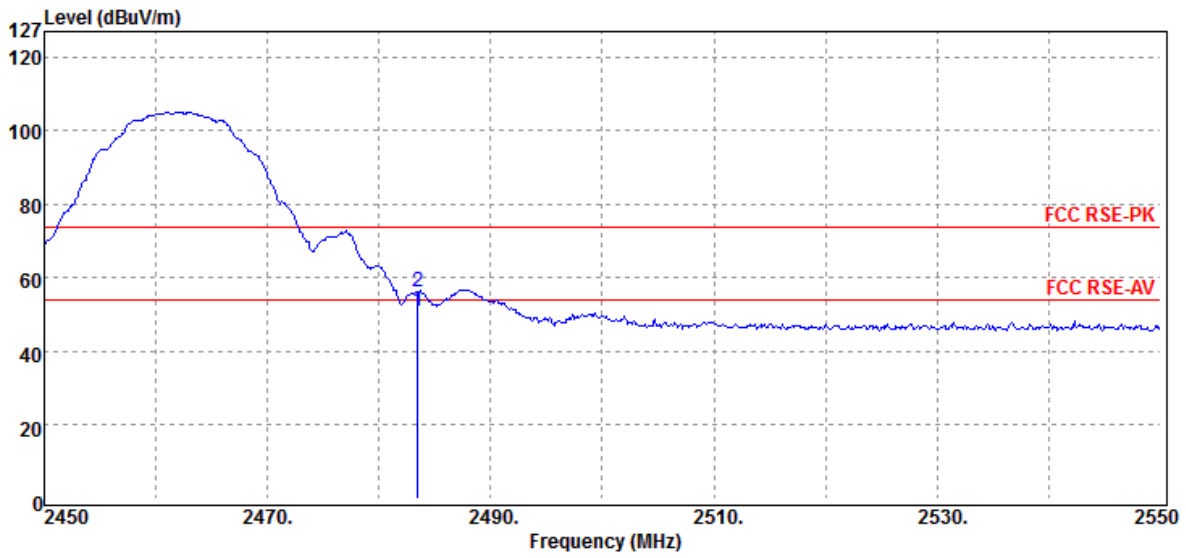
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Operation Band :802.11b
 Fundamental Frequency :2462 MHz
 Operation Mode :Bandedge CH HIGH
 EUT Pol. :H Plane

Test Date :2017-07-06
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Mike
 Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	52.62	-1.62	51.00	54.00	-3.00
2483.50	E	Peak	57.86	-1.62	56.24	74.00	-17.76

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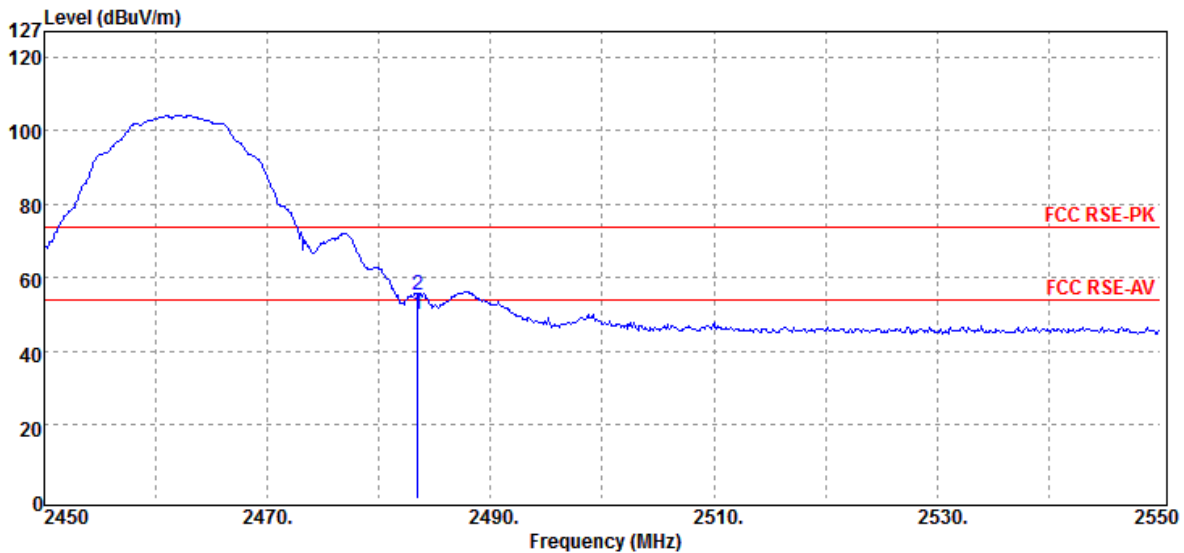
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Operation Band	:802.11b	Test Date	:2017-07-06
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
2483.50	E	Average	51.72	-1.62	50.10	54.00	-3.90
2483.50	E	Peak	57.15	-1.62	55.53	74.00	-18.47

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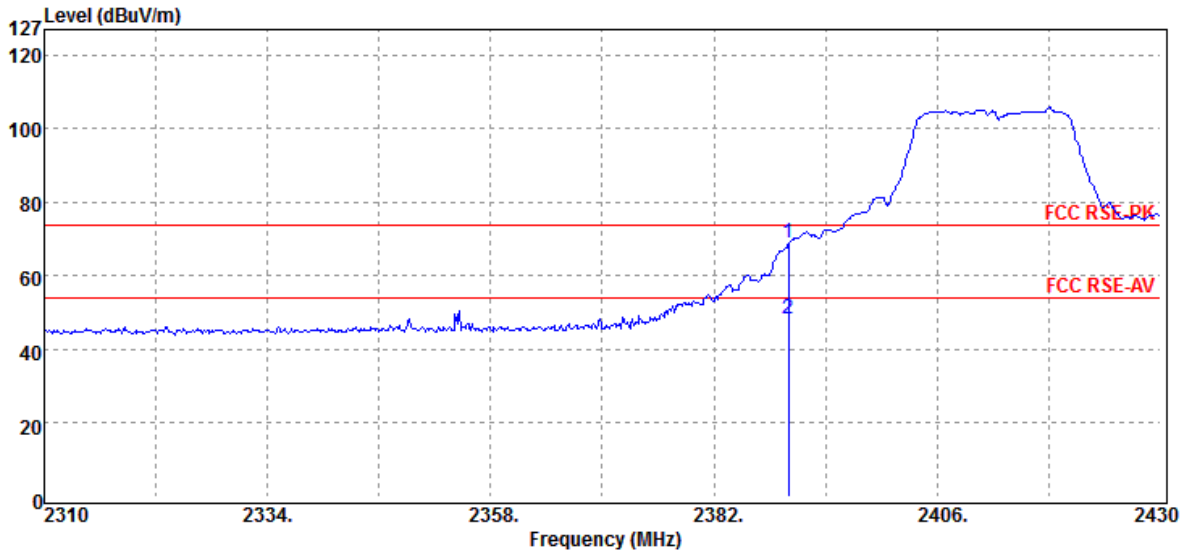
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Radiated Band Edge Measurement Result (802.11g)

Operation Band	:802.11g	Test Date	:2017-07-06
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Peak	70.67	-1.74	68.93	74.00	-5.07
2390.00	E	Peak	49.96	-1.74	48.22	74.00	-25.78

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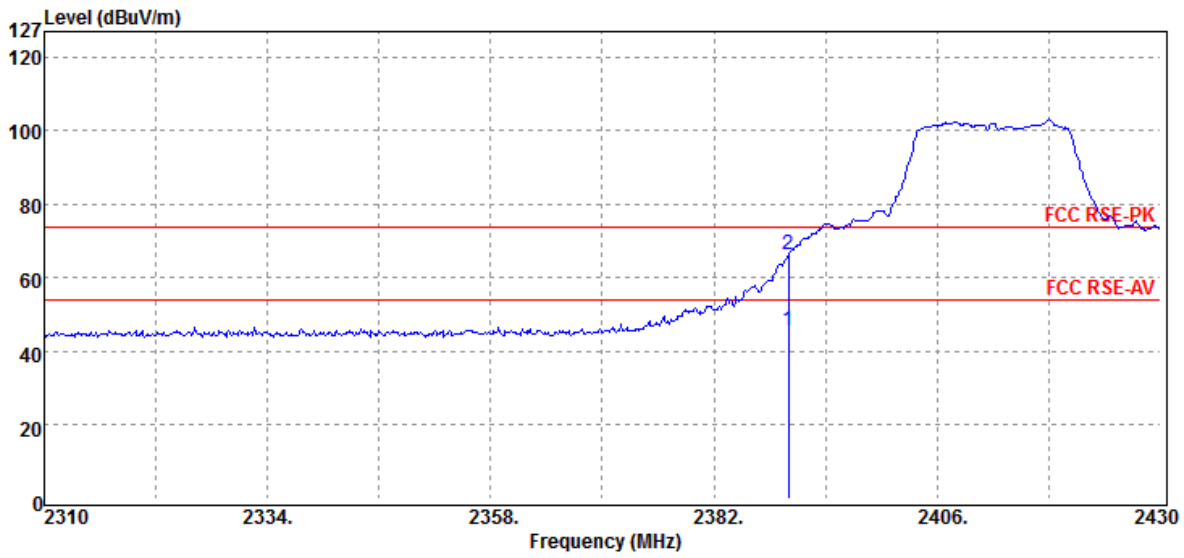
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Operation Band :802.11g
Fundamental Frequency :2412 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :H Plane

Test Date :2017-07-06
Temp./Humi. :21 deg_C / 62 RH
Engineer :Mike
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	47.32	-1.74	45.58	54.00	-8.42
2390.00	E	Peak	68.08	-1.74	66.34	74.00	-7.66

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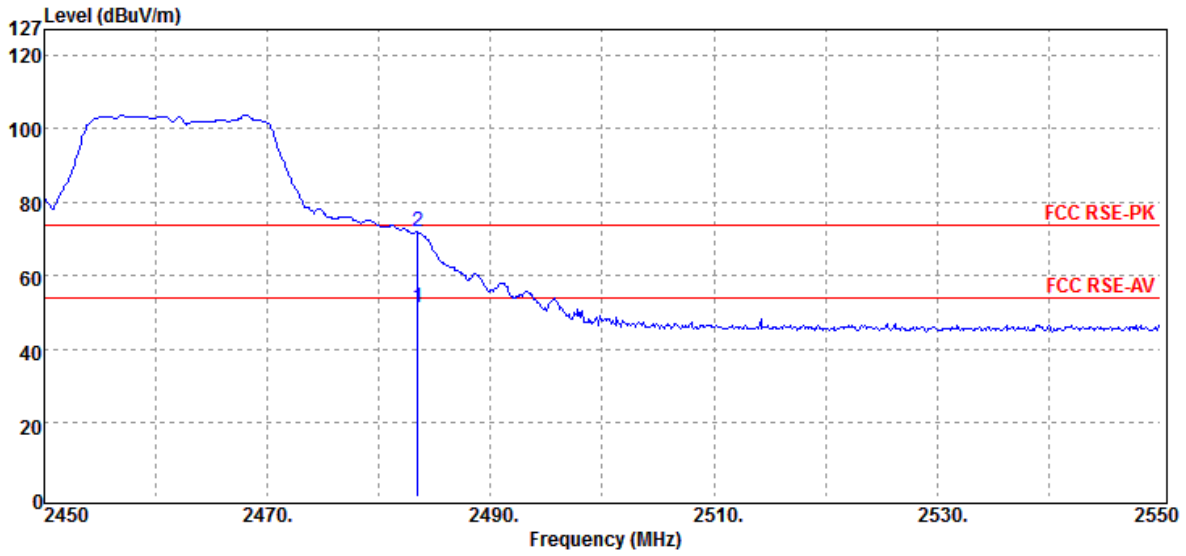
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Operation Band	:802.11g	Test Date	:2017-07-06
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	53.04	-1.62	51.42	54.00	-2.58
2483.50	E	Peak	73.51	-1.62	71.89	74.00	-2.11

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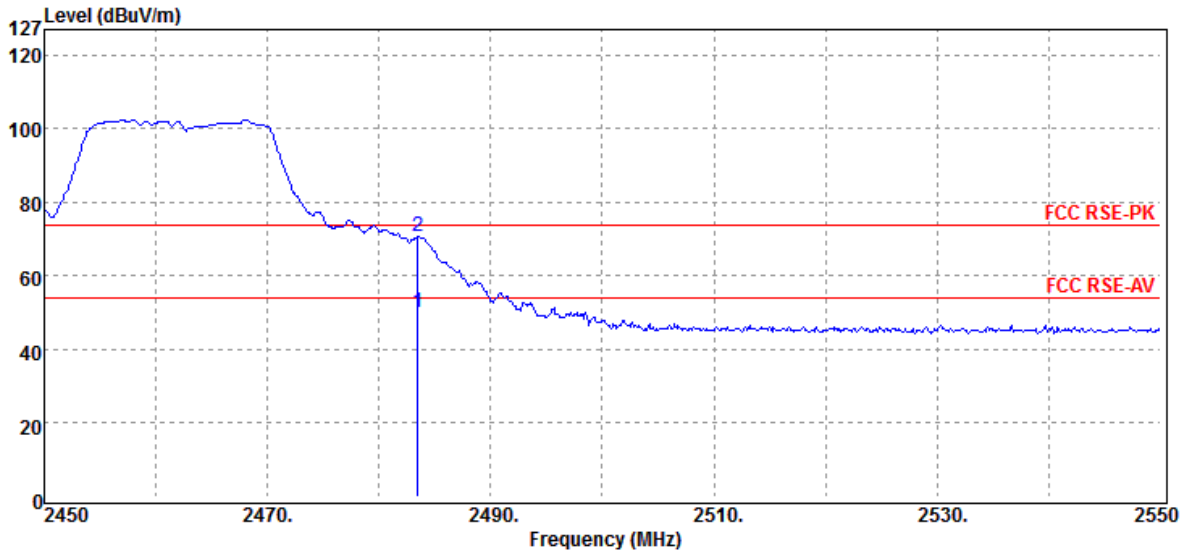
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Operation Band	:802.11g	Test Date	:2017-07-06
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
2483.50	E	Average	51.52	-1.62	49.90	54.00	-4.10
2483.50	E	Peak	72.25	-1.62	70.63	74.00	-3.37

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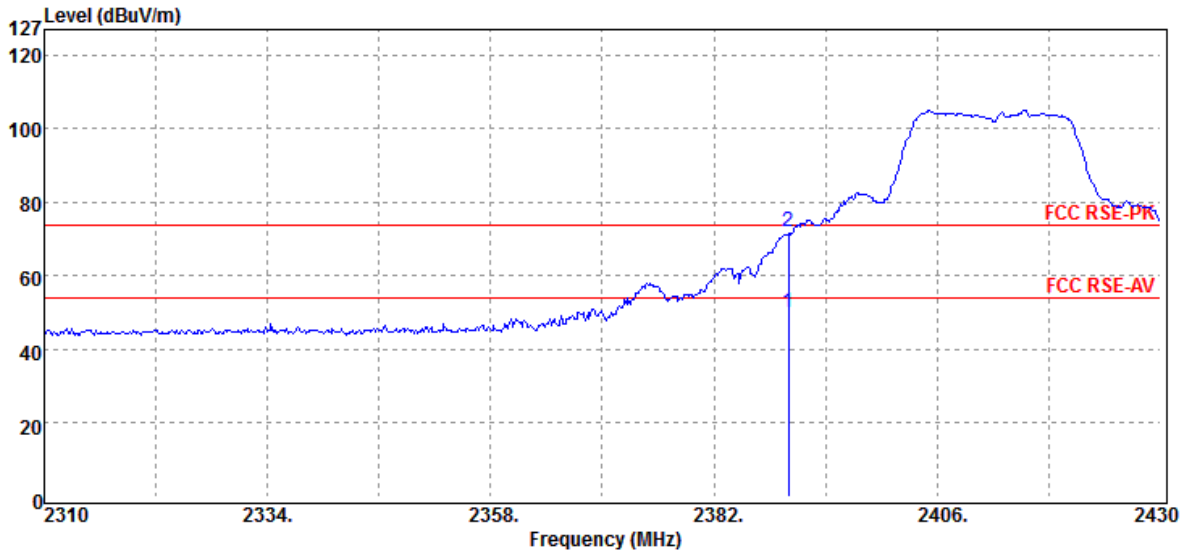
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Radiated Band Edge Measurement Result (802.11_HT20)

Operation Band	:802.11n20	Test Date	:2017-07-06
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
2390.00	E	Average	52.03	-1.74	50.29	54.00	-3.71
2390.00	E	Peak	73.69	-1.74	71.95	74.00	-2.05

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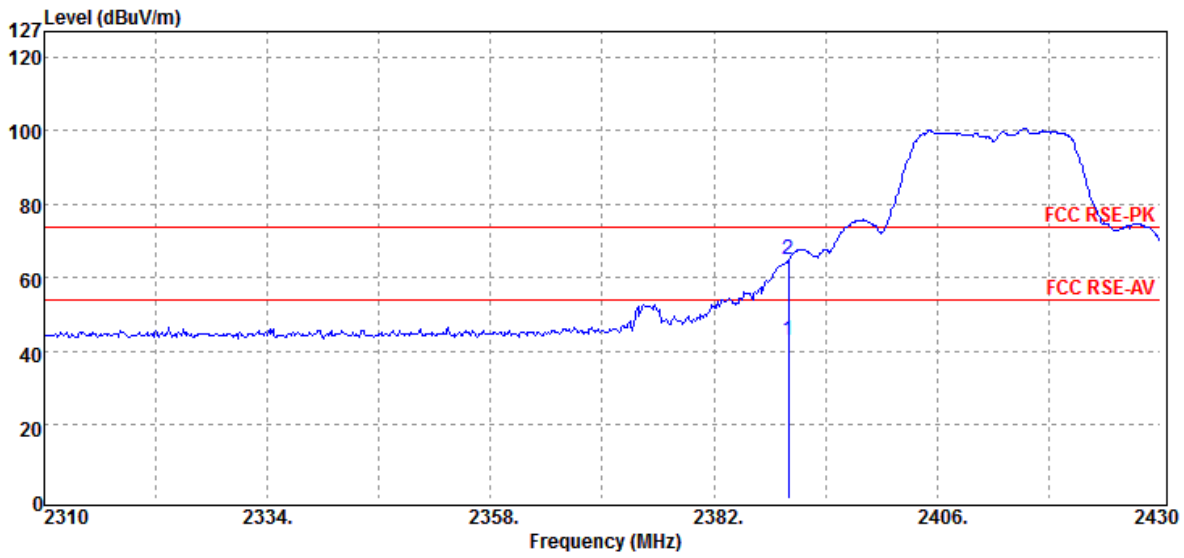
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Operation Band :802.11n20
Fundamental Frequency :2412 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :H Plane

Test Date :2017-07-06
Temp./Humi. :21 deg_C / 62 RH
Engineer :Mike
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	44.60	-1.74	42.86	54.00	-11.14
2390.00	E	Peak	66.98	-1.74	65.24	74.00	-8.76

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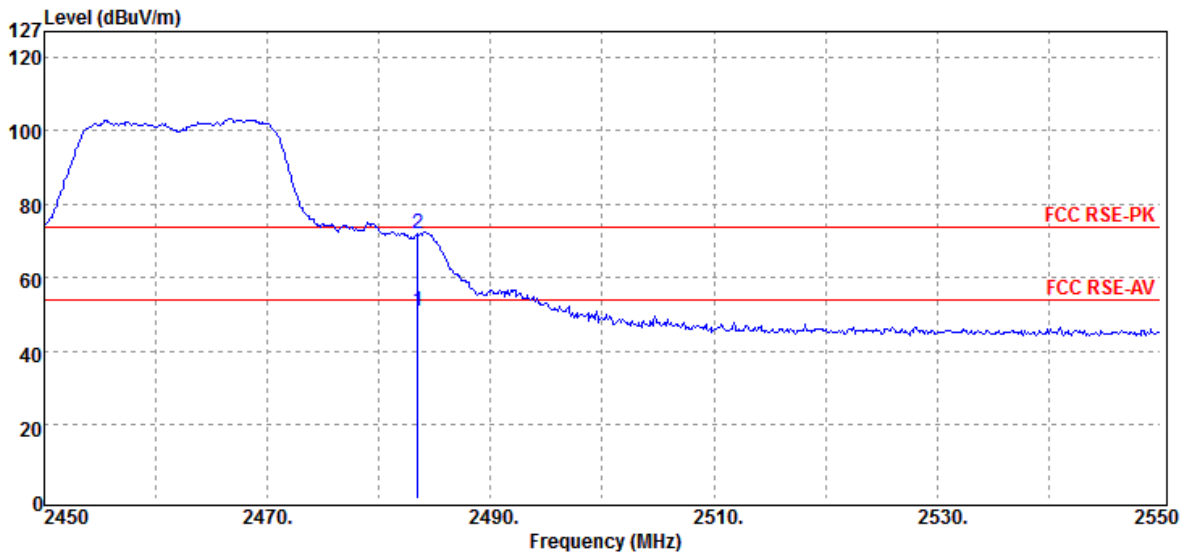
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Operation Band :802.11n20
Fundamental Frequency :2462 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :H Plane

Test Date :2017-07-06
Temp./Humi. :21 deg_C / 62 RH
Engineer :Mike
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	
2483.50	E	Average	52.48	-1.62	50.86	54.00	-3.14
2483.50	E	Peak	73.73	-1.62	72.11	74.00	-1.89

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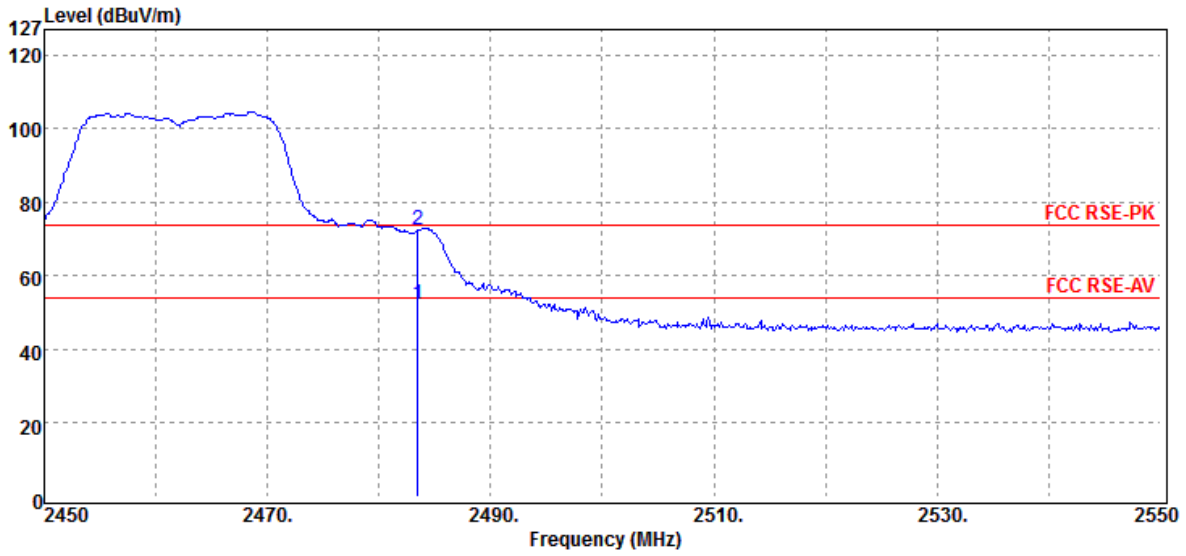
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Operation Band :802.11n20
Fundamental Frequency :2462 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :H Plane

Test Date :2017-07-06
Temp./Humi. :21 deg_C / 62 RH
Engineer :Mike
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	54.10	-1.62	52.48	54.00	-1.52
2483.50	E	Peak	74.12	-1.62	72.50	74.00	-1.50

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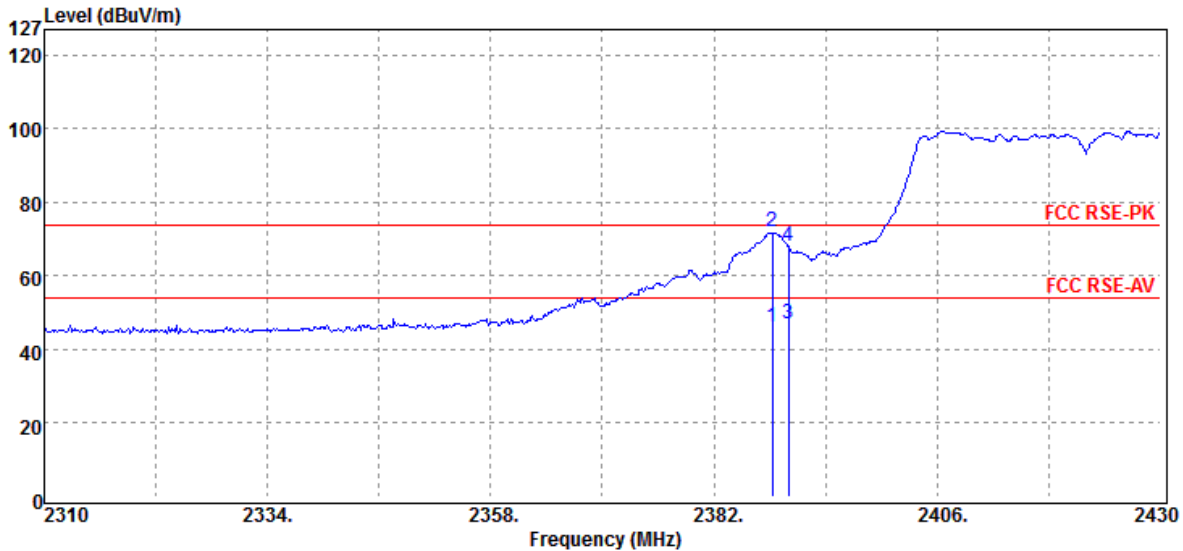
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Radiated Band Edge Measurement Result (802.11_HT40)

Operation Band	:802.11n40	Test Date	:2017-07-06
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBuV		dBuV/m	dBuV/m	
2388.24	S	Average	47.68	-1.73	45.95	54.00	-8.05
2388.24	S	Peak	74.00	-1.73	72.27	74.00	-1.73
2390.00	E	Average	48.63	-1.74	46.89	54.00	-7.11
2390.00	E	Peak	69.67	-1.74	67.93	74.00	-6.07

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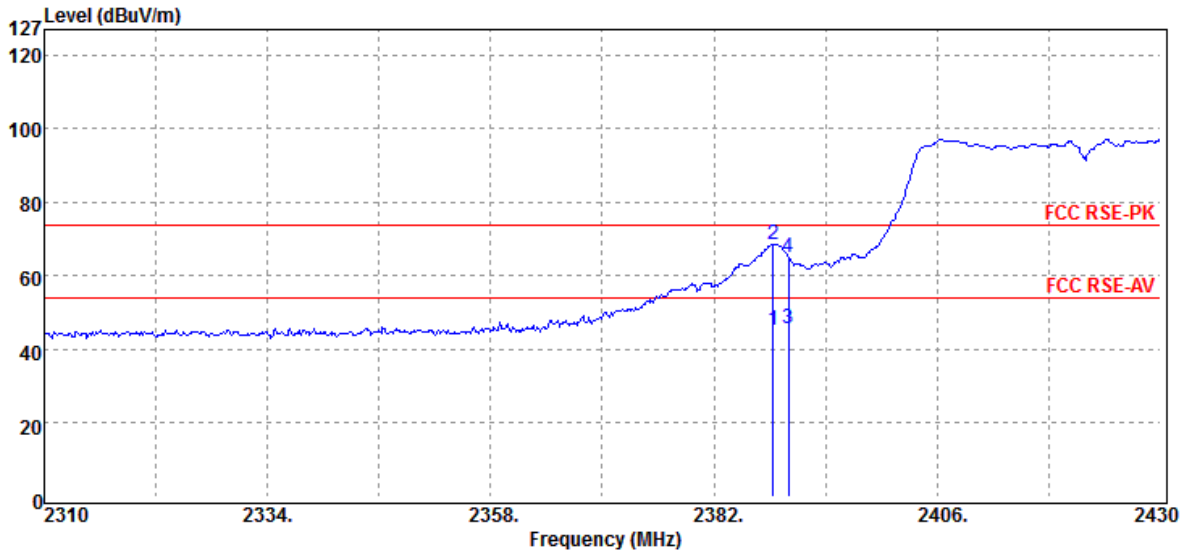
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Operation Band :802.11n40
Fundamental Frequency :2422 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :H Plane

Test Date :2017-07-06
Temp./Humi. :21 deg_C / 62 RH
Engineer :Mike
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2388.36	S	Average	47.08	-1.73	45.35	54.00	-8.65
2388.36	S	Peak	70.27	-1.73	68.54	74.00	-5.46
2390.00	E	Average	47.32	-1.74	45.58	54.00	-8.42
2390.00	E	Peak	66.80	-1.74	65.06	74.00	-8.94

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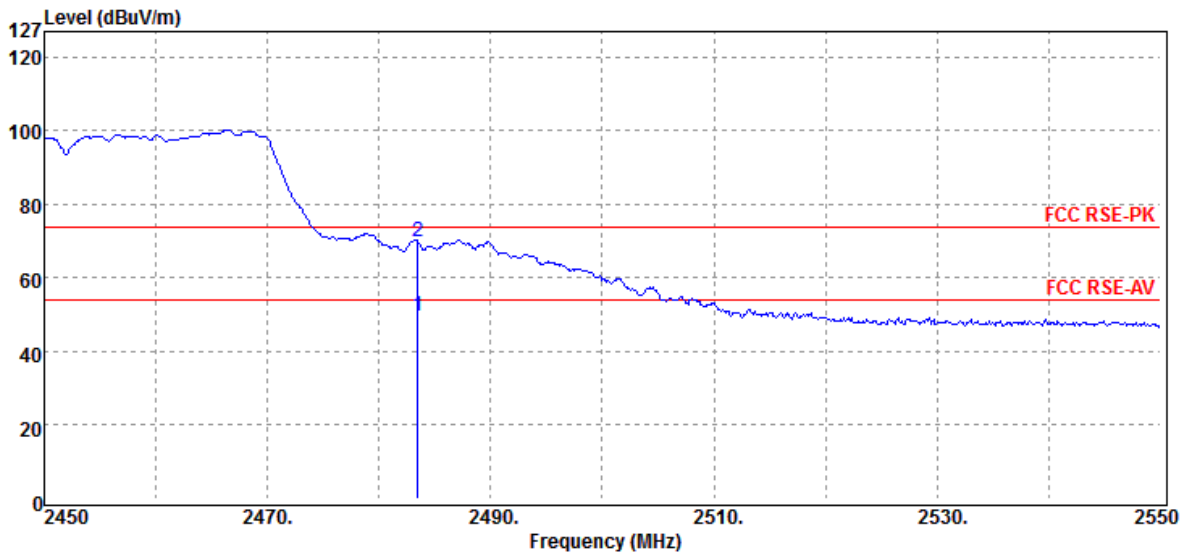
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Operation Band	:802.11n40	Test Date	:2017-07-06
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	51.49	-1.62	49.87	54.00	-4.13
2483.50	E	Peak	71.54	-1.62	69.92	74.00	-4.08

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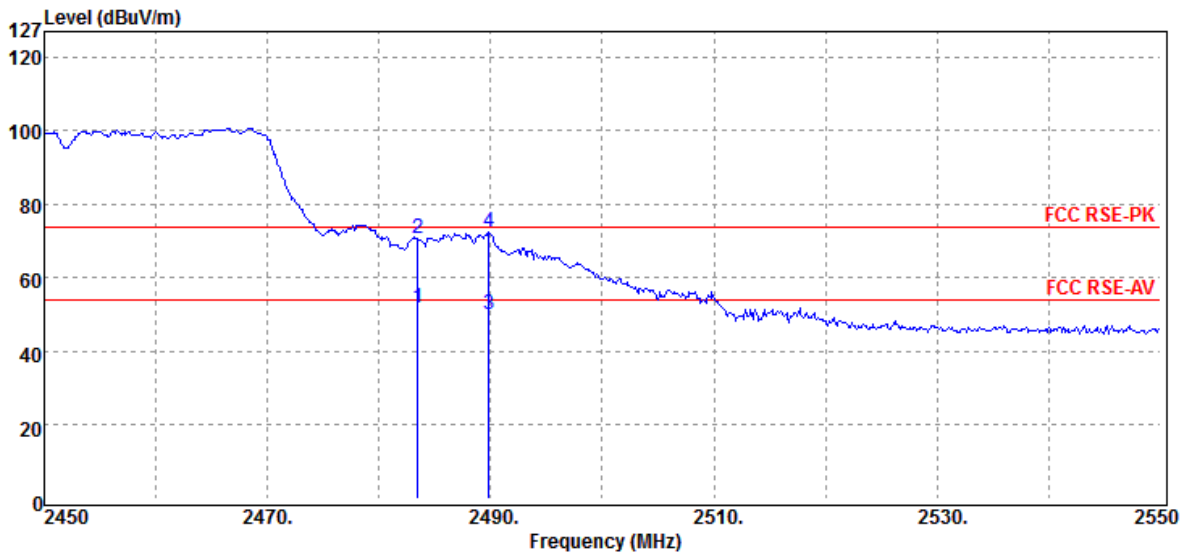
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Operation Band :802.11n40
Fundamental Frequency :2422 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :H Plane

Test Date :2017-07-06
Temp./Humi. :21 deg_C / 62 RH
Engineer :Mike
Measurement Antenna Pol. :HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
2483.50	E	Average	53.59	-1.62	51.97	54.00	-2.03
2483.50	E	Peak	72.22	-1.62	70.60	74.00	-3.40
2489.80	S	Average	51.57	-1.62	49.95	54.00	-4.05
2489.80	S	Peak	74.12	-1.62	72.50	74.00	-1.50

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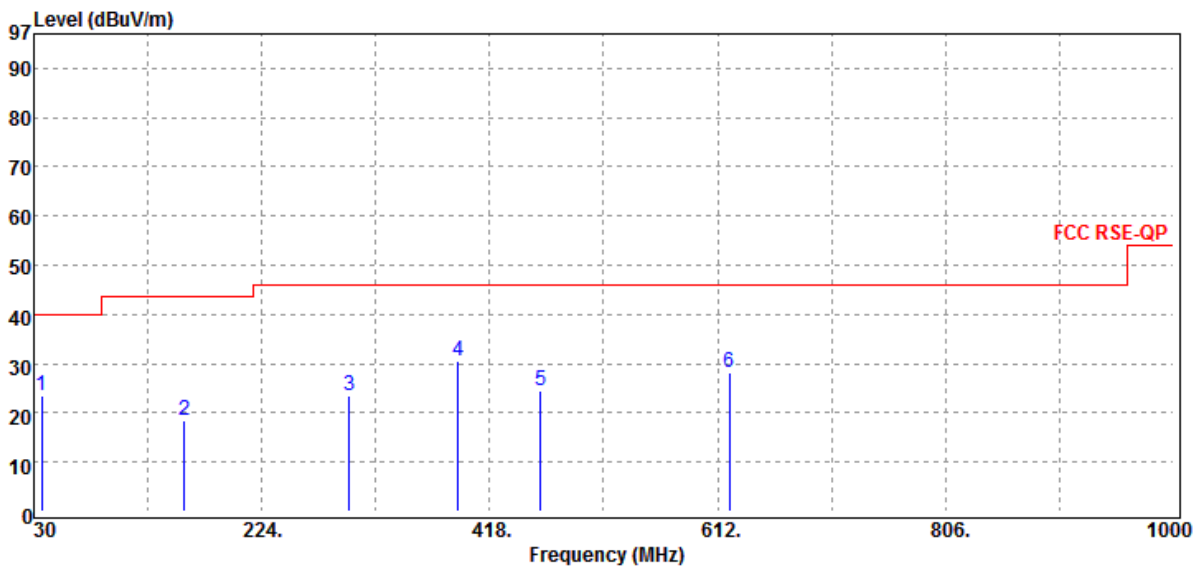
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Below 1GHz Worst-Case Data:

Radiated Spurious Emission Measurement Result (802.11 g)

Operation Band	:802.11g	Test Date	:2017-07-07
Fundamental Frequency	:2412 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
36.79	S	Peak	32.93	-9.47	23.46	40.00	-16.54
158.04	S	Peak	27.18	-8.85	18.33	43.50	-25.17
298.69	S	Peak	31.35	-7.72	23.63	46.00	-22.37
390.84	S	Peak	36.60	-6.21	30.39	46.00	-15.61
461.65	S	Peak	29.47	-4.98	24.49	46.00	-21.51
621.70	S	Peak	30.78	-2.52	28.26	46.00	-17.74

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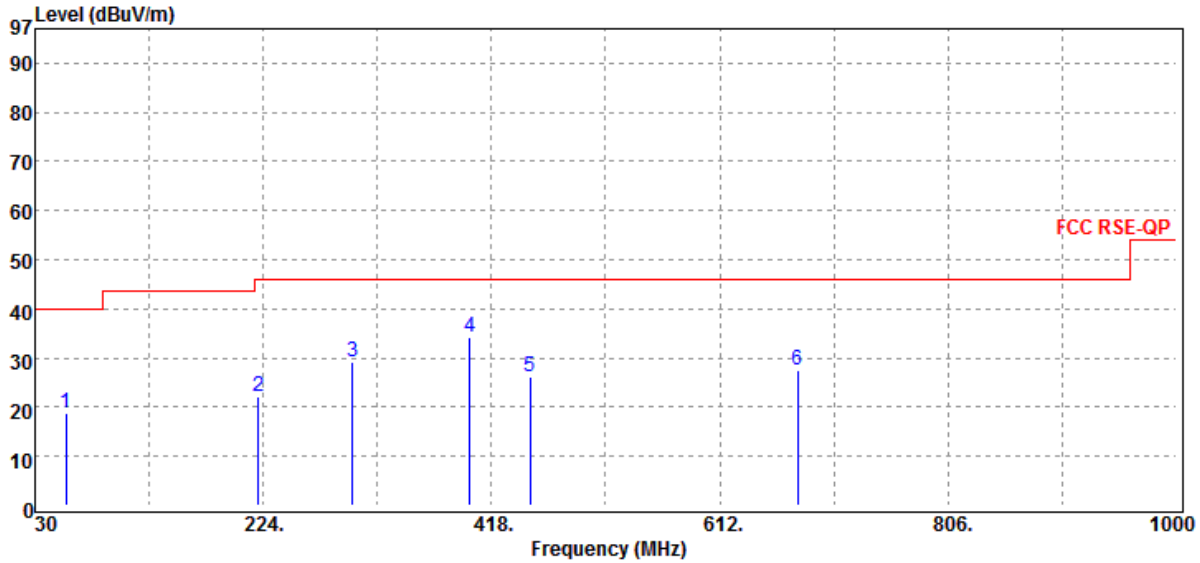
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Operation Band	:802.11g	Test Date	:2017-07-07
Fundamental Frequency	:2412 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
56.19	S	Peak	27.46	-8.71	18.75	40.00	-21.25
220.12	S	Peak	32.90	-10.79	22.11	46.00	-23.89
299.66	S	Peak	36.78	-7.71	29.07	46.00	-16.93
399.57	S	Peak	40.37	-6.01	34.36	46.00	-11.64
450.98	S	Peak	31.30	-5.03	26.27	46.00	-19.73
677.96	S	Peak	29.30	-1.84	27.46	46.00	-18.54

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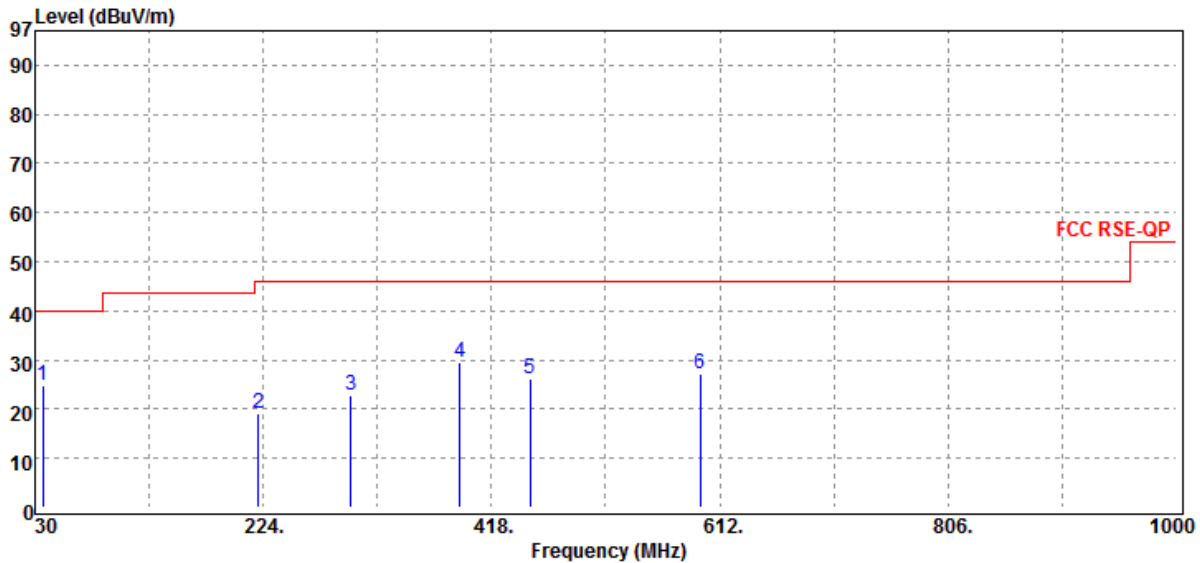
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Operation Band	:802.11g	Test Date	:2017-07-07
Fundamental Frequency	:2437 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
36.79	S	Peak	34.15	-9.47	24.68	40.00	-15.32
220.12	S	Peak	29.79	-10.79	19.00	46.00	-27.00
298.69	S	Peak	30.56	-7.72	22.84	46.00	-23.16
390.84	S	Peak	35.63	-6.21	29.42	46.00	-16.58
450.98	S	Peak	31.35	-5.03	26.32	46.00	-19.68
595.51	S	Peak	30.00	-2.70	27.30	46.00	-18.70

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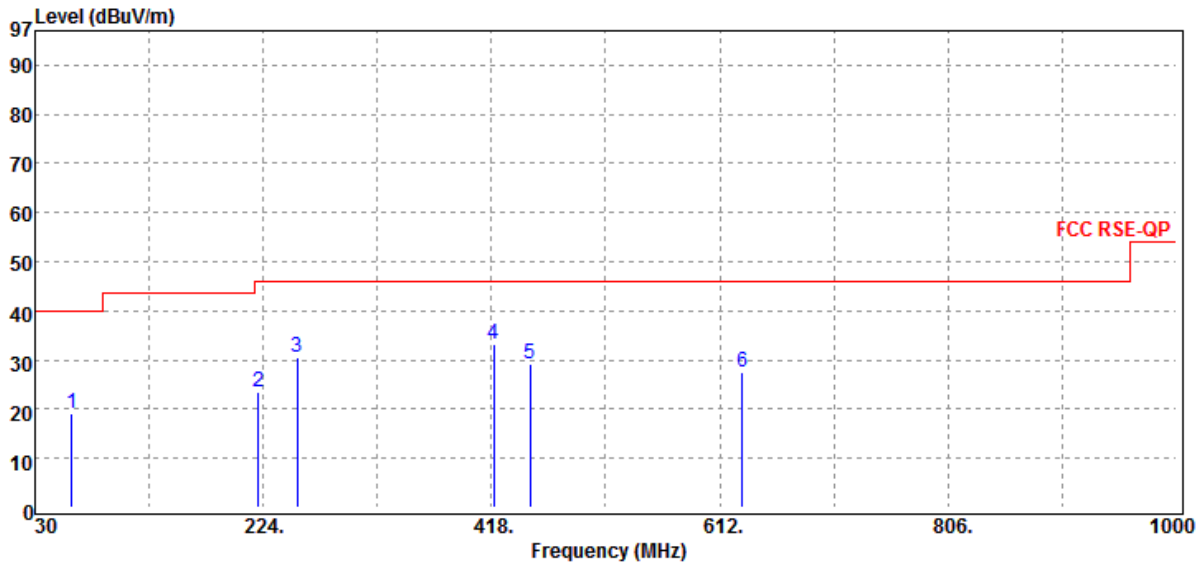
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Operation Band	:802.11g	Test Date	:2017-07-07
Fundamental Frequency	:2437 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
61.04	S	Peak	28.13	-9.13	19.00	40.00	-21.00
220.12	S	Peak	34.37	-10.79	23.58	46.00	-22.42
253.10	S	Peak	39.78	-9.35	30.43	46.00	-15.57
419.94	S	Peak	39.00	-5.68	33.32	46.00	-12.68
450.98	S	Peak	34.23	-5.03	29.20	46.00	-16.80
631.40	S	Peak	29.97	-2.59	27.38	46.00	-18.62

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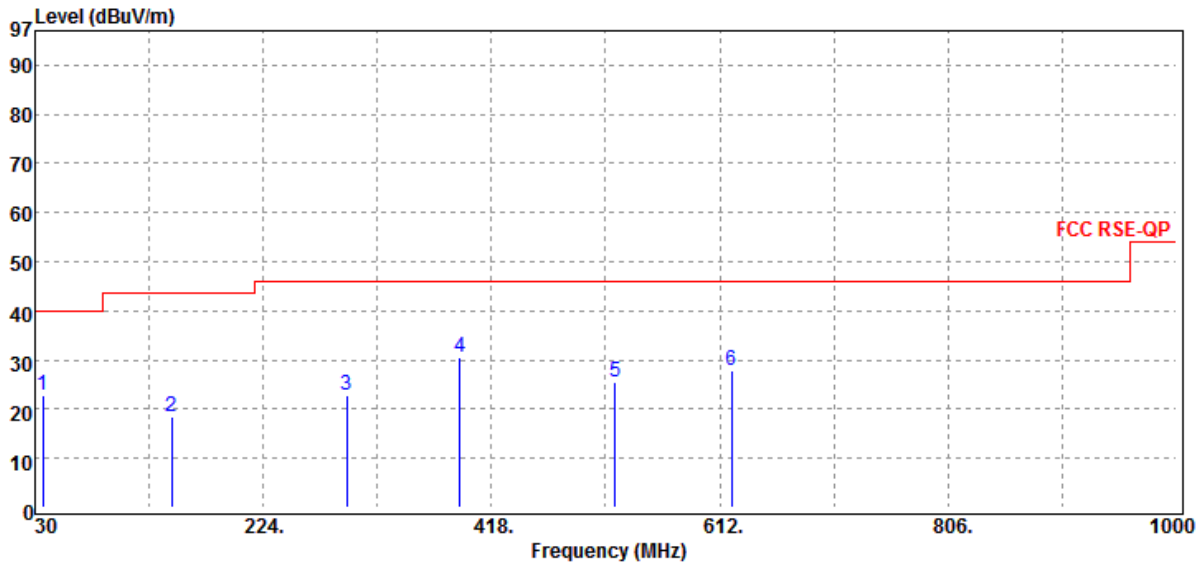
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Operation Band	:802.11g	Test Date	:2017-07-07
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
36.79	S	Peak	32.27	-9.47	22.80	40.00	-17.20
146.40	S	Peak	27.74	-9.18	18.56	43.50	-24.94
294.81	S	Peak	30.75	-7.78	22.97	46.00	-23.03
390.84	S	Peak	36.61	-6.21	30.40	46.00	-15.60
522.76	S	Peak	29.99	-4.34	25.65	46.00	-20.35
621.70	S	Peak	30.52	-2.52	28.00	46.00	-18.00

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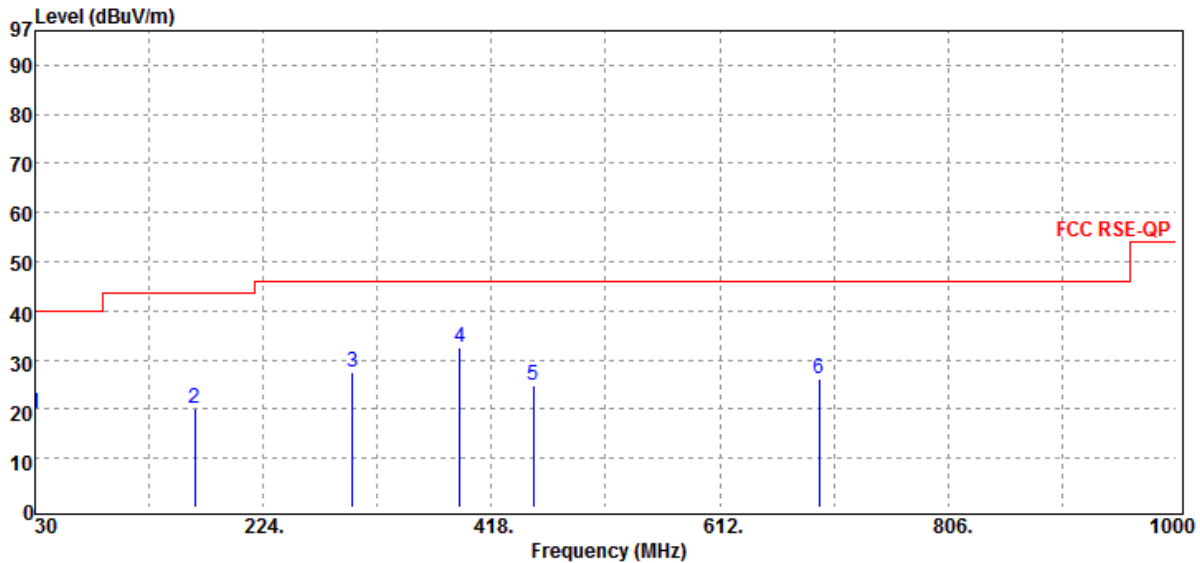
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Operation Band	:802.11g	Test Date	:2017-07-07
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
30.00	S	Peak	28.88	-9.77	19.11	40.00	-20.89
165.80	S	Peak	28.90	-8.91	19.99	43.50	-23.51
299.66	S	Peak	35.29	-7.71	27.58	46.00	-18.42
390.84	S	Peak	38.83	-6.21	32.62	46.00	-13.38
453.89	S	Peak	29.82	-5.04	24.78	46.00	-21.22
696.39	S	Peak	27.73	-1.58	26.15	46.00	-19.85

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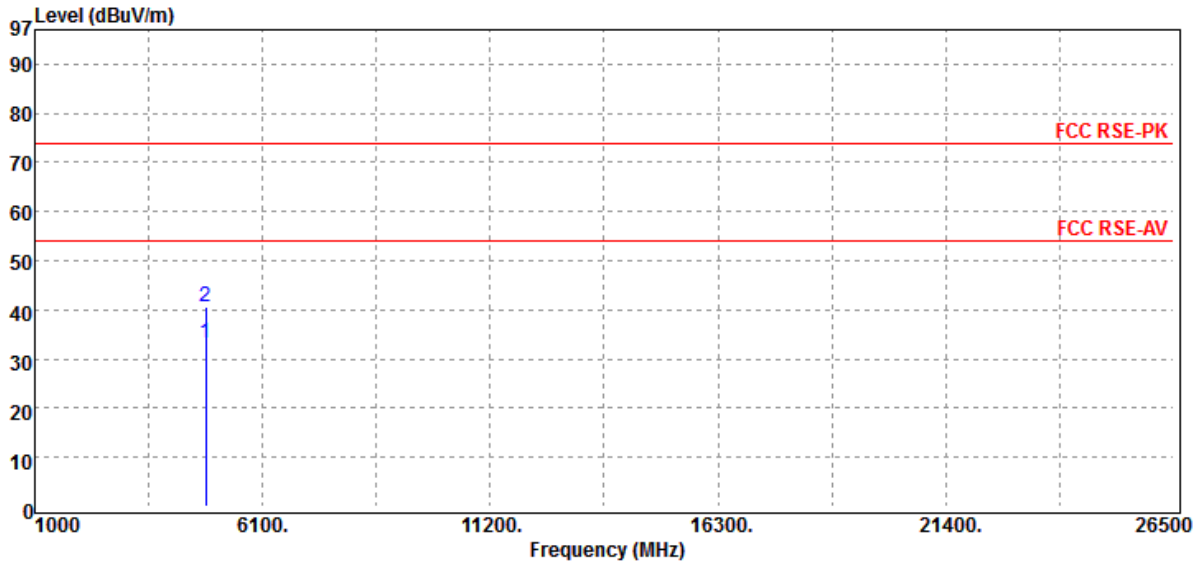
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Above 1GHz Data:

Radiated Spurious Emission Measurement Result (802.11 b)

Operation Band	:802.11b	Test Date	:2017-07-06
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



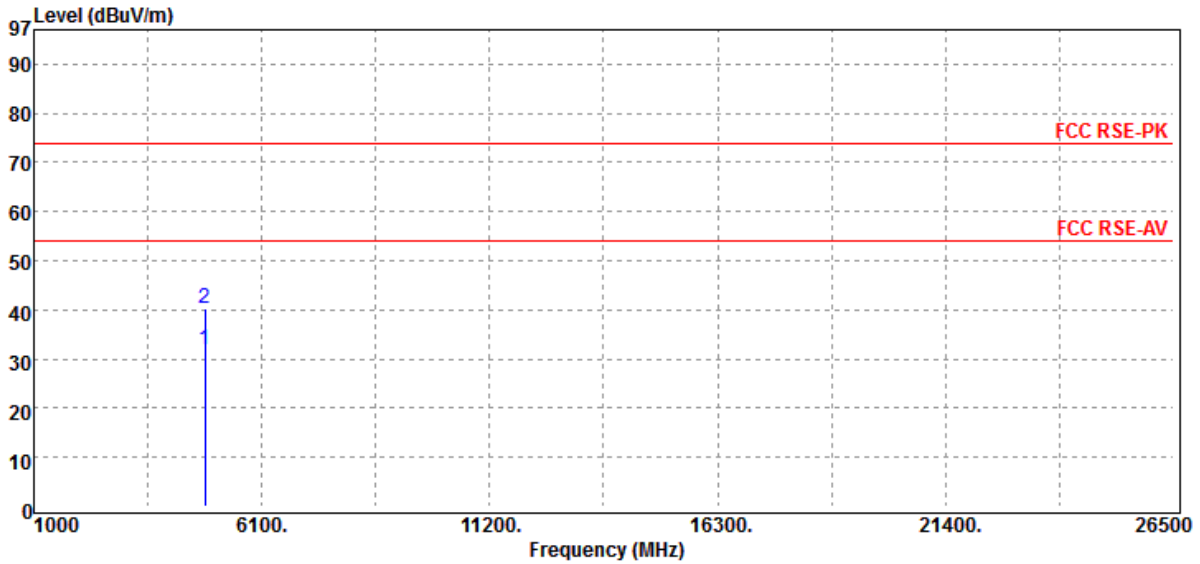
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4824.00	H	Average	28.26	4.93	33.19	54.00	-20.81
4824.00	H	Peak	35.53	4.93	40.46	74.00	-33.54

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Operation Band	:802.11b	Test Date	:2017-07-06
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	dB
4824.00	H	Average	26.90	4.93	31.83	54.00	-22.17
4824.00	H	Peak	35.37	4.93	40.30	74.00	-33.70

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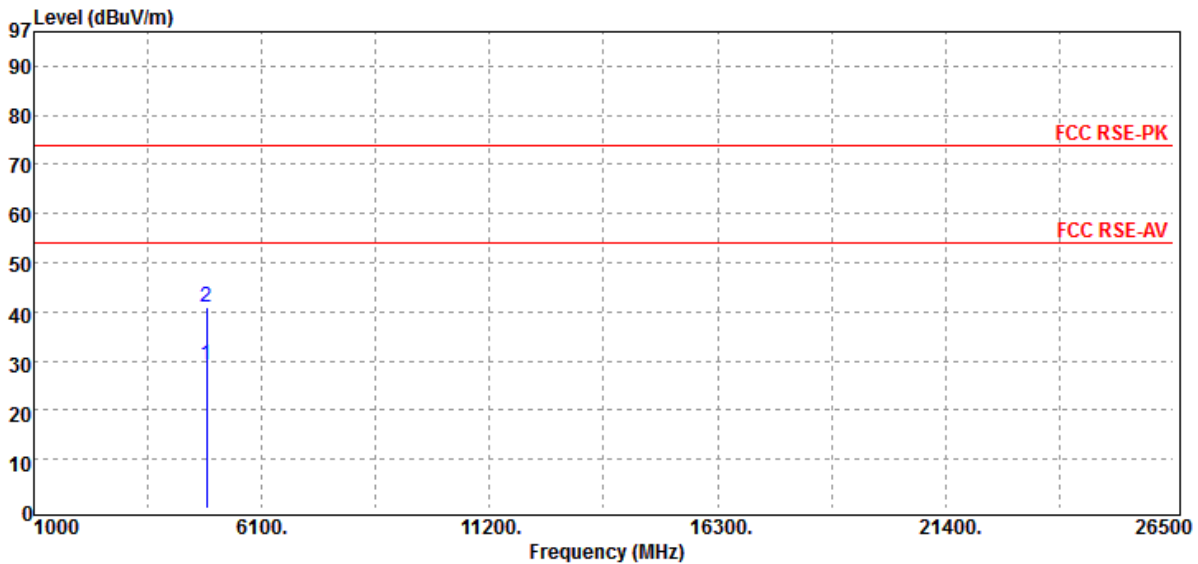
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Operation Band	:802.11b	Test Date	:2017-07-06
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
4874.00	H	Average	24.01	5.13	29.14	54.00	-24.86
4874.00	H	Peak	35.78	5.13	40.91	74.00	-33.09

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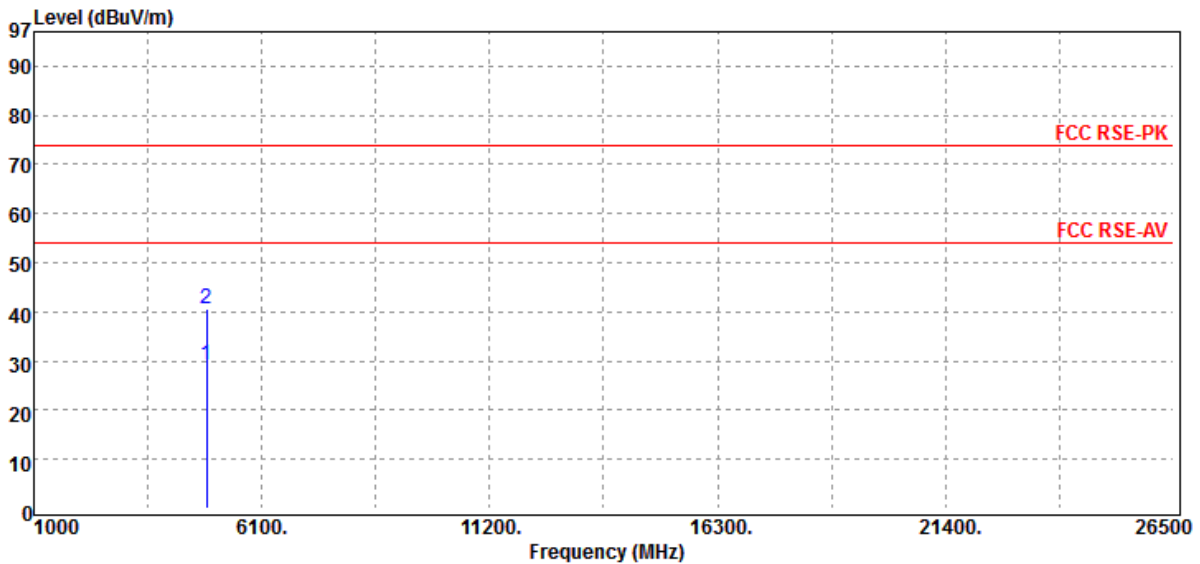
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Operation Band	:802.11b	Test Date	:2017-07-06
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4874.00	H	Average	24.11	5.13	29.24	54.00	-24.76
4874.00	H	Peak	35.43	5.13	40.56	74.00	-33.44

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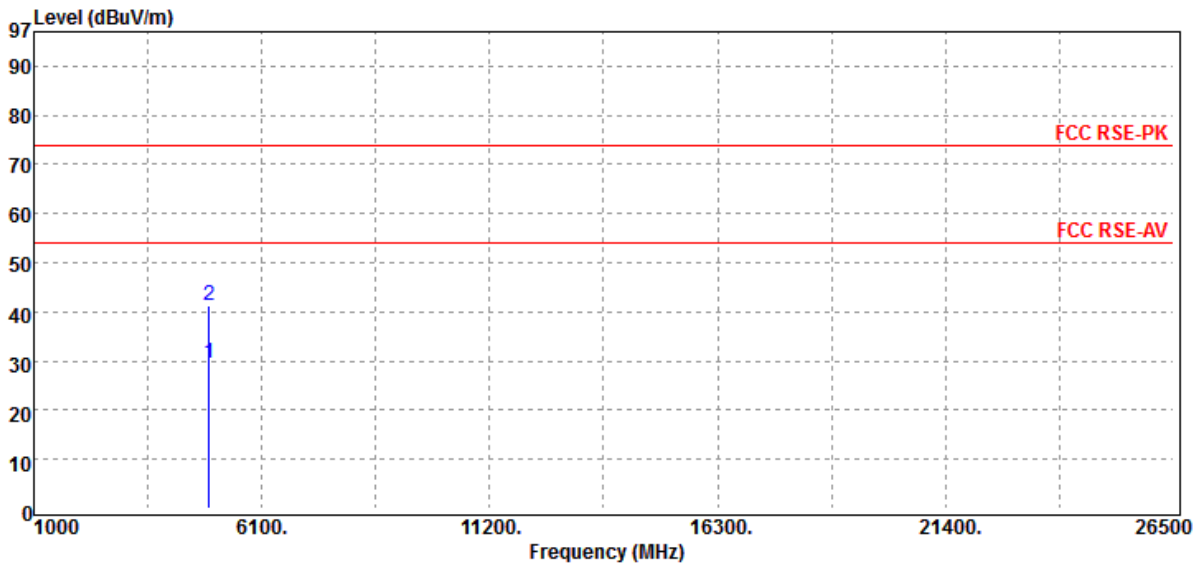
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Operation Band	:802.11b	Test Date	:2017-07-06
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4924.00	H	Average	24.33	5.25	29.58	54.00	-24.42
4924.00	H	Peak	35.96	5.25	41.21	74.00	-32.79

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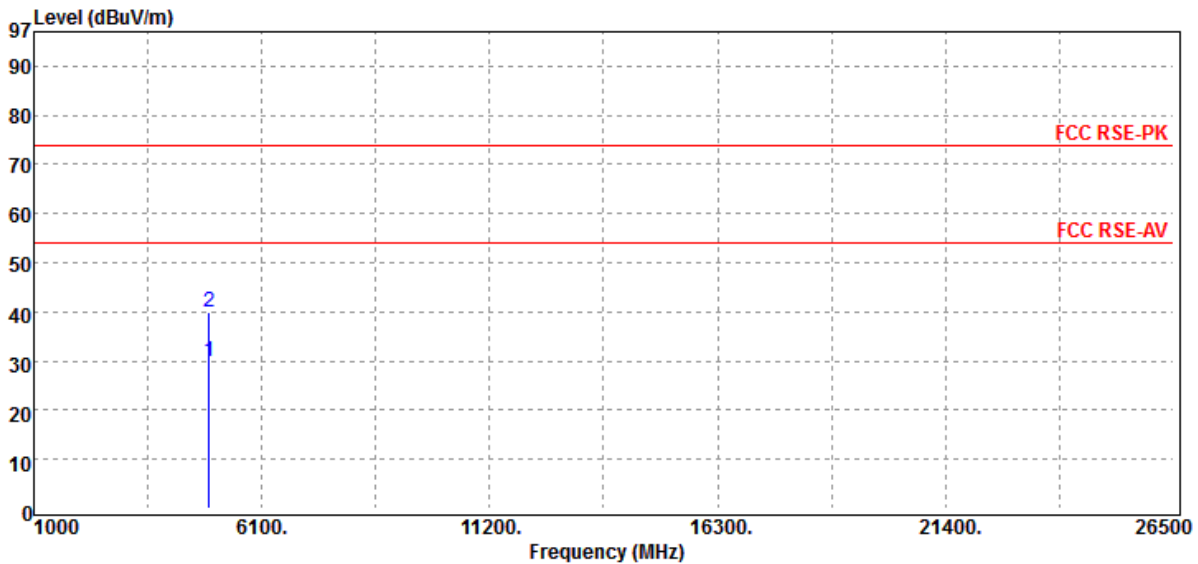
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Operation Band	:802.11b	Test Date	:2017-07-06
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	dB
4924.00	H	Average	24.47	5.25	29.72	54.00	-24.28
4924.00	H	Peak	34.86	5.25	40.11	74.00	-33.89

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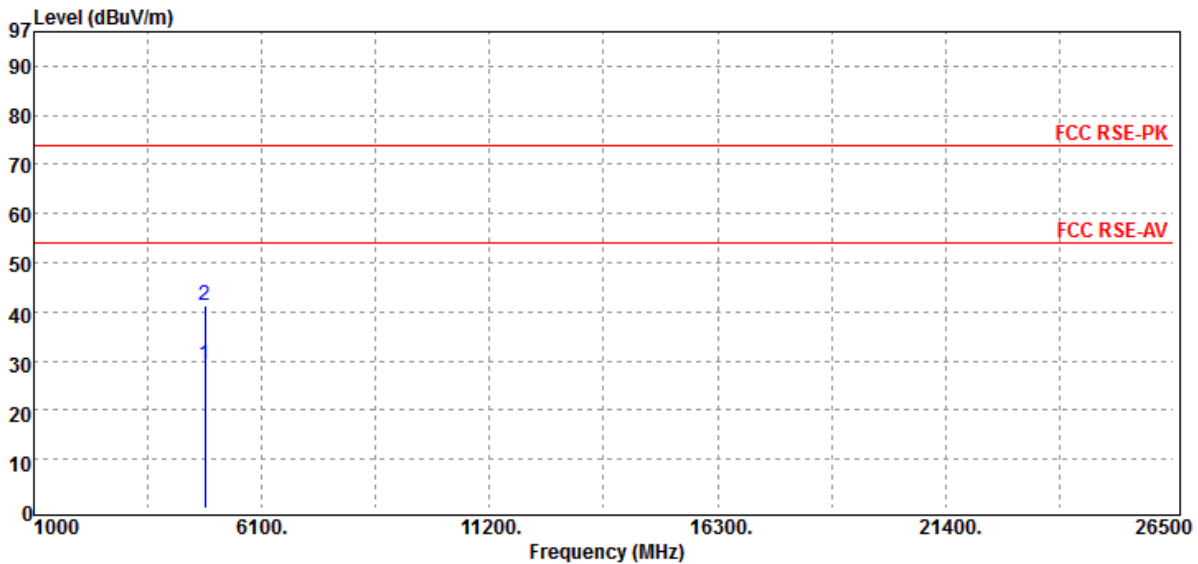
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Radiated Spurious Emission Measurement Result (802.11 g)

Operation Band	:802.11g	Test Date	:2017-07-06
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Safe Margin dB
4824.00	H	Average	24.17	4.93	29.10	54.00	-24.90
4824.00	H	Peak	36.34	4.93	41.27	74.00	-32.73

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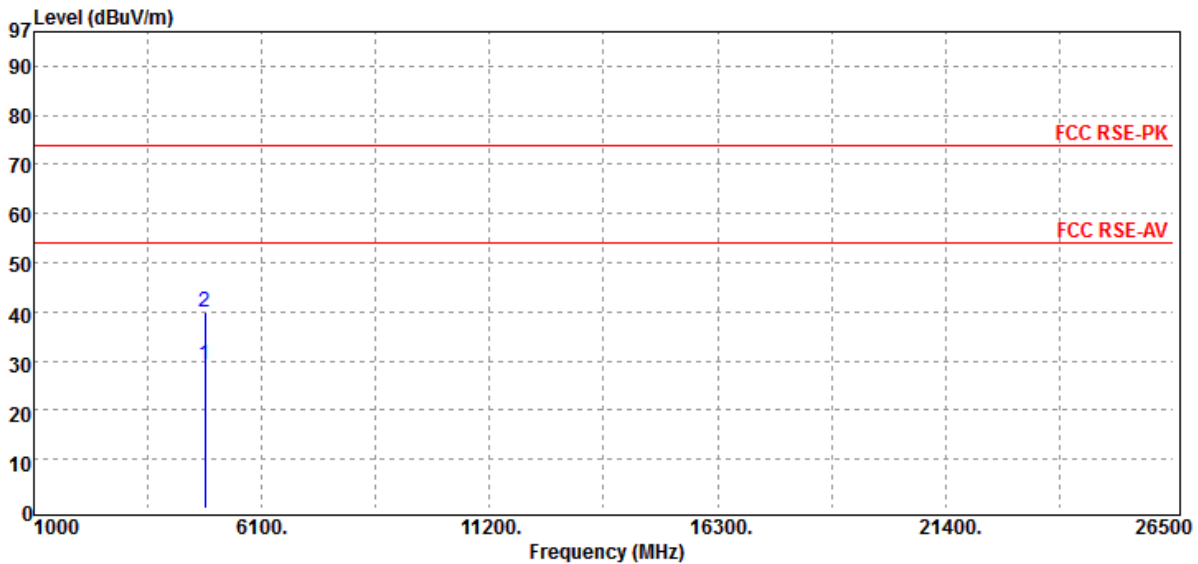
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Operation Band	:802.11g	Test Date	:2017-07-06
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



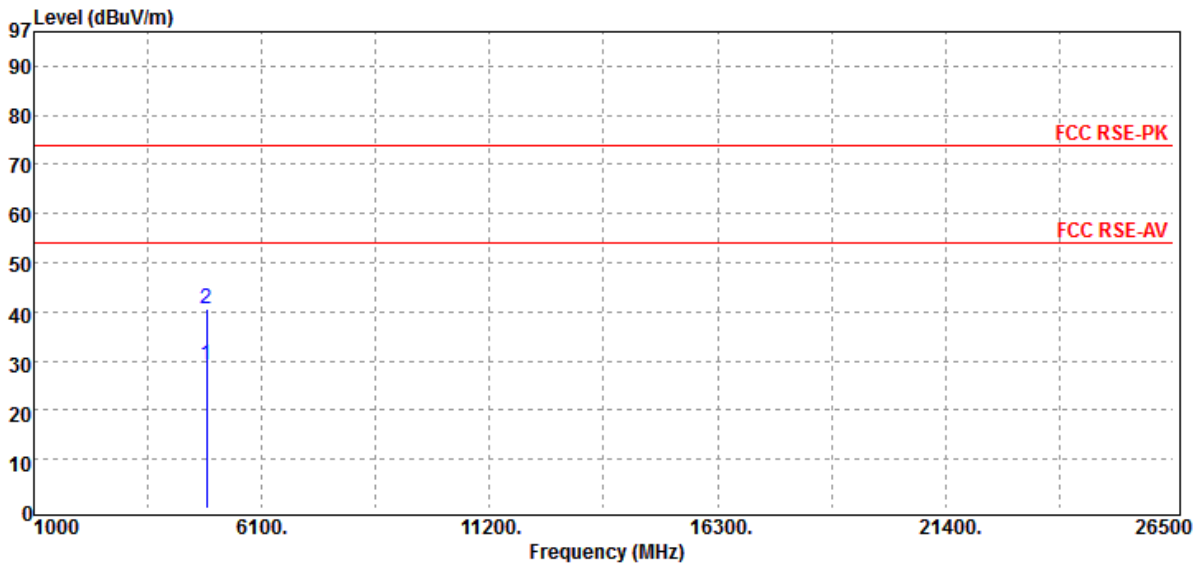
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4824.00	H	Average	24.24	4.93	29.17	54.00	-24.83
4824.00	H	Peak	35.16	4.93	40.09	74.00	-33.91

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Operation Band	:802.11g	Test Date	:2017-07-06
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	dB
4874.00	H	Average	24.21	5.13	29.34	54.00	-24.66
4874.00	H	Peak	35.60	5.13	40.73	74.00	-33.27

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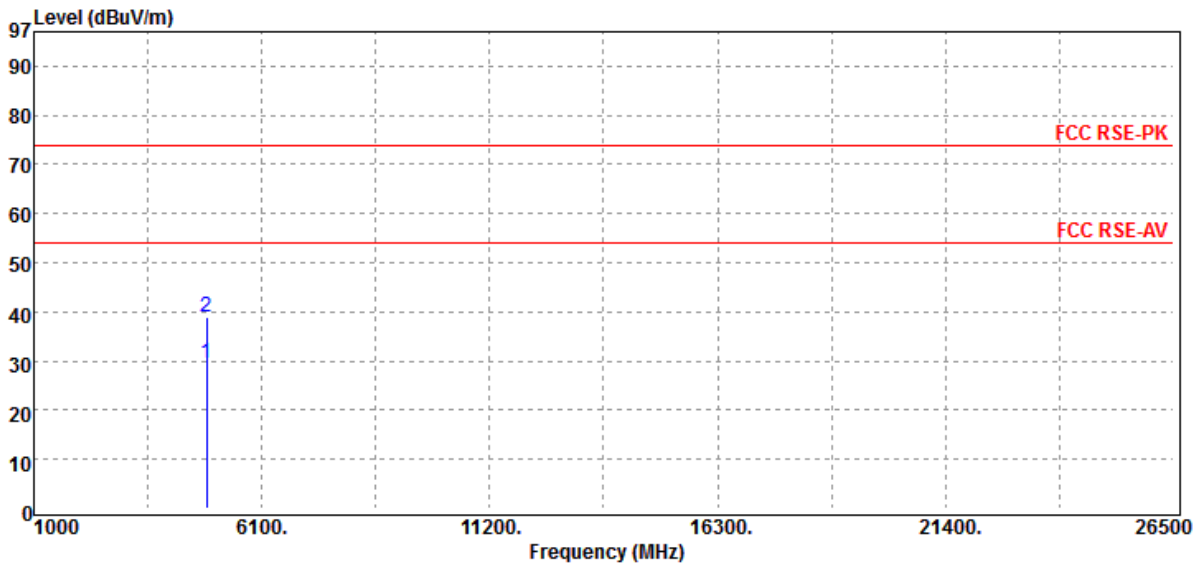
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Operation Band	:802.11g	Test Date	:2017-07-06
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
4874.00	H	Average	24.33	5.13	29.46	54.00	-24.54
4874.00	H	Peak	33.72	5.13	38.85	74.00	-35.15

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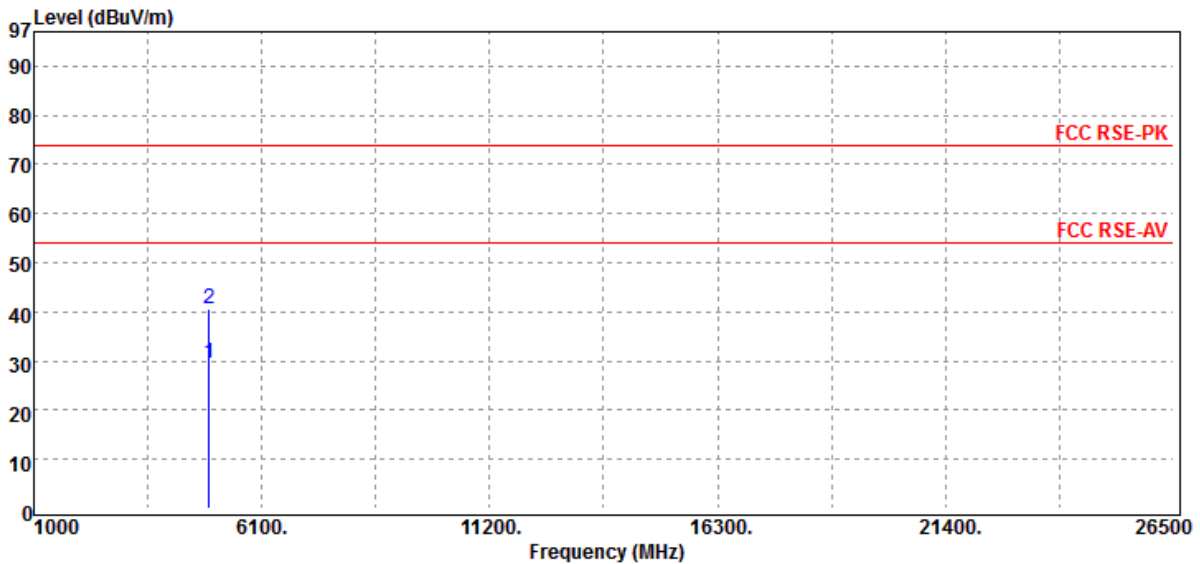
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Operation Band	:802.11g	Test Date	:2017-07-06
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4924.00	H	Average	24.44	5.25	29.69	54.00	-24.31
4924.00	H	Peak	35.29	5.25	40.54	74.00	-33.46

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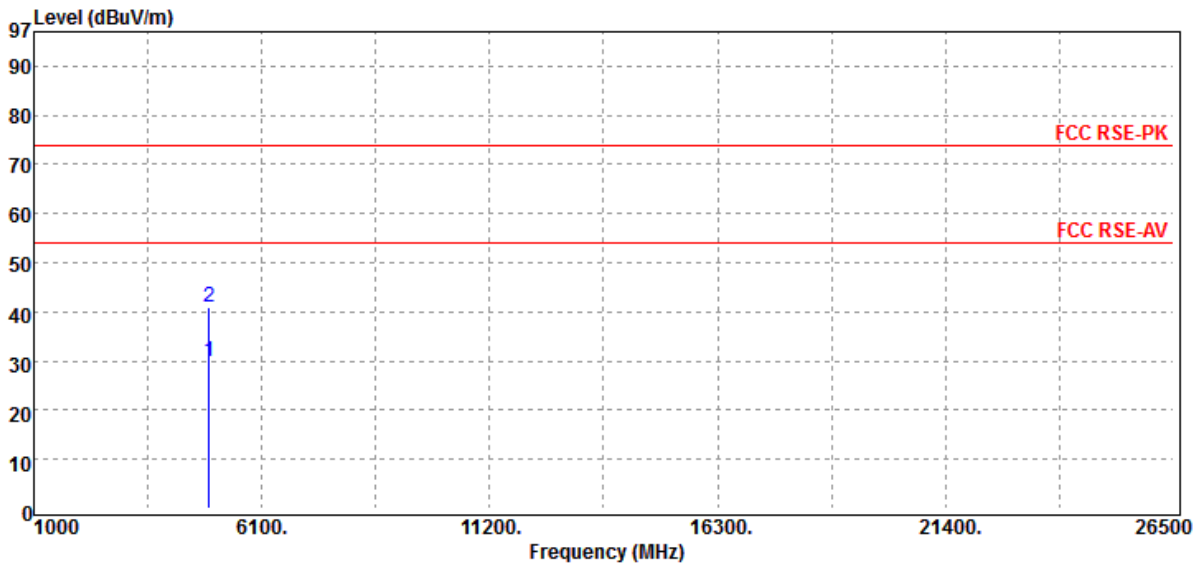
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Operation Band	:802.11g	Test Date	:2017-07-06
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	dB
4924.00	H	Average	24.57	5.25	29.82	54.00	-24.18
4924.00	H	Peak	35.55	5.25	40.80	74.00	-33.20

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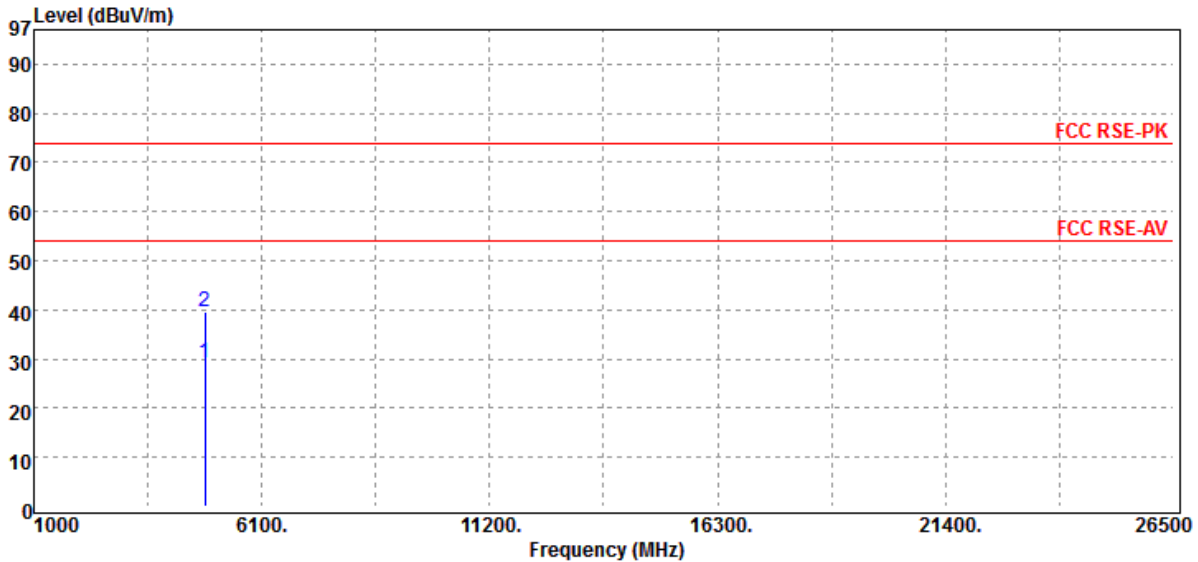
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Radiated Spurious Emission Measurement Result (802.11_HT20)

Operation Band	:802.11n20	Test Date	:2017-07-06
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4824.00	H	Average	24.19	4.93	29.12	54.00	-24.88
4824.00	H	Peak	34.72	4.93	39.65	74.00	-34.35

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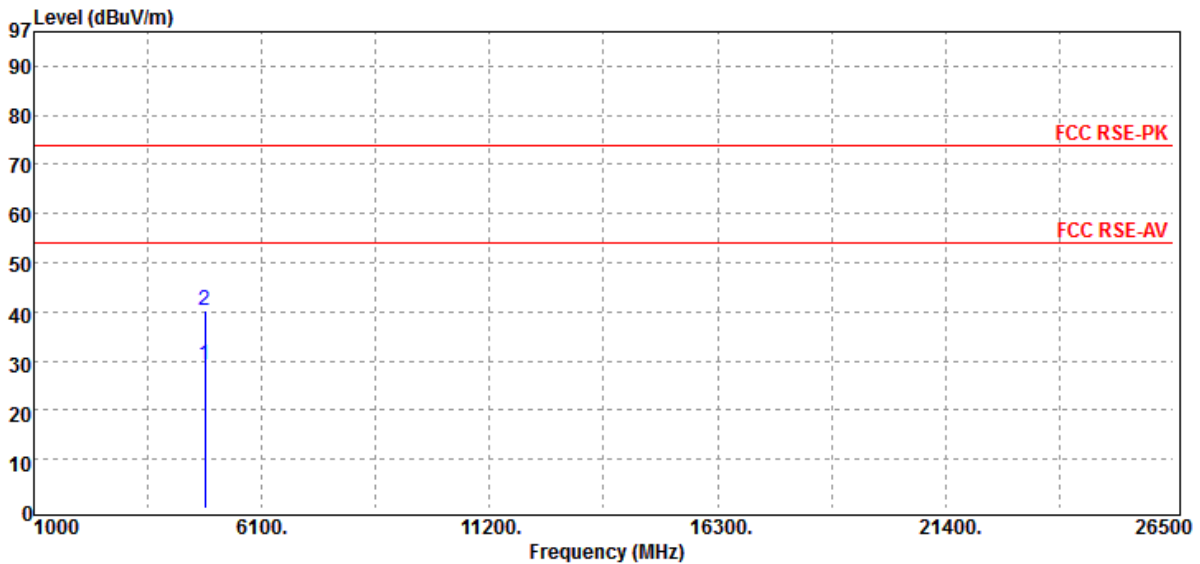
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Operation Band	:802.11n20	Test Date	:2017-07-06
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4824.00	H	Average	24.28	4.93	29.21	54.00	-24.79
4824.00	H	Peak	35.32	4.93	40.25	74.00	-33.75

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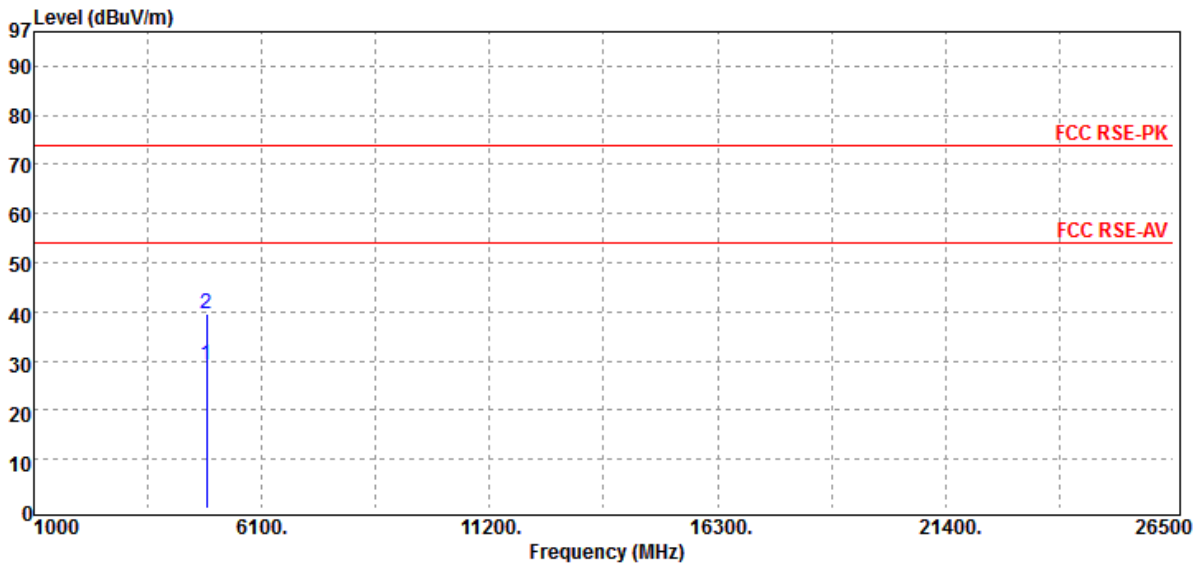
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Operation Band	:802.11n20	Test Date	:2017-07-06
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4874.00	H	Average	24.20	5.13	29.33	54.00	-24.67
4874.00	H	Peak	34.52	5.13	39.65	74.00	-34.35

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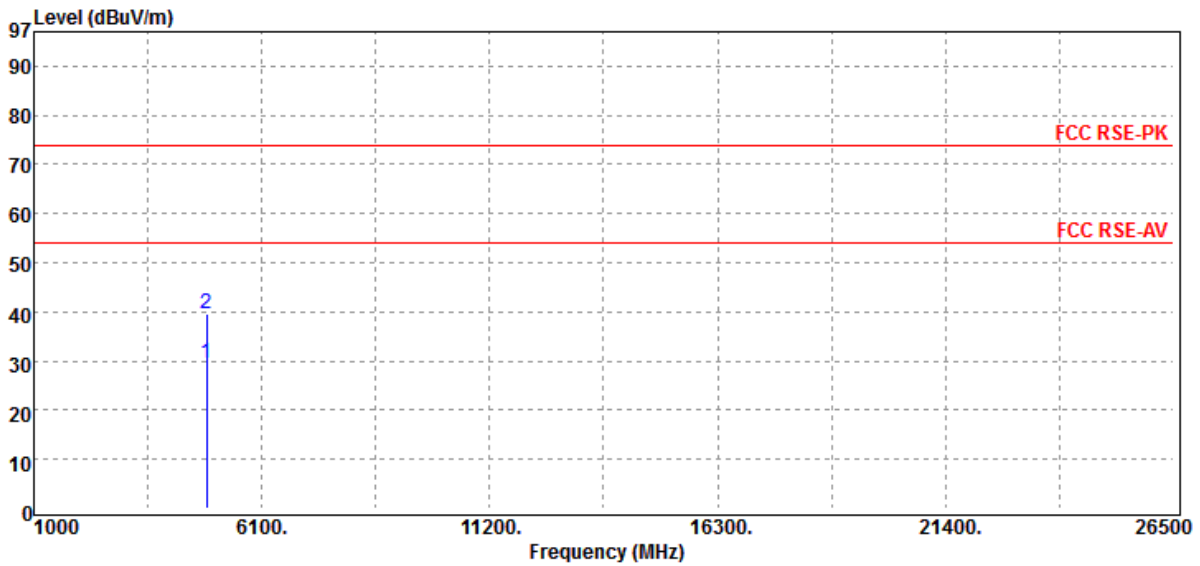
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Operation Band	:802.11n20	Test Date	:2017-07-06
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	dB
4874.00	H	Average	24.25	5.13	29.38	54.00	-24.62
4874.00	H	Peak	34.55	5.13	39.68	74.00	-34.32

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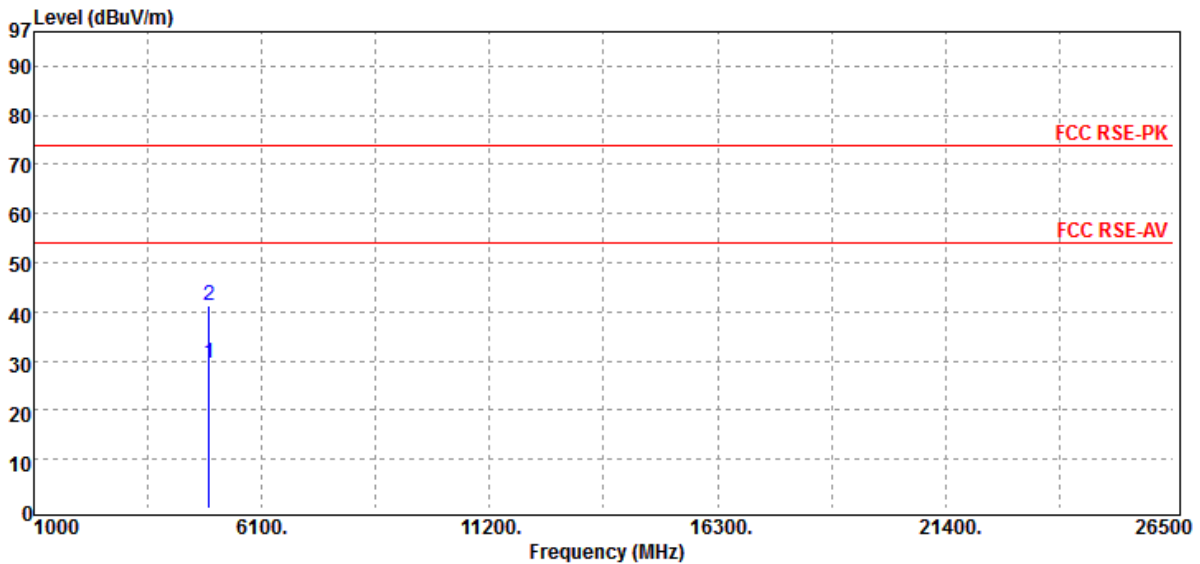
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Operation Band	:802.11n20	Test Date	:2017-07-06
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	dB
4924.00	H	Average	24.44	5.25	29.69	54.00	-24.31
4924.00	H	Peak	36.08	5.25	41.33	74.00	-32.67

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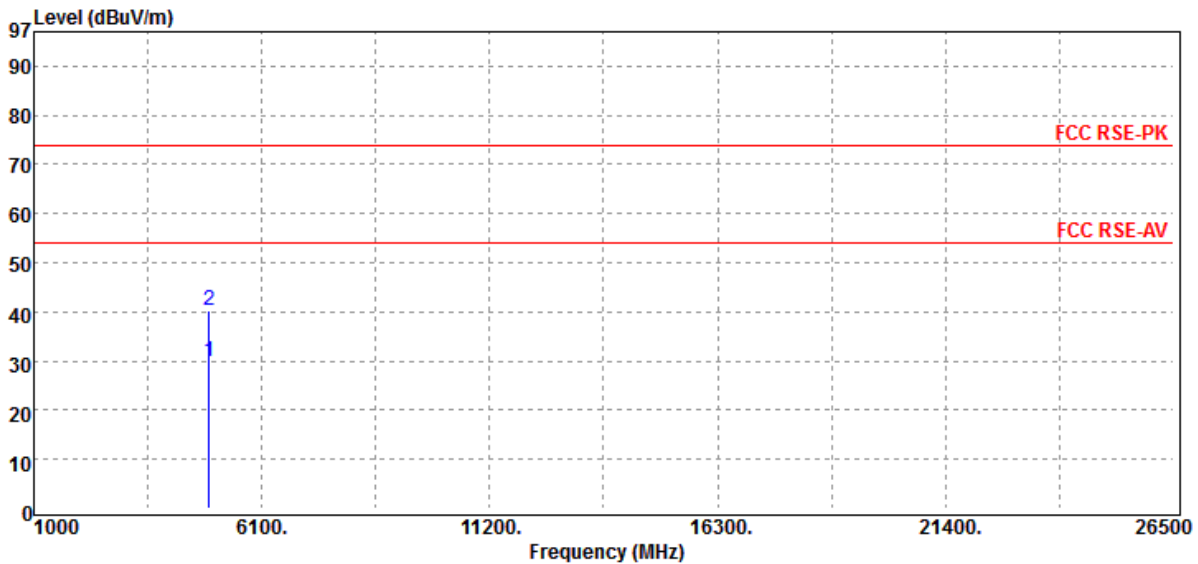
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Operation Band	:802.11n20	Test Date	:2017-07-06
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	dB
4924.00	H	Average	24.61	5.25	29.86	54.00	-24.14
4924.00	H	Peak	34.87	5.25	40.12	74.00	-33.88

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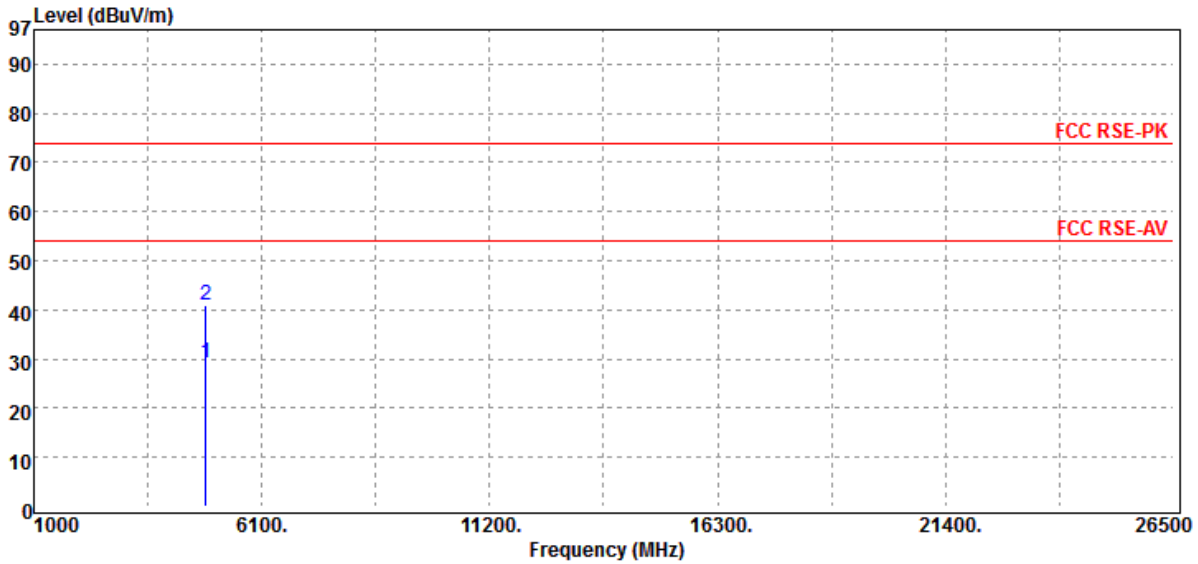
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Radiated Spurious Emission Measurement Result (802.11_HT40)

Operation Band	:802.11n40	Test Date	:2017-07-06
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4844.00	H	Average	24.23	4.97	29.20	54.00	-24.80
4844.00	H	Peak	35.88	4.97	40.85	74.00	-33.15

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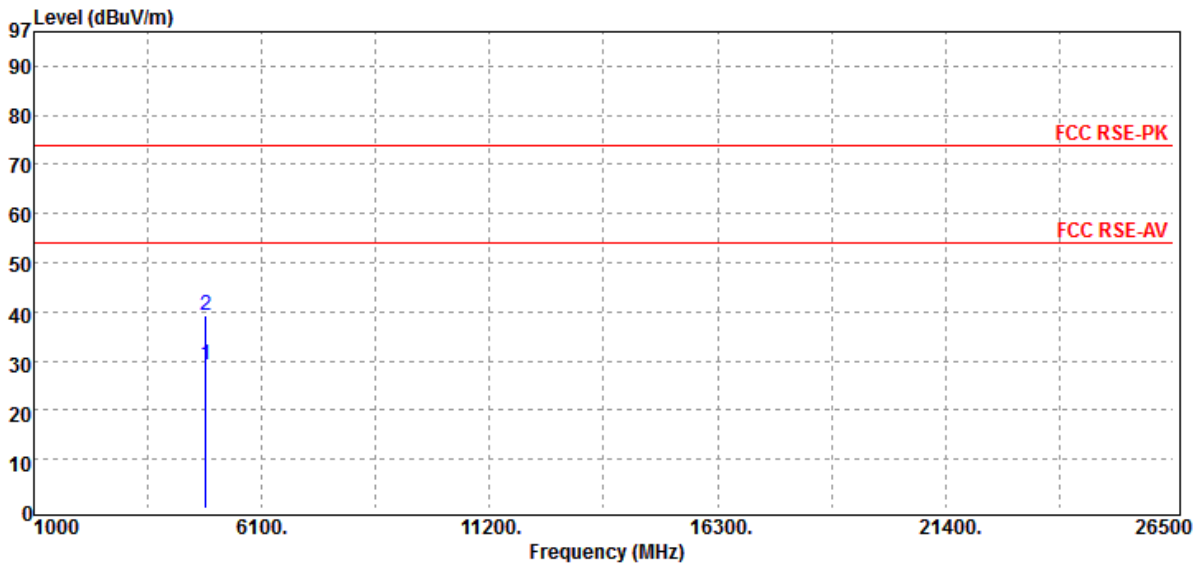
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Operation Band	:802.11n40	Test Date	:2017-07-06
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	dB
4844.00	H	Average	24.33	4.97	29.30	54.00	-24.70
4844.00	H	Peak	34.17	4.97	39.14	74.00	-34.86

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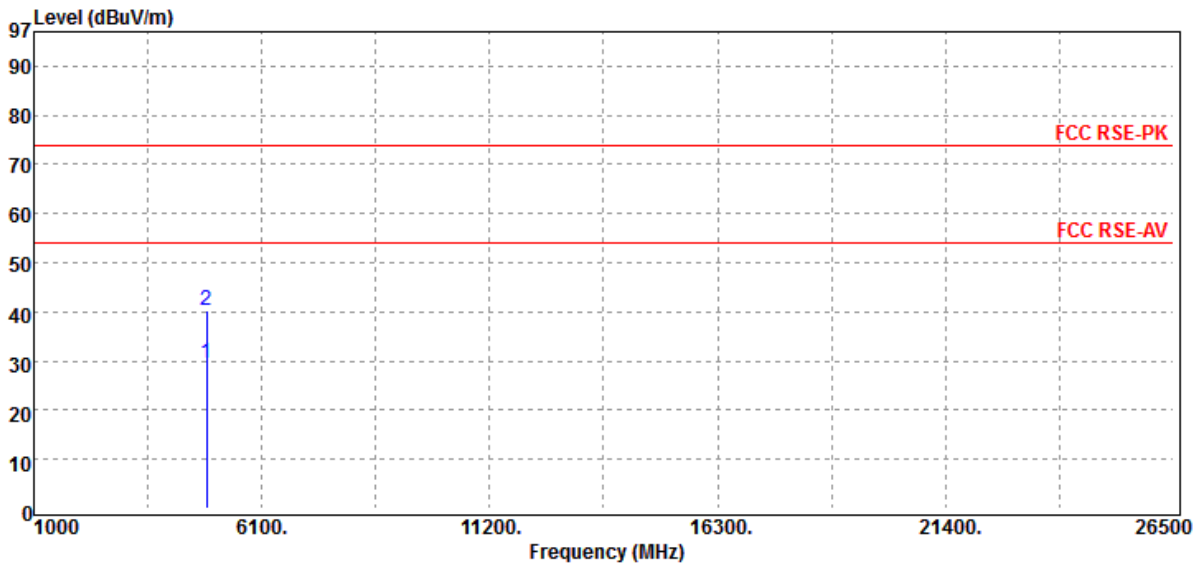
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Operation Band	:802.11n40	Test Date	:2017-07-06
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
4874.00	H	Average	24.26	5.13	29.39	54.00	-24.61
4874.00	H	Peak	35.27	5.13	40.40	74.00	-33.60

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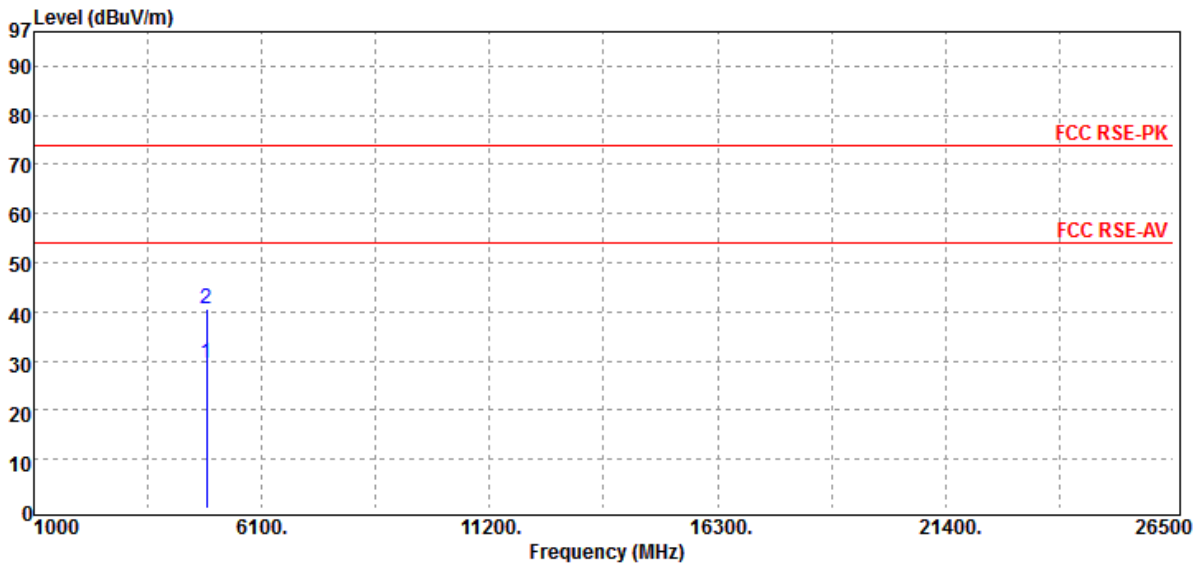
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Operation Band	:802.11n40	Test Date	:2017-07-06
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	dB
4874.00	H	Average	24.37	5.13	29.50	54.00	-24.50
4874.00	H	Peak	35.40	5.13	40.53	74.00	-33.47

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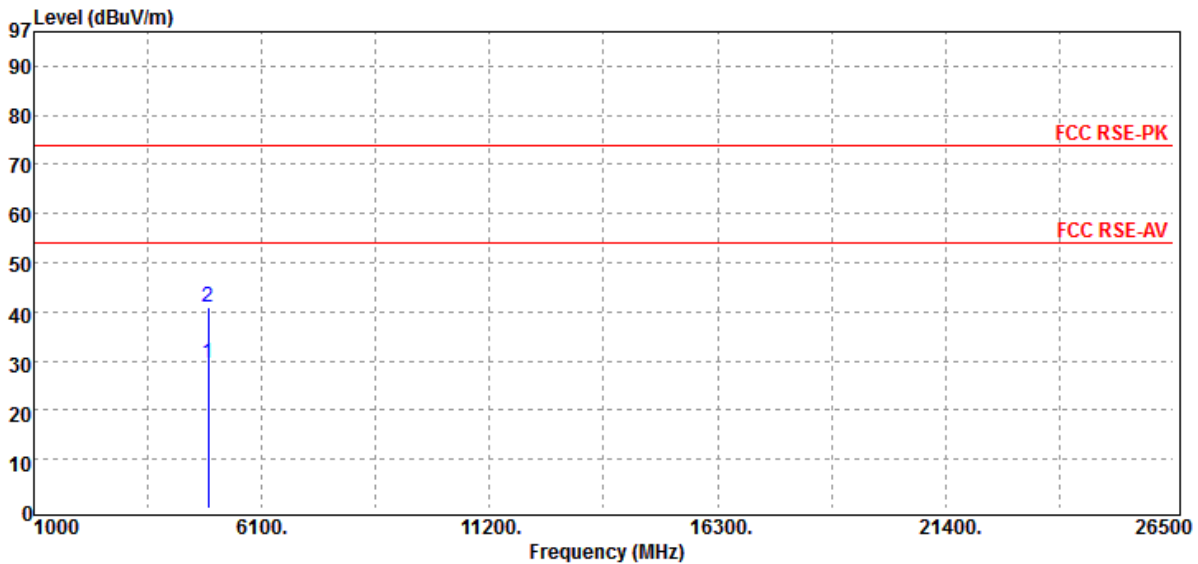
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Operation Band	:802.11n40	Test Date	:2017-07-06
Fundamental Frequency	:2452 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	dB
4904.00	H	Average	24.46	5.24	29.70	54.00	-24.30
4904.00	H	Peak	35.82	5.24	41.06	74.00	-32.94

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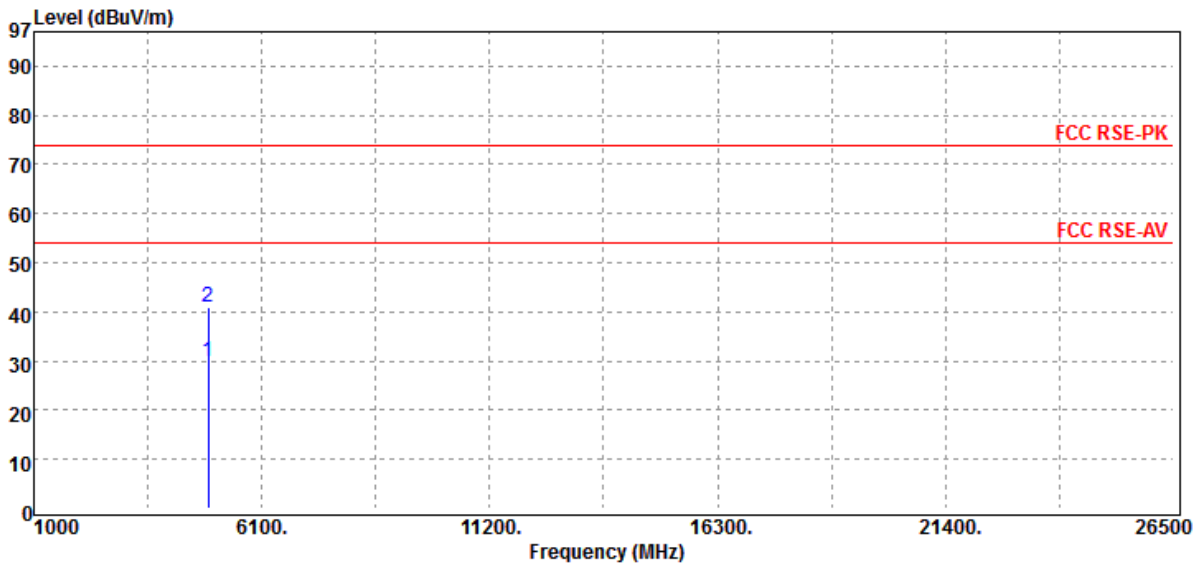
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Operation Band	:802.11n40	Test Date	:2017-07-06
Fundamental Frequency	:2452 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Mike
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	Margin
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	dB
4904.00	H	Average	24.57	5.24	29.81	54.00	-24.19
4904.00	H	Peak	35.59	5.24	40.83	74.00	-33.17

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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.

Note:

Antenna Gain: -1.50 dBi
 Aux1 Antenna Gain: -0.10 dBi
 Number Antenna: 2 pcs
 Limit: 8 dBm

The antenna gain is grater than 6dBi in MIMO mode the limit reduce as below:

Directional gain = gain of antenna element + 10 log (# of TX antenna elements)

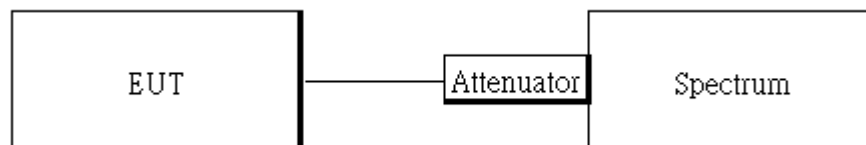
Effective Legacy Gain (dBi) = 0+3.01=3.01dBi

Limit: 8dBm – (3.01– 6dBi)=8

12.2 Measurement Equipment Used

SGS Conducted Room					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	12/15/2016	12/14/2017
Power Sensor	Anritsu	MA2411B	917032	12/15/2016	12/14/2017
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/05/2017	01/04/2018
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018
Splitter	Agilent	11636B	N/A	01/05/2017	01/04/2018
DC Power Supply	Agilent	E3640A	MY52410006	11/21/2016	11/20/2017
Temperature Chamber	TERCHY	MHG-120LF	911009	05/19/2017	05/18/2018

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.
11. 802.11g/n MIMO mode: offset is set following “measure and add 10 Log (N)” on spectrum to measure the PSD for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna. N=2 for this given application

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12.5 Measurement Result

POWER DENSITY 802.11b				POWER DENSITY 802.11g			
Freq. (MHz)	PSD (dBm)	Limit (dBm)	Result	Freq. (MHz)	PSD (dBm)	Limit (dBm)	Result
2412	-1.41	8.00	PASS	2412	-6.48	8.00	PASS
2437	-0.23	8.00	PASS	2437	-6.03	8.00	PASS
2462	-0.55	8.00	PASS	2462	-6.05	8.00	PASS

POWER DENSITY 802.11n HT20				POWER DENSITY 802.11n HT40			
Freq. (MHz)	PSD (dBm)	Limit (dBm)	Result	Freq. (MHz)	PSD (dBm)	Limit (dBm)	Result
2412	-7.72	8.00	PASS	2422	-11.8	8.00	PASS
2437	-5.71	8.00	PASS	2437	-8.22	8.00	PASS
2462	-7.94	8.00	PASS	2452	-10.9	8.00	PASS

**Refer to next page for plots*

Bandedge Limit 802.11b MODE			Bandedge Limit 802.11g MODE		
Freq. (MHz)	PSD (dBm)	Bandedge Limit (dBm)	Freq. (MHz)	PSD (dBm)	Bandedge Limit (dBm)
2412	13.84	-6.16	2412	8.99	-11.01
2462	13.47	-6.53	2462	8.55	-11.45

Bandedge Limit 802.11n20 MODE			Bandedge Limit 802.11n40 MODE		
Freq. (MHz)	PSD (dBm)	Bandedge Limit (dBm)	Freq. (MHz)	PSD (dBm)	Bandedge Limit (dBm)
2412	7.61	-12.39	2422	3.37	-16.63
2462	7.34	-12.66	2452	2.74	-17.26

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802.11b

Power Spectral Density Test Plot (CH-Low)



Power Spectral Density Test Plot (CH-Mid)



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Power Spectral Density Test Plot (CH-High)



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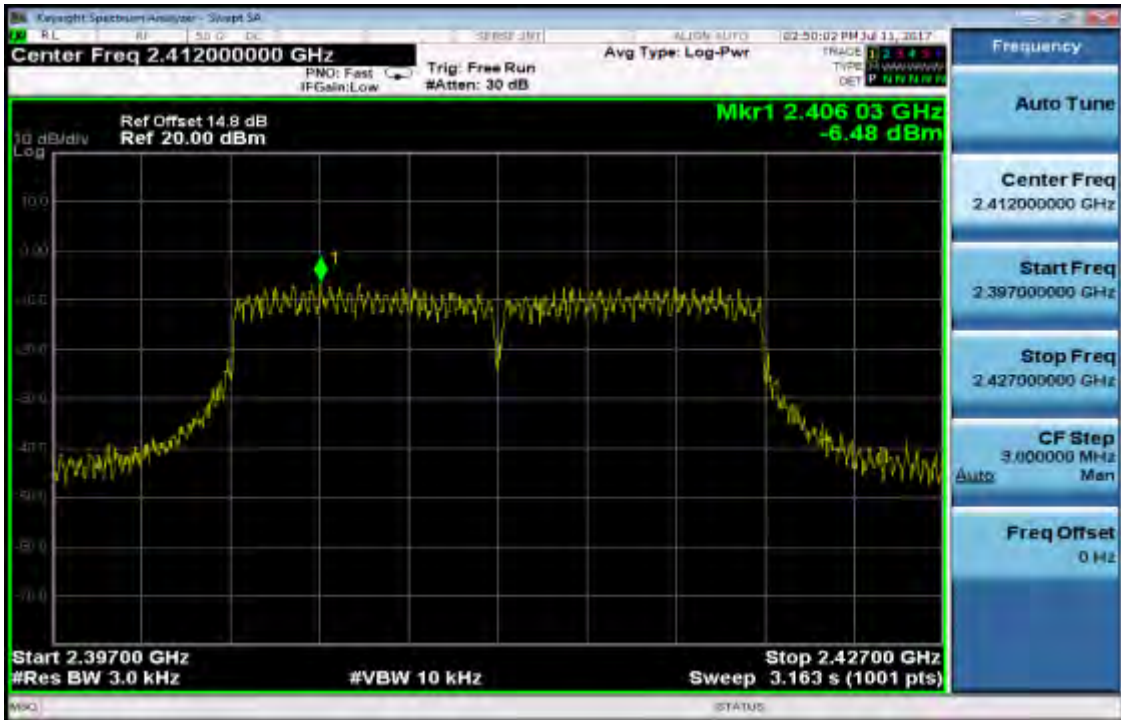
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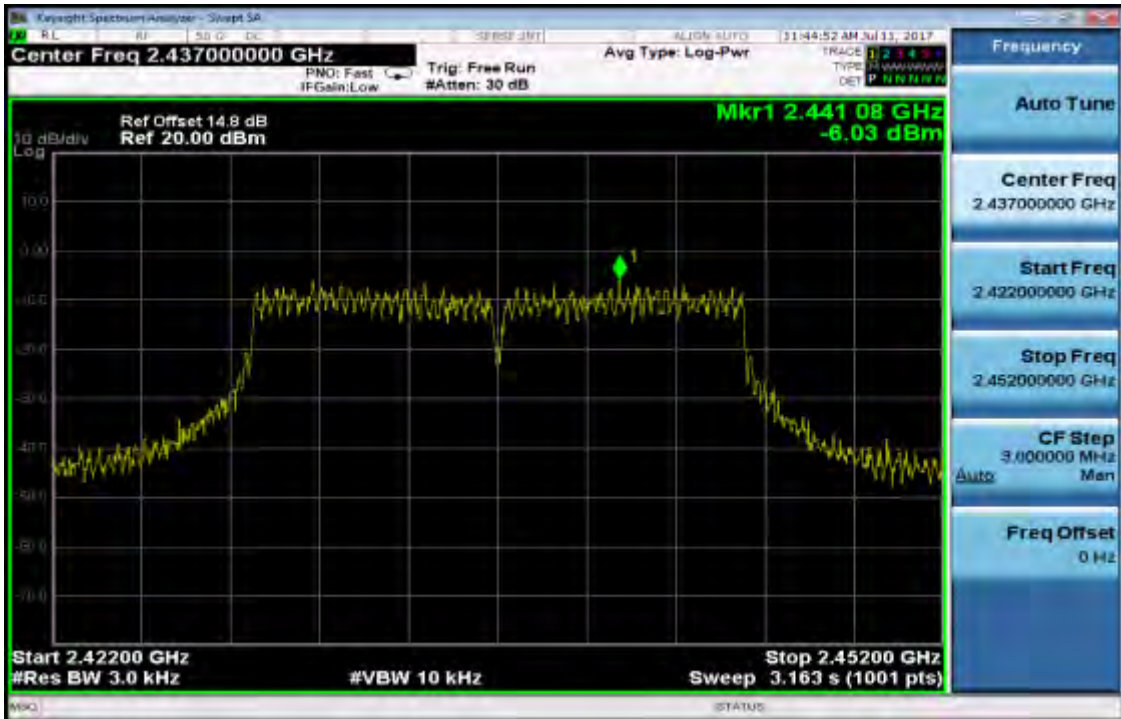
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802.11g

Power Spectral Density Test Plot (CH-Low)



Power Spectral Density Test Plot (CH-Mid)

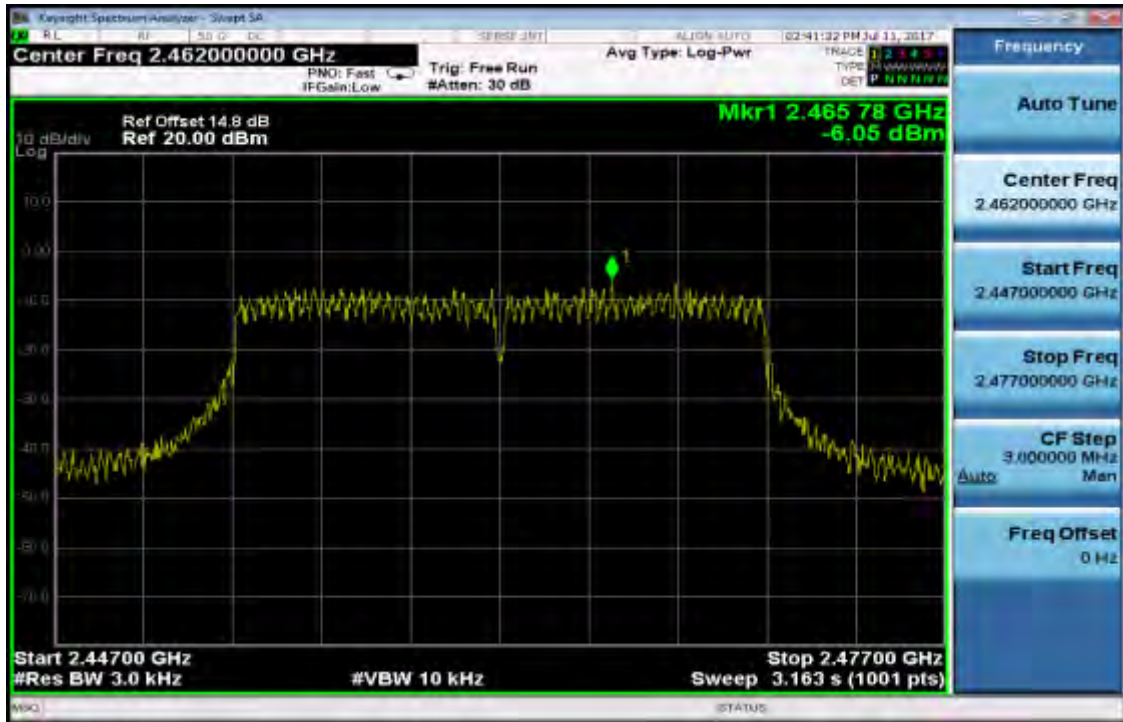


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Power Spectral Density Test Plot (CH-High)



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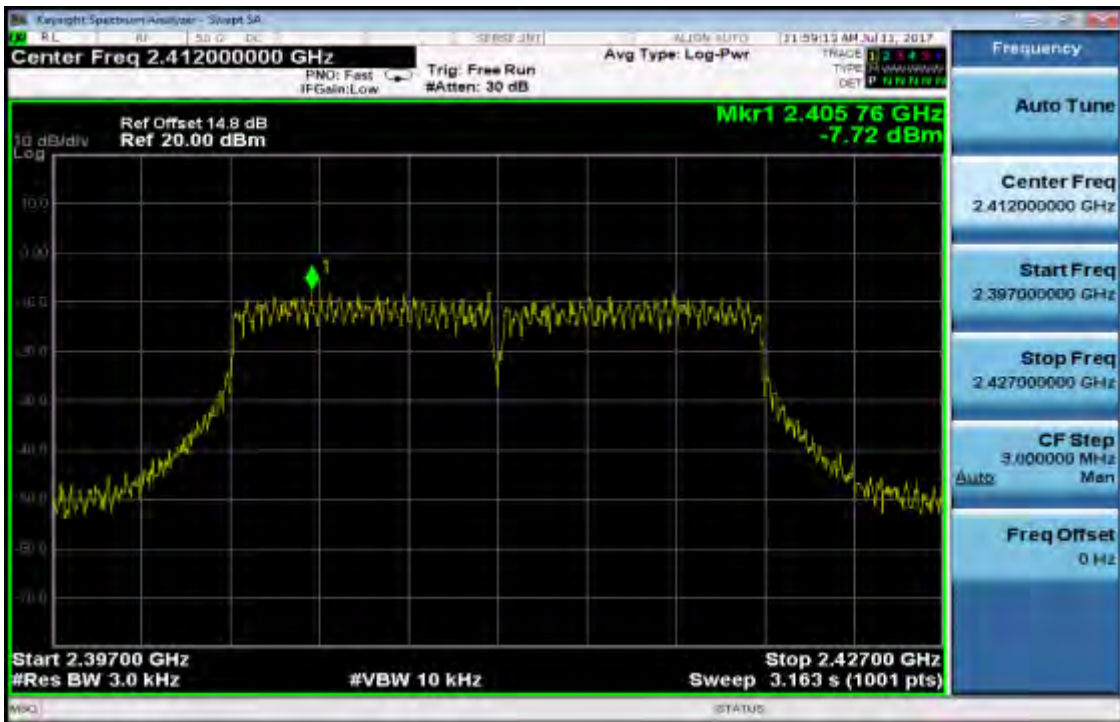
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802.11n_HT20 (MIMO)

Power Spectral Density Test Plot (CH-Low)



Power Spectral Density Test Plot (CH-Mid)



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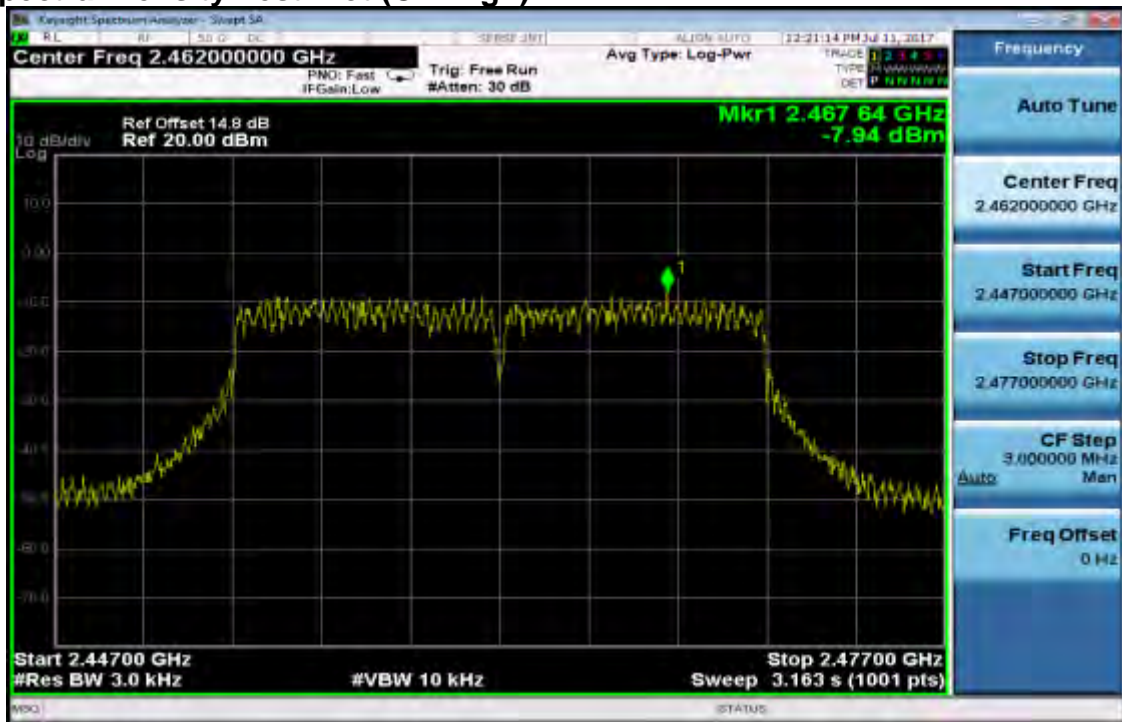
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Power Spectral Density Test Plot (CH-High)



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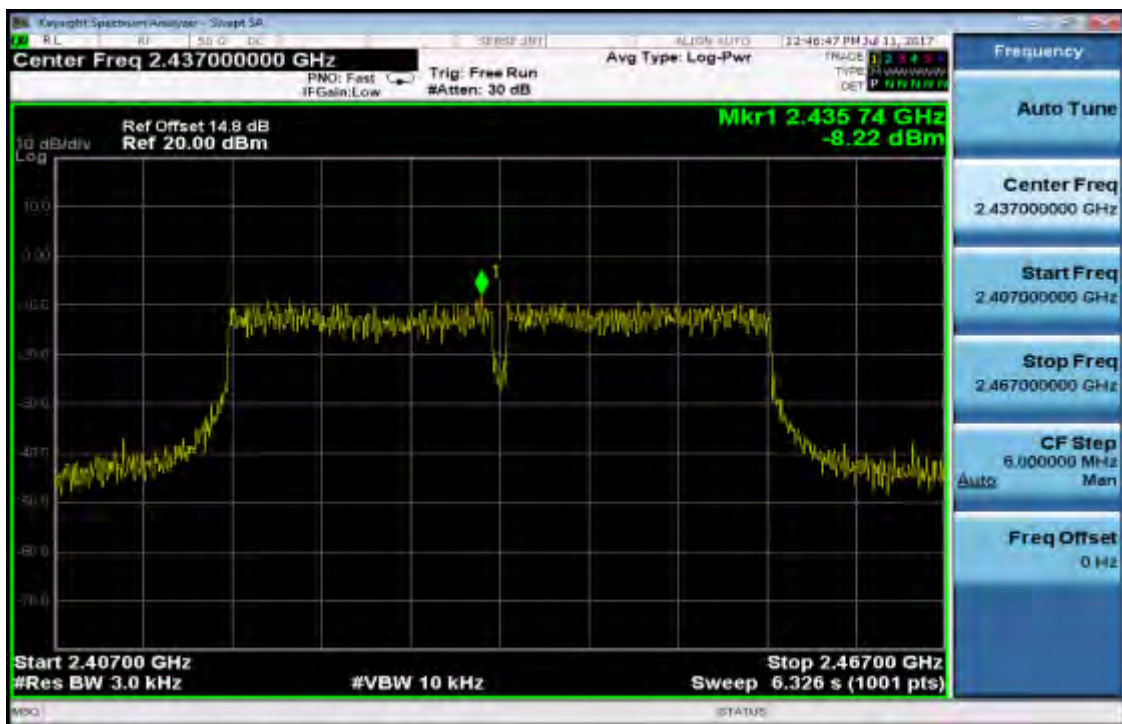
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802.11n_HT40 (MIMO)

Power Spectral Density Test Plot (CH-Low)



Power Spectral Density Test Plot (CH-Mid)



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Power Spectral Density Test Plot (CH-High)



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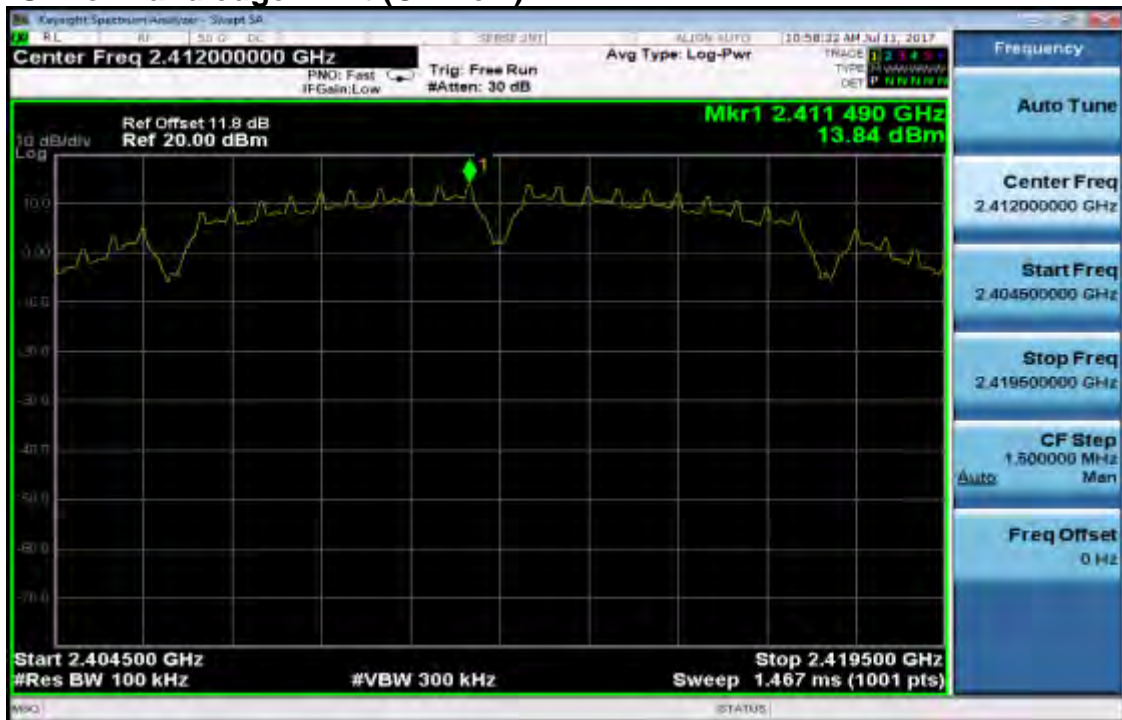
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802.11b PSD for Band edge Limit (CH-Low)



802.11b PSD for Bandedge Limit(CH-High)



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802.11g PSD for Bandedge Limit(CH-Low)



802.11g PSD for Bandedge Limit(CH-High)



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802.11n_HT20 PSD for Bandedge Limit(CH-Low)



802.11n_HT20 PSD for Bandedge Limit(CH-High)



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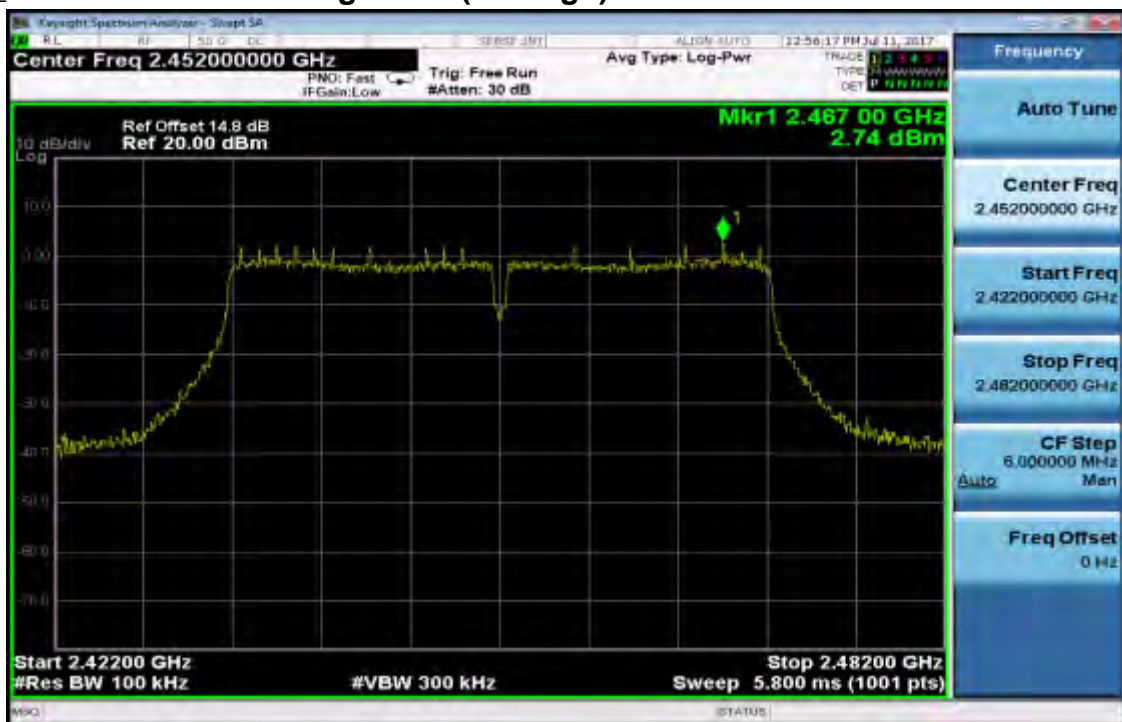
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802.11n_HT40 PSD for Bandedge Limit(CH-Low)



802.11n_HT40 PSD for Bandedge Limit(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.

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

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.

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

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14 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

14.1 Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

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14.2 Maximum Permissible Exposure (MPE) Evaluation (Worst Case)

802.11b Aux1						
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit		RESULT
1	2412	1	24.92	1 Watt	30.00 dBm	PASS
6	2437	1	25.18	1 Watt	30.00 dBm	PASS
11	2462	1	24.94	1 Watt	30.00 dBm	PASS
802.11b Aux1						
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Limit		RESULT
1	2412	1	22.76	1 Watt	30.00 dBm	PASS
6	2437	1	23.06	1 Watt	30.00 dBm	PASS
11	2462	1	22.81	1 Watt	30.00 dBm	PASS

MPE Prediction (802.11b)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4\pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

Max. output power including tune-up tolerancel:	23.06	(dBm)
Max. output power including tune-up tolerancel:	202.30192	(mW)
Duty cycle:	99.63	(%)
Maximum Pav :	201.5534	(mW)
Peak Antenna gain (Maximum):	-0.1	(dBi)
Peak Antenna gain (linear):	0.9772372	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.039	(mW/cm ²)
Measurement Result		
The predicted power density level at 20 cm is 0.039 mW/cm ² .		
This is below the uncontrolled exposure limit of 1 mW/cm ² at 2437MHz.		

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