

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

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

OF

Product Name: 801.11 a/b/g/n/ac WLAN and BT 4.1 Combo Module

Brand Name: Foxconn

Model No.: WBUB15

Model Difference: N/A

FCC ID: YE5-WBUB15

IC: 4613B-WBUB15

Report No.: ER/2015/80130

Issue Date: Oct. 20, 2015

FCC Rule Part: §15.247, Cat: DTS

IC Rule Part: RSS-247 issue 1 :2015

Prepared for: HON HAI PRECISION INDUSSTRY CO., LTD.
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VERIFICATION OF COMPLIANCE

Applicant: HON HAI PRECISION INDUSSTRY CO., LTD.
No.2, Zihyou St., Tucheng City, New Taipei City 236, Taiwan

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Report Number: ER/2015/80130

Date of test: Aug. 24, 2015 ~ Oct. 20, 2015

Date of EUT Received: Aug. 24, 2015

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:

JJ Chen

Date:

Oct. 20, 2015

JJ Chen / Engineer

Prepared By:

Karen Huang

Date:

Oct. 20, 2015

Karen Huang / Clerk

Approved By:

Jim Chang

Date:

Oct. 20, 2015

Jim Chang / Asst. Manager

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Revision History

Report Number	Revision	Description	Issue Date
ER/2015/80130	Rev.00	Initial creation of document	Oct. 20, 2015

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1 GENERAL INFORMATION

1.1 Product description

General:

Product Name:	801.11 a/b/g/n/ac WLAN and BT 4.1 Combo Module
Brand Name:	Foxconn
Model No.:	WBUB15
Model Difference:	N/A
Product SW/HW version:	7.35.143.36/ DVT
Radio SW/HW version:	7.35.143.36 / DVT
Test SW Version:	N/A
RF power setting in TEST SW:	N/A
Power Supply:	3.3Vdc form DC power supply.

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WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power / (EIRP)	Type of Emission	Modulation Technology
11b/g	2412-2462	11	b: 20.05dBm b:20.50dBm (EIRP) g: 23.73dBm g: 20.42dBm (EIRP)	b: 11M3G1D g:16M6D1D	DSSS, OFDM
11n	HT20 2412-2462	11	HT20: 24.74dBm (MIMO Chain 0+1) HT20:24.24dBm (MIMO Chain 0+1) (EIRP)	HT20:17M8D1D	OFDM
11n	HT40 2422-2452	7	HT40: 25.08dBm (MIMO Chain 0+1) HT40: 24.44dBm (MIMO Chain 0+1) (EIRP)	HT40:36M3D1D	OFDM
Antenna Designation:		PIFA Antenna, Main: Gain: 4.02dBi (Ant 1) Aux: Gain: 2.12dBi (Ant 2)			
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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1.2 Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is 801.11 a/b/g/n/ac WLAN and BT 4.1 Combo Module supporting, Wi-Fi 802.11a/b/g/n/ac and Bluetooth features, and below is details of information.

Product Feature	
Product Name:	801.11 a/b/g/n/ac WLAN and BT 4.1 Combo Module
Brand Name:	Foxconn
Model No.:	WBUB15
Model Difference:	N/A
FCC ID:	YE5-WBUB15
IC :	4613B-WBUB15
Wi-Fi Specification	802.11a/b/g/n/ac
Bluetooth Version	V4.1 dual mode

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

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1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance V03r03

FCC KDB 662911 D01 Multiple Transmitter Output V02r01

Canada RSS-247 issue 1 May 2015

Canada RSS-Gen issue 4 Nov. 2014

ANSI C63.10:2013

Note:

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

1.4 Test Facility

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

(TAF code 0513)

FCC Registration Numbers are: 990257

Canada Registration Number: 4620A-5.

1.5 Special Accessories

There are no special accessories used while test was conducted.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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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 three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

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2.4 Measurement Results Explanation Example

For all conducted test items:

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

Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor. Following shows an offset computation example with cable loss 1.0dB and 10dB attenuator.

Single mode offset

$$= \text{RF cable loss (dB)} + \text{attenuation factor(dB)} = 11.0(\text{dB})$$

N20/N40 MIMO mode offset

$$= \text{RF cable loss (dB)} + \text{attenuation factor(dB)} + 10 \log(\text{NANT}) \text{ dB} = 14.0(\text{dB})$$

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2.5 Configuration of Tested System

Fig. 2-1 Radiated & Conducted 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	DRTU	N/A	N/A	N/A	N/A
2.	DC Power Supply	Agilent	E3634A	MY53180030	N/A	Un-shield
3.	Notebook	Lenovo	L412	LR-957X7	shield	Un-shield

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3 SUMMARY OF TEST RESULTS

FCC Rules / IC Rules	Description Of Test	Result
§15.207(a) RSS-Gen §8.8	AC Power Line Conducted Emission	N/A
§15.247(b) (3) RSS-247 §5.4(4)	Peak Output Power	Compliant
§15.247(a)(2) RSS-247 §5.2 (1) RSS-Gen §6.6	6dB & 99% Emission Bandwidth	Compliant
§15.247(d) RSS-247 §5.5	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d) RSS-247 §5.5	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e) RSS-247 §5.2(2)	Power Spectral Density	Compliant
§15.203 §15.247(b) RSS- Gen §6.7 RSS- Gen §8.3	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

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

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

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RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1, 6, 11	DSSS	1	MAIN
802.11g	1 to 11	1, 6, 11	OFDM	6	MAIN
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS 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 E2 position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1, 6, 11	DSSS	1	MAIN
802.11g	1 to 11	1, 6, 11	OFDM	6	MAIN
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)	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)	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

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

6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/04/2015	05/03/2016
LISN	SCHWARZ BECK	NSLK 8127	8127-649	05/15/2015	05/14/2016
LISN	FCC	FCC-LISN-50/250-2 5-2-01	04034	03/13/2015	03/12/2016
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2014	11/25/2015

6.3 EUT Setup

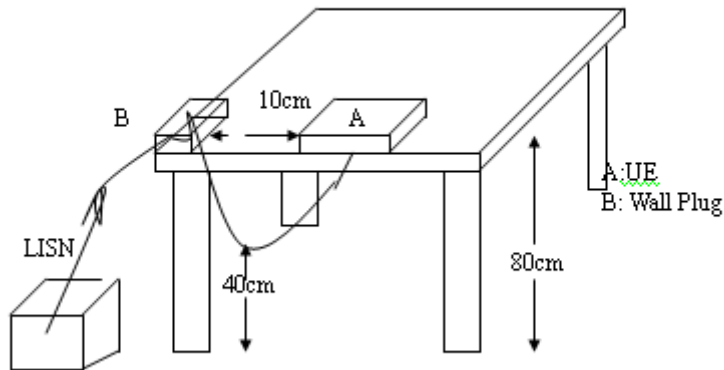
- The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure

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

6.6 Measurement Result

N/A, EUT powered by DC power supply.

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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	94.80	0.23
802.11g	94.80	0.23
802.11n_20	94.90	0.23
802.11n_40	83.60	0.78

$$\text{Duty Cycle Factor: } 10 * \log (1/0.948) = 0.23$$

$$\text{Duty Cycle Factor: } 10 * \log (1/0.948) = 0.23$$

$$\text{Duty Cycle Factor: } 10 * \log (1/0.949) = 0.23$$

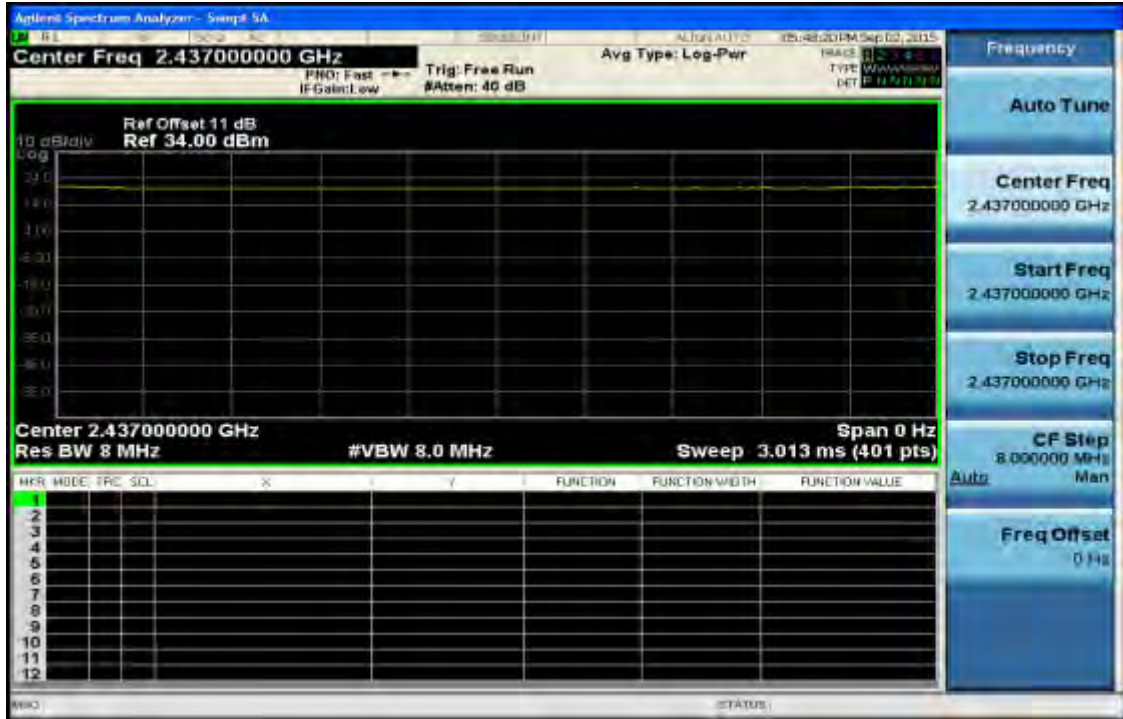
$$\text{Duty Cycle Factor: } 10 * \log (1/0.836) = 0.78$$

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7.1 DUTY CYCLE TEST SIGNAL Measurement Result
802.11 b



802.11 g

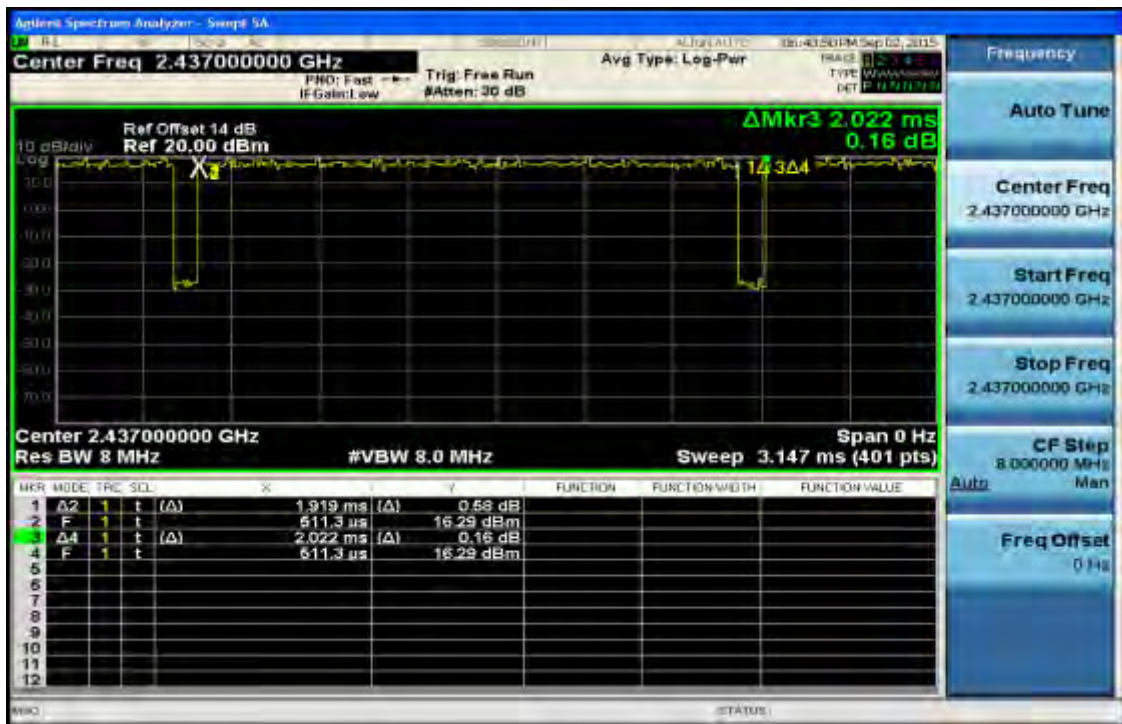


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802.11 n_20 MHz



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.

Note: The antenna gain is granter 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) = 4.02+3.01=7.03dBi

Limit: 30dBm – (7.03– 6dBi) = 28.97dBm

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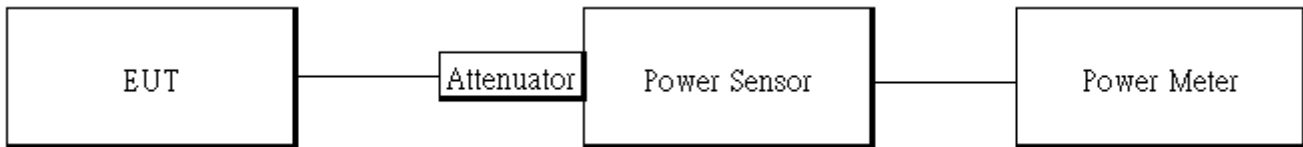
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8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	12/20/2014	12/19/2015
Power Sensor	Anritsu	MA2411B	917032	12/20/2014	12/19/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2015	01/01/2016
Attenuator	Mini-Circuit	BW-S10W2+	002	01/02/2015	01/01/2016
Splitter	Agilent	11636B	N/A	01/02/2015	01/01/2016

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 V03r03.
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

CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	1	19.88	97.27	1 Watt = 30.00 dBm	PASS
6	2437	1	20.05	101.16	1 Watt = 30.00 dBm	PASS
11	2462	1	19.87	97.05	1 Watt = 30.00 dBm	PASS

CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	1	16.4	43.65	1 Watt = 30.00 dBm	PASS
6	2437	1	16.48	44.46	1 Watt = 30.00 dBm	PASS
11	2462	1	16.46	44.26	1 Watt = 30.00 dBm	PASS

802.11g

CH	Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	6	19.68	92.90	1 Watt = 30.00 dBm	PASS
6	2437	6	23.73	236.05	1 Watt = 30.00 dBm	PASS
11	2462	6	20.14	103.28	1 Watt = 30.00 dBm	PASS

CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	6	12.43	17.50	1 Watt = 30.00 dBm	PASS
6	2437	6	16.4	43.65	1 Watt = 30.00 dBm	PASS
11	2462	6	12.48	17.70	1 Watt = 30.00 dBm	PASS

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802.11n_HT20 (MIMO)

802.11n 20M

CH	Frequency (MHz)	Data Rate	Peak Output Power		Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CHAIN 0	CHAIN 1				
1	2412	MCS8	19.71	17.8	21.87	153.80	1 Watt = 28.97 dBm	PASS
6	2437	MCS8	22.32	21.05	24.74	297.96	1 Watt = 28.97 dBm	PASS
11	2462	MCS8	20.4	19.42	22.95	197.15	1 Watt = 28.97 dBm	PASS

CH	Frequency (MHz)	Data Rate	Avg. Output Power		Total Avg Output Power (dBm)	Total Avg Output Power (mW)	Limit	RESULT
			CHAIN 0	CHAIN 1				
1	2412	MCS8	12.23	10.47	14.45	27.85	1 Watt = 28.97 dBm	PASS
6	2437	MCS8	15.01	13.2	17.21	52.59	1 Watt = 28.97 dBm	PASS
11	2462	MCS8	12.92	11.82	15.42	34.79	1 Watt = 28.97 dBm	PASS

802.11n_HT40 (MIMO)

802.11n 40M

CH	Frequency (MHz)	Data Rate	Peak Output Power		Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CHAIN 0	CHAIN 1				
1	2422	MCS8	18.13	16.24	20.30	107.09	1 Watt = 28.97 dBm	PASS
6	2437	MCS8	22.6	21.47	25.08	322.25	1 Watt = 28.97 dBm	PASS
11	2452	MCS8	18.89	17.74	21.36	136.88	1 Watt = 28.97 dBm	PASS

CH	Frequency (MHz)	Data Rate	Avg. Output Power		Total Avg Output Power (dBm)	Total Avg Output Power (mW)	Limit	RESULT
			CHAIN 0	CHAIN 1				
1	2422	MCS8	10.14	8.3	12.33	17.09	1 Watt = 28.97 dBm	PASS
6	2437	MCS8	15.05	13.64	17.41	55.11	1 Watt = 28.97 dBm	PASS
11	2452	MCS8	11.02	9.81	13.47	22.22	1 Watt = 28.97 dBm	PASS

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

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**EIRP Measurement:
802.11b**

CH	Frequency (MHz)	Avg. Output Power		GAIN (dBi)	EIRP	REQUIRED LIMIT (dBm)	RESULT
		TOTAL POWER (dBm)	TOTAL POWER (mW)				
1	2412	16.40	43.652	4.02	20.42	36	PASS
6	2437	16.48	44.463	4.02	20.50	36	PASS
11	2462	16.46	44.259	4.02	20.48	36	PASS

802.11g

CH	Frequency (MHz)	Avg. Output Power		GAIN (dBi)	EIRP	REQUIRED LIMIT (dBm)	RESULT
		TOTAL POWER (dBm)	TOTAL POWER (mW)				
1	2412	12.43	17.498	4.02	16.45	36	PASS
6	2437	16.40	43.652	4.02	20.42	36	PASS
11	2462	12.48	17.701	4.02	16.50	36	PASS

802.11n_20M (MIMO) Chain 0+Chain 1

CH	Frequency (MHz)	Avg. Output Power		GAIN (dBi)	EIRP	REQUIRED LIMIT (dBm)	RESULT
		TOTAL POWER (dBm)	TOTAL POWER (mW)				
1	2412	14.15	26.002	7.03	21.18	36	PASS
6	2437	17.21	52.602	7.03	24.24	36	PASS
11	2462	15.42	34.834	7.03	22.45	36	PASS

802.11n_40M (MIMO) Chain 0+Chain 1

CH	Frequency (MHz)	Avg. Output Power		GAIN (dBi)	EIRP	REQUIRED LIMIT (dBm)	RESULT
		TOTAL POWER (dBm)	TOTAL POWER (mW)				
1	2412	12.33	17.100	7.03	19.36	36	PASS
6	2437	17.41	55.081	7.03	24.44	36	PASS
11	2462	13.47	22.233	7.03	20.50	36	PASS

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

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9 6dB & 99% BANDWIDTH MEASUREMENT

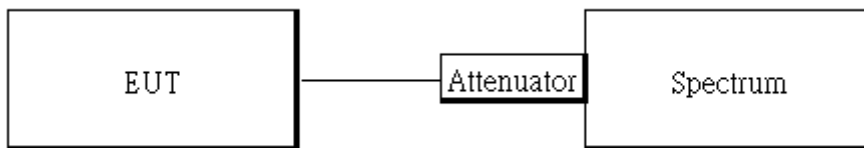
9.1 Standard Applicable

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

9.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2015	01/01/2016
Attenuator	Mini-Circuit	BW-S10W2+	002	01/02/2015	01/01/2016
Splitter	Agilent	11636B	N/A	01/02/2015	01/01/2016

9.3 Test Set-up



9.4 Measurement Procedure

- Place the EUT on the table and set it in transmitting mode.
- The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
- Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- For 6dB Bandwidth:
Set the spectrum analyzer as RBW = 100 kHz, VBW = 3*RBW, Span = 30M/50MHz, Detector=peak, Sweep=auto.
- Mark the peak frequency and -6dB (upper and lower) frequency.
- For 99% Bandwidth:
Set the spectrum analyzer as RBW=1%, VBW = 3*RBW, Span = 30M/50MHz, Detector=Sample, Sweep=auto.
- Turn on the 99% bandwidth function, max reading.
- Repeat above procedures until all frequency of interest measured was complete.

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9.5 Measurement Result

6dB Bandwidth

802.11b

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2412	7116	> 500	PASS
2437	8548	> 500	PASS
2462	8072	> 500	PASS

802.11g

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2412	16430	> 500	PASS
2437	16370	> 500	PASS
2462	16370	> 500	PASS

802.11n_20M (Main)

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2412	17640	> 500	PASS
2437	17610	> 500	PASS
2462	17670	> 500	PASS

802.11n_20M (Aux)

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2412	17550	> 500	PASS
2437	17560	> 500	PASS
2462	17600	> 500	PASS

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802.11n_40M (Main)

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2422	36330	> 500	PASS
2437	36310	> 500	PASS
2452	35530	> 500	PASS

802.11n_40M (Aux)

Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
2422	36370	> 500	PASS
2437	36060	> 500	PASS
2452	36080	> 500	PASS

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99% Bandwidth

802.11b

Frequency (MHz)	99%Bandwidth (MHz)
2412	11.333
2437	11.266
2462	10.431

802.11g

Frequency (MHz)	99%Bandwidth (MHz)
2412	16.618
2437	16.532
2462	16.634

802.11n 20M (Main)

Frequency (MHz)	99%Bandwidth (MHz)
2412	17.826
2437	17.708
2462	17.774

802.11n 20M (Aux)

Frequency (MHz)	99%Bandwidth (MHz)
2412	17.772
2437	17.758
2462	17.748

802.11n 40M (Main)

Frequency (MHz)	99%Bandwidth (MHz)
2422	36.346
2437	36.336
2452	36.227

802.11n 40M (Aux)

Frequency (MHz)	99%Bandwidth (MHz)
2422	36.275
2437	36.340
2452	36.317

**Refer to next page for plots*

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802.11b
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



802.11g

6dB Band Width Test Data CH-Low



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6dB Band Width Test Data CH-Mid



6dB Band Width Test Data CH-High



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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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6dB Band Width Test Data CH-High



802.11n_20M (Aux)

6dB Band Width Test Data CH-Low



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6dB Band Width Test Data CH-Mid



6dB Band Width Test Data CH-High



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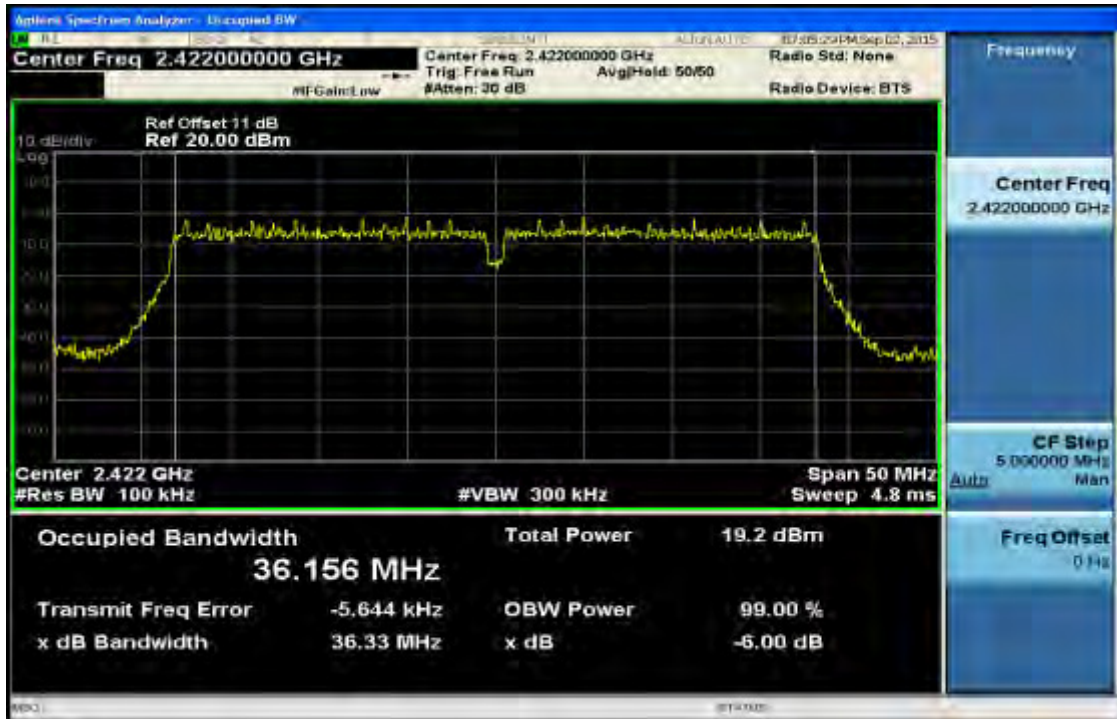
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802.11n_40M (Main) 6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid

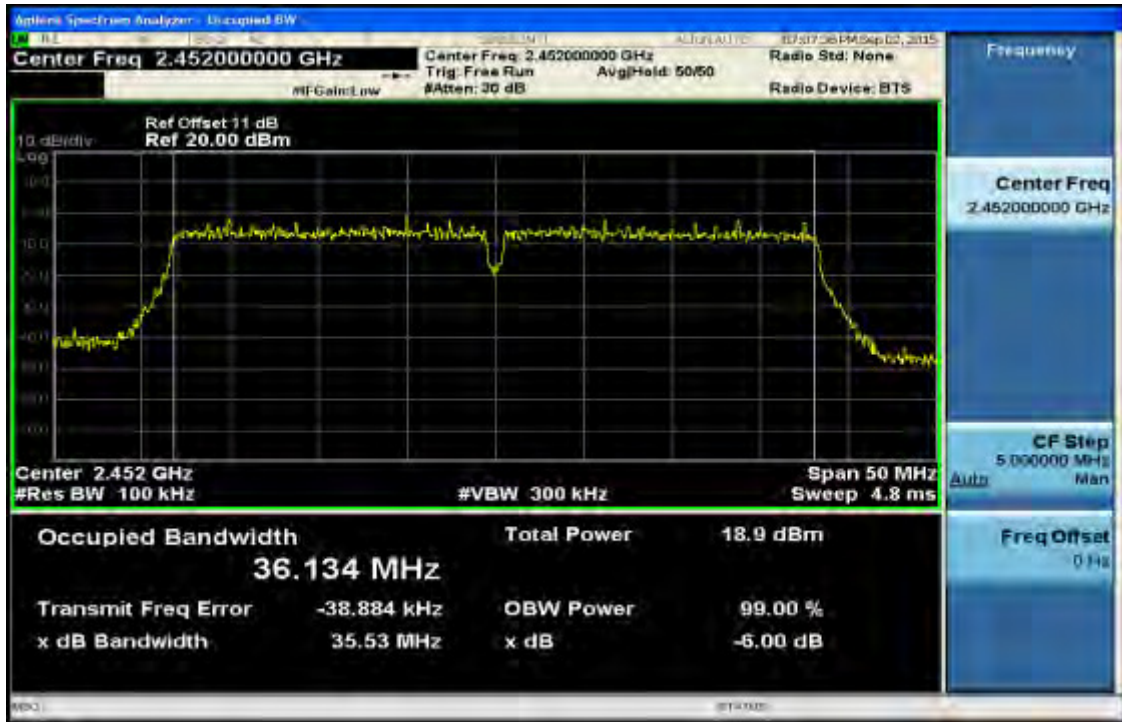


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6dB Band Width Test Data CH-High



802.11n_40M (Aux)

6dB Band Width Test Data CH-Low



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6dB Band Width Test Data CH-Mid



6dB Band Width Test Data CH-High



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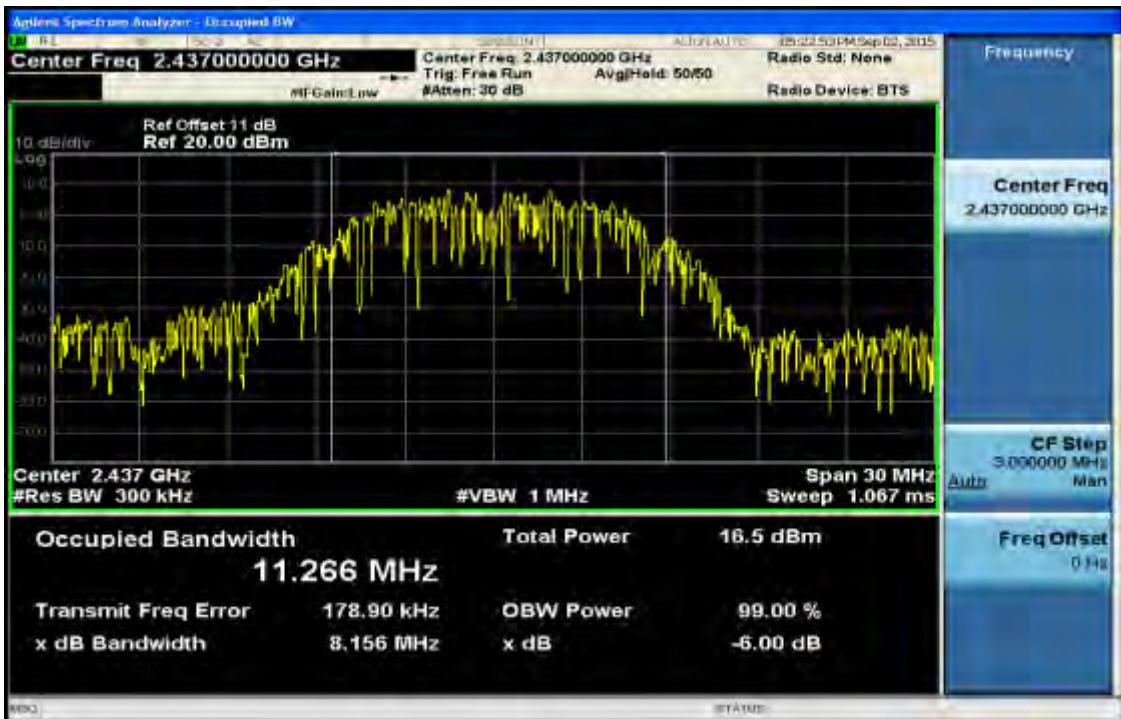
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802.11b
99% Band Width Test Data CH-Low



99% Band Width Test Data CH-Mid

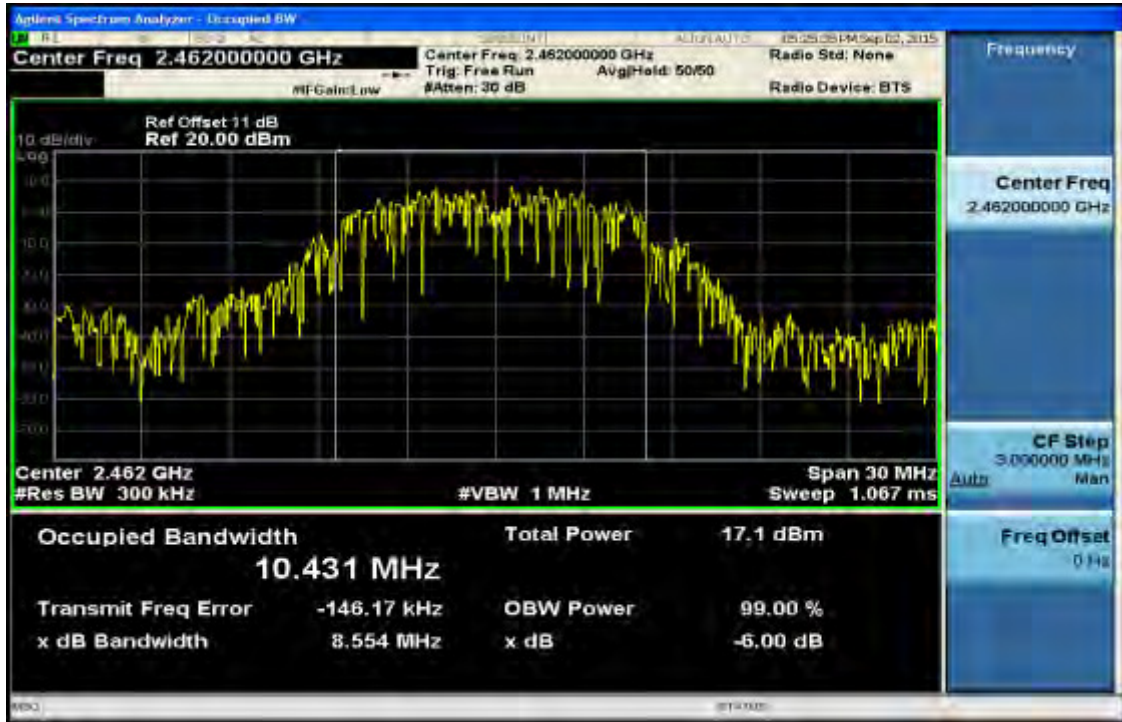


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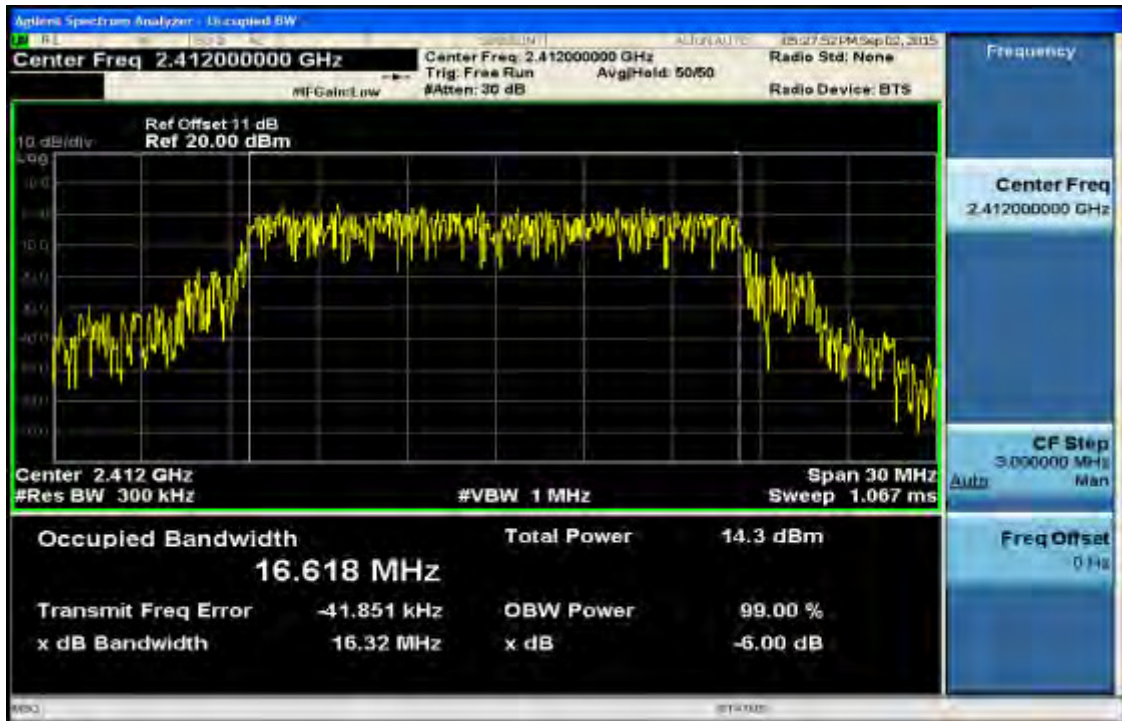
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99% Band Width Test Data CH-High



802.11g

99% Band Width Test Data CH-Low



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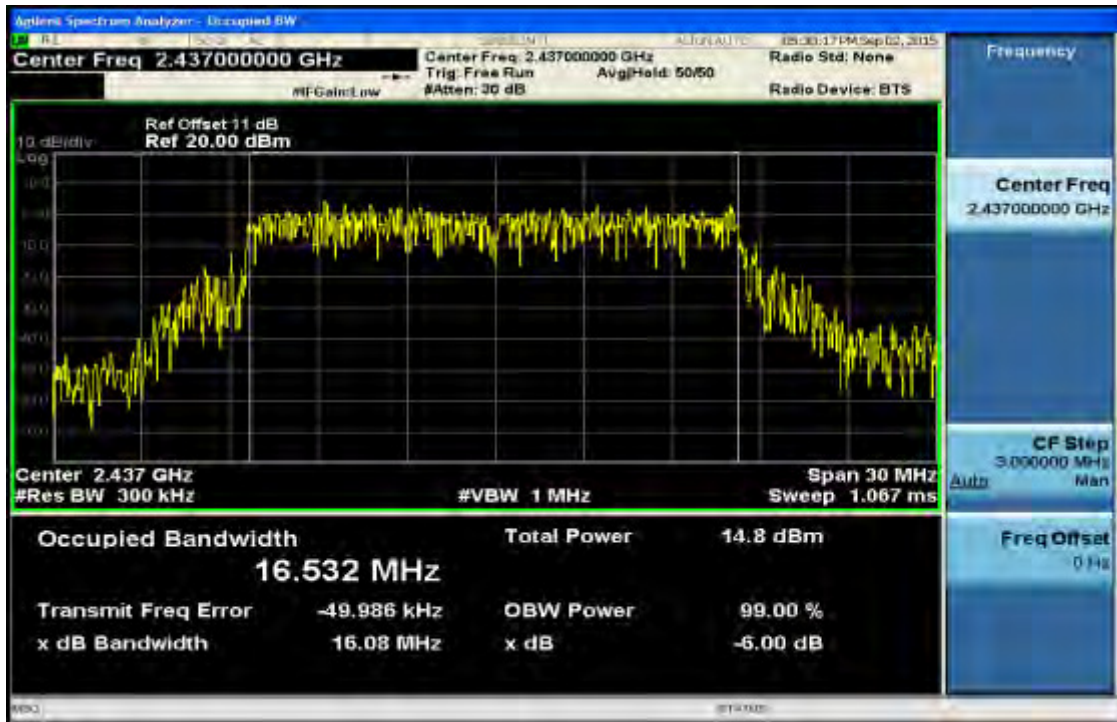
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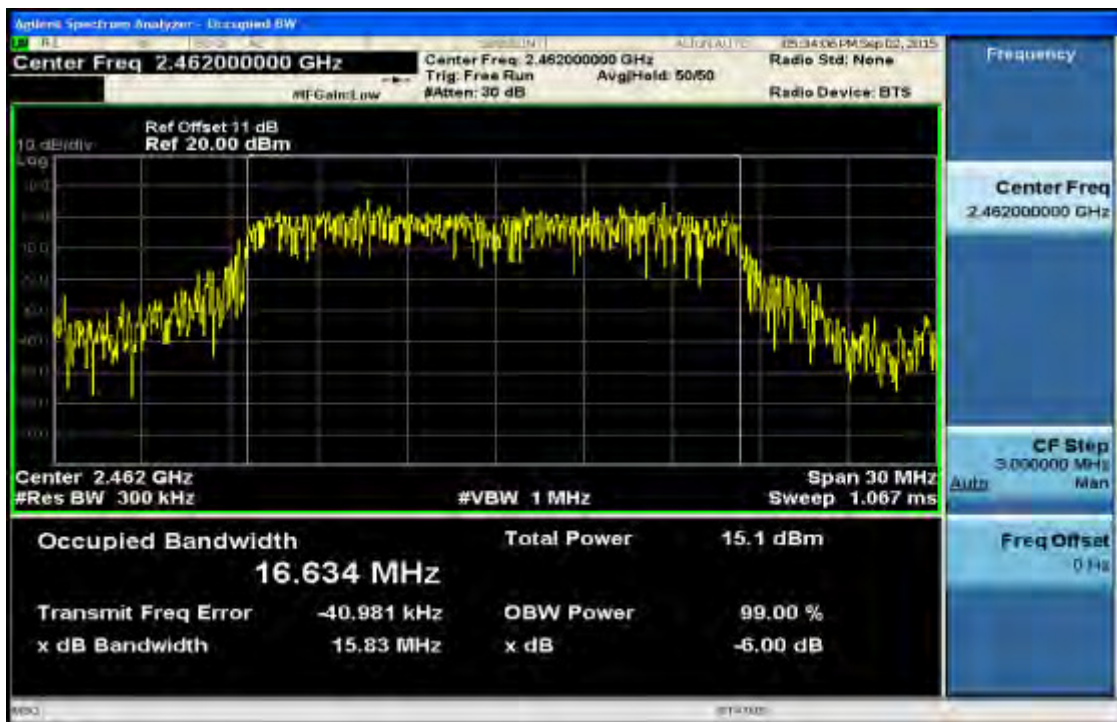
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99% Band Width Test Data CH-Mid



99% Band Width Test Data CH-High



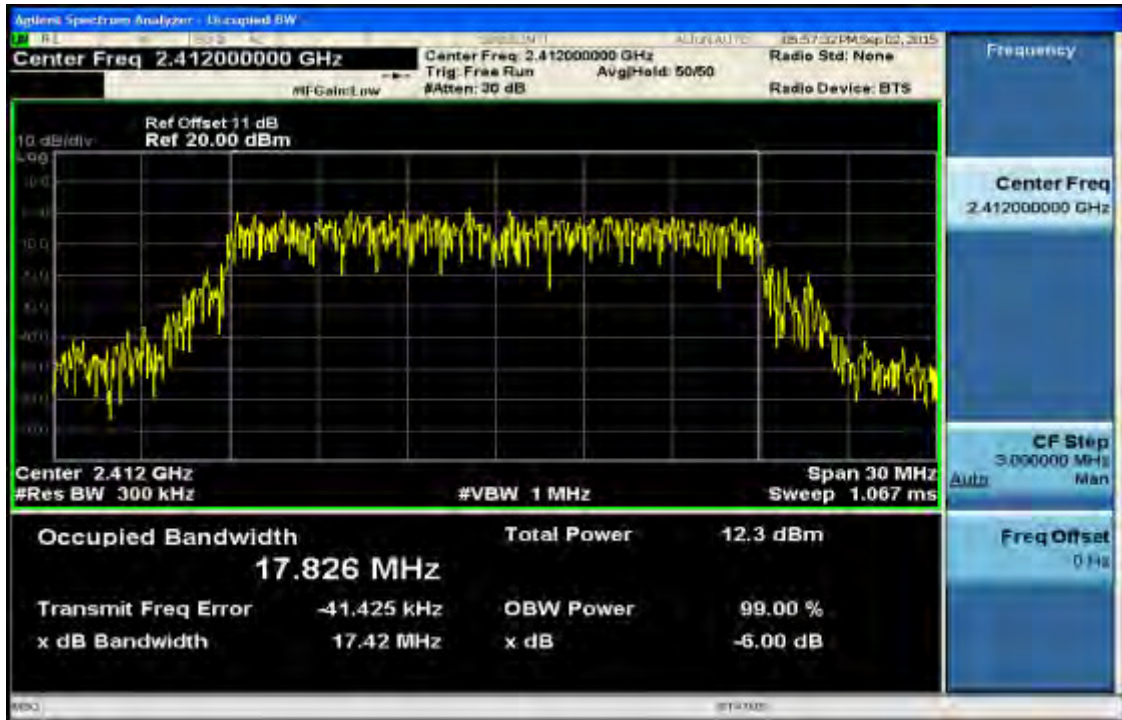
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802.11n_20M (Main)

99% Band Width Test Data CH-Low



99% Band Width Test Data CH-Mid

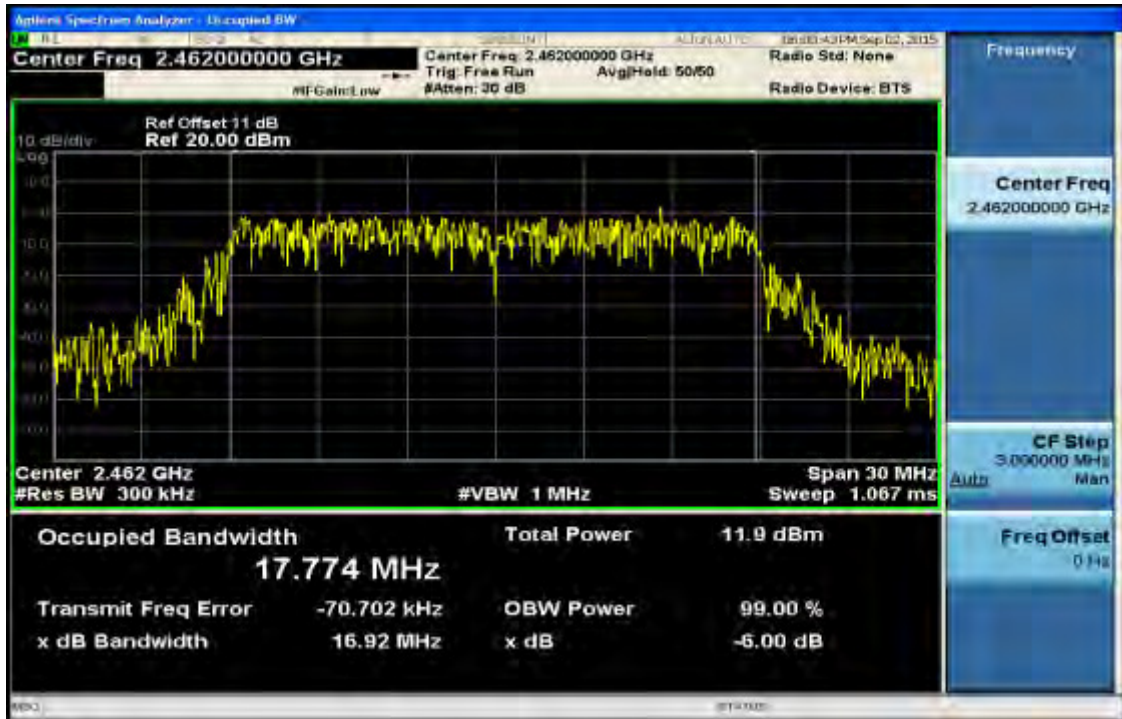


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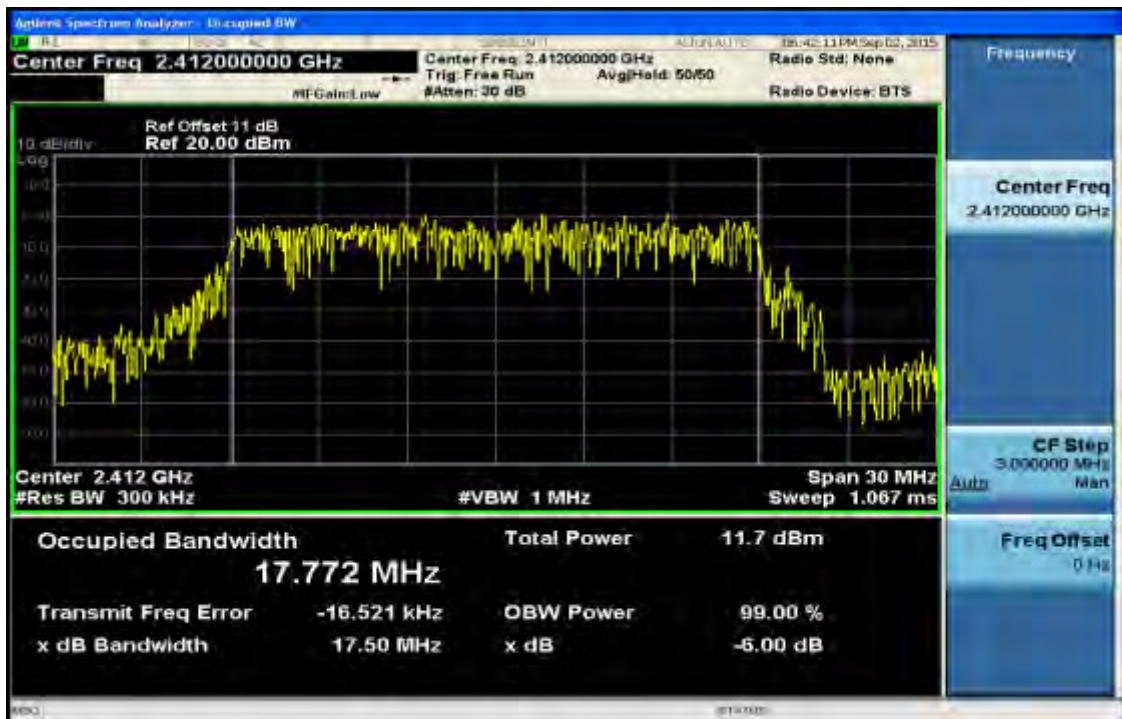
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99% Band Width Test Data CH-High



802.11n_20M (Aux)

99% Band Width Test Data CH-Low



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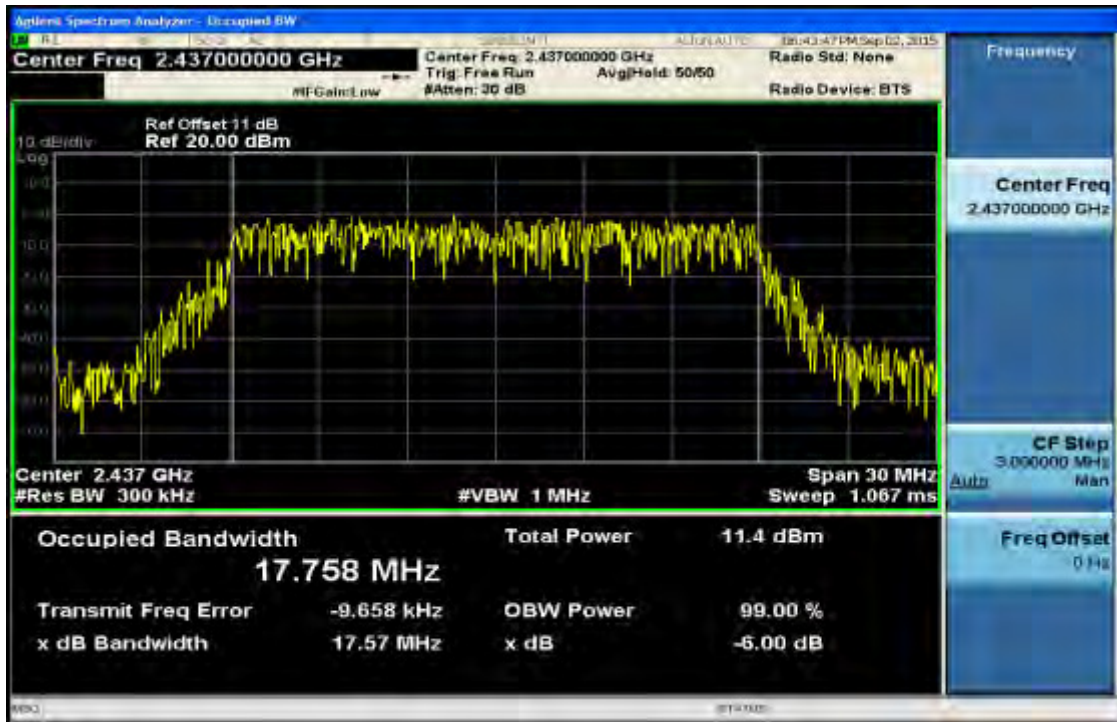
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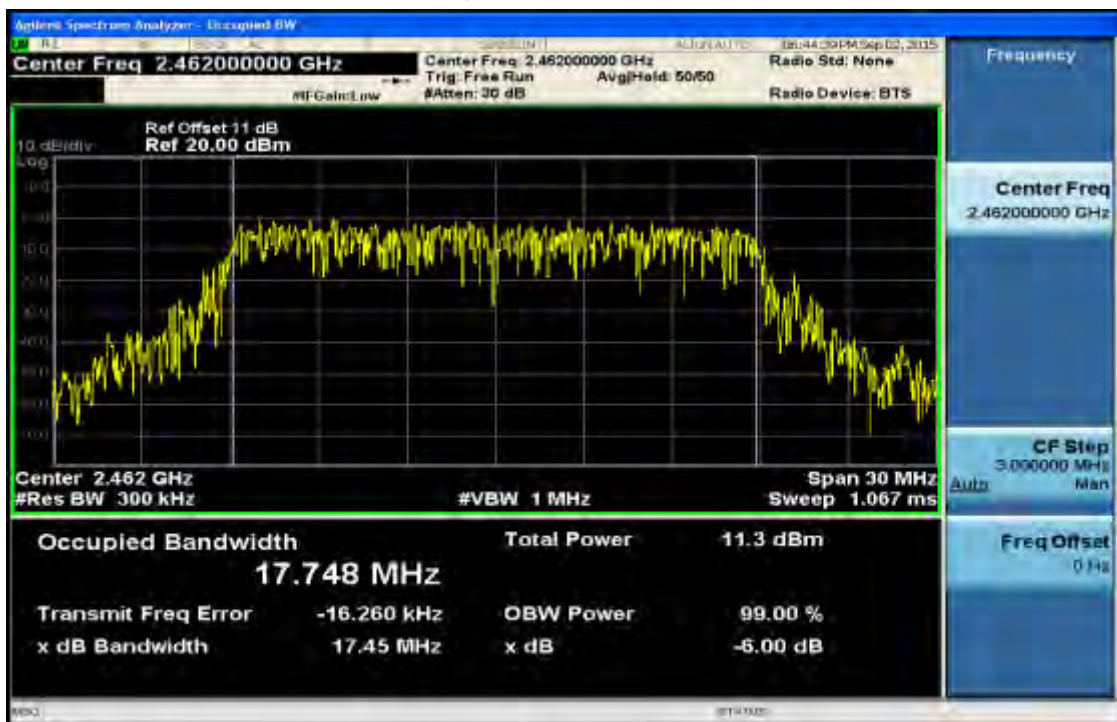
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99% Band Width Test Data CH-Mid



99% Band Width Test Data CH-High



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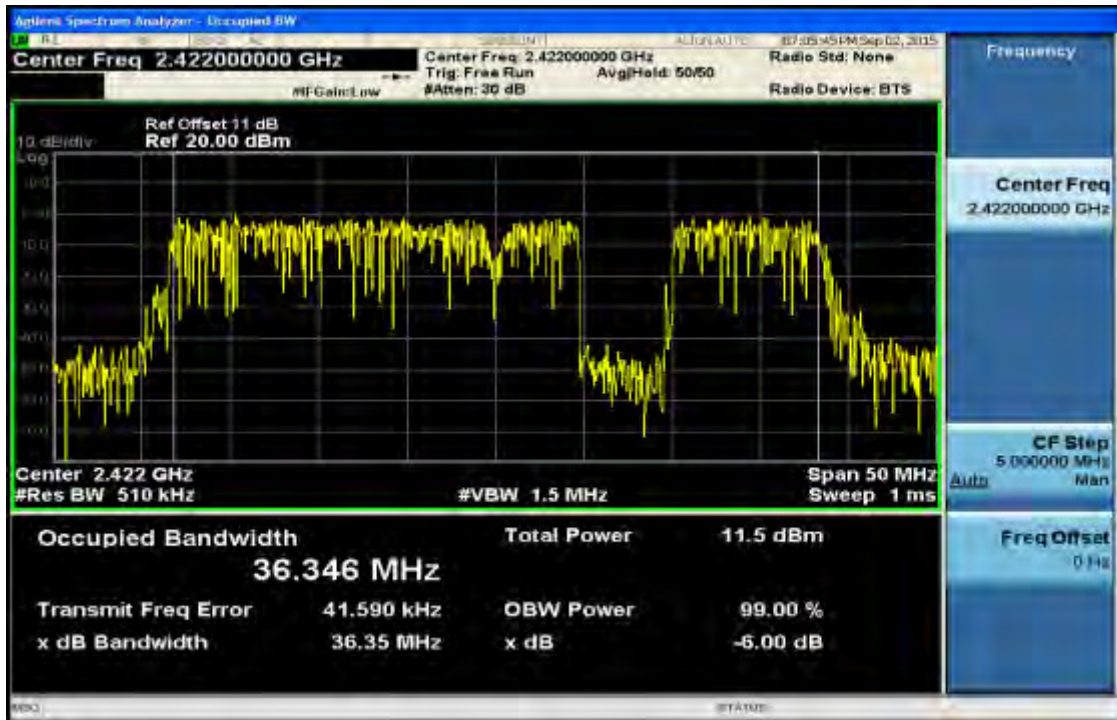
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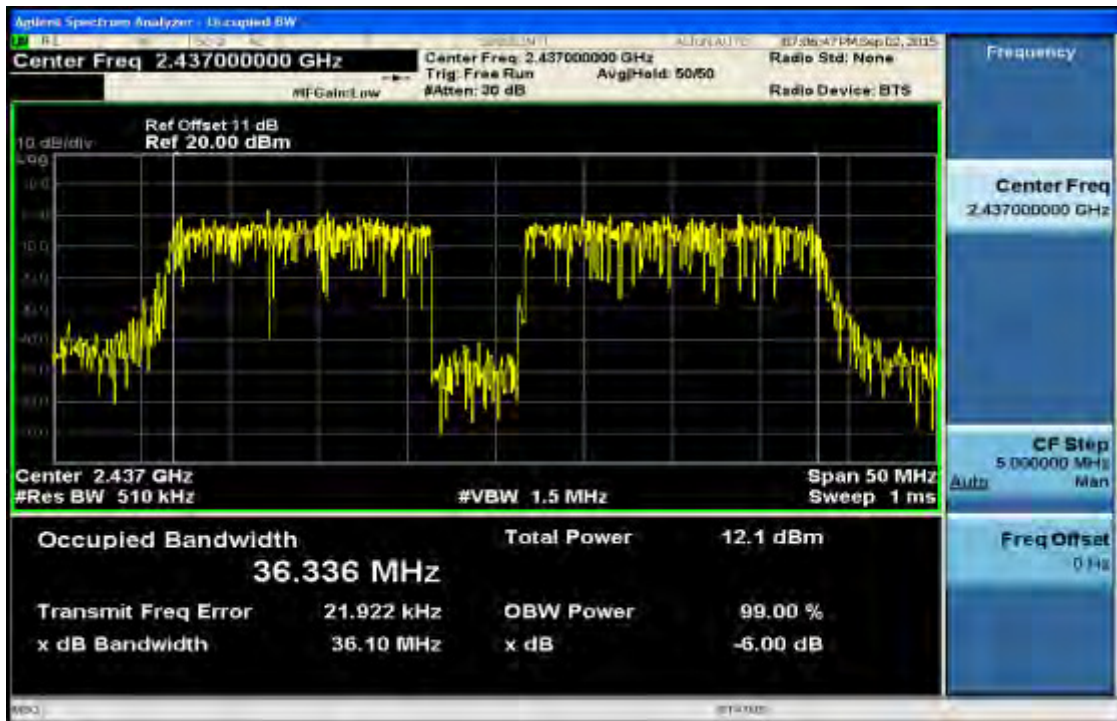
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802.11n_40M (Main)
99% Band Width Test Data CH-Low



99% Band Width Test Data CH-Mid

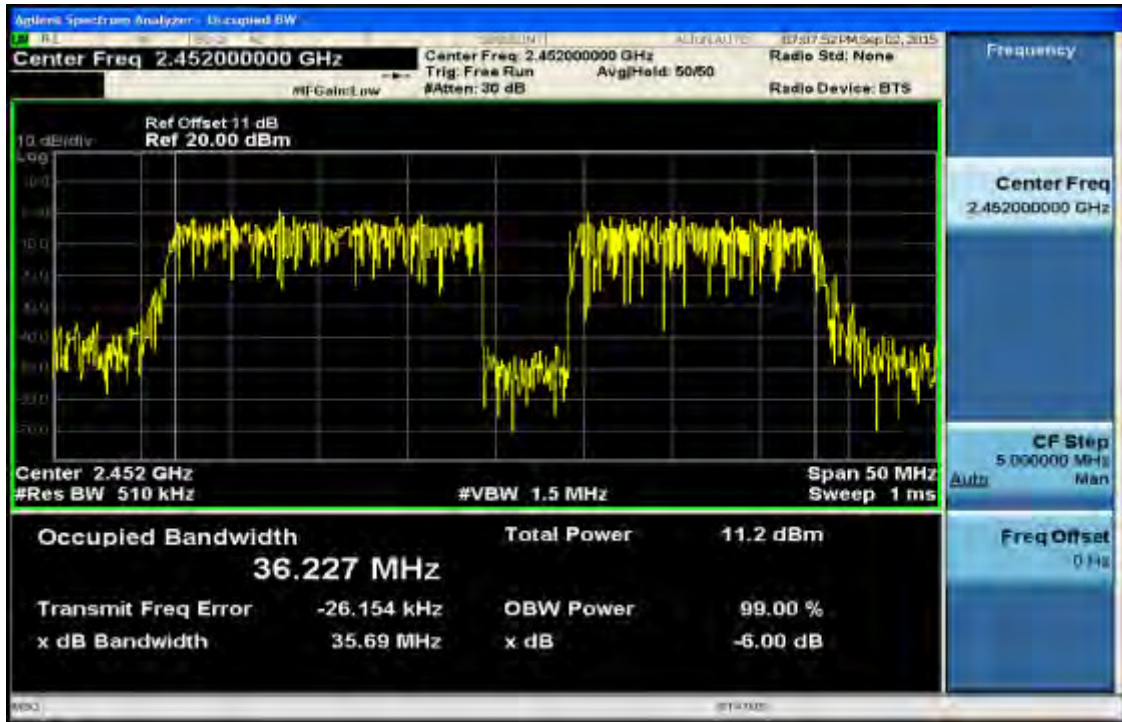


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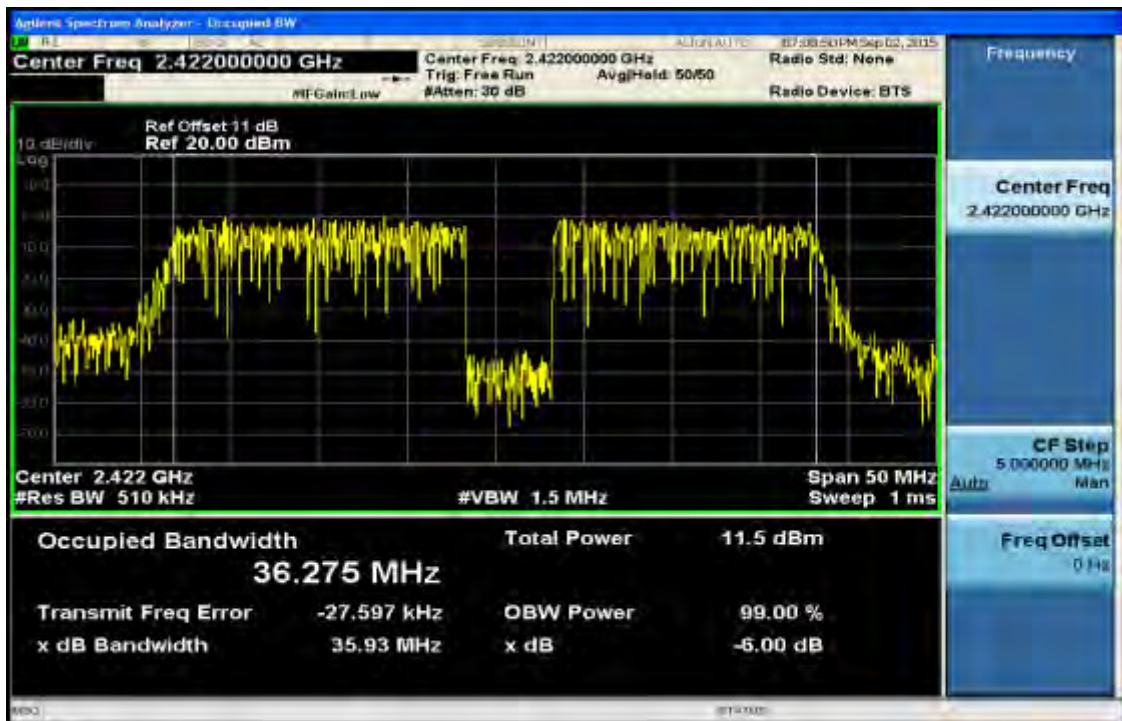
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99% Band Width Test Data CH-High



802.11n_40M (Aux)

99% Band Width Test Data CH-Low



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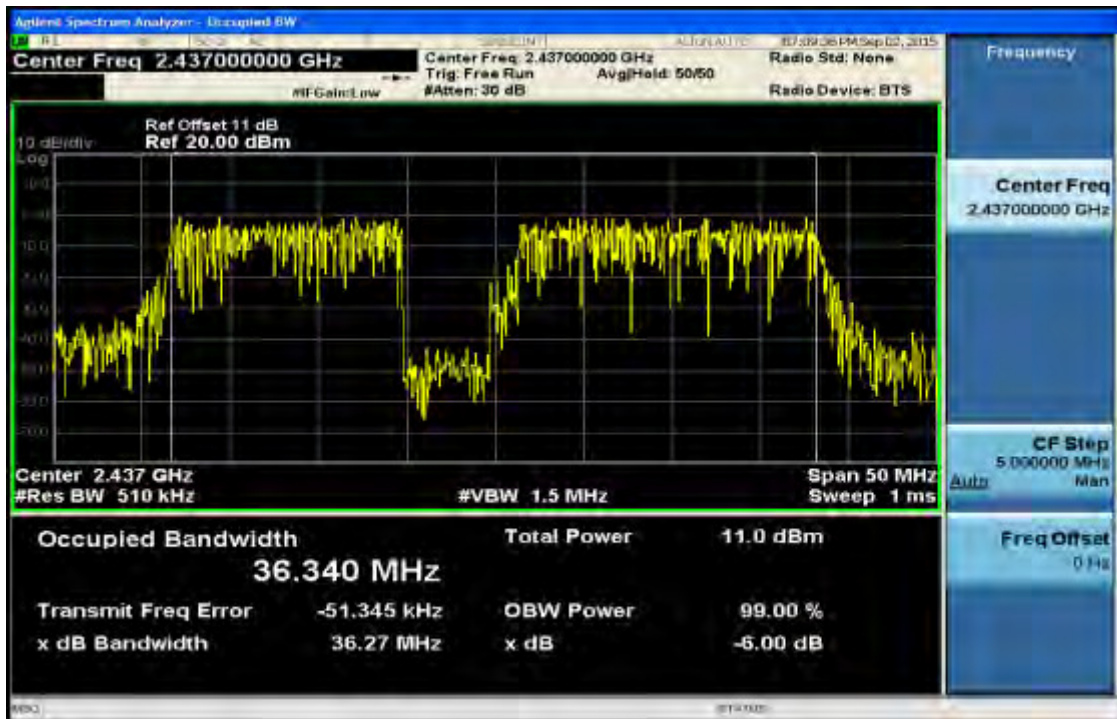
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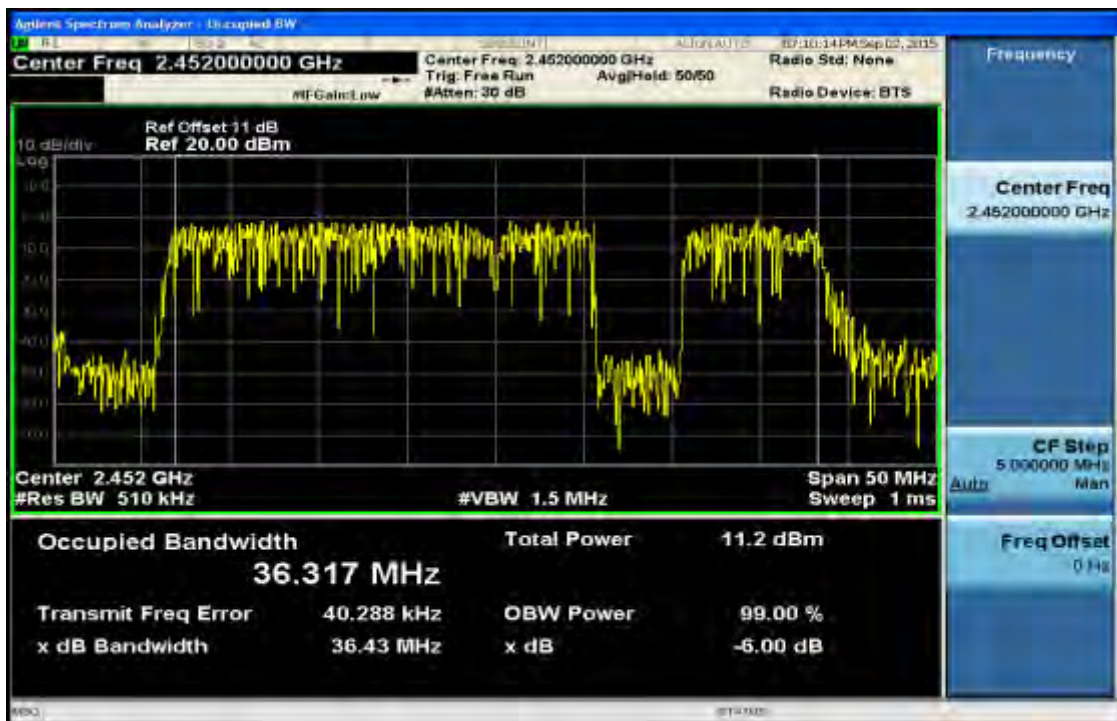
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99% Band Width Test Data CH-Mid



99% Band Width Test Data CH-High



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10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

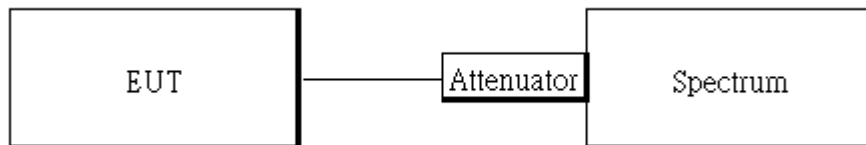
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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. Attenuation below the general field strength limits specified in RSS-Gen is not required.

10.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2015	01/01/2016
Attenuator	Mini-Circuit	BW-S10W2+	002	01/02/2015	01/01/2016
Splitter	Agilent	11636B	N/A	01/02/2015	01/01/2016

10.3 Test SET-UP



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10.3.1 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 V03r03.
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 V03r03.
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.

10.4 Measurement Result

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

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802.11b
Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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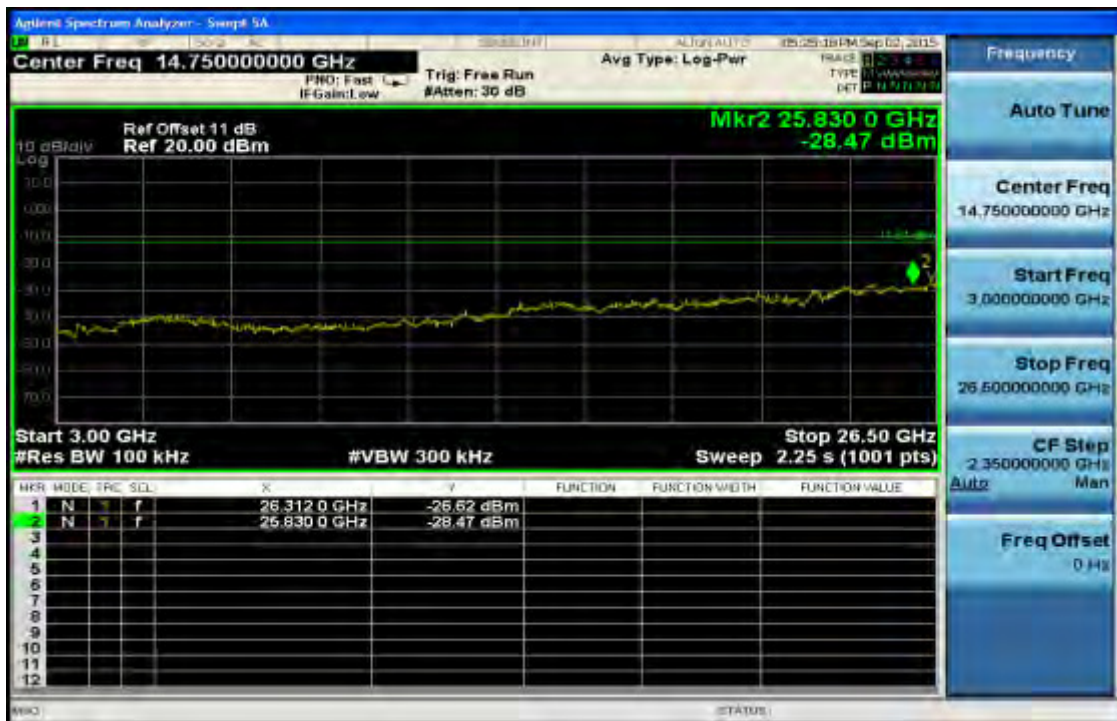
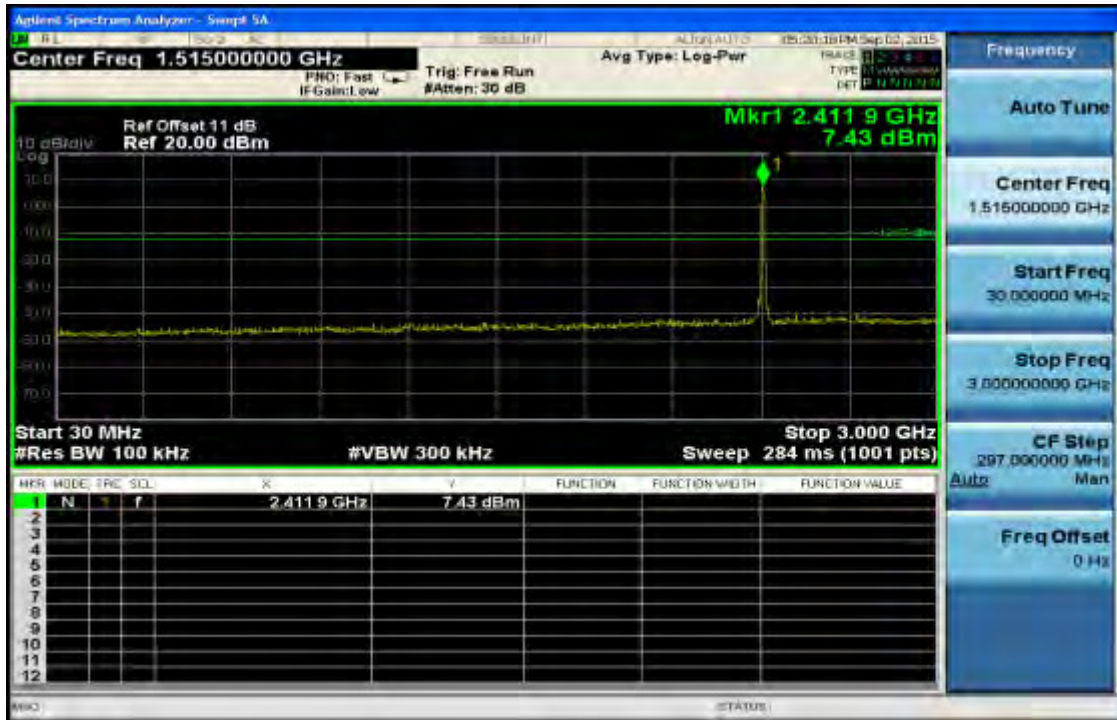
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802.11b
Spurious Emission Test Data CH-Low

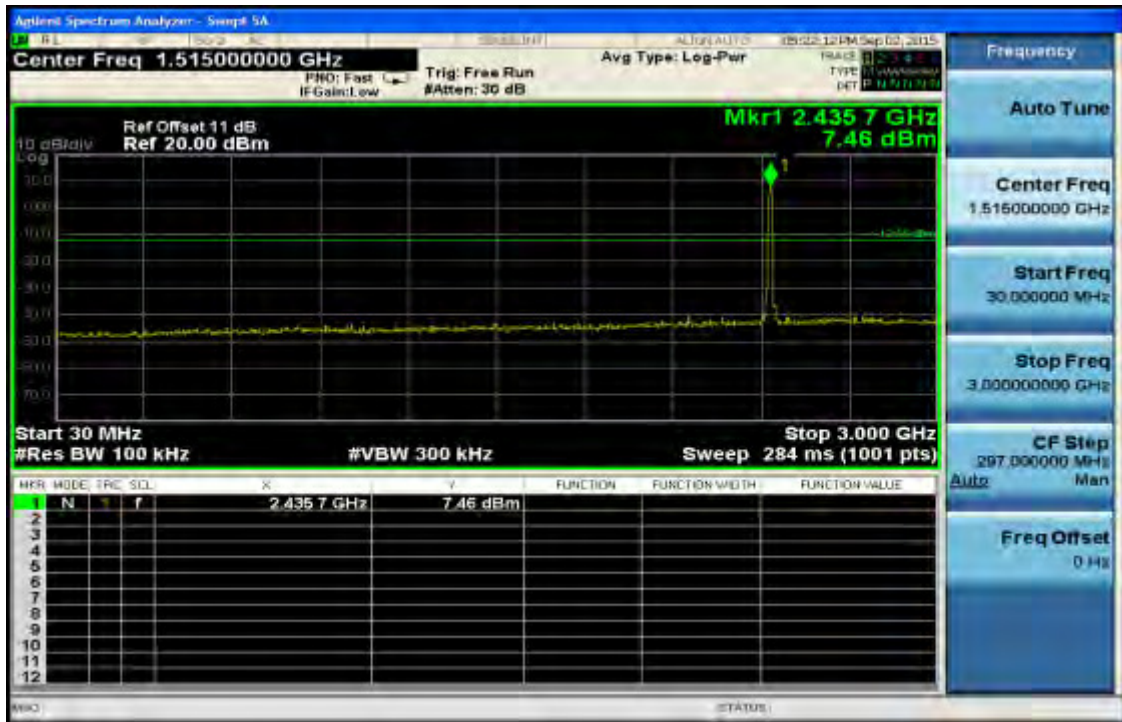


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Spurious Emission Test Data CH-Mid



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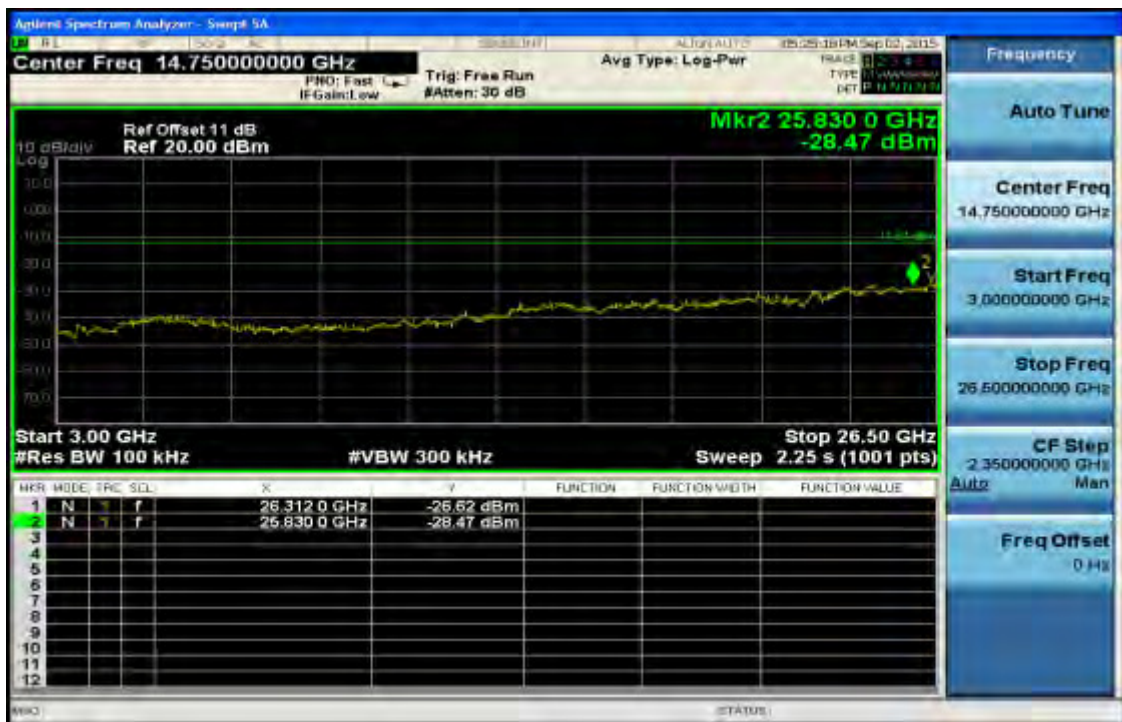
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Spurious Emission Test Data CH-High



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802.11g
Band Edges Test Data CH-Low



Band Edges Test Data CH-High

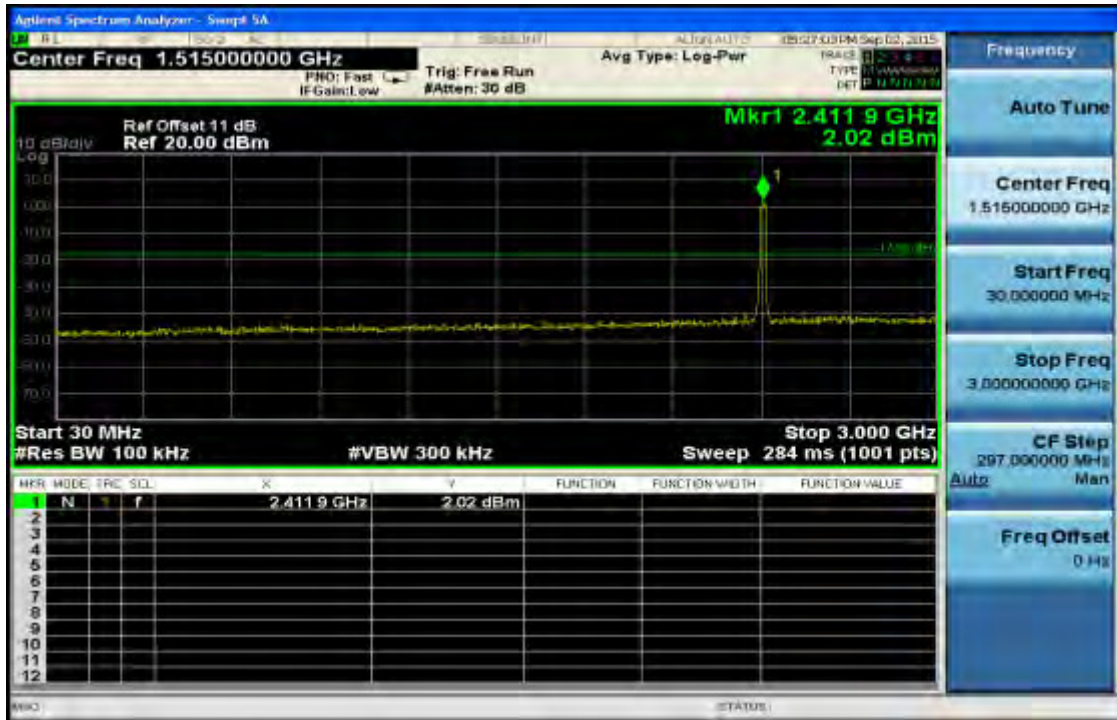


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802.11g
Spurious Emission Test Data CH-Low

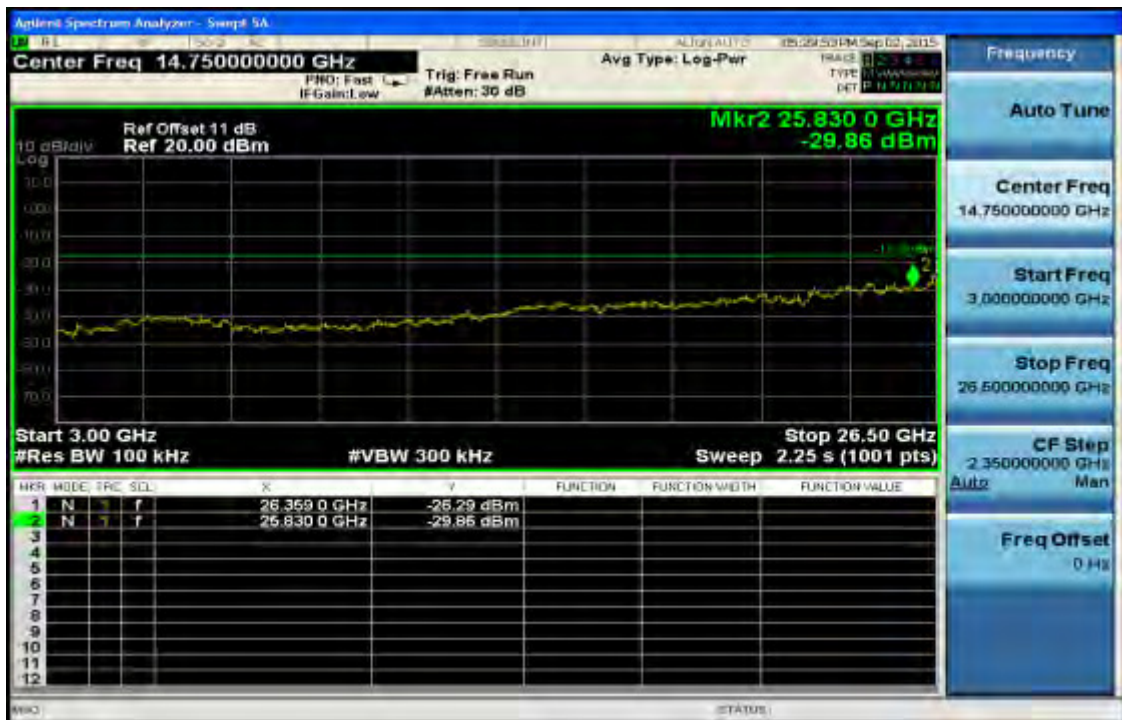
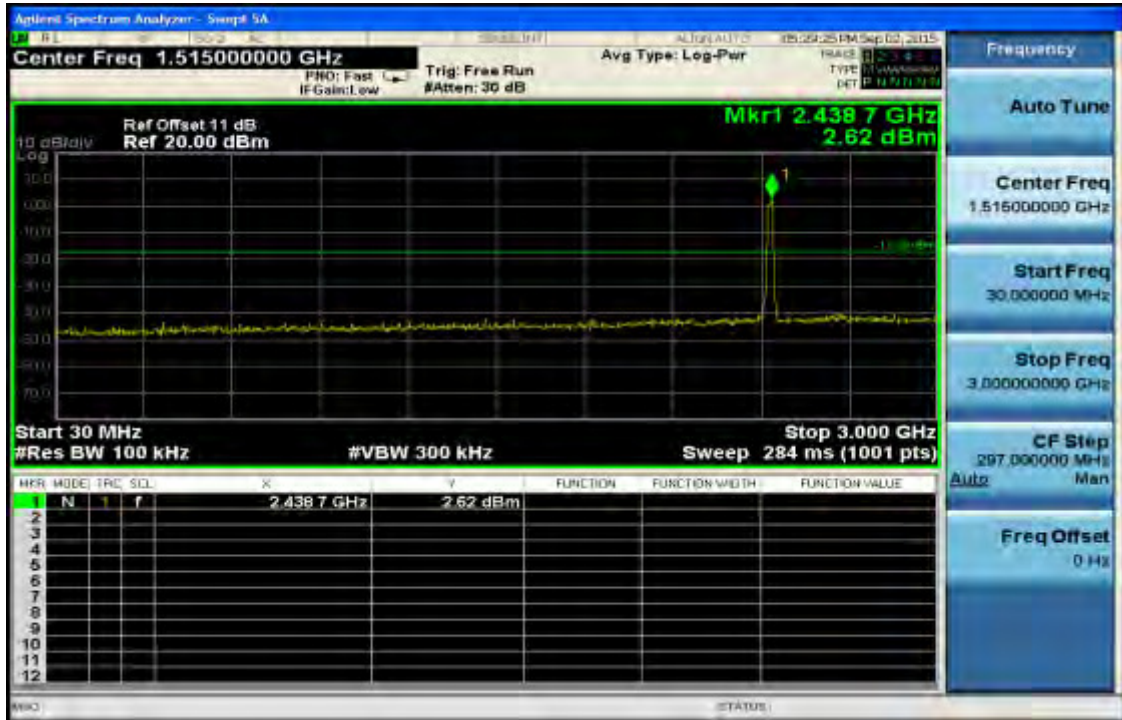


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Spurious Emission Test Data CH-Mid



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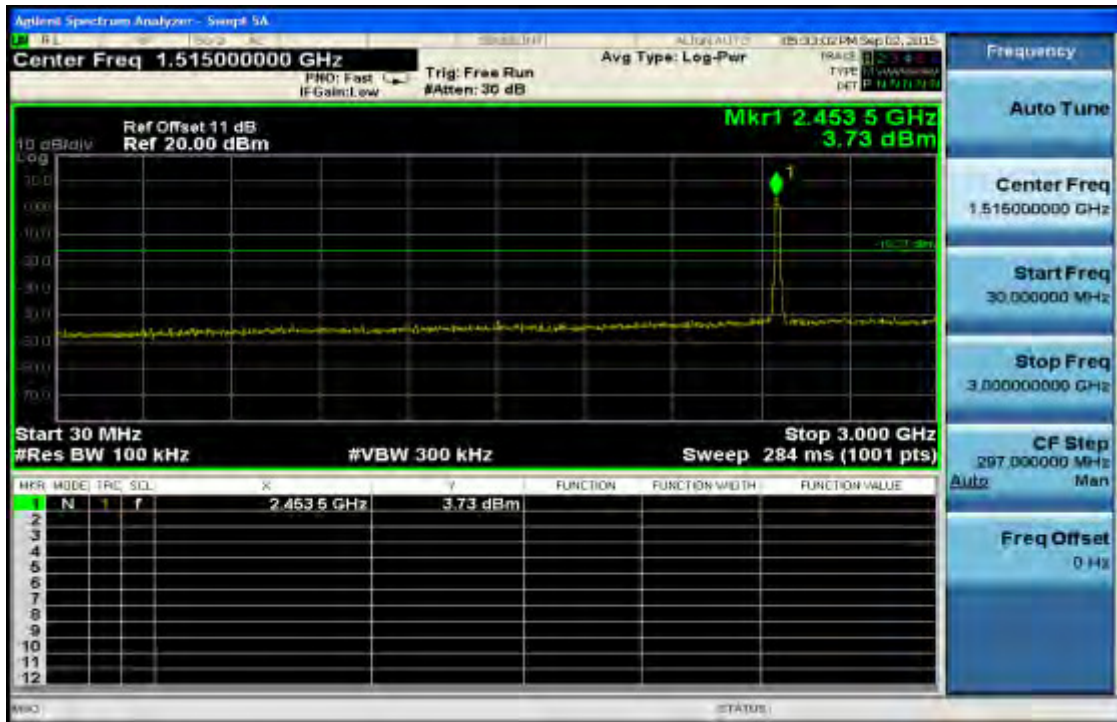
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Spurious Emission Test Data CH-High



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802.11n_HT20 (MIMO)
Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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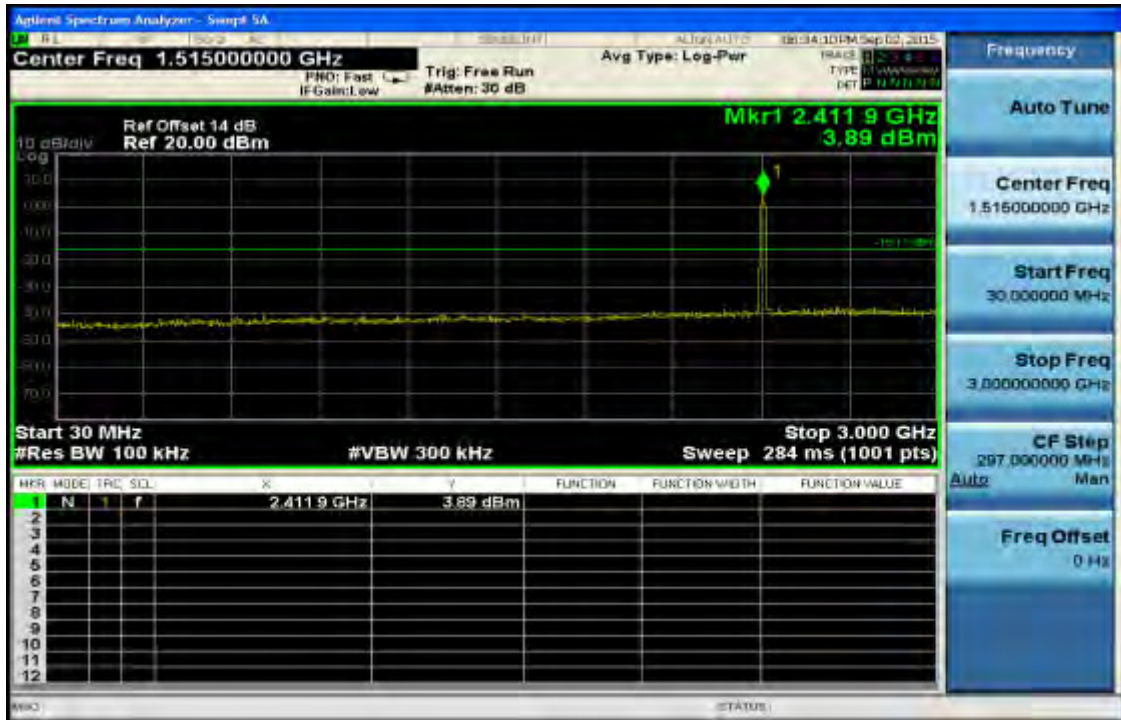
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802.11n_HT20 (MIMO)
Spurious Emission Test Data CH-Low



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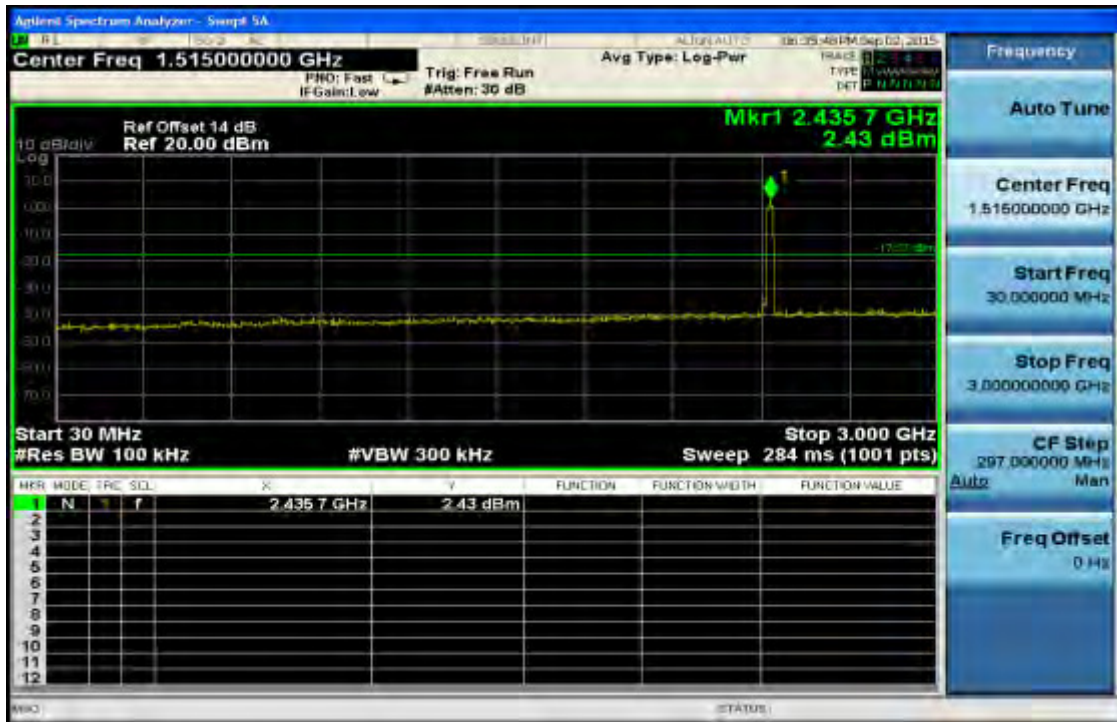
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Spurious Emission Test Data CH-Mid

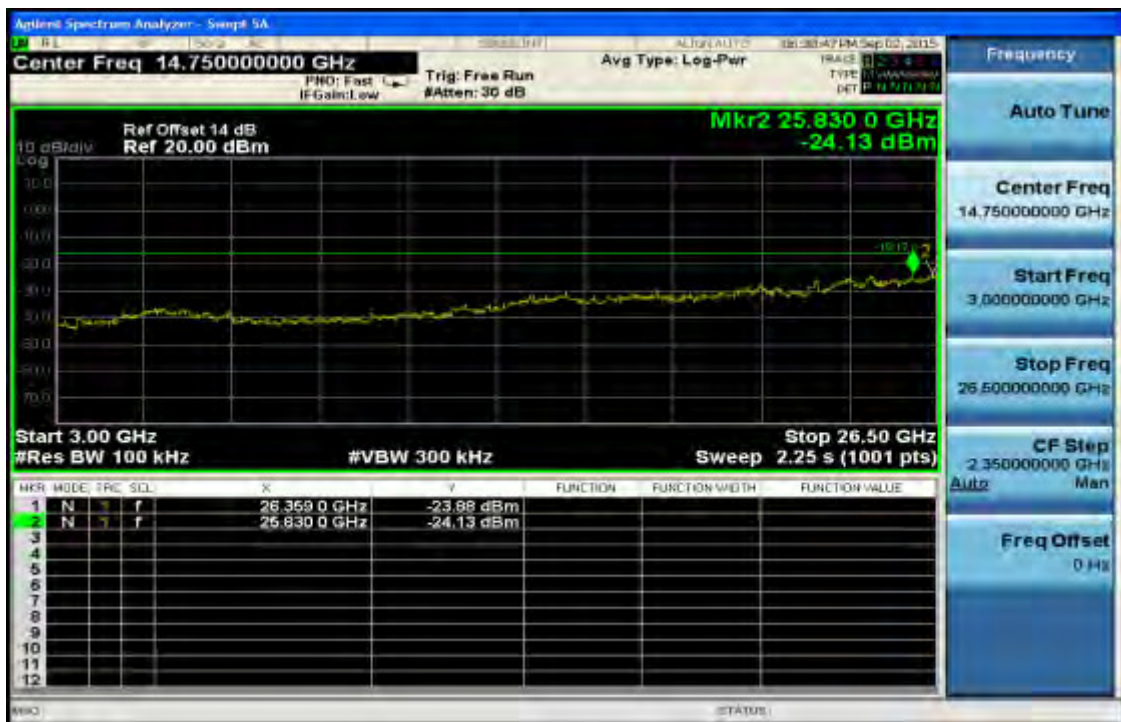
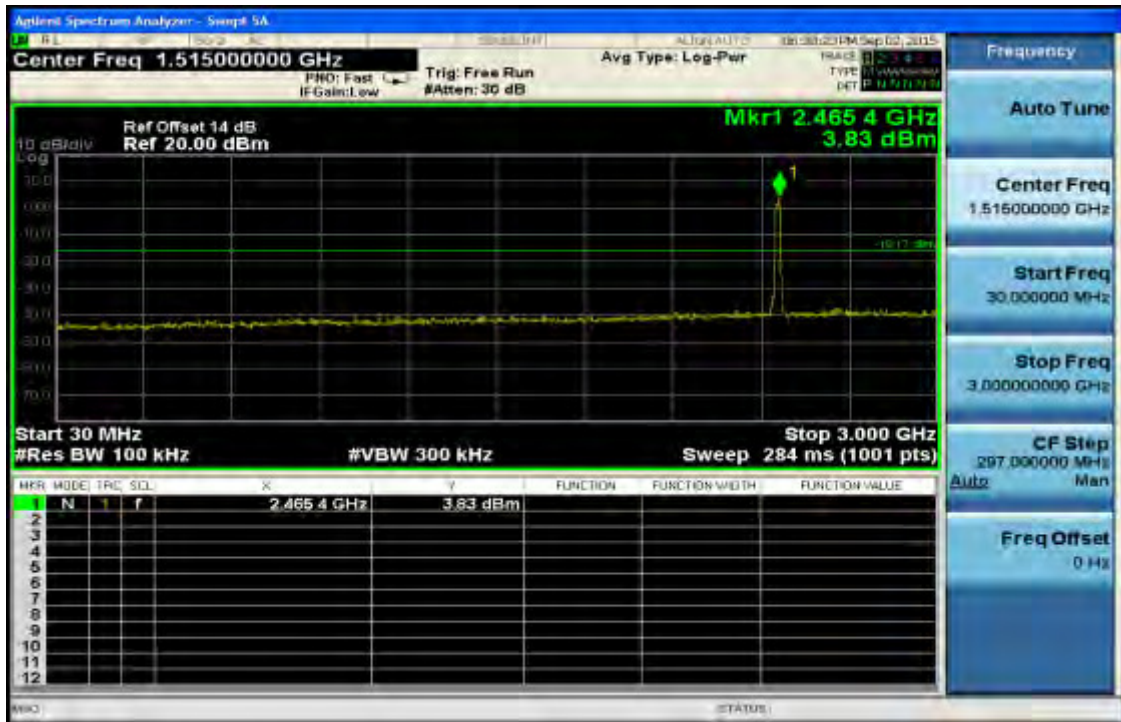


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Spurious Emission Test Data CH-High



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802.11n_HT40 (MIMO) Band Edges Test Data CH-Low



Band Edges Test Data CH-High

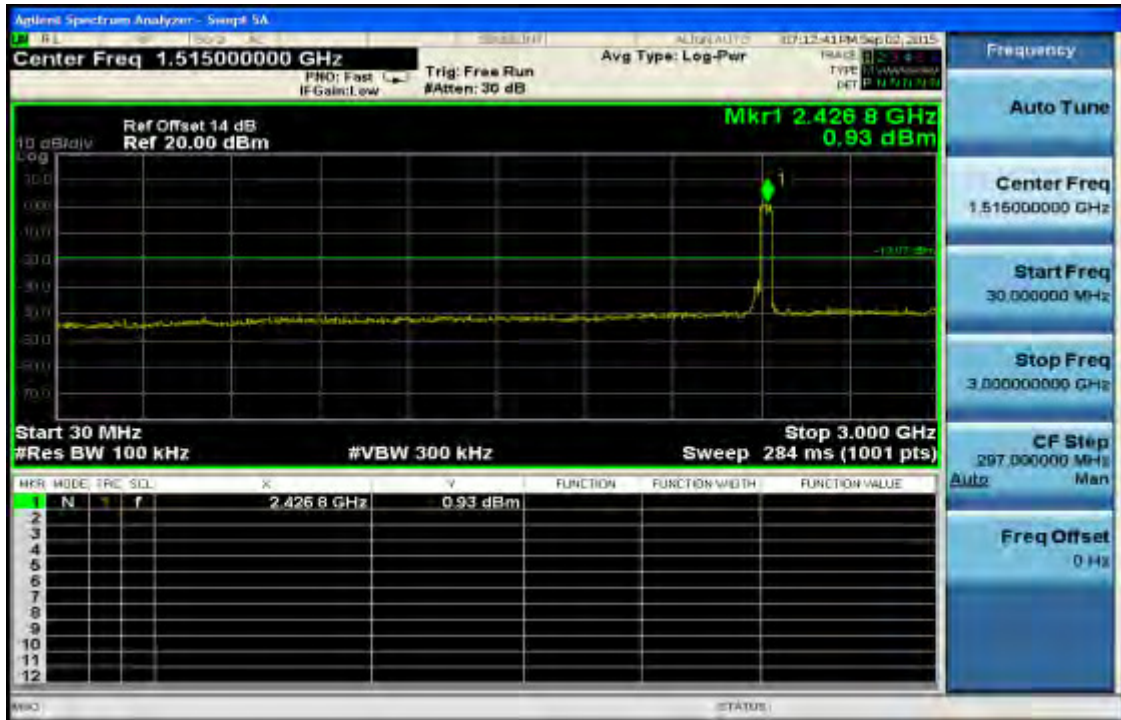


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802.11n_HT40 (MIMO)
Spurious Emission Test Data CH-Low



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Spurious Emission Test Data CH-Mid



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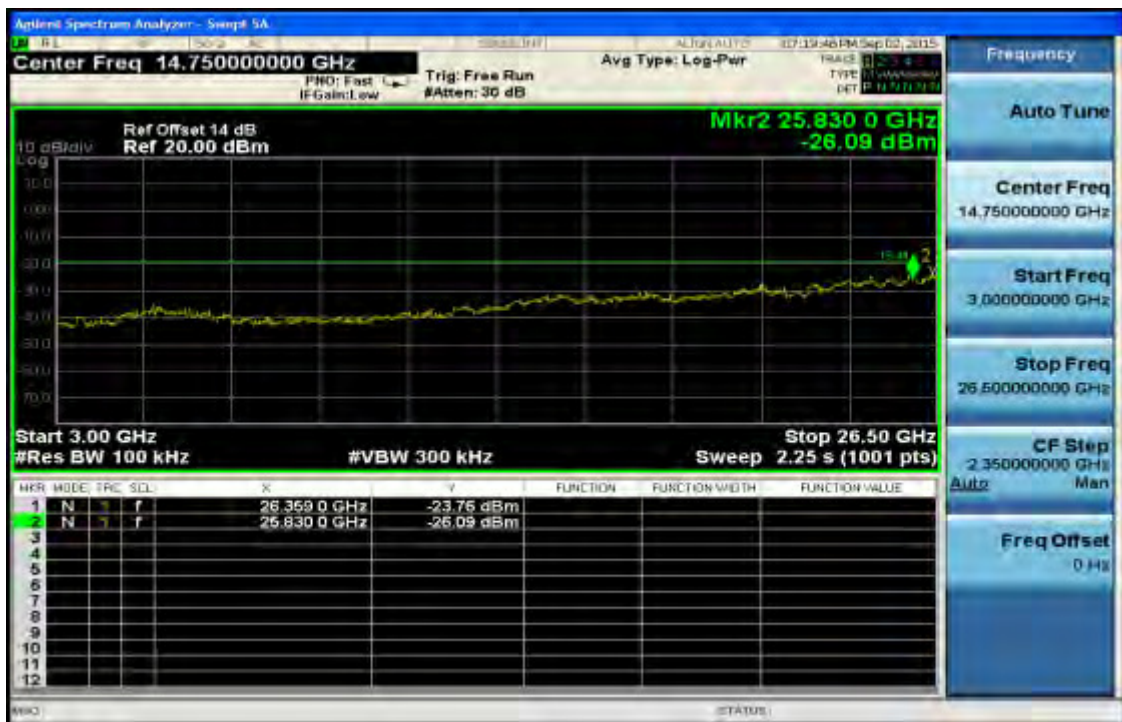
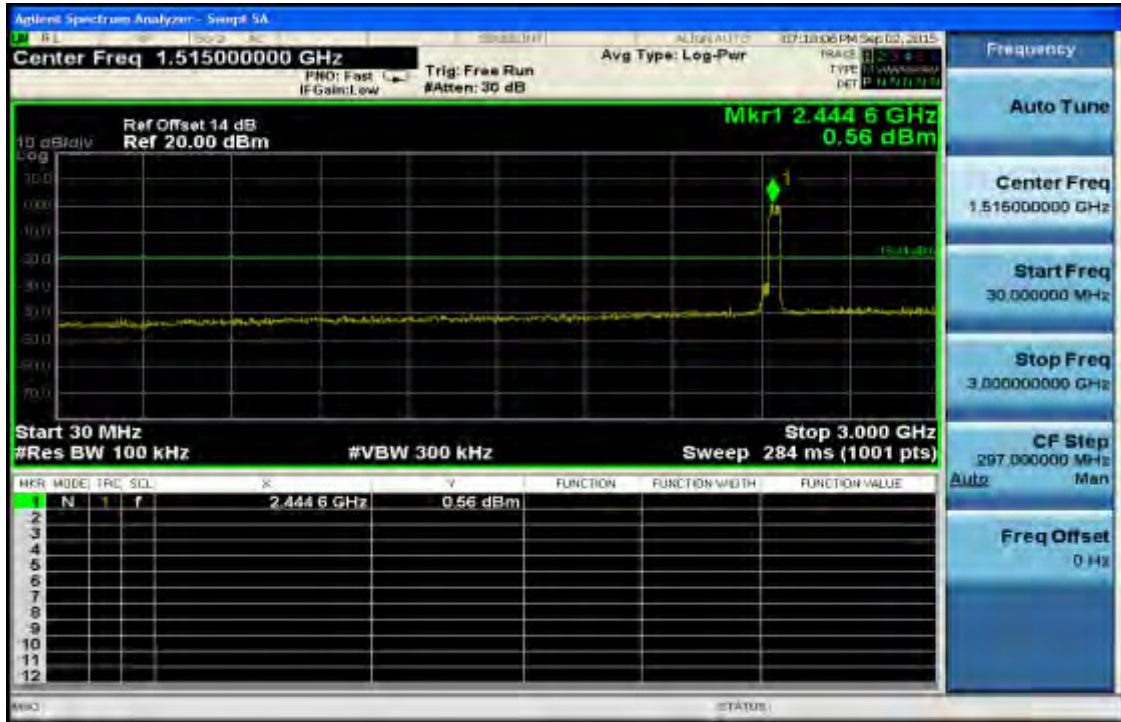
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11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

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 (dB μ V/m) = 20 log Emission level (dB μ V/m)

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11.2 Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100760	05/04/2015	05/03/2016
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	12/22/2014	12/21/2015
Spectrum Analyzer	R&S	FSV-30	101398	09/23/2015	09/22/2016
Loop Antenna	ETS.LINDGREN	6502	00143303	12/9/2014	12/08/2015
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/23/2014	12/22/2015
Horn antenna	ETS.LINDGREN	3117	123995	05/05/2015	05/04/2016
Horn Antenna	Schwarzbeck	BBHA9170	184	12/25/2014	12/24/2015
Pre-Amplifier	Agilent	8447D	2944A07676	01/02/2015	01/01/2016
Pre-Amplifier	Agilent	8449B	3008A00578	01/02/2015	01/01/2016
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/02/2015	01/01/2016
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	01/02/2015	01/01/2016
Attenuator	Mini-Circuit	BW-S10W2+	004	01/02/2015	01/01/2016
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	060776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_Rx	9	01/02/2015	01/01/2016
3m Site NSA	SGS	966 chamber	N/A	07/01/2015	06/30/2016

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

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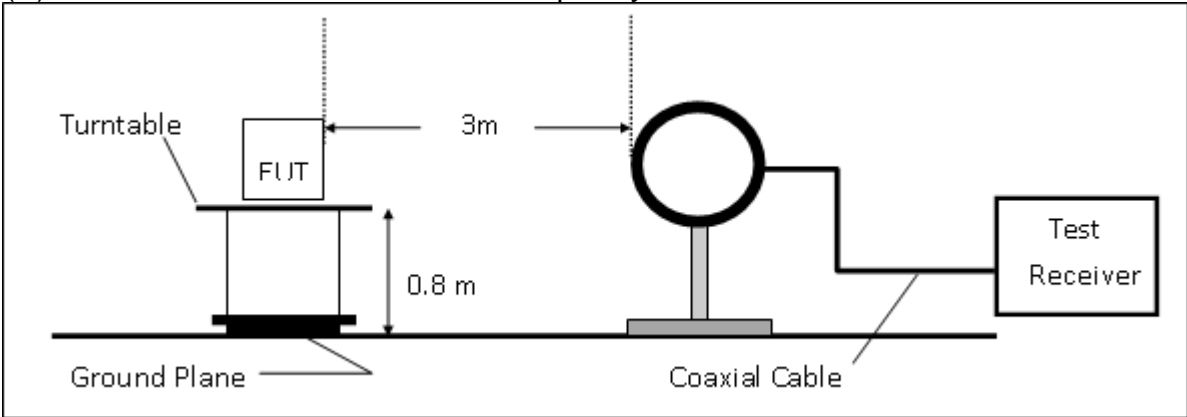
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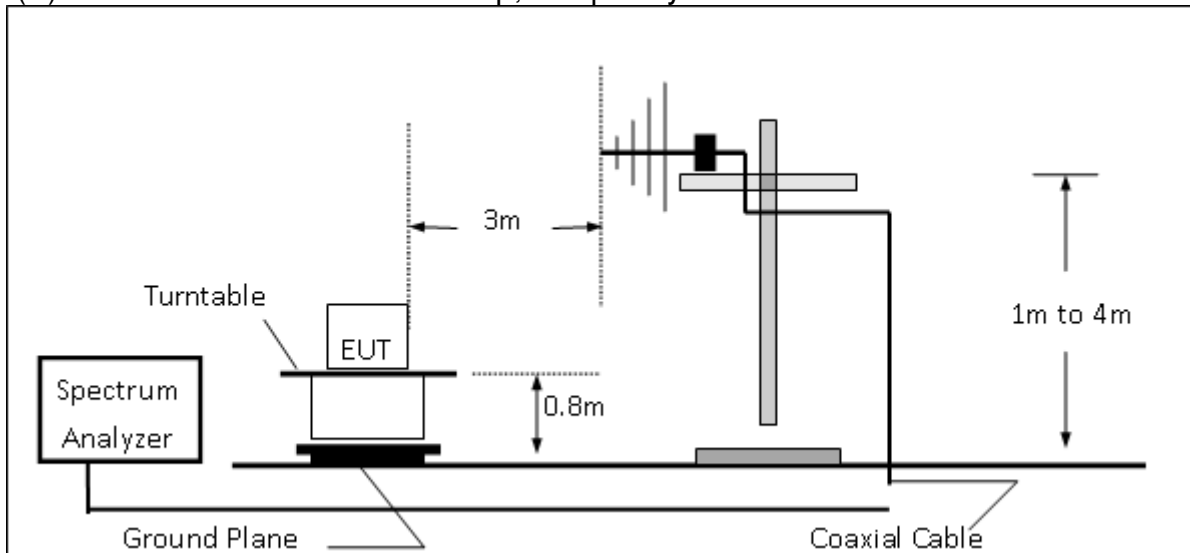
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11.3 Test SET-UP

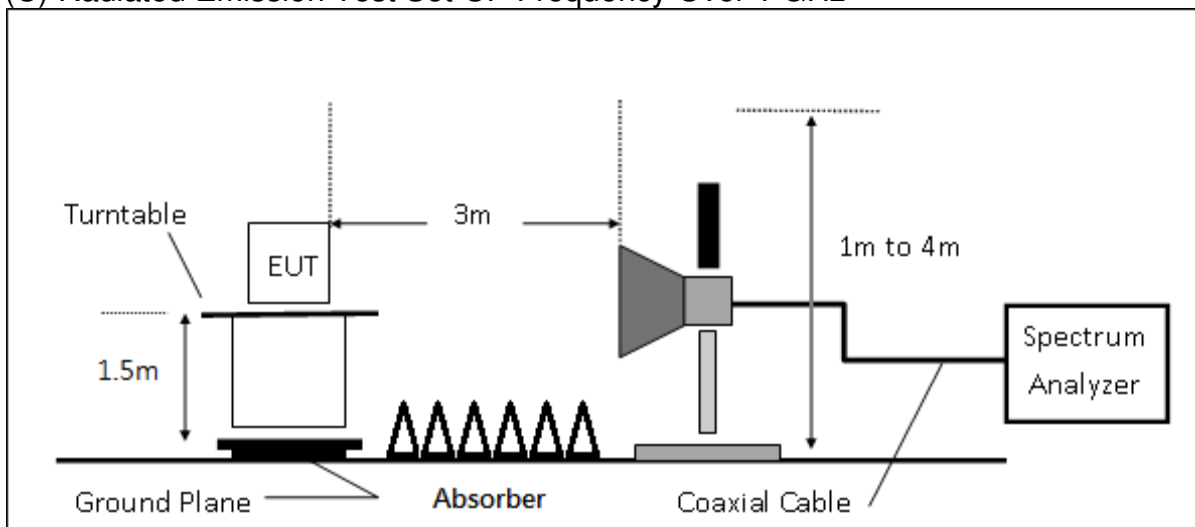
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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11.3.1 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
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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11.4 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.

11.5 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.

11.6 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	:802.11 b	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	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
2390.00	E	Average	33.92	5.16	39.08	54.00	-14.92
2390.00	E	Peak	44.90	5.16	50.06	74.00	-23.94

Operation Band	:802.11 b	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	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	39.35	5.16	44.51	54.00	-9.49
2390.00	E	Peak	49.88	5.16	55.04	74.00	-18.96

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Operation Band	:802.11 b	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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	31.22	6.01	37.23	54.00	-16.77
2483.50	E	Peak	42.40	6.01	48.41	74.00	-25.59

Operation Band	:802.11 b	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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	37.10	6.01	43.11	54.00	-10.89
2483.50	E	Peak	46.39	6.01	52.40	74.00	-21.60

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Radiated Band Edge Measurement Result (802.11g)

Operation Band	:802.11 g	Test Date	:2015-08-20
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	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
2390.00	E	Average	33.48	5.16	38.64	54.00	-15.36
2390.00	E	Peak	48.14	5.16	53.30	74.00	-20.70

Operation Band	:802.11 g	Test Date	:2015-08-20
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	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	39.09	5.16	44.25	54.00	-9.75
2390.00	E	Peak	48.06	5.16	53.22	74.00	-20.78

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Operation Band	:802.11 g	Test Date	:2015-08-20
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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	29.82	6.01	35.83	54.00	-18.17
2483.50	E	Peak	42.15	6.01	48.16	74.00	-25.84

Operation Band	:802.11 g	Test Date	:2015-08-20
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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	34.41	6.01	40.42	54.00	-13.58
2483.50	E	Peak	47.33	6.01	53.34	74.00	-20.66

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Radiated Band Edge Measurement Result (802.11_HT20) (MIMO)

Operation Band	:802.11 n20M	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	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
2390.00	E	Average	37.97	5.16	43.13	54.00	-10.87
2390.00	E	Peak	55.57	5.16	60.73	74.00	-13.27

Operation Band	:802.11 n20M	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	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	42.79	5.16	47.95	54.00	-6.05
2390.00	E	Peak	60.46	5.16	65.62	74.00	-8.38

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Operation Band	:802.11 n20M	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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	37.97	6.01	43.98	54.00	-10.02
2483.50	E	Peak	52.91	6.01	58.92	74.00	-15.08

Operation Band	:802.11 n20M	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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	40.95	6.01	46.96	54.00	-7.04
2483.50	E	Peak	57.04	6.01	63.05	74.00	-10.95

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Radiated Band Edge Measurement Result (802.11_HT40) (MIMO)

Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	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
2390.00	E	Average	37.09	5.16	42.25	54.00	-11.75
2390.00	E	Peak	52.88	5.16	58.04	74.00	-15.96

Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	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	40.69	5.16	45.85	54.00	-8.15
2390.00	E	Peak	58.46	5.16	63.62	74.00	-10.38

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Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2452 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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	dB μ V	dB	dB μ V/m	dB μ V/m	dB
2483.50	E	Average	39.20	6.01	45.21	54.00	-8.79
2483.50	E	Peak	56.82	6.01	62.83	74.00	-11.17

Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2452 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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	dB μ V	dB	dB μ V/m	dB μ V/m	dB
2483.50	E	Average	45.21	6.01	51.22	54.00	-2.78
2483.50	E	Peak	65.35	6.01	71.36	74.00	-2.64

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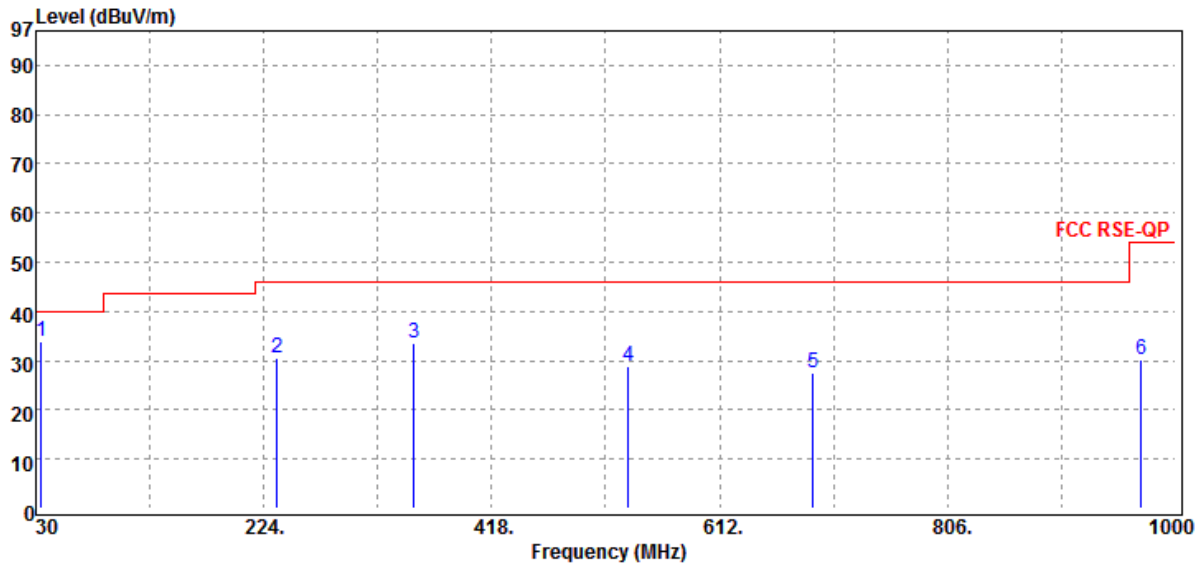
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Radiated Spurious Emission Measurement Result (802.11 g)

Below 1GHz Worst-Case Data:

Operation Band	:802.11 g	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



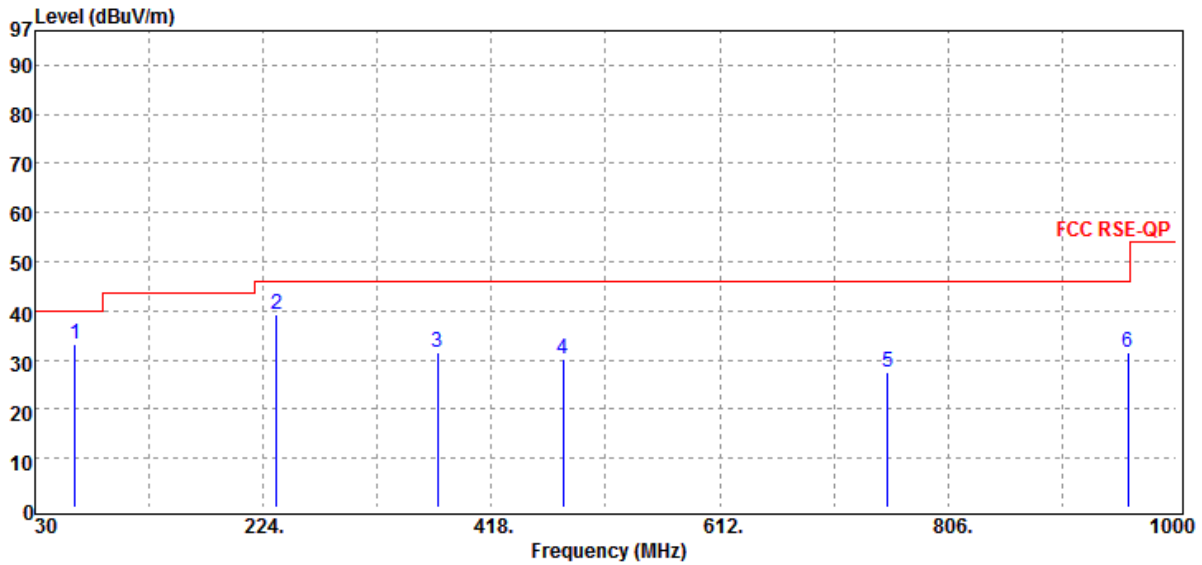
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
34.85	S	Peak	44.04	-10.17	33.87	40.00	-6.13
235.64	S	Peak	41.09	-10.56	30.53	46.00	-15.47
352.04	S	Peak	40.63	-7.13	33.50	46.00	-12.50
534.40	S	Peak	32.92	-4.00	28.92	46.00	-17.08
691.54	S	Peak	28.45	-0.82	27.63	46.00	-18.37
970.90	S	Peak	26.53	3.60	30.13	54.00	-23.87

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Operation Band	:802.11 g	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



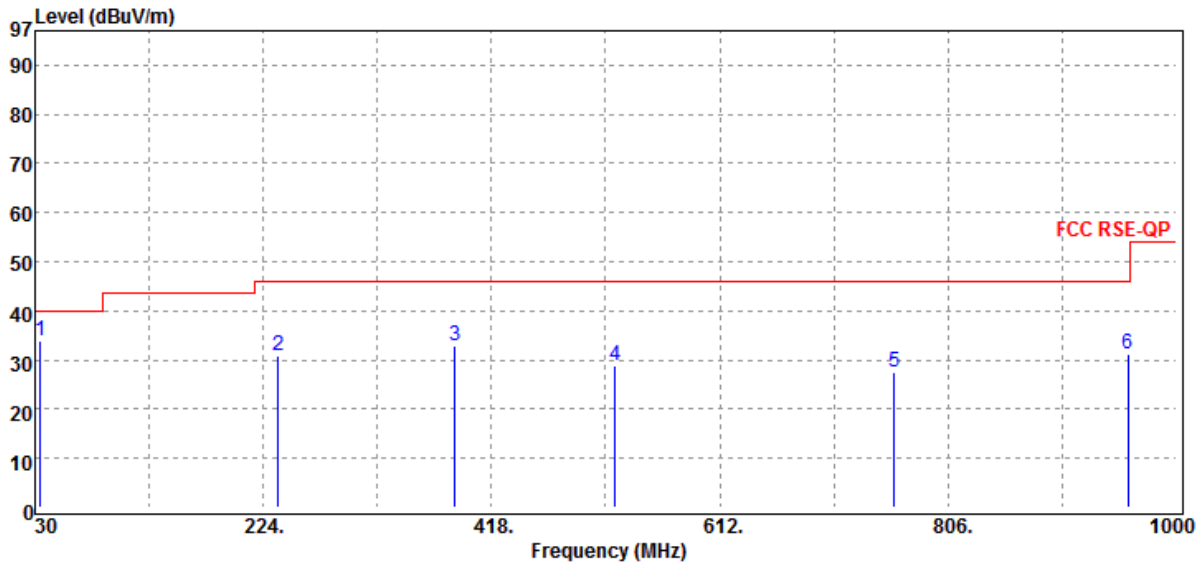
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
63.95	S	Peak	43.89	-10.79	33.10	40.00	-6.90
235.64	S	Peak	49.91	-10.56	39.35	46.00	-6.65
372.41	S	Peak	38.31	-6.73	31.58	46.00	-14.42
479.11	S	Peak	34.73	-4.63	30.10	46.00	-15.90
754.59	S	Peak	26.76	0.73	27.49	46.00	-18.51
959.26	S	Peak	27.85	3.65	31.50	46.00	-14.50

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Operation Band	:802.11 g	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



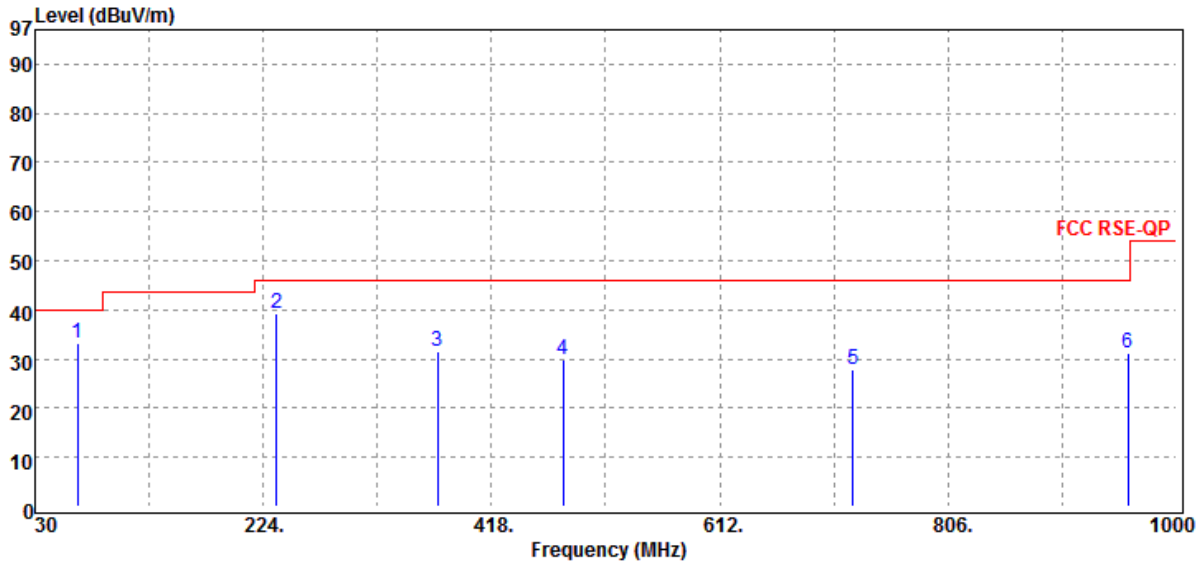
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
34.85	S	Peak	44.10	-10.17	33.93	40.00	-6.07
236.61	S	Peak	41.26	-10.49	30.77	46.00	-15.23
386.96	S	Peak	39.06	-6.20	32.86	46.00	-13.14
522.76	S	Peak	33.36	-4.33	29.03	46.00	-16.97
760.41	S	Peak	26.55	1.11	27.66	46.00	-18.34
959.26	S	Peak	27.42	3.65	31.07	46.00	-14.93

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Operation Band	:802.11 g	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	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
65.89	S	Peak	44.18	-11.07	33.11	40.00	-6.89
235.64	S	Peak	49.86	-10.56	39.30	46.00	-6.70
372.41	S	Peak	38.36	-6.73	31.63	46.00	-14.37
479.11	S	Peak	34.62	-4.63	29.99	46.00	-16.01
725.49	S	Peak	28.88	-1.02	27.86	46.00	-18.14
959.26	S	Peak	27.67	3.65	31.32	46.00	-14.68

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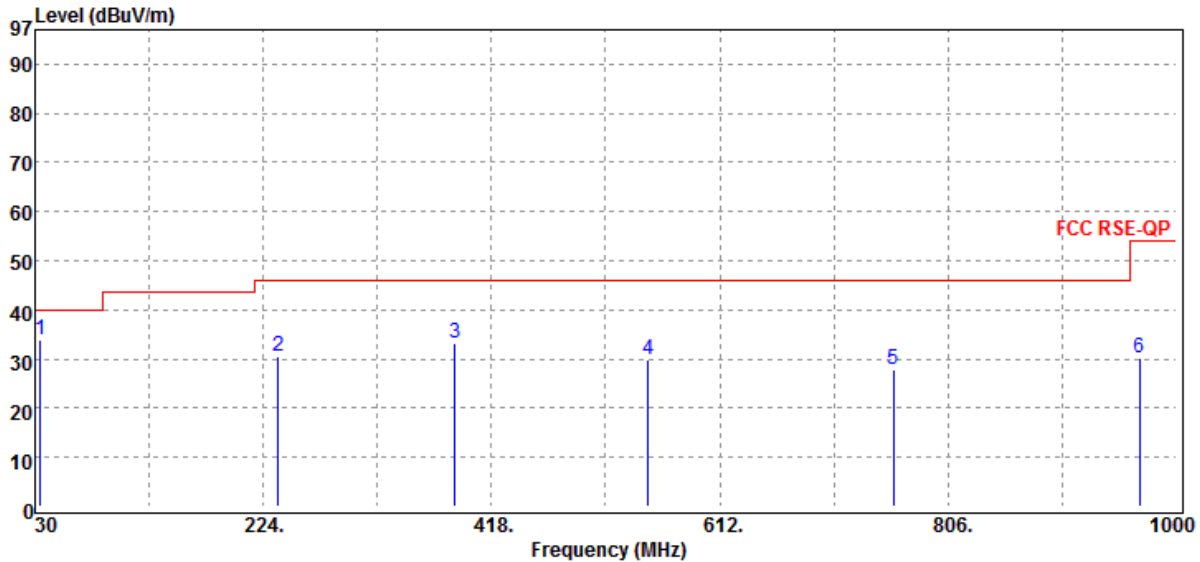
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Operation Band	:802.11 g	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



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
34.85	S	Peak	44.07	-10.17	33.90	40.00	-6.10
236.61	S	Peak	41.07	-10.49	30.58	46.00	-15.42
386.96	S	Peak	39.27	-6.20	33.07	46.00	-12.93
550.89	S	Peak	33.93	-4.05	29.88	46.00	-16.12
759.44	S	Peak	26.66	1.07	27.73	46.00	-18.27
968.96	S	Peak	26.70	3.64	30.34	54.00	-23.66

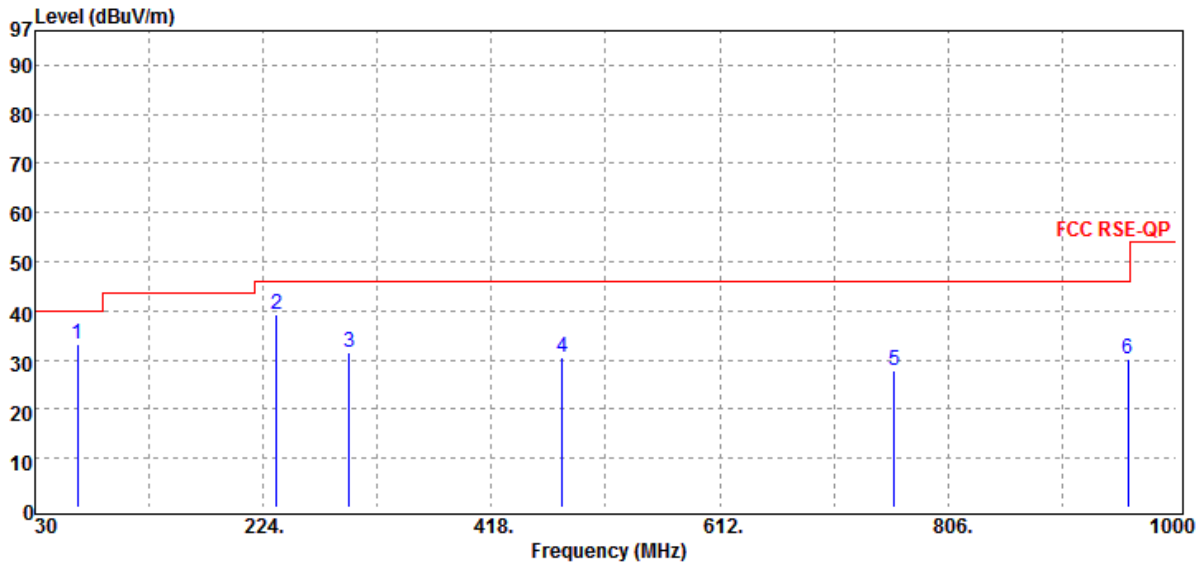
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Operation Band :802.11 g
Fundamental Frequency :2462 MHz
Operation Mode :TX HIGH
EUT Pol. :E2 Plan

Test Date :2015-10-13
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
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
65.89	S	Peak	44.32	-11.07	33.25	40.00	-6.75
235.64	S	Peak	49.86	-10.56	39.30	46.00	-6.70
296.75	S	Peak	39.67	-8.07	31.60	46.00	-14.40
478.14	S	Peak	35.21	-4.68	30.53	46.00	-15.47
760.41	S	Peak	26.70	1.11	27.81	46.00	-18.19
959.26	S	Peak	26.52	3.65	30.17	46.00	-15.83

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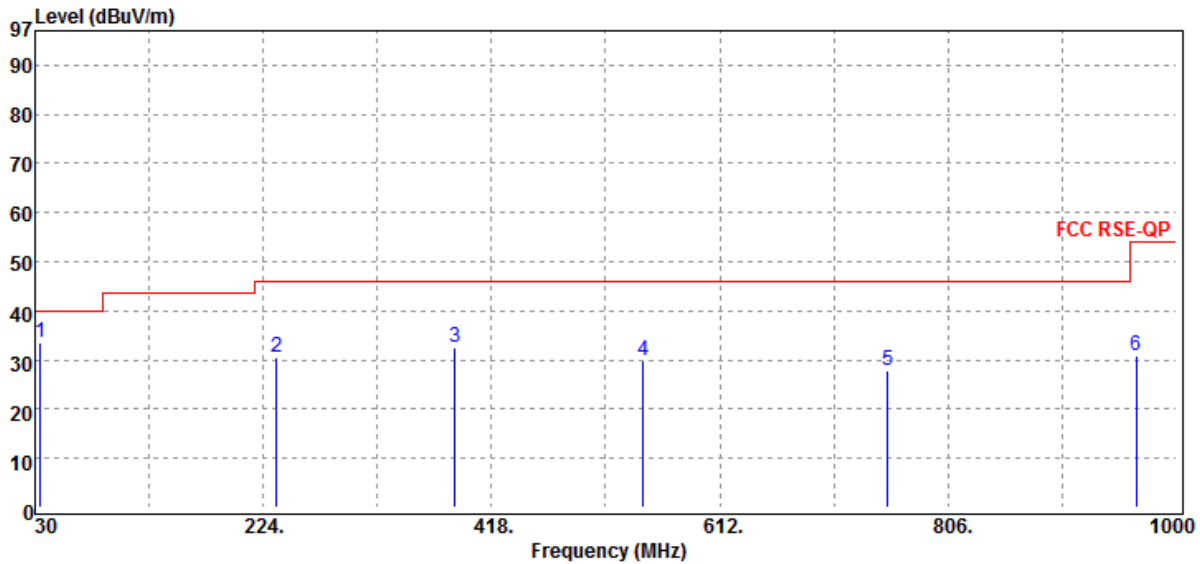
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Radiated Spurious Emission Measurement Result (802.11_HT40) (MIMO)

Operation Band	: 802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



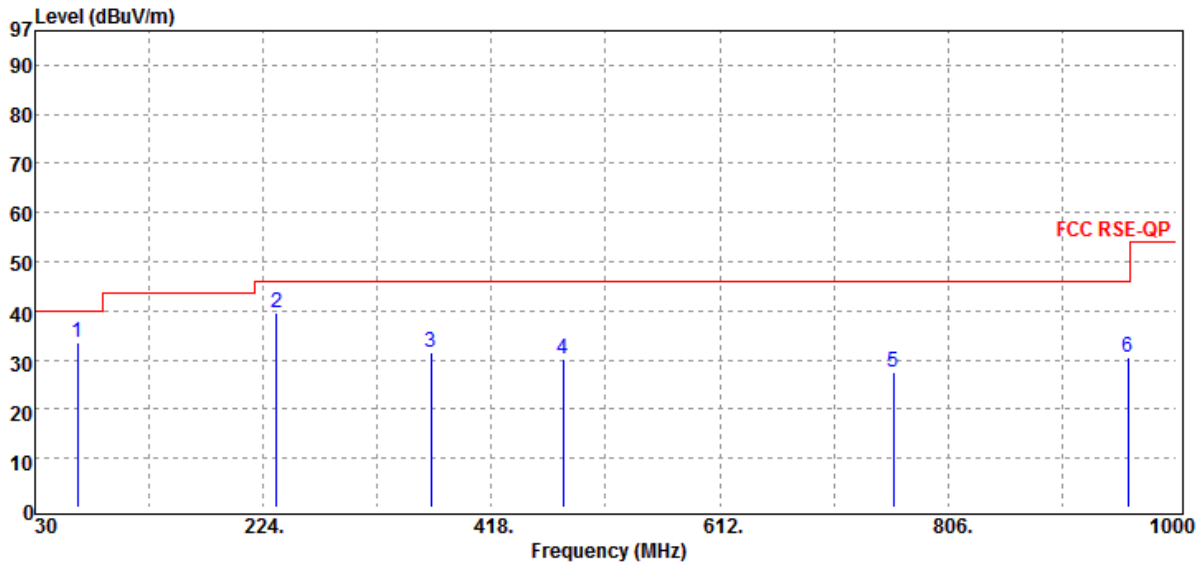
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
34.85	S	Peak	43.76	-10.17	33.59	40.00	-6.41
235.64	S	Peak	41.20	-10.56	30.64	46.00	-15.36
386.96	S	Peak	38.75	-6.20	32.55	46.00	-13.45
547.01	S	Peak	33.87	-4.03	29.84	46.00	-16.16
754.59	S	Peak	27.18	0.73	27.91	46.00	-18.09
966.05	S	Peak	27.15	3.67	30.82	54.00	-23.18

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Operation Band	: 802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



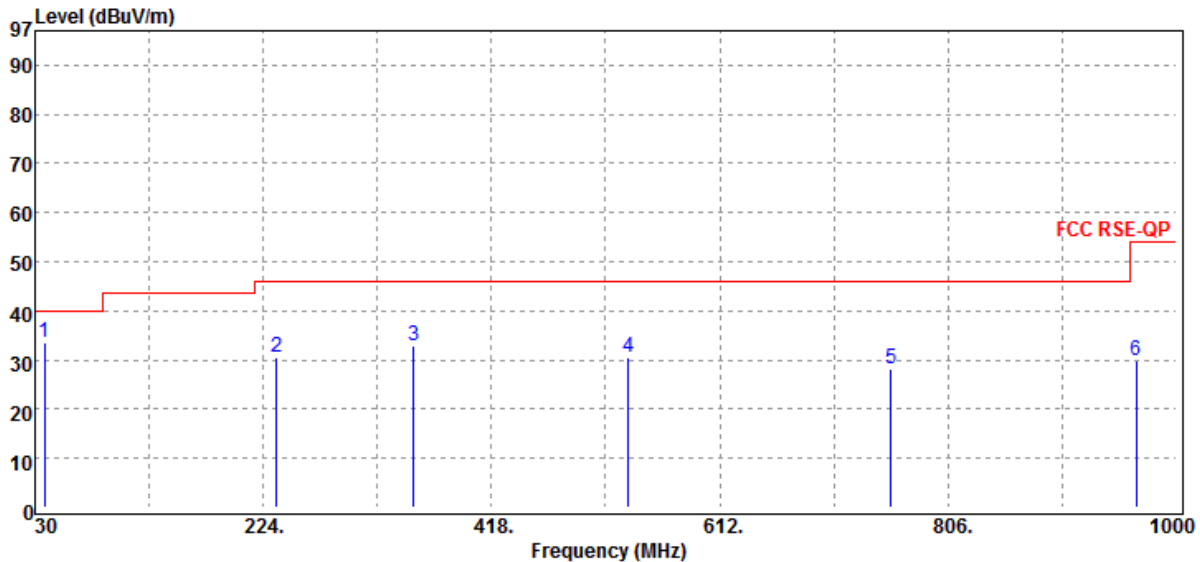
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
65.89	S	Peak	44.58	-11.07	33.51	40.00	-6.49
235.64	S	Peak	50.08	-10.56	39.52	46.00	-6.48
366.59	S	Peak	38.59	-6.92	31.67	46.00	-14.33
479.11	S	Peak	34.75	-4.63	30.12	46.00	-15.88
759.44	S	Peak	26.56	1.07	27.63	46.00	-18.37
959.26	S	Peak	27.06	3.65	30.71	46.00	-15.29

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Operation Band	: 802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



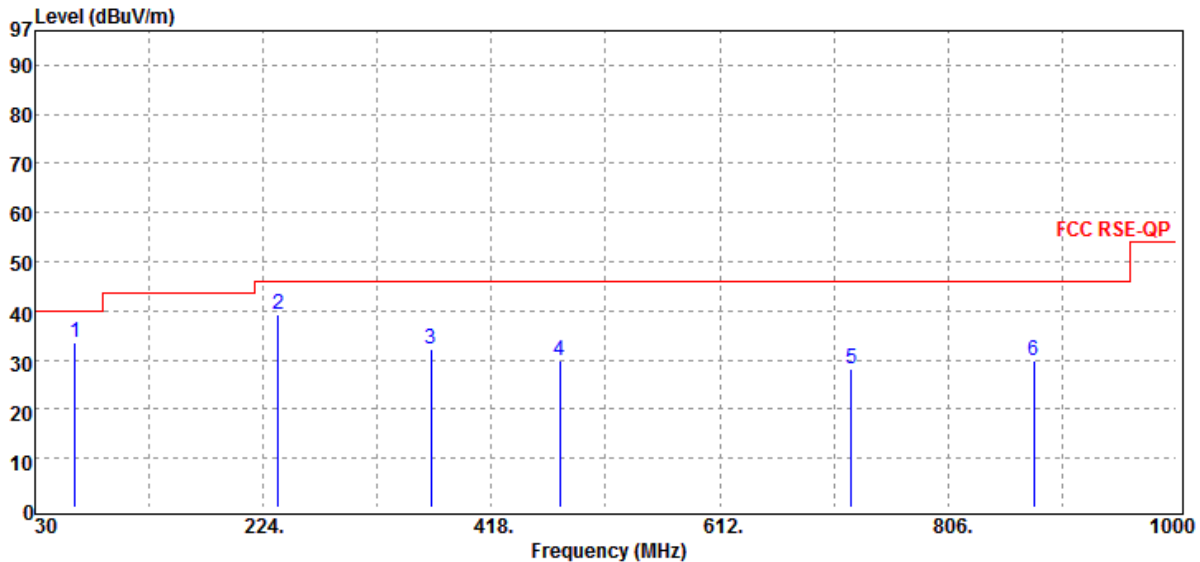
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
37.76	S	Peak	43.68	-9.95	33.73	40.00	-6.27
235.64	S	Peak	41.01	-10.56	30.45	46.00	-15.55
352.04	S	Peak	40.14	-7.13	33.01	46.00	-12.99
534.40	S	Peak	34.55	-4.00	30.55	46.00	-15.45
757.50	S	Peak	27.12	0.97	28.09	46.00	-17.91
966.05	S	Peak	26.31	3.67	29.98	54.00	-24.02

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Operation Band	: 802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



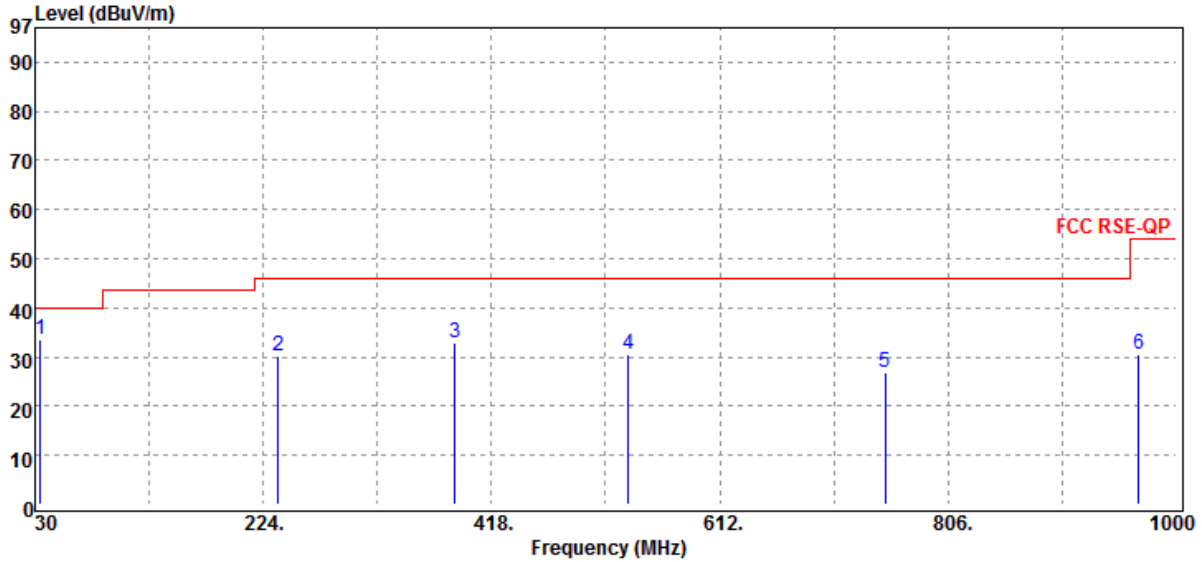
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
63.95	S	Peak	44.34	-10.79	33.55	40.00	-6.45
236.61	S	Peak	49.86	-10.49	39.37	46.00	-6.63
366.59	S	Peak	39.16	-6.92	32.24	46.00	-13.76
476.20	S	Peak	34.61	-4.78	29.83	46.00	-16.17
723.55	S	Peak	29.35	-1.11	28.24	46.00	-17.76
787.75	S	Peak	27.68	2.31	29.99	46.00	-16.01

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Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2452 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



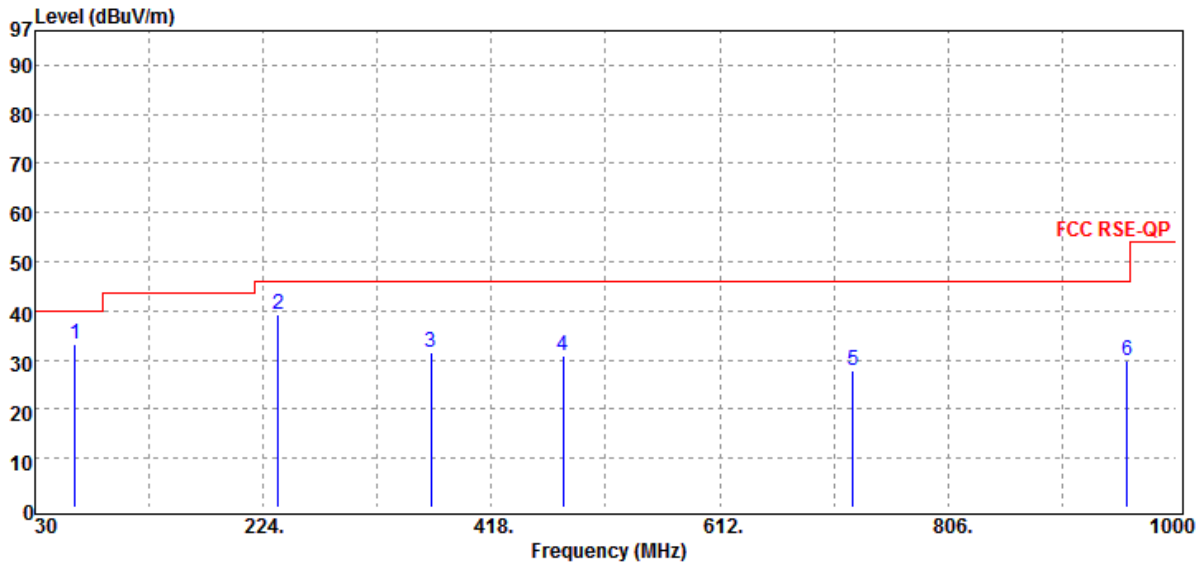
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
34.85	S	Peak	43.68	-10.17	33.51	40.00	-6.49
236.61	S	Peak	40.65	-10.49	30.16	46.00	-15.84
386.96	S	Peak	39.09	-6.20	32.89	46.00	-13.11
534.40	S	Peak	34.68	-4.00	30.68	46.00	-15.32
752.65	S	Peak	26.39	0.54	26.93	46.00	-19.07
967.99	S	Peak	26.95	3.66	30.61	54.00	-23.39

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Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2452 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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
63.95	S	Peak	44.13	-10.79	33.34	40.00	-6.66
236.61	S	Peak	49.88	-10.49	39.39	46.00	-6.61
366.59	S	Peak	38.48	-6.92	31.56	46.00	-14.44
479.11	S	Peak	35.44	-4.63	30.81	46.00	-15.19
725.49	S	Peak	28.89	-1.02	27.87	46.00	-18.13
958.29	S	Peak	26.12	3.62	29.74	46.00	-16.26

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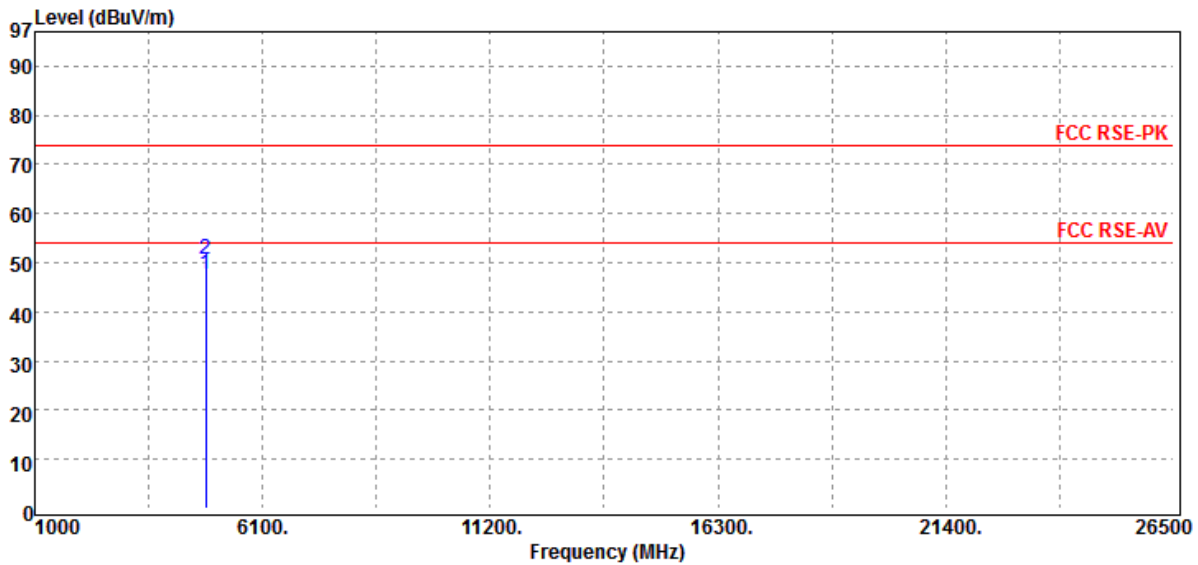
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Radiated Spurious Emission Measurement Result (802.11 b)

Above 1GHz Data:

Operation Band	:802.11 b	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



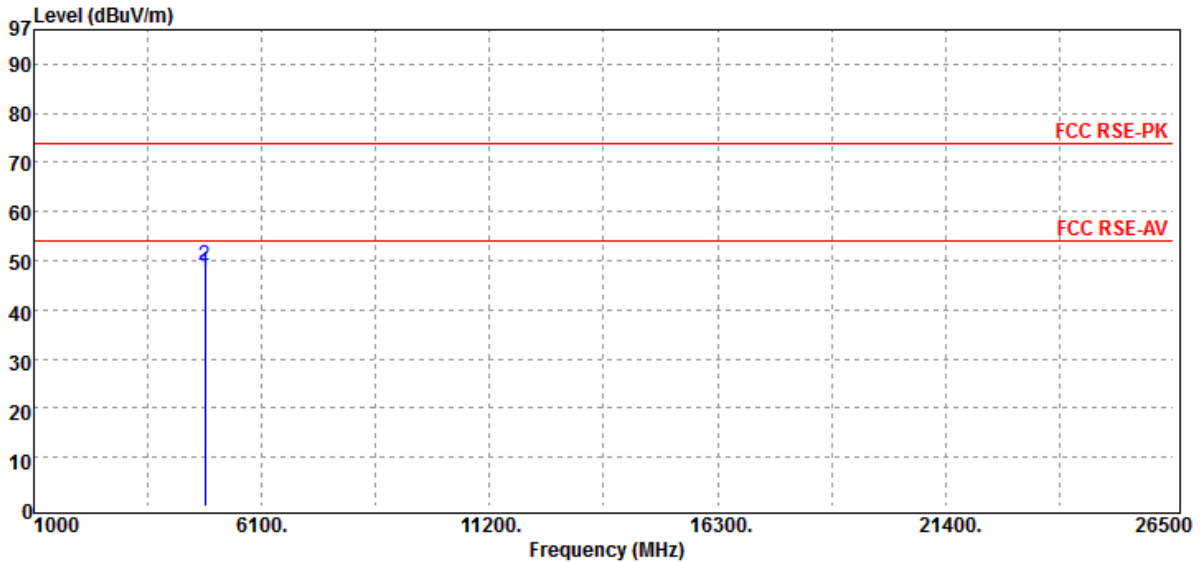
Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4824.00	H	Average	37.88	9.63	47.51	54.00	-6.49
4824.00	H	Peak	40.95	9.63	50.58	74.00	-23.42

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Operation Band	:802.11 b	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



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	Margin dB
4824.00	H	Average	37.93	9.63	47.56	54.00	-6.44
4824.00	H	Peak	39.26	9.63	48.89	74.00	-25.11

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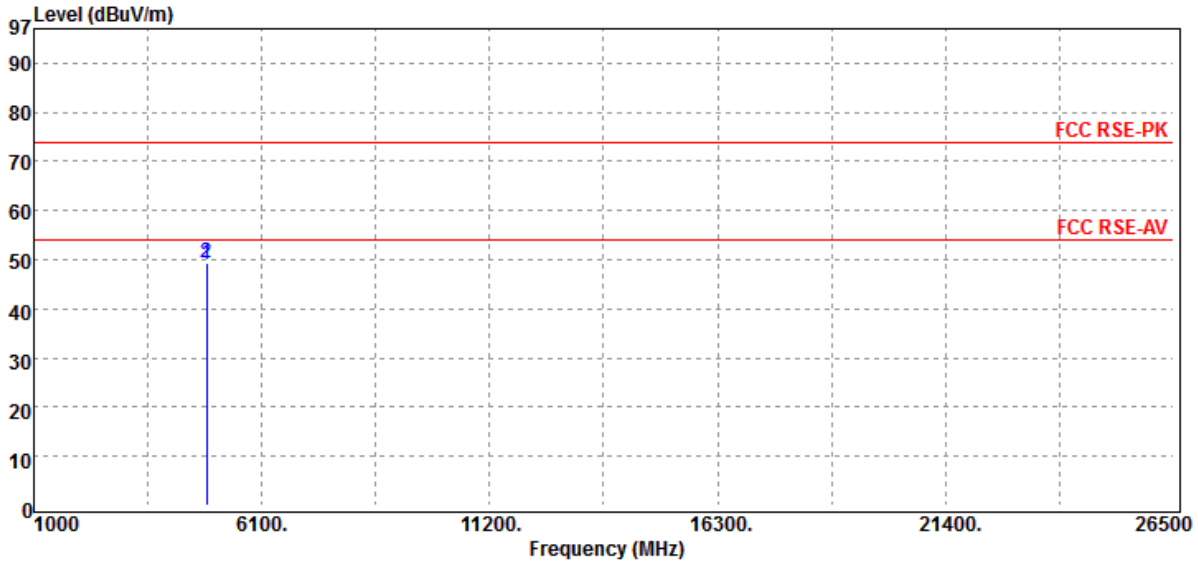
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Operation Band	:802.11 b	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



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
4874.00	H	Average	39.03	9.85	48.88	54.00	-5.12
4874.00	H	Peak	39.39	9.85	49.24	74.00	-24.76

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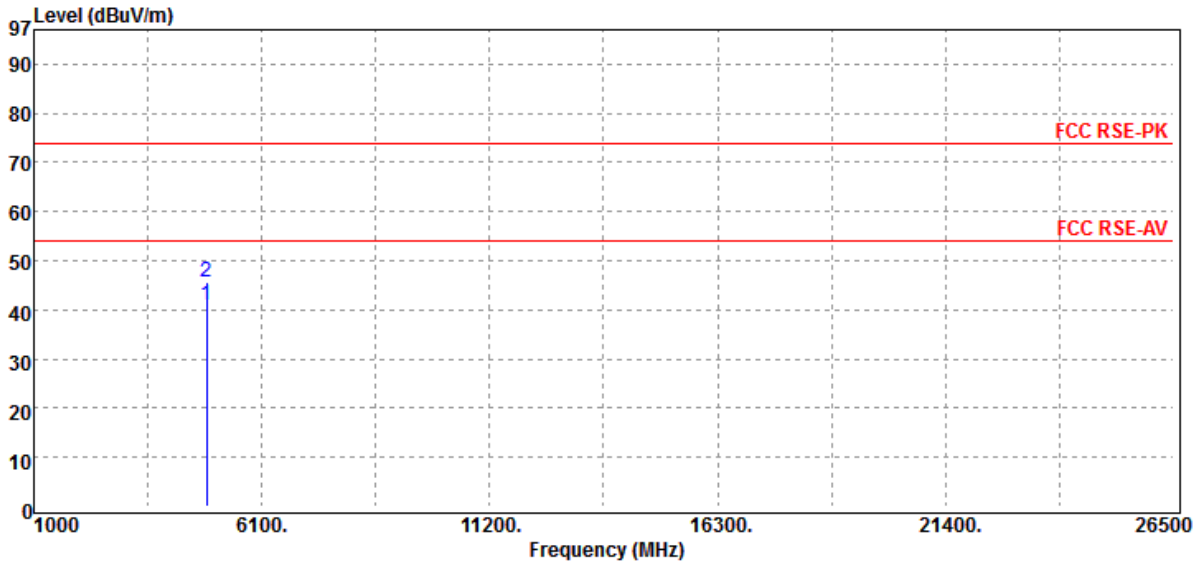
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Operation Band	:802.11 b	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



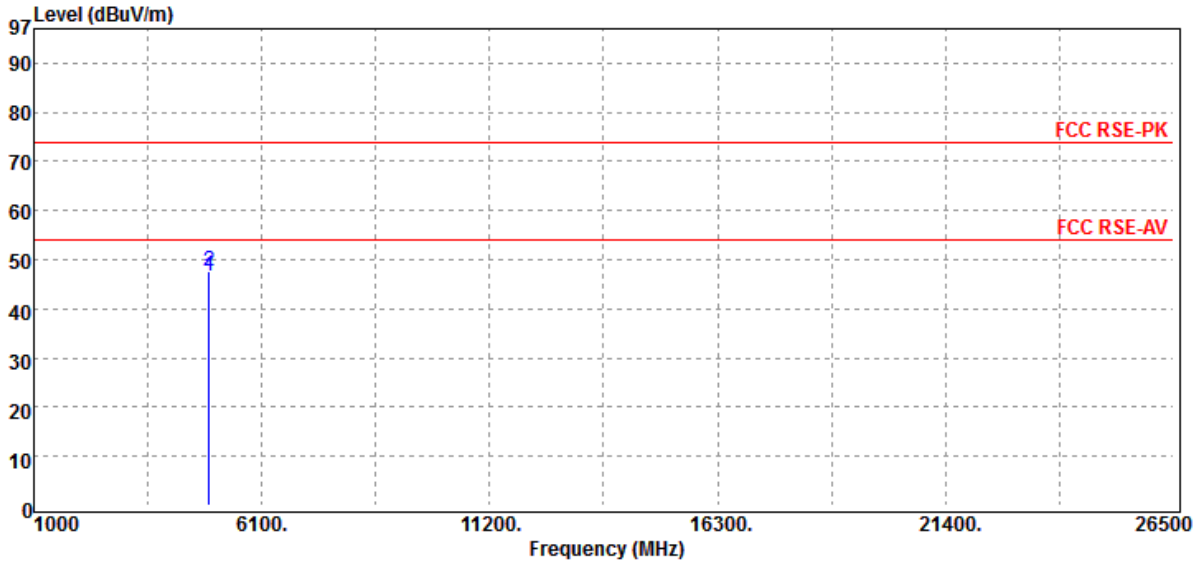
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	H	Average	31.09	9.85	40.94	54.00	-13.06
4874.00	H	Peak	35.70	9.85	45.55	74.00	-28.45

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Operation Band	:802.11 b	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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
4924.00	H	Average	36.65	9.86	46.51	54.00	-7.49
4924.00	H	Peak	37.76	9.86	47.62	74.00	-26.38

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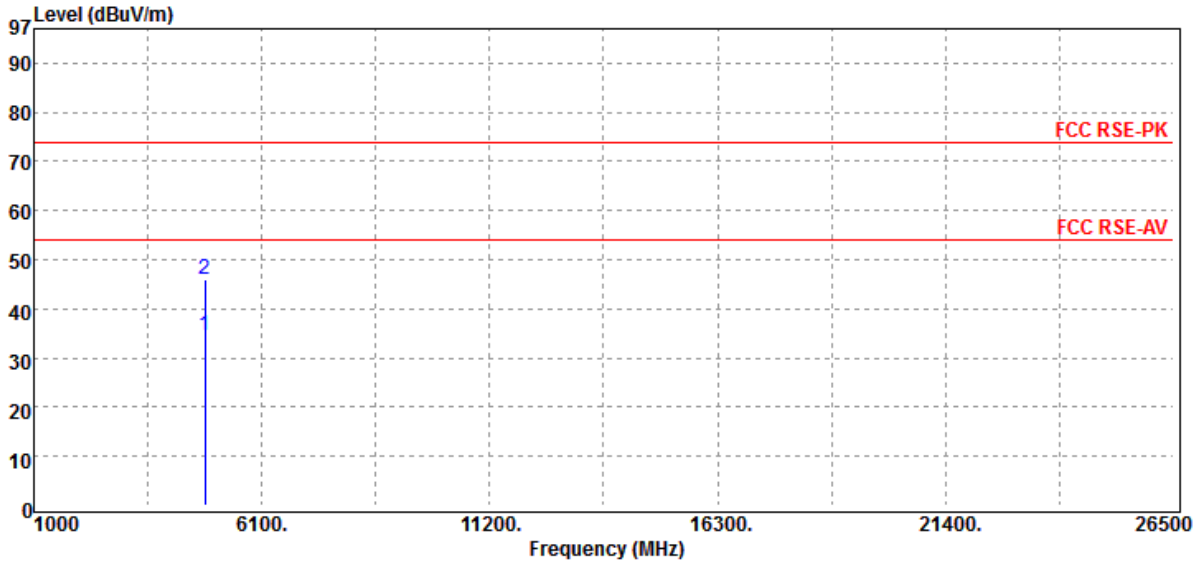
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Operation Band	:802.11 b	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



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
4824.00	H	Average	24.78	9.63	34.41	54.00	-19.59
4824.00	H	Peak	36.50	9.63	46.13	74.00	-27.87

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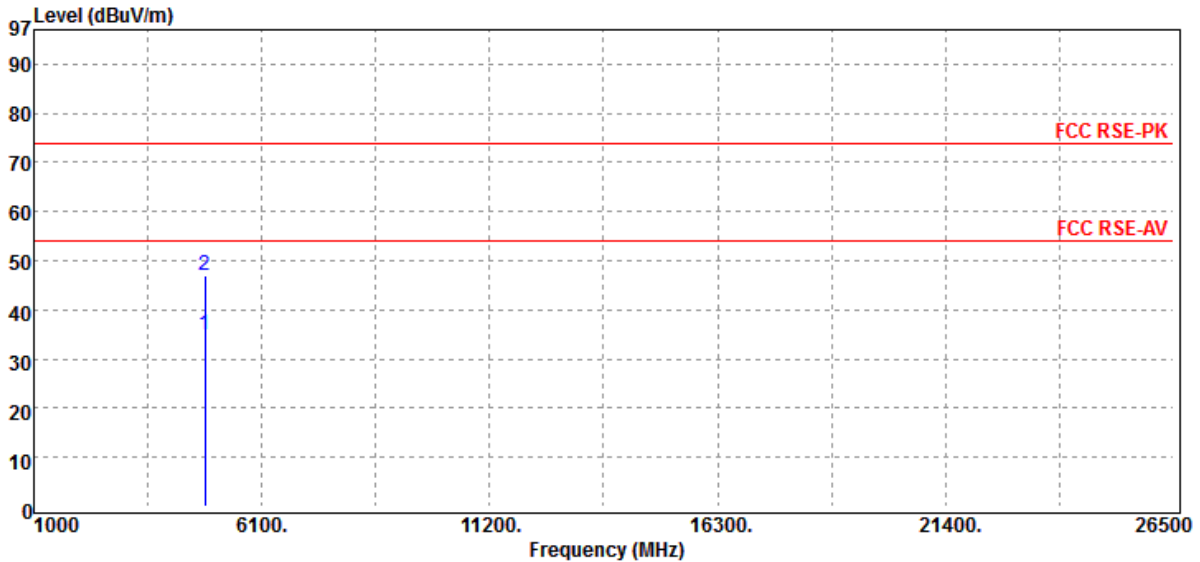
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Radiated Spurious Emission Measurement Result (802.11 g)

Operation Band	:802.11 g	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	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
4824.00	H	Average	25.41	9.63	35.04	54.00	-18.96
4824.00	H	Peak	37.47	9.63	47.10	74.00	-26.90

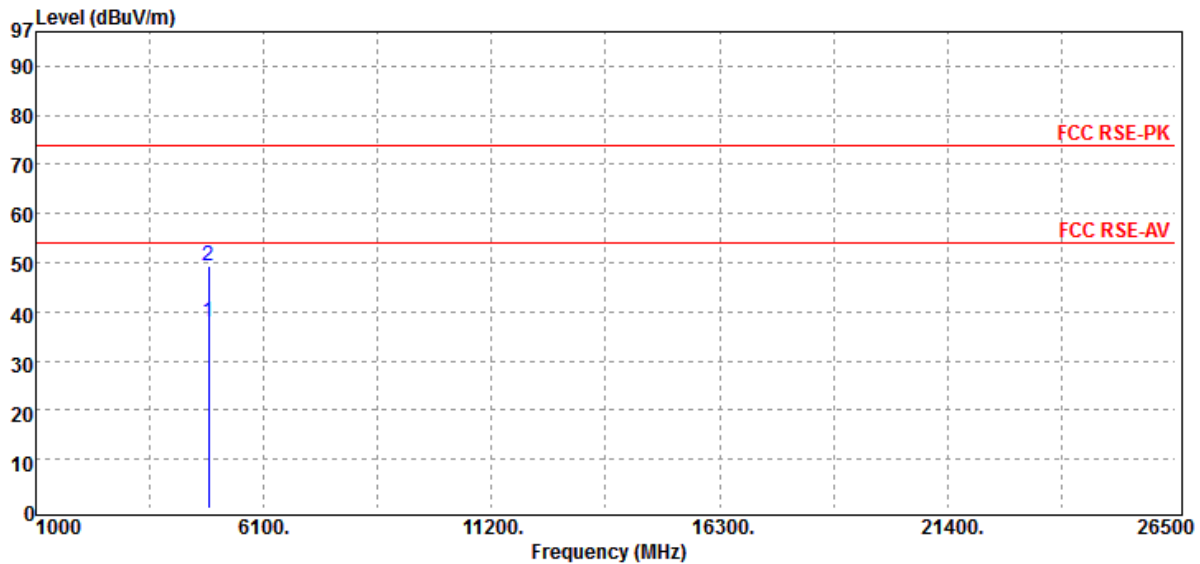
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Operation Band :802.11 g
Fundamental Frequency :2412 MHz
Operation Mode :TX LOW
EUT Pol. :E2 Plan

Test Date :2015-10-13
Temp./Humi. :21 deg_C / 61 RH
Engineer :Tin
Measurement Antenna Pol. :HORIZONTAL



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	
4874.00	H	Average	28.13	9.85	37.98	54.00	-16.02
4874.00	H	Peak	39.47	9.85	49.32	74.00	-24.68

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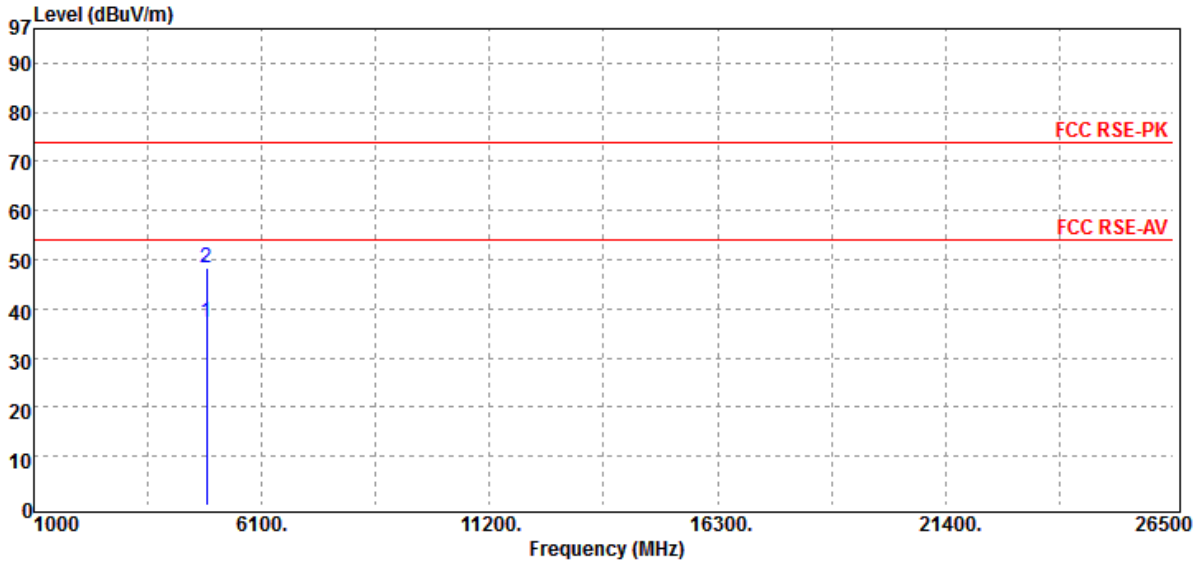
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Operation Band	:802.11 g	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



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
4874.00	H	Average	27.26	9.85	37.11	54.00	-16.89
4874.00	H	Peak	38.36	9.85	48.21	74.00	-25.79

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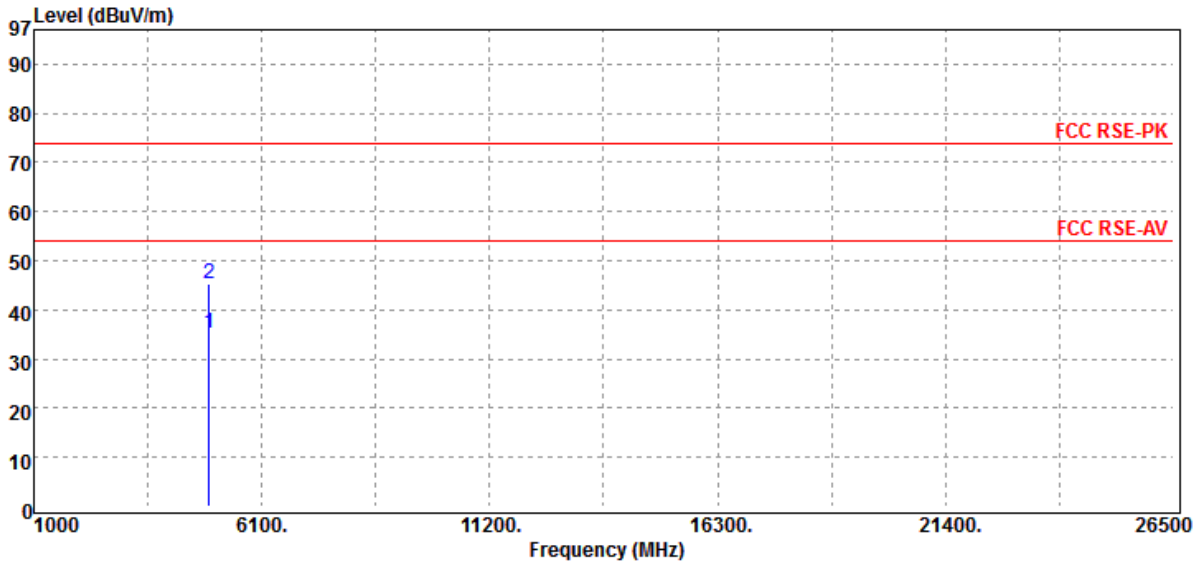
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Operation Band	:802.11 g	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



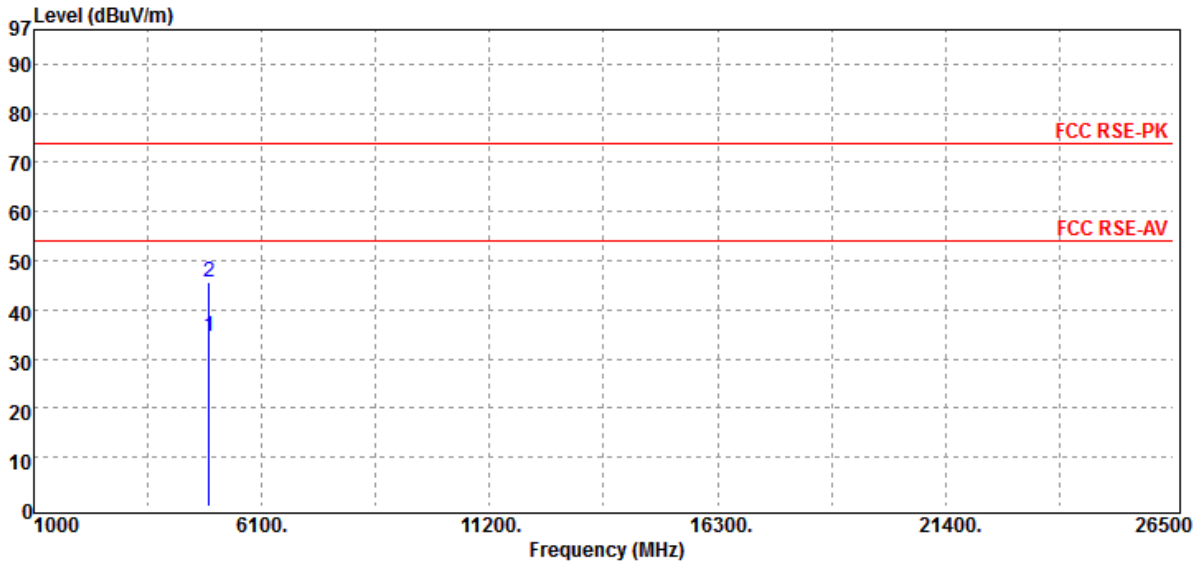
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	H	Average	25.25	9.86	35.11	54.00	-18.89
4924.00	H	Peak	35.47	9.86	45.33	74.00	-28.67

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Operation Band	:802.11 g	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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
4924.00	H	Average	24.86	9.86	34.72	54.00	-19.28
4924.00	H	Peak	35.67	9.86	45.53	74.00	-28.47

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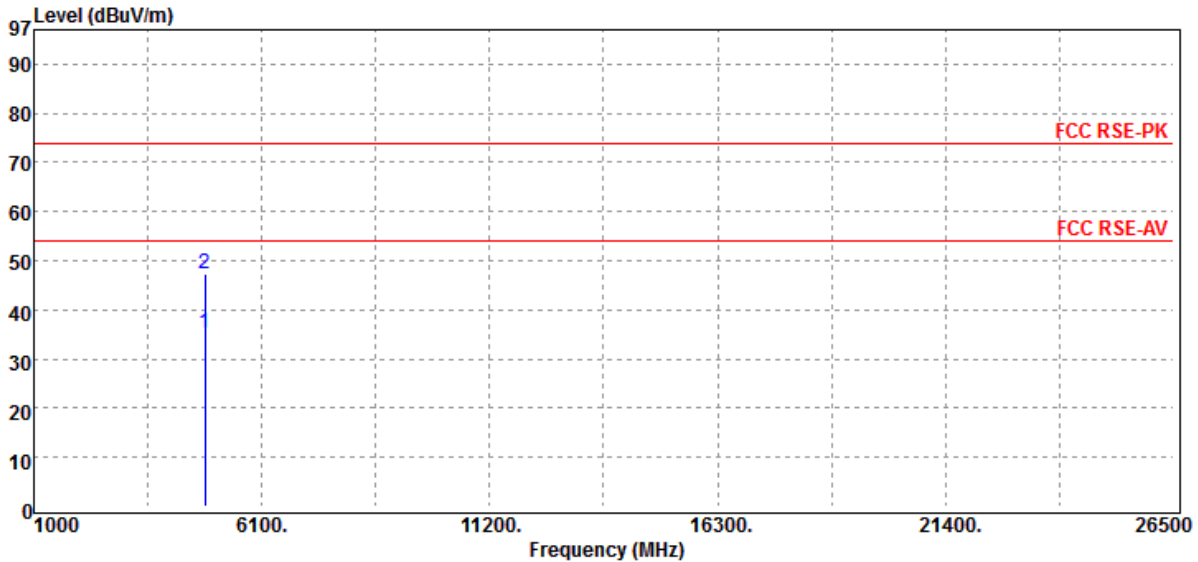
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Operation Band	:802.11 g	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	
4824.00	H	Average	25.68	9.63	35.31	54.00	-18.69
4824.00	H	Peak	37.77	9.63	47.40	74.00	-26.60

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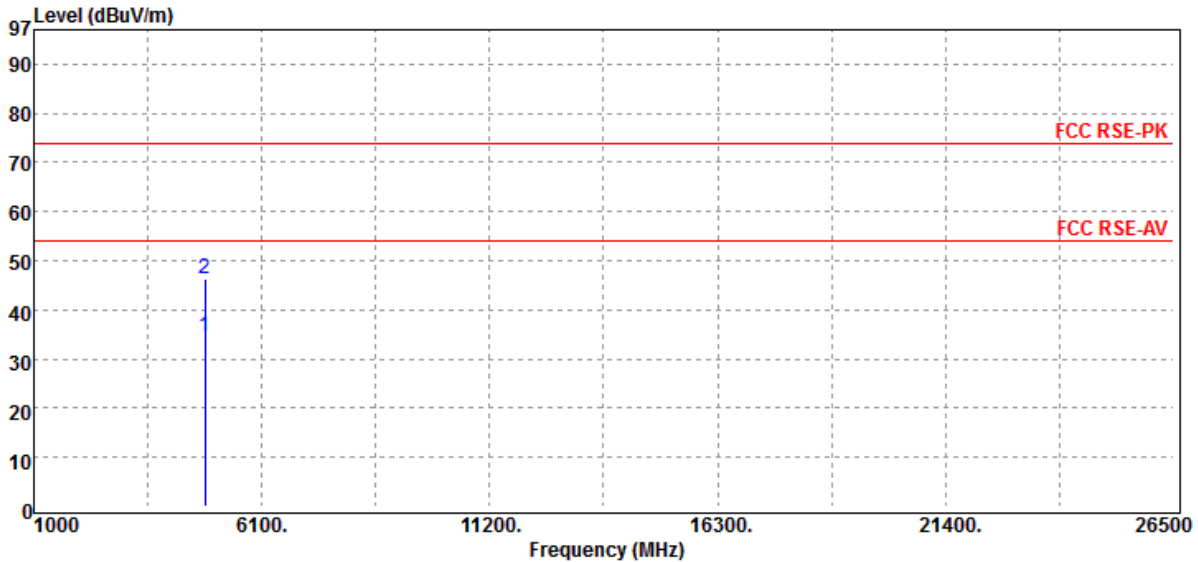
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Radiated Spurious Emission Measurement Result (802.11_HT20) (MIMO)

Operation Band	:802.11 n20M	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	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
4824.00	H	Average	25.06	9.63	34.69	54.00	-19.31
4824.00	H	Peak	36.74	9.63	46.37	74.00	-27.63

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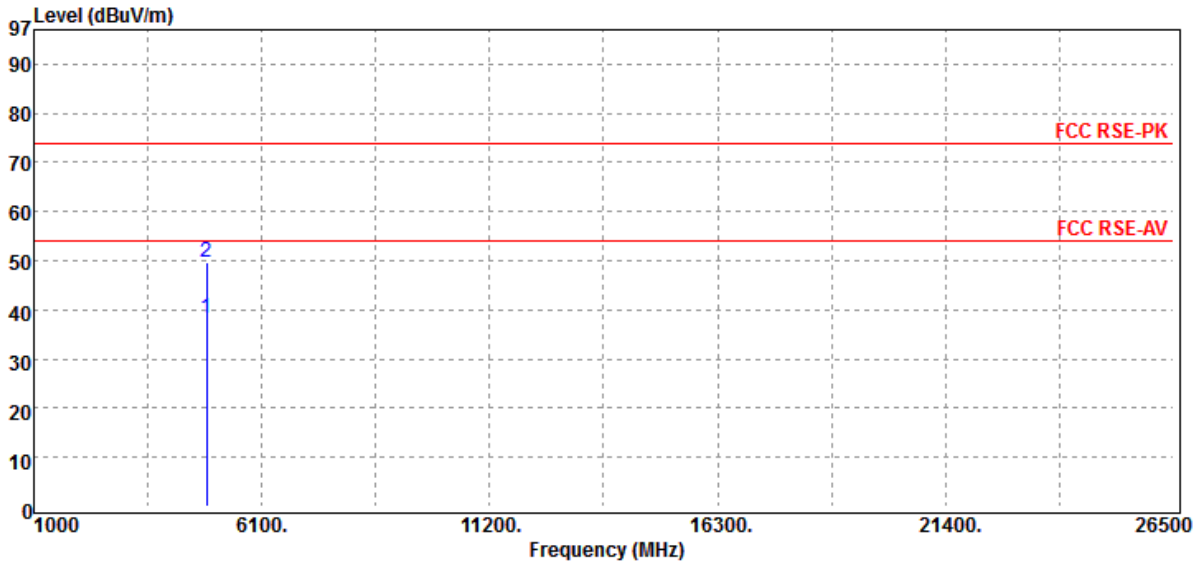
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Operation Band	:802.11 n20M	Test Date	:2015-10-13
Fundamental Frequency	:2412 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



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
4874.00	H	Average	28.55	9.85	38.40	54.00	-15.60
4874.00	H	Peak	39.68	9.85	49.53	74.00	-24.47

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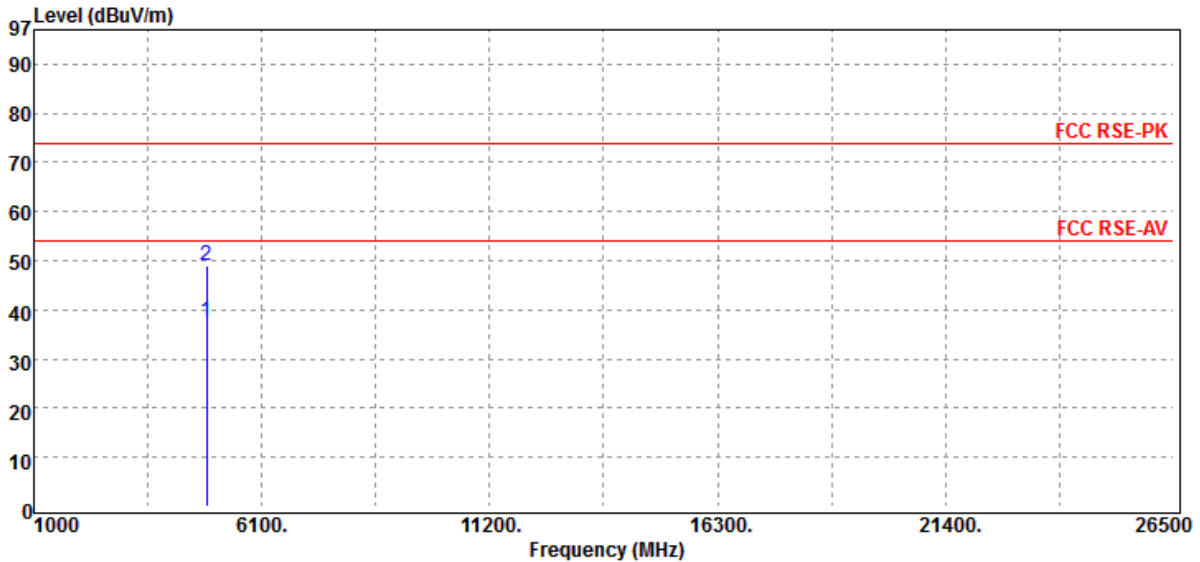
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Operation Band	:802.11 n20M	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

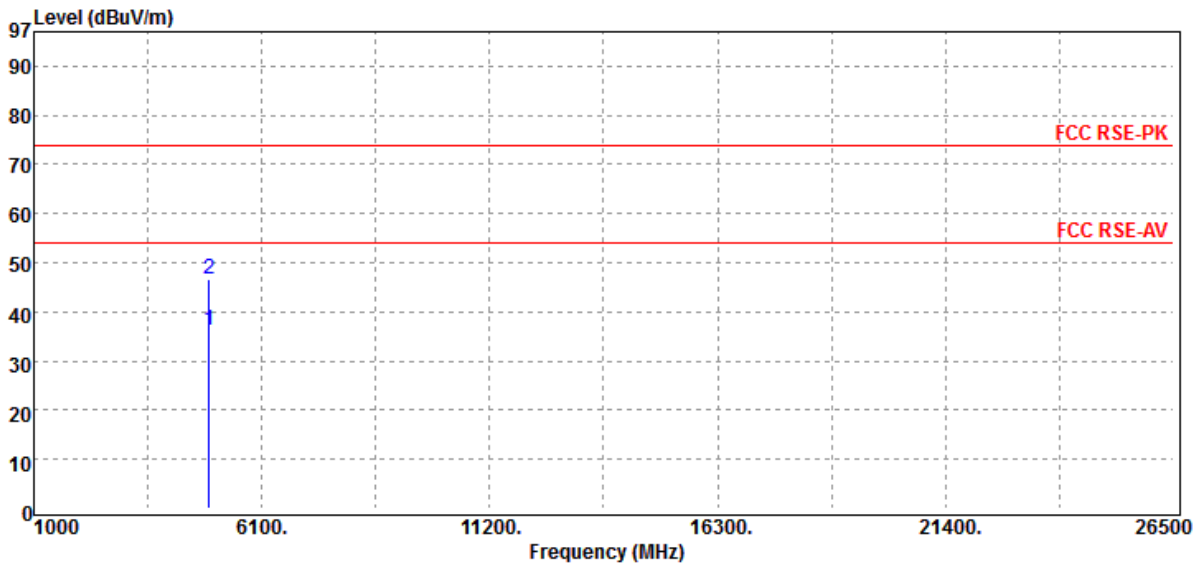


Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	H	Average	27.84	9.85	37.69	54.00	-16.31
4874.00	H	Peak	39.19	9.85	49.04	74.00	-24.96

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Operation Band	:802.11 n20M	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	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
4924.00	H	Average	26.37	9.86	36.23	54.00	-17.77
4924.00	H	Peak	36.92	9.86	46.78	74.00	-27.22

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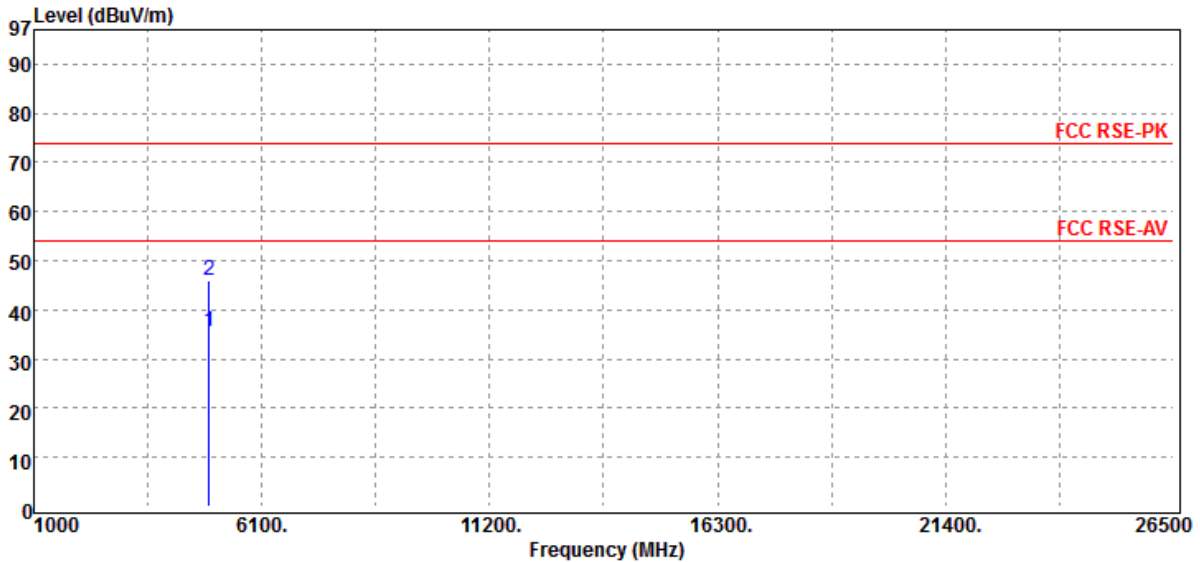
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Operation Band	:802.11 n20M	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



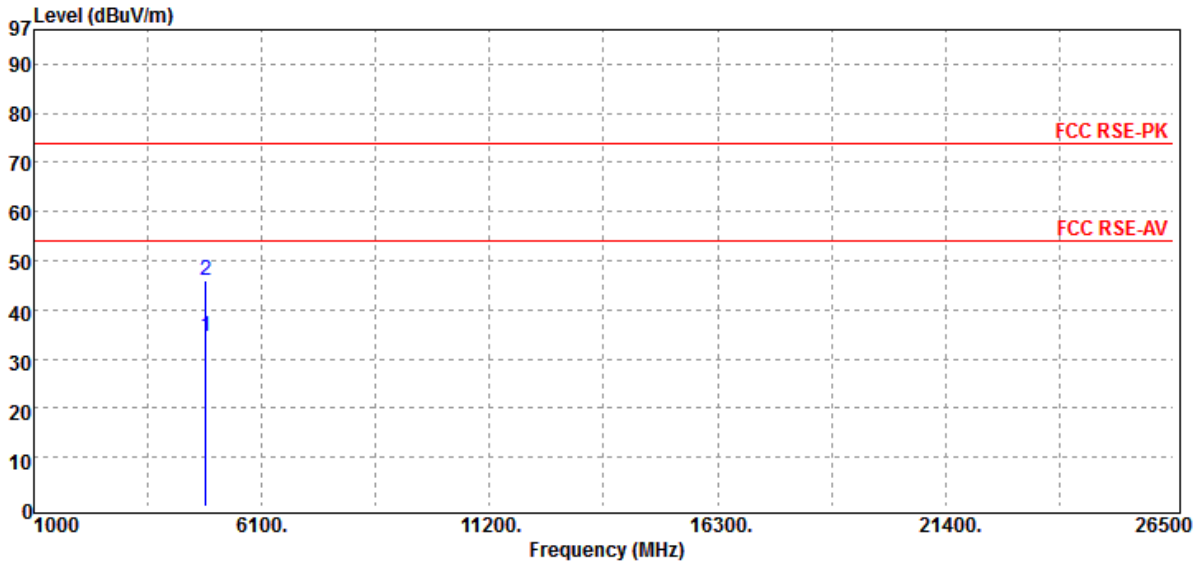
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	H	Average	25.73	9.86	35.59	54.00	-18.41
4924.00	H	Peak	36.01	9.86	45.87	74.00	-28.13

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Operation Band	:802.11 n20M	Test Date	:2015-10-13
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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
4844.00	H	Average	24.82	9.74	34.56	54.00	-19.44
4844.00	H	Peak	36.25	9.74	45.99	74.00	-28.01

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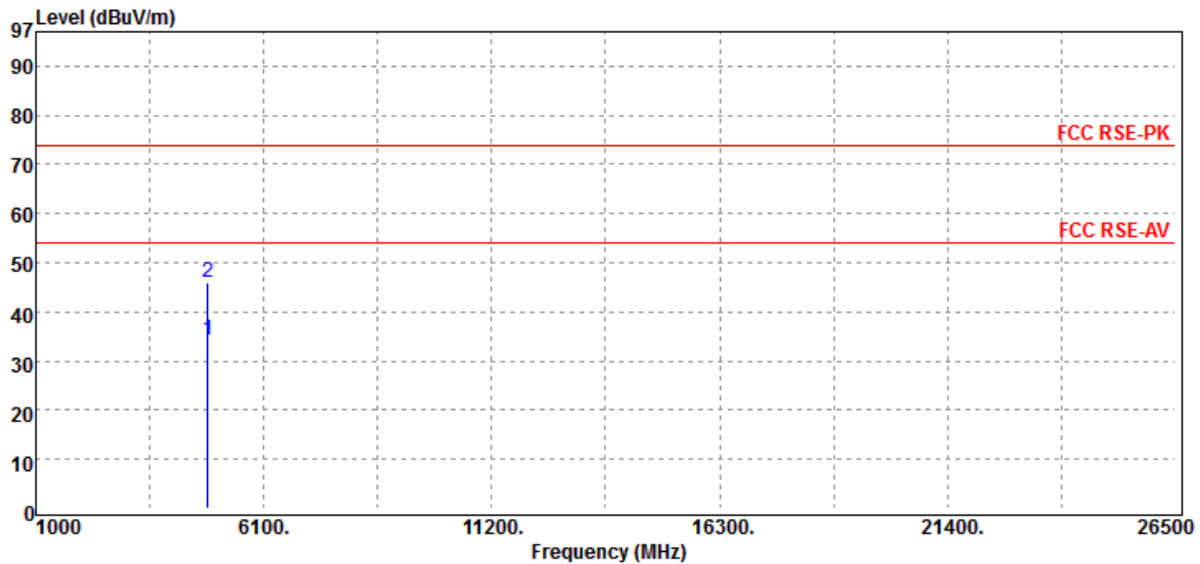
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Radiated Spurious Emission Measurement Result (802.11_HT40) (MIMO)

Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



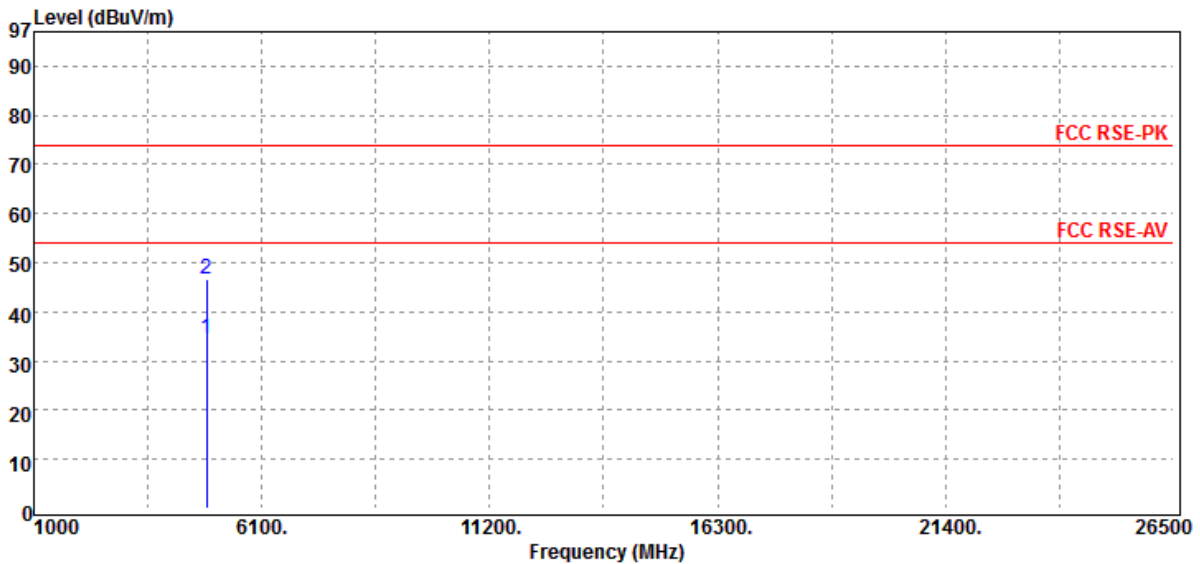
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	
4844.00	H	Average	24.66	9.74	34.40	54.00	-19.60
4844.00	H	Peak	36.27	9.74	46.01	74.00	-27.99

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Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2422 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



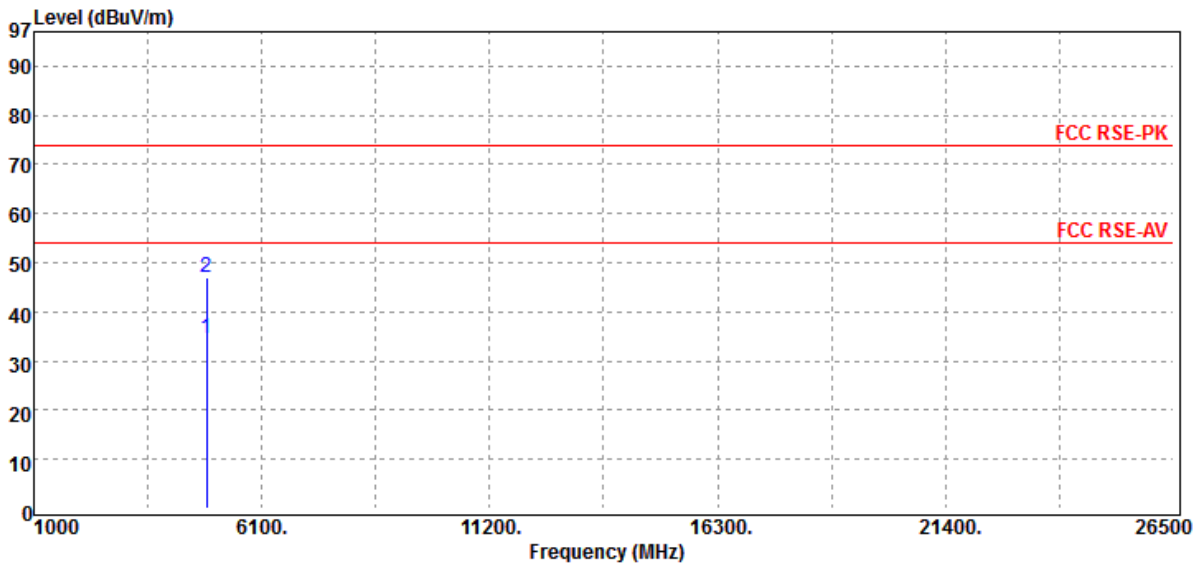
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	
4874.00	H	Average	24.87	9.85	34.72	54.00	-19.28
4874.00	H	Peak	36.91	9.85	46.76	74.00	-27.24

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Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	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	
4874.00	H	Average	24.60	9.85	34.45	54.00	-19.55
4874.00	H	Peak	37.05	9.85	46.90	74.00	-27.10

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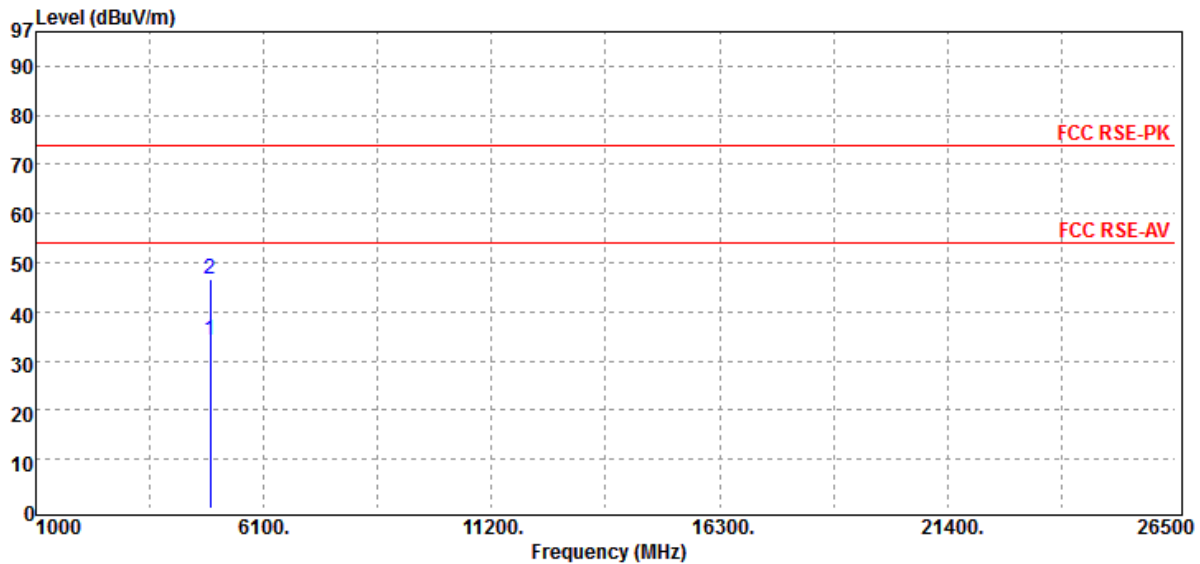
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Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2437 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	
4904.00	H	Average	24.35	9.84	34.19	54.00	-19.81
4904.00	H	Peak	36.94	9.84	46.78	74.00	-27.22

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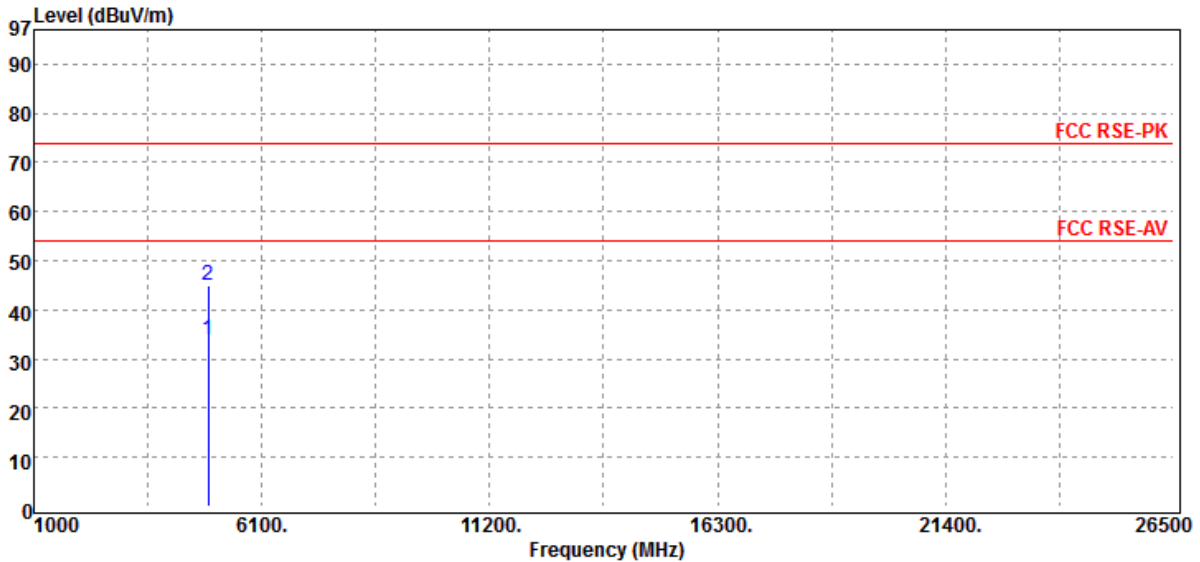
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Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2452 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL



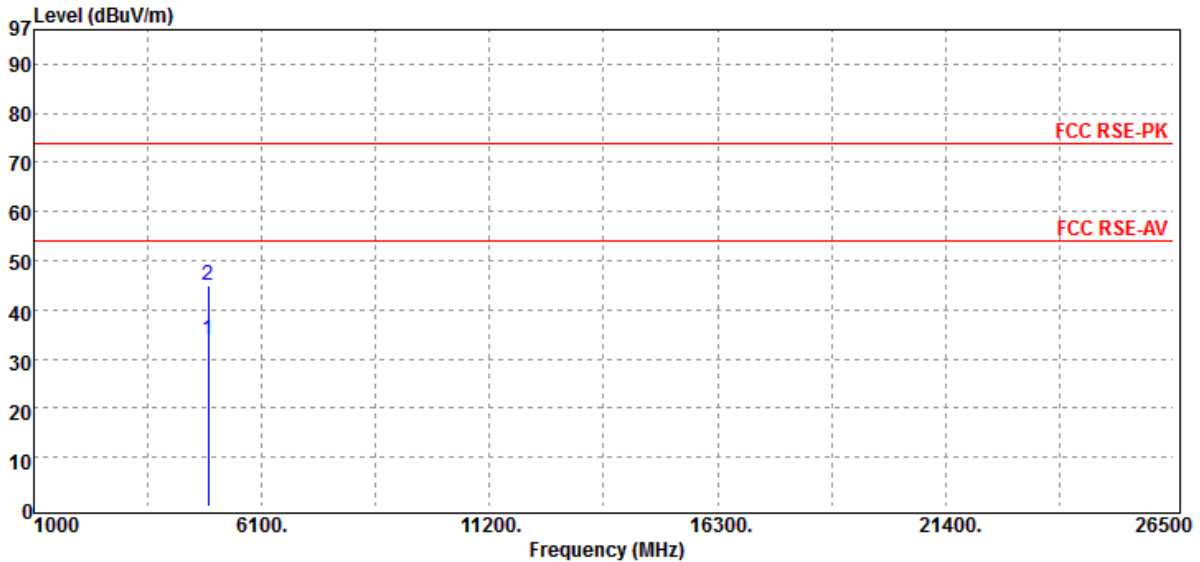
Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	
4904.00	H	Average	24.09	9.84	33.93	54.00	-20.07
4904.00	H	Peak	35.18	9.84	45.02	74.00	-28.98

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Operation Band	:802.11 n40M	Test Date	:2015-10-13
Fundamental Frequency	:2452 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:E2 Plan	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
4904.00	H	Average	24.09	9.84	33.93	54.00	-20.07
4904.00	H	Peak	35.18	9.84	45.02	74.00	-28.98

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12 PEAK POWER SPECTRAL DENSITY

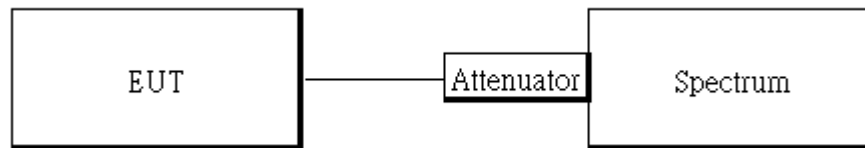
12.1 Standard Applicable

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

12.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2015	01/01/2016
Attenuator	Mini-Circuit	BW-S10W2+	002	01/02/2015	01/01/2016
Splitter	Agilent	11636B	N/A	01/02/2015	01/01/2016

12.3 Test Set-up



12.4 Measurement Procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance V03r03.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz.
5. Set the VBW = 10 kHz.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level.
11. 802.11n 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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Note: The antenna gain is greater than 6 dBi in MIMO mode the limit reduce as below:

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

Effective Legacy Gain (dBi) = 4.02+3.01=7.03dBi

Limit: 8dBm – (7.03– 6dBi) = 6.97dBm

12.5 Measurement Result

802.11b

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2412	-5.68	8	PASS
2437	-4.97	8	PASS
2462	-5.93	8	PASS

802.11g

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2412	-10.21	8	PASS
2437	-10.32	8	PASS
2462	-10.19	8	PASS

802.11n_20M (MIMO)

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2412	-9.74	6.97	PASS
2437	-10.15	6.97	PASS
2462	-9.85	6.97	PASS

802.11n_40M (MIMO)

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2422	-13.59	6.97	PASS
2437	-13.42	6.97	PASS
2452	-13.24	6.97	PASS

**Refer to next page for plots*

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802.11b

Power Spectral Density Test Plot (CH-Low)



Power Spectral Density Test Plot (CH-Mid)



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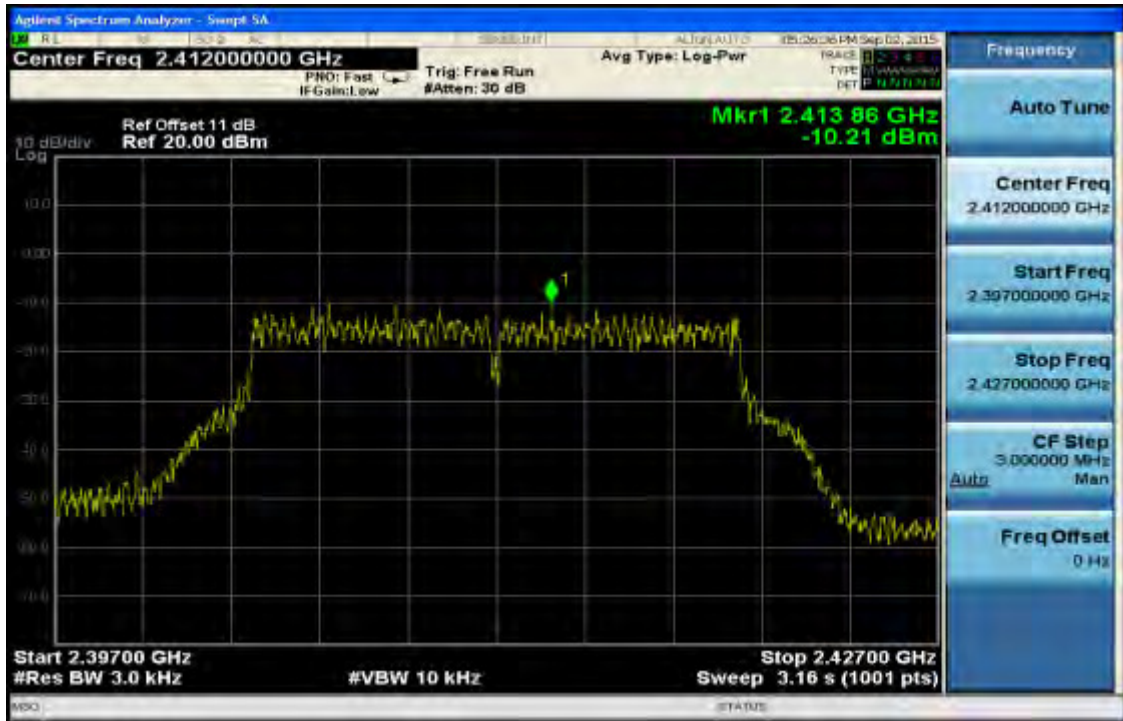
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Power Spectral Density Test Plot (CH-High)



802.11g

Power Spectral Density Test Plot (CH-Low)



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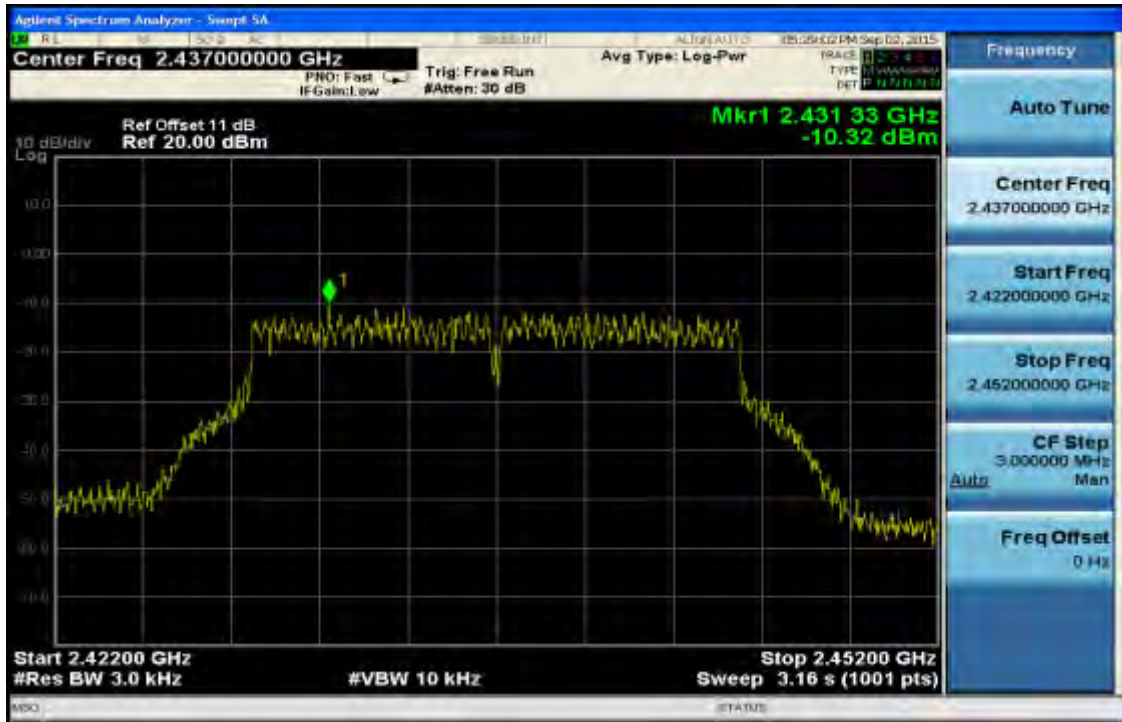
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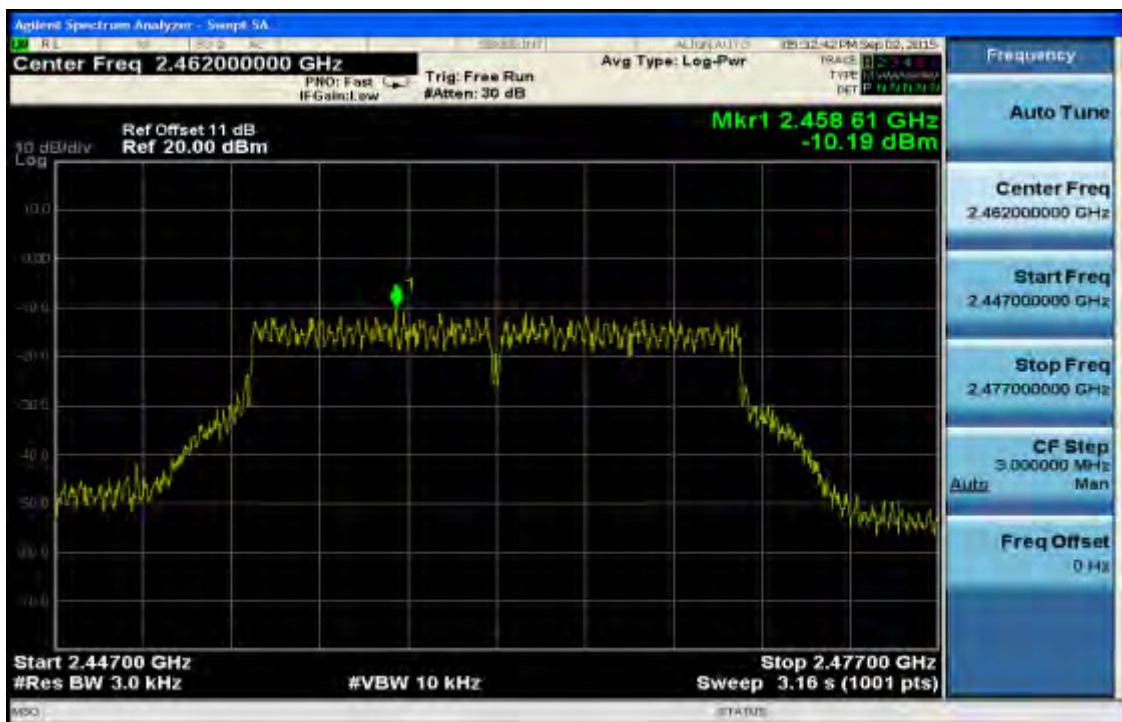
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Power Spectral Density Test Plot (CH-Mid)



Power Spectral Density Test Plot (CH-High)



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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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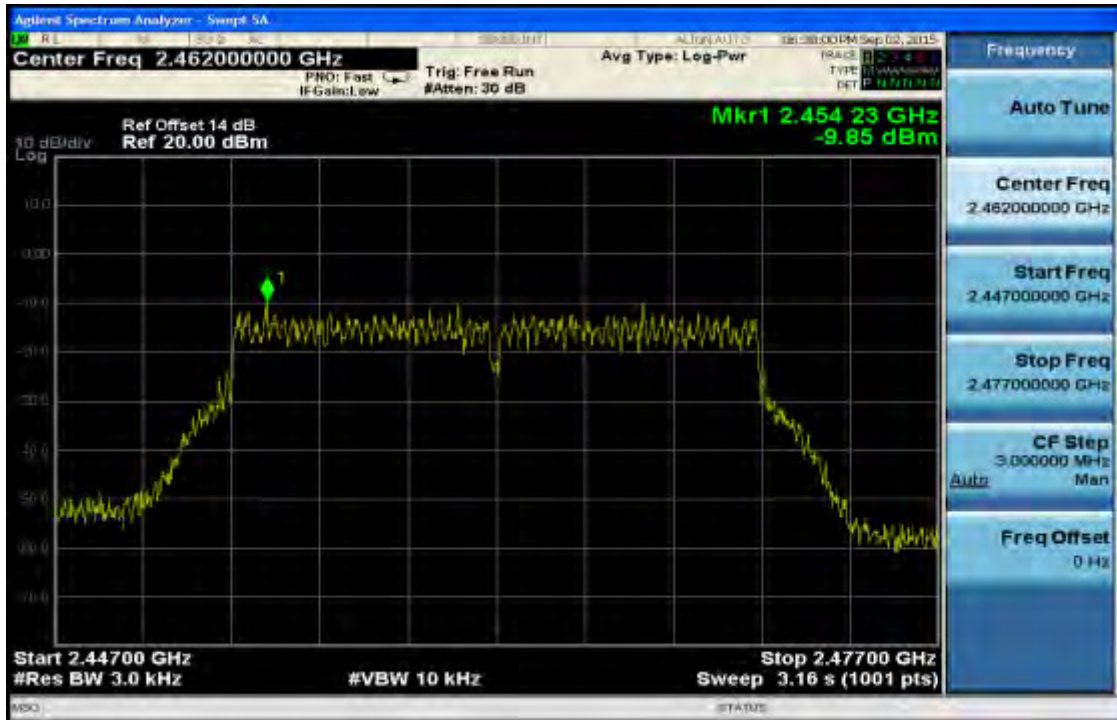
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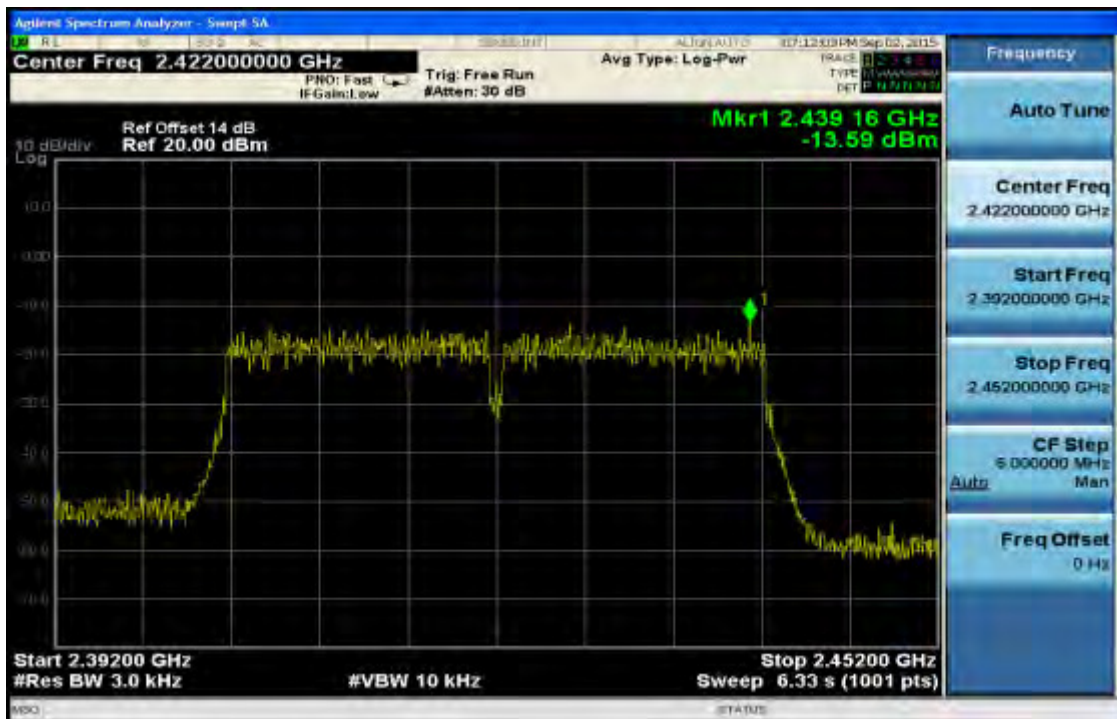
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Power Spectral Density Test Plot (CH-High)



802.11n_HT40 (MIMO)

Power Spectral Density Test Plot (CH-Low)



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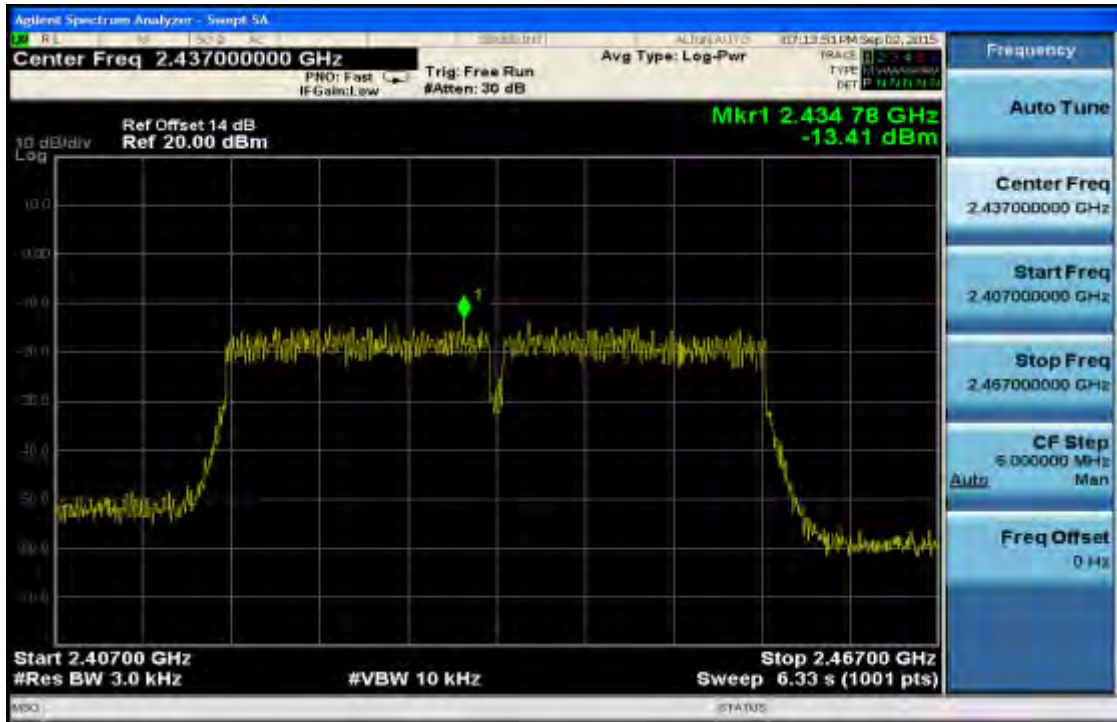
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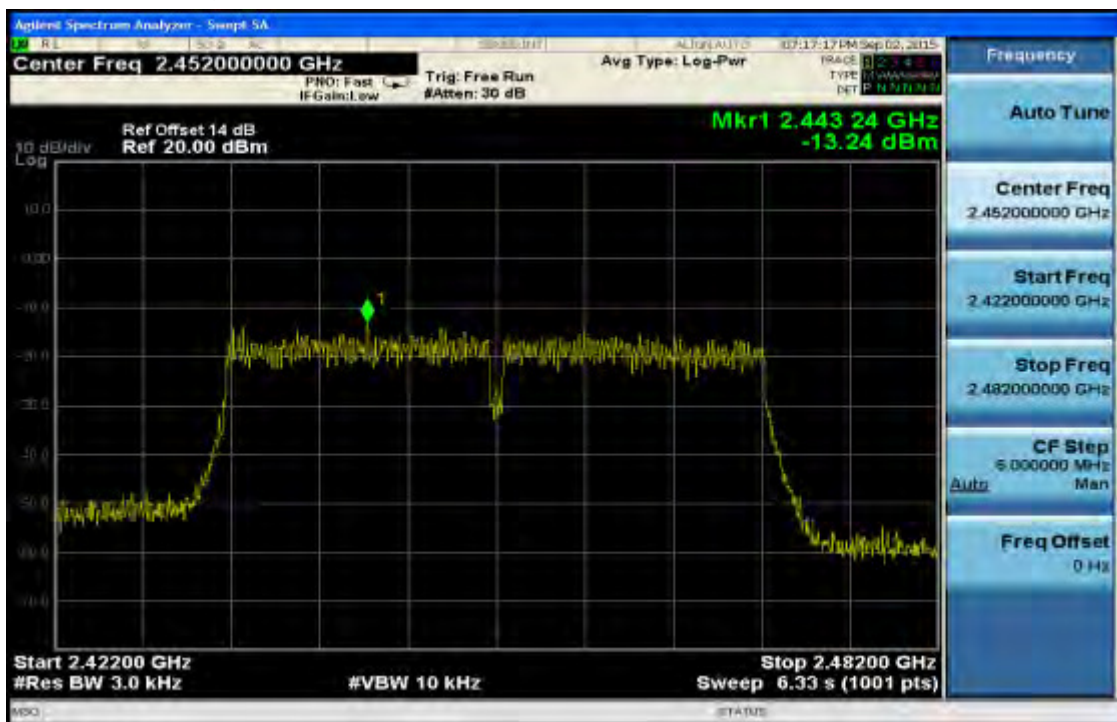
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Power Spectral Density Test Plot (CH-Mid)



Power Spectral Density Test Plot (CH-High)



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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.

According to RSS-GEN 8.3

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

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

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. 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.

~ *End of Report* ~

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