

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

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

OF

Applicant: Pioneer Corporation
28-8, Honkomagome 2-chome, Bunkyo-ku, Tokyo, Japan

Product Name: GPS Cycle Computer

Brand Name: Pioneer

Model No.: SGX-CA600

Model Difference: N/A

FCC ID: AJDK110

IC: 775E-K110

Report Number: E2/2018/A0041

FCC Rule Part: §15.247, Cat: DTS

IC Rule Part: RSS-247 issue 2 Feb 2017

Issue Date: Nov. 27, 2018

Date of Test: Oct. 22, 2018 ~ Nov. 08, 2018

Date of EUT Received: Oct. 22, 2018

We hereby certify that:

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

Tested By:

Aken Huang

Aken Huang / Engineer

Approved By:

Jay Lin

Jay Lin / Asst. Supervisor



Testing Laboratory
0513

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f (886-2) 2298-0488

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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
E2/2018/A0041	Rev.00	Initial creation of document	All	Nov. 27, 2018	Stefanie Yu / Clerk

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1 GENERAL INFORMATION

1.1 Product description

General:

Product Name:	GPS Cycle Computer	
Brand Name:	Pioneer	
Model No.:	SGX-CA600	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Power Supply:	3.7Vdc from Rechargeable Li-ion Battery	
	Battery:	Model No.: BP-N463-11/1500 MX, Supplier: PIONEER CORPORATION

WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power in dBm (Peak)	Rated Power in dBm (EIRP)	Type of Emission	Modulation Technology
802.11b	2412-2462	11	17.59	12.62	13M6G1D	DSSS,
802.11g			23.07	11.16	16M9D1D	OFDM
802.11n HT20			23.44	10.18	17M8D1D	
Antenna Designation:	PCB Antenna, Main Antenna Gain: -2.8 dBi Aux Antenna Gain: -2.8 dBi					
Modulation type:	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM					
Transition Rate:	802.11 b: 1/2/5.5/11 Mbps 802.11 g: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 144.4Mbps					

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance v05

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

RSS-247 issue 2 Feb. 2017

RSS-Gen. issue 5 Apr. 2018

ANSI C63.10:2013

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

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd.,
Guishan District, Taoyuan City, Taiwan 333

(TAF code 0513)

FCC Registration and Designation number are: 735305 / TW0002

Canada Registration Number: 4620A-5

1.4 Special Accessories

There are no special accessories used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

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

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a 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 50uH/50 ohm 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 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.3 Radiated Emissions

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

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2.4 Measurement Results Explanation Example

For all conducted test items:

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

Note:

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

2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration

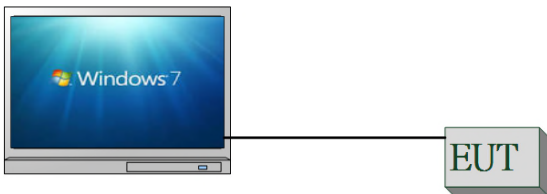


Fig.2-3 Conducted Emission (Antenna Port) Configuration

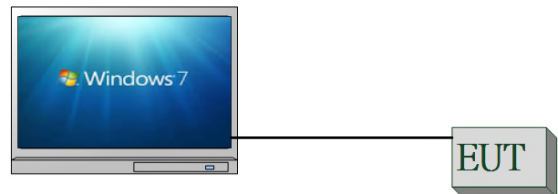


Fig. 2-2 Conducted Emission (AC Power Line) Configuration

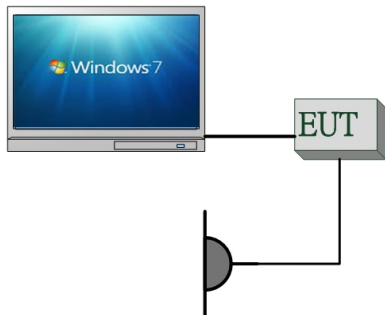


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2	Notebook	Lenovo	L420	S0011721	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	IC Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	RSS-247 §5.4(4)	Peak Output Power	Compliant
§15.247(a)(2)	RSS-247 §5.1 (1) RSS-Gen §6.7	6dB & 99% Emission Bandwidth	Compliant
§15.247(d)	RSS-247 §5.5 RSS-Gen §8.10	Conducted Band Edge and Spurious Emission	Compliant
§15.205 §15.209 §15.247(d)	RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10 RSS-Gen §6.13	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e)	RSS-247 §5.2(2)	Power Spectral Density	Compliant
§15.203 §15.247(b)	RSS- Gen §6.8	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

11 channels are provided for 802.11b, 802.11g and 802.11n_HT20

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

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4.2 The Worst Test Modes and Channel Details

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

RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11g	1 to 11	1,6,11	OFDM	6	Ch0

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	Ch0
802.11g	1 to 11	1, 6, 11	OFDM	6	Ch0
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS 0	Ch0

Note:

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

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11b	1 to 11	1, 6, 11	DSSS	11	Ch0
802.11g	1 to 11	1, 6, 11	OFDM	54	Ch0
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	MCS 8	Ch0

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5 MEASUREMENT UNCERTAINTY

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

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	9kHz-30MHz: +/-2.87dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

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

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

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable

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

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

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

6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LISN	TESEQ	NNB 51	36076	2018/02/14	2019/02/13
EMI Test Receiver	R&S	ESCI	101343	2018/07/31	2019/7/30
Notebook	Lenovo	L420	S0012467	N/A	N/A

6.3 EUT Setup

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

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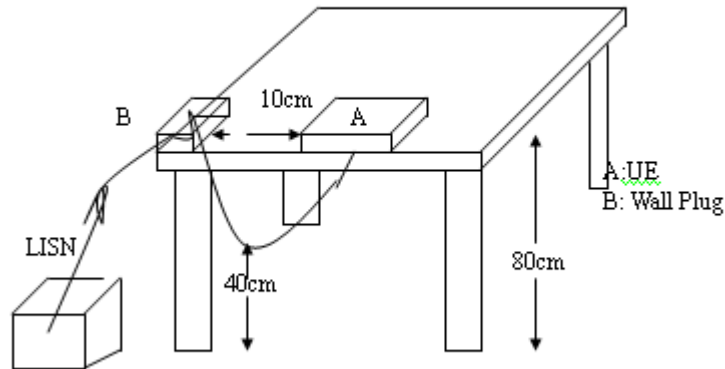
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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure

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

6.6 Measurement Result

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

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

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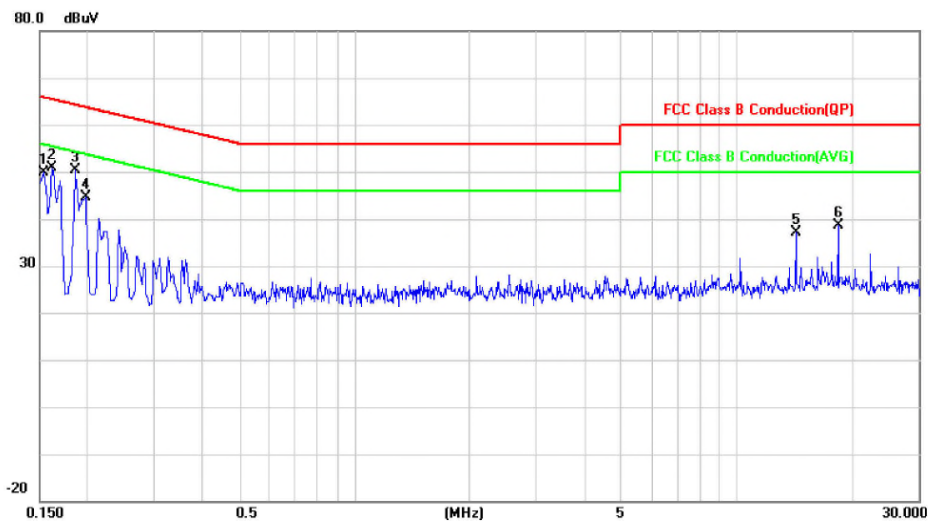
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Site : Conduction Room	Phase: L1	Temperature: 23 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 64 %
Mode:		
Note:		

Conducted Emission

File :Conduction Data :#1116 Date: 2018/10/23 Time: 下午 11:20:41



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1540	30.34	19.65	49.99	65.78	-15.79	peak	
2		0.1620	31.12	19.66	50.78	65.36	-14.58	peak	
3	*	0.1860	30.79	19.70	50.49	64.21	-13.72	peak	
4		0.1980	24.82	19.72	44.54	63.69	-19.15	peak	
5		14.3380	17.17	19.99	37.16	60.00	-22.84	peak	
6		18.4340	18.47	20.04	38.51	60.00	-21.49	peak	

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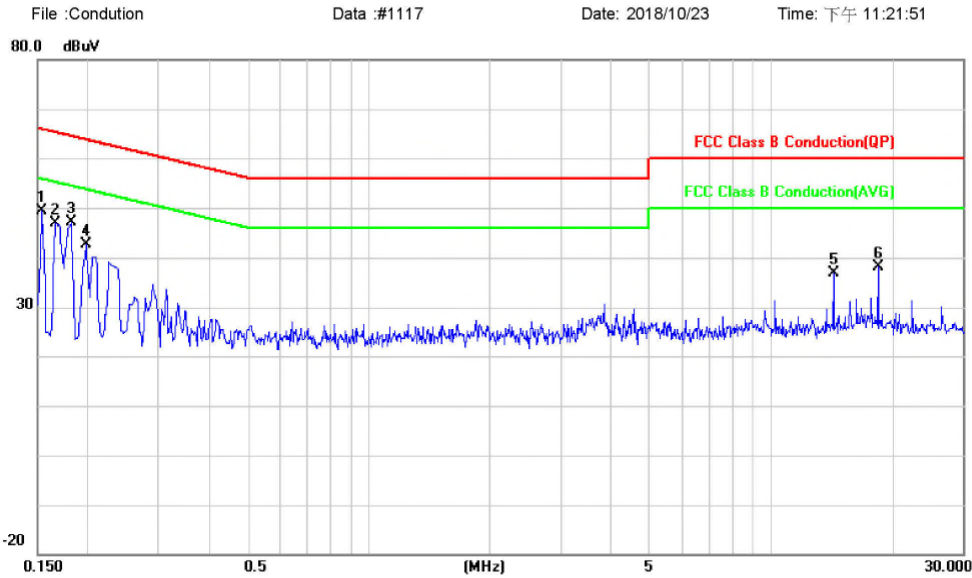
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Site : Conduction Room Phase: **N** Temperature: 23 °C
 Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 64 %
 Mode:
 Note:

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1540	29.82	19.65	49.47	65.78	-16.31	peak	
2		0.1660	27.30	19.66	46.96	65.16	-18.20	peak	
3		0.1820	27.48	19.69	47.17	64.39	-17.22	peak	
4		0.1980	22.86	19.72	42.58	63.69	-21.11	peak	
5		14.3380	16.89	19.99	36.88	60.00	-23.12	peak	
6		18.4340	18.13	20.04	38.17	60.00	-21.83	peak	

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7 DUTY CYCLE OF TEST SIGNAL

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

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

Formula:

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

Measurement Procedure:

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

Duty Cycle:

	Duty Cycle (%)	Duty Factor (dB)	1/T (kHz)	VBW setting (kHz)
802.11b	98.75	0.05	0.12	0.01
802.11g	92.89	0.32	0.72	1.00
802.11n_20	92.20	0.35	0.78	1.00

$$b = 98.75\%, g = 92.89\%, n_{ht_20} = 92.2\%$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.9875) = 0.05$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.9289) = 0.32$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.922) = 0.35$$

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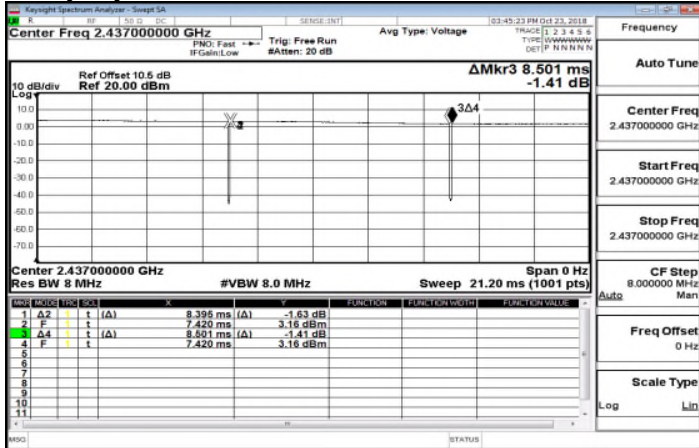
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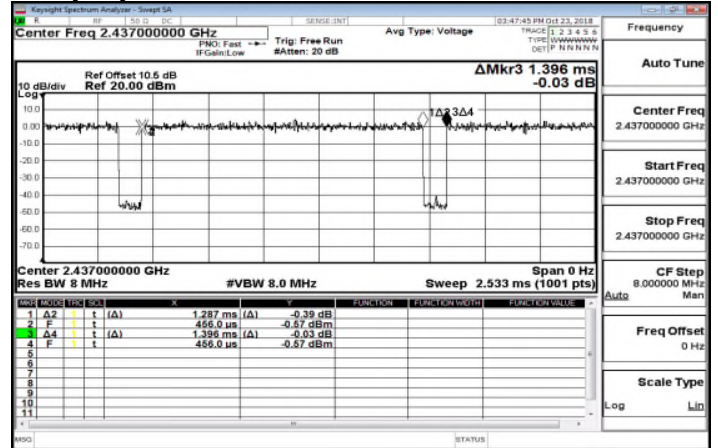
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7.1 DUTY CYCLE TEST SIGNAL Measurement Result

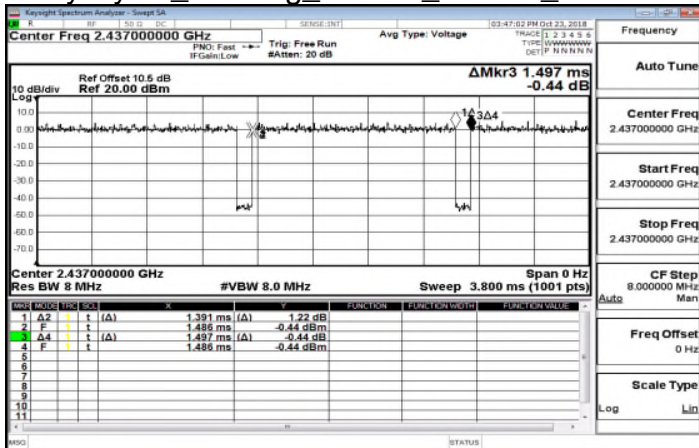
Duty Cycle 802.11b_20MHz_Chain0_2437MHz



Duty Cycle 802.11n_20MHz_Chain0_2437MHz



Duty Cycle 802.11g_20MHz_Chain0_2437MHz



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8 PEAK OUTPUT POWER MEASUREMENT

8.1 Standard Applicable

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

Per RSS-247 §5.4(4)

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

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.

As per FCC KDB 662911 D01

Unequal antenna gains, with equal transmit powers. For antenna gains given by G_1, G_2, \dots, G_N dBi.

(i) If transmit signals are correlated, then Directional gain
= $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$ dBi

[Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

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

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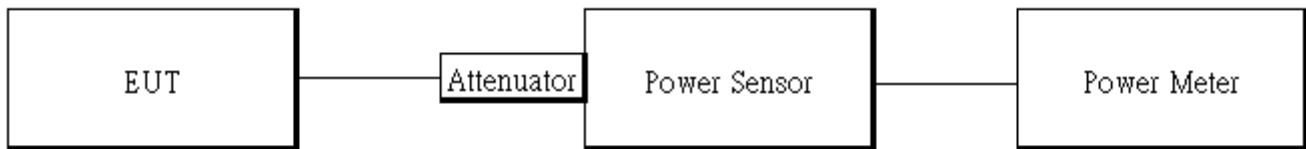
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8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1326001	2018/08/09	2019/08/02
Power Sensor	Anritsu	MA2411B	1315048	2018/08/09	2019/08/02
Power Sensor	Anritsu	MA2411B	1315049	2018/08/09	2019/08/02
Attenuator	Marvelous	MVE2213-10	RF31	2017/12/26	2018/12/25
Notebook	Lenovo	L420	S0011721	N/A	N/A

8.3 Test Set-up

Power Meter:



8.4 Measurement Procedure

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

Power Meter:

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

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

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8.5 Measurement Result

Antenna Chain 0

802.11b Ch0					
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit	RESULT
1	2412	1	17.45	1 Watt = 30.00 dBm	PASS
6	2437	1	17.54	1 Watt = 30.00 dBm	PASS
11	2462	1	17.59	1 Watt = 30.00 dBm	PASS
802.11b Ch0					
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit	RESULT
1	2412	1	15.28	1 Watt = 30.00 dBm	PASS
6	2437	1	15.41	1 Watt = 30.00 dBm	PASS
11	2462	1	15.42	1 Watt = 30.00 dBm	PASS
802.11g Ch0					
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit	RESULT
1	2412	6	23.07	1 Watt = 30.00 dBm	PASS
6	2437	6	22.93	1 Watt = 30.00 dBm	PASS
11	2462	6	22.96	1 Watt = 30.00 dBm	PASS
802.11g Ch0					
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit	RESULT
1	2412	6	13.96	1 Watt = 30.00 dBm	PASS
6	2437	6	13.70	1 Watt = 30.00 dBm	PASS
11	2462	6	13.76	1 Watt = 30.00 dBm	PASS

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802.11n_HT20M Ch0					
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Limit	RESULT
1	2412	MCS0	23.44	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	22.66	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	22.71	1 Watt = 30.00 dBm	PASS
802.11n_HT20M Ch0					
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Limit	RESULT
1	2412	MCS0	12.98	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	12.56	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	12.58	1 Watt = 30.00 dBm	PASS

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

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**EIRP
Antenna Chain 0**

802.11b Ch0								
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit		RESULT
1	2412	1	15.28	-2.80	12.48	4W=	36 dBm	PASS
6	2437	1	15.41	-2.80	12.61	4W=	36 dBm	PASS
11	2462	1	15.42	-2.80	12.62	4W=	36 dBm	PASS
802.11g Ch0								
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit		RESULT
1	2412	6	13.96	-2.80	11.16	4W=	36 dBm	PASS
6	2437	6	13.70	-2.80	10.90	4W=	36 dBm	PASS
11	2462	6	13.76	-2.80	10.96	4W=	36 dBm	PASS
802.11n_HT20M Ch0								
CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit		RESULT
1	2412	MCS0	12.98	-2.80	10.18	4W=	36 dBm	PASS
6	2437	MCS0	12.56	-2.80	9.76	4W=	36 dBm	PASS
11	2462	MCS0	12.58	-2.80	9.78	4W=	36 dBm	PASS

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

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9 6DB & 99% BANDWIDTH MEASUREMENT

9.1 Standard Applicable

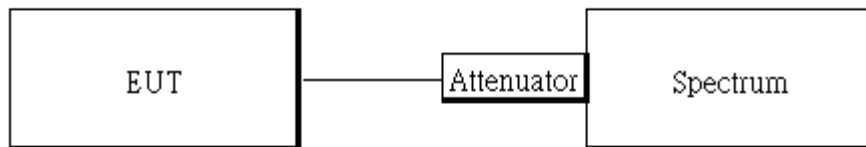
The minimum 6 dB bandwidth shall be at least 500 kHz.

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs

9.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY51440113	2018/06/20	2019/06/19
Attenuator	Marvelous	MVE2213-10	RF31	2017/12/26	2018/12/25
DC Block	PASTERNAK	PE8210	RF81	2017/12/26	2018/12/25
Notebook	Lenovo	L420	S0011721	N/A	N/A

9.3 Test Set-up



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9.4 Measurement Procedure

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

9.5 Measurement Result

6dB Bandwidth

Antenna Chain 0

802.11b Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	9071.00	> 500	PASS
2437	9071.30	> 500	PASS
2462	9070.10	> 500	PASS

802.11g Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	15176.00	> 500	PASS
2437	15355.00	> 500	PASS
2462	15175.00	> 500	PASS

802.11 n HT20 Ch0

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	15176.00	> 500	PASS
2437	16285.00	> 500	PASS
2462	15489.00	> 500	PASS

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99% Bandwidth Antenna Chain 0

802.11b Ch0	
Freq. (MHz)	99% BW (MHz)
2412	13.573
2437	13.621
2462	13.542

802.11g Ch0	
Freq. (MHz)	99% BW (MHz)
2412	16.946
2437	16.941
2462	16.925

802.11n HT20M Ch0	
Freq. (MHz)	99% BW (MHz)
2412	17.772
2437	17.751
2462	17.746

**Refer to next page for plots*

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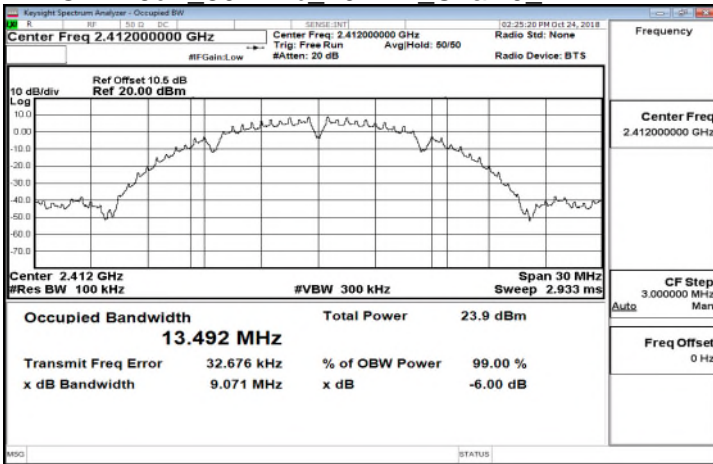
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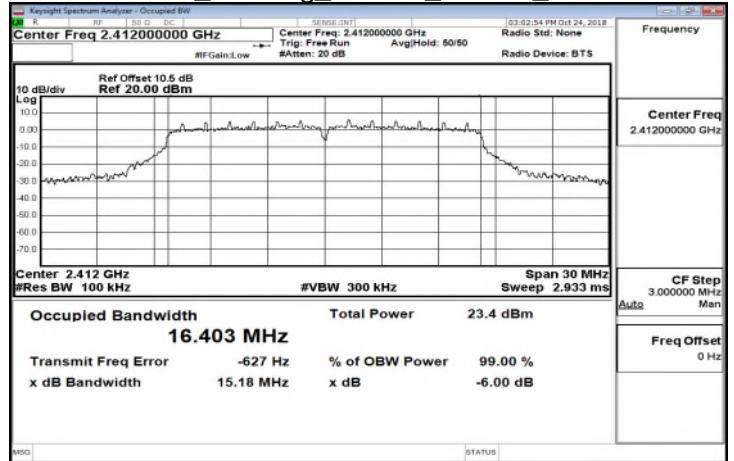
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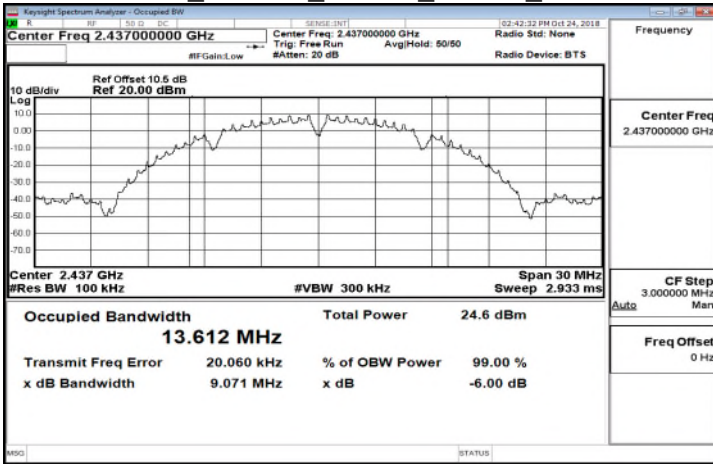
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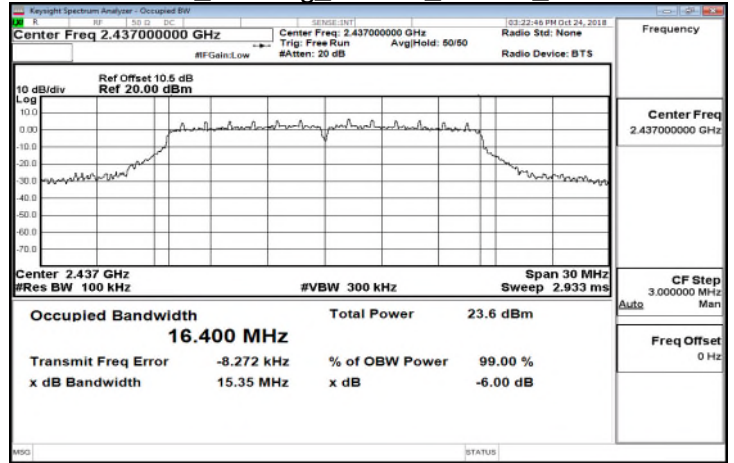
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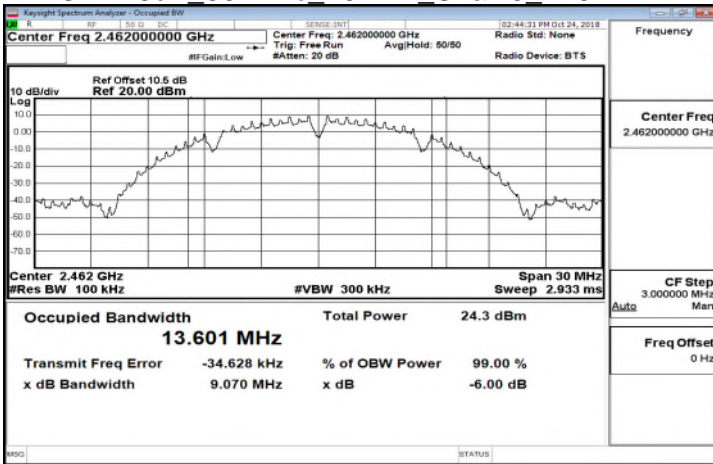
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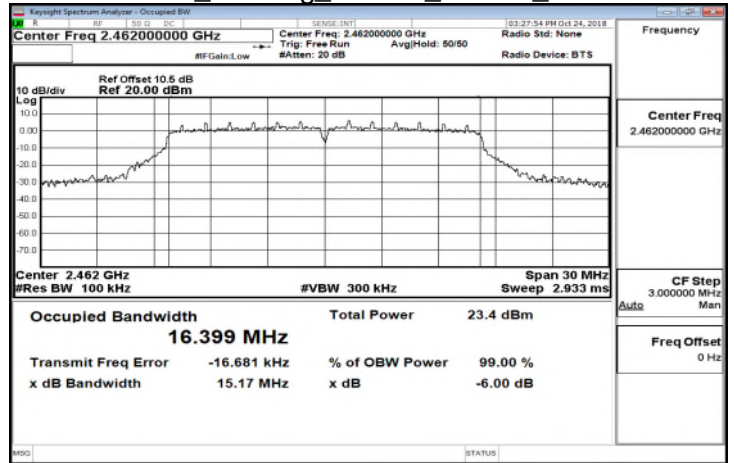
OBW 6dB 802.11g 20MHz Chain0 2437MHz



OBW 6dB 802.11b 20MHz Chain0 2462MHz



OBW 6dB 802.11g 20MHz Chain0 2462MHz

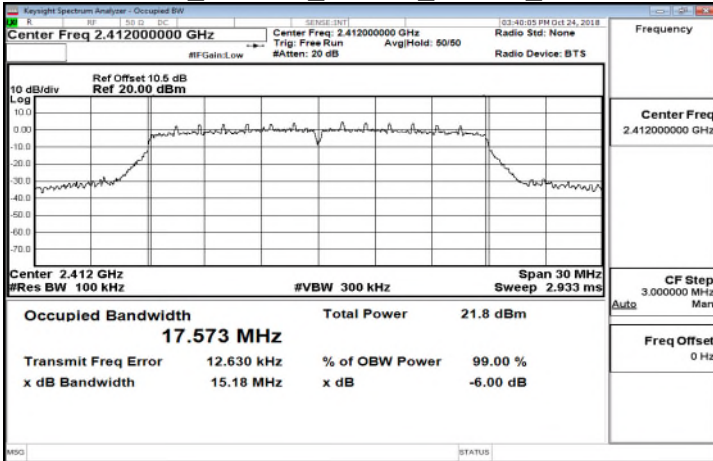


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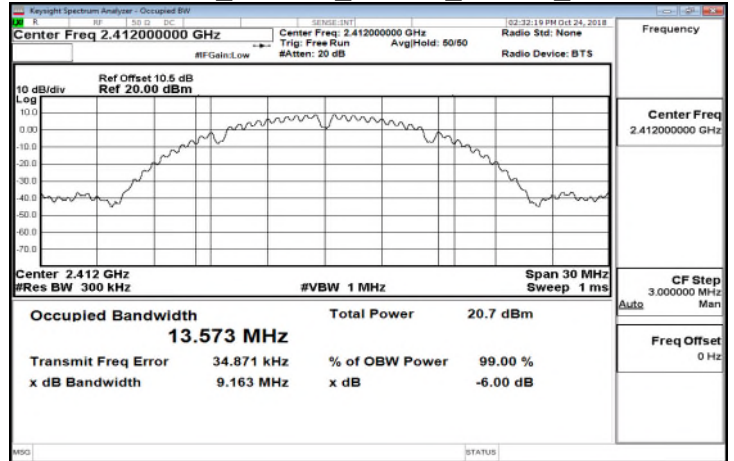
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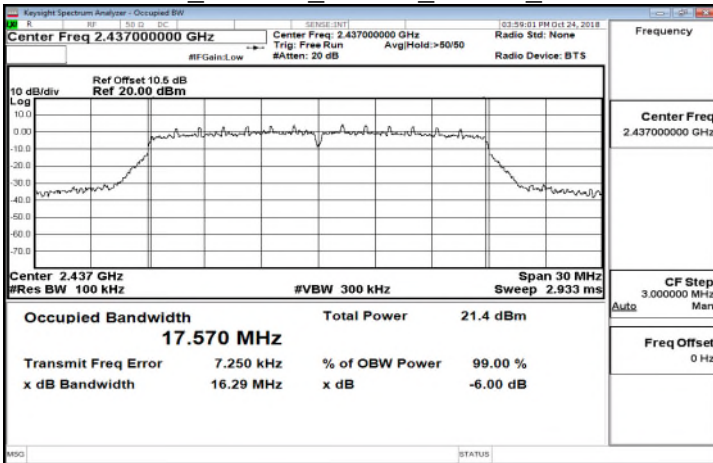
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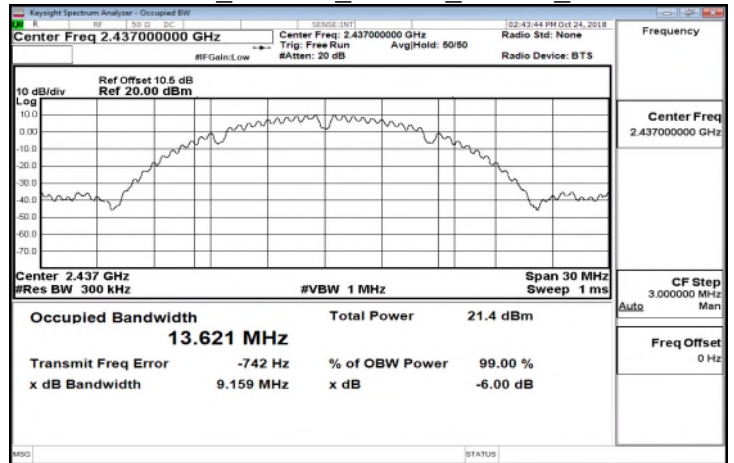
IC OBW 99% 802.11b_20MHz_Chain0_2412MHz



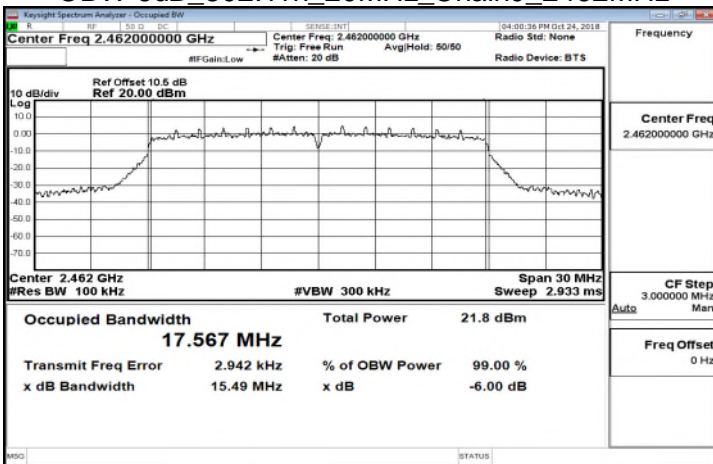
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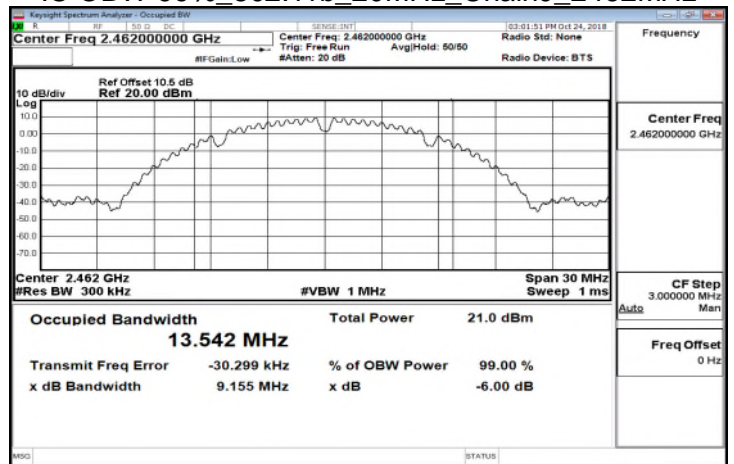
IC OBW 99% 802.11b_20MHz_Chain0_2437MHz



OBW 6dB 802.11n_20MHz_Chain0_2462MHz



IC OBW 99% 802.11b_20MHz_Chain0_2462MHz



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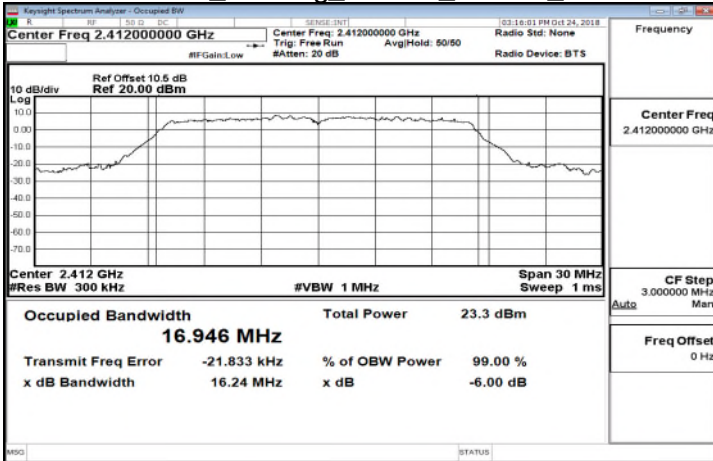
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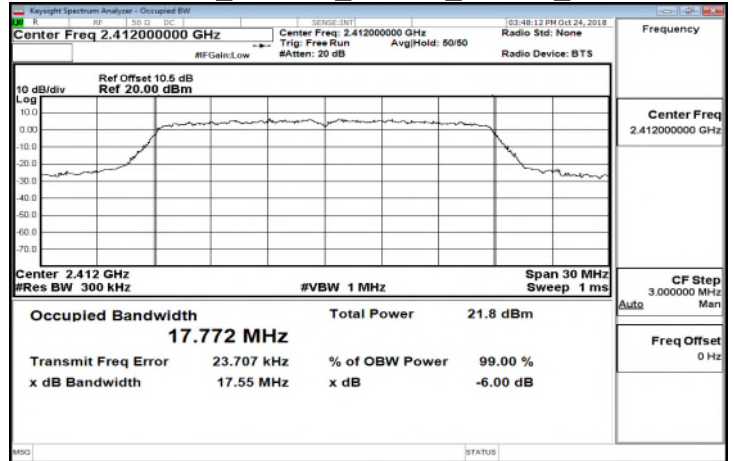
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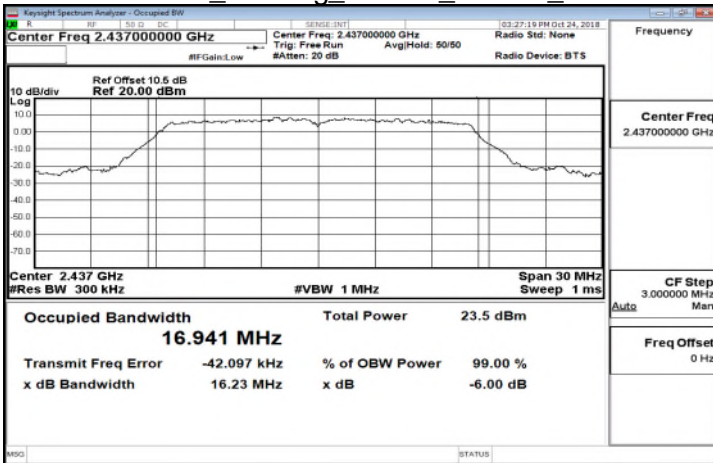
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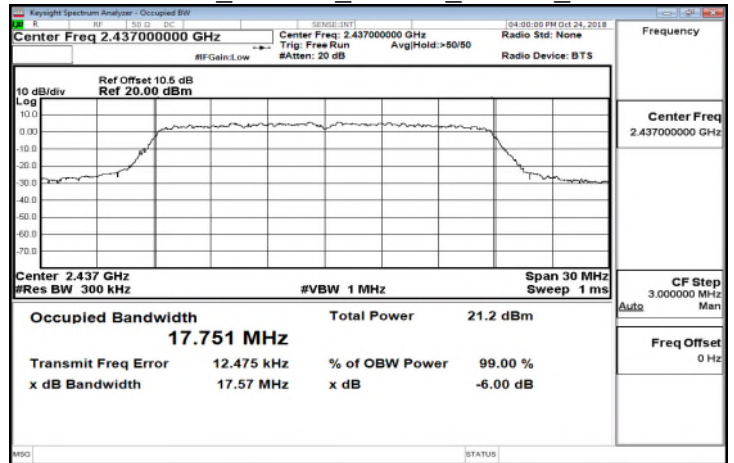
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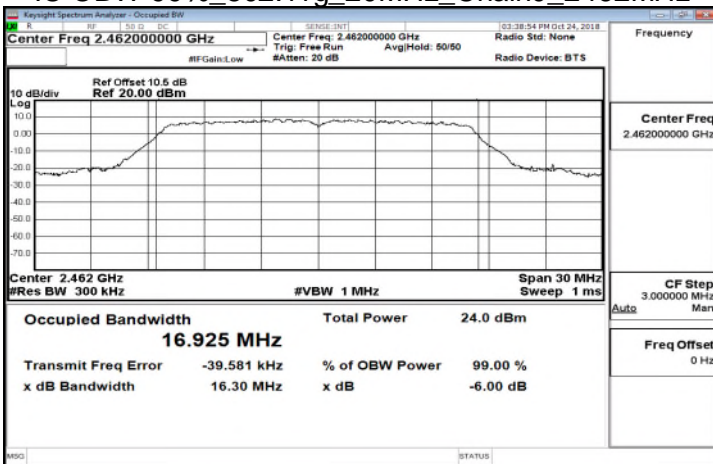
IC OBW 99%_802.11g_20MHz_Chain0_2437MHz



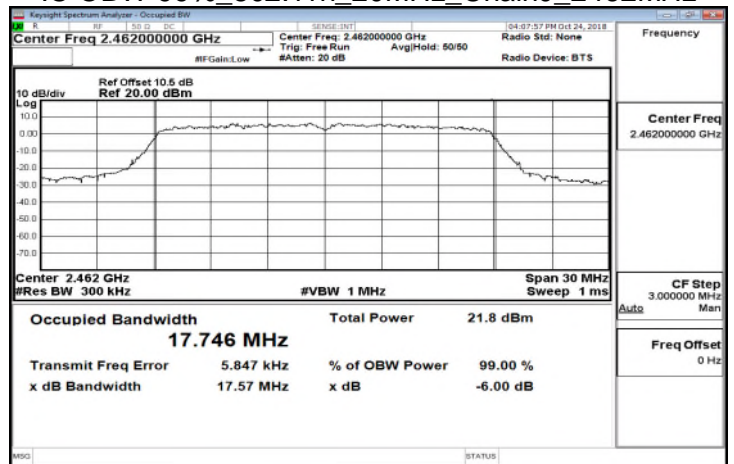
IC OBW 99%_802.11n_20MHz_Chain0_2437MHz



IC OBW 99%_802.11g_20MHz_Chain0_2462MHz



IC OBW 99%_802.11n_20MHz_Chain0_2462MHz



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10 CONDUCTED BAND EDGE AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

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

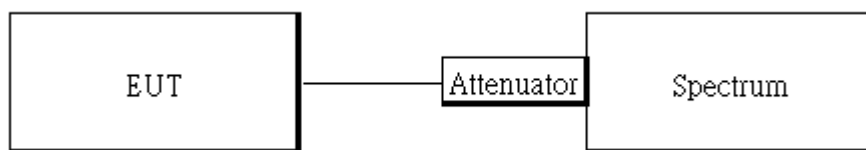
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) & RSS-Gen §8.10, must also comply with the radiated emission limits specified in §15.209(a) & RSS-Gen §8.9.

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(d), 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	N9010A	MY5144011 3	2018/06/20	2019/06/19
Attenuator	Marvelous	MVE2213-10	RF31	2017/12/26	2018/12/25
DC Block	PASTERNAK	PE8210	RF81	2017/12/26	2018/12/25

10.3 Test SET-UP



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10.4 Measurement Procedure

Conducted Band Edge Limit

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance & ANSI C63.10.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 100kHz & VBW = 300 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

Conducted Band Edge:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance & ANSI C63.10.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Mark the highest reading of the emission as the reference level measurement.
7. Set DL as the limit = reading on marker 1 – 20dBm
8. Marker on frequency, 2.3999GHz and 2.4836GHz, and examine shall 100 kHz immediately outside the authorized (2400~2483.5) be attenuated by 20dB at least relative to the maximum emission of power.
9. Repeat above procedures until all default test channel (low, middle, and high) was complete.

Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance & ANSI C63.10.
3. Set RBW = 100 kHz & VBW= 300 kHz, Detector =Peak, Sweep = Auto.
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

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10.5 Measurement Result

Reference Level of Limit 802.11b mode			Reference Level of Limit 802.11g mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)	Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	8.70	-11.30	2412	6.14	-13.86
2437	9.31	-10.69	2437	6.18	-13.82
2462	9.63	-10.37	2462	6.33	-13.67

Reference Level of Limit 802.11n20 mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	4.52	-15.48
2437	4.83	-15.17
2462	4.75	-15.25

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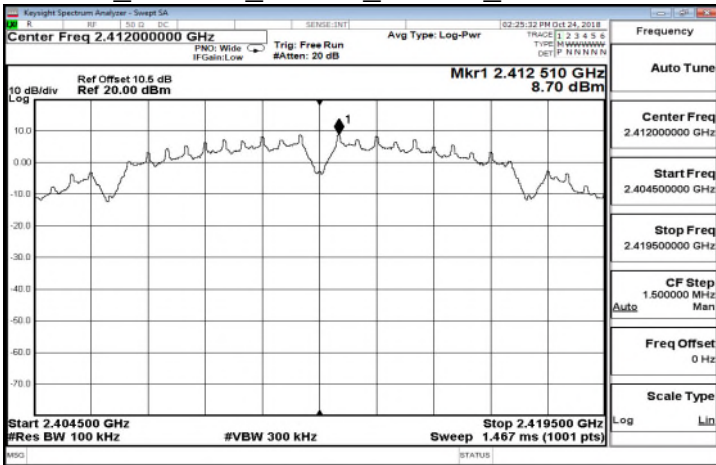
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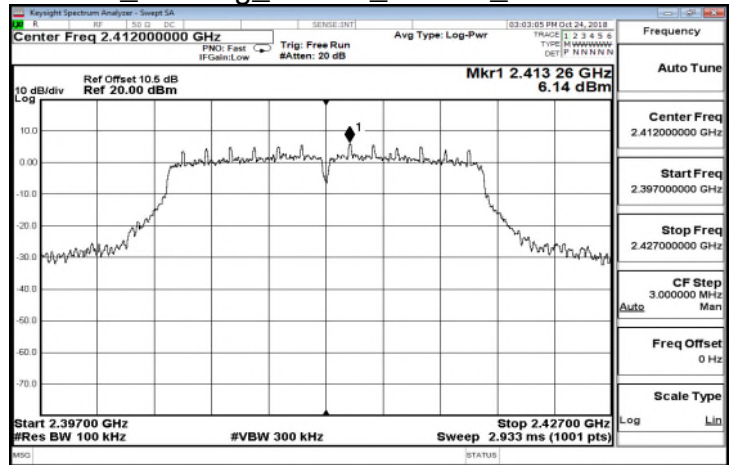
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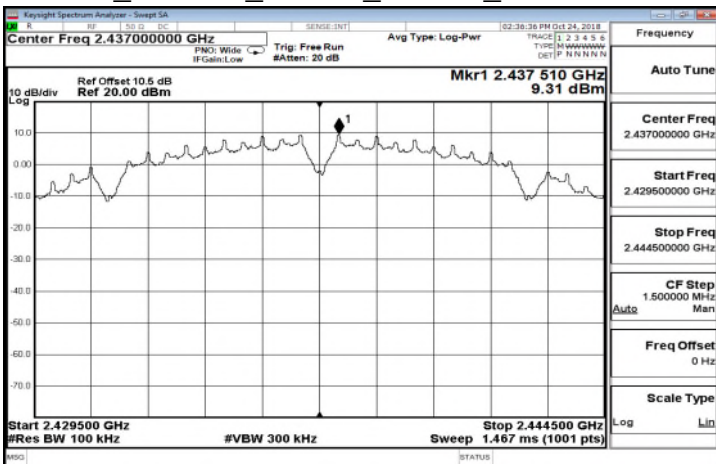
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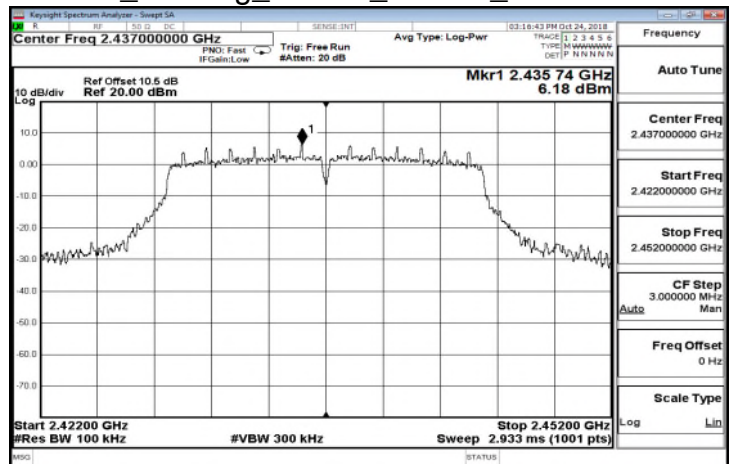
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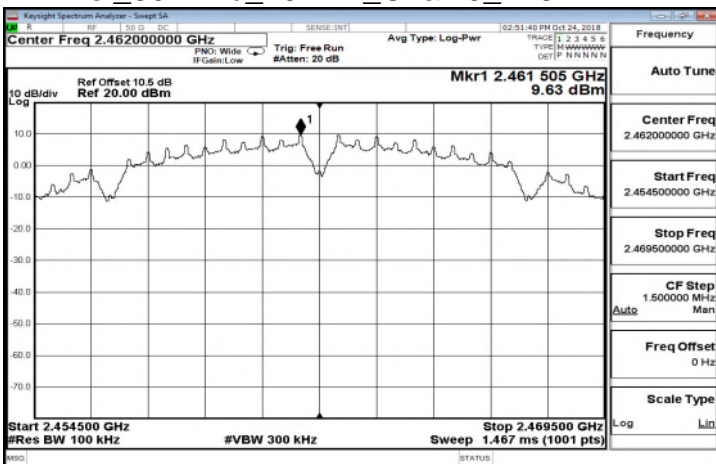
Reference Lev-
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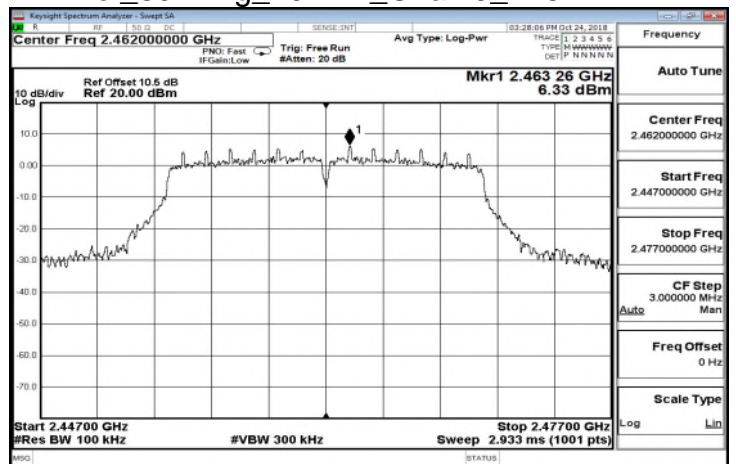
Reference Lev-
el_802.11g_20MHz_Chain0_2437MHz



Reference Lev-
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Reference Lev-
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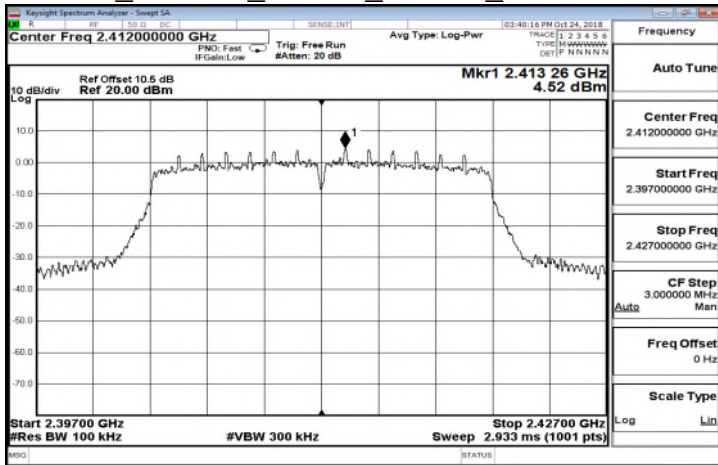


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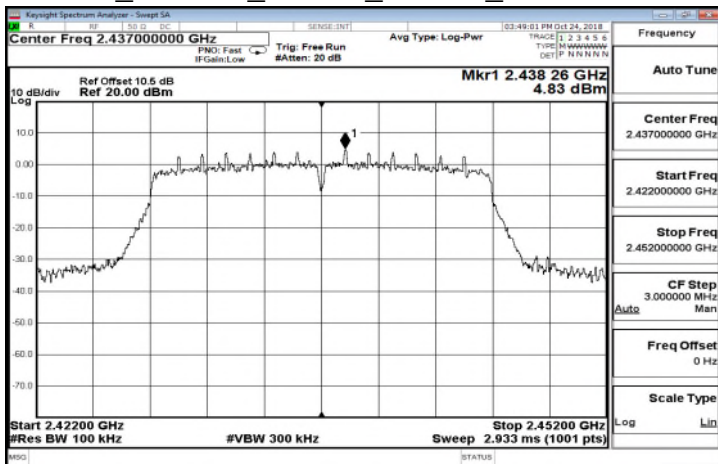
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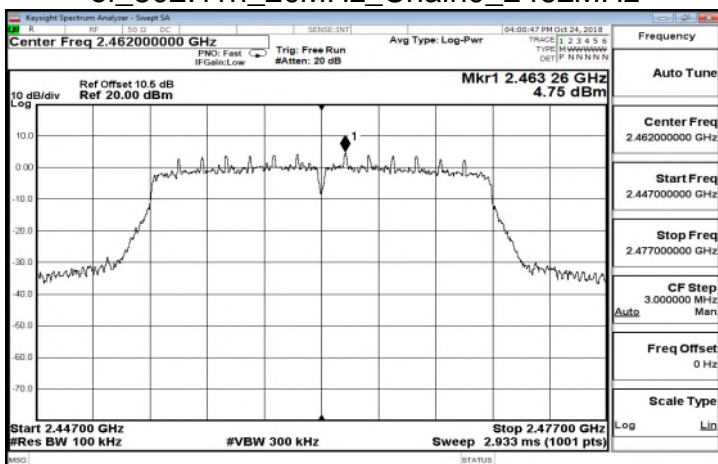
Reference Lev-
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Reference Lev-
el_802.11n_20MHz_Chain0_2437MHz



Reference Lev-
el_802.11n_20MHz_Chain0_2462MHz

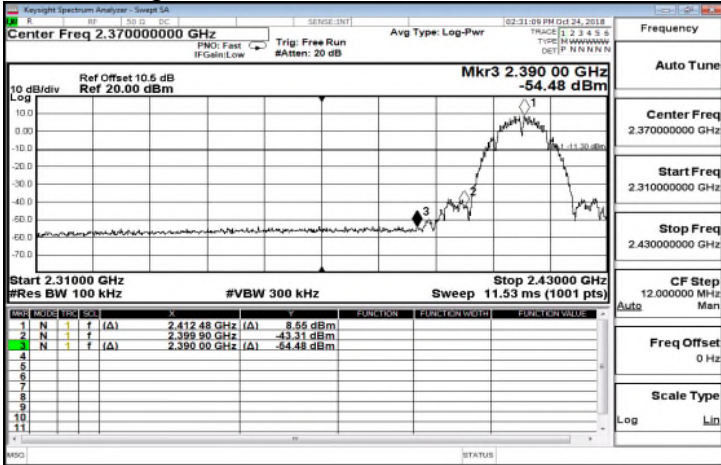


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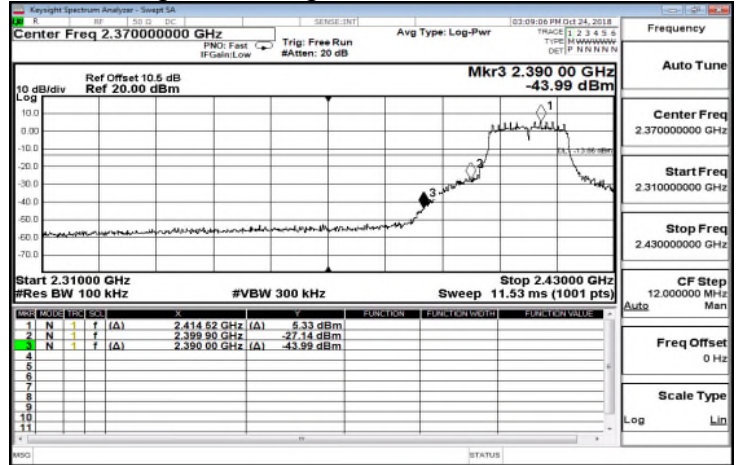
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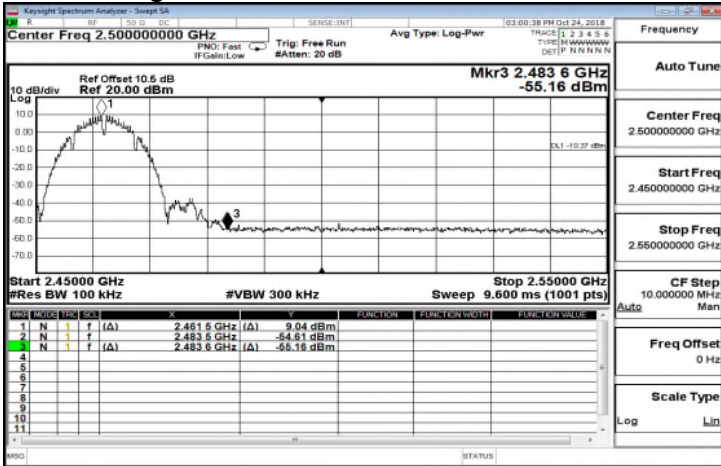
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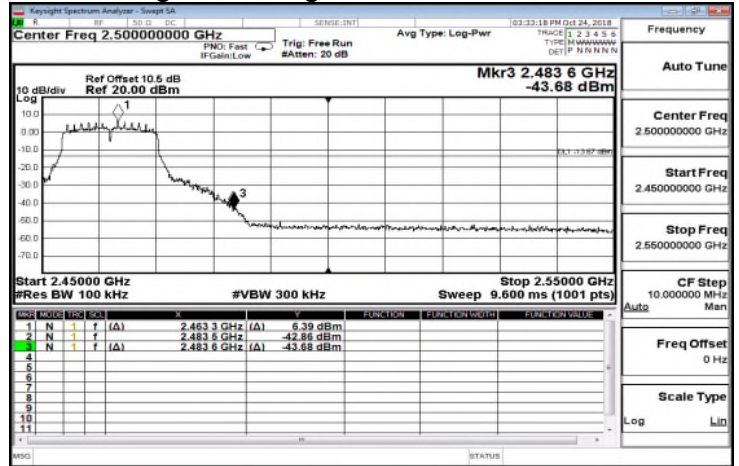
Band Edge_802.11g_20MHz_Chain0_2412MHz



Band Edge_802.11b_20MHz_Chain0_2462MHz



Band Edge_802.11g_20MHz_Chain0_2462MHz

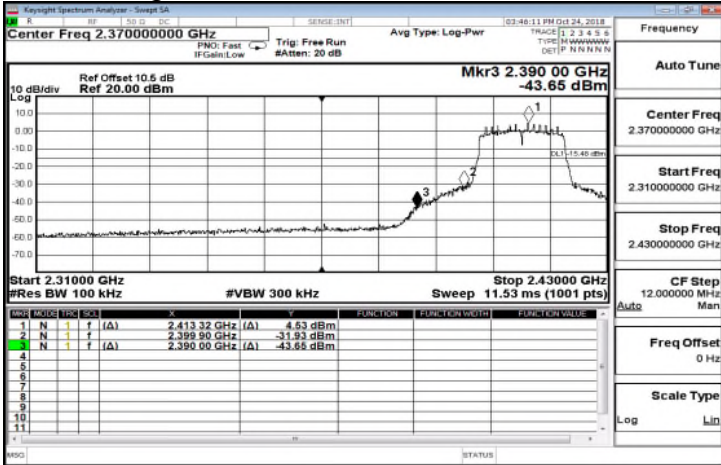


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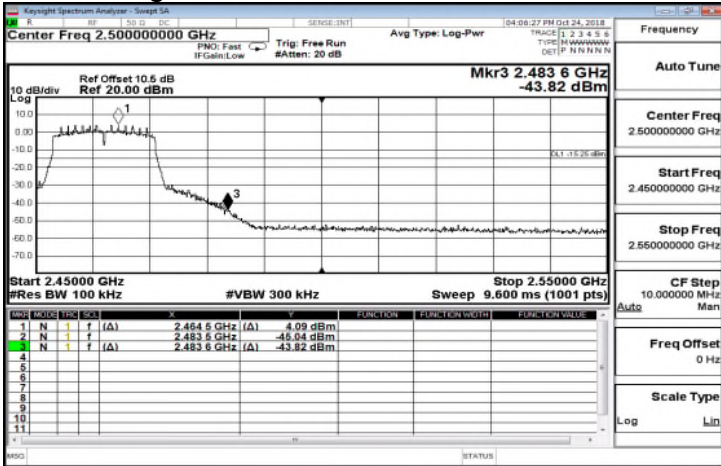
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Band Edge_802.11n_20MHz_Chain0_2412MHz



Band Edge_802.11n_20MHz_Chain0_2462MHz

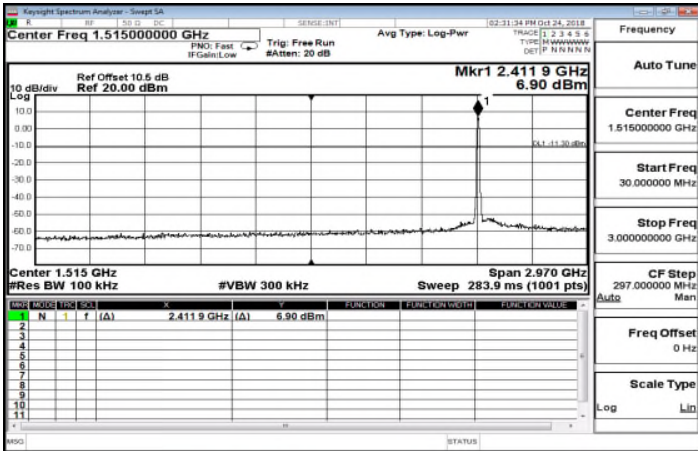


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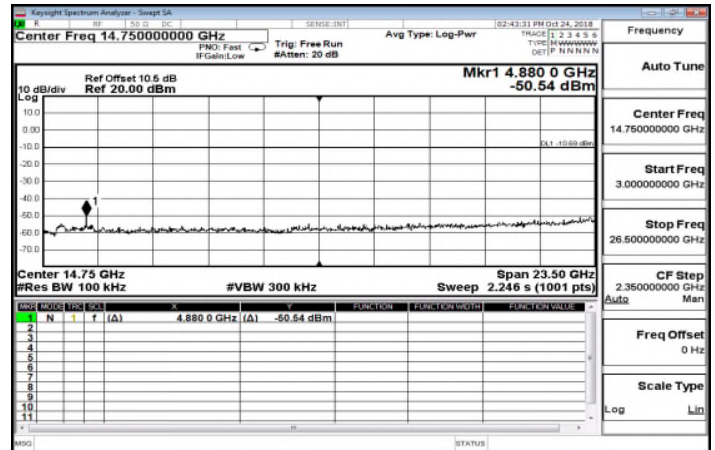
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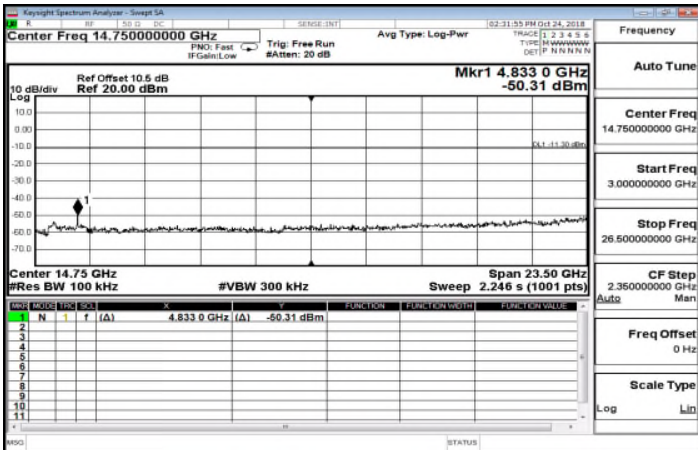
Spurious Emission_802.11b_CH-Low 30MHz – 3GHz



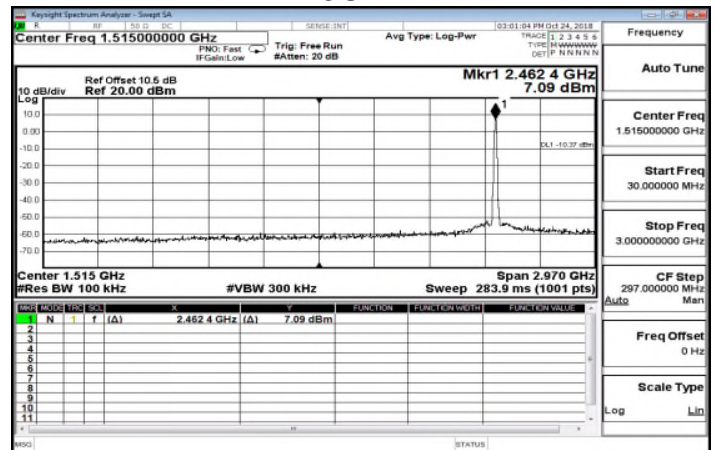
Spurious Emission_802.11b_CH-Mid 3GHz – 26.5GHz



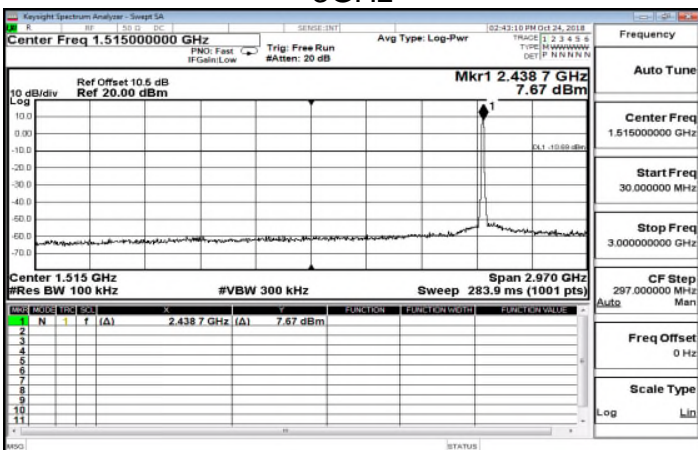
Spurious Emission_802.11b_CH-Low 30MHz – 26.5GHz



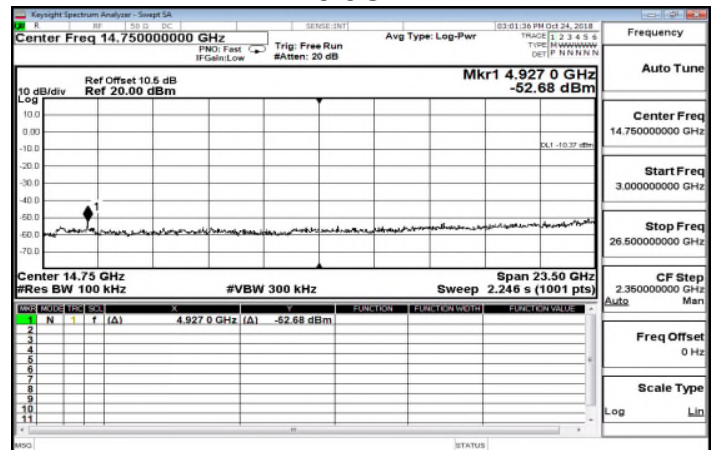
Spurious Emission_802.11b_CH-High 30MHz – 3GHz



Spurious Emission_802.11b_CH-Mid 30MHz – 3GHz



Spurious Emission_802.11b_CH-High 30MHz – 26.5GHz

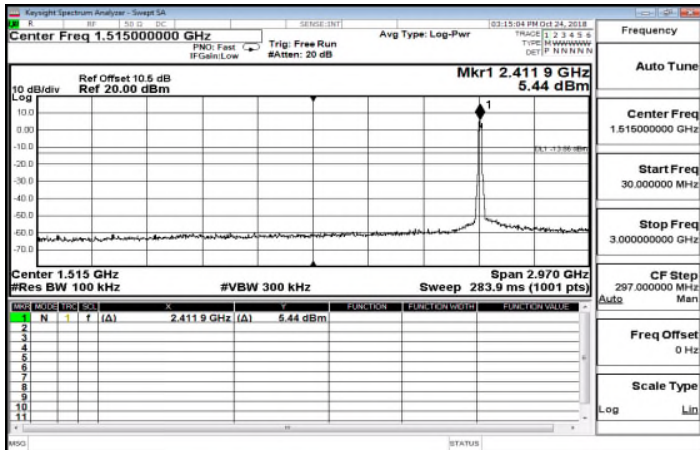


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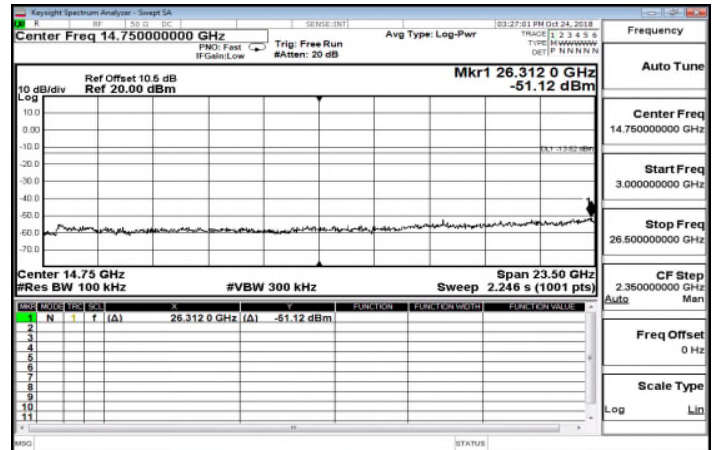
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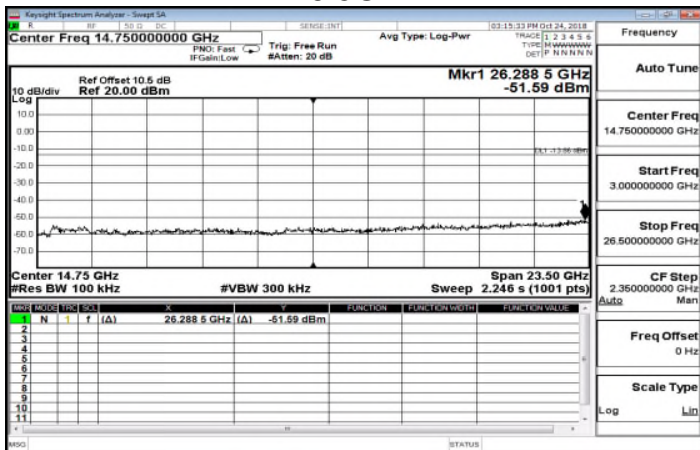
Spurious Emission_802.11g_CH-Low 30MHz – 3GHz



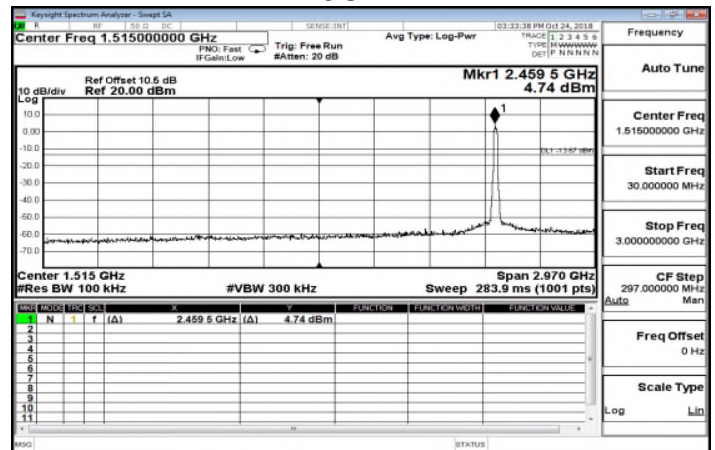
Spurious Emission_802.11g_CH-Mid 3GHz – 26.5GHz



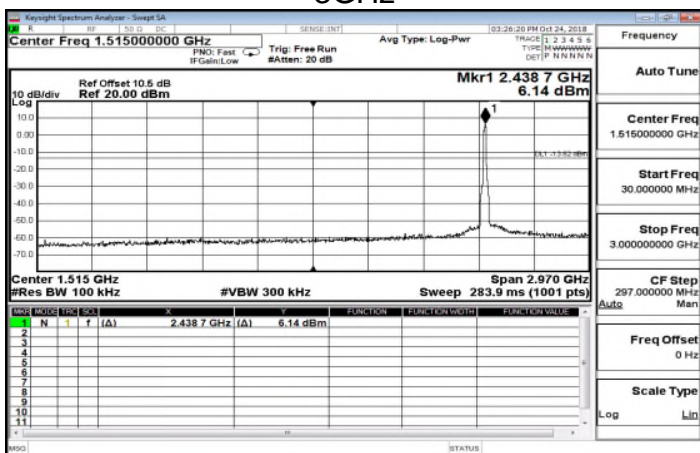
Spurious Emission_802.11g_CH-Low 30MHz – 26.5GHz



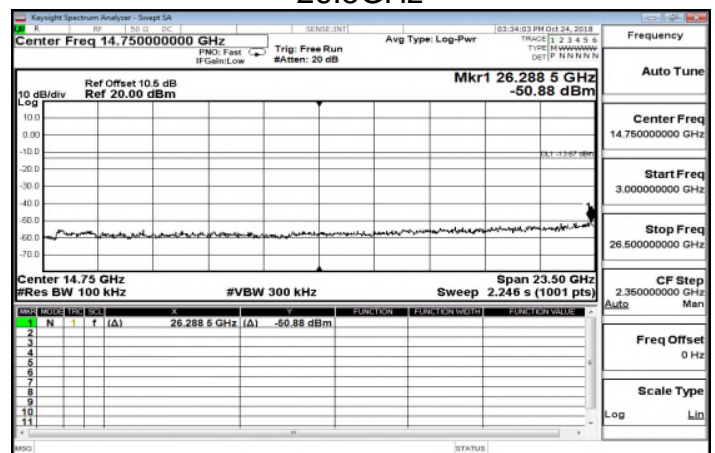
Spurious Emission_802.11g_CH-High 30MHz – 3GHz



Spurious Emission_802.11g_CH-Mid 30MHz – 3GHz



Spurious Emission_802.11g_CH-High 30MHz – 26.5GHz

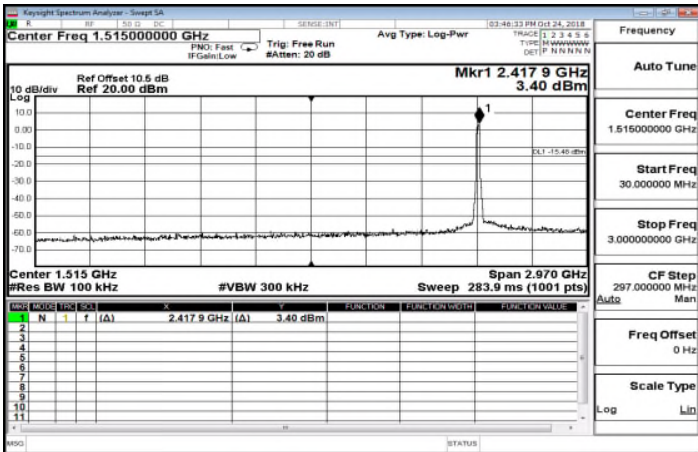


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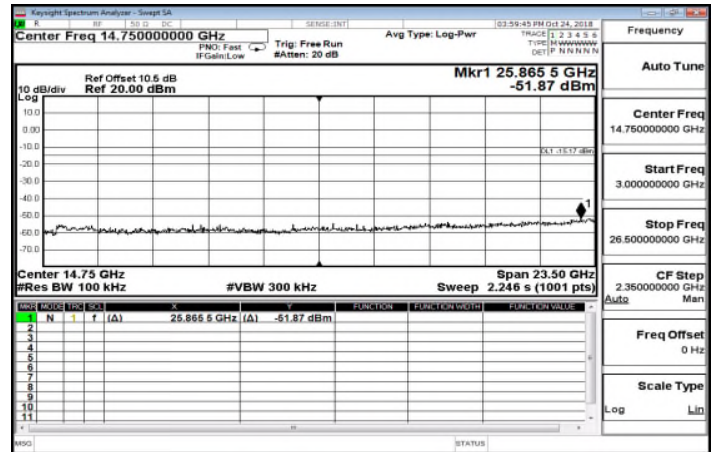
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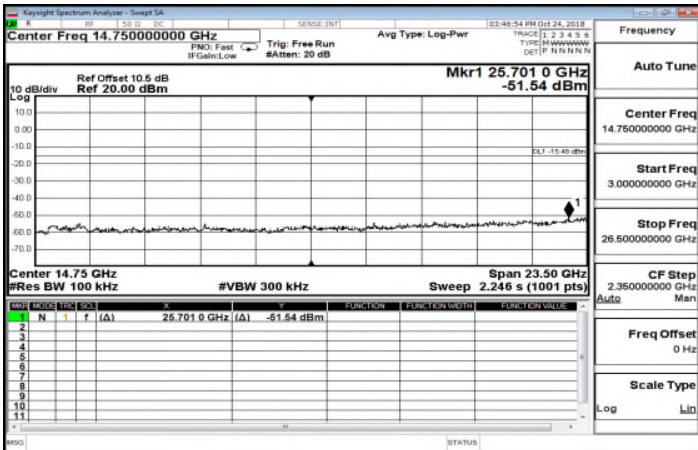
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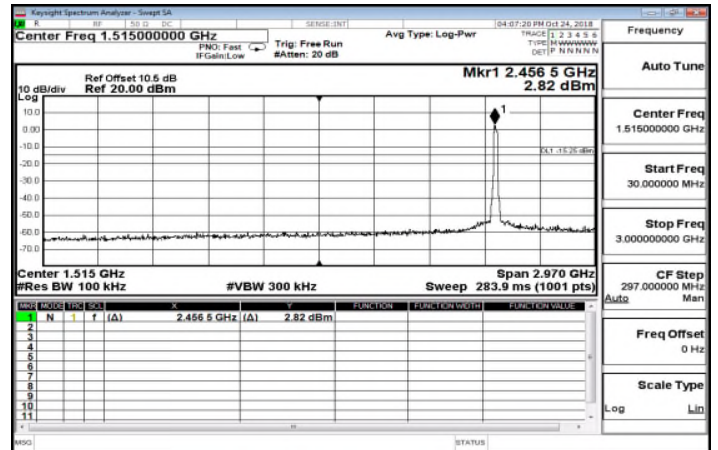
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3GHz – 26.5GHz



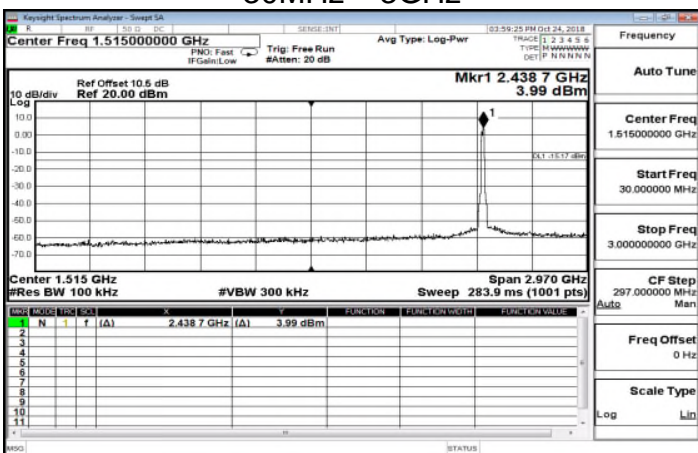
Spurious Emission_802.11n_20MHz_CH-Low
3GHz – 26.5GHz



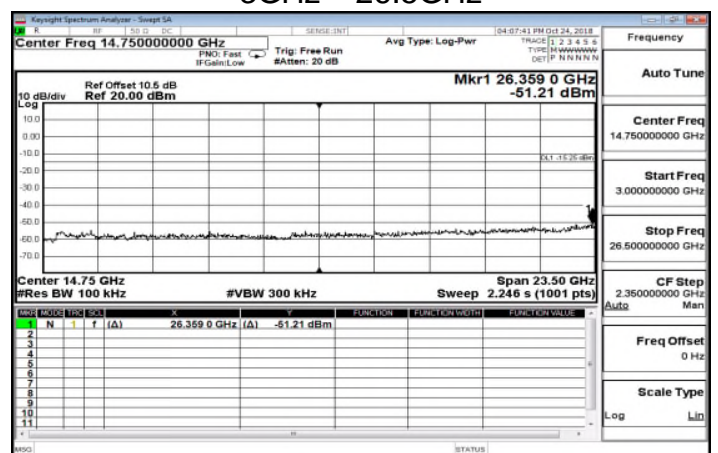
Spurious Emission_802.11n_20MHz_CH-High
30MHz – 3GHz



Spurious Emission_802.11n_20MHz_CH-Mid
30MHz – 3GHz



Spurious Emission_802.11n_20MHz_CH-High
3GHz – 26.5GHz



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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 RSS-Gen §8.10 Table 7.

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

According to RSS-Gen §8.9 Table 5 & 6 Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission

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

Note:

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

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11.2 Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWAZBECK	VULB 9168	9168-617	2017/10/27	2018/10/26
Horn Antenna	Schwarzbeck	BBHA9120D	1341	2018/06/07	2019/06/06
Horn Antenna	SCHWAZBECK	BBHA9170	184	2017/12/12	2018/12/11
Loop Antenna	ETS.LINDGREN	6502	148045	2018/04/19	2019/04/18
3m Site NSA	SGS	966 chamber D	N/A	2018/07/06	2019/07/05
EMI Test Receiver	R&S	ESU 40	100363	2018/04/11	2019/04/10
Pre-Amplifier	EMC Instruments	EMC184045B	980135	2017/10/27	2018/10/26
Pre-Amplifier	EMC Instruments	EMC9135	980234	2017/12/26	2018/12/25
Pre-Amplifier	EMC Instruments	EMC12630SE	980271	2017/12/26	2018/12/25
Attenuator	Marvelous	WATT-218FS-10	RF246	2017/12/26	2018/12/25
Highpass Filter	Micro Tronics	BRM50701-01	G008	2017/12/26	2018/12/25
Coaxial Cable	Huber Suhner	EMC106-SM-SM-7200	150703	2017/12/26	2018/12/25
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	2017/12/26	2018/12/25
Notebook	Lenovo	L420	S0012467	N/A	N/A

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

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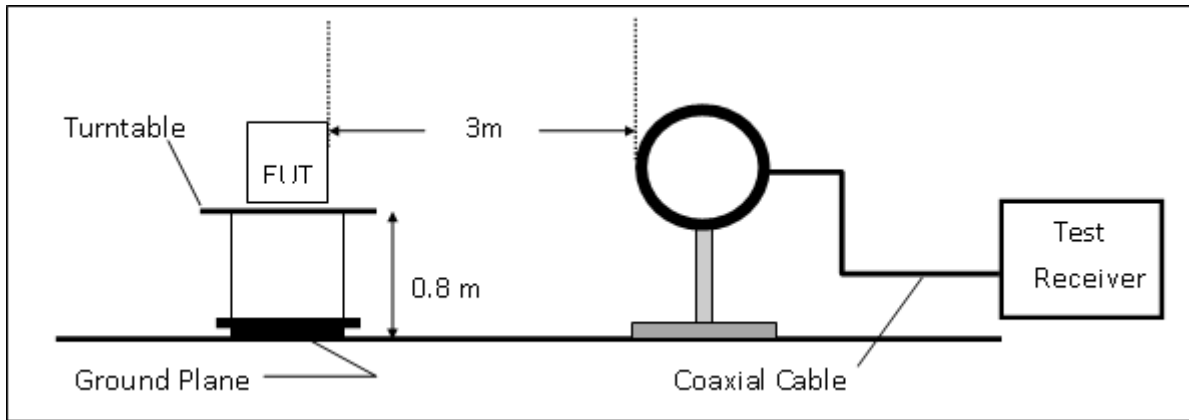
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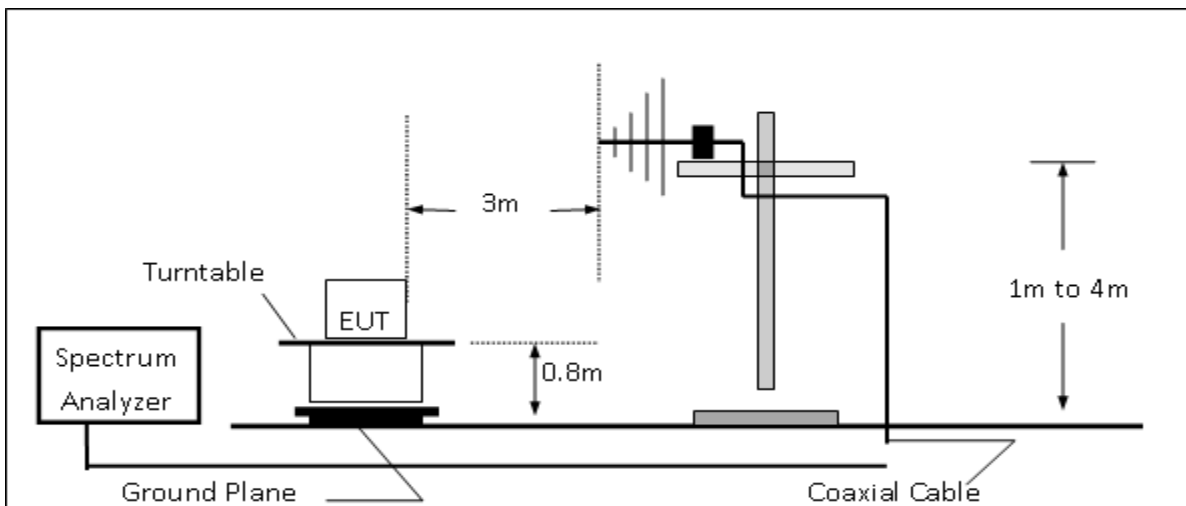
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11.3 Test SET-UP

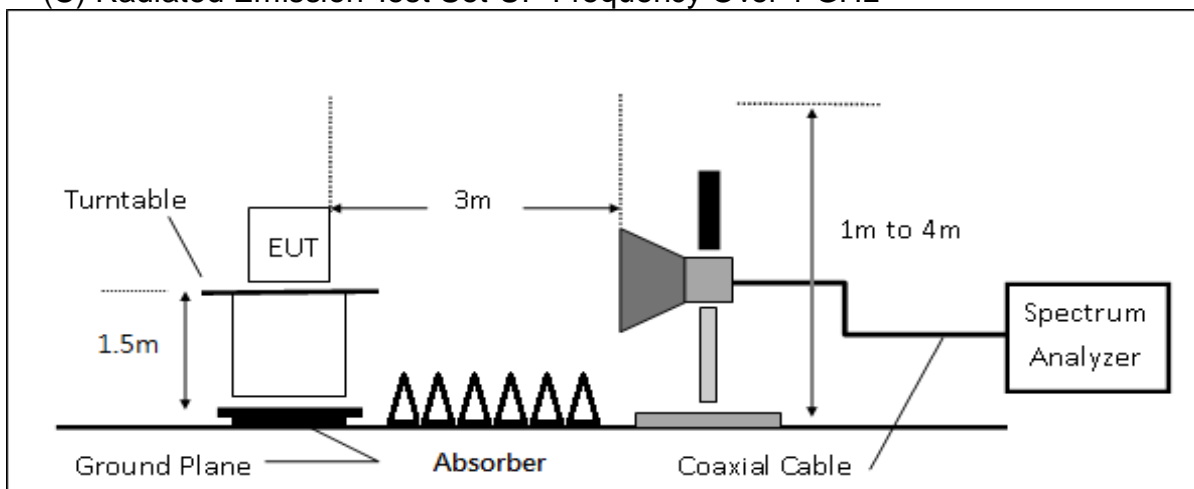
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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11.4 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance & ANSI C63.10.
2. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
6. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
9. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
12. Repeat above procedures until all default test channel measured were complete.

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11.5 Field Strength Calculation

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

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

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

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

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

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

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

11.7 Measurement Result

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

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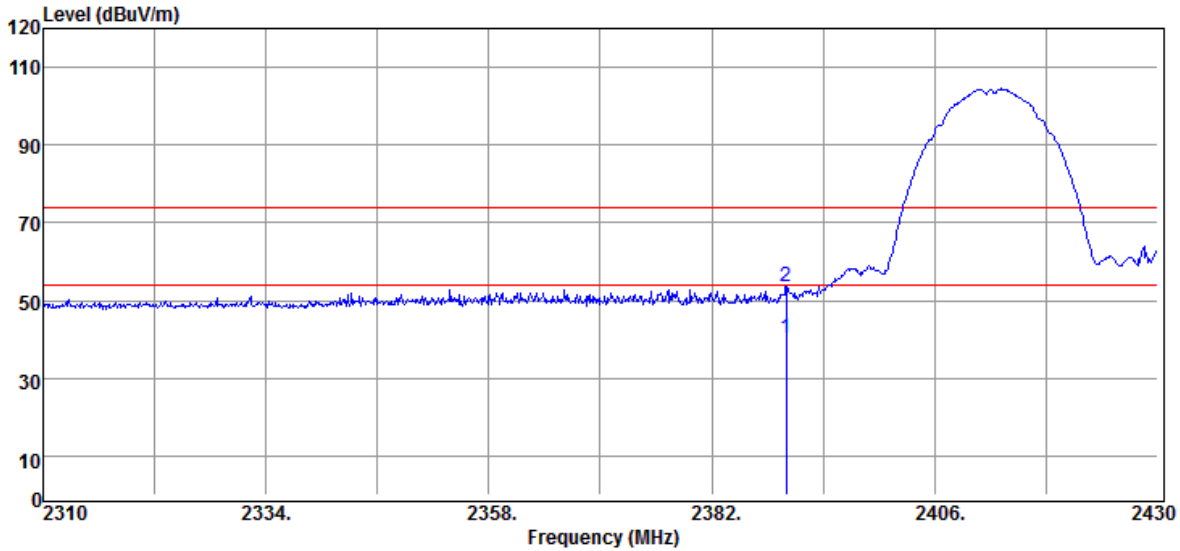
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Radiated Band Edge Measurement Result

Operation Mode	:802.11b	Test Date	:2018-10-23
Test Mode	:BE CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	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
2390.00	Average	45.68	-5.57	40.11	54.00	-13.89
2390.00	Peak	59.12	-5.57	53.55	74.00	-20.45

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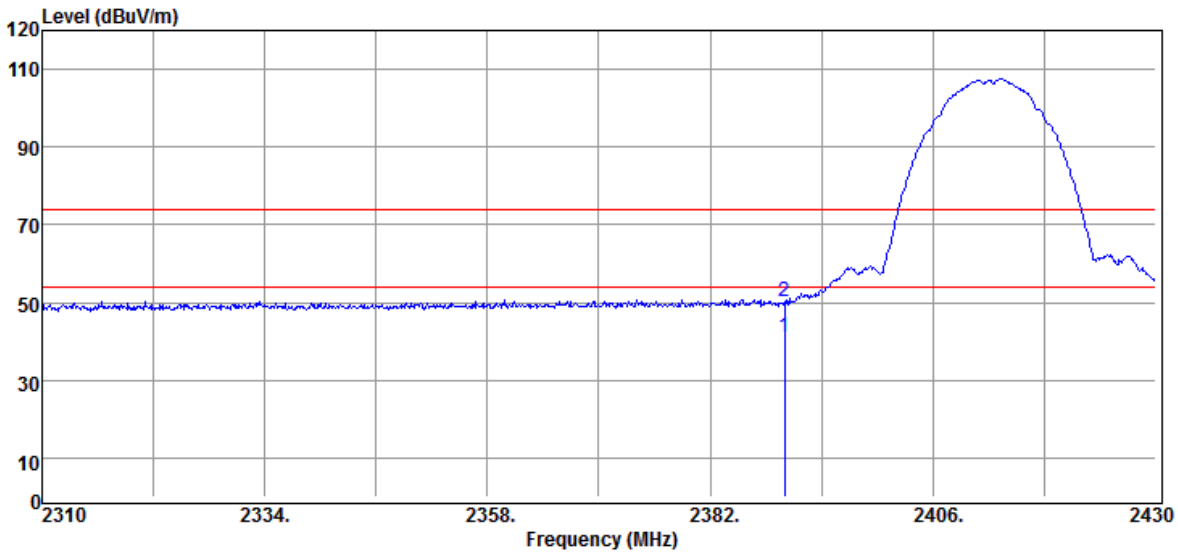
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Operation Mode	:802.11b	Test Date	:2018-10-23
Test Mode	:BE CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	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
2390.00	Average	46.63	-5.57	41.06	54.00	-12.94
2390.00	Peak	55.97	-5.57	50.40	74.00	-23.60

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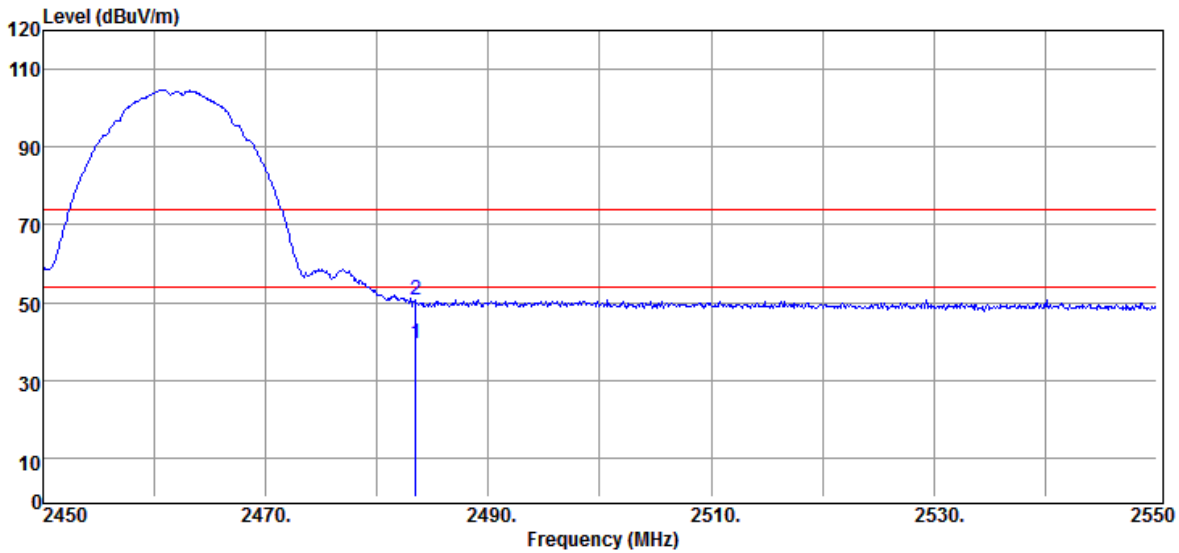
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Operation Mode	:802.11b	Test Date	:2018-10-23
Test Mode	:BE CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.50	Average	44.16	-4.90	39.26	54.00	-14.74
2483.50	Peak	55.49	-4.90	50.59	74.00	-23.41

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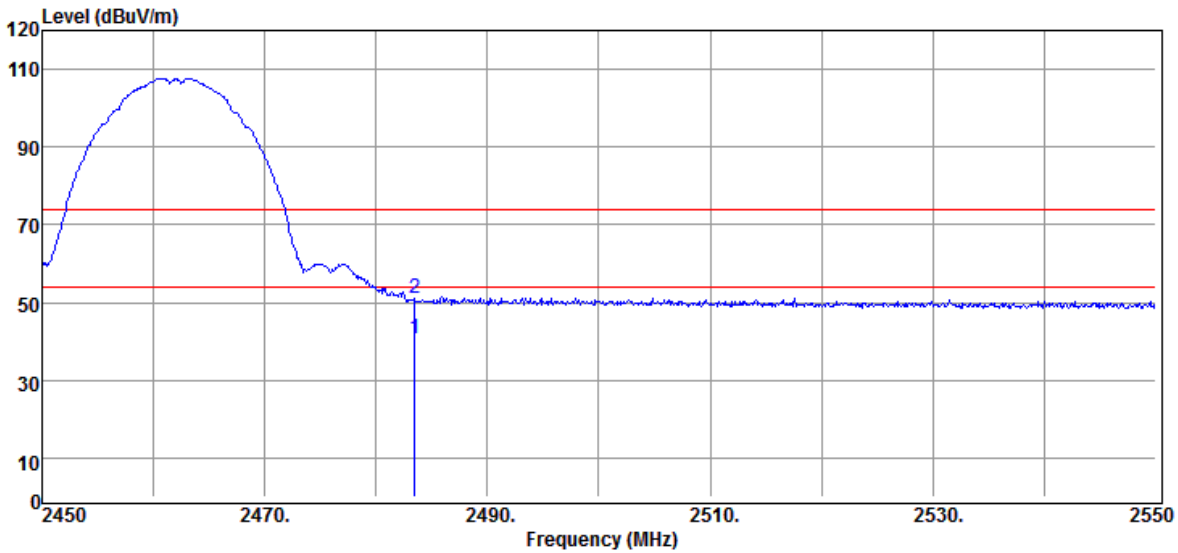
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Test Mode	:BE CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.50	Average	45.66	-4.90	40.76	54.00	-13.24
2483.50	Peak	56.09	-4.90	51.19	74.00	-22.81

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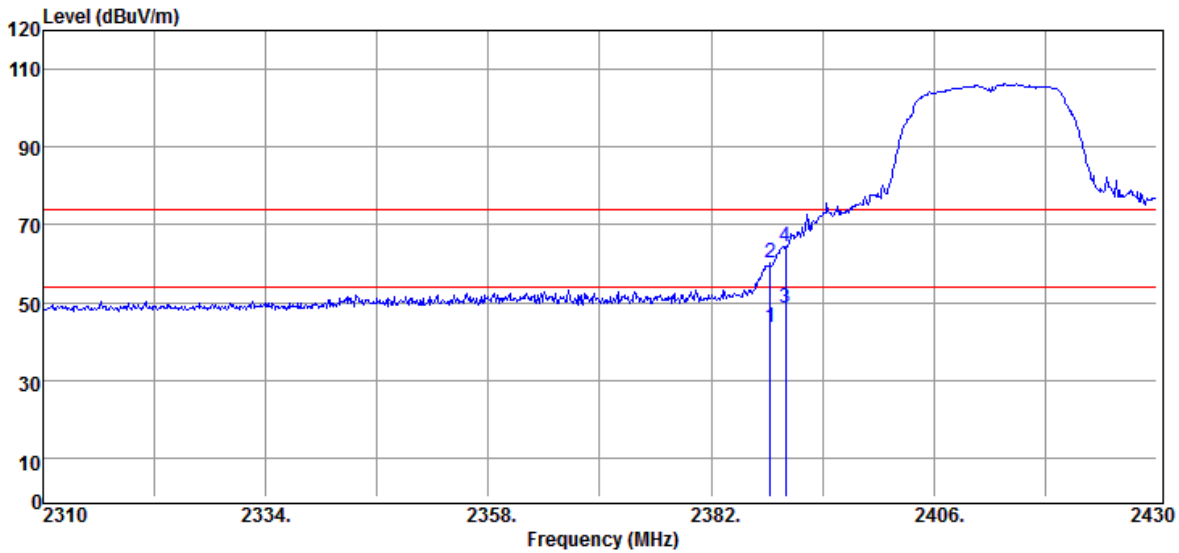
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:BE CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	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
2388.36	Average	49.26	-5.57	43.69	54.00	-10.31
2388.36	Peak	65.70	-5.57	60.13	74.00	-13.87
2390.00	Average	54.27	-5.57	48.70	54.00	-5.30
2390.00	Peak	69.96	-5.57	64.39	74.00	-9.61

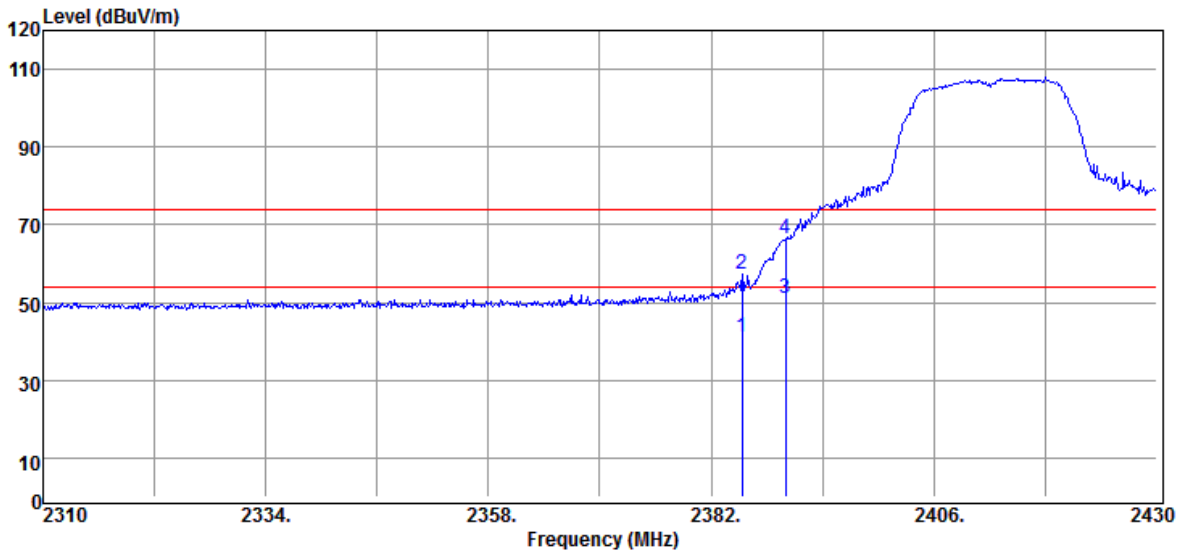
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Test Mode	:BE CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	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
2385.36	Average	46.85	-5.57	41.28	54.00	-12.72
2385.36	Peak	62.82	-5.57	57.25	74.00	-16.75
2390.00	Average	56.57	-5.57	51.00	54.00	-3.00
2390.00	Peak	72.15	-5.57	66.58	74.00	-7.42

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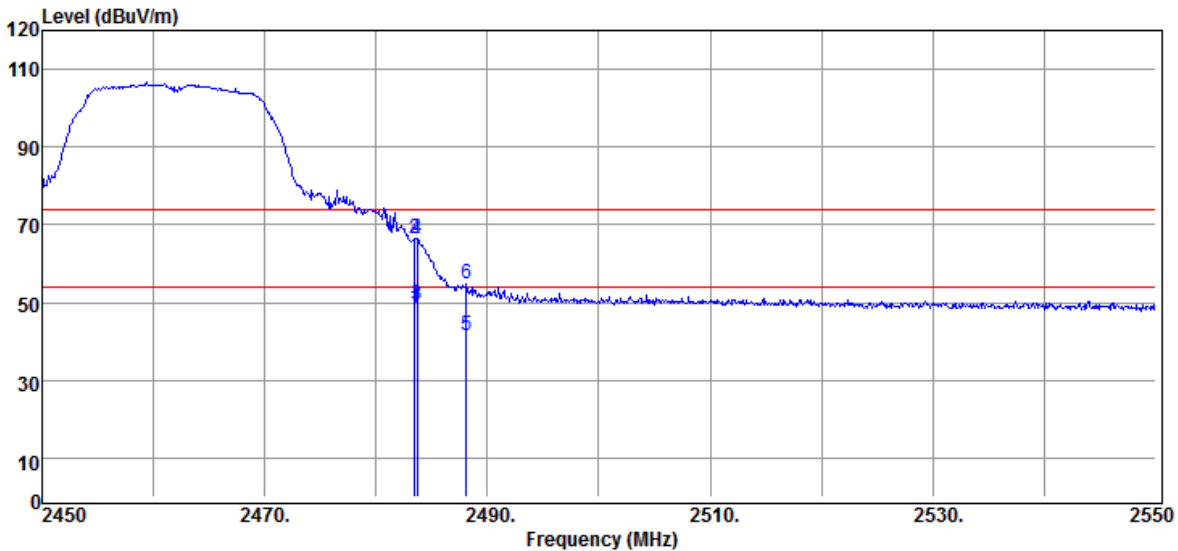
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:BE CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.50	Average	53.62	-4.90	48.72	54.00	-5.28
2483.50	Peak	71.27	-4.90	66.37	74.00	-7.63
2483.70	Average	54.38	-4.90	49.48	54.00	-4.52
2483.70	Peak	71.49	-4.90	66.59	74.00	-7.41
2488.10	Average	46.18	-4.86	41.32	54.00	-12.68
2488.10	Peak	59.81	-4.86	54.95	74.00	-19.05

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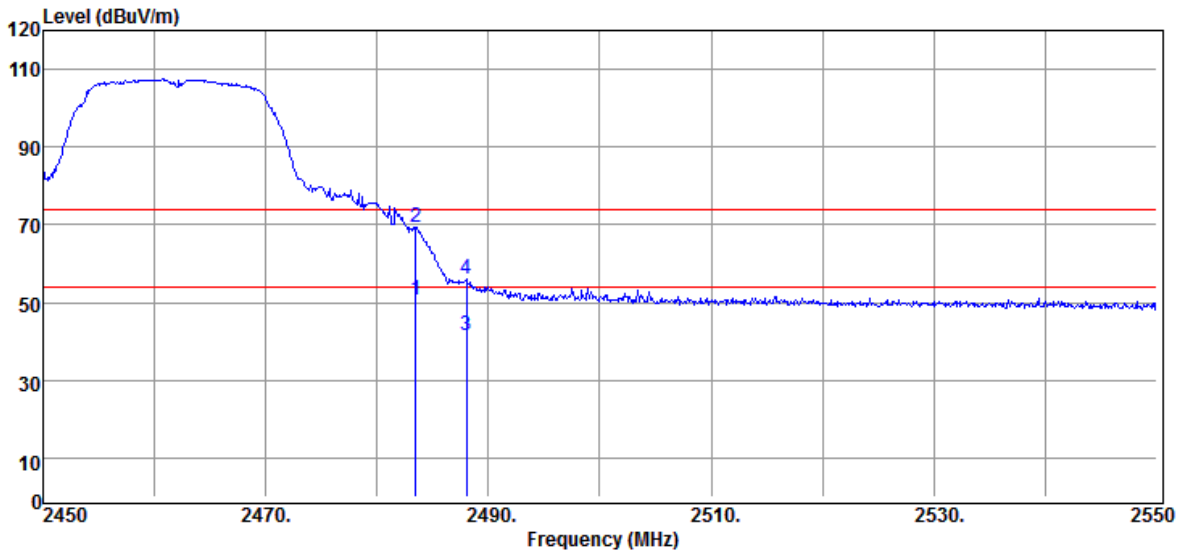
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:BE CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.50	Average	55.37	-4.90	50.47	54.00	-3.53
2483.50	Peak	74.08	-4.90	69.18	74.00	-4.82
2488.00	Average	46.26	-4.86	41.40	54.00	-12.60
2488.00	Peak	60.72	-4.86	55.86	74.00	-18.14

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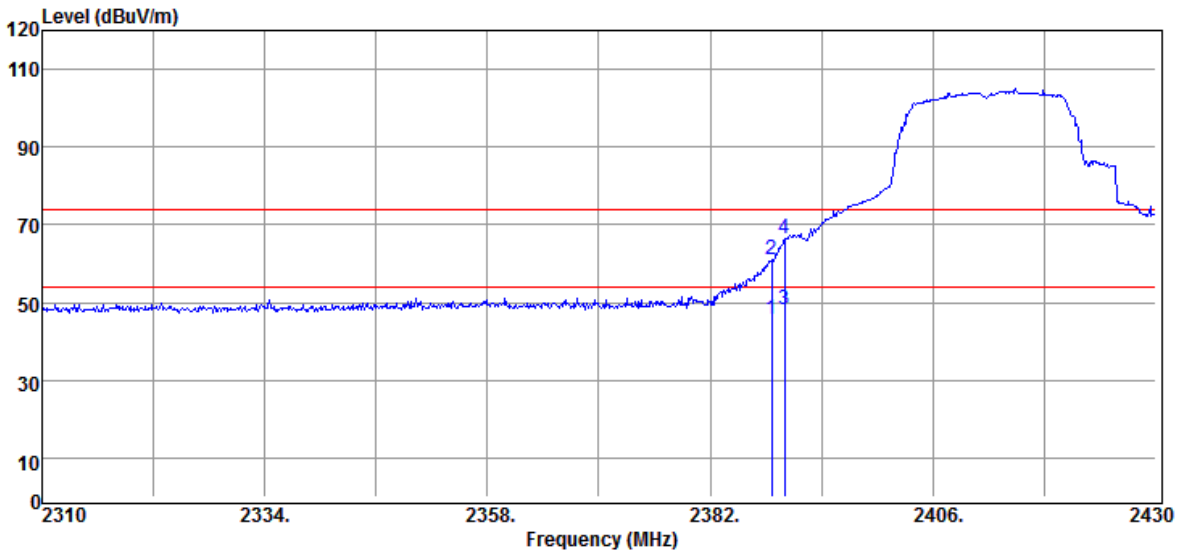
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Operation Mode	:802.11n20	Test Date	:2018-10-23
Test Mode	:BE CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	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
2388.60	Average	51.35	-5.57	45.78	54.00	-8.22
2388.60	Peak	66.43	-5.57	60.86	74.00	-13.14
2390.00	Average	53.68	-5.57	48.11	54.00	-5.89
2390.00	Peak	71.85	-5.57	66.28	74.00	-7.72

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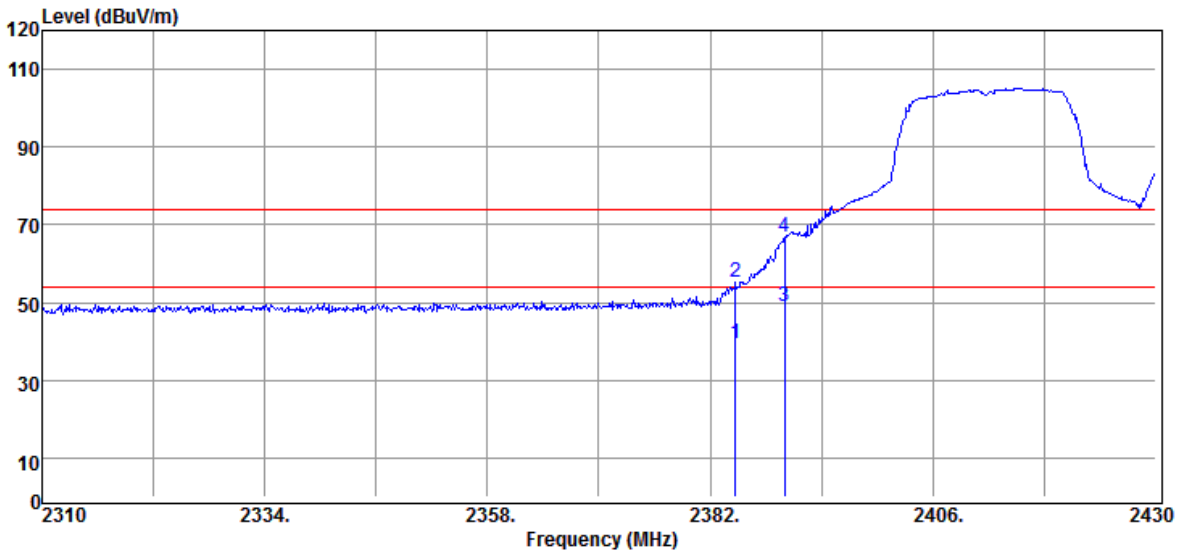
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Operation Mode	:802.11n20	Test Date	:2018-10-23
Test Mode	:BE CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	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
2384.76	Average	45.04	-5.57	39.47	54.00	-14.53
2384.76	Peak	60.91	-5.57	55.34	74.00	-18.66
2390.00	Average	54.71	-5.57	49.14	54.00	-4.86
2390.00	Peak	72.50	-5.57	66.93	74.00	-7.07

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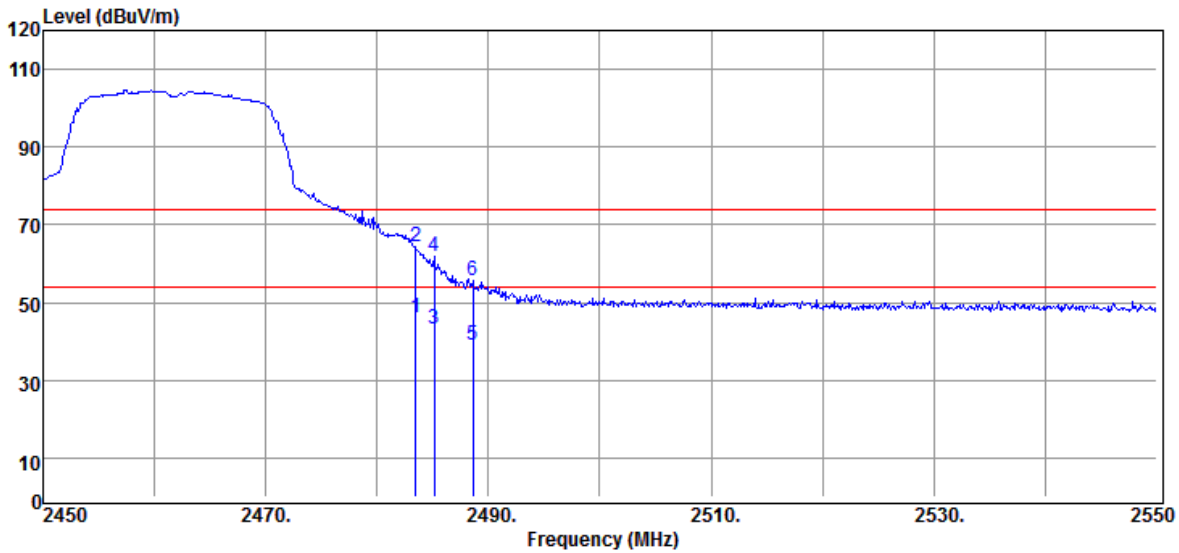
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Operation Mode	:802.11n20	Test Date	:2018-10-23
Test Mode	:BE CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	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
2483.50	Average	50.79	-4.90	45.89	54.00	-8.11
2483.50	Peak	69.24	-4.90	64.34	74.00	-9.66
2485.10	Average	48.05	-4.89	43.16	54.00	-10.84
2485.10	Peak	66.96	-4.89	62.07	74.00	-11.93
2488.60	Average	43.97	-4.85	39.12	54.00	-14.88
2488.60	Peak	60.32	-4.85	55.47	74.00	-18.53

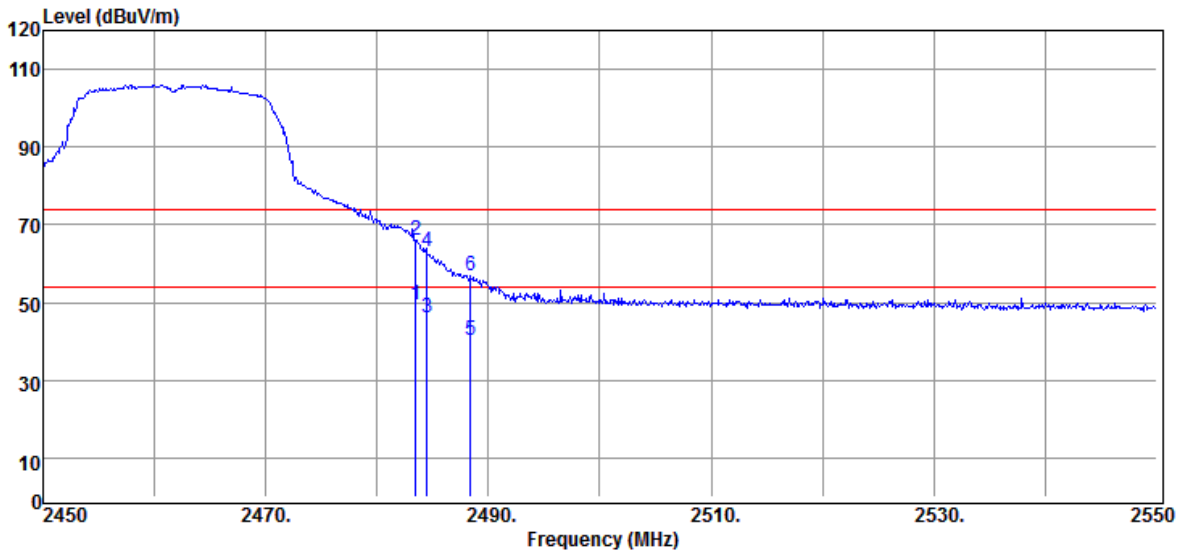
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Operation Mode	:802.11n20	Test Date	:2018-10-23
Test Mode	:BE CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	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
2483.50	Average	54.11	-4.90	49.21	54.00	-4.79
2483.50	Peak	70.99	-4.90	66.09	74.00	-7.91
2484.50	Average	50.99	-4.90	46.09	54.00	-7.91
2484.50	Peak	67.99	-4.90	63.09	74.00	-10.91
2488.40	Average	45.31	-4.85	40.46	54.00	-13.54
2488.40	Peak	61.68	-4.85	56.83	74.00	-17.17

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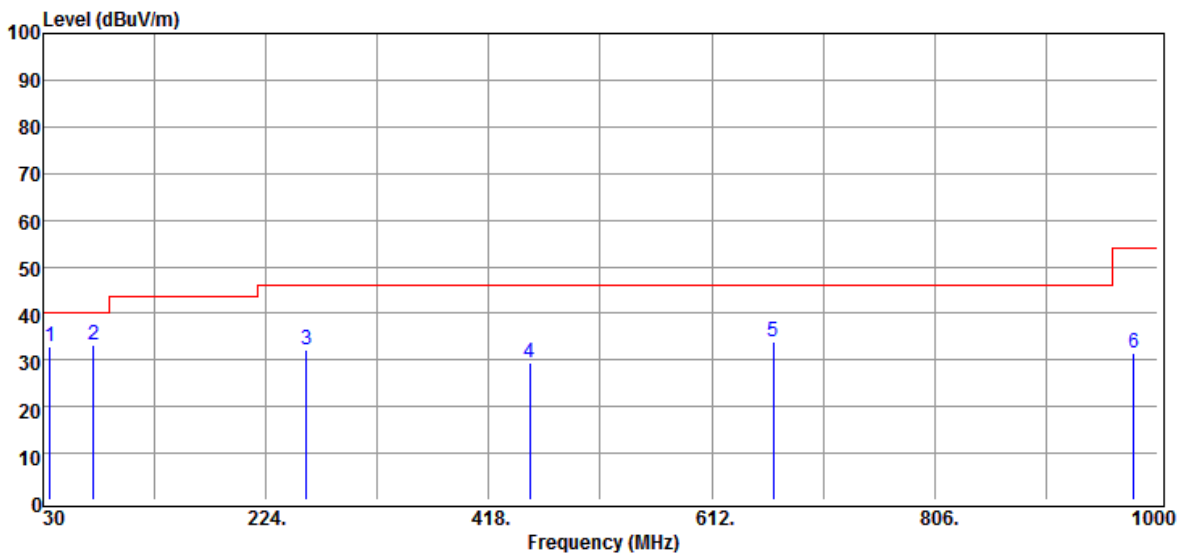
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**Below 1GHz Worst-Case Data:
Radiated Spurious Emission Measurement Result**

Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
35.82	Peak	51.09	-18.09	33.00	40.00	-7.00
73.65	Peak	53.42	-20.23	33.19	40.00	-6.81
258.92	Peak	48.80	-16.69	32.11	46.00	-13.89
453.89	Peak	41.31	-11.74	29.57	46.00	-16.43
665.35	Peak	42.67	-8.76	33.91	46.00	-12.09
979.63	Peak	35.11	-3.47	31.64	54.00	-22.36

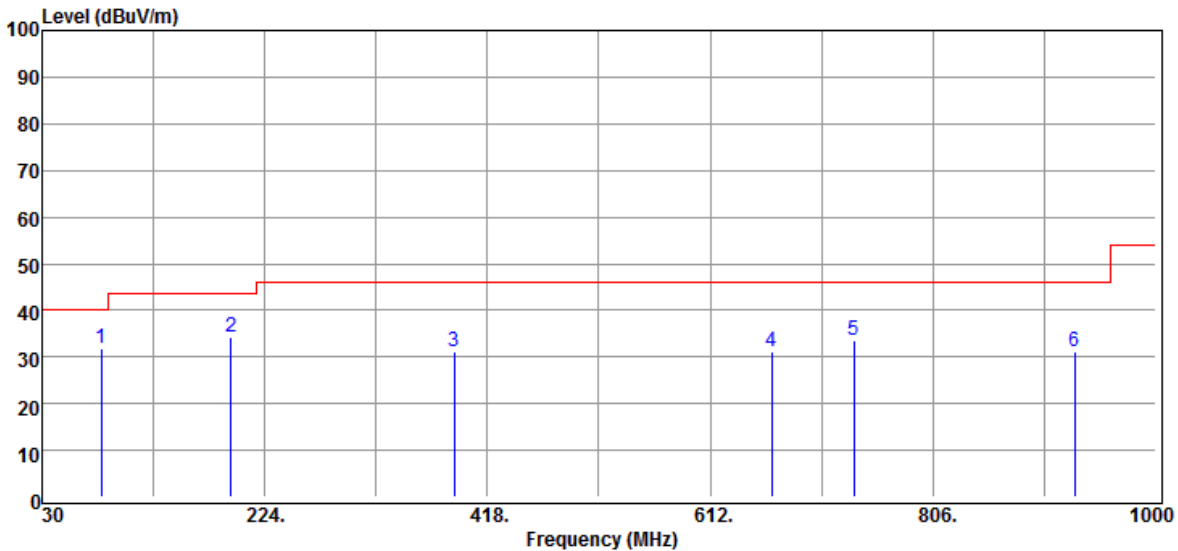
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
81.41	Peak	53.99	-22.24	31.75	40.00	-8.25
194.90	Peak	55.44	-21.27	34.17	43.50	-9.33
388.90	Peak	44.23	-13.07	31.16	46.00	-14.84
665.35	Peak	39.90	-8.76	31.14	46.00	-14.86
737.13	Peak	40.51	-7.05	33.46	46.00	-12.54
929.19	Peak	35.55	-4.41	31.14	46.00	-14.86

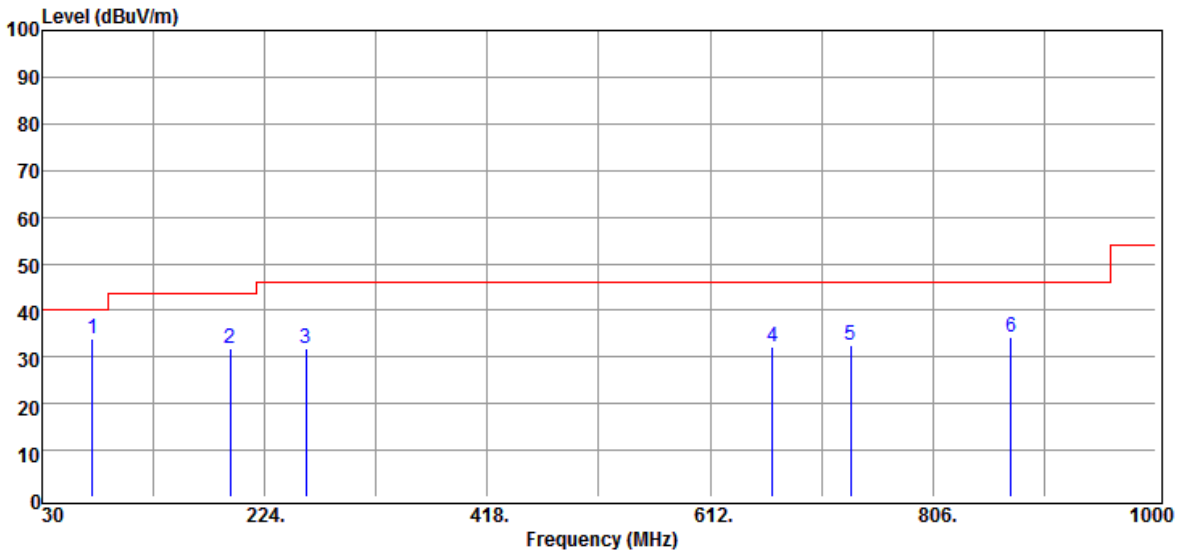
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2437 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
73.65	Peak	54.25	-20.23	34.02	40.00	-5.98
193.93	Peak	50.15	-18.45	31.70	43.50	-11.80
259.89	Peak	48.45	-16.68	31.77	46.00	-14.23
666.32	Peak	40.78	-8.72	32.06	46.00	-13.94
734.22	Peak	39.83	-7.14	32.69	46.00	-13.31
873.90	Peak	39.34	-5.08	34.26	46.00	-11.74

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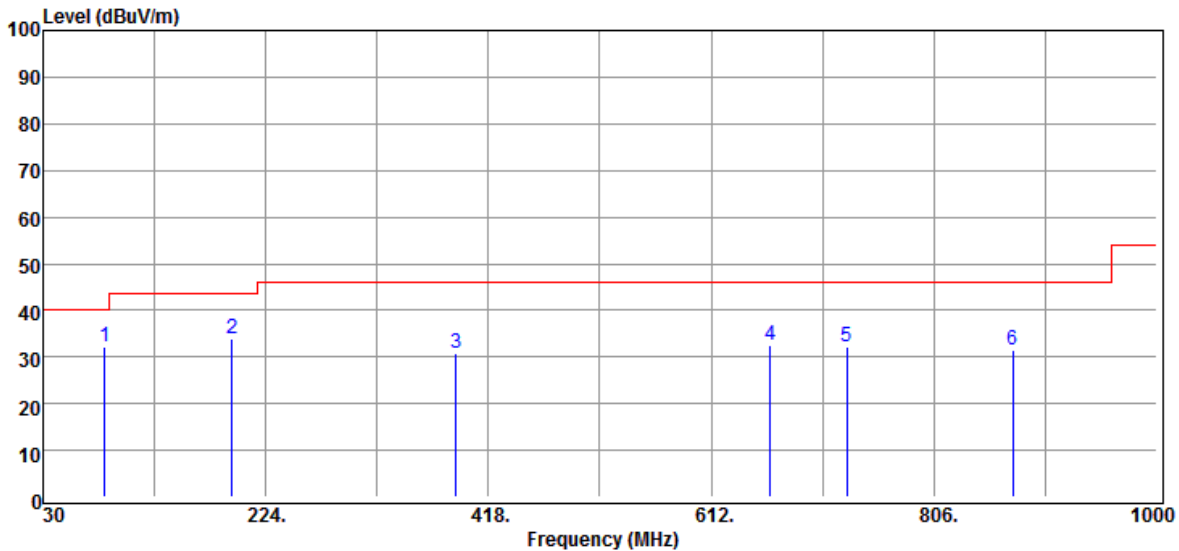
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2437 MHz	Engineer	:Jerry



Freq. MHz	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
83.35	Peak	55.44	-23.22	32.22	40.00	-7.78
194.90	Peak	55.11	-21.27	33.84	43.50	-9.66
389.87	Peak	43.79	-13.05	30.74	46.00	-15.26
663.41	Peak	41.27	-8.80	32.47	46.00	-13.53
730.34	Peak	39.59	-7.26	32.33	46.00	-13.67
874.87	Peak	36.71	-5.14	31.57	46.00	-14.43

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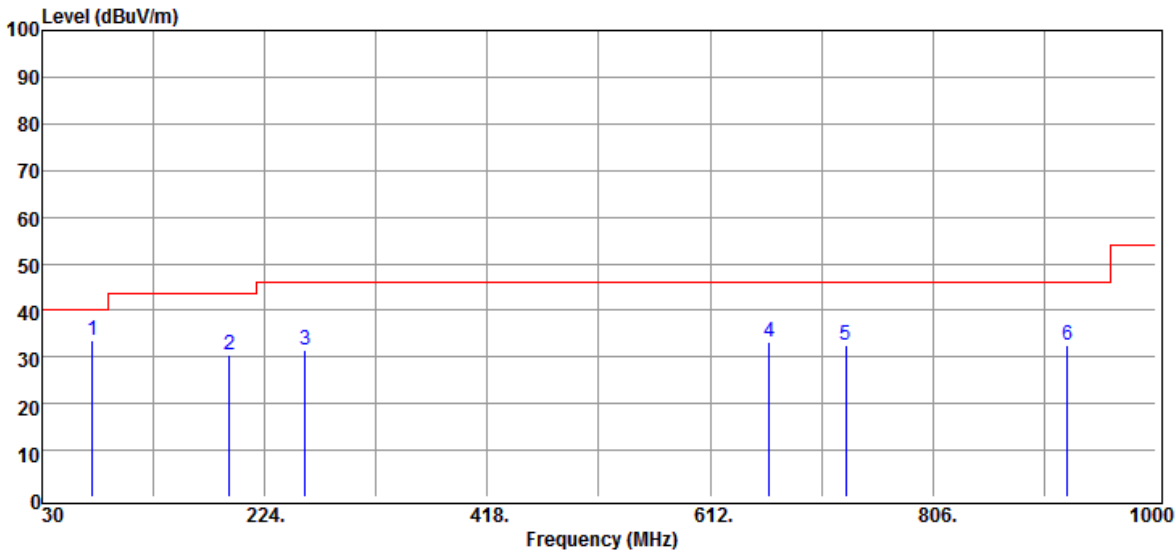
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	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
73.65	Peak	53.73	-20.23	33.50	40.00	-6.50
192.96	Peak	48.99	-18.42	30.57	43.50	-12.93
258.92	Peak	48.20	-16.69	31.51	46.00	-14.49
663.41	Peak	42.09	-8.80	33.29	46.00	-12.71
730.34	Peak	39.88	-7.26	32.62	46.00	-13.38
923.37	Peak	37.02	-4.42	32.60	46.00	-13.40

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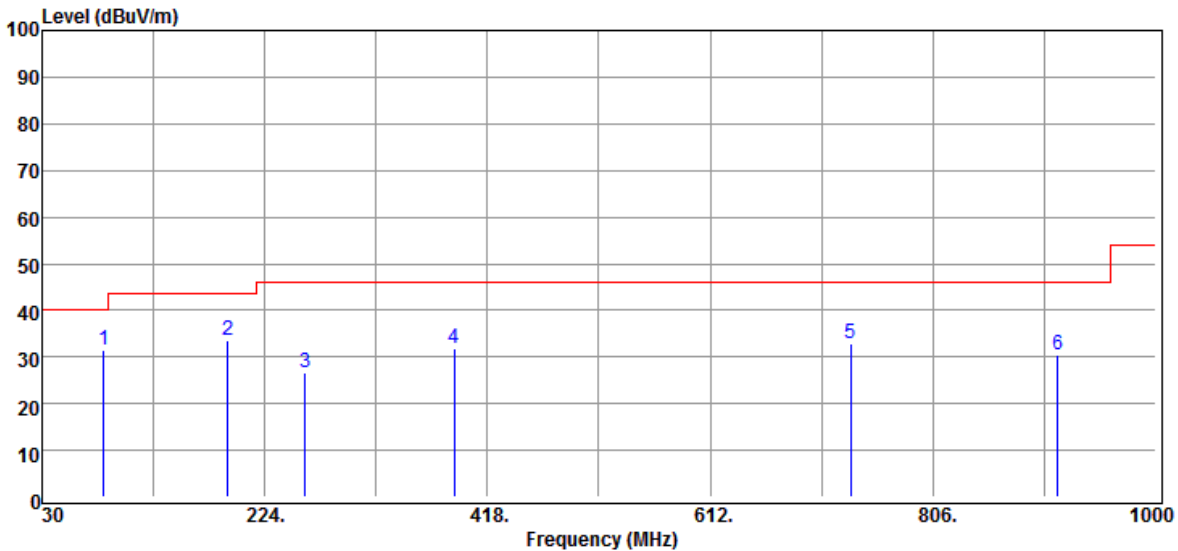
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
83.35	Peak	54.86	-23.22	31.64	40.00	-8.36
191.99	Peak	53.24	-19.52	33.72	43.50	-9.78
258.92	Peak	46.77	-20.17	26.60	46.00	-19.40
388.90	Peak	44.74	-13.07	31.67	46.00	-14.33
734.22	Peak	40.11	-7.14	32.97	46.00	-13.03
914.64	Peak	35.08	-4.55	30.53	46.00	-15.47

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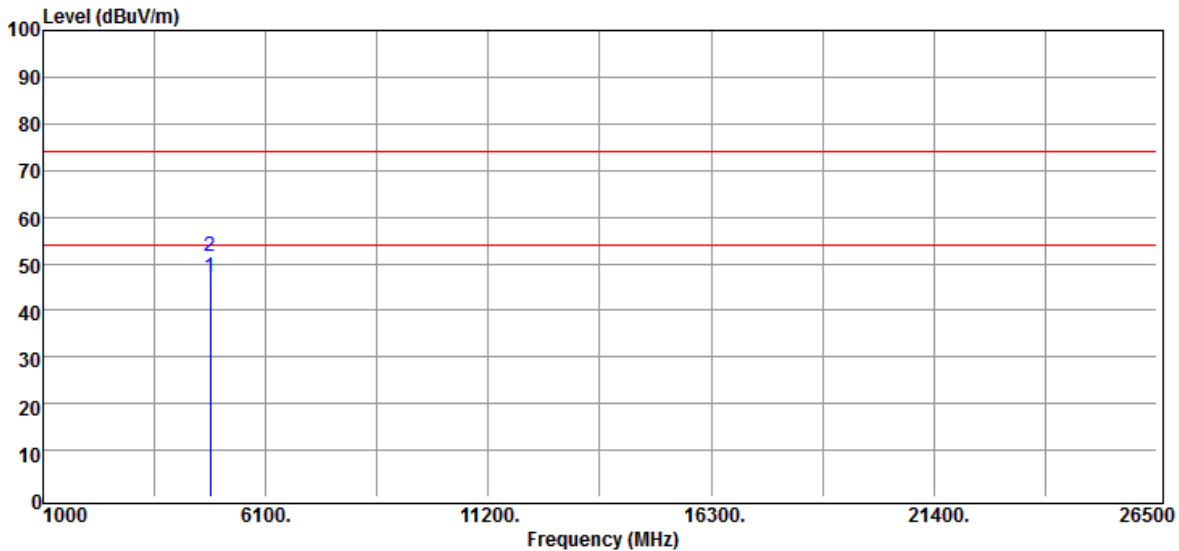
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Above 1GHz Data:

Radiated Spurious Emission Measurement Result

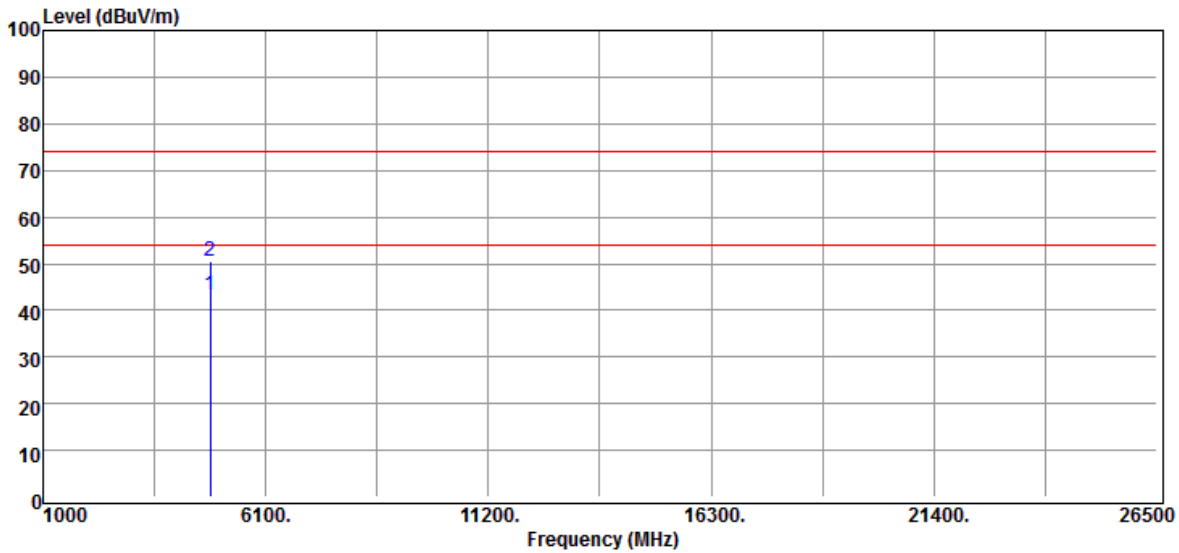
Operation Mode	:802.11b	Test Date	:2018-10-23
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	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	Average	46.82	0.38	47.20	54.00	-6.80
4824.00	Peak	51.23	0.38	51.61	74.00	-22.39

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Operation Mode	:802.11b	Test Date	:2018-10-23
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4824.00	Average	43.02	0.38	43.40	54.00	-10.60
4824.00	Peak	50.29	0.38	50.67	74.00	-23.33

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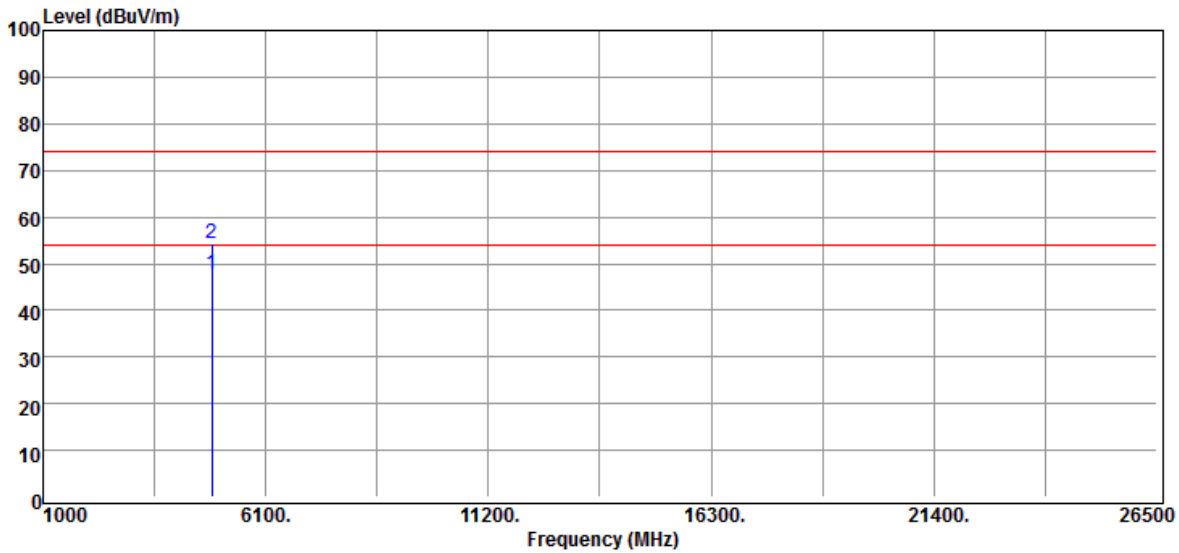
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Operation Mode	:802.11b	Test Date	:2018-10-23
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2437 MHz	Engineer	:Jerry



Freq. MHz	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	Average	47.11	0.66	47.77	54.00	-6.23
4874.00	Peak	53.76	0.66	54.42	74.00	-19.58

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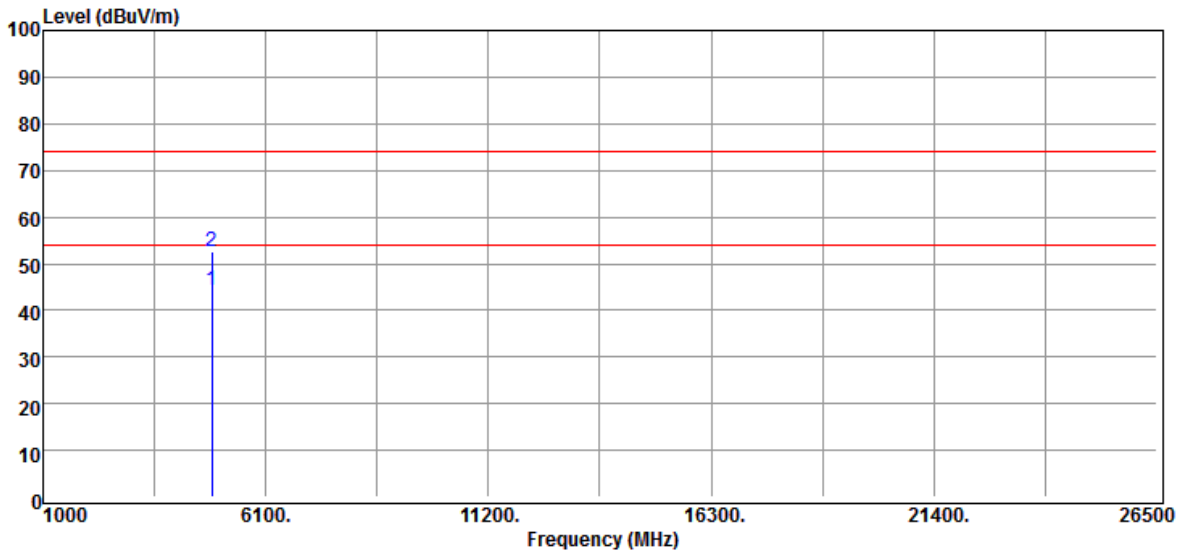
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Operation Mode	:802.11b	Test Date	:2018-10-23
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2437 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4874.00	Average	43.53	0.66	44.19	54.00	-9.81
4874.00	Peak	52.08	0.66	52.74	74.00	-21.26

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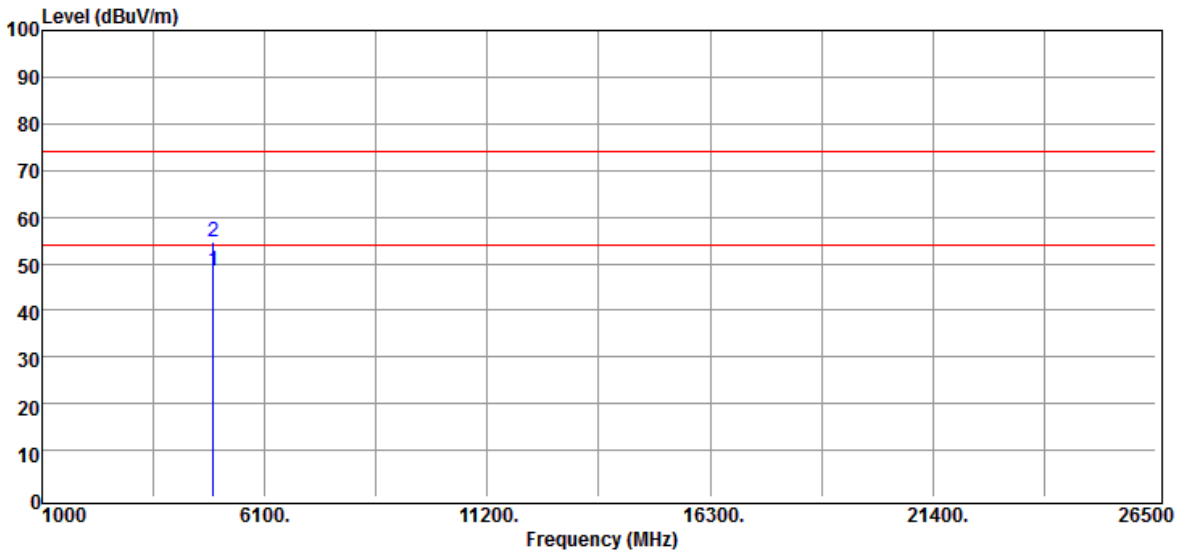
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Operation Mode	:802.11b	Test Date	:2018-10-23
Test Mode	:Tx CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4924.00	Average	47.40	0.97	48.37	54.00	-5.63
4924.00	Peak	53.83	0.97	54.80	74.00	-19.20

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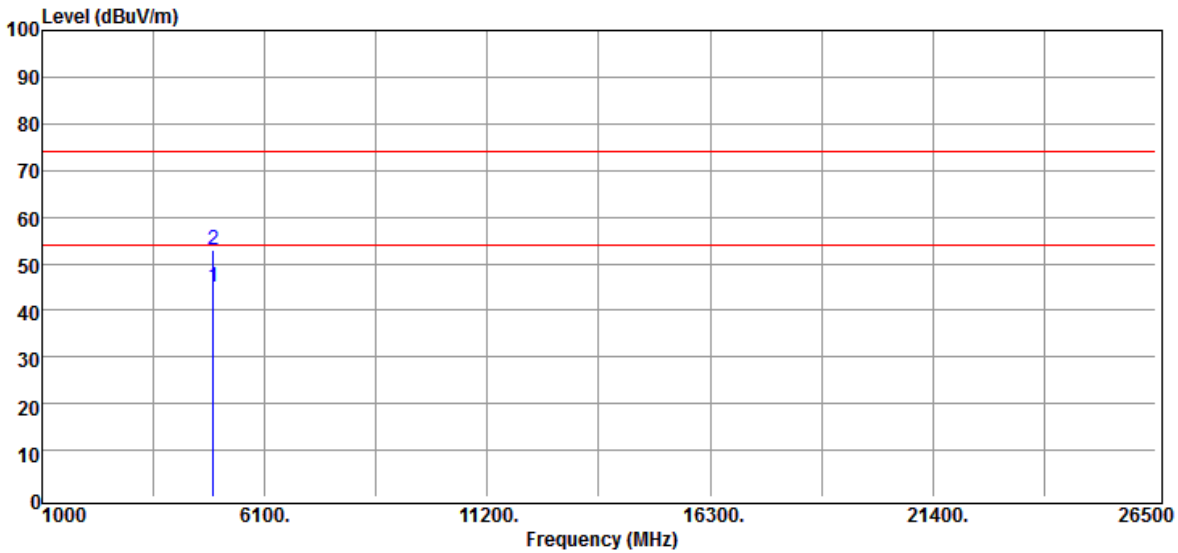
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Operation Mode	:802.11b	Test Date	:2018-10-23
Test Mode	:Tx CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4924.00	Average	44.14	0.97	45.11	54.00	-8.89
4924.00	Peak	51.89	0.97	52.86	74.00	-21.14

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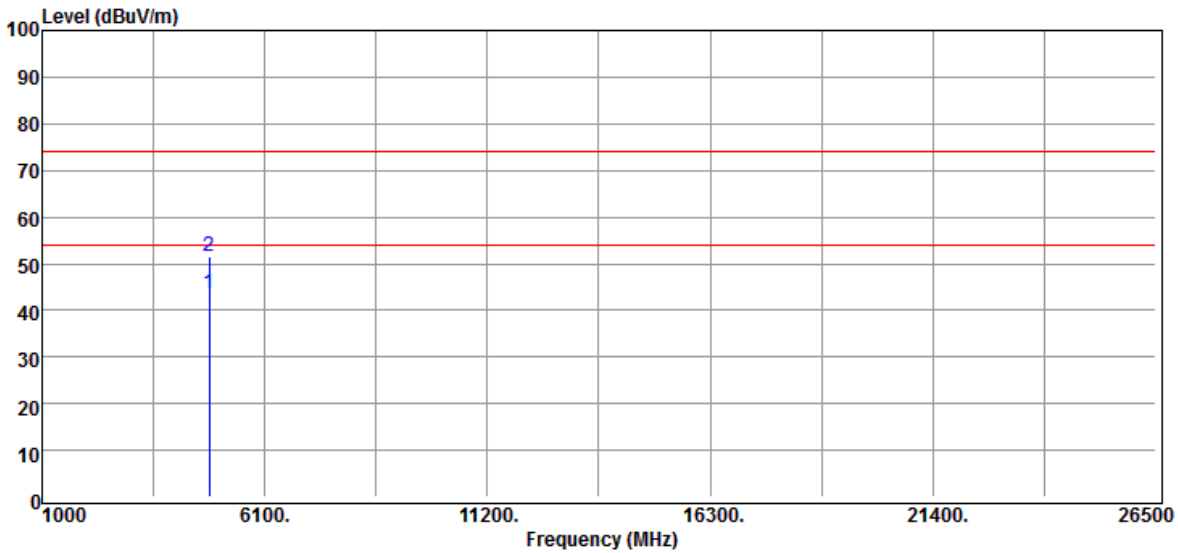
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4824.00	Average	43.25	0.38	43.63	54.00	-10.37
4824.00	Peak	51.35	0.38	51.73	74.00	-22.27

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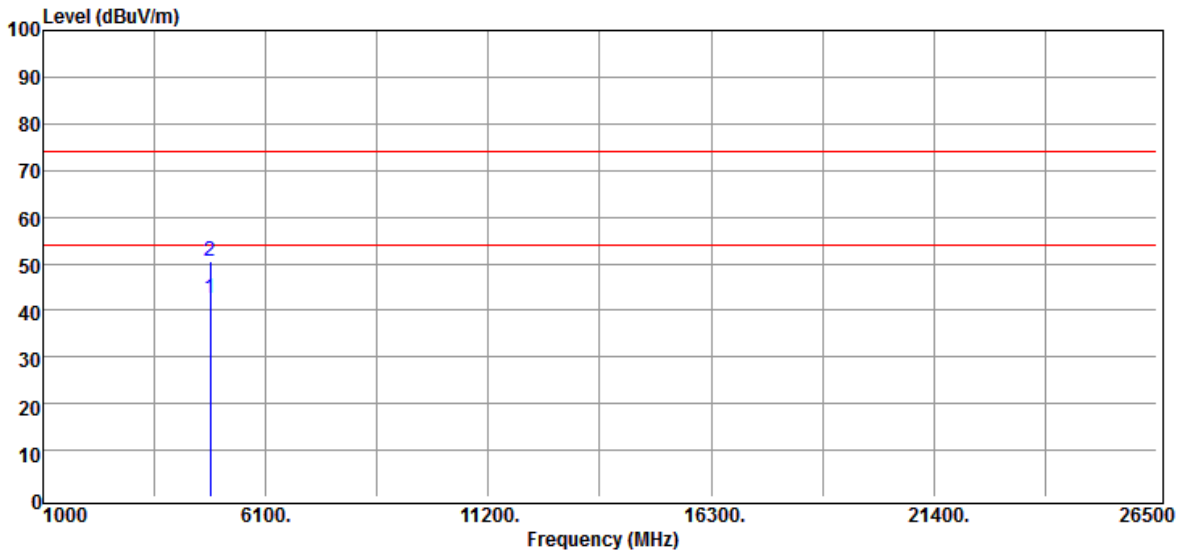
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	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	Average	42.13	0.38	42.51	54.00	-11.49
4824.00	Peak	50.28	0.38	50.66	74.00	-23.34

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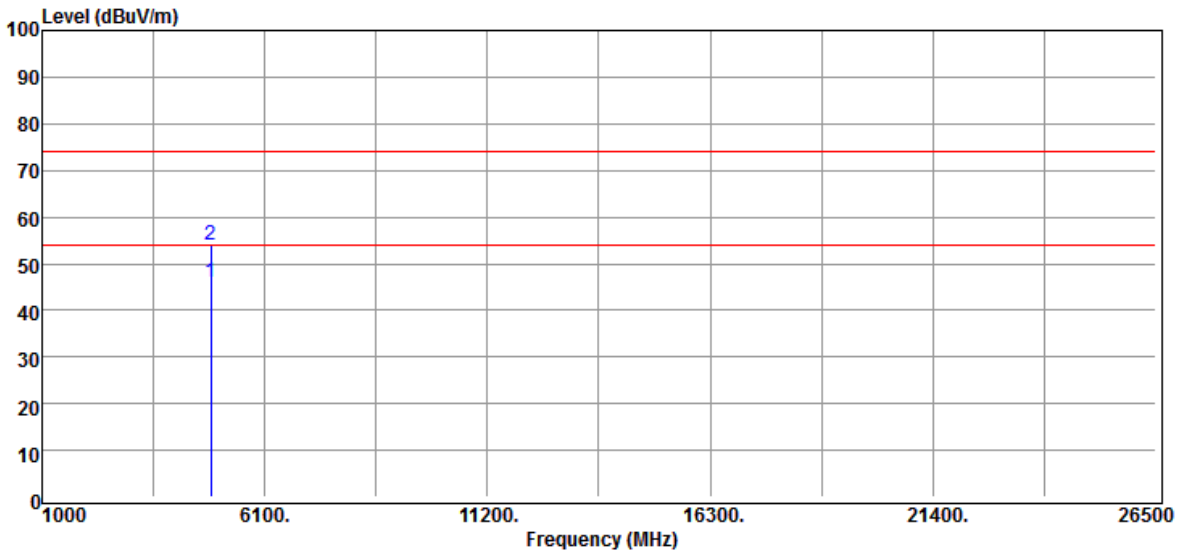
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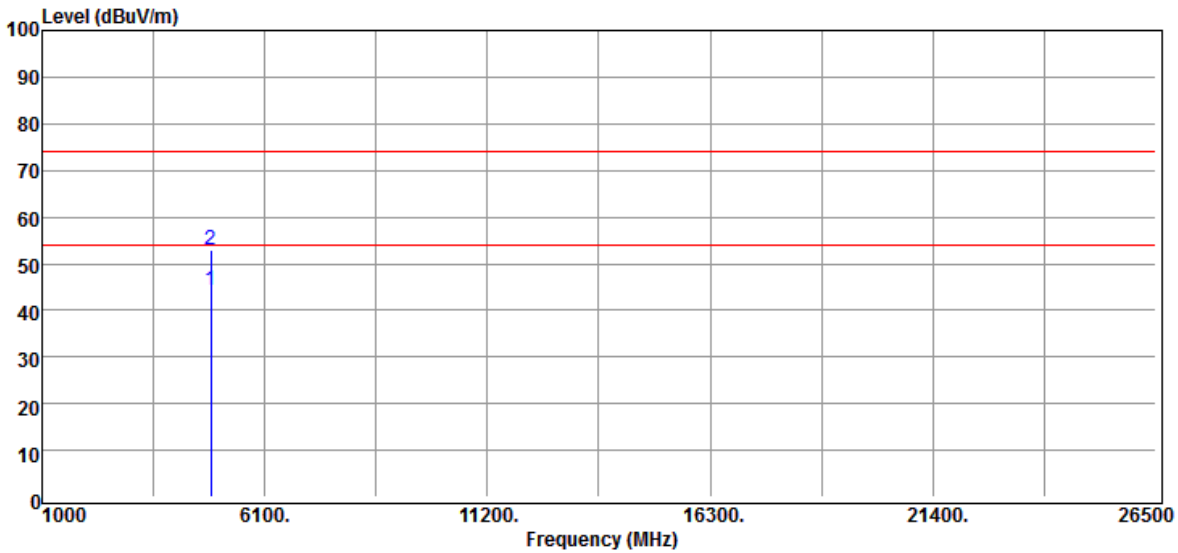
Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2437 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4874.00	Average	45.21	0.66	45.87	54.00	-8.13
4874.00	Peak	53.25	0.66	53.91	74.00	-20.09

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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2437 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4874.00	Average	43.56	0.66	44.22	54.00	-9.78
4874.00	Peak	52.13	0.66	52.79	74.00	-21.21

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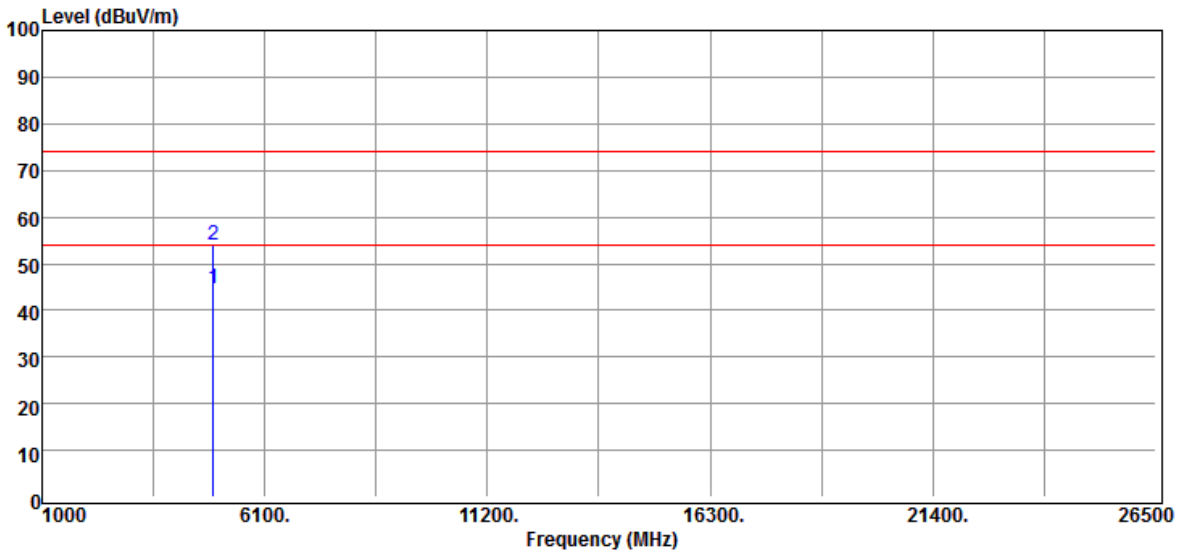
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4924.00	Average	43.69	0.97	44.66	54.00	-9.34
4924.00	Peak	52.89	0.97	53.86	74.00	-20.14

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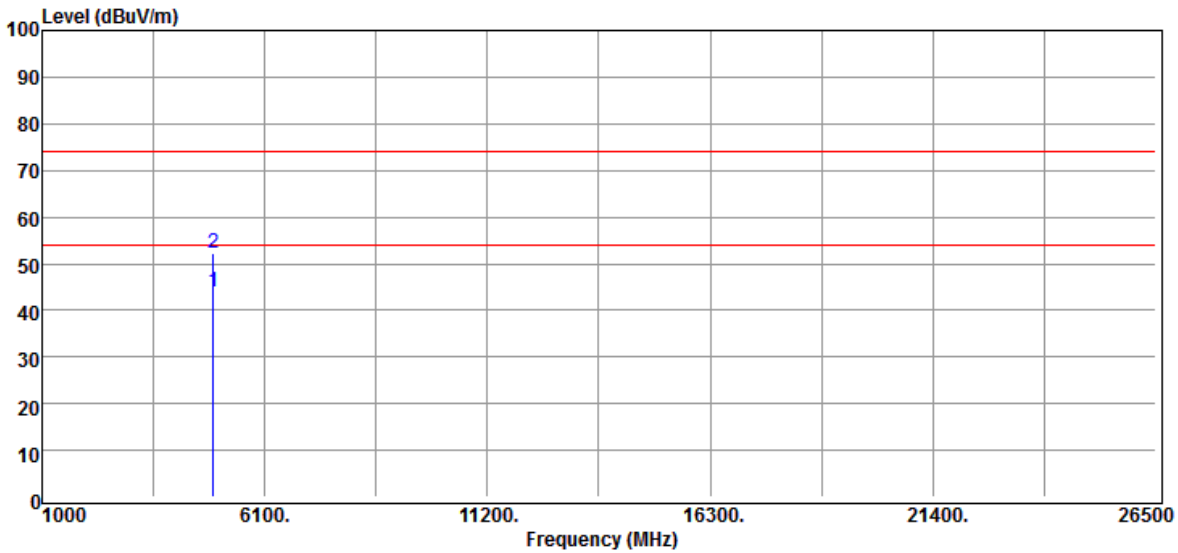
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Operation Mode	:802.11g	Test Date	:2018-10-23
Test Mode	:Tx CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4924.00	Average	43.13	0.97	44.10	54.00	-9.90
4924.00	Peak	51.24	0.97	52.21	74.00	-21.79

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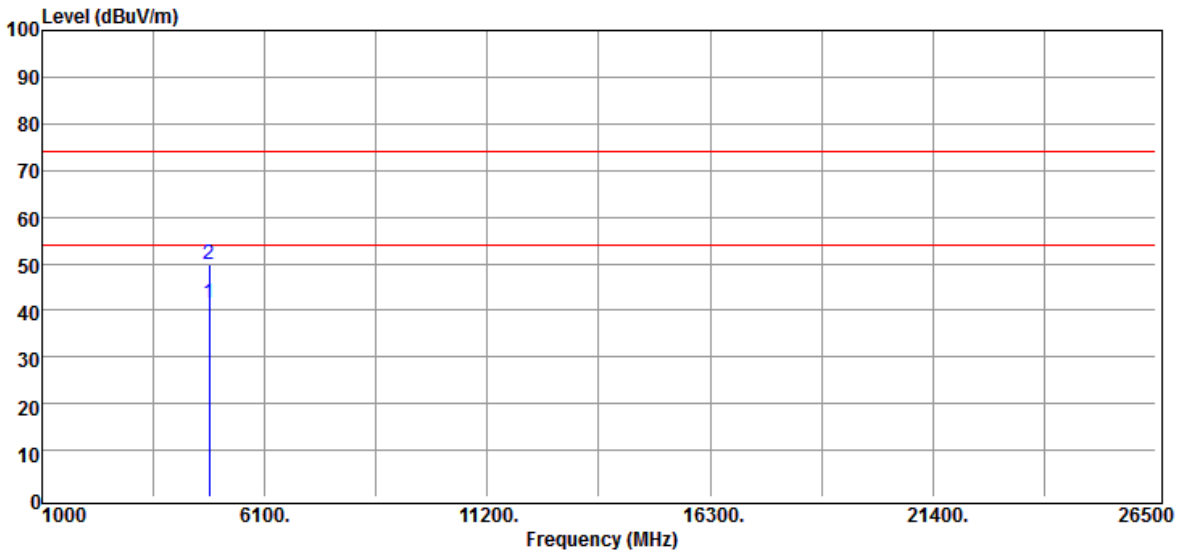
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Operation Mode	:802.11n20	Test Date	:2018-10-23
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	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	Average	41.05	0.38	41.43	54.00	-12.57
4824.00	Peak	49.28	0.38	49.66	74.00	-24.34

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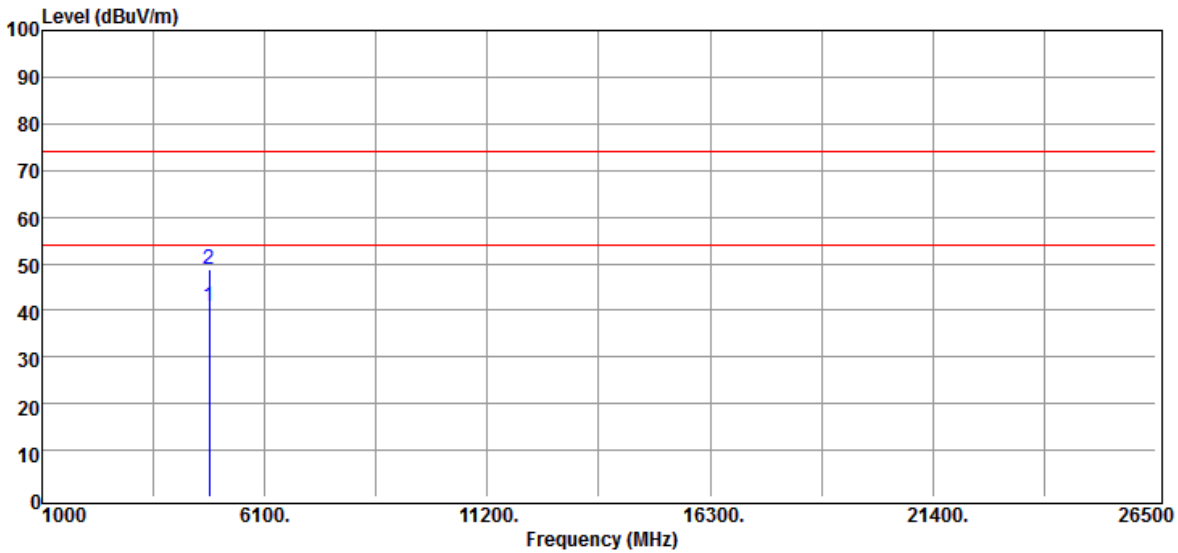
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Operation Mode	:802.11n20	Test Date	:2018-10-23
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2412 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4824.00	Average	40.53	0.38	40.91	54.00	-13.09
4824.00	Peak	48.55	0.38	48.93	74.00	-25.07

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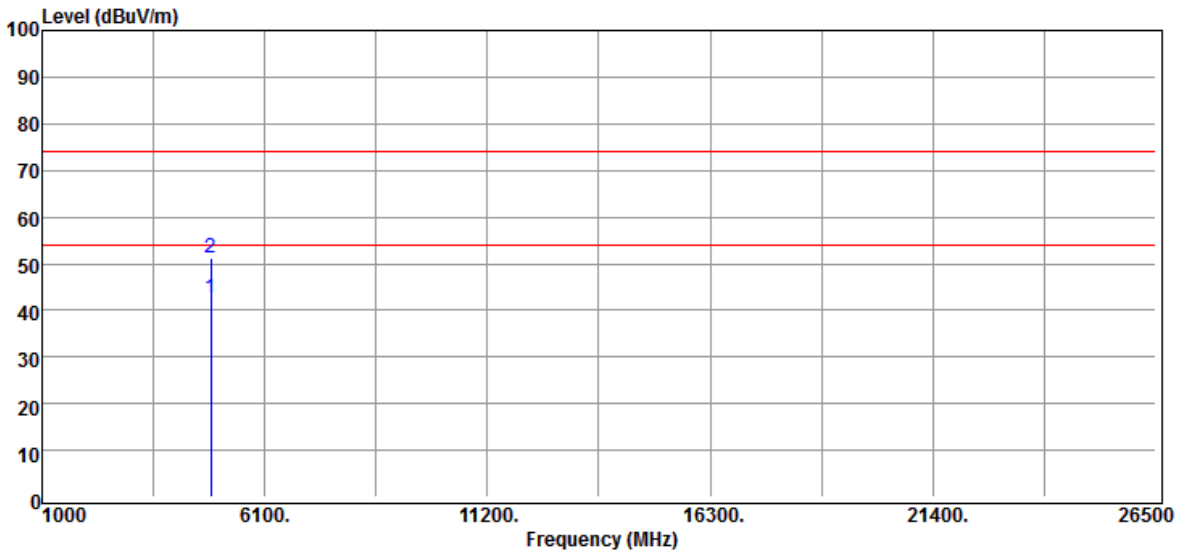
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Operation Mode	:802.11n20	Test Date	:2018-10-23
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2437 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4874.00	Average	41.76	0.66	42.42	54.00	-11.58
4874.00	Peak	50.55	0.66	51.21	74.00	-22.79

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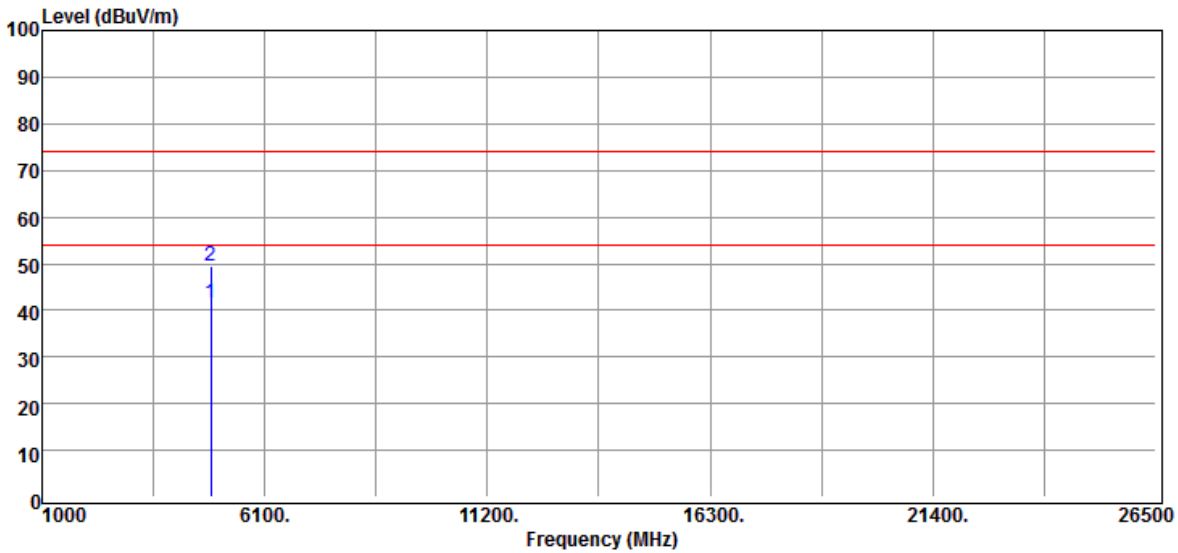
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Operation Mode	:802.11n20	Test Date	:2018-10-23
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2437 MHz	Engineer	:Jerry



Freq. MHz	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	Average	40.83	0.66	41.49	54.00	-12.51
4874.00	Peak	48.86	0.66	49.52	74.00	-24.48

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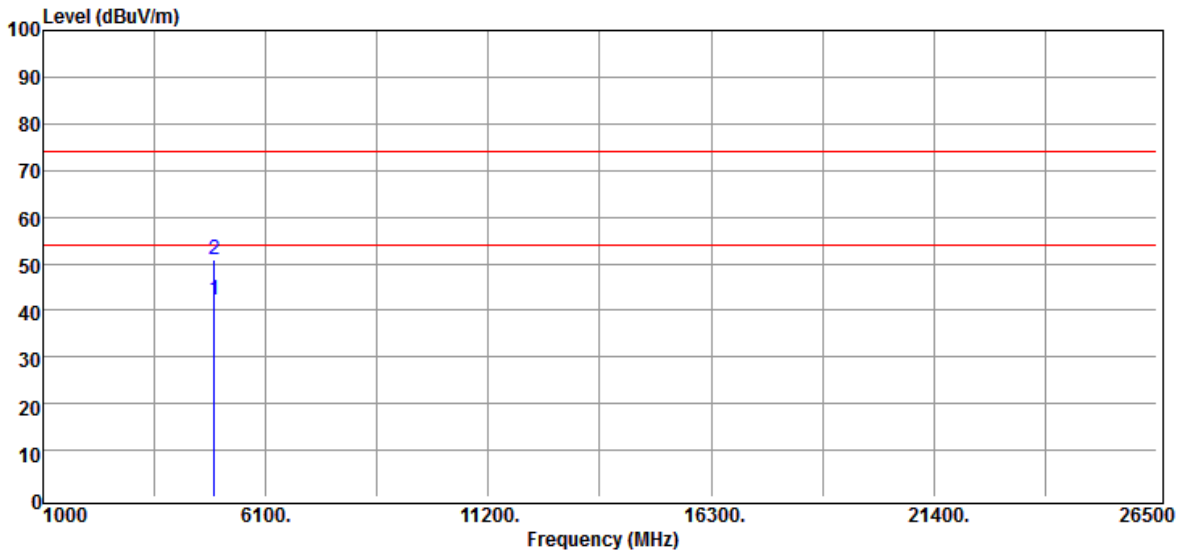
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Operation Mode	:802.11n20	Test Date	:2018-10-23
Test Mode	:Tx CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4924.00	Average	41.36	0.97	42.33	54.00	-11.67
4924.00	Peak	49.73	0.97	50.70	74.00	-23.30

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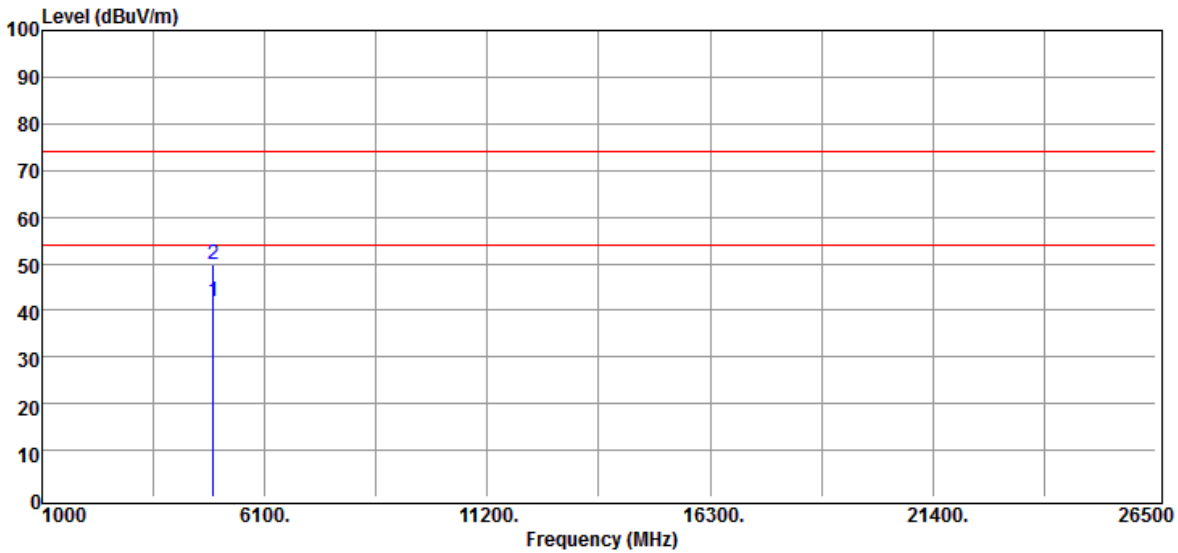
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Test Mode	:Tx CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2462 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4924.00	Average	40.90	0.97	41.87	54.00	-12.13
4924.00	Peak	48.94	0.97	49.91	74.00	-24.09

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12 PEAK POWER SPECTRAL DENSITY

12.1 Standard Applicable

Per Part 15.247 (e)

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

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

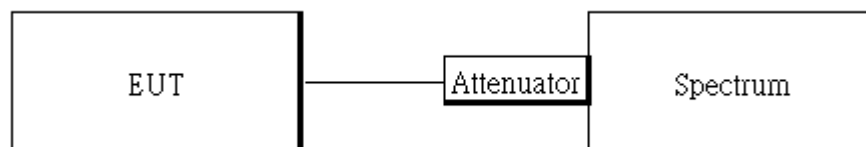
Per RSS-247 section 5.4 d

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

12.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY5144011 3	2018/06/20	2019/06/19
Attenuator	Marvelous	MVE2213-10	RF31	2017/12/26	2018/12/25
DC Block	PASTERNAK	PE8210	RF81	2017/12/26	2018/12/25

12.3 Test Set-up



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12.4 Measurement Procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance & ANSI C63.10.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz. & the VBW = 10 kHz
5. For defining Restricted Band Edge Limit:
Set the RBW = 100kHz & VBW = 300 kHz.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level.

As per FCC KDB 662911 D01

Unequal antenna gains, with equal transmit powers. For antenna gains given by G1, G2, ..., GN dBi.

(i) If transmit signals are correlated, then Directional gain
 $= 10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] \text{ dBi}$

[Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently].

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

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12.5 Measurement Result

POWER DENSITY 802.11b			
Freq. (MHz)	PPSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-8.76	8.00	PASS
2437	-6.31	8.00	PASS
2462	-6.68	8.00	PASS

POWER DENSITY 802.11g			
Freq. (MHz)	PPSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-11.50	8.00	PASS
2437	-11.65	8.00	PASS
2462	-10.52	8.00	PASS

POWER DENSITY 802.11n HT20			
Freq. (MHz)	PPSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-12.36	8.00	PASS
2437	-12.65	8.00	PASS
2462	-12.54	8.00	PASS

offset 10.50 dB for SISO mode

*Refer to next page for plots

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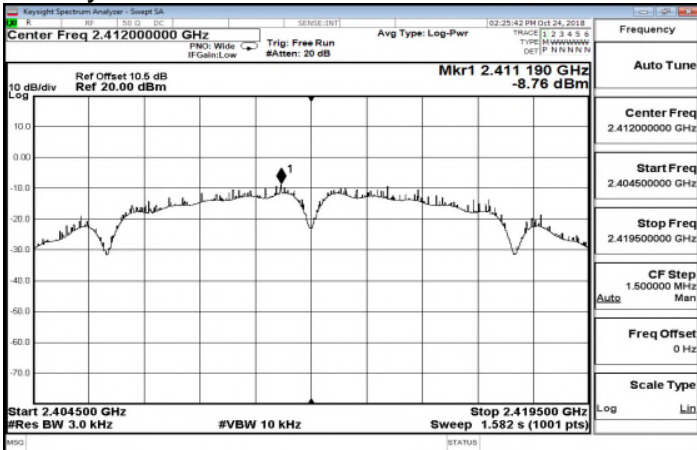
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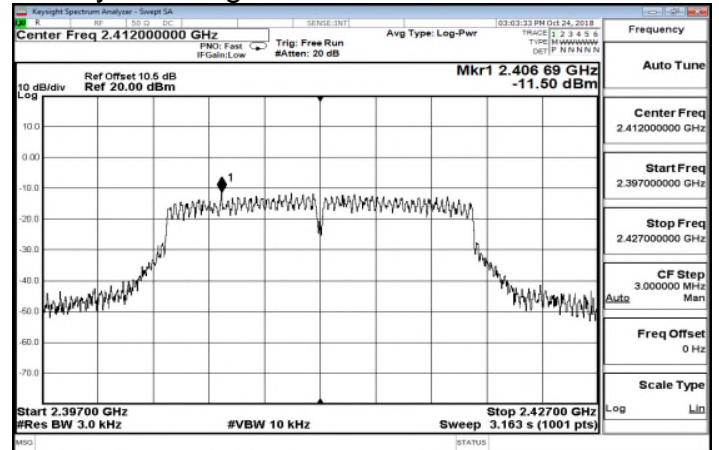
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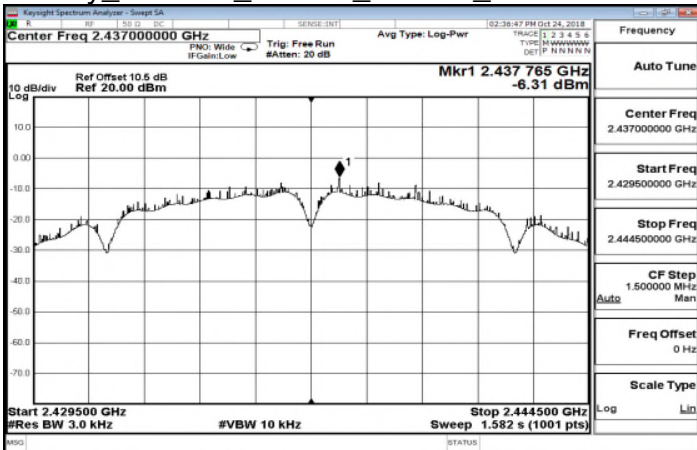
Power Density_802.11b_20MHz_Chain0_2412MHz



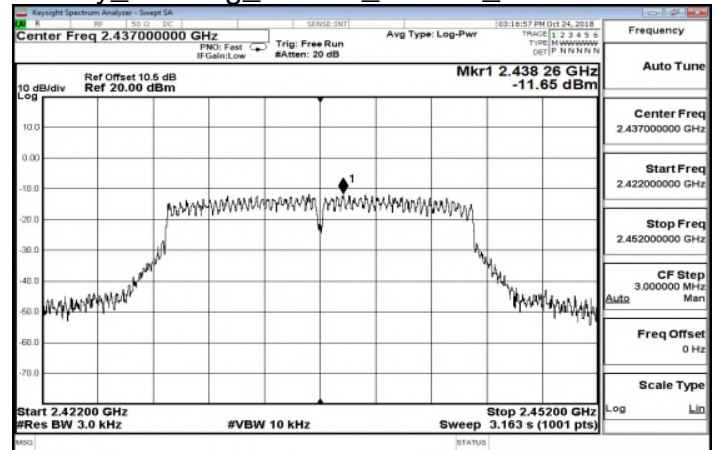
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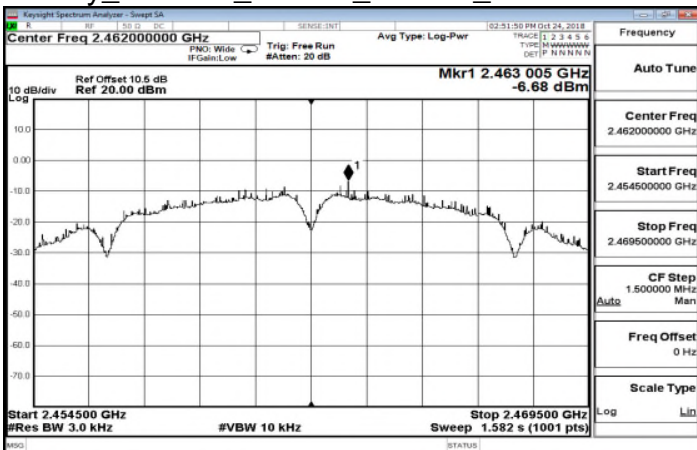
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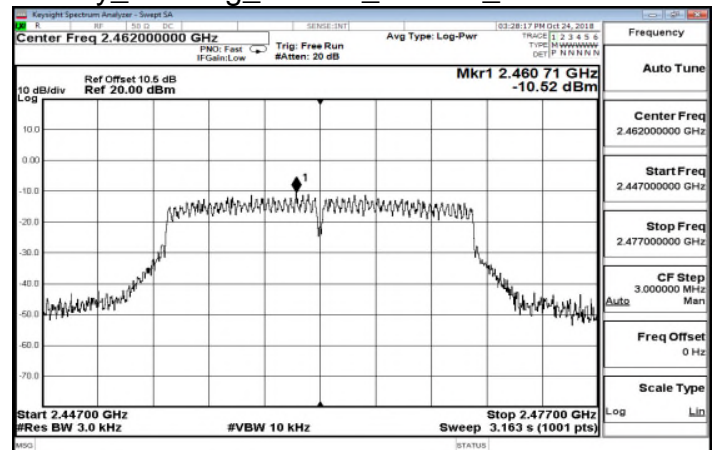
Power Density_802.11g_20MHz_Chain0_2437MHz



Power Density_802.11b_20MHz_Chain0_2462MHz



Power Density_802.11g_20MHz_Chain0_2462MHz

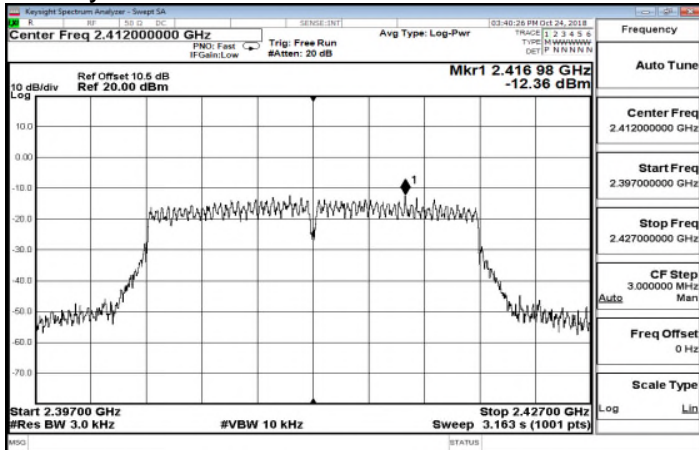


Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

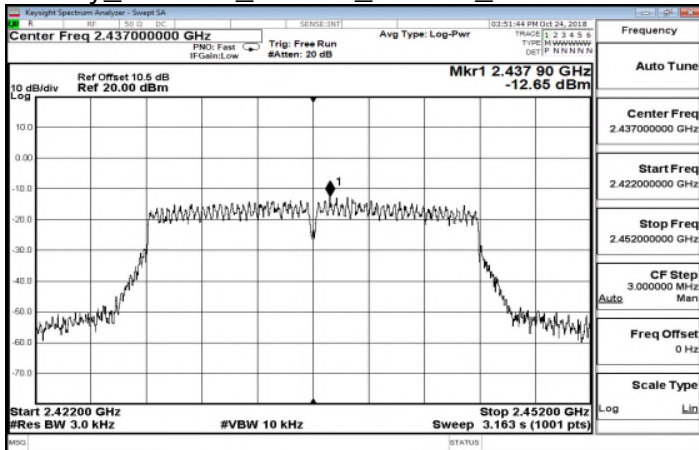
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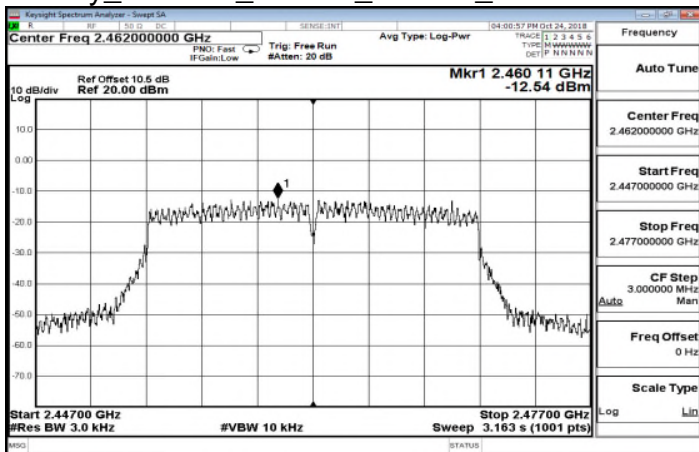
Power Density_802.11n_20MHz_Chain0_2412MHz



Power Density_802.11n_20MHz_Chain0_2437MHz



Power Density_802.11n_20MHz_Chain0_2462MHz



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13 ANTENNA REQUIREMENT

13.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

13.2 Antenna Connected Construction

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

~ End of Report ~

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SGS Taiwan Ltd.

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

台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

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