

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Applicant: ASKEY COMPUTER CORP.
10F, NO.119, JIANKANG RD., ZHONGHE DIST., NEW TAIPEI
CITY 23585, TAIWAN, R.O.C.

Product Name: Wireless module

Brand Name: Panasonic

Model No.: WLU5540B-D81(NB-RoHS)

Model Difference: N/A

FCC ID: H8N-WLU5540B-NB

Report Number: ER/2018/60110

FCC Rule Part: §15.247, Cat: DTS

Issue Date: Sep. 18, 2018

Date of Test: Jun. 25, 2018~ Sep. 06, 2018

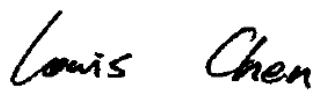
**Date of EUT Re-
ceived:** Jun. 25, 2018

We hereby certify that:

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

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

Tested By:



Louis Chen / Engineer

Approved By:



Blue Yang / Supervisor



Testing Laboratory
0513

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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
ER/2018/60110	Rev.00	Initial creation of document	All	Sep. 18, 2018	Stefanie Yu / Clerk

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1 GENERAL INFORMATION

1.1 Product description

General:

Product Name:	Wireless module
Brand Name:	Panasonic
Model No.:	WLU5540B-D81(NB-RoHS)
Model Difference:	N/A
Product HW version:	REV2
Product SW version:	N/A
Operating system:	Ubuntu 12.04.1
QA tool version:	v.62132
QA driver version:	v 0.0.4.26
Linux driver version:	v.1.0.1
Power Supply:	5Vdc from USB port

WLAN 2.4GHz:

WLAN	Frequency Range	Channels	Rated Power (dBm)	Modulation Technology
802.11b	2412-2462	11	24.65	DSSS
802.11g			27.74	OFDM
802.11n HT20			27.39 (MIMO)	
802.11n HT40	2422-2452	7	24.59 (MIMO)	
Antenna Designation:	PCB Antenna, Gain: 2.76 (Main) / 2.69dBi (Aux)			
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 802.11 n_40MHz: 13.5 – 300.0Mbps			

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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

ANSI C63.10:2013

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

1.3 Test Facility

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

(TAF code 0513)

FCC Registration Numbers are: 509634 / TW0001

1.4 Special Accessories

There are no special accessories used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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

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

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

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

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

2.3 Test Procedure

2.3.1 Conducted Emissions

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

2.3.2 Radiated Emissions

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

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.

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration



Fig. 2-3 Conducted (AC powerline) Emission Configuration



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

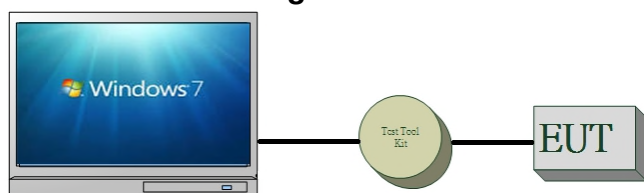


Table 2-1 Equipment Used in Tested System

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	L430	R9-X11BG	Shielded	Unshielded
3.	DC Power Supply	Agilent	E3640A	MY53130054	N/A	Unshielded

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3 SUMMARY OF TEST RESULTS

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

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4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

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

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

7 channels are provided for 802.11n HT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
3	2422 MHz	8	2447 MHz
4	2427 MHz	9	2452 MHz
5	2432 MHz		
6	2437 MHz		
7	2442 MHz		

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4.2 The Worst Test Modes and Channel Details

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

RADIATED EMISSION TEST:

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
RADIATED EMISSION TEST (BELOW 1 GHz)					
802.11g	1 to 11	1,6,11	OFDM	6	2TX
RADIATED EMISSION TEST (ABOVE 1 GHz)					
802.11b	1 to 11	1,6,11	DSSS	1	2TX
802.11g	1 to 11	1,2,6,10,11	OFDM	6	2TX
802.11n (HT20)	1 to 11	1,2,6,10,11	OFDM	MCS 8	MIMO
802.11n (HT40)	3 to 9	3,4,5,6,7,8,9	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 E1 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	2TX
802.11g	1 to 11	1,2,6,10,11	OFDM	6	2TX
802.11n (HT20)	1 to 11	1,2,6,10,11	OFDM	MCS 8	MIMO
802.11n (HT40)	3 to 9	3,4,5,6,7,8,9	OFDM	MCS 8	MIMO

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5 MEASUREMENT UNCERTAINTY

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

Radiated Spurious Emission:

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

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

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

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable

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

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

6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100335	2018/02/02	2018/08/28
LISN	SCHWARZ-BECK	NSLK 8127	8127-649	2018/05/18	2018/08/28
Notebook	Lenovo	L430	R9-WGNK5	2018/01/04	2019/01/03

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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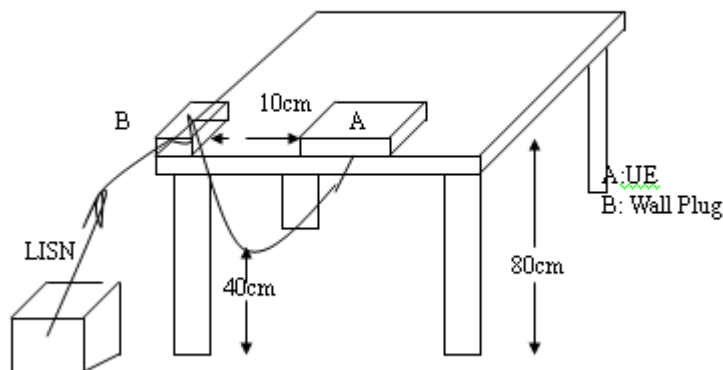
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6.4 Test SET-UP (Block Diagram of Configuration)



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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AC POWER LINE CONDUCTED EMISSION TEST DATA

Site: Conduction Room

Phase: L1

Temperature: 25 °C

Limit: FCC Class B Conduction(QP)

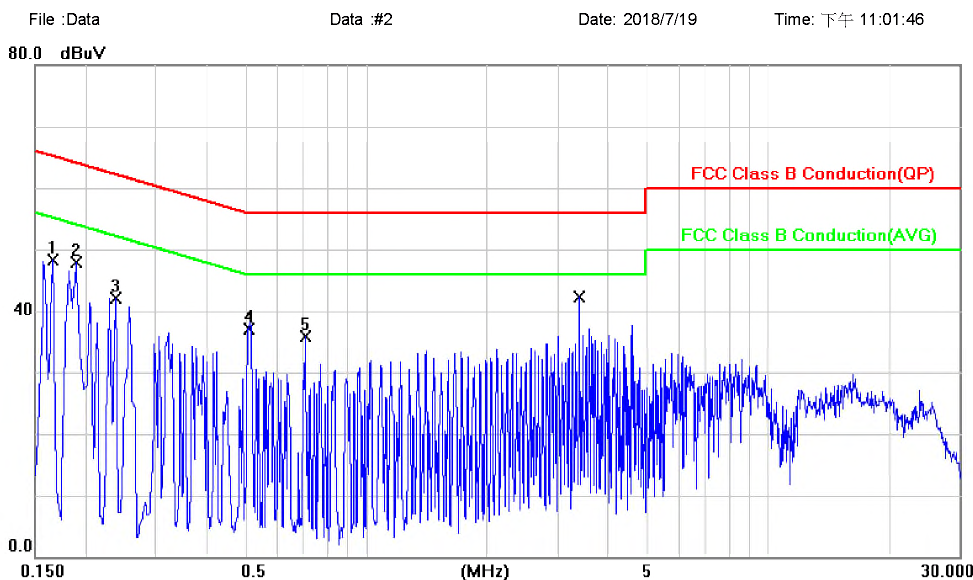
Power: AC 120V/60Hz

Humidity: 85 %

Mode: Operation

Note:

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1660	48.25	0.04	48.29	65.16	-16.87	peak	
2	*	0.1900	47.82	0.04	47.86	64.04	-16.18	peak	
3		0.2380	42.11	0.04	42.15	62.17	-20.02	peak	
4		0.5100	37.11	0.04	37.15	56.00	-18.85	peak	
5		0.7060	35.91	0.05	35.96	56.00	-20.04	peak	
6		3.4020	36.40	0.13	36.53	56.00	-19.47	QP	
7		3.4020	29.40	0.13	29.53	46.00	-16.47	AVG	

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Site Conduction Room

Phase: N

Temperature: 25 °C

Limit: FCC Class B Conduction(QP)

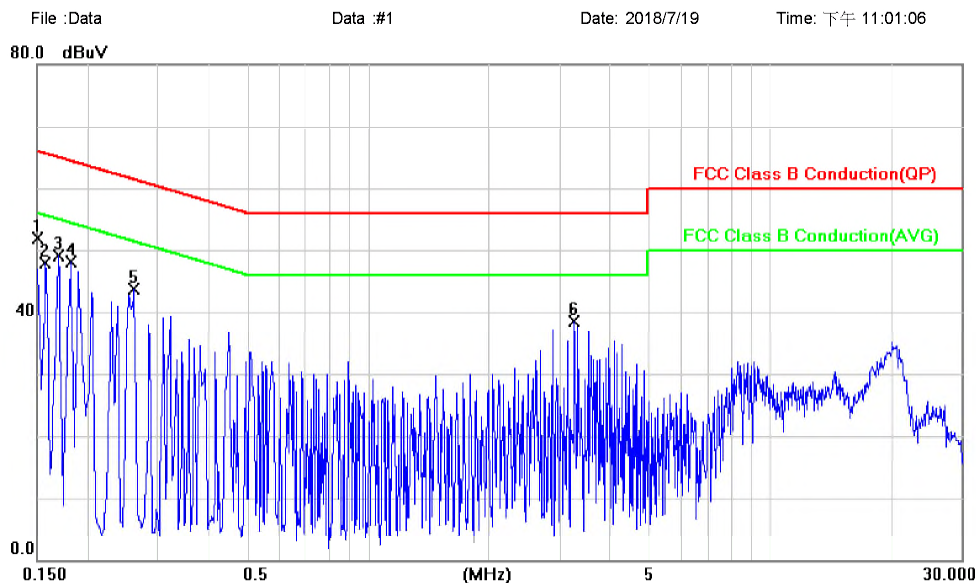
Power: AC 120V/60Hz

Humidity: 85 %

Mode: Operation

Note:

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1500	51.79	0.04	51.83	66.00	-14.17	peak	
2		0.1580	47.92	0.04	47.96	65.57	-17.61	peak	
3		0.1700	49.02	0.04	49.06	64.96	-15.90	peak	
4		0.1820	48.07	0.04	48.11	64.39	-16.28	peak	
5		0.2620	43.66	0.04	43.70	61.37	-17.67	peak	
6		3.2700	38.41	0.12	38.53	56.00	-17.47	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	99.60	0.02	0.12	0.01
802.11g	97.50	0.11	0.72	1.00
802.11n_20	94.90	0.23	1.49	2.00
802.11n_40	90.60	0.43	2.87	3.00

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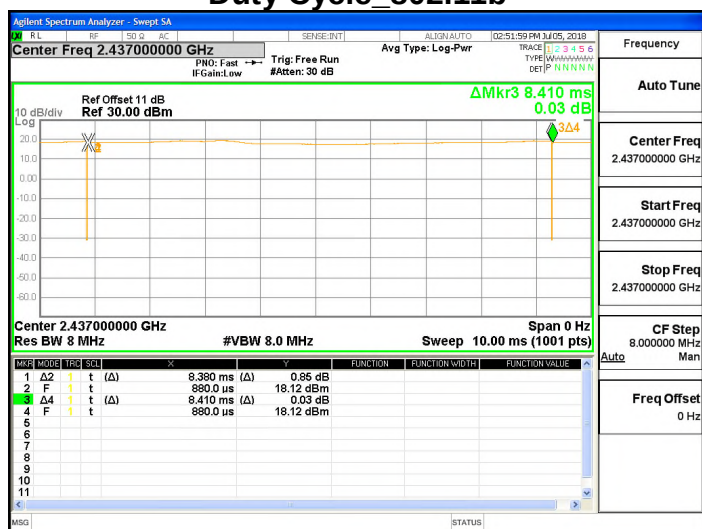
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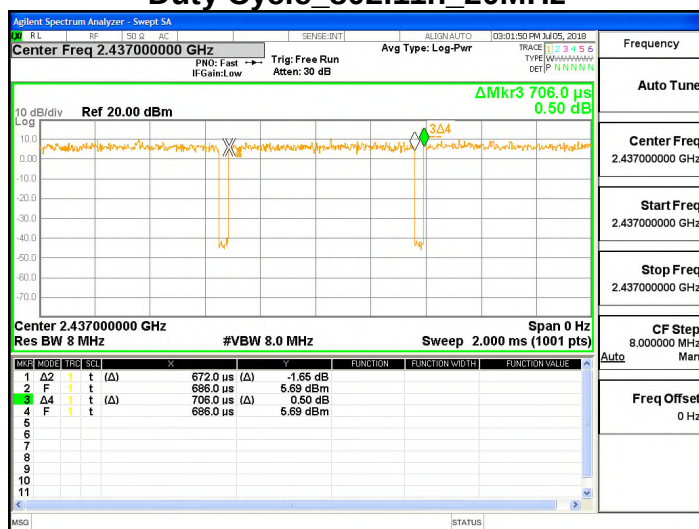
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7.1 DUTY CYCLE TEST SIGNAL Measurement Result

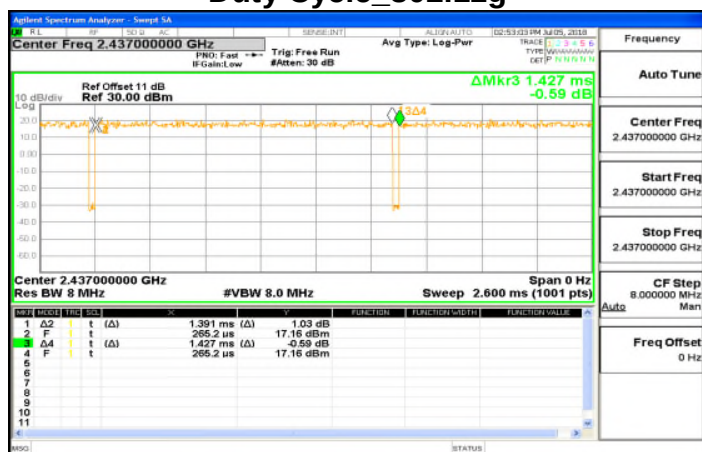
Duty Cycle_802.11b



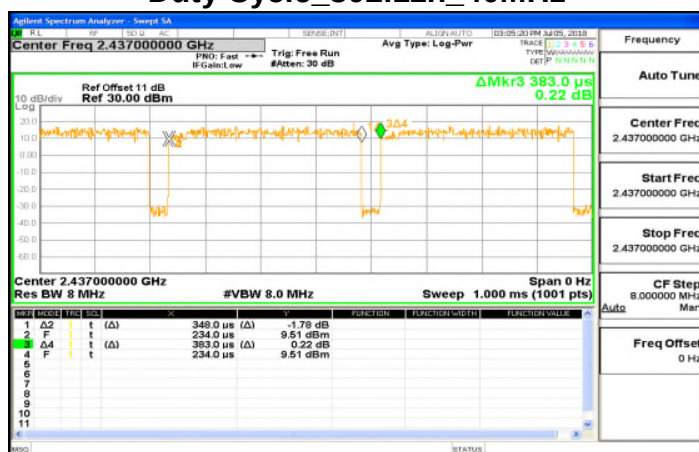
Duty Cycle_802.11n_20MHz



Duty Cycle_802.11g



Duty Cycle_802.11n_40MHz



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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:

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
 $= 10 \log[(10G_1/20 + 10G_2/20 + \dots + 10G_N/20)^2 / NANT]$ 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.]

Frequency (MHz)	Effective Legacy Gain (dBi)	Conducted Power Limit (dBm)
2412~2462	5.74	30.00

8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1242004	2017/10/16	2018/08/28
Power Sensor	Anritsu	MA2411B	917032	2017/12/29	2018/08/28
Attenuator	Mini-Circuit	BW-S10W2+	2	2017/11/29	2018/11/28
DC Block	Mini-Circuits	BLK-18-S+	1	2018/01/04	2019/01/03
Coaxial Cables	N/A	WK CE Cable	N/A	2017/12/20	2018/12/19
Notebook	Lenovo	L420	LR-7HXZA	2017/12/29	2018/12/28

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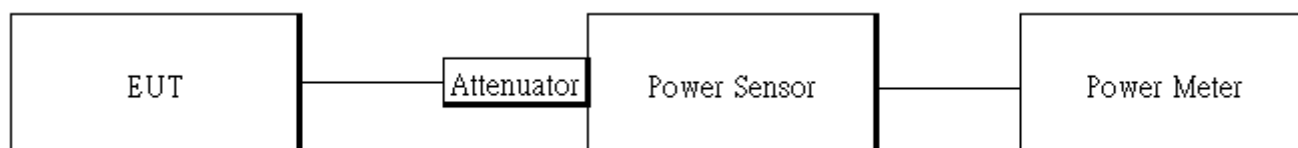
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8.3 Test Set-up

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.

8.5 Measurement Result

802.11b Main						
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	1	23.76	237.68	1 Watt = 30.00 dBm	PASS
6	2437	1	23.69	233.88	1 Watt = 30.00 dBm	PASS
11	2462	1	24.17	261.22	1 Watt = 30.00 dBm	PASS
802.11b Main						
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	1	21.90	154.73	1 Watt = 30.00 dBm	PASS
6	2437	1	22.37	172.41	1 Watt = 30.00 dBm	PASS
11	2462	1	22.47	176.43	1 Watt = 30.00 dBm	PASS

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802.11b Aux1

CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	1	24.15	260.02	1 Watt = 30.00 dBm	PASS
6	2437	1	24.18	261.82	1 Watt = 30.00 dBm	PASS
11	2462	1	24.18	261.82	1 Watt = 30.00 dBm	PASS

802.11b Aux1

CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Max. Avg. Output include tune up tolerance Power (mW)	Limit	RESULT
1	2412	1	21.88	154.02	1 Watt = 30.00 dBm	PASS
6	2437	1	22.25	167.71	1 Watt = 30.00 dBm	PASS
11	2462	1	22.34	171.22	1 Watt = 30.00 dBm	PASS

802.11b_2TX

CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)		Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CH 0	CH 1				
1	2412	1	21.15	21.42	24.30	268.99	1 Watt = 30.00 dBm	PASS
6	2437	1	21.78	21.49	24.65	291.59	1 Watt = 30.00 dBm	PASS
11	2462	1	21.66	21.42	24.55	285.23	1 Watt = 30.00 dBm	PASS

802.11b_2TX

CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)		Max. Avg. Output include tune up tolerance Power (dBm)	Max. Avg. Output include tune up tolerance Power (mW)	Limit	RESULT
			CH 0	CH 1				
1	2412	1	19.18	19.08	22.16	164.30	1 Watt = 30.00 dBm	PASS
6	2437	1	19.66	19.31	22.51	178.42	1 Watt = 30.00 dBm	PASS
11	2462	1	19.72	19.39	22.58	181.30	1 Watt = 30.00 dBm	PASS

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802.11g Main						
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	6	24.89	308.03	1 Watt = 30.00 dBm	PASS
2	2417	6	25.33	341.19	1 Watt = 30.00 dBm	PASS
6	2437	6	25.31	339.63	1 Watt = 30.00 dBm	PASS
10	2457	6	25.21	331.89	1 Watt = 30.00 dBm	PASS
11	2462	6	24.68	293.76	1 Watt = 30.00 dBm	PASS
802.11g Main						
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	6	17.69	58.78	1 Watt = 30.00 dBm	PASS
2	2417	6	19.69	93.16	1 Watt = 30.00 dBm	PASS
6	2437	6	19.75	94.45	1 Watt = 30.00 dBm	PASS
10	2457	6	20.06	101.44	1 Watt = 30.00 dBm	PASS
11	2462	6	17.69	58.78	1 Watt = 30.00 dBm	PASS
802.11g Aux1						
CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	6	25.27	336.51	1 Watt = 30.00 dBm	PASS
2	2417	6	25.76	376.70	1 Watt = 30.00 dBm	PASS
6	2437	6	25.69	370.68	1 Watt = 30.00 dBm	PASS
10	2457	6	25.69	370.68	1 Watt = 30.00 dBm	PASS
11	2462	6	25.02	317.69	1 Watt = 30.00 dBm	PASS
802.11g Aux1						
CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Max. Avg. Output include tune up tolerance Power (mW)	Limit	RESULT
1	2412	6	17.62	57.84	1 Watt = 30.00 dBm	PASS
2	2417	6	19.64	92.09	1 Watt = 30.00 dBm	PASS
6	2437	6	19.95	98.90	1 Watt = 30.00 dBm	PASS
10	2457	6	19.89	97.55	1 Watt = 30.00 dBm	PASS
11	2462	6	17.40	54.98	1 Watt = 30.00 dBm	PASS

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802.11g_2TX

CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)		Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CH 0	CH 1				
1	2412	6	22.23	22.32	25.29	337.72	1 Watt = 30.00 dBm	PASS
2	2417	6	24.56	24.68	27.63	579.52	1 Watt = 30.00 dBm	PASS
6	2437	6	24.73	24.72	27.74	593.65	1 Watt = 30.00 dBm	PASS
10	2457	6	24.58	24.78	27.69	587.69	1 Watt = 30.00 dBm	PASS
11	2462	6	21.87	22.01	24.95	312.67	1 Watt = 30.00 dBm	PASS

802.11g_2TX

CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)		Max. Avg. Output include tune up tolerance Power (dBm)	Max. Avg. Output include tune up tolerance Power (mW)	Limit	RESULT
			CH 0	CH 1				
1	2412	6	15.14	14.68	18.04	63.66	1 Watt = 30.00 dBm	PASS
2	2417	6	16.87	17.02	20.07	101.58	1 Watt = 30.00 dBm	PASS
6	2437	6	17.27	17.03	20.27	106.52	1 Watt = 30.00 dBm	PASS
10	2457	6	17.25	17.16	20.33	107.84	1 Watt = 30.00 dBm	PASS
11	2462	6	14.76	14.67	17.84	60.78	1 Watt = 30.00 dBm	PASS

802.11n_HT20M Main

CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	MCS0	24.97	314.05	1 Watt = 30.00 dBm	PASS
2	2417	MCS0	25.36	343.56	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	25.31	339.63	1 Watt = 30.00 dBm	PASS
10	2457	MCS0	25.34	341.98	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	25.01	316.96	1 Watt = 30.00 dBm	PASS

802.11n_HT20M Main

CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	MCS0	16.53	45.03	1 Watt = 30.00 dBm	PASS
2	2417	MCS0	19.11	81.56	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	19.62	91.72	1 Watt = 30.00 dBm	PASS
10	2457	MCS0	20.38	109.26	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	18.15	65.38	1 Watt = 30.00 dBm	PASS

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802.11n_HT20M Aux1

CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
1	2412	MCS0	25.34	341.98	1 Watt = 30.00 dBm	PASS
2	2417	MCS0	25.83	382.82	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	25.75	375.84	1 Watt = 30.00 dBm	PASS
10	2457	MCS0	25.83	382.82	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	25.42	348.34	1 Watt = 30.00 dBm	PASS

802.11n_HT20M Aux1

CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Max. Avg. Output include tune up tolerance Power (mW)	Limit	RESULT
1	2412	MCS0	16.49	44.61	1 Watt = 30.00 dBm	PASS
2	2417	MCS0	19.08	80.99	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	19.28	84.81	1 Watt = 30.00 dBm	PASS
10	2457	MCS0	20.34	108.26	1 Watt = 30.00 dBm	PASS
11	2462	MCS0	17.99	63.02	1 Watt = 30.00 dBm	PASS

802.11n_HT20M MIMO

CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)		Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CH 0	CH 1				
1	2412	MCS8	21.25	21.31	24.29	268.56	1 Watt = 30.00 dBm	PASS
2	2417	MCS8	23.82	23.98	26.91	491.03	1 Watt = 30.00 dBm	PASS
6	2437	MCS8	23.87	23.84	26.87	485.88	1 Watt = 30.00 dBm	PASS
10	2457	MCS8	24.30	24.46	27.39	548.41	1 Watt = 30.00 dBm	PASS
11	2462	MCS8	21.49	21.72	24.62	289.52	1 Watt = 30.00 dBm	PASS

802.11n_HT20M MIMO

CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)		Max. Avg. Output include tune up tolerance Power (dBm)	Max. Avg. Output include tune up tolerance Power (mW)	Limit	RESULT
			CH 0	CH 1				
1	2412	MCS8	13.86	13.43	16.88	48.70	1 Watt = 30.00 dBm	PASS
2	2417	MCS8	16.11	16.26	19.41	87.31	1 Watt = 30.00 dBm	PASS
6	2437	MCS8	16.63	16.34	19.71	93.59	1 Watt = 30.00 dBm	PASS
10	2457	MCS8	17.56	17.43	20.72	118.04	1 Watt = 30.00 dBm	PASS
11	2462	MCS8	15.11	15.04	18.30	67.61	1 Watt = 30.00 dBm	PASS

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802.11n_HT40M Main

CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
3	2422	MCS0	22.44	175.39	1 Watt = 30.00 dBm	PASS
4	2427	MCS0	22.48	177.01	1 Watt = 30.00 dBm	PASS
5	2432	MCS0	22.51	178.24	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	22.40	173.78	1 Watt = 30.00 dBm	PASS
7	2442	MCS0	22.64	183.65	1 Watt = 30.00 dBm	PASS
8	2447	MCS0	23.78	238.78	1 Watt = 30.00 dBm	PASS
9	2452	MCS0	23.67	232.81	1 Watt = 30.00 dBm	PASS

802.11n_HT40M Main

CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Max. Avg. Output include tune up tolerance Power (mW)	Limit	RESULT
3	2422	MCS0	15.10	32.33	1 Watt = 30.00 dBm	PASS
4	2427	MCS0	15.60	36.28	1 Watt = 30.00 dBm	PASS
5	2432	MCS0	15.81	38.07	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	17.43	55.29	1 Watt = 30.00 dBm	PASS
7	2442	MCS0	17.47	55.80	1 Watt = 30.00 dBm	PASS
8	2447	MCS0	17.10	51.24	1 Watt = 30.00 dBm	PASS
9	2452	MCS0	16.73	47.06	1 Watt = 30.00 dBm	PASS

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802.11n_HT40M Aux1

CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)	Peak Output Power (mW)	Limit	RESULT
3	2422	MCS0	22.87	193.64	1 Watt = 30.00 dBm	PASS
4	2427	MCS0	22.88	194.09	1 Watt = 30.00 dBm	PASS
5	2432	MCS0	22.75	188.36	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	22.77	189.23	1 Watt = 30.00 dBm	PASS
7	2442	MCS0	22.81	190.99	1 Watt = 30.00 dBm	PASS
8	2447	MCS0	24.18	261.82	1 Watt = 30.00 dBm	PASS
9	2452	MCS0	23.98	250.03	1 Watt = 30.00 dBm	PASS

802.11n_HT40M Aux1

CH	Freq. (MHz)	Data Rate	Max. Avg. Output include tune up tolerance Power (dBm)	Max. Avg. Output include tune up tolerance Power (mW)	Limit	RESULT
3	2422	MCS0	15.07	32.11	1 Watt = 30.00 dBm	PASS
4	2427	MCS0	15.58	36.11	1 Watt = 30.00 dBm	PASS
5	2432	MCS0	15.76	37.64	1 Watt = 30.00 dBm	PASS
6	2437	MCS0	17.16	51.95	1 Watt = 30.00 dBm	PASS
7	2442	MCS0	17.33	54.03	1 Watt = 30.00 dBm	PASS
8	2447	MCS0	16.73	47.06	1 Watt = 30.00 dBm	PASS
9	2452	MCS0	16.23	41.94	1 Watt = 30.00 dBm	PASS

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802.11n_HT40M MIMO

CH	Freq. (MHz)	Data Rate	Peak Output Power (dBm)		Total Peak Output Power (dBm)	Total Peak Output Power (mW)	Limit	RESULT
			CH 0	CH 1				
3	2422	MCS8	20.74	20.68	23.72	235.53	1 Watt = 30.00 dBm	PASS
4	2427	MCS8	20.64	20.58	23.62	230.17	1 Watt = 30.00 dBm	PASS
5	2432	MCS8	20.55	20.35	23.46	221.89	1 Watt = 30.00 dBm	PASS
6	2437	MCS8	20.90	20.65	23.79	239.17	1 Watt = 30.00 dBm	PASS
7	2442	MCS8	20.62	20.45	23.55	226.26	1 Watt = 30.00 dBm	PASS
8	2447	MCS8	21.62	21.54	24.59	287.77	1 Watt = 30.00 dBm	PASS
9	2452	MCS8	21.49	21.25	24.38	274.28	1 Watt = 30.00 dBm	PASS

802.11n_HT40M MIMO

CH	Freq. (MHz)	Data Rate	Avg. Output Power (dBm)		Max. Avg. Output include tune up tolerance Power (dBm)	Max. Avg. Output include tune up tolerance Power (mW)	Limit	RESULT
			CH 0	CH 1				
3	2422	MCS8	12.04	11.57	15.24	33.40	1 Watt = 30.00 dBm	PASS
4	2427	MCS8	12.54	12.03	15.72	37.32	1 Watt = 30.00 dBm	PASS
5	2432	MCS8	12.61	12.24	15.86	38.51	1 Watt = 30.00 dBm	PASS
6	2437	MCS8	14.17	14.09	17.56	56.97	1 Watt = 30.00 dBm	PASS
7	2442	MCS8	14.43	14.41	17.85	60.91	1 Watt = 30.00 dBm	PASS
8	2447	MCS8	14.11	13.97	17.47	55.81	1 Watt = 30.00 dBm	PASS
9	2452	MCS8	13.62	13.59	17.03	50.48	1 Watt = 30.00 dBm	PASS

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

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9 6DB & 99% BANDWIDTH MEASUREMENT

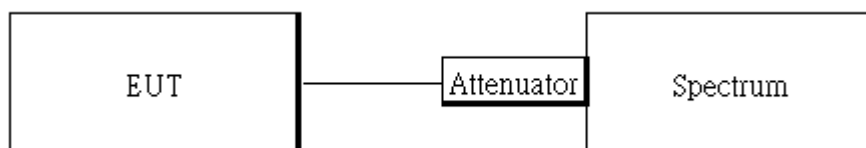
9.1 Standard Applicable

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

9.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	2018/05/03	2018/08/28
Attenuator	Mini-Circuit	BW-S10W2+	2	2017/11/29	2018/11/28
DC Block	Mini-Circuits	BLK-18-S+	1	2018/01/04	2019/01/03
Coaxial Cables	N/A	WK CE Cable	N/A	2017/12/20	2018/12/19
Notebook	Lenovo	L420	LR-7HXZA	2017/12/29	2018/12/28

9.3 Test Set-up



9.4 Measurement Procedure

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

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9.5 Measurement Result

802.11b Main

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	9073.00	> 500	PASS
2437	9115.00	> 500	PASS
2462	9116.00	> 500	PASS

802.11b Aux1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	9101.00	> 500	PASS
2437	9101.00	> 500	PASS
2462	8118.00	> 500	PASS

802.11g Main

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	15100.00	> 500	PASS
2417	15130.00	> 500	PASS
2437	15140.00	> 500	PASS
2457	15160.00	> 500	PASS
2462	15120.00	> 500	PASS

802.11g Aux1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	14470.00	> 500	PASS
2417	15140.00	> 500	PASS
2437	15120.00	> 500	PASS
2457	15150.00	> 500	PASS
2462	15140.00	> 500	PASS

802.11_n HT20 Main

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	15150.00	> 500	PASS
2417	15160.00	> 500	PASS
2437	15140.00	> 500	PASS
2457	15130.00	> 500	PASS
2462	15120.00	> 500	PASS

802.11_n HT20 Aux1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2412	15150.00	> 500	PASS
2417	15140.00	> 500	PASS
2437	15150.00	> 500	PASS
2457	15140.00	> 500	PASS
2462	15140.00	> 500	PASS

802.11_n HT40 Main

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2422	35180.00	> 500	PASS
2427	35170.00	> 500	PASS
2432	35160.00	> 500	PASS
2437	35180.00	> 500	PASS
2442	35170.00	> 500	PASS
2447	35160.00	> 500	PASS
2452	35915.00	> 500	PASS

802.11_n HT40 Aux1

Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2422	35150.00	> 500	PASS
2427	35170.00	> 500	PASS
2432	35170.00	> 500	PASS
2437	35160.00	> 500	PASS
2442	35170.00	> 500	PASS
2447	35350.00	> 500	PASS
2452	35906.00	> 500	PASS

*Refer to next page for plots

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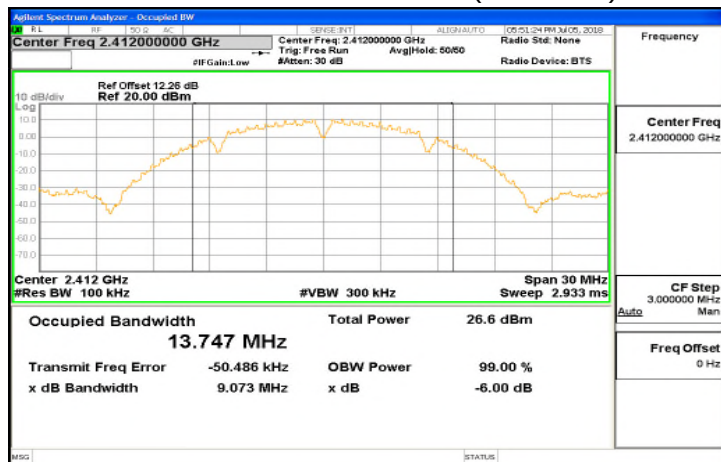
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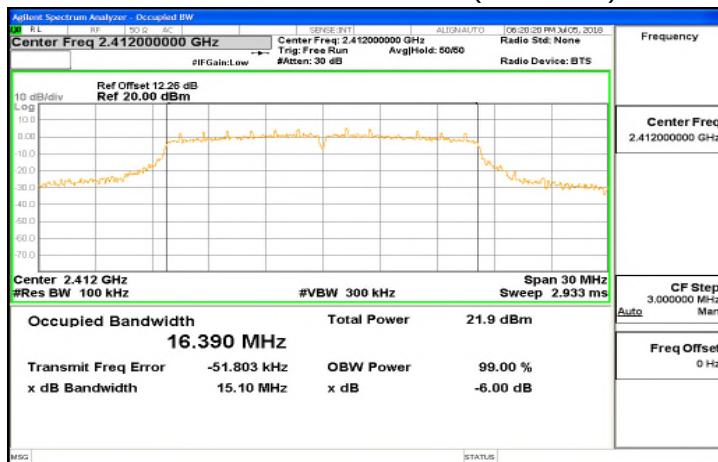
802.11b (Main)

6dB Band Width Test Data CH-Low (2412MHz)

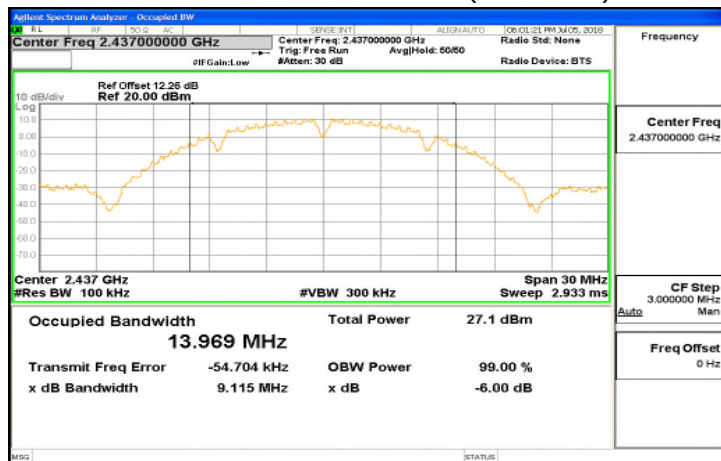


802.11g (Main)

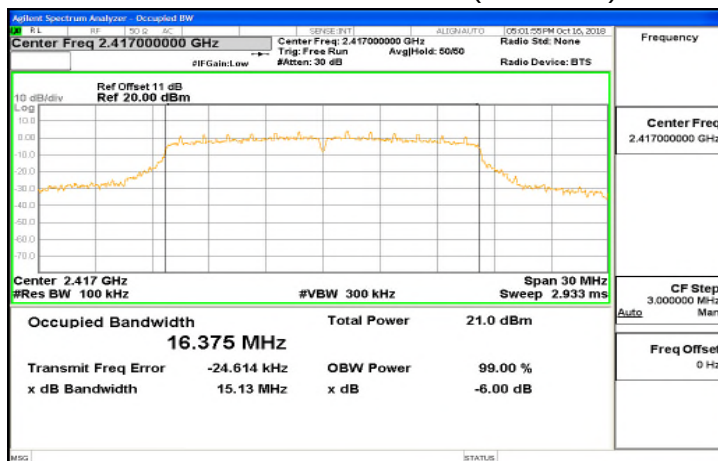
6dB Band Width Test Data CH-Low (2412MHz)



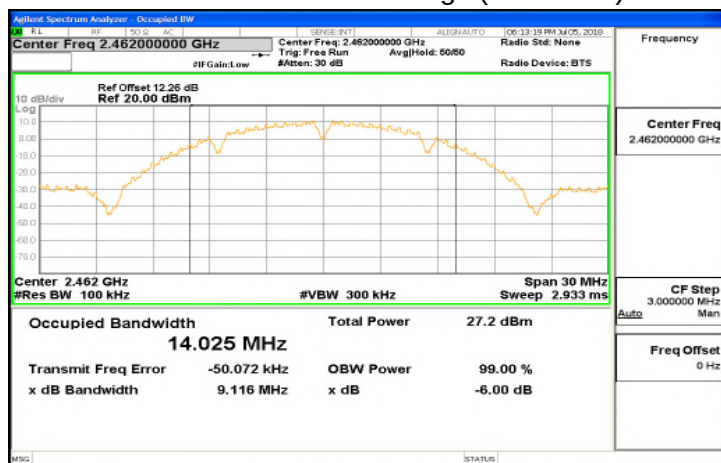
6dB Band Width Test Data CH-Mid (2437MHz)



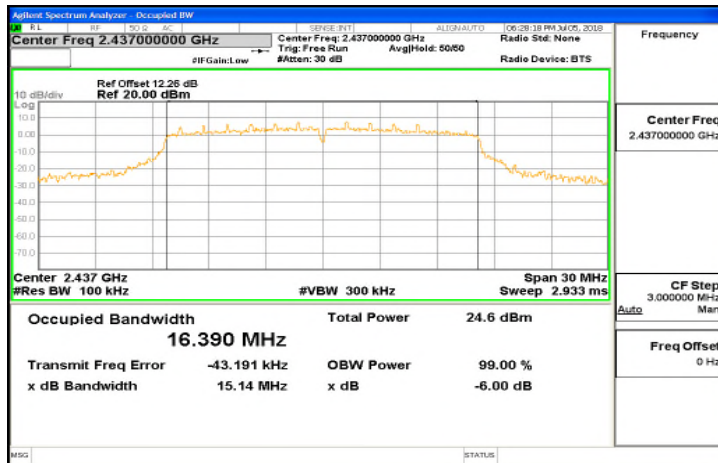
6dB Band Width Test Data CH-Low (2417MHz)



6dB Band Width Test Data CH-High (2462MHz)



6dB Band Width Test Data CH-Mid (2437MHz)



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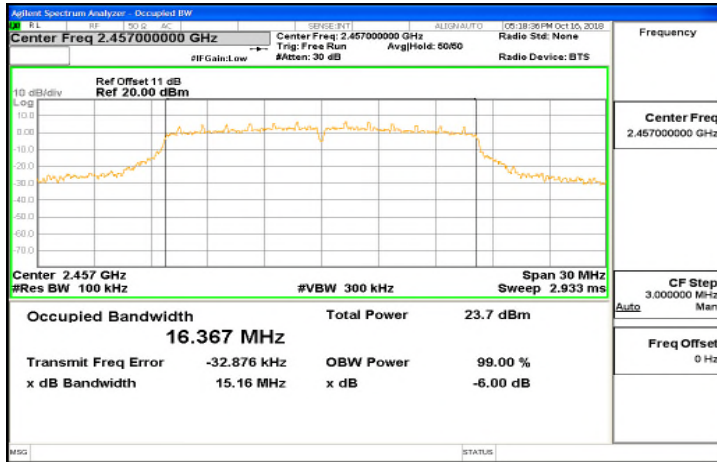
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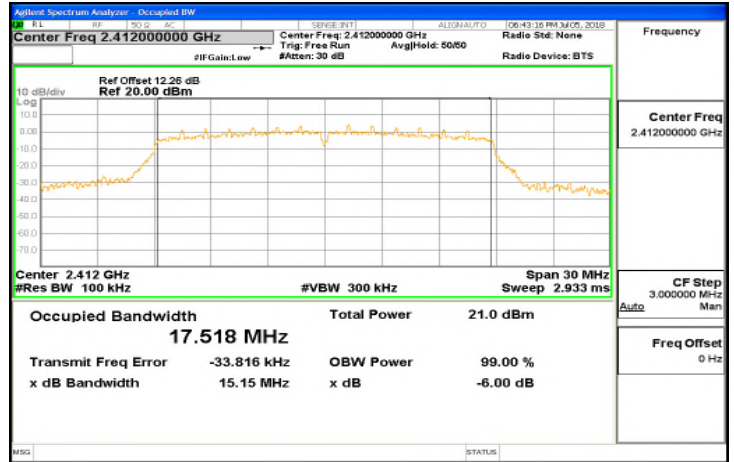
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6dB Band Width Test Data CH-High (2457MHz)

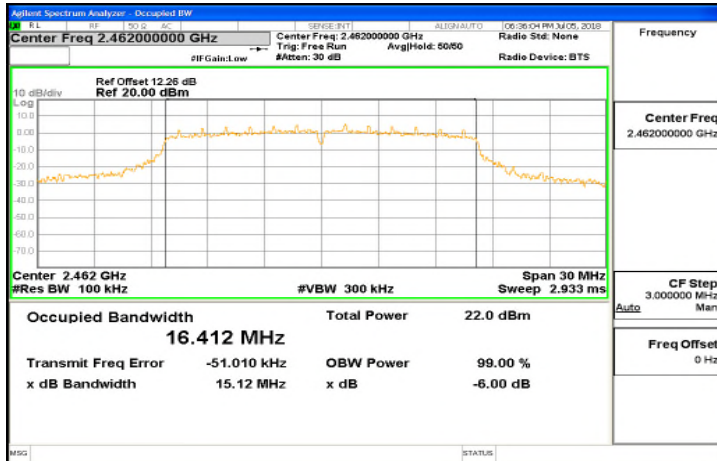


802.11n_20M (Main)

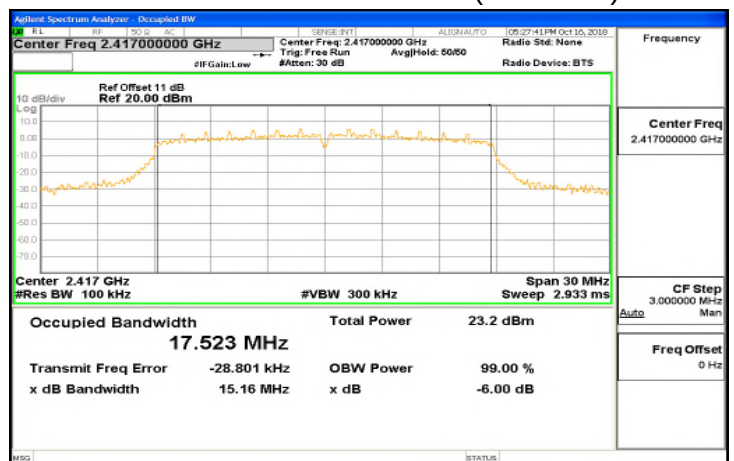
6dB Band Width Test Data CH-Low (2412MHz)



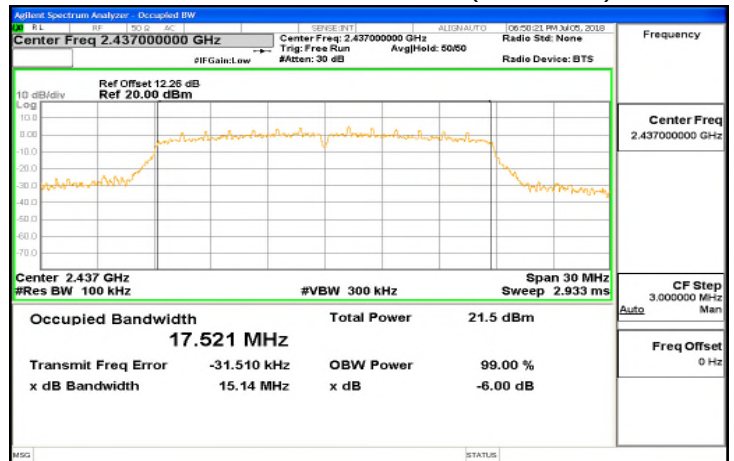
6dB Band Width Test Data CH-High (2462MHz)



6dB Band Width Test Data CH-Low (2417MHz)



6dB Band Width Test Data CH-Mid (2437MHz)



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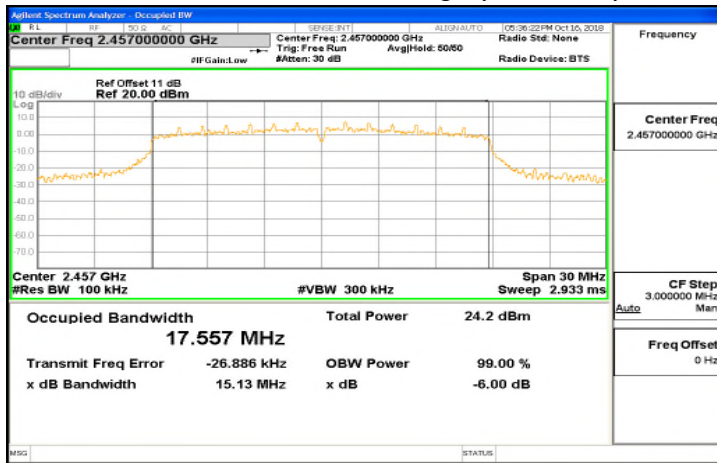
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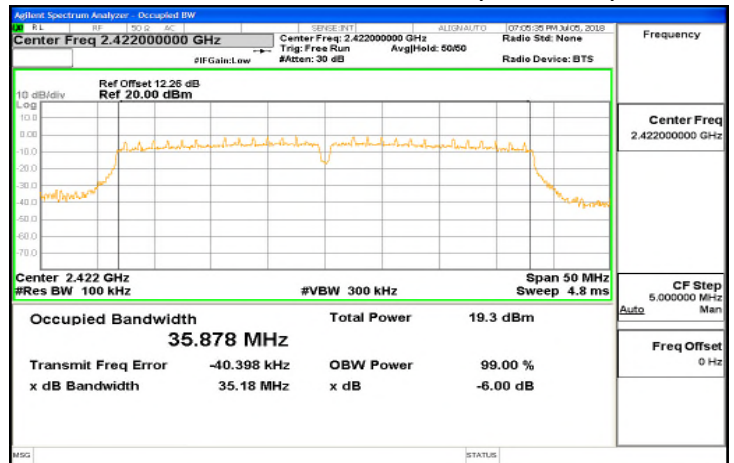
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6dB Band Width Test Data CH-High (2457MHz)

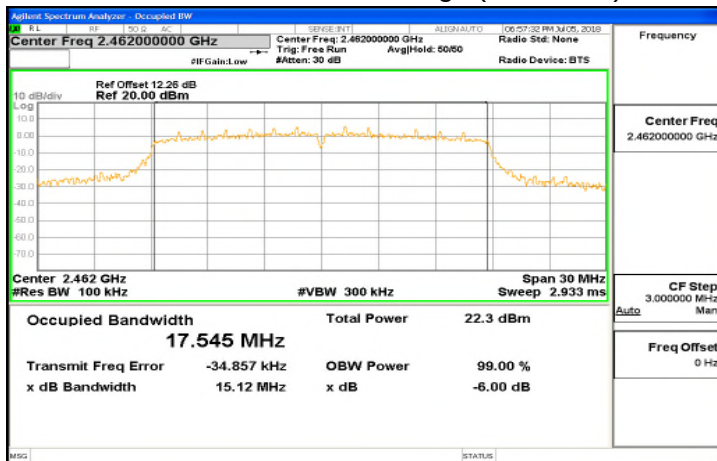


802.11n_40M (Main)

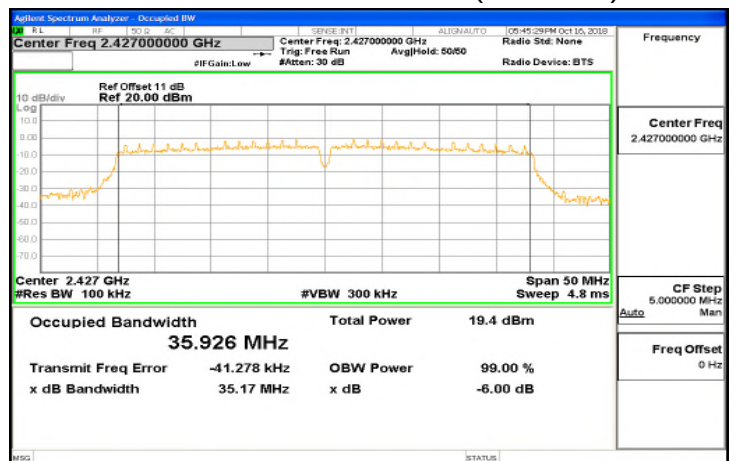
6dB Band Width Test Data CH-Low (2422MHz)



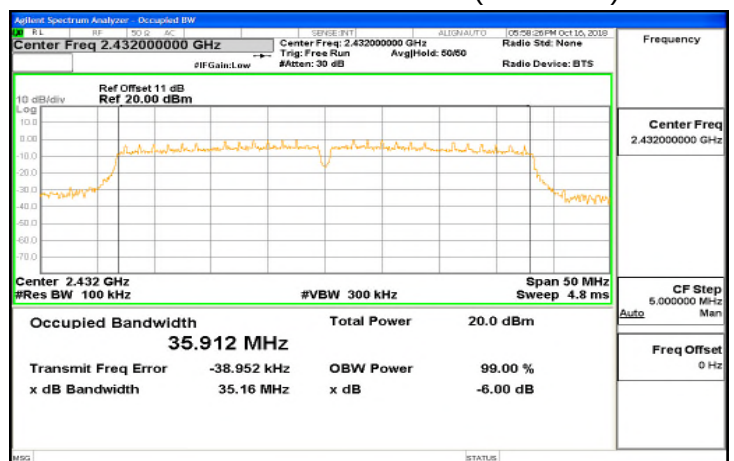
6dB Band Width Test Data CH-High (2462MHz)



6dB Band Width Test Data CH-Low (2427MHz)



6dB Band Width Test Data CH-Low (2432MHz)



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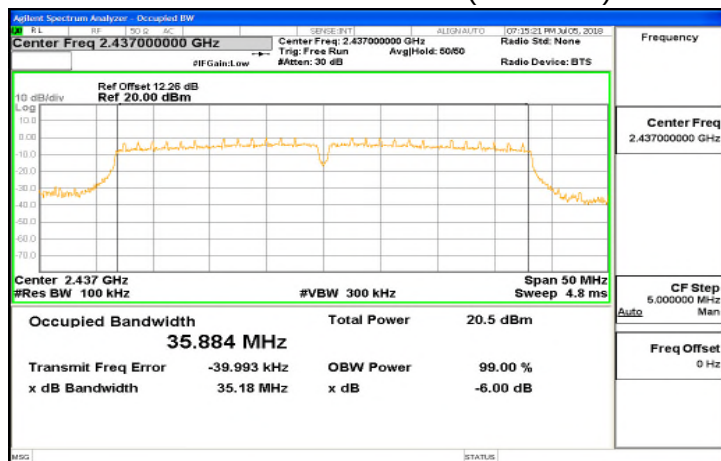
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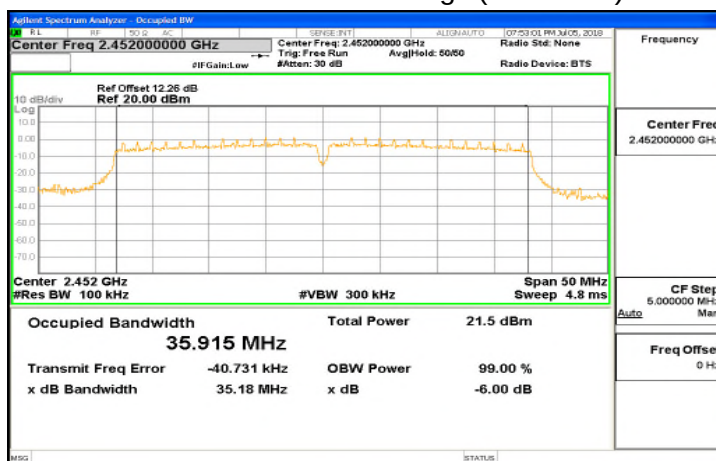
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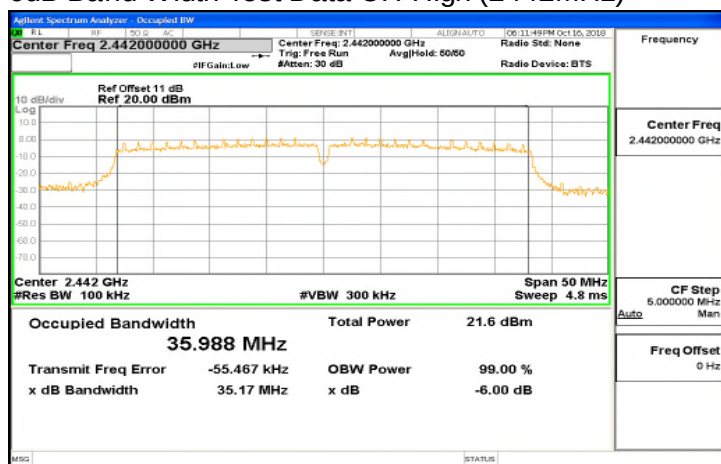
6dB Band Width Test Data CH-Mid (2437MHz)



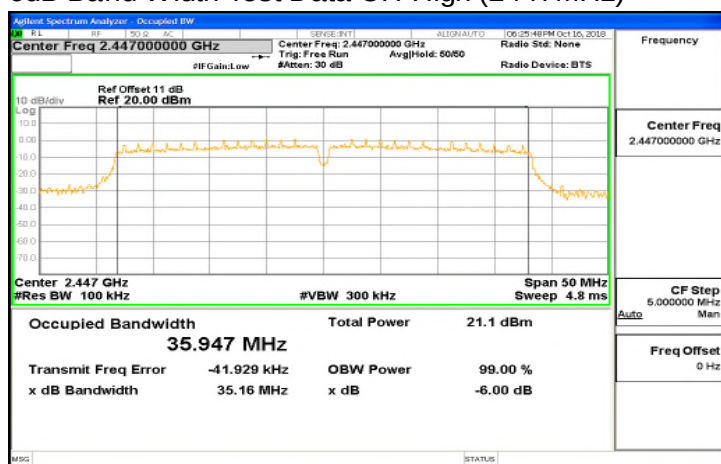
6dB Band Width Test Data CH-High (2452MHz)



6dB Band Width Test Data CH-High (2442MHz)



6dB Band Width Test Data CH-High (2447MHz)



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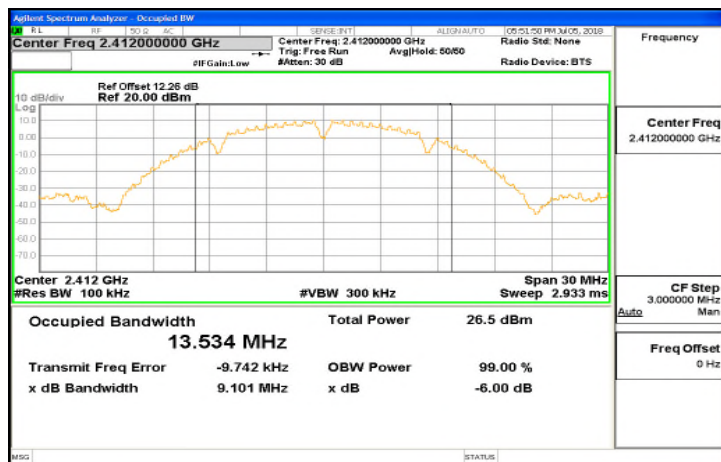
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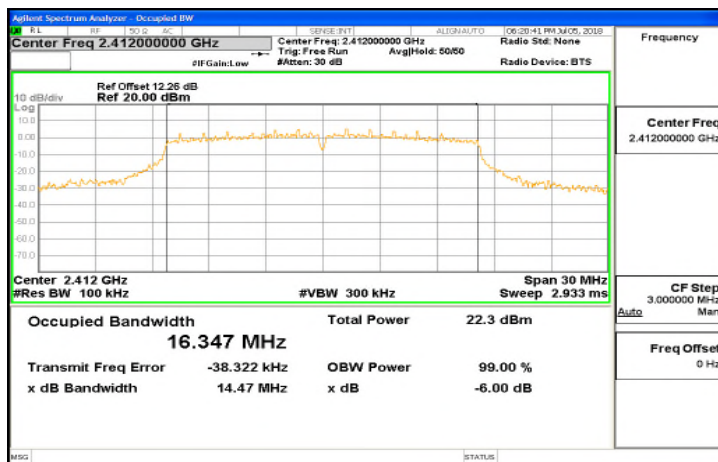
802.11b (Aux)

6dB Band Width Test Data CH-Low (2412MHz)

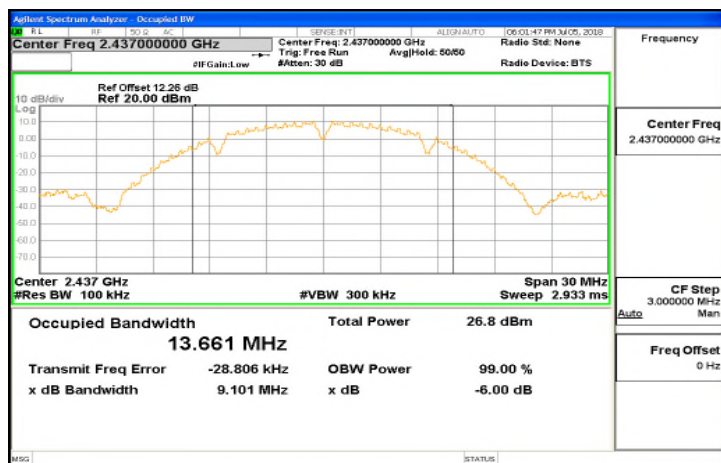


802.11g (Aux)

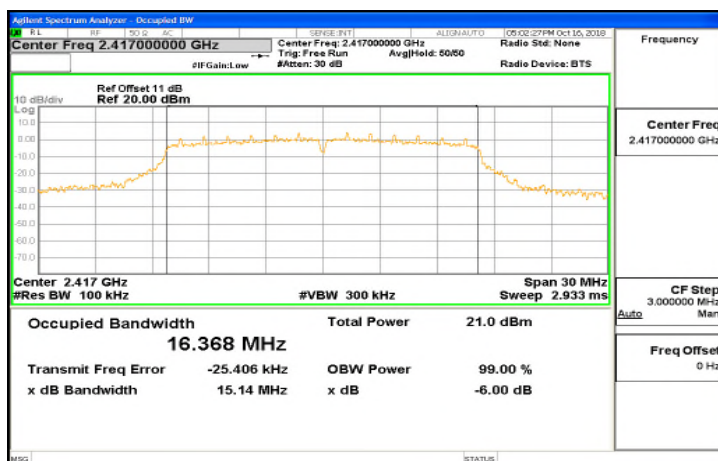
6dB Band Width Test Data CH-Low (2412MHz)



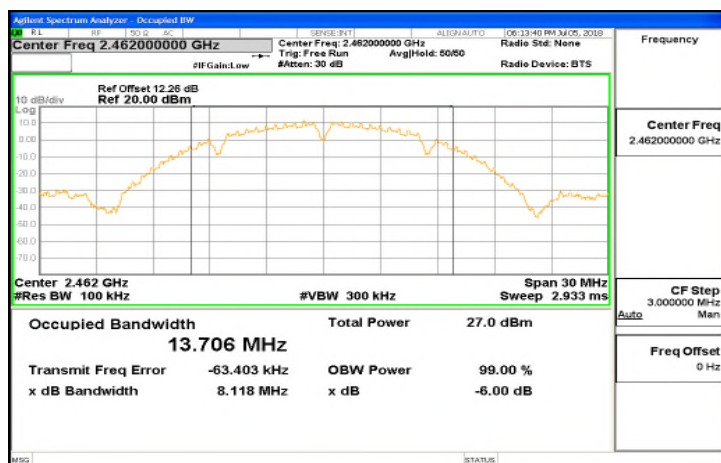
6dB Band Width Test Data CH-Mid (2437MHz)



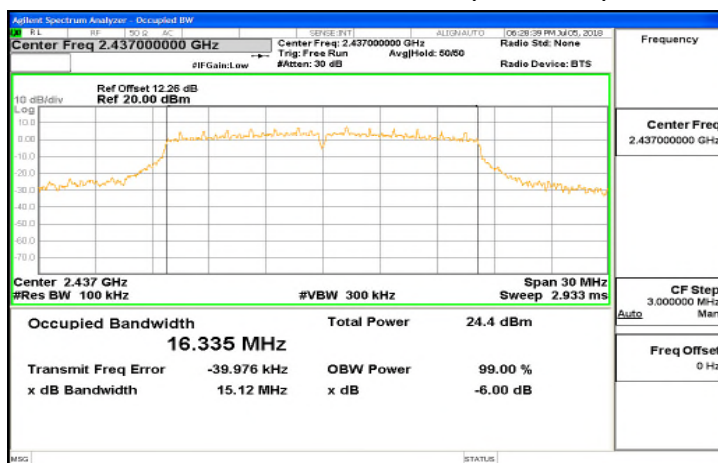
6dB Band Width Test Data CH-Low (2417MHz)



6dB Band Width Test Data CH-High (2462MHz)



6dB Band Width Test Data CH-Mid (2437MHz)



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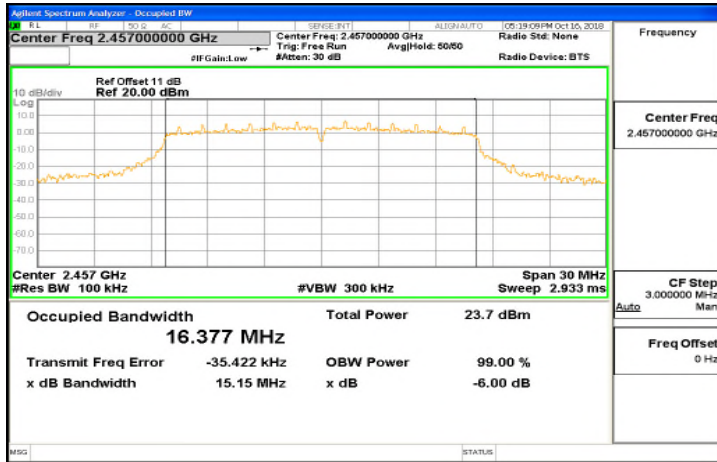
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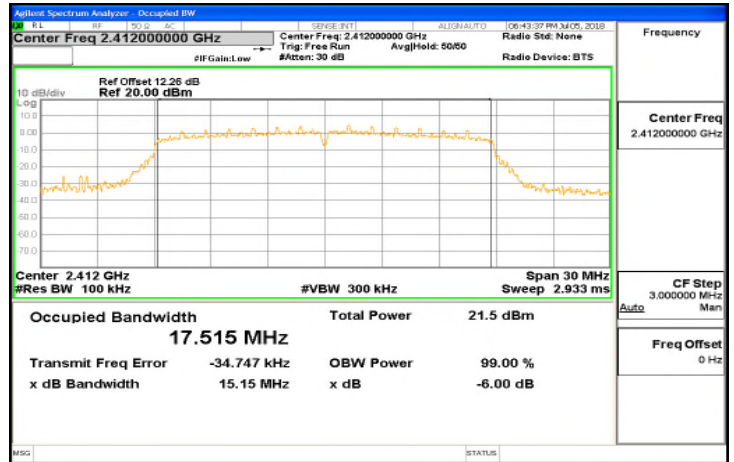
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802.11n_20M (Aux)

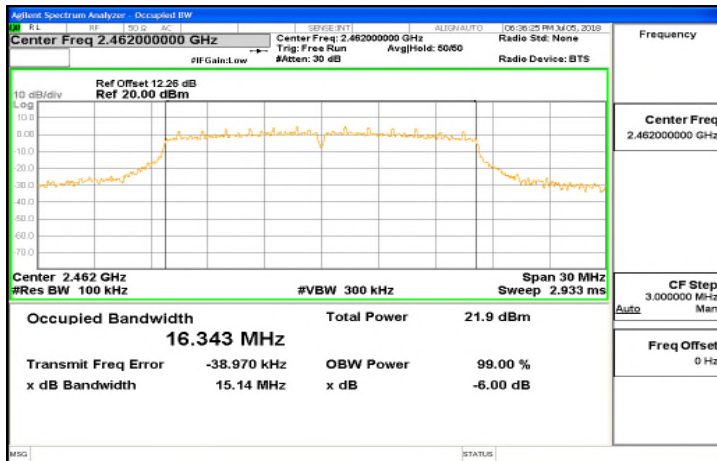
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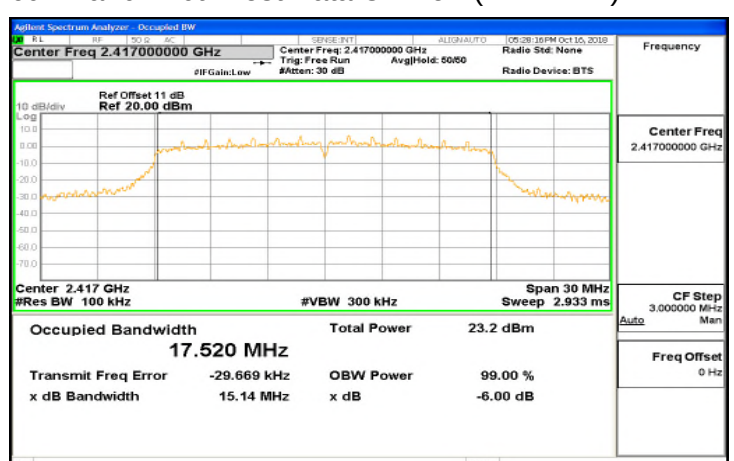
6dB Band Width Test Data CH-Low (2412MHz)



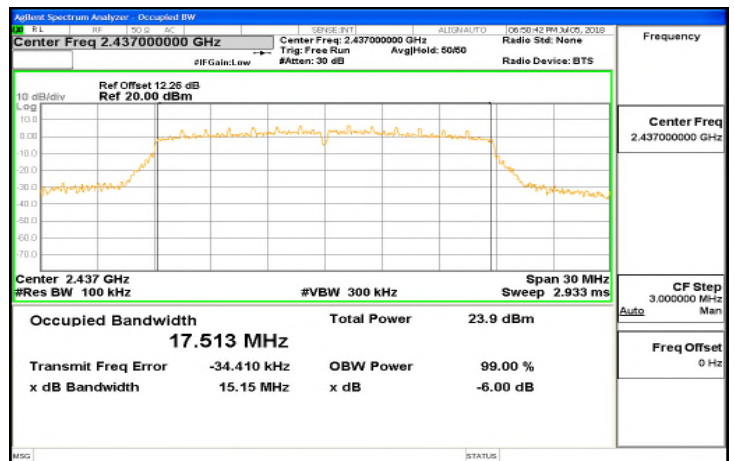
6dB Band Width Test Data CH-High (2462MHz)



6dB Band Width Test Data CH-Low (2417MHz)



6dB Band Width Test Data CH-Low (2437MHz)



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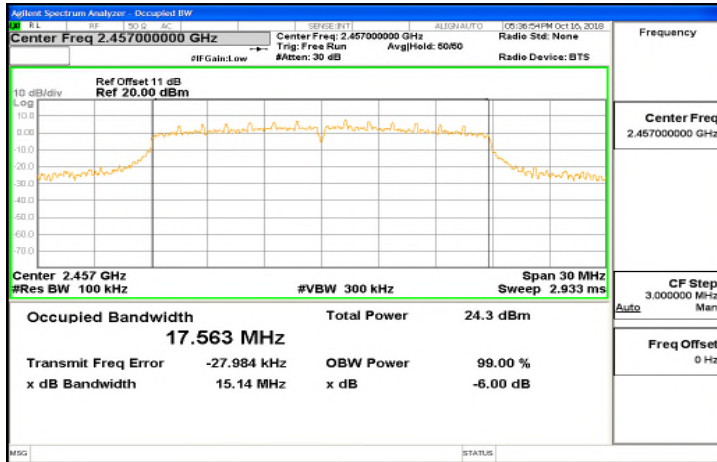
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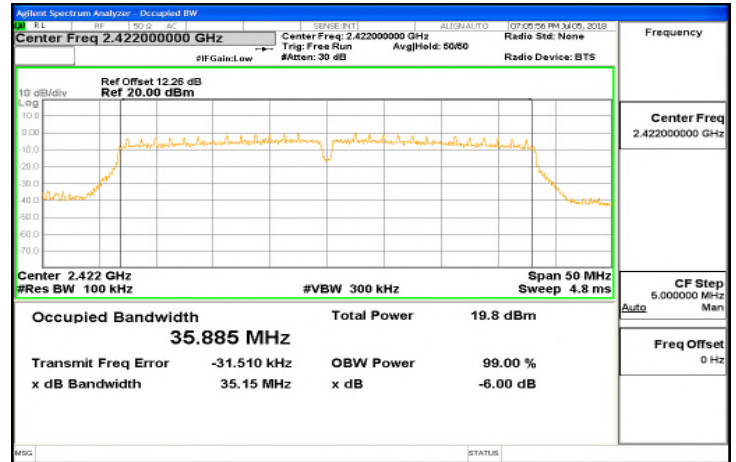
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802.11n_40M (Aux)

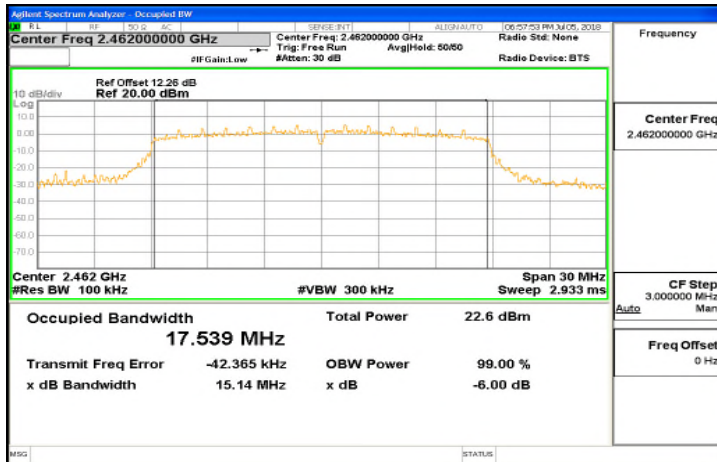
6dB Band Width Test Data CH- High (2457MHz)



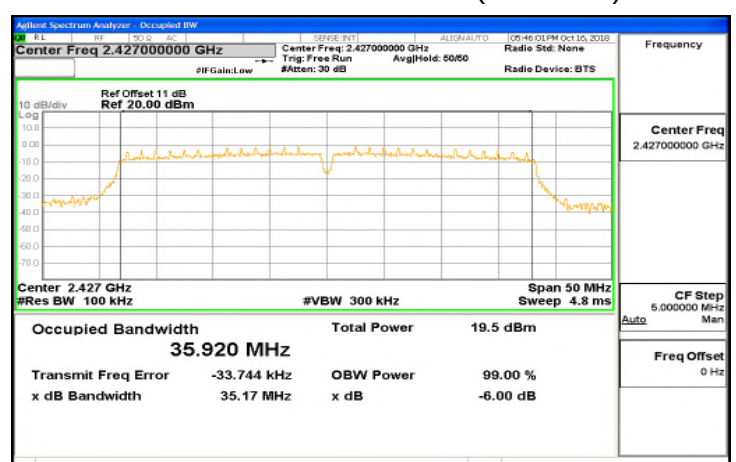
6dB Band Width Test Data CH-Low (2422MHz)



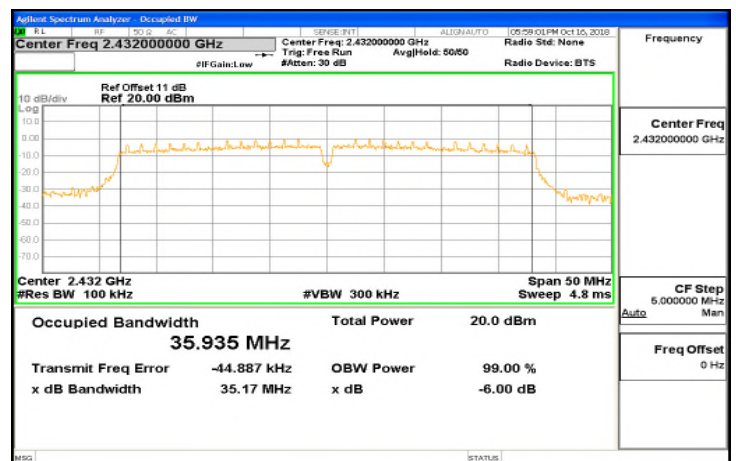
6dB Band Width Test Data CH- High (2462MHz)



6dB Band Width Test Data CH-Low (2427MHz)



6dB Band Width Test Data CH-Low (2432MHz)



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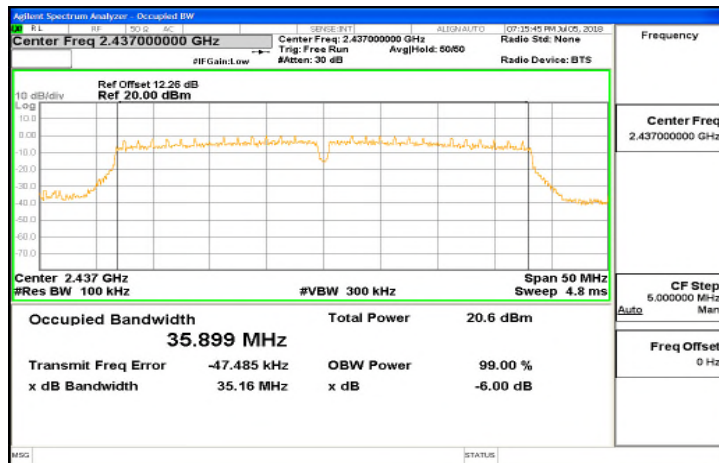
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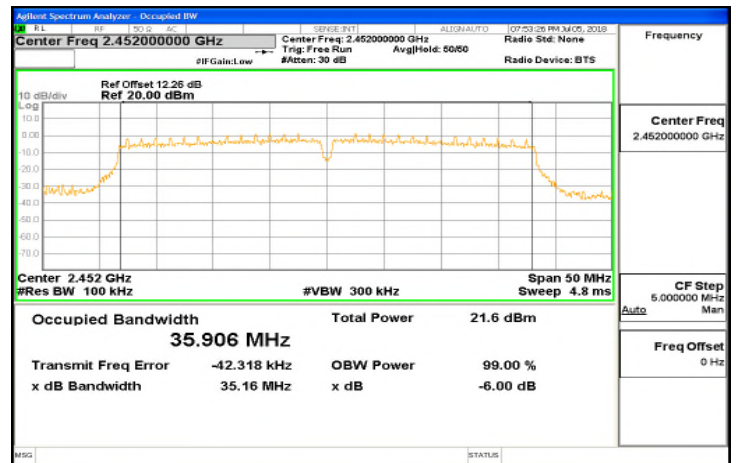
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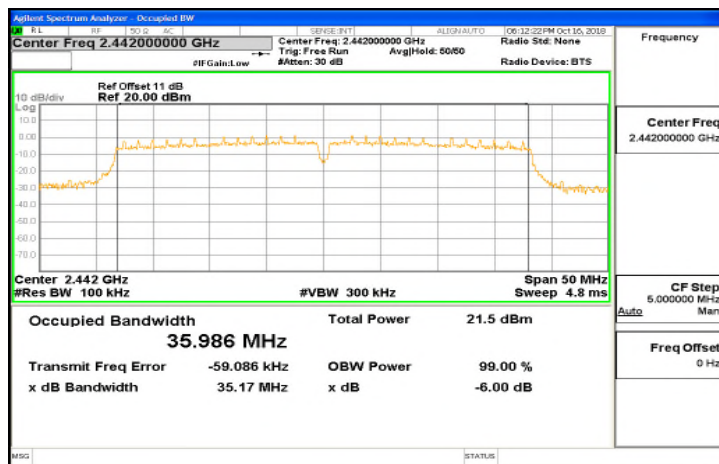
6dB Band Width Test Data CH-Mid (2437MHz)



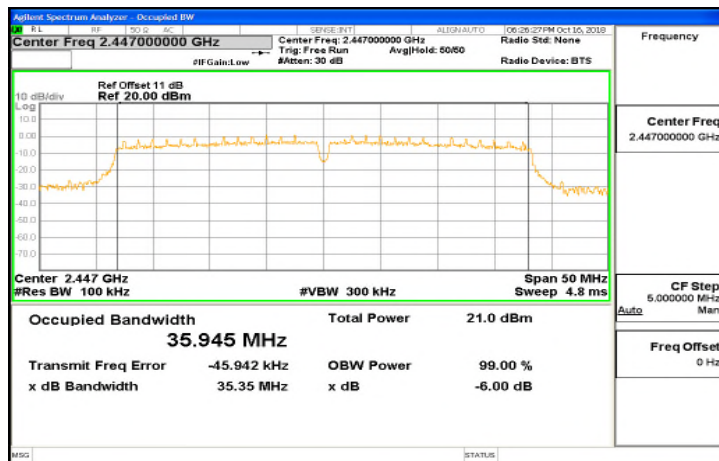
6dB Band Width Test Data CH-High (2452MHz)



6dB Band Width Test Data CH-High (2442MHz)



6dB Band Width Test Data CH-High (2447MHz)



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10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

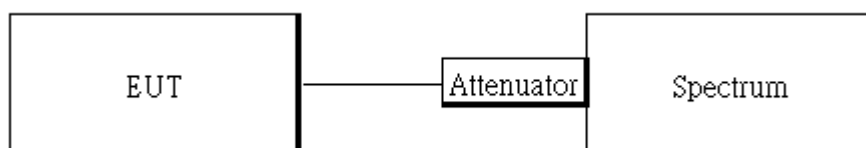
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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).

10.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	2018/05/03	2018/08/28
Attenuator	Mini-Circuit	BW-S10W2+	2	2017/11/29	2018/11/28
DC Block	Mini-Circuits	BLK-18-S+	1	2018/01/04	2019/01/03
Coaxial Cables	N/A	WK CE Cable	N/A	2017/12/20	2018/12/19
Notebook	Lenovo	L420	LR-7HXZA	2017/12/29	2018/12/28

10.3 Test SET-UP



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10.4 Measurement Procedure

Reference Level of Emission Calculation:

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

Conducted Band Edge:

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

Conducted Spurious Emission:

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

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10.5 Measurement Result

Reference Level of Limit 802.11b mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	13.31	-6.69
2437	13.72	-6.28
2462	13.67	-6.33

Reference Level of Limit 802.11g mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	7.75	-12.25
2417	7.38	-12.62
2437	10.89	-9.11
2457	9.90	-10.10
2462	8.25	-11.75

Reference Level of Limit 802.11n20 mode		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2412	6.99	-13.01
2417	9.14	-10.86
2437	10.18	-9.82
2457	10.24	-9.76
2462	8.35	-11.65

Reference Level of Limit 802.11n40 MODE		
Freq. (MHz)	PSD (dBm)	Reference Level of Limit (dBm)
2422	1.94	-18.06
2427	2.00	-18.00
2432	2.50	-17.50
2437	2.97	-17.03
2442	4.25	-15.75
2447	3.57	-16.43
2452	4.13	-15.87

offset 12.26 dB for MIMO mode

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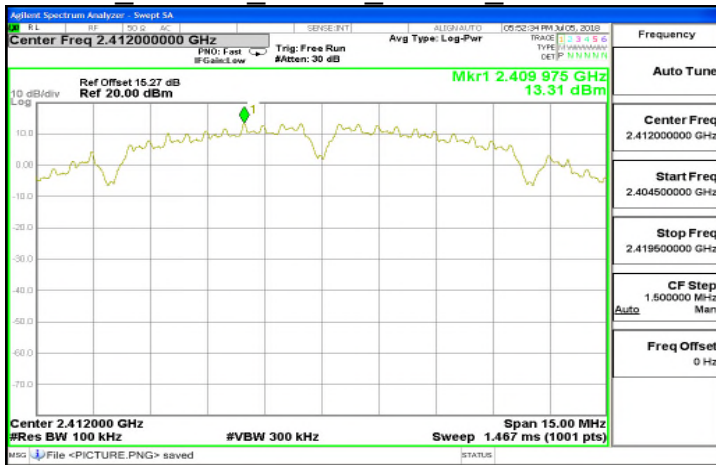
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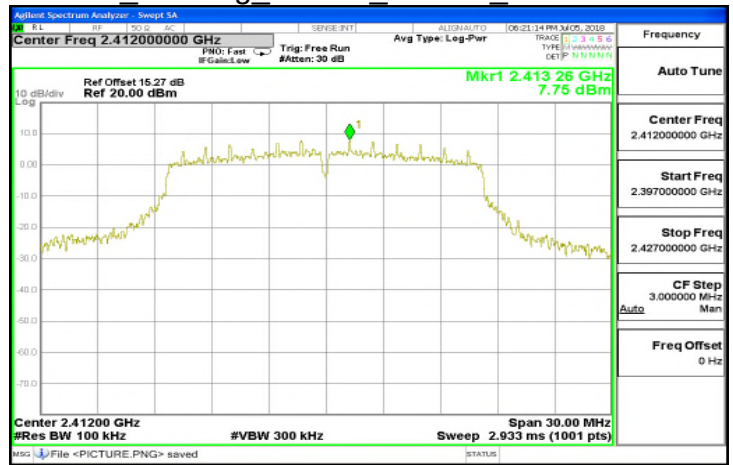
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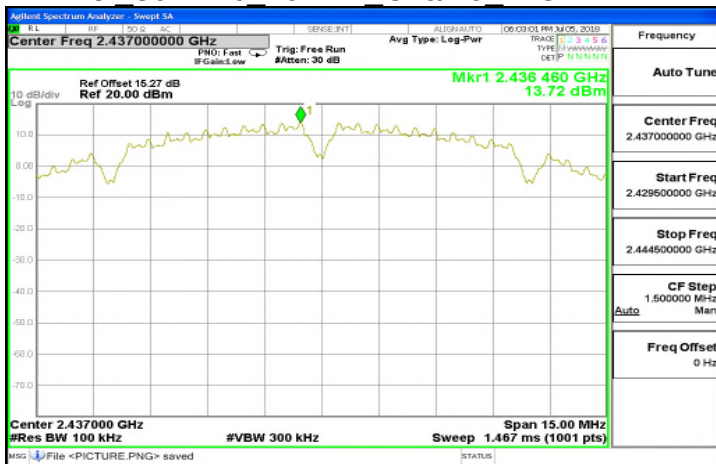
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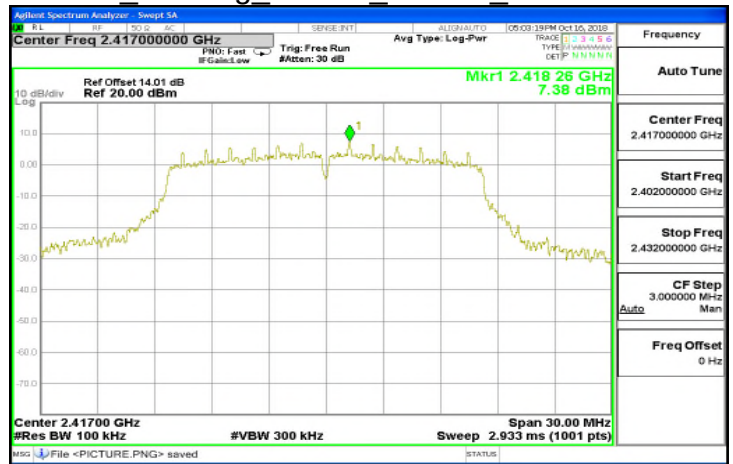
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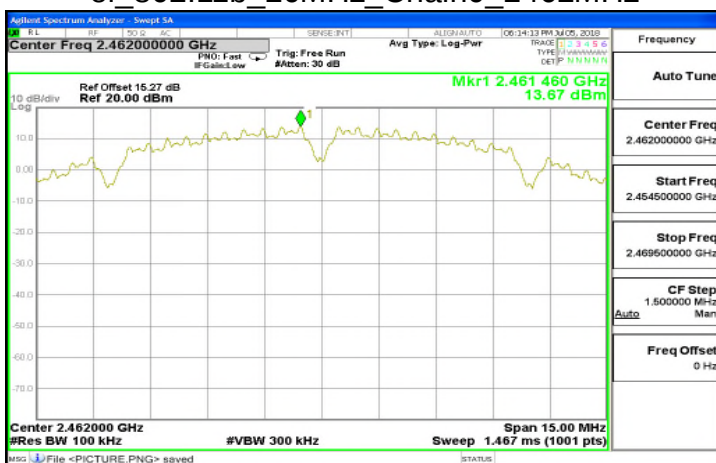
Reference Lev-
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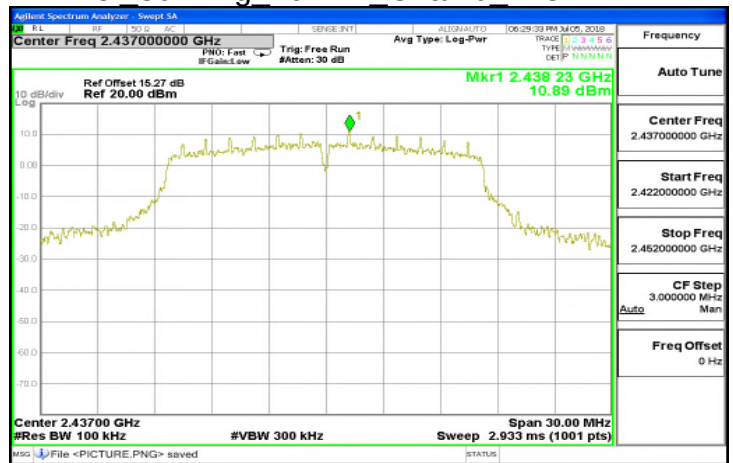
Reference Lev-
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Reference Lev-
el 802.11b 20MHz Chain0 2462MHz



Reference Lev-
el 802.11g 20MHz Chain0 2437MHz



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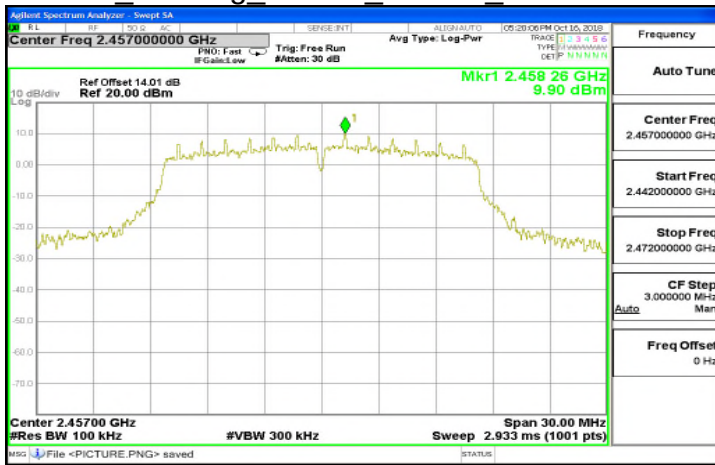
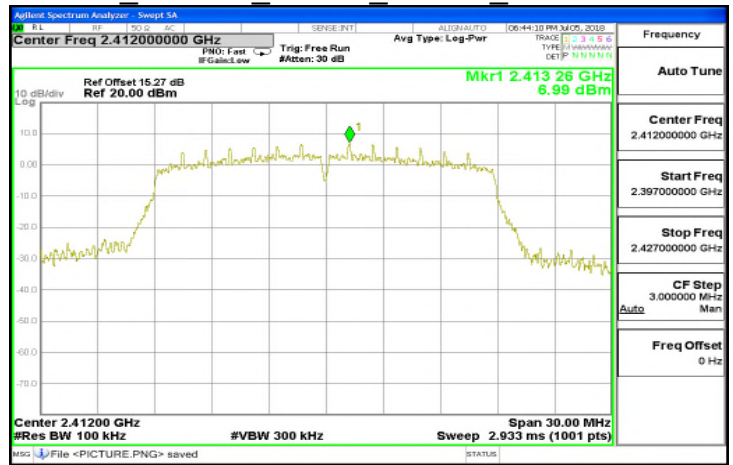
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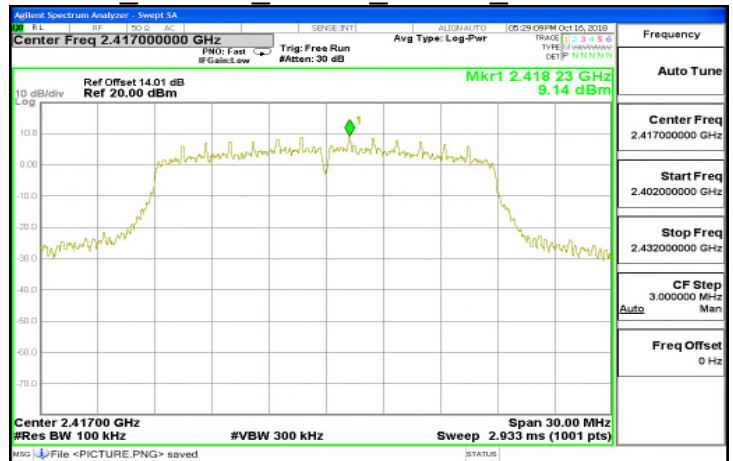
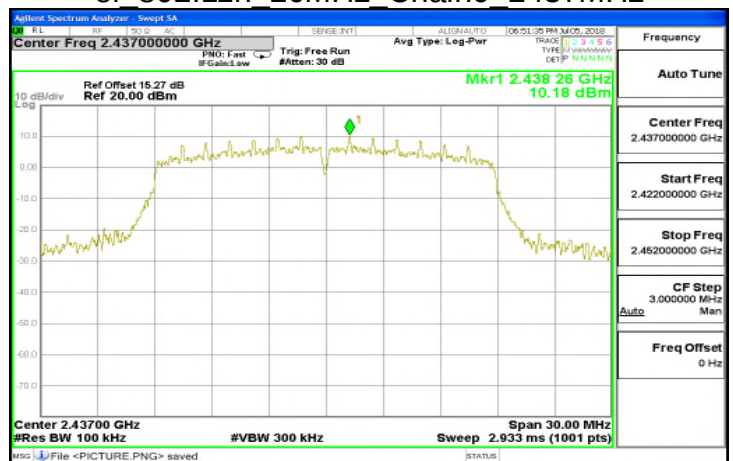
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Reference Level
802.11g 20MHz Chain0 2457MHz

Reference Level
802.11n 20MHz Chain0 2412MHz

Reference Level
802.11g 20MHz Chain0 2462MHz

Reference Level
802.11n 20MHz Chain0 2417MHz

Reference Level
802.11n 20MHz Chain0 2437MHz


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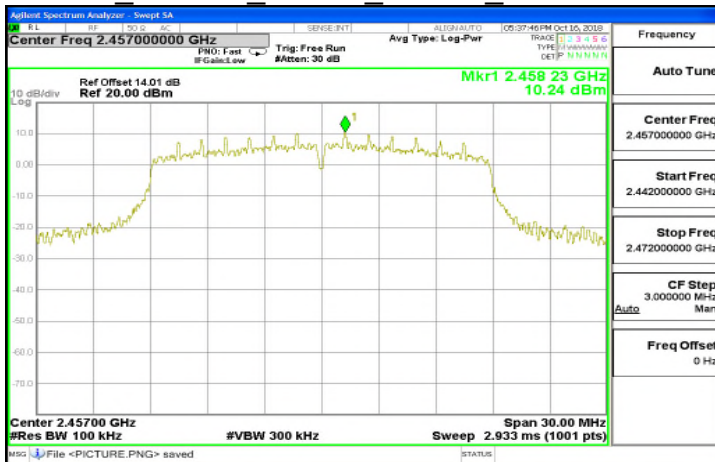
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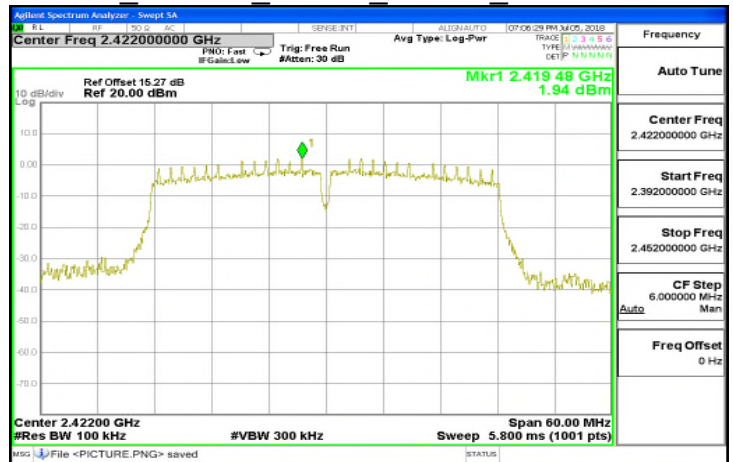
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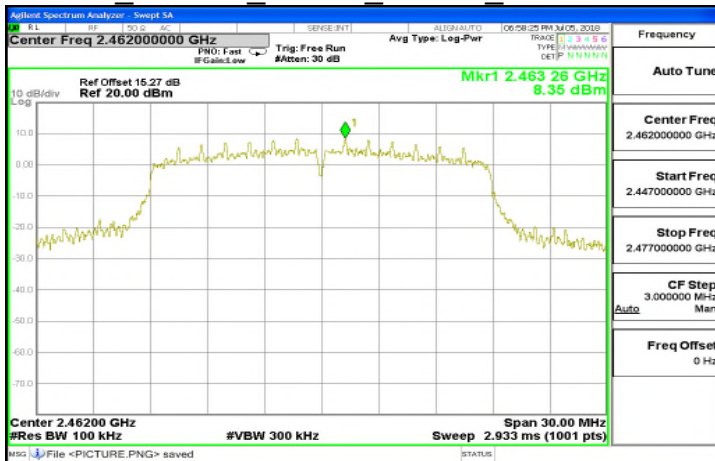
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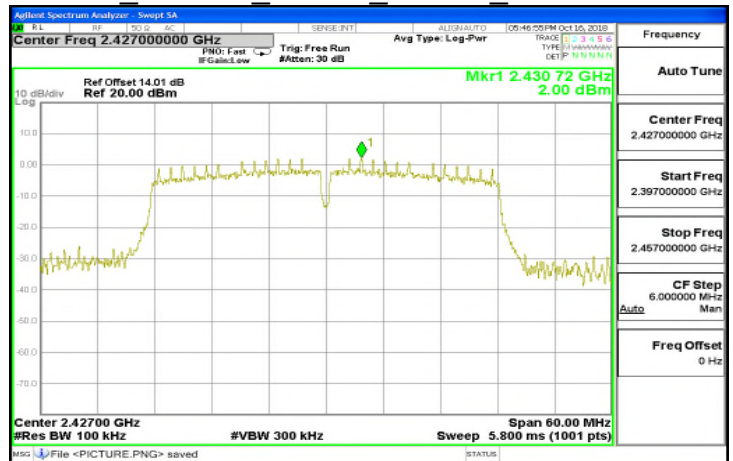
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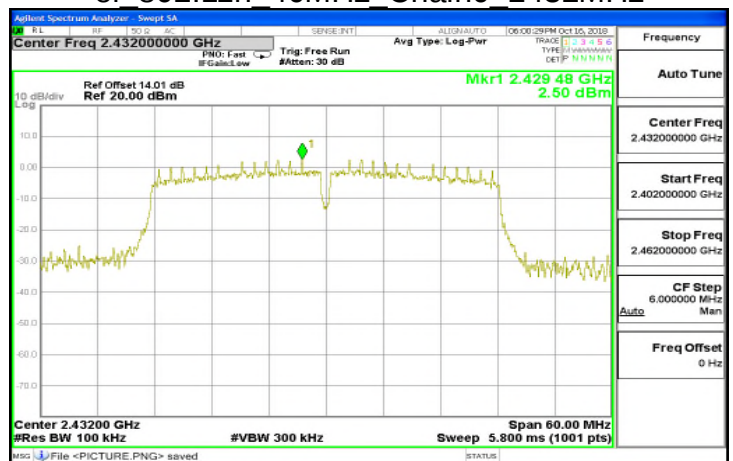
Reference Level 802.11n 20MHz Chain0 2462MHz



Reference Level 802.11n 40MHz Chain0 2427MHz



Reference Level 802.11n 40MHz Chain0 2432MHz



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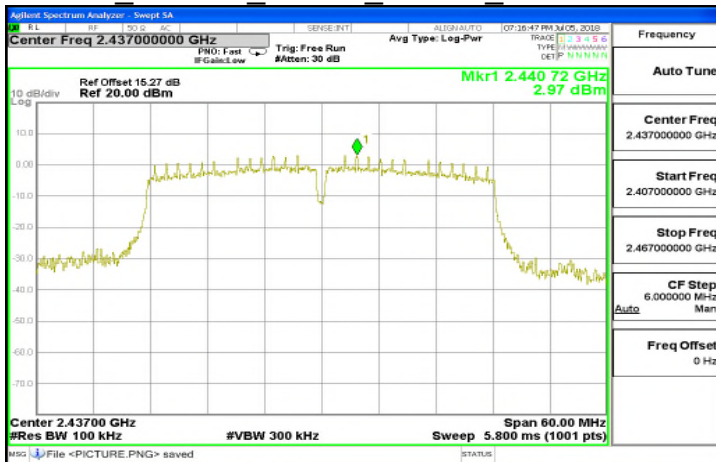
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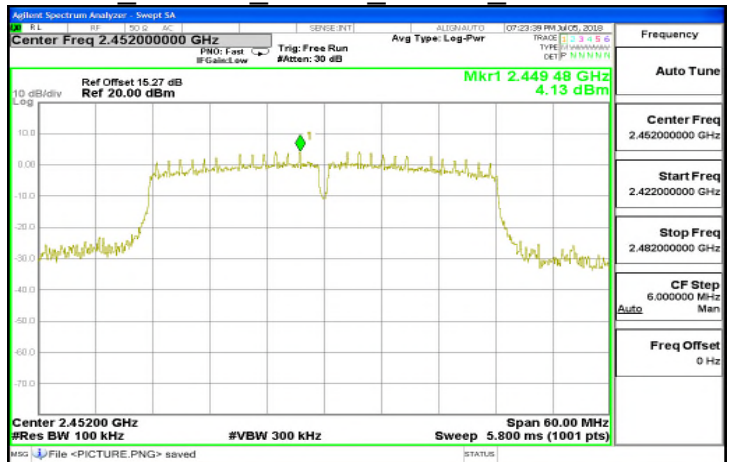
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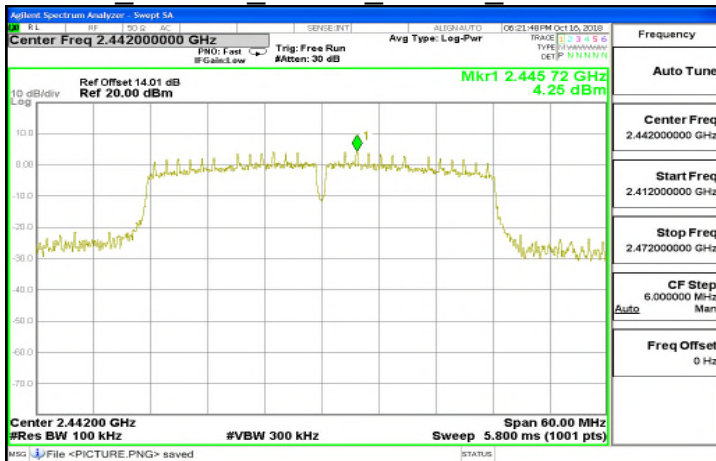
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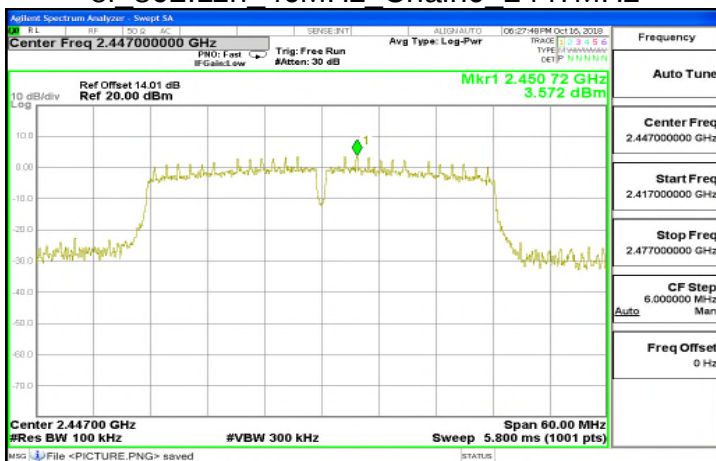
Reference Level 802.11n 40MHz Chain0 2452MHz



Reference Level 802.11n 40MHz Chain0 2442MHz



Reference Level 802.11n 40MHz Chain0 2447MHz



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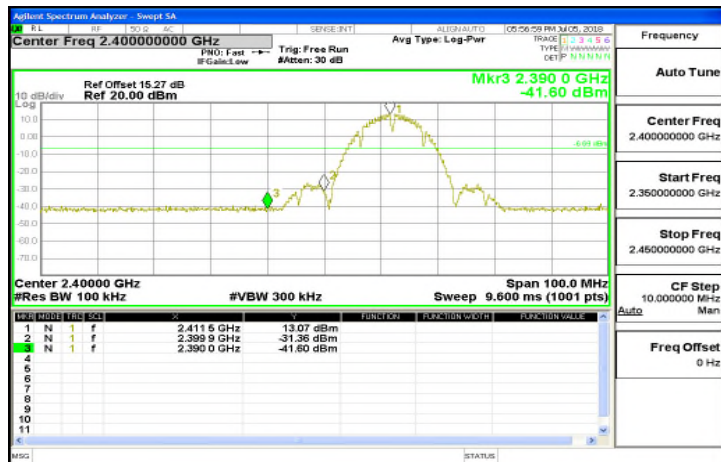
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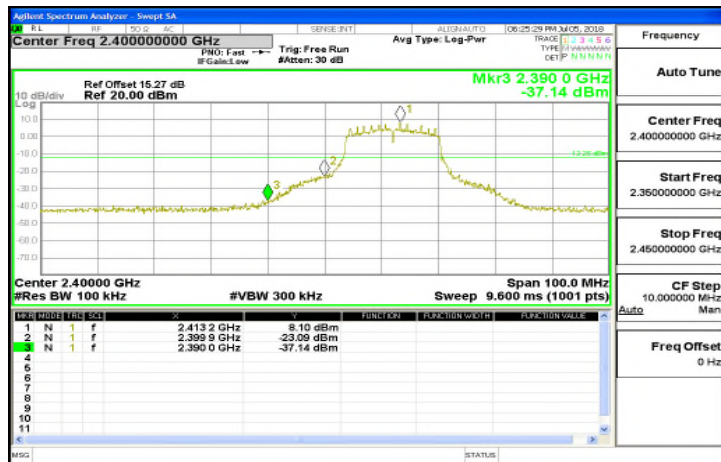
802.11b

Band Edge Test Data CH-Low-2412MHz



802.11g

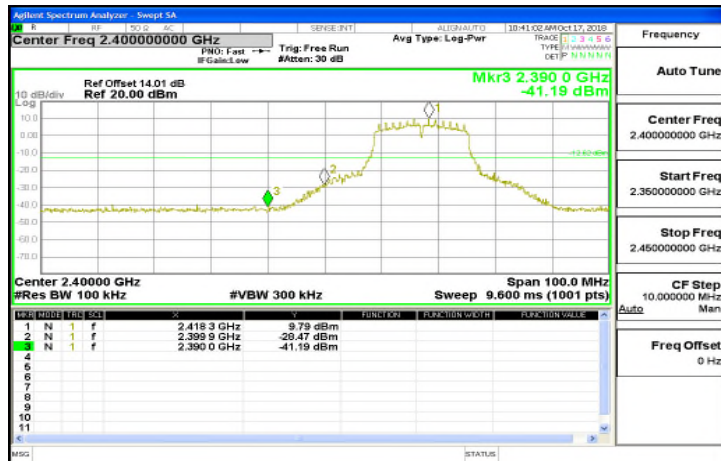
Band Edge Test Data CH-Low-2412MHz



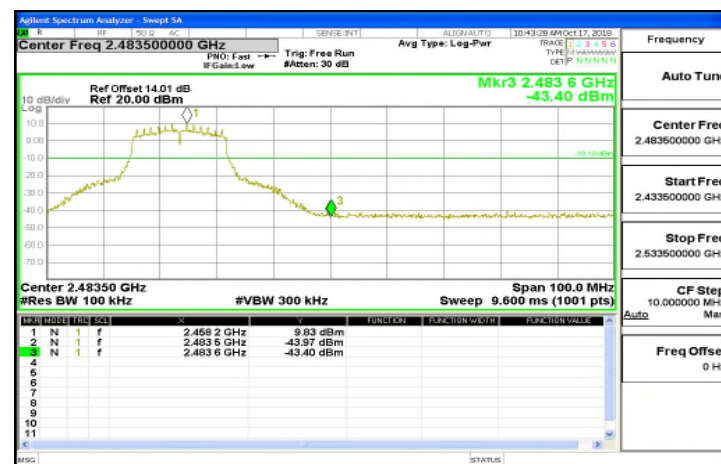
Band Edge Test Data CH-High-2462MHz



Band Edge Test Data CH-Low-2417MHz



Band Edge Test Data CH-High-2457MHz

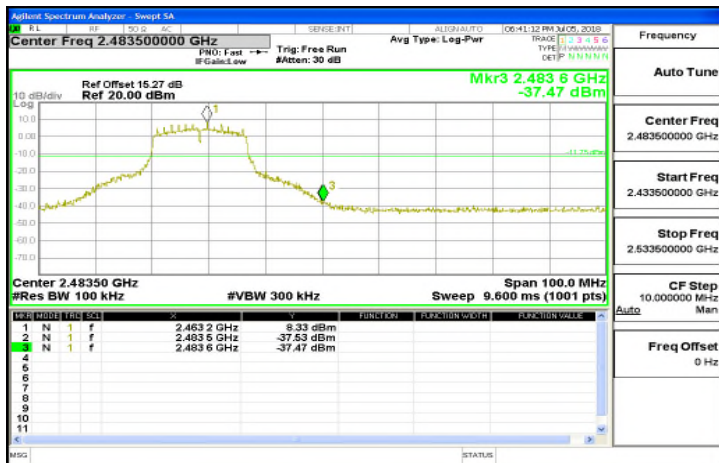


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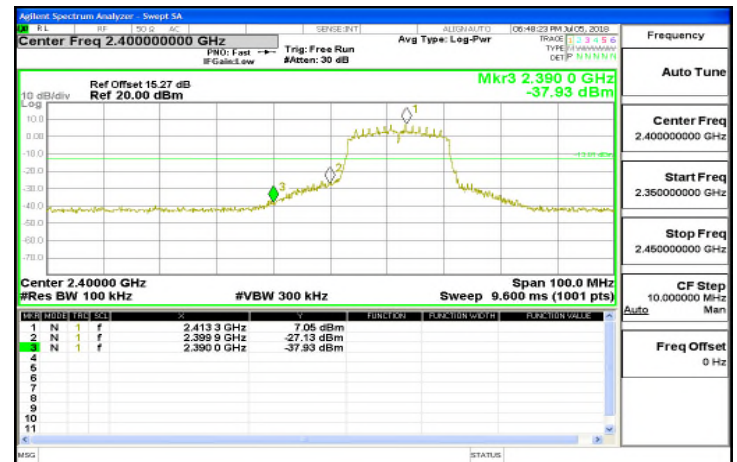
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Band Edge Test Data CH-High-2462MHz

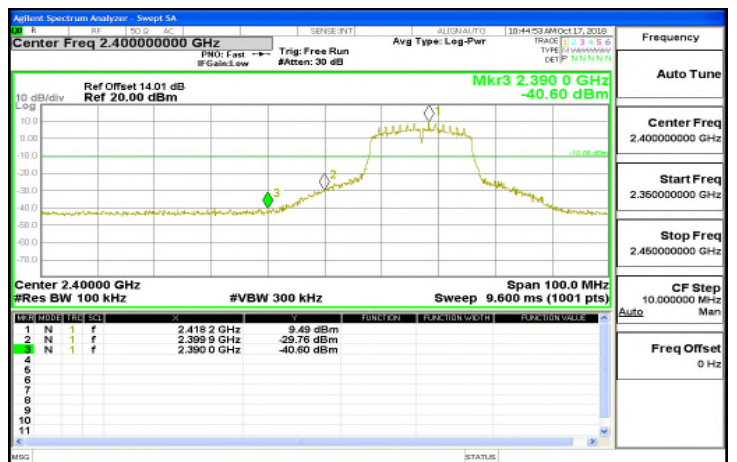


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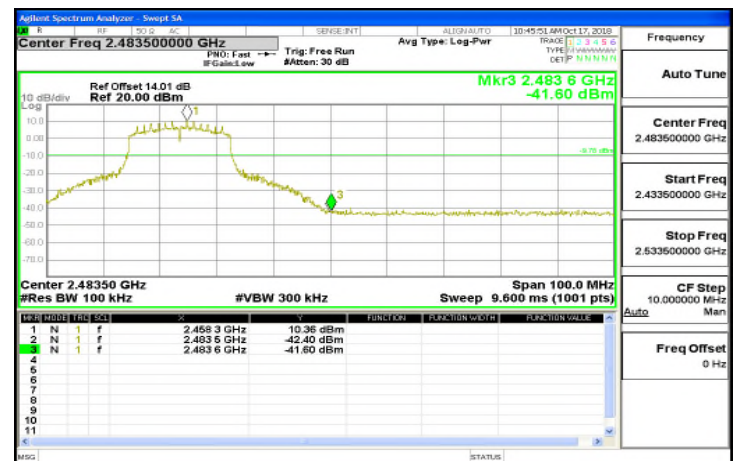
Band Edge Test Data CH-Low-2412MHz



Band Edge Test Data CH-Low-2417MHz



Band Edge Test Data CH-High-2457MHz



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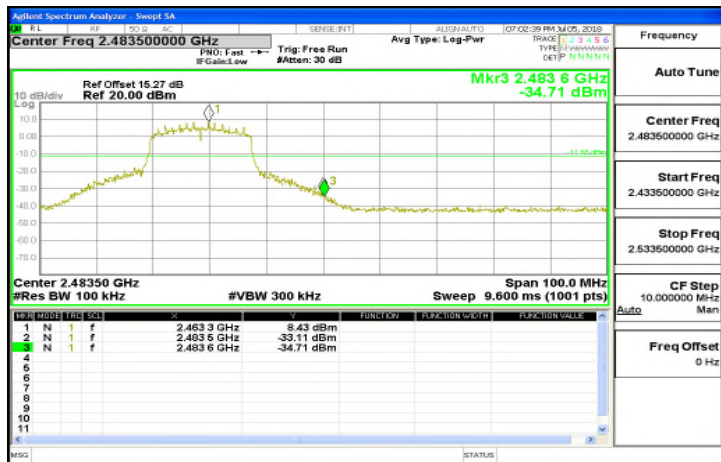
t (886-2) 2299-3279

f (886-2) 2298-0488

www.tw.sgs.com

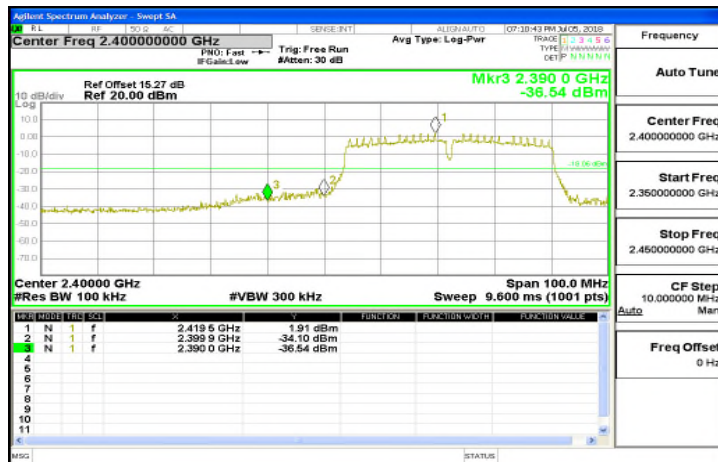
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Band Edge Test Data CH-High-2462HMz

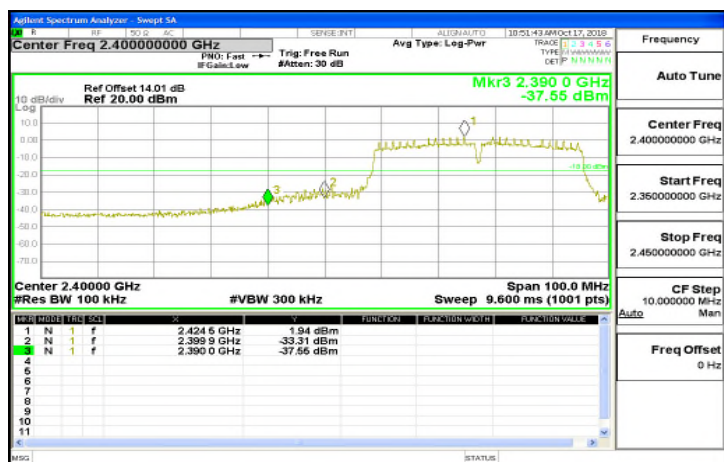


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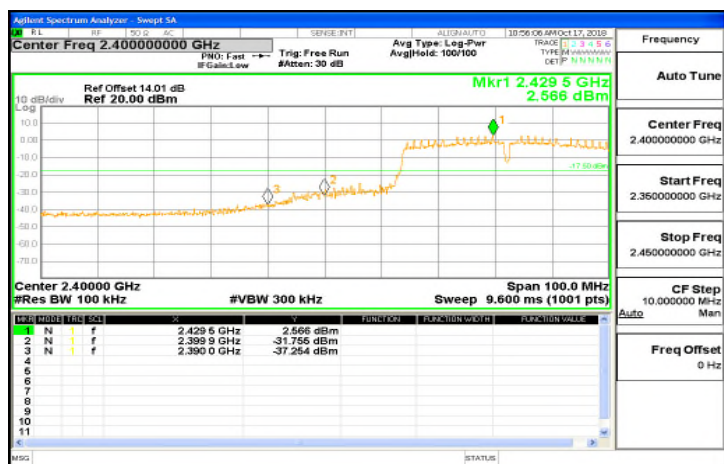
Band Edge Test Data CH-Low-2422HMz



Band Edge Test Data CH-Low-2427HMz



Band Edge Test Data CH-Low-2432HMz



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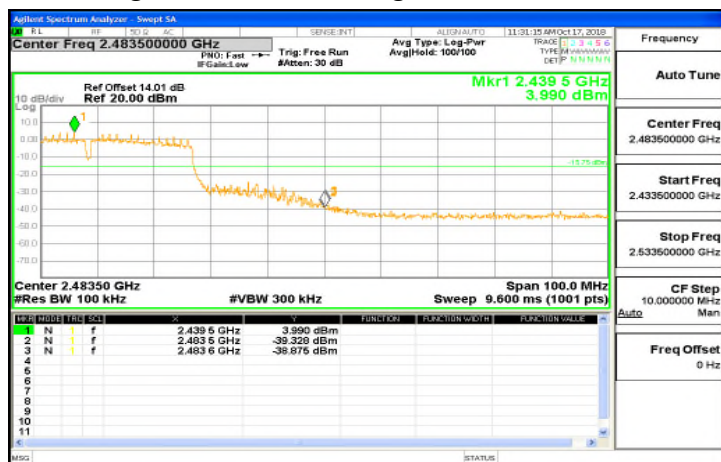
t (886-2) 2299-3279

f (886-2) 2298-0488

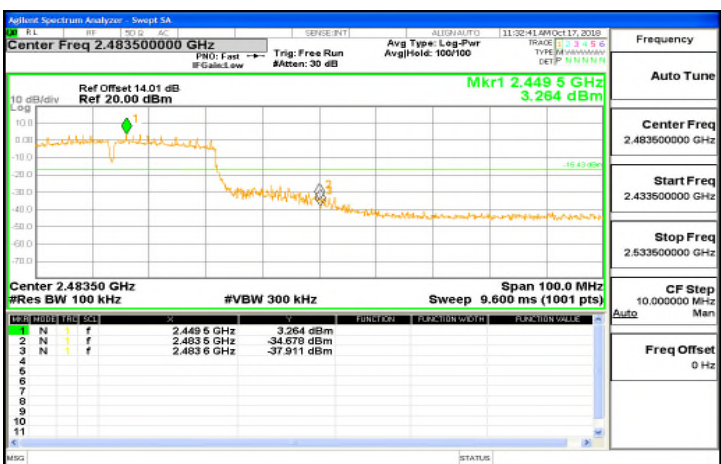
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Band Edge Test Data CH-High-2442HMz



Band Edge Test Data CH-High-2447HMz



Band Edge Test Data CH-High-2452HMz



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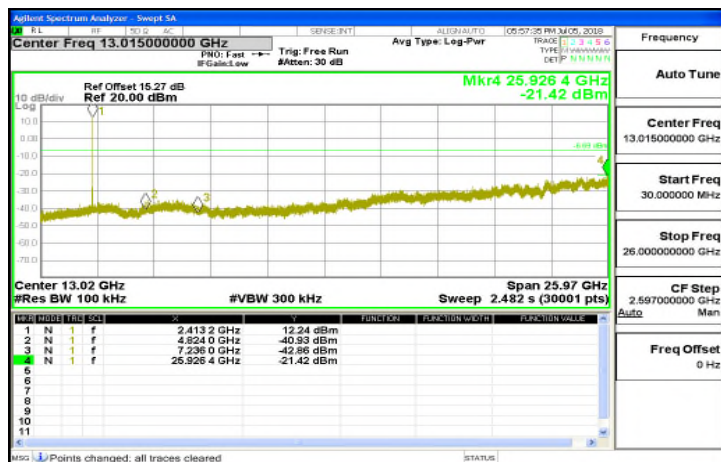
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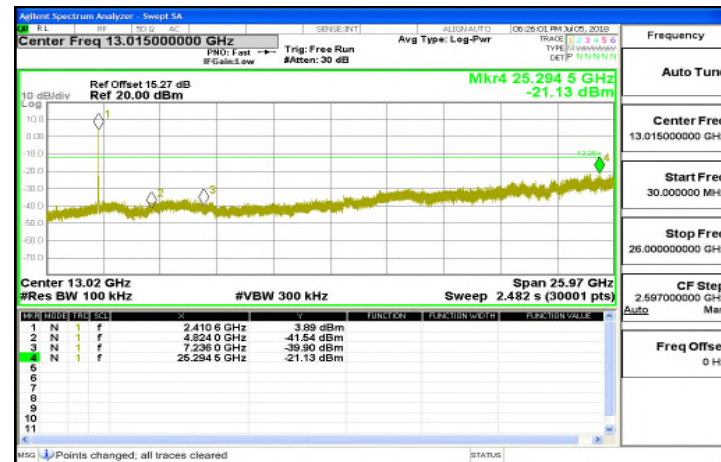
802.11b

30M-26GHz Spurious Emission Test Data CH-Low-2412MHz

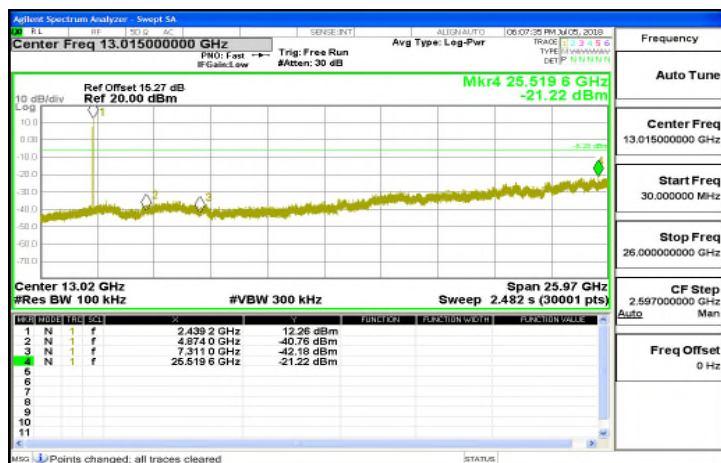


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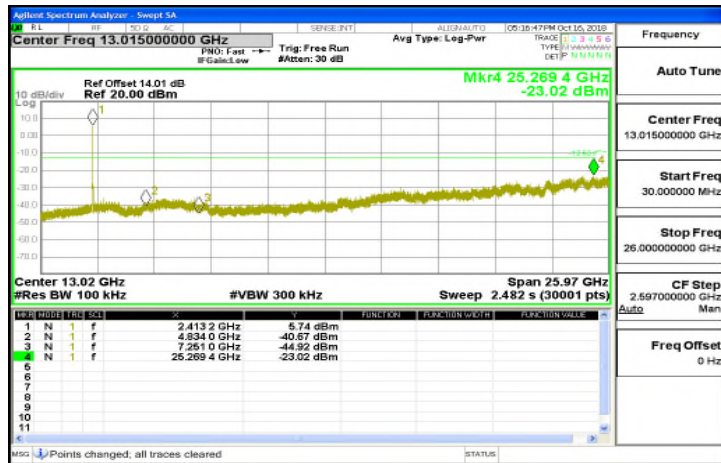
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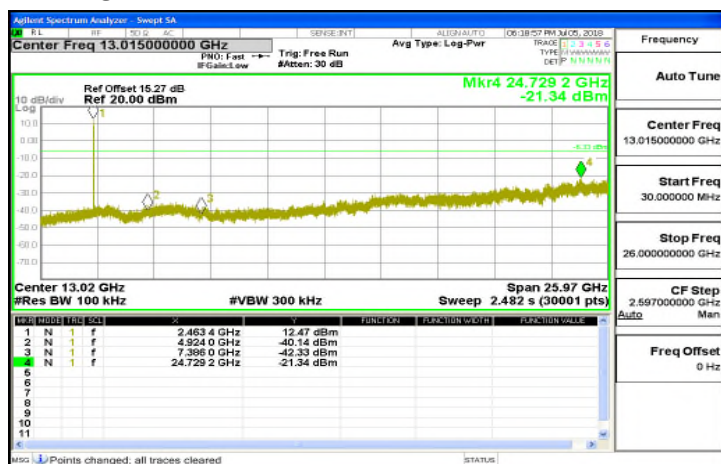
30M-26GHz Spurious Emission Test Data CH-Mid-2437MHz



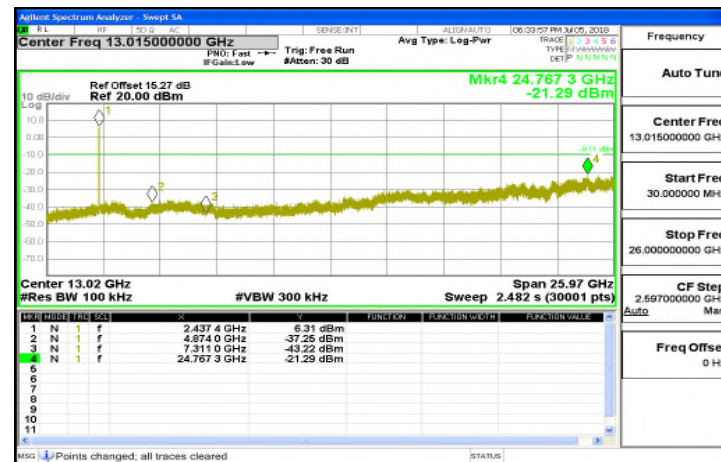
30M-26GHz Spurious Emission Test Data CH-Low-2417MHz



30M-26GHz Spurious Emission Test Data CH-High-2462MHz



30M-26GHz Spurious Emission Test Data CH-Mid-2437MHz



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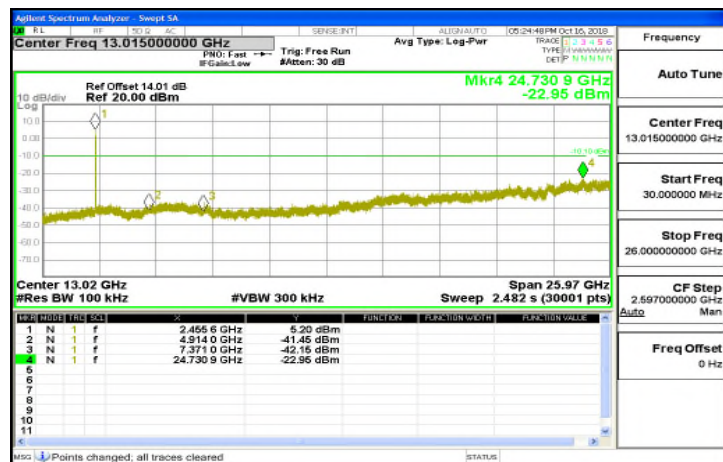
t (886-2) 2299-3279

f (886-2) 2298-0488

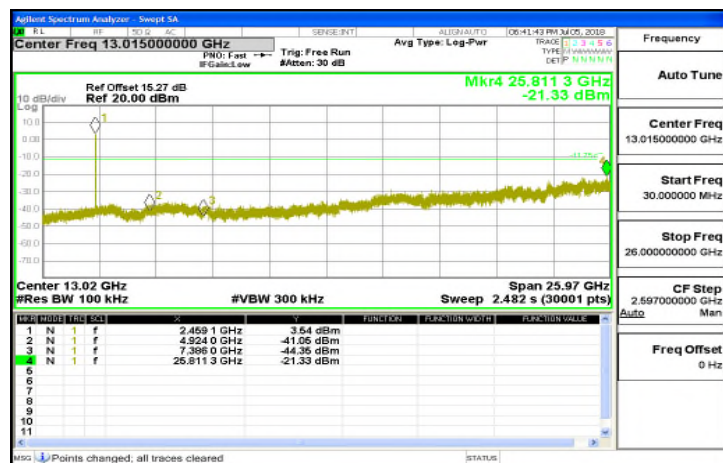
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30M-26GHz Spurious Emission Test Data CH-High-2457 MHz

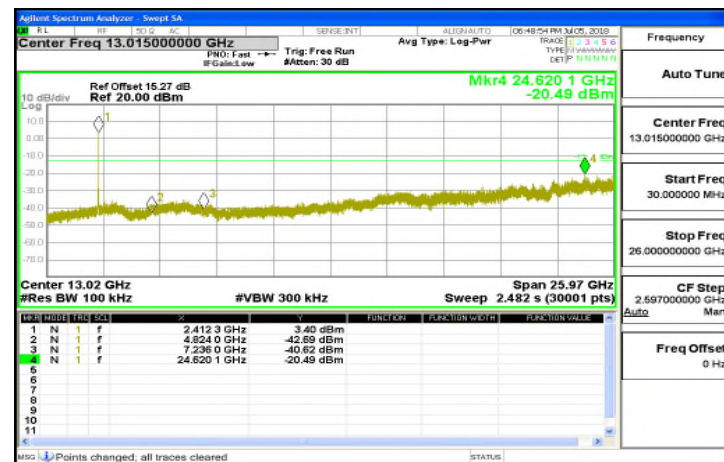


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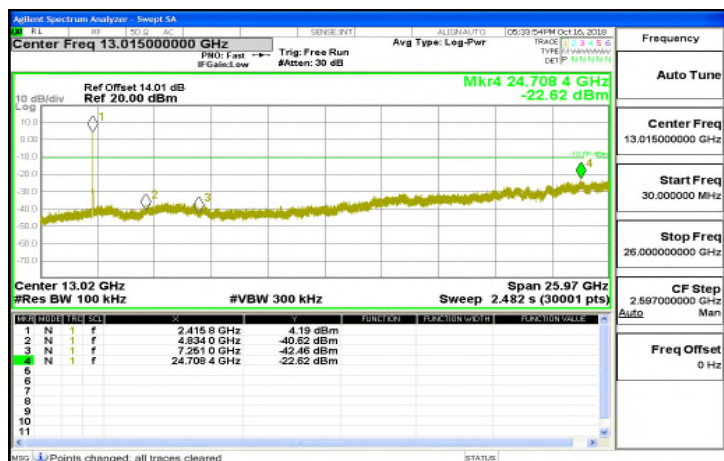


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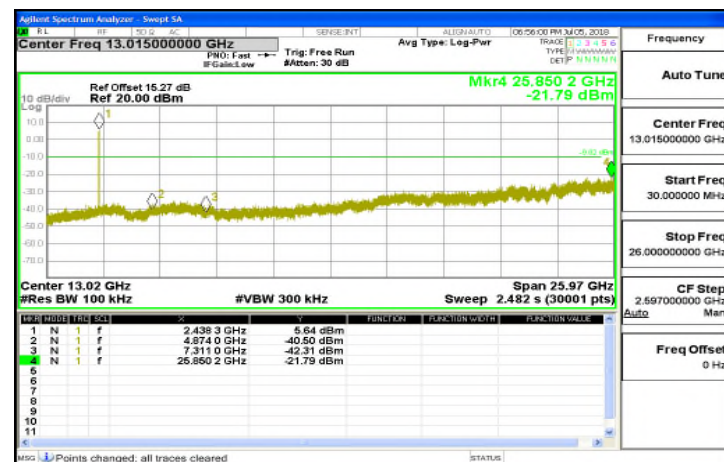
30M-26GHz Spurious Emission Test Data CH-Low-2412MHz



30M-26GHz Spurious Emission Test Data CH-Low-2417MHz



30M-26GHz Spurious Emission Test Data CH-Mid-2437MHz



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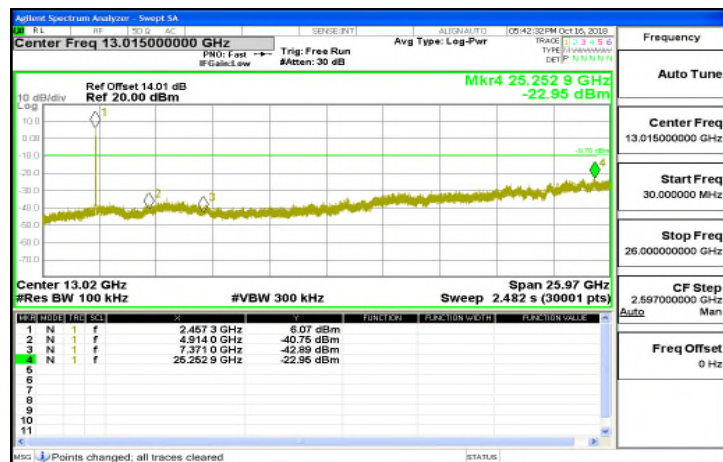
t (886-2) 2299-3279

f (886-2) 2298-0488

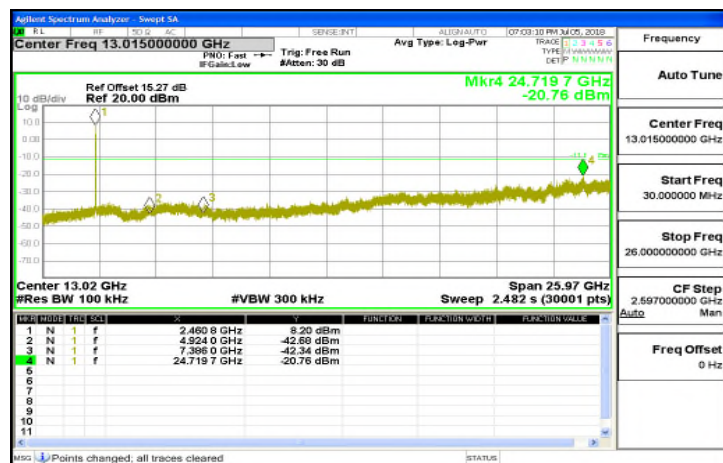
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30M-26GHz Spurious Emission Test Data CH-High-2457 MHz

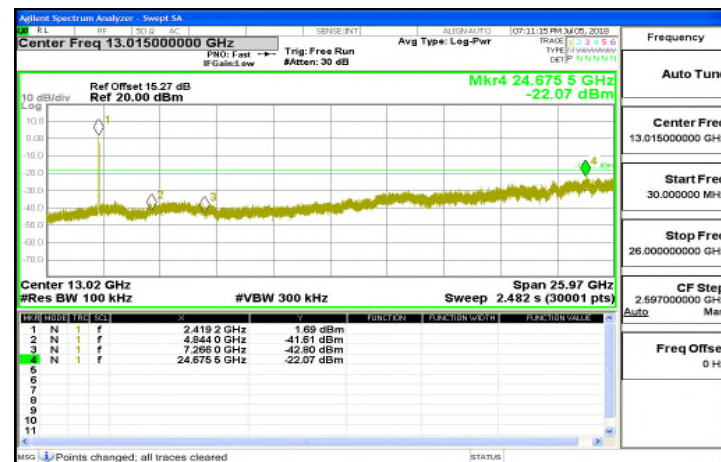


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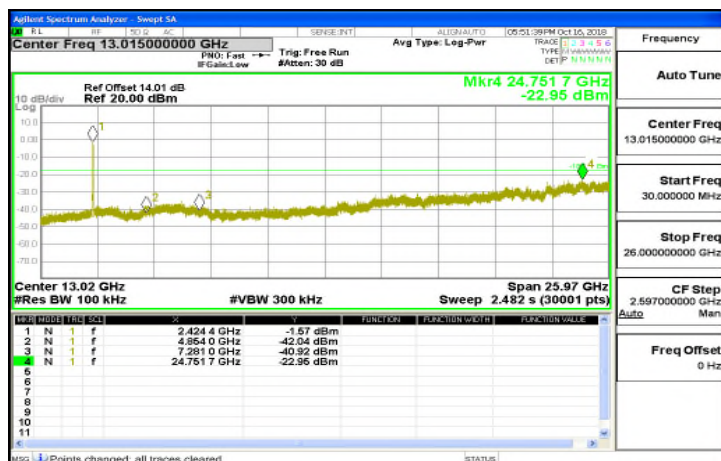


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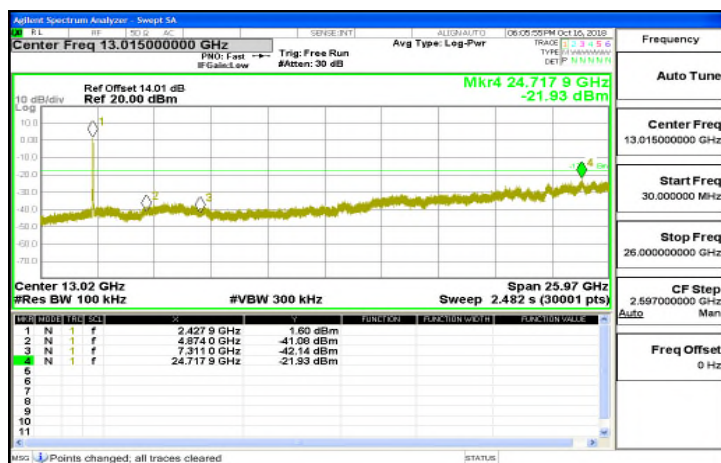
30M-26GHz Spurious Emission Test Data CH-Low-2422MHz



30M-26GHz Spurious Emission Test Data CH-Low-2427MHz



30M-26GHz Spurious Emission Test Data CH-Mid-2432MHz



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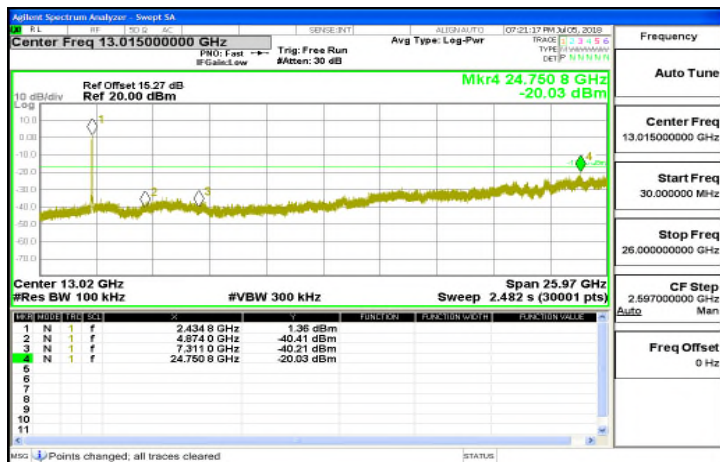
t (886-2) 2299-3279

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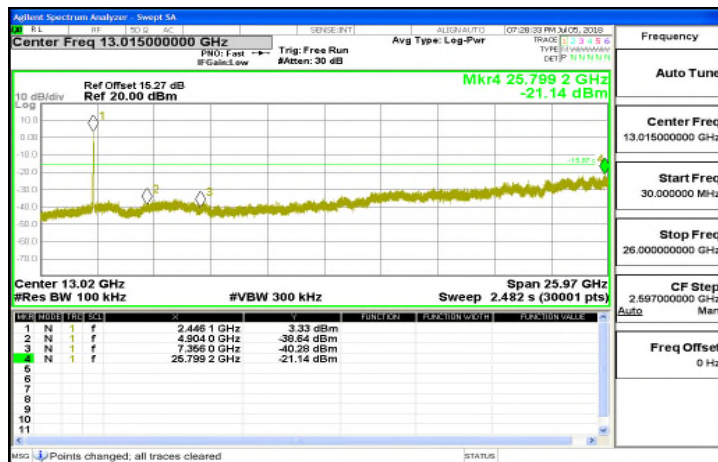
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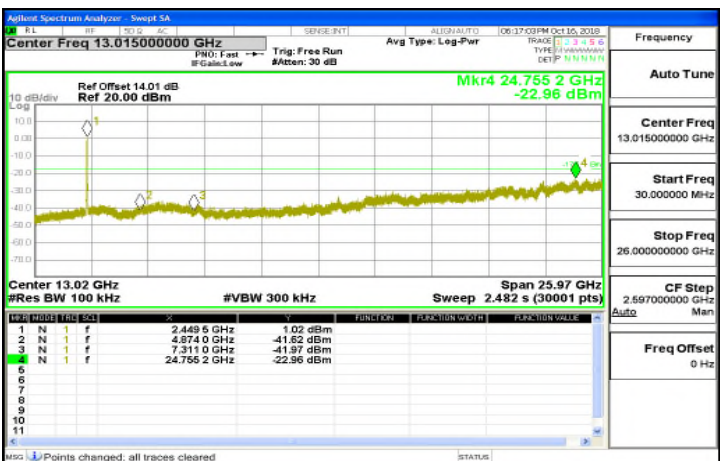
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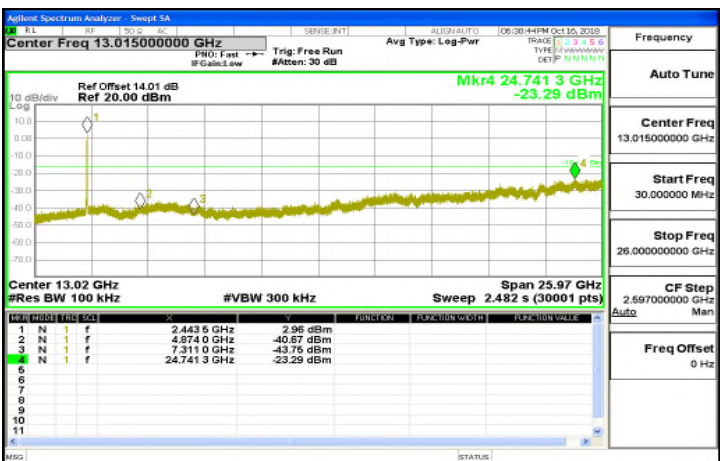
30M-26GHz Spurious Emission Test Data CH-High-2452 MHz



30M-26GHz Spurious Emission Test Data CH-High-2442MHz



30M-26GHz Spurious Emission Test Data CH-High-2447MHz



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11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

11.1 Standard Applicable

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

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

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

Note:

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

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11.2 Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Bi-log Antenna	SCHWAZBECK	VULB9168	378	2017/12/29	2018/12/28
Horn Antenna	Schwarzbeck	BBHA9120D	1441	2017/08/04	2018/08/03
Horn Antenna	Schwarzbeck	BBHA9170	184	2017/12/12	2018/12/11
Loop Antenna	ETS.LINDGREN	6502	148045	2017/09/26	2018/09/25
3m Site NSA	SGS	966 chamber	N/A	2018/01/02	2019/01/01
Spectrum Analyzer	Agilent	E4446A	MY51100003	2018/05/15	2018/08/28
EMI Test Receiver	R&S	ESCI7	100335	2018/02/02	2018/08/28
Pre-Amplifier	HP	8449B	3008A00578	2017/11/29	2018/11/28
Pre-Amplifier	HP	8447D	2944A07676	2018/01/04	2019/01/03
Pre-Amplifier	EMC Instruments	EMC184045B	980135	2017/12/29	2018/12/28
Attenuator	Mini-Circuit	BW-S10W2+	2	2017/11/29	2018/11/28
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M1	2017/09/26	2018/09/25
Low Loss Cable	Huber Suhner	966_RX	9	2017/11/29	2018/11/28
Notebook	Lenovo	L430	R9-X11BG	2017/08/04	2018/08/03

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

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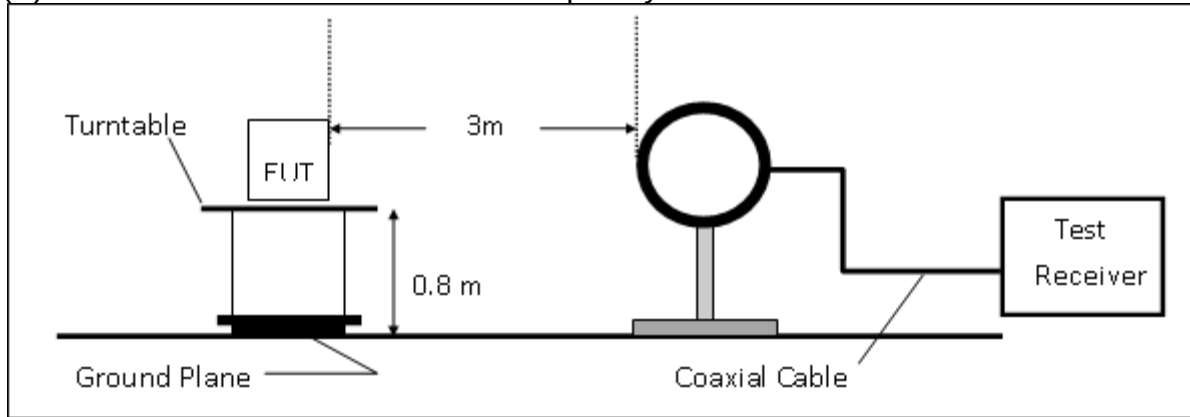
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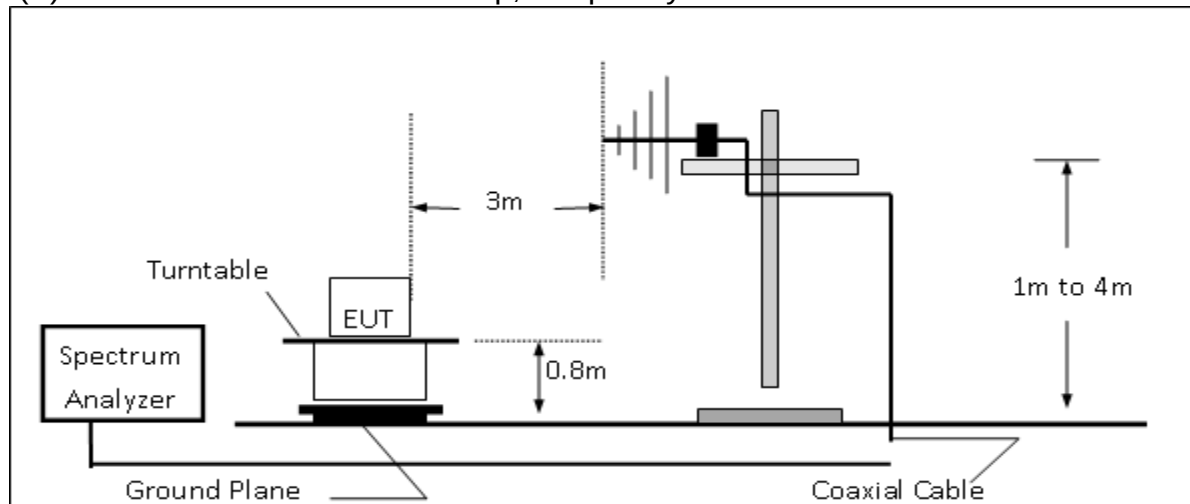
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11.3 Test SET-UP

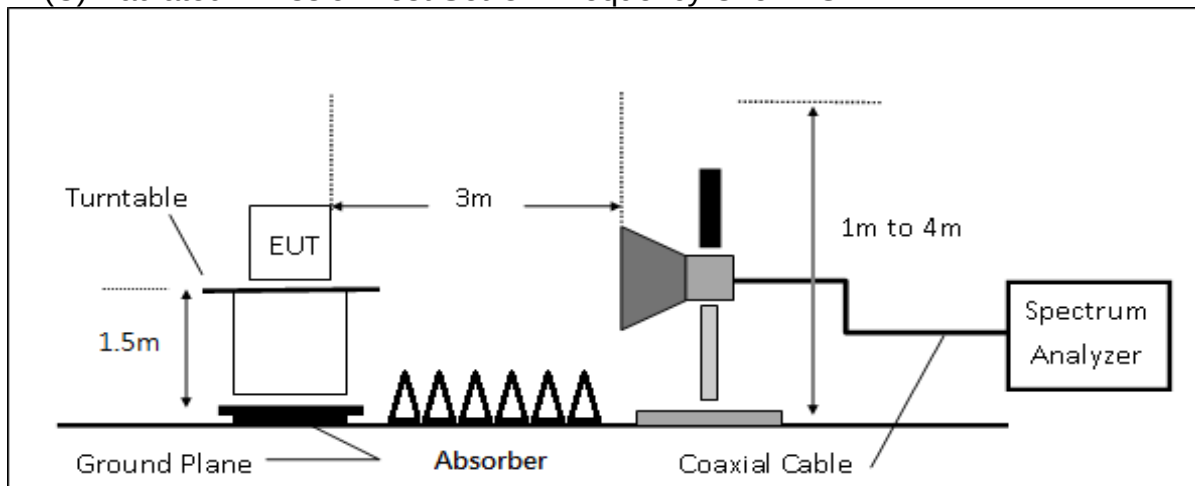
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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11.4 Measurement Procedure

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

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)

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

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

11.7 Measurement Result

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

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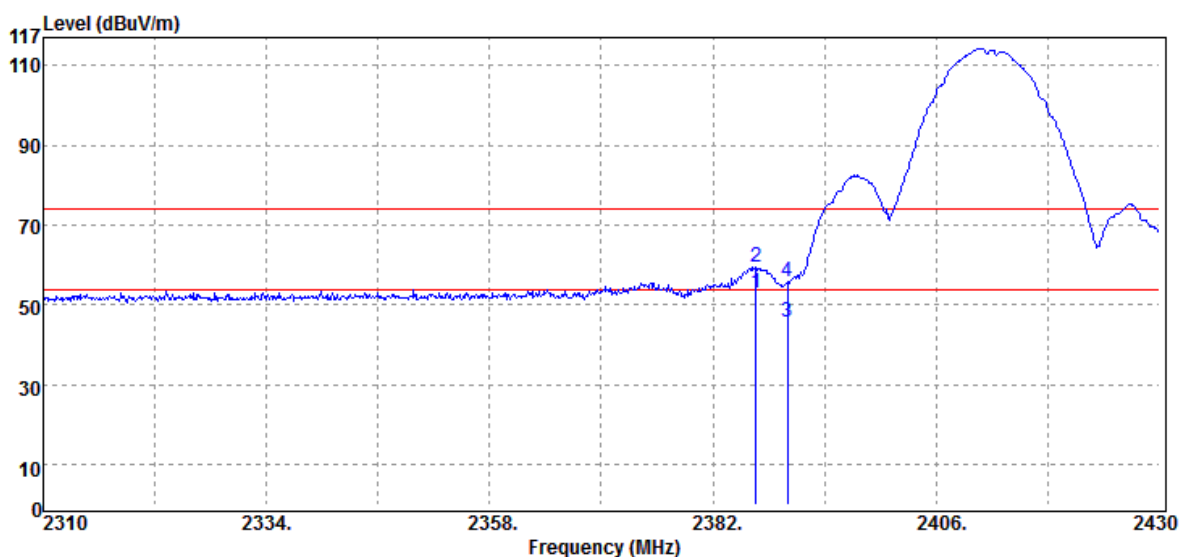
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Radiated Band Edge Measurement Result

Operation Band :802.11b
Fundamental Frequency :2412 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



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
2386.60	Average	52.65	0.19	52.84	54.00	-1.16
2386.60	Peak	59.28	0.19	59.47	74.00	-14.53
2390.00	Average	45.55	0.20	45.75	54.00	-8.25
2390.00	Peak	55.64	0.20	55.84	74.00	-18.16

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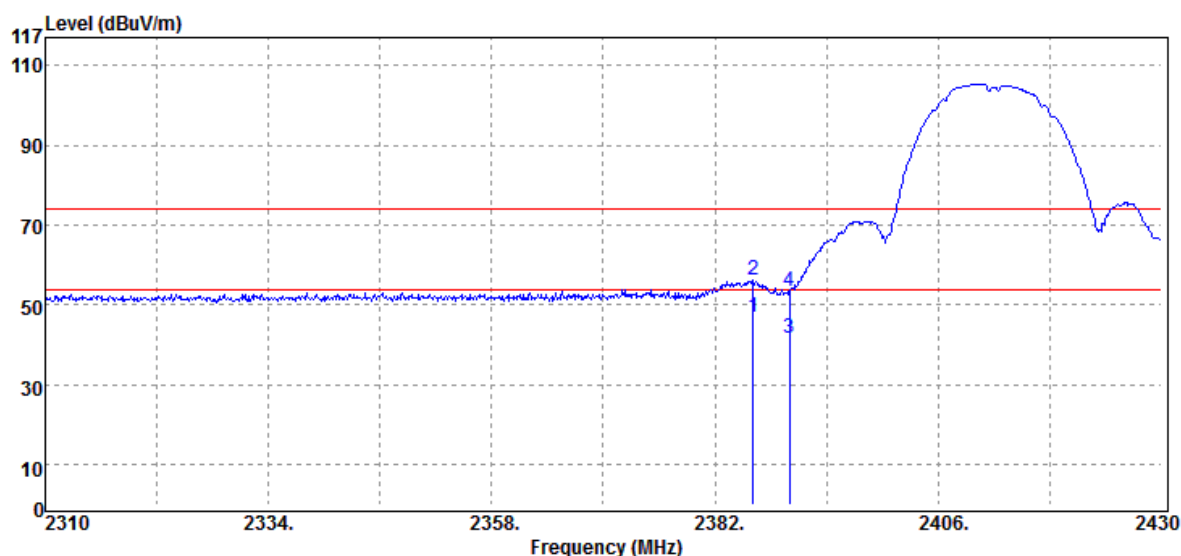
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Operation Band :802.11b
Fundamental Frequency :2412 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2386.08	Average	46.80	0.19	46.99	54.00	-7.01
2386.08	Peak	55.96	0.19	56.15	74.00	-17.85
2390.00	Average	41.39	0.20	41.59	54.00	-12.41
2390.00	Peak	53.21	0.20	53.41	74.00	-20.59

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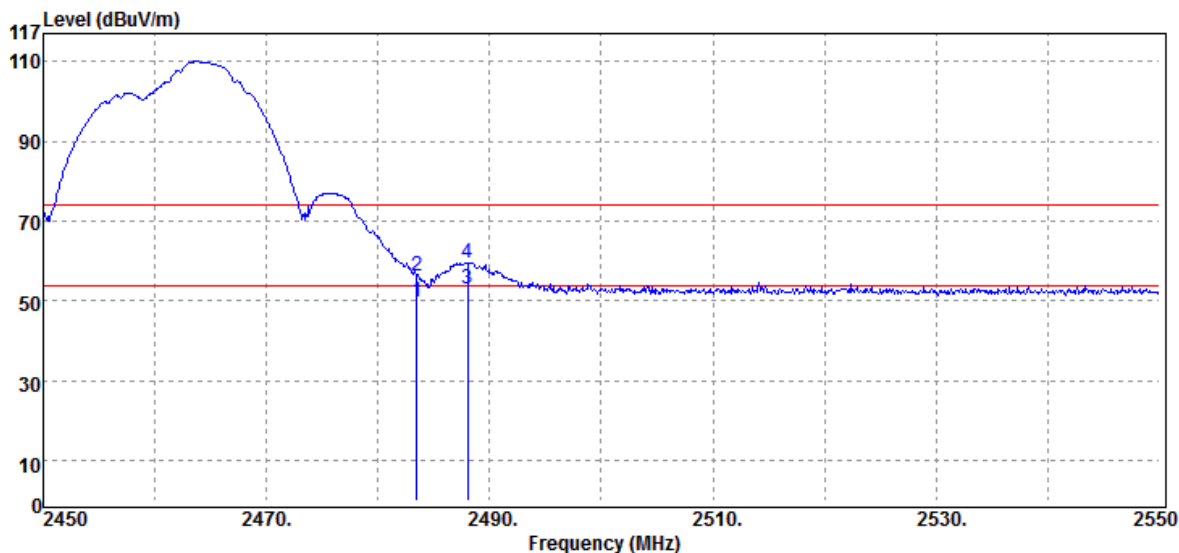
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Operation Band :802.11b
Fundamental Frequency :2462 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



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	49.12	0.53	49.65	54.00	-4.35
2483.50	Peak	55.89	0.53	56.42	74.00	-17.58
2488.00	Average	52.40	0.54	52.94	54.00	-1.06
2488.00	Peak	59.05	0.54	59.59	74.00	-14.41

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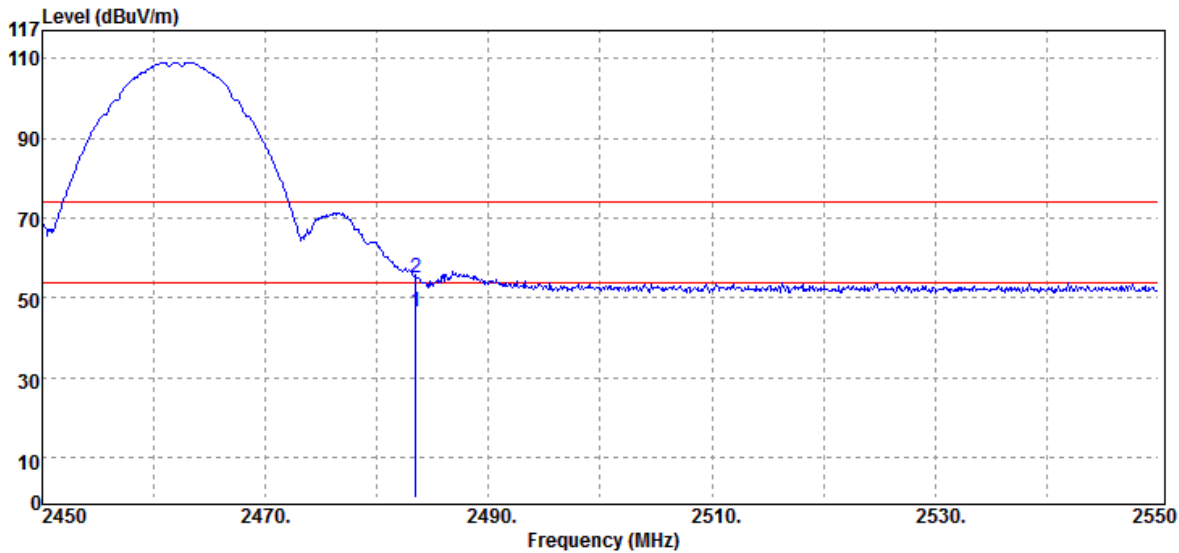
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Operation Band :802.11b
Fundamental Frequency :2462 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	46.14	0.53	46.67	54.00	-7.33
2483.50	Peak	54.67	0.53	55.20	74.00	-18.80

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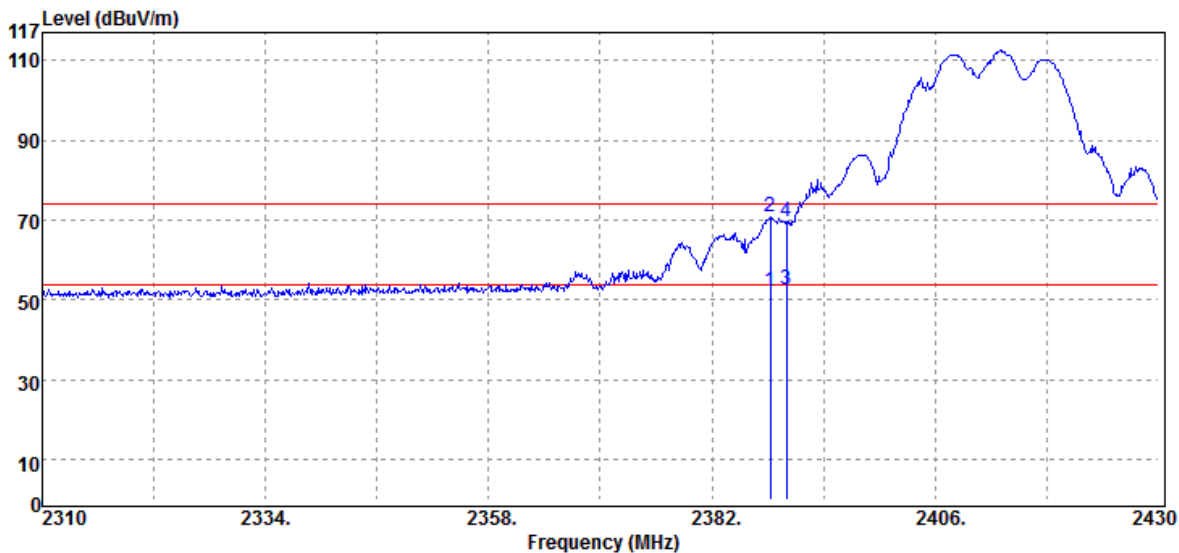
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Operation Band :802.11g
 Fundamental Frequency :2412 MHz
 Operation Mode :Bandedge CH LOW
 EUT Pol. :E1 Plane

Test Date :2018-07-05
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2388.24	Average	52.01	0.19	52.20	54.00	-1.80
2388.24	Peak	70.46	0.19	70.65	74.00	-3.35
2390.00	Average	52.25	0.20	52.45	54.00	-1.55
2390.00	Peak	69.24	0.20	69.44	74.00	-4.56

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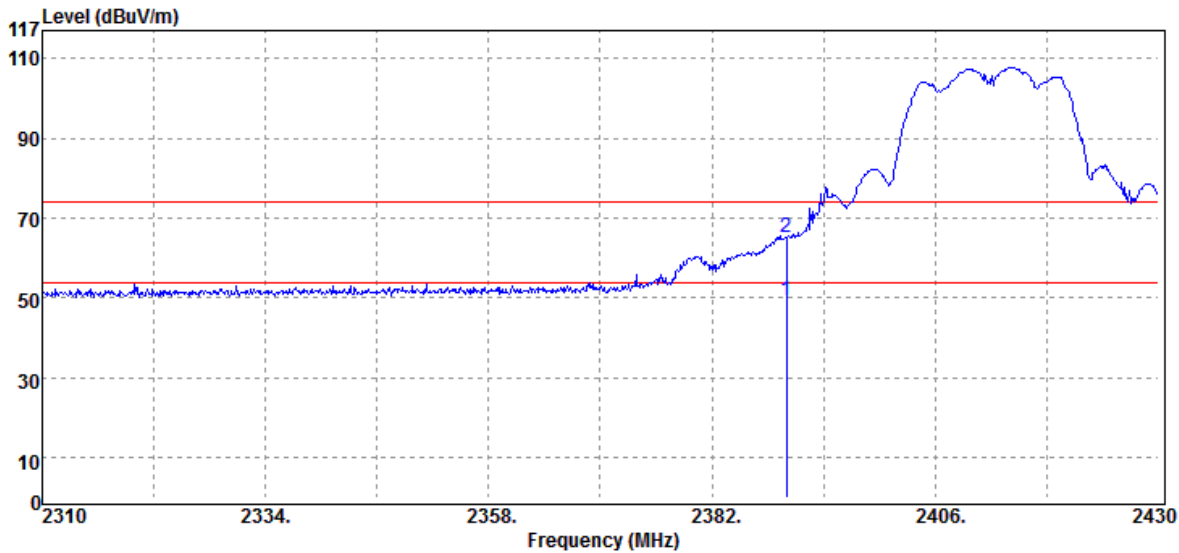
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Operation Band :802.11g
 Fundamental Frequency :2412 MHz
 Operation Mode :Bandedge CH LOW
 EUT Pol. :E1 Plane

Test Date :2018-07-05
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	49.33	0.20	49.53	54.00	-4.47
2390.00	Peak	65.18	0.20	65.38	74.00	-8.62

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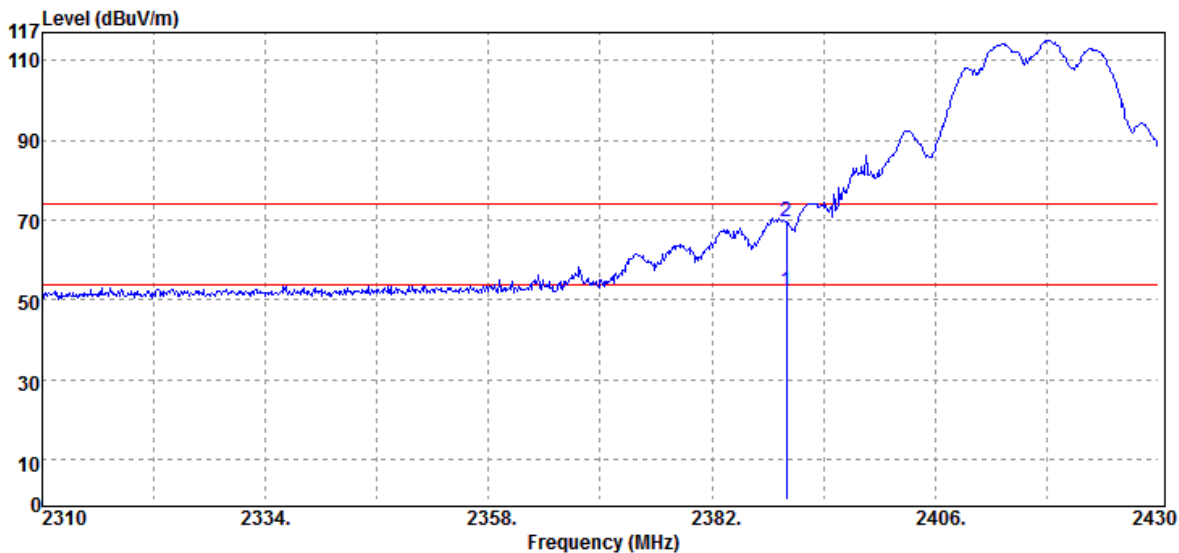
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Operation Band :802.11g
 Fundamental Frequency :2417 MHz
 Operation Mode :Bandedge CH LOW
 EUT Pol. :E1 Plane

Test Date :2018-07-05
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	52.14	0.20	52.34	54.00	-1.66
2390.00	Peak	69.54	0.20	69.74	74.00	-4.26

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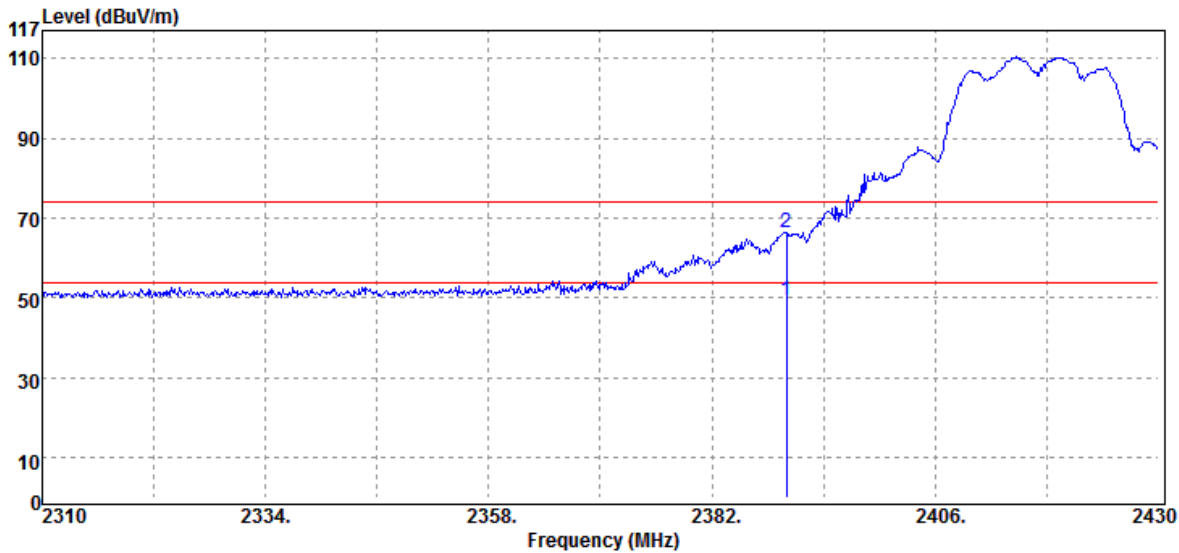
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www.tw.sgs.com

Member of SGS Group

Operation Band :802.11g
Fundamental Frequency :2417 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-05
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	49.25	0.20	49.45	54.00	-4.55
2390.00	Peak	66.02	0.20	66.22	74.00	-7.78

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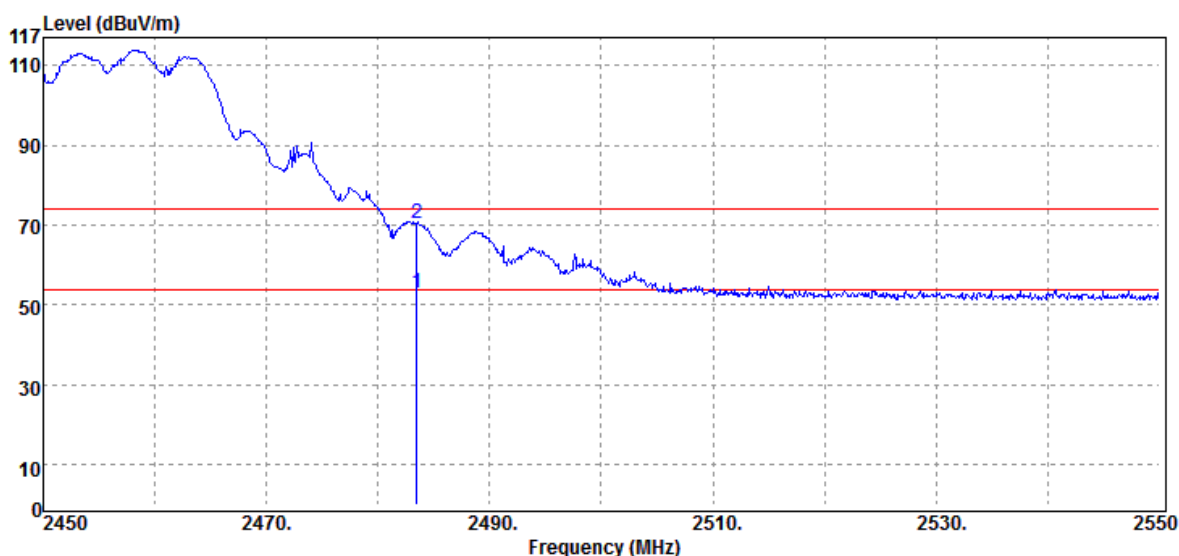
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www.tw.sgs.com

Member of SGS Group

Operation Band :802.11g
Fundamental Frequency :2457 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-05
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
2483.50	Average	52.31	0.53	52.84	54.00	-1.16
2483.50	Peak	69.99	0.53	70.52	74.00	-3.48

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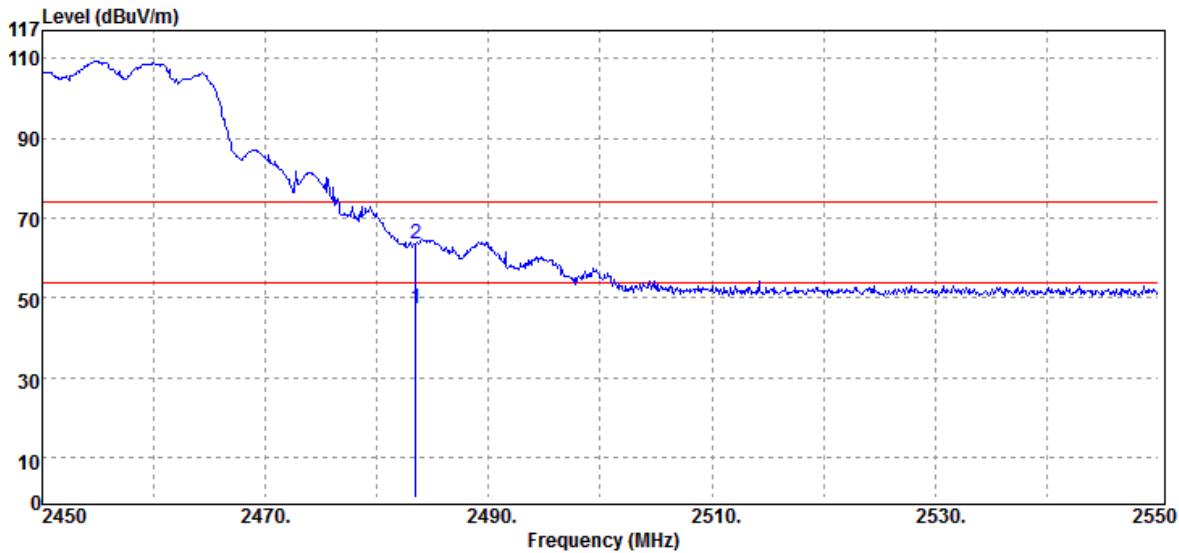
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Member of SGS Group

Operation Band :802.11g
Fundamental Frequency :2457 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-05
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	47.02	0.53	47.55	54.00	-6.45
2483.50	Peak	62.93	0.53	63.46	74.00	-10.54

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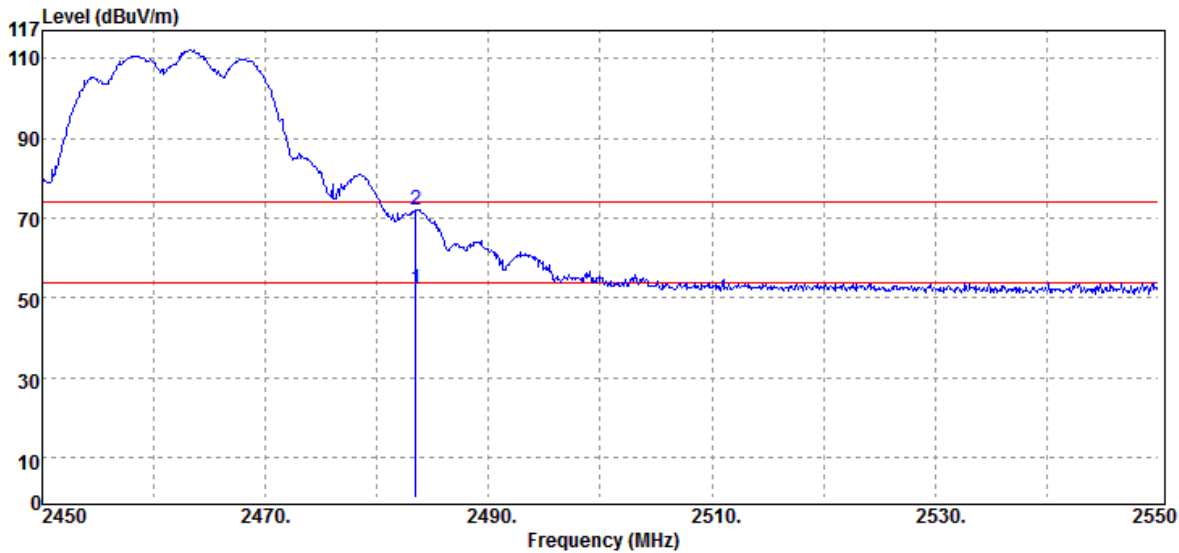
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Member of SGS Group

Operation Band :802.11g
Fundamental Frequency :2462 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-05
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	51.57	0.53	52.10	54.00	-1.90
2483.50	Peak	71.63	0.53	72.16	74.00	-1.84

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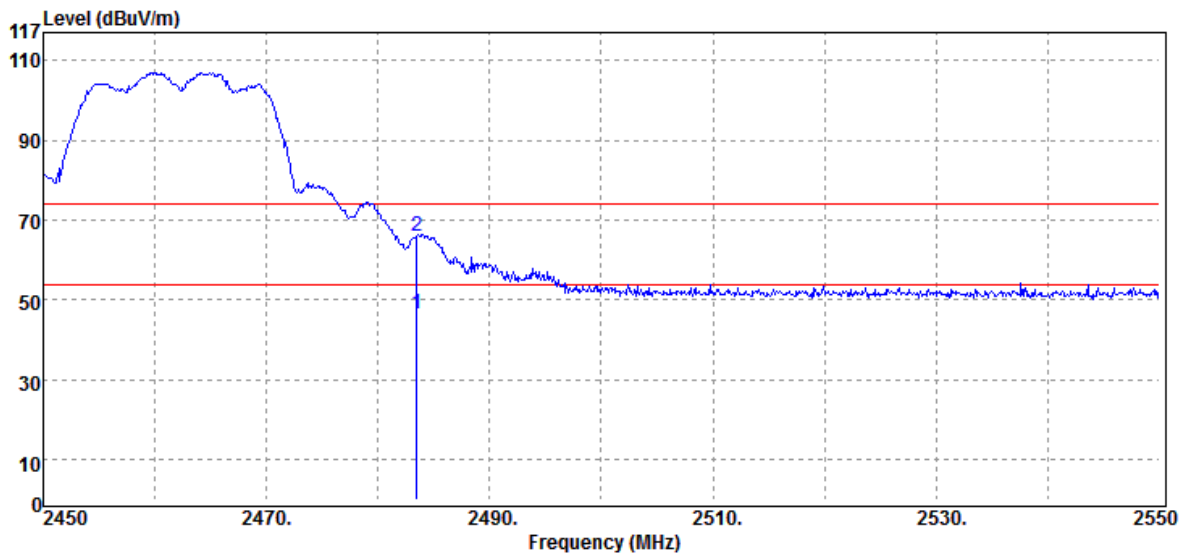
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Operation Band :802.11g
Fundamental Frequency :2462 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-05
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	45.98	0.53	46.51	54.00	-7.49
2483.50	Peak	65.29	0.53	65.82	74.00	-8.18

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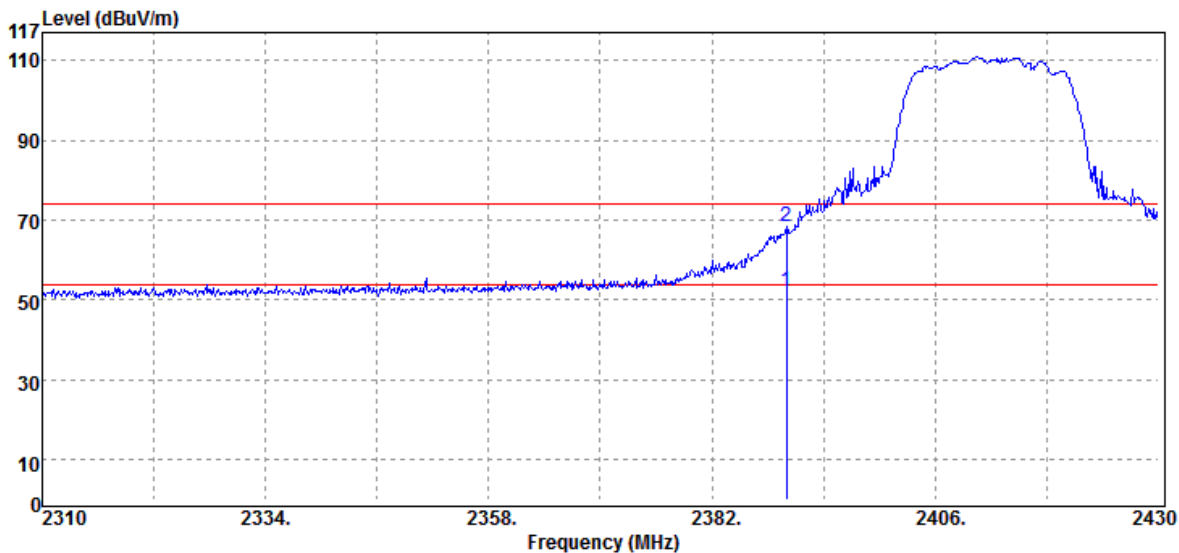
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Member of SGS Group

Operation Band :802.11n20
 Fundamental Frequency :2412 MHz
 Operation Mode :Bandedge CH LOW
 EUT Pol. :E1 Plane

Test Date :2018-07-04
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	51.86	0.20	52.06	54.00	-1.94
2390.00	Peak	68.06	0.20	68.26	74.00	-5.74

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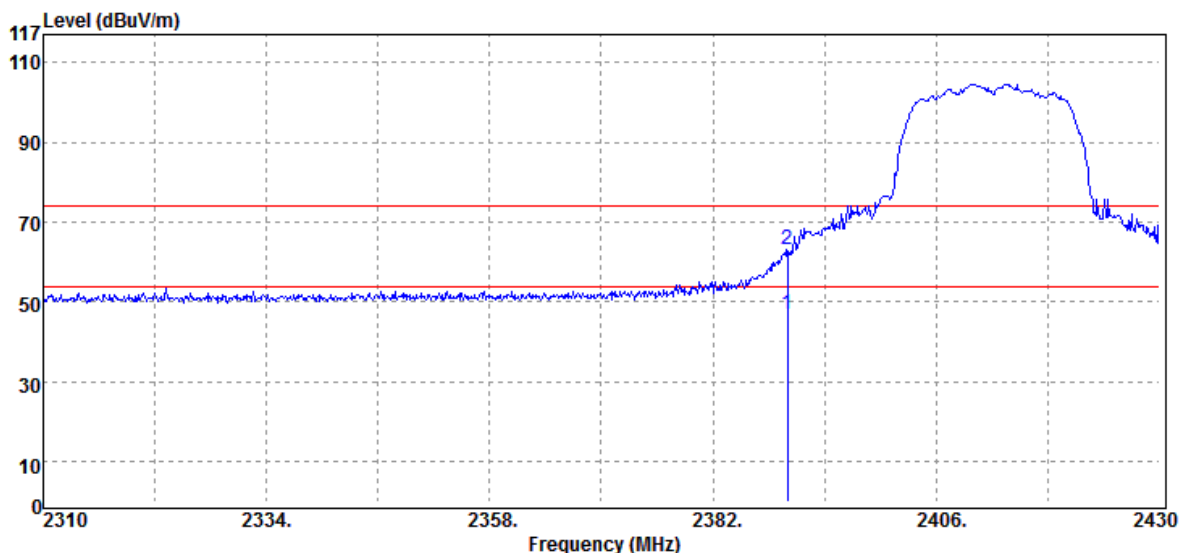
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Member of SGS Group

Operation Band :802.11n20
Fundamental Frequency :2412 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	46.86	0.20	47.06	54.00	-6.94
2390.00	Peak	63.15	0.20	63.35	74.00	-10.65

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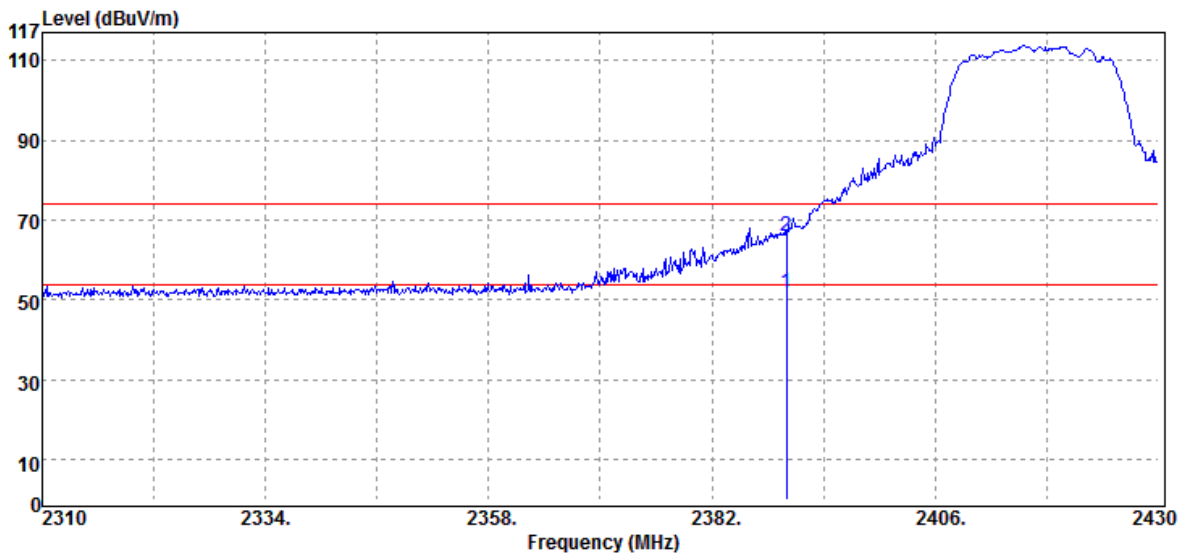
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Member of SGS Group

Operation Band :802.11n20
 Fundamental Frequency :2417 MHz
 Operation Mode :Bandedge CH LOW
 EUT Pol. :E1 Plane

Test Date :2018-07-04
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	51.75	0.20	51.95	54.00	-2.05
2390.00	Peak	65.75	0.20	65.95	74.00	-8.05

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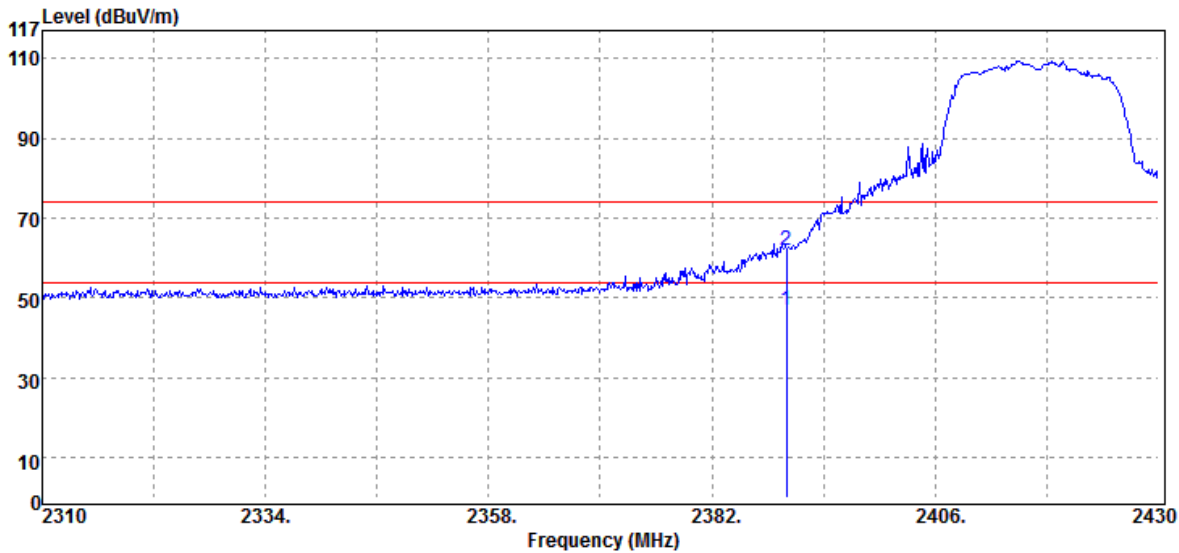
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Operation Band :802.11n20
 Fundamental Frequency :2417 MHz
 Operation Mode :Bandedge CH LOW
 EUT Pol. :E1 Plane

Test Date :2018-07-04
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	46.57	0.20	46.77	54.00	-7.23
2390.00	Peak	61.71	0.20	61.91	74.00	-12.09

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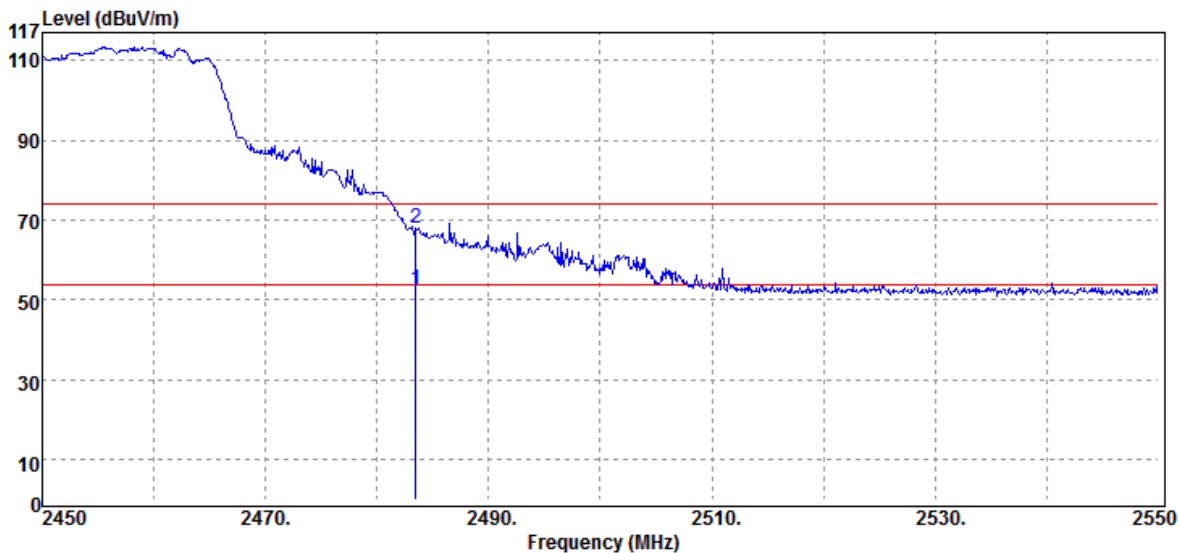
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Member of SGS Group

Operation Band :802.11n20
Fundamental Frequency :2457 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	51.94	0.53	52.47	54.00	-1.53
2483.50	Peak	67.33	0.53	67.86	74.00	-6.14

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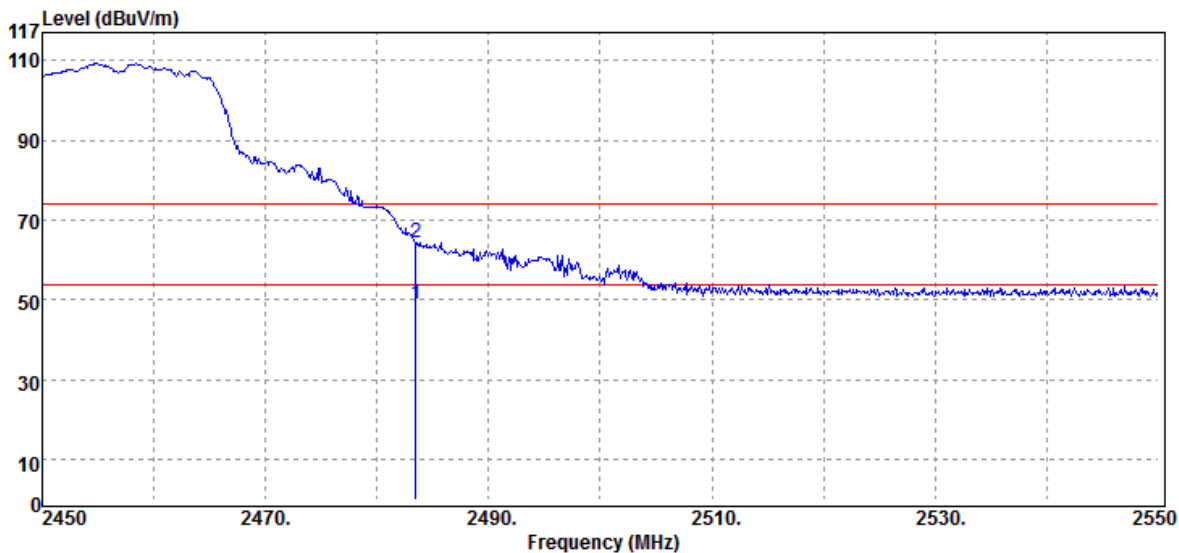
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Operation Band :802.11n20
 Fundamental Frequency :2457 MHz
 Operation Mode :Bandedge CH HIGH
 EUT Pol. :E1 Plane

Test Date :2018-07-04
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	48.55	0.53	49.08	54.00	-4.92
2483.50	Peak	63.87	0.53	64.40	74.00	-9.60

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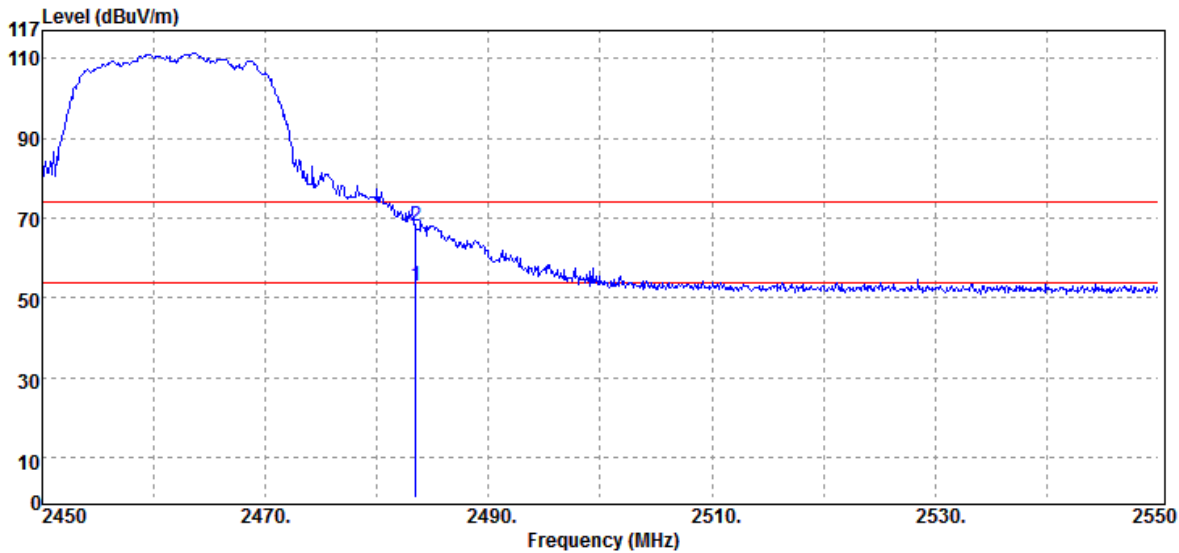
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www.tw.sgs.com

Member of SGS Group

Operation Band :802.11n20
Fundamental Frequency :2462 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	52.40	0.53	52.93	54.00	-1.07
2483.50	Peak	67.52	0.53	68.05	74.00	-5.95

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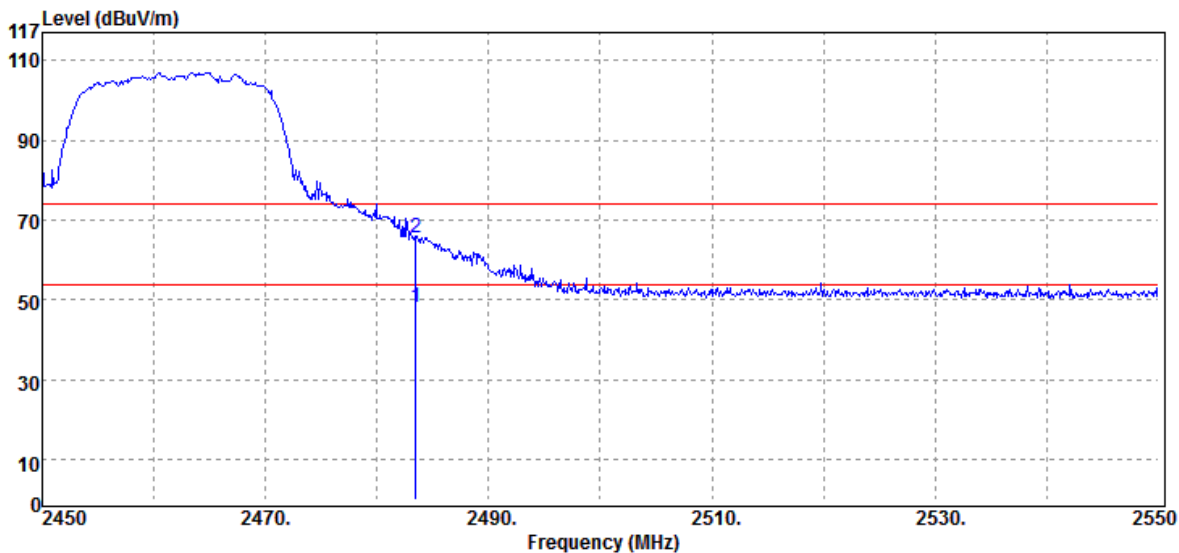
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Member of SGS Group

Operation Band :802.11n20
 Fundamental Frequency :2462 MHz
 Operation Mode :Bandedge CH HIGH
 EUT Pol. :E1 Plane

Test Date :2018-07-04
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	47.68	0.53	48.21	54.00	-5.79
2483.50	Peak	64.98	0.53	65.51	74.00	-8.49

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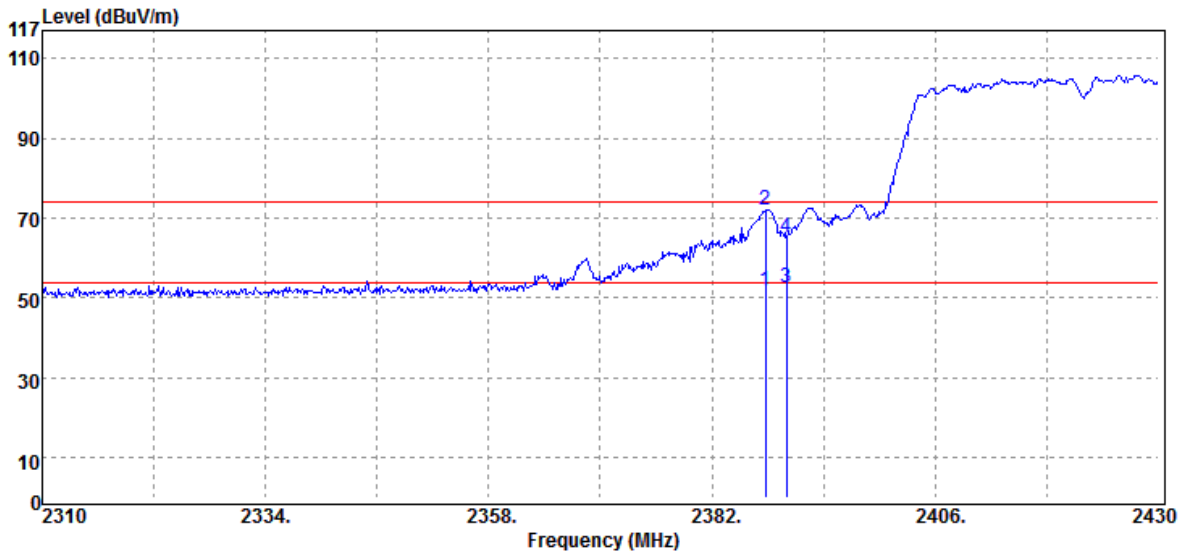
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Member of SGS Group

Operation Band :802.11n40
Fundamental Frequency :2422 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2387.76	Average	51.49	0.19	51.68	54.00	-2.32
2387.76	Peak	71.78	0.19	71.97	74.00	-2.03
2390.00	Average	52.38	0.20	52.58	54.00	-1.42
2390.00	Peak	65.04	0.20	65.24	74.00	-8.76

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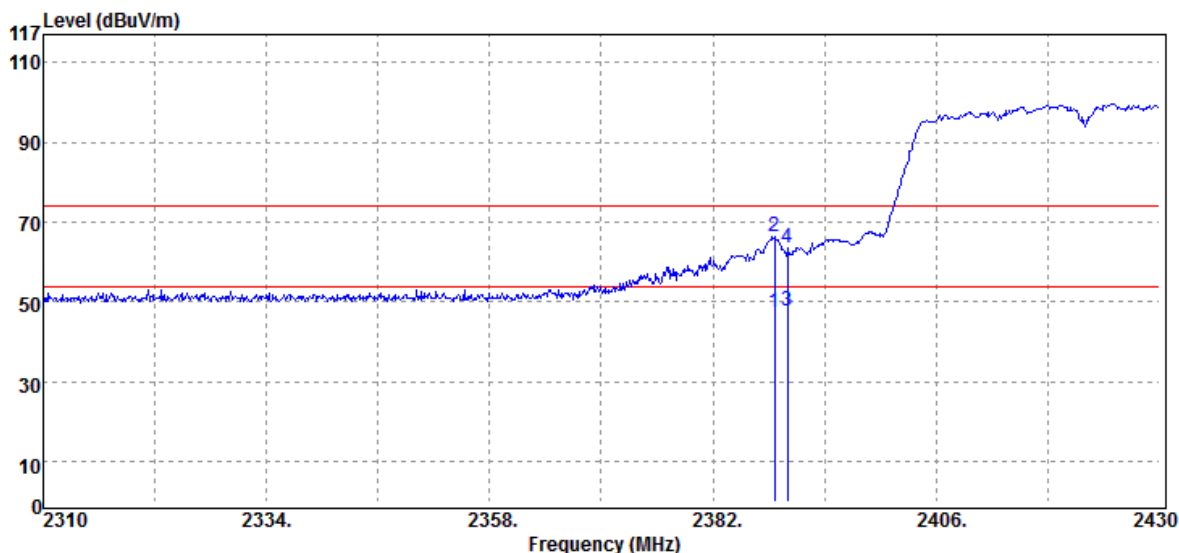
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Operation Band :802.11n40
Fundamental Frequency :2422 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2388.60	Average	47.19	0.19	47.38	54.00	-6.62
2388.60	Peak	66.15	0.19	66.34	74.00	-7.66
2390.00	Average	47.67	0.20	47.87	54.00	-6.13
2390.00	Peak	63.30	0.20	63.50	74.00	-10.50

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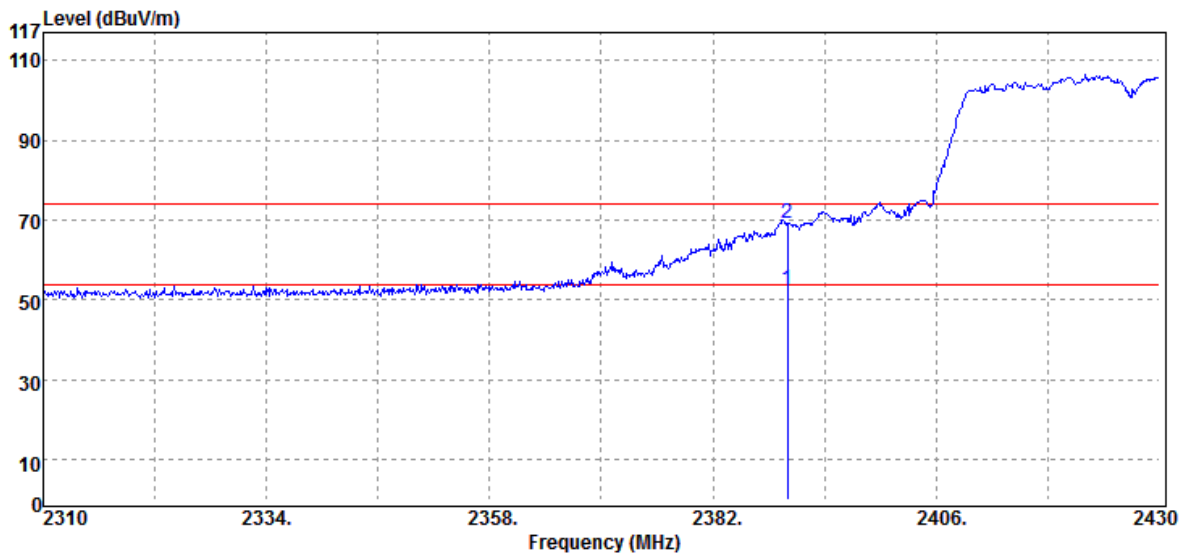
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Operation Band :802.11n40
 Fundamental Frequency :2427 MHz
 Operation Mode :Bandedge CH LOW
 EUT Pol. :E1 Plane

Test Date :2018-07-04
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	52.56	0.20	52.76	54.00	-1.24
2390.00	Peak	69.08	0.20	69.28	74.00	-4.72

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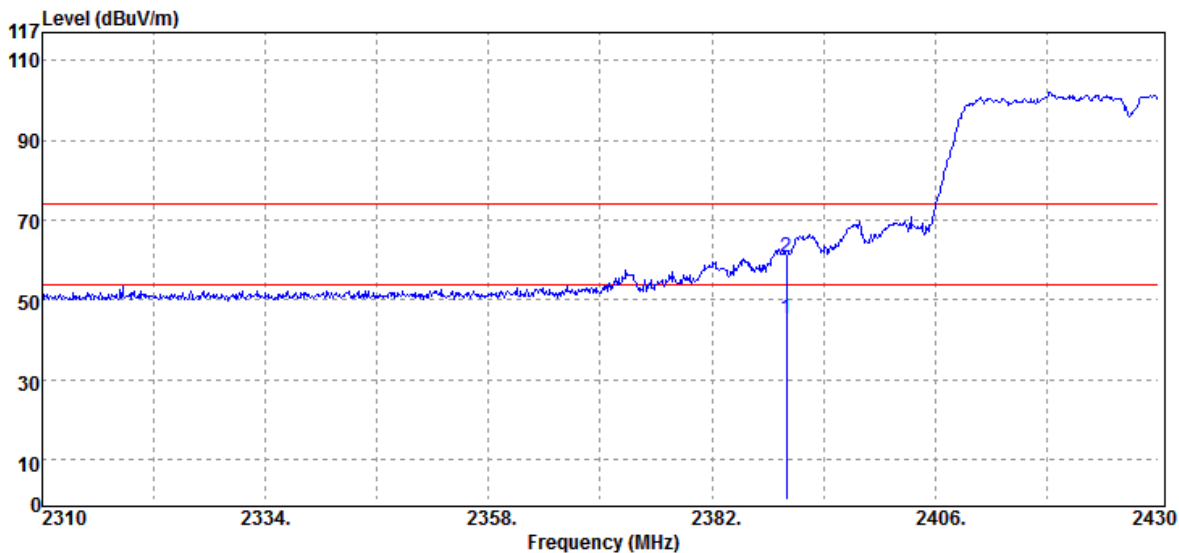
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Member of SGS Group

Operation Band :802.11n40
Fundamental Frequency :2427 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	45.28	0.20	45.48	54.00	-8.52
2390.00	Peak	60.68	0.20	60.88	74.00	-13.12

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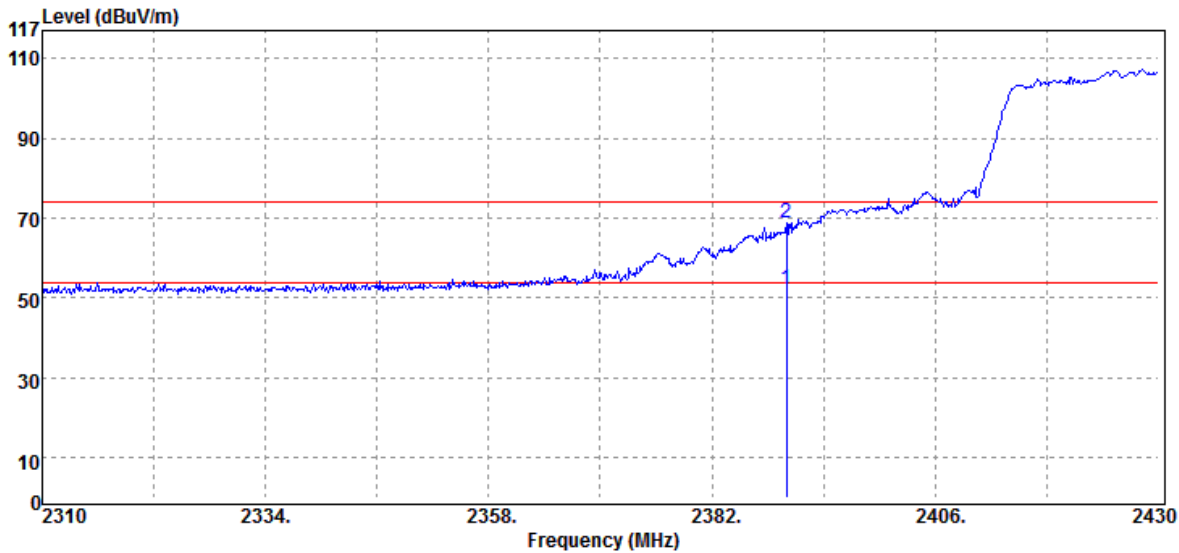
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Operation Band :802.11n40
Fundamental Frequency :2432 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-13
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	51.85	0.20	52.05	54.00	-1.95
2390.00	Peak	68.63	0.20	68.83	74.00	-5.17

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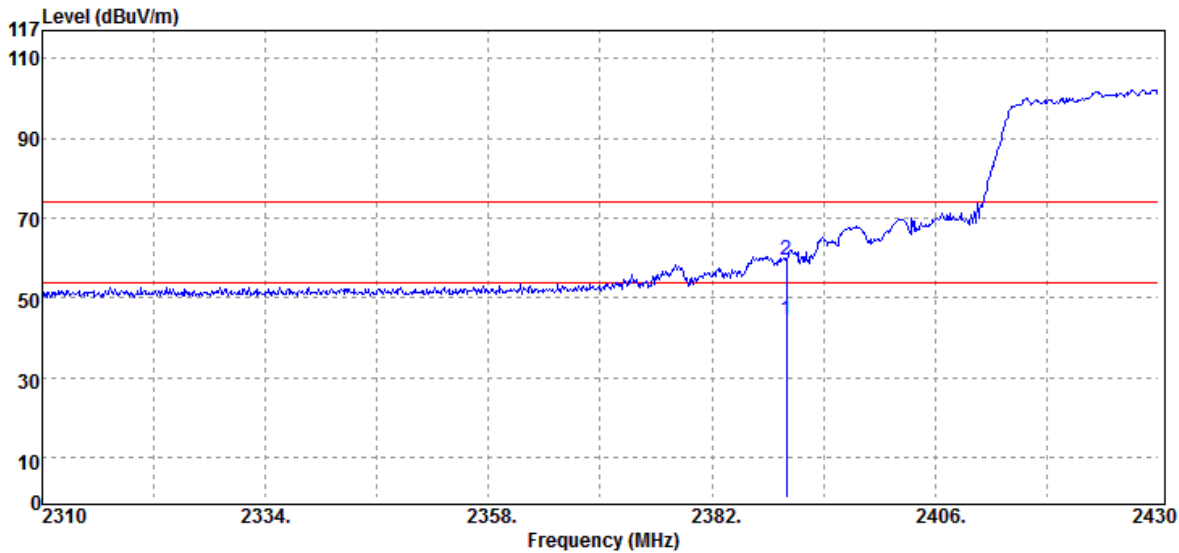
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Member of SGS Group

Operation Band :802.11n40
Fundamental Frequency :2432 MHz
Operation Mode :Bandedge CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-13
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	Average	44.20	0.20	44.40	54.00	-9.60
2390.00	Peak	59.36	0.20	59.56	74.00	-14.44

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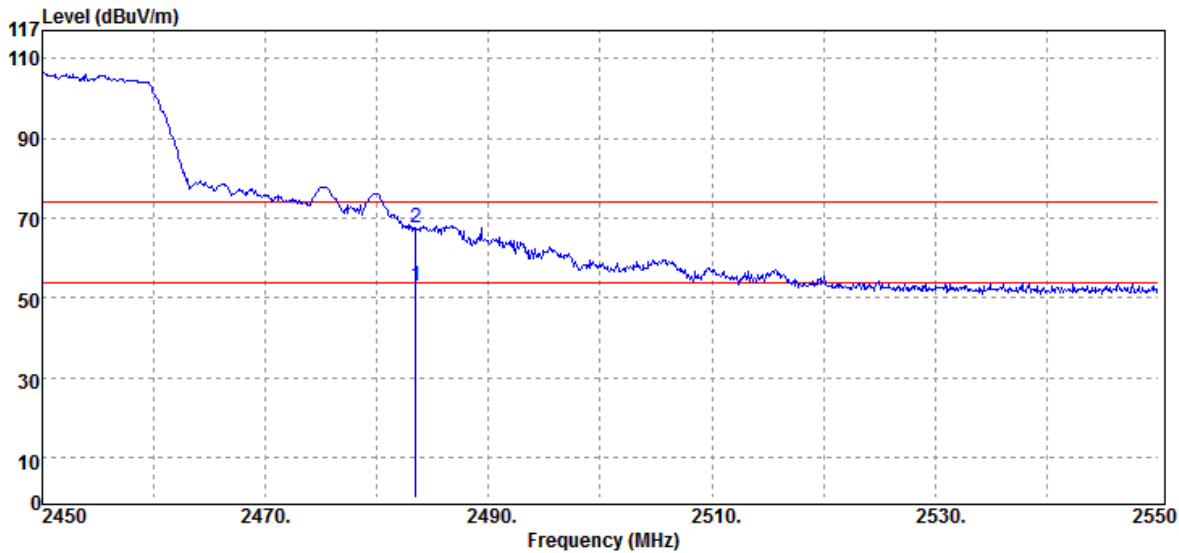
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Operation Band :802.11n40
Fundamental Frequency :2442 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-13
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	52.39	0.53	52.92	54.00	-1.08
2483.50	Peak	67.14	0.53	67.67	74.00	-6.33

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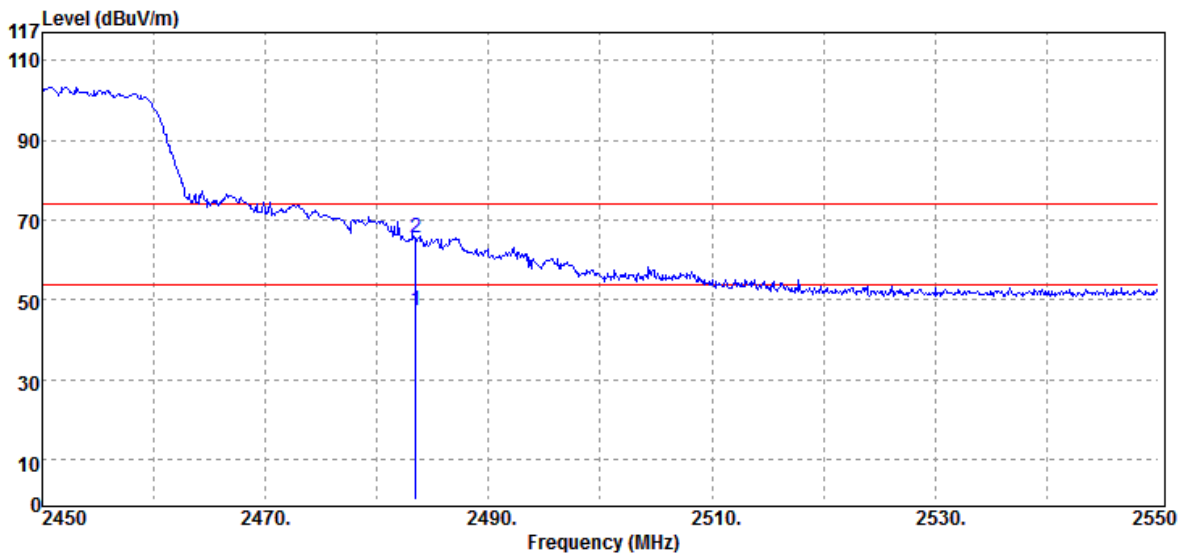
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Operation Band :802.11n40
 Fundamental Frequency :2442 MHz
 Operation Mode :Bandedge CH HIGH
 EUT Pol. :E1 Plane

Test Date :2018-07-13
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	47.02	0.53	47.55	54.00	-6.45
2483.50	Peak	65.15	0.53	65.68	74.00	-8.32

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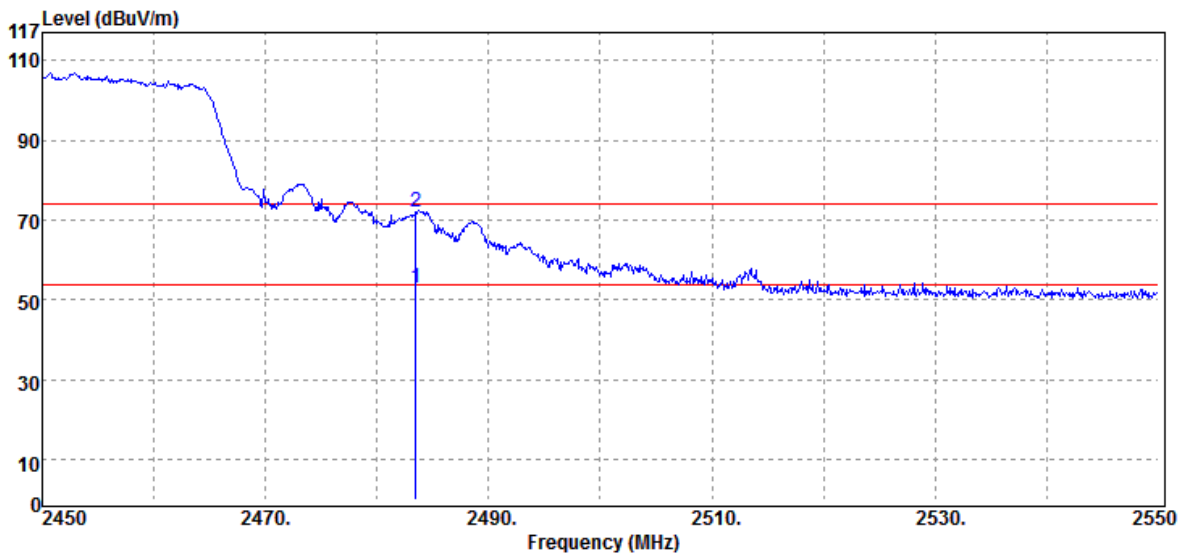
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Operation Band :802.11n40
 Fundamental Frequency :2447 MHz
 Operation Mode :Bandedge CH HIGH
 EUT Pol. :E1 Plane

Test Date :2018-07-04
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	52.35	0.53	52.88	54.00	-1.12
2483.50	Peak	71.52	0.53	72.05	74.00	-1.95

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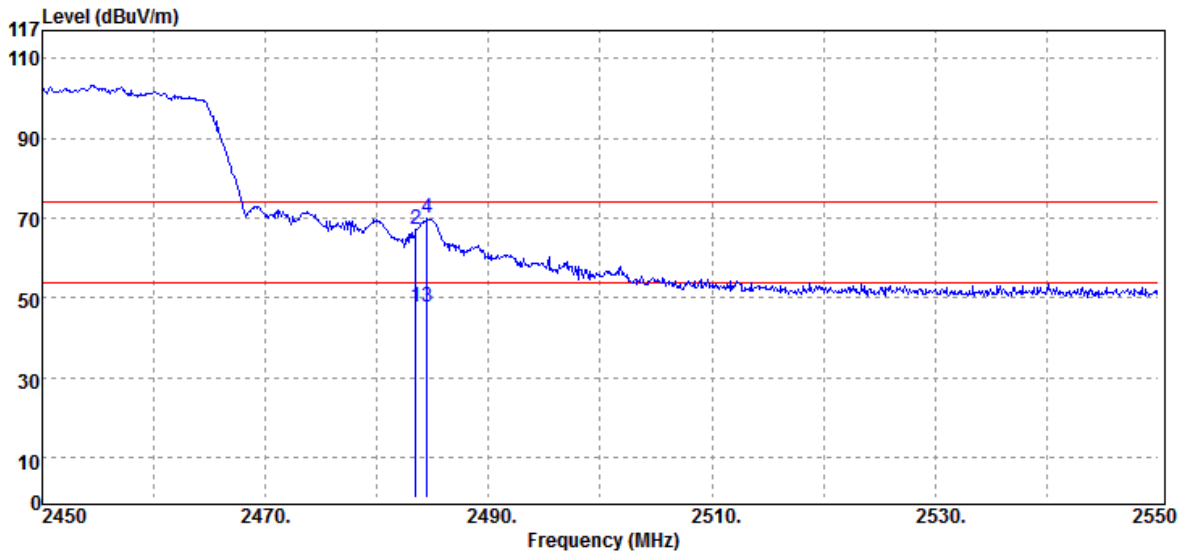
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Operation Band :802.11n40
Fundamental Frequency :2447 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	47.28	0.53	47.81	54.00	-6.19
2483.50	Peak	66.61	0.53	67.14	74.00	-6.86
2484.50	Average	47.14	0.53	47.67	54.00	-6.33
2484.50	Peak	69.53	0.53	70.06	74.00	-3.94

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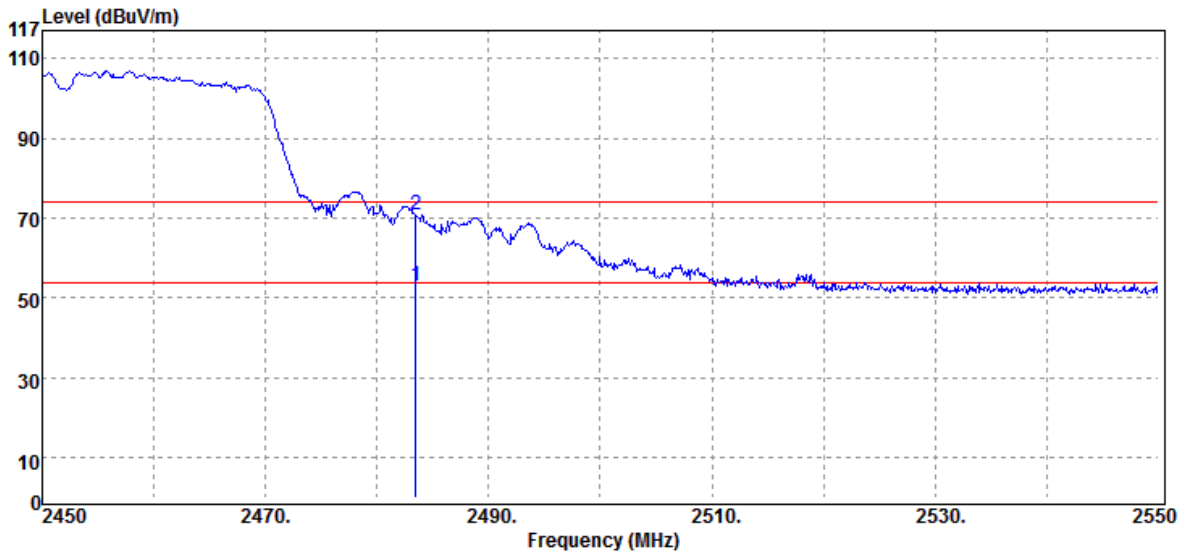
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Member of SGS Group

Operation Band :802.11n40
 Fundamental Frequency :2452 MHz
 Operation Mode :Bandedge CH HIGH
 EUT Pol. :E1 Plane

Test Date :2018-07-04
 Temp./Humi. :21 deg_C / 62 RH
 Engineer :Kane
 Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	52.39	0.53	52.92	54.00	-1.08
2483.50	Peak	70.45	0.53	70.98	74.00	-3.02

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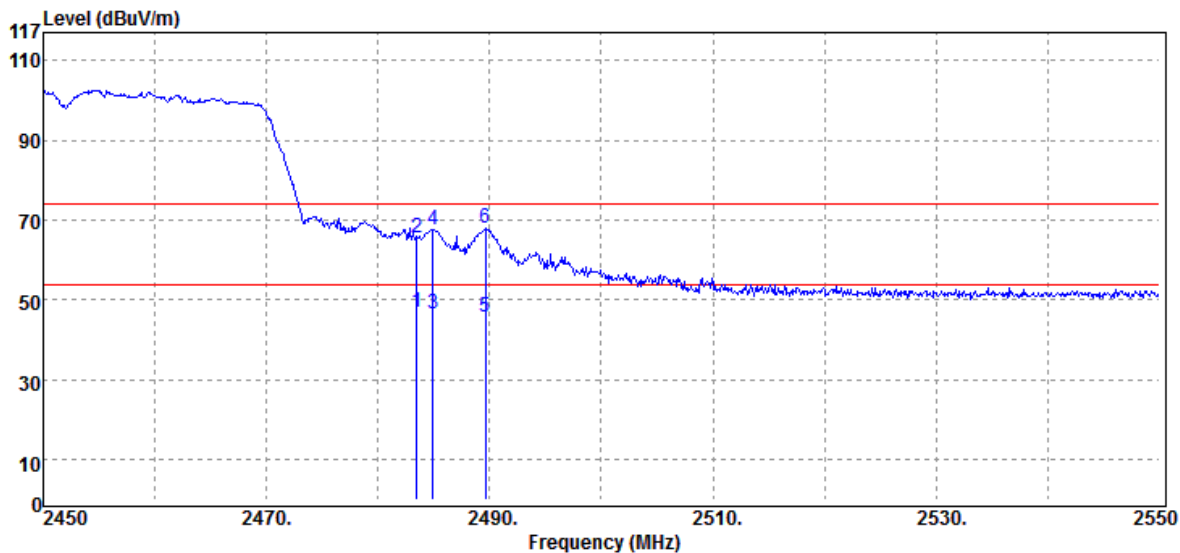
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Operation Band :802.11n40
Fundamental Frequency :2452 MHz
Operation Mode :Bandedge CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-04
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.50	Average	46.47	0.53	47.00	54.00	-7.00
2483.50	Peak	65.25	0.53	65.78	74.00	-8.22
2484.90	Average	46.06	0.53	46.59	54.00	-7.41
2484.90	Peak	67.21	0.53	67.74	74.00	-6.26
2489.60	Average	45.39	0.54	45.93	54.00	-8.07
2489.60	Peak	67.53	0.54	68.07	74.00	-5.93

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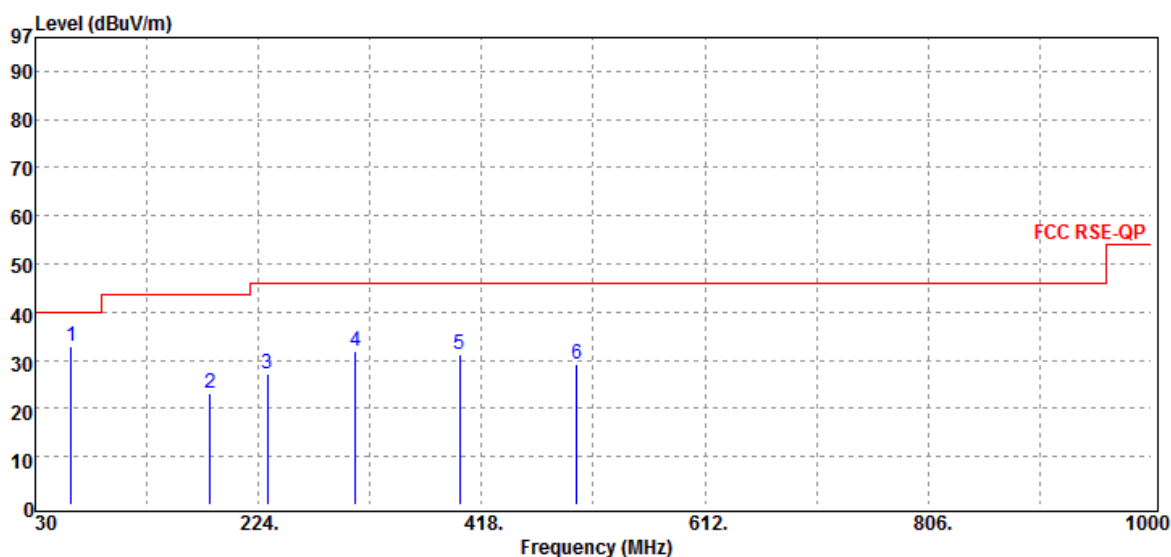
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Below 1GHz Worst-Case Data:

Radiated Spurious Emission Measurement Result

Operation Band :802.11g
Fundamental Frequency :2437 MHz
Operation Mode :Tx CH MID
EUT Pol. :E1 Plane

Test Date :2018-09-18
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
61.04	Peak	40.82	-8.05	32.77	40.00	-7.23
182.29	Peak	31.41	-8.37	23.04	43.50	-20.46
231.76	Peak	35.46	-8.42	27.04	46.00	-18.96
308.39	Peak	37.32	-5.28	32.04	46.00	-13.96
398.60	Peak	34.62	-3.41	31.21	46.00	-14.79
500.45	Peak	31.47	-2.36	29.11	46.00	-16.89

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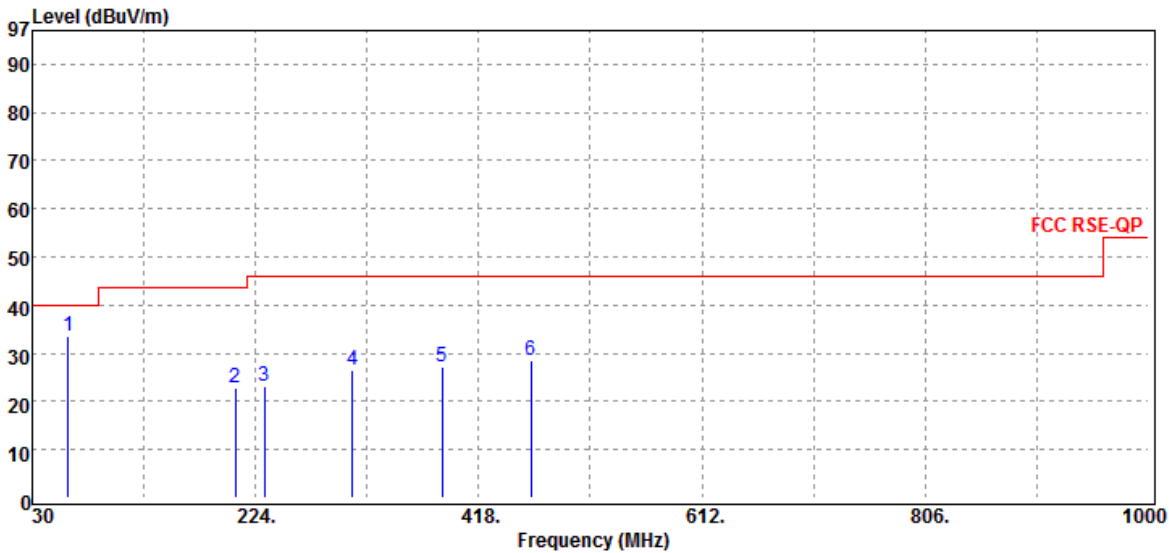
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Operation Band :802.11g
Fundamental Frequency :2437 MHz
Operation Mode :Tx CH MID
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
61.04	Peak	41.55	-8.05	33.50	40.00	-6.50
206.54	Peak	32.21	-9.25	22.96	43.50	-20.54
231.76	Peak	31.52	-8.42	23.10	46.00	-22.90
308.39	Peak	31.77	-5.28	26.49	46.00	-19.51
385.99	Peak	30.88	-3.77	27.11	46.00	-18.89
463.59	Peak	30.57	-2.16	28.41	46.00	-17.59

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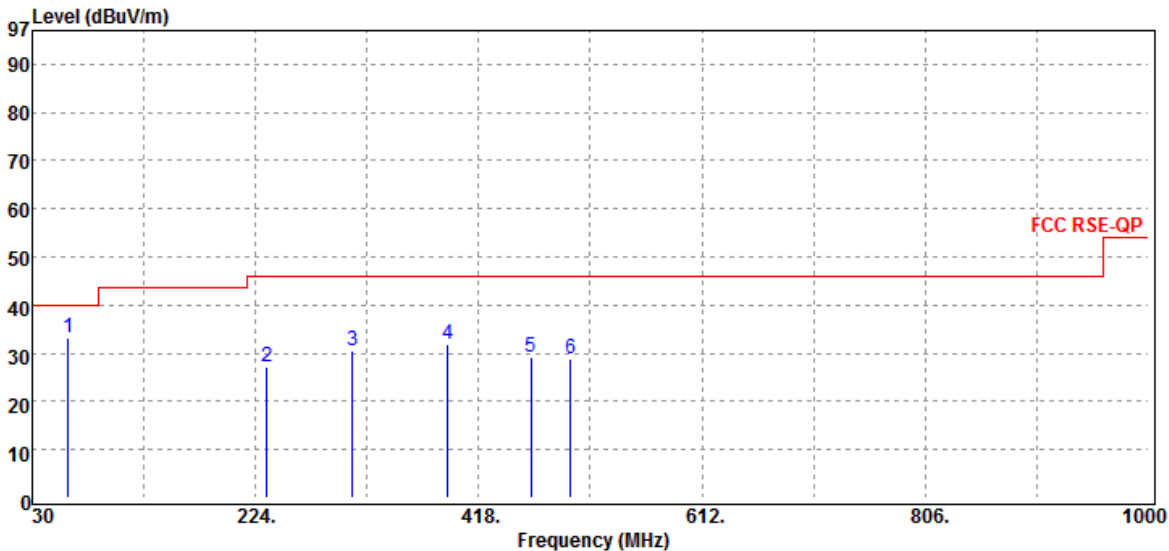
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Operation Band :802.11n40
Fundamental Frequency :2437 MHz
Operation Mode :Tx CH MID
EUT Pol. :E1 Plane

Test Date :2018-09-18
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
61.04	Peak	41.22	-8.05	33.17	40.00	-6.83
233.70	Peak	35.46	-8.24	27.22	46.00	-18.78
308.39	Peak	35.88	-5.28	30.60	46.00	-15.40
390.84	Peak	35.44	-3.62	31.82	46.00	-14.18
463.59	Peak	31.35	-2.16	29.19	46.00	-16.81
497.54	Peak	31.61	-2.64	28.97	46.00	-17.03

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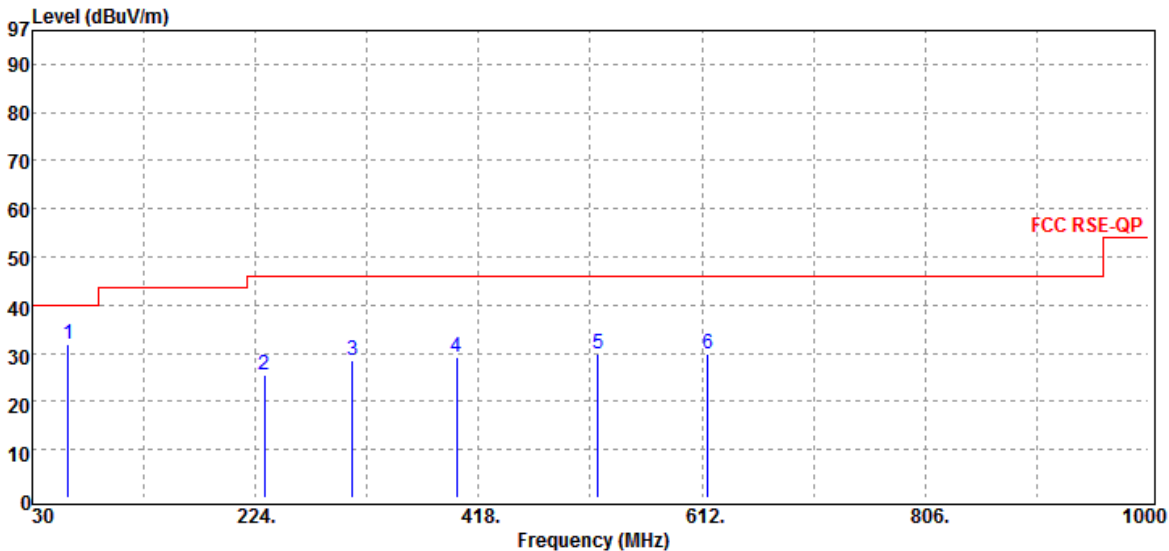
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Operation Band :802.11n40
Fundamental Frequency :2437 MHz
Operation Mode :Tx CH MID
EUT Pol. :E1 Plane

Test Date :2018-09-18
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
61.04	Peak	39.97	-8.05	31.92	40.00	-8.08
231.76	Peak	33.94	-8.42	25.52	46.00	-20.48
308.39	Peak	33.89	-5.28	28.61	46.00	-17.39
398.60	Peak	32.55	-3.41	29.14	46.00	-16.86
521.79	Peak	31.52	-1.50	30.02	46.00	-15.98
616.85	Peak	29.56	0.17	29.73	46.00	-16.27

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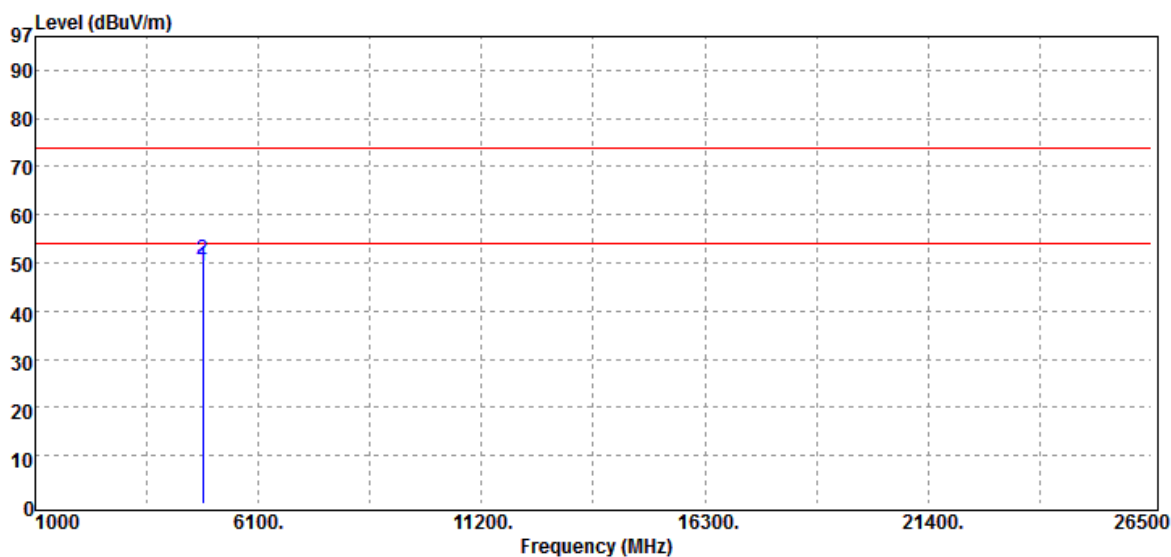
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Above 1GHz Data:

Radiated Spurious Emission Measurement Result

Operation Band :802.11b
Fundamental Frequency :2412 MHz
Operation Mode :Tx CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



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
4822.00	Average	43.77	5.60	49.37	54.00	-4.63
4822.00	Peak	45.14	5.60	50.74	74.00	-23.26

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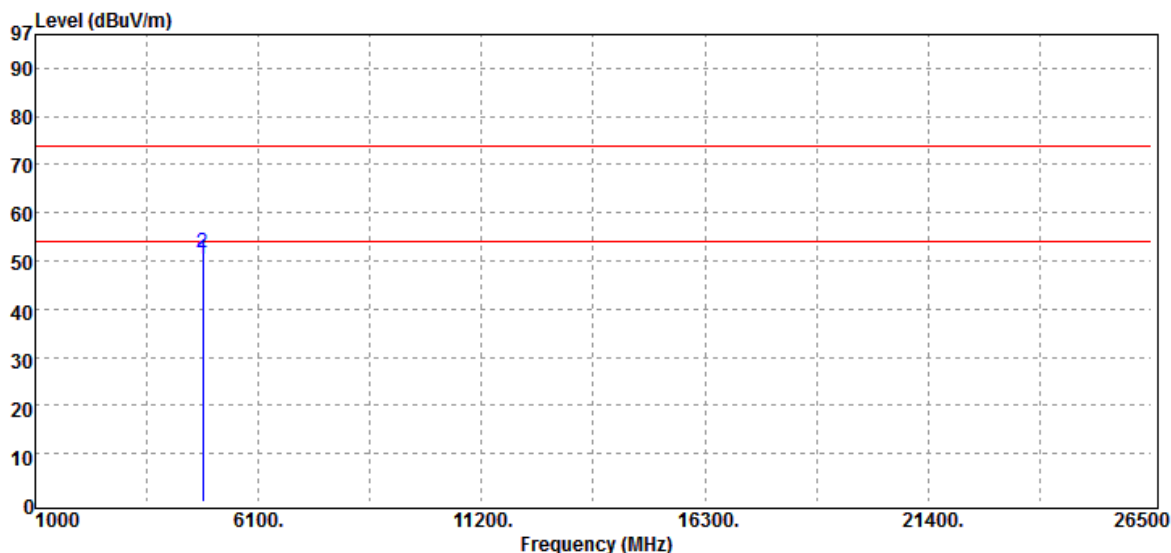
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Operation Band :802.11b
Fundamental Frequency :2412 MHz
Operation Mode :Tx CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4824.00	Average	44.62	5.61	50.23	54.00	-3.77
4824.00	Peak	46.21	5.61	51.82	74.00	-22.18

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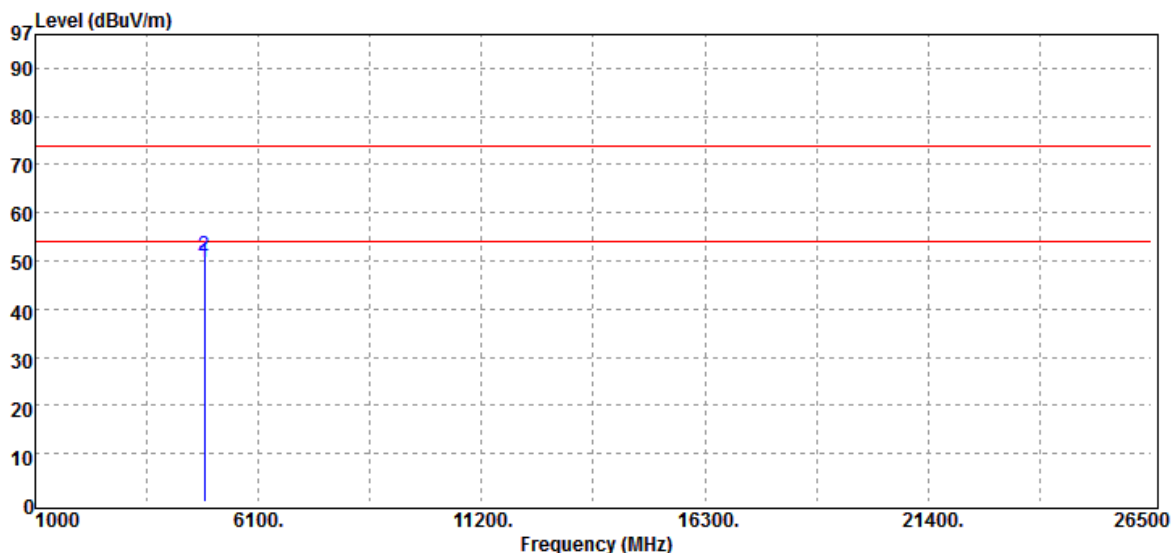
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Operation Band :802.11b
Fundamental Frequency :2437 MHz
Operation Mode :Tx CH MID
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	Average	43.68	5.85	49.53	54.00	-4.47
4874.00	Peak	45.28	5.85	51.13	74.00	-22.87

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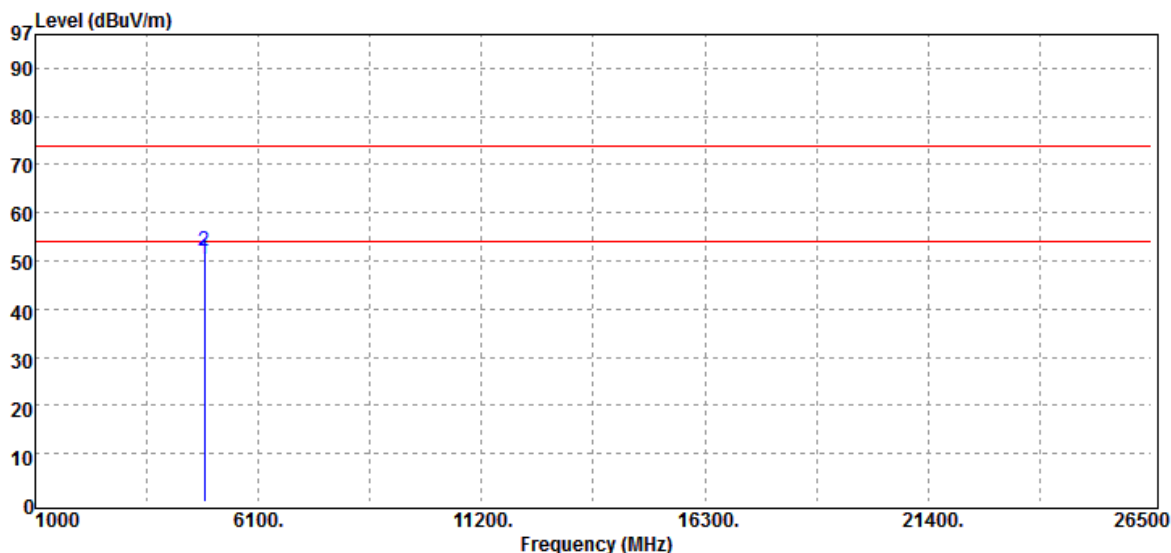
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www.tw.sgs.com

Member of SGS Group

Operation Band :802.11b
Fundamental Frequency :2437 MHz
Operation Mode :Tx CH MID
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	Average	44.39	5.85	50.24	54.00	-3.76
4874.00	Peak	46.10	5.85	51.95	74.00	-22.05

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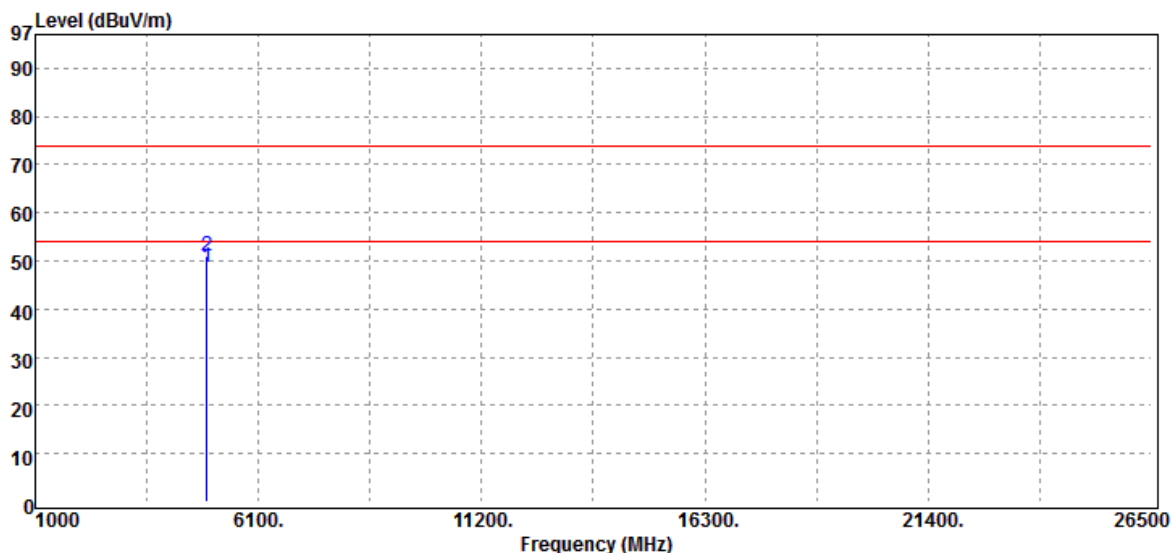
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www.tw.sgs.com

Member of SGS Group

Operation Band :802.11b
Fundamental Frequency :2462 MHz
Operation Mode :Tx CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4924.00	Average	42.82	5.82	48.64	54.00	-5.36
4924.00	Peak	45.29	5.82	51.11	74.00	-22.89

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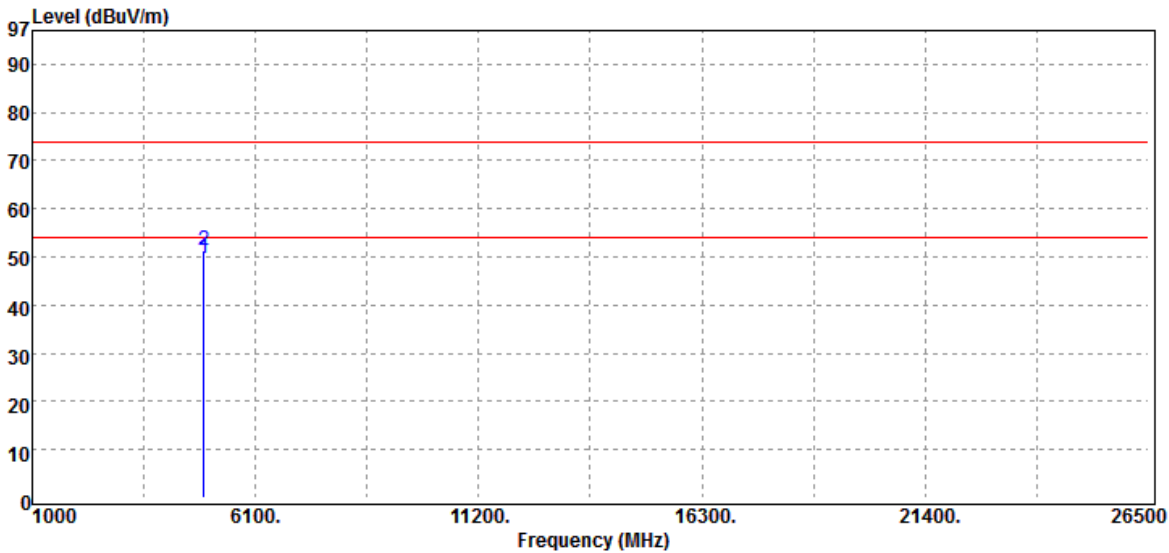
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Operation Band :802.11b
Fundamental Frequency :2462 MHz
Operation Mode :Tx CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	Average	43.70	5.82	49.52	54.00	-4.48
4924.00	Peak	45.70	5.82	51.52	74.00	-22.48

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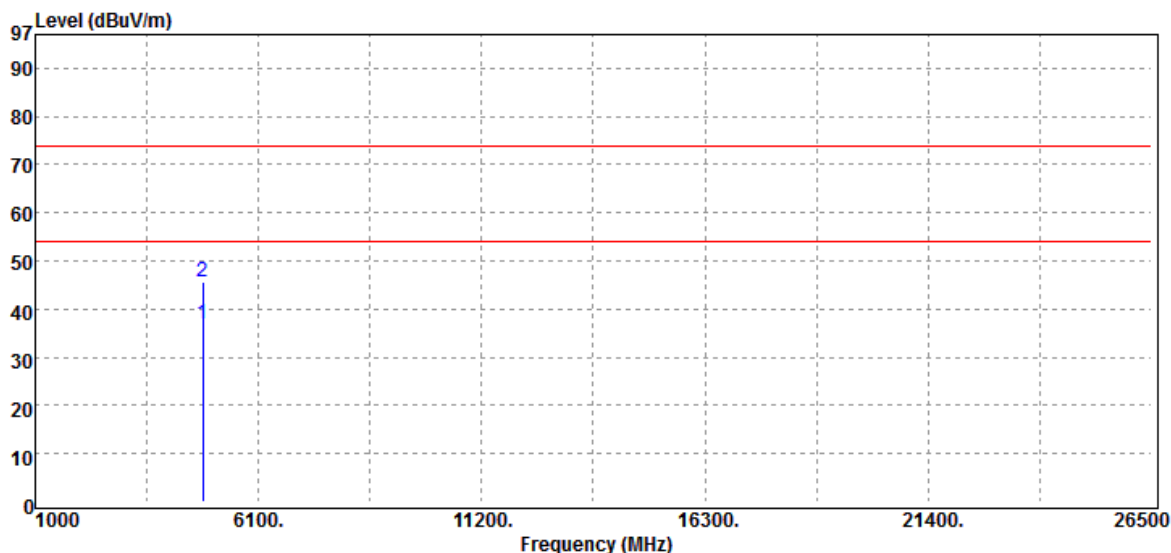
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Member of SGS Group

Operation Band :802.11g
Fundamental Frequency :2412 MHz
Operation Mode :Tx CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4824.00	Average	31.34	5.61	36.95	54.00	-17.05
4824.00	Peak	40.08	5.61	45.69	74.00	-28.31

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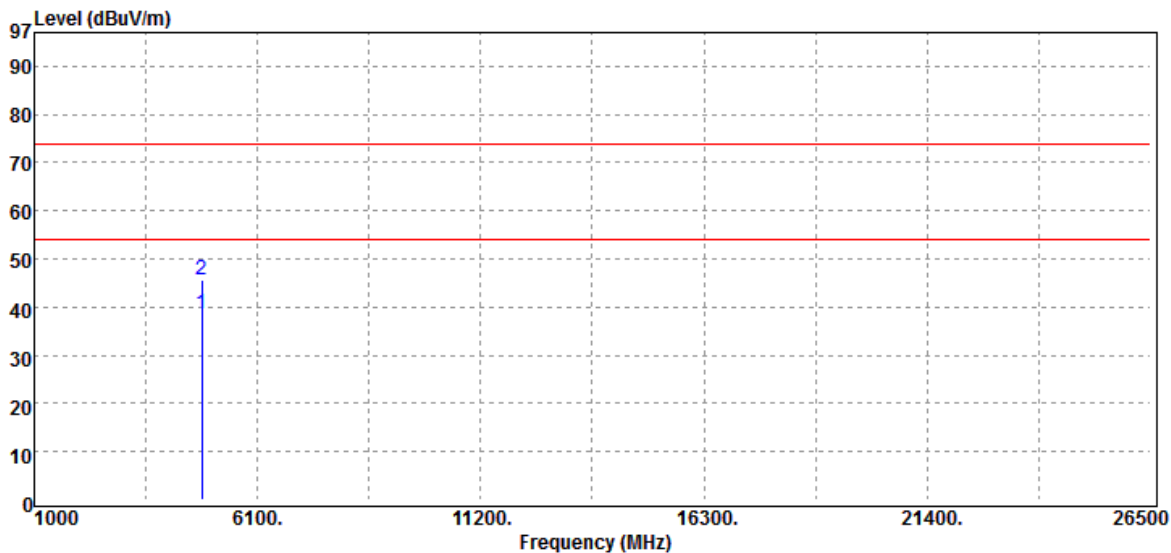
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www.tw.sgs.com

Member of SGS Group

Operation Band :802.11g
Fundamental Frequency :2412 MHz
Operation Mode :Tx CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4824.00	Average	33.05	5.61	38.66	54.00	-15.34
4824.00	Peak	39.88	5.61	45.49	74.00	-28.51

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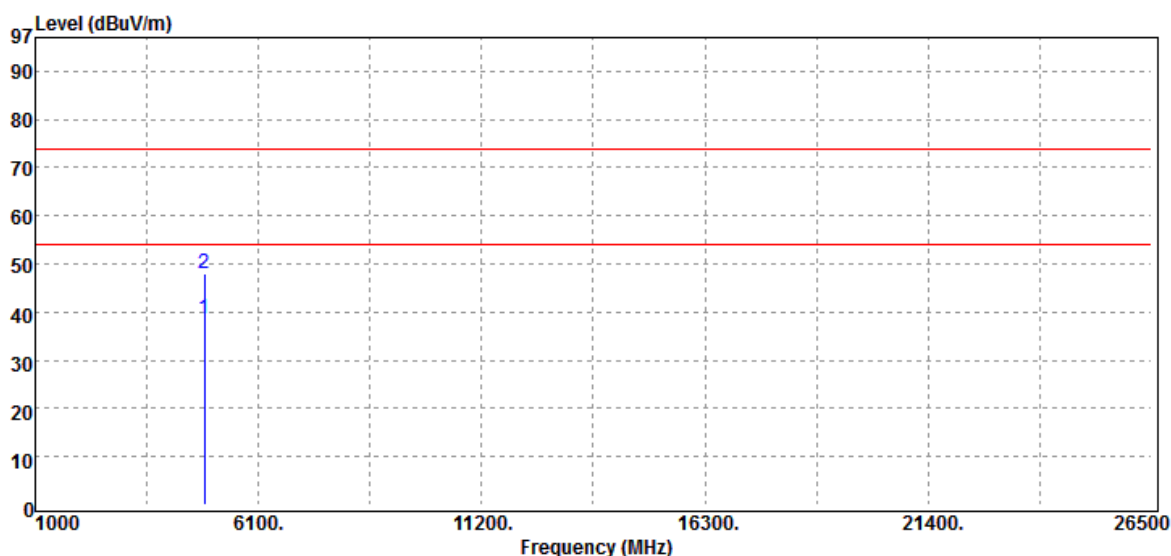
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Member of SGS Group

Operation Band :802.11g
Fundamental Frequency :2437 MHz
Operation Mode :Tx CH MID
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4874.00	Average	32.79	5.85	38.64	54.00	-15.36
4874.00	Peak	41.99	5.85	47.84	74.00	-26.16

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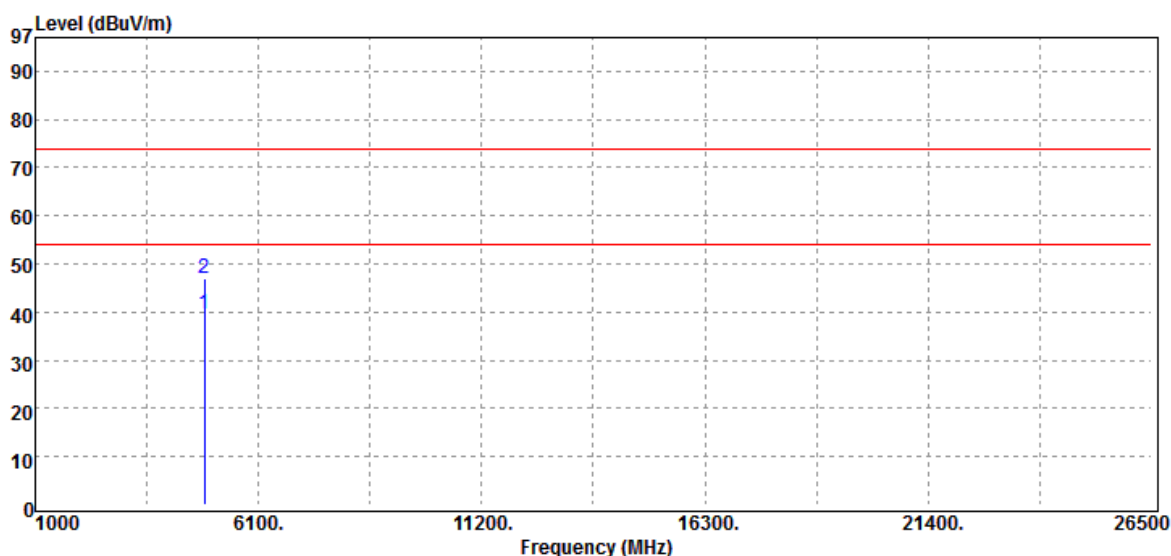
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Member of SGS Group

Operation Band :802.11g
Fundamental Frequency :2437 MHz
Operation Mode :Tx CH MID
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4874.00	Average	33.77	5.85	39.62	54.00	-14.38
4874.00	Peak	41.11	5.85	46.96	74.00	-27.04

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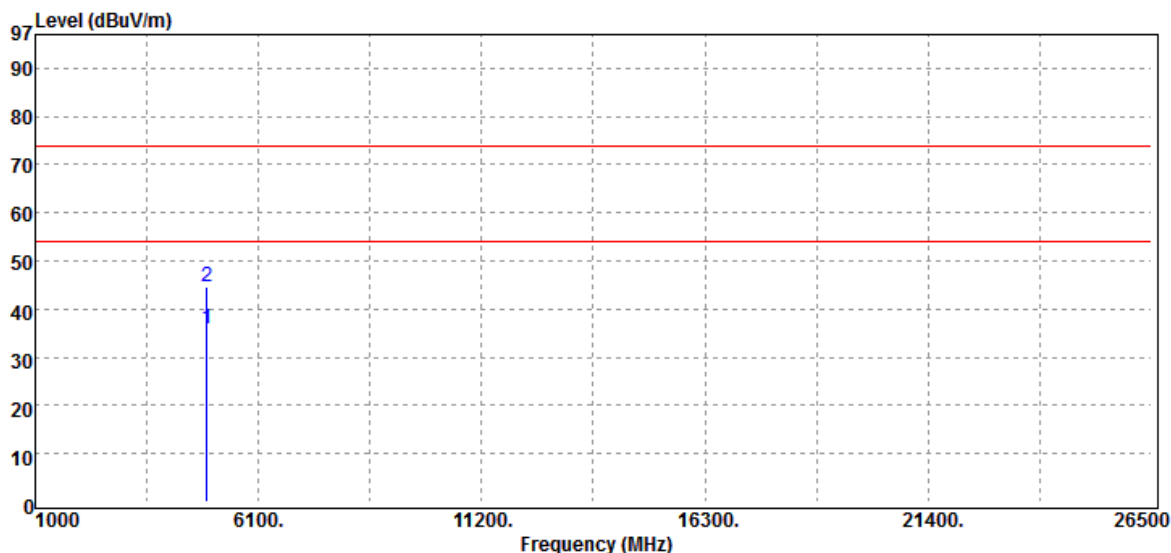
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Member of SGS Group

Operation Band :802.11g
Fundamental Frequency :2462 MHz
Operation Mode :Tx CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	Average	29.97	5.82	35.79	54.00	-18.21
4924.00	Peak	38.89	5.82	44.71	74.00	-29.29

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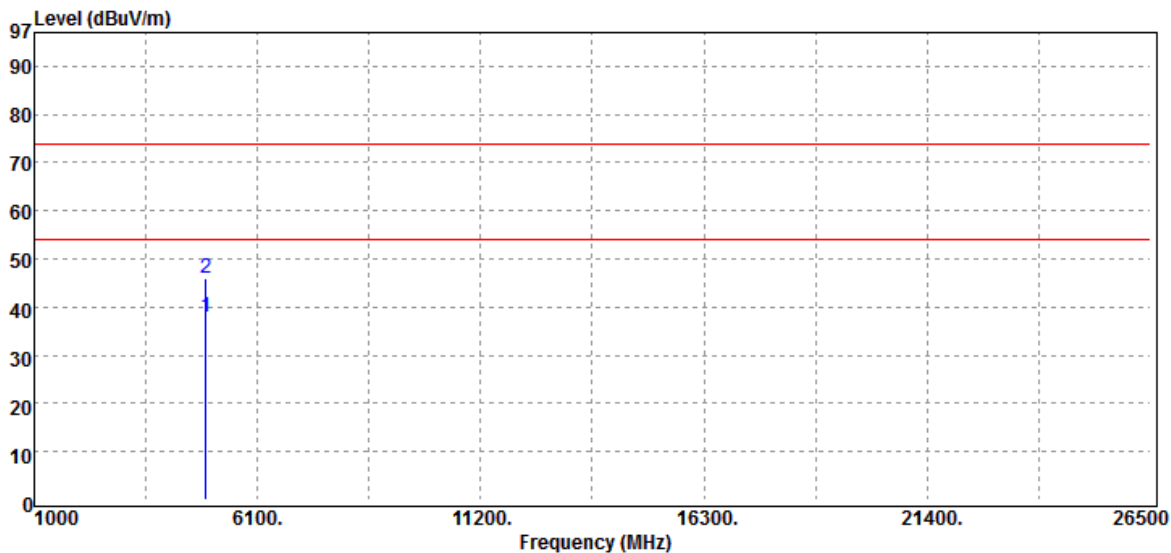
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Operation Band :802.11g
Fundamental Frequency :2462 MHz
Operation Mode :Tx CH HIGH
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	Average	32.11	5.82	37.93	54.00	-16.07
4924.00	Peak	40.03	5.82	45.85	74.00	-28.15

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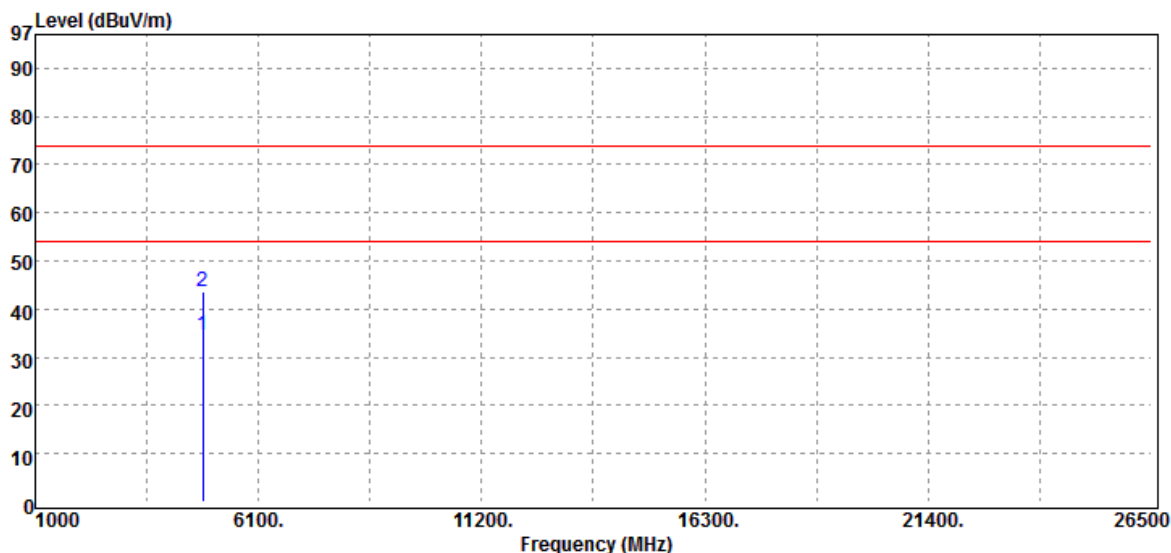
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Member of SGS Group

Operation Band :802.11n20
Fundamental Frequency :2412 MHz
Operation Mode :Tx CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4824.00	Average	28.89	5.61	34.50	54.00	-19.50
4824.00	Peak	38.03	5.61	43.64	74.00	-30.36

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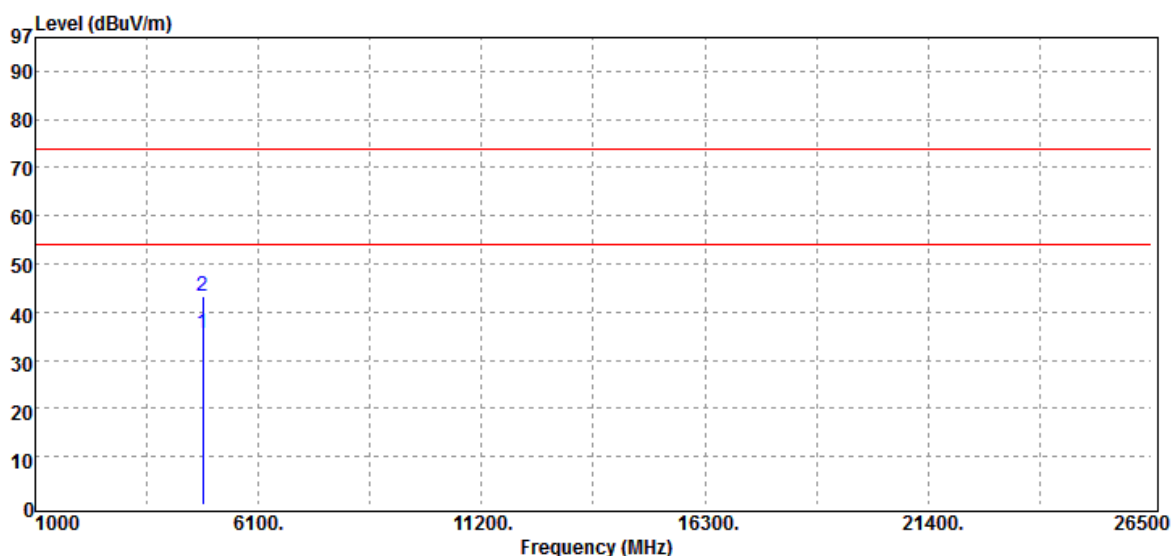
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Member of SGS Group

Operation Band :802.11n20
Fundamental Frequency :2412 MHz
Operation Mode :Tx CH LOW
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :HORIZONTAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4824.00	Average	29.88	5.61	35.49	54.00	-18.51
4824.00	Peak	37.65	5.61	43.26	74.00	-30.74

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

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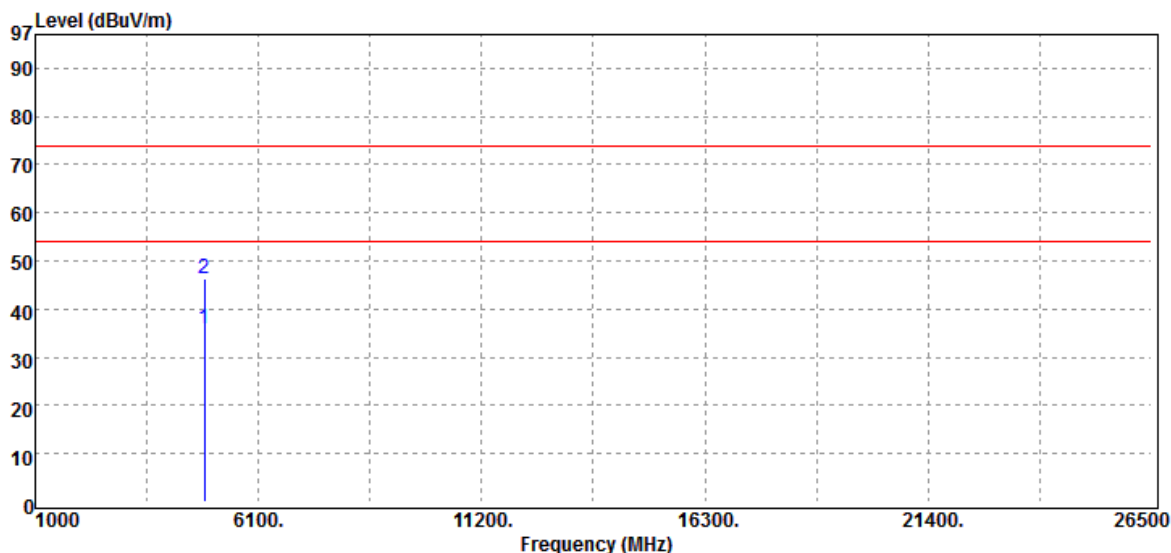
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Operation Band :802.11n20
Fundamental Frequency :2437 MHz
Operation Mode :Tx CH MID
EUT Pol. :E1 Plane

Test Date :2018-07-16
Temp./Humi. :21 deg_C / 62 RH
Engineer :Kane
Measurement Antenna Pol. :VERTICAL



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
4874.00	Average	30.21	5.85	36.06	54.00	-17.94
4874.00	Peak	40.48	5.85	46.33	74.00	-27.67

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