

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART E REQUIREMENT OF

Product Name: Diagnostic Ultrasound System
Brand Name: Qisda
Model No.: UH100
Model Difference: N/A
FCC ID: VRSUH100I
Report No.: ER/2015/80172
Issue Date: Oct. 05, 2015
FCC Rule Part: §15.407
Prepared for: QISDA CORPORATION
NO.157, SHAN-YING ROAD, SHAN-TING LI,
GUEISHAN DIST., TAOYUAN CITY 333,
TAIWAN, R.O.C.
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Taoyuan City, Taiwan 333



Testing Laboratory
0513

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VERIFICATION OF COMPLIANCE

Applicant: QISDA CORPORATION
NO.157, SHAN-YING ROAD, SHAN-TING LI, GUEISHAN DIST.,
TAOYUAN CITY 333, TAIWAN, R.O.C.

Product Name: Diagnostic Ultrasound System

Brand Name: Qisda

Model No.: UH100

Model Difference: N/A

FCC ID: VRSUH100I

File Number: ER/2015/80172

Date of test: Aug. 28, 2015 ~ Oct. 02, 2015

Date of EUT Received: Aug. 28, 2015

We hereby certify that:

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

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

Test By:



Date:

Oct. 05, 2015

Aken Huang / Engineer

Prepared By:



Date:

Oct. 05, 2015

Tiffany Kao / Clerk

Approved By:



Date:

Oct. 05, 2015

Jim Chang / Asst. Manager

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Revision History

Report Number	Revision	Description	Issue Date
ER/2015/80172	Rev.00	Initial creation of document	Oct. 05, 2015

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1. GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Diagnostic Ultrasound System					
Brand Name:	Qisda					
Model No.:	UH100					
Model Difference:	N/A					
Transducer:	<ol style="list-style-type: none">1. Model No.: C52A, Supplier: Qisda Corporation2. Model No.: L115A, Supplier: Qisda Corporation3. Model No.: P42A, Supplier: Qisda Corporation4. Model No.: E94A, Supplier: Qisda Corporation					
Hardware Version:	N/A					
Software Version:	N/A					
Power Supply:	<p>10.8Vdc form Rechargeable Li-ion Battery or 19V from AC/DC Adapter</p> <table border="1"><tr><td>Battery:</td><td>Model No.: QIC3000, Supplier: T-GEE Electronic Co., Ltd.</td></tr><tr><td>Adapter:</td><td>Model No.: ATM065-P190, Supplier: Adapter Technology Co., Ltd.</td></tr></table>		Battery:	Model No.: QIC3000, Supplier: T-GEE Electronic Co., Ltd.	Adapter:	Model No.: ATM065-P190, Supplier: Adapter Technology Co., Ltd.
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WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Rated Power (Avg.)	Modulation Technology	
11a	5150~5250	4	10.78dBm	OFDM	
	5725-5850	5	10.21dBm		
11n	HT20 5150~5250	4	13.55dBm (MIMO Chain 0+1)	OFDM	
	HT20 5725-5850	5	11.33dBm (MIMO Chain 0+1)		
11n	HT40 5150~5250	2	11.66dBm (MIMO Chain 0+1)	OFDM	
	HT40 5725-5850	2	10.38dBm (MIMO Chain 0+1)		
Antenna Designation	PIFA Antenna; Gain: 3.71dBi (Main) / 3.18dBi (Aux) (5150MHz-5250MHz) 4dBi (Main) / 5.02dBi (Aux) (5725MHz-5850MHz)				
Modulation type	64QAM, 16QAM, QPSK, BPSK for OFDM				
Transition Rate:	802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 144.4Mbps 802.11 n_40MHz: 13.5 – 300Mbps				

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1.2 Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is Bluetooth, WLAN and GPS features, and below is details of information.

Product Feature	
Product Name:	Diagnostic Ultrasound System
Brand Name:	Qisda
Model No.:	UH100
Model Difference:	N/A
FCC ID	VRSUH100I
Bluetooth Version:	V4.0 dual mode
WIFI:	802.11 a/b/g/n
Receiver:	GPS

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

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1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 789033 D02 General UNII Test Procedures New Rules v01

FCC KDB 662311 D01 Multiple Transmitter Output

ANSI C63.10:2013

Note:

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

1.4 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory o.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan. (TAF code 0513)

FCC Registration Numbers are: 628985

Canada Registration Number: 4620A-5.

1.5 Special Accessories

There are no special accessories used while test was conducted.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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2. SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

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

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is 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 30MHz,. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Radiated Emissions

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

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2.4 Measurement Results Explanation Example

For all conducted test items:

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

Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Following shows an offset computation example with cable loss 2.4dB for a/n_20, 5.4dB for n_40 and 10dB attenuator.

Single mode offset

= RF cable loss (dB)+ attenuation factor(dB) +duty factor =12.4(dB)

N20 MIMO mode offset

= RF cable loss (dB)+ attenuation factor(dB)+ 10 log(NANT) dB+duty factor=12.4(dB)

N40 MIMO mode offset

= RF cable loss (dB)+ attenuation factor(dB)+ 10 log(NANT) dB+duty factor=15.4(dB)

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2.5 Configuration of Tested System

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

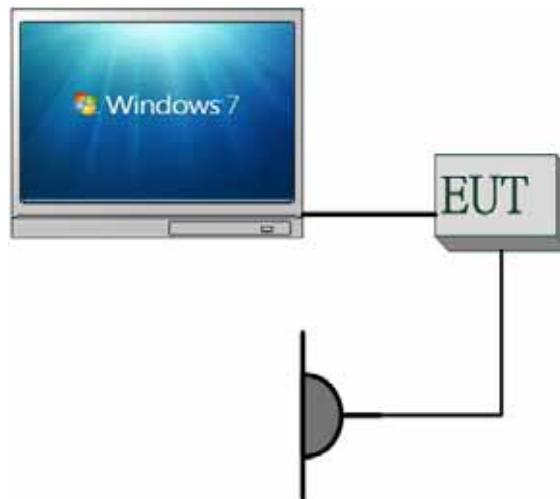


Fig. 2-2 AC Power Line Conducted Emission

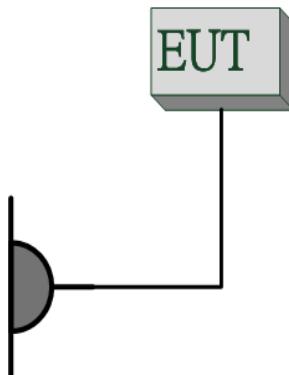


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L412	LR-027LM	N/A	N/A

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3. SUMMARY OF TEST RESULT

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§15.403(i) §15.407(e)	26 dB & 6dB Emission Bandwidth	Compliant
§15.407(a)	Maximum Conducted Output Power	Compliant
§15.407(a)	Power Spectral Density	Compliant
§15.407(b)	Undesirable Radiated Emissions	Compliant
§15.407(c)	Transmission in case of Absence of Information	Compliant
§15.407(g)	Frequency Stability	Compliant
§15.203 §15.407(a)	Antenna Requirement	Compliant

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4. DESCRIPTION OF TEST MODES

4.1 Operated in U-NII Bands

Operated band in 5150 MHz ~5250 MHz:

4 channels are provided for 802.11a, 802.11n_HT20

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n_HT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
38	5190 MHz	46	5230 MHz

Operated band in 5725 MHz ~5850 MHz:

5 channels are provided for 802.11a, 802.11n_HT20

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
149	5745 MHz	161	5805 MHz
153	5765 MHz	165	5825 MHz
157	5785 MHz		

2 channels are provided for 802.11n_HT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
151	5755 MHz	159	5795 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 mode is programmed.
3. Investigation has been done on all the possible configurations for searching the worst case.

RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	44	OFDM	6	MAIN
802.11a	5745~5825	149 to 165	157	OFDM	6	MAIN
RADIATED EMISSION TEST (ABOVE 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	MAIN
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	MAIN
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5755~5795	151 to 159	151,159	OFDM	MCS8	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 802.11a/n WLAN Transmitter for channel Low, Mid and High, the worst case H position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	MAIN
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	MAIN
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5755~5795	151 to 159	151,159	OFDM	MCS8	MIMO

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5. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
26dB Emission Bandwidth	+/- 123.36 Hz
The Maximum Output Power Measurement	+/- 0.96 dB
Peak Power Spectral Density Measurement	+/- 1.67 dB
Frequency Stability	+/- 123.36 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC=+/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB
Measurement uncertainty (Polarization : Horizontal)	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

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

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6. CONDUCTED EMISSION TEST

6.1. Standard Applicable

According to §15.207, frequency range within 150 kHz to 30 MHz shall not exceed the Limit table as below.

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

Note

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

6.2. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI 7	100950	12/12/2014	12/11/2015
Coaxial Cables	N/A	N30N30-1042-150cm	N/A	01/06/2015	01/07/2016
LISN	Schwarzbeck	NSLK 8127	8127-648	06/09/2015	06/08/2016
LISN	Rolf-Heine	NNB-2/16Z	99012	03/04/2015	03/03/2016
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

6.3. EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The LISN was connected with 120Vac/60Hz power source.

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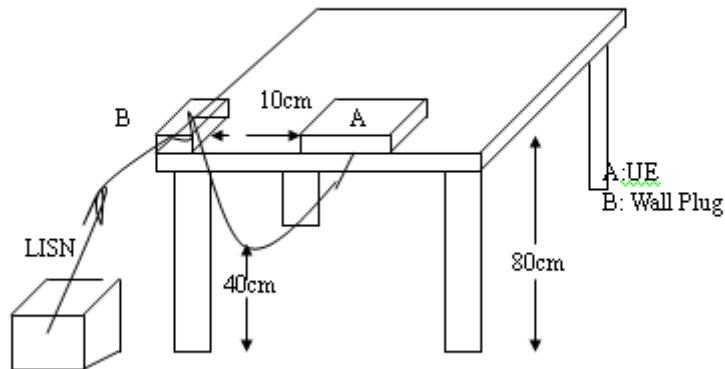
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6.4. Test SET-UP



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 that closet to the limit

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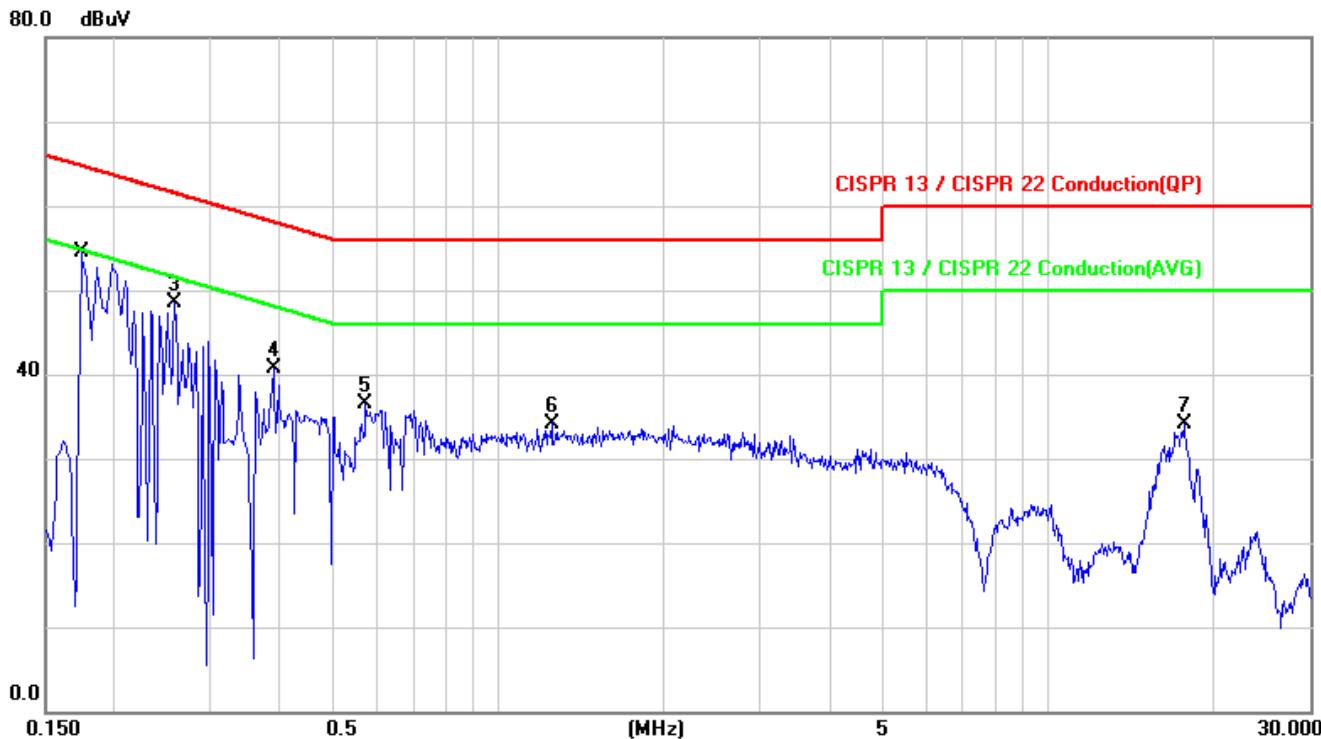
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Sep. 24, 2015
Temperature:	24	Humidity:	66 %	Test By:	Vito
				Phase:	L1/N



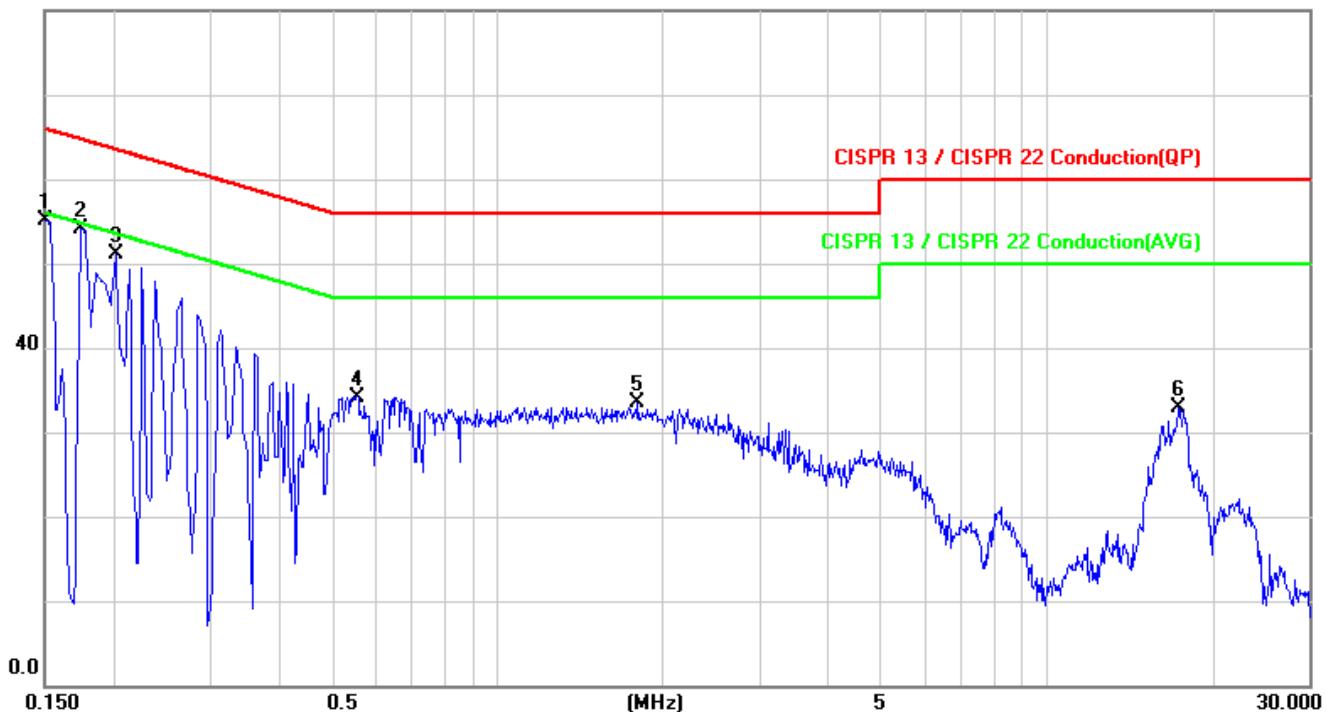
No.	Mk.	Freq. ^② (MHz)	Reading ^② dBuV	Factor ^② (dB)	Measurement ^② (dBuV)	Limit ^② (dBuV)	Over ^② (dB)	Detector ^②	Comment ^②
1 ^②		0.1740 ^②	47.80 ^②	0.08 ^②	47.88 ^②	64.77 ^②	-16.89 ^②	QP ^②	^②
2 ^②		0.1740 ^②	19.10 ^②	0.08 ^②	19.18 ^②	54.77 ^②	-35.59 ^②	AVG ^②	^②
3 ^②	*	0.2580 ^②	48.34 ^②	0.10 ^②	48.44 ^②	61.50 ^②	-13.06 ^②	peak ^②	^②
4 ^②		0.3900 ^②	40.58 ^②	0.16 ^②	40.74 ^②	58.06 ^②	-17.32 ^②	peak ^②	^②
5 ^②		0.5740 ^②	36.28 ^②	0.25 ^②	36.53 ^②	56.00 ^②	-19.47 ^②	peak ^②	^②
6 ^②		1.2500 ^②	33.74 ^②	0.46 ^②	34.20 ^②	56.00 ^②	-21.80 ^②	peak ^②	^②
7 ^②		17.6940 ^②	33.48 ^②	0.58 ^②	34.06 ^②	60.00 ^②	-25.94 ^②	peak ^②	^②

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80.0 dBuV



No.	Mk.	Freq. [‡]	Reading [‡]	Factor [‡]	Measurement [‡]	Limit [‡]	Over [‡]	Detector [‡]	Comment [‡]
1 [‡]	‡	0.1500 [‡]	55.03 [‡]	0.14 [‡]	55.17 [‡]	66.00 [‡]	-10.83 [‡]	peak [‡]	‡
2 [‡]	*‡	0.1740 [‡]	53.89 [‡]	0.14 [‡]	54.03 [‡]	64.77 [‡]	-10.74 [‡]	peak [‡]	‡
3 [‡]	‡	0.2020 [‡]	50.90 [‡]	0.13 [‡]	51.03 [‡]	63.53 [‡]	-12.50 [‡]	peak [‡]	‡
4 [‡]	‡	0.5580 [‡]	33.91 [‡]	0.29 [‡]	34.20 [‡]	56.00 [‡]	-21.80 [‡]	peak [‡]	‡
5 [‡]	‡	1.8060 [‡]	32.83 [‡]	0.61 [‡]	33.44 [‡]	56.00 [‡]	-22.56 [‡]	peak [‡]	‡
6 [‡]	‡	17.3260 [‡]	32.30 [‡]	0.62 [‡]	32.92 [‡]	60.00 [‡]	-27.08 [‡]	peak [‡]	‡

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7. DUTY CYCLE TEST SIGNAL

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

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

Formula:

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

Measurement Procedure:

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

Duty Cycle:

	Duty Cycle	Duty Factor (dB)
802.11a	98.19%	0.08
802.11n_20 (MIMO)	96.69%	0.15
802.11n_40 (MIMO)	78.68%	1.04

$$\text{Duty Cycle Factor: } 10 * \log (1/0.9819) = 0.08$$

$$\text{Duty Cycle Factor: } 10 * \log (1/0.9669) = 0.15$$

$$\text{Duty Cycle Factor: } 10 * \log (1/0.7868) = 1.04$$

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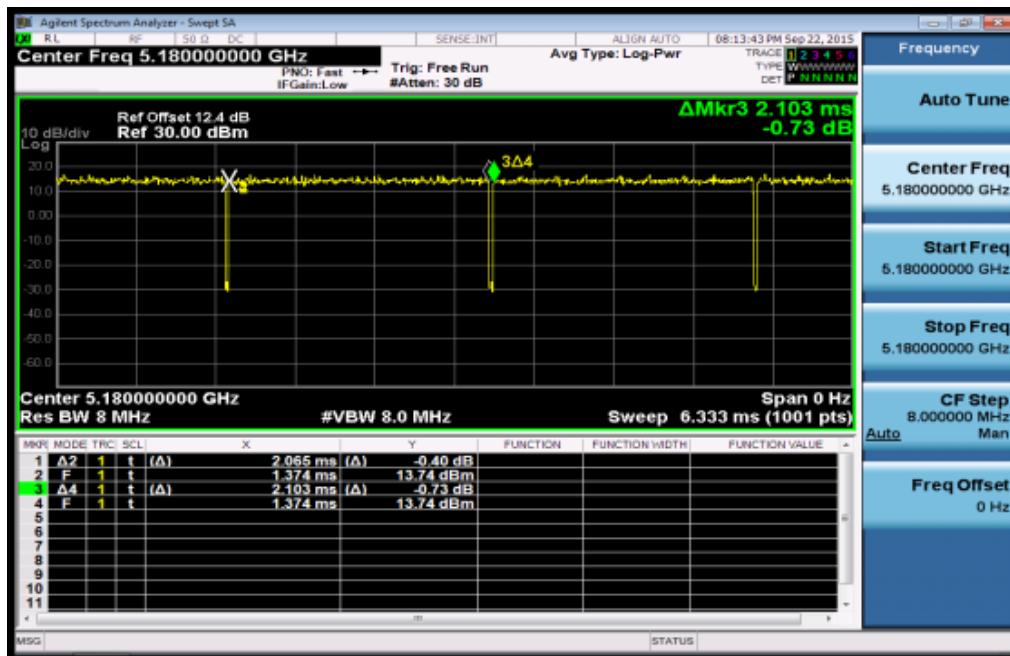
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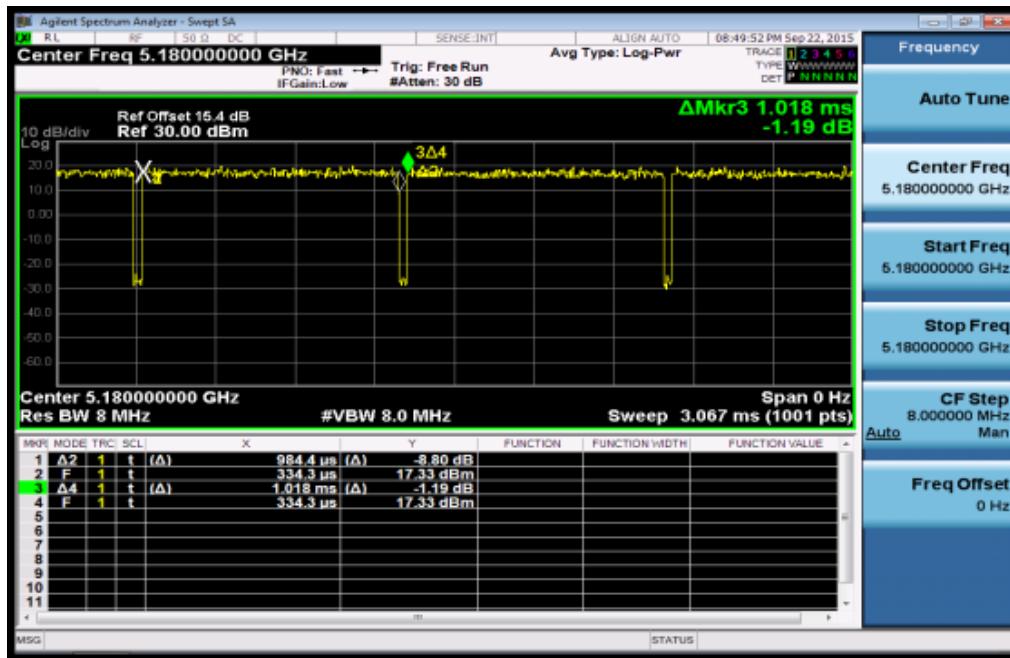
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DUTY CYCLE TEST SIGNAL Measurement Result

802.11a



802.11n HT20

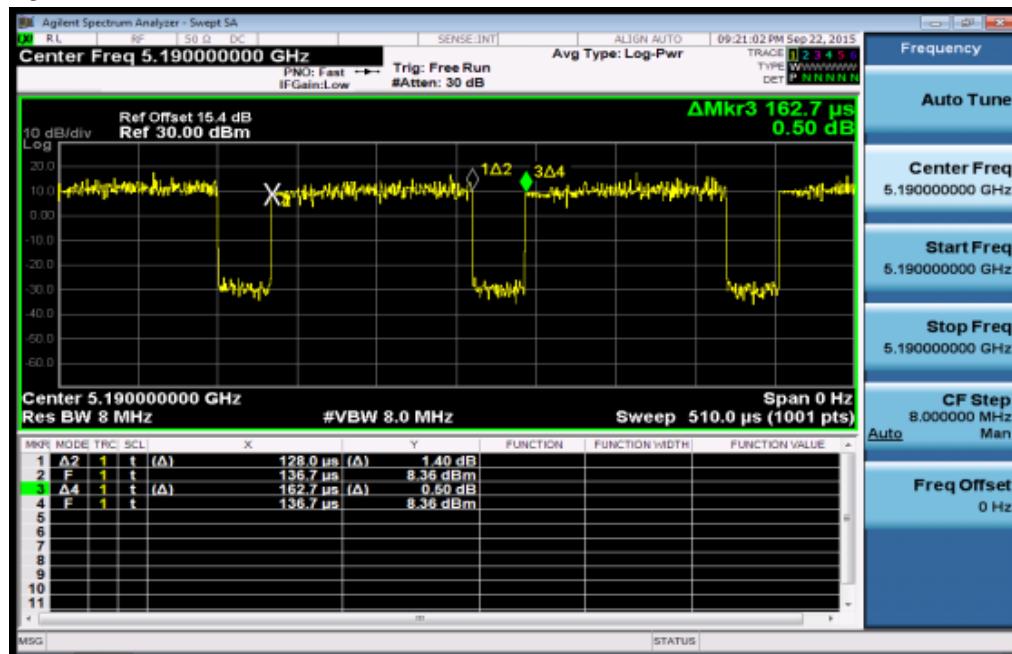


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802.11n HT40



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8. 26dB & 6dB EMISSION BANDWIDTH MEASUREMENT

8.1 Standard Applicable

There is no limit bandwidth for U-NII-1, U-NII-2-A and U-NII-2-C.

The minimum of 6dB Bandwidth measurement is 0.5 MHz for U-NII-3

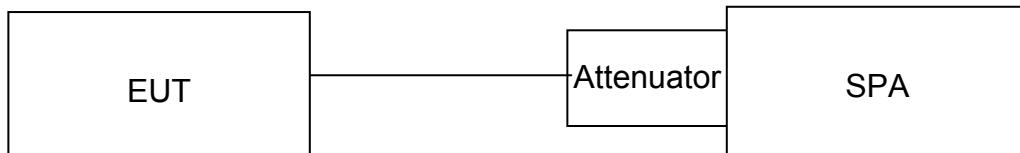
8.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the Antenna port to the spectrum analyzer.
 - a. 26dB Band width Measurement: Set the spectrum analyzer as 1% of emission BW Sweep=auto, Detector = Peak, Trace Mode = Max Hold, Manually readjust RBW until the RBW/EBW ratio is 1% based on EBW as observed on the result of pre-sequence measurement.
 - b. Mark the peak frequency and -26dB (upper and lower) frequency.
4. Repeat the procedures as list above until all test default channels (low, middle, and high) are completed.
5. Minimum Emission Bandwidth for the band 5.725-5.850GHz.
 - a. Set the spectrum analyzer as RBW = 100 kHz, VBW = 3*RBW, Span = 30M/50MHz, Detector=Peak, Sweep=auto
 - b. Mark the peak frequency and -6dB (upper and lower) frequency.
6. Repeat above procedures until all test default channel measured were complete.

8.3 Measurement Equipment Used

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

8.4 Test Set-up



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8.5 Measurement Result

26dB Bandwidth

802.11a

Frequency (MHz)	26dB Bandwidth (MHz)	10 Log (B) (dB)
5180	19.040	12.80
5220	19.380	12.87
5240	19.660	12.94

802.11n_HT20 (Main)

Frequency (MHz)	26dB Bandwidth (MHz)	10 Log (B) (dB)
5180	19.950	13.00
5220	20.200	13.05
5240	19.460	12.89

802.11n_HT20 (Aux)

Frequency (MHz)	26dB Bandwidth (MHz)	10 Log (B) (dB)
5180	20.170	13.05
5220	20.280	13.07
5240	19.620	12.93

802.11n _HT40 (Main)

Frequency (MHz)	26dB Bandwidth (MHz)	10 Log (B) (dB)
5190	43.390	16.37
5230	43.030	16.34

802.11n _HT40 (Aux)

Frequency (MHz)	26dB Bandwidth (MHz)	10 Log (B) (dB)
5190	43.900	16.42
5230	42.960	16.33

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6dB Bandwidth (5725 MHz~ 5850 MHz)

802.11a

Frequency (MHz)	6dB Bandwidth (MHz)	10 Log (B) (dB)
5745	16.380	12.14
5785	16.050	12.05
5825	15.940	12.02

802.11n_HT20 (Main)

Frequency (MHz)	6dB Bandwidth (MHz)	10 Log (B) (dB)
5745	17.600	12.46
5785	17.640	12.46
5825	16.570	12.19

802.11n_HT20 (Aux)

Frequency (MHz)	6dB Bandwidth (MHz)	10 Log (B) (dB)
5745	16.220	12.10
5785	17.530	12.44
5825	16.700	12.23

802.11n_HT40 (Main)

Frequency (MHz)	6dB Bandwidth (MHz)	10 Log (B) (dB)
5755	36.220	15.59
5795	36.030	15.57

802.11n_HT40 (Aux)

Frequency (MHz)	6dB Bandwidth (MHz)	10 Log (B) (dB)
5755	36.350	15.61
5795	36.150	15.58

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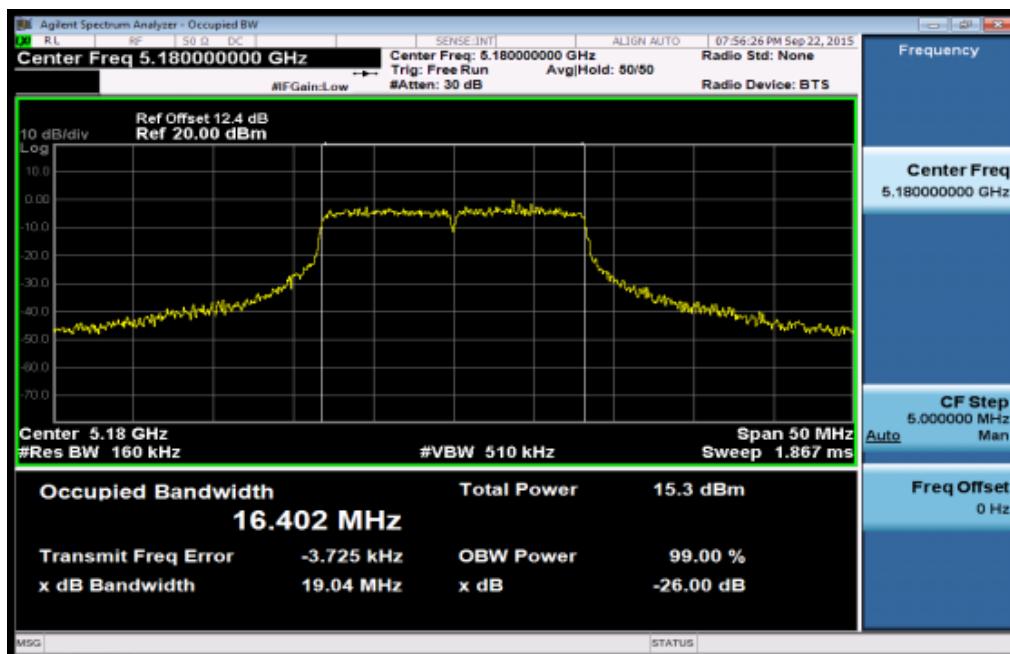
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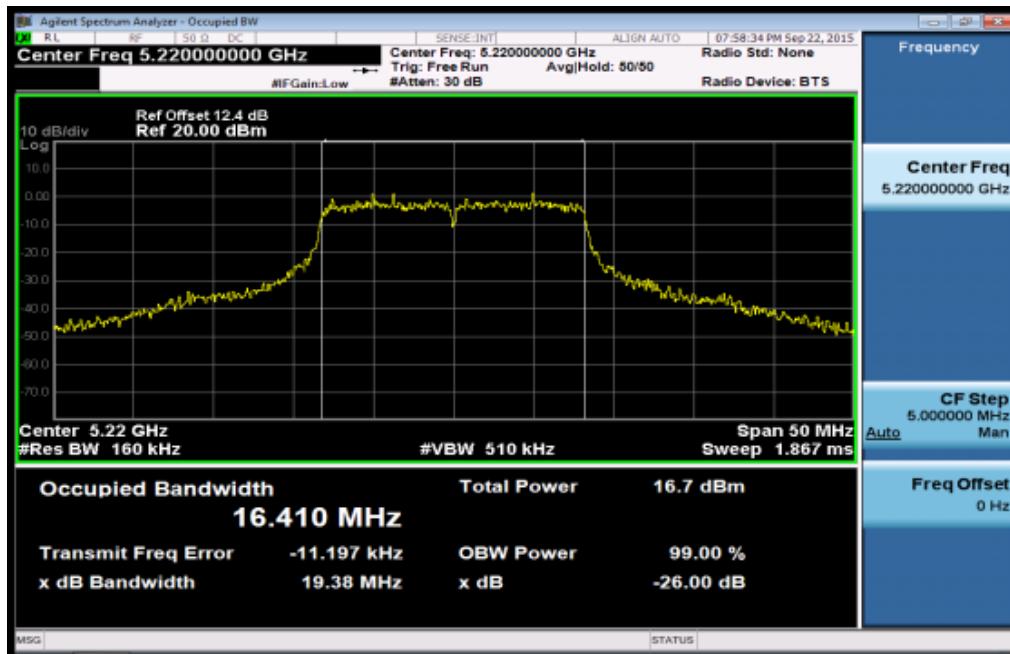
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802.11a, 5150~5250 MHz

26dB Band Width Test Data CH-Low (5180MHz)



26dB Band Width Test Data CH-Mid (5220MHz)

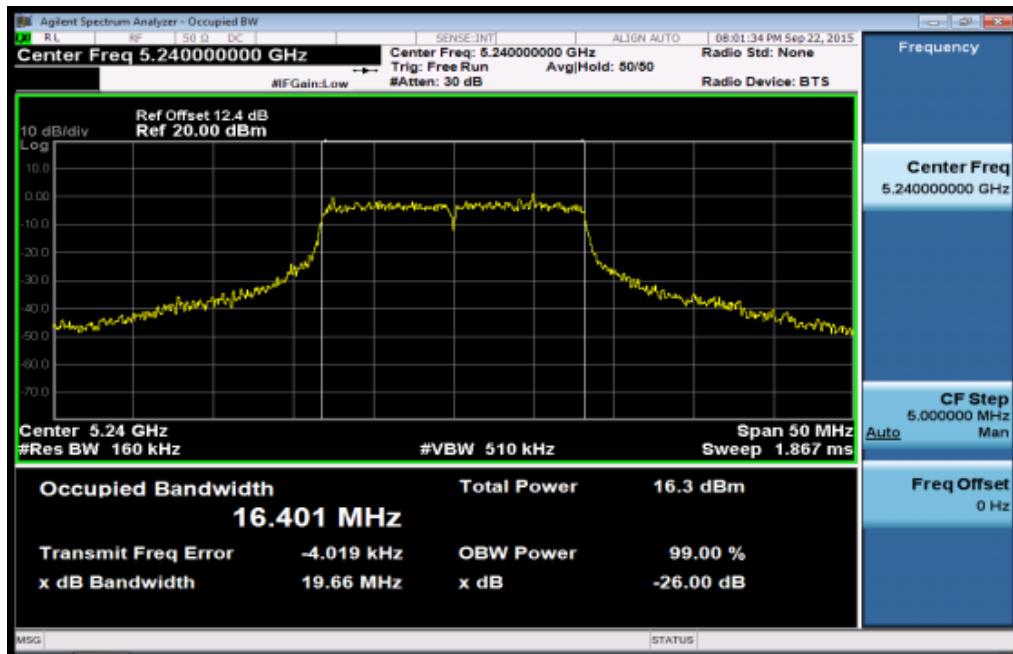


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26dB Band Width Test Data CH-High (5240MHz)



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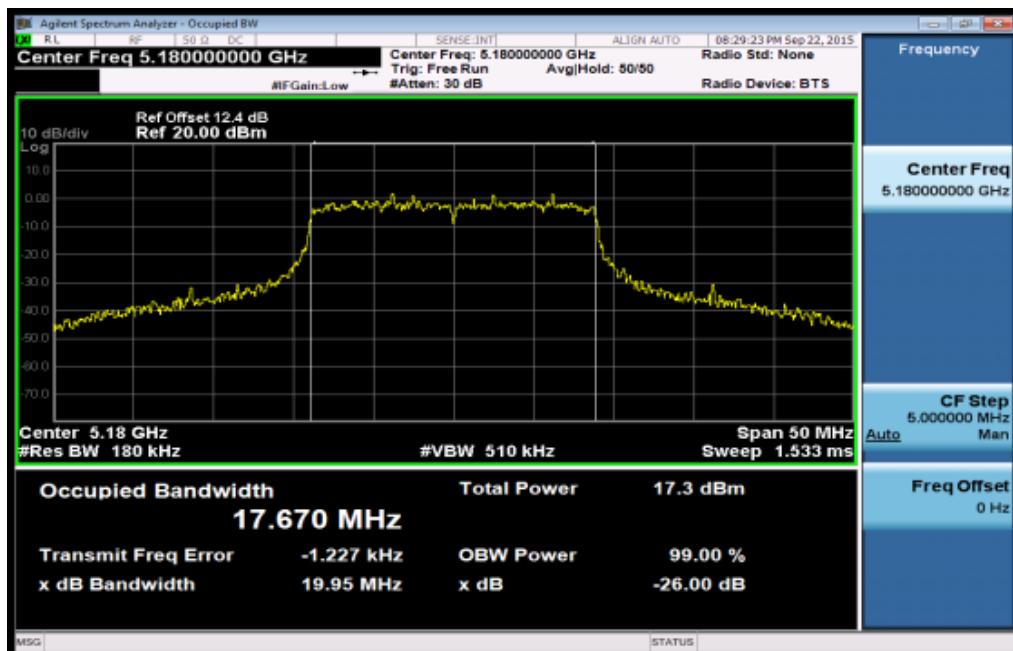
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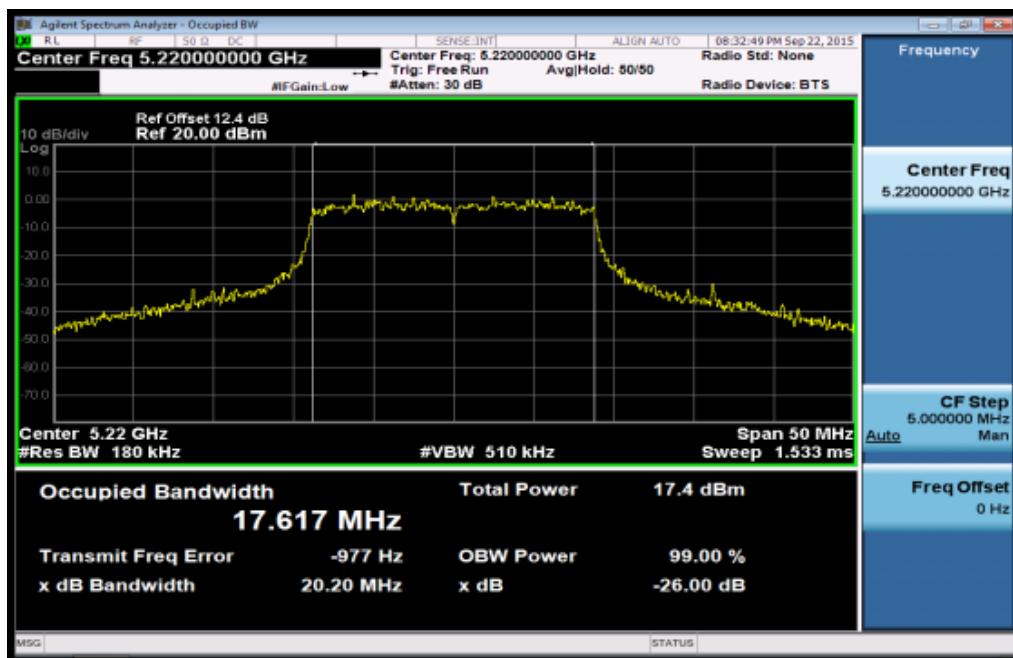
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802.11n HT20, 5150~5250 MHz (Main) 26dB Band Width Test Data CH-Low (5180 MHz)



26dB Band Width Test Data CH-Mid (5220 MHz)

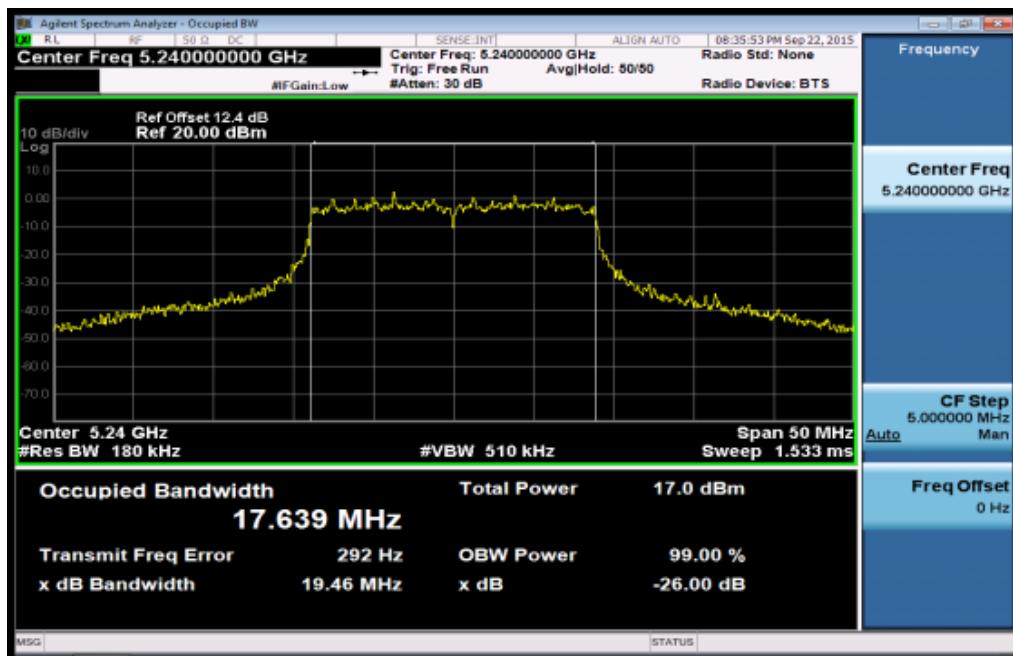


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26dB Band Width Test Data CH-High (5240 MHz)



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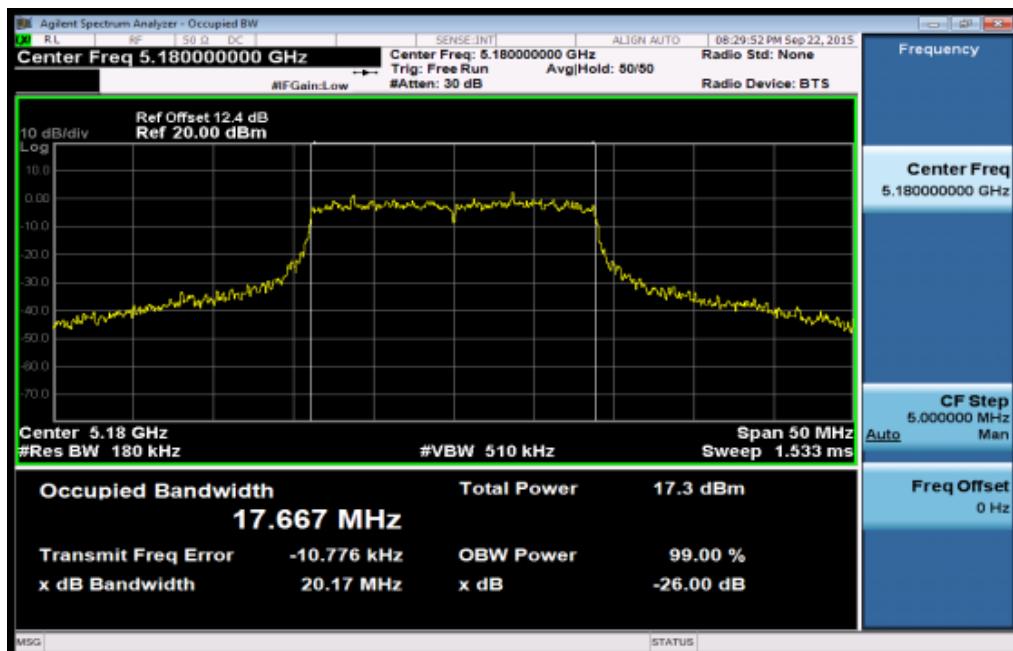
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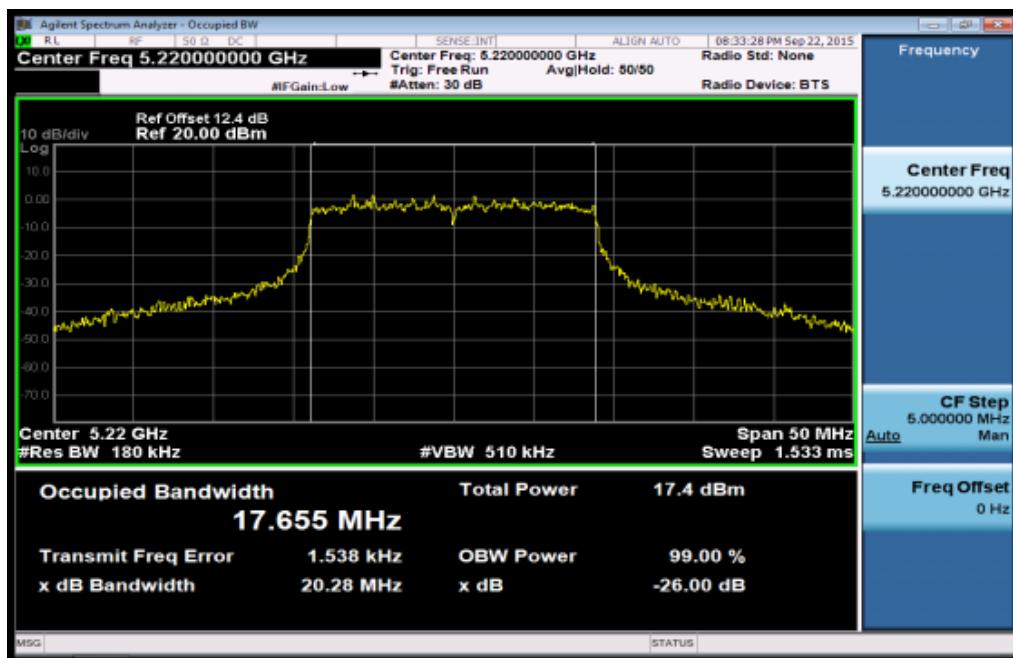
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802.11n HT20, 5150~5250 MHz (Aux) 26dB Band Width Test Data CH-Low (5180 MHz)



26dB Band Width Test Data CH-Mid (5220 MHz)

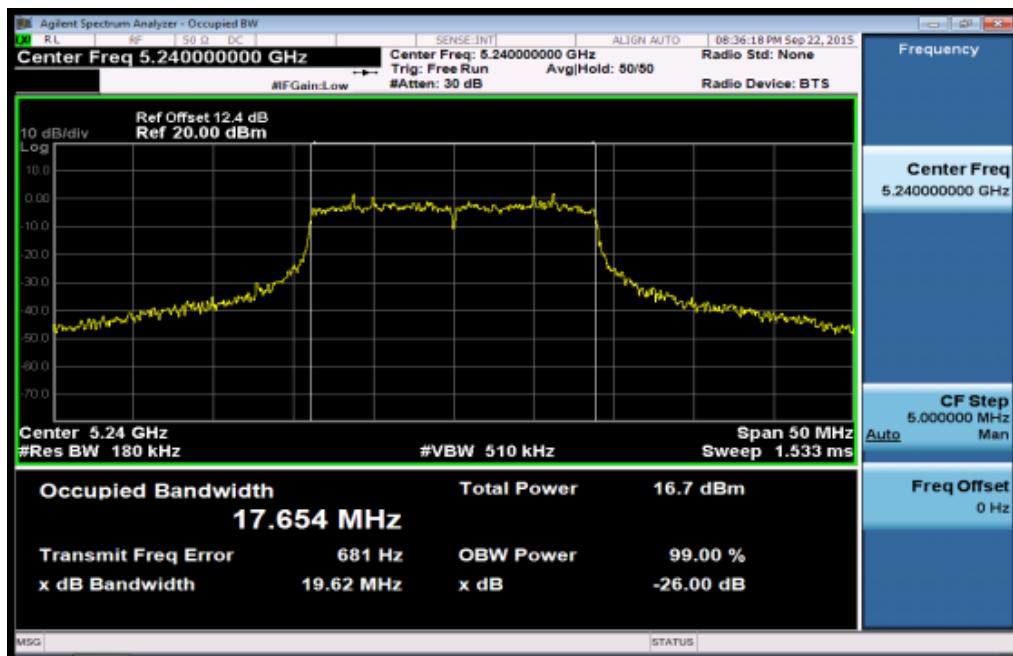


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26dB Band Width Test Data CH-High (5240 MHz)



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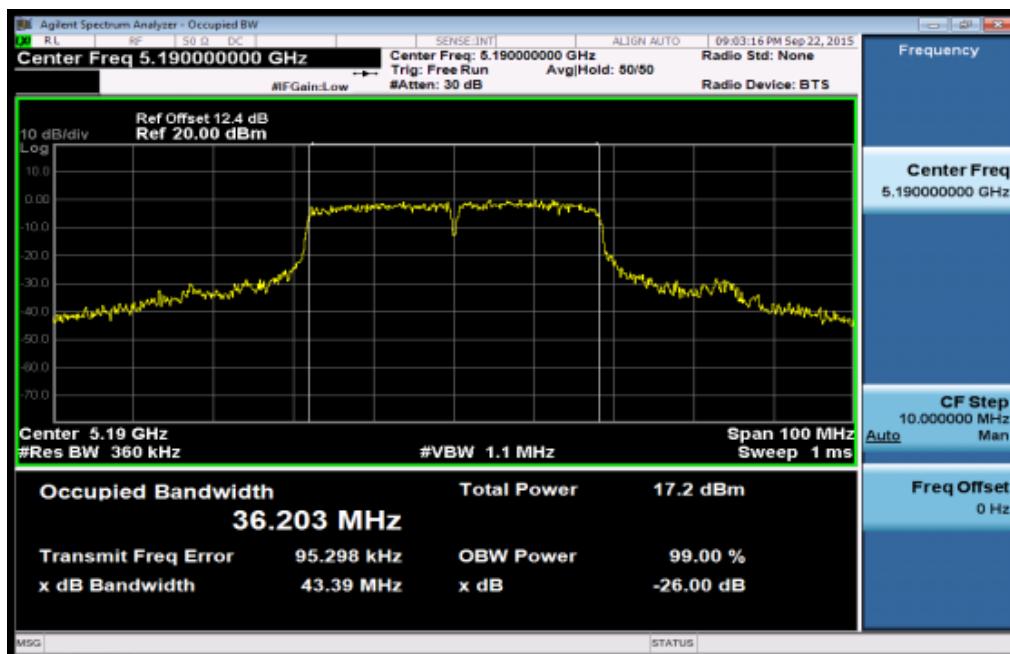
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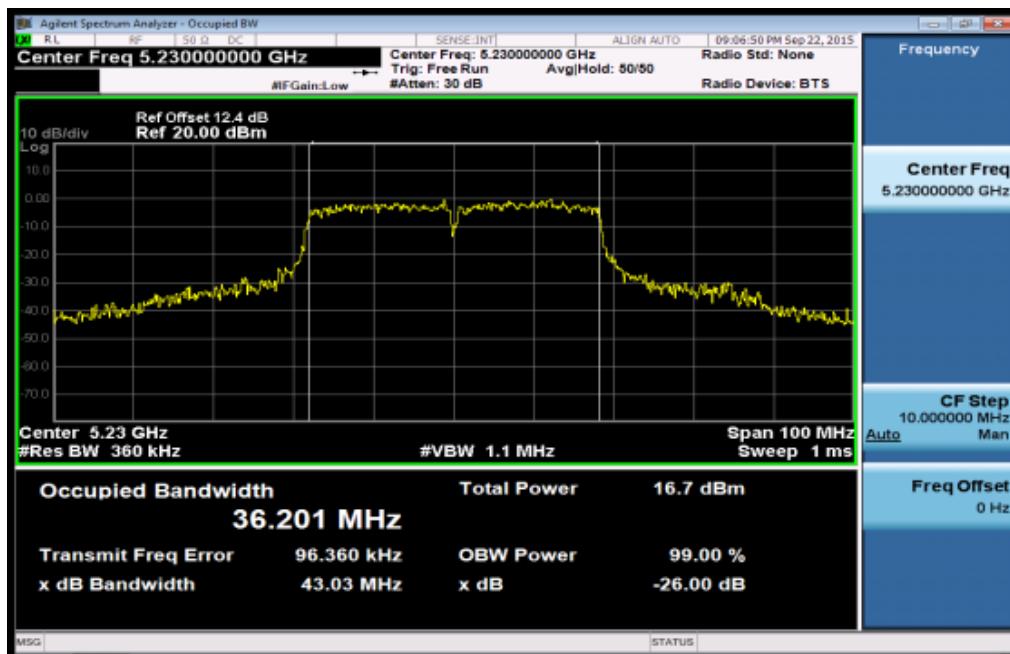
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802.11n HT40, 5150~5250 MHz (Main) 26dB Band Width Test Data CH-Low (5190 MHz)



26dB Band Width Test Data CH-High (5230 MHz)



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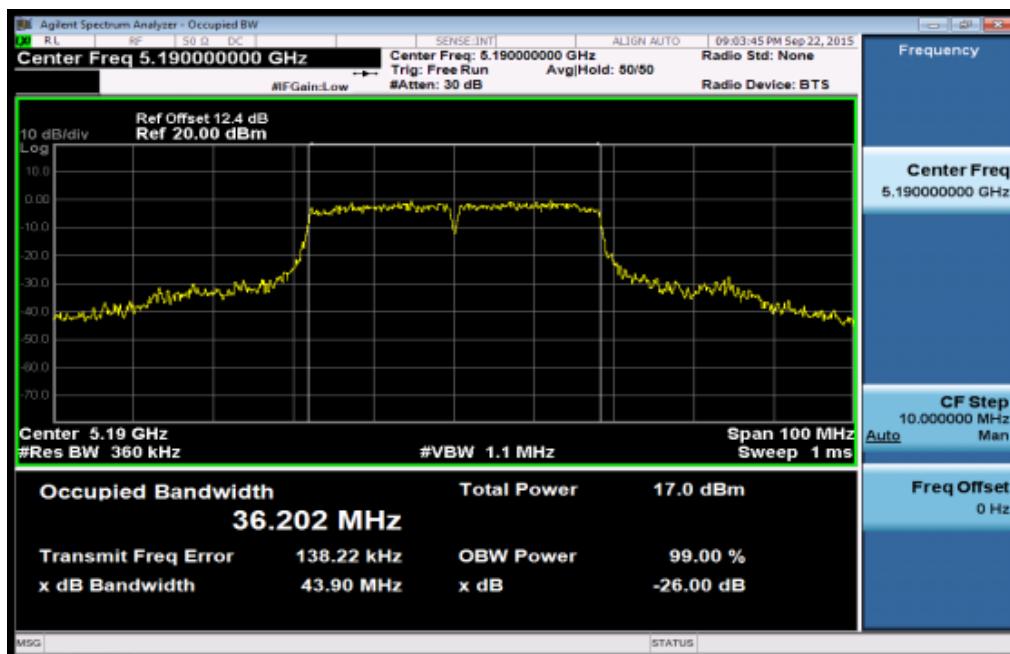
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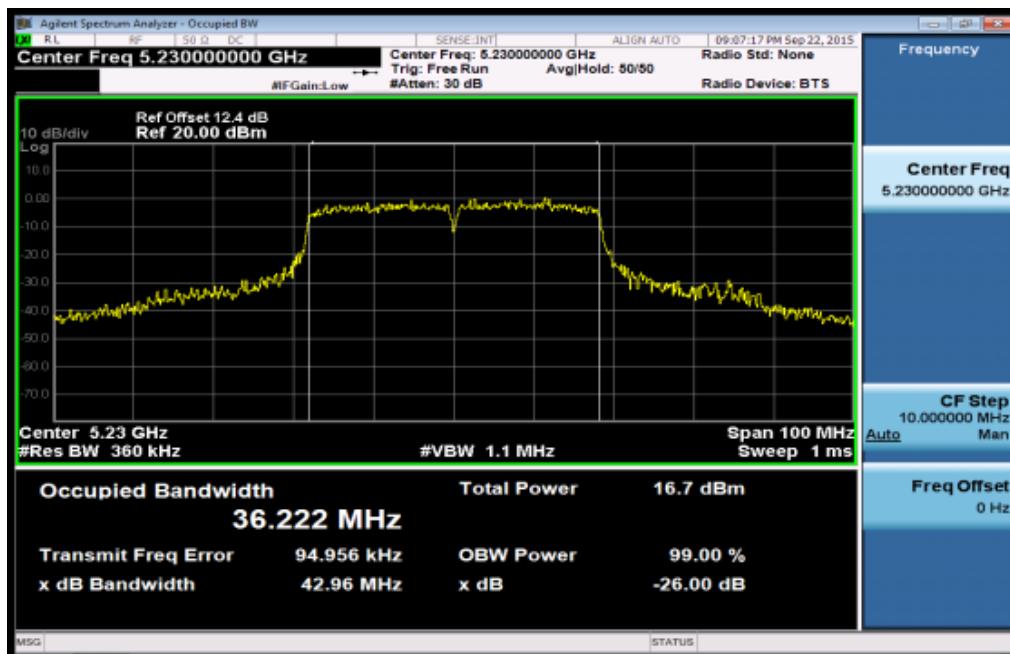
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802.11n HT40, 5150~5250 MHz (Aux) 26dB Band Width Test Data CH-Low (5190 MHz)



26dB Band Width Test Data CH-High (5230 MHz)



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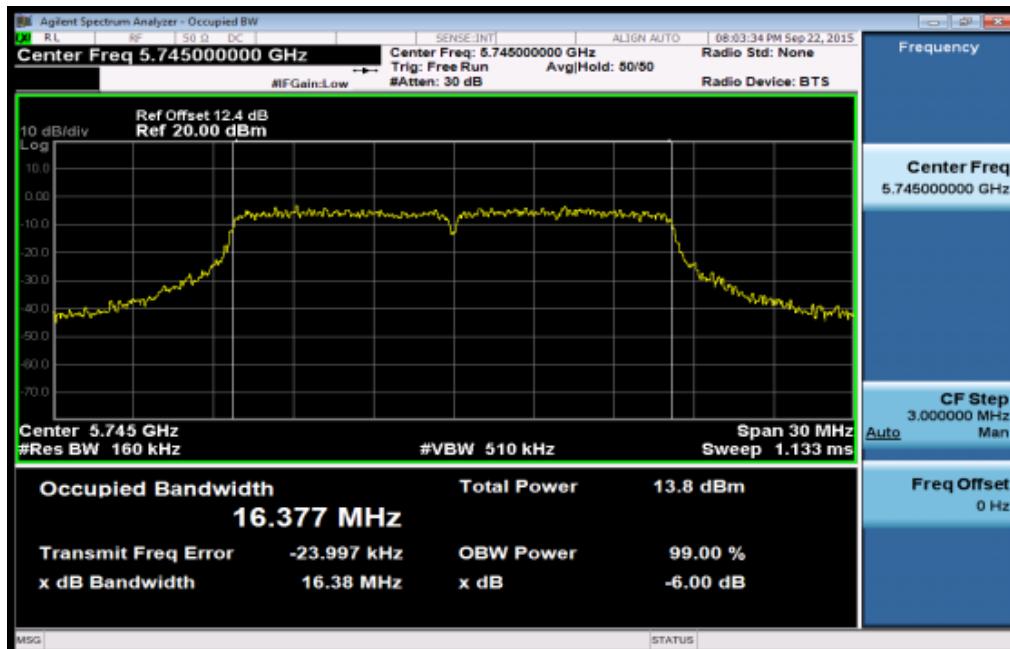
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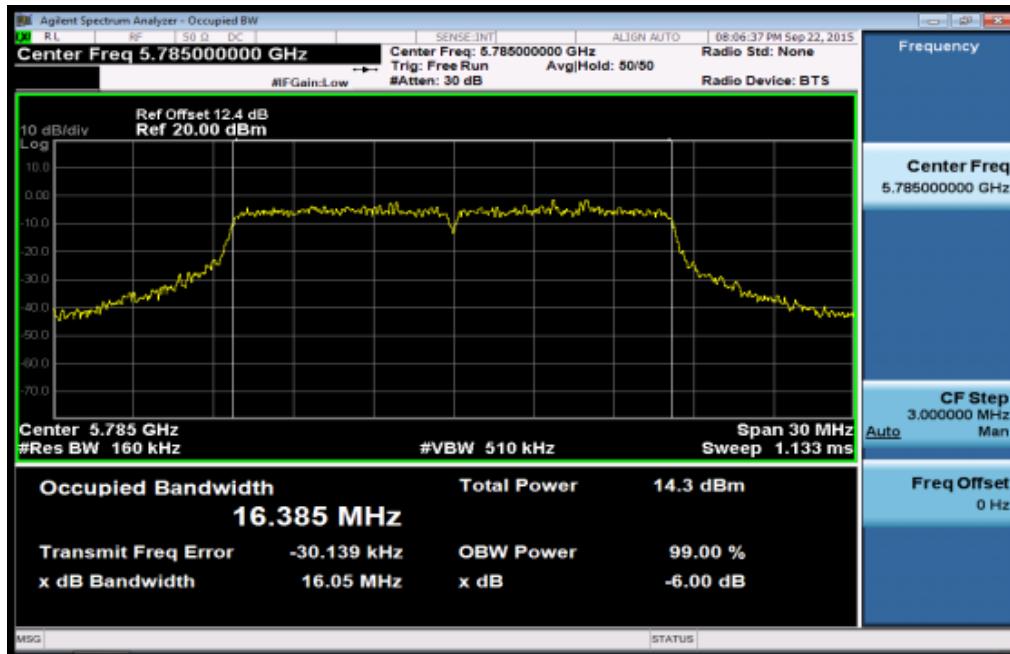
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802.11a, 5725~5850 MHz

6dB Band Width Test Data CH-Low (5745 MHz)



6dB Band Width Test Data CH-Mid (5785 MHz)



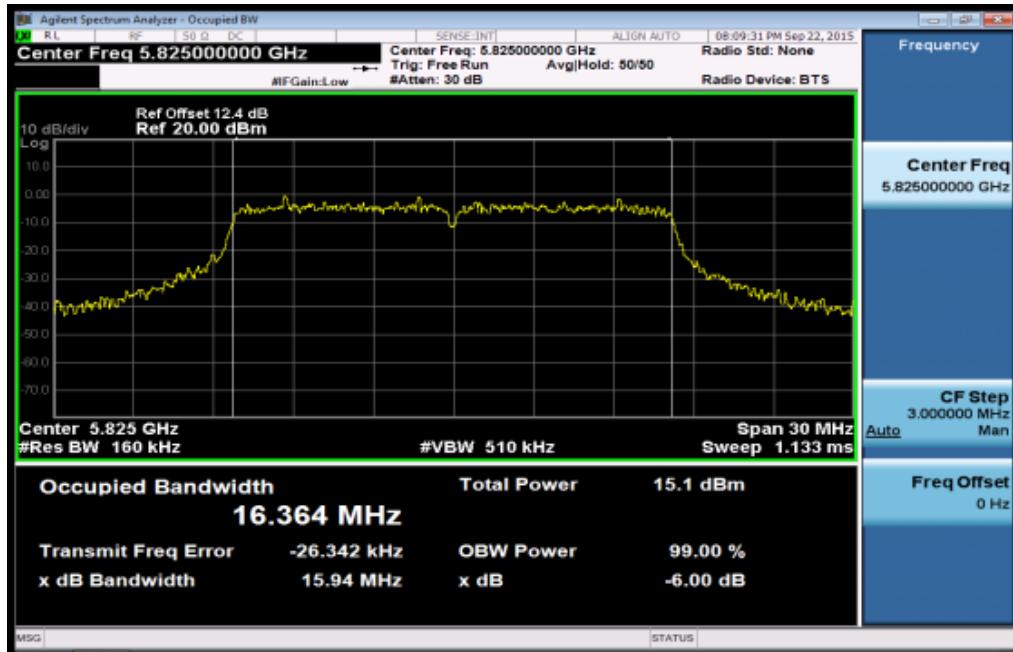
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6dB Band Width Test Data CH-High (5825 MHz)



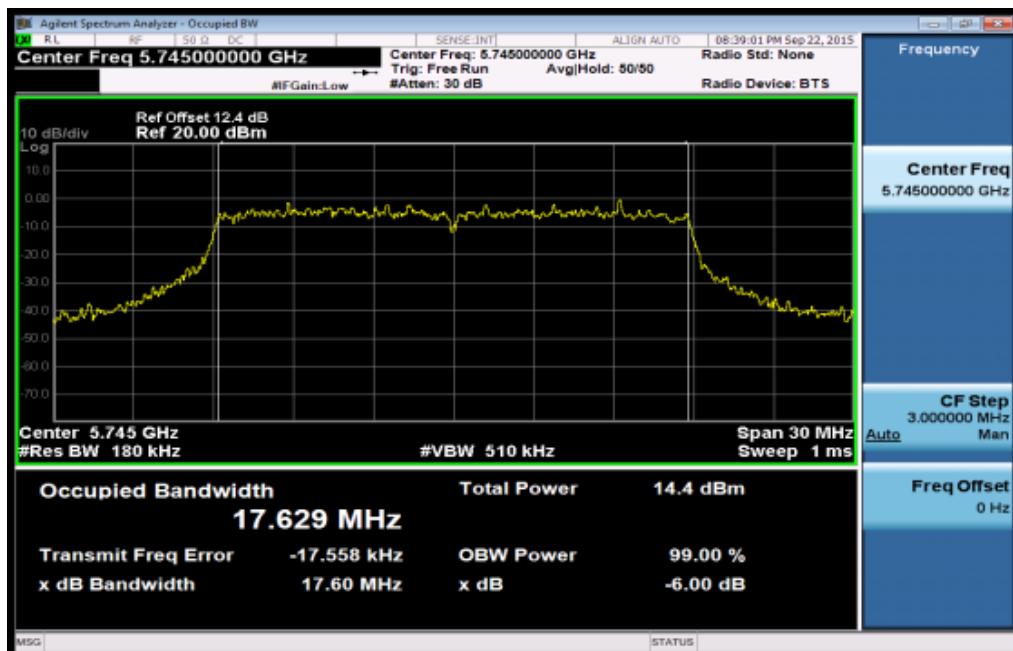
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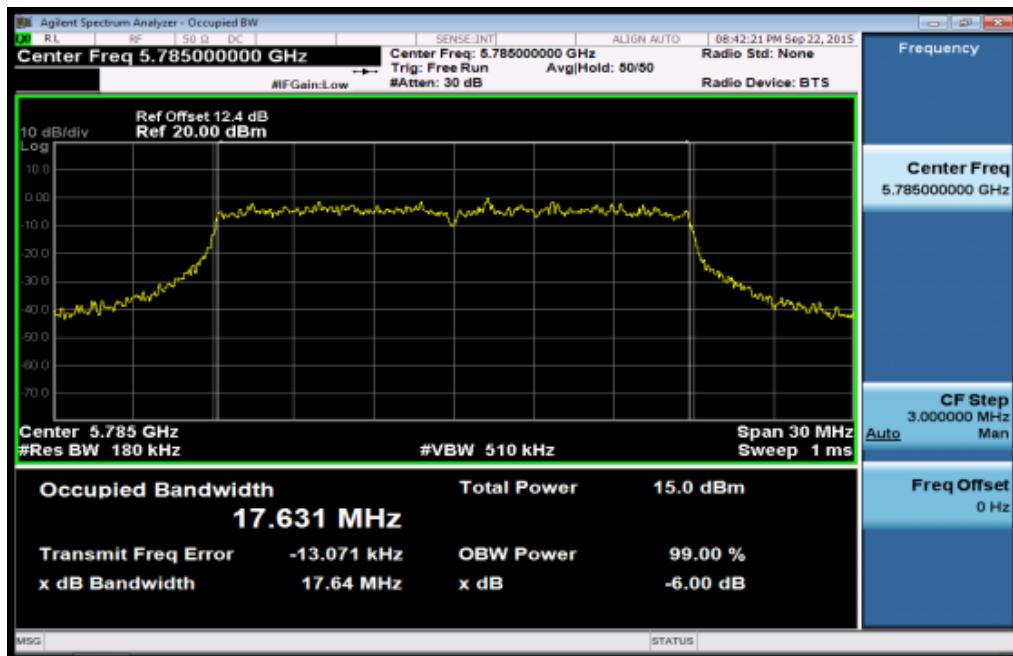
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802.11n HT20, 5725~5850 MHz (Main) 6dB Band Width Test Data CH-Low (5745 MHz)



6dB Band Width Test Data CH-Mid (5785 MHz)



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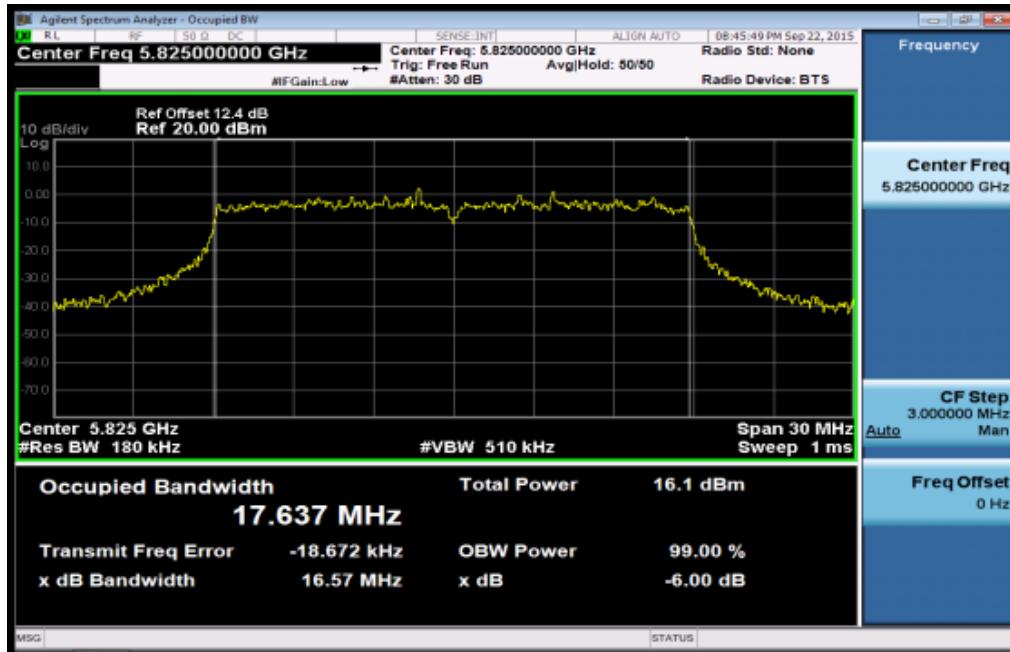
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6dB Band Width Test Data CH-High (5825 MHz)



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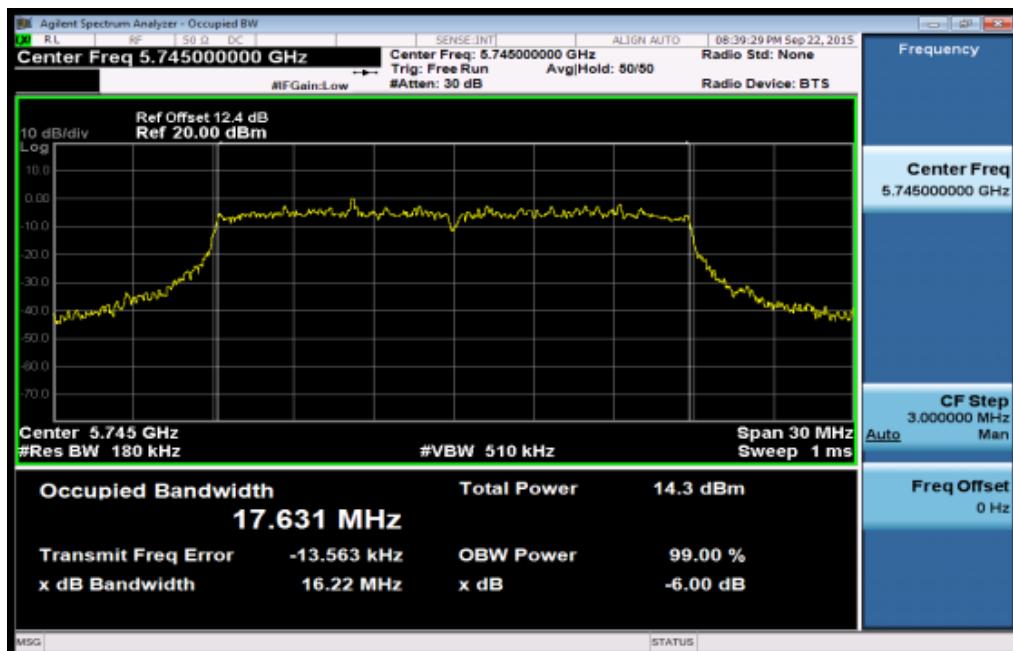
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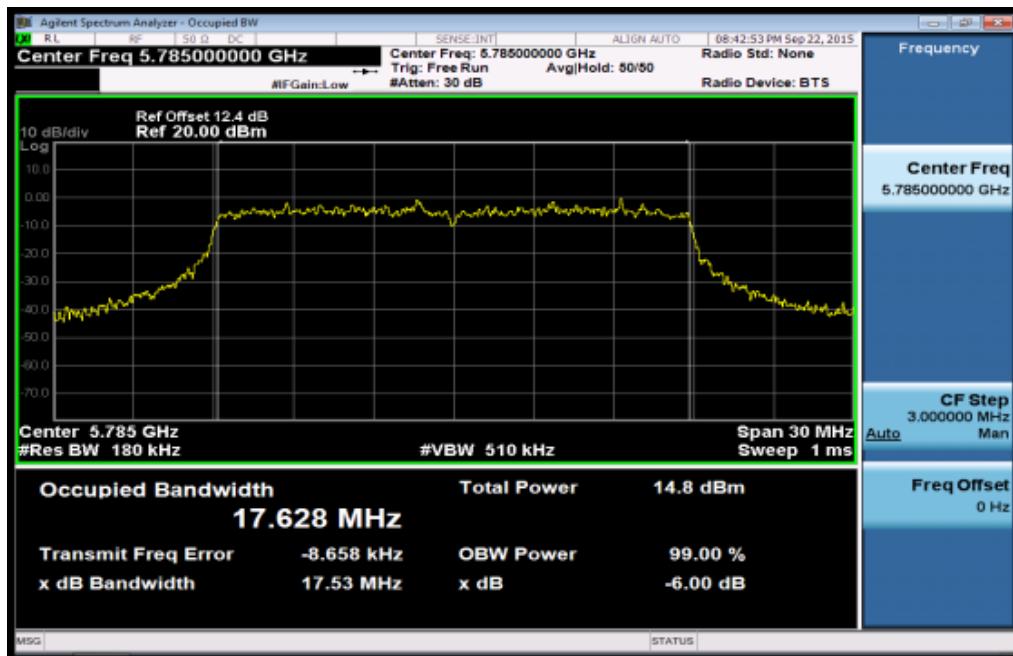
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802.11n HT20, 5725~5850 MHz (Aux) 6dB Band Width Test Data CH-Low (5745 MHz)



6dB Band Width Test Data CH-Mid (5785 MHz)



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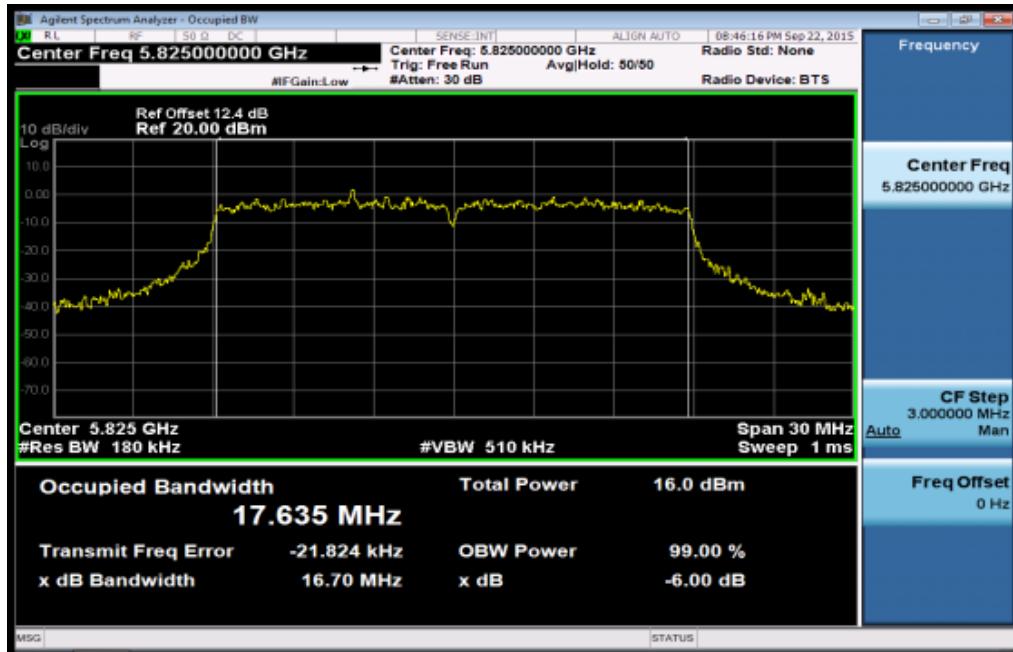
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6dB Band Width Test Data CH-High (5825 MHz)



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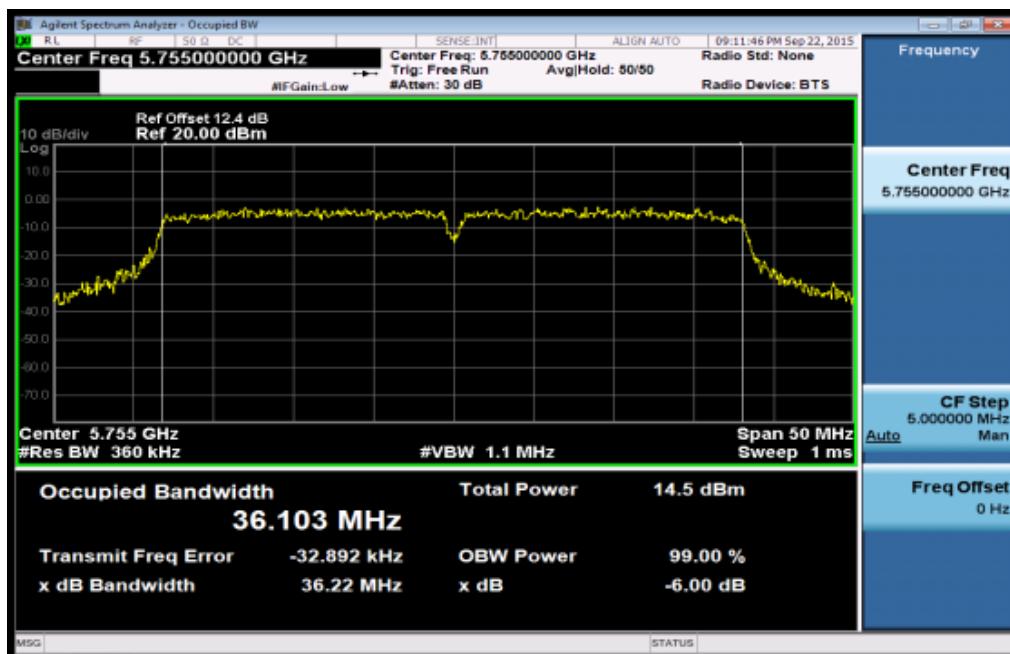
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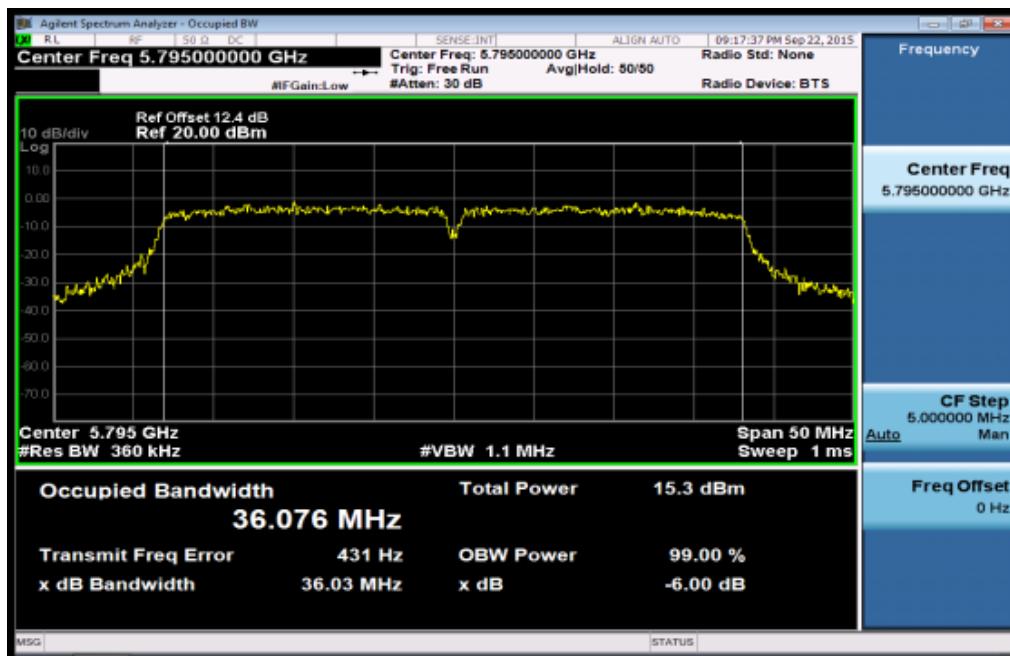
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802.11n HT40, 5725~5850 MHz (Main) 6dB Band Width Test Data CH-Low (5755 MHz)



6dB Band Width Test Data CH-High (5795 MHz)



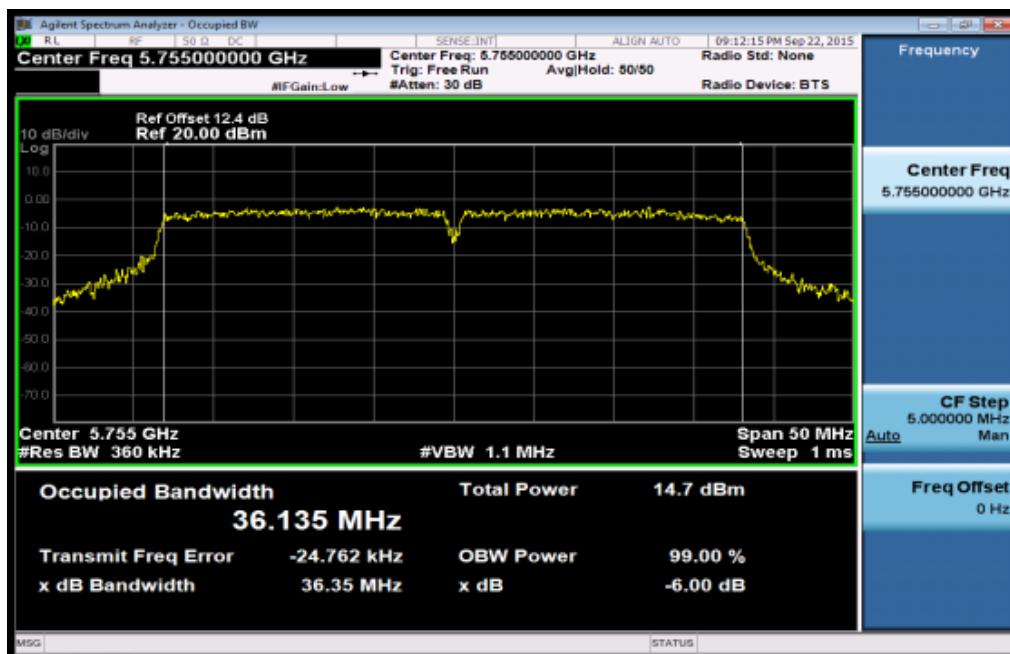
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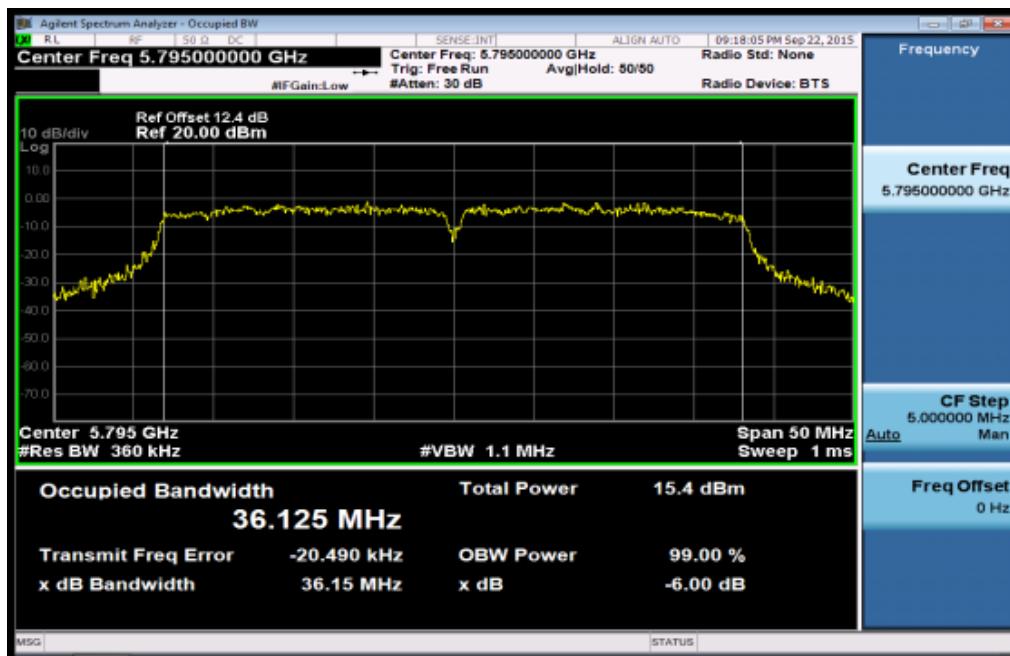
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802.11n HT40, 5725~5850 MHz (Aux) 6dB Band Width Test Data CH-Low (5755 MHz)



6dB Band Width Test Data CH-High (5795 MHz)



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9. MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT

9.1 Standard Applicable

OPERZTION Band	EUT CATEGORY		LIMIT
U-NII-1		Access Point (Mater device)	1 Watt(30dBm)
		Fixed point-to-point Acess Ponit	1 Watt(30dBm)
	√	Mobile and portable clinet device	250mW(23.98dBm)
U-NII-2A			250mW(23.98dBm) or 11dBm+10 log B
U-NII-2C			250mW(23.98dBm) or 11dBm+10 log B
U-NII-3	√		1 Watt(30dBm)

If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

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

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

Effective Legacy Gain (dBi) = 3.71+3.01=6.72dB

Limit: 23.98dBm – (6.72– 6dBi) = 23.26dBm

Therefore the limit needs to reduce for the U-NII-1 band.

Effective Legacy Gain (dBi) = 5.02+3.01=8.03dB

Limit: 30dBm – (8.03– 6dBi) = 27.97dBm

Therefore the limit needs to reduce for the U-NII-3 Band.

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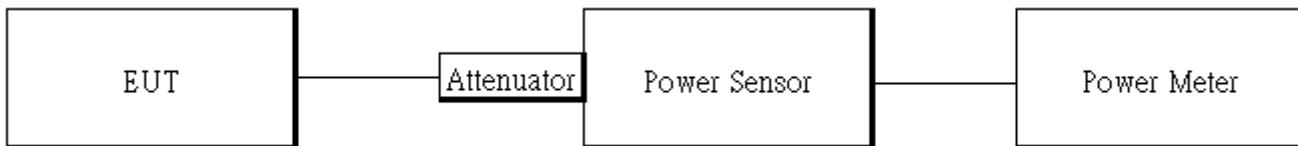
9.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter
4. Power Meter is used as the auxiliary test equipment to conduct the output power measurement.
5. Record the max. reading and add $10 \log(1/\text{duty cycle})$.
6. Repeat above procedures until all frequency (low, middle, and high channel) measured were complete.

9.3 Measurement Equipment Used

Refer to section 8.3 for details.

9.4 Test Set-up



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9.5 Measurement Result

802.11a

CH	Frequency (MHz)	TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
36	5180	10.35	10.839	23.98	PASS
44	5220	10.78	11.967	23.98	PASS
48	5240	10.35	10.839	23.98	PASS
149	5745	8.75	7.499	30	PASS
157	5785	9.20	8.318	30	PASS
165	5825	10.21	10.495	30	PASS

802.11n HT20 (MIMO)

CH	Frequency (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
		CHAIN 0	CHAIN 1				
36	5180	9.50	8.60	12.08	16.157	23.26	PASS
44	5220	11.20	9.75	13.55	22.623	23.26	PASS
48	5240	9.65	6.46	11.35	13.652	23.26	PASS
149	5745	8.35	5.85	10.29	10.685	27.97	PASS
157	5785	8.80	5.10	10.34	10.822	27.97	PASS
165	5825	9.65	6.40	11.33	13.591	27.97	PASS

802.11n HT40 (MIMO)

CH	Frequency (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
		CHAIN 0	CHAIN 1				
38	5190	9.20	7.85	11.59	14.413	23.26	PASS
46	5230	9.89	6.90	11.66	14.648	23.26	PASS
151	5755	8.26	5.35	10.05	10.127	27.97	PASS
159	5795	8.85	5.10	10.38	10.910	27.97	PASS

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

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10. PEAK POWER SPECTRAL DENSITY

10.1 Standard Applicable

OPERZTION Band	EUT CATEGORY		LIMIT
U-NII-1		Access Point (Mater device)	17dBm/ MHz
		Fixed point-to-point Acess Ponit	
	√	Mobile and portable clinet device	
U-NII-2A			11dBm/ MHz
U-NII-2C			11dBm/ MHz
U-NII-3	√		30dBm/ 500kHz

If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

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

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

Effective Legacy Gain (dBi) = 3.71+3.01=6.72dBi

Limit: 11dBm – (6.72– 6dBi) = 10.28dBm

Therefore the limit needs to reduce for the U-NII-1

Effective Legacy Gain (dBi) = 5.02+3.01=8.03dBi

Limit: 30dBm – (8.03– 6dBi) = 27.97dBm

Therefore the limit needs to reduce for the U-NII-3 band.

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10.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Spectrum.
4. **For U-NII1 Band:**

Set RBW=1MHz, VBW=3MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)

For U-NII-3 Band:

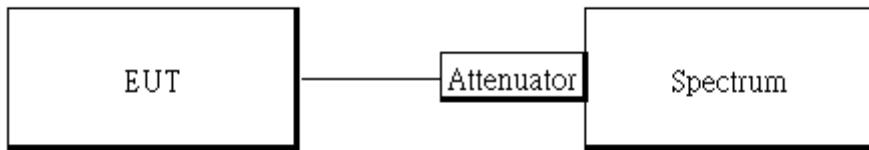
Set RBW=510 kHz, VBW= 3*RBW, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)

5. User the cursor on spectrum to peak search the highest level of trace
6. Record the max. reading and add $10 \log(1/\text{duty cycle})$.
7. MIMO Mode: offset is set following “measure and add $10 \log(N)$ ” on spectrum to measure the PSD for MIMO mode. Offset = cable loss + $10 \log(N)$, where N is number of transmitting antenna. N=2 for this given application.
8. Repeat above procedures until all default test channel (low, middle, and high) was complete.

10.3 Measurement Equipment Used

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

10.4 Test Set-up



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10.5 Measurement Result

802.11a

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5180	3.46	11.00	-7.54
5220	2.58	11.00	-8.42
5240	4.84	11.00	-6.16
5745	1.59	30.00	-28.41
5785	1.92	30.00	-28.08
5825	3.93	30.00	-26.07

802.11n HT20 (MIMO)

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5180	6.16	10.28	-4.12
5220	6.29	10.28	-3.99
5240	5.87	10.28	-4.41
5745	6.01	27.97	-21.96
5785	6.37	27.97	-21.60
5825	7.13	27.97	-20.84

802.11n HT40 (MIMO)

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5190	1.60	10.28	-8.68
5230	2.97	10.28	-7.31
5755	2.23	27.97	-25.74
5795	2.93	27.97	-25.04

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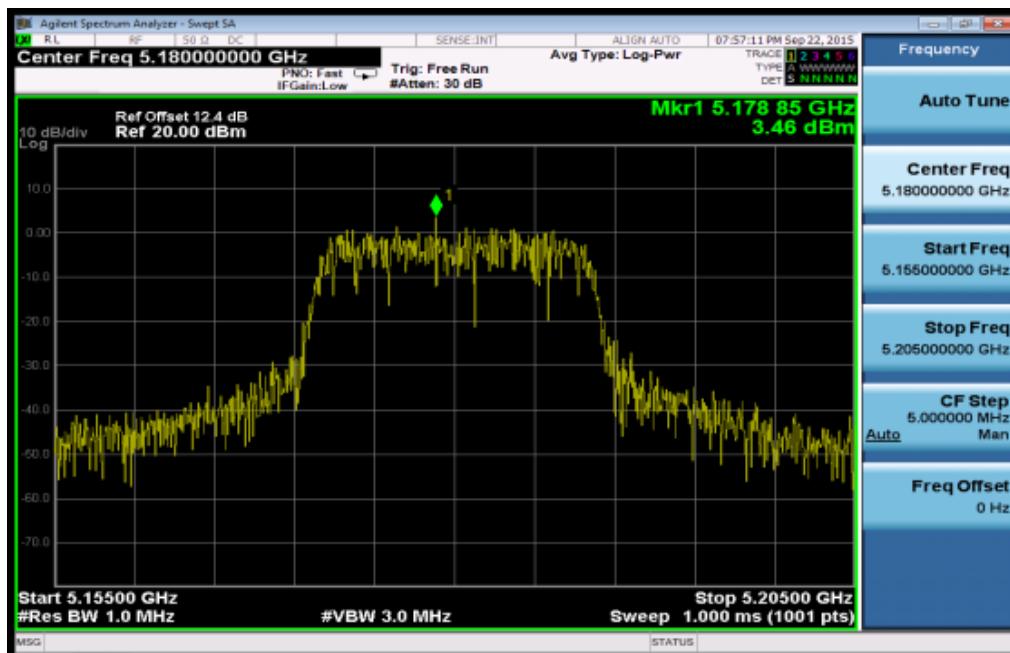
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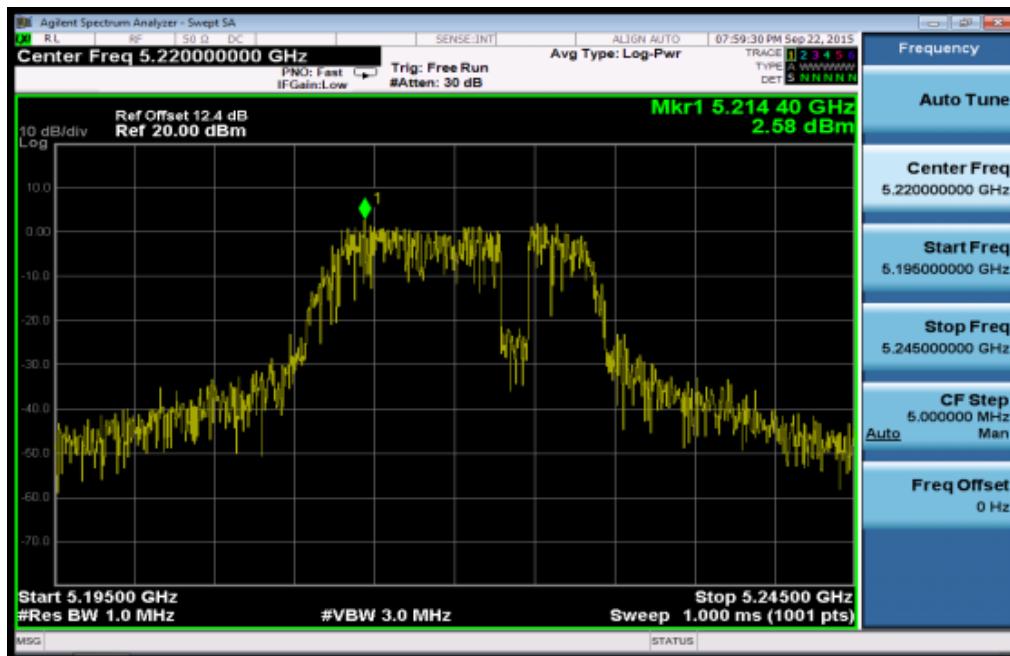
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802.11a, 5150~5250 MHz

Peak Power Spectral Density Data Plot (CH Low 5180 MHz)



Peak Power Spectral Density Data Plot (CH Mid 5220 MHz)



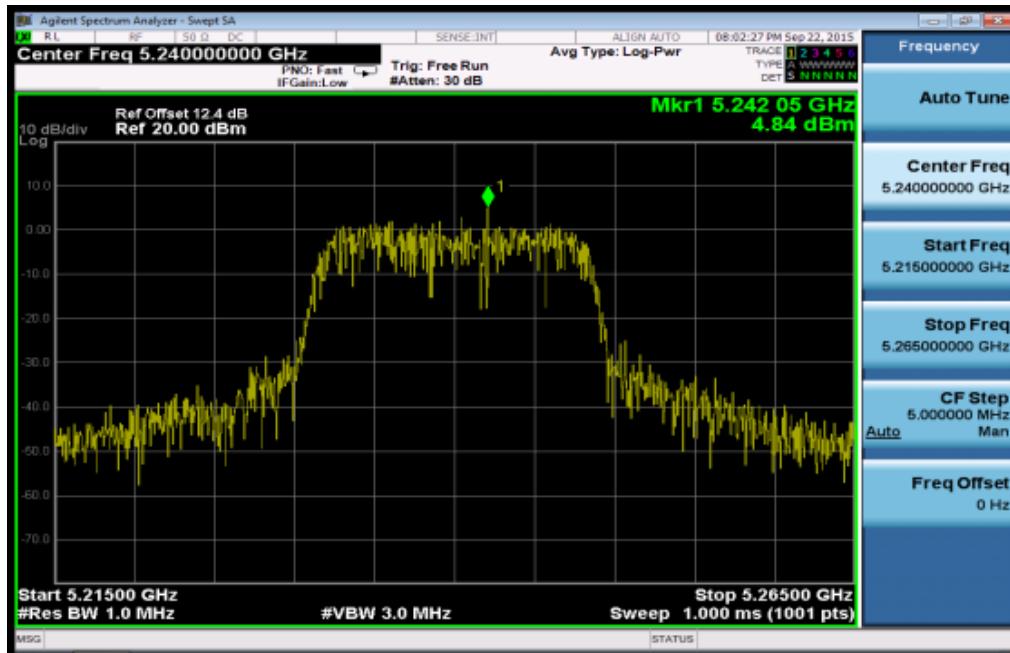
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Peak Power Spectral Density Data Plot (CH High 5240 MHz)



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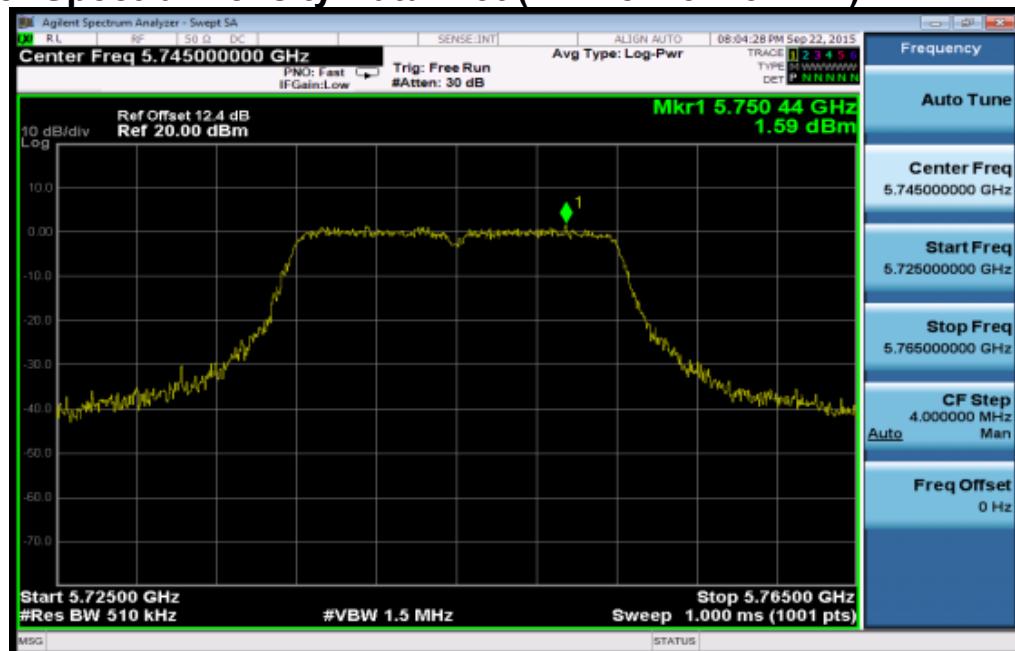
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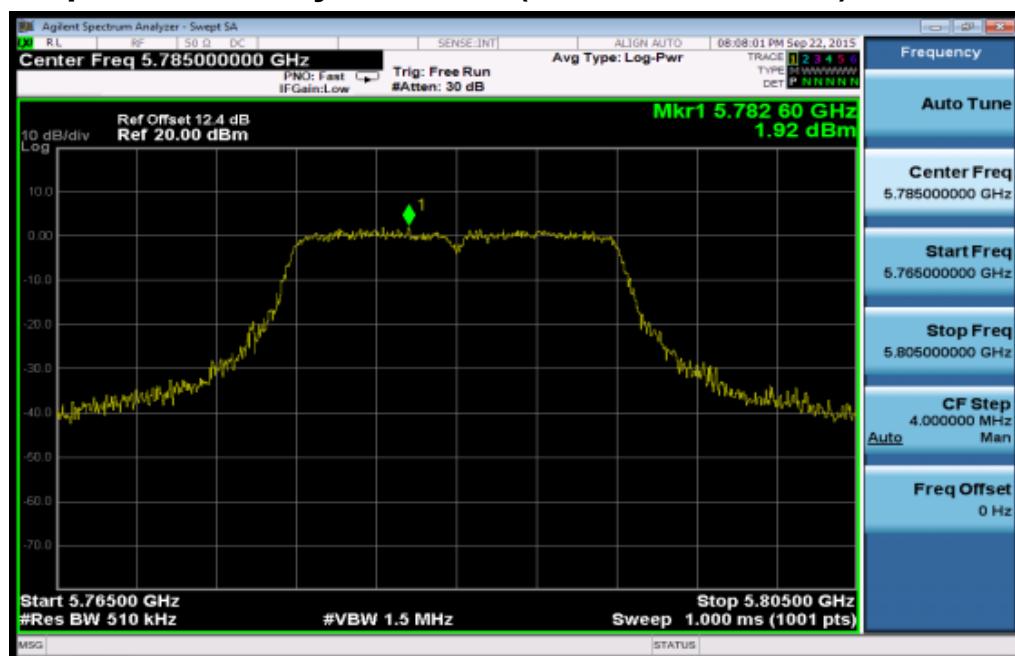
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802.11a, 5725~5850 MHz

Peak Power Spectral Density Data Plot (CH Low 5745 MHz)



Peak Power Spectral Density Data Plot (CH Mid 5785 MHz)



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Peak Power Spectral Density Data Plot (CH High 5825 MHz)



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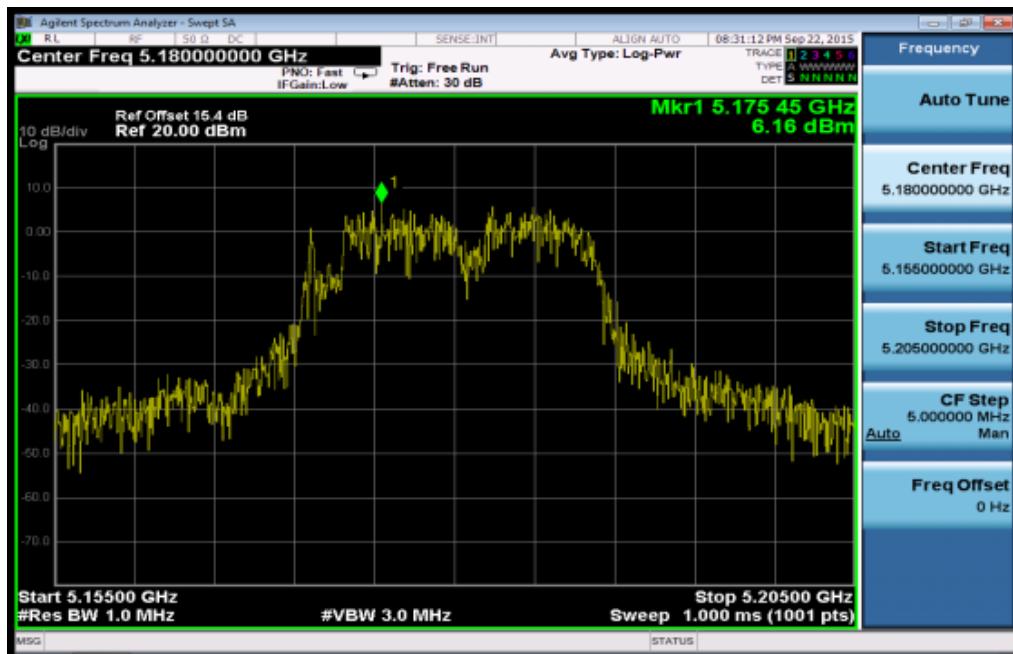
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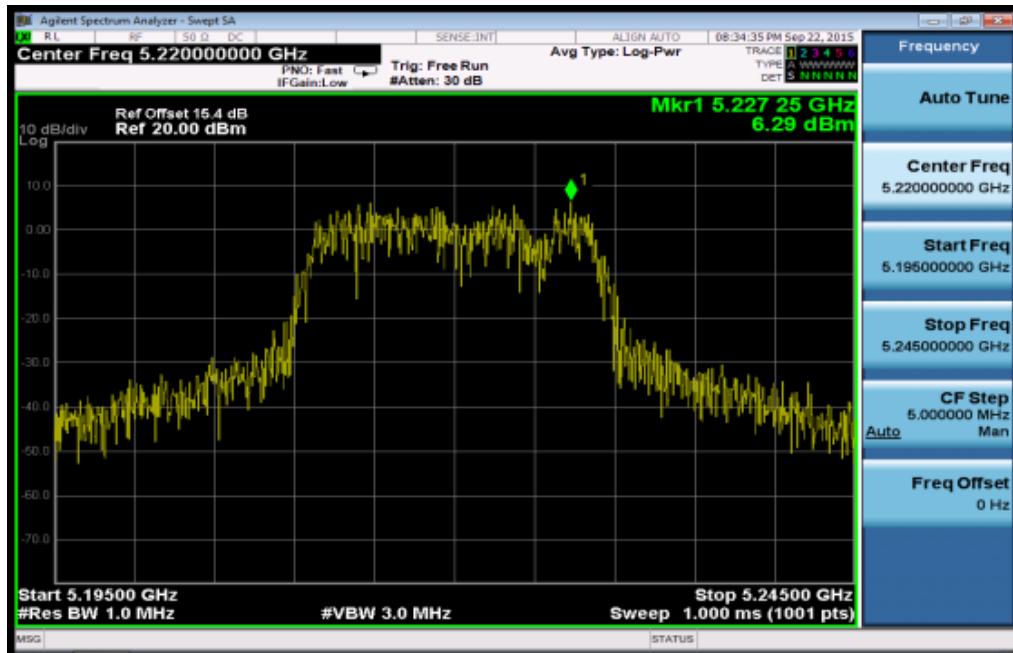
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802.11n HT20, 5150~5250 MHz (MIMO)

Peak Power Spectral Density Data Plot (CH Low 5180 MHz)



Peak Power Spectral Density Data Plot (CH Mid 5220 MHz)



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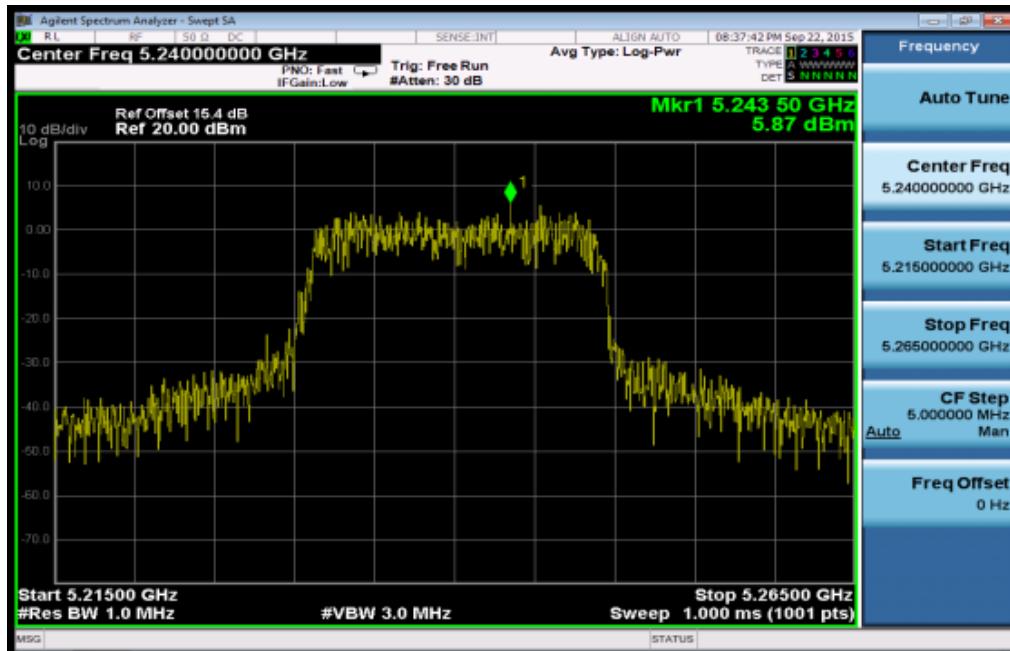
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Peak Power Spectral Density Data Plot (CH High 5240 MHz)



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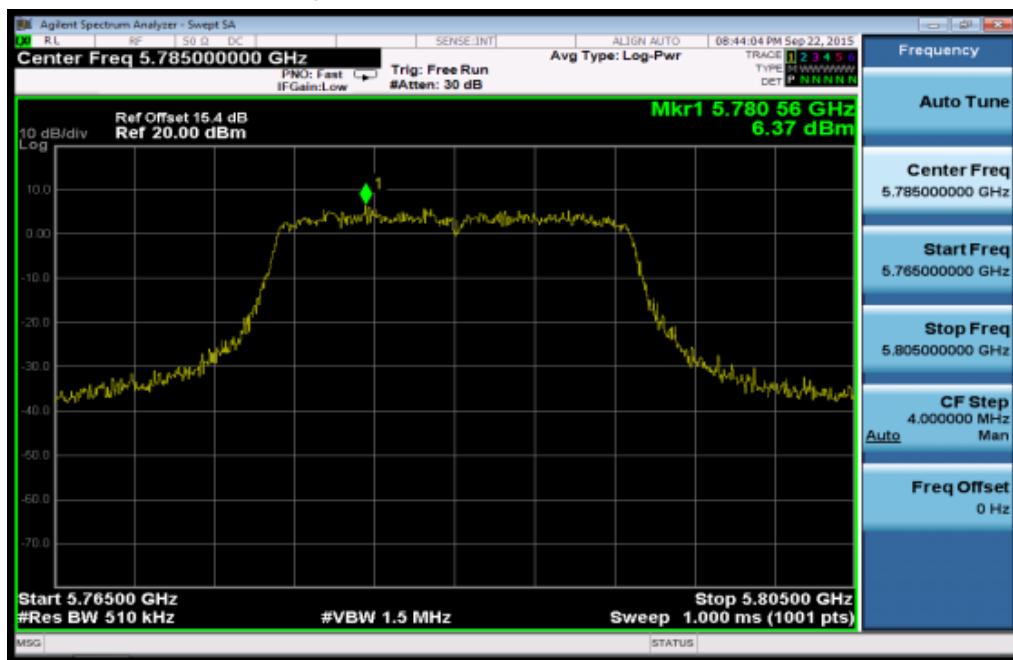
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802.11n HT20, 5725~5850 MHz (MIMO) Peak Power Spectral Density Data Plot (CH Low 5745 MHz)



Peak Power Spectral Density Data Plot (CH Mid 5785 MHz)



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Peak Power Spectral Density Data Plot (CH High 5825 MHz)



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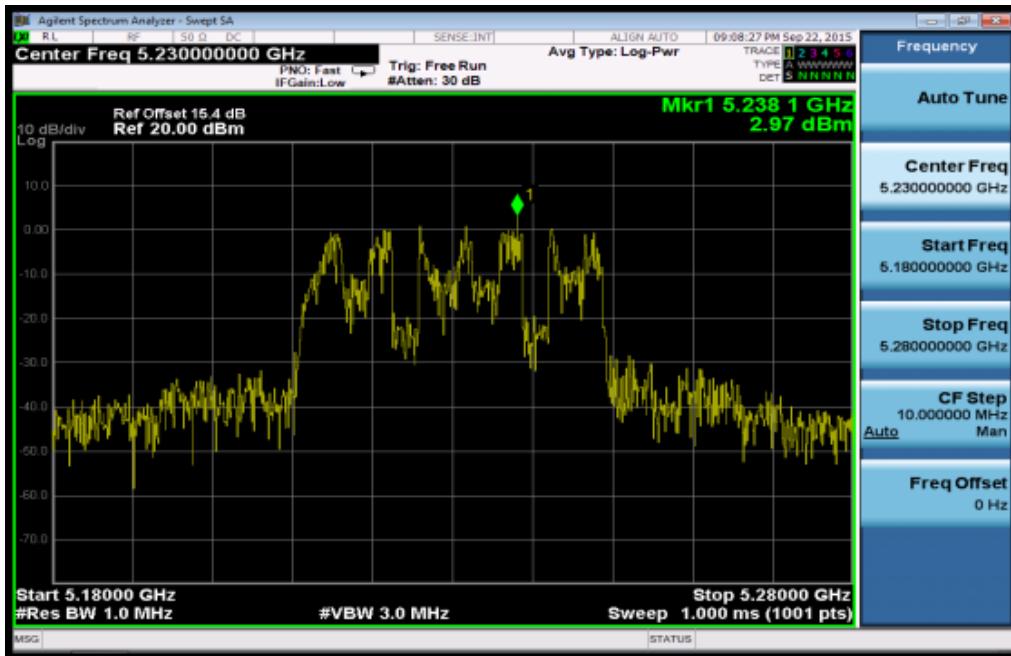
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802.11n HT40, 5150~5250 MHz (MIMO) Peak Power Spectral Density Data Plot (CH Low 5190MHz)



Peak Power Spectral Density Data Plot (CH High 5230MHz)



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802.11n HT40, 5725~5850 MHz (MIMO) Peak Power Spectral Density Data Plot (CH Low 5755 MHz)



Peak Power Spectral Density Data Plot (CH High 5795 MHz)



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11. UNDESIRABLE RADIATED EMISSION MEASUREMENT1

11.1 Standard Applicable

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

1. For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
2. For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
3. For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
4. For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

APPLICABLE TO	LIMIT	
FCC KDB 789033 D02 General UNII Test Procedures New Rules v01	FIELD STRENGTH AT 3m	
	PK: 74 (dB μ V/m)	AV 54 (dB μ V/m)
APPLICABLE TO	EIRP LIMIT	FIELD STRENGTH AT 3m
15.407(b)(1)		
15.407(b)(2)	PK: -27 (dBm/MHz)	PK: 68.3 (dB μ V/m)
15.407(b)(3)		
15.407(b)(4)	PK: -27 (dBm/MHz) PK: -17 (dBm/MHz)	PK: 68.3 (dB μ V/m) PK: 78.2 (dB μ V/m)

EIRP = ((E*d)^2) / 30, where E is the field in V/m, d is the measurement distance (3m), EIRP is the equivalent isotropically radiated power in Watts.

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Unwanted spurious emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table:

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

Note:

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

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11.2 Measurement Equipment Used

SGS 966 Chamber No.C					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESU 40	100363	04/09/2015	04/08/2016
Loop Antenna	ETS-Lindgren	6502	00143303	12/09/2014	12/08/2015
Broadband Antenna	TESEQ	CBL 6112D	35240	12/05/2014	12/04/2015
Horn Antenna	ETS-Lindgren	3117	00143272	12/08/2014	12/07/2015
Horn Antenna	ETS-Lindgren	3160-09	00117911	11/13/2014	11/12/2015
Horn Antenna	ETS-Lindgren	3160-10	00117783	11/13/2014	11/12/2015
Pre Amplifier	EMC Instruments	EMC330	980096	12/19/2014	12/18/2015
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/19/2014	12/18/2015
Pre Amplifier	R&S	SCU-18	10204	12/19/2014	12/18/2015
Pre Amplifier	R&S	SCU-26	100780	12/19/2014	12/18/2015
Pre Amplifier	R&S	SCU-40	100356	12/19/2014	12/18/2015
Pre Amplifier	EMC Instruments	EMC184045B	980135	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/19/2014	12/18/2015
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/19/2014	12/18/2015
Attenuator	WOKEN	218FS-10	RF27	12/19/2014	12/18/2015
Site NSA	SGS	966 Chamber C	SAC-C	03/04/2015	03/03/2016
Site VSWR	SGS	966 Chamber C	SAC-C	03/04/2015	03/03/2016
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2015	05/03/2016
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.

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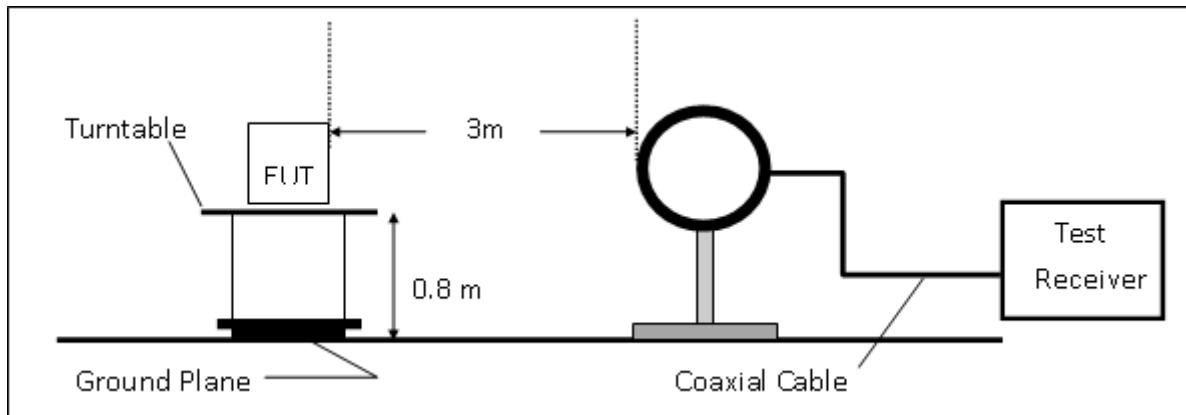
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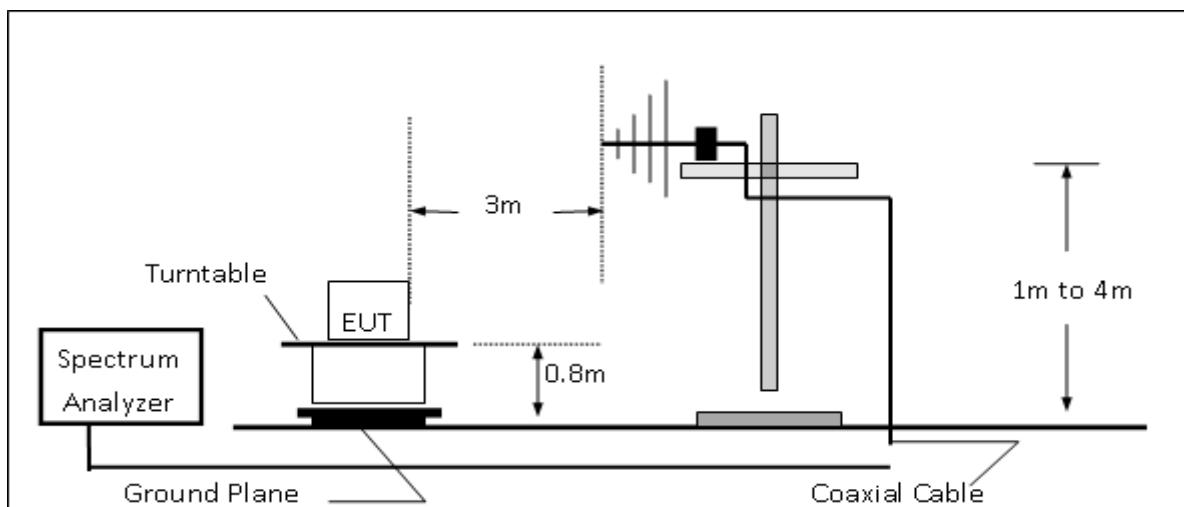
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11.3 Test SET-UP

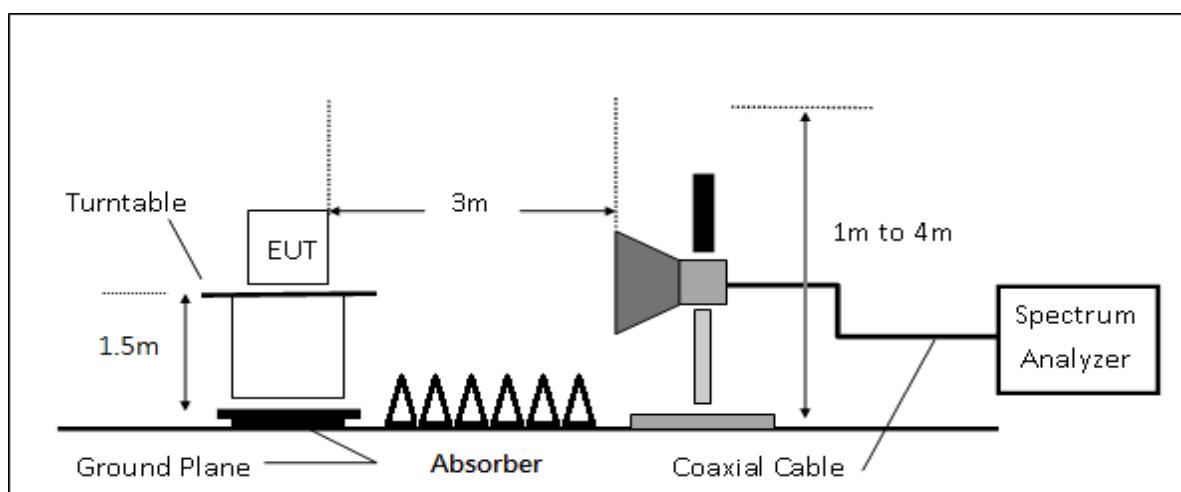
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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11.4 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.
3. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 0.8m for frequency > 1GHz above ground plane.
4. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
5. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
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 \geq 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
11. Repeat above procedures until all frequency 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(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

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

Note :

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

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

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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

Refer to attach tabular data sheets.

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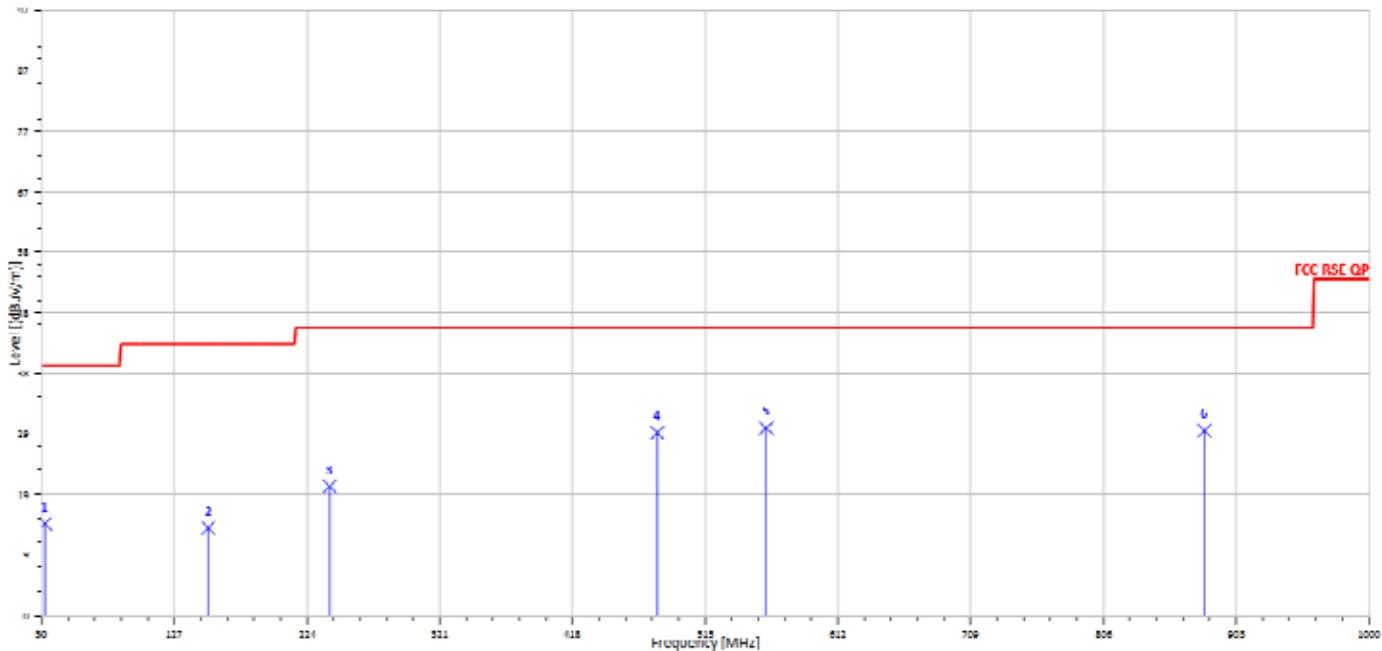
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Radiated Spurious Emission Measurement Result

Below 1GHz Worst-Case Data:

802.11a, 5150~5250 MHz

Operation Band	:802.11 a	Test Date	:2015-09-24
Fundamental Frequency	:5220 MHz	Temp./Humi.	:26.5 deg_C / 50 RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:H Plan	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum		Factor	Actual FS dBµV	Limit @3m dBµV/m	Margin dB
			PK/QP/AV	Reading Level dBµV				
32.91	S	Peak	39.04	-24.30	14.74	40	-25.26	
152.22	S	Peak	36.22	-22.19	14.04	43.5	-29.46	
240.49	S	Peak	43.79	-23.18	20.60	46	-25.40	
480.08	S	Peak	46.32	-17.03	29.29	46	-16.71	
559.62	S	Peak	46.15	-16.09	30.06	46	-15.94	
879.72	S	Peak	40.89	-11.23	29.66	46	-16.34	

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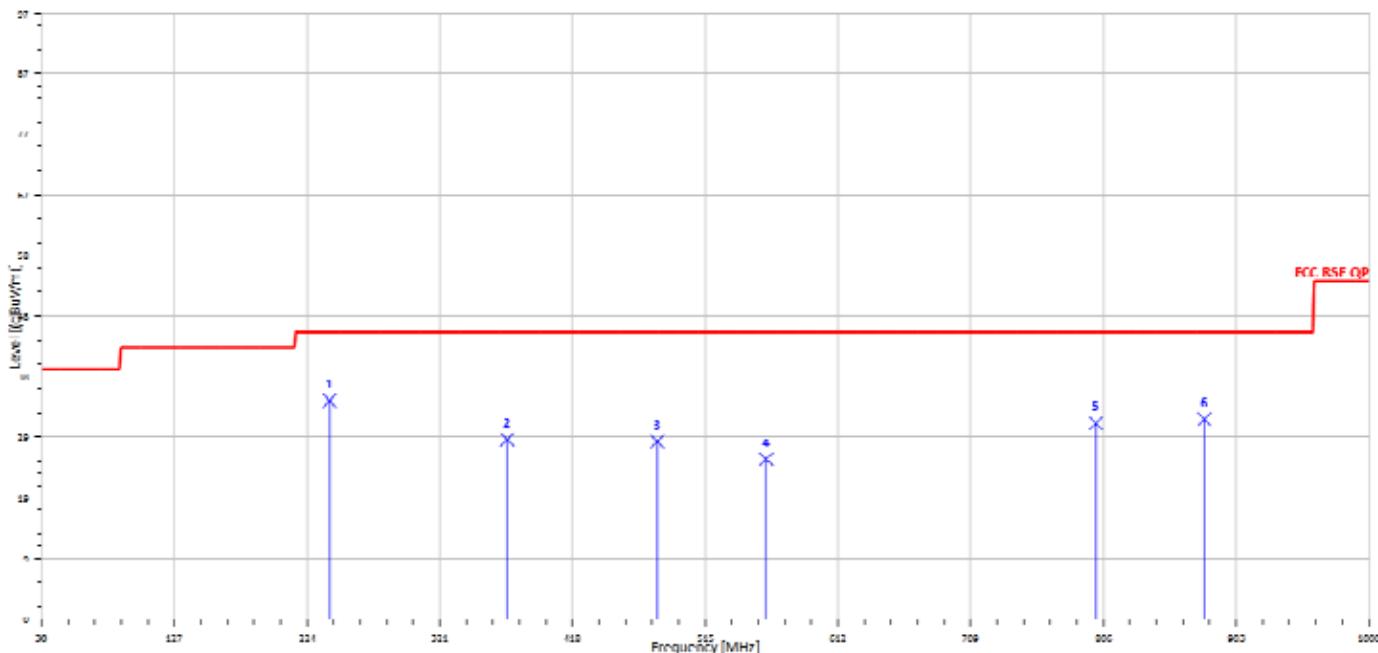
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Operation Band :802.11 a
 Fundamental Frequency :5220 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
			dBμV					
240.49	S	Peak	58.15	-23.18	34.97	46	46	-11.03
370.47	S	Peak	48.32	-19.59	28.72	46	46	-17.28
480.08	S	Peak	45.44	-17.03	28.40	46	46	-17.60
559.62	S	Peak	41.59	-16.09	25.51	46	46	-20.49
800.18	S	Peak	43.66	-12.28	31.37	46	46	-14.63
879.72	S	Peak	43.22	-11.23	31.99	46	46	-14.01

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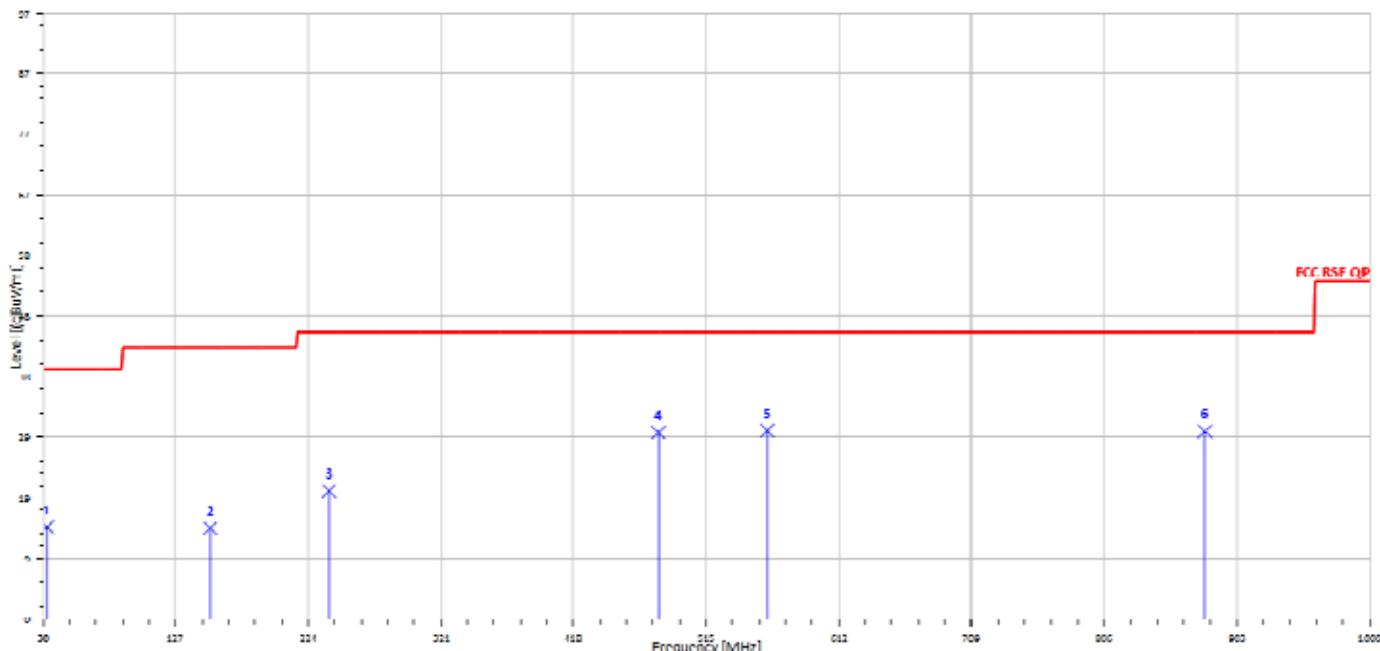
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802.11a, 5725~5850 MHz

Operation Band	:802.11 a	Test Date	:2015-09-24
Fundamental Frequency	:5785 MHz	Temp./Humi.	:26.5 deg_C / 50 RH
Operation Mode	:TX MID	Engineer	:Vito
EUT Pol.	:H Plan	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor	Actual FS dB	Limit @3m dBμV/m	Margin dB
			dBμV					
32.91	S	Peak	38.97	-24.30	14.67	40	-25.33	
152.22	S	Peak	36.71	-22.19	14.52	43.5	-28.98	
239.52	S	Peak	43.78	-23.21	20.57	46	-25.43	
480.08	S	Peak	46.88	-17.03	29.85	46	-16.15	
559.62	S	Peak	46.26	-16.09	30.17	46	-15.83	
879.72	S	Peak	41.30	-11.23	30.07	46	-15.93	

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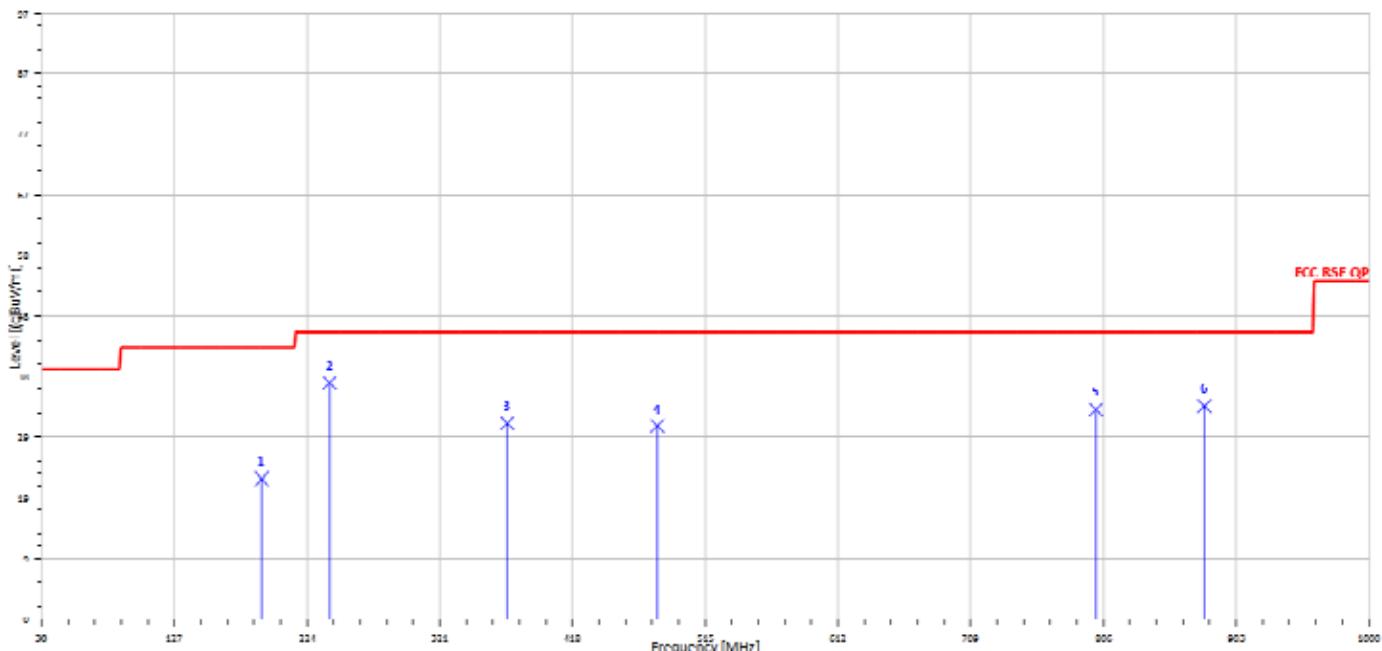
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Operation Band :802.11 a
 Fundamental Frequency :5785 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
			Reading dBµV	Level				
191.02	S	Peak	47.52	-25.07	22.45	43.5	43.5	-21.05
240.49	S	Peak	60.93	-23.18	37.75	46	46	-8.25
370.47	S	Peak	50.97	-19.59	31.37	46	46	-14.63
480.08	S	Peak	47.97	-17.03	30.94	46	46	-15.06
800.18	S	Peak	45.86	-12.28	33.58	46	46	-12.42
879.72	S	Peak	45.35	-11.23	34.12	46	46	-11.88

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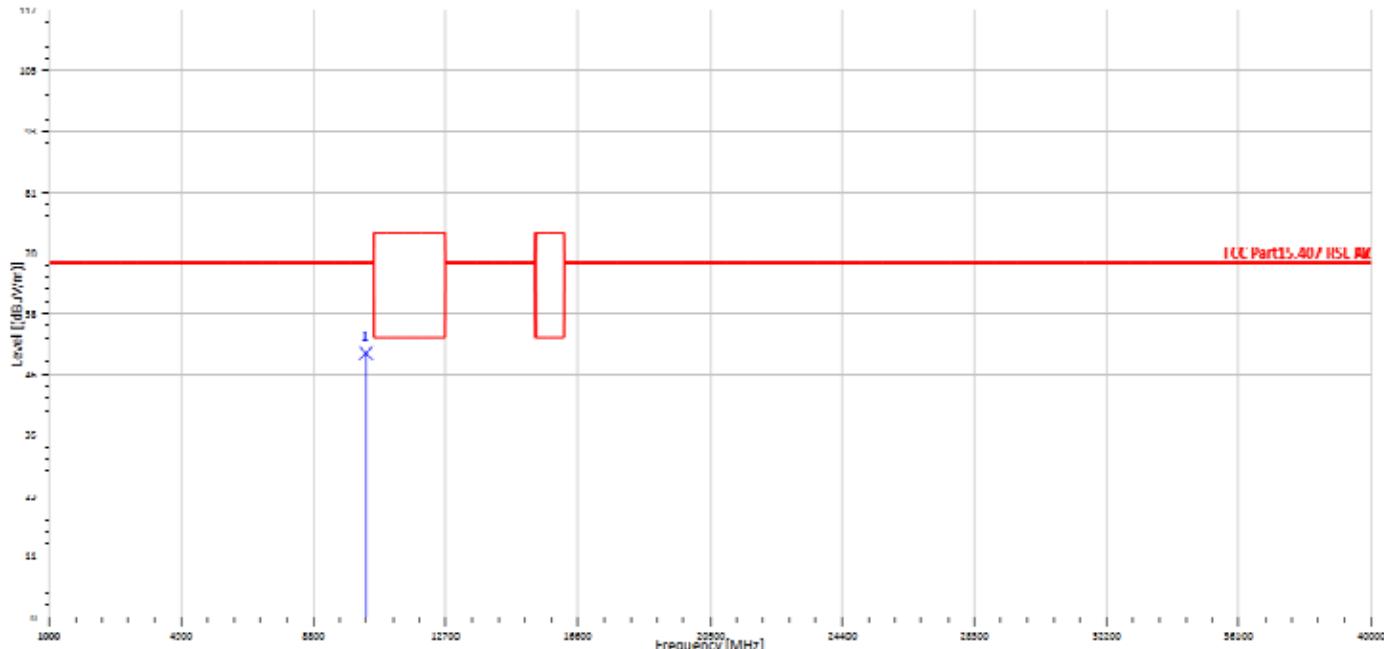
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Above 1GHz Worst-Case Data:

802.11a, 5150~5250 MHz

Operation Band :802.11 a
 Fundamental Frequency :5180 MHz
 Operation Mode :TX LOW
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
						Limit @3m dB μ V/m	Margin dB
10360.00	H	Peak	41.62	9.27	50.89	68.3	-17.41

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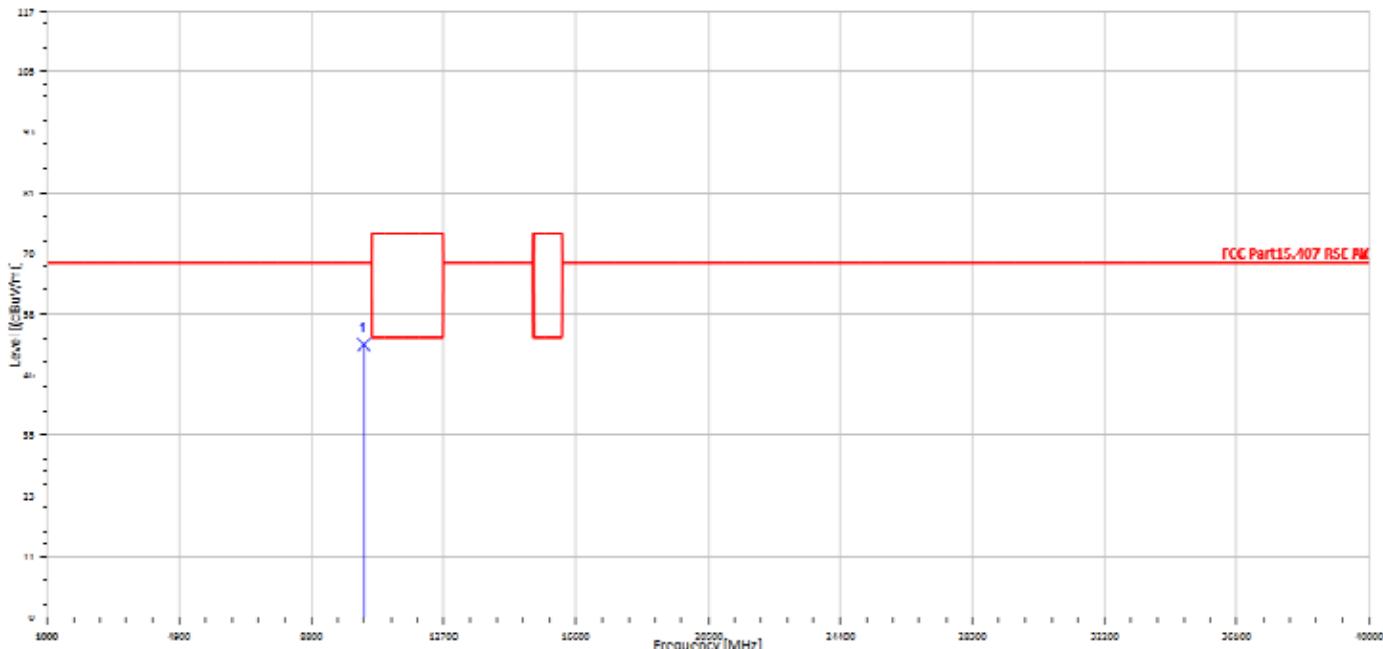
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www.tw.sgs.com

Member of SGS Group

Operation Band :802.11 a
 Fundamental Frequency :5180 MHz
 Operation Mode :TX LOW
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor Reading Level	Actual FS	Limit @3m	Margin dB
			PK/QP/AV			dB μ V/m	
10360.00	H	Peak	43.31	9.27	52.58	68.3	-15.72

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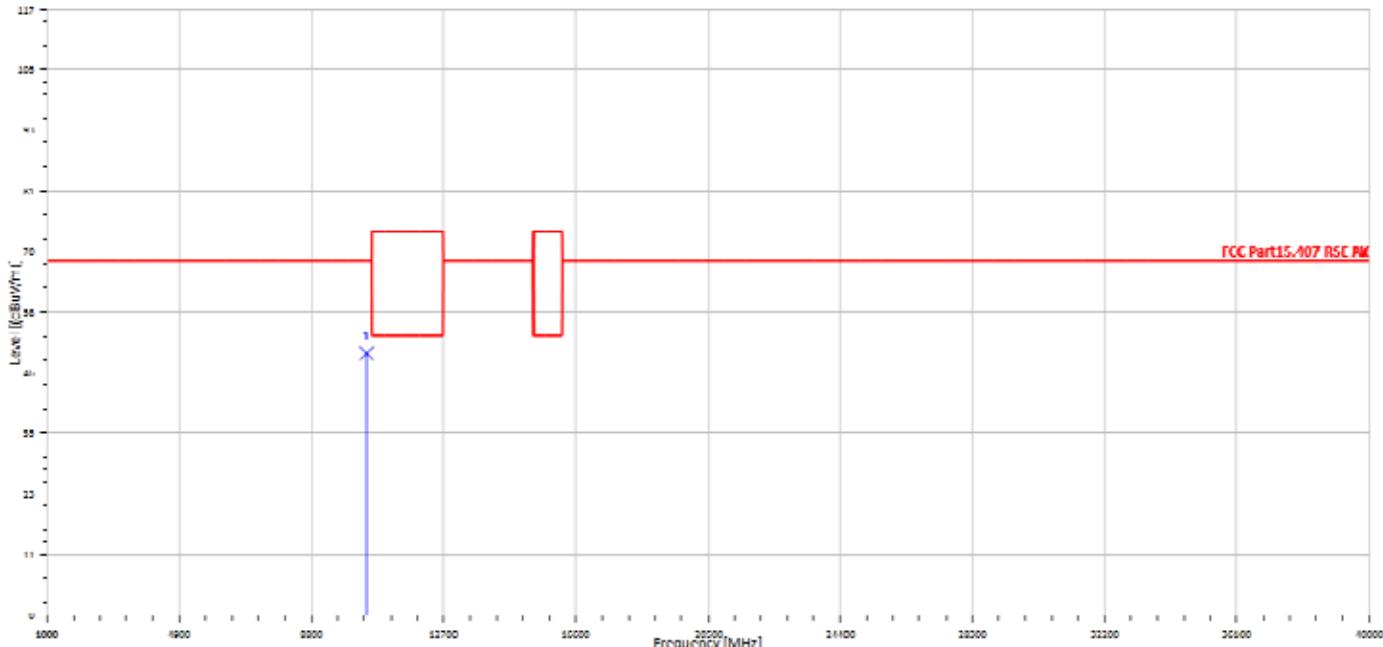
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www.tw.sgs.com

Member of SGS Group

Operation Band :802.11 a
 Fundamental Frequency :5220 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			Reading Level dB μ V				
10440.00	H	Peak	40.94	9.57	50.51	68.3	-17.79

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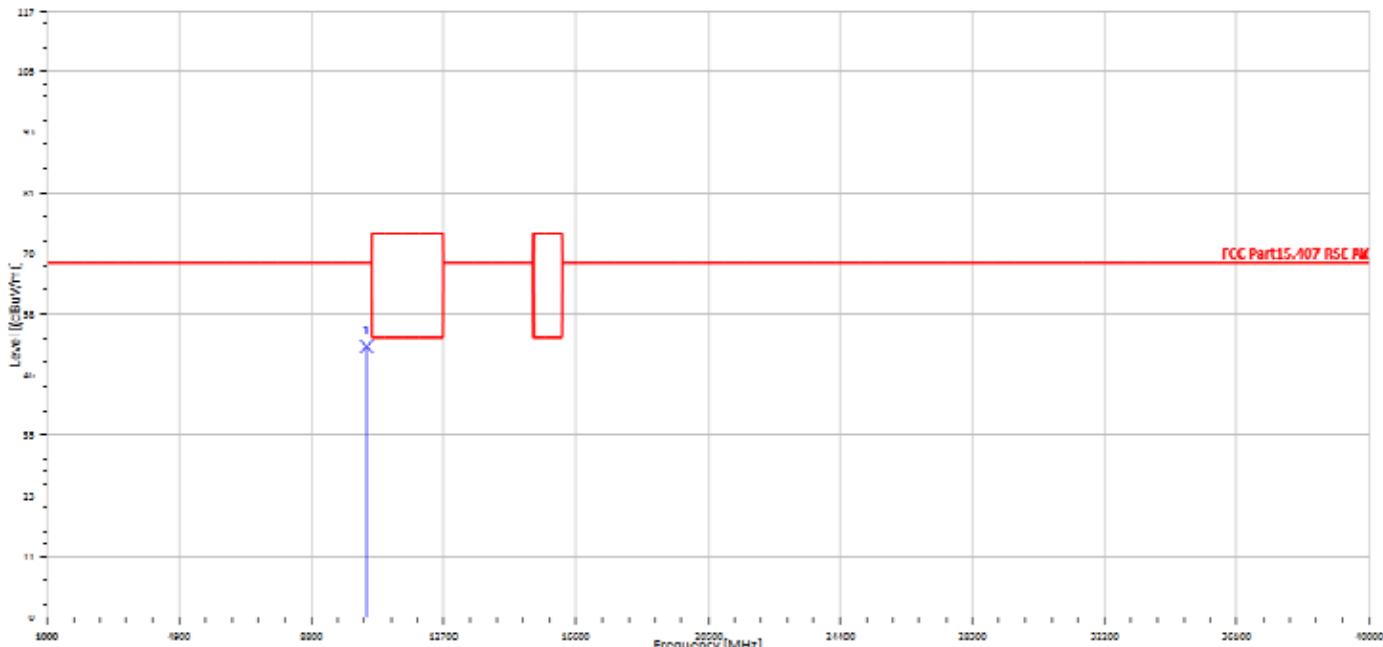
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www.tw.sgs.com

Member of SGS Group

Operation Band :802.11 a
 Fundamental Frequency :5220 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit	Margin
			Reading Level dB μ V			@3m dB μ V/m	dB μ V/m
10440.00	H	Peak	42.68	9.57	52.25	68.3	-16.05

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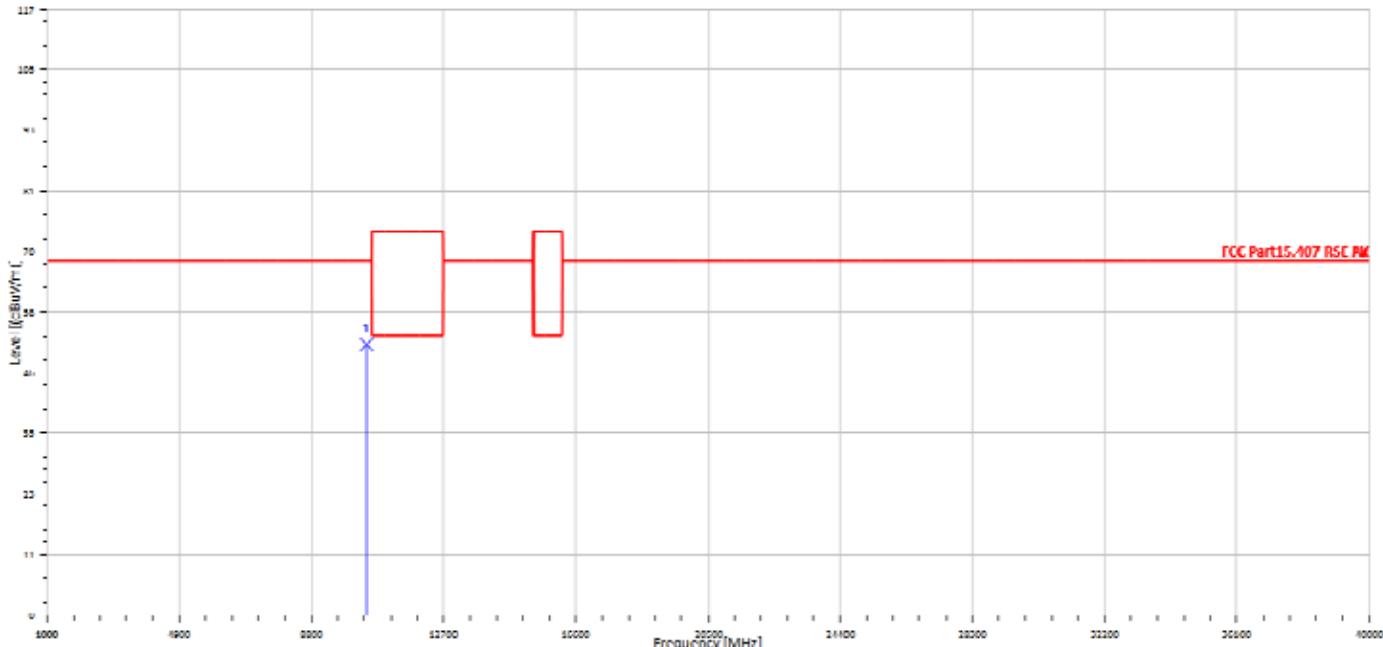
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Member of SGS Group

Operation Band :802.11 a
 Fundamental Frequency :5240 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit	Margin
			Reading Level dB μ V			@3m dB μ V/m	dB μ V/m
10480.00	H	Peak	42.15	9.64	51.80	68.3	-16.50

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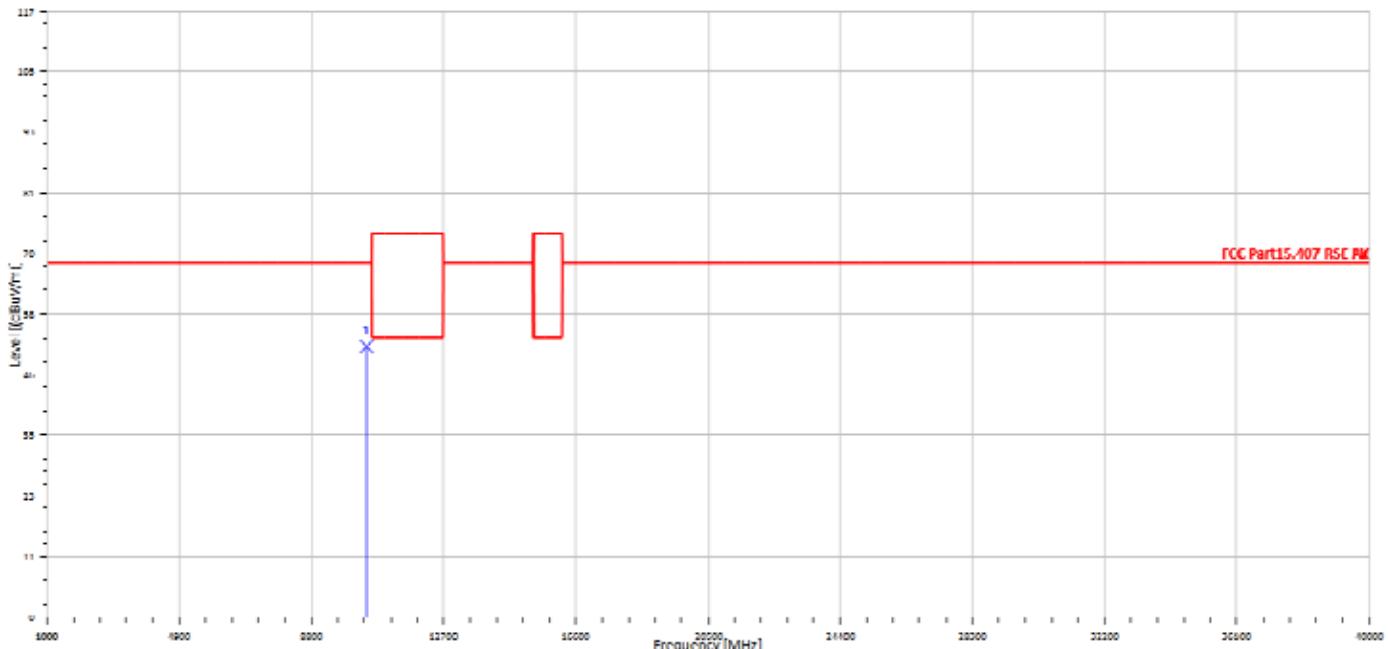
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Operation Band :802.11 a
 Fundamental Frequency :5240 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
			Reading Level dB μ V			dB μ V/m	dB
10480.00	H	Peak	41.34	9.64	50.98	68.3	-17.32

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Band edge falling to restricted band

Operation Band :802.11 a
 Fundamental Frequency :5180 MHz
 Operation Mode :Band Edge LOW
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
5150.00	E	Peak	52.50	-0.17	52.33	74	-21.67
5150.00	E	Average	39.52	-0.17	39.35	54	-14.65

Operation Band :802.11 a
 Fundamental Frequency :5180 MHz
 Operation Mode :Band Edge LOW
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
5150.00	E	Peak	52.00	-0.17	51.83	74	-22.17
5150.00	E	Average	39.42	-0.17	39.25	54	-14.75

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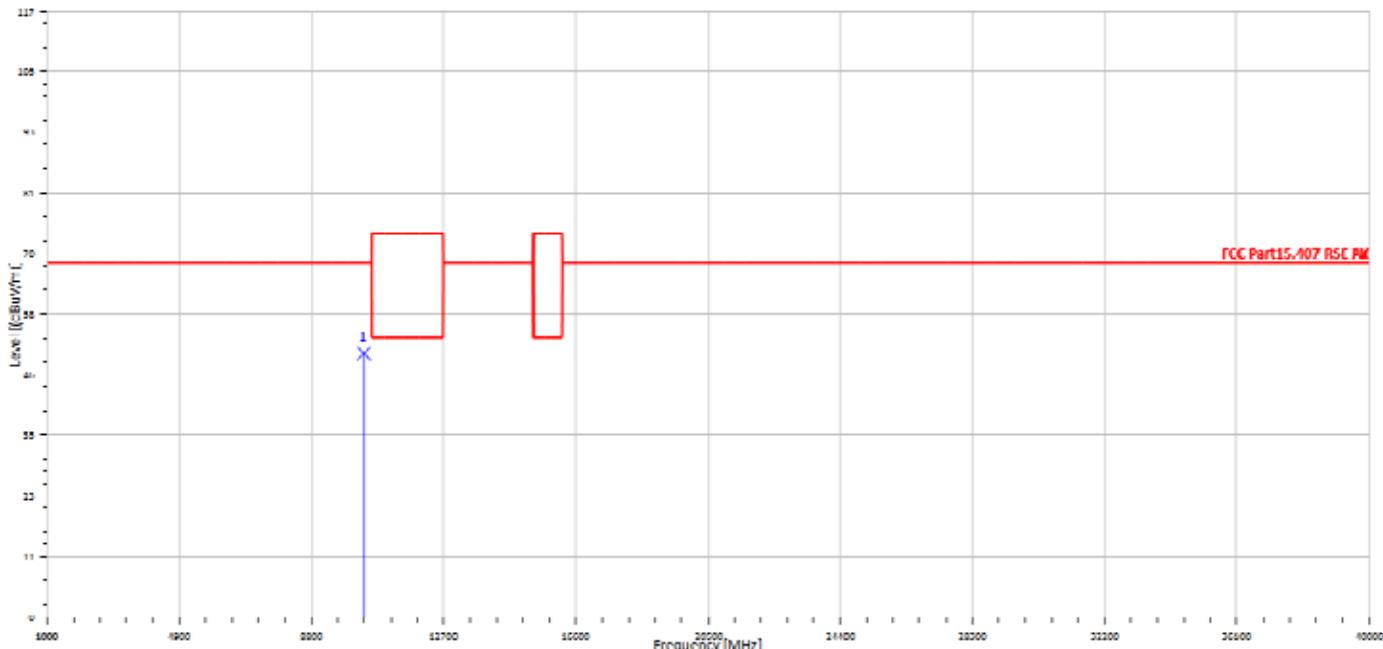
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Radiated Spurious Emission Measurement Result 802.11n HT20, 5150~5250 MHz (MIMO)

Operation Band :802.11 n20M Test Date :2015-09-24
 Fundamental Frequency :5180 MHz Temp./Humi. :26.5 deg_C / 50 RH
 Operation Mode :TX LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
			Reading Level dB μ V				
10360.00	H	Peak	41.64	9.27	50.91	68.3	-17.39

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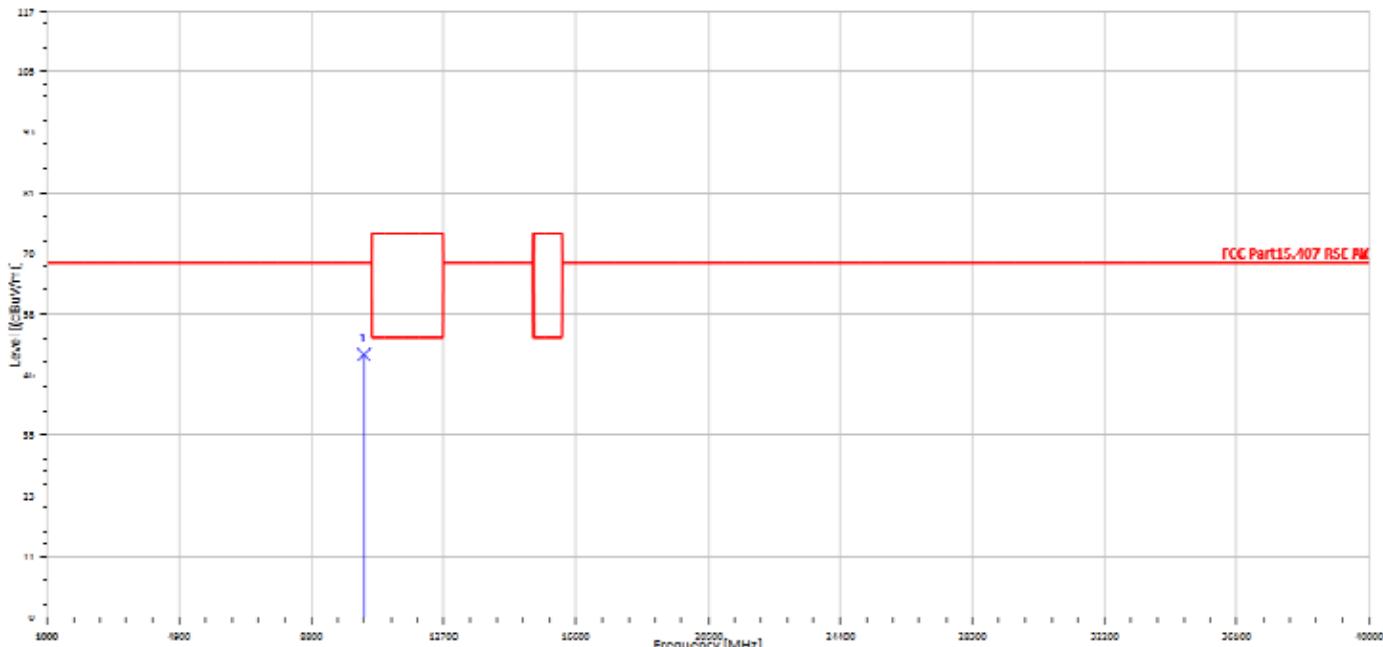
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www.tw.sgs.com

Member of SGS Group

Operation Band :802.11 n20M
 Fundamental Frequency :5180 MHz
 Operation Mode :TX LOW
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
			Reading Level dB μ V			dB μ V/m	dB μ V/m
10360.00	H	Peak	41.40	9.27	50.67	68.3	-17.63

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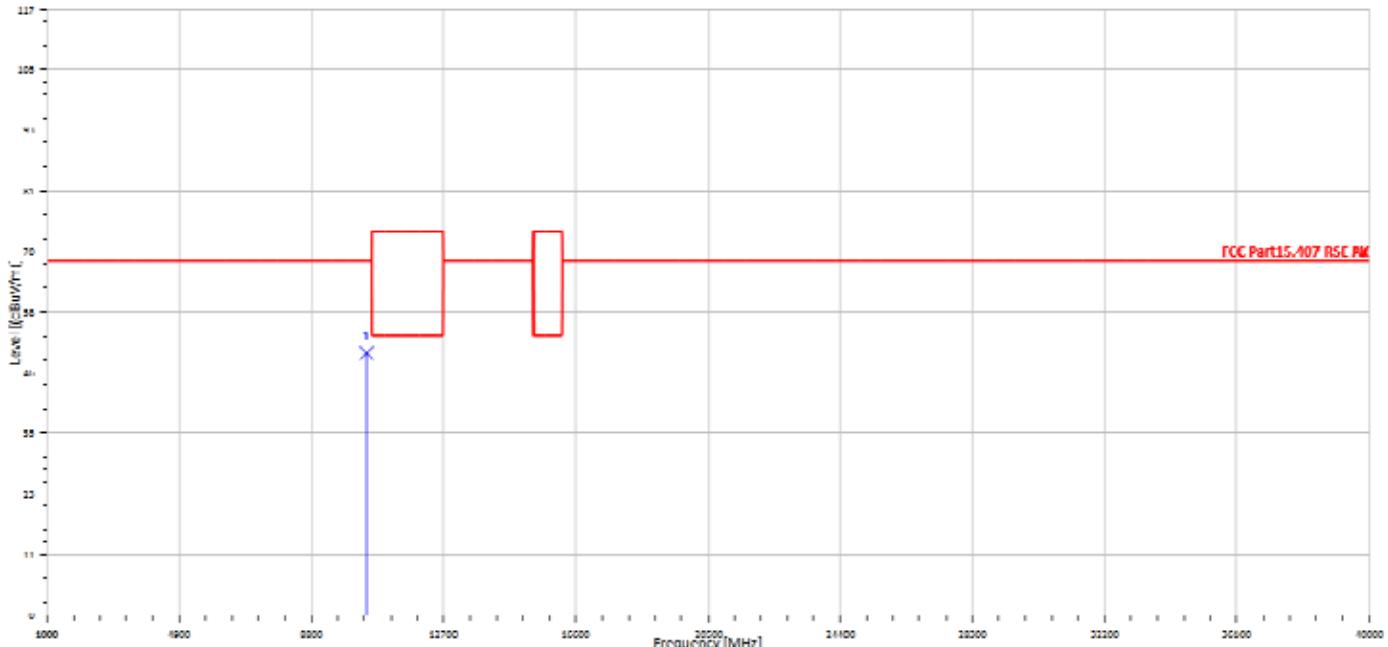
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Operation Band :802.11 n20M
 Fundamental Frequency :5220 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
			Reading Level dBµV				
10440.00	H	Peak	40.98	9.57	50.55	68.3	-17.75

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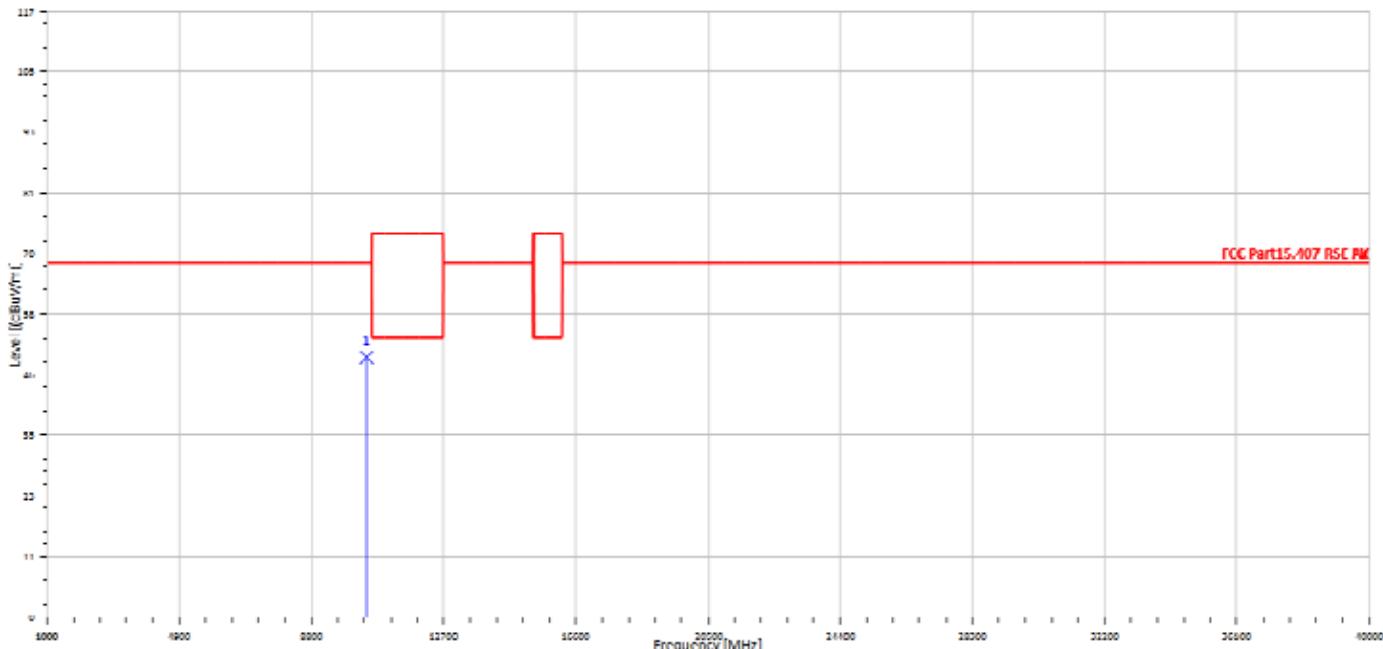
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Operation Band :802.11 n20M
 Fundamental Frequency :5220 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
			Reading Level dB μ V			dB μ V/m	dB
10440.00	H	Peak	40.57	9.57	50.13	68.3	-18.17

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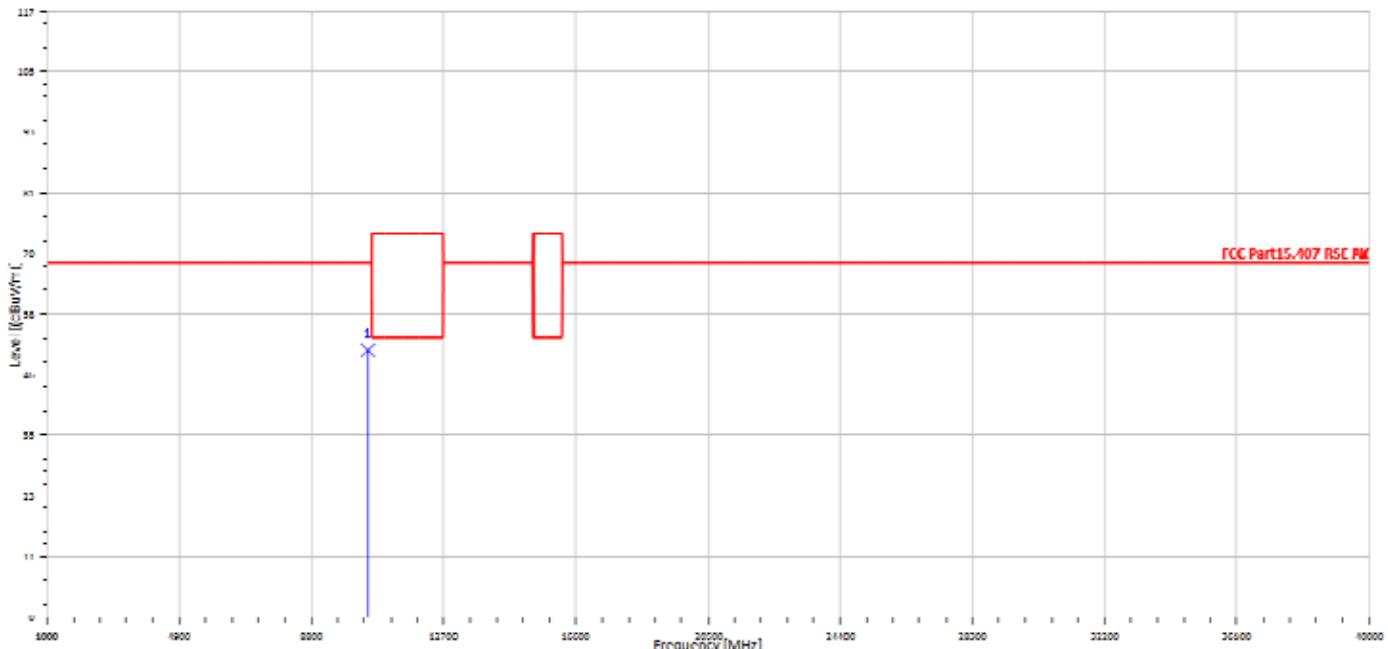
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Operation Band :802.11 n20M
 Fundamental Frequency :5240 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor Reading Level	Actual FS	Limit @3m	Margin
			PK/QP/AV			dB μ V/m	dB
10480.00	H	Peak	41.86	9.64	51.51	68.3	-16.79

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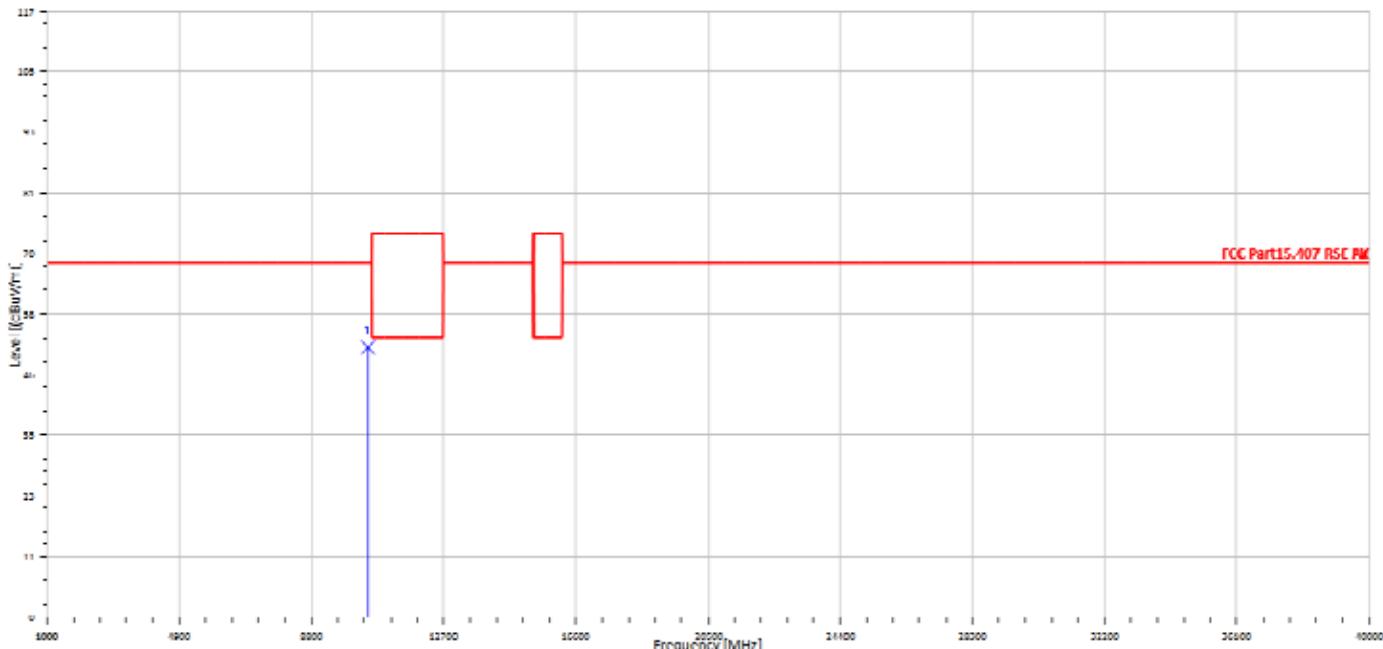
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Operation Band :802.11 n20M
 Fundamental Frequency :5240 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
			Reading Level dB μ V			dB μ V/m	dB
10480.00	H	Peak	42.44	9.64	52.08	68.3	-16.22

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Band edge falling to restricted band

Operation Band :802.11 n20M Test Date :2015-09-24
 Fundamental Frequency :5180 MHz Temp./Humi. :26.5 deg_C / 50 RH
 Operation Mode :Band Edge LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5150.00	E	Peak	52.68	-0.17	52.51	74	-21.49	
5150.00	E	Average	40.12	-0.17	39.95	54	-14.05	

Operation Band :802.11 n20M Test Date :2015-09-24
 Fundamental Frequency :5180 MHz Temp./Humi. :26.5 deg_C / 50 RH
 Operation Mode :Band Edge LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :HORIZONTAL

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

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

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

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

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5150.00	E	Peak	52.12	-0.17	51.95	74	-22.05	
5150.00	E	Average	39.63	-0.17	39.46	54	-14.54	

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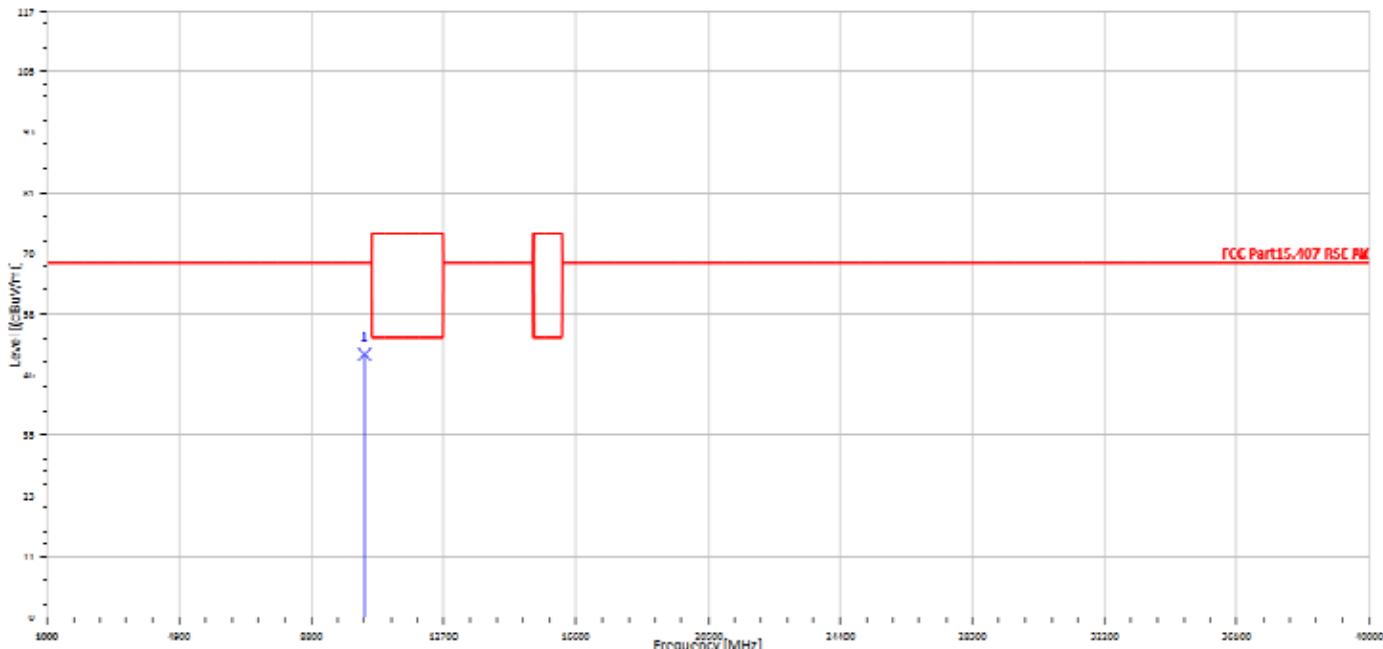
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Radiated Spurious Emission Measurement Result 802.11n HT40, 5150~5250 MHz (MIMO)

Operation Band :802.11 n40M Test Date :2015-09-24
 Fundamental Frequency :5190 MHz Temp./Humi. :26.5 deg_C / 50 RH
 Operation Mode :TX LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
			Reading Level dB μ V				
10380.00	H	Peak	41.35	9.38	50.74	68.3	-17.56

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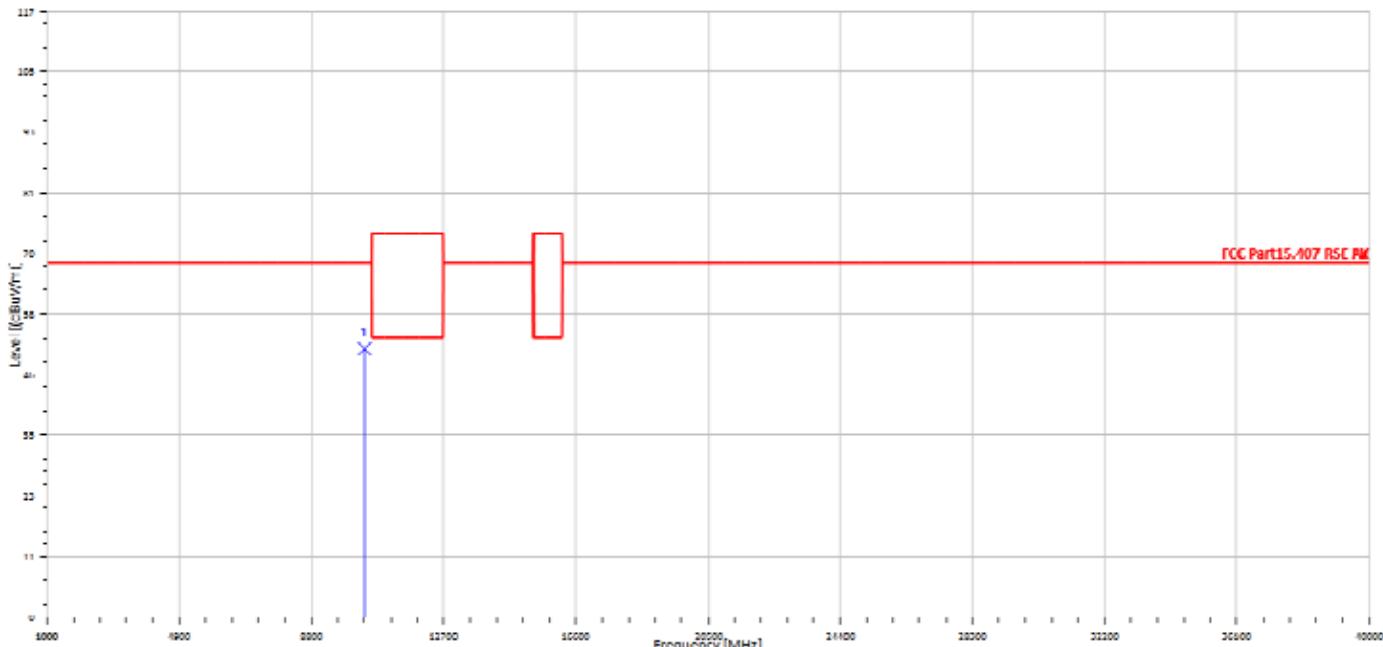
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Operation Band :802.11 n40M
 Fundamental Frequency :5190 MHz
 Operation Mode :TX LOW
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor Reading Level	Actual FS	Limit @3m	Margin dB
			PK/QP/AV			dB μ V/m	
10380.00	H	Peak	42.42	9.38	51.80	68.3	-16.50

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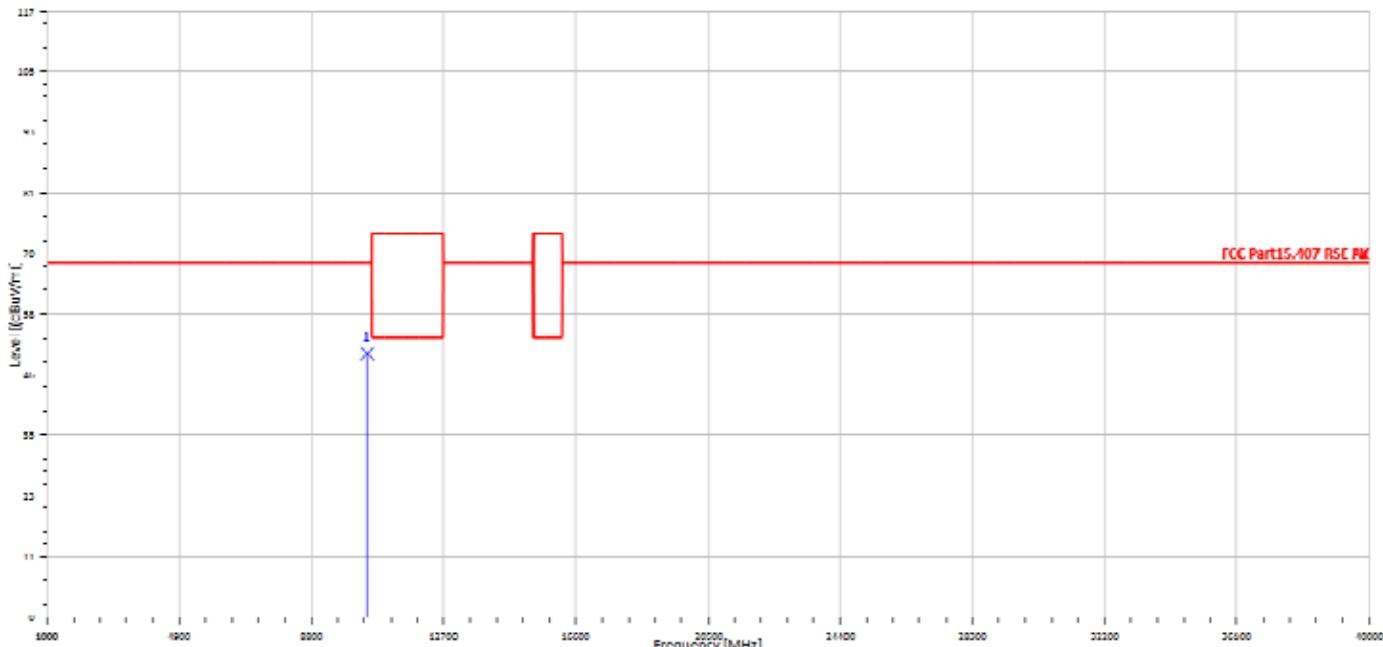
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Operation Band :802.11 n40M
 Fundamental Frequency :5230 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor Reading Level	Actual FS	Limit @3m	Margin dB
			PK/QP/AV			dB μ V/m	
10460.00	H	Peak	41.27	9.61	50.87	68.3	-17.43

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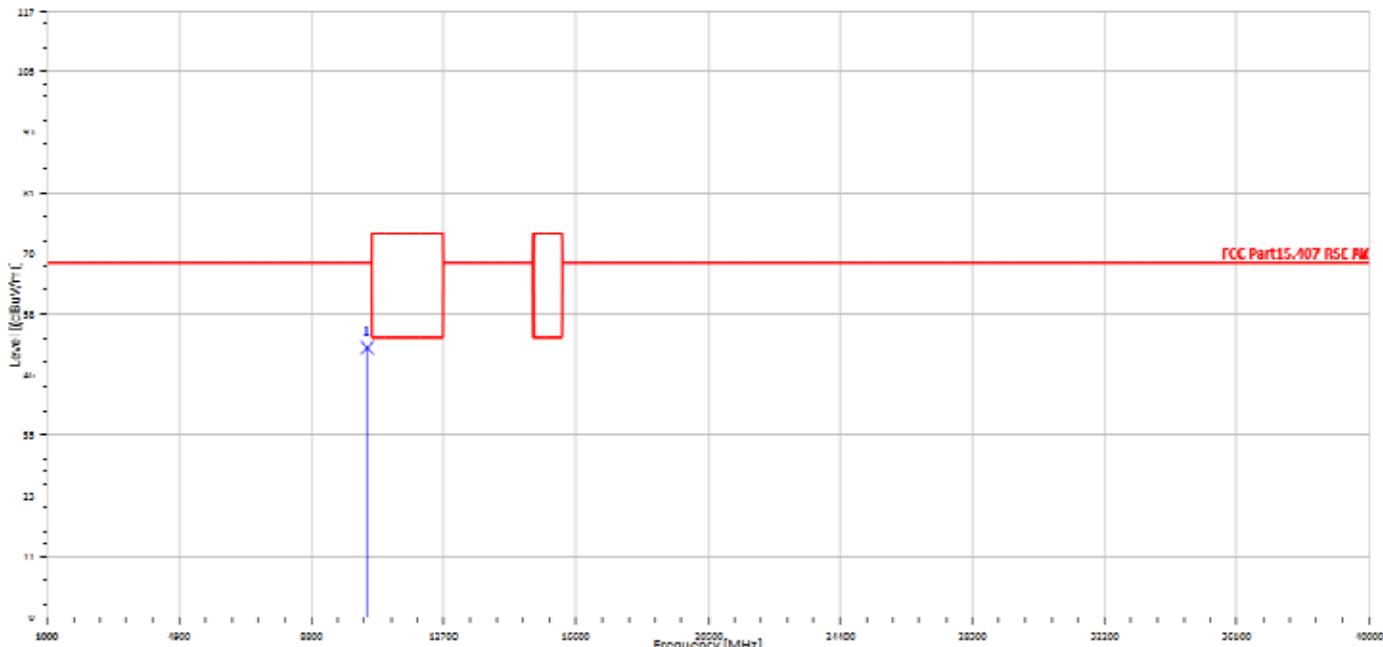
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Operation Band :802.11 n40M
 Fundamental Frequency :5230 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
			Reading Level dB μ V				
10460.00	H	Peak	42.42	9.61	52.03	68.3	-16.27

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Band edge falling to restricted band

Operation Band :802.11 n40M Test Date :2015-09-24
 Fundamental Frequency :5190 MHz Temp./Humi. :26.5 deg_C / 50 RH
 Operation Mode :Band Edge LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5149.36	S	Peak	66.99	-0.17	66.82	74	-7.18	
5149.36	S	Average	44.51	-0.17	44.34	54	-9.66	
5150.00	E	Peak	66.75	-0.17	66.58	74	-7.42	
5150.00	E	Average	45.44	-0.17	45.27	54	-8.73	

Operation Band :802.11 n40M Test Date :2015-09-24
 Fundamental Frequency :5190 MHz Temp./Humi. :26.5 deg_C / 50 RH
 Operation Mode :Band Edge LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :HORIZONTAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5149.36	S	Peak	64.49	-0.17	64.32	74	-9.68	
5149.36	S	Average	44.55	-0.17	44.38	54	-9.62	
5150.00	E	Peak	63.80	-0.17	63.63	74	-10.37	
5150.00	E	Average	45.05	-0.17	44.88	54	-9.12	

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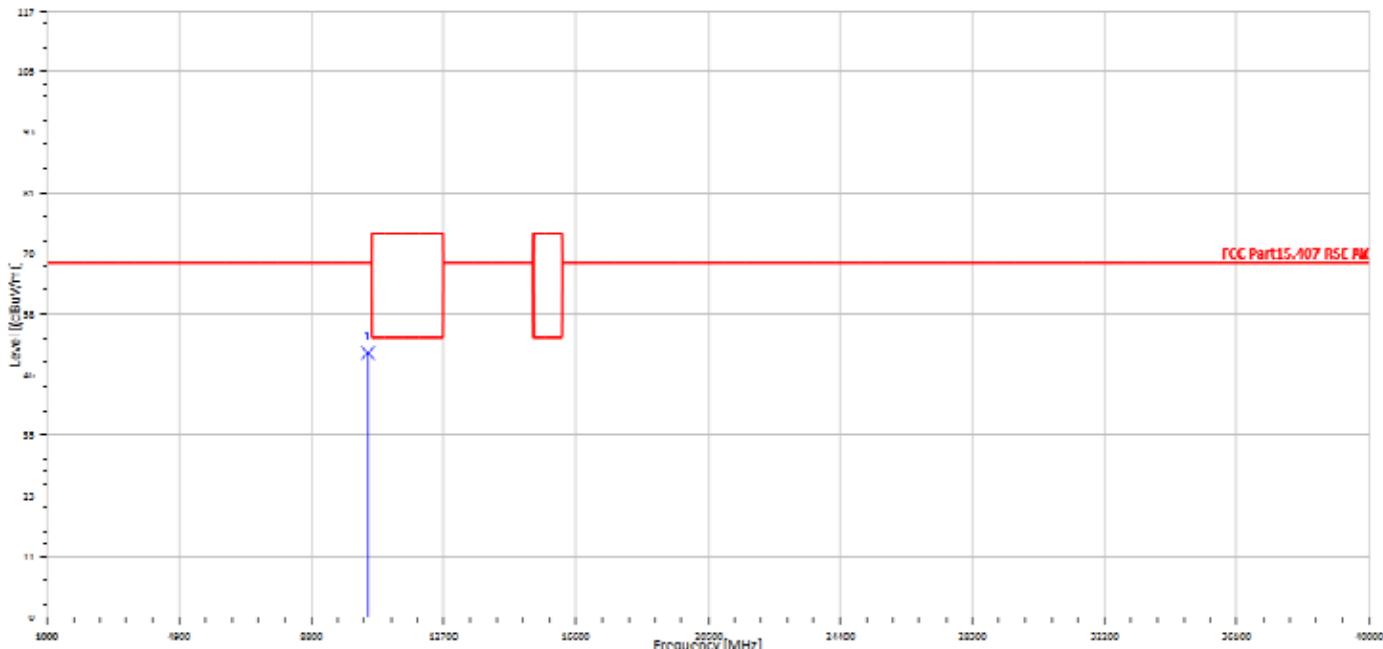
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Radiated Spurious Emission Measurement Result 802.11a, 5725~5850 MHz

Operation Band :802.11 a Test Date :2015-09-24
 Fundamental Frequency :5745 MHz Temp./Humi. :26.5 deg_C / 50 RH
 Operation Mode :TX LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			Peak	41.73				
11490.00	H	Peak	41.73	11.18	52.91	74	52.91	-21.09
11490.00	H	Average	29.09	11.18	40.27	54	40.27	-13.73

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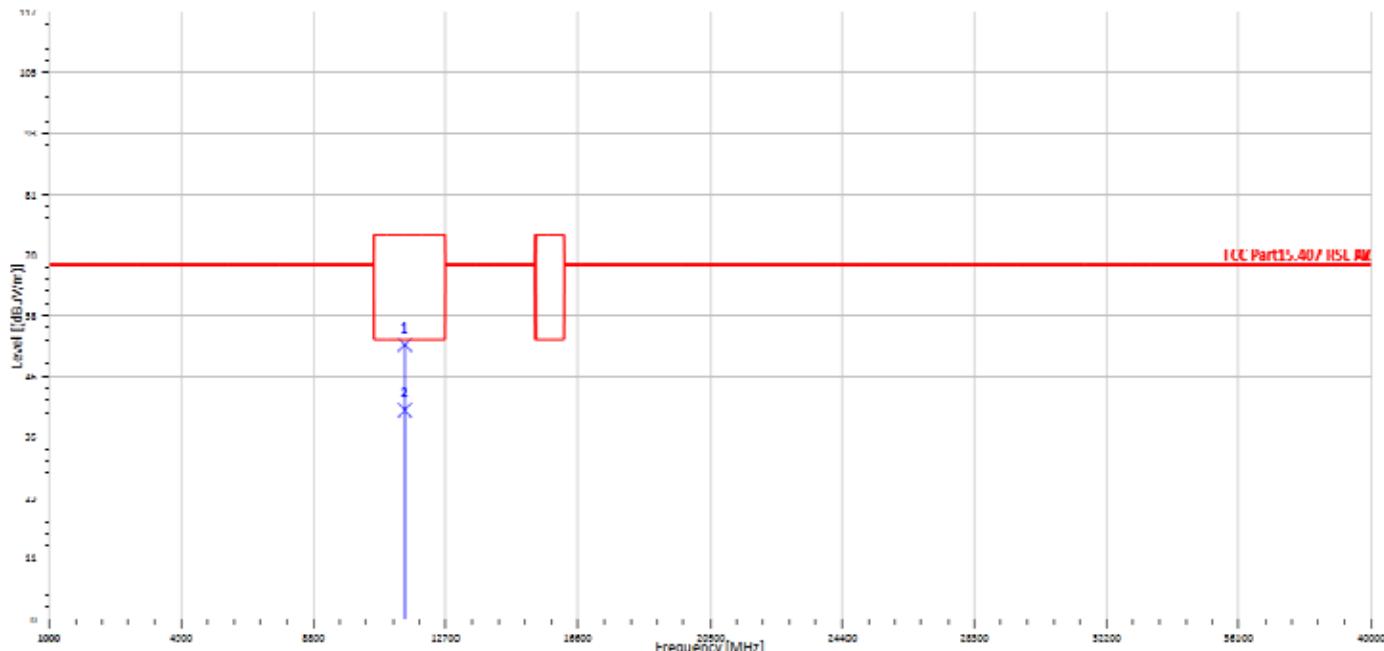
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Operation Band :802.11 a
 Fundamental Frequency :5745 MHz
 Operation Mode :TX LOW
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum		Factor	Actual FS dB ^μ V/m	Limit @3m dB ^μ V/m	Margin dB
			Reading	Level dB ^μ V				
11490.00	H	Peak	41.34	11.18	52.52	74	-21.48	
11490.00	H	Average	28.90	11.18	40.08	54	-13.92	

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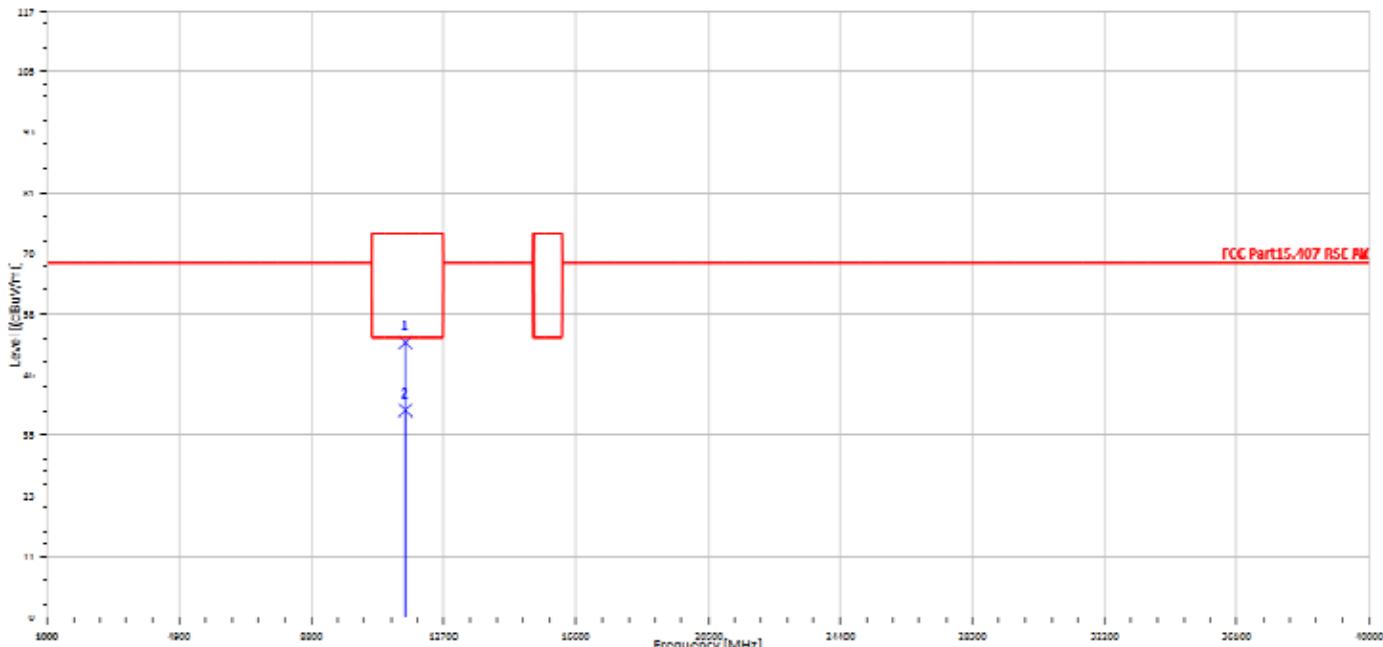
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Operation Band :802.11 a
 Fundamental Frequency :5785 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			PK/QP/AV	dB μ V				
11570.00	H	Peak	41.98	11.06	53.04	74	-20.96	
11570.00	H	Average	28.91	11.06	39.97	54	-14.03	

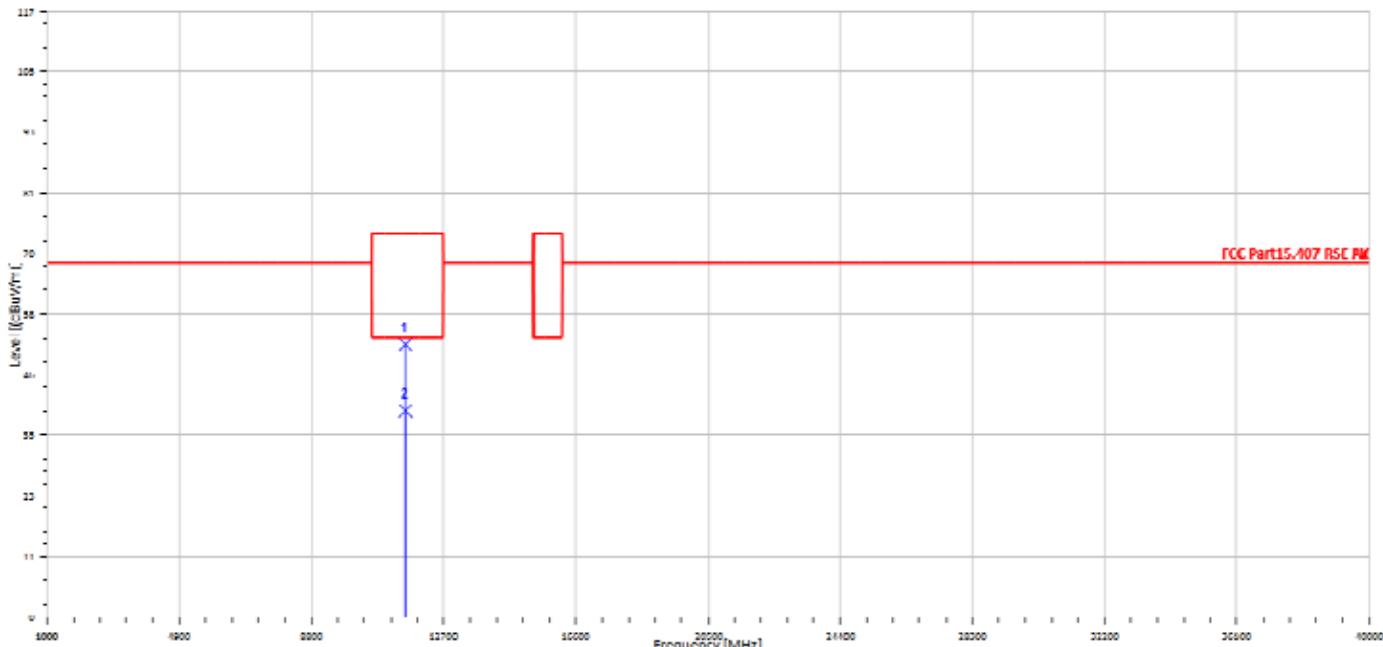
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Operation Band :802.11 a
 Fundamental Frequency :5785 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			PK/QP/AV	dB μ V				
11570.00	H	Peak	41.57	11.06	52.64	74	-21.37	
11570.00	H	Average	28.82	11.06	39.88	54	-14.12	

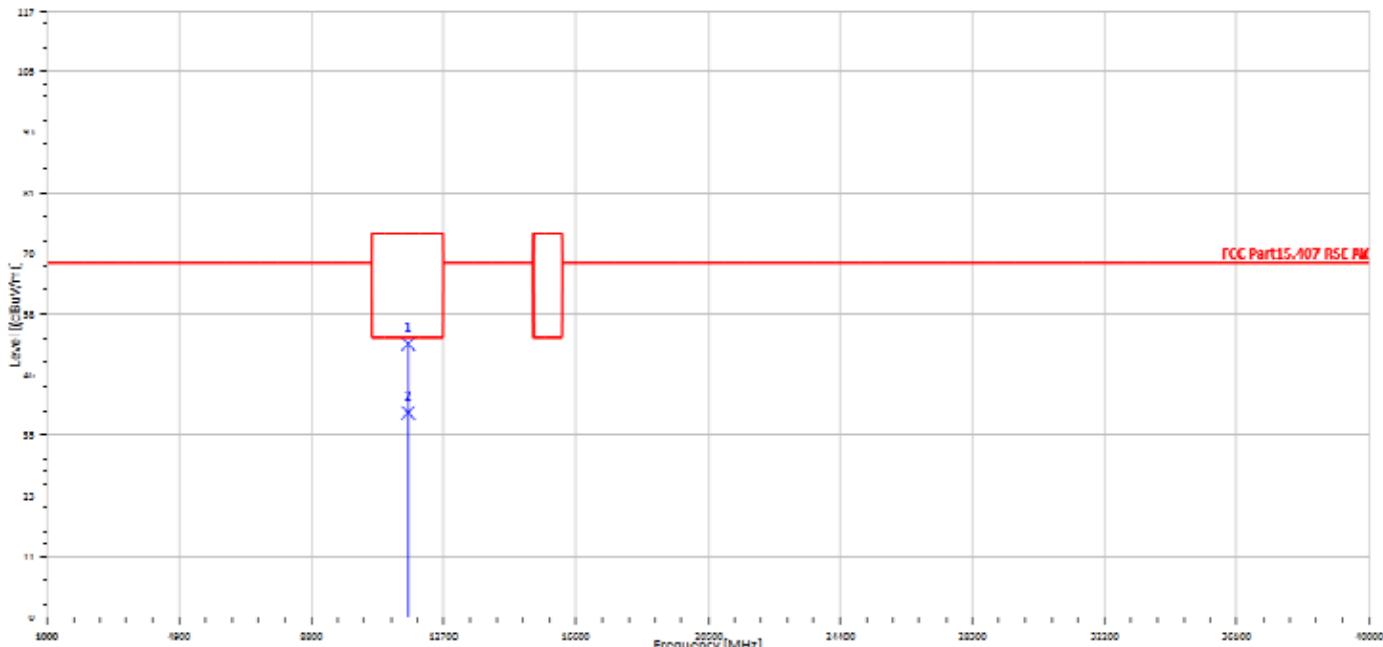
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Operation Band :802.11 a
 Fundamental Frequency :5825 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			PK/QP/AV	dB μ V				
11650.00	H	Peak	42.07	10.69	52.76	74	52.76	-21.24
11650.00	H	Average	28.78	10.69	39.47	54	39.47	-14.53

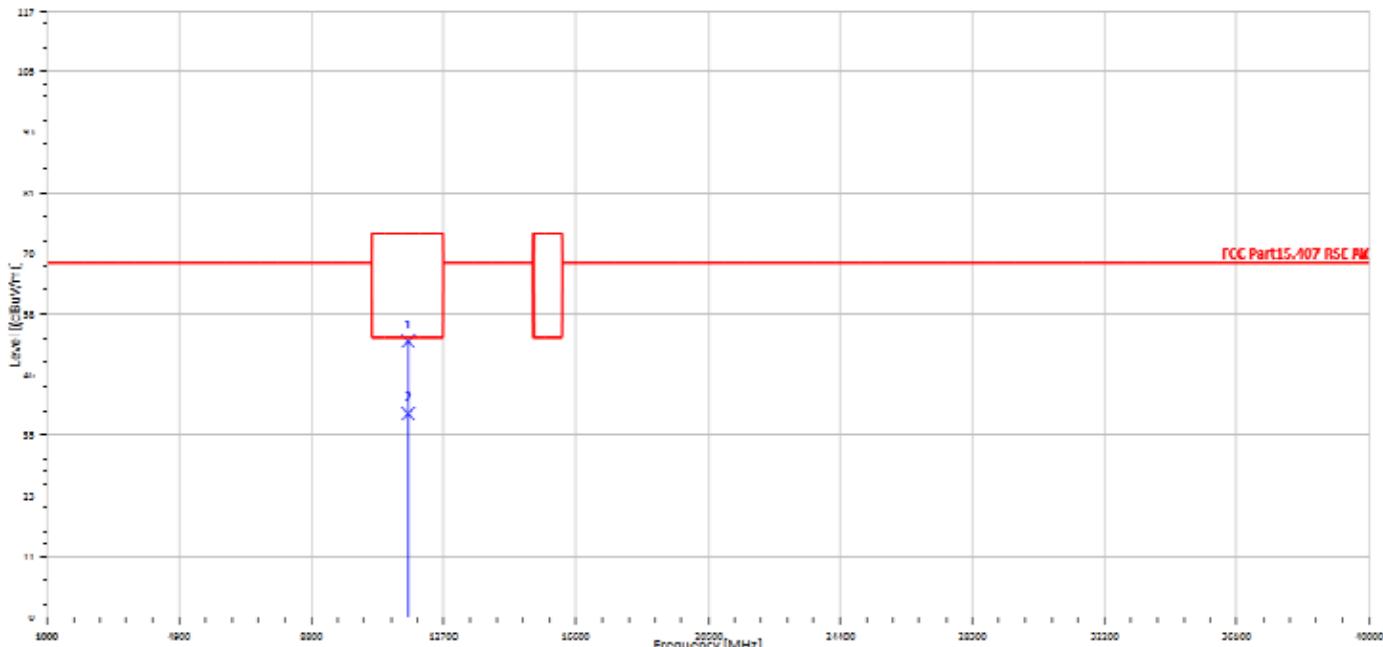
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Operation Band :802.11 a
 Fundamental Frequency :5825 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			Peak	42.58				
11650.00	H	Peak	42.58	10.69	53.27	74	53.27	-20.73
11650.00	H	Average	28.60	10.69	39.29	54	39.29	-14.71

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Band edge falling to restricted band

Operation Band :802.11 a
Fundamental Frequency :5745 MHz
Operation Mode :Band Edge LOW
EUT Pol. :H Plan

Test Date :2015-09-24
Temp./Humi. :26.5 deg_C / 50 RH
Engineer :Vito
Measurement Antenna Pol. :VERTICAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5725.00	E	Peak	60.04	0.69	60.72	78.2	-17.48	

Operation Band :802.11 a
Fundamental Frequency :5745 MHz
Operation Mode :Band Edge LOW
EUT Pol. :H Plan

Test Date :2015-09-24
Temp./Humi. :26.5 deg_C / 50 RH
Engineer :Vito
Measurement Antenna Pol. :HORIZONTAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5725.00	E	Peak	58.19	0.69	58.88	78.2	-19.32	

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Operation Band :802.11 a
Fundamental Frequency :5825 MHz
Operation Mode :Band Edge HIGH
EUT Pol. :H Plan

Test Date :2015-09-24
Temp./Humi. :26.5 deg_C / 50 RH
Engineer :Vito
Measurement Antenna Pol. :VERTICAL

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
					FS	@3m	dB
5850.00	E	Peak	53.53	1.01	54.54	78.2	-23.66

Operation Band :802.11 a
Fundamental Frequency :5825 MHz
Operation Mode :Band Edge HIGH
EUT Pol. :H Plan

Test Date :2015-09-24
Temp./Humi. :26.5 deg_C / 50 RH
Engineer :Vito
Measurement Antenna Pol. :HORIZONTAL

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
					FS	@3m	dB
5850.00	E	Peak	52.47	1.01	53.48	78.2	-24.72

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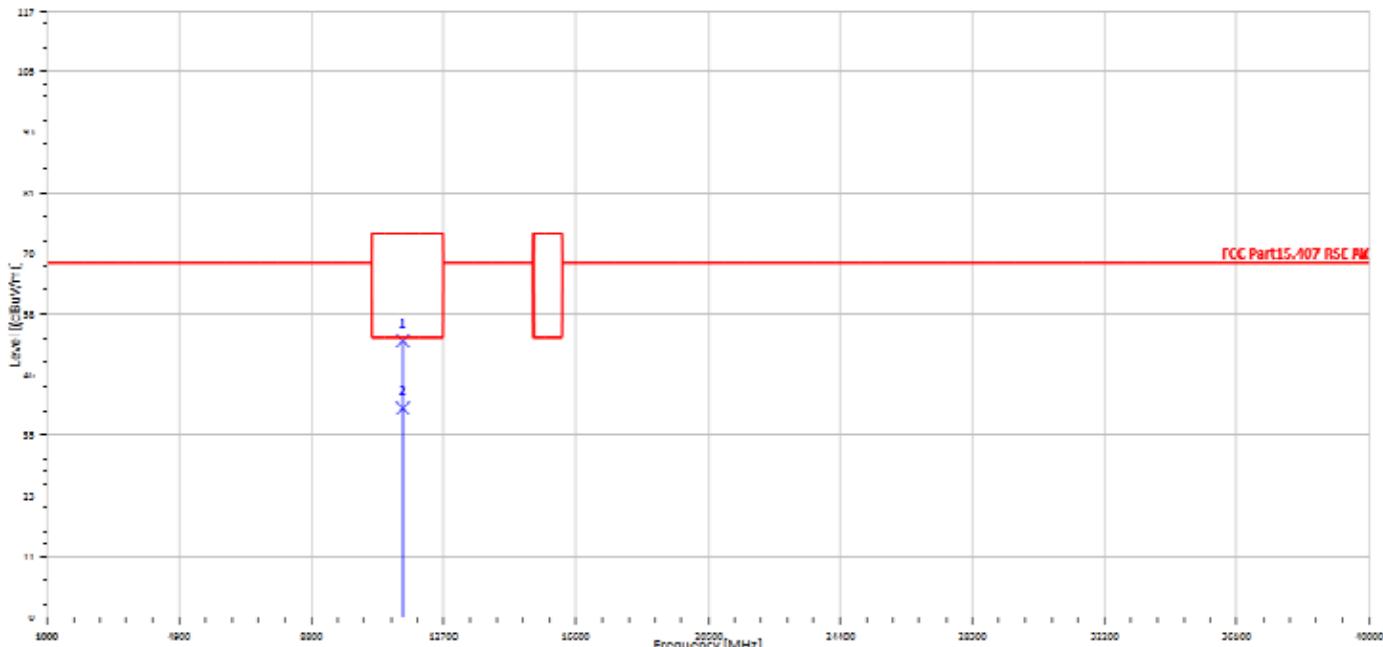
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Radiated Spurious Emission Measurement Result 802.11n HT20, 5725~5850 MHz (MIMO)

Operation Band :802.11 n20M Test Date :2015-09-24
 Fundamental Frequency :5745 MHz Temp./Humi. :26.5 deg_C / 50 RH
 Operation Mode :TX LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			PK/QP/AV	dB μ V				
11490.00	H	Peak	42.21	11.18	53.39	74	53.39	-20.61
11490.00	H	Average	29.17	11.18	40.35	54	40.35	-13.65

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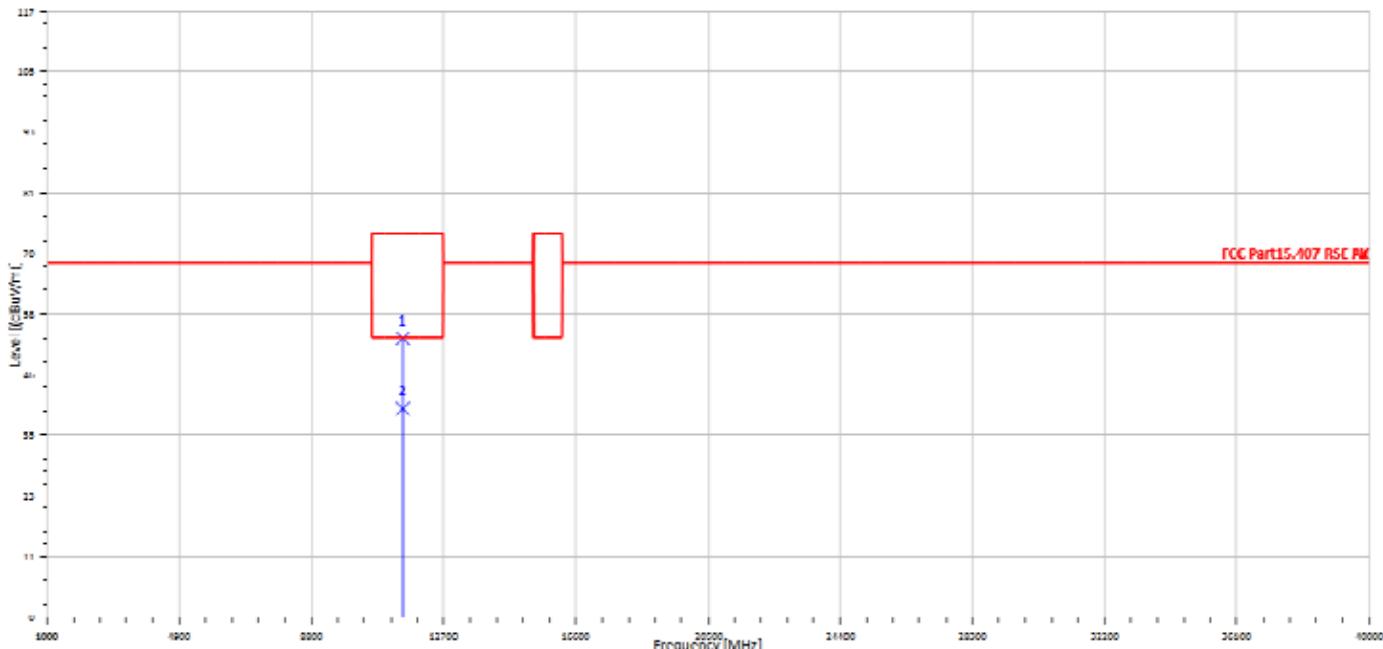
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Operation Band :802.11 n20M
 Fundamental Frequency :5745 MHz
 Operation Mode :TX LOW
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			PK/QP/AV	dB μ V				
11490.00	H	Peak	42.68	11.18	53.85	74	-20.15	
11490.00	H	Average	29.09	11.18	40.27	54	-13.73	

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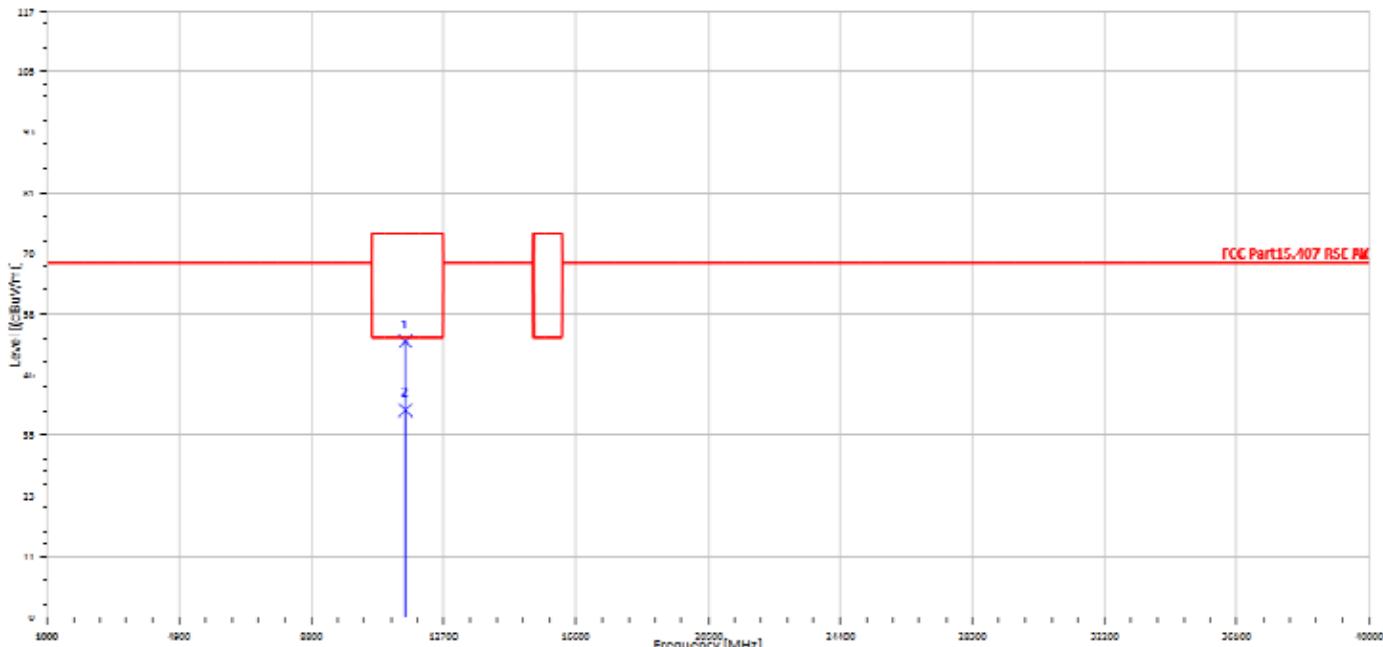
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Operation Band :802.11 n20M
 Fundamental Frequency :5785 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			Peak	42.74				
11570.00	H	Peak	42.74	11.06	53.81	74	53.81	-20.19
11570.00	H	Average	28.90	11.06	39.96	54	39.96	-14.04

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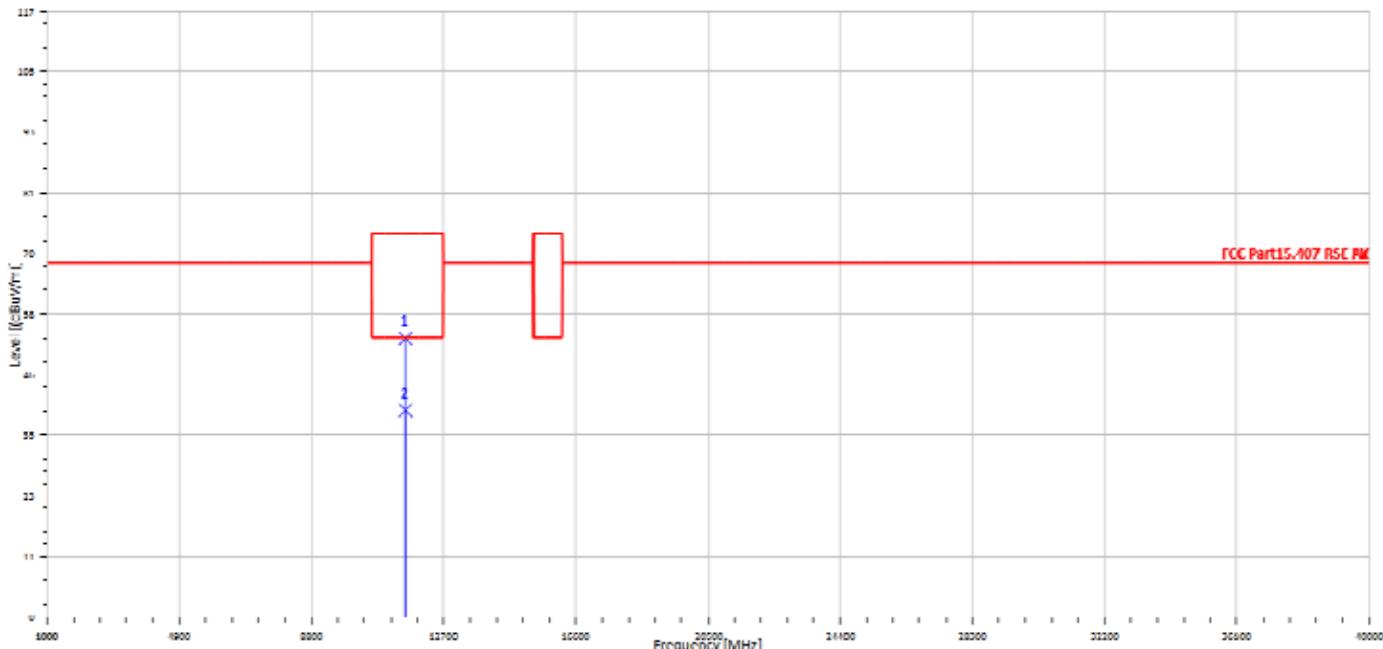
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Operation Band :802.11 n20M
 Fundamental Frequency :5785 MHz
 Operation Mode :TX MID
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			Peak	42.74				
11570.00	H	Peak	42.74	11.06	53.81	74	53.81	-20.19
11570.00	H	Average	28.90	11.06	39.96	54	39.96	-14.04

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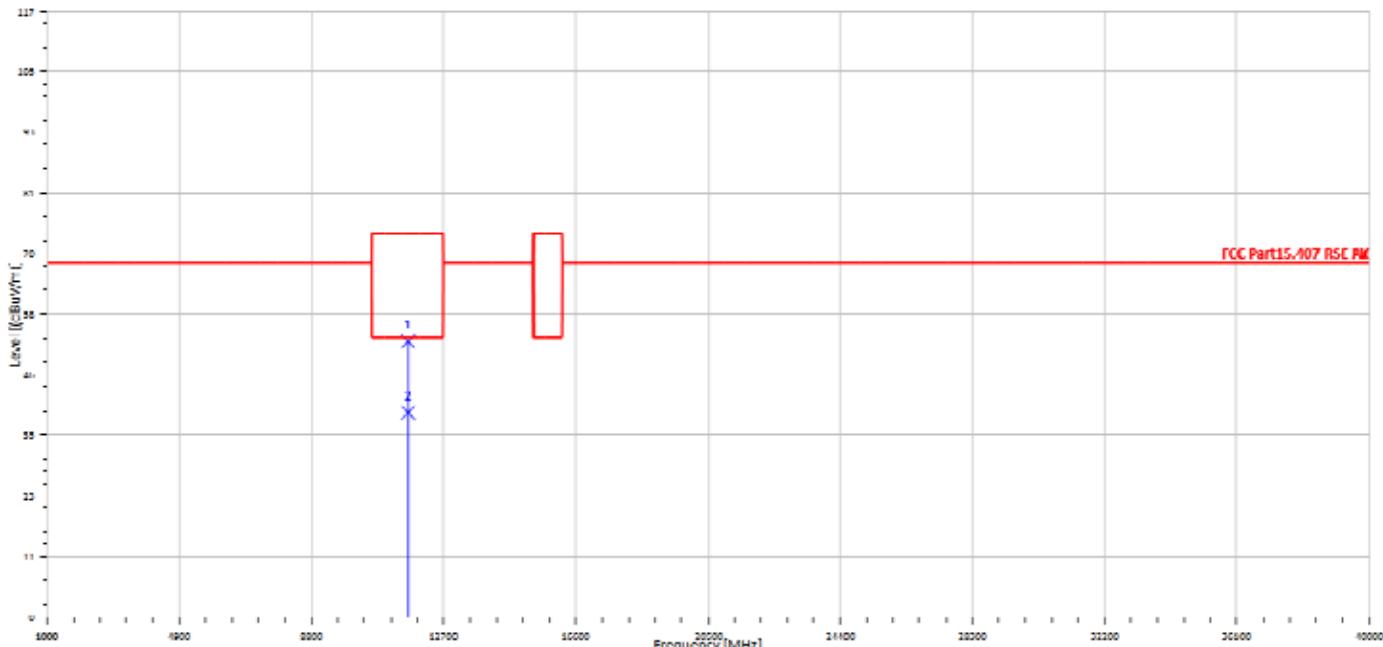
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Operation Band :802.11 n20M
 Fundamental Frequency :5825 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			Peak	42.54				
11650.00	H	Peak	42.54	10.69	53.23	74	-20.77	
11650.00	H	Average	28.81	10.69	39.50	54	-14.50	

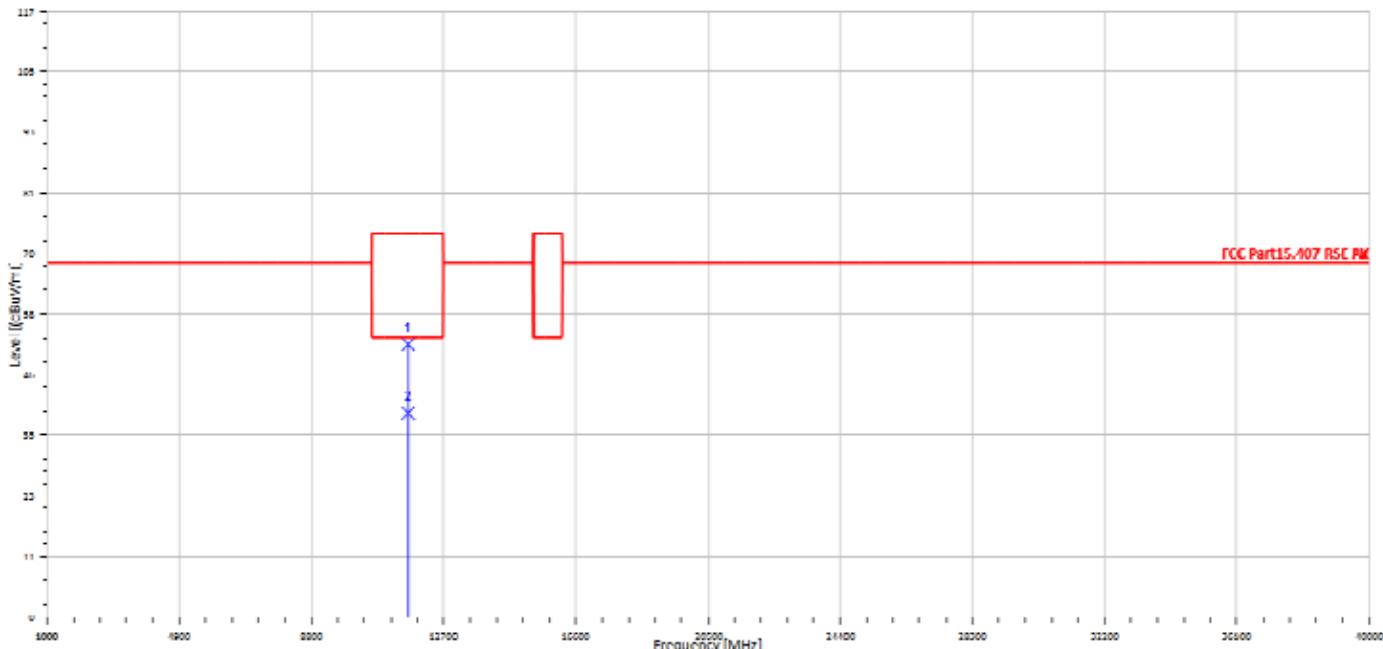
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Operation Band :802.11 n20M
 Fundamental Frequency :5825 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :26.5 deg_C / 50 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			Peak	Average				
11650.00	H	Peak	41.98		10.69	52.67	74	-21.33
11650.00	H	Average		28.71	10.69	39.40	54	-14.60

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Band edge falling to restricted band

Operation Band :802.11 n20M Test Date :2015-09-24
 Fundamental Frequency :5745 MHz Temp./Humi. :26.5 deg_C / 50 RH
 Operation Mode :Band Edge LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	dB
5725.00	E	Peak	60.27	0.69	60.96	78.2	-17.24	

Operation Band :802.11 n20M Test Date :2015-09-24
 Fundamental Frequency :5745 MHz Temp./Humi. :26.5 deg_C / 50 RH
 Operation Mode :Band Edge LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :HORIZONTAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	dB
5725.00	E	Peak	61.67	0.69	62.36	78.2	-15.84	

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Operation Band :802.11 n20M Test Date :2015-09-24
Fundamental Frequency :5825 MHz Temp./Humi. :26.5 deg_C / 50 RH
Operation Mode :Band Edge HIGH Engineer :Vito
EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5850.00	E	Peak	53.80	1.01	54.81	78.2	-23.39	

Operation Band :802.11 n20M Test Date :2015-09-24
Fundamental Frequency :5825 MHz Temp./Humi. :26.5 deg_C / 50 RH
Operation Mode :Band Edge HIGH Engineer :Vito
EUT Pol. :H Plan Measurement Antenna Pol. :HORIZONTAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5850.00	E	Peak	55.58	1.01	56.59	78.2	-21.61	

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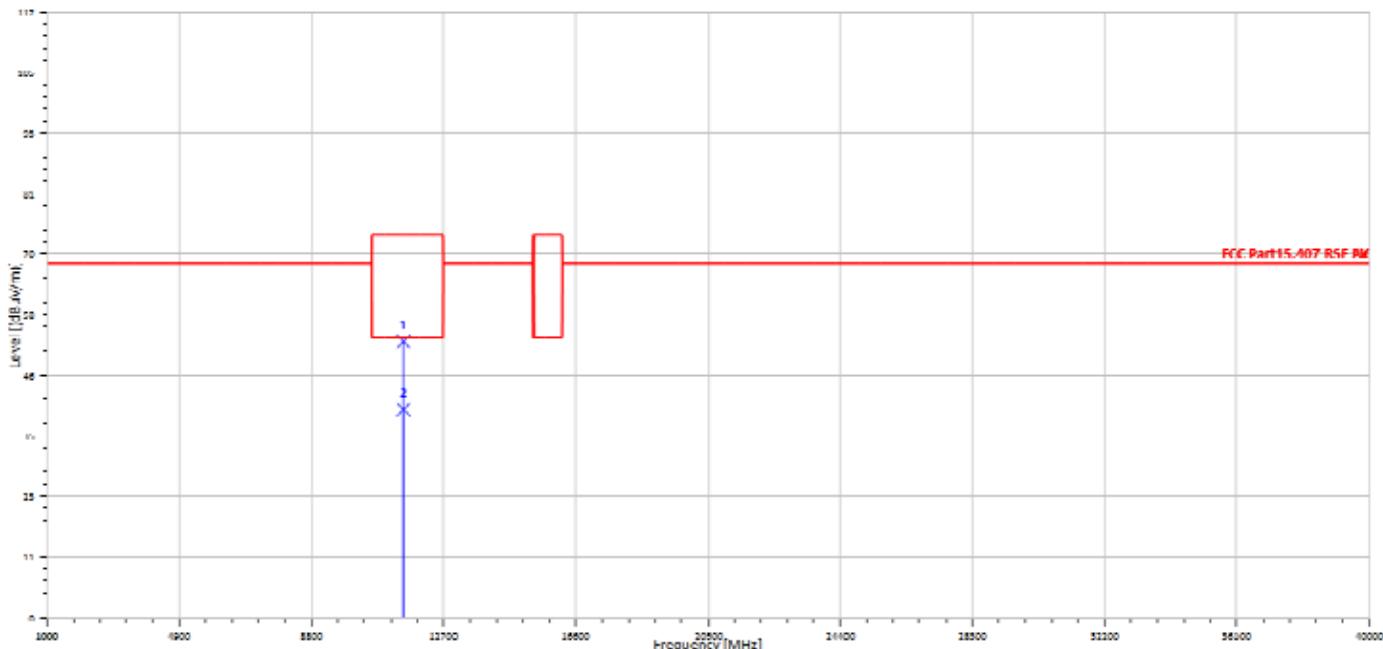
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Radiated Spurious Emission Measurement Result 802.11n HT40, 5725~5850 MHz (MIMO)

Operation Band :802.11 n40M Test Date :2015-09-24
 Fundamental Frequency :5755 MHz Temp./Humi. :23deg_C / 58 RH
 Operation Mode :TX LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
			PK/QP/AV	dBμV				
11510.00	H	Peak	42.12	11.12	53.24	74	54	-20.76
11510.00	H	Average	29.00	11.12	40.12	54	54	-13.88

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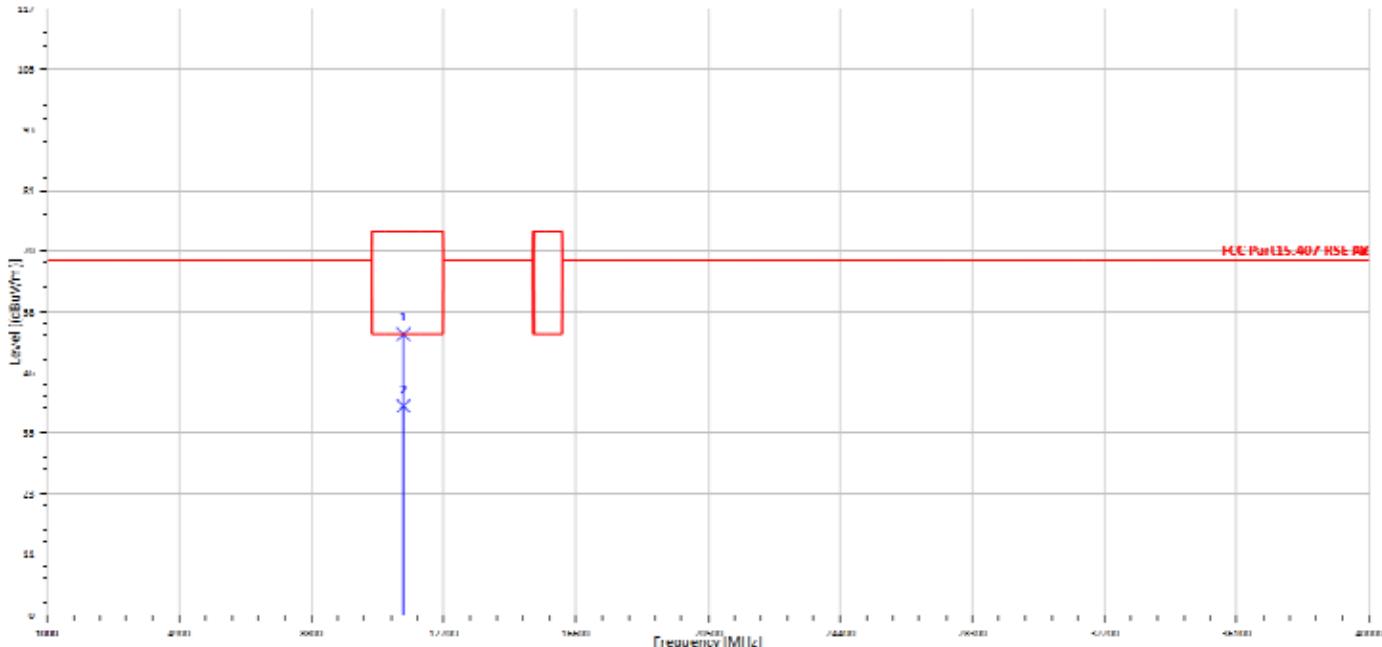
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Operation Band :802.11 n40M
 Fundamental Frequency :5755 MHz
 Operation Mode :TX LOW
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :23deg_C / 58 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level		Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
			Level dBµV	Level dBµV				
11510.00	H	Peak	42.89	11.12	54.01	74	54.01	-19.99
11510.00	H	Average	29.05	11.12	40.17	54	40.17	-13.83

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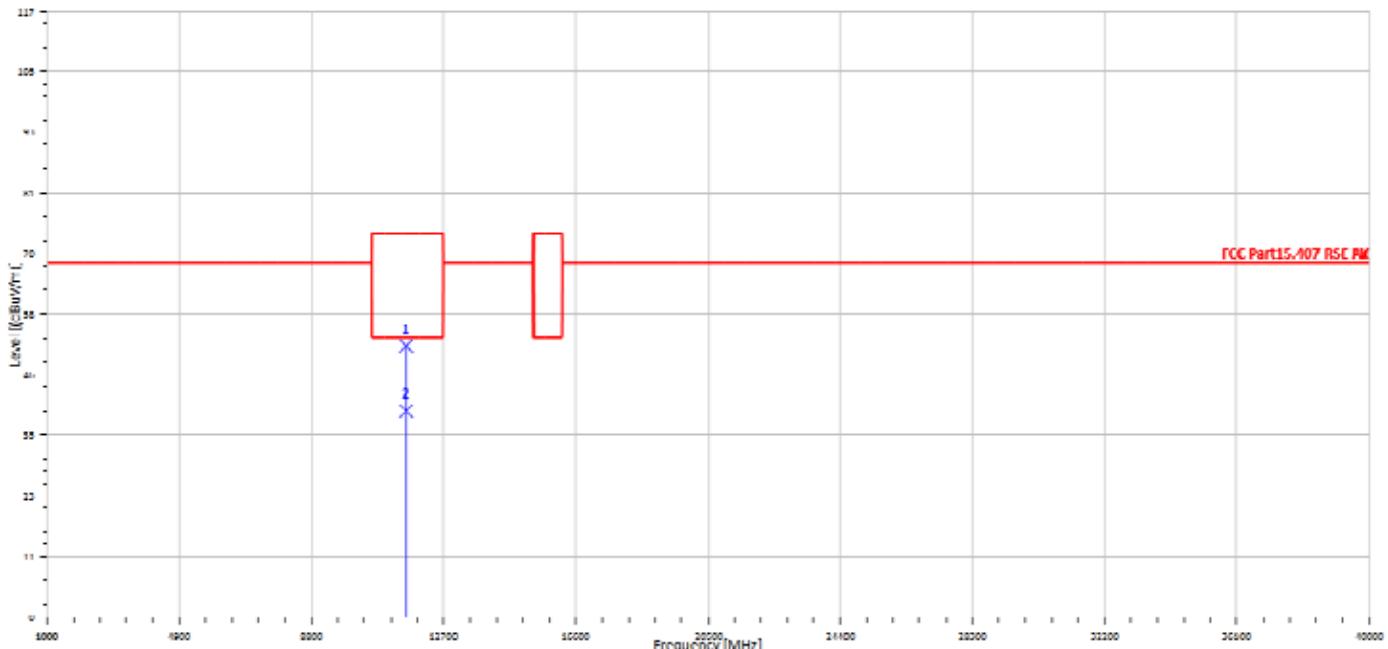
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Operation Band :802.11 n40M
 Fundamental Frequency :5795 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :23deg_C / 58 RH
 Engineer :Vito
 Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			PK/QP/AV	dB μ V				
11590.00	H	Peak	41.33	11.05	52.38	74	-21.62	
11590.00	H	Average	28.78	11.05	39.83	54	-14.17	

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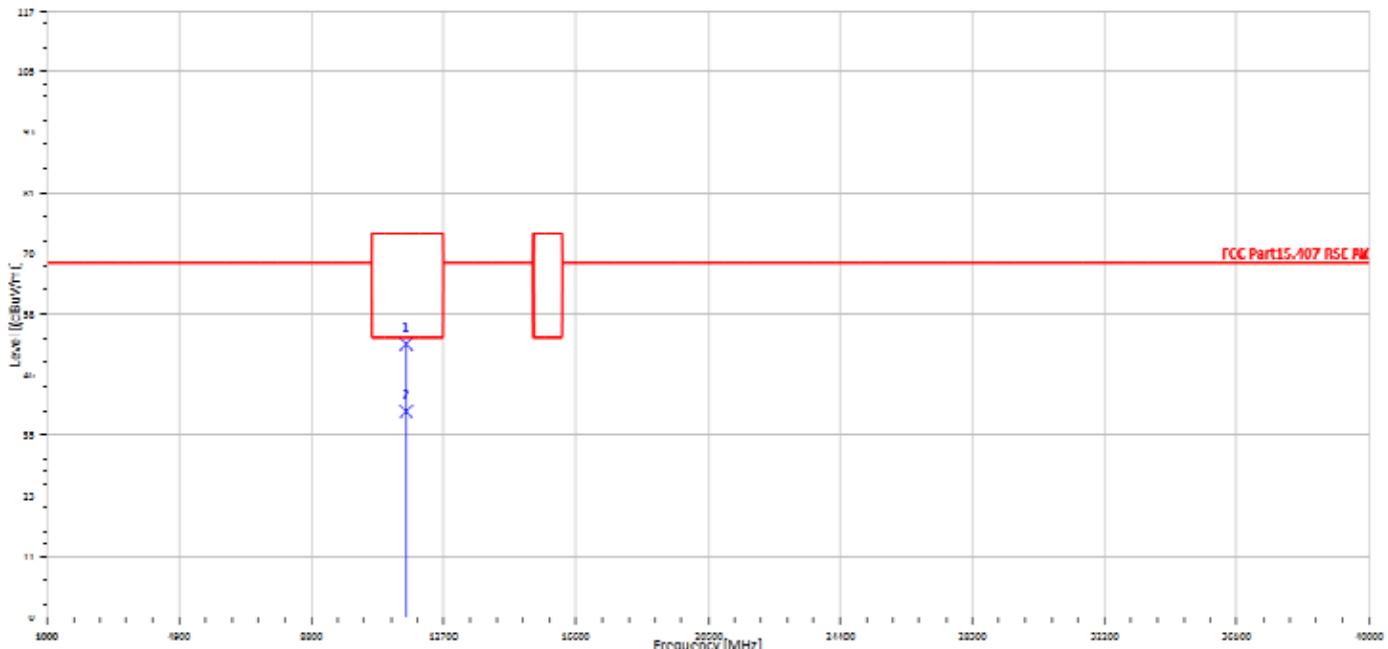
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Operation Band :802.11 n40M
 Fundamental Frequency :5795 MHz
 Operation Mode :TX HIGH
 EUT Pol. :H Plan

Test Date :2015-09-24
 Temp./Humi. :23deg_C / 58 RH
 Engineer :Vito
 Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level		Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
			PK/QP/AV	dB μ V				
11590.00	H	Peak		41.66	11.05	52.71	74	-21.29
11590.00	H	Average		28.65	11.05	39.70	54	-14.30

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Band edge falling to restricted band

Operation Band :802.11 n40M Test Date :2015-09-24
 Fundamental Frequency :5755 MHz Temp./Humi. :23deg_C / 58 RH
 Operation Mode :Band Edge LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5714.70	S	Peak	65.44	0.63	66.08	68.3	-2.22	
5718.30	S	Peak	71.67	0.65	72.32	78.2	-5.88	
5725.00	E	Peak	70.80	0.69	71.49	78.2	-6.71	

Operation Band :802.11 n40M Test Date :2015-09-24
 Fundamental Frequency :5755 MHz Temp./Humi. :23deg_C / 58 RH
 Operation Mode :Band Edge LOW Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :HORIZONTAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5714.80	S	Peak	64.02	0.63	64.66	68.3	-3.64	
5718.10	S	Peak	70.15	0.65	70.80	78.2	-7.40	
5725.00	E	Peak	69.40	0.69	70.08	78.2	-8.12	

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Operation Band :802.11 n40M Test Date :2015-09-24
 Fundamental Frequency :5795 MHz Temp./Humi. :23deg_C / 58 RH
 Operation Mode :Band Edge HIGH Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :VERTICAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	dB
5850.00	E	Peak	52.82	1.01	53.83	78.2	-24.37	

Operation Band :802.11 n40M Test Date :2015-09-24
 Fundamental Frequency :5795 MHz Temp./Humi. :23deg_C / 58 RH
 Operation Mode :Band Edge HIGH Engineer :Vito
 EUT Pol. :H Plan Measurement Antenna Pol. :HORIZONTAL

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	dB
5850.00	E	Peak	52.47	1.01	53.48	78.2	-24.72	

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12. TRANSMISSION IN THE ABSENCE OF DATA

12.1 Standard Applicable

According to §15.407(c)

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

12.2 Result

No non-compliance noted:

Refer to the theory of operation.

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13. FREQUENCY STABILITY

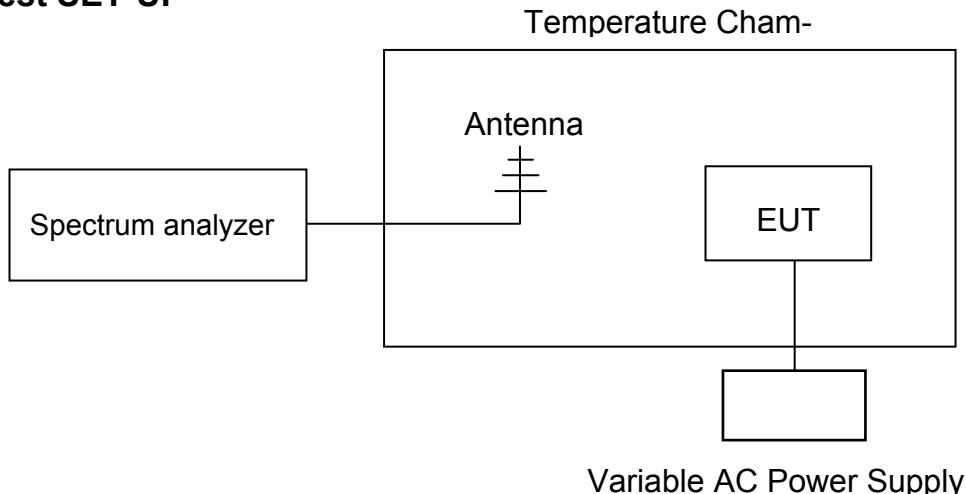
13.1 Standard Applicable

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

13.2 Measurement Procedure

1. The EUT was placed inside temperature chamber and powered and powered by nominal DC voltage.
2. Set EUT as normal operation.
3. Turn the EUT on and couple its output to spectrum.
4. Turn the EUT off and set the chamber to the highest temperature specified.
5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.
6. Repeat step with the temperature chamber set to the lowest temperature.

13.3 Test SET-UP



13.4 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016
Temperature Chamber	TERCHY	MHG-120LF	911009	05/06/2015	05/05/2016
AC Power Supply	APW-105N	887592	All Power	N/A	N/A

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13.5 Measurement Result

Operation Mode	TX	Test Date	2015.09.18
Temperature	17	Test By	Vito
Humidity	65 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
0	12.4V	36	5180.0000	5,179.95436	0.00000881
		44	5220.0000	5,219.95451	0.00000871
		48	5240.0000	5,239.95459	0.00000867
		149	5745.0000	5,744.95080	0.00000856
		157	5785.0000	5,784.94934	0.00000876
		165	5825.0000	5,824.94895	0.00000876
	9.7V	36	5180.0000	5,179.95536	0.00000862
		44	5220.0000	5,219.95468	0.00000868
		48	5240.0000	5,239.95506	0.00000858
		149	5745.0000	5,744.95038	0.00000864
		157	5785.0000	5,784.95024	0.00000860
		165	5825.0000	5,824.94894	0.00000877
25	10.8V	36	5180.0000	5,179.95396	0.00000889
		44	5220.0000	5,219.95382	0.00000885
		48	5240.0000	5,239.95363	0.00000885
		149	5745.0000	5,744.94910	0.00000886
		157	5785.0000	5,784.94853	0.00000890
		165	5825.0000	5,824.94842	0.00000885
40	12.4V	36	5180.0000	5,179.95374	0.00000893
		44	5220.0000	5,219.95245	0.00000911
		48	5240.0000	5,239.95261	0.00000904
		149	5745.0000	5,744.94732	0.00000917
		157	5785.0000	5,784.94827	0.00000894
		165	5825.0000	5,824.94724	0.00000906
	9.7V	36	5180.0000	5,179.95300	0.00000907
		44	5220.0000	5,219.95241	0.00000912
		48	5240.0000	5,239.95273	0.00000902
		149	5745.0000	5,744.94837	0.00000899
		157	5785.0000	5,784.94664	0.00000922
		165	5825.0000	5,824.94842	0.00000885

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14. ANTENNA REQUIREMENT

14.1 Standard Applicable

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

According to §15.407, If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

14.2 Antenna Connected Construction

An embedded-in antenna design is used.

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

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

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15. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

15.1 Standard Applicable

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

This is a Mobile device, the MPE is required.

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

Limits for Maximum Permissive Exposure (MPE)

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

F = frequency in MHz

* = Plane-wave equipment power density

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15.2 Maximum Permissible Exposure (MPE) Evaluation

Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5180	10.35	10.839	23.98
5220	10.78	11.697	23.98
5240	10.35	10.839	23.98

MPE Prediction (802.11a 5150~5250)

Prediction of MPE limit at a given distance

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

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

Where: S = Power density

P = Power input to antenna

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

R = Distance to the center of radiation of the antenna

Maximum average output power at antenna input	10.78	(dBm)
Maximum average output power at antenna input	11.967405	(mW)
Duty cycle:	98.2	(%)
Maximum Pav :	11.751992	(mW)
Antenna gain (Maximum):	3.71	(dBi)
Antenna gain (linear):	2.3496328	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5220	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0054962	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0055mW/cm². This is below the uncontrolled exposure limit of 1mW/cm² at 5220MHz.

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Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5180	12.08	16.157	23.26
5220	13.55	22.623	23.26
5240	11.35	13.562	23.26

MPE Prediction (802.11n HT20 5150~5250)

Prediction of MPE limit at a given distance

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

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

Where: S = Power density

P = Power input to antenna

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

R = Distance to the center of radiation of the antenna

Maximum average output power at antenna input	13.55	(dBm)
Maximum average output power at antenna input	22.646443	(mW)
Duty cycle:	96.7	(%)
Maximum Pav :	21.89911	(mW)
Antenna gain (Maximum):	6.72	(dBi)
Antenna gain (linear):	4.6989411	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5220	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0204822	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0205mW/cm². This is below the uncontrolled exposure limit of 1mW/cm² at 5220MHz.

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Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5190	11.59	14.413	23.26
5230	11.66	14.648	23.26

MPE Prediction (802.11n HT40 5150~5250)

Prediction of MPE limit at a given distance

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

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

Where: S = Power density

P = Power input to antenna

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

R = Distance to the center of radiation of the antenna

Maximum average output power at antenna input	11.66	(dBm)
Maximum average output power at antenna input	14.655478	(mW)
Duty cycle:	78.7	(%)
Maximum Pav :	11.533862	(mW)
Antenna gain (Maximum):	6.72	(dBi)
Antenna gain (linear):	4.6989411	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5230	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0107876	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0108mW/cm². This is below the uncontrolled exposure limit of 1mW/cm² at 5230MHz.

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Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5745	8.75	7.499	30
5785	9.20	8.318	30
5825	10.21	10.495	30

MPE Prediction (802.11a 5725~5850)

Prediction of MPE limit at a given distance

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

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

Where: S = Power density

P = Power input to antenna

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

R = Distance to the center of radiation of the antenna

Maximum average output power at antenna input	10.21	(dBm)
Maximum average output power at antenna input	10.495424	(mW)
Duty cycle:	98.2	(%)
Maximum Pav :	10.306507	(mW)
Antenna gain (Maximum):	5.02	(dBi)
Antenna gain (linear):	3.1768741	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5825	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0065172	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0065mW/cm². This is below the uncontrolled exposure limit of 1mW/cm² at 5825MHz.

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Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5745	10.29	10.685	27.97
5785	10.34	10.822	27.97
5825	11.33	13.951	27.97

MPE Prediction (802.11n HT20 5725~5850)

Prediction of MPE limit at a given distance

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

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

Where: S = Power density

P = Power input to antenna

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

R = Distance to the center of radiation of the antenna

Maximum average output power at antenna input	11.33	(dBm)
Maximum average output power at antenna input	13.583134	(mW)
Duty cycle:	96.7	(%)
Maximum Pav :	13.134891	(mW)
Antenna gain (Maximum):	8.03	(dBi)
Antenna gain (linear):	6.3533093	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5825	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0166103	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0166mW/cm². This is below the uncontrolled exposure limit of 1mW/cm² at 5825MHz.

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Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (dBm)
5755	10.05	10.127	27.97
5795	10.38	10.910	27.97

MPE Prediction (802.11n HT40 5725~5850)

Prediction of MPE limit at a given distance

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

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

Where: S = Power density

P = Power input to antenna

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

R = Distance to the center of radiation of the antenna

Maximum average output power at antenna input	10.38	(dBm)
Maximum average output power at antenna input	10.914403	(mW)
Duty cycle:	78.7	(%)
Maximum Pav :	8.5896354	(mW)
Antenna gain (Maximum):	8.03	(dBi)
Antenna gain (linear):	6.3533093	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5795	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0108624	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0109mW/cm². This is below the uncontrolled exposure limit of 1mW/cm² at 5795MHz.

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