

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.407

Report Reference No.....: **A150J166117-WLAN2**

FCC ID.....: **2AE4C-M210**

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Date of issue.....: July 27, 2015

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Testing Laboratory Name: Dongguan Dongdian Testing Service Co.,Ltd

Address: No.17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China

Applicant's name.....: **HwaCom Systems Inc.**

Address: 11Fl., No.108, Sec. 1, Hsin-Tai-Wu Rd., Hsi-Chih District, New Taipei City 221, Taiwan, R.O.C.

Test specification

Standard: **FCC Part 15.407: UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE DEVICES**

TRF Originator: Shenzhen CTL Electron Technology Co., Ltd.

Master TRF: Dated 2012-06

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Test item description: IP Set top box

Trade Mark: HawCom

Model/Type reference.....: M210

Listed Models: HC-J3600

Manufacturer: **Zhuhai Gotech Intelligent Technology Co., Ltd.**

Operation Frequency.....: From 5180MHz to 5240MHz/From 5725MHz to 5850MHz

Rating: DC 12.0V Adapter from AC 120V/60Hz

Result.....: **PASS**

TEST REPORT

Test Report No. :	A150J166117-WLAN2	July 27, 2015
		Date of issue

Equipment under Test : IP Set top box

Model /Type : M210

Listed Models : HC-J3600

Applicant : **HwaCom Systems Inc.**

Address : 11Fl., No.108, Sec. 1, Hsin-Tai-Wu Rd., Hsi-Chih District, New Taipei City 221, Taiwan, R.O.C.

Manufacturer : **Zhuhai Gotech Intelligent Technology Co., Ltd.**

Address : 66 Yongda Road, Hongqi Town, Jinwan District, Zhuhai, China

Test Result:	PASS
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1. TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15.407](#): UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE DEVICES.

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices

[KDB 789033 D02](#): GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL

INFORAMTION INFRASTRUCTURE (U-NII) DEVICES PART 15, SUBPART E

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	July 05, 2015
Testing commenced on	:	July 06, 2015
Testing concluded on	:	July 27, 2015

2.2. Product Description

The **HwaCom Systems Inc.**'s Model: M210 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	IP Set top box
Model Number	M210, HC-J3600
FCC ID	2AE4C-M210
WLAN	Supported 802.11b/802.11g/802.11n/802.11a
Bluetooth	Supported BT 4.0+EDR
Antenna Type	Internal
WLAN FCC Operation frequency	IEEE 802.11b: 2412MHz—2462MHz IEEE 802.11g: 2412MHz—2462MHz IEEE 802.11n HT20: 2412MHz—2462MHz/5150MHz—5250MHz/5725MHz—5850MHz IEEE 802.11a: 5150MHz—5250MHz/5725MHz—5850MHz
Bluetooth FCC Operation frequency	2402MHz-2480MHz
WLAN Modulation	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11a OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)
Bluetooth Modulation	EDR(GFSK,8DPSK, $\pi/4$ DQPSK)/BLE(GFSK)

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	<input type="radio"/>	120V / 60 Hz	<input type="radio"/>	115V / 60Hz
		<input type="radio"/>	12 V DC	<input type="radio"/>	24 V DC
		<input checked="" type="radio"/>	Other (specified in blank below)		

DC 12.0V Adapter from AC 120V/60Hz

2.4. Short description of the Equipment under Test (EUT)

2.4GHz (IP Set top box (M/N: M210))

For more details, refer to the user's manual of the EUT.

2.5. EUT operation mode

The application provider specific test software to control sample in continuous TX and RX

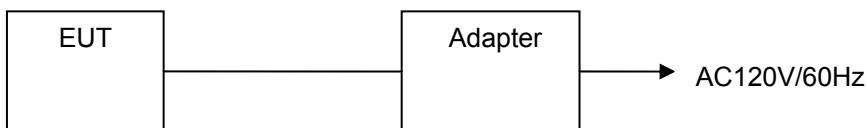
IEEE 802.11a/b/g/n: Thirteen channels are provided to the EUT.

UNII-1		UNII-1		UNII-1	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	38	5190	42	5210
40	5200	46	5230		
44	5220				
48	5240				

UNII-3		UNII-3		UNII-3	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	151	5755	155	5775
153	5765	159	5795		
157	5785				
161	5805				
165	5825				

2.6. Block Diagram of Test Setup

Fig. 2-1 Configuration of Tested System



Adapter:

MODEL:KNC010D-120100V
 INPUT:100-240V~0.3A 50/60Hz 0.4A Max
 OUTPUT: 12V DC 1A
 ◇ Shielded ◆ Unshielded

2.7. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AE4C-M210** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.8. Modifications

No modifications were implemented to meet testing criteria.

2.9. NOTE

- The EUT is a IP Set top box with WLAN and Bluetooth function,The functions of the EUT listed as below:

	Test Standards	Reference Report
WLAN-2.4GHz	FCC Part 15 Subpart C	A150J166117-WLAN1
WLAN-5.8GHz	FCC Part 15 Subpart E	A150J166117-WLAN2
Bluetooth-EDR	FCC Part 15 Subpart C	A150J166117-EDR
Bluetooth-BLE	FCC Part 15 Subpart C	A150J166117-BLE
MPE	FCC Per 47 CFR 2.1091(b)	A150J166117-MPE

- The frequency bands used in this EUT are listed as follows:

Frequency Band(MHz)	2400-2483.5	5150-5350	5470-5725	5725-5850
802.11a	—	✓	—	✓
802.11b	✓	—	—	—
802.11g	✓	—	—	—
802.11n HT20MHz	✓	✓	—	✓
802.11n HT40MHz	—	—	—	—

3. The EUT incorporates a SISO function, Physically, the EUT provides one completed transmitter and one completed receiver.

Modulation Mode	TX Function
802.11a	1TX
802.11b	1TX
802.11g	1TX
802.11n HT20MHz	1TX
802.11n HT40MHz	—

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Dongguan Dongdian Testing Service Co.,Ltd

No.17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Donguan City, Guangdong Province, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2003) and CISPR Publication 22.

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

IC Registration No.: 10288A-1

The 3m alternate test site of Dongguan Dongdian Testing Service Co.,Ltd EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 10288A-1 on May, 2012.

FCC-Registration No.: 270092

Dongguan Dongdian Testing Service Co.,Ltd EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 270092, Mar, 2015.

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 °C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. Test Description

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Pass	Fail	NA	NP	Remark
§15.203	Antenna gain	802.11a	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	802.11a	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.407(a)	Power spectral density	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.407(a)	Spectrum bandwidth – 26 dB bandwidth	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.407(e)	Spectrum bandwidth – 6 dB bandwidth	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.407(a)	Maximum output power	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.407(b)	Band edge compliance conducted	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Highest	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.407(b)	Band edge compliance radiated	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Highest	8802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies

§15.407(a)	TX spurious emissions conducted	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.407(a)	TX spurious emissions radiated	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	802.11a	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Middle <input checked="" type="checkbox"/> Highest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.407(g)	Frequency Stability	802.11a 802.11n HT20	<input checked="" type="checkbox"/> Lowest <input checked="" type="checkbox"/> Highest	802.11a	<input checked="" type="checkbox"/> Lowest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.109	RX spurious emissions radiated	-/-	-/-	-/-	-/-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.209(a)	TX spurious Emissions radiated < 30 MHz	802.11a	-/-	802.11a	-/-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	802.11a	-/-	802.11a	-/-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies

Remark:

1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Channel
Maximum Peak Conducted Output Power	11a/ OFDM	6 Mbps	36/40/44
Power Spectral Density			
6dB Bandwidth			
26dB Bandwidth			
Spurious RF conducted emission	11g/OFDM	6.5 Mbps	149/157/165
Radiated Emission 9kHz~1GHz&			
Radiated Emission 1GHz~10 th Harmonic			
Band Edge	11a/ OFDM	1 Mbps	36/40/44
	11g/OFDM	6 Mbps	149/157/165

3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Dongguan Dongdian Testing Service Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Dongguan Dongdian Testing Service Co.,Ltd laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	3.16 dB	(1)
Radiated Emission	1~18GHz	2.56 dB	(1)
Radiated Emission	18~40GHz	2.56 dB	(1)
Conducted Disturbance	0.15~30MHz	2.44 dB	(1)

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

3.6. Equipments Used during the Test

Radiated Emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	462	2014/04/12	3 years
2	EMI TEST Receiver	Rohde&Schwarz	ESU8	100316	2014/10/25	1 years
3	EMI TEST Software	Audix	E3	6.111111	N/A	N/A
4	Horn Anternna	EMCO	3116	00060095	2014/04/12	3 years
5	Pre-Amplifer	Rohde&Schwarz	SCU-01	10049	2014/10/25	1 years
6	Pre-Amplifer	A.H.	PAM0-0118	360	2014/10/25	1 years
7	Pre-Amplifer	A.H.	PAM-1840VH	562	2014/10/25	1 years
8	Double Ridged Horn Antenna	Rohde&Schwarz	HF907	100265	2014/04/12	3 years
9	Active Loop Antenna	Schwarz beck	FMZB1519	0.38	2014/04/12	3 years
11	TURNTABLE	MATURO	TT2.0	----	N/A	N/A
12	ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A	N/A
13	Spectrum Analyzer	R&S	FSU26	1166.1660.26	2014/10/25	1 years
14	Spectrum Analyzer	R&S	FSP40	1164.4391.32	2014/10/25	1 years

Maximum Peak Output Power / 26dB Bandwidth / Band Edge Compliance of RF Emission / Spurious RF Conducted Emission/ Power Spectral Density 26dB Bandwidth / Frequency Stability Measurement

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1	Power Sensor	Rohde&Schwarz	NRP-Z81	102638	2014/11/02	1 years
2	Spectrum Analyzer	Agilent	N9030A	MY49430428	2014/11/02	1 years
3	Spectrum Analyzer	R&S	FSP40	1164.4391.32	2014/10/25	1 years

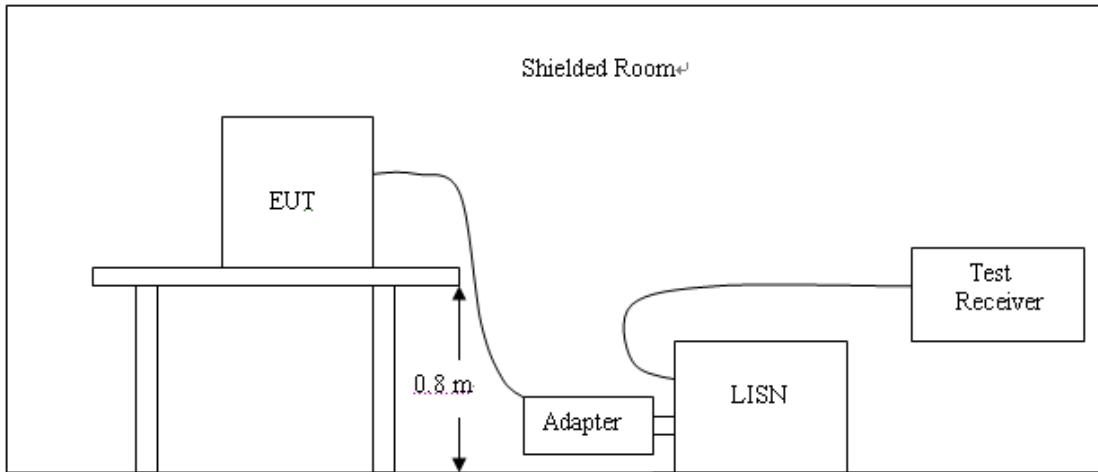
AC Power Conducted Emission

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1	Artificial Mains	Rohde&Schwarz	ENV216	101109	2014/10/25	1 years
2	Artificial Mains	Rohde&Schwarz	ESH3-Z5	100309	2014/10/25	1 years
3	EMI Test Receiver	Rohde&Schwarz	ESU8	100316	2014/10/25	1 years
4	Pulse Limiter	Rohde&Schwarz	ESH3-Z2	101242	2014/10/25	1 years
5	EMI TEST Software	Audix	E3	6.111111	N/A	N/A

4. TEST CONDITIONS AND RESULTS

4.1. AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2013
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
- 4 The EUT received DC12V power from PC, the adapter of PC received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

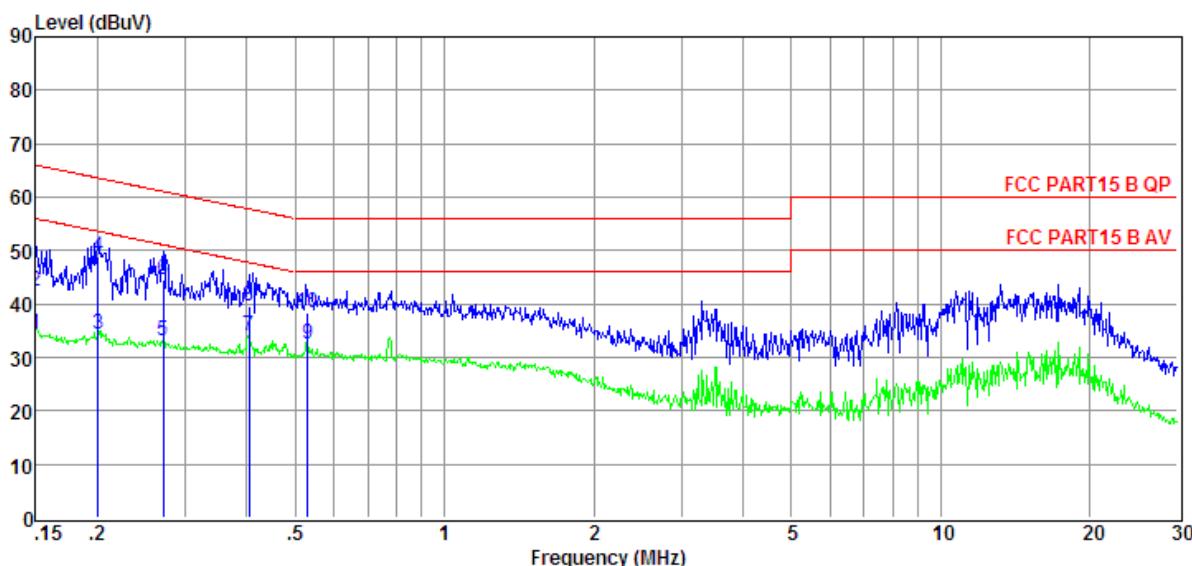
For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

Frequency (MHz)	Maximum RF Line Voltage (dB μ V)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

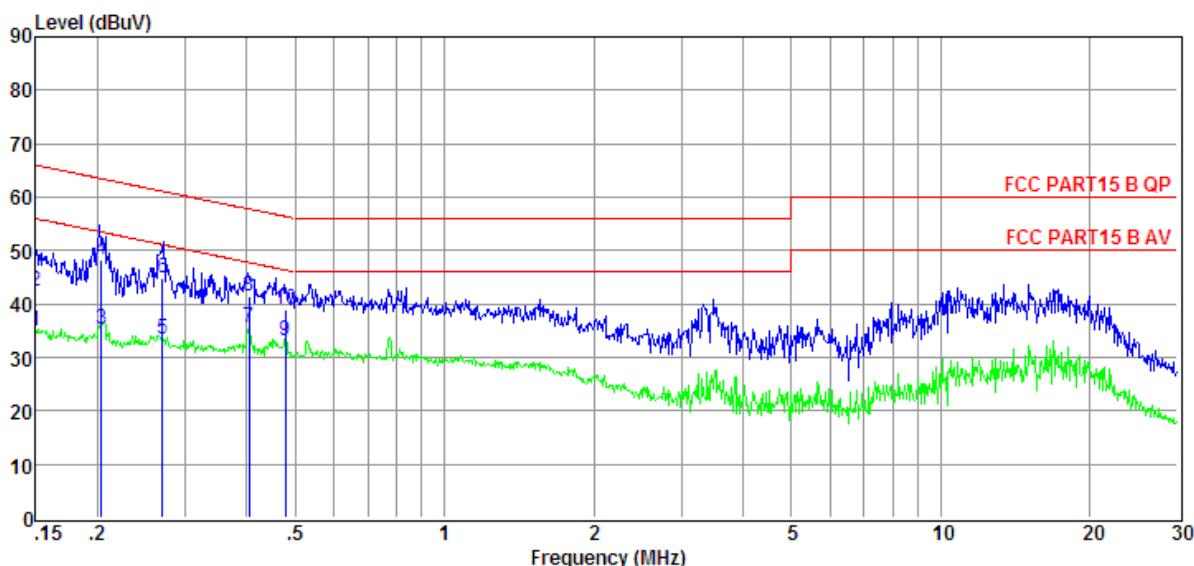
* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

The AC Power Conducted Emission measurement are performed at WLAN Link mode.



Item (Mark)	Freq (MHz)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Pulse Limiter Factor (dB)	Results Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Detector	Phase
1	0.15	15.01	9.60	0.01	9.84	34.46	56.00	-21.54	Average	NEUTRAL
2	0.15	22.91	9.60	0.01	9.84	42.36	66.00	-23.64	QP	NEUTRAL
3	0.20	14.79	9.59	0.02	9.85	34.25	53.58	-19.33	Average	NEUTRAL
4	0.20	29.49	9.59	0.02	9.85	48.95	63.58	-14.63	QP	NEUTRAL
5	0.27	13.59	9.60	0.02	9.85	33.06	51.07	-18.01	Average	NEUTRAL
6	0.27	25.19	9.60	0.02	9.85	44.66	61.07	-16.41	QP	NEUTRAL
7	0.40	14.61	9.61	0.03	9.86	34.11	47.77	-13.66	Average	NEUTRAL
8	0.40	20.11	9.61	0.03	9.86	39.61	57.77	-18.16	QP	NEUTRAL
9	0.53	12.87	9.61	0.04	9.87	32.39	46.00	-13.61	Average	NEUTRAL
10	0.53	18.72	9.61	0.04	9.87	38.24	56.00	-17.76	QP	NEUTRAL



Item (Mark)	Freq (MHz)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Pulse Limiter Factor (dB)	Results Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Detector	Phase
1	0.15	15.61	9.61	0.01	9.84	35.07	56.00	-20.93	Average	LINE
2	0.15	22.91	9.61	0.01	9.84	42.37	66.00	-23.63	QP	LINE
3	0.20	15.89	9.62	0.02	9.85	35.38	53.45	-18.07	Average	LINE
4	0.20	28.89	9.62	0.02	9.85	48.38	63.45	-15.07	QP	LINE
5	0.27	14.00	9.62	0.02	9.85	33.49	51.12	-17.63	Average	LINE
6	0.27	25.50	9.62	0.02	9.85	44.99	61.12	-16.13	QP	LINE
7	0.40	16.05	9.63	0.03	9.86	35.57	47.77	-12.20	Average	LINE
8	0.40	22.05	9.63	0.03	9.86	41.57	57.77	-16.20	QP	LINE
9	0.48	13.56	9.63	0.03	9.87	33.09	46.36	-13.27	Average	LINE
10	0.48	19.59	9.63	0.03	9.87	39.12	56.36	-17.24	QP	LINE

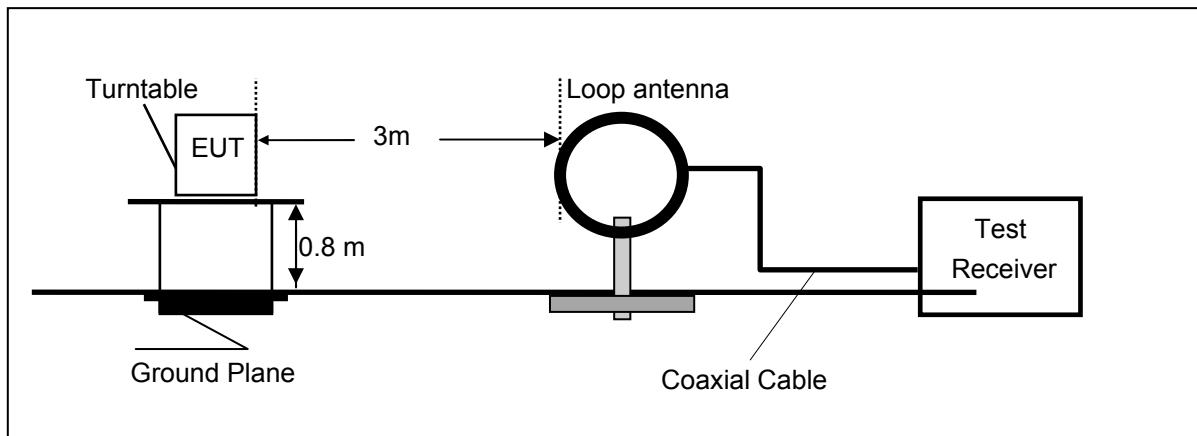
Note:

1. Result Level = Read Level + LISN Factor + Pulse Limiter Factor + Cable loss.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz), Step size: 4 kHz, Scan time: auto.

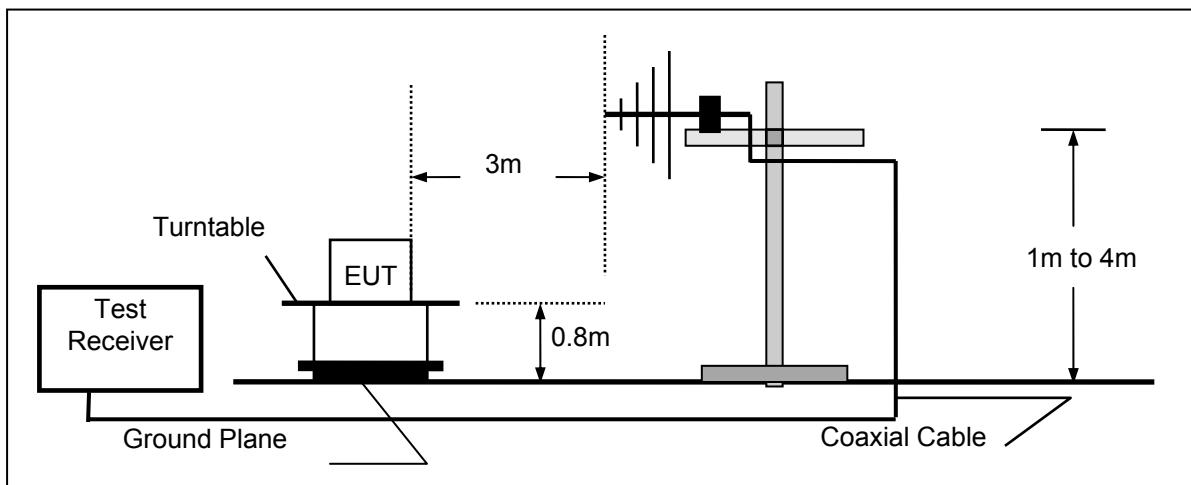
4.2. Radiated Emission

TEST CONFIGURATION

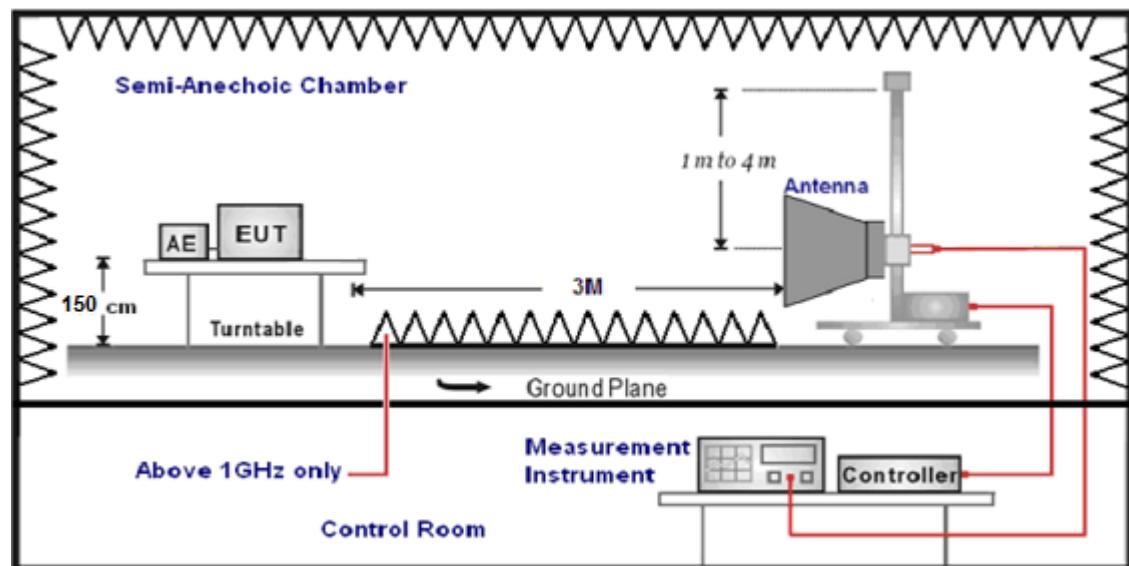
Frequency range 9KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-40GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane for below 1GHz and 1.5m above 1GHz.

2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0°C to 360°C to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 24MHz and maximum operation frequency was 5825MHz.so radiated emission test frequency band from 9KHz to 40GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-40GHz	Horn Antenna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

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	

For example

Frequency (MHz)	FS (dB μ V/m)	RA (dB μ V/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

$$\text{Transd} = \text{AF} + \text{CL} - \text{AG}$$

RADIATION LIMIT

According to §15.407 (b): Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits

Frequency (MHz)	EIRP Limit (dBm)	Equivalent Field Strength at 3m (dB μ V/m)
5150-5250	-27	68.3
5250-5350	-27	68.3
5470-5725	-27	68.3
5725-5850	-27 (beyond 10MHz of the bandedge)	68.3
	-17 (within 10 MHz of band edge)	78.3

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dB μ V/m)	Radiated (μ V/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

Remark: 1. We tested WLAN IEEE 802.11b Link mode for below 1G;

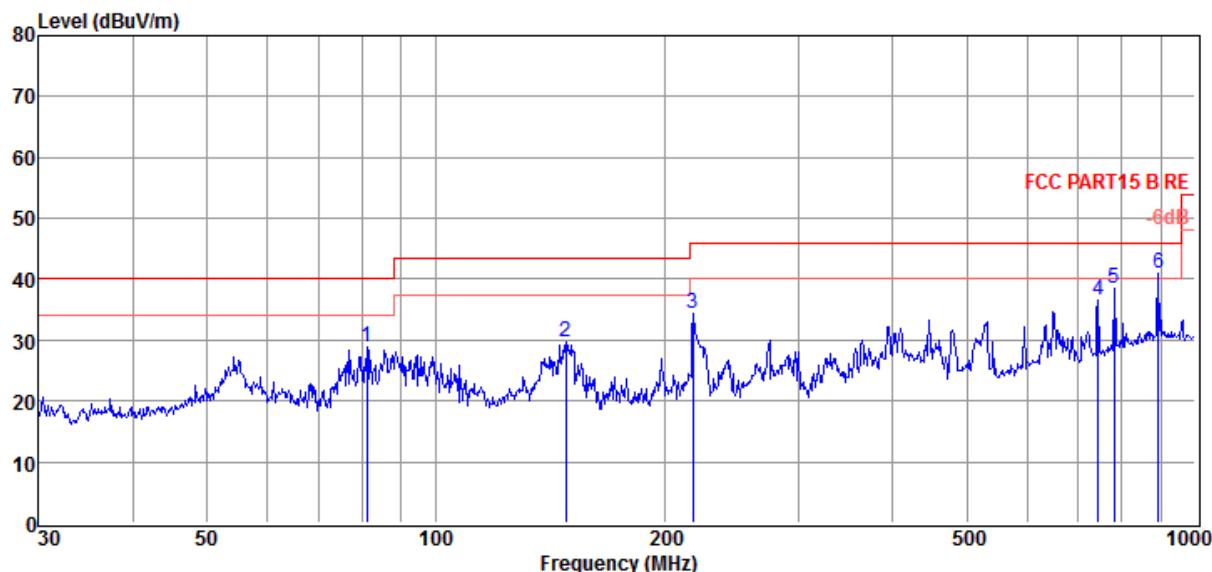
For 9KHz to 30MHz

Frequency (MHz)	Corrected Reading (dB μ V/m)@3m	FCC Limit (dB μ V/m) @3m	Over Limit (dB)	Detector
---	---	---	---	QP

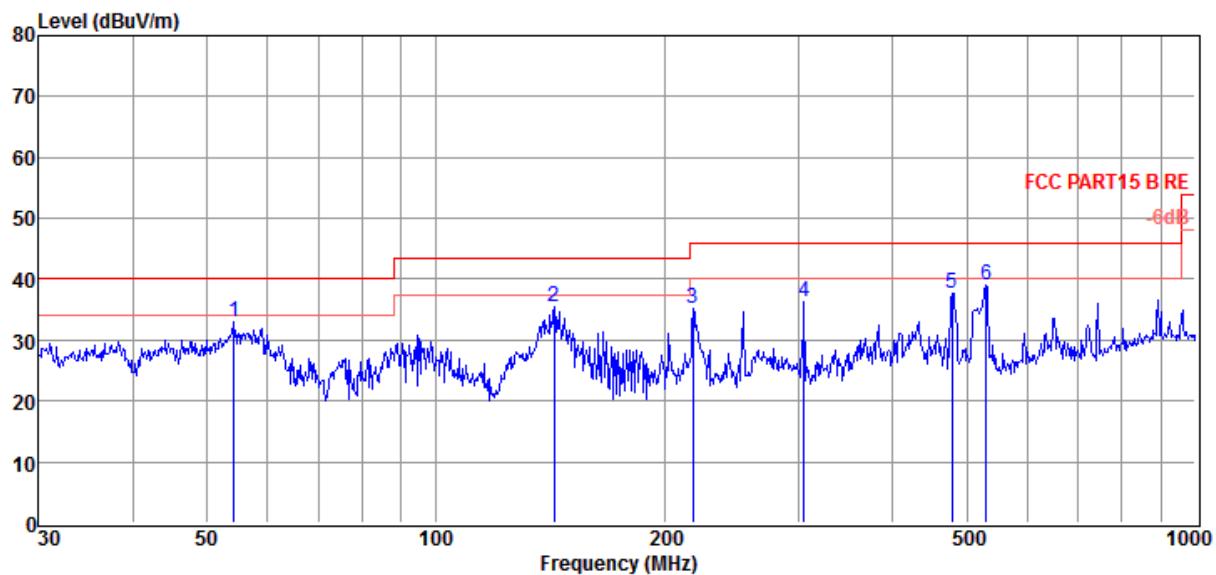
Remark:

1. Over Limit = Emission level - Limit value
2. “---” states emission level at least lower than limit 20dB, so without recorded any values;

For 30MHz to 1000MHz



Item (Mark)	Frequency (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	81.21	18.41	9.15	1.36	28.92	40.00	-11.08	QP	HORIZONTAL
2	148.44	19.35	8.67	1.79	29.81	43.50	-13.69	QP	HORIZONTAL
3	218.31	21.36	10.90	2.20	34.46	46.00	-11.54	QP	HORIZONTAL
4	744.87	12.62	19.33	4.52	36.47	46.00	-9.53	QP	HORIZONTAL
5	782.35	13.59	20.17	4.66	38.42	46.00	-7.58	QP	HORIZONTAL
6	893.86	14.02	22.03	4.95	41.00	46.00	-5.00	QP	HORIZONTAL



Item (Mark)	Frequency (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	54.26	17.69	14.20	1.09	32.98	40.00	-7.02	QP	VERTICAL
2	143.33	24.96	8.83	1.72	35.51	43.50	-7.99	QP	VERTICAL
3	218.31	22.21	10.90	2.20	35.31	46.00	-10.69	QP	VERTICAL
4	305.68	20.16	13.50	2.72	36.38	46.00	-9.62	QP	VERTICAL
5	478.85	18.18	15.98	3.62	37.78	46.00	-8.22	QP	VERTICAL
6	530.10	18.87	16.51	3.73	39.11	46.00	-6.89	QP	VERTICAL

Remark:

1. Over Limit = Emission level - Limit value
2. “---” states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.

For 1GHz to 40GHz**802.11a Mode@ Low Channel @ Channel 36 @ 5180 MHz**

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	10360.00	36.97	38.55	33.64	11.24	53.12	74.00	-20.88	Peak	Horizontal
1	15540.00	28.41	36.49	36.53	13.72	42.09	54.00	-11.91	AV ^[1]	Horizontal
2	10360.00	38.92	38.55	33.64	11.24	55.07	74.00	-18.93	Peak	Horizontal
2	15540.00	29.87	36.49	36.53	13.72	43.55	54.00	-10.45	AV ^[1]	Horizontal

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	10360.00	35.49	38.55	33.64	11.24	51.64	74.00	-22.36	Peak	Vertical
1	15540.00	26.29	36.49	36.53	13.72	39.97	54.00	-14.03	AV ^[1]	Vertical
2	10360.00	37.23	38.55	33.64	11.24	53.38	74.00	-20.62	Peak	Vertical
2	15540.00	27.38	36.49	36.53	13.72	41.06	54.00	-12.94	AV ^[1]	Vertical

802.11a Mode@ Middle Channel @ Channel 40 @ 5200 MHz

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	10400.00	40.49	38.55	33.64	11.36	56.76	74.00	-17.24	Peak	Horizontal
1	15600.00	32.02	36.49	36.53	13.91	45.89	54.00	-8.11	AV ^[1]	Horizontal
2	10400.00	42.97	38.55	33.64	11.36	59.24	74.00	-14.76	Peak	Horizontal
2	15600.00	32.85	36.49	36.53	13.91	46.72	54.00	-7.28	AV ^[1]	Horizontal

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	10400.00	38.17	38.55	33.64	11.36	54.44	74.00	-19.56	Peak	Vertical
1	15600.00	29.51	36.49	36.53	13.91	43.38	54.00	-10.62	AV ^[1]	Vertical
2	10400.00	40.34	38.55	33.64	11.36	56.61	74.00	-17.39	Peak	Vertical
2	15600.00	30.92	36.49	36.53	13.91	44.79	54.00	-9.21	AV ^[1]	Vertical

802.11a Mode@ High Channel @ Channel 48 @ 5240 MHz

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	10480.00	38.07	38.55	33.64	11.41	54.39	74.00	-19.61	Peak	Horizontal
1	15720.00	28.41	36.49	36.53	13.98	42.35	54.00	-11.65	AV ^[1]	Horizontal
2	10480.00	40.29	38.55	33.64	11.41	56.61	74.00	-17.39	Peak	Horizontal
2	15720.00	30.23	36.49	36.53	13.98	44.17	54.00	-9.83	AV ^[1]	Horizontal

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	10480.00	36.11	38.55	33.64	11.41	52.43	74.00	-21.57	Peak	Vertical
1	15720.00	27.72	36.49	36.53	13.98	41.66	54.00	-12.34	AV ^[1]	Vertical
2	10480.00	37.65	38.55	33.64	11.41	53.97	74.00	-20.03	Peak	Vertical
2	15720.00	27.45	36.49	36.53	13.98	41.39	54.00	-12.61	AV ^[1]	Vertical

802.11a Mode@ Low Channel @ Channel 149 @ 5745 MHz

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	11490.00	39.51	38.46	33.92	11.59	55.64	74.00	-18.36	Peak	Horizontal
1	17235.00	23.87	43.11	37.11	13.94	43.81	54.00	-10.19	AV ^[1]	Horizontal
2	11490.00	41.55	38.46	33.92	11.59	57.68	74.00	-16.32	Peak	Horizontal
2	17235.00	24.32	43.11	37.11	13.94	44.26	54.00	-9.74	AV ^[1]	Horizontal

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	11490.00	36.81	38.46	33.92	11.59	52.94	74.00	-21.06	Peak	Vertical
1	17235.00	21.23	43.11	37.11	13.94	41.17	54.00	-12.83	AV ^[1]	Vertical
2	11490.00	38.81	38.46	33.92	11.59	54.94	74.00	-19.06	Peak	Vertical
2	17235.00	22.29	43.11	37.11	13.94	42.23	54.00	-11.77	AV ^[1]	Vertical

802.11a Mode@ Middle Channel @ Channel 157 @ 5785 MHz

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	11570.00	41.17	38.46	33.92	11.66	57.37	74.00	-16.63	Peak	Horizontal
1	17355.00	26.04	43.11	37.11	14.02	46.06	54.00	-7.94	AV ^[1]	Horizontal
2	11570.00	46.03	38.46	33.92	11.66	62.23	74.00	-11.77	Peak	Horizontal
2	17355.00	29.64	43.11	37.11	14.02	49.66	54.00	-4.34	AV ^[1]	Horizontal

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	11570.00	38.78	38.46	33.92	11.66	54.98	74.00	-19.02	Peak	Vertical
1	17355.00	23.23	43.11	37.11	14.02	43.25	54.00	-10.75	AV ^[1]	Vertical
2	11570.00	42.92	38.46	33.92	11.66	59.12	74.00	-14.88	Peak	Vertical
2	17355.00	24.74	43.11	37.11	14.02	44.76	54.00	-9.24	AV ^[1]	Vertical

802.11a Mode@ High Channel @ Channel 165 @ 5825 MHz

Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	11650.00	41.08	38.46	33.92	11.71	57.33	74.00	-8.25	Peak	Horizontal
1	17475.00	25.57	43.11	37.11	14.18	45.75	54.00	-13.86	AV ^[1]	Horizontal
2	11650.00	43.89	38.46	33.92	11.71	60.14	74.00	-5.22	Peak	Horizontal
2	17475.00	28.60	43.11	37.11	14.18	48.78	54.00	-8.25	AV ^[1]	Horizontal

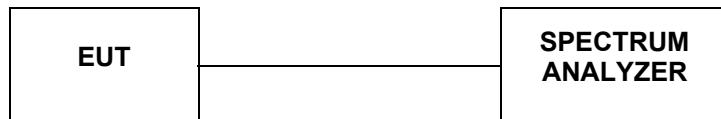
Item (Mark)	Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	11650.00	37.09	38.55	33.64	11.71	53.34	74.00	-20.66	Peak	Vertical
1	17475.00	21.84	36.49	36.53	14.18	42.02	54.00	-11.98	AV ^[1]	Vertical
2	11650.00	39.16	38.55	33.64	11.71	55.41	74.00	-18.59	Peak	Vertical
2	17475.00	24.08	36.49	36.53	14.18	44.26	54.00	-9.74	AV ^[1]	Vertical

REMARKS:

1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. The other emission levels were very low against the limit.
3. Over Limit= Emission Level - Limit.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=10Hz/Sweep time=Auto/Detector=Peak;
6. For Wireless 802.11a mode at 6Mbps.

4.3. Duty Cycle

TEST CONFIGURATION



TEST PROCEDURE

According to KDB789033 D02 General UNII Test Procedures New Rules v01 B Duty Cycle (x), Transmission Duration (T):

- A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on and off times of the transmitted signal
- The zero-span mode on a spectrum analyzer or EMI receiver, if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW \geq EBW if possible; otherwise, set RBW to the largest available value. Set VBW \geq RBW. Set detector = peak or average. The zerospan measurement method shall not be used unless both RBW and VBW are $> 50/T$, where T is defined in section II.B.1.a), and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \leq 16.7$ microseconds.)

TEST RESULTS

For UNII-1 Band

4.3.1 802.11a Test Mode

Channel	Frequency (MHz)	Duty Cycle	Duty factor (dB)	Refer to Plot
36	5180	0.979	0.09	Plot 4.3.1 A
40	5200	0.975	0.11	Plot 4.3.1 B
48	5240	0.979	0.09	Plot 4.3.1 C

4.3.2 802.11n HT20 Test Mode

Channel	Frequency (MHz)	Duty Cycle	Duty factor (dB)	Refer to Plot
36	5180	0.970	0.13	Plot 4.3.2 A
40	5200	0.973	0.12	Plot 4.3.2 B
48	5240	0.978	0.10	Plot 4.3.2 C

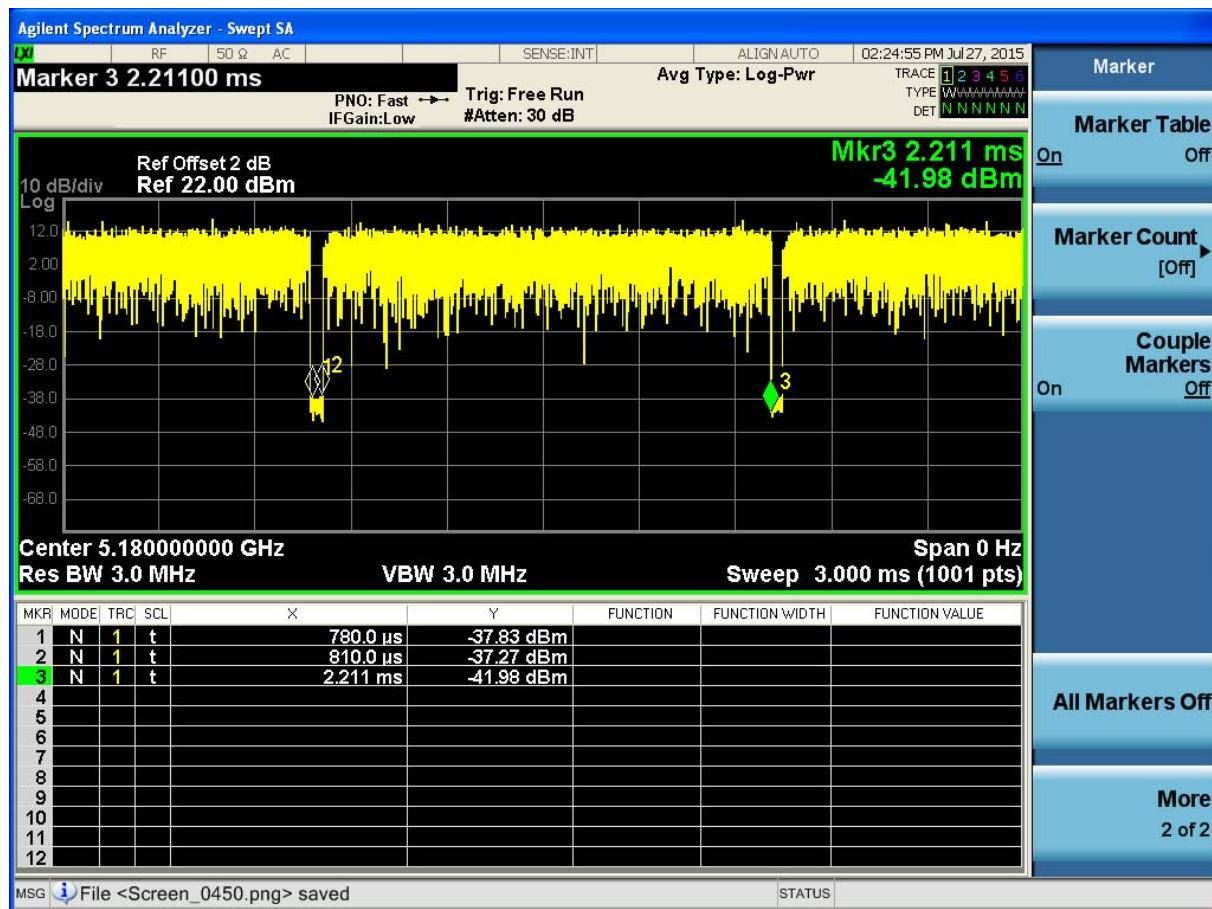
For UNII-3 Band

4.3.3 802.11a Test Mode

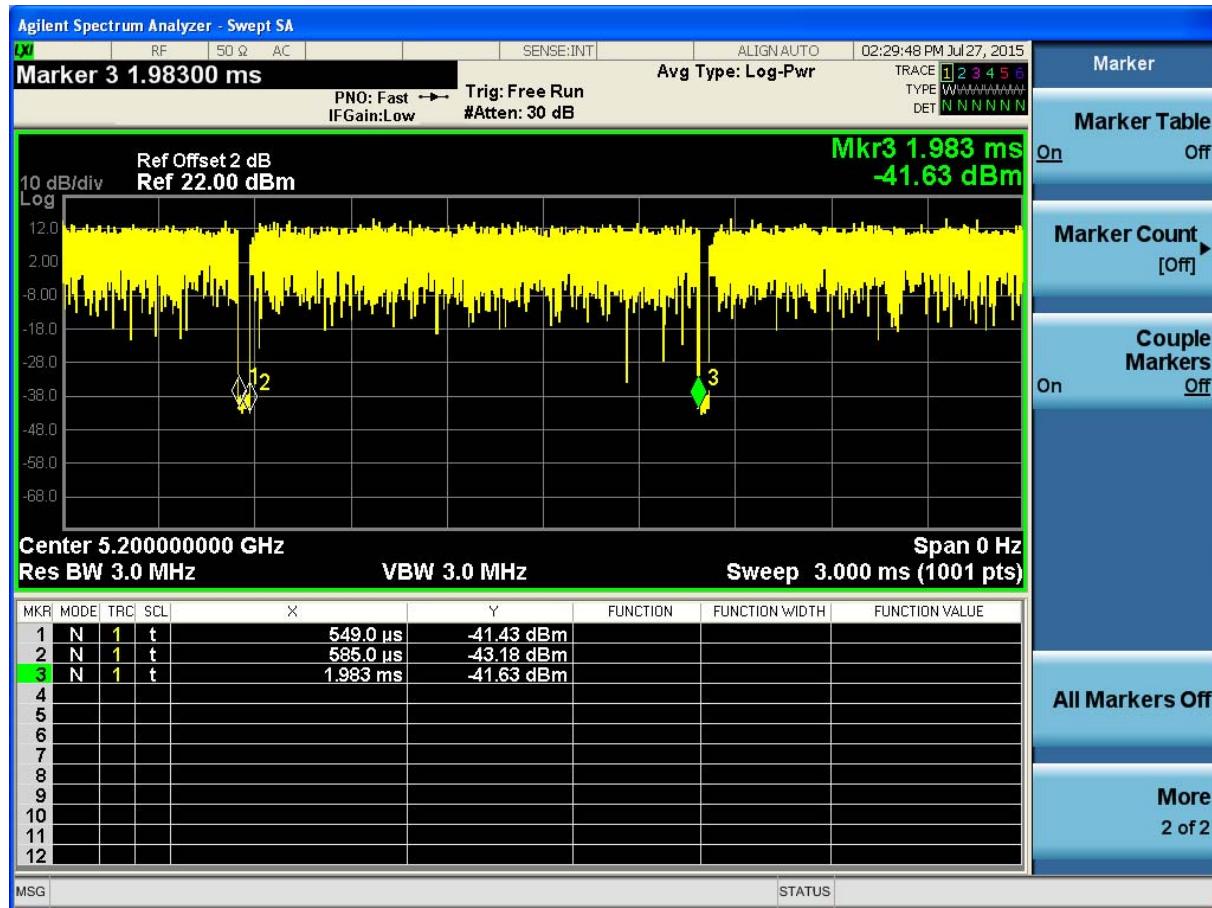
Channel	Frequency (MHz)	Duty Cycle	Duty factor (dB)	Refer to Plot
149	5745	0.978	0.10	Plot 4.3.3 A
157	5785	0.981	0.09	Plot 4.3.3 B
165	5825	0.979	0.09	Plot 4.3.3 C

4.3.4 802.11n HT20 Test Mode

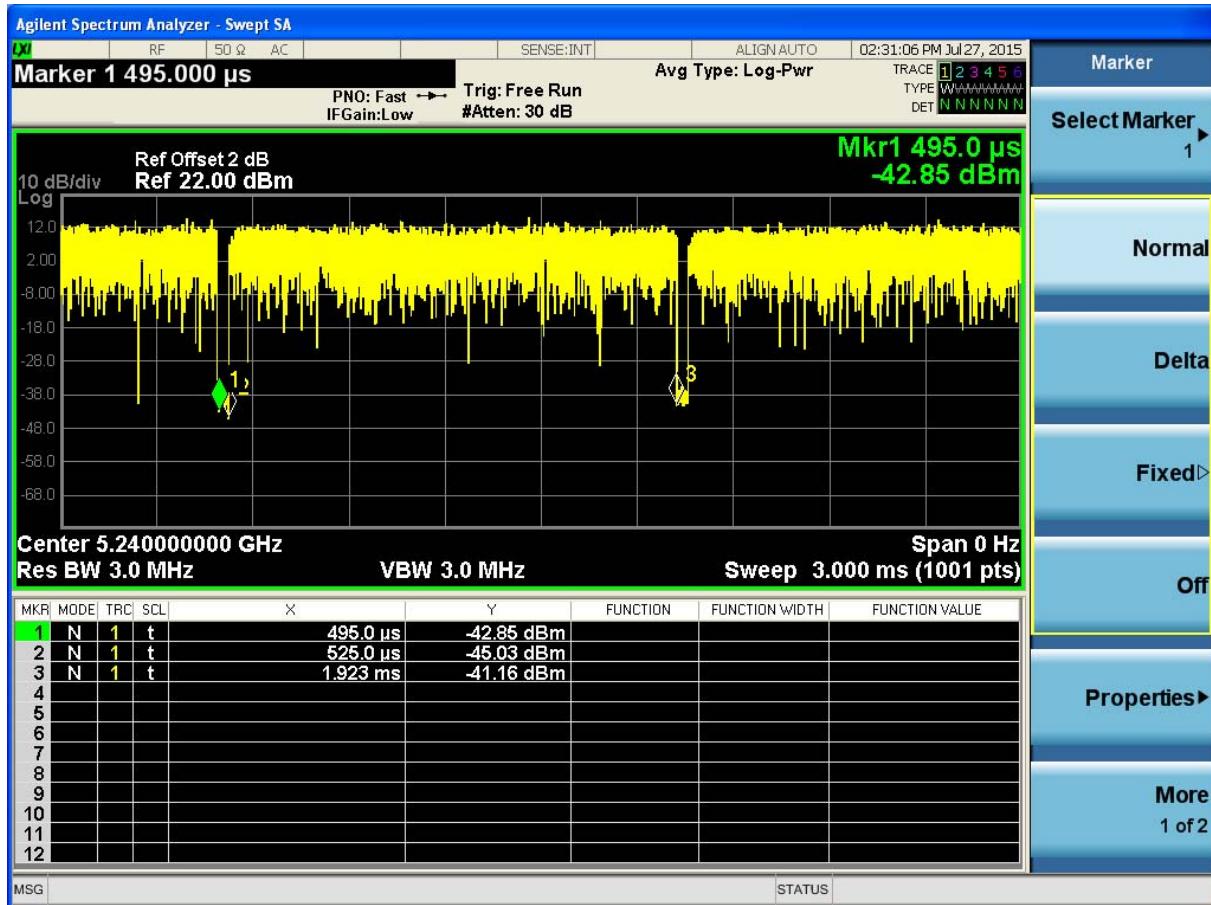
Channel	Frequency (MHz)	Duty Cycle	Duty factor (dB)	Refer to Plot
149	5745	0.976	0.11	Plot 4.3.4 A
157	5785	0.973	0.12	Plot 4.3.4 B
165	5825	0.987	0.06	Plot 4.3.4 C



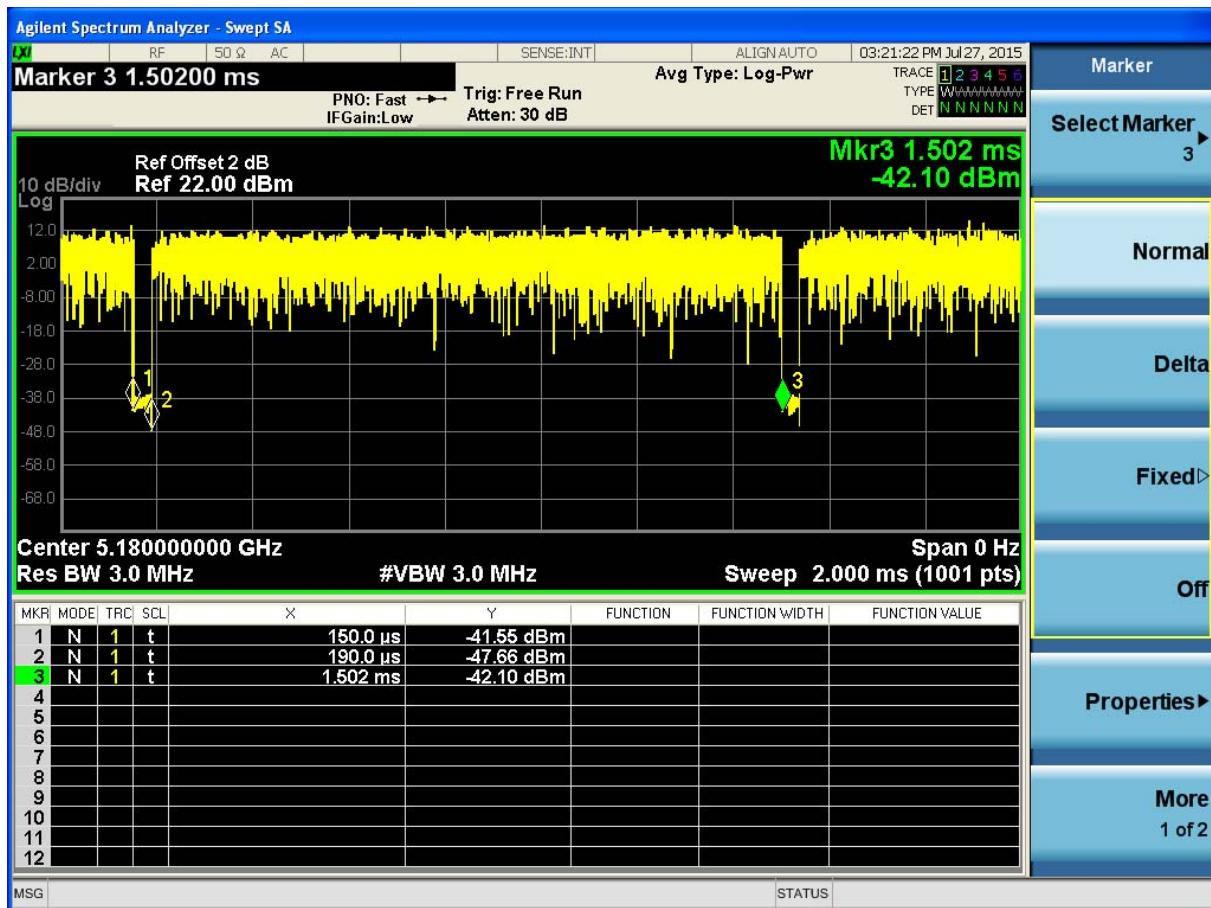
(Plot 4.3.1 A: Channel 36: 5180MHz @ 802.11a)



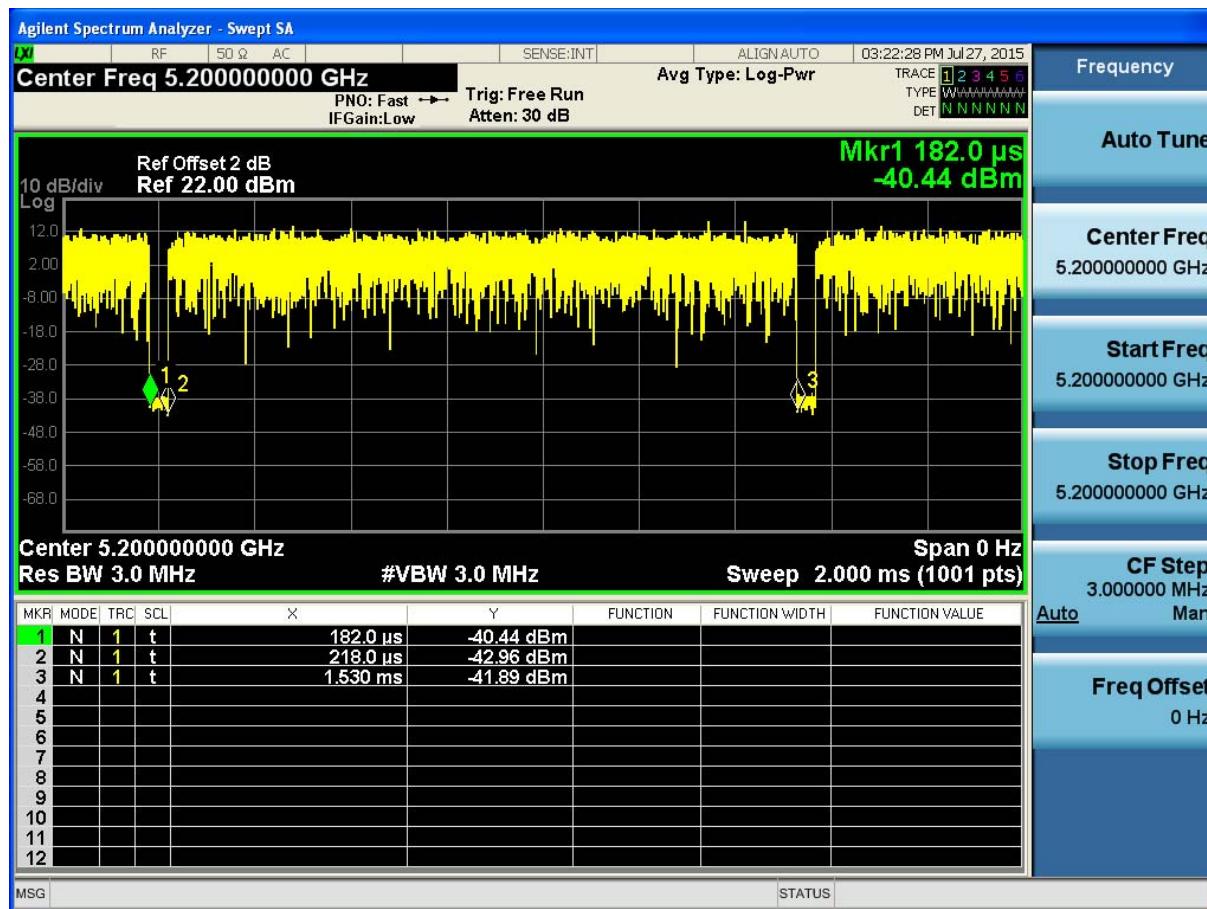
(Plot 4.3.1 B: Channel 40: 5200MHz @ 802.11a)



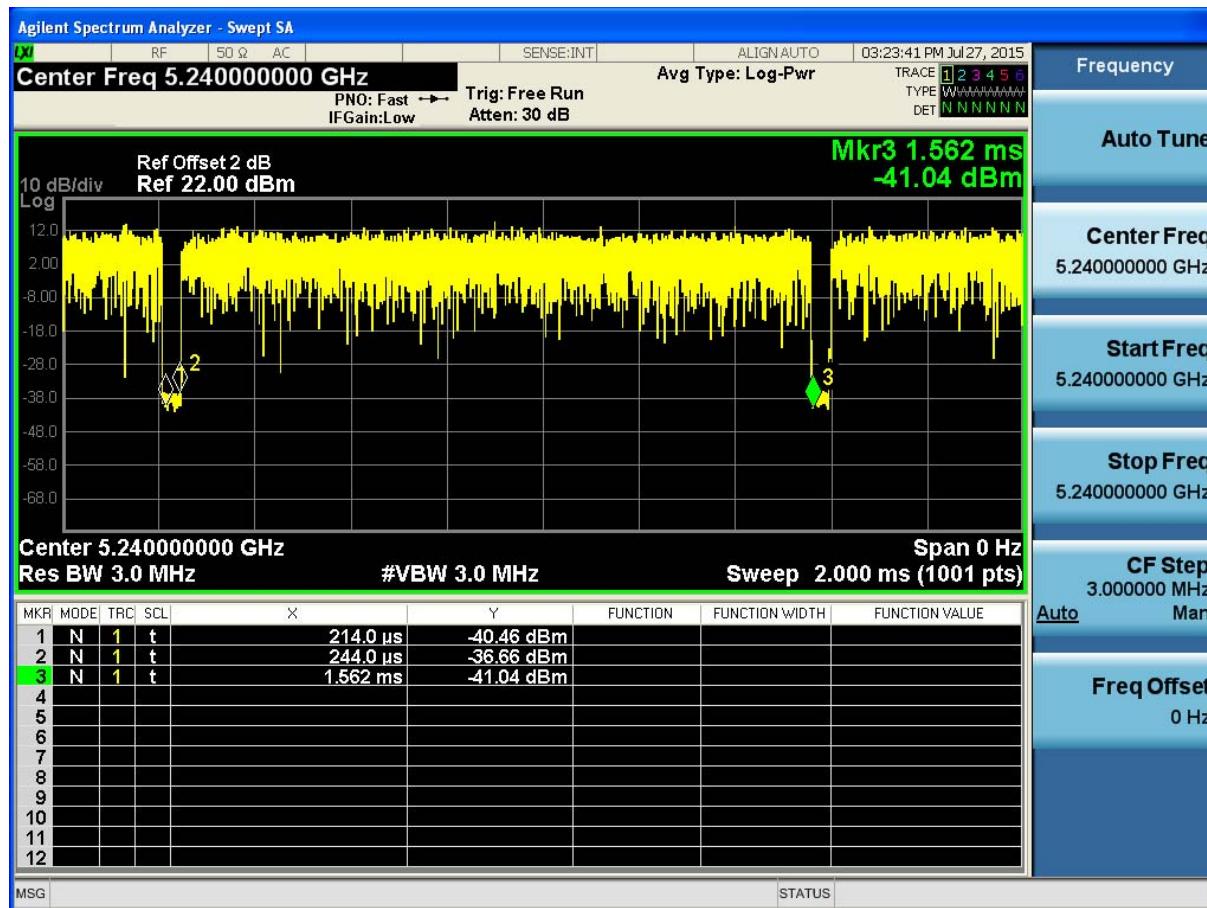
(Plot 4.3.1 C: Channel 48: 5240MHz @ 802.11a)



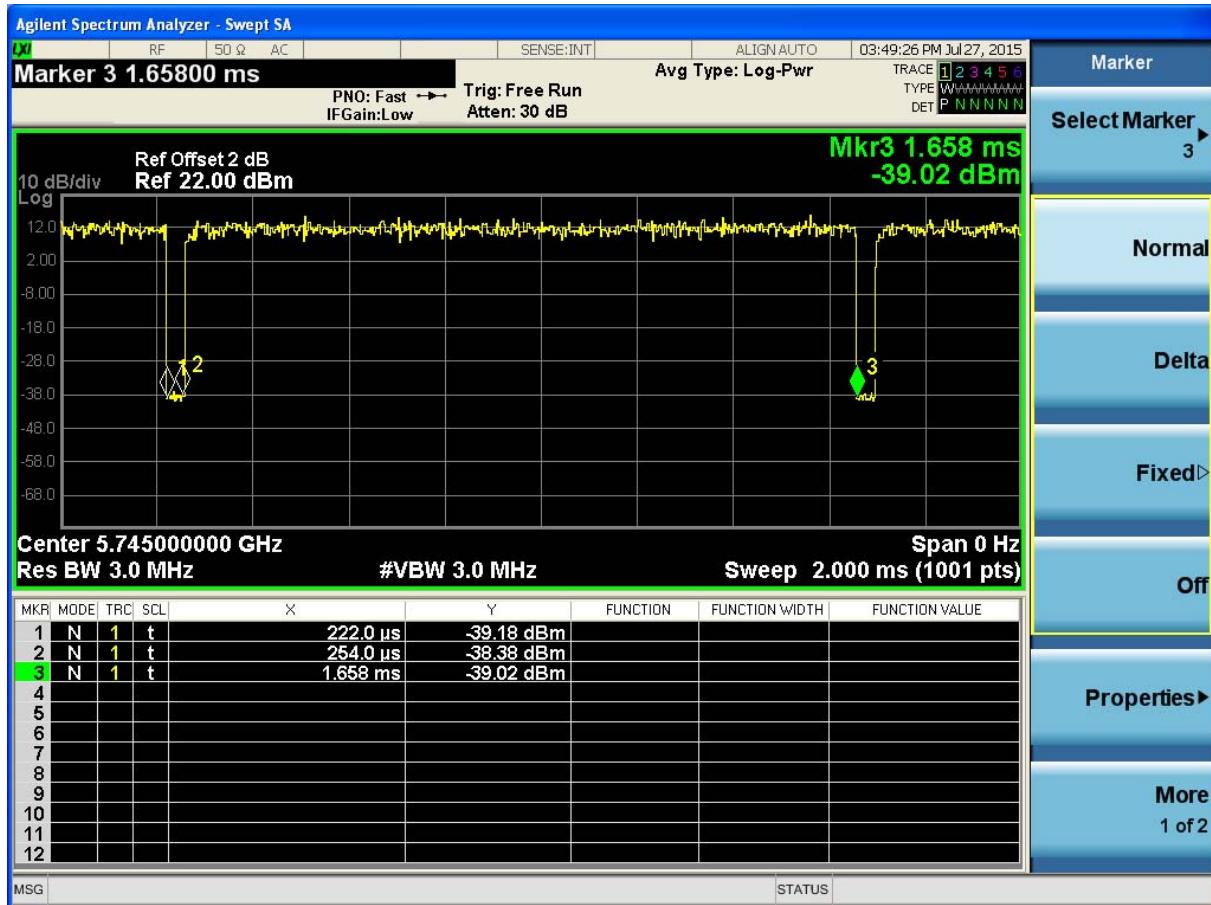
(Plot 4.3.2 A: Channel 36: 5180MHz @ 802.11n HT20)



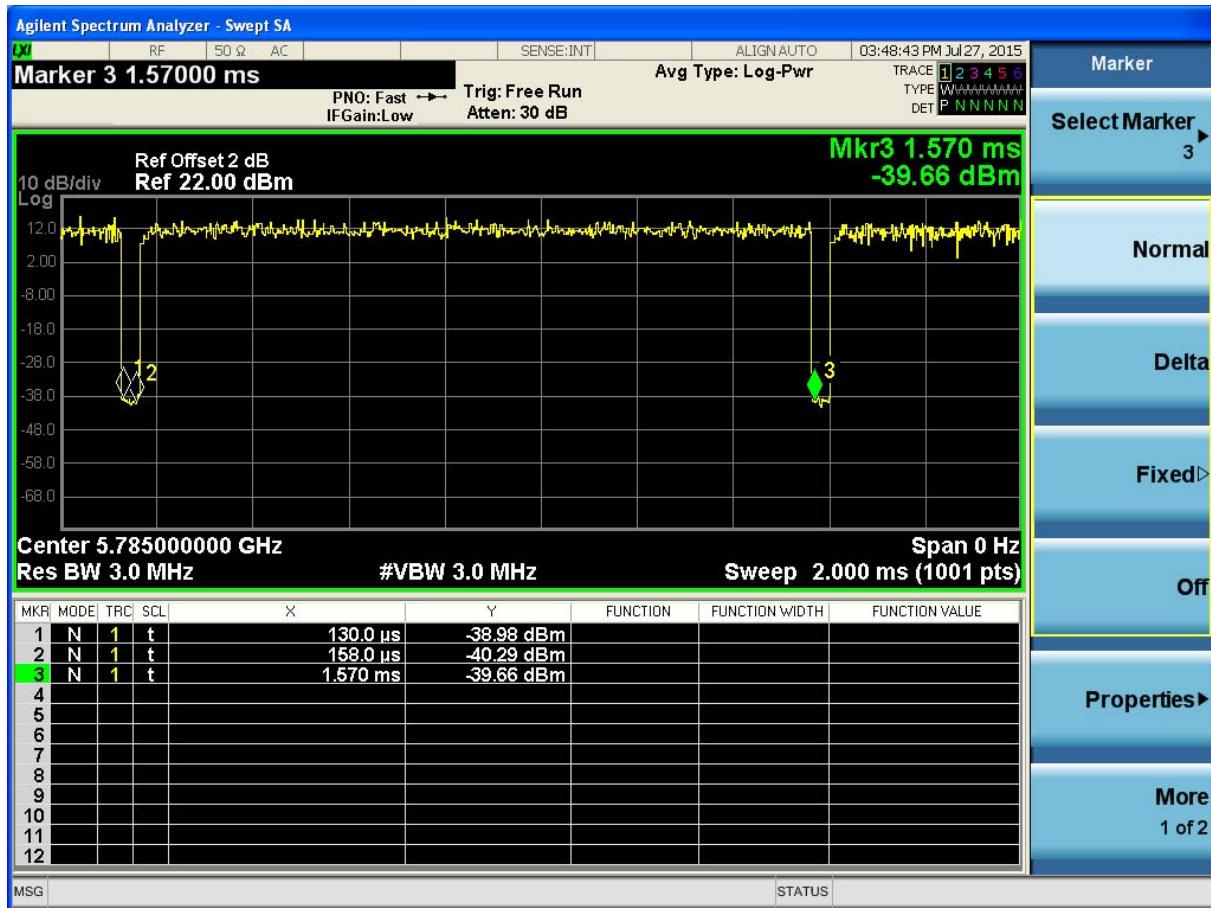
(Plot 4.3.2 B: Channel 40: 5200MHz @ 802.11n HT20)



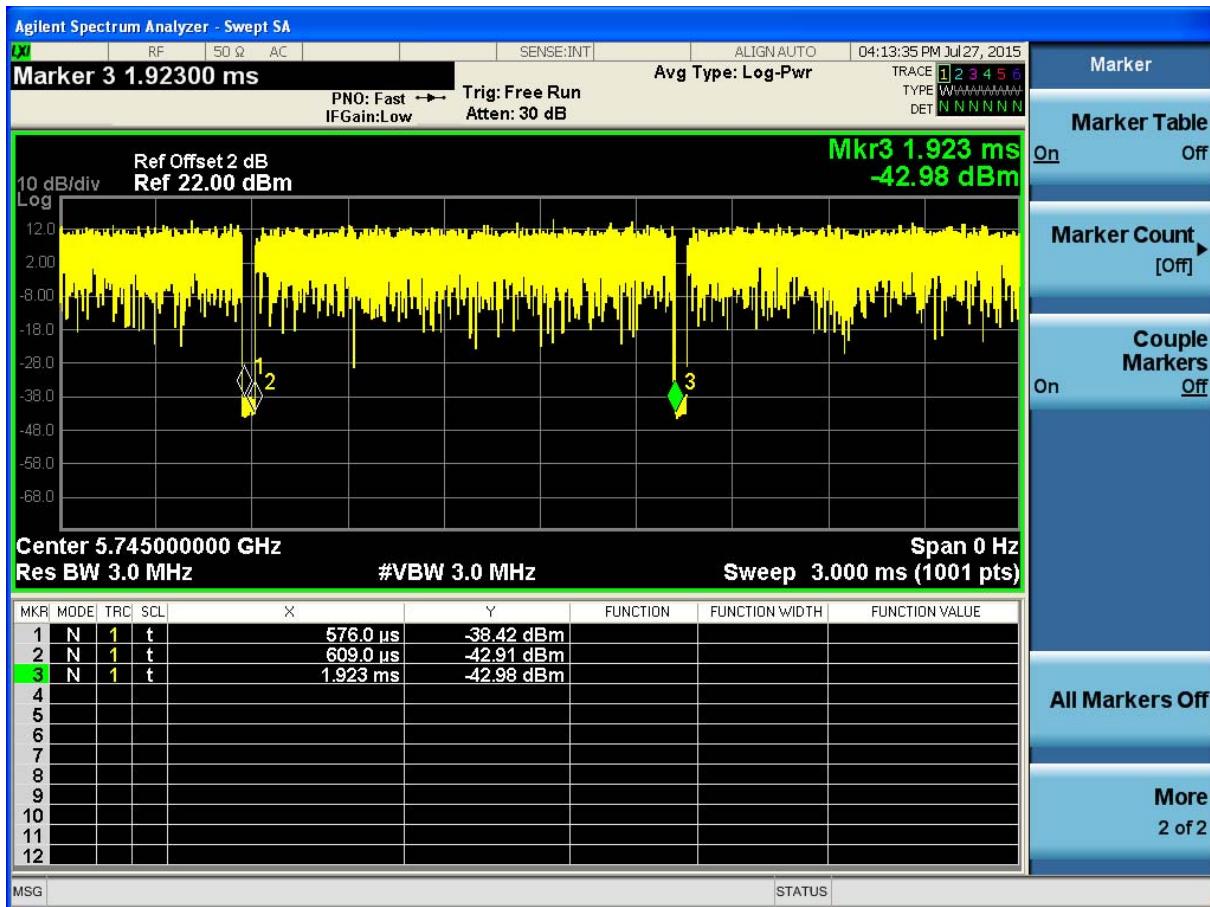
(Plot 4.3.2 C: Channel 48: 5240MHz @ 802.11n HT20)



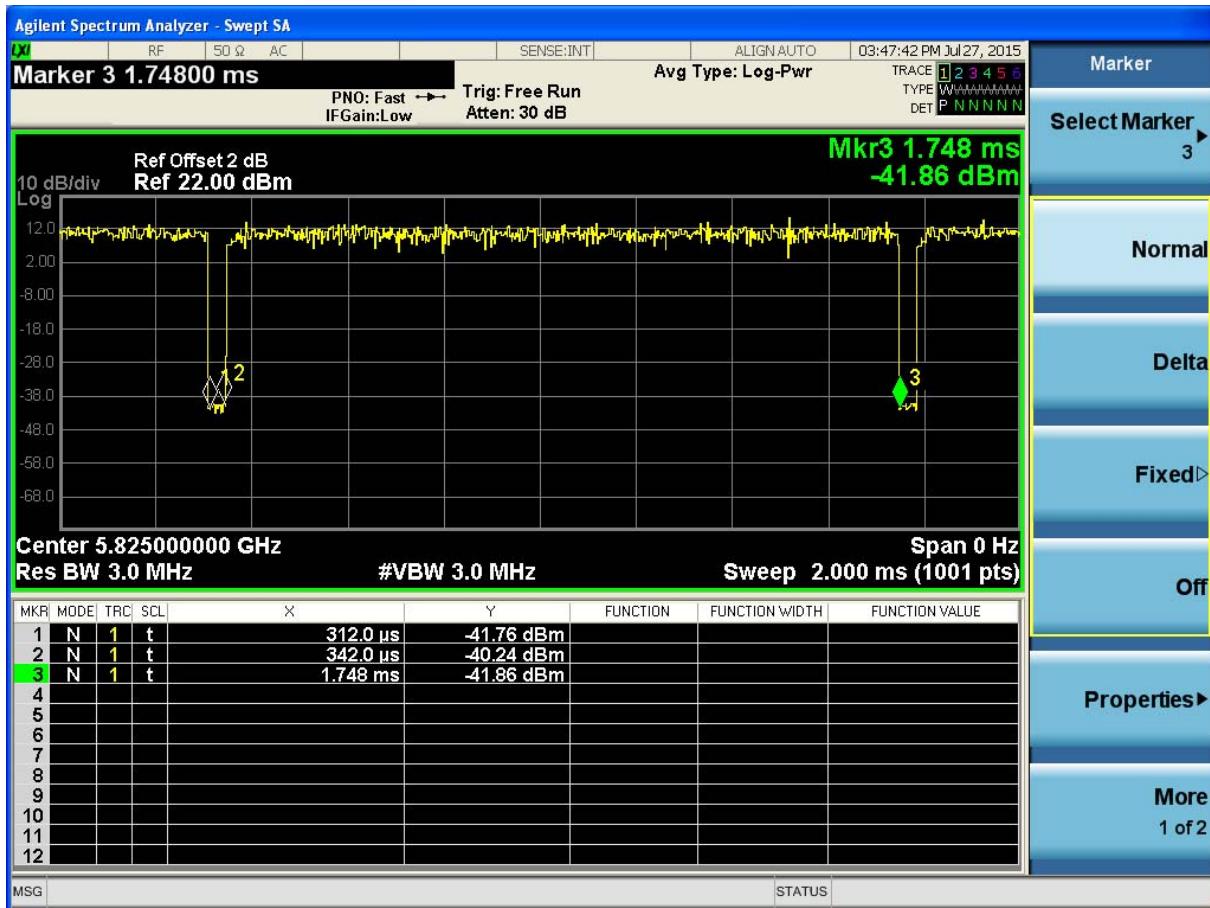
(Plot 4.3.3 A: Channel 149: 5745MHz @ 802.11a)



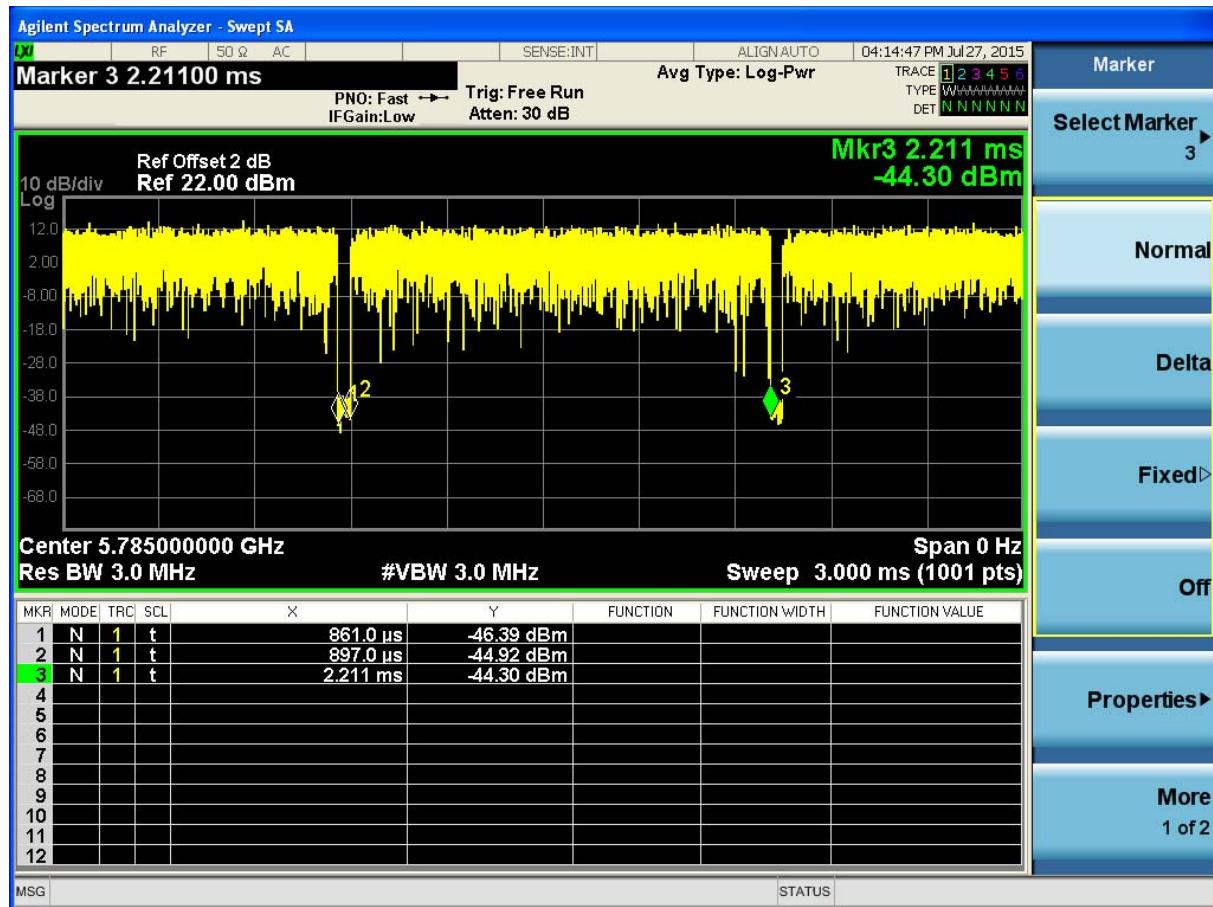
(Plot 4.3.3 B: Channel 157: 5785MHz @ 802.11a)



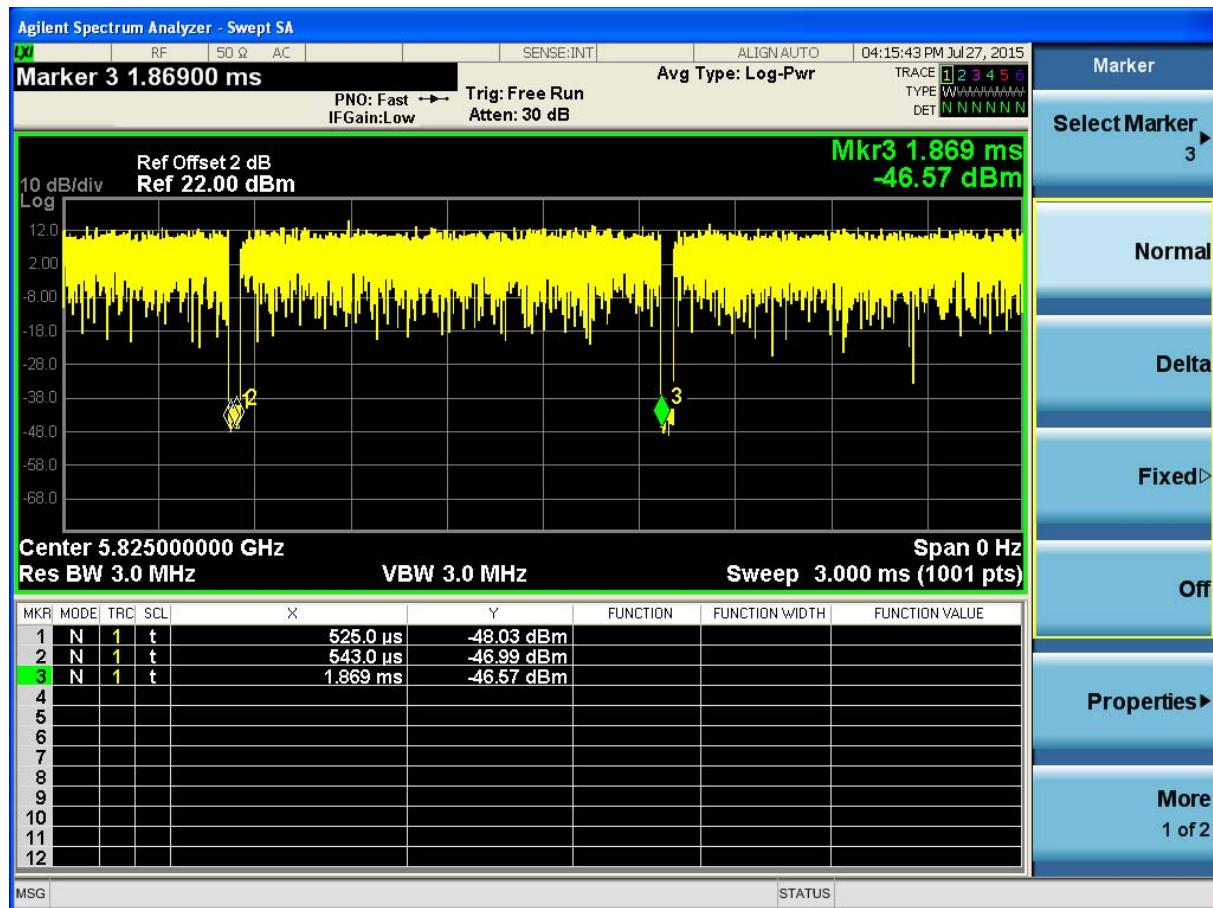
(Plot 4.3.3 C: Channel 165: 5825MHz @ 802.11a)



(Plot 4.3.4 A: Channel 149: 5745MHz @ 802.11n HT20)



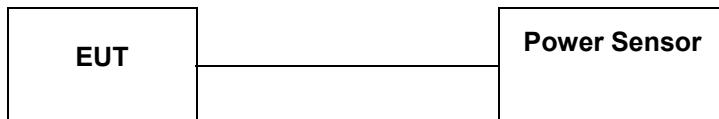
(Plot 4.3.4 B: Channel 157: 5785MHz @ 802.11n HT20)



(Plot 4.3.4 C: Channel 165: 5825MHz @ 802.11n HT20)

4.4. Maximum Average Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to KDB789033 D02 General UNII Test Procedures New Rules v01 Section E3 Measurement using a Power Meter (PM):

- a. Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied
 1. The EUT is configured to transmit continuously or to transmit with a constant duty cycle
 2. At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
 3. The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
- b. If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B
- c. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
- d. Adjust the measurement in dBm by adding $10 \log(1/x)$ where x is the duty cycle (e.g., $10 \log(1/0.25)$ if the duty cycle is 25 percent).

LIMIT

According to §15.407(a): The maximum output power should be not exceed follow:

Frequency Range (MHz)	Limit
5150-5250	Fixed: 1 Watt (30dBm) Mobile and portable: 250mW (24dBm)
5250-5350	250mW (24dBm)
5470-5725	250mW (24dBm)
5725-5850	1 Watt (30dBm)

Note: The maximum e.i.r.p at any elevation angle above 30 degrees as measured from the horizon must not exceed 125mW(21dBm)

TEST RESULTS

Remark: We measured output power at difference data rate for each mode and recorded worst case for each mode.

For UNII-1 Band

4.3.1 802.11a Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Output Power (dBm)	Duty factor (dB)	Output Power + Duty factor (dBm)	Limits (dBm)	Verdict
36	5180	12.74	0.09	12.83	24.00	PASS
40	5200	12.57	0.11	12.68	24.00	PASS
48	5240	12.20	0.09	12.29	24.00	PASS

4.3.2 802.11nHT20 Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Output Power (dBm)	Duty factor (dB)	Output Power + Duty factor (dBm)	Limits (dBm)	Verdict
36	5180	12.09	0.13	12.22	24.00	PASS
40	5200	12.02	0.12	12.14	24.00	PASS
48	5240	11.78	0.10	11.88	24.00	PASS

For UNII-3 Band

4.3.3 802.11a Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Output Power (dBm)	Duty factor (dB)	Output Power + Duty factor (dBm)	Limits (dBm)	Verdict
149	5745	13.46	0.10	13.56	30.00	PASS
157	5785	13.28	0.09	13.37	30.00	PASS
165	5825	13.47	0.09	13.56	30.00	PASS

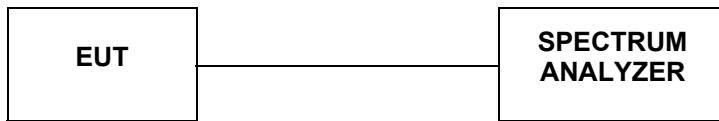
4.3.4 802.11nHT20 Test Mode

a. Test Verdict

Channel	Frequency (MHz)	Output Power (dBm)	Duty factor (dB)	Output Power + Duty factor (dBm)	Limits (dBm)	Verdict
149	5745	12.46	0.11	12.57	30.00	PASS
157	5785	12.27	0.12	12.39	30.00	PASS
165	5825	11.84	0.06	11.90	30.00	PASS

4.5. Power Spectral Density

TEST CONFIGURATION



TEST PROCEDURE

According to KDB 789033 D02 General UNII Test Procedures New Rules v01 F: The rules requires "maximum power spectral density" measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission

- a. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power...". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
- b. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
- c. Make the following adjustments to the peak value of the spectrum, if applicable:
 1. If Method SA-2 or SA-2 Alternative was used, add $10 \log(1/x)$, where x is the duty cycle, to the peak of the spectrum.
 2.) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g.(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
- d. The result is the Maximum PSD over 1 MHz reference bandwidth.
- e. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
 1. Set RBW $\geq 1/T$, where T is defined in section II.B.I.a).
 2. Set VBW ≥ 3 RBW.
 3. If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500\text{kHz}/\text{RBW})$ to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
 4. If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10\log(1\text{MHz}/\text{RBW})$ to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
 5. Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the sections 5.c) and 5.d) above, since RBW=100 kHz is available on nearly all spectrum analyzers.
- f. Adjust the measurement in dBm by adding $10 \log(1/x)$ where x is the duty cycle (e.g., 10 log(1/0.25) if the duty cycle is 25 percent).

LIMIT

According to §15.407(a): The maximum output power should be not exceed follow:

Frequency Range (MHz)	Limit
5150-5250	Other then Mobile and portable:17dBm/MHz Mobile and portable:11dBm/MHz
5250-5350	11dBm/MHz
5470-5725	11dBm/MHz
5725-5850	30dBm/500kHz

TEST RESULTS

For UNII-1 Band

4.5.1 802.11a Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Report PSD (dBm/1MHz)	Duty factor (dB)	RBW factor (dB)	Report PSD+ Duty factor+ RBW factor (dBm/1MHz)	Refer to Plot	Limits (dBm/1MHz)	Verdict
36	5180	4.963	0.09	0.00	5.053	Plot 4.5.1 A	11	PASS
40	5200	4.167	0.11	0.00	4.277	Plot 4.5.1 B	11	PASS
48	5240	4.791	0.09	0.00	4.881	Plot 4.5.1 C	11	PASS

Note:

1. For 802.11a mode at final test to get the worst-case emission at 6Mbps.
2. The test results including the cable lose.

4.5.2 802.11n HT20 Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Report PSD (dBm/1MHz)	Duty factor (dB)	RBW factor (dB)	Report PSD+ Duty factor+ RBW factor (dBm/1MHz)	Refer to Plot	Limits (dBm/1MHz)	Verdict
36	5180	6.663	0.13	0.00	6.793	Plot 4.5.2 A	11	PASS
40	5200	6.280	0.12	0.00	6.400	Plot 4.5.2 B	11	PASS
48	5240	6.531	0.10	0.00	6.631	Plot 4.5.2 C	11	PASS

Note:

1. For 802.11n HT20 mode at final test to get the worst-case emission at 6.5Mbps.
2. The test results including the cable lose.

For UNII-3 Band

4.5.3 802.11a Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Report PSD (dBm/1MHz)	Duty factor (dB)	RBW factor (dB)	Report PSD+ Duty factor+ RBW factor (dBm/1MHz)	Refer to Plot	Limits (dBm/1MHz)	Verdict
149	5745	6.108	0.10	-0.09	6.118	Plot 4.5.3 A	30	PASS
157	5785	6.163	0.09	-0.09	6.163	Plot 4.5.3 B	30	PASS
165	5825	5.349	0.09	-0.09	5.349	Plot 4.5.3 C	30	PASS

Note:

1. For 802.11a mode at final test to get the worst-case emission at 6Mbps.
2. The test results including the cable lose.

4.5.4 802.11n HT20 Test Mode

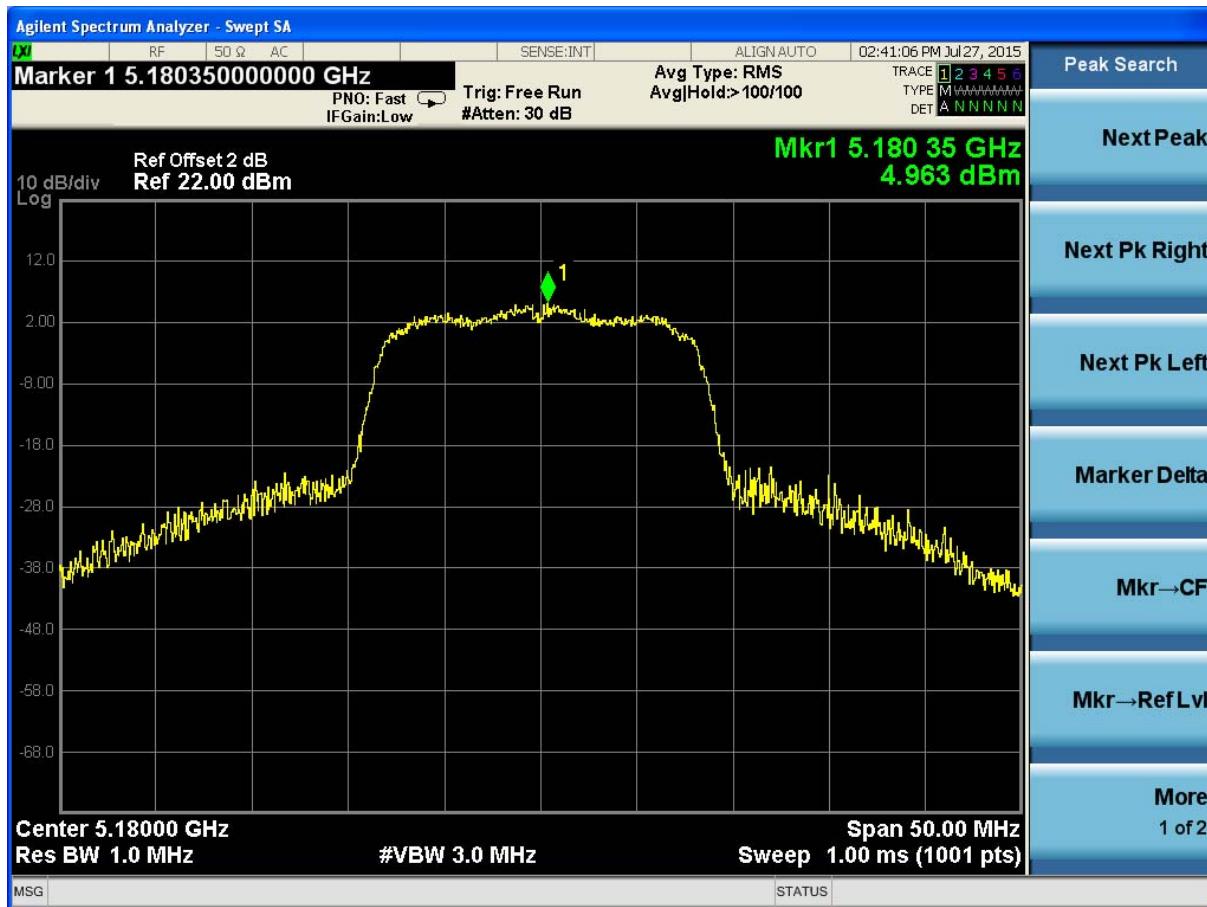
A. Test Verdict

Channel	Frequency (MHz)	Report PSD (dBm/1MHz)	Duty factor (dB)	RBW factor (dB)	Report PSD+ Duty factor+ RBW factor (dBm/1MHz)	Refer to Plot	Limits (dBm/1MHz)	Verdict
149	5745	4.584	0.11	-0.09	4.604	Plot 4.5.4 A	30	PASS
157	5785	4.932	0.12	-0.09	4.962	Plot 4.5.4 B	30	PASS
165	5825	3.901	0.06	-0.09	3.871	Plot 4.5.4 C	30	PASS

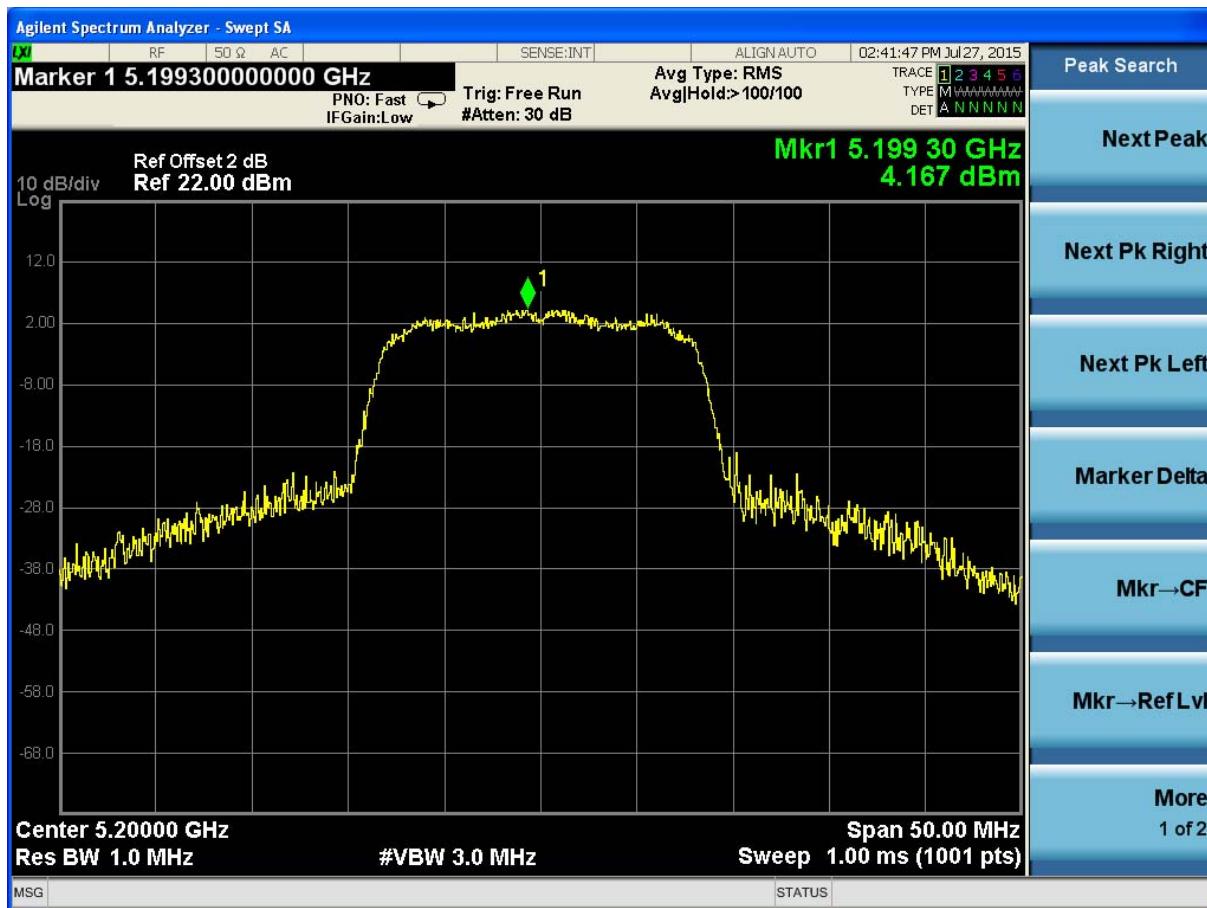
Note:

1. For 802.11n HT20 mode at final test to get the worst-case emission at 6.5Mbps.
2. The test results including the cable lose.

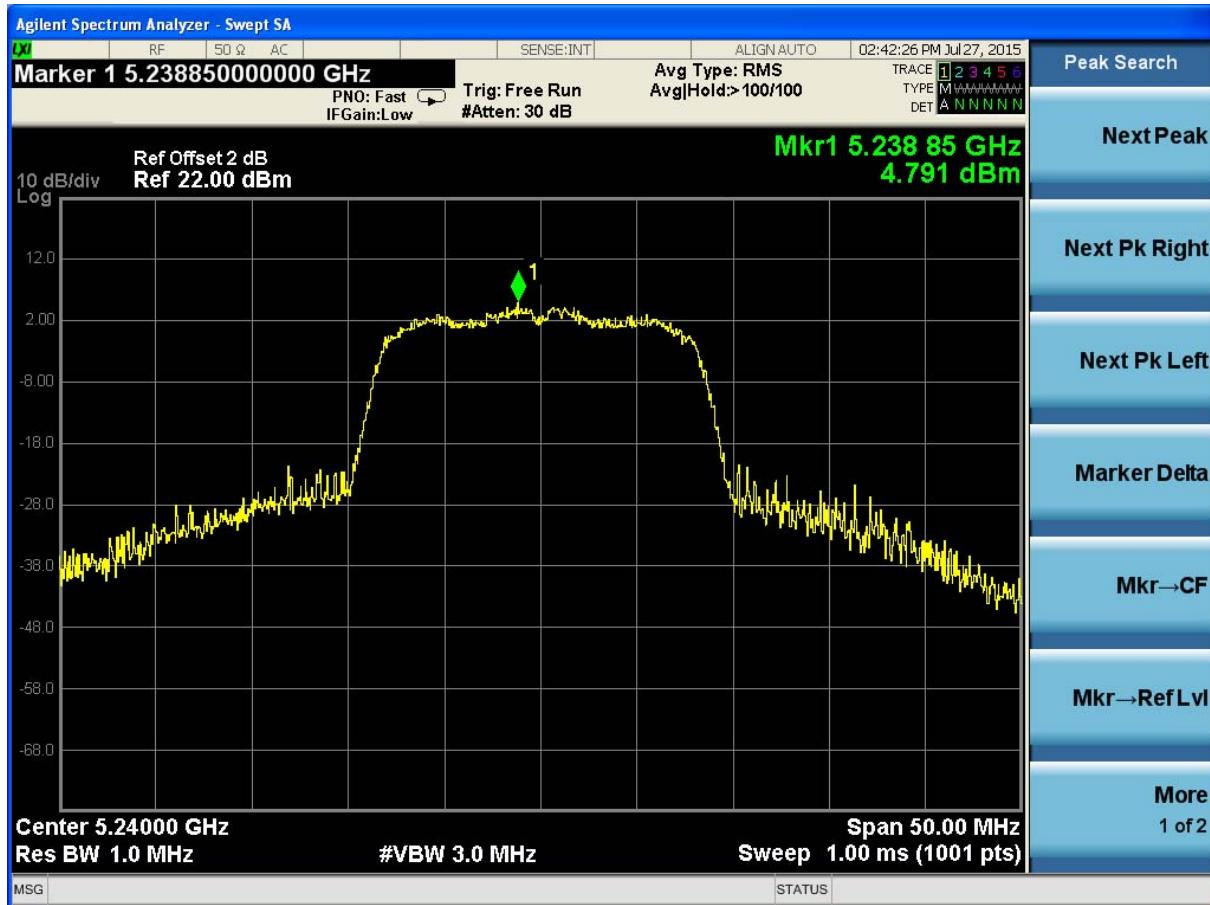
B. Test Plots



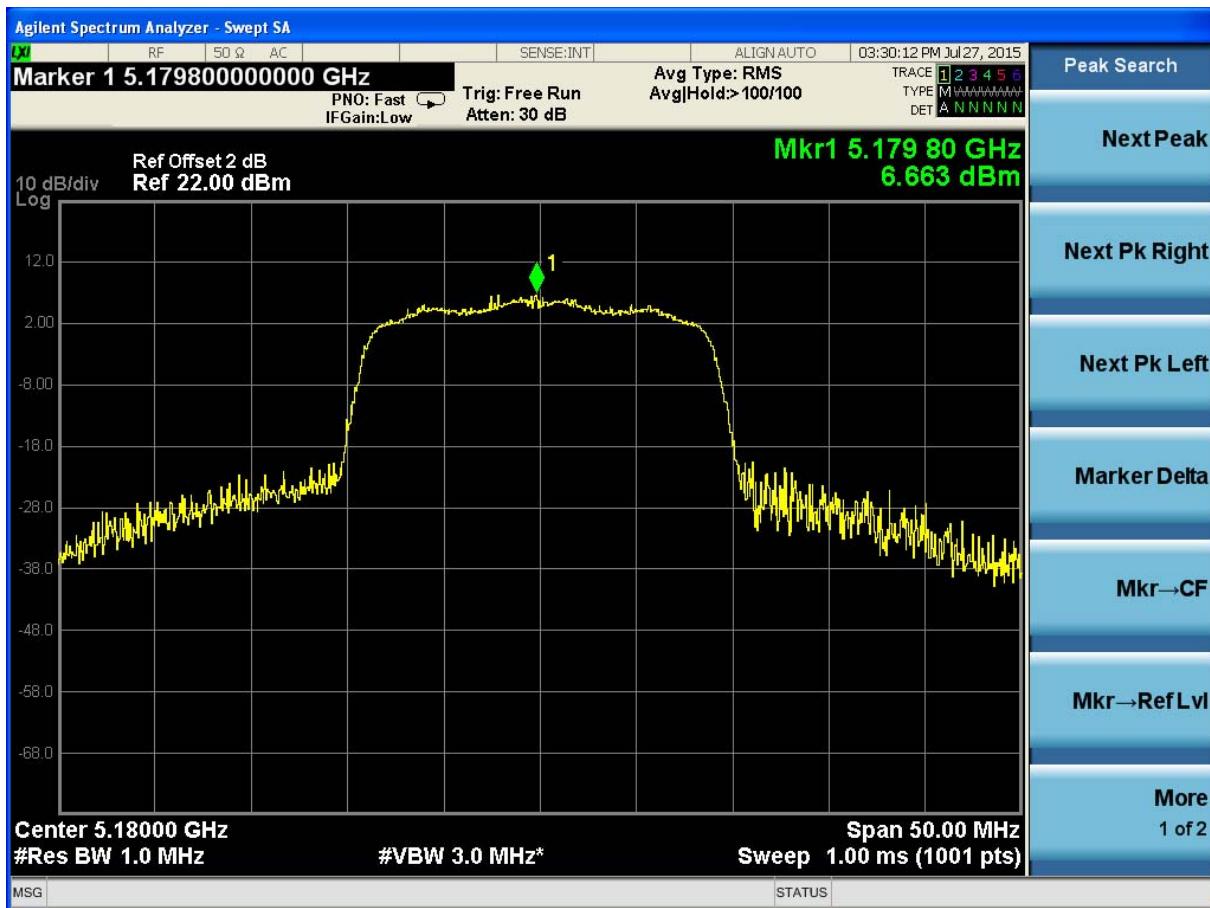
(Plot 4.5.1 A: Channel 36: 5180MHz @ 802.11a)



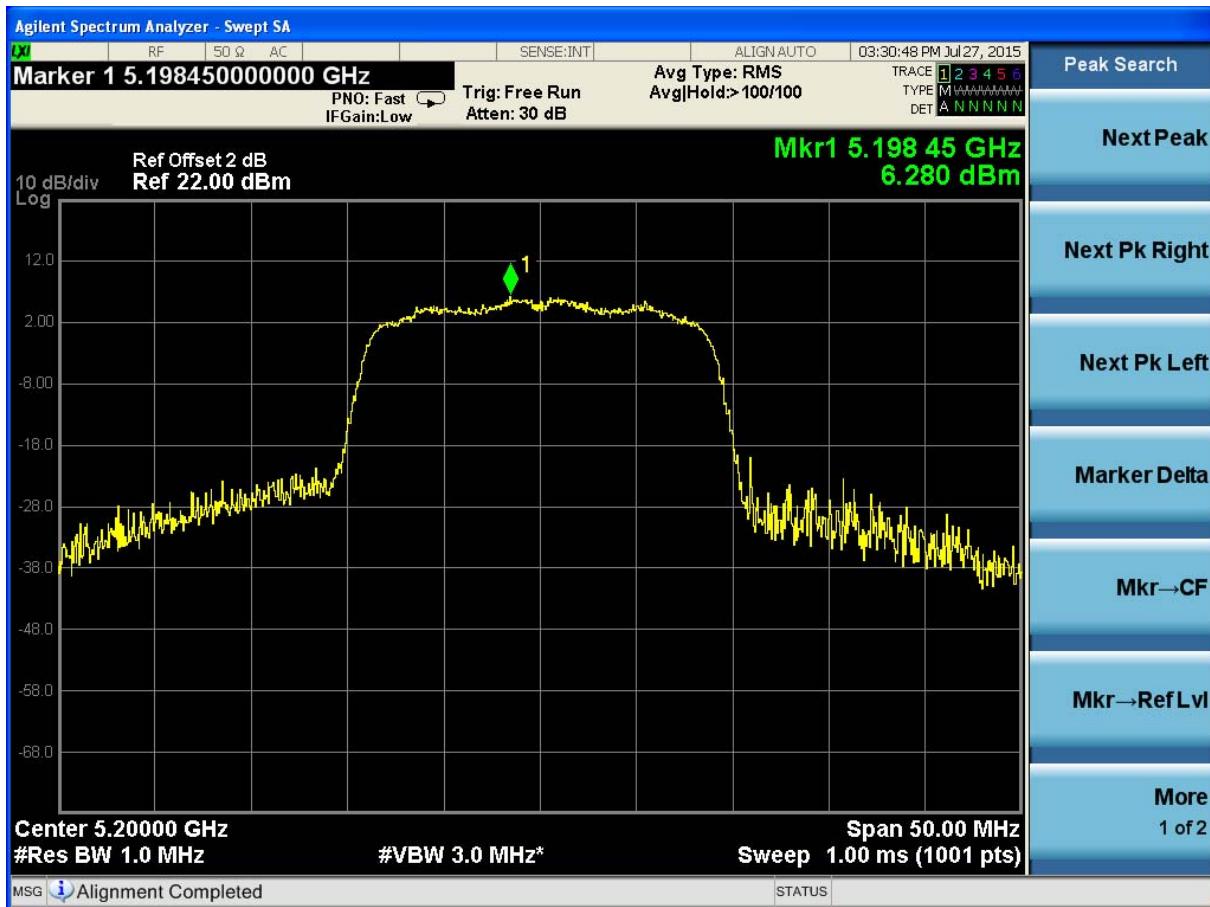
(Plot 4.5.1 B: Channel 40: 5200MHz @ 802.11a)



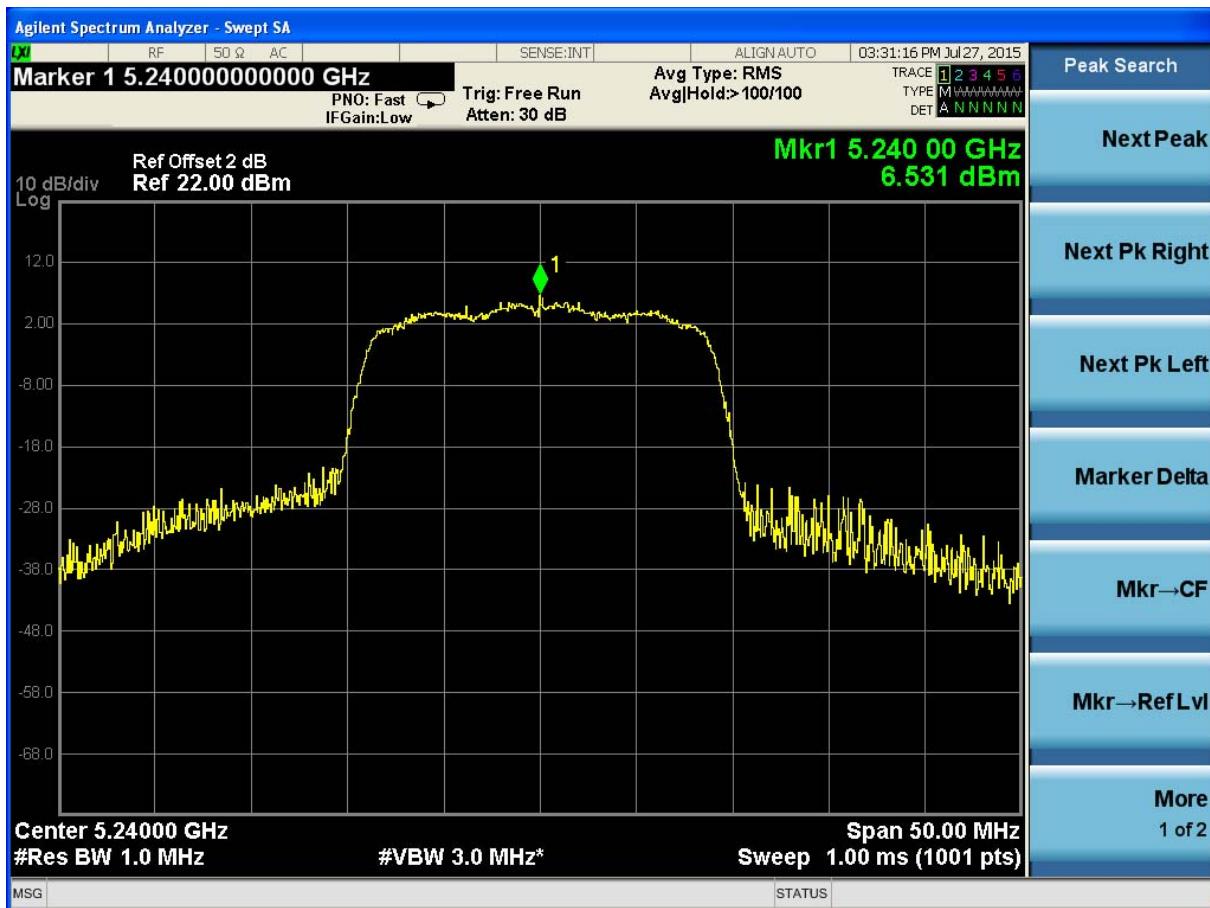
(Plot 4.5.1 C: Channel 48: 5240MHz @ 802.11a)



(Plot 4.5.2 A: Channel 36: 5180MHz @ 802.11n HT20)



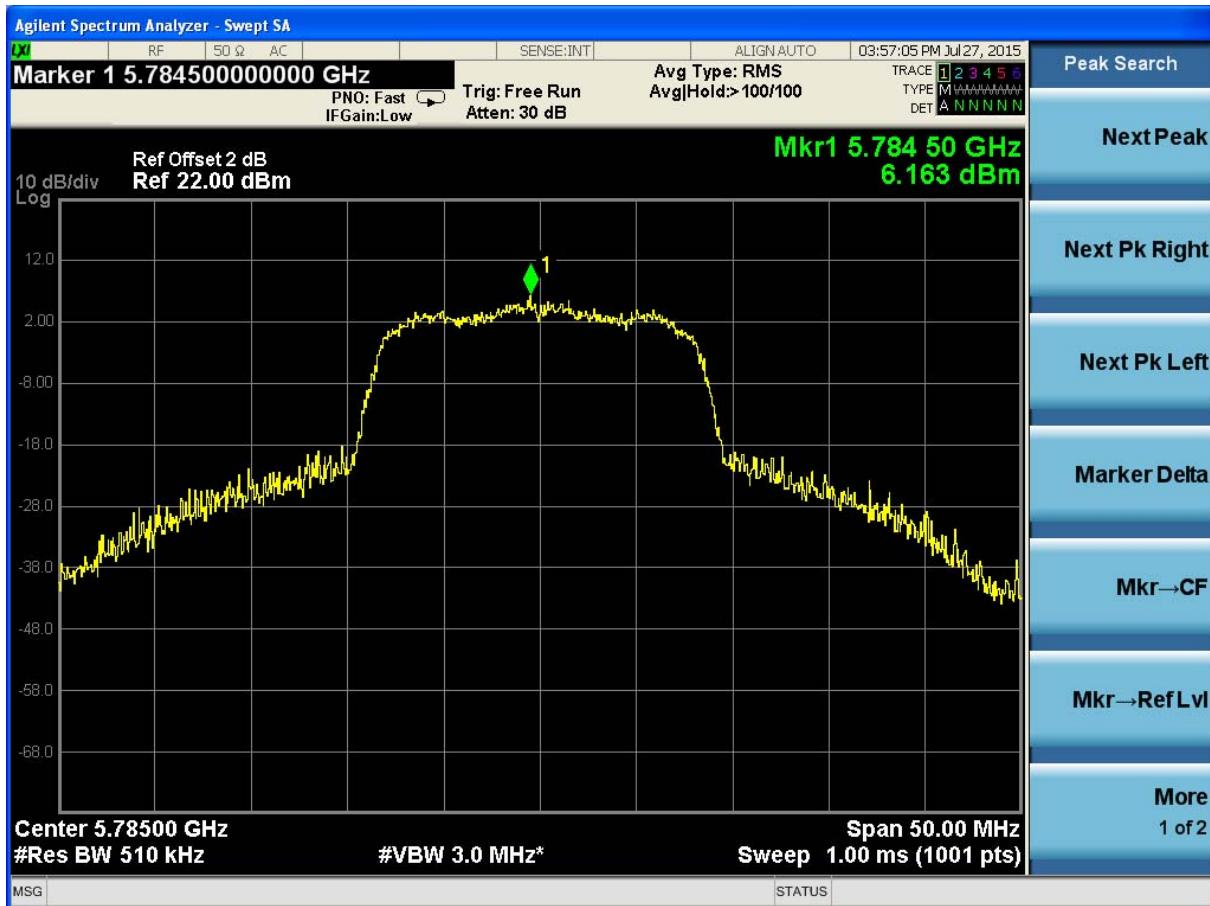
(Plot 4.5.2 B: Channel 40: 5200MHz @ 802.11n HT20)



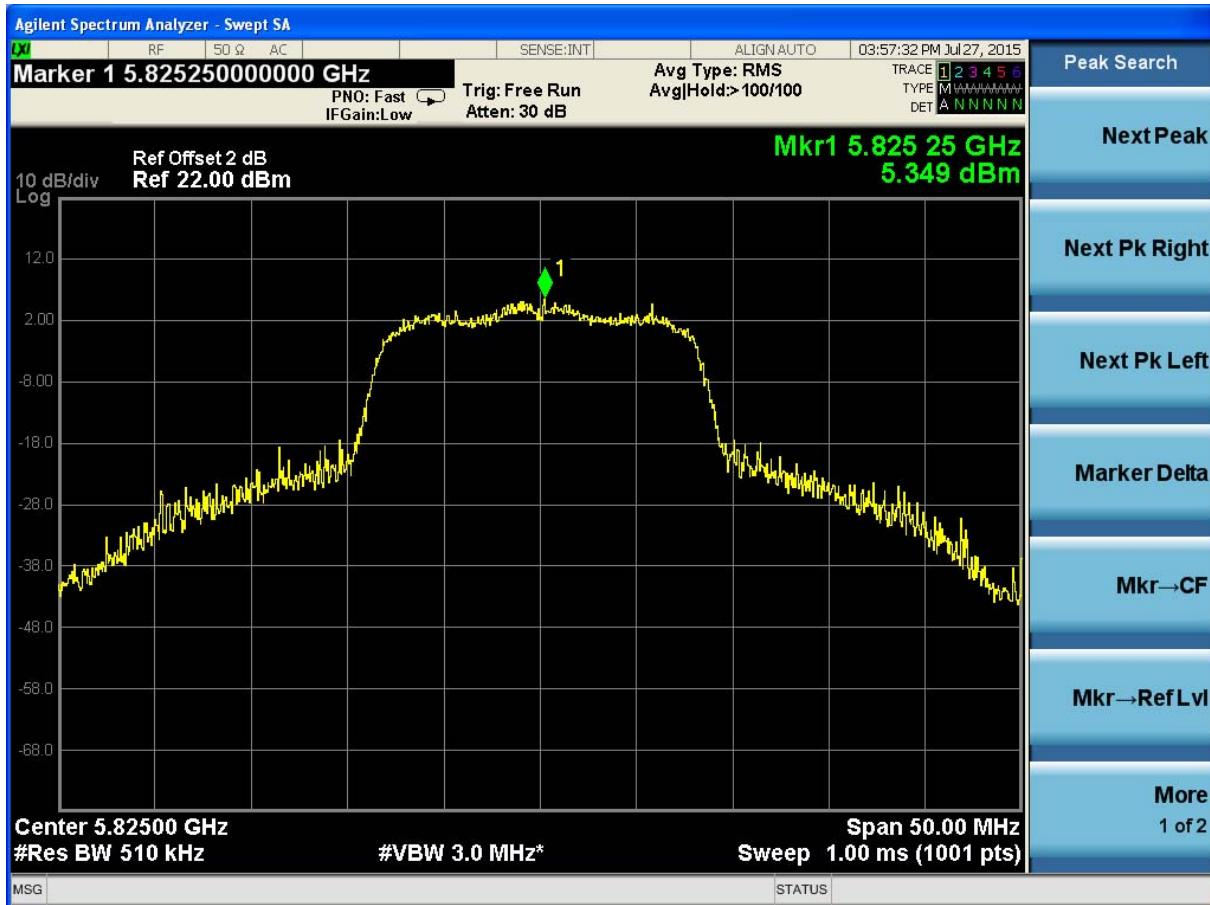
(Plot 4.5.2 C: Channel 48: 5240MHz @ 802.11n HT20)



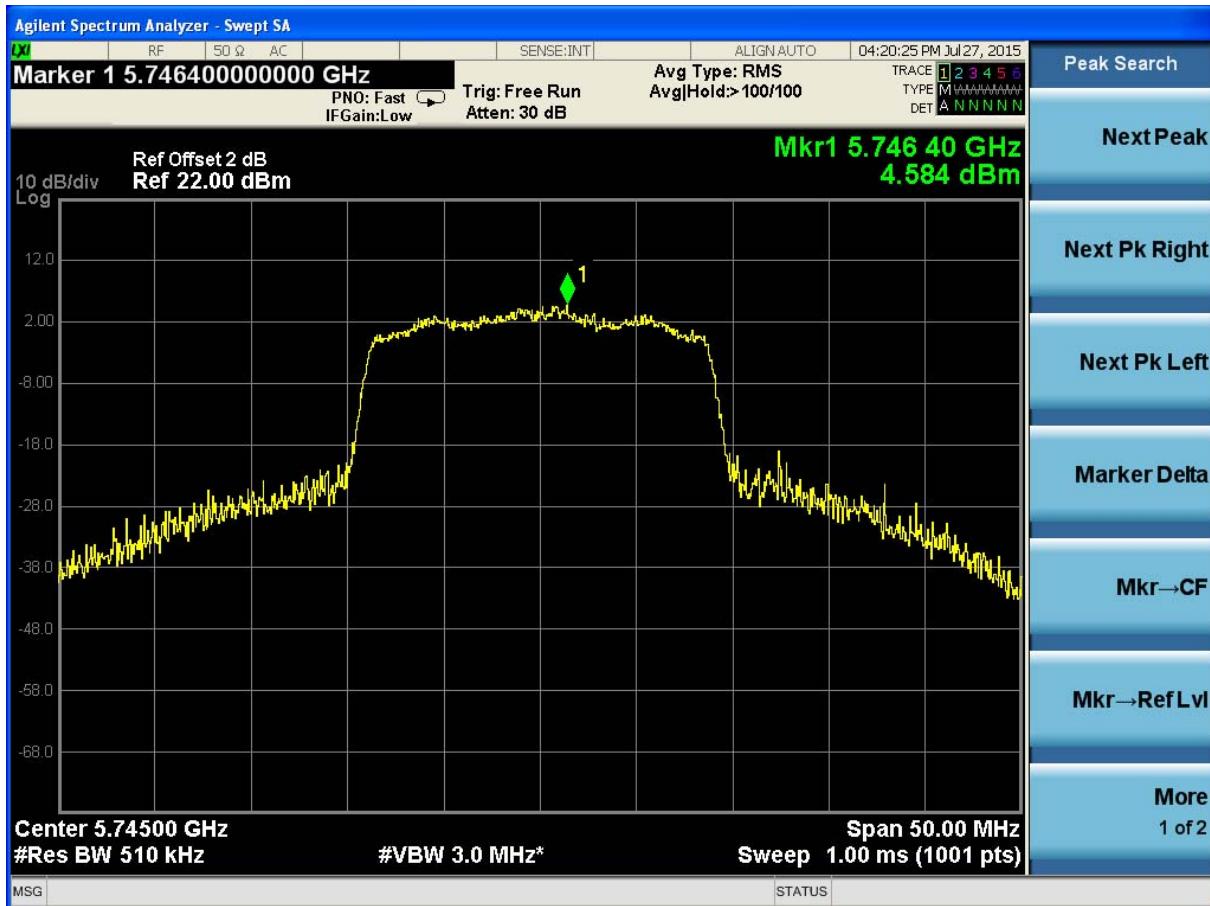
(Plot 4.5.3 A: Channel 149: 5745MHz @ 802.11a)



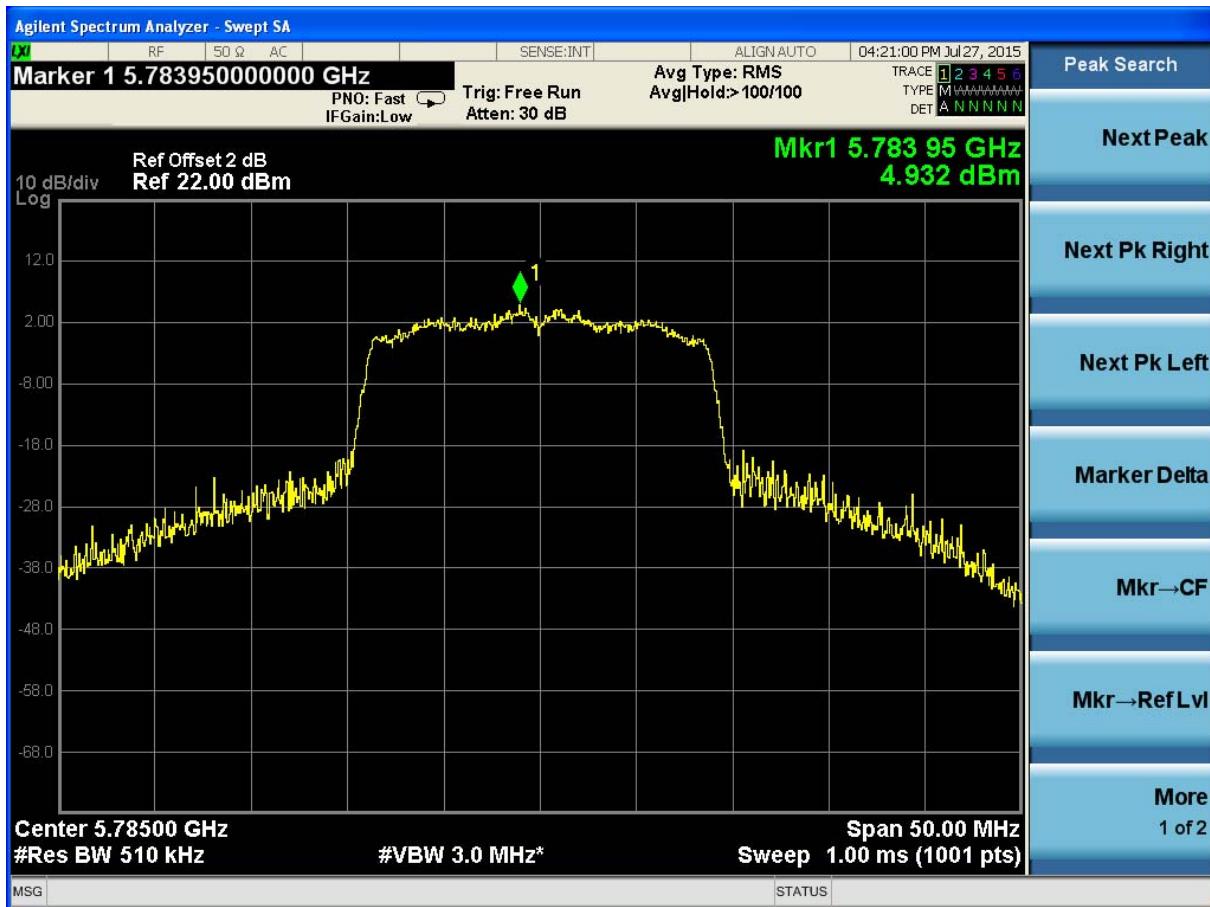
(Plot 4.5.3 B: Channel 157: 5785MHz @ 802.11a)



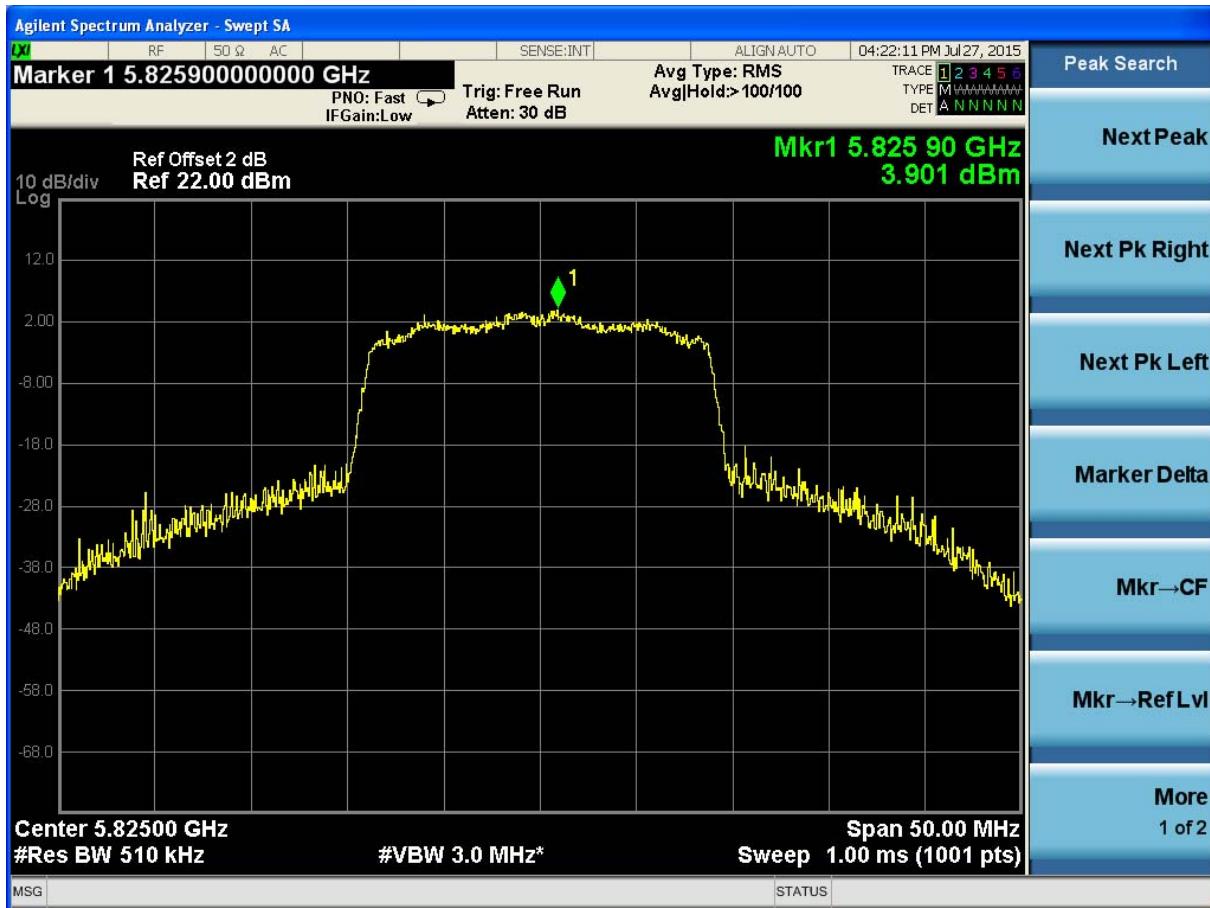
(Plot 4.5.3 C: Channel 165: 5825MHz @ 802.11a)



(Plot 4.5.4 A: Channel 149: 5745MHz @ 802.11n HT20)



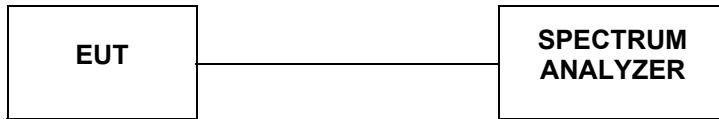
(Plot 4.5.4 B: Channel 157: 5785MHz @ 802.11n HT20)



(Plot 4.5.4 C: Channel 165: 5825MHz @ 802.11n HT20)

4.6. 6dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

According to KDB789033 D02 General UNII Test Procedures New Rules v01 for one of the following procedures may be used for section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- a. Set RBW = 100 kHz.
- b. Set the video bandwidth (VBW) $\geq 3 \times$ RBW
- c. Detector = Peak.
- d. Trace mode = max hold.
- e. Sweep = auto couple.
- f. Allow the trace to stabilize
- g. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

LIMIT

For Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz

TEST RESULTS

For UNII-3 Band

4.6.1 801.11a Test Mode

A. Test Verdict

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Verdict
149	5745	15.14	Plot 4.6.1 A	≥ 500	PASS
157	5785	15.16	Plot 4.6.1 B	≥ 500	PASS
165	5825	15.15	Plot 4.6.1 C	≥ 500	PASS

Note:

1. For 802.11a mode at final test to get the worst-case emission at 6Mbps.
2. The test results including the cable loss.

4.6.2 801.11n HT20 Test Mode

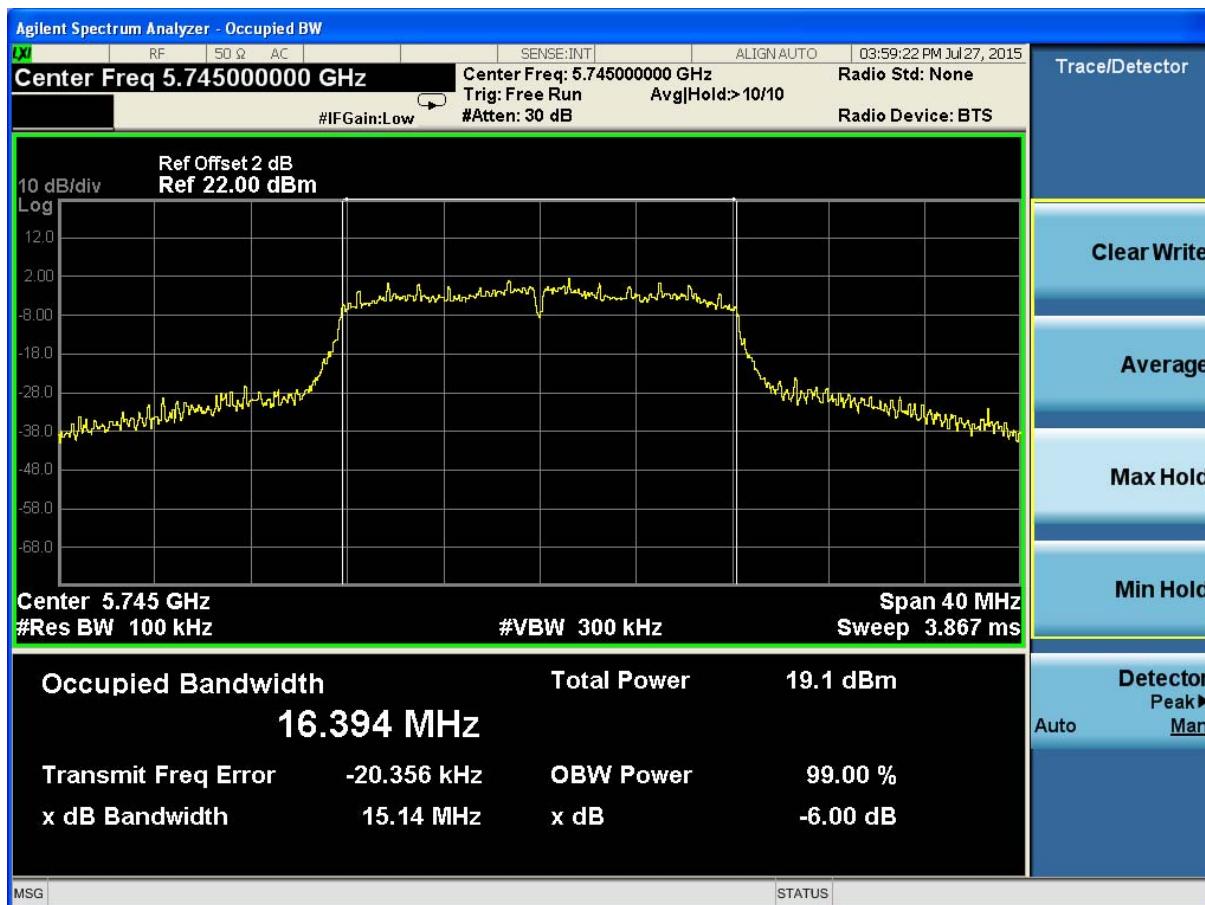
A. Test Verdict

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Verdict
149	5745	15.11	Plot 4.6.2 A	≥ 500	PASS
157	5785	15.14	Plot 4.6.2 B	≥ 500	PASS
165	5825	15.15	Plot 4.6.2 C	≥ 500	PASS

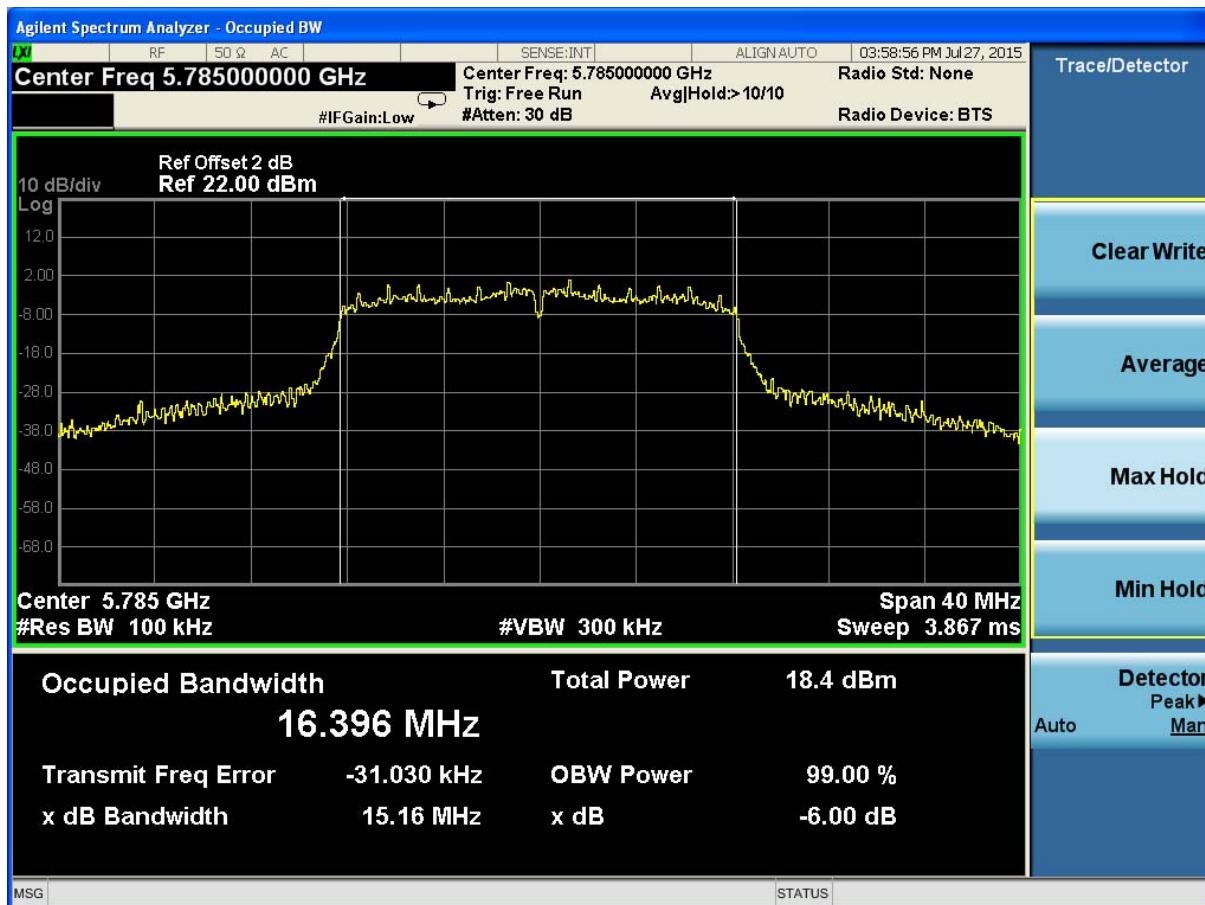
Note:

1. For 802.11n HT20 mode at final test to get the worst-case emission at 6.5Mbps.
2. The test results including the cable loss.

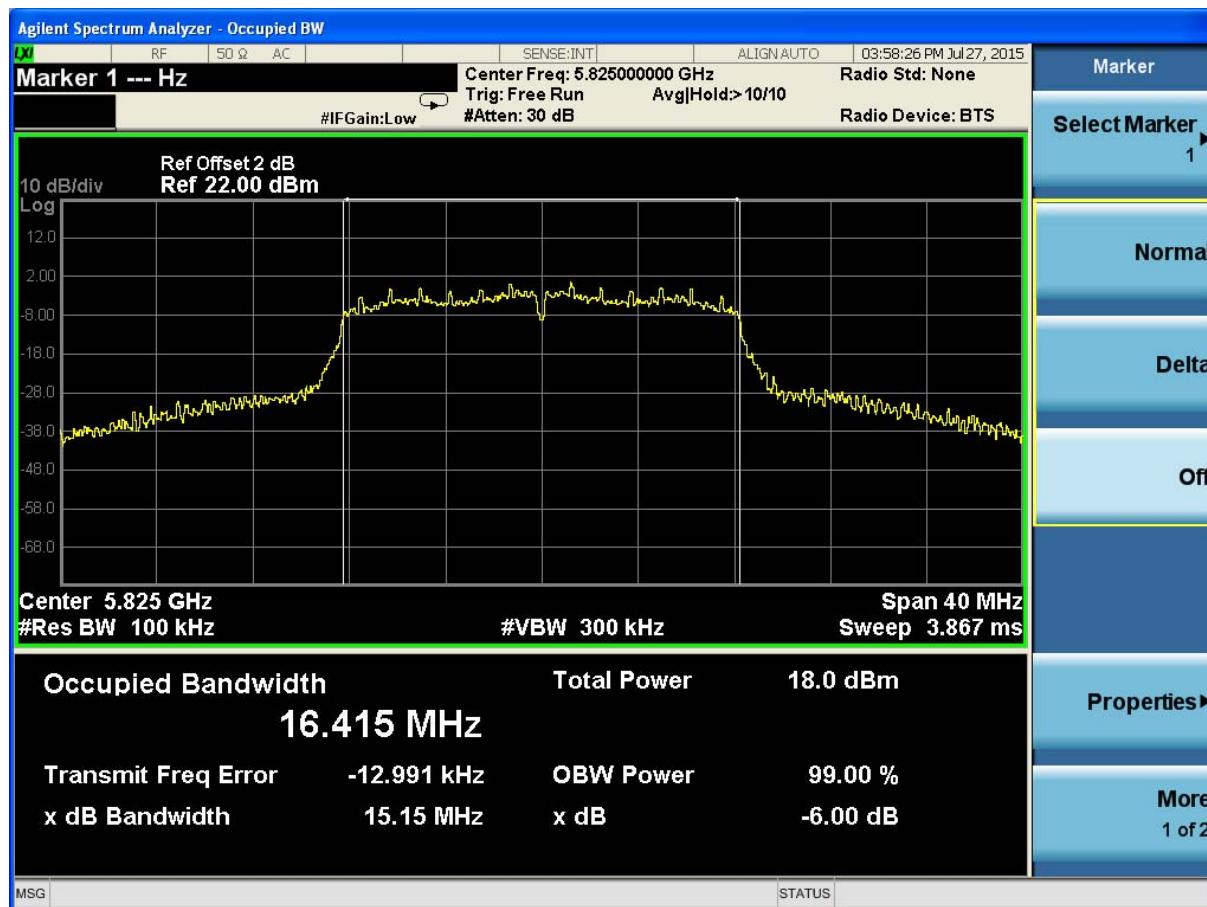
B. Test Plots



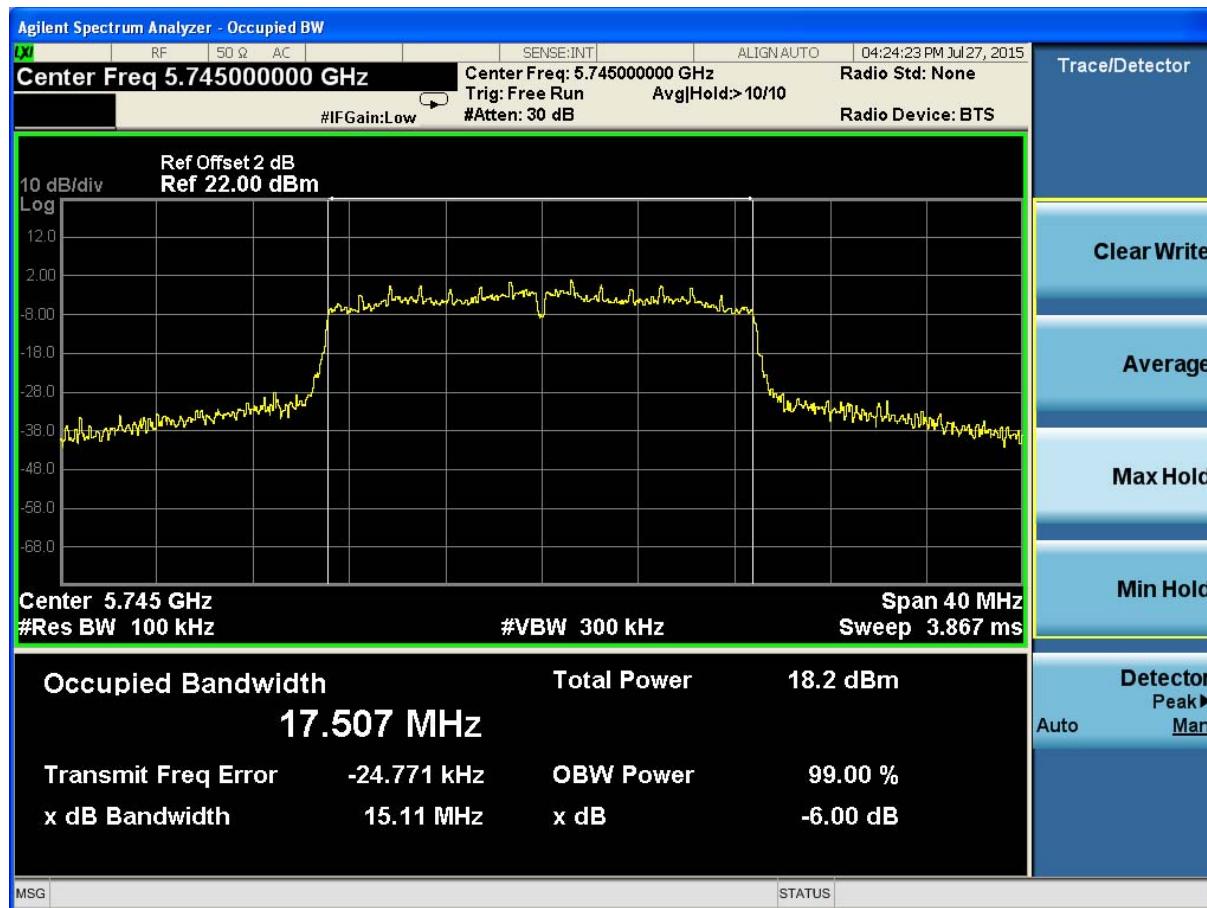
(Plot 4.6.1 A: Channel 149: 5745MHz @ 802.11a)



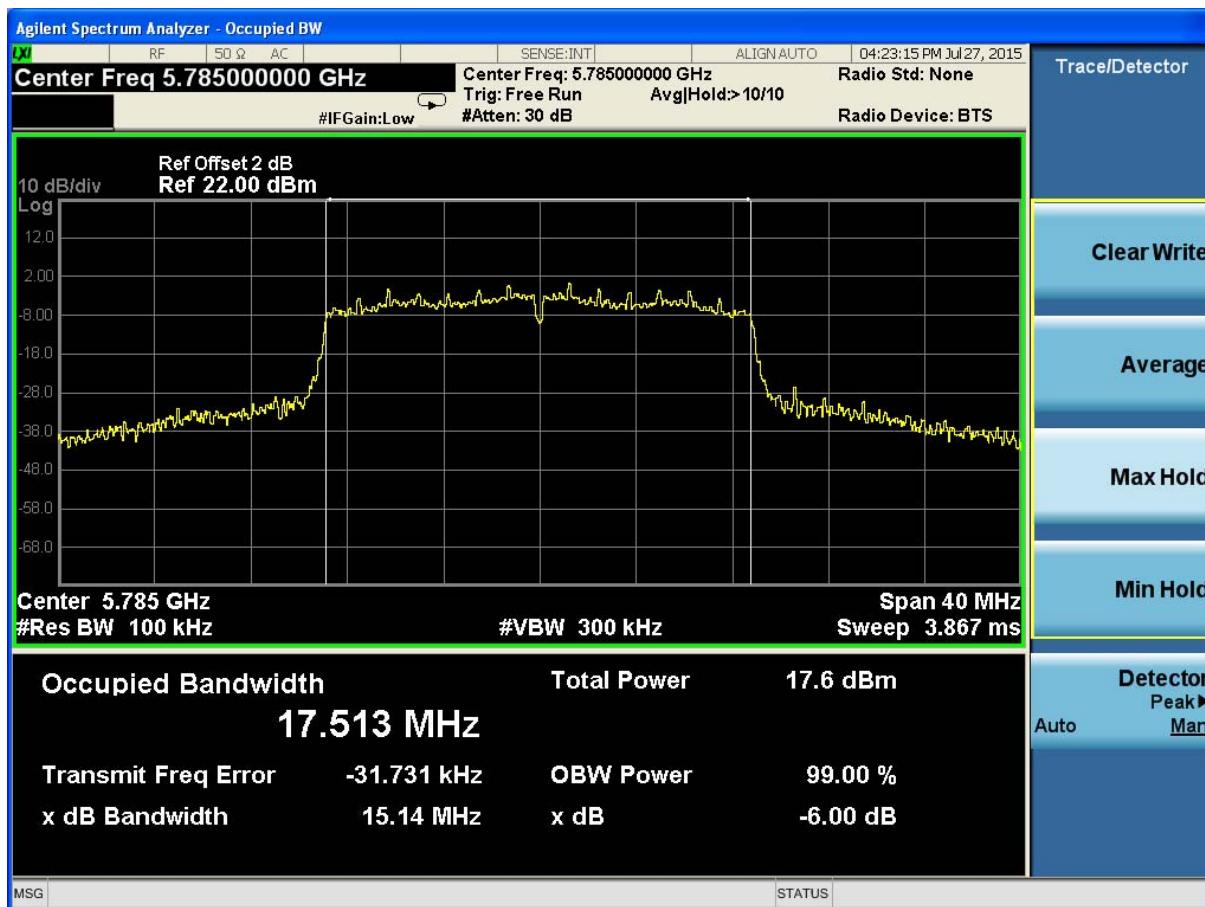
(Plot 4.6.1 B: Channel 157: 5785MHz @ 802.11a)



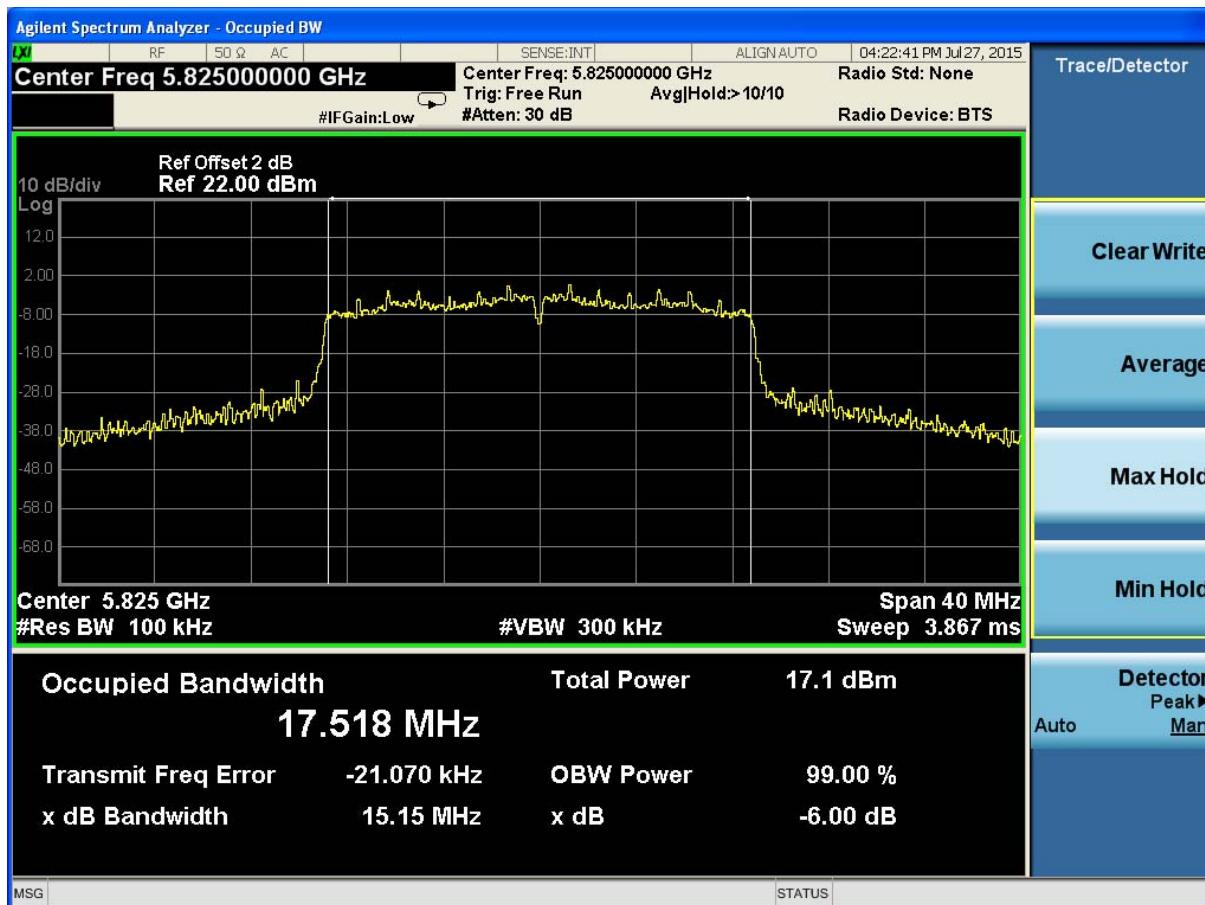
(Plot 4.6.1 C: Channel 165: 5825MHz @ 802.11a)



(Plot 4.6.2 A: Channel 149: 57MHz @ 802.11n HT20)



(Plot 4.6.2 B: Channel 157: 5785MHz @ 802.11n HT20)



(Plot 4.6.2 C: Channel 135: 5825MHz @ 802.11n HT20)