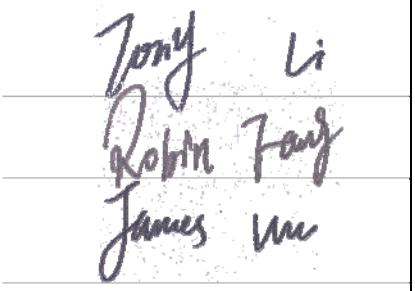
FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.....:	**A150J166117-WLAN1**
FCC ID..... :	**2AE4C-M210**
Compiled by (position+printed name+signature)..:	File administrators Tony Li
Supervised by (position+printed name+signature)..:	Technique principal Robin Fang
Approved by (position+printed name+signature)..:	Manager James Wu
Date of issue.....:	July 27, 2015



Representative Laboratory Name ....:	Shenzhen CTL Electron Technology Co., Ltd.
Address .....:	A0402, Block 1, Kefa Industrial District, Huanguan Nan Rd, Xintian community, Guanlan, Baoan, Shenzhen, China
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 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz**
TRF Originator.....:	Shenzhen CTL Electron Technology Co., Ltd.
Master TRF.....:	Dated 2012-06

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 2412MHz to 2462MHz
Rating .....:	DC 12.0V Adapter from AC 120V/60Hz
Result.....:	**PASS**

TEST REPORT

Test Report No. :	A150J166117-WLAN1	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**

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.

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices
KDB558074 D01 V03r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

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,π/4DQPSK)/BLE(GFSK)

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	120V / 60 Hz	○	115V / 60Hz
		○	12 V DC	○	24 V DC
		●	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 (Duty Cycle >98%)

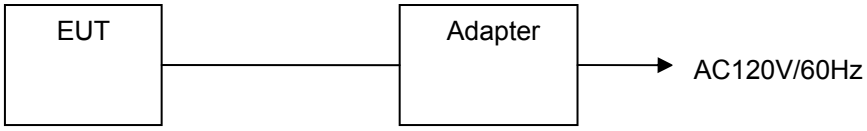
for testing meet KDB558074 test requirement.

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

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	**2412**	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	**11**	**2462**
5	2432	12	2467
6	**2437**	13	2472
7	2442		

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

1. 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

2. 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, Dongguan 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
§15.247(b)(4)	Antenna gain	802.11b	☒ Lowest ☒ Middle ☒ Highest	802.11b	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.247(e)	Power spectral density	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.247(a)(1)	Spectrum bandwidth – 6 dB bandwidth	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.247(b)(1)	Maximum output power	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	☒ ☒ ☒	☐	☐	☐	complies
§15.247(d)	Band edge compliance conducted	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Highest	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.205	Band edge compliance radiated	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Highest	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Highest	☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions conducted	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies

§15.247(d)	TX spurious emissions radiated	802.11b 802.11g 802.11n HT20	☒ Lowest ☒ Middle ☒ Highest	802.11b	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.109	RX spurious emissions radiated	-/-	-/-	-/-	-/-	☒	☐	☐	☐	complies
§15.209(a)	TX spurious Emissions radiated < 30 MHz	802.11b	-/-	802.11b	-/-	☒	☐	☐	☐	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	802.11b	-/-	802.11b	-/-	☒	☐	☐	☐	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 Power Spectral Density 6dB Bandwidth Spurious RF conducted emission Radiated Emission 9kHz~1GHz& Radiated Emission 1GHz~10th Harmonic	11b/DSSS	1 Mbps	1/6/11
	11g/OFDM	6 Mbps	1/6/11
	11n HT20MHz/OFDM	6.5Mbps	1/6/11
Band Edge	11b/DSSS	1 Mbps	1/11
	11g/OFDM	6 Mbps	1/11
	11n HT20MHz/OFDM	6.5Mbps	1/11

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

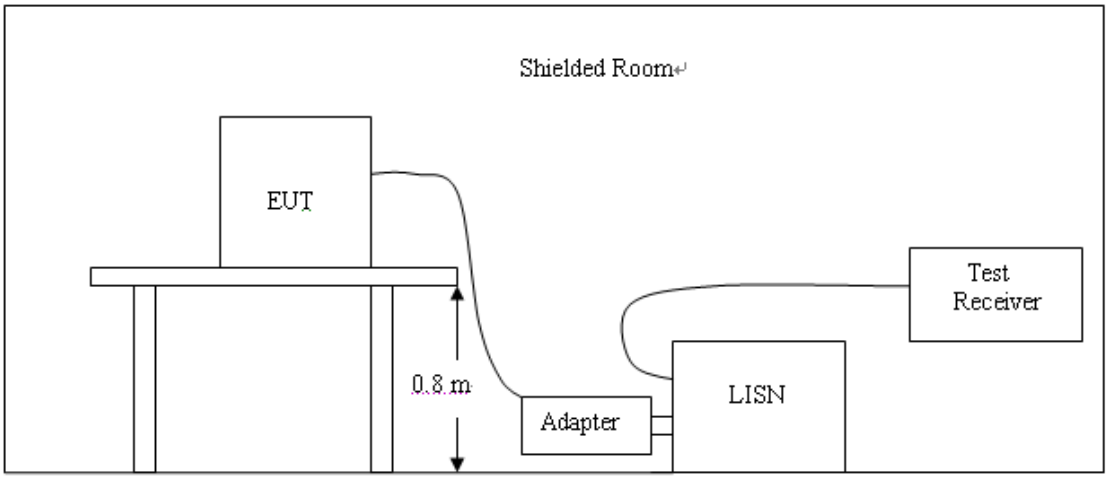
Maximum Peak Output Power / 6dB Bandwidth / Band Edge Compliance of RF Emission / Spurious RF Conducted Emission/ Power Spectral Density						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1	Power Sensor	Rohde&Schwarz	NRP-Z81	102638	2014/11/02	1 years
2	Spectrum Analyzer	Agilent	N9030A	MY49430428	2014/11/02	1 years

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

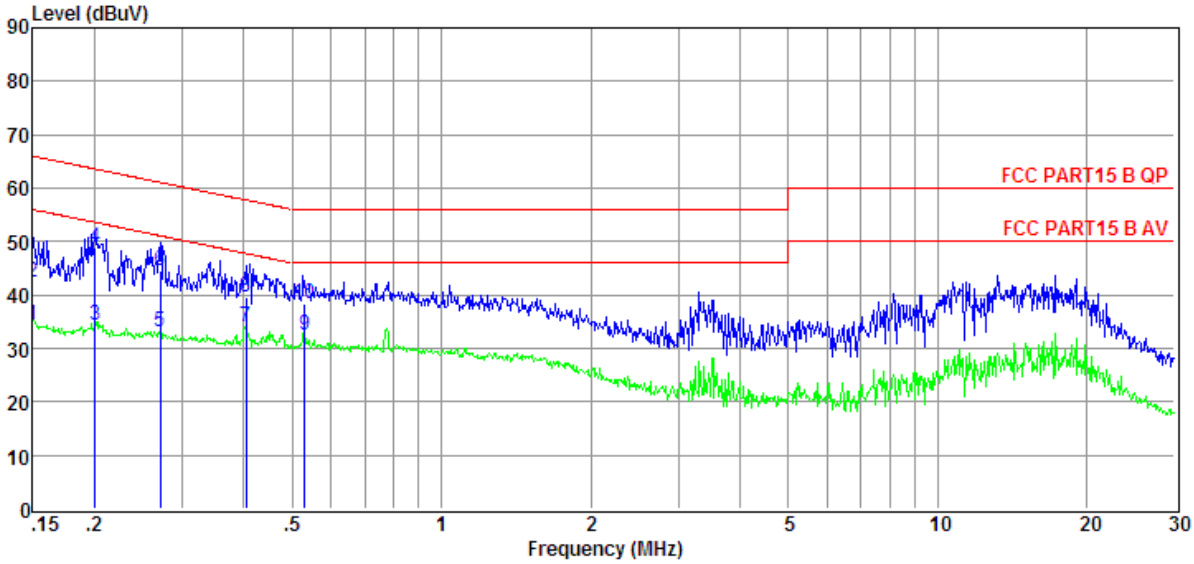
For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	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

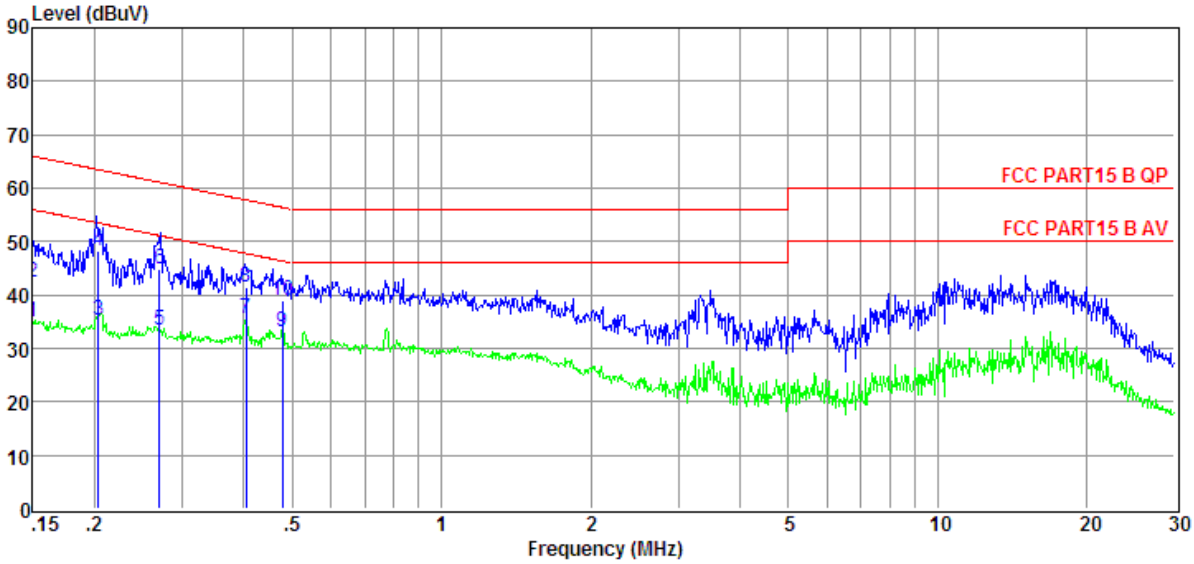
* Decreasing linearly with the logarithm of the frequency

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



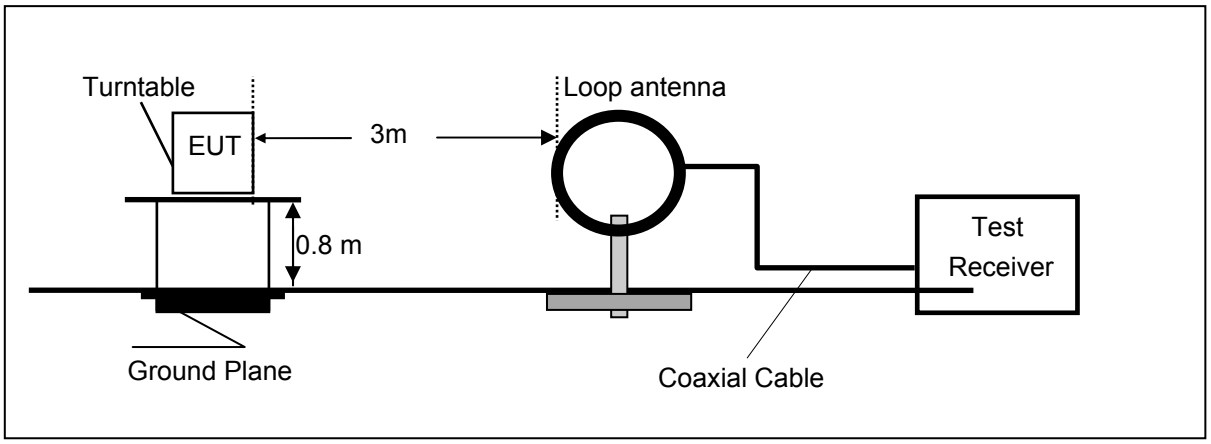
Item (Mark)	Freq (MHz)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Pulse Limiter Factor (dB)	Results Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Detector	Phase
1	0.15	15.61	9.61	0.01	9.84	35.07	56.00	-20.93	Average	LINE
2	0.15	22.91	9.61	0.01	9.84	42.37	66.00	-23.63	QP	LINE
3	0.20	15.89	9.62	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.

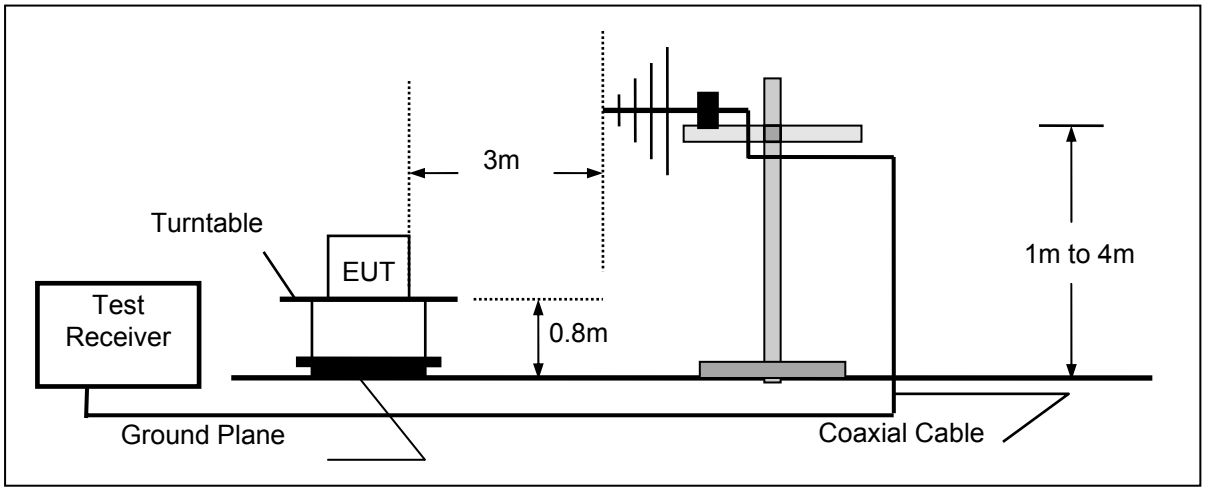
4.2. Radiated Emission

TEST CONFIGURATION

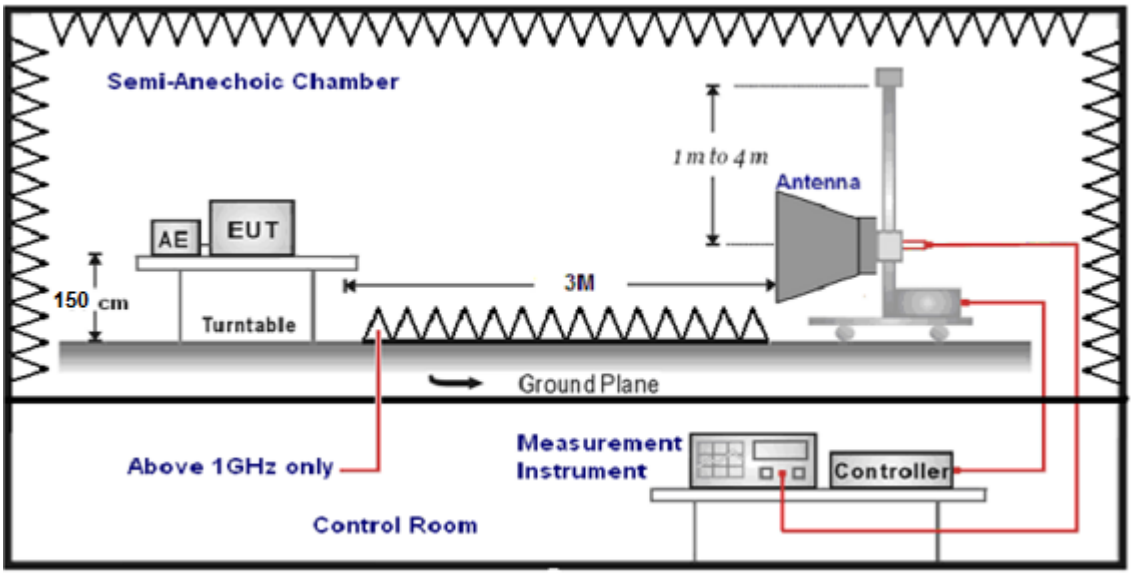
Frequency range 9KHz – 30MHz



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℃ to 360℃ 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 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.
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 Anternna	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 (dBμV/m)	RA (dBμV/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

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 (dBμV/m)	Radiated (μV/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

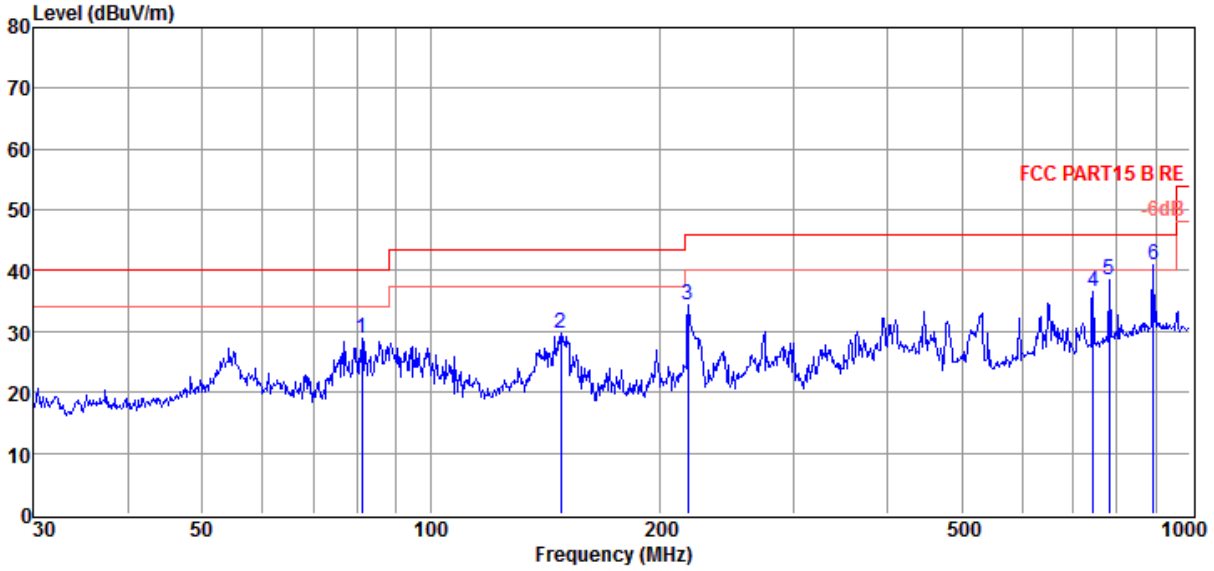
Remark: 1. We tested WLAN IEEE Link mode for below 1G;

For 9KHz to 30MHz

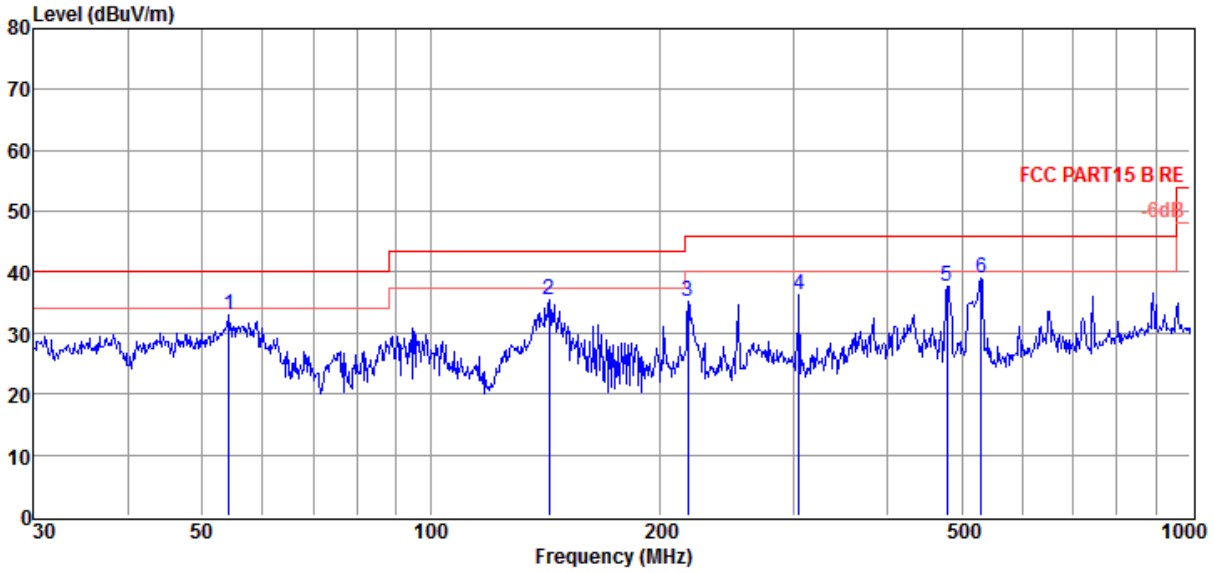
Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Over Limit (dB)	Detector
---	---	---	---	***QP***

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 (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/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 (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/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 25GHz

802.11b Mode@ Low Channel @ Channel 1 @ 2412 MHz

Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	4824.00	35.93	35.52	29.11	12.10	54.44	74.00	-19.56	Peak	Horizontal
1	4824.00	27.65	35.52	29.11	12.10	46.16	54.00	-7.84	AV[1]	Horizontal
2	7236.00	38.16	37.46	29.76	15.26	61.12	74.00	-12.88	Peak	Horizontal
2	7236.00	24.49	37.46	29.76	15.26	47.45	54.00	-6.55	AV[1]	Horizontal

Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	4824.00	33.24	35.52	29.11	12.10	51.75	74.00	-22.25	Peak	Vertical
1	4824.00	21.47	35.52	29.11	12.10	39.98	54.00	-14.02	AV[1]	Vertical
2	7236.00	34.81	37.46	29.76	15.26	57.77	74.00	-16.23	Peak	Vertical
2	7236.00	20.33	37.46	29.76	15.26	43.29	54.00	-10.71	AV[1]	Vertical

802.11b Mode@ Middle Channel @ Channel 6 @ 2437 MHz

Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	4874.00	39.35	35.51	29.08	12.04	57.82	74.00	-16.18	Peak	Horizontal
1	4874.00	27.77	35.51	29.08	12.04	46.24	54.00	-7.76	AV[1]	Horizontal
2	7311.00	38.52	37.30	29.88	15.32	61.26	74.00	-12.74	Peak	Horizontal
2	7311.00	26.09	37.30	29.88	15.32	48.83	54.00	-5.17	AV[1]	Horizontal

Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	4874.00	34.29	35.51	29.08	12.04	52.76	74.00	-21.24	Peak	Vertical
1	4874.00	21.61	35.51	29.08	12.04	40.08	54.00	-13.92	AV[1]	Vertical
2	7311.00	36.63	37.30	29.88	15.32	59.37	74.00	-14.63	Peak	Vertical
2	7311.00	22.31	37.30	29.88	15.32	45.05	54.00	-8.95	AV[1]	Vertical

802.11b Mode@ High Channel @ Channel 11 @ 2462 MHz

Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	4924.00	37.42	35.64	29.04	12.02	56.04	74.00	-17.96	Peak	Horizontal
1	4924.00	30.19	35.64	29.04	12.02	48.81	54.00	-5.19	AV[1]	Horizontal
2	7386.00	37.12	37.37	30.12	15.66	60.03	74.00	-13.97	Peak	Horizontal
2	7386.00	27.05	37.37	30.12	15.66	49.96	54.00	-4.04	AV[1]	Horizontal

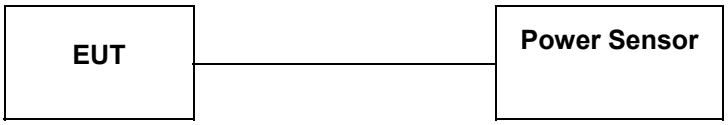
Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	4924.00	34.69	35.64	29.04	12.02	53.31	74.00	-20.69	Peak	Vertical
1	4924.00	24.16	35.64	29.04	12.02	42.78	54.00	-11.22	AV[1]	Vertical
2	7386.00	35.90	37.37	30.12	15.66	58.81	74.00	-15.19	Peak	Vertical
2	7386.00	22.63	37.37	30.12	15.66	45.54	54.00	-8.46	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 802.11b mode at 1Mbps.

4.3. Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to KDB558074 D01 DTS Measurement Guidance Section 9.1 Maximum peak conducted output power,9.1.1. The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

LIMIT

The Maximum Peak Output Power Measurement is 30dBm.

TEST RESULTS

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

4.3.1 802.11b Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
1	2412	16.56	30	PASS
6	2437	16.89	30	PASS
11	2462	15.66	30	PASS

4.3.2 802.11g Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
1	2412	20.81	30	PASS
6	2437	21.09	30	PASS
11	2462	19.94	30	PASS

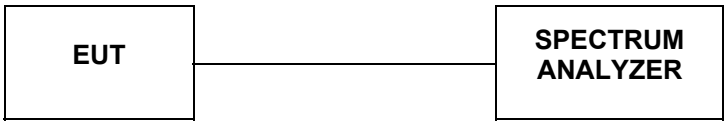
4.3.3 802.11n HT20Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
1	2412	19.84	30	PASS
6	2437	20.14	30	PASS
11	2462	19.07	30	PASS

4.4. Power Spectral Density

TEST CONFIGURATION



TEST PROCEDURE

According to KDB 558074 D01 V03 Method PKPSD (peak PSD) This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

LIMIT

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

TEST RESULTS

4.4.1 802.11b Test Mode

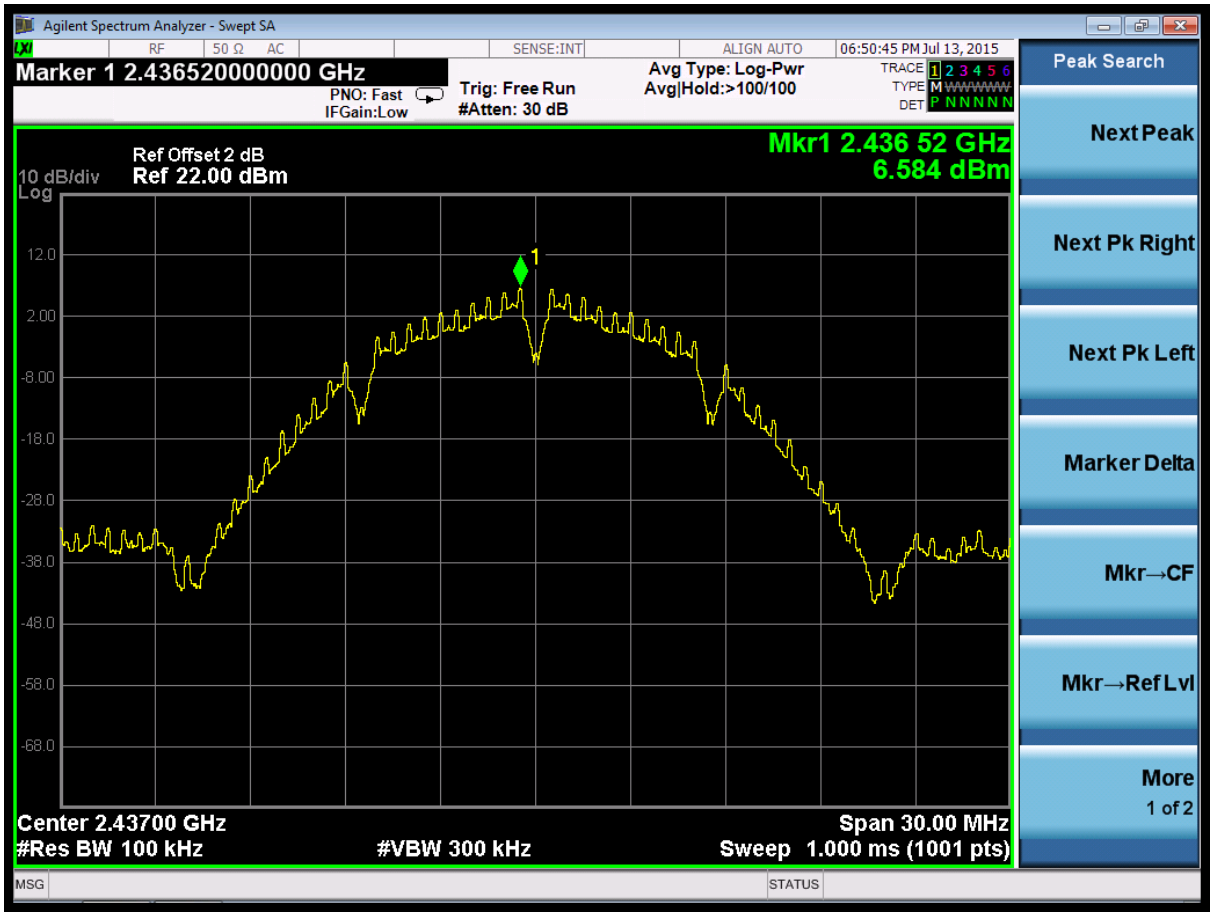
A. Test Verdict

Channel	Frequency (MHz)	Report PSD (dBm/100KHz)	Refer to Plot	Limits (dBm/3KHz)	Verdict
1	2412	6.271	Plot 4.4.1 A	8	PASS
6	2437	6.584	Plot 4.4.1 B	8	PASS
11	2462	5.397	Plot 4.4.1 C	8	PASS

Note:
1. For 802.11b mode at finial test to get the worst-case emission at 1Mbps.
2. The test results including the cable lose.

B. Test Plots

(Plot 4.4.1 A: Channel 1: 2412MHz @ 802.11b)



(Plot 4.4.1 B: Channel 6: 2437MHz @ 802.11b)

(Plot 4.4.1 C: Channel 11: 2462MHz @ 802.11b)

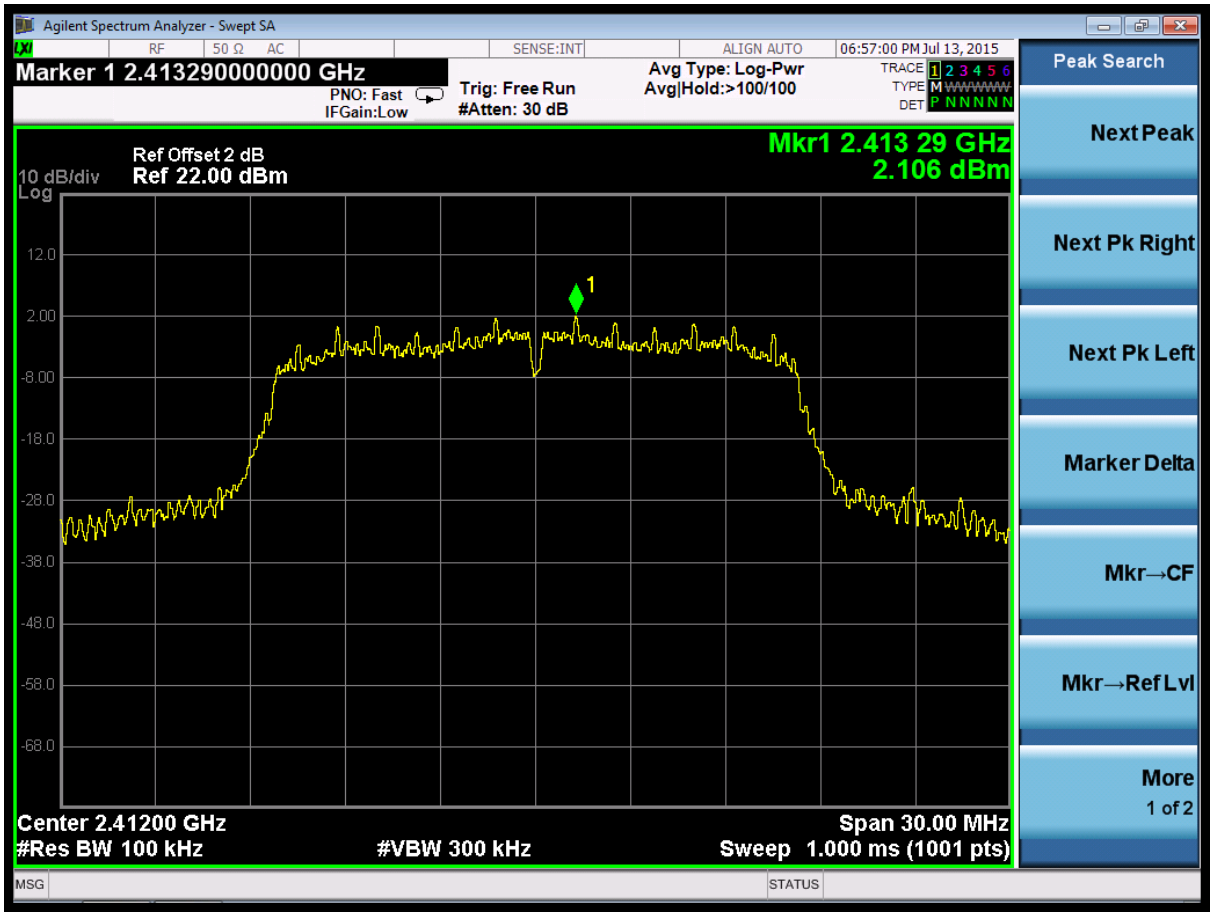
4.4.2 802.11g Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Report PSD (dBm/100KHz)	Refer to Plot	Limits (dBm/3KHz)	Verdict
1	2412	2.106	Plot 4.4.2 A	8	PASS
6	2437	2.122	Plot 4.4.2 B	8	PASS
11	2462	1.248	Plot 4.4.2 C	8	PASS

Note:
1. For 802.11g mode at finial test to get the worst-case emission at 6Mbps.
2. The test results including the cable lose.

B. Test Plots



(Plot 4.4.2 A: Channel 1: 2412MHz @ 802.11g)

(Plot 4.4.2 B: Channel 6: 2437MHz @ 802.11g)

(Plot 4.4.2 C: Channel 11: 2462MHz @ 802.11g)

4.4.3 802.11n HT20 Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Report PSD (dBm/100KHz)	Refer to Plot	Limits (dBm/3KHz)	Verdict
1	2412	1.147	Plot 4.4.3 A	8	PASS
6	2437	1.317	Plot 4.4.3 B	8	PASS
11	2462	0.244	Plot 4.4.3 C	8	PASS

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

B. Test Plots

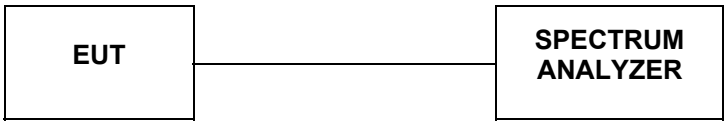
(Plot 4.4.3 A: Channel 1: 2412MHz @ 802.11n HT20)

(Plot 4.4.3 B: Channel 6: 2437MHz @ 802.11n HT20)

(Plot 4.4.3 C: Channel 11: 2462MHz @ 802.11n HT20)

4.5. 6dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300KHz.
The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.
According to KDB558074 D01 V03 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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.

LIMIT

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

TEST RESULTS

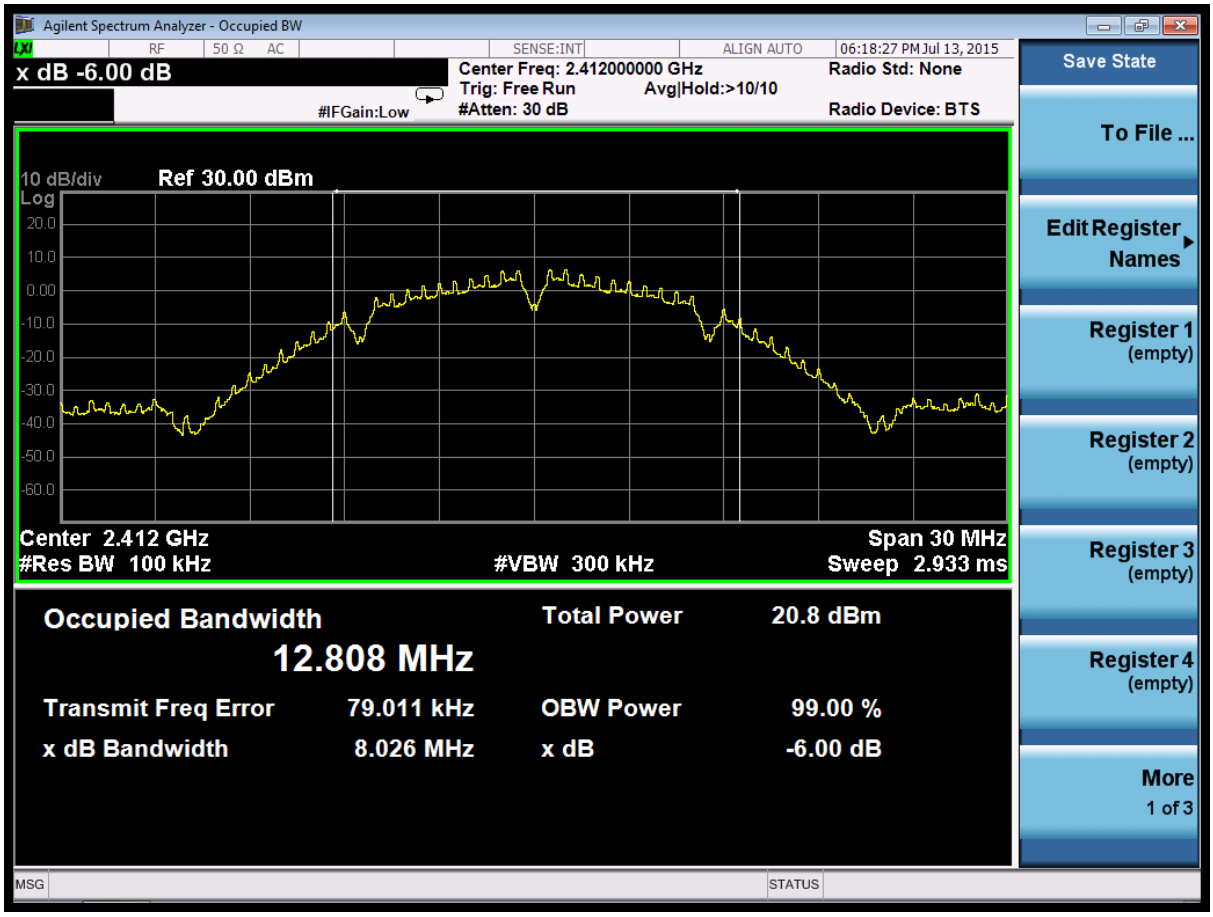
4.5.1 801.11b Test Mode

A. Test Verdict

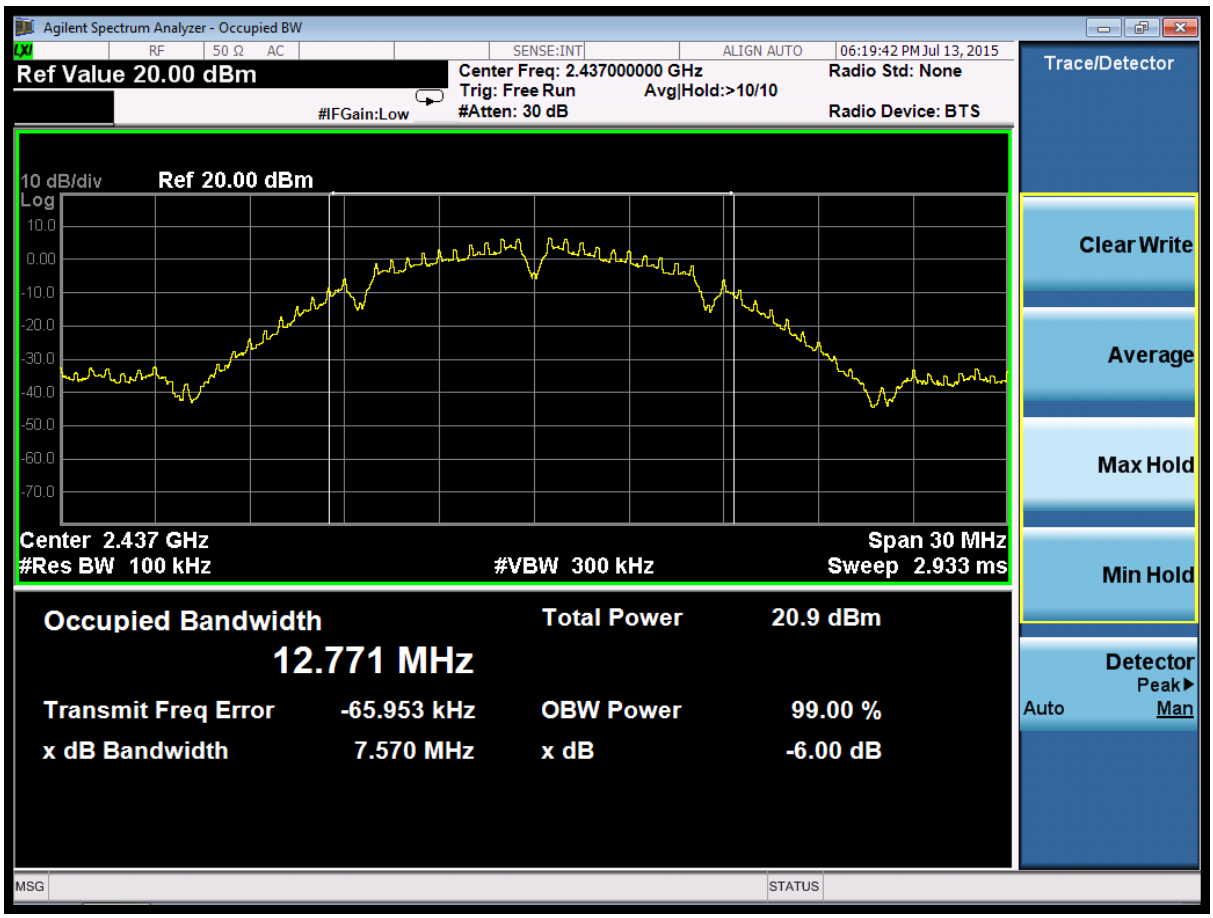
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Verdict
1	2412	8.026	Plot 4.5.1 A	≥500	PASS
6	2437	7.570	Plot 4.5.1 B	≥500	PASS
11	2462	8.052	Plot 4.5.1 C	≥500	PASS

Note:
1. For 802.11b mode at finial test to get the worst-case emission at 1Mbps.
2. The test results including the cable lose.

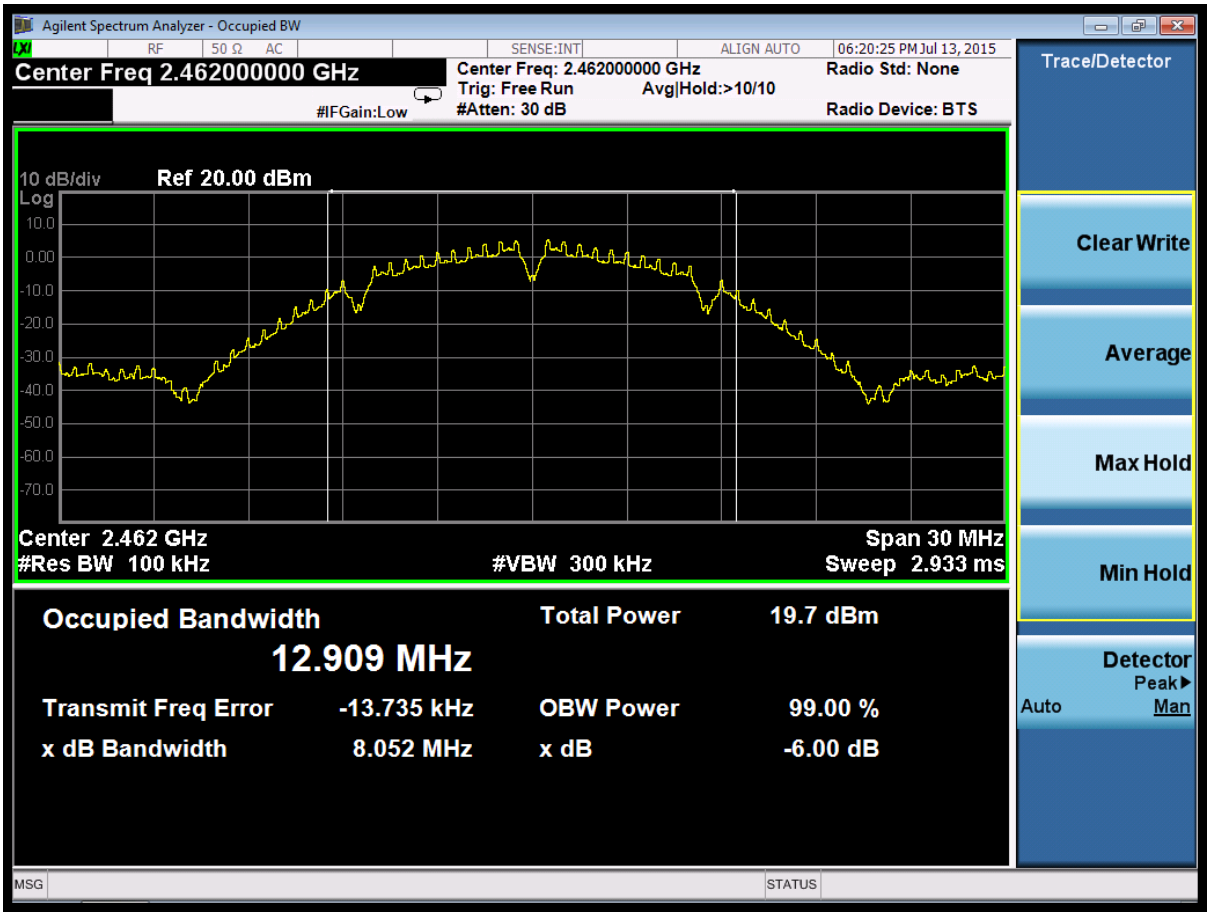
B. Test Plots



(Plot 4.5.1 A: Channel 1: 2412MHz @ 802.11b)



(Plot 4.5.1 B: Channel 6: 2437MHz @ 802.11b)



(Plot 4.5.1 C: Channel 11: 2462MHz @ 802.11b)

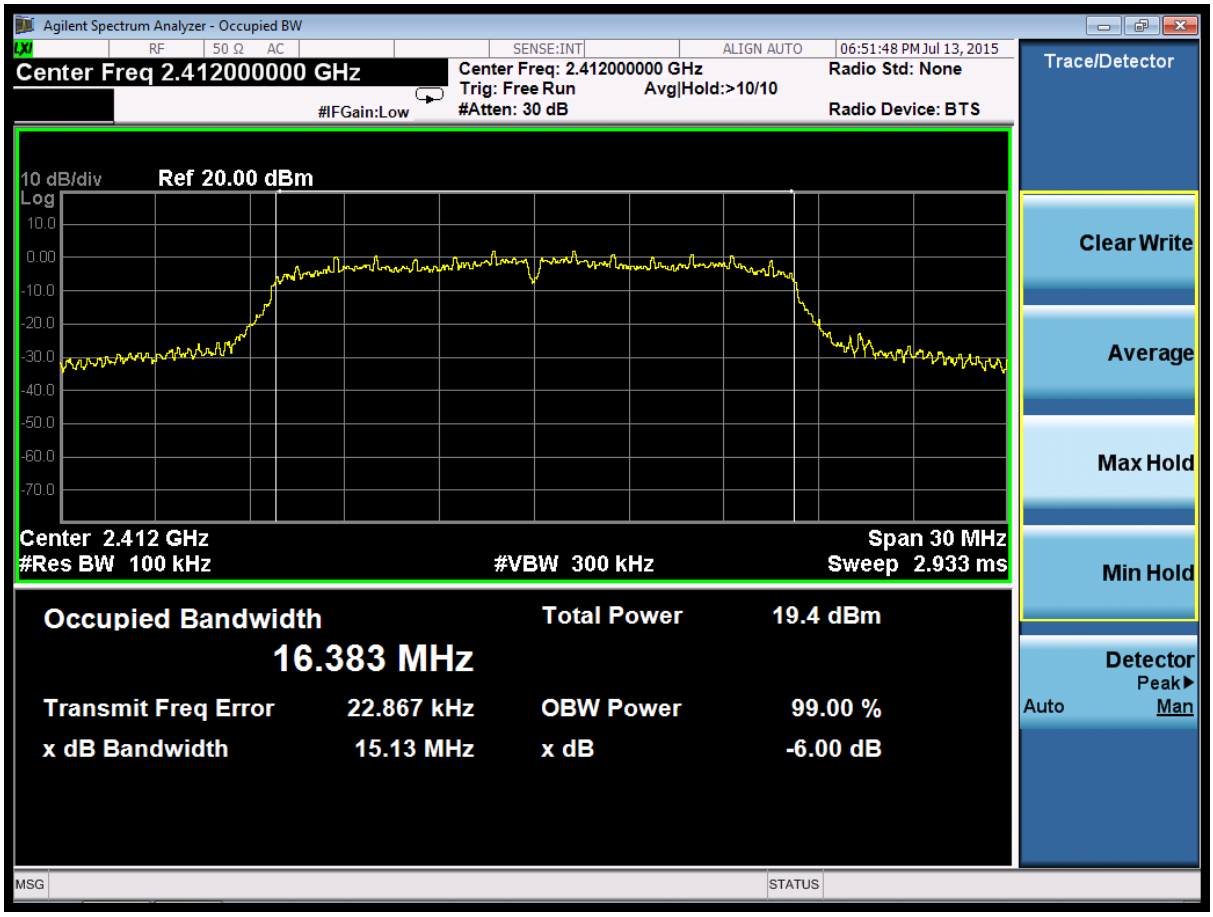
4.5.2 801.11g Test Mode

A. Test Verdict

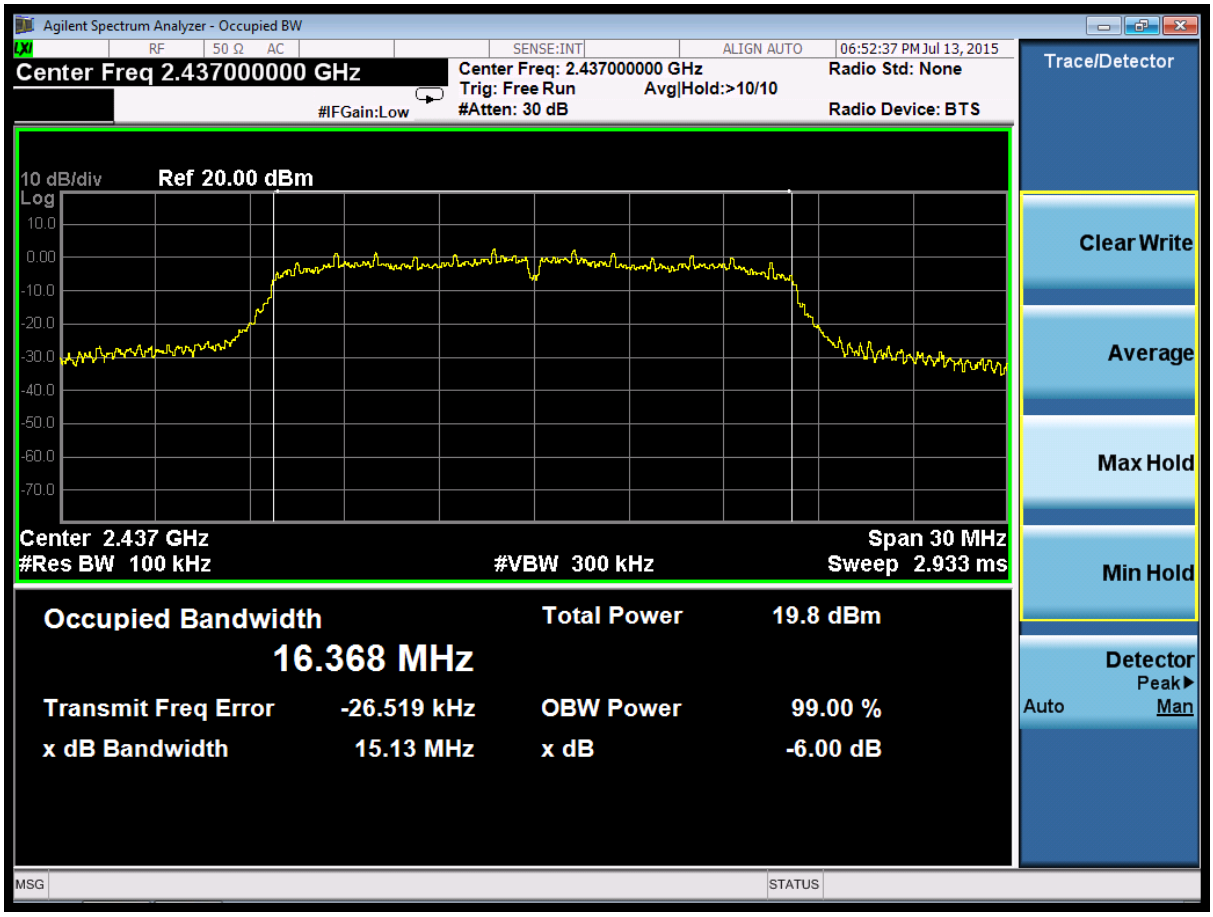
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Verdict
1	2412	15.13	Plot 4.5.2 A	≥500	PASS
6	2437	15.13	Plot 4.5.2 B	≥500	PASS
11	2462	15.13	Plot 4.5.2 C	≥500	PASS

Note:
1. For 802.11g mode at finial test to get the worst-case emission at 6Mbps.
2. The test results including the cable lose.

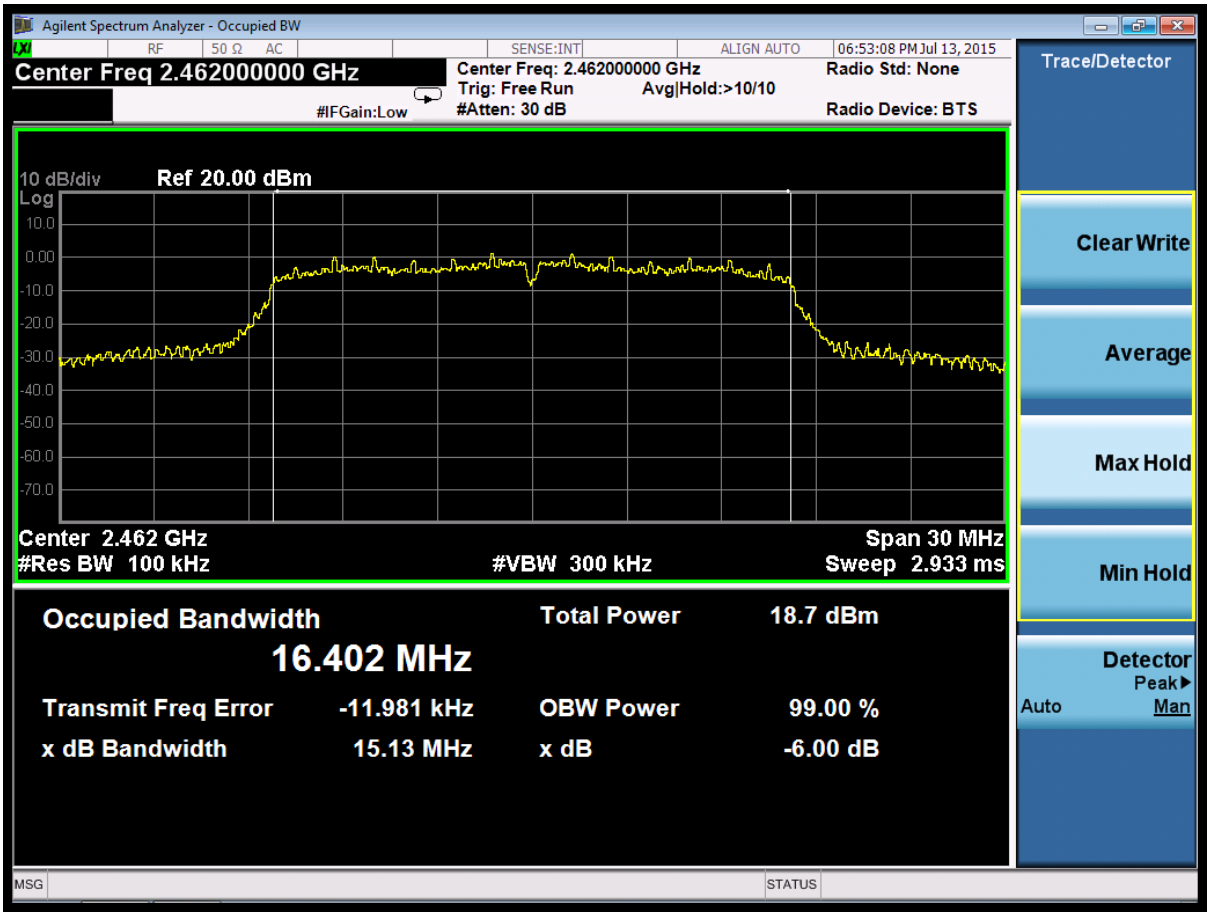
B. Test Plots



(Plot 4.5.2 A: Channel 1: 2412MHz @ 802.11g)



(Plot 4.5.2 B: Channel 6: 2437MHz @ 802.11g)



(Plot 4.5.2 C: Channel 11: 2462MHz @ 802.11g)

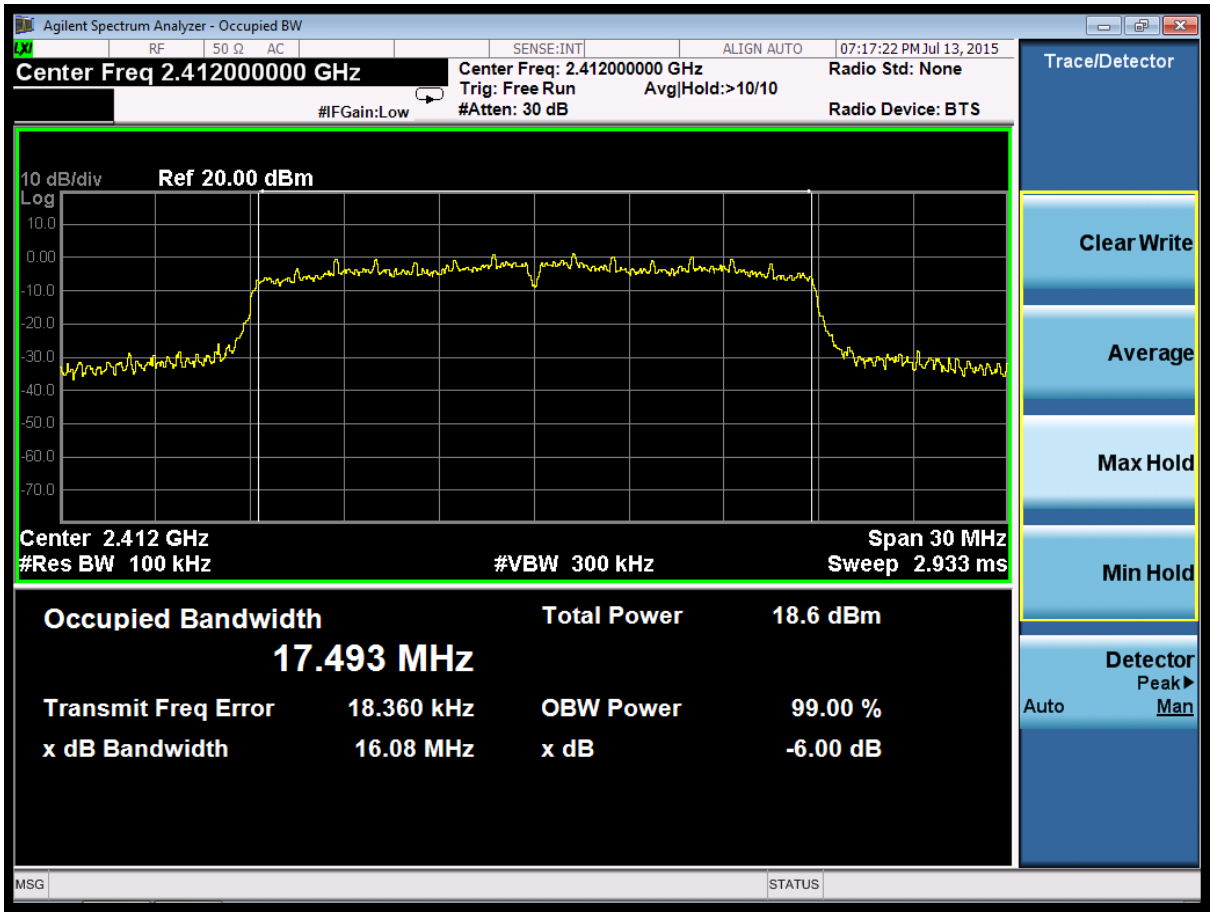
4.5.3 801.11n HT20 Test Mode

A. Test Verdict

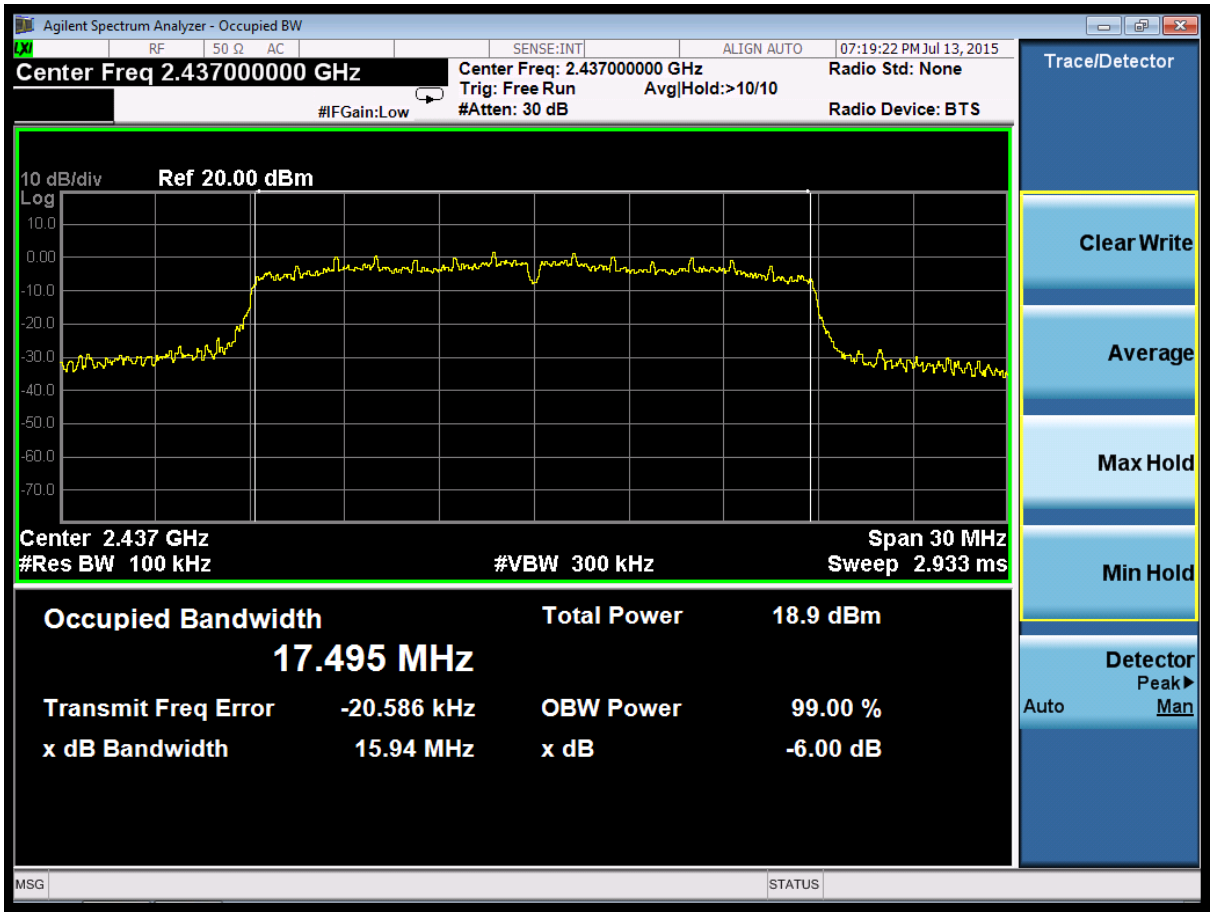
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Verdict
1	2412	16.08	Plot 4.5.3 A	≥500	PASS
6	2437	15.94	Plot 4.5.3 B	≥500	PASS
11	2462	15.94	Plot 4.5.3 C	≥500	PASS

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

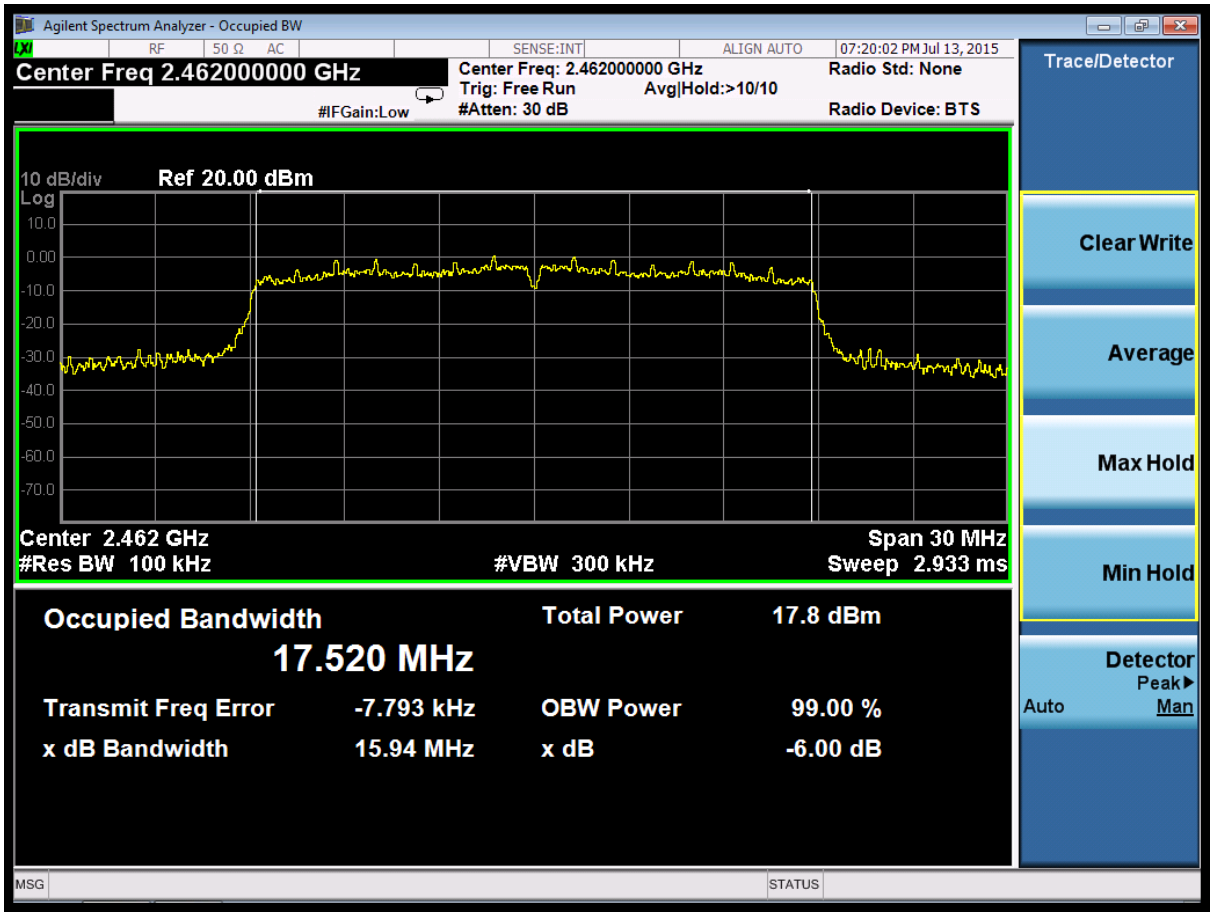
B. Test Plots



(Plot 4.5.3 A: Channel 1: 2412MHz @ 802.11n HT20)



(Plot 4.5.3 B: Channel 6: 2437MHz @ 802.11n HT20)



(Plot 4.5.3 C: Channel 11: 2462MHz @ 802.11n HT20)

4.6. Band Edge Compliance of RF Emission

TEST REQUIREMENT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

According to KDB 558074 D01 V03 for Antenna-port conducted measurement. Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=10Hz for average detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
    $E = EIRP – 20\log D + 104.8$

where:
E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

11. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.
12. Compare the resultant electric field strength level to the applicable regulatory limit.
13. Perform radiated spurious emission test dures until all measured frequencies were complete.

LIMIT

Below -20dB of the highest emission level in operating band.
Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)

TEST RESULTS

4.6.1 802.11b Test Mode

A. Test Verdict

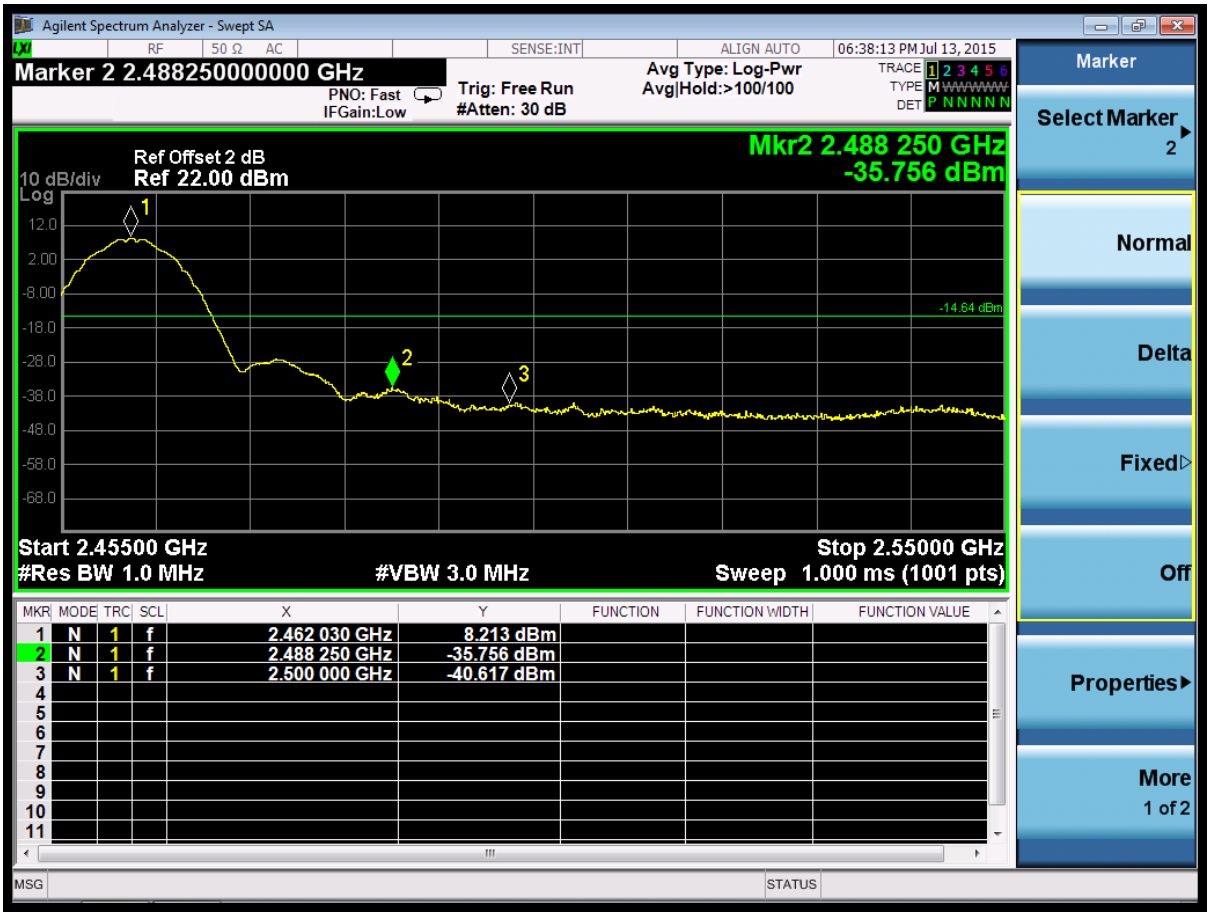
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Refer to Plot
2388.56	-39.221	2.00	0.00	58.039	Peak	74.00	Plot 4.6.1 A1
2385.44	-49.756	2.00	0.00	47.504	AV	54.00	Plot 4.6.1 A2
2412.20	9.067	2.00	0.00	106.327	Peak	---	Plot 4.6.1 A1
2411.24	5.512	2.00	0.00	102.772	AV	---	Plot 4.6.1 A2
2462.030	8.213	2.00	0.00	105.473	Peak	---	Plot 4.6.1 A3
2461.270	4.731	2.00	0.00	101.991	AV	---	Plot 4.6.1 A4
2488.250	-35.756	2.00	0.00	61.504	Peak	74.00	Plot 4.6.1 A3
2488.725	-45.241	2.00	0.00	52.019	AV	54.00	Plot 4.6.1 A4

Note:
1. For 802.11b mode at finial test to get the worst-case emission at 1Mbps.
2. The test results including the cable lose.
3. "---" means that the fundamental frequency not for 15.209 limits requirement.

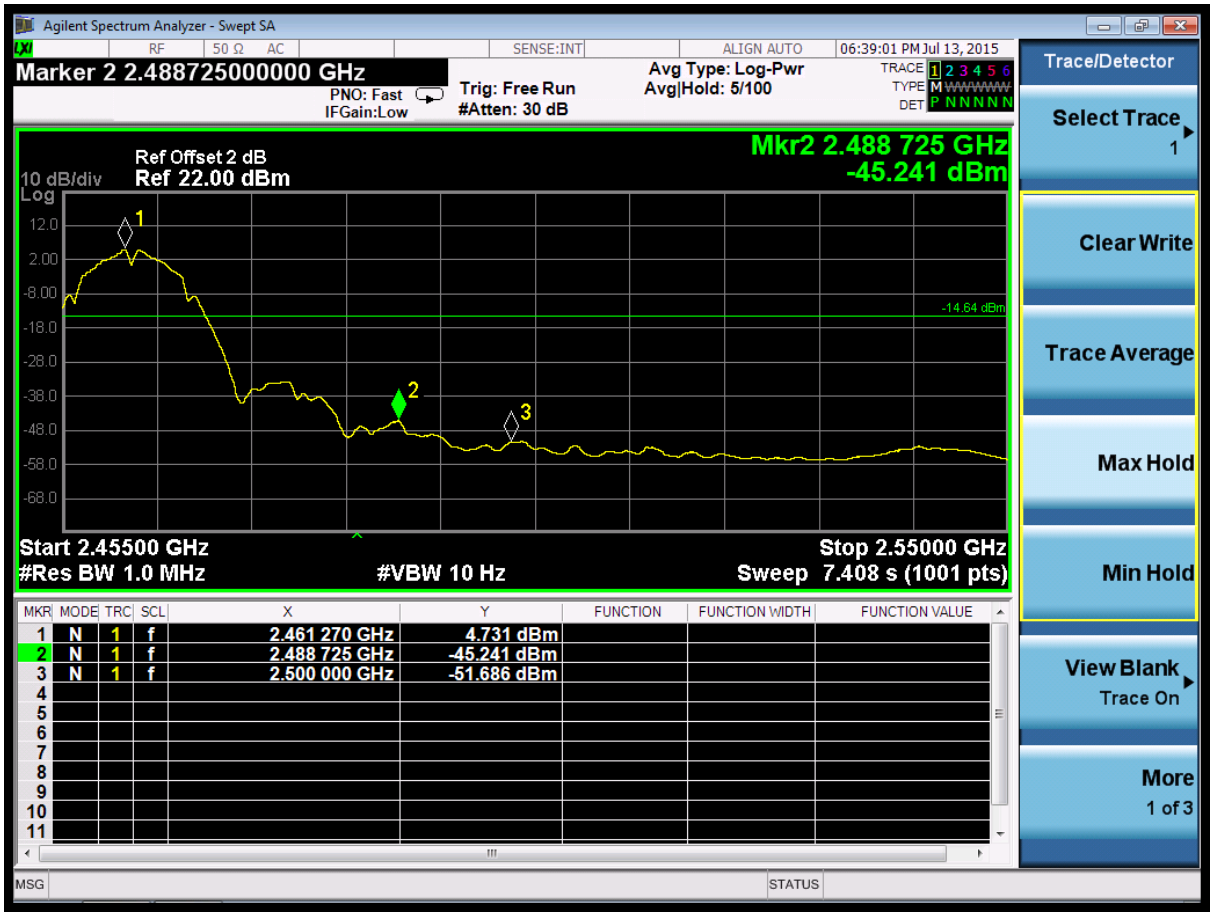
B. Test Plots

(Plot 4.6.1 A1: Channel 1: 2412MHz @ 802.11b)

(Plot 4.6.1 A2: Channel 1: 2412MHz @ 802.11b)



(Plot 4.6.1 A3: Channel 11: 2462MHz @ 802.11b)



(Plot 4.6.1 A4: Channel 11: 2462MHz @ 802.11b)

4.6.2 802.11g Test Mode

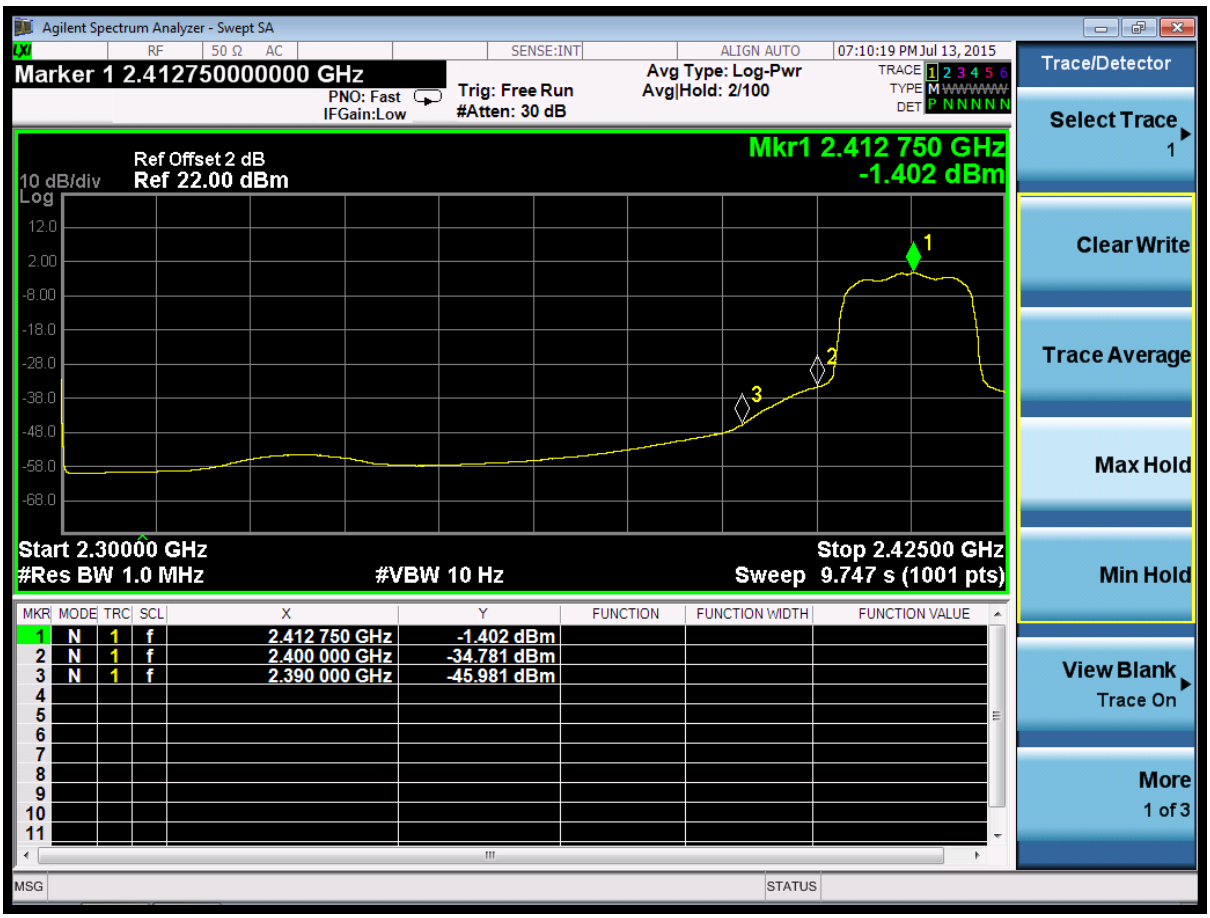
A. Test Verdict

Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Refer to Plot
2390.000	-25.510	2.00	0.00	71.750	Peak	74.00	Plot 4.6.2 A1
2390.000	-45.981	2.00	0.00	51.279	AV	54.00	Plot 4.6.2 A2
2412.125	10.635	2.00	0.00	107.895	Peak	---	Plot 4.6.2 A1
2412.750	-1.402	2.00	0.00	95.858	AV	---	Plot 4.6.2 A2
2462.700	9.890	2.00	0.00	107.150	Peak	---	Plot 4.6.2 A3
2461.200	-2.30	2.00	0.00	94.960	AV	---	Plot 4.6.2 A4
2483.700	-24.637	2.00	0.00	72.623	Peak	74.00	Plot 4.6.2 A3
2483.500	-44.369	2.00	0.00	52.891	AV	54.00	Plot 4.6.2 A4

Note:
1. For 802.11g mode at finial test to get the worst-case emission at 6Mbps.
2. The test results including the cable lose.
3. “---“ means that the fundamental frequency not for 15.209 limits requirement.

B. Test Plots

(Plot 4.6.2 A1: Channel 1: 2412MHz @ 802.11g)



(Plot 4.6.2 A2: Channel 1: 2412MHz @ 802.11g)

(Plot 4.6.2 A3: Channel 11: 2462MHz @ 802.11g)

(Plot 4.6.2 A4: Channel 11: 2462MHz @ 802.11g)

4.6.3 802.11n HT20 Test Mode

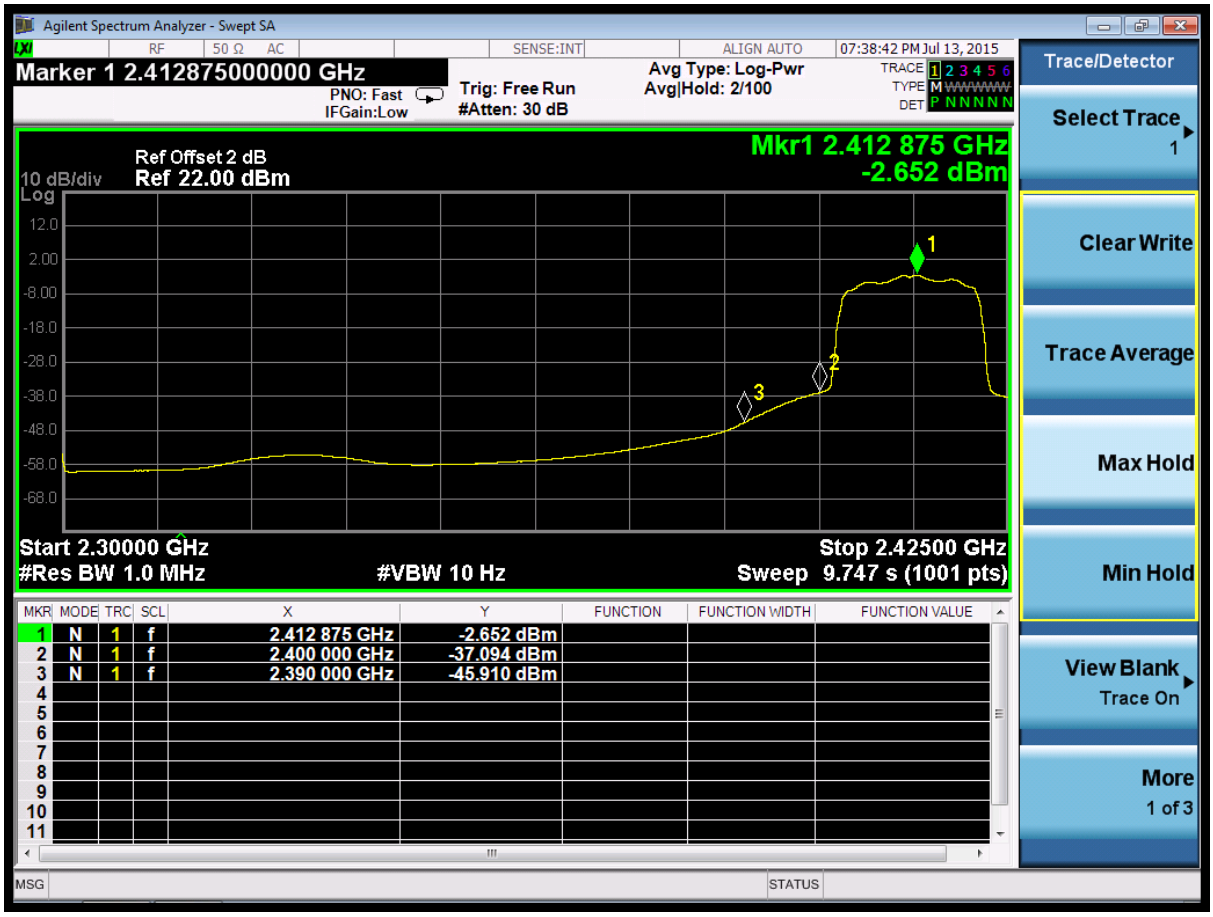
A. Test Verdict

Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Refer to Plot
2390.000	-26.875	2.00	0.00	70.385	Peak	74.00	Plot 4.6.3 A1
2390.000	-45.910	2.00	0.00	51.350	AV	54.00	Plot 4.6.3 A2
2412.375	10.240	2.00	0.00	107.50	Peak	---	Plot 4.6.3 A1
2412.875	-2.652	2.00	0.00	94.608	AV	---	Plot 4.6.3 A2
2461.700	8.733	2.00	0.00	105.993	Peak	---	Plot 4.6.3 A3
2461.100	-3.458	2.00	0.00	93.802	AV	---	Plot 4.6.3 A4
2484.000	-24.795	2.00	0.00	72.465	Peak	74.00	Plot 4.6.3 A3
2483.500	-45.044	2.00	0.00	52.216	AV	54.00	Plot 4.6.3 A4

Note:
1. For 802.11n HT20 mode at finial test to get the worst-case emission at 6.5Mbps.
2. The test results including the cable lose.
3. "---" means that the fundamental frequency not for 15.209 limits requirement.

B. Test Plots

(Plot 4.6.3 A1: Channel 1: 2412MHz @ 802.11n HT20)



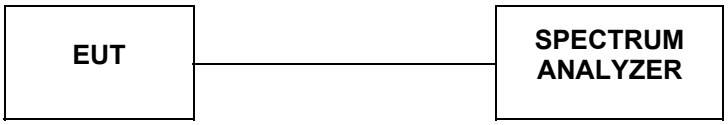
(Plot 4.6.3 A2: Channel 1: 2412MHz @ 802.11n HT20)

(Plot 4.6.3 A3: Channel 11: 2462MHz @ 802.11n HT20)

(Plot 4.6.3 A4: Channel 11: 2462MHz @ 802.11n HT20)

4.7. Spurious RF Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBW= 300KHz to measure the peak field strength , and mwasure frequeny range from 9KHz to 26.5GHz.

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST RESULTS

Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

4.7.1 802.11b Test Mode

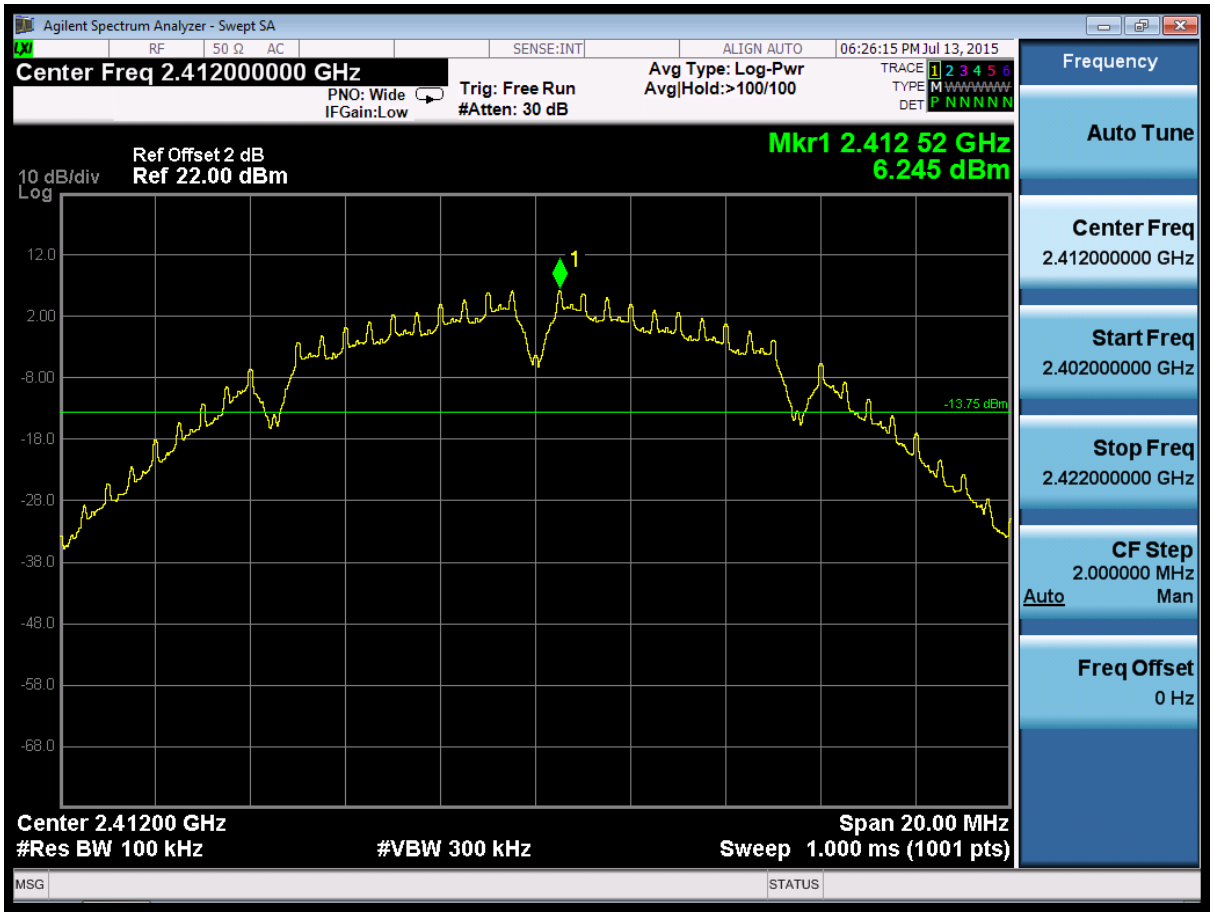
A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
1	2412	2412MHz	Plot 4.7.1 A1	N/A	PASS
		9KHz-30MHz	Plot 4.7.1 A2	-20	PASS
		30MHz-1GHz	Plot 4.7.1 A3	-20	PASS
		1GHz-8GHz	Plot 4.7.1 A4	-20	PASS
		8GHz-16GHz	Plot 4.7.1 A5	-20	PASS
		16GHz-26.5GHz	Plot 4.7.1 A6	-20	PASS
6	2437	2437MHz	Plot 4.7.1 B1	N/A	PASS
		9KHz-30MHz	Plot 4.7.1 B2	-20	PASS
		30MHz-1GHz	Plot 4.7.1 B3	-20	PASS
		1GHz-8GHz	Plot 4.7.1 B4	-20	PASS
		8GHz-16GHz	Plot 4.7.1 B5	-20	PASS
		16GHz-26.5GHz	Plot 4.7.1 B6	-20	PASS
11	2462	2462MHz	Plot 4.7.1 C1	N/A	PASS
		9KHz-30MHz	Plot 4.7.1 C2	-20	PASS
		30MHz-1GHz	Plot 4.7.1 C3	-20	PASS
		1GHz-8GHz	Plot 4.7.1 C4	-20	PASS
		8GHz-16GHz	Plot 4.7.1 C5	-20	PASS
		16GHz-26.5GHz	Plot 4.7.1 C6	-20	PASS

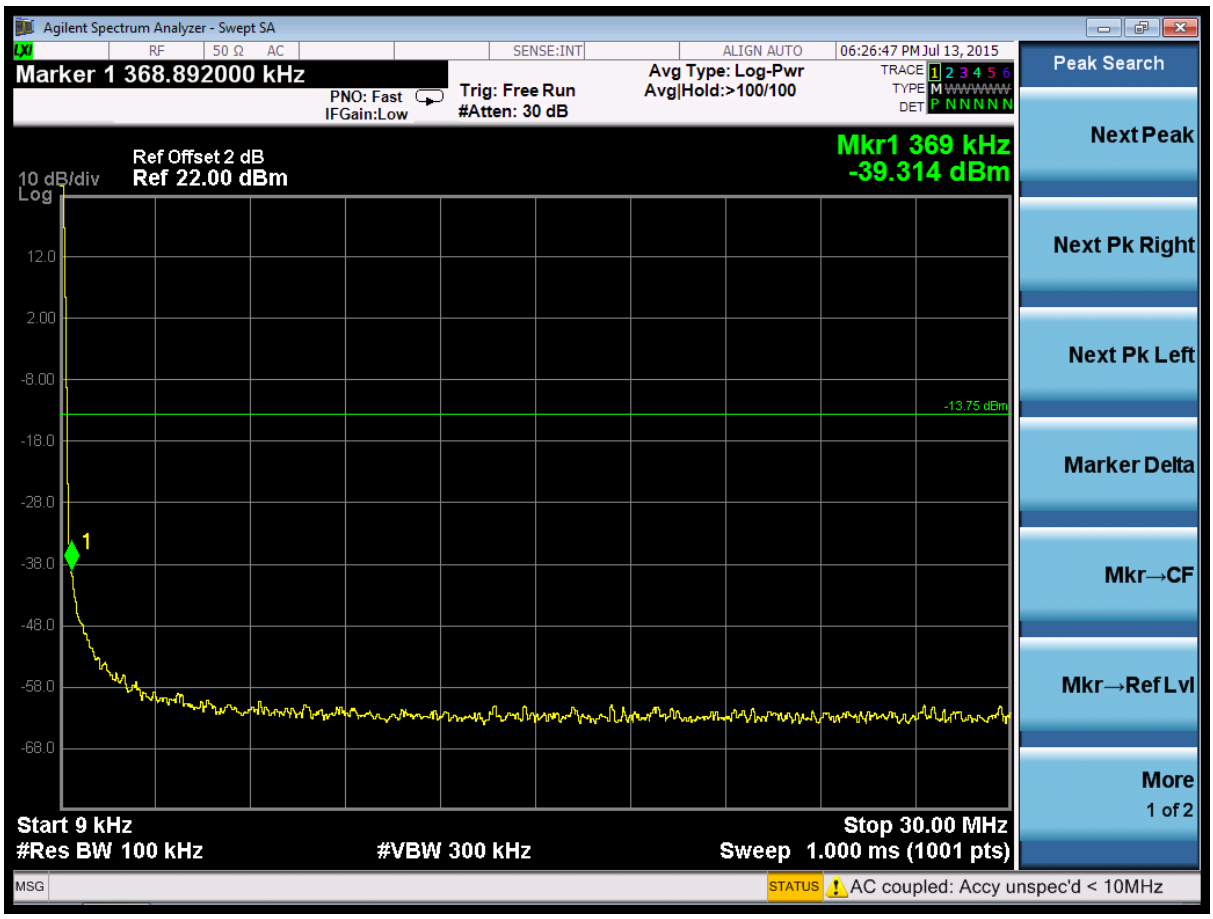
Frequency (MHz)	Delta Peak to Band emission (dBc)	Detector	Limit (dBc)	Refer to Plot	Verdict
2400.00	-41.581	Peak	-20	Plot 4.7.1 D	PASS
2483.50	-53.607	Peak	-20	Plot 4.7.1 E	PASS

Note:
1. For 802.11b mode at finial test to get the worst-case emission at 1Mbps.
2. The test results including the cable lose.

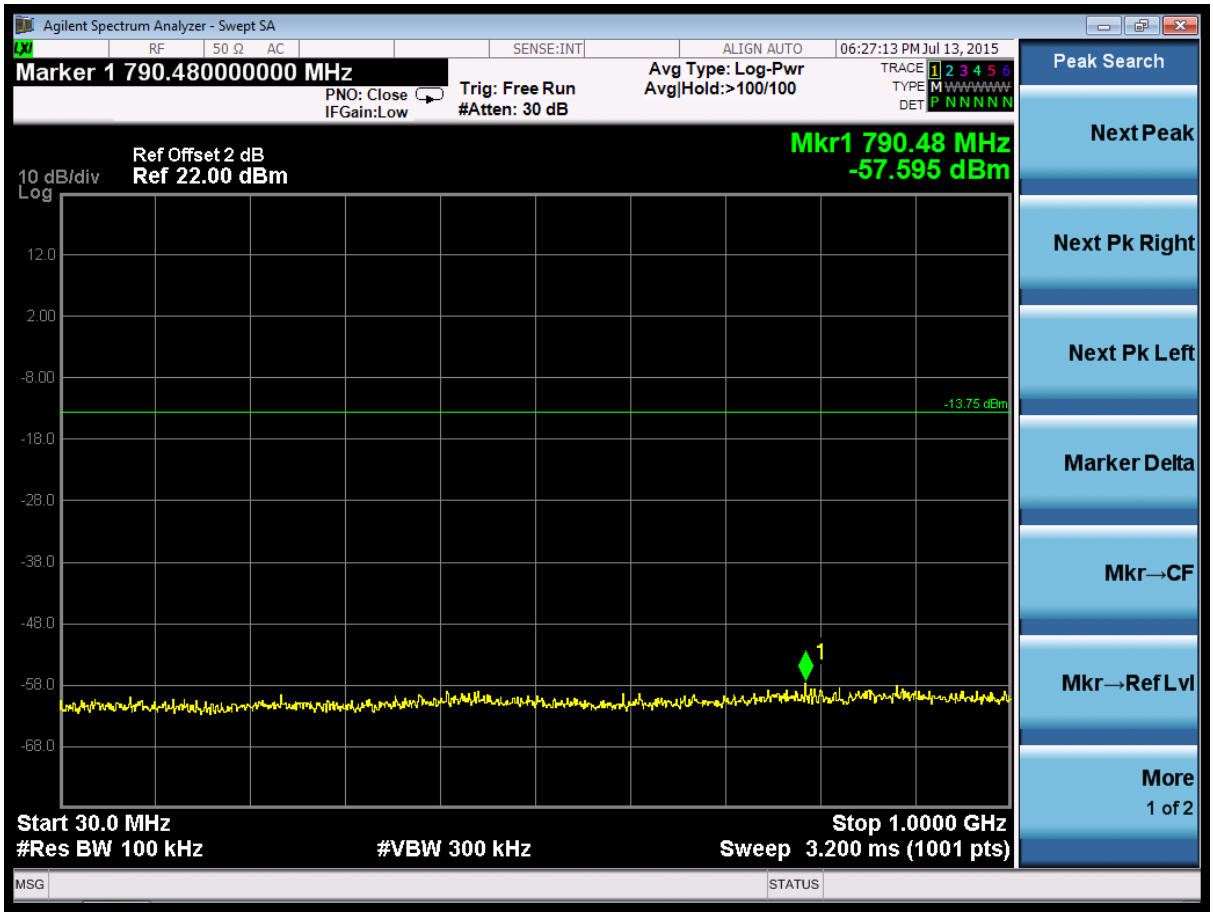
B. Test Plots



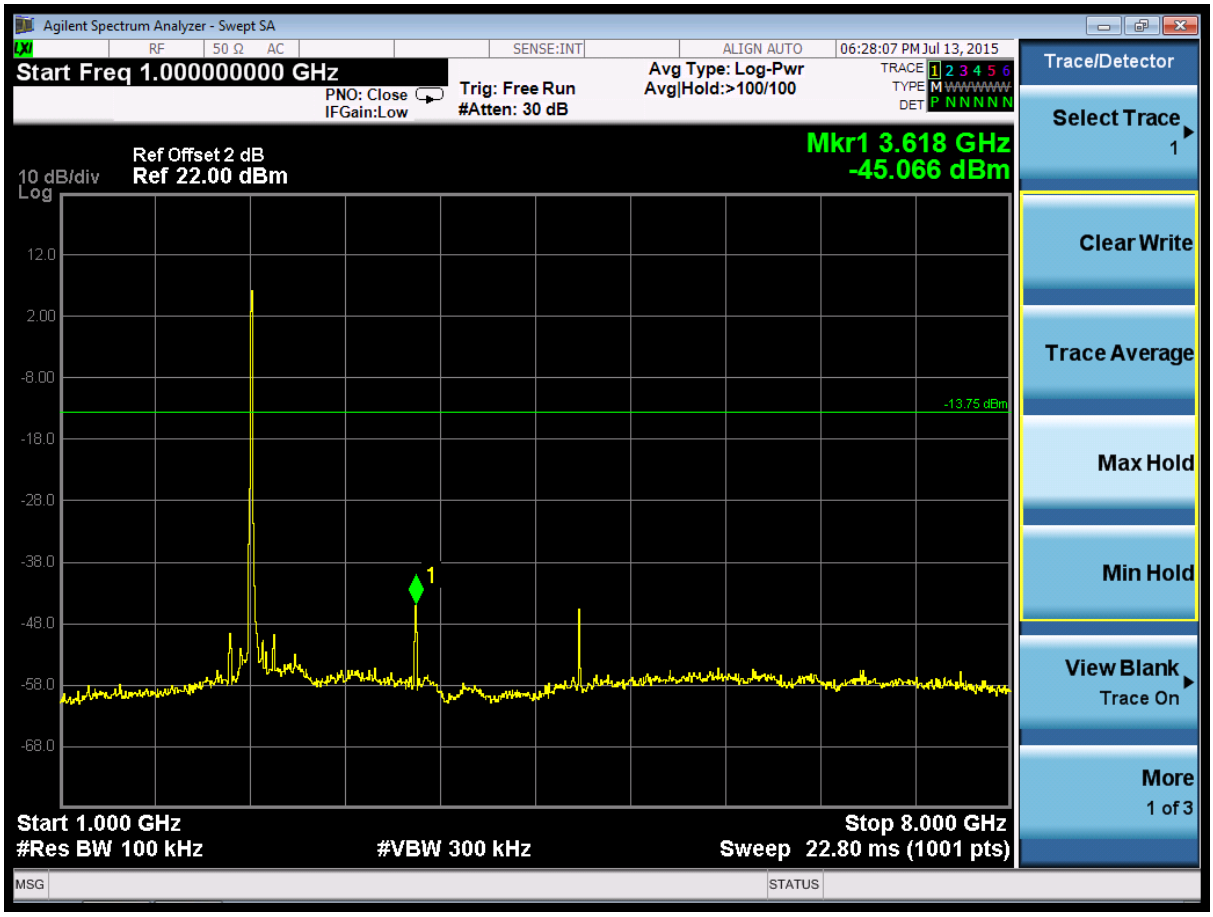
(Plot 4.7.1 A1: Channel 1: 2412MHz @ 802.11b)



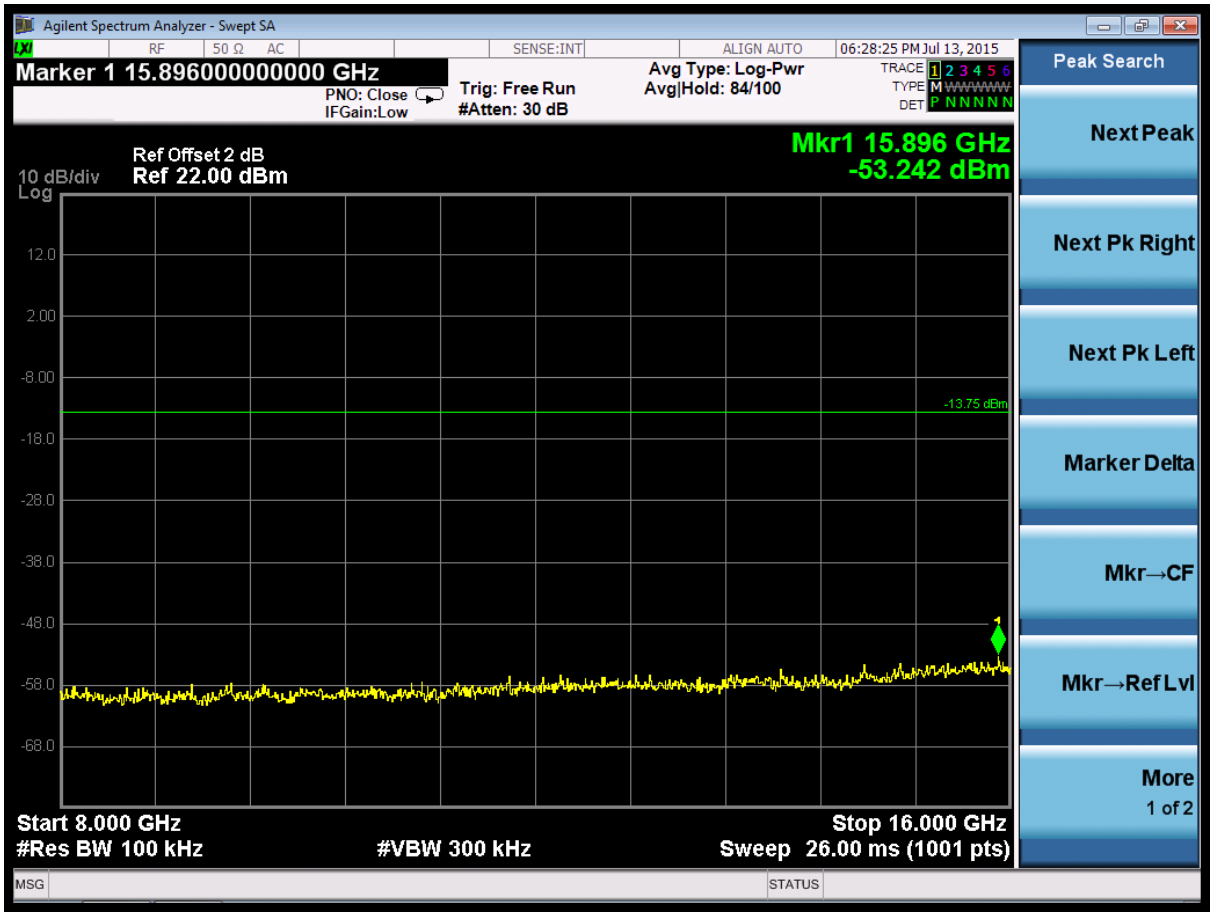
(Plot 4.7.1 A2: Channel 1: 2412MHz @ 802.11b)



(Plot 4.7.1 A3: Channel 1: 2412MHz @ 802.11b)

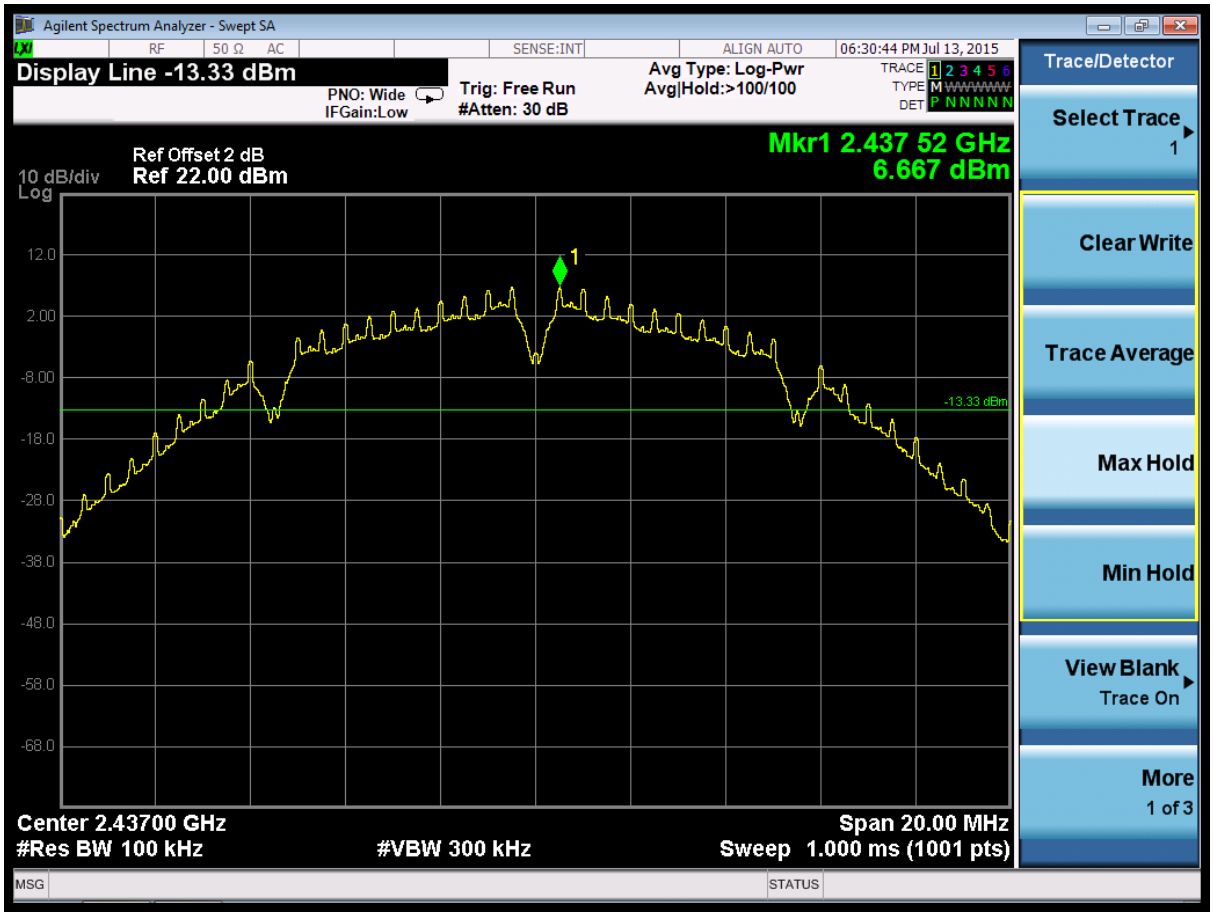


(Plot 4.7.1 A4: Channel 1: 2412MHz @ 802.11b)

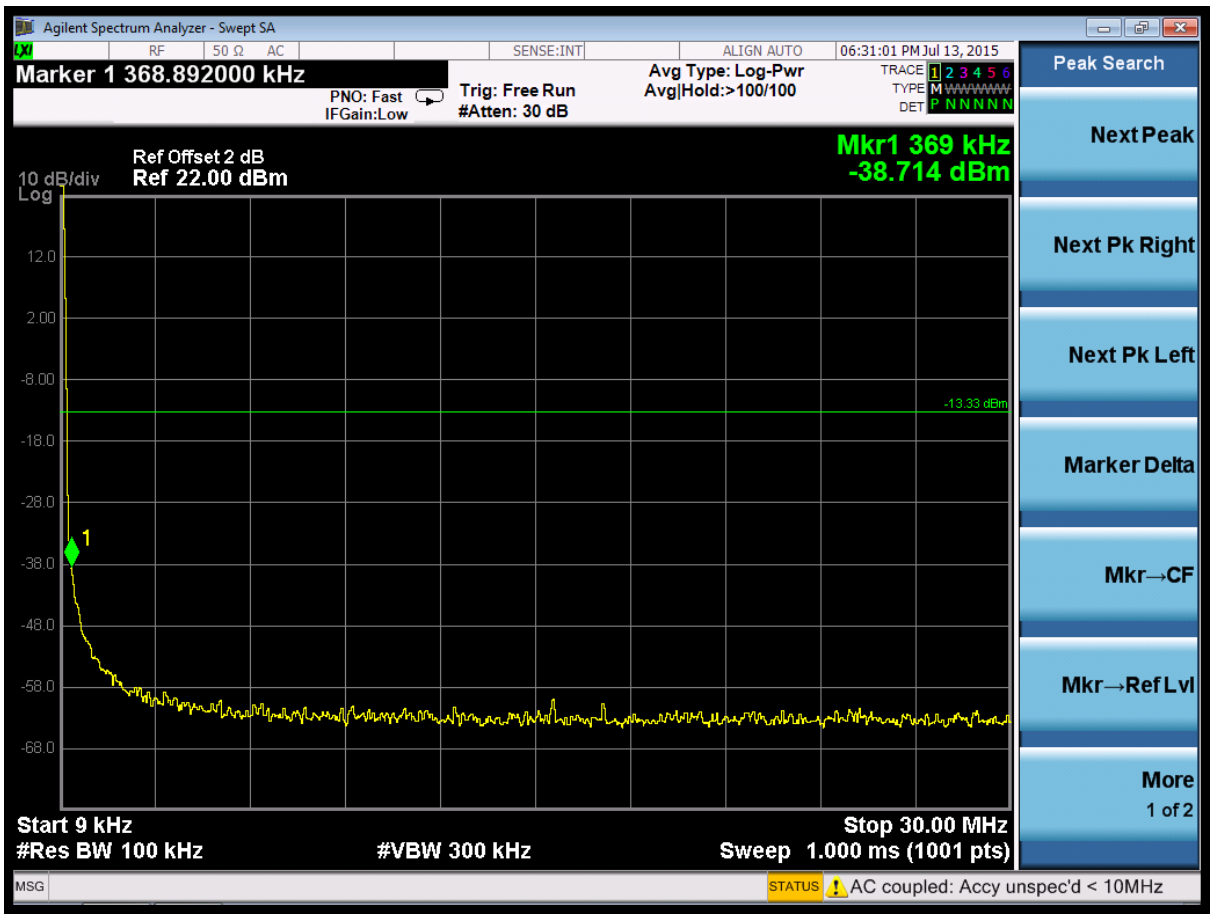


(Plot 4.7.1 A5: Channel 1: 2412MHz @ 802.11b)

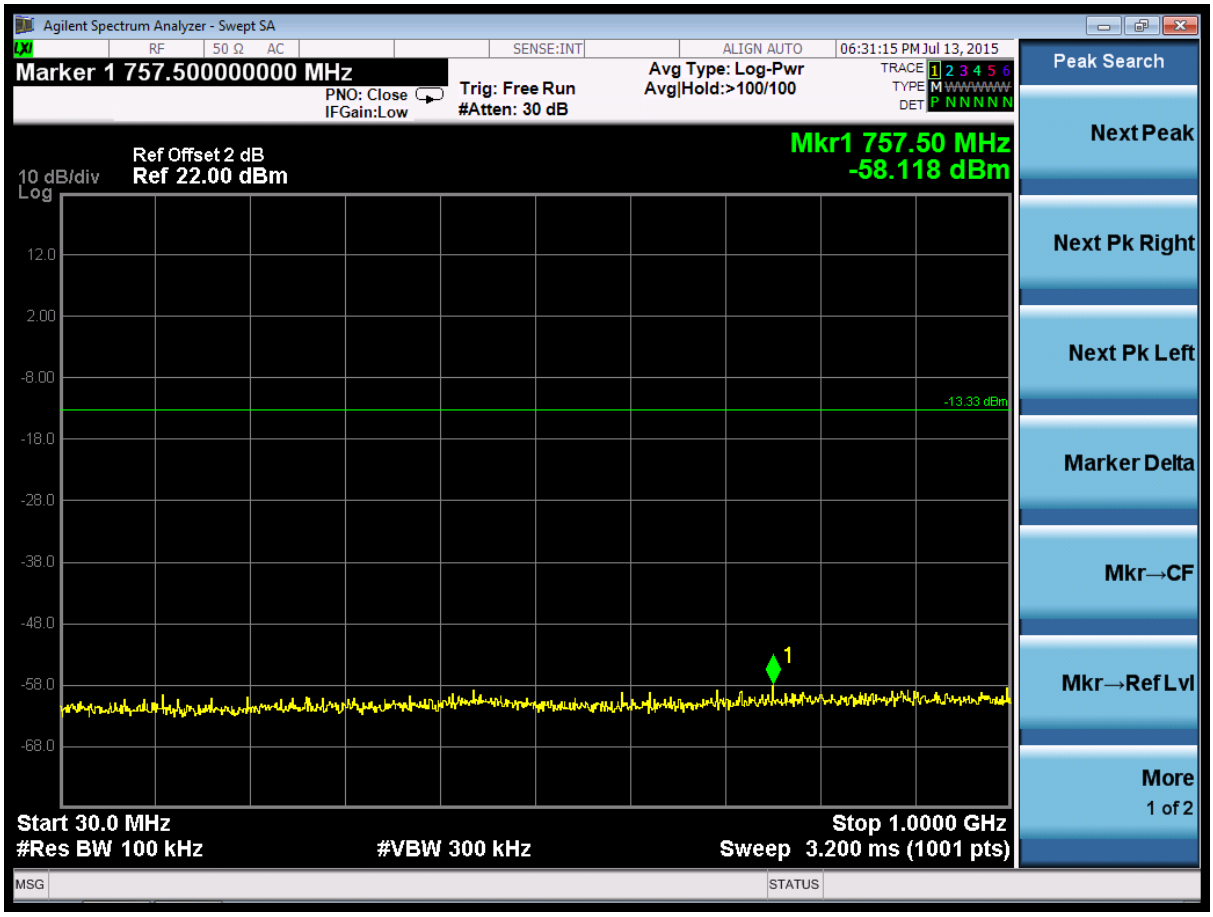
(Plot 4.7.1 A6: Channel 1: 2412MHz @ 802.11b)



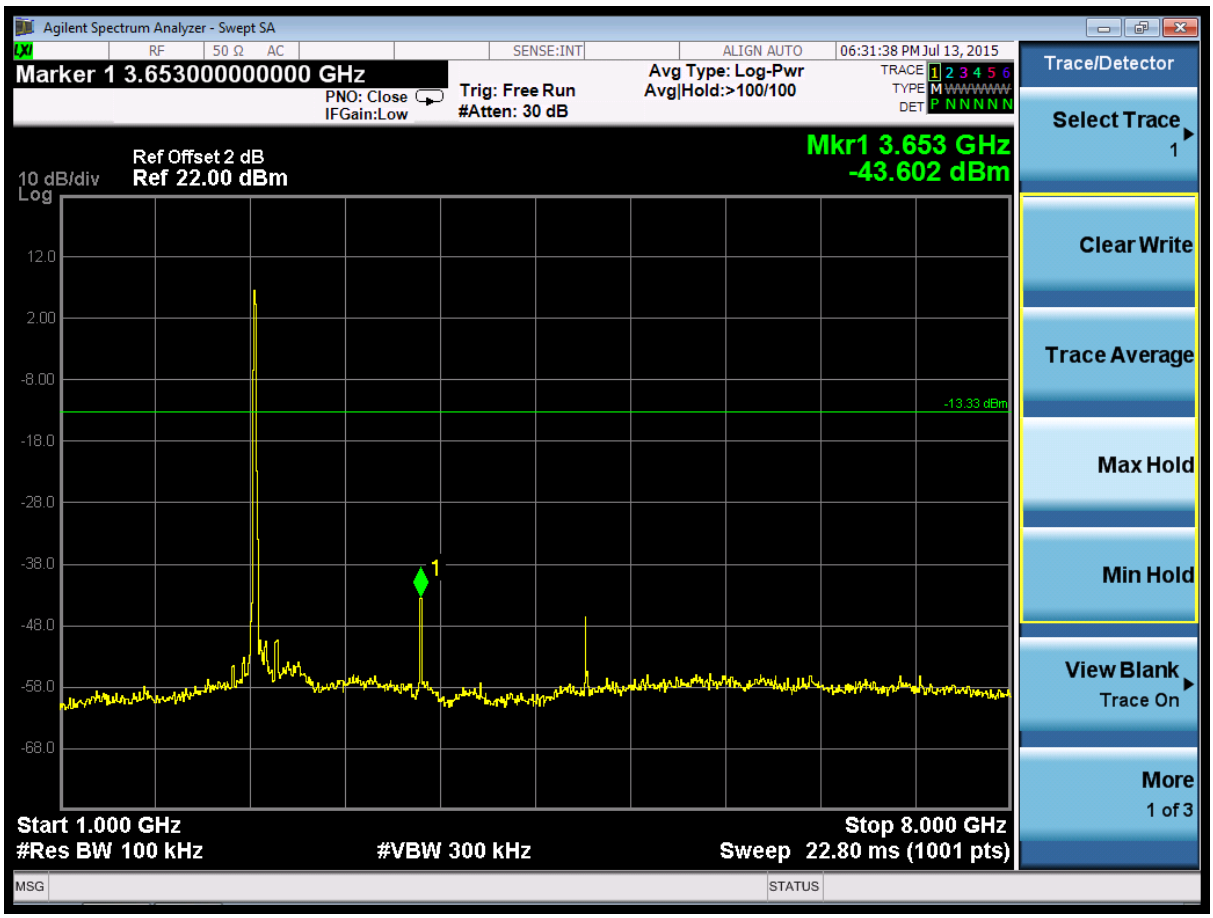
(Plot 4.7.1 B1: Channel 6: 2437MHz @ 802.11b)



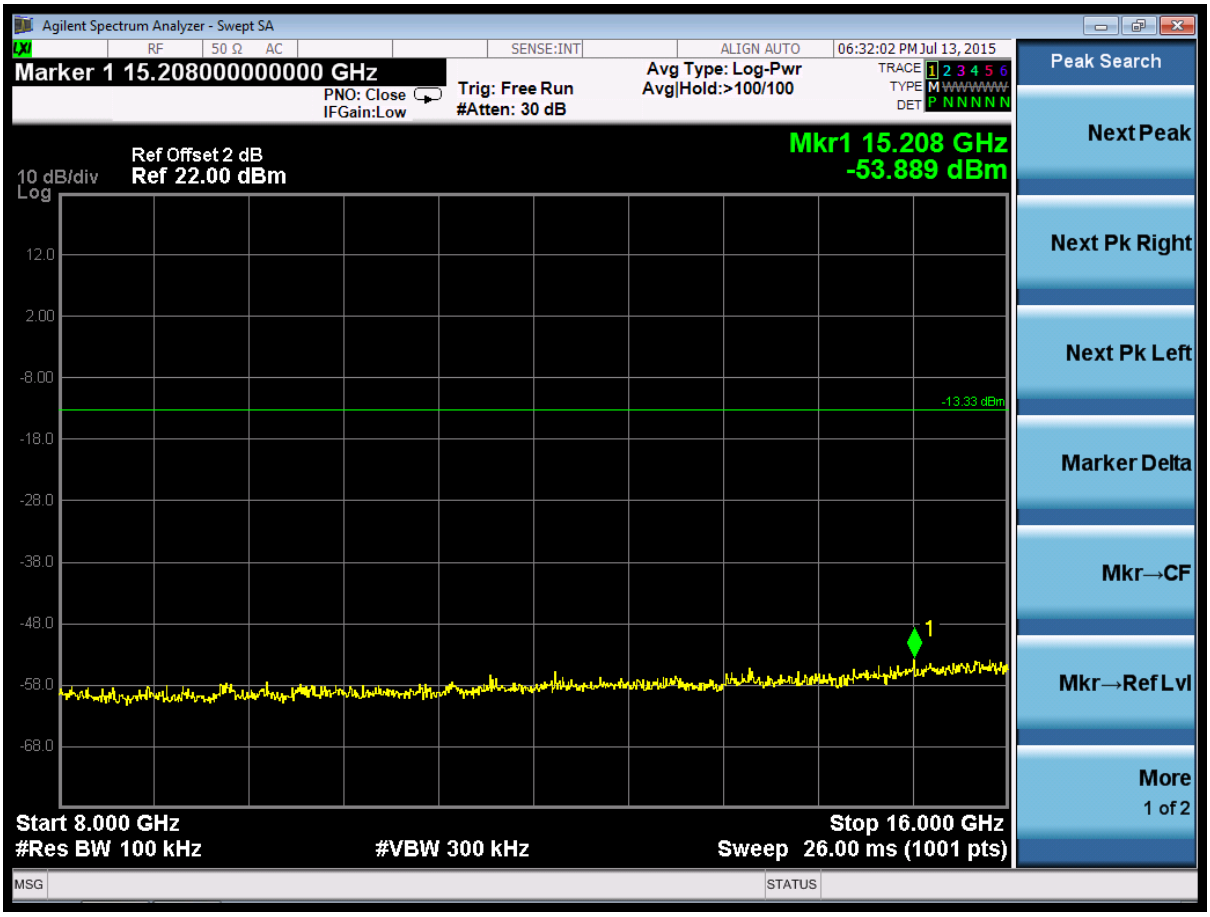
(Plot 4.7.1 B2: Channel 6: 2437MHz @ 802.11b)



(Plot 4.7.1 B3: Channel 6: 2437MHz @ 802.11b)

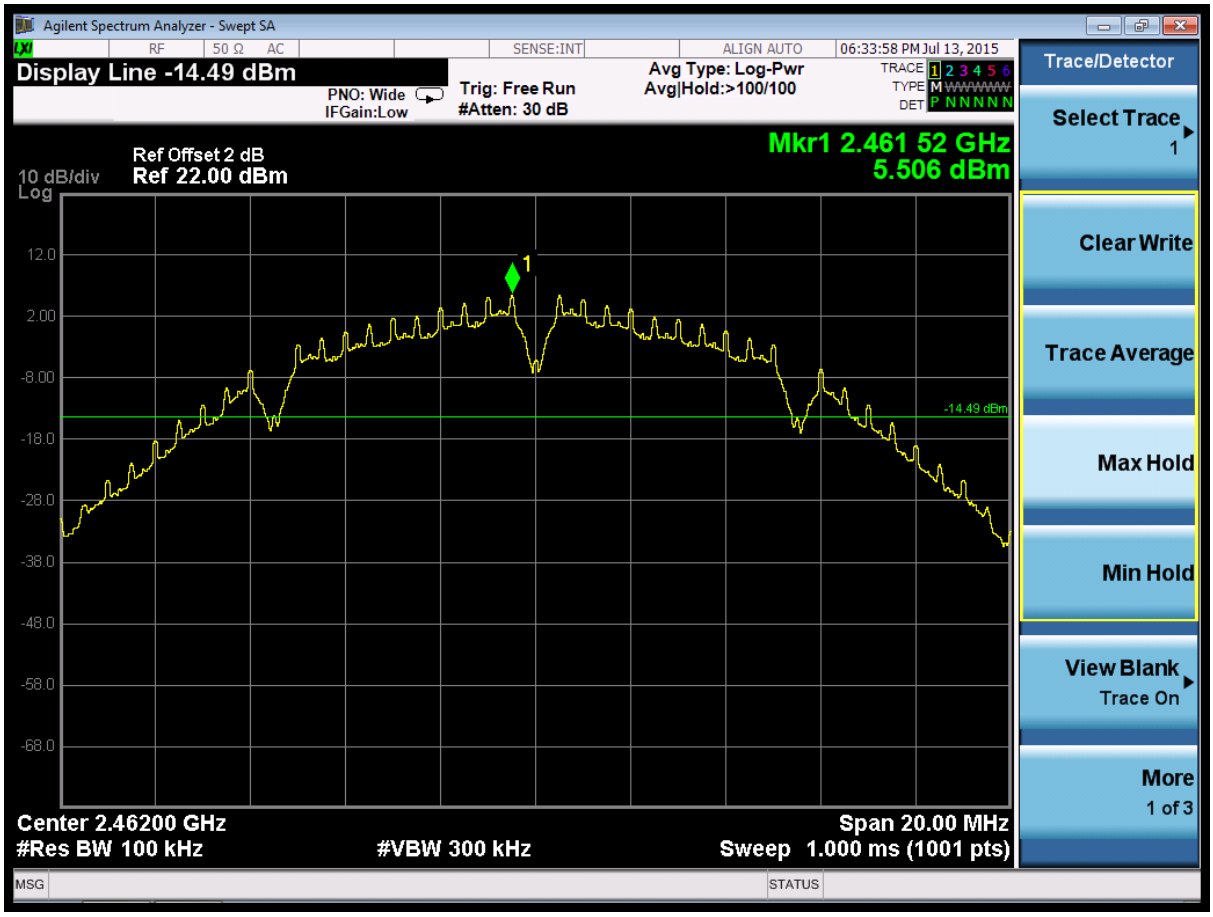


(Plot 4.7.1 B4: Channel 6: 2437MHz @ 802.11b)

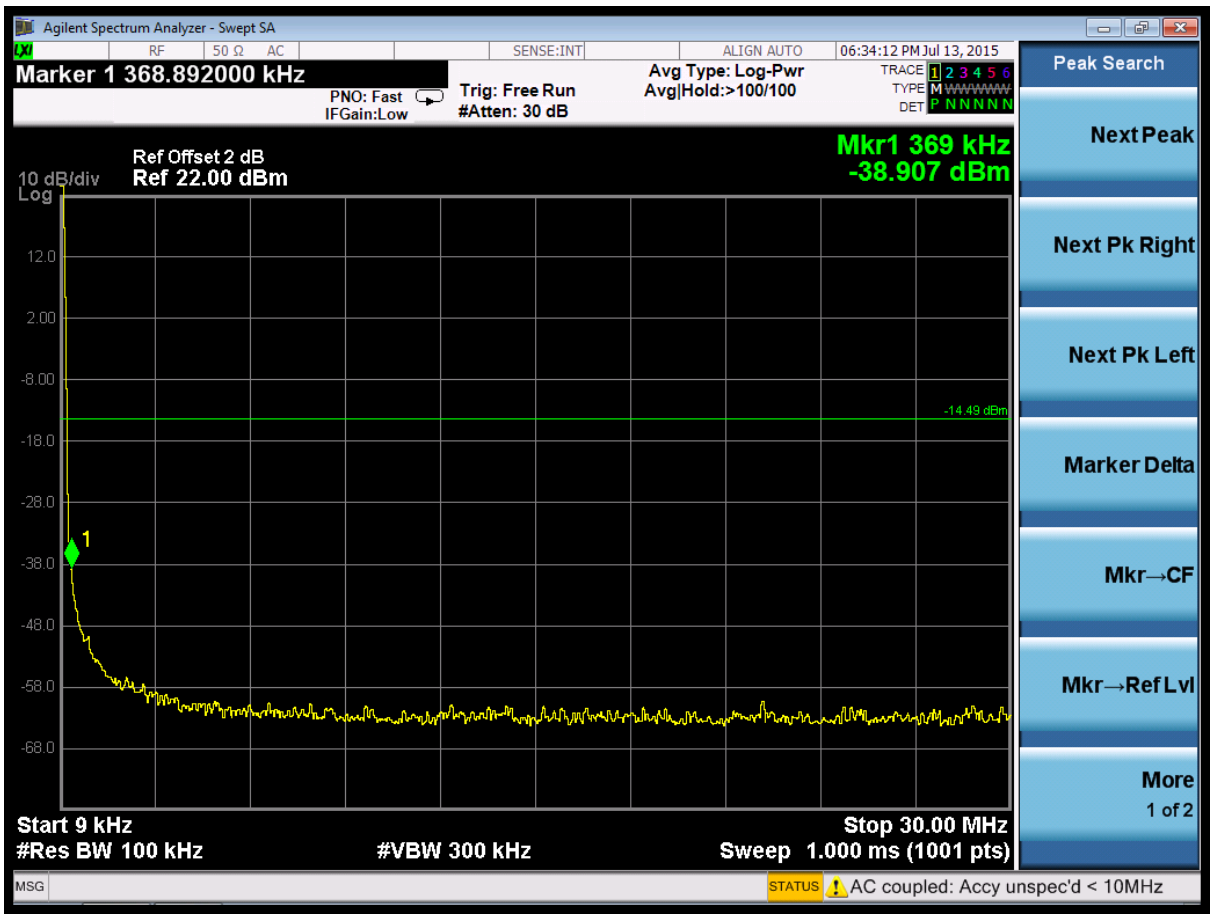


(Plot 4.7.1 B5: Channel 6: 2437MHz @ 802.11b)

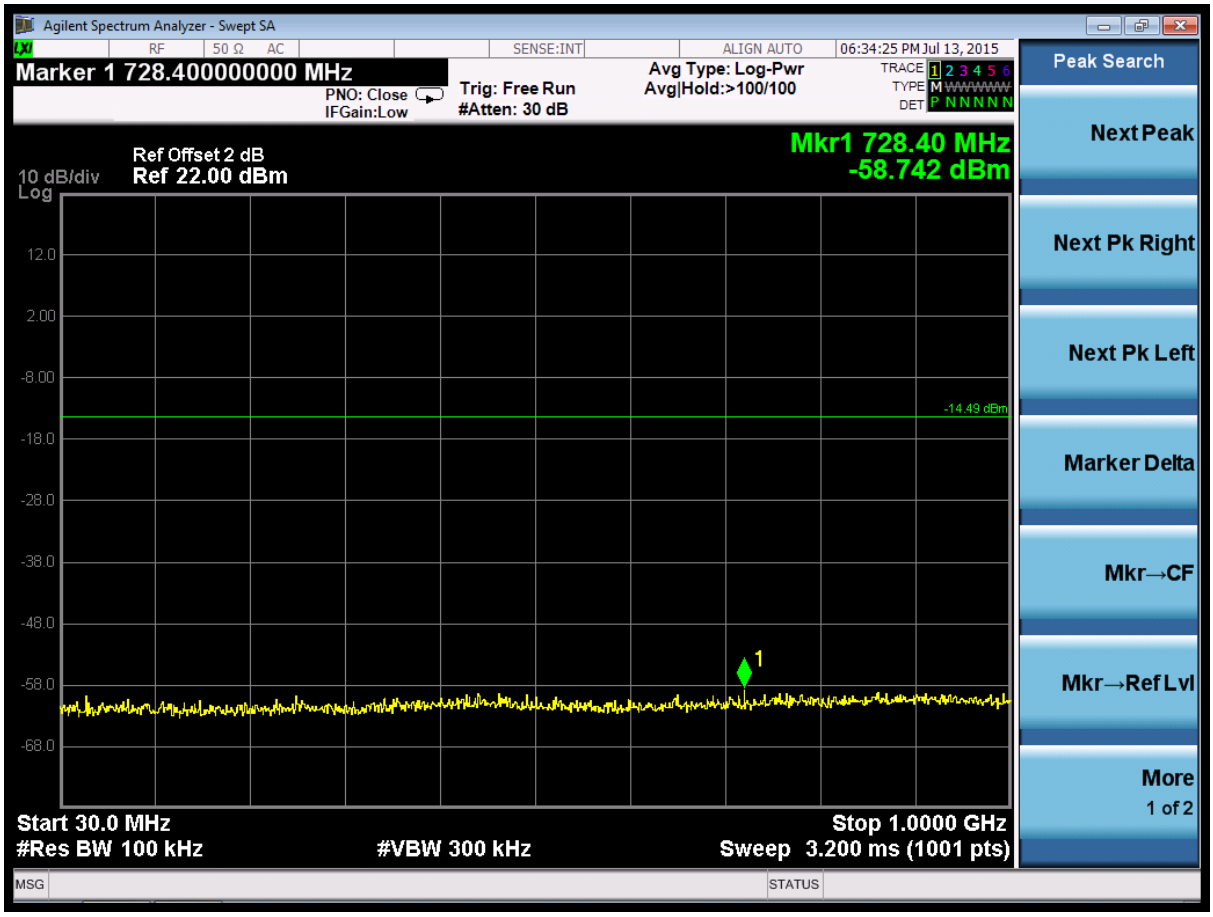
(Plot 4.7.1 B6: Channel 6: 2437MHz @ 802.11b)



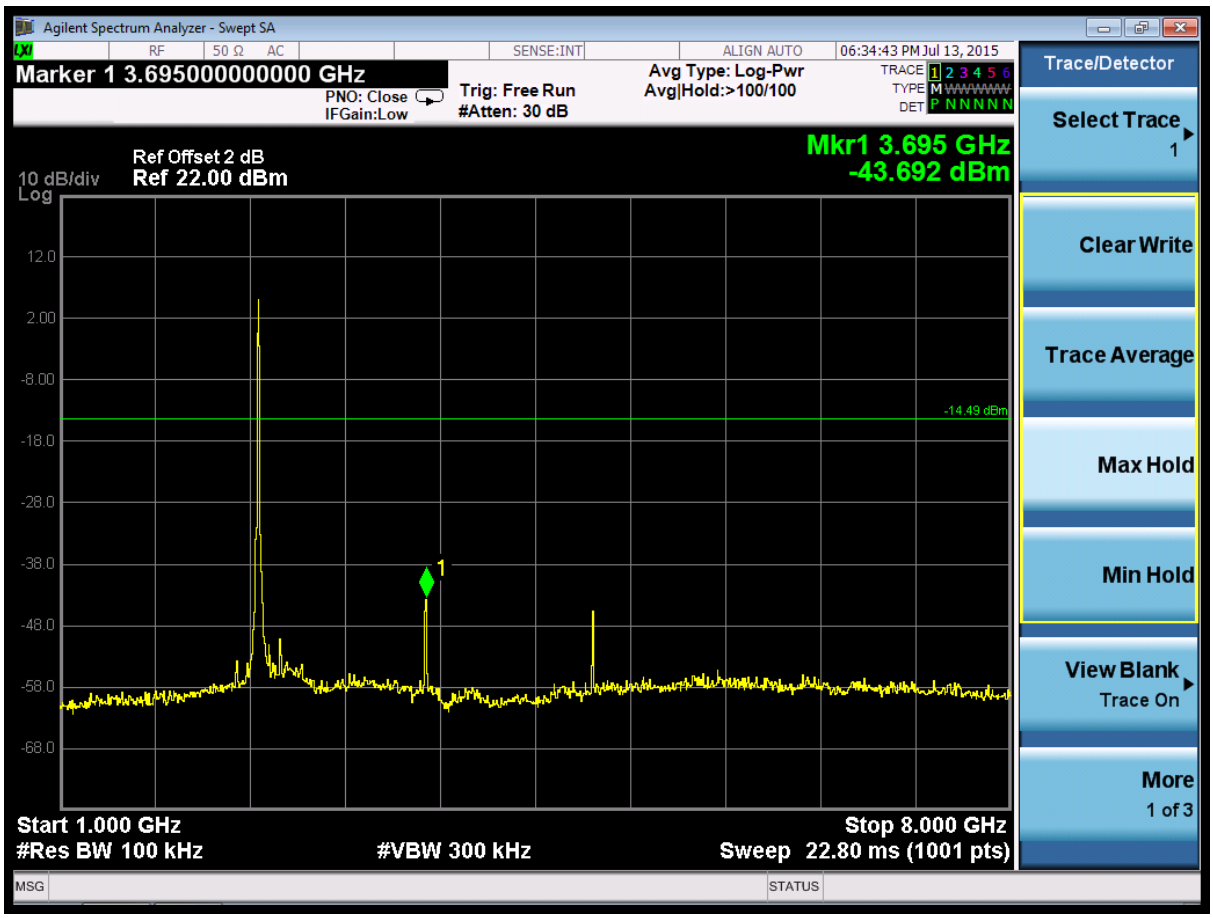
(Plot 4.7.1 C1: Channel 11: 2462MHz @ 802.11b)



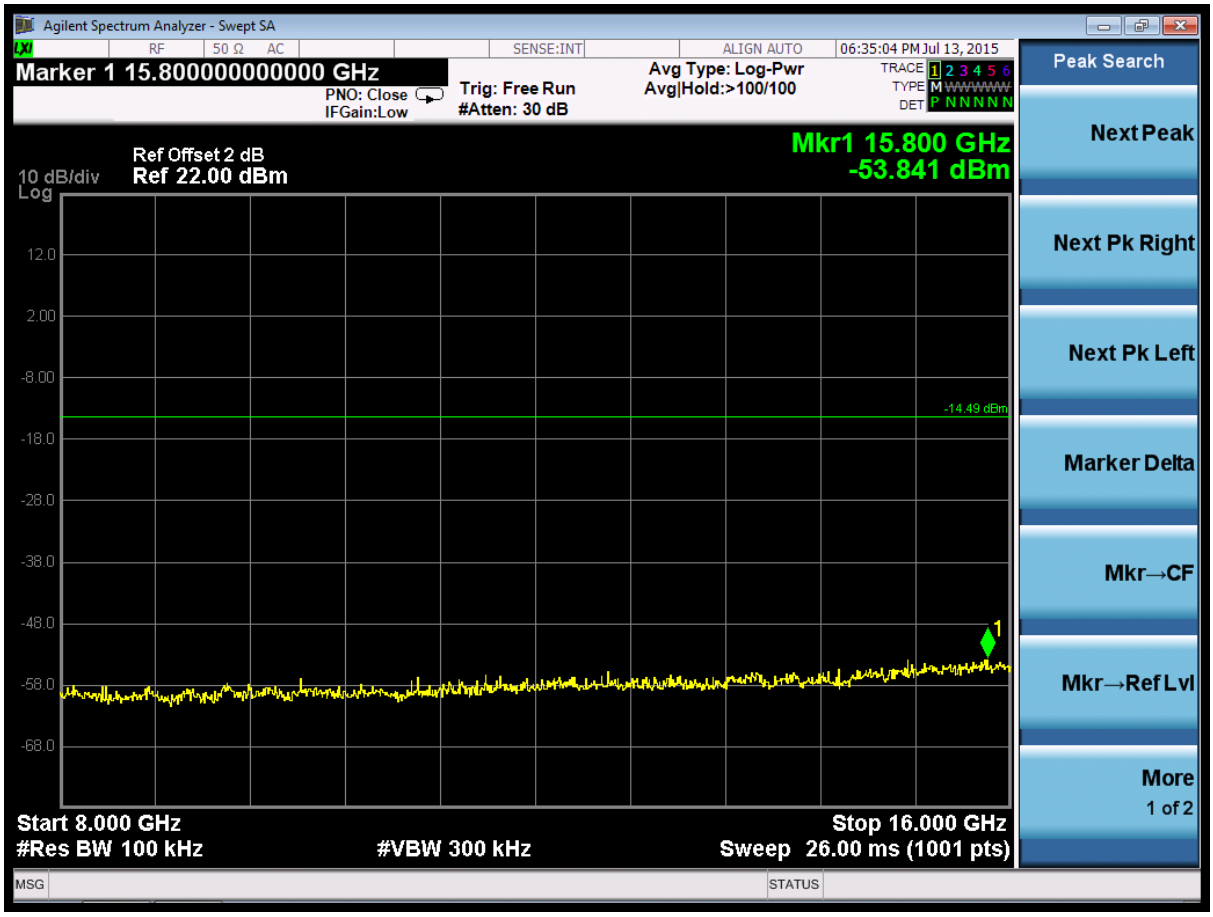
(Plot 4.7.1 C2: Channel 11: 2462MHz @ 802.11b)



(Plot 4.7.1 C3: Channel 11: 2462MHz @ 802.11b)



(Plot 4.7.1 C4: Channel 11: 2462MHz @ 802.11b)



(Plot 4.7.1 C5: Channel 11: 2462MHz @ 802.11b)

(Plot 4.7.1 C6: Channel 11: 2462MHz @ 802.11b)

(Plot 4.7.1 D: Channel 1: 2412MHz @ 802.11b)

(Plot 4.7.1 E: Channel 11: 2462MHz @ 802.11b)

4.7.2 802.11g Test Mode

A. Test Verdict

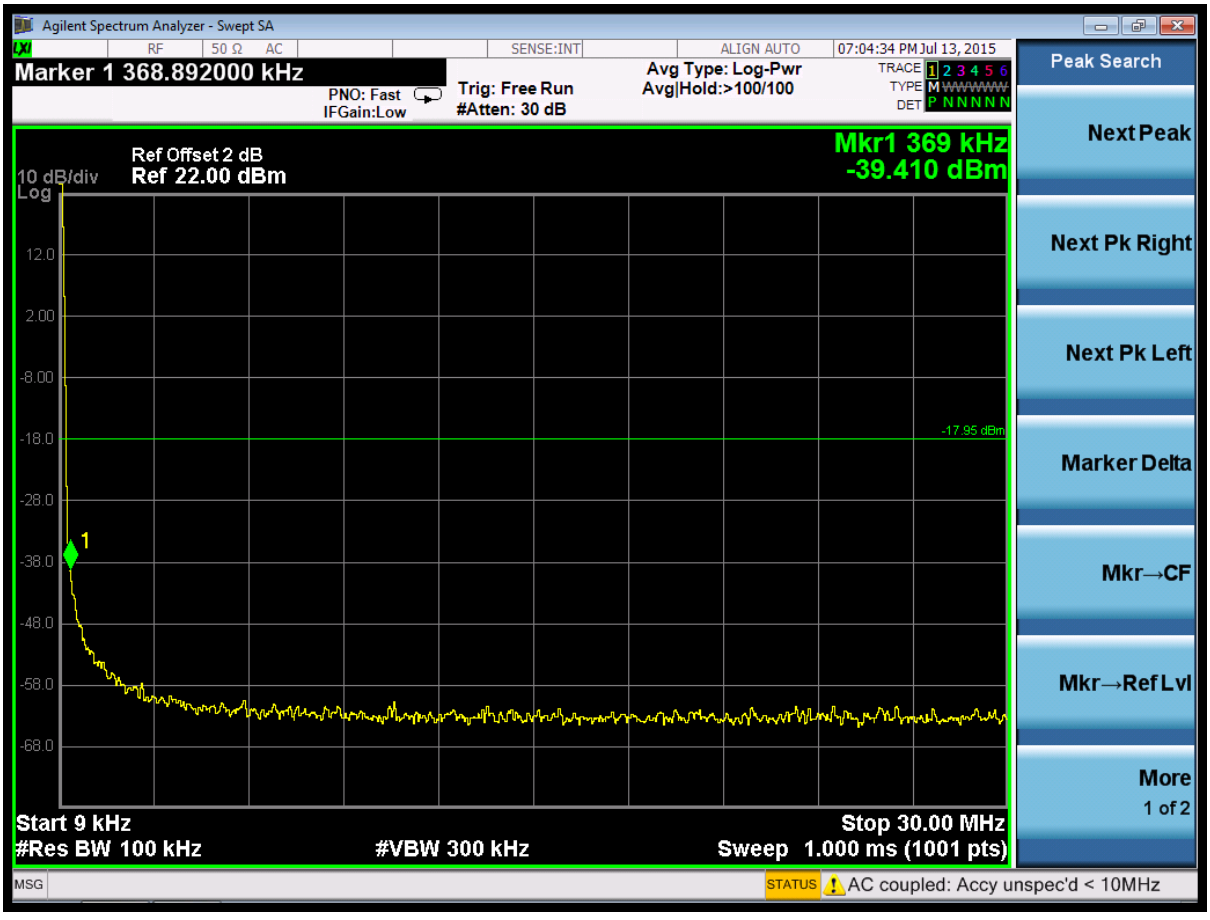
Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
1	2412	2412MHz	Plot 4.7.2 A1	N/A	PASS
		9KHz-30MHz	Plot 4.7.2 A2	-20	PASS
		30MHz-1GHz	Plot 4.7.2 A3	-20	PASS
		1GHz-8GHz	Plot 4.7.2 A4	-20	PASS
		8GHz-16GHz	Plot 4.7.2 A5	-20	PASS
		16GHz-26.5GHz	Plot 4.7.2 A6	-20	PASS
6	2437	2437MHz	Plot 4.7.2 B1	N/A	PASS
		9KHz-30MHz	Plot 4.7.2 B2	-20	PASS
		30MHz-1GHz	Plot 4.7.2 B3	-20	PASS
		1GHz-8GHz	Plot 4.7.2 B4	-20	PASS
		8GHz-16GHz	Plot 4.7.2 B5	-20	PASS
		16GHz-26.5GHz	Plot 4.7.2 B6	-20	PASS
11	2462	2462MHz	Plot 4.7.2 C1	N/A	PASS
		9KHz-30MHz	Plot 4.7.2 C2	-20	PASS
		30MHz-1GHz	Plot 4.7.2 C3	-20	PASS
		1GHz-8GHz	Plot 4.7.2 C4	-20	PASS
		8GHz-16GHz	Plot 4.7.2 C5	-20	PASS
		16GHz-26.5GHz	Plot 4.7.2 C6	-20	PASS

Frequency (MHz)	Delta Peak to Band emission (dBc)	Detector	Limit (dBc)	Refer to Plot	Verdict
2400.00	-29.437	Peak	-20	Plot 4.7.2 D	PASS
2483.50	-38.967	Peak	-20	Plot 4.7.2 E	PASS

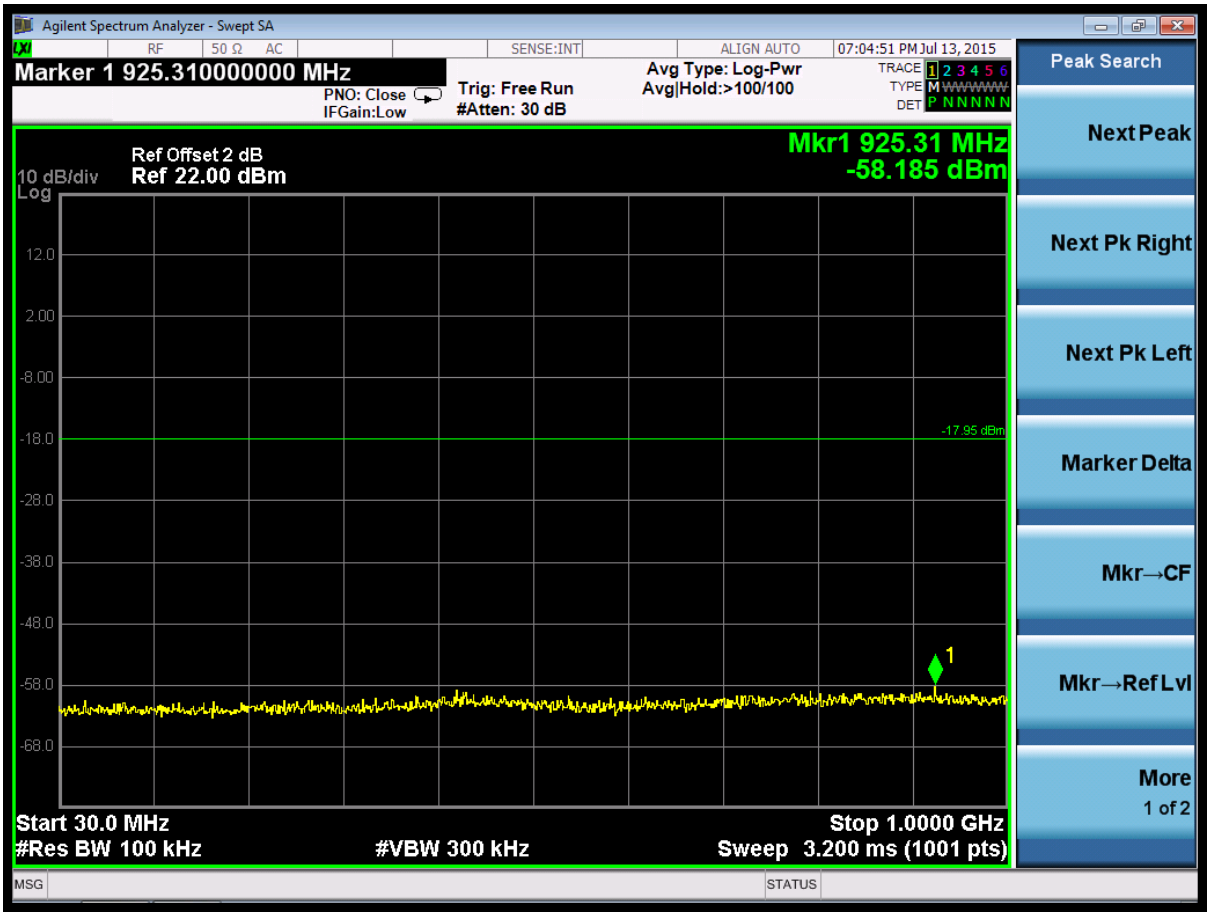
Note:
1. For 802.11g mode at finial test to get the worst-case emission at 6Mbps.
2. The test results including the cable lose.

B. Test Plots

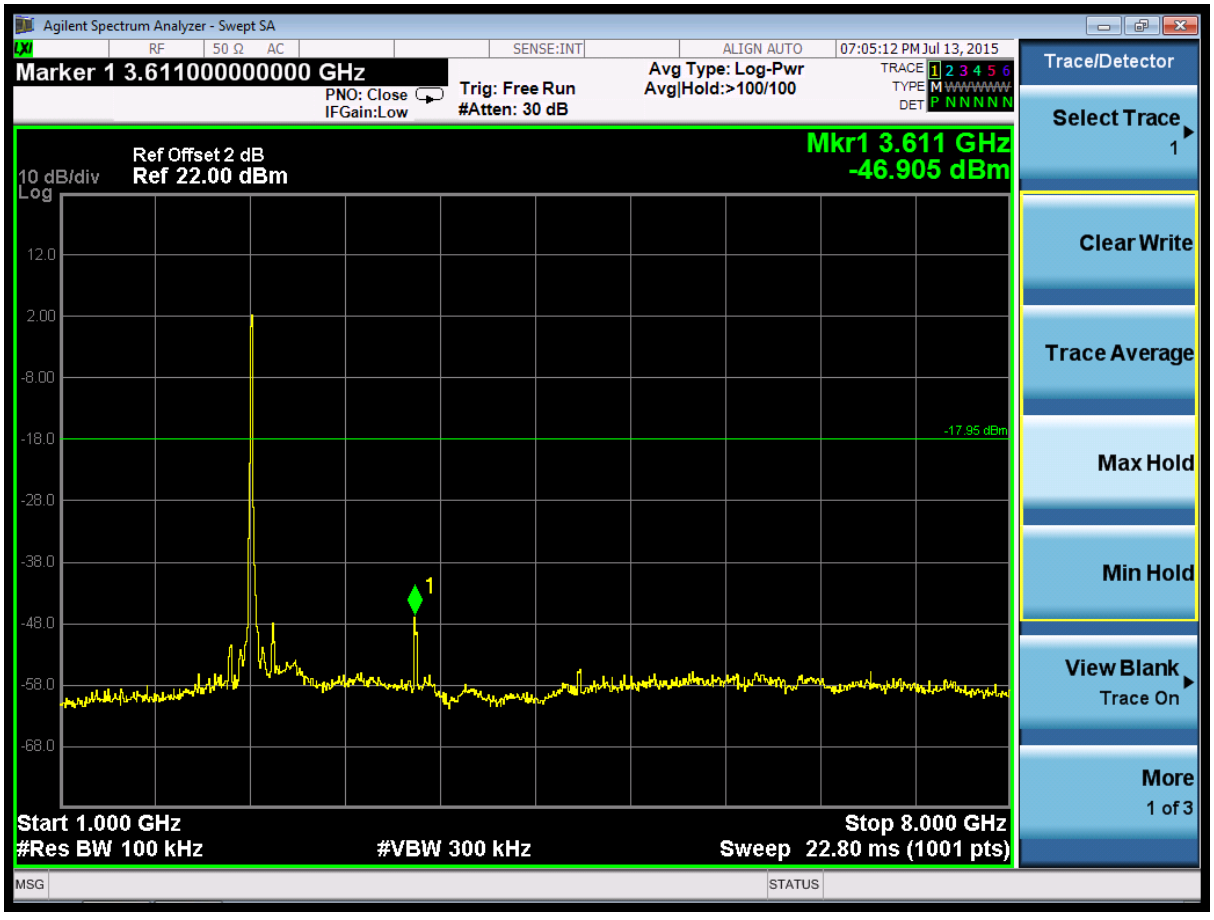
(Plot 4.7.2 A1: Channel 1: 2412MHz @ 802.11g)



(Plot 4.7.2 A2: Channel 1: 2412MHz @ 802.11g)



(Plot 4.7.2 A3: Channel 1: 2412MHz @ 802.11g)

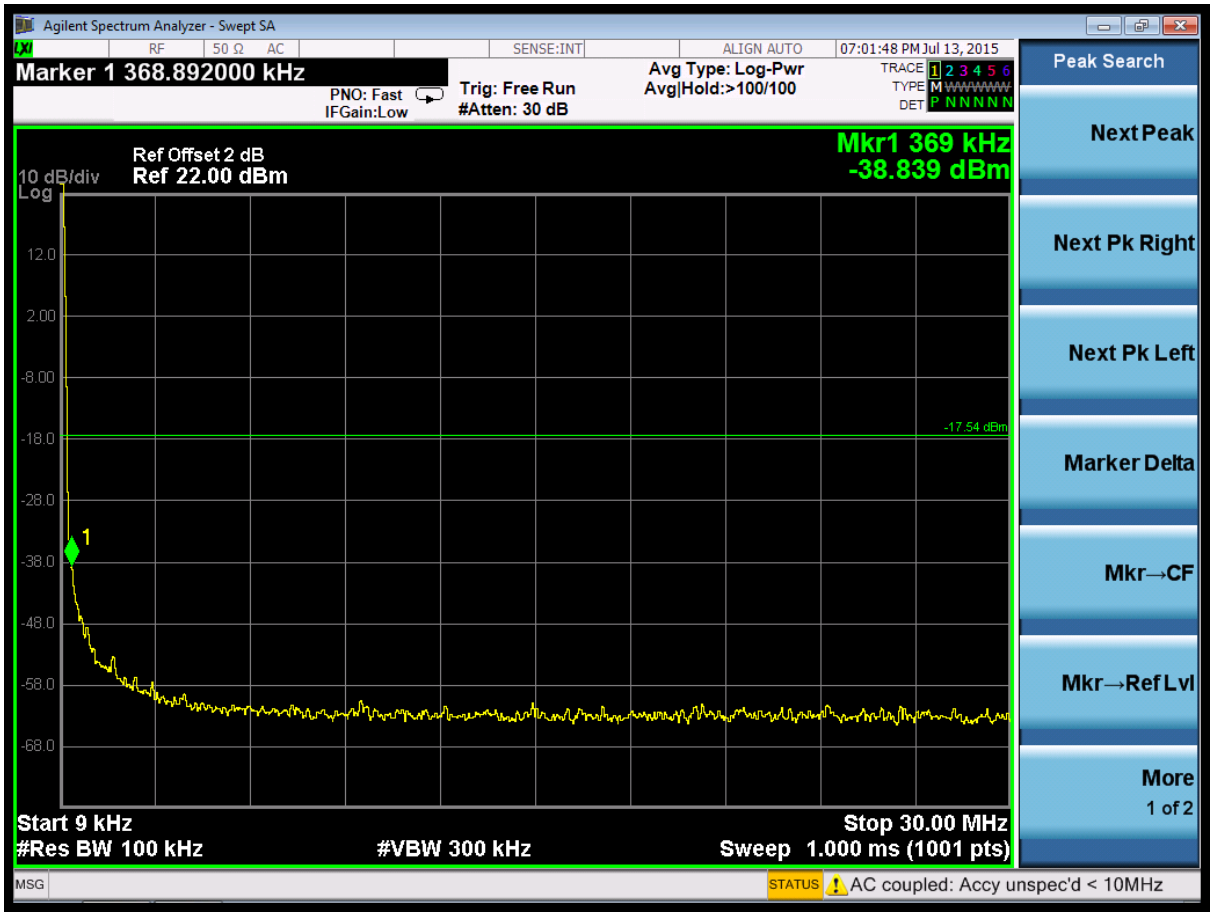


(Plot 4.7.2 A4: Channel 1: 2412MHz @ 802.11g)

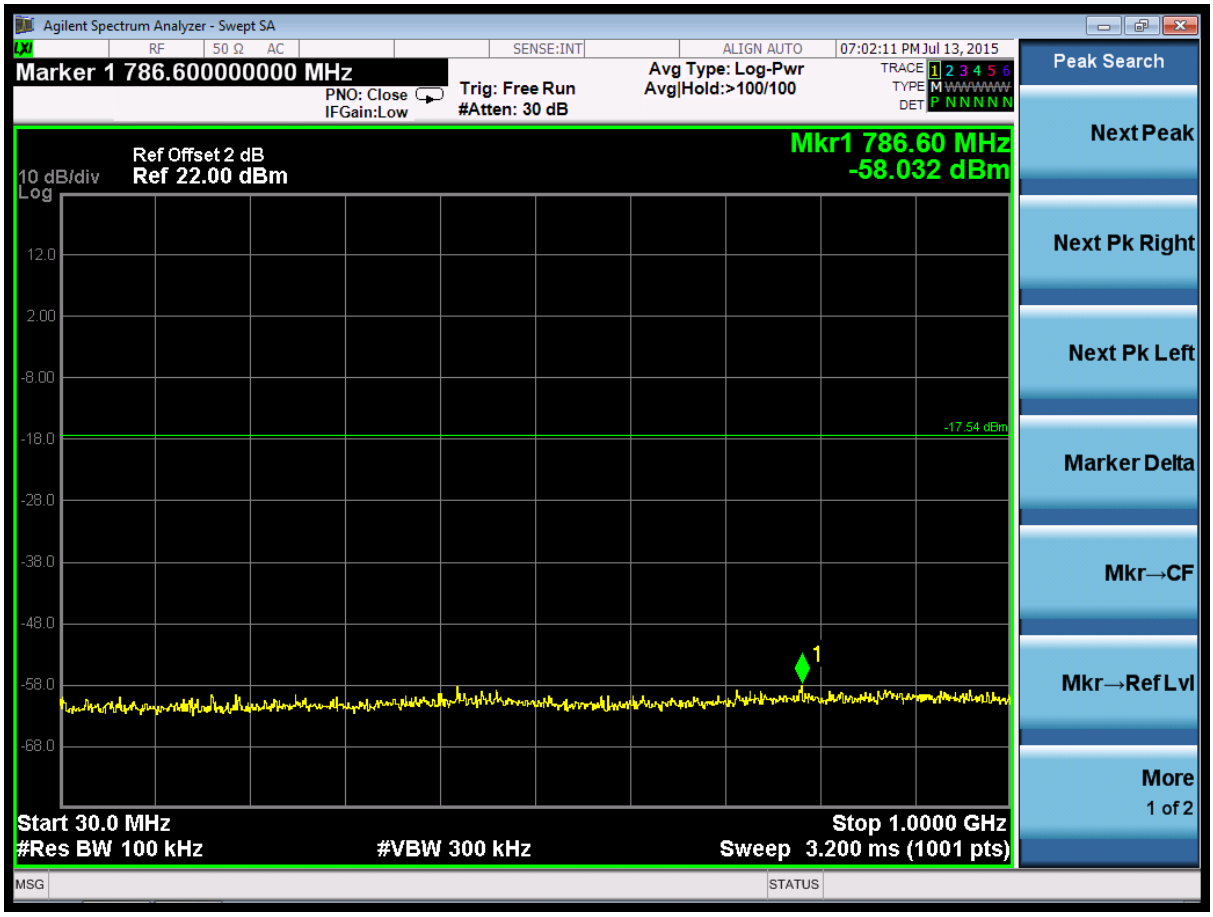
(Plot 4.7.2 A5: Channel 1: 2412MHz @ 802.11g)

(Plot 4.7.2 A6: Channel 1: 2412MHz @ 802.11g)

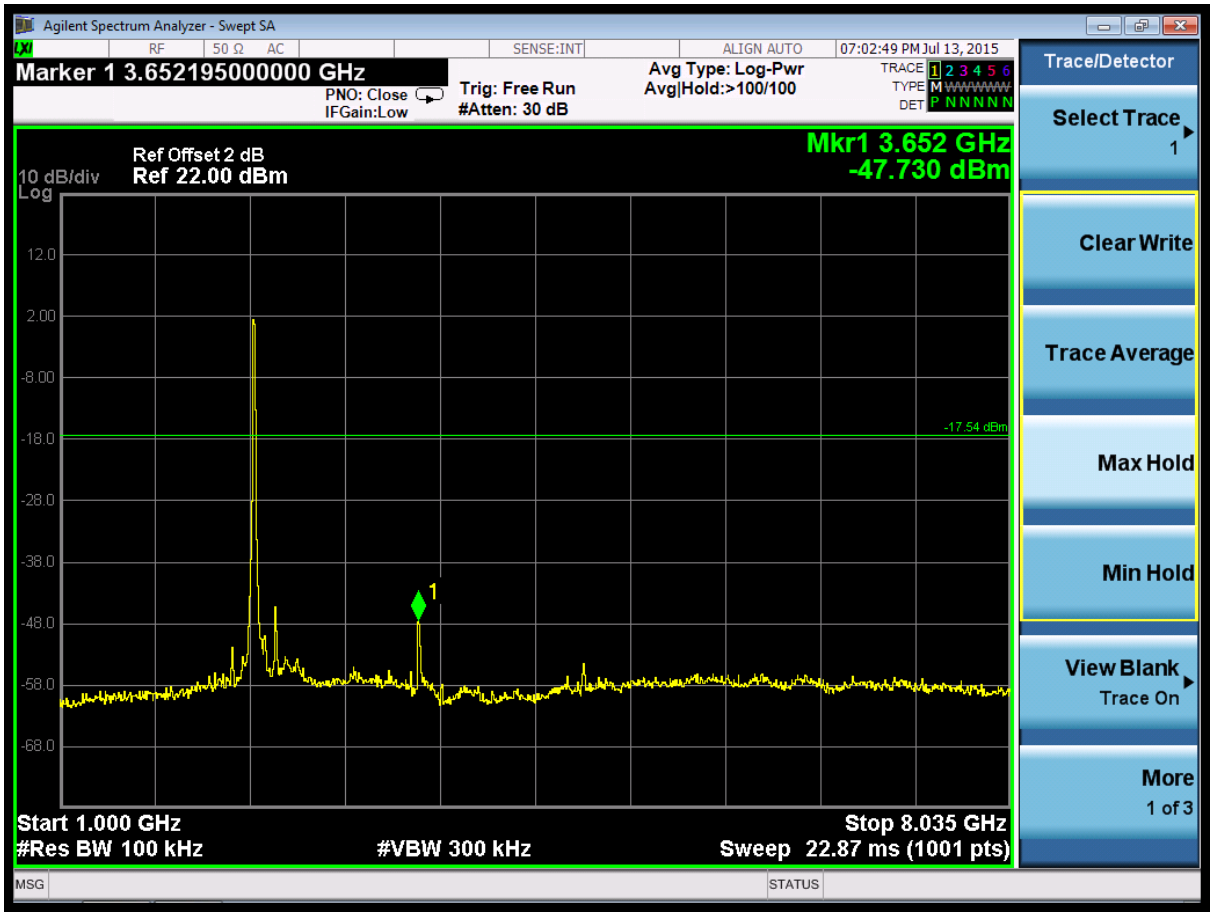
(Plot 4.7.2 B1: Channel 6: 2437MHz @ 802.11g)



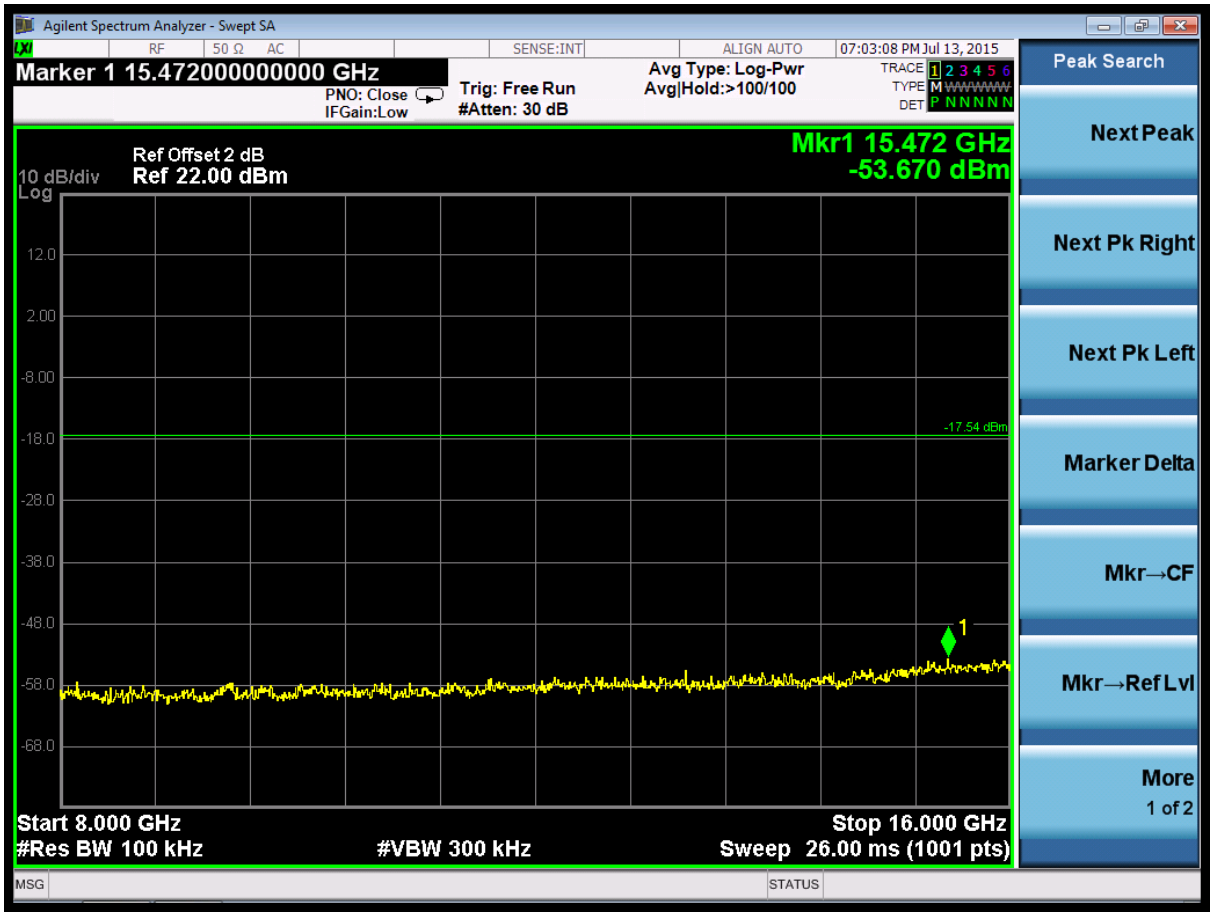
(Plot 4.7.2 B2: Channel 6: 2437MHz @ 802.11g)



(Plot 4.7.2 B3: Channel 6: 2437MHz @ 802.11g)



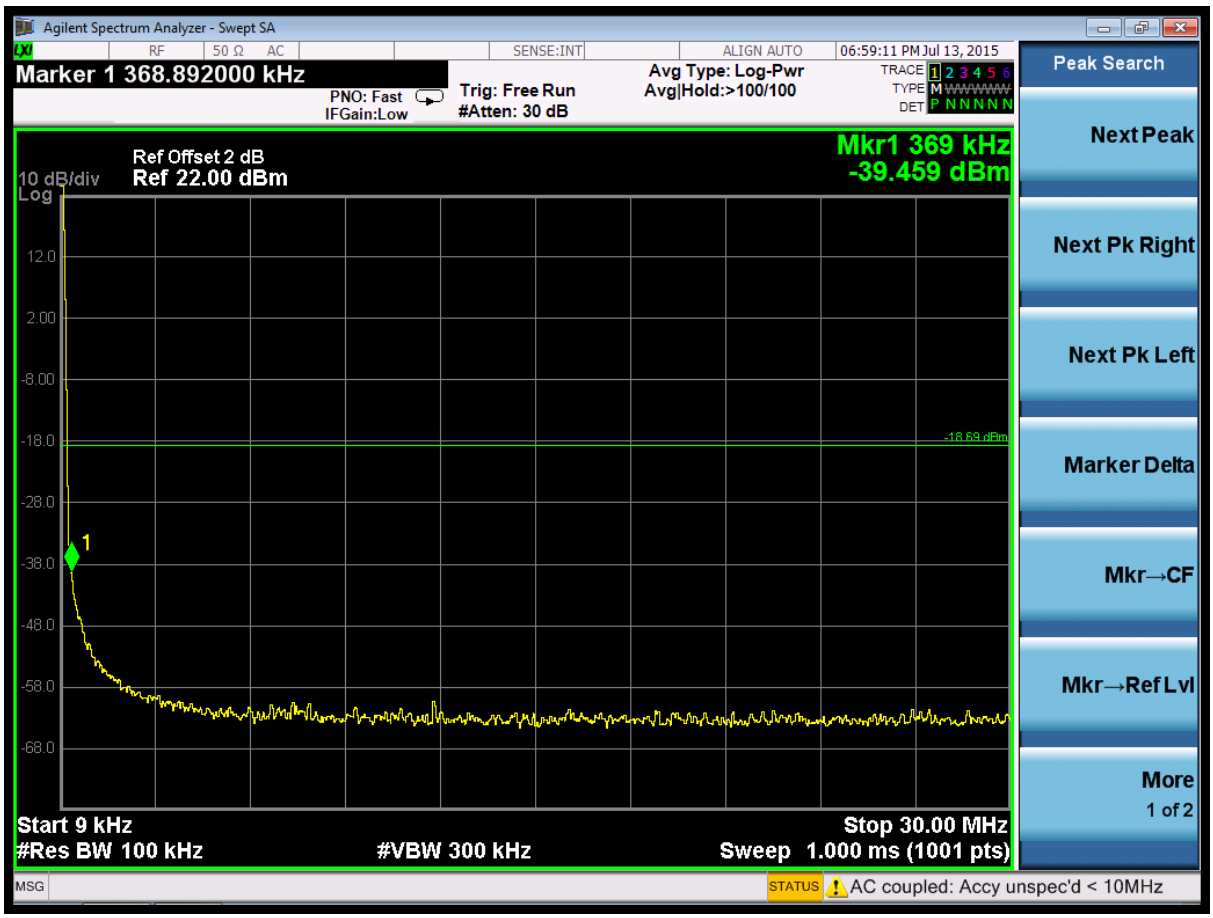
(Plot 4.7.2 B4: Channel 6: 2437MHz @ 802.11g)



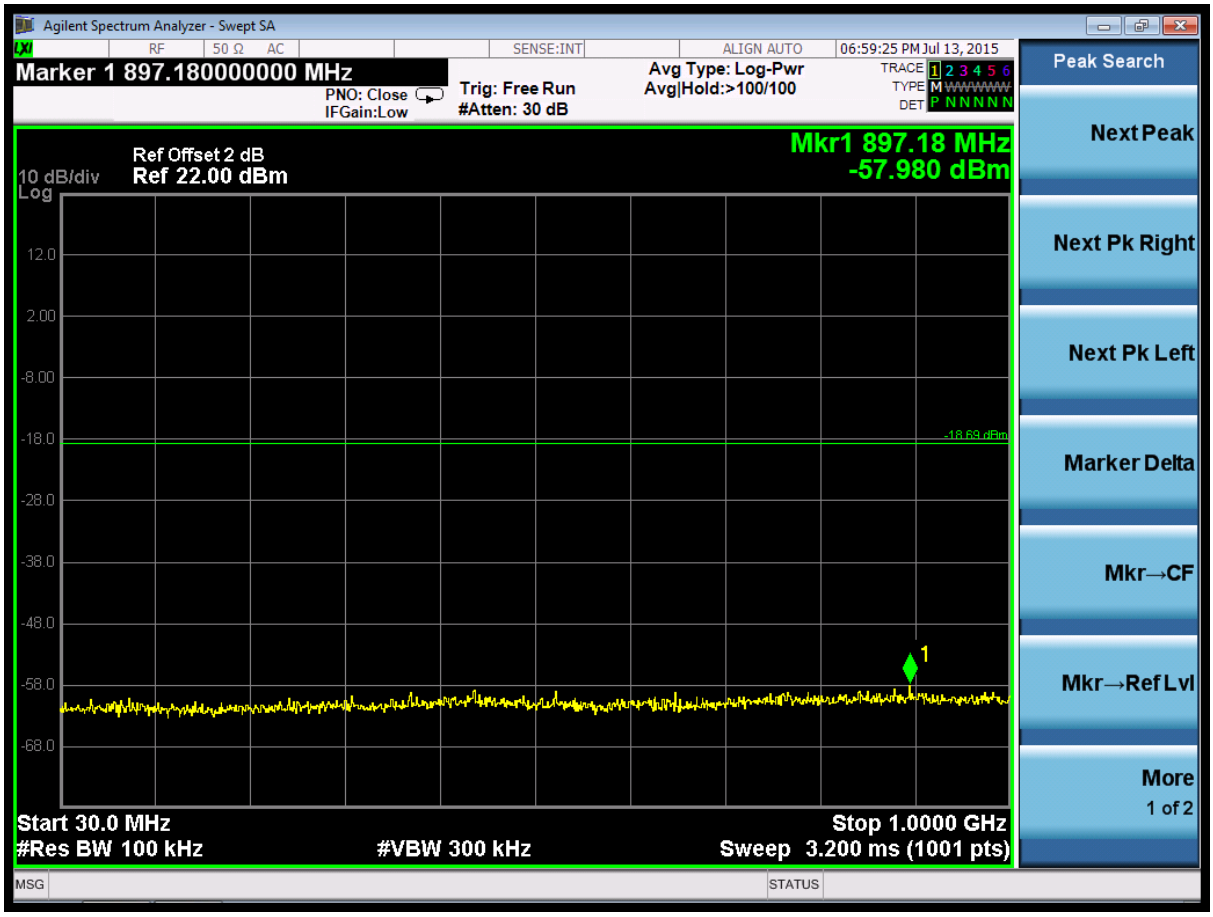
(Plot 4.7.2 B5: Channel 6: 2437MHz @ 802.11g)

(Plot 4.7.2 B6: Channel 6: 2437MHz @ 802.11g)

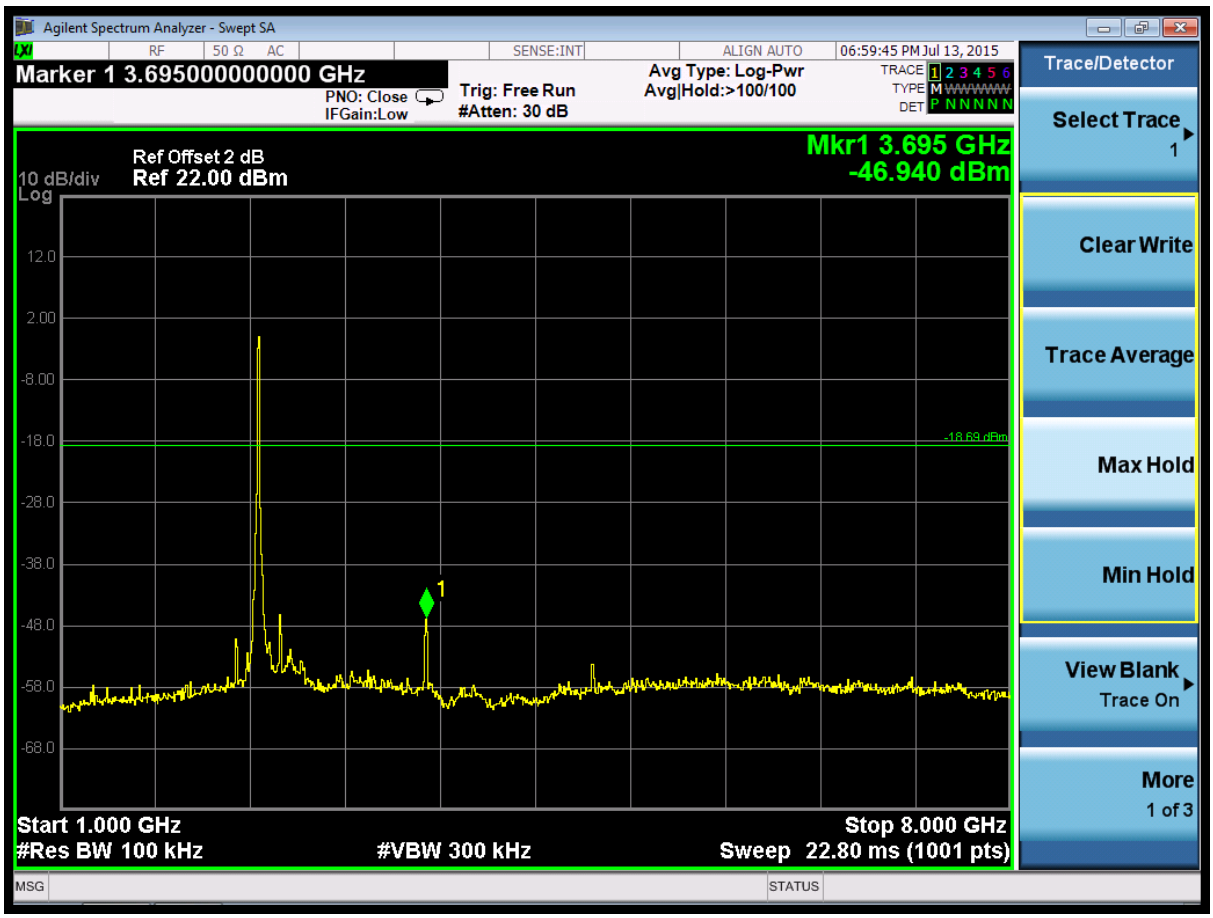
(Plot 4.7.2 C1: Channel 11: 2462MHz @ 802.11g)



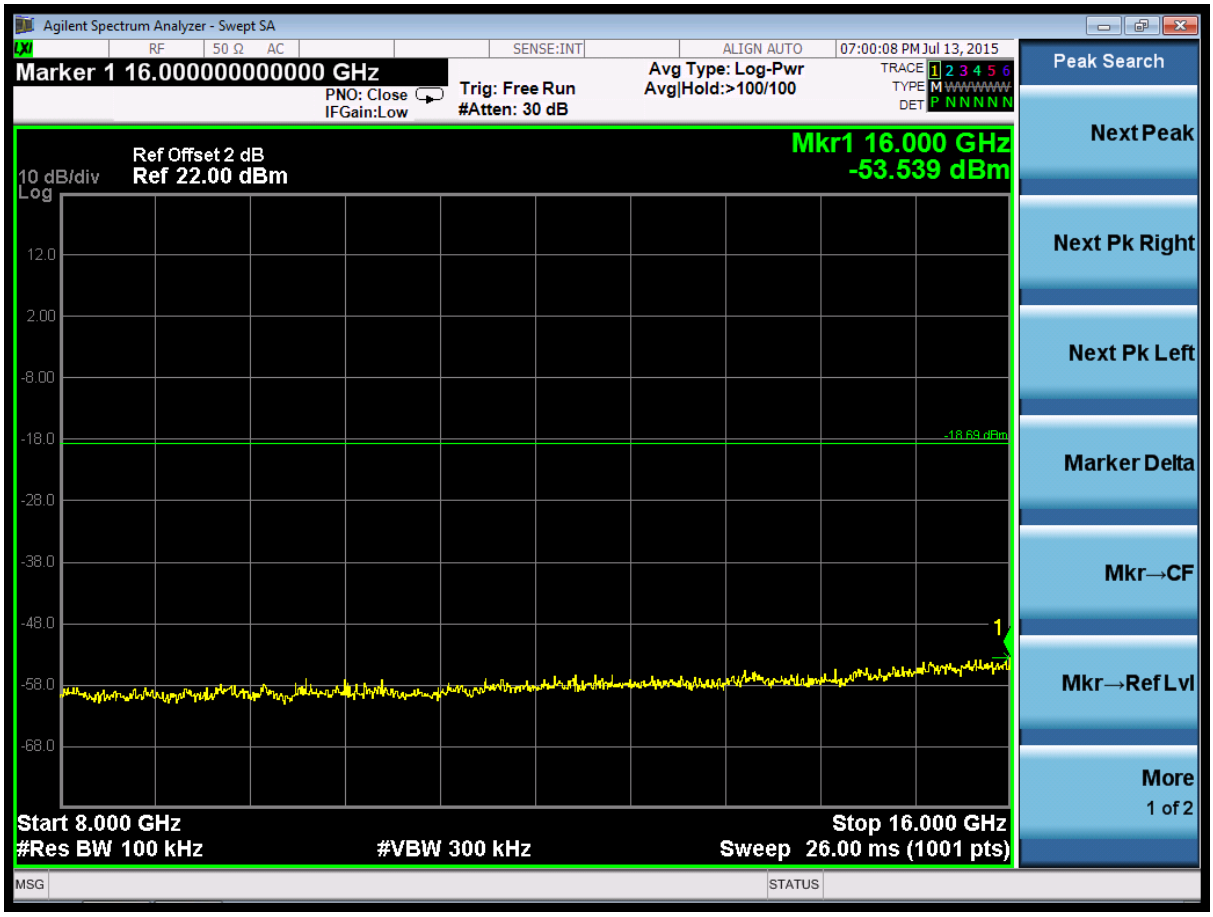
(Plot 4.7.2 C2: Channel 11: 2462MHz @ 802.11g)



(Plot 4.7.2 C3: Channel 11: 2462MHz @ 802.11g)

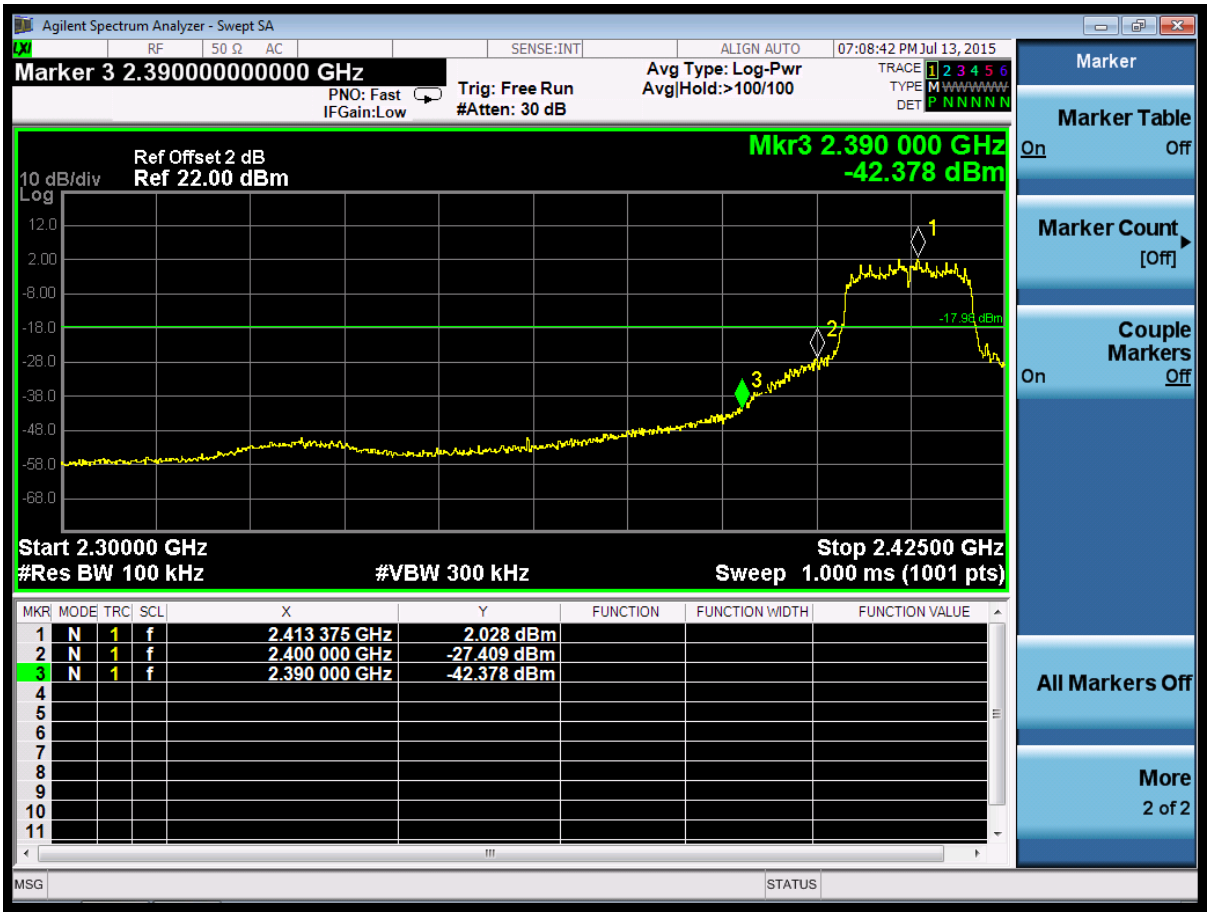


(Plot 4.7.2 C4: Channel 11: 2462MHz @ 802.11g)



(Plot 4.7.2 C5: Channel 11: 2462MHz @ 802.11g)

(Plot 4.7.2 C6: Channel 11: 2462MHz @ 802.11g)



(Plot 4.7.2 D: Channel 1: 2412MHz @ 802.11g)

(Plot 4.7.2 E: Channel 11: 2462MHz @ 802.11g)

4.7.3 802.11n HT20 Test Mode

A. Test Verdict

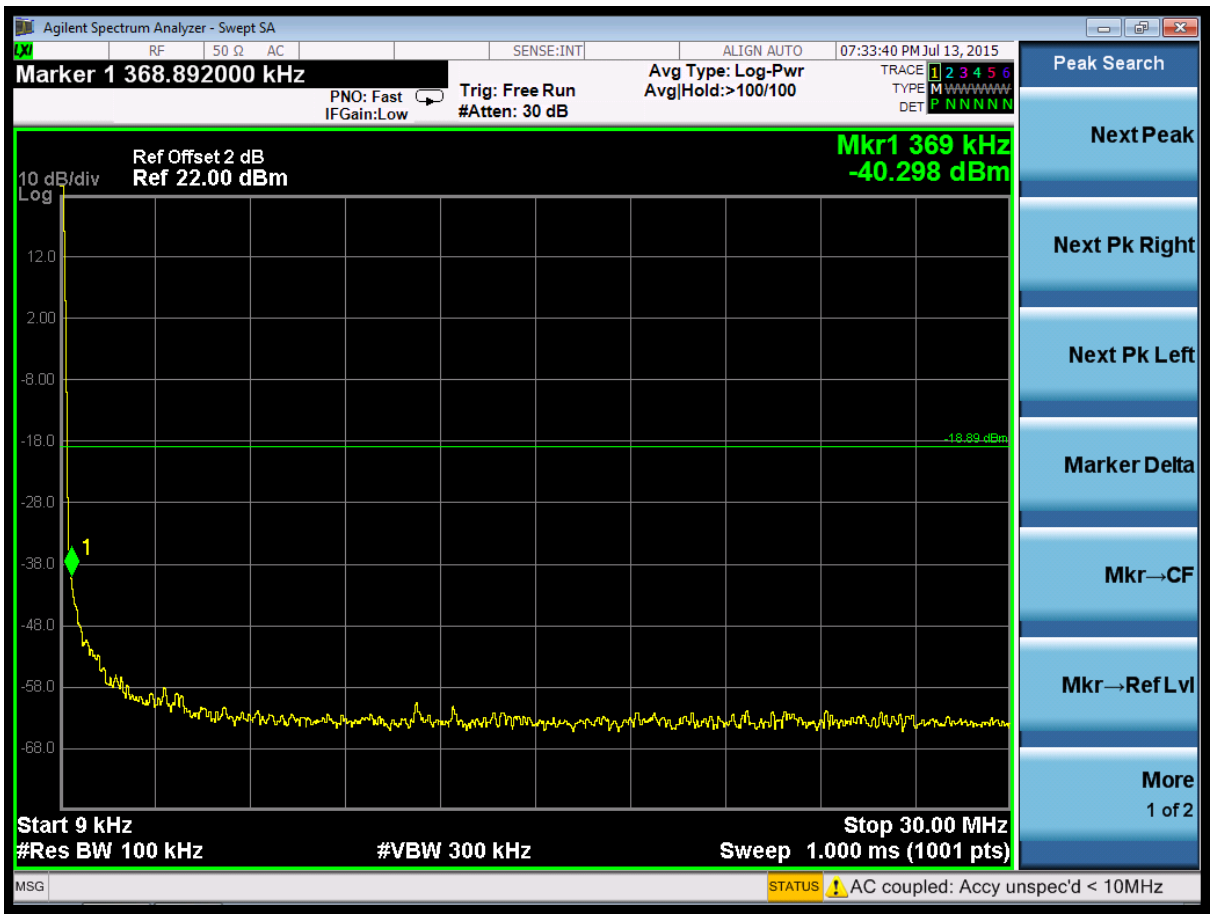
Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
1	2412	2412MHz	Plot 4.7.3 A1	N/A	PASS
		9KHz-30MHz	Plot 4.7.3 A2	-20	PASS
		30MHz-1GHz	Plot 4.7.3 A3	-20	PASS
		1GHz-8GHz	Plot 4.7.3 A4	-20	PASS
		8GHz-16GHz	Plot 4.7.3 A5	-20	PASS
		16GHz-26.5GHz	Plot 4.7.3 A6	-20	PASS
6	2437	2437MHz	Plot 4.7.3 B1	N/A	PASS
		9KHz-30MHz	Plot 4.7.3 B2	-20	PASS
		30MHz-1GHz	Plot 4.7.3 B3	-20	PASS
		1GHz-8GHz	Plot 4.7.3 B4	-20	PASS
		8GHz-16GHz	Plot 4.7.3 B5	-20	PASS
		16GHz-26.5GHz	Plot 4.7.3 B6	-20	PASS
11	2462	2462MHz	Plot 4.7.3 C1	N/A	PASS
		9KHz-30MHz	Plot 4.7.3 C2	-20	PASS
		30MHz-1GHz	Plot 4.7.3 C3	-20	PASS
		1GHz-8GHz	Plot 4.7.3 C4	-20	PASS
		8GHz-16GHz	Plot 4.7.3 C5	-20	PASS
		16GHz-26.5GHz	Plot 4.7.3 C6	-20	PASS

Frequency (MHz)	Delta Peak to Band emission (dBc)	Detector	Limit (dBc)	Refer to Plot	Verdict
2400.00	-30.510	Peak	-20	Plot 4.7.3 D	PASS
2483.50	-40.572	Peak	-20	Plot 4.7.3 E	PASS

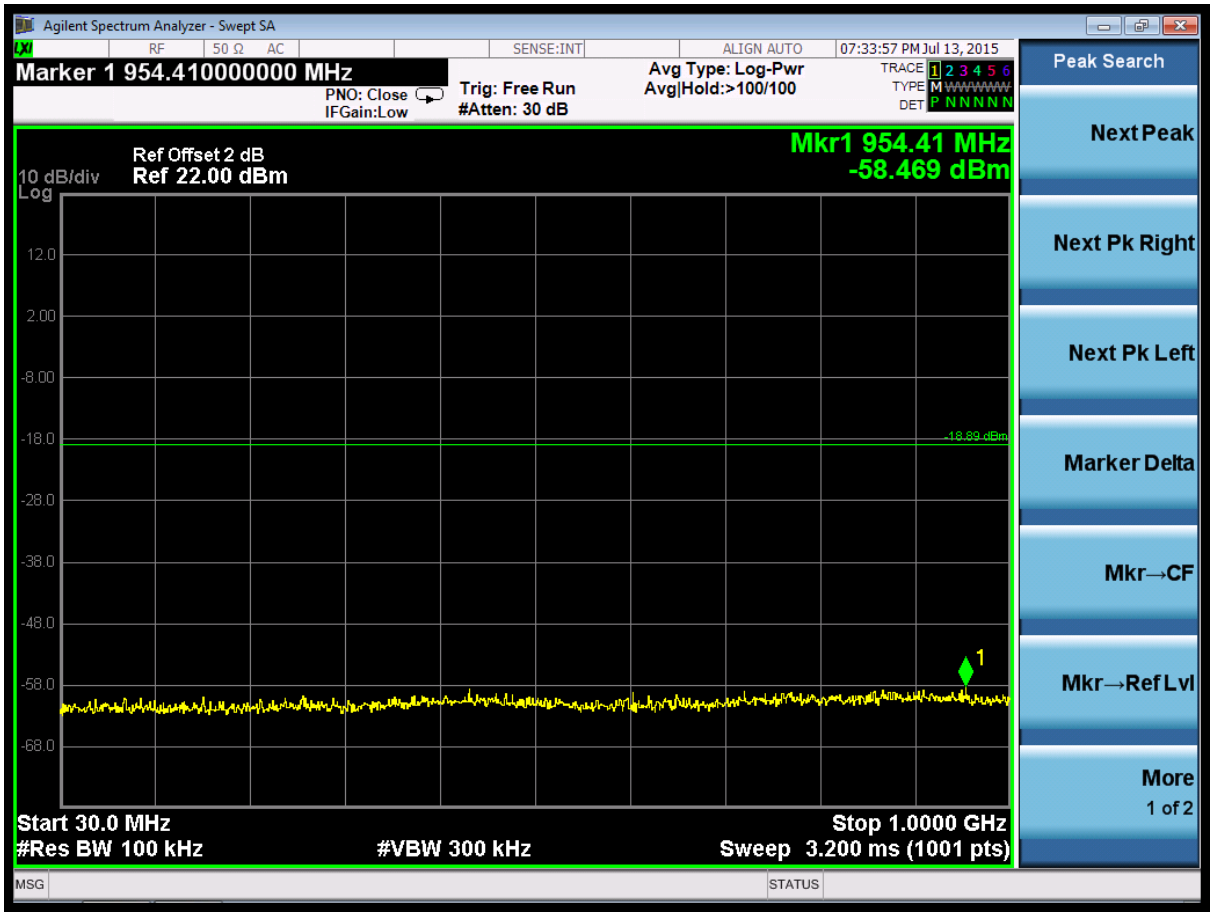
Note:
1. For 802.11n HT20 mode at finial test to get the worst-case emission at 6.5Mbps.
2. The test results including the cable lose.

B. Test Plots

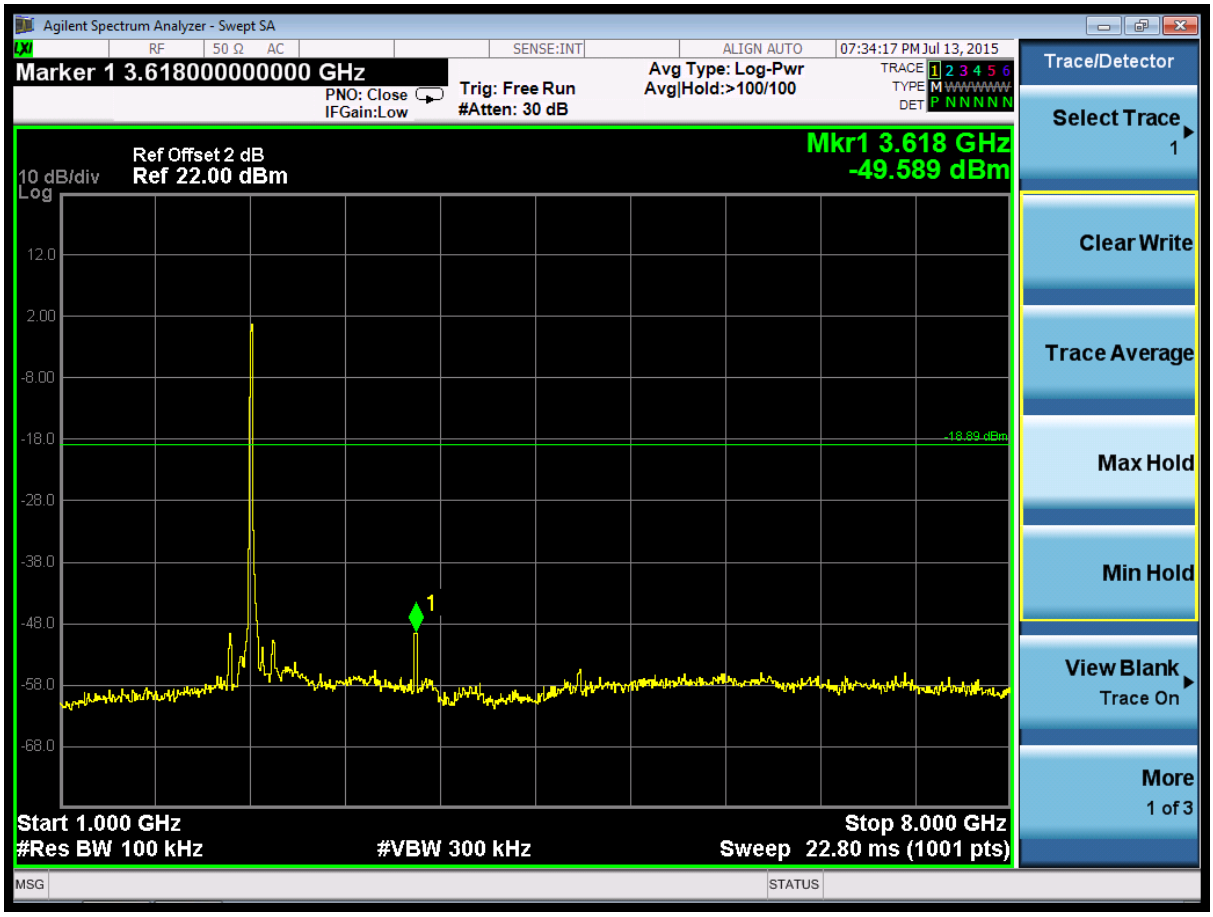
(Plot 4.7.3 A1: Channel 1: 2412MHz @ 802.11n HT20)



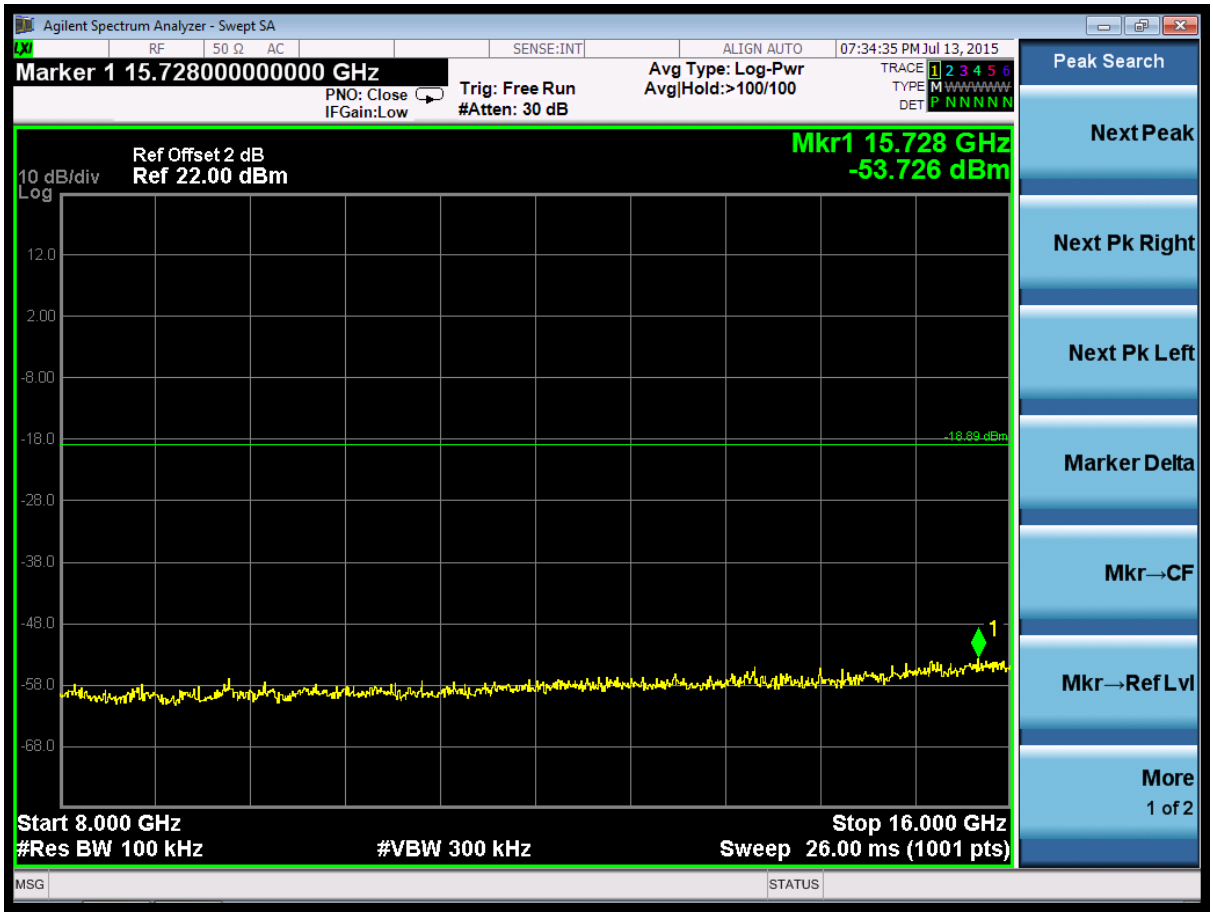
(Plot 4.7.3 A2: Channel 1: 2412MHz @ 802.11n HT20)



(Plot 4.7.3 A3: Channel 1: 2412MHz @ 802.11 n HT20)



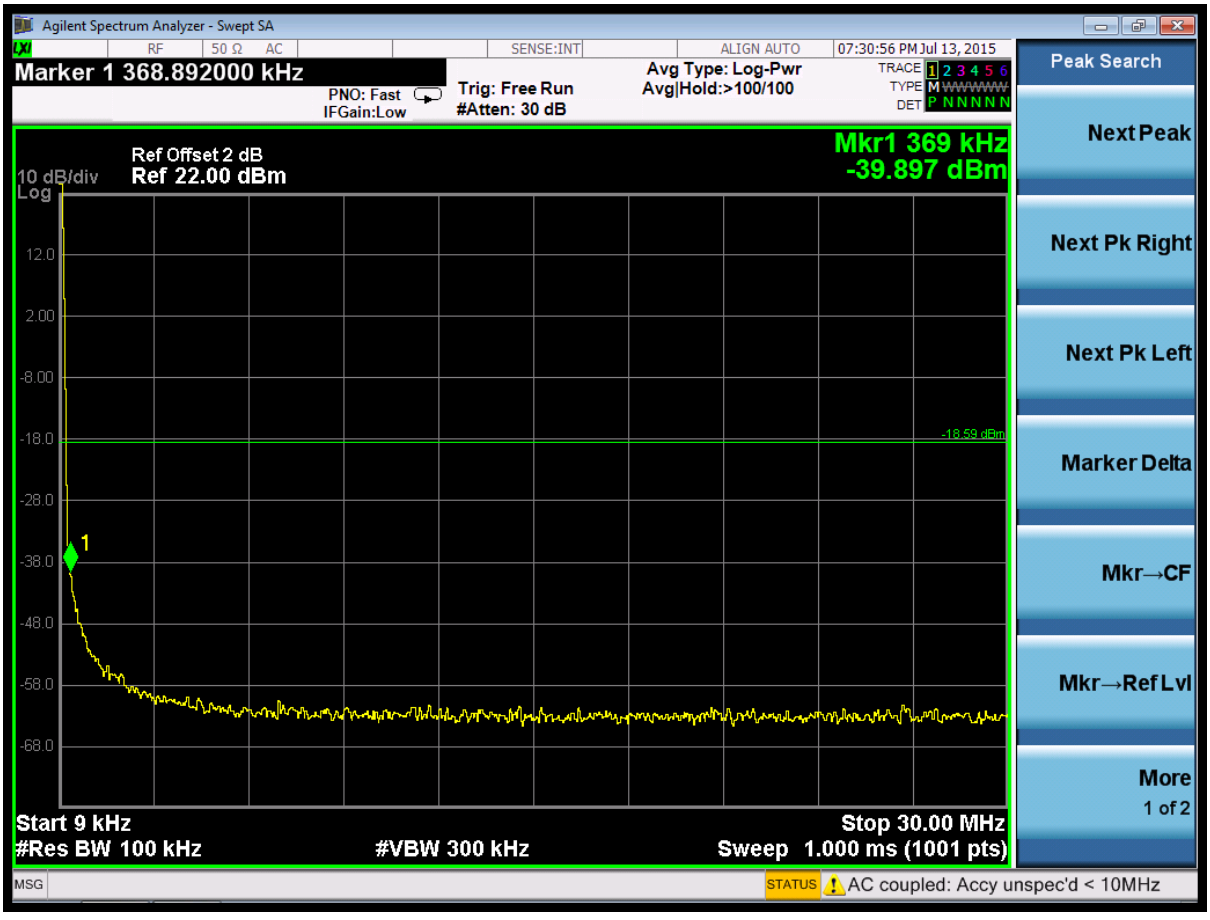
(Plot 4.7.3 A4: Channel 1: 2412MHz @ 802.11n HT20)



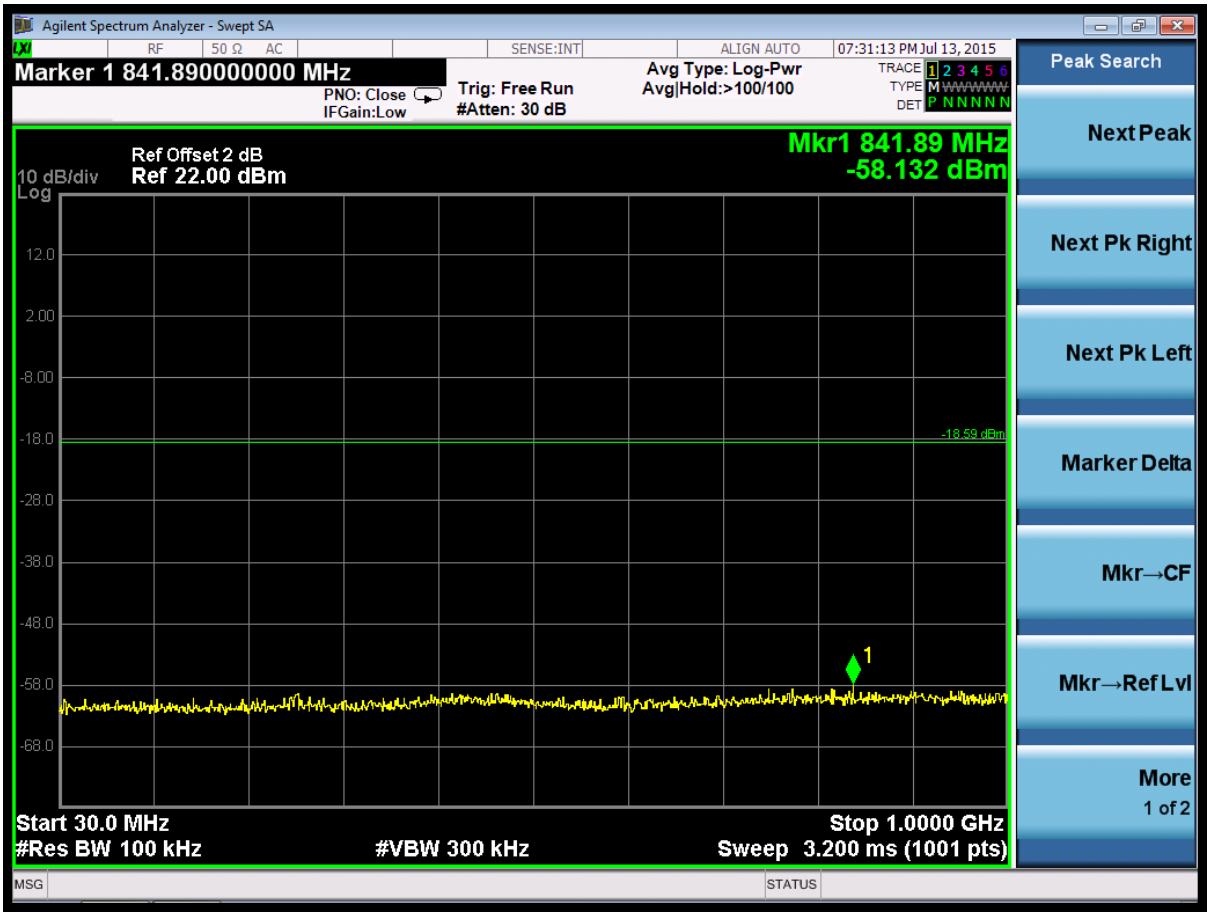
(Plot 4.7.3 A5: Channel 1: 2412MHz @ 802.11n HT20)

(Plot 4.7.3 A6: Channel 1: 2412MHz @ 802.11 n HT20)

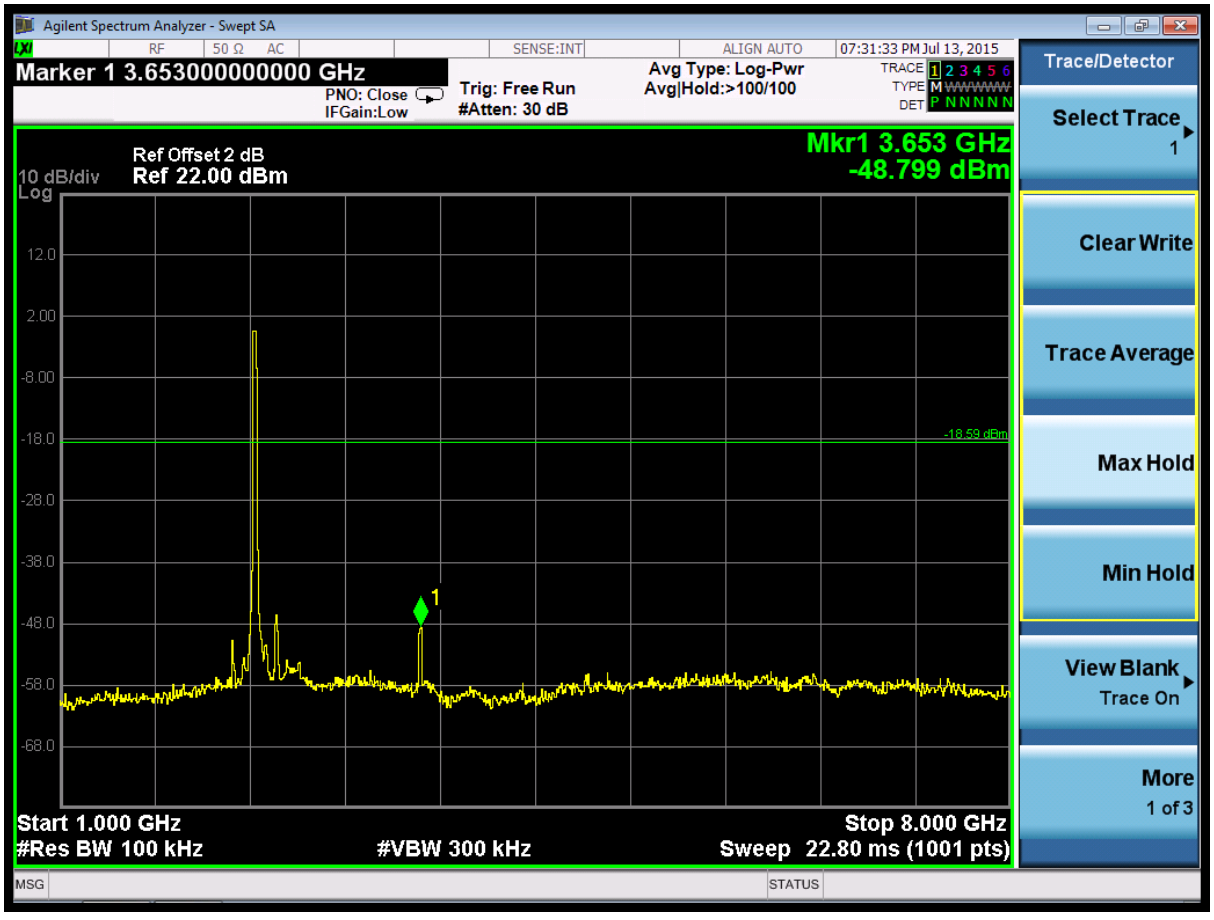
(Plot 4.7.3 B1: Channel 6: 2437MHz @ 802.11n HT20)



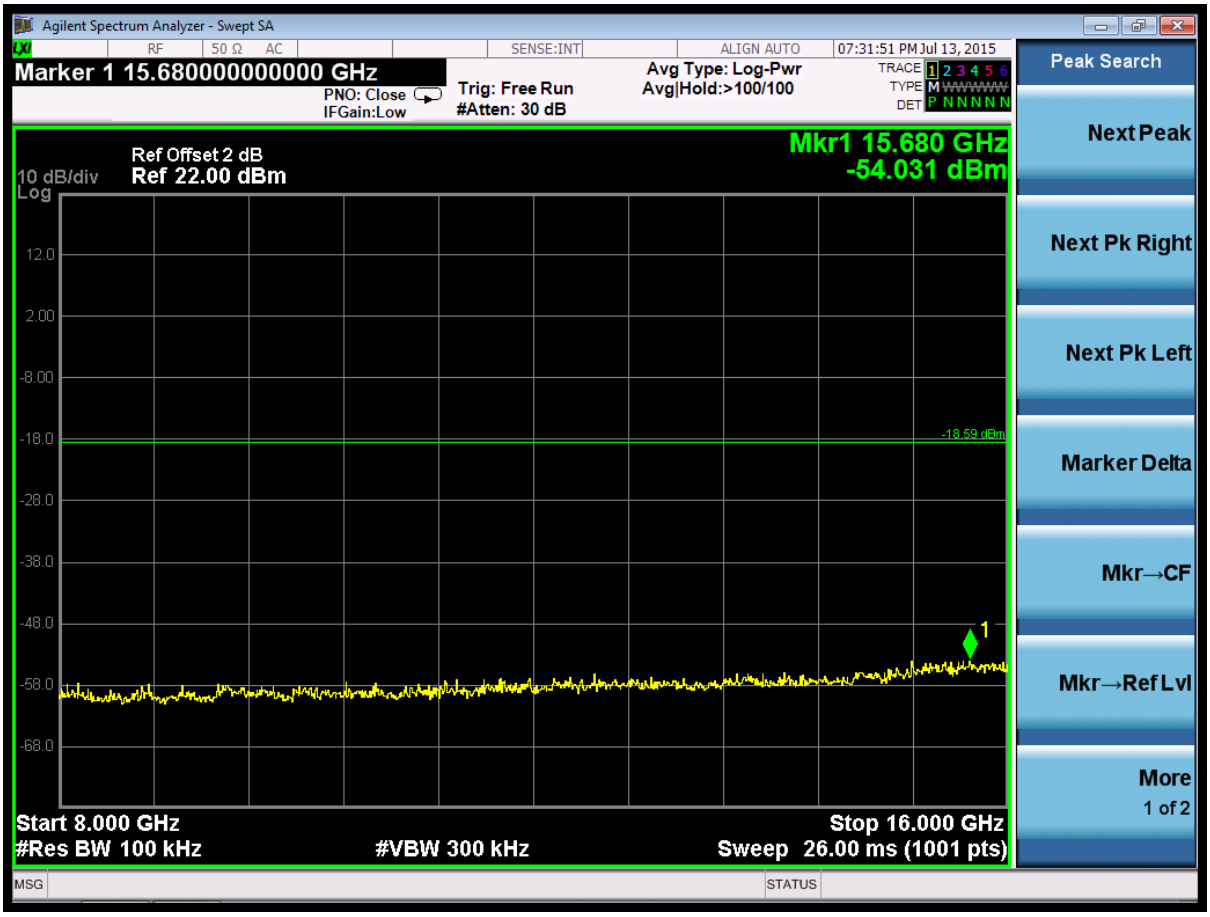
(Plot 4.7.3 B2: Channel 6: 2437MHz @ 802.11n HT20)



(Plot 4.7.3 B3: Channel 6: 2437MHz @ 802.11n HT20)



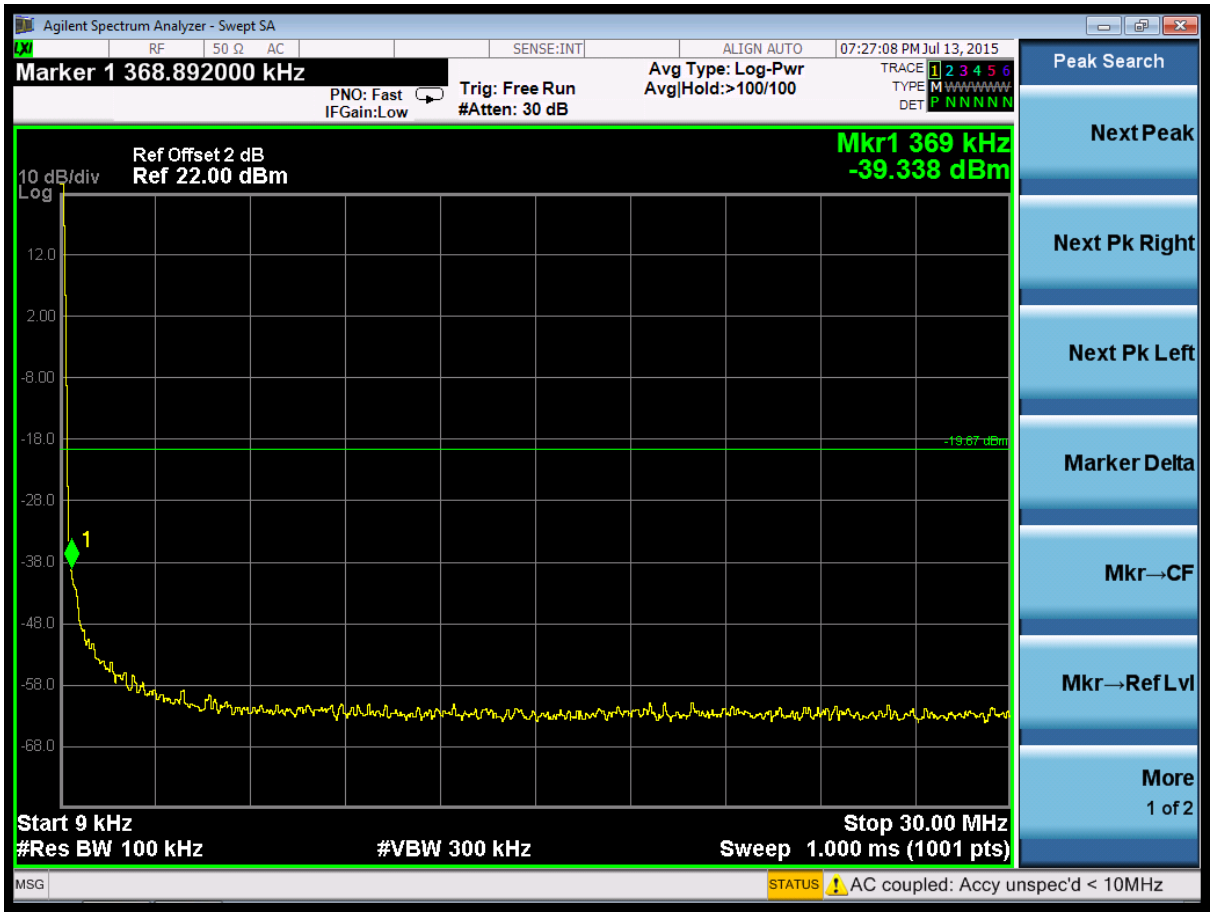
(Plot 4.7.3 B4: Channel 6: 2437MHz @ 802.11n HT20)



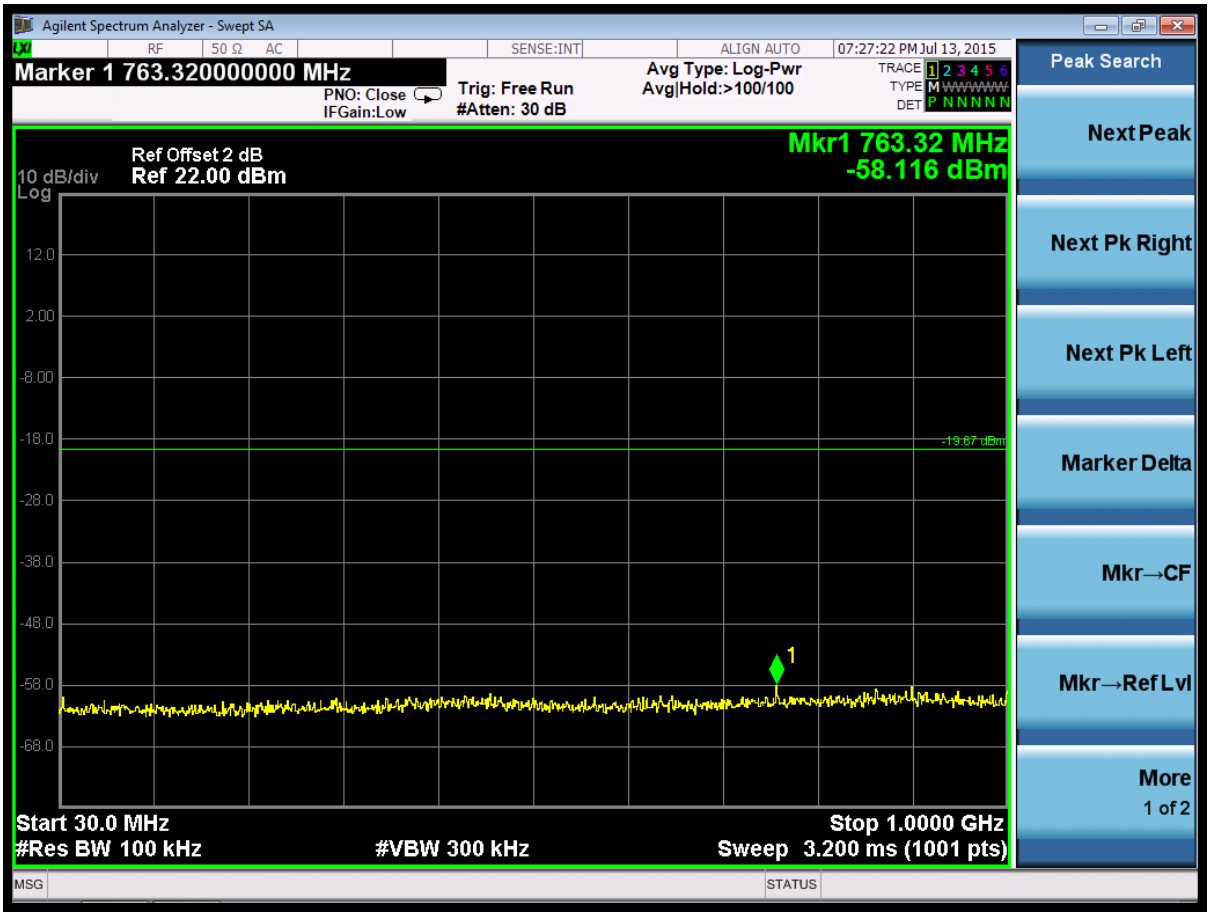
(Plot 4.7.3 B5: Channel 6: 2437MHz @ 802.11n HT20)

(Plot 4.7.3 B6: Channel 6: 2437MHz @ 802.11n HT20)

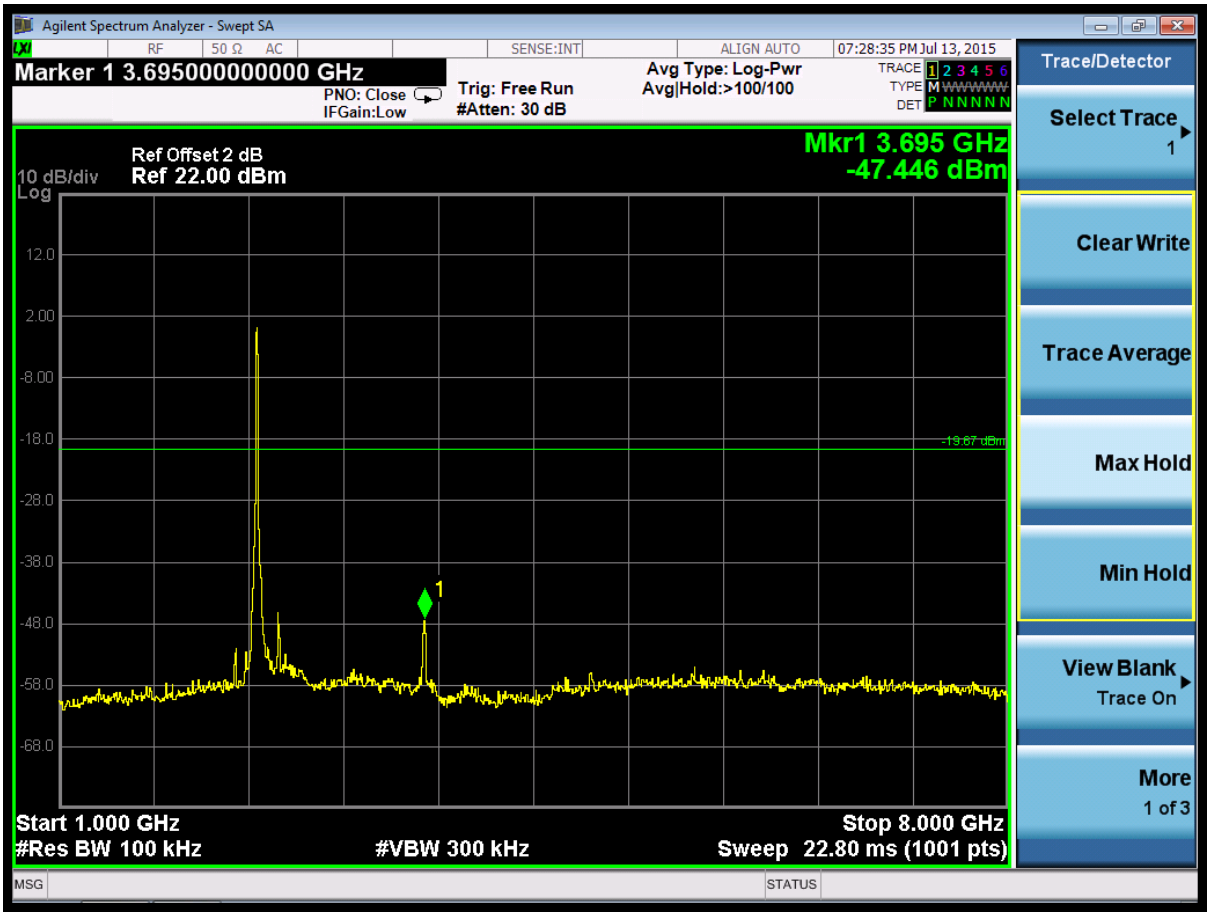
(Plot 4.7.3 C1: Channel 11: 2462MHz @ 802.11n HT20)



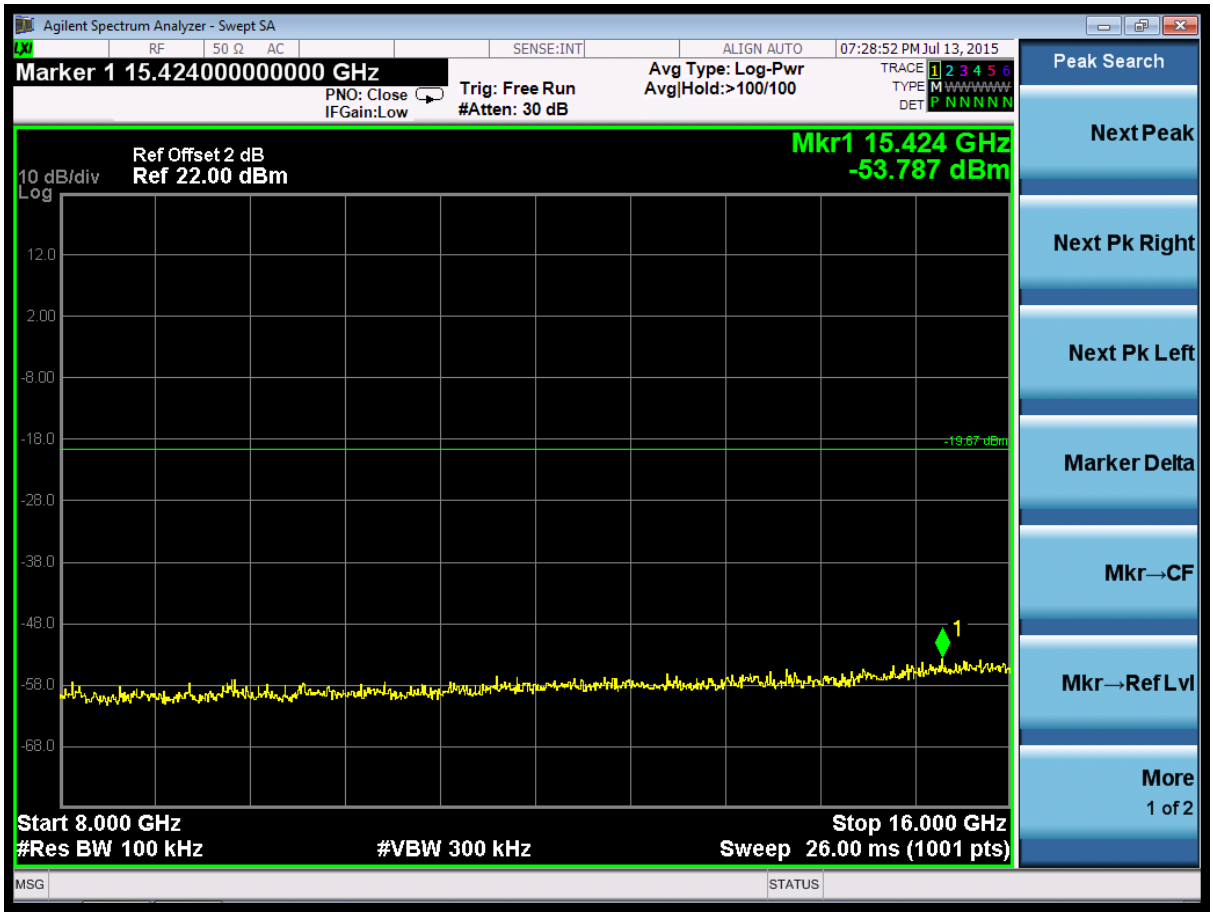
(Plot 4.7.3 C2: Channel 11: 2462MHz @ 802.11n HT20)



(Plot 4.7.3 C3: Channel 11: 2462MHz @ 802.11n HT20)



(Plot 4.7.3 C4: Channel 11: 2462MHz @ 802.11n HT20)



(Plot 4.7.3 C5: Channel 11: 2462MHz @ 802.11n HT20)

(Plot 4.7.3 C6: Channel 11: 2462MHz @ 802.11n HT20)

(Plot 4.7.3 D: Channel 1: 2412MHz @ 802.11n HT20)

(Plot 4.6.3 E: Channel 11: 2462MHz @ 802.11n HT20)

4.8. Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance.

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.For normal WLAN devices, the DSSS mode is used.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Limits

FCC	IC
Antenna Gain	
6 dBi	

Results

T_{nom}	V_{nom}	Lowest Channel 2412 MHz	Middle Channel 2437 MHz	Highest Channel 2462 MHz
Conducted power [dBm] Measured with DSSS modulation		9.885	9.971	9.456
Conducted power [dBm] Measured with DSSS modulation		8.126	8.647	7.789
Gain [dBi] Calculated		-1.759	-1.324	-1.667
Measurement uncertainty		± 0.6 dB (cond.) / ± 2.56 dB (rad.)		

.....End of Report.....