



FCC 47 CFR PART 15 SUBPART C

for

Pocket Projector

Model: PPX4935

Brand: PHILIPS

Test Report Number:

C160106Z03-RP1-3

Issued Date: February 20, 2016

Issued for

X-GEM SAS

9, rue de la Négresse 64200 BIARRITZ – FRANCE

Issued by:

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	February 20, 2016	Initial Issue	ALL	Amzula Chen



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1 TEST CERTIFICATION

Product	Pocket Projector
Model	PPX4935
Brand	PHILIPS
Tested	January 6~February 20, 2016
Applicant	X-GEM SAS 9, rue de la Négresse 64200 BIARRITZ – FRANCE
Manufacturer	X-GEM SAS 9, rue de la Négresse 64200 BIARRITZ – FRANCE

APPLICABLE STANDARDS

Standard	Test Type	Standard	Test Type
15.207(a)	Power Line Conducted Emissions	15.247(d) 15.209(a)	● Spurious Emissions ● Conducted Measurement ● Radiated Emissions
15.247(a)(2)	6dB Bandwidth Measurement	15.247(b)(3) 15.247(b)(4)	Peak Power Measurement
15.247(d)	Band Edges Measurement	15.247(e)	Peak Power Spectral Density

We hereby certify that:

The above equipment was tested by Compliance Certification Services (Shenzhen) Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in **ANSI C63.10: 2013** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

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

Approved by:

Sunday Hu
Supervisor of EMC Dept.
Compliance Certification Services (Shenzhen) Inc.

Reviewed by:

Ruby Zhang
Supervisor of Report Dept.
Compliance Certification Services (Shenzhen) Inc.



2 TEST RESULT SUMMARY

APPLICABLE STANDARDS			
Standard	Test Type	Result	Remark
15.247(a)(2)	6dB Bandwidth Measurement	Pass	Meet the requirement of limit.
15.247(b)(3) 15.247(b)(4)	Peak Power Measurement	Pass	Meet the requirement of limit.
15.247(d)	Band Edges Measurement	Pass	Meet the requirement of limit.
15.247(e)	Peak Power Spectral Density	Pass	Meet the requirement of limit.
15.247(d) 15.209(a)	● Spurious Emissions ● Conducted Measurement ● Radiated Emissions	Pass	Meet the requirement of limit.
15.207(a)	Power line Conducted Emissions	Pass	Meet the requirement of limit.

Note: 1. The statements of test result on the above are decided by the request of test standard only; the measurement uncertainties are not factored into this compliance determination.
2. The information of measurement uncertainty is available upon the customer's request.



3 EUT DESCRIPTION

Product	Pocket Projector
Model Number	PPX4935
Brand	PHILIPS
Model Discrepancy	N/A
Identify Number	C160106Z03-RP1-3
Received Date	January 6, 2016
Power Supply	DC19V supplied by the adapter or DC7.4V supplied by the Battery
Adapter Manufacturer /Model No.	Huntkey / HKA04519024-XA INPUT: 100-240VAC, 50/60Hz, 1.2A OUTPUT : 19VDC, 2.37 A DC Cable: Unshielded, 1.80m
Battery Manufacturer /Model No.	Fujian Unltd/BT-E004 2000mAh/7.4V/14.8Wh
Transmit Power	IEEE 802.11b mode: 17.00dBm IEEE 802.11g mode: 21.50dBm IEEE 802.11n HT20 MHz mode: 21.10dBm
Modulation Technique	IEEE 802.11b mode: DSSS(CCK,QPSK, BPSK) IEEE 802.11g mode: OFDM (BPSK/QPSK/16QAM/64QAM) IEEE 802.11n HT20 MHz mode: OFDM (BPSK/QPSK/16QAM/64QAM)
Transmit Data Rate	IEEE 802.11b: 11Mbps(CCK) with fall back rates of 5.5/2/1Mbps IEEE 802.11g: 54Mbps with fall back rates of 48/36/24/18/12/9 /6Mbps IEEE 802.11n HT20: 65.0Mbps with fall back rates of 65.0/58.5/52.0/ 39.0/26.0/19.5/13.0/6.5 Mbps
Number of Channels	IEEE 802.11b mode: 11 Channels IEEE 802.11g mode: 11 Channels IEEE 802.11n HT20 MHz mode: 11 Channels
Antenna Specification	FPC Antenna with2.0dBi gain (Max)
Channels Spacing	IEEE 802.11b/g ,802.11n HT20/HT40 : 5MHz
Temperature Range	+5°C ~ +35°C
Hardware Version	V1.08b
Software Version	8967C

- Note:**
1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
 2. This submittal(s) (test report) is intended for FCC ID: 2AGG8PPX4935 filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.



4 TEST METHODOLOGY

4.1. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Test Item	Test mode	Worse mode
Conducted Emission	Mode 1: HDMI IN	<input checked="" type="checkbox"/>
Radiated Emission	Mode 1: TX	<input checked="" type="checkbox"/>

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only, and power line conducted emission below 30MHz, which worst case was in normal link mode.

IEEE802.11b mode: Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 1Mbps data rate were chosen for full testing.

IEEE802.11g mode: Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11n HT20 MHz mode: Channel Low (2412MHz), Channel Mid(2437MHz) and Channel High (2462MHz) with 6.5Mbps data rate were chosen for full testing.



5 SETUP OF EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Equipment	Model No.	Serial No.	FCC ID	Brand	Data Cable	Power Cord
1	N/A						

Note:

Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

5.2. CONFIGURATION OF SYSTEM UNDER TEST

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.



6 FACILITIES AND ACCREDITATIONS

6.1. FACILITIES

All measurement facilities used to collect the measurement data are located at
**No.10-1 Mingkeda Logistics park, No.18, Huanguan South Rd., Guan Lan Town,
Baoan District, Shenzhen, China**

The sites are constructed in conformance with the requirements of ANSI C63.10, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

6.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

USA	A2LA
China	CNAS

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

USA	FCC
Japan	VCCI(C-4815,R-4320,T-2317, G-10624)
Canada	INDUSTRY CANADA

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccssz.com>

6.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Parameter	Uncertainty
Radiated Emission, 30 to 200 MHz Test Site : 966(2)	+/-3.6880dB
Radiated Emission, 200 to 1000 MHz Test Site : 966(2)	+/-3.6695dB
Radiated Emission, 1 to 8 GHz	+/-5.1782dB
Radiated Emission, 8 to 18 GHz	+/-5.2173dB
Conducted Emissions	+/-3.6836dB
Band Width	178kHz
Peak Output Power MU	+/-1.906dB
Band Edge MU	+/-0.182dB
Channel Separation MU	416.178Hz
Duty Cycle MU	0.054ms
Frequency Stability MU	226Hz

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

The measured result is above (below) the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance (non-compliance) is more probable than non-compliance) with the specification limit.



7 FCC PART 15.247 REQUIREMENTS

7.1. POWER LINE CONDUCTED EMISSIONS MEASUREMENT

7.1.1. LIMITS OF CONDUCTED EMISSIONS MEASUREMENT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

NOTE:

- (1) The lower limit shall apply at the transition frequencies.
- (2) The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
- (3) All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

7.1.2. TEST INSTRUMENTS

Conducted Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	02/28/2015	02/27/2016
LISN(EUT)	ROHDE&SCHWARZ	ENV216	101543-WX	02/28/2015	02/27/2016
LISN	EMCO	3825/2	8901-1459	02/28/2015	02/27/2016
Temp. / Humidity Meter	VICTOR	HTC-1	N/A	02/28/2015	02/27/2016
Test S/W	FARAD	EZ-EMC/ CCS-3A1-CE			

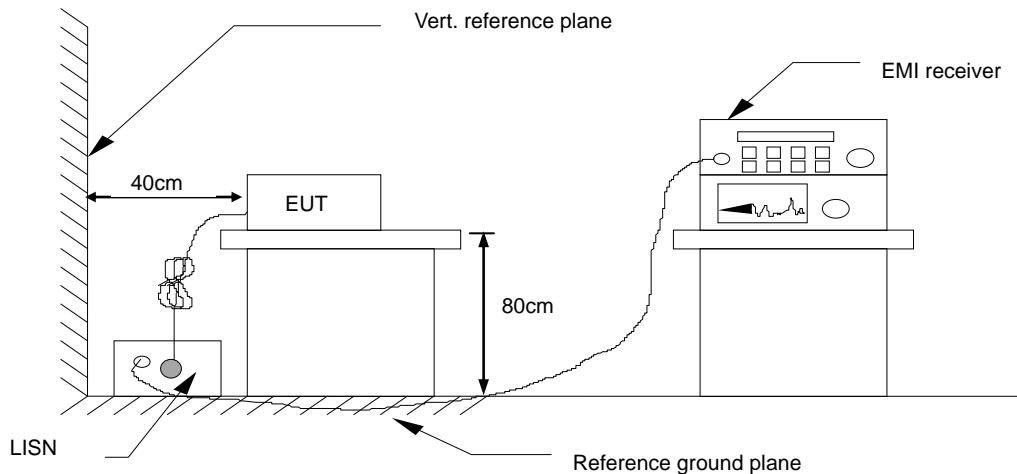
- NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R = No Calibration Request.



7.1.3. TEST PROCEDURES (please refer to measurement standard)

- The EUT and Support equipment, if needed, was placed on a non-conducted table, which is 0.8m above the ground plane and 0.4m away from the conducted wall.
- The test equipment EUT installed received AC main power, through a Line Impedance Stabilization Network (LISN), which supplied power source and was grounded to the ground plane. All support equipment power received from a second LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
- The frequency range from 150 kHz to 30 MHz was searched. The test data of the worst-case condition(s) was recorded. Emission levels under limit 20dB were not recorded.

7.1.4. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

7.1.5. DATA SAMPLE

Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
X.XXXX	32.69	25.65	11.52	44.21	37.17	65.78	55.79	-21.57	-18.62	Pass

Factor = Insertion loss of LISN + Cable Loss

Result = Quasi-peak Reading/ Average Reading + Factor

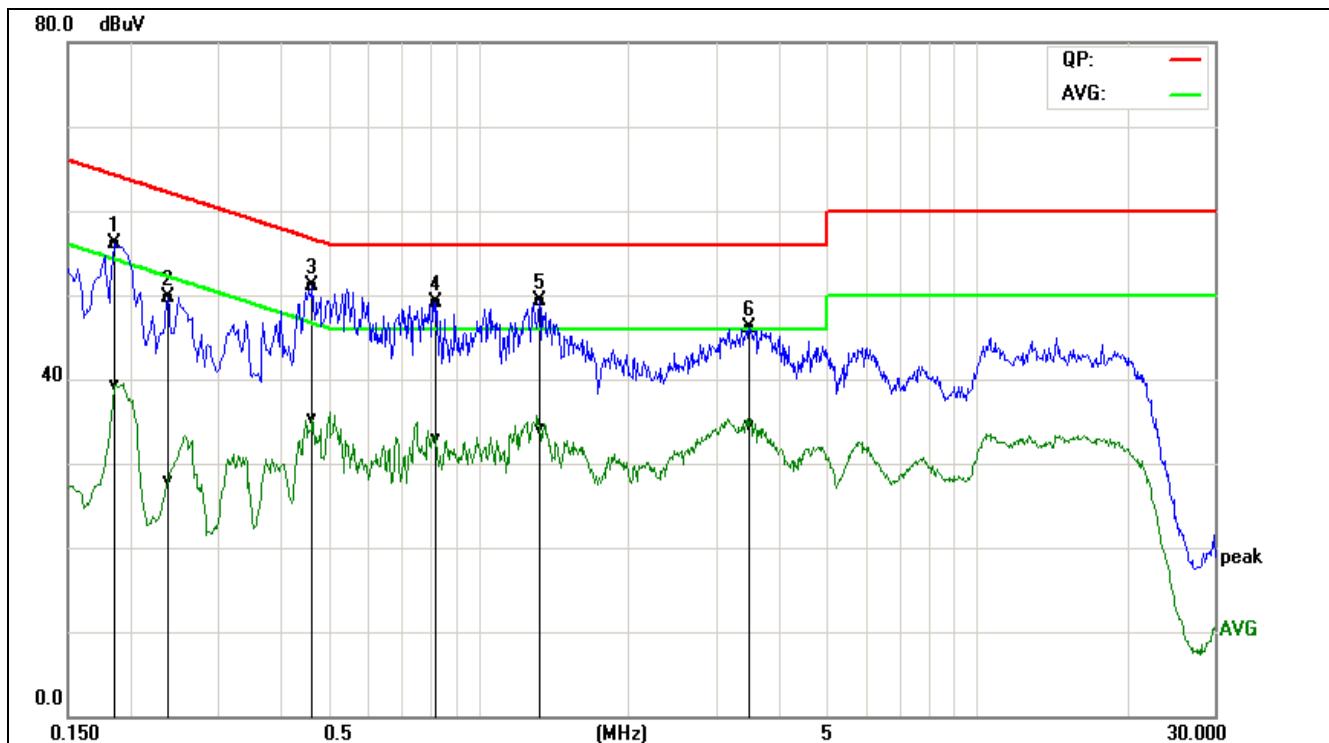
Limit = Limit stated in standard

Margin = Result (dBuV) – Limit (dBuV)



7.1.6. TEST RESULTS

Model No.	PPX4935	RBW,VBW	9 kHz
Environmental Conditions	22°C, 45% RH	Test Mode	Mode 1
Tested by	Eve Wang	Line	L1
Test Date	January 10, 2016		

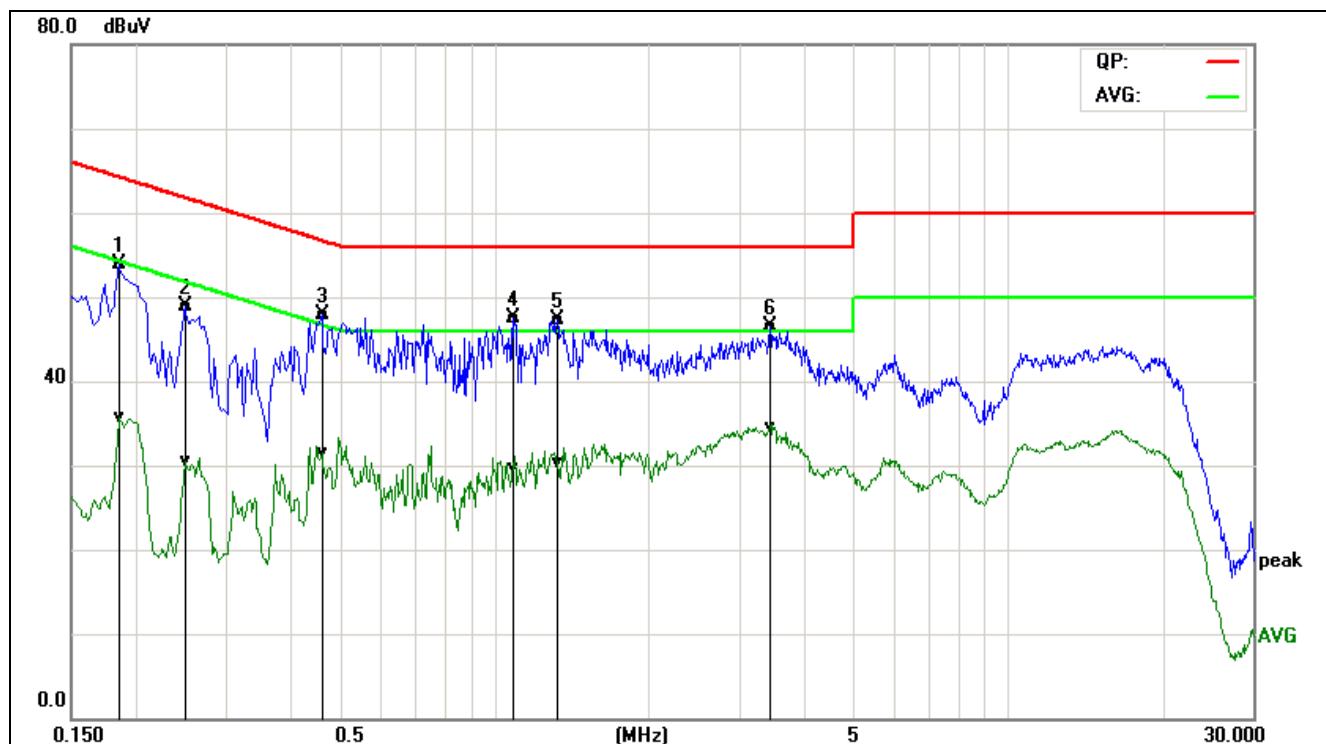


Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)	Line (L1/L2)
0.1860	46.52	29.69	9.66	56.18	39.35	64.21	54.21	-8.03	-14.86	Pass	L1
0.2380	40.07	18.18	9.69	49.76	27.87	62.16	52.17	-12.40	-24.30	Pass	L1
0.4660	41.42	25.53	9.68	51.10	35.21	56.58	46.58	-5.48	-11.37	Pass	L1
0.8260	39.40	23.16	9.76	49.16	32.92	56.00	46.00	-6.84	-13.08	Pass	L1
1.3260	39.54	24.42	9.72	49.26	34.14	56.00	46.00	-6.74	-11.86	Pass	L1
3.5020	36.31	24.88	9.70	46.01	34.58	56.00	46.00	-9.99	-11.42	Pass	L1

REMARKS: L1 = Line One (Live Line)



Model No.	PPX4935	RBW,VBW	9 kHz
Environmental Conditions	22°C, 45% RH	Test Mode	Mode 1
Tested by	Eve Wang	Line	L2
Test Date	January 10, 2016		



Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)	Line (L1/L2)
0.1860	44.13	25.99	9.79	53.92	35.78	64.21	54.21	-10.29	-18.43	Pass	L2
0.2500	39.11	20.73	9.77	48.88	30.50	61.75	51.76	-12.87	-21.26	Pass	L2
0.4620	38.30	21.79	9.69	47.99	31.48	56.66	46.66	-8.67	-15.18	Pass	L2
1.0900	37.65	19.85	9.80	47.45	29.65	56.00	46.00	-8.55	-16.35	Pass	L2
1.3260	37.59	20.43	9.79	47.38	30.22	56.00	46.00	-8.62	-15.78	Pass	L2
3.4500	36.78	24.68	9.75	46.53	34.43	56.00	46.00	-9.47	-11.57	Pass	L2

REMARKS: L2 = Line Two (Neutral Line)



7.2. SPURIOUS EMISSIONS MEASUREMENT

7.2.1. CONDUCTED EMISSIONS MEASUREMENT

7.2.1.1. LIMITS OF CONDUCTED EMISSIONS MEASUREMENT

§15.247(d) specifies that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to 15.247(b)(3) requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to 15.247(b)(3) requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

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 Section 15.205(c)).

7.2.1.2. TEST INSTRUMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	02/28/2015	02/27/2016

7.2.1.3. TEST PROCEDURE (please refer to measurement standard)

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site. The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

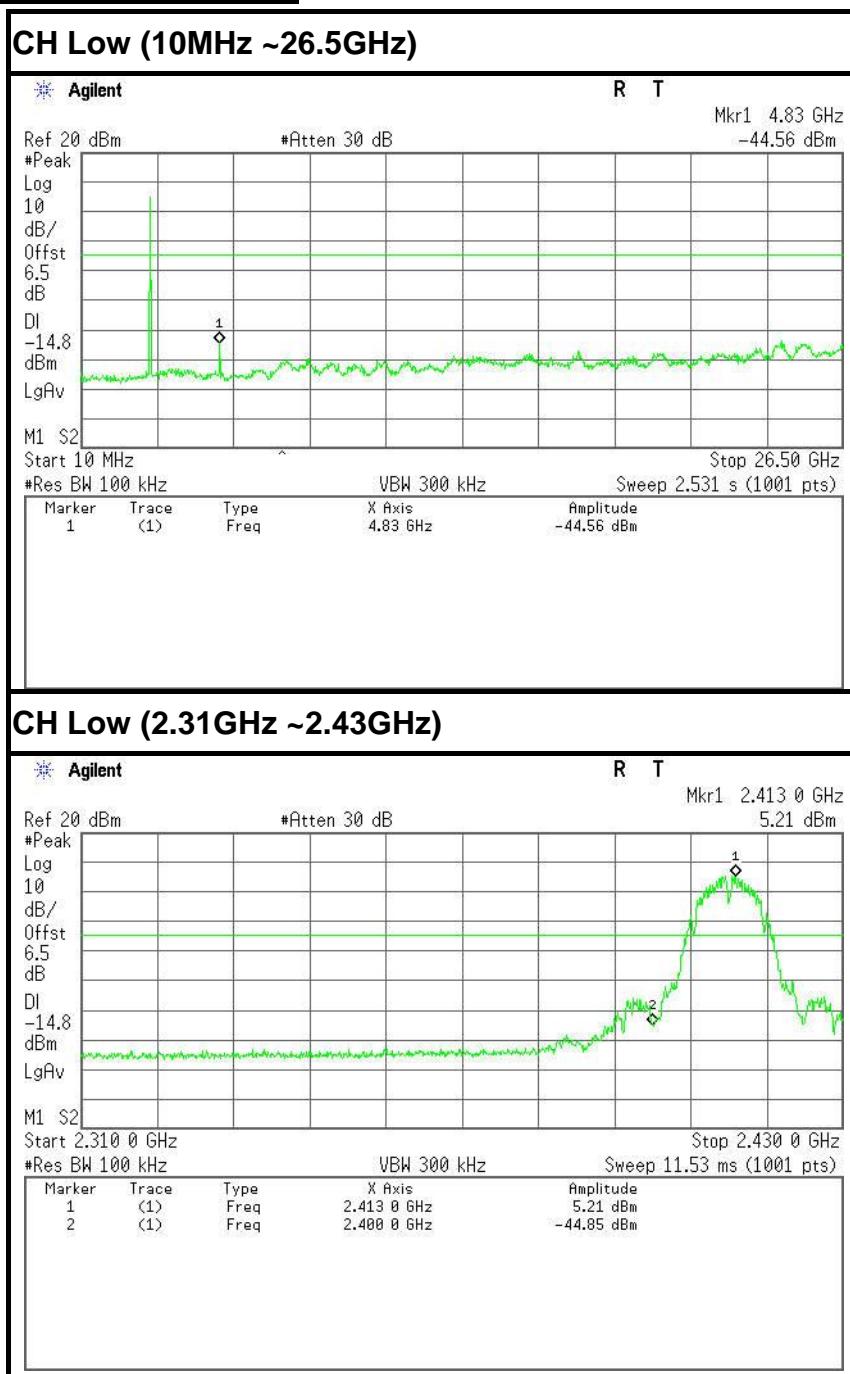
Measurements are made over the 10MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels. No emission found between lowest internal used/generated frequency to 10MHz , it is only recorded 10MHz to 26GHz.

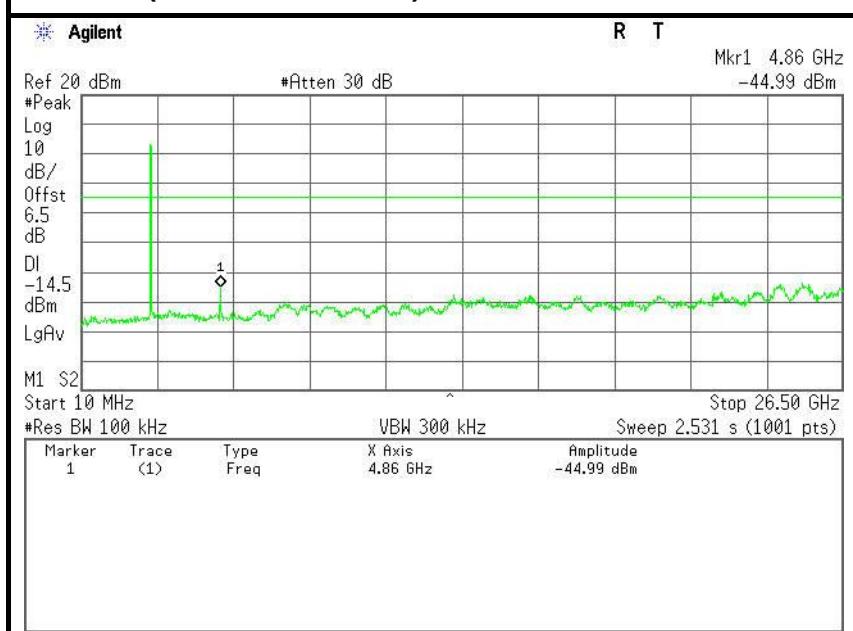


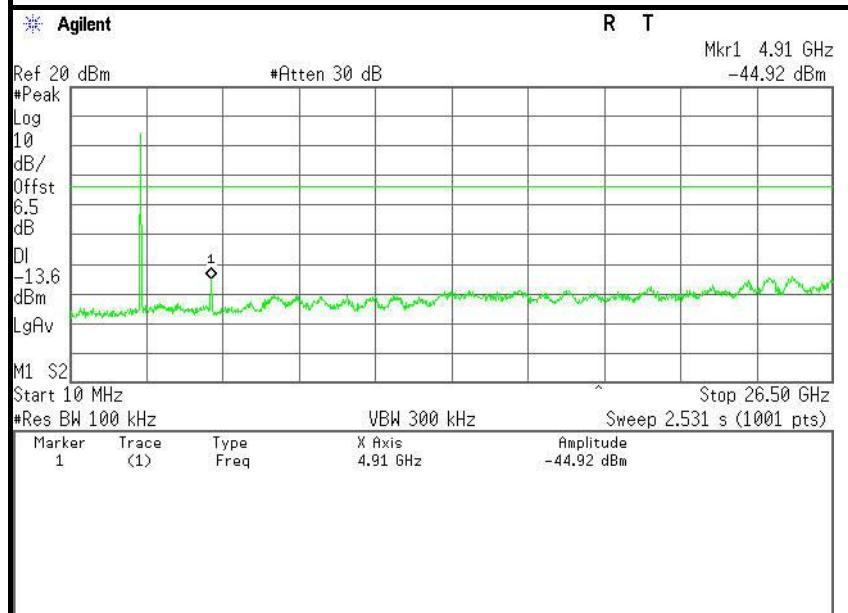
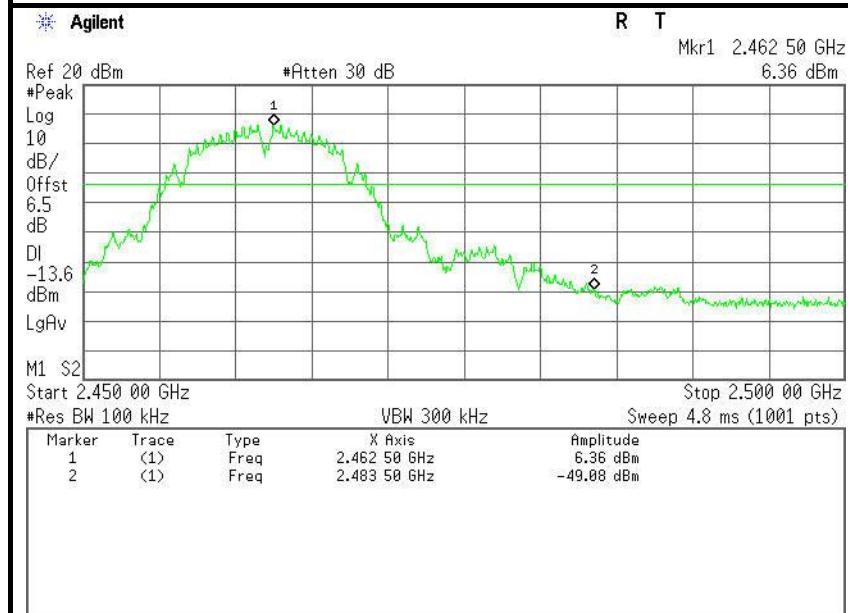
7.2.1.4. TEST RESULTS

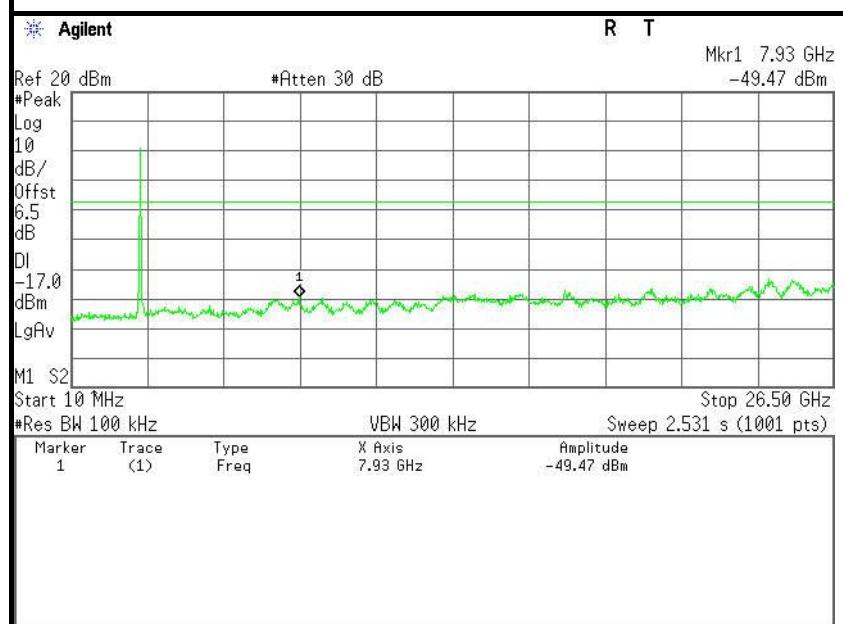
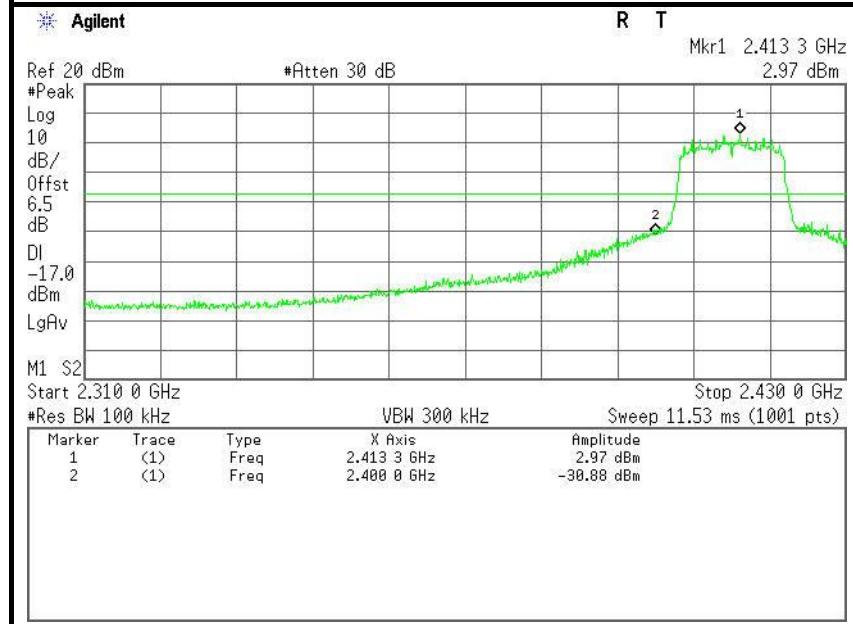
Test Plot

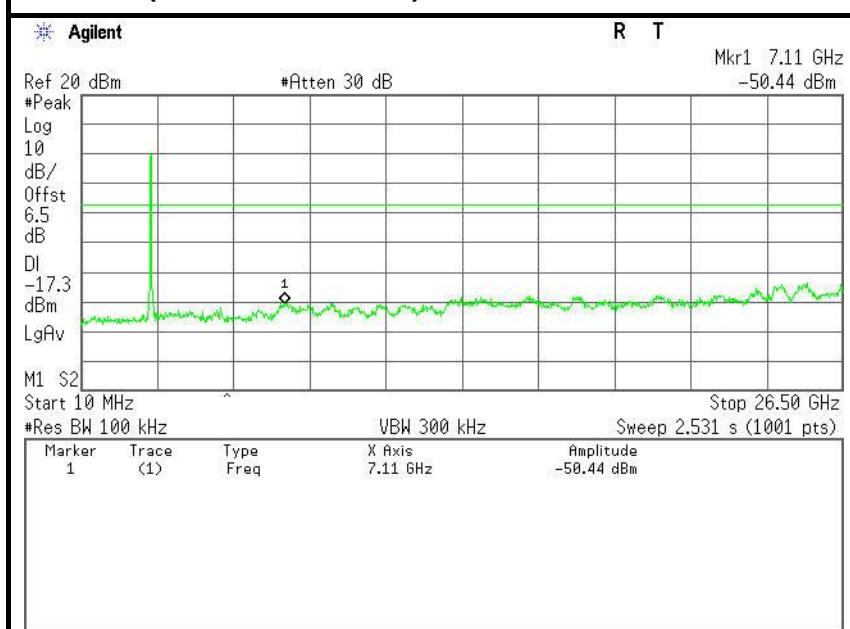
IEEE 802.11b mode

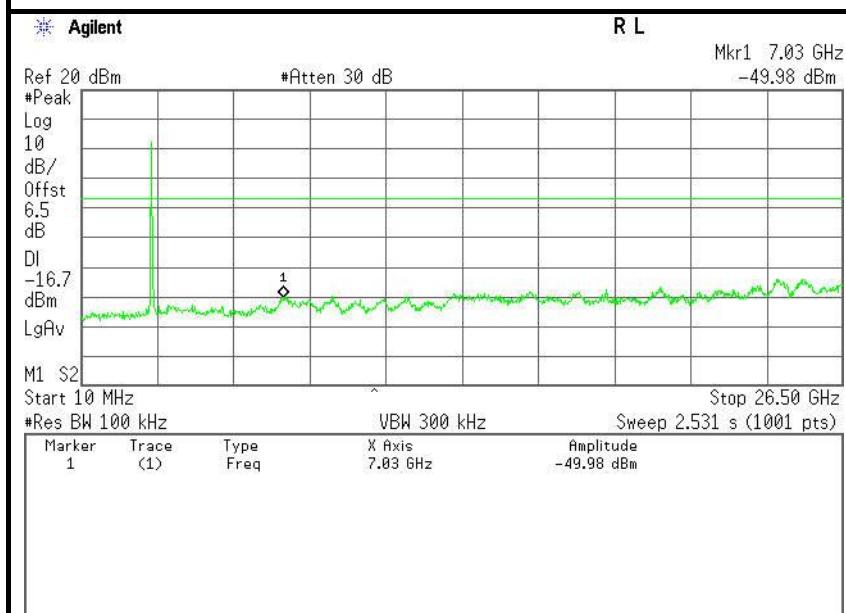
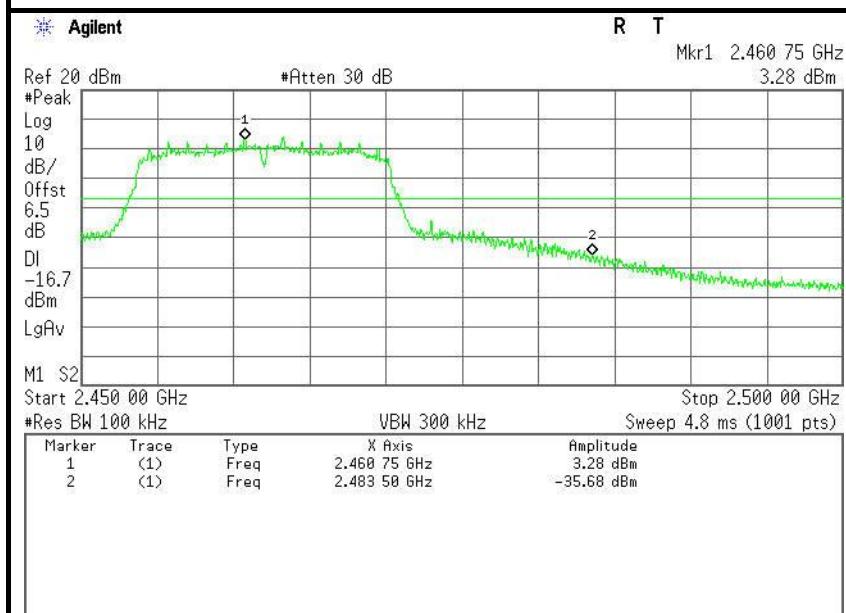


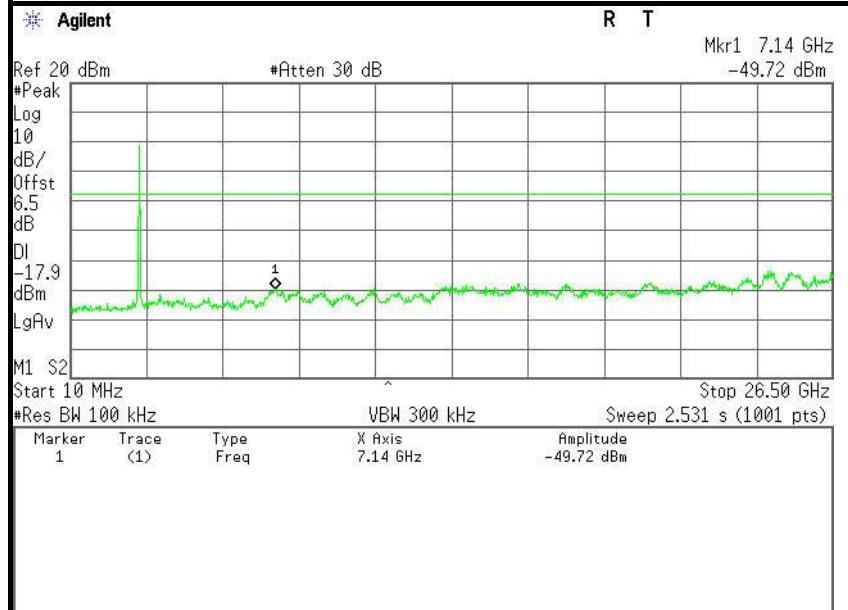
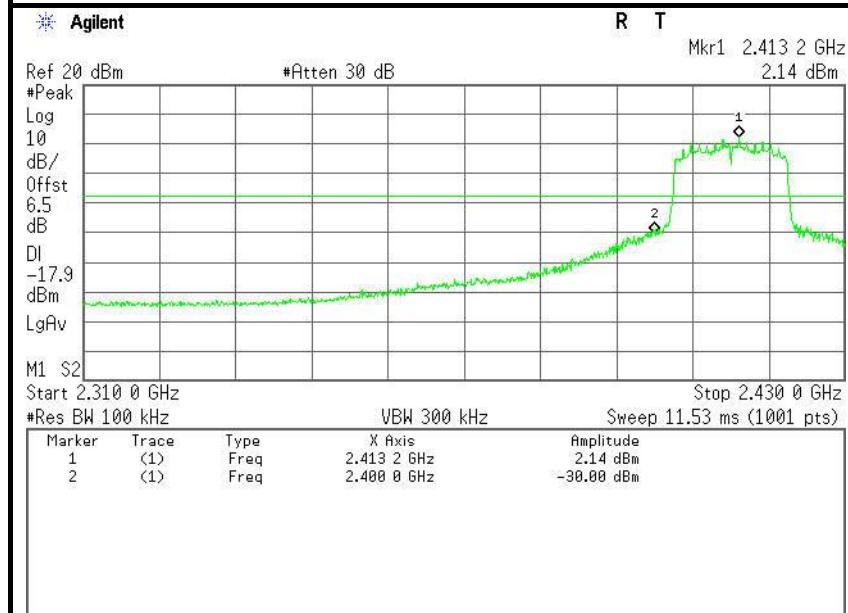
**CH Mid (10MHz ~26.5GHz)**

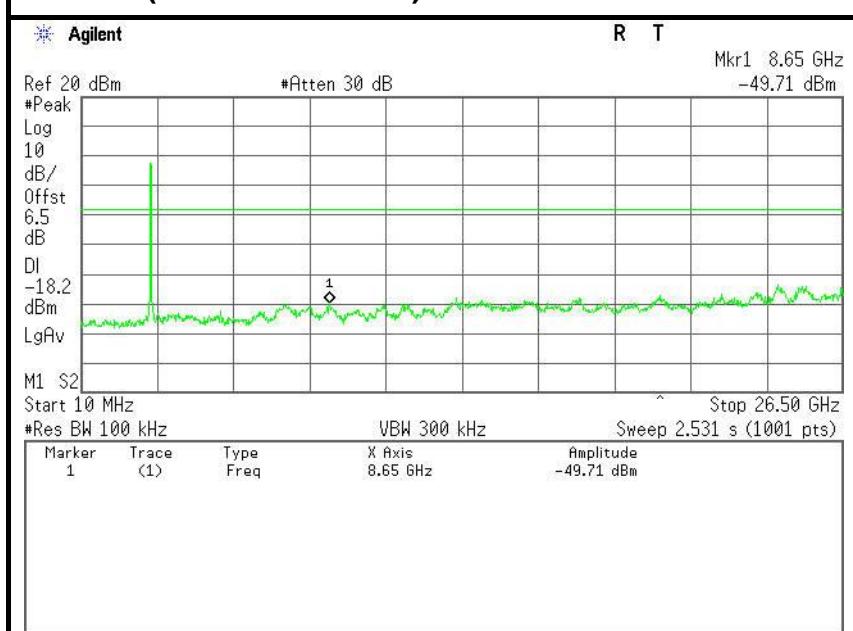
**CH High (10MHz ~26.5GHz)****CH High (2.45GHz ~2.5GHz)**

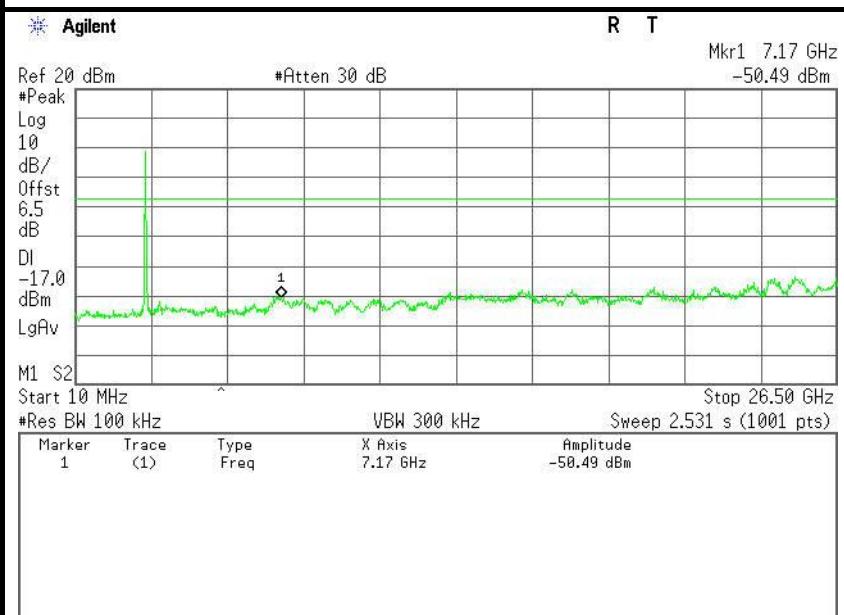
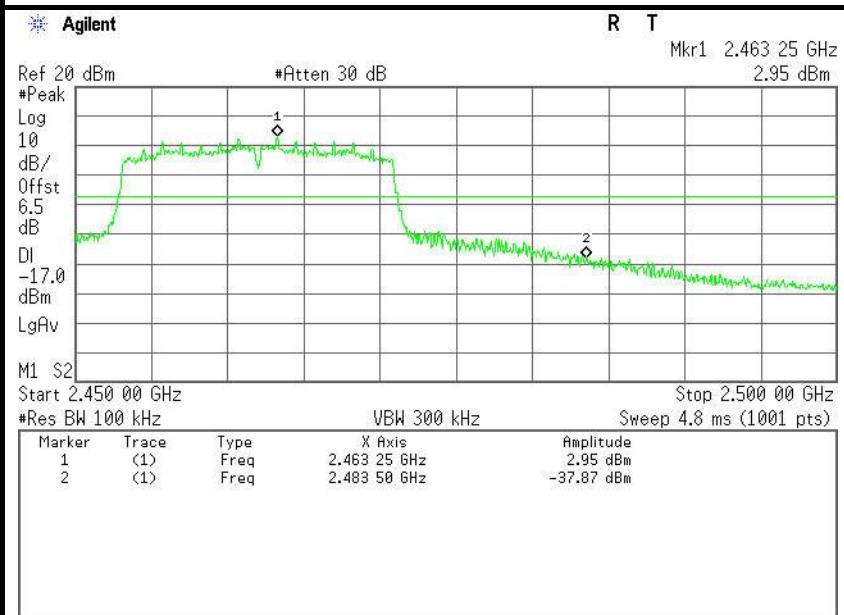
**IEEE 802.11g mode****CH Low (10MHz ~26.5GHz)****CH Low (2.31GHz ~2.43GHz)**

**CH Mid (10MHz ~26.5GHz)**

**CH High (10MHz ~26.5GHz)****CH High (2.45GHz ~2.5GHz)**

**IEEE 802.11n HT20 MHz mode****CH Low (10MHz ~26.5GHz)****CH Low (2.31GHz ~2.43GHz)**

**CH Mid (10MHz ~26.5GHz)**

**CH High (10MHz ~26.5GHz)****CH High (2.45GHz ~2.5GHz)**



7.2.2. RADIATED EMISSIONS MEASUREMENT

7.2.2.1. LIMITS OF RADIATED EMISSIONS MEASUREMENT

According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (mV/m)	Measurement Distance (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

1. In the emission table above, the tighter limit applies at the band edges.

Frequency (MHz)	Field Strength (μ V/m at 3-meter)	Field Strength (dB μ V/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

NOTE:(1) The lower limit shall apply at the transition frequencies.

(2) Emission level (dB μ V/m) = 20 log Emission level (μ V/m).



7.2.2.2. TEST INSTRUMENTS

Radiated Emission Test Site 966(2)					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	02/28/2015	02/27/2016
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	02/28/2015	02/27/2016
Amplifier	MITEQ	AM-1604-3000	1123808	03/18/2015	03/18/2016
High Noise Amplifier	Agilent	8449B	3008A01838	02/28/2015	02/27/2016
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170-497	02/28/2015	02/27/2016
Bilog Antenna	SCHAFFNER	CBL6143	5082	02/28/2015	02/27/2016
Horn Antenna	SCHWARZBECK	BBHA9120	D286	02/28/2015	02/27/2016
Loop Antenna	COM-POWER	AL-130	121044	09/25/2015	09/24/2016
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R
Controller	Sunol Sciences	SC104V	022310-1	N.C.R	N.C.R
Controller	CT	N/A	N/A	N.C.R	N.C.R
Temp. / Humidity Meter	Anymetre	JR913	N/A	02/28/2015	02/27/2016
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R
Test S/W	FARAD	LZ-RF / CCS-SZ-3A2			

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The FCC Site Registration number is 101879.
3. N.C.R = No Calibration Required.



7.2.2.3. TEST PROCEDURE (please refer to measurement standard)

1. The EUT is placed on a turntable, which is 0.8m or 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

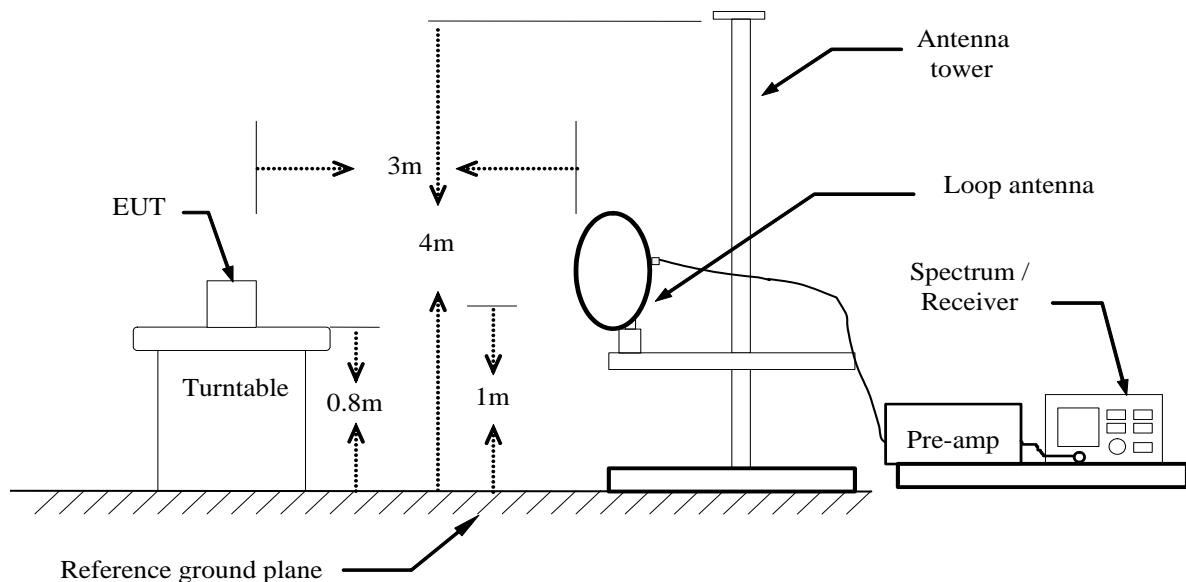
(a) PEAK: RBW=1MHz,VBW=3MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO / Detector=Peak

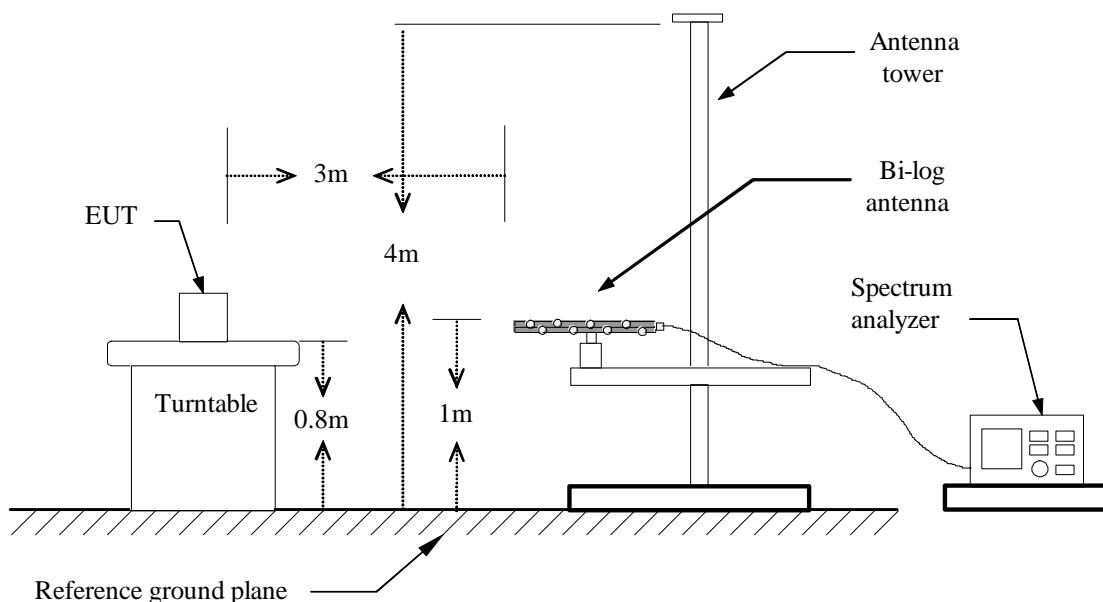
7. Repeat above procedures until the measurements for all frequencies
8. are complete.

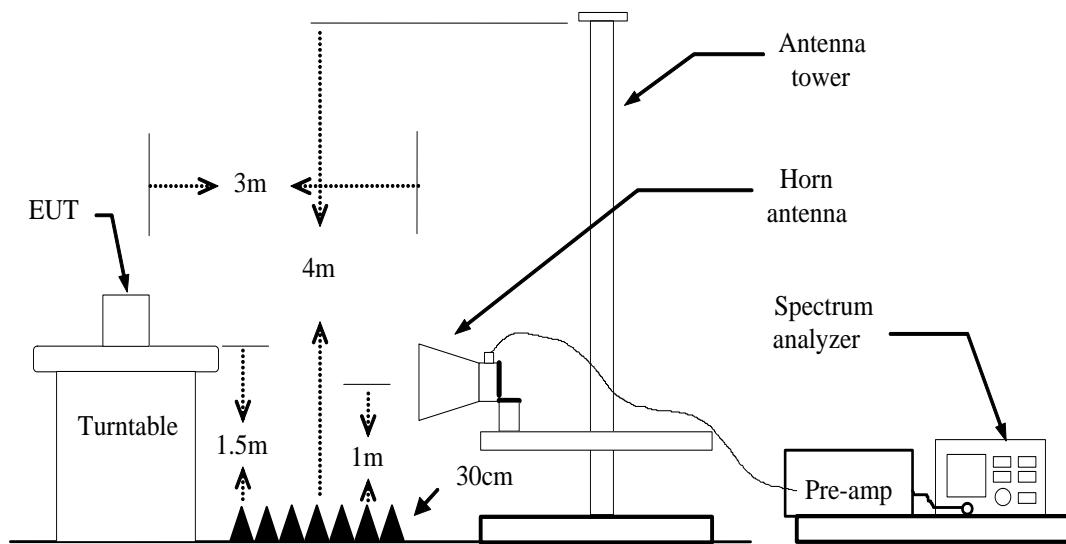
7.2.2.4. TEST SETUP

Below 30MHz



Below 1 GHz



Above 1 GHz

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.



7.2.2.5. DATA SAMPLE

Below 1GHz

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
XXX.XXXX	36.37	-12.20	24.17	40.00	-15.83	V	QP

Frequency (MHz) = Emission frequency in MHz
 Reading (dBuV) = Uncorrected Analyzer / Receiver reading
 Correct Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain
 Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)
 Limit (dBuV/m) = Limit stated in standard
 Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)
 Q.P. = Quasi-peak Reading

Above 1GHz

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
XXXX.XXXX	62.09	-11.42	50.67	74.00	-23.33	V	Peak
XXXX.XXXX	49.78	-11.42	38.36	54.00	-15.64	V	AVG

Frequency (MHz) = Emission frequency in MHz
 Reading (dBuV) = Uncorrected Analyzer / Receiver reading
 Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain
 Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)
 Limit (dBuV/m) = Limit stated in standard
 Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)
 Peak = Peak Reading
 AVG = Average Reading

Calculation Formula

Margin (dB) = Result (dBuV/m) – Limits (dBuV/m)
 Result (dBuV/m) = Reading (dBuV) + Correction Factor



7.2.2.6. TEST RESULTS

Below 1 GHz

Test Mode: TX

Tested by: Eve Wang

Ambient temperature: 24°C Relative humidity: 52% RH Date: January 15, 2016

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
86.2600	56.48	-25.47	31.01	40.00	-8.99	V	QP
143.4900	55.01	-21.43	33.58	43.50	-9.92	V	QP
375.3200	52.57	-16.82	35.75	46.00	-10.25	V	QP
418.0000	51.83	-15.46	36.37	46.00	-9.63	V	QP
580.9600	48.99	-13.10	35.89	46.00	-10.11	V	QP
640.1300	49.91	-12.47	37.44	46.00	-8.56	V	QP
101.7800	54.94	-23.35	31.59	43.50	-11.91	H	QP
238.5500	57.48	-21.55	35.93	46.00	-10.07	H	QP
333.6100	52.47	-18.31	34.16	46.00	-11.84	H	QP
440.3100	52.98	-15.67	37.31	46.00	-8.69	H	QP
624.6100	49.24	-12.73	36.51	46.00	-9.49	H	QP
833.1600	42.47	-10.63	31.84	46.00	-14.16	H	QP

**Remark: No emission found between lowest internal used/generated frequency to 30MHz.

Notes:

1. Radiated emissions measured in frequency range from 9kHz to 1GHz were made with an instrument using Quasi-peak detector mode.
2. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. The IF bandwidth of Receiver between 30MHz to 1GHz was 120kHz.
4. Frequency (MHz).
Reading (dB μ V/m) = Emission frequency in MHz
Correction Factor (dB) = Receiver reading
Limit (dB μ V/m) = Antenna factor + Cable loss – Amplifier gain
Margin (dB) = Limit stated in standard
Antenna Pole(H/V) = Measured (dB μ V/m) – Limits (dB μ V/m)
= Current carrying line of reading

**Above 1 GHz****Test Mode:** TX / IEEE 802.11b(CH Low)**Tested by:** Eve Wang**Ambient temperature:** 24°C **Relative humidity:** 52% RH **Date:** February 20, 2016

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1549.000	46.93	-6.79	40.14	74.00	-33.86	V	peak
2548.000	45.15	-2.17	42.98	74.00	-31.02	V	peak
2863.000	45.16	-1.61	43.55	74.00	-30.45	V	peak
4825.000	45.29	4.41	49.70	74.00	-24.30	V	peak
5707.000	40.74	5.96	46.70	74.00	-27.30	V	peak
7165.000	39.12	8.02	47.14	74.00	-26.86	V	peak
<hr/>							
1090.000	49.43	-8.21	41.22	74.00	-32.78	H	Peak
1549.000	50.78	-6.79	43.99	74.00	-30.01	H	Peak
2593.000	44.45	-2.09	42.36	74.00	-31.64	H	Peak
4825.000	46.95	4.41	51.36	74.00	-22.64	H	peak
5779.000	40.90	5.99	46.89	74.00	-27.11	H	peak
7210.000	40.17	8.11	48.28	74.00	-25.72	H	peak

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Test Mode:** TX / IEEE 802.11b (CH Mid)**Tested by:** Eve Wang**Ambient temperature:** 24°C **Relative humidity:** 52% RH **Date:** February 20, 2016

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
2530.000	45.30	-2.21	43.09	74.00	-30.91	V	Peak
2818.000	44.58	-1.69	42.89	74.00	-31.11	V	Peak
2818.000	44.58	-1.69	42.89	74.00	-31.11	V	Peak
4870.000	44.54	4.56	49.10	74.00	-24.90	V	Peak
5581.000	40.63	5.90	46.53	74.00	-27.47	V	Peak
7732.000	40.74	9.13	49.87	74.00	-24.13	V	Peak
1549.000	49.63	-6.79	42.84	74.00	-31.16	H	Peak
2494.000	44.84	-2.29	42.55	74.00	-31.45	H	Peak
4870.000	45.64	4.56	50.20	74.00	-23.80	H	Peak
6310.000	39.91	6.58	46.49	74.00	-27.51	H	Peak
7228.000	40.73	8.14	48.87	74.00	-25.13	H	Peak
7759.000	41.04	9.18	50.22	74.00	-23.78	H	Peak

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Test Mode:** TX / IEEE 802.11b (CH High)**Tested by:** Eve Wang**Ambient temperature:** 24°C **Relative humidity:** 52% RH **Date:** February 20, 2016

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1090.000	48.55	-8.21	40.34	74.00	-33.66	V	Peak
2566.000	44.85	-2.14	42.71	74.00	-31.29	V	Peak
3889.000	42.58	1.12	43.70	74.00	-30.30	V	Peak
4924.000	45.66	4.73	50.39	74.00	-23.61	V	Peak
6391.000	40.52	6.71	47.23	74.00	-26.77	V	Peak
7480.000	40.05	8.64	48.69	74.00	-25.31	V	Peak
1081.000	49.08	-8.24	40.84	74.00	-33.16	H	Peak
1549.000	50.58	-6.79	43.79	74.00	-30.21	H	Peak
2818.000	44.97	-1.69	43.28	74.00	-30.72	H	Peak
4222.000	41.62	2.37	43.99	74.00	-30.01	H	Peak
4924.000	45.46	4.73	50.19	74.00	-23.81	H	Peak
5887.000	40.48	6.03	46.51	74.00	-27.49	H	Peak

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Test Mode:** TX / IEEE 802.11g(CH Low)**Tested by:** Eve Wang**Ambient temperature:** 24°C **Relative humidity:** 52% RH **Date:** February 20, 2016

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
2125.000	45.50	-4.31	41.19	74.00	-32.81	V	Peak
2872.000	44.80	-1.59	43.21	74.00	-30.79	V	Peak
4825.000	43.09	4.41	47.50	74.00	-26.50	V	Peak
5284.000	41.31	5.49	46.80	74.00	-27.20	V	Peak
6121.000	40.21	6.28	46.49	74.00	-27.51	V	Peak
7264.000	40.35	8.21	48.56	74.00	-25.44	V	Peak
1090.000	49.39	-8.21	41.18	74.00	-32.82	H	Peak
1549.000	50.58	-6.79	43.79	74.00	-30.21	H	Peak
2521.000	44.97	-2.22	42.75	74.00	-31.25	H	Peak
4042.000	42.67	1.74	44.41	74.00	-29.59	H	Peak
4825.000	43.11	4.41	47.52	74.00	-26.48	H	Peak
6913.000	40.75	7.56	48.31	74.00	-25.69	H	Peak

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Test Mode:** TX / IEEE 802.11g (CH Mid)**Tested by:** Eve Wang**Ambient temperature:** 24°C **Relative humidity:** 52% RH **Date:** February 20, 2016

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1279.000	47.58	-7.50	40.08	74.00	-33.92	V	Peak
2557.000	45.62	-2.16	43.46	74.00	-30.54	V	Peak
4186.000	43.29	2.24	45.53	74.00	-28.47	V	Peak
4870.000	42.40	4.56	46.96	74.00	-27.04	V	Peak
6238.000	40.57	6.47	47.04	74.00	-26.96	V	Peak
6931.000	41.40	7.59	48.99	74.00	-25.01	V	Peak
1090.000	51.07	-8.21	42.86	74.00	-31.14	H	Peak
1549.000	50.35	-6.79	43.56	74.00	-30.44	H	Peak
2566.000	45.80	-2.14	43.66	74.00	-30.34	H	Peak
4870.000	42.66	4.56	47.22	74.00	-26.78	H	Peak
6823.000	41.70	7.41	49.11	74.00	-24.89	H	Peak
7750.000	41.58	9.16	50.74	74.00	-23.26	H	Peak

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Test Mode:** TX / IEEE 802.11g (CH High)**Tested by:** Eve Wang**Ambient temperature:** 24°C **Relative humidity:** 52% RH **Date:** February 20, 2016

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1279.000	47.60	-7.50	40.10	74.00	-33.90	V	Peak
2512.000	45.40	-2.24	43.16	74.00	-30.84	V	Peak
4204.000	41.88	2.31	44.19	74.00	-29.81	V	Peak
4924.000	43.00	4.73	47.73	74.00	-26.27	V	Peak
5590.000	41.38	5.91	47.29	74.00	-26.71	V	Peak
6967.000	40.77	7.65	48.42	74.00	-25.58	V	Peak
1090.000	48.91	-8.21	40.70	74.00	-33.30	H	Peak
1765.000	49.57	-6.35	43.22	74.00	-30.78	H	Peak
2575.000	45.33	-2.12	43.21	74.00	-30.79	H	Peak
3889.000	42.84	1.12	43.96	74.00	-30.04	H	Peak
4267.000	42.26	2.53	44.79	74.00	-29.21	H	Peak
4924.000	42.20	4.73	46.93	74.00	-27.07	H	Peak

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Test Mode:** TX / IEEE 802.11n HT20 MHz (CH Low)**Tested by:** Eve Wang**Ambient temperature:** 24°C **Relative humidity:** 52% RH**Date:** February 20, 2016

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1288.000	47.22	-7.47	39.75	74.00	-34.25	V	Peak
2548.000	45.27	-2.17	43.10	74.00	-30.90	V	Peak
4177.000	42.59	2.21	44.80	74.00	-29.20	V	Peak
5032.000	41.75	5.04	46.79	74.00	-27.21	V	Peak
5581.000	41.06	5.90	46.96	74.00	-27.04	V	Peak
6481.000	40.82	6.86	47.68	74.00	-26.32	V	Peak
1090.000	49.28	-8.21	41.07	74.00	-32.93	H	Peak
1549.000	50.13	-6.79	43.34	74.00	-30.66	H	Peak
2512.000	44.93	-2.24	42.69	74.00	-31.31	H	Peak
4816.000	41.99	4.38	46.37	74.00	-27.63	H	Peak
5590.000	41.29	5.91	47.20	74.00	-26.80	H	Peak
6949.000	41.21	7.62	48.83	74.00	-25.17	H	Peak

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Test Mode:** TX / IEEE 802.11n HT20 MHz (CH Mid)**Tested by:** Eve Wang**Ambient temperature:** 24°C **Relative humidity:** 52% RH **Date:** February 20, 2016

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1090.000	49.23	-8.21	41.02	74.00	-32.98	V	Peak
1549.000	49.53	-6.79	42.74	74.00	-31.26	V	Peak
2593.000	45.45	-2.09	43.36	74.00	-30.64	V	Peak
4051.000	42.25	1.77	44.02	74.00	-29.98	V	Peak
4942.000	41.78	4.79	46.57	74.00	-27.43	V	Peak
5491.000	41.67	5.85	47.52	74.00	-26.48	V	Peak
1549.000	50.84	-6.79	44.05	74.00	-29.95	H	Peak
2575.000	45.67	-2.13	43.54	74.00	-30.46	H	Peak
4879.000	42.47	4.59	47.06	74.00	-26.94	H	Peak
5905.000	40.10	6.04	46.14	74.00	-27.86	H	Peak
6535.000	40.93	6.95	47.88	74.00	-26.12	H	Peak
6922.000	40.94	7.57	48.51	74.00	-25.49	H	Peak

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Test Mode:** TX / EEE 802.11n HT20 MHz (CH High)**Tested by:** Eve Wang**Ambient temperature:** 24°C **Relative humidity:** 52% RH **Date:** February 20, 2016

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1135.000	47.84	-8.04	39.80	74.00	-34.20	V	Peak
2548.000	45.24	-2.17	43.07	74.00	-30.93	V	Peak
3223.000	43.96	-0.99	42.97	74.00	-31.03	V	Peak
4177.000	42.48	2.21	44.69	74.00	-29.31	V	Peak
5491.000	41.49	5.85	47.34	74.00	-26.66	V	Peak
6895.000	40.73	7.53	48.26	74.00	-25.74	V	Peak
1090.000	50.06	-8.21	41.85	74.00	-32.15	H	Peak
1549.000	50.46	-6.79	43.67	74.00	-30.33	H	Peak
2530.000	45.18	-2.21	42.97	74.00	-31.03	H	Peak
4276.000	42.88	2.56	45.44	74.00	-28.56	H	Peak
5257.000	40.88	5.44	46.32	74.00	-27.68	H	Peak
6976.000	40.81	7.66	48.47	74.00	-25.53	H	Peak

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



7.3. 6dB BANDWIDTH MEASUREMENT

7.3.1. LIMITS

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz. The minimum 6 dB bandwidth shall be at least 500 kHz.

7.3.2. TEST INSTRUMENTS

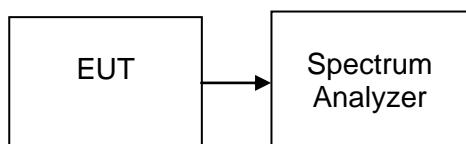
Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	02/28/2015	02/27/2016

7.3.3. TEST PROCEDURES (please refer to measurement standard)

8.1 Option 1:

- 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.

7.3.4. TEST SETUP





7.3.5. TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b

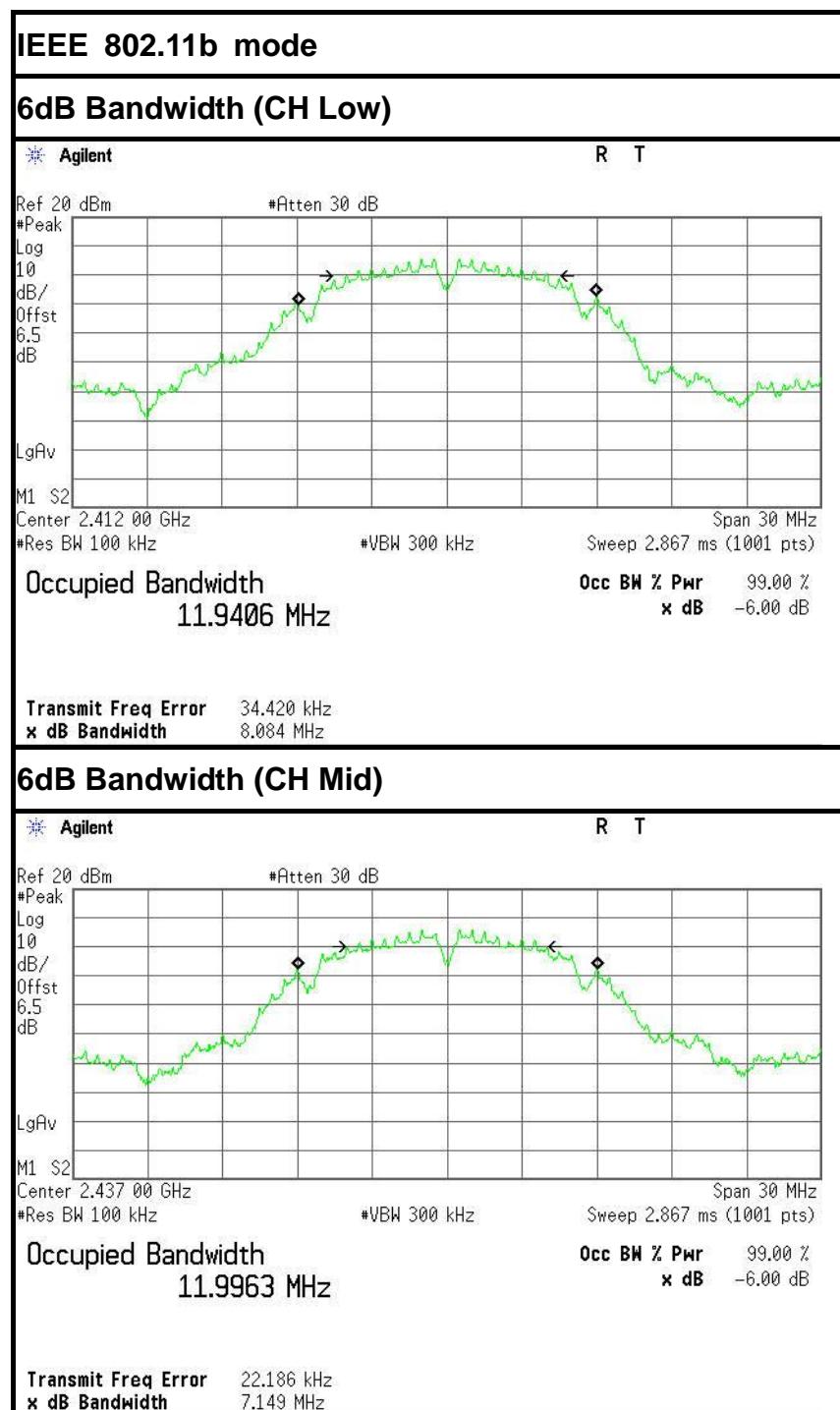
Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2412	8084	>500	PASS
Mid	2437	7149		PASS
High	2462	8075		PASS

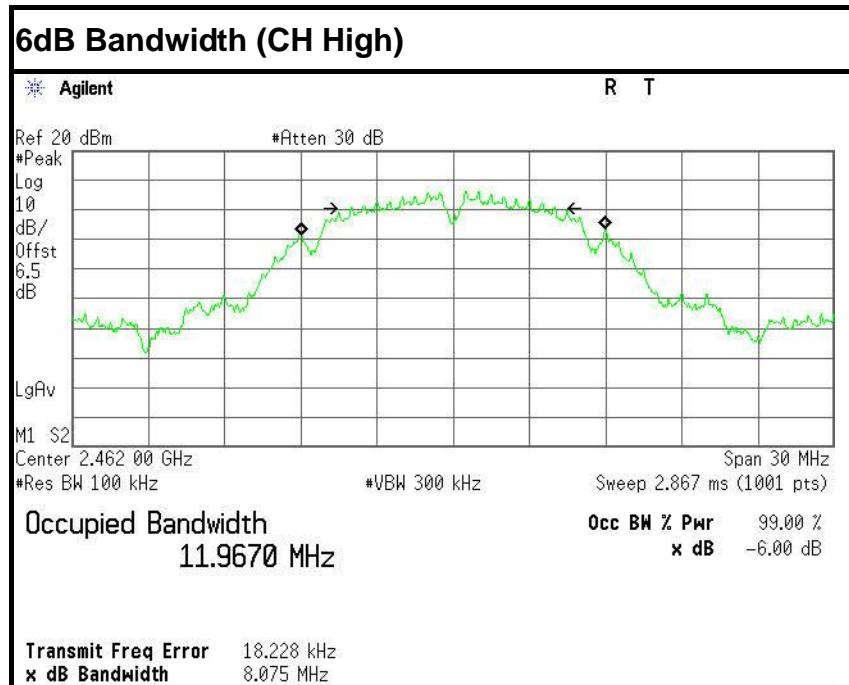
Test mode: IEEE 802.11g

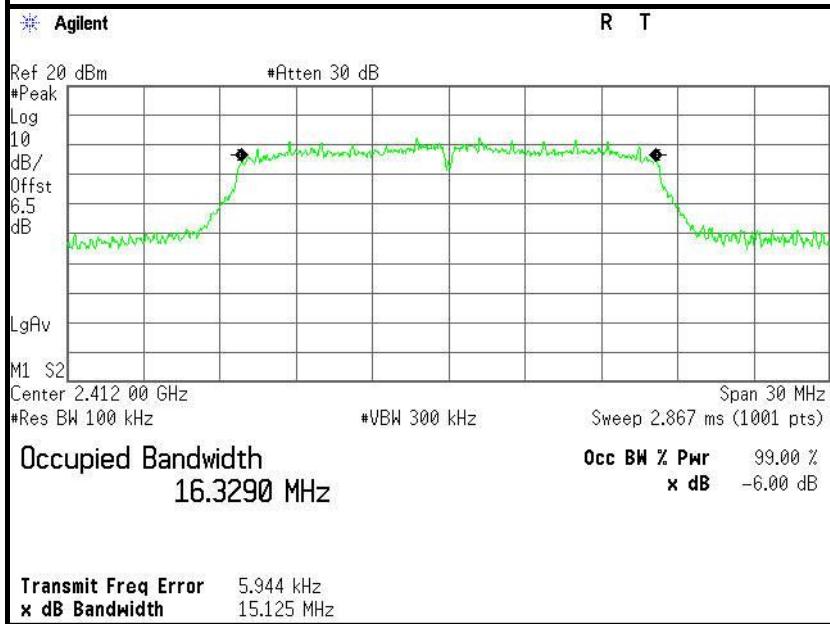
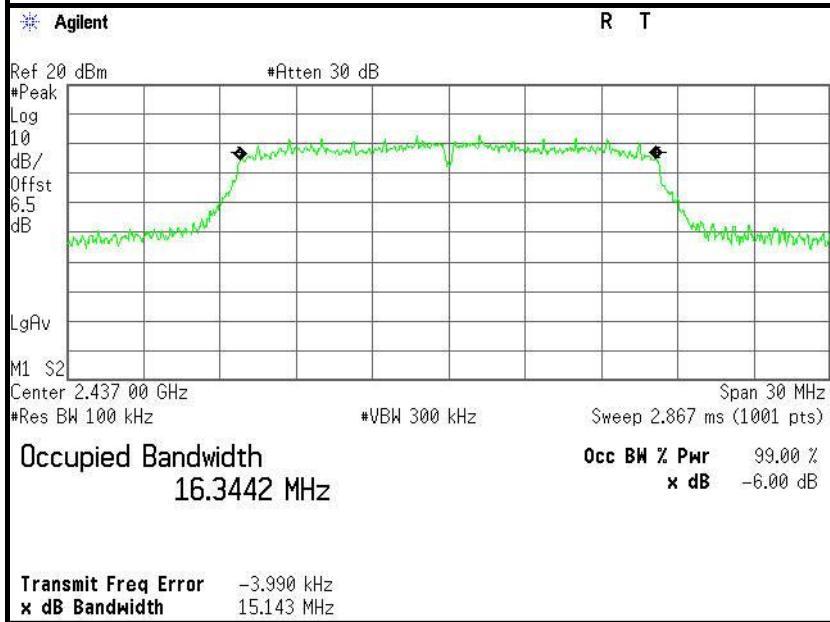
Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2412	15125	>500	PASS
Mid	2437	15143		PASS
High	2462	15105		PASS

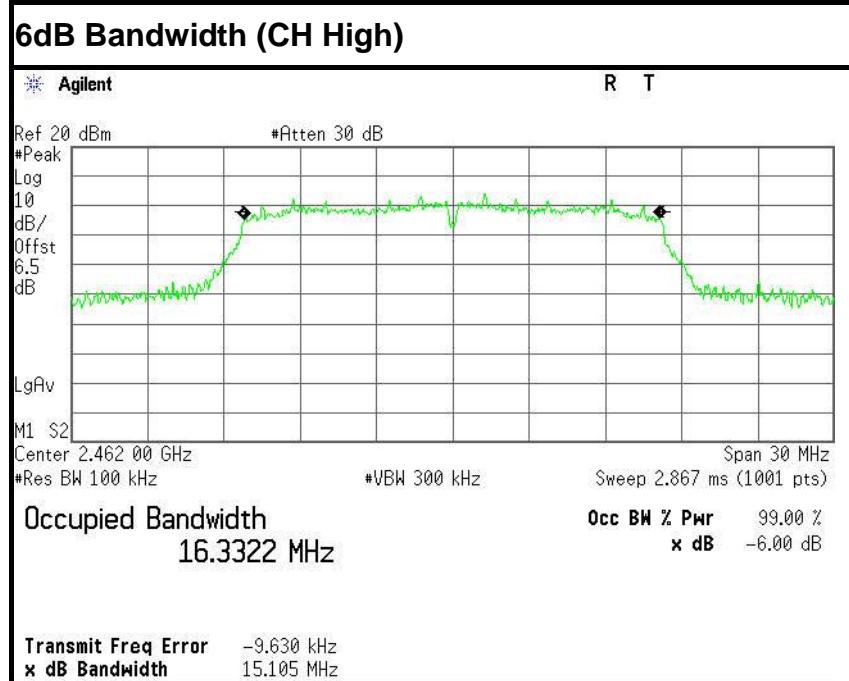
Test mode: IEEE 802.11n HT20 MHz

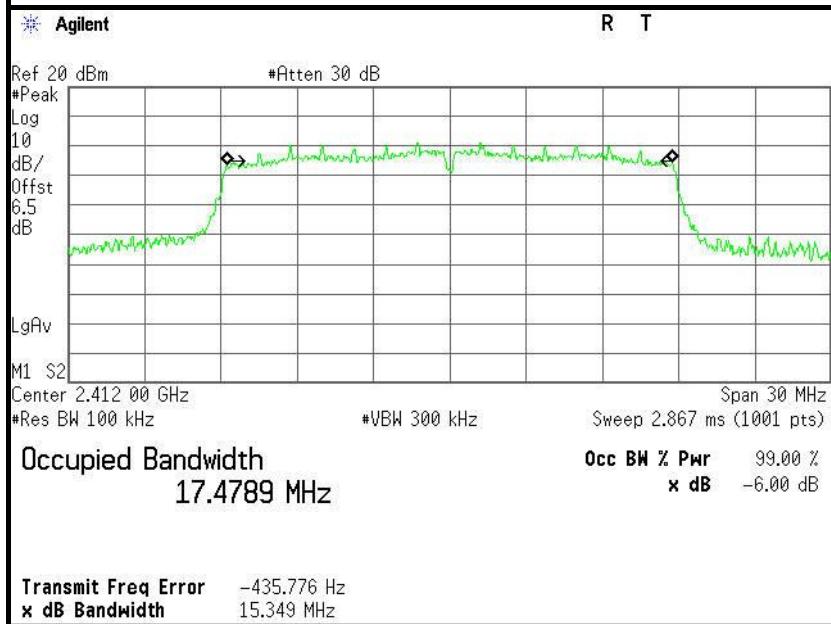
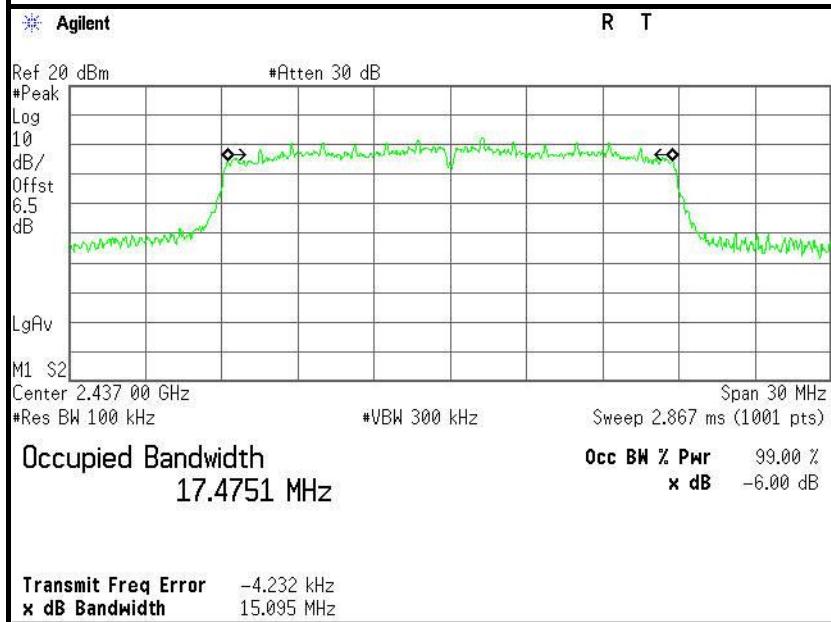
Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2412	15349	>500	PASS
Mid	2437	15095		PASS
High	2462	15126		PASS

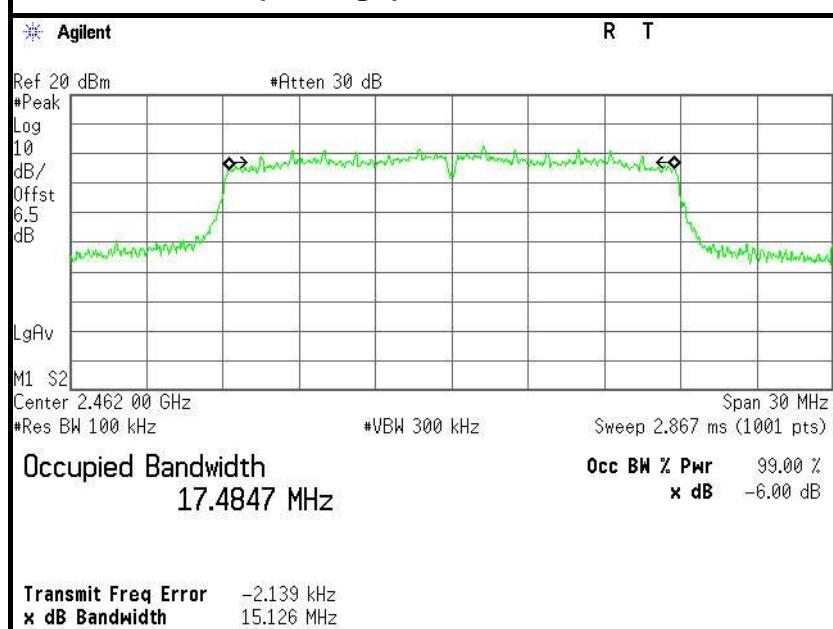
**Test Plot**



**IEEE 802.11g mode****6dB Bandwidth (CH Low)****6dB Bandwidth (CH Mid)**



**IEEE 802.11n HT20 MHz mode****6dB Bandwidth (CH Low)****6dB Bandwidth (CH Mid)**

**6dB Bandwidth (CH High)**



7.4. ANTENNA GAIN

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	3 MHz
Video bandwidth	3 MHz
Trace-Mode	Max hold

LIMITS

FCC	IC
Antenna Gain	
6 dBi	

TEST RESULTS

IEEE 802.11b mode

T _{nom}	V _{nom}	Lowest channel 2412MHz	Middle channel 2437MHz	Highest channel 2462MHz
Conducted power [dBm/MHz] Measured with DSSS modulation		5.43	5.71	6.22
Radiated power [dBm/MHz] Measured with DSSS modulation		4.03	5.76	7.48
Gain [dBi] Calculated		-1.40	-0.05	1.26
Measurement uncertainty	± 1.5 dB (cond.) / ± 3 dB (rad.)			



7.5. PEAK OUTPUT POWER

7.5.1. LIMITS

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.5.2. TEST INSTRUMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Power Meter	Anritsu	ML2495A	1204003	02/28/2015	02/27/2016
Power Sensor	Anritsu	MA2411B	1126150	02/28/2015	02/27/2016

7.5.3. TEST PROCEDURES (please refer to measurement standard)

9.1.1 RBW \geq DTS bandwidth

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the *DTS bandwidth*.

- a) Set the RBW \geq DTS bandwidth.
- b) Set VBW \geq 3 RBW.
- c) Set span \geq 3 x RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.



9.1.2 Integrated band power method

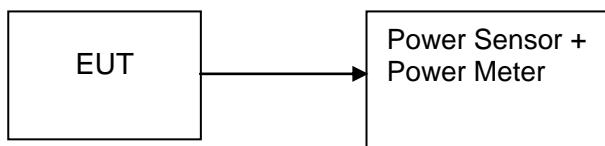
This procedure may be used when the maximum available RBW of the measurement instrument is less than the *DTS bandwidth*.

- a) Set the RBW = 1 MHz.
- b) Set the VBW \geq 3 RBW
- c) Set the span \geq 1.5 x DTS bandwidth.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

9.1.3 PKPM1 Peak power meter method

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.

7.5.4. TEST SETUP





7.5.5. TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Peak / AVG	Result
Low	2412	16.20	0.04169	1	Peak	PASS
Mid	2437	16.50	0.04467			PASS
High	2462	17.00	0.05012			PASS
Low	2412	13.30	0.02138	1	AVG	PASS
Mid	2437	13.60	0.02291			PASS
High	2462	14.10	0.02570			PASS

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Peak / AVG	Result
Low	2412	20.90	0.12303	1	Peak	PASS
Mid	2437	21.40	0.13804			PASS
High	2462	21.50	0.14125			PASS
Low	2412	13.40	0.02188	1	AVG	PASS
Mid	2437	13.60	0.02291			PASS
High	2462	13.90	0.02455			PASS

Test mode: IEEE 802.11n HT20 MHz

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Peak / AVG	Result
Low	2412	20.70	0.11749	1	Peak	PASS
Mid	2437	20.90	0.12303			PASS
High	2462	21.10	0.12882			PASS
Low	2412	12.30	0.01698	1	AVG	PASS
Mid	2437	12.50	0.01778			PASS
High	2462	13.00	0.01995			PASS



7.6. BAND EDGES MEASUREMENT

7.6.1. LIMITS

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

7.6.2. TEST INSTRUMENTS

Radiated Emission Test Site 966(2)					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
EMI TEST RECEIVER	Agilent	N9038A	US44300399	02/28/2015	02/27/2016
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	02/28/2015	02/27/2016
Amplifier	MITEQ	AM-1604-3000	1123808	03/18/2015	03/18/2016
High Noise Amplifier	Agilent	8449B	3008A01838	02/28/2015	02/27/2016
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170-497	02/28/2015	02/27/2016
Bilog Antenna	SCHAFFNER	CBL6143	5082	02/28/2015	02/27/2016
Horn Antenna	SCHWARZBECK	BBHA9120	D286	02/28/2015	02/27/2016
Loop Antenna	COM-POWER	AL-130	121044	09/25/2015	09/24/2016
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R
Controller	Sunol Sciences	SC104V	022310-1	N.C.R	N.C.R
Controller	CT	N/A	N/A	N.C.R	N.C.R
Temp. / Humidity Meter	Anymetre	JR913	N/A	02/28/2015	02/27/2016
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R
Test S/W	FARAD		LZ-RF / CCS-SZ-3A2		

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

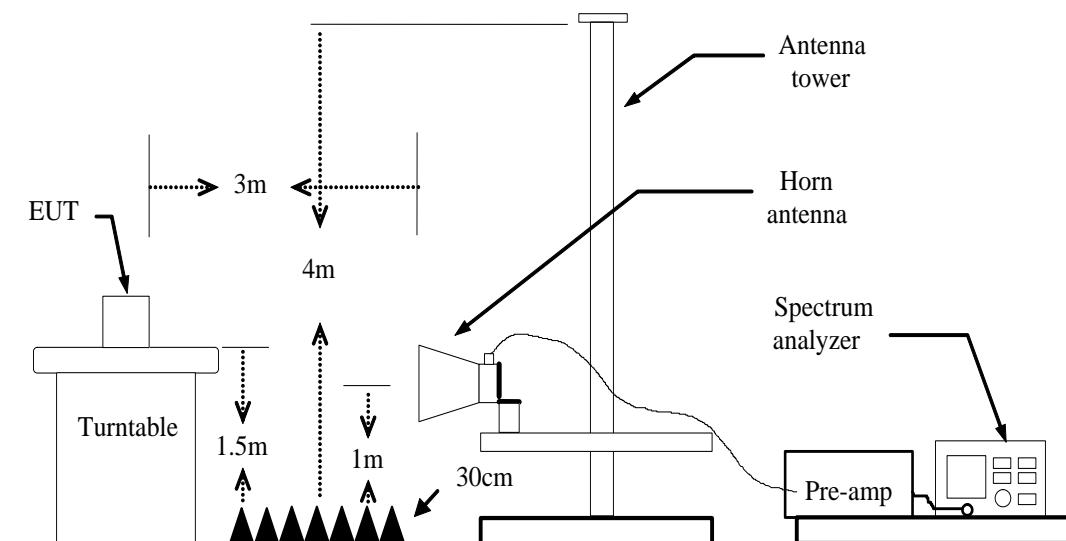
2. The FCC Site Registration number is 101879.

3. N.C.R = No Calibration Required.

7.6.3. TEST PROCEDURES (please refer to measurement standard)

1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO / Detector=Peak
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

7.6.4. TEST SETUP



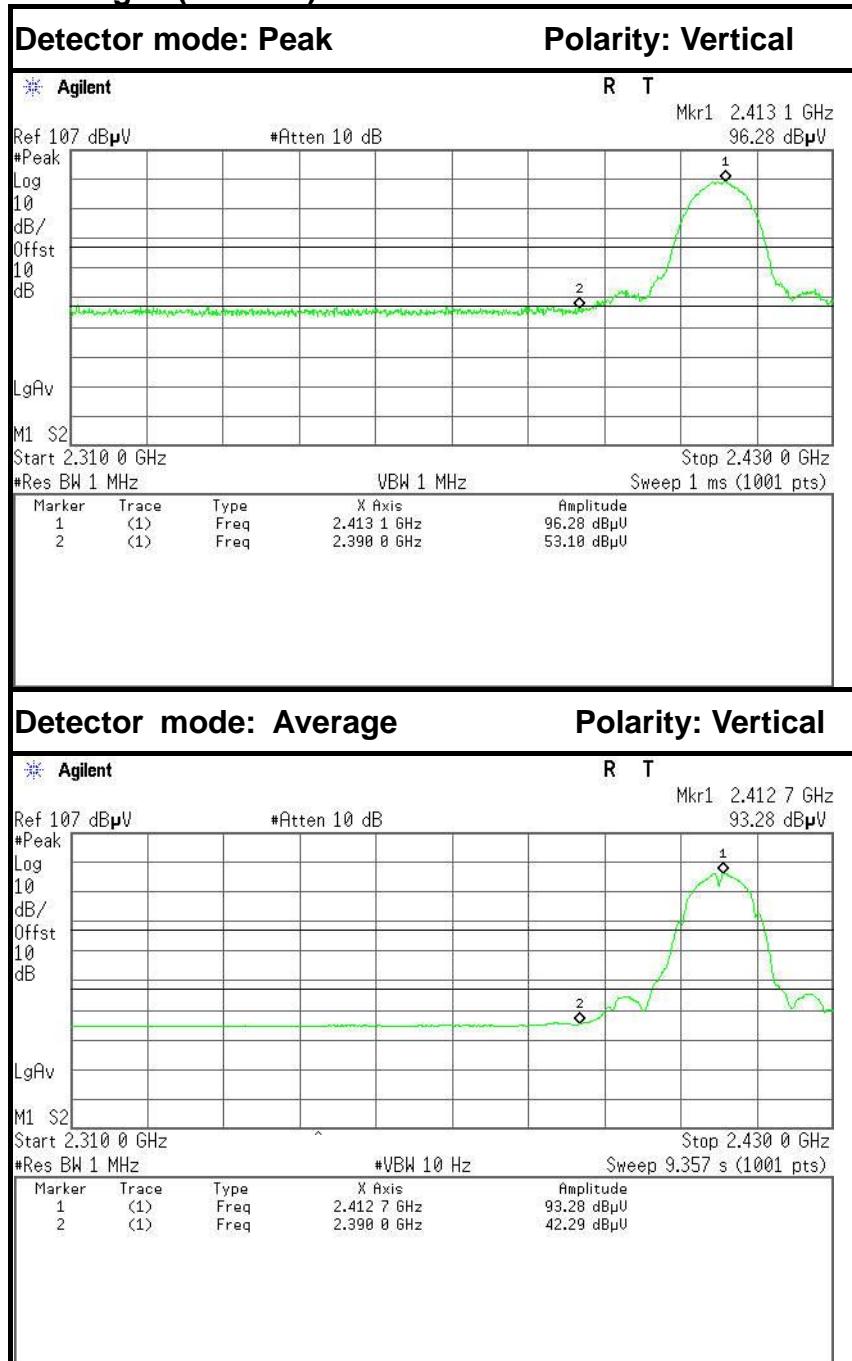


7.6.5. TEST RESULTS

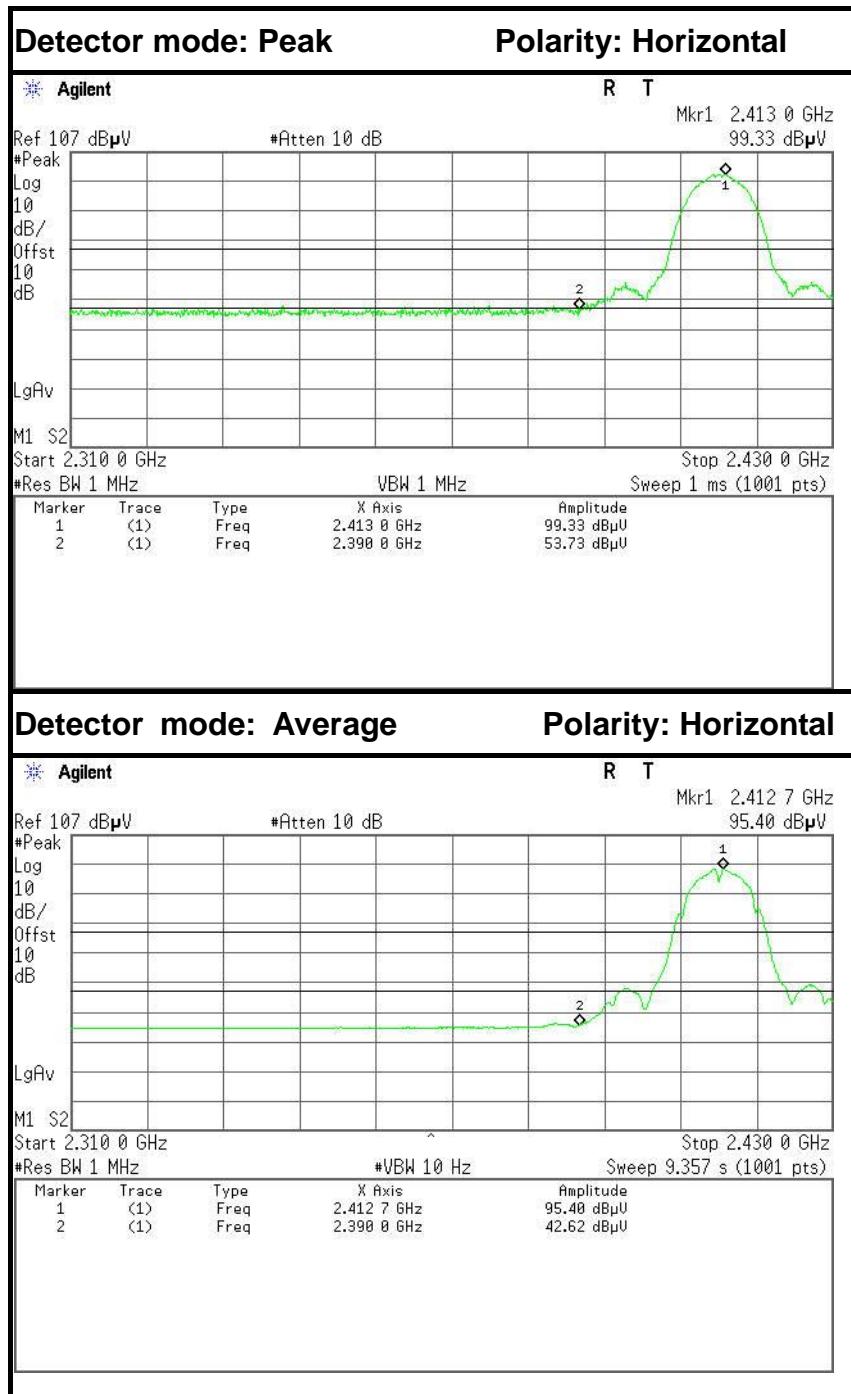
Test Plot

IEEE 802.11b mode

Band Edges (CH Low)



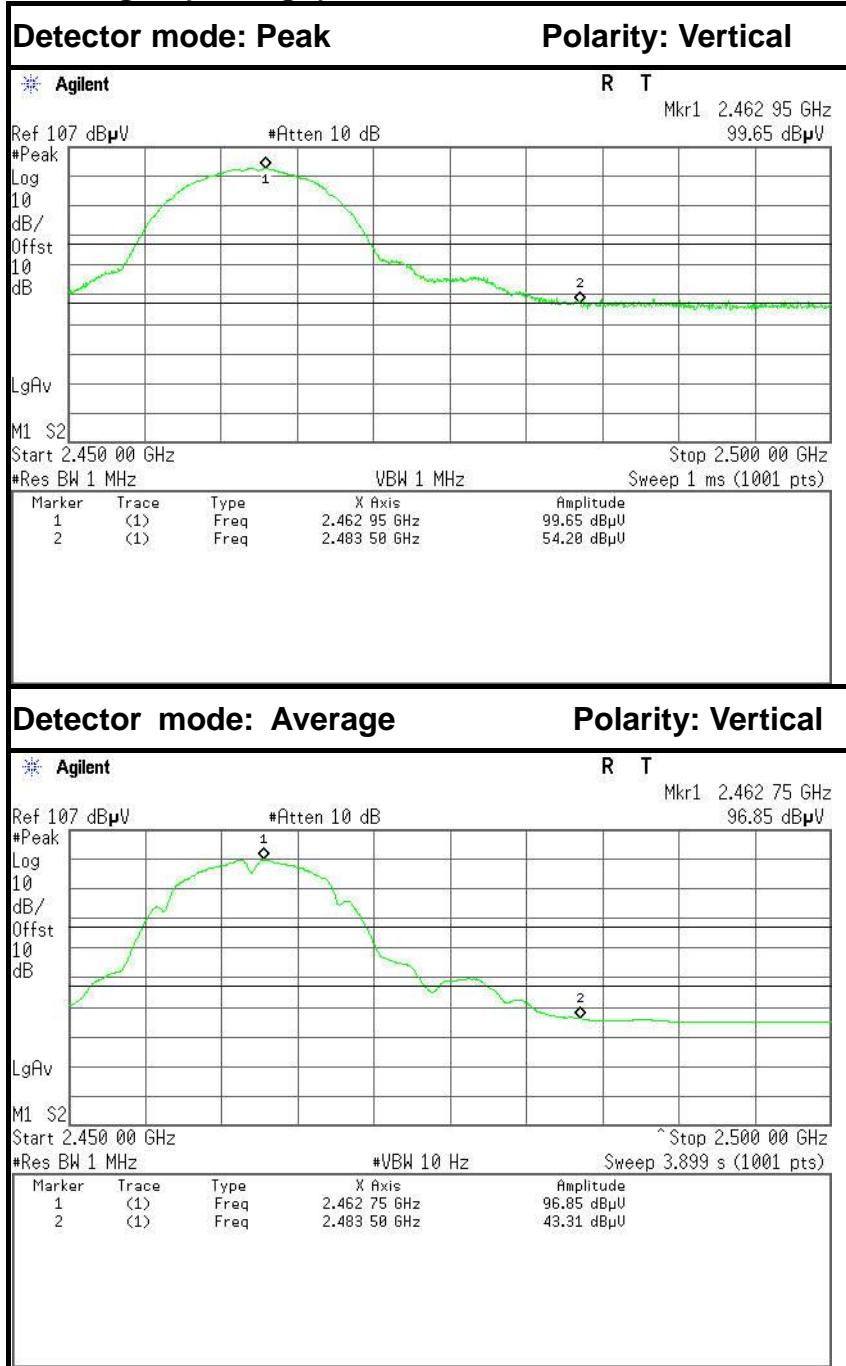
No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	46.50	-6.60	53.10	74.00	-20.90	Peak	Vertical
2	2390.0000	35.69	-6.60	42.29	54.00	-11.71	Average	Vertical



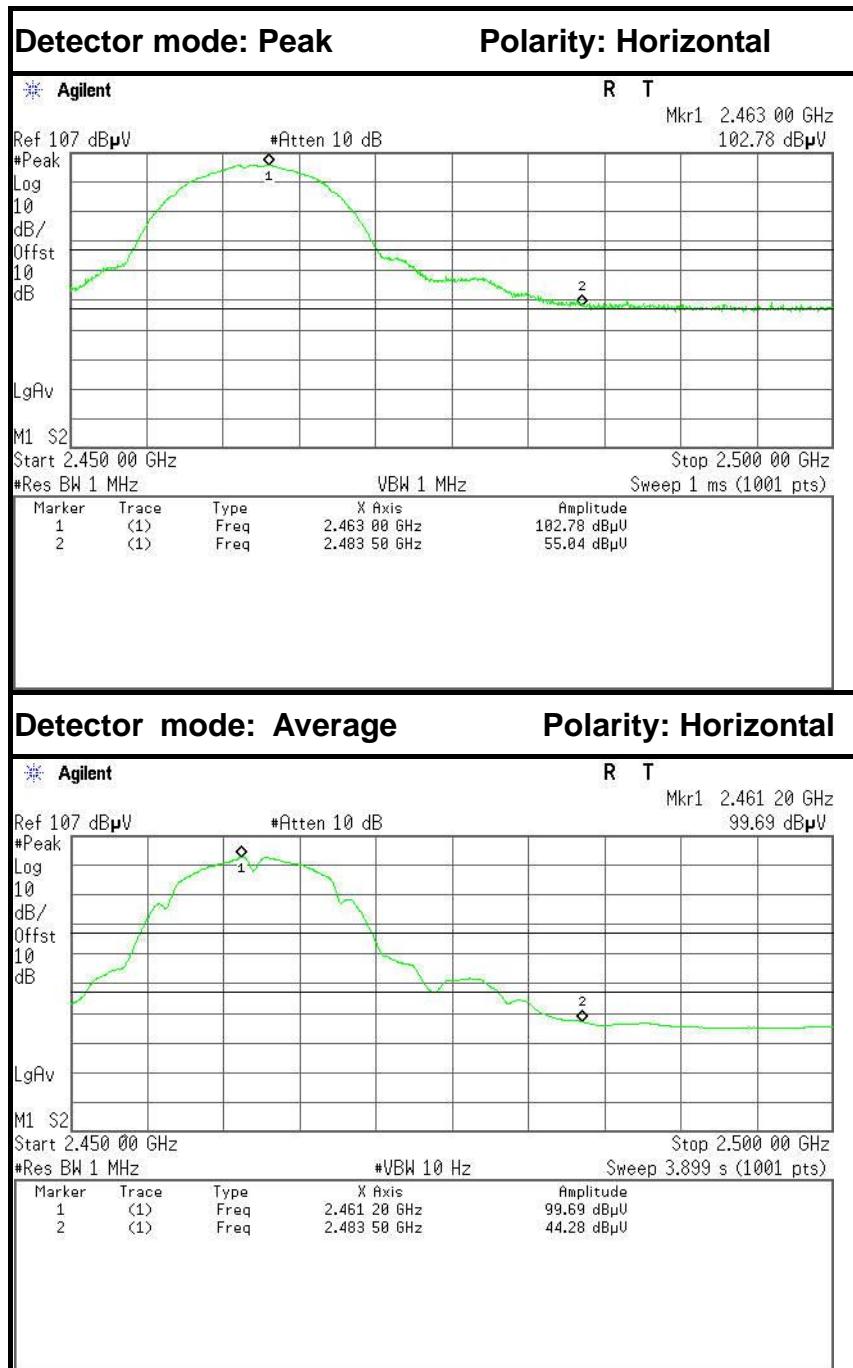
No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	47.13	-6.60	53.73	74.00	-20.27	Peak	Horizontal
2	2390.0000	36.02	-6.60	42.62	54.00	-11.38	Average	Horizontal



Band Edges (CH High)



No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	47.96	-6.24	54.20	74.00	-19.80	Peak	Vertical
2	2483.5000	37.07	-6.24	43.31	54.00	-10.69	Average	Vertical

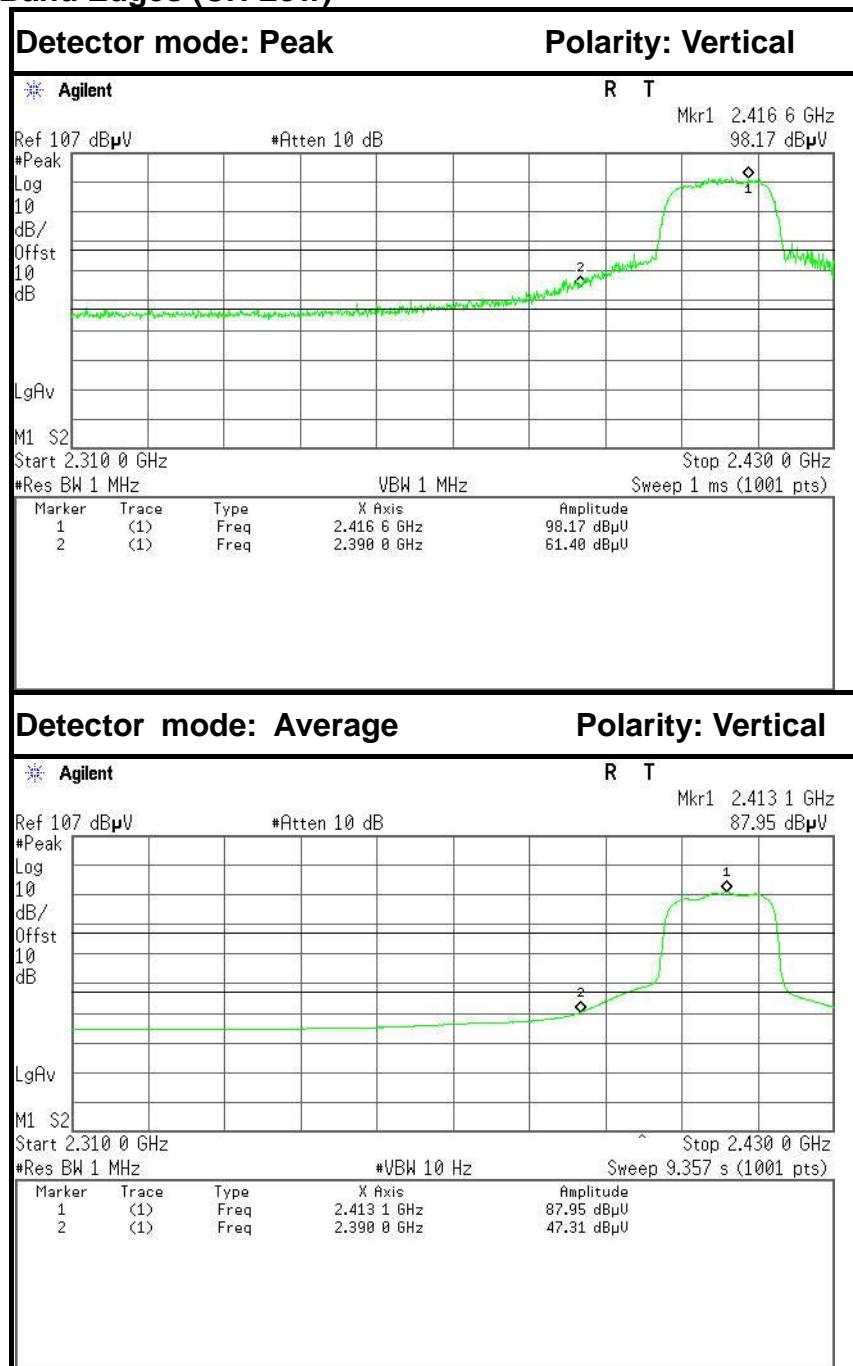


No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	48.80	-6.24	55.04	74.00	-18.96	Peak	Horizontal
2	2483.5000	38.04	-6.24	44.28	54.00	-9.72	Average	Horizontal

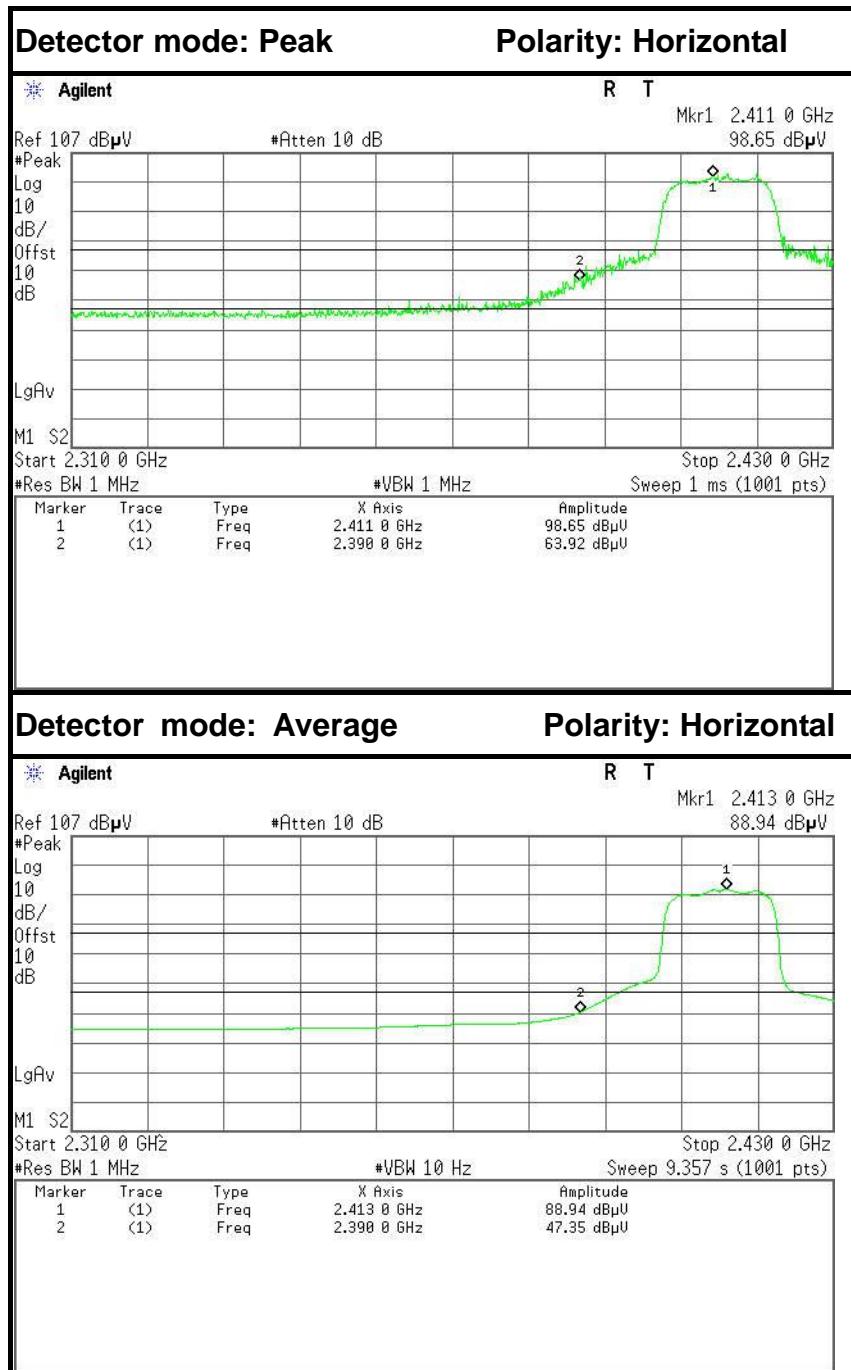


IEEE 802.11g mode

Band Edges (CH Low)



No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	54.80	-6.60	61.40	74.00	-12.60	Peak	Vertical
2	2390.0000	40.71	-6.60	47.31	54.00	-6.69	Average	Vertical



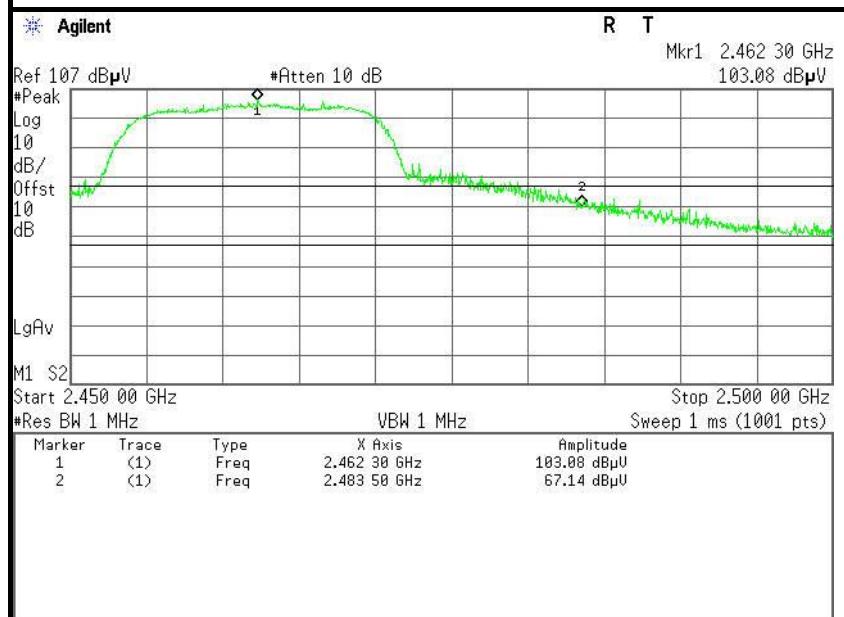
No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	57.32	-6.60	63.92	74.00	-10.08	Peak	Horizontal
2	2390.0000	40.75	-6.60	47.35	54.00	-6.65	Average	Horizontal



Band Edges (CH High)

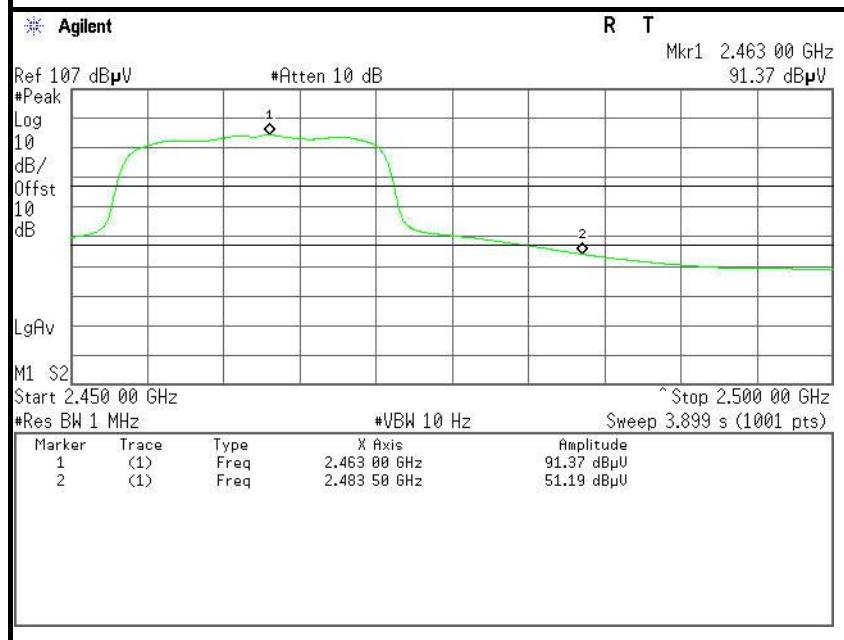
Detector mode: Peak

Polarity: Vertical

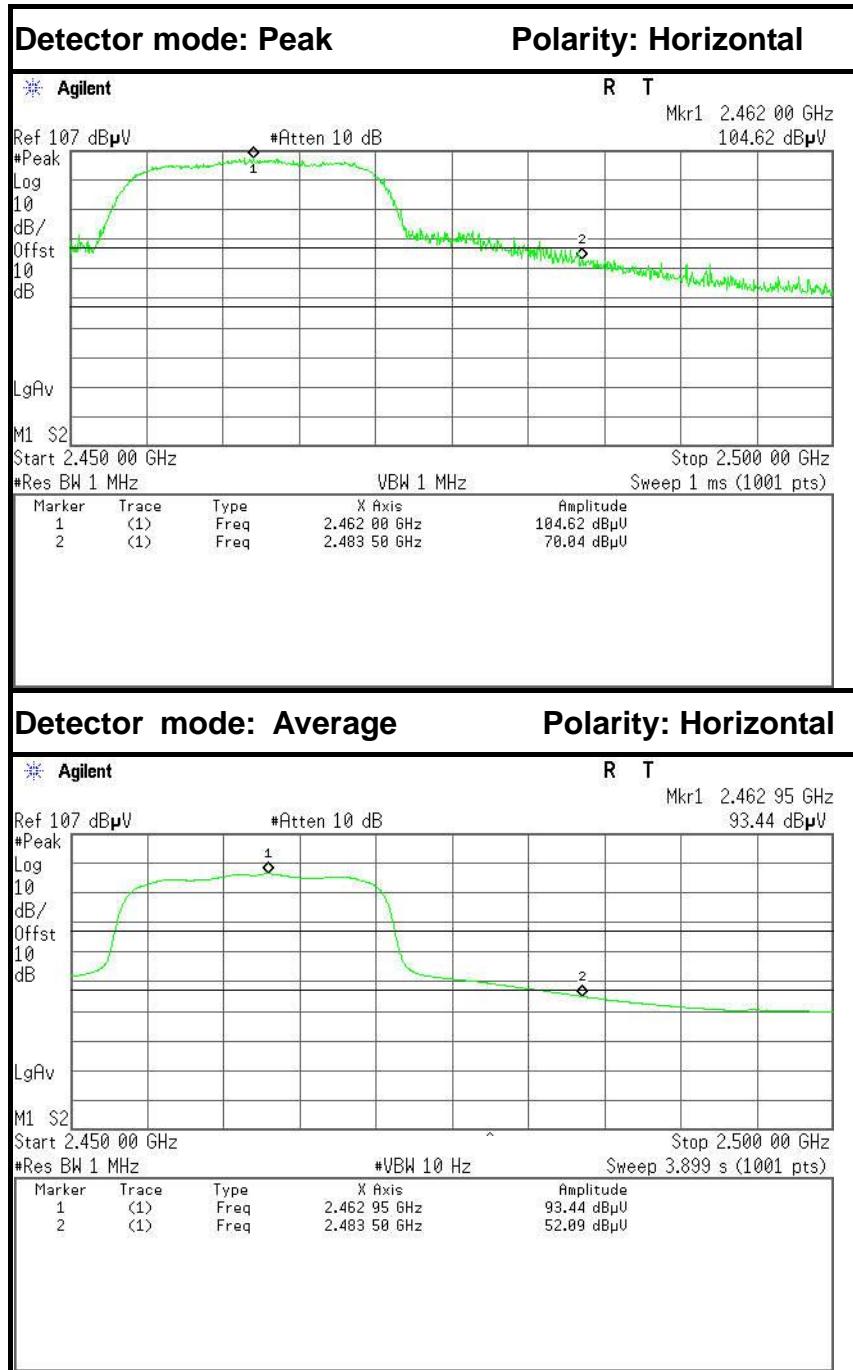


Detector mode: Average

Polarity: Vertical



No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	60.90	-6.24	67.14	74.00	-6.86	Peak	Vertical
2	2483.5000	44.95	-6.24	51.19	54.00	-2.81	Average	Vertical

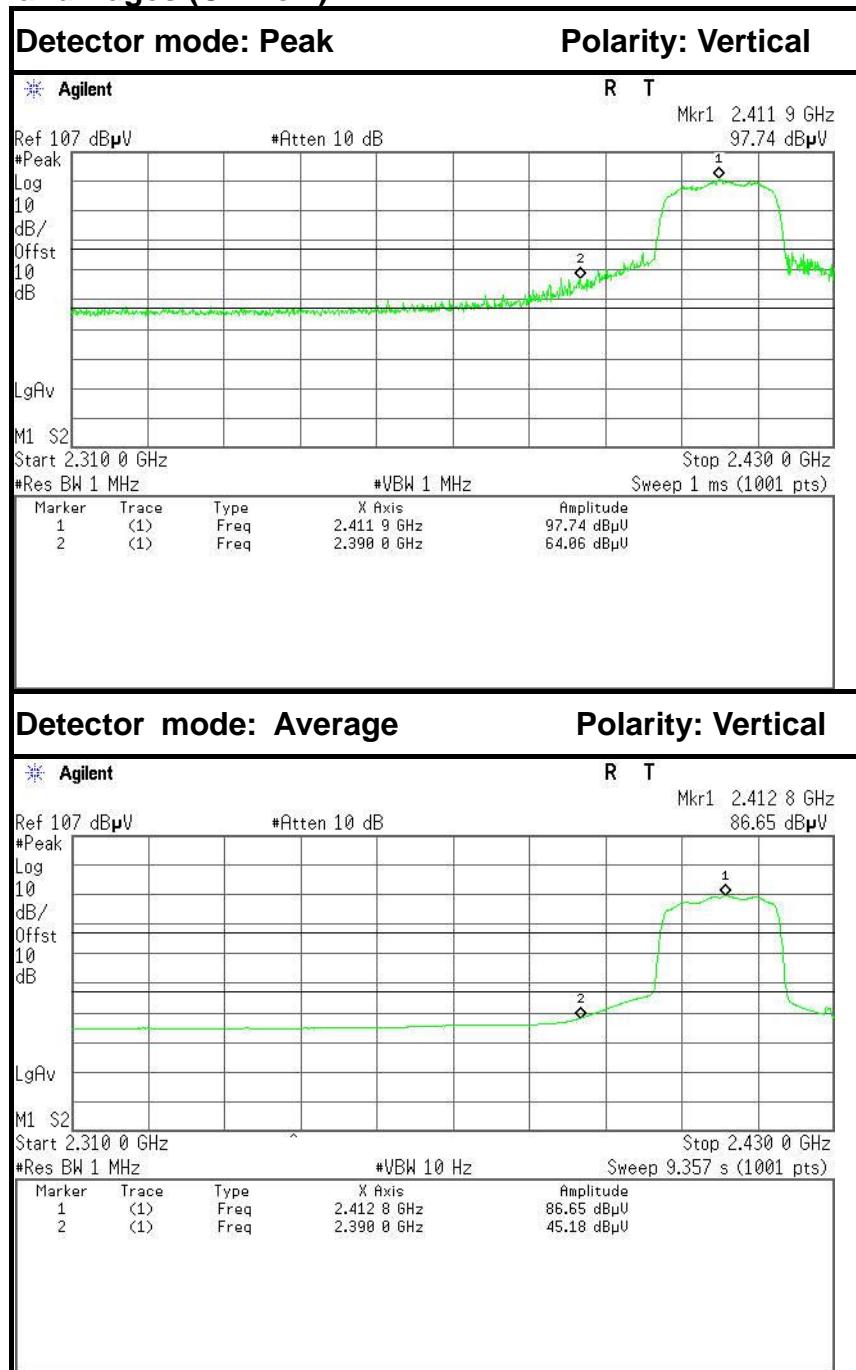


No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	63.80	-6.24	70.04	74.00	-3.96	Peak	Horizontal
2	2483.5000	45.85	-6.24	52.09	54.00	-1.91	Average	Horizontal

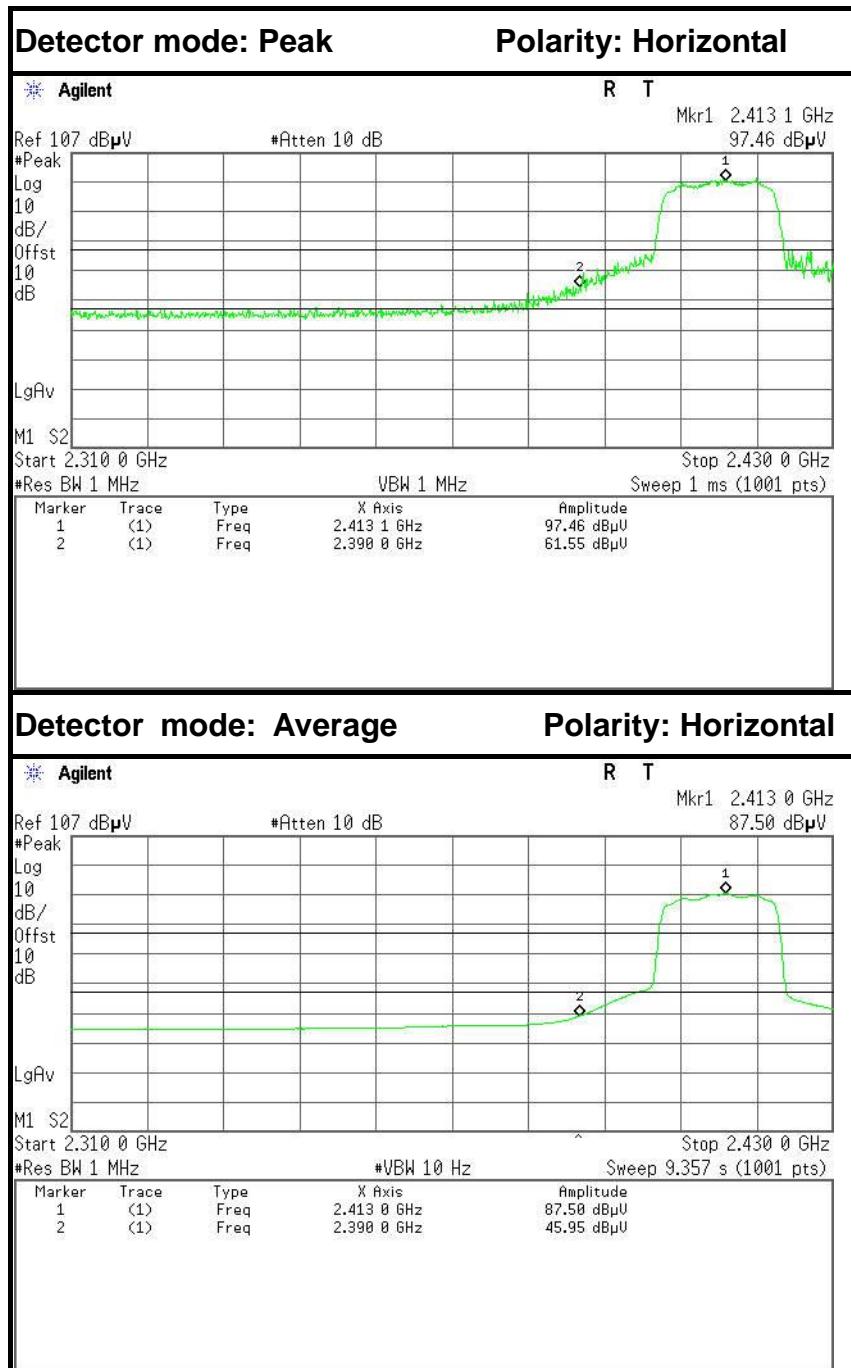


IEEE 802.11n HT20 MHz mode

Band Edges (CH Low)



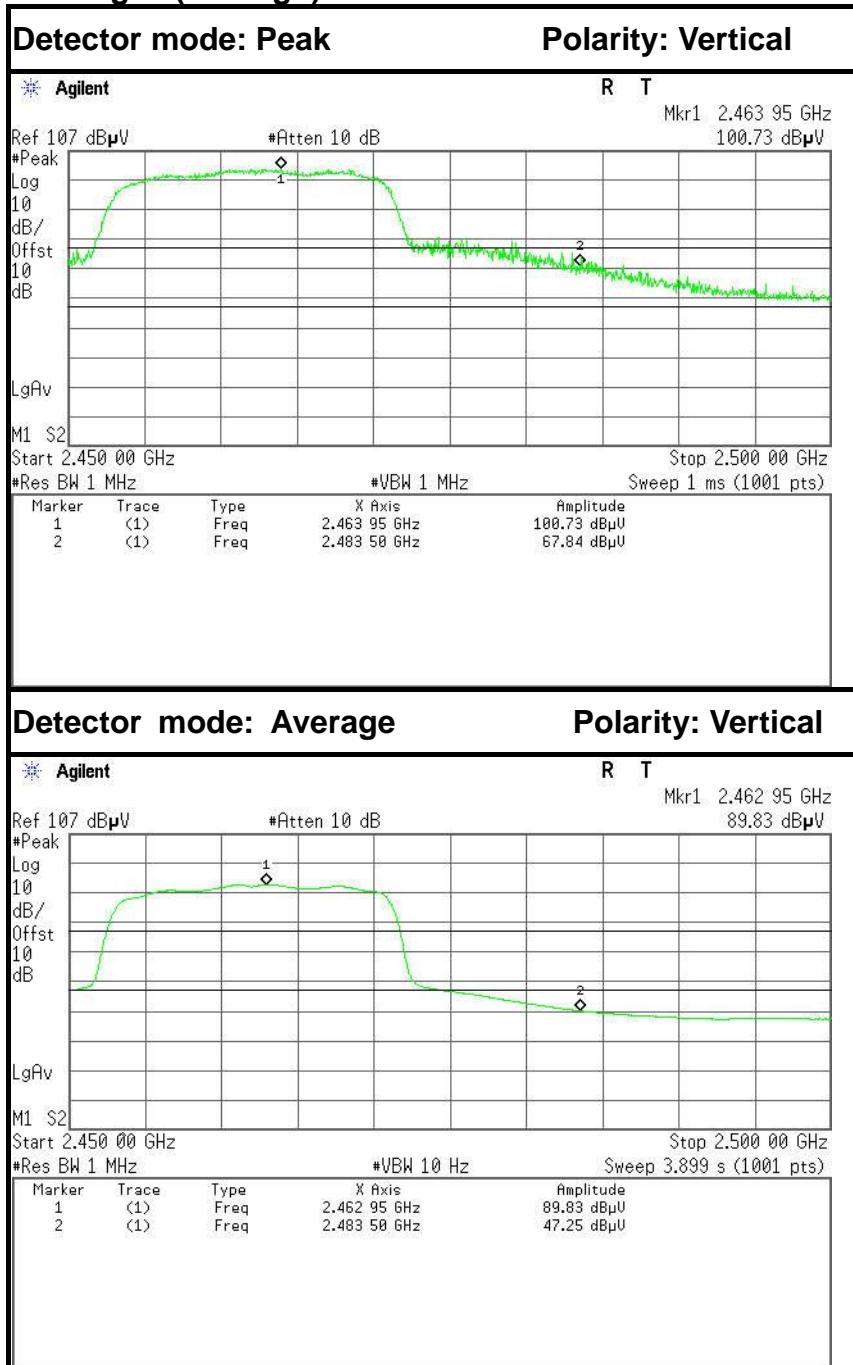
No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	57.46	-6.60	64.06	74.00	-9.94	Peak	Vertical
2	2390.0000	38.58	-6.60	45.18	54.00	-8.82	Average	Vertical



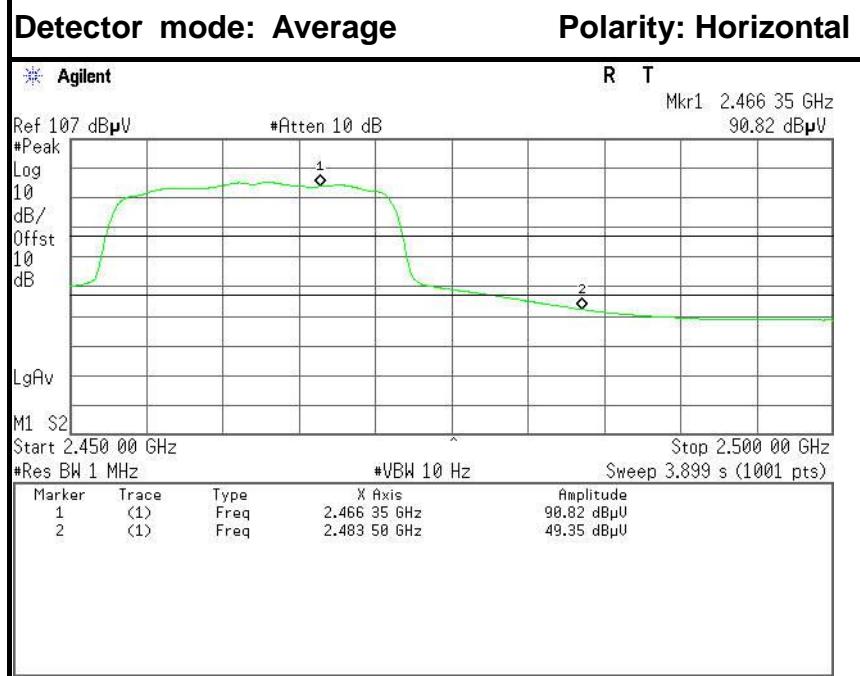
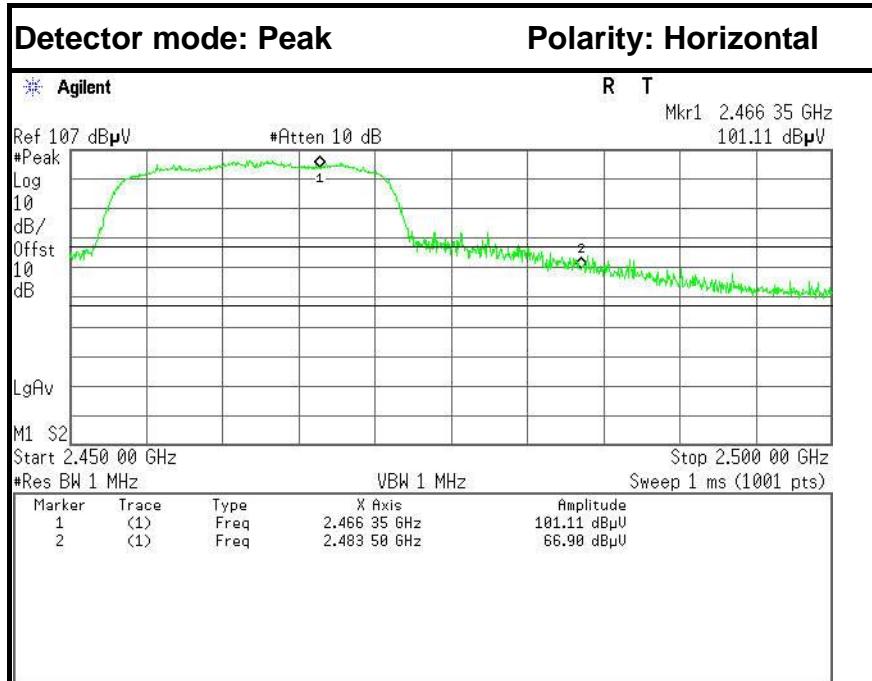
No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	54.95	-6.60	61.55	74.00	-12.45	Peak	Horizontal
2	2390.0000	39.35	-6.60	45.95	54.00	-8.05	Average	Horizontal



Band Edges (CH High)



No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	61.60	-6.24	67.84	74.00	-6.16	Peak	Vertical
2	2483.5000	41.01	-6.24	47.25	54.00	-6.75	Average	Vertical



No.	Frequency (MHz)	Reading (dB μ V)	Corrected (dB)	Result (dB μ V)	Limit (dB μ V)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	60.66	-6.24	66.90	74.00	-7.10	Peak	Horizontal
2	2483.5000	43.11	-6.24	49.35	54.00	-4.65	Average	Horizontal



7.7. PEAK POWER SPECTRAL DENSITY MEASUREMENT

7.7.1. LIMITS

According to §15.247(e), 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.

According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

7.7.2. TEST INSTRUMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	02/28/2015	02/27/2016

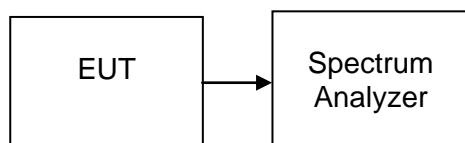
7.7.3. TEST PROCEDURES (please refer to measurement standard)

§15.247(e) specifies a conducted power spectral density (PSD) limit of 8 dBm in any 3 kHz band segment within the fundamental EBW during any time interval of continuous transmission. The same method as used to determine the conducted output power shall be used to determine the power spectral density (i.e., if peak-detected fundamental power was measured then use the peak PSD procedure and if average fundamental power was measured then use the average PSD procedure).

10.2 Method PKPSD (peak PSD)

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: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
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.

7.7.4. TEST SETUP





7.7.5. TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b

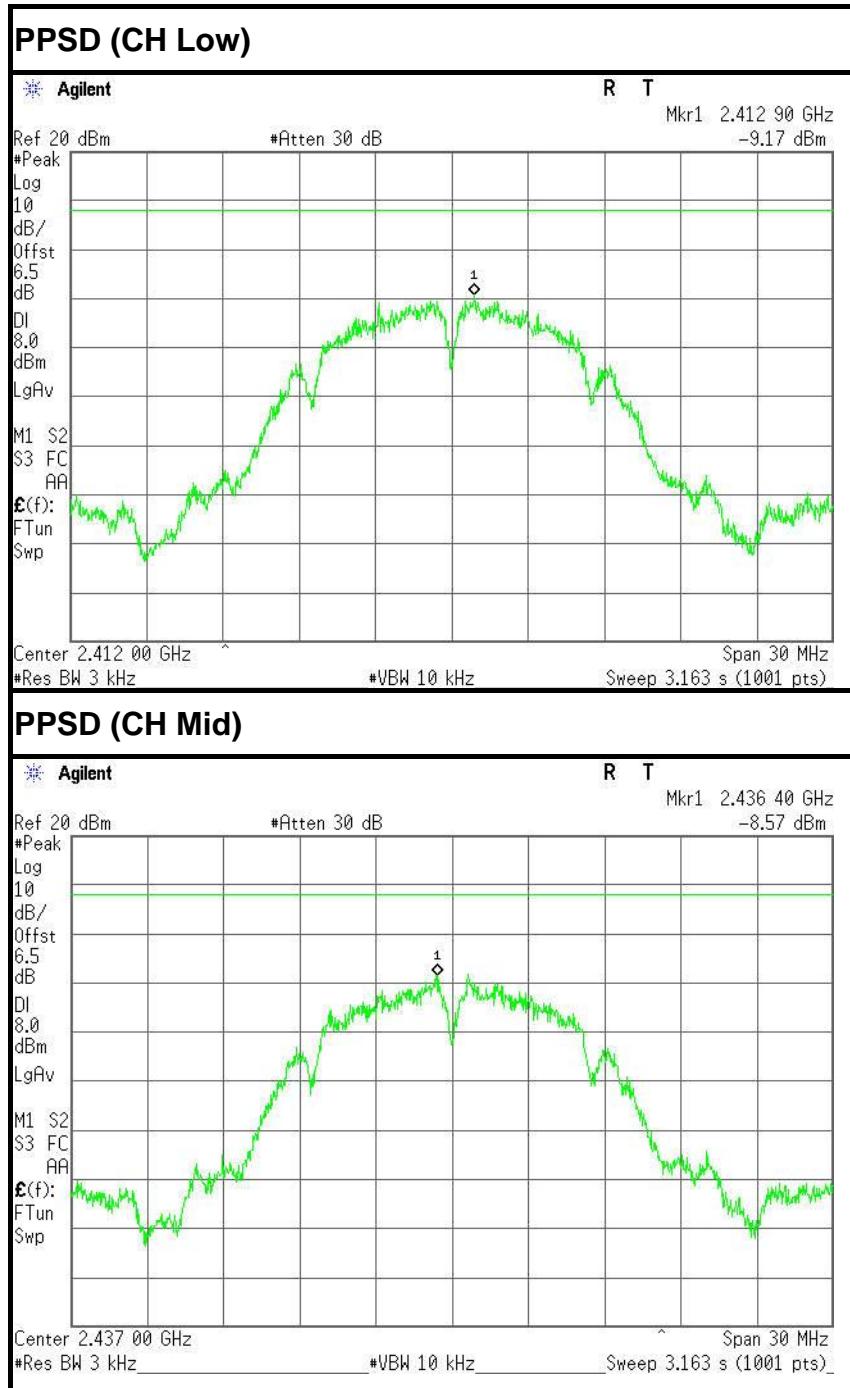
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-9.17	8	PASS
Mid	2437	-8.57		PASS
High	2462	-7.97		PASS

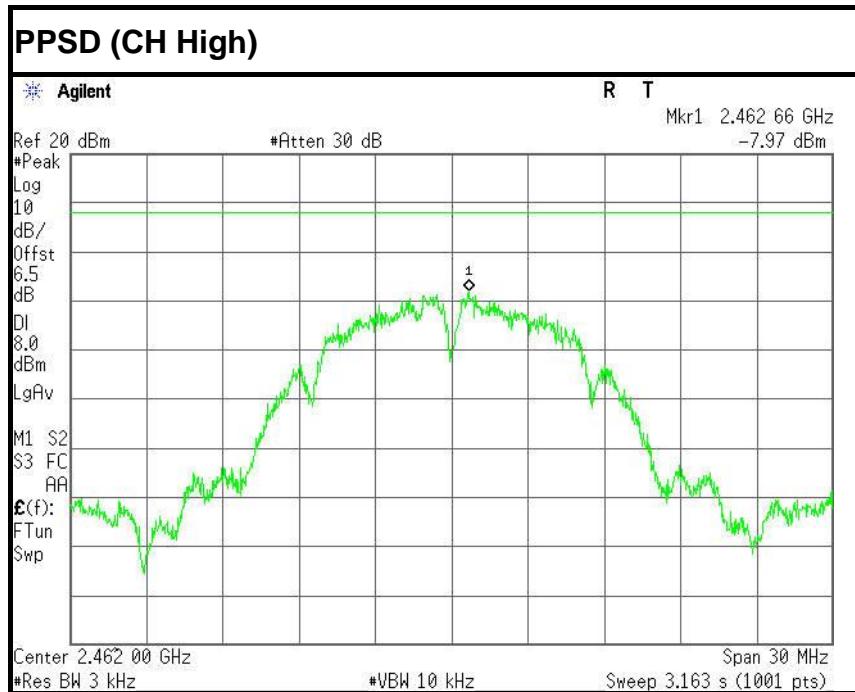
Test mode: IEEE 802.11g

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-12.31	8	PASS
Mid	2437	-11.69		PASS
High	2462	-10.98		PASS

Test mode: IEEE 802.11n HT20 MHz

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-13.70	8	PASS
Mid	2437	-11.62		PASS
High	2462	-10.85		PASS

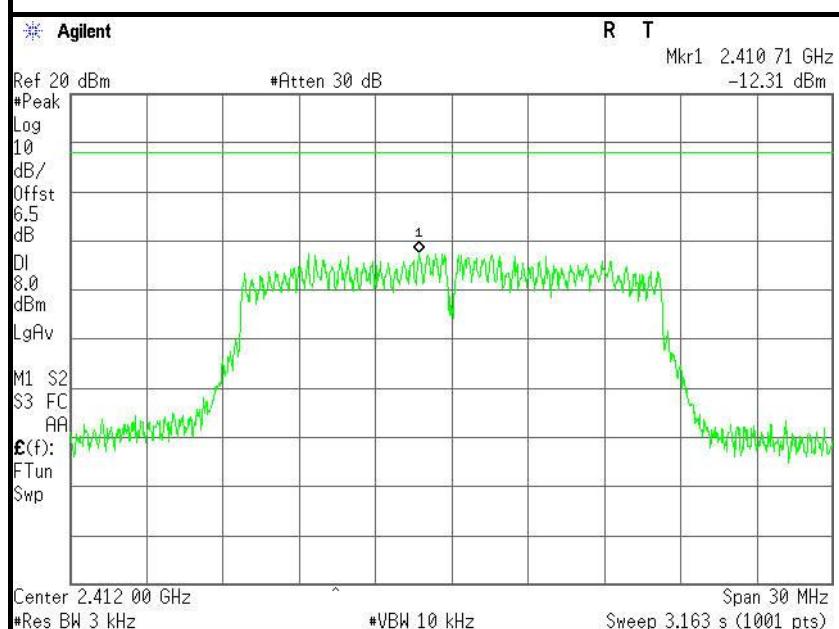
**Test Plot****IEEE 802.11b mode**



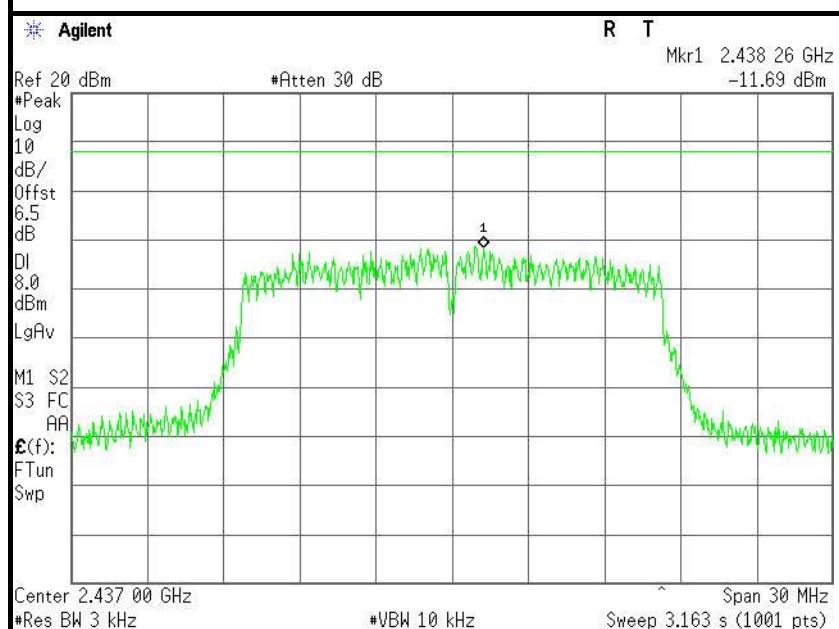


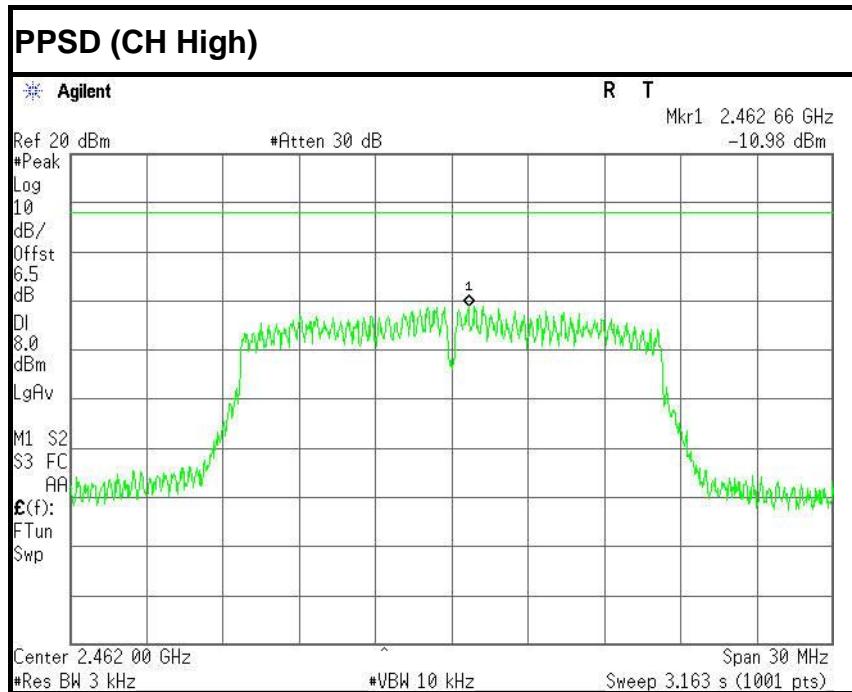
IEEE 802.11g mode

PPSD (CH Low)



PPSD (CH Mid)

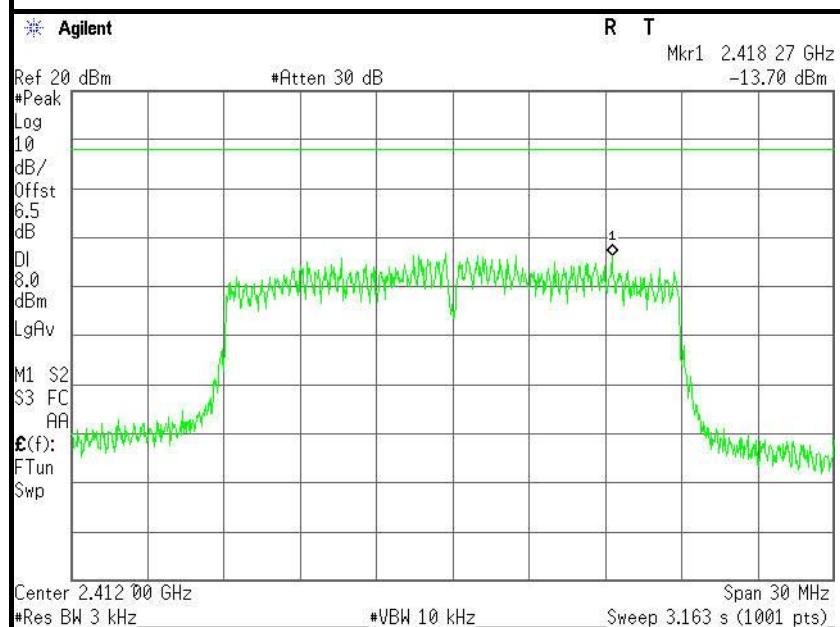






IEEE 802.11n HT20 MHz mode

PPSD (CH Low)



PPSD (CH Mid)

