



FCC PART 15 SUBPART C

TEST AND MEASUREMENT REPORT

For

Actiontec Electronics, Inc.

760 N. Mary Ave.,
Sunnyvale, CA 94085, USA

FCC ID: LNQC2000A

Report Type: Original Report	Product Type: 802.11 b/g/n Wireless Router
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1208029-247	Original Report	2012-08-29

Based on the declaration of similarity (Appendix I), the following models are similar to the tested model:

Models Covered by the Declaration of Similarity
FV2200

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Actiontec Electronics, Inc.*, and their product FCC ID: LNQC2000A, model: *C2000A 802.11n Router* or the “EUT” as referred on this report is an 802.11 b/g/n wireless router with 20 MHz bandwidth only.

1.2 Mechanical Description of EUT

The “EUT” measures approximately *22.5cm (L) x 14.5cm (W) x 4cm (H)*, and weighs approximately *398g*.

The test data gathered are from typical production sample, serial number: CVQA2241100097 provided by the manufacturer.

1.3 Objective

This report is prepared on behalf of *Actiontec Electronics, Inc.* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15.247 rules for Output Power, Antenna Requirements, 6 dB Bandwidth, and power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emissions, Conducted and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

No Related Submittals.

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2: 2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from ± 2.0 dB for Conducted Emissions tests and ± 4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BAACL Corp.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22: 2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24: 2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: R-3729, C-4176, G-469, and T-1206. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

<http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b>

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2009.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

The EUT had been tested with the following data rate settings (worst case):

Radio Mode	Bandwidth (MHz)	Frequency/Data Rate		
		Low CH (MHz/Mbps)	Mid CH (MHz/Mbps)	High CH (MHz)
802.11b	20	2412/1	2437/1	2462/1
802.11g	20	2412/6	2437/6	2462/6
802.11n	20	2412/MCS0	2437/MCS0	2462/MCS0

2.2 EUT Exercise Software

The test utility used was DOS Window. The code was provided by Actiontec and was verified by Jeffrey Wu to comply with the standard requirements being tested against.

2.3 Special Equipment

There were no special accessories required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
DELL	Laptop	Latitude D600	7T390 A02
Lenovo	Laptop	G560	CB08585694

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
Actiontec	Main PCB	C2000A	CVQA2241100097
Actiontec	Support PCB	06771A	GB00011A000EC1203 80612300056

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
RF Cable	1	EUT	PSA
Ethernet Cable	>1	EUT	Laptop

2.8 External I/O Cabling List and AC Cord

Cable Description	Length (m)	From	To
AC/DC Adapter	>1	EUT	AC

2.9 Power Supply List and Details

Manufacturer	Description	Model	Serial Number
Actiontec	Power Adapter	STD-12018U1	K2434234

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§15.247(i), §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.247(d), §2.1051	Spurious Emissions at Antenna Port	Compliant
FCC §15.205	Restricted Bands	Compliant
§15.209, §15.247(d)	Radiated Spurious Emissions	Compliant
§15.247(a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Peak Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

4 FCC §15.247 (i) & §2.1091 – RF Exposure

4.1 Applicable Standard

According to FCC §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* (180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

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

Where: S = power density

P = power input to antenna

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

R = distance to the center of radiation of the antenna

4.3 MPE Results

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>24.94</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>311.89</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>2437</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>5</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>3.16</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.196</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1.0</u>

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.196 mW/cm², Limit is 1.0 mW/cm².

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to FCC §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2 Antenna List

P/NO	Antenna Gain (dBi)
C787-510006-A	5

The antenna of the EUT has maximum gain of 5 dBi and consists of a reversed SMA connector, which in accordance to sections FCC §15.203, is considered sufficient to comply with the provisions of these sections. Please refer to the EUT photos.



EUT Antenna

6 FCC §15.207 – AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 Conducted limits:

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 frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 ¹	56 to 46 ¹
0.5-5	56	46
5-30	60	50

Note ¹: Decreases with the logarithm of the frequency.

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2009 measurement procedure. The specification used was FCC §15.207 limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V/60 Hz AC power.

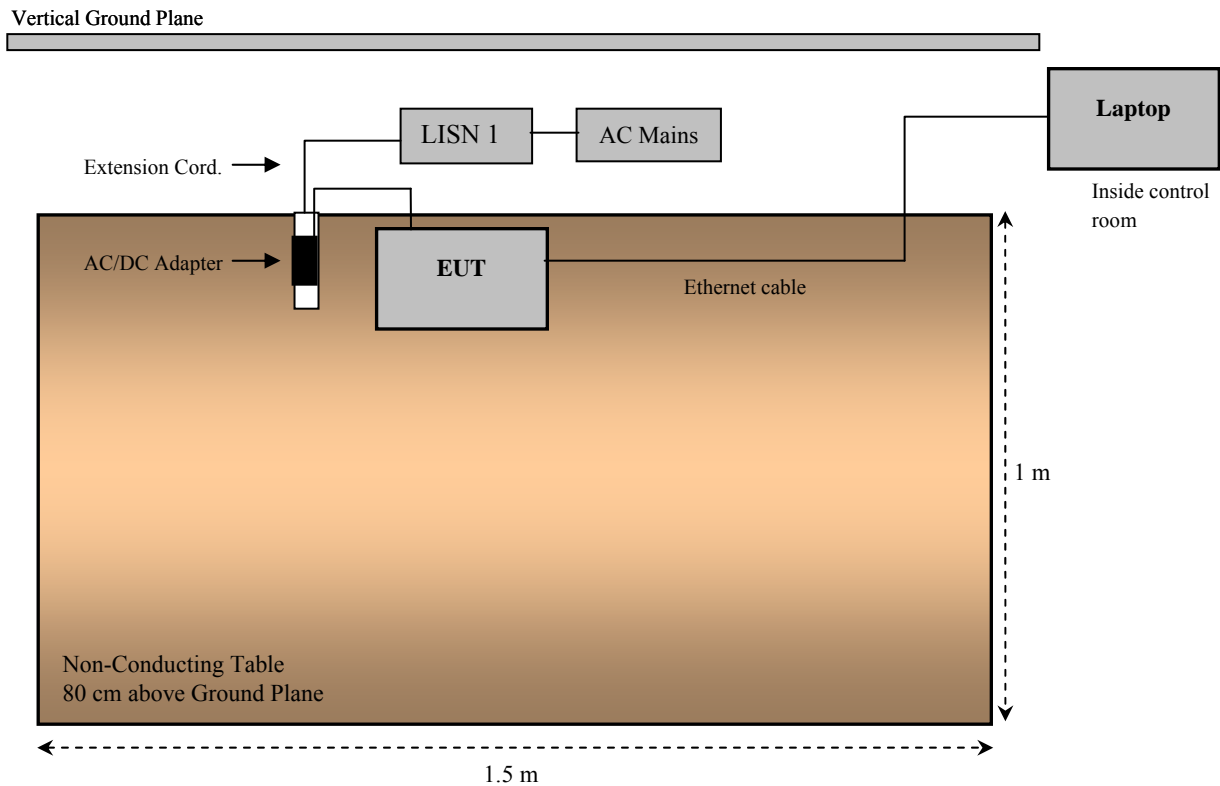
6.3 Test Procedure

During the conducted emissions test, the AC/DC adapter of the EUT was connected to the mains outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a “QP.” Average readings are distinguished with an “Ave”.

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

$$CA = Ai + AF + CL + Atten - Ga$$

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Solar Electronics	EMC LISN	9252-50-R-24-N	511213	2012-06-25
TTE	High Pass Filter	H985-150k-50-720N	M1149	2012-05-30
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2012-03-22

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

6.7 Test Environmental Conditions

Temperature:	22°C
Relative Humidity:	59%
ATM Pressure:	101.1kPa

The testing was performed by Jeffrey Wu on 2012-08-15 at 5m chamber 3.

6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Part 15.207 standard's conducted emissions limits, with the margin reading of:

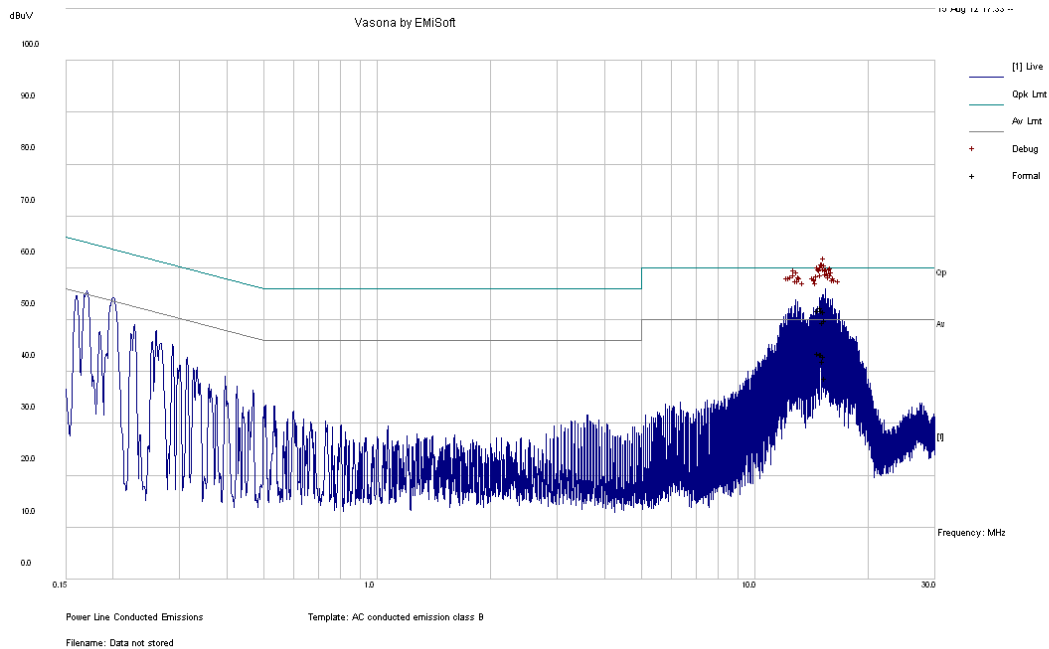
Transmitting Mode the Worst Case: 802.11 n Middle channel

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	Frequency (MHz)	Conductor Mode (Line/Neutral)	Range (MHz)
-6.46	14.78882	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

Transmitting Mode the Worst Case: 802.11 n Middle channel

120 V, 60 Hz – Line



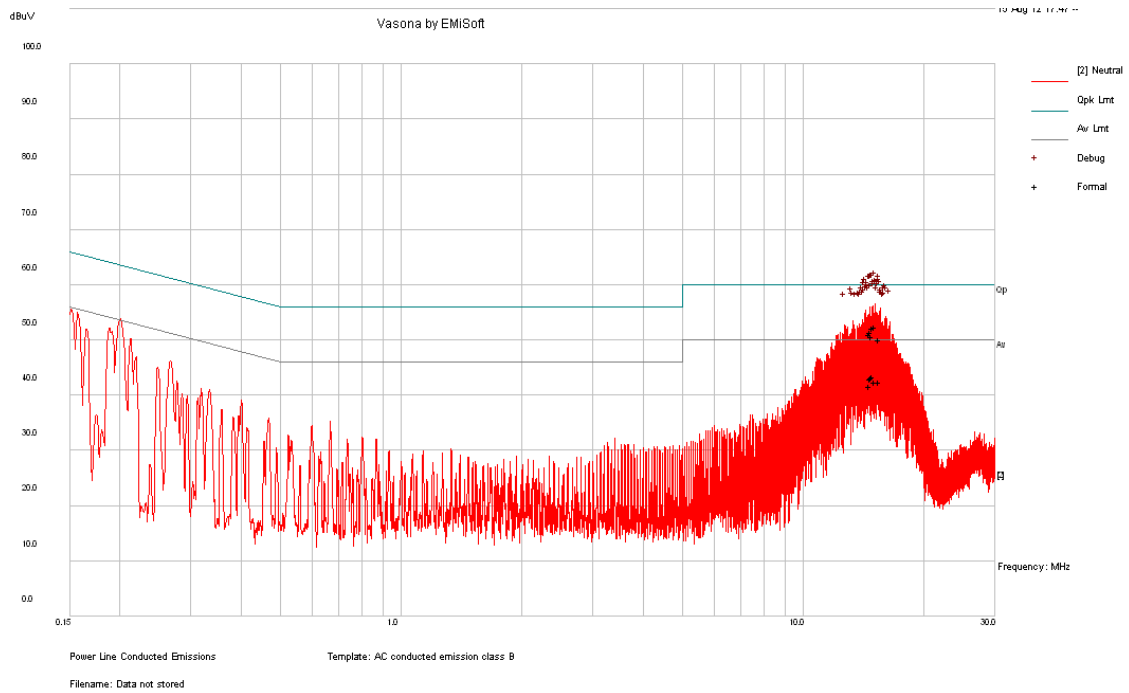
Quasi-Peak Measurements:

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
14.99598	52.48	Line	60	-7.52
14.78882	51.91	Line	60	-8.09
15.1283	51.9	Line	60	-8.1
15.32922	51.58	Line	60	-8.42
15.39876	49.85	Line	60	-10.15
15.19532	49.62	Line	60	-10.38

Average Measurements:

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
14.78882	43.54	Line	50	-6.46
15.1283	43.46	Line	50	-6.54
14.99598	43.38	Line	50	-6.62
15.32922	42.98	Line	50	-7.02
15.19532	42.06	Line	50	-7.94
15.39876	38.77	Line	50	-11.23

120 V, 60 Hz – Neutral



Quasi-Peak Measurements:

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
15.12554	52.44	Neutral	60	-7.56
14.92467	52.22	Neutral	60	-7.78
14.78268	51.39	Neutral	60	-8.61
14.66094	51.02	Neutral	60	-8.98
14.85203	50.69	Neutral	60	-9.31
15.51971	50.07	Neutral	60	-9.93

Average Measurements:

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
14.92467	43.39	Neutral	50	-6.61
14.85203	43.12	Neutral	50	-6.88
14.78268	42.97	Neutral	50	-7.03
15.12554	42.5	Neutral	50	-7.5
15.51971	42.39	Neutral	50	-7.61
14.66094	41.6	Neutral	50	-8.4

7 FCC §2.1051 & §15.247(d) – Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

For FCC §15.247(d) 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.

7.2 Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	22.8 °C
Relative Humidity:	58%
ATM Pressure:	101.4kPa

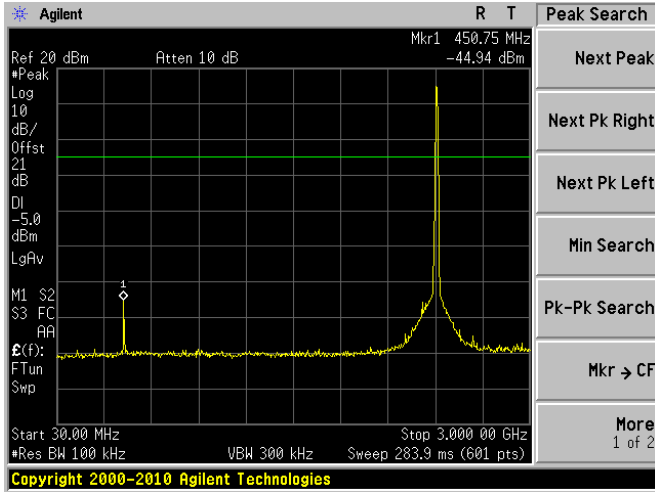
The testing was performed by Lionel Lara on 2012-08-17 at the RF Site.

7.5 Test Results

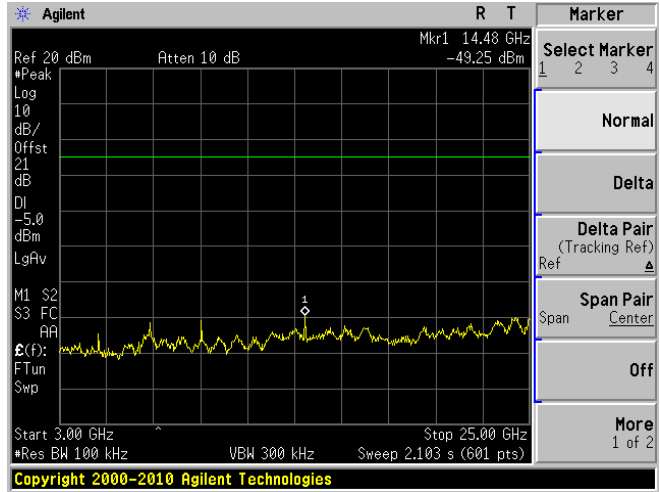
Please refer to following plots of spurious emissions.

Antenna 0, 802.11b, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

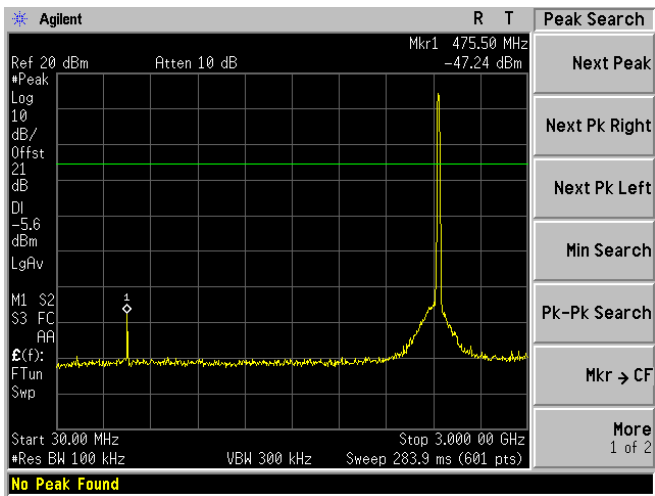


Plot: 3 GHz – 25 GHz

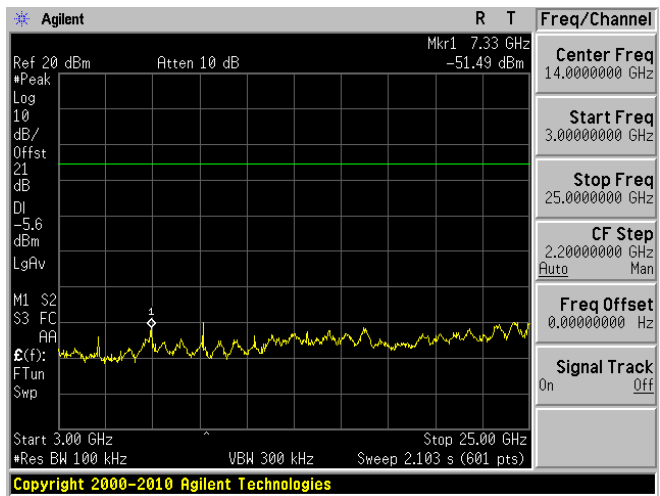


Antenna 0, 802.11b, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

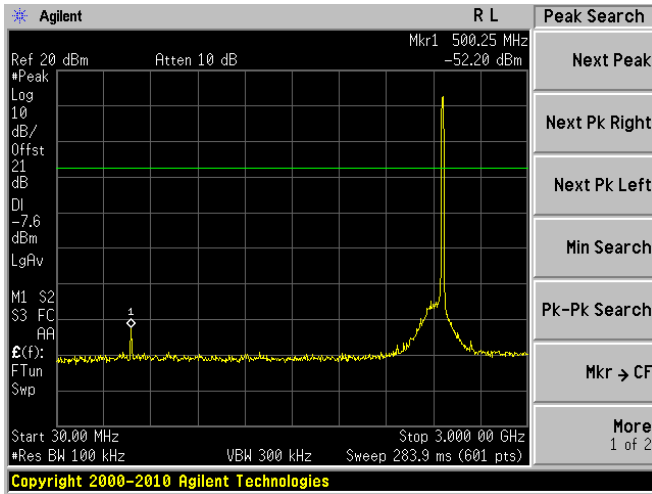


Plot: 3 GHz – 25 GHz

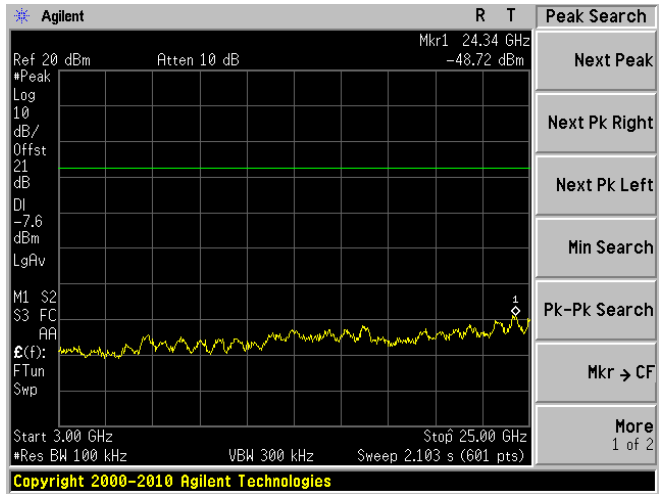


Antenna 0, 802.11b, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz

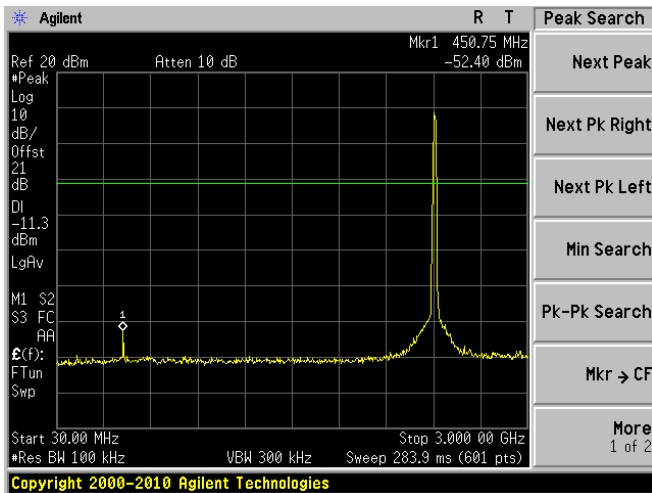


Plot: 3 GHz – 25 GHz

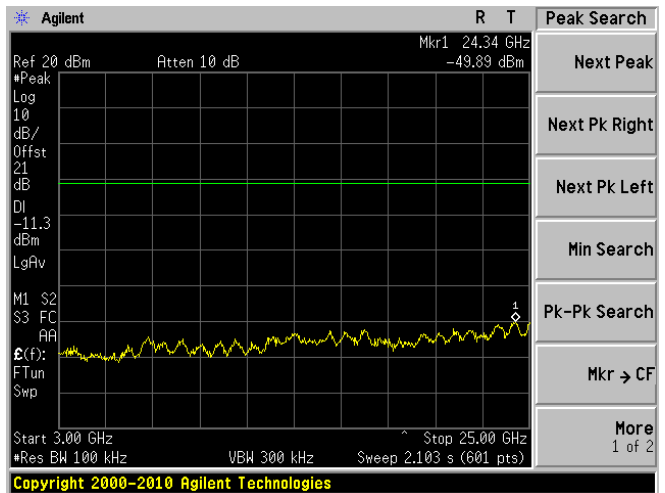


Antenna 0, 802.11g, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

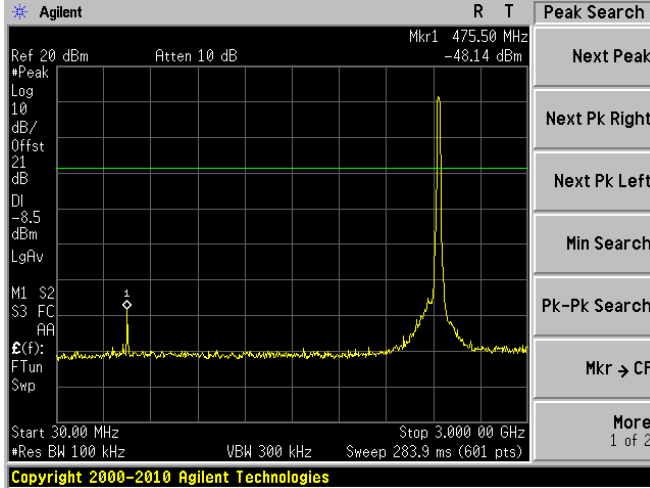


Plot: 3 GHz – 25 GHz

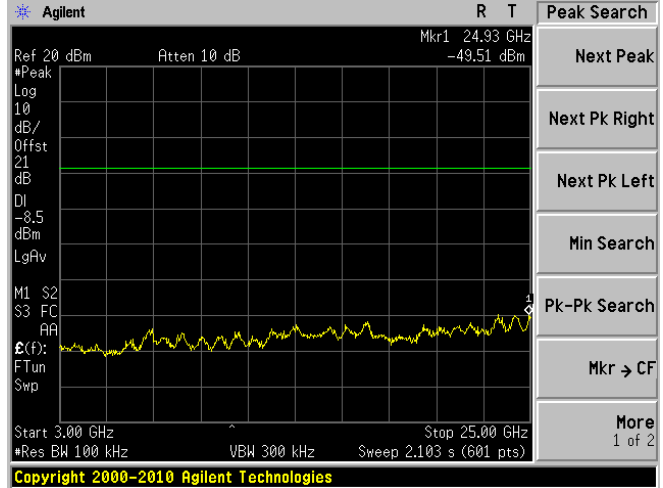


Antenna 0, 802.11g, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

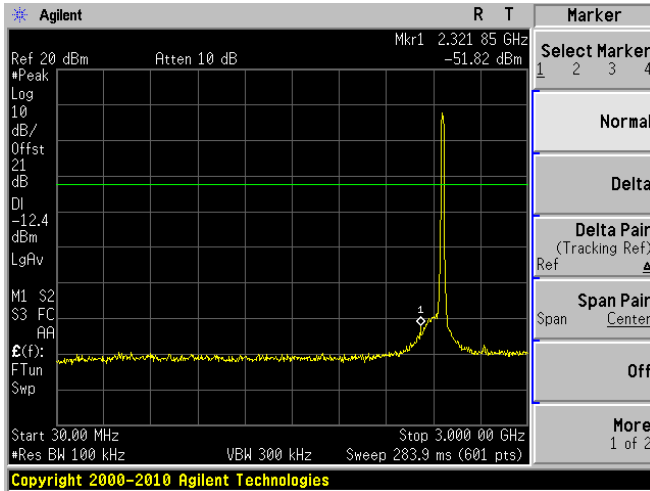


Plot: 3 GHz – 25 GHz

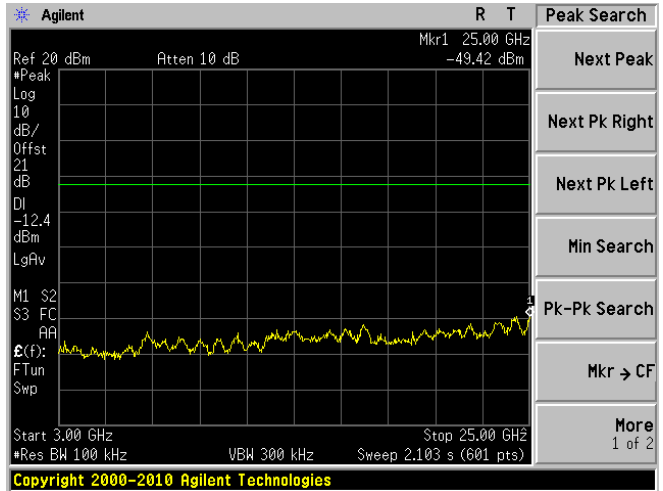


Antenna 0, 802.11g, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz

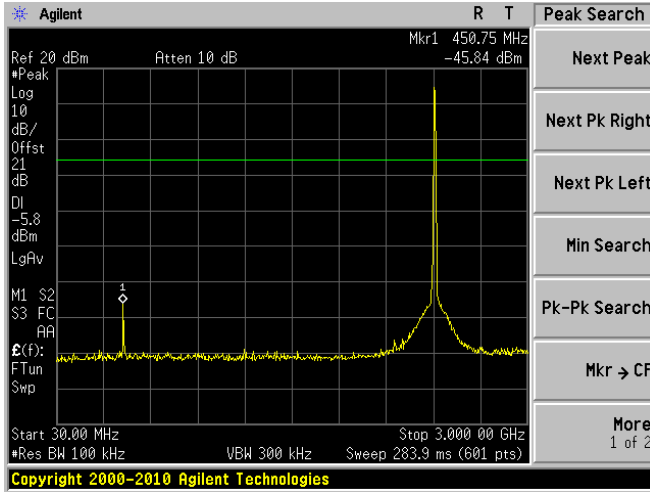


Plot: 3 GHz – 25 GHz

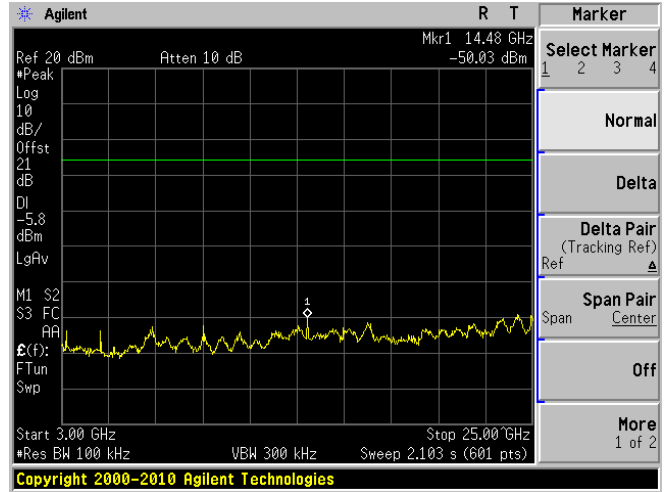


Antenna 1, 802.11b, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

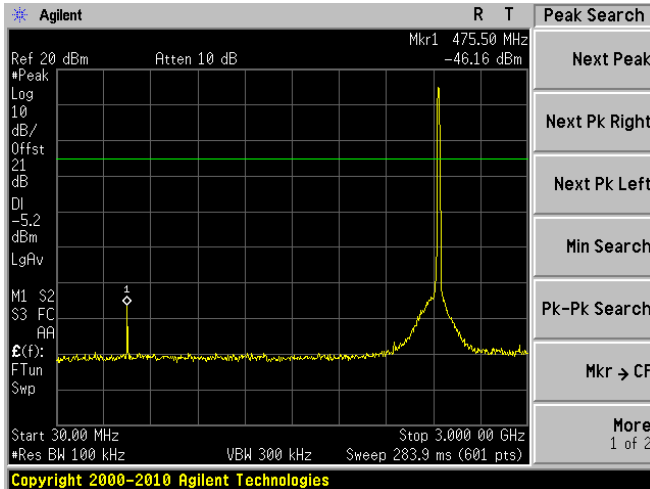


Plot: 3 GHz – 25 GHz

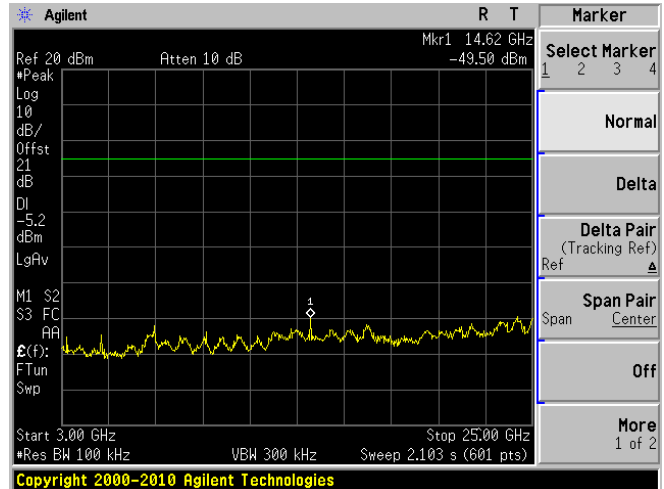


Antenna 1, 802.11b, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

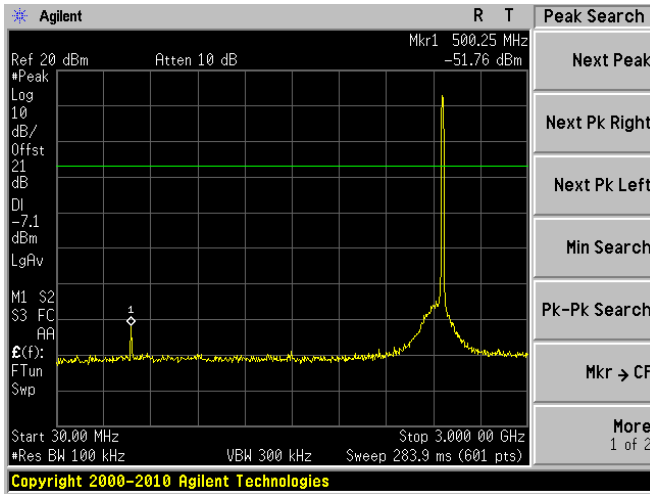


Plot: 3 GHz – 25 GHz

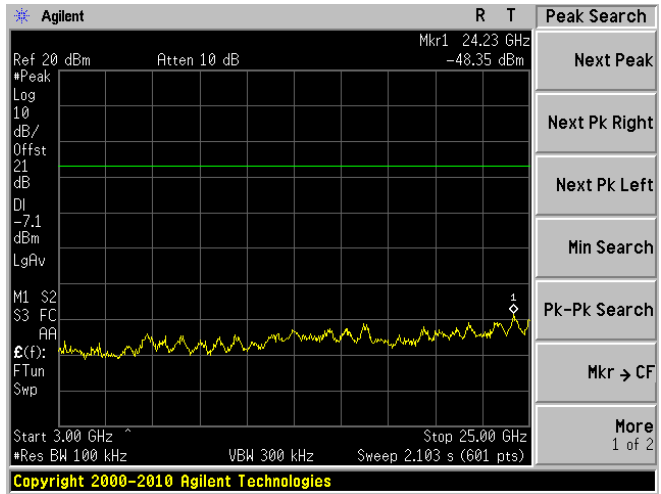


Antenna 1, 802.11b, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz

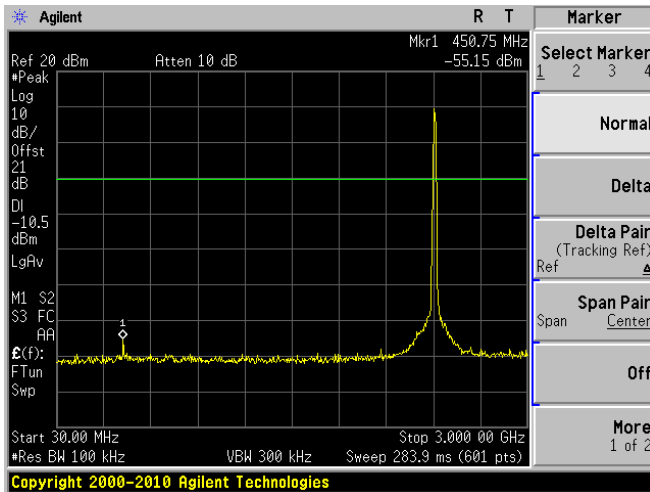


Plot: 3 GHz – 25 GHz

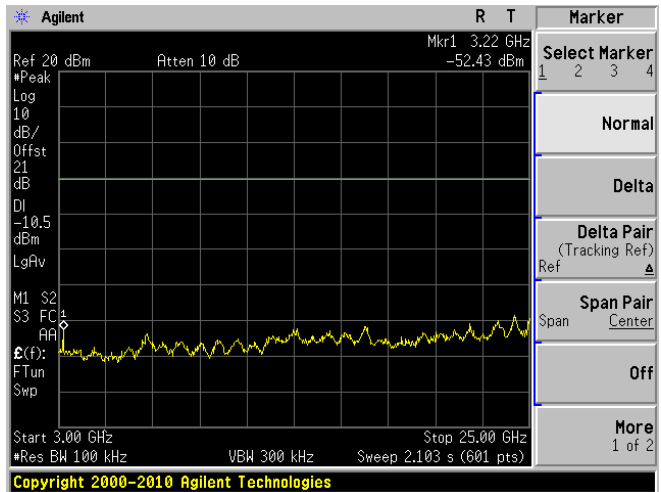


Antenna 1, 802.11g, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

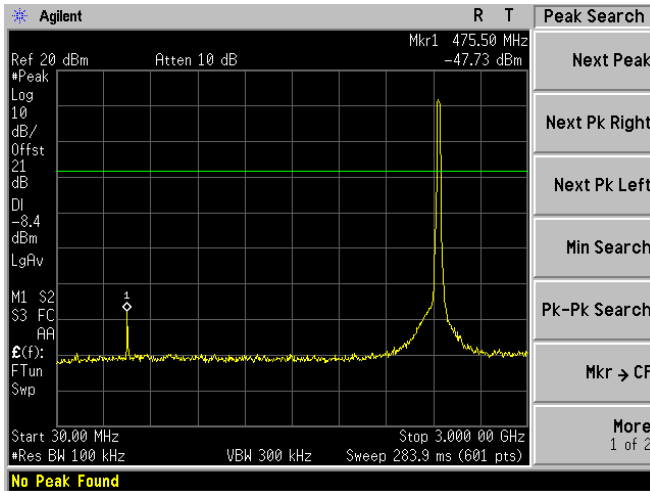


Plot: 3 GHz – 25 GHz

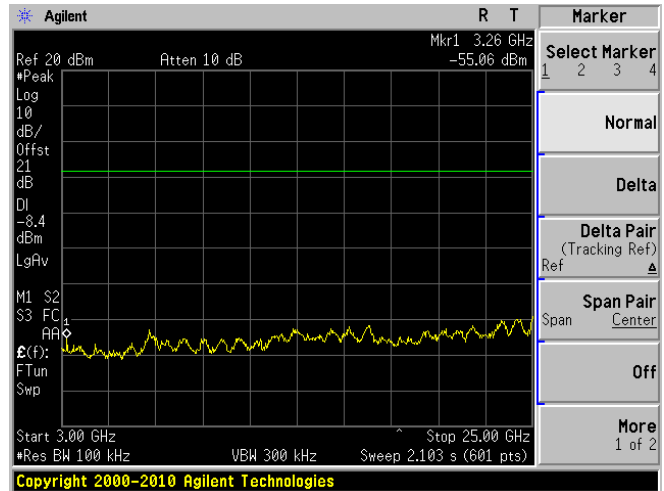


Antenna 1, 802.11g, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

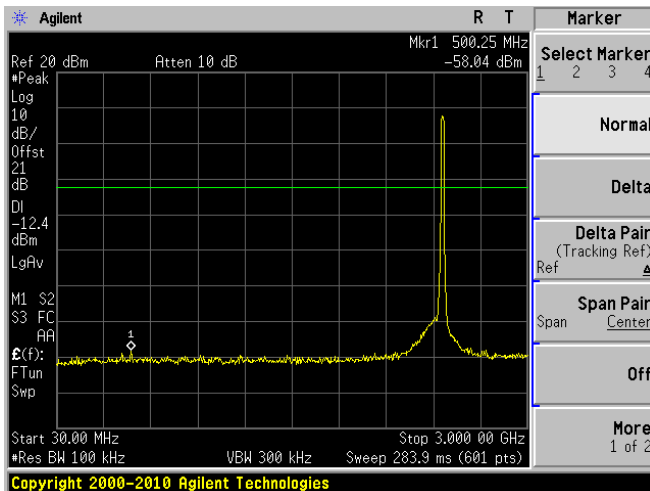


Plot: 3 GHz – 25 GHz

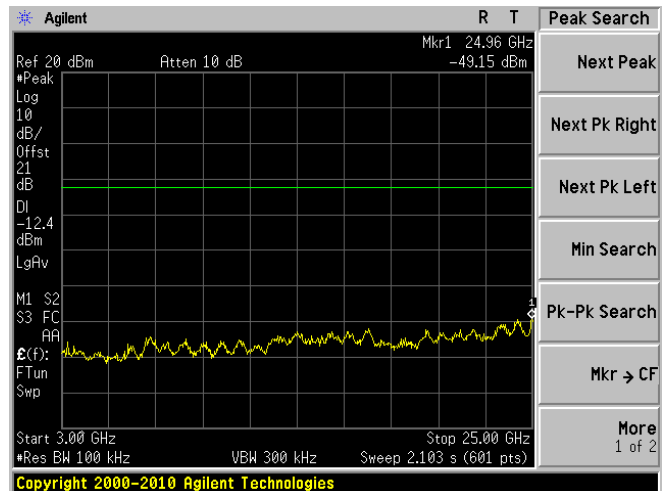


Antenna 1, 802.11g, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz

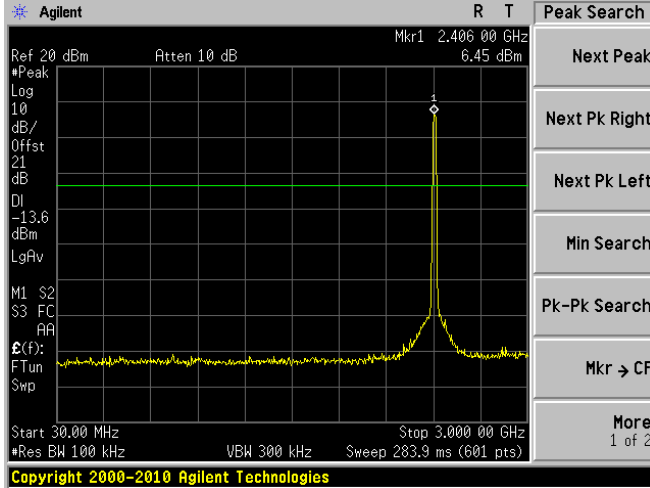


Plot: 3 GHz – 25 GHz

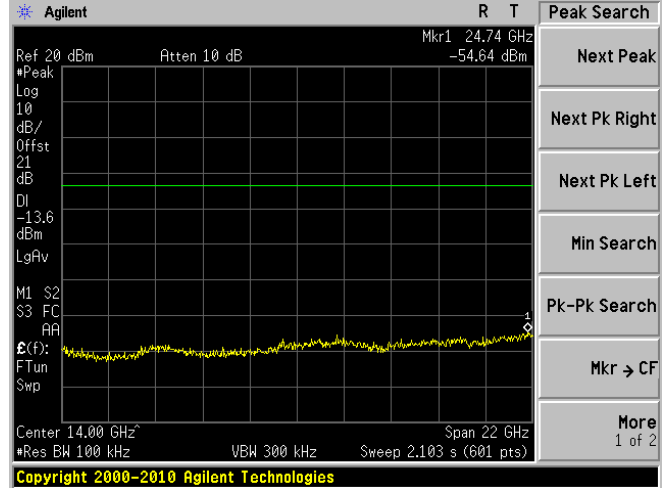


Antenna 0, 802.11n, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

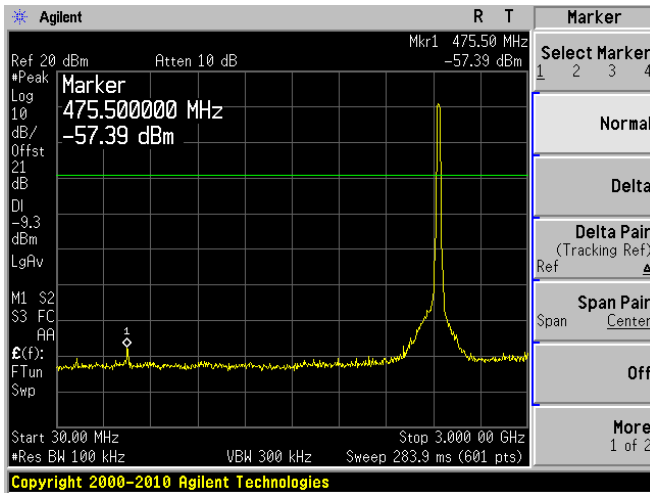


Plot: 3 GHz – 25 GHz

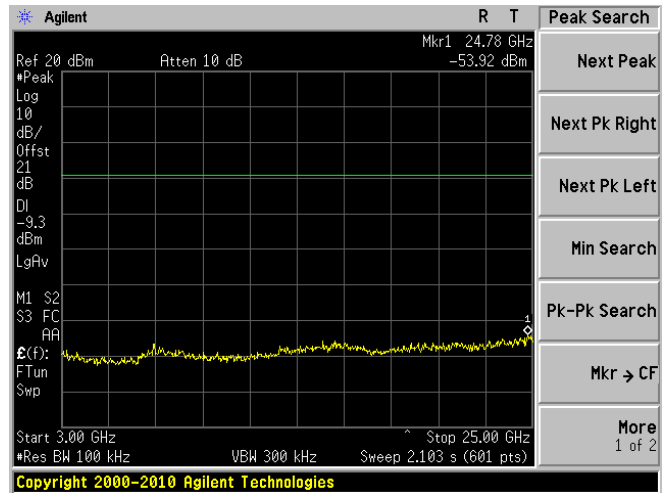


Antenna 0, 802.11n, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

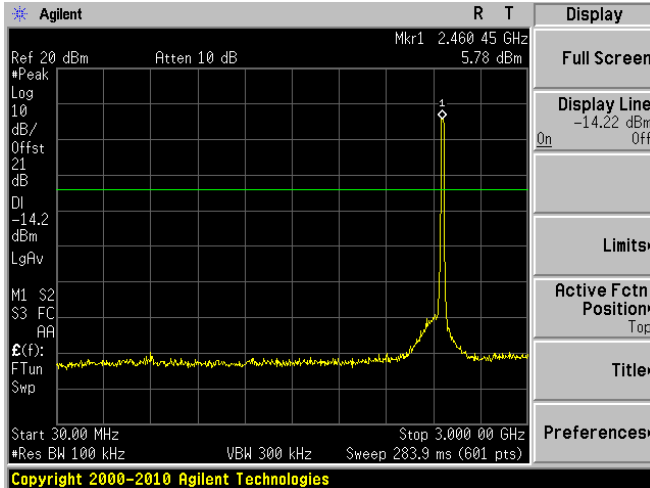


Plot: 3 GHz – 25 GHz

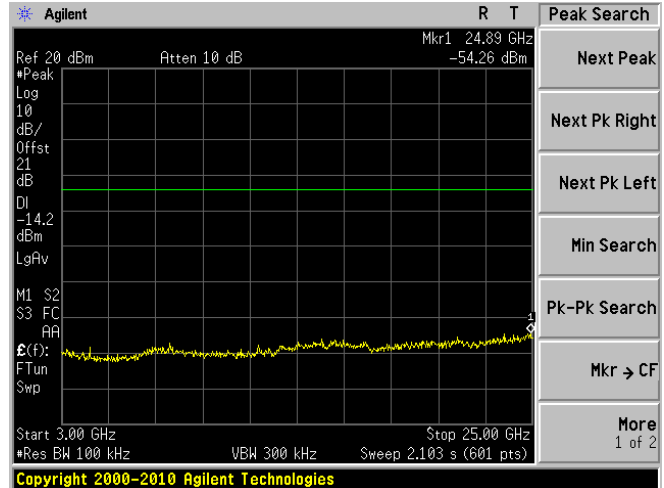


Antenna 0, 802.11n, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz

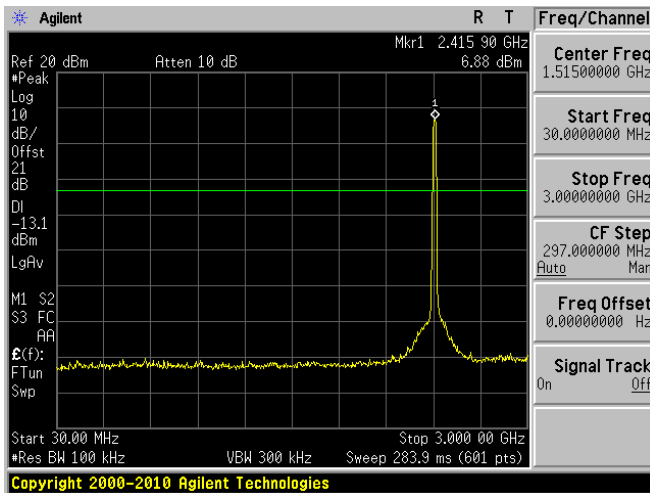


Plot: 3 GHz – 25 GHz

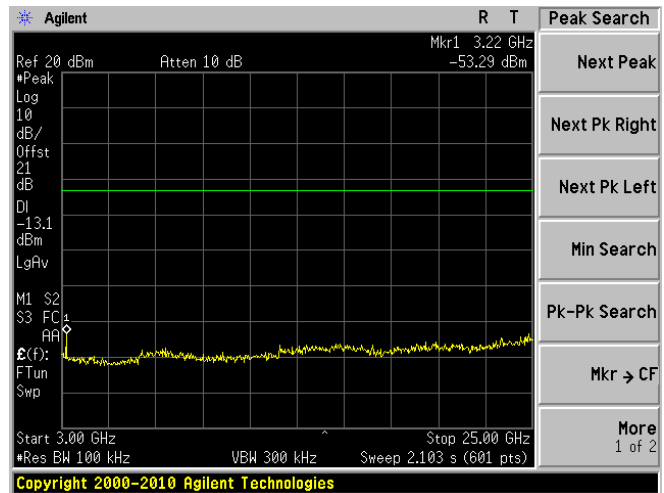


Antenna 1, 802.11n, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

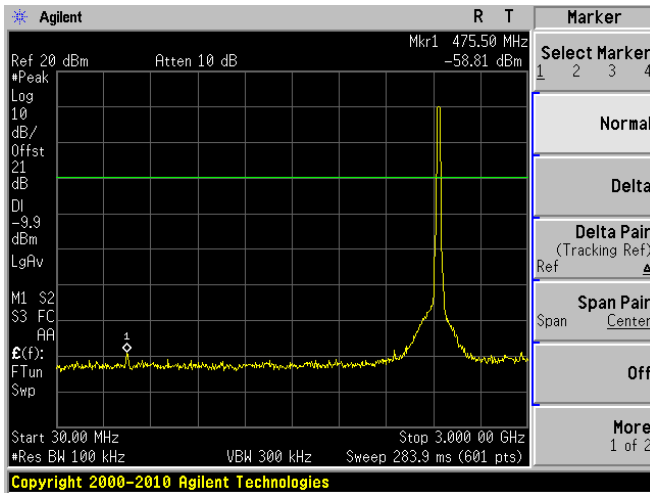


Plot: 3 GHz – 25 GHz

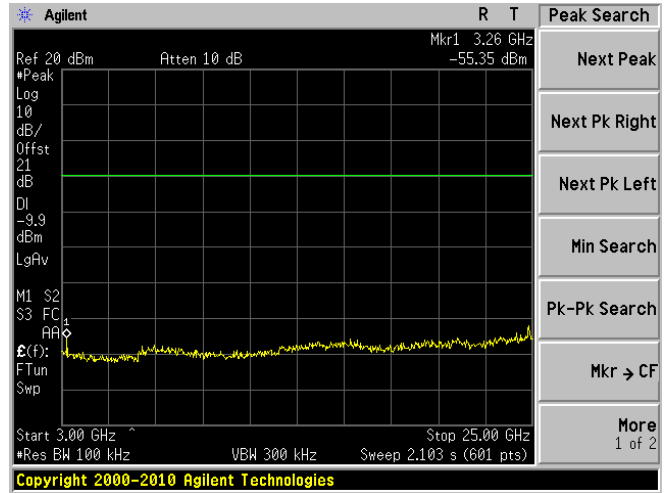


Antenna 1, 802.11n, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

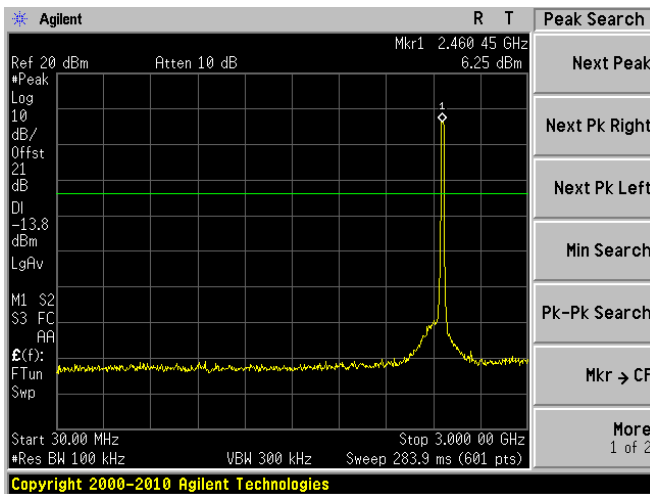


Plot: 3 GHz – 25 GHz

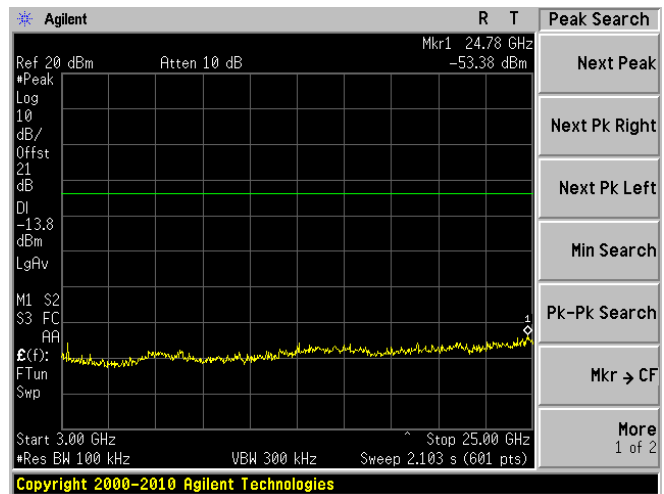


Antenna 1, 802.11n, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz



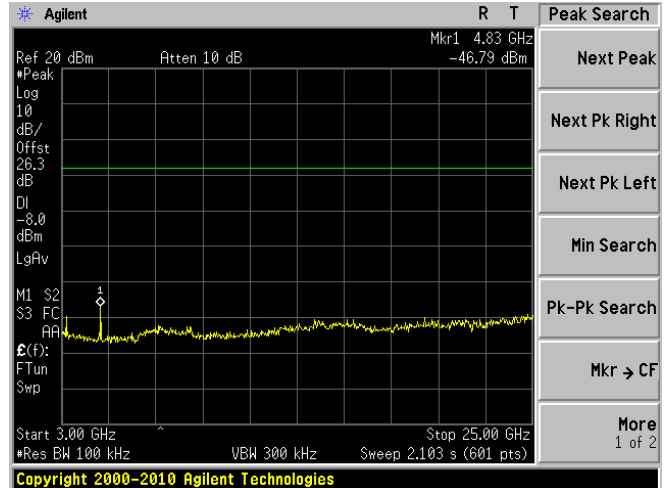
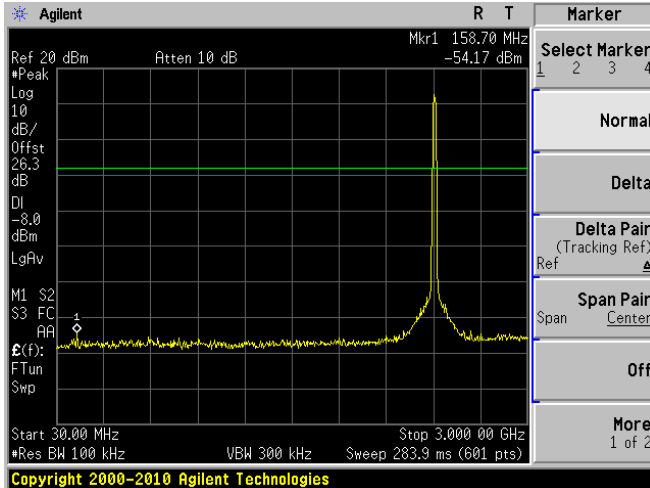
Plot: 3 GHz – 25 GHz



Antenna 0+1, 802.11n, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

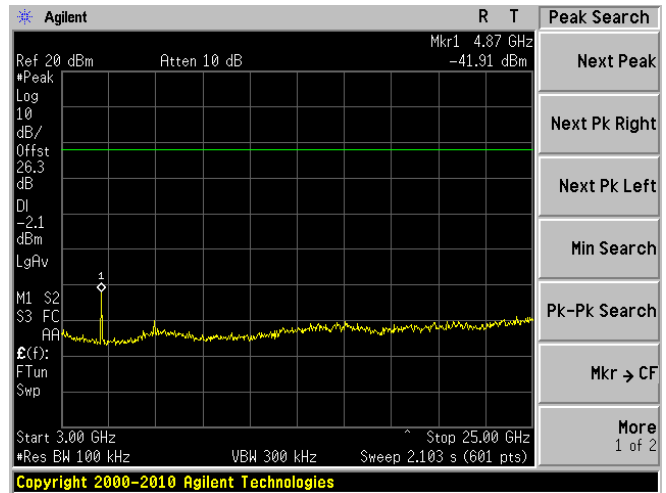
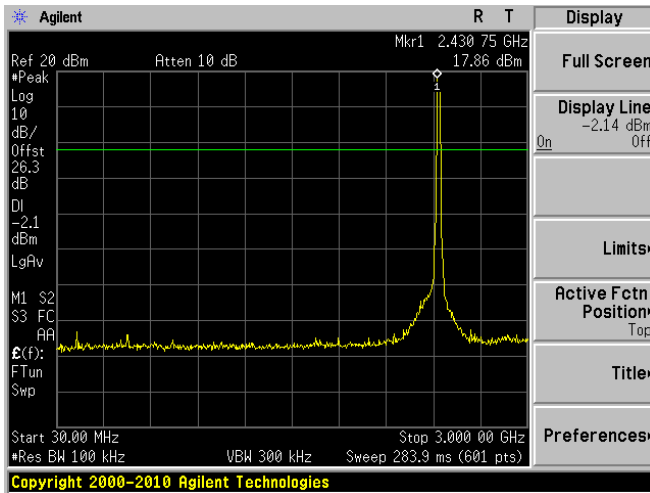
Plot: 3 GHz – 25 GHz



Antenna 0+1, 802.11n, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

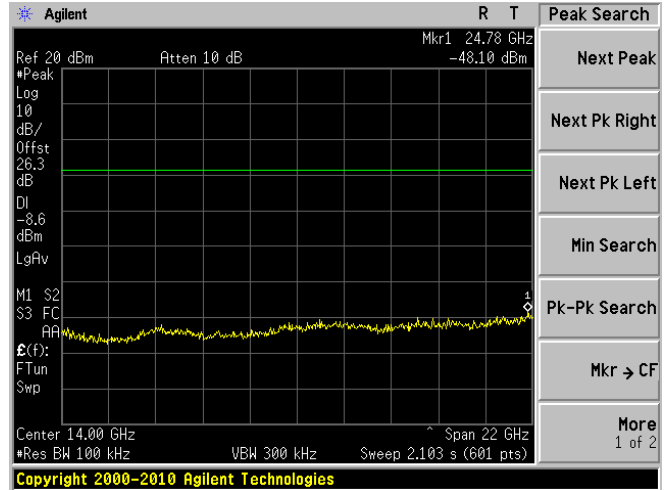
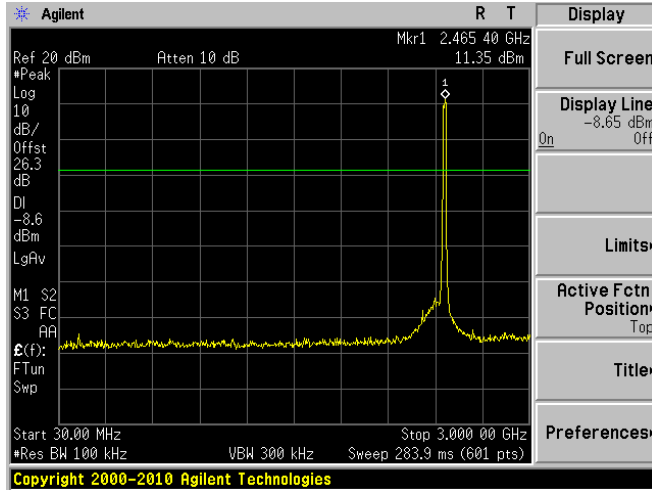
Plot: 3 GHz – 25 GHz



Antenna 0+1, 802.11n, High Channel, 2462 MHz

Plot: 30 MHz – 3 GHz

Plot: 3 GHz – 25 GHz



8 FCC §15.205, §15.209 & §15.247(d) – Spurious Radiated Emissions

8.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §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 (micro volts/meter)	Measurement Distance (meters)
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

** 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.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5.35 – 5.46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 – 167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3.3458 – 3.358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per FCC §15.247 (d) 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)).

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 3 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

8.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000 MHz:

- (1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
- (2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

8.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

$$CA = Ai + AF + CL + Atten - Ga$$

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

8.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10
EMCO	Horn Antenna	3115	9511-4627	2011-10-03
Mini-Circuits	Pre -amplifier	ZVA-183-S	570400946	2012-05-09
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2012-03-22
HP	Pre-amplifier	8447D	2944A06639	2012-06-09
Sunol Sciences	Biconi-Log Antenna	JB3	A020106-3	2012-06-18
Sunol Sciences	Sytem Controller	SC99V	011003-1	N/R

Statement of Traceability: BAAC attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

8.6 Test Environmental Conditions

Temperature:	22°C
Relative Humidity:	59%
ATM Pressure:	101.1kPa

The testing was performed by Jeffrey Wu on 2012-08-14 to 2012-08-15 at 5m chamber 3.

8.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Mode, Channel, Range
-0.13	400.007	Horizontal	802.11n, Low Channel, 30 MHz to 1 GHz

1 – 25 GHz:

Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Mode, Channel, Range
-0.458	2483.5	Horizontal	802.11n, High, 1 GHz to 25 GHz

Please refer to the following tables for specific test result details

8.8 Radiated Emissions Test Data and Plots

1) 30 MHz – 1 GHz, Measured at 3 meters

802.11b Mode, Low Channel (2412 MHz)

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
250.005	35.33	100	V	0	46	-10.67	QP
250.005	43.85	100	H	0	46	-2.15	QP
400.007	40.25	100	V	337	46	-5.75	QP
400.007	45.07	100	H	0	46	-0.93	QP
990.01	30.03	100	V	262	54	-23.97	QP
990.01	36.96	100	H	322	54	-17.04	QP

802.11b Mode, Middle channel (2437 MHz)

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
250.005	35.37	100	V	0	46	-10.63	QP
250.005	43.81	100	H	0	46	-2.19	QP
400.007	40.23	100	V	337	46	-5.77	QP
400.007	45.73	100	H	0	46	-0.27	QP
990.01	30.07	100	V	262	54	-23.93	QP
990.01	36.94	100	H	322	54	-17.06	QP

802.11b Mode, High Channel (2462 MHz)

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
250.005	35.38	100	V	0	46	-10.62	QP
250.005	43.91	100	H	0	46	-2.09	QP
400.007	40.03	100	V	337	46	-5.97	QP
400.007	45.01	100	H	0	46	-0.99	QP
990.01	30.01	100	V	262	54	-23.99	QP
990.01	36.96	100	H	322	54	-17.04	QP

802.11g Mode, Low Channel (2412 MHz)

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
250.005	35.38	100	V	0	46	-10.62	QP
250.005	43.84	100	H	0	46	-2.16	QP
400.007	40.28	100	V	337	46	-5.72	QP
400.007	45.03	100	H	0	46	-0.97	QP
990.01	30.26	100	V	262	54	-23.74	QP
990.01	36.96	100	H	322	54	-17.04	QP

802.11g Mode, Middle channel (2437 MHz)

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
250.005	35.1	100	V	0	46	-10.9	QP
250.005	43.87	100	H	0	46	-2.13	QP
400.007	40.01	100	V	335	46	-5.99	QP
400.007	45.53	100	H	0	46	-0.47	QP
990.01	24.46	100	V	253	54	-29.54	QP
990.01	30.03	100	H	322	54	-23.97	QP

802.11g Mode, High Channel (2462 MHz)

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
250.005	35.35	100	V	0	46	-10.65	QP
250.005	43.74	100	H	0	46	-2.26	QP
400.007	40.03	100	V	337	46	-5.97	QP
400.007	45.49	100	H	0	46	-0.51	QP
990.01	30.12	100	V	262	54	-23.88	QP
990.01	37.04	100	H	322	54	-16.96	QP

802.11n Mode, Low Channel (2412 MHz)

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
250.005	36.26	100	V	0	46	-9.74	QP
250.005	44.47	100	H	0	46	-1.53	QP
400.007	43.08	100	V	337	46	-2.92	QP
400.007	45.87	100	H	0	46	-0.13	QP
990.01	30.05	100	V	262	54	-23.95	QP
990.01	36.43	100	H	326	54	-17.57	QP

802.11n Mode, Middle channel (2437 MHz)

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
250.005	36.42	100	V	0	46	-9.58	QP
250.005	44.81	100	H	0	46	-1.19	QP
400.007	42.65	100	V	337	46	-3.35	QP
400.007	45.74	100	H	0	46	-0.26	QP
990.01	29.98	100	V	262	54	-24.02	QP
990.01	36.35	100	H	312	54	-17.65	QP

802.11n Mode, High Channel (2462 MHz)

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB μ V/m)	Margin (dB)	Comment
250.005	36.85	100	V	0	46	-9.15	QP
250.005	44.85	100	H	0	46	-1.15	QP
400.007	44.274	100	V	337	46	-1.726	QP
400.007	45.46	100	H	0	46	-0.54	QP
990.01	30.06	100	V	262	54	-23.94	QP
990.01	36.52	100	H	327	54	-17.48	QP

2) 1–25 GHz, Measured at 3 meters

802.11b mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz, measured at 3 meters											
2412	83.61	296	144	V	28.159	2.94	0	114.709	Fund.	-	Peak
2412	85.94	322	141	H	28.159	2.94	0	117.039	Fund.	-	Peak
2412	78.69	296	144	V	28.159	2.94	0	109.789	Fund.	-	Ave
2412	80.92	322	141	H	28.159	2.94	0	112.019	Fund.	-	Ave
4824	36.64	60	111	V	32.726	4.06	27.7	45.726	74	-28.274	Peak
4824	37.73	281	122	H	32.726	4.06	27.7	46.816	74	-27.184	Peak
4824	28.21	60	111	V	32.726	4.06	27.7	37.296	54	-16.704	Ave
4824	31.01	281	122	H	32.726	4.06	27.7	40.096	54	-13.904	Ave
7236	37.59	62	140	V	35.765	4.93	27.51	50.775	94.709	-43.93	Peak
7236	40.71	315	140	H	35.765	4.93	27.51	53.895	97.039	-43.14	Peak
7236	28.79	62	140	V	35.765	4.93	27.51	41.975	89.789	-47.814	Ave
7236	33.28	315	140	H	35.765	4.93	27.51	46.465	92.019	-45.55	Ave
9648	32.59	31	113	V	37.766	5.82	27.06	49.116	94.709	-45.59	Peak
9648	31.8	286	124	H	37.766	5.82	27.06	48.326	97.039	-48.71	Peak
9648	21.23	31	113	V	37.766	5.82	27.06	37.756	89.789	-52.03	Ave
9648	21.11	286	124	H	37.766	5.82	27.06	37.636	92.019	-54.38	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	78.96	339	191	V	28.159	2.94	0	110.059	Fund.	-	Peak
2437	87.14	308	161	H	28.159	2.94	0	118.239	Fund.	-	Peak
2437	73.31	339	191	V	28.159	2.94	0	104.409	Fund.	-	Ave
2437	81.85	308	161	H	28.159	2.94	0	112.949	Fund.	-	Ave
4874	40.37	58	100	V	32.726	4.1	27.76	49.436	74	-24.564	Peak
4874	37.64	274	113	H	32.726	4.1	27.76	46.706	74	-27.294	Peak
4874	31.33	58	100	V	32.726	4.1	27.76	40.396	54	-13.604	Ave
4874	30.88	274	113	H	32.726	4.1	27.76	39.946	54	-14.054	Ave
7311	41.74	228	134	V	36.016	4.88	27.51	55.126	74	-18.874	Peak
7311	39.71	310	132	H	36.016	4.88	27.51	53.096	74	-20.904	Peak
7311	29.29	228	134	V	36.016	4.88	27.51	42.676	54	-11.324	Ave
7311	30.64	310	132	H	36.016	4.88	27.51	44.026	54	-9.974	Ave
9748	32.1	0	100	V	37.883	5.74	26.98	48.743	90.059	-41.32	Peak
9748	32.52	0	100	H	37.883	5.74	26.98	49.163	98.239	-49.08	Peak
9748	19.14	0	100	V	37.883	5.74	26.98	35.783	84.409	-48.63	Ave
9748	17.16	0	100	H	37.883	5.74	26.98	33.803	92.949	-59.15	Ave

Frequency (MHz)	S.A. Reading (dB μ V)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dB μ V/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dB μ V/m)	Margin (dB)	
High Channel 2462 MHz, measured at 3 meters											
2462	81.73	298	140	V	28.284	3.1	0	113.114	Fund.	-	Peak
2462	84.78	322	138	H	28.284	3.1	0	116.164	Fund.	-	Peak
2462	76.86	298	140	V	28.284	3.1	0	108.244	Fund.	-	Ave
2462	79.94	322	138	H	28.284	3.1	0	111.324	Fund.	-	Ave
4924	35.96	7	100	V	32.8	4.1	27.75	45.11	74	-28.89	Peak
4924	36.03	290	100	H	32.8	4.1	27.75	45.18	74	-28.82	Peak
4924	28.41	7	100	V	32.8	4.1	27.75	37.56	54	-16.44	Ave
4924	27.74	290	100	H	32.8	4.1	27.75	36.89	54	-17.11	Ave
7386	33.07	0	100	V	36.143	4.89	27.51	46.593	74	-27.407	Peak
7386	33.99	0	100	H	36.143	4.89	27.51	47.513	74	-26.487	Peak
7386	19.29	0	100	V	36.143	4.89	27.51	32.813	54	-21.187	Ave
7386	19.29	0	100	H	36.143	4.89	27.51	32.813	54	-21.187	Ave
9848	34.06	0	100	V	38.174	5.77	26.98	51.024	93.114	-42.09	Peak
9848	33.26	0	100	H	38.174	5.77	26.98	50.224	96.164	-45.94	Peak
9848	18.54	0	100	V	38.174	5.77	26.98	35.504	88.244	-52.74	Ave
9848	18.76	0	100	H	38.174	5.77	26.98	35.724	91.324	-55.6	Ave

802.11g mode

Frequency (MHz)	S.A. Reading (dB μ V)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dB μ V/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dB μ V/m)	Margin (dB)	
Low Channel 2412 MHz, measured at 3 meters											
2412	80.82	227	126	V	28.159	2.94	0	111.919	Fund.	-	Peak
2412	83.11	332	129	H	28.159	2.94	0	114.209	Fund.	-	Peak
2412	66.34	227	126	V	28.159	2.94	0	97.439	Fund.	-	Ave
2412	69.71	332	129	H	28.159	2.94	0	100.809	Fund.	-	Ave
4824	35.32	0	100	V	32.726	4.06	27.7	44.406	74	-29.594	Peak
4824	35.56	0	100	H	32.726	4.06	27.7	44.646	74	-29.354	Peak
4824	20.78	0	100	V	32.726	4.06	27.7	29.866	54	-24.134	Ave
4824	21.04	0	100	H	32.726	4.06	27.7	30.126	54	-23.874	Ave
7236	36.8	0	100	V	35.765	4.93	27.51	49.985	91.919	-41.93	Peak
7236	36.05	0	100	H	35.765	4.93	27.51	49.235	94.209	-44.97	Peak
7236	20.39	0	100	V	35.765	4.93	27.51	33.575	77.439	-43.86	Ave
7236	20.15	0	100	H	35.765	4.93	27.51	33.335	80.809	-47.47	Ave
9648	34.33	0	100	V	37.766	5.82	27.06	50.856	91.919	-41.06	Peak
9648	34.09	0	100	H	37.766	5.82	27.06	50.616	94.209	-43.59	Peak
9648	19.43	0	100	V	37.766	5.82	27.06	35.956	77.439	-41.48	Ave
9648	19.34	0	100	H	37.766	5.82	27.06	35.866	80.809	-44.94	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 2437 MHz, measured at 3 meters											
2437	86.17	290	100	V	28.159	2.94	0	117.269	Fund.	-	Peak
2437	88.82	133	100	H	28.159	2.94	0	119.919	Fund.	-	Peak
2437	72.82	290	100	V	28.159	2.94	0	103.919	Fund.	-	Ave
2437	75.01	133	100	H	28.159	2.94	0	106.109	Fund.	-	Ave
4874	33.83	0	100	V	32.726	4.1	27.76	42.896	74	-31.104	Peak
4874	34.43	0	100	H	32.726	4.1	27.76	43.496	74	-30.504	Peak
4874	19.78	0	100	V	32.726	4.1	27.76	28.846	54	-25.154	Ave
4874	19.36	0	100	H	32.726	4.1	27.76	28.426	54	-25.574	Ave
7311	42.55	225	100	V	36.016	4.88	27.51	55.936	74	-18.064	Peak
7311	38.3	134	100	H	36.016	4.88	27.51	51.686	74	-22.314	Peak
7311	25.32	225	100	V	36.016	4.88	27.51	38.706	54	-15.294	Ave
7311	22.66	134	100	H	36.016	4.88	27.51	36.046	54	-17.954	Ave
9748	31.54	0	100	V	37.883	5.74	26.98	48.183	97.269	-49.09	Peak
9748	32.14	0	100	H	37.883	5.74	26.98	48.783	99.919	-51.14	Peak
9748	17.12	0	100	V	37.883	5.74	26.98	33.763	83.919	-50.16	Ave
9748	17.11	0	100	H	37.883	5.74	26.98	33.753	86.109	-52.36	Ave
High Channel 2462 MHz, measured at 3 meters											
2462	79.88	338	113	V	28.284	3.1	0	111.264	Fund.	-	Peak
2462	85	331	124	H	28.284	3.1	0	116.384	Fund.	-	Peak
2462	66.03	338	113	V	28.284	3.1	0	97.414	Fund.	-	Ave
2462	70.58	331	124	H	28.284	3.1	0	101.964	Fund.	-	Ave
4924	34.3	0	100	V	32.8	4.1	27.75	43.45	74	-30.55	Peak
4924	34.3	0	100	H	32.8	4.1	27.75	43.45	74	-30.55	Peak
4924	18.95	0	100	V	32.8	4.1	27.75	28.1	54	-25.9	Ave
4924	18.95	0	100	H	32.8	4.1	27.75	28.1	54	-25.9	Ave
7386	33.15	0	100	V	36.143	4.89	27.51	46.673	74	-27.327	Peak
7386	33.15	0	100	H	36.143	4.89	27.51	46.673	74	-27.327	Peak
7386	18.04	0	100	V	36.143	4.89	27.51	31.563	54	-22.437	Ave
7386	18.04	0	100	H	36.143	4.89	27.51	31.563	54	-22.437	Ave
9848	31.9	0	100	V	38.174	5.77	26.98	48.864	91.264	-42.4	Peak
9848	31.9	0	100	H	38.174	5.77	26.98	48.864	96.384	-47.52	Peak
9848	16.59	0	100	V	38.174	5.77	26.98	33.554	77.414	-43.86	Ave
9848	16.59	0	100	H	38.174	5.77	26.98	33.554	81.964	-48.41	Ave

802.11n mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz, measured at 3 meters											
2412	84.41	340	116	V	28.159	2.94	0	115.509	Fund.	-	Peak
2412	86.02	191	120	H	28.159	2.94	0	117.119	Fund.	-	Peak
2412	70.92	340	116	V	28.159	2.94	0	102.019	Fund.	-	Ave
2412	72.36	191	120	H	28.159	2.94	0	103.459	Fund.	-	Ave
4824	35.5	0	100	V	32.726	4.06	27.7	44.586	74	-29.414	Peak
4824	35.09	0	100	H	32.726	4.06	27.7	44.176	74	-29.824	Peak
4824	20.78	0	100	V	32.726	4.06	27.7	29.866	54	-24.134	Ave
4824	20.97	0	100	H	32.726	4.06	27.7	30.056	54	-23.944	Ave
7236	36.17	0	100	V	35.765	4.93	27.51	49.355	95.509	-46.15	Peak
7236	35.02	0	100	H	35.765	4.93	27.51	48.205	97.119	-48.91	Peak
7236	20.22	0	100	V	35.765	4.93	27.51	33.405	82.019	-48.61	Ave
7236	20.1	0	100	H	35.765	4.93	27.51	33.285	83.459	-50.17	Ave
9648	34.29	0	100	V	37.766	5.82	27.06	50.816	95.509	-44.69	Peak
9648	34.44	0	100	H	37.766	5.82	27.06	50.966	97.119	-46.15	Peak
9648	19.5	0	100	V	37.766	5.82	27.06	36.026	82.019	-45.99	Ave
9648	19.52	0	100	H	37.766	5.82	27.06	36.046	83.459	-47.41	Ave
Middle Channel 2437 MHz, measured at 3 meters											
2437	90.01	67	100	V	28.159	2.94	0	121.109	Fund.	-	Peak
2437	87.82	147	100	H	28.159	2.94	0	118.919	Fund.	-	Peak
2437	76.57	67	100	V	28.159	2.94	0	107.669	Fund.	-	Ave
2437	74.56	225	100	H	28.159	2.94	0	105.659	Fund.	-	Ave
4874	36.07	134	100	V	32.726	4.1	27.76	45.136	74	-28.864	Peak
4874	34.44	280	100	H	32.726	4.1	27.76	43.506	74	-30.494	Peak
4874	20.92	134	100	V	32.726	4.1	27.76	29.986	54	-24.014	Ave
4874	20.51	280	100	H	32.726	4.1	27.76	29.576	54	-24.424	Ave
7311	42.35	224	100	V	36.016	4.88	27.51	55.736	74	-18.264	Peak
7311	37.85	207	100	H	36.016	4.88	27.51	51.236	74	-22.764	Peak
7311	24.78	224	100	V	36.016	4.88	27.51	38.166	54	-15.834	Ave
7311	22.42	207	100	H	36.016	4.88	27.51	35.806	54	-18.194	Ave
9748	31.82	0	100	V	37.883	5.74	26.98	48.463	101.109	-52.65	Peak
9748	32.27	0	100	H	37.883	5.74	26.98	48.913	98.919	-50.01	Peak
9748	17.18	0	100	V	37.883	5.74	26.98	33.823	87.669	-53.85	Ave
9748	17.09	0	100	H	37.883	5.74	26.98	33.733	85.659	-51.93	Ave

Frequency (MHz)	S.A. Reading (dB μ V)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dB μ V/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dB μ V/m)	Margin (dB)	
High Channel 2462 MHz, measured at 3 meters											
2462	84.09	338	108	V	28.284	3.1	0	115.474	Fund.	-	Peak
2462	85.07	334	120	H	28.284	3.1	0	116.454	Fund.	-	Peak
2462	70.5	338	108	V	28.284	3.1	0	101.884	Fund.	-	Ave
2462	71.76	334	120	H	28.284	3.1	0	103.144	Fund.	-	Ave
4924	34.23	0	100	V	32.8	4.1	27.75	43.38	74	-30.62	Peak
4924	34	0	100	H	32.8	4.1	27.75	43.15	74	-30.85	Peak
4924	19.36	0	100	V	32.8	4.1	27.75	28.51	54	-25.49	Ave
4924	19.31	0	100	H	32.8	4.1	27.75	28.46	54	-25.54	Ave
7386	34.4	0	100	V	36.143	4.89	27.51	47.923	74	-26.077	Peak
7386	34.72	0	100	H	36.143	4.89	27.51	48.243	74	-25.757	Peak
7386	19.58	0	100	V	36.143	4.89	27.51	33.103	54	-20.897	Ave
7386	19.77	0	100	H	36.143	4.89	27.51	33.293	54	-20.707	Ave
9848	33.84	0	100	V	38.174	5.77	26.98	50.804	95.474	-44.67	Peak
9848	33.42	0	100	H	38.174	5.77	26.98	50.384	96.454	-46.07	Peak
9848	18.61	0	100	V	38.174	5.77	26.98	35.574	81.884	-46.31	Ave
9848	18.62	0	100	H	38.174	5.77	26.98	35.584	83.144	-47.56	Ave

3) Restricted Band Edges, Measured at 3 meters

802.11b mode

Frequency (MHz)	S.A. Reading (dB μ V)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dB μ V/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dB μ V/m)	Margin (dB)	
Low Channel 2412 MHz, measured at 3 meters											
2390	32.42	296	144	V	28.159	2.94	0	63.519	74	-10.481	Peak
2390	33.9	322	141	H	28.159	2.94	0	64.999	74	-9.001	Peak
2390	18.23	296	144	V	28.159	2.94	0	49.329	54	-4.671	Ave
2390	20.52	322	141	H	28.159	2.94	0	51.619	54	-2.381	Ave
High Channel 2462 MHz, measured at 3 meters											
2483.5	33.51	298	140	V	28.422	3.1	0	65.032	74	-8.968	Peak
2483.5	41.36	322	138	H	28.422	3.1	0	72.882	74	-1.118	Peak
2483.5	16.477	298	140	V	28.422	3.1	0	47.999	54	-6.001	Ave
2483.5	19.01	322	138	H	28.422	3.1	0	50.532	54	-3.468	Ave

802.11g mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz, measured at 3 meters											
2390	37.8	227	126	V	28.159	2.94	0	68.899	74	-5.101	Peak
2390	42.18	332	129	H	28.159	2.94	0	73.279	74	-0.721	Peak
2390	14.8	227	126	V	28.159	2.94	0	45.899	54	-8.101	Ave
2390	17.78	332	129	H	28.159	2.94	0	48.879	54	-5.121	Ave
High Channel 2462 MHz, measured at 3 meters											
2483.5	37.31	331	124	V	28.422	3.1	0	68.832	74	-5.168	Peak
2483.5	41.57	338	113	H	28.422	3.1	0	73.092	74	-0.908	Peak
2483.5	14.22	331	124	V	28.422	3.1	0	45.742	54	-8.258	Ave
2483.5	16.54	338	113	H	28.422	3.1	0	48.062	54	-5.938	Ave

802.11n mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz, measured at 3 meters											
2390	42.11	340	116	V	28.159	2.94	0	73.209	74	-0.791	Peak
2390	42.28	191	120	H	28.159	2.94	0	73.379	74	-0.621	Peak
2390	19.05	340	116	V	28.159	2.94	0	50.149	54	-3.851	Ave
2390	19.83	191	120	H	28.159	2.94	0	50.929	54	-3.071	Ave
High Channel 2462 MHz, measured at 3 meters											
2483.5	41.63	338	108	V	28.422	3.1	0	73.152	74	-0.848	Peak
2483.5	42.02	334	120	H	28.422	3.1	0	73.542	74	-0.458	Peak
2483.5	16.57	338	108	V	28.422	3.1	0	48.092	54	-5.908	Ave
2483.5	16.61	334	120	H	28.422	3.1	0	48.132	54	-5.868	Ave

9 FCC§15.247(a) (2) – 6 dB & 99% Emission Bandwidth

9.1 Applicable Standard

According to FCC §15.247(a)(2), systems using digital modulation techniques may operate in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

9.4 Test Environmental Conditions

Temperature:	23.9 °C
Relative Humidity:	59%
ATM Pressure:	101.0kPa

The testing was performed by Lionel Lara on 2012-08-14 at the RF Site.

9.5 Test Results

Antenna 0, 802.11b mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	8.227	10.1595	> 0.5	Pass
Middle	2437	8.234	10.1562	> 0.5	Pass
High	2462	8.223	10.1303	> 0.5	Pass

Antenna 0, 802.11g mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	16.371	16.6790	> 0.5	Pass
Middle	2437	16.375	16.6531	> 0.5	Pass
High	2462	16.247	16.6140	> 0.5	Pass

Antenna 0, 802.11n mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	17.301	17.6876	> 0.5	Pass
Middle	2437	17.731	17.7337	> 0.5	Pass
High	2462	17.669	17.7191	> 0.5	Pass

Antenna 1, 802.11b mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	8.238	10.1740	> 0.5	Pass
Middle	2437	8.225	10.1765	> 0.5	Pass
High	2462	8.226	10.1598	> 0.5	Pass

Antenna 1, 802.11g mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	16.291	16.6179	> 0.5	Pass
Middle	2437	16.224	16.6557	> 0.5	Pass
High	2462	16.190	16.6701	> 0.5	Pass

Antenna 1, 802.11n mode:

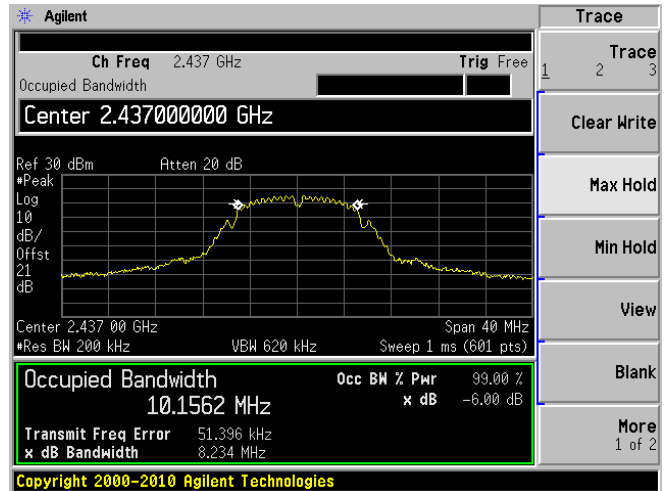
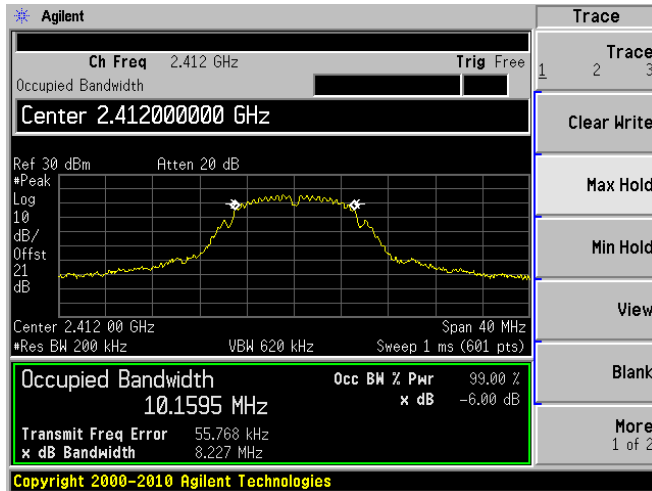
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	17.729	17.7233	> 0.5	Pass
Middle	2437	17.727	17.7409	> 0.5	Pass
High	2462	17.748	17.7223	> 0.5	Pass

Please refer to the following plots for detailed test results

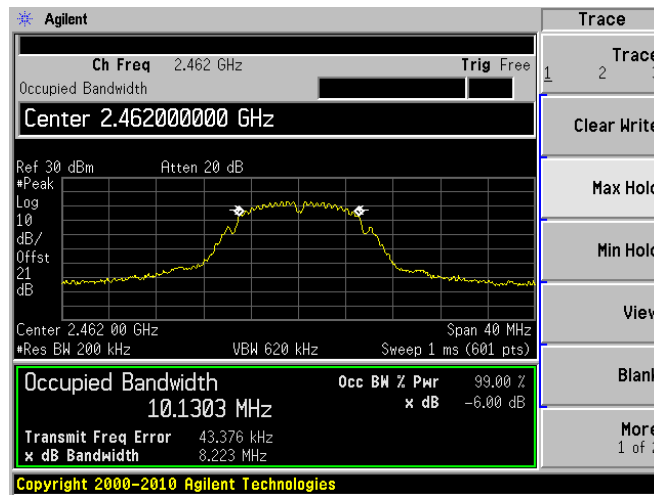
Antenna 0, 802.11b mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



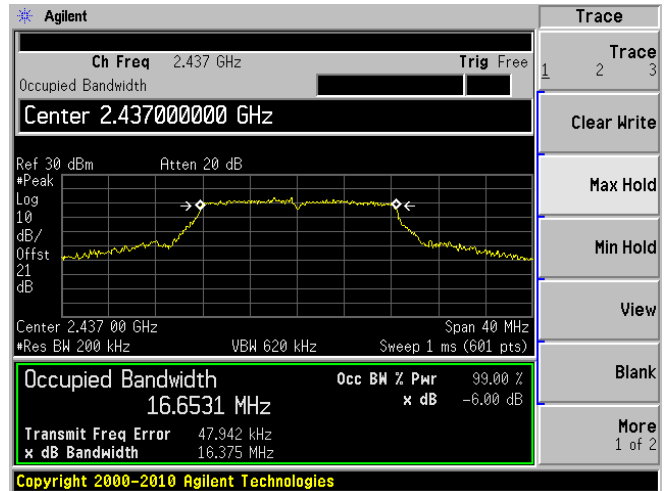
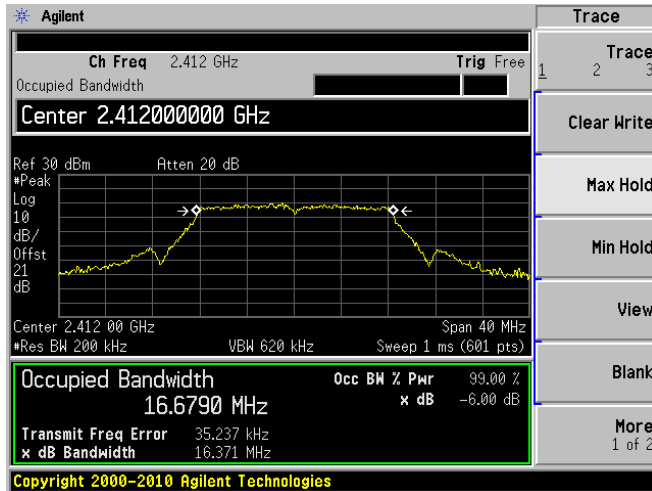
High channel: 2462 MHz



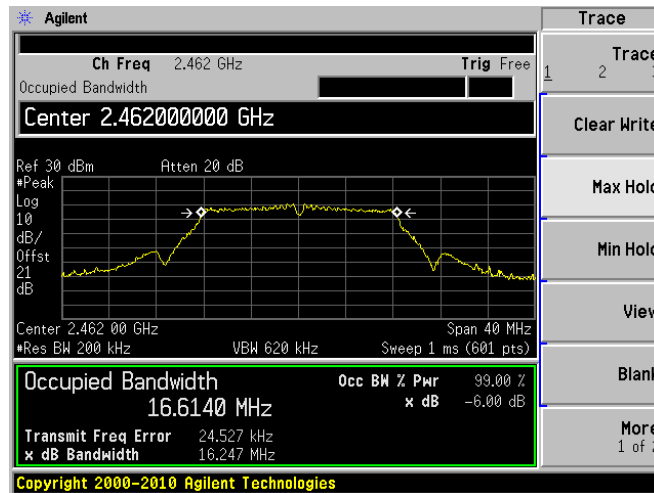
Antenna 0, 802.11g mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



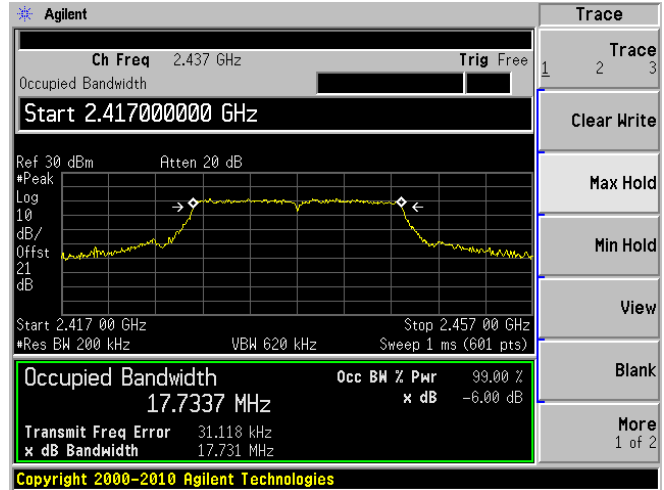
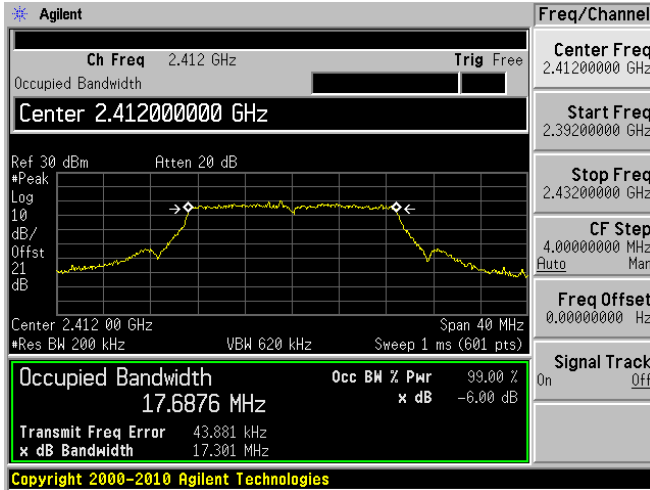
High channel: 2462 MHz



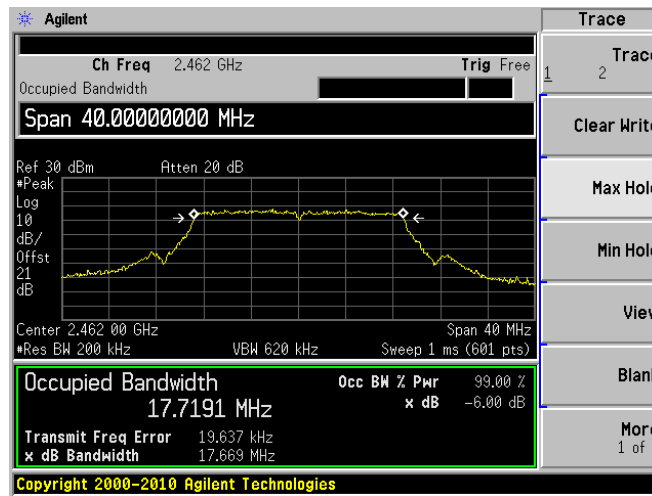
Antenna 0, 802.11n mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



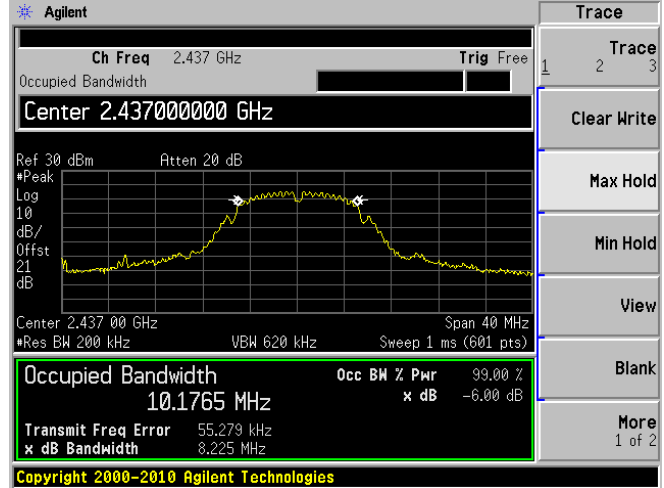
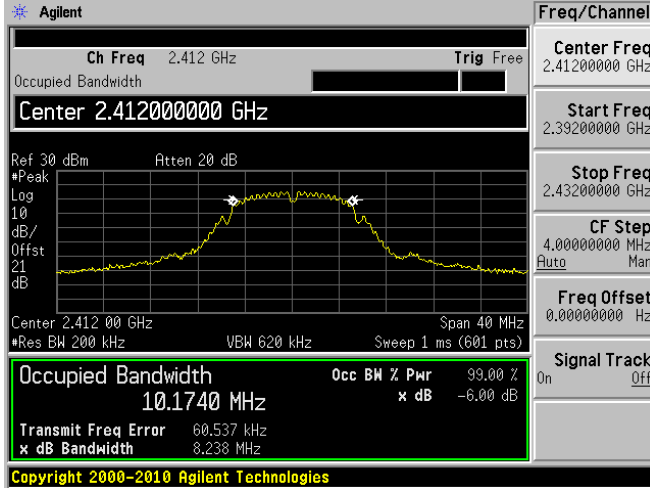
High channel: 2462 MHz



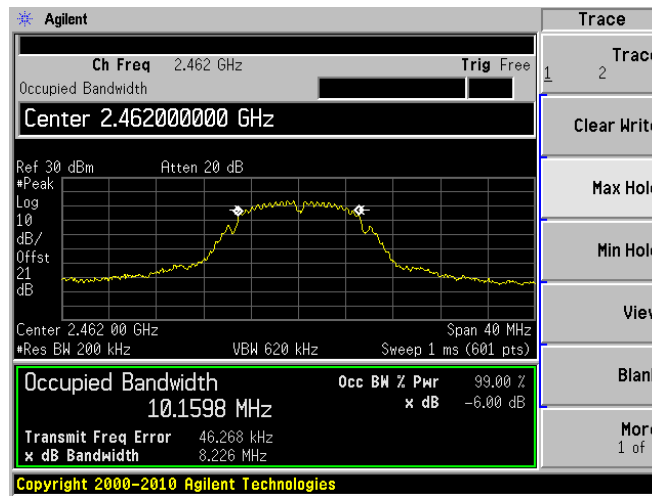
Antenna 1, 802.11b mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



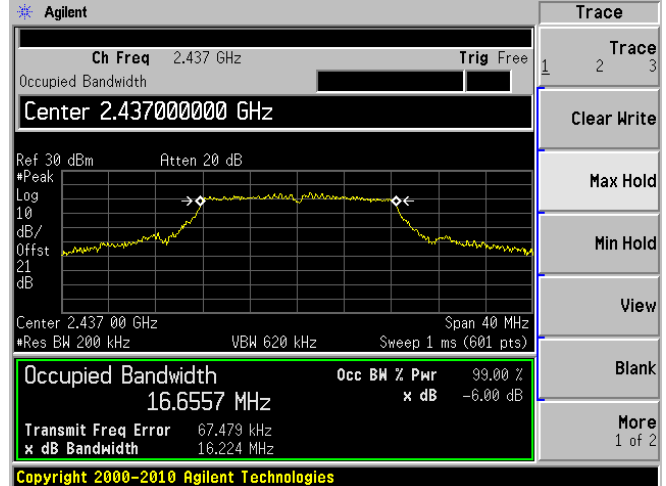
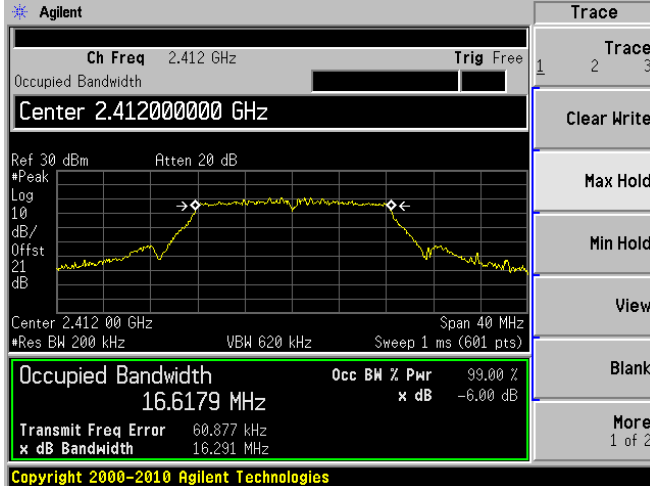
High channel: 2462 MHz



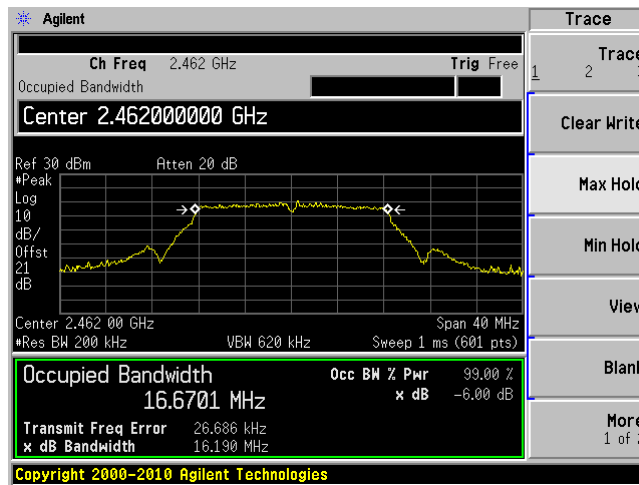
Antenna 1, 802.11g mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



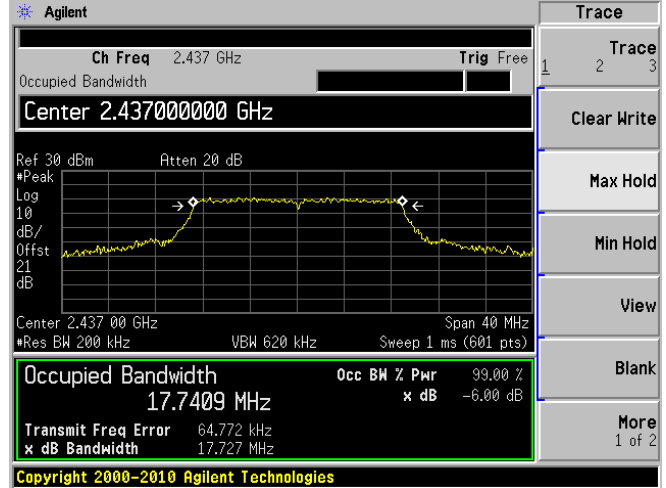
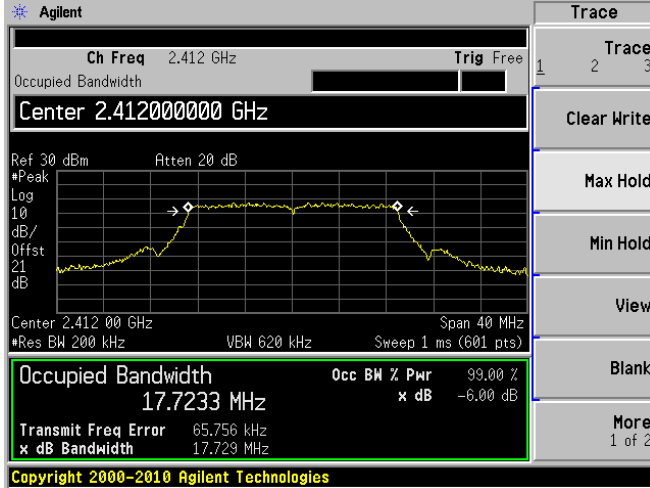
High channel: 2462 MHz



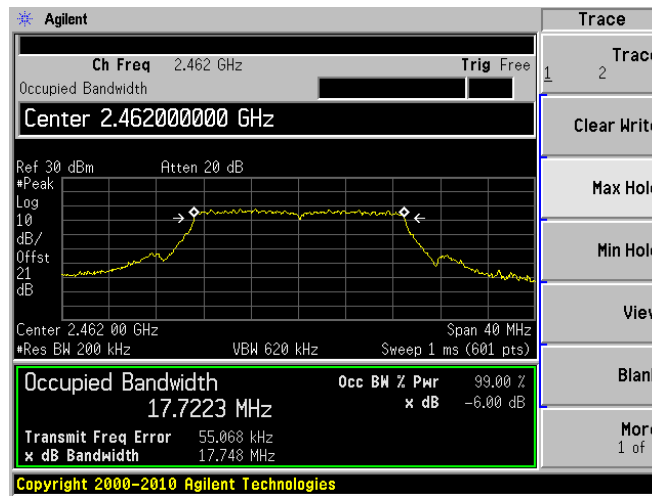
Antenna 1, 802.11n mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



High channel: 2462 MHz



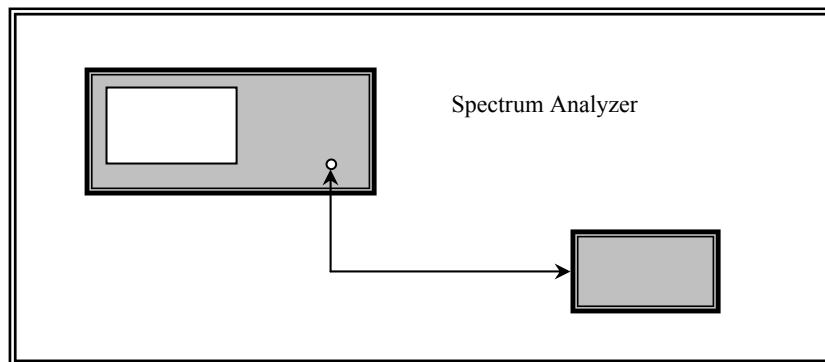
10 FCC §15.247(b) – Peak Output Power Measurement

10.1 Applicable Standard

According to FCC §15.247(b) for systems using digital modulation in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands: 1 Watt.

10.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.



10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

10.4 Test Environmental Conditions

Temperature:	23.98 °C
Relative Humidity:	59%
ATM Pressure:	101.0kPa

The testing was performed by Lionel Lara on 2012-08-21 at the RF Site.

10.5 Test Results

802.11b mode

Channel	Frequency (MHz)	TX Antenna 0 Power (dBm)	TX Antenna 1 Power (dBm)	Worst Case (dBm)	Limit (dBm)	Margin (dB)
Low	2412	23.34	23.14	23.34	30	-6.66
Middle	2437	23.15	23.10	23.15	30	-6.85
High	2462	20.77	20.77	20.77	30	-9.23

802.11g mode

Channel	Frequency (MHz)	TX Antenna 0 Power (dBm)	TX Antenna 1 Power (dBm)	Worst Case (dBm)	Limit (dBm)	Margin (dB)
Low	2412	19.04	19.02	19.04	30	-10.96
Middle	2437	22.40	22.12	22.40	30	-7.60
High	2462	18.35	18.43	18.43	30	-11.57

802.11n mode

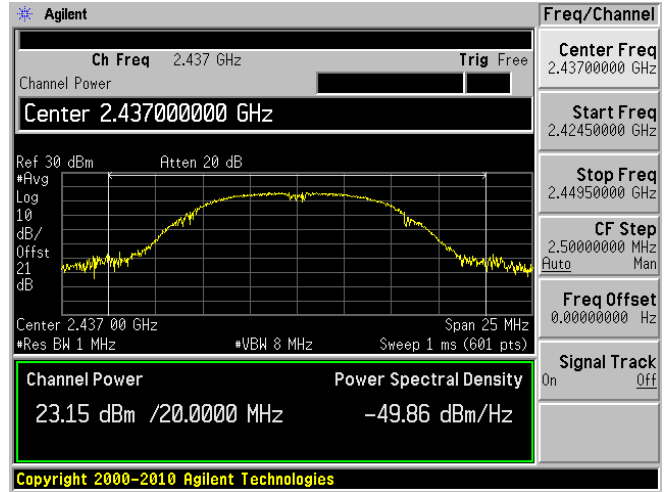
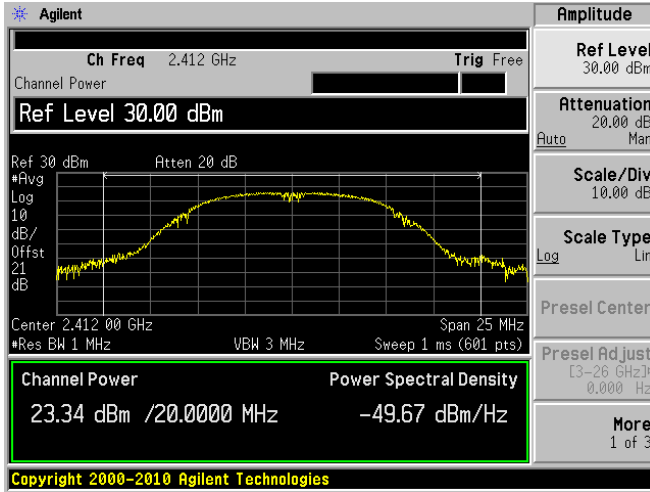
Channel	Frequency (MHz)	TX Antenna 0 Power (dBm)	TX Antenna 1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	18.41	17.80	21.13	30	-8.9
Middle	2437	22.34	21.48	24.94	30	-5.1
High	2462	17.49	17.50	20.51	30	-9.5

Please refer to the following plots for detailed test results

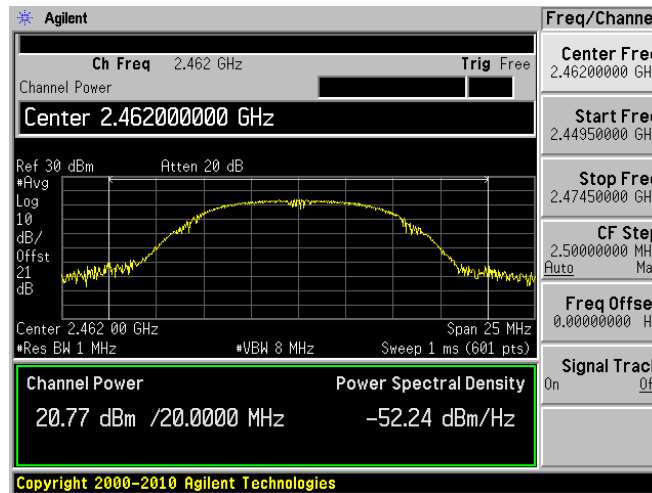
Antenna 0, 802.11b mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



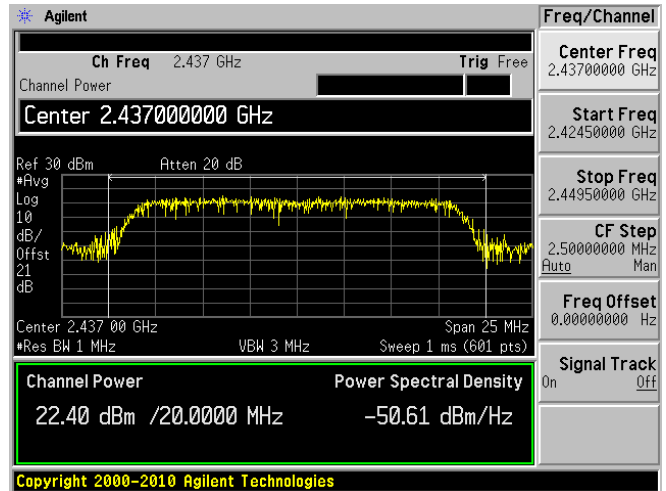
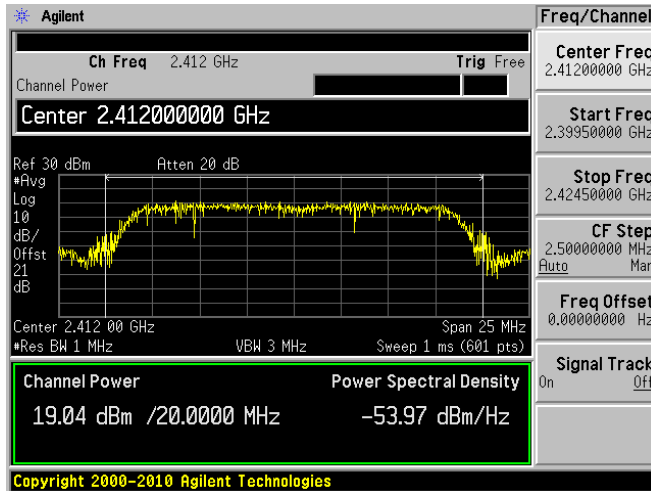
High channel: 2462 MHz



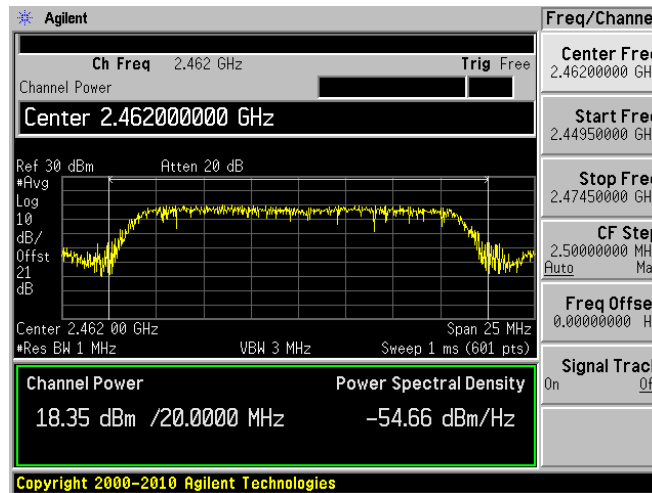
Antenna 0, 802.11g mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



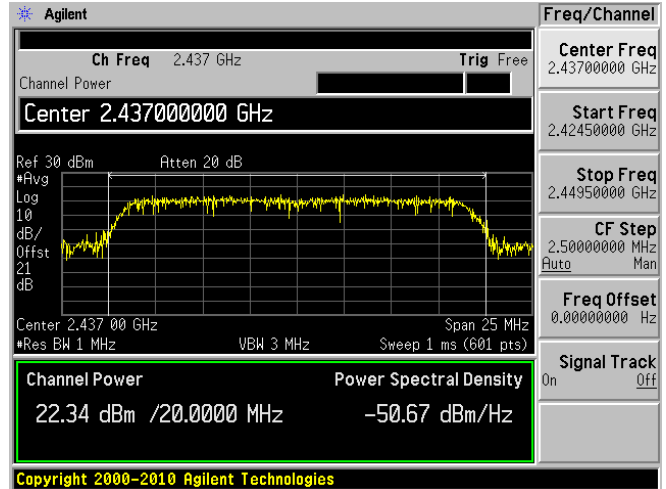
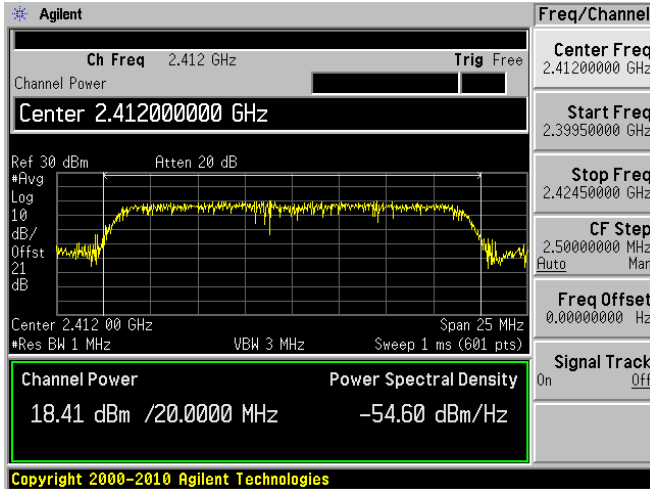
High channel: 2462 MHz



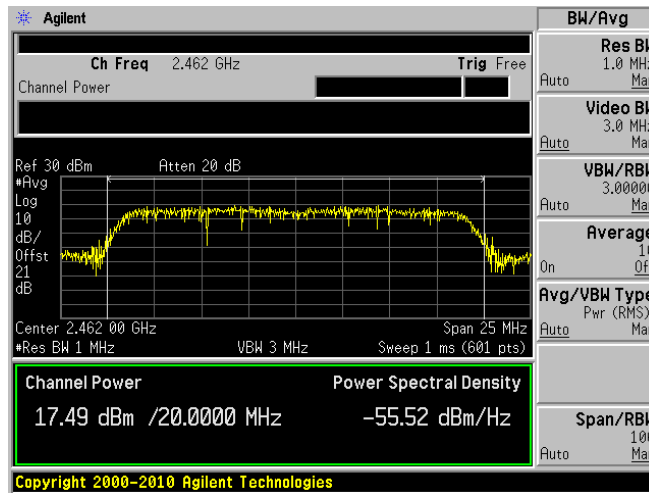
Antenna 0, 802.11n mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



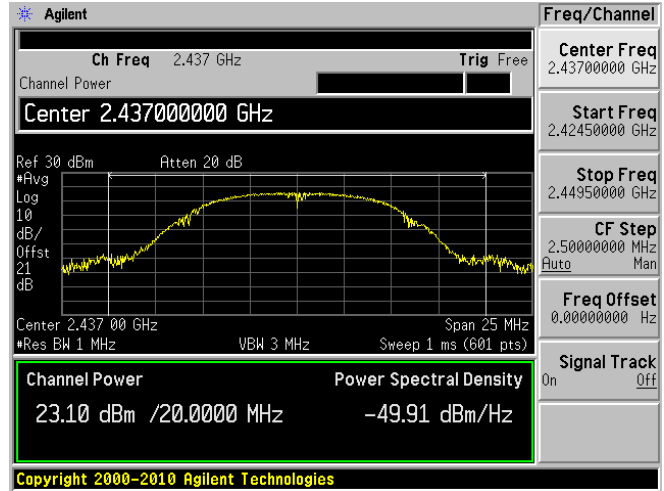
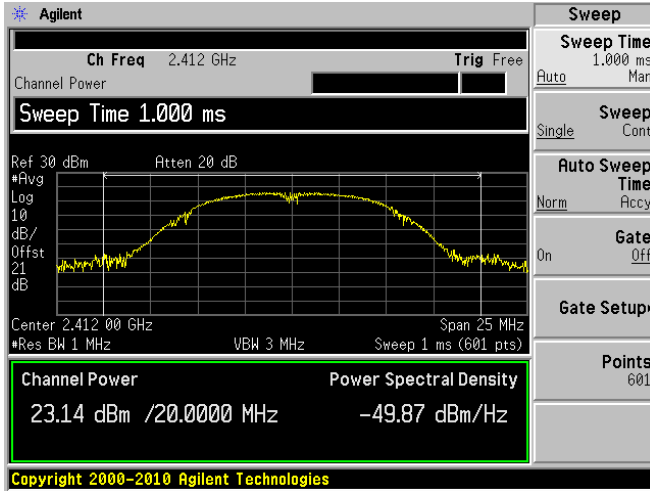
High channel: 2462 MHz



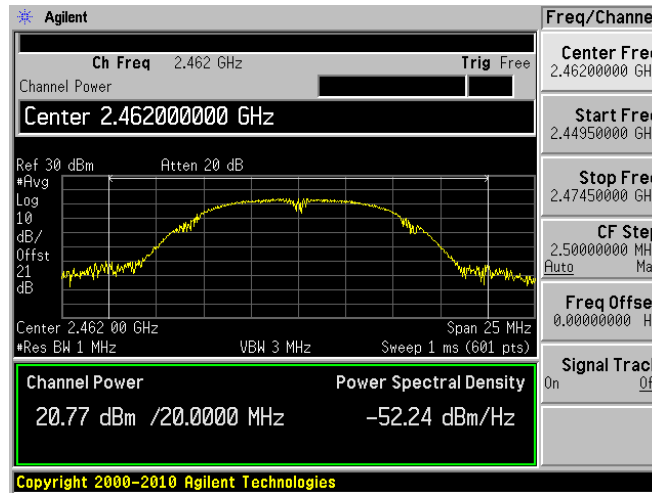
Antenna 1, 802.11b mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



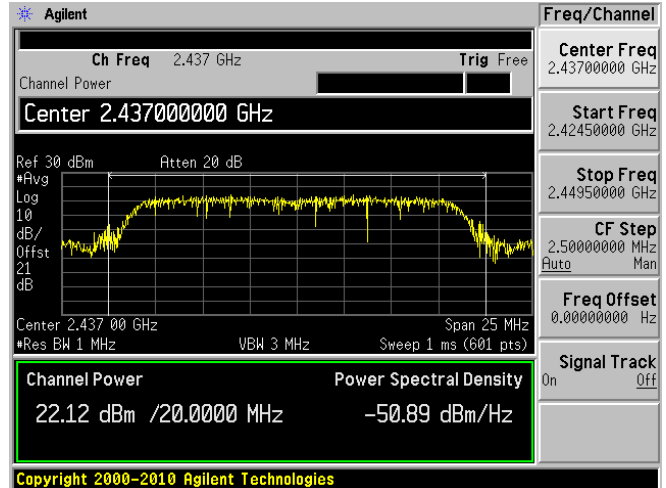
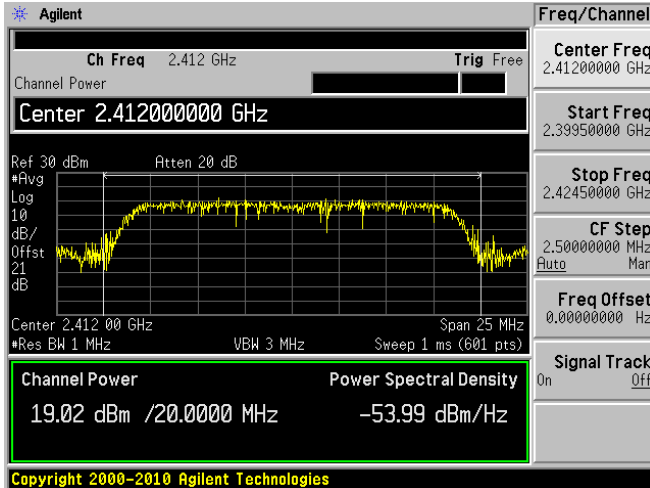
High channel: 2462 MHz



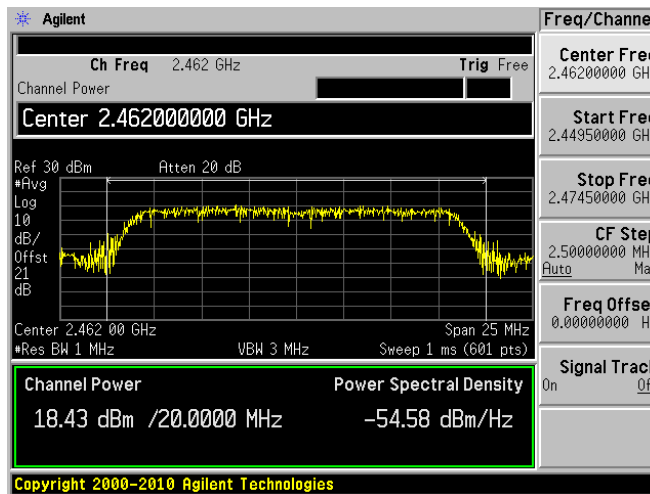
Antenna 1, 802.11g mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



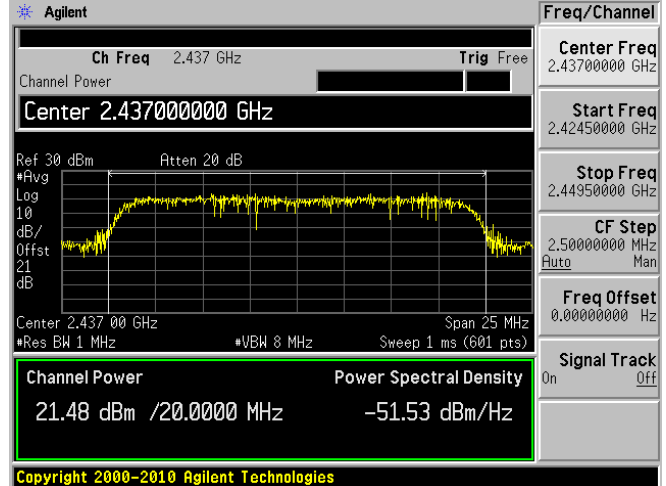
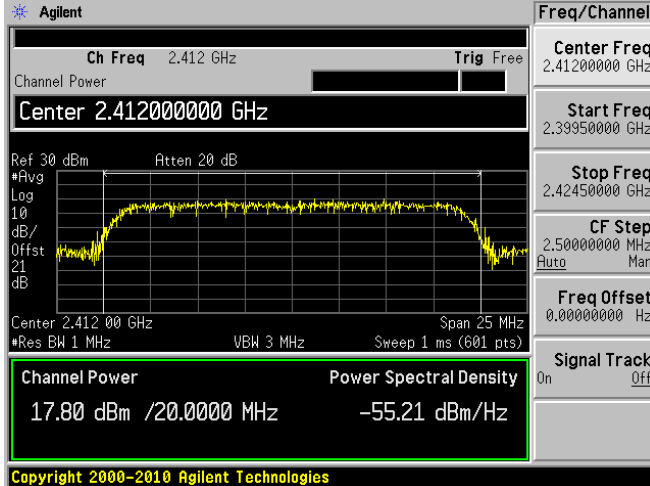
High channel: 2462 MHz



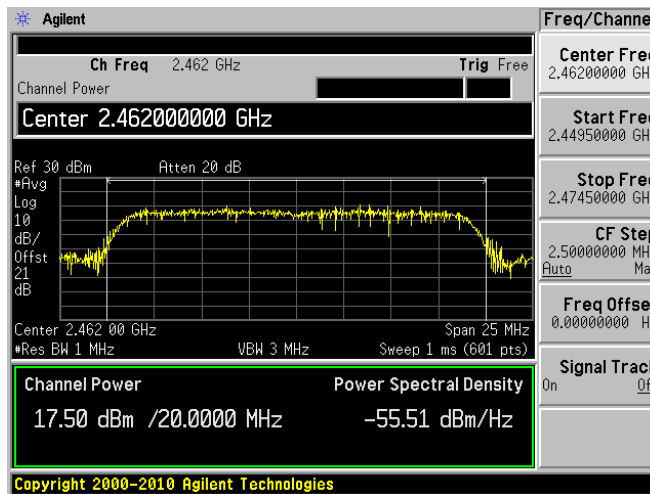
Antenna 1, 802.11n mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



High channel: 2462 MHz



11 FCC §15.247(d) – 100 kHz Bandwidth of Band Edges

11.1 Applicable Standard

According to FCC §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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

11.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency 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 100 kHz bandwidth from band edge.
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.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

11.4 Test Environmental Conditions

Temperature:	22.8 °C
Relative Humidity:	58%
ATM Pressure:	101.4kPa

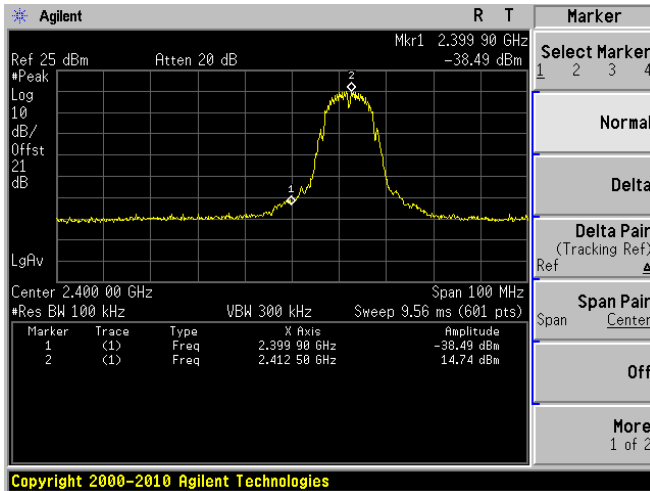
The testing was performed by Lionel Lara on 2012-08-17 at the RF Site.

11.5 Test Results

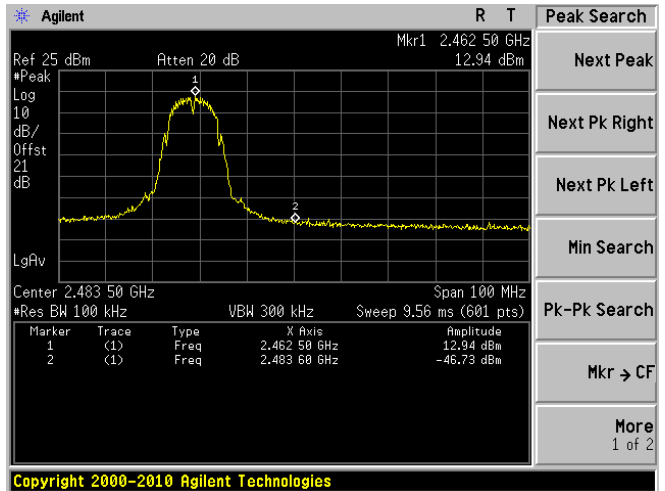
Please refer to following pages for plots of band edge.

Antenna 0, 802.11b mode

Low Band Edge

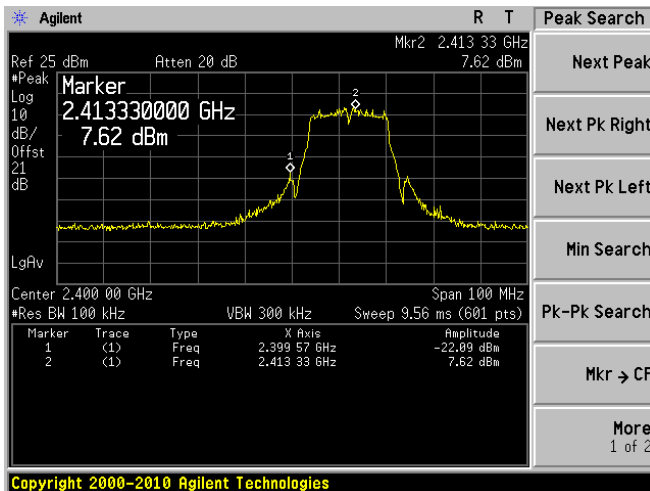


High Band Edge

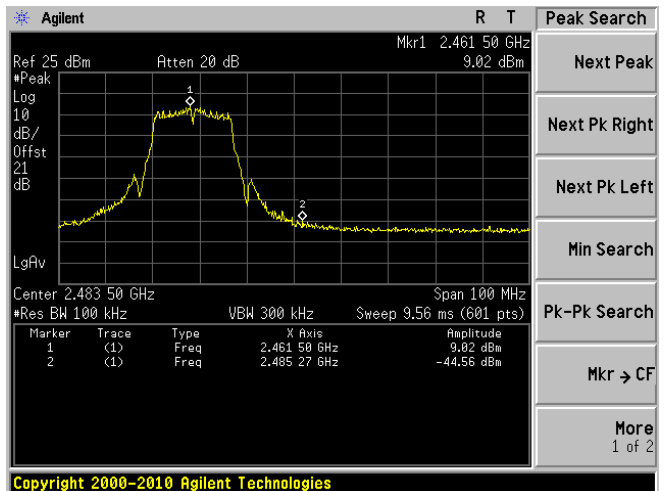


Antenna 0, 802.11g mode

Low Band Edge

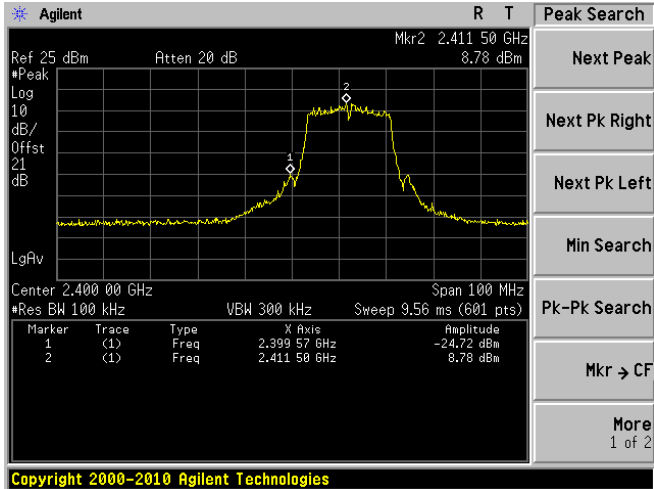


High Band Edge

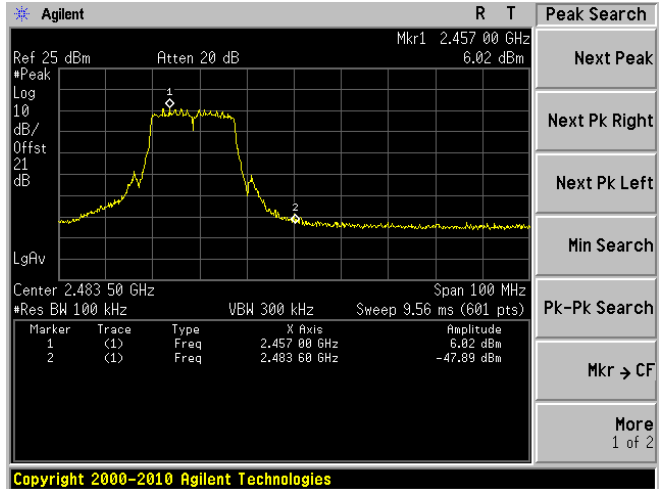


Antenna 0, 802.11n mode

Low Band Edge

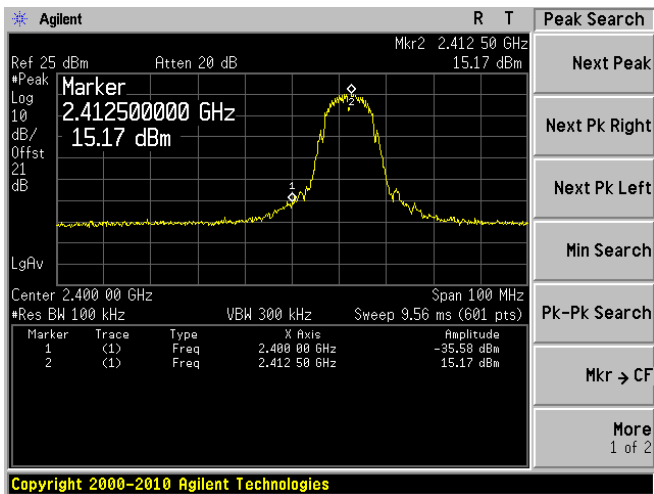


High Band Edge

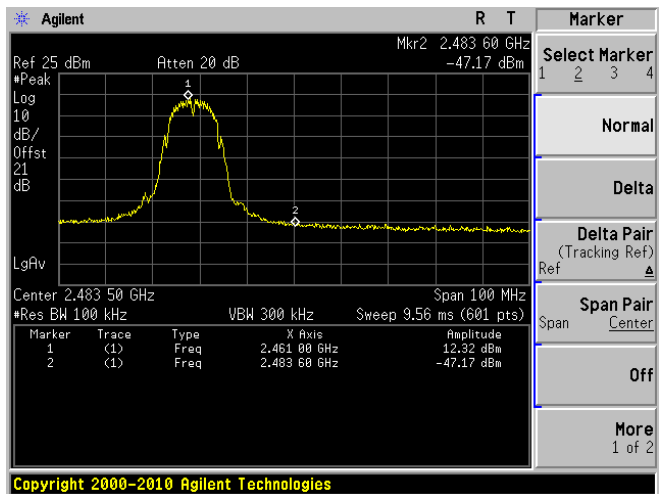


Antenna 1, 802.11b mode

Low Band Edge

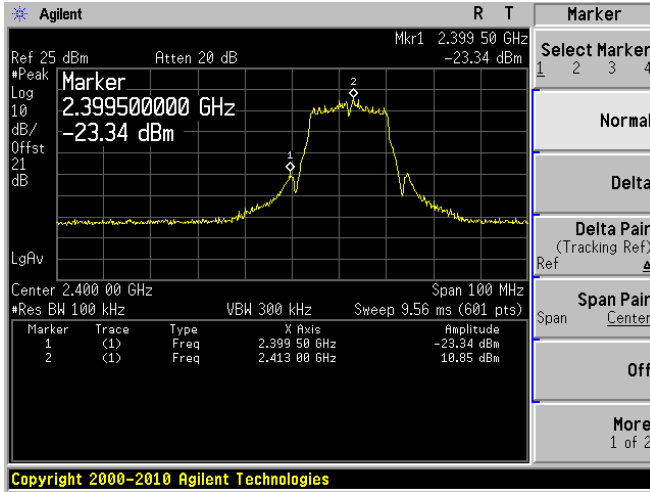


High Band Edge

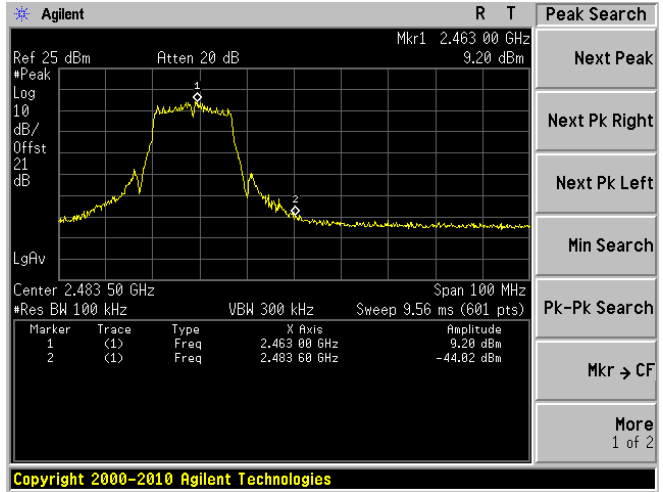


Antenna 1, 802.11g mode

Low Band Edge

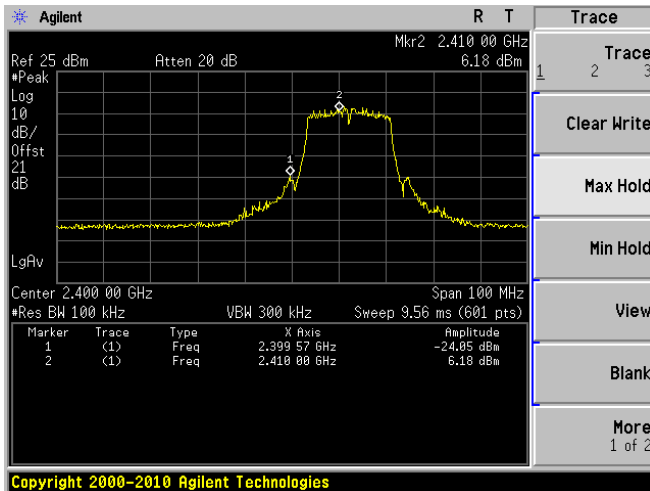


High Band Edge

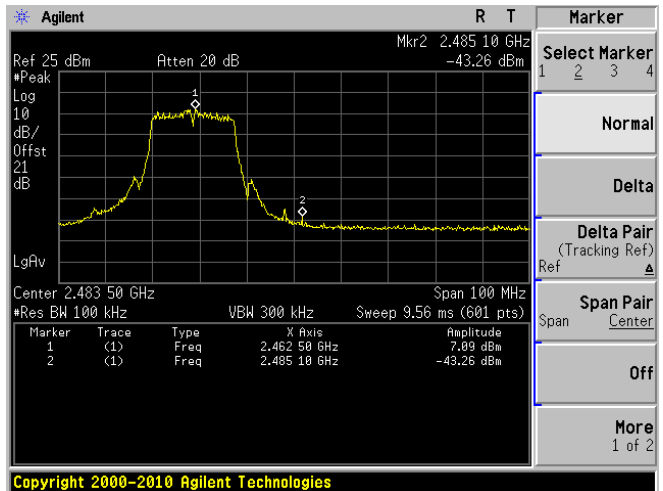


Antenna 1, 802.11n mode

Low Band Edge



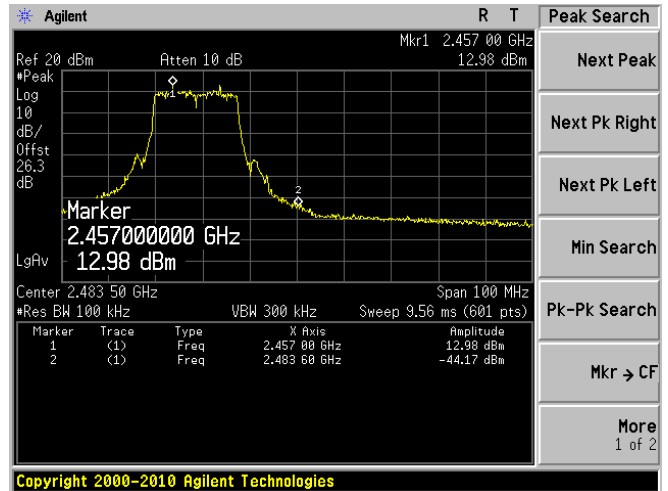
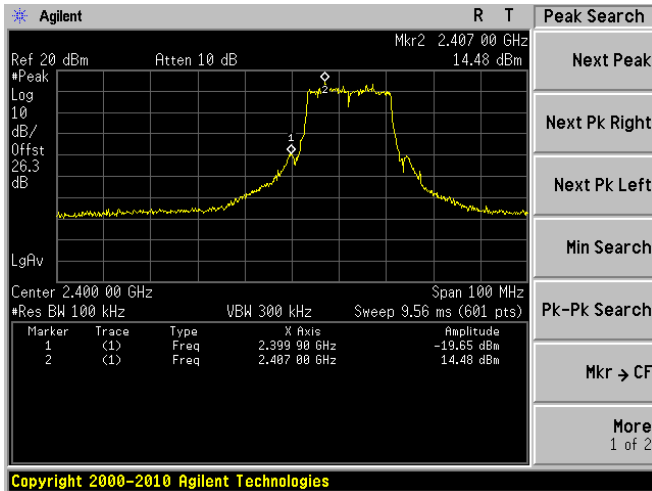
High Band Edge



Antenna 0+1, 802.11n mode

Low Band Edge

High Band Edge



12 FCC §15.247(e) – Power Spectral Density

12.1 Applicable Standard

According to FCC §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.

12.2 Measurement Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 100 kHz.
3. Set the VBW \geq 300 kHz.
4. Set the span to 5-30 % greater than the EBW.
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 power level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(3\text{ kHz}/100\text{ kHz} = -15.2\text{ dB})$.
11. The resulting peak PSD level must be \leq 8 dBm.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-05-10

Statement of Traceability: BA CL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

12.4 Test Environmental Conditions

Temperature:	23.9 °C
Relative Humidity:	59%
ATM Pressure:	101.0kPa

The testing was performed by Lionel Lara on 2012-08-14 at the RF Site.

12.5 Test Results

Antenna 0, 802.11b mode:

Channel	Frequency (MHz)	Power Spectral Density (dBm/100 kHz)	Corrected PSD (dBm)	FCC Limit (dBm/3 kHz)	Results
Low	2412	15.07	-0.13	8	Pass
Mid	2437	14.70	-0.50	8	Pass
High	2462	12.67	-2.53	8	Pass

Antenna 0, 802.11g mode:

Channel	Frequency (MHz)	Power Spectral Density (dBm/100 kHz)	Corrected PSD (dBm)	FCC Limit (dBm/3 kHz)	Results
Low	2412	10.40	-4.80	8	Pass
Mid	2437	12.33	-2.87	8	Pass
High	2462	10.02	-5.18	8	Pass

Antenna 1, 802.11b mode:

Channel	Frequency (MHz)	Power Spectral Density (dBm/100 kHz)	Corrected PSD (dBm)	FCC Limit (dBm/3kHz)	Results
Low	2412	15.00	-0.20	8	Pass
Mid	2437	14.65	-0.55	8	Pass
High	2462	12.50	-2.70	8	Pass

Antenna 1, 802.11g mode:

Channel	Frequency (MHz)	Power Spectral Density (dBm/100 kHz)	Corrected PSD (dBm)	FCC Limit (dBm/3 kHz)	Results
Low	2412	9.52	-5.68	8	Pass
Mid	2437	12.51	-2.69	8	Pass
High	2462	8.84	-6.36	8	Pass

Antenna 0+1, 802.11n mode:

Antenna 0

Channel	Frequency (MHz)	Power Spectral Density (dBm/100 kHz)	Corrected PSD (dBm)
Low	2412	8.35	-6.85
Mid	2437	10.89	-4.31
High	2462	6.08	-9.12

Antenna 1

Channel	Frequency (MHz)	Power Spectral Density (dBm/100 kHz)	Corrected PSD (dBm)
Low	2412	6.98	-8.22
Mid	2437	10.69	-4.51
High	2462	6.28	-8.92

Antenna 0+1

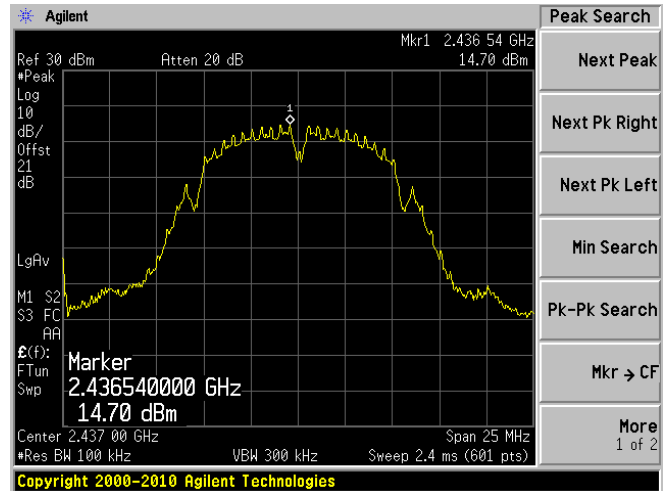
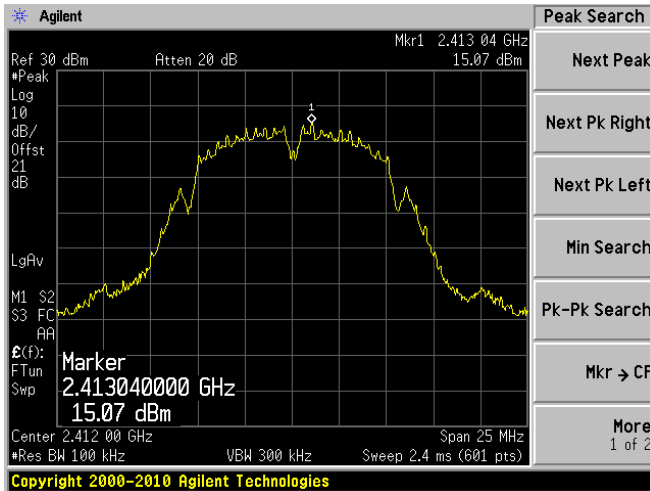
Channel	Frequency (MHz)	Combined PSD (dBm)	FCC Limit (dBm/3 kHz)	Results
Low	2412	-4.47	8	Pass
Mid	2437	-1.40	8	Pass
High	2462	-6.01	8	Pass

Please refer to the following plots for detailed test results:

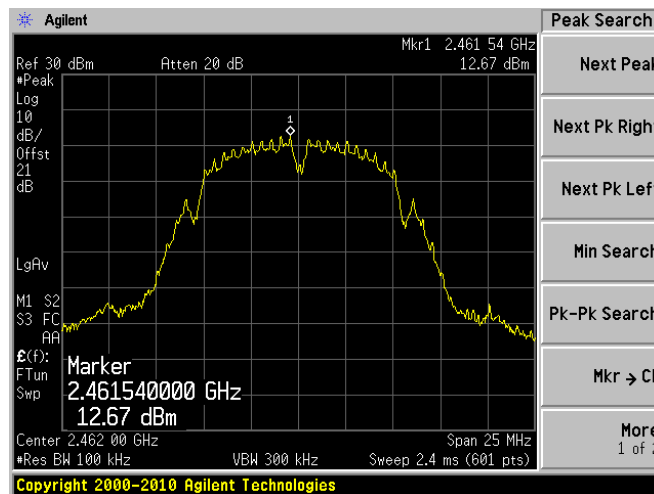
Antenna 0, 802.11b mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



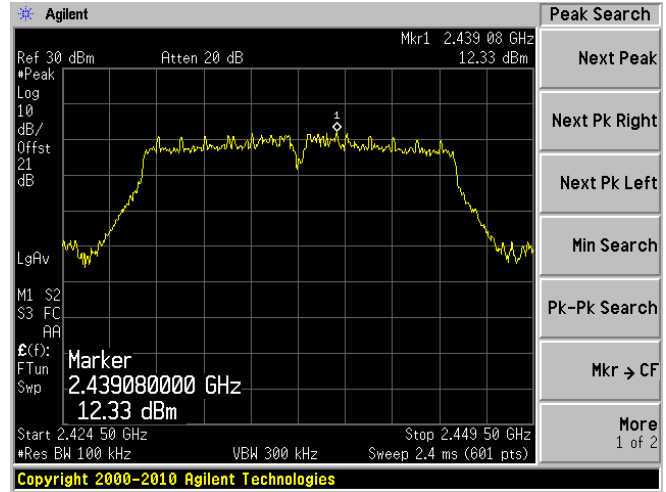
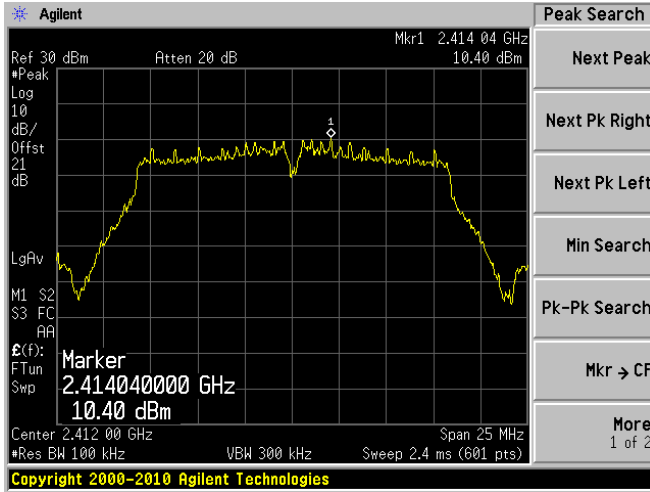
High channel: 2462 MHz



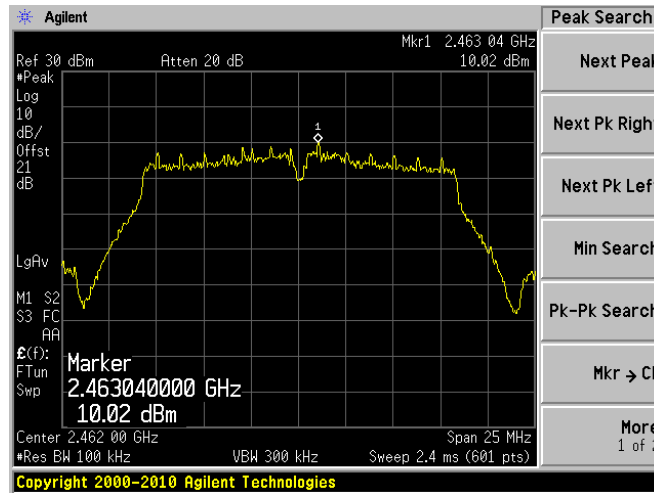
Antenna 0, 802.11g mode

Low channel: 2412 MHz

Middle channel: 2437 MHz

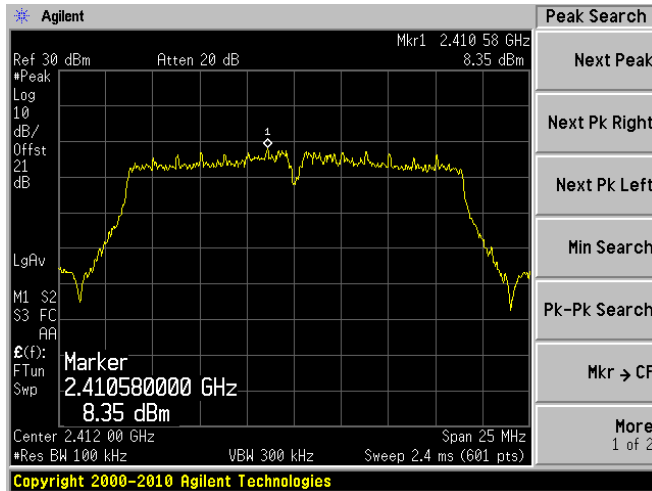


High channel: 2462 MHz

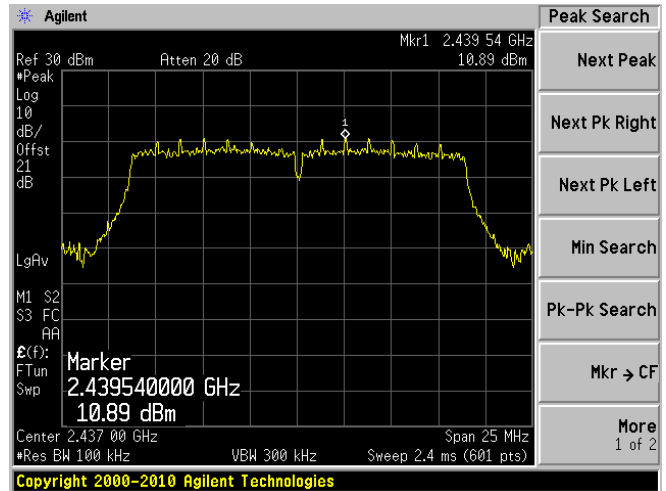


Antenna 0, 802.11n mode

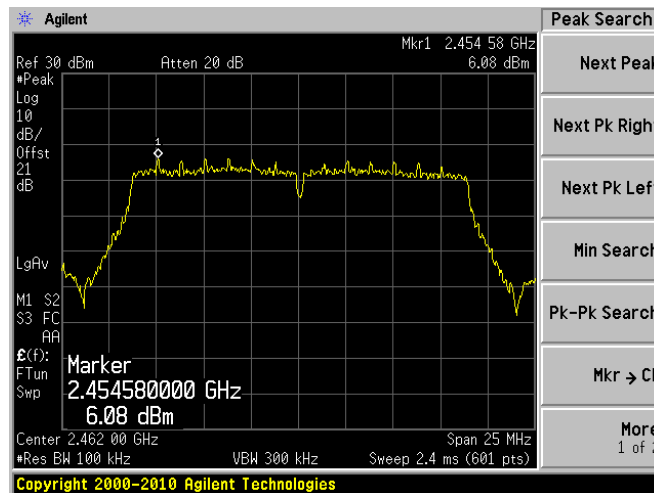
Low channel: 2412 MHz



Middle channel: 2437 MHz



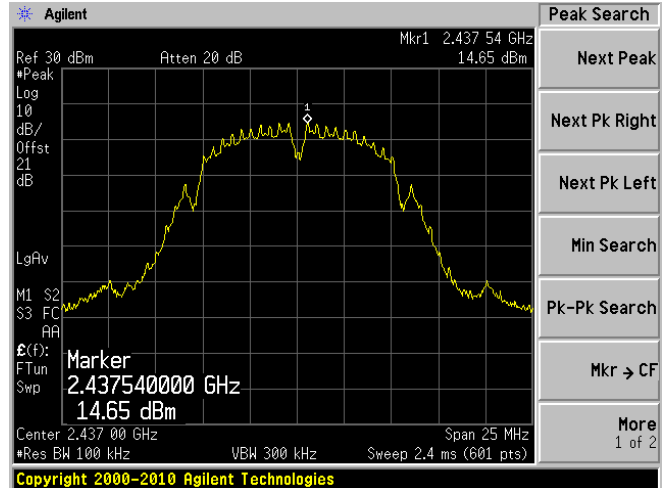
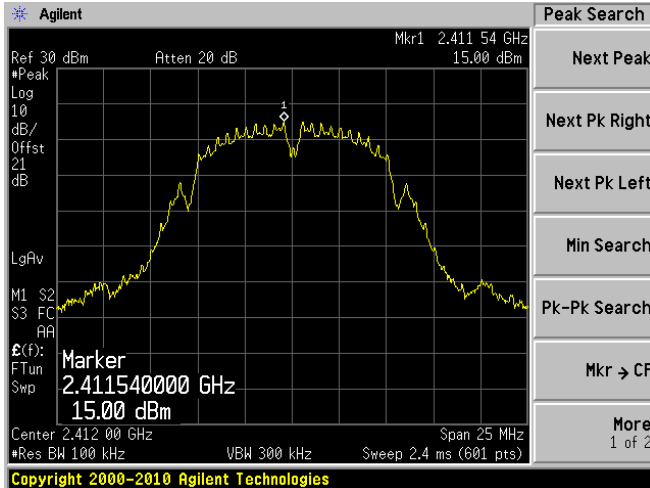
High channel: 2462 MHz



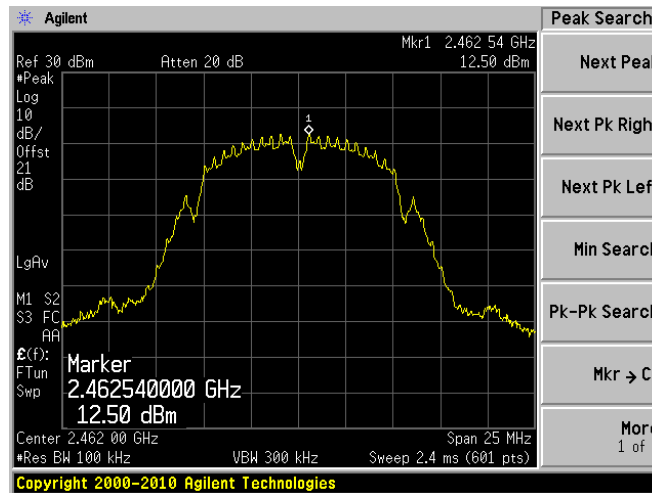
Antenna 1, 802.11b mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



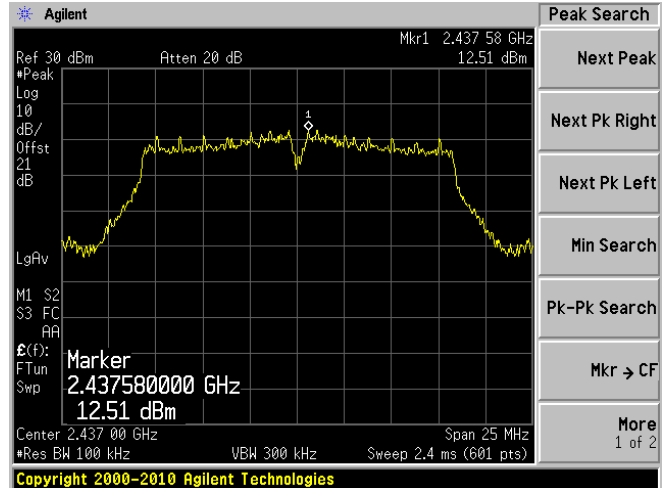
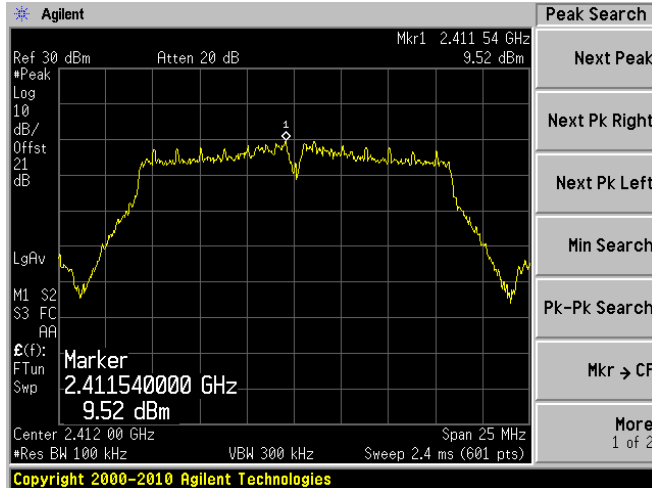
High channel: 2462 MHz



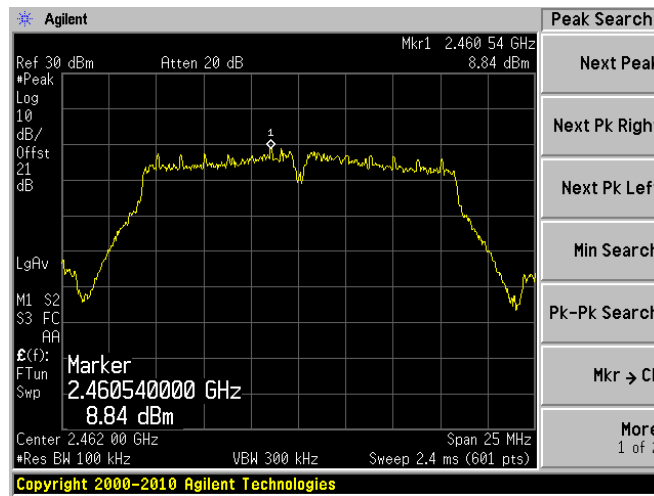
Antenna 1, 802.11g mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



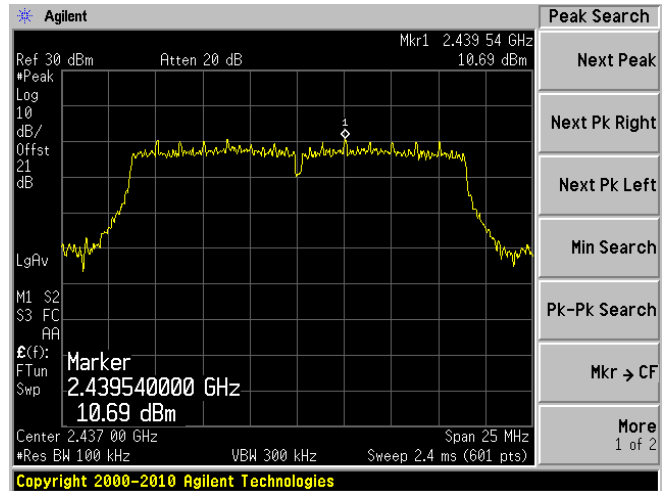
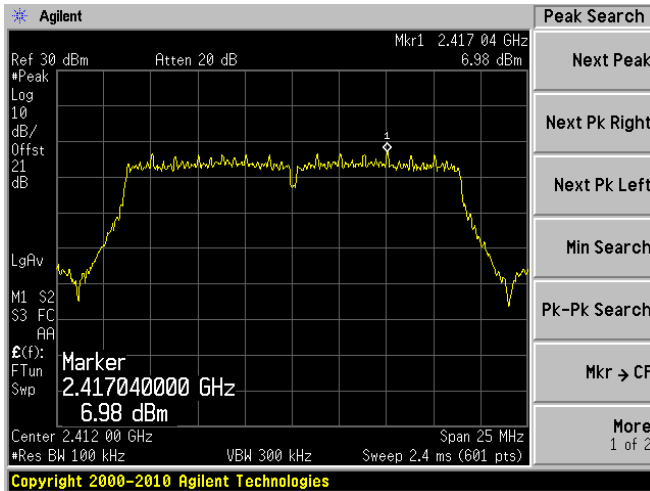
High channel: 2462 MHz



Antenna 1, 802.11n mode

Low channel: 2412 MHz

Middle channel: 2437 MHz



High channel: 2462 MHz

