Lab Code: 200167-0

FCC PART 15.247

INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007

MEASUREMENT AND TEST REPORT

For

Trimble Navigation New Zealand

11 Birmingham Drive
P.O. Box 8729
Riccarton, Christchurch, New Zealand

FCC ID: JUP614
IC: 1756A-614

Report Type:	**Product Type:**
☒ Original Report (rev. 1)	Bluetooth, GPS Receiver and 802.11b/g Device

Test Engineer(s):	Steve Xue
Report Number:	R0803171-a (WI)
Testing Date(s)	2008-04-03 through 2008-04-08
Report Date:	2008-04-23
Reviewed By:	Sr. RF Test Engineer, Boni Baniqued
Prepared By: (24)	Bay Area Compliance Laboratories Corp. 1274 Anvilwood Ave. Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732-9164

TABLE OF CONTENTS

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The *Trimble Navigation New Zealand* product, FCC ID: JUP614 or the "EUT" as referred to in this report, is a wireless Bluetooth, GPS Receiver and 802.11 b/g device.

1.2 Mechanical Description of EUT

The *Trimble Navigation New Zealand* product, FCC ID: JUP614 is a portable device and measures approximately 21.5 cm **(L)** x 9.9 cm **(W)** x 7.7 cm **(H)**, weighing approximately *0.78 kg*.

1.3 Objective

This report is prepared on behalf of *Trimble Navigation New Zealand.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules and Industry Canada RSS-210 Issue 7, June 2007.

The objective is to determine compliance with FCC and IC standards, rules and limits for this device including:

- RF Exposure
- Antenna Requirement
- Conducted Emissions
- Radiated Spurious Emissions
- Restricted Band
- Receiver Spurious Emissions
- 6 dB Bandwidth & 99% Bandwidth
- Maximum Peak Output Power
- 100 kHz Bandwidth of Frequency Band Edge
- Power Spectral Density

1.4 Related Submittal(s)/Grant(s)

Please see BACL report prepared on behalf of Trimble R0803171 (BT) for measurement and testing required for the Bluetooth portion of this device.

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, 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 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 NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from $\pm$2.0 for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

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 sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has 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 facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: C-2463 and R-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2001670.htm

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The host system was configured for testing according to ANSI C63.4-2003.

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

2.2 EUT Exercise Software

The EUT exercise software (DuTapi CF8385) is provided by the client and the following power setting and data rate were used during the testing:

Mode	2412 MHz	2437 MHz	2472 MHz	Data Rate
802.11b	20 dBm	20 dBm	20 dBm	1Mbps
802.11g	20 dBm	20 dBm	20dBm	6Mbps

2.3 Special Accessories

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

2.4 Equipment Modifications

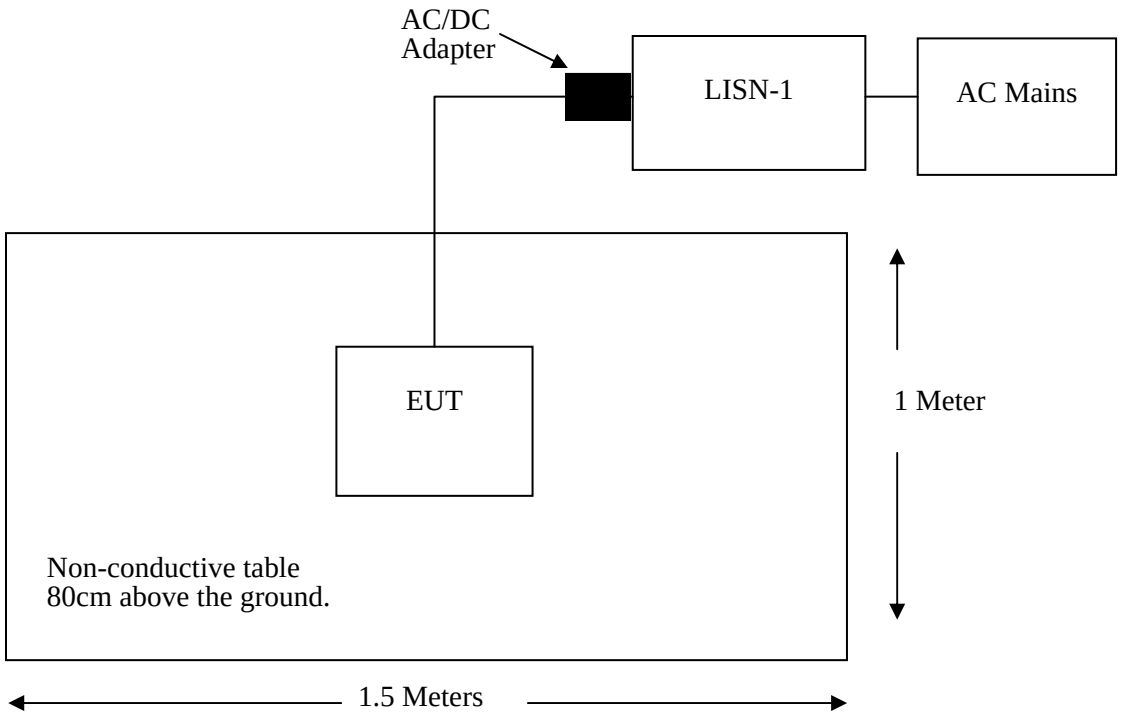
No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

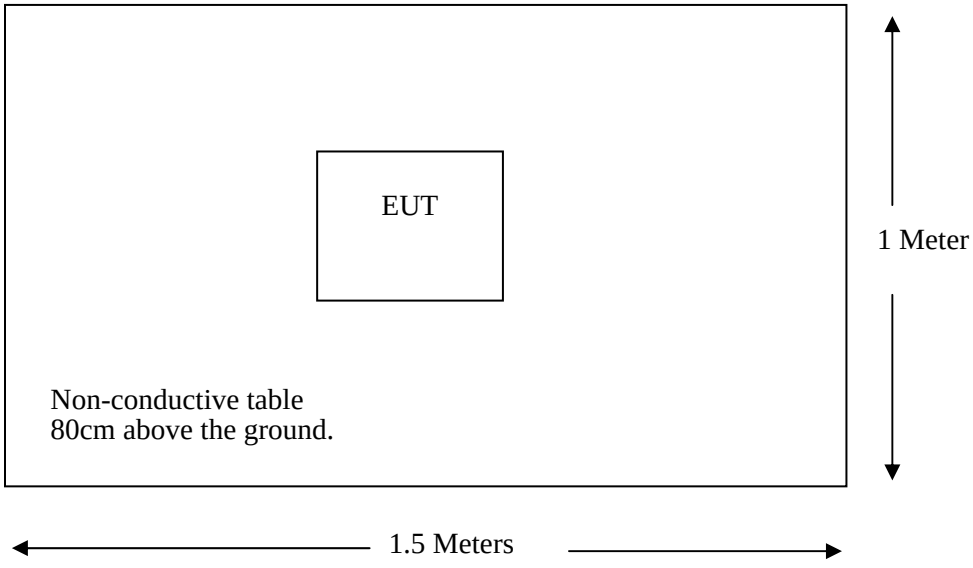
N/A

2.6 Test Setup Block Diagrams

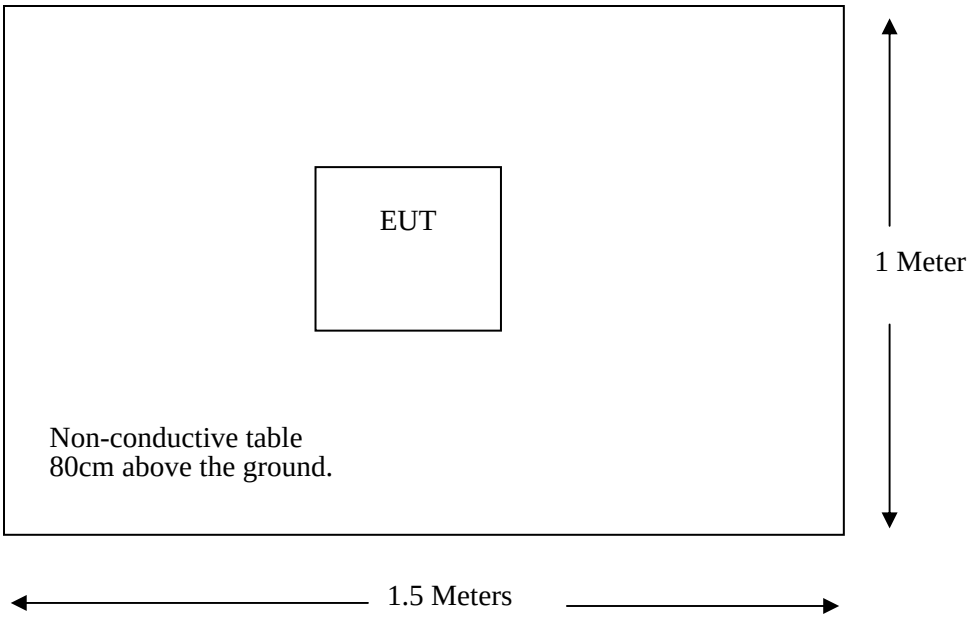
Conducted Emissions



Receiver Radiated Emissions



Transmitter Radiated Emission



3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC Part15C & RSS-210 Rules	Description of Test	Result	Note
FCC §15.247 (i) and §2.1091, IC RSS-Gen 5.5 & RSS-102	RF Exposure	Compliant	-
FCC §15.203, IC RSS-Gen §7.1.4	Antenna Requirement	Compliant	-
FCC §15.207, IC RSS-Gen §7.2.2	AC line Conducted Emissions	Compliant	-
§15.205, §15.209 & IC RSS-Gen §4.9	Radiated Spurious Emissions	Compliant	-
FCC §15.205, RSS 210 § 2.6	Restricted Band	Compliant	-
§15.109, RSS-Gen § 6(a)	Receiver Spurious Emissions	Compliant	-
§15.247 (a)(2), RSS-210 § A8.2 (a)	6 dB Bandwidth & 99% Bandwidth	Compliant	-
§15.247 (b)(3), RSS210 § A8.4	Maximum Peak Output Power	Compliant	-
§ 15.247 (d), RSS210 § A8.5	Band Edge	Compliant	-

4 FCC §15.247 (i) and §2.1093, IC RSS-Gen 5.5 & RSS-102 - RF EXPOSURE

4.1 Applicable Standard

According to §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

According to FCC Exclusion list, In the following table, fGHz is mid-band frequency in GHz, and d is the distance to a person'sbody, excluding hands, wrists, feet, and ankles.

Exposure category	low threshold	high threshold
general population	$(60/f_{GHz})$ mW, $d < 2.5$ cm $(120/f_{GHz})$ mW, $d \geq 2.5$ cm	$(900/f_{GHz})$ mW, $d < 20$ cm
occupational	$(375/f_{GHz})$ mW, $d < 2.5$ cm $(900/f_{GHz})$ mW, $d \geq 2.5$ cm	$(2250/f_{GHz})$ mW, $d < 20$ cm

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evaluation is not required, portable transmitters with output power greater than the applicable low threshold require SAR evaluation to qualify for TCB approval.

According to RSS-102 Issue 2, November 2005 §2.5.1 Exemption from Routine Evaluation Limits – SAR Evaluation

SAR evaluation is required if the separation distance between the user and the device is less than or equal to 20 cm, except when the device operates:

- above 2.2 GHz up to 3 GHz inclusively and its output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based time-averaged output power) is less than, or equal to 20 mW for General Public Use and 100 mW for Controlled Use;

4.2 Result:

This is a portable device and the Max peak output power are 17.685 mW (802.11b) and 9.016 mW (802.11g) < 24.59 = (60/2.437GHz) mW The SAR measurement is exempt.

According to RSS-102 section 2.5.1, this device exempts the RF exposure evaluation.

5 FCC §15.203, IC RSS-GEN §7.1.4 – ANTENNA REQUIREMENT

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.

As per IC RSS-Gen §7.1.4: Transmitter Antenna, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

5.2 Result

The Antenna is an integral antenna with a gain of: 0 dBi.

☒ **Compliant** ☐ **N/A**

6 FCC §15.207, IC RSS-Gen §7.2.2 - CONDUCTED EMISSIONS

6.1 Section 15.207 & RSS-Gen 7.2.2 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 µH/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 *	56 to 46 *
0.5-5	56	46
5-30	60	50

** 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 – 2003 measurement procedure. The specification used was FCC Class B limits.

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

The EUT was powered via connection to AC/DC adapter, which was plugged into the LISN.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Solar Electronics	LISN	9252-R-24-BNC	511205	2007-07-07
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100338	2008-04-05

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

6.4 Test Procedure

During the conducted emissions test, the power cord of the system was connected to the main 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".

6.5 Environmental Conditions

Temperature:	27 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

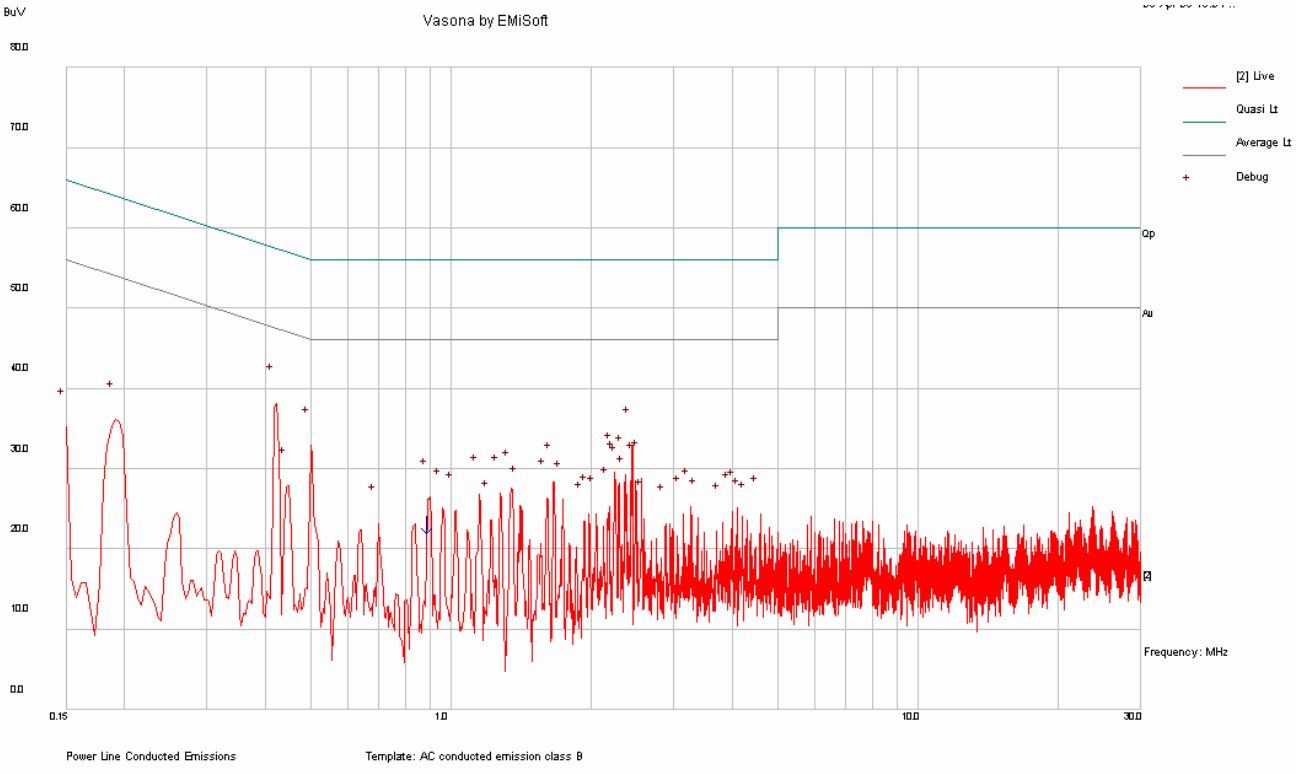
**The testing was performed by Steve Xue on 2008-04-03.*

6.6 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC & IC standard's conducted emissions limits, with the *worst* margin reading of:

Connection: AC/DC Adapter			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Hot/Neutral)**	**Range (MHz)**
-9.25	0.422	Neutral	0.15 to 30

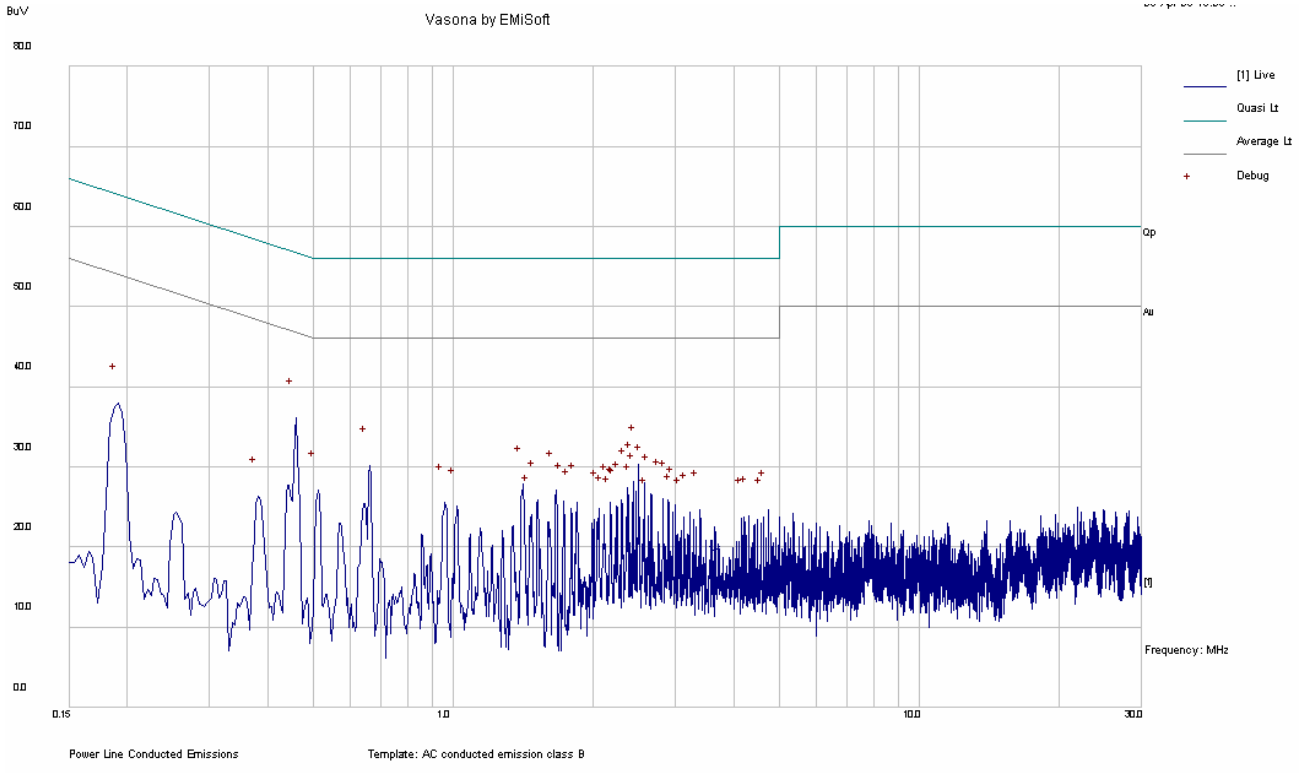
120V / 60 Hz Neutral:



Frequency (MHz)	Peak (dBµV)	Conductor (Live/Neutral)	Limit (dBµV)	Margin (dB)
0.422	38.15	Neutral	47.4	-9.25
2.445	32.88	Neutral	46.0	-13.12
0.501	32.84	Neutral	46.0	-13.16
2.236	29.58	Neutral	46.0	-16.42
2.359	29.29	Neutral	46.0	-16.71
2.553	28.73	Neutral	46.0	-17.27

Note: The peak emission levels are below the average limit, thus average and quasi-peak measurements have been omitted.

120V / 60 Hz Live:



Frequency (MHz)	Peak (dBµV)	Conductor (Hot/Neutral)	Limit (dBµV)	Margin (dB)
0.460	36.16	Hot	46.70	-10.54
2.493	30.34	Hot	46.00	-15.66
0.661	30.17	Hot	46.00	-15.83
0.191	38.00	Hot	53.99	-15.99
2.437	28.20	Hot	46.00	-17.80
2.568	27.98	Hot	46.00	-18.02

Note: The peak emission levels are below the average limit, thus average and quasi-peak measurements have been omitted.

7 FCC §15.109, §15.205, §15.209 & §15.247(c), IC RSS-Gen §4.9 - SPURIOUS RADIATED EMISSIONS

7.1 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 §15.247(c)(1)(i): Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

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)).

IC RSS-GEN §4.9 the measurement method shall be described in the test report. The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements. The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

7.2 Test Setup

The radiated emissions tests were performed in the 3-meter open area test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

7.3 EUT Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15C limits.

The spacing between the peripherals was 10 centimeters.

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

7.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonoma Instruments	Pre amplifier	317	260407	2007-04-26
HP	Pre amplifier	8449B	3147A00400	2007-08-21
Sunol Science Corp	Combination Antenna	JB1 Antenna	A020106-1	2007-05-21
A.R.A	Antenna Horn	DRG-118/A	1132	2007-06-18
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

7.5 Test Procedure

For the radiated emissions test, the EUT, 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 meters away from the testing antenna, which is varied from 1-4 meters, 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 1000MHz:

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

Above 1000MHz:

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

7.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

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

Margin = Corrected Amplitude - Limit

7.7 Environmental Conditions

Temperature:	27 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by Steve Xue on 2008-04-09.*

7.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC and IC requirements, and had the worst margin readings of:

Unintentional Emissions, (30-1000 MHz):

Mode: Receiver			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-20.02	215.444	Vertical	30 MHz to 1000 MHz

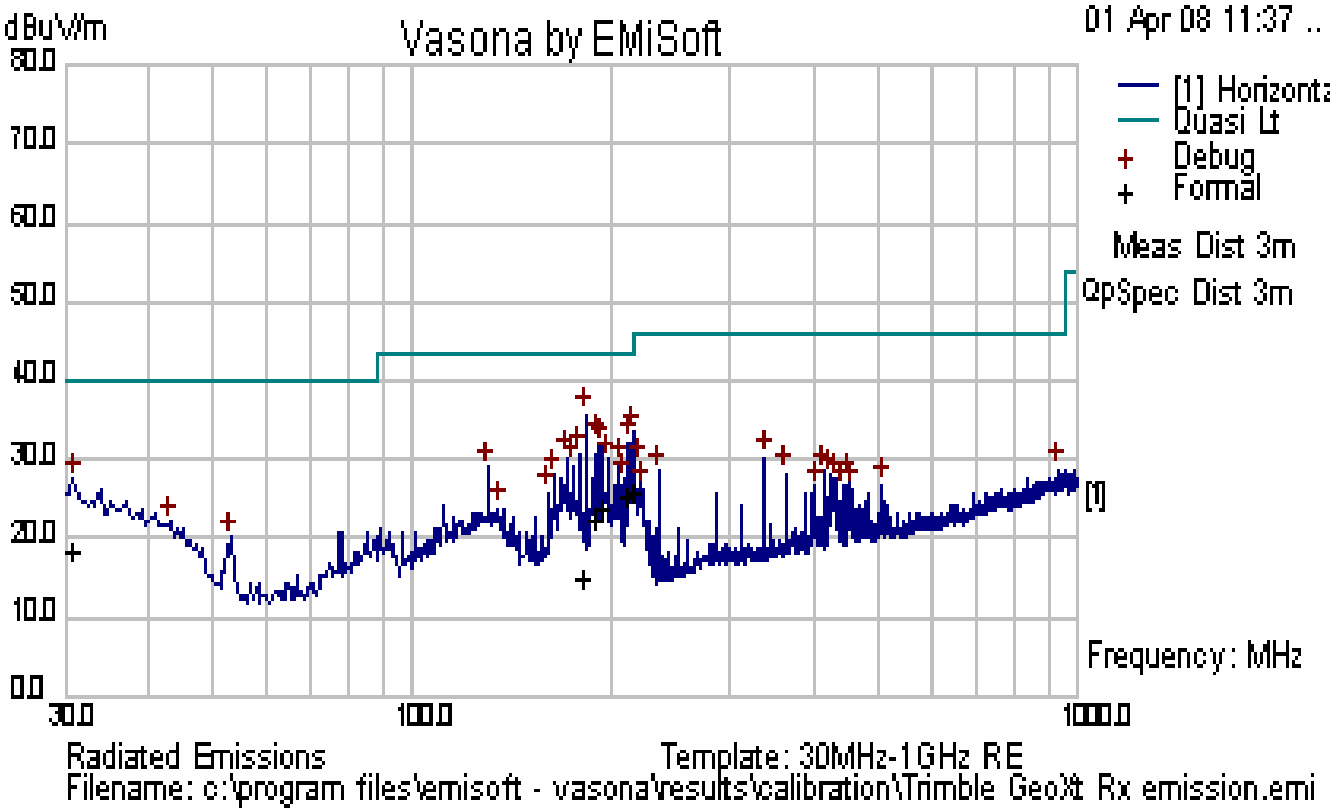
Out of Band Emissions:

Mode: 802.11b Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range (GHz)**
-11.06	4824.00	Horizontal	Low, 1 GHz – 25GHz
-8.51	4874.00	Horizontal	Middle, 1 GHz – 25GHz
-8.94	4924.00	Horizontal	High, 1 GHz – 25GHz

Mode: 802.11g Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range (GHz)**
-20.77	2725.00	Vertical	Low, 1 GHz – 25GHz
-20.57	2709.00	Vertical	Middle, 1 GHz – 25GHz
-20.56	2709.00	Horizontal	High, 1 GHz – 25GHz

7.9 Radiated Emissions Test plot & data:

Unintentional Emissions, (30-1000 MHz):



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (degrees)	Limit (dBµV/m)	Margin (dB)
215.444	23.48	133	V	84	43.5	-20.02
211.726	23.03	99	V	292	43.5	-20.47
193.145	21.38	262	V	31	43.5	-22.12
189.655	20.17	158	H	247	43.5	-23.33
31.200	16.22	256	V	19	40.0	-23.78
181.571	12.40	251	H	242	43.5	-31.10

7.10 Radiated Spurious Emissions Test Data

802.11b mode, 1 GHz – 25 GHz

Low channel 2412 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth (Degrees)	Ant. Height (m)	Ant. Polarity (H/V)	Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
4824.00	43.08	100	2.0	V	32.81	8.22	40.52	43.59	74	-30.41	Peak
4824.00	45.48	340	1.5	H	32.81	8.22	40.52	45.99	74	-28.01	Peak
4824.00	38.35	100	2.0	V	32.81	8.22	40.52	38.86	54	-15.14	Average
4824.00	42.43	340	1.5	H	32.81	8.22	40.52	42.94	54	-11.06	Average

Middle channel 2437 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth (Degrees)	Ant. Height (m)	Ant. Polarity (H/V)	Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
4874.00	44.58	220	1.5	V	32.81	8.31	40.35	45.35	74	-28.65	Peak
4874.00	47.63	350	1.5	H	32.81	8.31	40.35	48.40	74	-25.60	Peak
4874.00	42.32	220	1.5	V	32.81	8.31	40.35	43.09	54	-10.91	Average
4874.00	44.72	350	1.5	H	32.81	8.31	40.35	45.49	54	-8.51	Average

High channel 2462 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth (Degrees)	Ant. Height (m)	Ant. Polarity (H/V)	Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
4924.00	45.25	270	1.5	V	32.81	8.31	40.35	46.02	74	-27.98	Peak
4924.00	46.50	330	1.5	H	32.81	8.31	40.35	47.27	74	-26.73	Peak
4924.00	43.27	270	1.5	V	32.81	8.31	40.35	44.04	54	-9.96	Average
4924.00	44.29	330	1.5	H	32.81	8.31	40.35	45.06	54	-8.94	Average

802.11g mode, 1 GHz – 25 GHz

Low channel 2412 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth (Degrees)	Ant. Height (m)	Ant. Polarity (H/V)	Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
2725.00	46.86	270	1.5	V	33.6	8.22	40.52	48.16	74	-25.84	Peak
2726.00	46.27	330	1.5	H	32.81	8.22	40.52	46.78	74	-27.22	Peak
2725.00	32.72	270	1.5	V	32.81	8.22	40.52	33.23	54	-20.77	Average
2726.00	32.70	330	1.5	H	32.81	8.22	40.52	33.21	54	-20.79	Average

Middle channel 2437 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth (Degrees)	Ant. Height (m)	Ant. Polarity (H/V)	Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
2709.00	46.64	280	1.0	V	32.81	8.31	40.35	47.41	74	-26.59	Peak
2701.00	43.24	320	1.0	H	32.81	8.31	40.35	44.01	74	-29.99	Peak
2709.00	32.66	280	1.0	V	32.81	8.31	40.35	33.43	54	-20.57	Average
2701.00	32.59	320	1.0	H	32.81	8.31	40.35	33.36	54	-20.64	Average

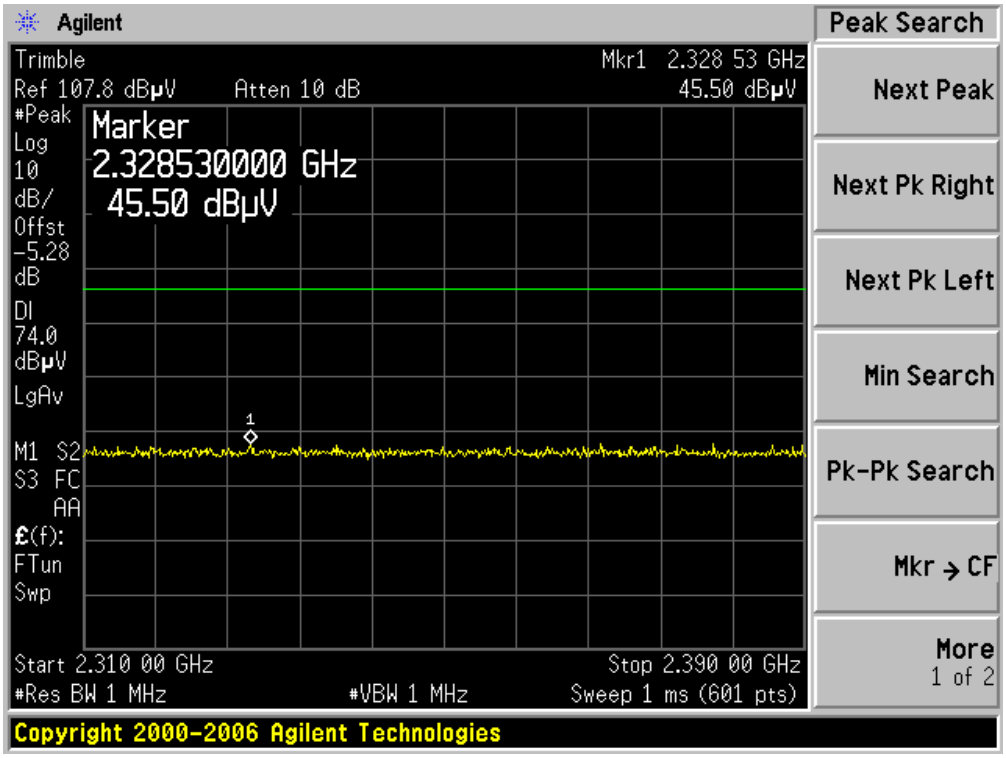
High channel 2462 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth (Degrees)	Ant. Height (m)	Ant. Polarity (H/V)	Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
2686.00	46.10	290	1.5	V	32.81	8.31	40.35	46.87	74	-27.13	Peak
2709.00	46.83	300	1.5	H	32.81	8.31	40.35	47.60	74	-26.40	Peak
2713.00	32.62	290	1.5	V	32.81	8.31	40.35	33.39	54	-20.61	Average
2709.00	32.67	300	1.5	H	32.81	8.31	40.35	33.44	54	-20.56	Average

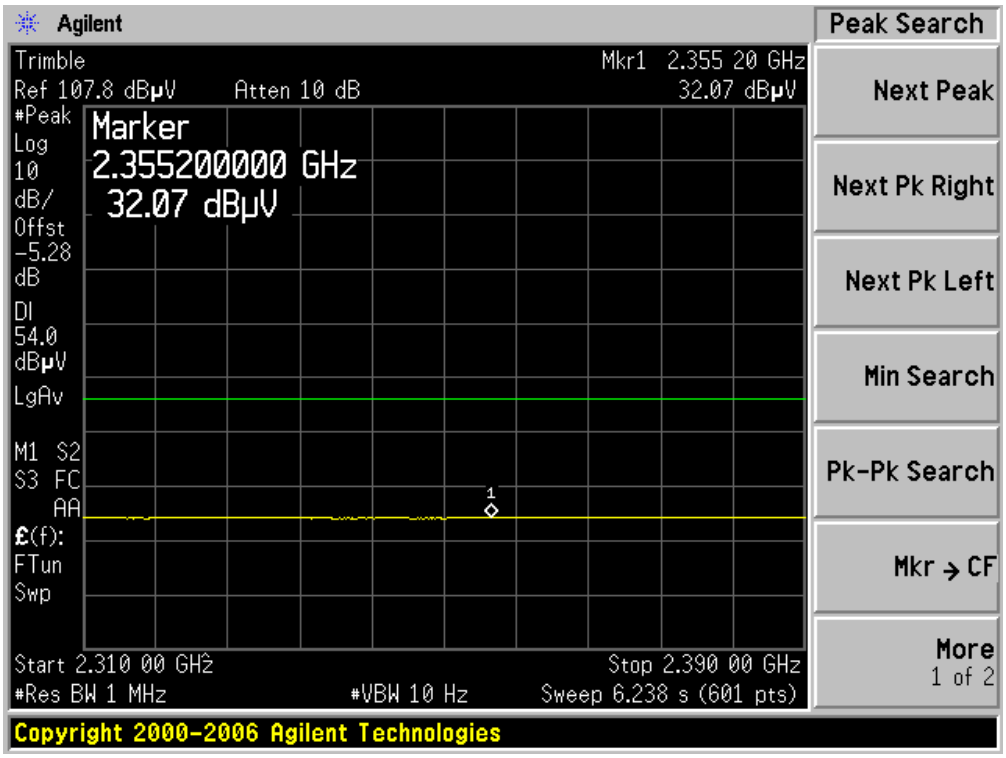
Restricted Band Edge

802.11b mode @ Low Channel

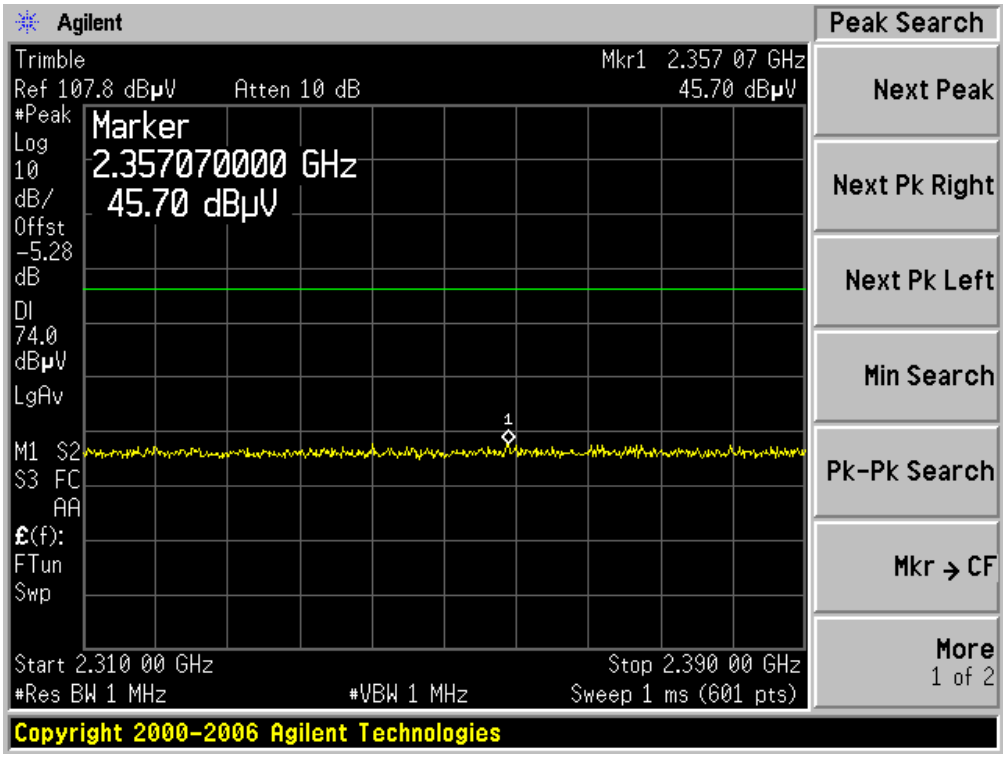
Peak, Horizontal



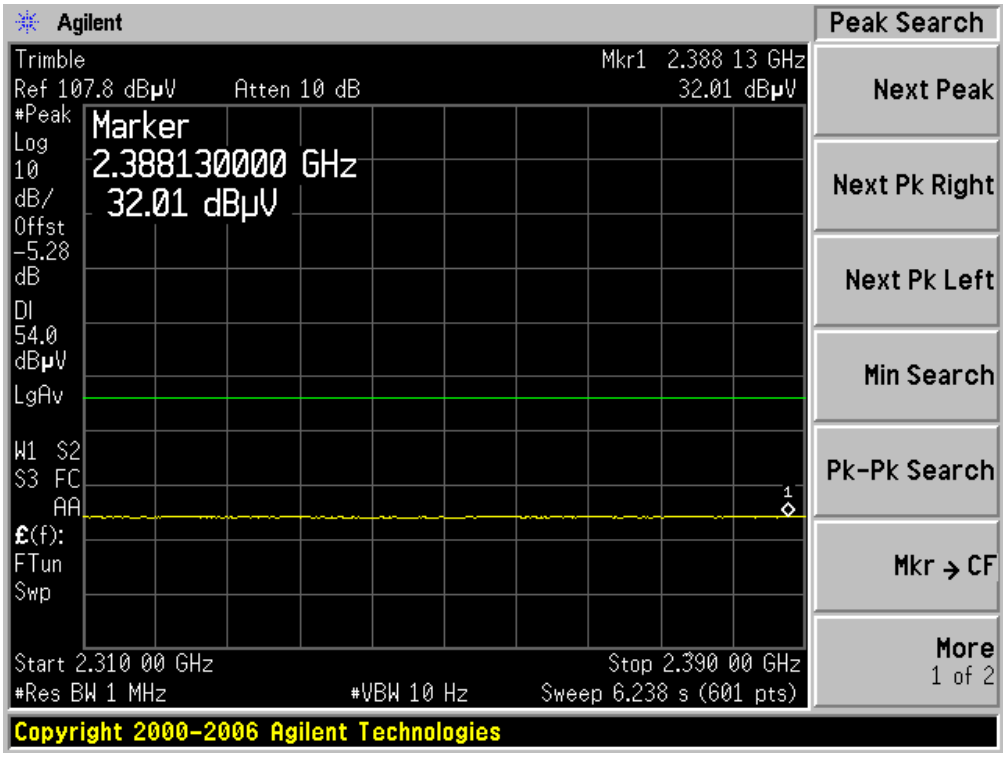
Average, Horizontal



Peak, Vertical

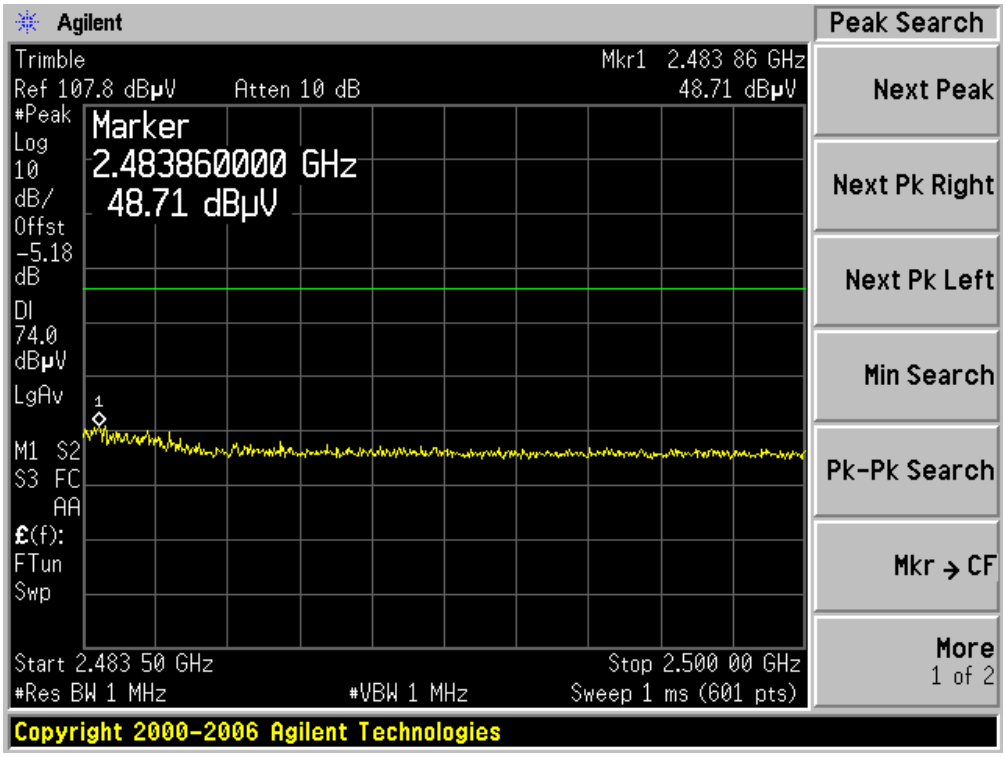


Average, Vertical

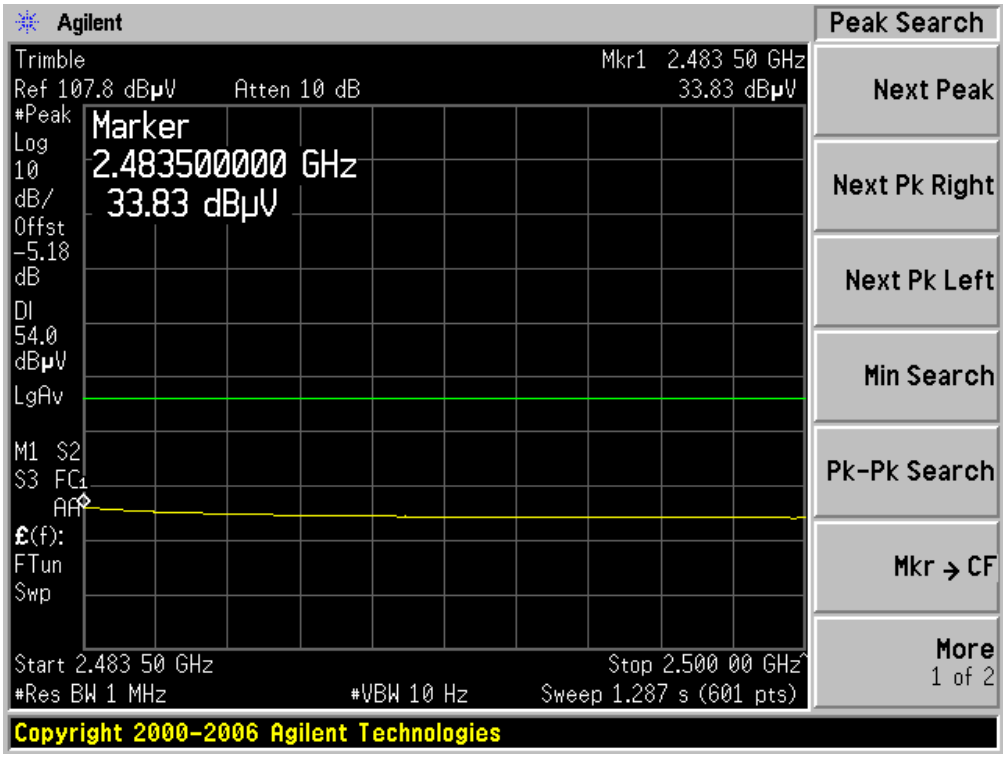


High Channel

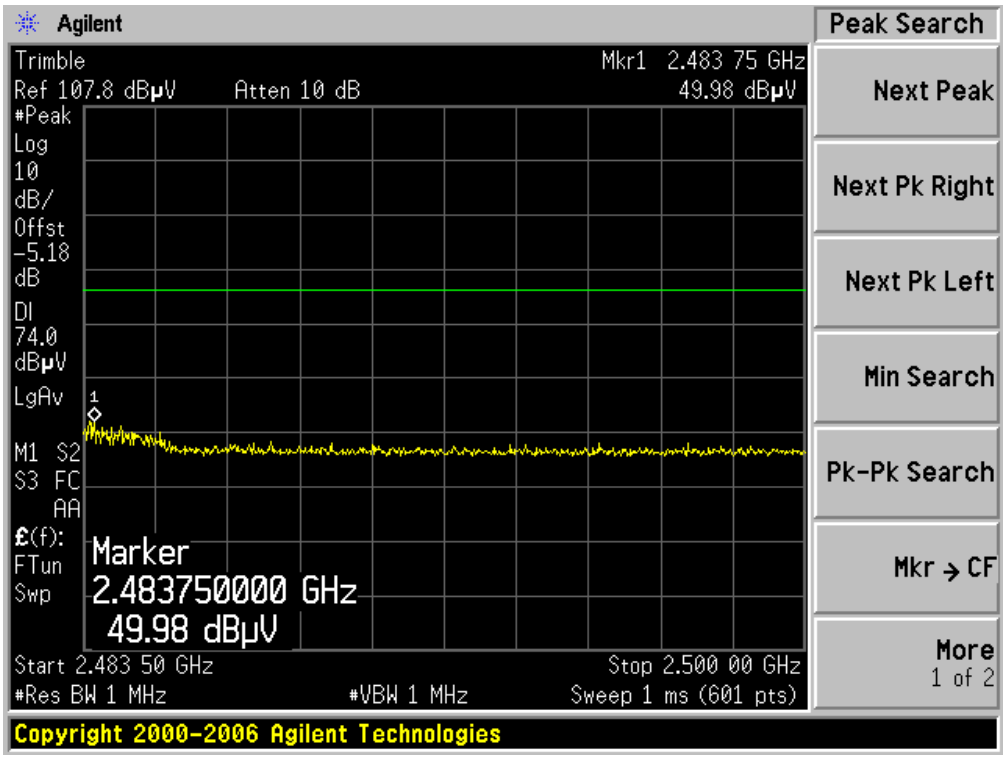
Peak, Horizontal



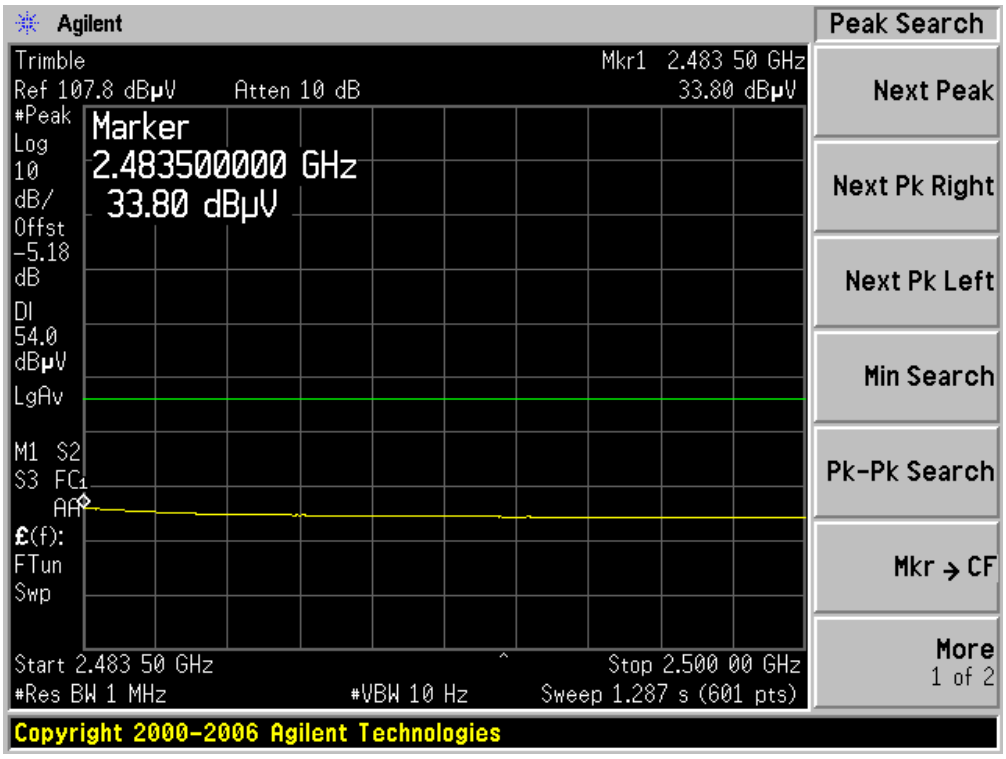
Average, Horizontal



Peak, Vertical

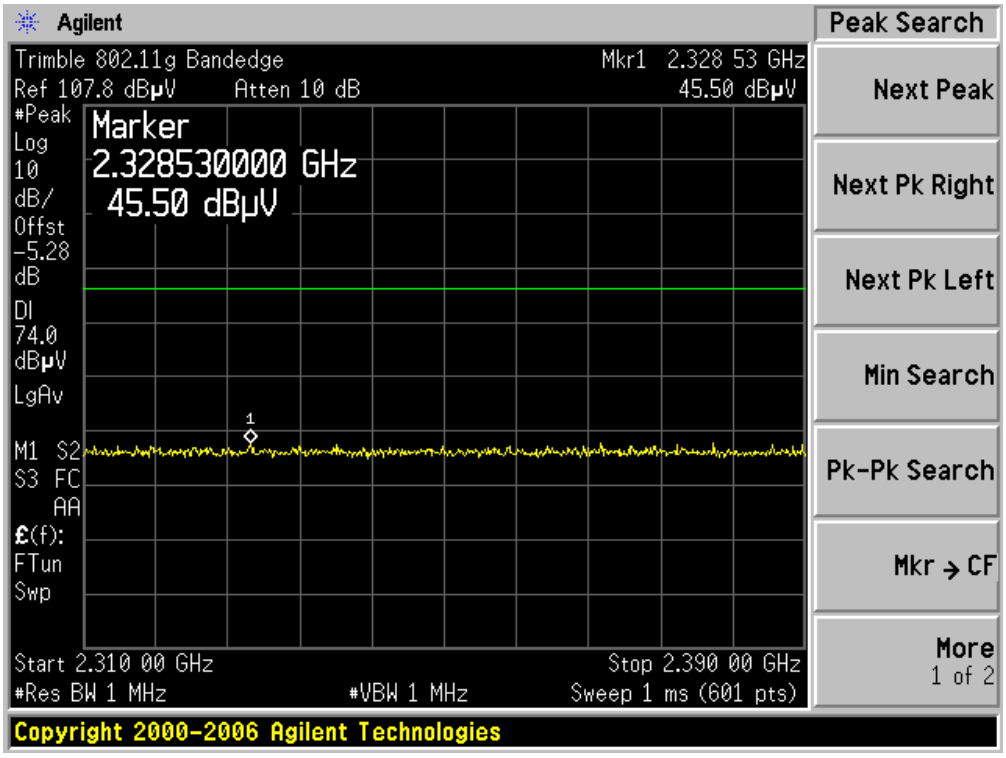


Average, Vertical

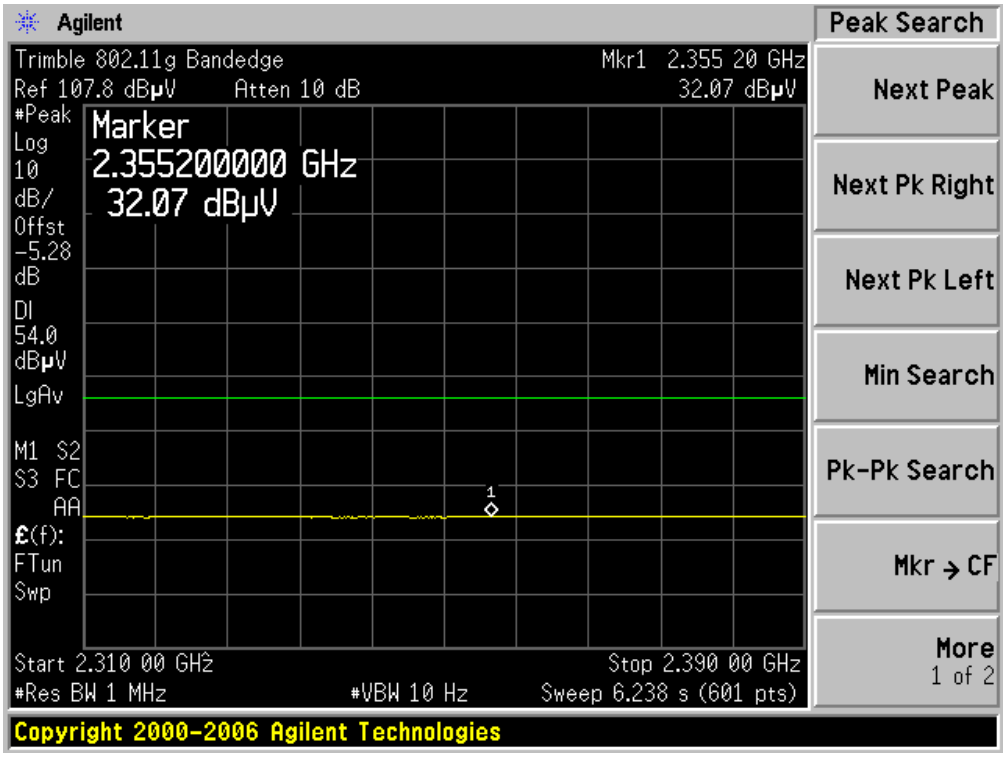


802.11g mode @ Low Channel

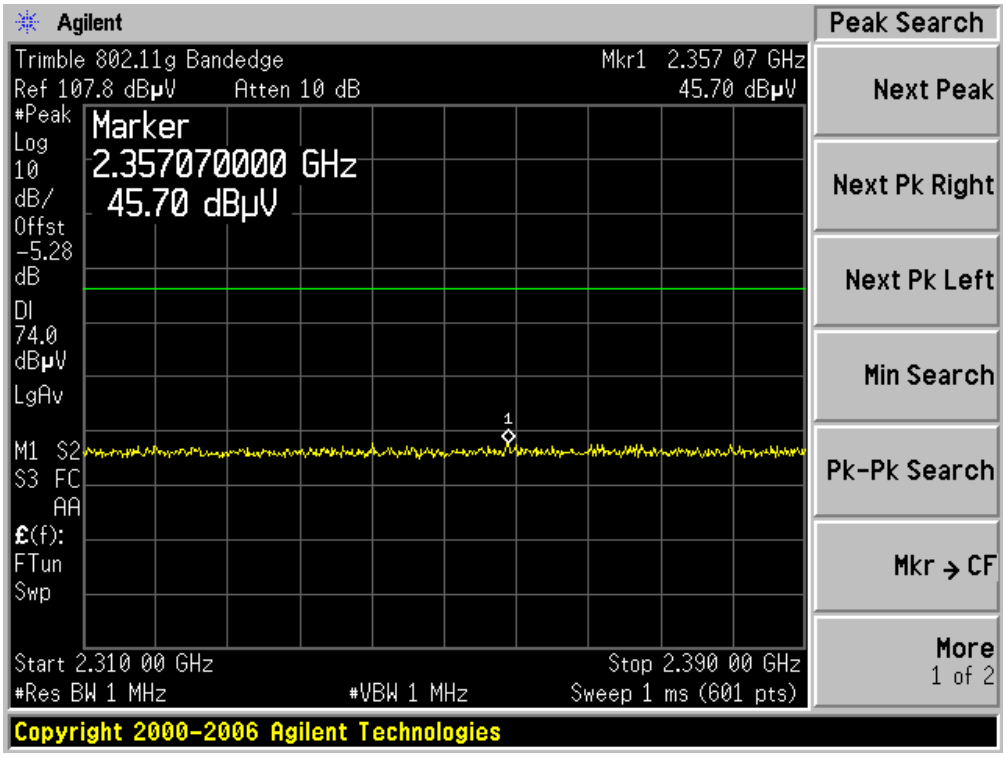
Peak, Horizontal



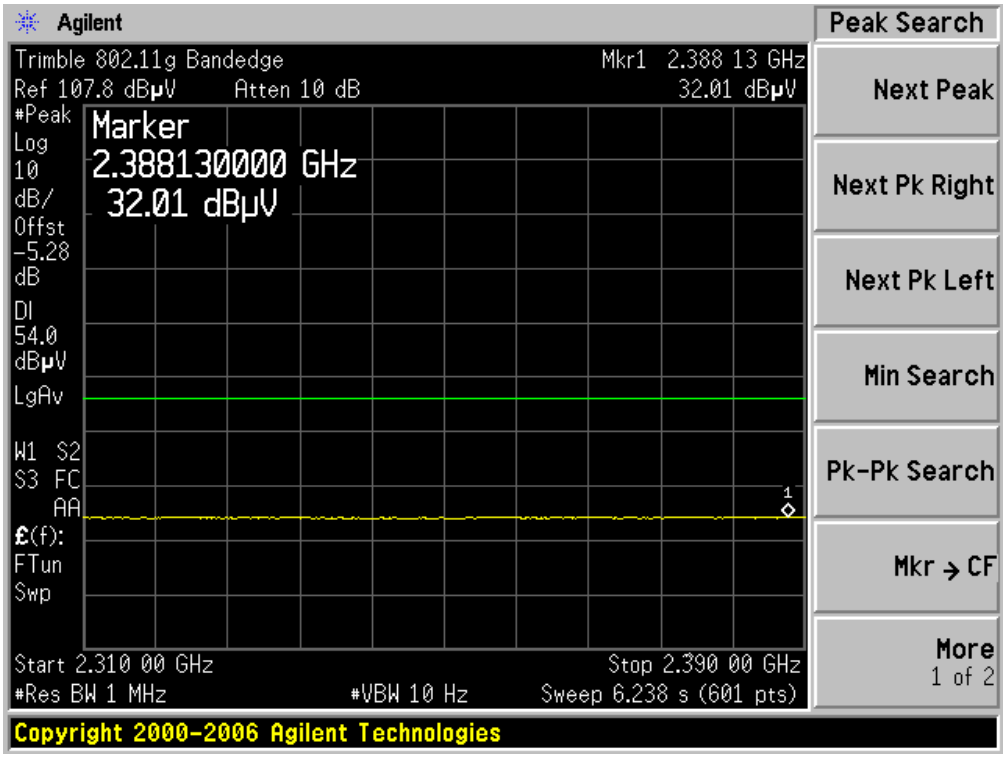
Average, Horizontal



Peak, Vertical

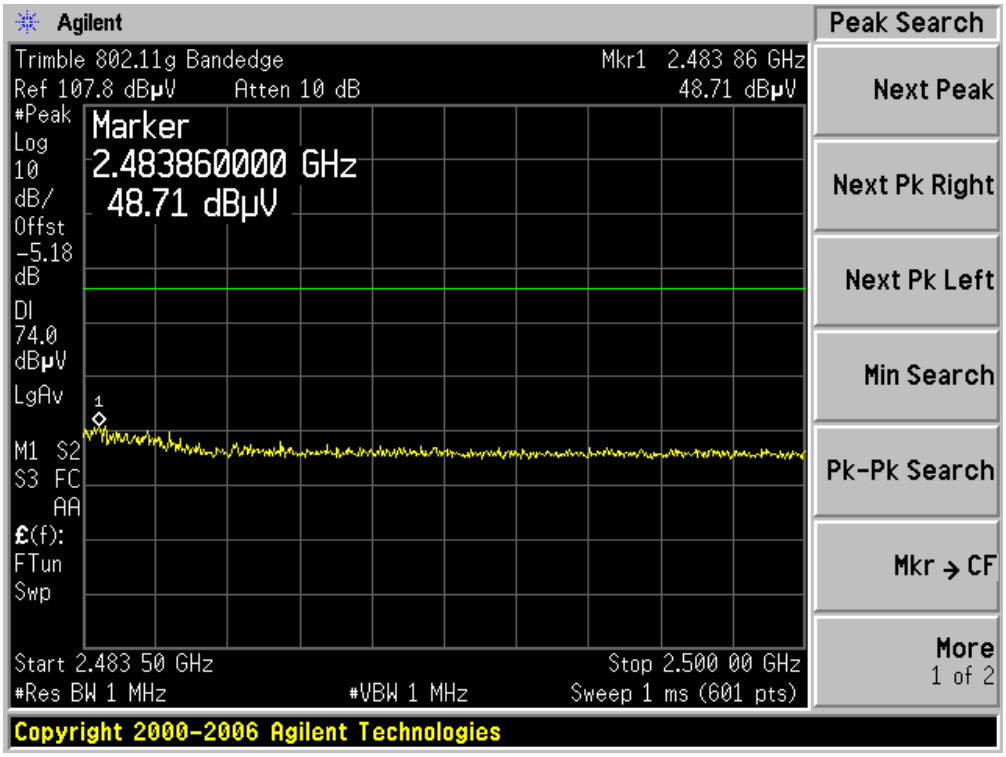


Average, Vertical

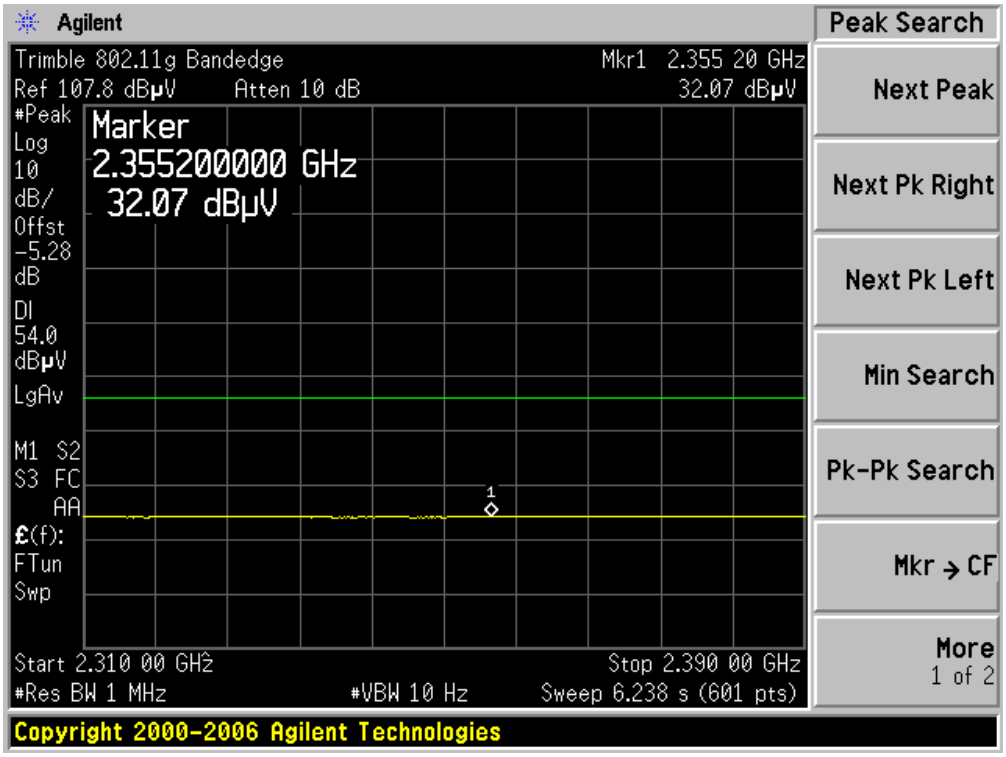


High Channel

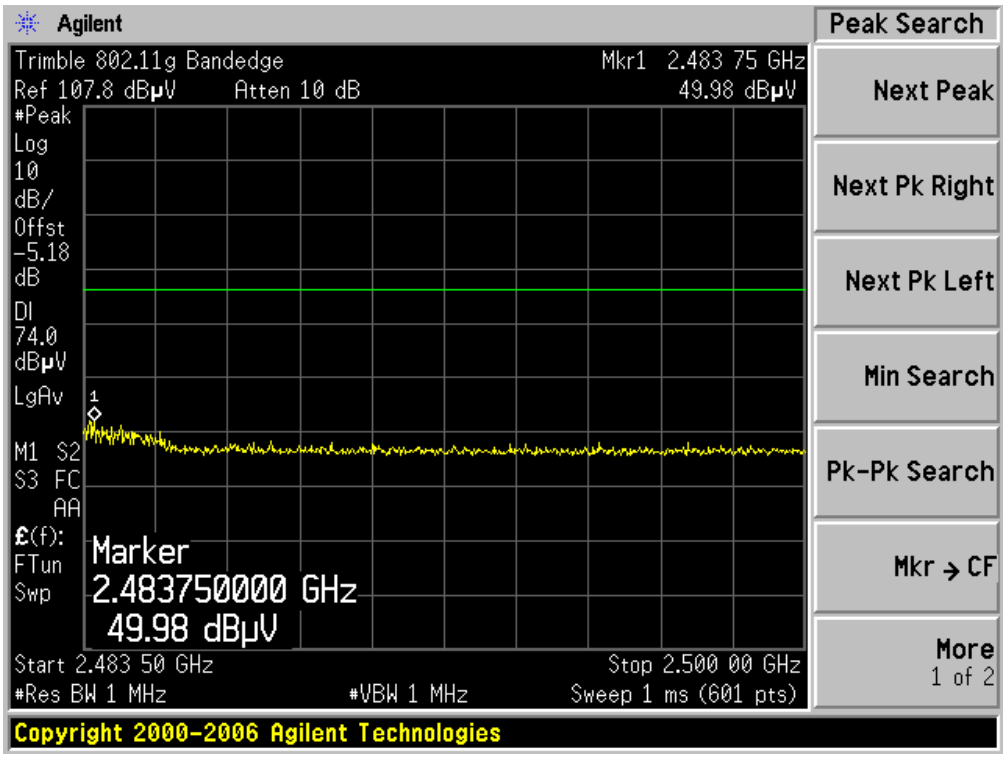
Peak, Horizontal



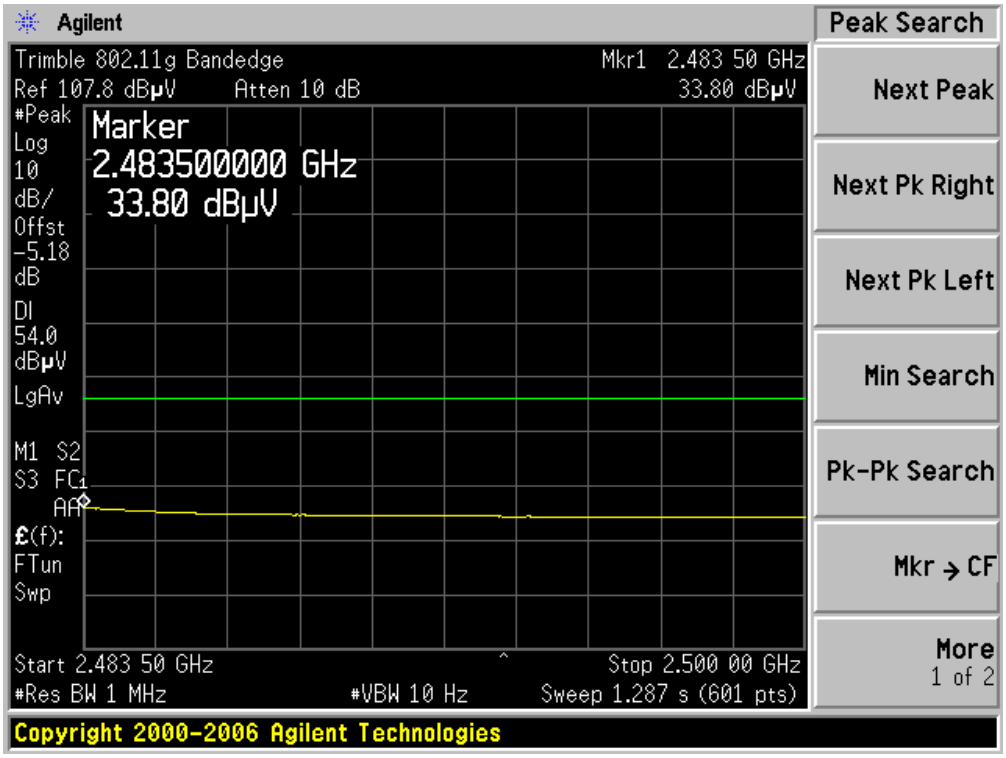
Average, Horizontal



Peak, Vertical



Average, Vertical



8 FCC §15.247(a) (2), RSS-210 § A8.2 (a) – 6 dB BANDWIDTH & OCCUPIED BANDWIDTH

8.1 Applicable Standard

According to §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

8.2 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. (6 dB bandwidth for DTS)
4. Repeat above procedures until all frequencies measured were complete.

8.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

8.4 Environmental Conditions

Temperature:	27 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by James Ma on 2008-04-08.*

8.5 Summary of Test Results

802.11b mode

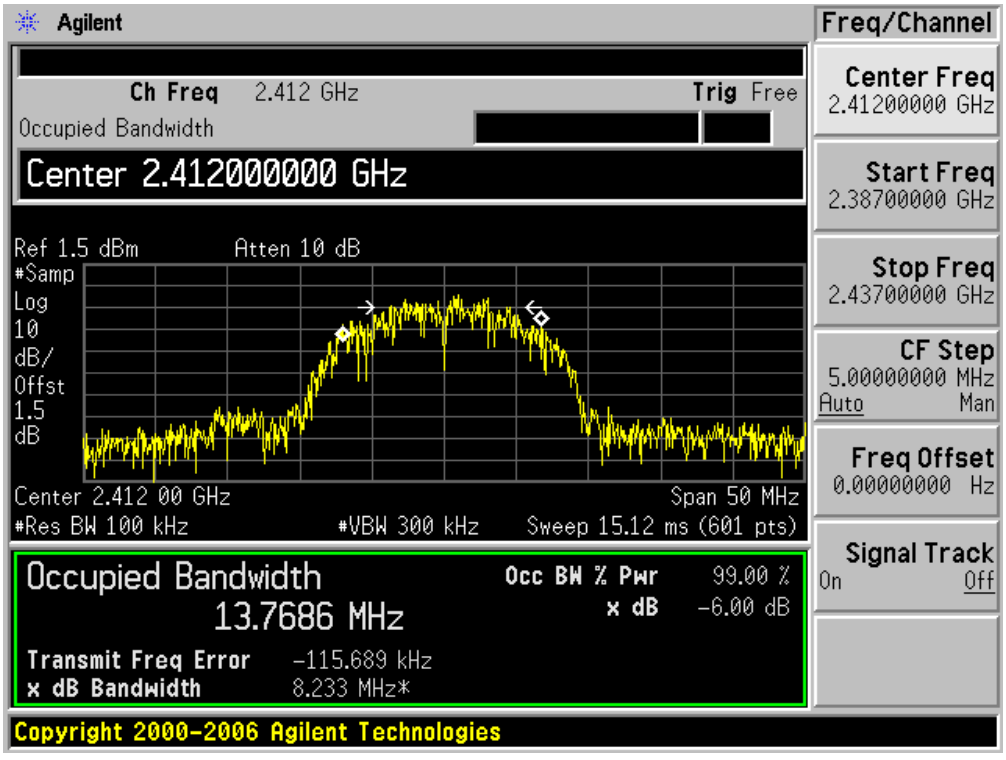
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2412	8.233	13.7686
Middle	2437	9.670	13.3511
High	2462	9.665	13.4368

802.11g mode

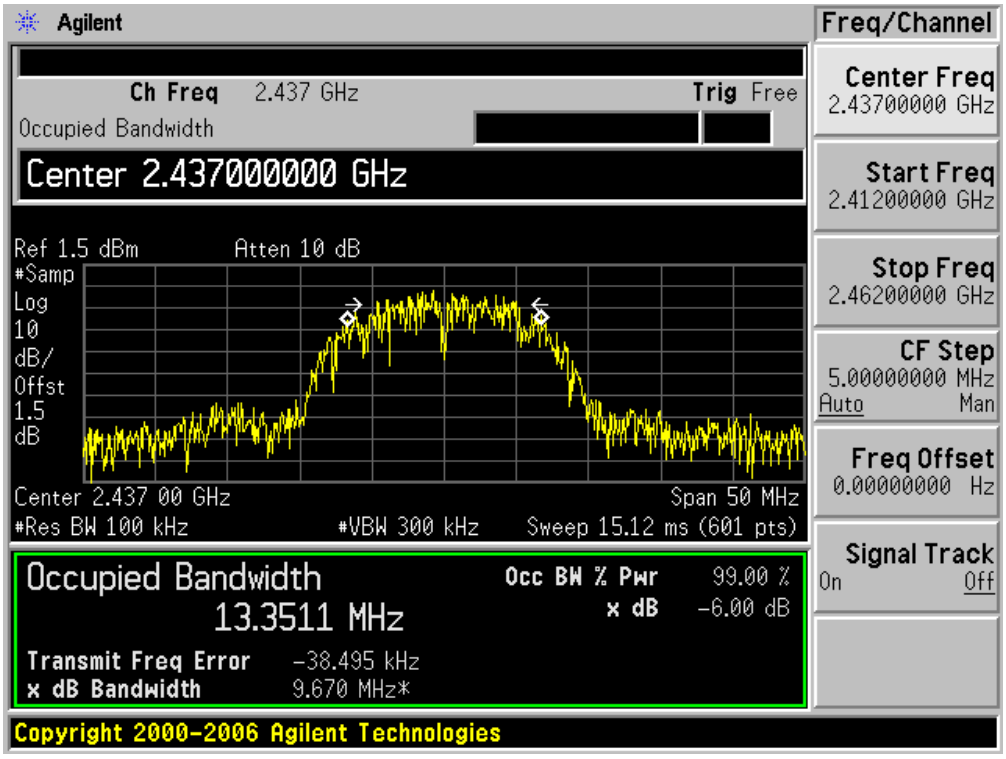
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2412	16.237	16.3333
Middle	2437	16.004	16.3420
High	2462	16.086	16.4228

Please refer to the following plots for detailed test results

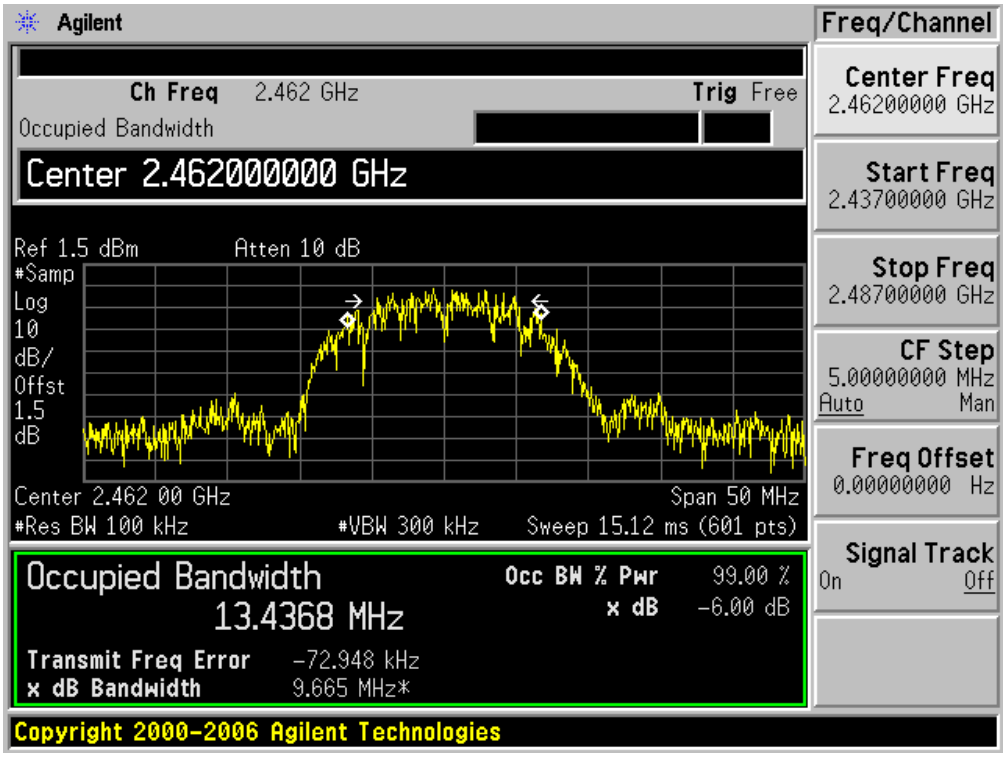
Plot 1: 802.11b mode @ Low Channel



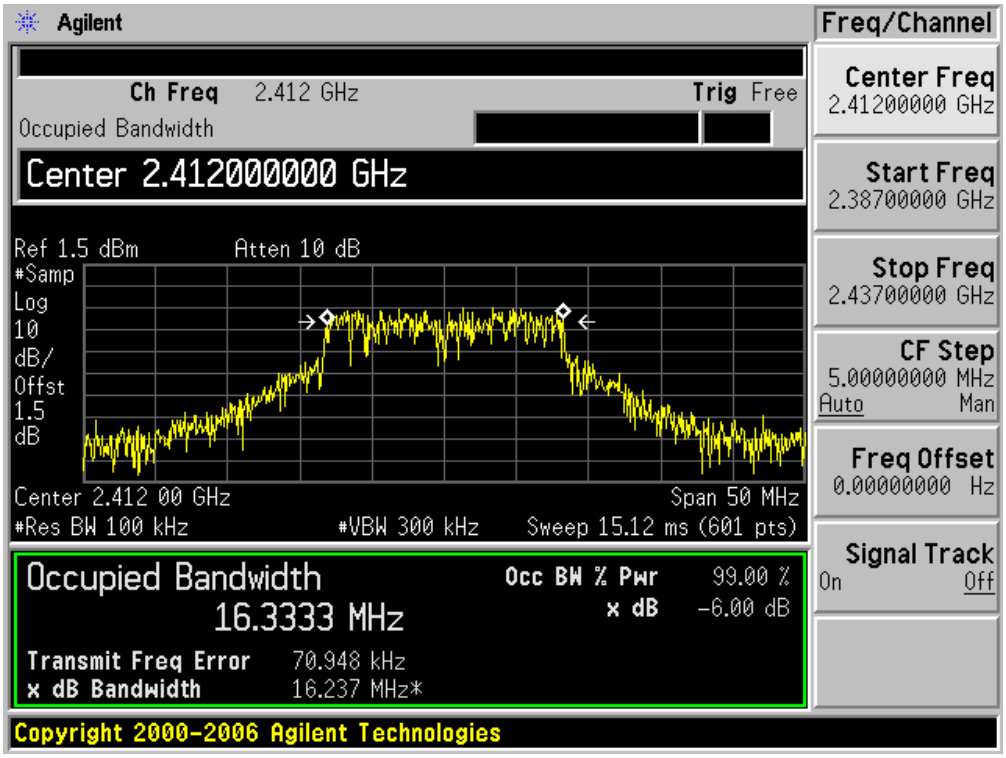
Plot 2: 802.11b mode @ Middle Channel



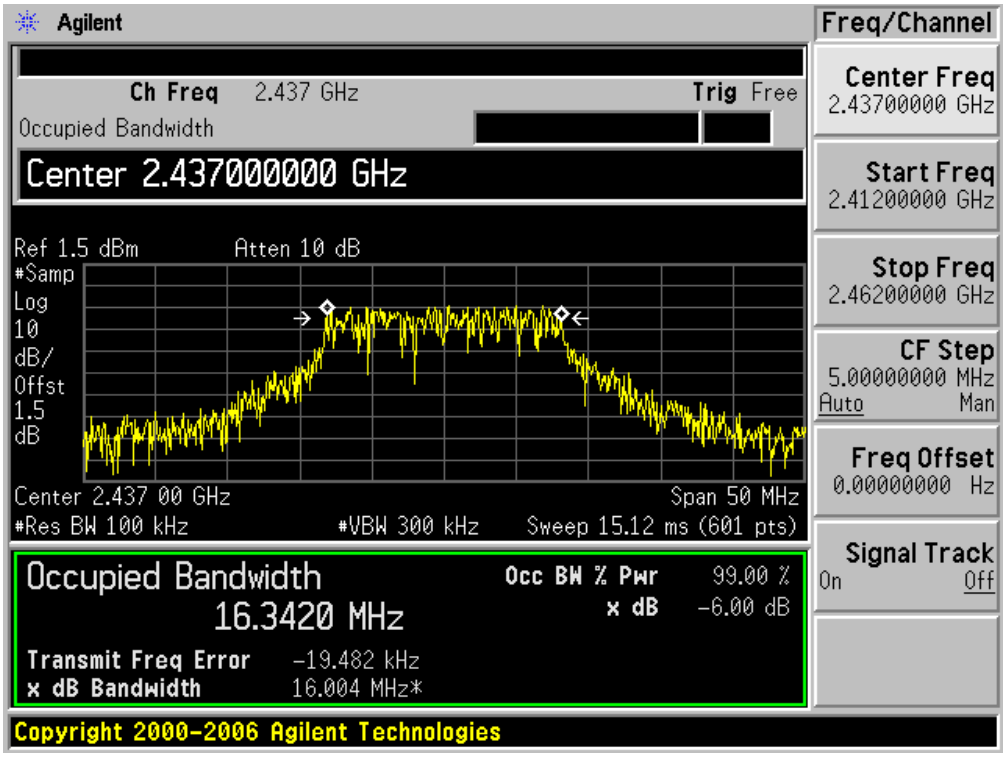
Plot 3: 802.11b mode @ High Channel



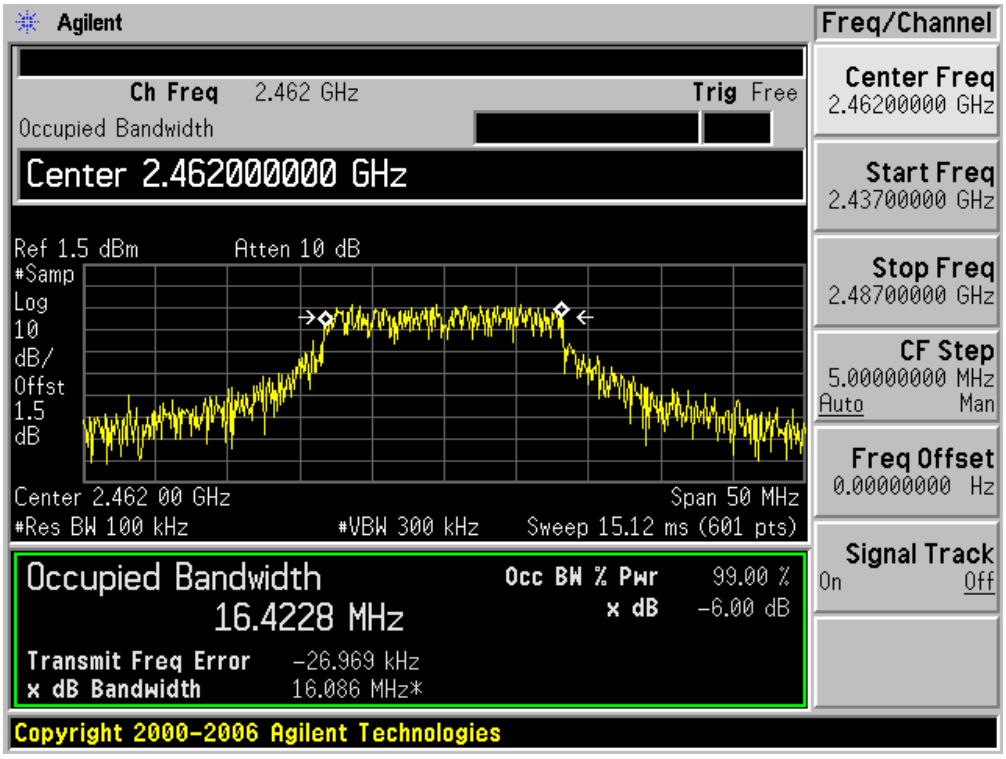
Plot 4: 802.11g mode @ Low Channel



Plot 5: 802.11g mode @ Middle Channel



Plot 6: 802.11g mode @ High Channel



9 FCC §15.247(b), RSS210 § A8.4 - PEAK OUTPUT POWER MEASUREMENT

9.1 Applicable Standard

§15.247(b) the maximum peak output power of the intentional radiator shall not exceed the following:

§15.247(b) (3) and RSS210 § A8.4 (4) for systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

§15.247(b) (4) (i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

9.2 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.

9.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

9.4 Environmental Conditions

Temperature:	27 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by Steve Xue on 2008-04-08.*

9.5 Summary of Test Results

802.11b mode:

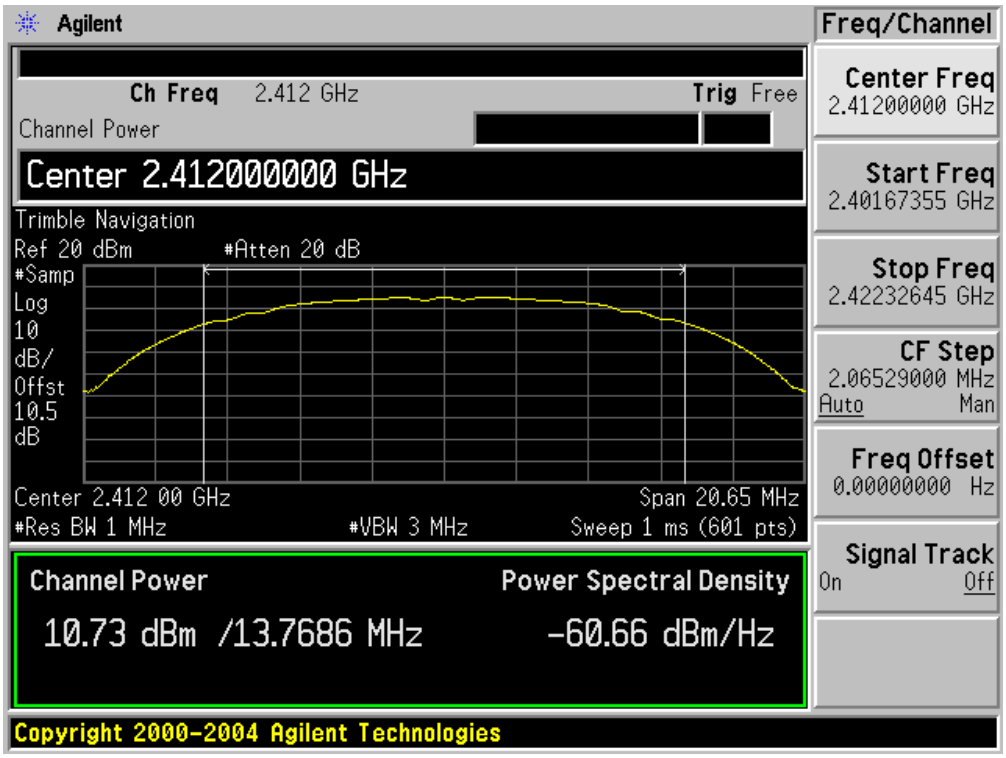
Channel	Frequency (MHz)	Max Power (dBm)	Max Power (mW)	Limit (mW)	Result
Low	2412	10.73	11.830	1000	Compliant
Mid	2437	10.80	12.023	1000	Compliant
High	2462	12.52	17.685	1000	Compliant

802.11g mode:

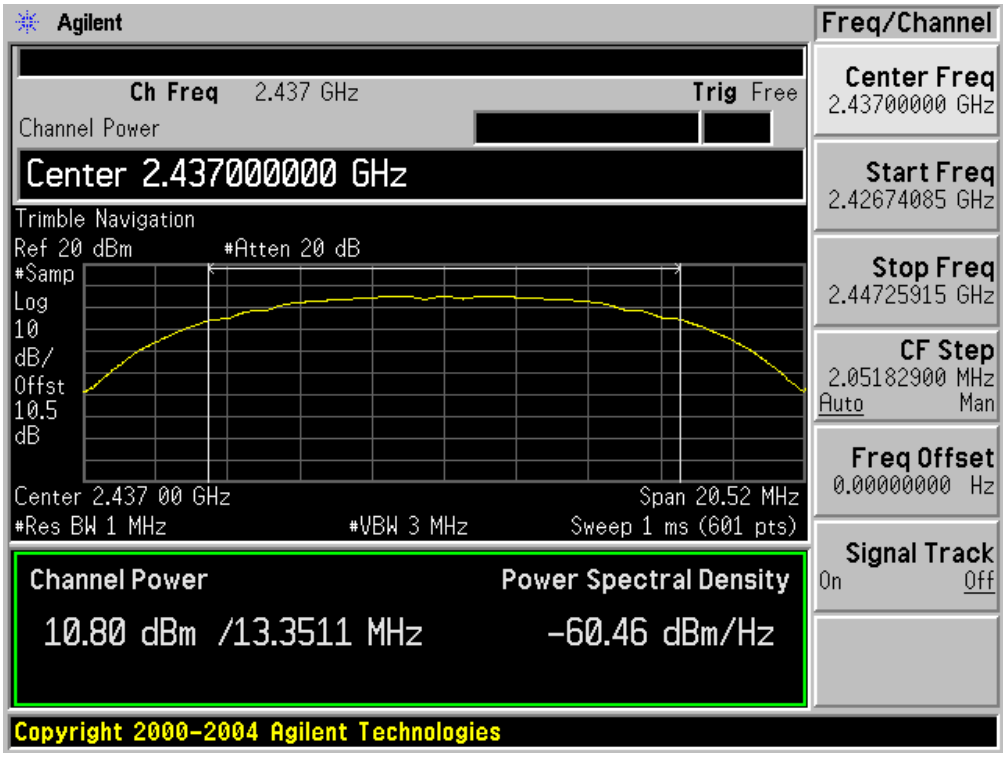
Channel	Frequency (MHz)	Max Power (dBm)	Max Power (mW)	Limit (mW)	Result
Low	2412	6.65	4.624	1000	Compliant
Mid	2437	6.82	4.808	1000	Compliant
High	2462	9.55	9.016	1000	Compliant

Please refer to the following Plots

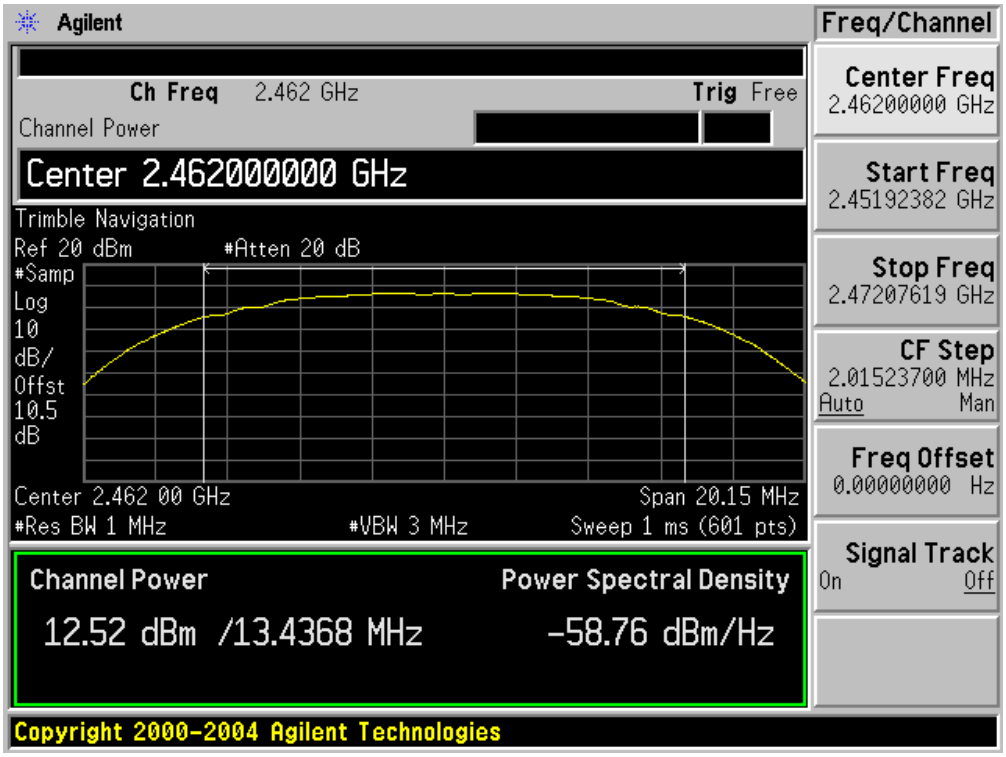
Plot 1: 802.11b mode @ Low Channel



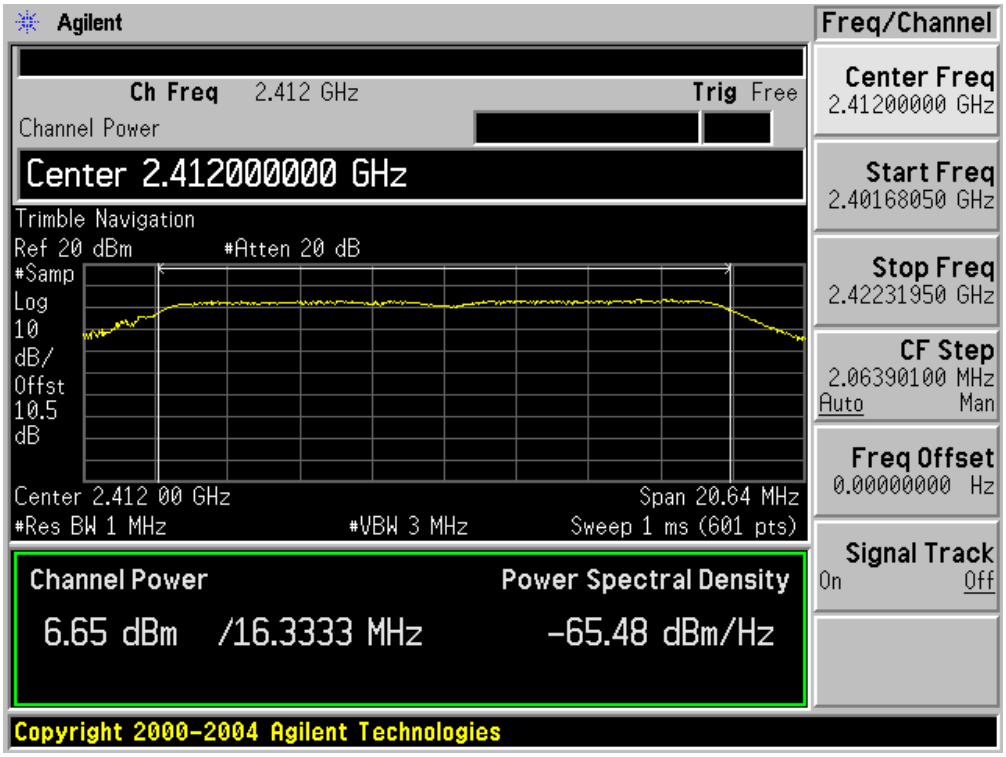
Plot 2: 802.11b mode @ Middle Channel



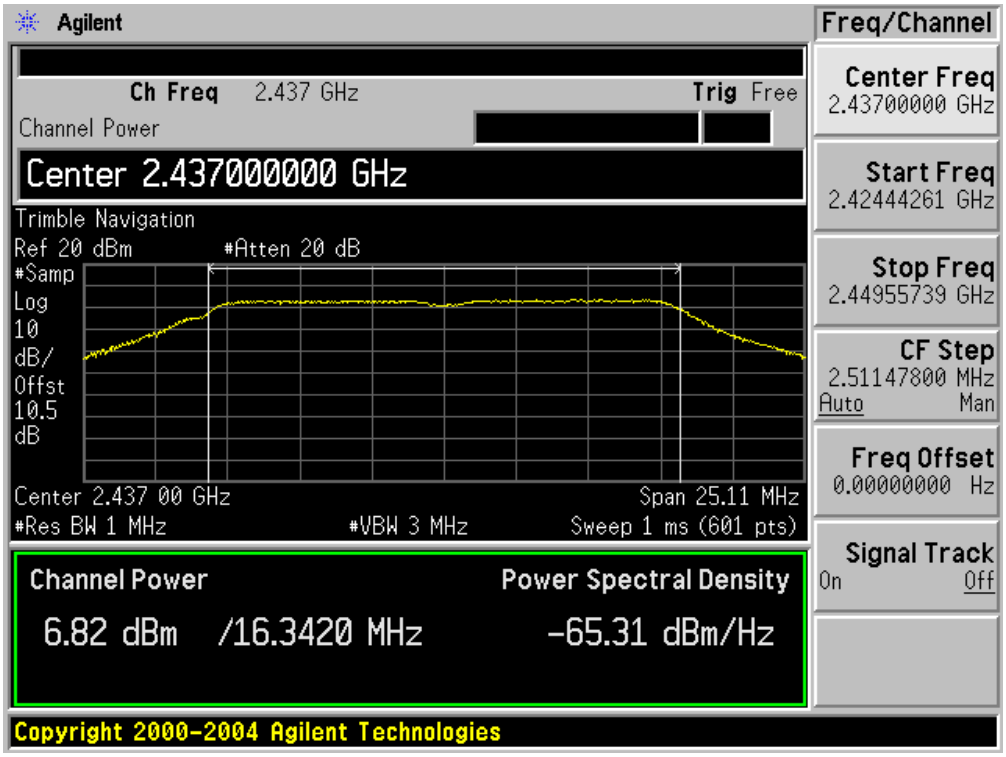
Plot 3: 802.11b mode @ High Channel



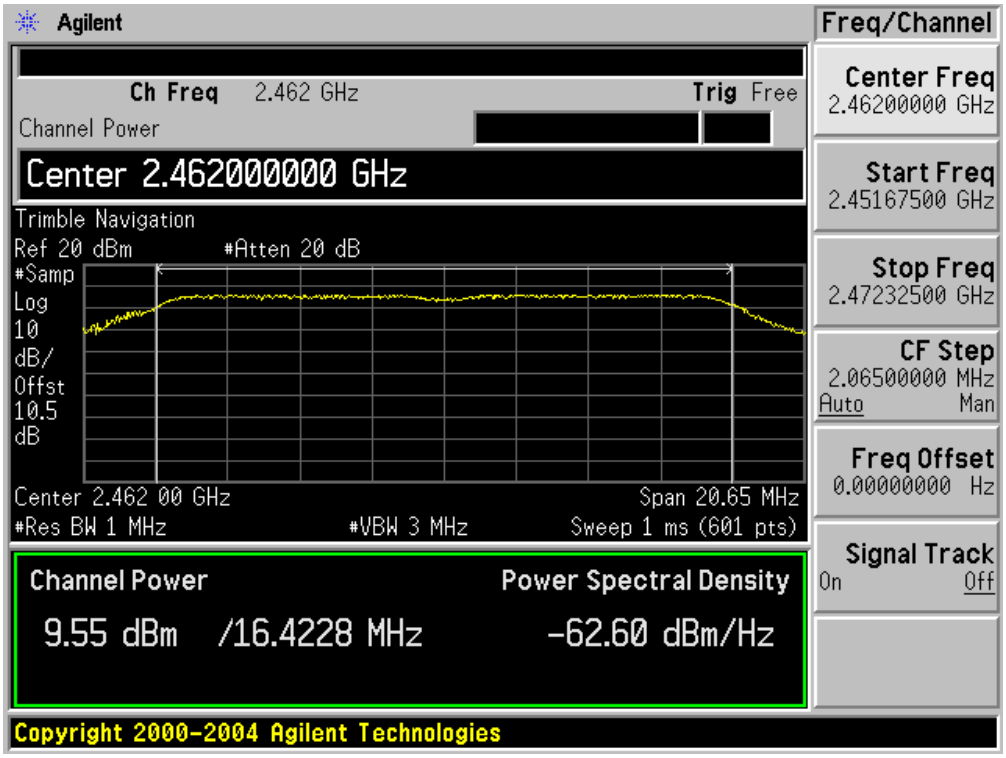
Plot 4: 802.11g mode @ Low Channel



Plot 4: 802.11g mode @ Middle Channel



Plot 4: 802.11g mode @ High Channel



10 FCC §15.247(d), RSS-210 § A8.5 - 100 kHz BANDWIDTH OF BAND EDGES

10.1 Applicable Standard

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. 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)).

RSS210§ A8.5: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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 section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emissions limits specified in Tables 2 and 3.

10.2 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.

10.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

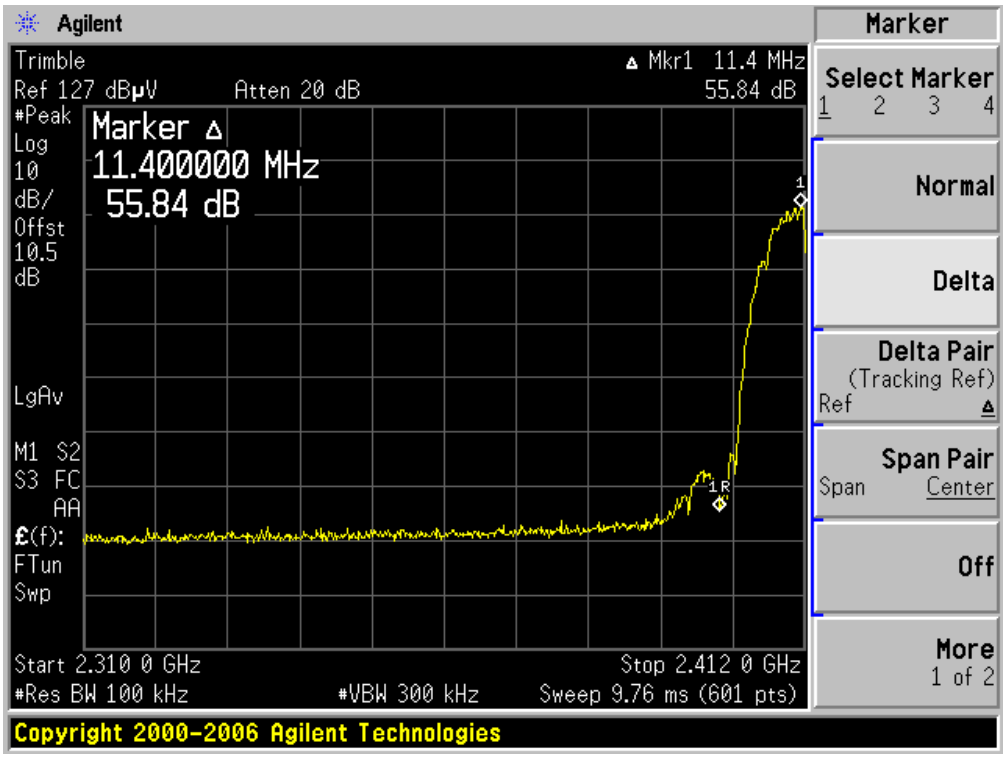
10.4 Environmental Conditions

Temperature:	27 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

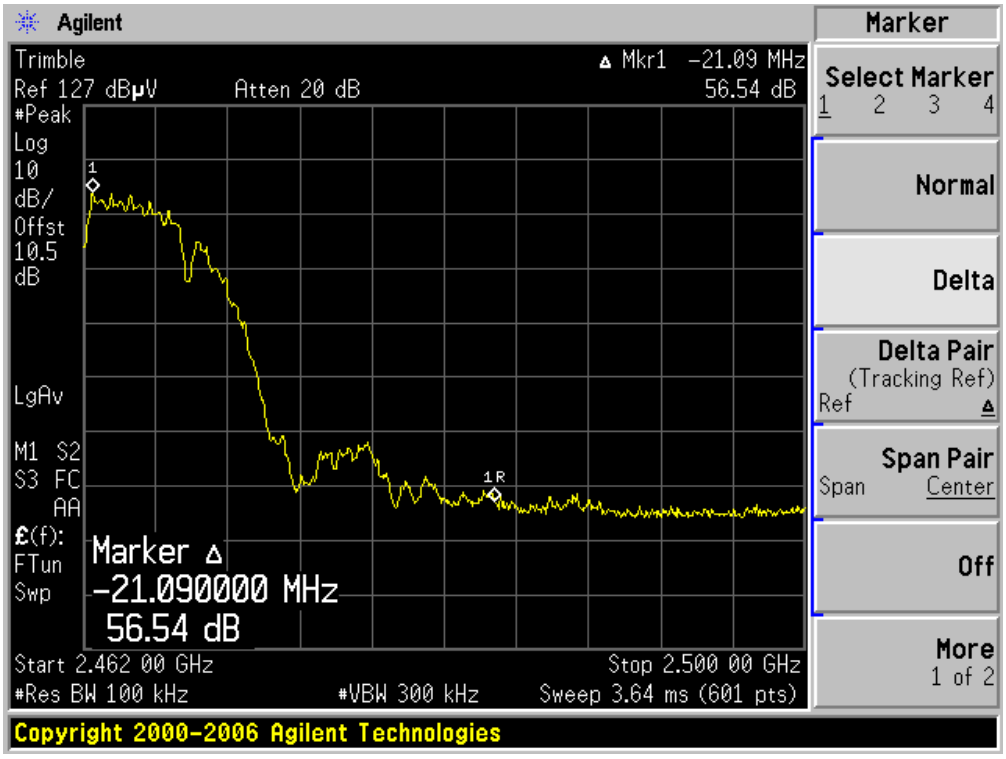
**The testing was performed by Steve Xue on 2008-04-08.*

Please Refer to the Following Plots

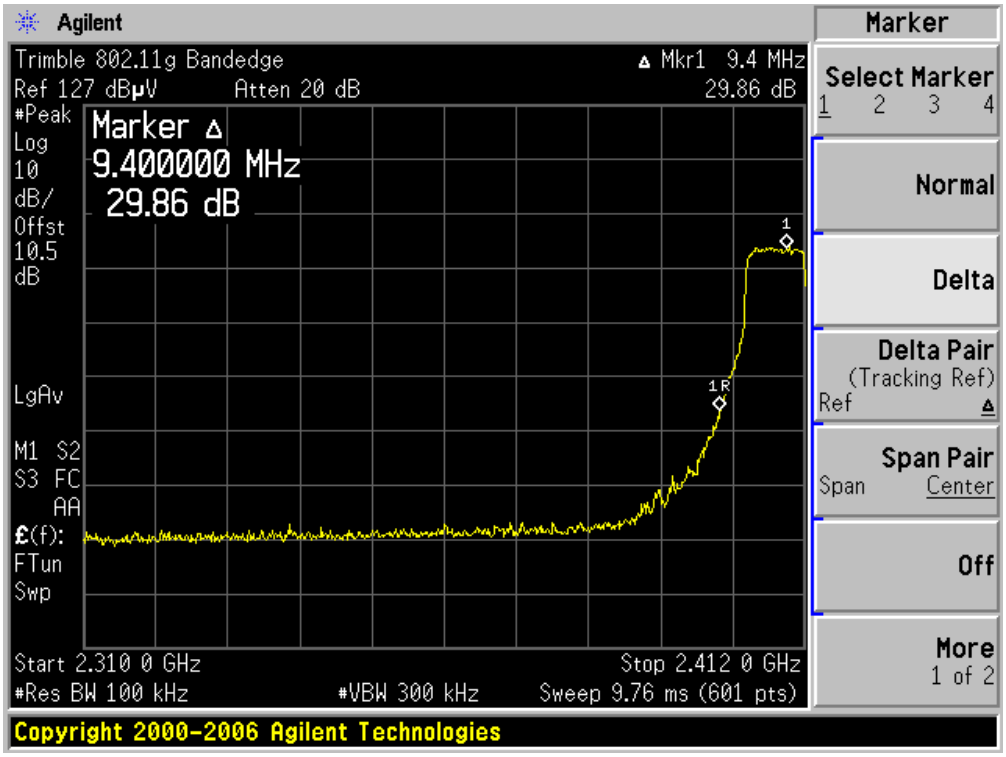
Plot 1: 802.11b mode @ Lowest Channel



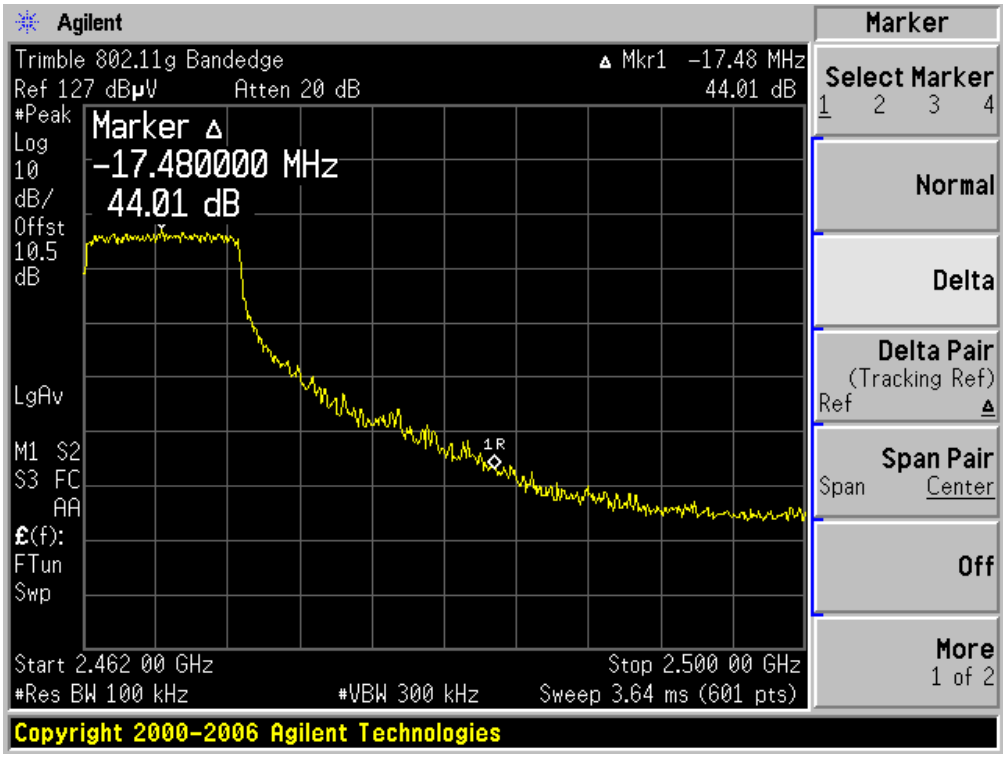
Plot 2: 802.11b mode @ Highest Channel



Plot 3: 802.11g mode @ Lowest Channel



Plot 4: 802.11g mode @ Highest Channel



11 FCC §15.247(e), RSS-210 § A8.2 (b) - POWER SPECTRAL DENSITY

11.1 Applicable Standard

According to §15.247 (e) and RSS-210 § A8.2 (b) , 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.

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 was set 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. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value. (DTS)
4. Repeat above procedures until all frequencies measured were complete.

11.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

11.4 Environmental Conditions

Temperature:	27 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by Steve Xue from 2008-04-07.*

11.5 Summary of Test Results

802.11b mode:

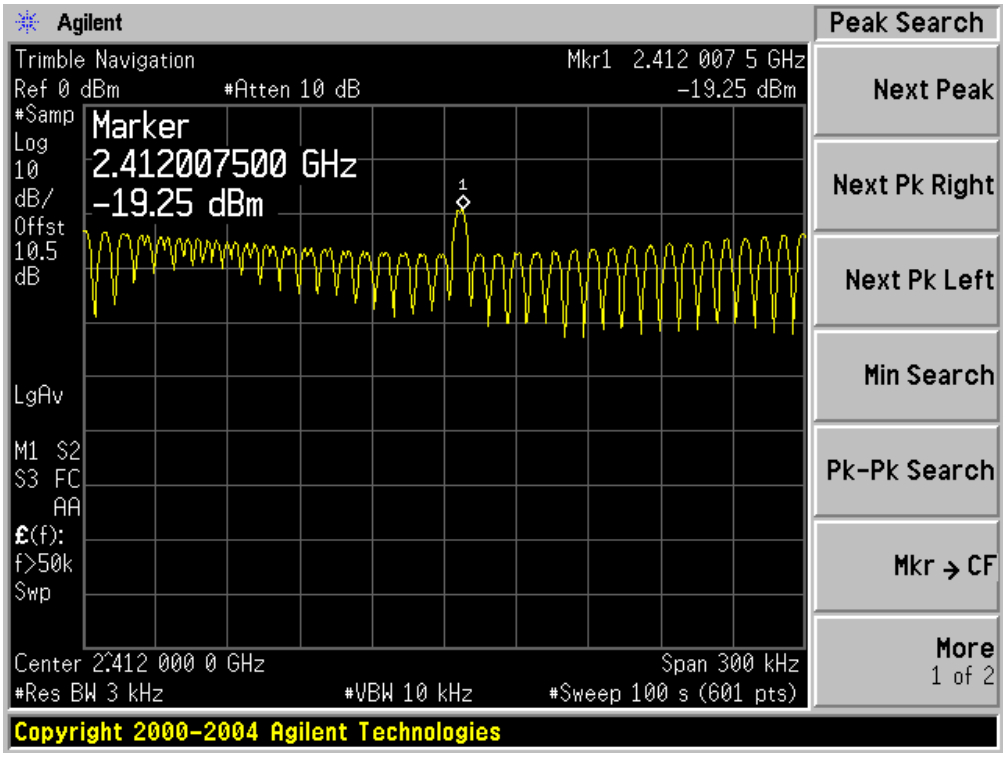
Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
2412	-19.25	8	Compliant
2437	-22.07	8	Compliant
2462	-19.27	8	Compliant

802.11g mode:

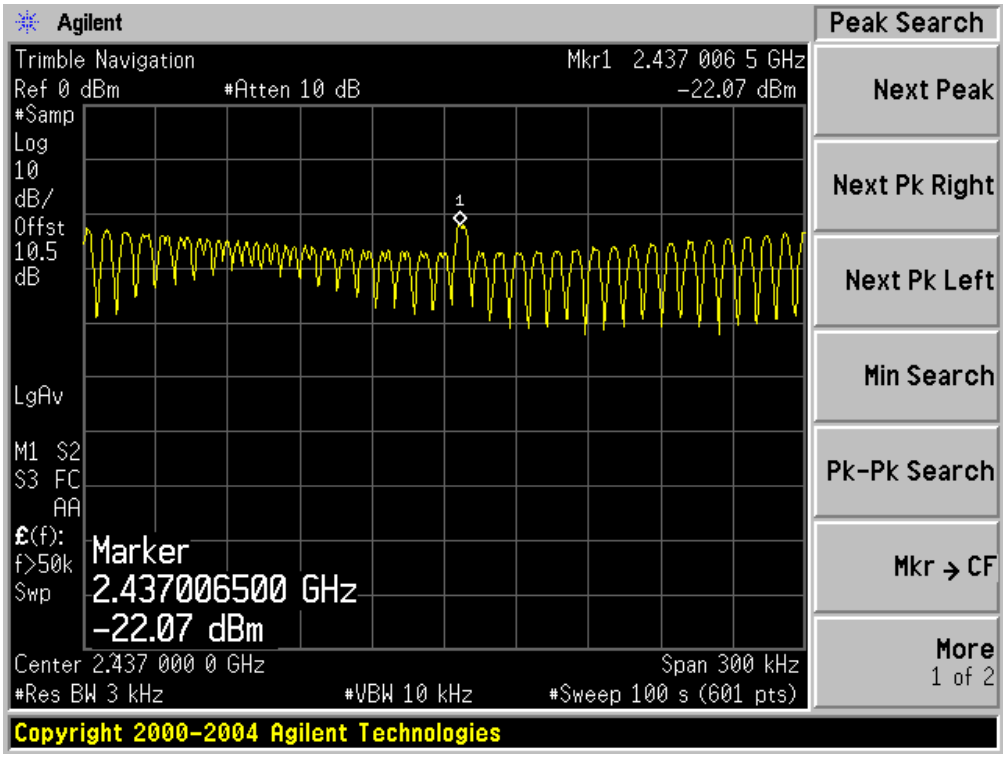
Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
2412	-20.27	8	Compliant
2437	-21.61	8	Compliant
2462	-21.66	8	Compliant

Please refer to the following plots for detailed test results

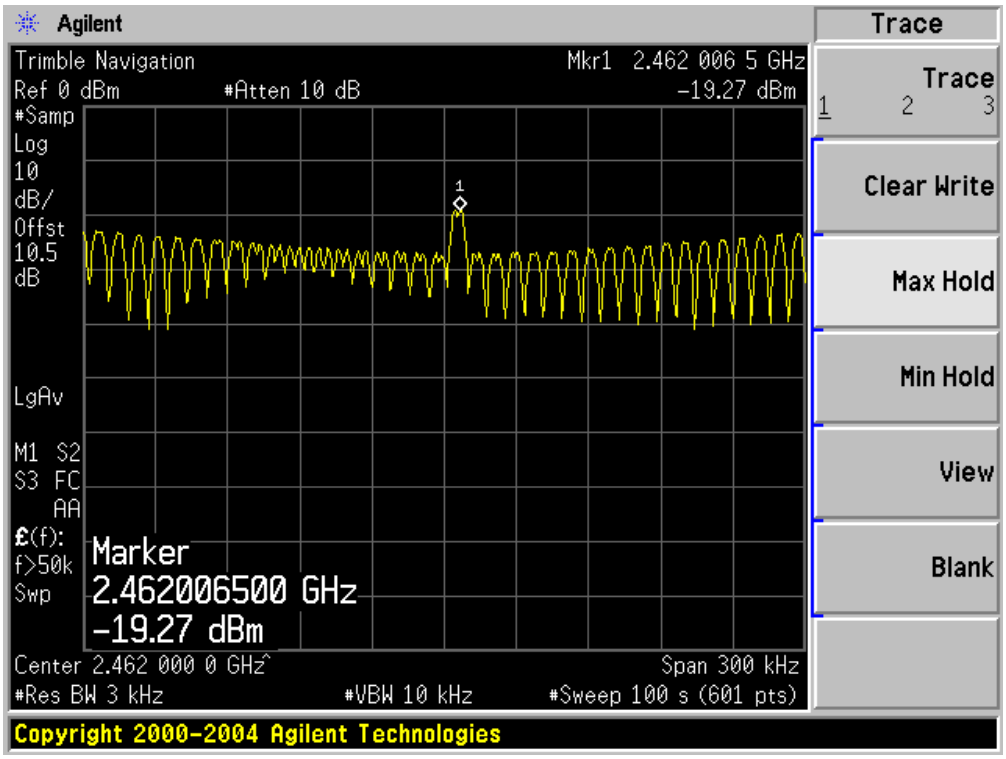
Plot 1: 802.11b mode @ Low Channel



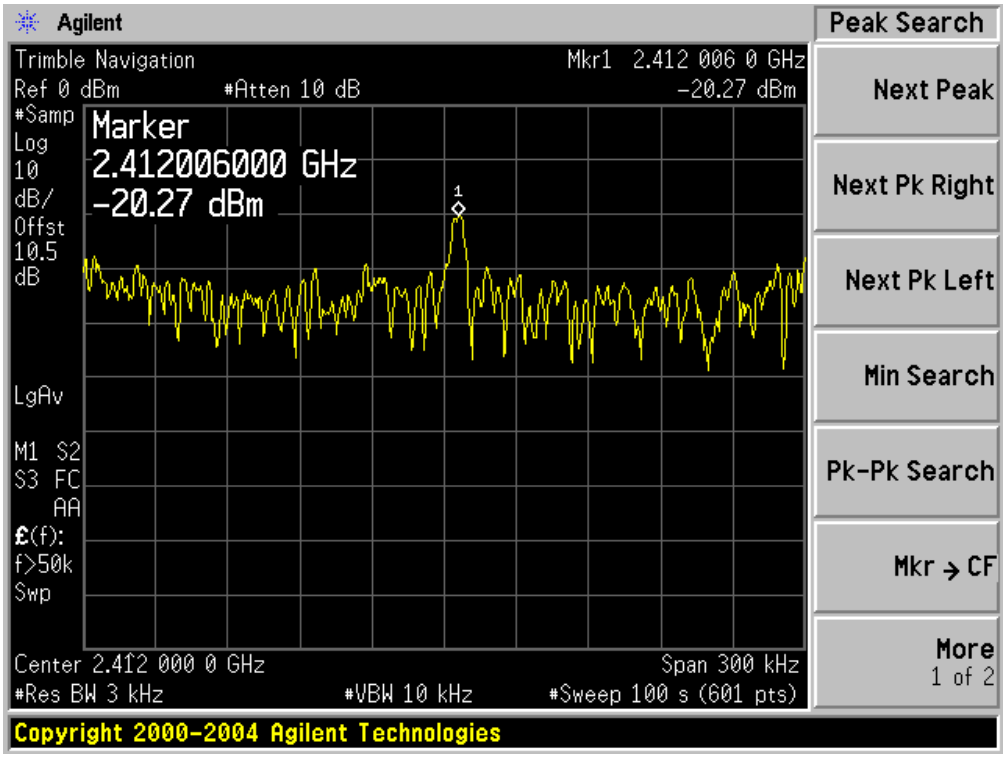
Plot 2: 802.11b mode @ Middle Channel



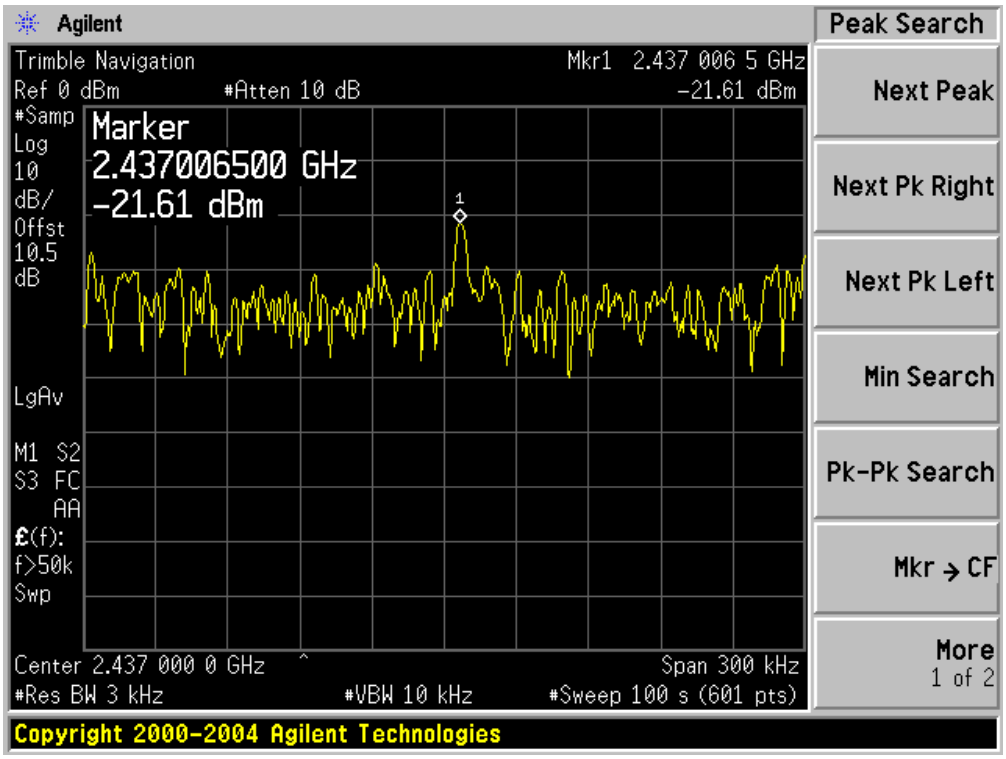
Plot 3: 802.11b mode @ High Channel



Plot 4: 802.11g mode @ Low Channel



Plot 5: 802.11g mode @ Middle Channel



Plot 6: 802.11g mode @ High Channel