

FCC PART 15.247
INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007
MEASUREMENT AND TEST REPORT

For

Wi2Wi, Inc.

2107 N. First Street, Ste. 540
San Jose, CA 95131, USA

FCC ID: U9R-W2SW0001
IC ID: 7089A-W2SW0001
Model: W2SW0001

Report Type: ☒ Original Report		Product Type: 802.11b/g Module
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Report Number:	R0708036	
Report Date:	2007-09-26	
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TABLE OF CONTENTS

1	GENERAL INFORMATION	4
1.1	PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
1.2	MECHANICAL DESCRIPTION OF EUT	4
1.3	ANTENNA DESCRIPTION	4
1.4	EUT PHOTOGRAPH	5
1.5	OBJECTIVE	5
1.6	RELATED SUBMITTAL(S)/GRANT(S)	5
1.7	TEST METHODOLOGY	5
1.8	MEASUREMENT UNCERTAINTY	6
1.9	TEST FACILITY	6
2	SYSTEM TEST CONFIGURATION	7
2.1	JUSTIFICATION	7
2.2	EUT EXERCISE SOFTWARE	7
2.3	SPECIAL ACCESSORIES	7
2.4	EQUIPMENT MODIFICATIONS	7
2.5	LOCAL SUPPORT EQUIPMENT LIST AND DETAILS	7
2.6	TEST SETUP BLOCK DIAGRAMS	8
3	SUMMARY OF TEST RESULTS	9
4	FCC §15.203, IC RSS-Gen §7.1.4 – ANTENNA REQUIREMENT	10
4.1	APPLICABLE STANDARD	10
4.2	RESULT	10
5	FCC §15.207, IC RSS-Gen §7.2.2 - CONDUCTED EMISSIONS	11
5.1	SECTION 15.207 & RSS-Gen 7.2.2 CONDUCTED LIMITS:	11
5.2	TEST SETUP	11
5.3	TEST EQUIPMENT LIST AND DETAILS	11
5.4	TEST PROCEDURE	12
5.5	ENVIRONMENTAL CONDITIONS	12
5.6	SUMMARY OF TEST RESULTS	12
6	FCC §2.1051 & §15.247(d), RSS-210 § A8.5 & RSS-Gen 7.2 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS	15
6.1	APPLICABLE STANDARD	15
6.2	MEASUREMENT PROCEDURE	15
6.3	EQUIPMENT LIST	15
6.4	ENVIRONMENTAL CONDITIONS	15
6.5	MEASUREMENT RESULT:	15
7	FCC §15.109, §15.205, §15.209 & §15.247(c), IC RSS-Gen §4.9 - SPURIOUS RADIATED EMISSIONS	28
7.1	APPLICABLE STANDARD	28
7.2	TEST SETUP	29
7.3	EUT SETUP	29
7.4	TEST EQUIPMENT LIST AND DETAILS	29
7.5	TEST PROCEDURE	30
7.6	CORRECTED AMPLITUDE & MARGIN CALCULATION	30
7.7	ENVIRONMENTAL CONDITIONS	31
7.8	SUMMARY OF TEST RESULTS	31
7.9	RADIATED EMISSIONS TEST PLOT & DATA:	32
7.10	RADIATED SPURIOUS EMISSIONS TEST DATA	33
8	FCC §15.247(a) (2), RSS-210 § A8.2 (a) – 6 dB BANDWIDTH & OCCUPIED BANDWIDTH	45
8.1	APPLICABLE STANDARD	45
8.2	MEASUREMENT PROCEDURE	45
8.3	EQUIPMENT LIST	45

8.4	ENVIRONMENTAL CONDITIONS.....	45
8.5	SUMMARY OF TEST RESULTS.....	46
9	FCC §15.247(b), RSS210 § A8.4 - PEAK OUTPUT POWER MEASUREMENT.....	50
9.1	APPLICABLE STANDARD	50
9.2	MEASUREMENT PROCEDURE.....	50
9.3	EQUIPMENT LIST.....	50
9.4	ENVIRONMENTAL CONDITIONS.....	50
9.5	SUMMARY OF TEST RESULTS.....	51
10	FCC §15.247(d), RSS-210 § A8.5 - 100 kHz BANDWIDTH OF BAND EDGES.....	55
10.1	APPLICABLE STANDARD	55
10.2	MEASUREMENT PROCEDURE.....	55
10.3	EQUIPMENT LIST.....	55
10.4	ENVIRONMENTAL CONDITIONS.....	55
11	FCC §15.247(e), RSS-210 § A8.2 (b) - POWER SPECTRAL DENSITY	58
11.1	APPLICABLE STANDARD	58
11.2	MEASUREMENT PROCEDURE.....	58
11.3	EQUIPMENT LIST.....	58
11.4	ENVIRONMENTAL CONDITIONS.....	58
11.5	SUMMARY OF TEST RESULTS.....	59

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The Wi2Wi, Inc. product, *FCC ID: U9R-W2SW0001, IC: 7089A-W2SW0001, model: W2SW0001*, or the “EUT” as referred to in this report, is an 802.11b/g module. W2SW0001 is a complete system-in-package of Marvell 88W8686 802.11b/g. It includes all the components to operate WiFi radio.

1.2 Mechanical Description of EUT

The Wi2Wi, Inc. product, *model: W2SW0001*, measures approximately 12mmL x 12mmW x 1.4mmH, and weighs approximately 0.05 g.

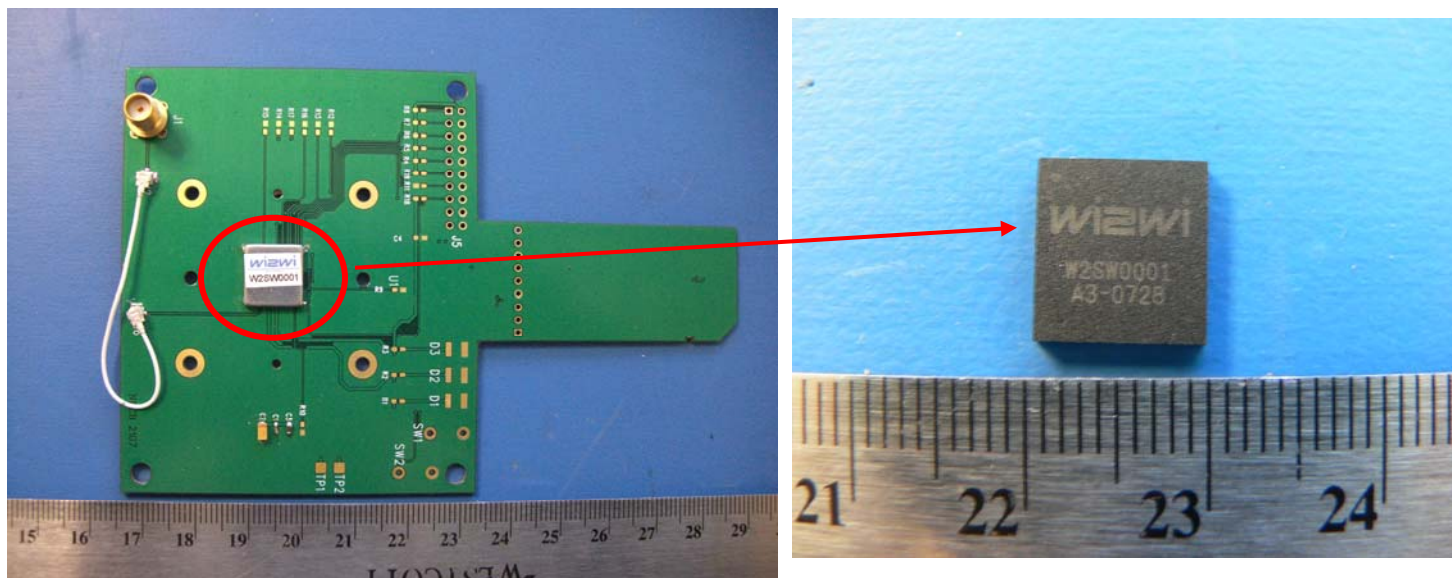
**The test data gathered are from production sample, serial number: A3-0728, provided by the manufacturer.*

1.3 Antenna Description

The antenna used is portable, center fed, whip antenna. It is a coaxial sleeve design with an omni-directional pattern.

Number	Model/Type	
Antenna 1.	Model number:	HG2403RD-RSF
	Manufacturer:	HyperLink Technologies, Inc.
	Frequency Range:	2400-2500 MHz
	Connector Type/ Maximum Gain	Reverse Polarity SMA Plug/ 3 dBi
	Antenna Type/ Pattern:	Monopole/omni-directional
	Measurement:	Length: 13 mmD x 137 mmL; Weight: 23 g

1.4 EUT Photograph



EUT built on the support board

EUT

Please refer to Exhibit C for more EUT photographs.

1.5 Objective

This type approval report is prepared on behalf of *Wi2Wi Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC 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.

1.6 Related Submittal(s)/Grant(s)

N/A

1.7 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.

1.8 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 ± 2.0 for Conducted Emissions tests and ± 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.

1.9 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, 1997 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the test methods and procedures set forth in ANSI C63.4-2003 & TIA/EIA-603.

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-2463 and C-2698. 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 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/ts/htdocs/210/214/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.

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.

2.2 EUT Exercise Software

The EUT is programmed with the following data rate settings that were used during testing:

Channel	2412 MHz	2437 MHz	2462 MHz
802.11b Data rate	11Mbps	11Mbps	11Mbps
802.11g Data rate	54Mbps	54Mbps	54Mbps

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

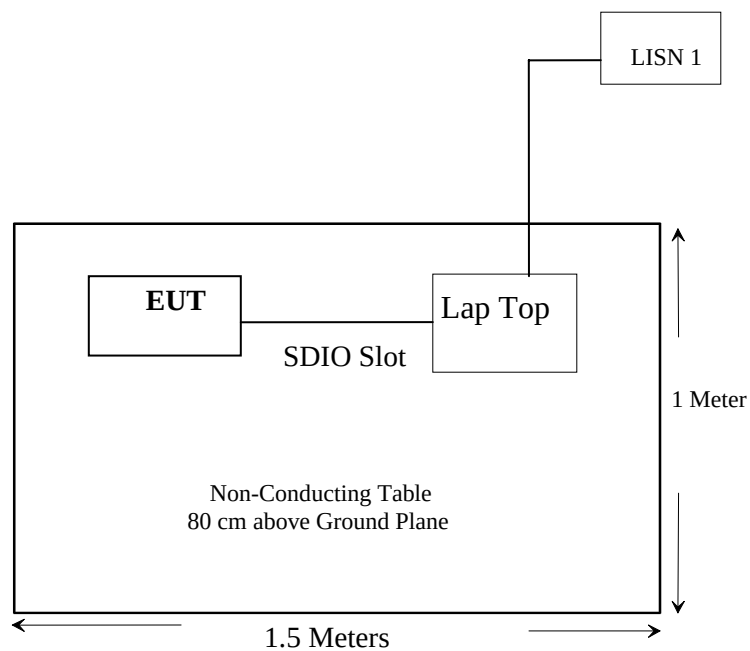
No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

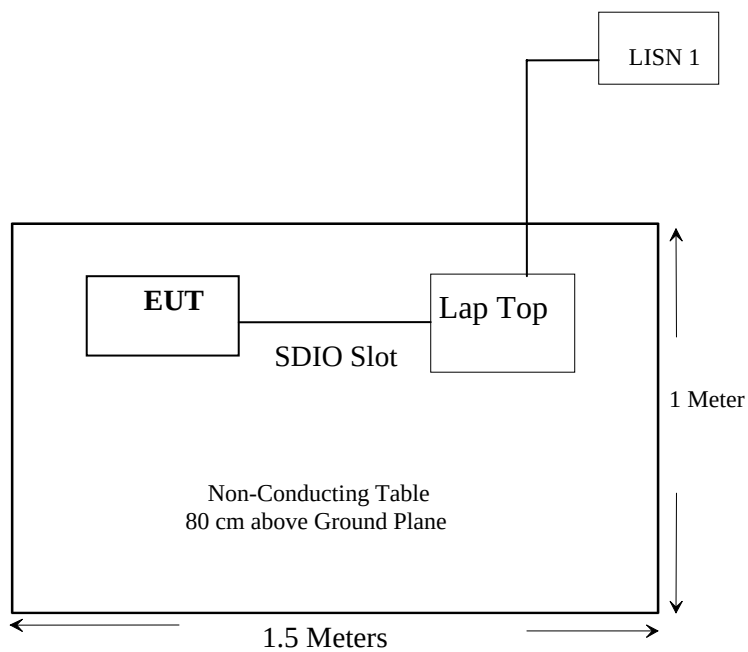
Manufacturer	Description	Model	Serial Number
Toshiba	Laptop	Satellite R15-S829	Y5040228H

2.6 Test Setup Block Diagrams

Conducted Emissions



Radiated Emissions



3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC & 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	Conducted Emissions	Compliant	-
FCC §2.1051 & §15.247(d), RSS210 § A8.5 § RSS-Gen §7.2	Spurious Emissions at Antenna Port	Compliant	-
FCC §15.109, §15.205, §15.209 & §15.247(c), IC RSS-Gen §4.9	Radiated Spurious Emissions	Compliant	-
FCC §15.205	Restricted Band	Compliant	-
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	100 kHz Bandwidth of Frequency Band Edge	Compliant	-
§15.247 (e), RSS-210 §A8.2 (b)	Power Spectral Density	Compliant	-

4 FCC §15.203, IC RSS-Gen §7.1.4 – ANTENNA REQUIREMENT

4.1 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.

4.2 Result

The antenna, model: HG2403RD-RSF for this device is a center fed monopole whip antennae with a maximum gain of 3 dBi that will only provided by Wi2Wi, Inc. It features a reverse polarity connection type to ensure that non-OEM antennae cannot be implemented by the end user.

☒ **Compliant**

☐ **N/A**

Please refer to the following antenna photo for details.



Antenna photo

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

5.1 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 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 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

5.2 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.

5.3 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	2007-04-05

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

5.4 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”.

5.5 Environmental Conditions

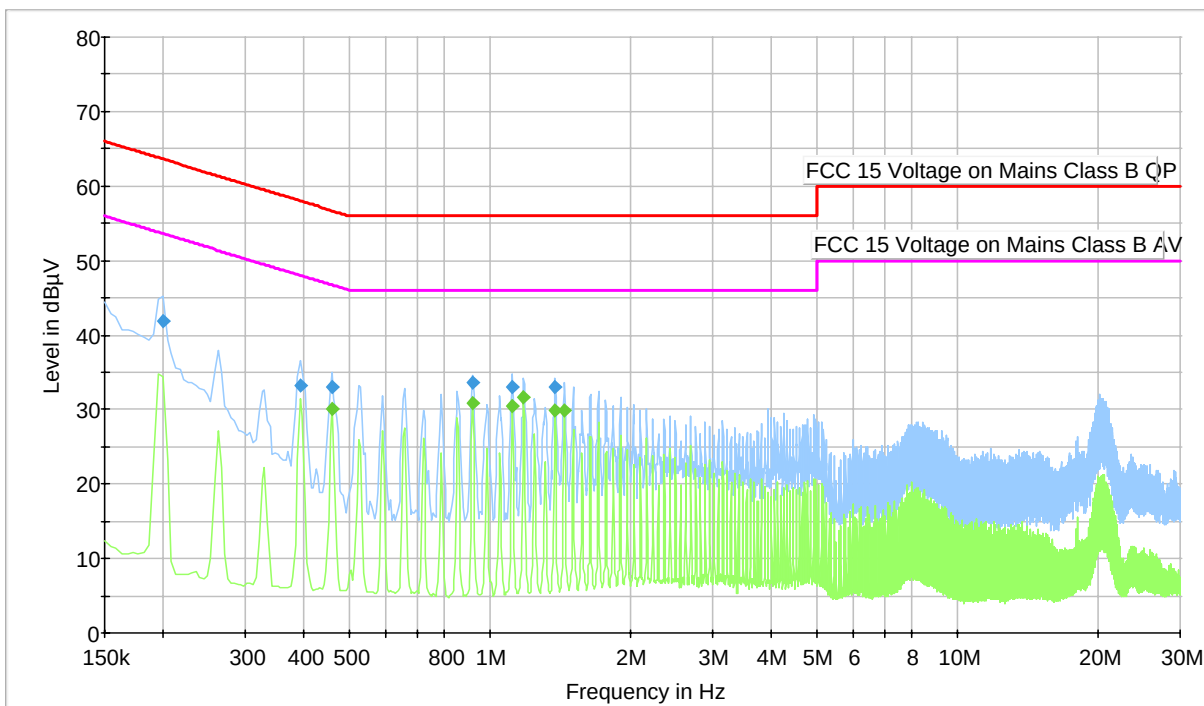
Temperature:	27 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by James Ma from 2007-09-04.*

5.6 Summary of Test Results

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

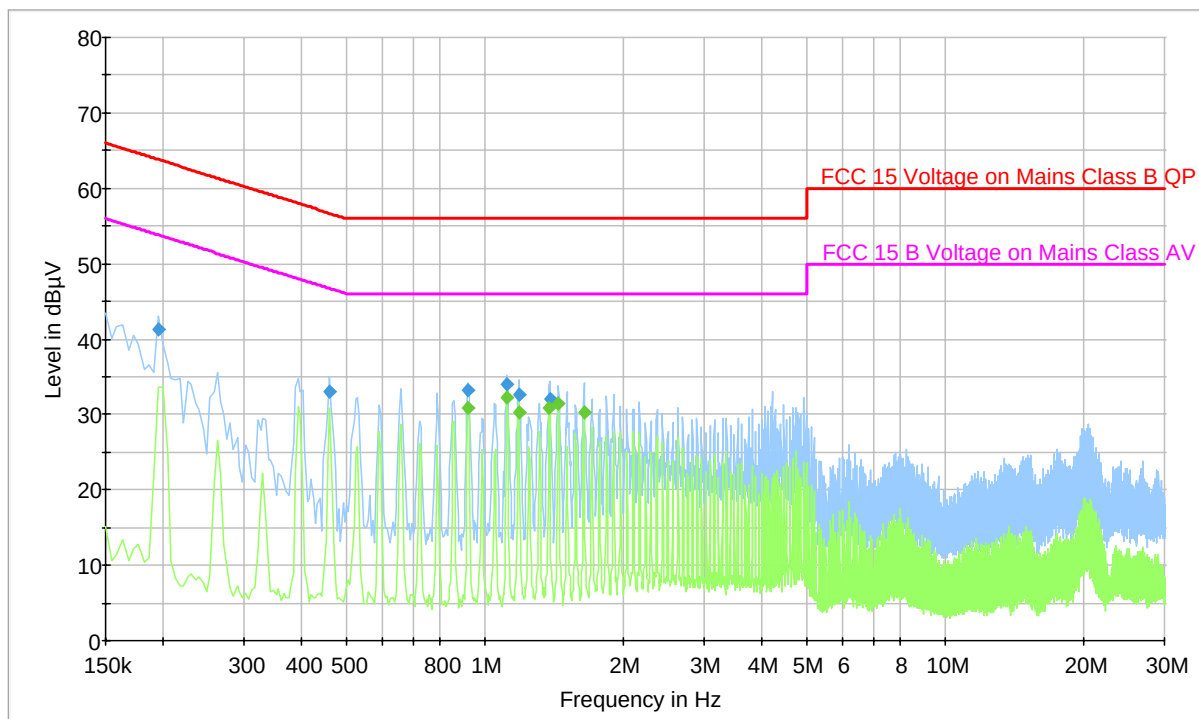
Connection: AC/DC Adapter			
Margin (dB)	Frequency (MHz)	Conductor Mode (Hot/Neutral)	Range (MHz)
-13.7	1.117500	Neutral	0.150 MHz to 30 MHz

120V/60 Hz Hot:**Final Measurement Quasi-Peak Detector**

Frequency (MHz)	Quasi-Peak (dBμV)	Conductor (H/N)	Limit (dBμV)	Margin (dB)
0.199500	41.8	H	63.6	-21.8
0.919500	33.6	H	56.0	-22.4
1.117500	33.1	H	56.0	-22.9
1.378500	32.9	H	56.0	-23.1
0.460500	33.0	H	56.7	-23.7
0.393000	33.3	H	58.0	-24.7

Final Measurement Average Detector

Frequency (MHz)	Average (dBμV)	Conductor (H/N)	Limit (dBμV)	Margin (dB)
1.180500	31.6	H	46.0	-14.4
0.919500	30.8	H	46.0	-15.2
1.117500	30.5	H	46.0	-15.5
1.446000	30.0	H	46.0	-16.0
1.378500	29.8	H	46.0	-16.2
0.460500	30.1	H	46.7	-16.6

120V/60 Hz Neutral:**Final Measurement Quasi-Peak Detector**

Frequency (MHz)	Quasi-Peak (dBμV)	Conductor (H/N)	Limit (dBμV)	Margin (dB)
1.117500	33.9	N	56.0	-22.1
0.195000	41.4	N	63.8	-22.5
0.919500	33.2	N	56.0	-22.8
1.185000	32.5	N	56.0	-23.5
0.460500	33.1	N	56.7	-23.6
1.383000	32.1	N	56.0	-23.9

Final Measurement Average Detector

Frequency (MHz)	Average (dBμV)	Conductor (H/N)	Limit (dBμV)	Margin (dB)
1.117500	32.3	N	46.0	-13.7
1.446000	31.4	N	46.0	-14.6
0.919500	30.8	N	46.0	-15.2
1.378500	30.8	N	46.0	-15.2
1.185000	30.4	N	46.0	-15.6
1.644000	30.2	N	46.0	-15.8

6 FCC §2.1051 & §15.247(d), RSS-210 § A8.5 & RSS-Gen 7.2 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

6.1 Applicable Standard

For §15.247(d) and RSS-210 § A8.5 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.

Requirements: CFR 47, §2.1051.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1057.

6.2 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.

6.3 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.

6.4 Environmental Conditions

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

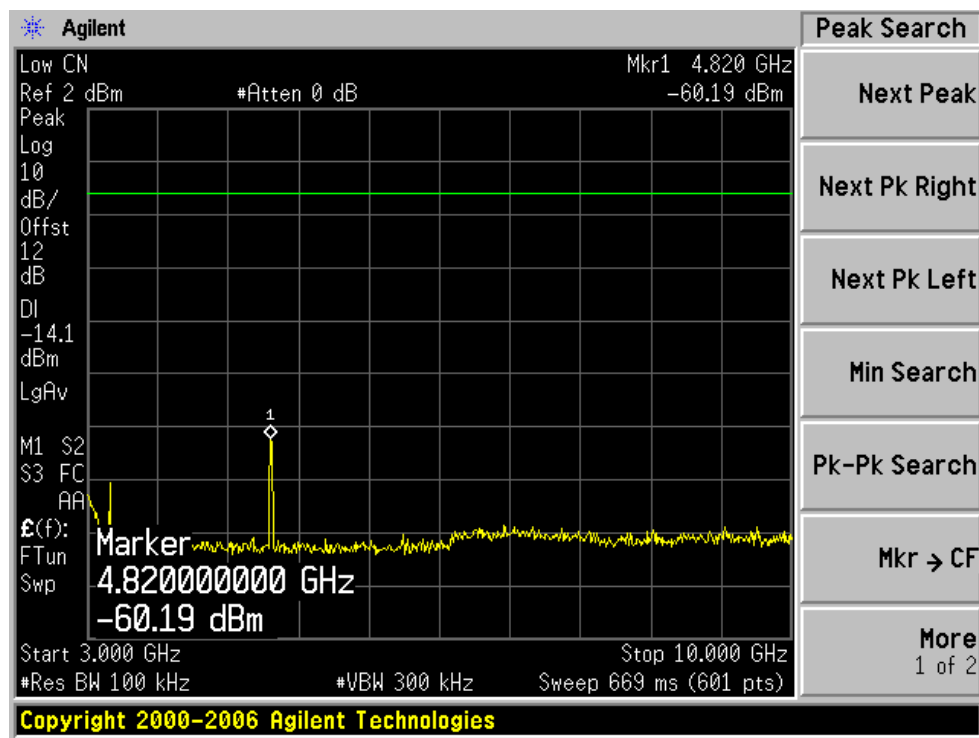
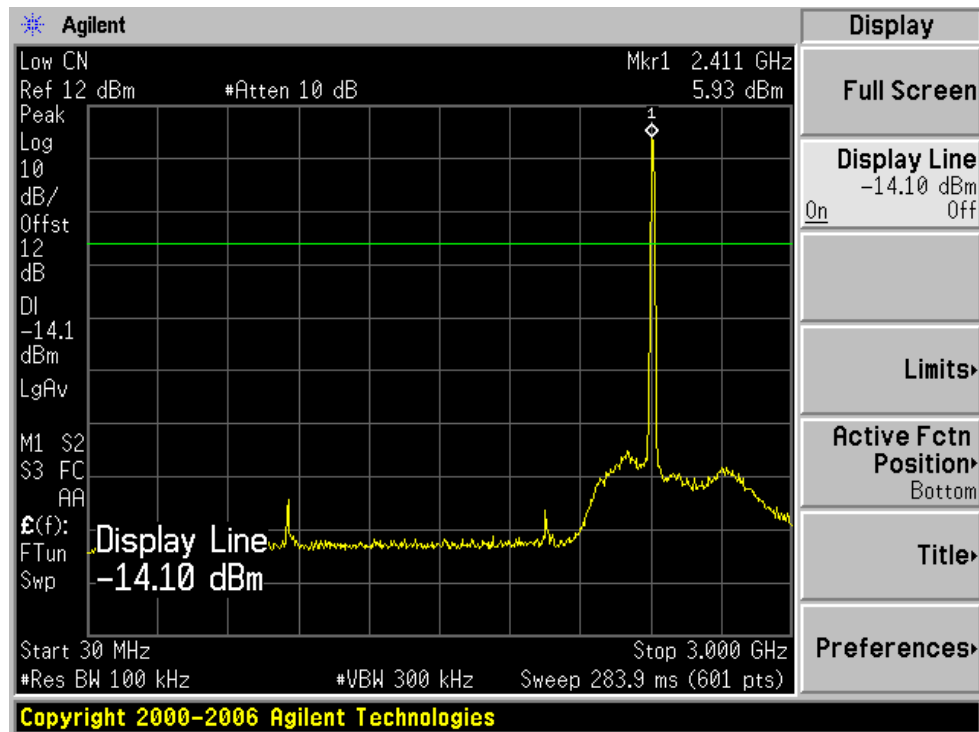
*The testing was performed by James Ma from 2007-09-04.

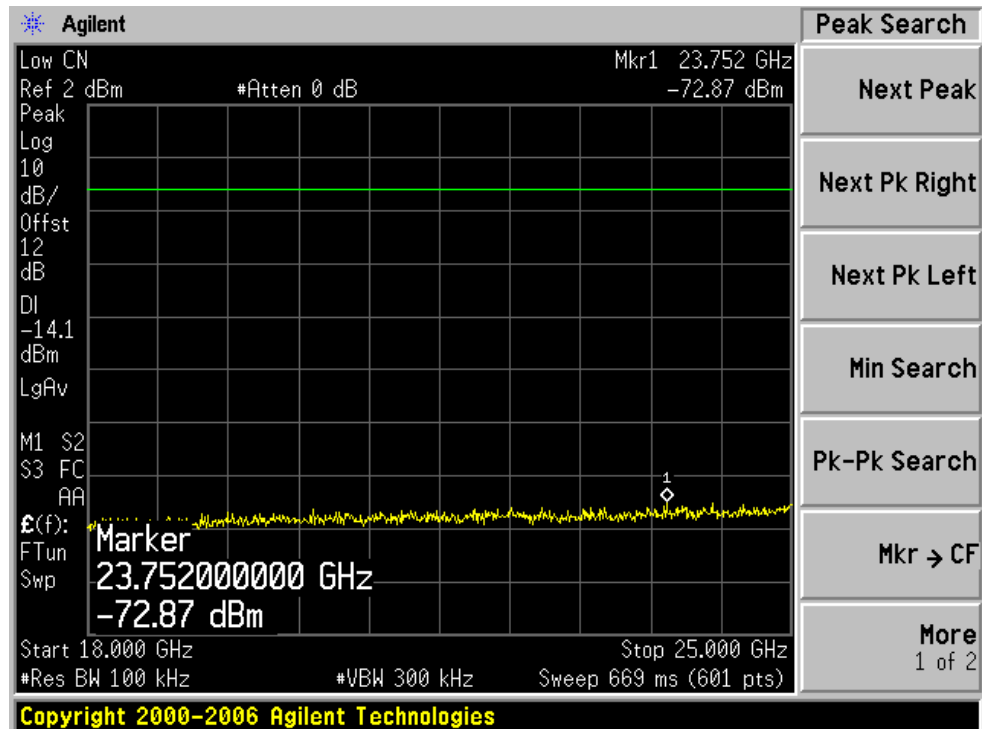
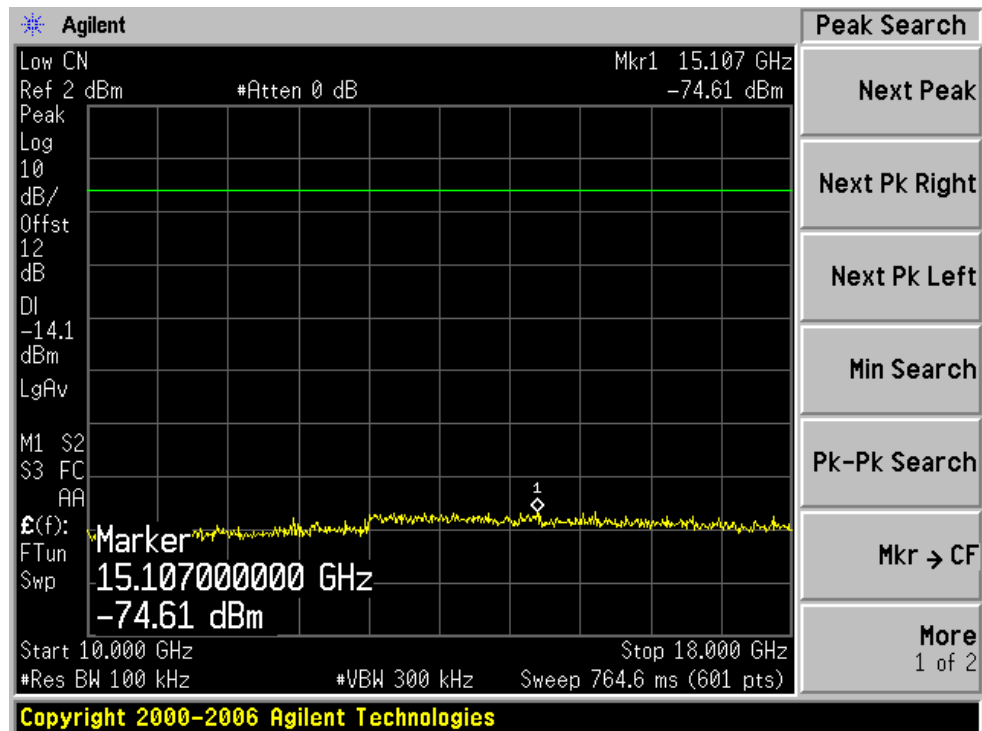
6.5 Measurement Result:

Please refer to following pages for plots of spurious emissions.

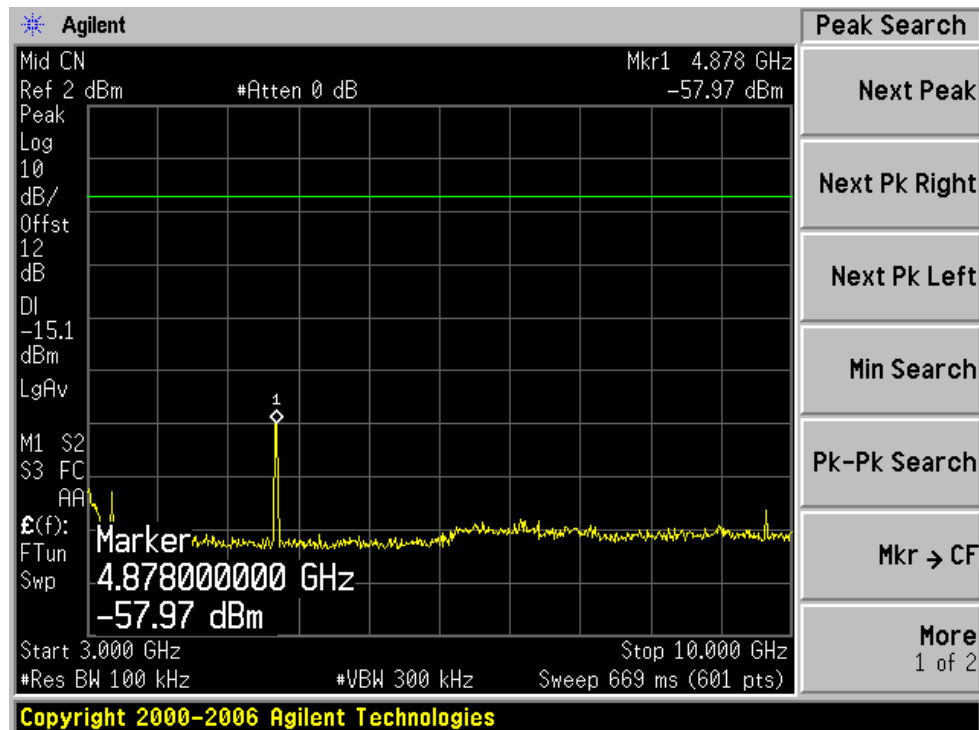
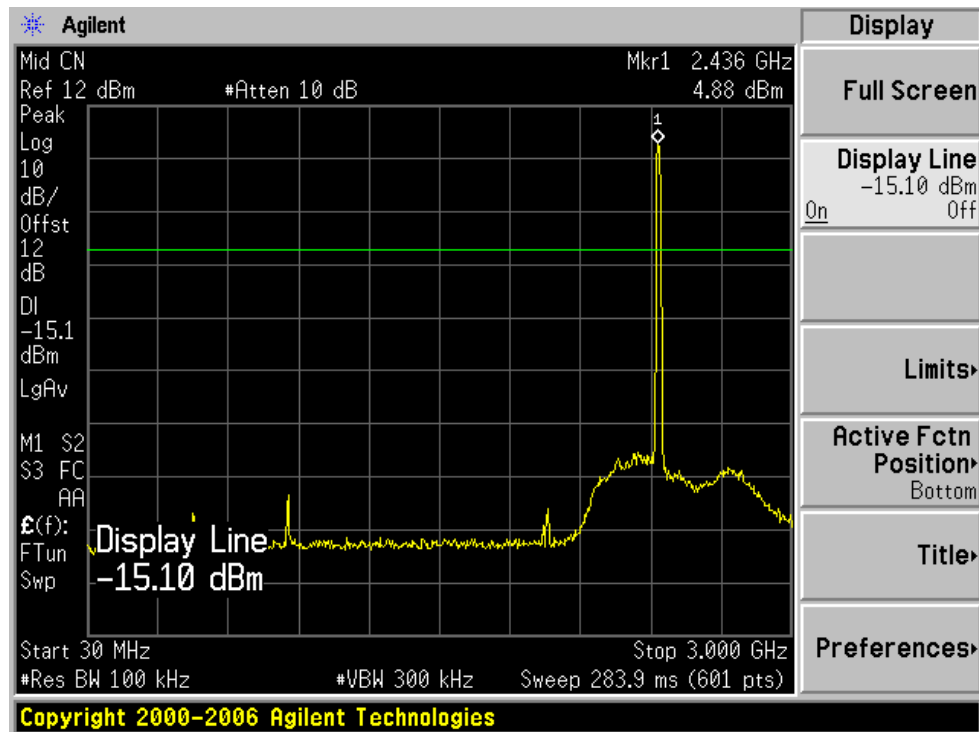
802.11b mode

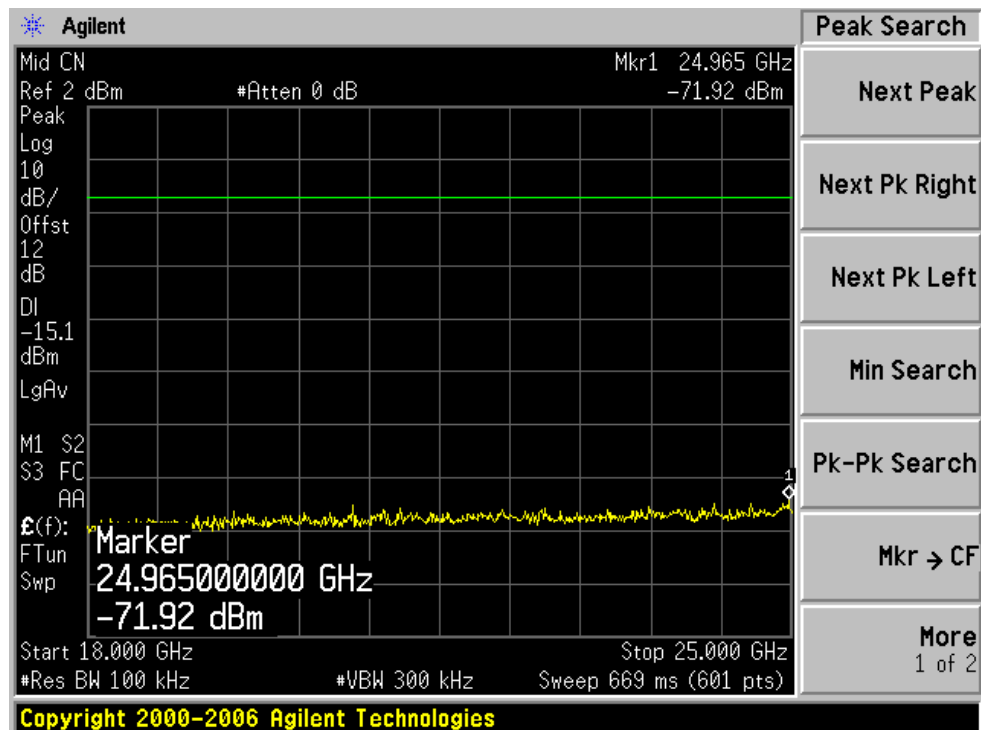
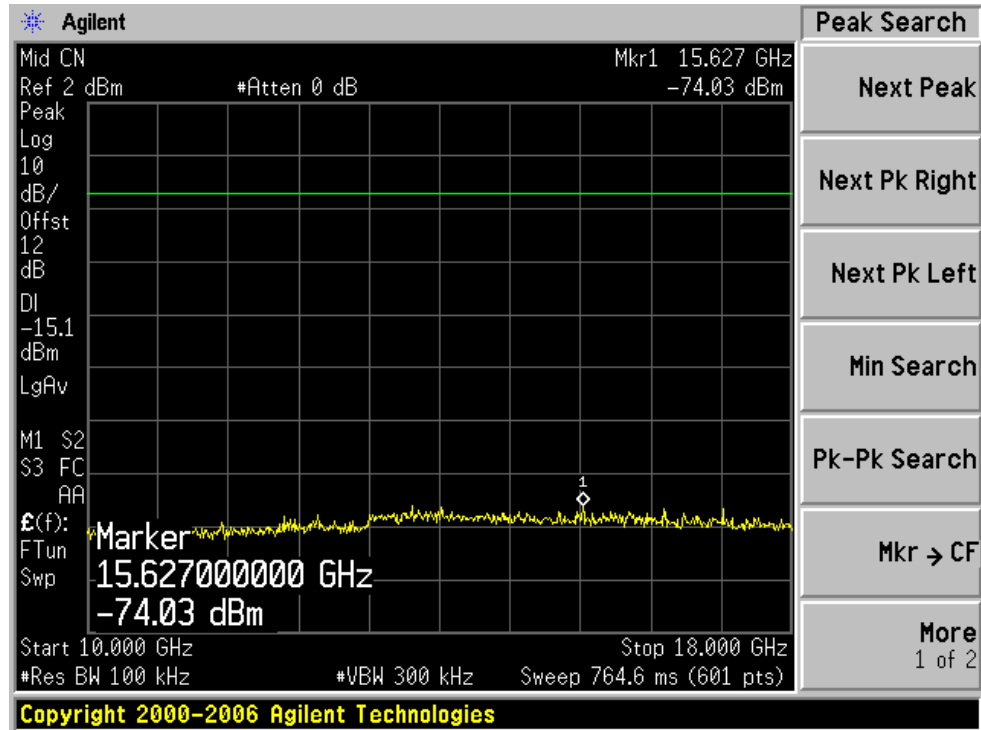
Low Channel



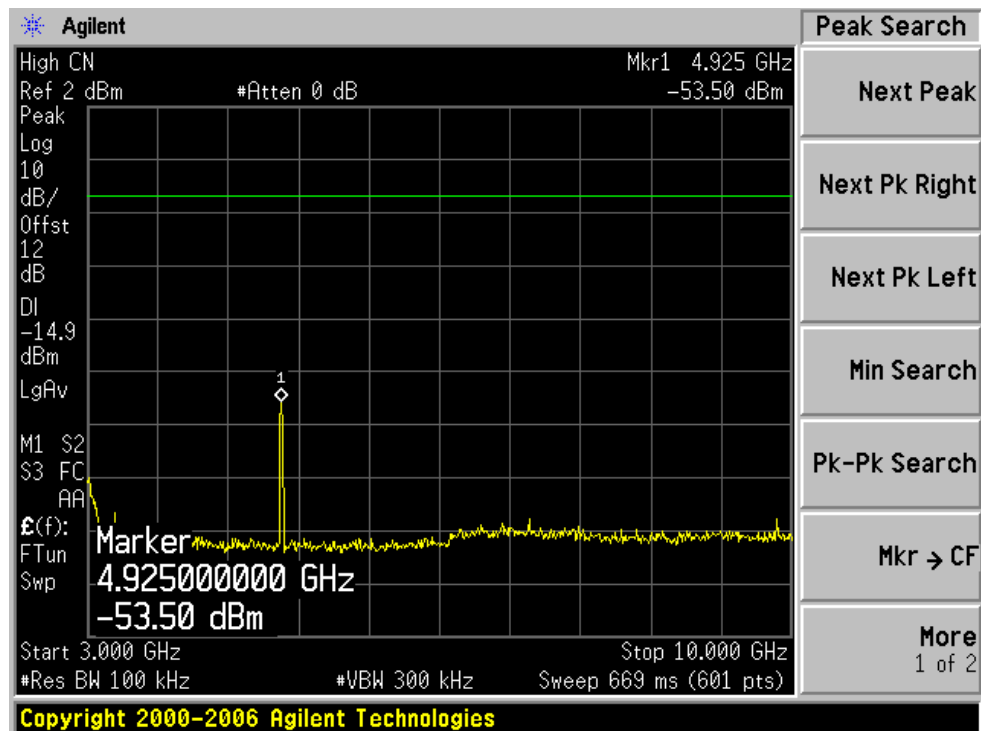
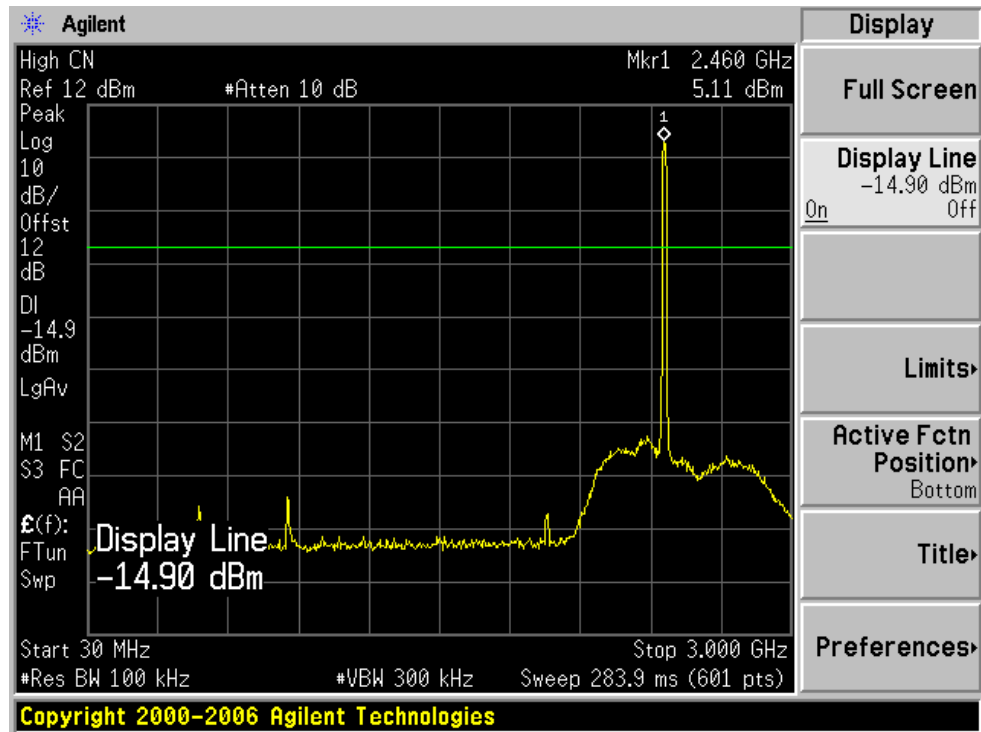


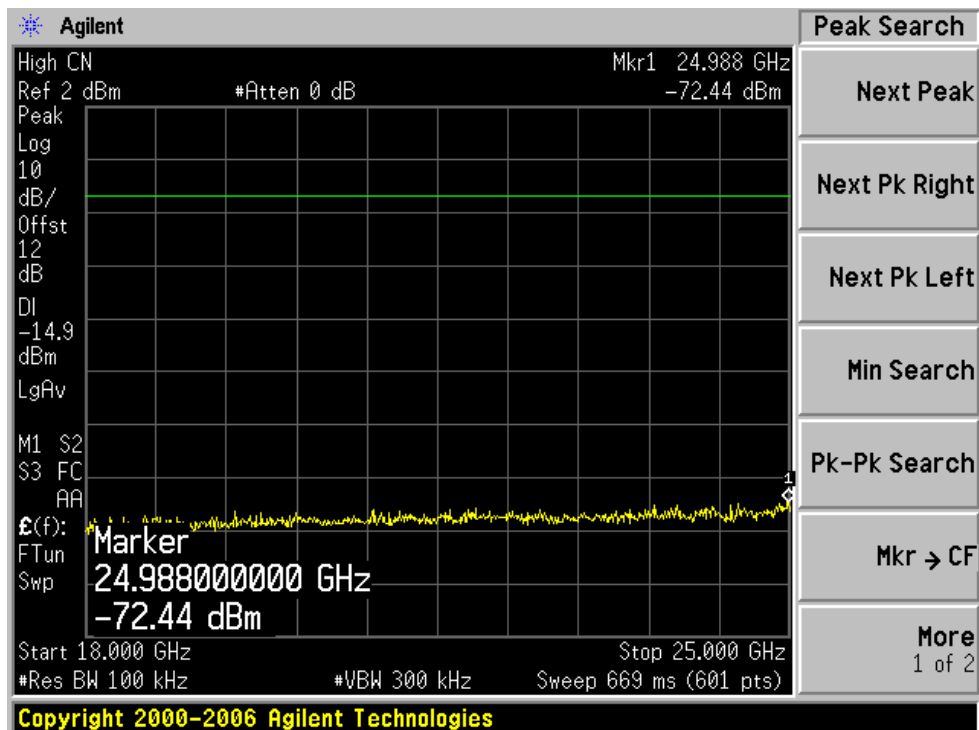
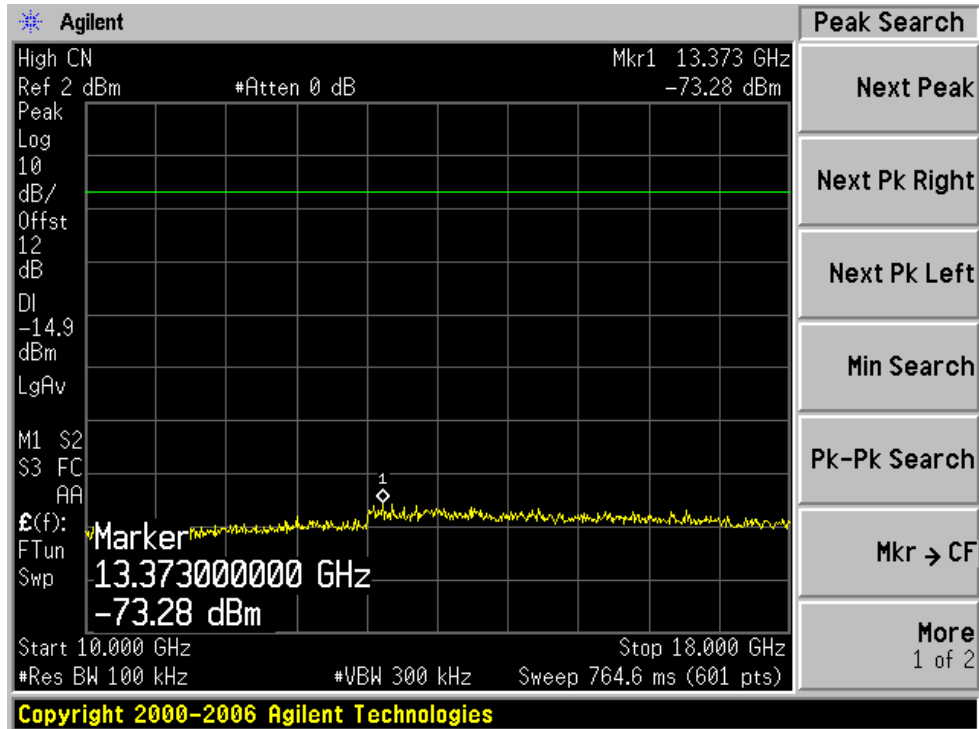
Middle Channel





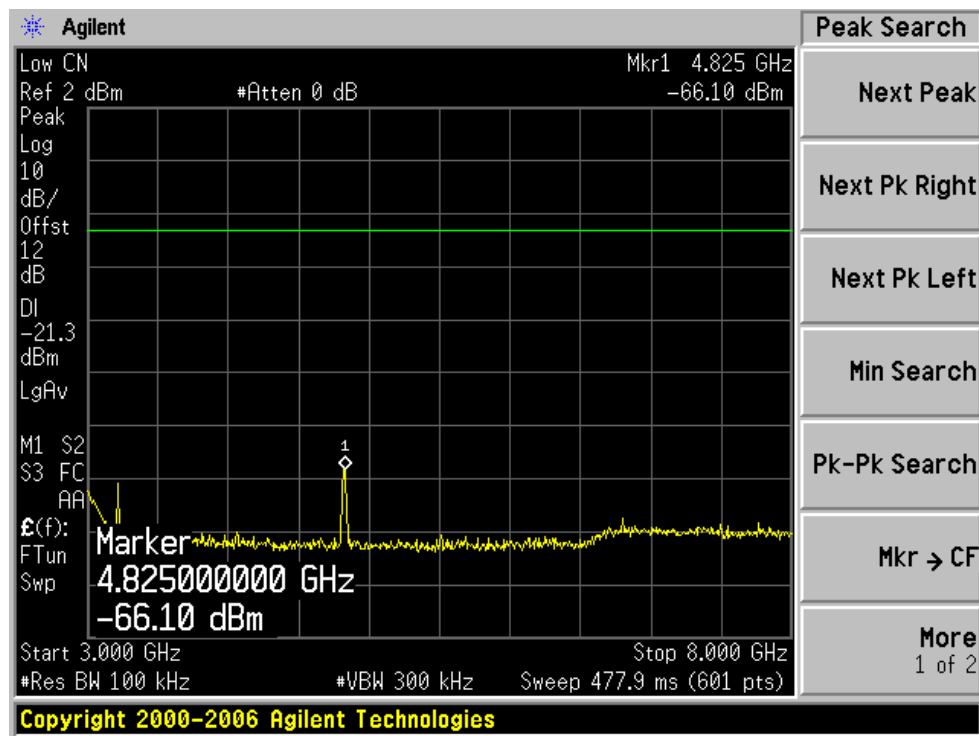
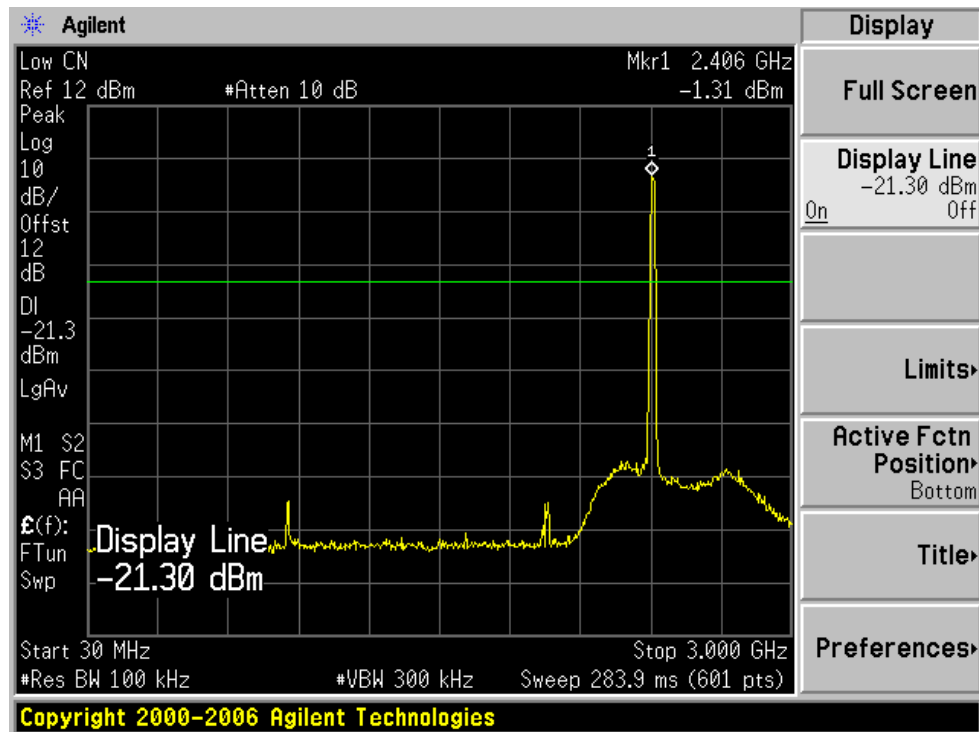
High Channel

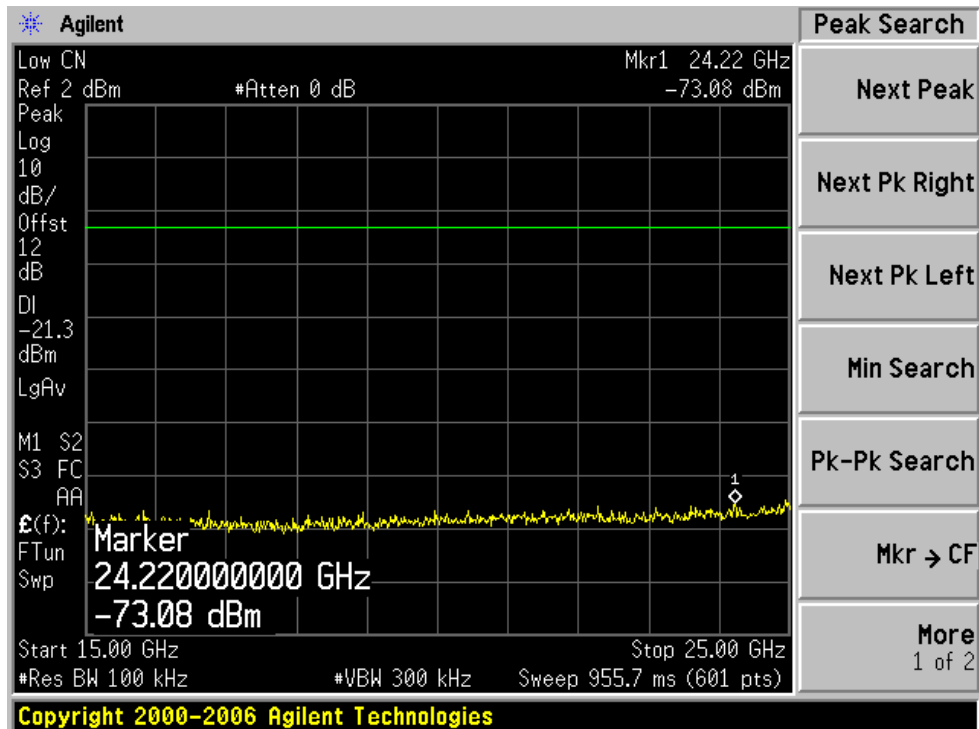
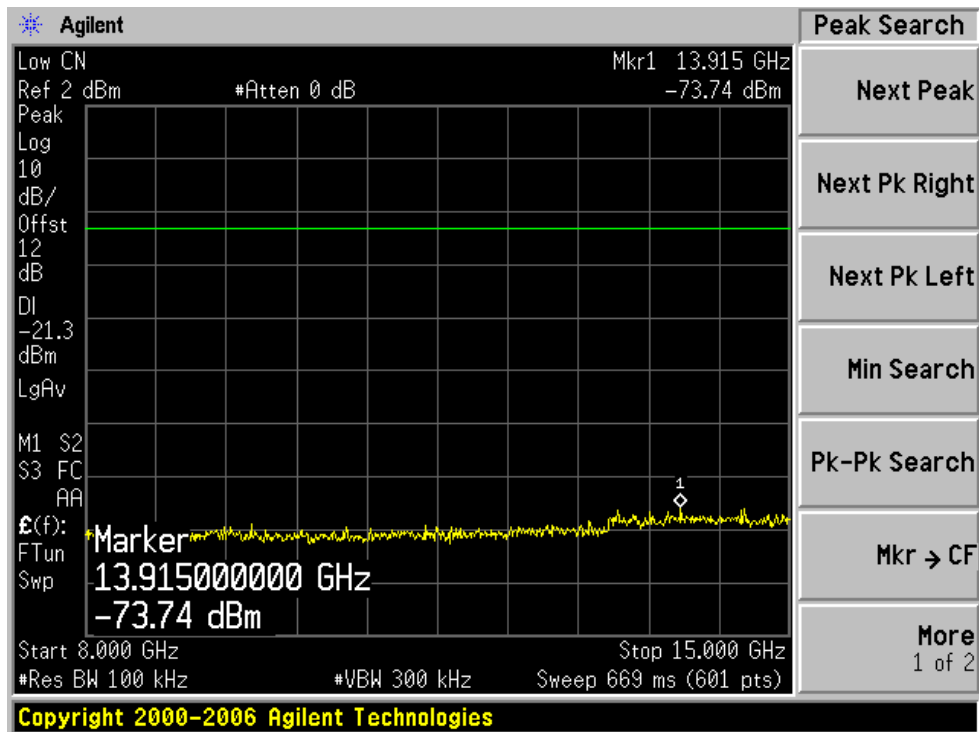




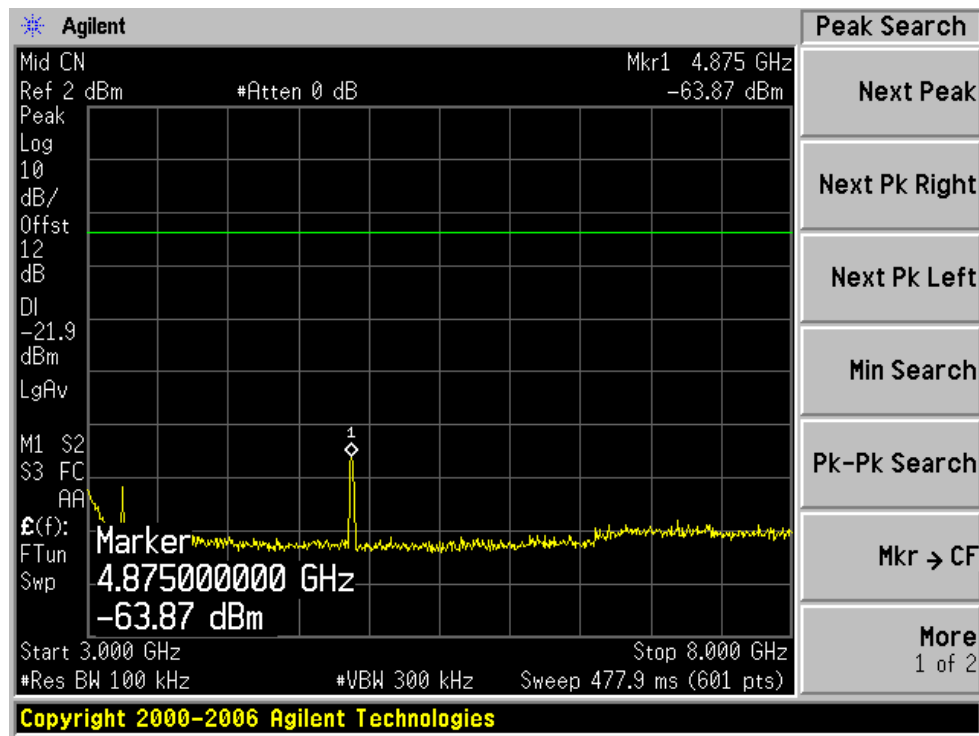
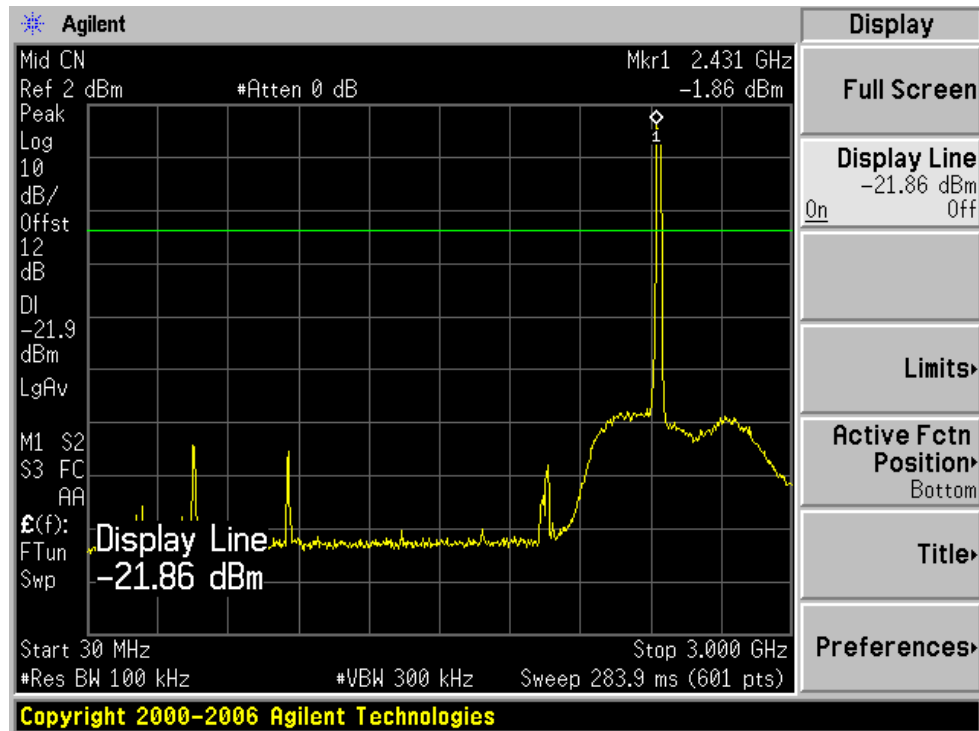
802.11g mode

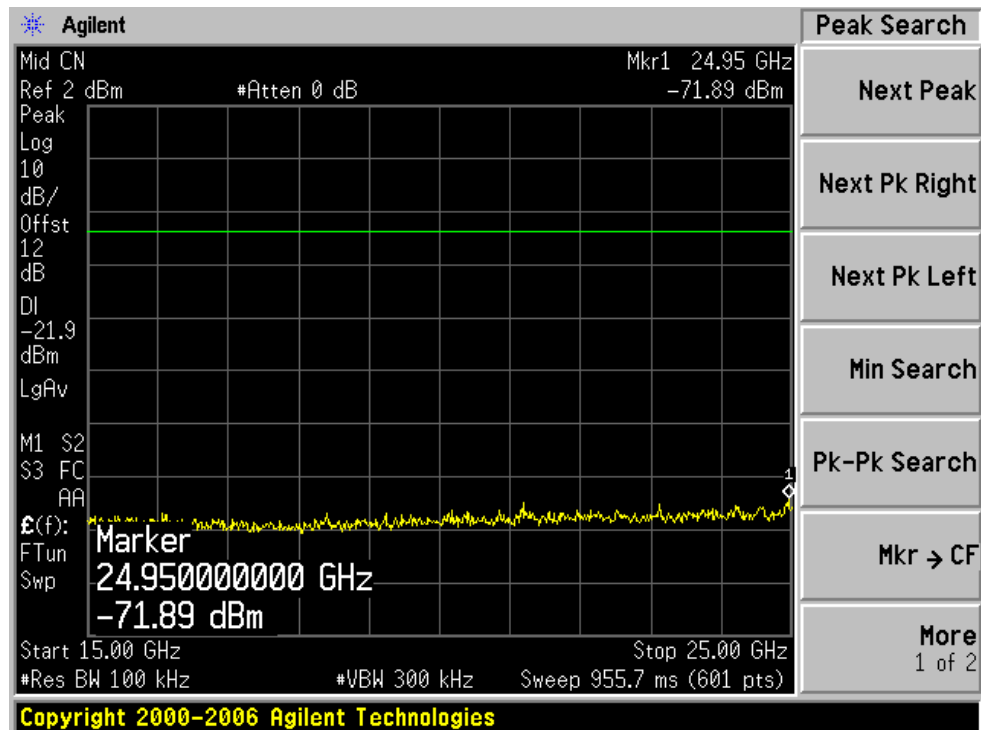
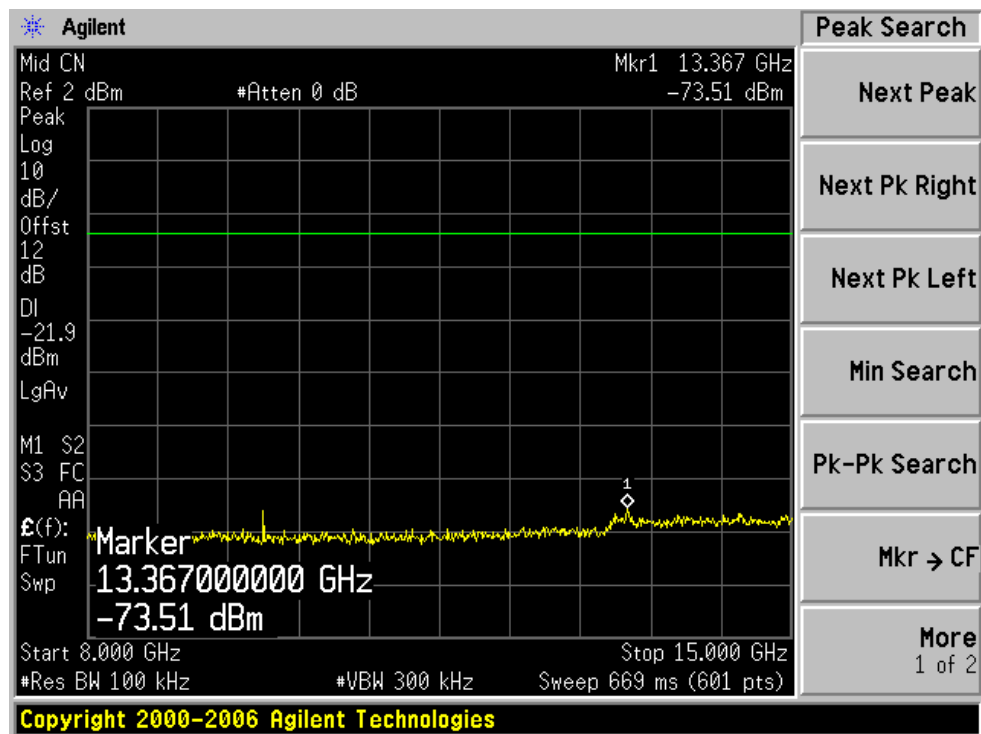
Low Channel



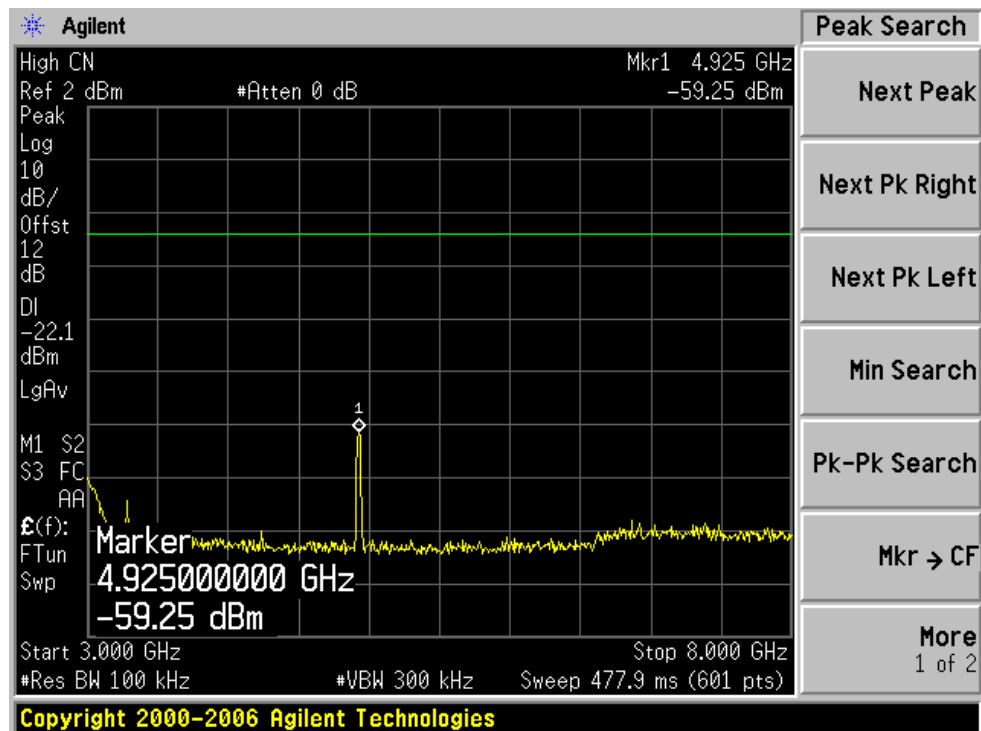
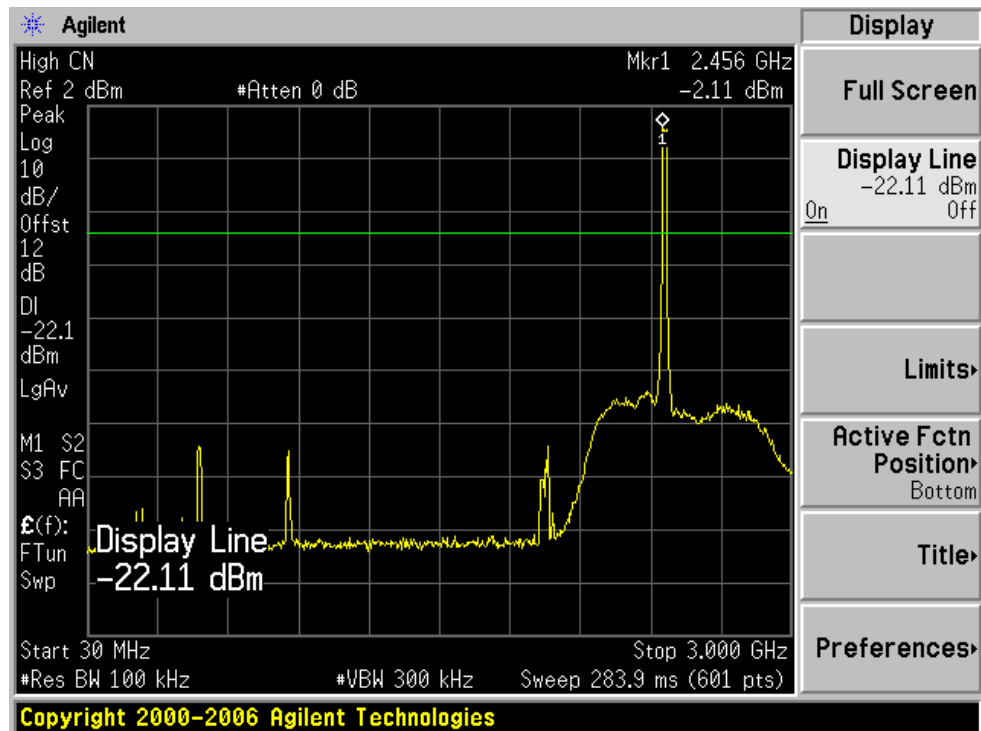


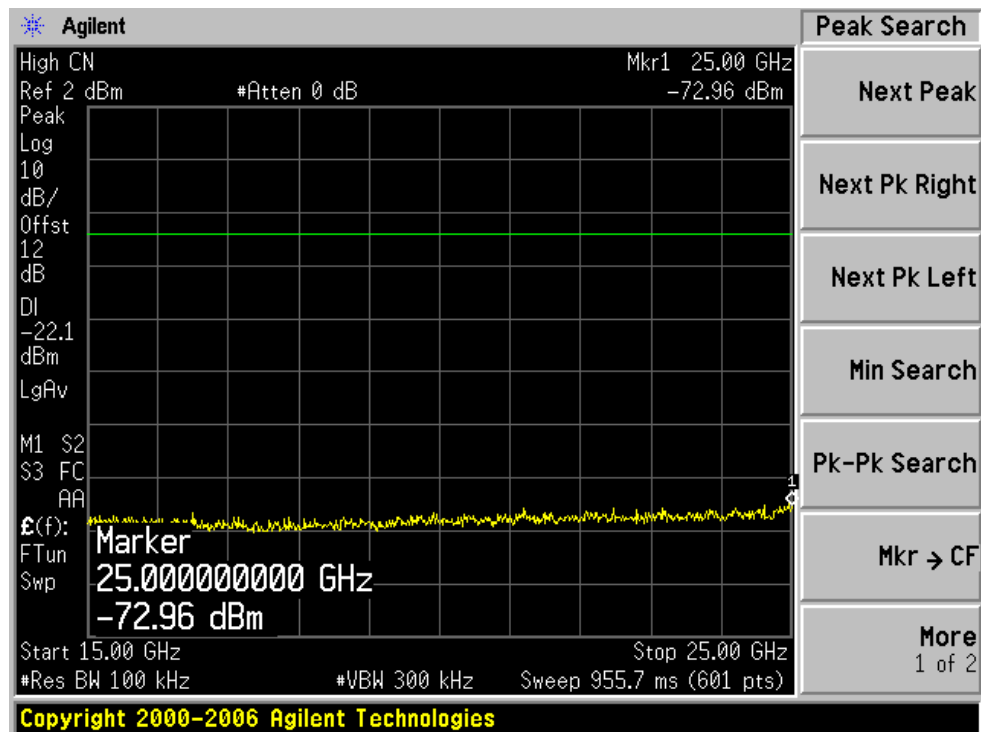
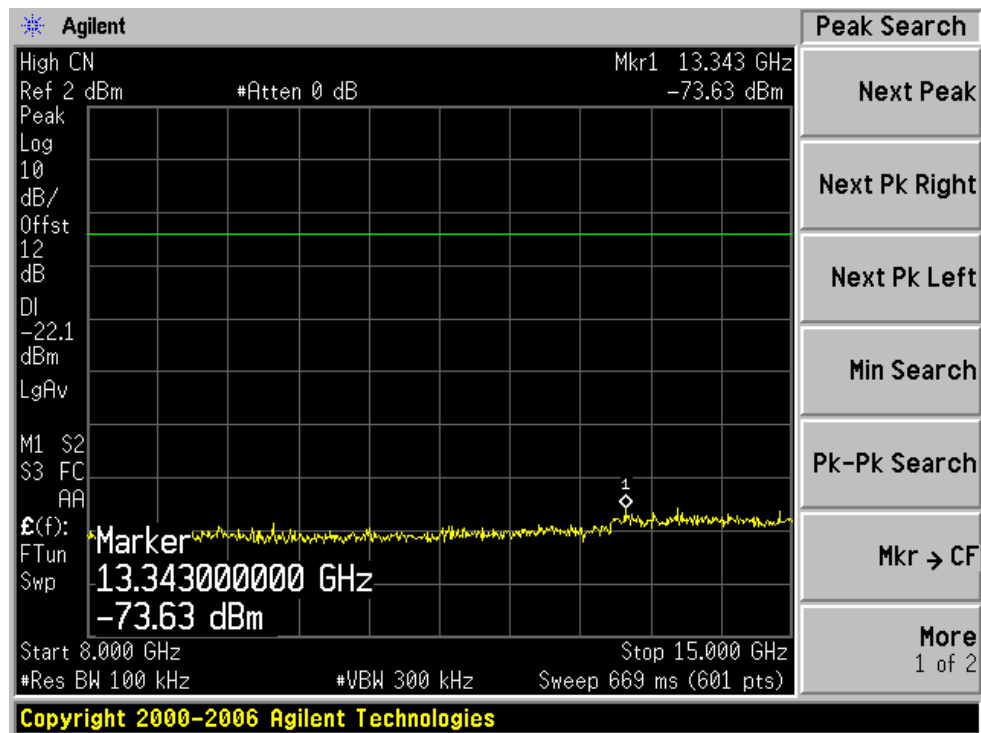
Mid Channel





High Channel





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 bundled 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	2007-06-27
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
A.R.A	Antenna Horn	DRG-118/A	1132	2007-06-18
Rohde & Schwarz	Receiver	ESCI	100337	2007-03-08
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:

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

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:

$$\text{Corrected Amplitude} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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:

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

7.7 Environmental Conditions

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

*The testing was performed by James Ma from 2007-09-04.

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)
-0.4	71.992500	Horizontal	30 MHz to 1000 MHz

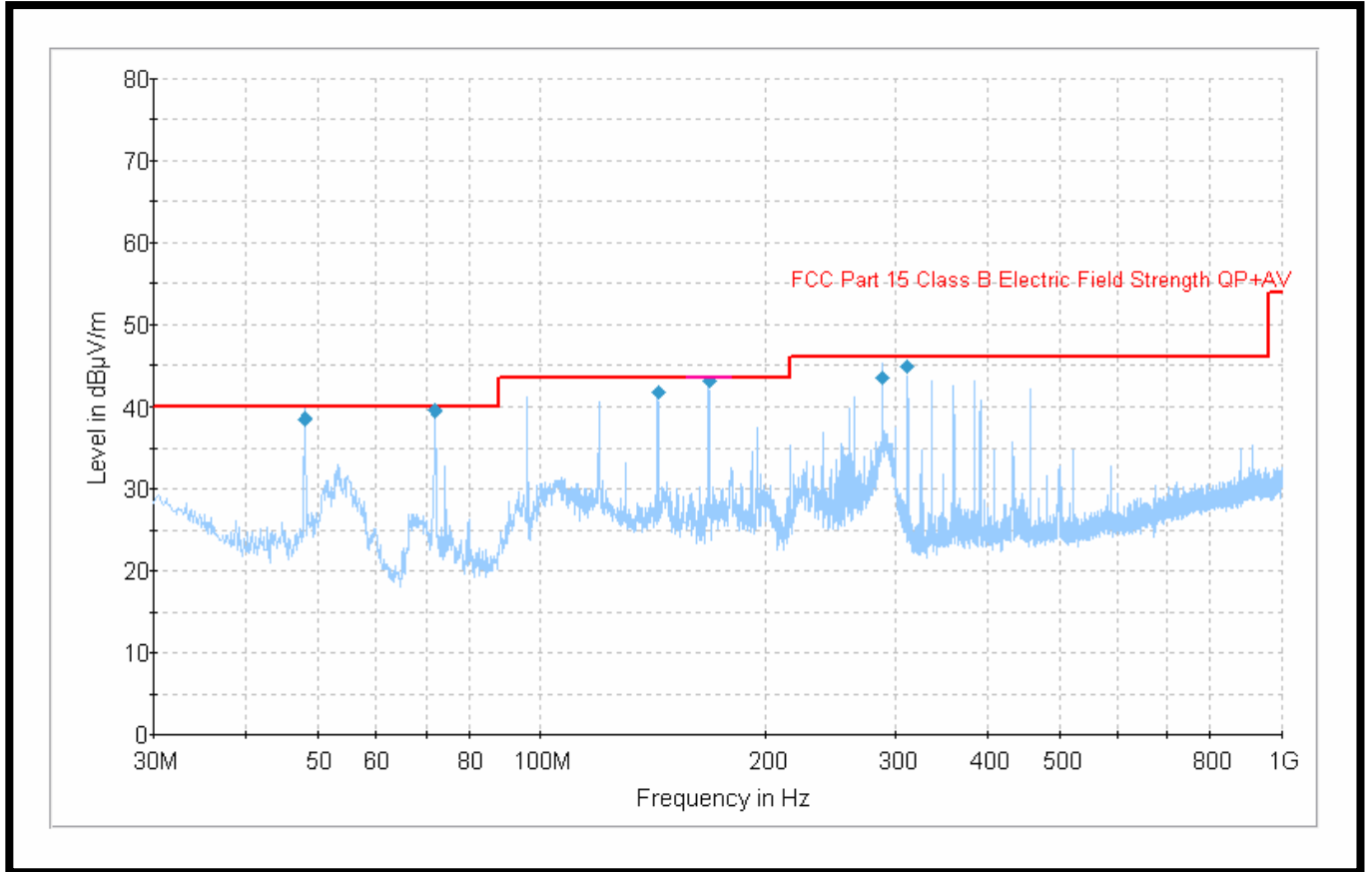
Out of Band Emissions:

Mode: Regular Antenna 802.11b (2412-2462 MHz)			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Channel, Range (GHz)
-13.2	7236.0000	Vertical	Low, 1 GHz – 25GHz
-13.3	7311.0000	Vertical	Middle, 1 GHz – 25GHz
-13.0	7386.0000	Vertical	High, 1 GHz – 25GHz

Mode: Regular Antenna 802.11g (2412-2462 MHz)			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Channel, Range (GHz)
-12.9	4824.0000	Vertical	Low, 1 GHz – 25GHz
-13.3	7311.0000	Vertical	Middle, 1 GHz – 25GHz
-13.7	7386.0000	Vertical	High, 1 GHz – 25GHz

7.9 Radiated Emissions Test plot & data:

30MHz -1GHz



Frequency (MHz)	Quasi-Peak (dBμV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (deg)	Corr. (dB)	Limit (dBμV/m)	Margin (dB)
71.992500	39.6	397.0	H	228.0	-6.6	40.0	-0.4
167.982500	42.8	162.0	H	31.0	-2.6	43.5	-0.7
311.987500	44.9	99.0	H	143.0	-0.3	46.0	-1.1
47.985000	38.5	100.0	V	256.0	-6.1	40.0	-1.5
144.015000	41.7	201.0	H	336.0	-1.7	43.5	-1.8
287.980000	43.5	114.0	H	26.0	-0.5	46.0	-2.5

7.10 Radiated Spurious Emissions Test Data**Regular Antenna (3.0 dBi)**

802.11b, 2412 - 2462 MHz, Measured at 3 meters, 1 GHz – 25 GHz

Low channel 2412 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2412.00	108.2	220	1.5	V	28.2	4.4	36.2	104.6			Fund/Peak
2412.00	98.2	320	1.5	H	28.2	4.4	36.2	94.6			Fund/Peak
2412.00	103.6	220	1.8	V	28.2	4.4	36.2	100.0			Ave
2412.00	92.0	320	1.5	H	28.2	4.4	36.2	88.4			Ave
7236.00	27.8	90	2.0	V	37.6	12.3	36.9	40.8	54	-13.2	Ave
7236.00	27.0	200	1.0	H	37.6	12.3	36.9	40.0	54	-14.0	Ave
4824.00	35.2	260	1.2	V	32.1	6.0	34.4	38.9	54	-15.1	Ave
4824.00	28.3	180	2.3	H	32.1	6.0	34.4	32.0	54	-22.0	Ave
7236.00	35.5	90	2.0	V	37.6	12.3	36.9	48.5	74	-25.5	Peak
4824.00	44.6	260	1.2	V	32.1	6.0	34.4	48.3	74	-25.7	Peak
7236.00	34.1	200	1.0	H	37.6	12.3	36.9	47.1	74	-26.9	Peak
4824.00	37.1	70	1.7	H	32.1	6.0	34.4	40.8	74	-33.2	Peak

Middle channel 2437 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2437.00	107.4	45	1.0	V	28.2	4.4	36.2	103.8			Fund/Peak
2437.00	98.5	45	1.2	H	28.2	4.4	36.2	94.9			Fund/Peak
2437.00	104.2	45	1.0	V	28.2	4.4	36.2	100.6			Ave
2437.00	93.2	45	1.2	H	28.2	4.4	36.2	89.6			Ave
7311.00	27.7	30	1.3	V	37.6	12.3	36.9	40.7	54	-13.3	Ave
7311.00	27.3	180	1.0	H	37.6	12.3	36.9	40.3	54	-13.7	Ave
4874.00	32.8	300	1.3	V	32.1	6.0	34.4	36.5	54	-17.5	Ave
4874.00	28.4	160	2.2	H	32.1	6.0	34.4	32.1	54	-21.9	Ave
7311.00	35.5	30	1.3	V	37.6	12.3	36.9	48.5	74	-25.5	Peak
7311.00	34.7	180	1.0	H	37.6	12.3	36.9	47.7	74	-26.3	Peak
4874.00	42.3	300	1.3	V	32.1	6.0	34.4	46.0	74	-28.0	Peak
4874.00	34.7	160	2.2	H	32.1	6.0	34.4	38.4	74	-35.6	Peak

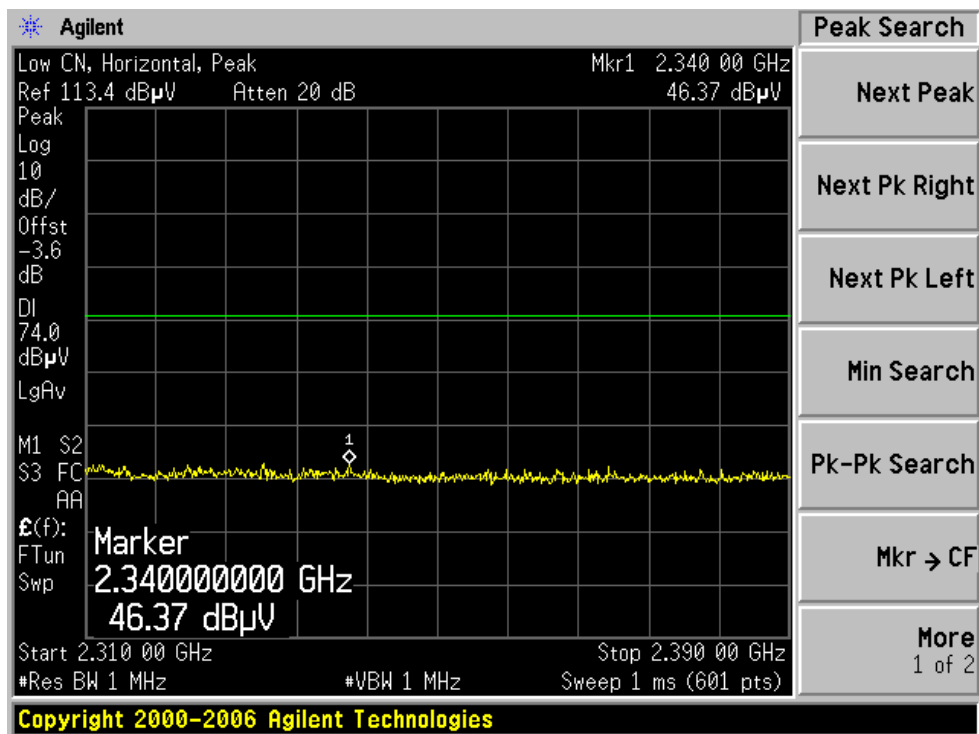
High channel 2462 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2462.00	107.6	40	1.3	V	28.2	4.4	36.2	104.0			Fund/Peak
2462.00	98.4	180	1.2	H	28.2	4.4	36.2	94.8			Fund/Peak
2462.00	103.5	40	1.3	V	28.2	4.4	36.2	99.9			Ave
2462.00	92.0	180	1.2	H	28.2	4.4	36.2	88.4			Ave
7386.00	28.0	270	2.4	V	37.6	12.3	36.9	41.0	54	-13.0	Ave
7386.00	27.5	180	1.2	H	37.6	12.3	36.9	40.5	54	-13.5	Ave
4924.00	33.0	60	2.0	V	32.1	6.0	34.4	36.7	54	-17.3	Ave
4924.00	29.1	90	2.1	H	32.1	6.0	34.4	32.8	54	-21.2	Ave
7386.00	36.0	270	2.4	V	37.6	12.3	36.9	49.0	74	-25.0	Peak
7386.00	34.5	180	1.2	H	37.6	12.3	36.9	47.5	74	-26.5	Peak
4924.00	43.4	60	2.0	V	32.1	6.0	34.4	47.1	74	-26.9	Peak
4924.00	35.6	90	2.1	H	32.1	6.0	34.4	39.3	74	-34.7	Peak

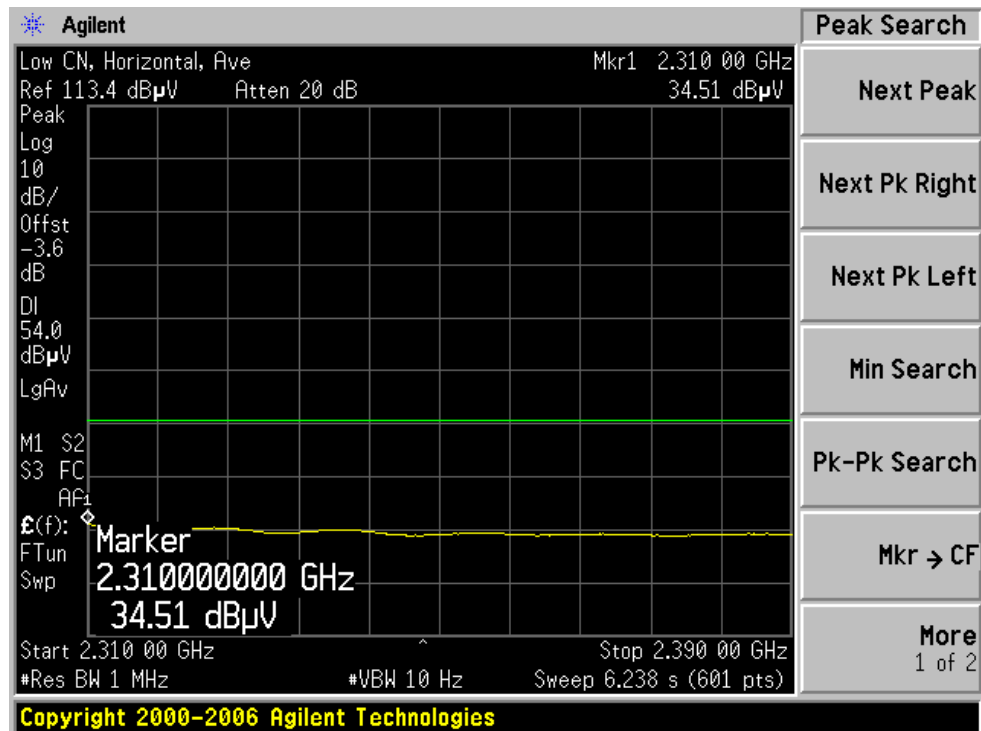
Restricted Band Edge

Low Channel

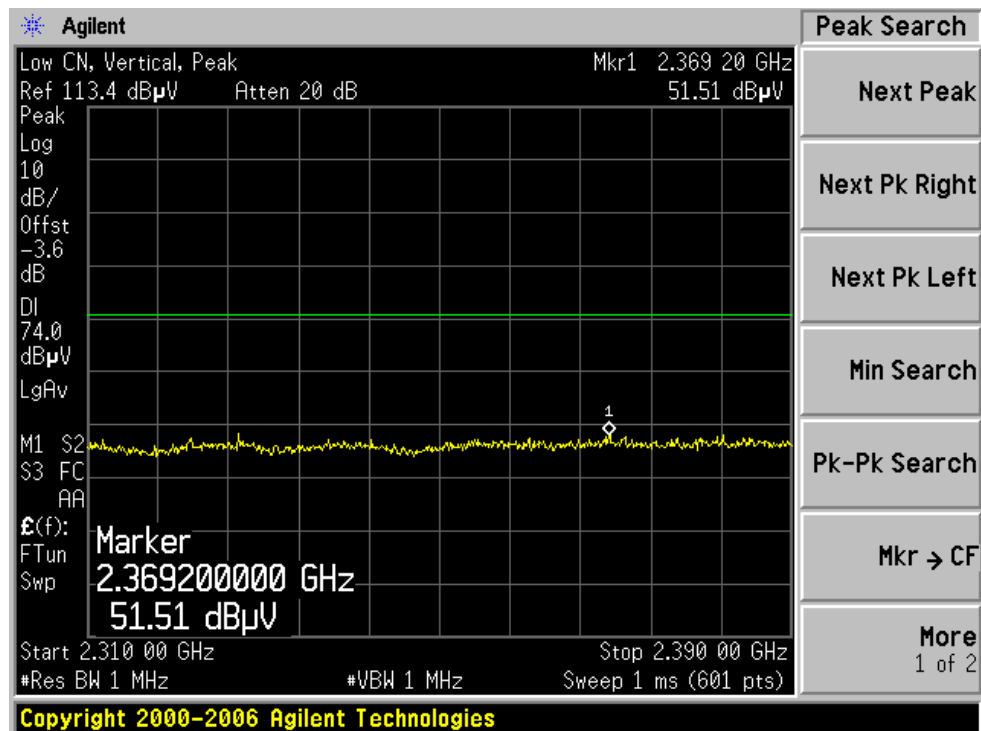
Peak, Horizontal



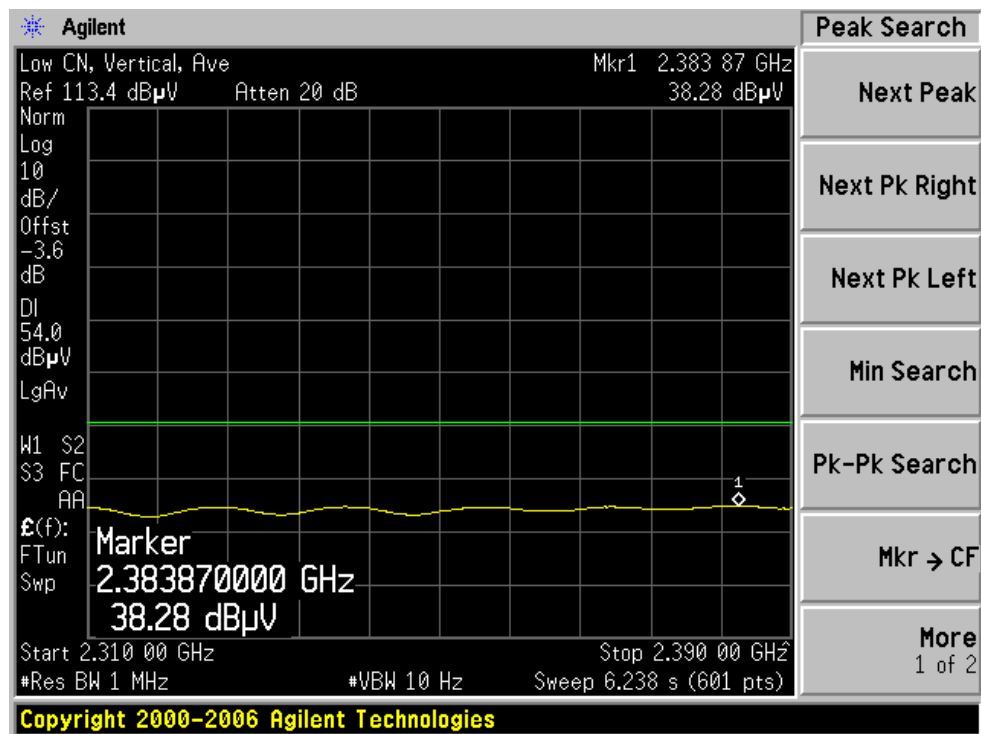
Average, Horizontal



Peak, Vertical

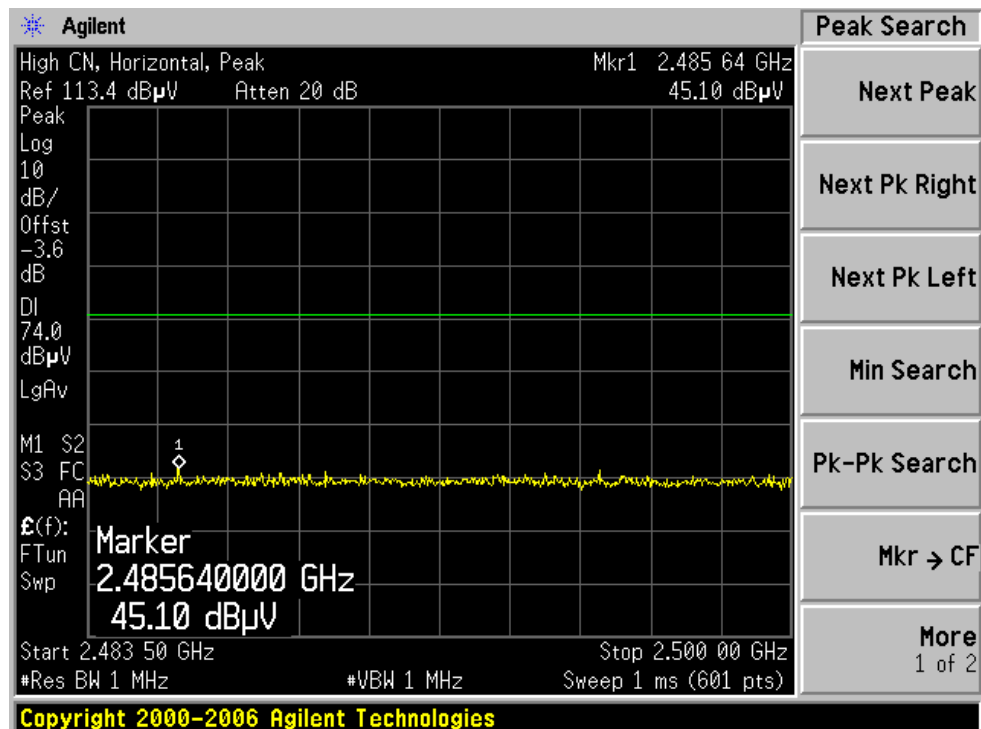


Average, Vertical

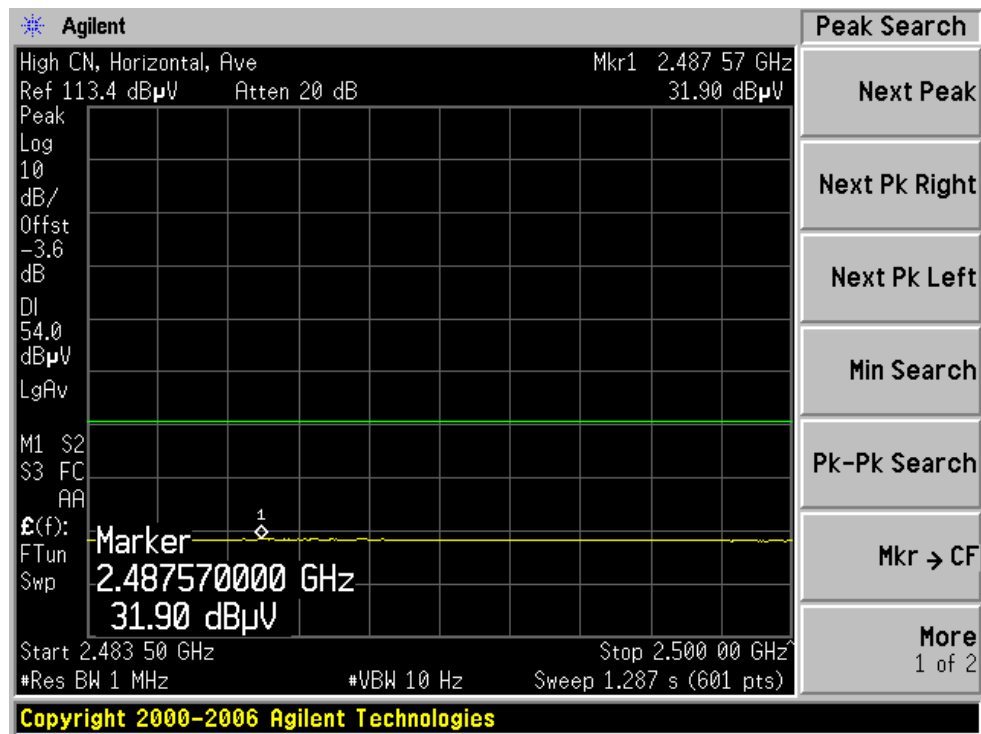


High Channel

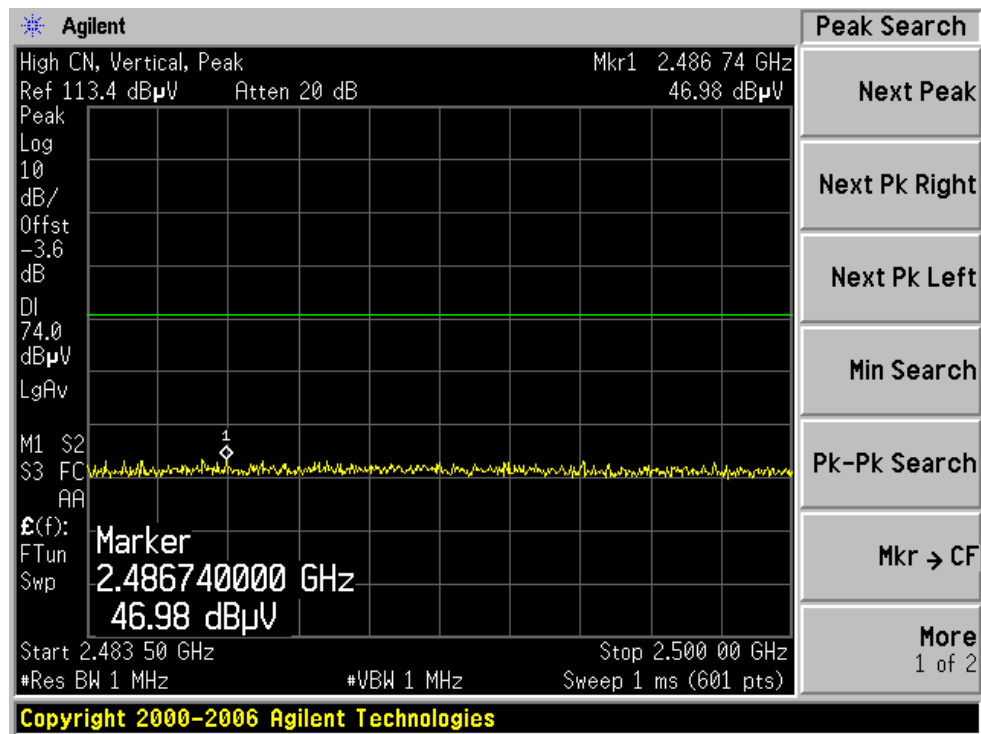
Peak, Horizontal



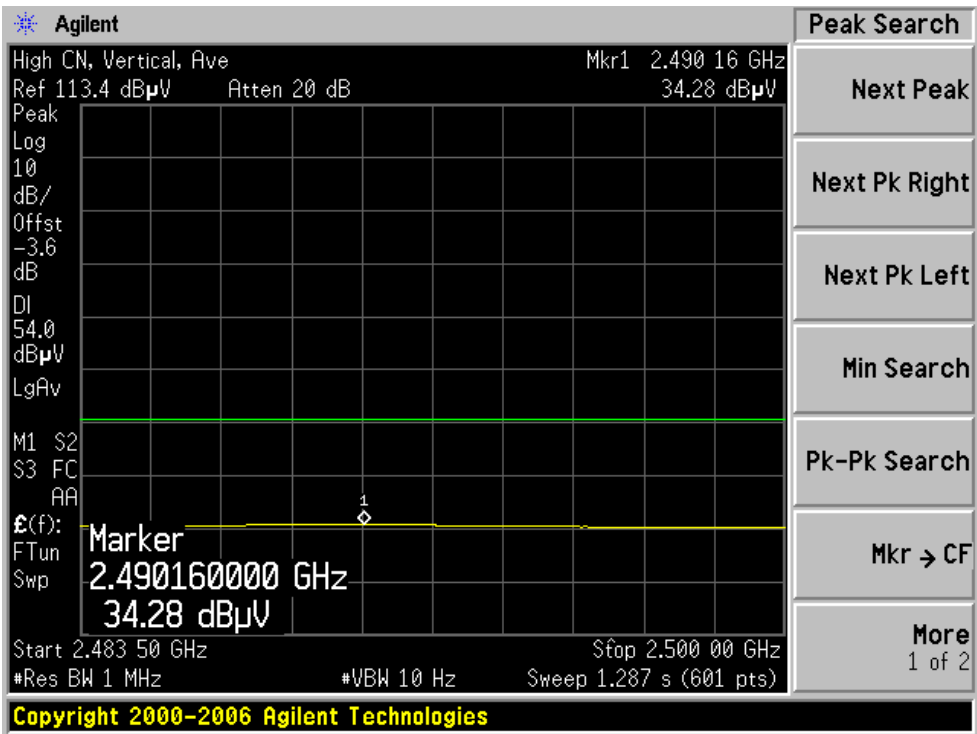
Average, Horizontal



Peak, Vertical



Average, Vertical



Regular Antenna (3.0 dBi)

802.11g, 2412 - 2462 MHz, Measured at 3 meters, 1 GHz – 25 GHz

Low channel 2412 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2412.00	104.7	50	1.5	V	28.2	4.4	36.2	101.1			Fund/Peak
2412.00	94.2	60	1.5	H	28.2	4.4	36.2	90.6			Fund/Peak
2412.00	99.8	50	1.8	V	28.2	4.4	36.2	96.2			Ave
2412.00	87.0	60	1.5	H	28.2	4.4	36.2	83.4			Ave
4824.00	37.4	300	1.3	V	32.1	6.0	34.4	41.1	54	-12.9	Ave
7236.00	28.1	90	2.0	V	37.6	12.3	36.9	41.1	54	-12.9	Ave
7236.00	27.0	200	1.0	H	37.6	12.3	36.9	40.0	54	-14.0	Ave
4824.00	32.5	0	2.0	H	32.1	6.0	34.4	36.2	54	-17.8	Ave
4824.00	46.5	300	1.3	V	32.1	6.0	34.4	50.2	74	-23.8	Peak
7236.00	35.4	90	2.0	V	37.6	12.3	36.9	48.4	74	-25.6	Peak
7236.00	34.7	200	1.0	H	37.6	12.3	36.9	47.7	74	-26.3	Peak
4824.00	43.2	0	2.0	H	32.1	6.0	34.4	46.9	74	-27.1	Peak

Middle channel 2437 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2437.00	103.2	45	1.0	V	28.2	4.4	36.2	99.6			Fund/Peak
2437.00	94.5	45	1.2	H	28.2	4.4	36.2	90.9			Fund/Peak
2437.00	99.6	45	1.0	V	28.2	4.4	36.2	96.0			Ave
2437.00	87.9	45	1.2	H	28.2	4.4	36.2	84.3			Ave
7311.00	27.7	30	1.3	V	37.6	12.3	36.9	40.7	54	-13.3	Ave
7311.00	27.2	180	1.0	H	37.6	12.3	36.9	40.2	54	-13.8	Ave
4874.00	31.8	35	1.5	V	32.1	6.0	34.4	35.5	54	-18.5	Ave
4874.00	28.0	160	2.2	H	32.1	6.0	34.4	31.7	54	-22.3	Ave
4874.00	44.2	35	1.5	V	32.1	6.0	34.4	47.9	74	-26.1	Peak
7311.00	34.8	30	1.3	V	37.6	12.3	36.9	47.8	74	-26.2	Peak
7311.00	34.0	180	1.0	H	37.6	12.3	36.9	47.0	74	-27.0	Peak
4874.00	40.3	160	2.2	H	32.1	6.0	34.4	44.0	74	-30.0	Peak

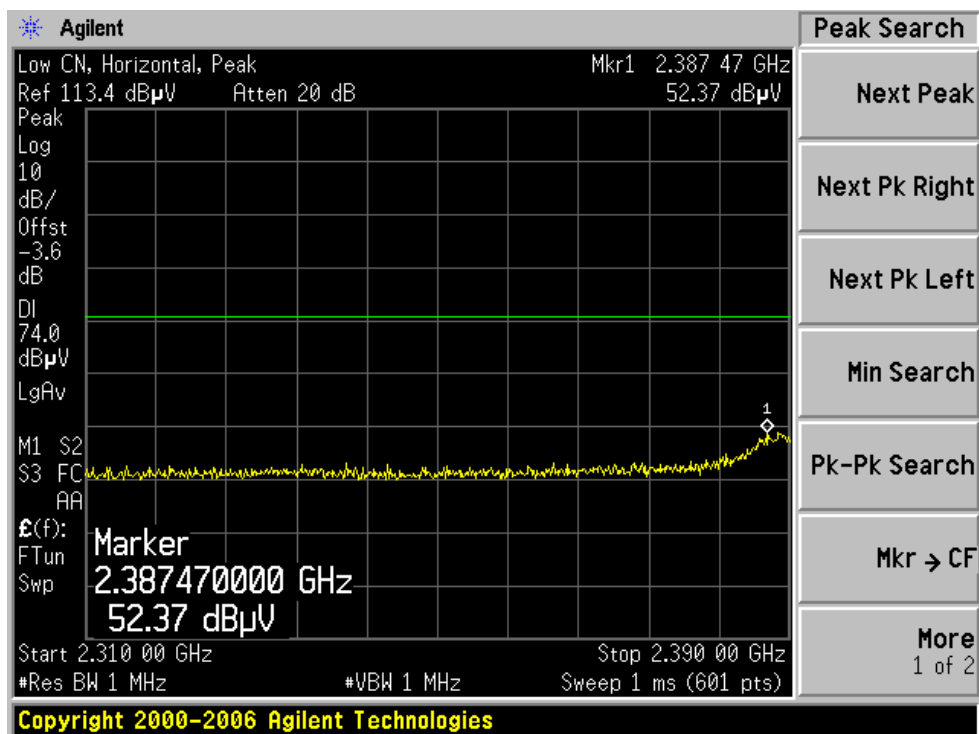
High channel 2462 MHz

Frequency (MHz)	Reading (dBμV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comments
2462.00	102.9	60	1.3	V	28.2	4.4	36.2	99.3			Fund/Peak
2462.00	95.7	180	1.2	H	28.2	4.4	36.2	92.1			Fund/Peak
2462.00	98.1	60	1.3	V	28.2	4.4	36.2	94.5			Ave
2462.00	88.6	180	1.2	H	28.2	4.4	36.2	85.0			Ave
7386.00	27.3	270	2.4	V	37.6	12.3	36.9	40.3	54	-13.7	Ave
7386.00	27.0	180	1.2	H	37.6	12.3	36.9	40.0	54	-14.0	Ave
4924.00	33.6	60	2.0	V	32.1	6.0	34.4	37.3	54	-16.7	Ave
4924.00	31.8	90	2.1	H	32.1	6.0	34.4	35.5	54	-18.5	Ave
4924.00	45.3	60	2.0	V	32.1	6.0	34.4	49.0	74	-25.0	Peak
7386.00	33.5	270	2.4	V	37.6	12.3	36.9	46.5	74	-27.5	Peak
4924.00	41.9	90	2.1	H	32.1	6.0	34.4	45.6	74	-28.4	Peak
7386.00	32.4	180	1.2	H	37.6	12.3	36.9	45.4	74	-28.6	Peak

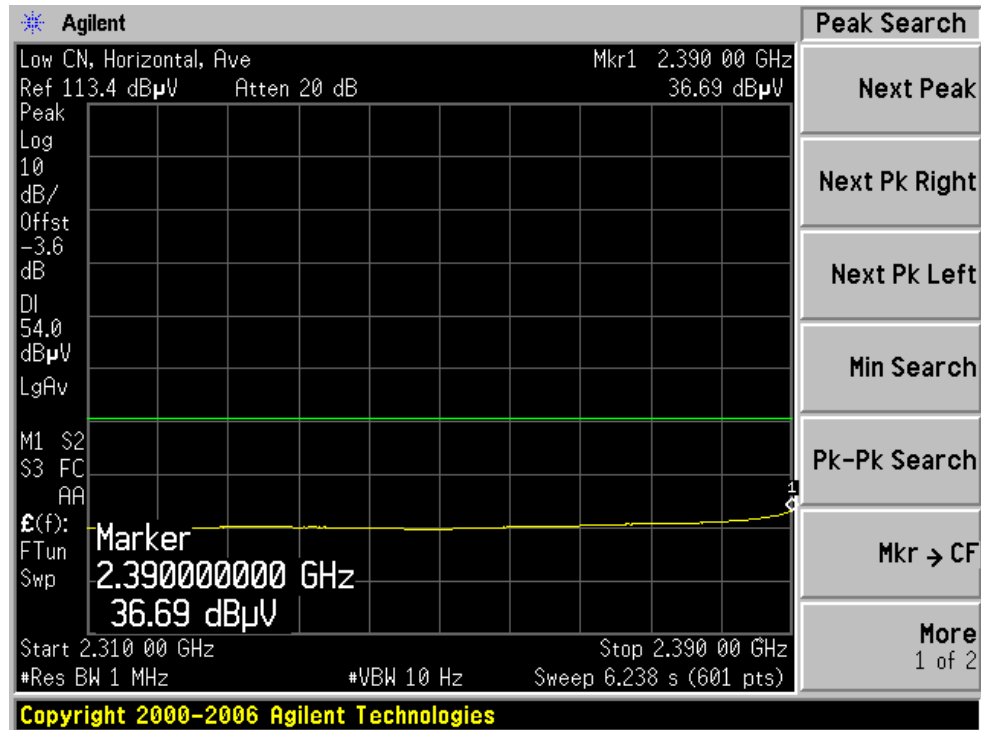
Restricted Band Edge

Low Channel

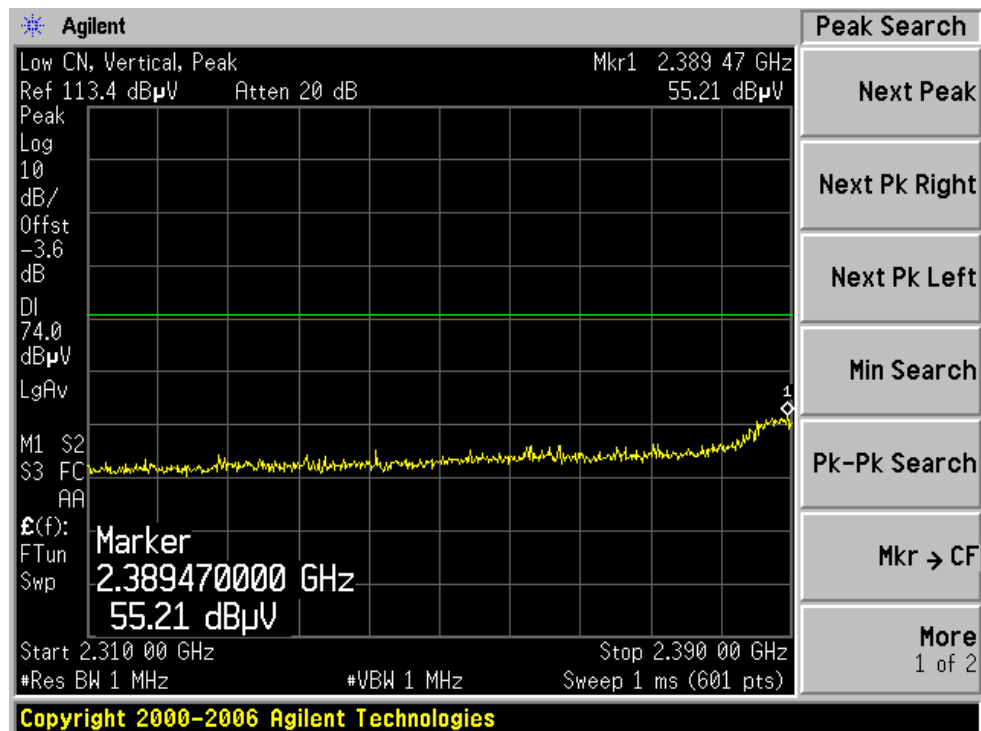
Peak, Horizontal



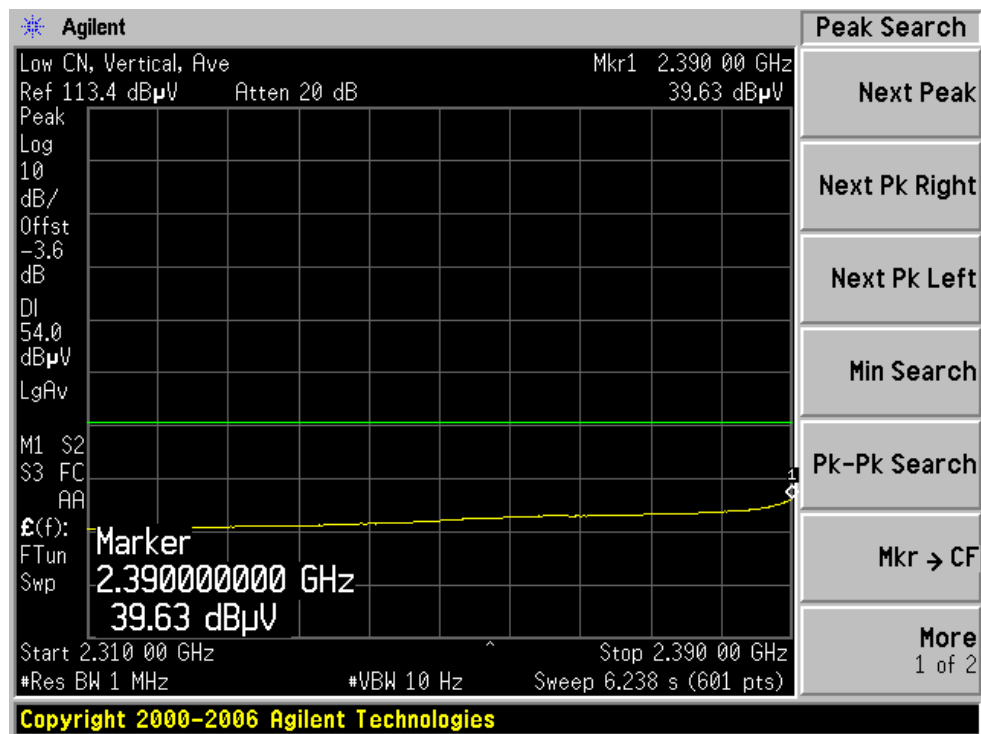
Average, Horizontal



Peak, Vertical

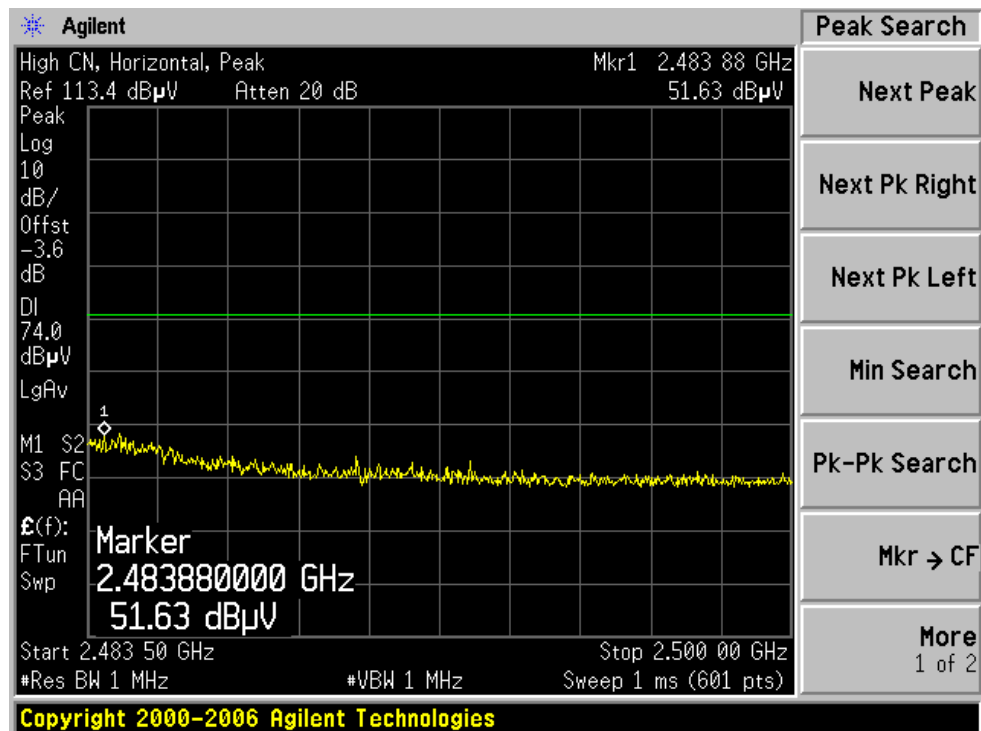


Average, Vertical

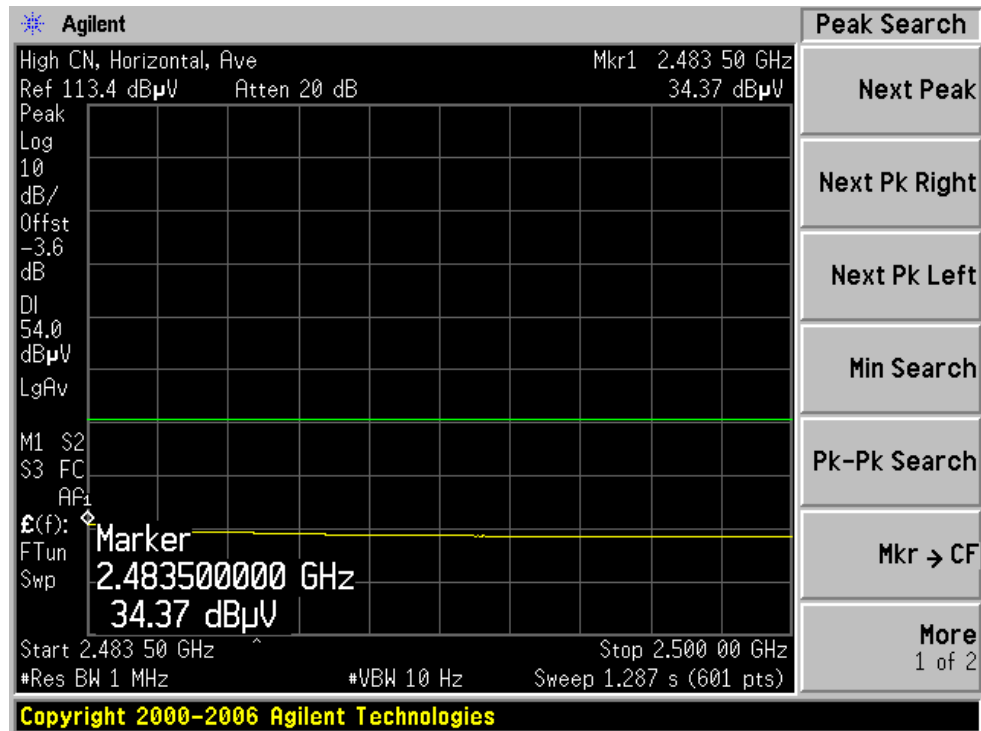


High Channel

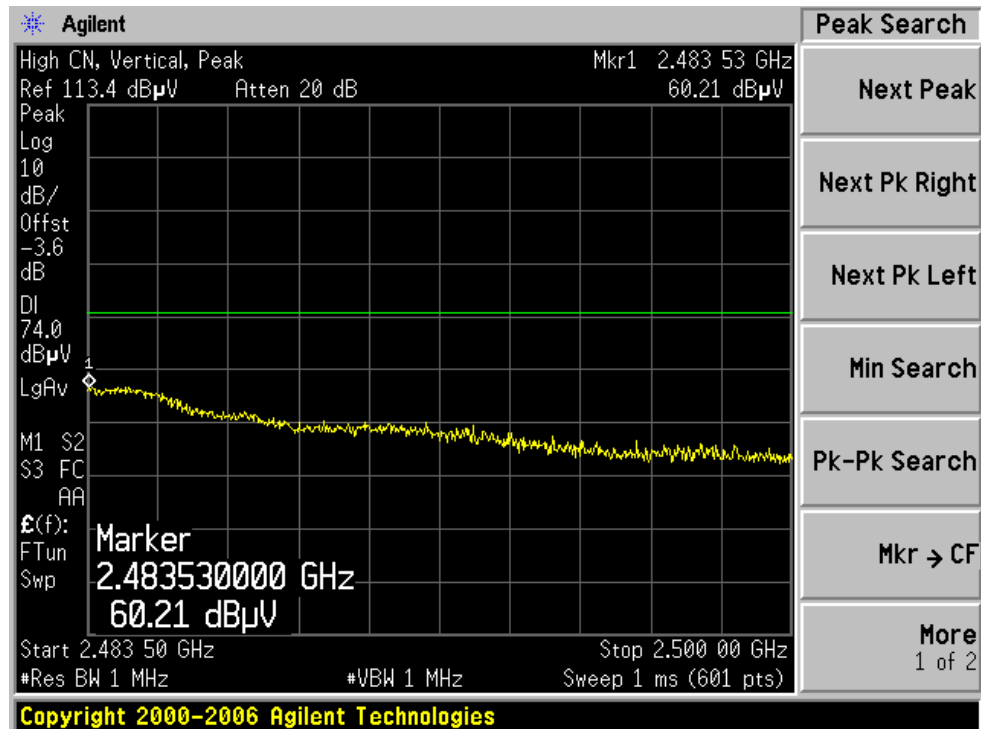
Peak, Horizontal



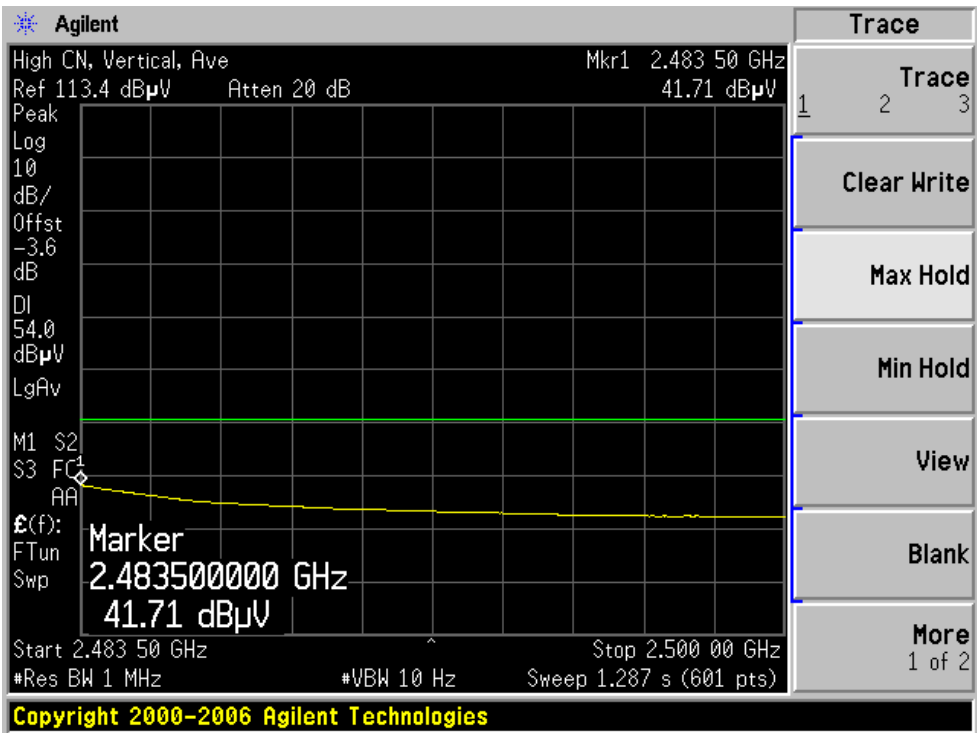
Average, Horizontal



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), RSS-210 §A8.2 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 from 2007-09-05.*

8.5 Summary of Test Results

802.11b

Channel	Frequency (MHz)	6 dB BW (kHz)	Limit (kHz)	Result
Low	2412	9592	>500	Compliant
Middle	2437	9592	>500	Compliant
High	2462	9589	>500	Compliant

Channel	Frequency (MHz)	99% Occupied BW (kHz)
Low	2412	13605
Middle	2437	13620
High	2462	13627

802.11g

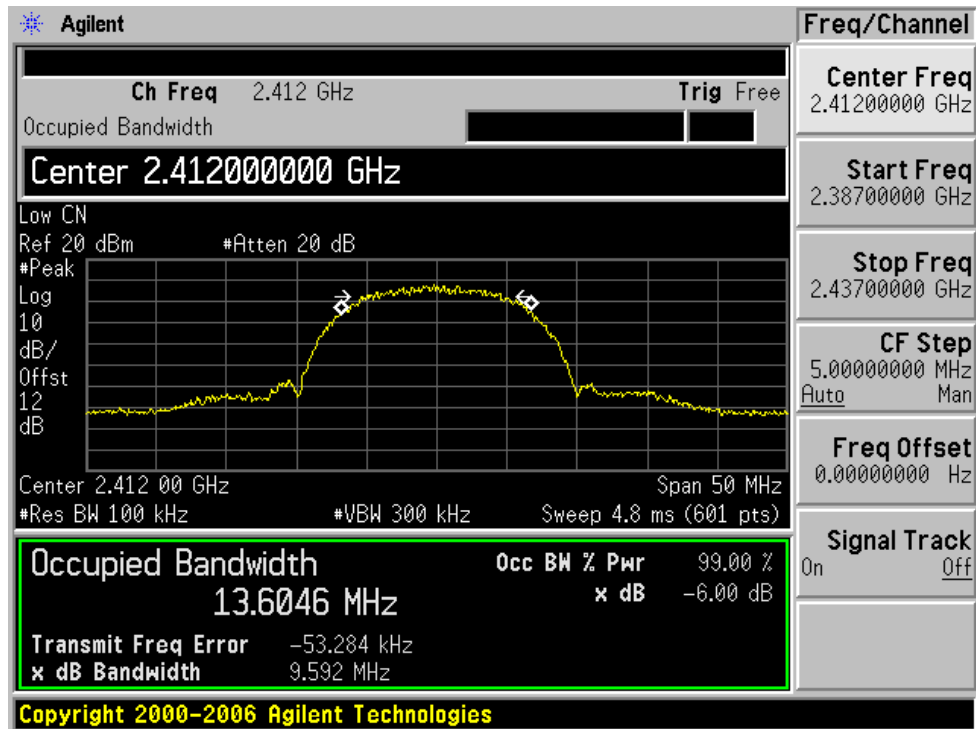
Channel	Frequency (MHz)	6 dB BW (kHz)	Limit (kHz)	Result
Low	2412	16610	>500	Compliant
Middle	2437	16560	>500	Compliant
High	2462	16594	>500	Compliant

Channel	Frequency (MHz)	99% Occupied BW (kHz)
Low	2412	16494
Middle	2437	16469
High	2462	16491

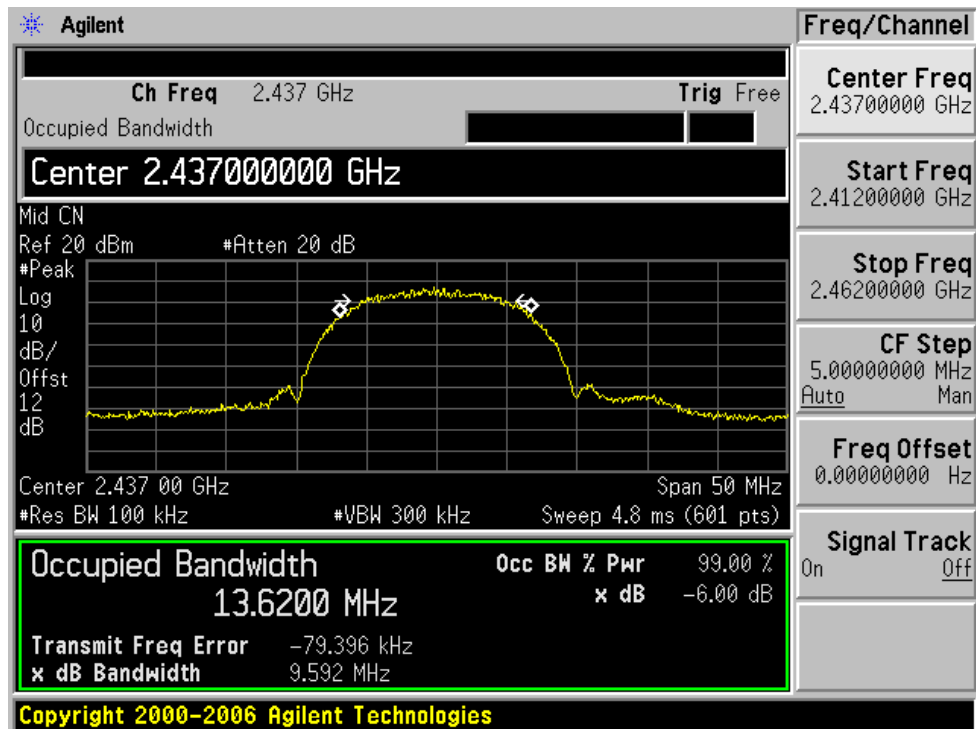
Please refer to the following plots for detailed test results

802.11b

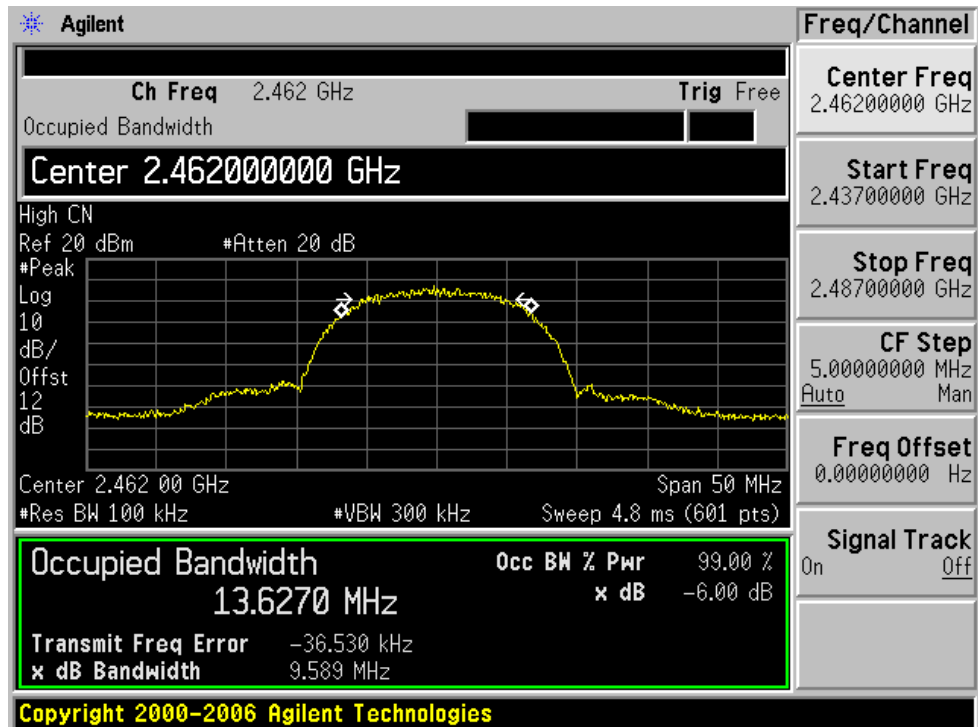
Low Channel



Mid Channel

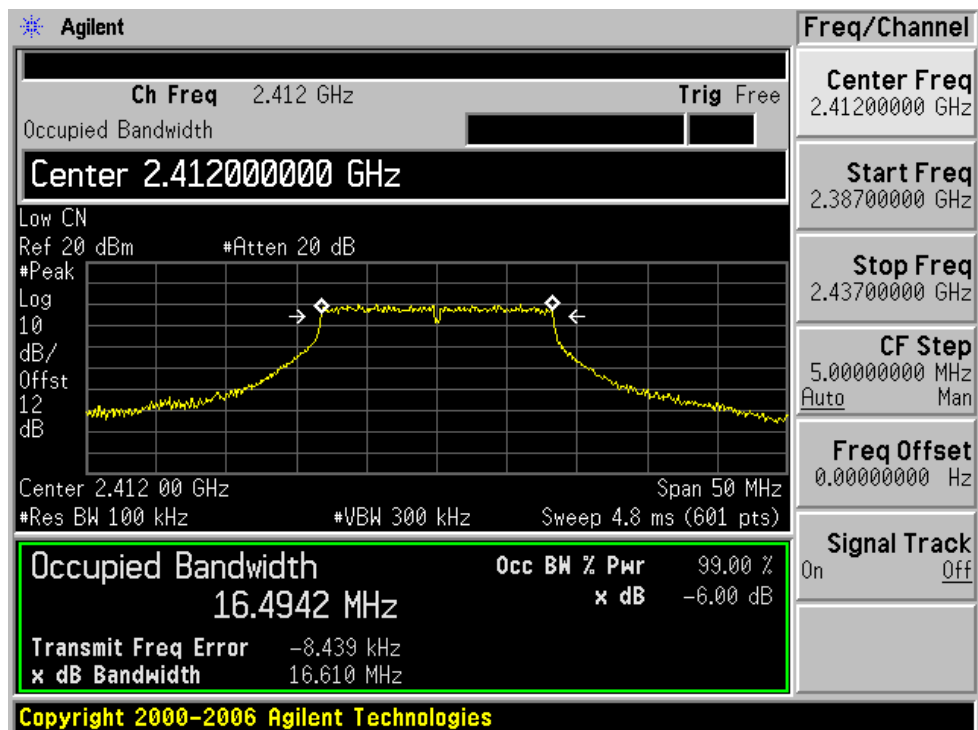


High Channel

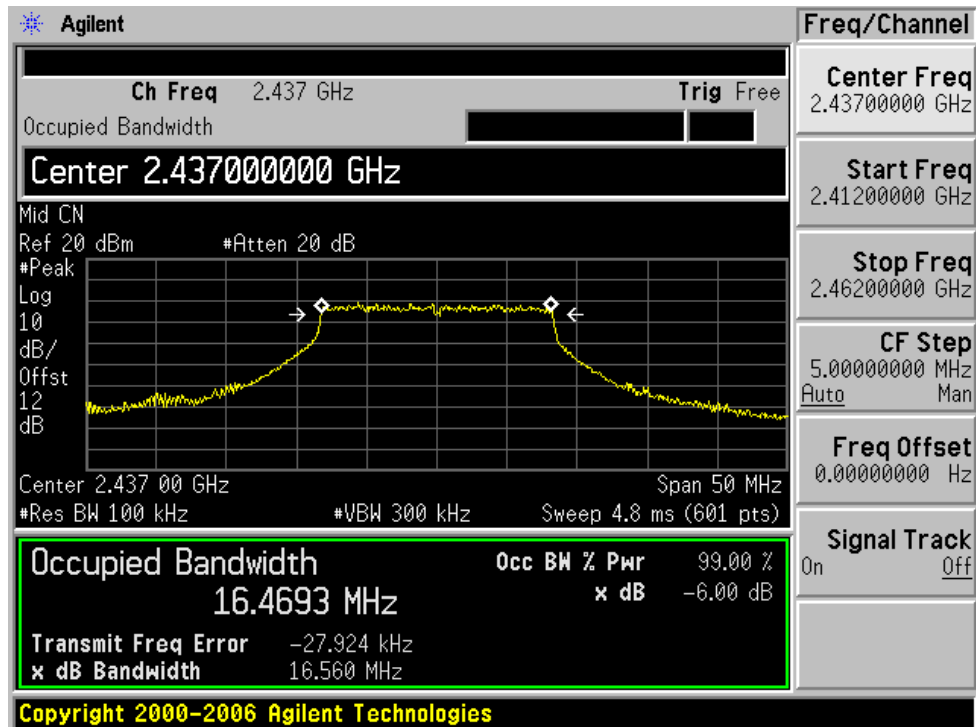


802.11g

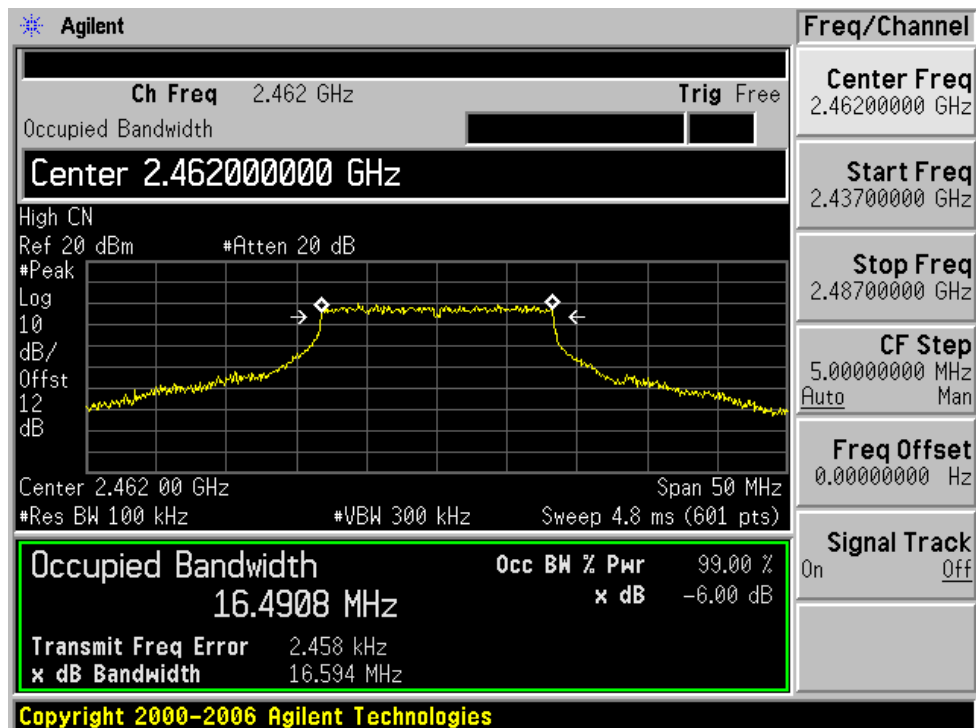
Low Channel



Mid Channel



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 James Ma from 2007-07-09-05.*

9.5 Summary of Test Results

802.11b

Channel	Frequency (MHz)	Max Power (dBm)	Max Power (mW)	Limit (mW)	Result
Low	2412	14.71	29.58	1000	Compliant
Mid	2437	14.77	29.99	1000	Compliant
High	2462	14.69	29.44	1000	Compliant

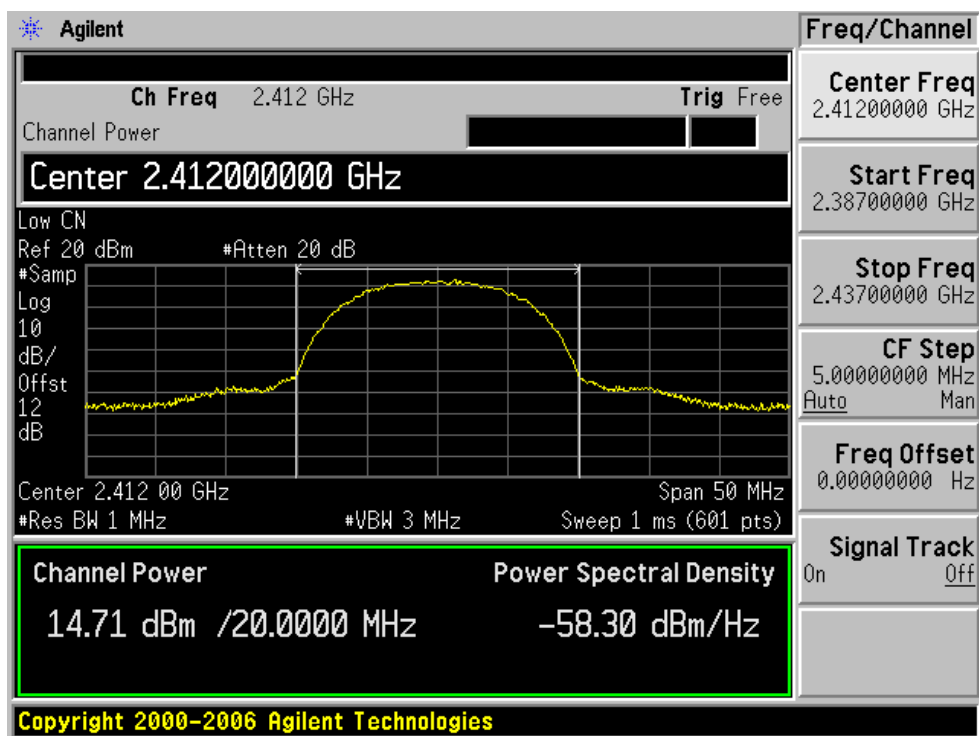
802.11g

Channel	Frequency (MHz)	Max Power (dBm)	Max Power (mW)	Limit (mW)	Result
Low	2412	12.24	16.75	1000	Compliant
Mid	2437	12.27	16.87	1000	Compliant
High	2462	12.40	17.38	1000	Compliant

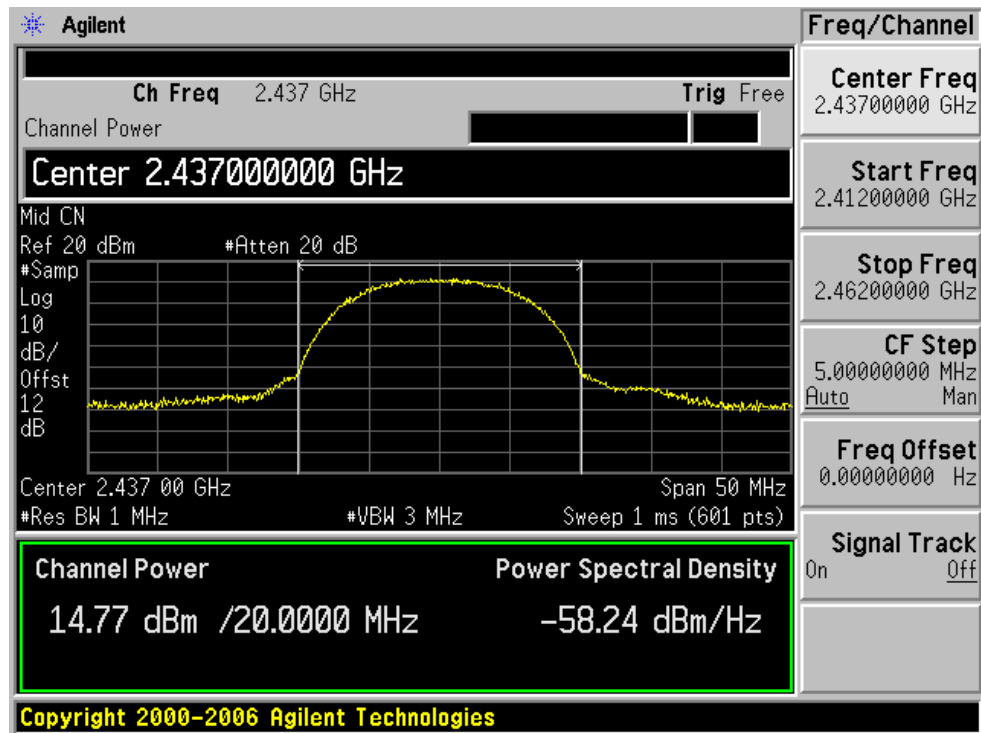
Please See the Following Plots

802.11b

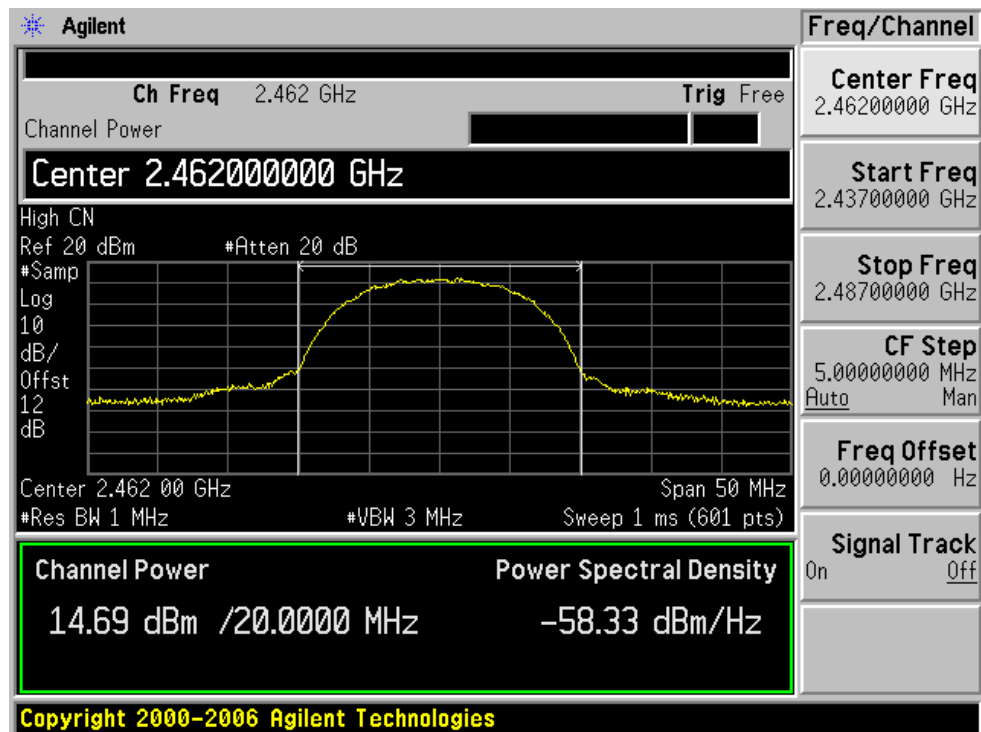
Low Channel



Mid Channel

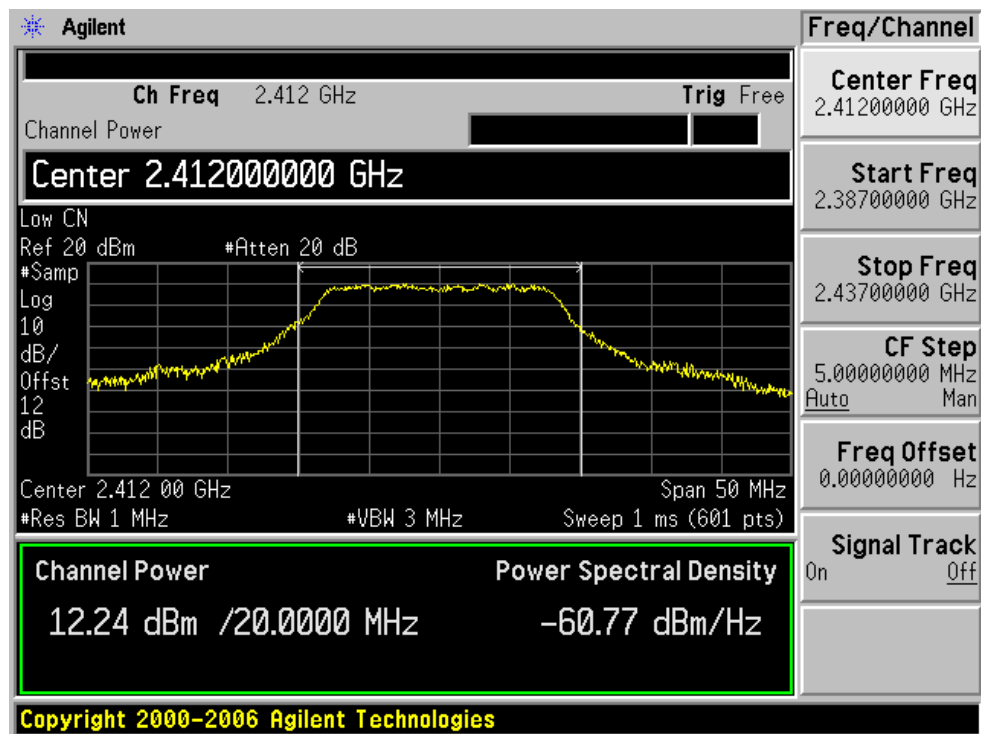


High Channel

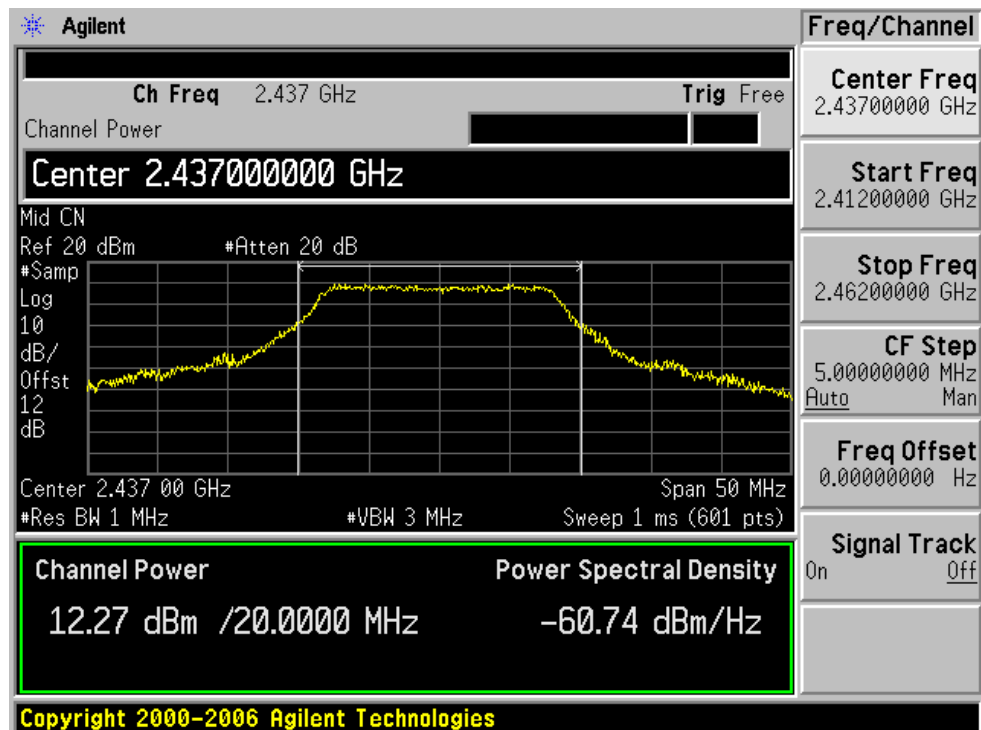


802.11g

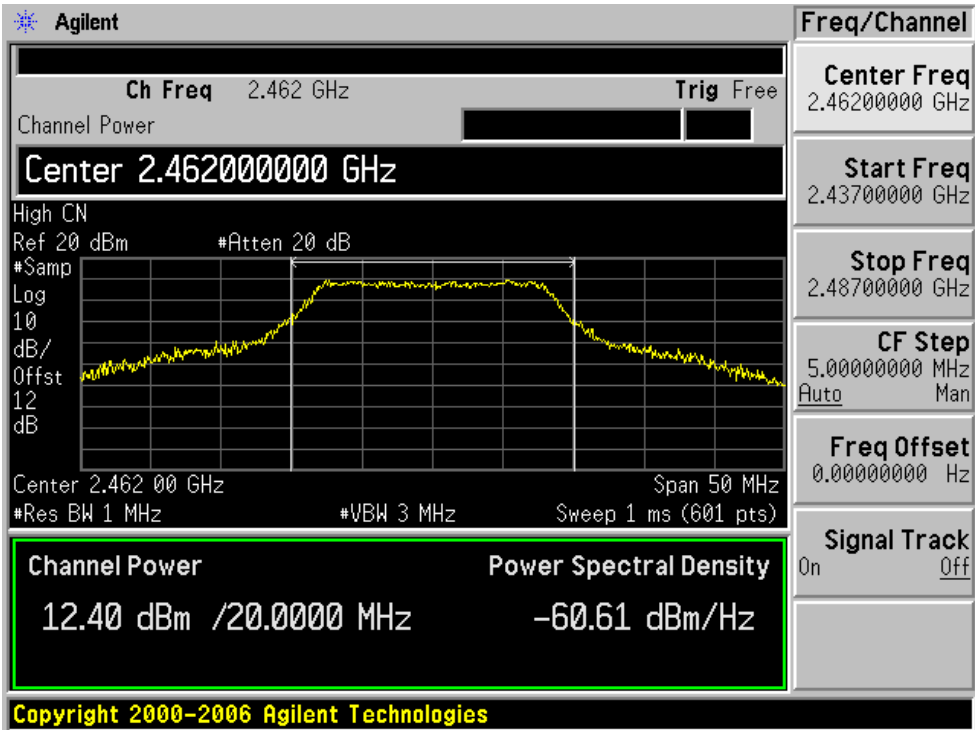
Low Channel



Mid Channel



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

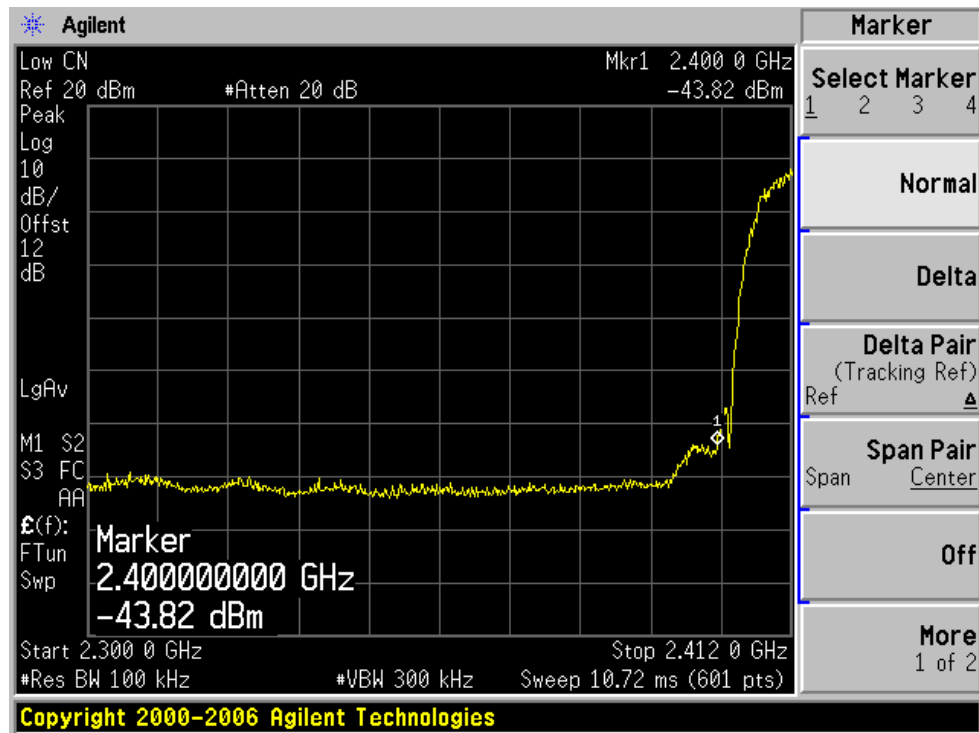
Temperature:	27 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by James Ma from 2007-09-05.*

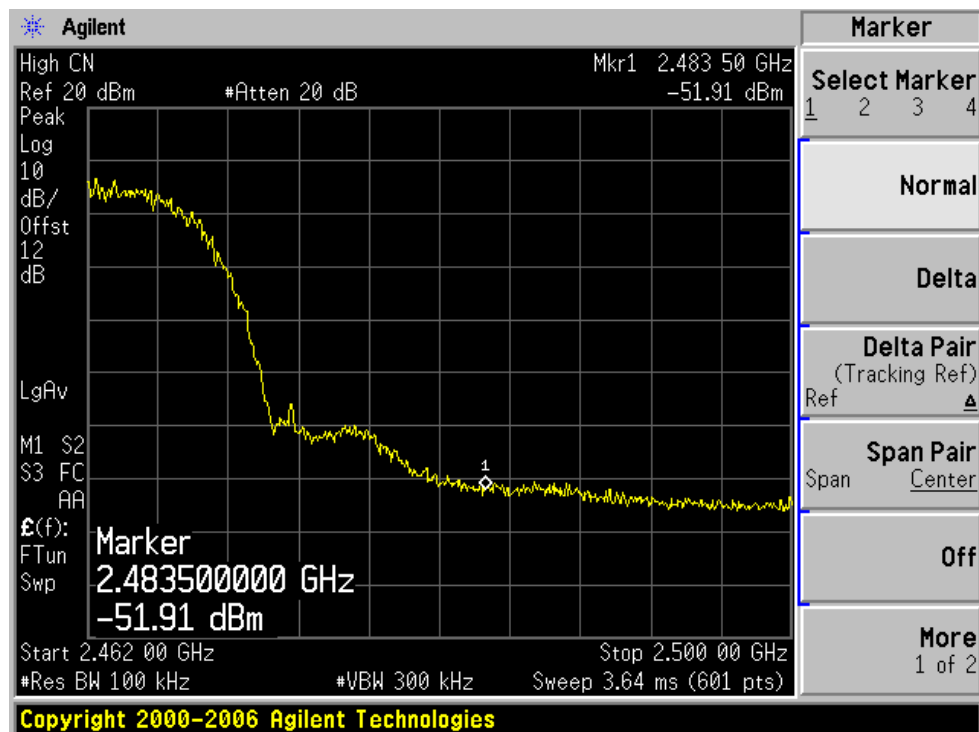
Please Refer to the Following Plots

802.11b

Low Channel

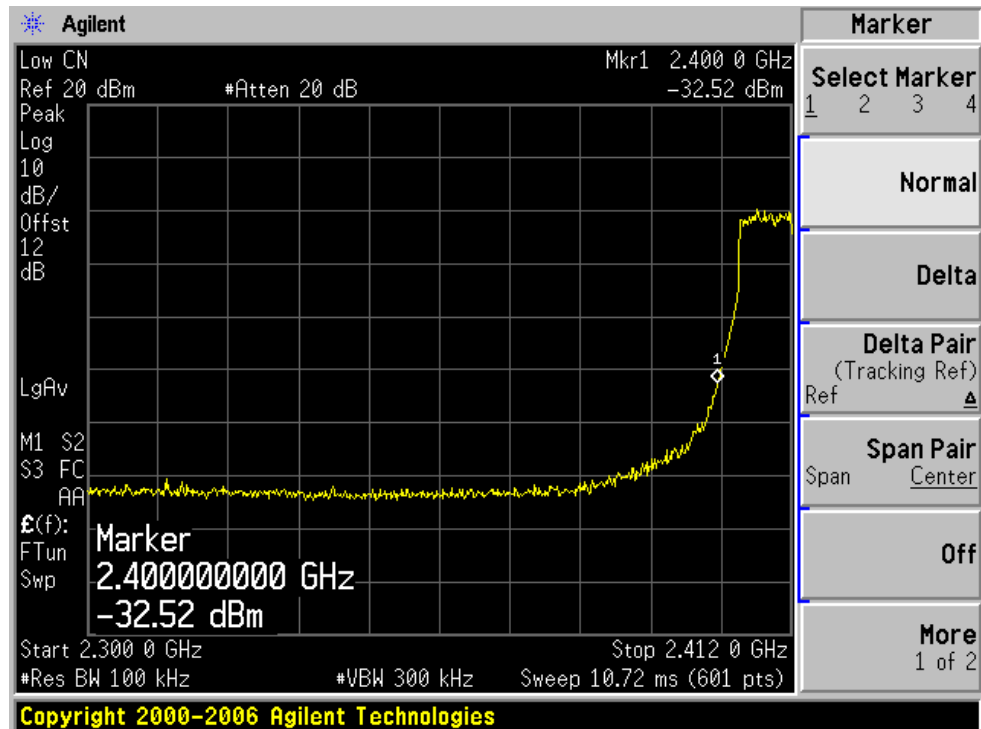


High Channel

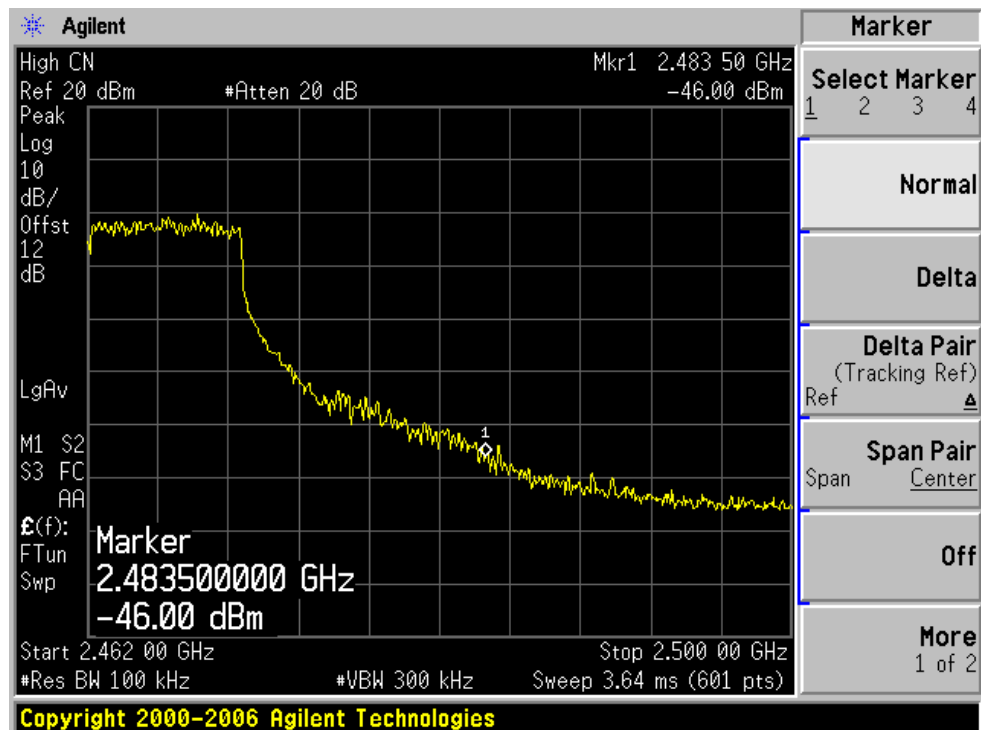


802.11g

Low Channel



High 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 James Ma from 2007-09-05.*

11.5 Summary of Test Results

802.11b

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
2412	-8.78	8	Compliant
2437	-8.70	8	Compliant
2462	-10.31	8	Compliant

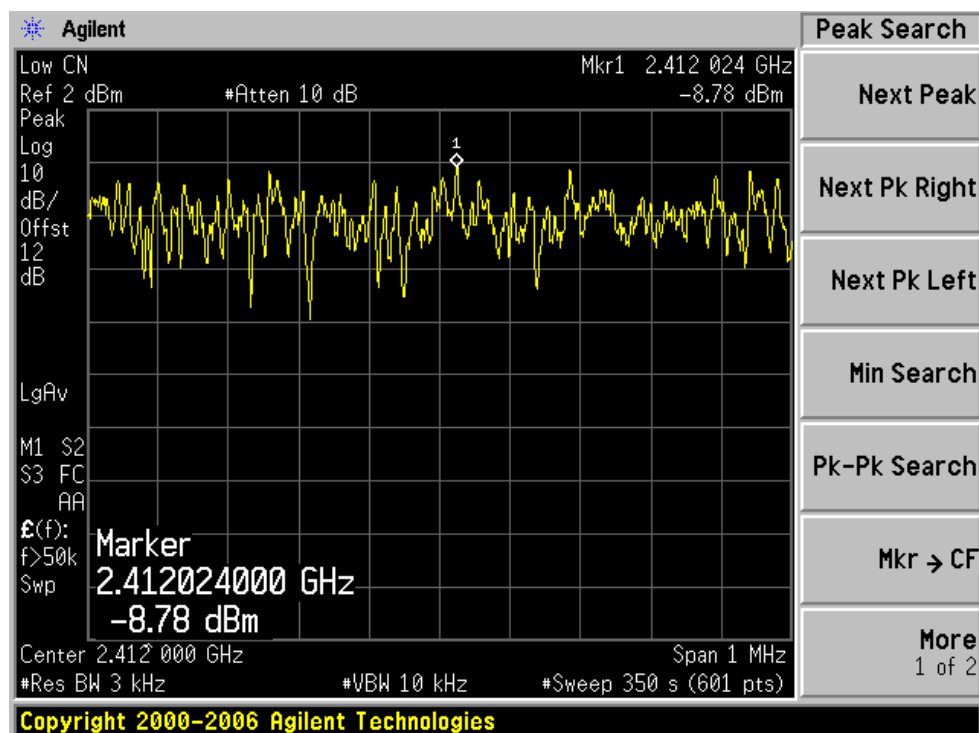
802.11g

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
2412	-14.67	8	Compliant
2437	-14.00	8	Compliant
2462	-11.12	8	Compliant

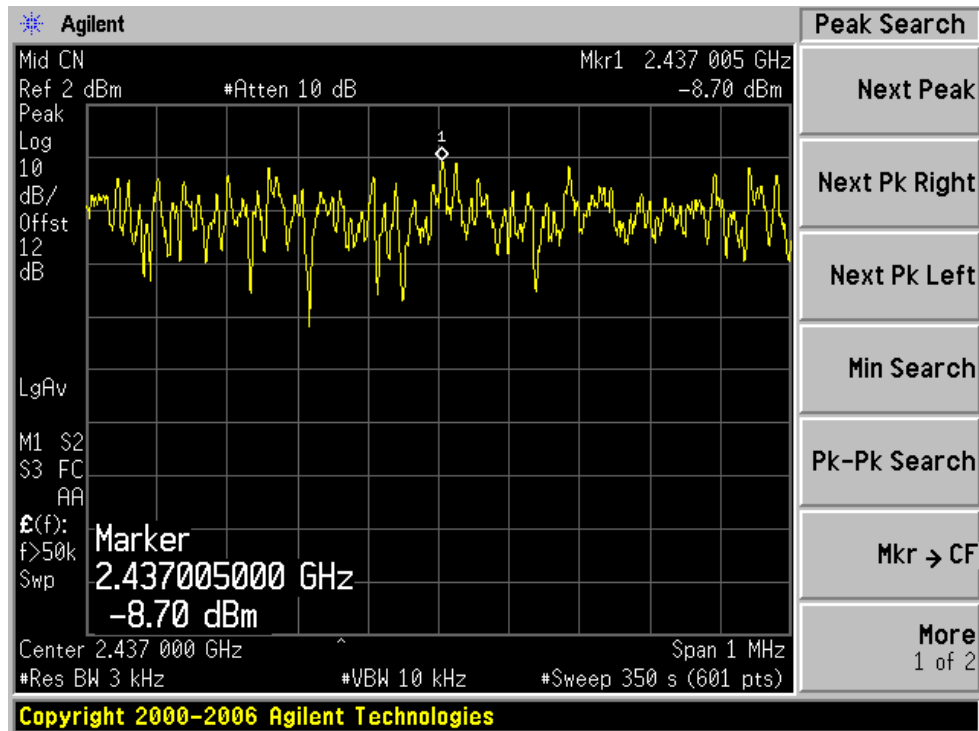
Please refer to the following plots for detailed test results

802.11b

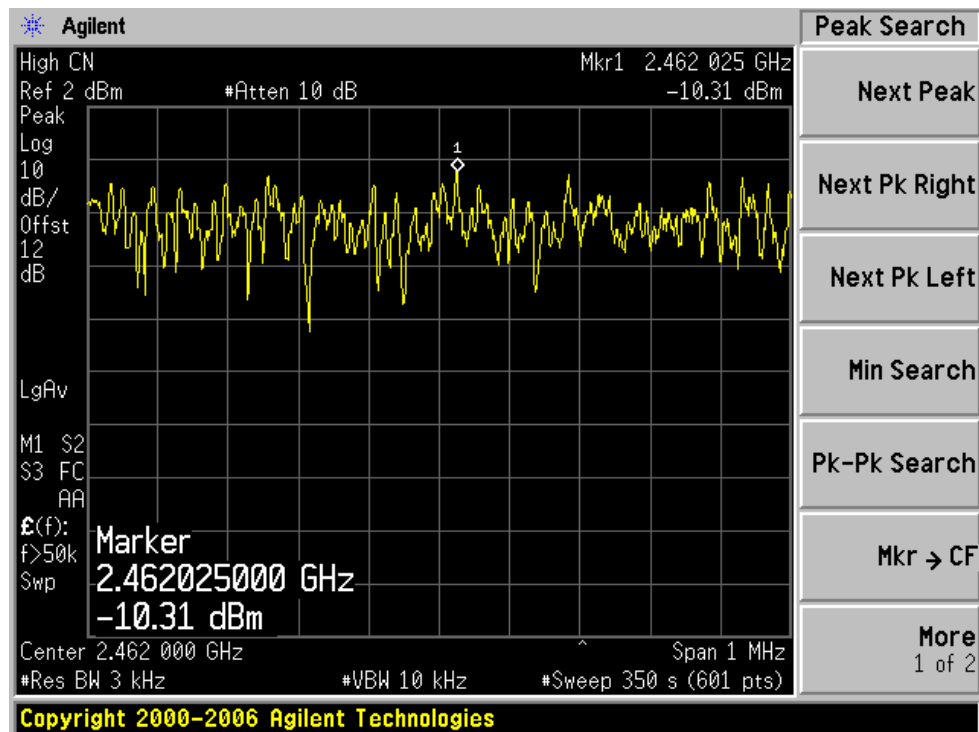
Low Channel



Mid Channel

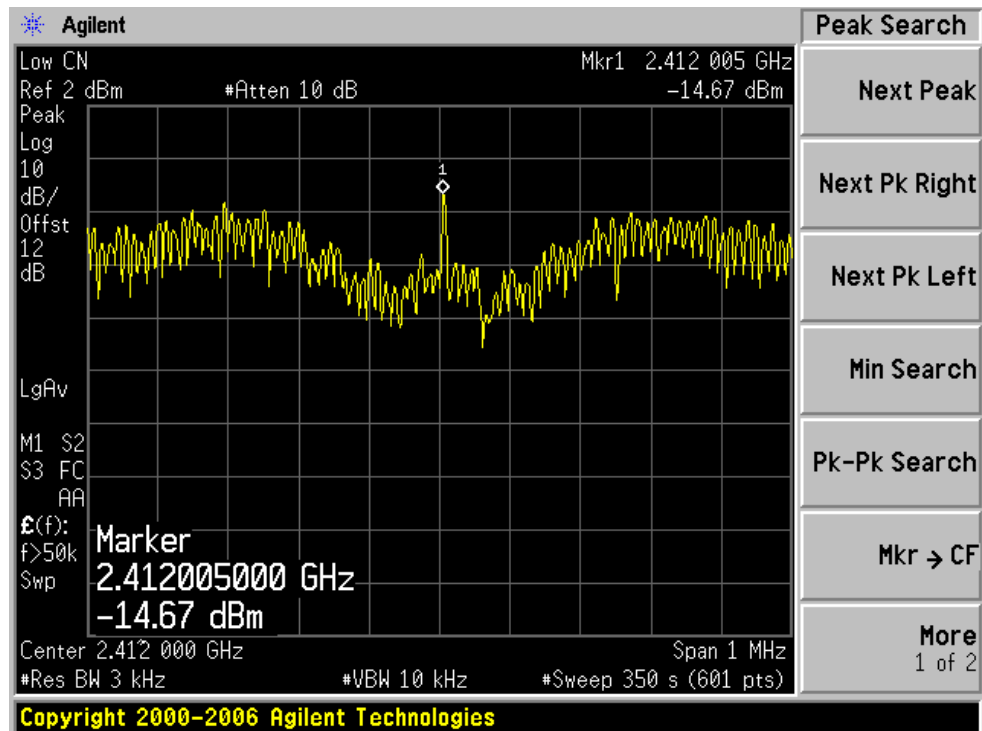


High Channel

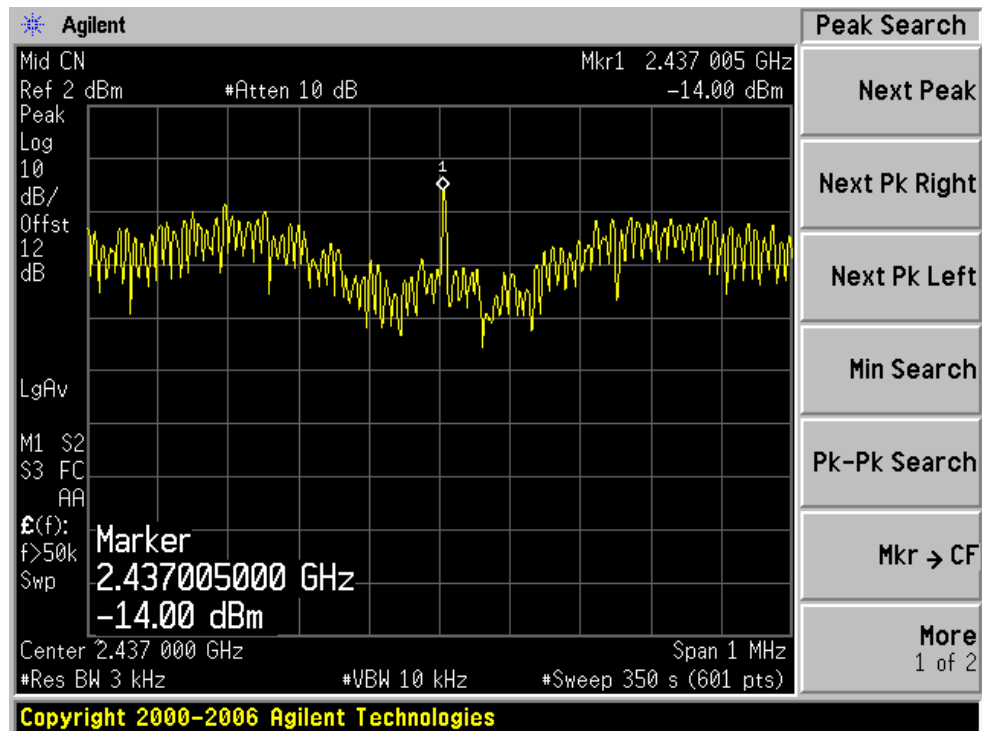


802.11g

Low Channel



Mid Channel



High Channel

