Lab Code: 200167-0

FCC PART 15 SUBPART C

MEASUREMENT AND TEST REPORT

For

Actiontec Electronics, Inc.

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

FCC ID: LNQGT704WGB

This Report Concerns:	Product type:
☒ Original Report	ADSL/4 Port Ethernet/USB Device/Wireless Gateway

Test Engineer:	Xiao Ming Hu
Report No.:	R0805084-DTS
Report Date:	2008-06-23
Reviewed By:	Boni Baniqued, Sr. RF Test Engineer
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1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The *Actiontec Electronics, Inc.* product, *FCC ID: LNQGT704WGB, model: GT704WG Rev.B* , the "EUT" as referred to in this report is the GT704WG Rev. B is a cost-effective ADSL2+ 4 Port Ethernet LAN /USB Device/Wireless Gateway. It provides 4 10/100Base-T Ethernet LAN port, one USB 1.1 device port, and an embedded 802.11b/g wireless Access Point. The ADSL2+ is rate-adaptive and it supports downstream data rates up to 29Mbps and upstream data rates up to 3Mbps.
GT704WG Rev. B is based on Broadcom's BCM6358S Broadband Communication Processor, and BCM4318E 802.11 MAC and Base-band Processor.

The EUT has measured approximately 170.15 mm (L) x 120.65 mm (W) x 42.3 mm (H).

** The test data gathered are from typical production sample, serial number:* 0805084 *provided by the manufacturer.*

1.2 EUT Photo

Additional photos please refer to Appendix C

1.3 Objective

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

The objective is to determine compliance with FCC rules for Maximum Output Power, Antenna Requirements, 6 dB Bandwidth, and peak power spectral density, Band Edges Measurement, 100KHz Band Edge, Conducted and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

None.

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.

1.7 Test Facility

The Test site used by BACL Corp. to collect emissions measurement data is located at it's facility in Sunnyvale, California, USA.

Test site at BACL 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 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 and Voluntary Control Council for Interference have the reports on file and is listed under FCC registration number: 90464 and VCCI Registration No.: C-1298 and R-1234. 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 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:

Radio Mode	2412 MHz	2437 MHz	2462 MHz
802.11b	1Mbps	1Mbps	1Mbps
802.11g	6Mbps	6Mbps	6Mbps
Power Level setting	17 dBm	17 dBm	17 dBm

2.3 Special Accessories

The unit was tested with OEM supplied cabling and accessories as would be normally supplied by the manufacturer to the customer; no special accessories were used.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

Manufacturer / Product Type	Model	Serial Number
Sony Laptop	GR370	-
IBM Laptop	ThinkPad 2373	-

2.6 Interface Ports and Cabling

Cable Description	Length (m)	From	To
CAT5 Cable	1.5	EUT	Dell Laptop

2.7 Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number
Actiontec	I.T.E Power Supply	MT12-Y120100-A1	0813

3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC Rules	Description of Test	Result
§15.247(i),§2.1091	RF Exposure	Compliant
FCC §15.203	Antenna Requirement	Compliant
FCC §15.207	Conducted Emissions	Compliant
FCC § 15.247(d)	Spurious Emissions at Antenna Port	Compliant
FCC§15.205; §15.209 §15.247(d)	Spurious Radiated Emissions	Compliant
FCC §15.247 (a)	6 dB & 99% Bandwidth	Compliant
FCC §15.247(a)(2)	Maximum Peak Output Power	Compliant
FCC §15.247(e)	Power Spectral Density	Compliant

4 FCC§15.247 (i), §2.1091 - 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.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

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

f = frequency in MHz
* = Plane-wave equivalent power density

4.2 MPE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

802.11b Mode:

Maximum peak output power at antenna input terminal (dBm):	16.74
Maximum peak output power at antenna input terminal (mW):	47.21
Prediction distance (cm):	20
Prediction frequency (MHz):	2437
Maximum Antenna Gain, typical (dBi):	2
Maximum Antenna Gain (numeric):	1.58
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0148
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

802.11g Mode:

Maximum peak output power at antenna input terminal (dBm):	13.68
Maximum peak output power at antenna input terminal (mW):	23.33
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	2
Maximum Antenna Gain (numeric):	1.58
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0073
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

4.3 Results:

FCC§15.247(i) and §2.1091:

For 802.11b mode, the power density level at 20 cm is 0.0148mW/cm², which is below the uncontrolled exposure limit of 1.0mW/cm² at 2437 MHz.

For 802.11g mode, the power density level at 20 cm is 0.0073mW/cm², which is below the uncontrolled exposure limit of 1.0mW/cm² at 2412 MHz.

5 FCC §15.203 - Antenna Requirement

5.1 Applicable Standard

According to § 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 § 15.407 (a)(1) and (a)(2), if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2 Result:

The SMA-plug reverse Omni-directional antenna is from Wha Yu Industrial Co., Ltd, part number: C787-510029-A Rev .X1, Maximum gain is 2dBi, Frequency range from 2.4GHz-2.5GHz.

Antenna Photo

6 FCC §15.207 (a) - Conducted Emissions

6.1 Section 15.207 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 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 frequency 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 connected with LISN-1.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	Artificial-Mains Network	ESH2-Z5	871884/039	2007-11-14
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2008-03-31

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

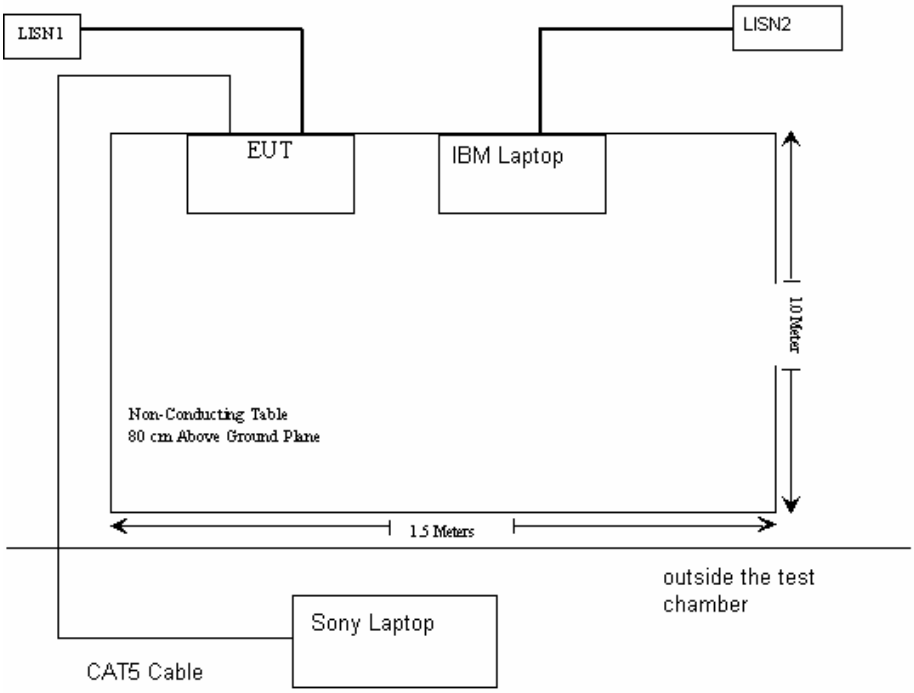
6.4 Test Procedure

During the conducted emissions test, the power cord of the EUT was connected to the mains outlet of the LISN-1.

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

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

6.5 Test Setup Diagram



6.6 Environmental Conditions

Temperature:	20° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

**The testing was performed by Xiao Ming Hu from 2008-06-08*

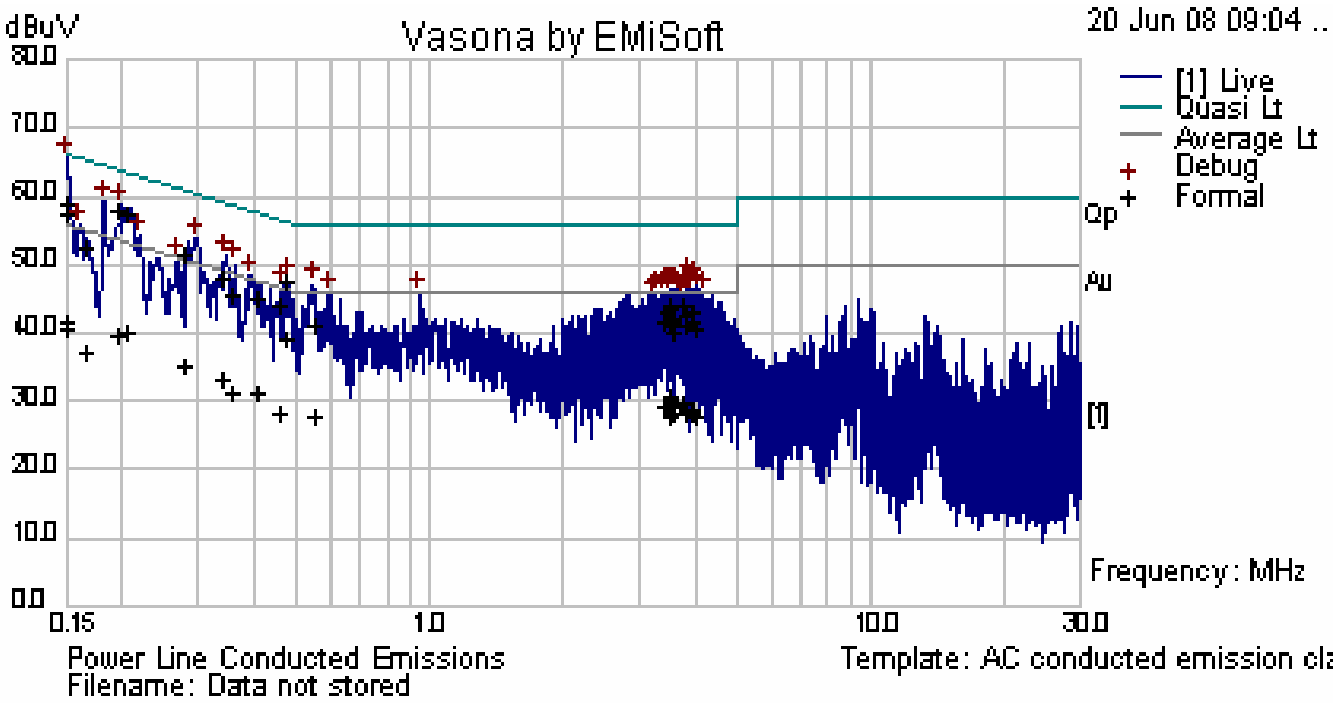
6.7 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15.207 with the *worst* margin reading of:

-6.76 dB at **0.15 MHz** in the **Neutral** conductor mode

6.8 Test Plot and Data

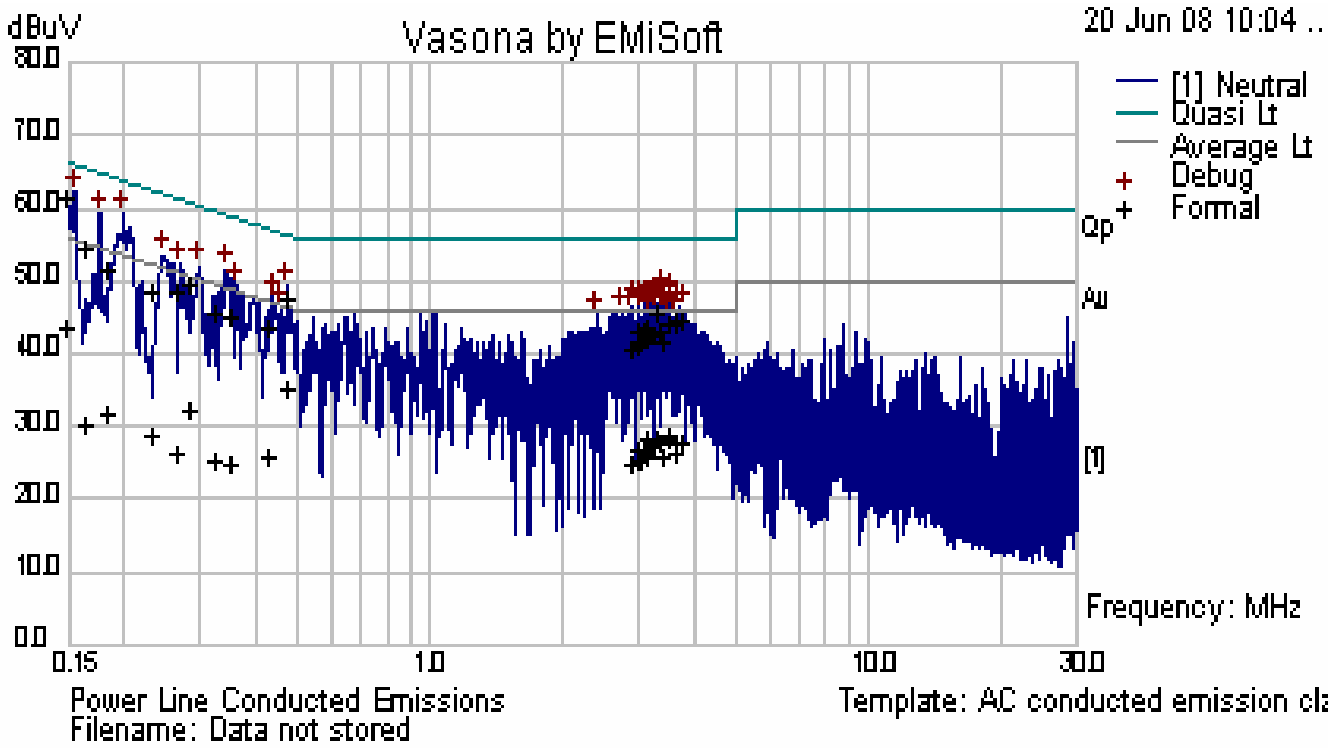
120V/60 Hz Line:



Quasi-Peak and Average Measurements:

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	Corrected Reading (dBuV)	Measurement Type	Line (N/L)	Limit (dBuV)	Margin (dB)
0.2	45.67	10.2	55.87	Quasi Peak	Line	63.6	-7.73
0.209	44.88	10.2	55.08	Quasi Peak	Line	63.23	-8.15
0.152	46.74	10.11	56.85	Quasi Peak	Line	65.86	-9.01
0.479	26.82	10.32	37.14	Average	Line	46.36	-9.22
0.153	45.13	10.11	55.24	Quasi Peak	Line	65.86	-10.62
0.479	34.93	10.32	45.25	Quasi Peak	Line	56.36	-11.11
0.283	38.82	10.2	49.02	Quasi Peak	Line	60.72	-11.71
0.209	27.74	10.2	37.94	Average	Line	53.23	-15.29
0.2	27.22	10.2	37.42	Average	Line	53.6	-16.18
0.152	29.13	10.11	39.23	Average	Line	55.86	-16.63
0.153	28.21	10.11	38.32	Average	Line	55.86	-17.54
3.546	18.07	10.3	28.37	Average	Line	46	-17.63

120V/60 Hz Neutral:



Quasi-Peak and Average Measurements:

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	Corrected Reading (dBuV)	Measurement Type	Line (L/N)	Limit (dBuV)	Margin (dB)
0.15	49.14	10.1	59.24	Quasi Peak	Neutral	66	-6.76
0.476	34.85	10.32	45.18	Quasi Peak	Neutral	56.4	-11.22
3.336	33.2	10.3	43.5	Quasi Peak	Neutral	56	-12.5
0.165	42.1	10.13	52.24	Quasi Peak	Neutral	65.19	-12.95
0.289	37.18	10.2	47.38	Quasi Peak	Neutral	60.55	-13.18
0.476	22.38	10.32	32.7	Average	Neutral	46.4	-13.7
3.842	31.84	10.3	42.14	Quasi Peak	Neutral	56	-13.86
0.15	31.41	10.1	41.51	Average	Neutral	56	-14.49
3.548	15.99	10.3	26.29	Average	Neutral	46	-19.71
3.548	15.74	10.3	26.04	Average	Neutral	46	-19.96
3.336	15.69	10.3	25.99	Average	Neutral	46	-20.01
3.189	15.55	10.3	25.85	Average	Neutral	46	-20.15

7 FCC §15.247(d) - Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

FCC §15.247 (d)

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

7.2 Measurement Procedure

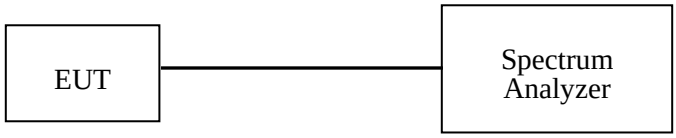
The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1 MHz. sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

7.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2008-05-19

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

7.4 Test Setup Diagram



7.5 Environmental Conditions

Temperature:	20° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

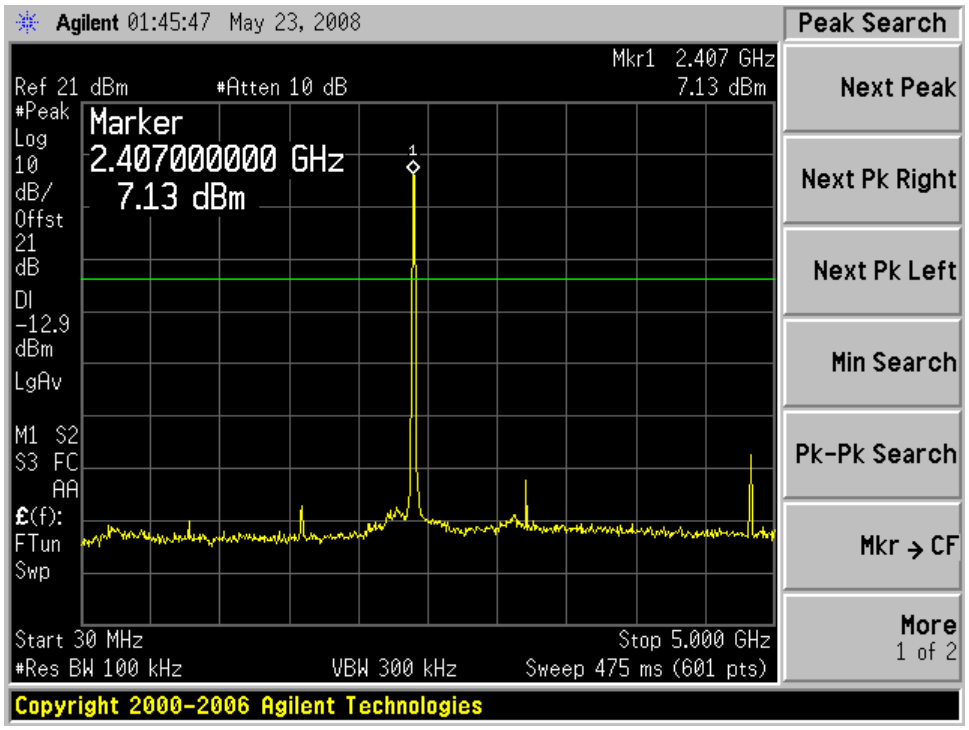
**The testing was performed by Xiao Ming Hu from 2008-06-23.*

7.6 Measurement Result

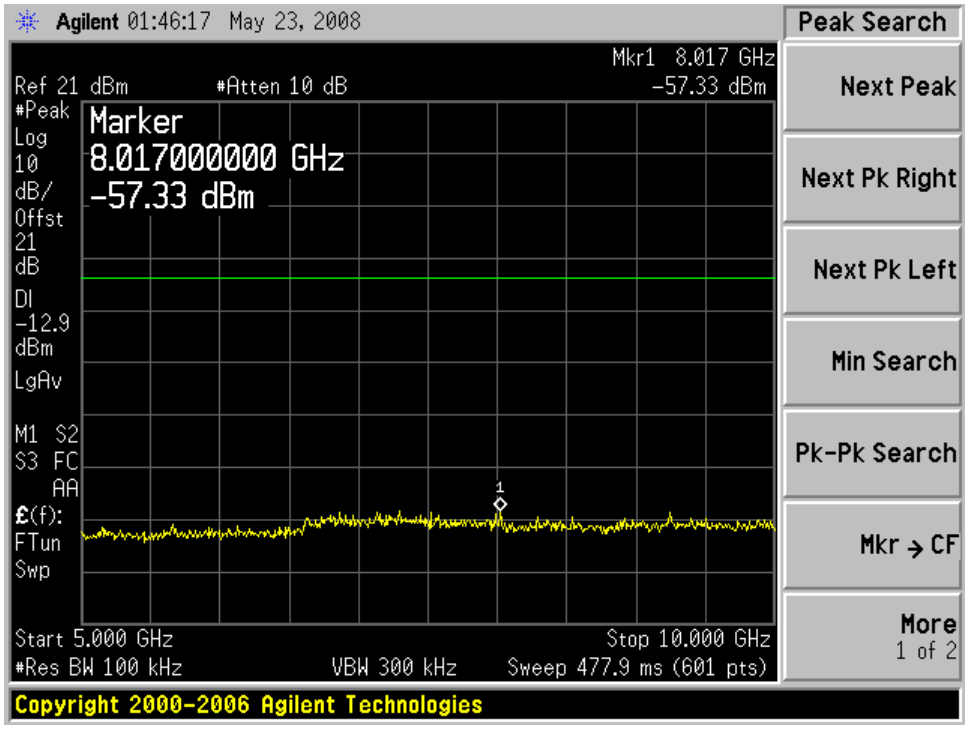
Please refer to following pages for plots of spurious emissions.

802.11b mode

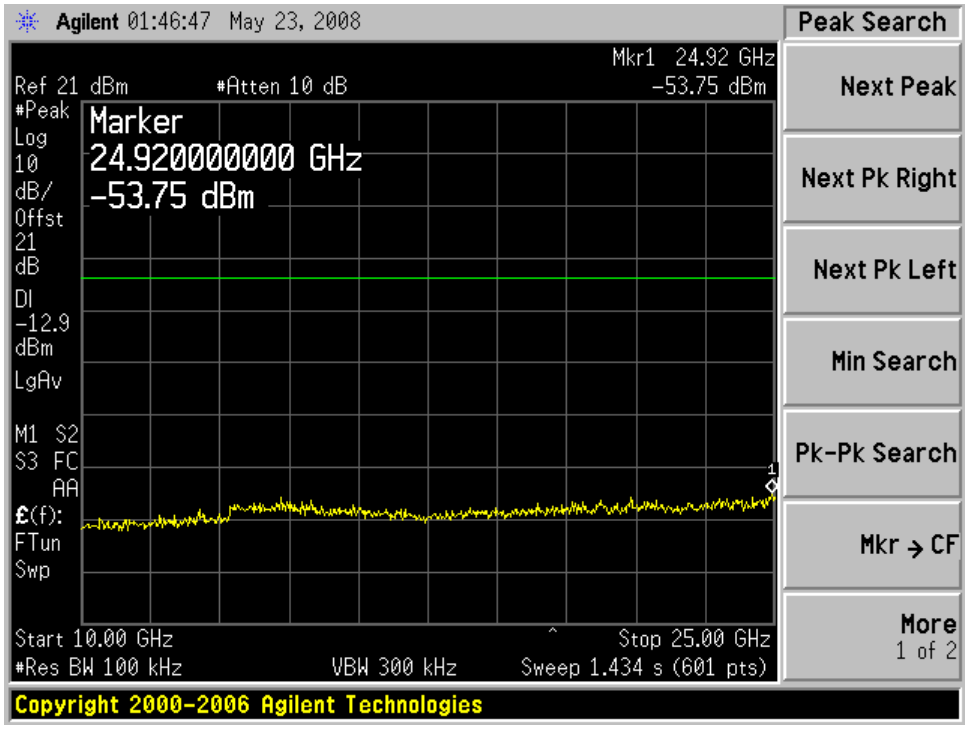
Low Channel



Plot 1: 30 MHz – 5 GHz

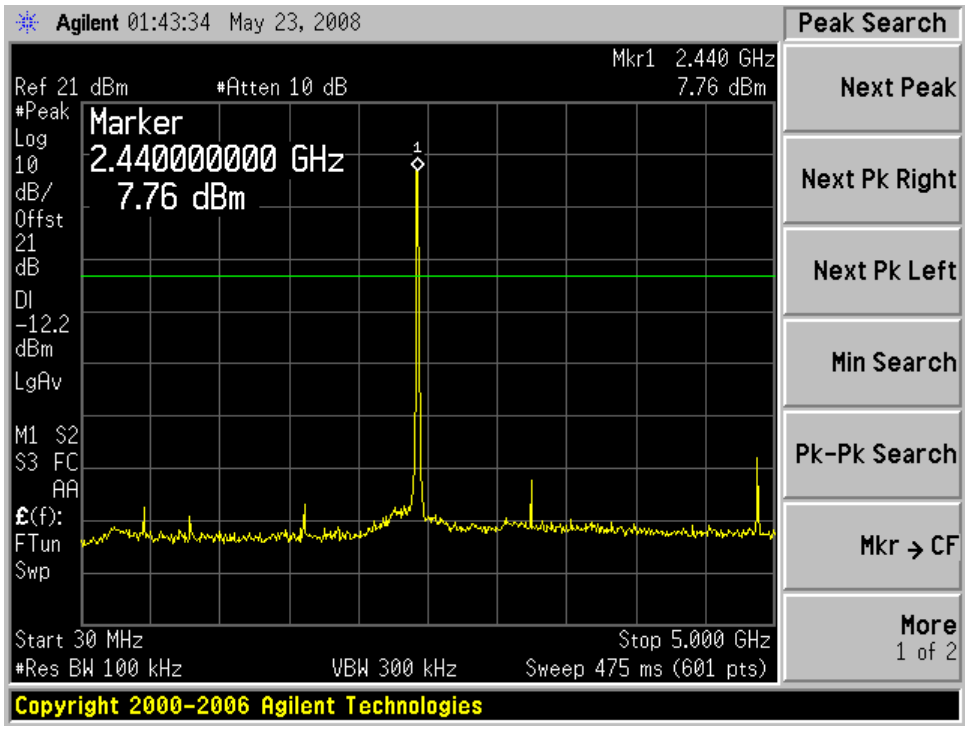


Plot 2: 5 GHz – 10 GHz

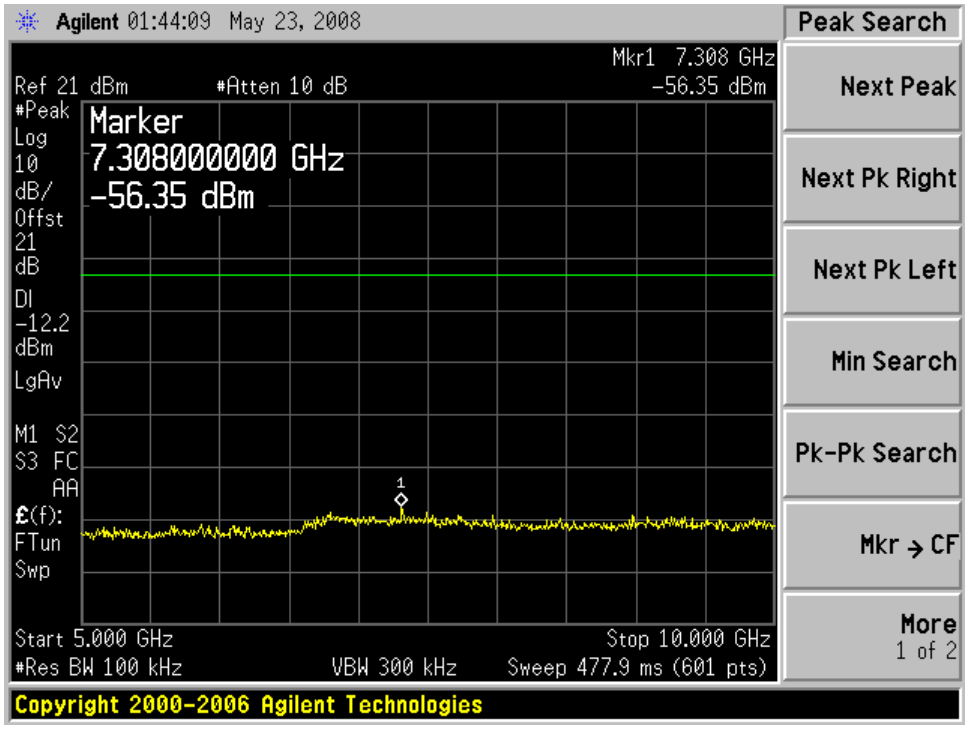


Plot 3: 10 GHz – 25 GHz

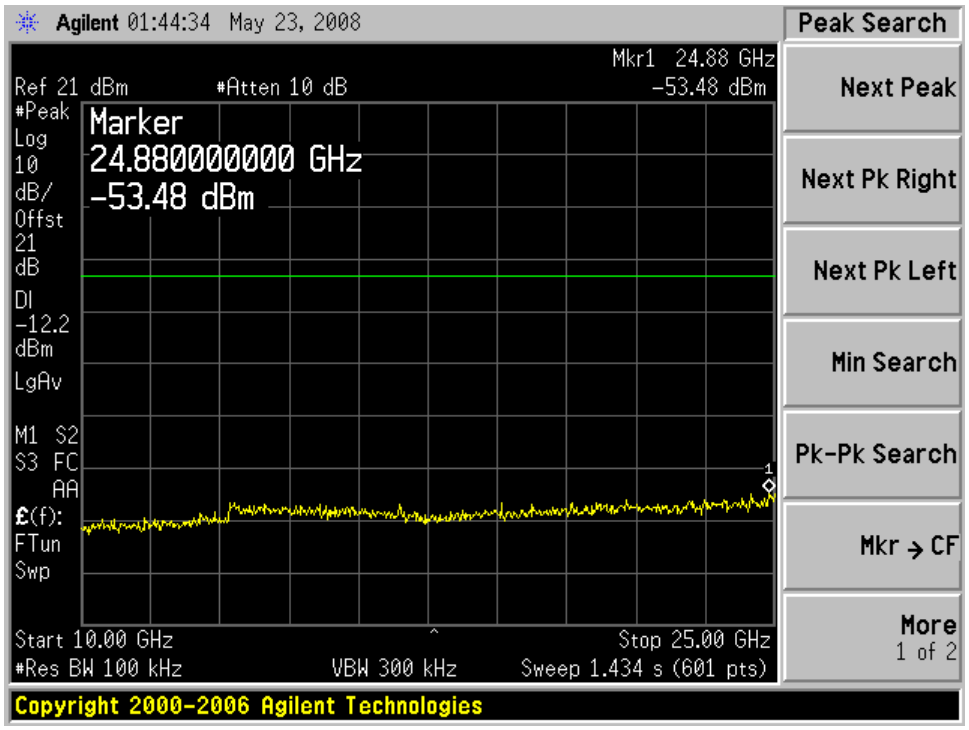
Middle Channel



Plot 1: 30 MHz – 5 GHz

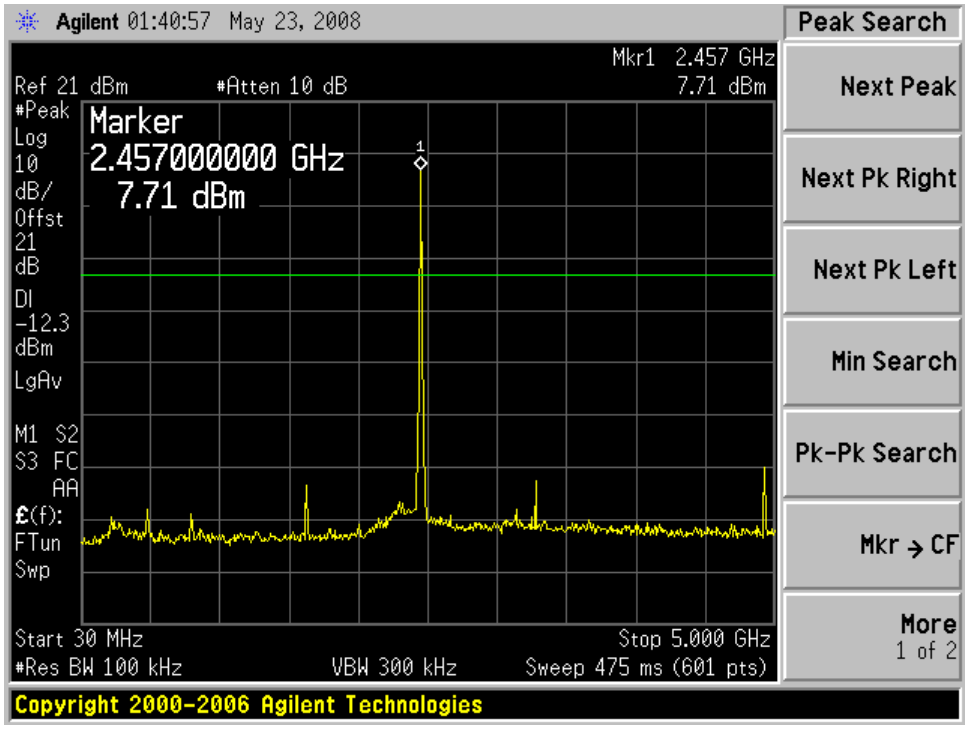


Plot 2: 5 GHz – 10 GHz

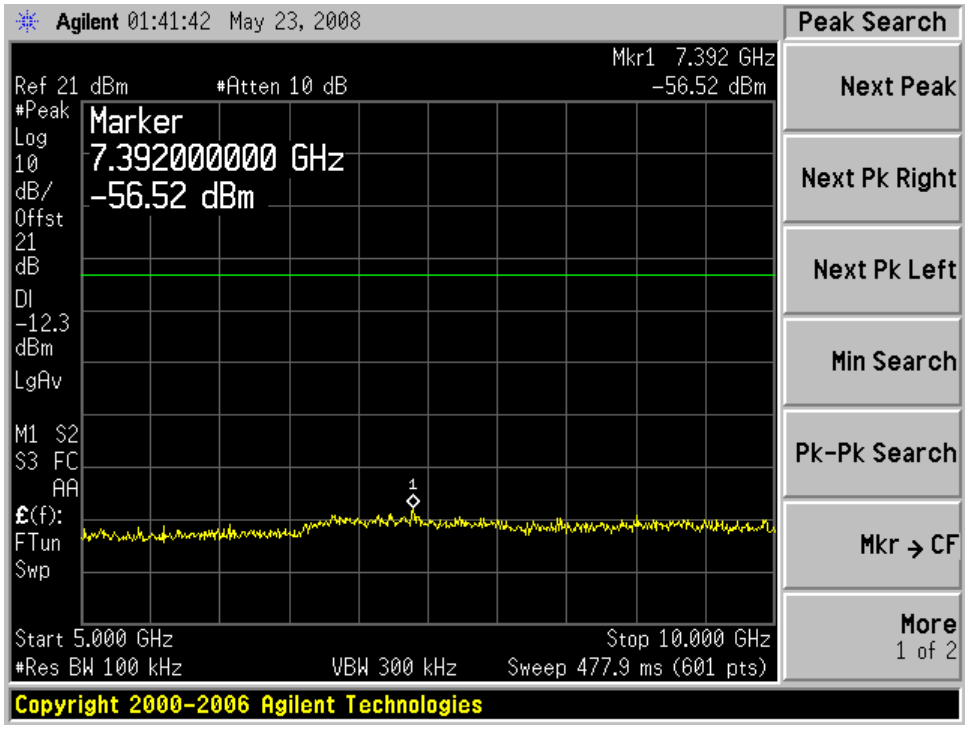


Plot 3: 10 GHz – 25 GHz

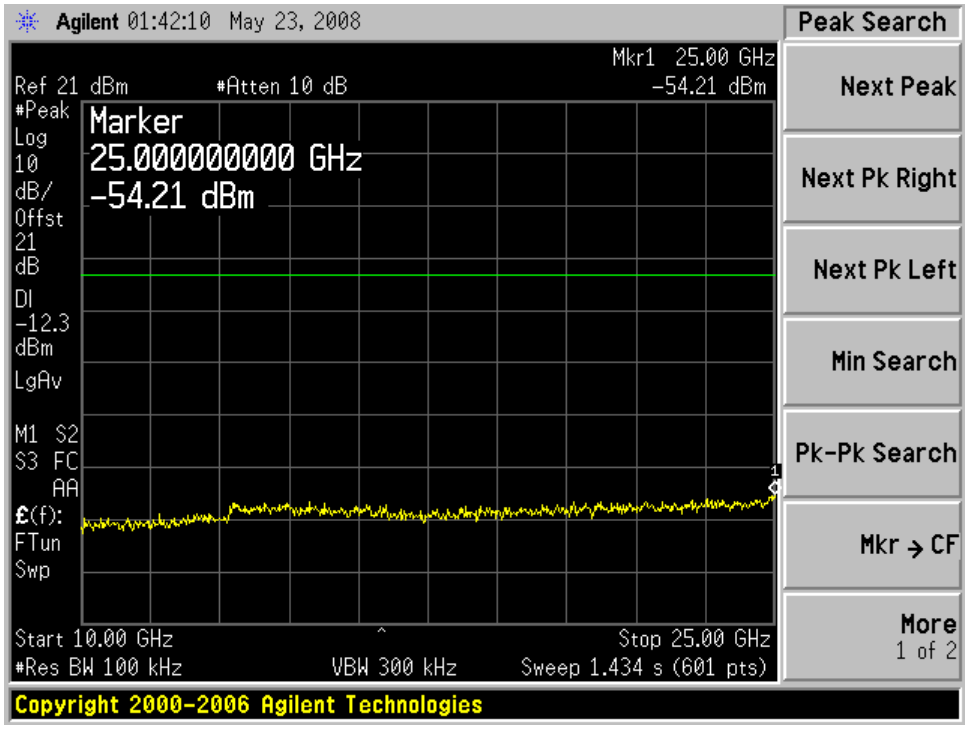
High Channel



Plot 1: 30 MHz – 5 GHz



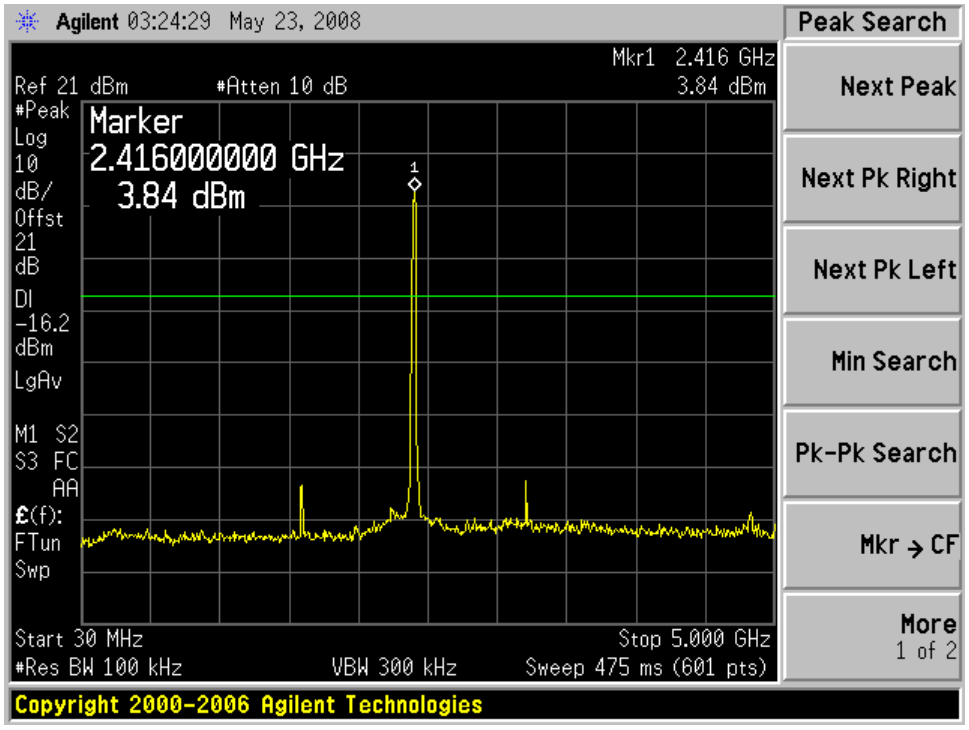
Plot 2: 5 GHz – 10 GHz



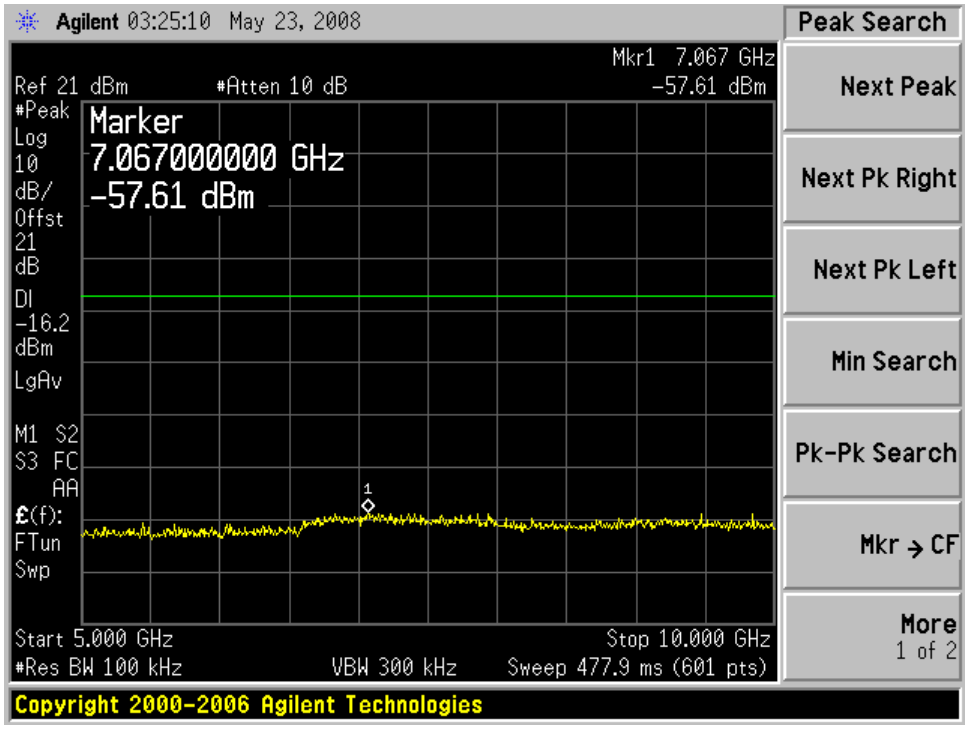
Plot 3: 10 GHz – 25 GHz

802.11g mode

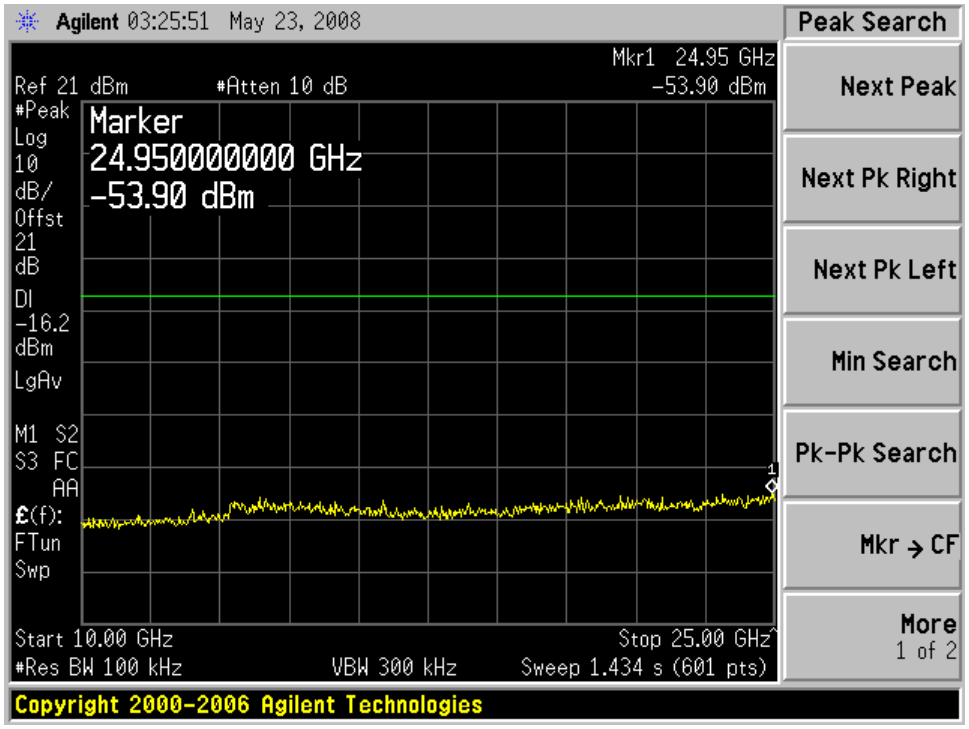
Low Channel



Plot 1: 30 MHz – 5 GHz

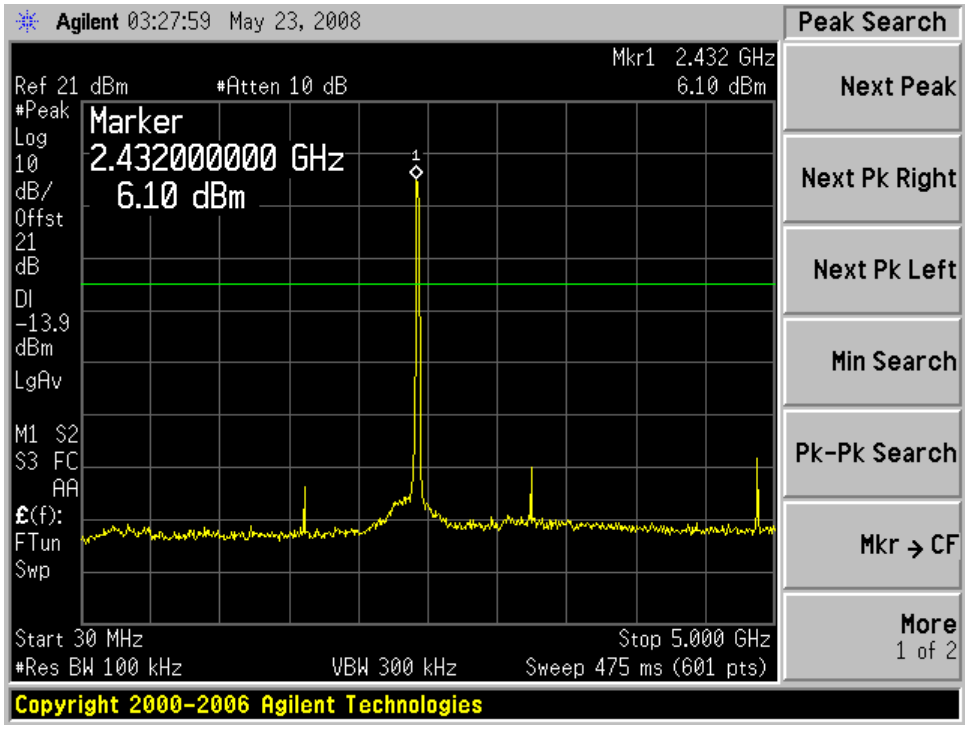


Plot 2: 5 GHz – 10 GHz

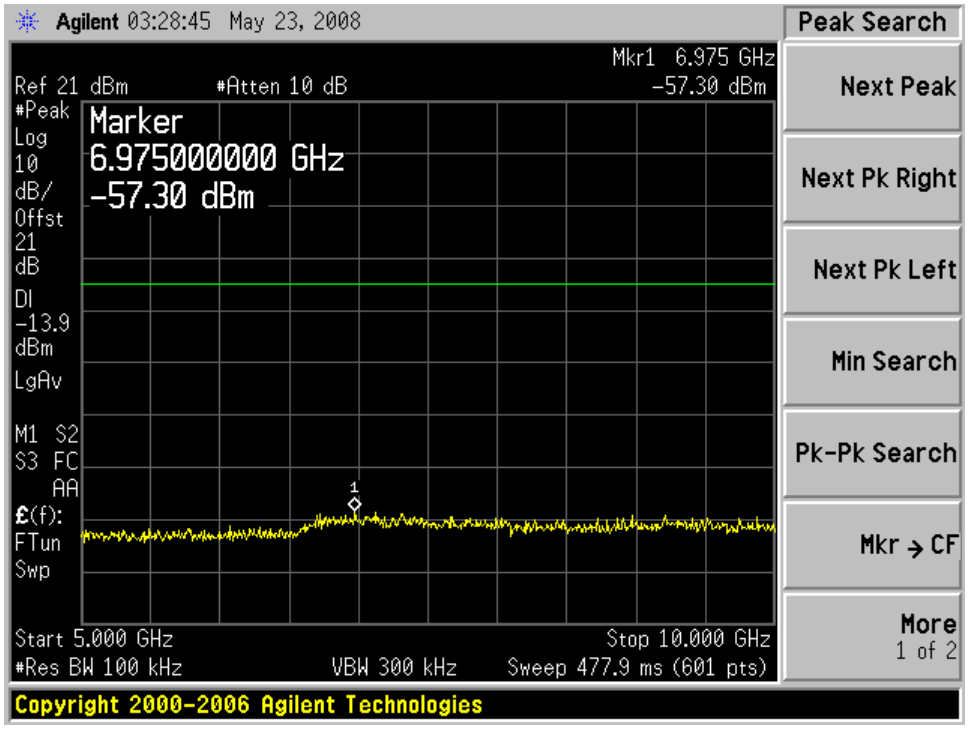


Plot 3: 10 GHz – 25 GHz

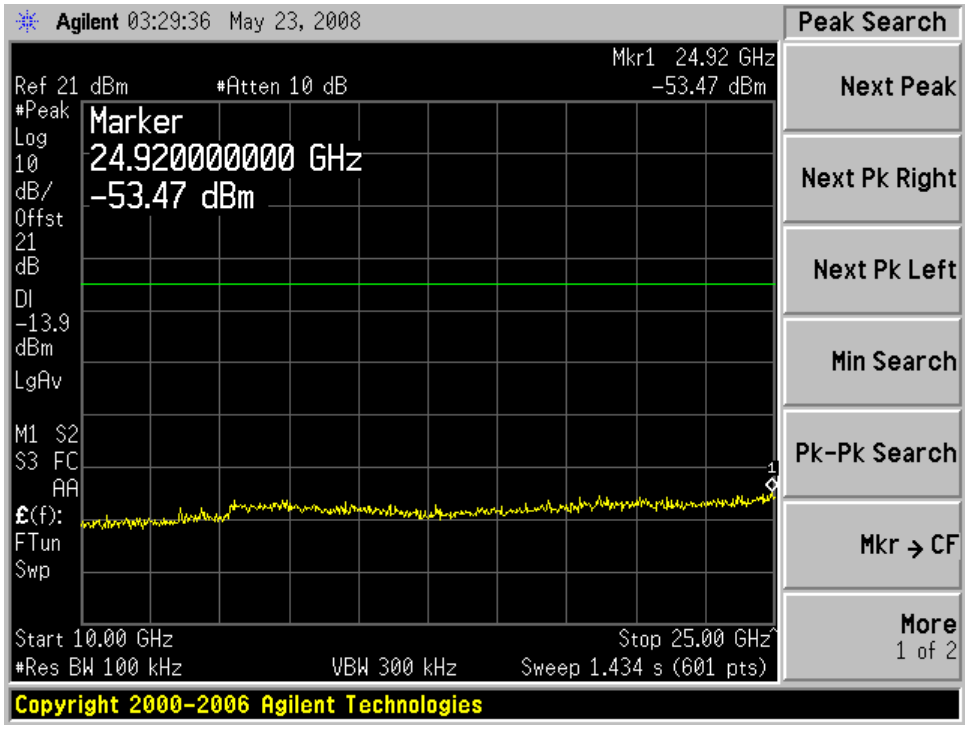
Middle Channel



Plot 1: 30 MHz – 5 GHz

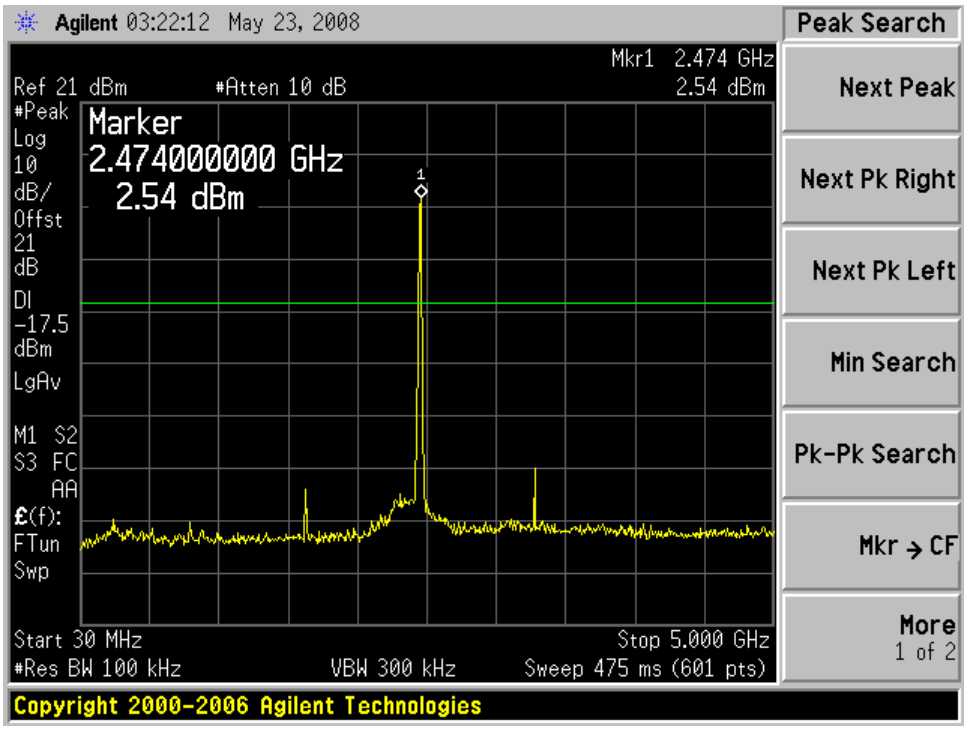


Plot 2: 5 GHz – 10 GHz

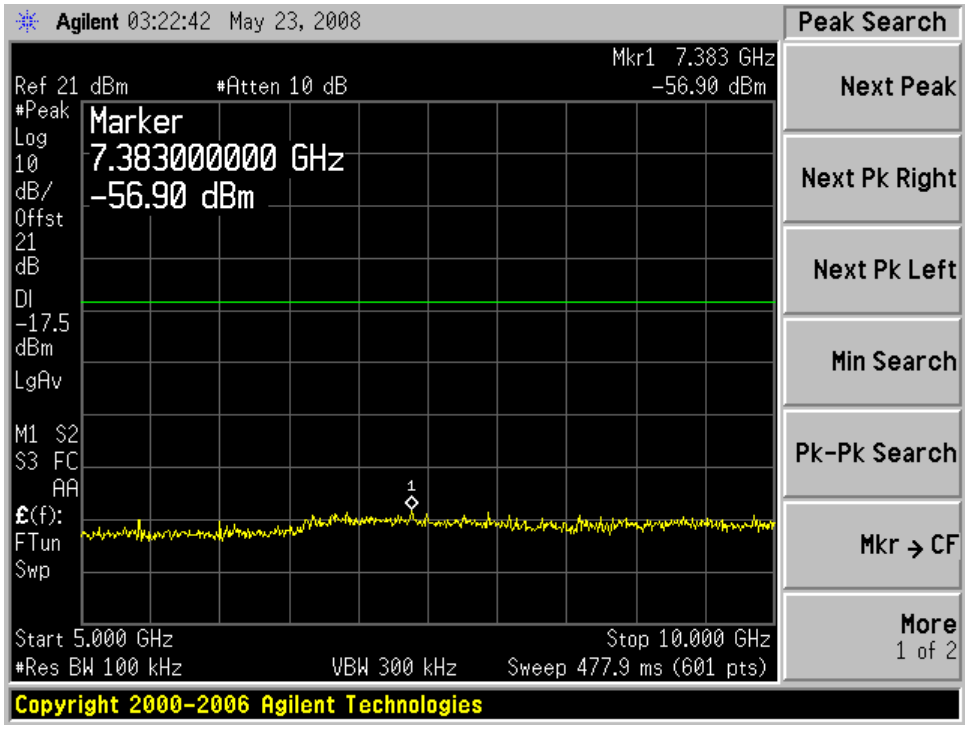


Plot 3: 10 GHz – 25 GHz

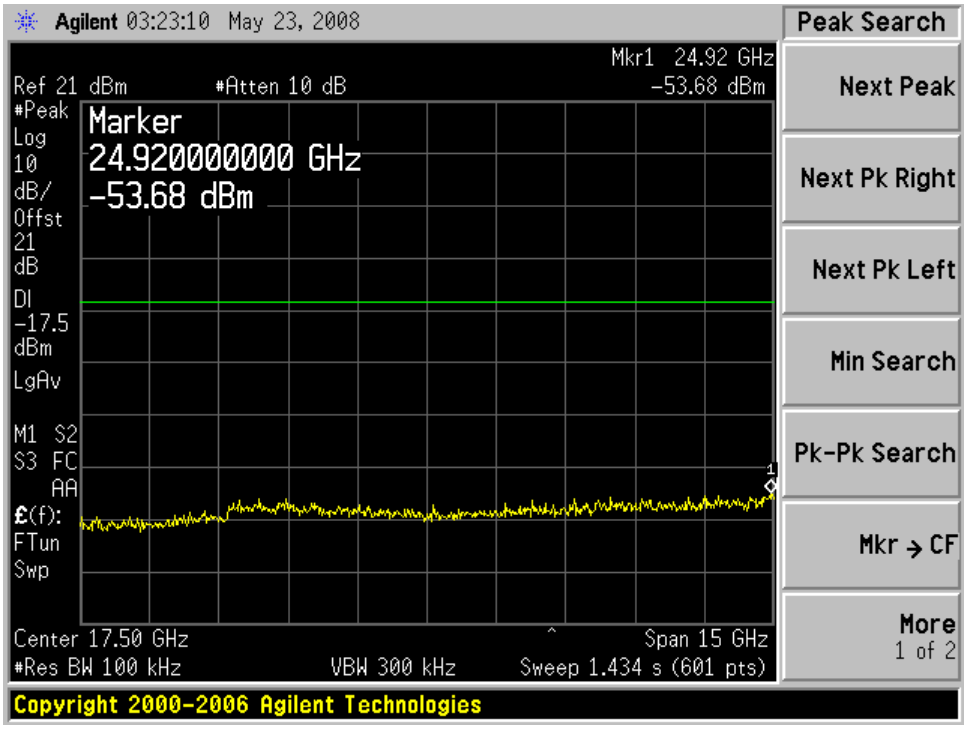
High Channel



Plot 1: 30 MHz – 5 GHz



Plot 2: 5 GHz – 10 GHz



Plot 3: 10 GHz – 25 GHz

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

8.1 Applicable Standard

FCC §15.247(d)

As per 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 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 (microvolts/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 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		

8.2 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 and E 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.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal Date
HP	Pre amplifier	8447D	2944A07030	2007-11-12
Agilent	Pre amplifier	8449B	3008A01978	2007-11-02
Sunol Science	Combination Antenna	JB1 Antenna	A013105-3	2008-03-25
Antenna Research Associates, Inc.	Horn Antenna	DRG-118/A	1132	2007-06-18
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	1000337	2008-04-21
Sunol Science	System Controller	SC99V	122303-1	NR
Agilent	Spectrum analyzer	E4440A	MY44303352	2008-04-28

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

8.4 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 meter away from the testing antenna, which is varied from 1-4 mete, 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

Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

8.5 Corrected Amplitude & Margin Calculation

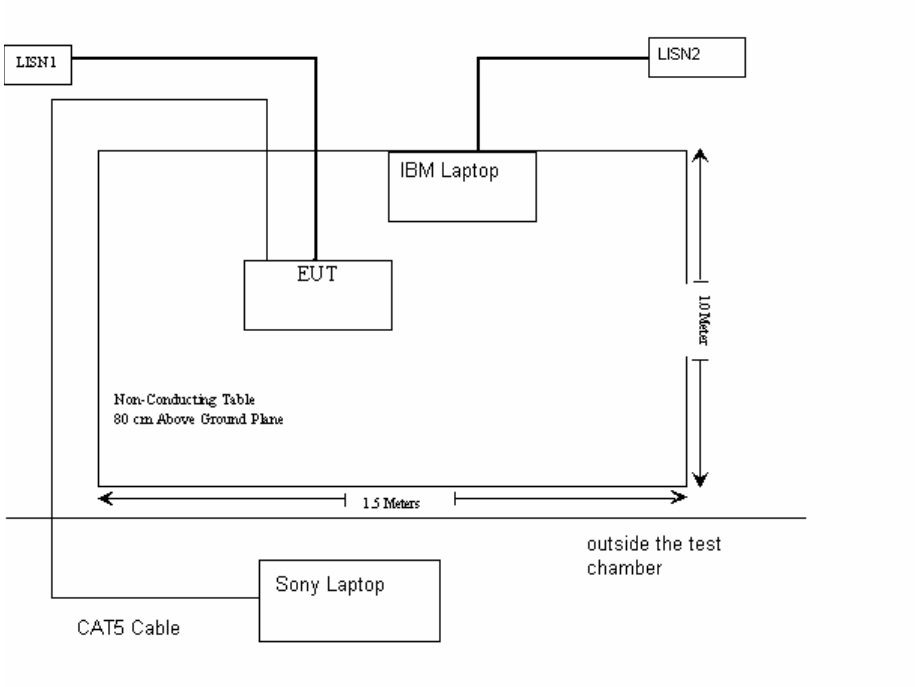
The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

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 - FCC Limit

8.6 Test Setup Diagram



8.7 Environmental Conditions

Temperature:	20° C -23° C
Relative Humidity:	30% - 63%
ATM Pressure:	1011mbar - 1019 mbar

**The testing was performed by Xiao Ming Hu and Jerry Wang from 2008-05-29 to 2008-06-08.*

8.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15.205, 15.209, 15.247, had the worst margin of:

5725-5850 MHz Band (W58)

802.11b

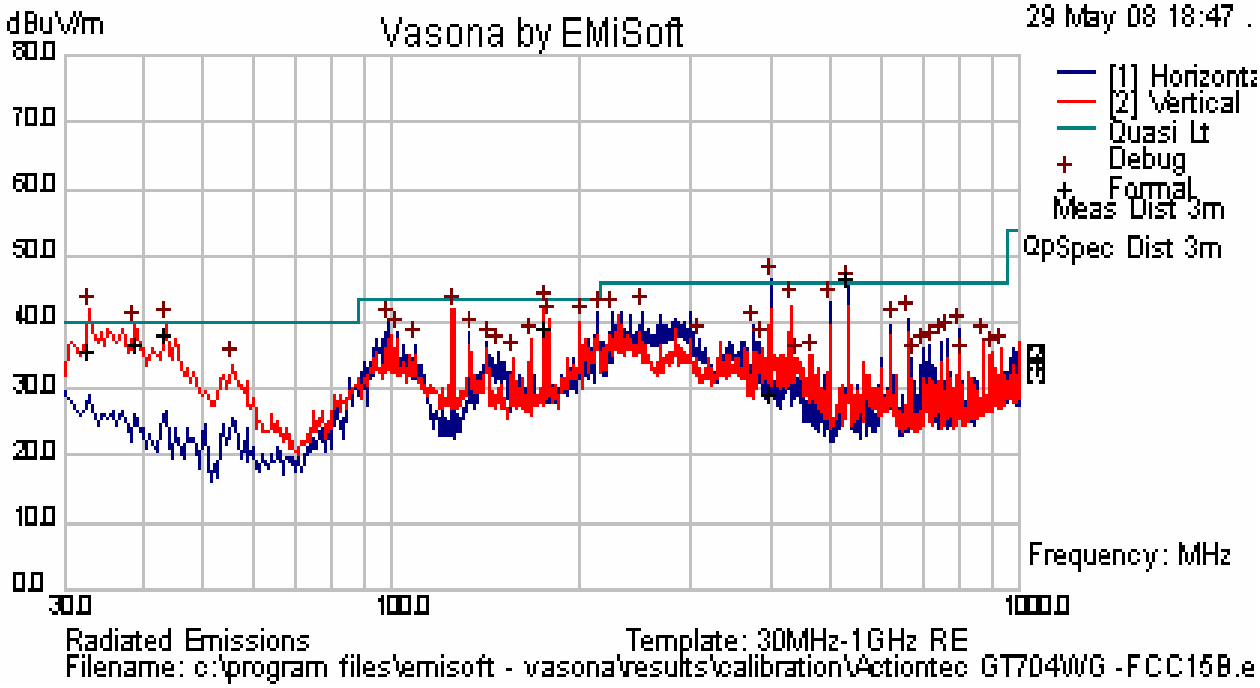
- **0.84dB** at **17489.42 MHz** in the **Vertical** polarization for **Low Channel**, 1GHz – 40 GHz
- **2.14dB** at **17712.78MHz** in the **Horizontal** polarization for **Middle Channel**, 1GHz – 40 GHz
- **0.7dB** at **7388.353MHz** in the **Vertical** polarization for **High Channel**, 1GHz – 40 GHz

802.11g

- **1.66dB** at **17503.33MHz** in the **Vertical** polarization for **Low Channel**, 1GHz – 40 GHz
- **2.62dB** at **17894.69MHz** in the **Vertical** polarization for **High Channel**, 1GHz – 40 GHz
- **1.66dB** at **17545.86MHz** in the **Horizontal** polarization for **High Channel**, 1GHz – 40 GHz

8.9 Test Plot and Data

Radiated Spurious Emissions Worst-case scan below 1 GHz



Quasi-Peak Measurements:

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV/m)	Measurement Type	Ant. Pol. (H/V)	Hgt (cm)	Azt Deg	Limit (dBuV/m)	Margin (dB)
533.315	44.69	11.42	-11.87	44.24	Quasi-Peak	H	209	0	46	-1.76
43.809	43.60	10.46	-18.32	35.74	Quasi-Peak	V	109	3	40	-4.26
38.966	38.89	10.45	-14.83	34.50	Quasi-Peak	V	102	142	40	-5.50
32.891	33.34	10.43	-10.19	33.58	Quasi-Peak	V	107	42	40	-6.42
174.988	44.19	10.80	-18.34	36.65	Quasi-Peak	V	108	112	43.5	-6.85
400.569	29.58	11.23	-13.69	27.12	Quasi-Peak	H	102	17	46	-18.88

8.9.1 802.11b

Low channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
17489.42	24.92	16.29	11.94	53.16	Average	V	194	80	54	-0.84
4823.769	46.13	8.16	-1.91	52.37	Average	H	121	16	54	-1.63
14530.25	26.32	14.64	8.33	49.29	Average	V	130	261	54	-4.71
2413.22	35.65	5.67	-6.49	34.82	Average	H	171	111	54	-19.18
2140.921	30.79	5.29	-7.2	28.88	Average	V	131	86	54	-25.12
1889.908	28.76	4.94	-8.39	25.31	Average	H	116	314	54	-28.69

Middle channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
17712.78	24.13	16.39	11.35	51.86	Average	H	200	93	54	-2.14
7309.975	38.5	10.15	2.82	51.48	Average	V	181	57	54	-2.52
14569.94	25.17	14.67	8.24	48.08	Average	H	171	114	54	-5.92
2435.355	41.9	5.7	-6.44	41.16	Average	V	133	278	54	-12.84
5602.155	23.94	8.79	-0.16	32.57	Average	V	109	247	54	-21.43
1891.13	26.53	4.94	-8.38	23.09	Average	H	110	202	54	-30.91

High channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
7388.353	40.2	10.22	2.88	53.3	Average	V	168	57	54	-0.7
17720.27	24.13	16.39	11.32	51.84	Average	H	157	41	54	-2.16
2458.272	42.51	5.73	-6.39	41.84	Average	V	125	238	54	-12.16
4923.839	25.09	8.25	-1.62	31.71	Average	H	157	269	54	-22.29
1891.684	26.57	4.94	-8.37	23.14	Average	H	186	224	54	-30.86
1194.205	28.82	4.06	-12.22	20.65	Average	H	131	294	54	-33.35

802.11g:

Low channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
17503.33	24.03	16.3	12.01	52.34	Average	V	156	294	54	-1.66
14411.94	25.43	14.57	8.27	48.27	Average	H	187	20	54	-5.73
7294.573	36.23	10.14	2.81	49.18	Average	H	120	270	54	-4.82
2405.178	48.7	5.66	-6.51	47.85	Average	V	130	45	54	-6.15
5615.62	33.46	8.8	-0.15	42.11	Average	H	99	361	54	-11.89
1890.83	42.71	4.94	-8.38	39.27	Average	H	175	0	54	-14.73

Middle channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
17894.69	24.21	16.46	10.71	51.38	Average	V	150	108	54	-2.62
14749.23	25.02	14.78	7.82	47.63	Average	V	154	-1	54	-6.37
2434.026	38.97	5.7	-6.44	38.22	Average	V	133	273	54	-15.78
7313.416	24.21	10.16	2.83	37.2	Average	H	126	290	54	-16.8
5602.336	22.94	8.79	-0.16	31.57	Average	H	167	36	54	-22.43
1594.78	29.01	4.52	-10.55	22.99	Average	V	129	208	54	-31.01

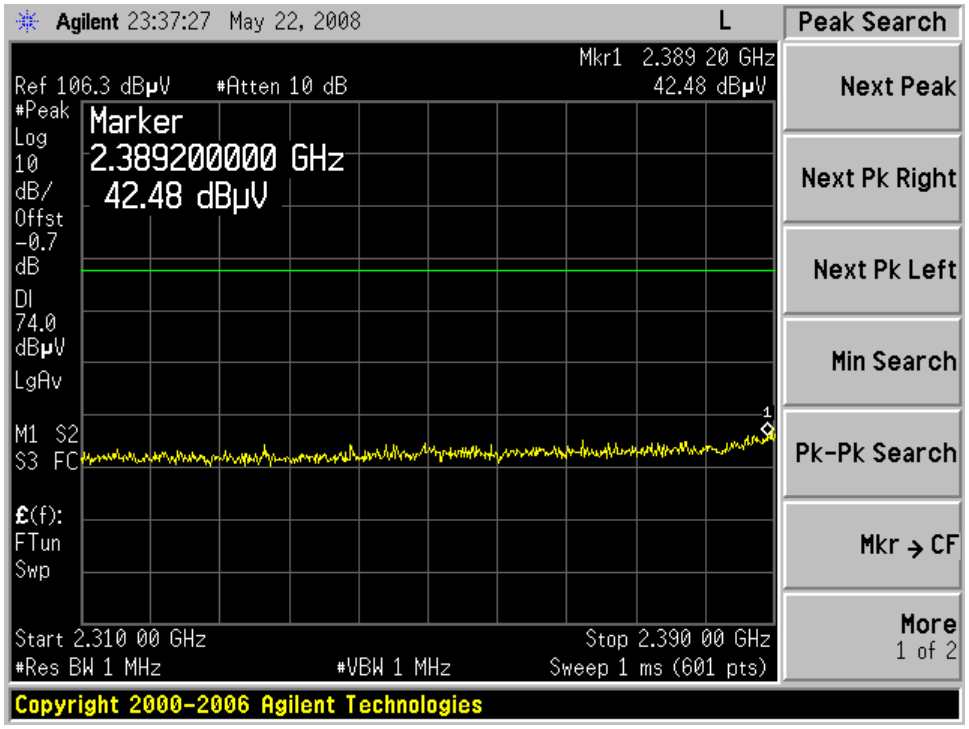
High channel

Frequency (MHz)	Raw data (dBuV)	Cable Loss (dB)	AF+ P-A (dB)	Corrected Reading (dBuV)	Measurement Type	Ant. Pol. (V/H)	Ant. Hgt (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)
17545.86	24.14	16.32	11.88	52.34	Average	H	185	186	54	-1.66
14741.64	25.02	14.78	7.84	47.63	Average	H	116	292	54	-6.37
7386.358	30.93	10.21	2.88	44.03	Average	V	188	54	54	-9.97
2458.903	35.93	5.73	-6.39	35.26	Average	V	122	239	54	-18.74
1598.176	31.32	4.53	-10.52	25.33	Average	V	119	192	54	-28.67
1439.079	28.15	4.31	-11.43	21.04	Average	V	181	284	54	-32.96

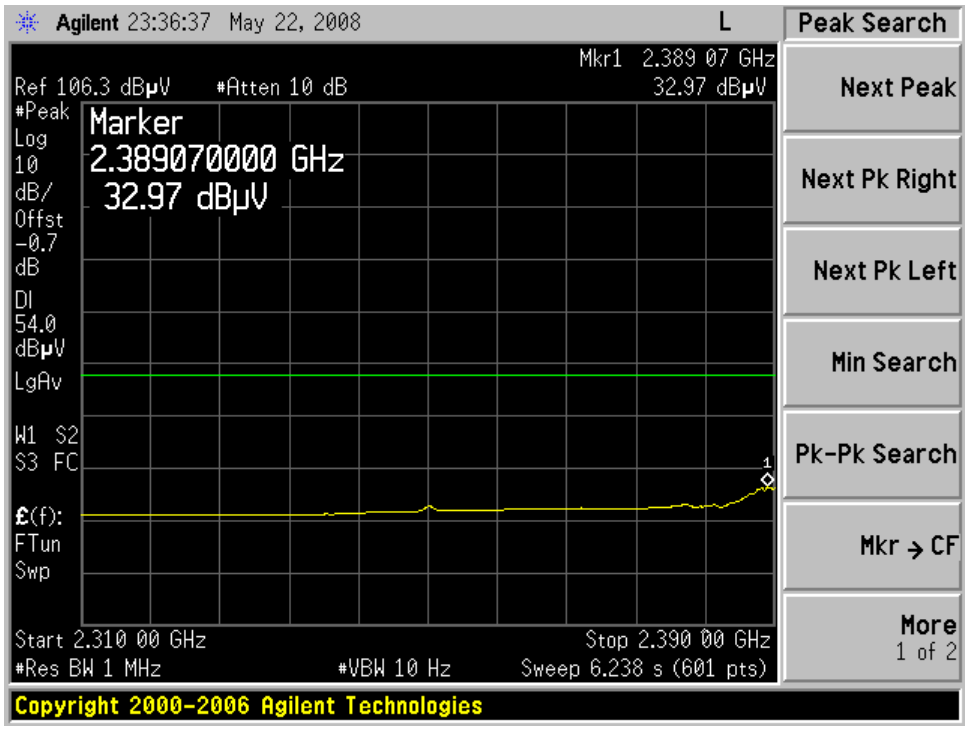
Restriction Band

802.11b:

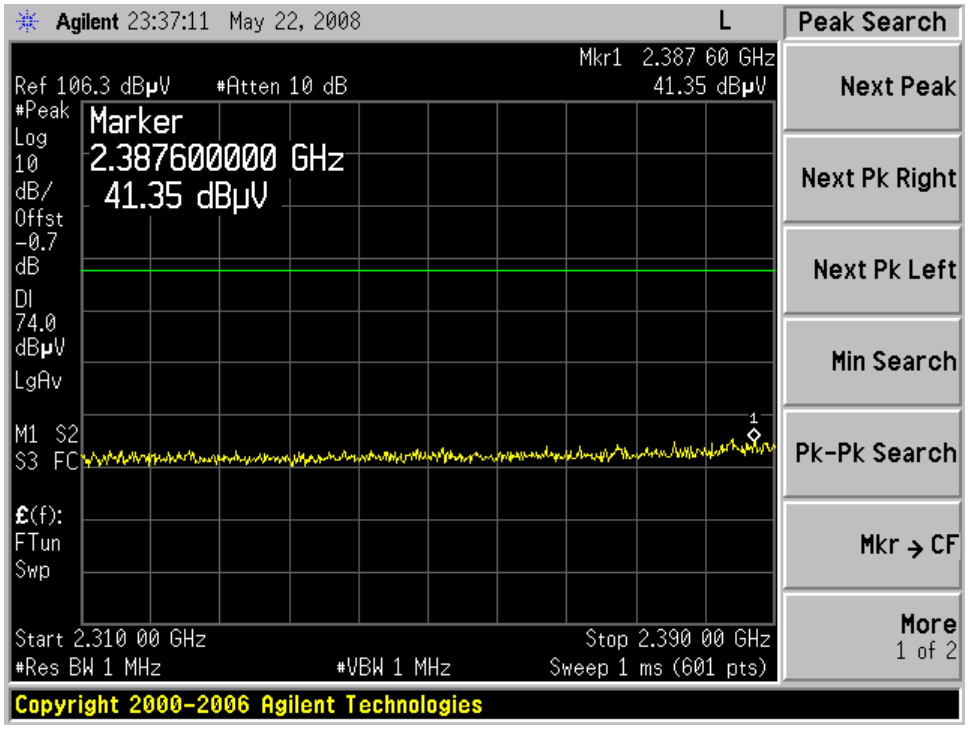
Plot 1: Low Channel; Vertical Peak



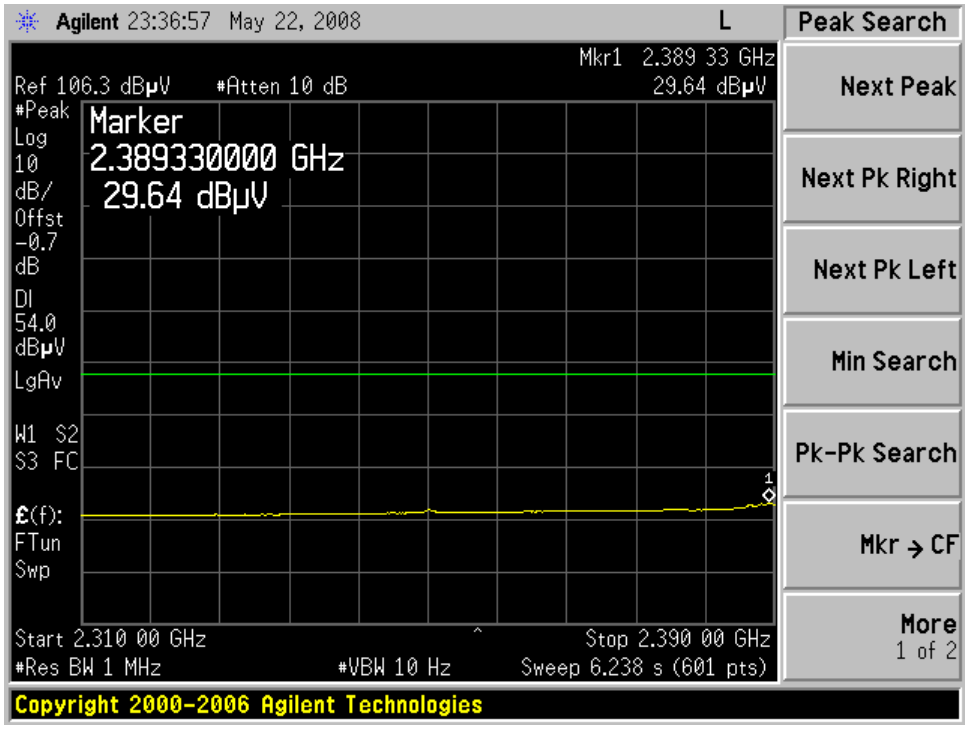
Plot 2: Low Channel; Vertical Average



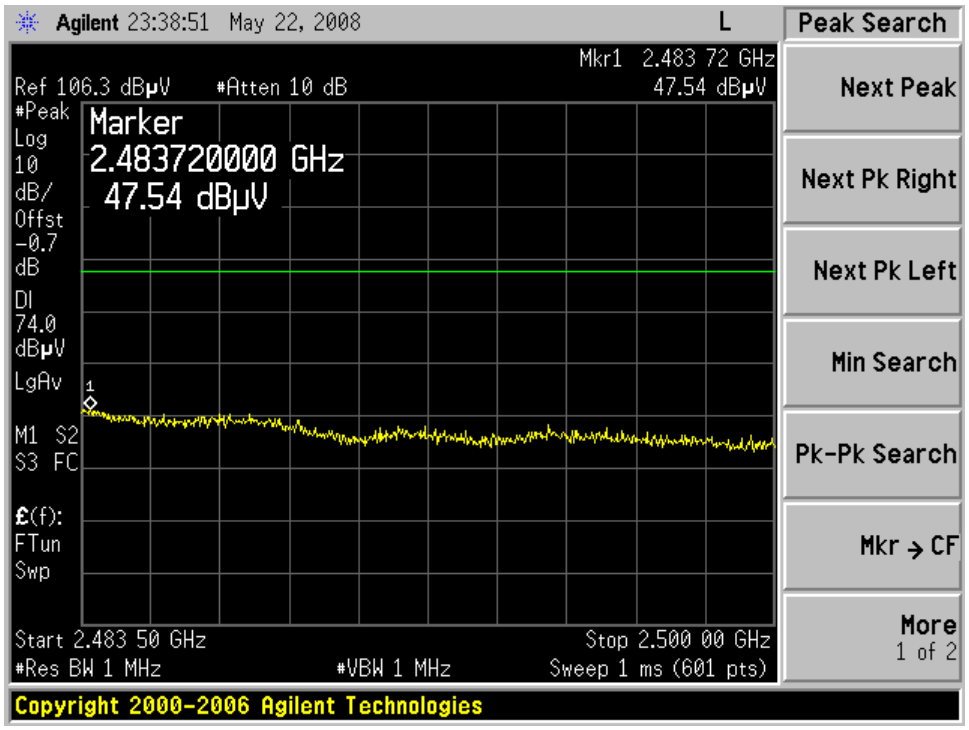
Plot 3: Low Channel; Horizontal Peak



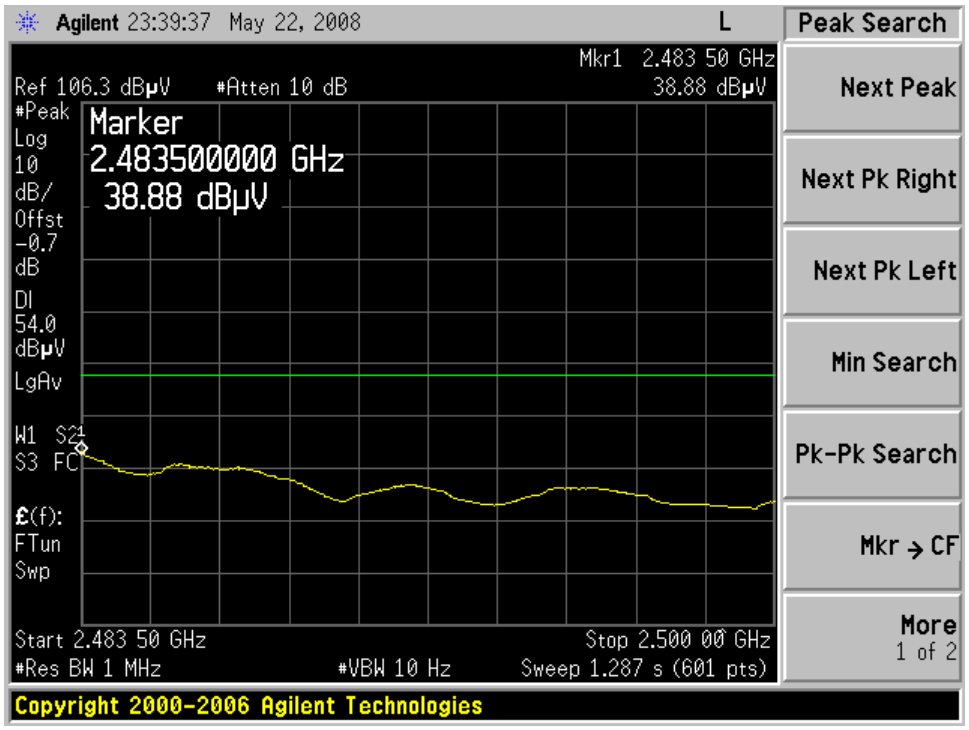
Plot 4: Low Channel; Horizontal Average



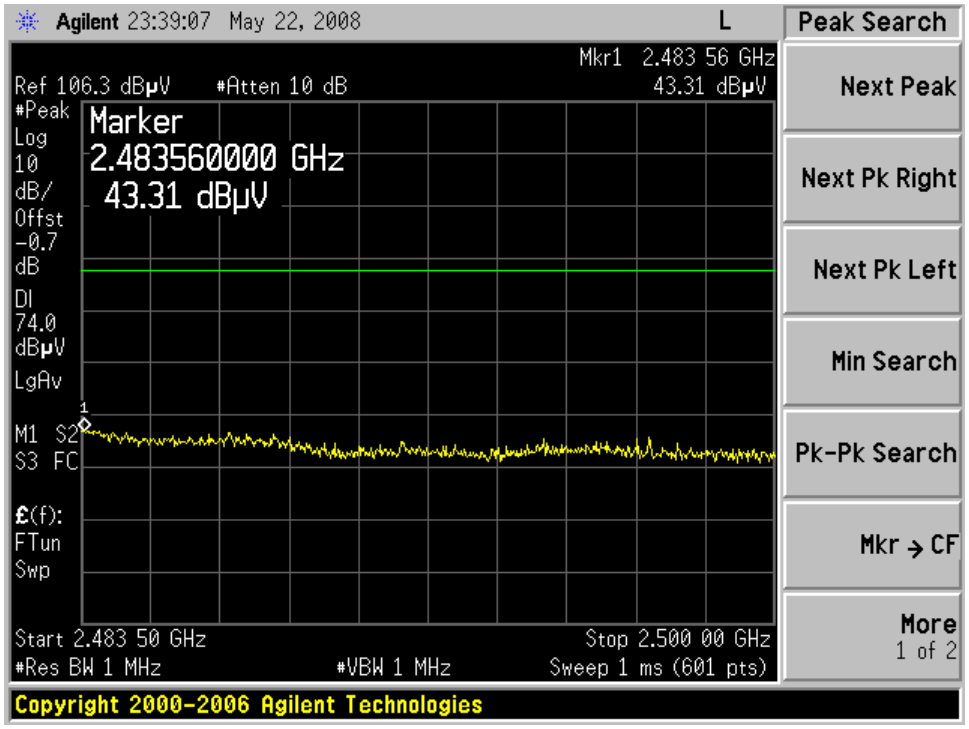
Plot 5: High Channel; Vertical Peak



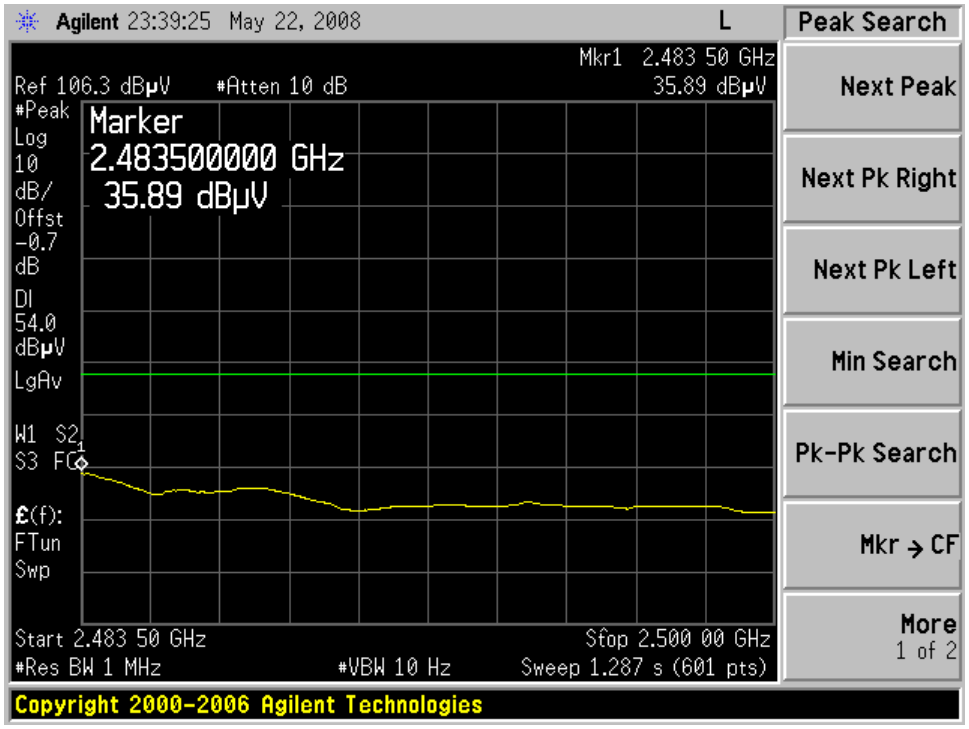
Plot 6: High Channel; Vertical Average



Plot 7: High Channel; Horizontal Peak

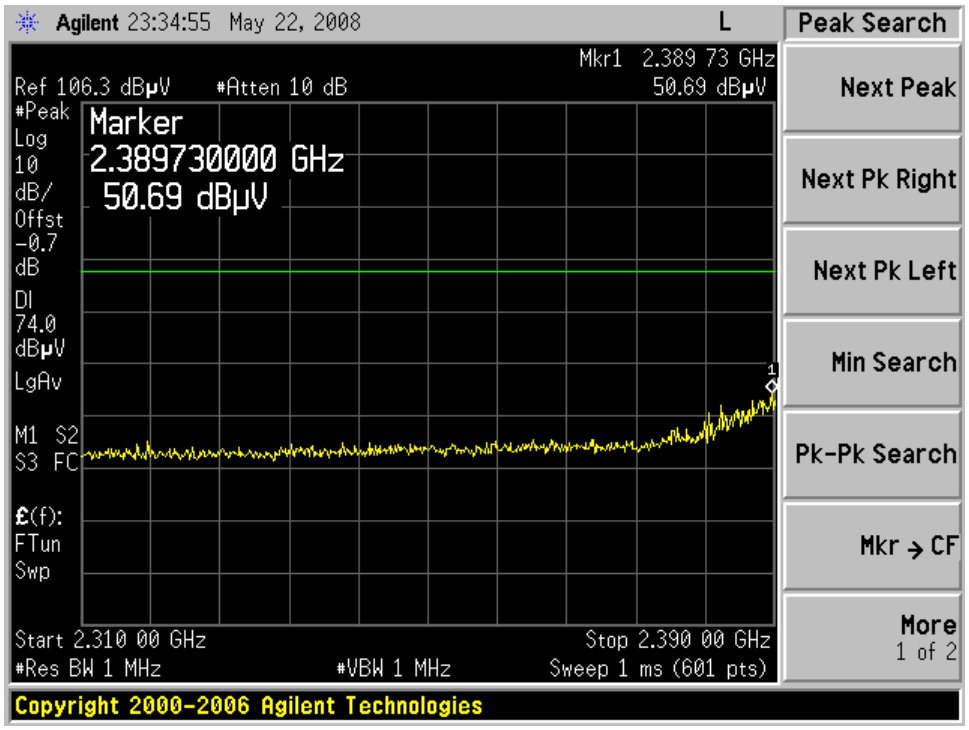


Plot 8: High Channel; Horizontal Average

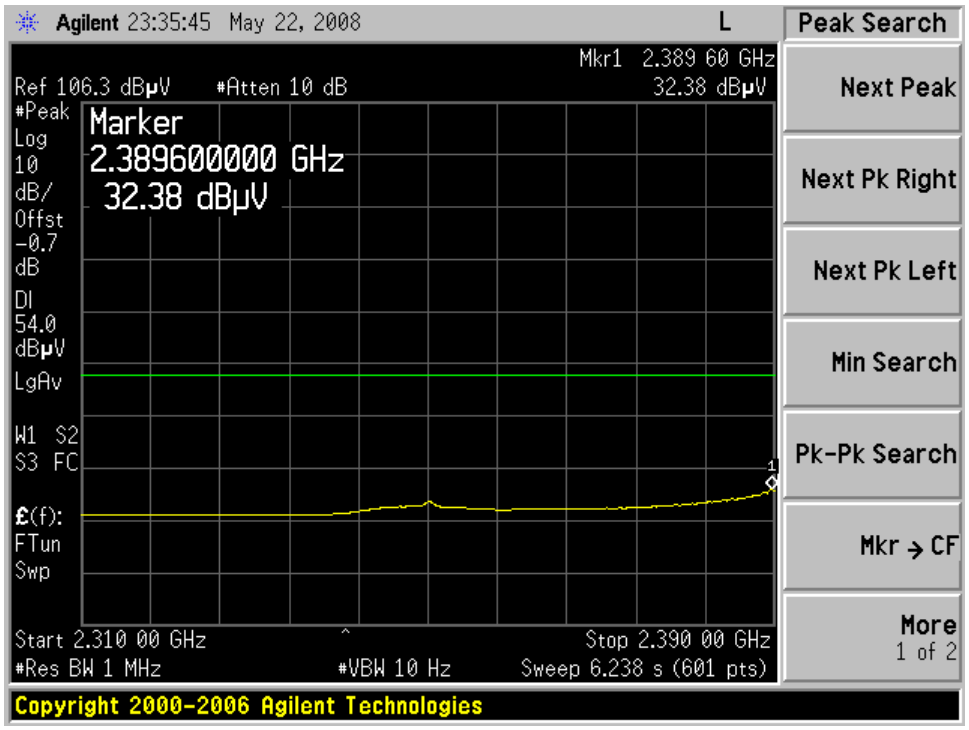


802.11g:

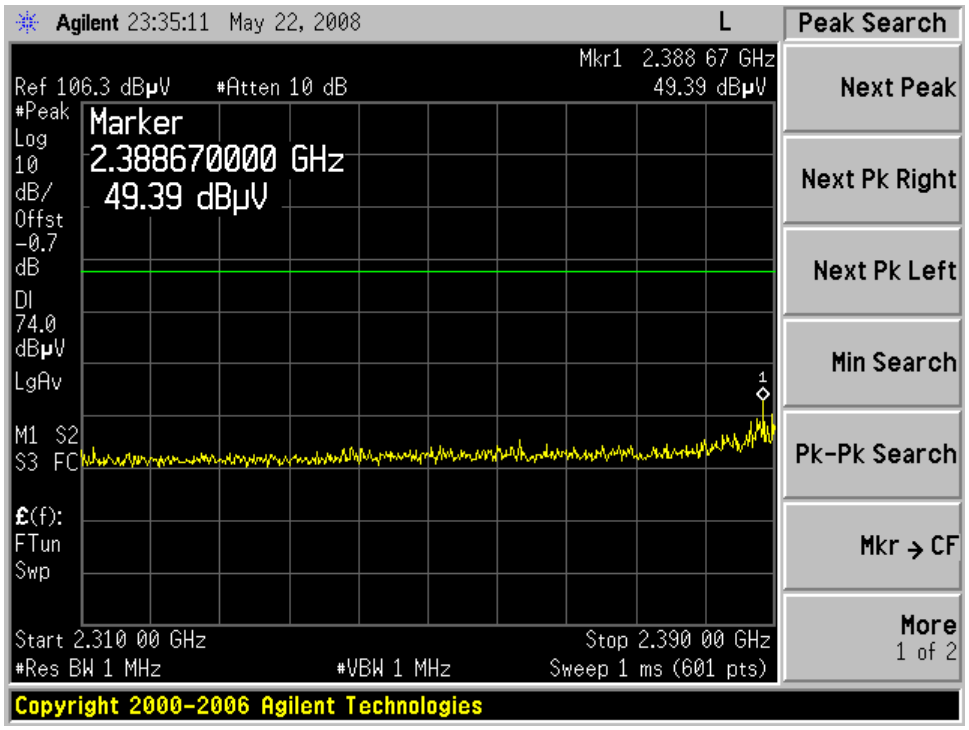
Plot 1: Low Channel; Vertical Peak



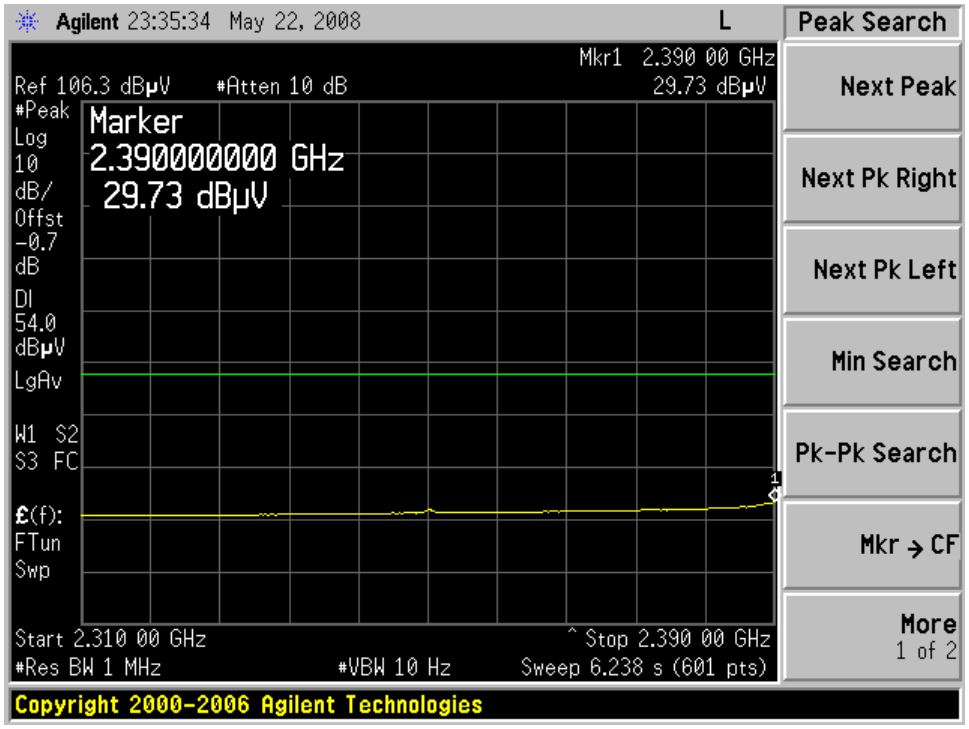
Plot 2: Low Channel; Vertical Average



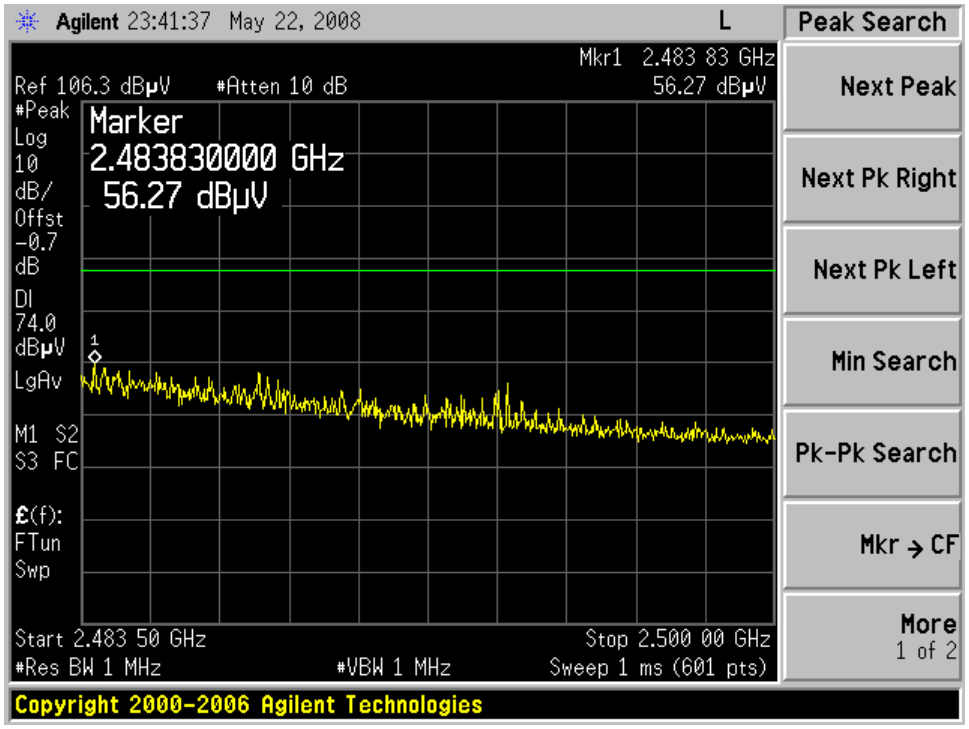
Plot 3: Low Channel; Horizontal Peak



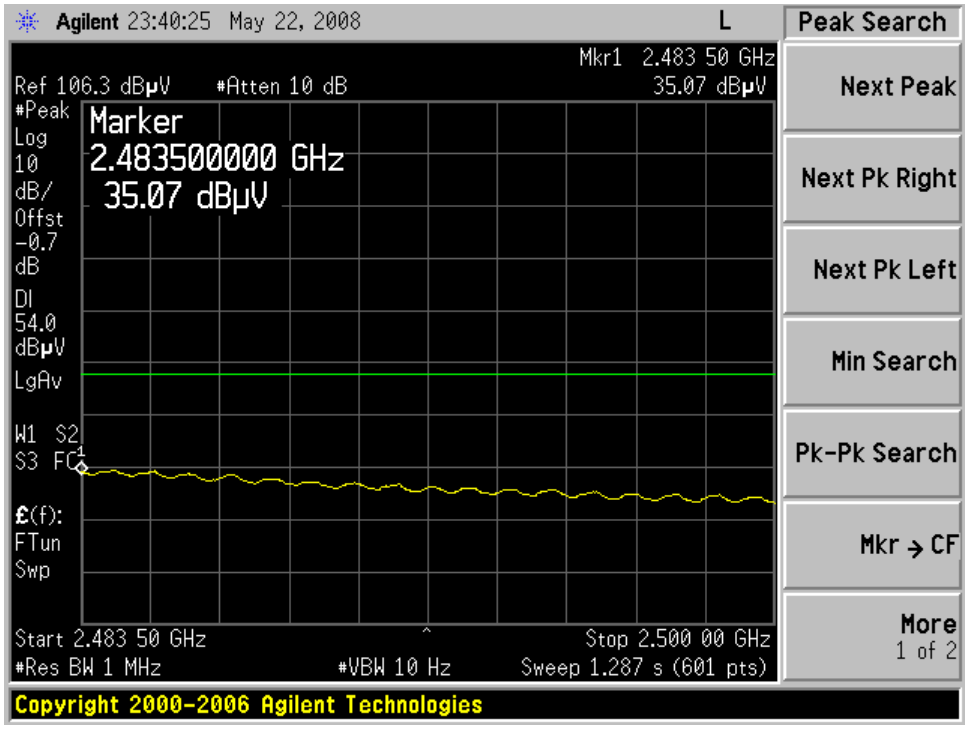
Plot 4: Low Channel Horizontal Average



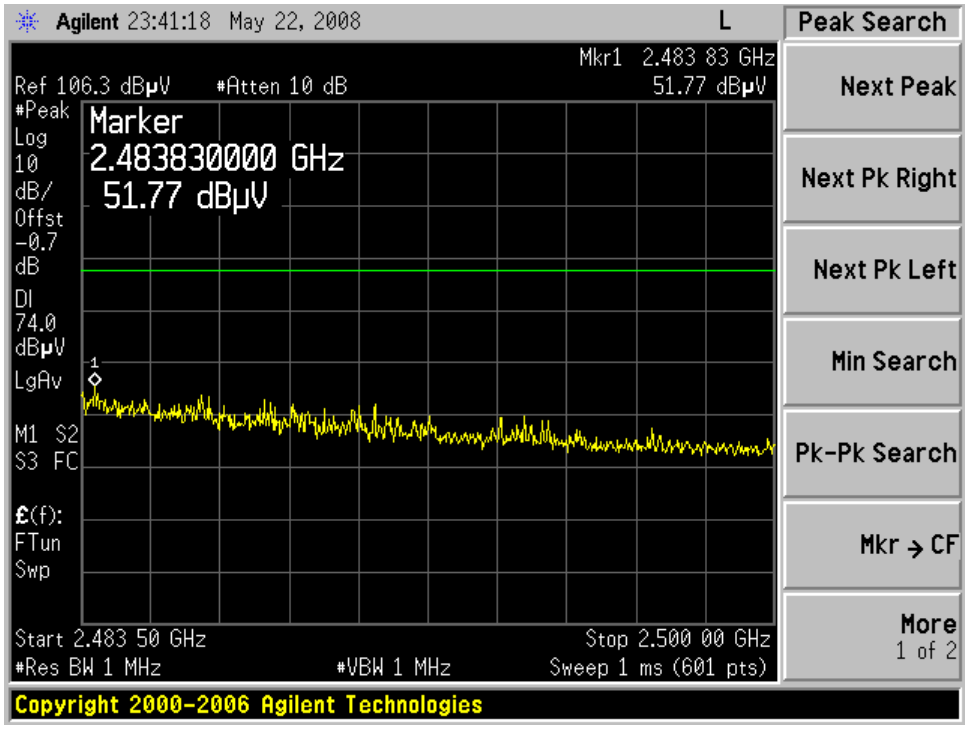
Plot 5: High Channel; Vertical Peak



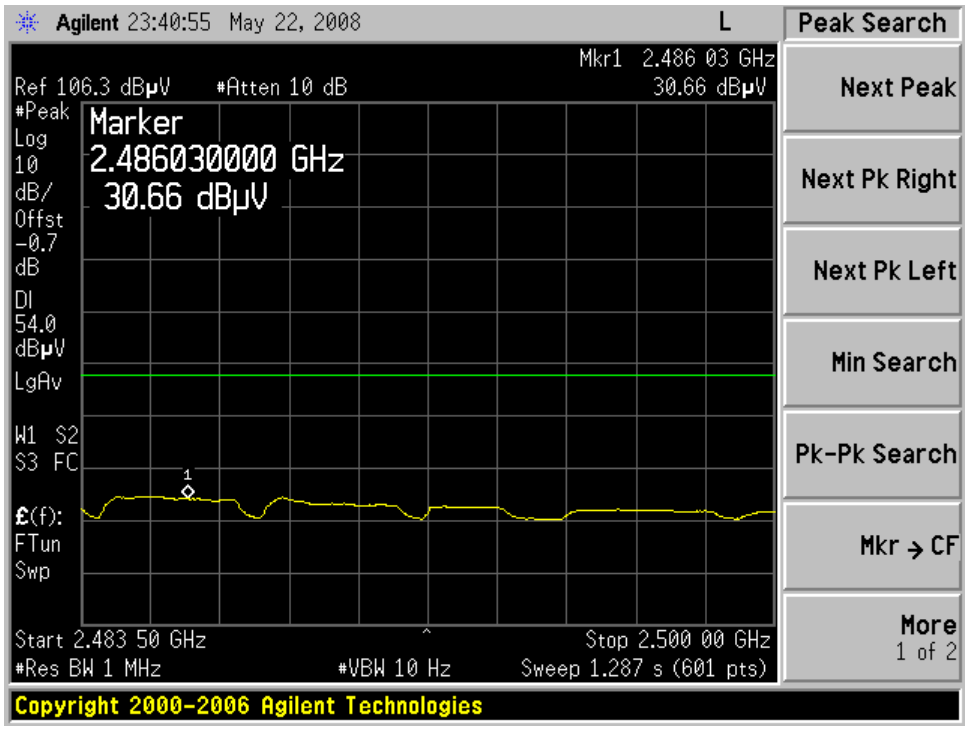
Plot 6: High Channel Vertical Average



Plot 7: High Channel Horizontal Peak



Plot 8: High Channel; Horizontal Average



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

9.1 Applicable Standard

FCC §15.247 (a) (2);

9.2 Measurement Procedure

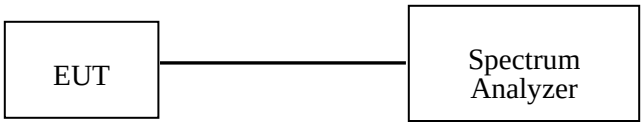
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency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

9.3 Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28

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

9.4 Test Setup Diagram



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9.5 Environmental Conditions

Temperature:	20° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

**The testing was performed by Xiao Ming Hu from 2008-06-13.*

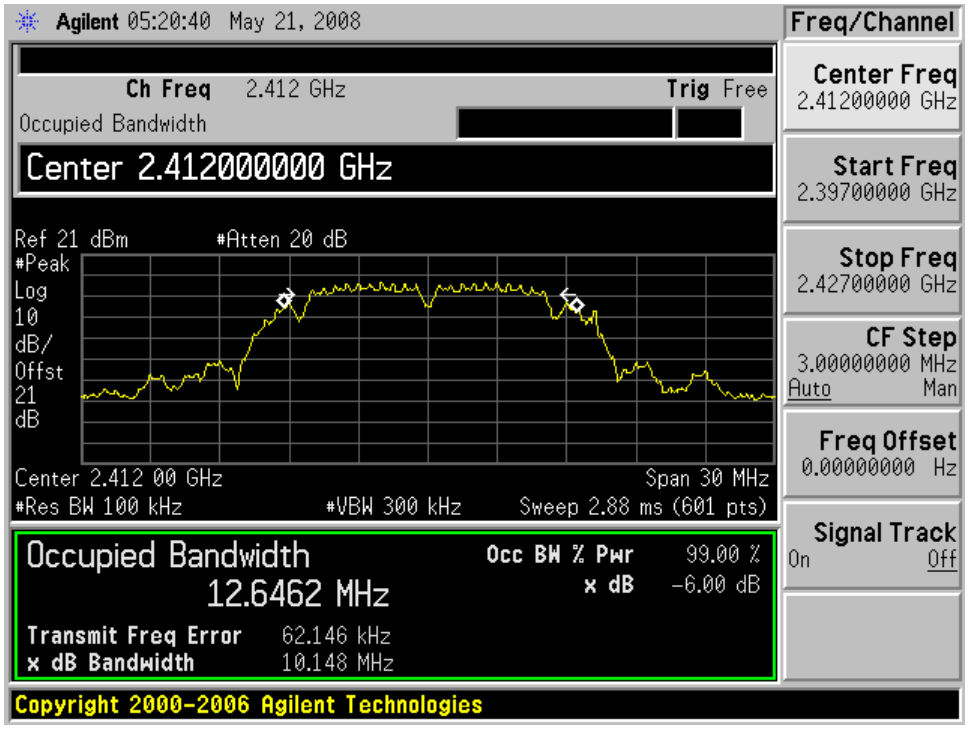
9.6 Test Results:

Channel	Frequency (MHz)	6 dB BW (MHz)	99% BW (MHz)
802.11 b Mode			
Low	2412	10.148	12.6462
Middle	2437	10.150	12.4814
High	2462	10.154	12.4977
802.11 g Mode			
Low	2412	15.152	16.3088
Middle	2437	15.431	16.2622
High	2462	15.643	16.3085

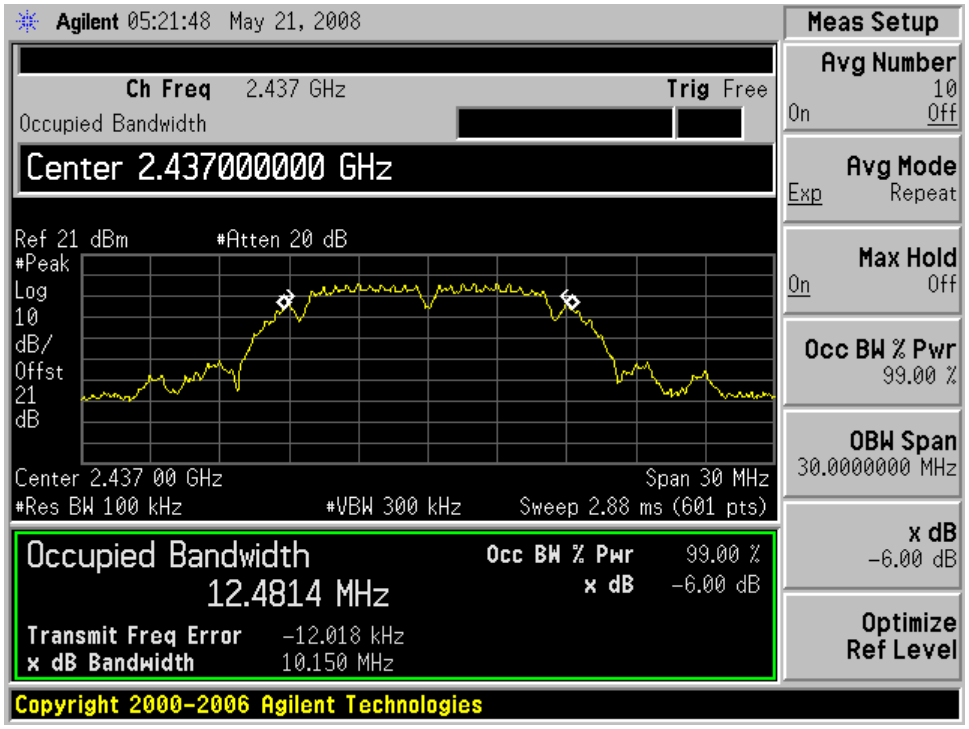
Please refer to the following plots:

802.11b:

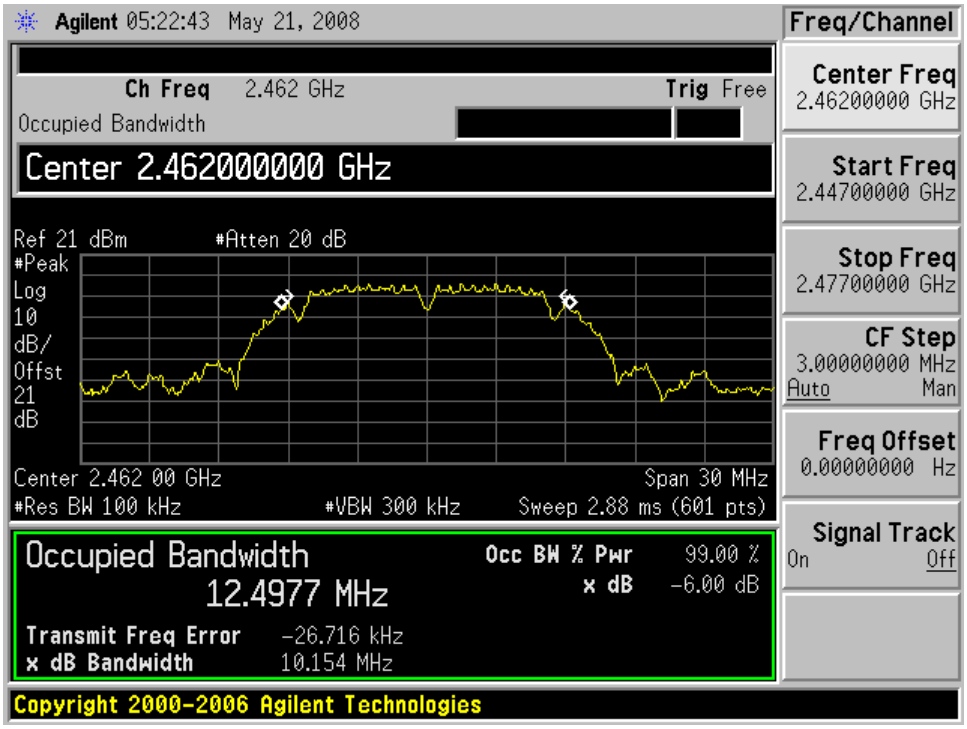
Low Channel



Middle Channel

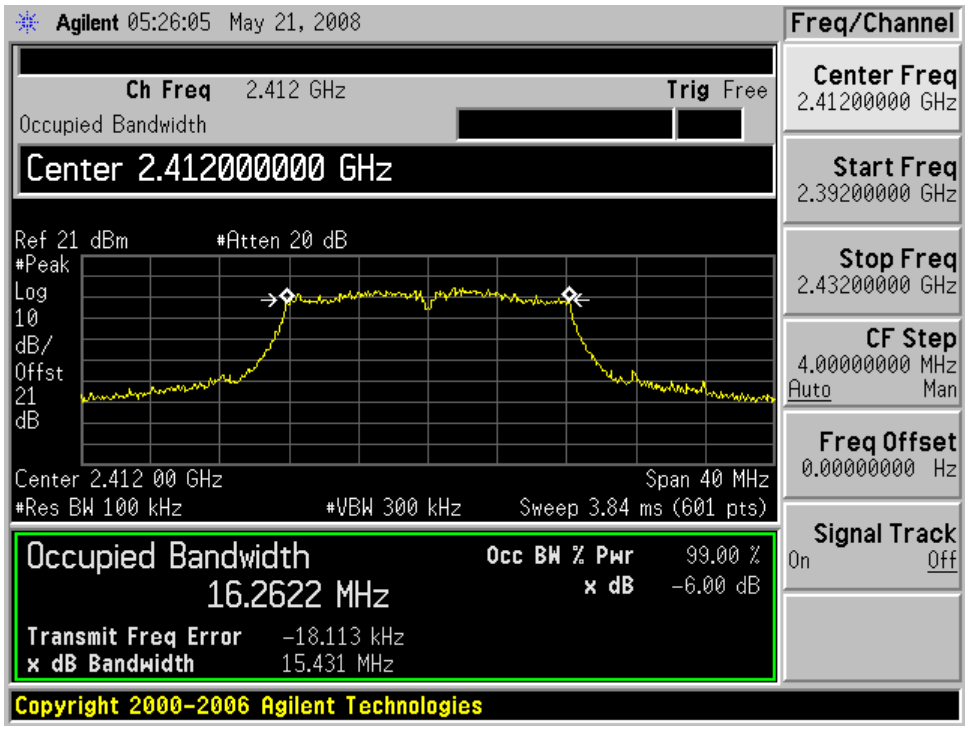


High Channel

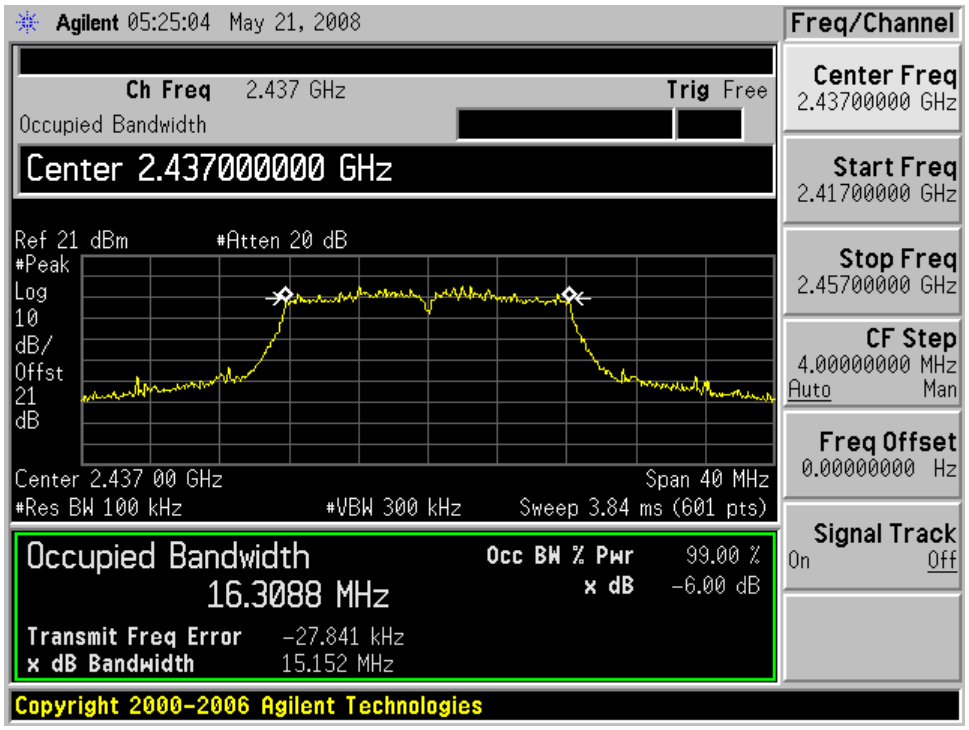


802.11g:

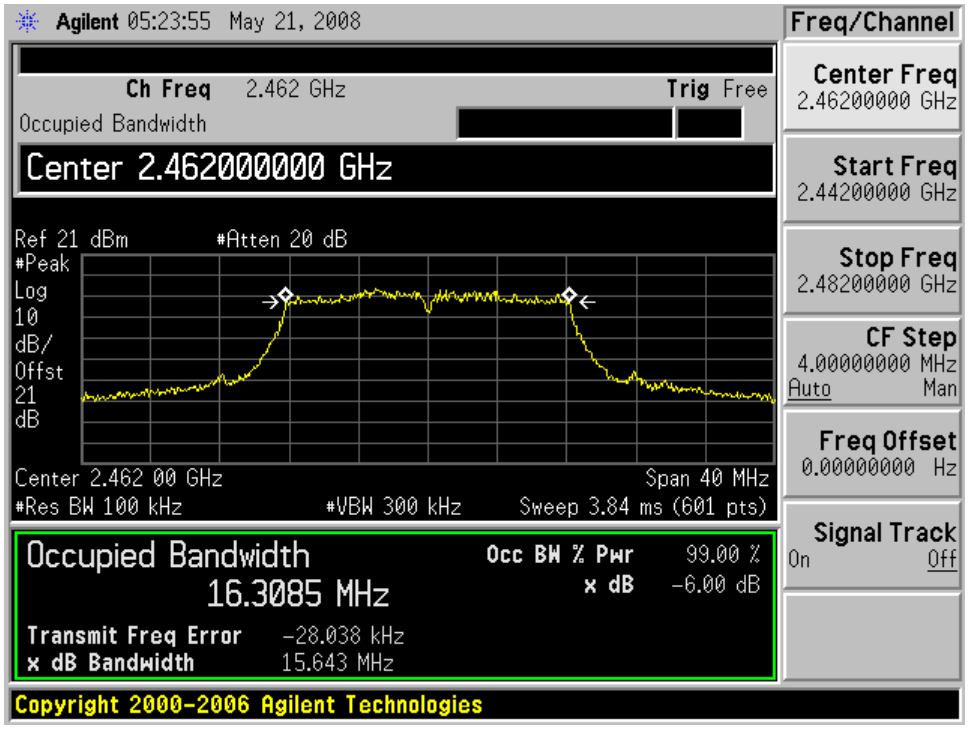
Low Channel



Middle Channel



High Channel



10 FCC §15.247(b) - Maximum Output Power

10.1 Applicable Standard

FCC §15.247 (b)

10.2 Measurement Procedure

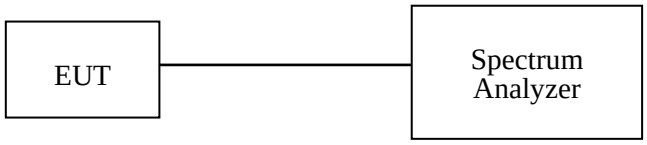
1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.

10.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28

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

10.4 Test Setup Diagram



10.5 Environmental Conditions

Temperature:	20° C
Relative Humidity:	30%
ATM Pressure:	1011mbar

**The testing was performed by Xiao Ming Hu from 2008-06-19.*

10.6 Test Result

802.11b mode:

Frequency (MHz)	RF Power (dBm)	RF Power (mW)	Limit (dBm)	Margin (dB)
2412	16.47	44.36	30	-13.53
2437	16.55	45.19	30	-13.45
2462	16.74	47.21	30	-13.26

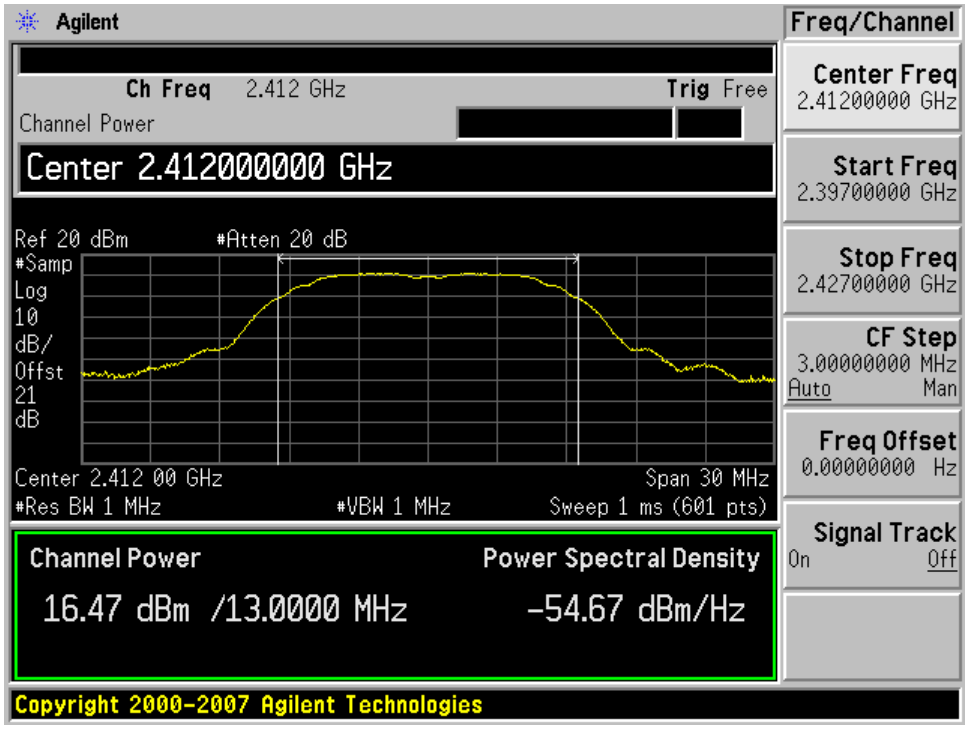
802.11g mode:

Frequency (MHz)	RF Power (dBm)	RF Power (mW)	Limit (dBm)	Margin (dB)
2412	14.59	28.77	30	-15.41
2437	14.39	27.48	30	-15.61
2462	14.11	25.76	30	-15.89

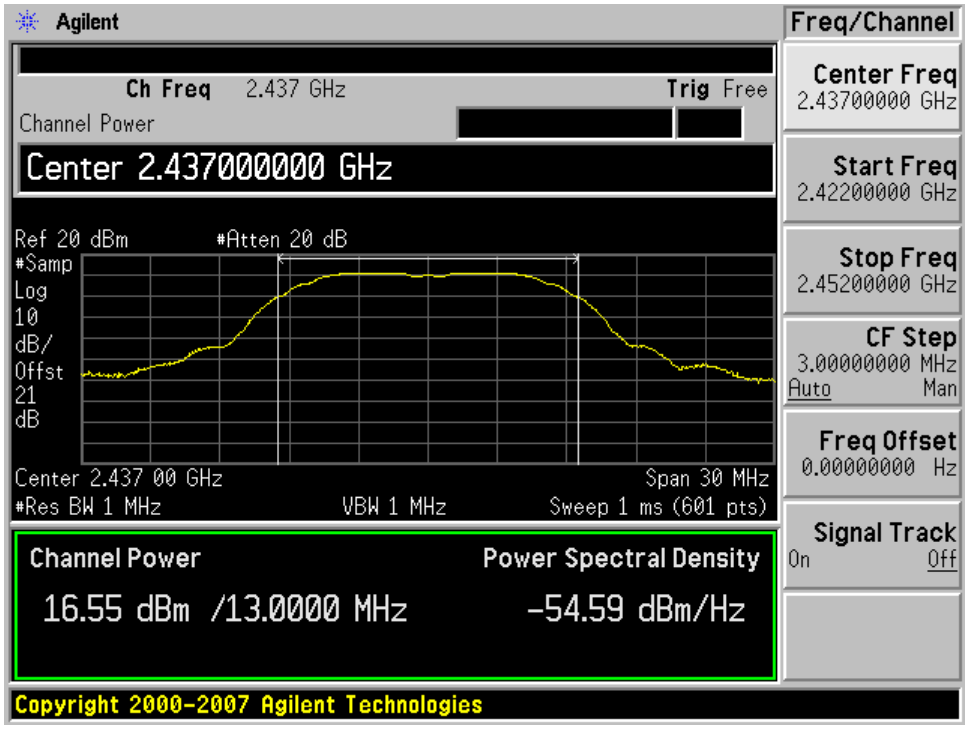
Please refer to the following plots:

802.11b

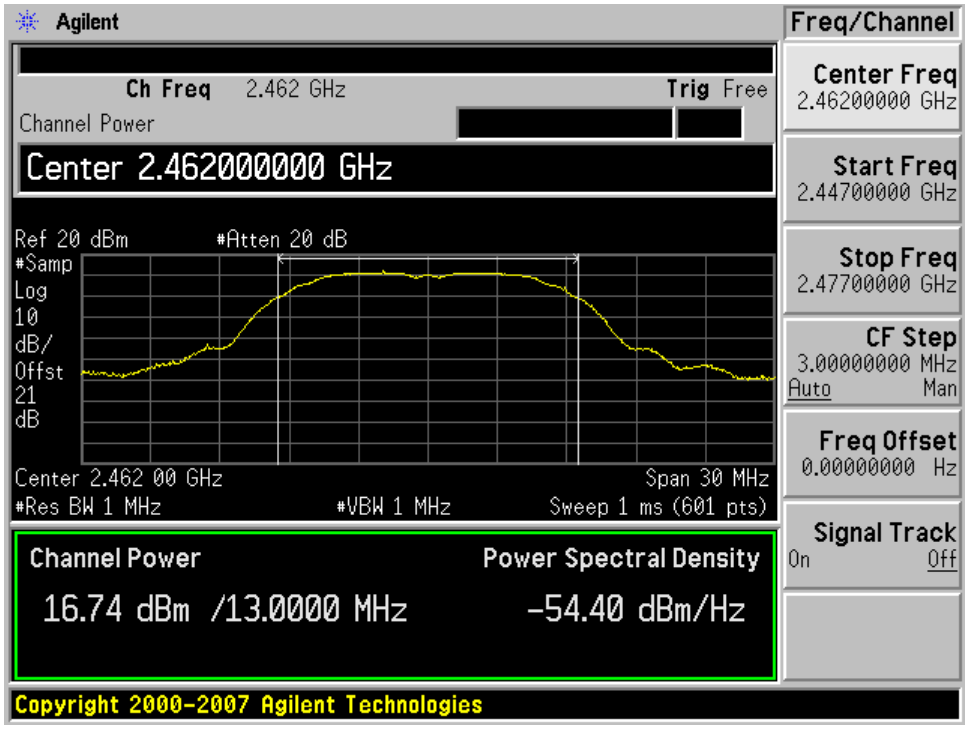
Low Channel



Middle Channel

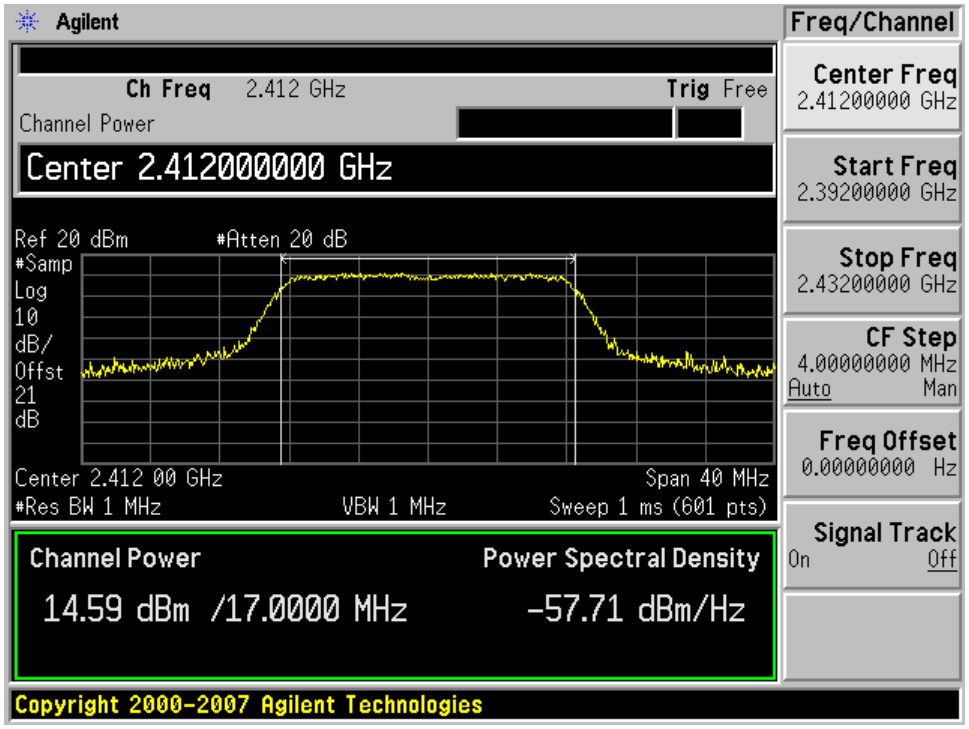


High Channel

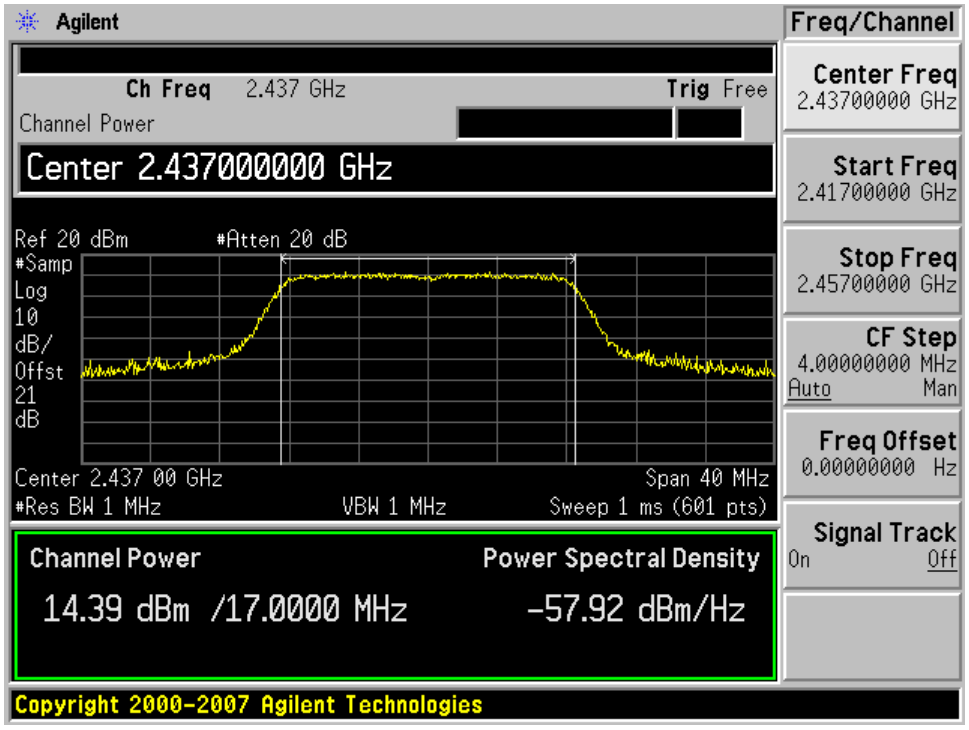


802.11g

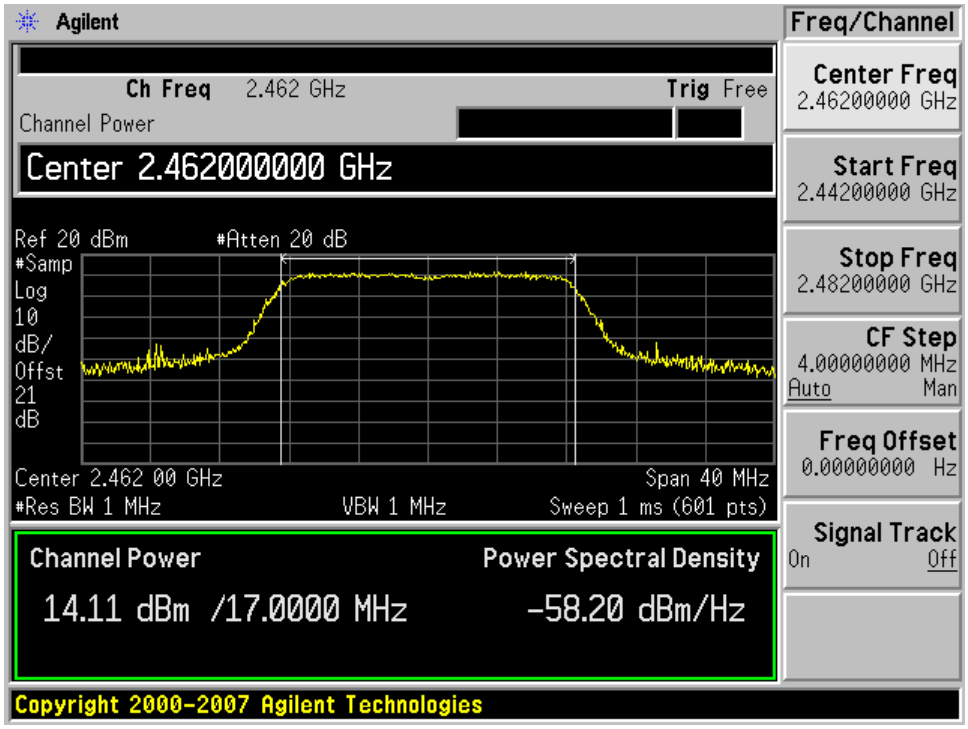
Low Channel



Middle Channel



High Channel



11 FCC §15.247 (d) - 100 KHz Bandwidth of Band Edge

11.1 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)).

11.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

11.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28

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

11.4 Environmental Conditions

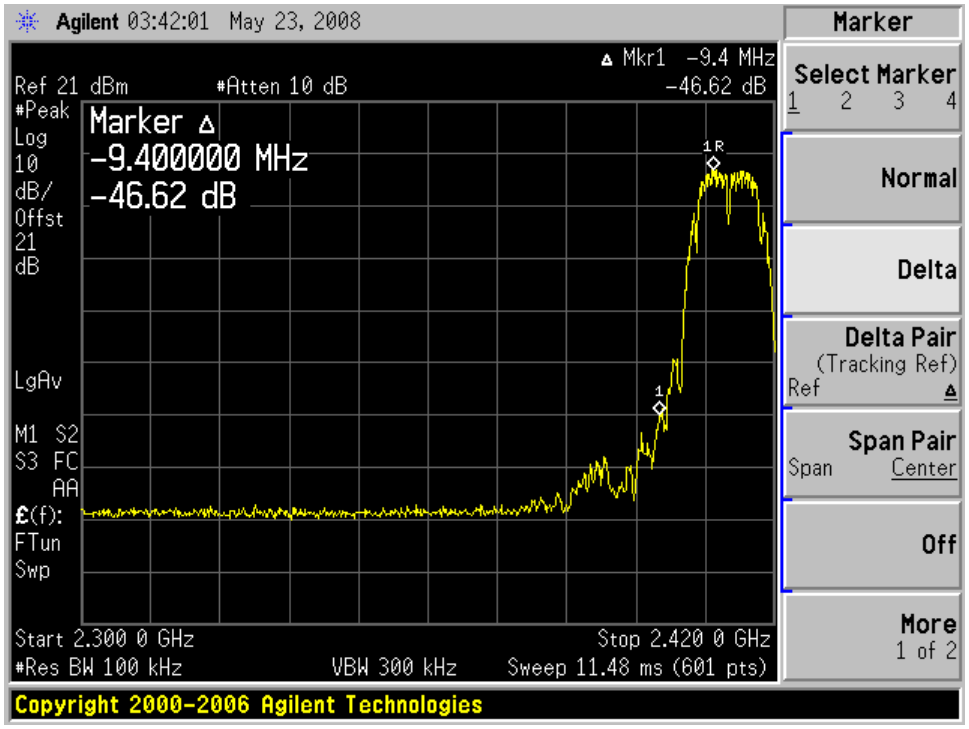
Temperature:	20° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

**The testing was performed by Xiao Ming Hu from 2008-06-23.*

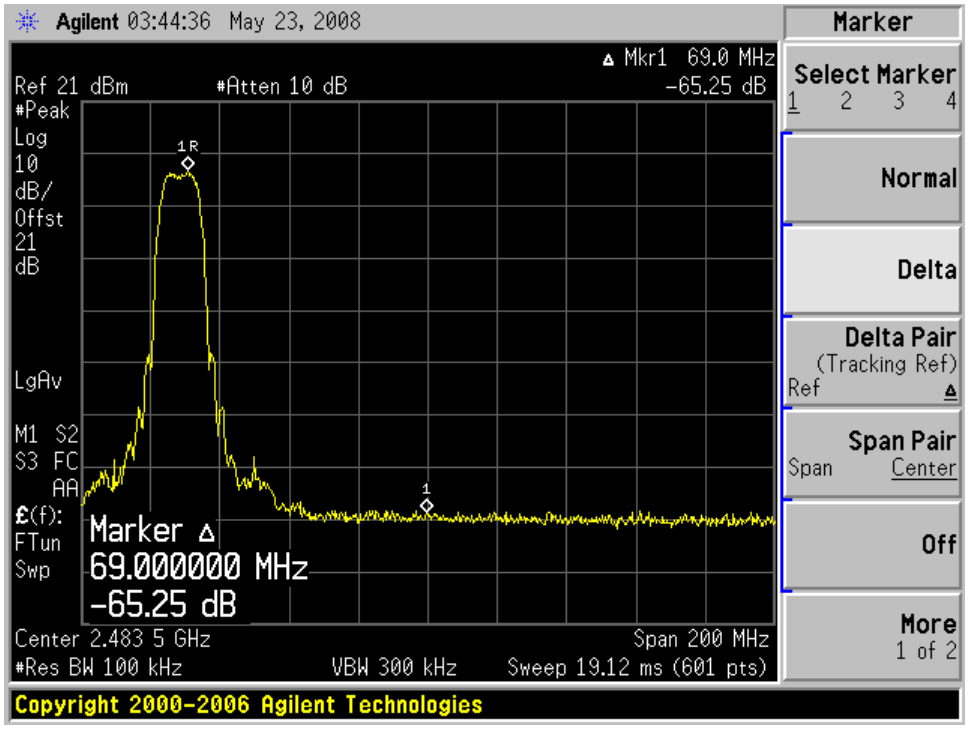
11.5 Measurement Result

Please refer to following pages for plots of band edge.

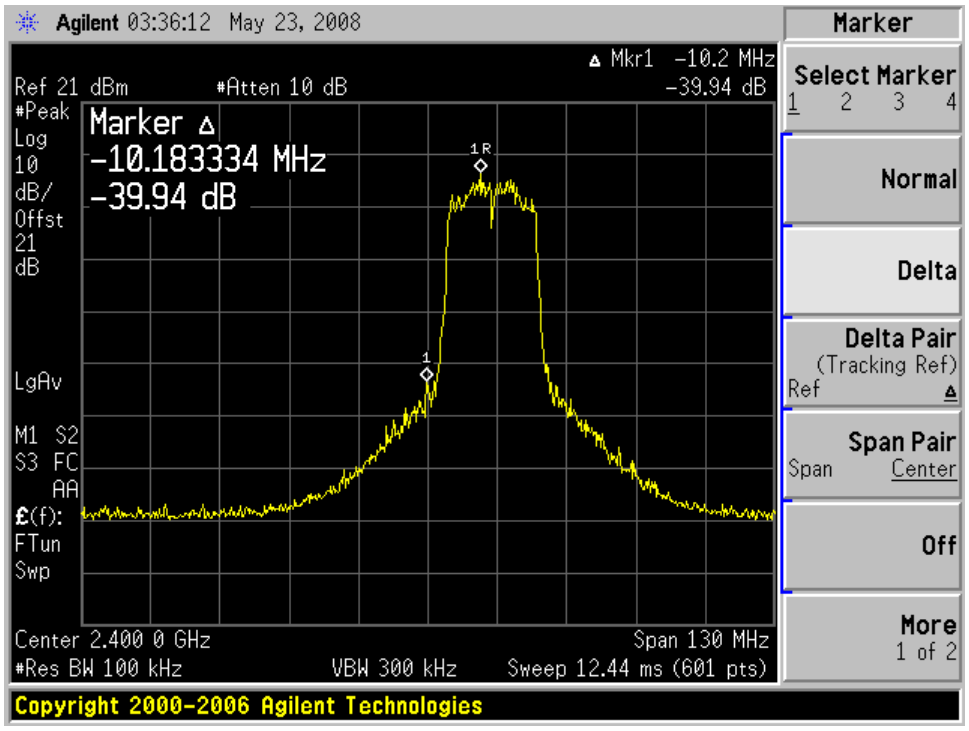
802.11 b – Low Channel



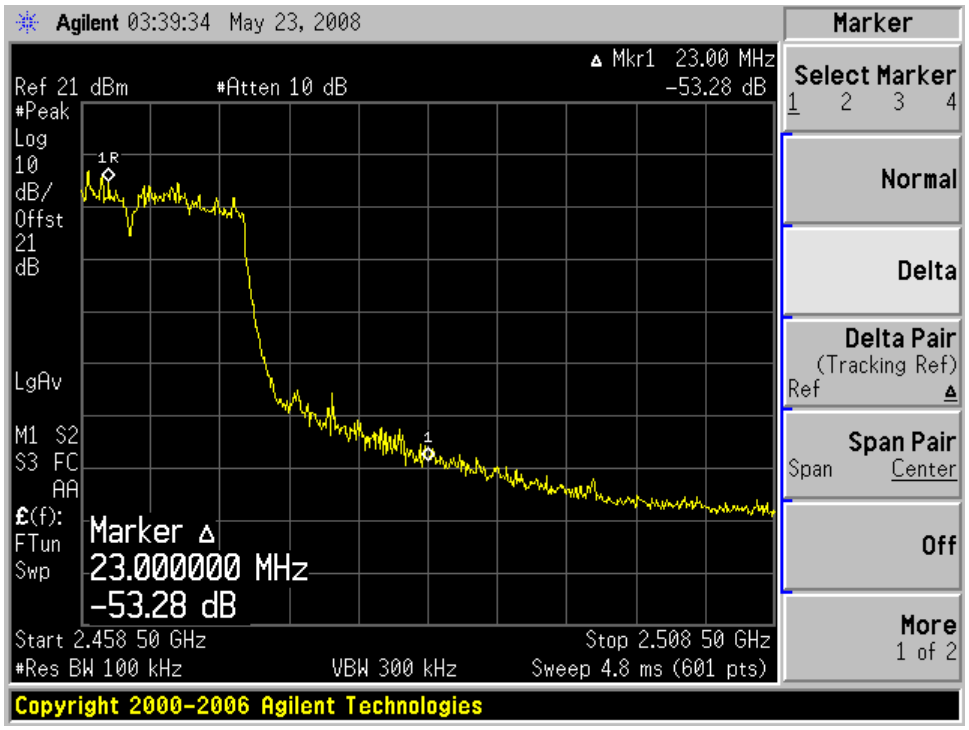
802.11 b – High Channel



802.11 g – Low Channel



802.11 g – High Channel



12 FCC 247(e) - PEAK POWER SPECTRAL DENSITY

12.1 Applicable Standard

FCC §15.247(e)

The power spectral density conducted from the transmitter antenna port shall not be greater than 8 dBm in any 3 kHz band during any time interval of continues transmission.

12.2 Measurement Procedure

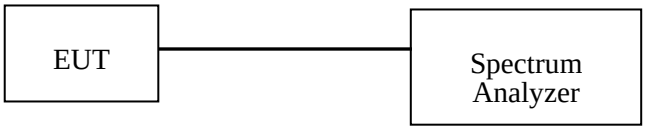
Output power was measured based on the use a peak measurement, therefore the power spectral density was measured using PDS Option 1in accordance with FCC document "Measurement of Digital Transmission System Operating under section 15.247, March 2005"

12.3 Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28

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

12.4 Test Setup Diagram



12.5 Environmental Conditions

Temperature:	20° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

**The testing was performed by Xiao Ming Hu from 2008-06-23.*

12.6 Test Result

802.11b mode:

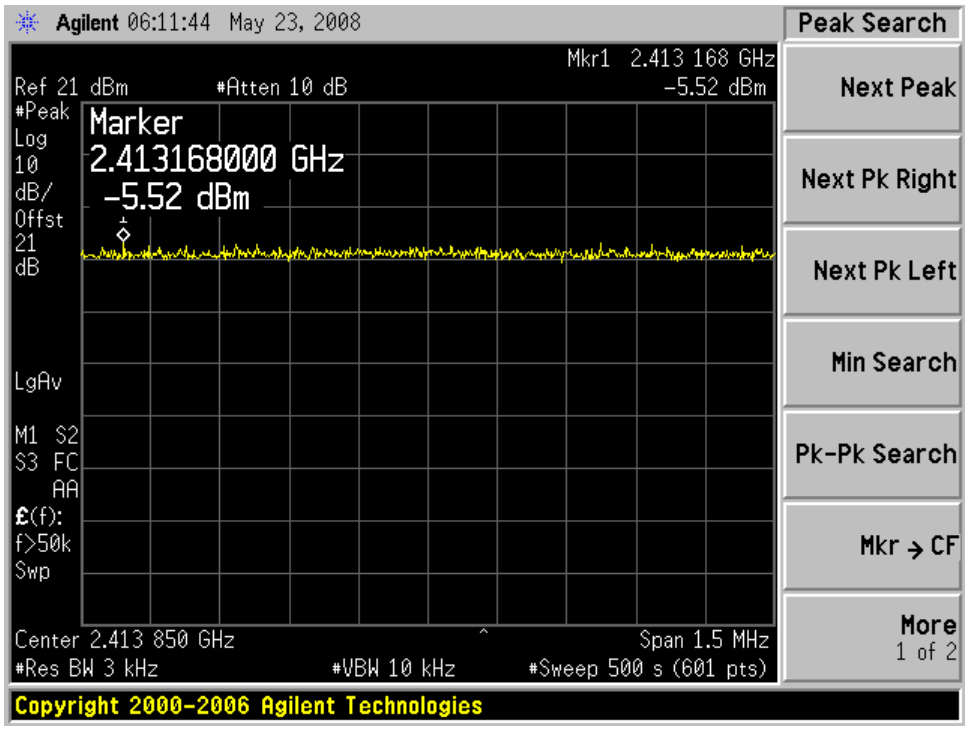
Frequency (MHz)	PSD with Combiner (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
2412	-5.52	8	-13.52
2437	-5.63	8	-13.63
2462	-4.84	8	-12.84

802.11g mode:

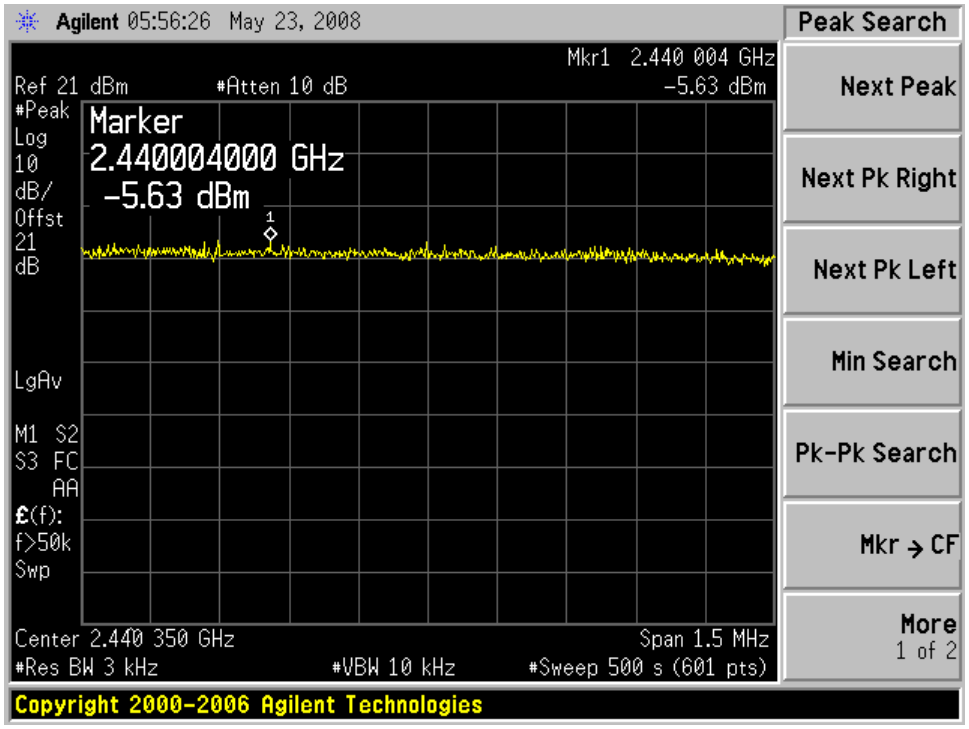
Frequency (MHz)	PSD with Combiner (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
2412	-7.59	8	-15.59
2437	-6.31	8	-14.31
2462	-6.88	8	-14.88

802.11b

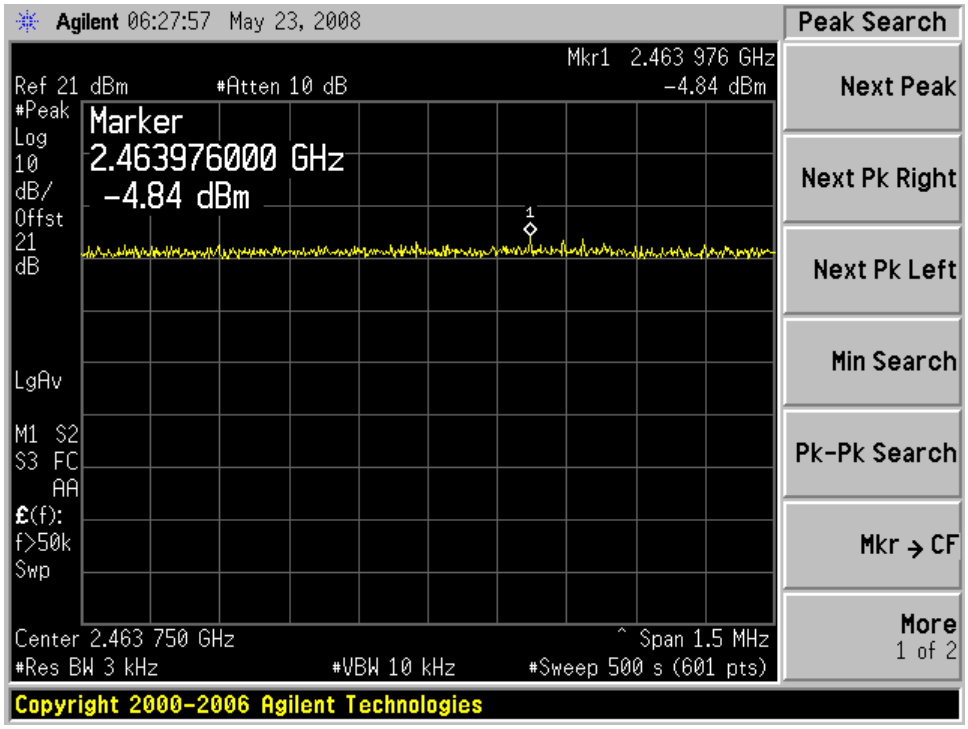
Low Channel



Middle Channel

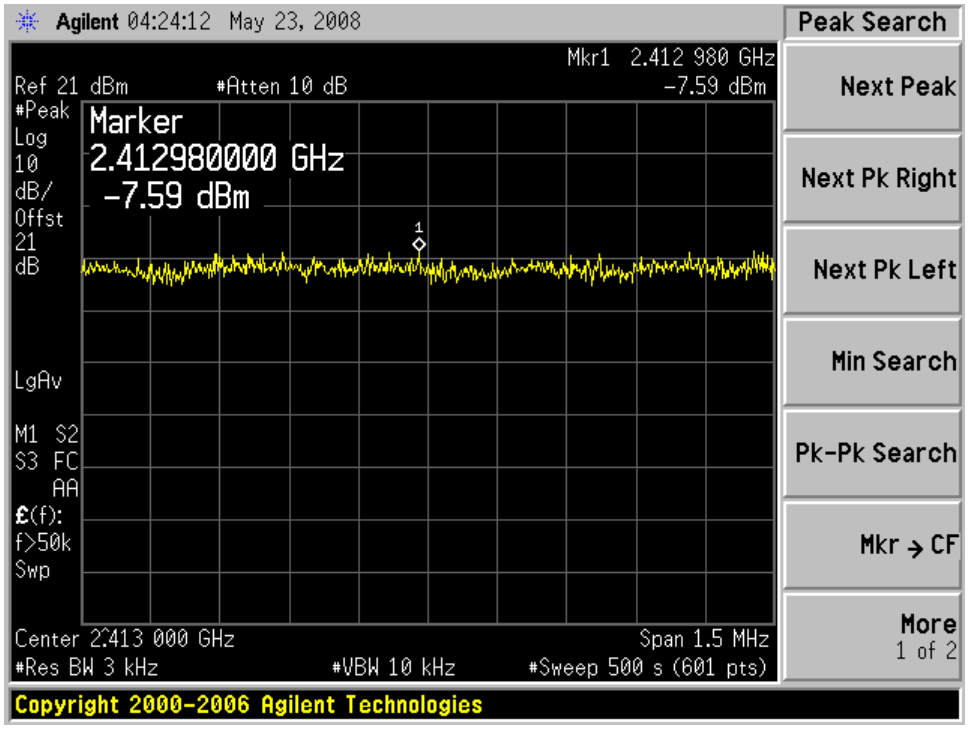


High Channel

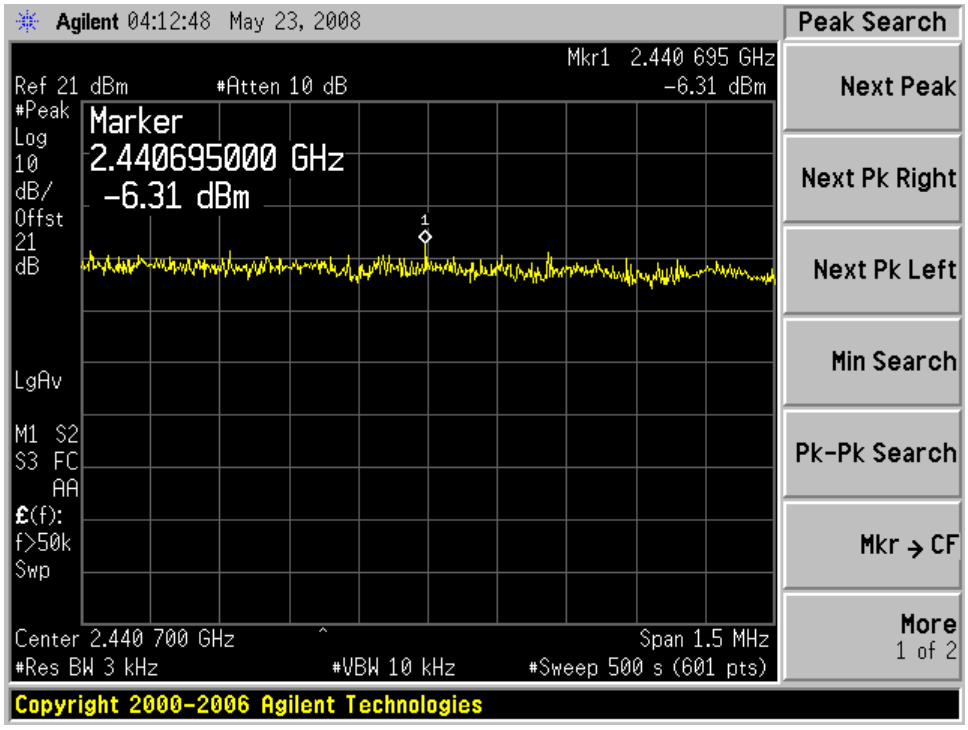


802.11g

Low Channel



Middle Channel



High Channel