Lab Code: 200167-0

FCC PART 15 SUBPART 247

MEASUREMENT AND TEST REPORT

For

Netopia Inc.

6001 Shellmound Street, 4th Floor, Emeryville, CA 94608, USA

FCC ID: GZ5224762
Model: 2247-62 Annex A
2257-62 Annex B

Report Type:	**Product Type:**
Original Report	ADSL2+ 802.11b/g Ethernet Modem

Test Engineers:	Victor Zhang
Report Number:	R0805066-247C
Report Date:	2008-07-07
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DOCUMENT REVISION HISTORY

Revision #	Report Number	Description of Revision	Date of Revision
0	R0805066-247	Original Report	2008-06-10
1	R0805066-247A	Revised Model Name	2008-06-30
2	R0805066-247B	Revised Company Name	2008-07-01
3	R0805066-247C	Revised Header	2008-07-07

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GENERAL INFORMATION

Product Description for EUT under Test (EUT)

The *Netopia Inc.*. product, models: *2247-62 Annex A & 2257-62 Annex B*, or the "EUT" as referred to in this report is an ADSL2+ 802.11b/g Ethernet Modem. The EUT has a single DSL port for connection to the Central Office, and 4 Ethernet ports. The EUT is powered by a 12 V AC/DC adapter power supply.

Mechanical Description of EUT

The *Netapia Ltd.* EUT measures approximately *190 mm L x 150 mm W x35 mm H*, and weighs approximately 0.23 *kg.*

EUT Photo

Please refer to Exhibit A for more EUT photographs.

Objective

This original measurement and test report is prepared on behalf of *Netopia 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.

Related Submittal(s)/Grant(s)

No Related Submittals

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.

Measurement Uncertainty

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

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from $\pm$2.0 for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

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

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

Test Facility

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

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

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

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

SYSTEM TEST CONFIGURATION

Justification

The EUT and its host were configured for testing according to ANSI C63.4-2003.

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

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

EUT Exercise Software

Netopia SOC OS version 7.8.1 <build d9RK>

Device setting: for Tx output power

Channel Number	Frequency (MHz)	Tx Output Power (dBm)
01	2412	21
06	2437	21
11	2462	21

Equipment Modifications

No modifications were made to the EUT.

Special Accessories

N/A

Local Support Equipment:

Manufacturer	Description	Model	Serial Number
Dell	Laptop	Insprion 1300	-

EUT Internal Configuration:

Manufacturer	Description	Model	Serial Number	FCC ID
Aztech	PCB	CE-406 94V-0 E92552	-	-
Aztech	RF module	WL600M(L2)	-	-

Power Supply Information

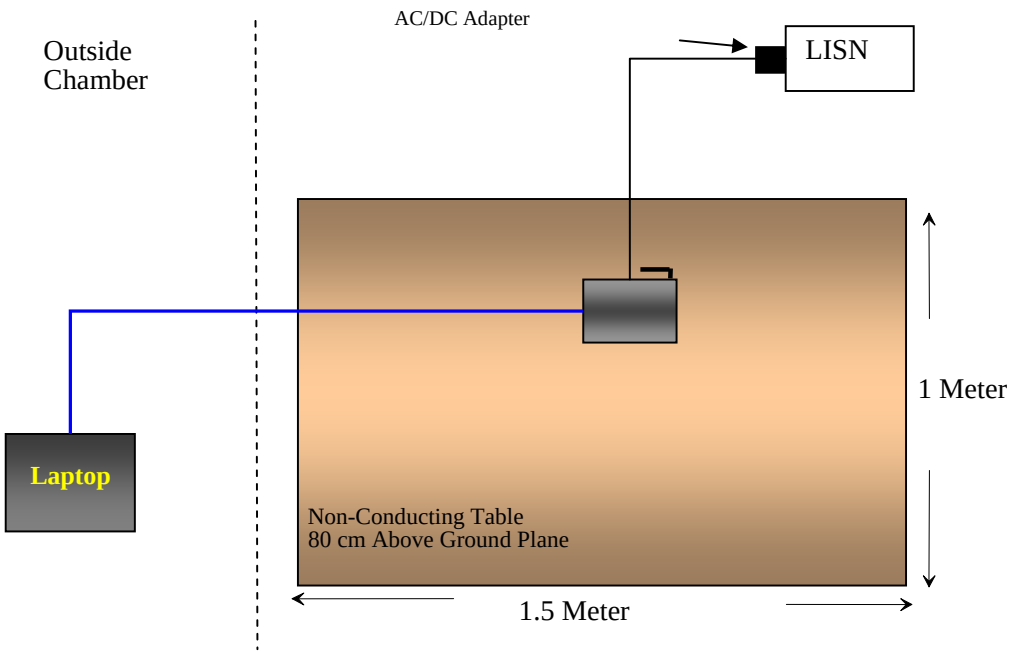
100 – 240 V/ 50-60 Hz AC adapter provided by direct connection to the device.

External I/O Cabling List and Details

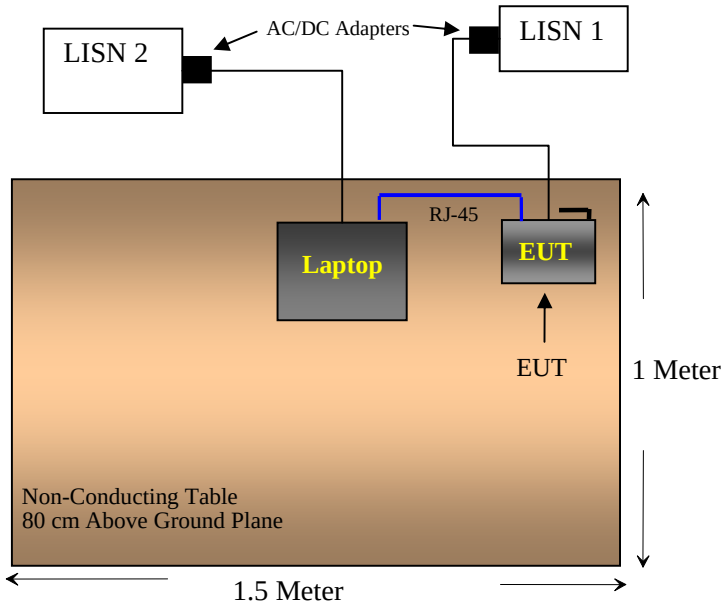
Cable Description	Length (m)	From	To
Unshielded CAT5 Cable	1	EUT	Laptop

Test Setup Block Diagram

Radiated Emissions



Conducted Emissions



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
§15.203	Antenna Requirement	Compliant
§ 15.207 (a)	Conducted Emissions	Compliant
§2.1051 & §15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205	Restricted Bands	Compliant
§15.109, 15.209 (a) & §15.247(d)	Radiated Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Bandwidth	Compliant
§15.247 (b)(3)	Maximum Peak Output Power	Compliant
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247 (e)	Power Spectral Density	Compliant

15.247 (i) and § 2.1091 - RF EXPOSURE

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

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

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

MPE Prediction

Predication 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

802.11 b Mode:

Maximum peak output power at antenna input terminal (dBm):	16.56
Maximum peak output power at antenna input terminal (mW):	45.29
Prediction distance(cm):	20
Prediction frequency(MHz):	2437
Antenna Gain (typical)(dBi):	3
Maximum Antenna Gain(numeric):	1.995
Power density at prediction frequency at 20 cm (mW/cm^2):	0.01798
MPE limit for uncontrolled exposure at predication frequency(mW/cm^2):	1.0

802.11 g Mode:

Maximum peak output power at antenna input terminal (dBm):	11.26
Maximum peak output power at antenna input terminal (mW):	13.37
Prediction distance(cm):	20
Prediction frequency(MHz):	2437
Antenna Gain (typical)(dBi):	3
Maximum Antenna Gain(numeric):	1.995
Power density at prediction frequency at 20 cm (mW/cm^2):	0.0053
MPE limit for uncontrolled exposure at predication frequency(mW/cm^2):	1.0

Conclusion

The predicted power density level at 20 cm is 0.01798 mW/cm^2 for 802.11 b mode, and 0.0053 mW/cm^2 for 802.11 g mode. Both are below the uncontrolled exposure limit of 1.0 mW/cm^2 at 2437 MHz. The EUT is used at least 20 cm away from user's body. It is determined as mobile equipment and complies with the MPE limit.

§15.203 - ANTENNA REQUIREMENT

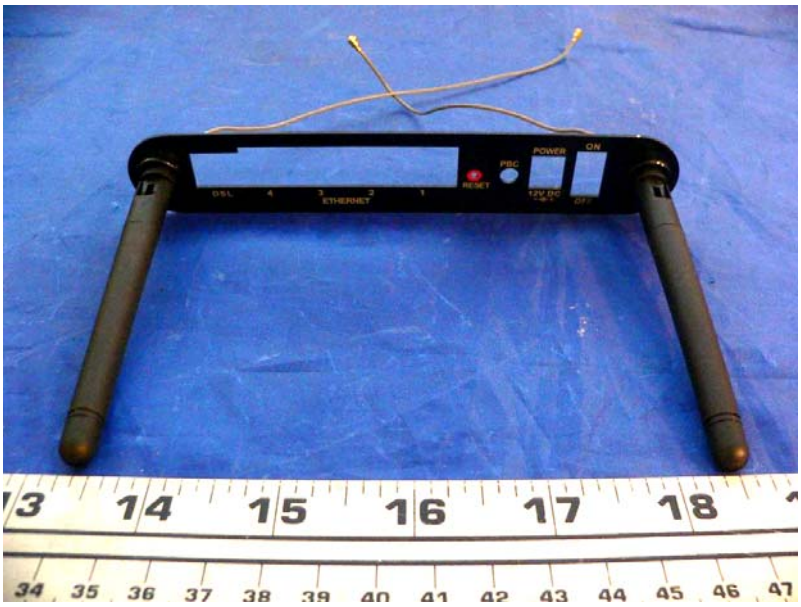
Applicable Standard

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 § 15.247 (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.

Antenna Connected Construction

EUT has a transmitter and receiver antennae which are both external antennae and features a permanent attachment to the EUT chassis as well as non-standard connector. The Transmitter antenna has a max gain of 3 dBi which fulfills the requirements of FCC rule 15.203, and the directional gain is less than 6 dBi thus not requiring reduction of the EUT output power.



Antenna Photo

§15.207 - CONDUCTED EMISSIONS

Applicable Standard

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

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

** Decreases with the logarithm of the frequency.*

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

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 1166.5950K03	100337	2008-04-12

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

Test Procedure

During the conducted emissions test, the power cord of the EUT was connected to the mains outlet of the LISN-2.

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".

Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	101.2 kPa

**The testing was performed by victor Zhang from 2008-05-27.*

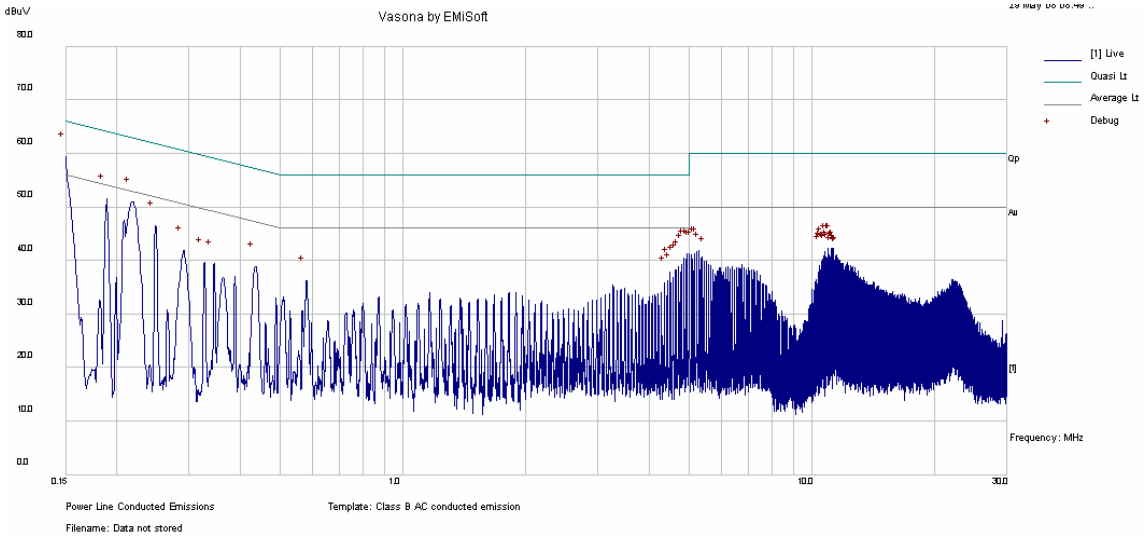
Summary of Test Results

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

Connection: AC/DC adapter connected to 120 V/60 Hz AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Hot/Neutral)**	**Range (MHz)**
-10.04	4.935	Hot	0.150 to 30 MHz
-11.22	0.218	Neutral	0.150 to 30 MHz

Conducted Emissions Test Plots and Data

120 V, 60 Hz – Line



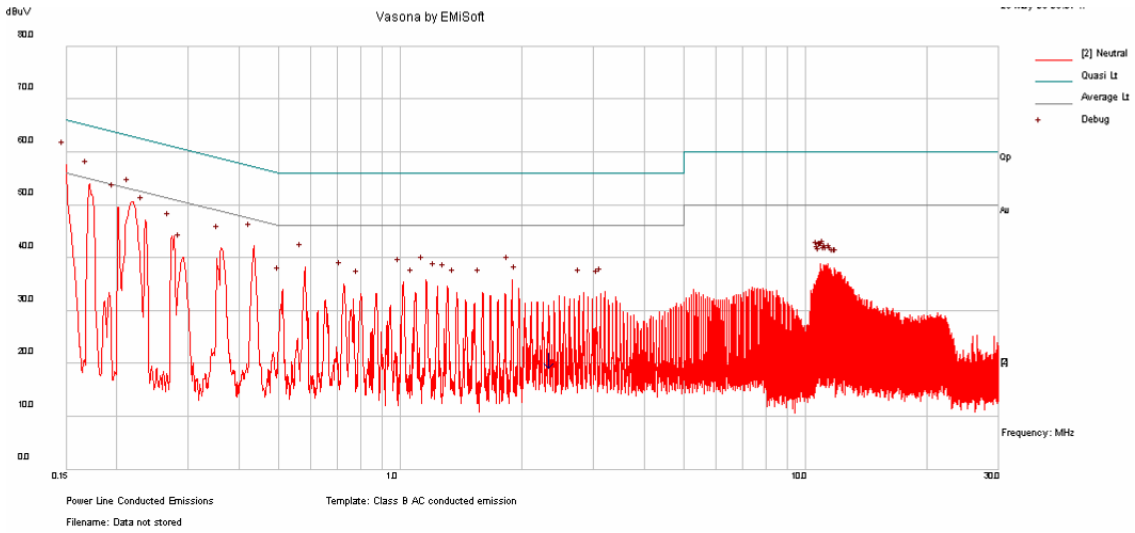
Quasi-Peak Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.218	49.86	Line	62.88	-13.03
0.150	51.38	Line	65.99	-14.61
4.935	39.88	Line	56.00	-16.12
4.861	38.75	Line	56.00	-17.25
11.177	40.68	Line	60.00	-19.32
0.178	42.77	Line	64.60	-21.83

Average Measurements

Frequency (MHz)	Average (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
4.935	35.96	Line	46.00	-10.04
4.861	35.33	Line	46.00	-10.67
11.177	36.89	Line	50.00	-13.11
0.218	39.14	Line	52.88	-13.74
0.150	38.34	Line	55.99	-17.65
0.178	13.92	Line	54.60	-40.68

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.218	49.85	Neutral	62.91	-13.06
0.215	48.32	Neutral	62.99	-14.67
0.154	47.07	Neutral	65.78	-18.71
0.434	36.31	Neutral	57.17	-20.86
11.319	36.87	Neutral	60	-23.13
1.886	31.17	Neutral	56	-24.83

Average Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.218	41.69	Neutral	52.91	-11.22
0.434	34.73	Neutral	47.17	-12.44
0.215	40.20	Neutral	52.99	-12.79
11.319	32.90	Neutral	50.00	-17.10
1.886	25.01	Neutral	46.00	-20.99
0.154	25.84	Neutral	55.78	-29.95

§2.1051 & §15.247(d) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

For §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.

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.

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 10^{th} harmonic.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration 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.

Environmental Conditions

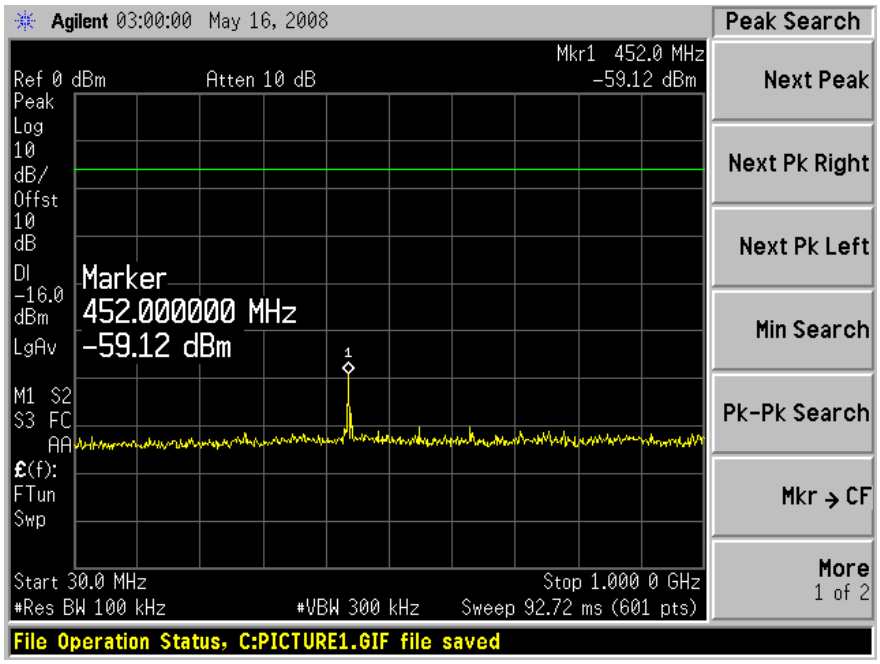
Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	101.2 kPa

**The testing was performed by Victor Zhang from 2008-05-27.*

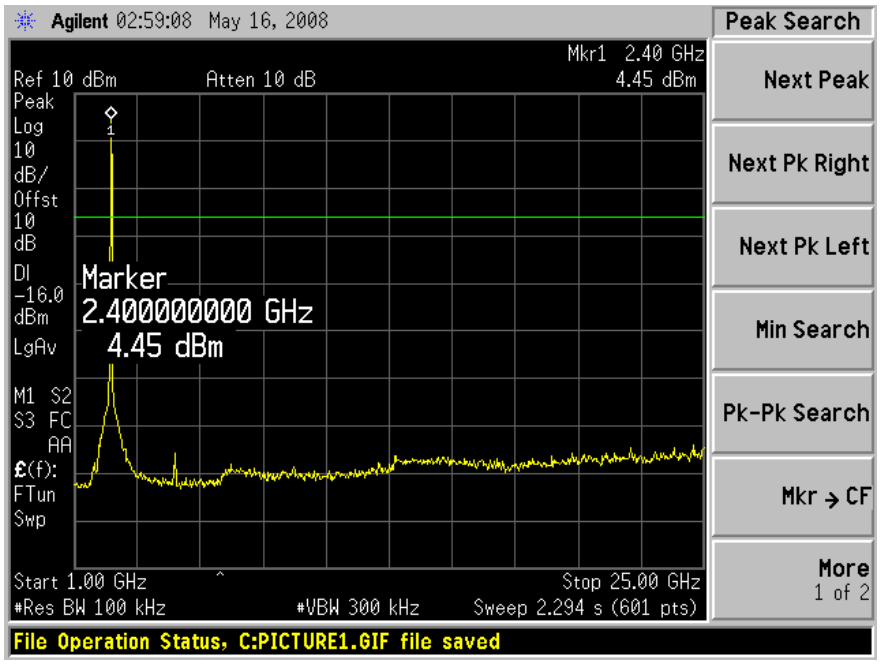
Measurement Result:

Please refer to following pages for plots of spurious emissions.

802.11 b, Low Channel

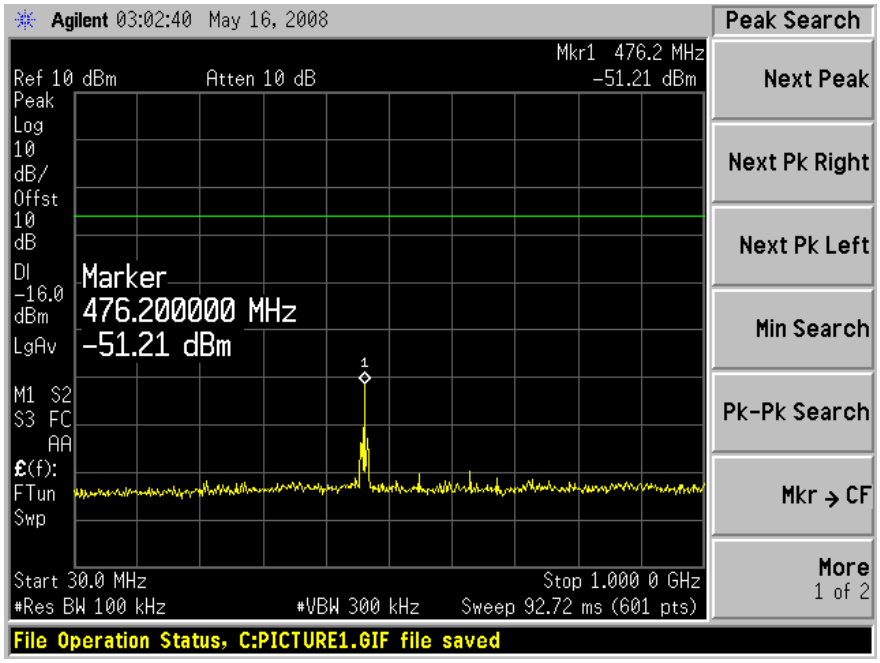


30 MHz – 1 GHz

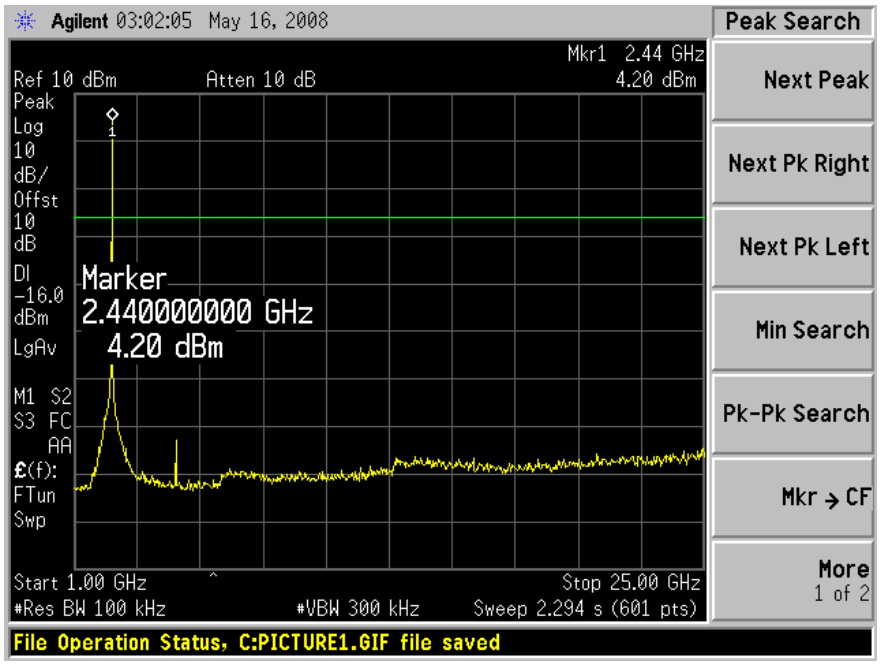


1 – 25 GHz

802.11 b, Middle Channel

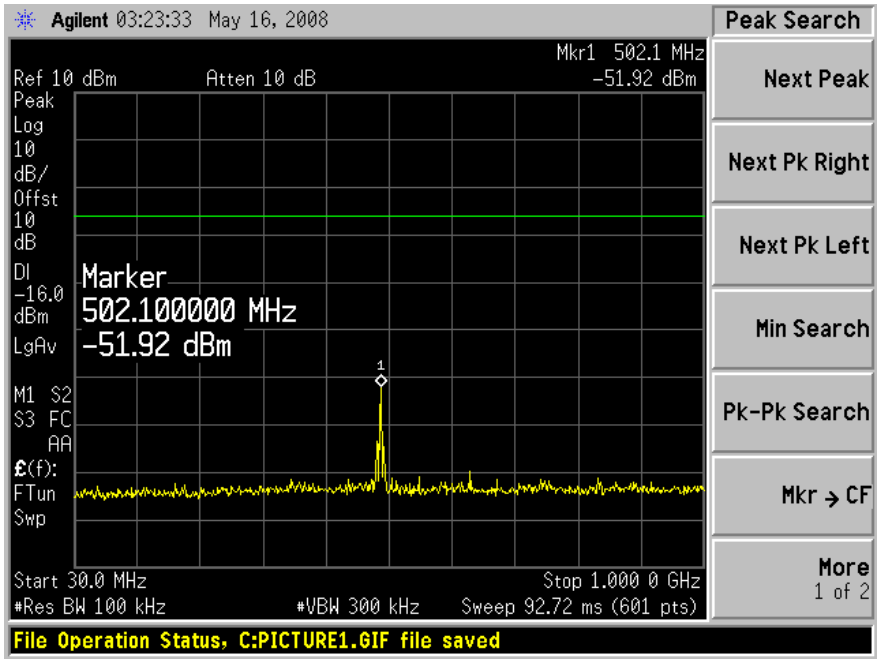


30 MHz – 1 GHz

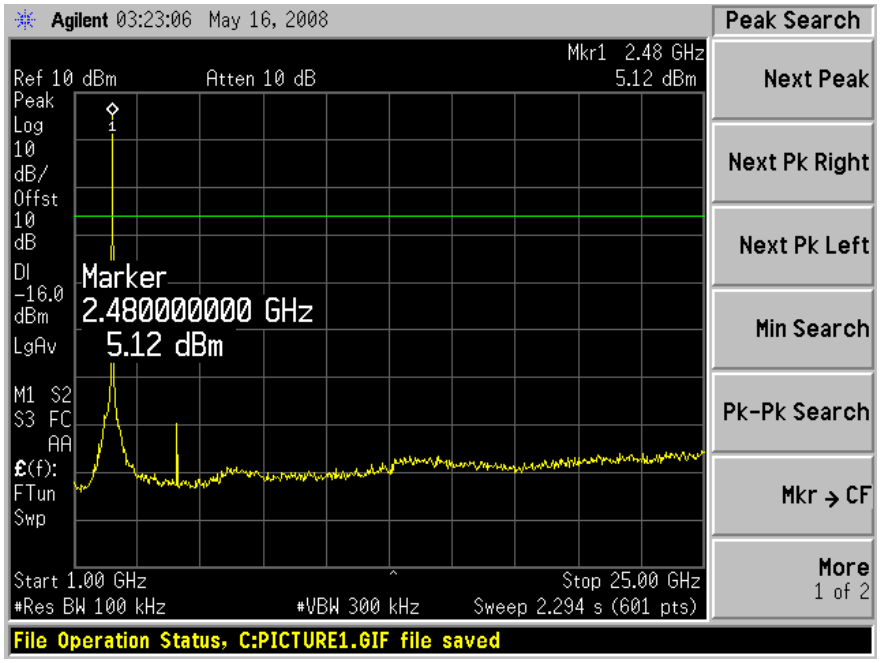


1 – 25 GHz

802.11 b, High Channel

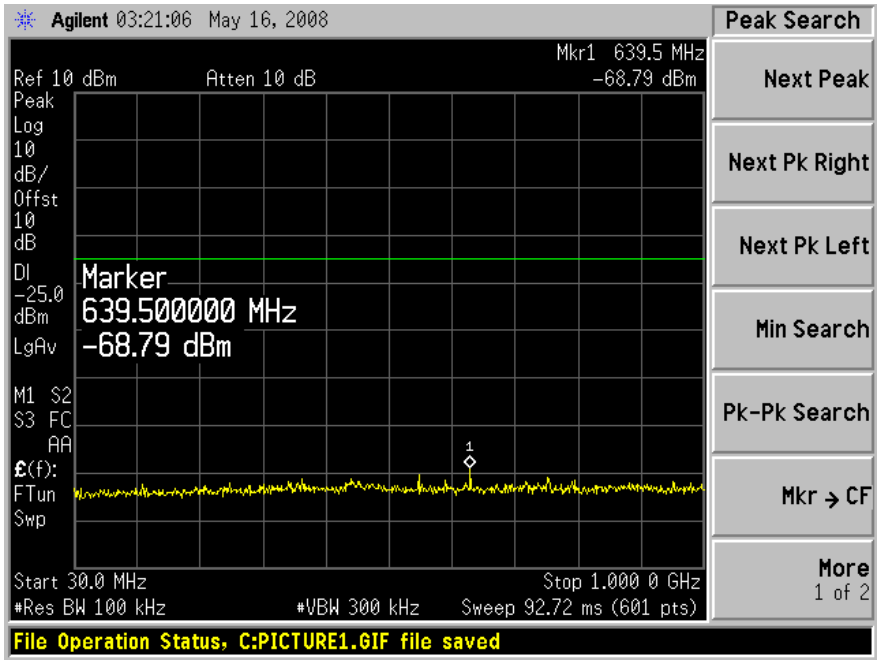


30 MHz – 1 GHz

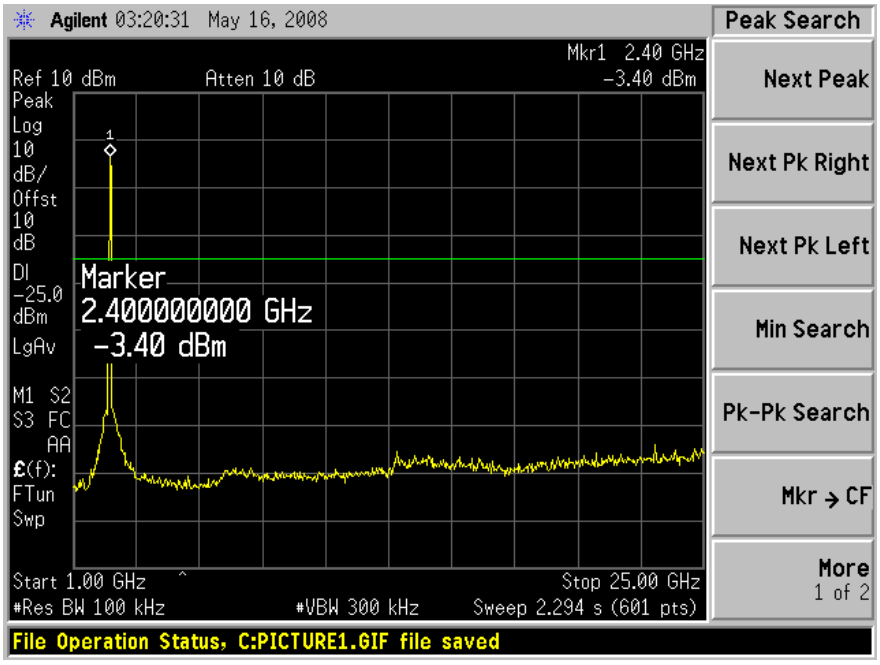


1 – 25 GHz

802.11 g, Low Channel

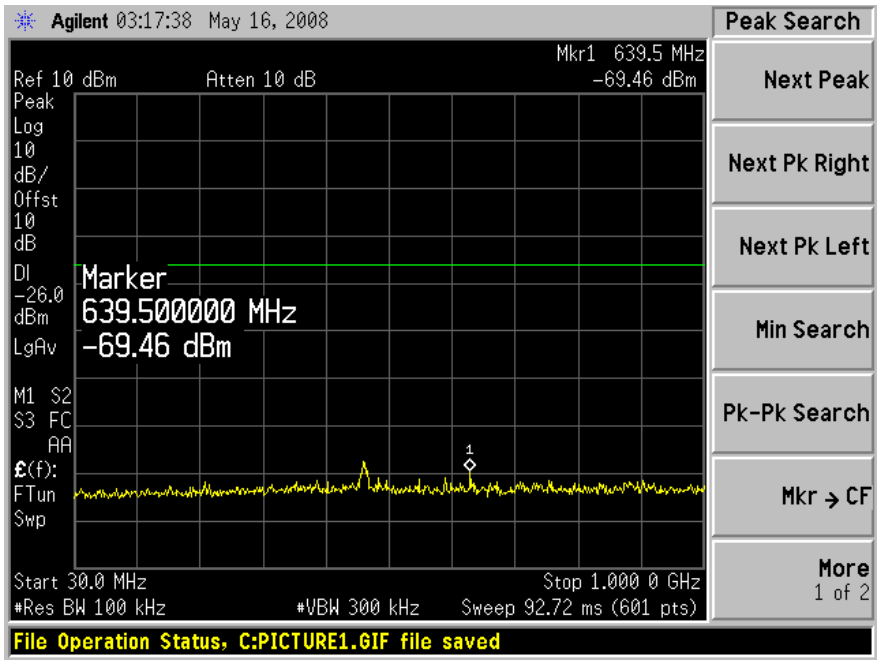


30 MHz – 1 GHz

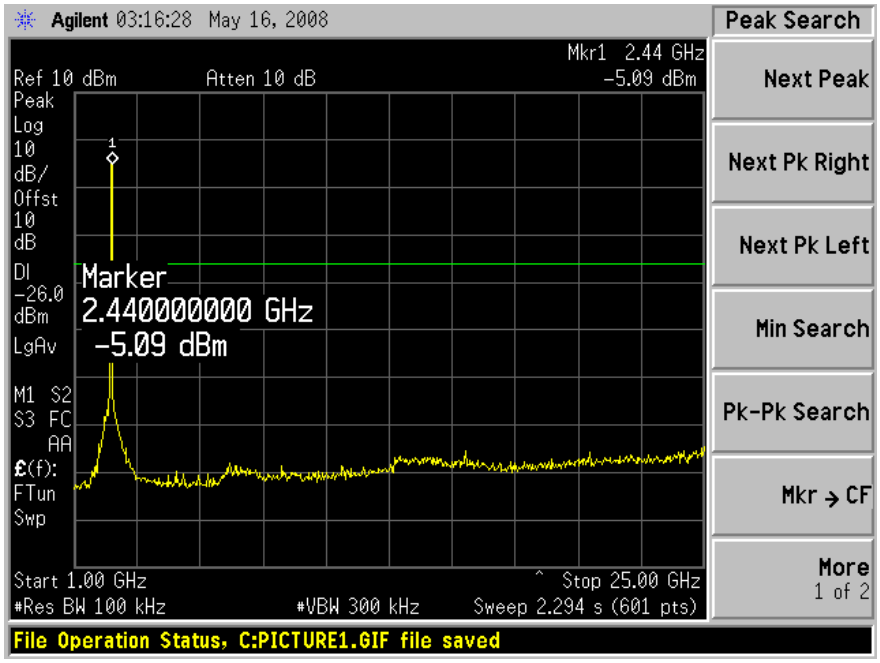


1 – 25 GHz

802.11 g, Middle Channel

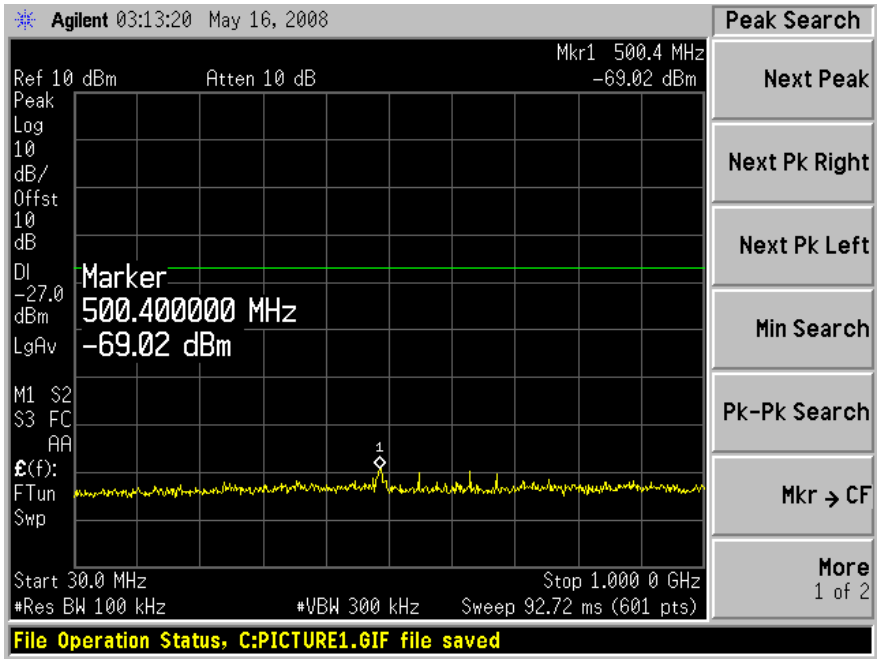


30 MHz – 1 GHz

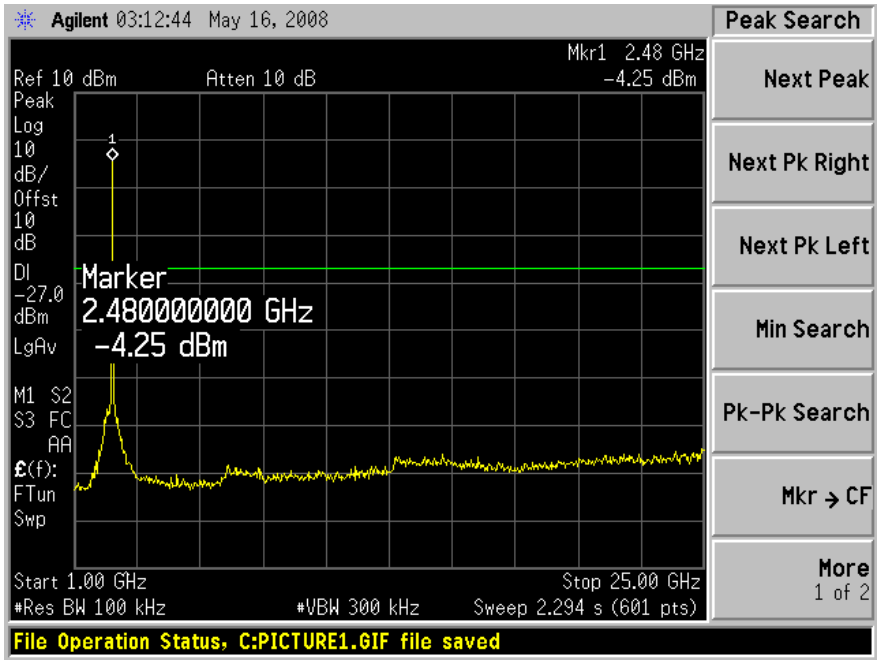


1 – 25 GHz

802.11 g, High Channel



30 MHz – 1 GHz



1 – 25 GHz

§15.109, §15.205, §15.209 & §15.247(d) - SPURIOUS RADIATED EMISSIONS

Applicable Standard

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 (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 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:

f (MHz)	f (MHz)	f (MHz)	f (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 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)).

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.

EUT Setup

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

The spacing between the peripherals was 10 centimeters.

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Mini-Circuits	Pre amplifier	ZKL-2	7786100643	2008-01-02
HP	Pre amplifier	8449B	3147A00400	2007-11-02
Sunol Science Corp	Combination Antenna	JB1 Antenna	A103105-3	2008-03-25
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2007-06-07
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.

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

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

Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	101.2 kPa

**The testing was performed by Victor Zhang from 2008-05-27.*

Summary of Test Results

According to the data hereinafter, the EUT complied with the limits presented in FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247, and had the worst margin of:

802.11 b Mode:

Harmonics & Spurious, (30-1000 MHz):

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-3.37	500.005	Horizontal	Low, 30 MHz – 1GHz
-1.79	750.035	Horizontal	Mid, 30 MHz – 1GHz
-0.96	750.043	Horizontal	High, 30 MHz – 1GHz

Harmonics & Spurious, (Above 1GHz)

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-0.74	4824	Vertical	Low, 1GHz – 25GHz
-0.21	4874	Vertical	Mid, 1GHz – 25GHz
-4.57	4924	Vertical	High, 1GHz – 25GHz

802.11 g Mode:

Harmonics & Spurious, (30-1000 MHz):

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-1.42	750.033	Horizontal	Low, 30 MHz – 1GHz
-1.46	750.039	Horizontal	Mid, 30 MHz – 1GHz
-2.15	750.036	Horizontal	High, 30 MHz – 1GHz

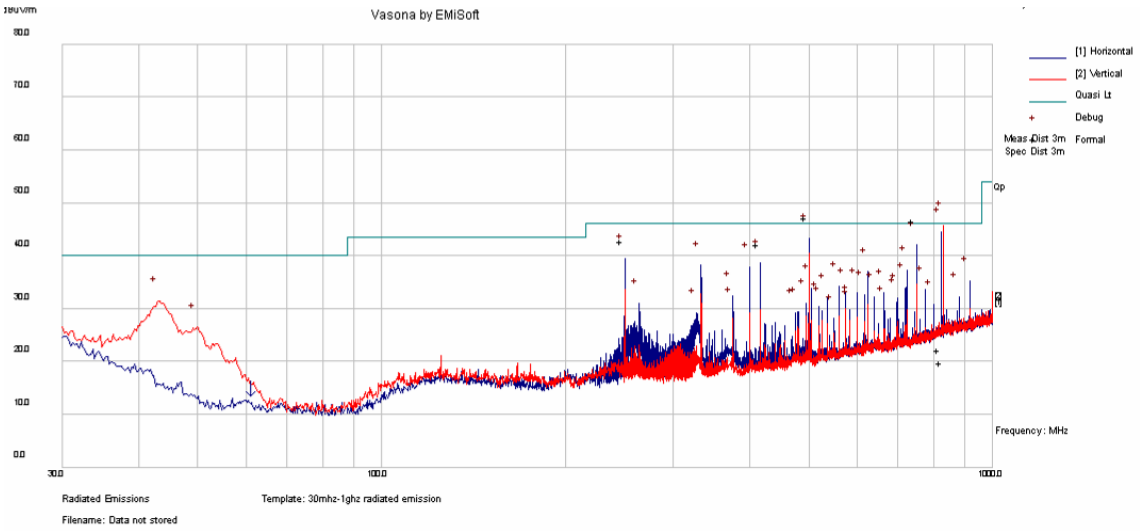
Harmonics & Spurious, (Above 1GHz)

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-20.71	4824	Vertical	Low, 1GHz – 25GHz
-24.79	4874	Vertical	Mid, 1GHz – 25GHz
-27.42	4924	Vertical	High, 1GHz – 25GHz

Radiated Emissions Test Plot & Data

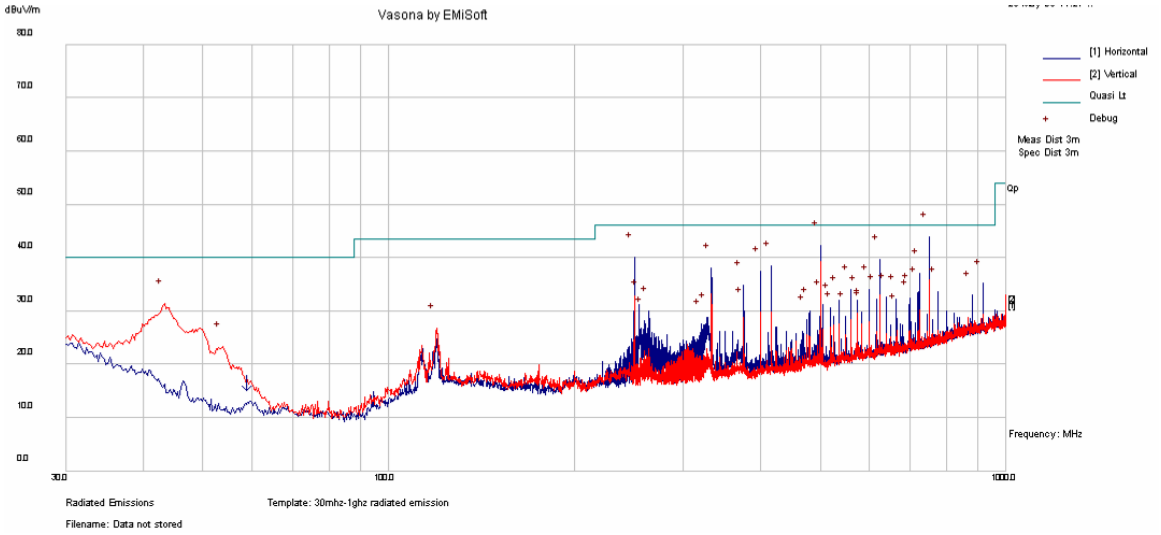
30-1000 MHz:

802.11 b, Low Channel



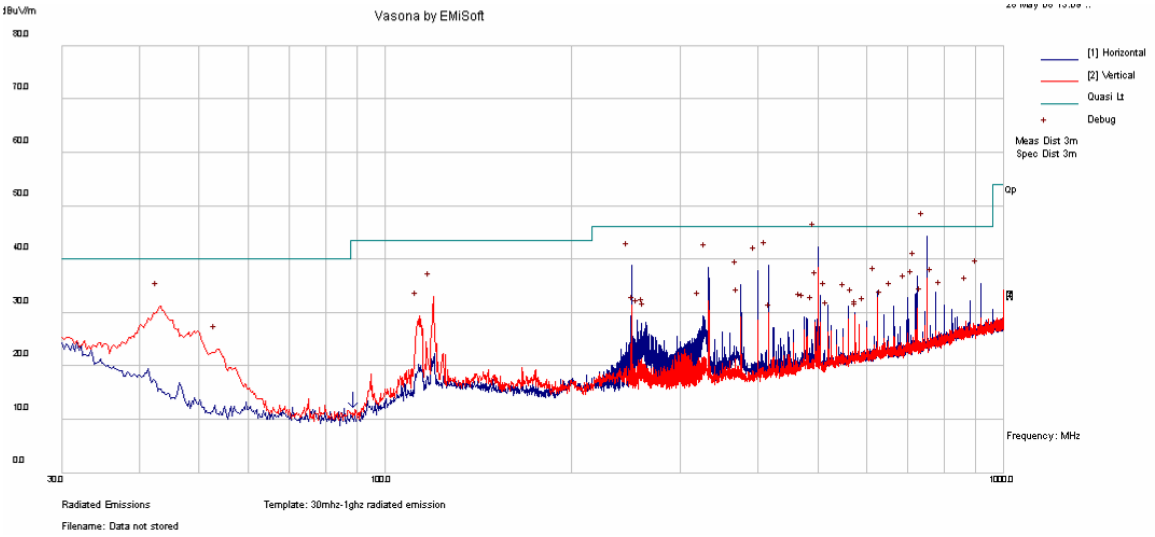
Frequency (MHz)	Corrected QP Reading (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (deg.)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
500.005	42.63	180	H	194	0.50	46	-3.37
750.039	42.18	107	H	24	4.20	46	-3.82
249.998	38.29	124	H	22	-4.50	46	-7.71
416.698	37.57	99	H	86	-0.44	46	-8.43
825.011	17.76	353	H	90	5.65	46	-28.24
830.126	15.21	278	V	70	5.78	46	-30.79

802.11 b, Middle Channel



Frequency (MHz)	Corrected QP Reading (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (deg.)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
750.035	44.21	111	H	18	4.20	46	-1.79
500.024	41.67	179	H	222	0.50	46	-4.33
625.033	38.57	128	H	290	2.50	46	-7.43
250.011	38.46	109	H	18	-4.50	46	-7.54
416.670	37.38	99	H	92	-0.44	46	-8.62
333.351	37.15	99	H	126	-2.07	46	-8.85

802.11 b, High Channel



Frequency (MHz)	Corrected QP Reading (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (deg.)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
750.043	45.04	115	H	15	4.20	46	-0.96
500.015	41.68	194	H	62	0.50	46	-4.32
250.002	38.45	128	H	6	-4.50	46	-7.55
416.681	38.08	99	H	92	-0.44	46	-7.92
333.361	37.58	99	H	125	-2.07	46	-8.42
400.023	36.95	102	H	90	-0.80	46	-9.05

Above 1 GHz:

802.11 b, Low Channel

Freq. (MHz)	S.A. Reading (dBµV)	Azimuth (Degree)	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15.247/209		Comments
									Limit (dBµV/m)	Margin (dB)	
4824	53.31	282	1.33	V	33.5	4.99	38.54	53.26	54	-0.74	Ave.
4824	54.77	282	1.33	V	33.5	4.99	38.54	54.72	74	-19.28	Peak
4824	29.36	153	1.0	H	33.5	4.99	38.54	29.31	54	-24.69	Ave.
4824	38.88	153	1.0	H	33.5	4.99	38.54	38.83	74	-35.17	Peak

802.11 b, Middle Channel

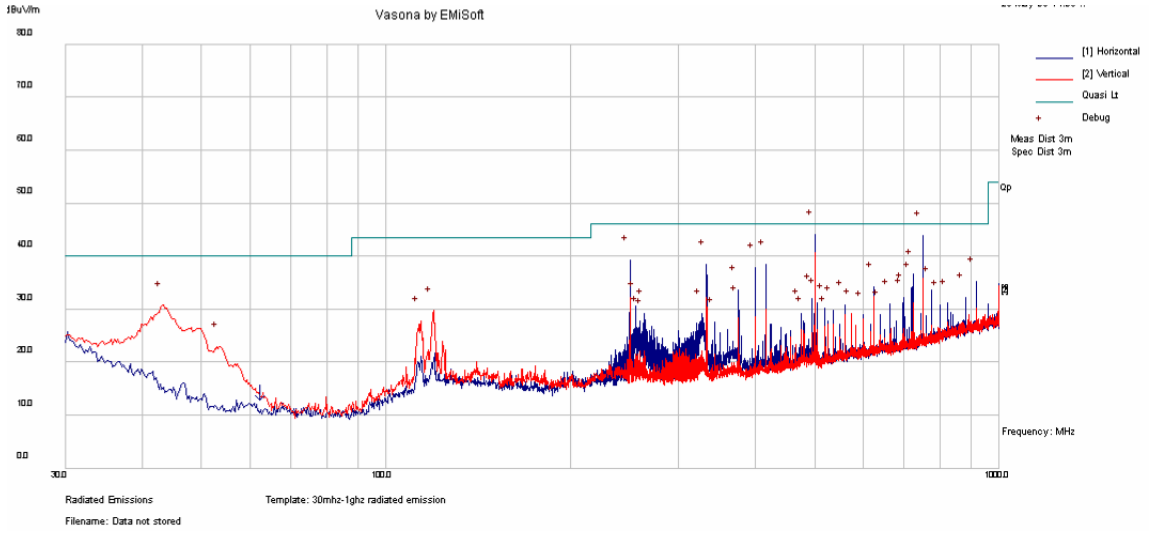
Freq. (MHz)	S.A. Reading (dBµV)	Azimuth (Degree)	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15.247/209		Comments
									Limit (dBµV/m)	Margin (dB)	
4874	53.87	285	1.35	V	33.4	4.92	38.4	53.79	54	-0.21	Ave.
4874	55.01	285	1.35	V	33.4	4.92	38.4	54.93	74	-19.07	Peak
4874	33.47	150	1.26	H	33.4	4.92	38.4	33.39	54	-20.61	Ave.
4874	40.24	150	1.26	H	33.4	4.92	38.4	40.16	74	-33.84	Peak

802.11 b, High Channel

Freq. (MHz)	S.A. Reading (dBµV)	Azimuth (Degree)	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15.247/209		Comments
									Limit (dBµV/m)	Margin (dB)	
4924	49.31	285	1.36	V	33.6	4.92	38.4	49.43	54	-4.57	Ave.
4924	50.47	285	1.36	V	33.6	4.92	38.4	50.59	74	-23.41	Peak
4924	28.51	154	1.27	H	33.6	4.92	38.4	28.63	54	-25.37	Ave.
4924	37.27	154	1.27	H	33.6	4.92	38.4	37.39	74	-36.61	Peak

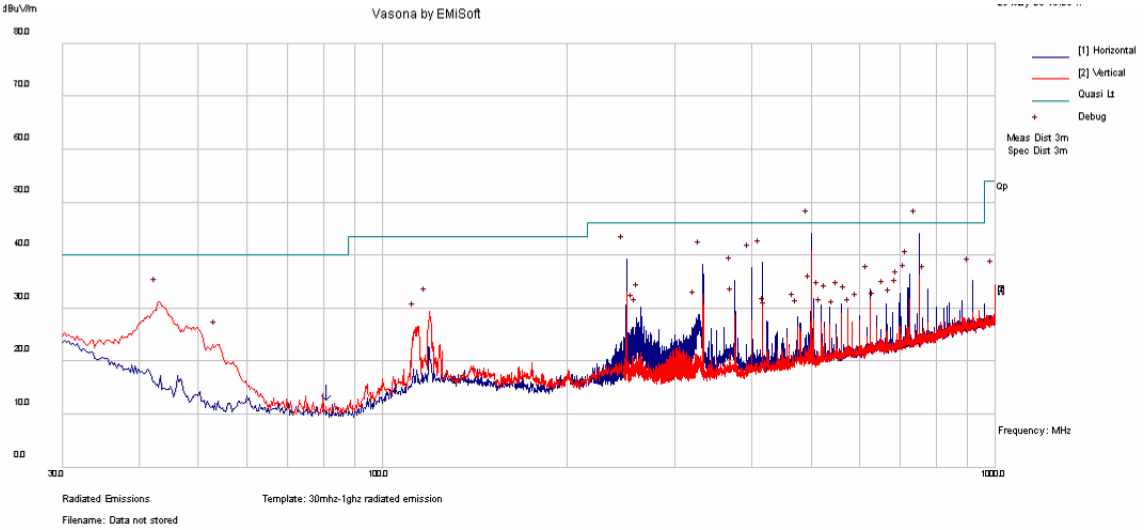
30-1000 MHz:

802.11 g, Low Channel



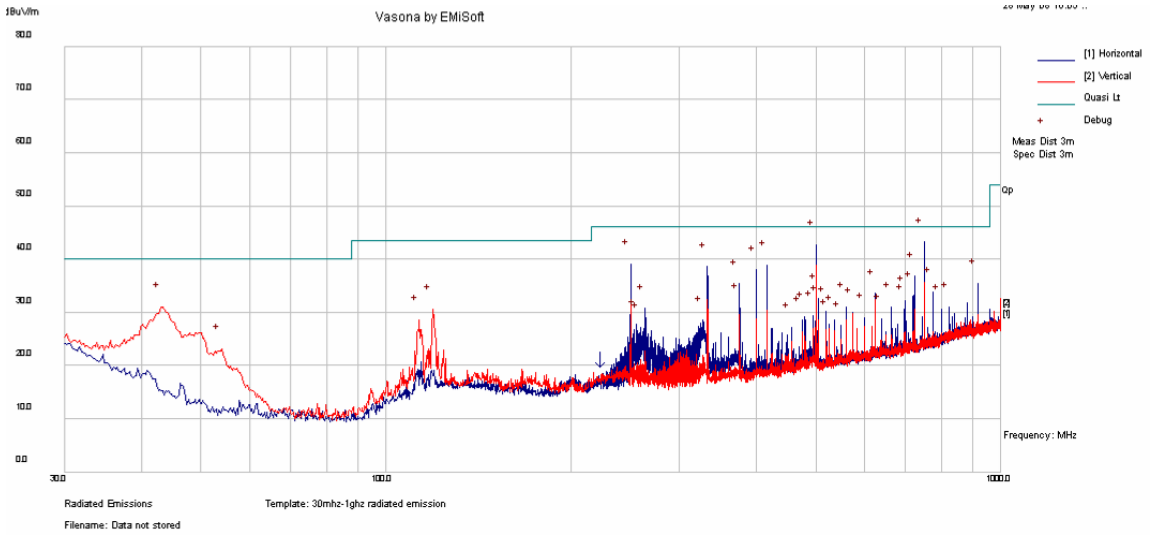
Frequency (MHz)	Corrected QP Reading (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (deg.)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
750.033	44.58	110	H	6	4.20	46	-1.42
500.040	44.17	175	H	172	0.50	46	-1.83
250.019	38.82	136	H	22	-4.50	46	-7.18
416.698	37.88	99	H	82	-0.44	46	-8.12
333.341	37.58	99	H	140	-2.07	46	-8.42
400.025	36.93	99	H	108	-0.80	46	-9.07

802.11 g, Middle Channel



Frequency (MHz)	Corrected QP Reading (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (deg.)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
750.039	44.54	110	H	0	4.20	46	-1.46
500.006	43.93	174	H	168	0.50	46	-2.07
416.679	37.94	99	H	85	-0.44	46	-8.06
250.013	37.68	127	H	328	-4.50	46	-8.32
333.365	37.05	106	H	132	-2.07	46	-8.95
400.002	36.72	99	H	98	-0.80	46	-9.28

802.11 g, High Channel



Frequency (MHz)	Corrected QP Reading (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (deg.)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
750.036	43.85	115	H	10	4.20	46	-2.15
500.032	41.86	193	H	46	0.50	46	-4.14
250.020	38.44	129	H	26	-4.50	46	-7.56
416.689	38.16	99	H	90	-0.44	46	-7.84
333.355	37.73	99	H	138	-2.07	46	-8.27
400.018	37.13	101	H	92	-0.80	46	-8.87

Above 1 GHz:

802.11 g, Low Channel

Freq. (MHz)	S.A. Reading (dBµV)	Azimuth (Degree)	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15.247/209		Comments
									Limit (dBµV/m)	Margin (dB)	
4824	33.34	285	1.33	V	33.5	4.99	38.54	33.29	54	-20.71	Ave.
4824	26.98	155	1.27	H	33.5	4.99	38.54	26.93	54	-27.07	Ave.
4824	43.82	285	1.33	V	33.5	4.99	38.54	43.77	74	-30.23	Peak
4824	37.96	155	1.27	H	33.5	4.99	38.54	37.91	74	-36.09	Peak

802.11 g, Middle Channel

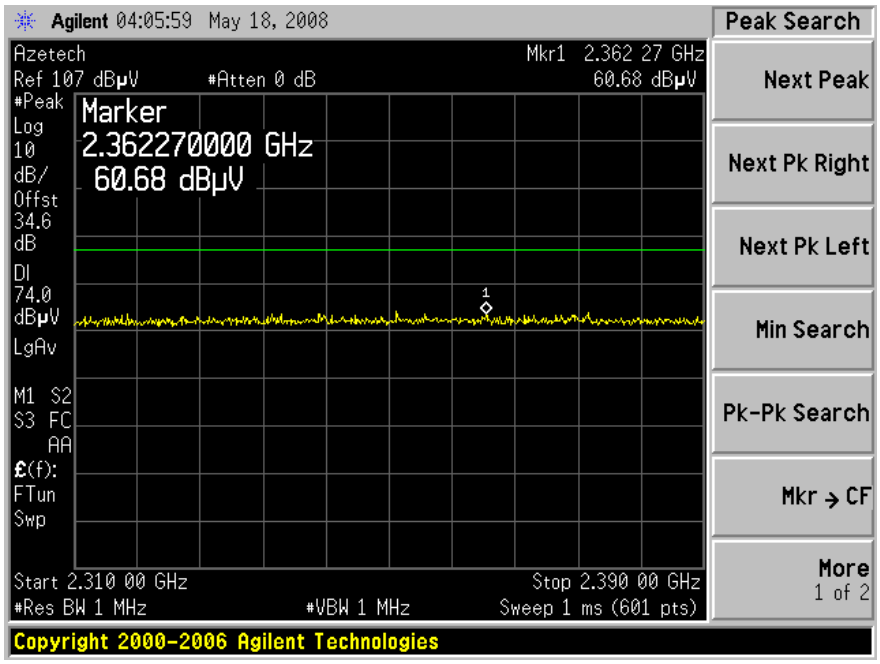
Freq. (MHz)	S.A. Reading (dBµV)	Azimuth (Degree)	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15.247/209		Comments
									Limit (dBµV/m)	Margin (dB)	
4874	29.29	283	1.35	V	33.4	4.92	38.4	29.21	54	-24.79	Ave.
4874	25.38	159	1.28	H	33.4	4.92	38.4	25.3	54	-28.7	Ave.
4874	42.54	283	1.35	V	33.4	4.92	38.4	42.46	74	-31.54	Peak
4874	38.02	159	1.28	H	33.4	4.92	38.4	37.94	74	-36.06	Peak

802.11 g, High Channel

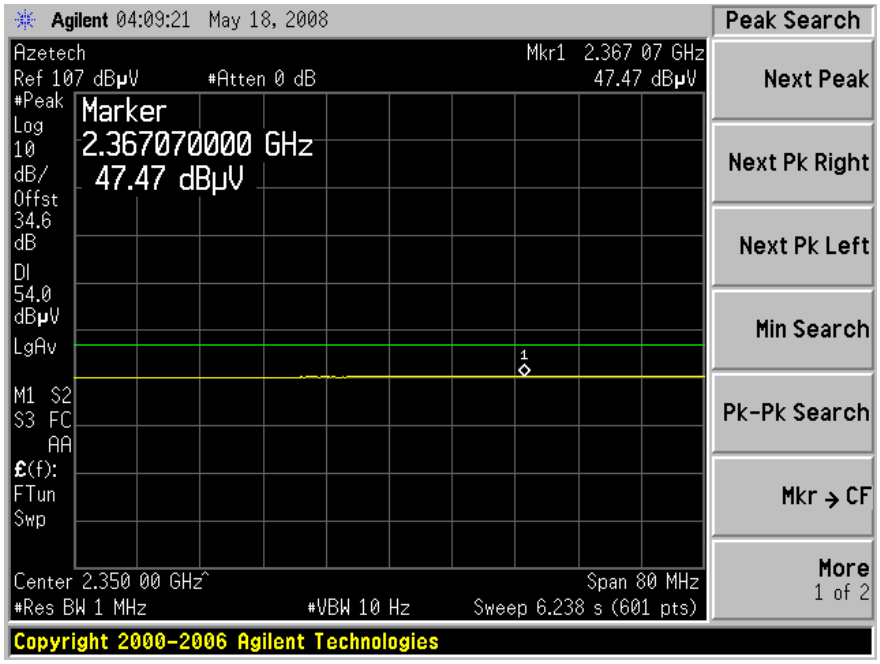
Freq. (MHz)	S.A. Reading (dBµV)	Azimuth (Degree)	Ant. Height (m)	Ant. Polar. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15.247/209		Comments
									Limit (dBµV/m)	Margin (dB)	
4924	26.46	282	1.36	V	33.6	4.92	38.4	26.58	54	-27.42	Ave.
4924	25.29	162	1.3	H	33.6	4.92	38.4	25.41	54	-28.59	Ave.
4924	39.35	282	1.36	V	33.6	4.92	38.4	39.47	74	-34.53	Peak
4924	36.91	162	1.3	H	33.6	4.92	38.4	37.03	74	-36.97	Peak

Restricted Band and Band Edge:

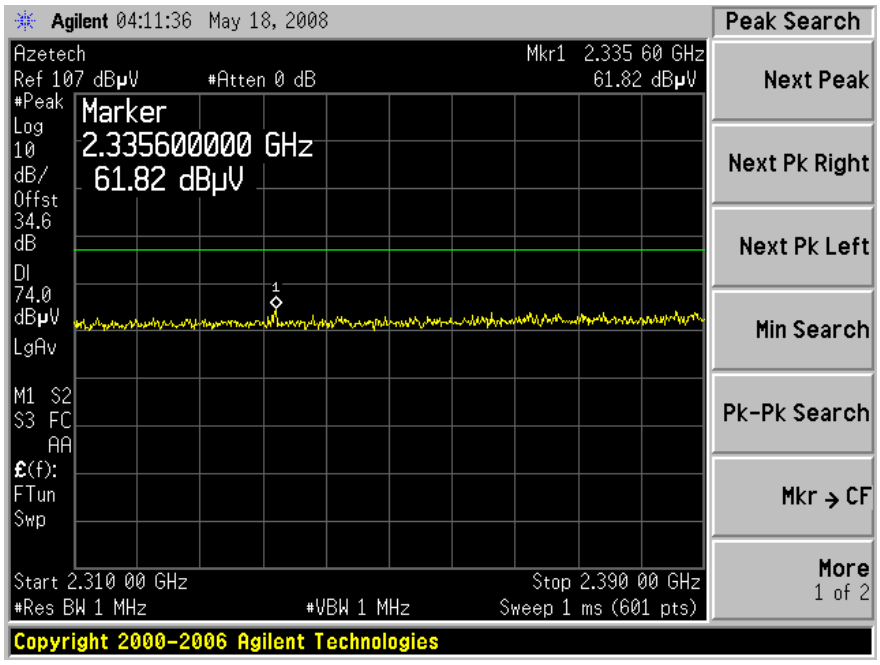
802.11 b, Lowest Channel



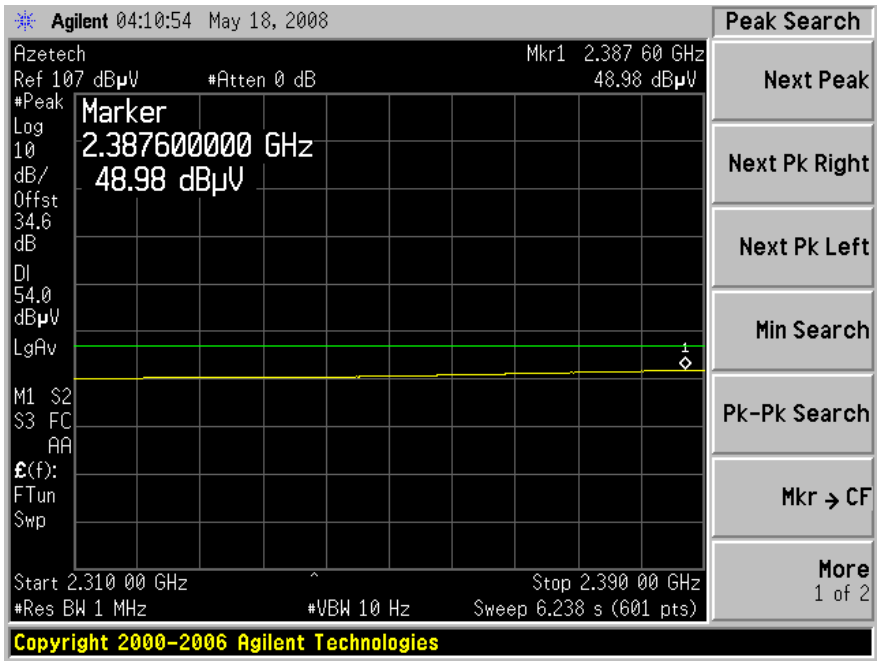
Horizontal Peak



Horizontal Average

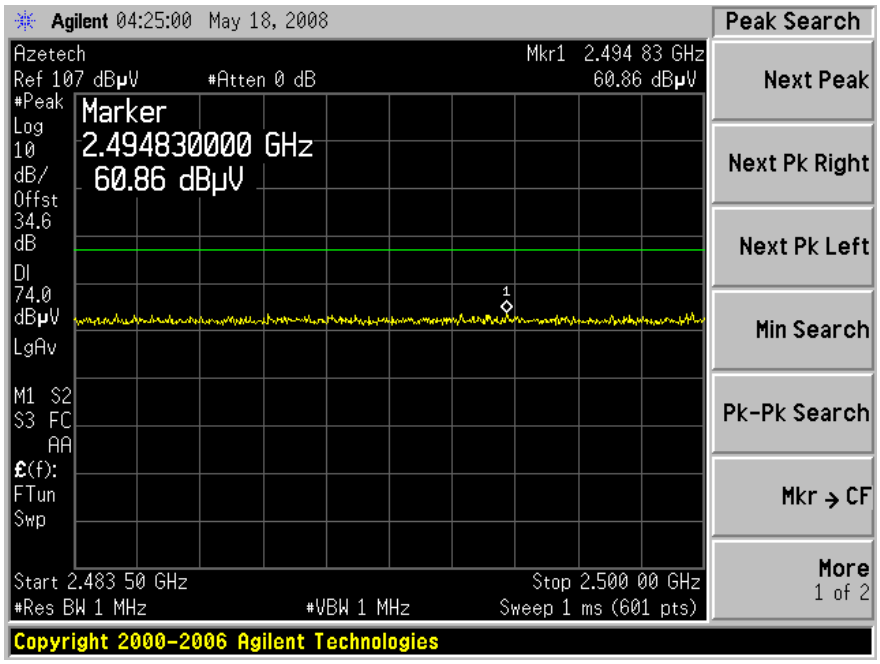


Vertical Peak

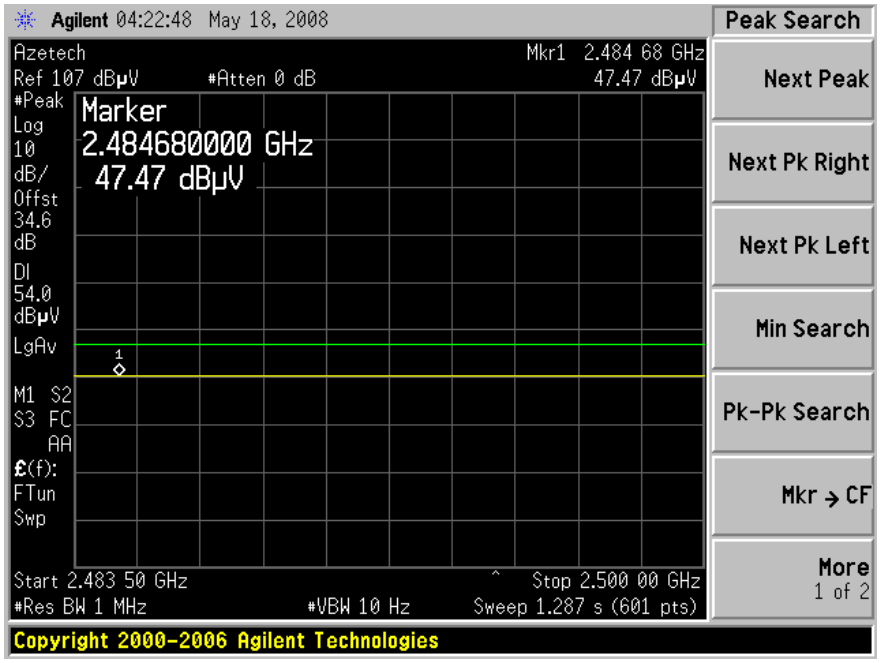


Vertical Average

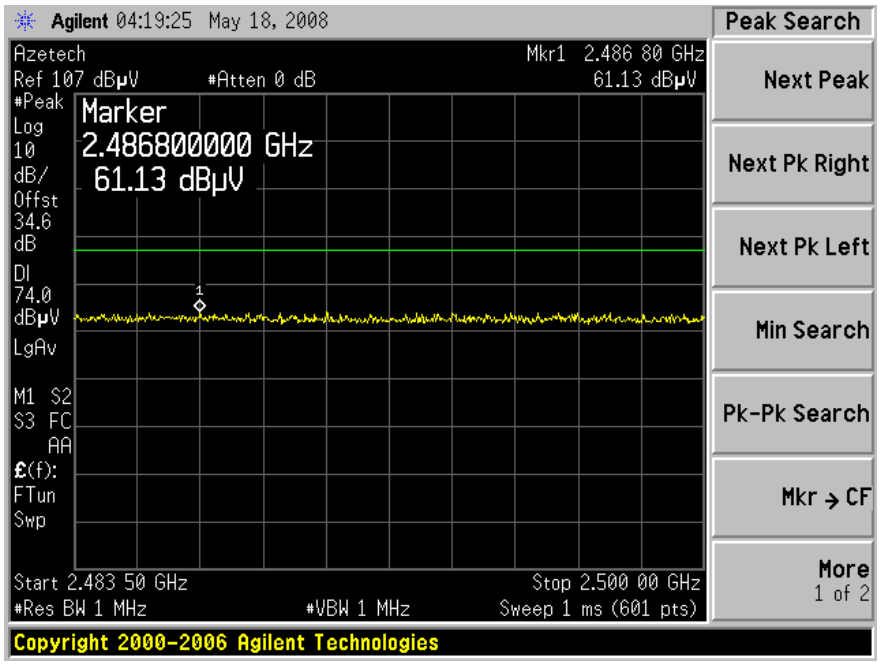
802.11 b, Highest Channel;



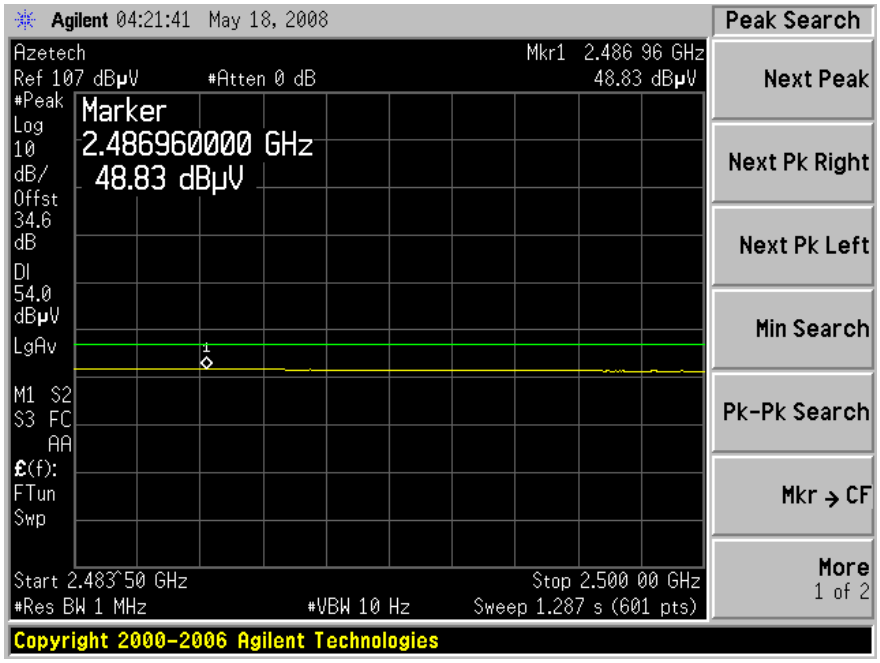
Horizontal Peak



Horizontal Average

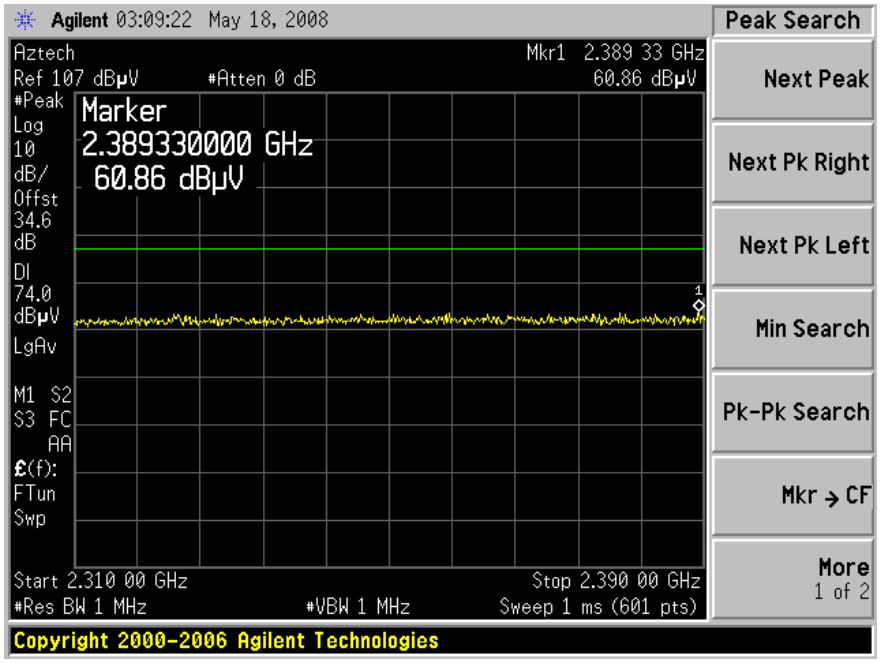


Vertical Peak

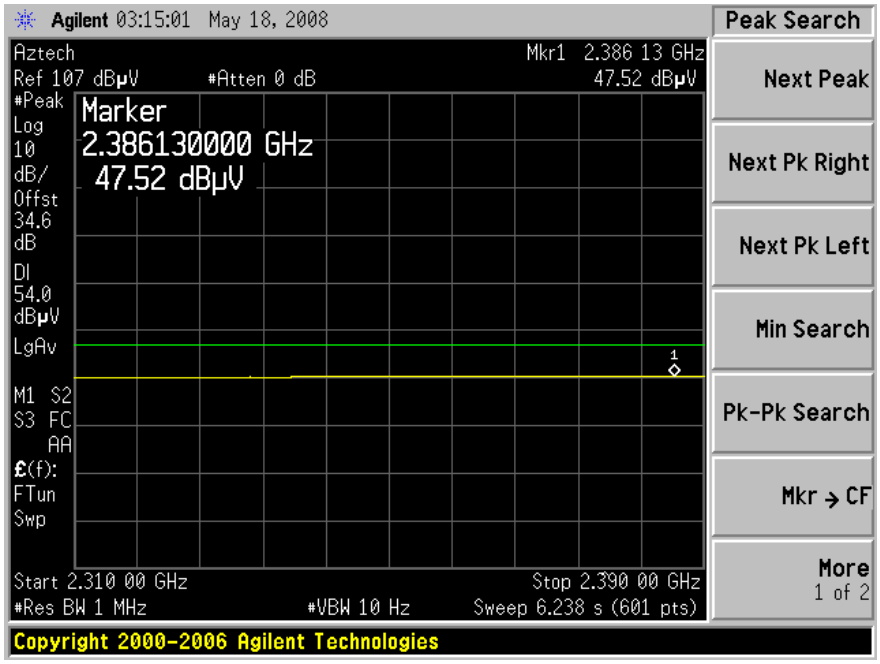


Vertical Average

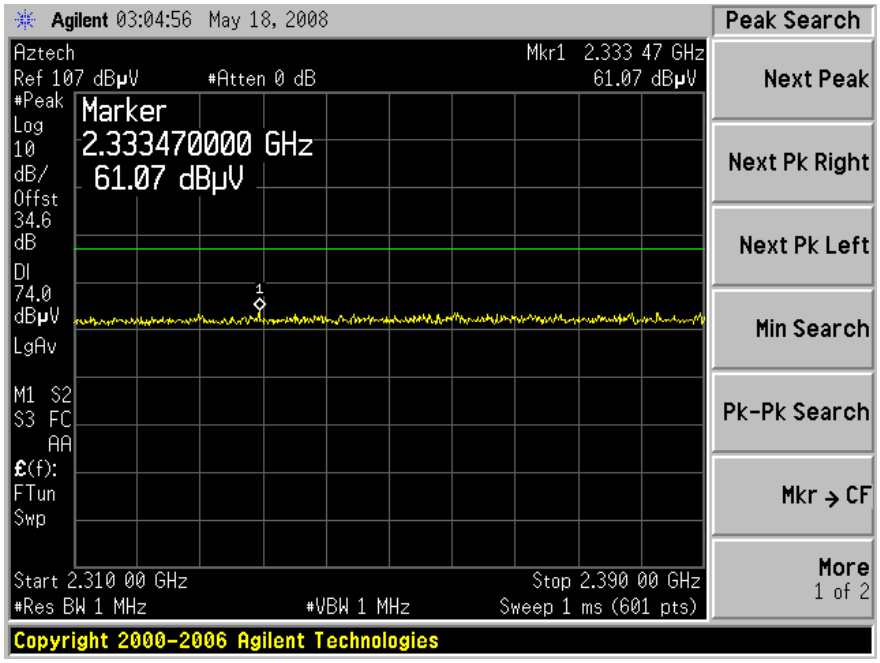
802.11 g, Lowest Channel



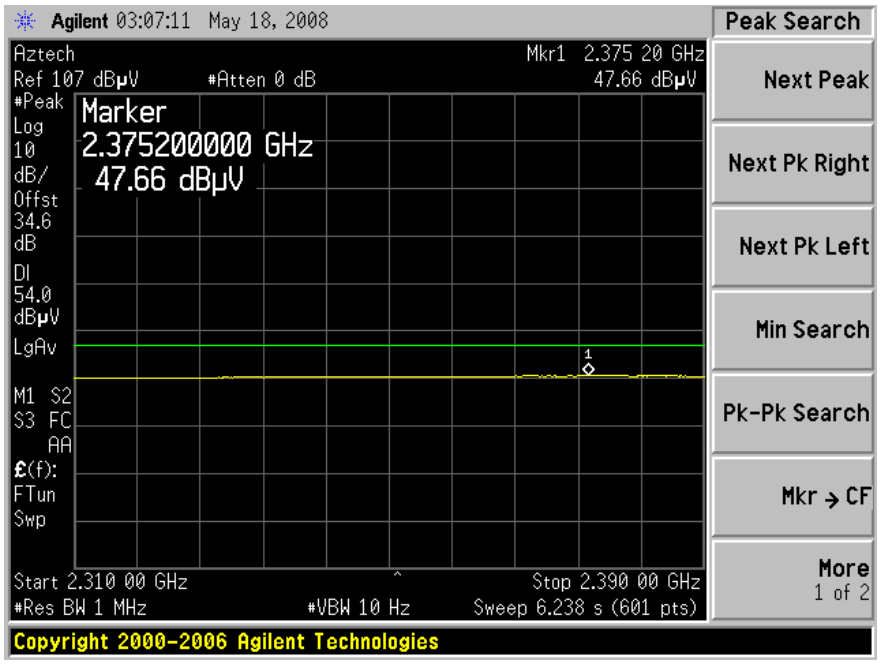
Horizontal Peak



Horizontal Average

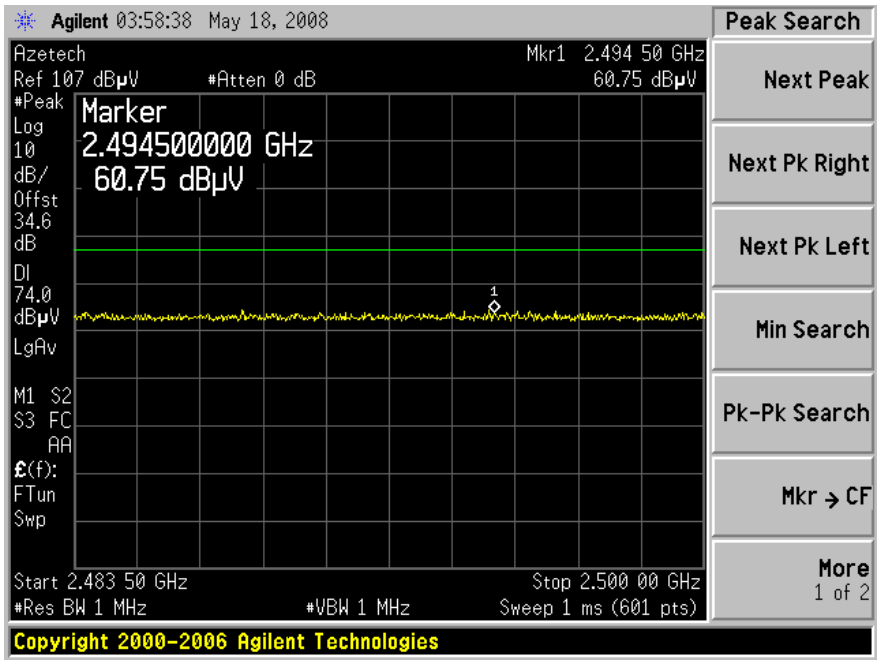


Vertical Peak

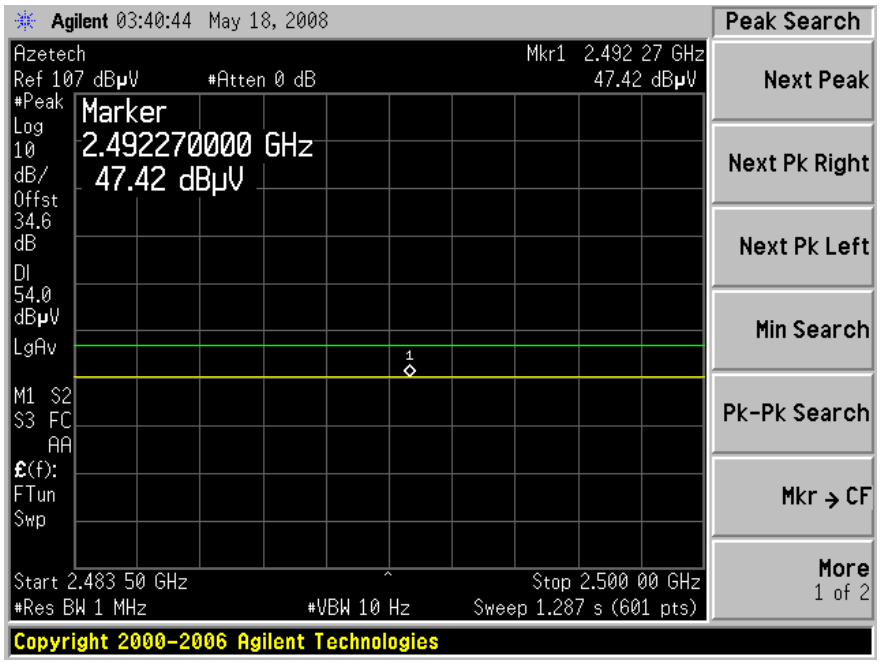


Vertical Average

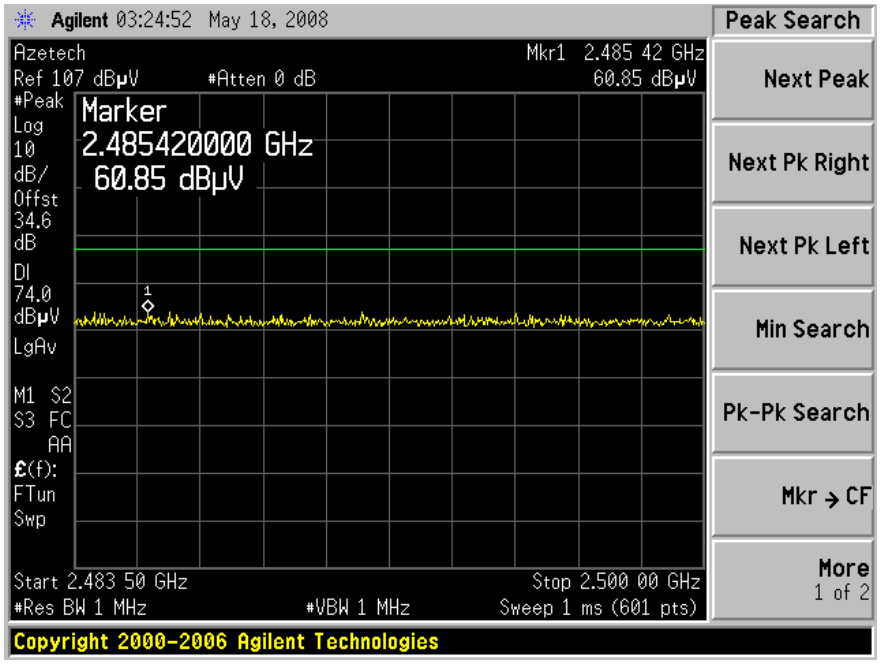
802.11 g, Highest Channel



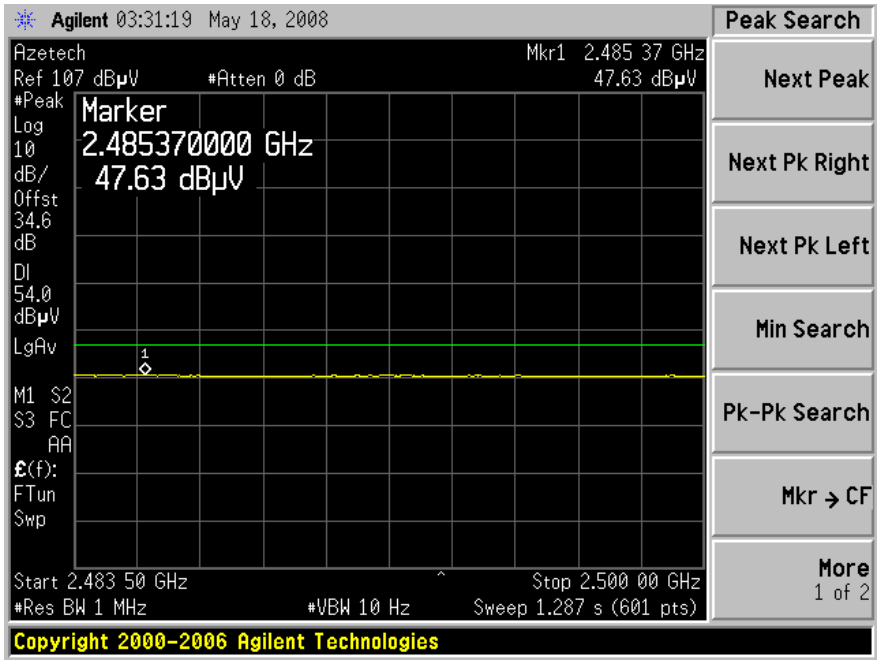
Horizontal Peak



Horizontal Average



Vertical Peak



Vertical Average

§15.247(a) (2) – 6 dB & 99% BANDWIDTH

Applicable Standard

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

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration 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.

Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	101.2 kPa

**The testing was performed by Victor Zhang from 2008-05-27.*

Summary of Test Results

802.11 b Mode:

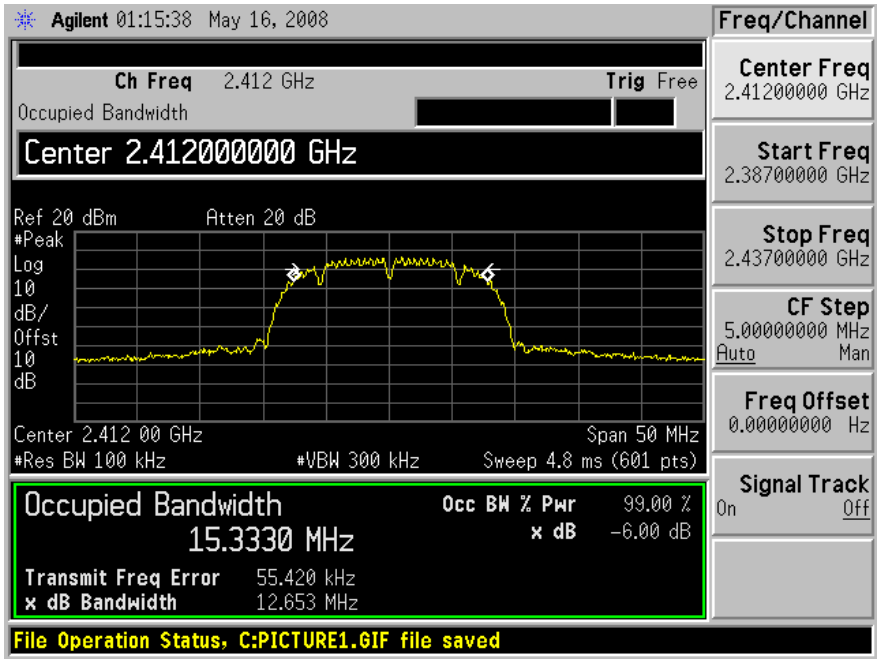
Channel	Frequency (MHz)	6 dB Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Part 15.247 Limit (kHz)
Low	2412	12.653	15.3330	>500
Middle	2437	13.089	15.3534	>500
High	2462	12.650	15.3669	>500

802.11 g Mode:

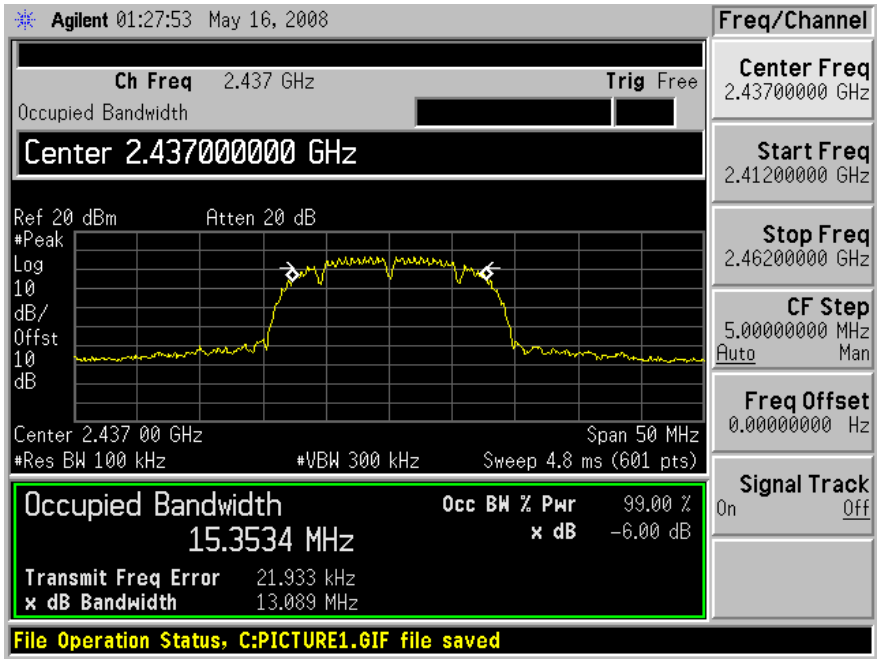
Channel	Frequency (MHz)	6 dB Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Part 15.247 Limit (kHz)
Low	2412	16.548	16.5174	>500
Middle	2437	16.520	16.5122	>500
High	2462	16.483	16.4959	>500

Please refer to the following plots for detailed test results

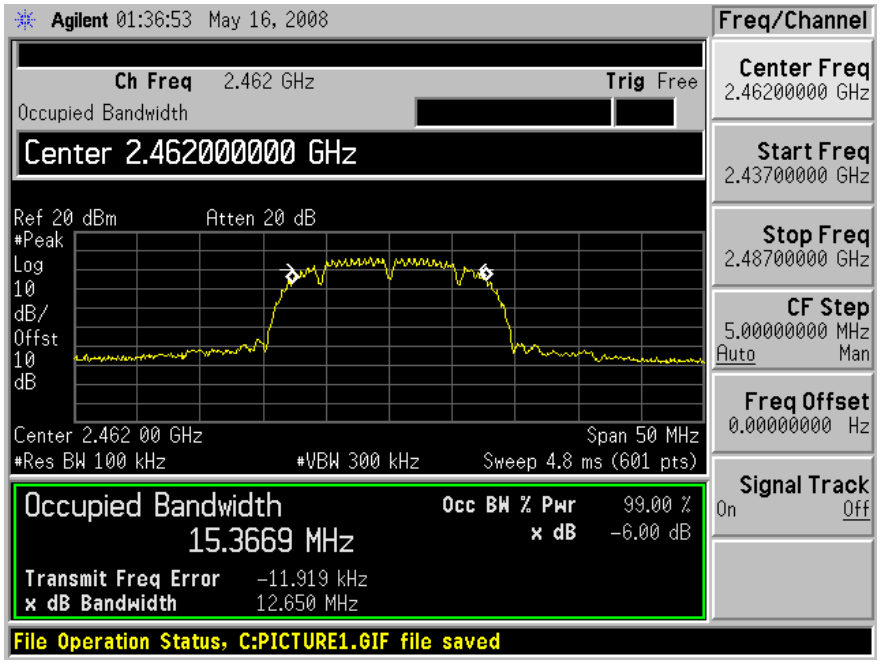
802.11 b – Low Channel



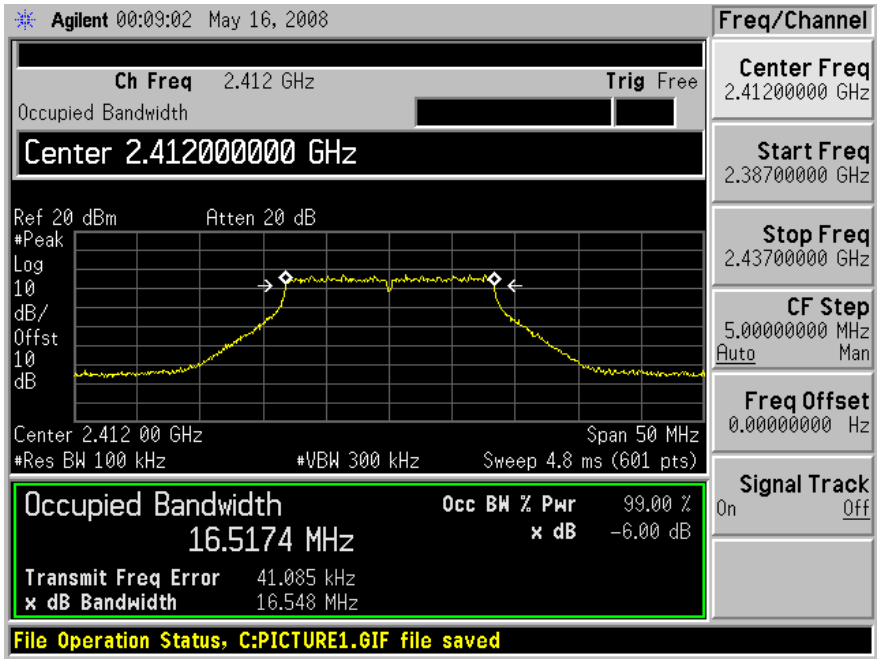
802.11 b – Middle Channel



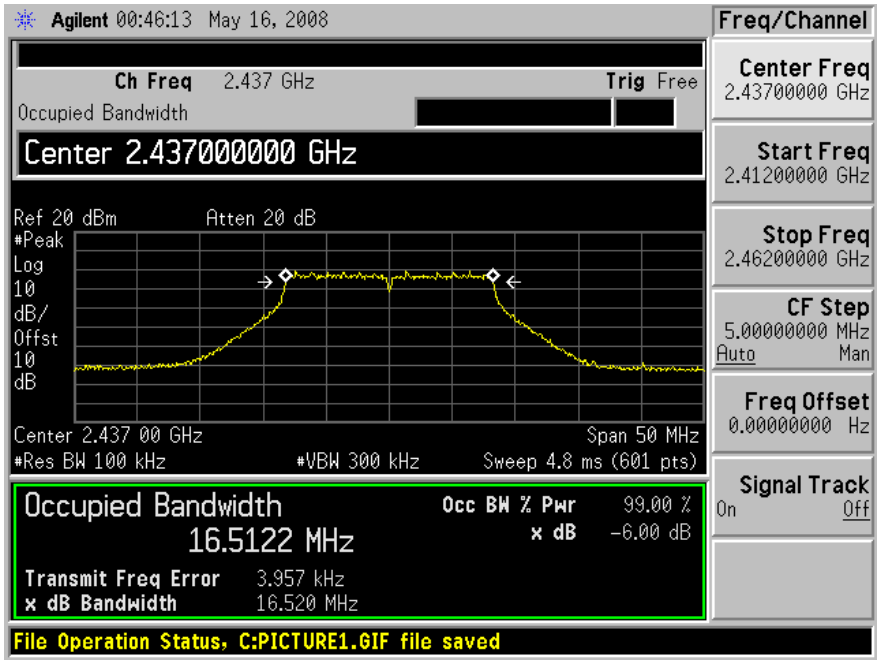
802.11 b – High Channel



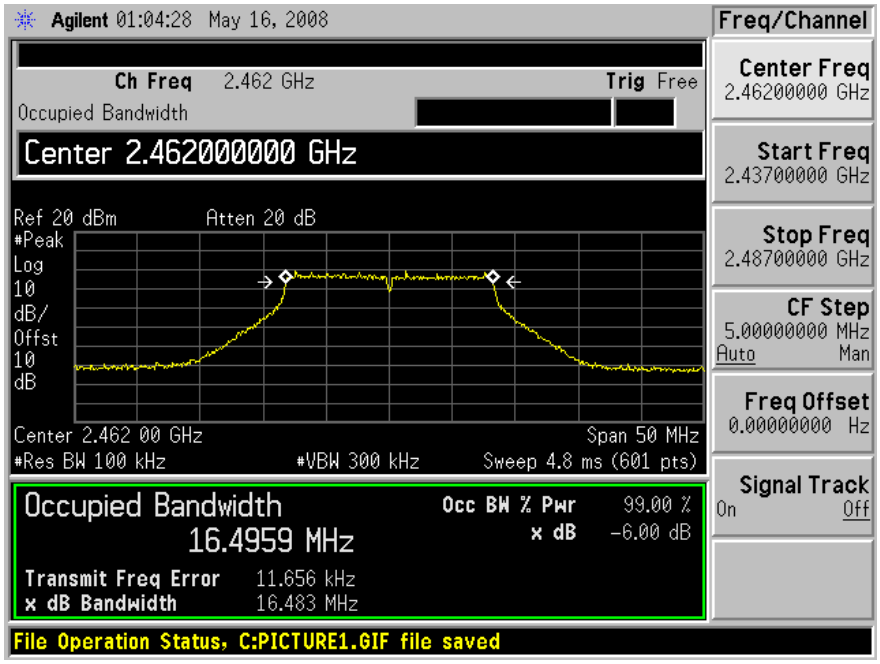
802.11 g – Low Channel



802.11 g – Middle Channel



802.11 g – High Channel



§15.247(b) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

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

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

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration 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.

Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	101.2 kPa

**The testing was performed by Victor Zhang from 2008-05-27.*

Summary of Test Results

802.11 b Mode:

Frequency (MHz)	Max Output Power (dBm)	Max Output Power (mw)	FCC Part 15.247 Limit (mw)
2412	16.03	40.09	1000
2437	16.56	45.29	1000
2462	16.03	40.09	1000

802.11g Mode:

Frequency (MHz)	Max Output Power (dBm)	Max Output Power (mw)	FCC Part 15.247 Limit (mw)
2412	11.04	12.71	1000
2437	11.26	13.37	1000
2462	11.04	12.71	1000

§15.247(d) - 100 kHz BANDWIDTH OF BAND EDGES

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)).

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration 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.

Environmental Conditions

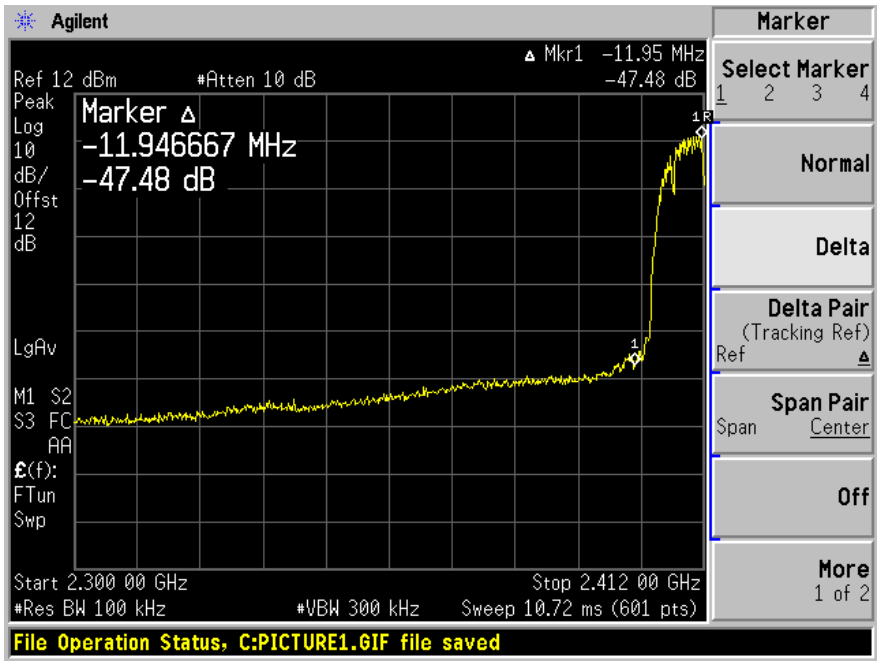
Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	101.2 kPa

**The testing was performed by Victor Zhang from 2008-05-27.*

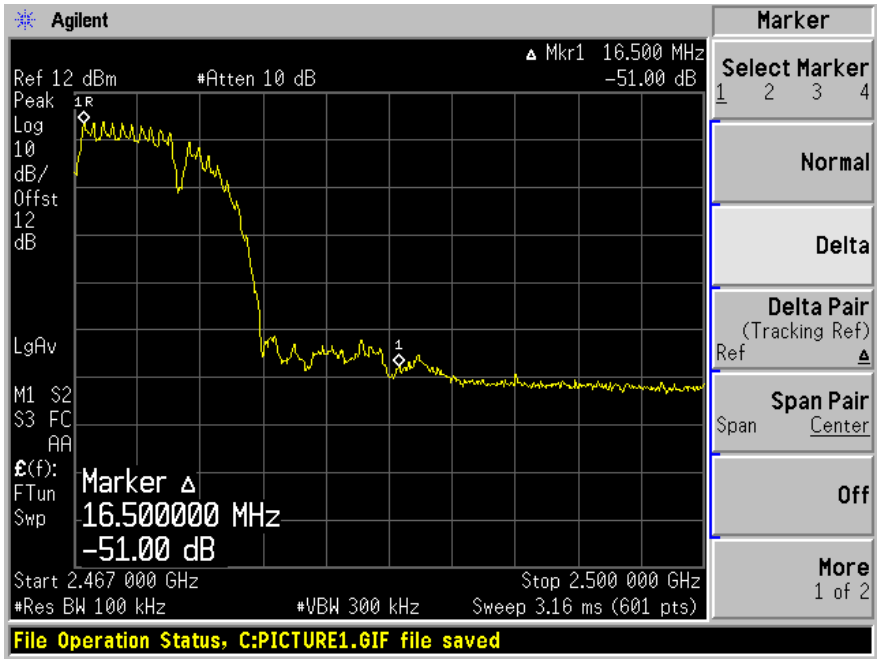
Measurement Result

Please refer to following pages for plots of band edge.

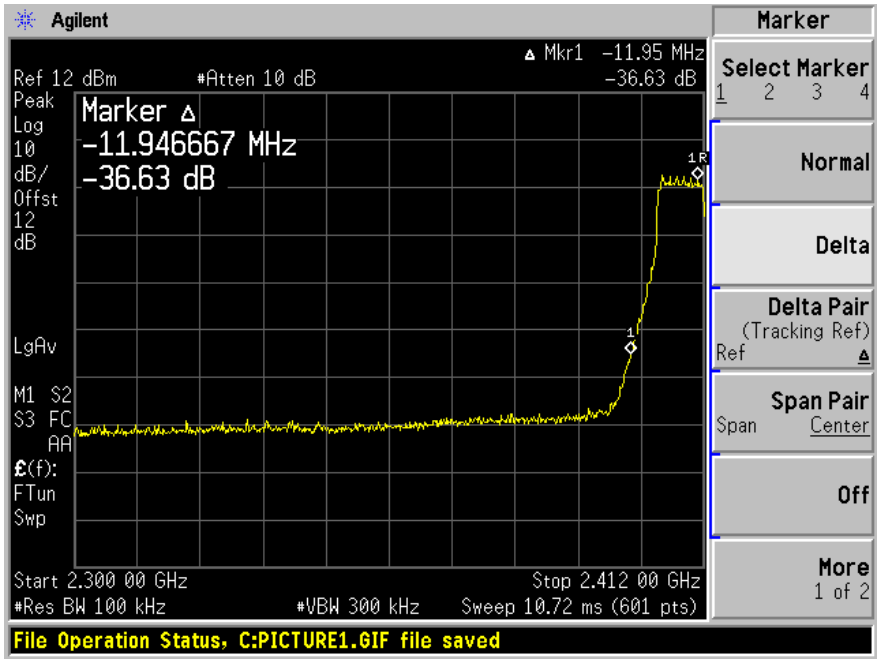
802.11 b – Low Band edge



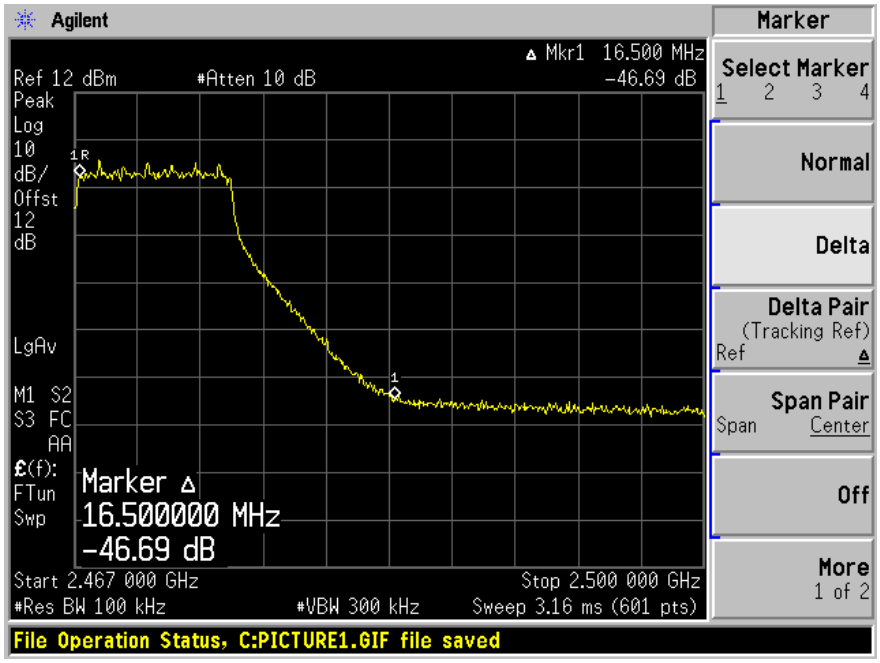
802.11 b – High Band edge



802.11 g –Low Band edge



802.11 g – High Band edge



§15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

According to §15.247 (e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration 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.

Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	101.2 kPa

**The testing was performed by Victor Zhang from 2008-05-27.*

Summary of Test Results

802.11 b Mode:

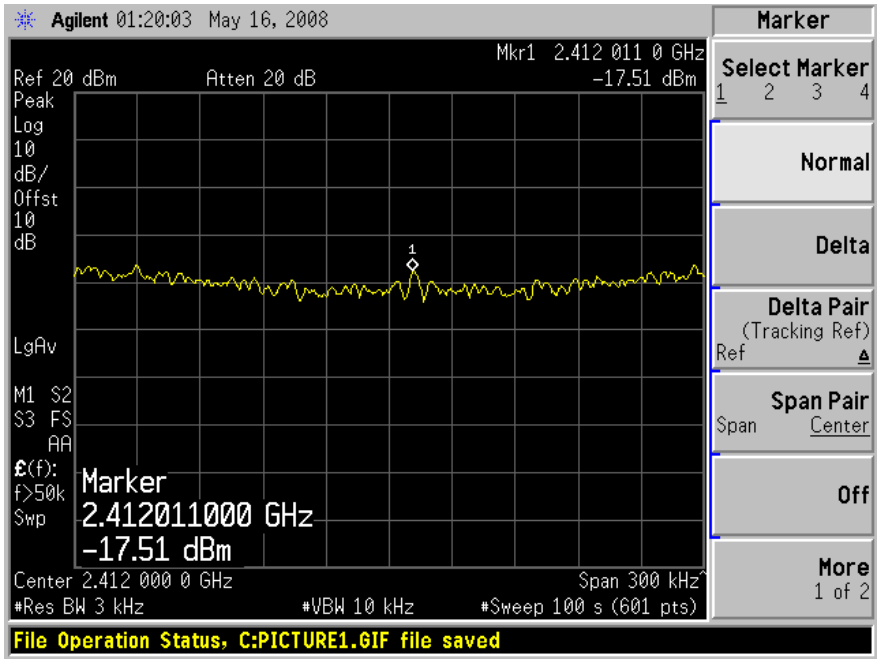
Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm)
Low	2412	-17.51	8
Middle	2437	-15.85	8
High	2462	-16.41	8

802.11 g Mode:

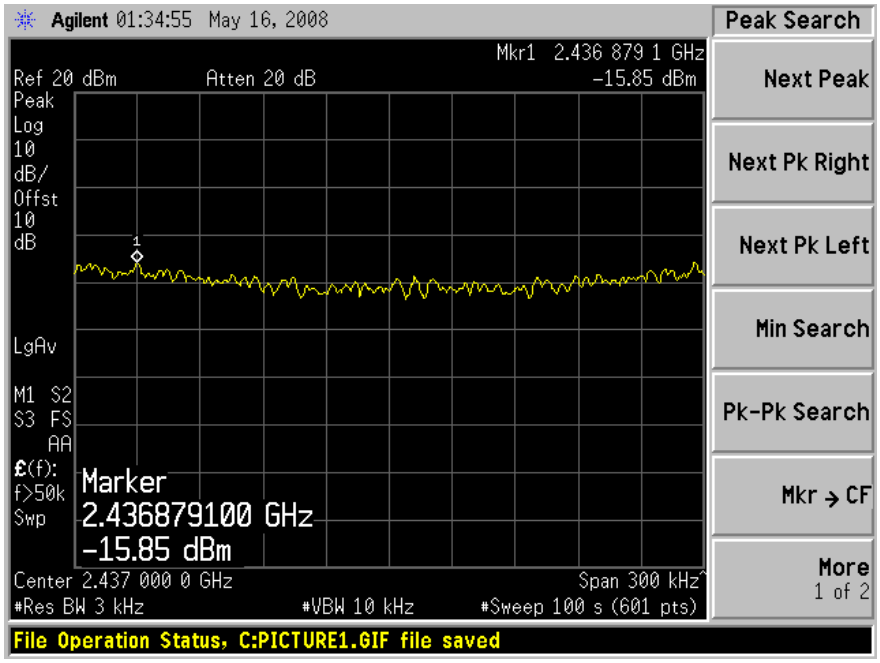
Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm)
Low	2412	-21.05	8
Middle	2437	-22.98	8
High	2462	-22.83	8

Please refer to the following plots for detailed test results

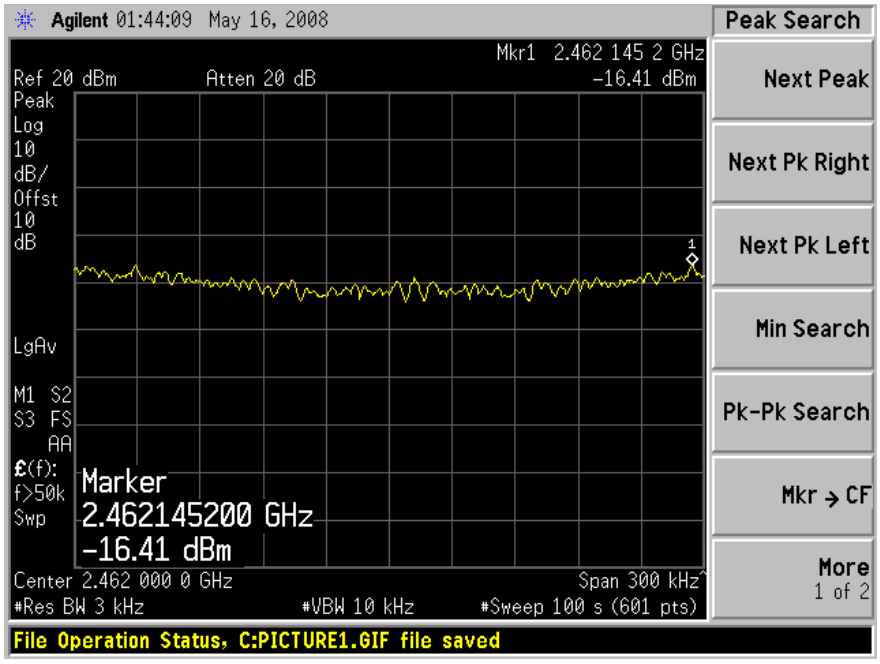
802.11 b – Low Channel



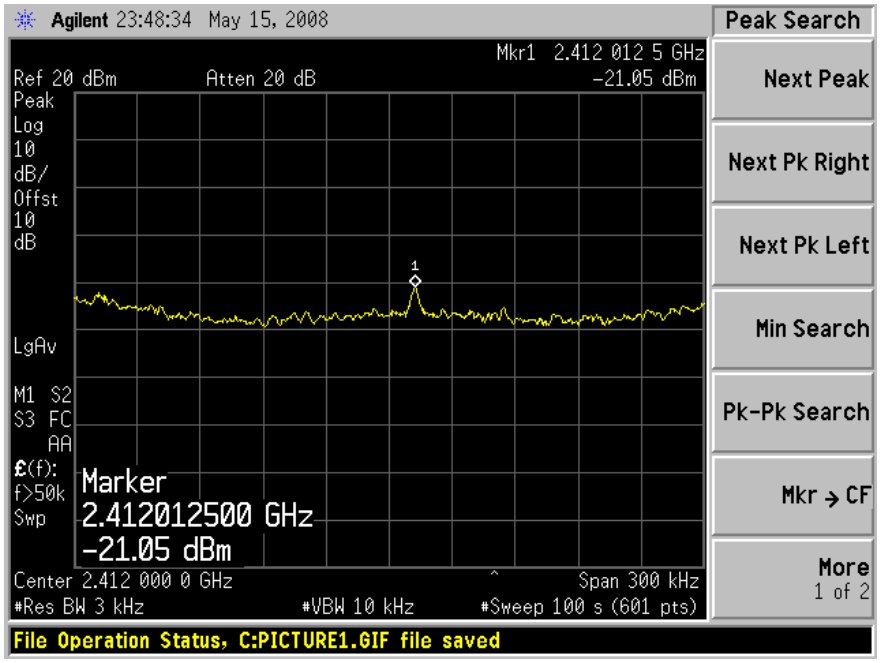
802.11 b – Middle Channel



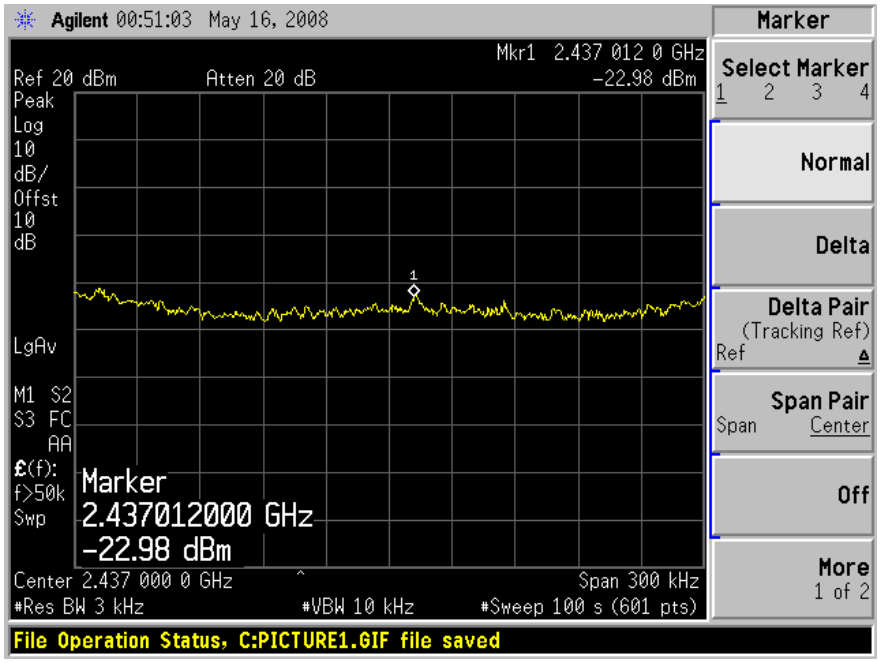
802.11 b –High Channelz



802.11 g – Low Channel



802.11 g – Middle Channel



802.11 g –High Channel