Lab Code: 200167-0

Bay Area Compliance Labs Corp.

FCC PART 15C

IC RSS-210 ISSUE 7, JUNE 2007

TEST AND MEASUREMENT REPORT

For

Nvidia Corporation

2701 San Tomas Expressway,

Santa Clara, CA 95050, USA

FCC ID: VOB-E1162
IC: 7361A-E1162

Report Type:	**Product Type:**
Original Report	Developer Kit with embedded Wi-Fi and BT

Test Engineer:	Jack Liu
Report Number:	R1003235-247WiFi
Report Date:	2010-11-01
Reviewed By:	Victor Zhang RF Lead
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP*, NIST, or any agency of the Federal Government.
* This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk "*" (Rev.2)

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1003235-247WiFi	Original Report	2010-11-10

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Nvidia Corporaton* and their product, *model: E1162, FCC ID: VOB-E1162, IC: 7361A-E1162* or the "EUT" as referred to this report. The EUT is designed to support system integration and software development for the Tegra mobile web processor. The wireless supports Bluetooth and 802.11b/g Wi-Fi. Bluetooth supports EDR up to 3 Mbps; W-iFi 802.11b/g at 54Mbps. Full QoS for 802.11e and security support 802.11i. Operates at 2400 to 2483.5 MHz.

1.2 Mechanical Description of EUT

The EUT measures approximately 170 mm **(L)** x 210 mm **(W)** x 40 mm **(H)** and weighs approximately 521.5 g.

The data gathered are from a typical production sample provided by the manufacturer with serial numberR1003235-1 assigned by BACL.

1.3 Objective

This report is prepared on behalf of *Nvidia Corporation.* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commissions rules and IC RSS-210 Issue 7, June 2007.

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

1.4 Related Submittal(s)/Grant(s)

Bluetooth submission with the same FCC ID, report number: R1003235-247BT.

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 +2.0 for Conducted Emissions tests and +4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

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

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

1.7 Test Facility

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

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

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

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

2 System Test Configuration

2.1 Justification

The EUT was 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.

2.2 EUT Exercise Software

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

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

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Special Accessories

N/A

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
IBM	Laptop	T41	00416

2.6 Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number
TMC	I.T.E Power Supply	HK-H1-A15	N/A

2.7 Interface Ports and Cabling

Cable Description	Length (m)	From	To
USB	< 3 m	EUT	Laptop

2.8 Internal Parts List and Details

Manufacturers	Descriptions	Models	Serial Numbers
NVIDIA	Processor	Tegra T30	N/A
Murata	WiFi-BT module	LBEE19QMBC-256	N/A
TI	LVDS Transmitter	SN75LVDS83BDGGR	N/A
Hynix	DDR2 SDRAM Memory	H5PS1G83EFR-Y5C	N/A
SMSC	USB Transceiver	USB3315C-CP-TR	N/A
SMSC	USB Hub w/ Integrated Ethernet Controller	LAN9514-JZX	N/A
TI	SLVS	TPS658621AZGUR	N/A

3 Summary of Test Results

FCC & IC Rules	Description of Test	Result
FCC §15.247 (i), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.4	Antenna Requirements	Compliant
FCC §15.207 (a) IC RSS-Gen §7.2.2	AC Line Conducted Emissions	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	Compliant
FCC §15.205, §15.209, §15.247(d) IC RSS-210 §2.2, §2.6, RSS-210 §A8.5	Restricted Bands, Spurious Radiated Emissions	Compliant
FCC §15.247 (a)(2) IC RSS-210 §A8.2	6 dB & 99% Emission Bandwidth	Compliant
FCC §15.247(e) IC RSS-210 §A8.2	Power Spectral Density	Compliant
FCC §15.247(a) IC RSS-210 §A8.4	Maximum Peak Output Power	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	Band Edge	Compliant
FCC Part 15.109 IC RSS-Gen §6	Receiver Spurious Emission	Compliant

4 FCC §15.247 (i), §2.1091 & IC & RSS-102 - RF Exposure Information

4.1 Applicable Standard

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

Limits for General Population/Uncontrolled Exposure

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

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

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF fields.

According to RSS-102 Issue 2 section 4.1, RF limits used for general public will be applied to the EUT.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Time Averaging (min)
0.003 - 1	280	2.19	-	6
1 - 10	280 / f	2.19 / f	-	6
10 - 30	28	2.19 / f	-	6
30 – 300	28	0.073	2*	6
300 – 1 500	$1.585\ f^{0.5}$	$0.0042\ f^{0.5}$	f / 150	6
1 500 – 15 000	61.4	0.163	10	6
15 000 – 150 000	61.4	0.163	10	$616000 / f^{1.2}$
150 000- 300 000	$0.158\ f^{0.5}$	$4.21 \times 10\ -4\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000 / f^{1.2}$

Note: f is frequency in MHz
* Power density limit is applicable at frequencies greater than 100 MHz

4.2 MPE Prediction

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

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

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

4.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	15.43
Maximum peak output power at antenna input terminal (mW):	34.914
Prediction distance (cm):	20
Prediction frequency (MHz):	2437
Maximum Antenna Gain, typical (dBi):	2.0
Maximum Antenna Gain (numeric):	1.585
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.011
Power density of prediction frequency at 20.0 cm (W/m^2):	0.11
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	10

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.011 mW/cm^2 (0.11 W/m^2).Limit is 1 mW/cm^2 (10 W/m^2).

5 FCC §15.203 & IC RSS-Gen §7.1.4 – ANTENNA REQUIREMENT

5.1 Applicable Standard

For intentional device, according to FCC Part §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

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

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in IC RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to IC RSS-210 Annex 8 or RSS-210 Annex 9, the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to IC RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

5.2 Result

The EUT has maximum gain of 2dBi antenna, which in accordance to sections FCC Part 15.203 and IC RSS-Gen §7.1.4, is considered sufficient to comply with the provisions of these sections. Please refer to the EUT photos.

EUT Antenna

6 FCC §15.207 & RSS-Gen 7.2.2- Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 & IC RSS-Gen §7.2.2 Conducted limits:

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

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

* *Decreases with the logarithm of the frequency.*

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2003 measurement procedure. The specification used was FCC Part15.207 and IC RSS-Gen limits.

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

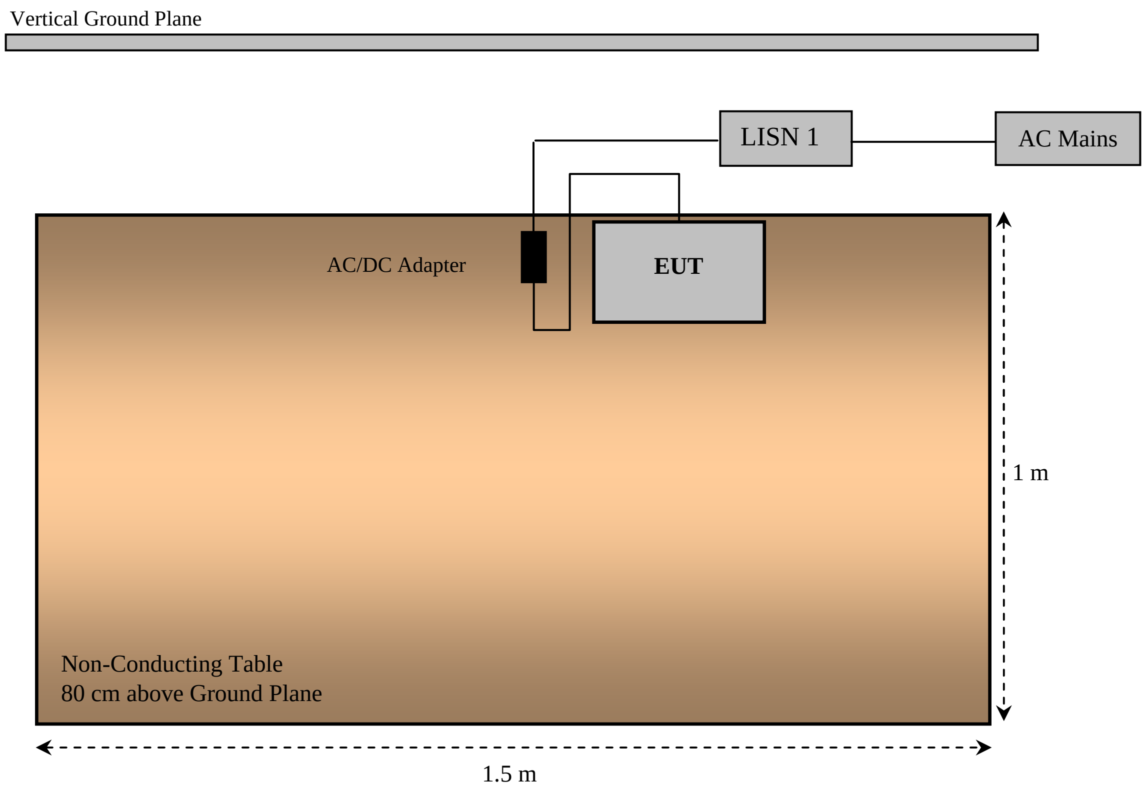
The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2010-04-19
Solar Electronics	LISN	9252-R-24-BNC	511205	2009-06-09
TTE	Filter, High Pass	H9962-150K-50-21378	K7133	2009-06-01

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

6.4 Test Setup Block Diagram



6.5 Test Procedure

During the conducted emissions test, the power cord of the EUT host system 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”.

6.6 Test Environmental Conditions

Temperature:	18~25 °C
Relative Humidity:	30~50 %
ATM Pressure:	101.1-102.8kPa

The testing was performed by Jack Liu from 2010-04-06 to 2010-06-06.

6.7 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Cable Loss, and Attenuator Factor adding to the Indicated Reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Cable Loss + Attenuator Factor

For example, a Corrected Amplitude of 34.08 dBuV/m = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10dB)

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

Margin = Corrected Amplitude - Limit

6.8 Summary of Test Results

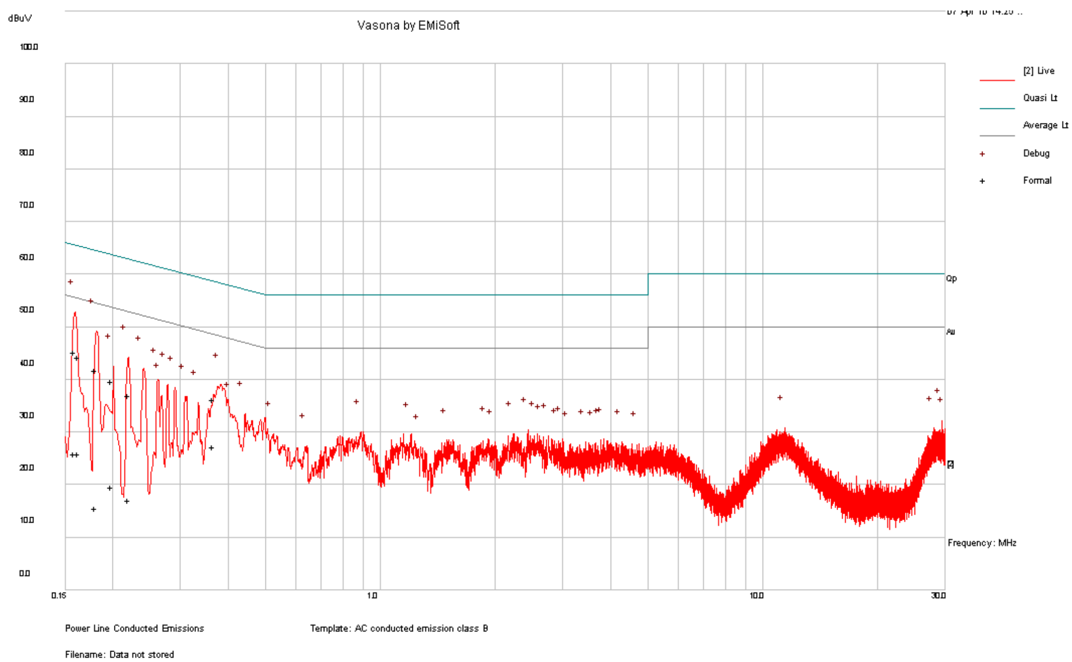
According to the recorded data in following table, the EUT <u>complied with the FCC/IC standard’s</u> conducted emissions limits, with the margin reading of:

Worst Case: 802.11b 20 MHz BW – Low Channel Transmitting Mode

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-20.09	0.162156	Line	0.15 to 30
-19.97	0.160344	Neutral	0.15 to 30

6.9 Conducted Emissions Test Plots and Data

120V/60 Hz Line:



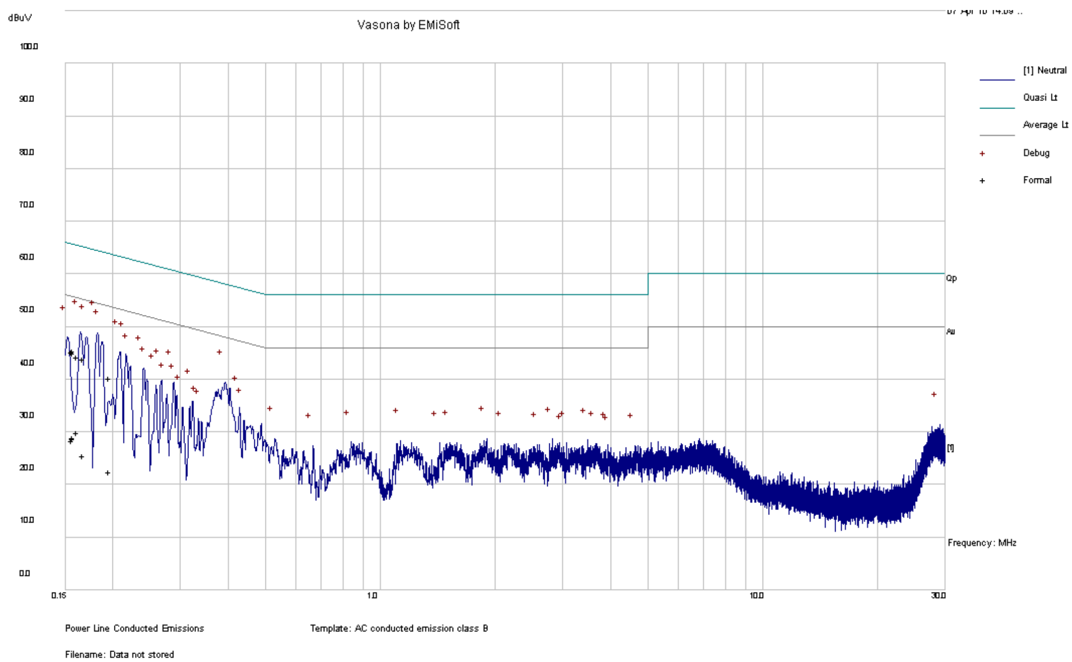
Quasi-Peak Measurement

Frequency (MHz)	Corrected Reading (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.162156	45.26	Quasi-Peak	L	65.35	-20.09
0.165651	44.32	Quasi-Peak	L	65.18	-20.86
0.372867	36.15	Quasi-Peak	L	58.44	-22.29
0.183678	41.71	Quasi-Peak	L	64.32	-22.61
0.202824	39.58	Quasi-Peak	L	63.49	-23.91
0.224985	37.04	Quasi-Peak	L	62.63	-25.59

Average Measurement

Frequency (MHz)	Corrected Reading (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.372867	27.17	Average	L	48.44	-21.27
0.165651	25.95	Average	L	55.18	-29.23
0.162156	25.9	Average	L	55.35	-29.45
0.202824	19.53	Average	L	53.49	-33.96
0.224985	17.07	Average	L	52.63	-35.56
0.183678	15.6	Average	L	54.32	-38.71

120V/60 Hz Neutral:



Quasi-Peak Measurement

Frequency (MHz)	Corrected Reading (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.160344	45.48	Quasi-Peak	N	65.45	-19.97
0.159798	45.17	Quasi-Peak	N	65.47	-20.31
0.160665	45.05	Quasi-Peak	N	65.43	-20.37
0.16464	44.23	Quasi-Peak	N	65.23	-21
0.170547	43.9	Quasi-Peak	N	64.93	-21.04
0.199941	40.31	Quasi-Peak	N	63.61	-23.31

Average Measurement

Frequency (MHz)	Corrected Reading (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.16464	30.01	Average	N	55.23	-25.22
0.160665	28.92	Average	N	55.43	-26.5
0.160344	28.72	Average	N	55.45	-26.72
0.159798	28.37	Average	N	55.47	-27.11
0.170547	25.57	Average	N	54.93	-29.36
0.199941	22.54	Average	N	53.61	-31.08

7 FCC §15.247(d) & IC RSS-210 §A8.5 - Spurious Emissions at Antenna Port

7.1 Applicable Standard

For §15.247(d) and RSS-210 § A8.5 in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Requirements: CFR 47, §2.1051.

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

7.2 Measurement Procedure

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

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-07-23

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

7.4 Test Environmental Conditions

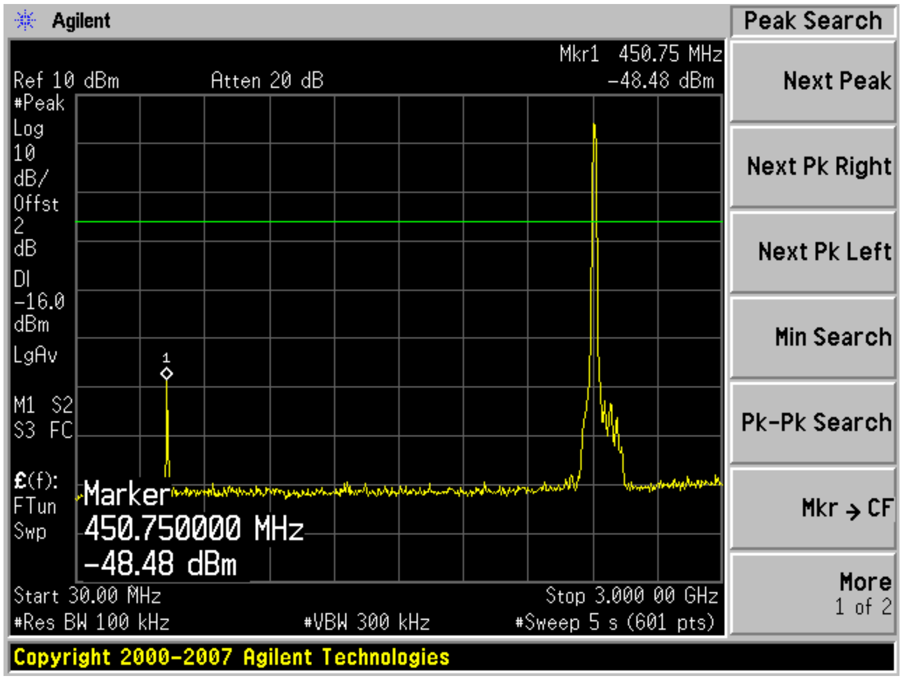
Temperature:	18~25 °C
Relative Humidity:	30~50 %
ATM Pressure:	101.1-102.8kPa

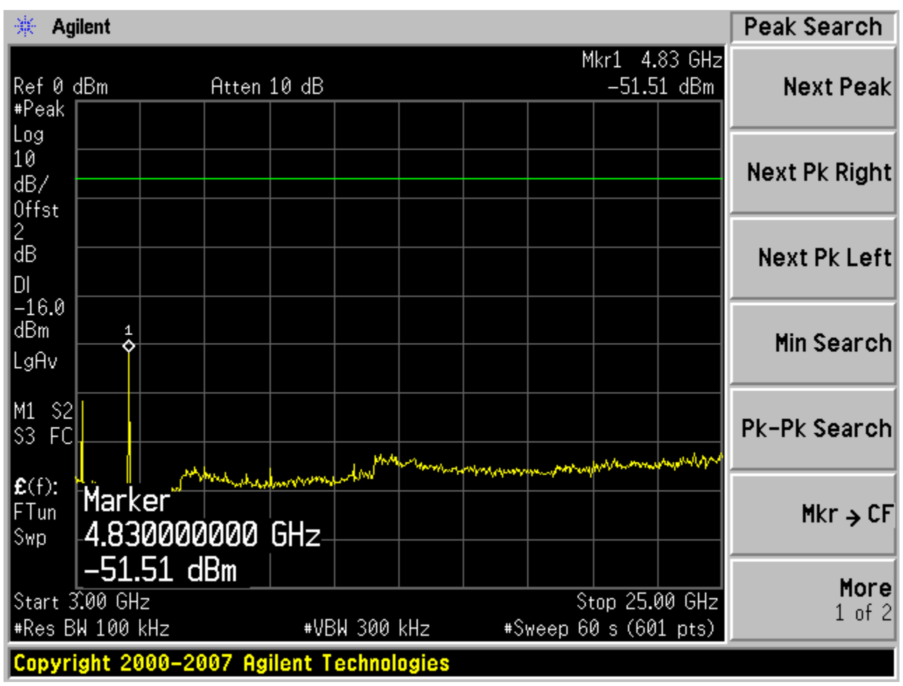
The testing was performed by Jack Liu from 2010-04-06 to 2010-06-06.

7.5 Measurement Result:

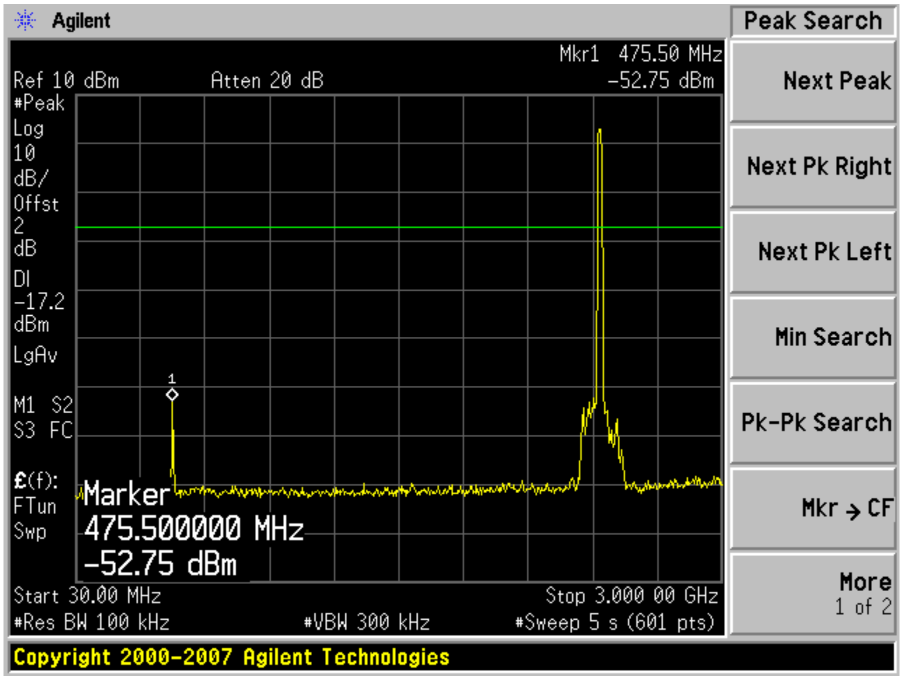
Please refer to following plots of spurious emissions.

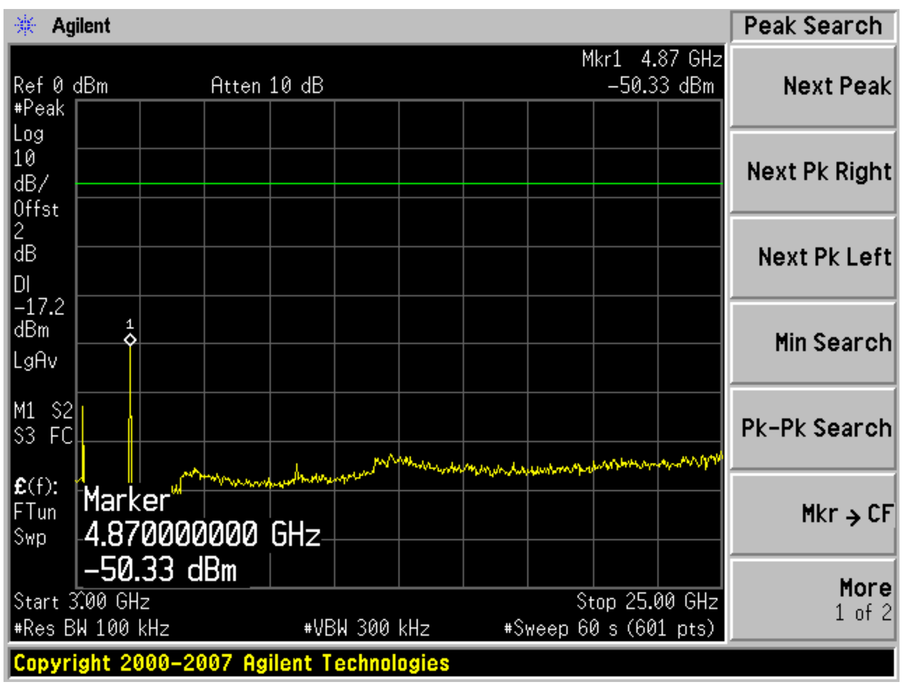
802.11 b, Low Channel 2412 MHz



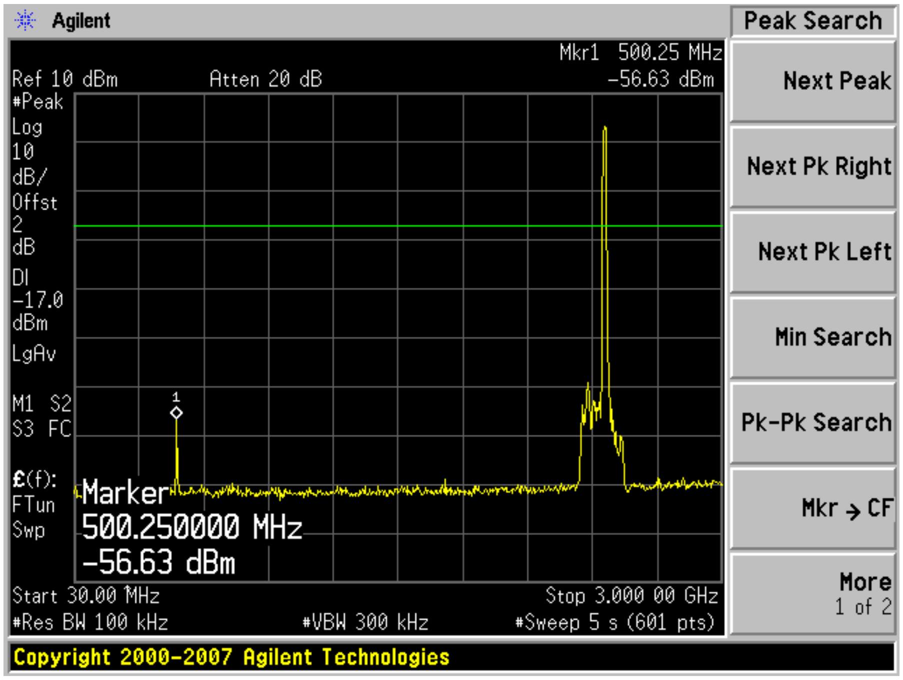


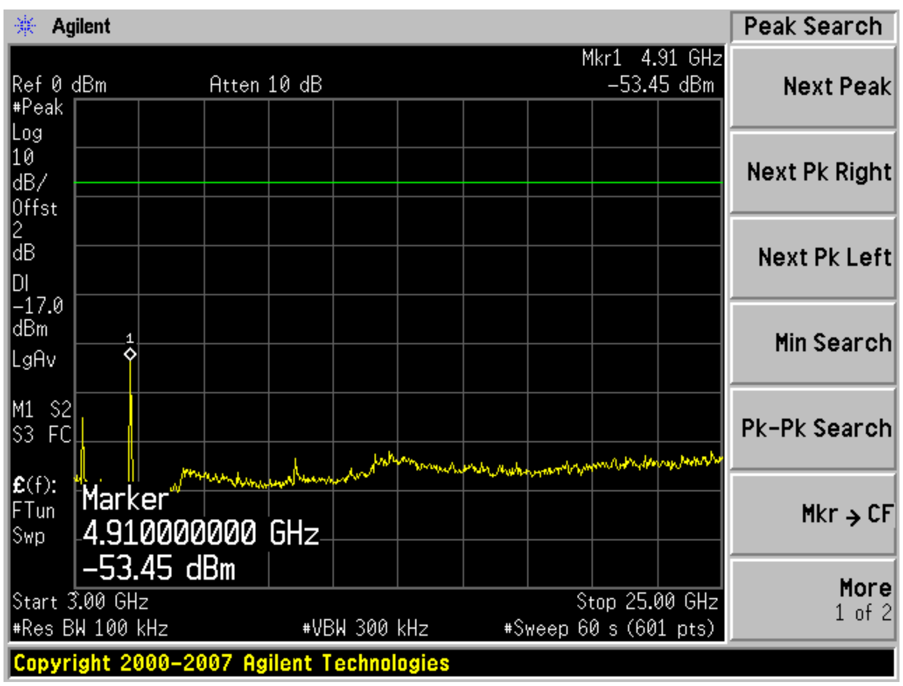
802.11 b, Middle Channel 2437 MHz



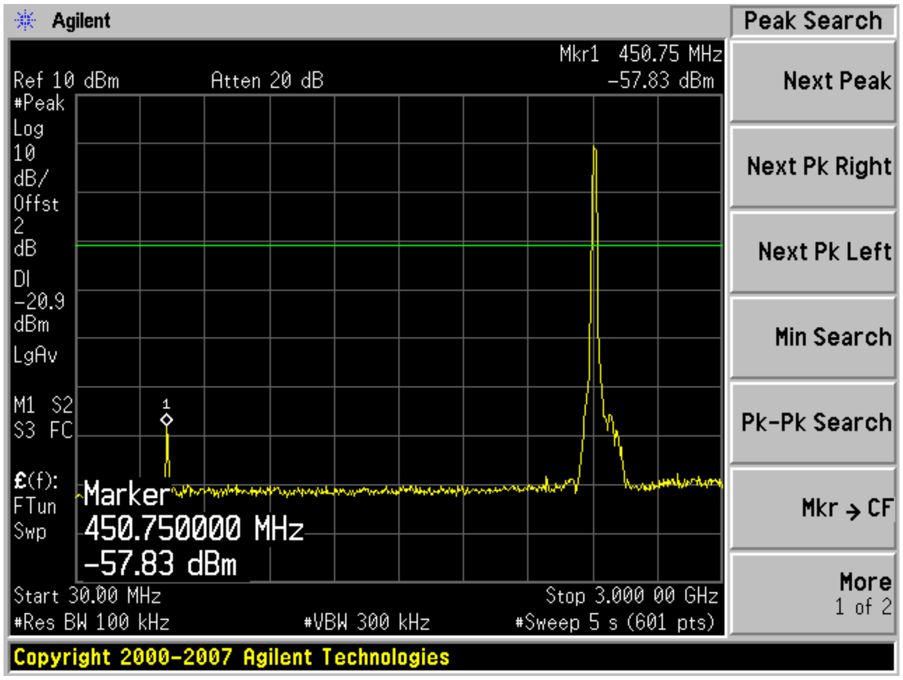


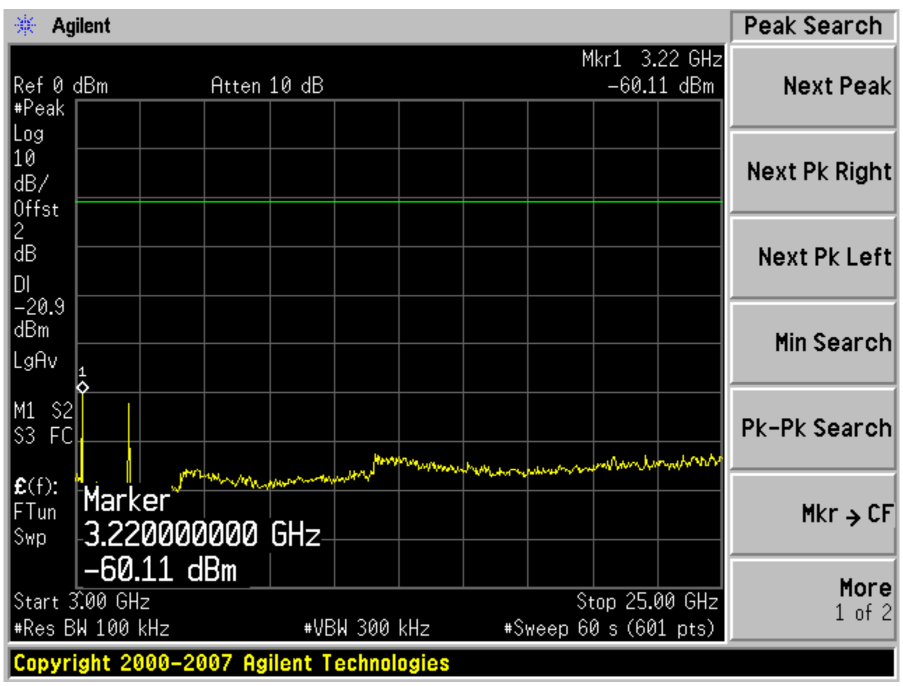
802.11 b, High Channel 2462 MHz



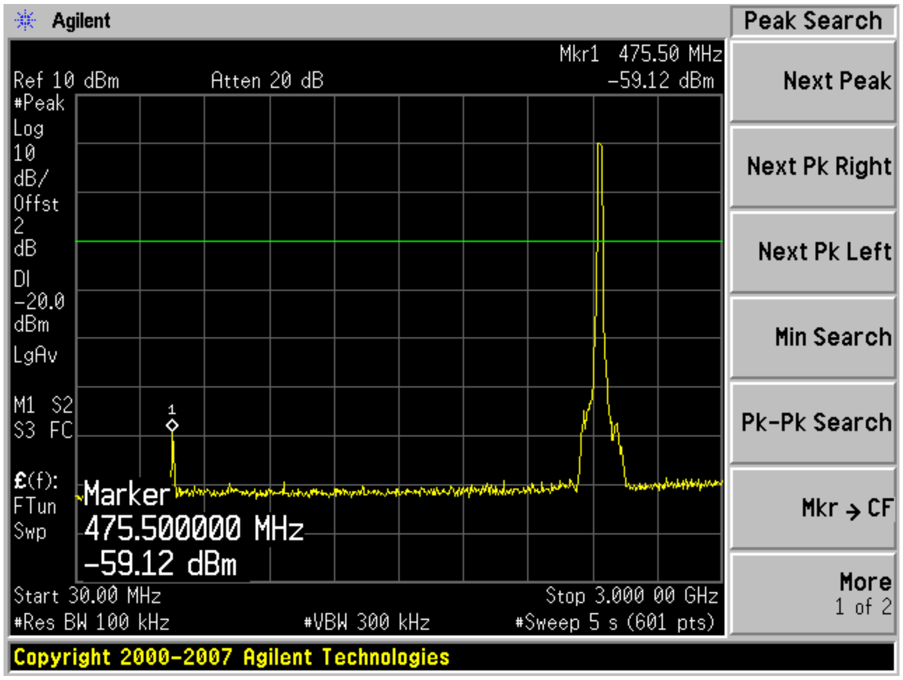


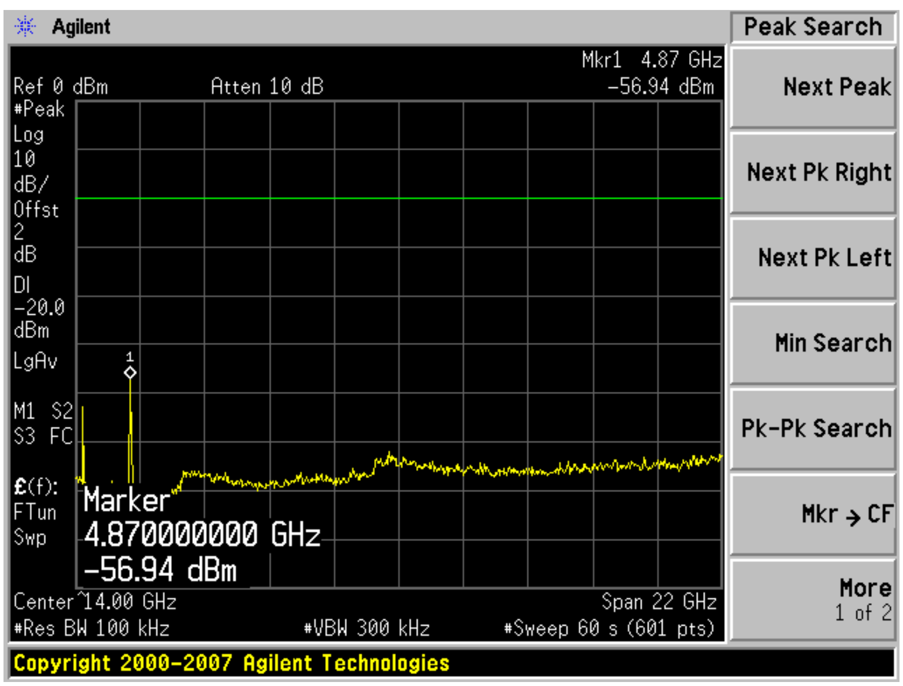
802.11 g, Low Channel 2412 MHz



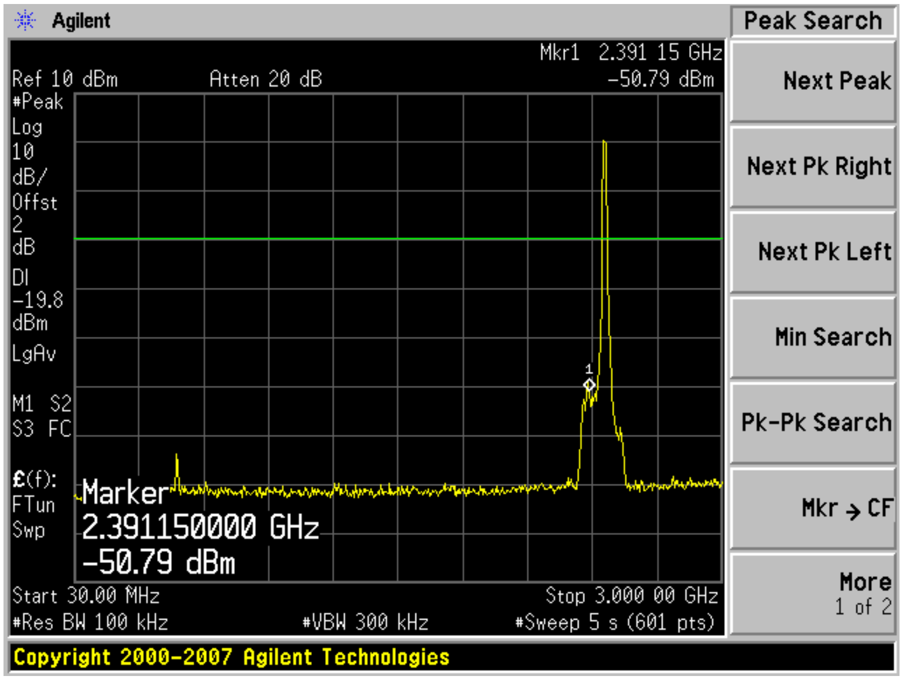


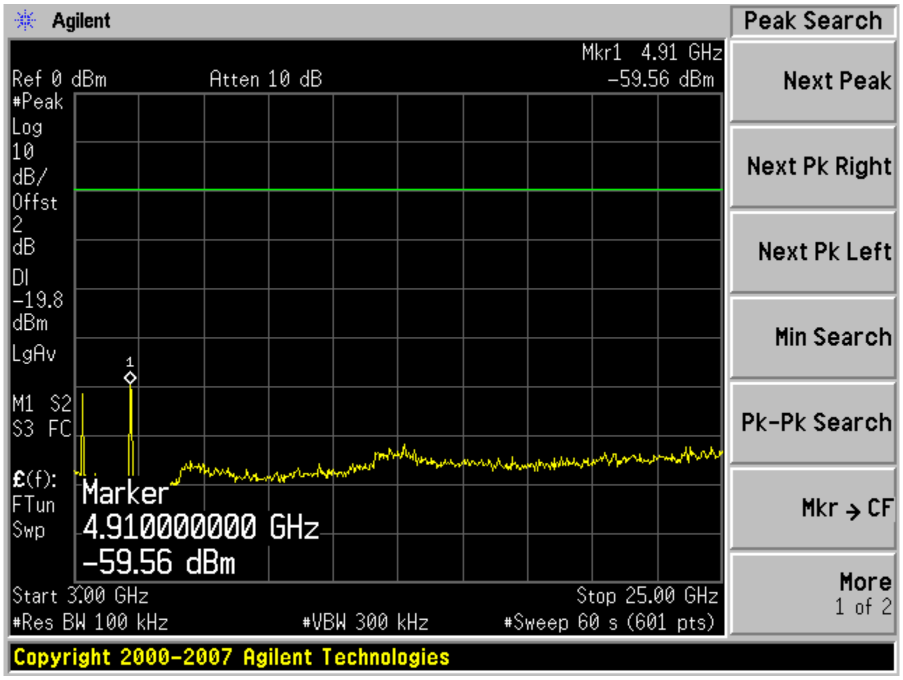
802.11 g, Middle Channel 2437 MHz





802.11 g, High Channel 2462 MHz





8 FCC §15.205, §15.209, §15.247(d) & IC RSS-210 §2.2, §2.6, §A8.5 – Spurious Radiated Emissions

8.1 Applicable Standard

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

As per FCC §15.209(a) and RSS-210: Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

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

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15C and IC RSS-210 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 No.	Serial No.	Calibration Date
A.H Systems	Antenna, Horn	SAS-200/571	261	2009-09-23
Hewlett Packard	Pre amplifier	8447D	2944A06639	2009-06-05
Sunol Science Corp	Combination Antenna	JB3	A0020106-2	2009-08-20
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2010-03-24
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
A.R.A Inc	Horn antenna	DRG-1181A	1132	2009-10-27
Agilent	PSA Series Spectrum Analyzer	E4440A	US45303156	2009-07-23
HP	Pre Amplifier	8449B	3147A00400	2010-02-01

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 host, and all support equipment power cords was connected to the AC floor outlet.

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

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

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

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

Above 1000 MHz:

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

8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Cable Loss, and Attenuator Factor adding to the Indicated Reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Cable Loss + Attenuator Factor

For example, a Corrected Amplitude of 34.08 dBuV/m = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10dB)

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

Margin = Corrected Amplitude - Limit

8.6 Test Environmental Conditions

Temperature:	18~25 °C
Relative Humidity:	30~50 %
ATM Pressure:	101.1-102.8kPa

The testing was performed by Jack Liu from 2010-04-06 to 2010-06-06.

8.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15C and IC RSS-210 standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-1.95	360.0335	Horizontal	802.11g, Low, 30 MHz – 1 GHz

Above 1 GHz:

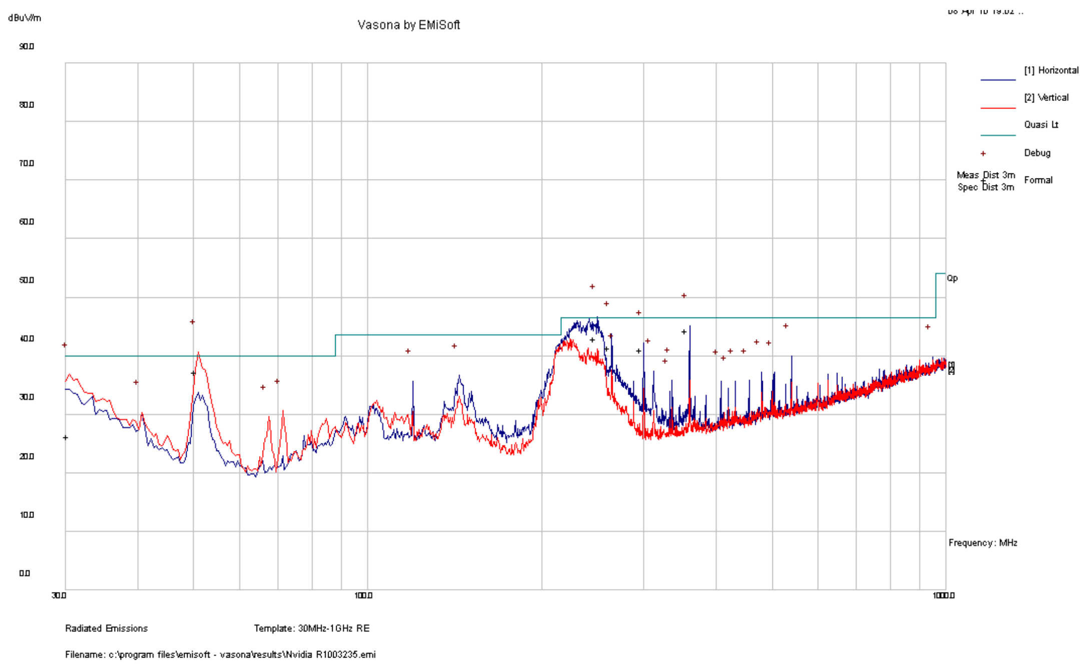
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-	-	-	Low, 1GHz – 25GHz
-	-	-	Mid, 1GHz – 25GHz
-	-	-	High, 1GHz – 25GHz

- **Note:** *All Frequencies are 20 dB below the limit or are on the noise floor level*
Please refer to the following table and plots for specific test result details

8.8 Radiated Emissions Test Result Data:

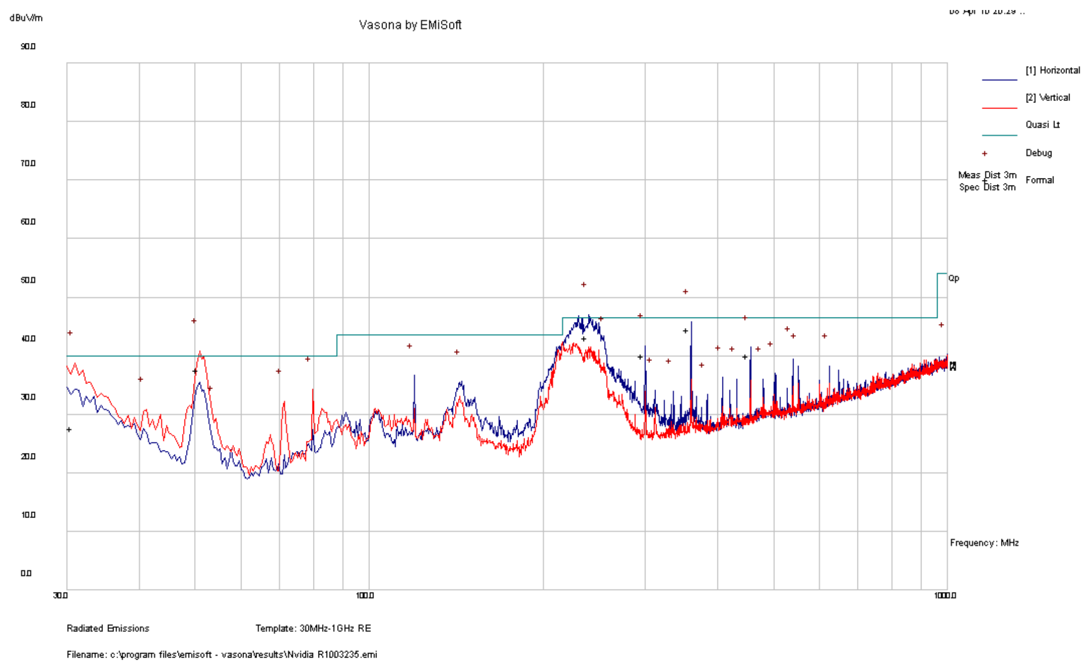
1) 30 MHz – 1 GHz, Radiated Spurious Emission measured at 3 meters

802.11b Mode, Low channel (2412 MHz)



Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
359.9807	44.4	98	H	151	46	-2.1
51.06428	37.32	107	V	18	40	-2.68
249.9392	43.01	127	H	227	46	-3.49
263.9807	41.4	119	H	230	46	-5.1
300.032	41.04	104	H	254	46	-5.46
30.61964	26.2	135	V	242	40	-13.8

802.11g Mode, Low channel (2412 MHz)



Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)
360.0335	44.55	98	H	150	46	-1.95
51.04868	37.55	103	V	10	40	-2.45
239.6134	43.08	136	H	231	46	-3.42
455.9663	39.99	194	H	150	46	-6.51
300.0435	39.98	113	H	234	46	-6.52
30.95584	27.63	98	V	108	40	-12.37

2) 1 – 25 GHz, Radiated Spurious Emissions Measured at 3 meters

802.11b Mode:

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC & IC		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel (2412 MHz)											
-	-	-	-	-	-	-	-	-	-	-	-
Middle Channel (2437 MHz)											
-	-	-	-	-	-	-	-	-	-	-	-
High Channel (2462 MHz)											
-	-	-	-	-	-	-	-	-	-	-	-

- **Note:** *All Frequencies are 20 dB below the limit or are on the noise floor level*

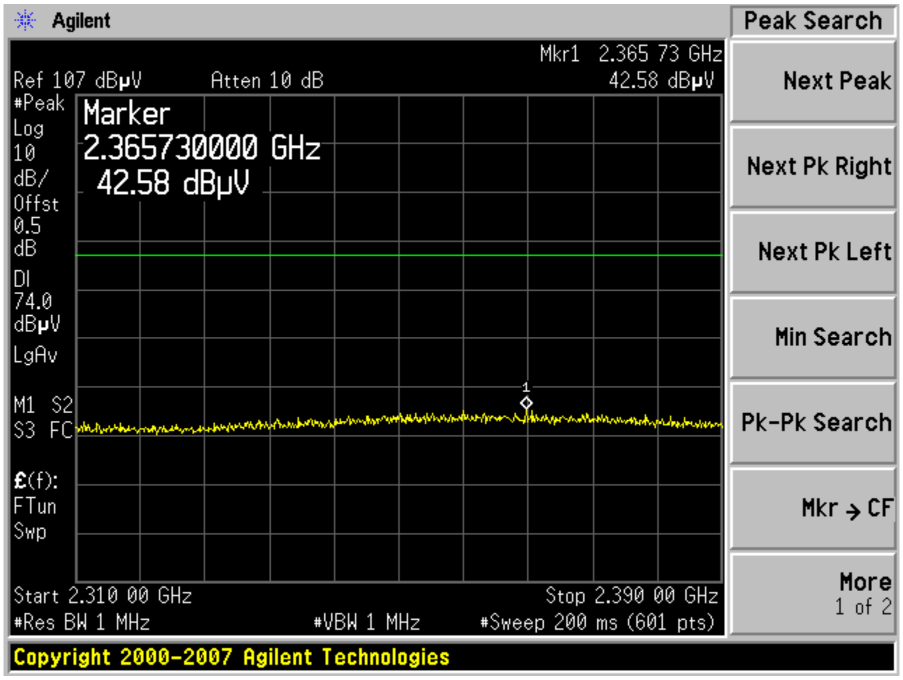
802.11g Mode:

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC & IC		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel (2412 MHz)											
-	-	-	-	-	-	-	-	-	-	-	-
Middle Channel (2437 MHz)											
-	-	-	-	-	-	-	-	-	-	-	-
High Channel (2462 MHz)											
-	-	-	-	-	-	-	-	-	-	-	-

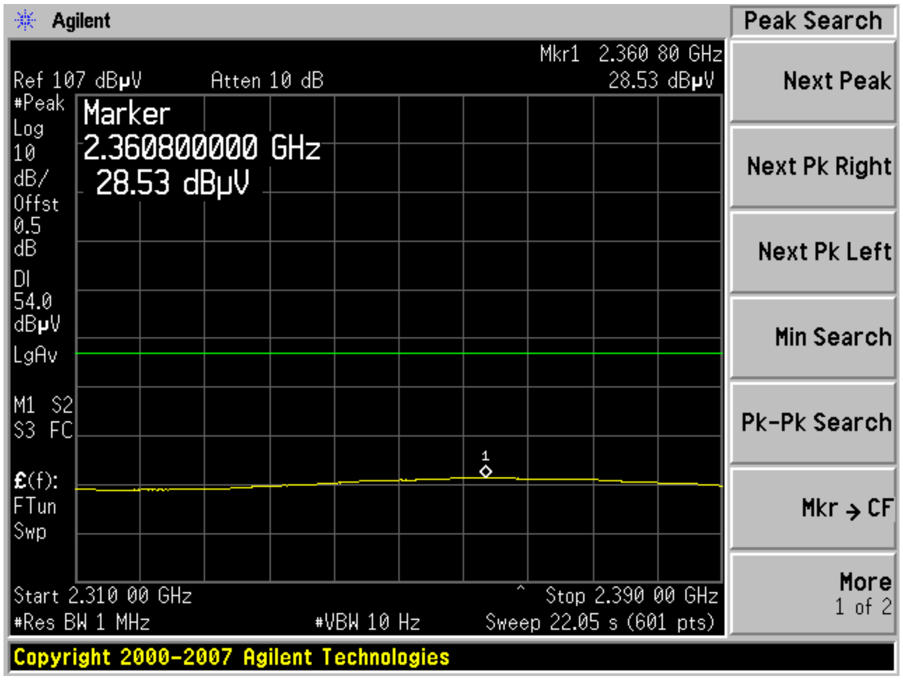
- **Note:** *All Frequencies are 20 dB below the limit or are on the noise floor level*

3) Spurious Emissions in Restricted Band

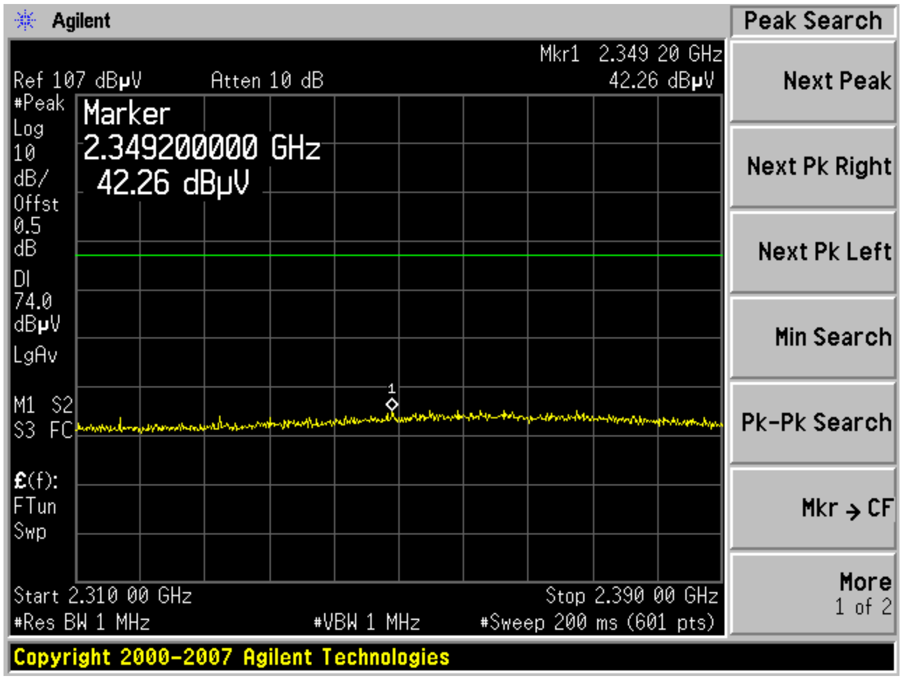
802.11 b, Lowest Channel at Horizontal, Peak



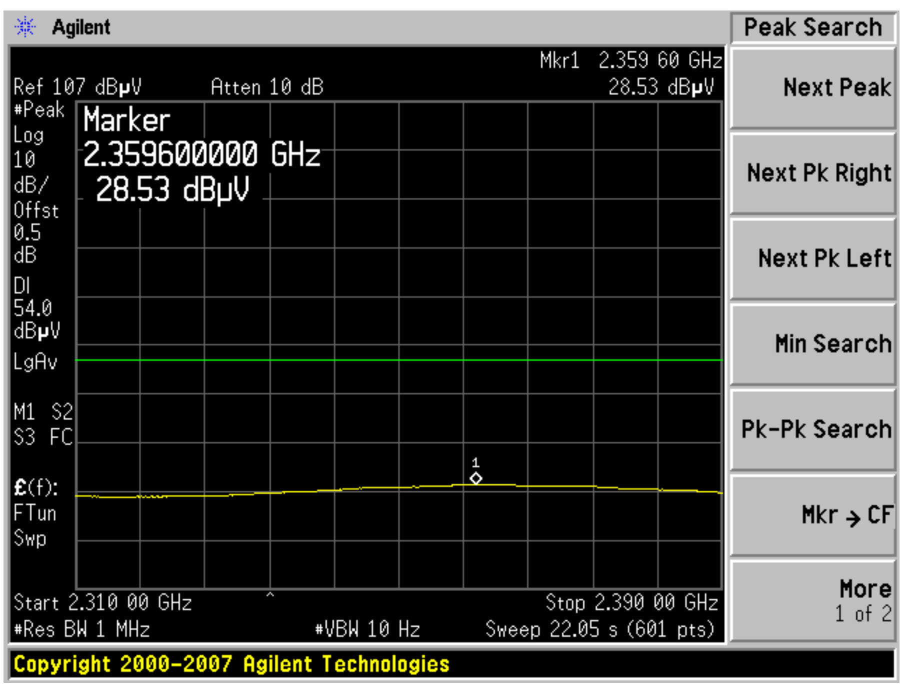
802.11b, Lowest Channel at Horizontal, Average



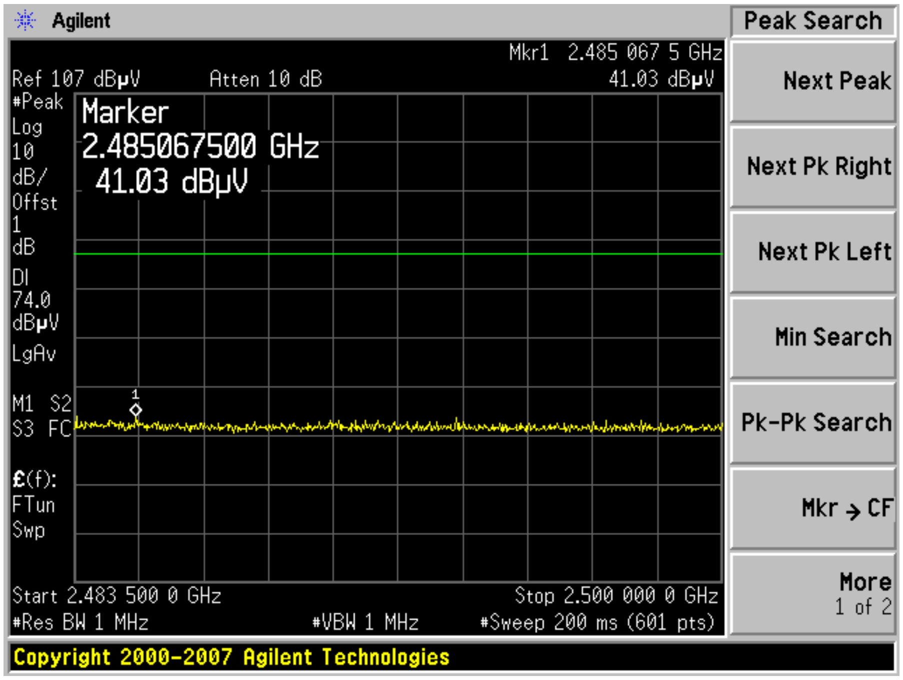
802.11b, Lowest Channel at Vertical, Peak



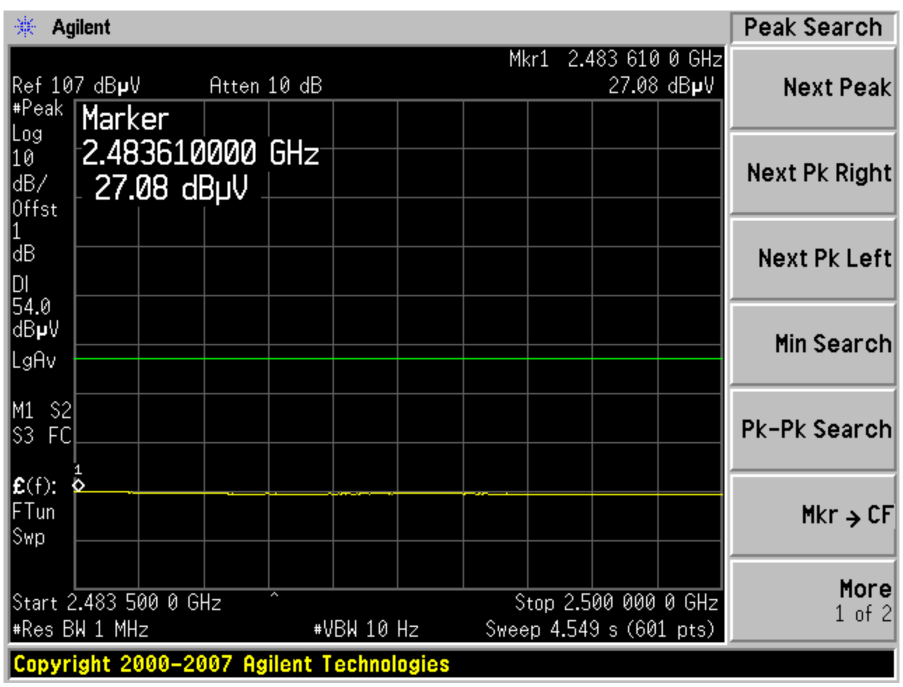
802.11b, Lowest Channel at Vertical, Average



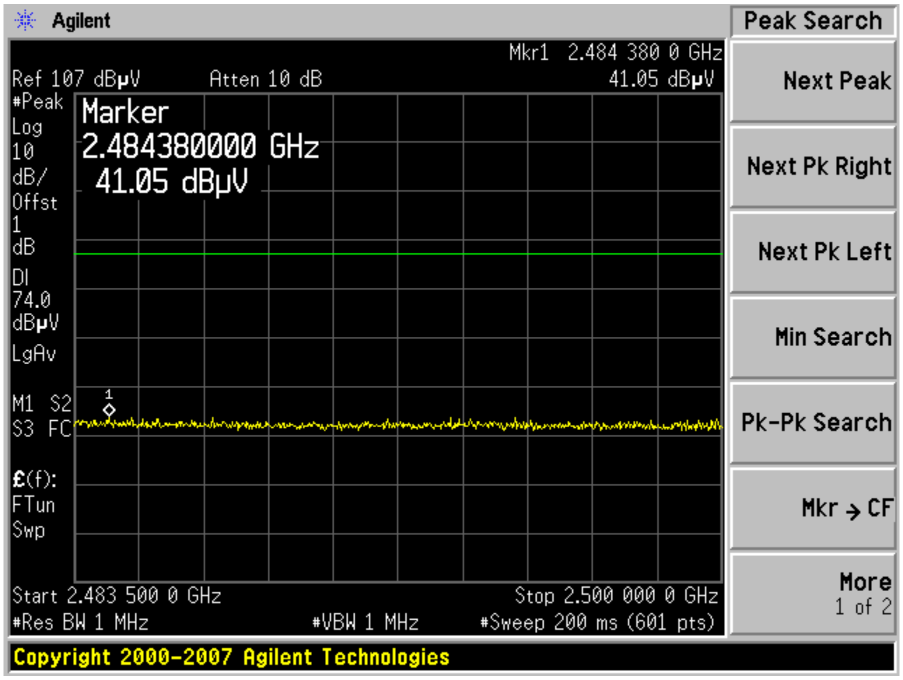
802.11b, Highest Channel at Horizontal, Peak



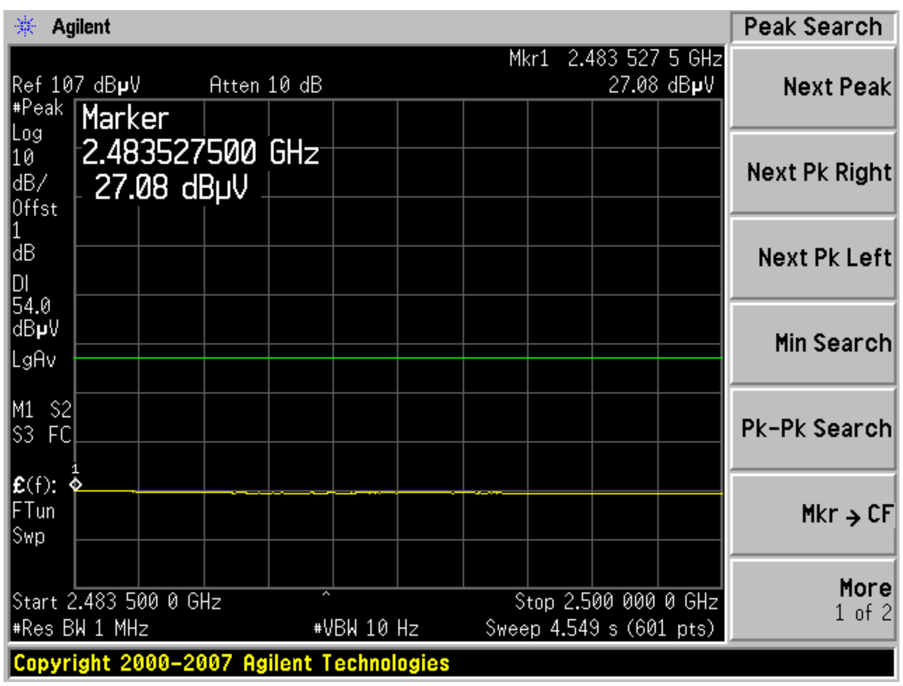
802.11b, Highest Channel at Horizontal, Average



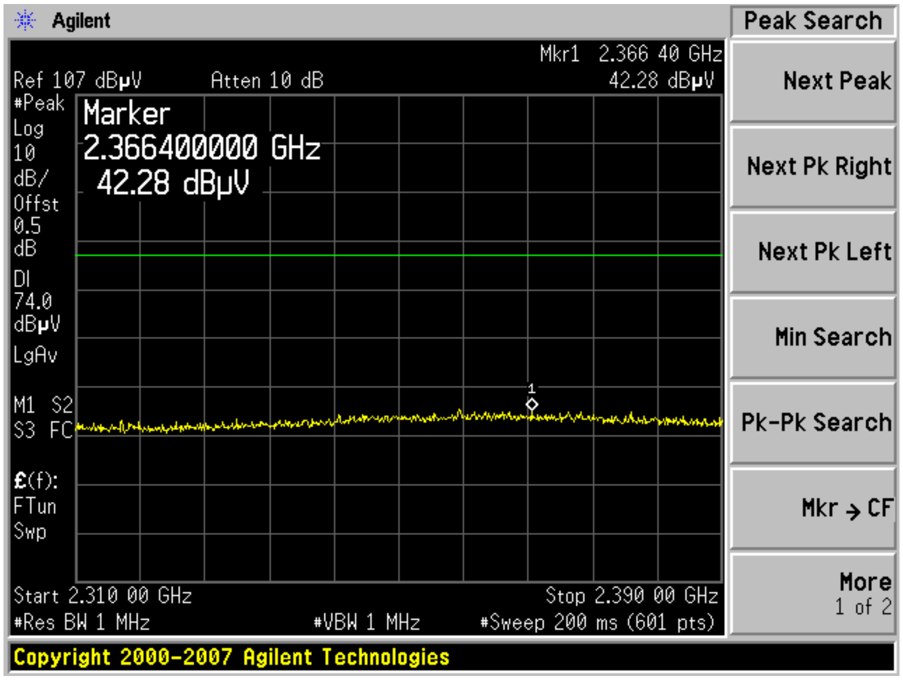
802.11b, Highest Channel at Vertical, Peak



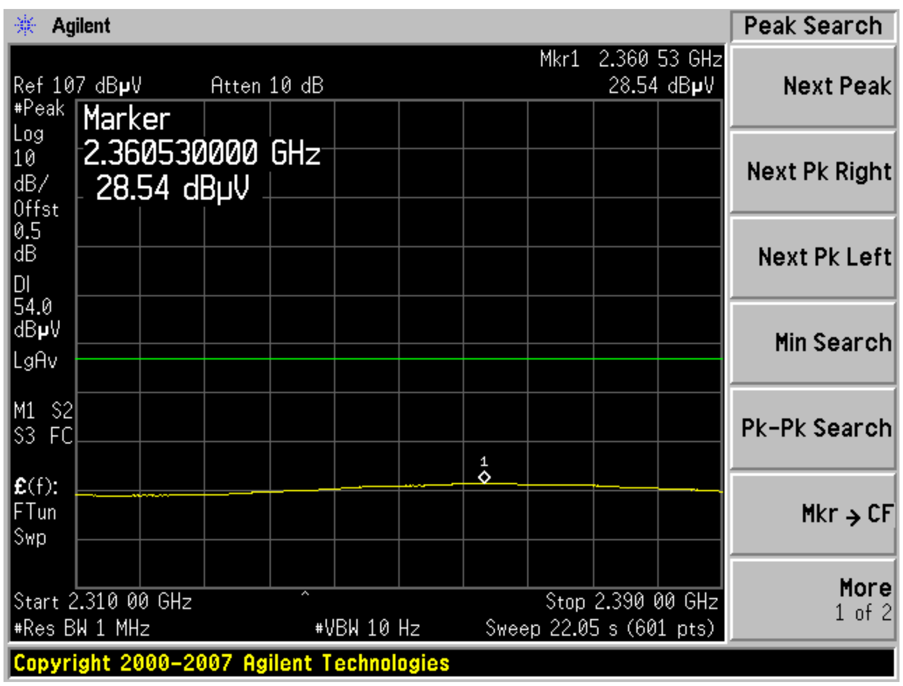
802.11b, Highest Channel at Vertical, Average



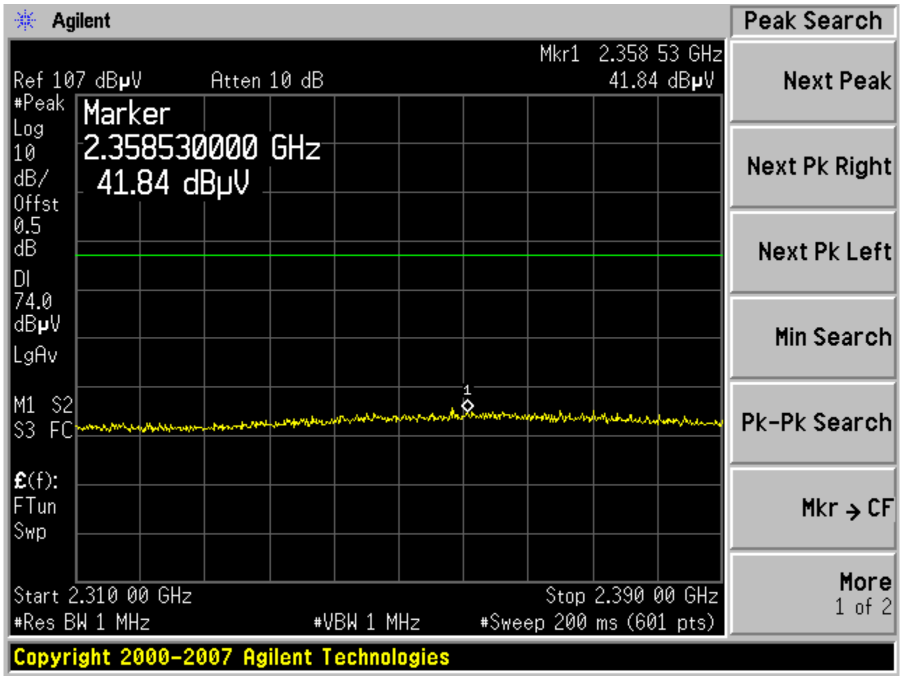
802.11 g, Lowest Channel at Horizontal, Peak



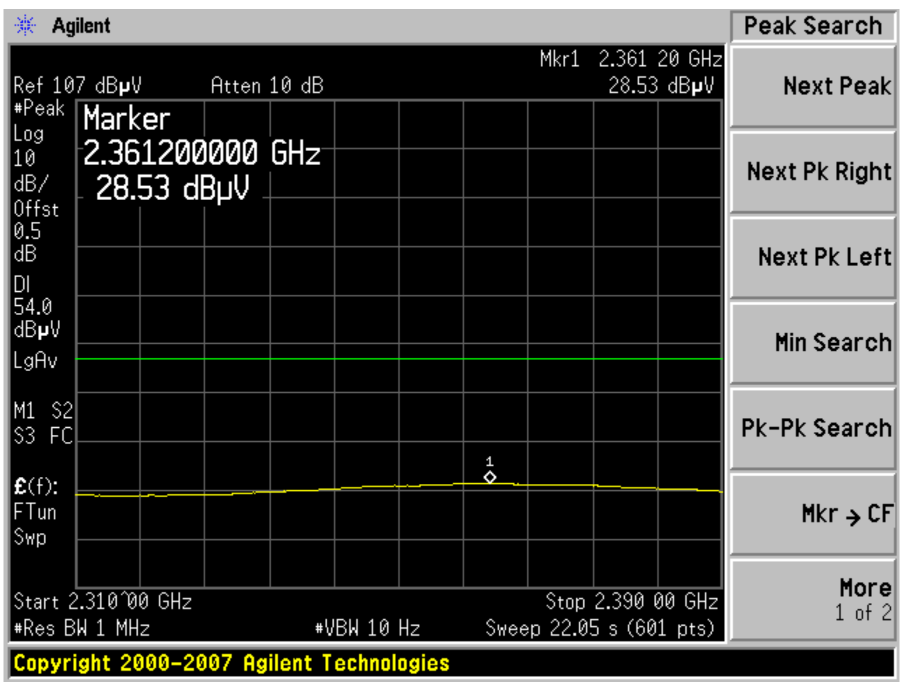
802.11g, Lowest Channel at Horizontal, Average



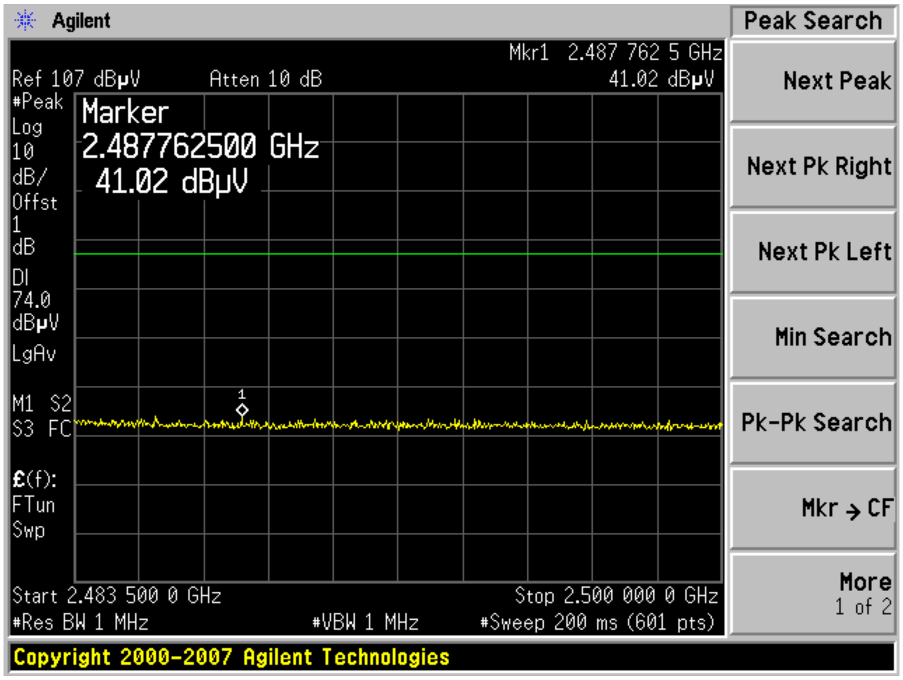
802.11g, Lowest Channel at Vertical, Peak



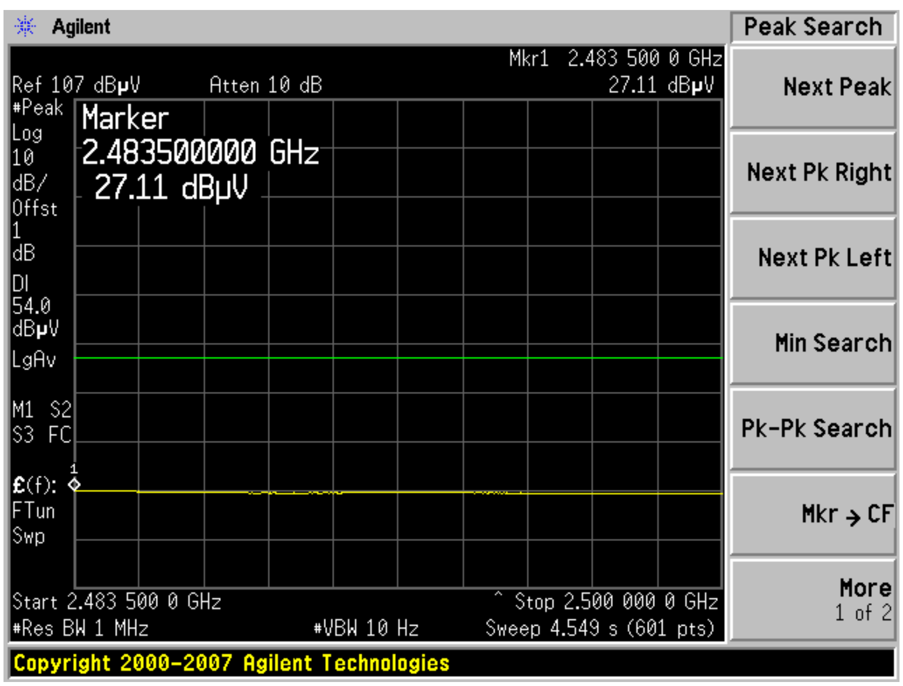
802.11g, Lowest Channel at Vertical, Average



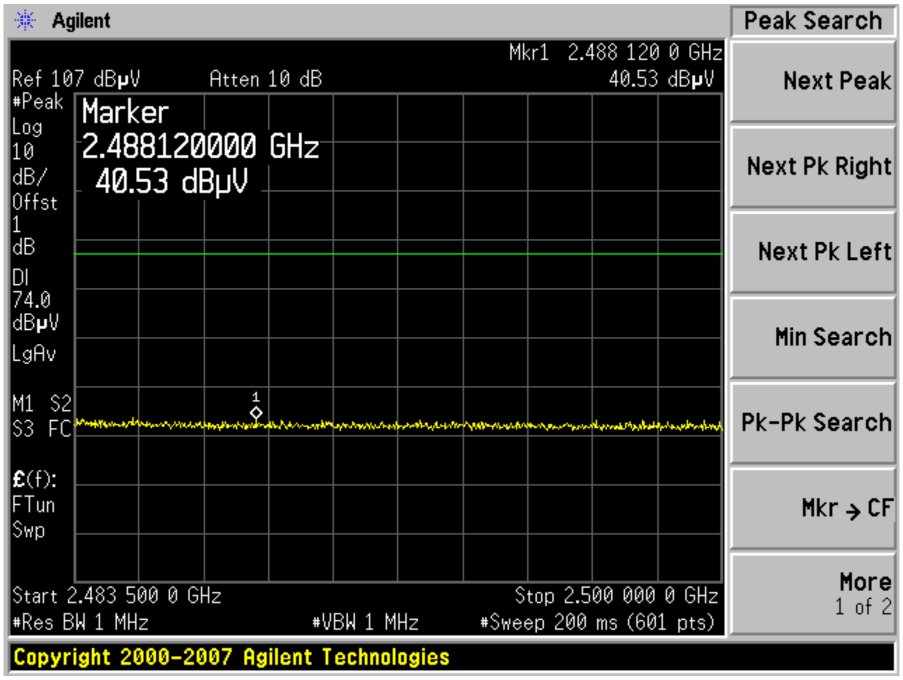
802.11g, Highest Channel at Horizontal, Peak



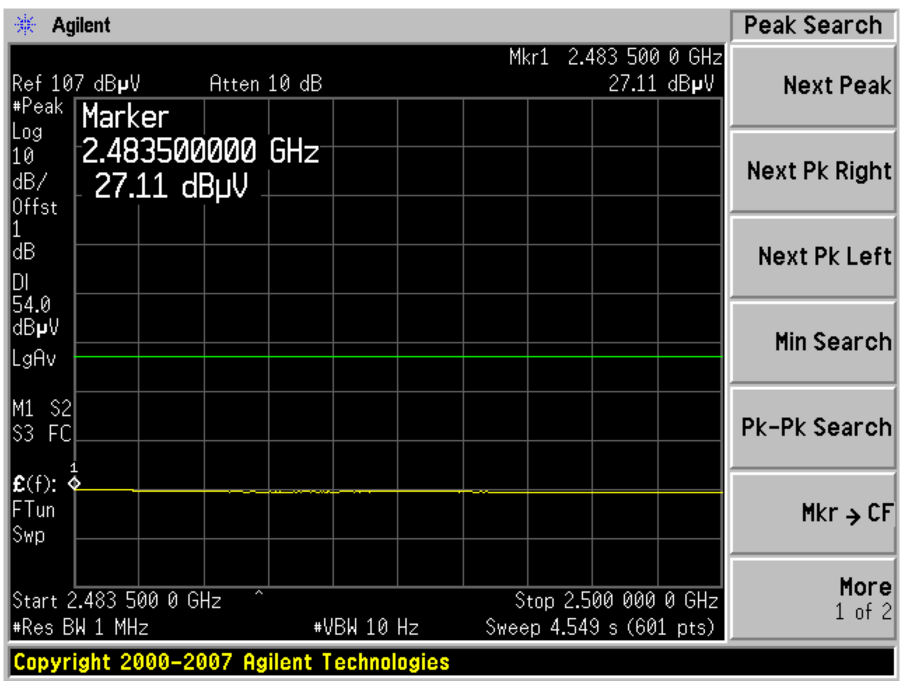
80.211g, Highest Channel at Horizontal, Average



802.11g, Highest Channel at Vertical, Peak



802.11g, Highest Channel at Vertical, Average



9 FCC §15.247(a) & IC RSS-210 §A8.2 – 6 dB & 99% Emission Bandwidth

9.1 Applicable Standard

According to FCC §15.247(a)(2) and IC RSS-210 §A8.2 (a), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

9.2 Measurement Procedure

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

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-07-23

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

9.4 Test Environmental Conditions

Temperature:	18~25 °C
Relative Humidity:	30~50 %
ATM Pressure:	101.1-102.8kPa

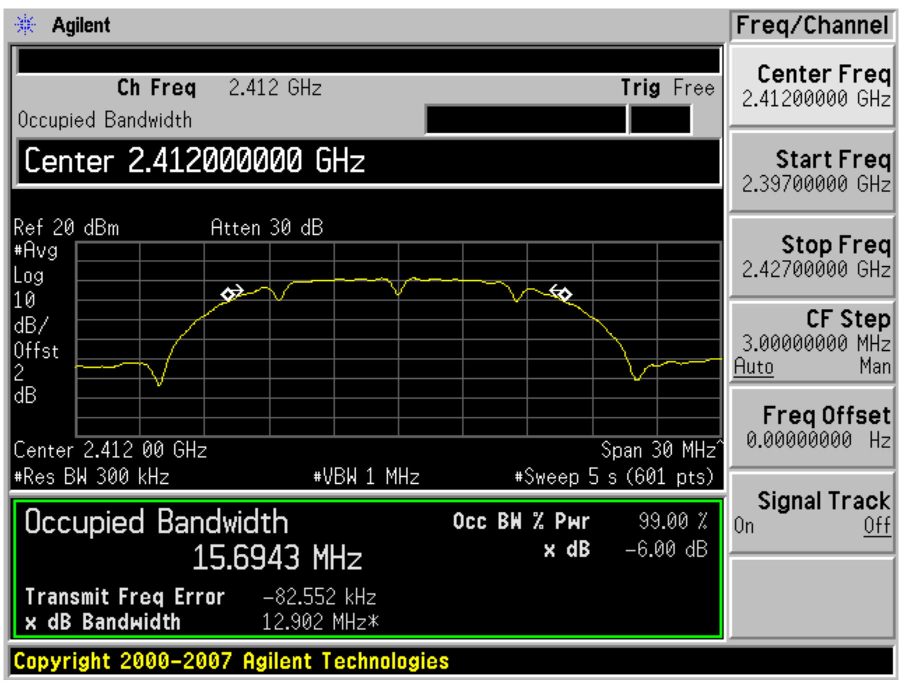
The testing was performed by Jack Liu from 2010-04-06 to 2010-06-06.

9.5 Measurement Results

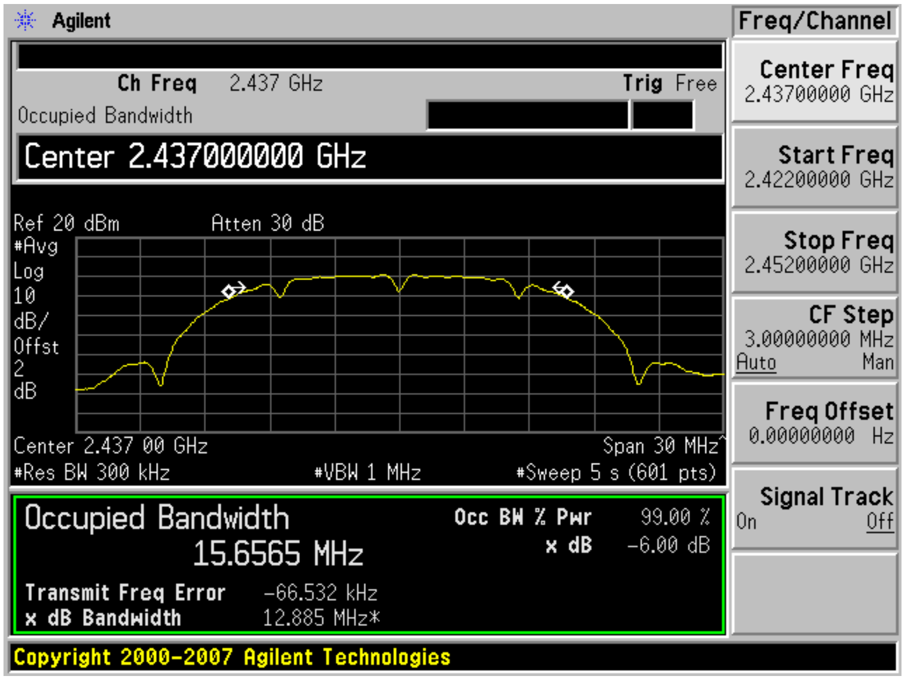
Mode	Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (kHz)	Results
802.11b	Low	2412	12.902	15.6943	> 500	Compliant
	Middle	2437	12.885	15.6565	> 500	Compliant
	High	2462	12.873	15.6432	> 500	Compliant
802.11g	Low	2412	16.716	16.5445	> 500	Compliant
	Middle	2437	16.719	16.5401	> 500	Compliant
	High	2462	16.704	16.5363	> 500	Compliant

Please refer to the following plots for detailed test results:

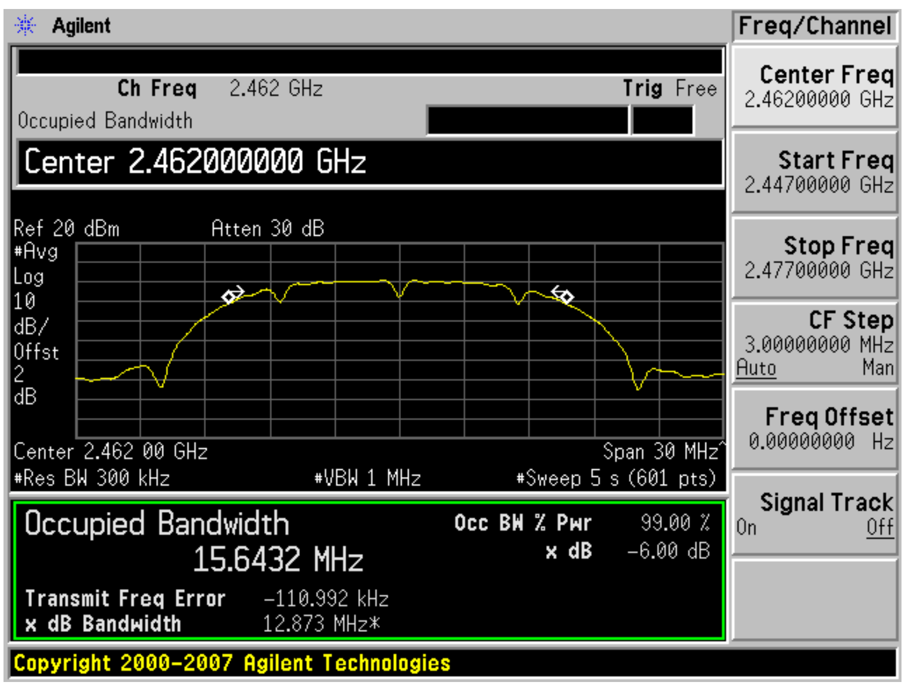
802.11b, Low Channel 2412 MHz



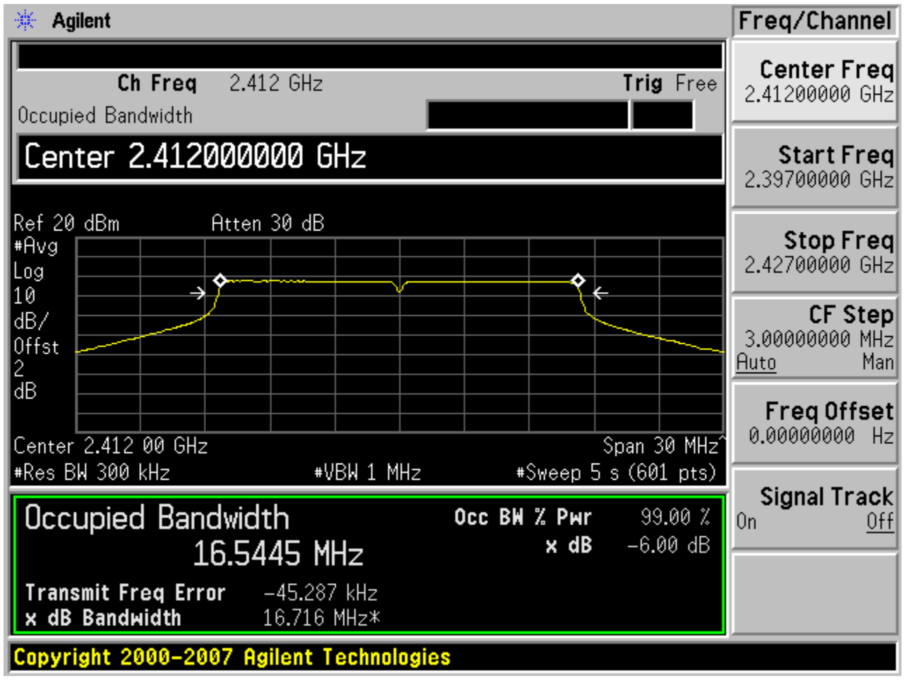
802.11b, Middle Channel 2437 MHz



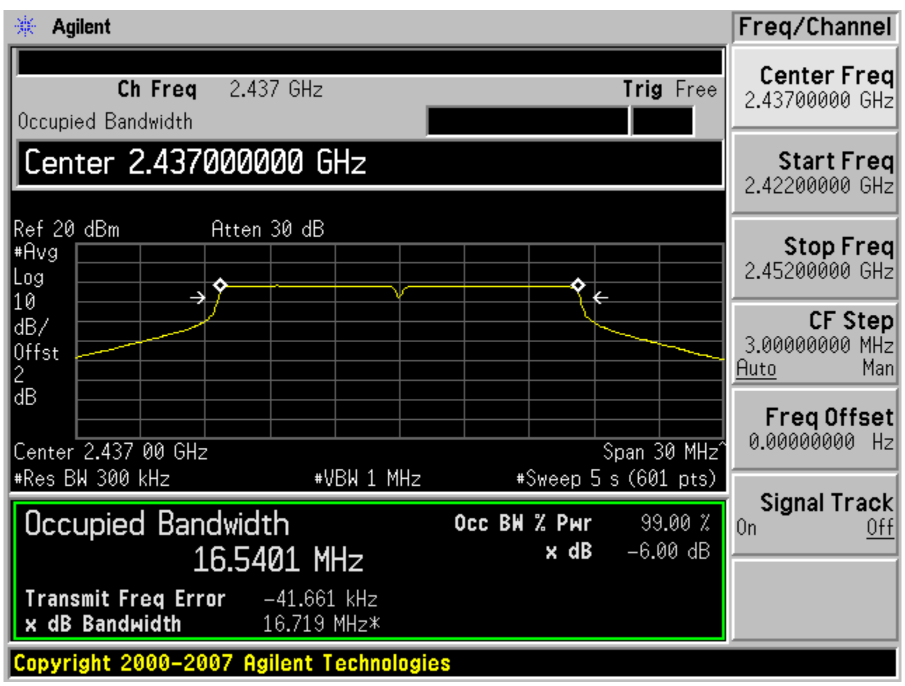
802.11b, High Channel 2462 MHz



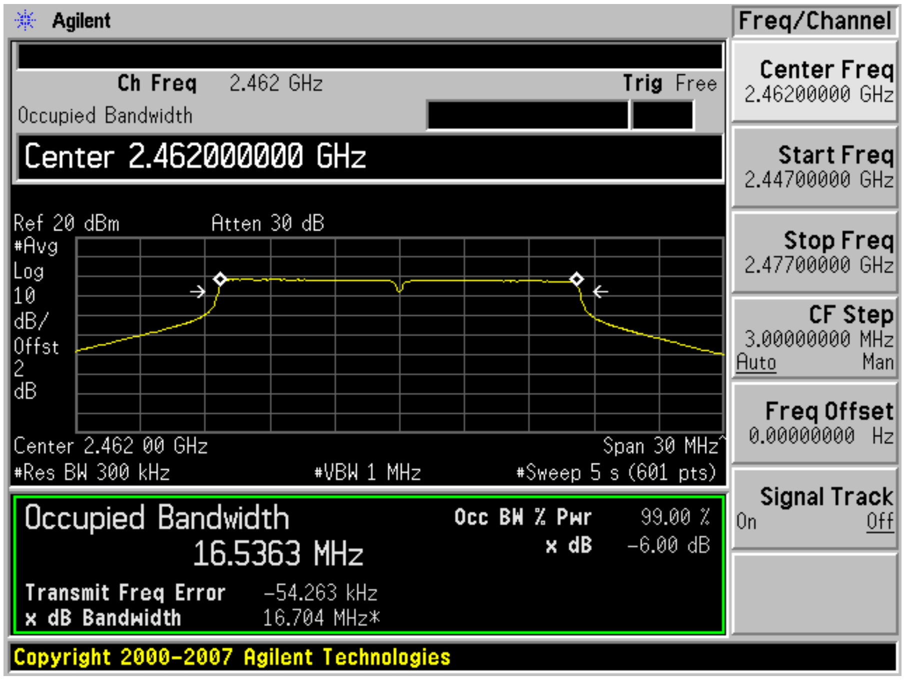
802.11 g, Low Channel 2412 MHz



802.11g, Middle Channel 2437 MHz



802.11g, High Channel 2462 MHz



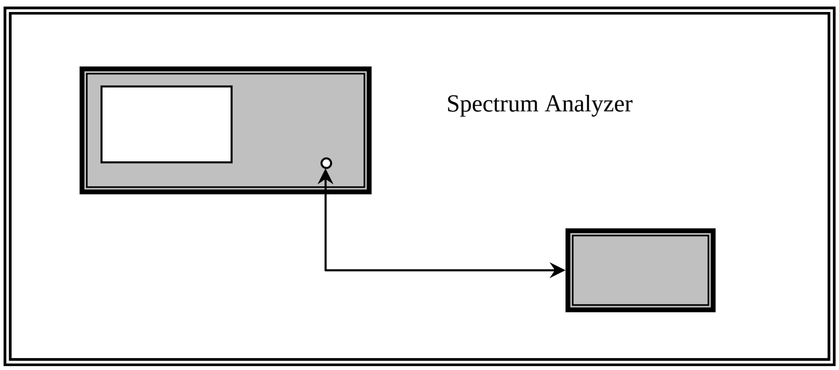
10 FCC §15.247(b) & IC RSS-210 §A8.4- Maximum Peak Output Power

10.1 Applicable Standard

According to FCC §15.247(b)(3) and IC RSS-210 §A8.4 (4), for systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

10.2 Measurement Procedure

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



10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-07-23

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

10.4 Test Environmental Conditions

Temperature:	18~25 °C
Relative Humidity:	30~50 %
ATM Pressure:	101.1-102.8kPa

The testing was performed by Jack Liu from 2010-04-06 to 2010-06-06.

10.5 Measurement Results

Radio Mode	Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11 b	Low	2412	15.43	30	-14.57
	Mid	2437	14.87	30	-15.13
	High	2462	14.93	30	-15.07
802.11 g	Low	2412	15.05	30	-14.95
	Mid	2437	14.89	30	-15.11
	High	2462	14.87	30	-15.13

11 FCC §15.247(d) & IC RSS-210 §A8.5 – Band Edges Emissions

11.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency band 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. Attenuation below the general limits specified in §15.209(a) is not required.

According to IC RSS-210 §A 8.5.In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

11.2 Measurement Procedure

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

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-07-23

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

11.4 Test Environmental Conditions

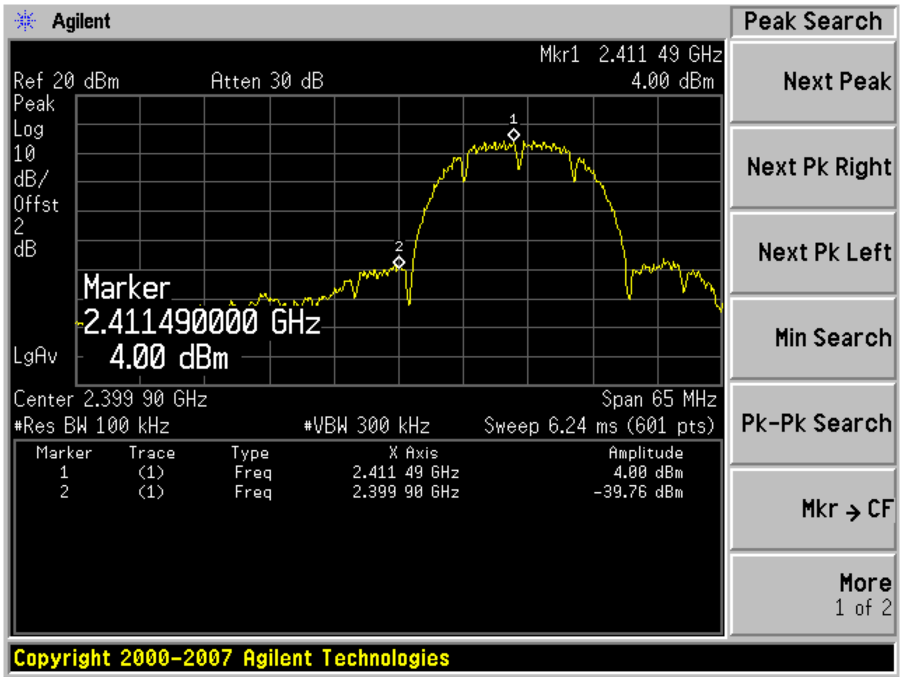
Temperature:	18~25 °C
Relative Humidity:	30~50 %
ATM Pressure:	101.1-102.8kPa

The testing was performed by Jack Liu from 2010-04-06 to 2010-06-06.

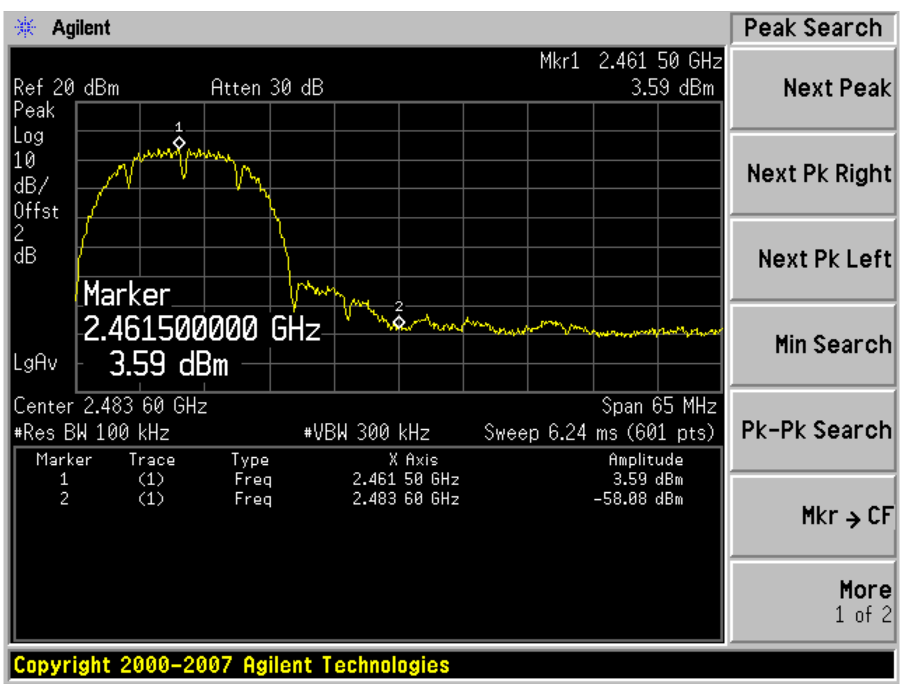
11.5 Measurement Results

Please refer to following pages for plots of band edge.

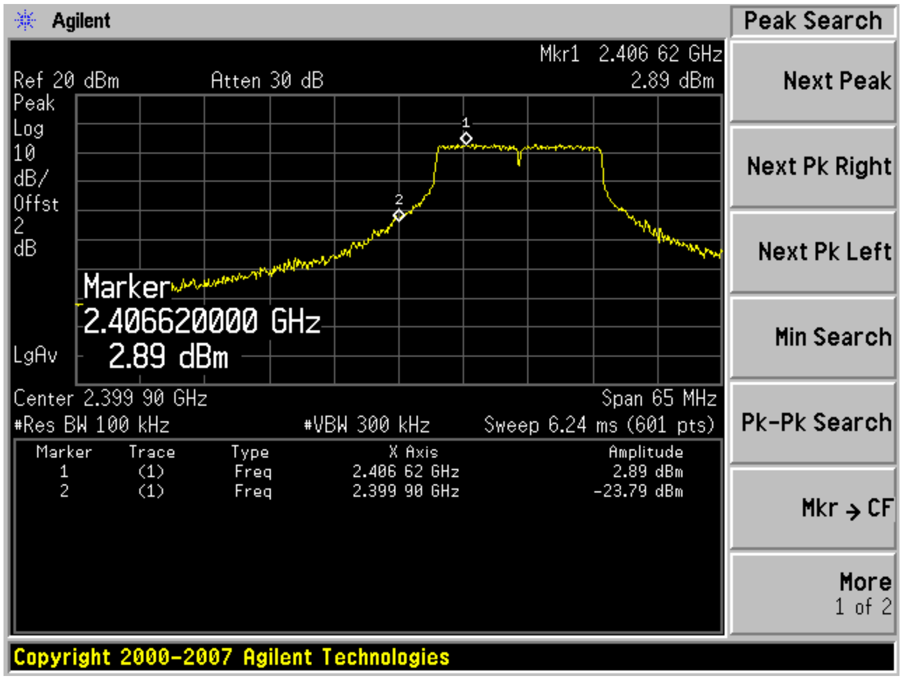
802.11b, Low Band Edge



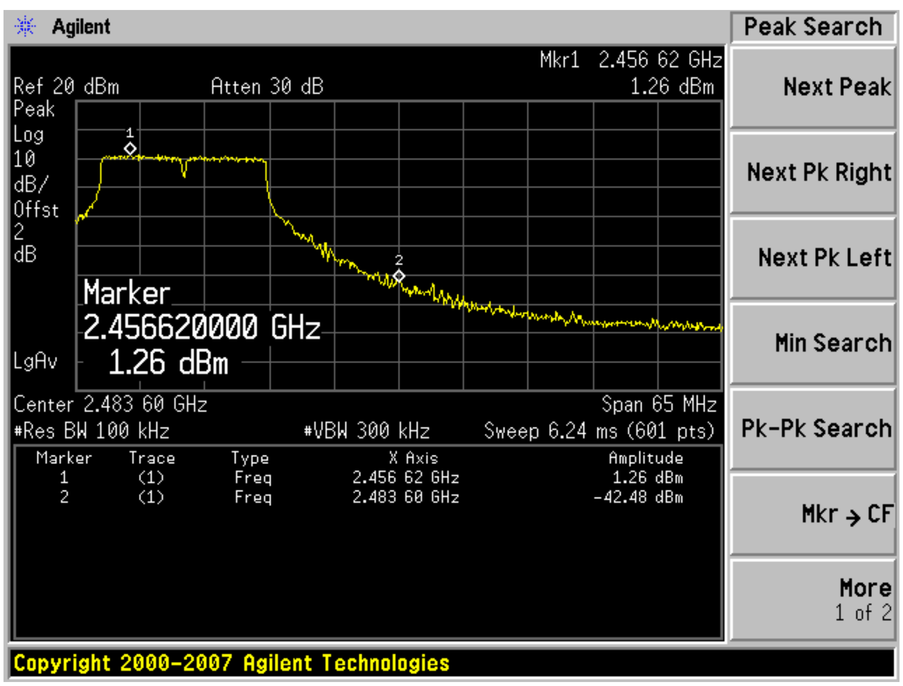
802.11b, High Band Edge



802.11g, Low Band Edge



802.11g, High Band Edge



12 FCC §15.247(e) & IC RSS-210 §A8.2 (b) - Power Spectral Density

12.1 Applicable Standard

According to FCC §15.247 (e) and IC RSS-210 §A8.2 (b) , for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

12.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Repeat above procedures until all frequencies measured were complete.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-07-23

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

12.4 Test Environmental Conditions

Temperature:	18~25 °C
Relative Humidity:	30~50 %
ATM Pressure:	101.1-102.8kPa

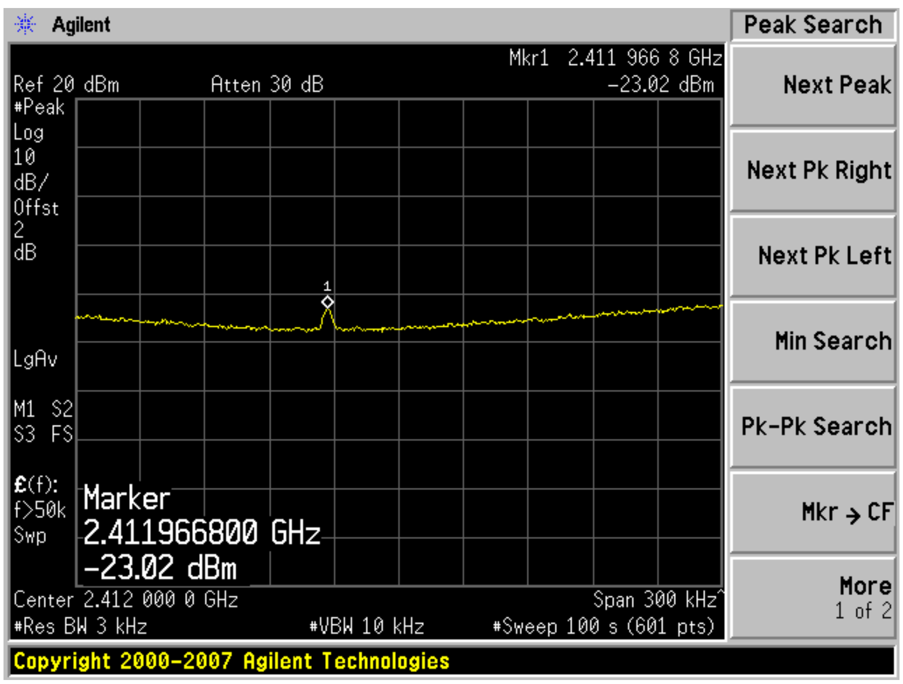
The testing was performed by Jack Liu from 2010-04-06 to 2010-06-06.

12.5 Measurement Results

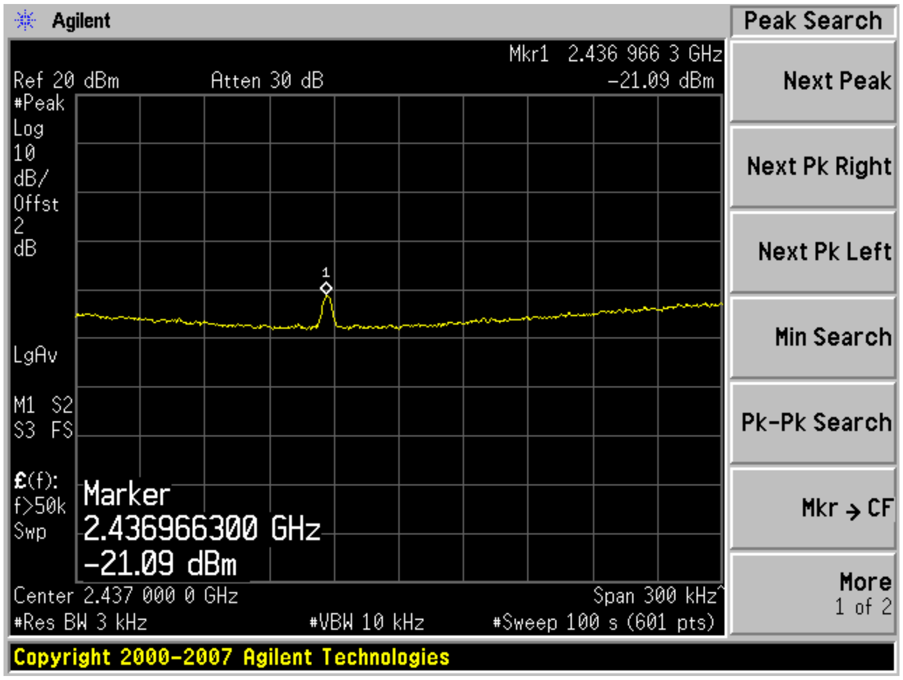
Radio Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm)	Result
802.11 b	Low	2412	-23.02	8	Compliant
	Mid	2437	-21.09	8	Compliant
	High	2462	-21.53	8	Compliant
802.11 g	Low	2412	-14.28	8	Compliant
	Mid	2437	-17.75	8	Compliant
	High	2462	-20.26	8	Compliant

Please refer to the following plots for detailed test results:

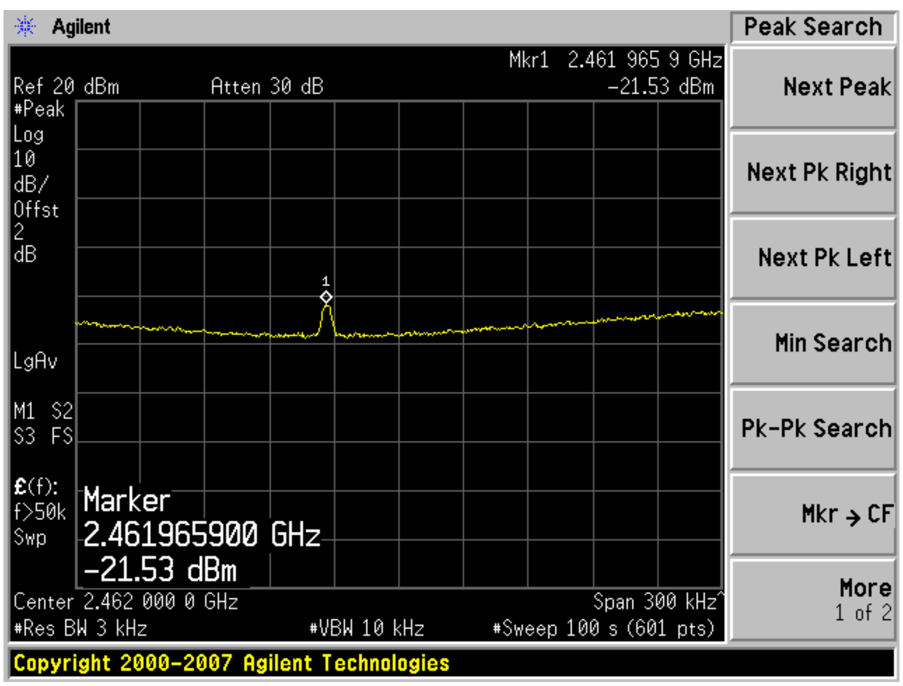
802.11 b, Low Channel 2412 MHz



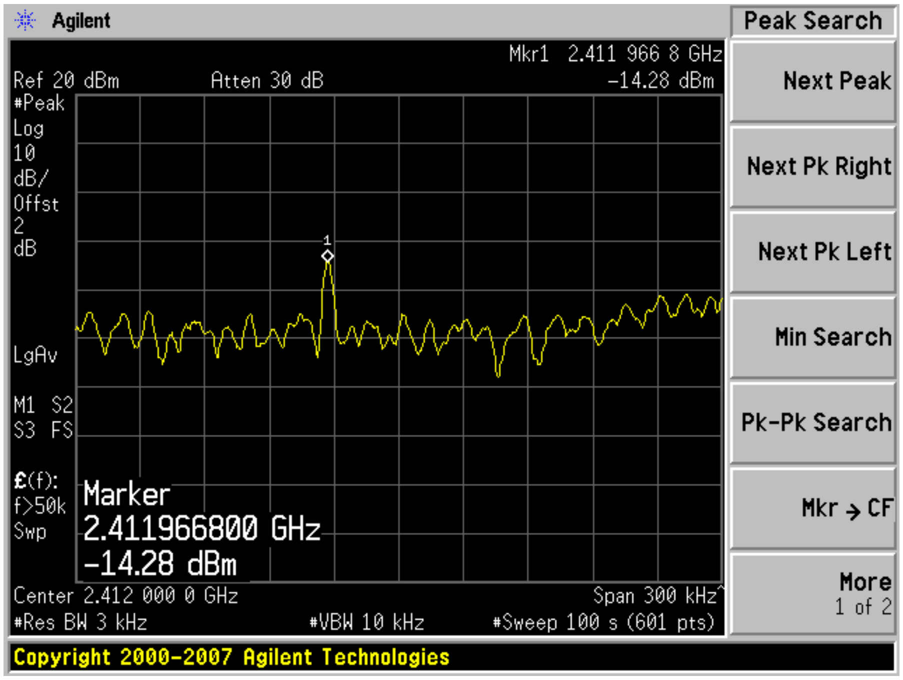
802.11 b, Middle Channel 2437 MHz



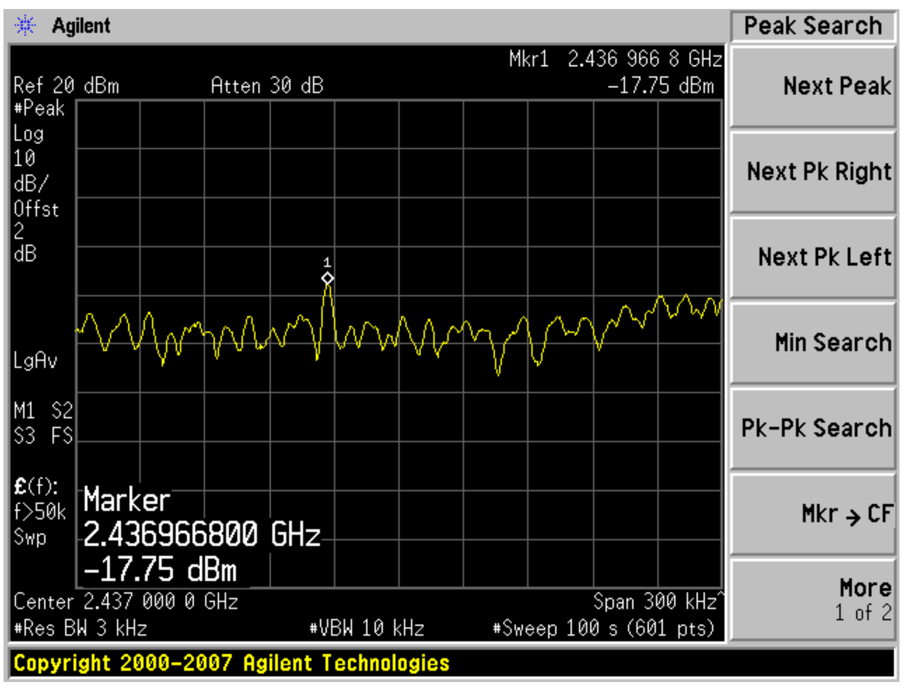
802.11 b, High Channel 2462 MHz



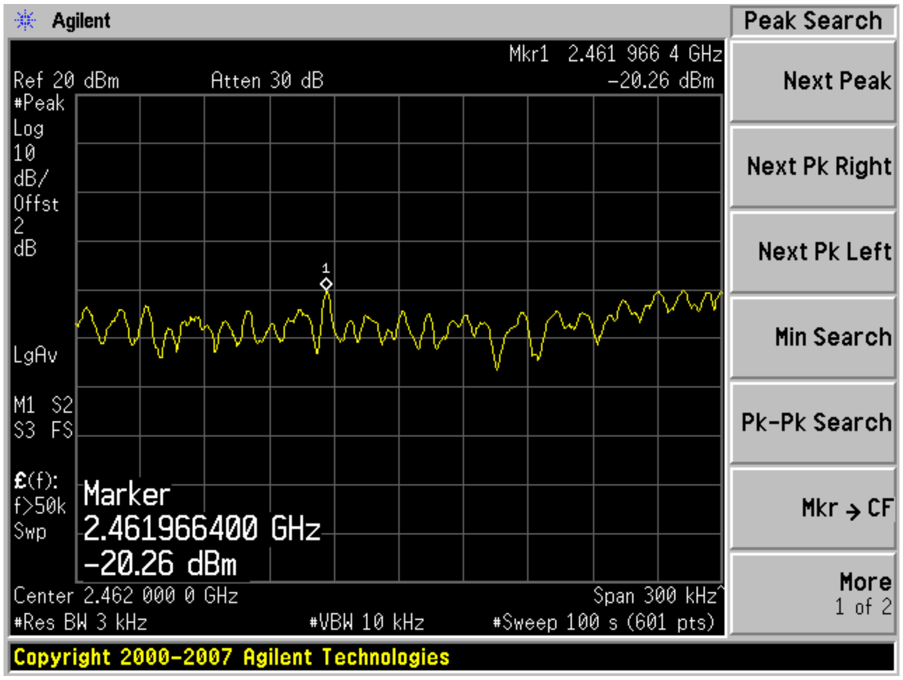
802.11 g, Low Channel 2412 MHz



802.11 g, Middle Channel 2437 MHz



802.11 g, High Channel 2462 MHz



13 FCC §15.109 & IC RSS-Gen §6 - Receiver Radiated Spurious Emissions

13.1 Applicable Standards

FCC §15.109 and IC RSS-Gen §6

13.2 EUT Setup

The radiated emissions tests were performed in the 3 meter chamber, using the setup in accordance with ANSI C63.4-2003.

13.3 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emissions was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

13.4 Corrected Amplitude & Margin Calculation

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

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

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

Margin = Corrected Amplitude - Limit

13.5 Test Equipment Lists and Details

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2009-06-05
Sunol Science Corp	Combination Antenna	JB3	A0020106-2	2009-08-20
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2010-03-24
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
A.R.A Inc	Horn antenna	DRG-1181A	1132	2009-10-27
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-07-23
HP	Pre Amplifier	8449B	3147A00400	2010-02-01

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

13.6 Test Environmental Conditions

Temperature:	18~25 °C
Relative Humidity:	30~50 %
ATM Pressure:	101.1-102.8kPa

**The testing was performed by Jack Liu from 2010-04-06 to 2010-06-06.*

13.7 Summary of Test Results

According to the test data, the EUT complied with the RSS-210, with the closest margins from the limit listed below:

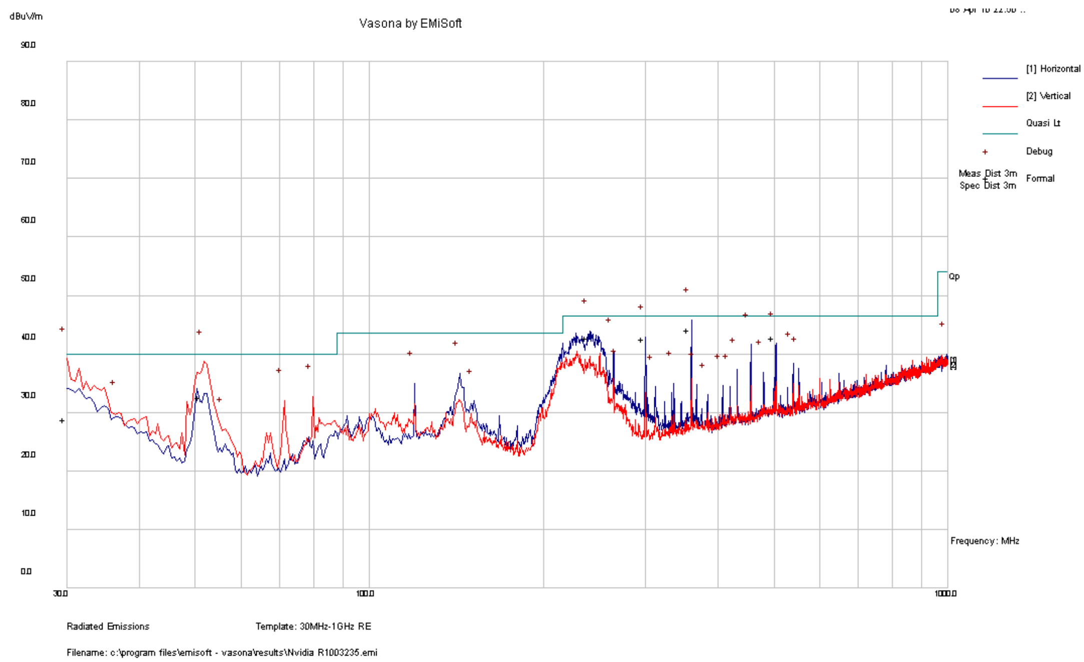
Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-2.3	360.0107	Horizontal	30 MHz to 1000 MHz
-	-	-	1GHz – 25GHz

- **Note:** *All Frequencies are 20 dB below the limit or are on the noise floor level*

Please refer to the following table and plots for specific test result details

13.8 Measurement Results

1) 30 MHz -1 GHz, measured at 3 meters



Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
360.0107	44.2	92	H	122	46	-2.3
239.9968	42.74	122	H	207	46	-3.76
503.9962	42.71	171	H	152	46	-3.79
299.989	42.57	92	H	240	46	-3.93
51.42636	32.54	153	V	290	40	-7.46
30	28.88	122	V	169	40	-11.12

2) 1 – 25 GHz, measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC & IC		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
-	-	-	-	-	-	-	-	-	-	-	-

- **Note:** *All Frequencies are 20 dB below the limit or are on the noise floor level*