Lab Code: 200167-0

FCC PART 15 SUBPART C
IC RSS-210, ISSUE 8, DECEMBER 2010

TEST AND MEASUREMENT REPORT

For

Microsoft Corporation

One Microsoft Way
Redmond, WA 98052, USA

FCC ID: C3K1501
IC: 3048A-1501

Report Type:	**Product Type:**
Original Report	802.11 b/g/n WiFi module

Test Engineers:	Jack Liu Quinn Jiang
Report Number:	R1109011-247 Rev C
Report Date:	2012-03-02
Reviewed By:	Victor Zhang EMC/RF Lead
Prepared By: **(84)**	Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732-9164

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1109011-247	Original Report	2011-09-27
1	R1109011-247 Rev A	Update Internal configuration Detail	2012-01-24
2	R1109011-247 Rev B	Update Report with Correct Version	2012-02-24
3	R1109011-247 Rev C	Update Section 4.3	2012-03-02

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Microsoft Corporation*, and their product FCC ID: C3K1501, IC: 3048A-1501, model: *1501* which will henceforth be referred to as the EUT (Equipment Under Test). The EUT is an 802.11 b/g/n WiFi module

1.2 Mechanical Description of EUT

The "EUT" measures *51.50mm (L) x 32.46mm (W) x 13 mm (H)*, and weighs approximately *6.5*g.

The test data gathered are from typical production sample with MAC number: 9439E5537190 for main antenna Conducted Test.
The test data gathered are from typical production sample with MAC number: 9439E5537188 for AUX Test.

The test data gathered are from typical production sample with MAC number: 9439E553718C for Radiated Test.

1.3 Objective

This report is prepared on behalf of *Microsoft 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 8, December 2010.

The objective is to determine compliance with FCC Part 15.247 and IC RSS-210 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)

No Related Submittals.

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.

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 investigated in three orthogonal orientations X, Y & Z, for Main & Auxillary Antenna. It was found that X-Orientation, Main Antenna is the worst-case; therefore, all the final testing was performed on the Main Antenna with EUT laid down in the X-Orientation

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.

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	2442/1	2472/1
802.11g	20	2412/6	2442/6	2472/6
802.11n HT20	20	2412/MCS0	2442/ MCS0	2472/ MCS0
802.11n HT40	40	2422/MCS0	2442/ MCS0	2462/ MCS0

2.2 EUT Exercise Software

The test utility software used MFG-USB-8782-FC8-X86-1.1.7.18-14-1.11.p44 was provided by client and was verified by Jack Liu to comply with the standard requirements being tested against.

2.3 Special Equipment

N/A

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Marvell	Module Adapter	Module Adapter Board v2.0	14727`PAC015
IBM	Laptop	R51	18308MN
Dell	Laptop	Vostro 1000	42376521709
Dell	Laptop	D600	37140867901
NETGEAR	Router	N750	2KE1167A00ECE

2.6 Power Supply List and Details

Manufacturer	Description	Model No.	Serial No.
Globalscale	Sheeva Plug	003-SP1001	1043-002049

2.7 EUT Internal Configuration Details

Manufacturers	Description	Model No.	Serial No.
Microsoft	802.11 b/g/n WiFi Module	1501	9439E553718C

2.8 External I/O Cabling List and AC Cord

Cable Description	Length (m)	From	To
RF cable	<1m	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §15.247(i), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.4	Antenna Requirement	Compliant
FCC §15.207(a) IC RSS-Gen §7.2.2	Conducted Emissions	Compliant
FCC §15.209 IC RSS-210 §2.6	Spurious Emissions at Antenna Port	Compliant
FCC §15.205 IC RSS-210 §2.2	Restricted Bands	Compliant
FCC §15.209, §15.247 IC RSS-210 §2.6	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) IC RSS-210 §A8.2	6 dB Bandwidth	Compliant
FCC §15.247(b)(3) IC RSS-210 §A8.4	Maximum Peak Output Power	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(e) IC RSS-210 §A8.2(b)	Power Spectral Density	Compliant
IC RSS-210 §2.6 & RSS-Gen §4.10	Receiver Spurious Emission	Compliant

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

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 IC 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

Output power at antenna input terminal (dBm):	18.44
Output power at antenna input terminal (mW):	69.823
Prediction distance (cm):	20
Prediction frequency (MHz):	2457
Maximum Antenna Gain, typical (dBi):	1.1
Maximum Antenna Gain (numeric):	1.29
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0179
Power density of prediction frequency at 20.0 cm (W/m^2):	0.179
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 0.0179mW/cm2 (0.179W/m2).Limit is 1mW/cm2 (10W/m2).

5 FCC §15.203 & IC RSS-Gen §7.1.4 – Antenna Description

5.1 Applicable Standard

According to FCC §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to IC RSS-Gen §7.1.4: Transmitter Antenna

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

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 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 RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

5.2 Antenna Connector Construction

The radio utilizes two antennas: Main Antenna – Printed balanced Metamaterial antenna & Auxiliary Antenna – Printed Metamaterial antenna. Below are the Max Antenna Gains:

Main Antenna:	+1.1 dBi
Auxiliary Antenna:	-0.2 dBi

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

6.1 Applicable Standards

As per FCC §15.207 and 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 §15.207 and IC RSS-Gen §7.2.2 limits.

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

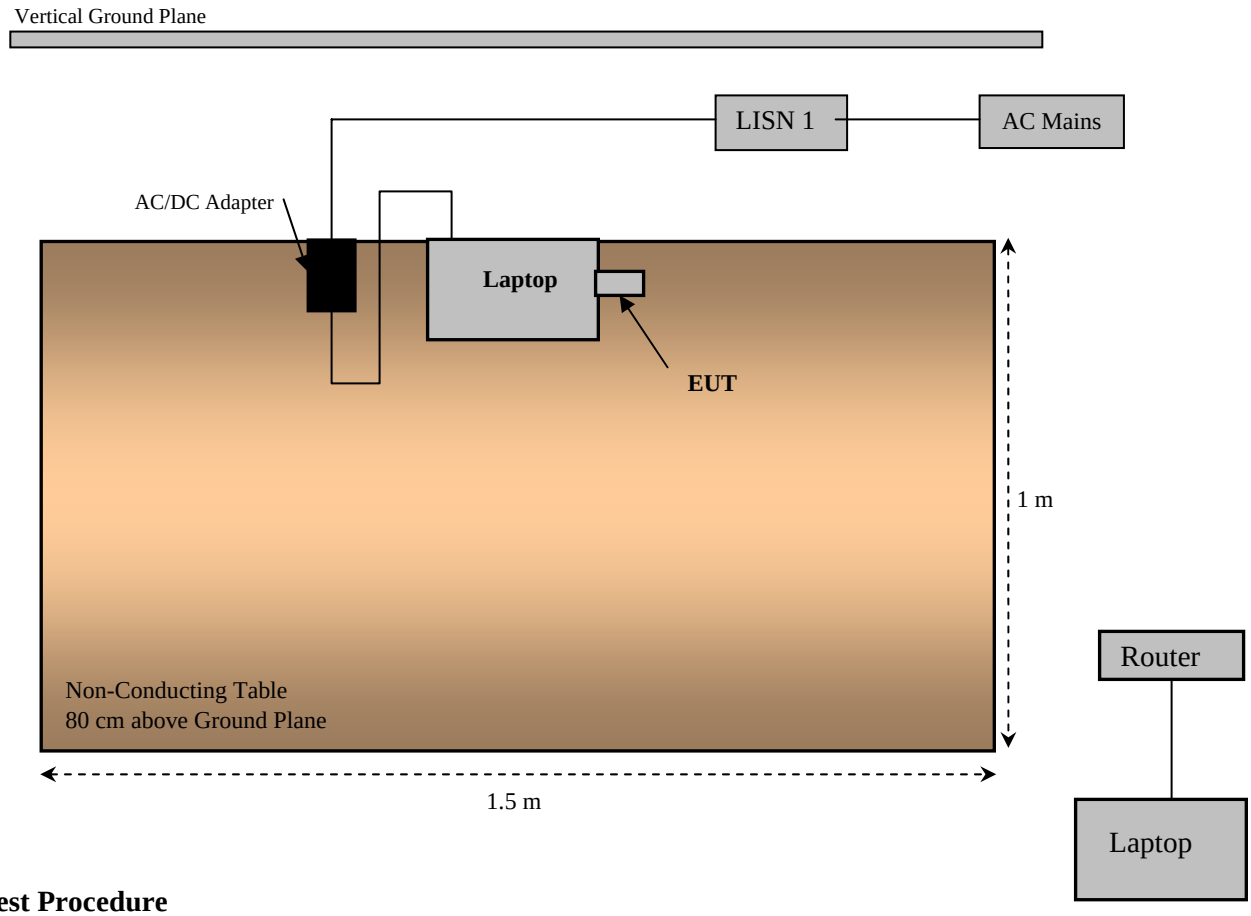
The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2011-04-14
Solar Electronics	LISN	9252-R-24-BNC	511205	2011-06-25
TTE	Filter, High Pass	H9962-150K-50-21378	K7133	2011-06-10

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:	22 °C
Relative Humidity:	49%
ATM Pressure:	101.3kPa

The testing was performed by Hieu Song NguyenPham from 2011-09-10 at 5meter chamber2.

6.7 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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

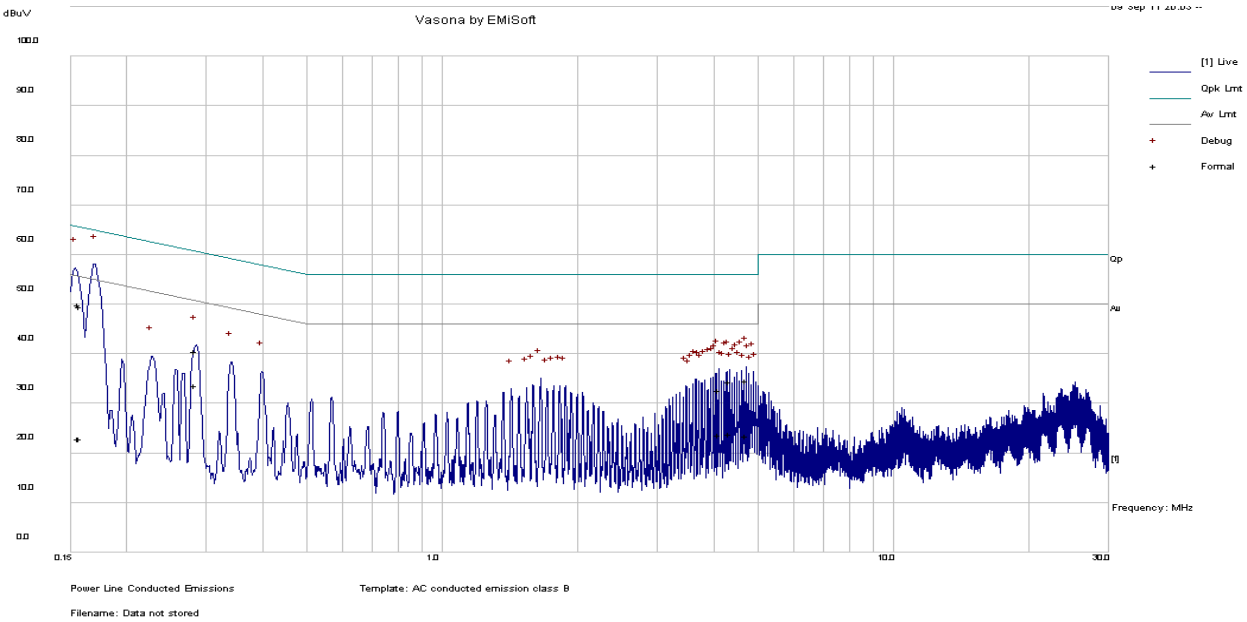
According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits, with the margin reading of:

Transceiver Mode

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-7.56	0.170863	Neutral	0.15 to 30

6.9 Conducted Emissions Test Plots and Data

120 V, 60 Hz – Line



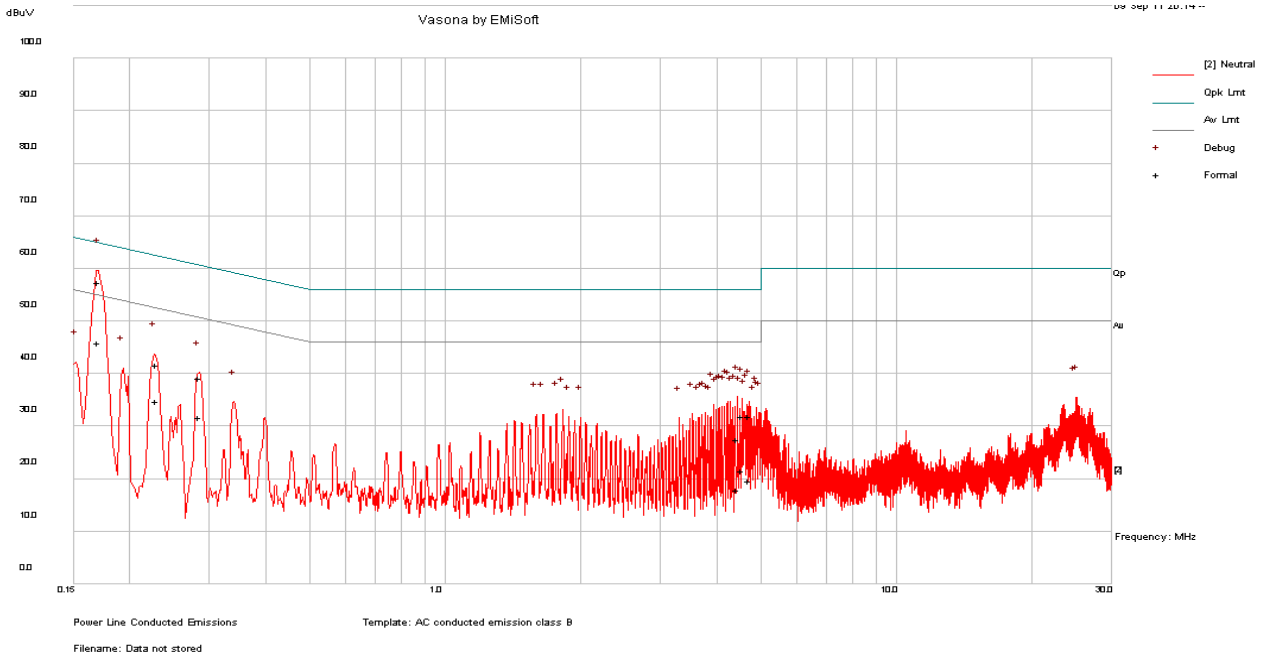
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.156697	49.87	Line	65.64	-15.77
0.157385	49.53	Line	65.6	-16.07
0.283416	40.54	Line	60.72	-20.18
4.724978	34.54	Line	56	-21.46
4.327754	34.39	Line	56	-21.61
4.10042	32.61	Line	56	-23.39

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.283416	33.69	Line	50.72	-17.03
4.327754	23.89	Line	46	-22.11
4.10042	23.71	Line	46	-22.29
4.724978	23.49	Line	46	-22.51
0.156697	22.99	Line	55.64	-32.65
0.157385	22.83	Line	55.6	-32.77

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.170863	57.35	Neutral	64.92	-7.56
0.229258	41.75	Neutral	62.48	-20.73
0.285342	39.2	Neutral	60.66	-21.46
4.72874	31.96	Neutral	56	-24.04
4.558154	31.94	Neutral	56	-24.06
4.447796	27.43	Neutral	56	-28.57

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.170863	45.89	Neutral	54.92	-9.03
0.229258	34.86	Neutral	52.48	-17.62
0.285342	31.7	Neutral	50.66	-18.96
4.558154	21.56	Neutral	46	-24.44
4.72874	19.7	Neutral	46	-26.30
4.447796	17.88	Neutral	46	-28.12

7 FCC §2.1051, §15.247(d) & IC RSS-210 §A8.5 - Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

For FCC §15.247(d) and IC 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.

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	MY44303352	2011-05-10

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:	23-25 °C
Relative Humidity:	35-50 %
ATM Pressure:	101-103kPa

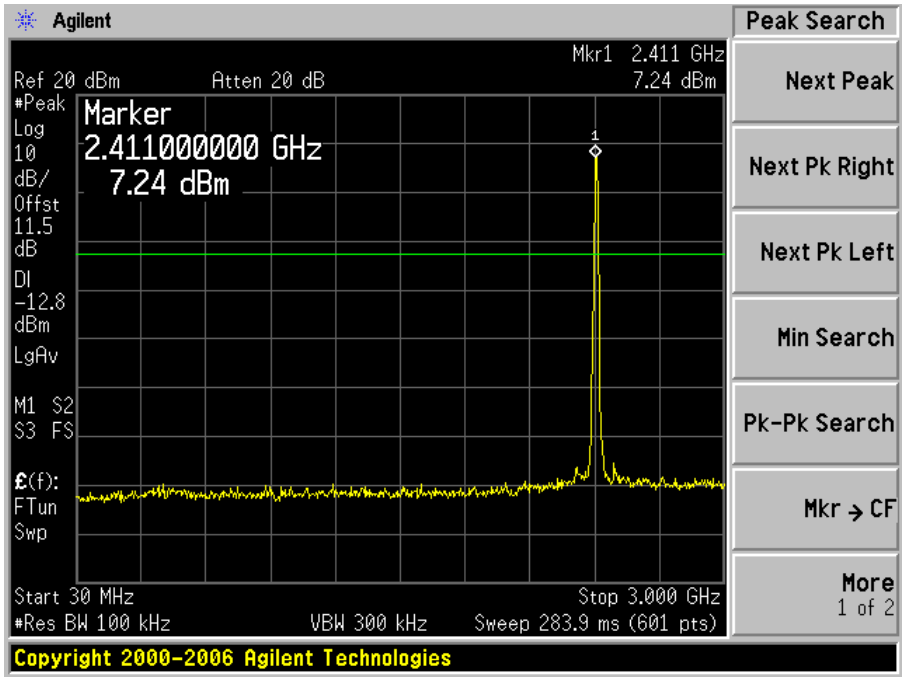
The testing was performed by Jack Liu and Quinn Jiang on 2011-09-07~ 2011-09-11 at RF Site.

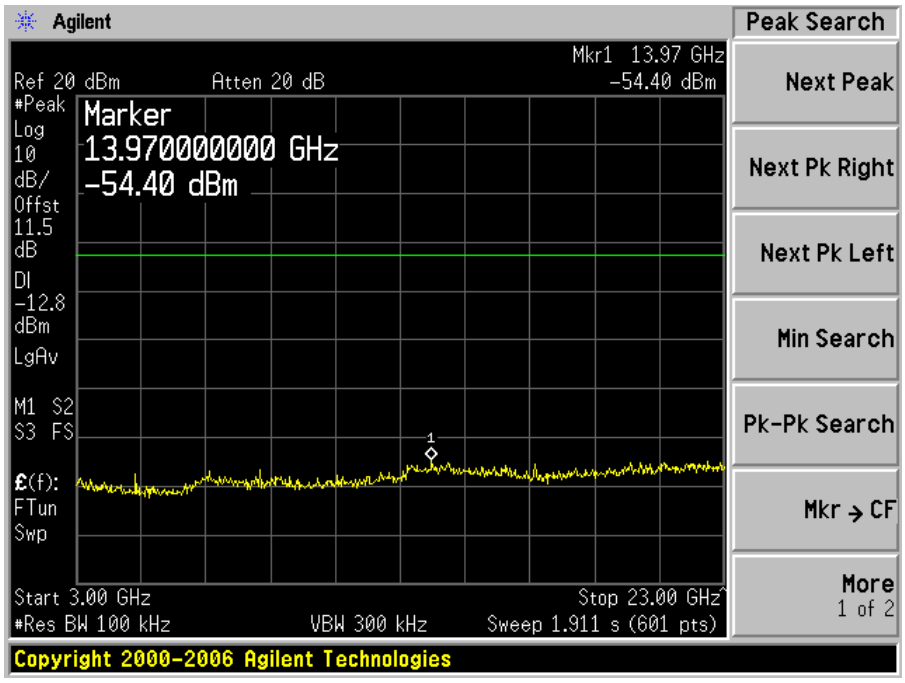
7.5 Measurement Result

Please refer to following plots of spurious emissions.

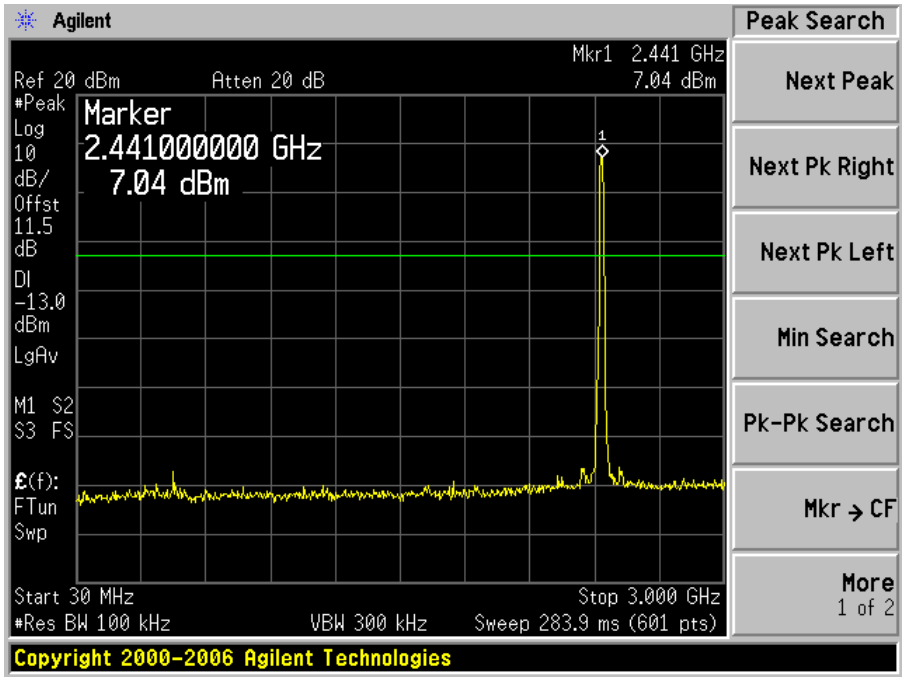
802.11 b 20MHz BW (Worst Antenna Port Main Antenna Port)

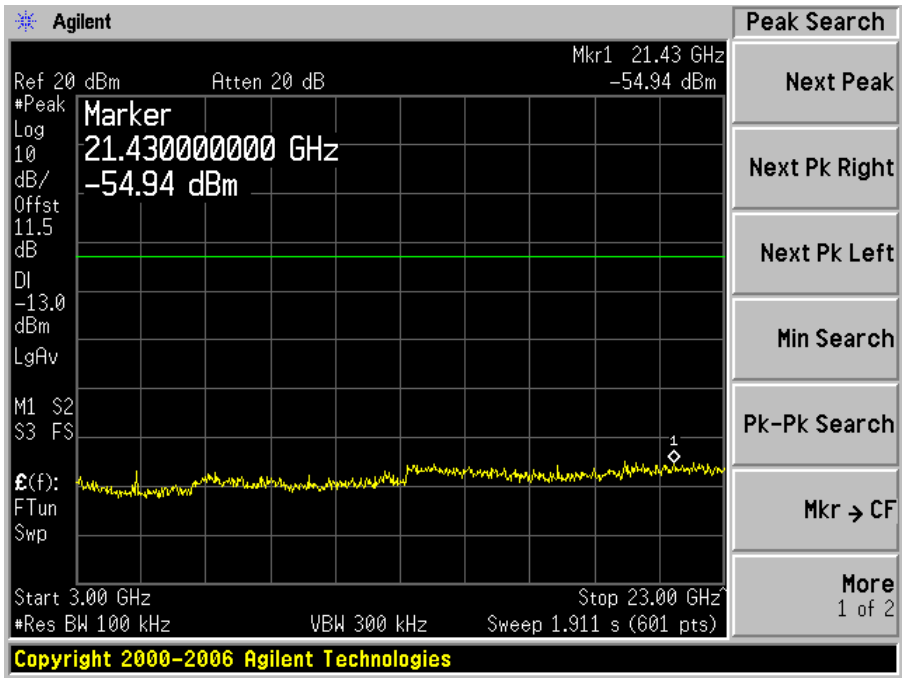
Low Channel 2412 MHz



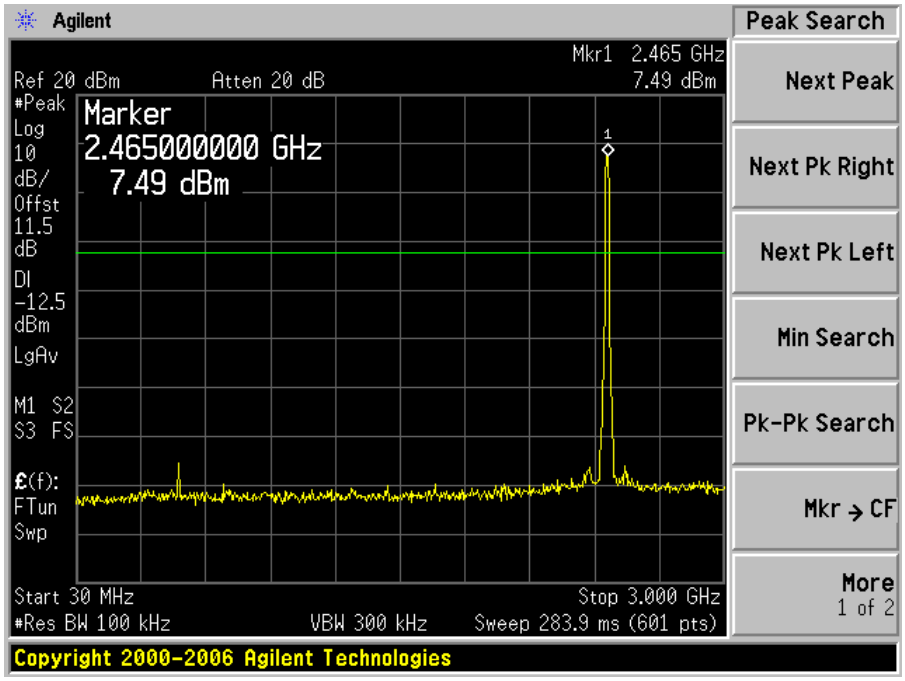


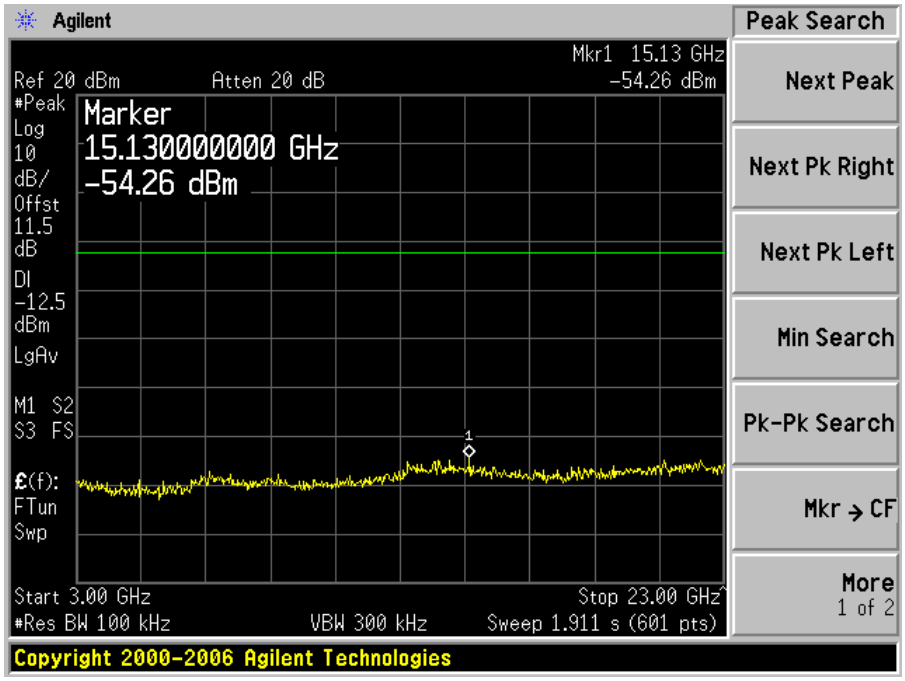
Middle Channel 2437 MHz





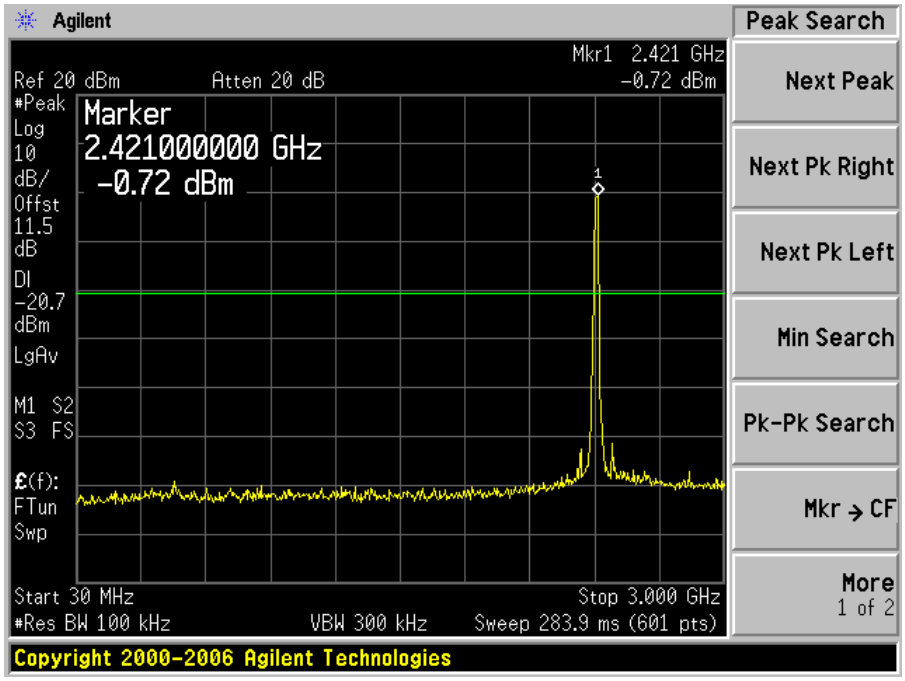
High Channel 2462MHz

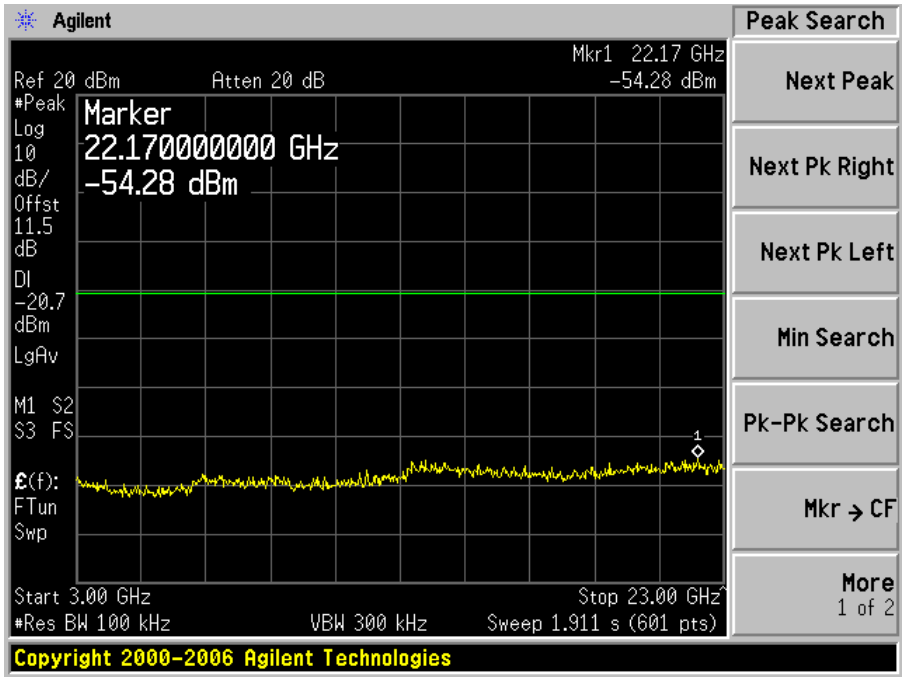




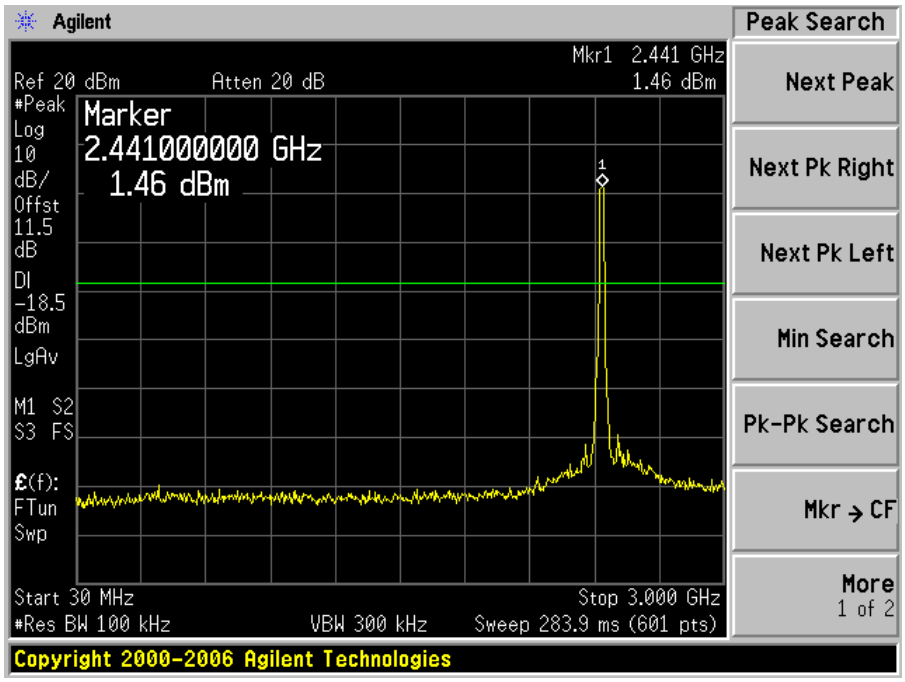
802.11 g 20MHz BW (Worst Antenna Port Main Antenna Port)

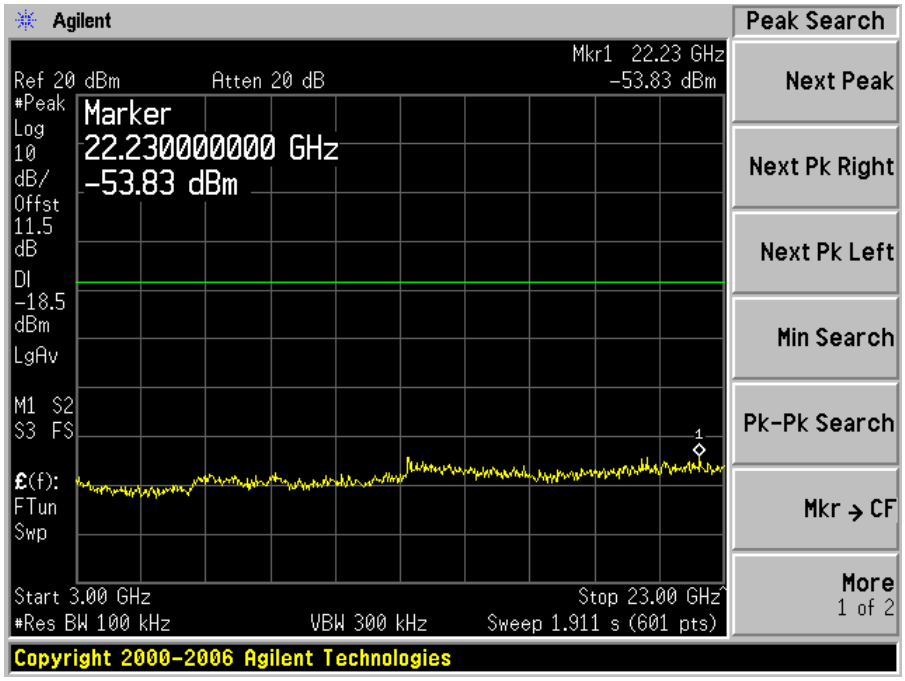
Low Channel 2412 MHz



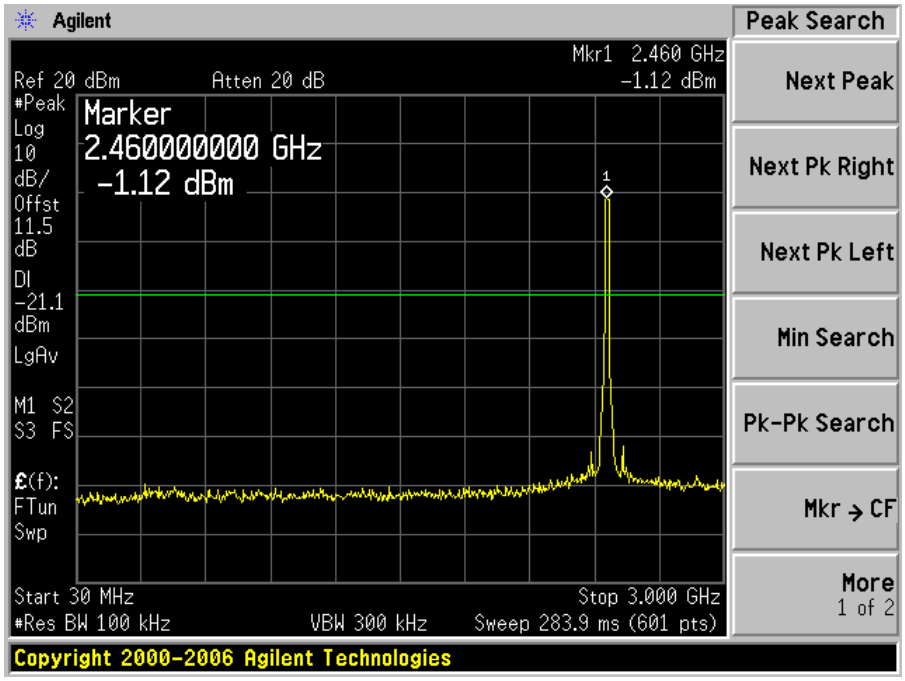


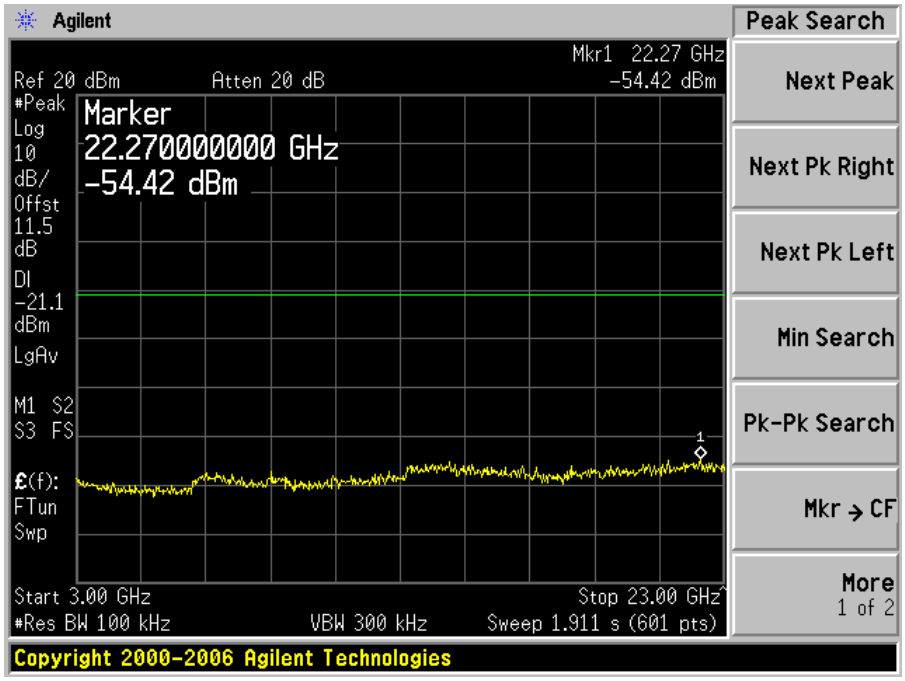
Middle Channel 2437 MHz





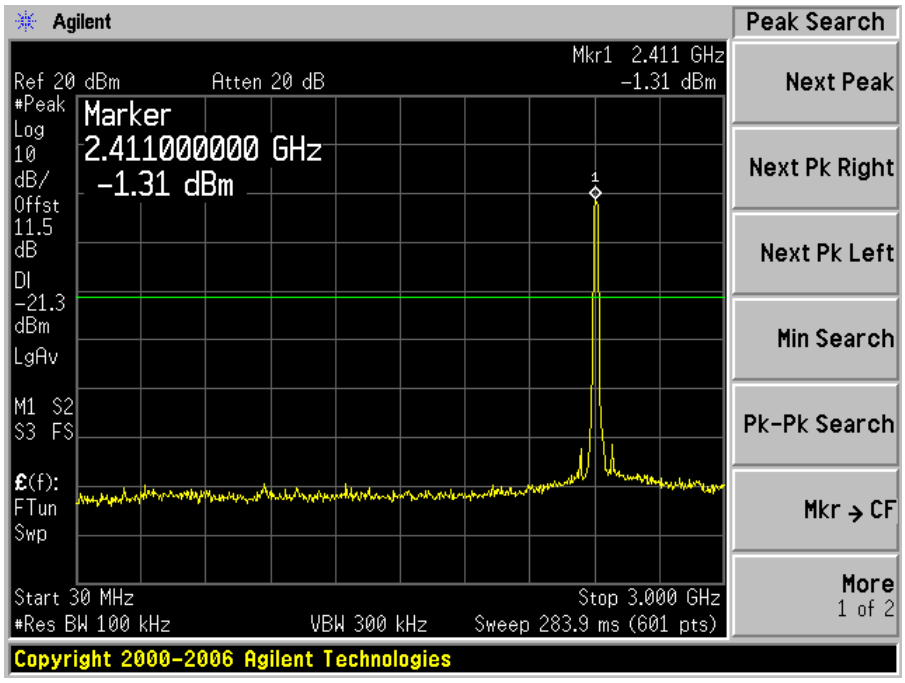
High Channel 2462 MHz

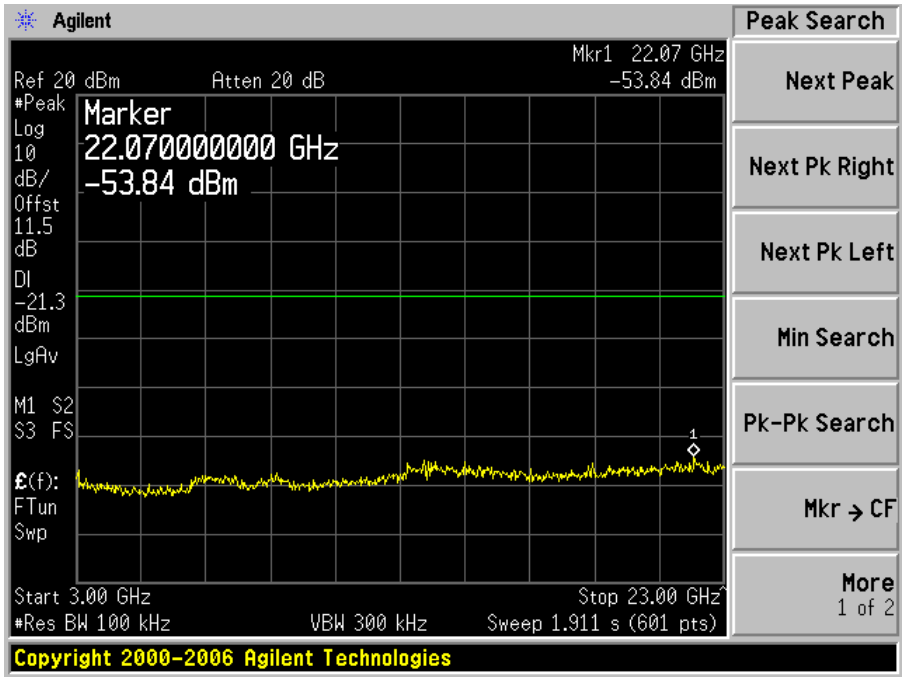




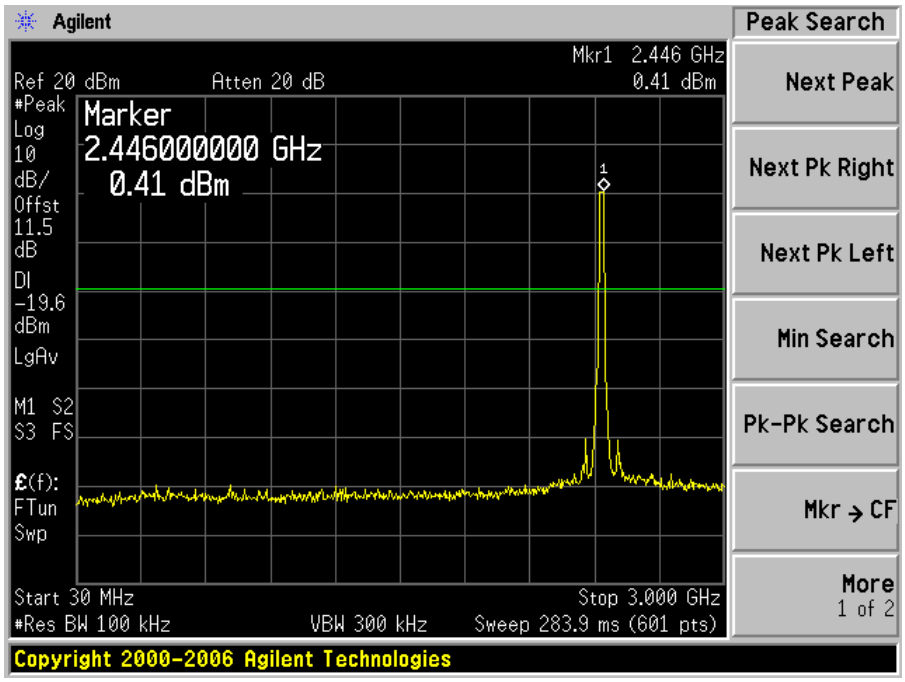
802.11 n 20MHz BW (Worst Antenna Port Main Antenna Port)

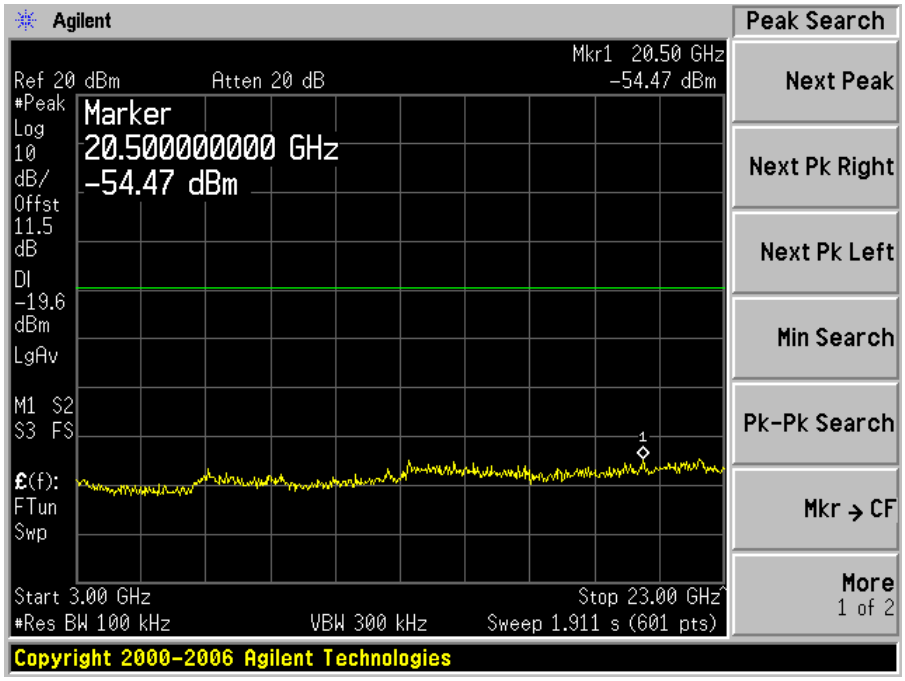
Low Channel 2412 MHz



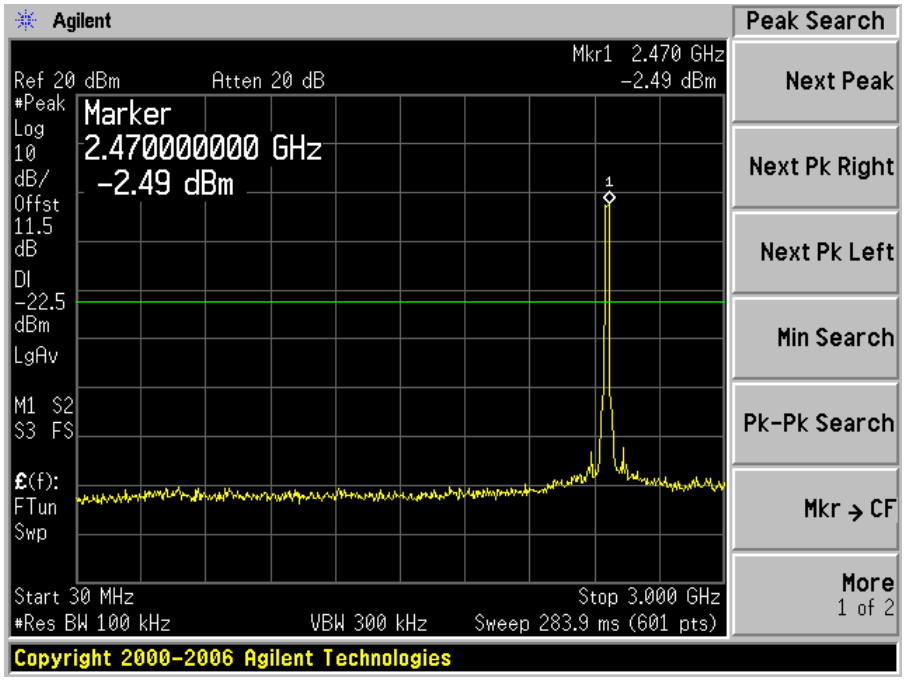


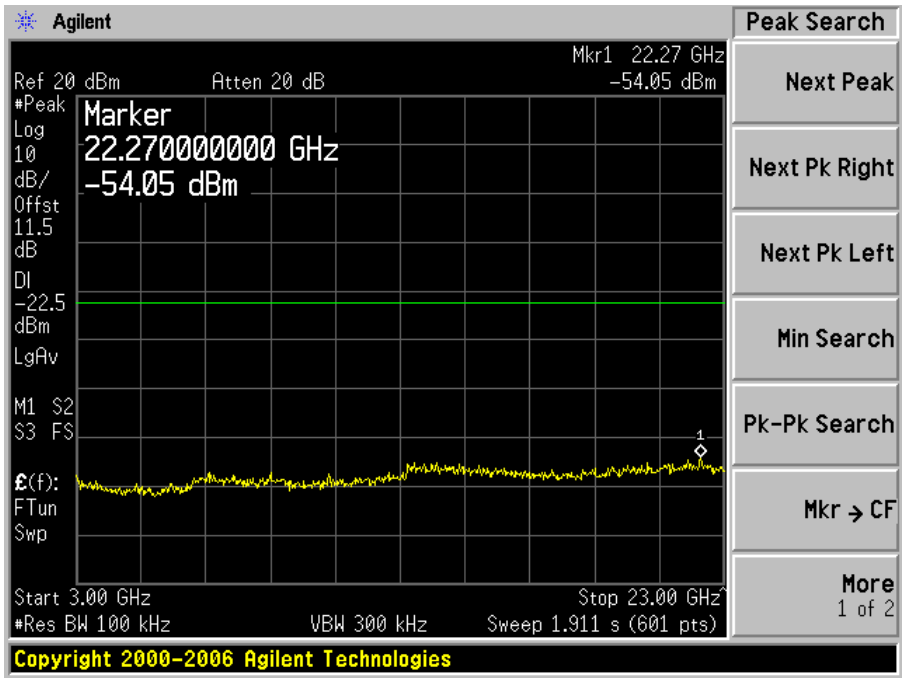
Middle Channel 2437 MHz





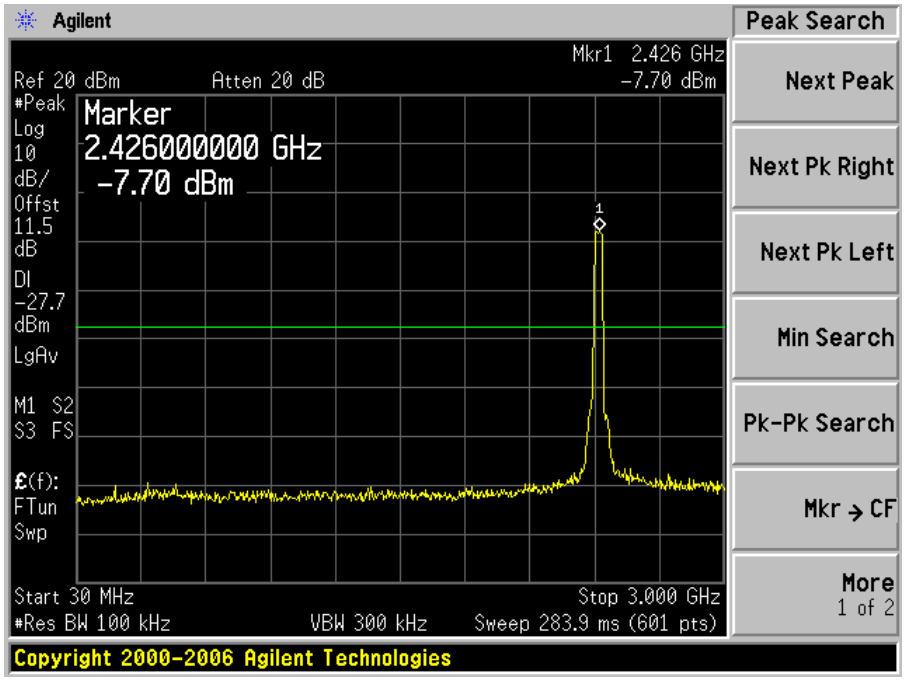
High Channel 2462 MHz

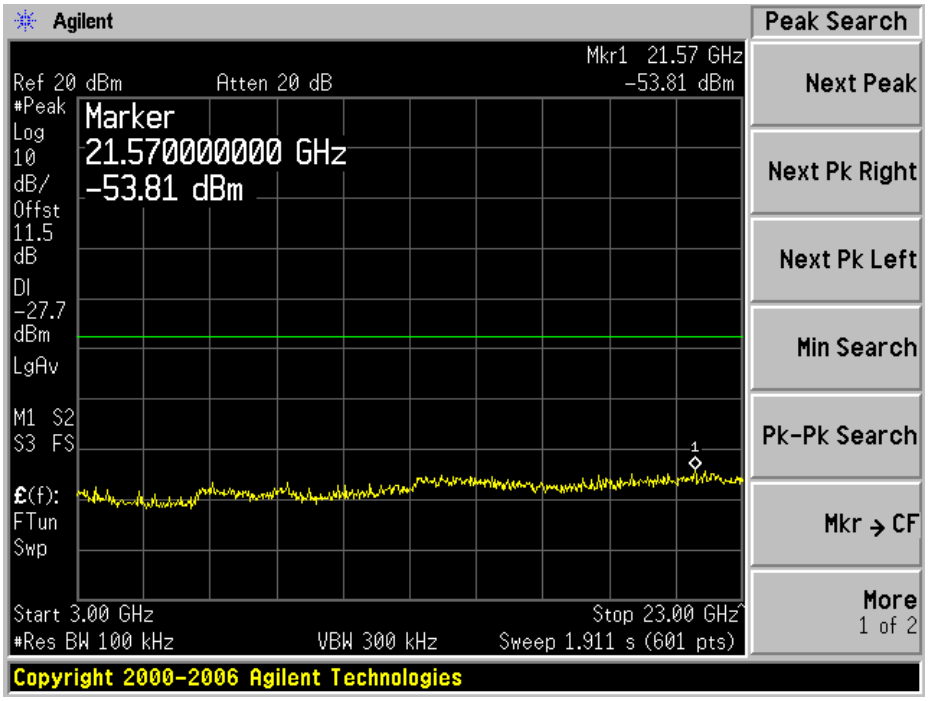




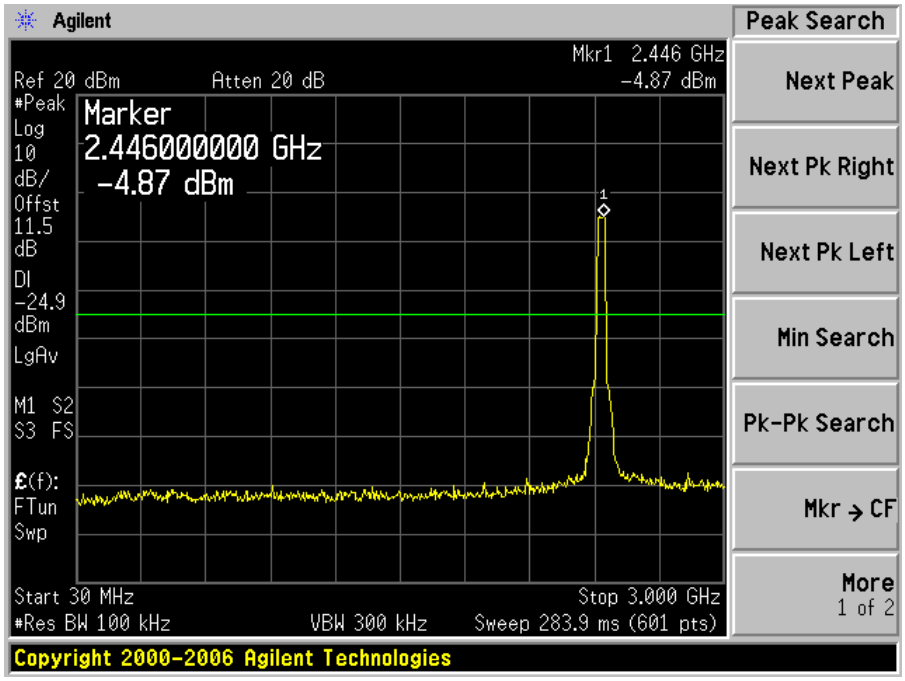
802.11 n 40MHz BW (Worst Antenna Port Main Antenna Port)

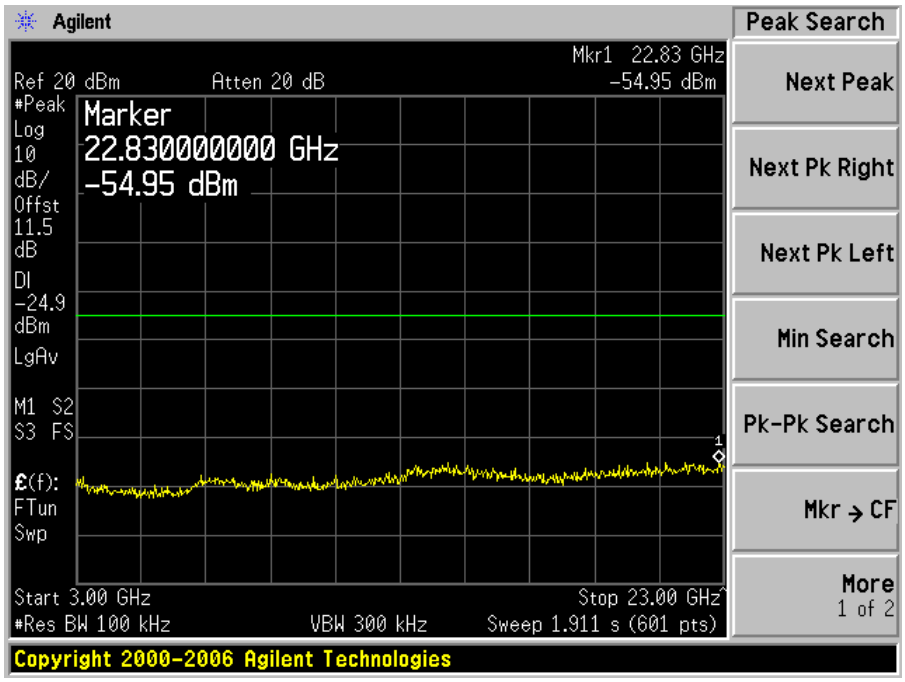
Low Channel 2422 MHz



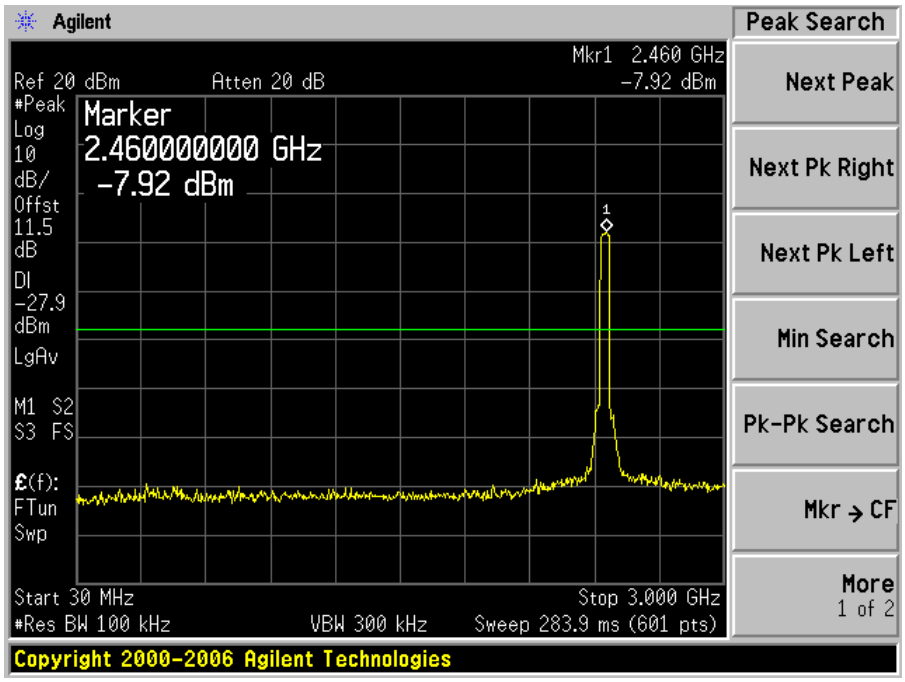


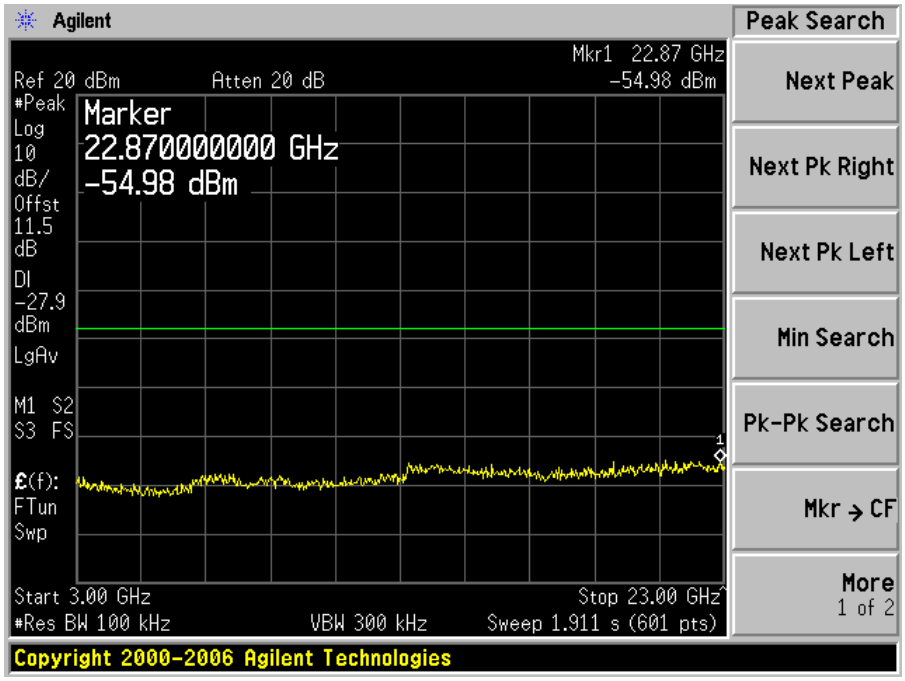
Middle Channel 2437 MHz





High Channel 2452 MHz





8 FCC §15.205, §15.209 & §15.247(c) & IC RSS-210 §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 15 Subpart C and IC RSS-210 limits.

8.3 EUT Setup

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

The spacing between the peripherals was 3 centimeters.

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

8.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2011-03-21
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A0020106-3	2011-06-29
A.R.A Inc	Horn antenna	DRG-1181A	1132	2010-11-29
Hewlett Packard	Pre amplifier	8447D	2944A06639	2011-06-09
Mini-Circuits	Pre Amplifier	ZVA-183-S	570400946	2011-05-09

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

8.5 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

8.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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

8.7 Test Environmental Conditions

Temperature:	23-25 °C
Relative Humidity:	35-50 %
ATM Pressure:	101-103kPa

The testing was performed by Jack Liu and Quinn Jiang on 2011-09-07~ 2011-09-11 at RF Site.

8.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, 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**
-11.47	479.9675	Horizontal	30-1000 MHz

1 – 25 GHz:

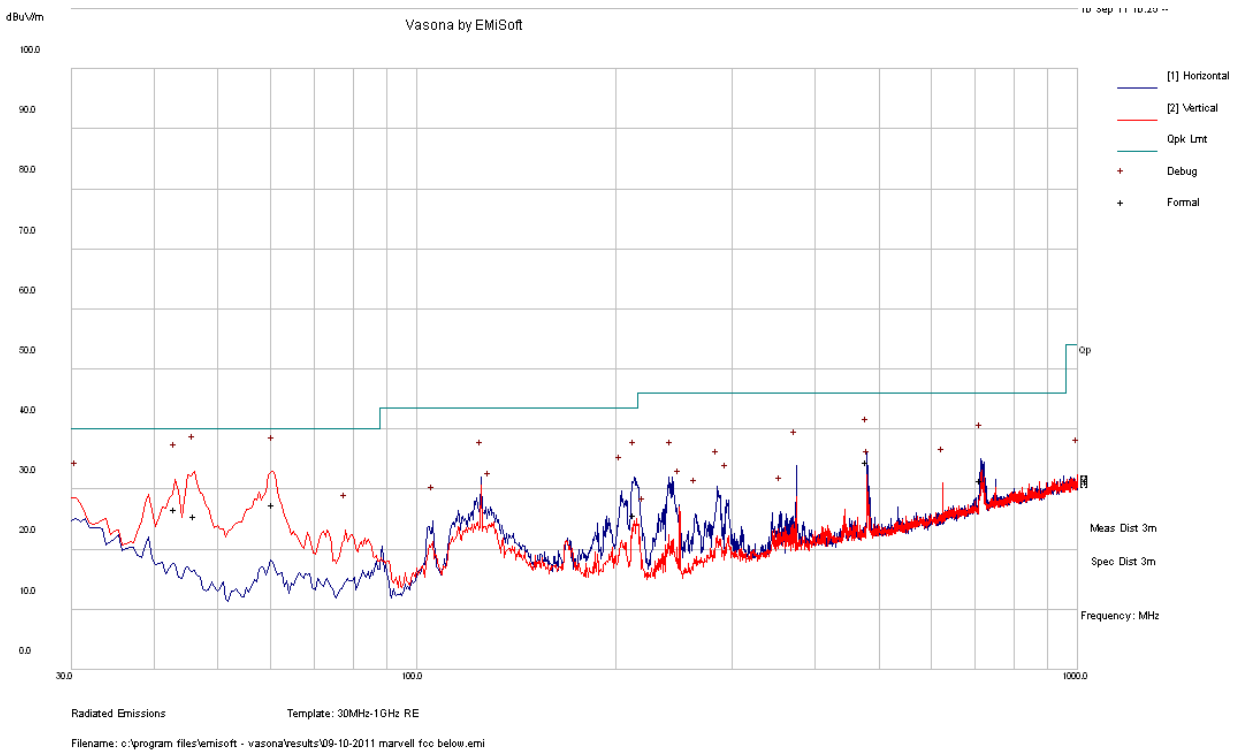
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-6.13	1375	Horizontal	802.11b High, 1GHz – 25GHz

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

8.9 Radiated Emissions Test Data and Plots

1) 30 MHz – 1 GHz, Measured at 3 meters

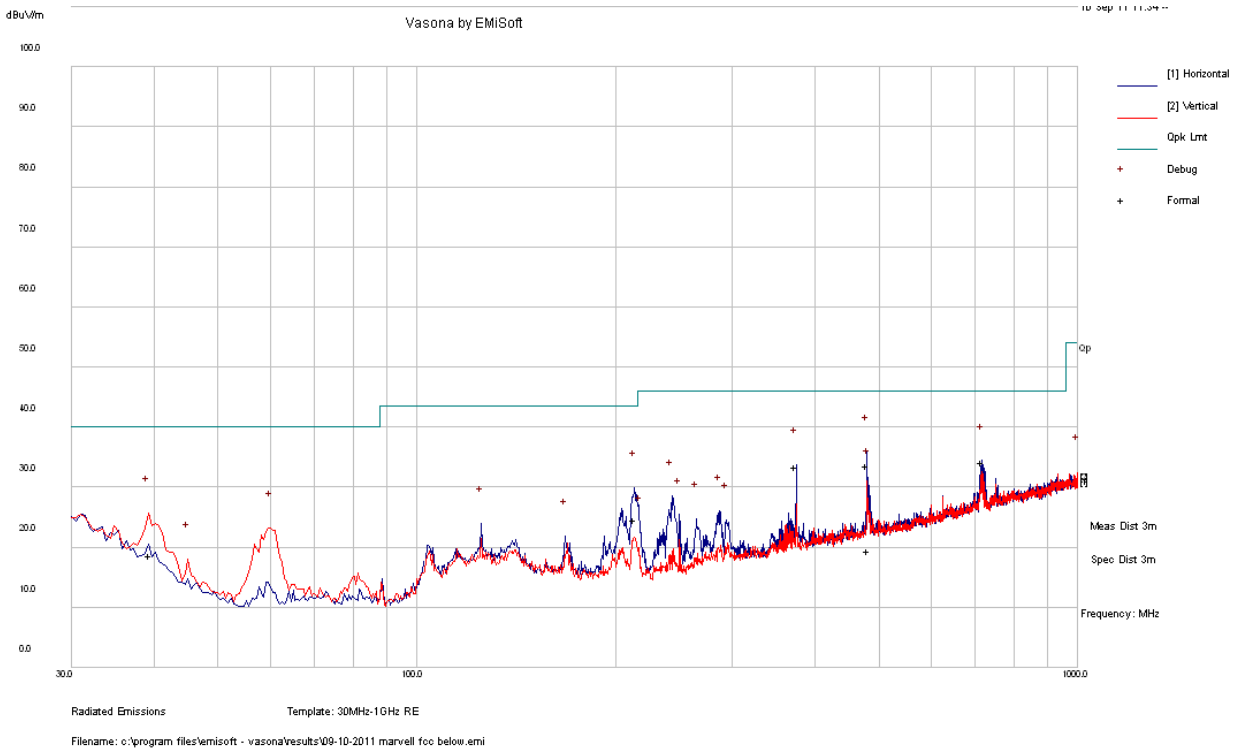
20MHz Worst Mode: 802.11b Mode, Middle channel (2437 MHz)



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
479.9675	34.53	168	H	222	46	-11.47
60.58825	27.45	100	V	79	40	-12.55
43.1065	26.67	124	V	135	40	-13.33
712.9513	31.57	116	H	207	46	-14.43
46.21875	25.49	174	V	221	40	-14.51
213.366	25.74	135	H	277	43.5	-17.76

40MHz Worst Mode: 802.11n 40MHz Mode, Middle channel (2437 MHz)



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
716.115	34.17	103	H	217	46	-11.83
480.028	33.56	164	H	232	46	-12.44
375.0195	33.42	101	H	319	46	-12.58
213.1958	24.59	102	H	77	43.5	-18.91
39.40025	18.76	121	V	327	40	-21.24
482.7275	19.41	162	H	232	46	-26.59

2) 1–25 GHz, Measured at 3 meters

802.11b mode:

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz, measured at 3 meters											
1125	46.70	100	146	V	24.3	2.60	27.1	46.50	74	-27.50	peak
1125	47.58	181	147	H	24.3	2.60	27.1	47.38	74	-26.62	peak
1125	38.89	100	146	V	24.3	2.60	27.1	38.69	54	-15.31	Ave
1125	40.63	181	147	H	24.3	2.60	27.1	40.43	54	-13.57	Ave
1375	51.15	227	100	V	25.0	2.80	27.4	51.55	74	-22.45	peak
1375	53.34	210	109	H	25.0	2.80	27.4	53.74	74	-20.26	peak
1375	45.96	227	100	V	25.0	2.80	27.4	46.36	54	-7.64	Ave
1375	47.44	210	109	H	25.0	2.80	27.4	47.84	54	-6.16	Ave
2385	42.32	328	100	V	27.8	3.79	27.8	46.11	74	-27.89	peak
2385	57.48	268	190	H	27.8	3.79	27.8	61.27	74	-12.73	peak
2385	31.53	328	100	V	27.8	3.79	27.8	35.32	54	-18.68	Ave
2385	41.66	268	190	H	27.8	3.79	27.8	45.45	54	-8.55	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 2437 MHz, measured at 3 meters											
1125	46.96	100	146	V	24.3	2.6	27.1	46.76	74	-27.24	peak
1125	47.31	179	146	H	24.3	2.6	27.1	47.11	74	-26.89	peak
1125	39.25	100	146	V	24.3	2.6	27.1	39.05	54	-14.95	Ave
1125	40.36	179	146	H	24.3	2.6	27.1	40.16	54	-13.84	Ave
1375	51.74	231	100	V	25	2.8	27.4	52.14	74	-21.86	Peak
1375	53.17	210	103	H	25	2.8	27.4	53.57	74	-20.43	Peak
1375	46.27	231	100	V	25	2.8	27.4	46.67	54	-7.33	Ave
1375	47.38	210	103	H	25	2.8	27.4	47.78	54	-6.22	Ave
2385	44.54	292	100	V	27.8	3.79	27.8	48.33	74	-25.67	peak
2385	53.41	263	189	H	27.8	3.79	27.8	57.20	74	-16.80	peak
2385	29.24	292	100	V	27.8	3.79	27.8	33.03	54	-20.97	Ave
2385	35.23	263	189	H	27.8	3.79	27.8	39.02	54	-14.98	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 2462 MHz, measured at 3 meters											
1125	46.93	99	158	V	24.3	2.6	27.1	46.73	74	-27.27	Peak
1125	46.83	166	136	H	24.3	2.6	27.1	46.63	74	-27.37	Peak
1125	39.7	99	158	V	24.3	2.6	27.1	39.5	54	-14.5	Ave
1125	39.96	166	136	H	24.3	2.6	27.1	39.76	54	-14.24	Ave
1375	51.56	229	100	V	25.0	2.80	27.4	51.96	74	-22.04	Peak
1375	53.11	210	104	H	25.0	2.80	27.4	53.51	74	-20.49	Peak
1375	46.45	229	100	V	25.0	2.80	27.4	46.85	54	-7.15	Ave
1375	47.47	210	104	H	25.0	2.80	27.4	47.87	54	-6.13	Ave
2385	44.64	292	100	V	27.8	3.79	27.8	48.43	74	-25.57	peak
2385	48.59	268	189	H	27.8	3.79	27.8	52.38	74	-21.62	peak
2385	29.22	292	100	V	27.8	3.79	27.8	33.01	54	-20.99	Ave
2385	36.18	268	189	H	27.8	3.79	27.8	39.97	54	-14.03	Ave

802.11g mode:

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz, measured at 3 meters											
1375	51.65	228	100	V	25.0	2.80	27.4	52.05	74	-21.95	peak
1375	52.38	202	105	H	25.0	2.80	27.4	52.78	74	-21.22	peak
1375	46.11	228	100	V	25.0	2.80	27.4	46.51	54	-7.49	Ave
1375	46.59	202	105	H	25.0	2.80	27.4	46.99	54	-7.01	Ave
2385	49.78	328	100	V	27.8	3.79	27.8	53.57	74	-20.43	peak
2385	61.03	279	195	H	27.8	3.79	27.8	64.82	74	-9.18	peak
2385	31.67	328	100	V	27.8	3.79	27.8	35.46	54	-18.54	Ave
2385	42.74	279	195	H	27.8	3.79	27.8	46.53	54	-7.47	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 2437 MHz, measured at 3 meters											
1375	52.05	230	100	V	25.0	2.80	27.4	52.45	74	-21.55	peak
1375	52.18	201	104	H	25.0	2.80	27.4	52.58	74	-21.42	peak
1375	46.19	230	100	V	25.0	2.80	27.4	46.59	54	-7.41	Ave
1375	46.36	201	104	H	25.0	2.80	27.4	46.76	54	-7.24	Ave
2365	43.85	331	100	V	27.8	3.79	27.8	47.64	74	-26.36	Peak
2365	53.68	266	190	H	27.8	3.79	27.8	57.47	74	-16.53	Peak
2365	32.25	331	100	V	27.8	3.79	27.8	36.04	54	-17.96	Ave
2365	42.66	266	190	H	27.8	3.79	27.8	46.45	54	-7.55	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 2462 MHz, measured at 3 meters											
1375	51.63	229	100	V	25.0	2.80	27.4	52.03	74	-21.97	Peak
1375	52.18	203	103	H	25.0	2.80	27.4	52.58	74	-21.42	Peak
1375	46.09	229	100	V	25.0	2.80	27.4	46.49	54	-7.51	Ave
1375	46.34	203	103	H	25.0	2.80	27.4	46.74	54	-7.26	Ave
2375	42.8	341	100	V	27.8	3.79	27.8	46.59	74	-27.41	Peak
2375	47.51	268	190	H	27.8	3.79	27.8	51.30	74	-22.70	Peak
2375	27.23	341	100	V	27.8	3.79	27.8	31.02	54	-22.98	Ave
2375	35.25	268	190	H	27.8	3.79	27.8	39.04	54	-14.96	Ave

802.11n 20MHz mode:

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz, measured at 3 meters											
1375	51.75	231	100	V	25.0	2.80	27.4	52.15	74	-21.85	peak
1375	53.5	206	104	H	25.0	2.80	27.4	53.90	74	-20.10	peak
1375	45.62	231	100	V	25.0	2.80	27.4	46.02	54	-7.98	Ave
1375	46.57	206	104	H	25.0	2.80	27.4	46.97	54	-7.03	Ave
2385	49.77	346	100	V	27.8	3.79	27.8	53.56	74	-20.44	peak
2385	59.6	267	190	H	27.8	3.79	27.8	63.39	74	-10.61	peak
2385	30.55	346	100	V	27.8	3.79	27.8	34.34	54	-19.66	Ave
2385	39.78	267	190	H	27.8	3.79	27.8	43.57	54	-10.43	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 2437 MHz, measured at 3 meters											
1375	51.78	232	100	V	25.0	2.80	27.4	52.18	74	-21.82	peak
1375	53.21	207	103	H	25.0	2.80	27.4	53.61	74	-20.39	peak
1375	45.53	232	100	V	25.0	2.80	27.4	45.93	54	-8.07	Ave
1375	46.54	207	103	H	25.0	2.80	27.4	46.94	54	-7.06	Ave
2365	43.96	333	100	V	27.8	3.79	27.8	47.75	74	-26.25	Peak
2365	53.48	264	190	H	27.8	3.79	27.8	57.27	74	-16.73	Peak
2365	32.24	333	100	V	27.8	3.79	27.8	36.03	54	-17.97	Ave
2365	42.37	264	190	H	27.8	3.79	27.8	46.16	54	-7.84	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 2462 MHz, measured at 3 meters											
1375	51.79	232	100	V	25.0	2.80	27.4	52.19	74	-21.81	Peak
1375	53.82	210	104	H	25.0	2.80	27.4	54.22	74	-19.78	Peak
1375	45.54	232	100	V	25.0	2.80	27.4	45.94	54	-8.06	Ave
1375	46.54	210	104	H	25.0	2.80	27.4	46.94	54	-7.06	Ave
2375	43.41	294	100	V	27.8	3.79	27.8	47.20	74	-26.80	Peak
2375	47.06	266	190	H	27.8	3.79	27.8	50.85	74	-23.15	Peak
2375	29.47	294	100	V	27.8	3.79	27.8	33.26	54	-20.74	Ave
2375	34.63	266	190	H	27.8	3.79	27.8	38.42	54	-15.58	Ave

802.11n 40MHz mode:

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2422 MHz, measured at 3 meters											
1375	51.82	232	100	V	25.0	2.80	27.4	52.22	74	-21.78	peak
1375	53.52	210	104	H	25.0	2.80	27.4	53.92	74	-20.08	peak
1375	45.64	232	100	V	25.0	2.80	27.4	46.04	54	-7.96	Ave
1375	46.49	210	104	H	25.0	2.80	27.4	46.89	54	-7.11	Ave
2385	51.82	215	100	V	27.8	3.79	27.8	55.61	74	-18.39	peak
2385	60.32	262	190	H	27.8	3.79	27.8	64.11	74	-9.89	peak
2385	36.83	215	100	V	27.8	3.79	27.8	40.62	54	-13.38	Ave
2385	45.8	262	190	H	27.8	3.79	27.8	49.59	54	-4.41	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 2437 MHz, measured at 3 meters											
1375	52.09	230	100	V	25.0	2.80	27.4	52.49	74	-21.51	peak
1375	53.42	208	103	H	25.0	2.80	27.4	53.82	74	-20.18	peak
1375	45.99	230	100	V	25.0	2.80	27.4	46.39	54	-7.61	Ave
1375	46.45	208	103	H	25.0	2.80	27.4	46.85	54	-7.15	Ave
2381	48.53	216	100	V	27.8	3.79	27.8	52.32	74	-21.68	Peak
2381	57.9	267	190	H	27.8	3.79	27.8	61.69	74	-12.31	Peak
2381	33.64	216	100	V	27.8	3.79	27.8	37.43	54	-16.57	Ave
2381	41.74	267	190	H	27.8	3.79	27.8	45.53	54	-8.47	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 2452 MHz, measured at 3 meters											
1375	52.3	232	100	V	25.0	2.80	27.4	52.70	74	-21.30	Peak
1375	53.62	203	102	H	25.0	2.80	27.4	54.02	74	-19.98	Peak
1375	45.66	232	100	V	25.0	2.80	27.4	46.06	54	-7.94	Ave
1375	47.01	203	102	H	25.0	2.80	27.4	47.41	54	-6.59	Ave
2499	45.29	215	100	V	28.5	3.97	27.8	49.96	74	-24.04	Peak
2499	54.07	259	179	H	28.5	3.97	27.8	58.74	74	-15.26	Peak
2499	31.74	215	100	V	28.5	3.97	27.8	36.41	54	-17.59	Ave
2499	40.09	259	179	H	28.5	3.97	27.8	44.76	54	-9.24	Ave

3) Restricted Band Emissions

802.11b 20MHz mode:

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH1 Low Channel 2412 MHz, measured at 3 meters											
2390	26.79	204	187	V	27.8	3.12	0	57.71	74	-16.29	Peak
2390	35.71	271	178	H	27.8	3.12	0	66.63	74	-7.37	Peak
2390	13.2	204	287	V	27.8	3.12	0	44.12	54	-9.88	Avg
2390	17.39	271	178	H	27.8	3.12	0	48.31	54	-5.69	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH10 Channel 2457 MHz, measured at 3 meters											
2483.5	26.59	217	190	V	28.5	3.25	0	58.34	74	-15.66	Peak
2483.5	38.09	280	184	H	28.5	3.25	0	69.84	74	-4.16	Peak
2483.5	13.2	217	190	V	28.5	3.25	0	44.95	54	-9.05	Avg
2483.5	16.64	280	184	H	28.5	3.25	0	48.39	54	-5.61	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH11 High Channel 2462 MHz, measured at 3 meters											
2483.5	30.07	209	187	V	28.5	3.25	0	61.82	74	-12.18	Peak
2483.5	41.49	265	180	H	28.5	3.25	0	73.24	74	-0.76	Peak
2483.5	13.24	209	187	V	28.5	3.25	0	44.99	54	-9.01	Avg
2483.5	16.28	265	180	H	28.5	3.25	0	48.03	54	-5.97	Avg

802.11g 20MHz mode:

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH1 Low Channel 2412 MHz, measured at 3 meters											
2390	28.01	215	191	V	27.8	3.12	0	58.93	74	-15.07	Peak
2390	40.45	271	183	H	27.8	3.12	0	71.37	74	-2.63	Peak
2390	14.61	215	191	V	27.8	3.12	0	45.53	54	-8.47	Avg
2390	22.63	271	183	H	27.8	3.12	0	53.55	54	-0.45	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH2 Channel 2417 MHz, measured at 3 meters											
2390	28.58	215	191	V	27.8	3.12	0	59.5	74	-14.5	Peak
2390	39.95	270	184	H	27.8	3.12	0	70.87	74	-3.13	Peak
2390	14.22	215	191	V	27.8	3.12	0	45.14	54	-8.86	Avg
2390	20.89	270	184	H	27.8	3.12	0	51.81	54	-2.19	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH3 Channel 2422 MHz, measured at 3 meters											
2390	27.76	215	191	V	27.8	3.12	0	58.68	74	-15.32	Peak
2390	36.87	269	184	H	27.8	3.12	0	67.79	74	-6.21	Peak
2390	13.64	215	191	V	27.8	3.12	0	44.56	54	-9.44	Avg
2390	19.86	269	184	H	27.8	3.12	0	50.78	54	-3.22	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH10 Channel 2457 MHz, measured at 3 meters											
2483.5	26.45	213	186	V	28.5	3.25	0	58.2	74	-15.8	Peak
2483.5	38.31	280	183	H	28.5	3.25	0	70.06	74	-3.94	Peak
2483.5	13.48	213	186	V	28.5	3.25	0	45.23	54	-8.77	Avg
2483.5	18.01	280	183	H	28.5	3.25	0	49.76	54	-4.24	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH11 High Channel 2462 MHz, measured at 3 meters											
2483.5	27.31	205	185	V	28.5	3.25	0	59.06	74	-14.94	Peak
2483.5	39.31	263	182	H	28.5	3.25	0	71.06	74	-2.94	Peak
2483.5	13.56	205	185	V	28.5	3.25	0	45.31	54	-8.69	Avg
2483.5	13.09	263	182	H	28.5	3.25	0	44.84	54	-9.16	Avg

802.11n 20MHz mode:

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH1 Low Channel 2412 MHz, measured at 3 meters											
2390	28.62	212	126	V	27.8	3.12	0	59.54	74	-14.46	Peak
2390	39.17	276	188	H	27.8	3.12	0	70.09	74	-3.91	Peak
2390	14.57	212	126	V	27.8	3.12	0	45.49	54	-8.51	Avg
2390	22.38	276	188	H	27.8	3.12	0	53.3	54	-0.7	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH2 Channel 2417 MHz, measured at 3 meters											
2390	31.37	212	100	V	27.8	3.12	0	62.29	74	-11.71	Peak
2390	39.93	269	183	H	27.8	3.12	0	70.85	74	-3.15	Peak
2390	15.14	212	100	V	27.8	3.12	0	46.06	54	-7.94	Avg
2390	22.7	269	183	H	27.8	3.12	0	53.62	54	-0.38	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH10 Channel 2457 MHz, measured at 3 meters											
2483.5	26.68	208	184	V	28.5	3.25	0	58.43	74	-15.57	Peak
2483.5	35.67	266	181	H	28.5	3.25	0	67.42	74	-6.58	Peak
2483.5	13.2	208	184	V	28.5	3.25	0	44.95	54	-9.05	Avg
2483.5	17.18	266	181	H	28.5	3.25	0	48.93	54	-5.07	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH11 High Channel 2462 MHz, measured at 3 meters											
2483.5	27.22	208	182	V	28.5	3.25	0	58.97	74	-15.03	Peak
2483.5	37.59	281	182	H	28.5	3.25	0	69.34	74	-4.66	Peak
2483.5	13.75	208	182	V	28.5	3.25	0	45.5	54	-8.5	Avg
2483.5	20.1	281	182	H	28.5	3.25	0	51.85	54	-2.15	Avg

802.11n 40MHz mode:

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH3 Low Channel 2422 MHz, measured at 3 meters											
2390	27.47	213	100	V	27.8	3.12	0	58.39	74	-15.61	Peak
2390	36.07	269	185	H	27.8	3.12	0	66.99	74	-7.01	Peak
2390	14.34	213	100	V	27.8	3.12	0	45.26	54	-8.74	Avg
2390	22.01	269	185	H	27.8	3.12	0	52.93	54	-1.07	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH4 Channel 2427 MHz, measured at 3 meters											
2390	26.55	211	126	V	27.8	3.12	0	57.47	74	-16.53	Peak
2390	34.54	269	184	H	27.8	3.12	0	65.46	74	-8.54	Peak
2390	13.76	211	126	V	27.8	3.12	0	44.68	54	-9.32	Avg
2390	21.21	269	184	H	27.8	3.12	0	52.13	54	-1.87	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH5 Channel 2432 MHz, measured at 3 meters											
2390	27.26	210	126	V	27.8	3.12	0	58.18	74	-15.82	Peak
2390	36.8	266	184	H	27.8	3.12	0	67.72	74	-6.28	Peak
2390	14.39	210	126	V	27.8	3.12	0	45.31	54	-8.69	Avg
2390	22.47	266	184	H	27.8	3.12	0	53.39	54	-0.61	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH6 Channel 2437 MHz, measured at 3 meters											
2390	26.83	212	126	V	27.8	3.12	0	57.75	74	-16.25	Peak
2390	36.18	264	184	H	27.8	3.12	0	67.1	74	-6.9	Peak
2390	13.86	212	126	V	27.8	3.12	0	44.78	54	-9.22	Avg
2390	20.77	264	184	H	27.8	3.12	0	51.69	54	-2.31	Avg
2483.5	27.55	212	126	V	28.5	3.25	0	59.3	74	-14.7	Peak
2483.5	35.39	264	184	H	28.5	3.25	0	67.14	74	-6.86	Peak
2483.5	13.88	212	126	V	28.5	3.25	0	45.63	54	-8.37	Avg
2483.5	19.52	264	184	H	28.5	3.25	0	51.27	54	-2.73	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH8 High Channel 2447 MHz, measured at 3 meters											
2483.5	28.04	206	228	V	28.5	3.25	0	59.79	74	-14.21	Peak
2483.5	36.07	267	183	H	28.5	3.25	0	67.82	74	-6.18	Peak
2483.5	14.15	206	228	V	28.5	3.25	0	45.9	54	-8.1	Avg
2483.5	21.74	267	183	H	28.5	3.25	0	53.49	54	-0.51	Avg

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
CH9 High Channel 2452 MHz, measured at 3 meters											
2483.5	27.48	208	126	V	28.5	3.25	0	59.23	74	-14.77	Peak
2483.5	35.88	266	182	H	28.5	3.25	0	67.63	74	-6.37	Peak
2483.5	13.54	208	126	V	28.5	3.25	0	45.29	54	-8.71	Avg
2483.5	20.09	266	182	H	28.5	3.25	0	51.84	54	-2.16	Avg

9 FCC§15.247(a)(2) & IC RSS-210§A8.2– 6 dB & 99% 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	MY44303352	2011-05-10

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:	23-25 °C
Relative Humidity:	35-50 %
ATM Pressure:	101-103kPa

The testing was performed by Jack Liu and Quinn Jiang on 2011-09-07~ 2011-09-11 at RF Site.

9.5 Summary of Test Results

802.11 b 20 MHz Mode:

Antenna Port	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)	Results
Main	Low	2412	13.6399	10.123	> 500	Compliant
	Middle	2437	13.6348	10.120	> 500	Compliant
	High	2462	13.6718	10.122	> 500	Compliant
Aux	Low	2412	13.6527	10.090	> 500	Compliant
	Middle	2437	13.6604	10.123	> 500	Compliant
	High	2462	13.6719	10.125	> 500	Compliant

802.11 g 20 MHz Mode:

Antenna Port	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)	Results
Main	Low	2412	16.4867	16.717	> 500	Compliant
	Middle	2437	16.4914	16.715	> 500	Compliant
	High	2462	16.4833	16.714	> 500	Compliant
Aux	Low	2412	16.4845	16.714	> 500	Compliant
	Middle	2437	16.4892	16.717	> 500	Compliant
	High	2462	16.4856	16.718	> 500	Compliant

802.11 n 20 MHz Mode:

Antenna Port	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)	Results
Main	Low	2412	17.7128	17.971	> 500	Compliant
	Middle	2437	17.7134	17.970	> 500	Compliant
	High	2462	17.7130	17.974	> 500	Compliant
Aux	Low	2412	17.7126	17.970	> 500	Compliant
	Middle	2437	17.7131	17.971	> 500	Compliant
	High	2462	17.7126	17.973	> 500	Compliant

802.11 n 40 MHz Mode:

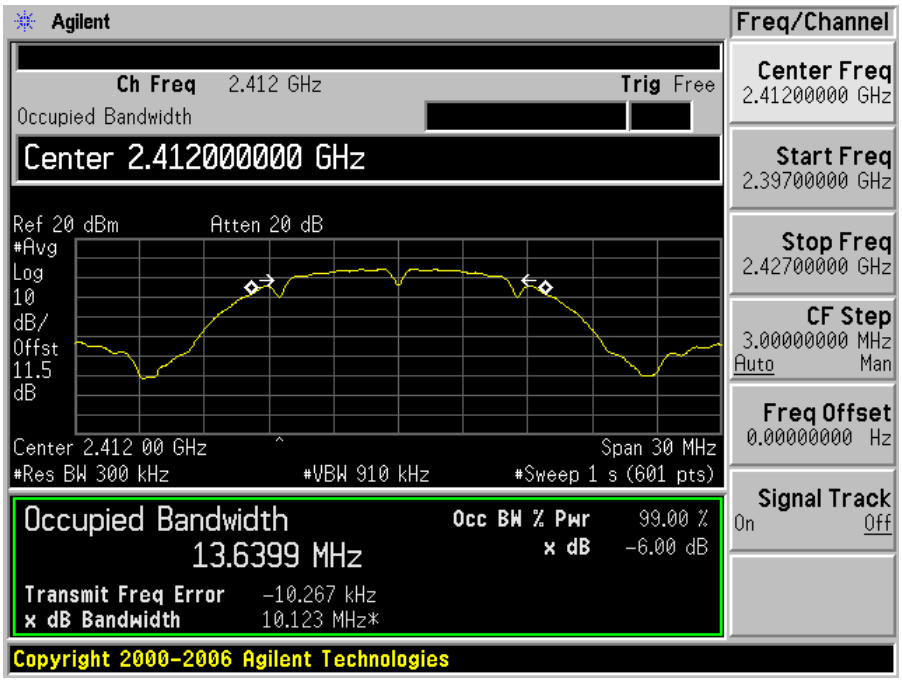
Antenna Port	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)	Results
Main	Low	2422	36.2246	36.821	> 500	Compliant
	Middle	2437	36.2260	36.816	> 500	Compliant
	High	2452	36.2268	36.828	> 500	Compliant
Aux	Low	2422	36.2261	36.822	> 500	Compliant
	Middle	2437	36.2285	36.824	> 500	Compliant
	High	2452	36.2286	36.827	> 500	Compliant

Please refer to the following plots for detailed test results

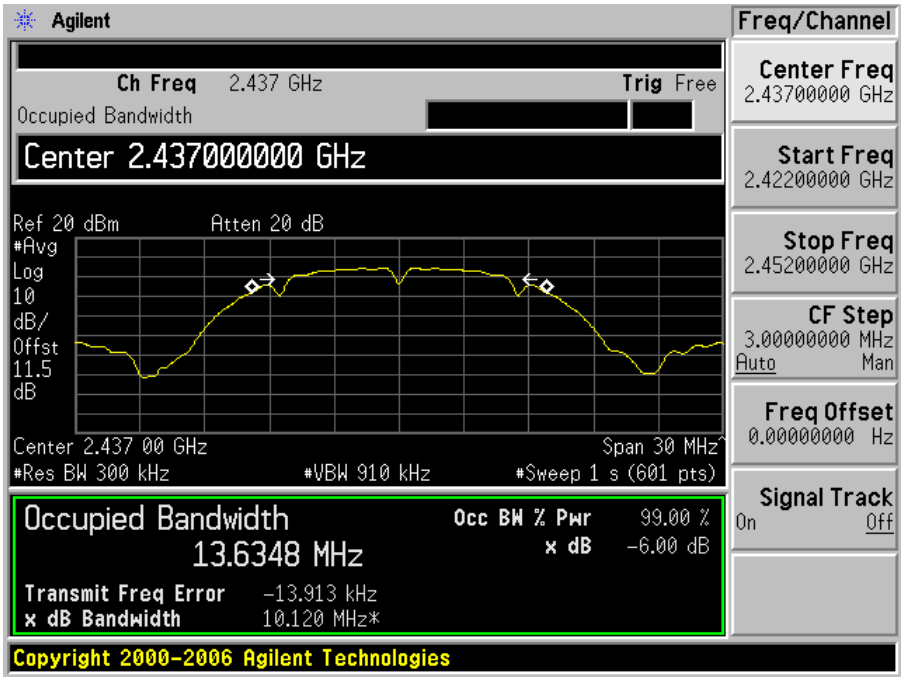
802.11 b 20MHz

Main Antenna Port

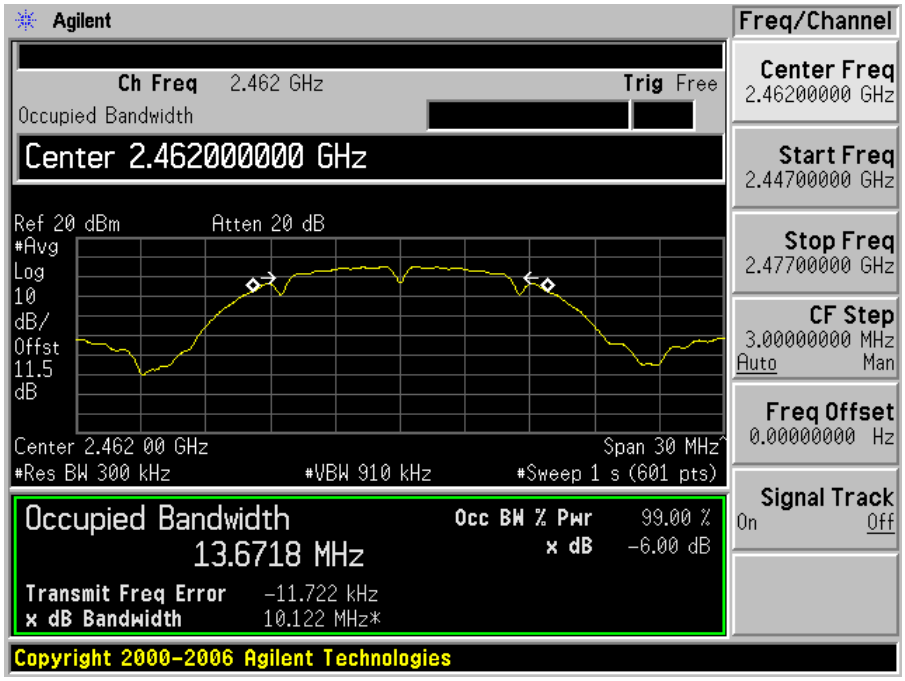
Low channel



Middle channel

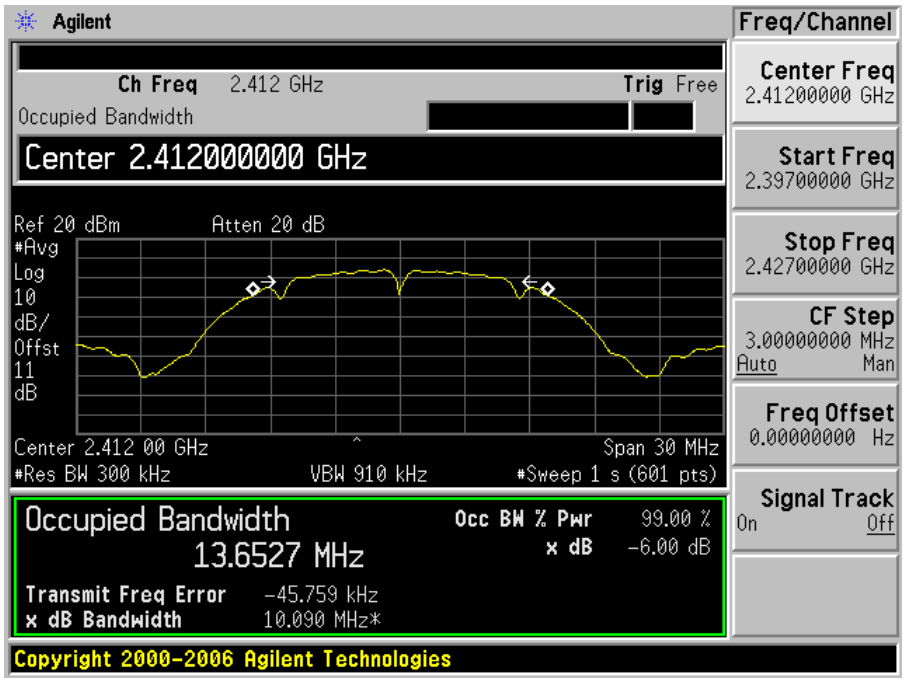


High channel

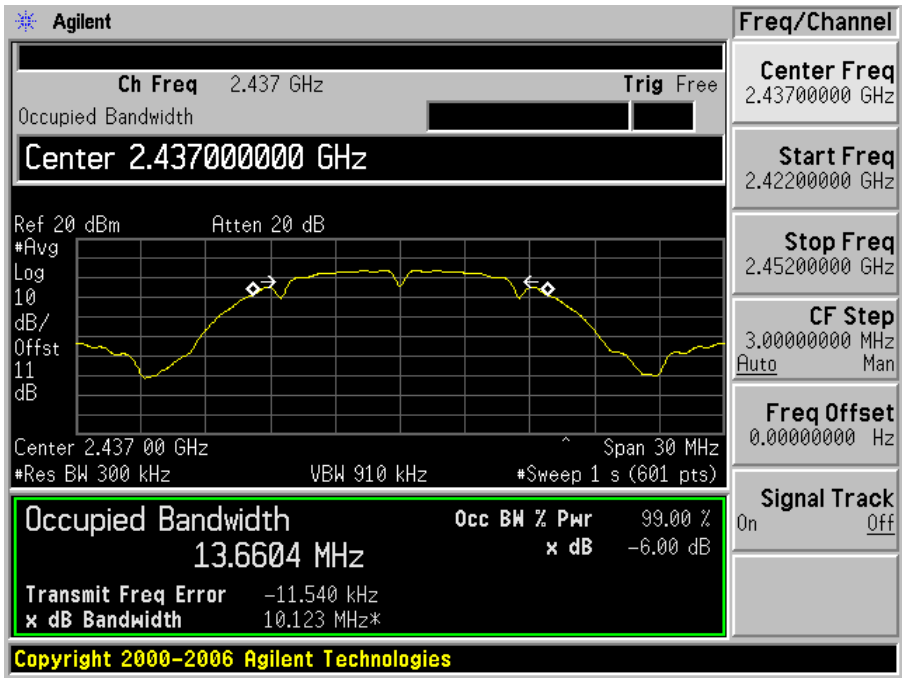


Aux Antenna Port

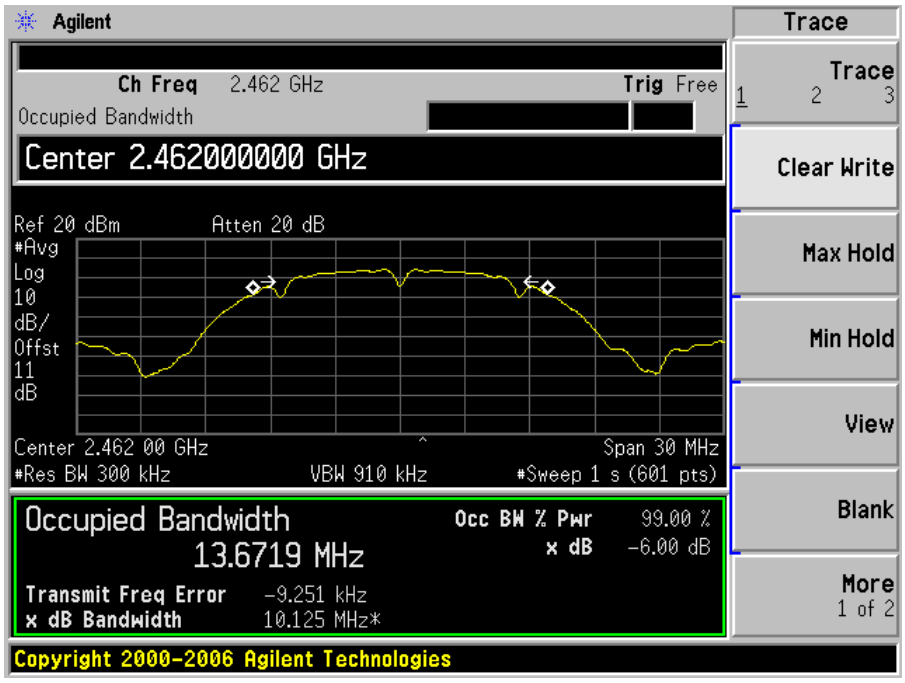
Low channel



Middle channel



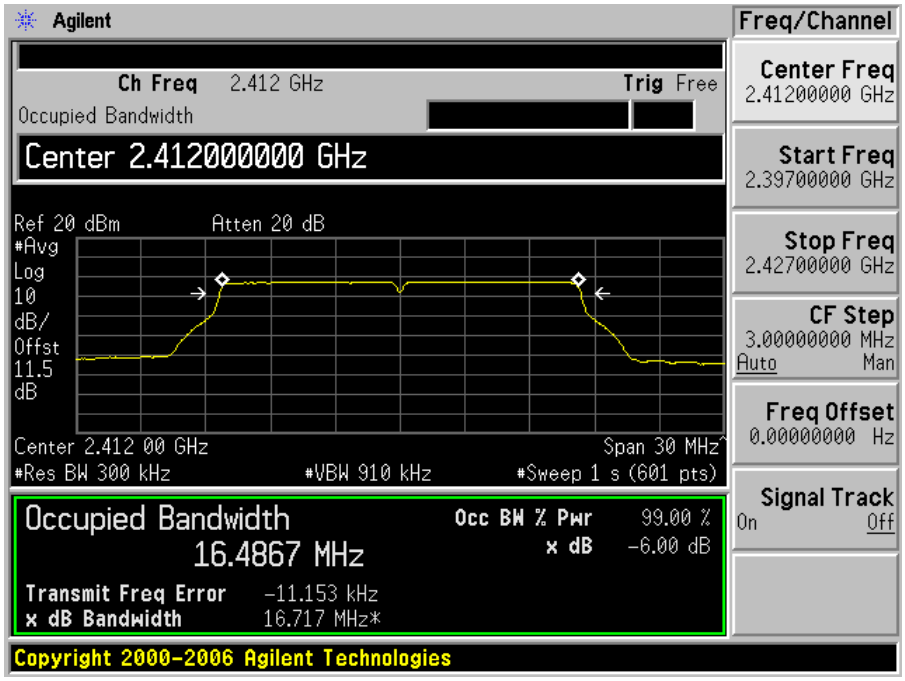
High channel



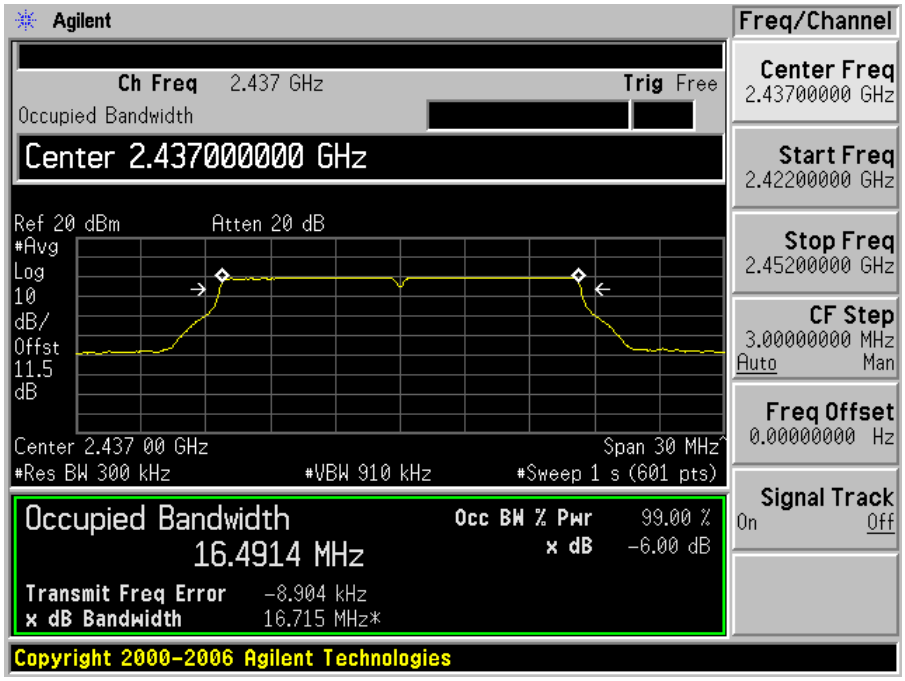
802.11 g 20MHz

Main Antenna Port

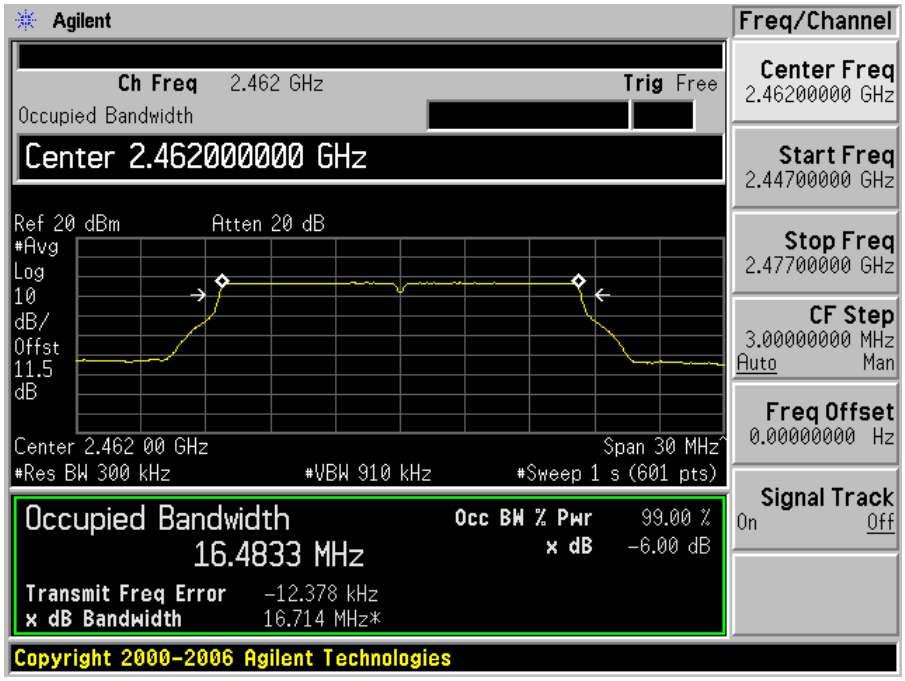
Low channel



Middle channel

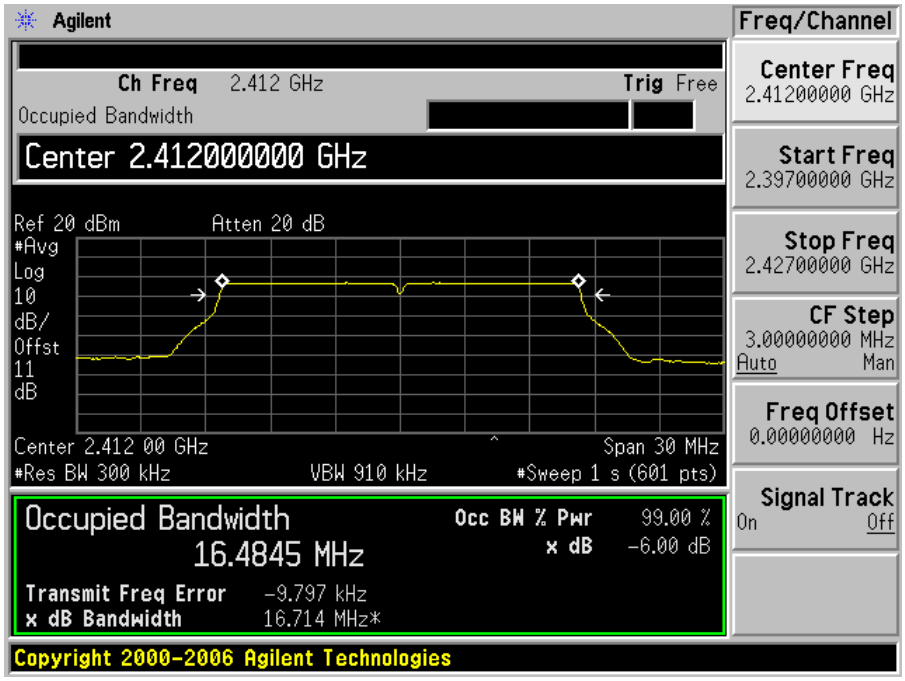


High channel

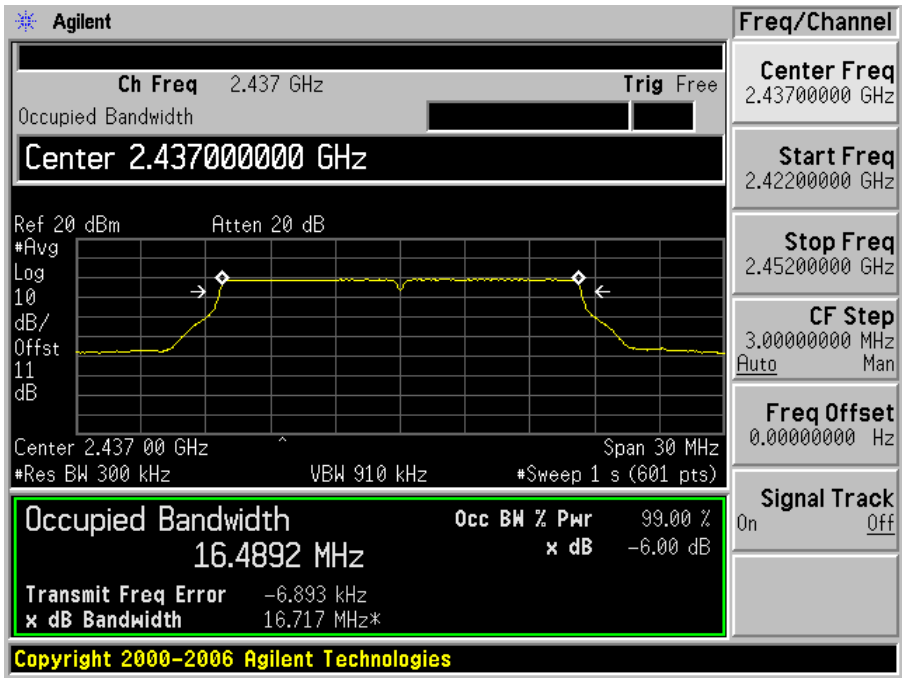


Aux Antenna Port

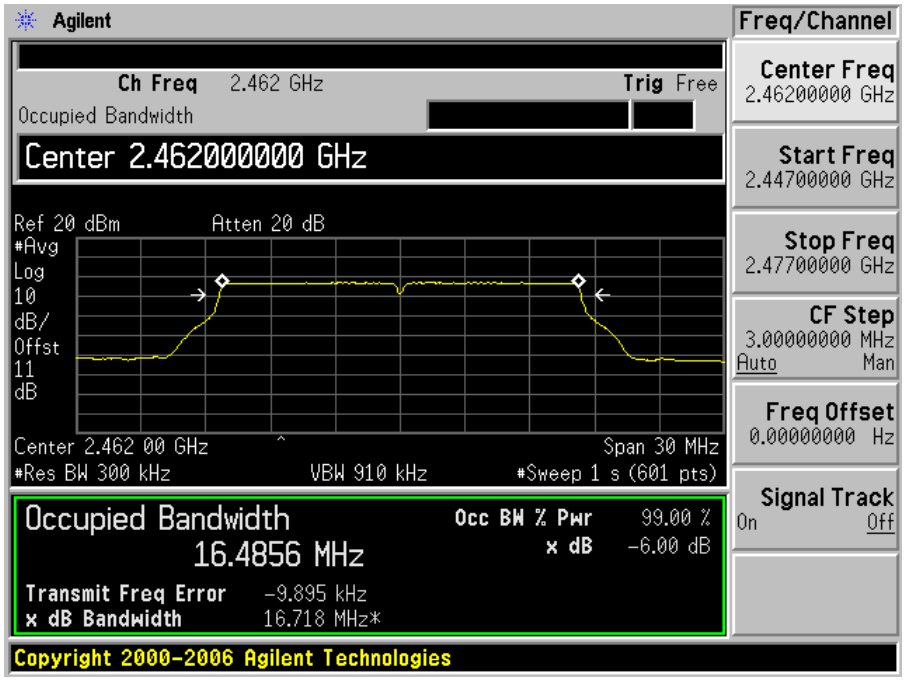
Low channel



Middle channel



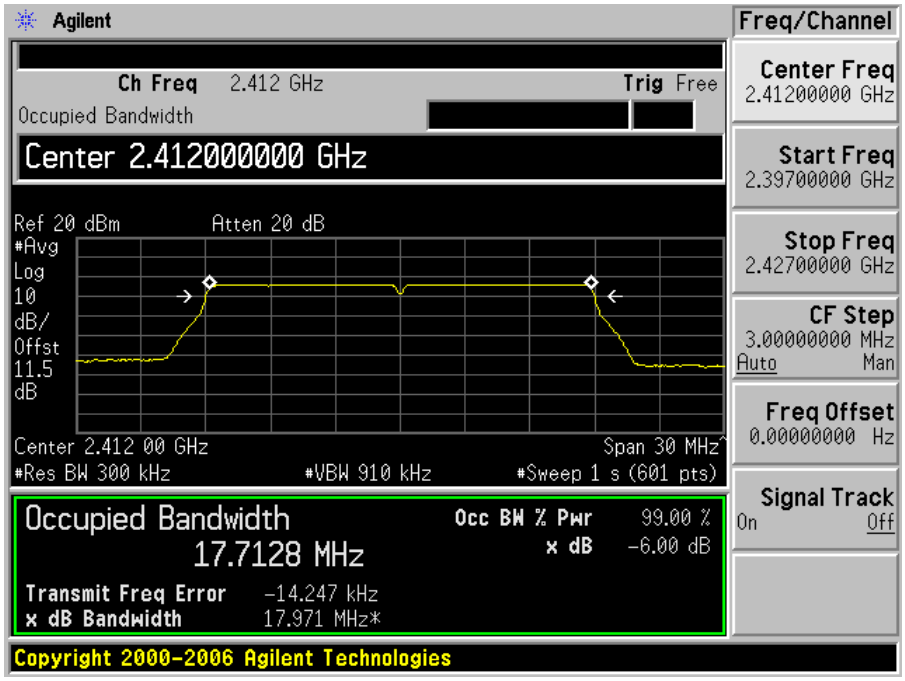
High channel



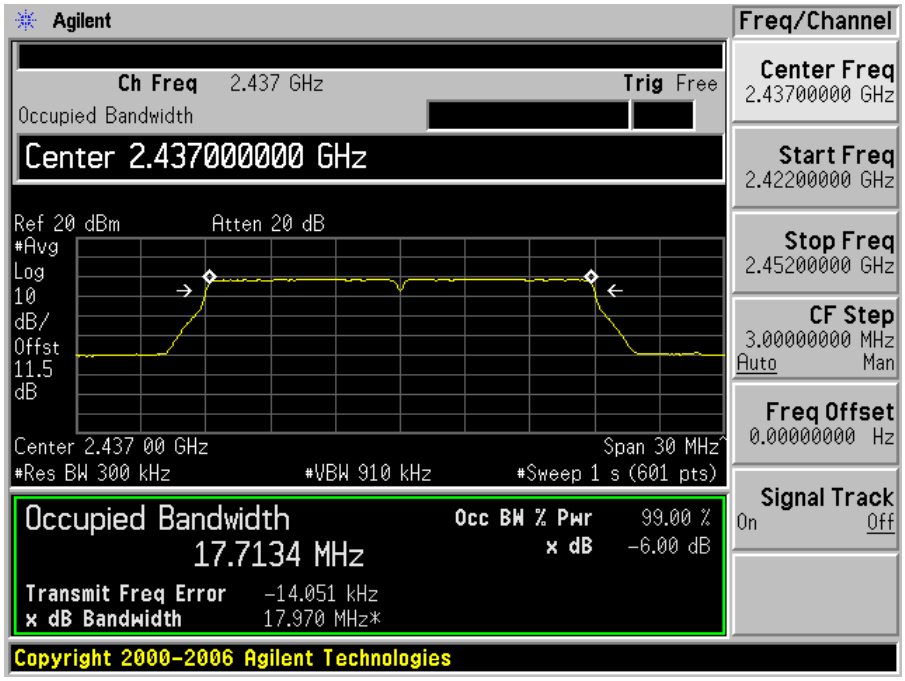
802.11 n 20MHz

Main Antenna Port

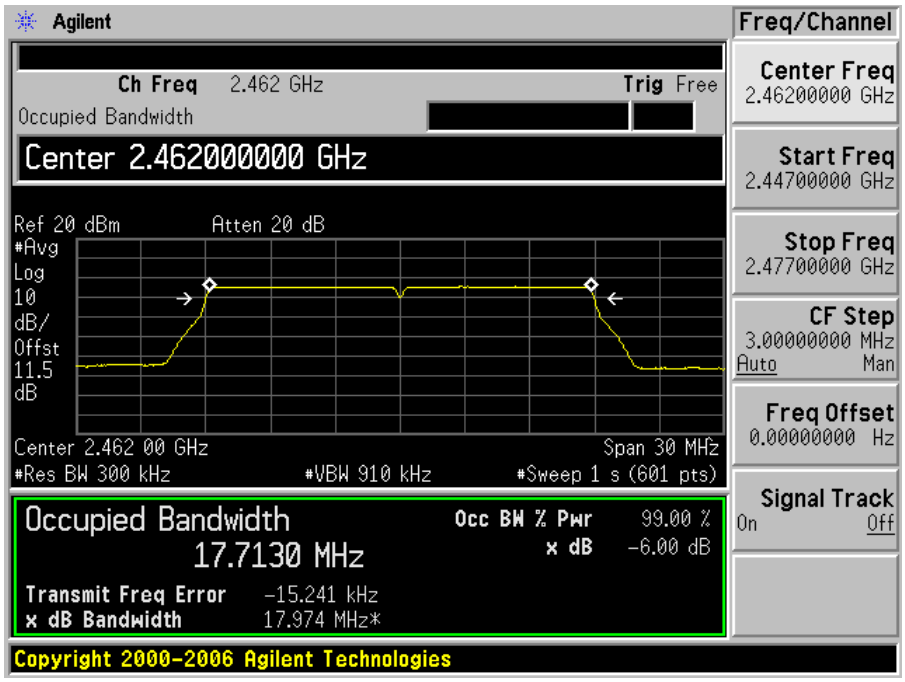
Low channel



Middle channel

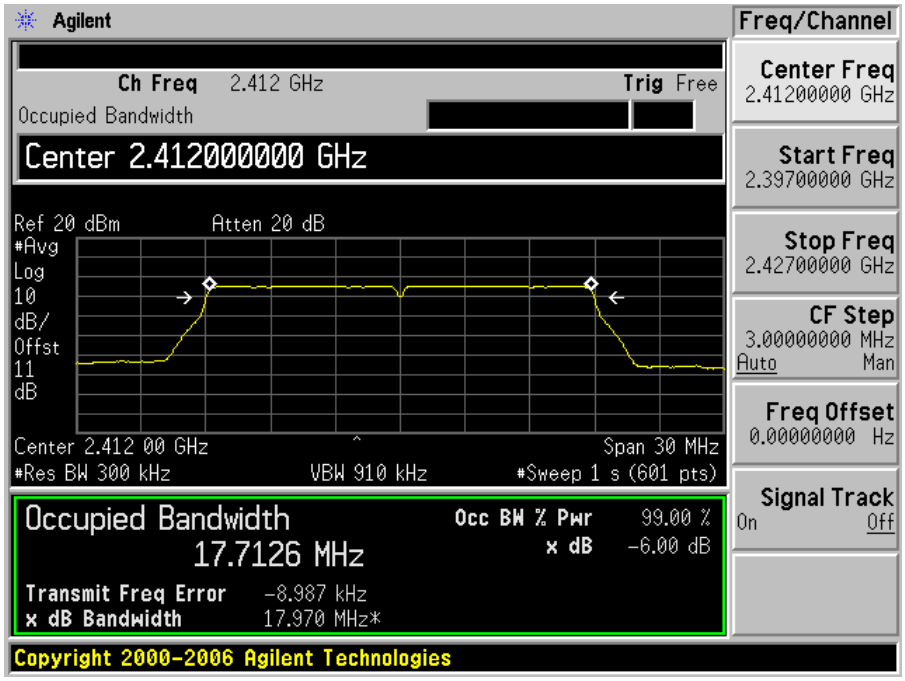


High channel

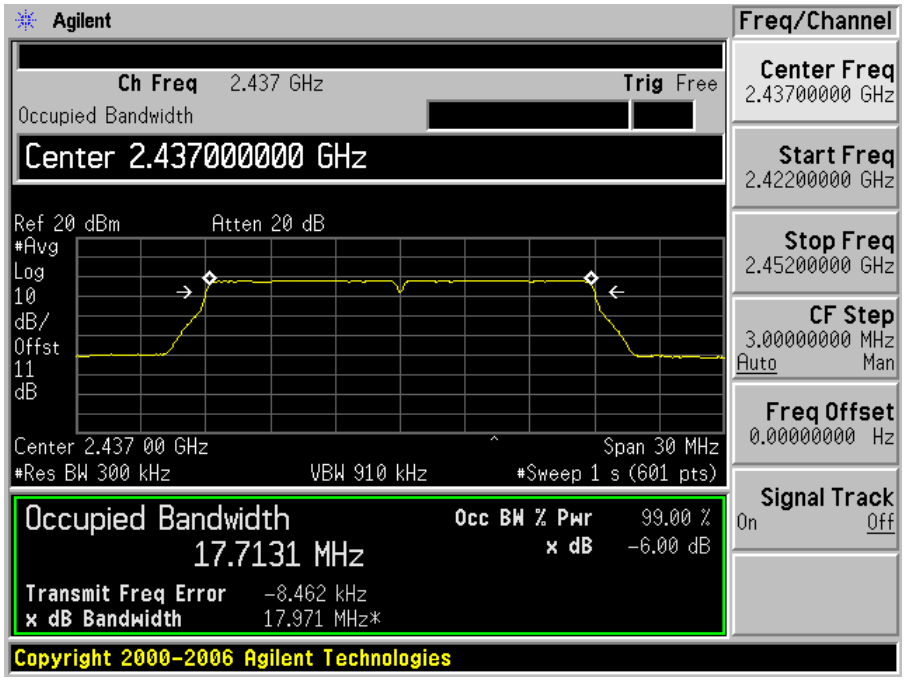


Aux Antenna Port

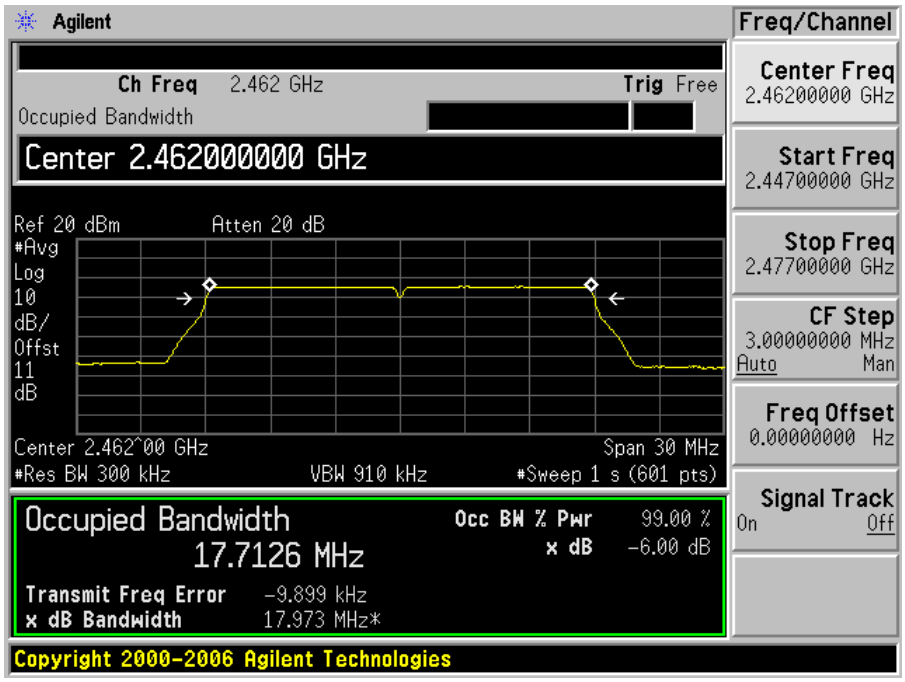
Low channel



Middle channel



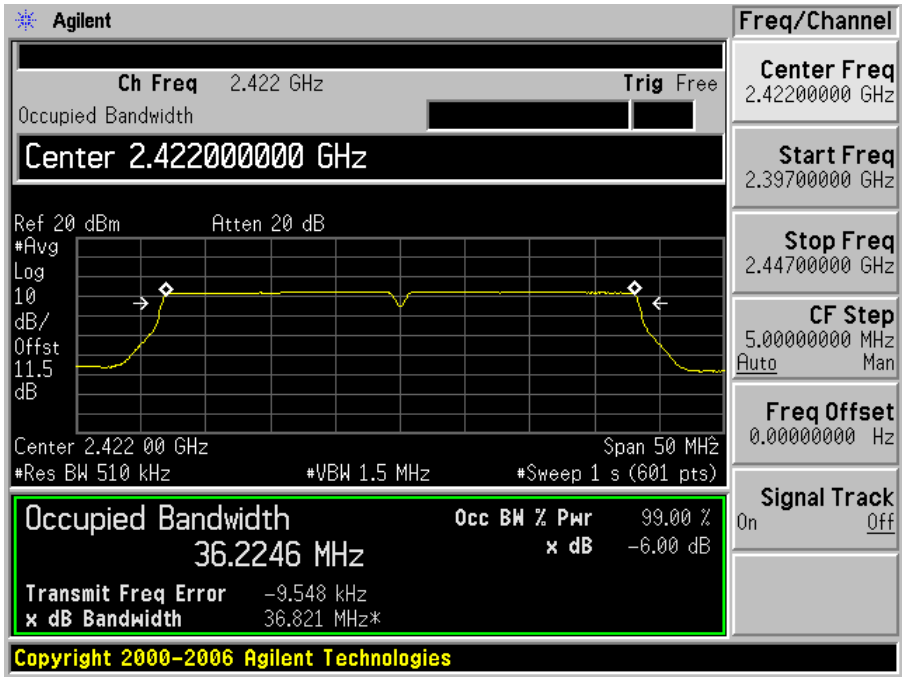
High channel



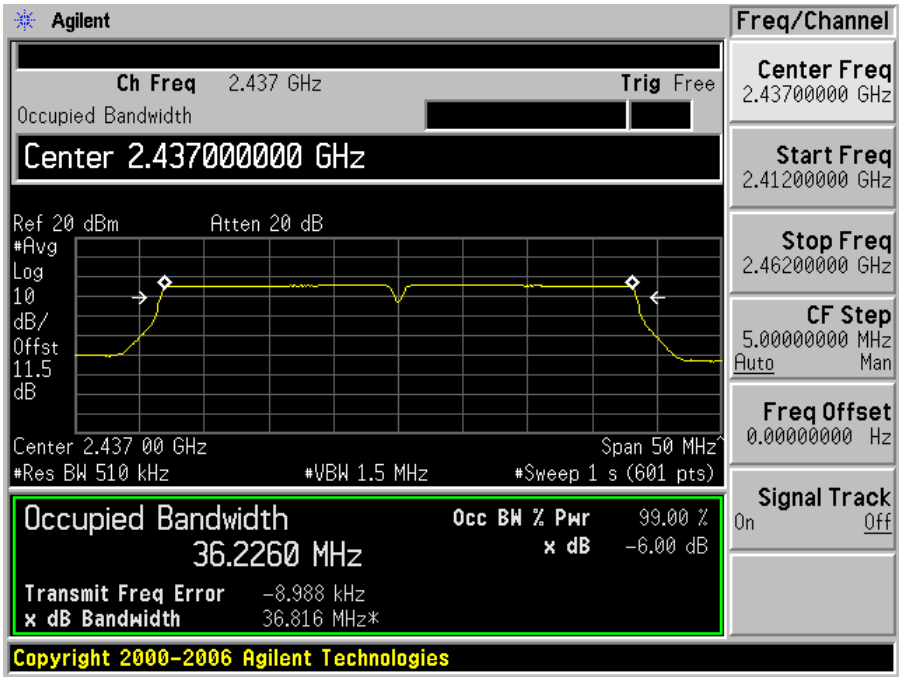
802.11 n 40MHz

Main Antenna Port

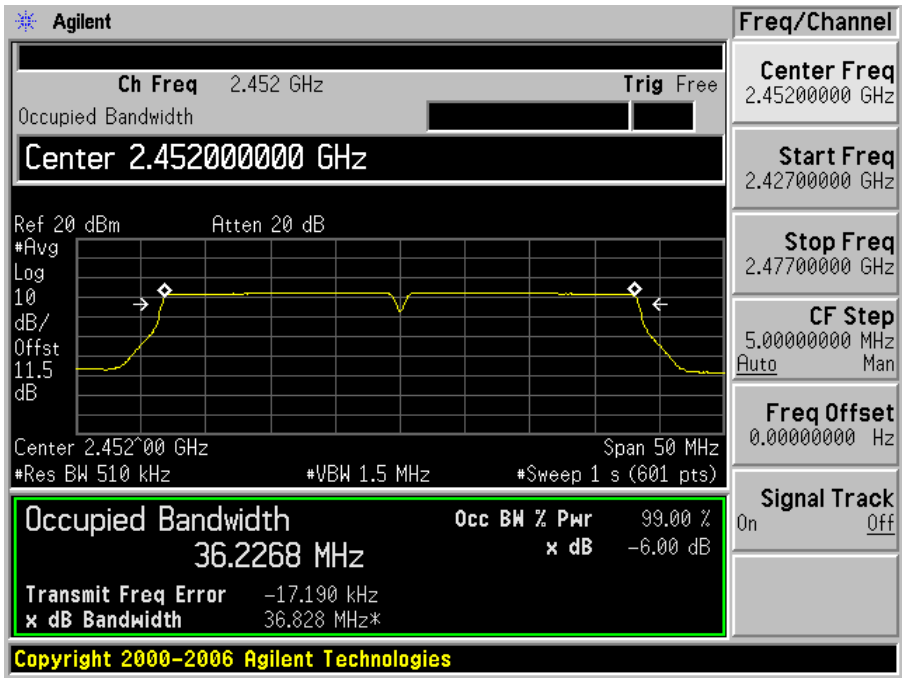
Low channel



Middle channel

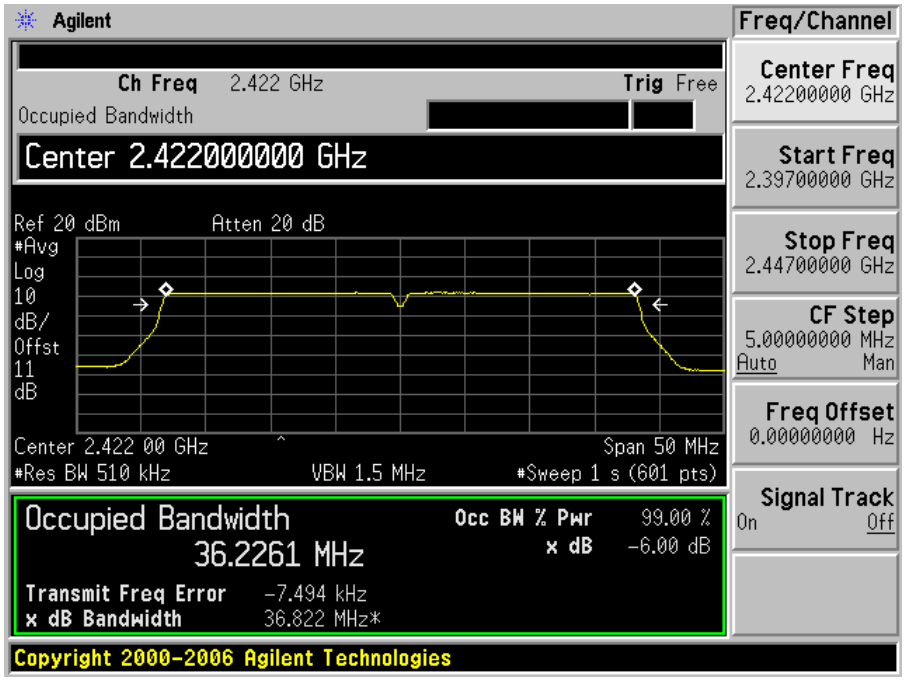


High channel

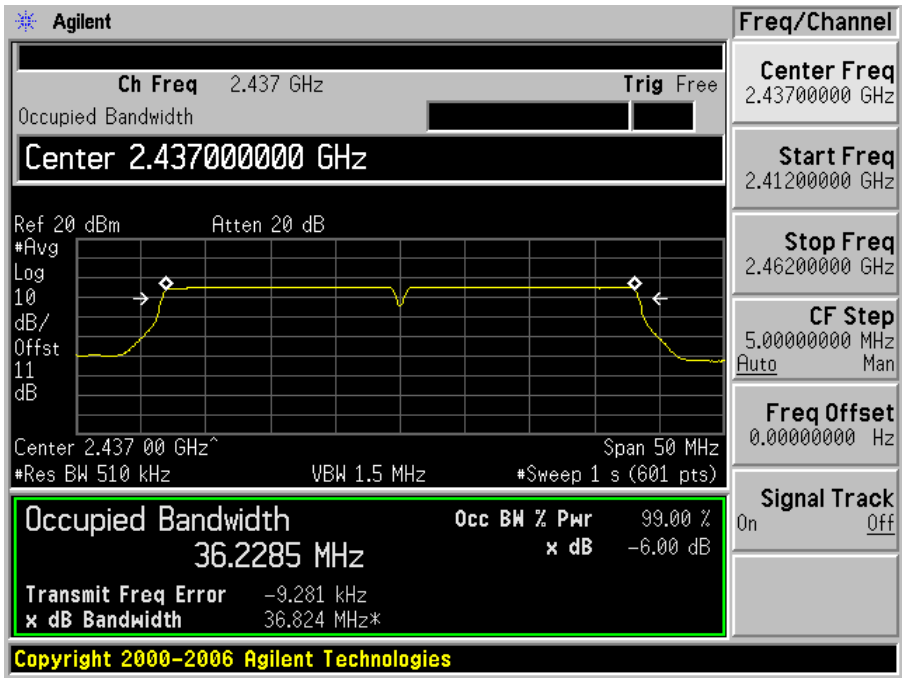


Aux Antenna Port

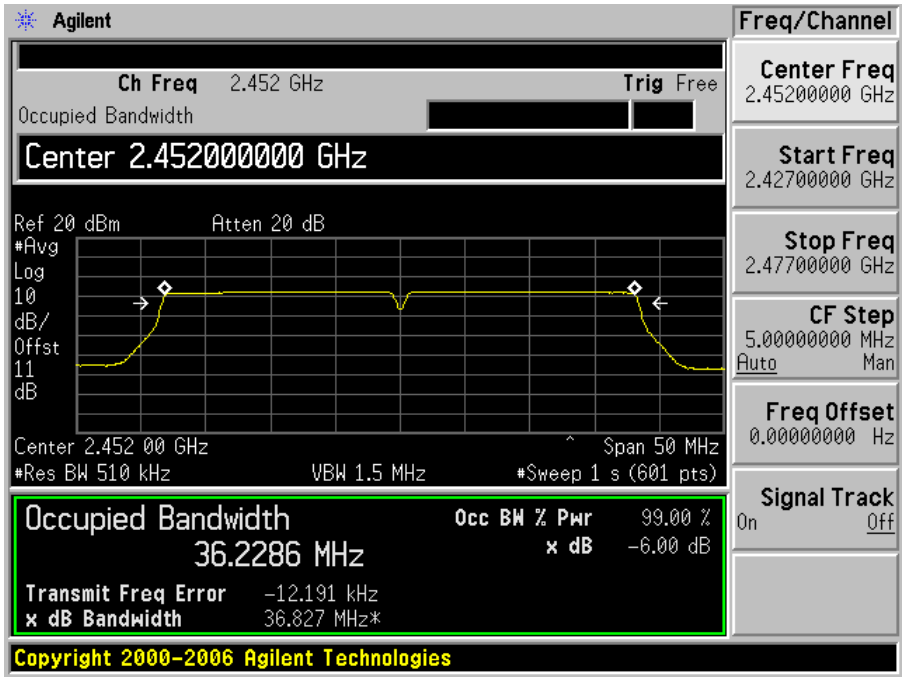
Low channel



Middle channel



High channel



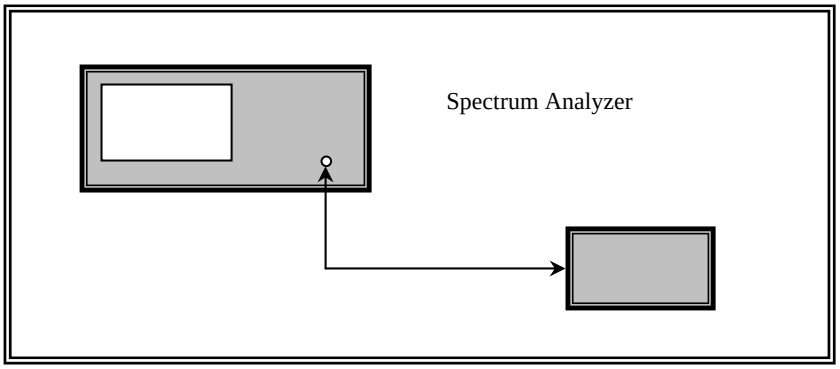
10 FCC §15.247(b) & IC RSS-210§A8.4- Peak Output Power Measurement

10.1 Applicable Standard

According to FCC §15.247(b) 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	MY44303352	2011-05-10

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:	23-25 °C
Relative Humidity:	35-50 %
ATM Pressure:	101-103kPa

The testing was performed by Jack Liu and Quinn Jiang on 2011-09-07~ 2011-09-11 at RF Site.

10.5 Test Results

802.11 b 20 MHz: Peak Power Measurement

Main Antenna

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
CH1/Low	2412	20.79	30	-9.21
CH2	2417	20.89	30	-9.11
CH6/Middle	2437	20.88	30	-9.12
CH10	2457	21.3	30	-8.7
CH11/High	2462	21.48	30	-8.52

Aux Antenna

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
CH1/Low	2412	20.11	30	-9.89
CH6/Middle	2437	20.1	30	-9.9
CH11/High	2462	20.66	30	-9.34

802.11 g 20 MHz:

Main Antenna

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
CH1/Low	2412	21.43	30	-8.57
CH2	2417	23.36	30	-6.64
CH3	2422	24.06	30	-5.94
CH6/Middle	2437	23.79	30	-6.21
CH10	2457	23.74	30	-6.26
CH11/High	2462	21.22	30	-8.78

Aux Antenna

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
CH1/Low	2412	21.34	30	-8.66
CH6/Middle	2437	23.44	30	-6.56
CH11/High	2462	21.09	30	-8.91

802.11 n 20 MHz:

Main Antenna

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
CH1/Low	2412	20.72	30	-9.28
CH2	2417	23.97	30	-6.03
CH6/Middle	2437	23.51	30	-6.49
CH10	2457	23.04	30	-6.96
CH11/High	2462	20.2	30	-9.8

Aux Antenna

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
CH1/Low	2412	20.21	30	-9.79
CH6/Middle	2437	22.93	30	-7.07
CH11/High	2462	20.32	30	-9.68

802.11 n 40 MHz:

Main Antenna

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
CH3/Low	2422	17.67	30	-12.33
CH4	2427	17.79	30	-12.21
CH5	2432	20.17	30	-9.83
CH6/Middle	2437	21.33	30	-8.67
CH8	2447	21.07	30	-8.93
CH9/High	2452	18	30	-12

Aux Antenna

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
CH1/Low	2412	17.81	30	-12.19
CH6/Middle	2437	20.98	30	-9.02
CH11/High	2462	17.86	30	-12.14

802.11 b 20 MHz: Average Power Measurement

Main Antenna

Channel	Frequency (MHz)	Output Power (dBm)
CH1/Low	2412	17.82
CH2	2417	18.13
CH6/Middle	2437	18.03
CH10	2457	18.44
CH11/High	2462	18.14

Aux Antenna

Channel	Frequency (MHz)	Output Power (dBm)
CH1/Low	2412	17.31
CH6/Middle	2437	17.39
CH11/High	2462	17.77

802.11 g 20 MHz:

Main Antenna

Channel	Frequency (MHz)	Output Power (dBm)
CH1/Low	2412	14.07
CH2	2417	15.56
CH3	2422	16.26
CH6/Middle	2437	16.09
CH10	2457	16.13
CH11/High	2462	13.97

Aux Antenna

Channel	Frequency (MHz)	Output Power (dBm)
CH1/Low	2412	13.91
CH6/Middle	2437	15.65
CH11/High	2462	13.62

802.11 n 20 MHz:

Main Antenna

Channel	Frequency (MHz)	Output Power (dBm)
CH1/Low	2412	12.93
CH2	2417	15.99
CH6/Middle	2437	15.4
CH10	2457	15.14
CH11/High	2462	12.56

Aux Antenna

Channel	Frequency (MHz)	Output Power (dBm)
CH1/Low	2412	12.52
CH6/Middle	2437	15.01
CH11/High	2462	12.44

802.11 n 40 MHz:

Main Antenna

Channel	Frequency (MHz)	Output Power (dBm)
CH3/Low	2422	9.99
CH4	2427	10.19
CH5	2432	12.73
CH6/Middle	2437	13.36
CH8	2447	13.22
CH9/High	2452	10.41

Aux Antenna

Channel	Frequency (MHz)	Output Power (dBm)
CH1/Low	2412	9.67
CH6/Middle	2437	13.18
CH11/High	2462	9.86

11 FCC §15.247(d) & IC RSS-210§A8.5 - 100 kHz Bandwidth of Band Edges

11.1 Applicable Standard

According to FCC §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).

According to IC Rss-210 §A8.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

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	MY44303352	2011-05-10

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:	23-25 °C
Relative Humidity:	35-50 %
ATM Pressure:	101-103kPa

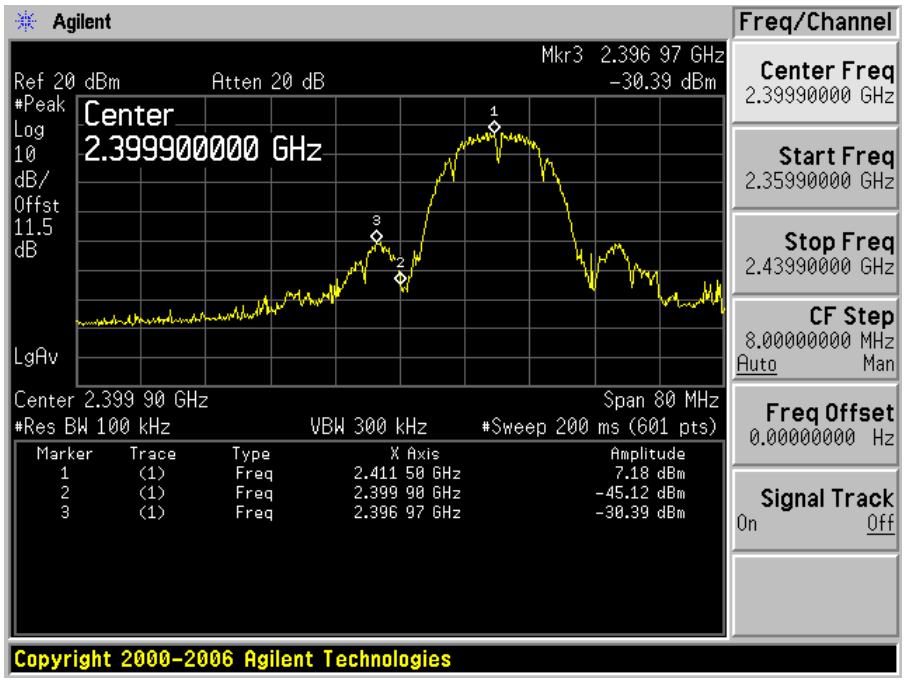
The testing was performed by Jack Liu and Quinn Jiang on 2011-09-07~ 2011-09-11 at RF Site.

11.5 Measurement Results

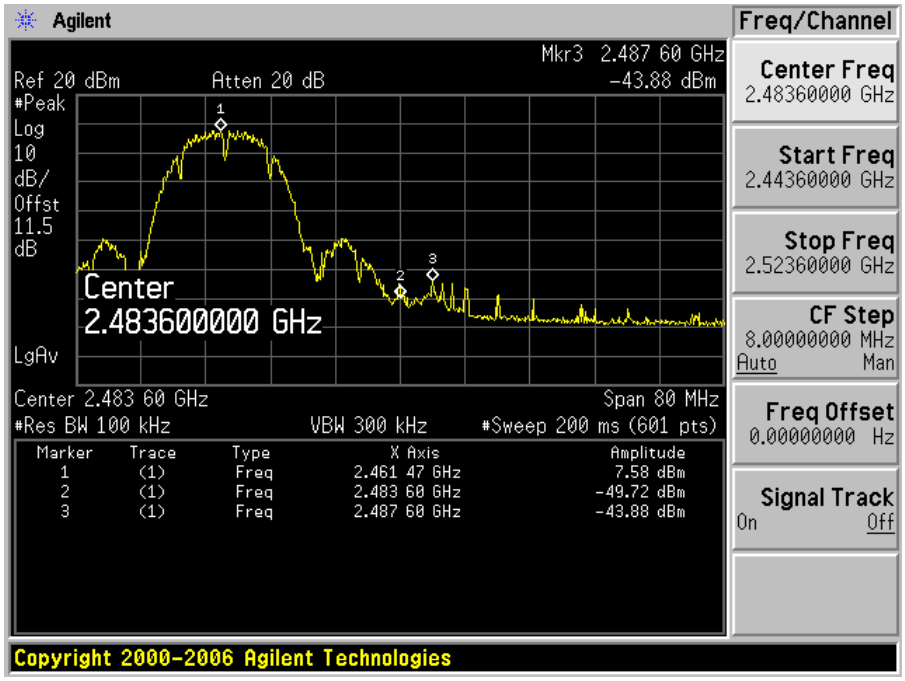
Please refer to following pages for plots of band edge.

802.11 b 20 MHz – Worst Antenna Port Main Antenna

Low Band Edge

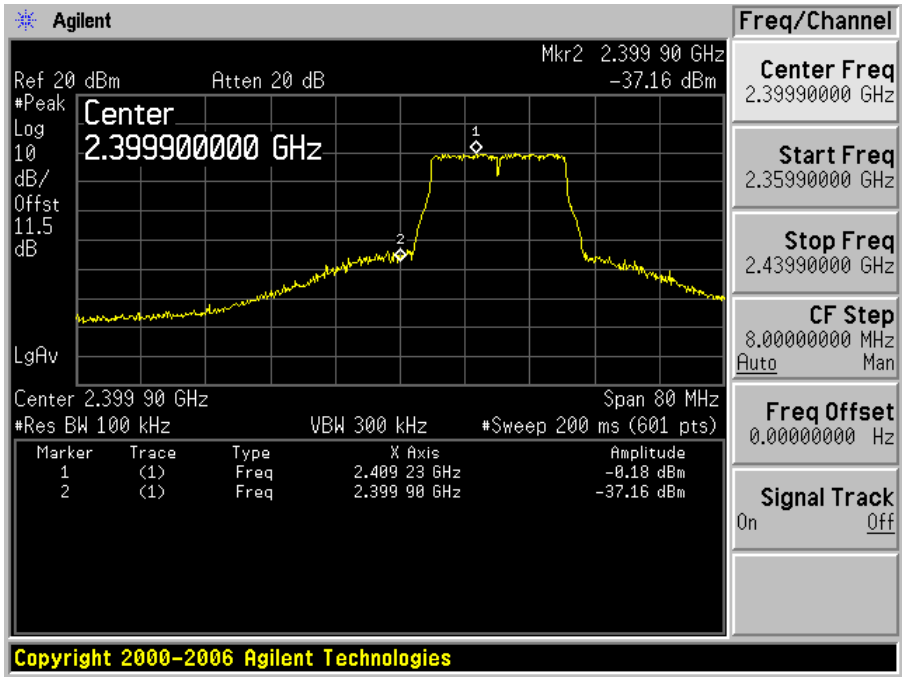


High Band Edge

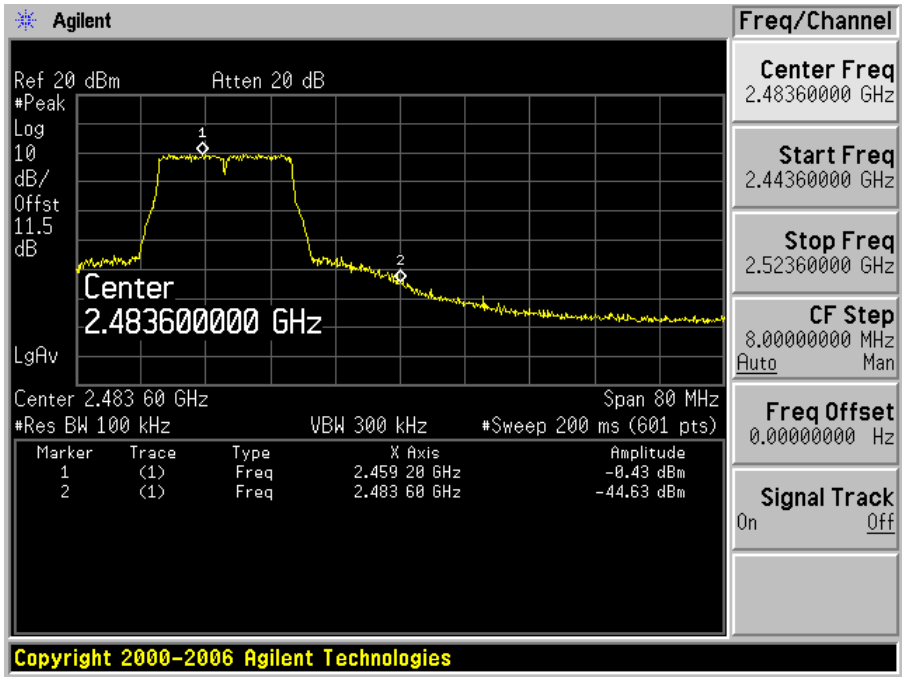


802.11 g 20 MHz – Worst Antenna Port Main Antenna

Low Band Edge

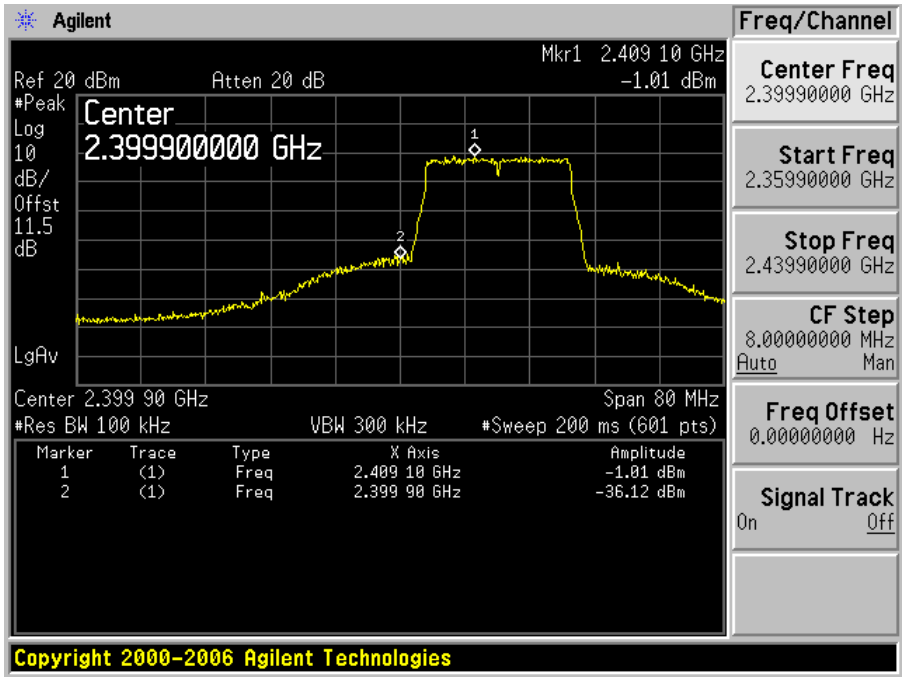


High Band Edge

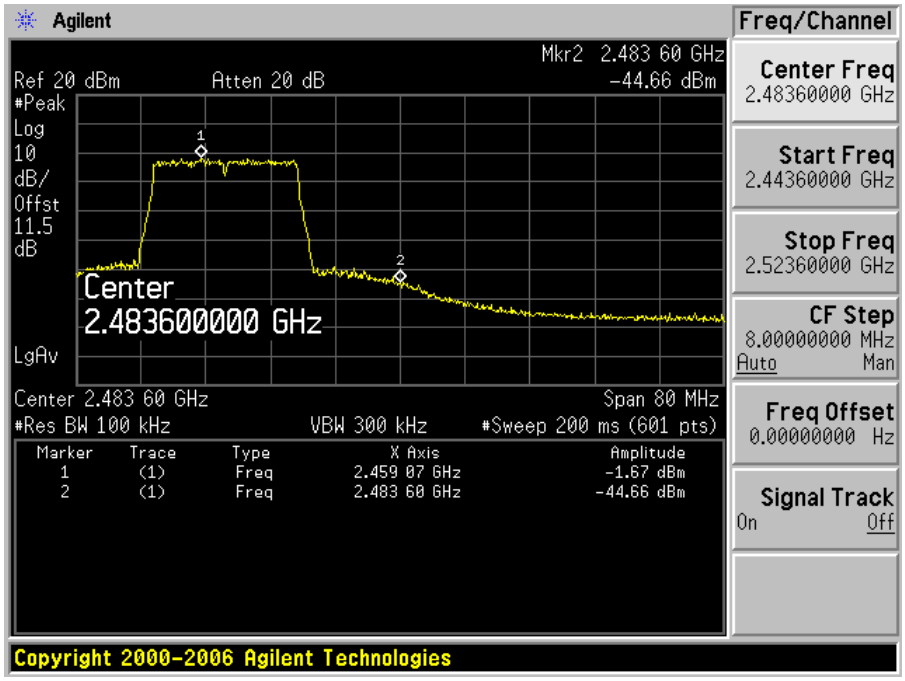


802.11 n 20 MHz – Worst Antenna Port Main Antenna

Low Band Edge

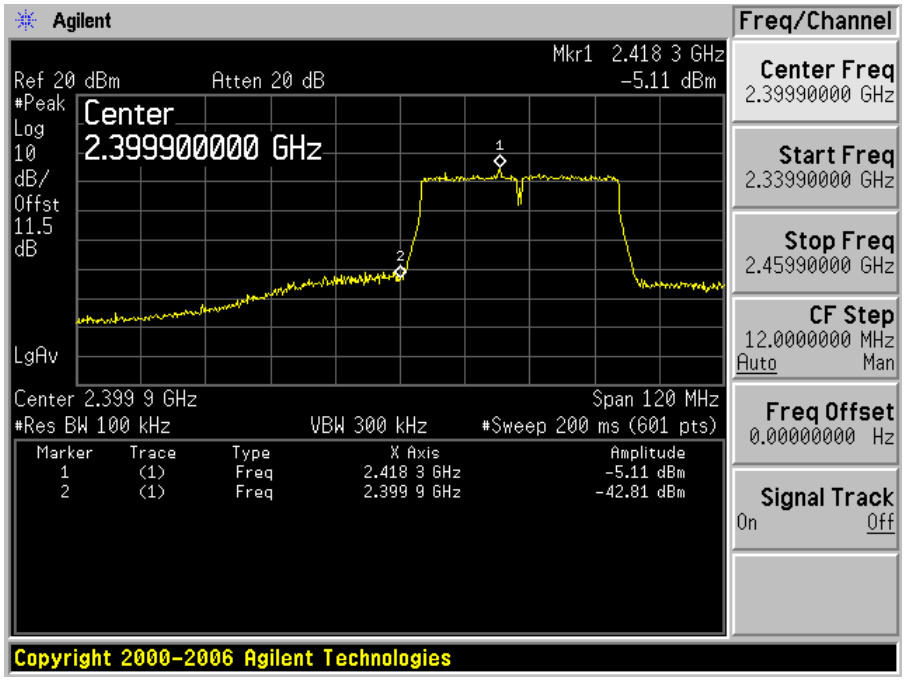


High Band Edge

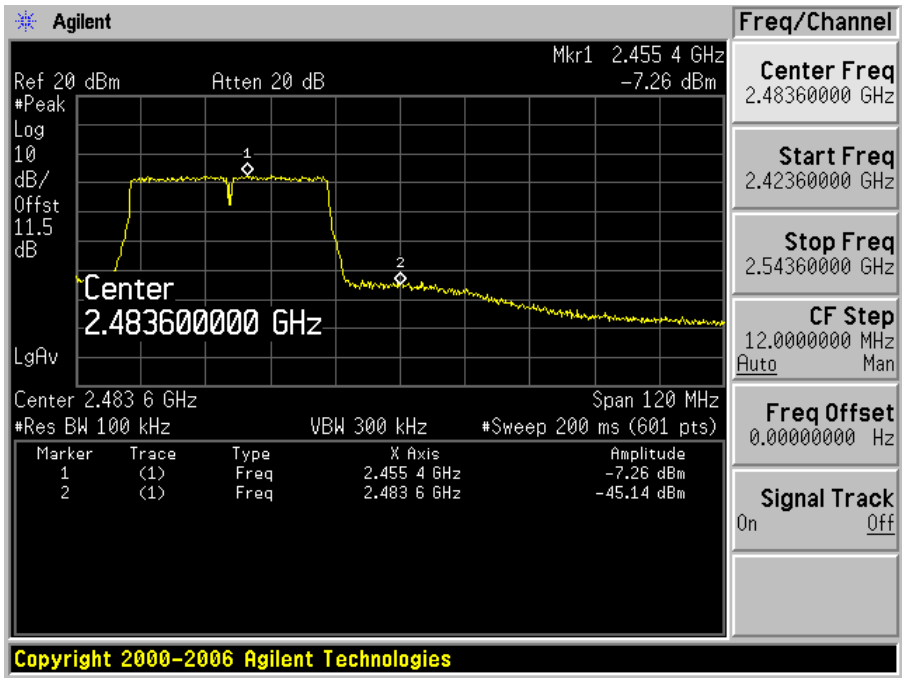


802.11 n 40 MHz – Worst Antenna Port Main Antenna

Low Band Edge



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 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	MY44303352	2011-05-10

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:	23-25 °C
Relative Humidity:	35-50 %
ATM Pressure:	101-103kPa

The testing was performed by Jack Liu and Quinn Jiang on 2011-09-07~ 2011-09-11 at RF Site.

12.5 Summary of Test Results

802.11 b 20 MHz mode:

Antenna Port	Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Worst Antenna Port Main	Low	2412	-6.01	8	Compliant
	Mid	2437	-6.28	8	Compliant
	High	2462	-5.93	8	Compliant

802.11 g 20 MHz mode:

Antenna Port	Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Worst Antenna Port Main	Low	2412	-15.56	8	Compliant
	Mid	2437	-11.29	8	Compliant
	High	2462	-14.90	8	Compliant

802.11 n 20 MHz mode:

Antenna Port	Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Worst Antenna Port Main	Low	2412	-15.45	8	Compliant
	Mid	2437	-15.12	8	Compliant
	High	2462	-15.25	8	Compliant

802.11 n 40 MHz mode:

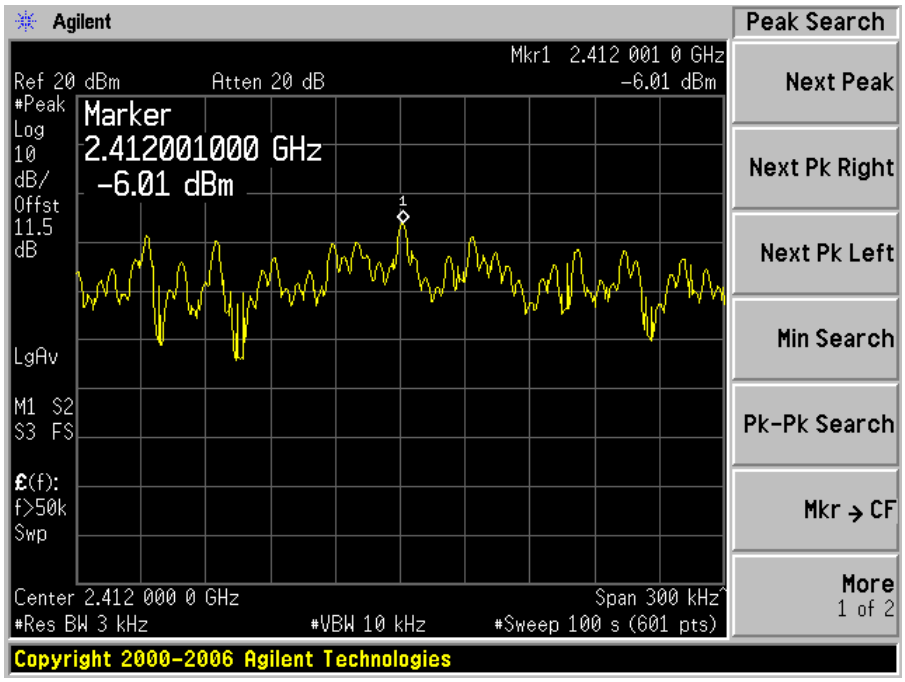
Antenna Port	Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Worst Antenna Port Main	Low	2422	-16.14	8	Compliant
	Mid	2437	-18.12	8	Compliant
	High	2452	-17.10	8	Compliant

Please refer to the following plots for detailed test results:

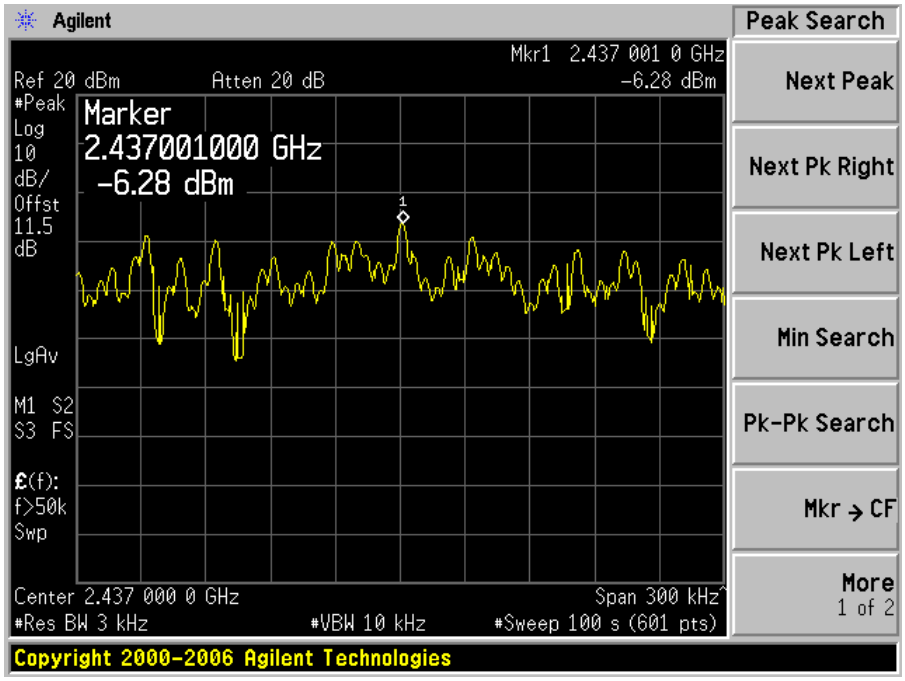
802.11 b 20MHz

Worst Antenna Port Main Antenna Port

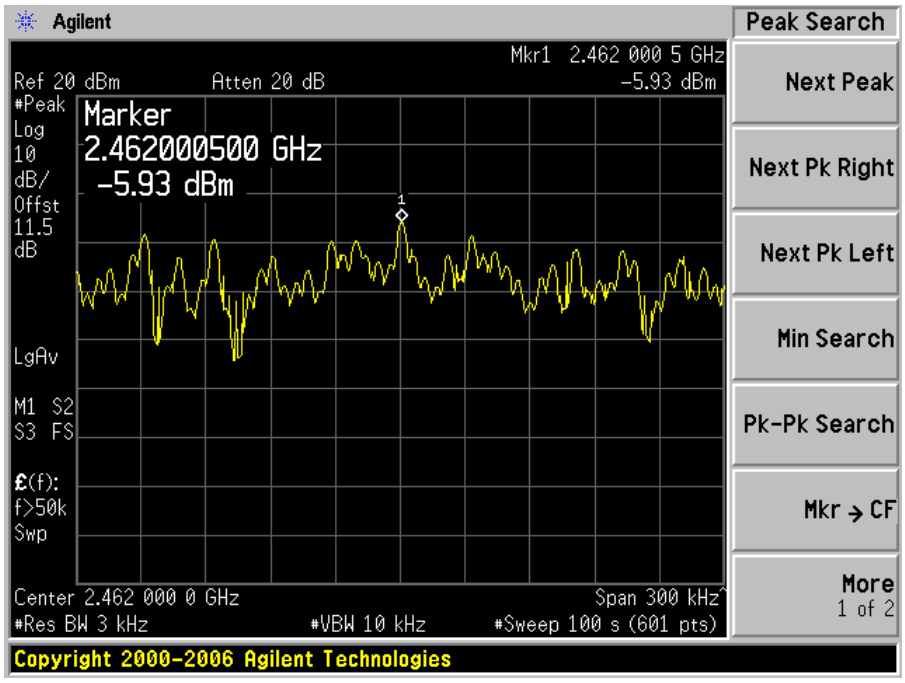
Low channel



Middle channel



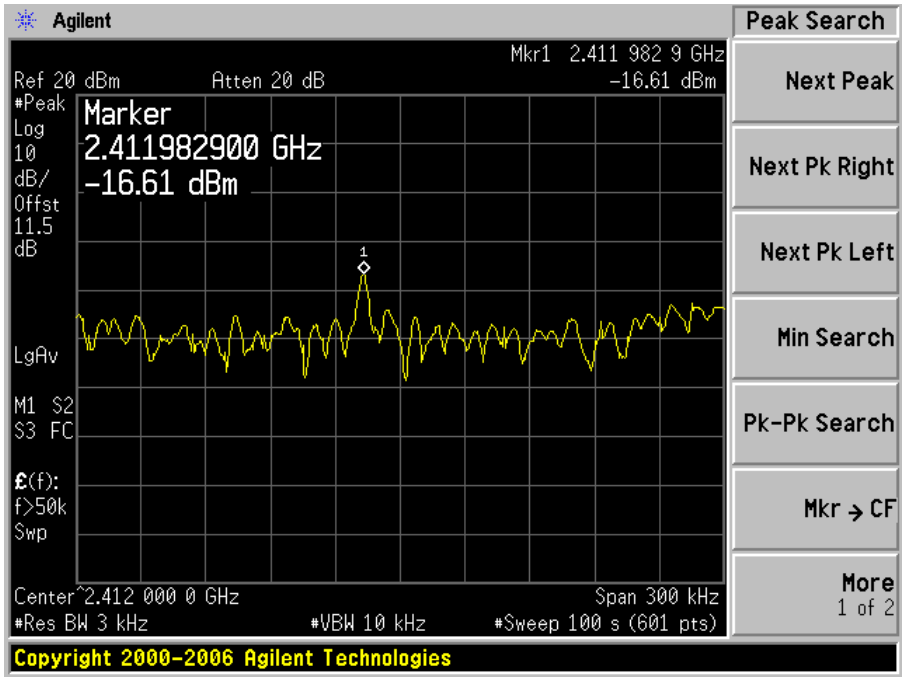
High channel



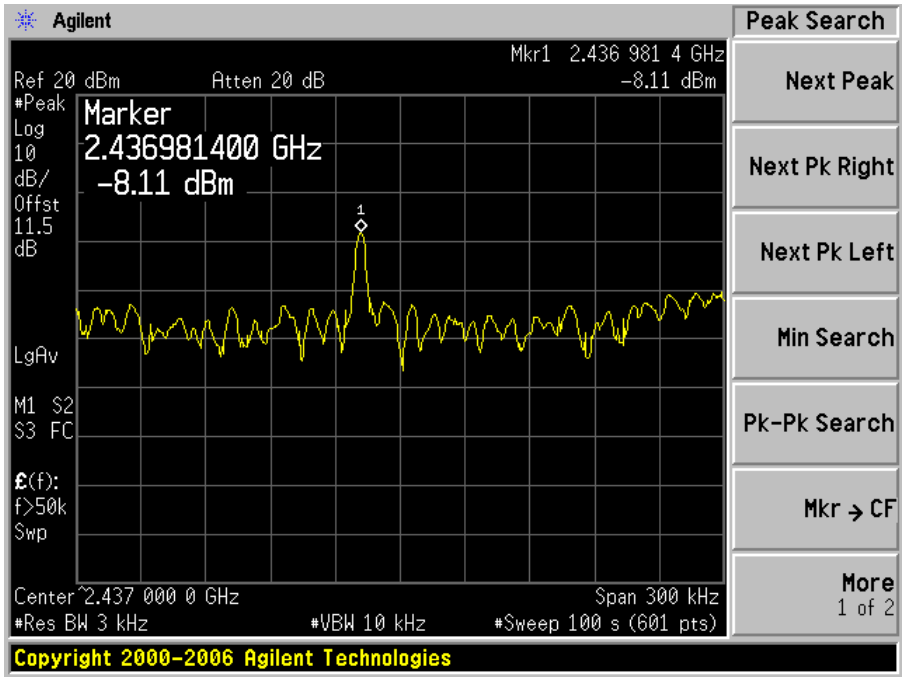
802.11 g 20MHz

Worst Antenna Port Main Antenna Port

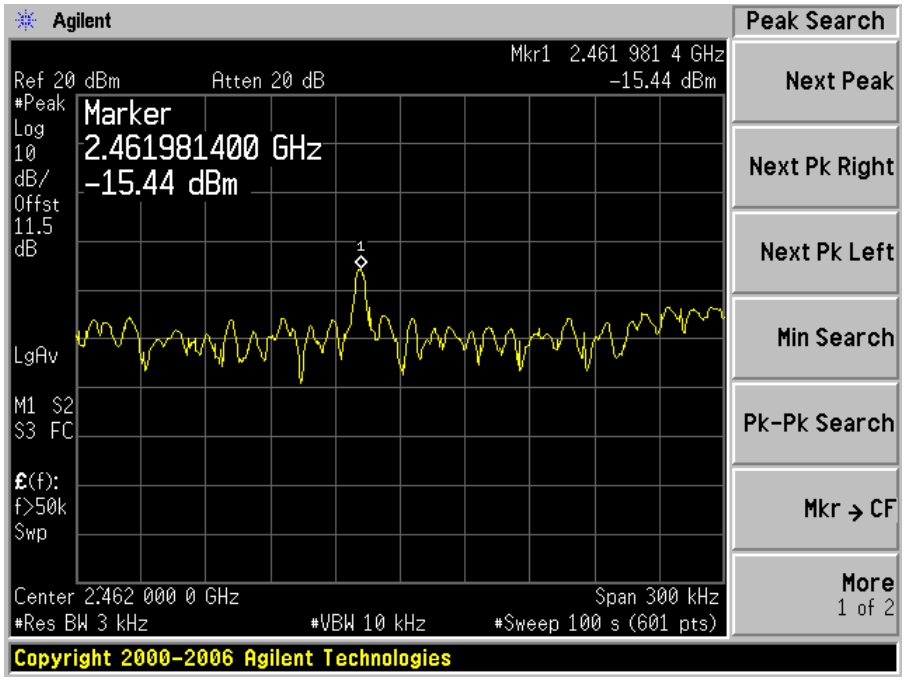
Low channel



Middle channel



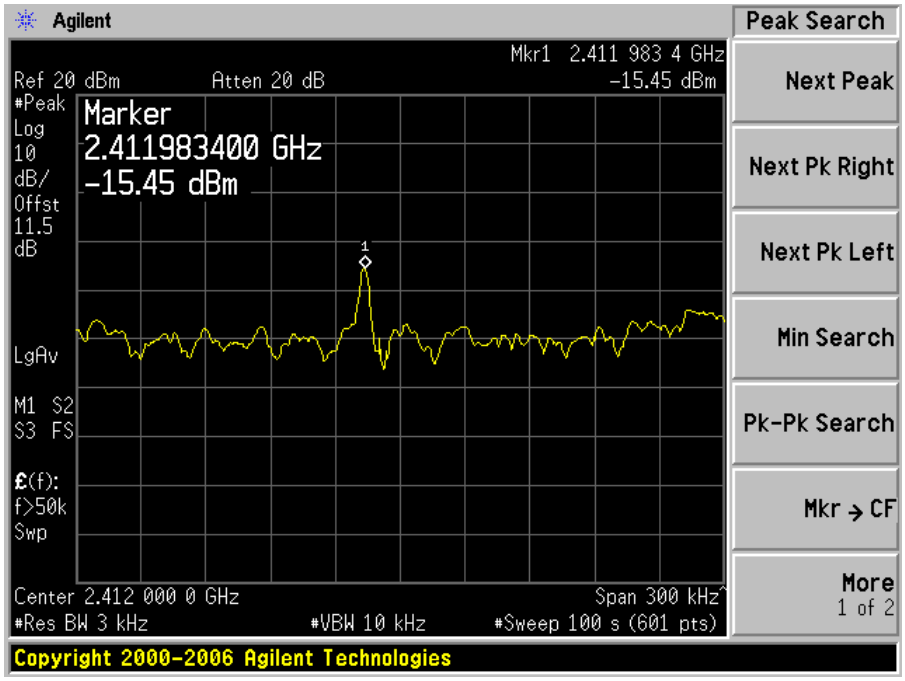
High channel



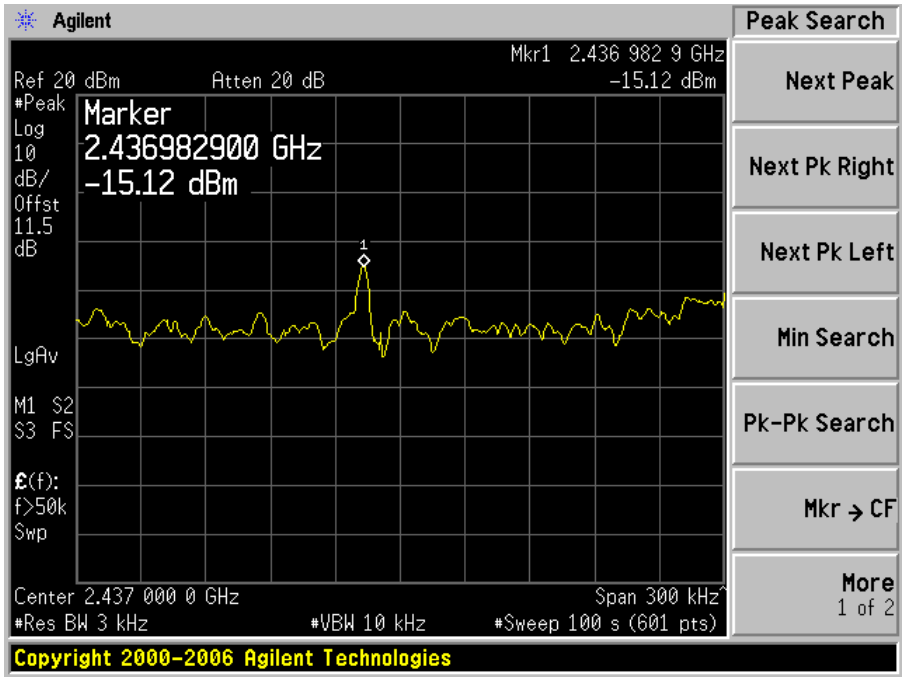
802.11 n 20MHz

Worst Antenna Port Main Antenna Port

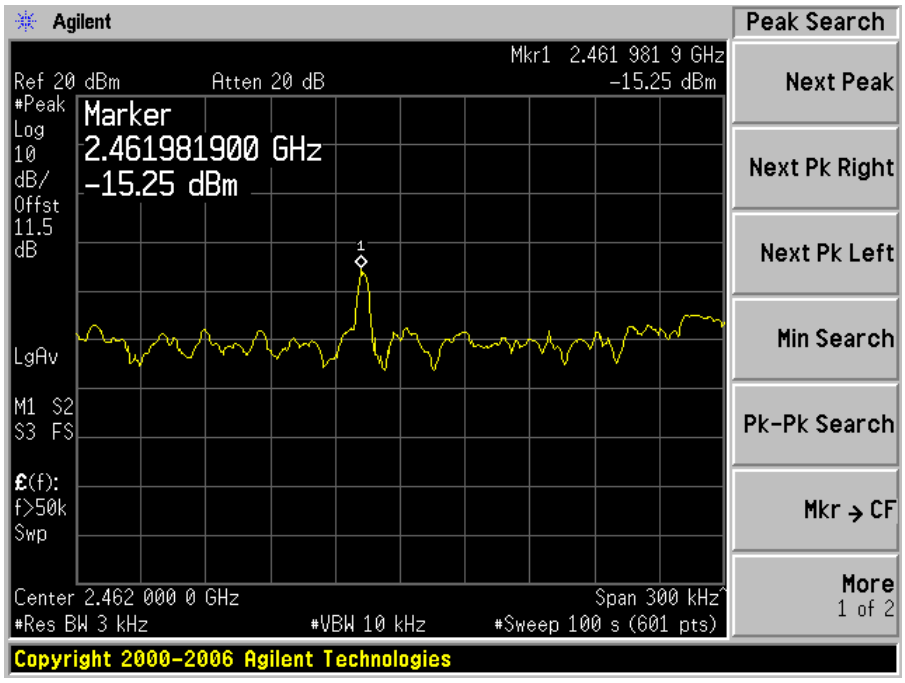
Low channel



Middle channel



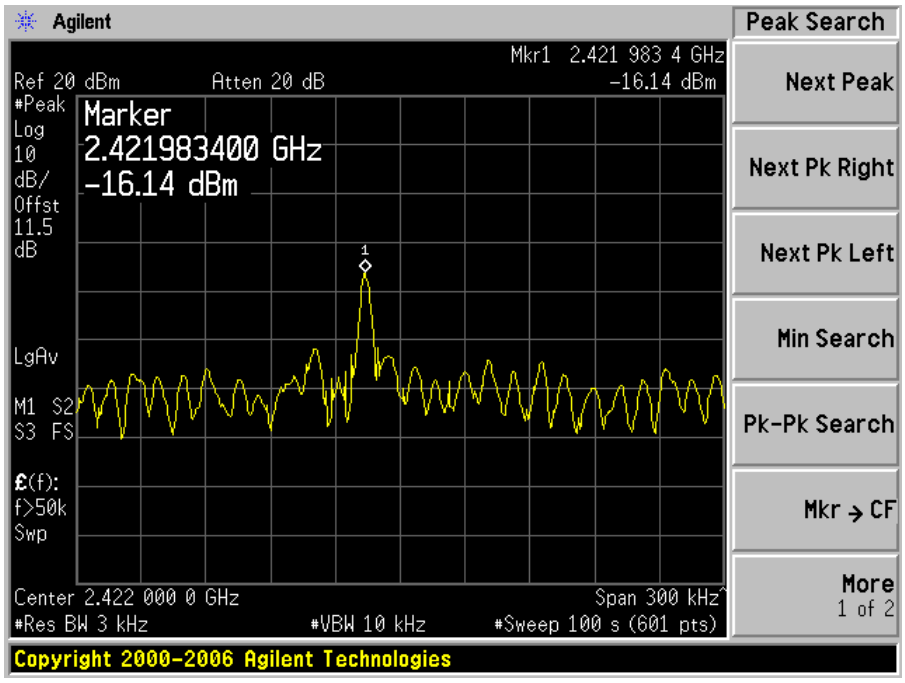
High channel



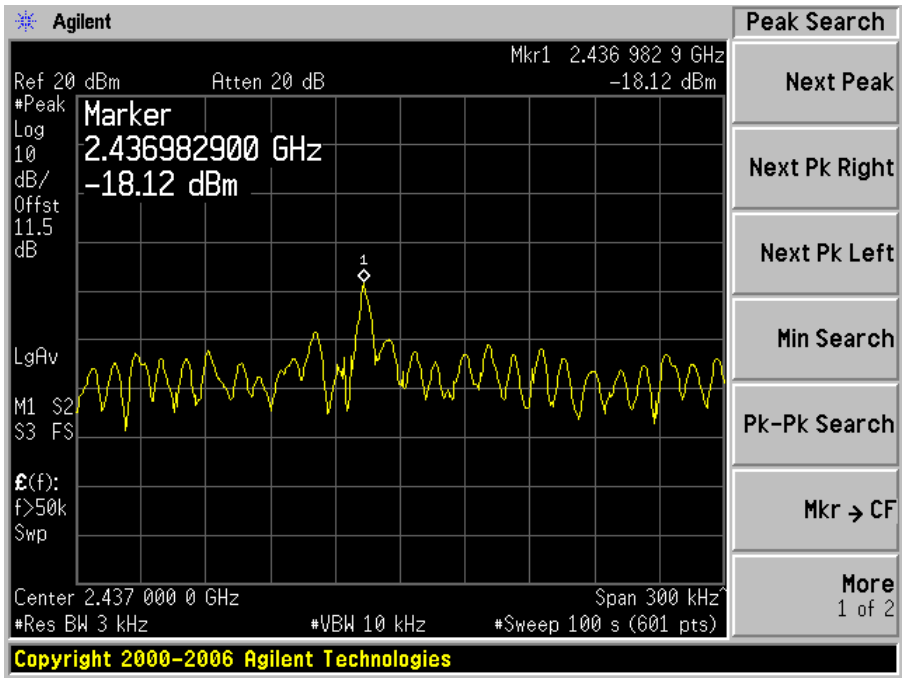
802.11 n 40MHz

Worst Antenna Port Main Antenna Port

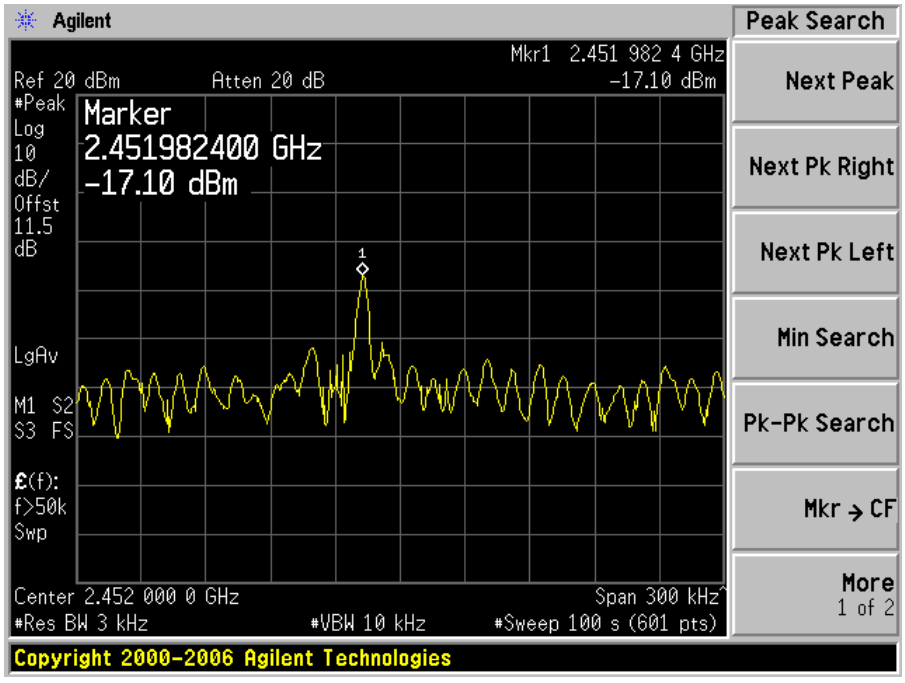
Low channel



Middle channel



High channel



13 IC RSS-210 §2.6 & RSS-Gen §4.10-Receiver Spurious Radiated Emissions

13.1 Applicable Standard

According to IC RSS-Gen §4.10, the receiver shall be operated in the normal receive mode near the mid-point of the band over which the receiver is designed to operate.

Unless otherwise specified in the applicable RSS, the radiated emission measurement is the standard measurement method (with the device's antenna in place) to measure receiver spurious emissions.

Radiated emission measurements are to be performed using a calibrated open-area test site.

For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tuneable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

For emissions below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector with the same measurement bandwidth as that for CISPR quasi-peak measurements. Above 1 GHz, measurements shall be performed using an average detector and a resolution bandwidth of 300 kHz to 1 MHz.

According to RSS-210 §2.6, Tables 2 and 3 show the general field strength limits of unwanted emissions, where applicable, for transmitters and receivers operating in accordance with the provisions specified in this RSS. Transmitters whose wanted emissions are also within the limits shown in Tables 2 and 3 may operate in any of the frequency bands of Tables 2 and 3, other than the restricted bands of Table 1 and the TV bands, and shall be certified under RSS-210.

Table 2: General Field Strength Limits for Transmitters and Receivers at Frequencies above 30 MHz **(Note)**

Frequency (MHz)	Field Strength Microvolts/m at 3 meters (watts, e.i.r.p.)	
	Transmitters	**Receivers**
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8 nW)	150 (6.8 nW)
216-960	200 (12 nW)	200 (12 nW)
Above 960	500 (75 nW)	500 (75 nW)

Note: Transmitting devices are not permitted in Table 1 bands or in TV bands (54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz, and 614-806 MHz). Prohibition of operation in TV bands does not apply to momentary devices, or to medical telemetry devices in the band 174-216 MHz, and to perimeter protection systems in the bands 54-72 and 76-88 MHz. The perimeter protection devices are to meet Table 3 field strengths limits.

Table 3: General Field Strength Limits for Transmitters at Frequencies below 30 MHz (Transmit)

Frequency (fundamental or spurious)	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1.705-30 MHz	30	N/A	30

Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average detector.

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 (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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

13.5 Test Equipment Lists and Details

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2011-03-21
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A0020106-3	2011-06-29
A.R.A Inc	Horn antenna	DRG-1181A	1132	2010-11-29
Hewlett Packard	Pre amplifier	8447D	2944A06639	2011-06-09
Mini-Circuits	Pre Amplifier	ZVA-183-S	570400946	2011-05-09

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

13.6 Test Environmental Conditions

Temperature:	23-25 °C
Relative Humidity:	35-50 %
ATM Pressure:	101-103kPa

The testing was performed by Jack Liu and Quinn Jiang on 2011-09-07~ 2011-09-11 at RF Site.

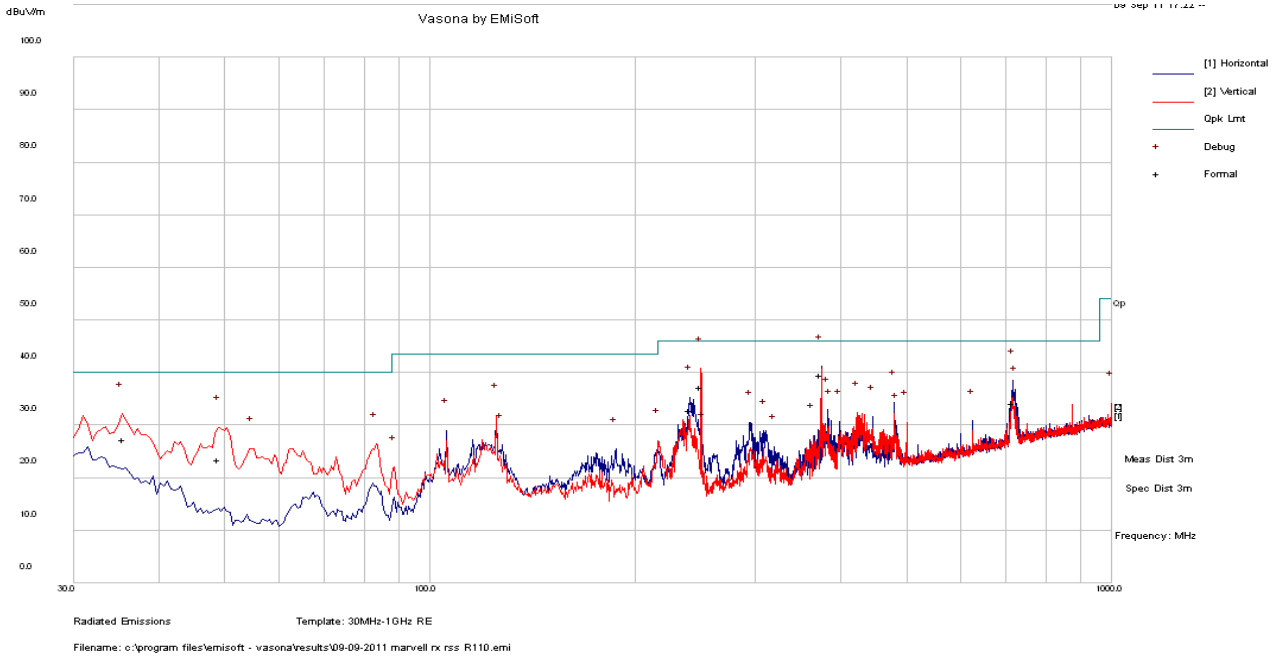
13.7 Summary of Test Results

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

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-6.49	375.0303	Horizontal	30 to 25000

13.8 Test data and Plots

1) 30-1000 MHz, Measured at 3 meters



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
375.0303	39.51	108	H	131	46	-6.49
249.955	37.33	99	V	205	46	-8.67
716.0595	34.23	106	H	203	46	-11.77
35.5735	27.22	99	V	211	40	-12.78
240.7053	32.93	116	H	124	46	-13.07
48.9565	23.48	151	V	306	40	-16.52

2) Above 1 GHz Measured at 3 meters

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
17976.92	39.4	193	H	89	54	-14.60
14764.58	37.1	166	H	3	54	-16.90
1200.373	32.7	104	V	182	54	-21.30
1375.027	31.37	196	V	159	54	-22.63

Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
17975.1	52.26	200	H	89	74	-21.74
14766.45	50.25	300	H	3	74	-23.75
1199.243	43.05	100	V	182	74	-30.95
1375.656	38.28	200	V	159	74	-35.72

14 Exhibit A - FCC & IC Equipment Labeling Requirements

14.1 FCC ID Label Requirements

As per FCC §2.925,

(a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in §2.926. The FCC Identifier shall be preceded by the term FCC ID in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID XXX123

Where: XXX—Grantee Code 123—Equipment Product Code

As per FCC §15.19,

(a) In addition to the requirements in part 2 of this chapter, a device subject to certification, or verification shall be labeled as follows:

(3) All other devices shall bear the following statement in a conspicuous location on the device:
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified above is required to be affixed only to the main control unit. If the EUT is integrated within another device then a label affixed to the host shall also state, “Contains FCC ID: XXXXXX”

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

14.2 IC Label Requirements

As per IC RSS-Gen § 5, the certification number shall appear as follows:

IC: XXXXXX-YYYYYYYY

Where:

- "XXXXXX-YYYYYYYY" is the certification number
- "XXXXXX" is the Certificate Holder Number (CHN), made of at most 6 alphanumeric characters (A-Z, 0-9), assigned by Industry Canada; and
- "YYYYYYYY" is the Unique Product Number (UPN), made of at most 11 alphanumeric characters (A-Z, 0-9) assigned by the applicant.
- Note 1: The term "IC" before the equipment certification number only signifies that the Industry Canada technical specifications were met.
- Note 2: Note 1 shall be conspicuously placed in the equipment user manual.
- Note 3: Permitted alphanumeric characters used in the CHN and UPN are limited to capital letters (A-Z) and digits (0-9). Other characters, such as "#", "/" or "-", shall not be used.

As per RSS-Gen §5.2 Equipment Labeling:

Equipment subject to certification under the applicable RSS, shall be permanently labeled on each item, or as an inseparable combination. The label must contain the following information for full compliance:
(a) the certification number, prefixed by the term “IC:”;
(b) the manufacturer's name, trade name or brand name; and
(c) a model name or number.
Equipment for which a certificate has been issued is not considered certified if it is not properly labeled.
The information on the Canadian label can be combined with the manufacturer’s other labeling requirements.
If the device size is too small to put a label, the label can be included in the user’s manual, upon agreement with Industry Canada.

15 EXHIBIT B - TEST SETUP PHOTOGRAPHS

Refer to Annex 2 – FCC & IC Test Setup Photos.pdf

16 EXHIBIT C - EUT PHOTOGRAPHS

Refer to Annex 4 – EUT Photos.pdf

--- END OF REPORT ---