Lab Code: 200167-0

# FCC PART 15.247

# INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007

# TEST AND MEASUREMENT REPORT

For

## Eye-Fi, Inc.

305 W. Evelyn Avenue,

Mountain View, CA.94041, USA

**FCC ID: VHE-3**
**IC: 7846A-3**

| **Report Type:** | **Product Type:** |
|---|---|
| Original Report | Wireless SD Memory Card |

| | |
|---|---|
| **Test Engineer:** | Kevin Li |
| **Report Number:** | R0910282-247 |
| **Report Date:** | 2010-01-04 |
| **Reviewed By:** | Boni Baniqued<br>EMC/RF Supervisor |
| **Prepared By: (84)** | Bay Area Compliance Laboratories Corp.<br>1274 Anvilwood Avenue,<br>Sunnyvale, CA 94089, USA<br>Tel: (408) 732-9162<br>Fax: (408) 732 9164 |

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## DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|---|---|---|---|
| 0 | R0910282-247 | Original Report | 2010-01-04 |

# 1 General Information

## 1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Eye-Fi, Inc.*, and their product, *FCC ID:VHE-3, IC: 7846A-3, model: EYE-FI X-2*, which will be henceforth in this report referred to as the EUT (Equipment under Test). The EUT is an SD card with embedded 802.11 b/g/n wireless communication capabilities. It is intended for use in SD host devices such as digital cameras.

## 1.2 Mechanical Description of EUT

The EUT measures approximately 25 mm **(L)** x 35 mm **(W)** x 2 mm **(H)** and weighs approximately 2.5 g.

**The data gathered are from a typical production sample provided by the manufacturer with serial number: R0910282-2 assigned by BACL.*

## 1.3 EUT Photo


*Please refer to Exhibit C for addition EUT photographs.*

### 1.4 Objective

This report is prepared on behalf of *Eye-Fi, Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules and Industry Canada RSS-210 Issue 7, June 2007.

The objective is to determine compliance with FCC and IC standards, rules and limits for this device including:

- RF Exposure
- Antenna Requirement
- Conducted Emissions
- Spurious Emissions at Antenna Port
- Radiated Spurious Emissions
- Restricted Band
- Receiver Spurious Emissions
- 6 dB Bandwidth & 99% Bandwidth
- Maximum Peak Output Power
- 100 kHz Bandwidth of Frequency Band Edge
- Power Spectral Density

### 1.5 Related Submittal(s)/Grant(s)

No related submittals.

### 1.6 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.

### 1.7 Measurement Uncertainty

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

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

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

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

## 1.8 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 host system was configured for testing according to ANSI C63.4-2003.

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

## 2.2 EUT Exercise Software

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

| Radio Mode | Band Width (MHz) | Frequency/Data rate | | |
|---|---|---|---|---|
| | | Low Channel (MHz/Mbps) | Middle Channel (MHz/Mbps) | High Channel (MHz) |
| 802.11b | 20 | 2412/1 | 2437/1 | 2462/1 |
| 802.11g | 20 | 2412/6 | 2437/6 | 2462/6 |
| 802.11n(20) | 20 | 2412/6.5 | 2437/6.5 | 2462/6.5 |
| 802.11n(40) | 20 | 2422/13 | 2437/13 | 2452/13 |

## 2.3 Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

## 2.4 Equipment Modifications

No modifications were made to the EUT.

## 2.5 Local Support Equipment

| Manufacturer | Description | Model No. | Serial No. |
|---|---|---|---|
| Wireless Router | Linksys | WRT310N | CSF01H250300 |
| HP | Laptop | Dv6500 | CNF74270XW |

## 2.6 Internal Parts List and Details

| Manufacturer | Description | Model No. | Serial No. |
|---|---|---|---|
| Eye-Fi Inc. | PCB Board | SO C480 | - |

## 2.7 Interface Ports and Cabling

| Cable Description | Length (m) | From | To |
|---|---|---|---|
| Ethernet cable | < 10m | EUT | Router |

# 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;<br>IC RSS-102 | RF Exposure | Compliant |
| FCC §15.203;<br>IC RSS-Gen §7.1.4 | Antenna Requirement | Compliant |
| FCC §15.207(a);<br>IC RSS-Gen §7.2.2 | Conducted Emissions | Compliant |
| FCC §15.205, §15.209;<br>IC RSS-210 §2.2 | Restricted Bands | Compliant |
| FCC §15.209(a), §15.247(d);<br>IC RSS-210 §A8.5, §2.6 | Radiated Spurious Emissions | Compliant |
| FCC §15.247(a)(2);<br>IC RSS-210 §A8.2 | 6 dB Bandwidth | Compliant |
| FCC §15.247(b)(3);<br>IC RSS-210 §A8.4 | Maximum Peak Output Power | Compliant |
| FCC §15.247(d);<br>IC RSS-210 §A8.5 | 100 kHz Bandwidth of Frequency Band Edge | Compliant |
| FCC §15.247(e);<br>IC RSS-210 §A8.2(b) | Power Spectral Density | Compliant |
| IC RSS-210 §2.6<br>RSS-Gen § 4.10 | Receiver Spurious Emission | Compliant |

# 4 FCC §15.203 & IC RSS-Gen §7.1.4 – Antenna Requirement

## 4.1 Applicable Standard

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

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

As per IC RSS-Gen §7.1.4: Transmitter Antenna

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

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.

## 4.2 Result

The EUT has maximum gain of 2 dBi 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.

# 5 FCC §15.207 & IC RSS-Gen §7.2.2- Conducted Emissions

## 5.1 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.*

## 5.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2003 measurement procedure. The specification used was FCC 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 host system was connected to LISN-1 which is connected to 120 V / 60 Hz AC power.

## 5.3 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.

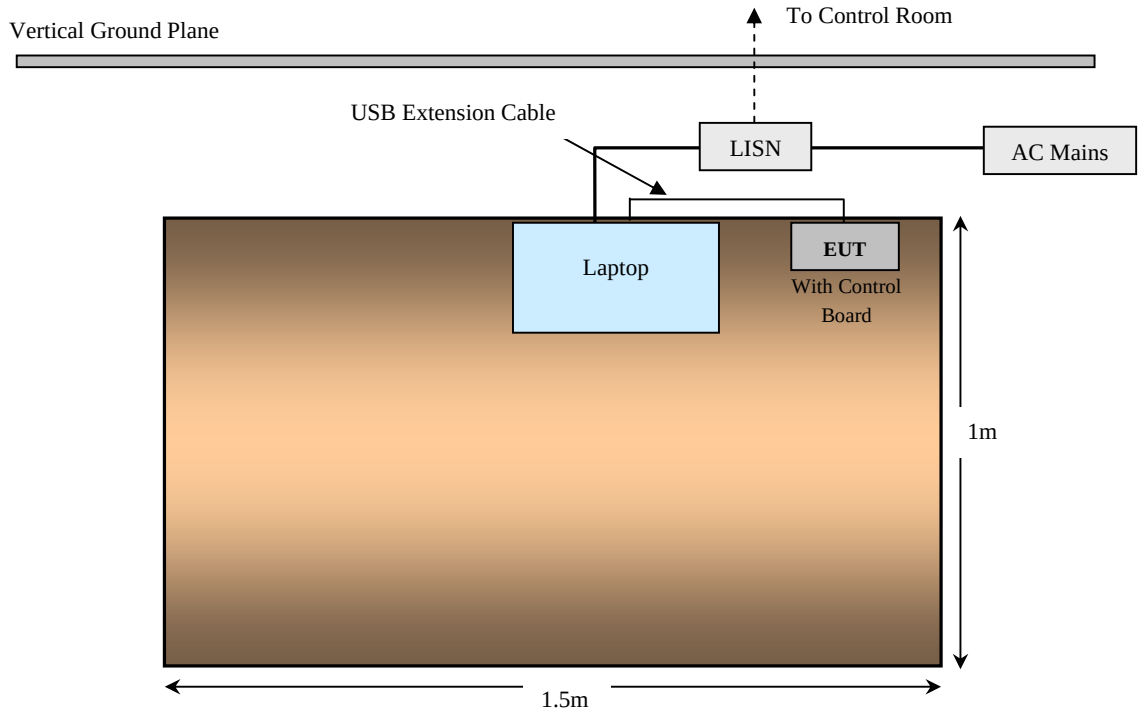
All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a "QP". Average readings are distinguished with an "Ave".

## 5.4 Test Equipment List and Details

| Manufacturers | Description | Models | Serial Numbers | Calibration Dates |
|---|---|---|---|---|
| Solar Electronics | LISN | 9252-R-24-BNC | 511205 | 2009-06-09 |
| Rohde & Schwarz | EMI Test Receiver | ESCI 1166.5950K03 | 100338 | 2009-02-28 |

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

## 5.5 Test Setup Block Diagrams




## 5.6 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22 °C |
| **Relative Humidity:** | 33 % |
| **ATM Pressure:** | 102.0kPa |

**The testing was performed by Kevin Li on 2009-12-18.*

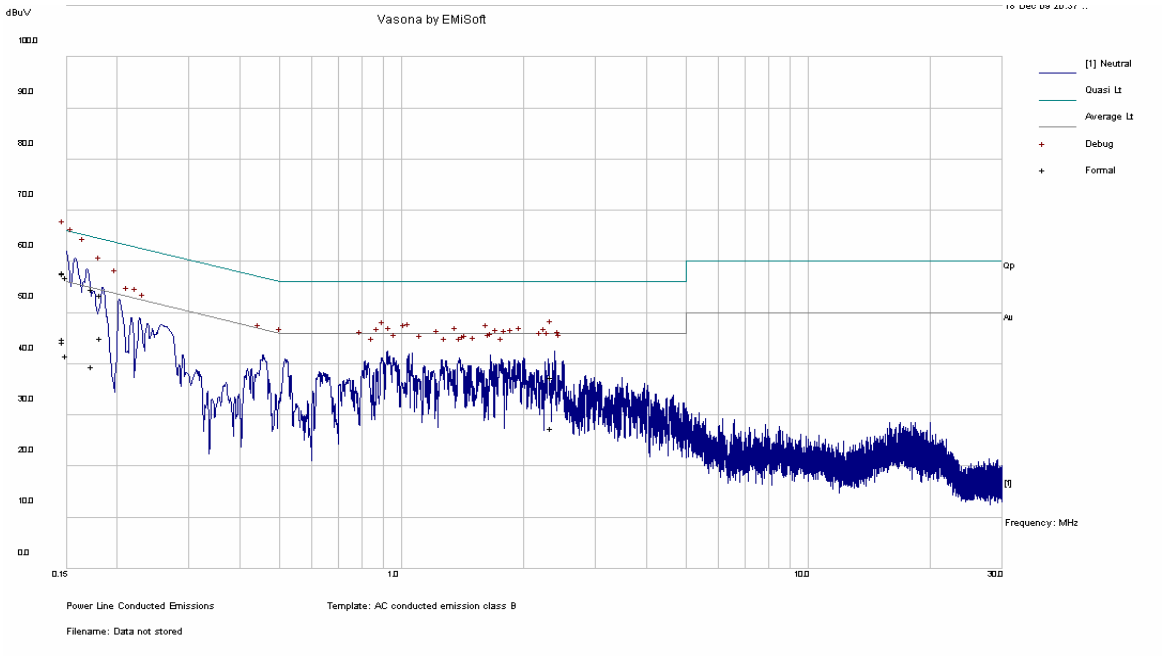
## 5.7 Test Results

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

| **Connection: 120V/60Hz** | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Conductor (Line/Neutral)** | **Range (MHz)** |
| -7.78 | 0.150236 | Neutral | 0.15 to 30 MHz |

Please refer to the following plots and data:

**120V/60 Hz Line:**



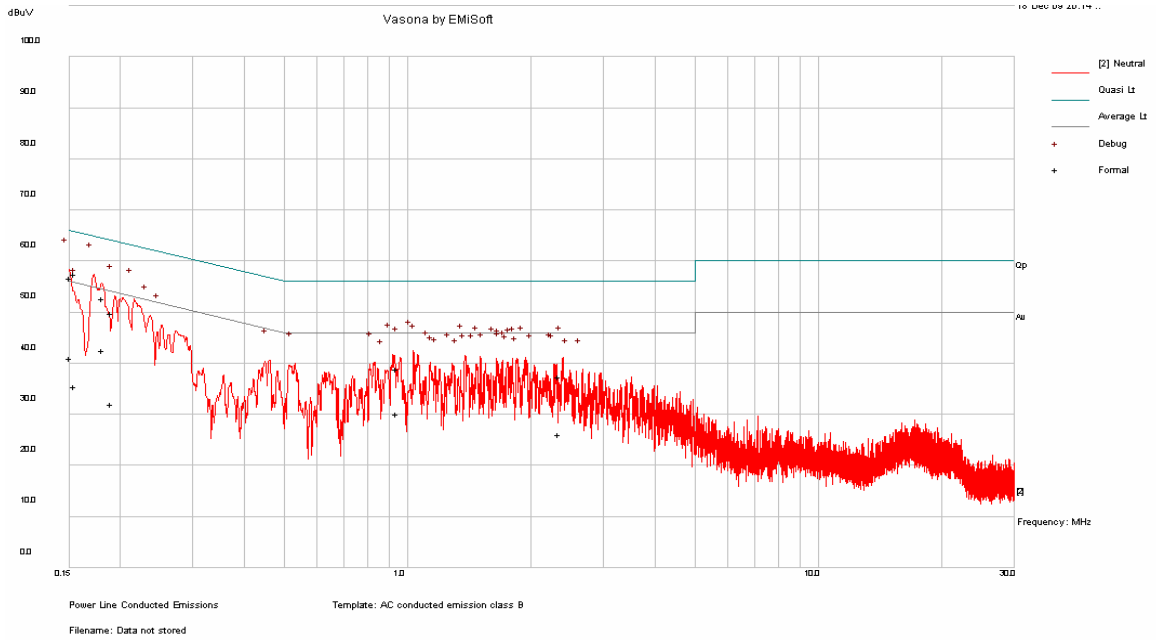

**Quasi-Peak Measurement:**

| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (L/N) | Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|
| 0.150211 | 57.83 | L | 65.99 | -8.16 |
| 0.150534 | 57.73 | L | 65.97 | -8.24 |
| 0.153414 | 56.90 | L | 65.81 | -8.92 |
| 0.176727 | 54.68 | L | 64.64 | -9.96 |
| 0.186102 | 53.43 | L | 64.21 | -10.78 |
| 2.381583 | 37.30 | L | 56.00 | -18.70 |

**Average Measurement:**

| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (L/N) | Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|
| 0.186102 | 45.05 | L | 54.21 | -9.16 |
| 0.150534 | 44.83 | L | 55.97 | -11.14 |
| 0.150211 | 44.28 | L | 55.99 | -11.71 |
| 0.153414 | 41.5 | L | 55.81 | -14.32 |
| 0.176727 | 39.55 | L | 54.64 | -15.09 |
| 2.381583 | 27.34 | L | 46.00 | -18.66 |

**120V/60 Hz Neutral:**




**Quasi-Peak Measurement:**

| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (L/N) | Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|
| 0.150236 | 58.21 | N | 65.99 | -7.78 |
| 0.151830 | 57.71 | N | 65.9 | -8.19 |
| 0.155454 | 56.82 | N | 65.7 | -8.88 |
| 0.177687 | 55.55 | N | 64.59 | -9.05 |
| 0.199251 | 50.15 | N | 63.64 | -13.50 |
| 0.218070 | 48.27 | N | 62.89 | -14.62 |

**Average Measurement:**

| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (L/N) | Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|
| 0.151830 | 47.27 | N | 55.90 | -8.63 |
| 0.150236 | 46.23 | N | 55.99 | -9.76 |
| 0.177687 | 44.04 | N | 54.59 | -10.56 |
| 0.155454 | 39.18 | N | 55.70 | -16.52 |
| 0.199251 | 32.65 | N | 53.64 | -21.00 |
| 0.218070 | 31.87 | N | 52.89 | -21.02 |

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

## 6.1 Applicable Standards

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) and IC RSS-210 §2.2, only spurious emissions are permitted in any of the frequency bands listed below:

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

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

IC RSS-Gen §4.9 the measurement method shall be described in the test report. The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements. The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

## 6.2 Test Setup

The radiated emissions tests were performed in the 3-meter open area test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C and RSS-210/RSS-Gen limits.

## 6.3 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 and RSS-210/RSS-Gen 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.

## 6.4 Test Procedure

For the radiated emissions test, the EUT was connected to the DC power source, and all support equipment power cords was connected to the AC floor outlet.

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

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

The spectrum analyzer or receiver is set as:

Below 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

## 6.5 Corrected Amplitude & Margin Calculation

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

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

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

Margin = Corrected Amplitude - Limit

## 6.6 Test Equipment List and Details

| Manufacturers | Description | Models | Serial Numbers | Calibration Dates |
|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | US44303352 | 2009-04-27 |
| Sunol Sciences | Antenna | JB1 | A020106-1 | 2009-04-17 |
| A.R.A | Horn Antenna | DRG-118/A | 1132 | 2009-10-27 |
| HP | Pre-Amplifier | 8447D | 2944A06639 | 2009-06-05 |

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

## 6.7 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22°C |
| **Relative Humidity:** | 31 % |
| **ATM Pressure:** | 101.1kPa |

**The testing was performed by Kevin Li on 2009-12-17.*

## 6.8 Test Results

According to the data hereinafter, the EUT complied with the limits presented in FCC Title 47, Part 15, Subpart C and IC RSS-210/Gen , and had the worst margin of:

802.11 b mode:

| Mode: Transmitting. 30-1000 MHz(Worst Channel) | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Channel, Range** |
| -5.64 | 105.6888 | Vertical | Middle, 30 to 1000 MHz |
| **Mode: Transmitting, Above 1000 MHz** | | | |
| -19.14 | 4824 | Vertical | Low, 1 to 25 GHz |
| -19.71 | 4874 | Vertical | Middle, 1 to 25 GHz |
| -15.28 | 4924 | Vertical | High, 1 to 25 GHz |

802.11 g mode:

| Mode: Transmitting. 30-1000 MHz(Worst Channel) | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Channel, Range** |
| -3.51 | 97.649 | Horizontal | Middle, 30 to 1000 MHz |
| **Mode: Transmitting, Above 1000 MHz** | | | |
| -19.61 | 4824 | Horizontal | Low, 1 to 25 GHz |
| -20.91 | 4874 | Vertical | Middle, 1 to 25 GHz |
| -17.27 | 4924 | Vertical | High, 1 to 25 GHz |

802.11 n 20MHz BW mode:

| Mode: Transmitting. 30-1000 MHz(Worst Channel) | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Channel, Range** |
| -1.24 | 124.9906 | Horizontal | Middle, 30 to 1000 MHz |
| **Mode: Transmitting, Above 1000 MHz** | | | |
| -18.64 | 4824 | Horizontal | Low, 1 to 25 GHz |
| -21.33 | 4874 | Vertical | Middle, 1 to 25 GHz |
| -17.60 | 4924 | Vertical | High, 1 to 25 GHz |

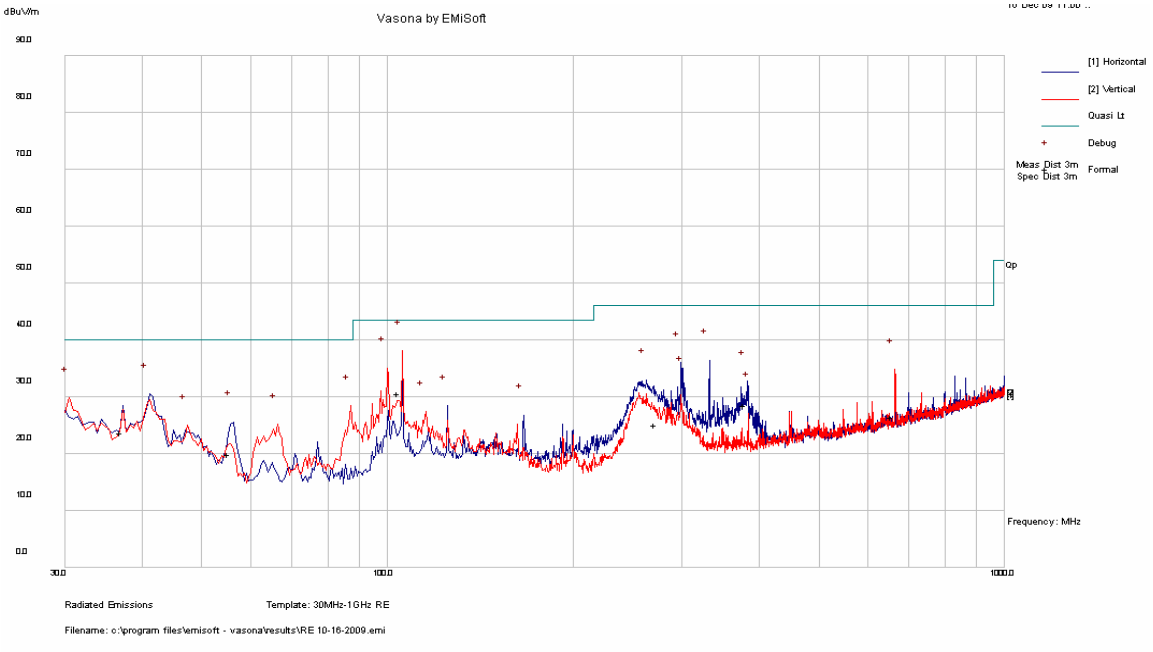
802.11 n 40MHz BW mode:

| Mode: Transmitting. 30-1000 MHz(Worst Channel) | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Channel, Range** |
| -4.94 | 424.987 | Horizontal | Middle, 30 to 1000 MHz |
| **Mode: Transmitting, Above 1000 MHz** | | | |
| -15.38 | 4844 | Vertical | Low, 1 to 25 GHz |
| -21.12 | 4874 | Horizontal | Middle, 1 to 25 GHz |
| -20.35 | 4904 | Vertical | High, 1 to 25 GHz |

## 6.9 Radiated Emissions Test Plot & Data

### 30 MHz – 1 GHz, measured at 3 meters

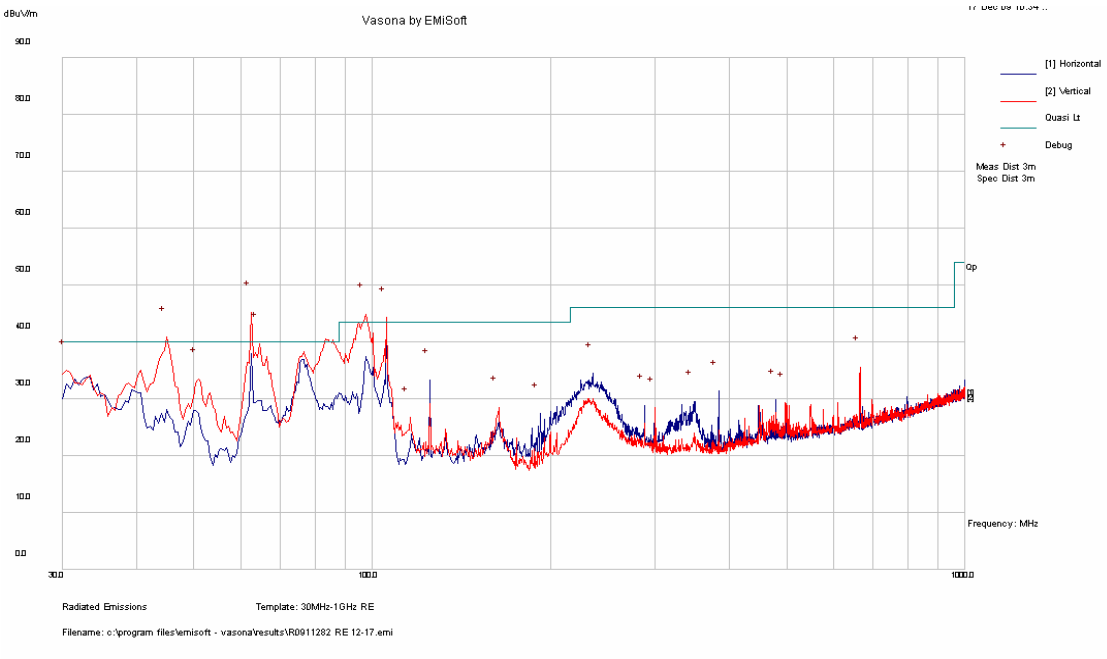
802.11b mode, (worst case)




### Quasi-Peak Measurement

| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 105.6888 | 37.86 | 103 | V | 236 | 43.5 | -5.64 |
| 100.0058 | 29.44 | 195 | V | 14 | 43.5 | -14.06 |
| 40.9606 | 21.76 | 98 | H | 255 | 40.0 | -18.24 |
| 299.3236 | 27.29 | 136 | H | 15 | 46.0 | -18.71 |
| 30.65228 | 18.26 | 259 | V | 131 | 40.0 | -21.74 |
| 332.058 | 22.64 | 97 | H | 33 | 46.0 | -23.36 |

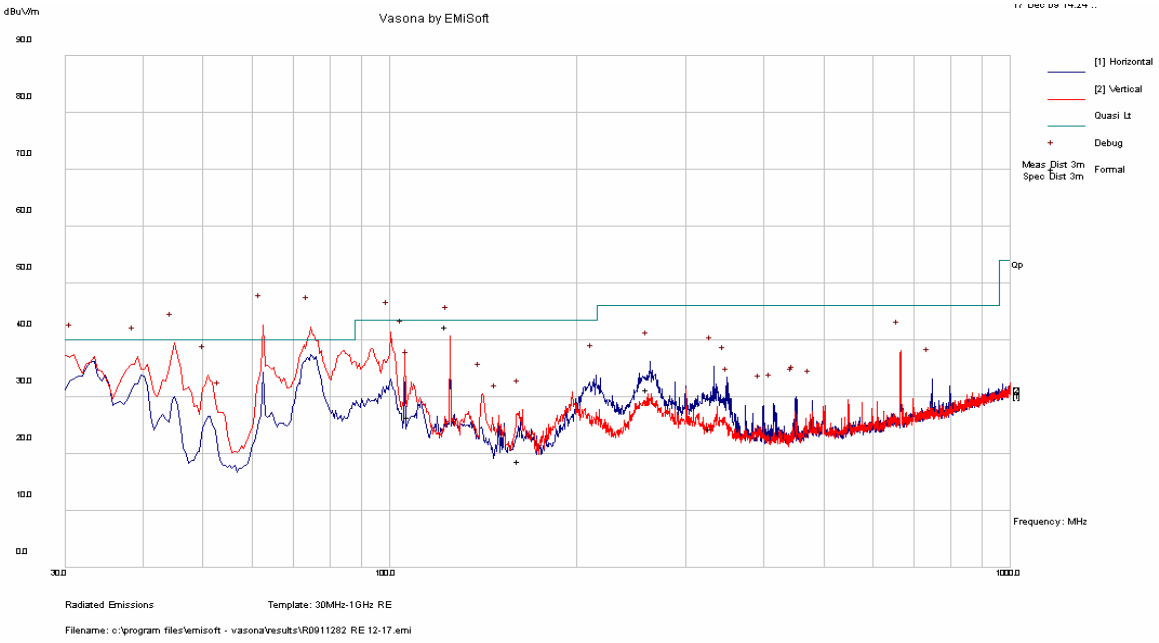
802.11g mode, (worst case)




**Quasi-Peak Measurement**

| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 97.64900 | 39.99 | 227 | V | 291 | 43.5 | -3.51 |
| 105.67580 | 38.60 | 206 | V | 314 | 43.5 | -4.90 |
| 45.26324 | 34.29 | 112 | V | 359 | 40.0 | -5.71 |
| 64.24324 | 34.01 | 250 | V | 232 | 40.0 | -5.99 |
| 62.50796 | 32.80 | 231 | V | 27 | 40.0 | -7.20 |
| 30.25196 | 32.53 | 292 | V | 335 | 40.0 | -7.47 |

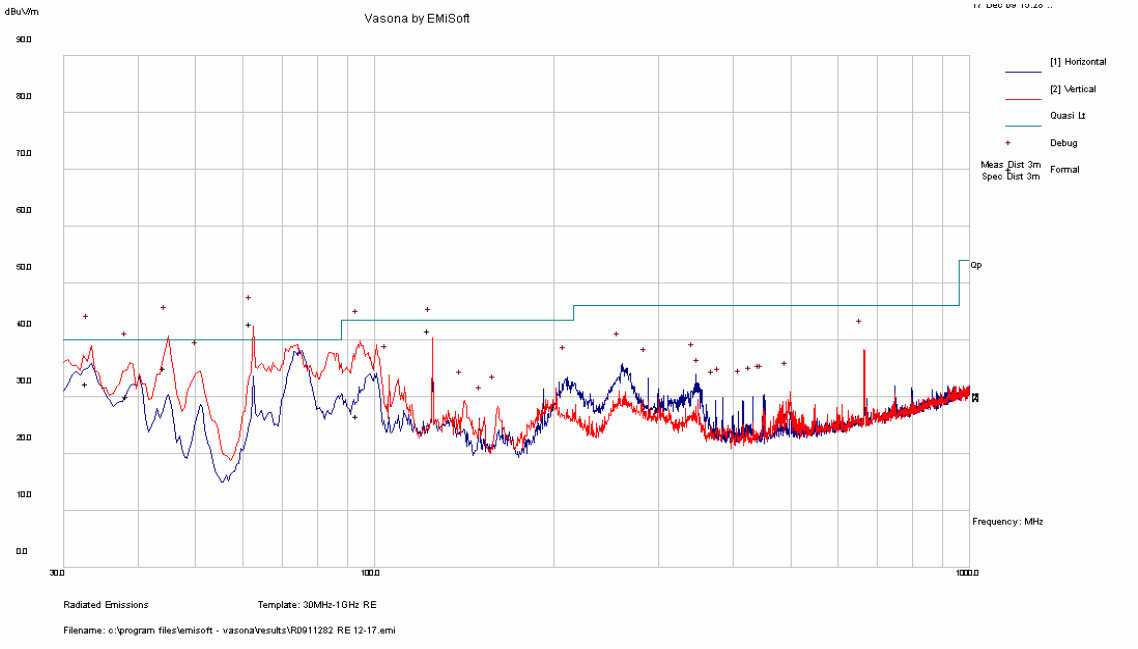
802.11n, 20 MHz mode, (worst case)




**Quasi-Peak Measurement**

| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 124.9906 | 42.26 | 107 | V | 212 | 43.5 | -1.24 |
| 262.8492 | 31.36 | 119 | H | 83 | 46.0 | -14.64 |
| 108.2722 | 26.49 | 116 | V | 222 | 43.5 | -17.01 |
| 332.4233 | 24.35 | 111 | H | 215 | 46.0 | -21.65 |
| 163.1602 | 18.63 | 293 | V | 154 | 43.5 | -24.87 |

802.11n, 40 MHz mode, (worst case)




**Quasi-Peak Measurement**

| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 124.98700 | 41.59 | 109 | V | 340 | 43.5 | -1.91 |
| 44.88956 | 35.06 | 98 | V | 212 | 40 | -4.94 |
| 33.21572 | 32.33 | 98 | V | 237 | 40 | -7.67 |
| 38.80776 | 30.09 | 300 | V | 322 | 40 | -9.91 |
| 94.63436 | 26.65 | 98 | V | 278 | 43.5 | -16.85 |

**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 (m) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 2412 MHz, measured at 3 meters | | | | | | | | | | | |
| 4824 | 47.62 | 130 | 138 | V | 33.3 | 8 | 36.54 | 52.38 | 74 | -21.62 | Peak |
| 4824 | 44.05 | 89 | 185 | H | 33.3 | 8 | 36.54 | 48.81 | 74 | -25.19 | Peak |
| 4824 | 30.1 | 130 | 138 | V | 33.3 | 8 | 36.54 | 34.86 | 54 | -19.14 | Ave |
| 4824 | 28.84 | 89 | 185 | H | 33.3 | 8 | 36.54 | 33.6 | 54 | -20.40 | Ave |
| Middle channel 2437 MHz measured at 3 meters | | | | | | | | | | | |
| 4874 | 44.95 | 124 | 189 | V | 33.3 | 8 | 36.54 | 49.71 | 74 | -24.29 | Peak |
| 4874 | 44.92 | 62 | 151 | H | 33.3 | 8 | 36.54 | 49.68 | 74 | -24.32 | Peak |
| 4874 | 29.53 | 124 | 189 | V | 33.3 | 8 | 36.54 | 34.29 | 54 | -19.71 | Ave |
| 4874 | 28.73 | 62 | 151 | H | 33.3 | 8 | 36.54 | 33.49 | 54 | -20.51 | Ave |
| High channel 2462 MHz measured at 3 meters | | | | | | | | | | | |
| 4924 | 45.96 | 125 | 180 | V | 33.3 | 8 | 36.54 | 50.72 | 74 | -23.28 | Peak |
| 4924 | 45.21 | 26 | 100 | H | 33.3 | 8 | 36.54 | 49.97 | 74 | -24.03 | Peak |
| 4924 | 33.96 | 125 | 180 | V | 33.3 | 8 | 36.54 | 38.72 | 54 | -15.28 | Ave |
| 4924 | 32.43 | 26 | 100 | H | 33.3 | 8 | 36.54 | 37.19 | 54 | -16.81 | 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 (m) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 2412 MHz, measured at 3 meters | | | | | | | | | | | |
| 4824 | 46.19 | 119 | 100 | V | 33.3 | 8 | 36.54 | 50.95 | 74 | -23.05 | Peak |
| 4824 | 43.46 | 78 | 172 | H | 33.3 | 8 | 36.54 | 48.22 | 74 | -25.78 | Peak |
| 4824 | 28.95 | 119 | 100 | V | 33.3 | 8 | 36.54 | 33.71 | 54 | -20.29 | Ave |
| 4824 | 29.63 | 78 | 172 | H | 33.3 | 8 | 36.54 | 34.39 | 54 | -19.61 | Ave |
| Middle channel 2437 MHz measured at 3 meters | | | | | | | | | | | |
| 4874 | 42.93 | 137 | 100 | V | 33.3 | 8 | 36.54 | 47.69 | 74 | -26.31 | Peak |
| 4874 | 42.1 | 89 | 120 | H | 33.3 | 8 | 36.54 | 46.86 | 74 | -27.14 | Peak |
| 4874 | 28.33 | 137 | 100 | V | 33.3 | 8 | 36.54 | 33.09 | 54 | -20.91 | Ave |
| 4874 | 28.22 | 89 | 120 | H | 33.3 | 8 | 36.54 | 32.98 | 54 | -21.02 | Ave |
| High channel 2462 MHz measured at 3 meters | | | | | | | | | | | |
| 4924 | 44.31 | 122 | 158 | V | 33.3 | 8 | 36.54 | 49.07 | 74 | -24.93 | Peak |
| 4924 | 45.59 | 28 | 167 | H | 33.3 | 8 | 36.54 | 50.35 | 74 | -23.65 | Peak |
| 4924 | 31.97 | 122 | 158 | V | 33.3 | 8 | 36.54 | 36.73 | 54 | -17.27 | Ave |
| 4924 | 31.03 | 28 | 167 | H | 33.3 | 8 | 36.54 | 35.79 | 54 | -18.21 | Ave |

802.11n, 20 MHz Mode:

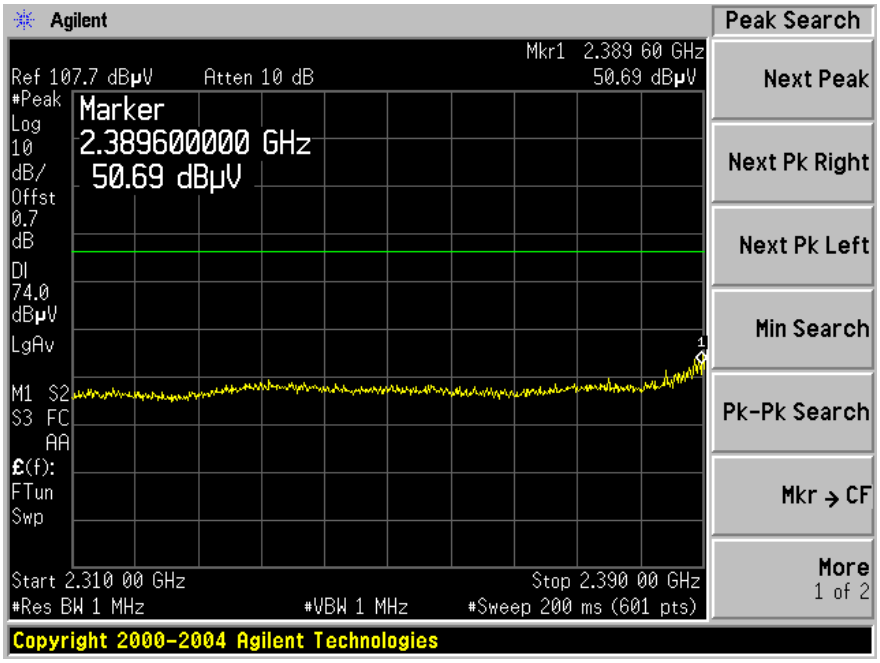
| Frequency (MHz) | S.A. Reading (dBµV) | Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC/IC | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 2412 MHz, measured at 3 meters | | | | | | | | | | | |
| 4824 | 43.51 | 272 | 100 | V | 33.3 | 8 | 36.54 | 48.27 | 74 | -25.73 | Peak |
| 4824 | 42.93 | 43 | 100 | H | 33.3 | 8 | 36.54 | 47.69 | 74 | -26.31 | Peak |
| 4824 | 28.24 | 272 | 100 | V | 33.3 | 8 | 36.54 | 33.00 | 54 | -21.00 | Ave |
| 4824 | 30.60 | 43 | 100 | H | 33.3 | 8 | 36.54 | 35.36 | 54 | -18.64 | Ave |
| Middle channel 2437 MHz measured at 3 meters | | | | | | | | | | | |
| 4874 | 42.36 | 62 | 100 | V | 33.3 | 8 | 36.54 | 47.12 | 74 | -26.88 | Peak |
| 4874 | 42.02 | 132 | 186 | H | 33.3 | 8 | 36.54 | 46.78 | 74 | -27.22 | Peak |
| 4874 | 27.91 | 62 | 100 | V | 33.3 | 8 | 36.54 | 32.67 | 54 | -21.33 | Ave |
| 4874 | 27.9 | 132 | 186 | H | 33.3 | 8 | 36.54 | 32.66 | 54 | -21.34 | Ave |
| High channel 2462 MHz measured at 3 meters | | | | | | | | | | | |
| 4924 | 45.72 | 142 | 153 | V | 33.3 | 8 | 36.54 | 50.48 | 74 | -23.52 | Peak |
| 4924 | 44.3 | 0 | 182 | H | 33.3 | 8 | 36.54 | 49.06 | 74 | -24.94 | Peak |
| 4924 | 31.64 | 142 | 153 | V | 33.3 | 8 | 36.54 | 36.4 | 54 | -17.60 | Ave |
| 4924 | 28.65 | 0 | 182 | H | 33.3 | 8 | 36.54 | 33.41 | 54 | -20.59 | Ave |

802.11n, 40 MHz Mode:

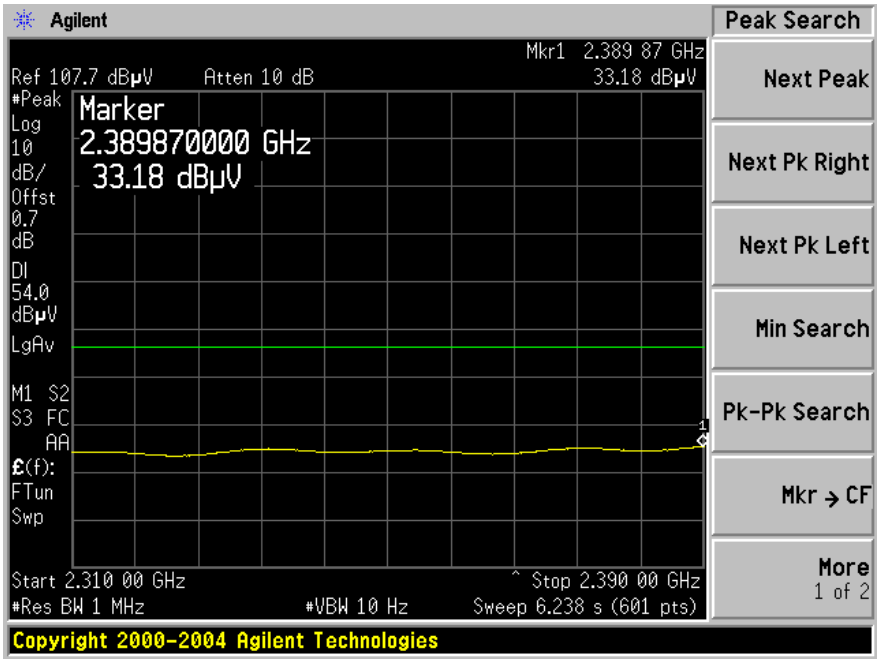
| Frequency (MHz) | S.A. Reading (dBµV) | Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC/IC | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 2422 MHz, measured at 3 meters | | | | | | | | | | | |
| 4844 | 43.25 | 89 | 237 | V | 33.3 | 8 | 36.54 | 48.01 | 74 | -25.99 | Peak |
| 4844 | 43.04 | 124 | 100 | H | 33.3 | 8 | 36.54 | 47.8 | 74 | -26.2 | Peak |
| 4844 | 33.86 | 89 | 237 | V | 33.3 | 8 | 36.54 | 38.62 | 54 | -15.38 | Ave |
| 4844 | 28.16 | 124 | 100 | H | 33.3 | 8 | 36.54 | 32.92 | 54 | -21.08 | Ave |
| Middle channel 2437 MHz measured at 3 meters | | | | | | | | | | | |
| 4874 | 42.22 | 128 | 100 | V | 33.3 | 8 | 36.54 | 46.98 | 74 | -27.02 | Peak |
| 4874 | 42.35 | 92 | 100 | H | 33.3 | 8 | 36.54 | 47.11 | 74 | -26.89 | Peak |
| 4874 | 27.8 | 128 | 100 | V | 33.3 | 8 | 36.54 | 32.56 | 54 | -21.44 | Ave |
| 4874 | 28.12 | 92 | 100 | H | 33.3 | 8 | 36.54 | 32.88 | 54 | -21.12 | Ave |
| High channel 2452 MHz measured at 3 meters | | | | | | | | | | | |
| 4904 | 42.76 | 78 | 100 | V | 33.3 | 8 | 36.54 | 47.52 | 74 | -26.48 | Peak |
| 4904 | 42.73 | 160 | 149 | H | 33.3 | 8 | 36.54 | 47.49 | 74 | -26.51 | Peak |
| 4904 | 28.89 | 78 | 100 | V | 33.3 | 8 | 36.54 | 33.65 | 54 | -20.35 | Ave |
| 4904 | 28.58 | 160 | 149 | H | 33.3 | 8 | 36.54 | 33.34 | 54 | -20.66 | Ave |

**Restricted Band Emissions**

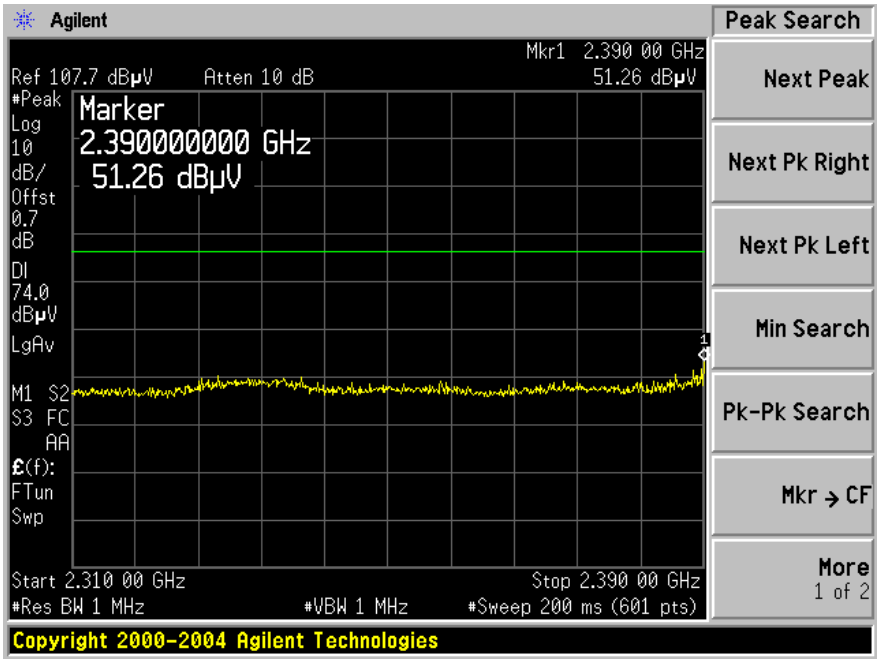
802.11 b, Lowest Channel at Horizontal, Peak



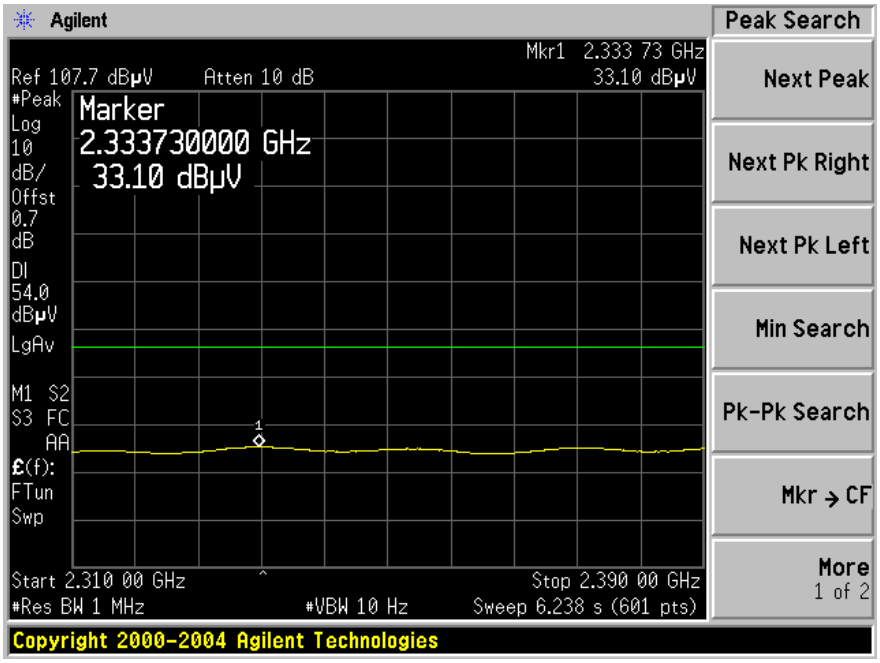

802.11b, Lowest Channel at Horizontal, Average



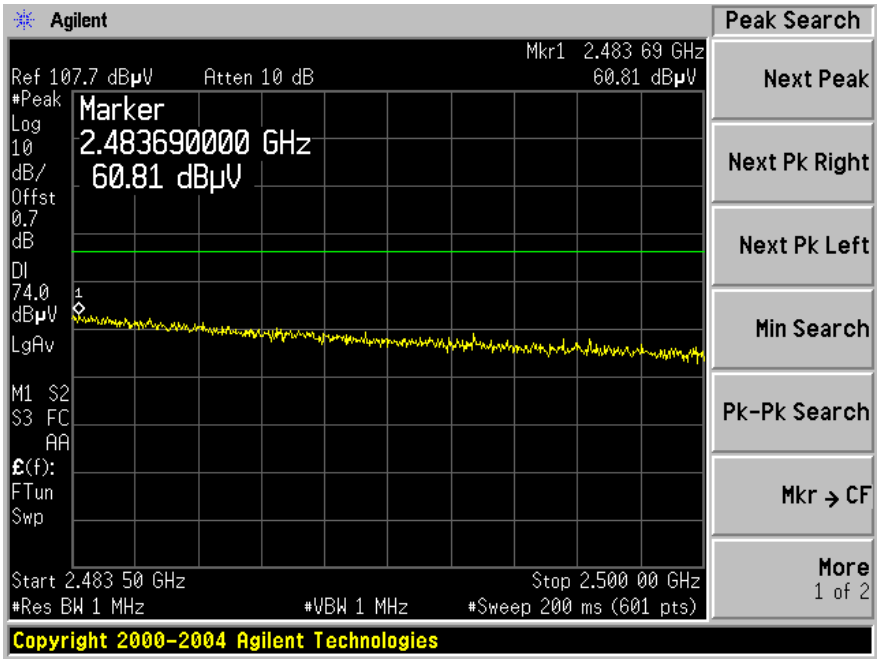
802.11b, Lowest Channel at Vertical, Peak



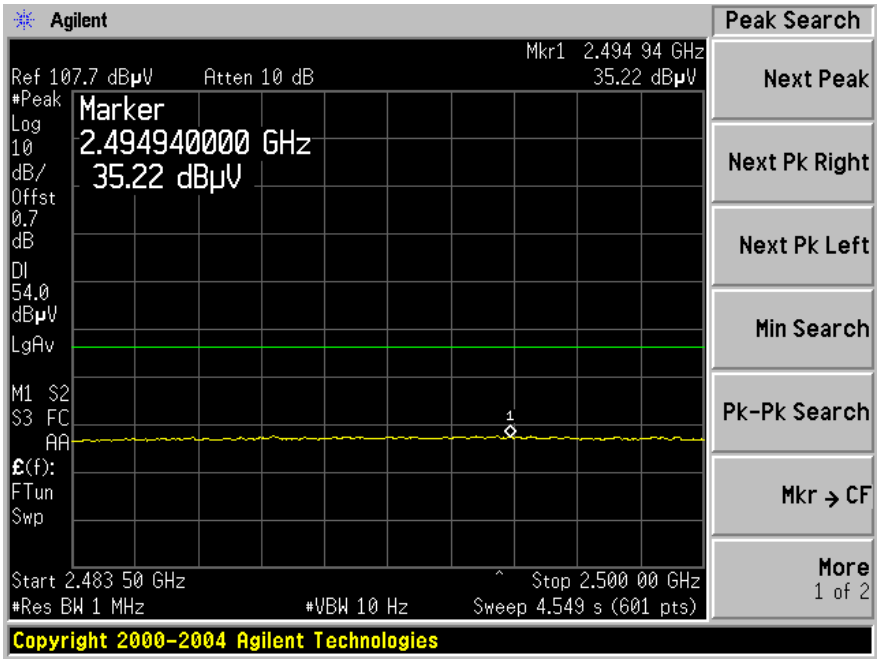

802.11b, Lowest Channel at Vertical, Average



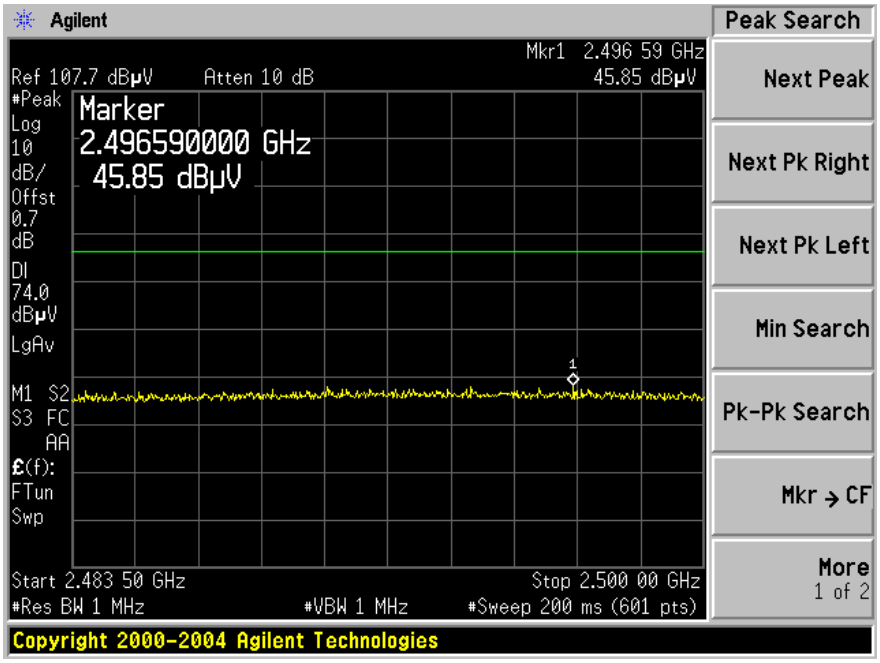
802.11b, Highest Channel at Horizontal, Peak



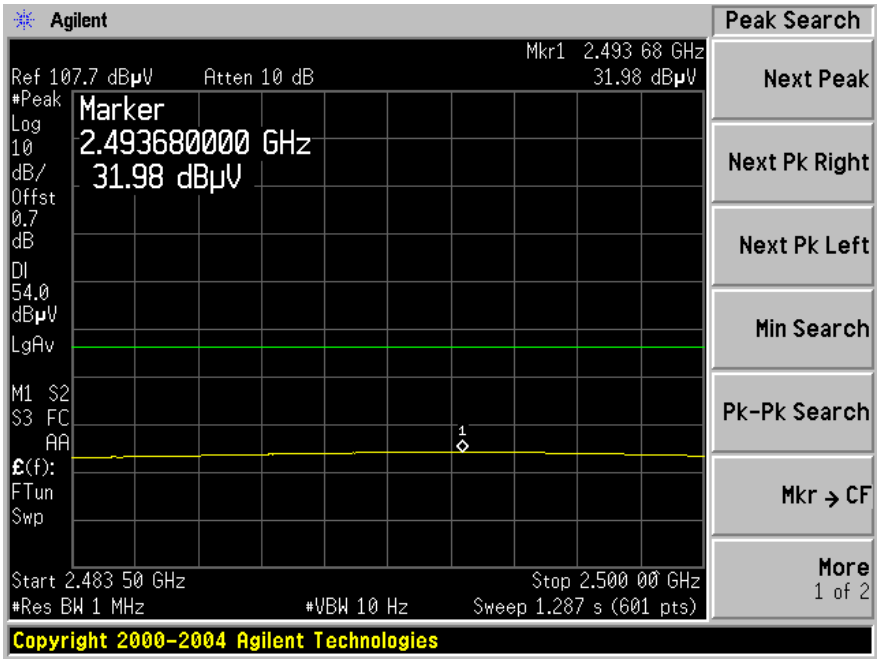

802.11b, Highest Channel at Horizontal, Average



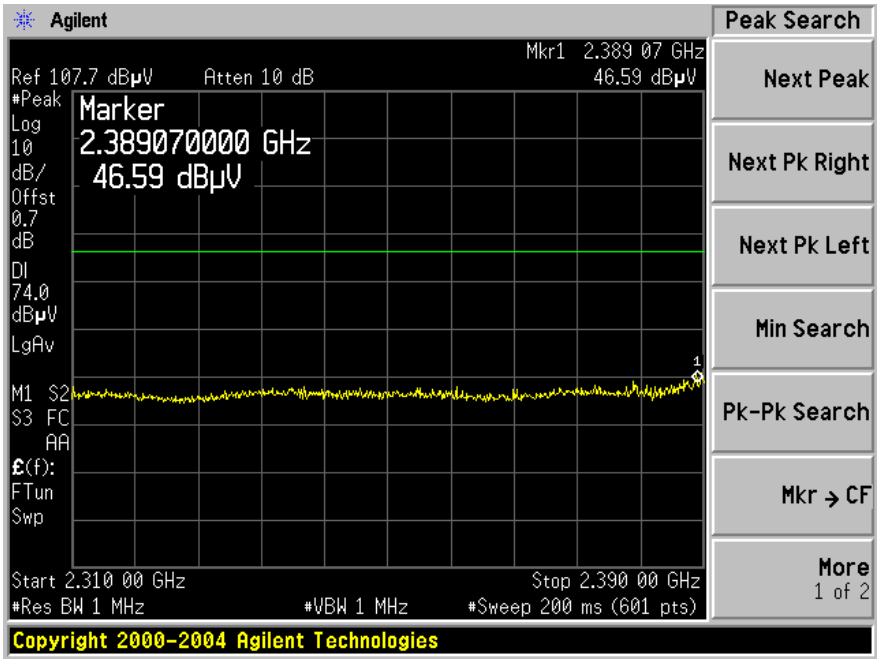
802.11b, Highest Channel at Vertical, Peak



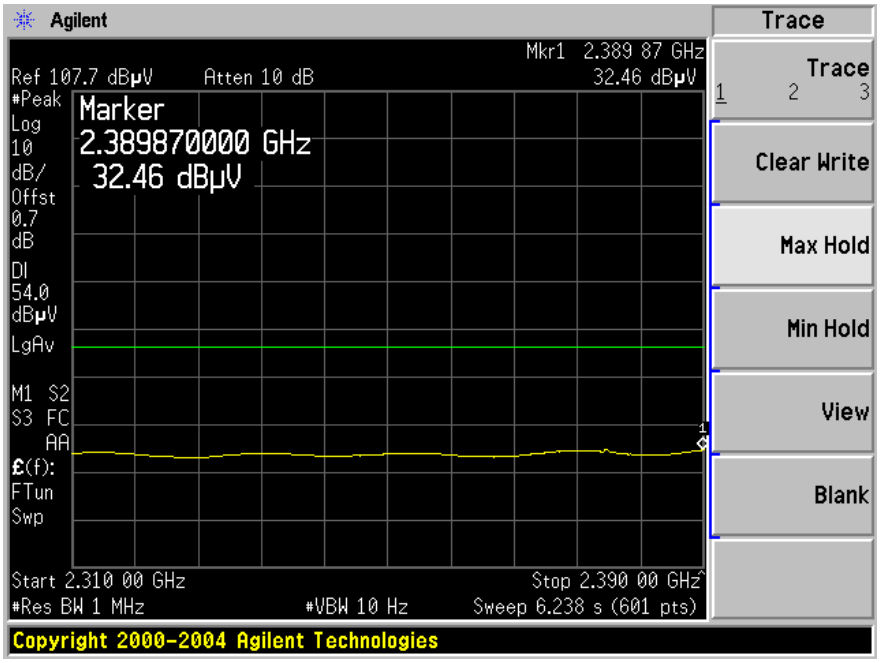

802.11b, Highest Channel at Vertical, Average



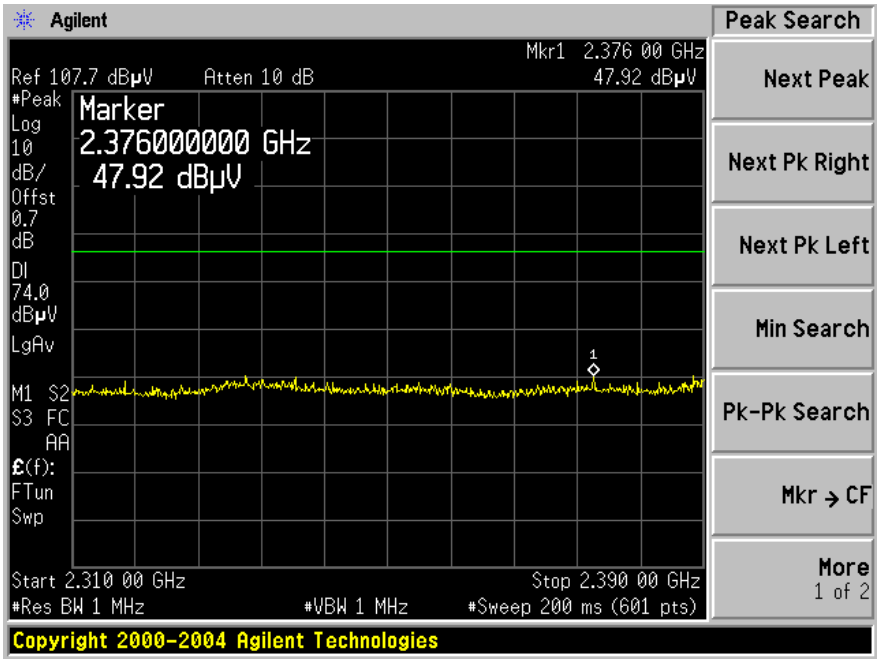
802.11 g, Lowest Channel at Horizontal, Peak



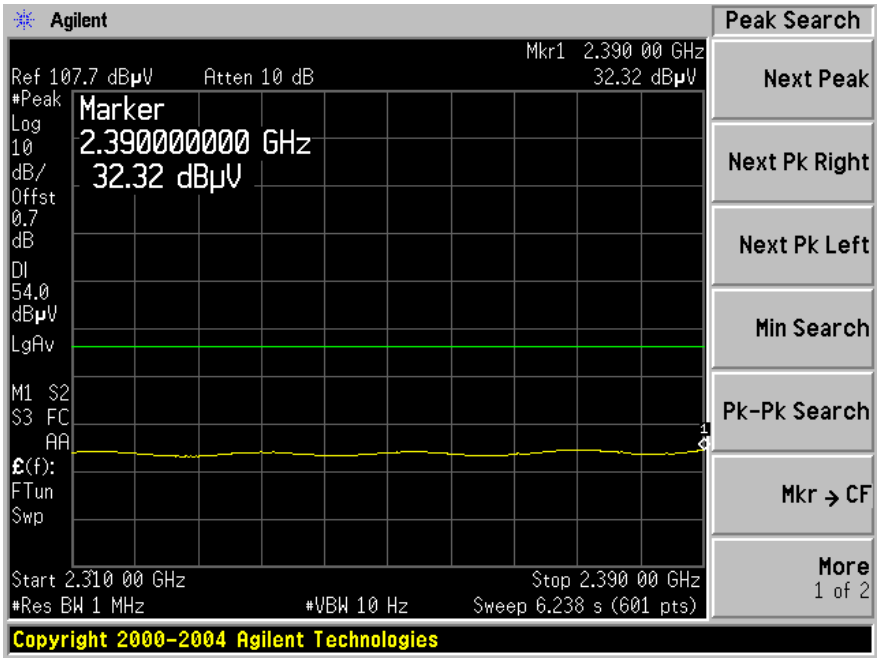

802.11g, Lowest Channel at Horizontal, Average



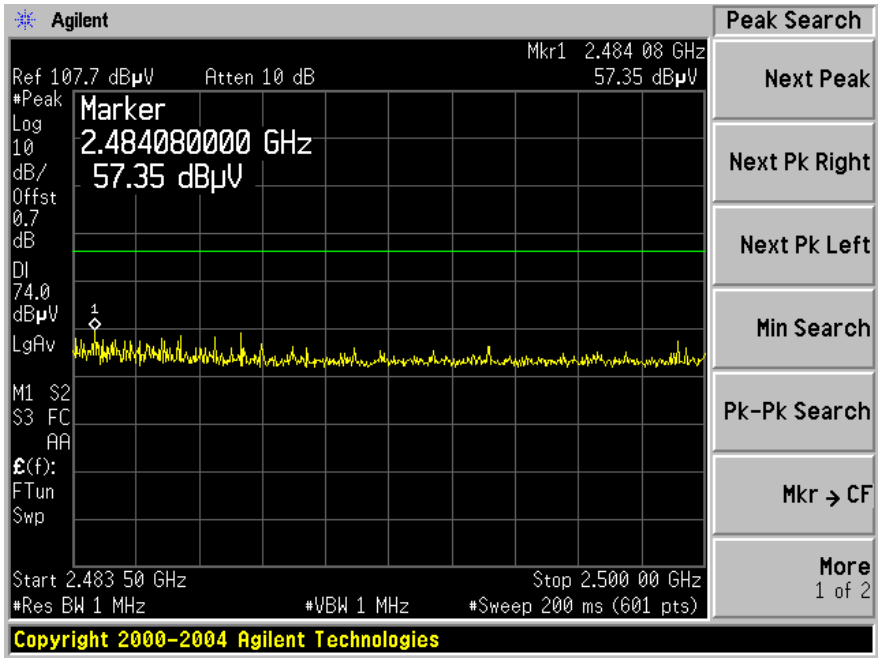
802.11g, Lowest Channel at Vertical, Peak



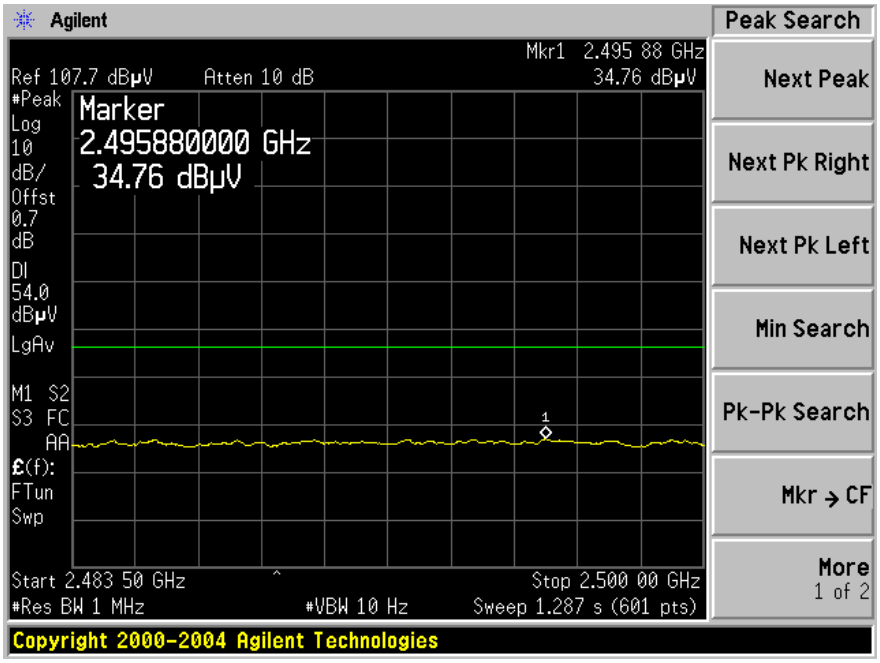

802.11g, Lowest Channel at Vertical, Average



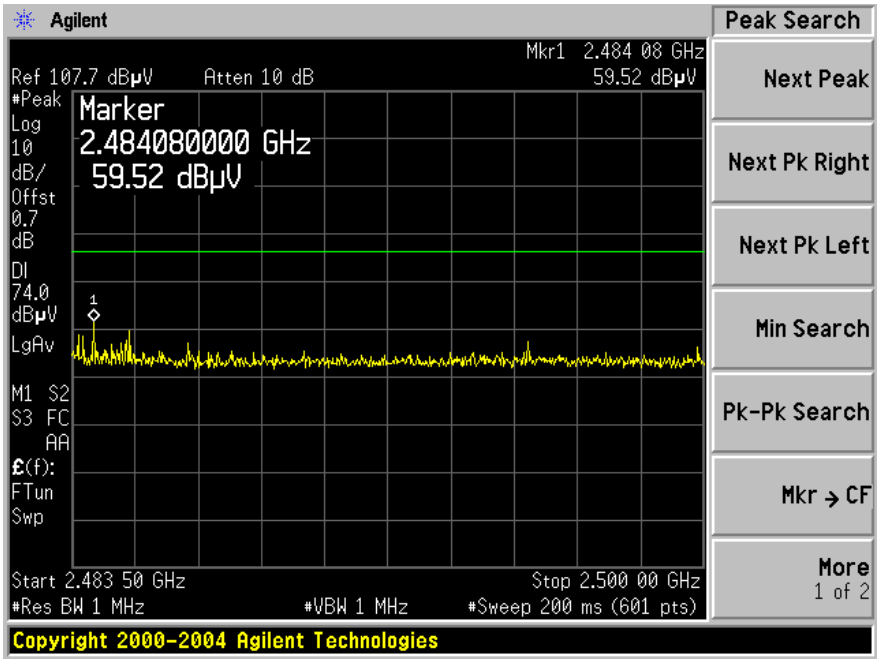
802.11g, Highest Channel at Horizontal, Peak



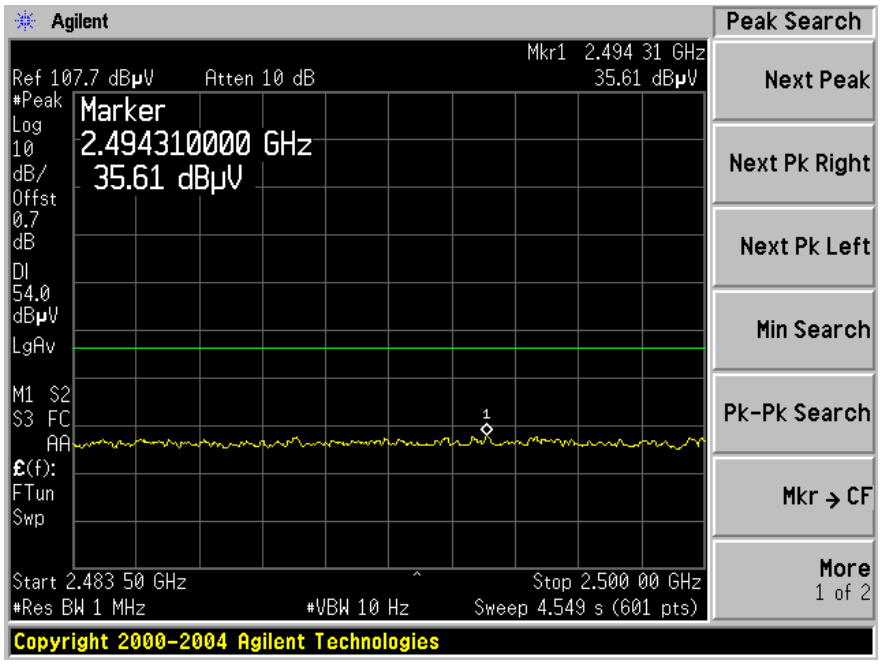

80.211g, Highest Channel at Horizontal, Average



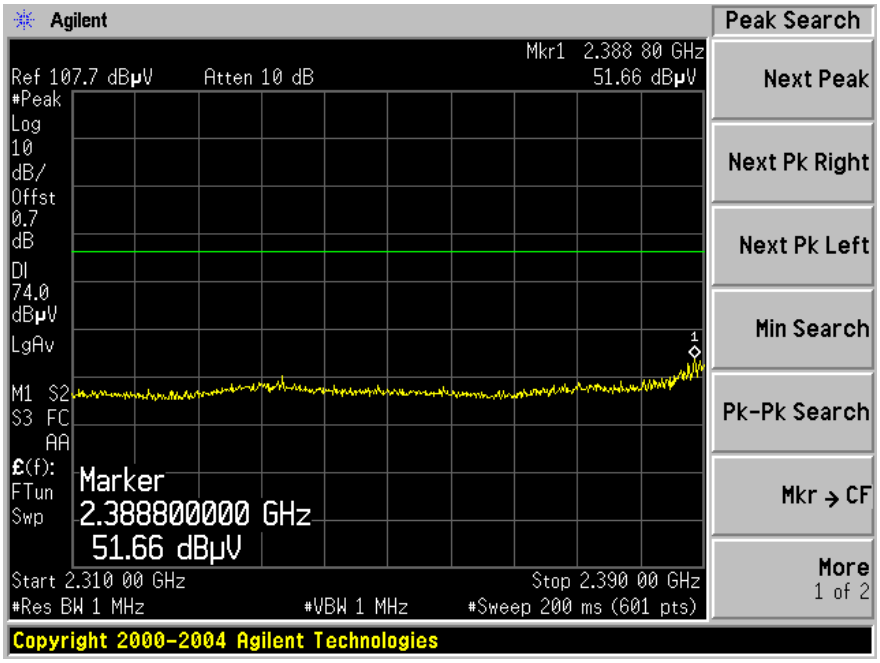
802.11g, Highest Channel at Vertical, Peak



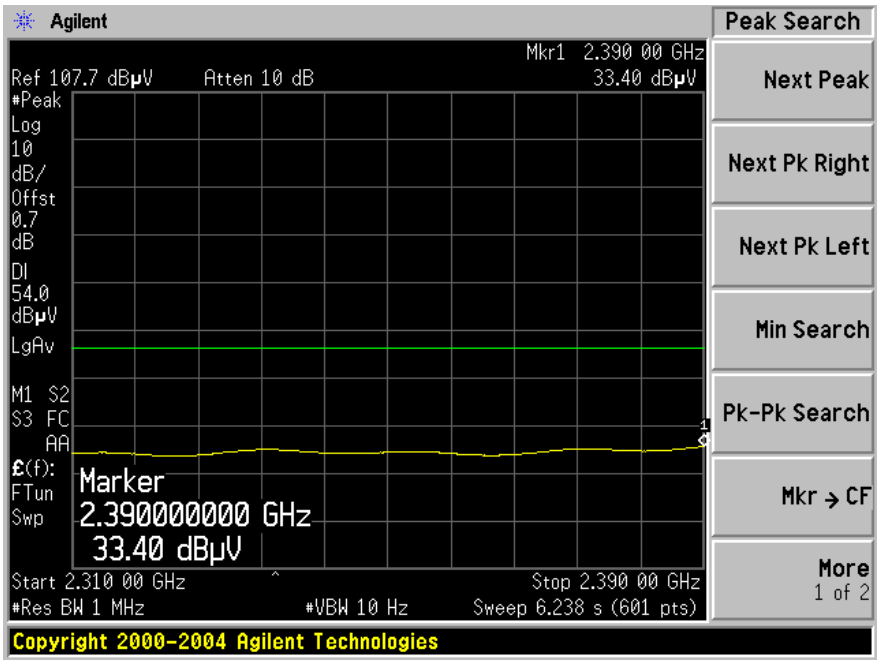

802.11g, Highest Channel at Vertical, Average



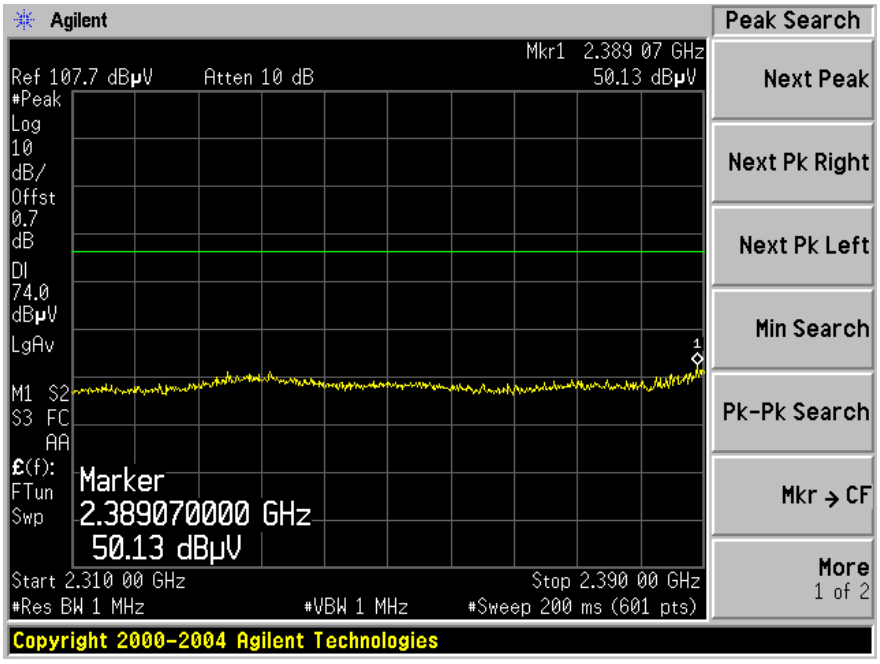
802.11 n20, Lowest Channel at Horizontal, Peak



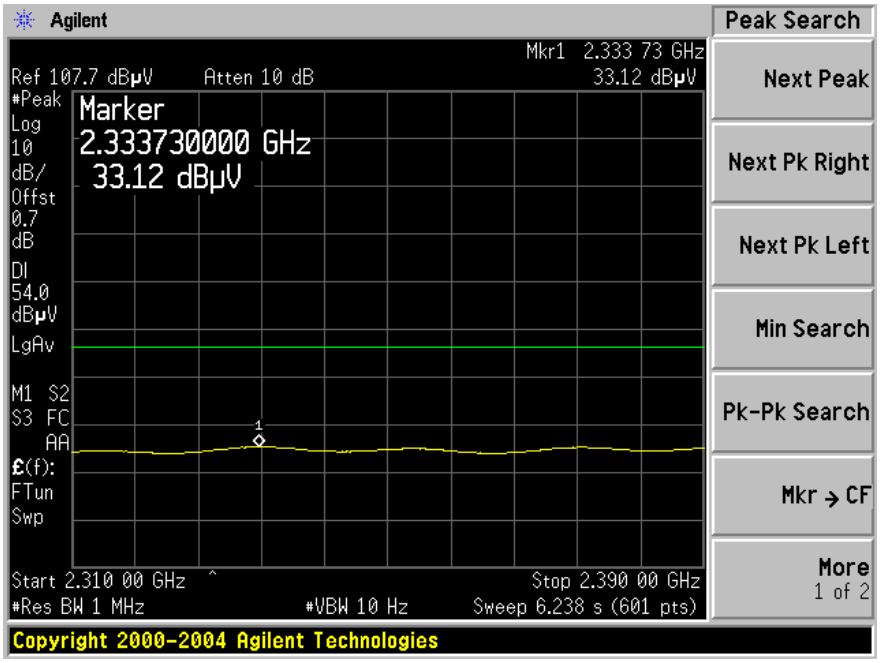

802.11n20, Lowest Channel at Horizontal, Average



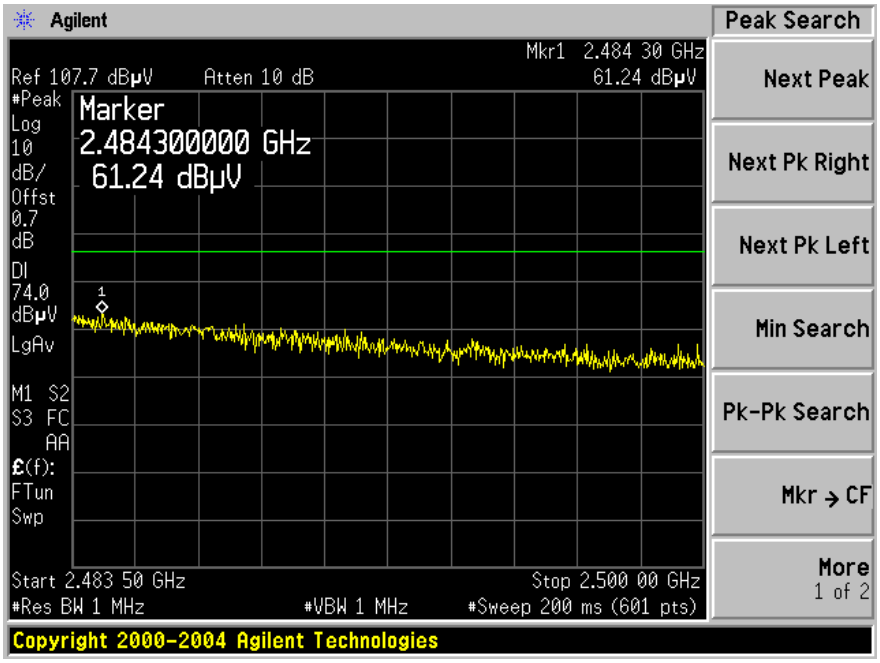
802.11n20, Lowest Channel at Vertical, Peak



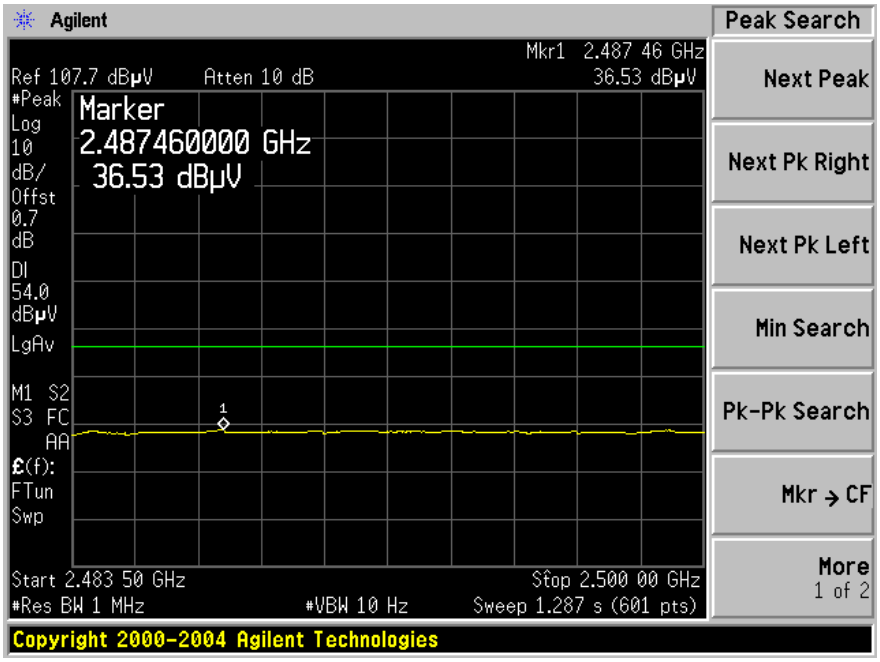

802.11n20, Lowest Channel at Vertical, Average



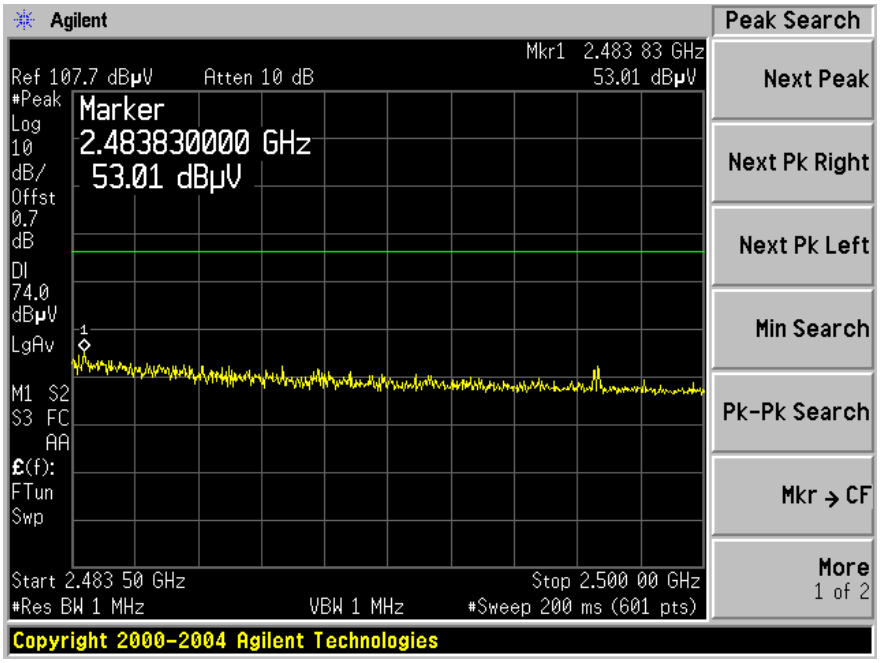
802.11n20, Highest Channel at Horizontal, Peak



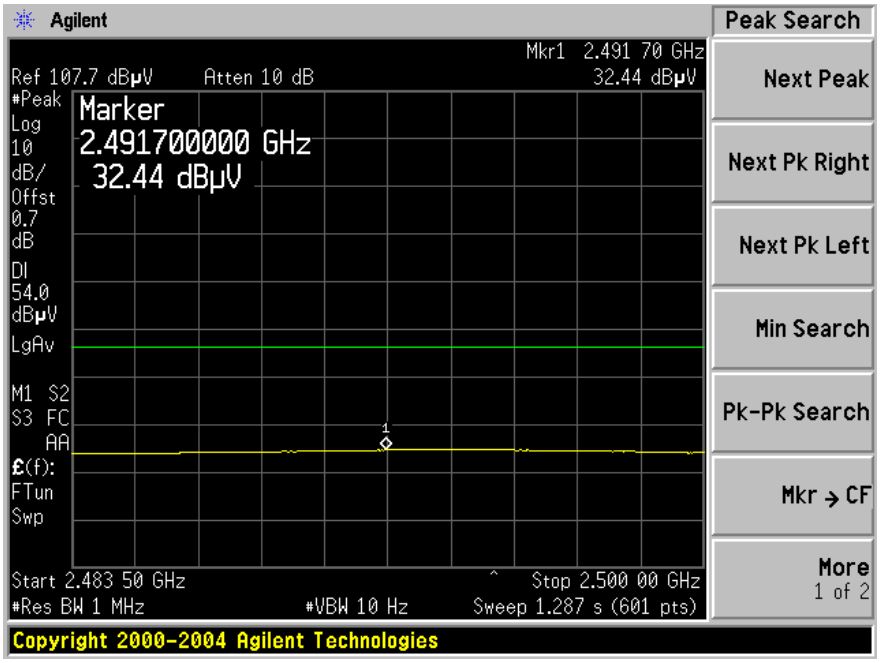

802.11n20, Highest Channel at Horizontal, Average



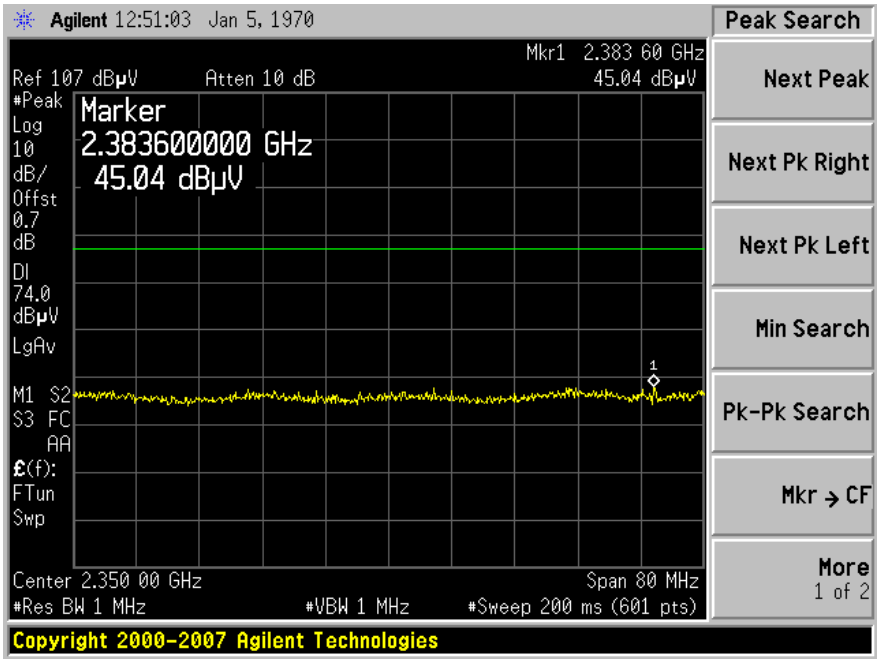
802.11n20, Highest Channel at Vertical, Peak



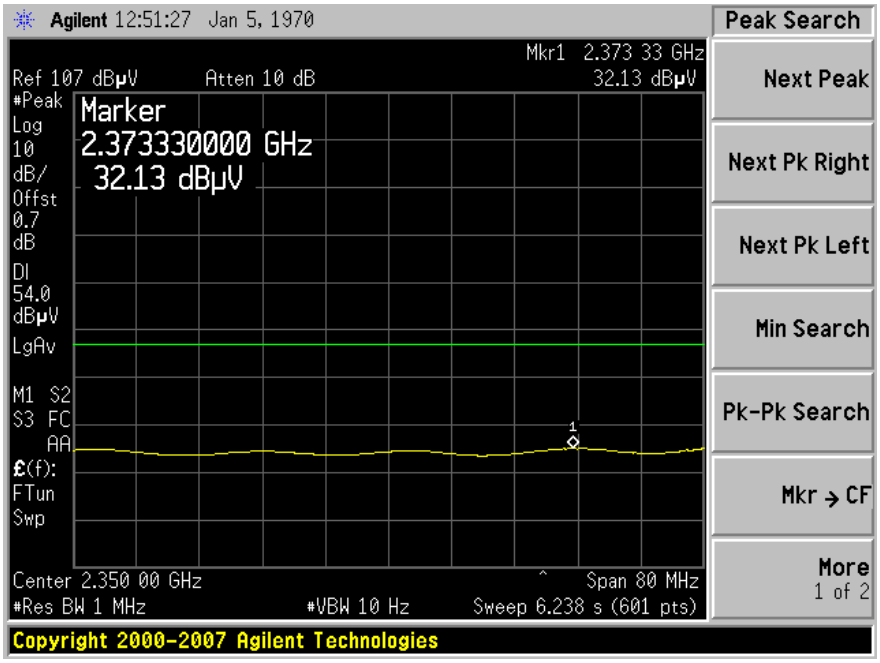

802.11n20, Highest Channel at Vertical, Average



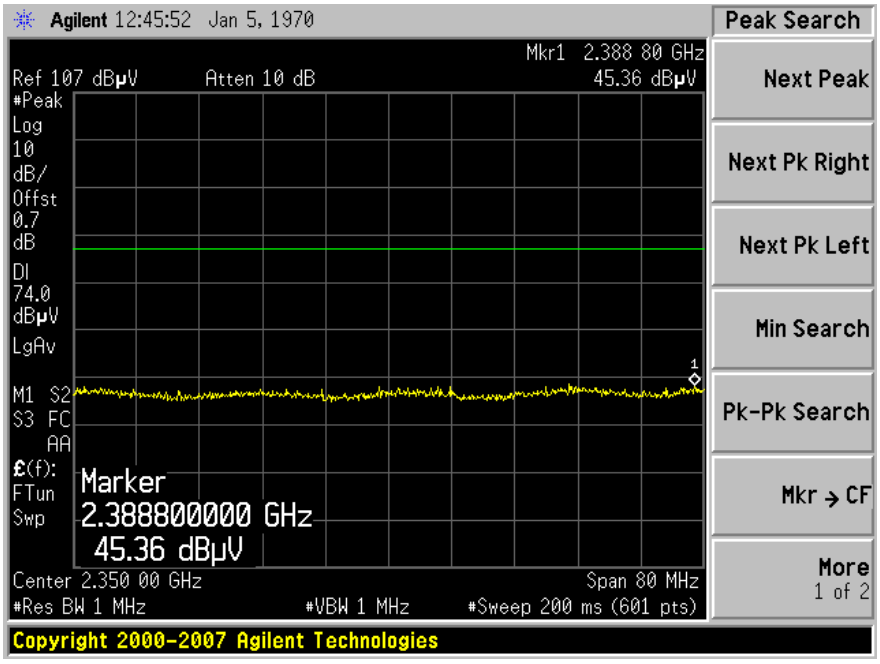
802.11 n40, Lowest Channel at Horizontal, Peak



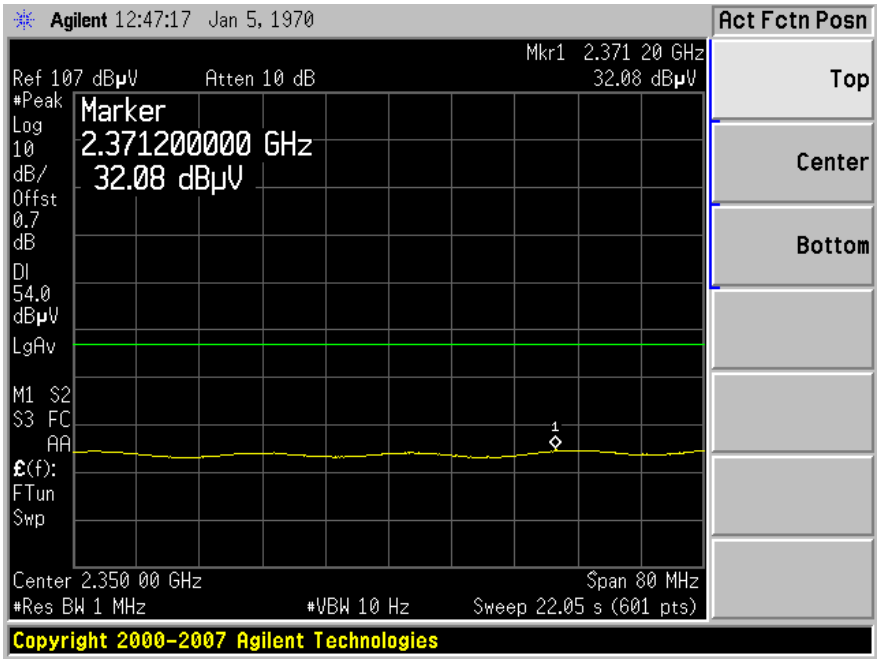

802.11 n40, Lowest Channel at Horizontal, Average



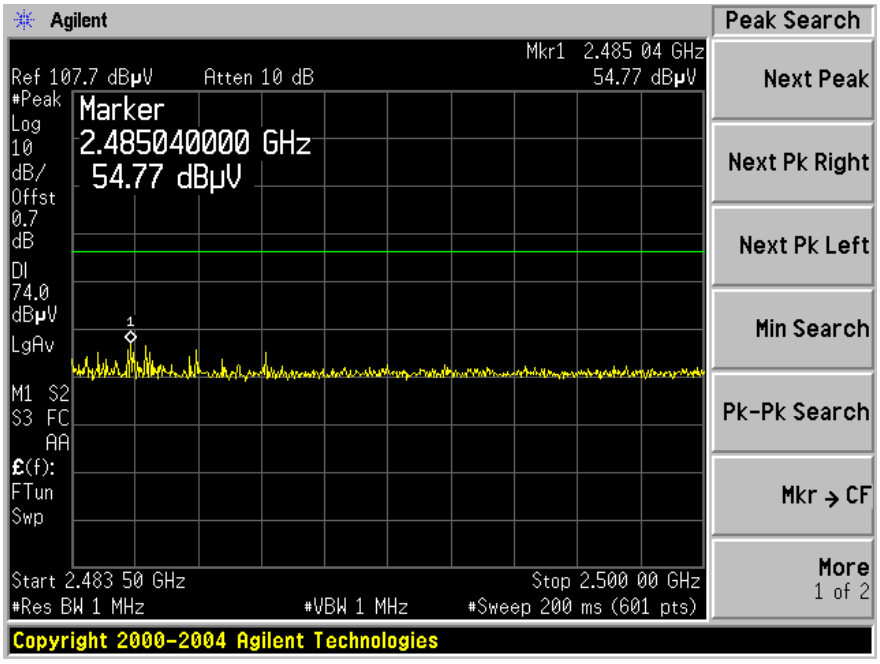
802.11 n40, Lowest Channel at Vertical, Peak



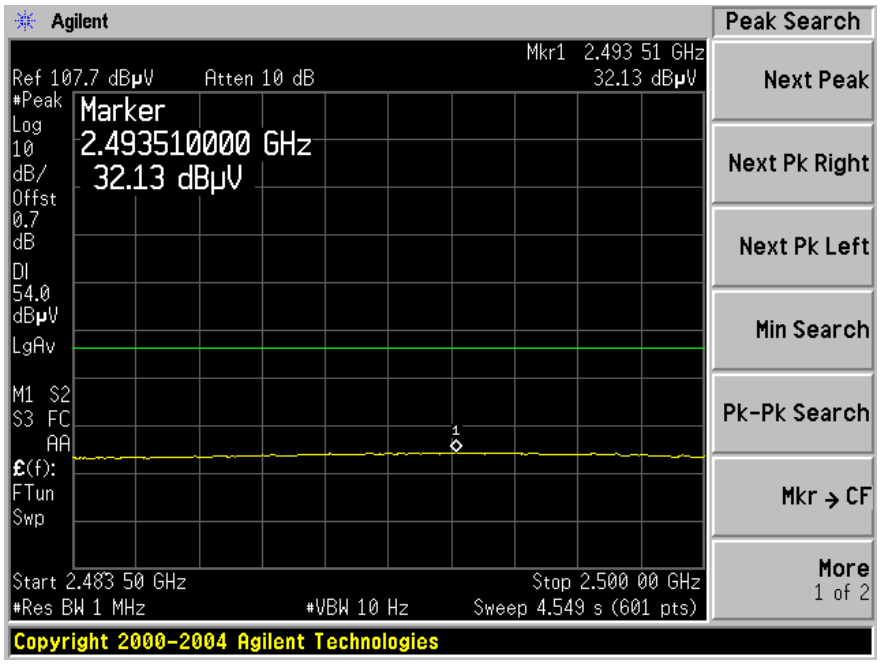

802.11 n40, Lowest Channel at Vertical, Average



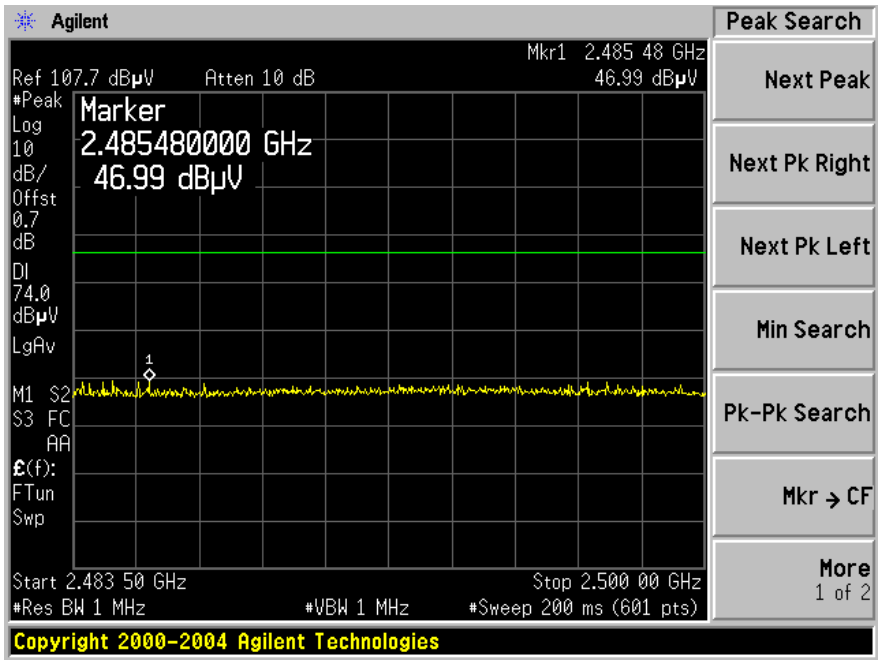
802.11 n40, Highest Channel at Horizontal, Peak



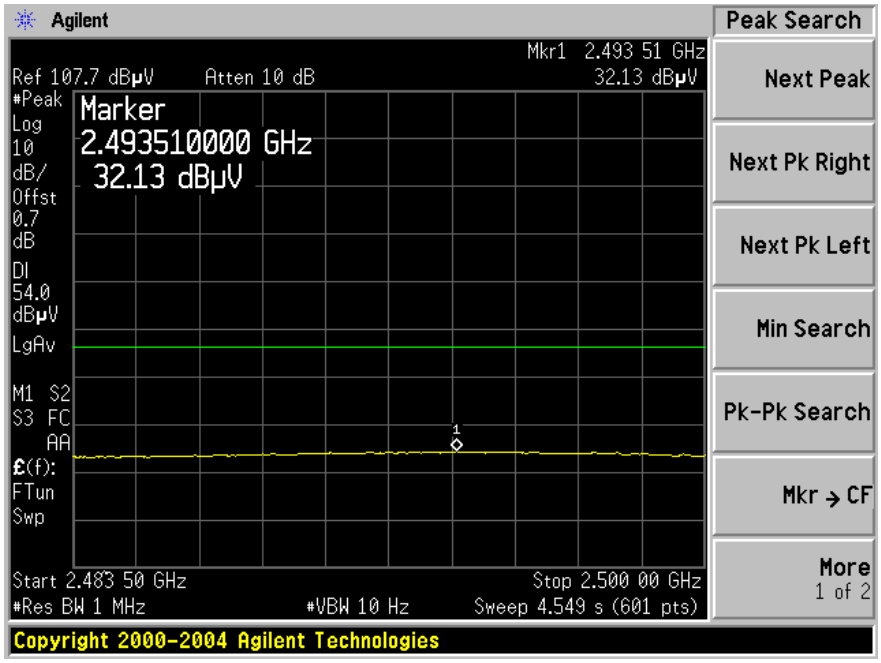

802.11 n40, Highest Channel at Horizontal, Average



802.11 n40, Highest Channel at Vertical, Peak




802.11 n40, Highest Channel at Vertical, Average



# 7 FCC §15.247(a)(2) & IC RSS-210 §A8.2(a) – 6 dB Occupied Bandwidth

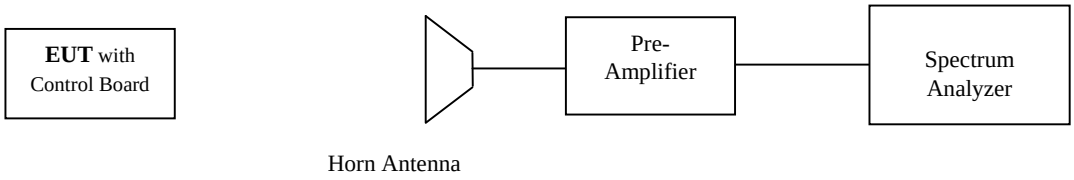
## 7.1 Applicable Standard

According to FCC §15.247(a)(2) and 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

## 7.2 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 on the table. Turn on the EUT , the spectrum analyzer and the pre-amplifier. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emissions bandwidth. (6 dB bandwidth for DTS)
4. Repeat above procedures until all frequencies measured were complete.

## 7.3 Test Setup Block Diagram




## 7.4 Test Equipment List and Details

| Manufacturers | Description | Models | Serial Numbers | Calibration Dates |
|---|---|---|---|---|
| A.R.A | Horn Antenna | DRG-118/A | 1132 | 2009-10-27 |
| HP | Pre-Amplifier | 8447D | 2944A06639 | 2009-06-05 |
| Agilent | Spectrum Analyzer | E4440A | US45303156 | 2009-03-25 |

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

## 7.5 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22°C |
| **Relative Humidity:** | 33 % |
| **ATM Pressure:** | 101.1kPa |

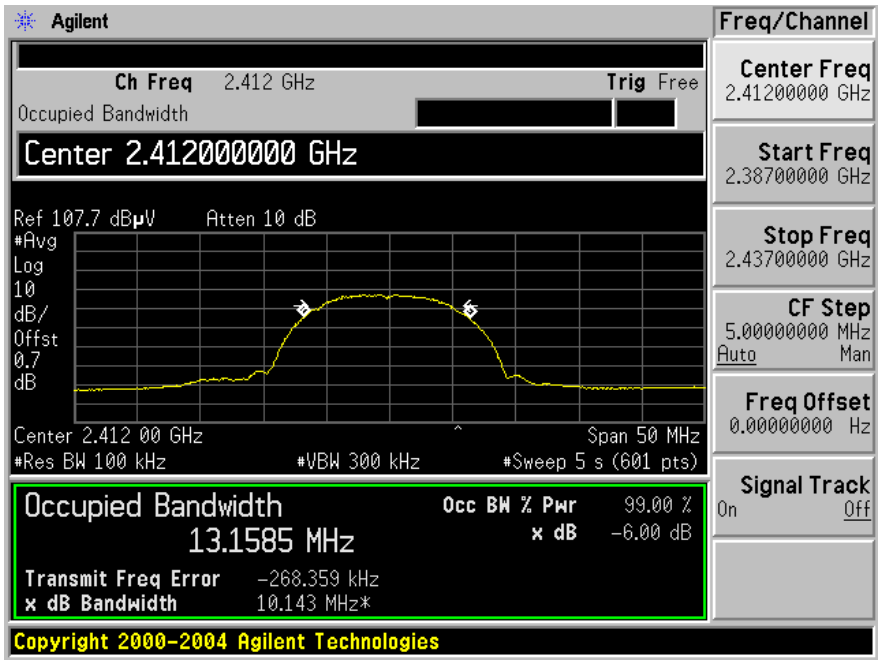
**The testing was performed by Kevin Li on 2009-12-22.*

## 7.6 Test Results

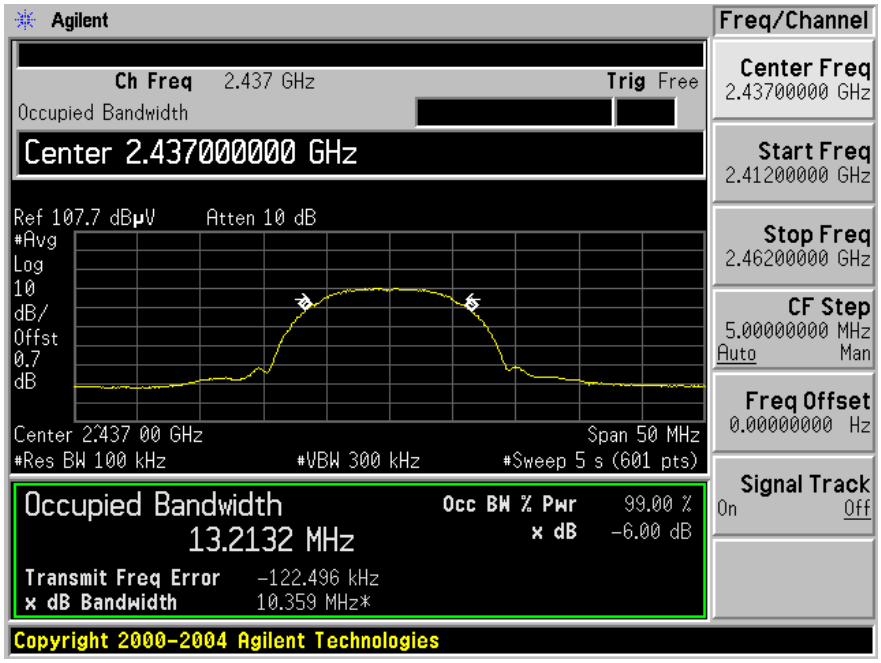
| Radio Mode | Channel | Frequency (MHz) | 6 dB Channel Bandwidth (MHz) | 99% Bandwidth (MHz) | Limit (MHz) | Results |
|---|---|---|---|---|---|---|
| 802.11 b | Low | 2412 | 10.143 | 13.1585 | > 0.5 | Compliance |
| | Middle | 2437 | 10.359 | 13.2132 | > 0.5 | Compliance |
| | High | 2462 | 10.387 | 13.4969 | > 0.5 | Compliance |
| 802.11g | Low | 2412 | 14.061 | 16.3842 | > 0.5 | Compliance |
| | Middle | 2437 | 16.412 | 16.538 | > 0.5 | Compliance |
| | High | 2462 | 14.451 | 16.3615 | > 0.5 | Compliance |
| 802.11 n20 | Low | 2412 | 12.248 | 16.3689 | > 0.5 | Compliance |
| | Middle | 2437 | 16.453 | 16.3946 | > 0.5 | Compliance |
| | High | 2462 | 11.753 | 16.3615 | > 0.5 | Compliance |
| 802.11 n40 | Low | 2422 | 36.084 | 37.198 | > 0.5 | Compliance |
| | Middle | 2437 | 34.754 | 36.396 | > 0.5 | Compliance |
| | High | 2452 | 35.879 | 36.332 | > 0.5 | Compliance |

*Please refer to the following plots for detailed test results*

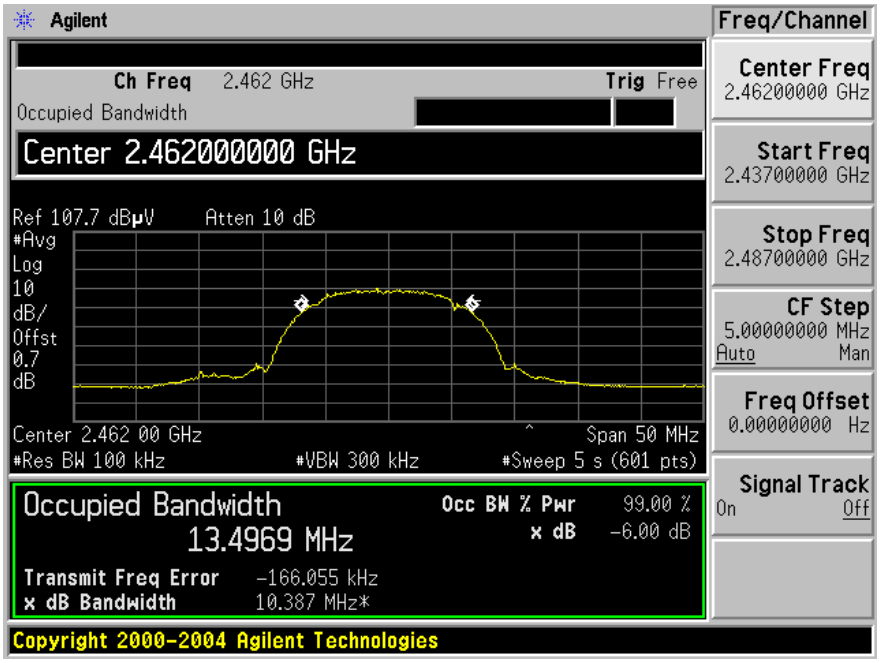
802.11b, Low Channel 2412 MHz



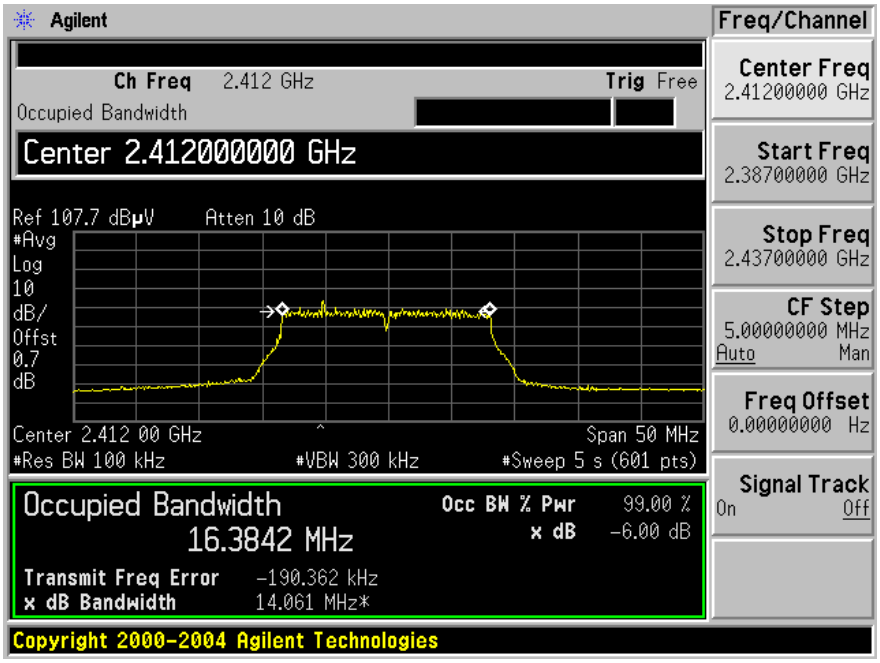

802.11b, Middle Channel 2437 MHz



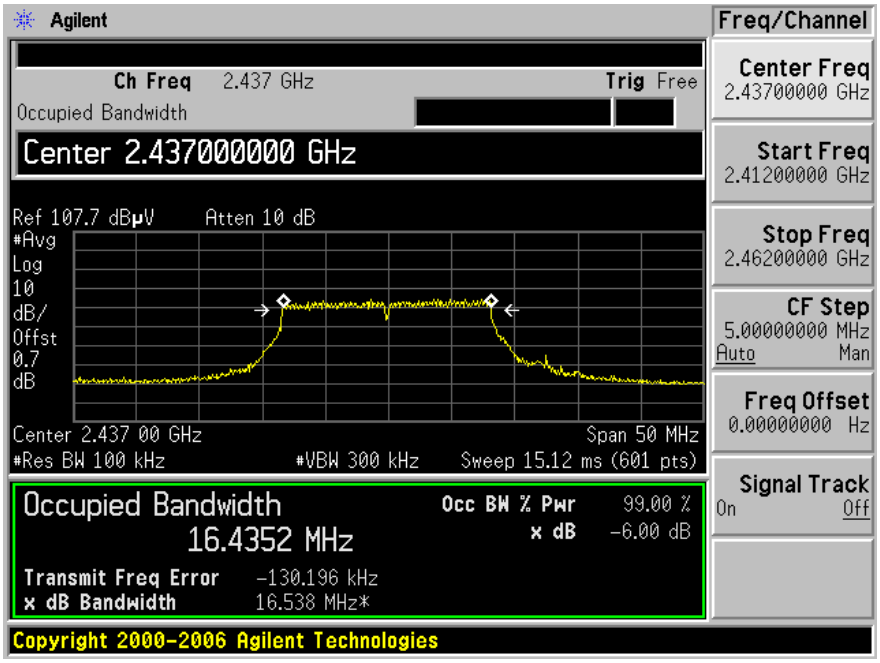
802.11b, High Channel 2462 MHz



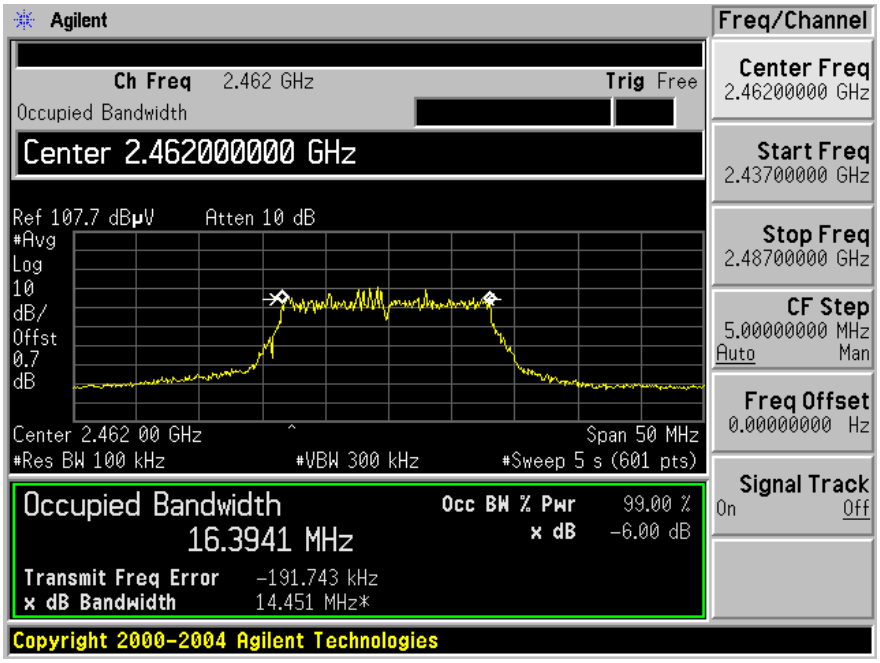

802.11 g, Low Channel 2412 MHz



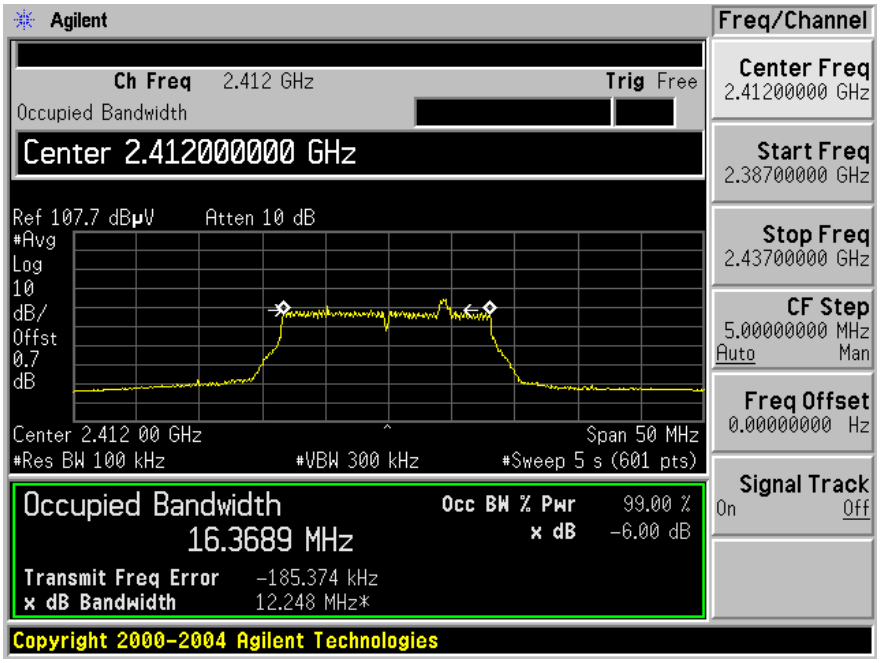
802.11g, Middle Channel 2437 MHz



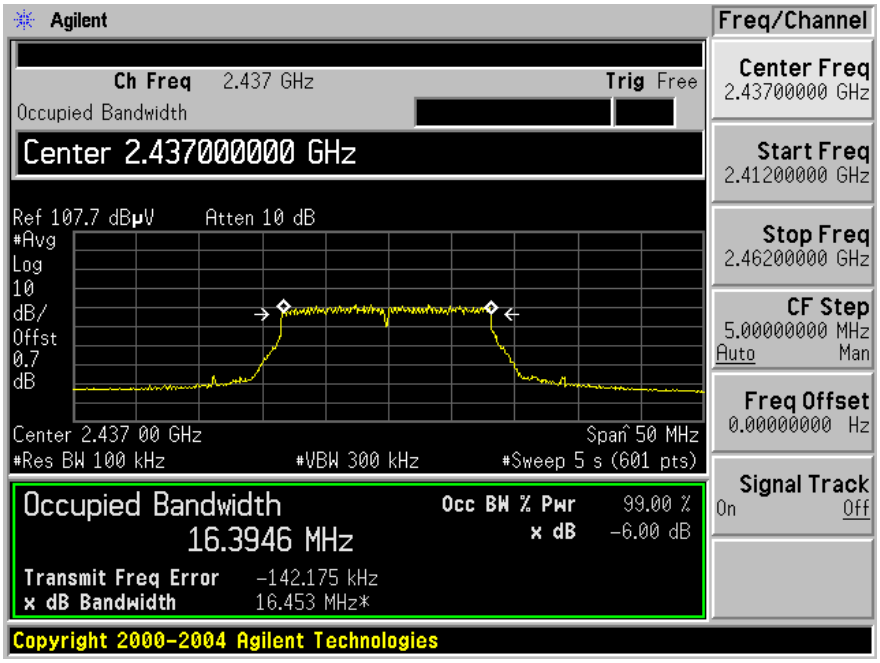

802.11g, High Channel 2462 MHz



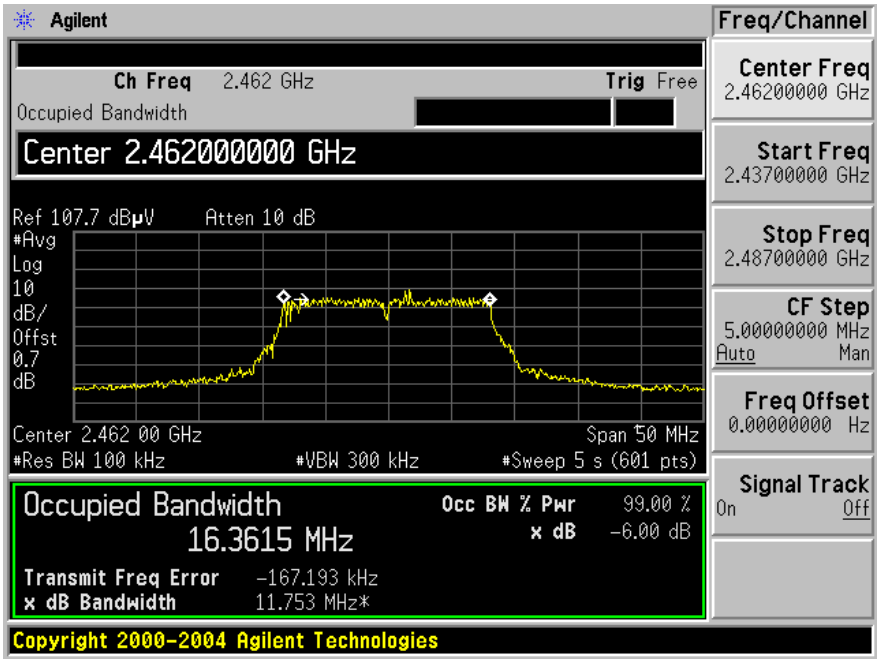
802.11 n20, Low Channel 2412 MHz



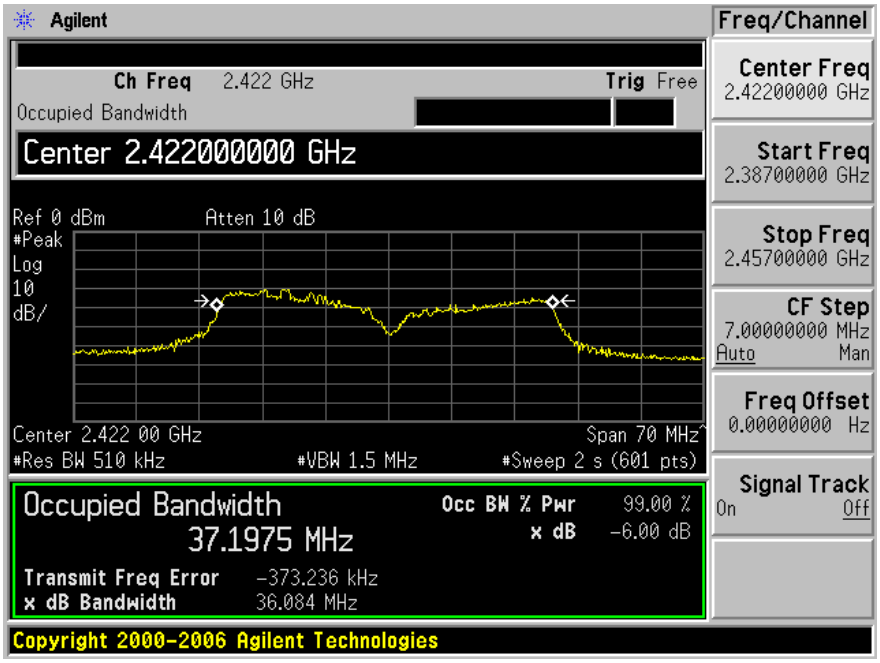

802.11 n20, Middle Channel 2437 MHz



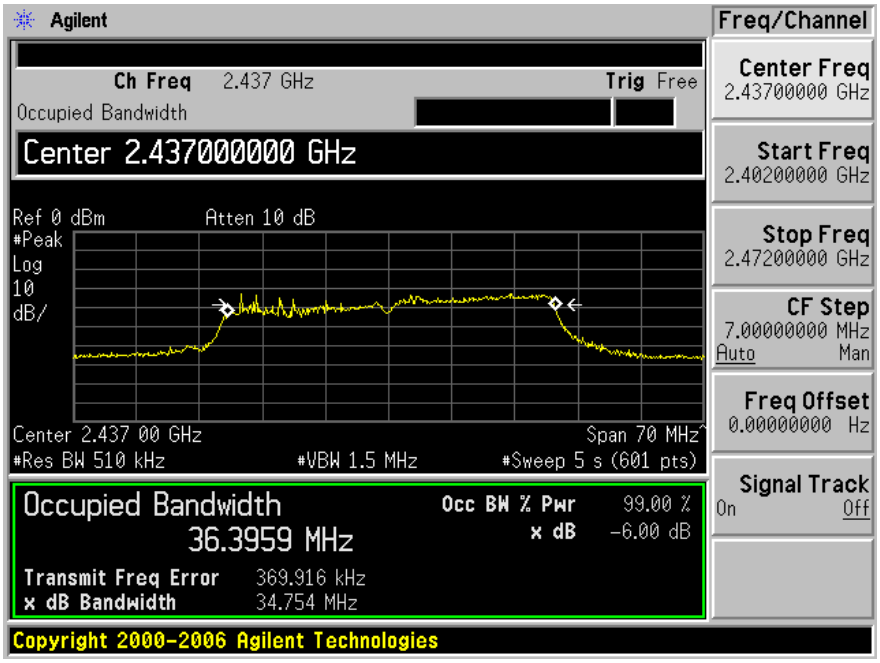
802.11 n20, High Channel 2462 MHz



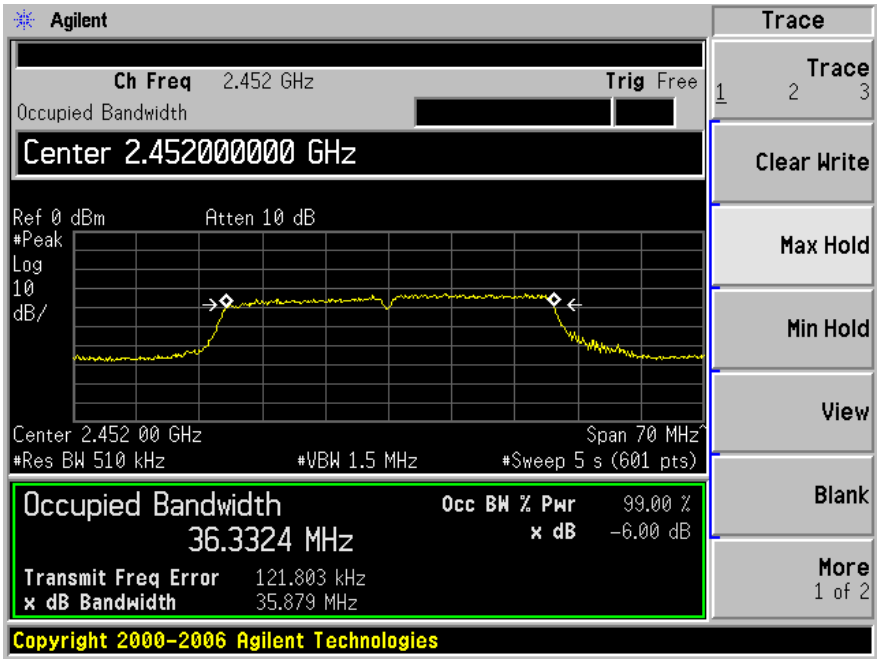

802.11 n40, Low Channel 2422 MHz



802.11 n40, Middle Channel 2437 MHz




802.11 n40, High Channel 2452 MHz



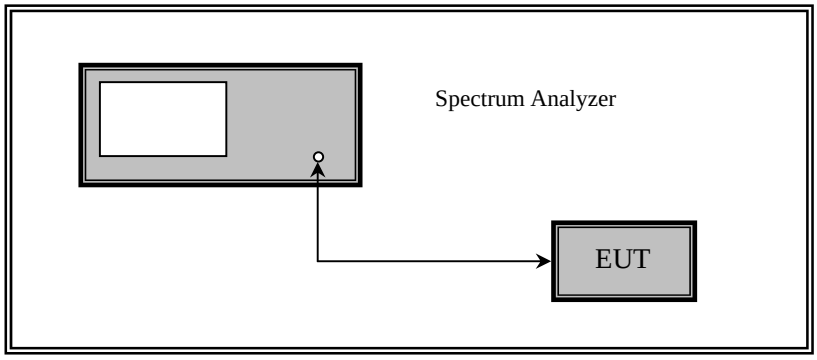
# 8 FCC §15.247(b) & IC RSS-210 §A8.4 – Peak Output Power

## 8.1 Applicable Standard

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

## 8.2 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.




## 8.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date |
|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | MY44303352 | 2009-07-23 |

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

## 8.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22° |
| **Relative Humidity:** | 31 % |
| **ATM Pressure:** | 101.20kPa |

**The testing was performed by Kevin Li 2009-12-22.*

## 8.5 Test Results

| Radio Mode | Channel | Frequency (MHz) | Conducted Output Power | | FCC/IC | |
|---|---|---|---|---|---|---|
| | | | (dBm) | (mw) | Limit (dBm) | Margin (dB) |
| 802.11b | Low | 2412 | 10.48 | 11.169 | 30 | -19.52 |
| | Mid | 2437 | 10.05 | 10.116 | 30 | -19.95 |
| | High | 2462 | 9.67 | 9.268 | 30 | -20.33 |
| 802.11g | Low | 2412 | 9.72 | 9.376 | 30 | -20.28 |
| | Mid | 2437 | 9.28 | 8.472 | 30 | -20.72 |
| | High | 2462 | 9.25 | 8.414 | 30 | -20.75 |
| 802.11 n20 | Low | 2412 | 9.81 | 9.572 | 30 | -20.19 |
| | Mid | 2437 | 9.68 | 9.290 | 30 | -20.32 |
| | High | 2462 | 9.16 | 8.241 | 30 | -20.84 |
| 802.11 n40 | Low | 2422 | 8.93 | 7.816 | 30 | -21.07 |
| | Mid | 2437 | 8.78 | 7.551 | 30 | -21.22 |
| | High | 2452 | 8.64 | 7.311 | 30 | -21.36 |

# 9 FCC §15.247(d) & IC RSS-210 §A8.5 – Out of Band Emissions

## 9.1 Applicable Standard

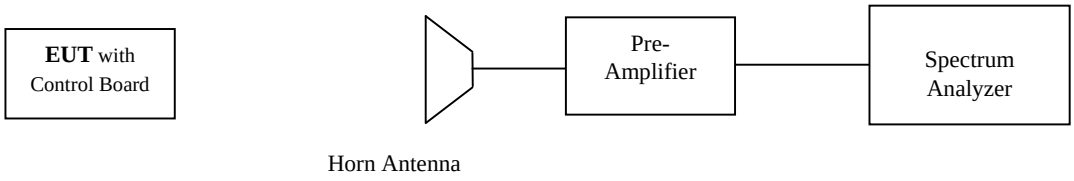
According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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.

## 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 on the table. Turn on the EUT , the spectrum analyzer and the pre-amplifier. 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.

## 9.3 Test Setup Block Diagram



## 9.4 Test Equipment List and Details

| Manufacturers | Description | Models | Serial Numbers | Calibration Dates |
|---|---|---|---|---|
| A.R.A | Horn Antenna | DRG-118/A | 1132 | 2009-10-27 |
| HP | Pre-Amplifier | 8447D | 2944A06639 | 2009-06-05 |
| Agilent | Spectrum Analyzer | E4440A | MY44303352 | 2009-07-23 |

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

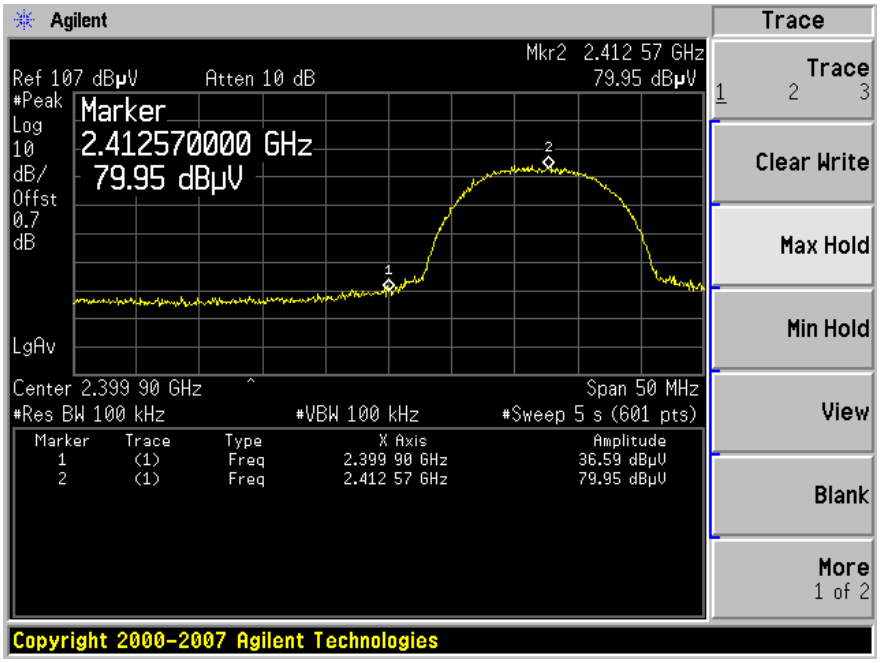
## 9.5 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22°C |
| **Relative Humidity:** | 31% |
| **ATM Pressure:** | 102kPa |

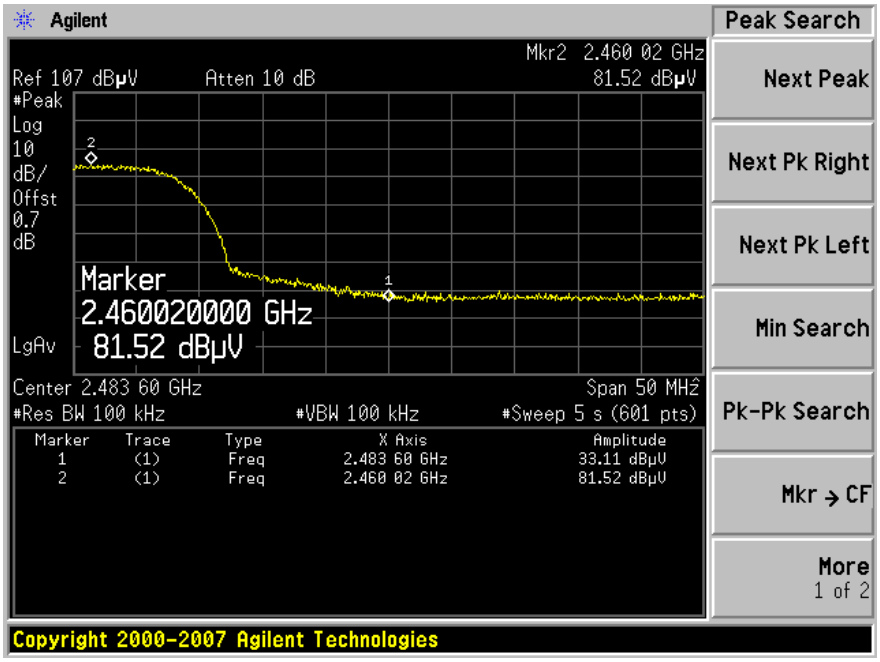
**The testing was performed by Kevin Li 2009-12-22.*

*Please refer to the following plots for detailed results*

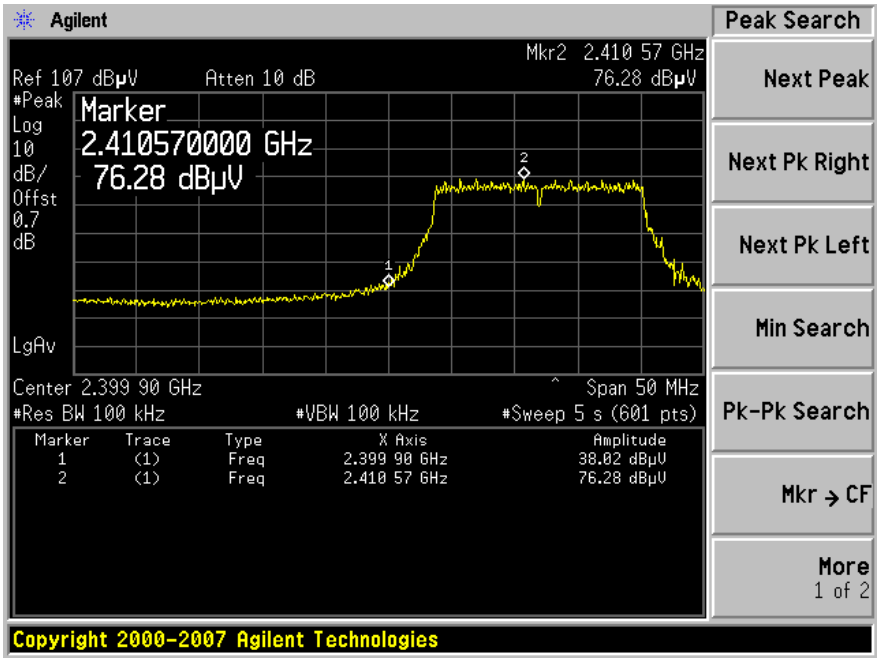
802.11b, Low Band Edge



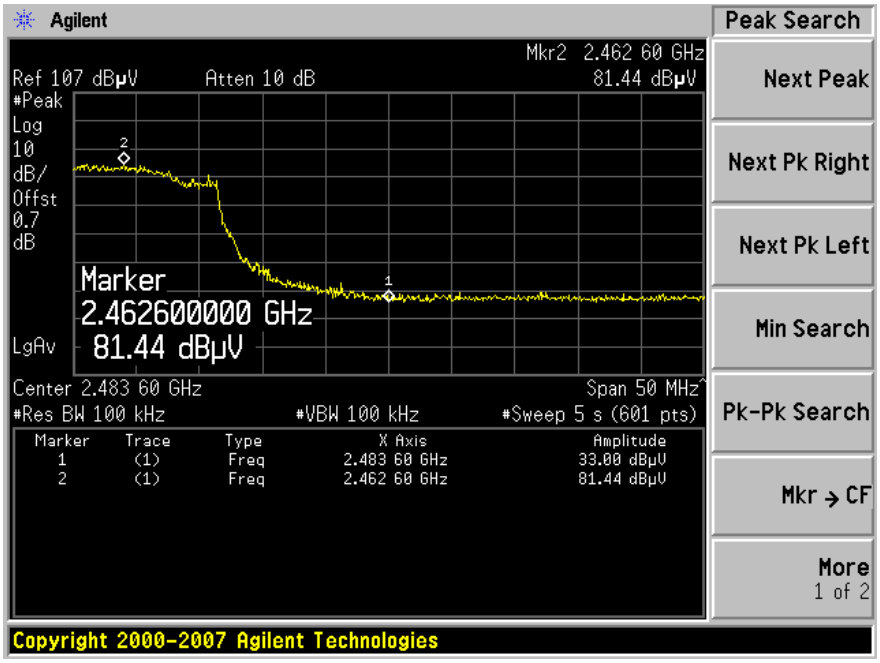

802.11b, High Band Edge



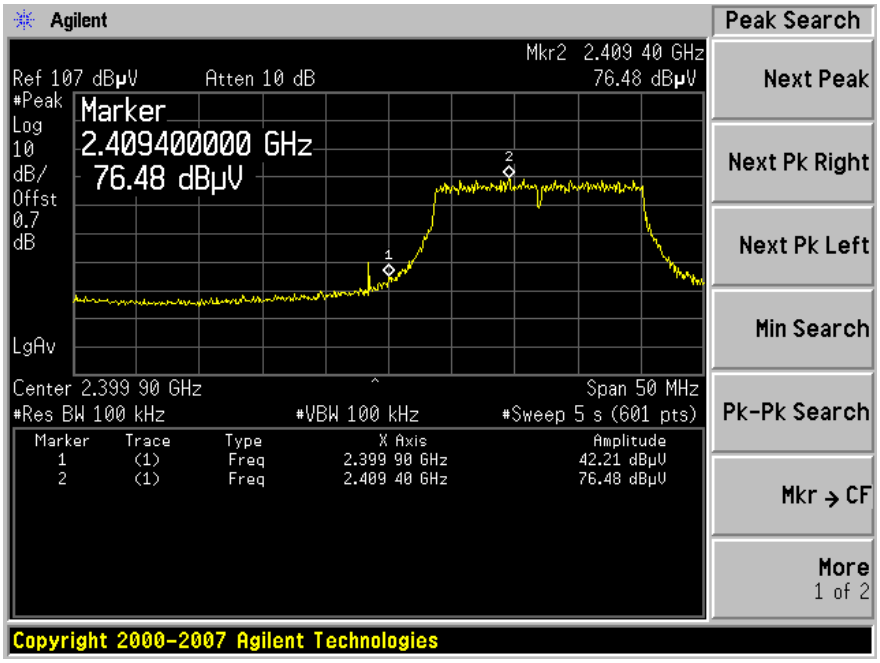
802.11g, Low Band Edge



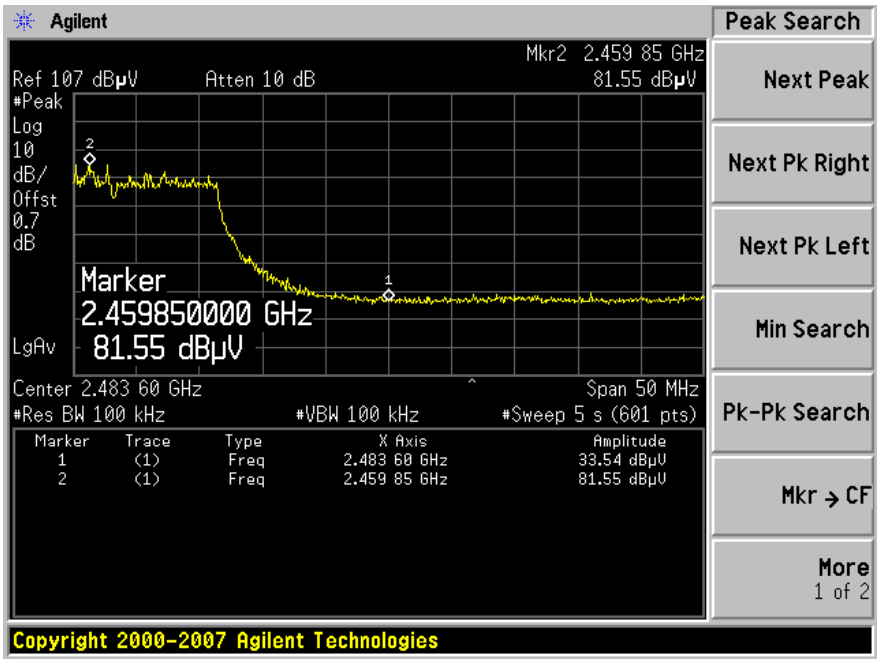

802.11g, High Band Edge



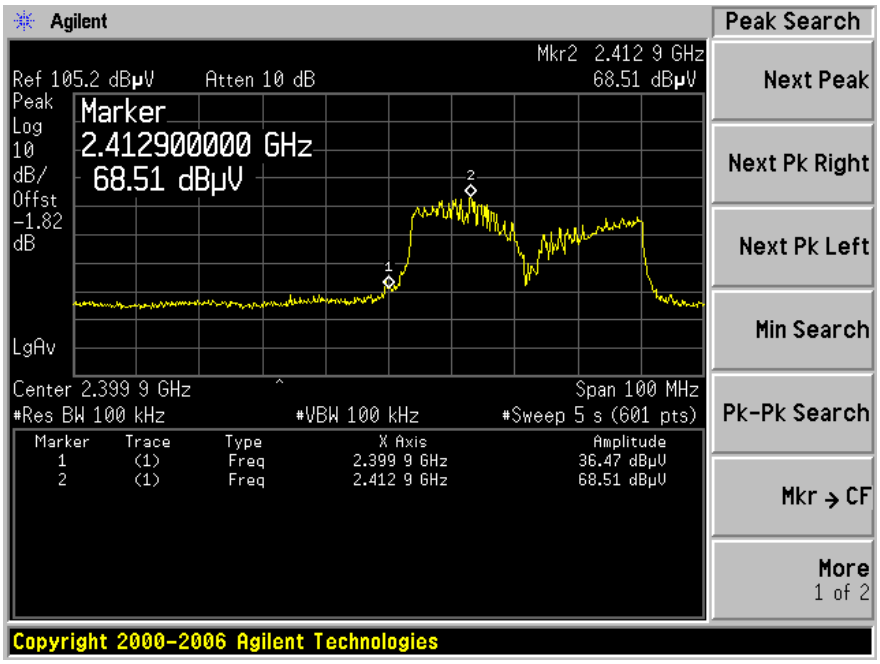
802.11 n20, Low Band Edge



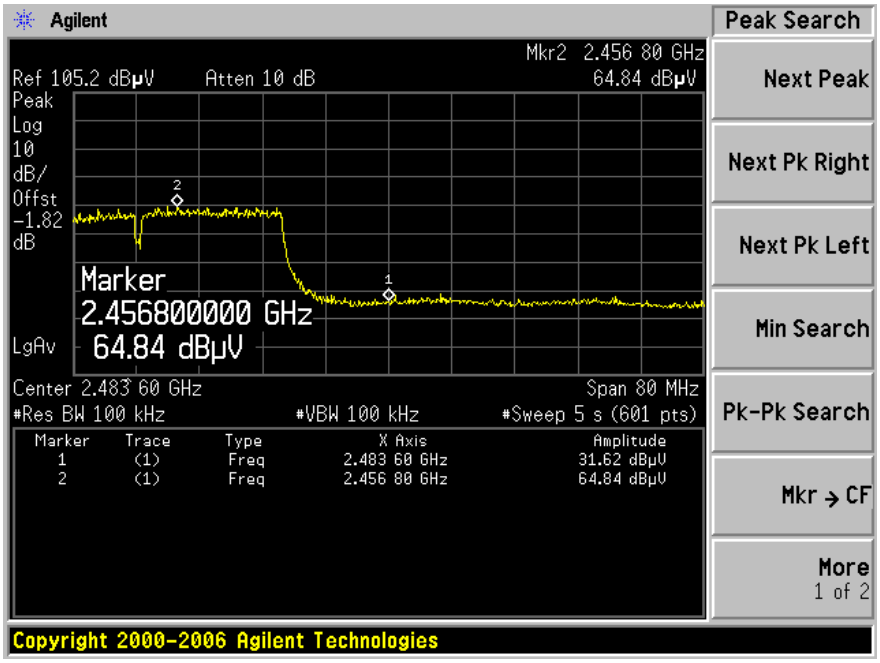

802.11 n20, High Band Edge



802.11 n40, Low Band Edge




802.11 n40, High Band Edge



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

## 10.1 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.

## 10.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT 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.

## 10.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date |
|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | MY44303352 | 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:** | 22°C |
| **Relative Humidity:** | 31 % |
| **ATM Pressure:** | 101.1kPa |

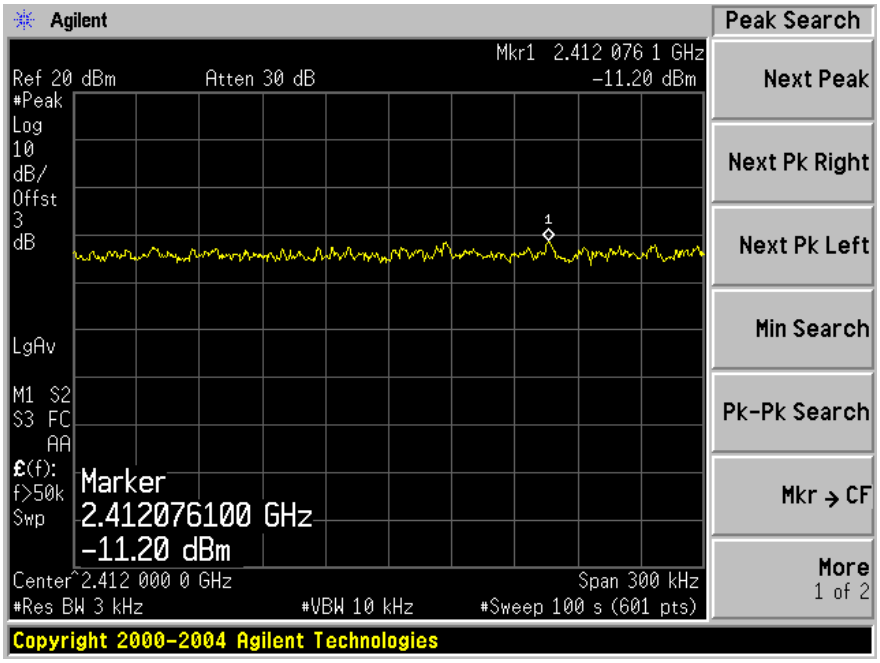
**The testing was performed by Kevin Li on 2009-12-22.*

## 10.5 Test Results

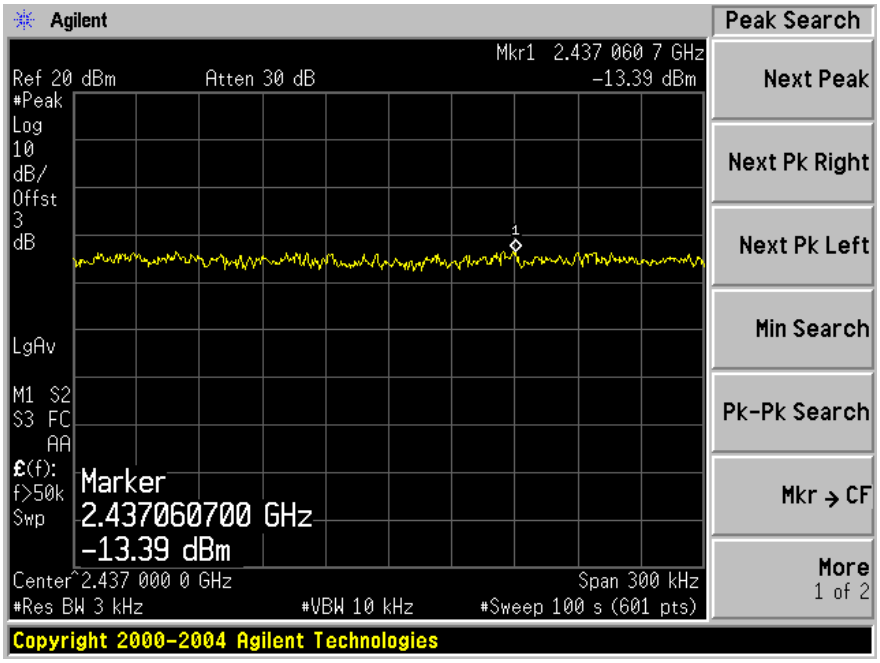
| Radio Mode | Channel | Frequency (MHz) | Power Spectral Density (dBm) | FCC/IC Limit (dBm) | Result |
|---|---|---|---|---|---|
| 802.11 b | Low | 2412 | -11.20 | 8 | Compliance |
| | Mid | 2437 | -13.39 | 8 | Compliance |
| | High | 2462 | -12.96 | 8 | Compliance |
| 802.11 g | Low | 2412 | -13.29 | 8 | Compliance |
| | Mid | 2437 | -12.75 | 8 | Compliance |
| | High | 2462 | -13.50 | 8 | Compliance |
| 802.11 n20 | Low | 2412 | -13.17 | 8 | Compliance |
| | Mid | 2437 | -13.52 | 8 | Compliance |
| | High | 2462 | -14.64 | 8 | Compliance |
| 802.11 n40 | Low | 2422 | -15.05 | 8 | Compliance |
| | Mid | 2437 | -14.11 | 8 | Compliance |
| | High | 2452 | -14.99 | 8 | Compliance |

*Please refer to the following plots for detailed test results*

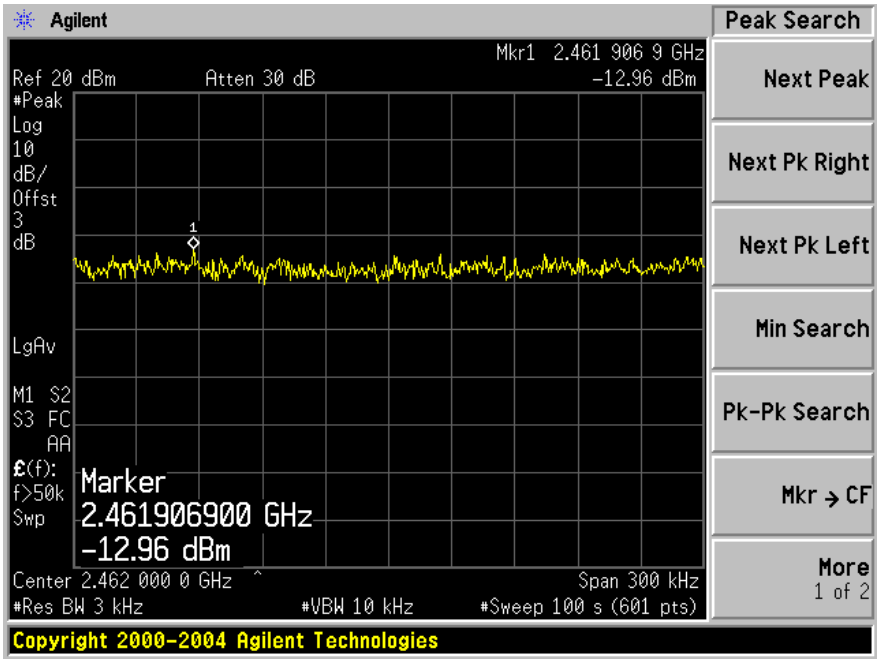
802.11 b, Low Channel 2412 MHz



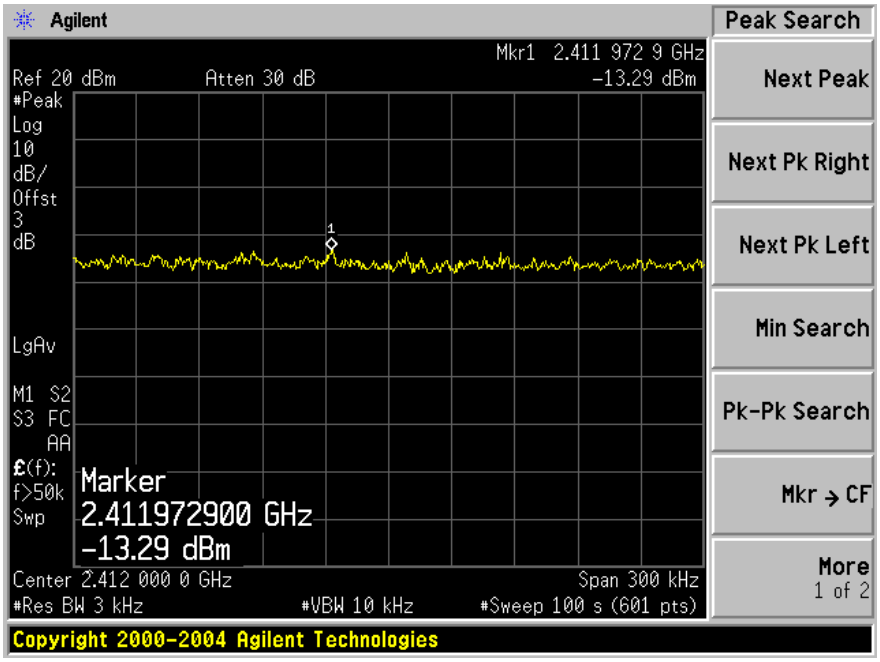

802.11 b, Middle Channel 2437 MHz



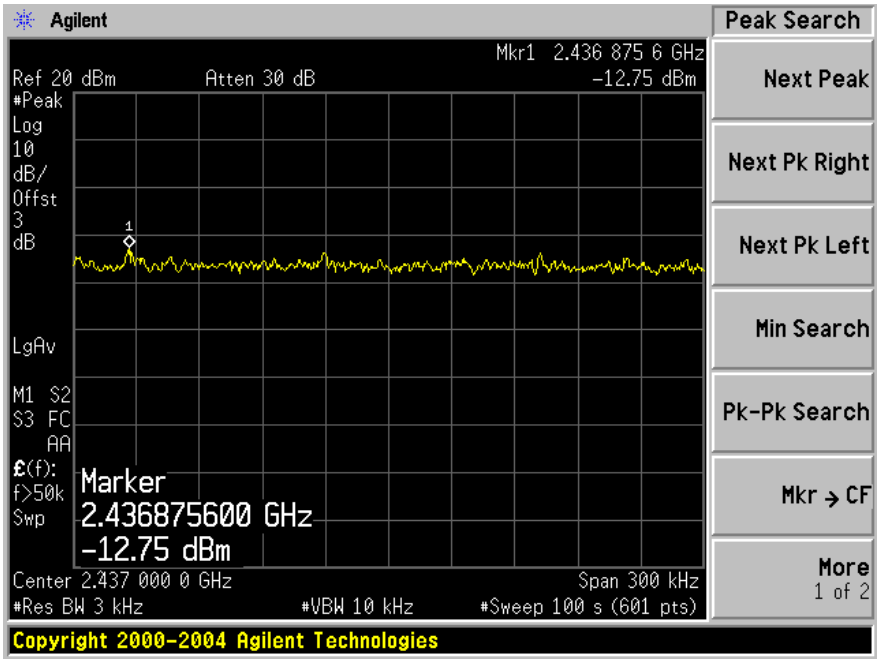
802.11 b, High Channel 2462 MHz



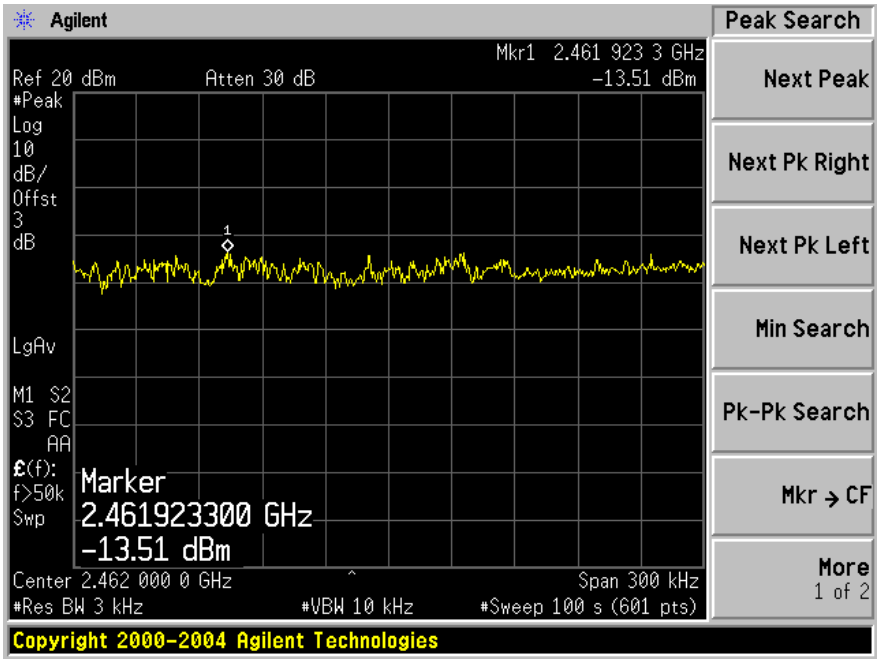

802.11 g, Low Channel 2412 MHz



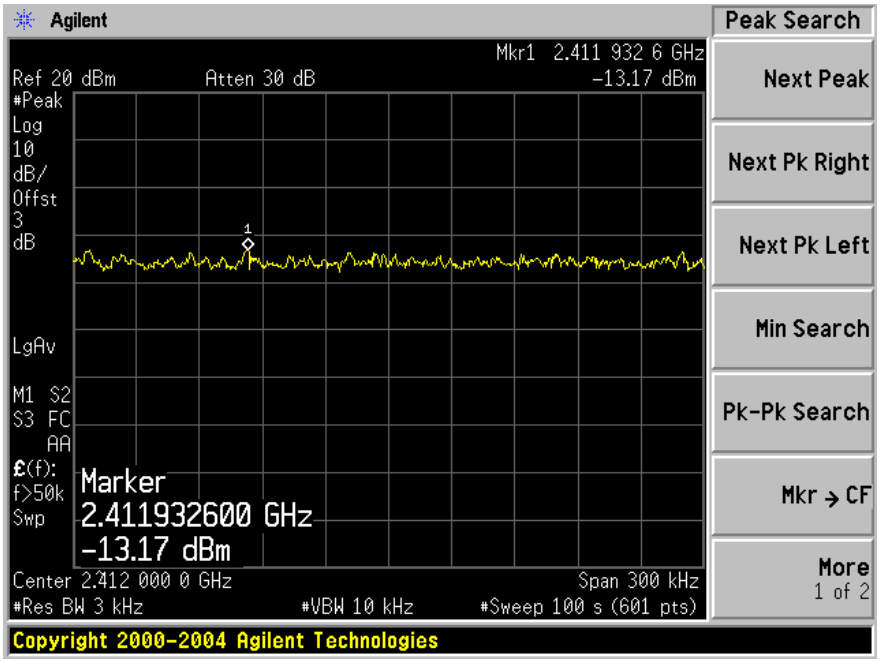
802.11 g, Middle Channel 2437 MHz



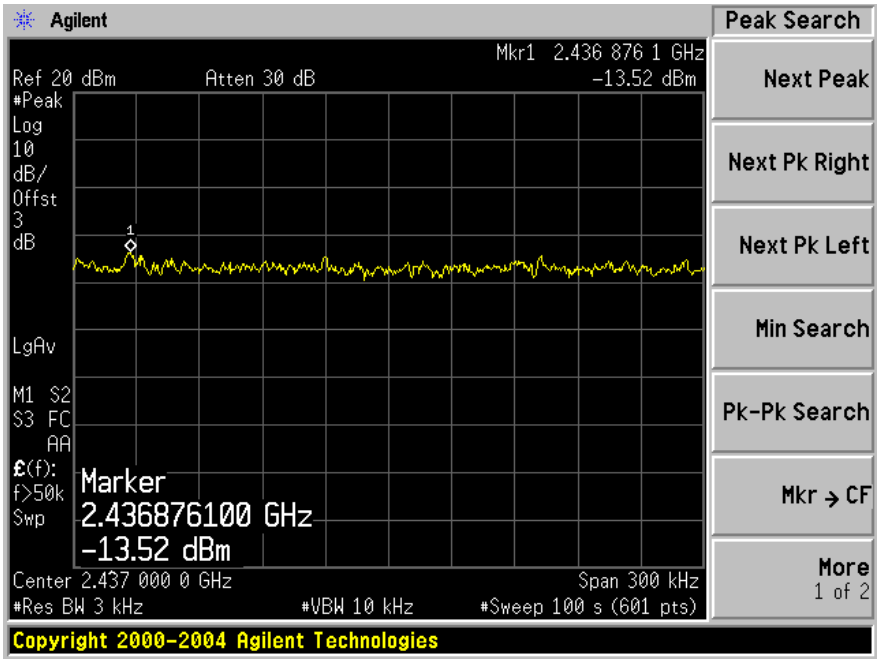

802.11 g, High Channel 2462 MHz



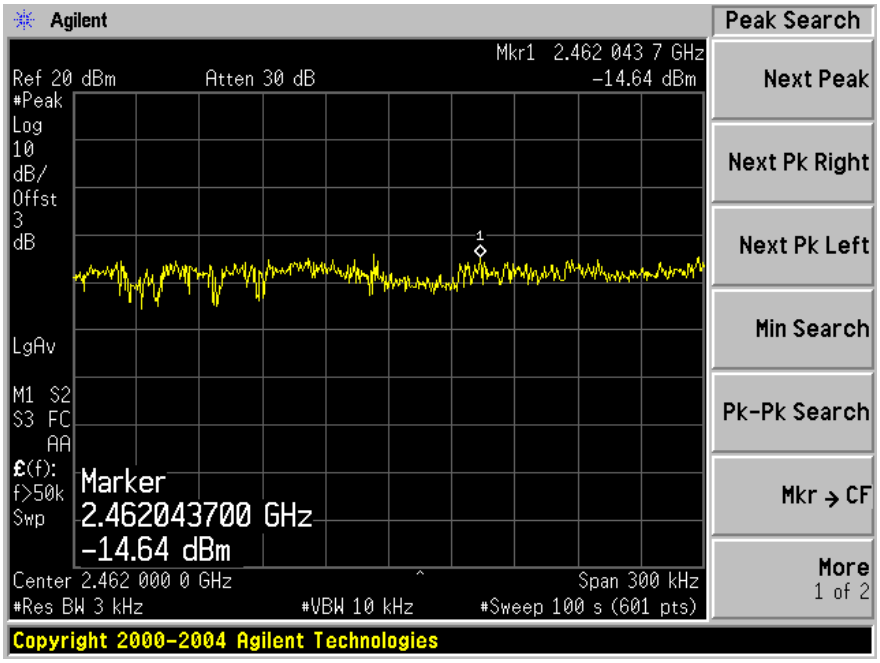
802.11 n20, Low Channel 2412 MHz



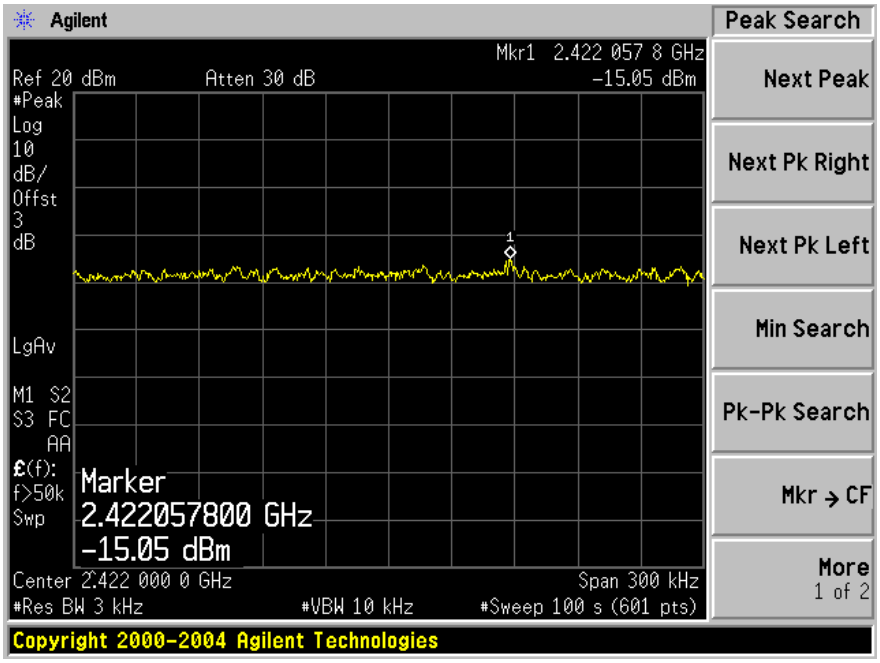

802.11 n20, Middle Channel 2437 MHz



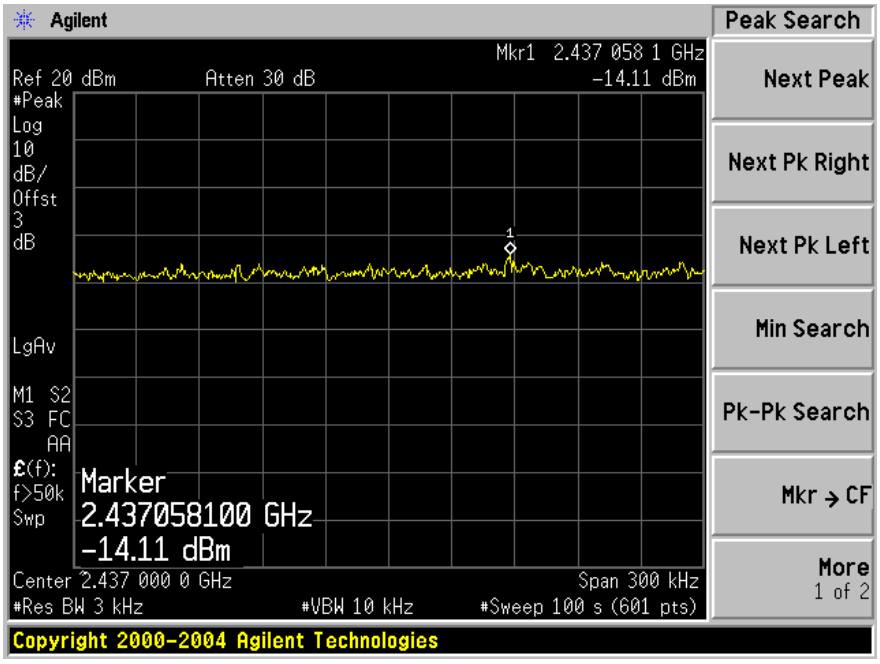
802.11 n20, High Channel 2462 MHz



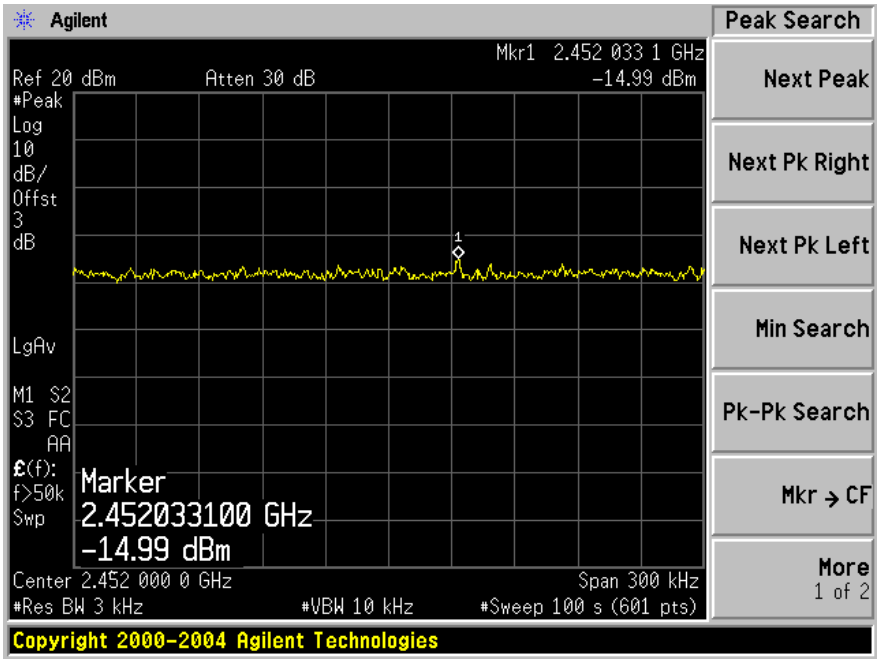

802.11 n40, Low Channel 2422 MHz



802.11 n40, Middle Channel 2437 MHz




802.11 n40, High Channel 2452 MHz



# 11 IC RSS-Gen §4.10 & RSS-210 §2.6 Receiver Spurious Emissions

## 11.1 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.

## 11.2 Test Setup

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

## 11.3 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.

## 11.4 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

## 11.5 Test Equipment List and Details

| Manufacturers | Description | Models | Serial Numbers | Calibration Dates |
|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | US45303156 | 2009-03-25 |
| Sunol Sciences | Antenna | JB1 | A020106-1 | 2009-04-17 |
| A.R.A | Horn Antenna | DRG-118/A | 1132 | 2009-10-27 |
| A. H. Systems | Antenna, Horn, DRG | SAS-200/571 | 261 | 2009-09-23 |
| Ducommun | Pre-Amplifier | ALN-09173030-01 | 990297-01R | 2009-03-04 |
| HP | Pre-Amplifier | 8447D | 2944A06639 | 2009-06-05 |

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

## 11.6 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22°C |
| **Relative Humidity:** | 31 % |
| **ATM Pressure:** | 101.2kPa |

**The testing was performed by Kevin Li on 2009-12-21.*

### 11.7 Test Results

According to the recorded data, the EUT complied with RSS-210/Gen Standard, and had the worst margin reading of:

Receiving Mode:

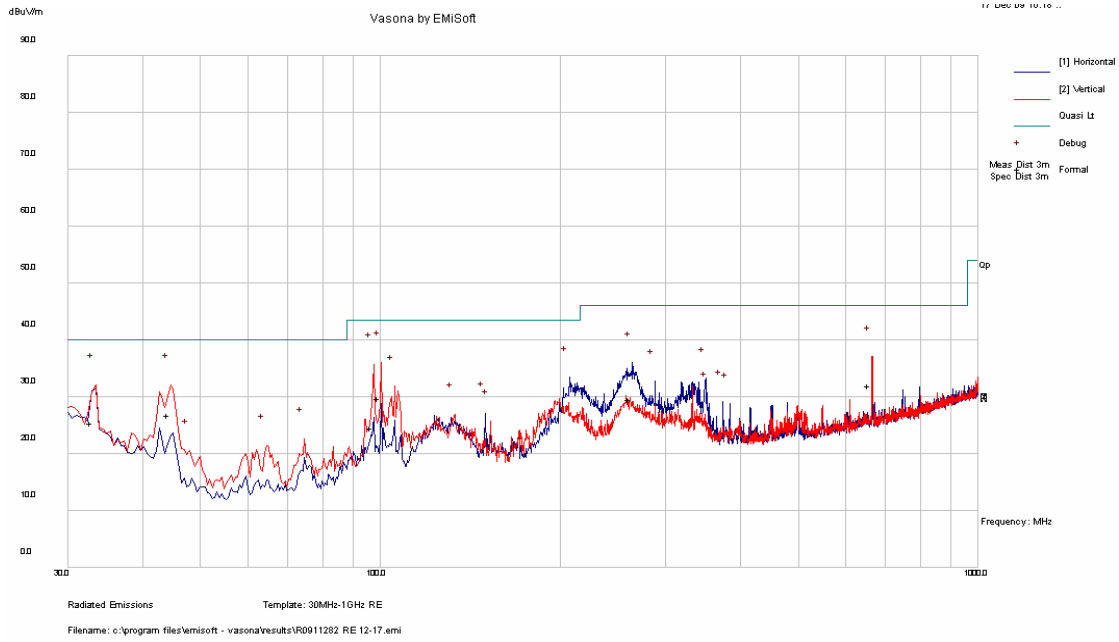
| Margin (dB) | Frequency (MHz) | Polarization (Horizontal/Vertical) | Range |
|---|---|---|---|
| -13.14 | 44.70168 | Vertical | 30 MHz to 1 GHz |
| - | - | - | Above 1 GHz* |

***Note:** All above 1 GHz emission levels are at the noise floor and/or more then 20 dB below the limit.

*Please refer to the following plot and data:*

## 11.8 Radiated Emissions Test Plots and Data

30 MHz – 1 GHz




| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 100.2948 | 29.72 | 238 | V | 265 | 43.5 | -13.78 |
| 97.65236 | 24.62 | 243 | V | 336 | 43.5 | -18.88 |
| 33.18404 | 25.36 | 167 | V | 356 | 40 | -14.64 |
| 44.70168 | 26.86 | 94 | V | 117 | 40 | -13.14 |
| 664.2972 | 31.98 | 98 | V | 288 | 46 | -14.02 |
| 263.9838 | 29.62 | 125 | H | 107 | 46 | -16.38 |

Above 1 GHz (Middle Channel measured at 3 meters)

| Frequency (MHz) | Indicated Reading (dBµV) | Table Azimuth (degree) | Test Antenna | | | Cable Loss ( dB) | Pre-Amp. Gain (dB) | Corrected Reading (dBµV/m) | IC RSS-Gen | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| - | - | - | - | - | - | - | - | - | - | - | * |
| - | - | - | - | - | - | - | - | - | - | - | * |

***Note:** All emission levels are at the noise floor and/or more then 20 dB below the limit.

# 12 FCC §15.247(i), § 2.1093 & IC RSS-102 - RF Exposure

## 12.1 Applicable Standards

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

The category of EUT is General Population/Uncontrolled Exposure

According to FCC Exclusion list, In the following table, f (GHz) is mid-band frequency in GHz, and d is the distance to a person's body, excluding hands, wrists, feet, and ankles.

| Exposure category | low threshold | high threshold |
|---|---|---|
| general population | $(60/f_{GHz})$ mW, $d < 2.5$ cm<br>$(120/f_{GHz})$ mW, $d \geq 2.5$ cm | $(900/f_{GHz})$ mW, $d < 20$ cm |
| occupational | $(375/f_{GHz})$ mW, $d < 2.5$ cm<br>$(900/f_{GHz})$ mW, $d \geq 2.5$ cm | $(2250/f_{GHz})$ mW, $d < 20$ cm |

## 12.2 Result

The EUT is a portable device and the Max EIRP output power is 10.48 dBm+2 dBi = 12.48 dBm = 17.7 mw < 24.61 = (60/2.438GHz) mW, The SAR measurement is exempt.