Lab Code: 200167-0

FCC PART 15 SUBPART 247

TEST AND MEASUREMENT REPORT

For

Actiontec Electronics, Inc.

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

FCC ID: LNQ802MBN
Model: 802MBN

Report Type:	**Product Type:**
Original Report	Mini PCI 802.11b/g/n Wireless Network Card

Test Engineers:	Victor Zhang
Report Number:	R0904024
Report Date:	2009-05-06
Reviewed By:	Boni Baniqued Sr. RF Engineer
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R0904024	Original	2009-05-06

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

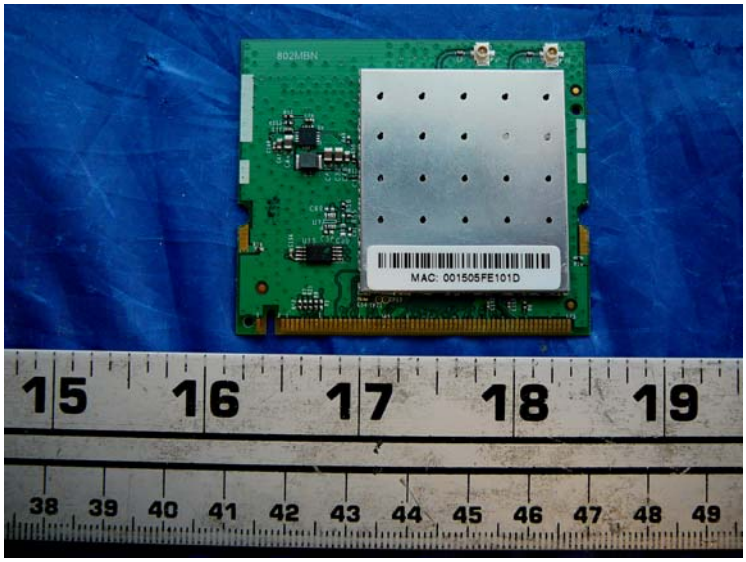
The *Actiontec Electronics, Inc.* product, model: *802MBN, FCC ID: LNQ802MBN* or the "EUT" as referred to in this report is a mini PCI 802.11 b/g/n wireless network card. Actiontec 802MBN provides ultra high performance (up to 300 Mbps) transmission rate in 2.4 GHz bands. Backward compatible with the current 802.11b/g network devices gives your laptop the freedom of wireless connectivity with the performance, security, and manageability that businesses desire. A firmware-based architecture is capable of supporting the latest industry standards in the security and quality of service (QoS), as the draft 802.11i and 802.11e standards, respectively. The 802MBN is complemented by drivers and networking tools for various versions of embedded operating system (e.g. Linux). Extensive technical documentation on integration issues such as antenna design, customizing drivers, and management software can be obtained by request.

1.2 Mechanical Description of EUT

The "EUT" measures approximately *60m L x 51m W x4mm H,* and weighs approximately 12.5g.

** The test data gathered are from typical production sample, serial number: C91300030, provided by the manufacturer.*

1.3 EUT Photo



Please refer to Exhibit C for more EUT photographs.

1.4 Objective

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

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

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: C-2463 and R-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

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

2 System Test Configuration

2.1 Justification

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

The EUT was tested in a testing mode to represent worst-case results during the final qualification test with the host model: Q1000.

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

2.2 EUT Exercise Software

The EUT 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	2412/6.5	2437/6.5	2462/6.5
802.11n	40	2422/13.5	2437/13.5	2452/13.5

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Special Accessories

N/A

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
IBM	Laptop	T41	00416
D-Link	Wireless Notebook Adapter	DWA-652	F35H285000691

2.6 Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number
Actiontec Electronics, Inc	AC/DC Power Adapter	STD-10016U	828000224

2.7 Support Host Detail

Manufacturer	Description	Model	Serial Number
Actiontec Electronics, Inc	Wireless Mesh Router	Q1000	NA
Actiontec Electronics, Inc	PCB Board	CS-BD17	CVAA9131100008

2.8 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RF cable	< 3m	Output/ EUT	Spectrum analyzer

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§15.247 (i) §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§ 15.207 (a)	Conducted Emissions	Compliant
§2.1051 §15.247 (d)	Spurious Emissions at Antenna Port	Compliant
§15.205	Restricted Bands	Compliant
§15.209 (a) §15.247 (d)	Radiated Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Bandwidth	Compliant
§15.247 (b)(3)	Maximum Peak Output Power	Compliant
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247 (e)	Power Spectral Density	Compliant

4 §15.247 (i) and § 2.1091 - RF Exposure

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

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

Limits for General Population/Uncontrolled Exposure

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

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

4.1 MPE Prediction

Predication of MPE limit at a given distance

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

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

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

4.2 MPE Results

Mode	Frequency Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mw/cm^2)	Result
WLAN	2.4 GHz	20	23.88	8	0.307	Compliance

The predicted power density level at 20 cm is 0.307 mw/cm^2 which is below the uncontrolled exposure limit of 1.0 mW/cm^2. The EUT is used at least 20 cm away from user's body. It is determined as mobile equipment and complies with the MPE limit.

5 §15.203 - Antenna Requirement

5.1 Applicable Standard

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

And according to § 15.247 (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.

5.2 Antenna Connector Construction

EUT has two Transmitter/Receiver antennae which are both external antennae and features a permanent attachment to the EUT chassis as well as non-standard connector. The Transmitter antenna has a max gain of 5 dBi which fulfills the requirements of FCC rule 15.203.

Frequency Band	Antenna 0 Gain (dBi)	Antenna 1 Gain (dBi)	Maximum Effective Gain (dBi)
2.4 GHz	5.0	5.0	8.01

5.3 Antenna Detail Photo

6 §15.207 - Conducted Emissions

6.1 Applicable Standard

Section 15.207 Conducted limits:

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

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

** Decreases with the logarithm of the frequency.*

6.2 Test Setup

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

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

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

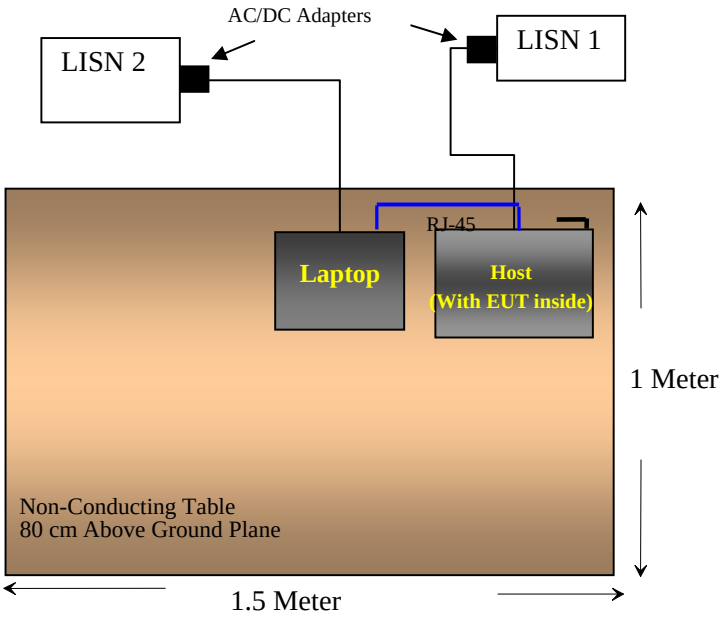
6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Solar Electronics	LISN	9252-R-24-BNC	511205	2008-07-31
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2009-04-21

*** 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

Conducted Emissions



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 Environmental Conditions

Temperature:	18-22 °C
Relative Humidity:	40-44 %
ATM Pressure:	101-103kPa

**The testing was performed by Victor Zhang from 2009-04-20 to 2009-04-24.*

6.7 Summary of Test Results

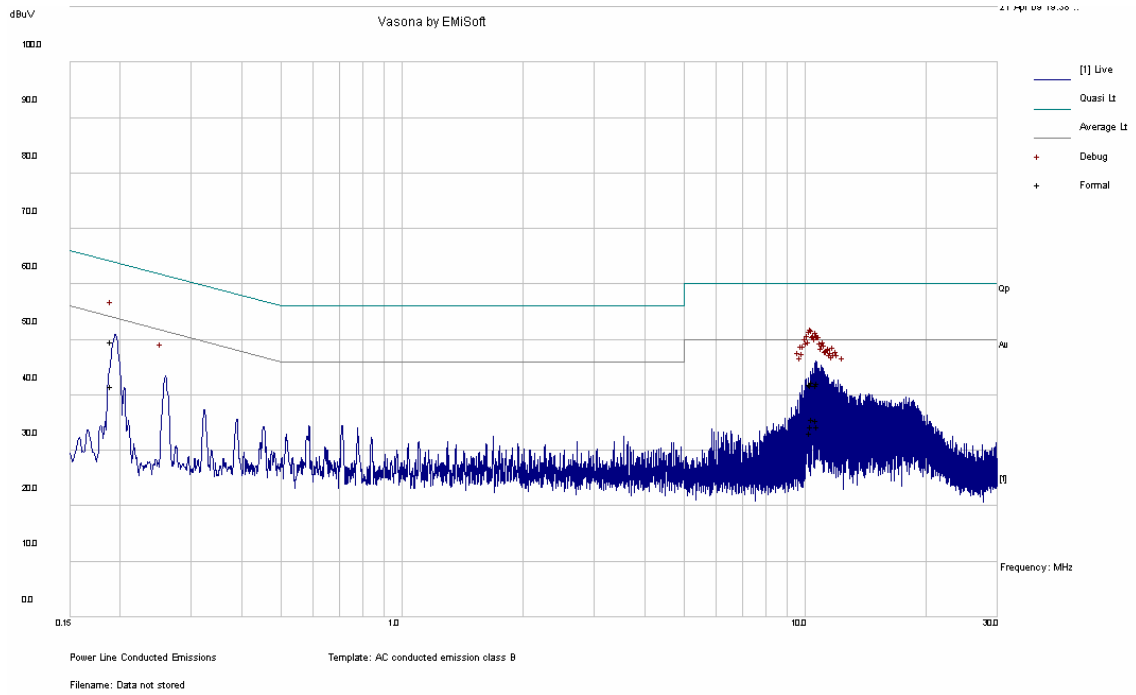
According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits, with the *worst* margin reading of:

Worst Case: 802.11n 40MHz BW

Connection: AC/DC adapter connected to 120 V/60 Hz AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-12.3	0.194337	Line	0.15 to 30 MHz
-13.73	0.194337	Neutral	0.15 to 30 MHz

6.8 Conducted Emissions Test Plots and Data

120 V, 60 Hz – Line



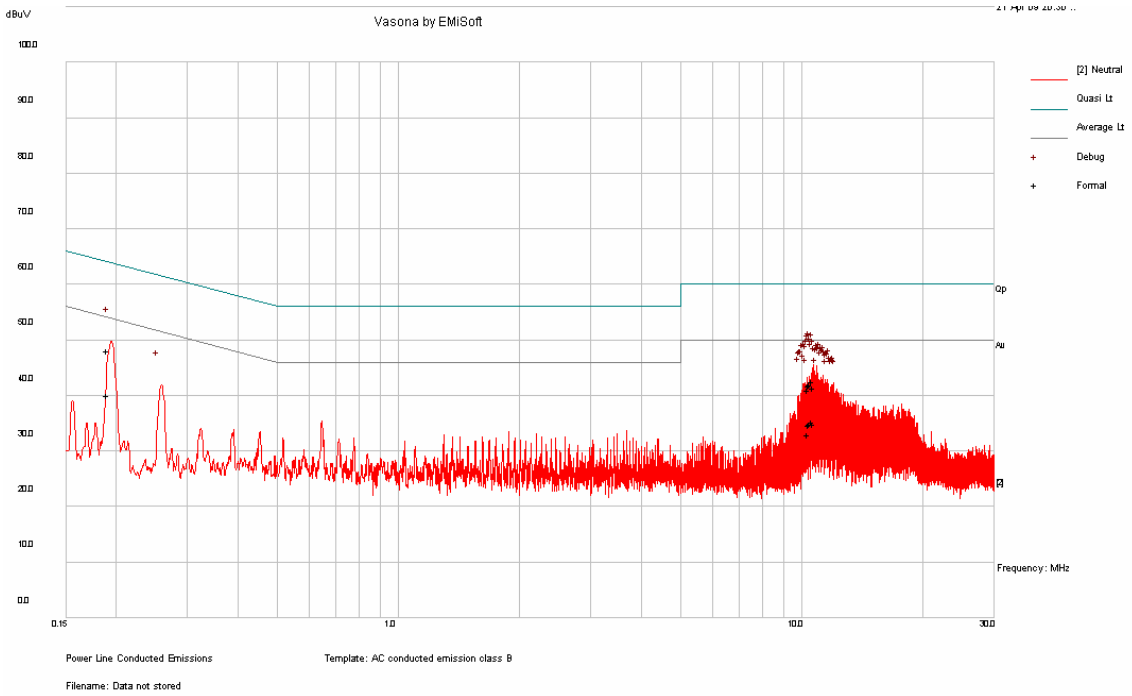
Quasi-Peak Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.194337	49.61	Line	63.85	-14.24
10.66649	42.32	Line	60.00	-17.68
10.99419	42.25	Line	60.00	-17.75
10.53362	42.04	Line	60.00	-17.96
10.92548	41.71	Line	60.00	-18.29
10.59813	41.70	Line	60.00	-18.30

Average Measurements

Frequency (MHz)	Average (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.194337	41.55	Line	53.85	-12.30
10.66649	35.62	Line	50.00	-14.38
10.92548	35.48	Line	50.00	-14.52
10.99419	34.38	Line	50.00	-15.62
10.59813	34.22	Line	50.00	-15.78
10.53362	33.18	Line	50.00	-16.82

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.194337	48.12	Neutral	63.85	-15.73
10.86000	42.46	Neutral	60.00	-17.54
10.72534	41.94	Neutral	60.00	-18.06
10.66623	41.72	Neutral	60.00	-18.28
10.92223	41.45	Neutral	60.00	-18.55
10.60481	41.03	Neutral	60.00	-18.97

Average Measurements

Frequency (MHz)	Average (dBµV)	Conductor (Line/ Neutral)	Limit (dBµV)	Margin (dB)
0.194337	40.12	Neutral	53.85	-13.73
10.86000	35.22	Neutral	50.00	-14.78
10.92223	34.95	Neutral	50.00	-15.05
10.72534	34.89	Neutral	50.00	-15.11
10.66623	34.70	Neutral	50.00	-15.30
10.60481	33.00	Neutral	50.00	-17.00

7 §2.1051 & §15.247(d) - Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

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

Requirements: CFR 47, §2.1051.

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

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	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28

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

7.4 Environmental Conditions

Temperature:	18-22 °C
Relative Humidity:	40-44 %
ATM Pressure:	101-103kPa

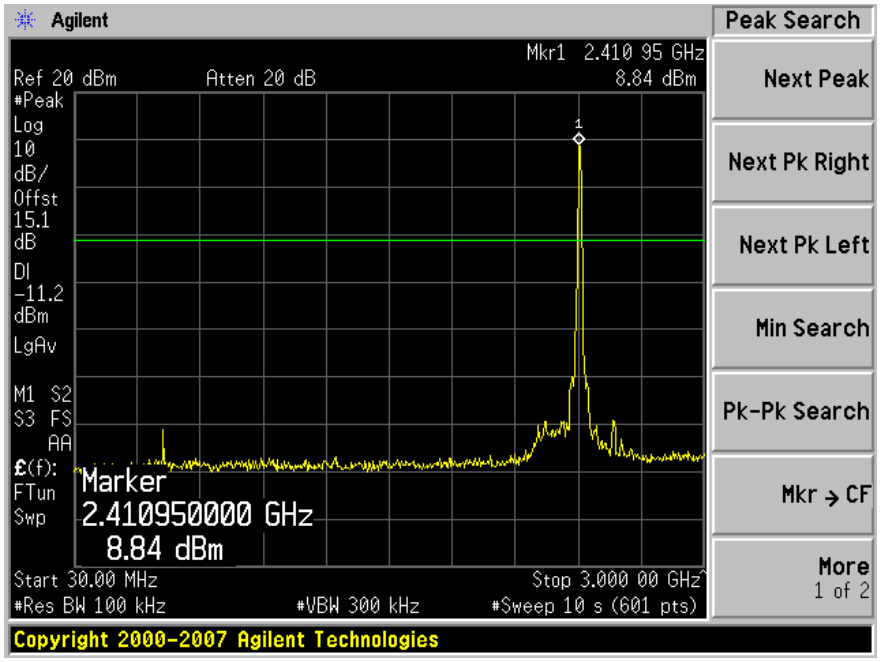
**The testing was performed by Victor Zhang from 2009-04-20 to 2009-04-24.*

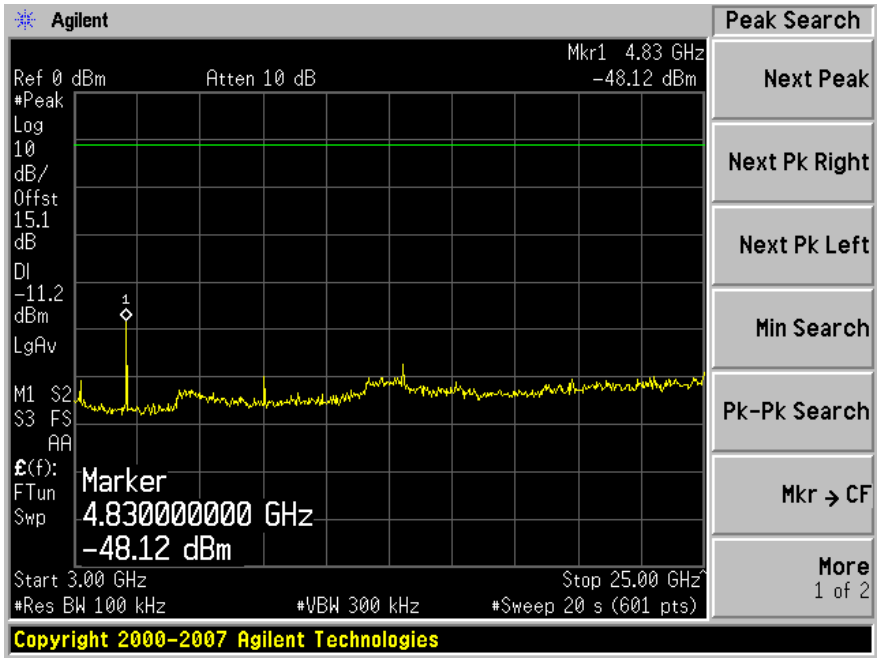
7.5 Measurement Result:

Please refer to following plots of spurious emissions.

802.11 b (Antenna #0)

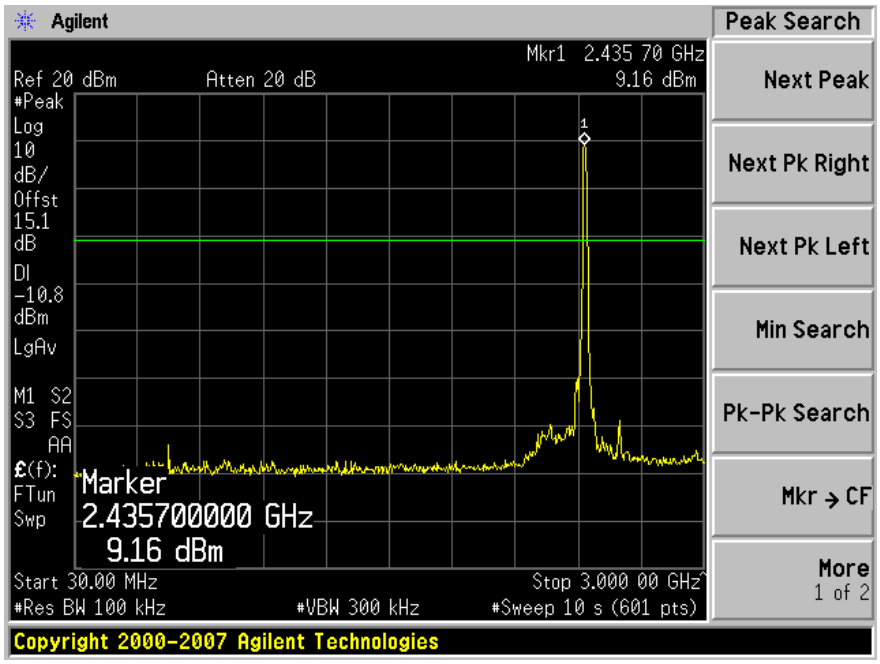
Low Channel 2412 MHz

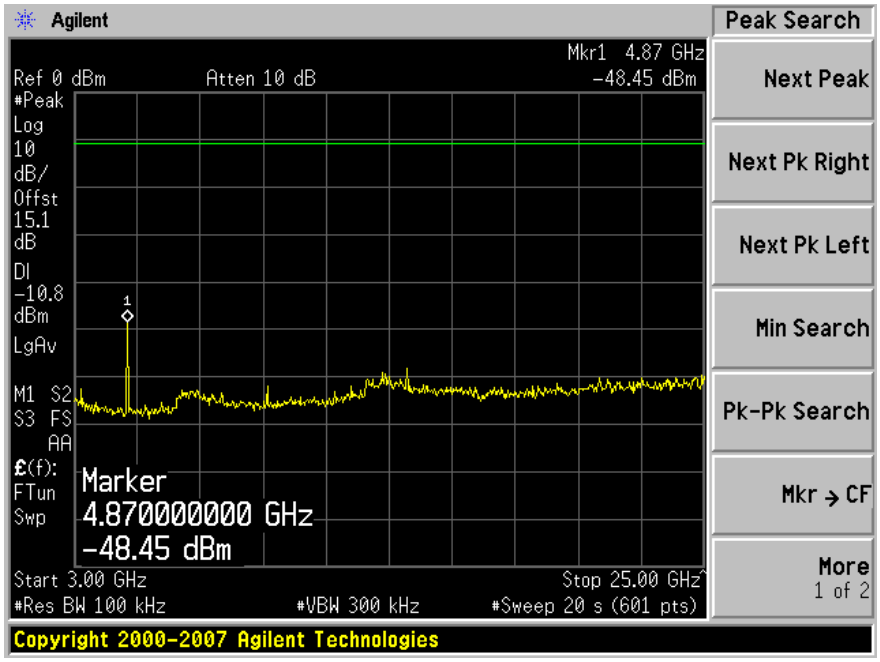




802.11 b (Antenna #0)

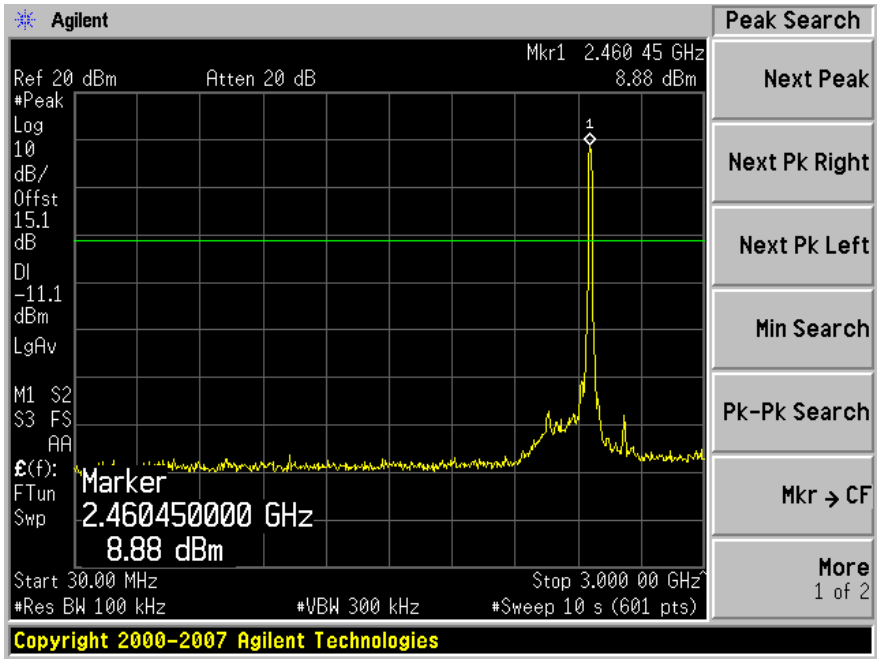
Middle Channel 2437 MHz

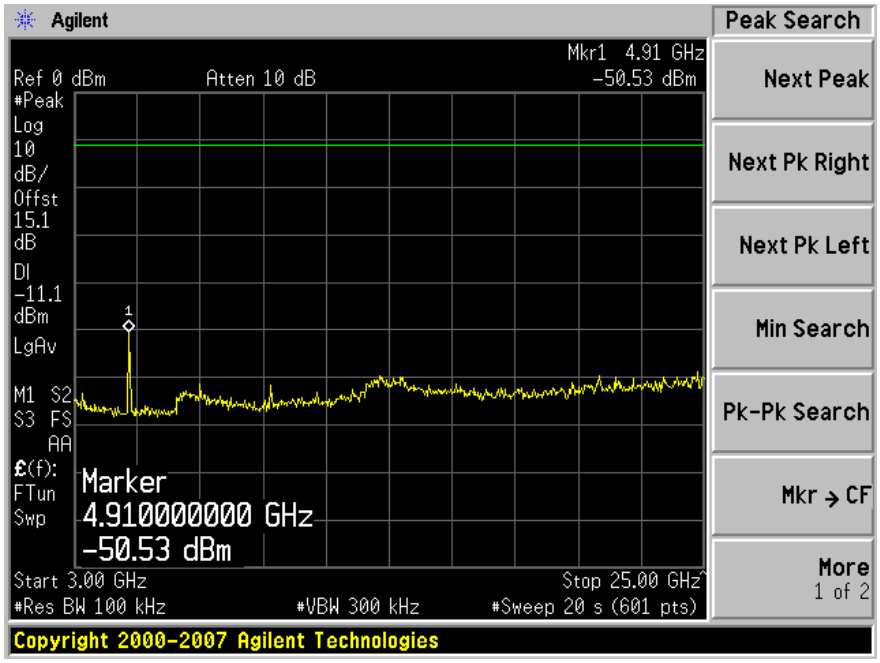




802.11 b (Antenna #0)

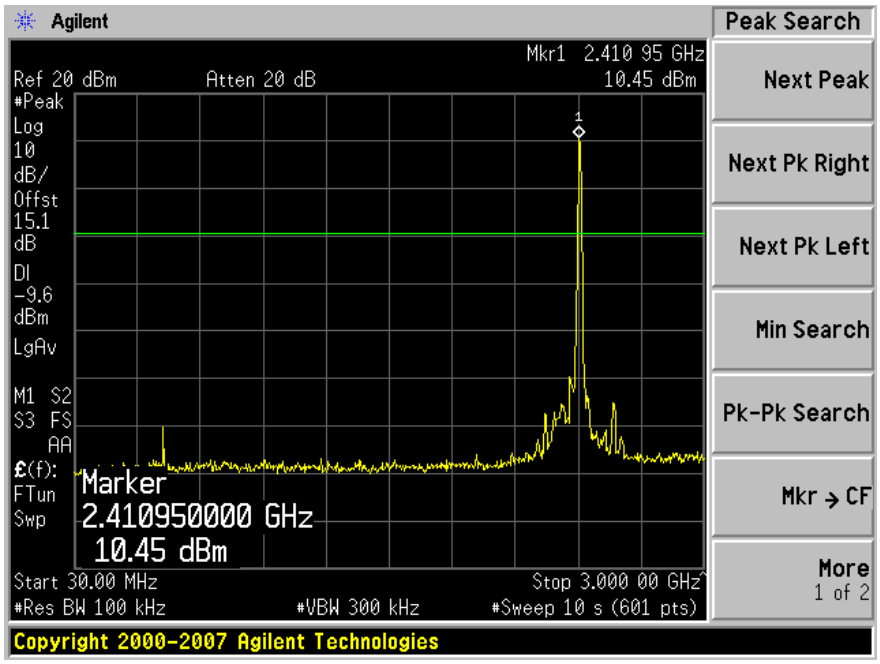
High Channel 2462 MHz

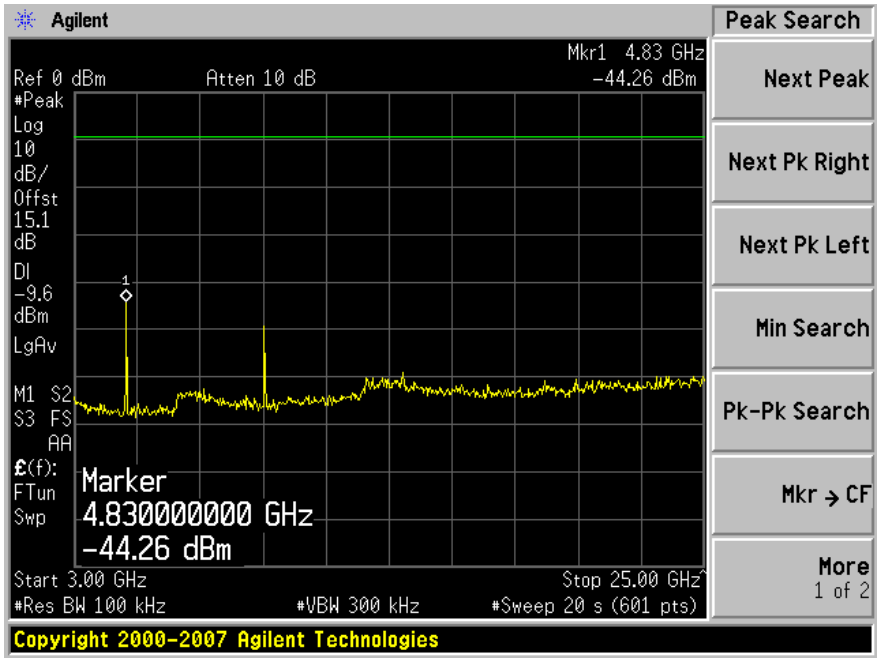




802.11 b (Antenna #1)

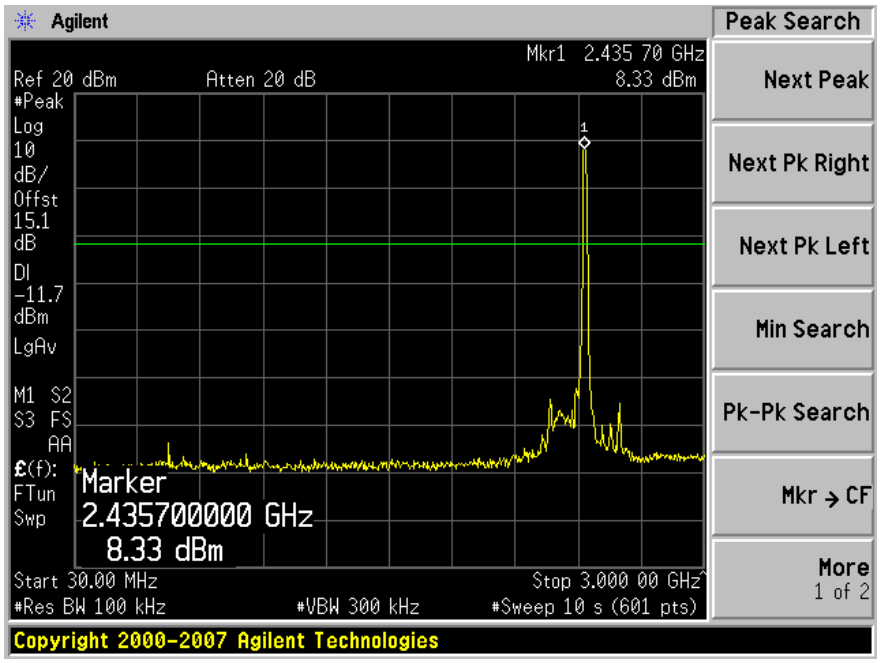
Low Channel 2412 MHz

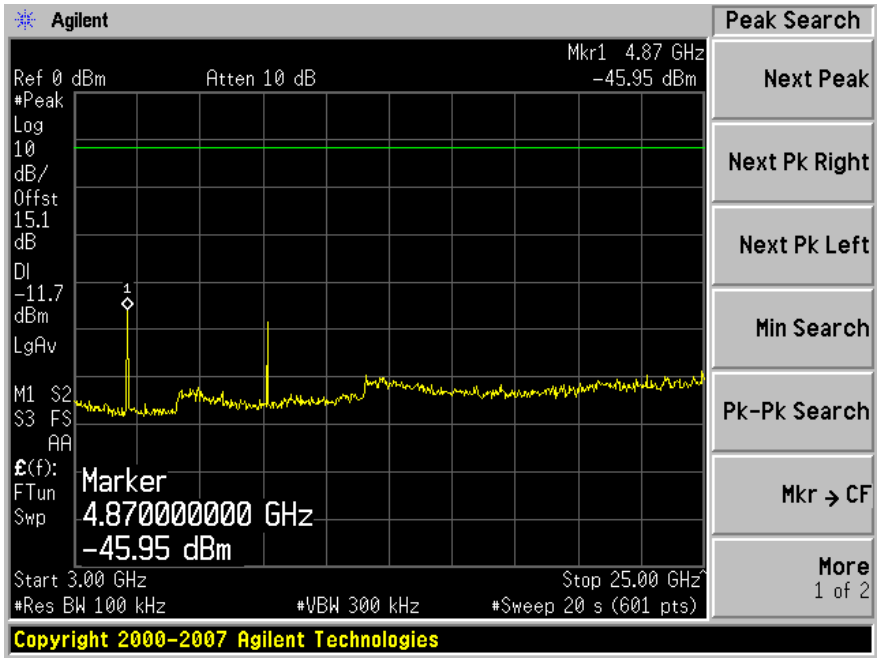




802.11 b (Antenna #1)

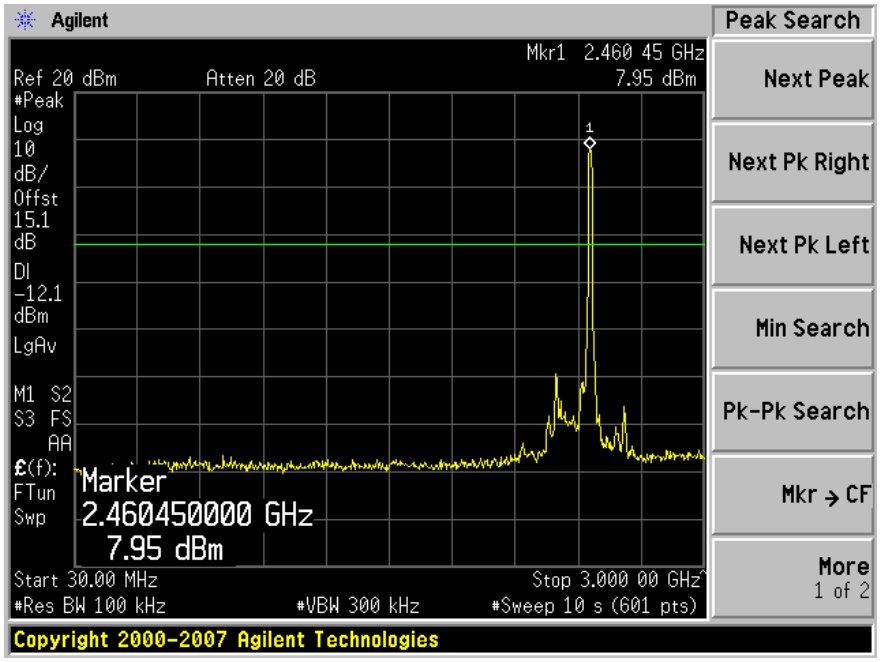
Middle Channel 2437 MHz

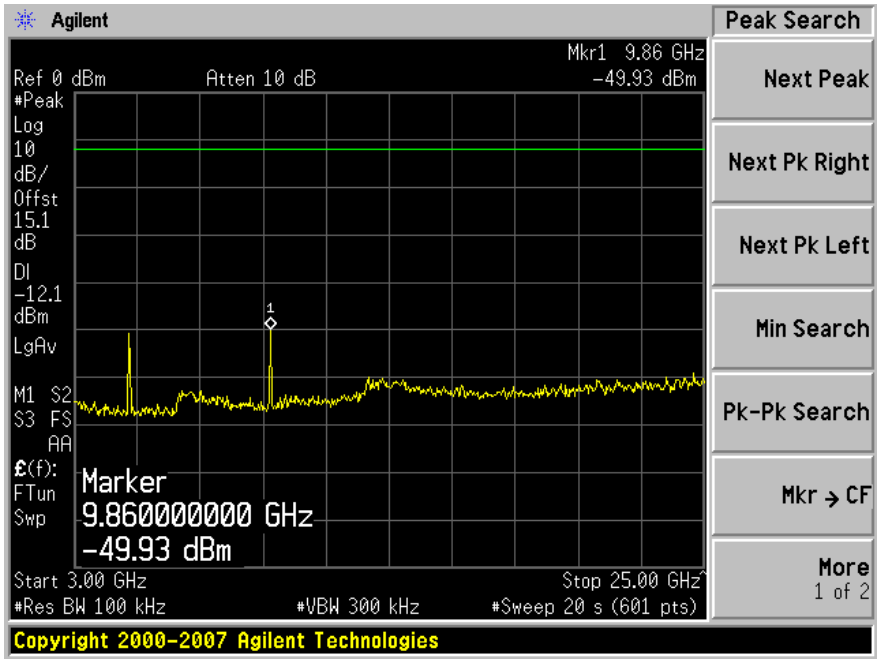




802.11 b (Antenna #1)

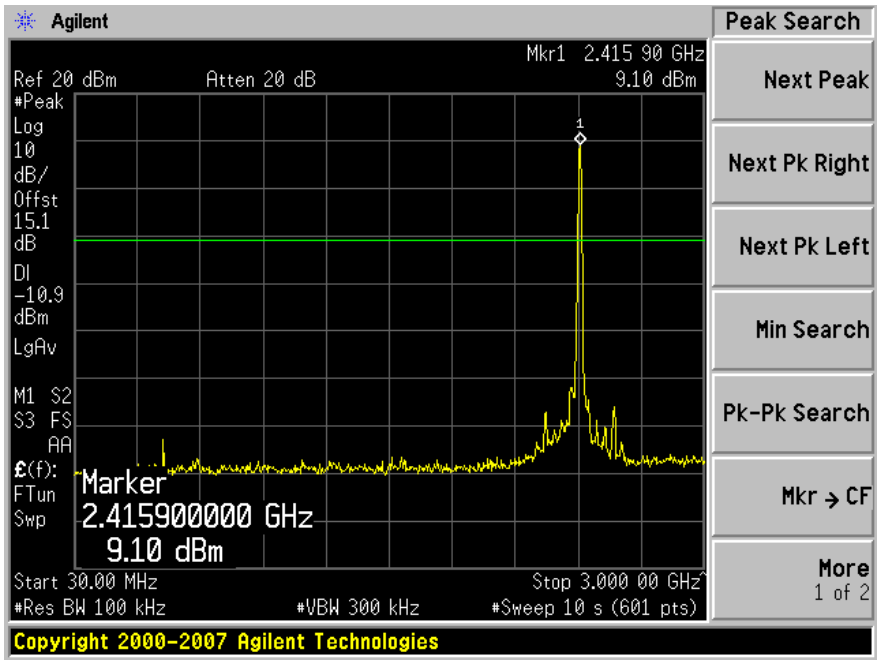
High Channel 2462 MHz

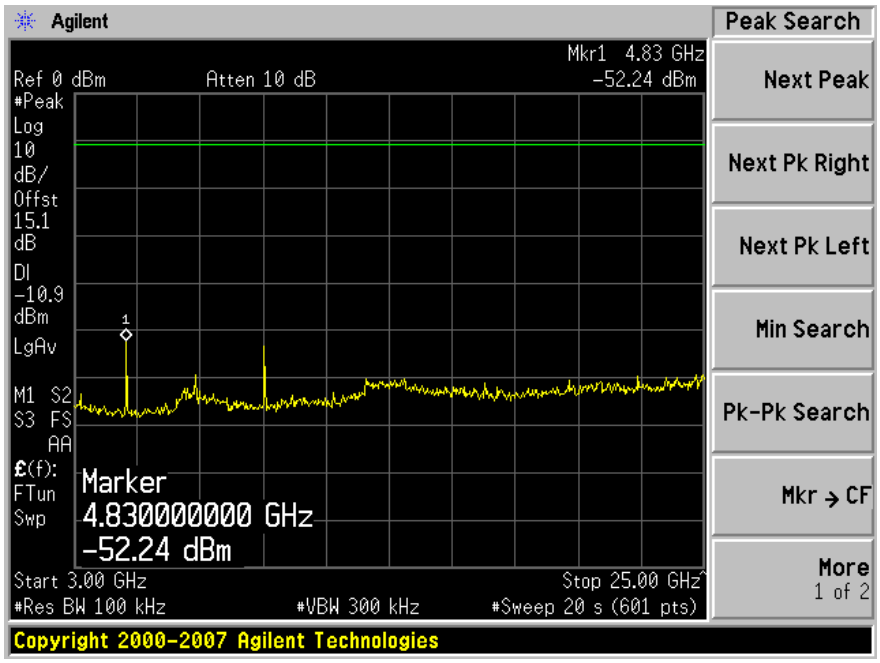




802.11 b (Antenna #0 + Antenna #1)

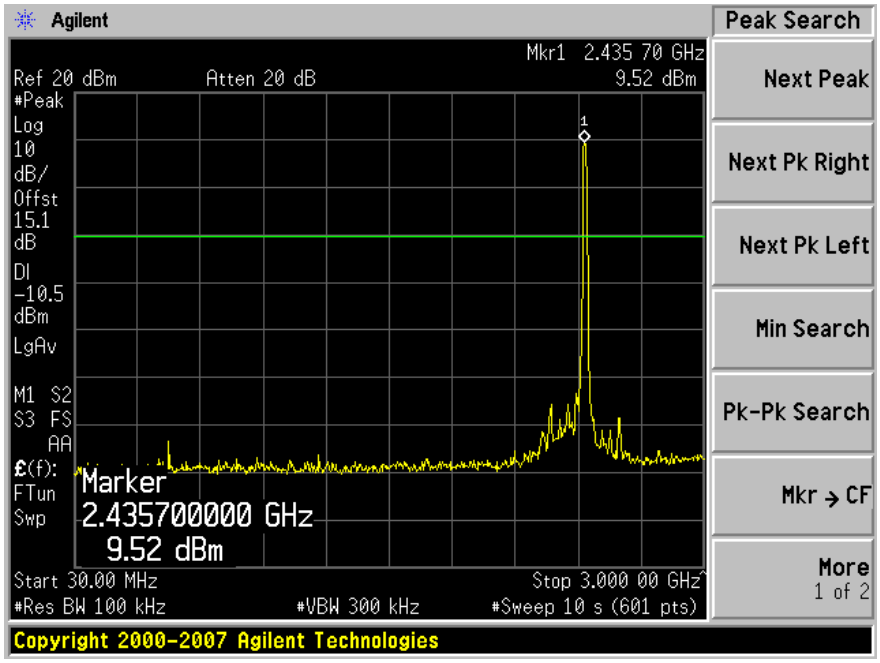
Low Channel 2412 MHz

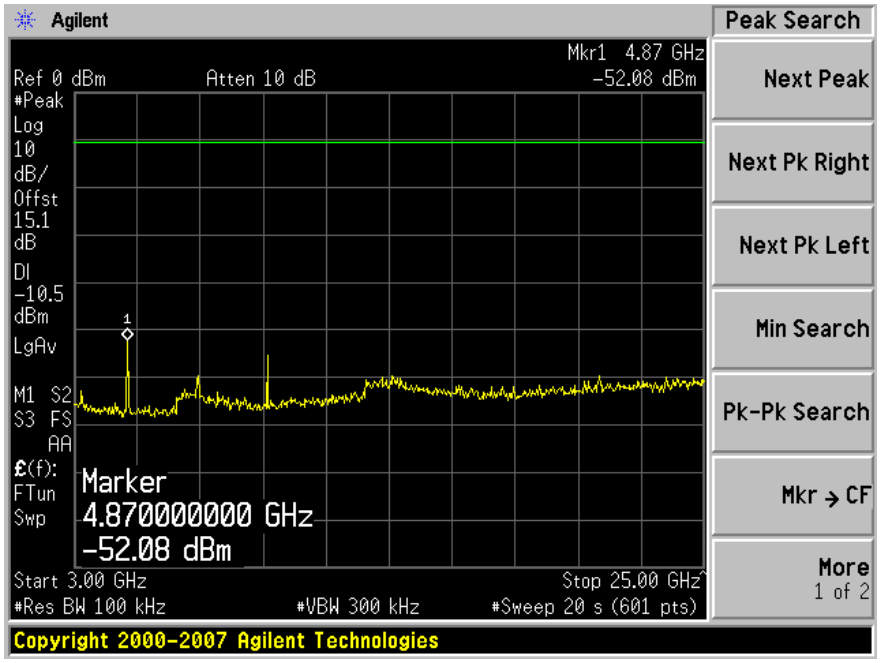




802.11 b (Antenna #0 + Antenna #1)

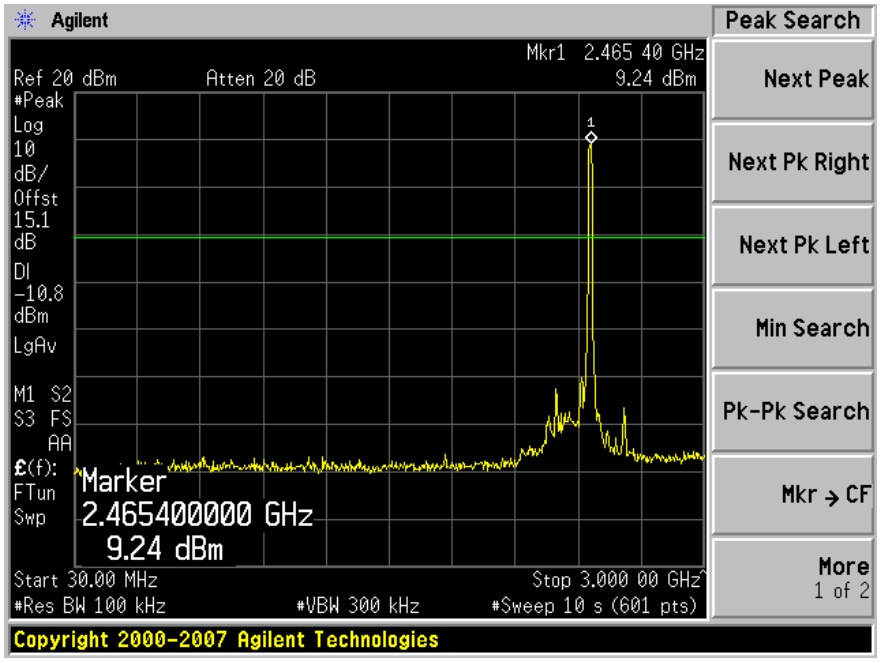
Middle Channel 2437 MHz

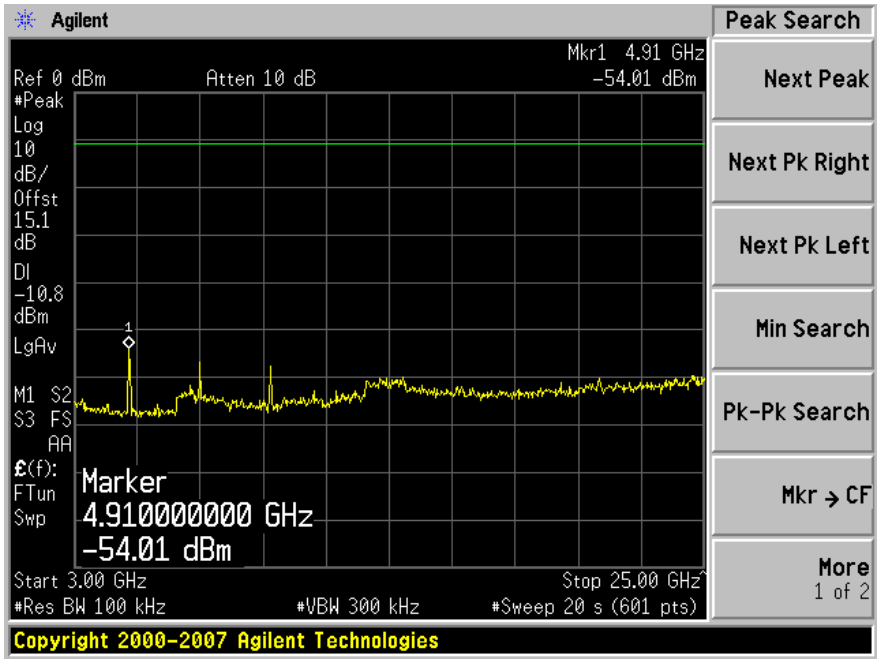




802.11 b (Antenna #0 + Antenna #1)

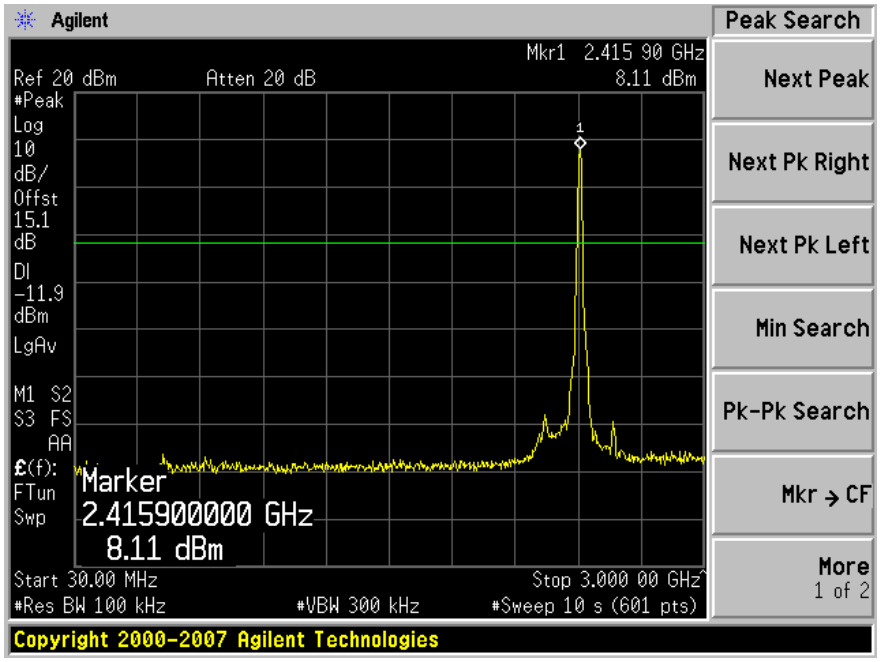
High Channel 2462 MHz

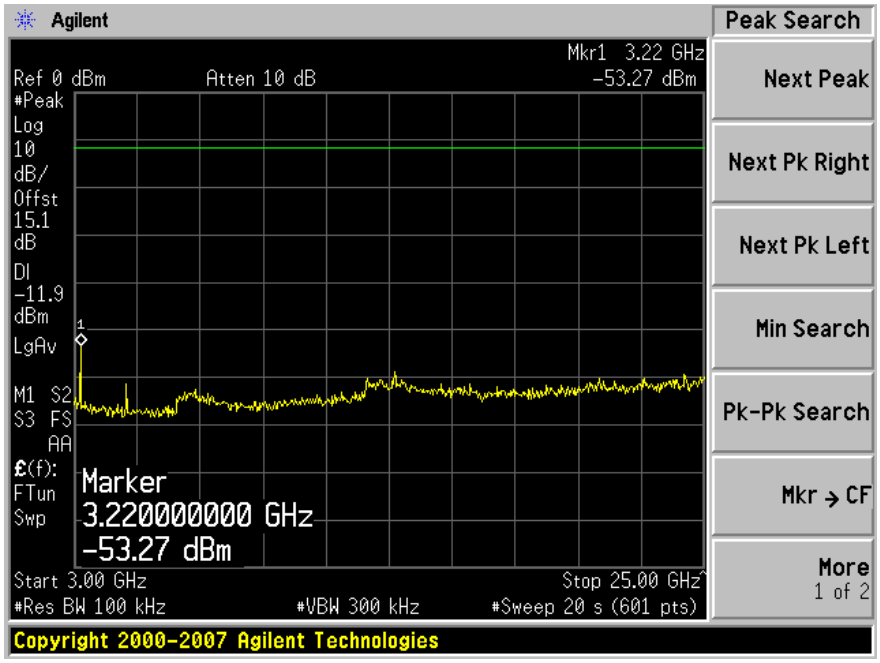




802.11 g (Antenna #0)

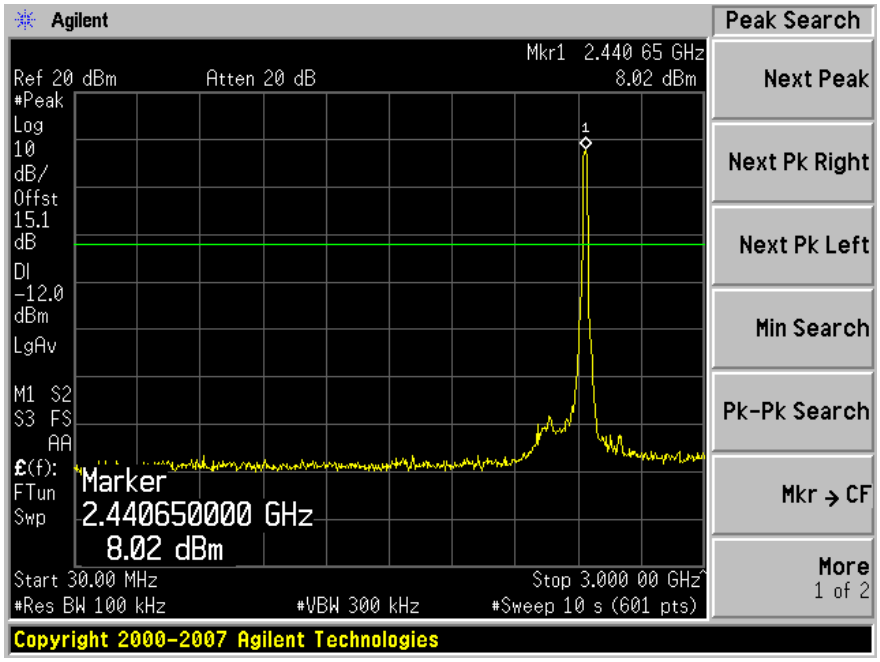
Low Channel 2412 MHz

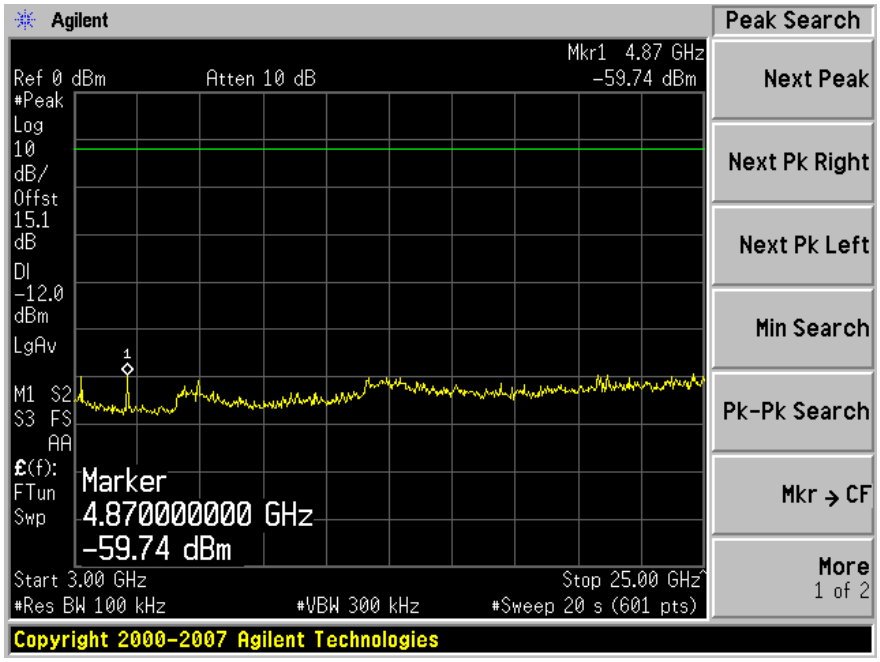




802.11 g (Antenna #0)

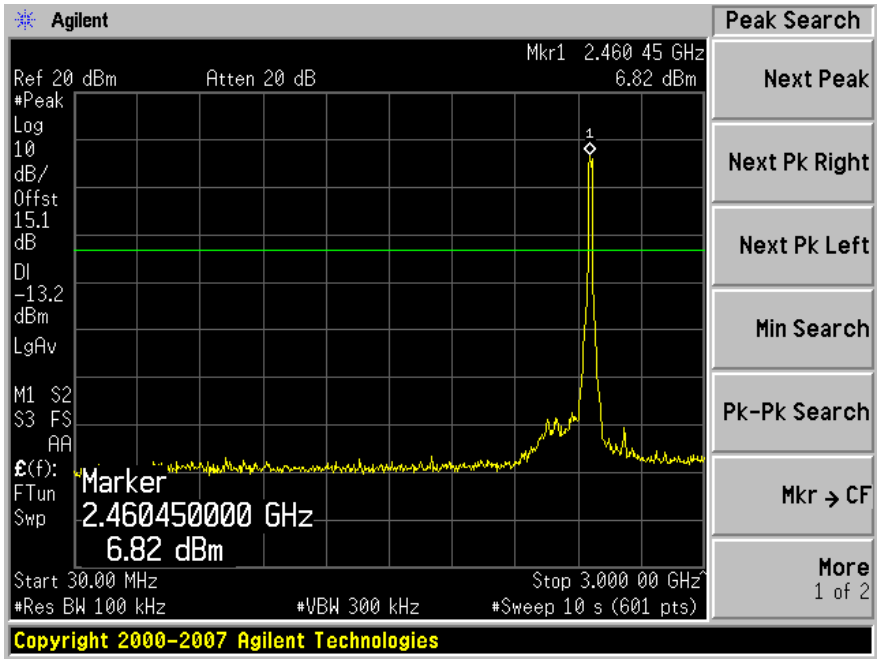
Middle Channel 2437 MHz

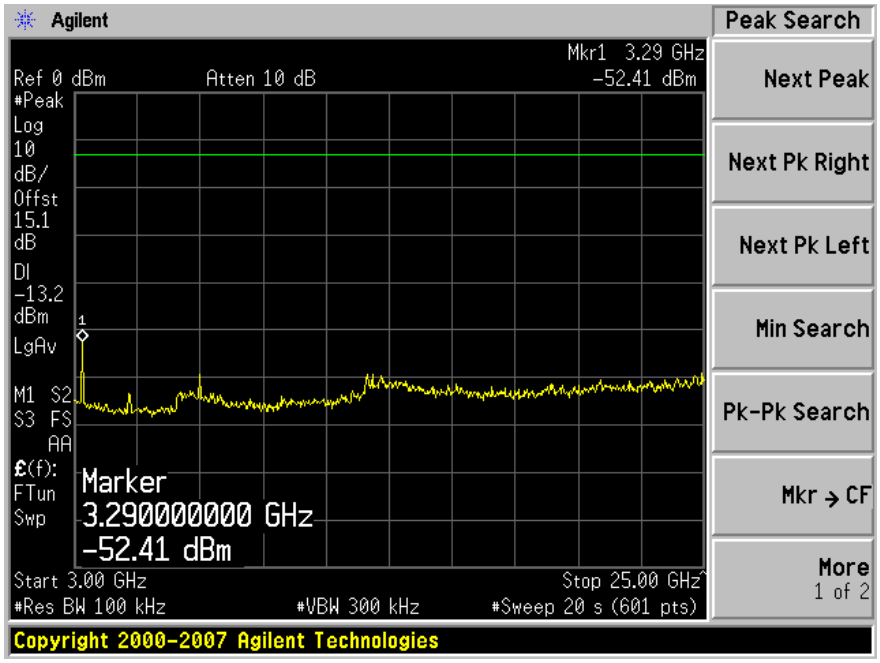




802.11 g (Antenna #0)

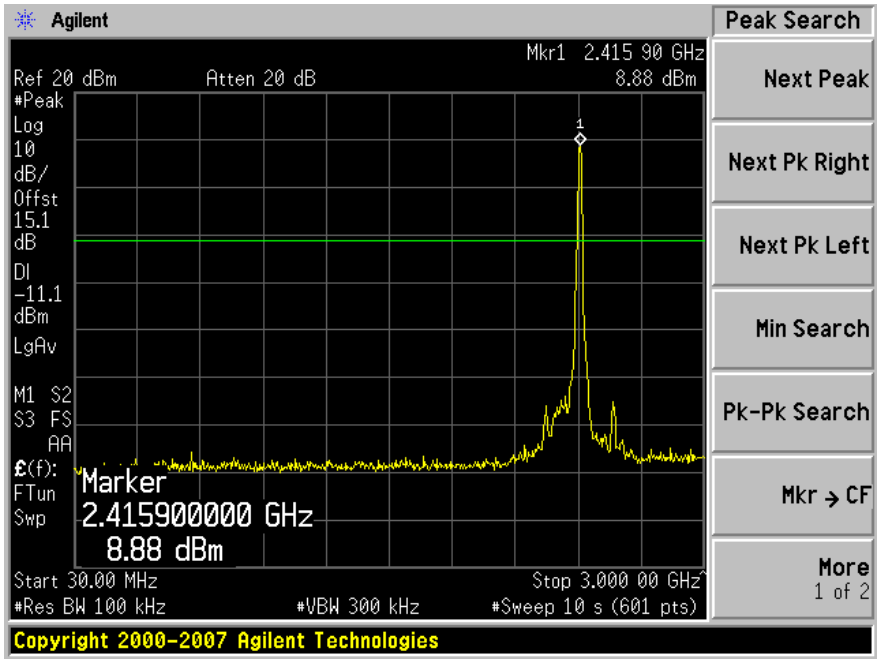
High Channel 2462 MHz

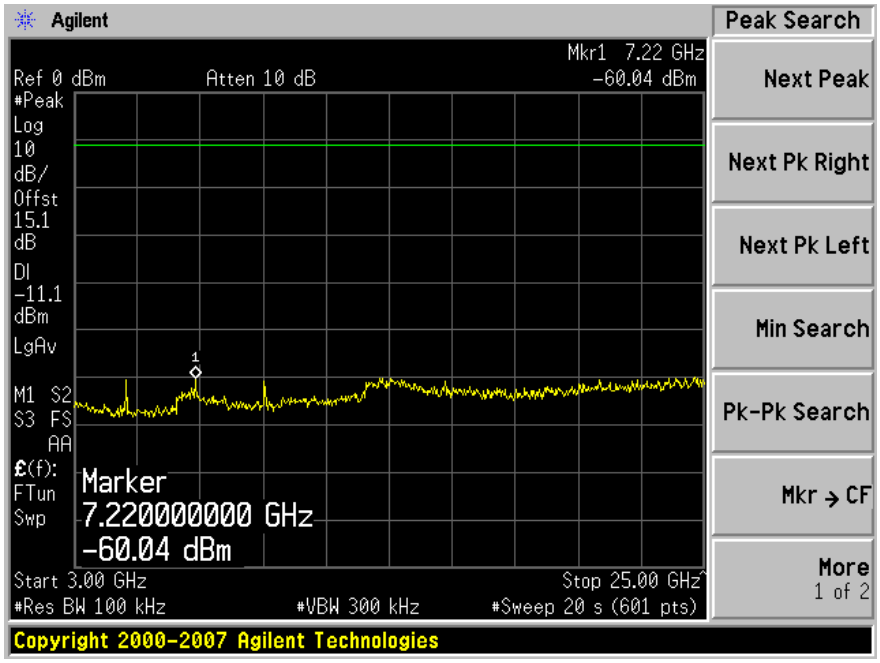




802.11 g (Antenna #1)

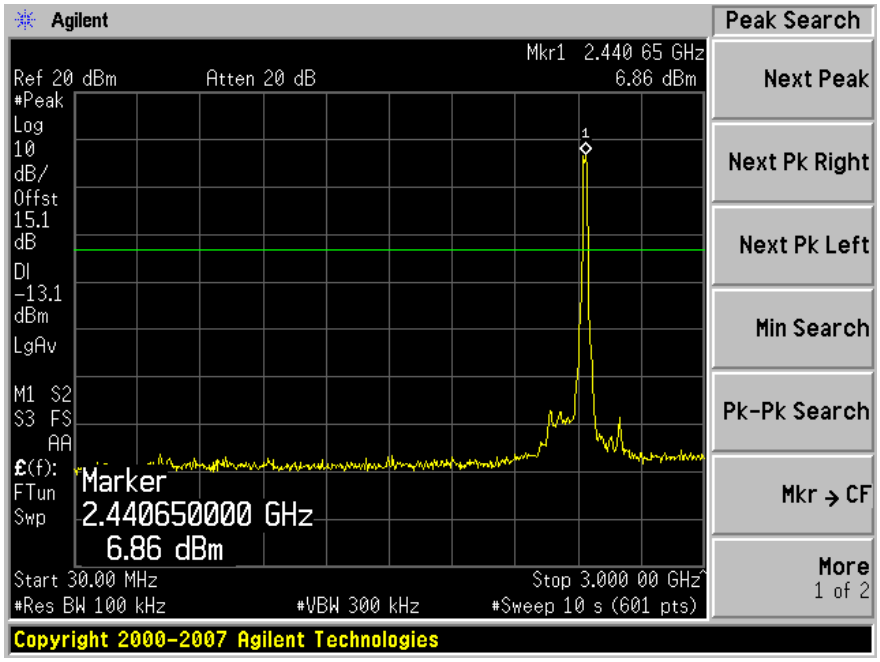
Low Channel 2412 MHz

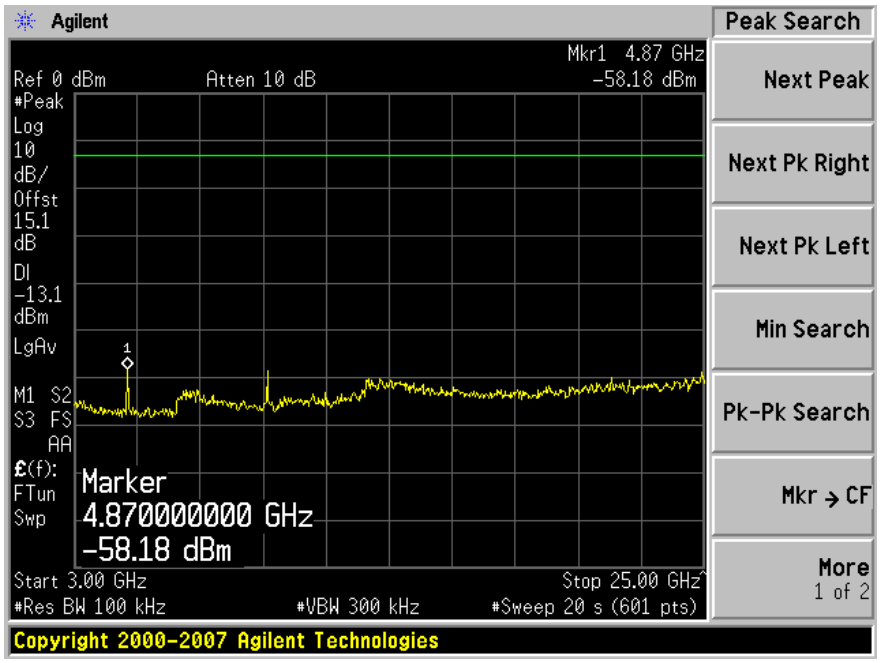




802.11 g (Antenna #1)

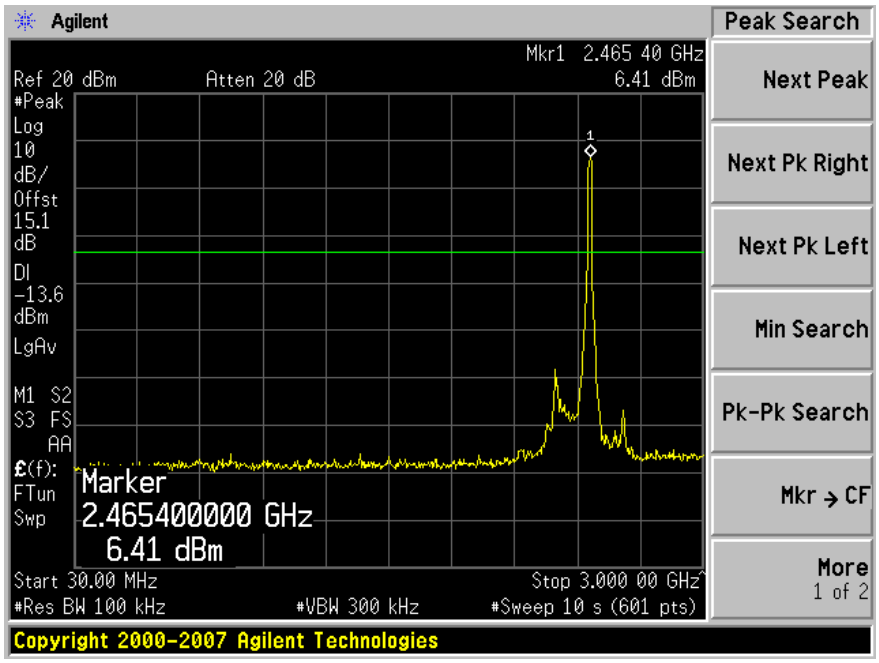
Middle Channel 2437 MHz

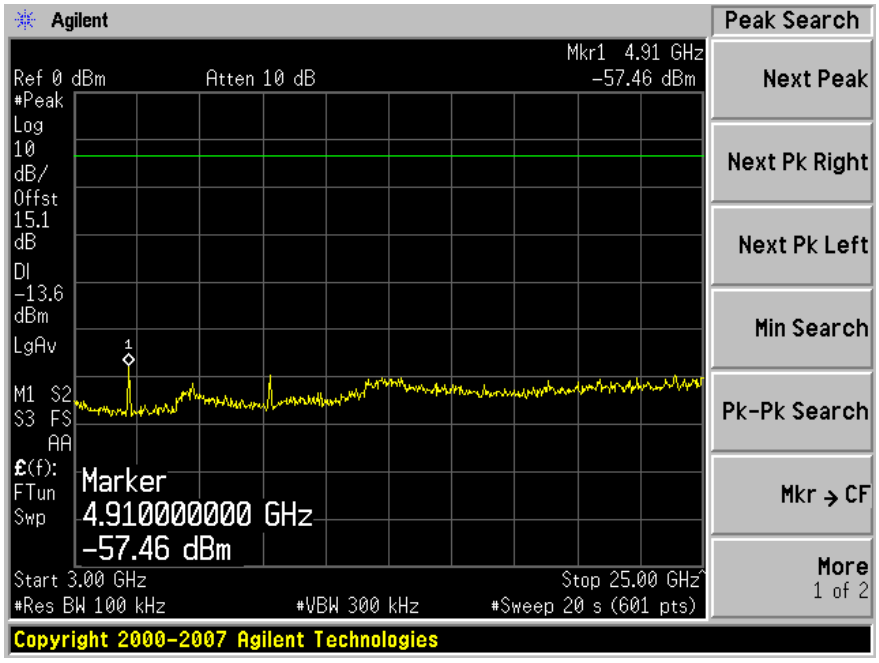




802.11 g (Antenna #1)

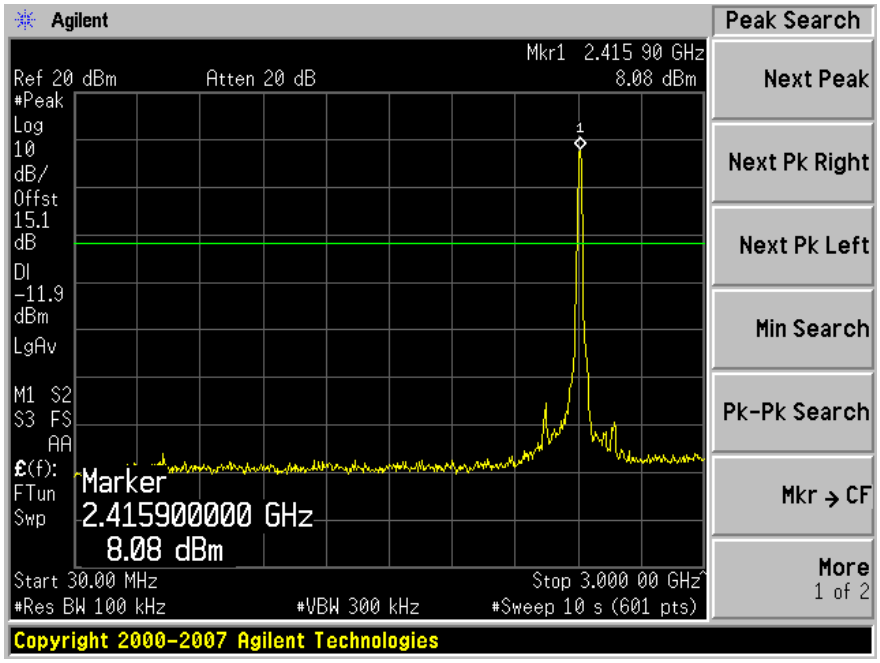
High Channel 2462 MHz

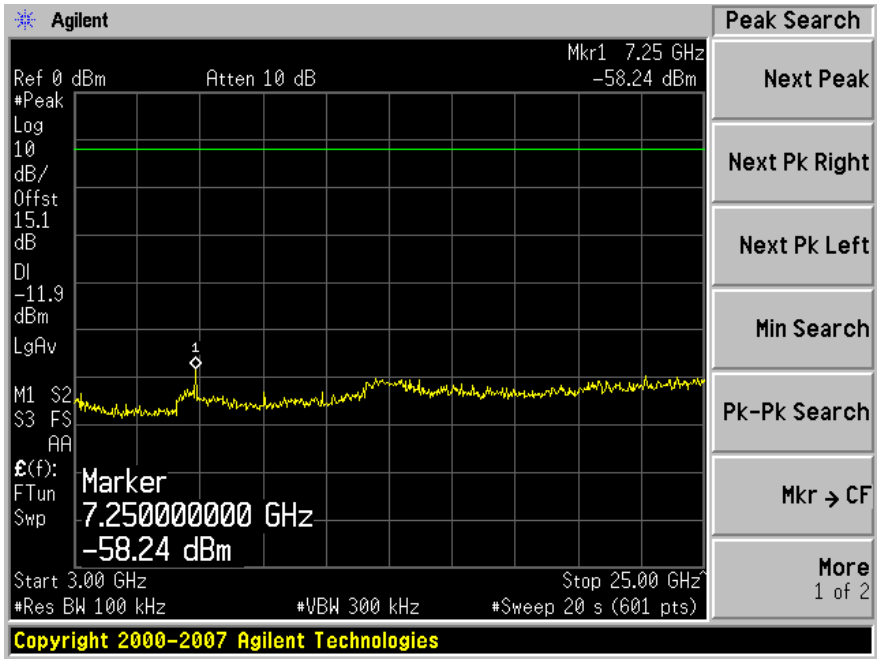




802.11 g (Antenna #0 + Antenna #1)

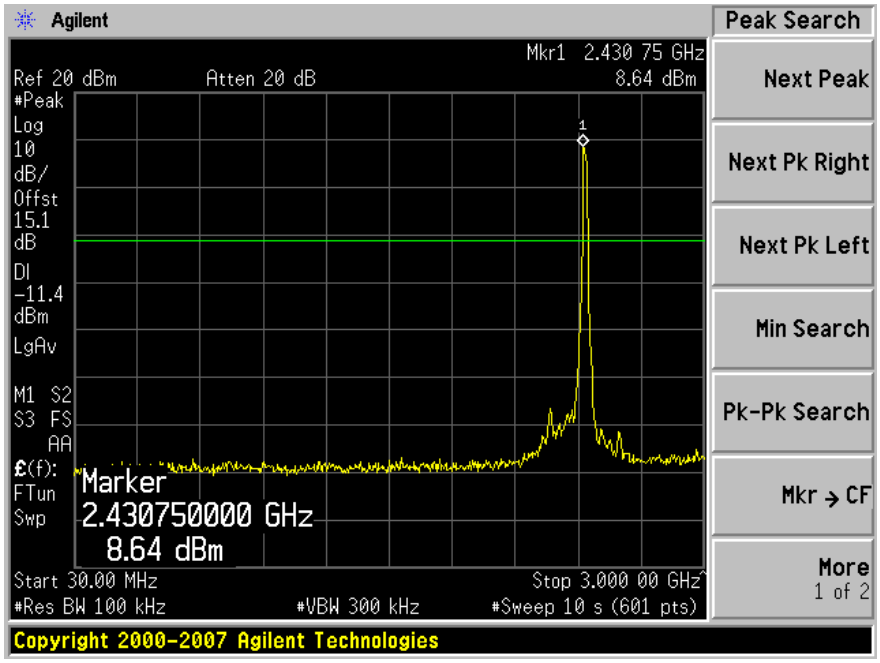
Low Channel 2412 MHz

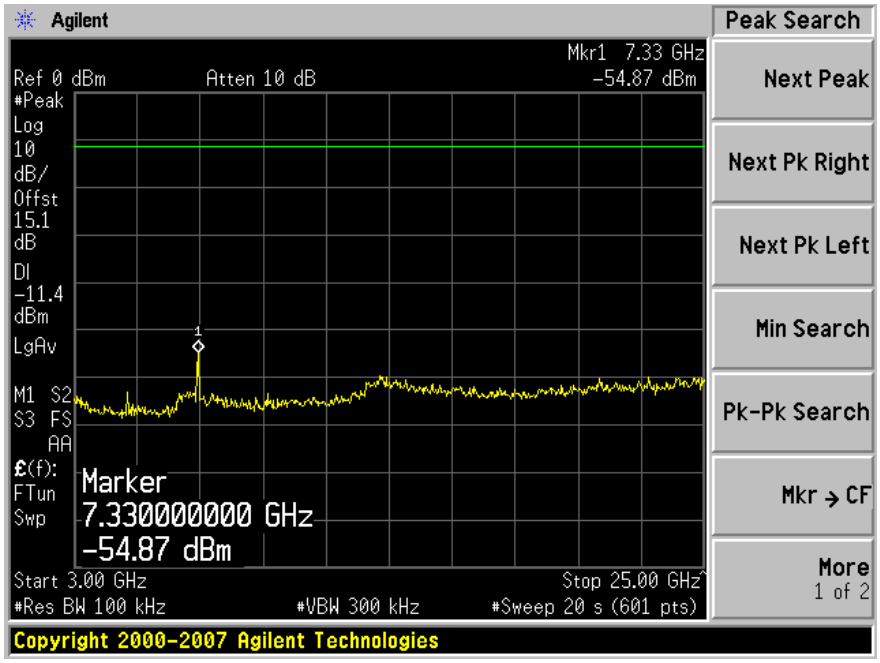




802.11 g (Antenna #0 + Antenna #1)

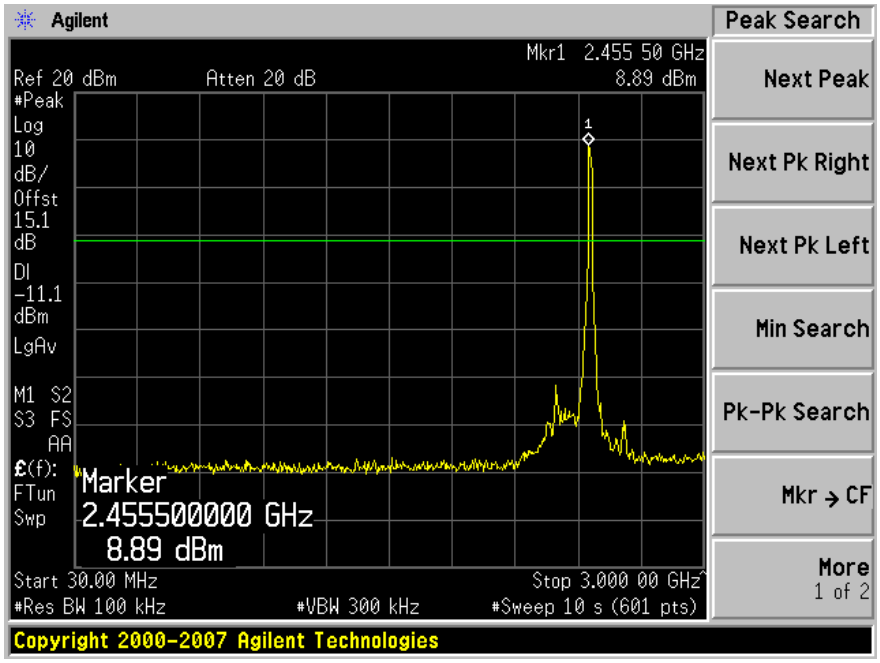
Middle Channel 2437 MHz

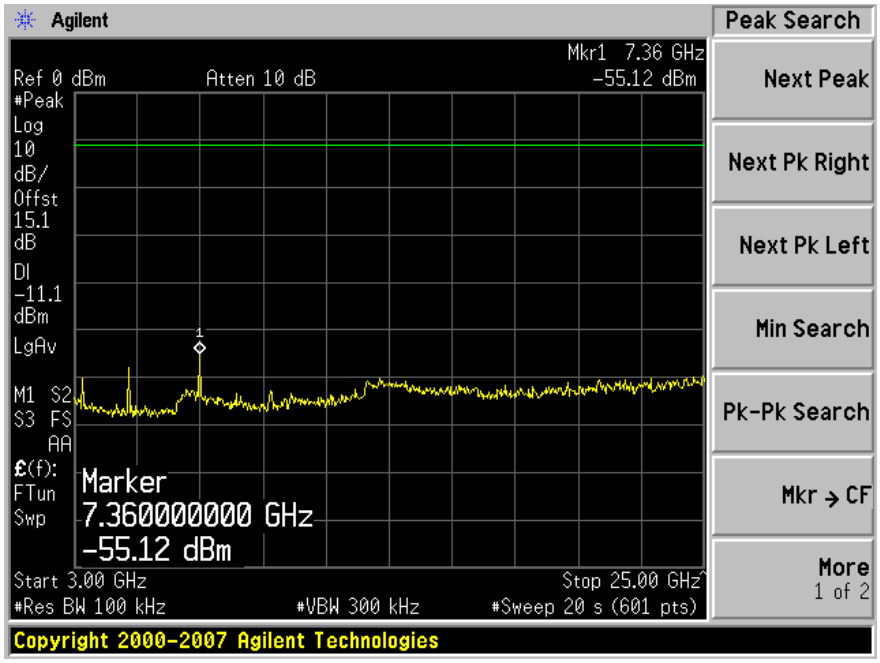




802.11 g (Antenna #0 + Antenna #1)

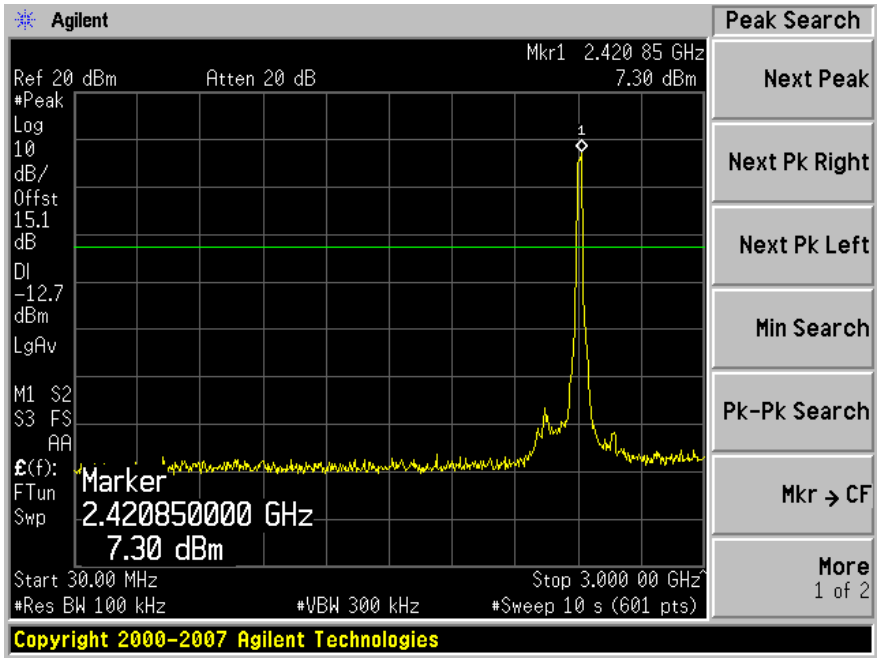
High Channel 2462 MHz

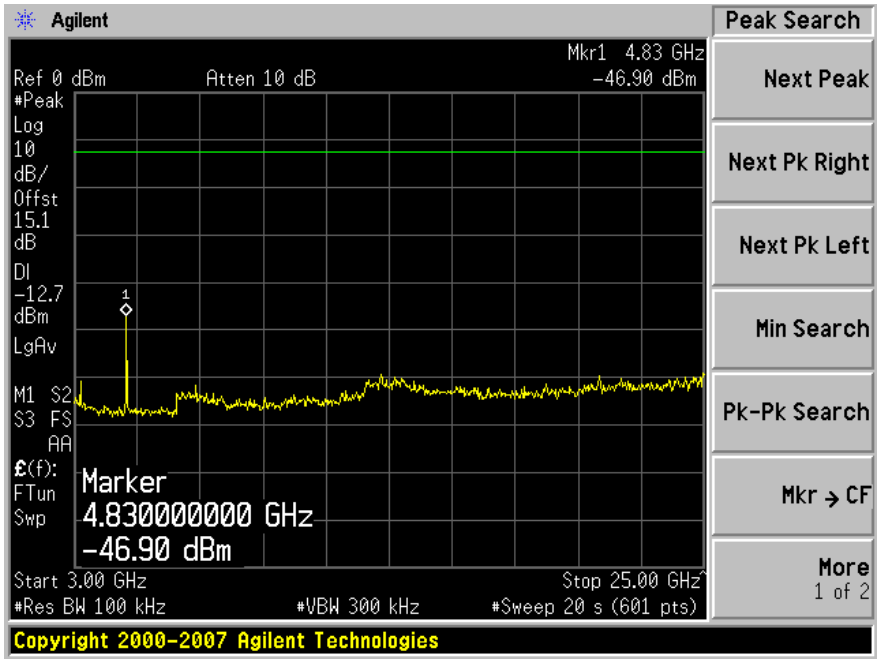




802.11 n 20 MHz (Antenna #0)

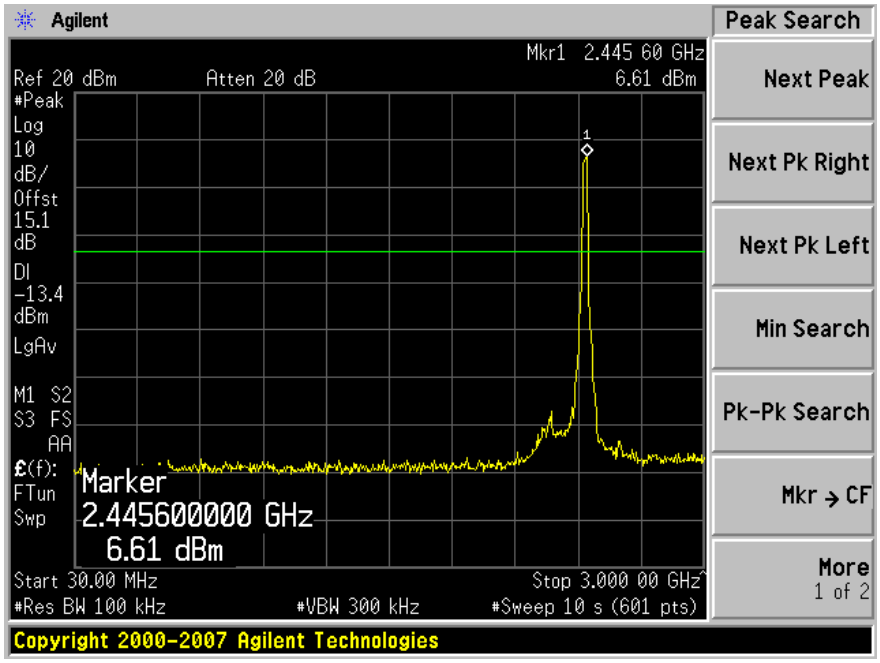
Low Channel 2412 MHz

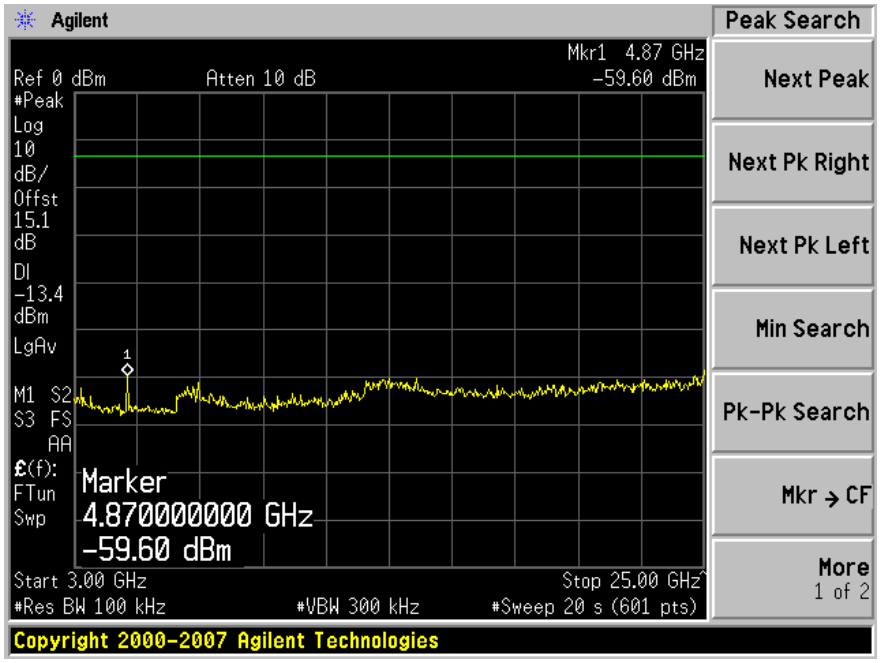




802.11 n 20 MHz (Antenna #0)

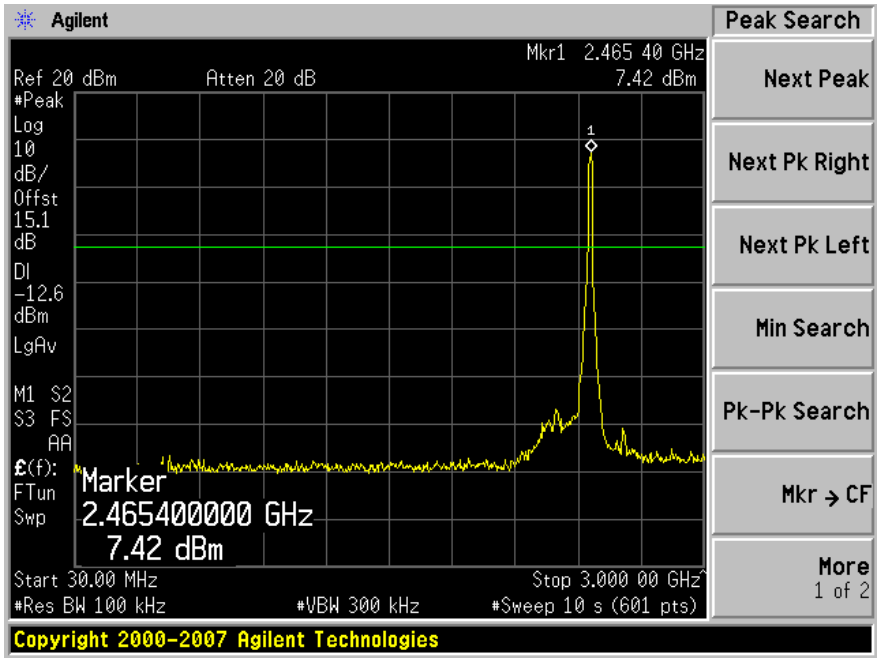
Middle Channel 2437 MHz

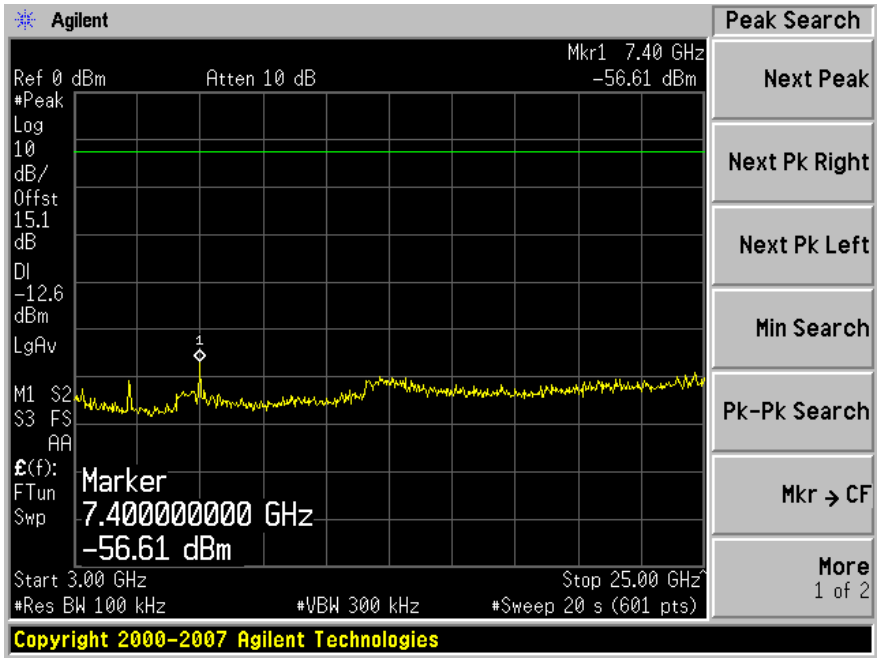




802.11 n 20 MHz (Antenna #0)

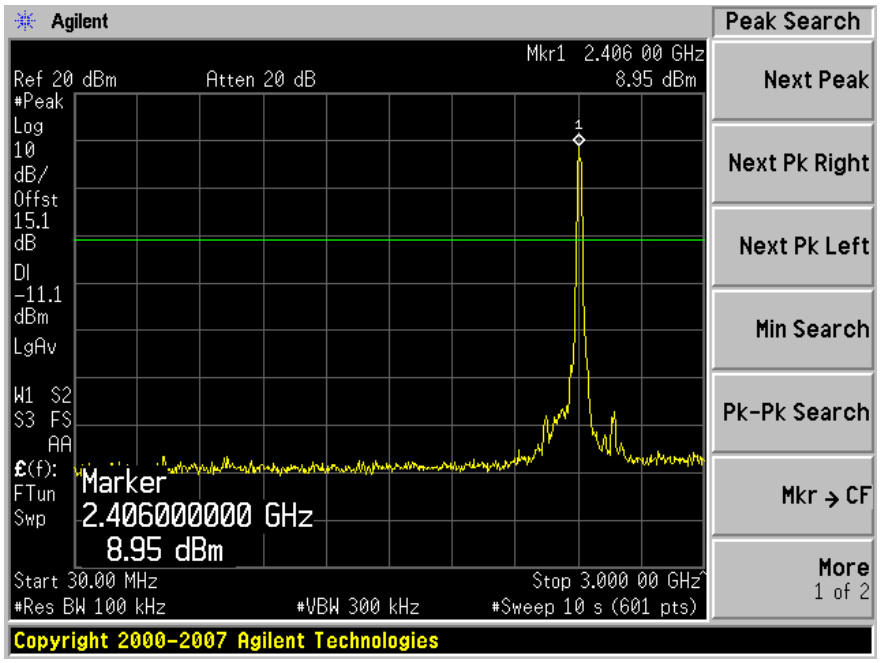
High Channel 2462 MHz

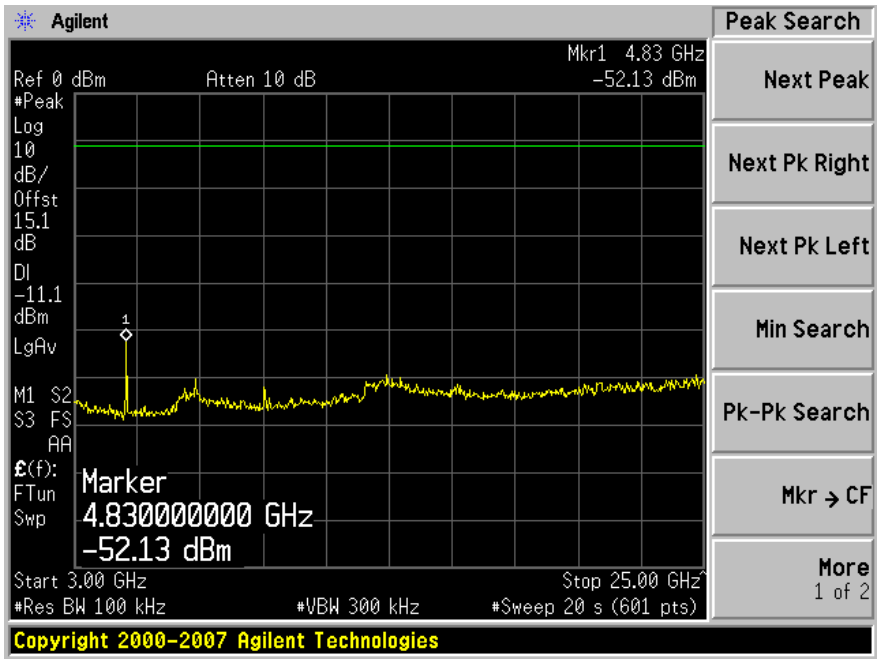




802.11 n 20 MHz (Antenna #1)

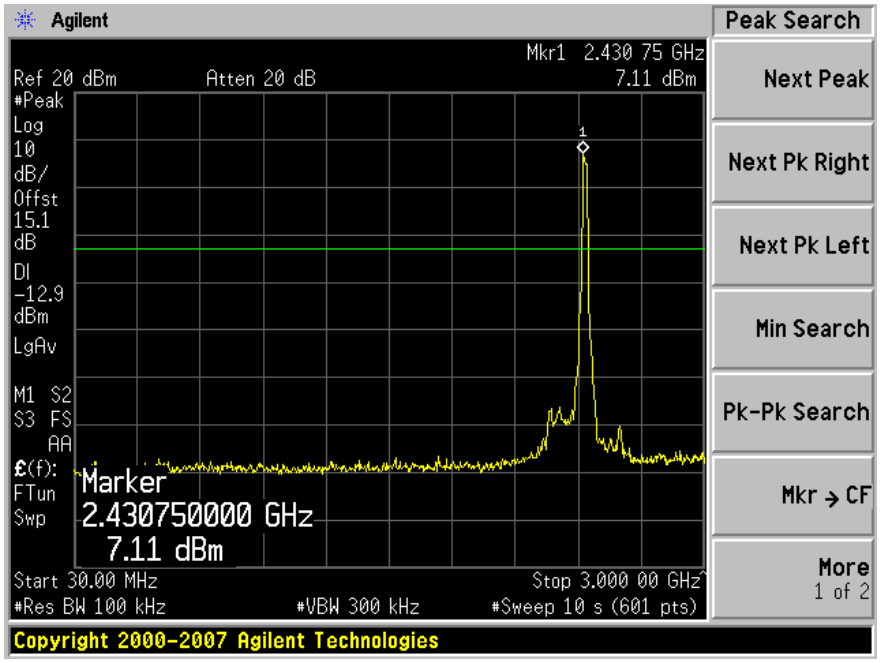
Low Channel 2412 MHz

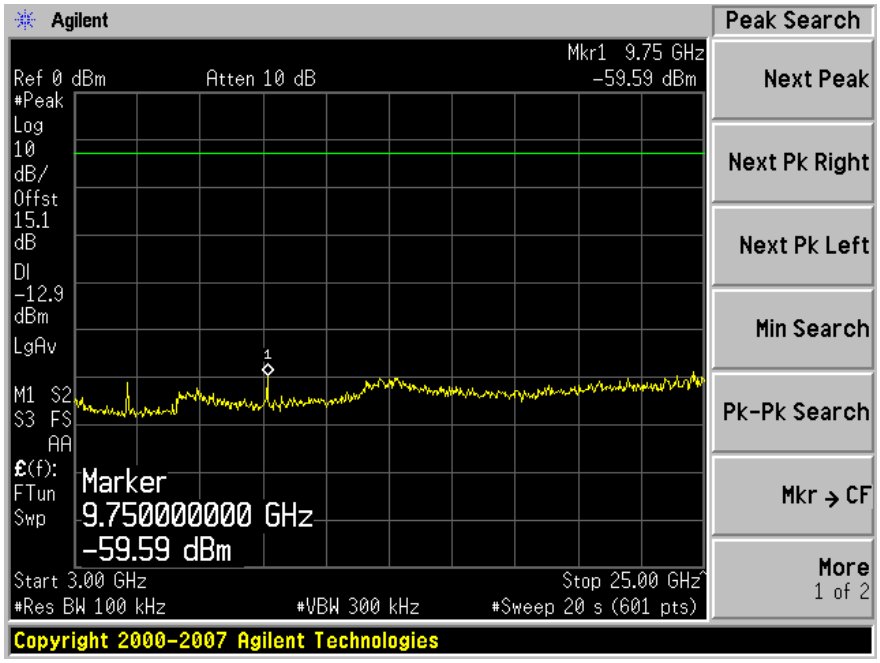




802.11 n 20 MHz (Antenna #1)

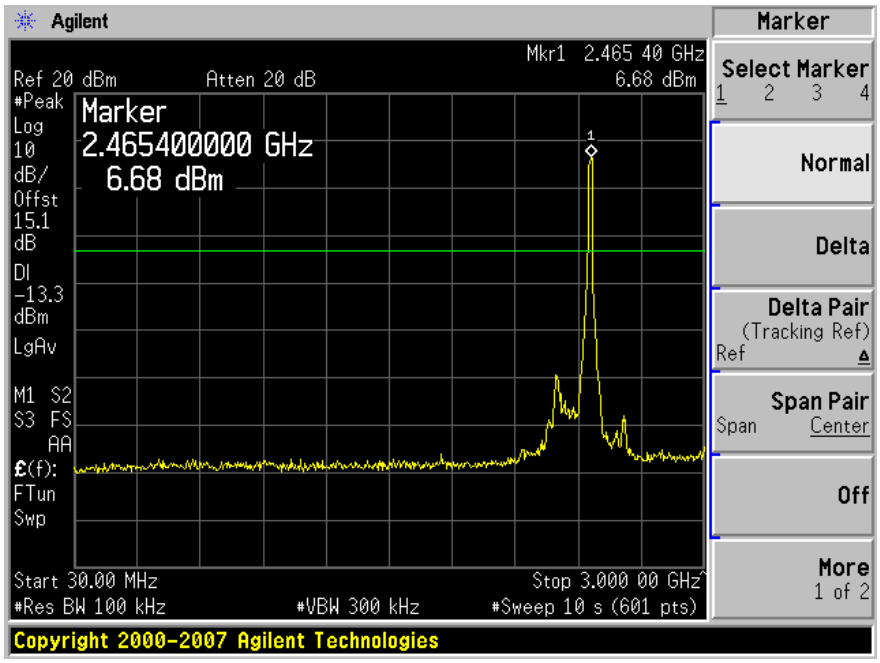
Middle Channel 2437 MHz

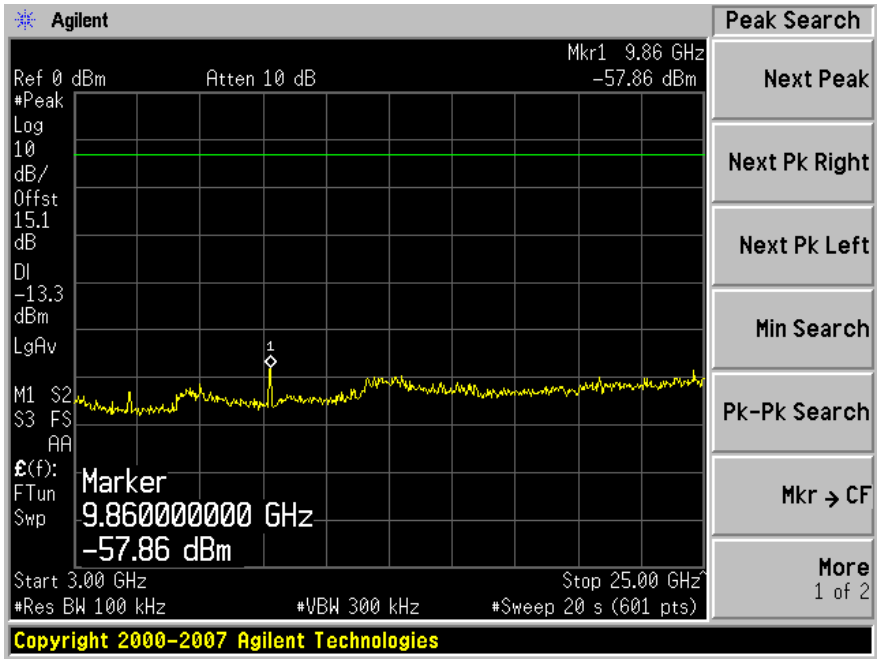




802.11 n 20 MHz (Antenna #1)

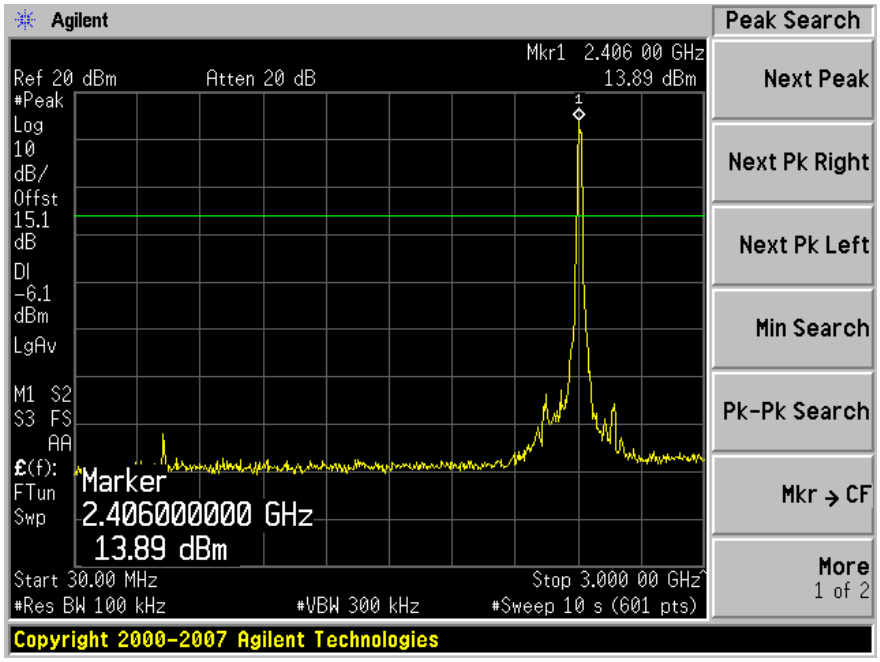
High Channel 2462 MHz

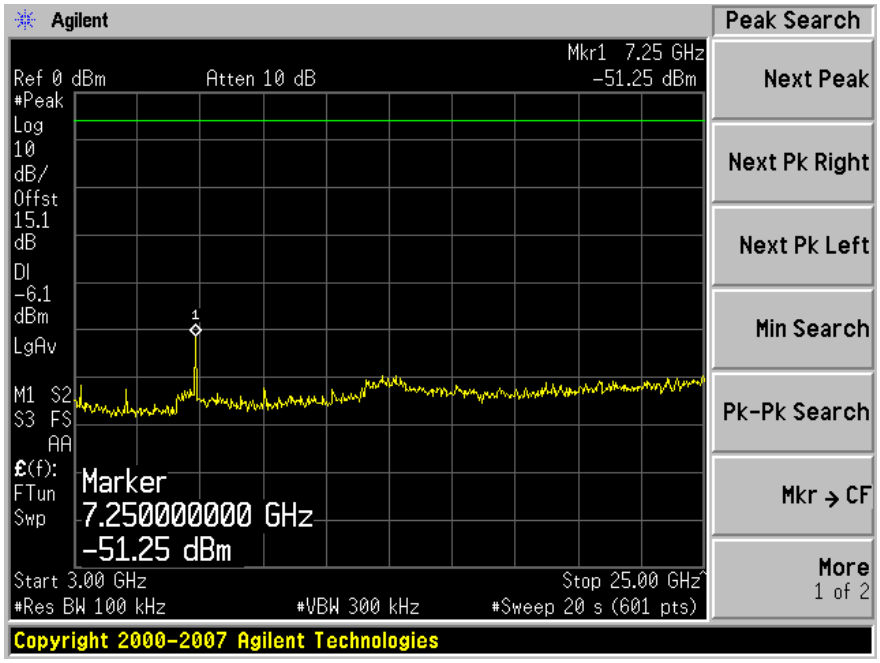




802.11 n 20 MHz (Antenna #0 + Antenna #1)

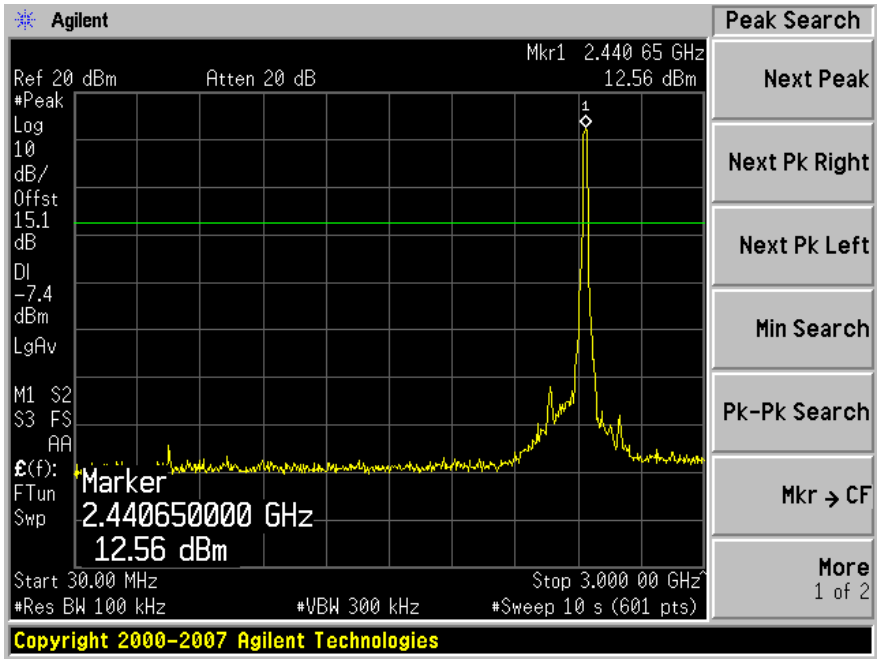
Low Channel 2412 MHz

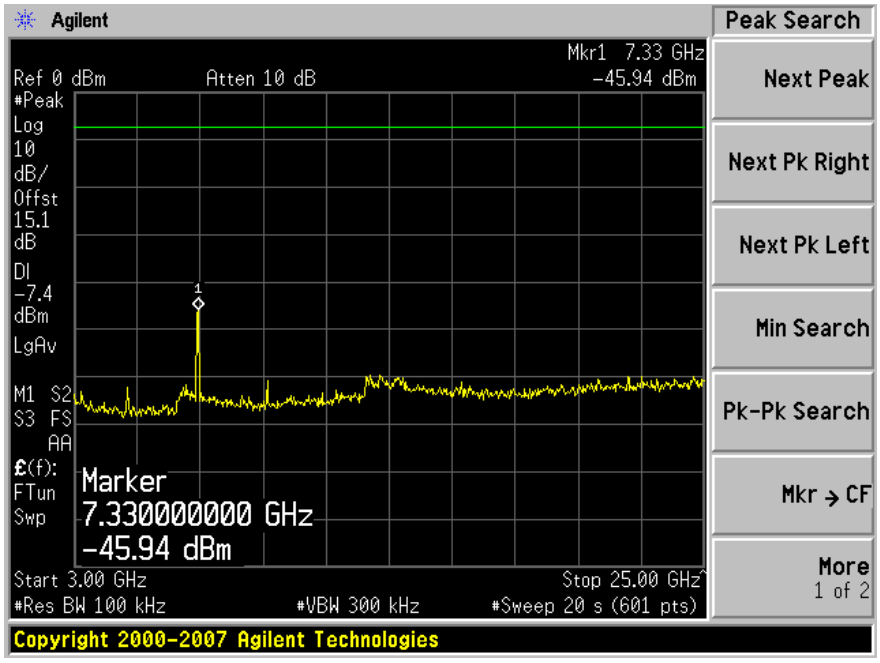




802.11 n 20 MHz (Antenna #0 + Antenna #1)

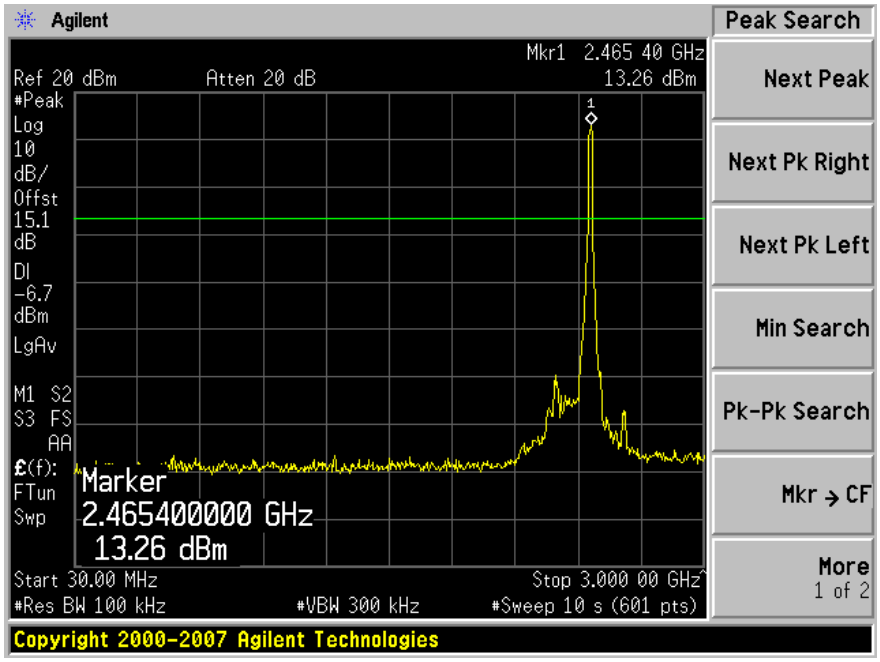
Middle Channel 2437 MHz

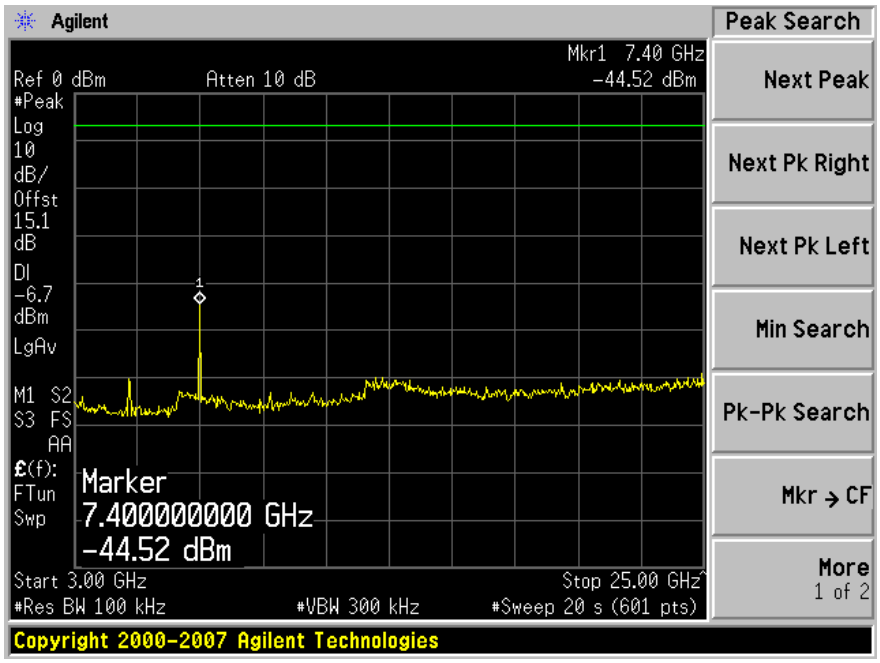




802.11 n 20 MHz (Antenna #0 + Antenna #1)

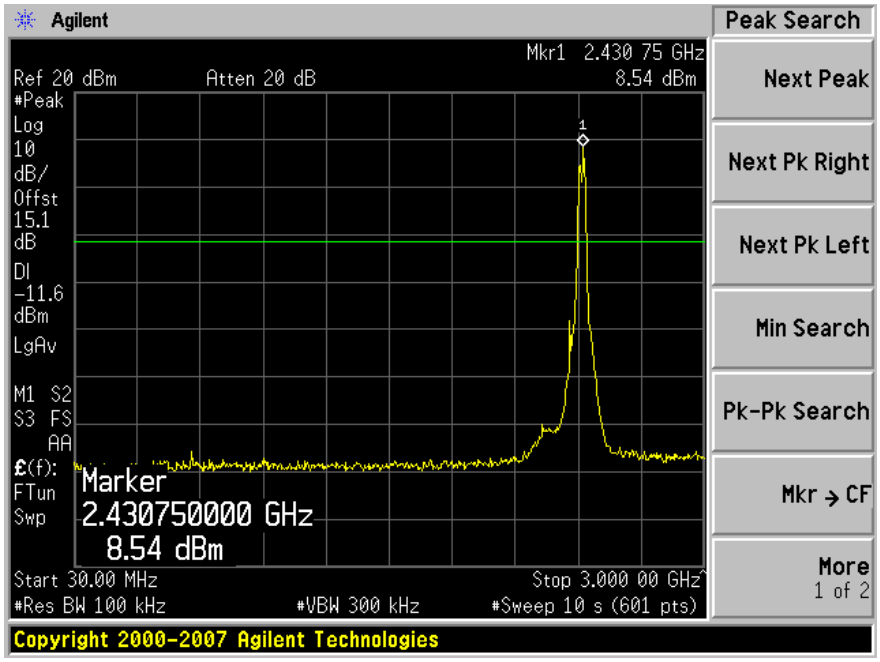
High Channel 2462 MHz

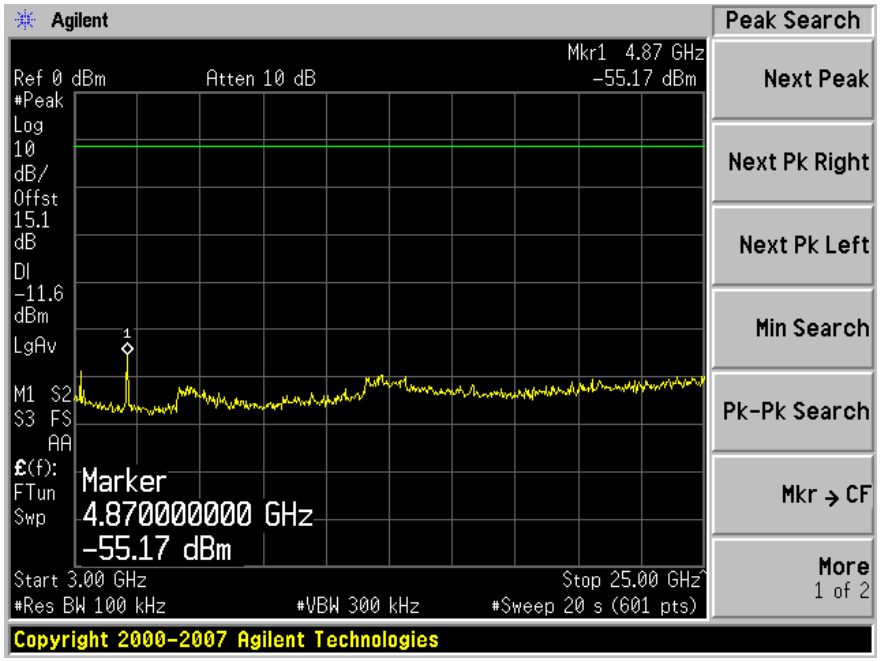




802.11 n 40 MHz (Antenna #0)

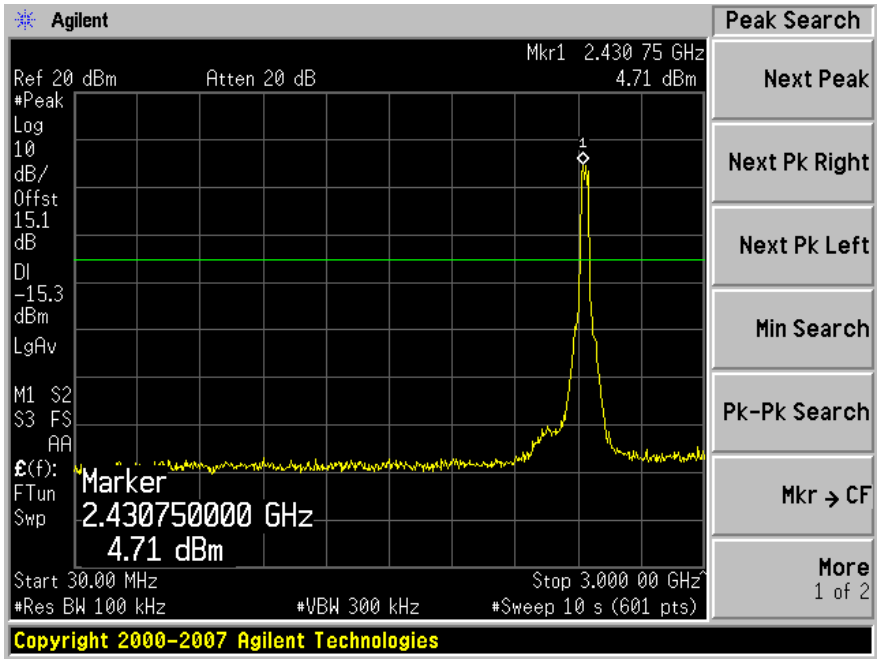
Low Channel 2422 MHz

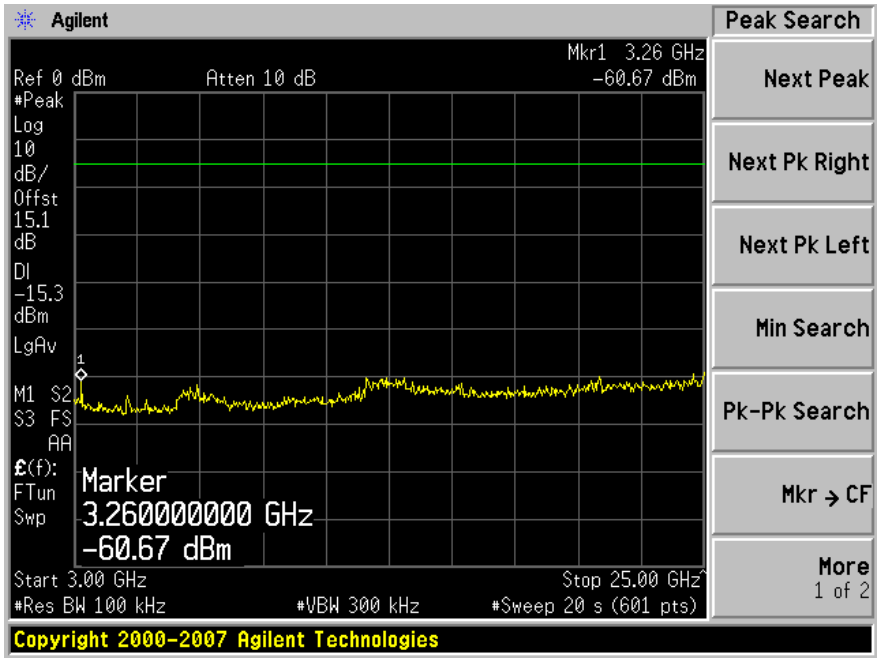




802.11 n 40 MHz (Antenna #0)

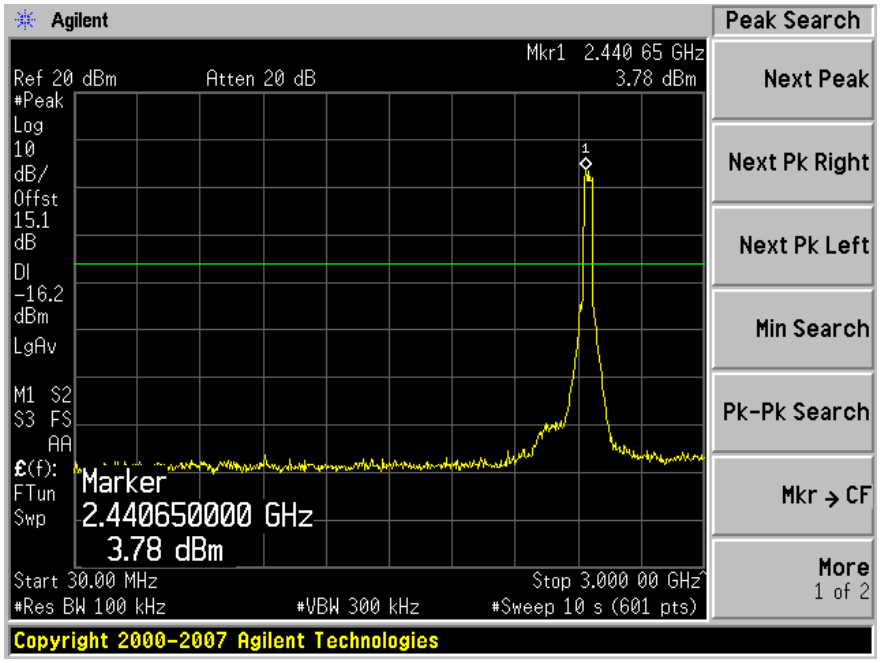
Middle Channel 2437 MHz

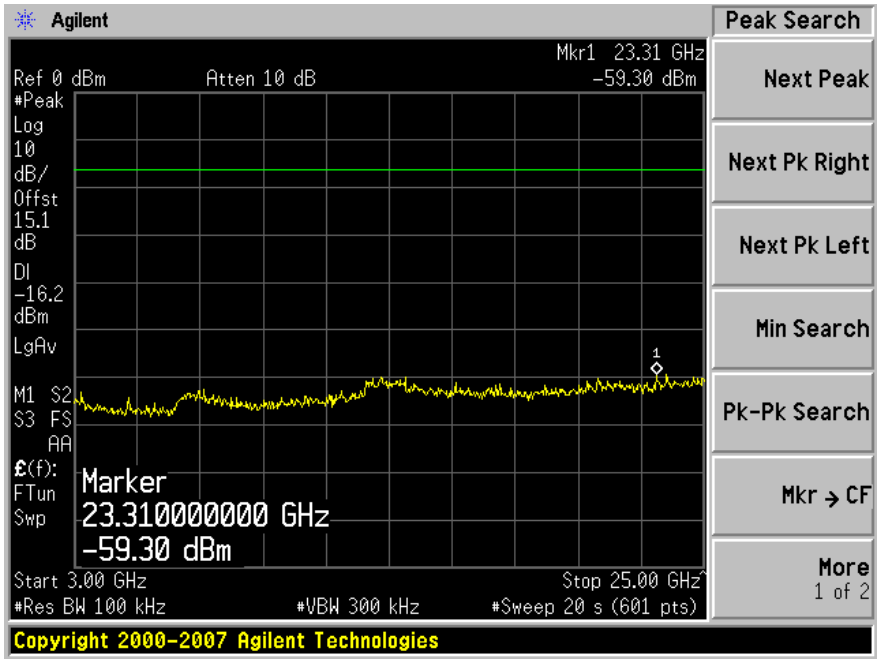




802.11 n 40 MHz (Antenna #0)

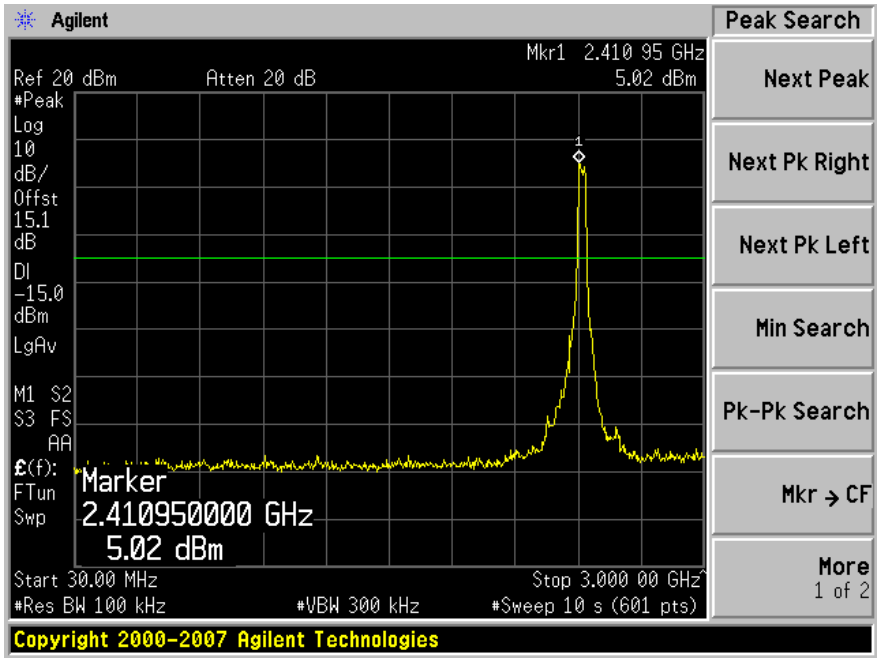
High Channel 2452 MHz

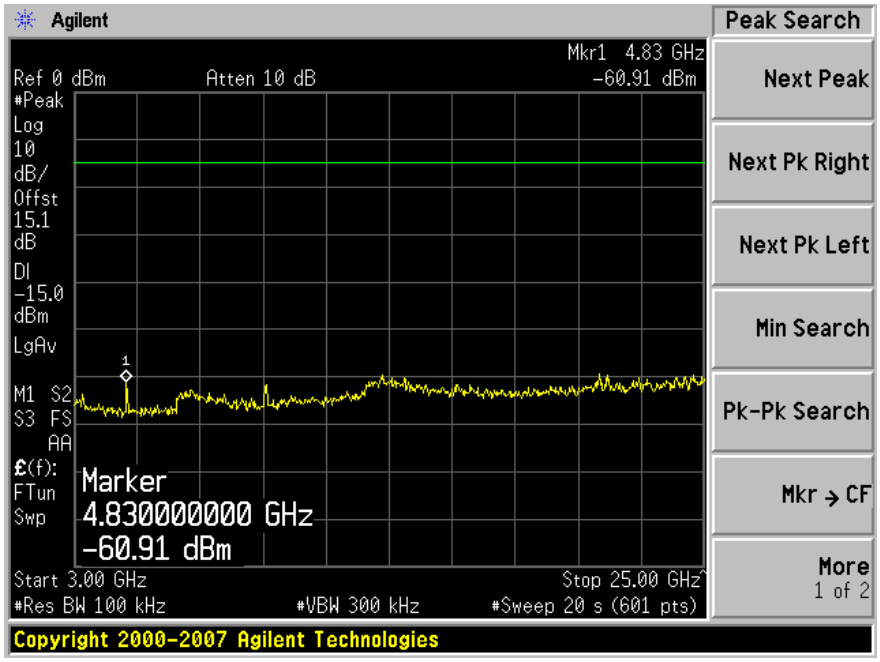




802.11 n 40 MHz (Antenna #1)

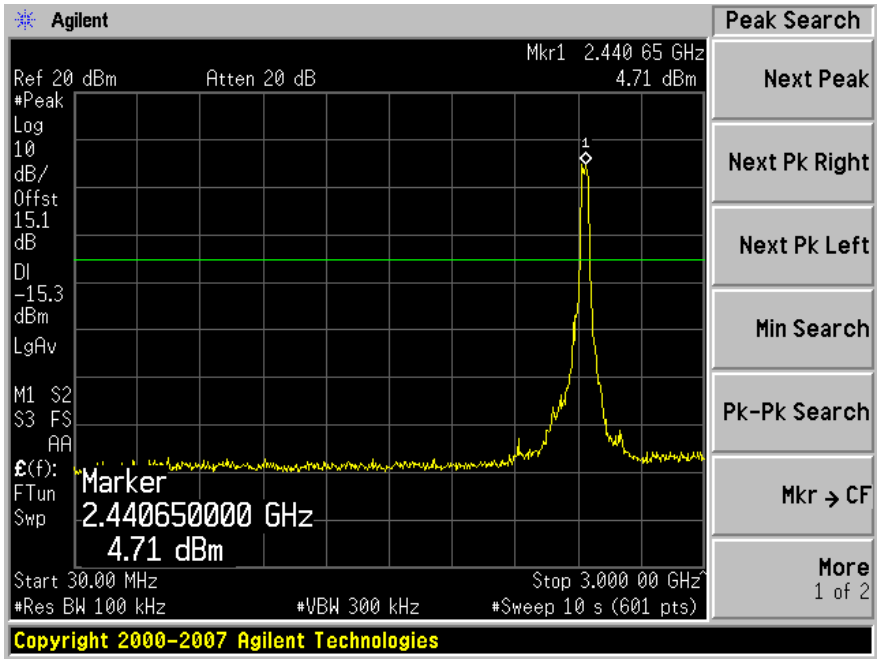
Low Channel 2422 MHz

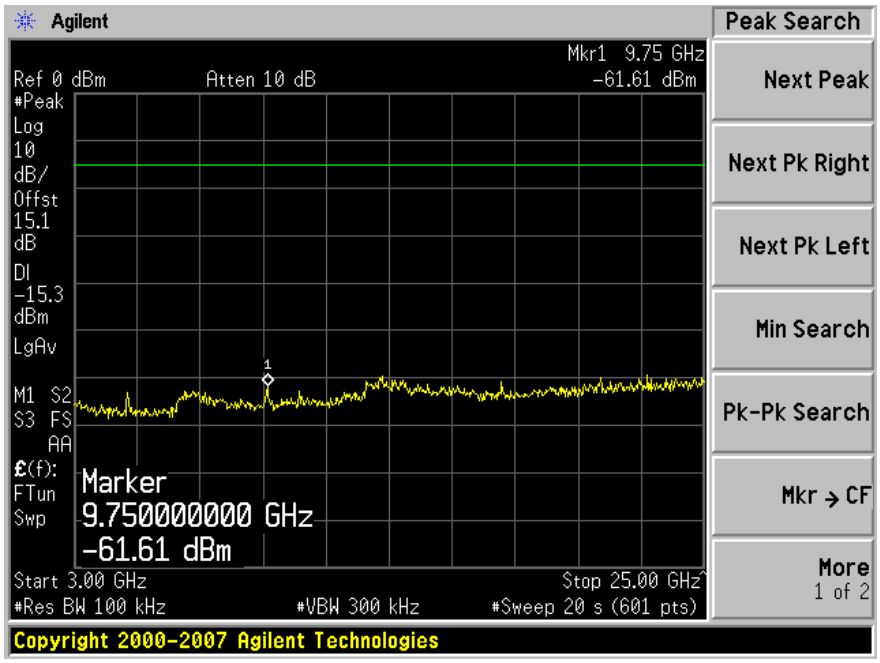




802.11 n 40 MHz (Antenna #1)

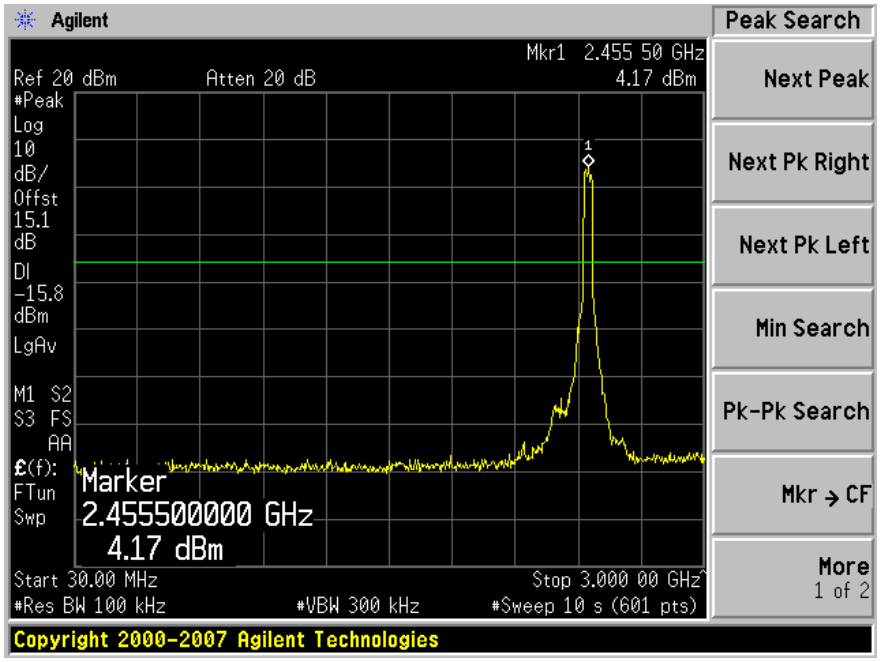
Middle Channel 2437 MHz

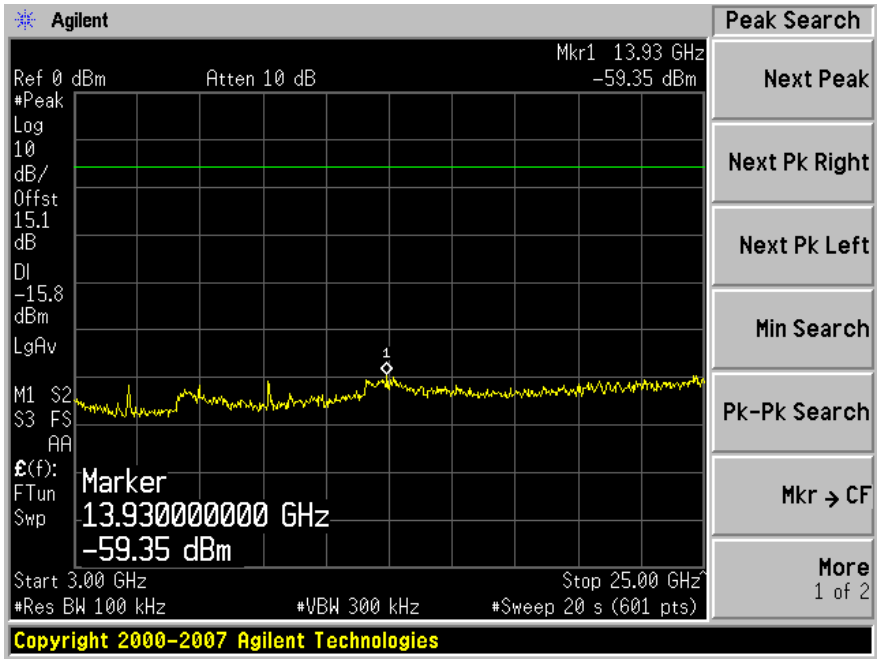




802.11 n 40 MHz (Antenna #1)

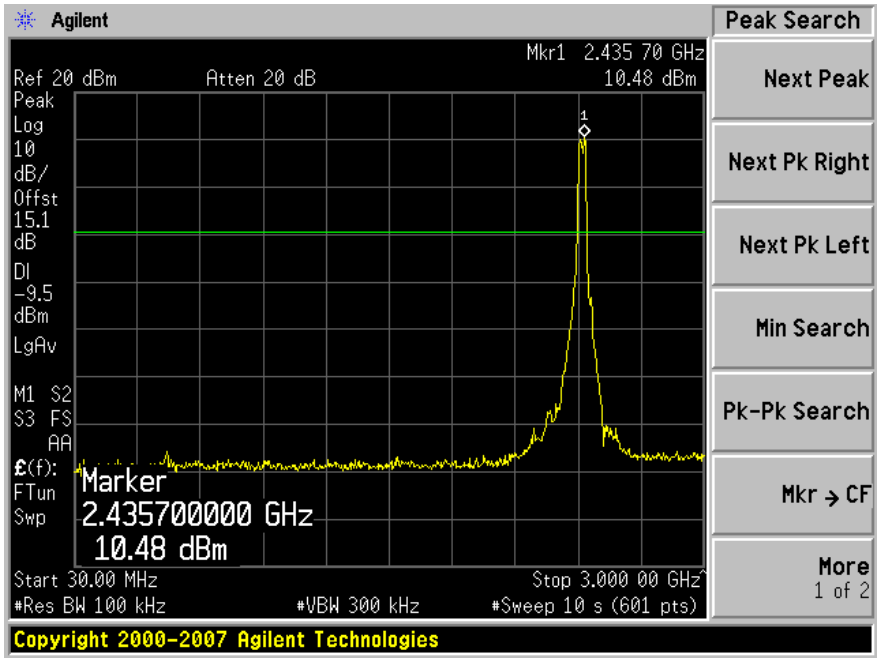
High Channel 2452 MHz

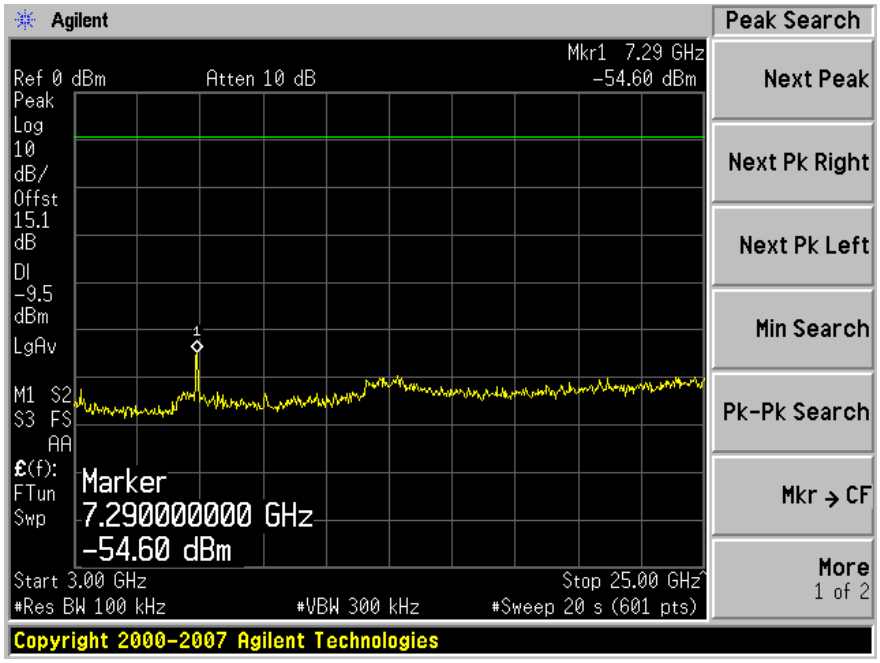




802.11 n 40 MHz (Antenna #0 + Antenna #1)

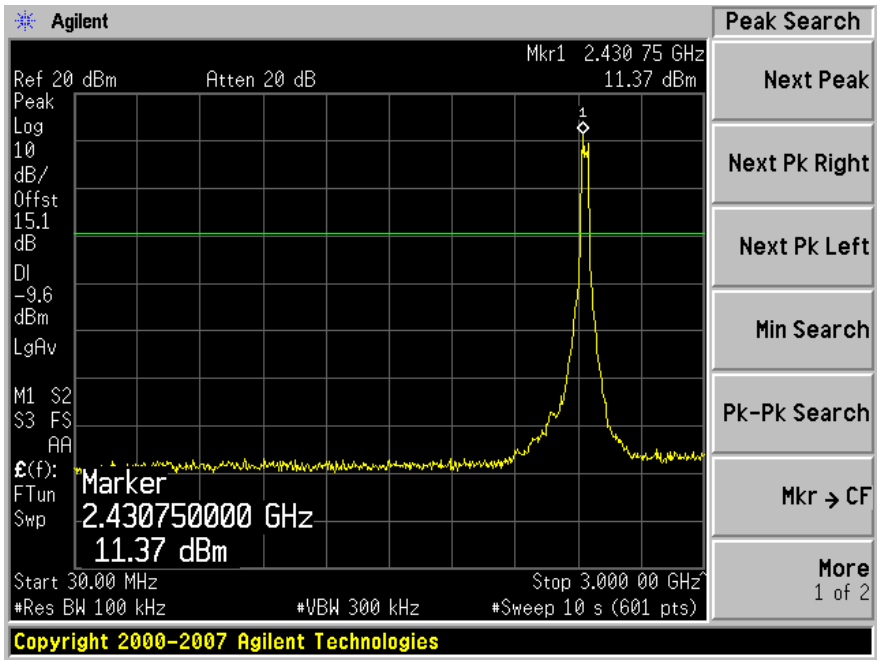
Low Channel 2422 MHz

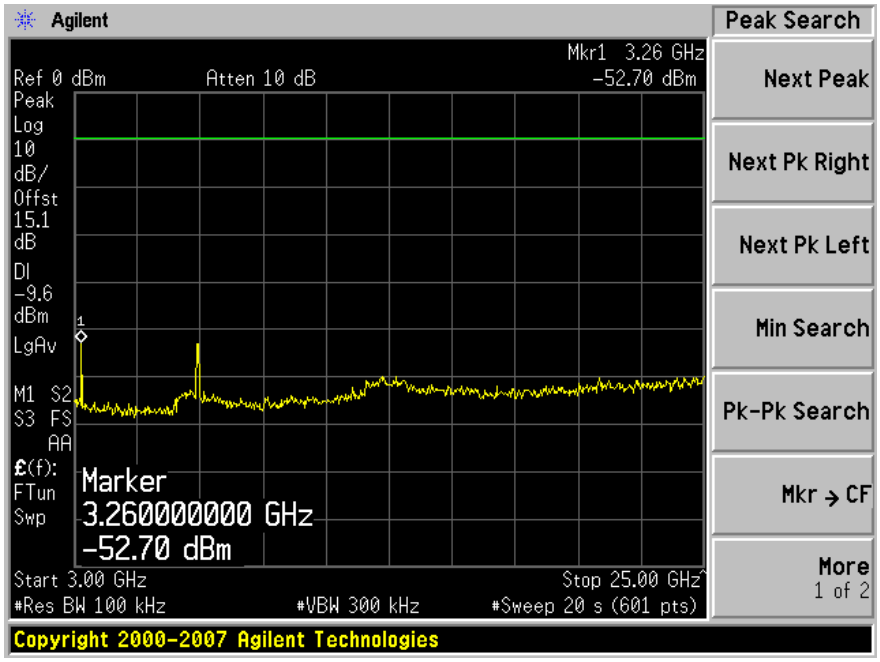




802.11 n 40 MHz (Antenna #0 + Antenna #1)

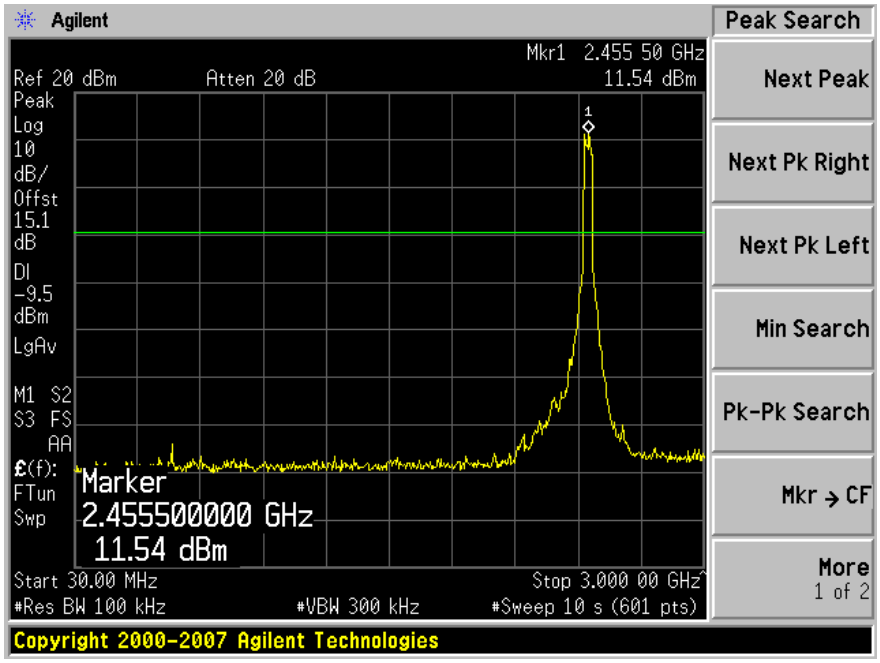
Middle Channel 2437 MHz

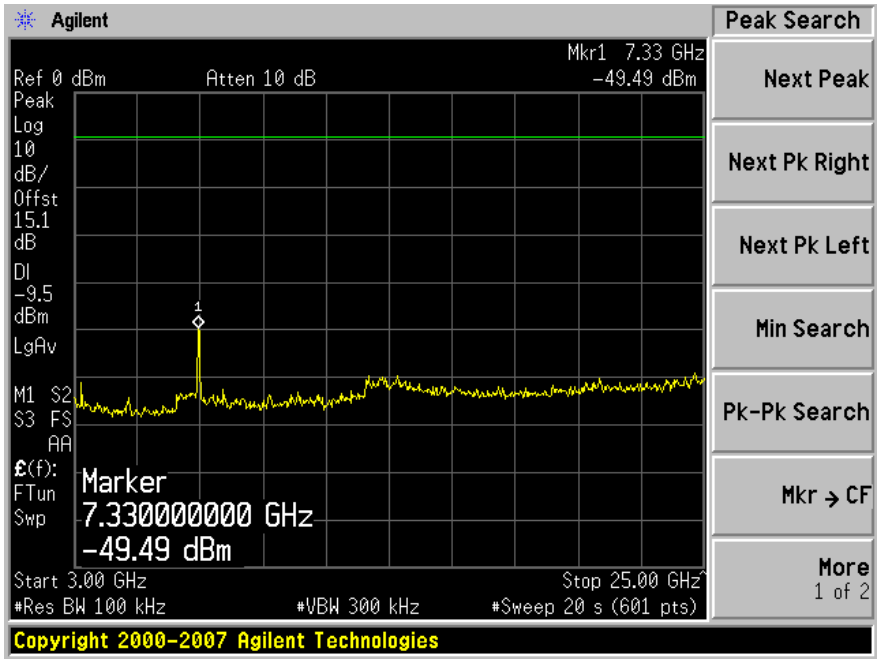




802.11 n 40 MHz (Antenna #0 + Antenna #1)

High Channel 2452 MHz





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

8.1 Applicable Standard

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

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

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

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

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

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

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

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 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 10 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	Serial Number	Calibration Date
Mini-Circuits	Pre amplifier	ZKL-2	7786100643	2009-03-03
HP	Pre amplifier	8449B	3147A00400	2008-10-20
Sunol Science Corp	Combination Antenna	JB1 Antenna	A103105-3	2009-03-25
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2008-07-01
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28
A.R.A.	Antenna, Horn	DRG-118/A	1132	2008-07-28

* **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 1000MHz:

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

Above 1000MHz:

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

8.6 Corrected Amplitude & Margin Calculation

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

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

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

Margin = Corrected Amplitude - FCC Limit

8.7 Environmental Conditions

Temperature:	18-22 °C
Relative Humidity:	40-44 %
ATM Pressure:	101-103kPa

**The testing was performed by Victor Zhang from 2009-04-20 to 2009-04-24.*

8.8 Summary of Test Results

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

802.11 b mode:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-1.00	33.3386	Vertical	Mid, 30 MHz – 1GHz

Above 1 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-9.77	4824	Vertical	Low, 1GHz – 25GHz
-11.61	4874	Vertical	Mid, 1GHz – 25GHz
-9.95	4927	Vertical	High, 1GHz – 25GHz

802.11 g mode:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-1.45	800.0343	Horizontal	Mid, 30 MHz – 1GHz

Above 1 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-18.58	4824	Vertical	Low, 1GHz – 25GHz
-18.84	4874	Vertical	Mid, 1GHz – 25GHz
-18.02	4927	Vertical	High, 1GHz – 25GHz

802.11 n 20 MHz mode:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-1.57	500.0124	Horizontal	Mid, 30 MHz – 1GHz

Above 1 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-17.99	4824	Vertical	Low, 1GHz – 25GHz
-17.28	4874	Vertical	Mid, 1GHz – 25GHz
-18.33	4927	Vertical	High, 1GHz – 25GHz

802.11 n 40 MHz mode:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-1.89	800.0312	Horizontal	Mid, 30 MHz – 1GHz

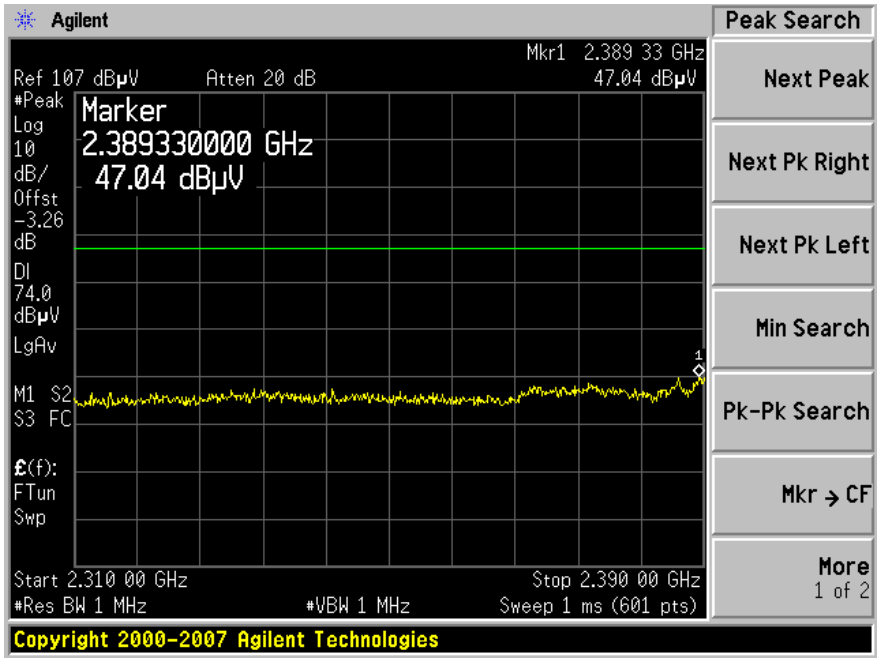
Above 1 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-15.48	4844	Vertical	Low, 1GHz – 25GHz
-16.30	4874	Vertical	Mid, 1GHz – 25GHz
-17.33	4904	Vertical	High, 1GHz – 25GHz

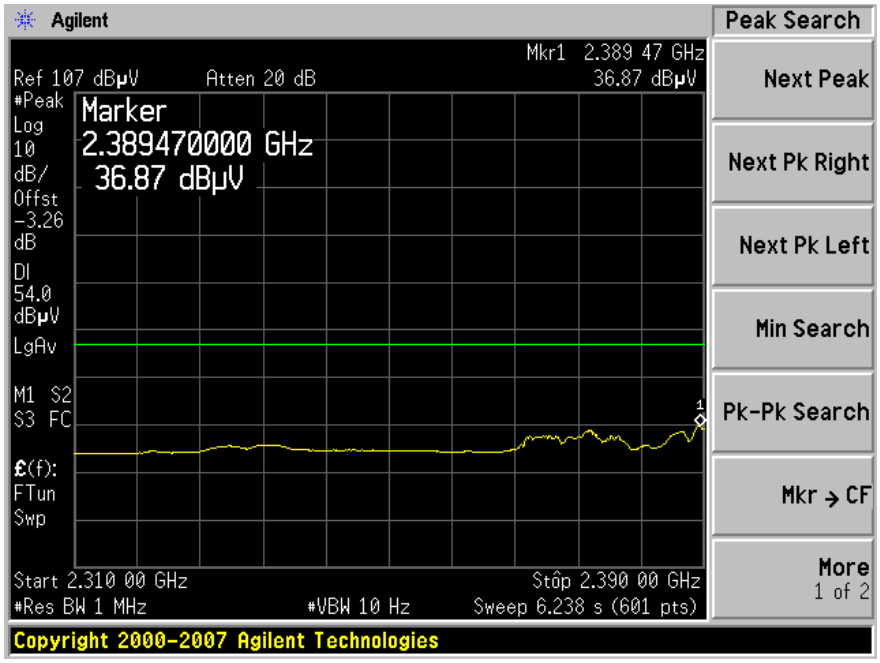
Band Edge Emissions

802.11 b mode:

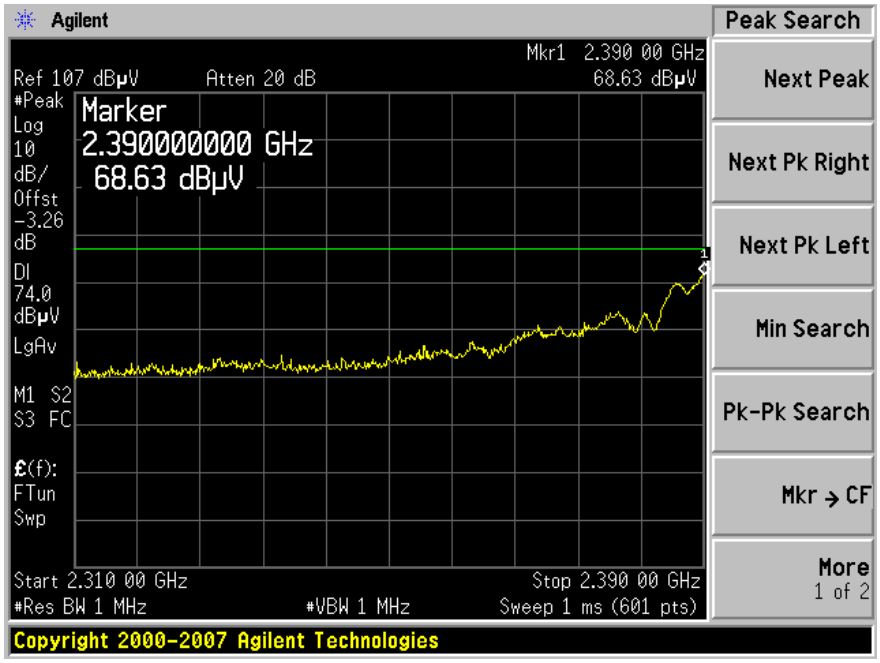
Lowest Channel at Horizontal, Peak



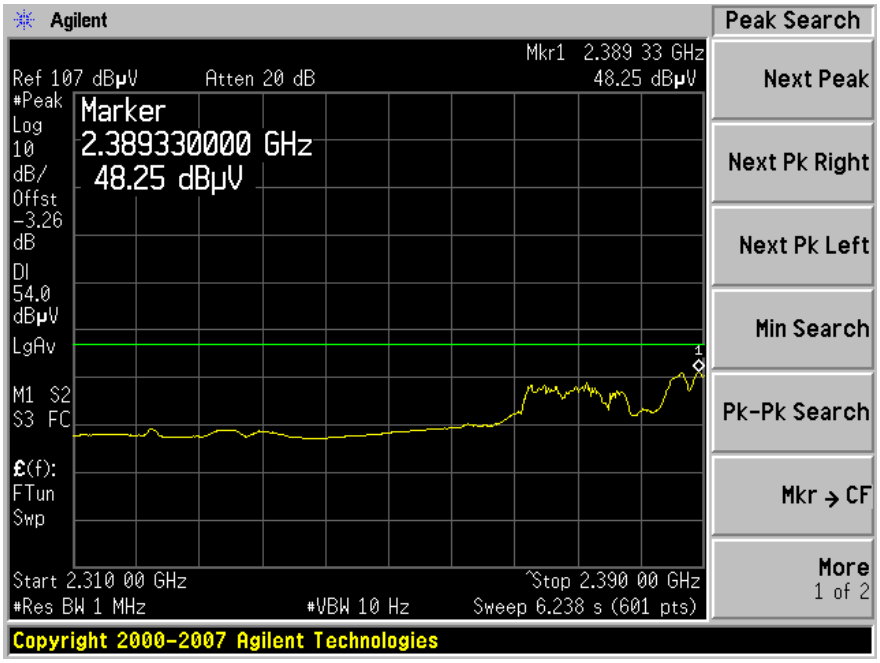
Lowest Channel at Horizontal, Average



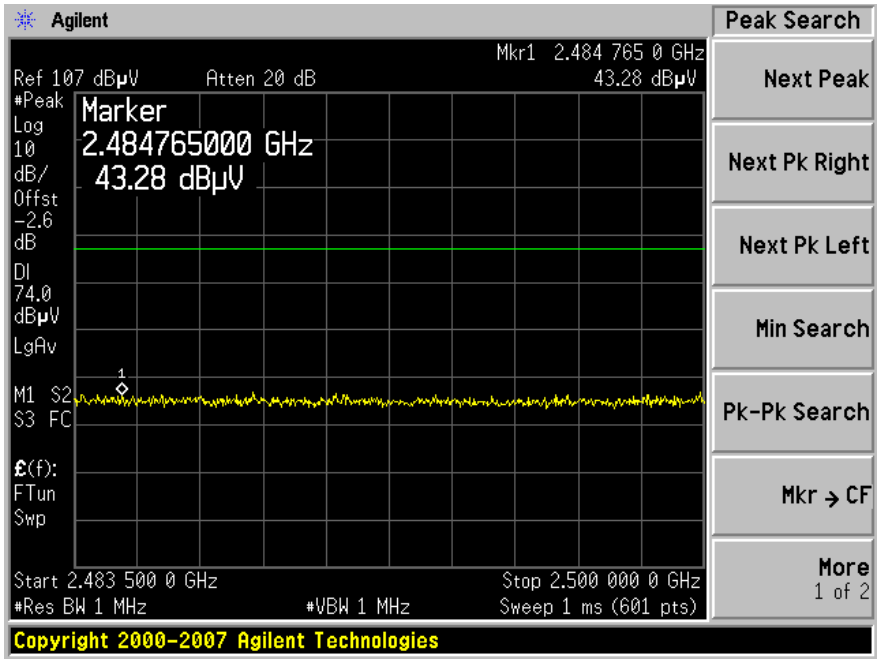
Lowest Channel at Vertical, Peak



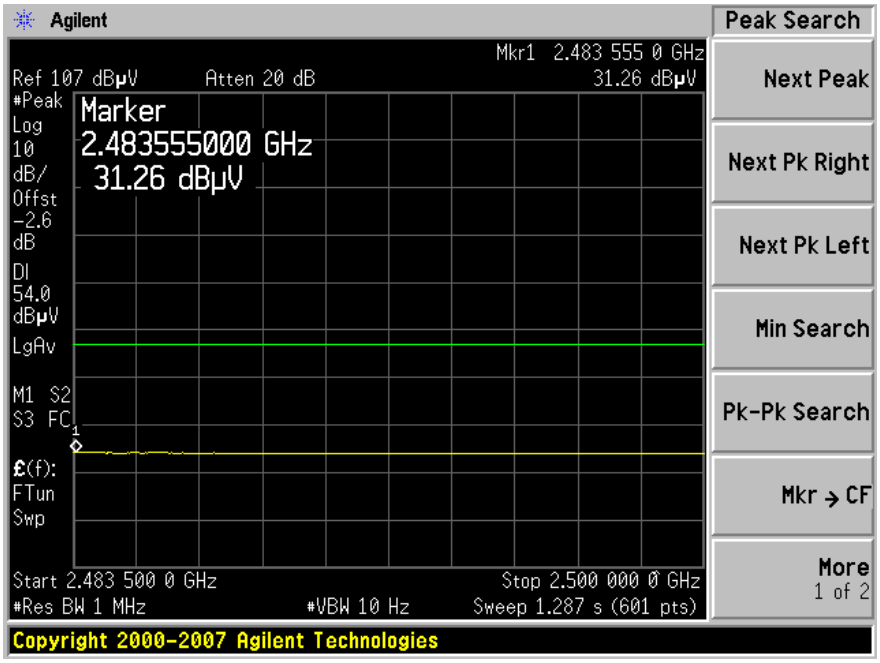
Lowest Channel at Vertical, Average



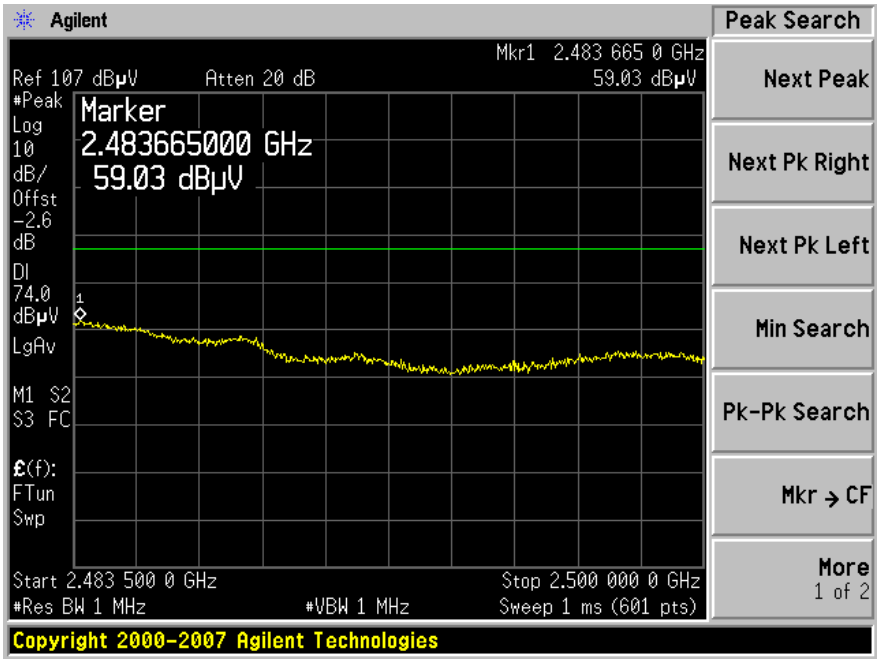
Highest Channel at Horizontal, Peak



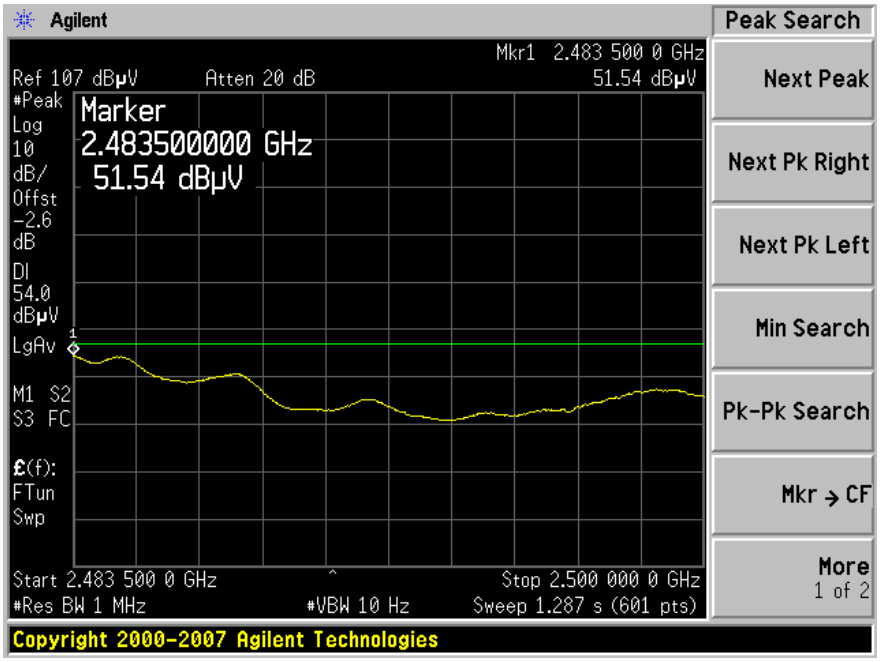
Highest Cannel at Horizontal, Average



Highest Channel at Vertical, Peak

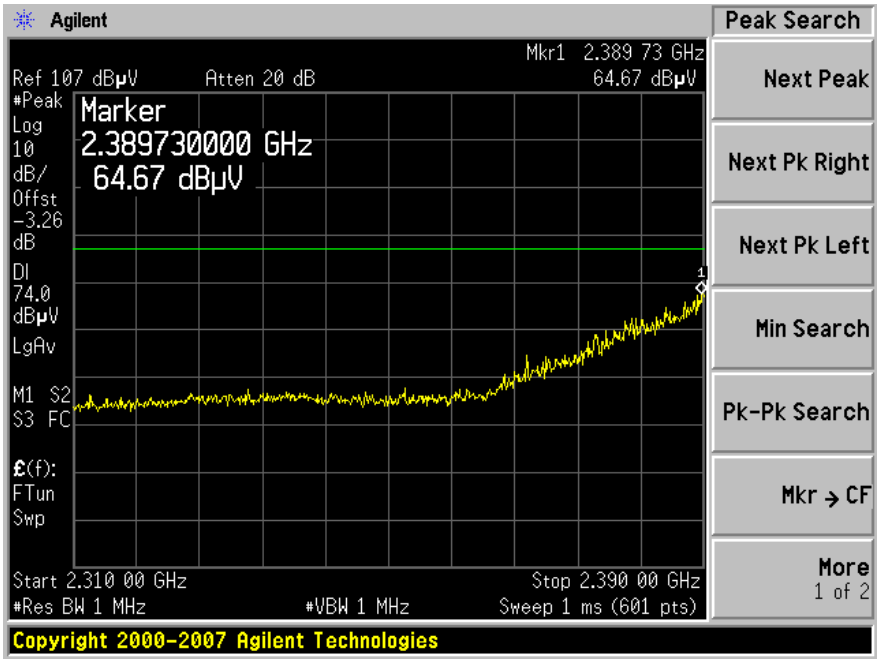


Highest Channel at Vertical, Average

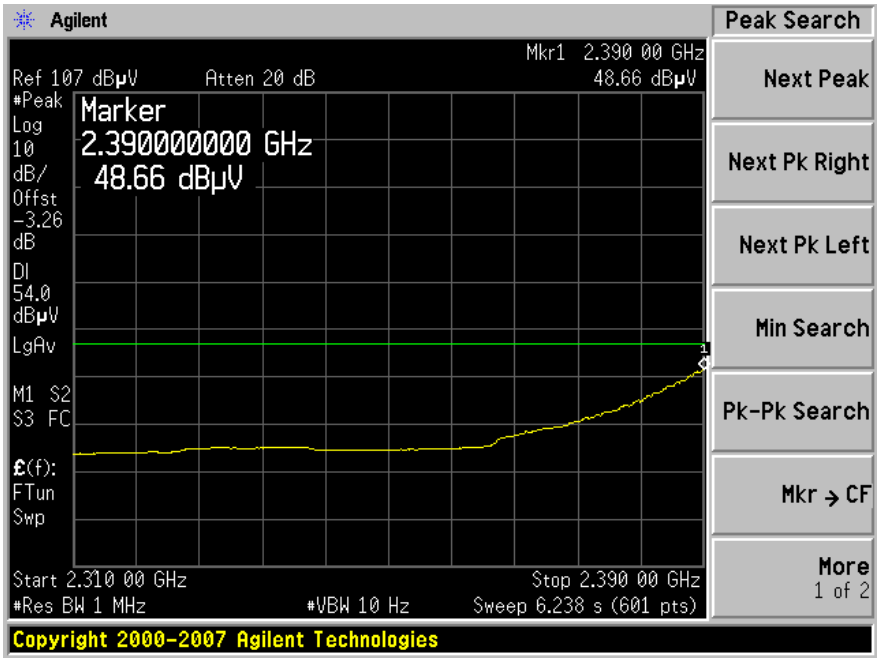


802.11 g mode:

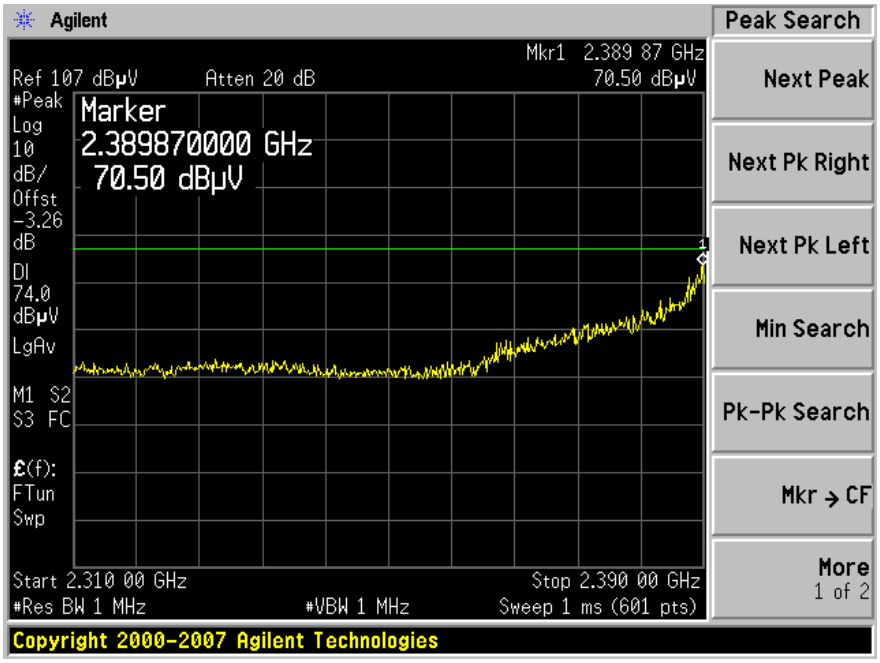
Lowest Channel at Horizontal, Peak



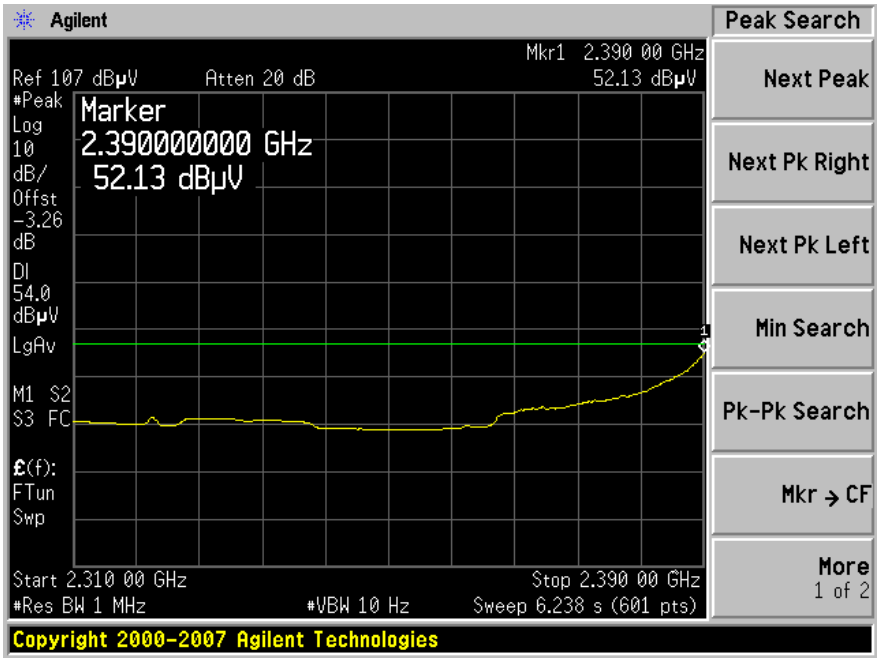
Lowest Channel at Horizontal, Average



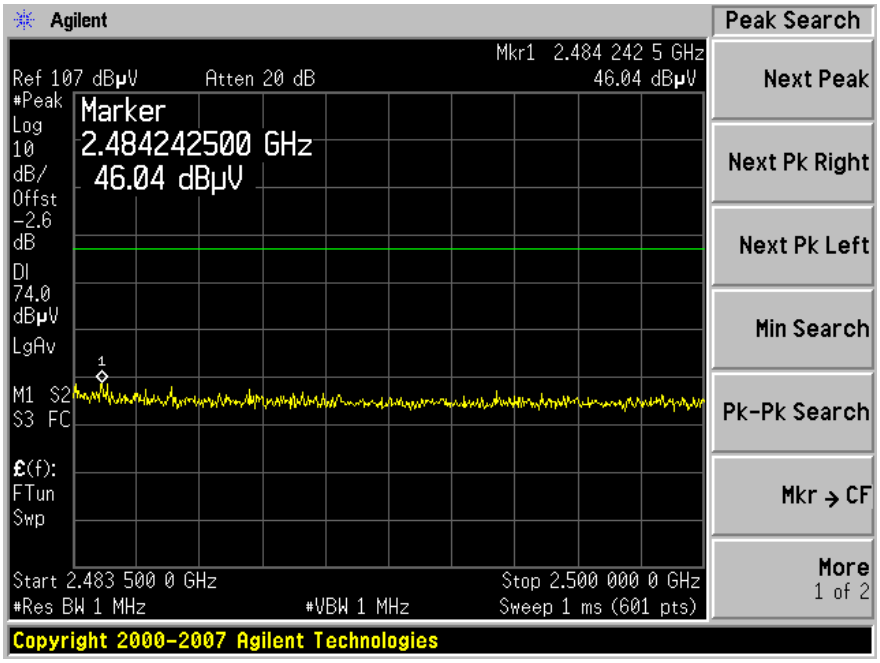
Lowest Channel at Vertical, Peak



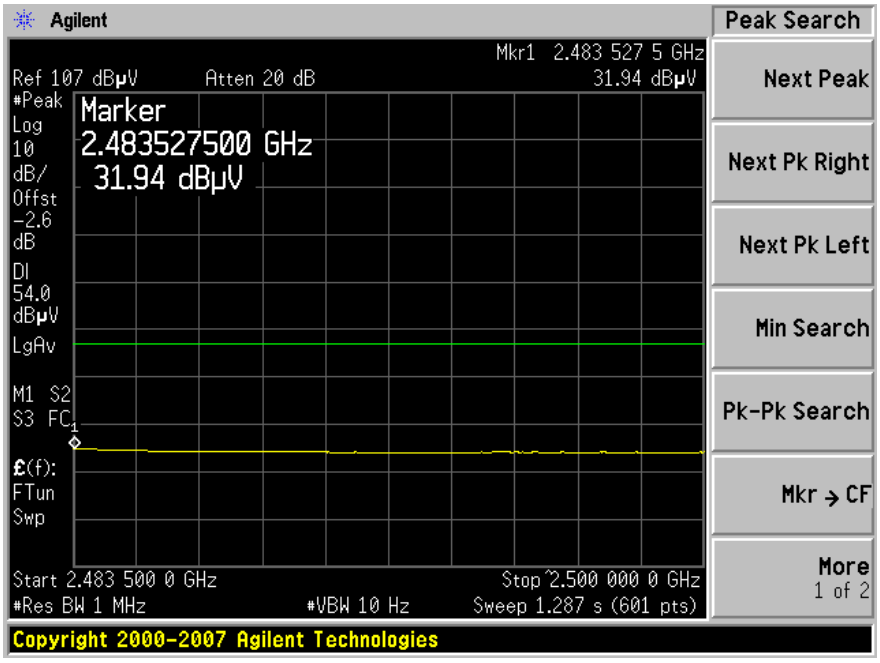
Lowest Channel at Vertical, Average



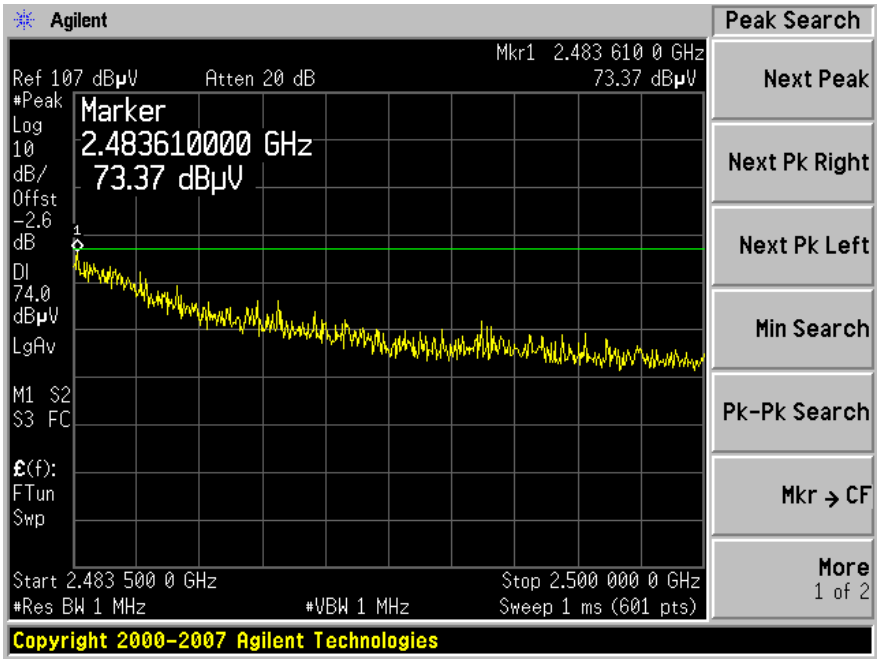
Highest Channel at Horizontal, Peak



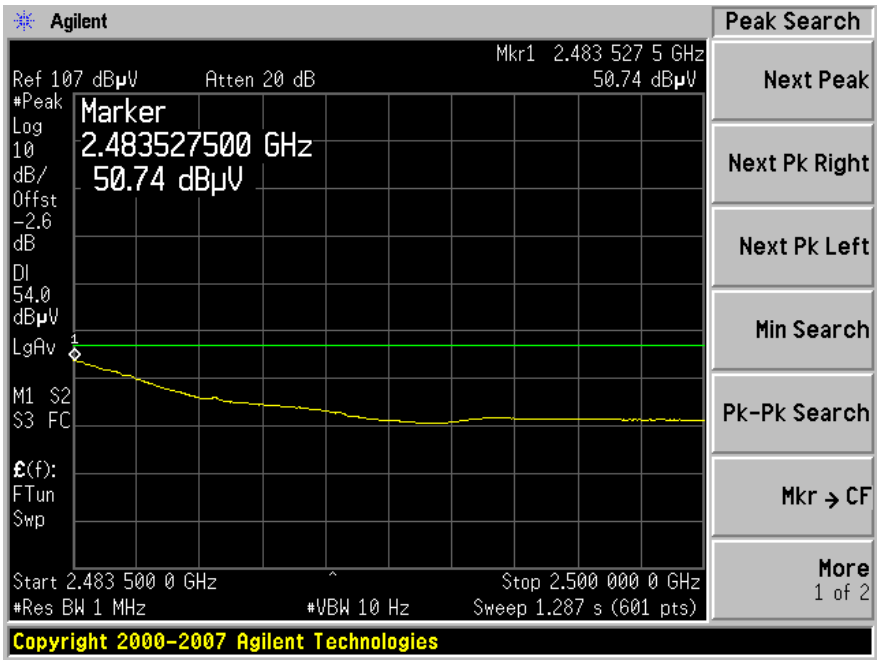
Highest Channel at Horizontal, Average



Highest Channel at Vertical, Peak

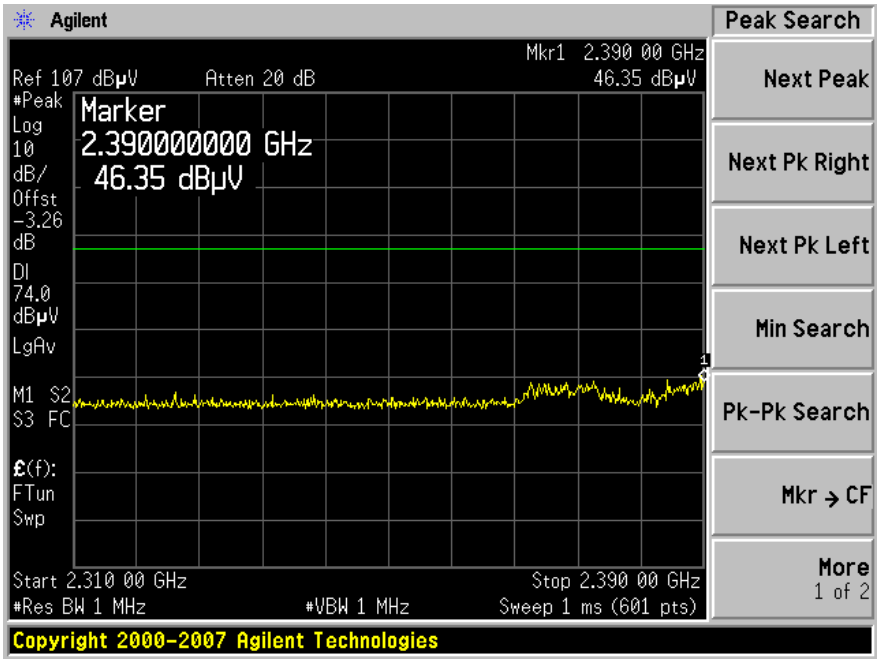


Highest Channel at Vertical, Average

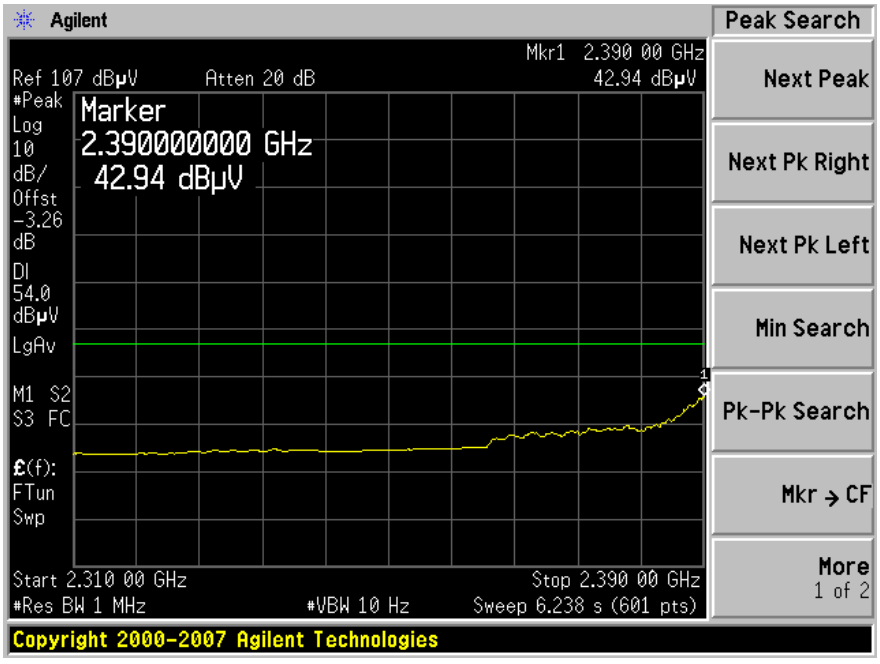


802.11 n 20 MHz mode:

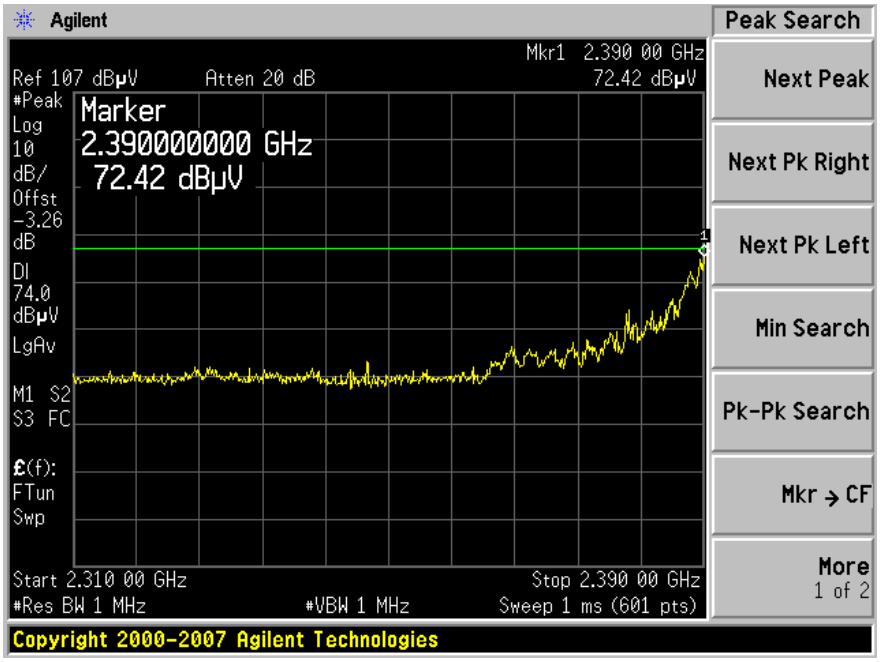
Lowest Channel at Horizontal, Peak



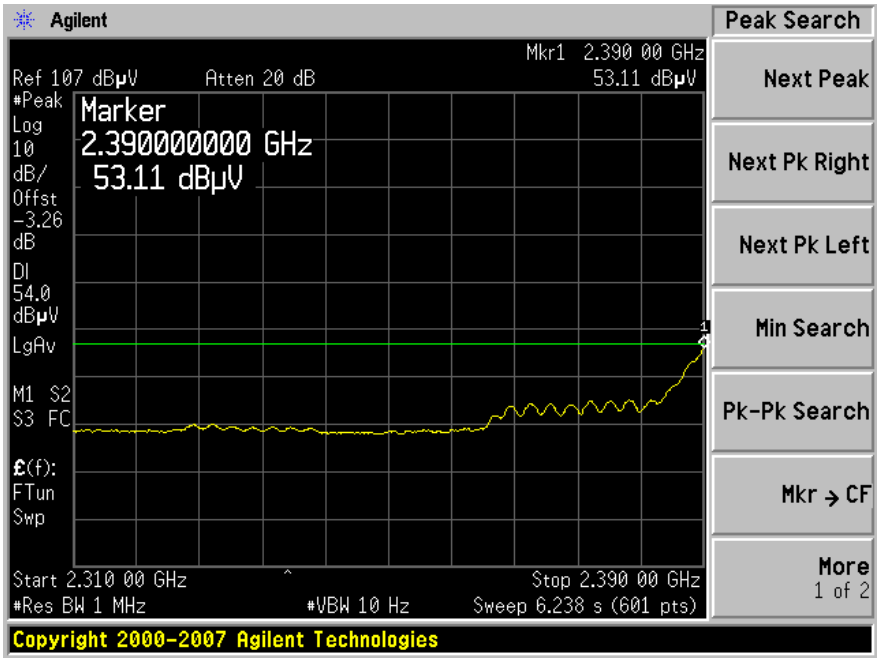
Lowest Channel at Horizontal, Average



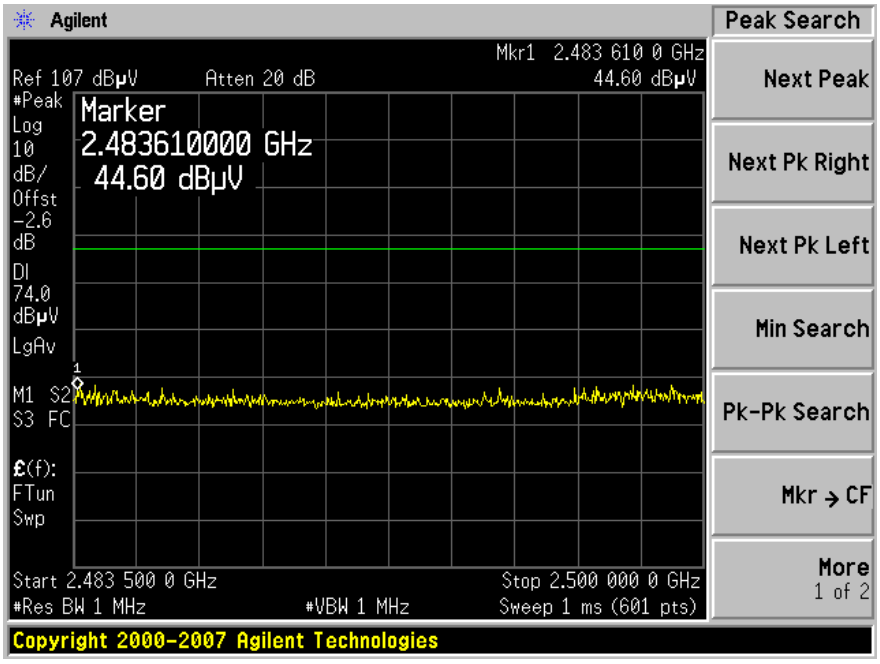
Lowest Channel at Vertical, Peak



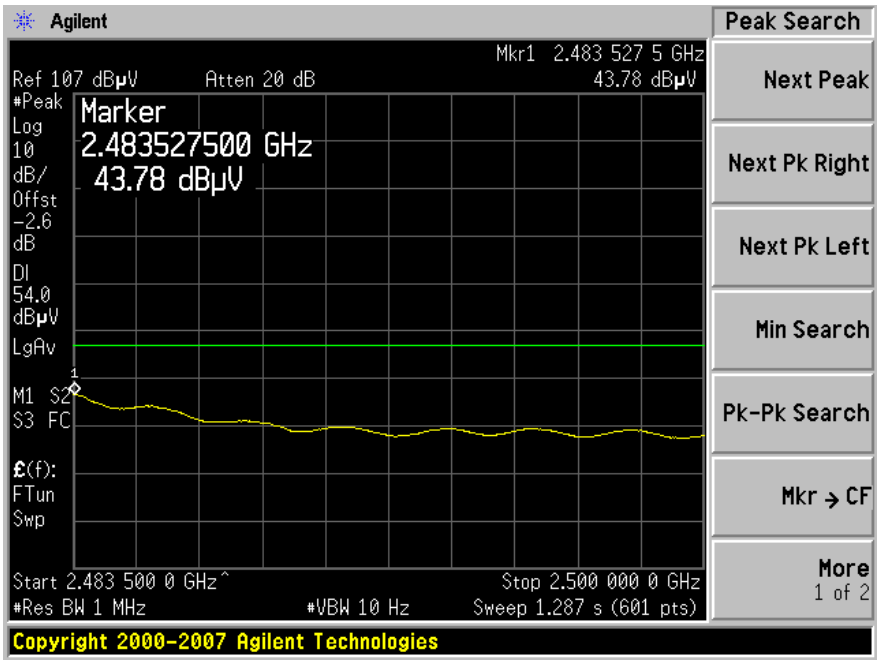
Lowest Channel at Vertical, Average



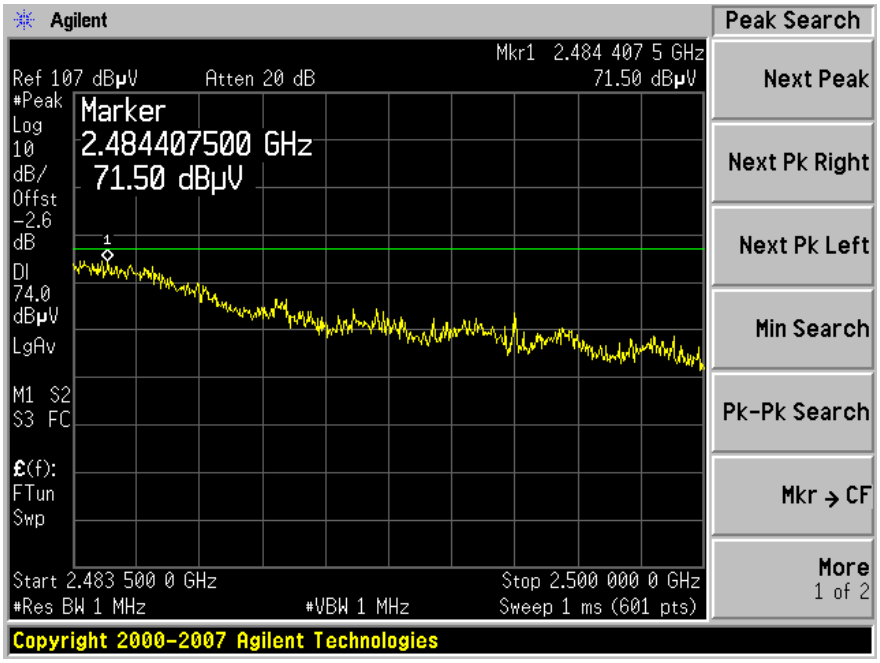
Highest Channel at Horizontal, Peak



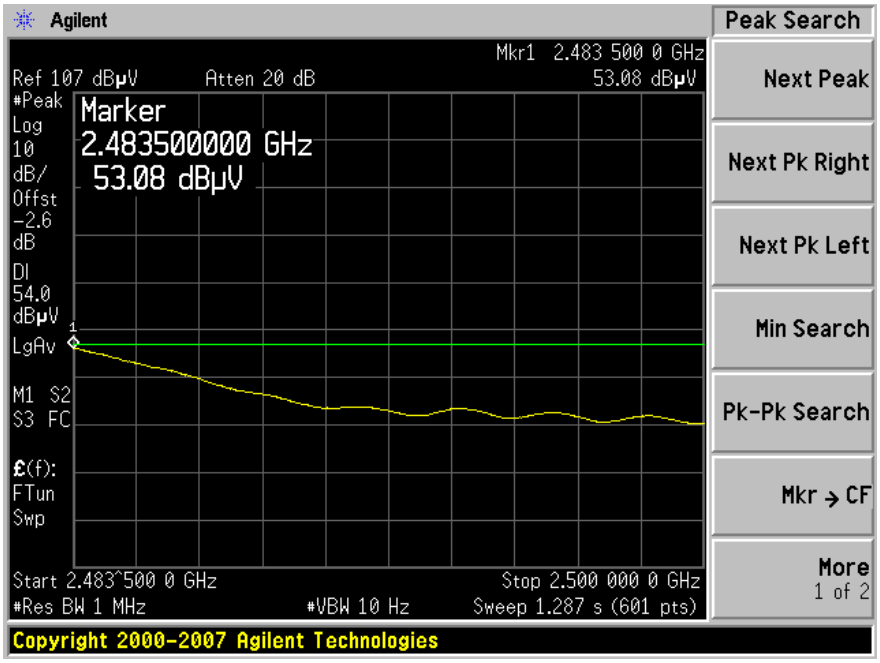
Highest Channel at Horizontal, Average



Highest Channel at Vertical, Peak

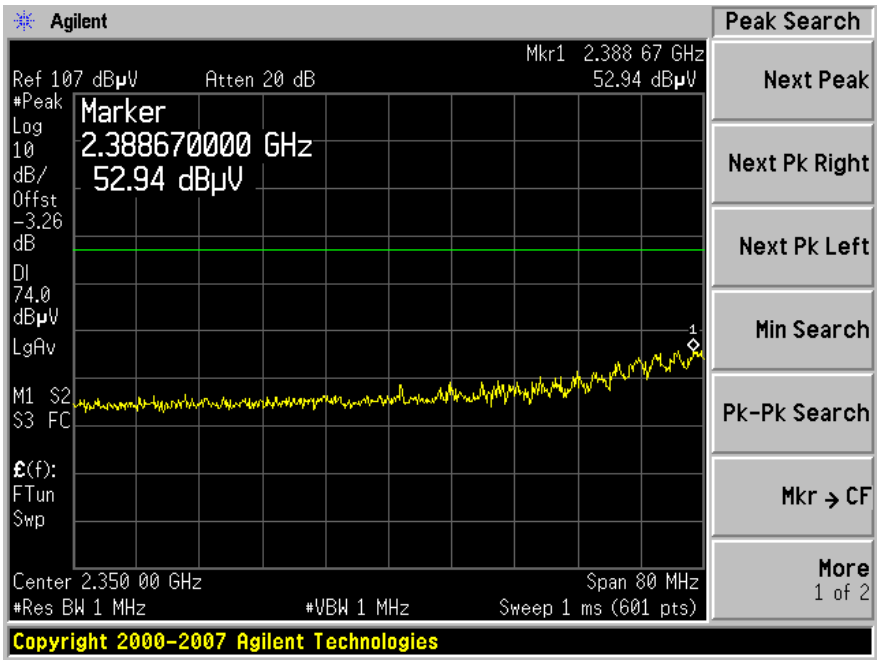


Highest Channel at Vertical, Average

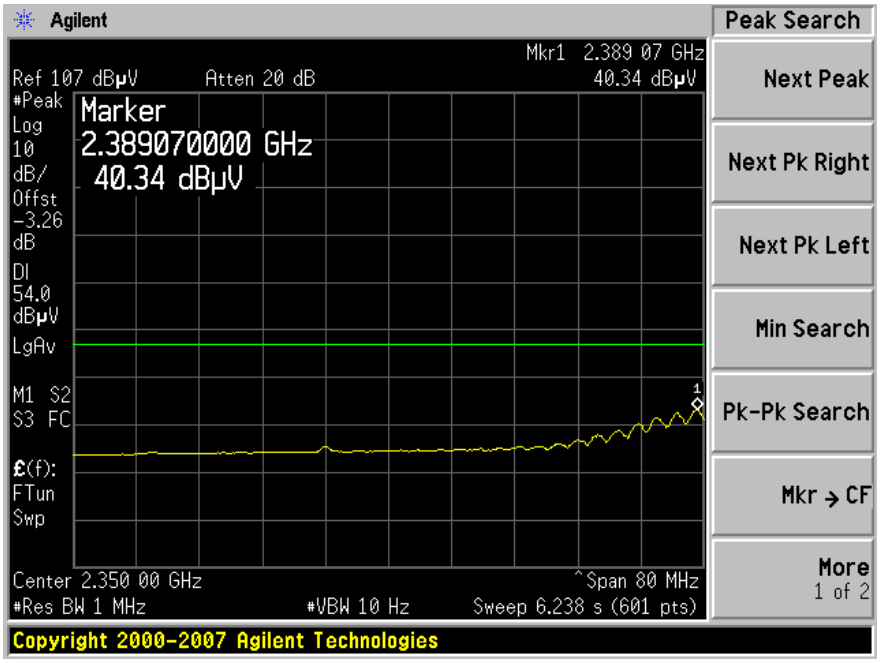


802.11 n 40 MHz mode:

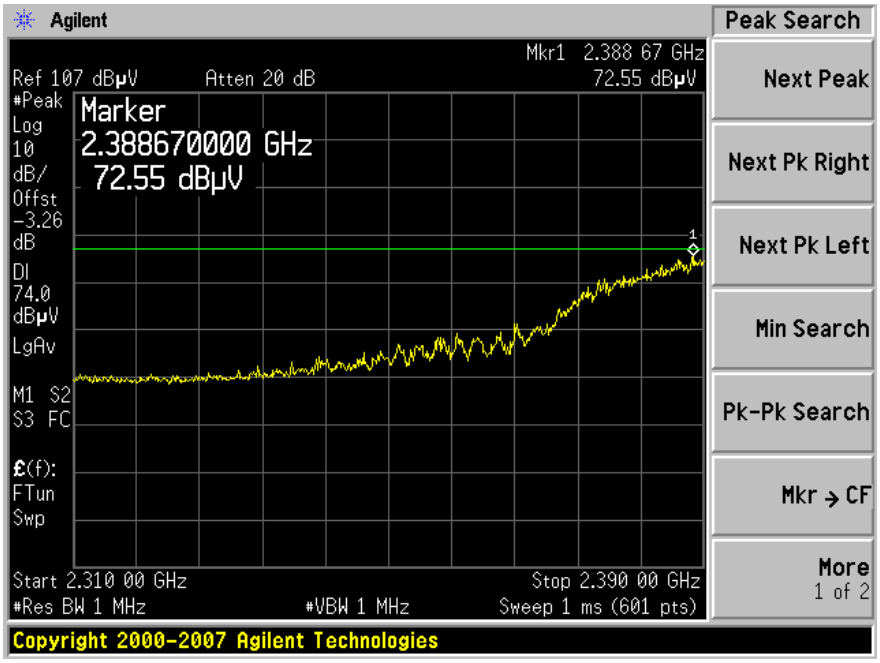
Lowest Channel at Horizontal, Peak



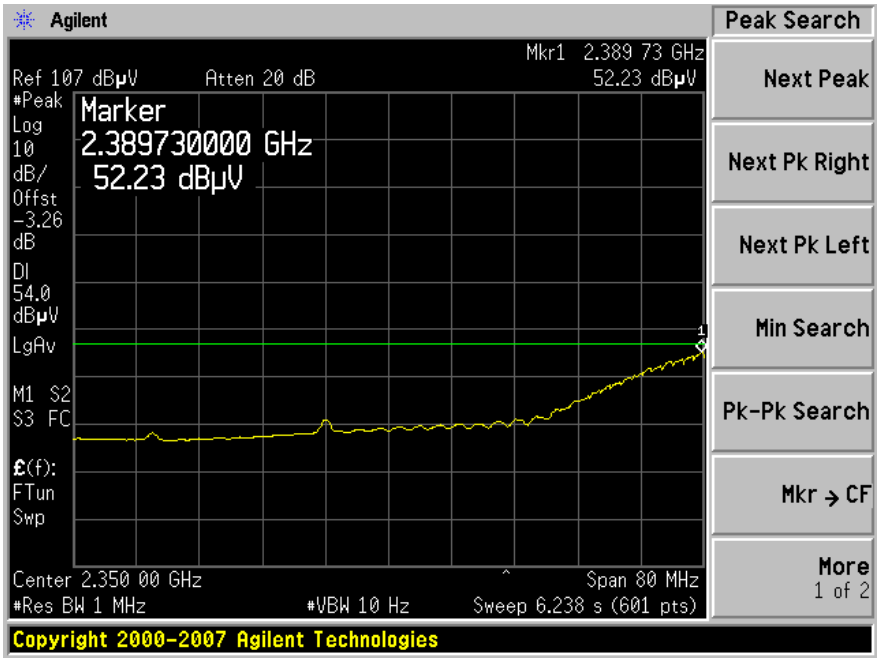
Lowest Channel at Horizontal, Average



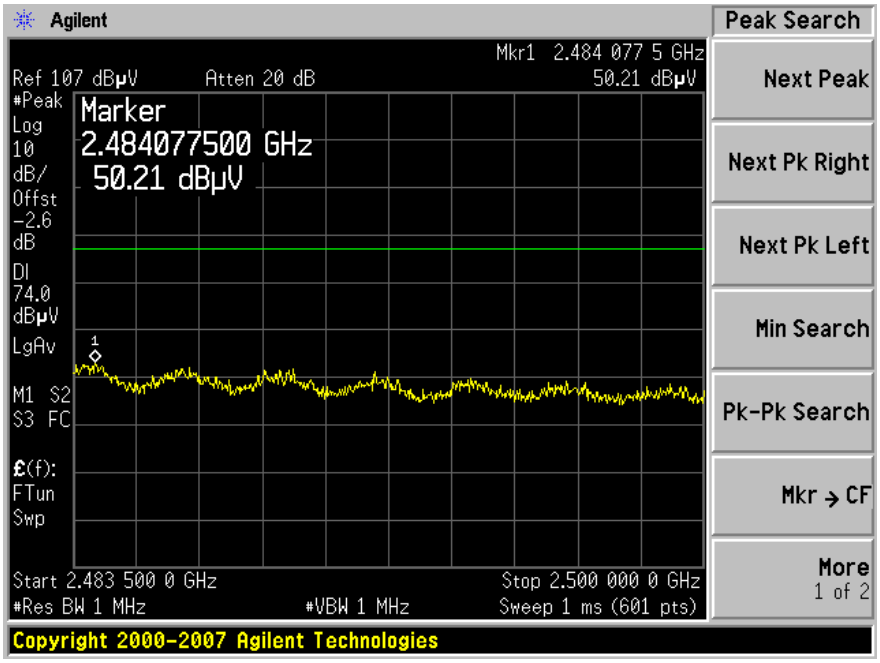
Lowest Channel at Vertical, Peak



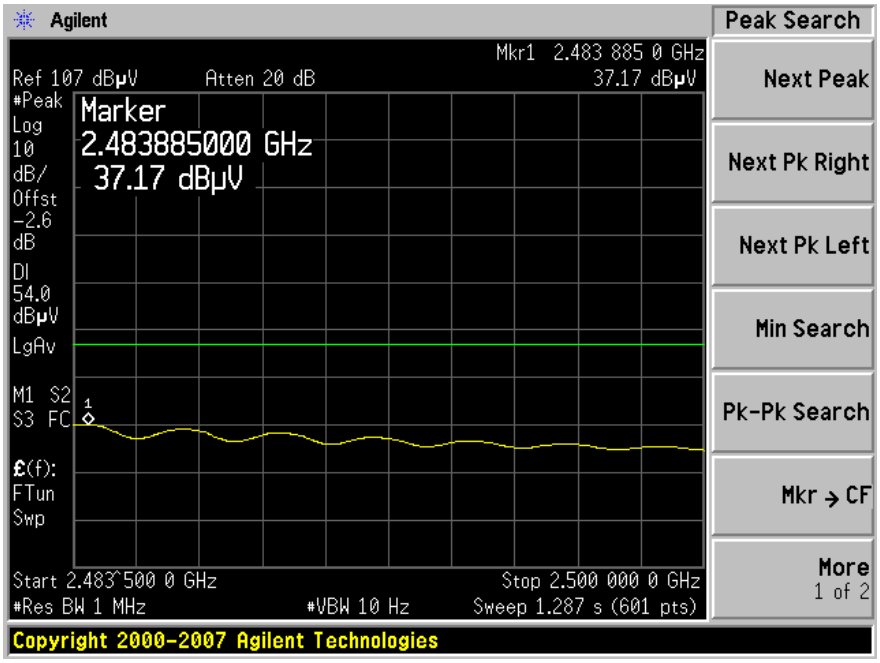
Lowest Channel at Vertical, Average



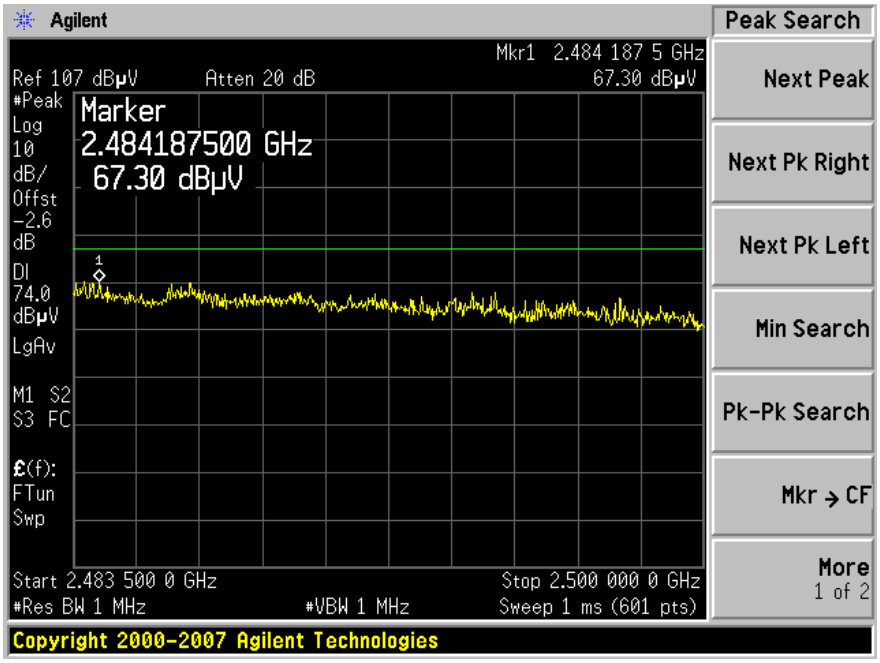
Highest Channel at Horizontal, Peak



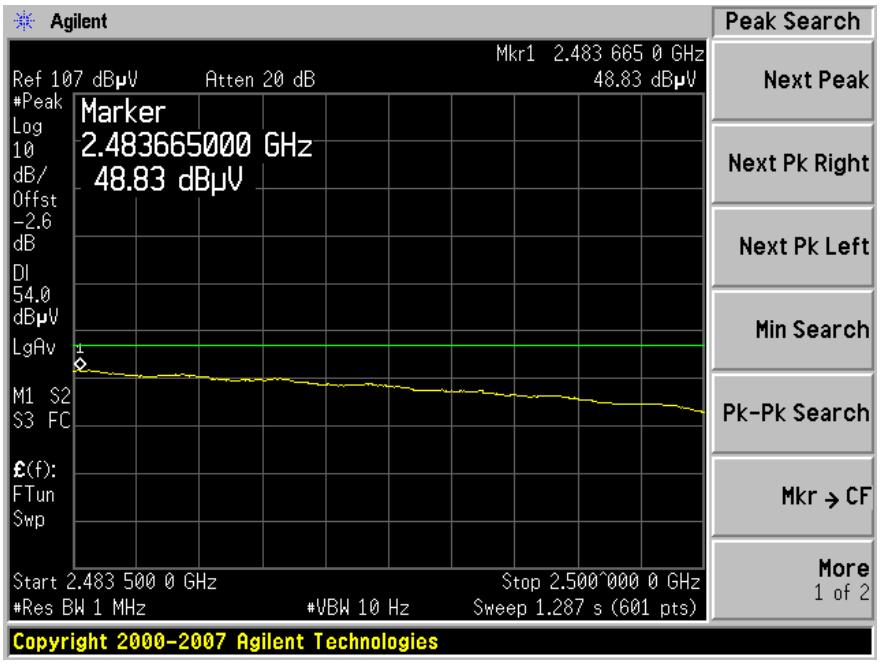
Highest Channel at Horizontal, Average



Highest Channel at Vertical, Peak



Highest Channel at Vertical, Average

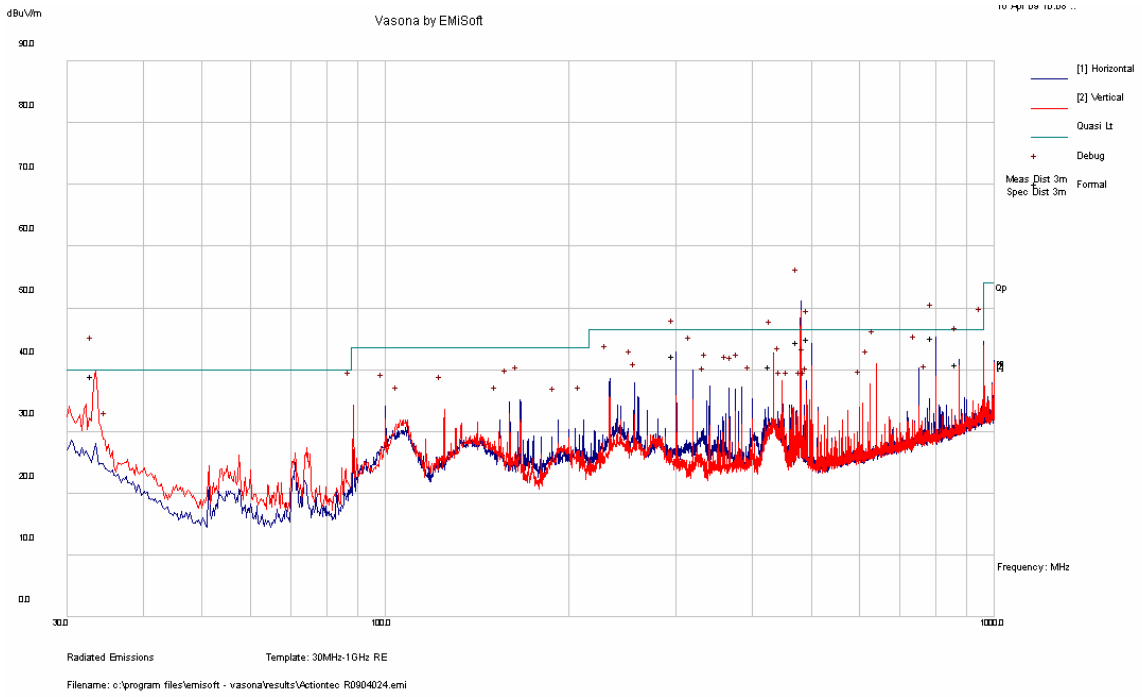


8.9 Radiated Emissions Test plot & data:

802.11b Mode:

30 MHz – 1000 MHz:

Worst Case, Middle Channel 2437 MHz, measured at 3 meters



Frequency (MHz)	Corrected Amp. (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degree)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
33.3386	39	102	V	81	1.96	40	-1.0
800.0233	45.19	101	H	359	6.02	46.5	-1.31
500.01	44.99	172	H	225	1.51	46.5	-1.51
480.0827	44.46	162	H	159	1.47	46.5	-2.04
300.0071	42.27	102	H	51	-1.75	46.5	-4.23
433.3299	40.51	100	H	133	0.52	46.5	-5.99

Above 1 GHz:

802.11 b, Low Channel 2412 MHz, measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4824	38.24	228	124	V	33.1	9.79	36.9	44.23	54	-9.77	Ave
4824	32.74	218	1.55	H	33.1	9.79	36.9	38.73	54	-15.27	Ave
4824	44.04	228	124	V	33.1	9.79	36.9	50.03	74	-23.97	Peak
4824	41.53	218	1.55	H	33.1	9.79	36.9	47.52	74	-26.48	Peak

802.11 b, Middle channel 2437 MHz, measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4874	36.54	269	1.38	V	33.1	9.75	37	42.39	54	-11.61	Ave
4874	28.75	146	1.32	H	33.1	9.75	37	34.60	54	-19.40	Ave
4874	43.45	269	1.38	V	33.1	9.75	37	49.30	74	-24.70	Peak
4874	41.03	146	1.32	H	33.1	9.75	37	46.88	74	-27.12	Peak

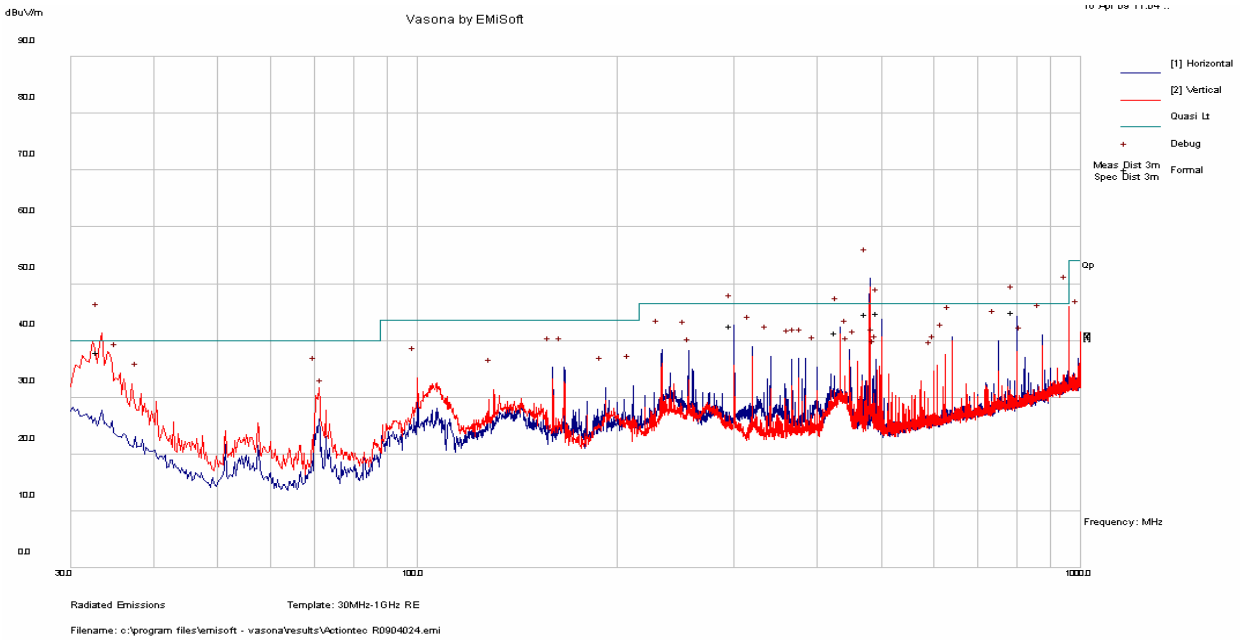
802.11 b, High channel 2462 MHz measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4924	37.74	118	1.37	V	33.6	9.71	37	44.05	54	-9.95	Ave
4924	31.52	299	1.38	H	33.6	9.71	37	37.83	54	-16.17	Ave
4924	45.68	118	1.37	V	33.6	9.71	37	51.99	74	-22.01	Peak
4924	40.4	299	1.38	H	33.6	9.71	37	46.71	74	-27.29	Peak

802.11 g Mode:

30 MHz – 1000 MHz:

Worst Case, Middle Channel 2437 MHz, measured at 3 meters



Frequency (MHz)	Corrected Amp. (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degree)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
800.03430	45.05	100	H	359	6.02	46.5	-1.45
500.02460	44.79	171	H	226	1.51	46.5	-1.71
480.08250	44.62	179	H	159	1.47	46.5	-1.88
33.33428	37.96	102	V	269	1.96	40.0	-2.04
300.01190	42.62	100	H	64	-1.75	46.5	-3.88
433.35580	41.40	100	H	339	0.52	46.5	-5.10

Above 1 GHz:

802.11 g, Low Channel 2412 MHz, measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4824	29.43	128	1.33	V	33.1	9.79	36.9	35.42	54	-18.58	Ave
4824	26.18	225	1.33	H	33.1	9.79	36.9	32.17	54	-21.83	Ave
4824	42.92	128	1.33	V	33.1	9.79	36.9	48.91	74	-25.09	Peak
4824	39.37	225	1.33	H	33.1	9.79	36.9	45.36	74	-28.64	Peak

802.11 g, Middle channel 2437 MHz measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4874	29.31	147	1.34	V	33.1	9.75	37	35.16	54	-18.84	Ave
4872	26.54	189	1.32	H	33.1	9.75	37	32.39	54	-21.61	Ave
4874	41.77	147	1.34	V	33.1	9.75	37	47.62	74	-26.38	Peak
4874	39.23	189	1.32	H	33.1	9.75	37	45.08	74	-28.92	Peak

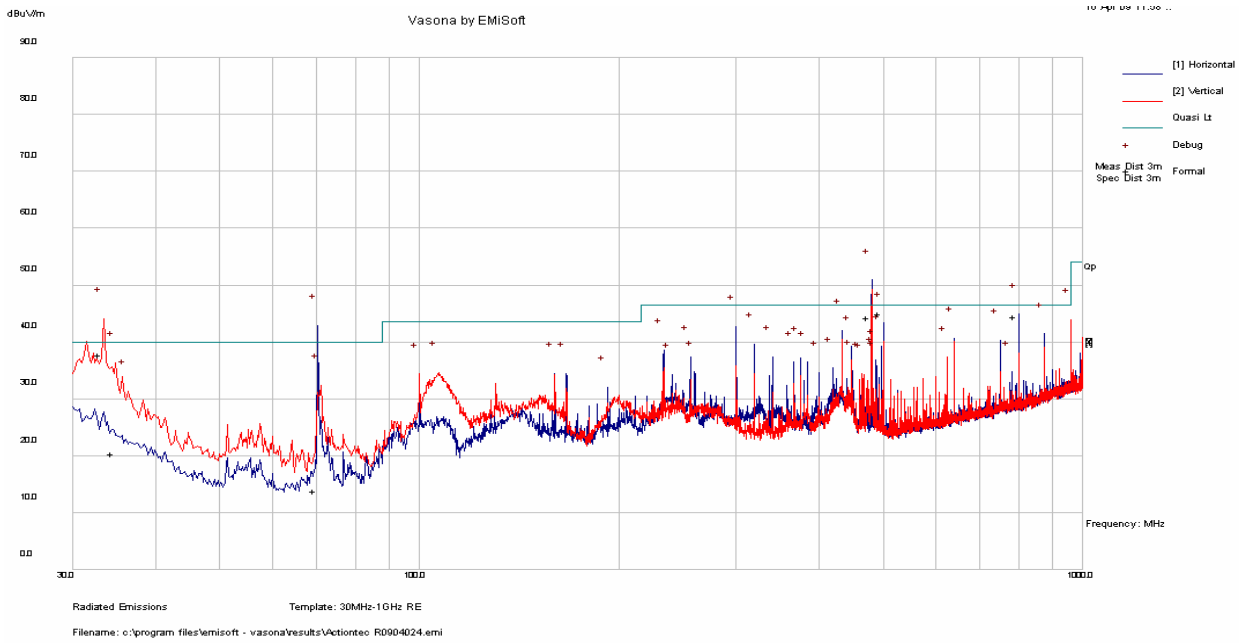
802.11 g, High channel 2462 MHz measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4924	29.67	172	1.34	V	33.6	9.71	37	35.98	54	-18.02	Ave
4924	26.37	223	1.37	H	33.6	9.71	37	32.68	54	-21.32	Ave
4924	42.89	172	1.34	V	33.6	9.71	37	49.20	74	-24.80	Peak
4924	39.44	223	1.37	H	33.6	9.71	37	45.75	74	-28.25	Peak

802.11 n 20 MHz Mode:

30 MHz – 1000 MHz:

Worst Case, Middle Channel 2437 MHz, measured at 3 meters



Frequency (MHz)	Corrected Amp. (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degree)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
500.01240	44.93	170	H	225	1.51	46.5	-1.57
800.03000	44.50	121	H	359	6.02	46.5	-2.00
480.08300	44.36	165	H	161	1.47	46.5	-2.14
33.33188	37.72	101	V	213	1.97	40.0	-2.28
34.83872	20.47	174	V	220	0.85	40.0	-19.53
70.44124	13.82	269	H	50	-8.77	40.0	-26.18

Above 1 GHz:

802.11 n 20 MHz, Low Channel 2412 MHz, measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4824	30.02	157	1.40	V	33.1	9.79	36.9	36.01	54	-17.99	Ave
4824	26.13	225	1.33	H	33.1	9.79	36.9	32.12	54	-21.88	Ave
4824	43.80	157	1.40	V	33.1	9.79	36.9	49.79	74	-24.21	Peak
4824	39.44	225	1.33	H	33.1	9.79	36.9	45.43	74	-28.57	Peak

802.11 n 20 MHz, Middle channel 2437 MHz measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4874	30.87	138	1.35	V	33.1	9.75	37	36.72	54	-17.28	Ave
4872	26.05	221	1.35	H	33.1	9.75	37	31.90	54	-22.10	Ave
4874	44.12	138	1.35	V	33.1	9.75	37	49.97	74	-24.03	Peak
4874	38.77	221	1.35	H	33.1	9.75	37	44.62	74	-29.38	Peak

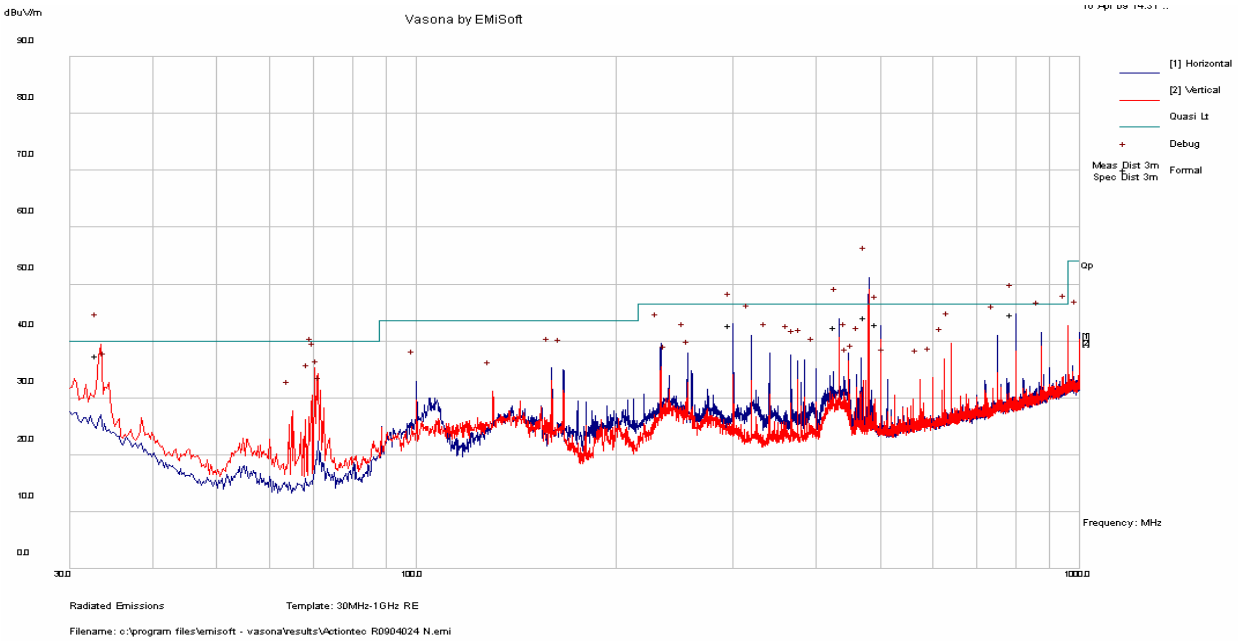
802.11 n 20 MHz, High channel 2462 MHz measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4924	29.36	161	1.52	V	33.6	9.71	37	35.67	54	-18.33	Ave
4924	26.94	211	1.37	H	33.6	9.71	37	33.25	54	-20.75	Ave
4924	43.20	161	1.52	V	33.6	9.71	37	49.51	74	-24.49	Peak
4924	39.64	211	1.37	H	33.6	9.71	37	45.95	74	-28.05	Peak

802.11 n 40 MHz Mode:

30 MHz – 1000 MHz:

Worst Case, Middle Channel 2437 MHz, measured at 3 meters



Frequency (MHz)	Corrected Amp. (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degree)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
800.03120	44.61	100	H	360	6.02	46.5	-1.89
480.08270	44.14	202	H	0	1.47	46.5	-2.36
33.33572	37.43	106	V	107	1.96	40.0	-2.57
500.01480	42.90	161	H	224	1.51	46.5	-3.60
300.01050	42.73	100	H	62	-1.75	46.5	-3.77
433.34550	42.39	100	H	148	0.52	46.5	-4.11

Above 1 GHz:

802.11 n 40 MHz, Low Channel 2422 MHz, measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4844	32.53	150	1.00	V	33.1	9.79	36.9	38.52	54	-15.48	Ave
4844	29.03	213	1.00	H	33.1	9.79	36.9	35.02	54	-18.98	Ave
4844	45.72	150	1.00	V	33.1	9.79	36.9	51.71	74	-22.29	Peak
4844	41.24	213	1.00	H	33.1	9.79	36.9	47.23	74	-26.77	Peak

802.11 n 40 MHz, Middle channel 2437 MHz measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4874	31.85	145	1.20	V	33.1	9.75	37	37.70	54	-16.30	Ave
4872	27.32	210	1.10	H	33.1	9.75	37	33.17	54	-20.83	Ave
4874	46.53	145	1.20	V	33.1	9.75	37	52.38	74	-21.62	Peak
4874	40.12	210	1.10	H	33.1	9.75	37	45.97	74	-28.03	Peak

802.11 n 40 MHz, High channel 2452 MHz measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (m)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4904	30.36	144	1.13	V	33.6	9.71	37	36.67	54	-17.33	Ave
4904	27.94	220	1.12	H	33.6	9.71	37	34.25	54	-19.75	Ave
4904	42.13	144	1.13	V	33.6	9.71	37	48.44	74	-25.56	Peak
4904	38.53	220	1.12	H	33.6	9.71	37	44.84	74	-29.16	Peak

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

9.1 Applicable Standard

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

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	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28

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

9.4 Environmental Conditions

Temperature:	18-22 °C
Relative Humidity:	40-44 %
ATM Pressure:	101-103kPa

**The testing was performed by Victor Zhang from 2009-04-20 to 2009-04-24.*

9.5 Summary of Test Results

802.11 b Mode:

Antenna #0

Channel	Frequency (MHz)	6 dB Channel Bandwidth (kHz)	99% Bandwidth (MHz)	Limit (kHz)	Results
Low	2412	10.108	13.1075	>500	Compliant
Middle	2437	10.120	13.0608	>500	Compliant
High	2462	10.123	13.0816	>500	Compliant

Antenna #1

Channel	Frequency (MHz)	6 dB Channel Bandwidth (kHz)	99% Bandwidth (MHz)	Limit (kHz)	Results
Low	2412	10.088	13.0948	>500	Compliant
Middle	2437	10.140	13.0652	>500	Compliant
High	2462	10.147	13.0701	>500	Compliant

802.11 g Mode:

Antenna #0

Channel	Frequency (MHz)	6 dB Channel Bandwidth (kHz)	99% Bandwidth (MHz)	Limit (kHz)	Results
Low	2412	15.689	16.5351	>500	Compliant
Middle	2437	15.951	16.5289	>500	Compliant
High	2462	16.344	16.5680	>500	Compliant

Antenna #1

Channel	Frequency (MHz)	6 dB Channel Bandwidth (kHz)	99% Bandwidth (MHz)	Limit (kHz)	Results
Low	2412	16.362	16.5161	>500	Compliant
Middle	2437	16.450	16.5250	>500	Compliant
High	2462	15.819	16.5441	>500	Compliant

802.11 n 20 MHz Mode:

Antenna #0

Channel	Frequency (MHz)	6 dB Channel Bandwidth (kHz)	99% Bandwidth (MHz)	Limit (kHz)	Results
Low	2412	17.603	17.7561	>500	Compliant
Middle	2437	17.596	17.6848	>500	Compliant
High	2462	17.555	17.6946	>500	Compliant

Antenna #1

Channel	Frequency (MHz)	6 dB Channel Bandwidth (kHz)	99% Bandwidth (MHz)	Limit (kHz)	Results
Low	2412	17.611	17.6598	>500	Compliant
Middle	2437	17.597	17.6712	>500	Compliant
High	2462	17.593	17.6663	>500	Compliant

802.11 n 40 MHz Mode:

Antenna #0

Channel	Frequency (MHz)	6 dB Channel Bandwidth (kHz)	99% Bandwidth (MHz)	Limit (kHz)	Results
Low	2422	36.474	36.6906	>500	Compliant
Middle	2437	36.392	36.7690	>500	Compliant
High	2452	36.388	36.6276	>500	Compliant

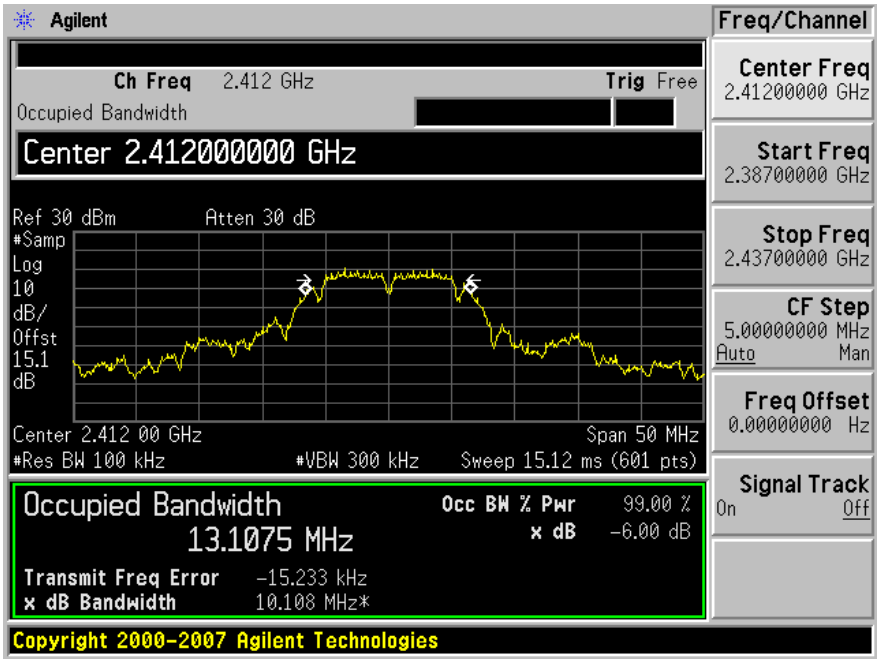
Antenna #1

Channel	Frequency (MHz)	6 dB Channel Bandwidth (kHz)	99% Bandwidth (MHz)	Limit (kHz)	Results
Low	2422	36.404	36.5776	>500	Compliant
Middle	2437	36.541	36.7742	>500	Compliant
High	2452	36.374	36.6197	>500	Compliant

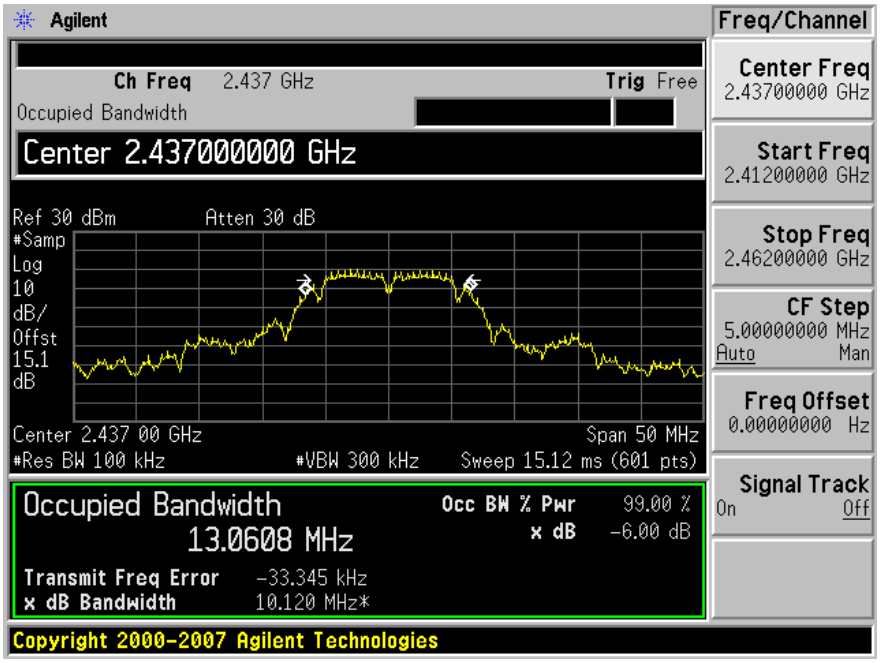
Please refer to the following plots for detailed test results

802.11 b (Antenna #0)

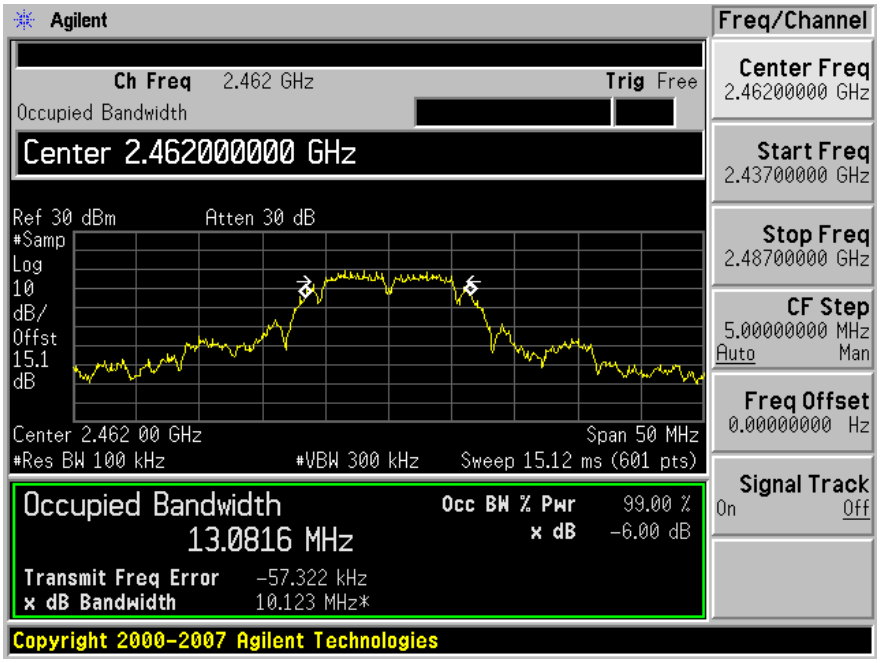
Low Channel 2412 MHz



Middle Channel 2437 MHz

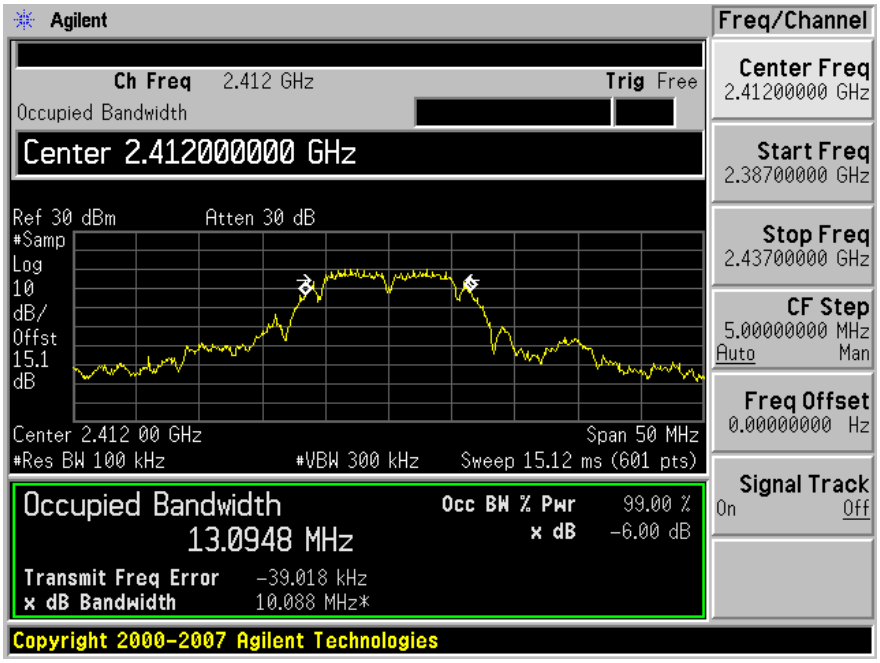


High Channel 2462 MHz

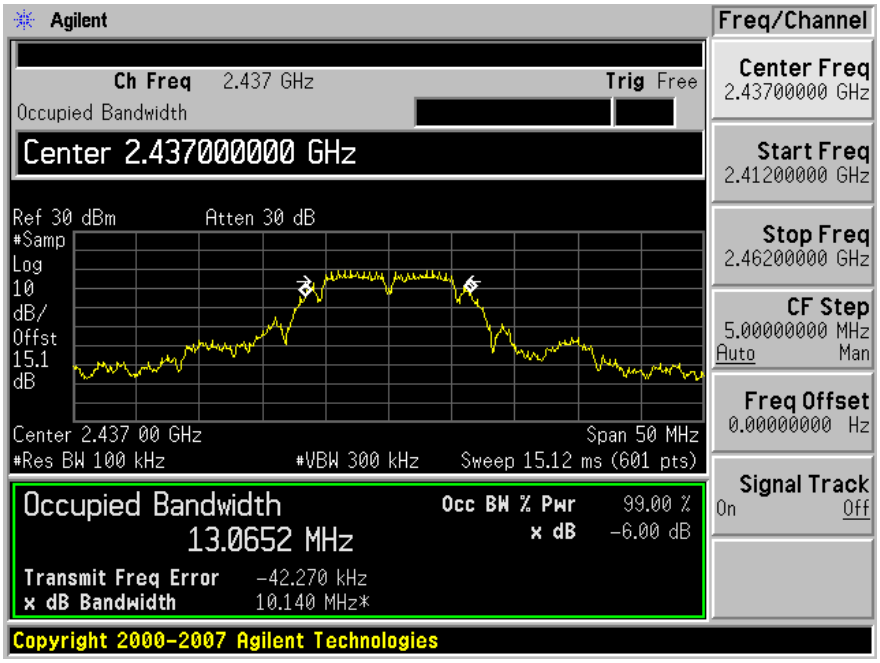


802.11 b (Antenna #1)

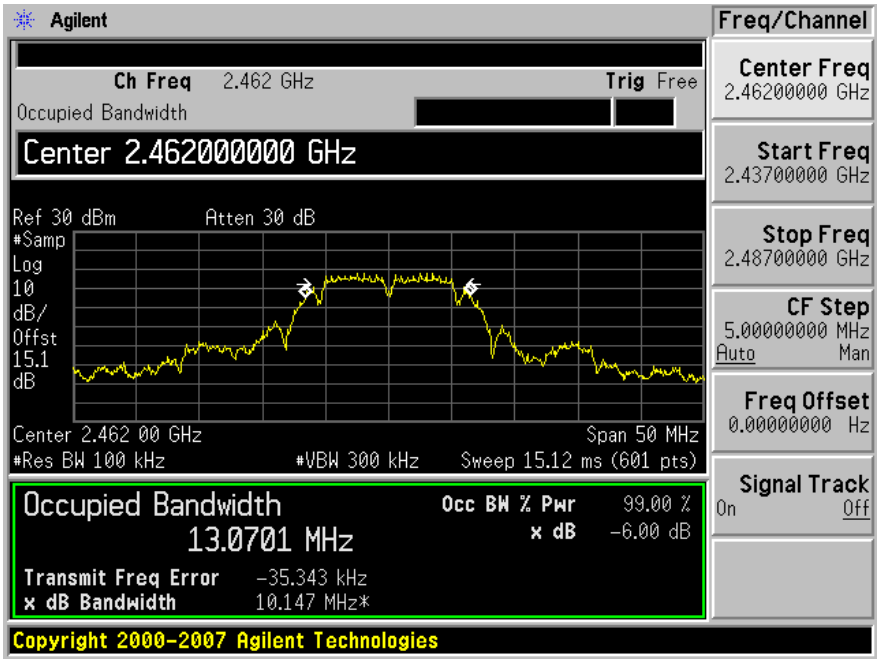
Low Channel 2412 MHz



Middle Channel 2437 MHz

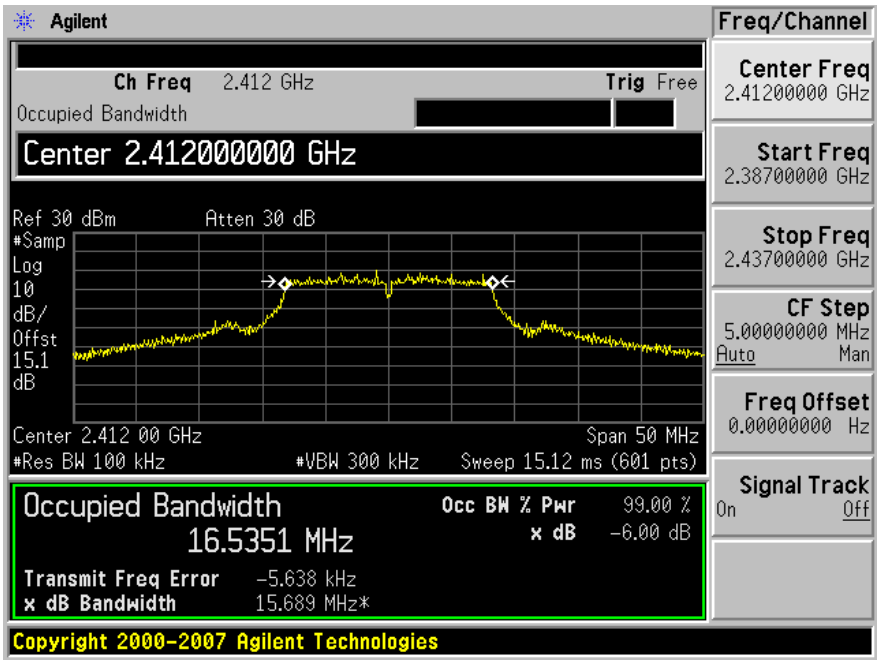


High Channel 2462 MHz

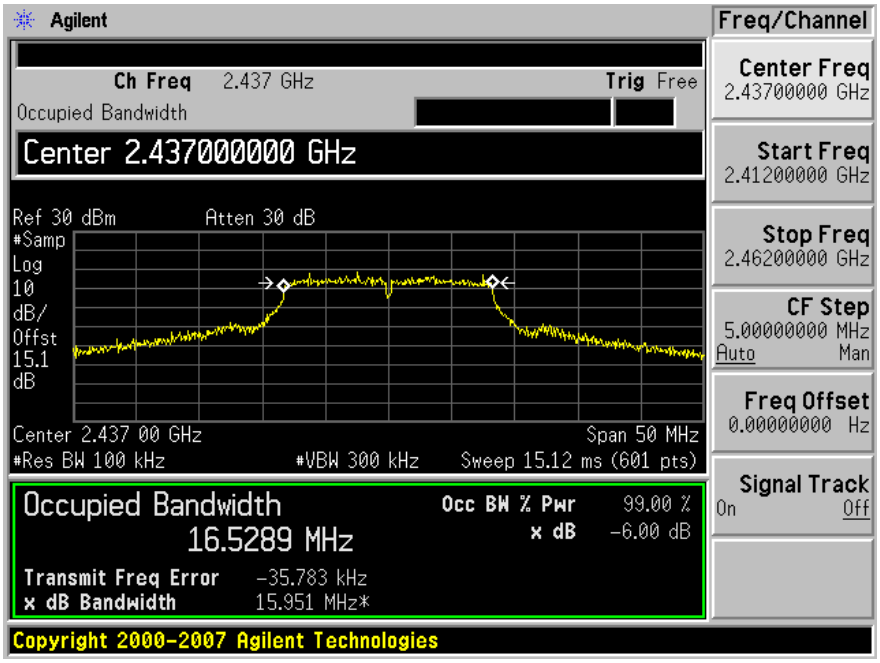


802.11 g (Antenna #0)

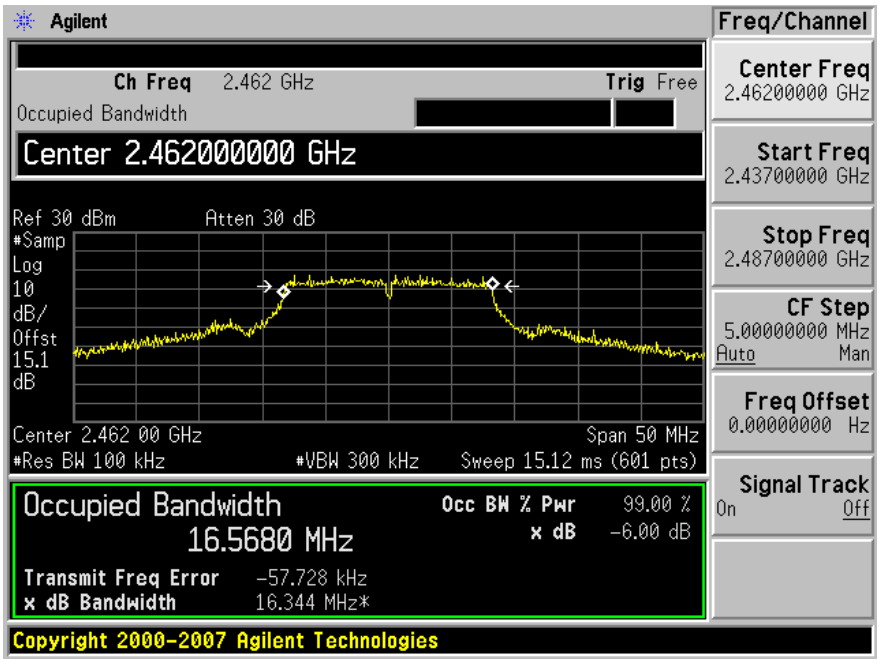
Low Channel 2412 MHz



Middle Channel 2437 MHz

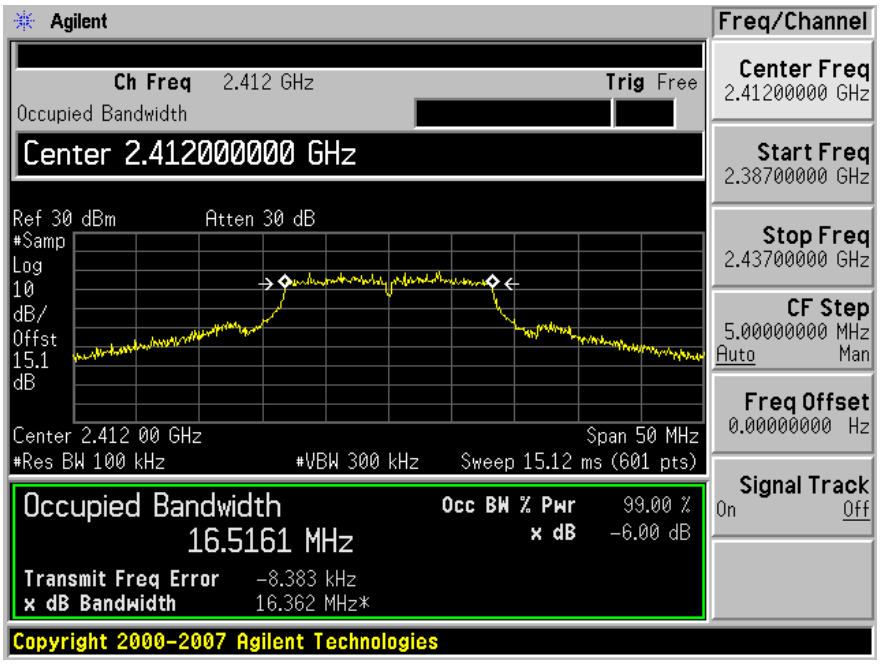


High Channel 2462 MHz

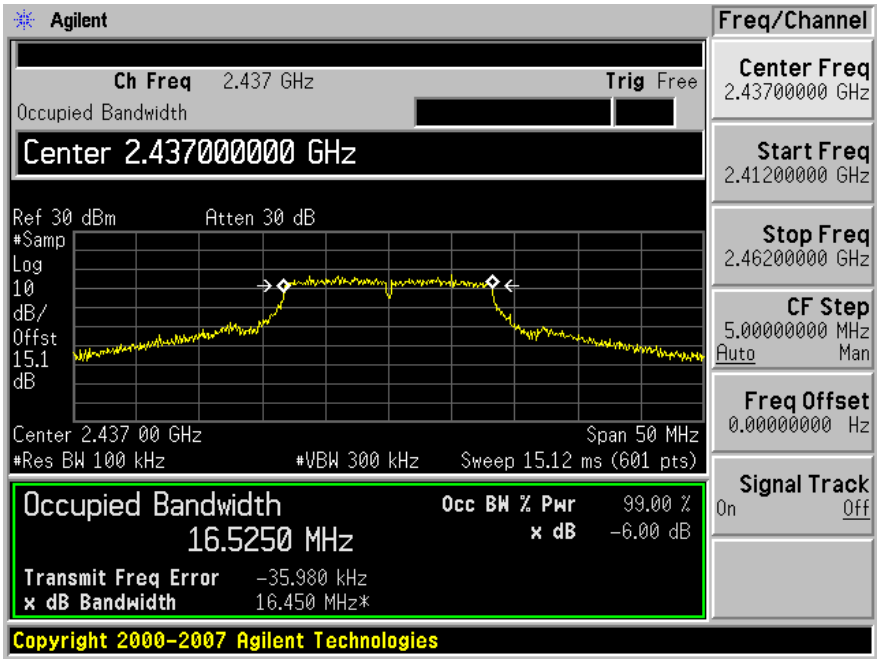


802.11 g (Antenna #1)

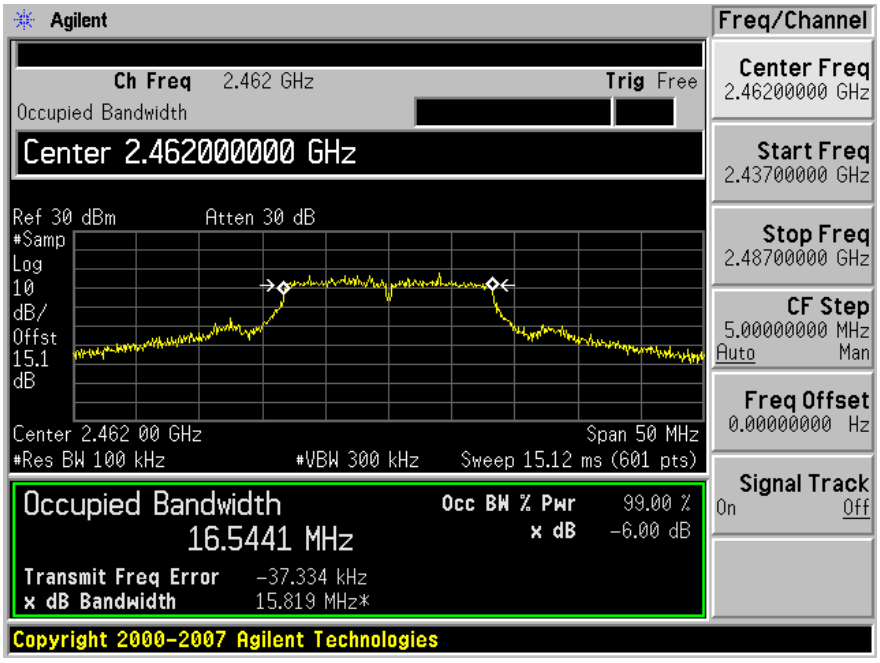
Low Channel 2412 MHz



Middle Channel 2437 MHz

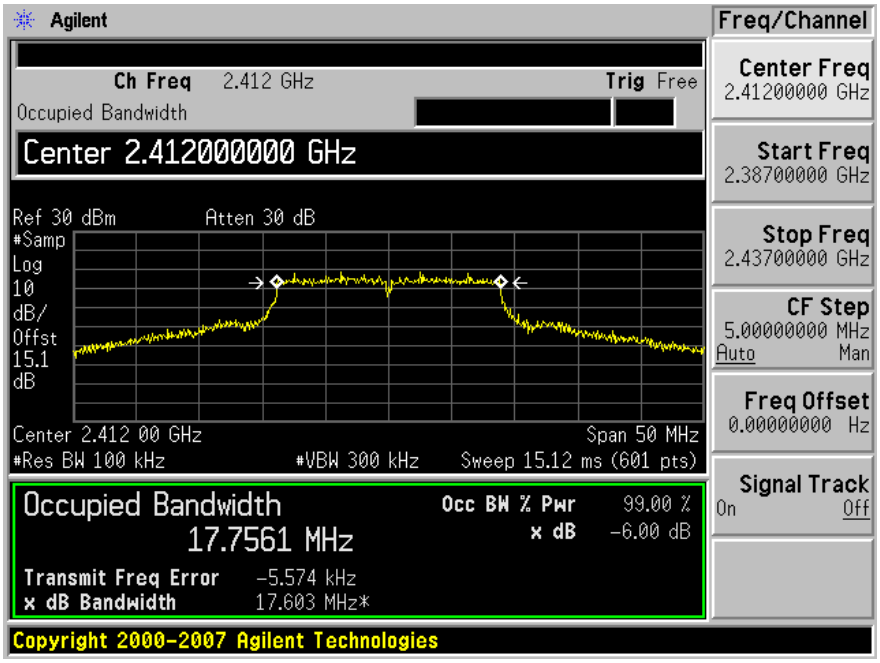


High Channel 2462 MHz

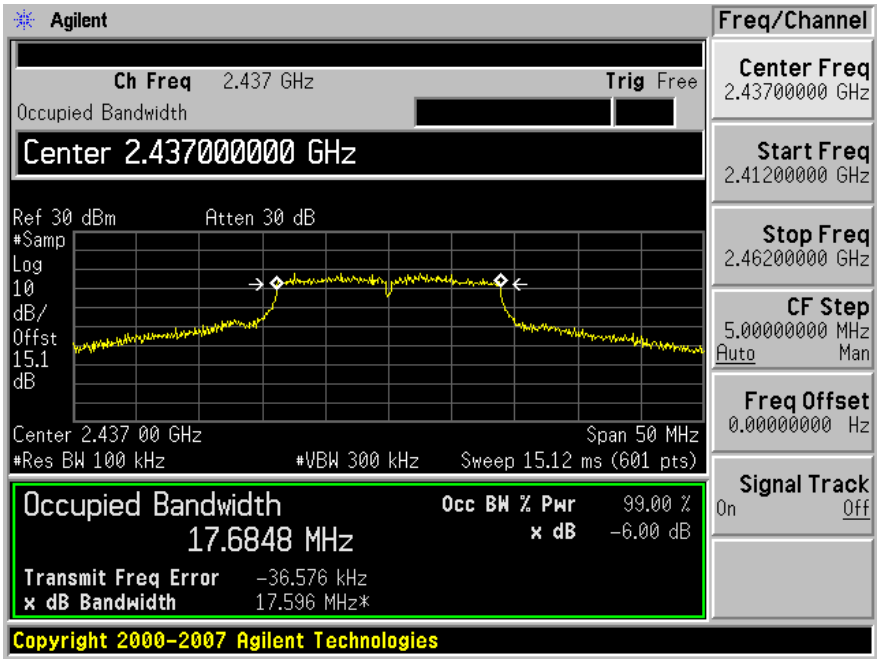


802.11 n 20 MHz (Antenna #0)

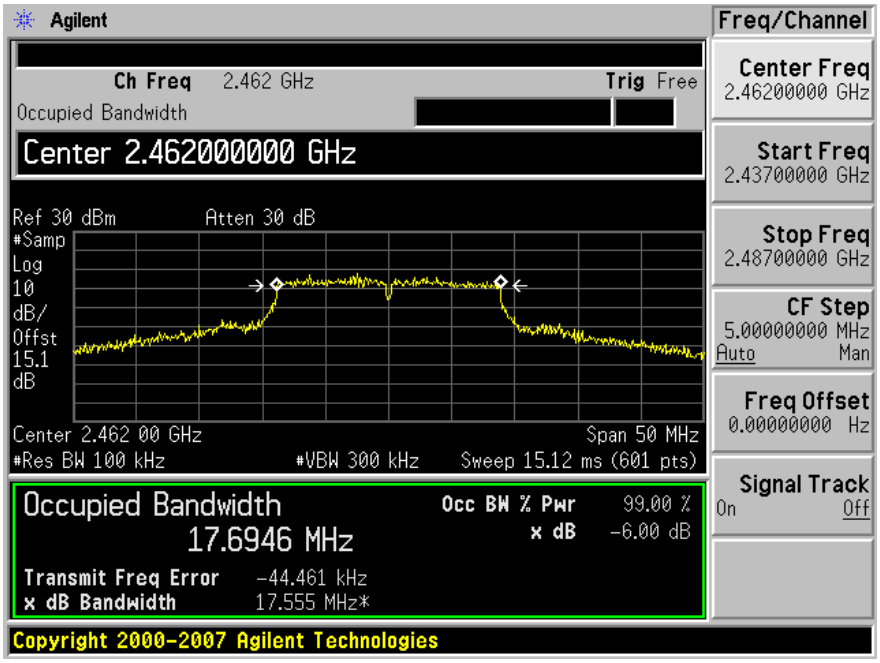
Low Channel 2412 MHz



Middle Channel 2437 MHz

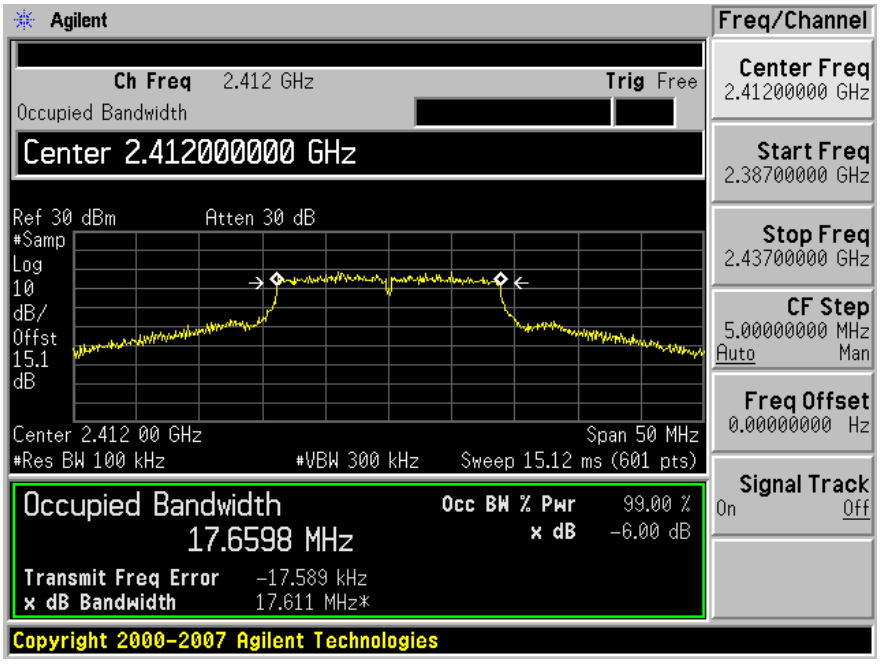


High Channel 2462 MHz

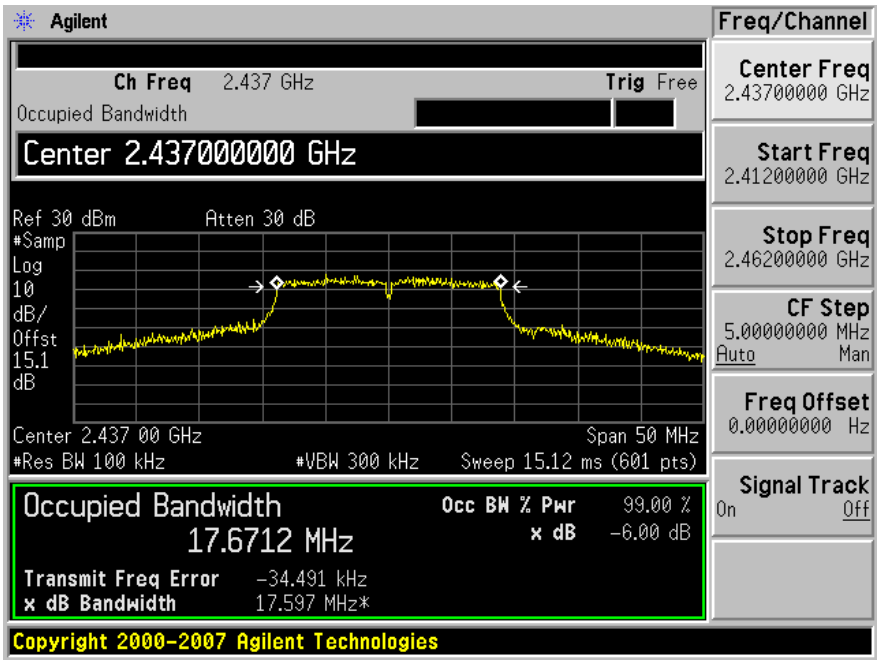


802.11 n 20 MHz (Antenna #1)

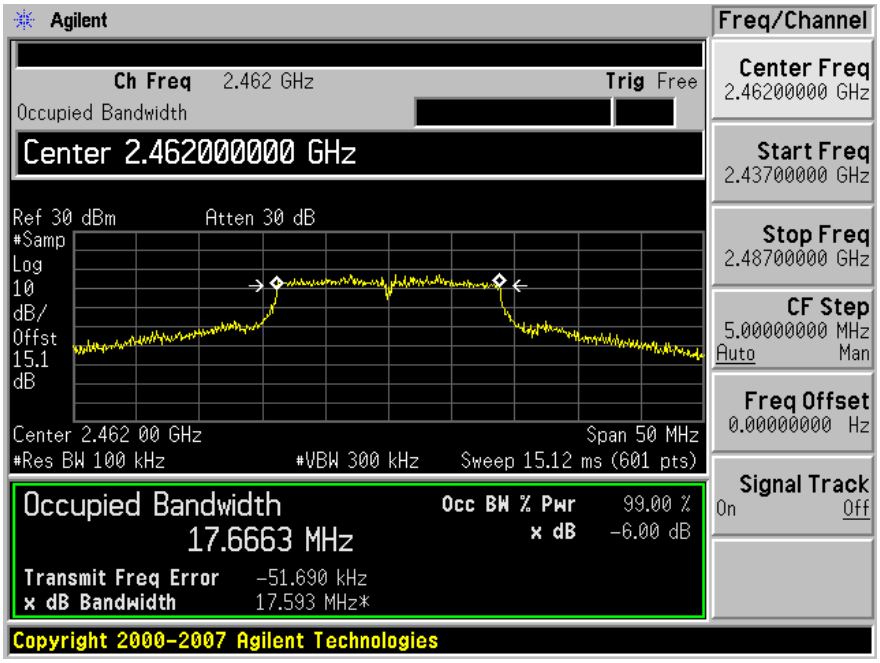
Low Channel 2412 MHz



Middle Channel 2437 MHz

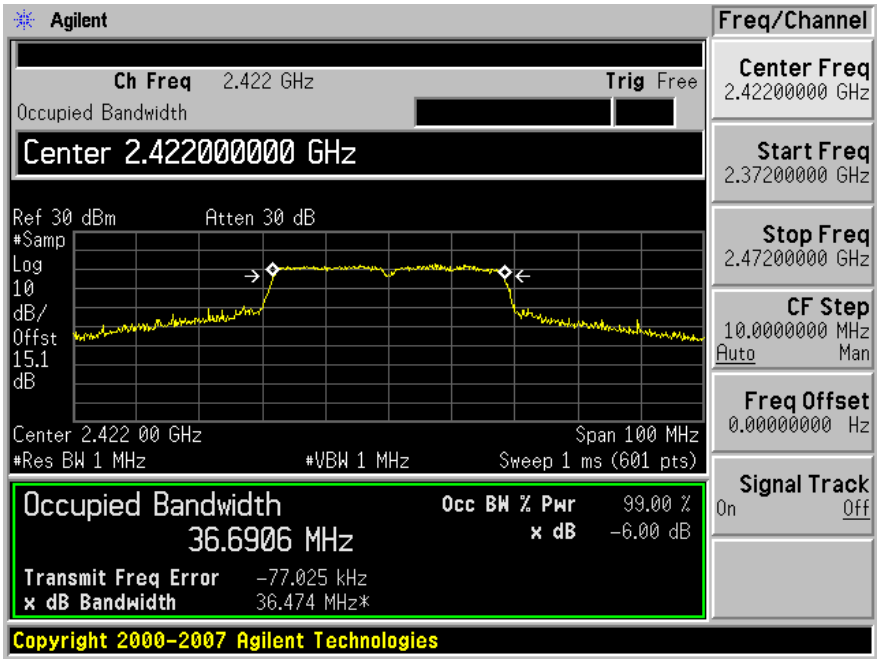


High Channel 2462 MHz

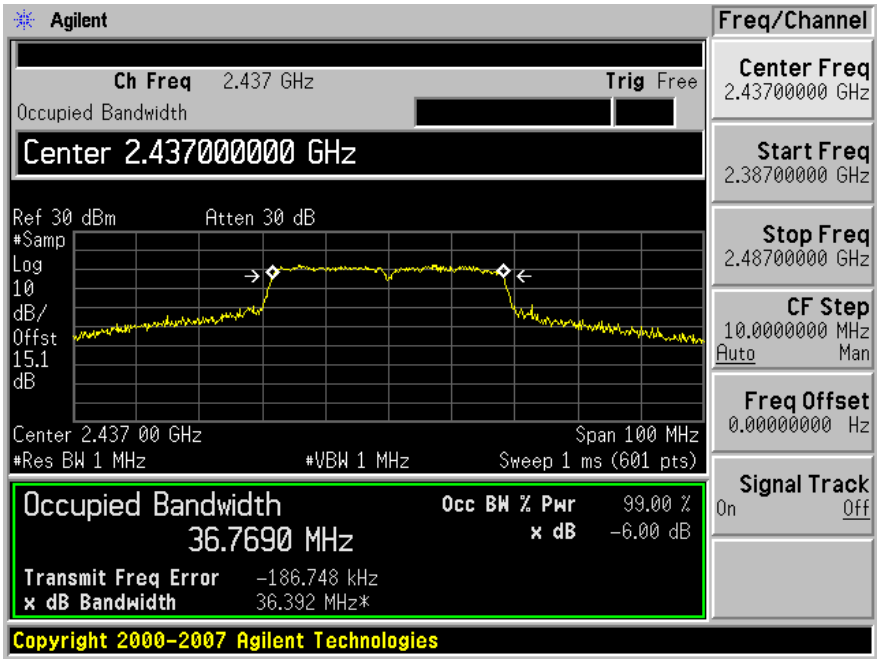


802.11 n 40 MHz (Antenna #0)

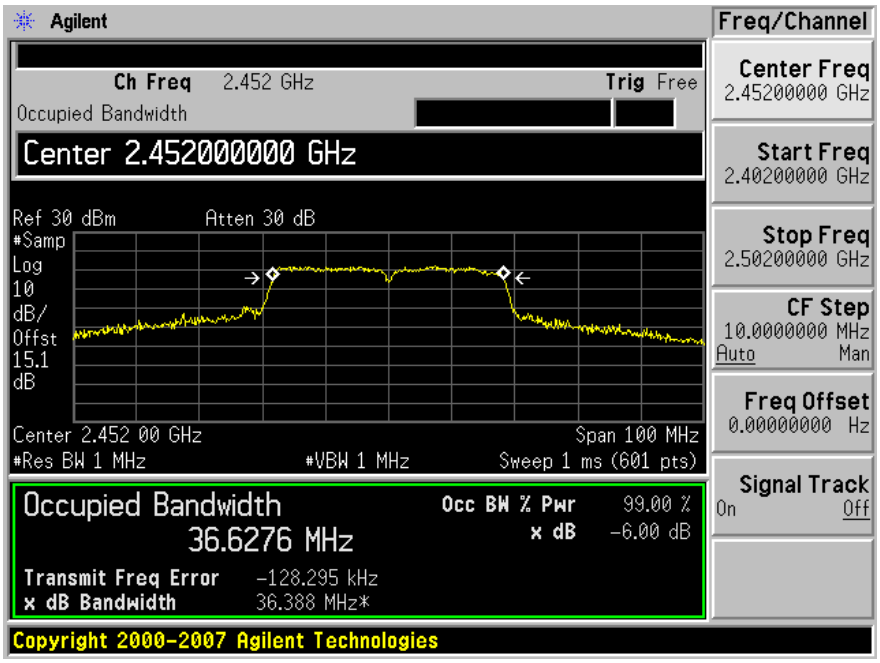
Low Channel 2422 MHz



Middle Channel 2437 MHz

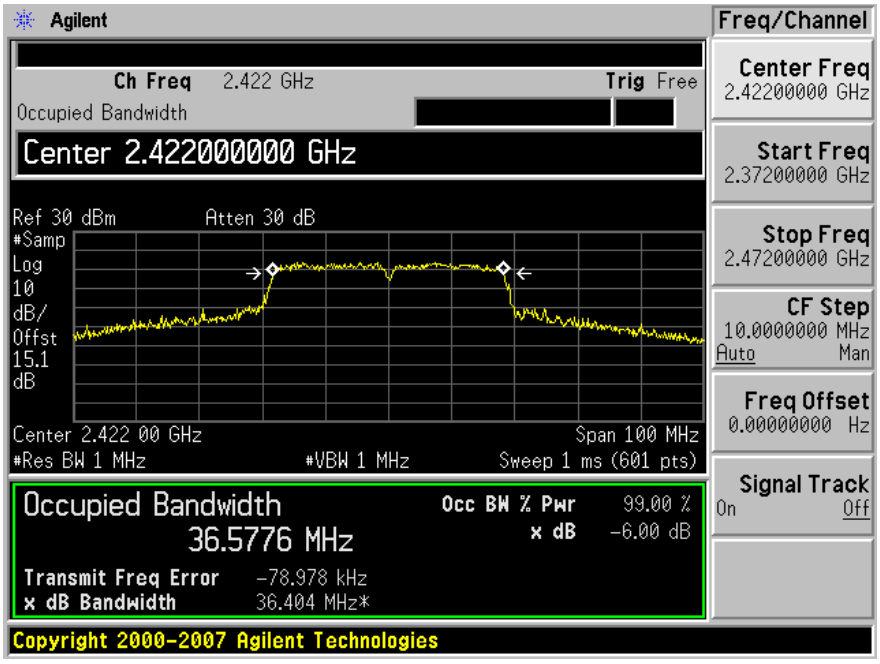


High Channel 2452 MHz

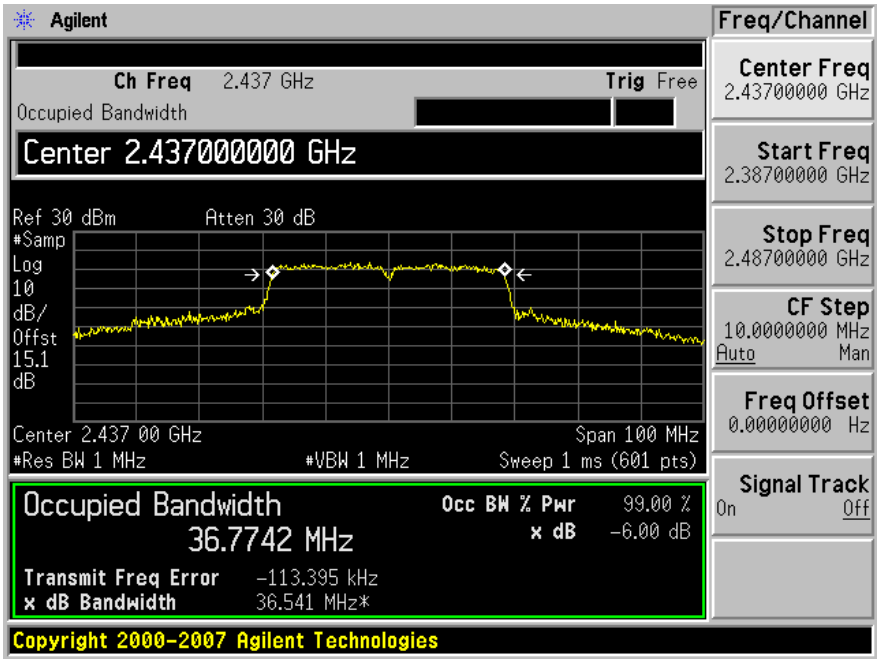


802.11 n 40MHz (Antenna #1)

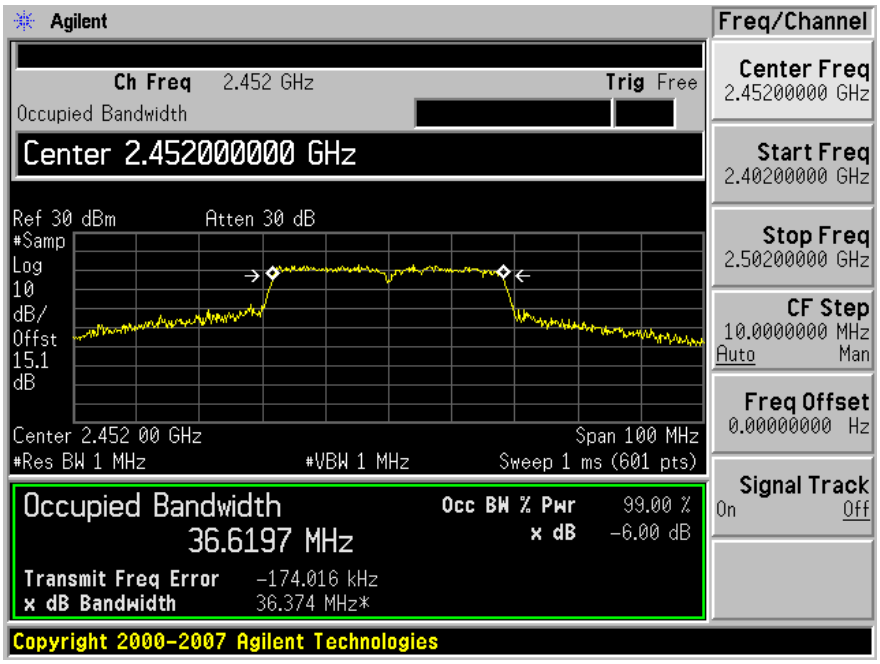
Low Channel 2422 MHz



Middle Channel 2437 MHz



High Channel 2452MHz



10 §15.247(b) - Peak Output Power Measurement

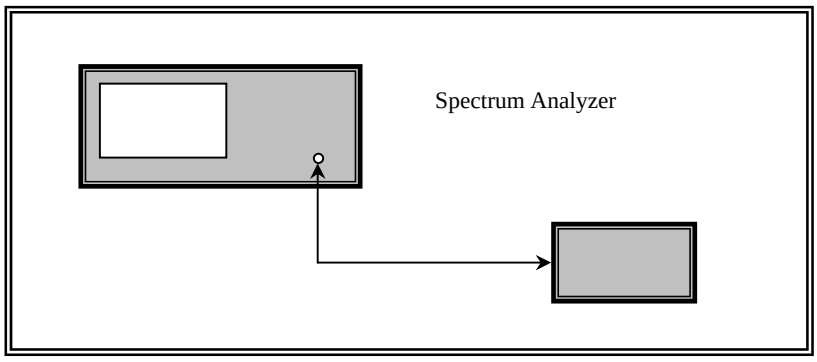
10.1 Applicable Standard

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

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

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	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28

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

10.4 Environmental Conditions

Temperature:	18-22 °C
Relative Humidity:	40-44 %
ATM Pressure:	101-103kPa

**The testing was performed by Victor Zhang from 2009-04-20 to 2009-04-24.*

10.5 Summary of Test Results

802.11 b mode:

Channel	Frequency (MHz)	Output Power Chain 0 (dBm)	Output Power Chain 1 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	19.96	20.22	23.10	28	4.90
Mid	2437	19.39	19.13	22.27	28	5.73
High	2462	18.98	18.27	21.65	28	6.35

802.11 g mode:

Channel	Frequency (MHz)	Output Power Chain 0 (dBm)	Output Power Chain 1 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	19.87	20.41	23.16	28	4.84
Mid	2437	19.48	19.36	22.43	28	5.57
High	2462	18.92	18.30	21.63	28	6.37

802.11 n 20 MHz mode:

Channel	Frequency (MHz)	Output Power Chain 0 (dBm)	Output Power Chain 1 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	20.69	21.05	23.88	28	4.12
Mid	2437	20.24	19.85	23.06	28	4.94
High	2462	19.75	18.91	22.36	28	5.64

802.11 n 40 MHz Mode:

Channel	Frequency (MHz)	Output Power Chain 0 (dBm)	Output Power Chain 1 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2422	19.07	20.09	22.62	28	5.38
Mid	2437	18.76	19.38	22.09	28	5.91
High	2452	18.45	18.93	21.71	28	6.29

Note: The maximum antenna gain is 5 dBi, antenna number is 2
the effective gain of antenna is $5 + 10\log 2 = 8$ dBi which is over 2 dBi of 6 dBi, therefore the limit is $30 - 2 = 28$ dBm

11 §15.247(d) - 100 kHz Bandwidth of Band Edges

11.1 Applicable Standard

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c)).

11.2 Measurement Procedure

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

11.3 Test Equipment List and Details

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

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

11.4 Environmental Conditions

Temperature:	18-22 °C
Relative Humidity:	40-44 %
ATM Pressure:	101-103kPa

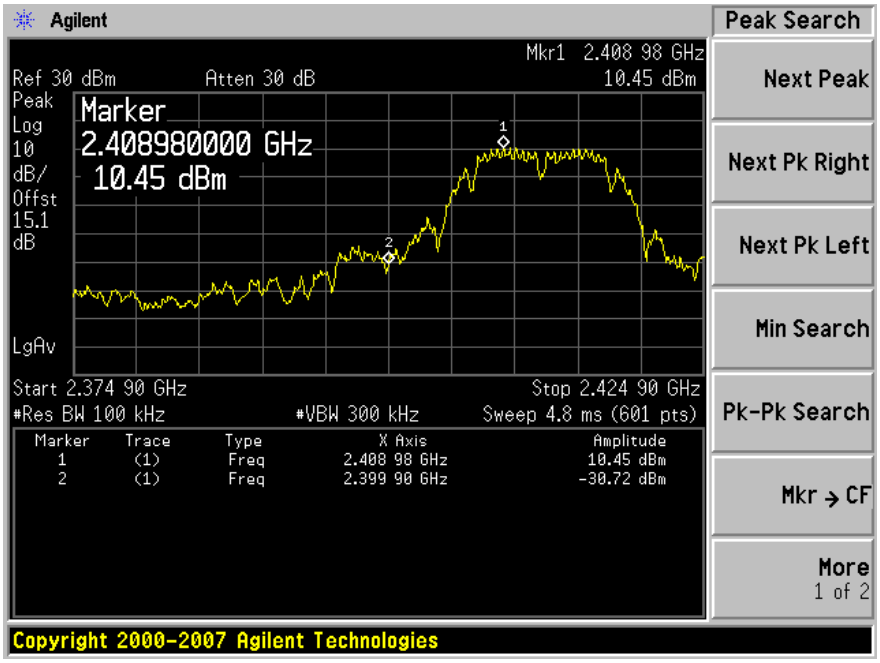
**The testing was performed by Victor Zhang from 2009-04-20 to 2009-04-24.*

11.5 Measurement Results

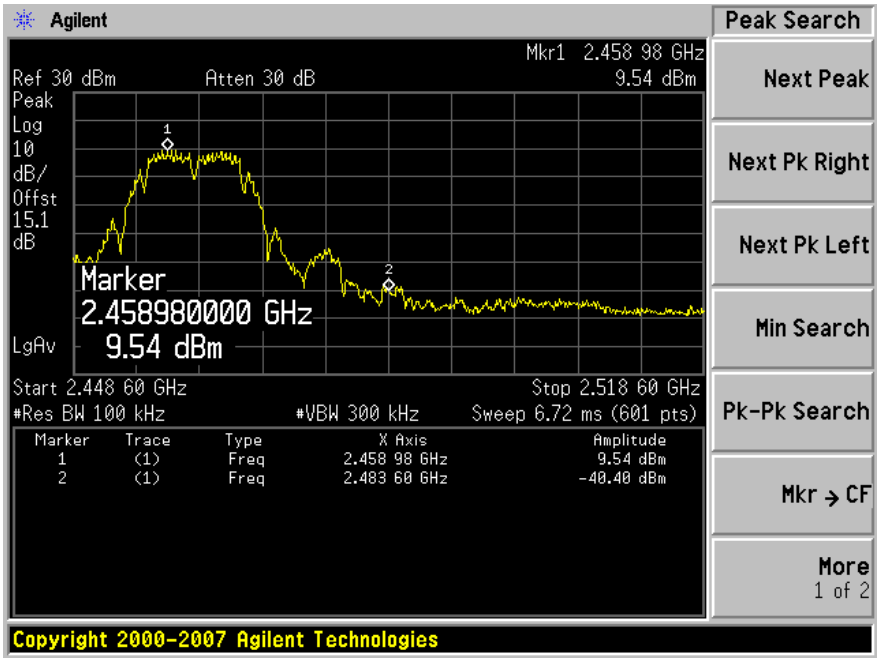
Please refer to following pages for plots of band edge.

802.11 b – Antenna #0

Low Band Edge

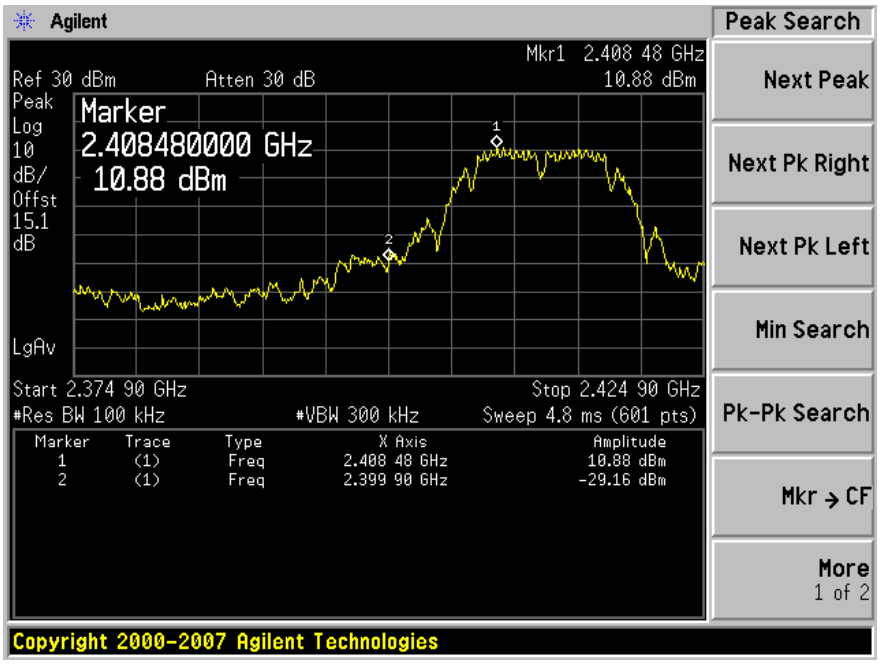


High Band Edge

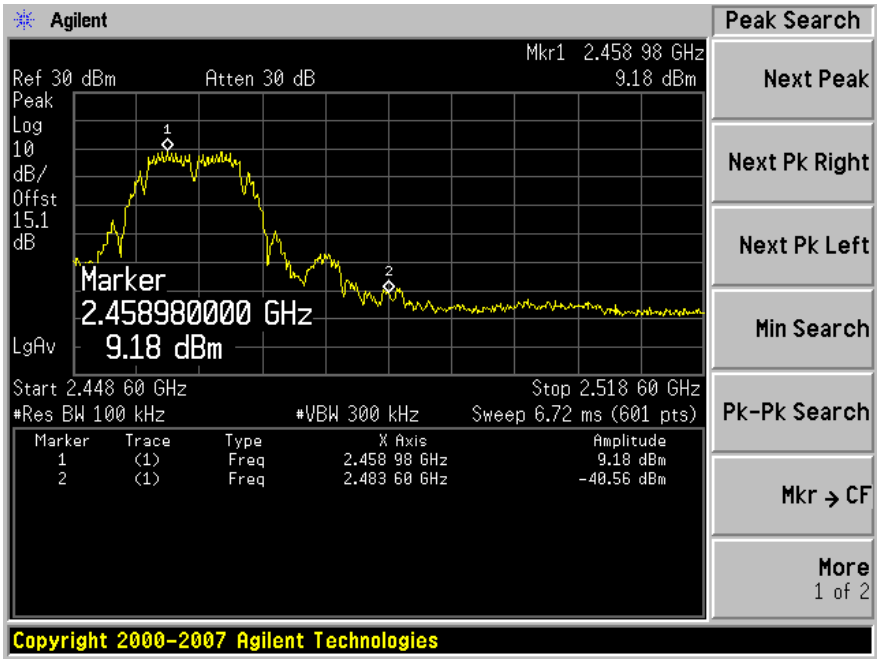


802.11 b – Antenna #1

Low Band Edge

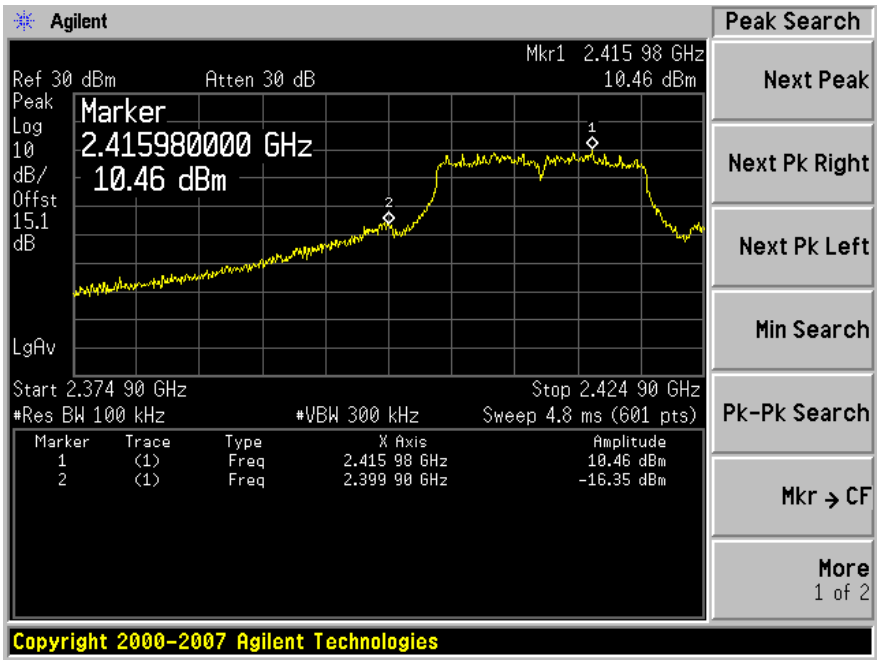


High Band Edge

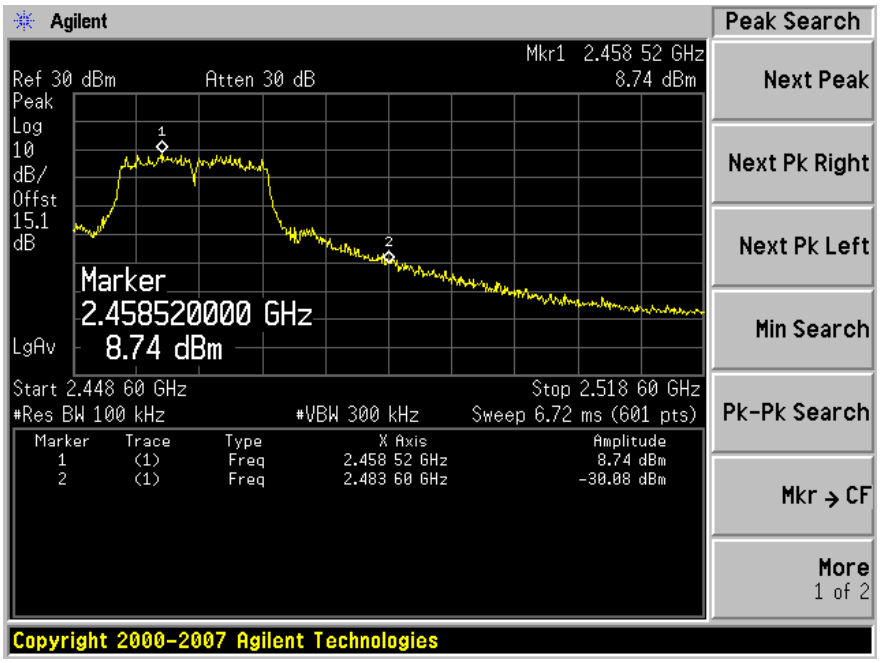


802.11 g – Antenna #0

Low Band Edge

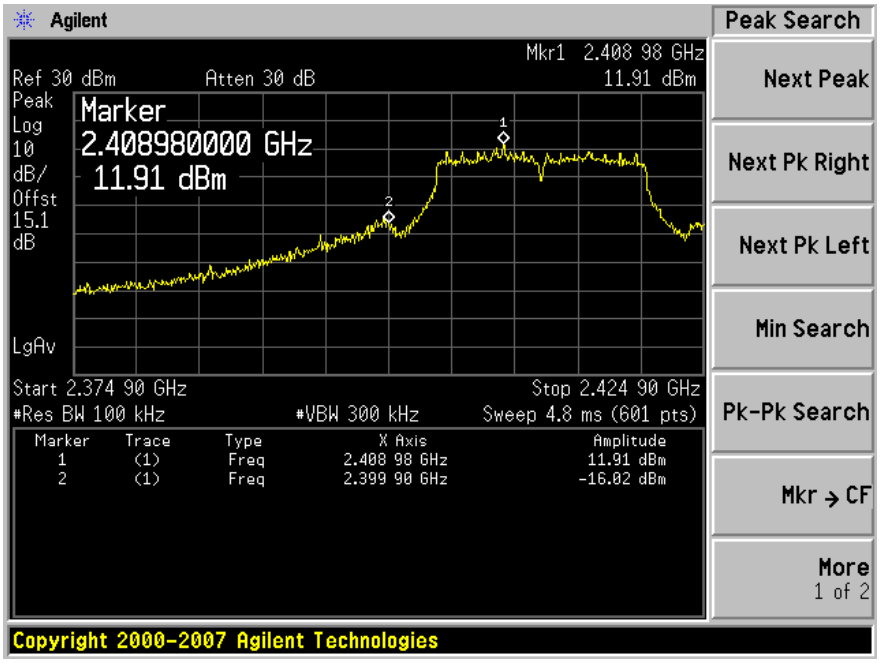


High Band Edge

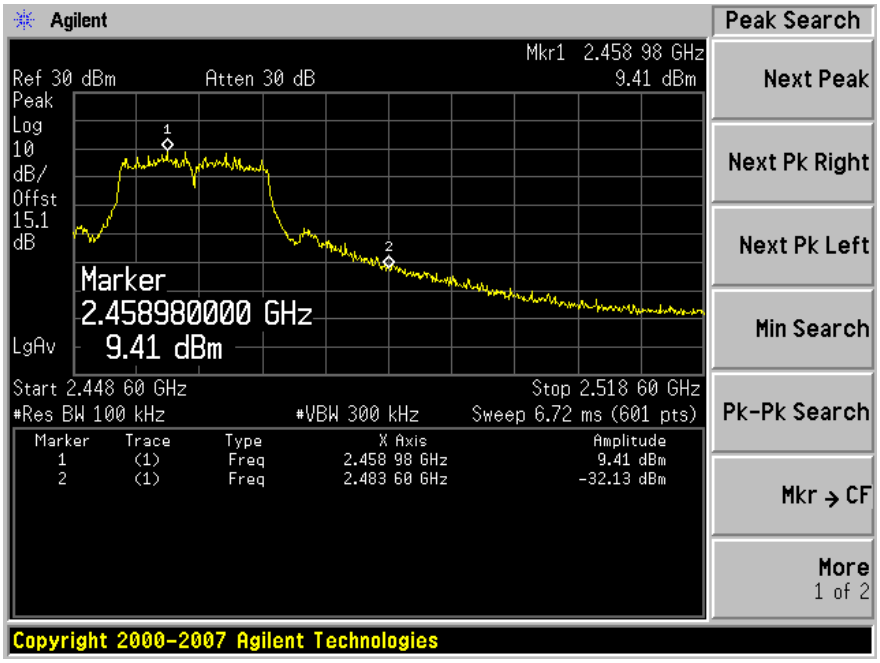


802.11 g – Antenna #1

Low Band Edge

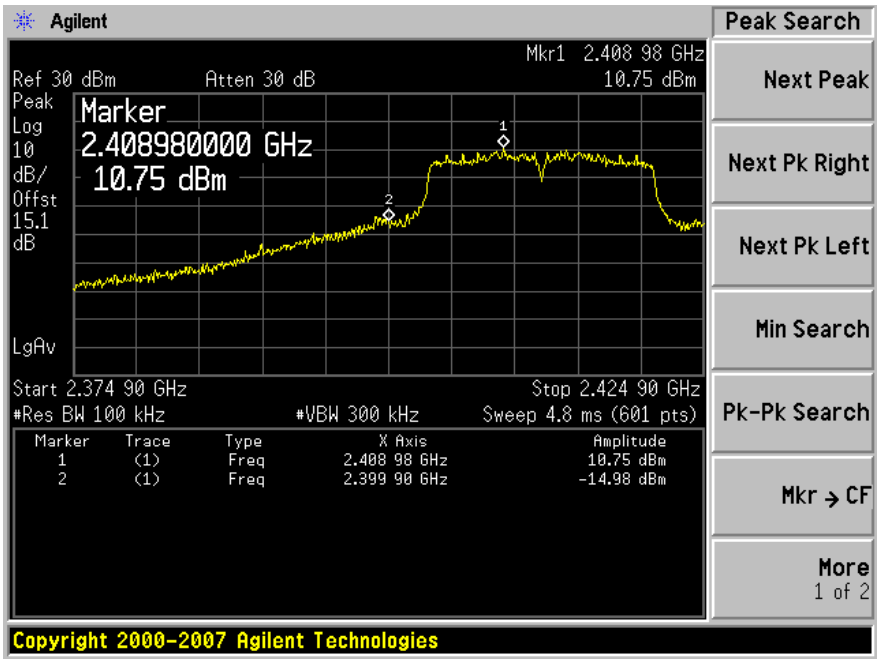


High Band Edge

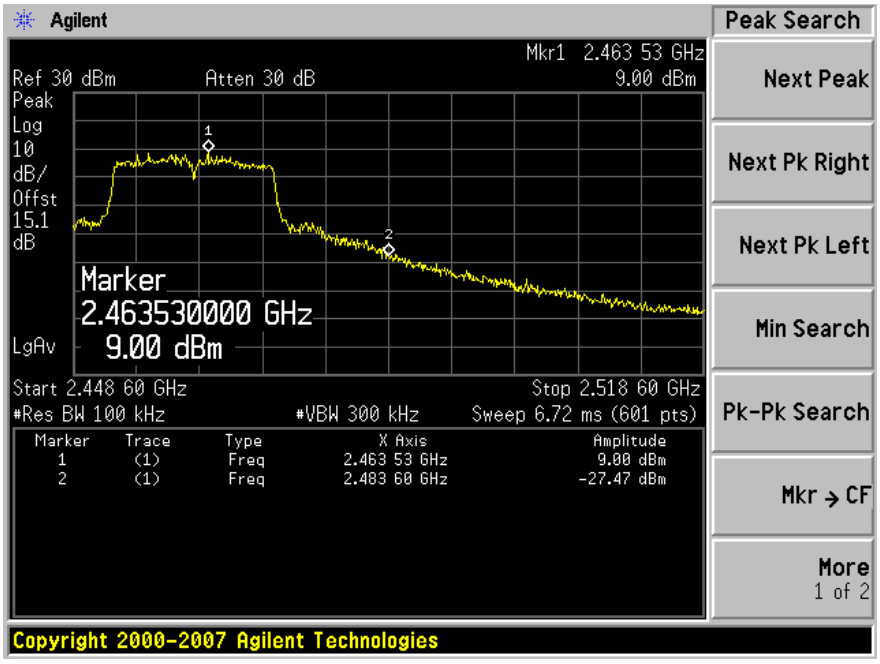


802.11 n 20 MHz – Antenna #0

Low Band Edge

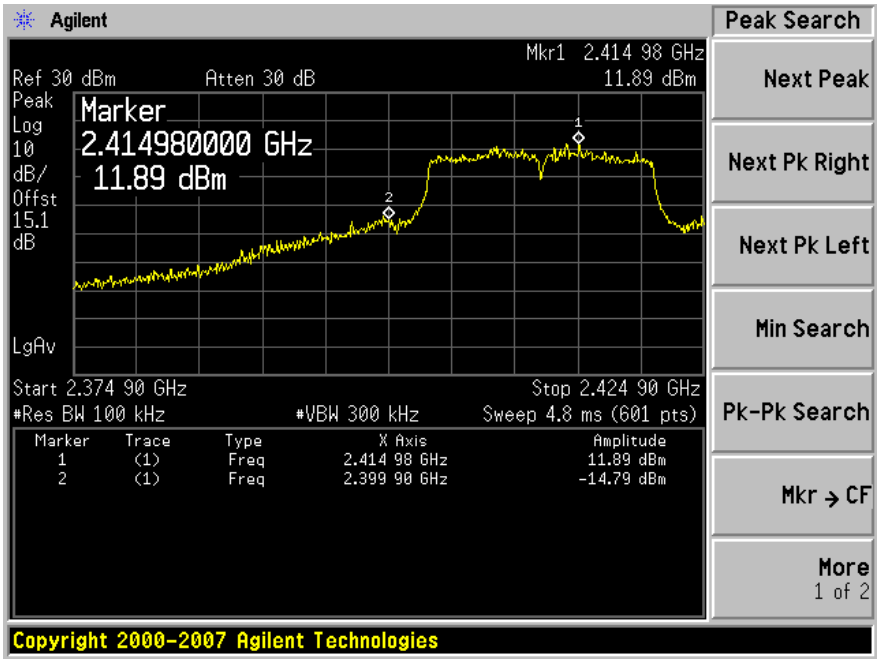


High Band Edge

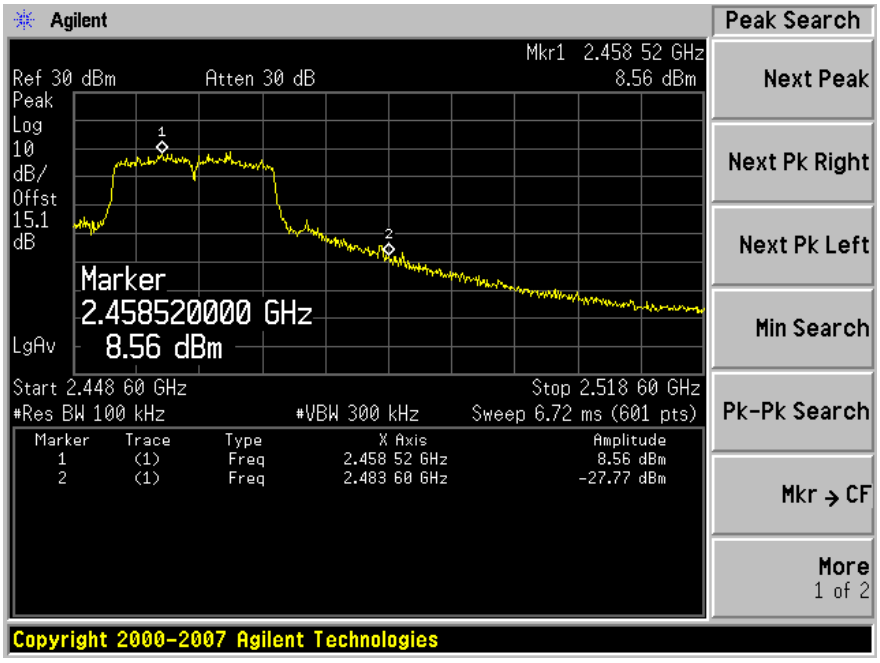


802.11 n 20 MHz – Antenna #1

Low Band Edge

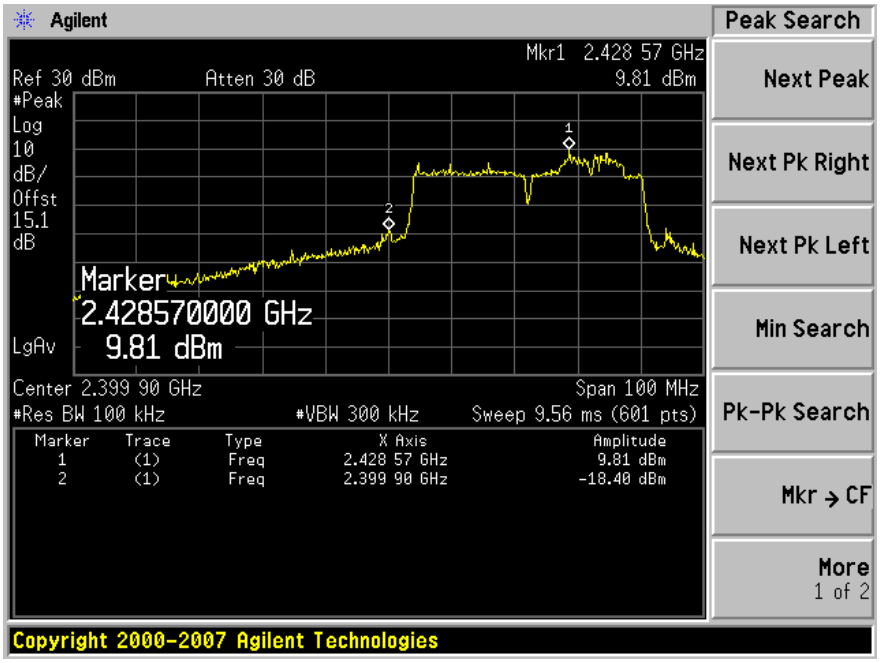


High Band Edge

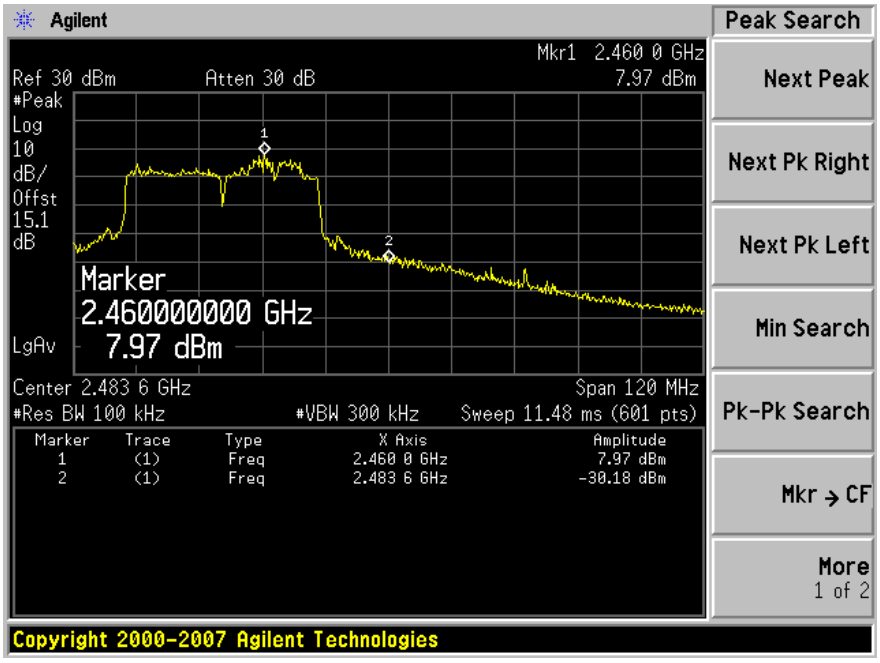


802.11 n 40 MHz – Antenna #0

Low Band Edge

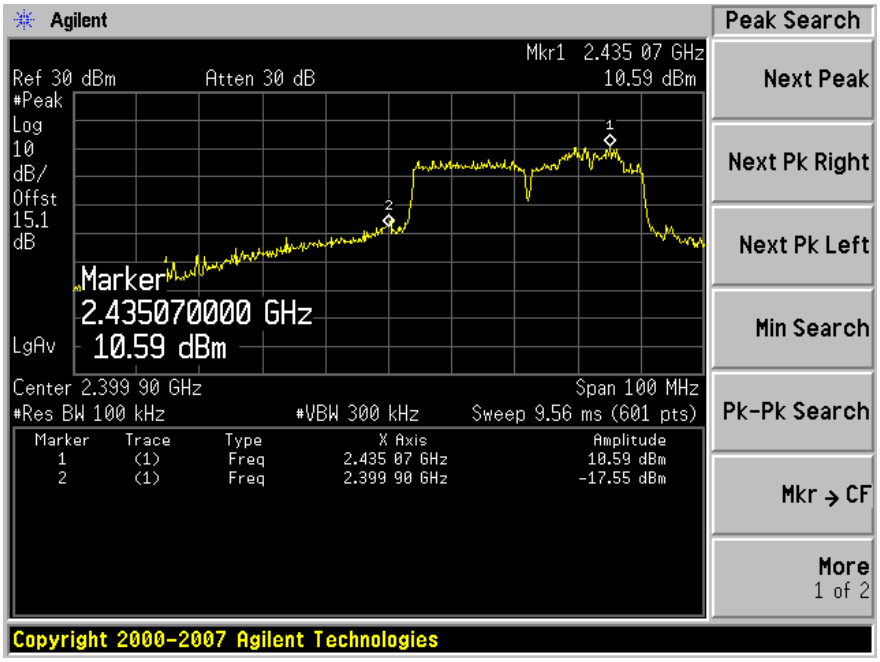


High Band Edge

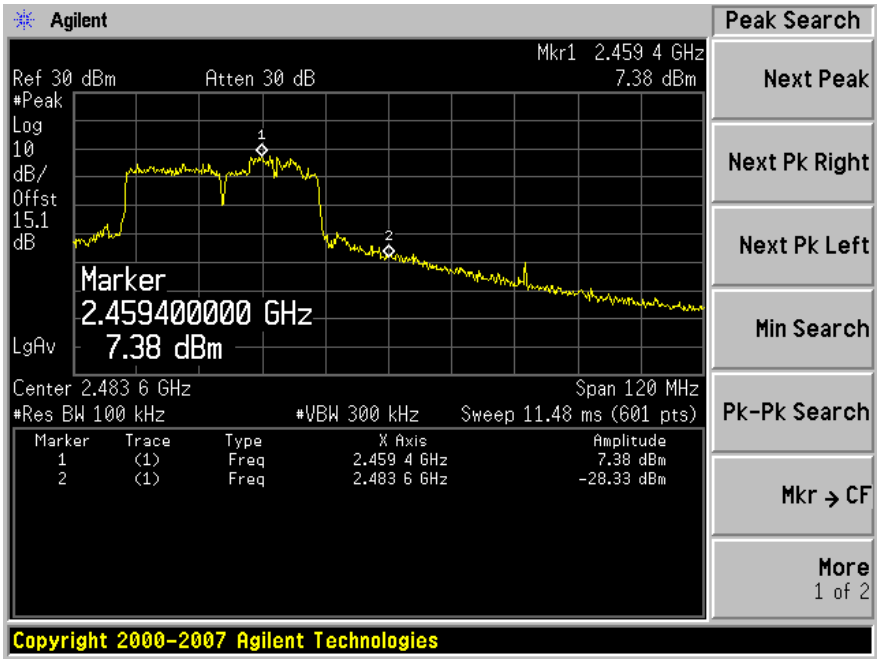


802.11 n 40 MHz – Antenna #1

Low Band Edge



High Band Edge



12 §15.247(e) - Power Spectral Density

12.1 Applicable Standard

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

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	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2008-04-28

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

12.4 Environmental Conditions

Temperature:	18-22 °C
Relative Humidity:	40-44 %
ATM Pressure:	101-103kPa

**The testing was performed by Victor Zhang from 2009-04-20 to 2009-04-24.*

12.5 Summary of Test Results

802.11 b mode:

Antenna #0

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2412	-6.30	8	Compliant
Mid	2437	-6.02	8	Compliant
High	2462	-7.06	8	Compliant

Antenna #1

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2412	-6.20	8	Compliant
Mid	2437	-4.27	8	Compliant
High	2462	-8.09	8	Compliant

Antenna #0 + Antenna #1

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2412	-8.06	8	Compliant
Mid	2437	-6.51	8	Compliant
High	2462	-2.16	8	Compliant

802.11 g mode:

Antenna #0

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2412	-3.25	8	Compliant
Mid	2437	-6.82	8	Compliant
High	2462	-7.30	8	Compliant

Antenna #1

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2412	-5.23	8	Compliant
Mid	2437	-6.34	8	Compliant
High	2462	-8.27	8	Compliant

Antenna #0 + Antenna #1

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2412	-7.92	8	Compliant
Mid	2437	-1.02	8	Compliant
High	2462	-1.82	8	Compliant

802.11 n 20 MHz mode:

Antenna #0

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2412	-5.23	8	Compliant
Mid	2437	-6.59	8	Compliant
High	2462	-5.51	8	Compliant

Antenna #1

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2412	-6.07	8	Compliant
Mid	2437	-7.09	8	Compliant
High	2462	-8.91	8	Compliant

Antenna #0 + Antenna #1

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2412	-7.66	8	Compliant
Mid	2437	-4.79	8	Compliant
High	2462	-3.23	8	Compliant

802.11 n 40 MHz mode:

Antenna #0

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2422	-17.08	8	Compliant
Mid	2437	-15.20	8	Compliant
High	2452	-18.62	8	Compliant

Antenna #1

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2422	-14.99	8	Compliant
Mid	2437	-18.67	8	Compliant
High	2452	-20.02	8	Compliant

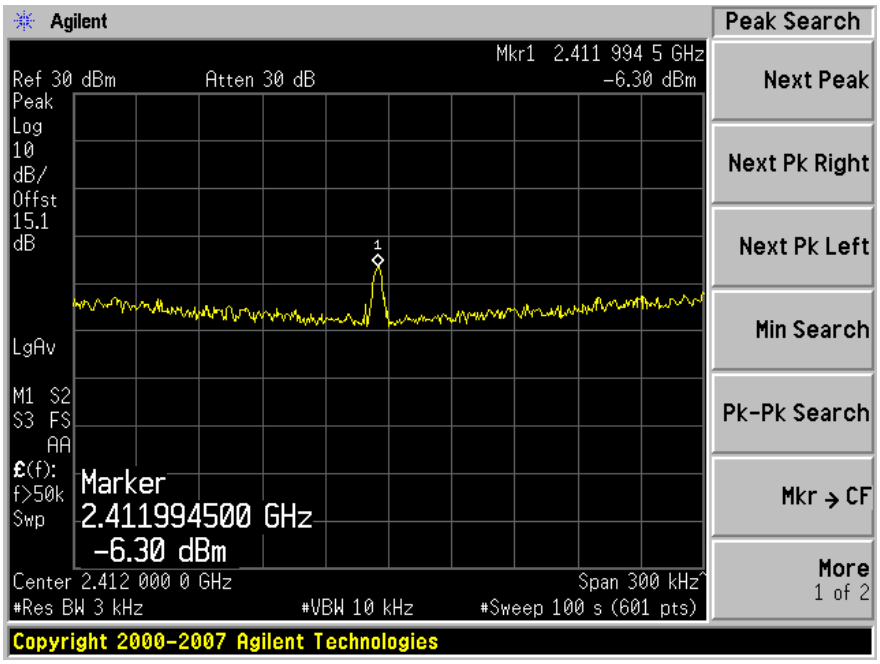
Antenna #0 + Antenna #1

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
Low	2422	-13.62	8	Compliant
Mid	2437	-12.90	8	Compliant
High	2452	-11.89	8	Compliant

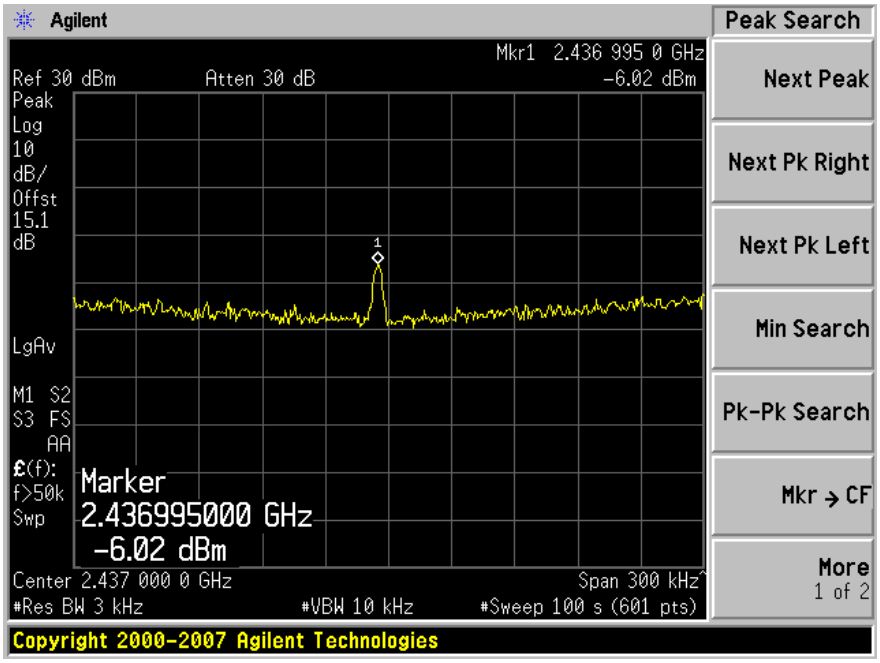
Please refer to the following plots for detailed test results

802.11 b (Antenna #0)

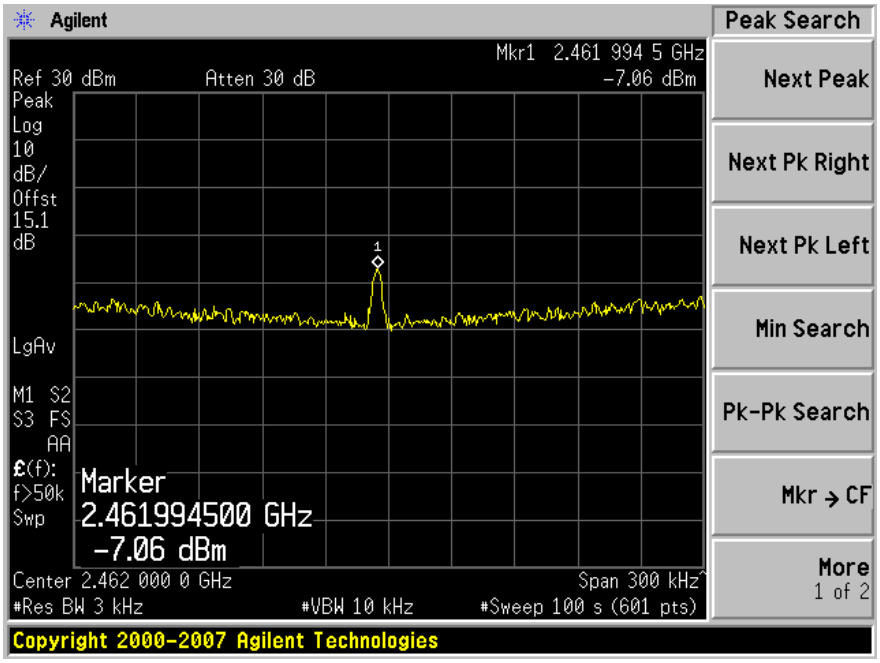
Low Channel 2412 MHz



Middle Channel 2437 MHz

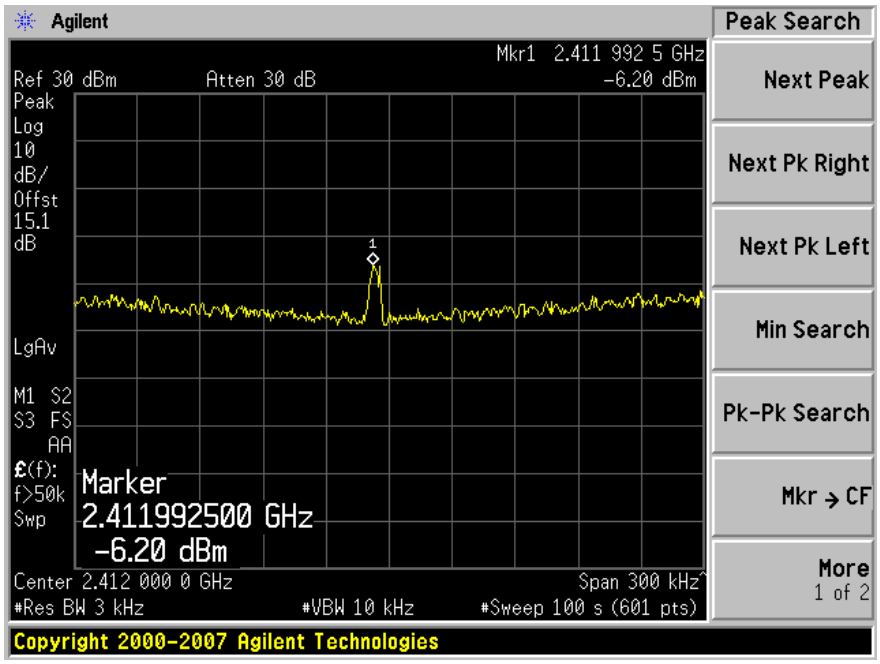


High Channel 2462 MHz

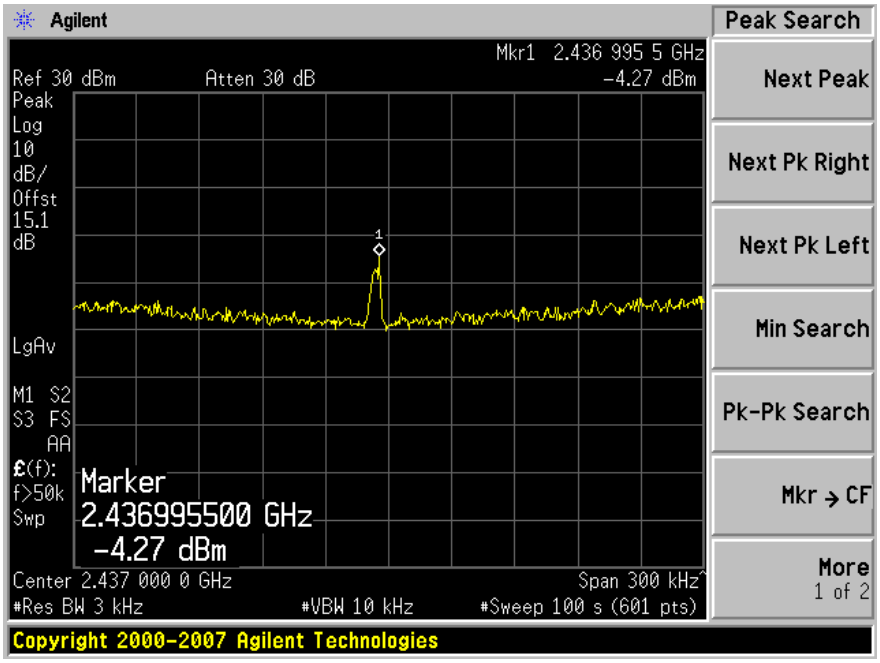


802.11 b (Antenna #1)

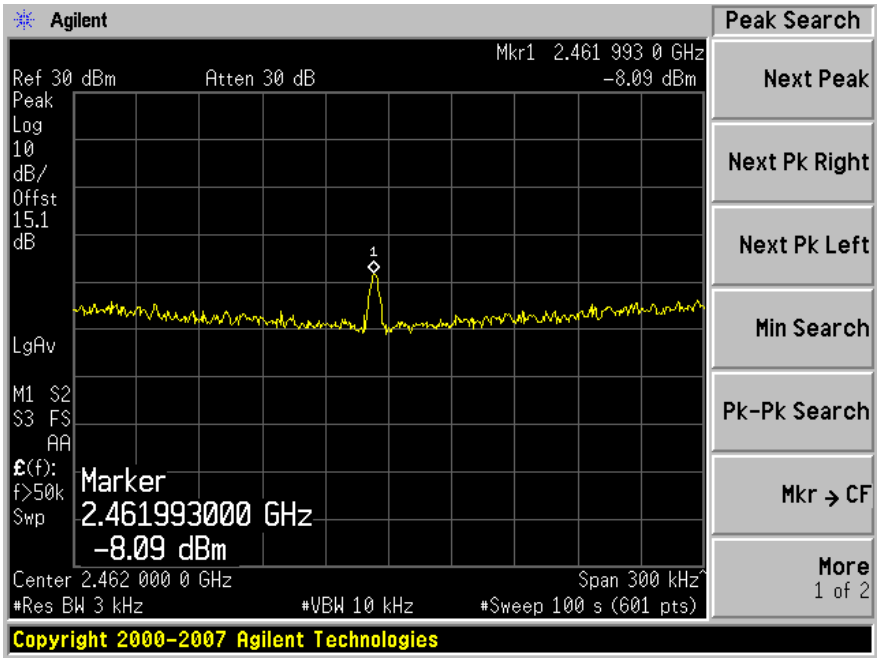
Low Channel 2412 MHz



Middle Channel 2437 MHz

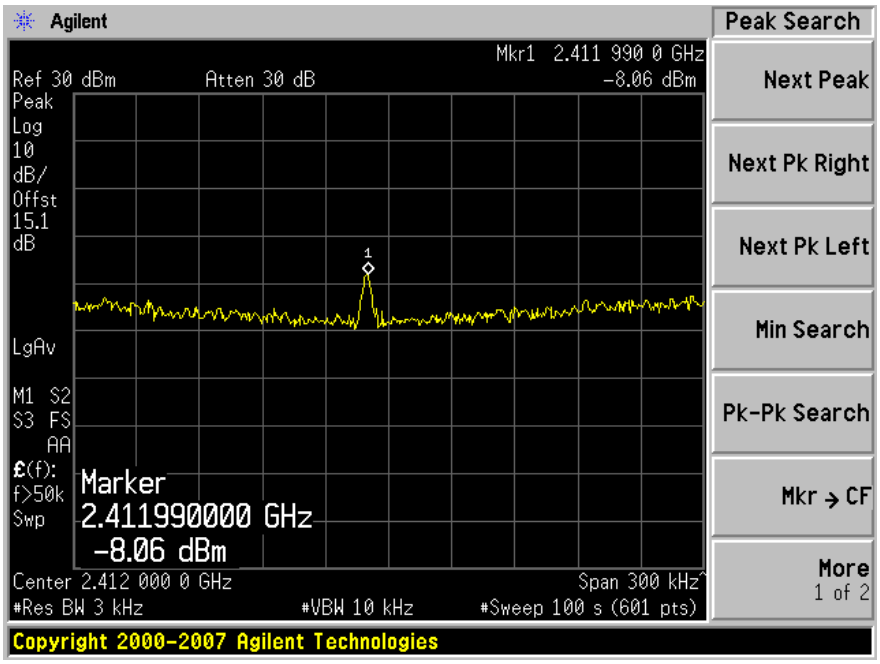


High Channel 2462 MHz

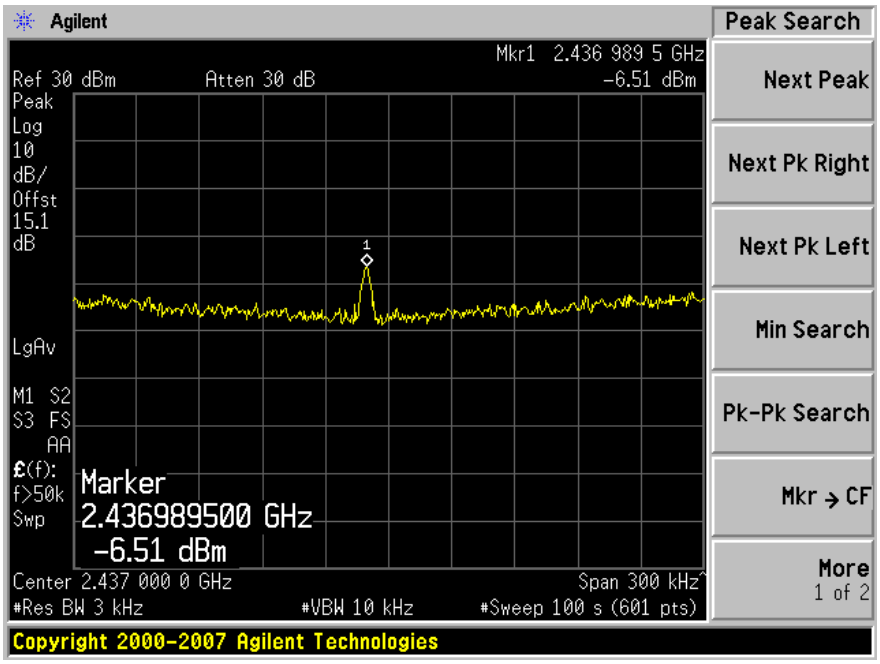


802.11 b (Antenna #0 + Antenna #1)

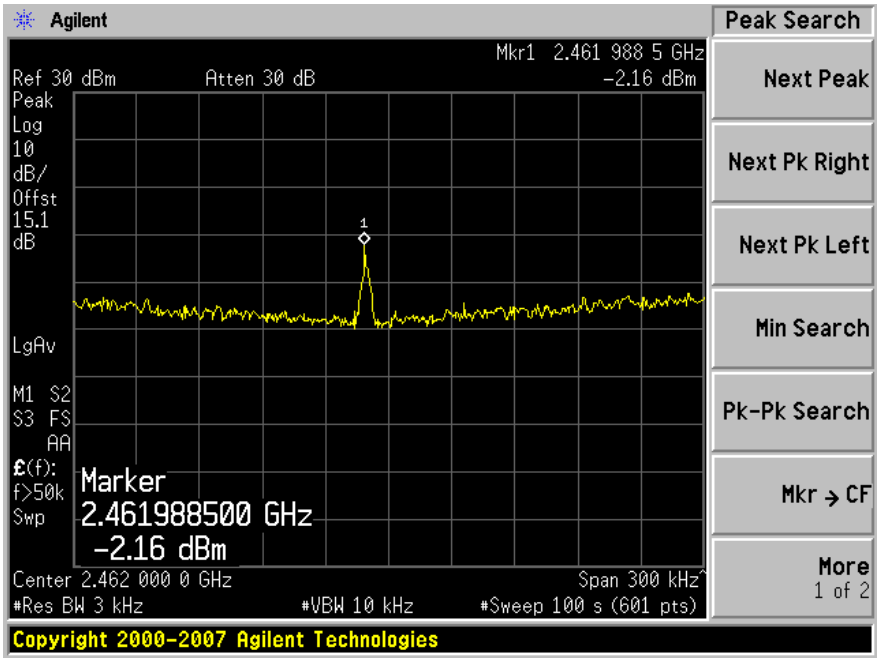
Low Channel 2412 MHz



Middle Channel 2437 MHz

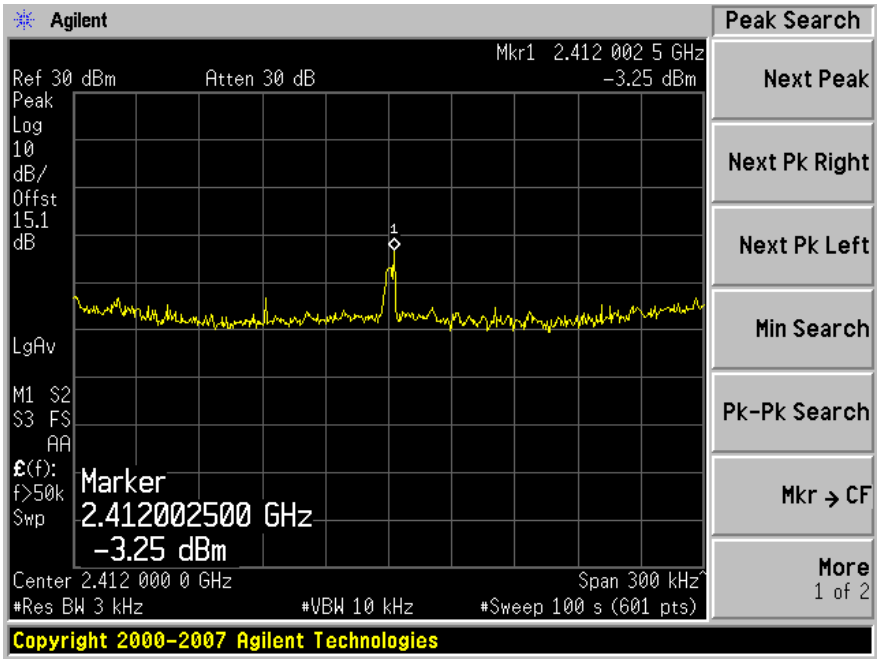


High Channel 2462 MHz

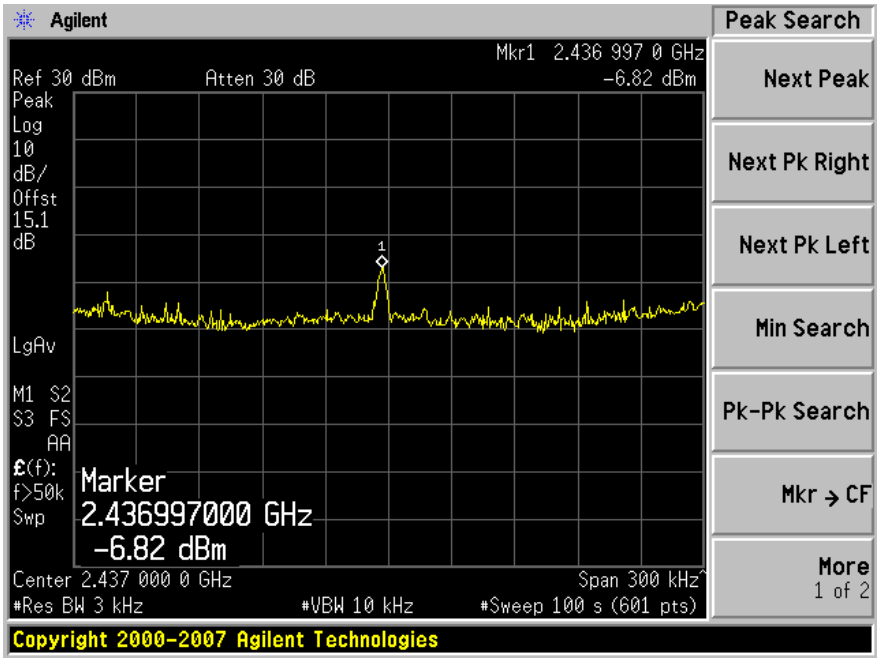


802.11 g (Antenna #0)

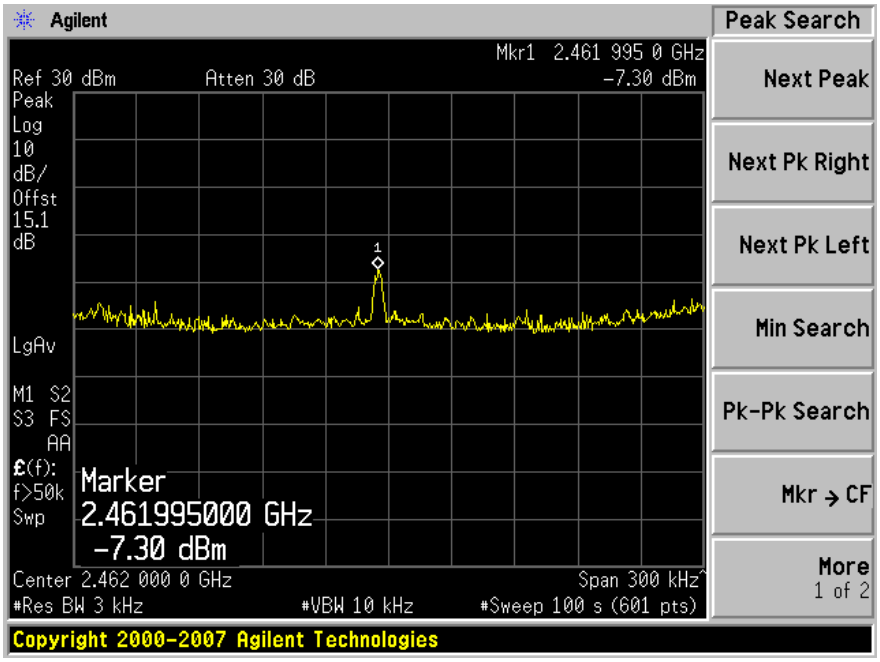
Low Channel 2412 MHz



Middle Channel 2437 MHz

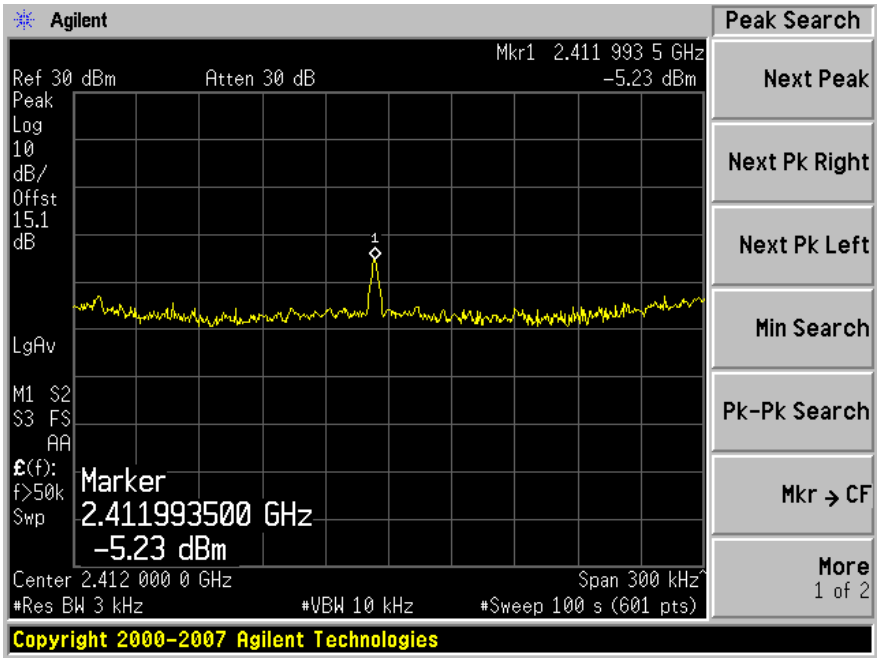


High Channel 2462 MHz

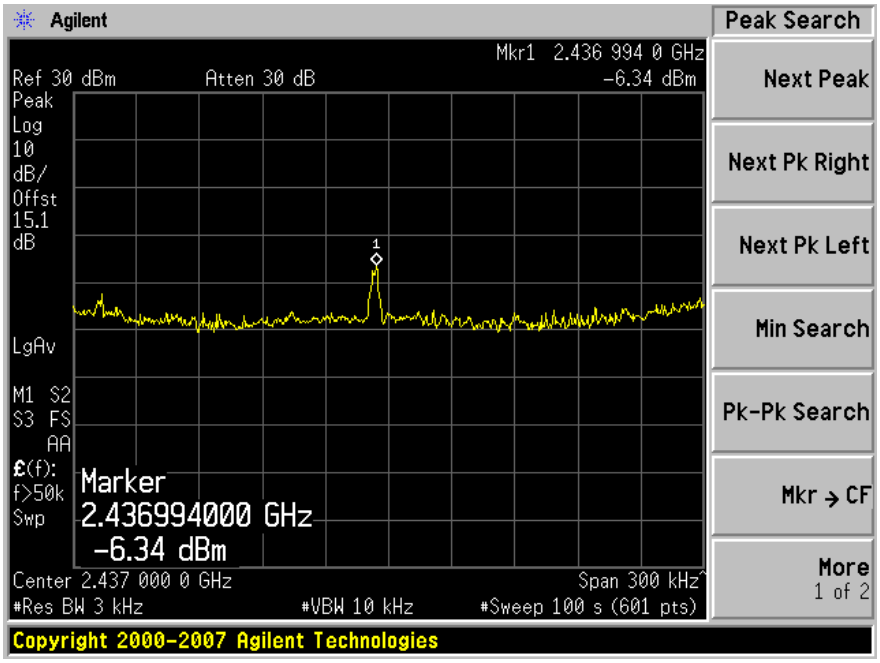


802.11 g (Antenna #1)

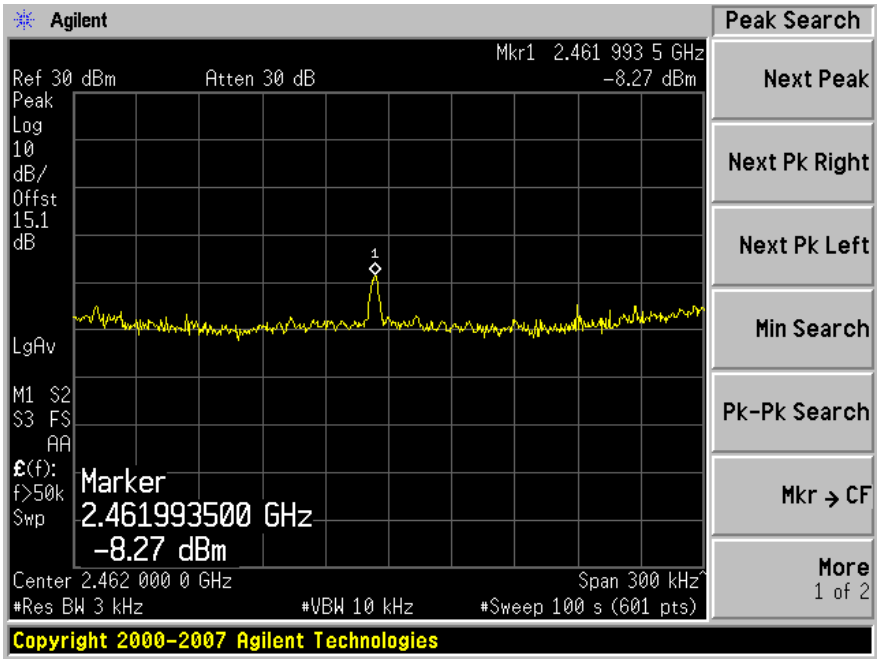
Low Channel 2412 MHz



Middle Channel 2437 MHz

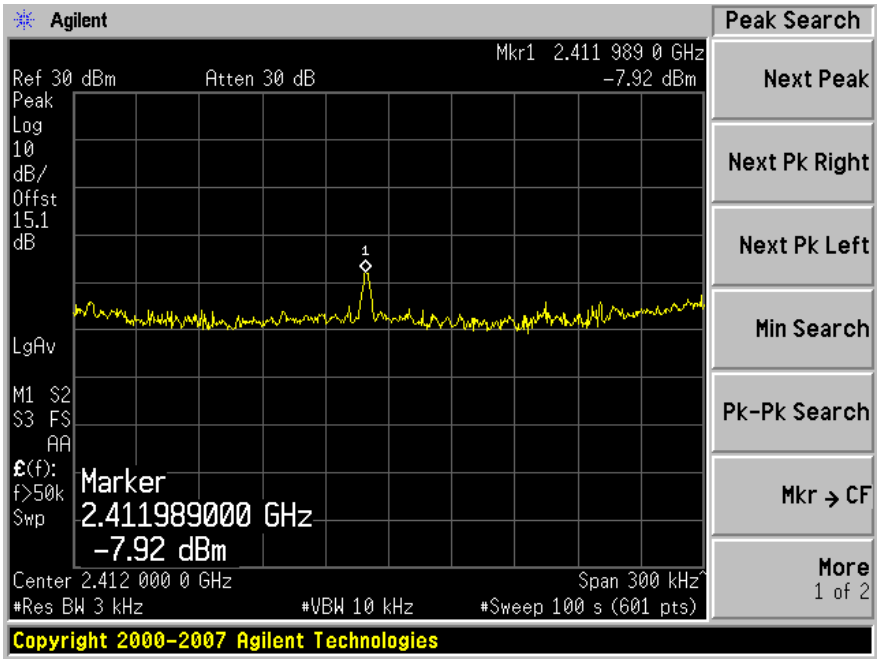


High Channel 2462 MHz

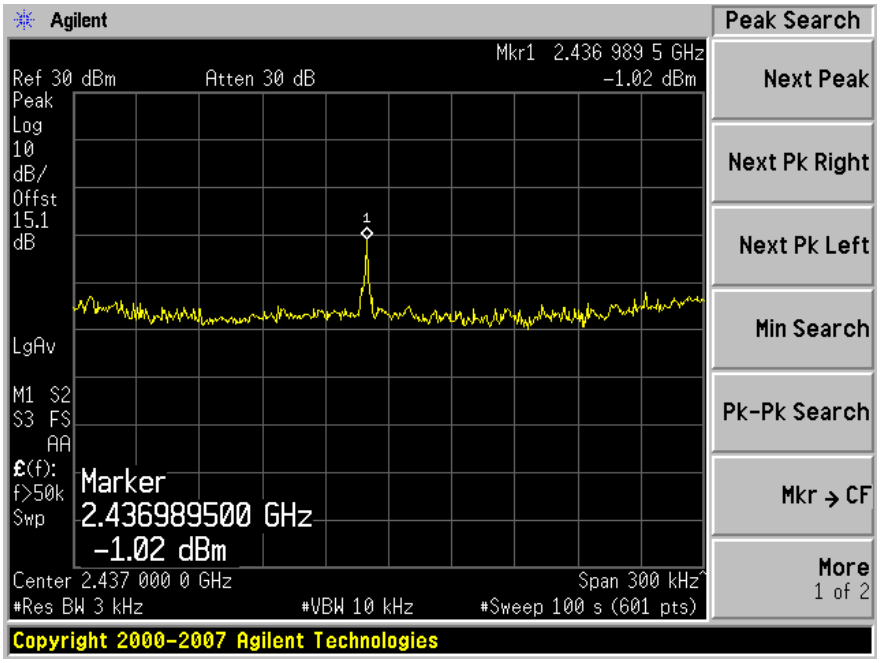


802.11 g (Antenna #0 + Antenna #1)

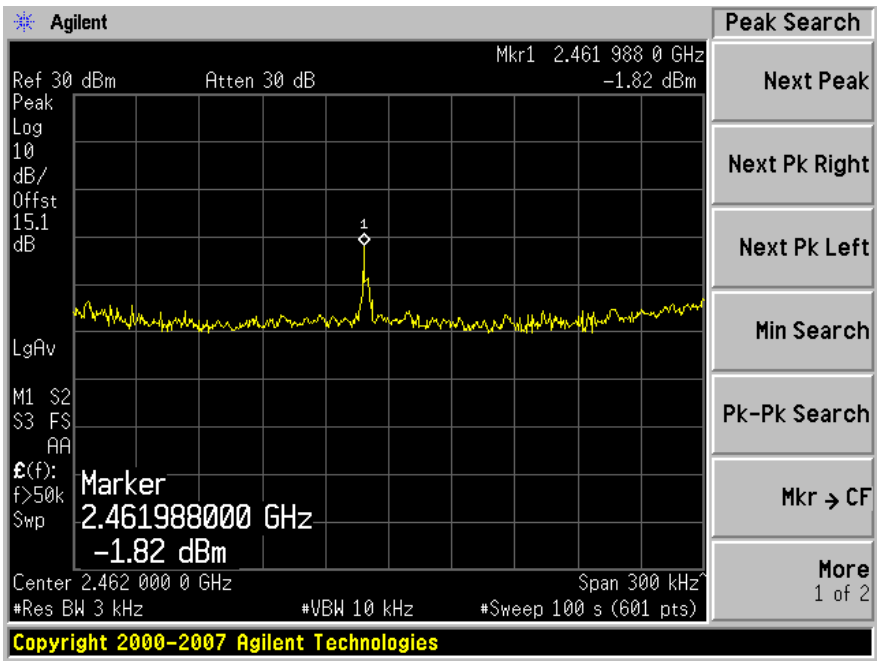
Low Channel 2412 MHz



Middle Channel 2437 MHz

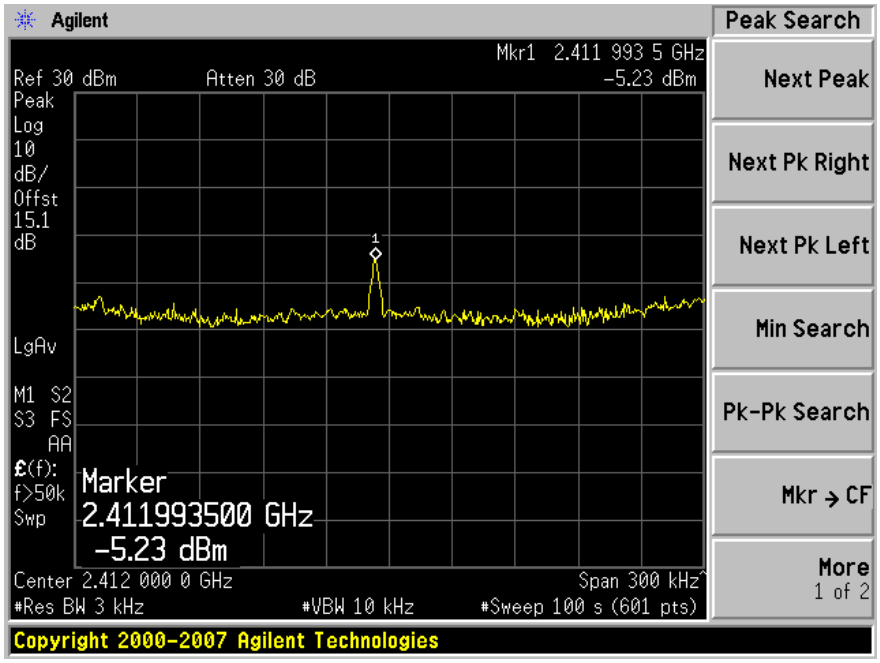


High Channel 2462 MHz

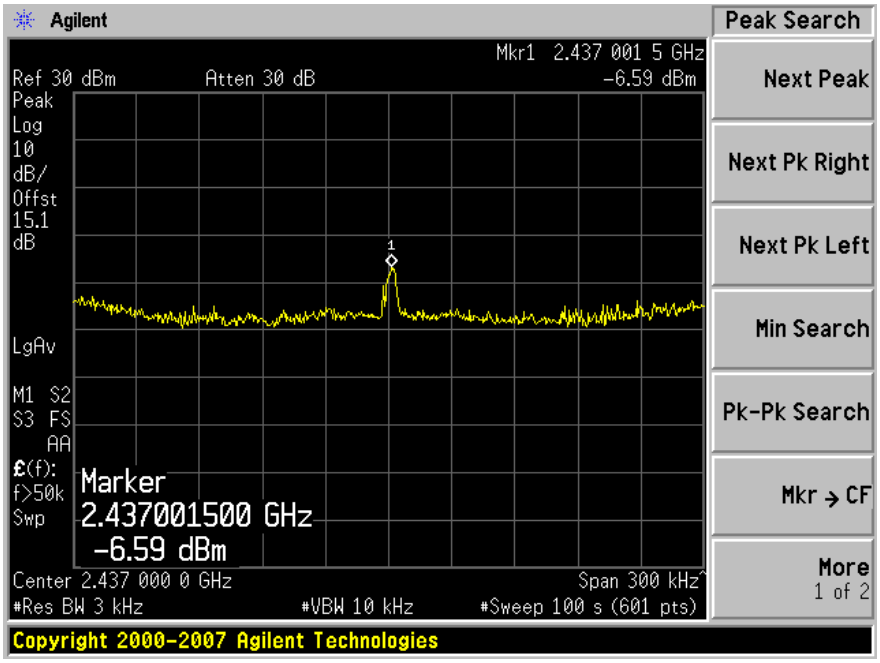


802.11 n 20 MHz (Antenna #0)

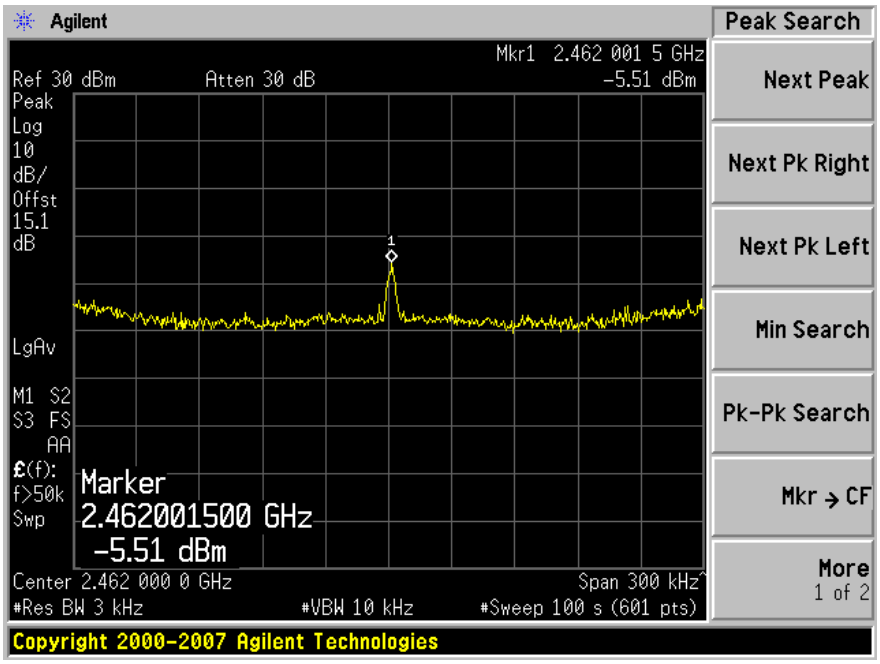
Low Channel 2412 MHz



Middle Channel 2437 MHz

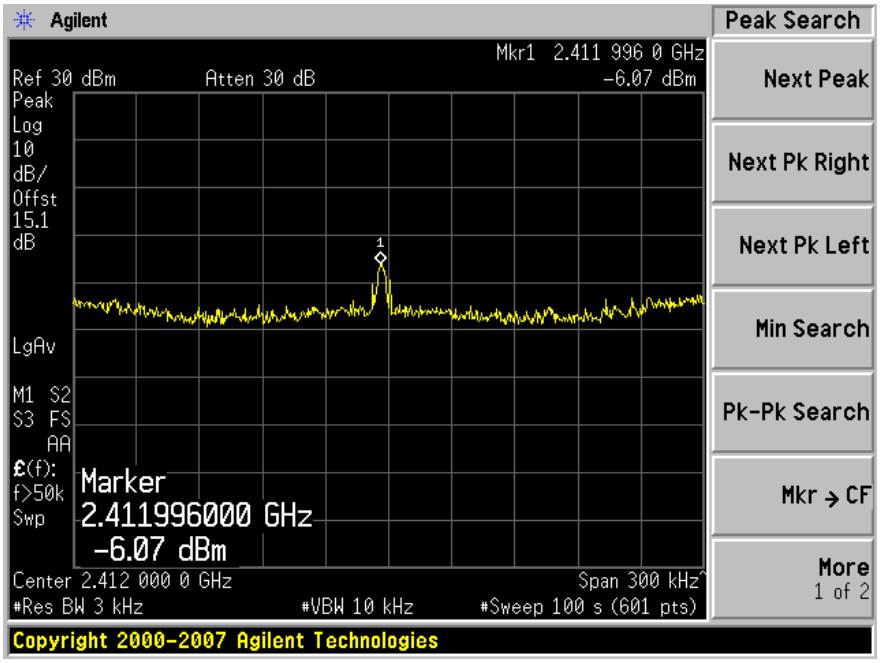


High Channel 2462 MHz

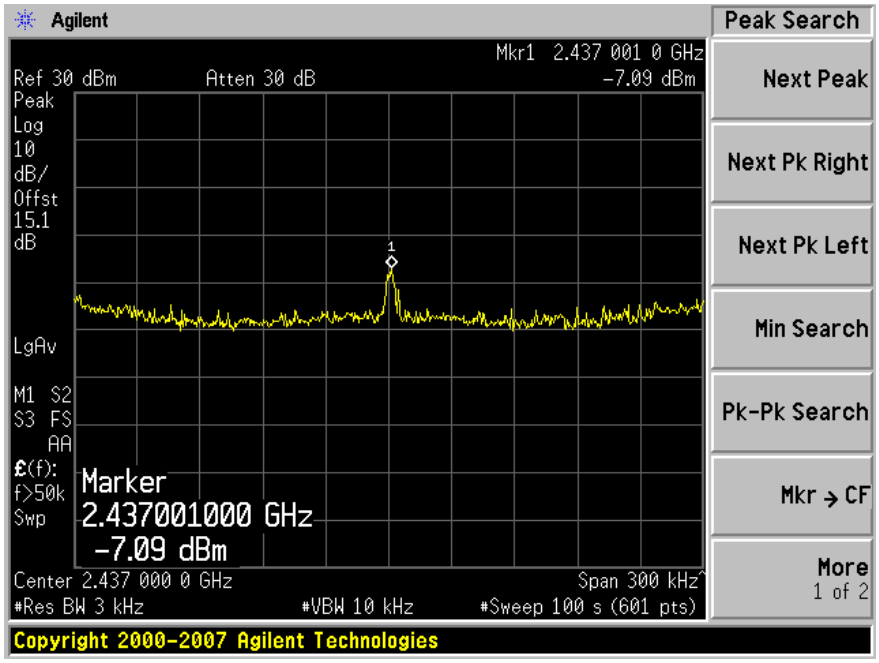


802.11 n 20 MHz (Antenna #1)

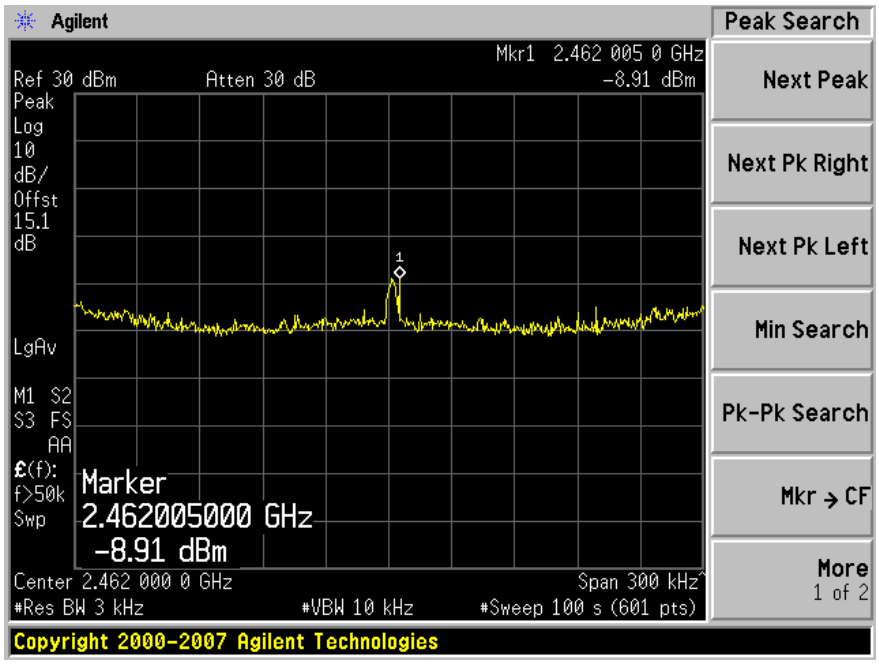
Low Channel 2412 MHz



Middle Channel 2437 MHz

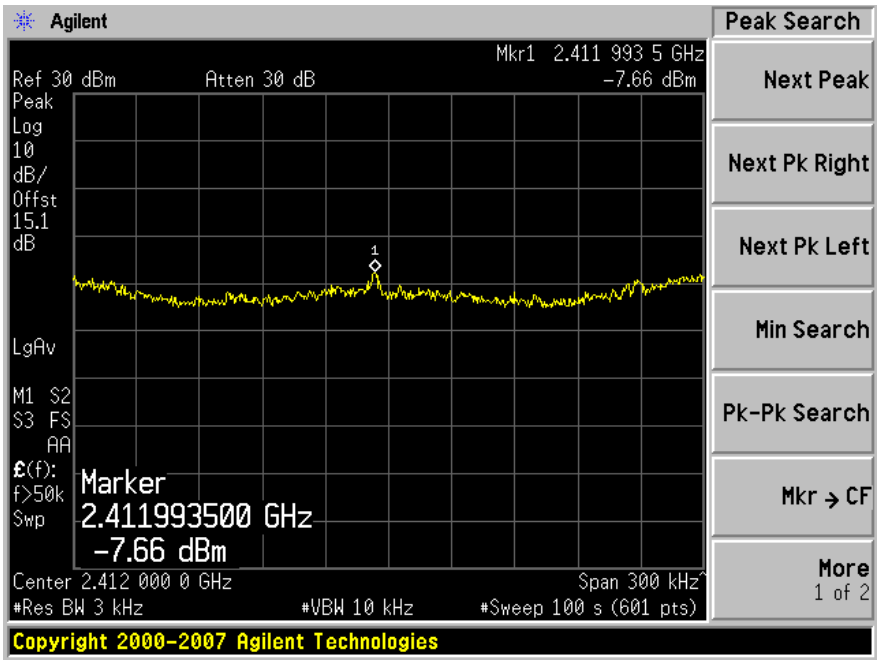


High Channel 2462 MHz

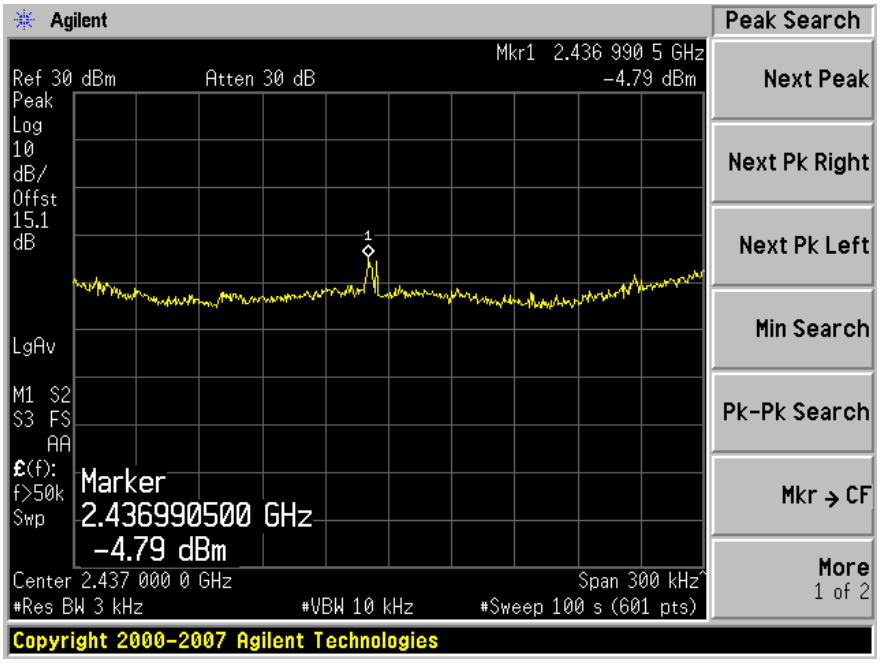


802.11 n 20 MHz (Antenna #0 + Antenna #1)

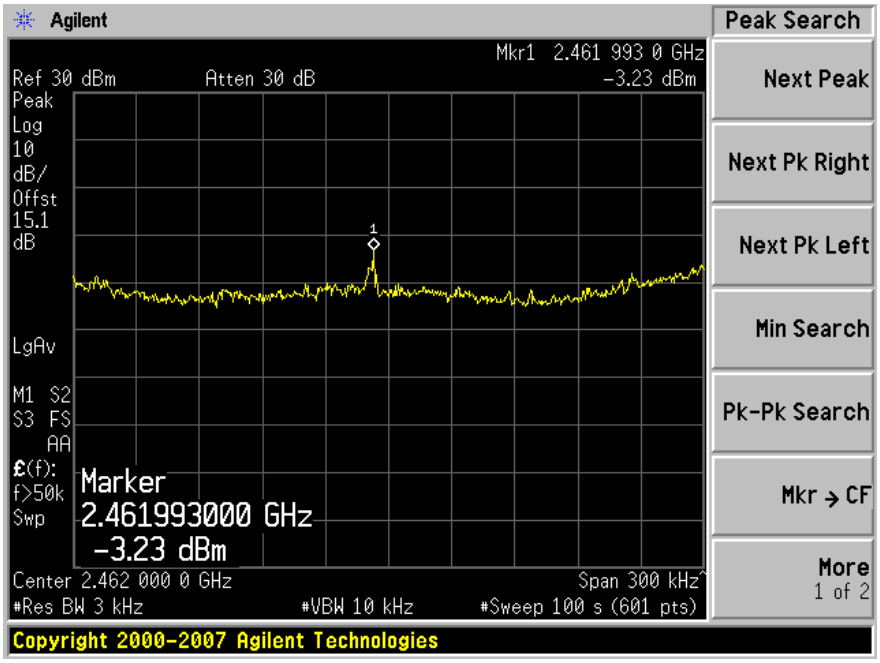
Low Channel 2412 MHz



Middle Channel 2437 MHz

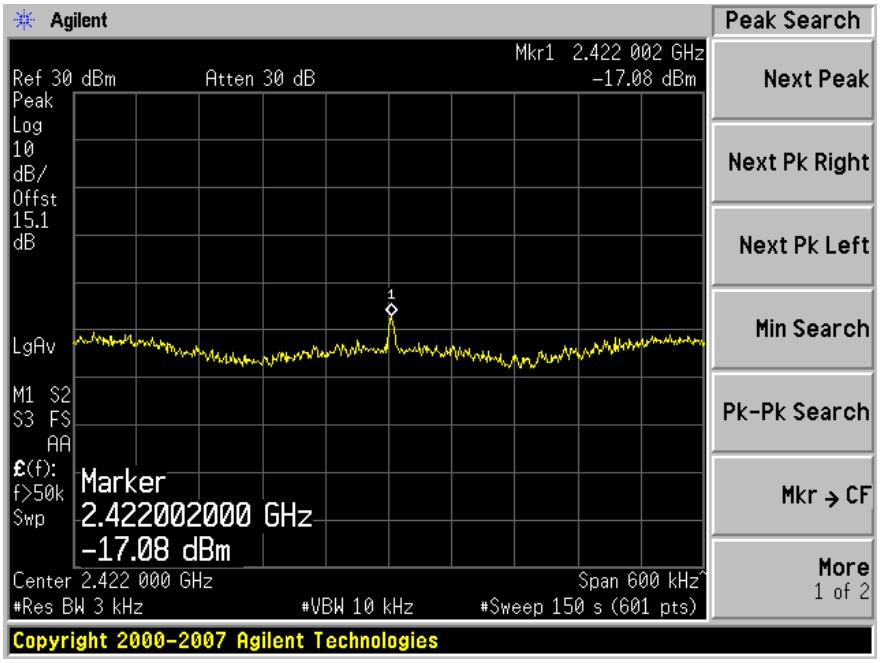


High Channel 2462 MHz

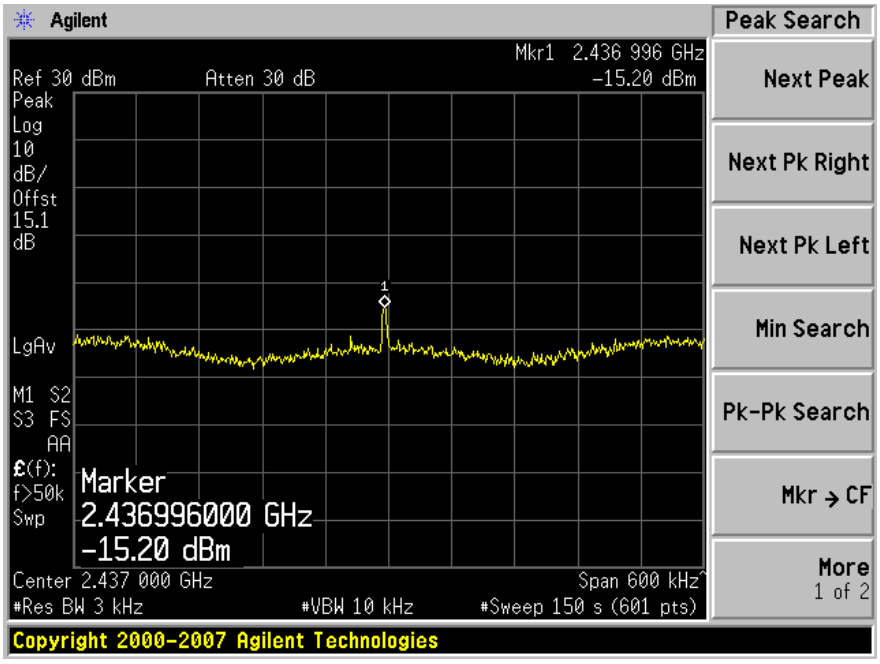


802.11 n 40 MHz (Antenna #0)

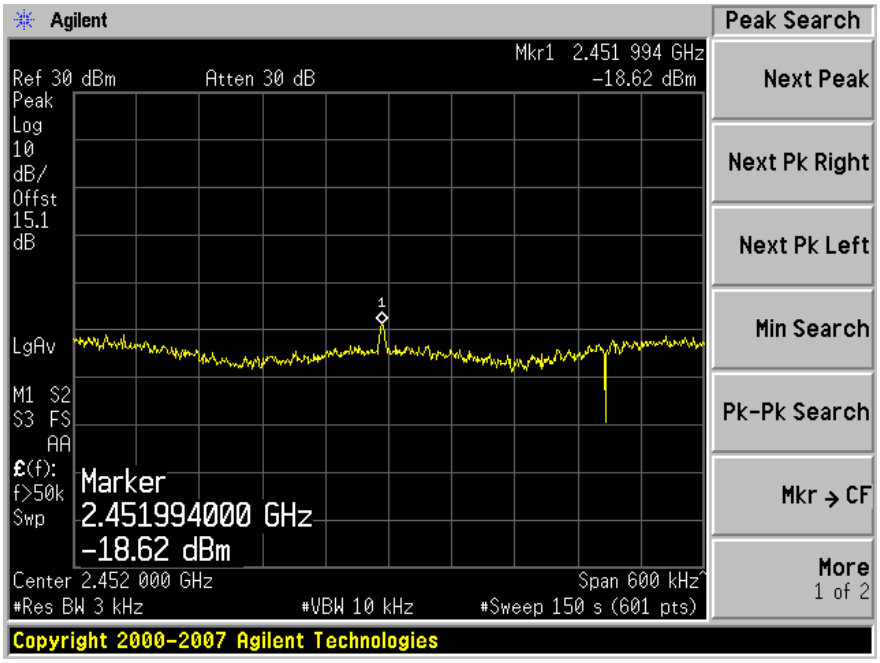
Low Channel 2422 MHz



Middle Channel 2437 MHz

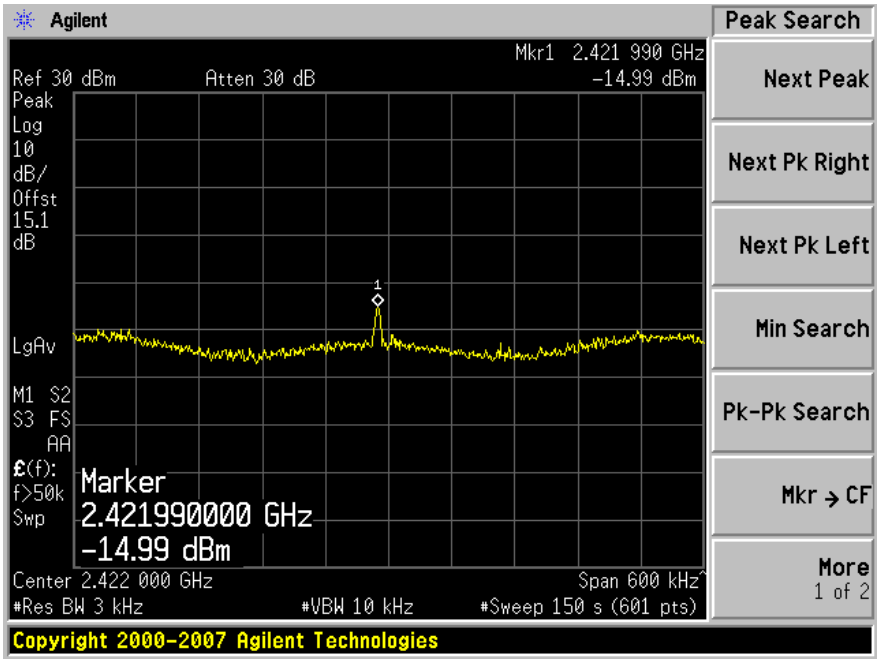


High Channel 2452 MHz

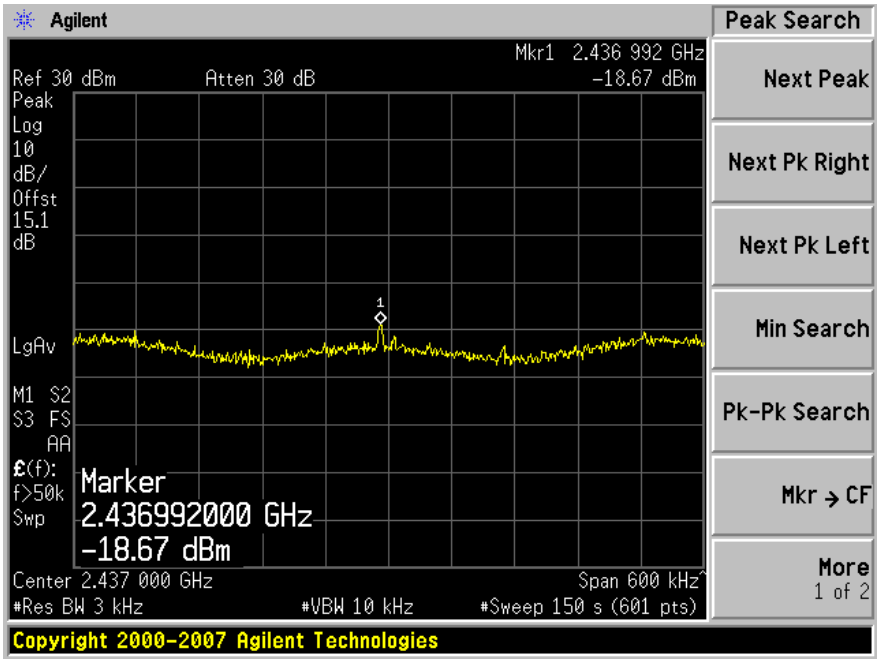


802.11 n 40 MHz (Antenna #1)

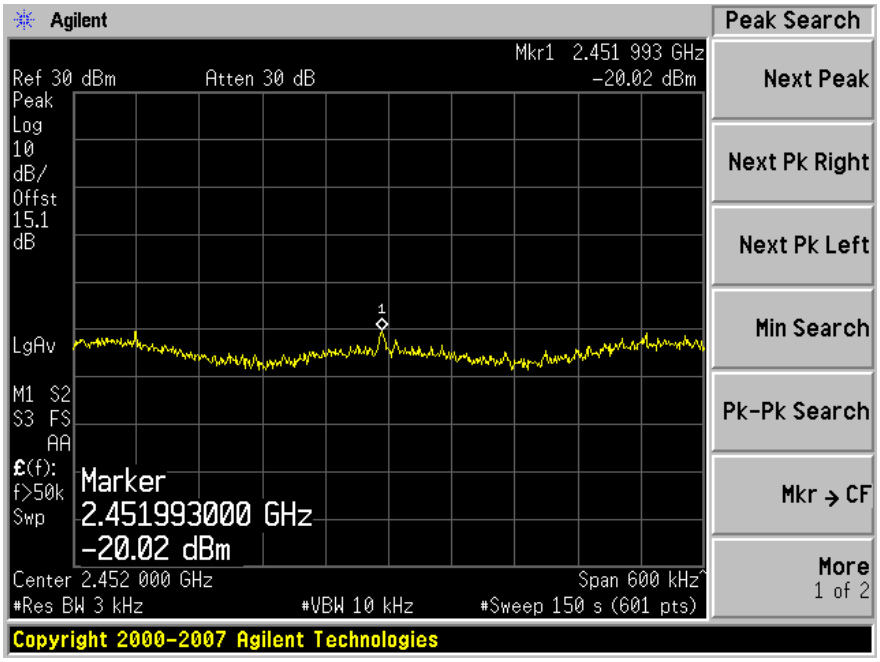
Low Channel 2422 MHz



Middle Channel 2437 MHz

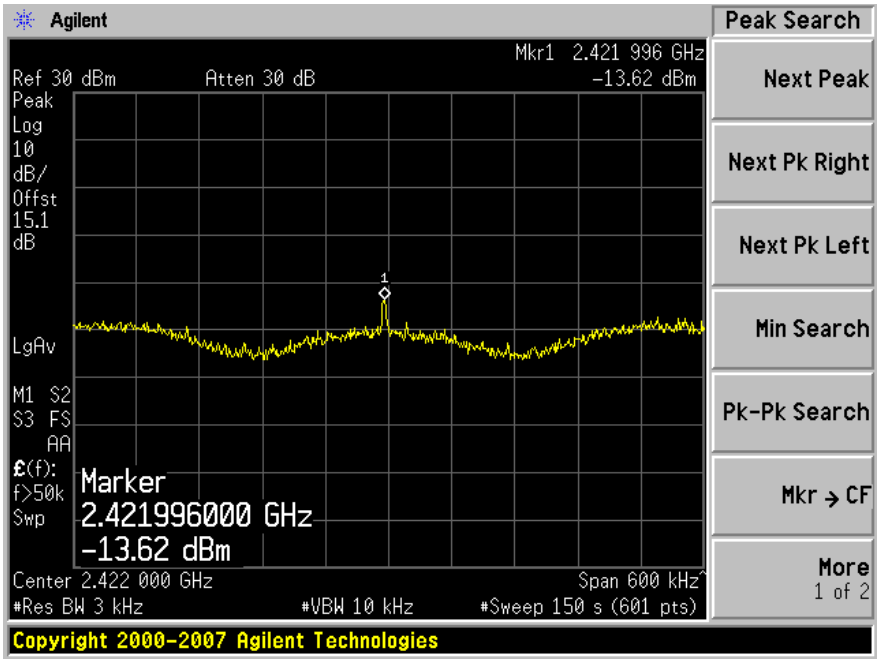


High Channel 2452 MHz

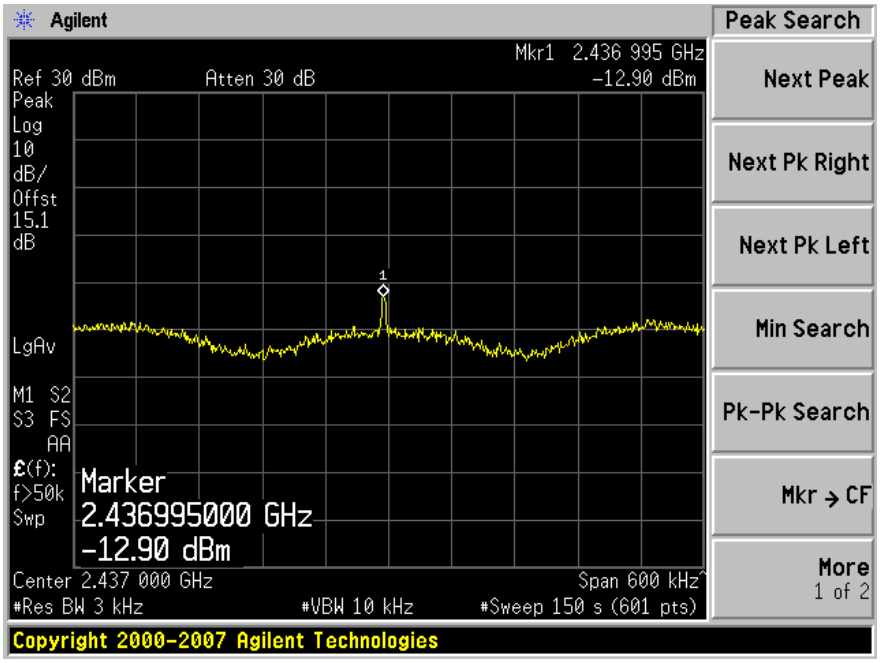


802.11 n 40 MHz (Antenna #0 + Antenna #1)

Low Channel 2412 MHz



Middle Channel 2437 MHz



High Channel 2452 MHz