



FCC PART 15.407  
IC RSS-210, ISSUE 8, DEC 2010  
TEST AND MEASUREMENT REPORT

For

**Ruckus Wireless, Inc.**

350 West Java Drive,  
Sunnyvale, CA 94089, USA

**FCC ID: S9G-MPE5AC33A**  
**IC: 5912A-MPE5AC33A**

<b>Report Type:</b> Original Report	<b>Product Type:</b> 802.11 ac mini-PCI Express Radio Module
<b>Test Engineers:</b> <u>Ning Ma</u>	<i>NM</i>
<b>Report Number:</b> <u>R1302145-407 W52</u>	
<b>Report Date:</b> <u>2013-08-05</u>	
<b>Reviewed By:</b> <u>Quinn Jiang</u>	<i>QJ</i>
Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732-9164	

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\* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "\*" (Rev.3)

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**DOCUMENT REVISION HISTORY**

<b>Revision Number</b>	<b>Report Number</b>	<b>Description of Revision</b>	<b>Date of Revision</b>
0	R1302145-407 W52	Original Report	2013-08-05

## 1 General Description

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

This test and measurement report was prepared on behalf of *Ruckus Wireless, Inc.*, and their product FCC ID: S9G-MPE5AC33A, IC: 5912A-MPE5AC33A, model: *MPE5AC33A* or the “EUT” as referred on this report. The EUT is a 802.11 a/n/ac WLAN Access Point.

### 1.2 Mechanical Description of EUT

The “EUT” measures approximately 6.7cm (L) x 3.8cm (W) x 1.1cm (H), and weighs approximately 16g.

*The test data gathered are from typical production sample, serial number: CTS0413RK0085 provided by the manufacture.*

### 1.3 Objective

This report is prepared on behalf of *Ruckus Wireless, Inc.*, in accordance with FCC CFR47 §15.407 and IC RSS-210 Issue 8, Dec 2010.

The objective is to determine compliance with FCC Part 15.407 and IC RSS-210 rules for Antenna Requirements, Conducted Emissions, Occupied Bandwidth, Output Power, Power Spectral Density, Radiated and Conducted Spurious Emissions, and Band Edge. Please refer to the detail antenna list in the antenna requirement section.

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

FCC Part 15.247 DTS with FCC ID: S9G-MPE5AC33A, IC: 5912A-MPE5AC33A

### 1.5 Test Methodology

FCC CFR 47 Part2, Part15.407 and IC RSS-210 Issue 8, Dec 2010.

### 1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the 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 CISPR16-4-2: 2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from  $\pm 2.0$  dB 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 Corp.

## 1.7 Test Facility

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

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have 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 test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

<http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b>

## 2 EUT Test Configuration

### 2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2009.

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

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

### 2.2 EUT Exercise Software

The test utility used was CART Version: 4.4, CartBuildDate: 4494324 was provided by Ruckus Wireless Inc, and was verified Ning Ma to comply with the standard requirements being tested against.

### 2.3 Local Support Equipment

Manufacturer	Description	Model	Serial Number
DELL	Laptop	P15F	-

### 2.4 EUT Internal Configuration Details

N/A: The EUT is a module and the serial number is shown on section 1.2.

### 2.5 Power Supply List and Details

Manufacturer	Description	Model	Serial Number
Ruckus Wireless	Switching adapter	MPBS-12020000	-

### 2.6 Interface Ports and Cables

Cable Description	Length (m)	To	From
RF Cable	<1.0	PSA	EUT
RJ 45 Cable	<1.0	Laptop	EUT



### 3 Summary of Test Results

FCC & IC Rules	Description of Test	Result
FCC §15.407(f), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.2	Antenna Requirement	Compliant
FCC §15.207 IC RSS-Gen §7.2.4	AC Power Line Conducted Emissions	Compliant
FCC §15.209(a), §15.407(b) IC RSS-210 §A9.2	Spurious Radiated Emissions	Compliant
FCC §15.407(a) IC RSS-210 §A9.2	26 dB and 99% Emission Bandwidth	Compliant
FCC §407(a)(1) IC RSS-210 §A9.2	Peak Output Power Measurement	Compliant
FCC §2.1051, §15.407(b) IC RSS-210 §A9.2	Out of Band Emissions	Compliant
FCC §15.407(a)(1) IC RSS-210 §A9.2	Power Spectral Density	Compliant
FCC §15.407(a)(6)	Peak Excursion Ratio	Compliant
IC RSS-210 §2.3 IC RSS-Gen §6.1	Receiver Spurious Radiated Emissions	Compliant
FCC §2.1051, §15.407(b) IC RSS-210 §A9.2	Spurious Emissions at Antenna Terminals	Compliant

## 4 FCC §15.407(f), §2.1091 & IC RSS-102 - RF Exposure

### 4.1 Applicable Standard

According to FCC §15.407(f) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

#### Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	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 <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

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

According to IC RSS-102 Issue 4 section 4.2, RF limits used for general public will be applied to the EUT.

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

**Note:** f is frequency in MHz

\* = Power density limit is applicable at frequencies greater than 100 MHz

## 4.2 MPE Prediction

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

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

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

## 4.3 MPE Results

W52 Band:

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>16.83</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>48.19</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>5200</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>3</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.995</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>):</u>	<u>0.019</u>
<u>Power density of prediction frequency at 20.0 cm (W/m<sup>2</sup>):</u>	<u>0.19</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u>	<u>1.0</u>
<u>MPE limit for uncontrolled exposure at prediction frequency (W/m<sup>2</sup>):</u>	<u>10</u>

The device meets FCC/IC MPE requirement for uncontrolled exposure environment at 20 cm distance.

## **5 FCC §15.203 & IC RSS-Gen §7.1.2 – Antenna Requirements**

### **5.1 Applicable Standard**

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

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

According to IC RSS-Gen §7.1.2: Transmitter Antenna

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

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 mW or less. For devices of output powers greater than 10 mW, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

### **5.2 Result**

The EUT will antennas that consist of UFL connectors and gain of 3 dBi; therefore, it complies with the antenna requirement. Please refer to the internal photos.

## 6 FCC §15.207 & IC RSS-Gen §7.2.4 - AC Power Line Conducted Emissions

### 6.1 Applicable Standards

As per FCC §15.207 and IC RSS-Gen §7.2.4 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  $\mu$ H/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 Note 1	56 to 46 Note 1
0.5-5	56	46
5-30	60	50

*Note 1 Decreases with the logarithm of the frequency.*

### 6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2003 measurement procedure. The specification used was FCC §15.207 and IC RSS-Gen §7.2.4 limits.

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

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

### 6.3 Test Procedure

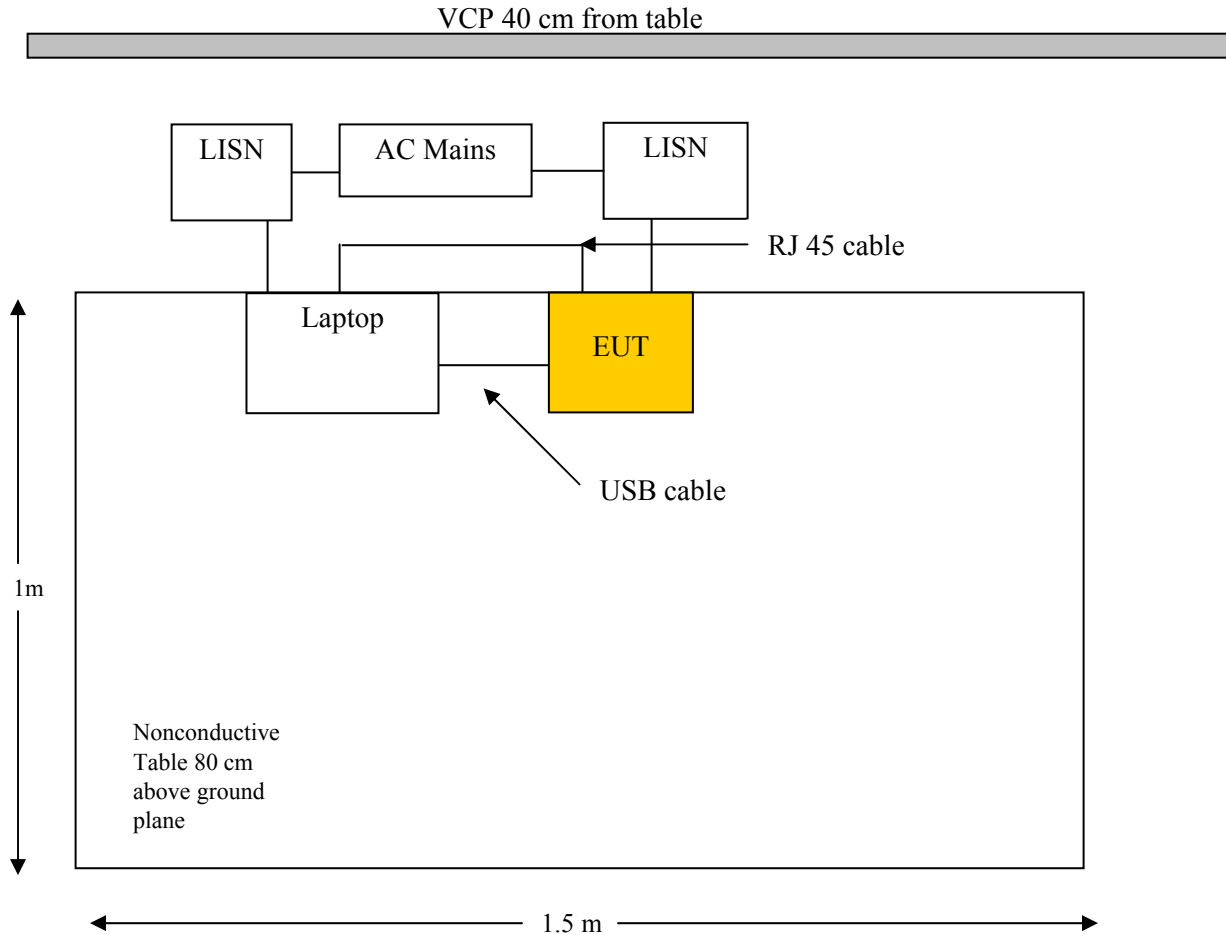
During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-2.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

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

## 6.4 Test Setup Block Diagram

### AC/DC Adaptor:



## 6.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL), the Attenuator Factor (Atten) to indicated Amplitude ( $A_i$ ) reading. The basic equation is as follows:

$$CA = A_i + CL + \text{Atten}$$

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

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

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

## 6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100337	2013-03-28	1 year
TTE	Filter, High Pass	H962-150k-50-21378	K7133	2012-05-30	1 year
Solar Electronics	LISN, EMC	9252-50-R-24-N	511205	2012-06-25	1 year
Solar Electronics	LISN, EMC	9252-50-R-24-N	511213	2012-06-25	1 year

**Statement of Traceability:** *BACL Corp.* attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

## 6.7 Test Environmental Conditions

<b>Temperature:</b>	21 °C
<b>Relative Humidity:</b>	41%
<b>ATM Pressure:</b>	102.1 kPa

The testing was performed by Ning Ma on 2013-05-07 in 5 m chamber 3.

## 6.8 Summary of Test Results

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

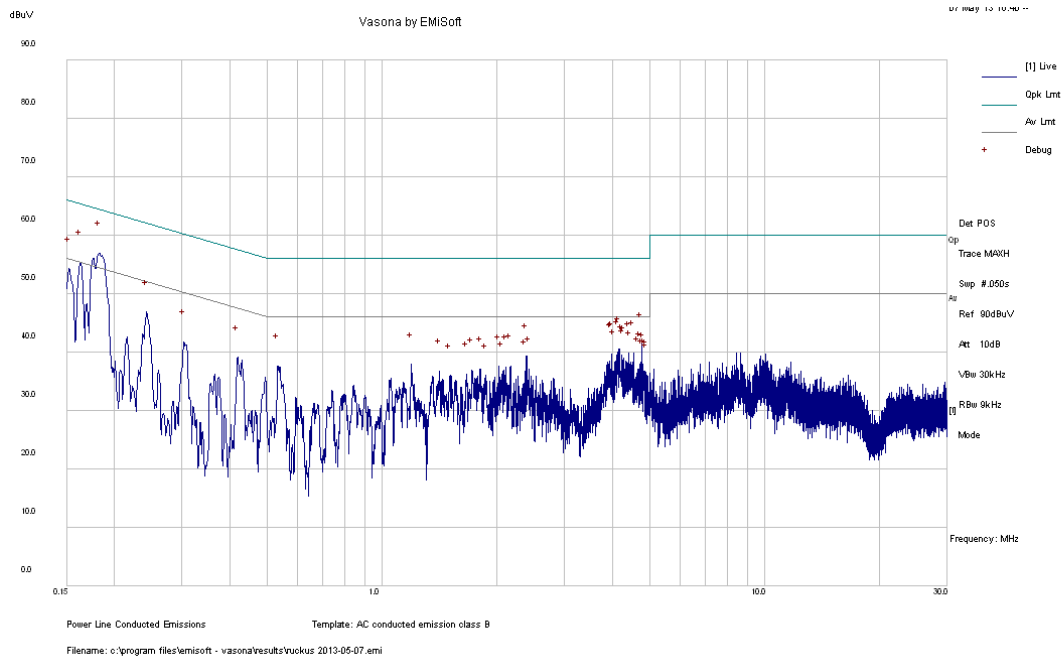
Transmitting Mode: 802.11n HT20, middle channel

Connection: 120 V/60 Hz, AC			
Margin (dB)	Frequency (MHz)	Conductor (Line/Neutral)	Range (MHz)
-9.19	0.180882	Line	0.15-30

### 6.9 Conducted Emissions Test Plots and Data

Transmitting Mode: 802.11n HT20, middle channel

#### 120 V, 60 Hz – Line, AC/DC Adaptor

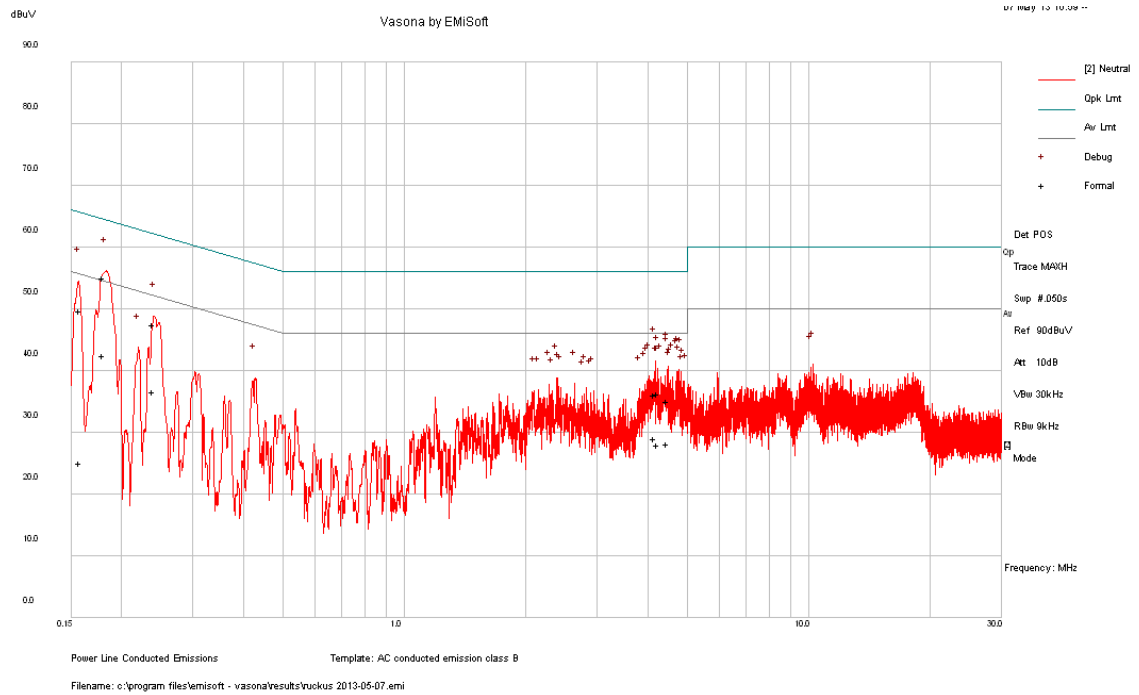


Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.179217	55.05	Line	64.52	-9.47	QP
0.180882	55.26	Line	64.45	-9.19	QP
0.157968	49.64	Line	65.57	-15.93	QP
4.760582	38.13	Line	56	-17.87	QP
0.239271	47.35	Line	62.12	-14.77	QP
4.179254	36.53	Line	56	-19.47	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.179217	42.9	Line	54.52	-11.62	Ave.
0.180882	44.03	Line	54.45	-10.42	Ave.
0.157968	26.82	Line	55.57	-28.75	Ave.
4.760582	32.71	Line	46	-13.29	Ave.
0.239271	36.25	Line	52.12	-15.87	Ave.
4.179254	29.54	Line	46	-16.46	Ave.



**120 V, 60 Hz – Neutral, AC/DC Adaptor**



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.180477	55.03	Neutral	64.46	-9.43	QP
0.157881	49.79	Neutral	65.57	-15.78	QP
0.240213	47.43	Neutral	62.09	-14.66	QP
4.16297	36.19	Neutral	56	-19.81	QP
4.481285	35.13	Neutral	56	-20.87	QP
4.22396	36.25	Neutral	56	-19.75	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.180477	42.46	Neutral	54.46	-12	Ave.
0.157881	25.03	Neutral	55.57	-30.54	Ave.
0.240213	36.71	Neutral	52.09	-15.37	Ave.
4.16297	28.98	Neutral	46	-17.02	Ave.
4.481285	28.22	Neutral	46	-17.78	Ave.
4.22396	28.1	Neutral	46	-17.9	Ave.

## 7 FCC §15.209, §15.407(b) & IC RSS-210 §A9.2 - Spurious Radiated Emissions

### 7.1 Applicable Standard

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

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

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 Note 1	3
88 - 216	150 Note 1	3
216 - 960	200 Note 1	3
Above 960	500	3

Note 1: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

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

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5.35 – 5.46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 – 167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3.3458 – 3.358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

## 7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. The specification used was the FCC 15C/15E and IC RSS-210/RSS-Gen 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.

## 7.3 Test Procedure

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

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

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

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000 MHz:

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

## 7.4 Corrected Amplitude & Margin Calculation

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

$$\text{CA} = \text{Ai} + \text{CL} + \text{Atten}$$

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

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

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

## 7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 year
HP	Pre-amplifier	8449B	3147A00400	2013-02-04	1 year
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-10-16	1 year
A.R.A	Horn Antenna	DRG-118/A	1132	2013-01-29	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2012-09-19	1 year

**Statement of Traceability:** *BACL Corp.* attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

## 7.6 Test Environmental Conditions

<b>Temperature:</b>	22°C
<b>Relative Humidity:</b>	41%
<b>ATM Pressure:</b>	102.1kPa

The testing was performed by Ning Ma from 2013-05-08 at 5 meter 3.

## 7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15.205, 15.209 and 15.407 & IC RSS-210, RSS-Gen standard's radiated emissions limits, and had the worst margin of:

5150-5250 MHz

Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-0.38	125.0015	Vertical	30 MHz to 1 GHz,
-1.755	5150	Vertical	1 GHz to 40 GHz,

Note: Termination method was used.

## 7.8 Radiated Emissions Test Result Data

### 1). 30 MHz – 1 GHz, Measured at 3 meters, Quasi-Peak Measurements

#### 802.11a mode, High Channel

Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB $\mu$ V/m)	Margin (dB)
874.9955	36.11	159	V	139	46	-9.89
125.0015	42.91	107	V	52	43.5	-0.59
625.015	43.19	124	H	154	46	-2.81
249.999	40.16	112	H	136	46	-5.84

#### 802.11n HT20 mode, Middle Channel

Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB $\mu$ V/m)	Margin (dB)
874.9955	36.51	159	V	139	46	-9.49
125.0015	43.12	107	V	52	43.5	-0.38
625.015	42.96	124	H	154	46	-3.04
249.999	40.07	112	H	136	46	-5.93

#### 802.11n HT40 mode, Low Channel

Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB $\mu$ V/m)	Margin (dB)
874.9955	36.42	159	V	139	46	-9.58
125.0015	42.79	107	V	52	43.5	-0.71
625.015	42.88	124	H	154	46	-3.12
249.999	39.91	112	H	136	46	-6.09

#### 802.11ac 80 mode

Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB $\mu$ V/m)	Margin (dB)
874.9955	36.09	159	V	139	46	-9.91
125.0015	41.67	107	V	52	43.5	-1.83
625.015	41.57	124	H	154	46	-4.43
249.999	40	112	H	136	46	-6

Note: Only digital emissions present from 30MHz to 1GHz, therefore only one channel was tested per modulation.

## 2) 1-40 GHz, Measured at 3 meters,

802.11a mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5180 MHz, measured at 3 meters											
10360	27.58	0	100	V	39.79	7.02	26.98	47.41	74	-26.59	Peak
10360	26.92	0	100	H	39.79	7.02	26.98	46.75	74	-27.25	Peak
10360	16.83	0	100	V	39.79	7.02	26.98	36.66	54	-17.34	Ave
10360	17.22	0	100	H	39.79	7.02	26.98	37.05	54	-16.95	Ave
15540	32.52	0	100	V	39.284	8.38	25.92	54.264	74	-19.736	Peak
15540	30.42	0	100	H	39.284	8.38	25.92	52.164	74	-21.836	Peak
15540	16.46	0	100	V	39.284	8.38	25.92	38.204	54	-15.796	Ave
15540	17.06	0	100	H	39.284	8.38	25.92	38.804	54	-15.196	Ave
5150	26.75	0	100	V	33.825	4.56	0	65.135	74	-8.865	Peak
5150	27.01	0	100	H	33.825	4.56	0	65.395	74	-8.605	Peak
5150	12.81	0	100	V	33.825	4.56	0	51.195	54	-2.805	Ave
5150	12.05	0	100	H	33.825	4.56	0	50.435	54	-3.565	Ave
5350	27.63	0	100	V	34.05	4.71	0	66.39	74	-7.61	Peak
5350	27.51	0	100	H	34.05	4.71	0	66.27	74	-7.73	Peak
5350	12.19	0	100	V	34.05	4.71	0	50.95	54	-3.05	Ave
5350	12.56	0	100	H	34.05	4.71	0	51.32	54	-2.68	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 5200 MHz, measured at 3 meters											
10400	27.72	0	100	V	39.79	6.99	26.97	47.53	74	-26.47	Peak
10400	28.36	0	100	H	39.79	6.99	26.97	48.17	74	-25.83	Peak
10400	13.84	0	100	V	39.79	6.99	26.97	33.65	54	-20.35	Ave
10400	13.67	0	100	H	39.79	6.99	26.97	33.48	54	-20.52	Ave
15600	31.88	0	100	V	39.213	8.42	25.92	53.593	74	-20.407	Peak
15600	32.09	0	100	H	39.213	8.42	25.92	53.803	74	-20.197	Peak
15600	16.69	0	100	V	39.213	8.42	25.92	38.403	54	-15.597	Ave
15600	15.38	0	100	H	39.213	8.42	25.92	37.093	54	-16.907	Ave
5150	27.05	0	100	V	33.825	4.56	0	65.435	74	-8.565	Peak
5150	26.91	0	100	H	33.825	4.56	0	65.295	74	-8.705	Peak
5150	13.86	0	100	V	33.825	4.56	0	52.245	54	-1.755	Ave
5150	12.91	0	100	H	33.825	4.56	0	51.295	54	-2.705	Ave
5350	28.03	0	100	V	34.05	4.71	0	66.79	74	-7.21	Peak
5350	27.93	0	100	H	34.05	4.71	0	66.69	74	-7.31	Peak
5350	12.34	0	100	V	34.05	4.71	0	51.1	54	-2.9	Ave
5350	12.76	0	100	H	34.05	4.71	0	51.52	54	-2.48	Ave

Frequency (MHz)	S.A. Reading (dB $\mu$ V)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dB $\mu$ V/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dB $\mu$ V/m)	Margin (dB)	
High Channel 5240 MHz, measured at 3 meters											
10480	28.59	0	100	V	39.79	6.99	26.97	48.4	74	-25.6	Peak
10480	28.22	0	100	H	39.79	6.99	26.97	48.03	74	-25.97	Peak
10480	13.83	0	100	V	39.79	6.99	26.97	33.64	54	-20.36	Ave
10480	13.61	0	100	H	39.79	6.99	26.97	33.42	54	-20.58	Ave
15720	32.15	0	100	V	39.213	8.42	25.92	53.863	74	-20.137	Peak
15720	31.31	0	100	H	39.213	8.42	25.92	53.023	74	-20.977	Peak
15720	17.05	0	100	V	39.213	8.42	25.92	38.763	54	-15.237	Ave
15720	17.16	0	100	H	39.213	8.42	25.92	38.873	54	-15.127	Ave
5150	27.19	0	100	V	33.825	4.56	0	65.575	74	-8.425	Peak
5150	27.63	0	100	H	33.825	4.56	0	66.015	74	-7.985	Peak
5150	12.86	0	100	V	33.825	4.56	0	51.245	54	-2.755	Ave
5150	12.53	0	100	H	33.825	4.56	0	50.915	54	-3.085	Ave
5350	27.46	0	100	V	34.05	4.71	0	66.22	74	-7.78	Peak
5350	27.51	0	100	H	34.05	4.71	0	66.27	74	-7.73	Peak
5350	12.69	0	100	V	34.05	4.71	0	51.45	54	-2.55	Ave
5350	12.72	0	100	H	34.05	4.71	0	51.48	54	-2.52	Ave

## 802.11n HT20 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5180 MHz, measured at 3 meters											
10360	28.64	0	100	V	39.79	7.02	26.98	48.47	74	-25.53	Peak
10360	28.46	0	100	H	39.79	7.02	26.98	48.29	74	-25.71	Peak
10360	13.86	0	100	V	39.79	7.02	26.98	33.69	54	-20.31	Ave
10360	13.82	0	100	H	39.79	7.02	26.98	33.65	54	-20.35	Ave
15540	30.91	0	100	V	39.284	8.38	25.92	52.654	74	-21.346	Peak
15540	31.97	0	100	H	39.284	8.38	25.92	53.714	74	-20.286	Peak
15540	16.47	0	100	V	39.284	8.38	25.92	38.214	54	-15.786	Ave
15540	16.52	0	100	H	39.284	8.38	25.92	38.264	54	-15.736	Ave
5150	27.06	0	100	V	33.825	4.56	0	65.445	74	-8.555	Peak
5150	26.94	0	100	H	33.825	4.56	0	65.325	74	-8.675	Peak
5150	12.35	0	100	V	33.825	4.56	0	50.735	54	-3.265	Ave
5150	12.42	0	100	H	33.825	4.56	0	50.805	54	-3.195	Ave
5350	28.06	0	100	V	34.05	4.71	0	66.82	74	-7.18	Peak
5350	27.51	0	100	H	34.05	4.71	0	66.27	74	-7.73	Peak
5350	12.33	0	100	V	34.05	4.71	0	51.09	54	-2.91	Ave
5350	12.12	0	100	H	34.05	4.71	0	50.88	54	-3.12	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 5200 MHz, measured at 3 meters											
10400	28.41	0	100	V	39.79	6.99	26.97	48.22	74	-25.78	Peak
10400	29.31	0	100	H	39.79	6.99	26.97	49.12	74	-24.88	Peak
10400	13.8	0	100	V	39.79	6.99	26.97	33.61	54	-20.39	Ave
10400	13.57	0	100	H	39.79	6.99	26.97	33.38	54	-20.62	Ave
15600	32	0	100	V	39.213	8.42	25.92	53.713	74	-20.287	Peak
15600	31.68	0	100	H	39.213	8.42	25.92	53.393	74	-20.607	Peak
15600	16.38	0	100	V	39.213	8.42	25.92	38.093	54	-15.907	Ave
15600	17.02	0	100	H	39.213	8.42	25.92	38.733	54	-15.267	Ave
5150	28.01	0	100	V	33.825	4.56	0	66.395	74	-7.605	Peak
5150	27.56	0	100	H	33.825	4.56	0	65.945	74	-8.055	Peak
5150	12.88	0	100	V	33.825	4.56	0	51.265	54	-2.735	Ave
5150	13.05	0	100	H	33.825	4.56	0	51.435	54	-2.565	Ave
5350	27.62	0	100	V	34.05	4.71	0	66.38	74	-7.62	Peak
5350	27.89	0	100	H	34.05	4.71	0	66.65	74	-7.35	Peak
5350	12.57	0	100	V	34.05	4.71	0	51.33	54	-2.67	Ave
5350	12.53	0	100	H	34.05	4.71	0	51.29	54	-2.71	Ave



Frequency (MHz)	S.A. Reading (dB $\mu$ V)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dB $\mu$ V/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dB $\mu$ V/m)	Margin (dB)	
High Channel 5240 MHz, measured at 3 meters											
10480	28.73	0	100	V	39.79	6.99	26.97	48.54	74	-25.46	Peak
10480	28.69	0	100	H	39.79	6.99	26.97	48.5	74	-25.5	Peak
10480	13.77	0	100	V	39.79	6.99	26.97	33.58	54	-20.42	Ave
10480	13.92	0	100	H	39.79	6.99	26.97	33.73	54	-20.27	Ave
15720	33.67	0	100	V	39.213	8.42	25.92	55.383	74	-18.617	Peak
15720	32.93	0	100	H	39.213	8.42	25.92	54.643	74	-19.357	Peak
15720	17.02	0	100	V	39.213	8.42	25.92	38.733	54	-15.267	Ave
15720	17.59	0	100	H	39.213	8.42	25.92	39.303	54	-14.697	Ave
5150	27.35	0	100	V	33.825	4.56	0	65.735	74	-8.265	Peak
5150	27.81	0	100	H	33.825	4.56	0	66.195	74	-7.805	Peak
5150	12.49	0	100	V	33.825	4.56	0	50.875	54	-3.125	Ave
5150	12.36	0	100	H	33.825	4.56	0	50.745	54	-3.255	Ave
5350	27.91	0	100	V	34.05	4.71	0	66.67	74	-7.33	Peak
5350	27.58	0	100	H	34.05	4.71	0	66.34	74	-7.66	Peak
5350	12.88	0	100	V	34.05	4.71	0	51.64	54	-2.36	Ave
5350	12.29	0	100	H	34.05	4.71	0	51.05	54	-2.95	Ave

## 802.11n HT40 mode

Frequency (MHz)	S.A. Reading (dB $\mu$ V)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dB $\mu$ V/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dB $\mu$ V/m)	Margin (dB)	
Low Channel 5190 MHz, measured at 3 meters											
10380	28.49	0	100	V	39.79	6.99	26.97	48.3	74	-25.7	Peak
10380	28.13	0	100	H	39.79	6.99	26.97	47.94	74	-26.06	Peak
10380	13.78	0	100	V	39.79	6.99	26.97	33.59	54	-20.41	Ave
10380	13.26	0	100	H	39.79	6.99	26.97	33.07	54	-20.93	Ave
15570	31.47	0	100	V	39.213	8.42	25.92	53.183	74	-20.817	Peak
15570	32.06	0	100	H	39.213	8.42	25.92	53.773	74	-20.227	Peak
15570	16.54	0	100	V	39.213	8.42	25.92	38.253	54	-15.747	Ave
15570	17.01	0	100	H	39.213	8.42	25.92	38.723	54	-15.277	Ave
5150	27.95	0	100	V	33.825	4.56	0	66.335	74	-7.665	Peak
5150	27.22	0	100	H	33.825	4.56	0	65.605	74	-8.395	Peak
5150	13.41	0	100	V	33.825	4.56	0	51.795	54	-2.205	Ave
5150	12.85	0	100	H	33.825	4.56	0	51.235	54	-2.765	Ave
5350	27.84	0	100	V	34.05	4.71	0	66.6	74	-7.4	Peak
5350	27.55	0	100	H	34.05	4.71	0	66.31	74	-7.69	Peak
5350	12.62	0	100	V	34.05	4.71	0	51.38	54	-2.62	Ave
5350	12.23	0	100	H	34.05	4.71	0	50.99	54	-3.01	Ave

Frequency (MHz)	S.A. Reading (dB $\mu$ V)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dB $\mu$ V/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dB $\mu$ V/m)	Margin (dB)	
High Channel 5230 MHz, measured at 3 meters											
10460	28.71	0	100	V	39.662	7	26.93	48.442	74	-25.558	Peak
10460	28.23	0	100	H	39.662	7	26.93	47.962	74	-26.038	Peak
10460	13.77	0	100	V	39.662	7	26.93	33.502	54	-20.498	Ave
10460	13.64	0	100	H	39.662	7	26.93	33.372	54	-20.628	Ave
15690	31.56	0	100	V	39.206	8.44	25.95	53.256	74	-20.744	Peak
15690	32.07	0	100	H	39.206	8.44	25.95	53.766	74	-20.234	Peak
15690	17.01	0	100	V	39.206	8.44	25.95	38.706	54	-15.294	Ave
15690	17.06	0	100	H	39.206	8.44	25.95	38.756	54	-15.244	Ave
5150	27.86	0	100	V	33.825	4.56	0	66.245	74	-7.755	Peak
5150	27.62	0	100	H	33.825	4.56	0	66.005	74	-7.995	Peak
5150	12.52	0	100	V	33.825	4.56	0	50.905	54	-3.095	Ave
5150	12.69	0	100	H	33.825	4.56	0	51.075	54	-2.925	Ave
5350	27.91	0	100	V	34.05	4.71	0	66.67	74	-7.33	Peak
5350	27.63	0	100	H	34.05	4.71	0	66.39	74	-7.61	Peak
5350	12.66	0	100	V	34.05	4.71	0	51.42	54	-2.58	Ave
5350	12.48	0	100	H	34.05	4.71	0	51.24	54	-2.76	Ave

## 802.11ac 80 mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Channel 5210 MHz, measured at 3 meters											
10420	28.66	0	100	V	40.419	6.99	26.97	49.099	74	-24.901	Peak
10420	27.98	0	100	H	40.419	6.99	26.97	48.419	74	-25.581	Peak
10420	13.79	0	100	V	40.419	6.99	26.97	34.229	54	-19.771	Ave
10420	13.58	0	100	H	40.419	6.99	26.97	34.019	54	-19.981	Ave
15630	31.64	0	100	V	39.213	8.26	25.99	53.123	74	-20.877	Peak
15630	31.09	0	100	H	39.213	8.26	25.99	52.573	74	-21.427	Peak
15630	16.77	0	100	V	39.213	8.26	25.99	38.253	54	-15.747	Ave
15630	17.03	0	100	H	39.213	8.26	25.99	38.513	54	-15.487	Ave
5150	27.15	0	100	V	33.825	4.56	0	65.535	74	-8.465	Peak
5150	27.22	0	100	H	33.825	4.56	0	65.605	74	-8.395	Peak
5150	12.81	0	100	V	33.825	4.56	0	51.195	54	-2.805	Ave
5150	12.56	0	100	H	33.825	4.56	0	50.945	54	-3.055	Ave
5350	27.69	0	100	V	34.05	4.71	0	66.45	74	-7.55	Peak
5350	27.51	0	100	H	34.05	4.71	0	66.27	74	-7.73	Peak
5350	12.19	0	100	V	34.05	4.71	0	50.95	54	-3.05	Ave
5350	12.28	0	100	H	34.05	4.71	0	51.04	54	-2.96	Ave

## 8 FCC §15.407(a) & IC RSS-210 §A9.2 – 26 dB & 99% Emission Bandwidth

### 8.1 Applicable Standard

FCC §15.407(a) and IC RSS-210 §A9.2.

### 8.2 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 26 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

### 8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2012-09-29	1 year

*Statement of Traceability: BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.*

### 8.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	40 %
ATM Pressure:	101.8 kPa

*The testing was performed by Ning Ma on 2013-04-16 in RF site.*

## 8.5 Test Results

802.11a mode:

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)			99% Emission Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2	Chain 0	Chain 1	Chain 2
Low	5180	23.123	24.044	22.878	16.7378	16.7446	16.6965
Middle	5200	23.673	24.313	23.453	16.7474	16.7623	16.7561
High	5240	23.601	24.019	23.881	16.7910	16.7480	16.8040

802.11n HT20 mode:

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)			99% Emission Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2	Chain 0	Chain 1	Chain 2
Low	5180	23.904	24.808	23.367	17.8947	17.8918	17.8769
Middle	5200	24.517	23.573	24.260	17.8552	17.8431	17.8193
High	5240	23.903	23.982	23.745	17.8730	17.9038	17.8497

802.11n HT40 mode:

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)			99% Emission Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2	Chain 0	Chain 1	Chain 2
Low	5190	48.689	48.061	47.183	36.4899	36.3921	36.4454
High	5230	47.504	46.895	48.867	36.4948	36.4814	36.5092

802.11ac 80 mode:

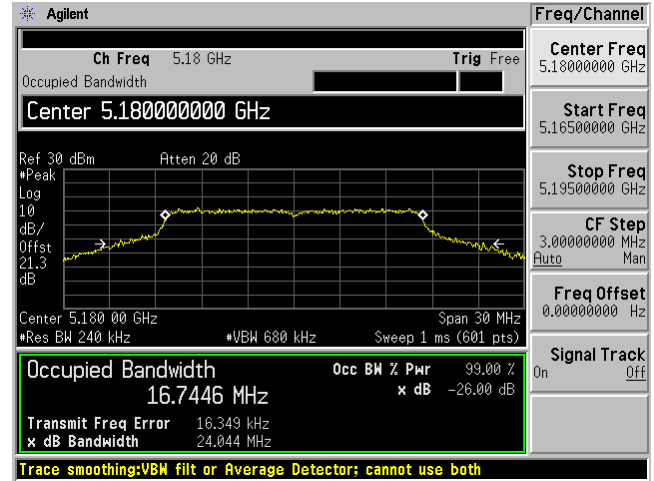
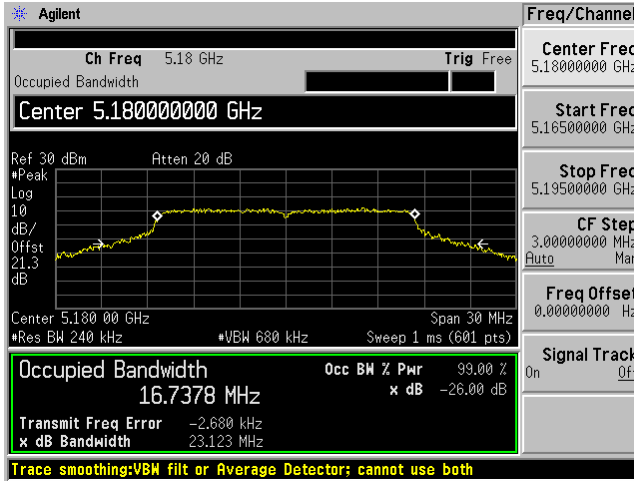
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)			99% Emission Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2	Chain 0	Chain 1	Chain 2
/	5210	93.950	98.670	97.950	75.8547	75.9996	76.0090

Please refer to the following plots.

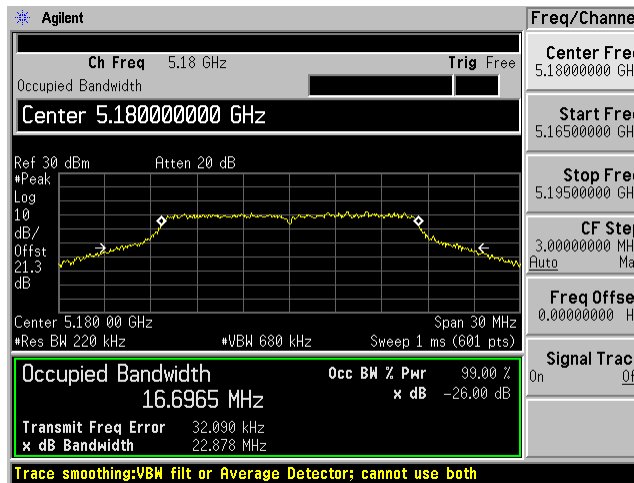
802.11a mode

Low channel: Chain 0

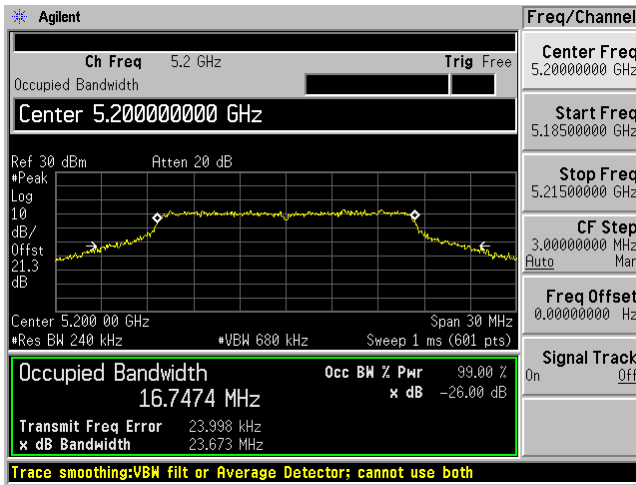
Low channel: Chain 1



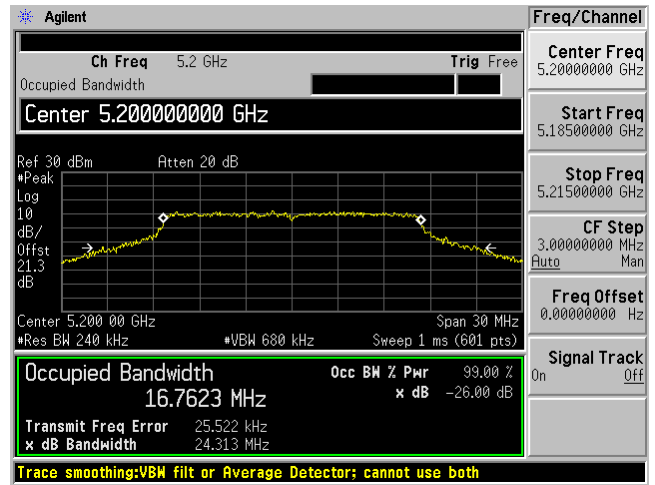
Low Channel: Chain 2



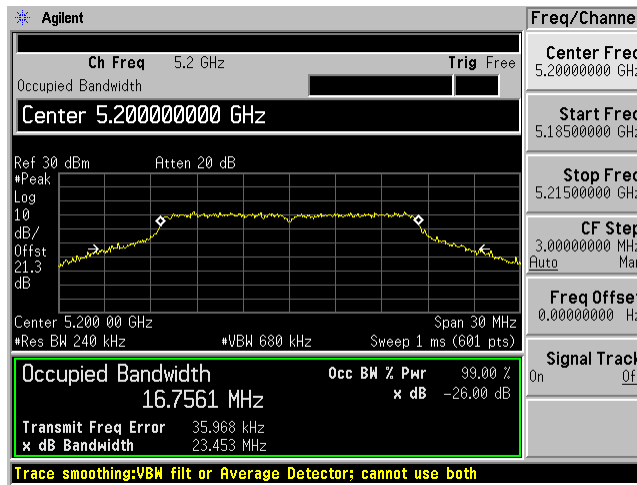
Middle channel: Chain 0



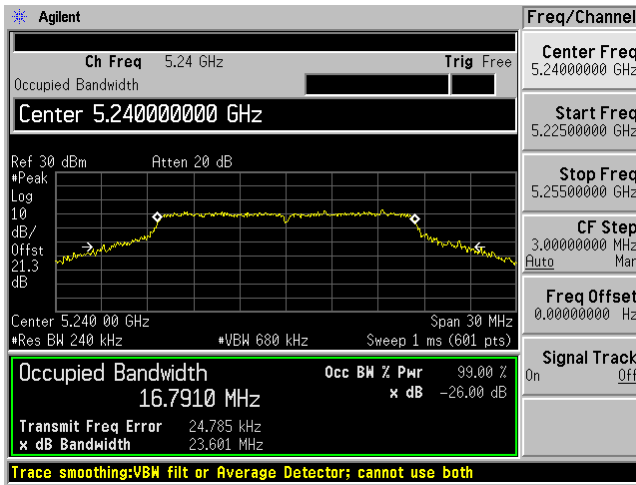
Middle channel: Chain 1



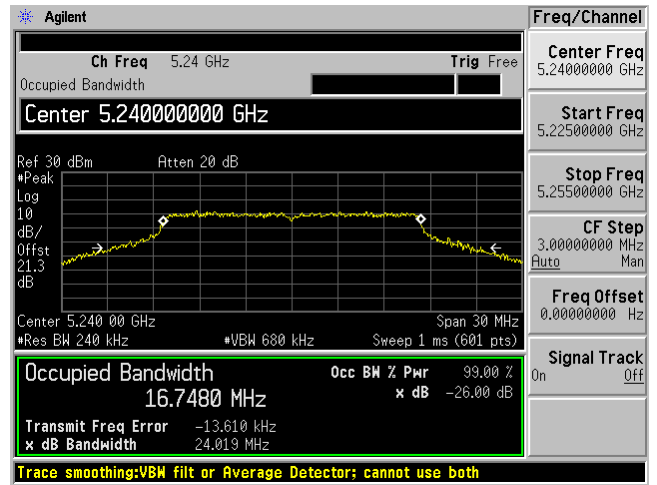
Middle Channel: Chain 2



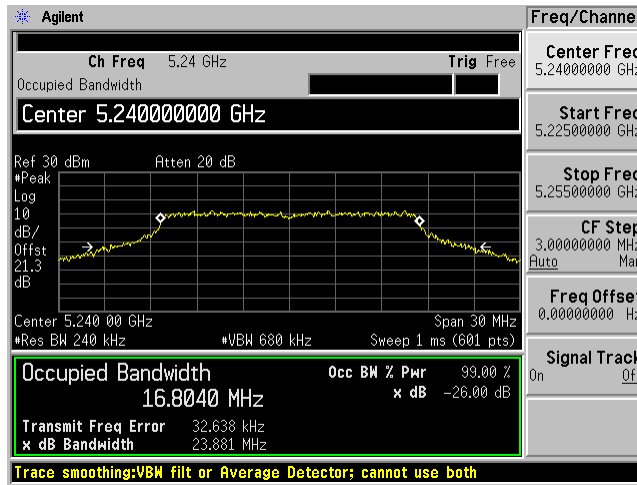
High channel: Chain 0



High channel: Chain 1



High Channel: Chain 2

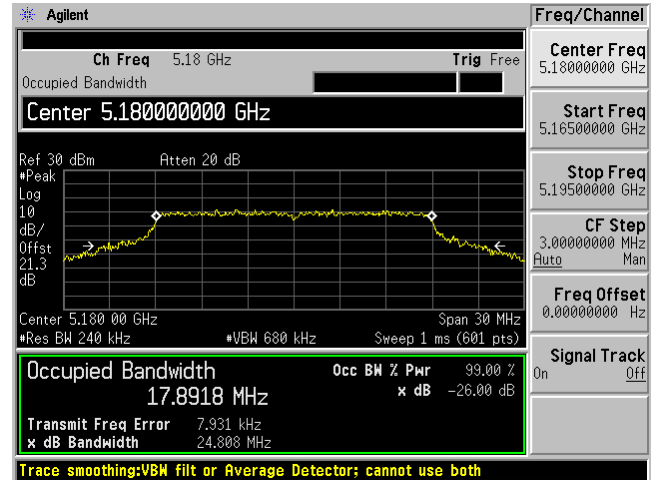
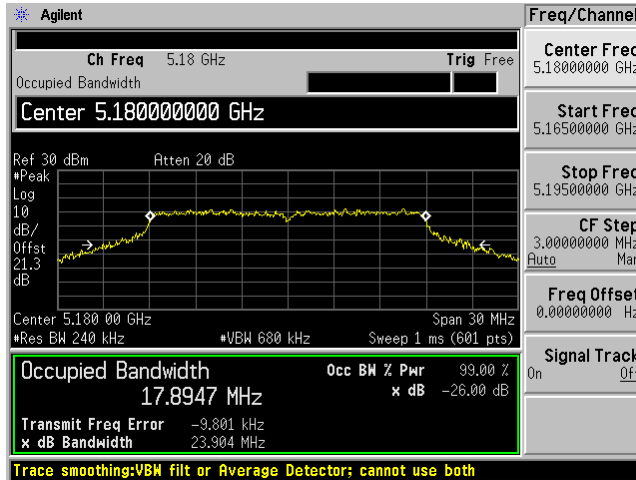




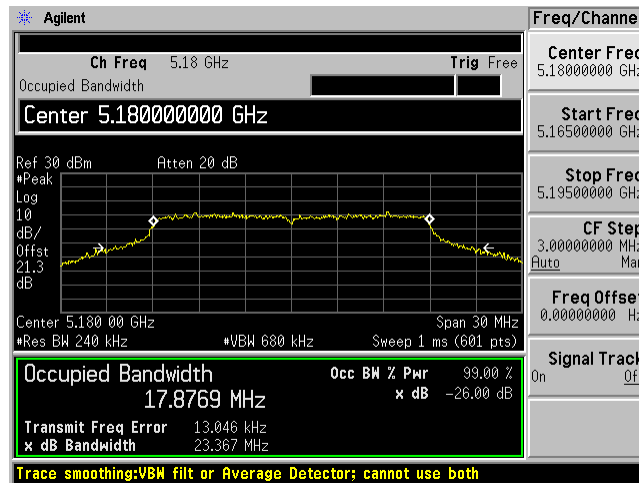
802.11n HT20 mode

Low channel: Chain 0

Low channel: Chain 1

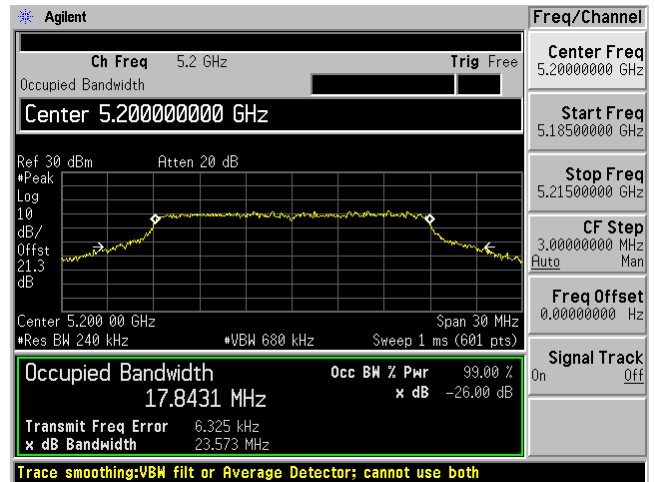
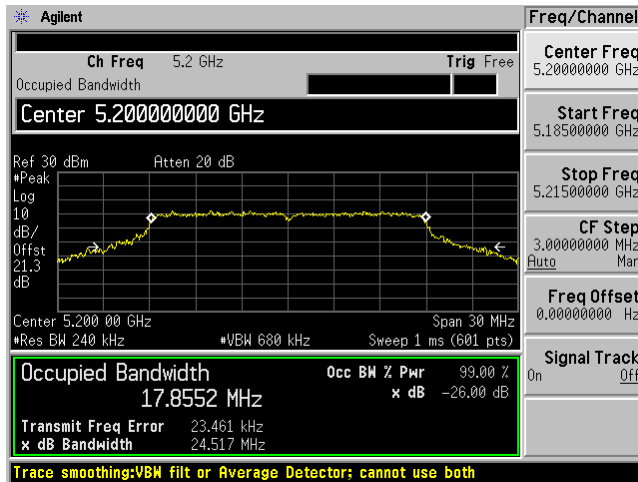


Low Channel: Chain 2

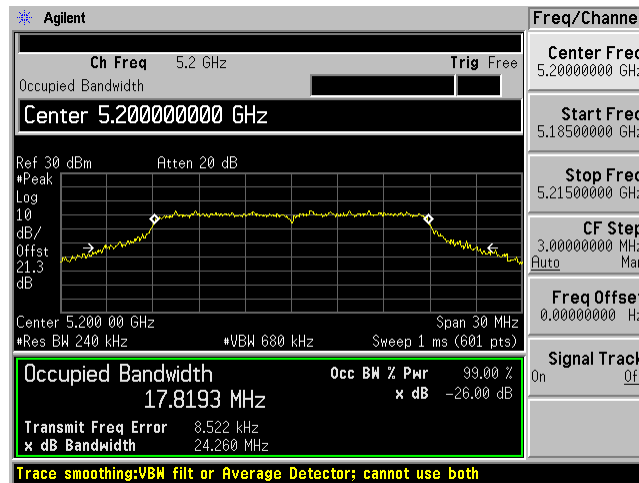


Middle channel: Chain 0

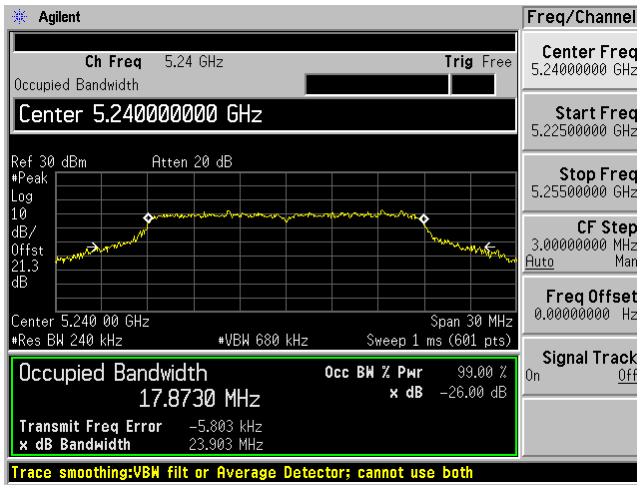
Middle channel: Chain 1



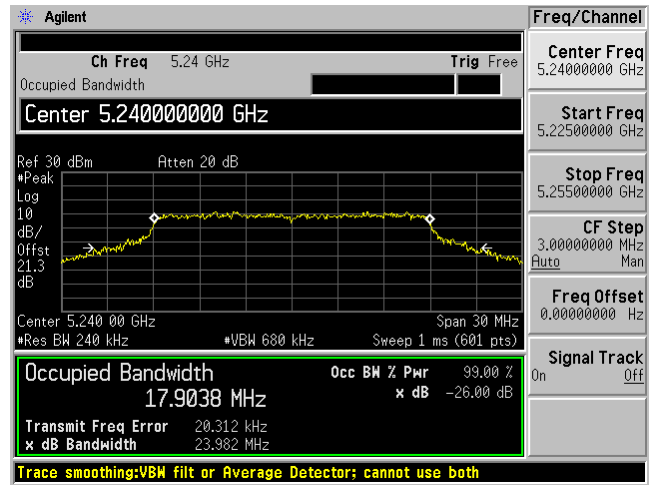
Middle Channel: Chain 2



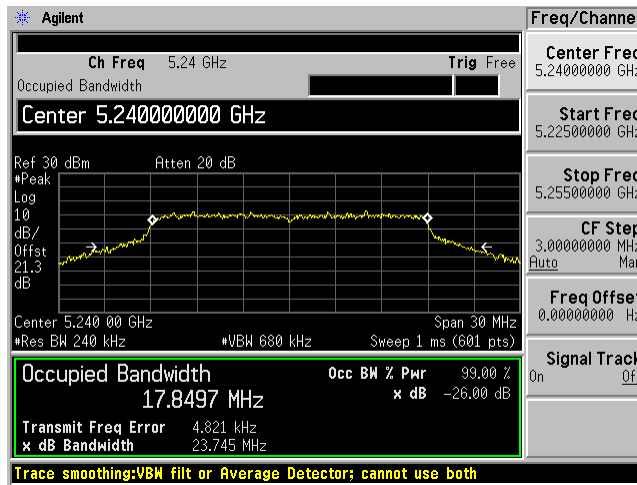
High channel: Chain 0



High channel: Chain 1

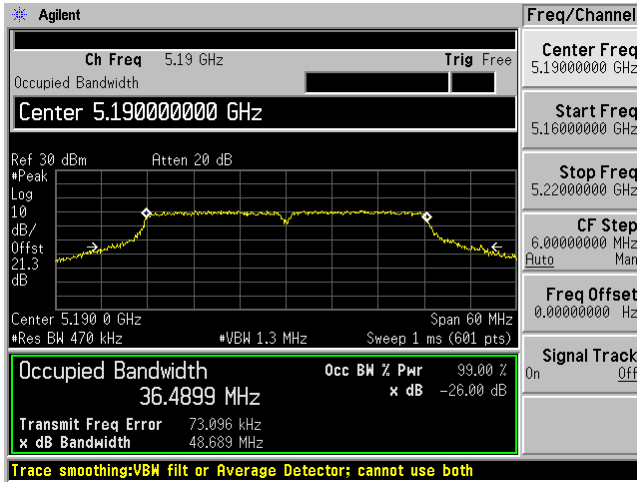


High Channel: Chain 2

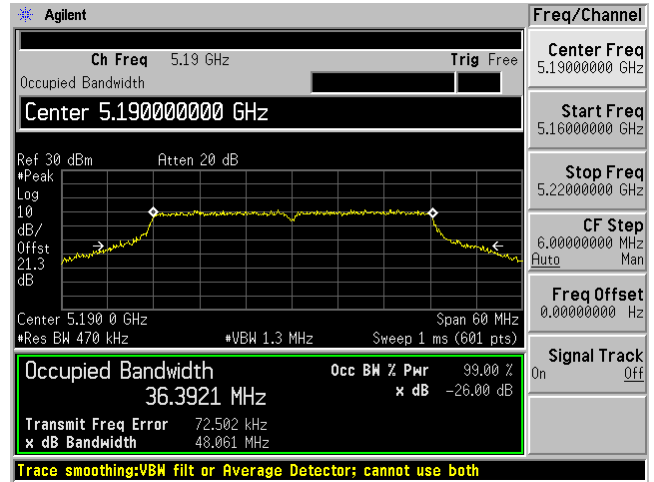


802.11n HT40 mode

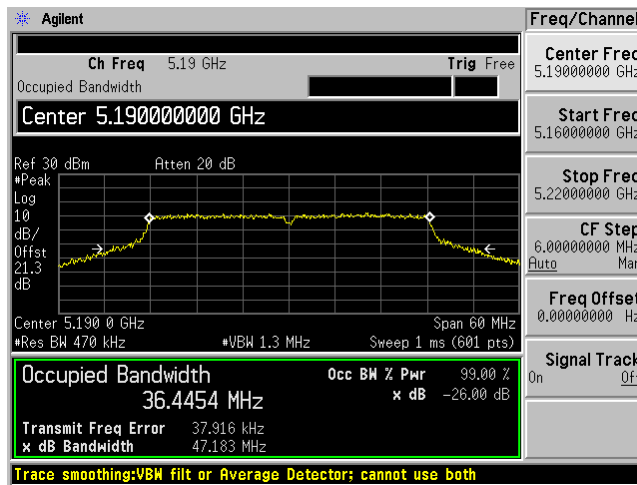
Low channel: Chain 0



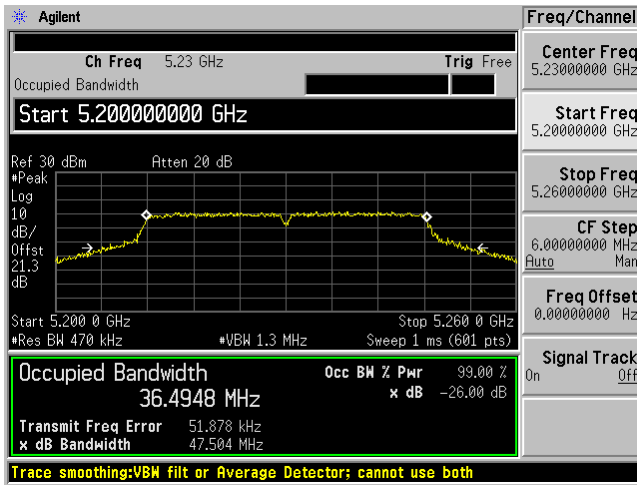
Low channel: Chain 1



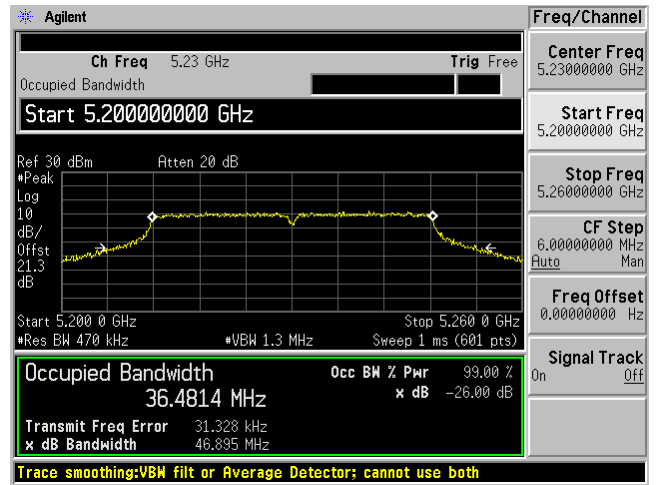
Low Channel: Chain 2



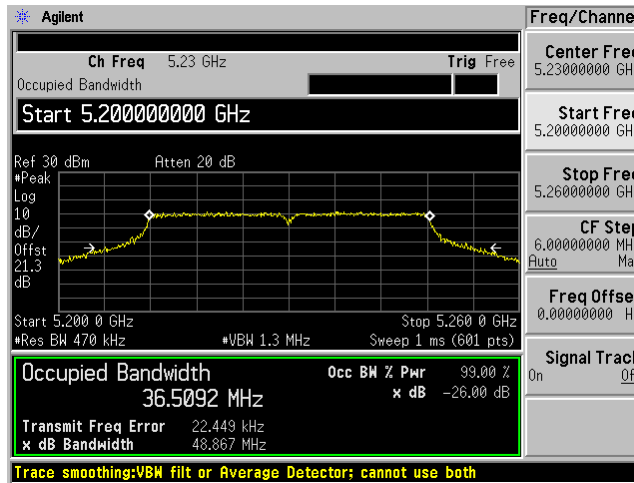
High channel: Chain 0



High channel: Chain 1

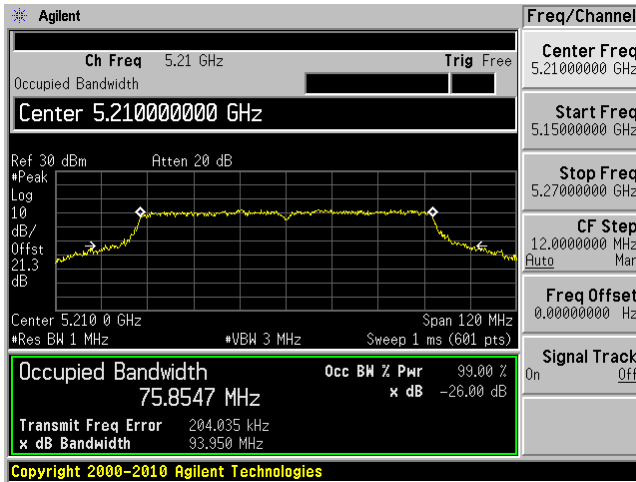


High Channel: Chain 2

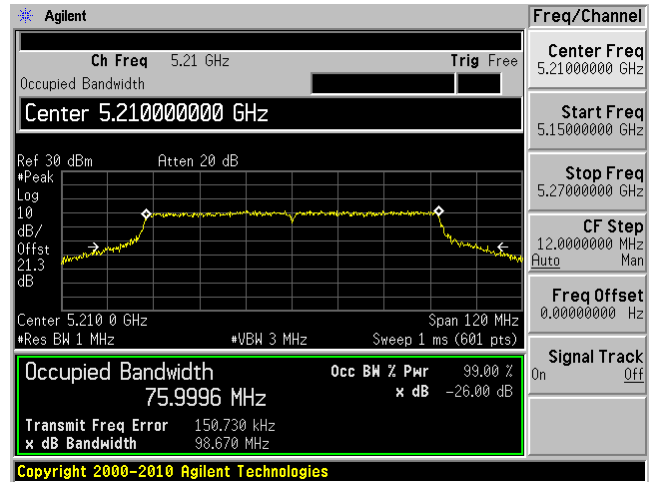


802.11ac 80 mode

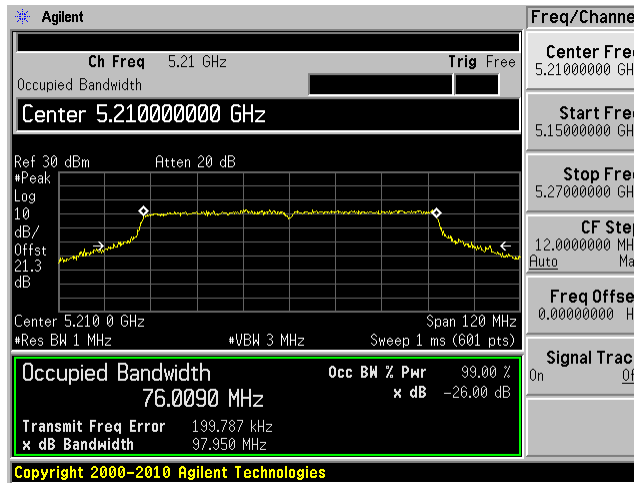
Chain 0



Chain 1



Chain 2



## 9 FCC §407(a)(1) & IC RSS-210 §A9.2 - Peak Output Power Measurement

### 9.1 Applicable Standard

#### According to FCC §15.407(a)(1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

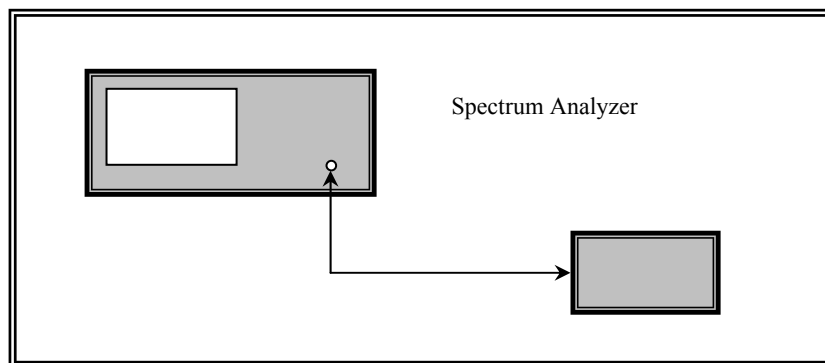
For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### According to IC RSS-210 §A9.2:

For the 5.15–5.250 GHz bands, the maximum e.i.r.p shall not exceed 200 mW or  $10 + 10 \log B$ , whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p spectral density shall not exceed 10 dBm in any 1.0 MHz band.

### 9.2 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.



### 9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2012-09-29	1 year

*Statement of Traceability: BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.*

### 9.4 Test Environmental Conditions

<b>Temperature:</b>	21 °C
<b>Relative Humidity:</b>	43 %
<b>ATM Pressure:</b>	101.3 kPa

*The testing was performed by Ning Ma from 2013-04-16 at the RF site.*



## 9.5 Test Results

802.11a mode:

Frequency (MHz)	Conducted Output Power (dBm)			Total Power (dBm)	Limit (dBm)	Margin (dB)	Software Power Setting
	Chain 0	Chain 1	Chain 2				
5180	10.67	10.17	10.37	15.18	17	-1.82	12.5
5200	10.17	10.02	10.29	14.93	17	-2.07	12.5
5240	10.73	10.14	10.38	15.19	17	-1.81	12.5

802.11n HT20 mode:

Frequency (MHz)	Conducted Output Power (dBm)			Total Power (dBm)	Limit (dBm)	Margin (dB)	Software Power Setting
	Chain 0	Chain 1	Chain 2				
5180	11.48	11.17	10.25	15.77	17	-1.23	12.5
5200	12.02	11.94	12.2	16.83	17	-0.17	13
5240	11.84	11.34	11.37	16.29	17	-0.71	12.5

802.11n HT40 mode:

Frequency (MHz)	Conducted Output Power (dBm)			Total Power (dBm)	Limit (dBm)	Margin (dB)	Software Power Setting
	Chain 0	Chain 1	Chain 2				
5190	11.26	10.73	11.55	15.96	17	-1.04	13
5230	11.41	10.72	11.22	15.90	17	-1.10	13

802.11ac 80 mode:

Frequency (MHz)	Conducted Output Power (dBm)			Total Power (dBm)	Limit (dBm)	Margin (dB)	Software Power Setting
	Chain 0	Chain 1	Chain 2				
5210	10.72	10.32	10.7	15.36	17	-1.64	25

## 10 FCC §15.407(b) & IC RSS-210 §A9.2 - Out of Band Emissions

### 10.1 Applicable Standard

#### According to FCC §15.407(b)

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz

**According to RSS-210 §A9.2**, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

### 10.2 Measurement Procedure

1. Set RBW = 100 KHz.
2. Set VBW  $\geq 3 \times$  RBW
3. Perform a band-power intergration across the 1 MHz bandwidth in which the band-edge emission level is to be measured.
4. Detector = RMS.
5. Averaging type = power
6. Sweep time = auto.
7. Perform a trace average of at least 100 traces if the transmission is continuous.

### 10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2012-09-29	1 year

*Statement of Traceability: BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.*

### 10.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	40 %
ATM Pressure:	101.8 kPa

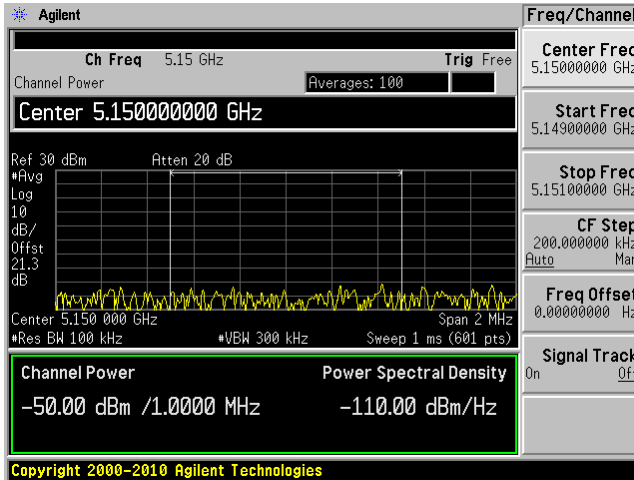
*The testing was performed by Ning Ma on 2013-04-16 in RF site.*

## 10.5 Test Results

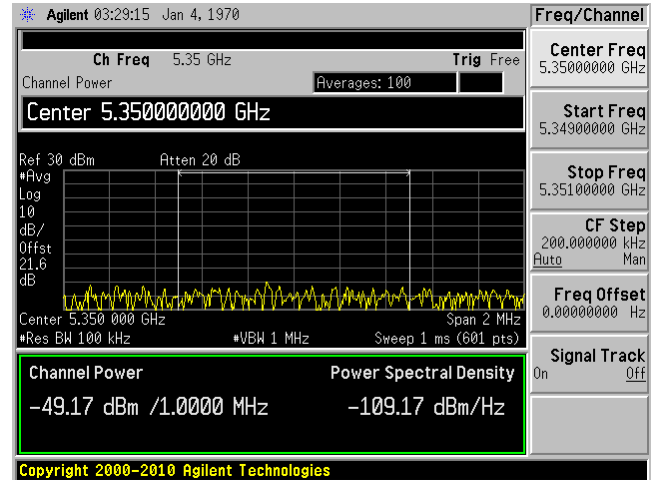
Please refer to following pages for plots of band edge.

### 802.11a mode

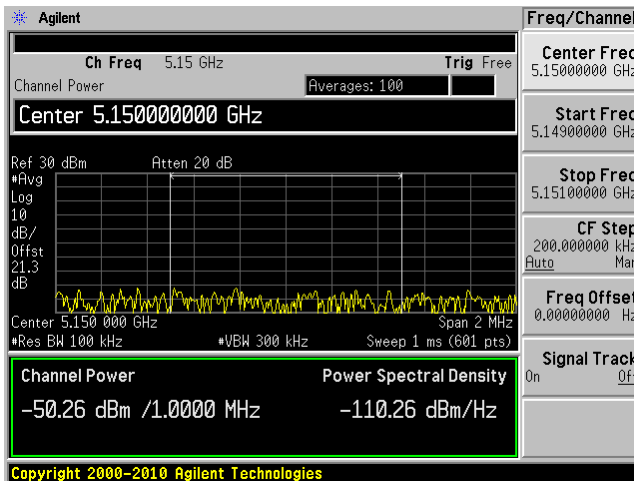
802.11a, Chain 0 Low Band Edge



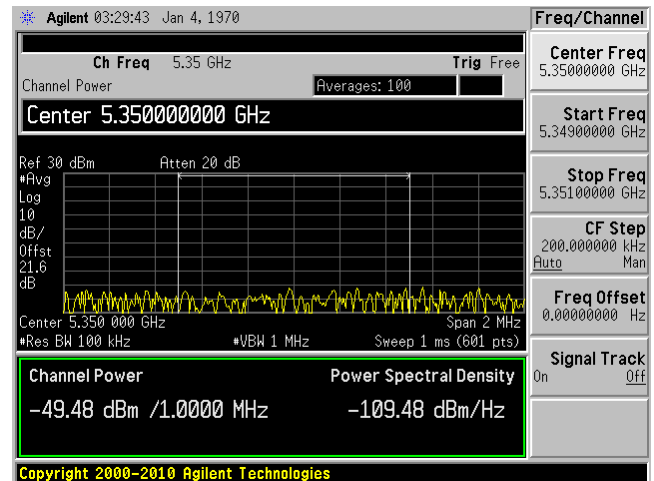
802.11a, Chain 0 High Band Edge



802.11a, Chain 1 Low Band Edge

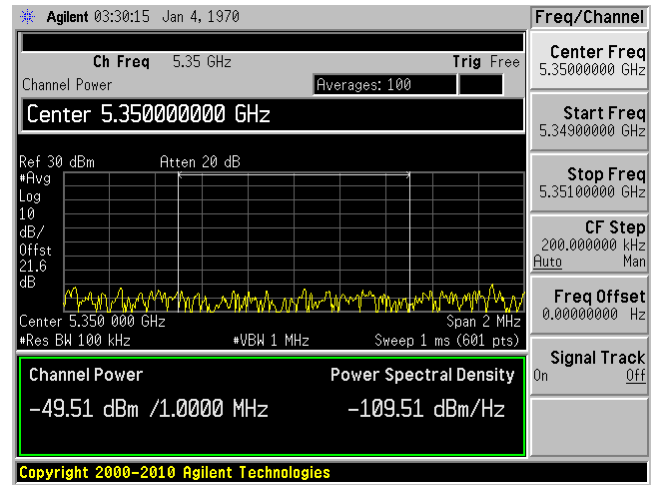
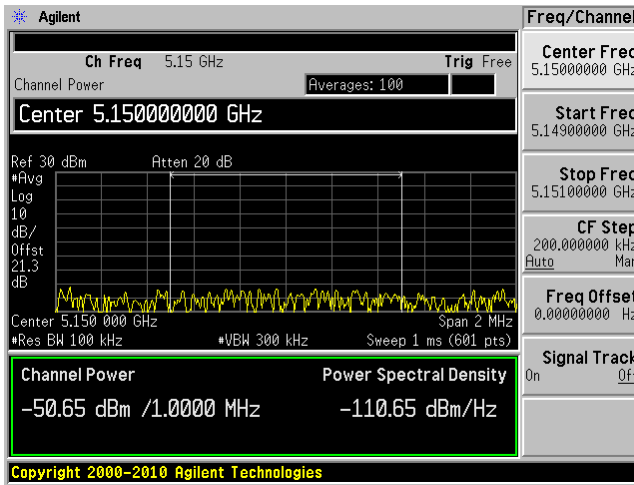


802.11a, Chain 1 High Band Edge



802.11a, Chain 2 Low Band Edge

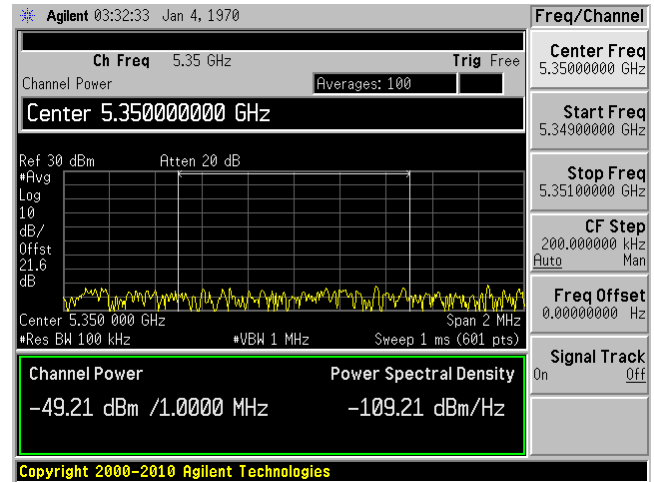
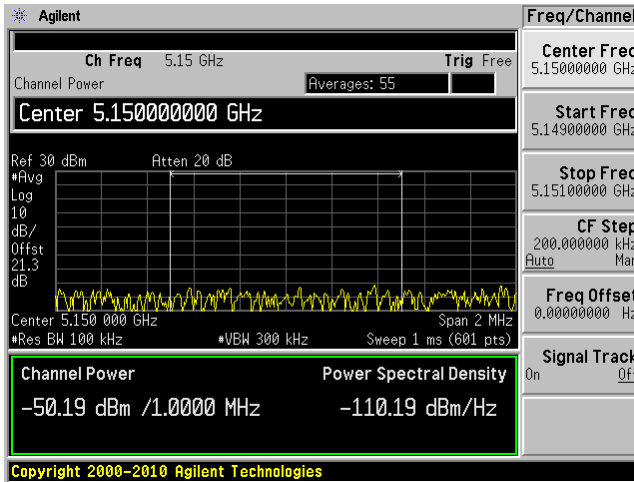
802.11a, Chain 2 High Band Edge



802.11n HT20 mode

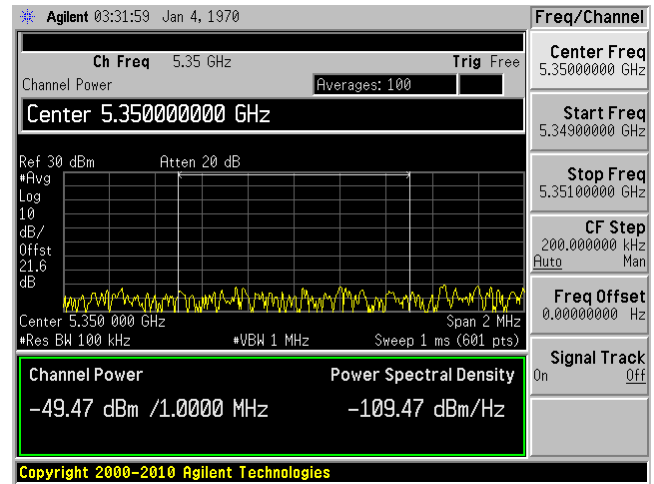
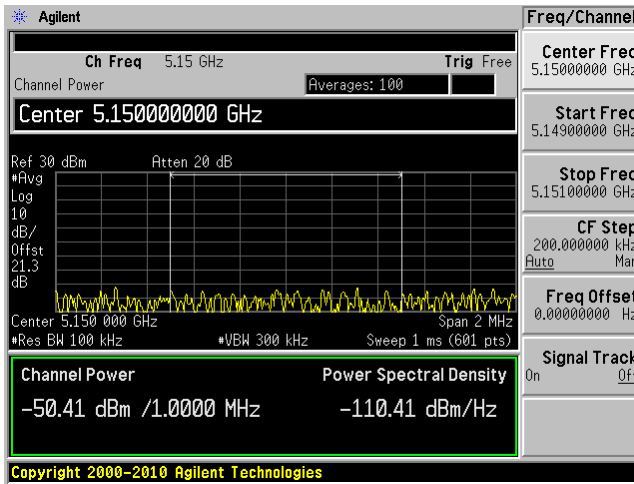
802.11n HT20, Chain 0 Low Band Edge

802.11n HT20, Chain 0 High Band Edge



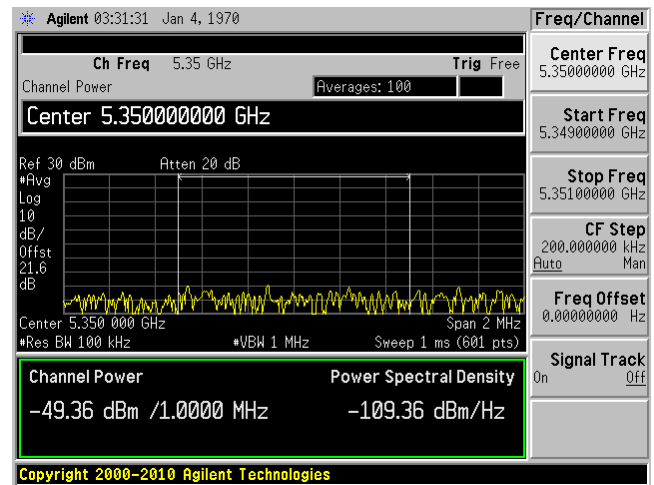
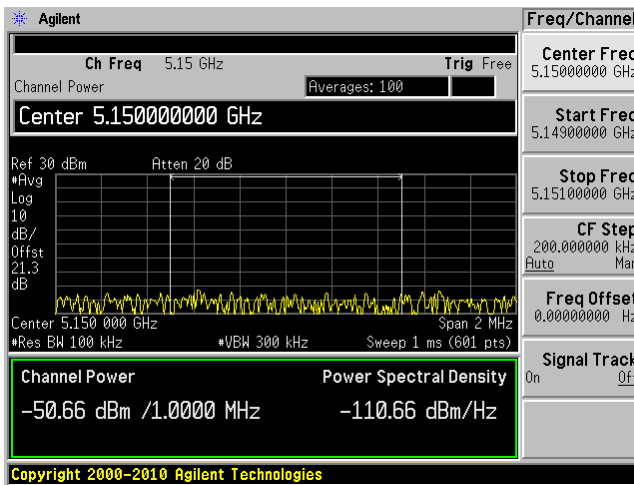
802.11n HT20, Chain 1 Low Band Edge

802.11n HT20, Chain 1 High Band Edge



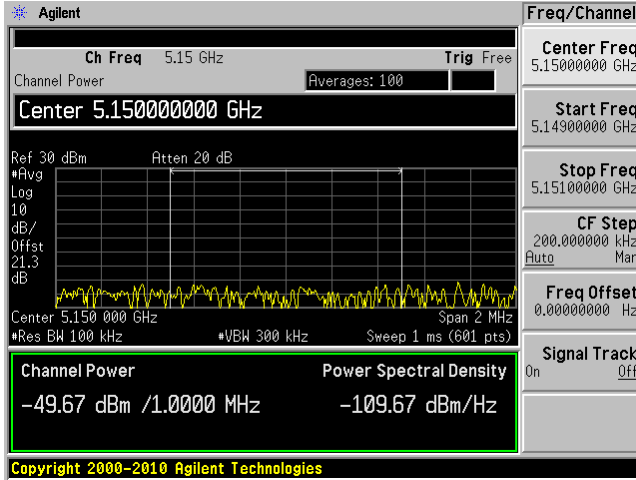
802.11n HT20, Chain 2 Low Band Edge

802.11n HT20, Chain 2 High Band Edge

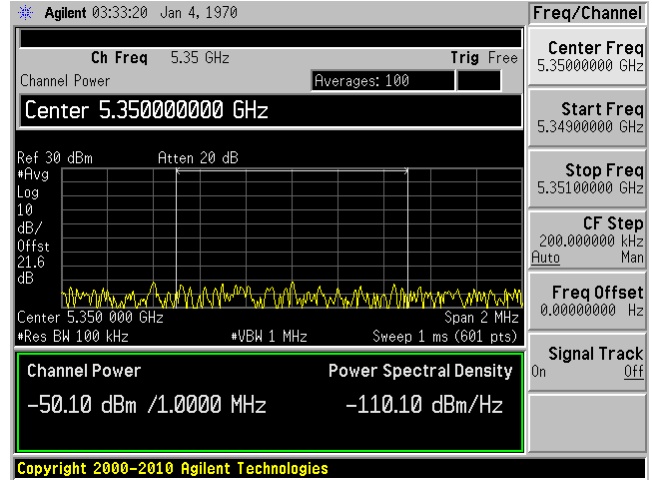


**802.11n HT40 mode**

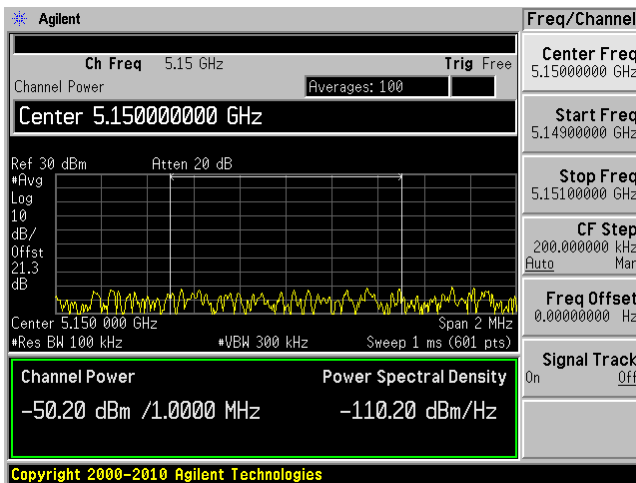
802.11n HT40, Chain 0 Low Band Edge



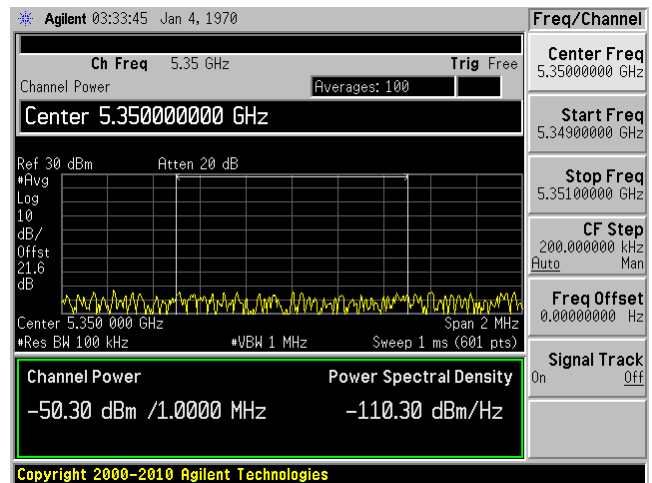
802.11n HT40, Chain 0 High Band Edge



802.11n HT40, Chain 1 Low Band Edge

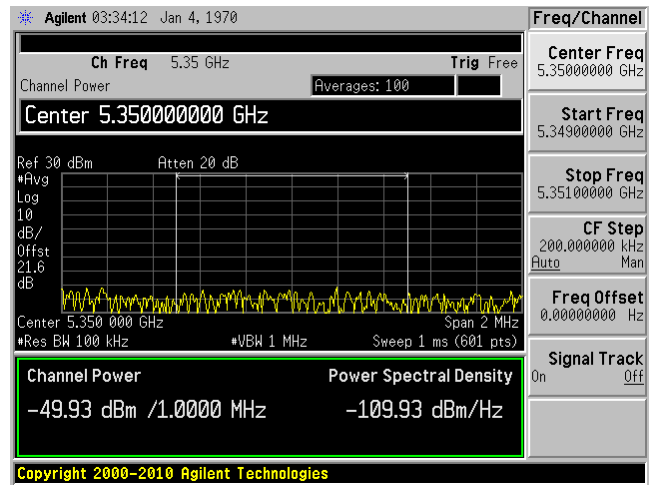
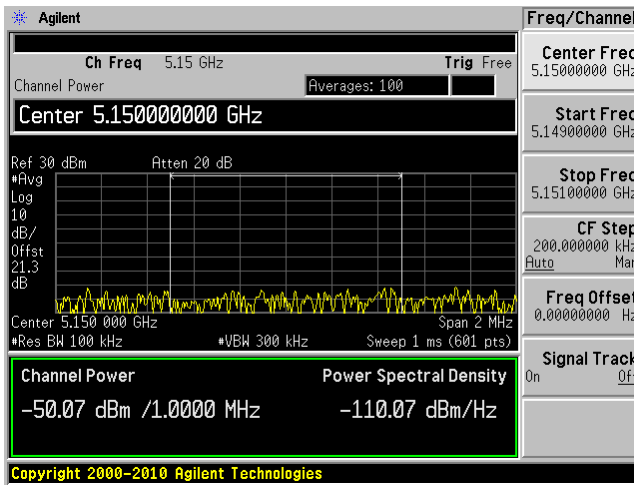


802.11n HT40, Chain 1 High Band Edge



802.11n HT40, Chain 2 Low Band Edge

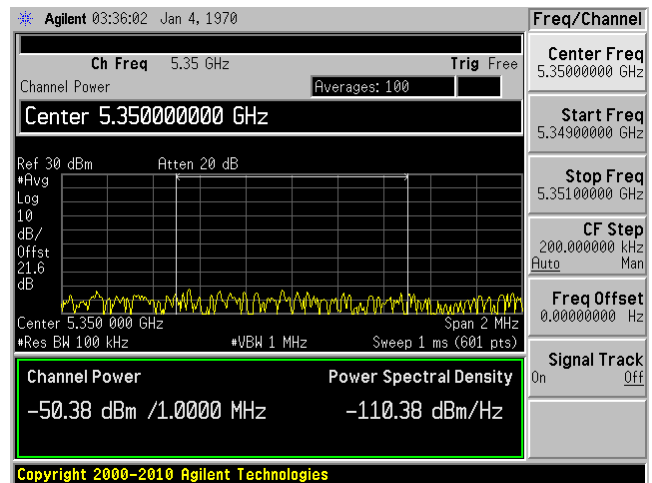
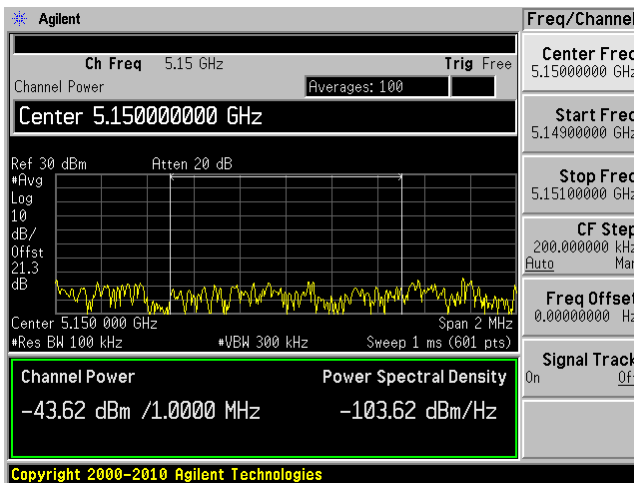
802.11n HT40, Chain 2 High Band Edge



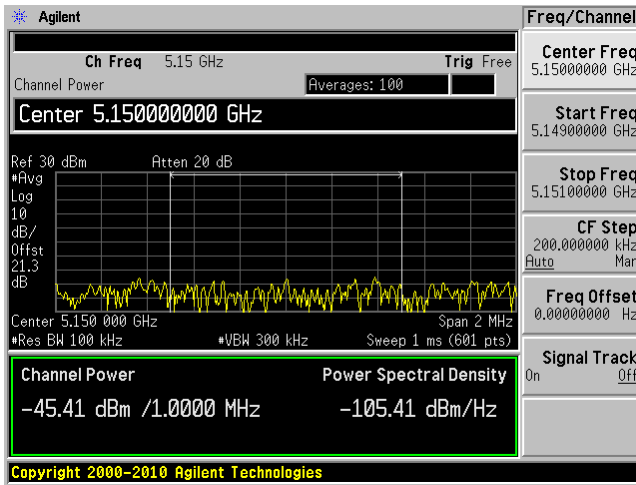
802.11ac 80 mode

802.11ac 80, Chain 0 Low Band Edge

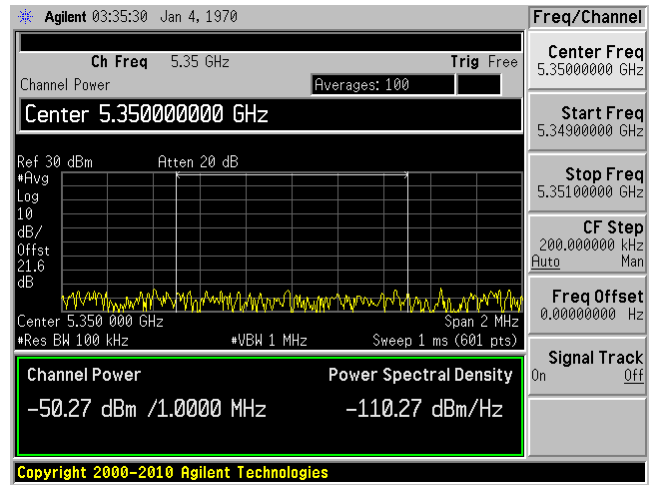
802.11ac 80, Chain 0 High Band Edge



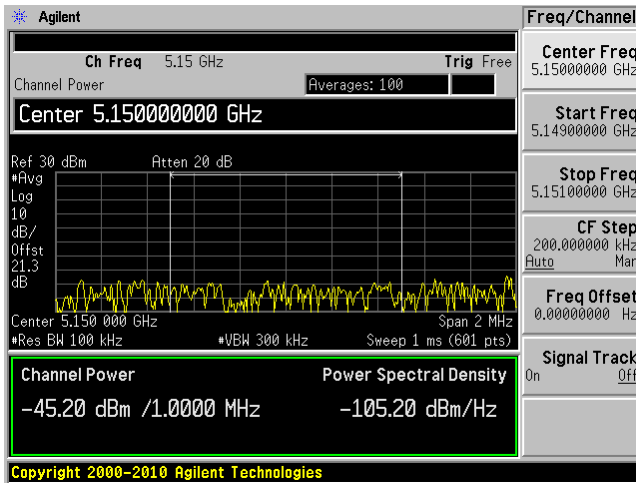
802.11ac 80, Chain 1 Low Band Edge



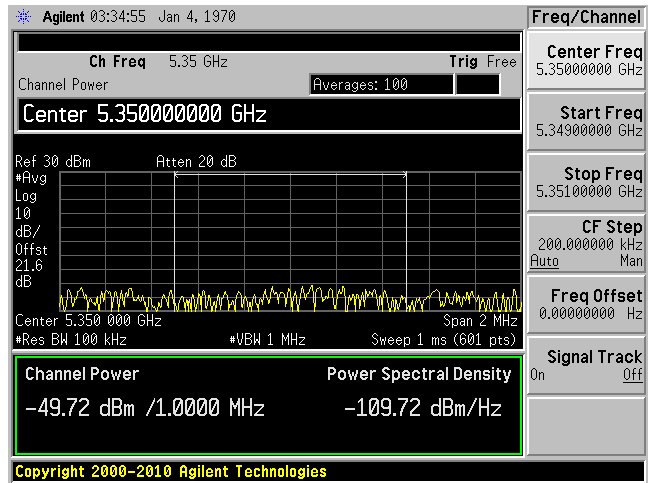
802.11ac 80, Chain 1 High Band Edge



802.11ac 80, Chain 2 Low Band Edge



802.11ac 80, Chain 2 High Band Edge





## 11 FCC §15.407(a)(1) & IC RSS-210 §A9.2 - Power Spectral Density

### 11.1 Applicable Standard

#### According to FCC §15.407(a)(1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### According to IC RSS-210 §A9.2:

5150-5250MHz the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10 B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

### 11.2 Measurement Procedure

- (i) Set span to encompass the entire emission bandwidth (EBW) of the signal.
- (ii) Set RBW = 1 MHz.
- (iii) Set VBW  $\geq$  3 MHz.
- (iv) Number of points in sweep  $\geq$  2 Span / RBW. (This ensures that bin-to-bin spacing is  $\leq$  RBW/2, so that narrowband signals are not lost between frequency bins.)
- (v) Sweep time = auto.
- (vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- (vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle  $\geq$  98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.
- (viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- (ix) Compute power by integrating the spectrum across the 26 dB EBW of the signal using the spectrum analyzer’s band power measurement function with band limits set equal to the EBW band edges. If the spectrum analyzer does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the 26 dB EBW of the spectrum.

### 11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2012-09-29	1 year

**Statement of Traceability:** *BACL Corp.* attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

## 11.4 Test Environmental Conditions

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	40 %
<b>ATM Pressure:</b>	101.8kPa

The testing was performed by Ning Ma from 2013-04-16 at the RF site.

## 11.5 Test Results

802.11a mode:

Frequency (MHz)	Power Spectral Density (dBm)			Total PSD (dBm)	Limit (dBm)	Margin (dB)	Software Power Setting
	Chain 0	Chain 1	Chain 2				
5180	-0.967	-1.462	-0.953	3.65	4	-0.35	12.5
5200	-1.139	-1.128	-0.502	3.86	4	-0.14	12.5
5240	-1.085	-1.299	-1.12	3.60	4	-0.40	12.5

802.11n HT20 mode:

Frequency (MHz)	Power Spectral Density (dBm)			Total PSD (dBm)	Limit (dBm)	Margin (dB)	Software Power Setting
	Chain 0	Chain 1	Chain 2				
5180	-1.167	-1.273	-1.661	3.41	4	-0.59	12.5
5200	-0.977	-1.06	-1.381	3.64	4	-0.36	13
5240	-1.222	-1.443	-1.553	3.37	4	-0.63	12.5

802.11n HT40 mode:

Frequency (MHz)	Power Spectral Density (dBm)			Total PSD (dBm)	Limit (dBm)	Margin (dB)	Software Power Setting
	Chain 0	Chain 1	Chain 2				
5190	-2.597	-3.378	-3.084	1.76	4	-2.24	13
5230	-3.218	-3.836	-2.984	1.44	4	-2.56	13

802.11ac 80 mode:

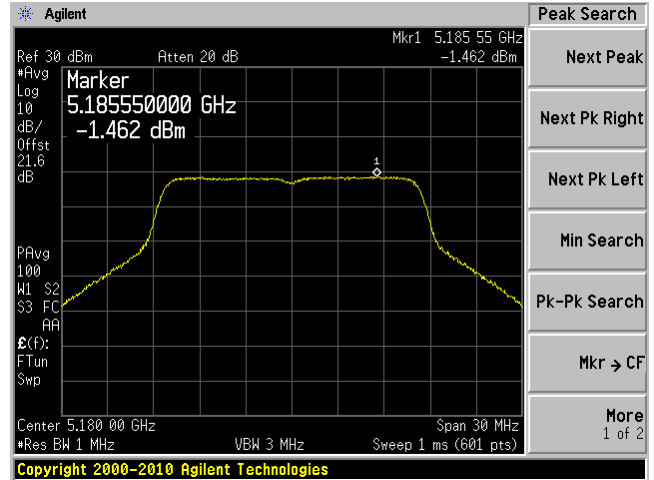
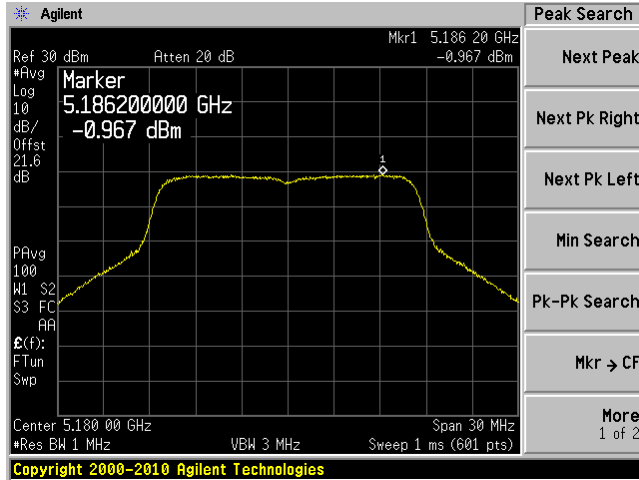
Frequency (MHz)	Power Spectral Density (dBm)			Total PSD (dBm)	Limit (dBm)	Margin (dB)	Software Power Setting
	Chain 0	Chain 1	Chain 2				
5210	-5.222	-6.435	-5.925	-1.06	4	-5.06	14

Please refer to the following plots.

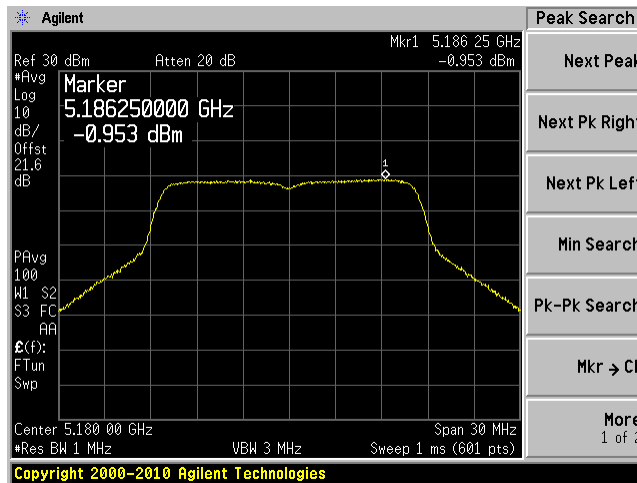
802.11a mode

Low channel: Chain 0

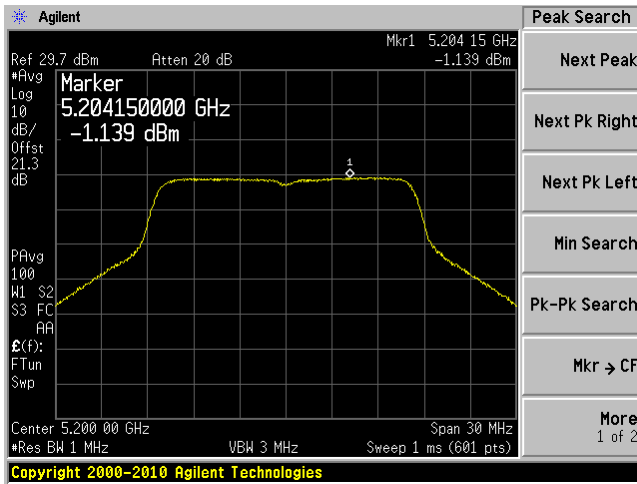
Low channel: Chain 1



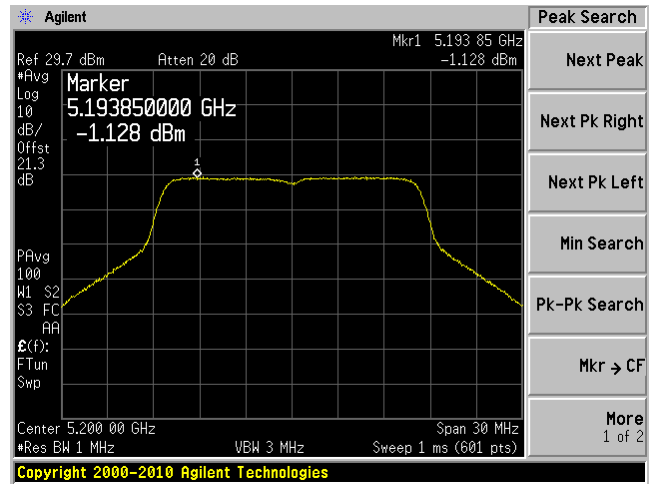
Low Channel: Chain 2



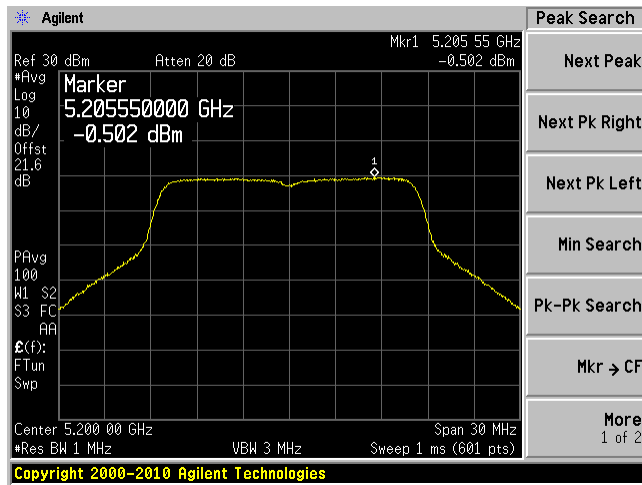
Middle channel: Chain 0



Middle channel: Chain 1

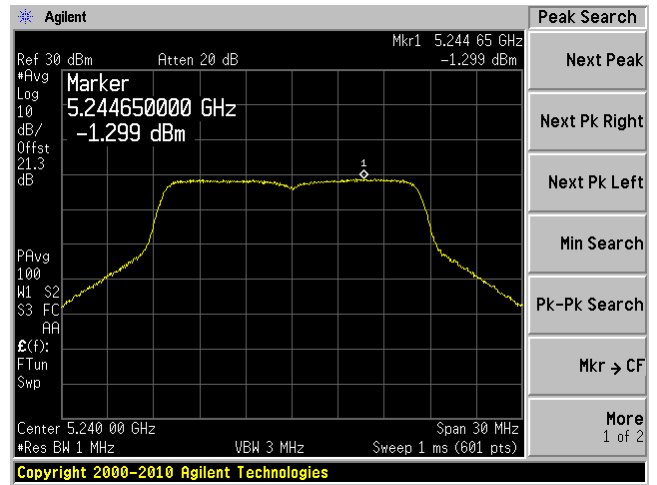
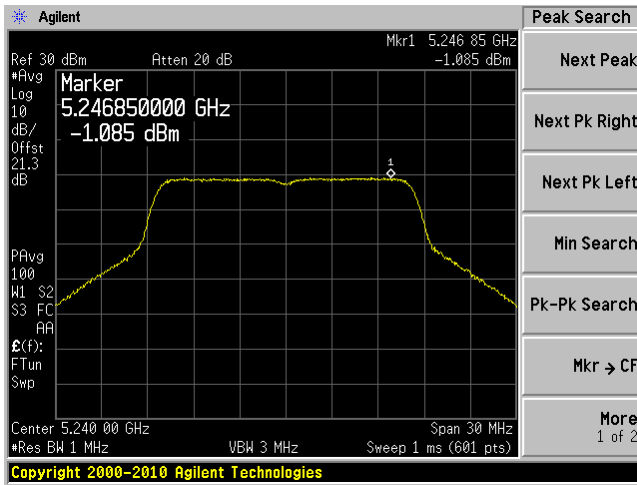


Middle Channel: Chain 2

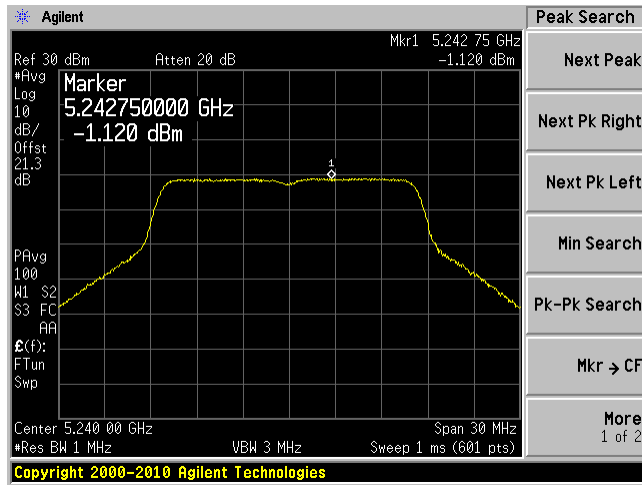


High channel: Chain 0

High channel: Chain 1

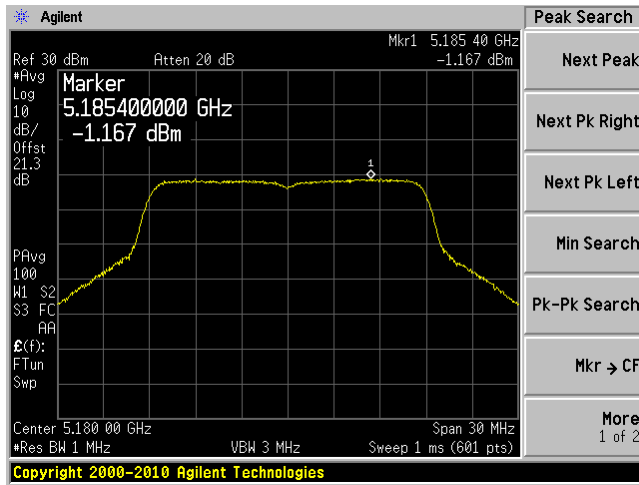


High Channel: Chain 2

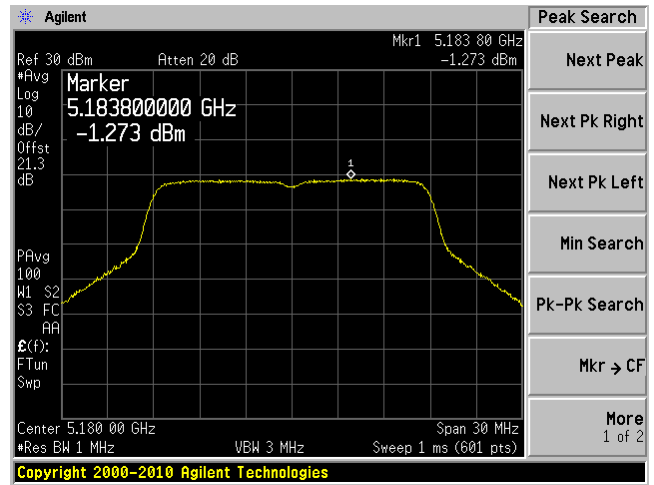


### 802.11 n HT20 mode

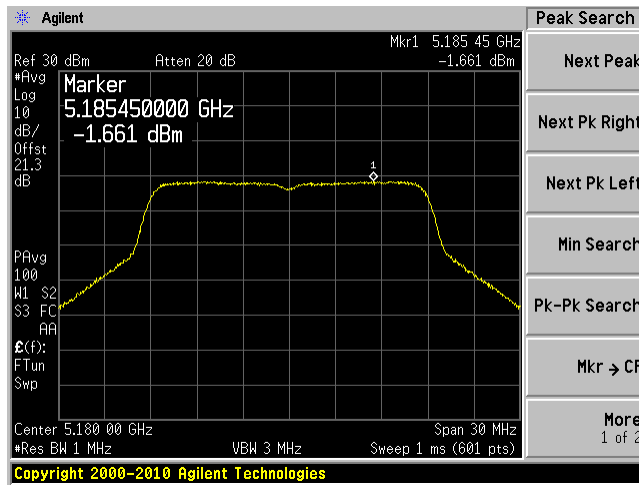
Low channel: Chain 0



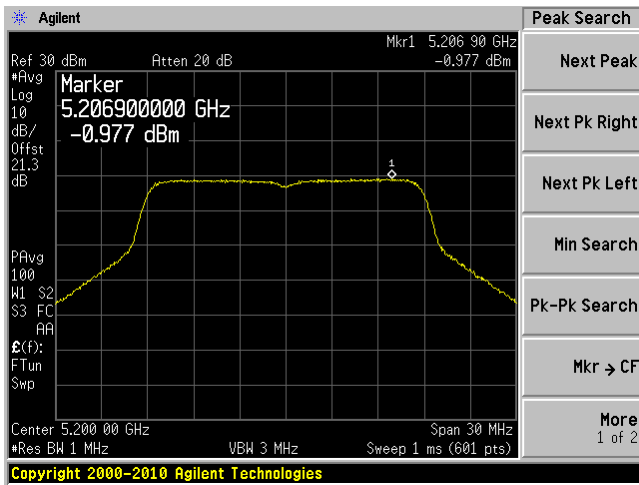
Low channel: Chain 1



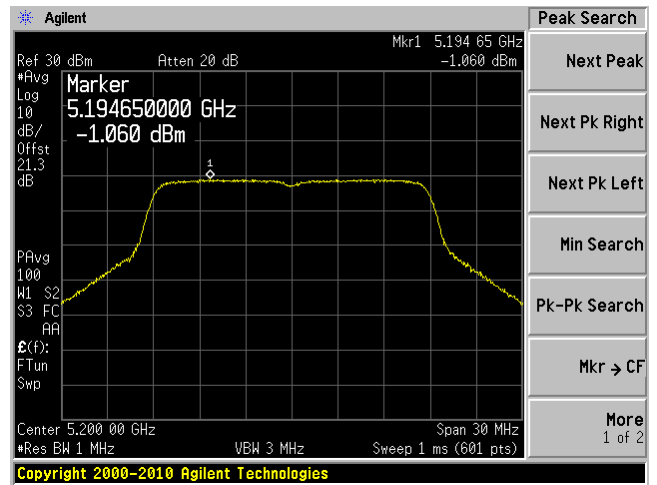
Low Channel: Chain 2



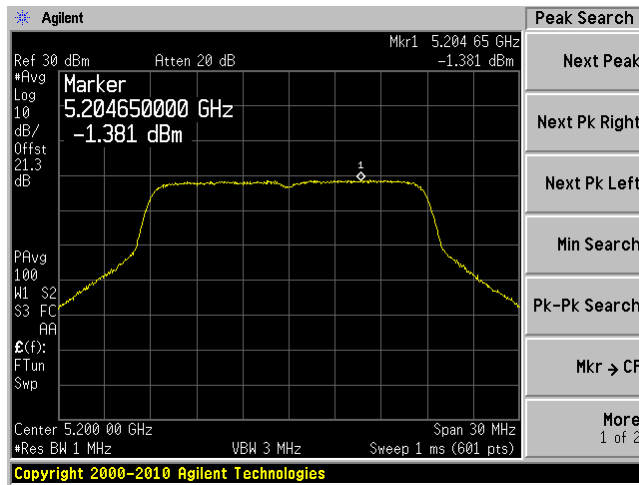
Middle channel: Chain 0



Middle channel: Chain 1

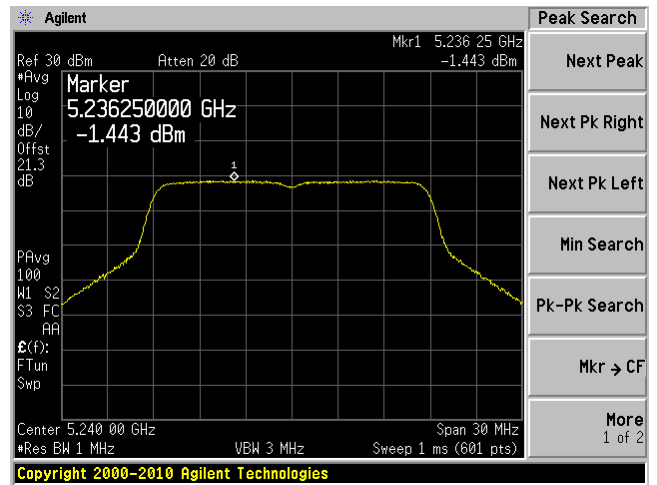
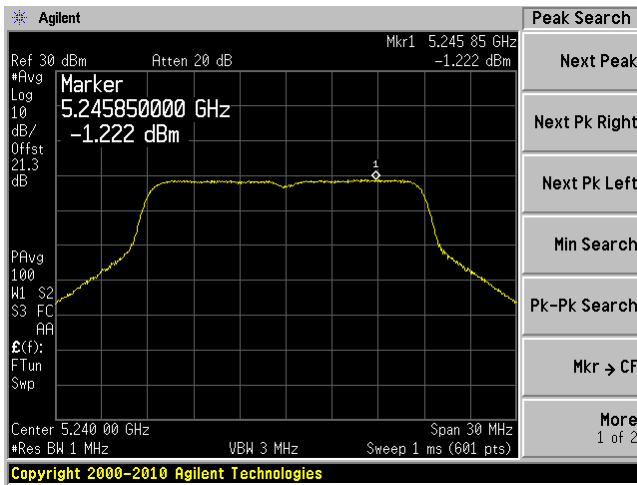


Middle Channel: Chain 2

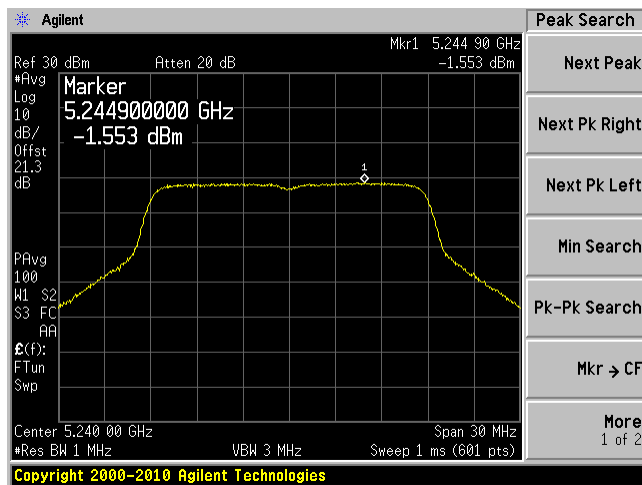


High channel: Chain 0

High channel: Chain 1



High Channel: Chain 2

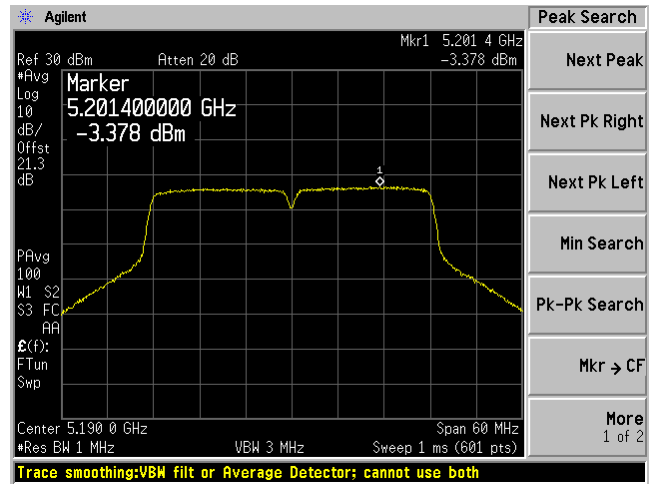
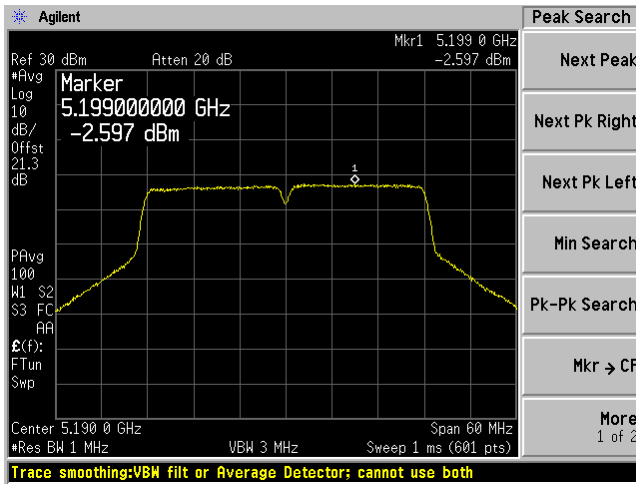




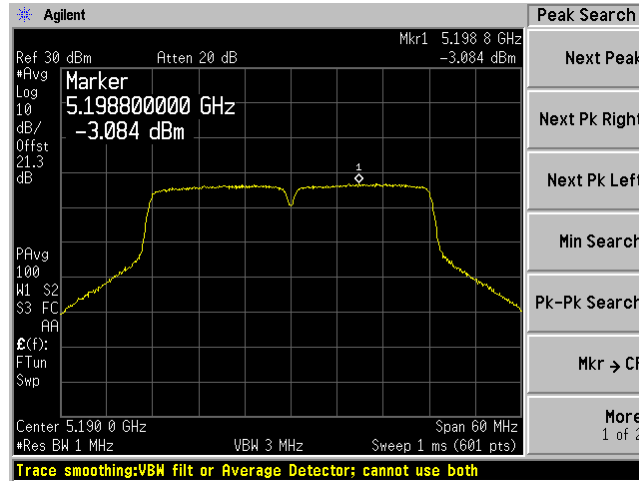
### 802.11n HT40 mode

Low channel: Chain 0

Low channel: Chain 1

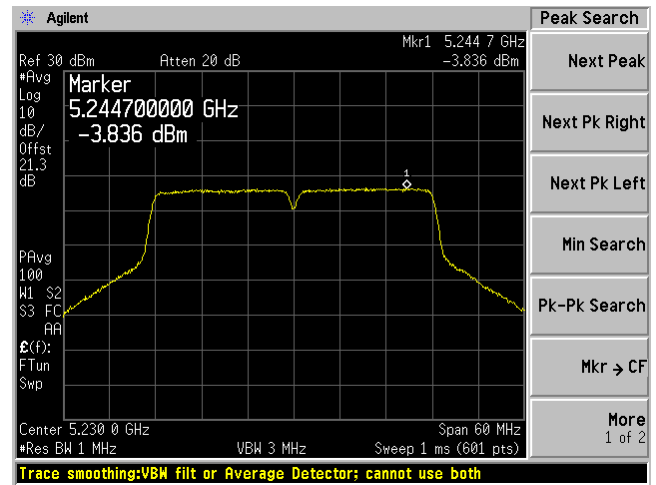
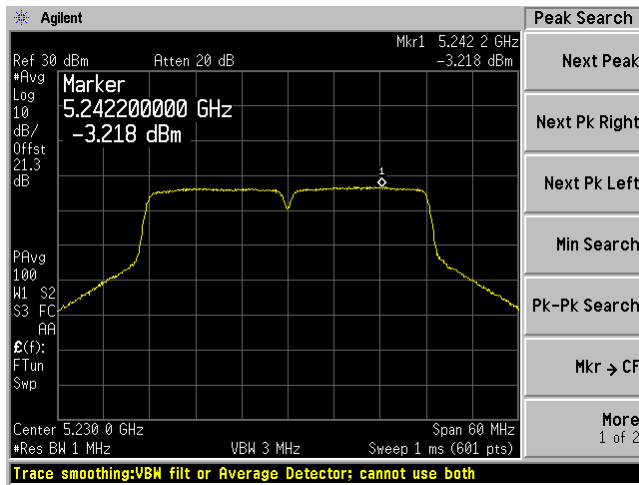


Low Channel: Chain 2

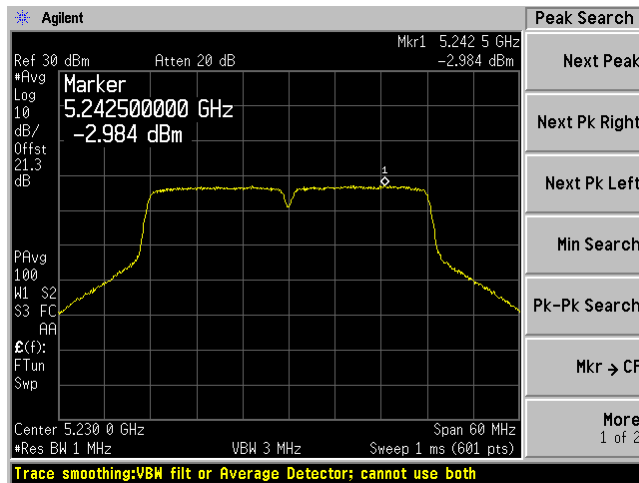


High channel: Chain 0

High channel: Chain 1

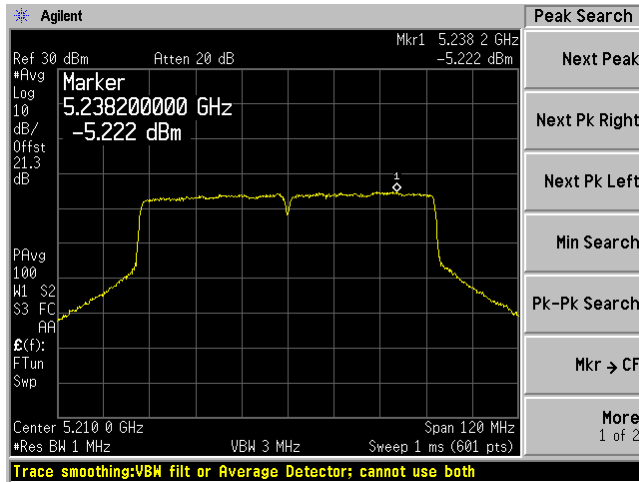


High Channel: Chain 2

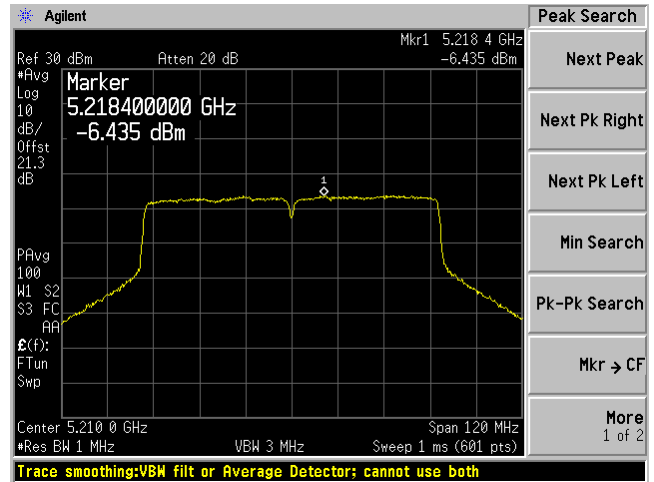


802.11 ac 80 mode

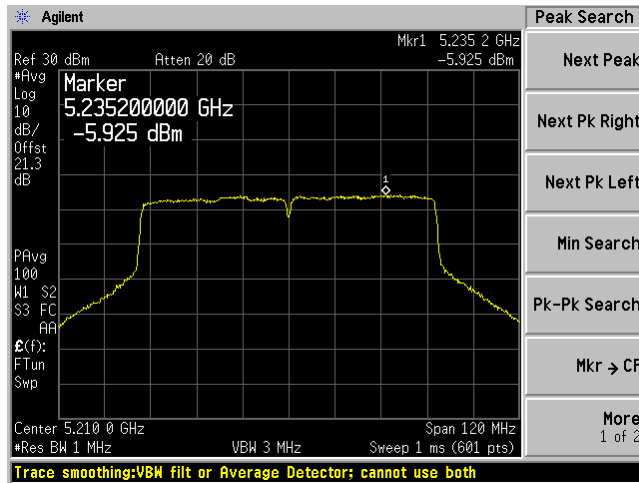
Chain 0



Chain 1



Chain 2



## 12 FCC §15.407(a)(6) – Peak Excursion Ratio

### 12.1 Applicable Standard

According to FCC §15.407(a) (6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### 12.2 Test Procedure

Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be  $\leq 13$  dB for all frequencies across the emission bandwidth. Submit a plot.

1st Trace:

- Set RBW = 1 MHz, VBW  $\geq 3$  MHz with peak detector and maxhold settings.

2nd Trace:

- create the 2nd trace using the settings described in the section “FCC §15.407(a)(1)(2) – CONDUCTED TRANSMITTER OUTPUT POWER”.

### 12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2012-09-29	1 year

*Statement of Traceability: BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.*

### 12.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	40 %
ATM Pressure:	101.8 kPa

*The testing was performed by Ning Ma on 2013-04-16 in RF site.*

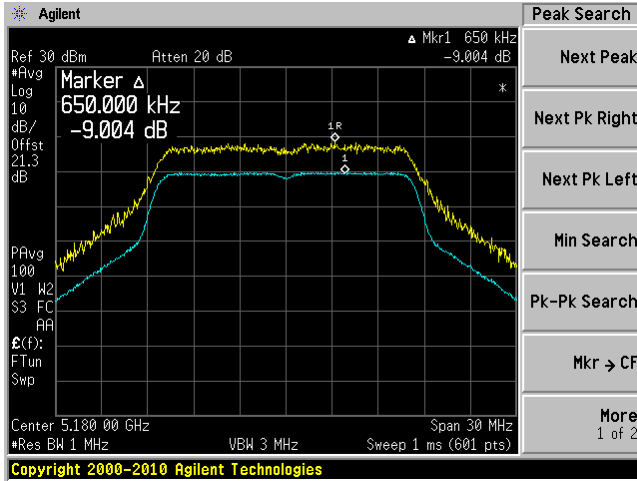
**12.5 Test Results**

Channel	Frequency (MHz)	TX Chain 0 PER (dB)	TX Chain 1 PER (dB)	TX Chain 2 PER (dB)	Limit (dB)
802.11 a mode					
Low	5180	9.004	8.007	9.604	13
Middle	5200	8.424	9.9	9.382	
High	5240	9.245	9.406	8.963	
802.11 n 20					
Low	5180	8.482	8.882	8.896	13
Middle	5200	8.623	8.996	8.809	
High	5240	8.844	8.790	9.123	
802.11 n 40					
Low	5190	8.856	9.161	10.557	13
High	5230	9.023	9.131	10.216	
802.11 ac 80					
/	5210	8.785	9.183	10.337	13

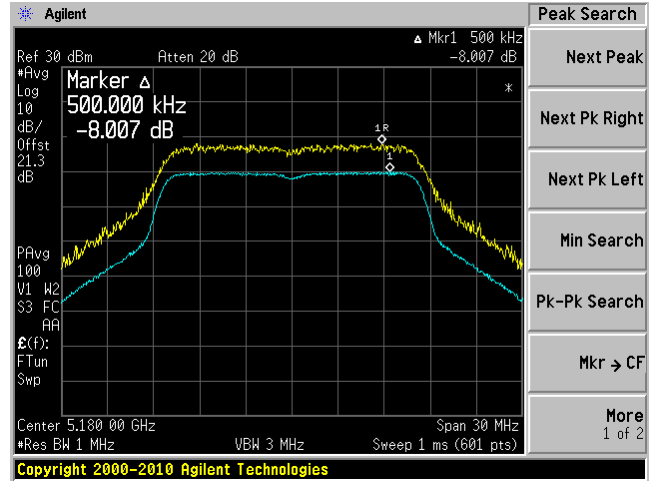
Please refer to the following plots for detailed test results:

802.11a mode

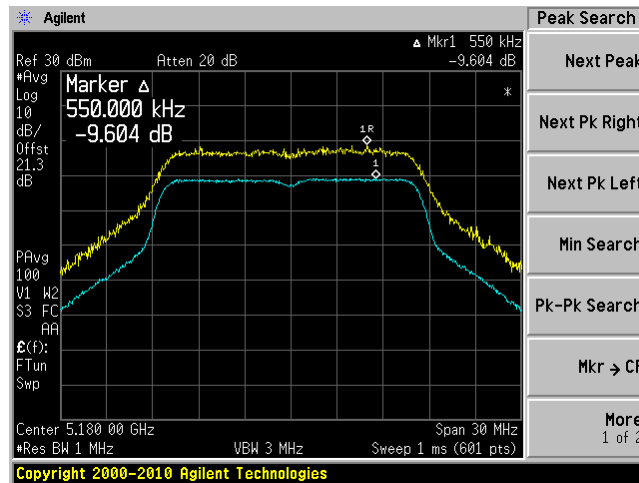
Low channel: Chain 0



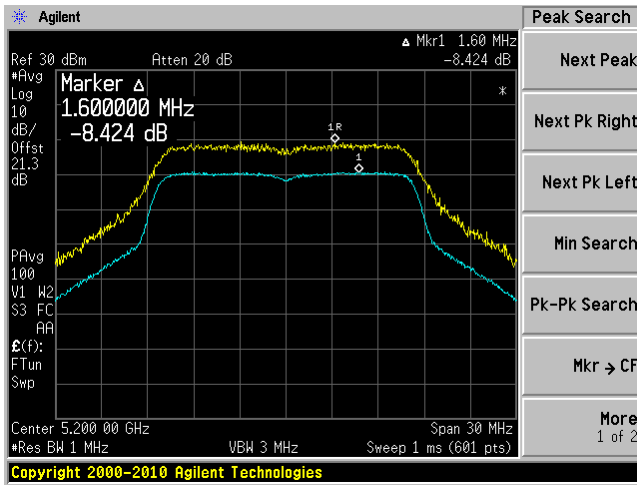
Low channel: Chain 1



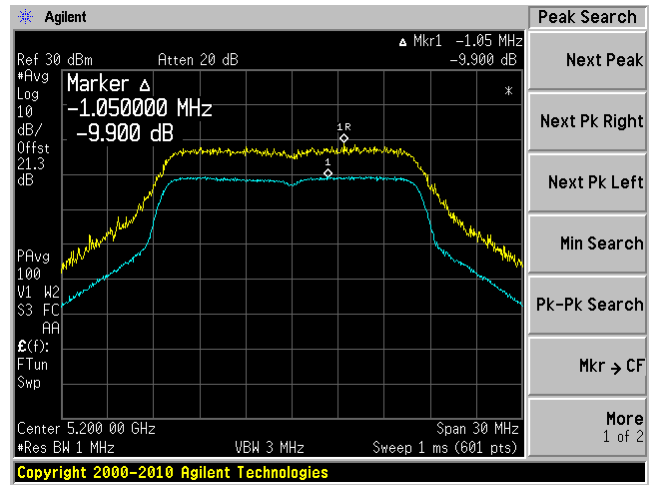
Low Channel: Chain 2



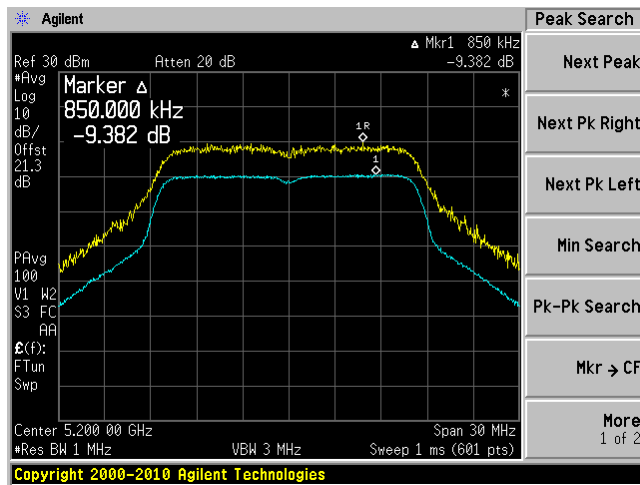
Middle channel: Chain 0



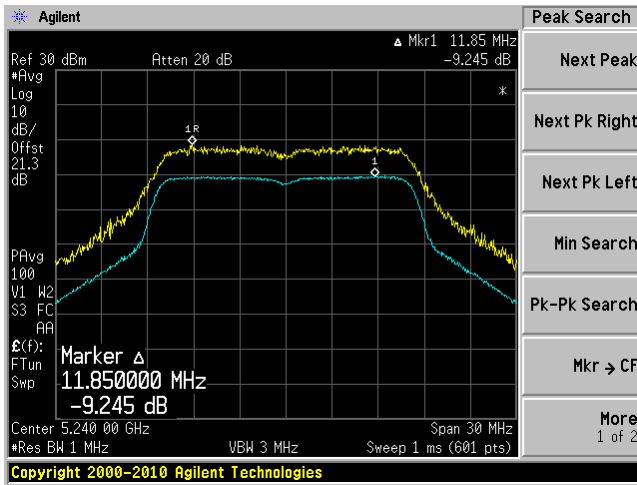
Middle channel: Chain 1



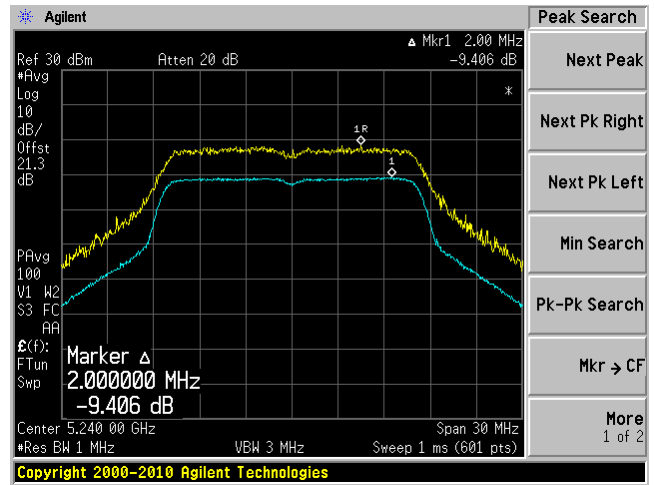
Middle Channel: Chain 2



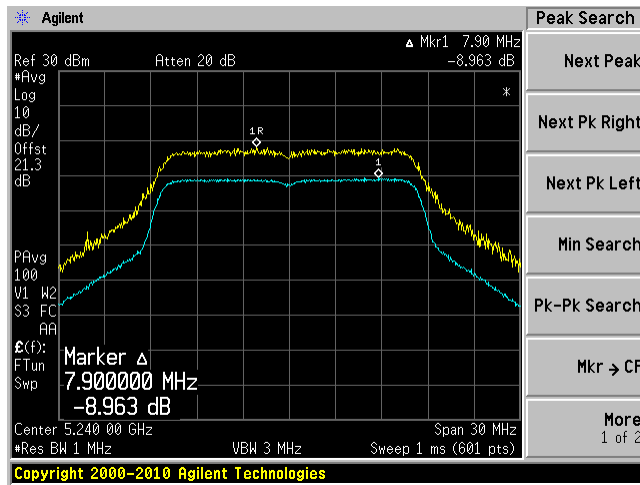
High channel: Chain 0



High channel: Chain 1



High Channel: Chain 2

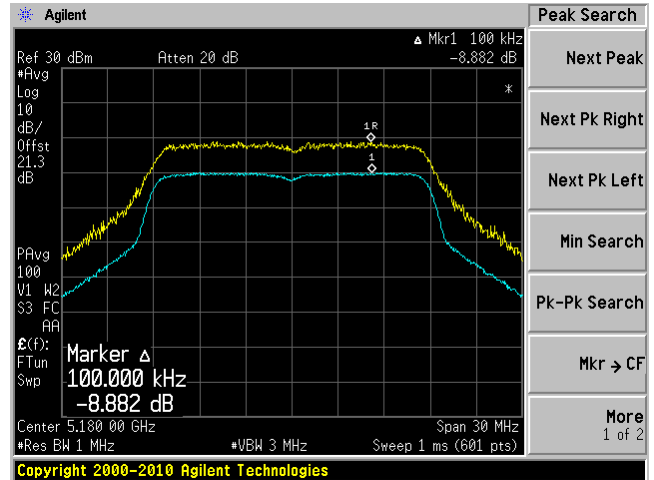
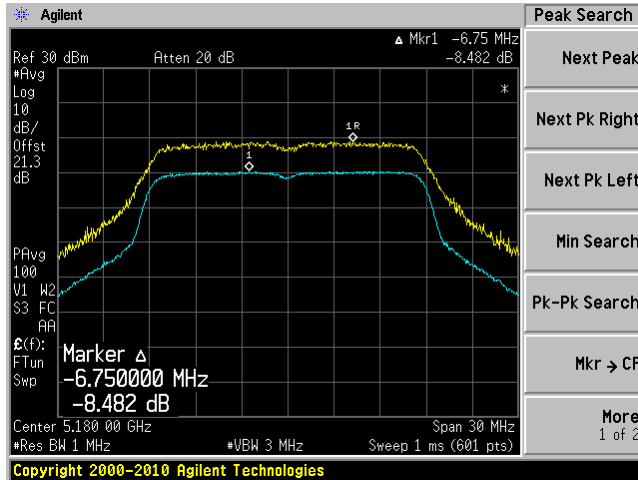




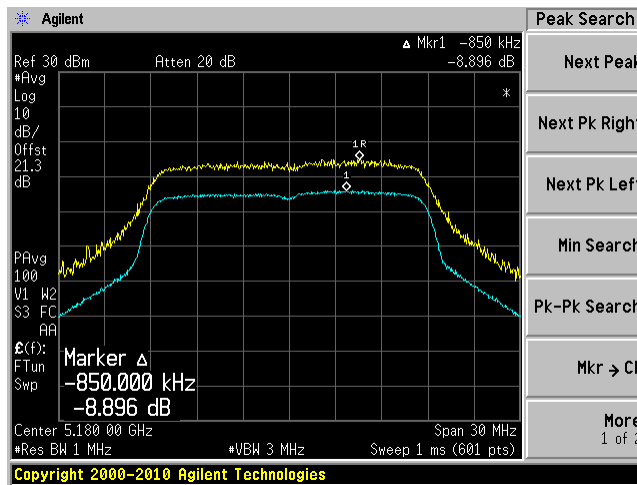
### 802.11n HT20 mode

Low channel: Chain 0

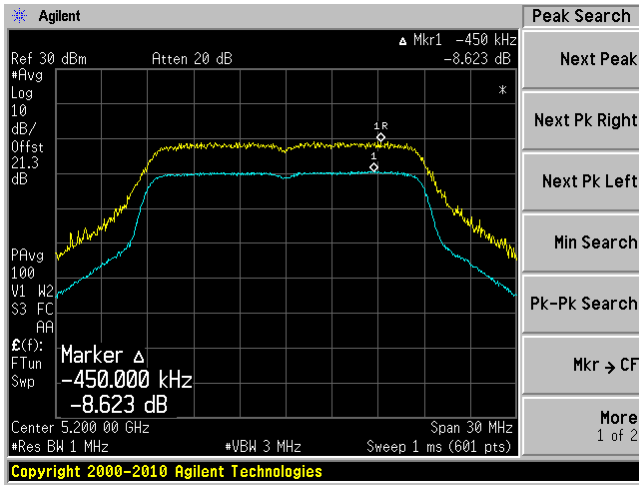
Low channel: Chain 1



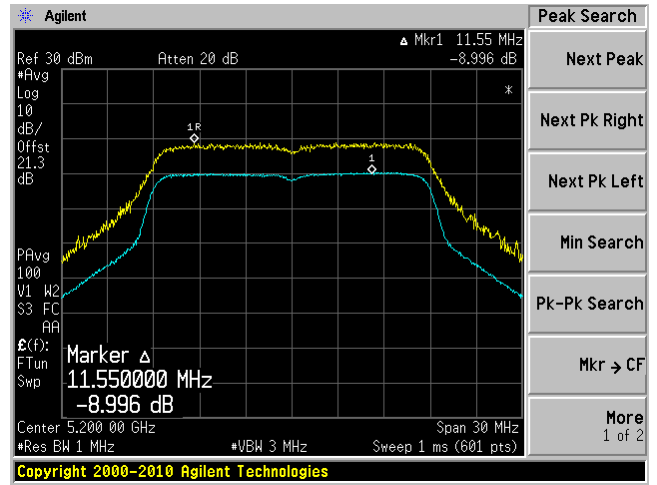
Low Channel: Chain 2



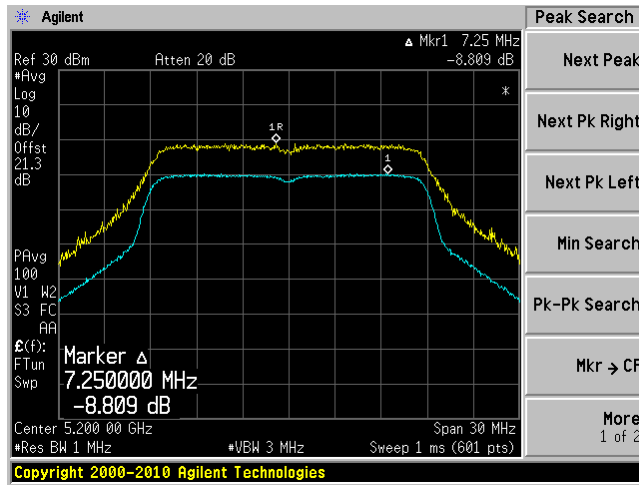
Middle channel: Chain 0



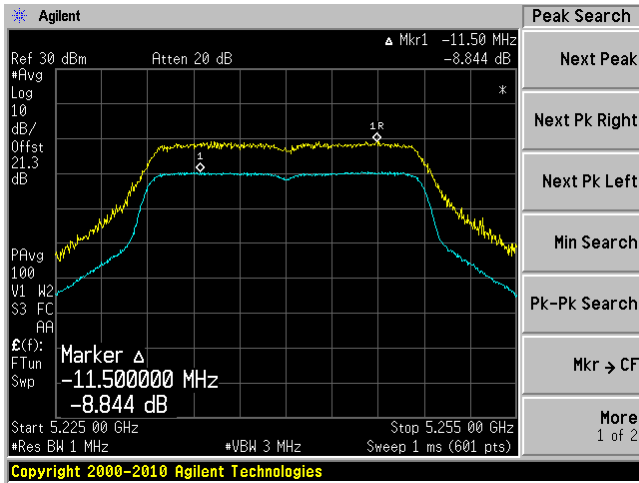
Middle channel: Chain 1



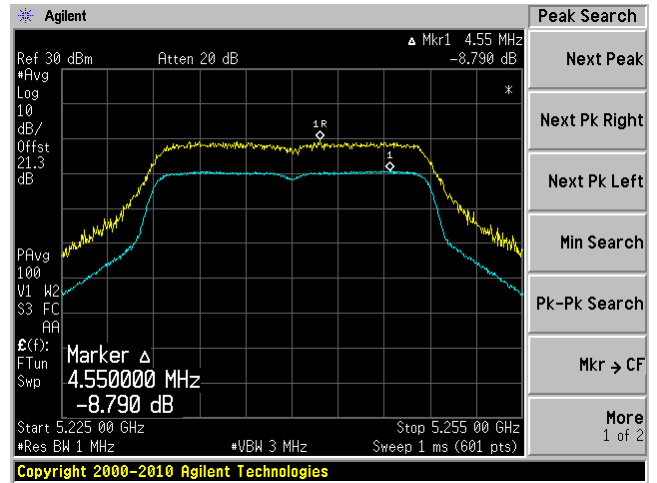
Middle Channel: Chain 2



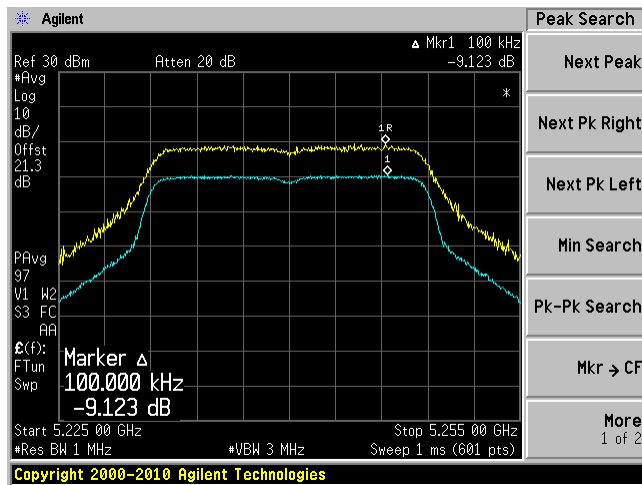
High channel: Chain 0



High channel: Chain 1

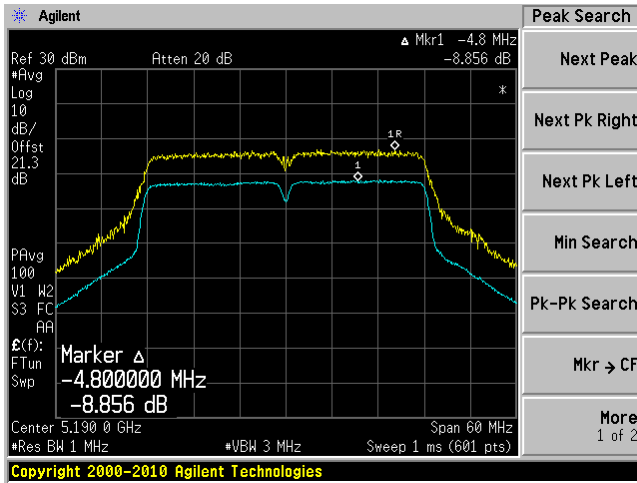


High Channel: Chain 2

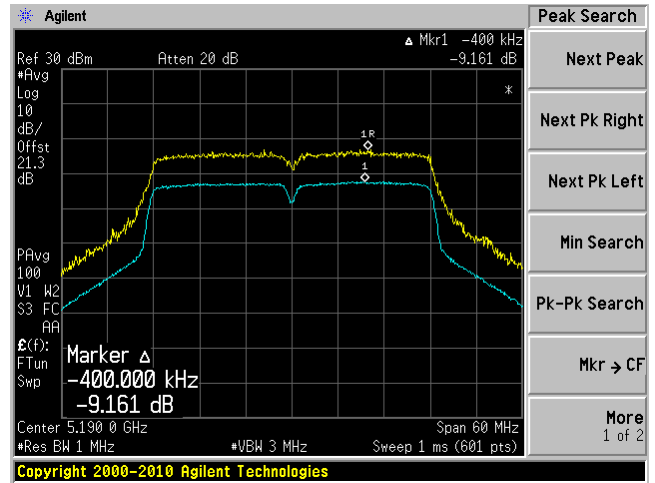


### 802.11 n HT40 mode

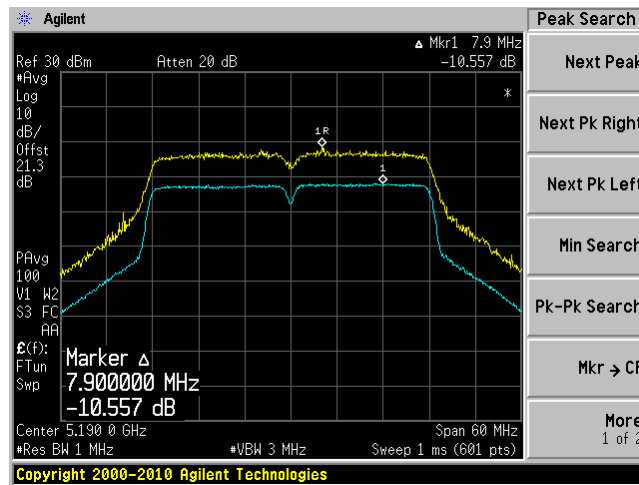
Low channel: Chain 0



Low channel: Chain 1

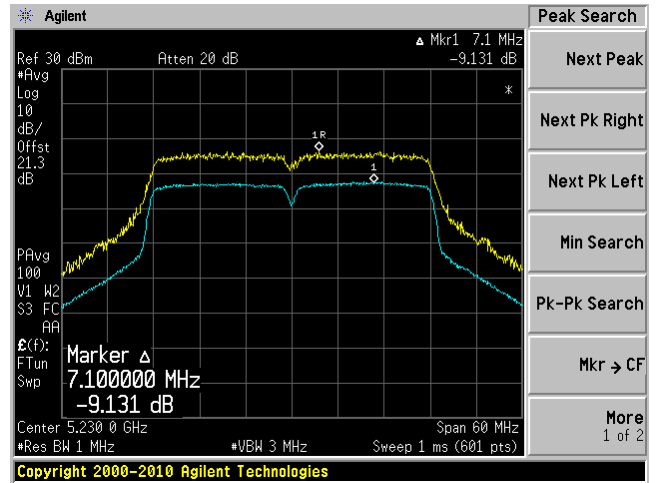
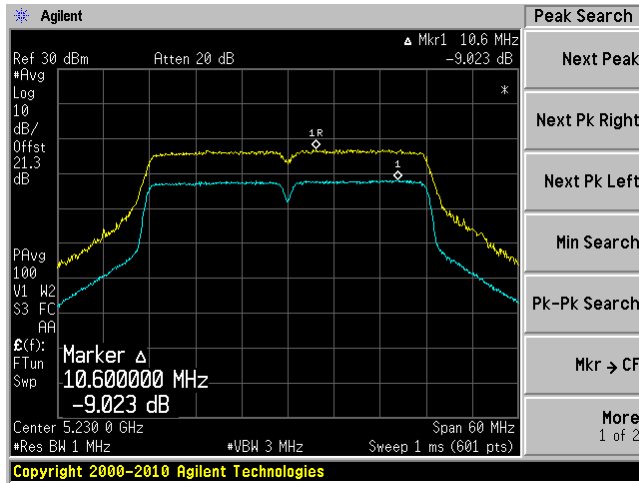


Low Channel: Chain 2

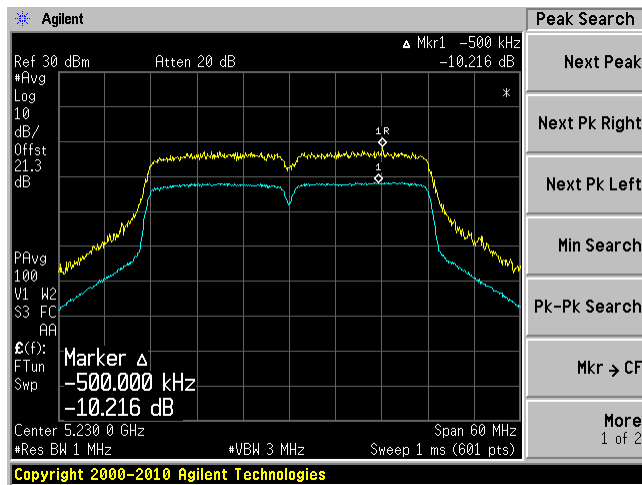


High channel: Chain 0

High channel: Chain 1



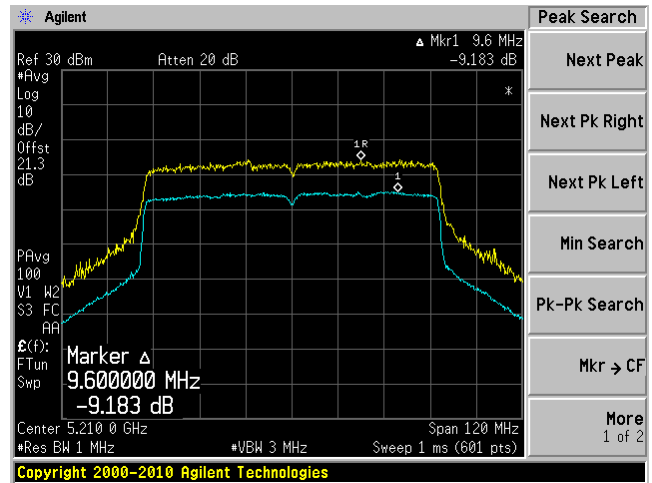
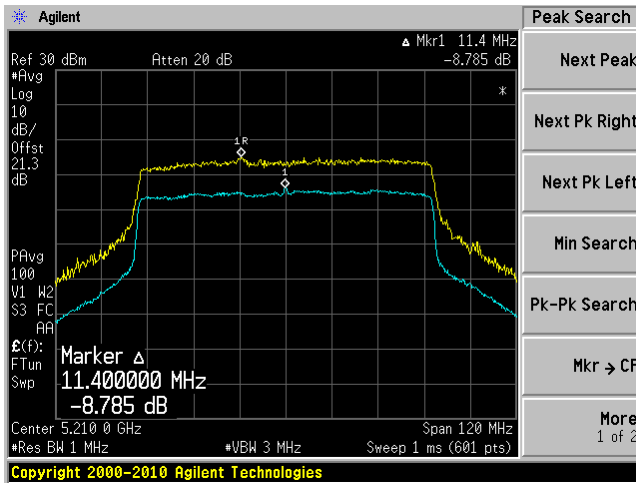
High Channel: Chain 2



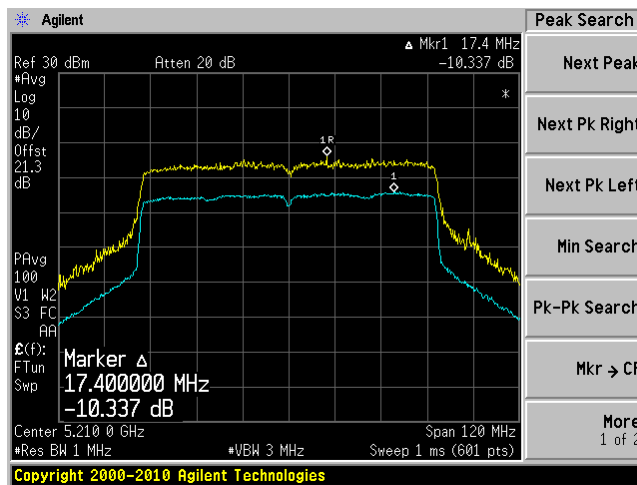
### 802.11 ac 80 mode

Chain 0

Chain 1



Chain 2



## 13 IC RSS-210 §2.3 & RSS-Gen §6.1 - Receiver Spurious Radiated Emissions

### 13.1 Applicable Standard

According to IC RSS-Gen §6.1, spurious emissions from receivers shall not exceed the radiated limits shown in the table below.

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

Frequency (MHz)	Field Strength Microvolts/m at 3 meters
30-88	100
88-216	150
216-960	200
Above 960	500

### 13.2 EUT Setup

The radiated emissions tests were performed in the 3 meter chamber, using the setup in accordance with ANSI C63.4-2009.

### 13.3 Test Procedure

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

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

### 13.4 Corrected Amplitude & Margin Calculation

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

$$CA = Ai + AF + CL + Atten - Ga$$

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

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

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

### 13.5 Test Equipment Lists and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 year
HP	Pre-amplifier	8449B	3147A00400	2013-02-04	1 year
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-10-16	1 year
A.R.A	Horn Antenna	DRG-118/A	1132	2013-01-29	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100338	2012-09-19	1 year

*Statement of Traceability:* BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

### 13.6 Test Environmental Conditions

<b>Temperature:</b>	22 °C
<b>Relative Humidity:</b>	41 %
<b>ATM Pressure:</b>	102.1 kPa

The testing was performed by Ning Ma from 2013-05-08 at 5 meter 3.

### 13.7 Summary of Test Results

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

Mode: Receiving			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-0.65	125.0015	Vertical	30-40000



### 13.8 Test Results

30 MHz - 40 GHz, Measured at 3 meters,

Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dB $\mu$ V/m)	Margin (dB)
874.9955	36.59	161	V	140	46	-9.41
125.0015	42.85	100	V	55	43.5	-0.65
625.015	43.76	126	H	154	46	-2.24
249.999	40.11	110	H	132	46	-5.89

Note: Emissions above 1 GHz are 20 dB below the margin/under the noise floor.

## 14 FCC §15.407(b) & IC RSS-210 §A9.2 - Spurious Emissions at Antenna Terminals

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### 14.1 Applicable Standard

#### According to FCC §15.407(b)

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz

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

### 14.2 Measurement Procedure

4) Procedure for Unwanted Emissions Measurements Below 1000 MHz.

- a) Follow the requirements in section G)3), “General Requirements for Unwanted Emissions Measurements”.
- b) Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

6) Procedures for Average Unwanted Emissions Measurements above 1000 MHz.

- a) Follow the requirements in section G)3), “General Requirements for Unwanted Emissions Measurements”.
- b) Average emission levels shall be measured using one of the following two methods.

c) Method AD (Average Detection): Primary method

(i) RBW = 1 MHz.

(ii) VBW  $\geq$  3 MHz.

(iii) Detector = RMS, if span/(# of points in sweep)  $\leq$  RBW/2. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.

(iv) Averaging type = power (i.e., RMS)

• As an alternative, the detector and averaging type may be set for linear voltage averaging. Some analyzers require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

(v) Sweep time = auto.

(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces should be averaged.

(vii) If tests are performed with the EUT transmitting at a duty cycle less than 98 percent, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

• If power averaging (RMS) mode was used in step (iv) above, the correction factor is  $10 \log(1/x)$ , where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.

- If linear voltage averaging mode was used in step (iv) above, the correction factor is  $20 \log(1/x)$ , where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.

### 14.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US42221851	2013-03-05	1 year

*Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

### 14.4 Test Environmental Conditions

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	40 %
<b>ATM Pressure:</b>	101.8kPa

*The testing was performed by Ning Ma on 2013-10-04 in RF site.*

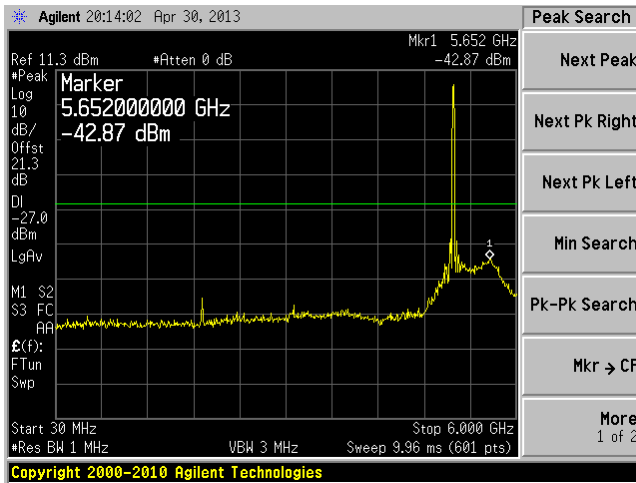
### 14.5 Test Results

Please refer to following plots of spurious emissions.

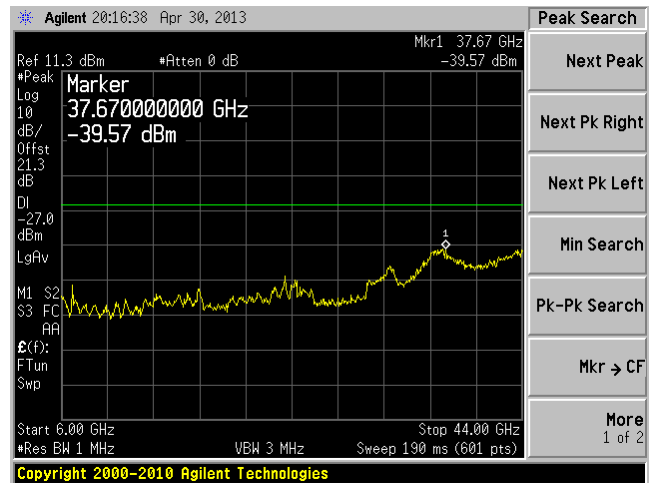
### 5150-5250 MHz Band

#### 802.11a, Low Channel

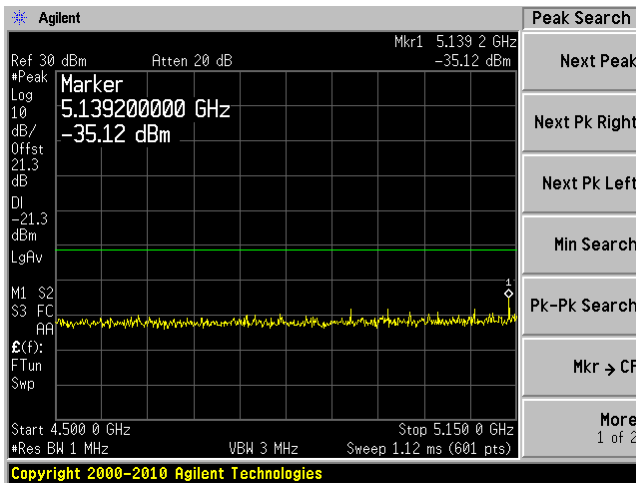
Chain 0, Plot: 30 MHz – 6 GHz



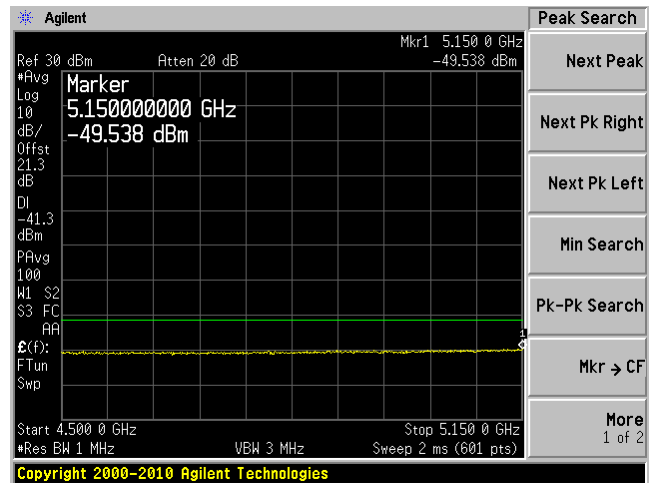
Chain 0, Plot: 6 GHz – 44 GHz



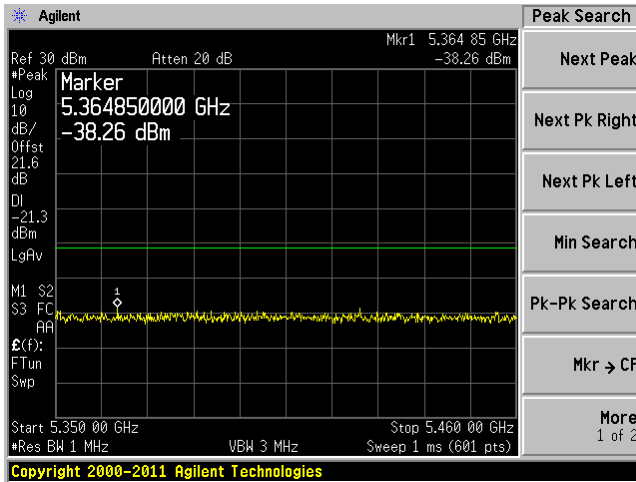
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



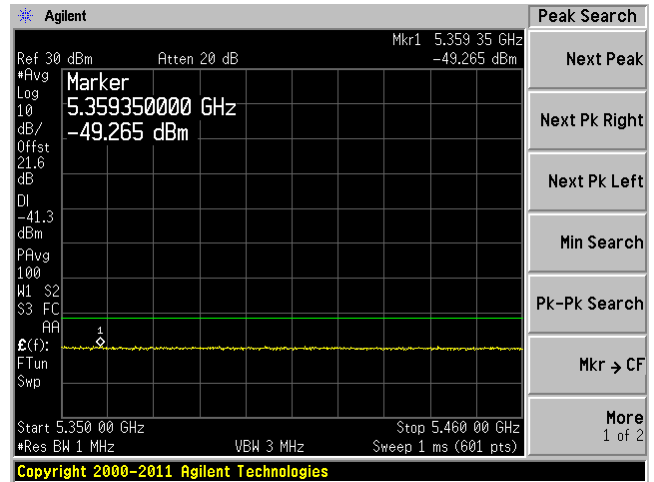
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



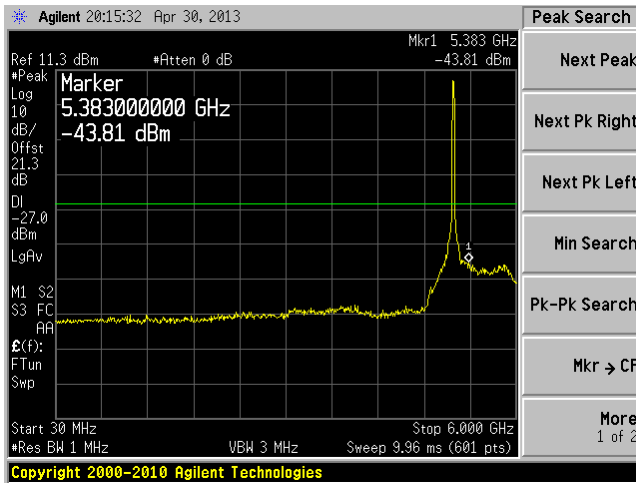
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



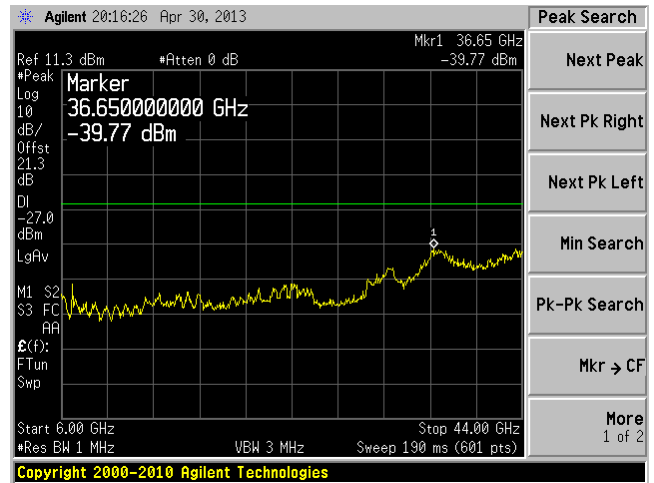
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



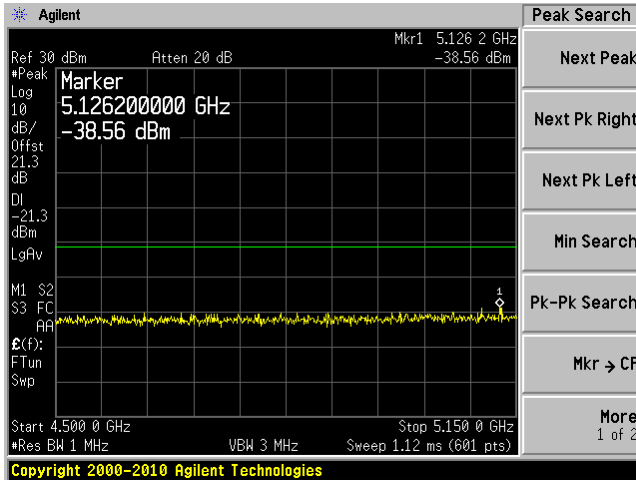
Chain 1, Plot: 30 MHz – 6 GHz



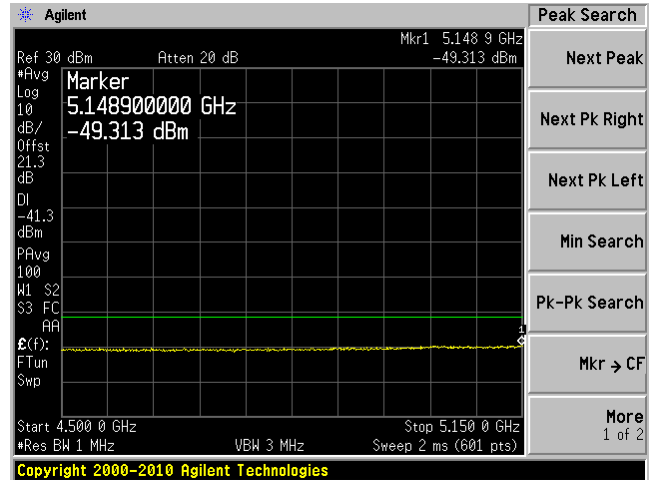
Chain 1, Plot: 6 GHz – 44 GHz



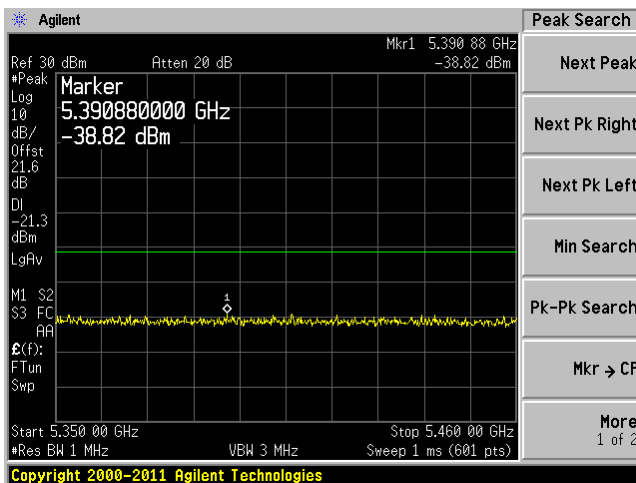
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



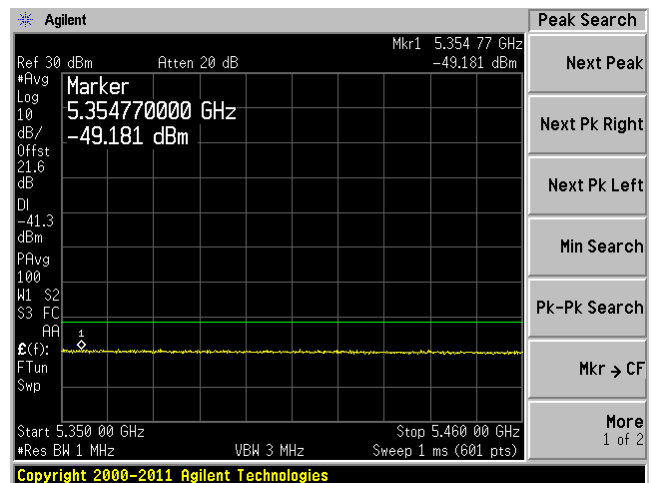
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



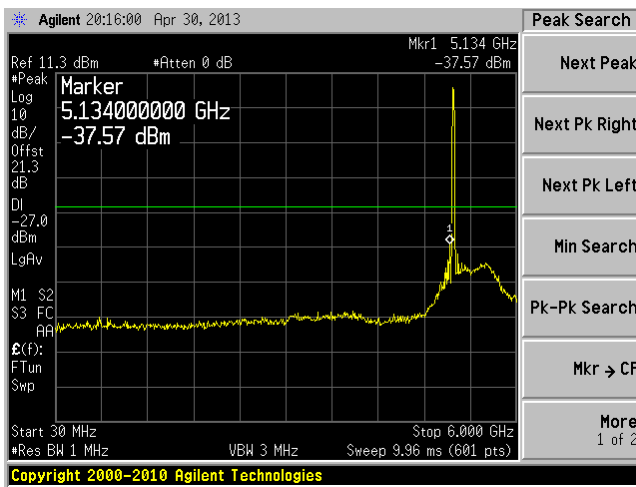
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



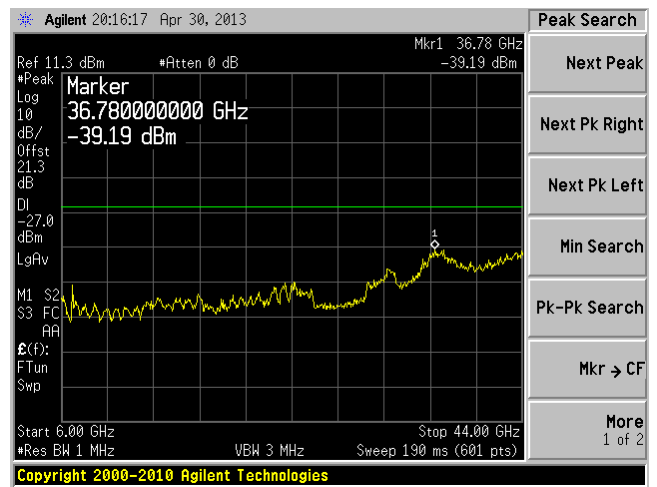
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



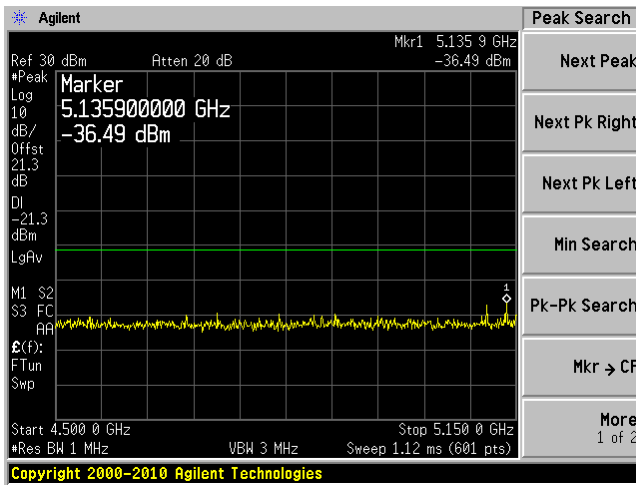
Chain 2, Plot: 30 MHz – 6 GHz



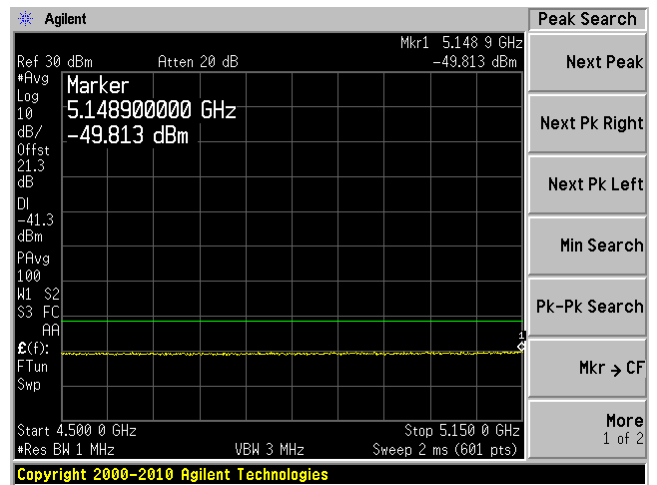
Chain 2, Plot: 6 GHz – 44 GHz



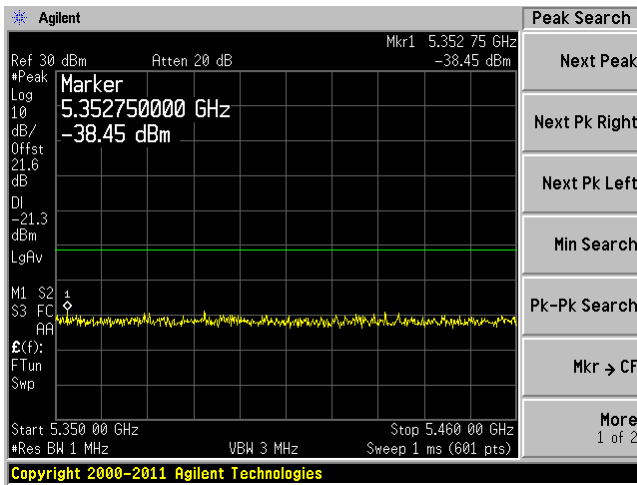
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict Band) Peak



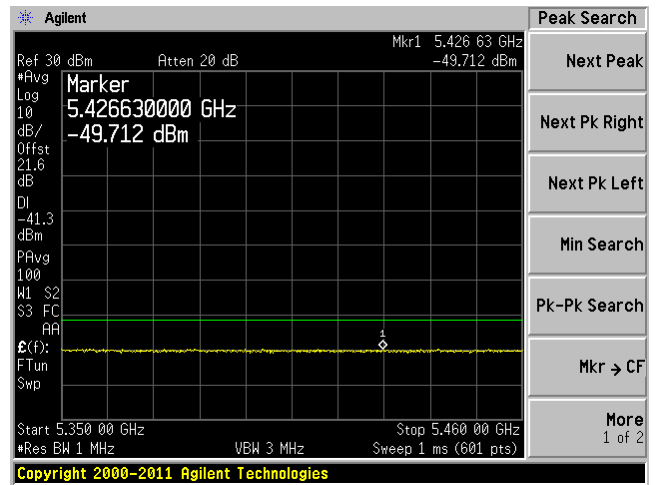
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict band) Ave



Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak

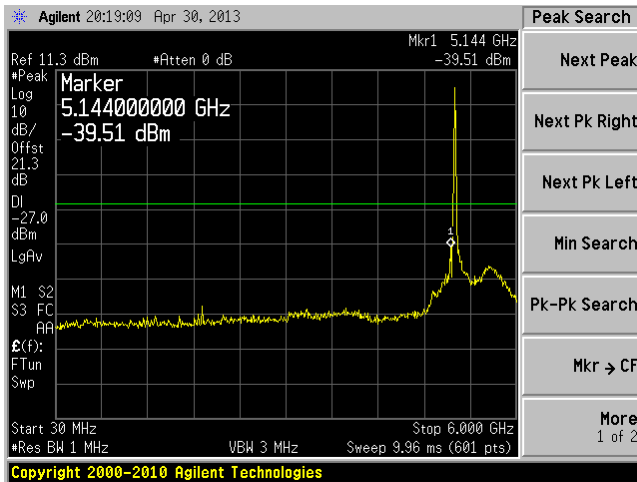


Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave

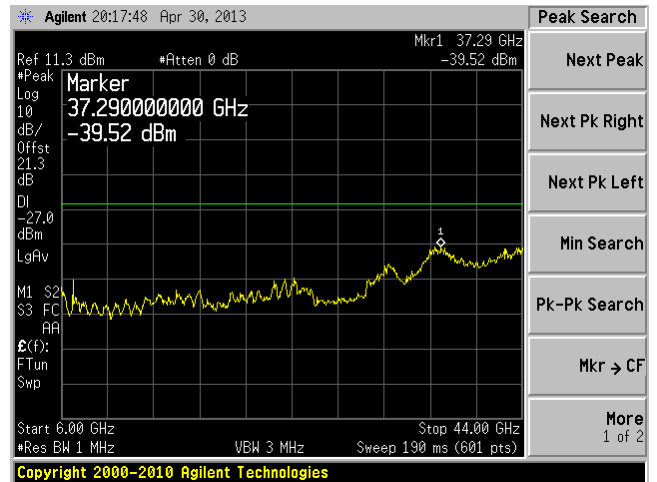


### 802.11a, Middle Channel

Chain 0, Plot: 30 MHz – 6 GHz

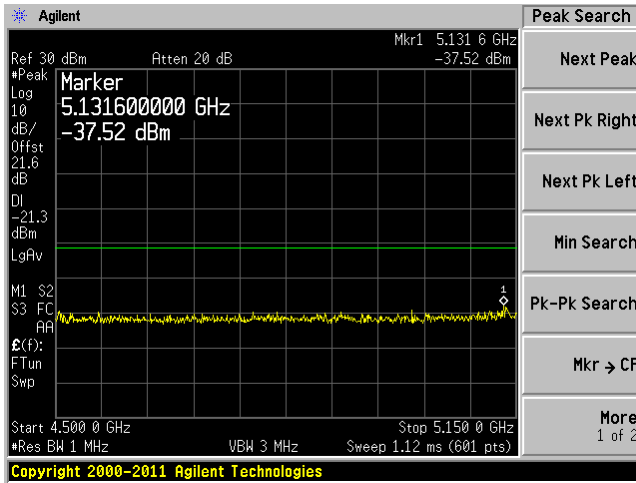


Chain 0, Plot: 6 GHz – 44 GHz

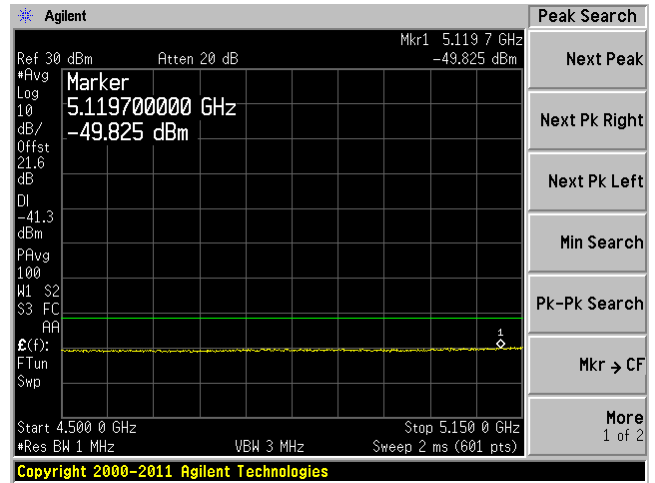




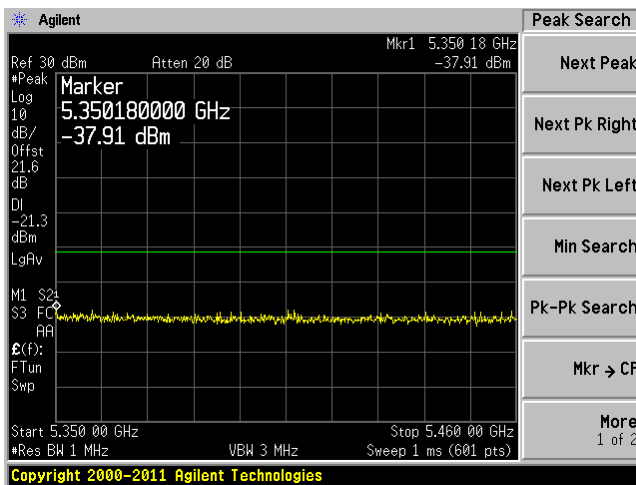
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



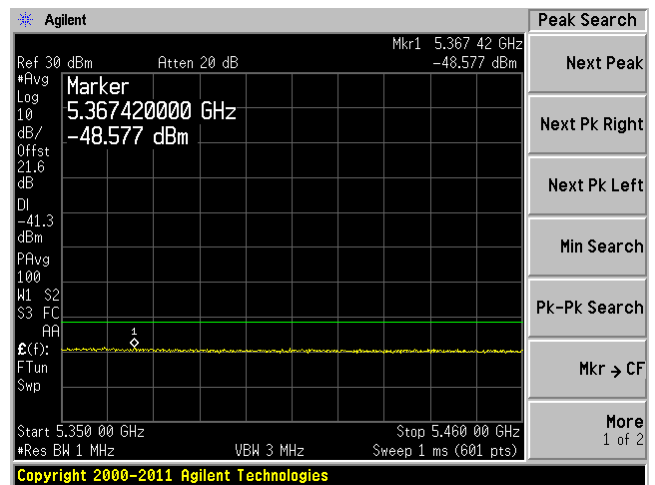
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



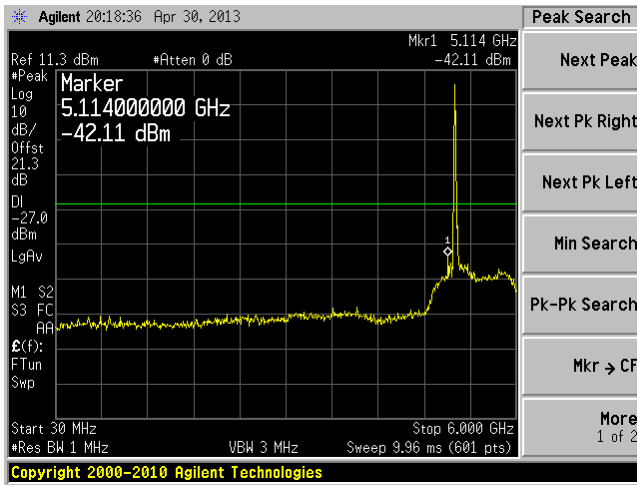
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



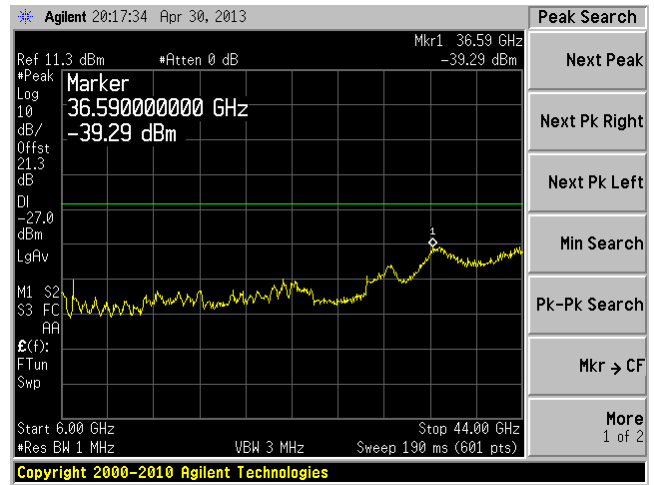
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



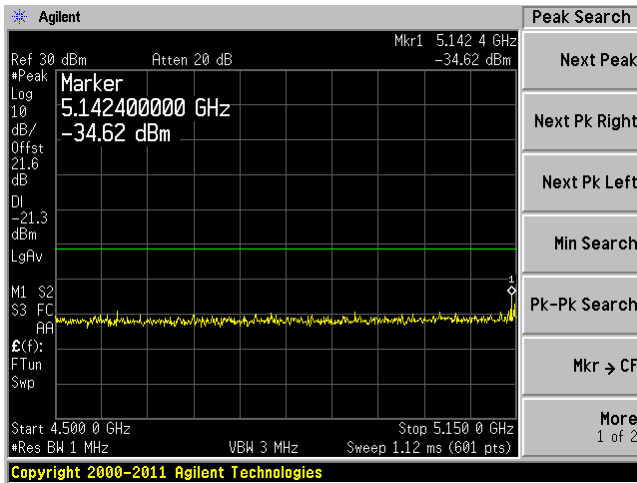
Chain 1, Plot: 30 MHz – 6 GHz



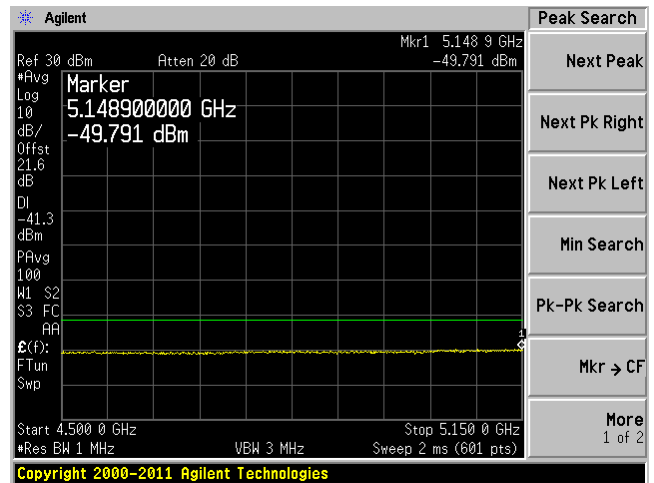
Chain 1, Plot: 6 GHz – 44 GHz



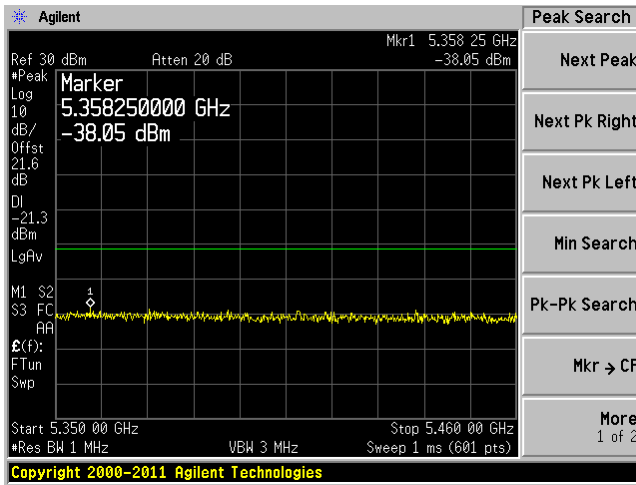
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict Band) Peak



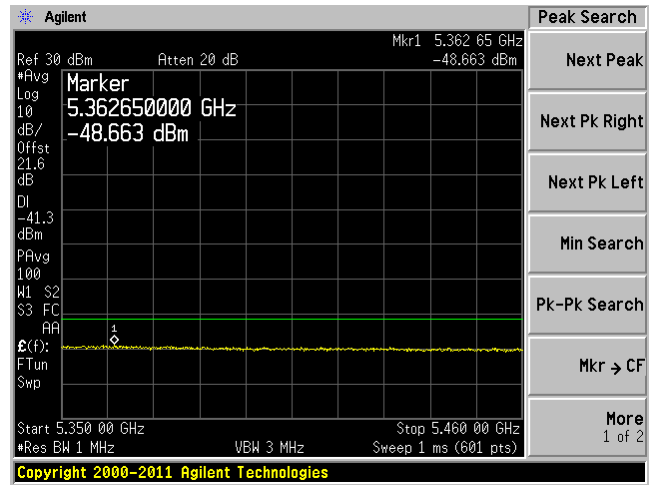
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict band) Ave



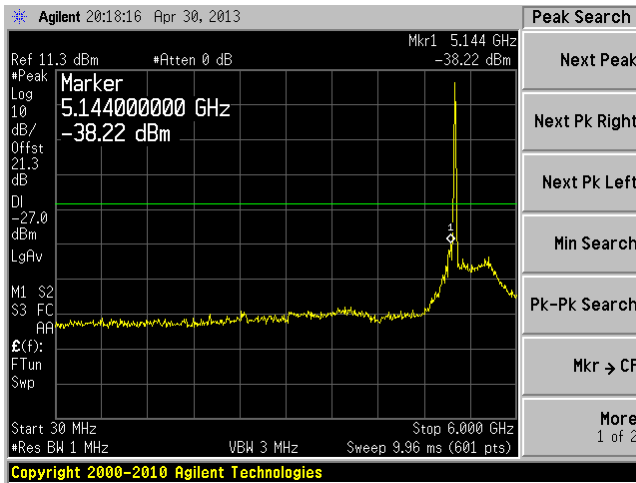
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



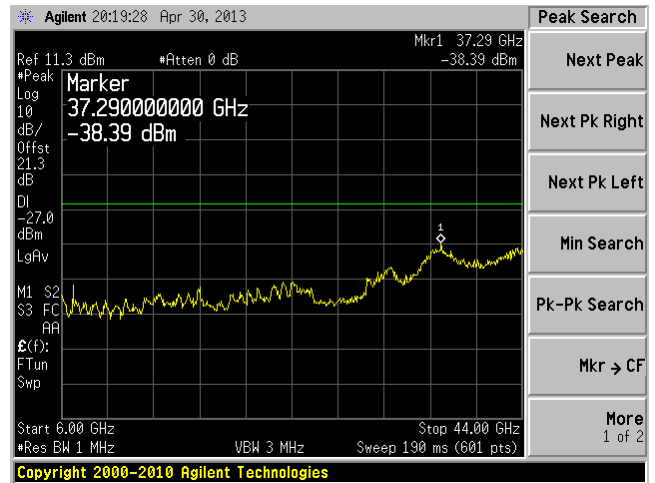
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



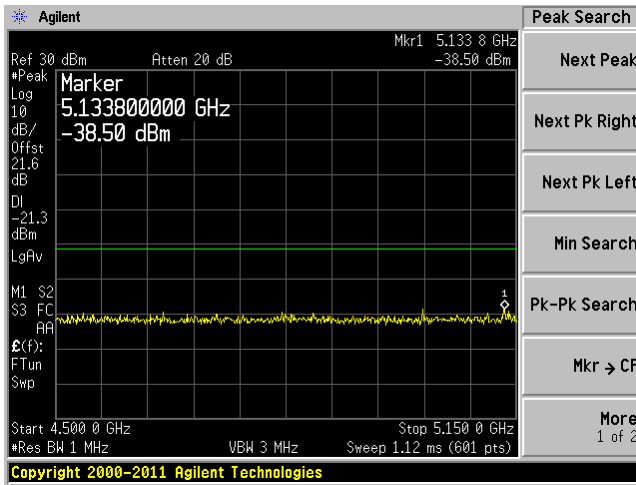
Chain 2, Plot: 30 MHz – 6 GHz



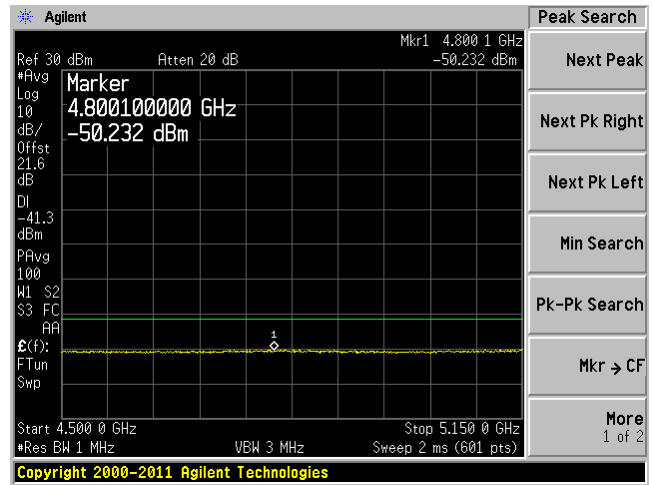
Chain 2, Plot: 6 GHz – 44 GHz



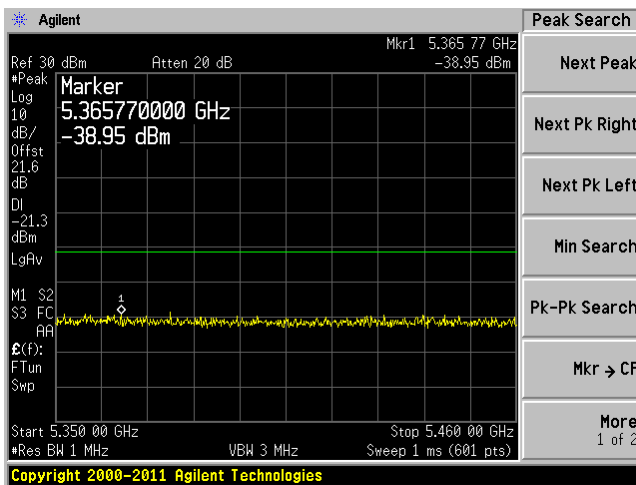
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



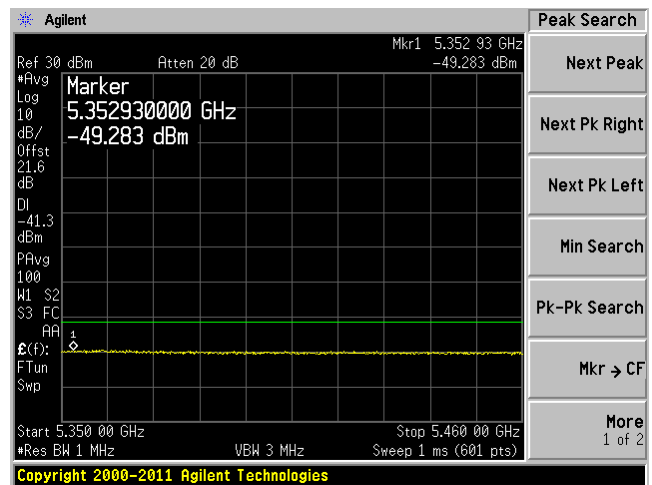
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak

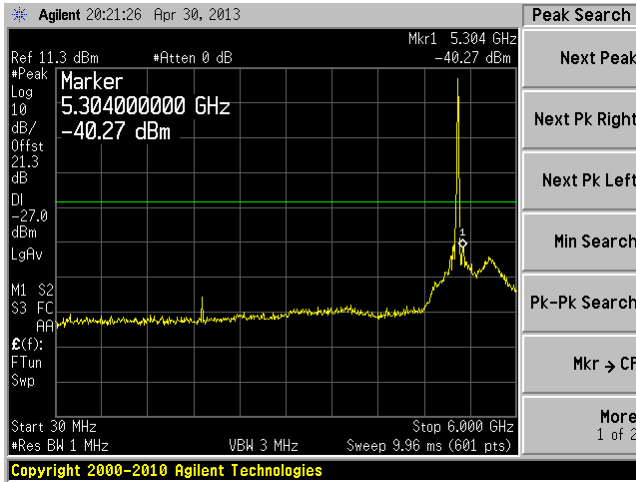


Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave

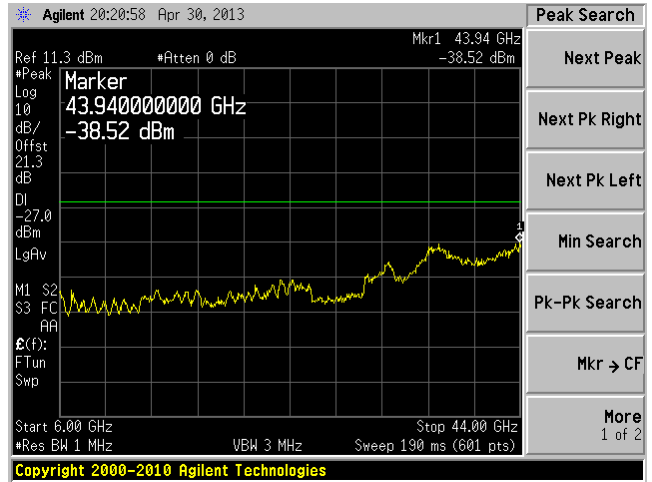


802.11a, High Channel

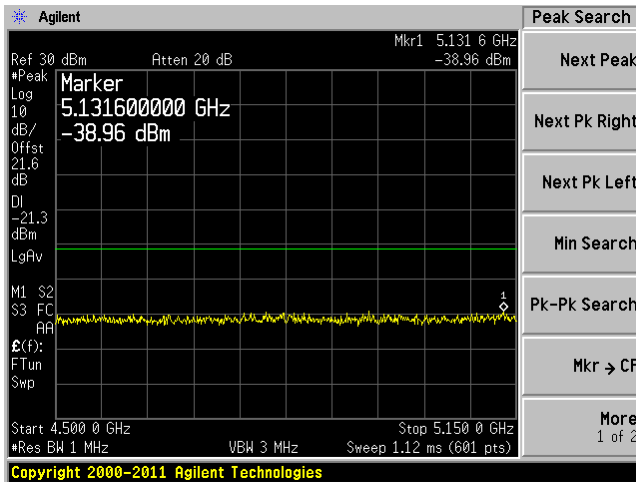
Chain 0, Plot: 30 MHz – 6 GHz



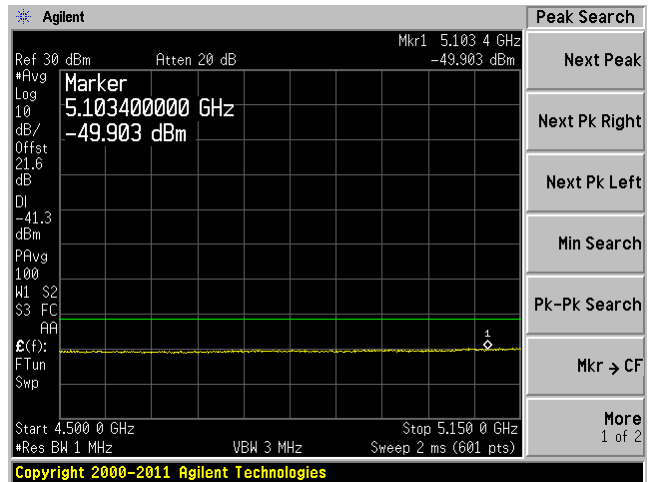
Chain 0, Plot: 6 GHz – 44 GHz



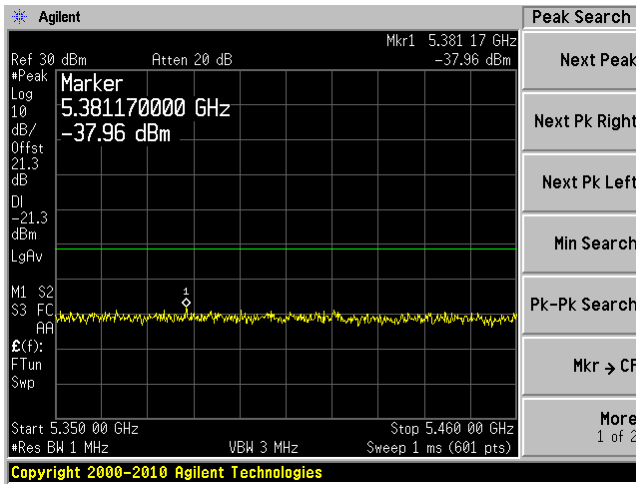
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



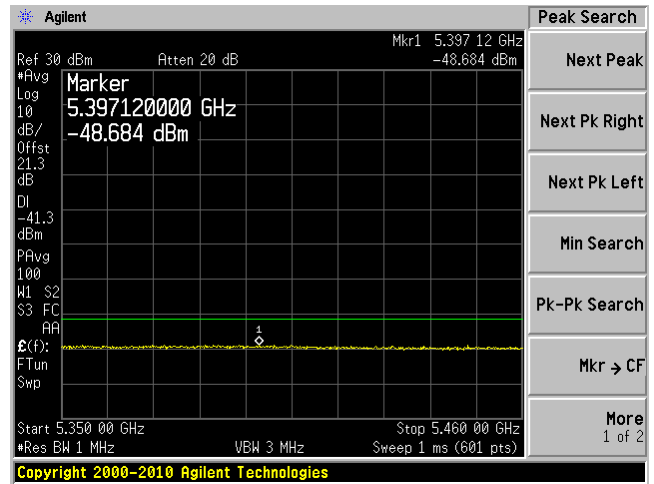
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



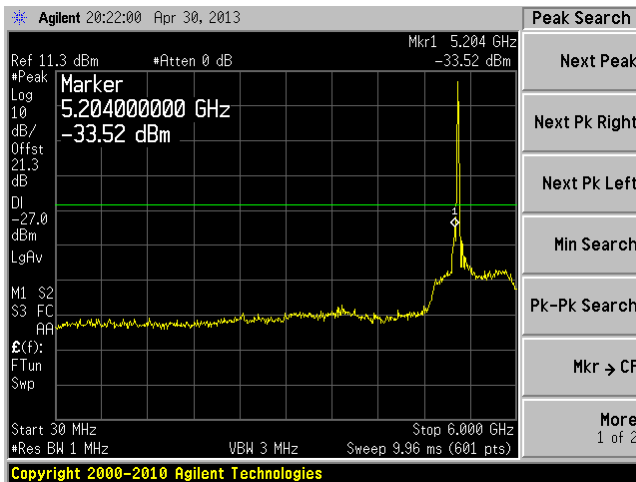
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



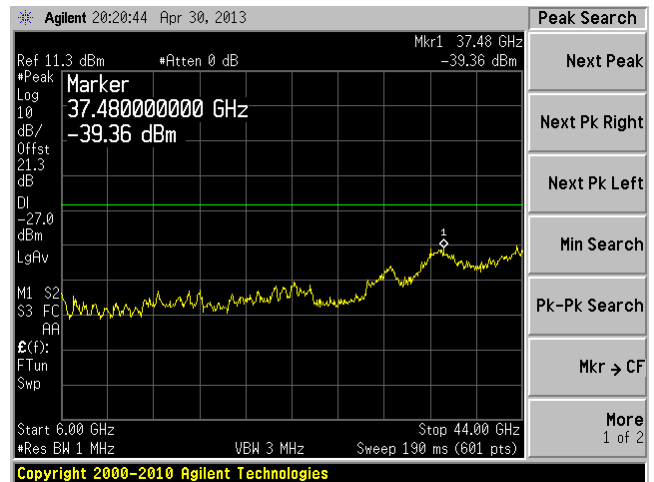
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



Chain 1, Plot: 30 MHz – 6 GHz

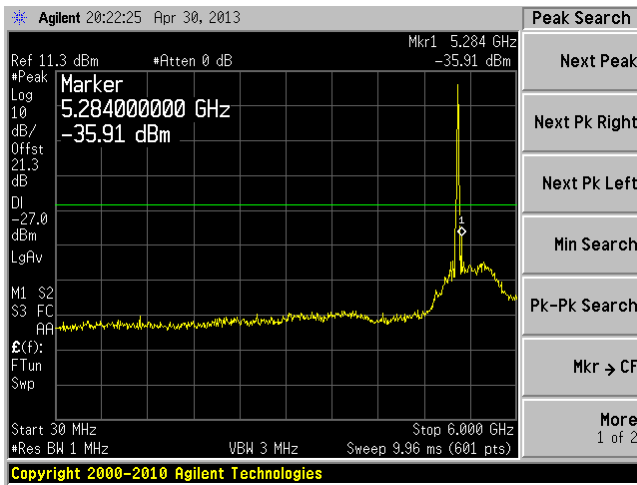


Chain 1, Plot: 6 GHz – 44 GHz

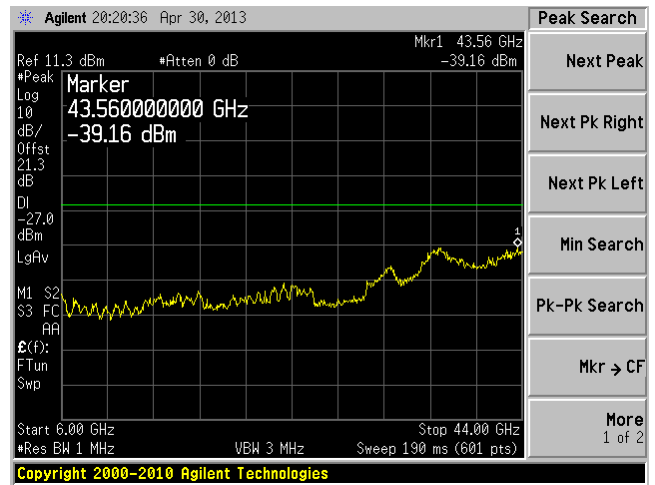




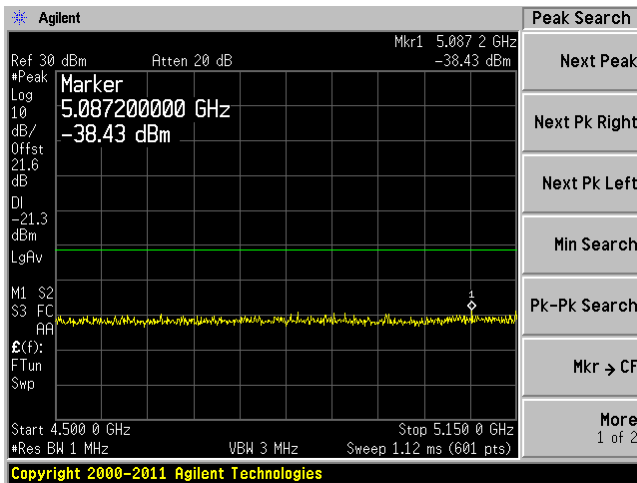
Chain 2, Plot: 30 MHz – 6 GHz



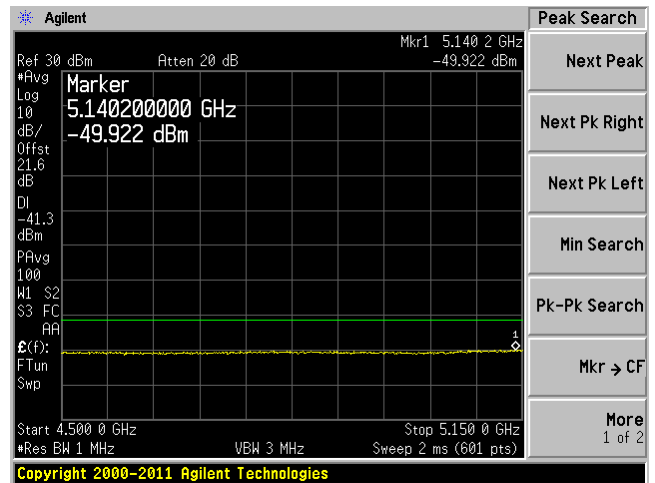
Chain 2, Plot: 6 GHz – 44 GHz



Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict Band) Peak

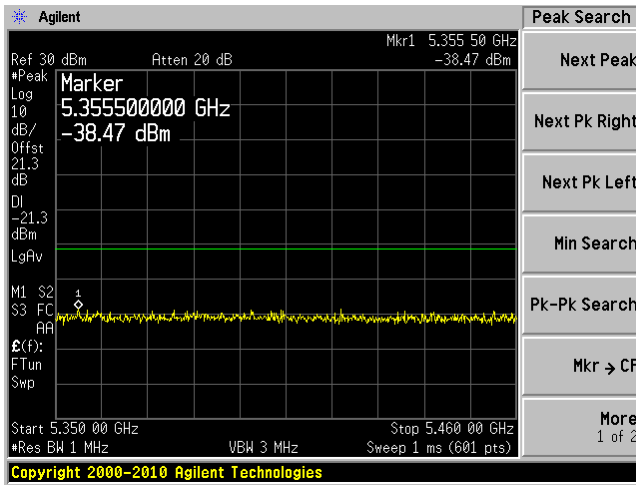


Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict band) Ave

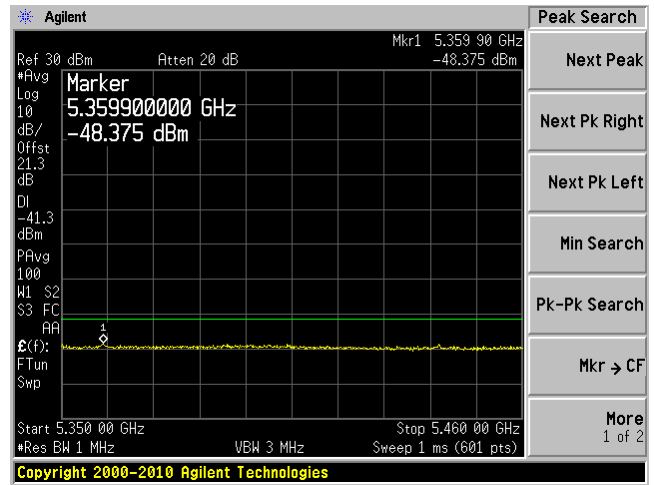




Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak

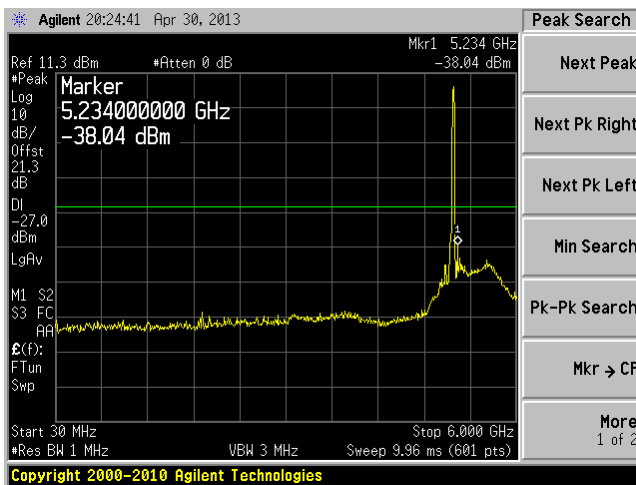


Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave

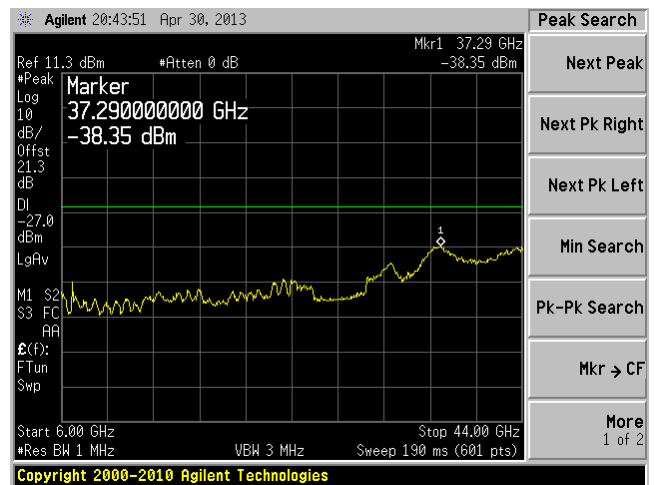


### 802.11n HT20, Low Channel

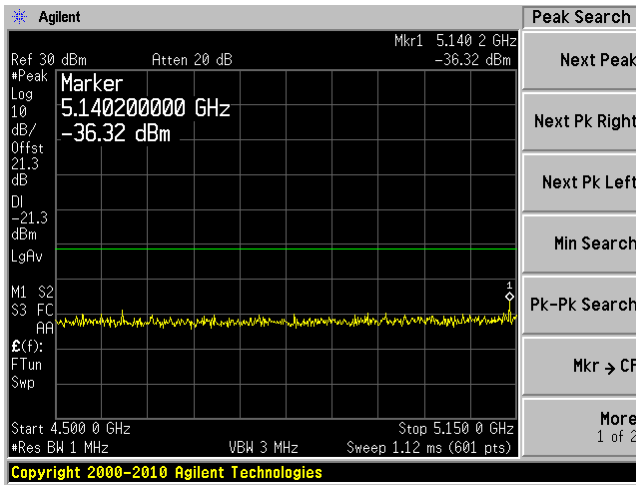
Chain 0, Plot: 30 MHz – 6 GHz



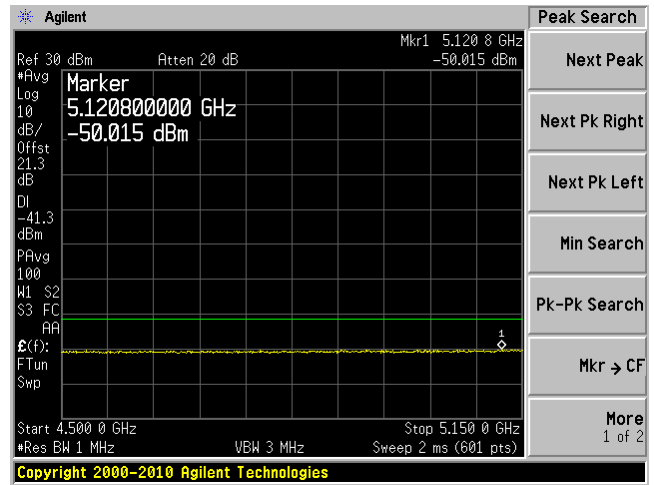
Chain 0, Plot: 6 GHz – 44 GHz



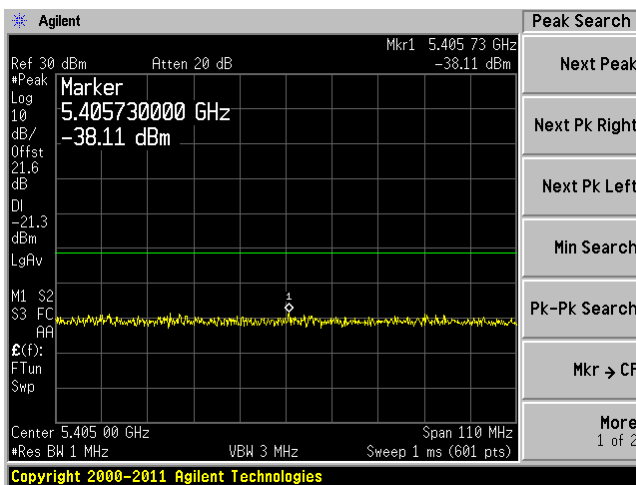
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



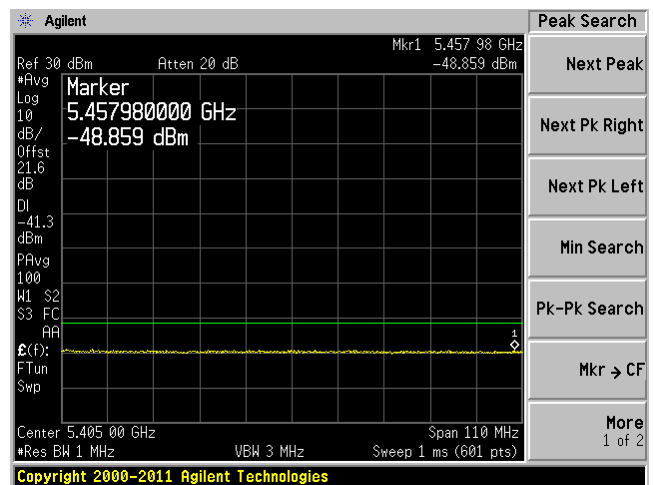
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



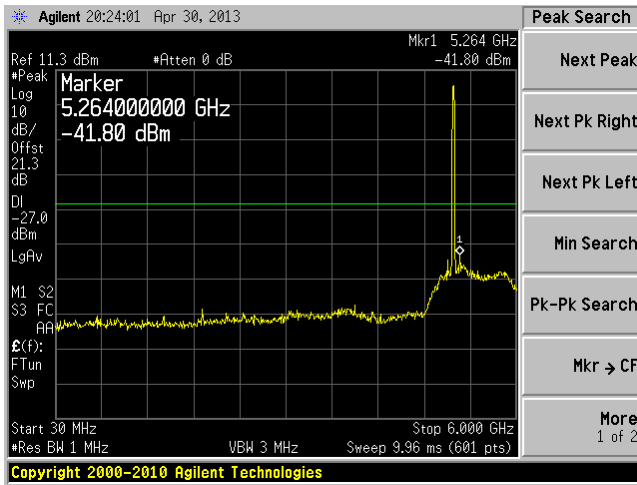
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



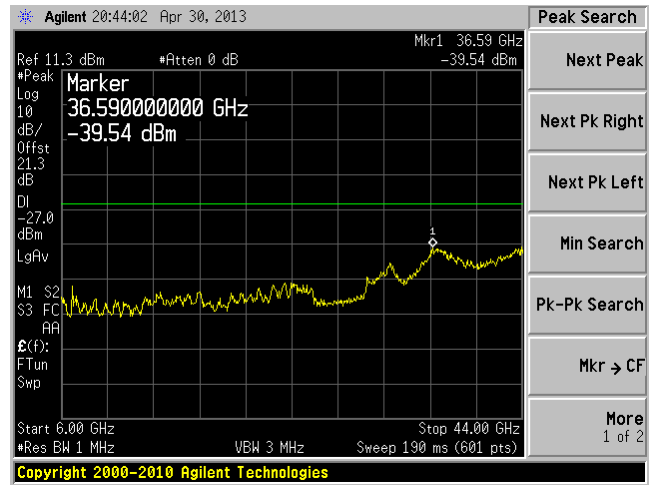
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



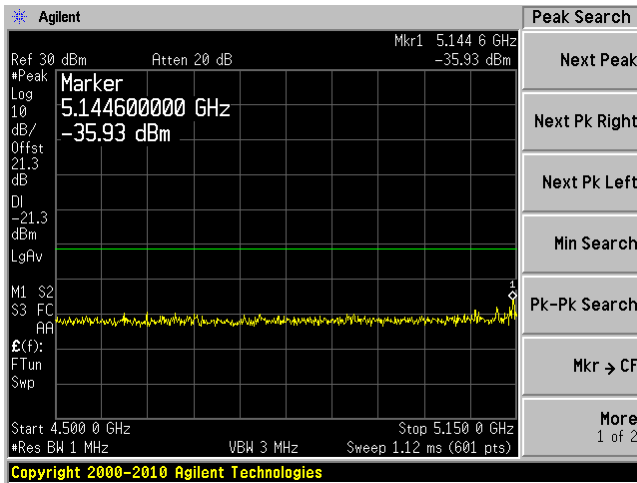
Chain 1, Plot: 30 MHz – 6 GHz



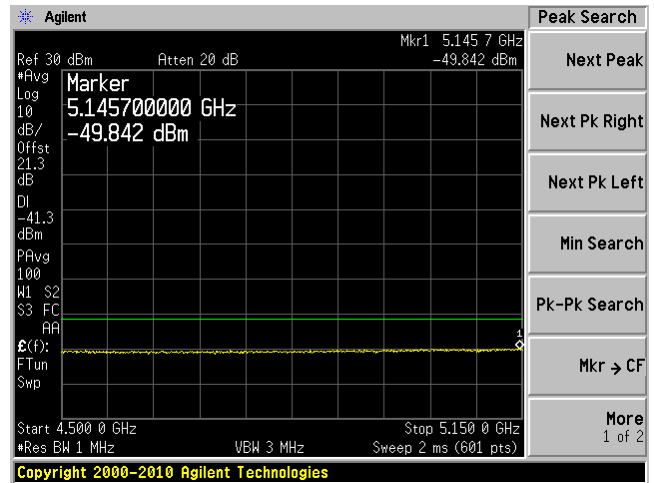
Chain 1, Plot: 6 GHz – 44 GHz



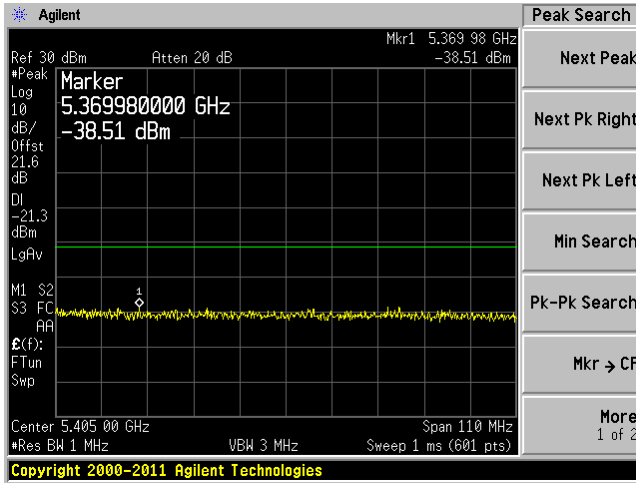
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict Band) Peak



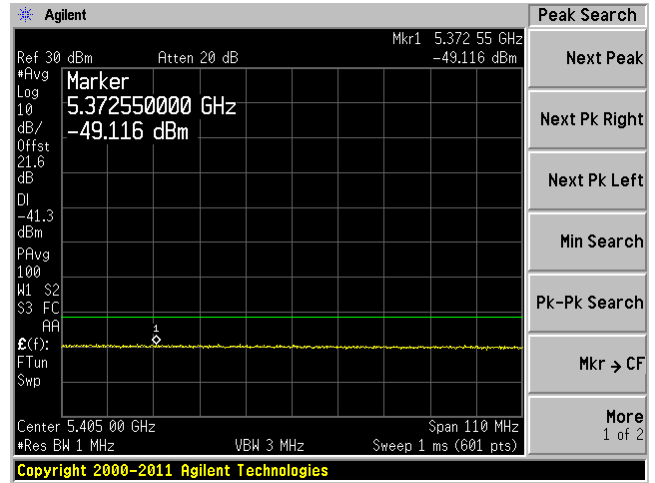
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict band) Ave



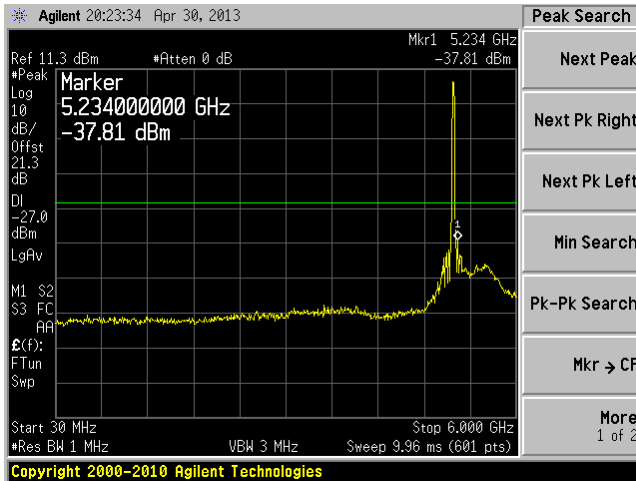
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



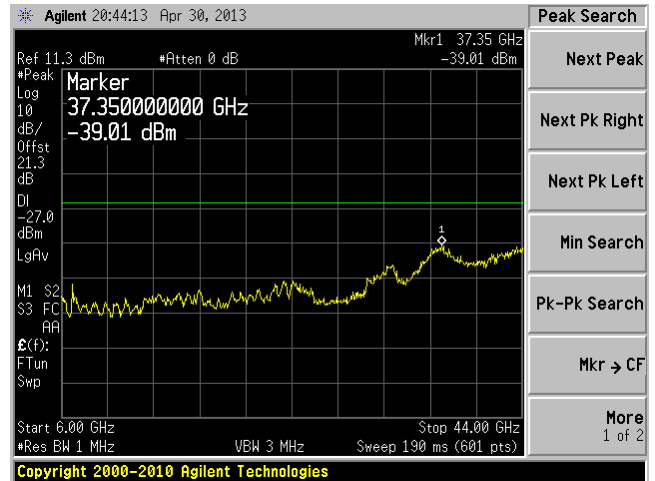
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



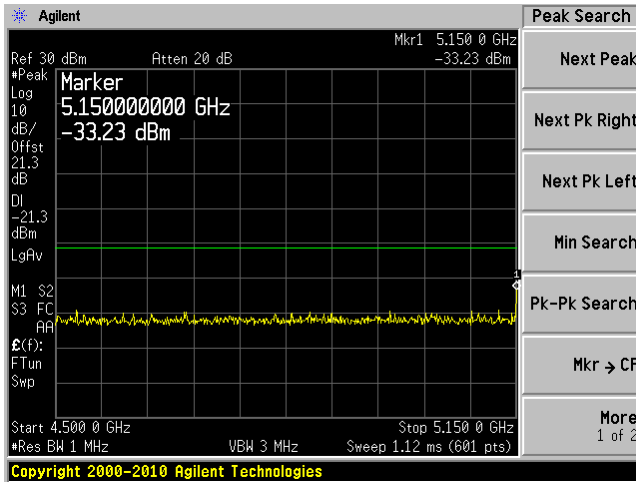
Chain 2, Plot: 30 MHz – 6 GHz



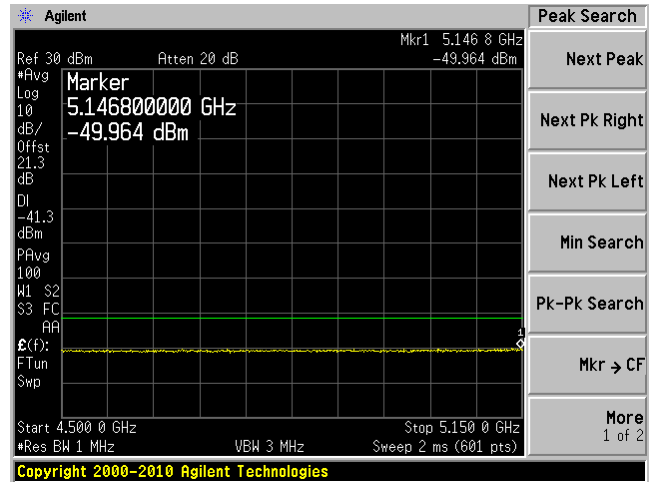
Chain 2, Plot: 6 GHz – 44 GHz



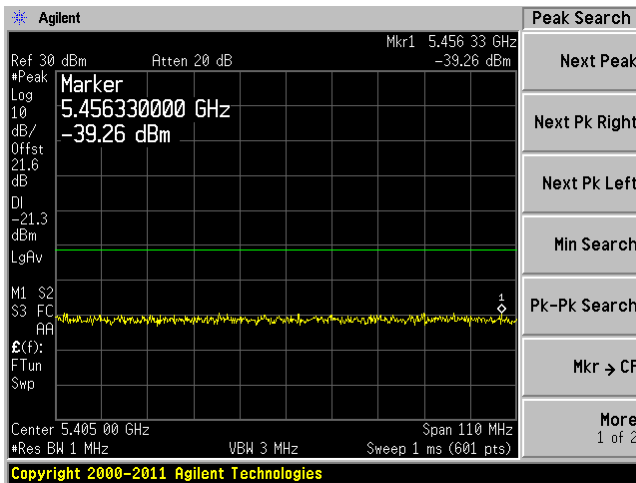
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



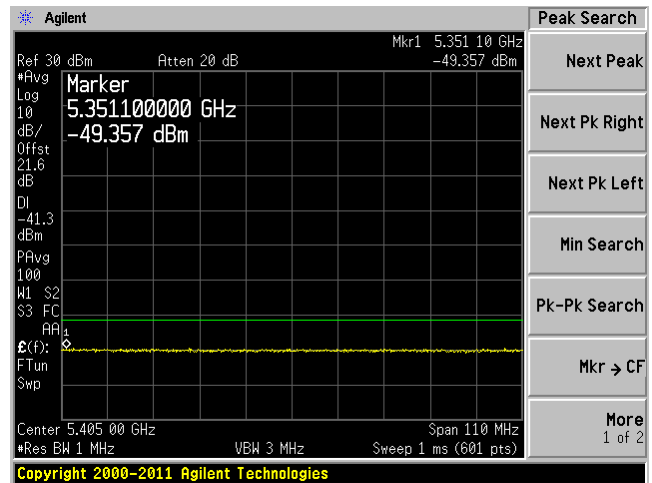
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak

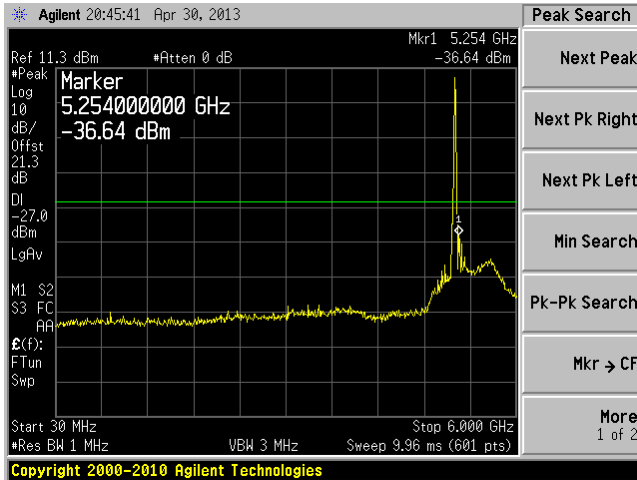


Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave

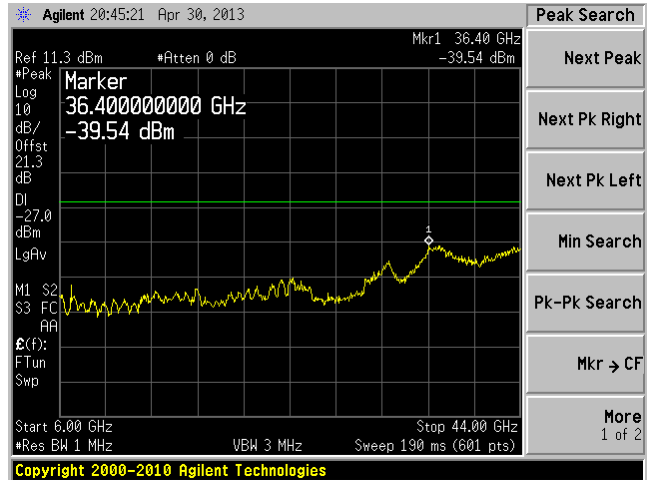


### 802.11n HT20, Middle Channel

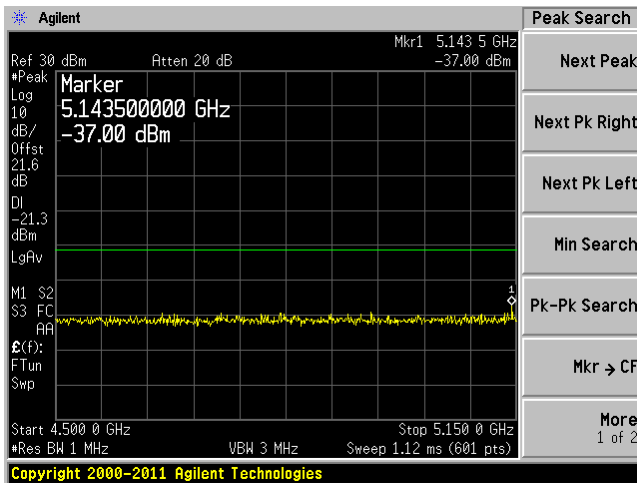
Chain 0, Plot: 30 MHz – 6 GHz



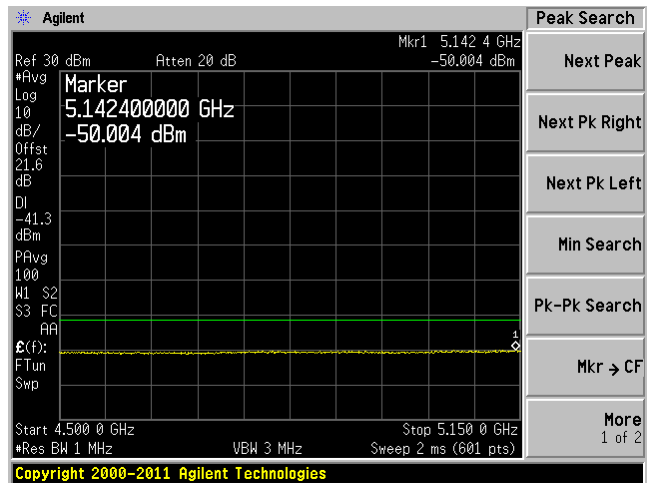
Chain 0, Plot: 6 GHz – 44 GHz



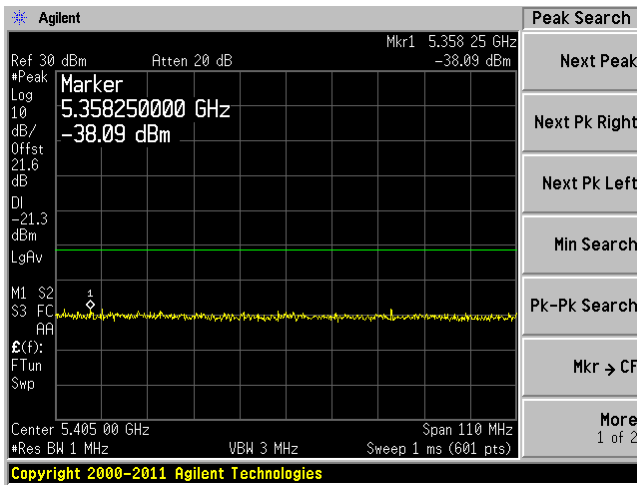
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



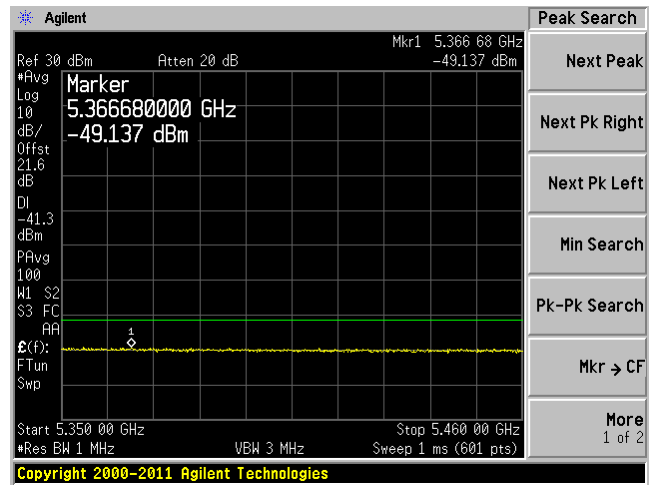
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



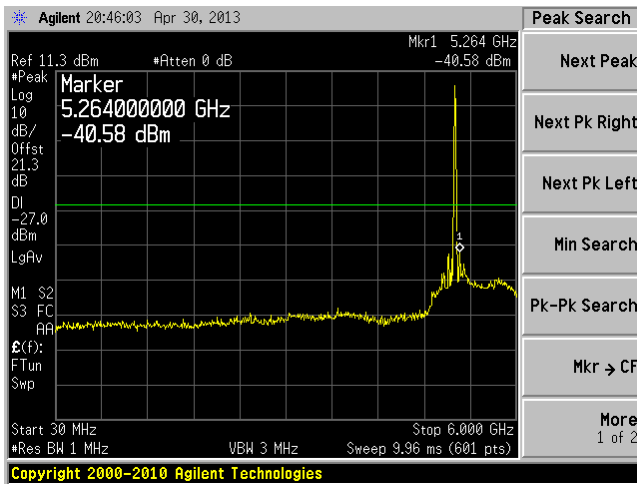
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



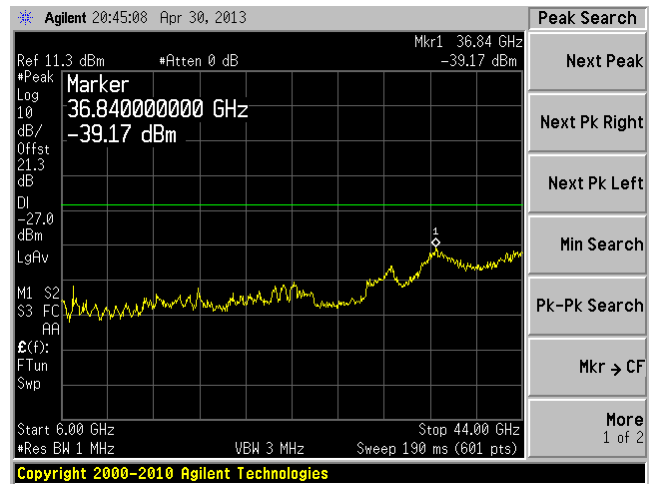
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



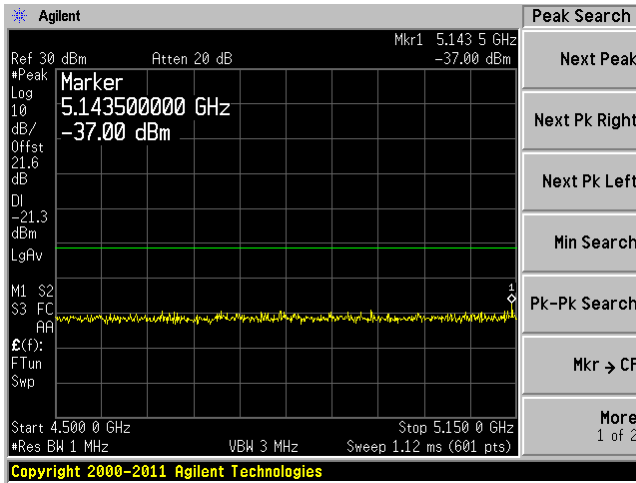
Chain 1, Plot: 30 MHz – 6 GHz



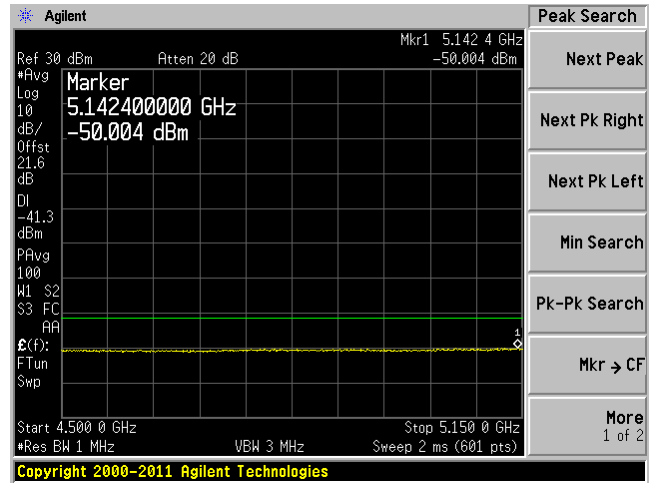
Chain 1, Plot: 6 GHz – 44 GHz



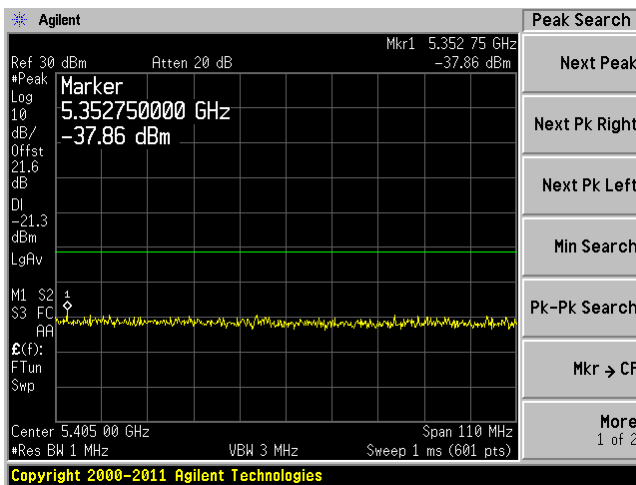
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



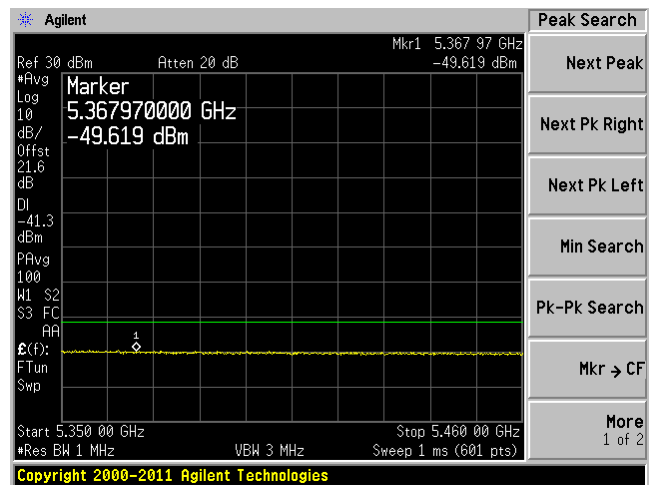
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak

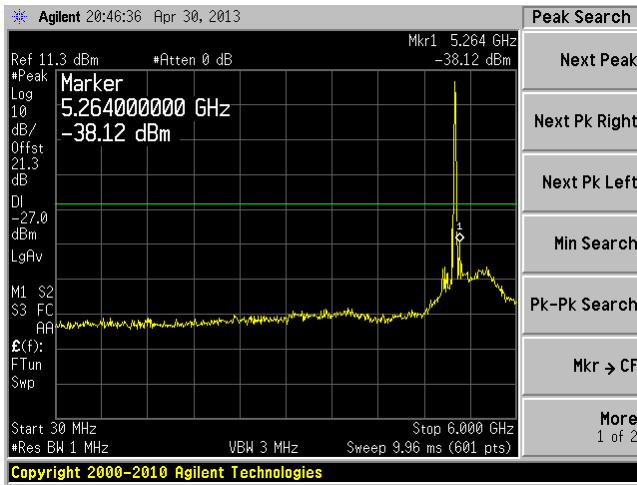


Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave

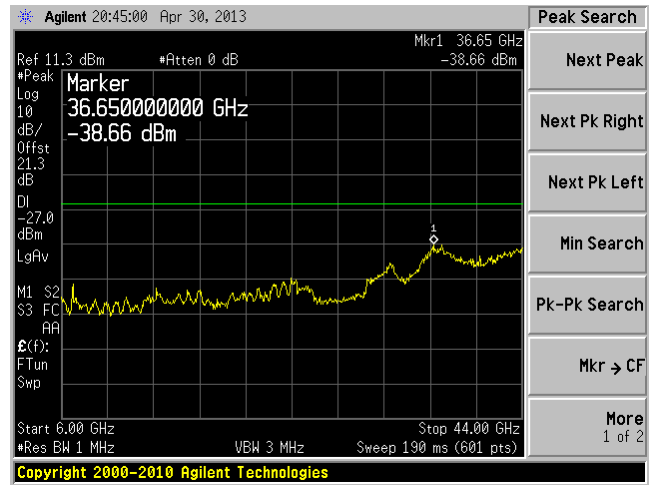




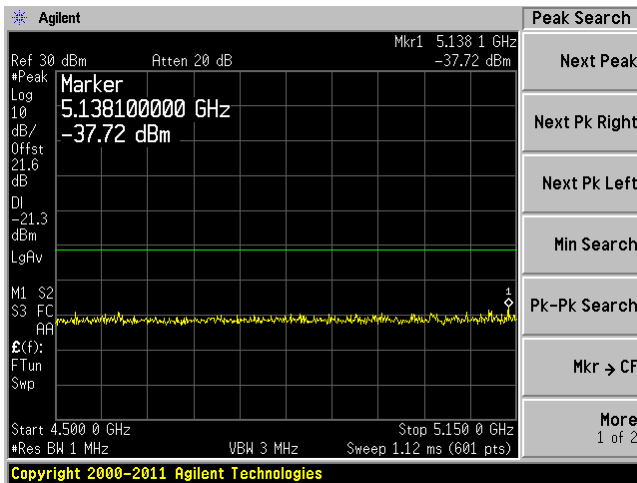
Chain 2, Plot: 30 MHz – 6 GHz



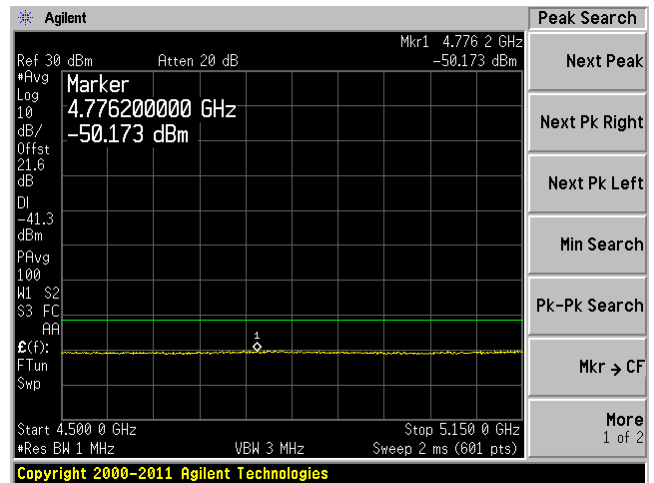
Chain 2, Plot: 6 GHz – 44 GHz



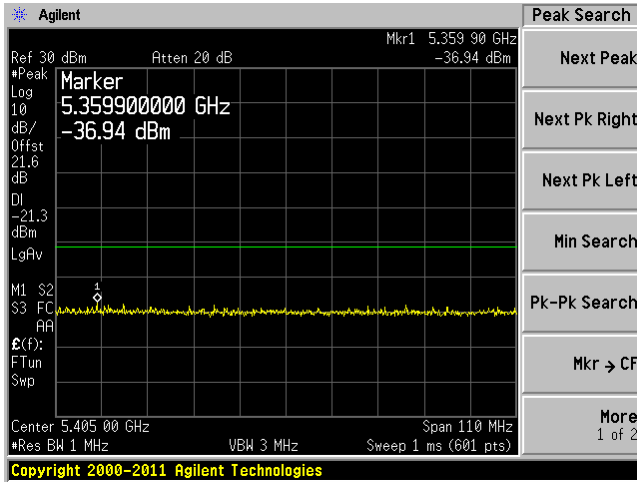
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict Band) Peak



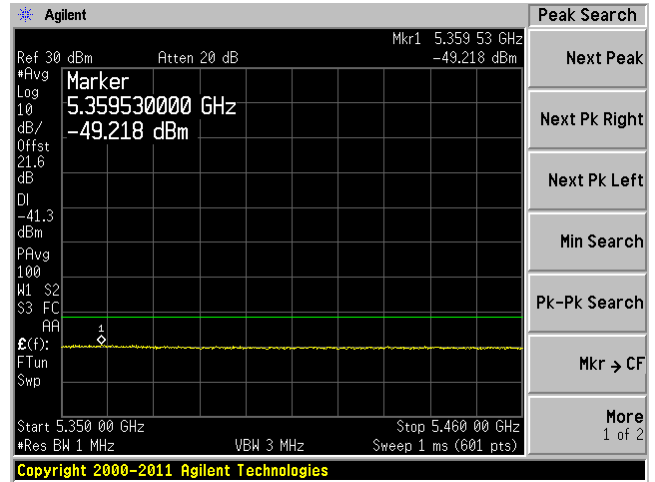
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict band) Ave



Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak

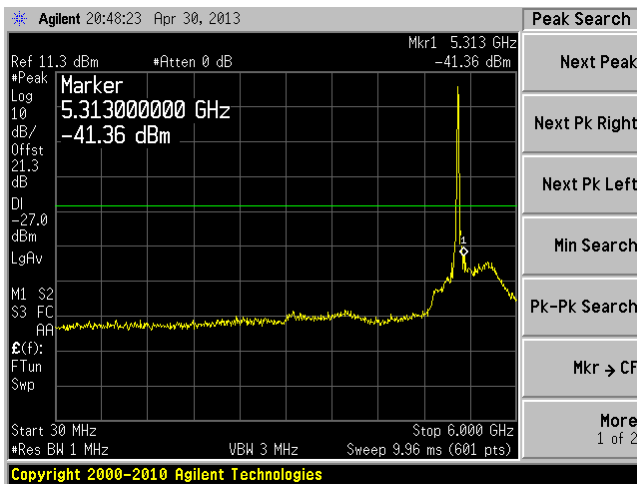


Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave

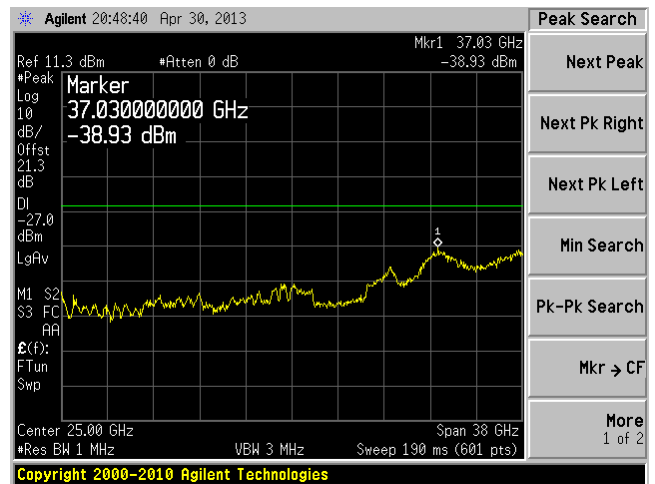


### 802.11n HT20, High Channel

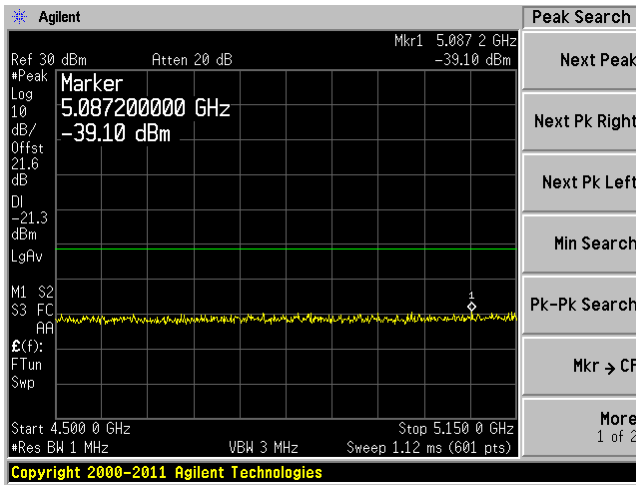
Chain 0, Plot: 30 MHz – 6 GHz



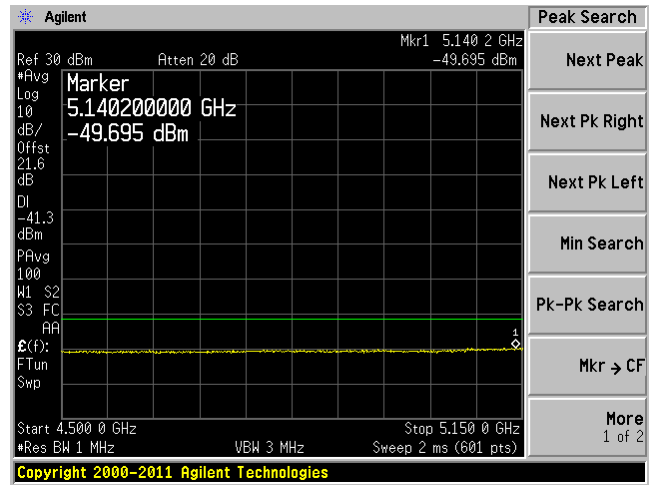
Chain 0, Plot: 6 GHz – 44 GHz



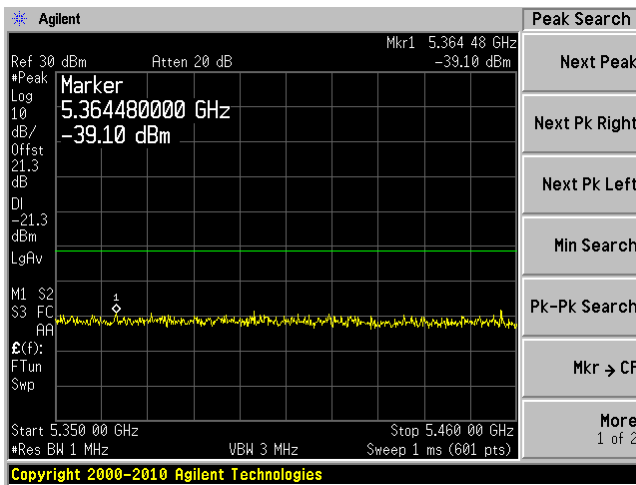
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



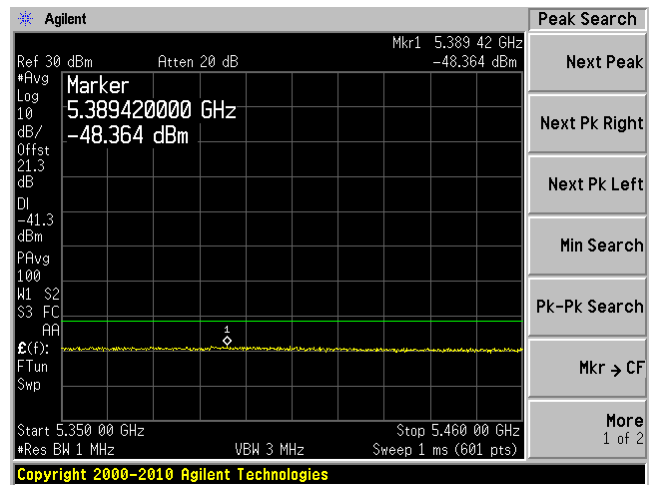
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



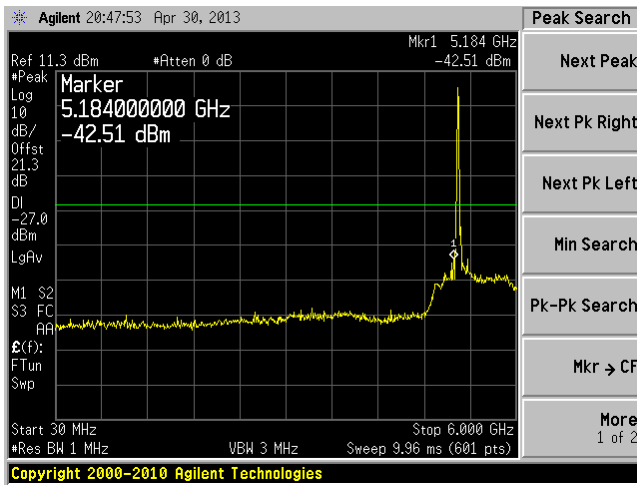
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



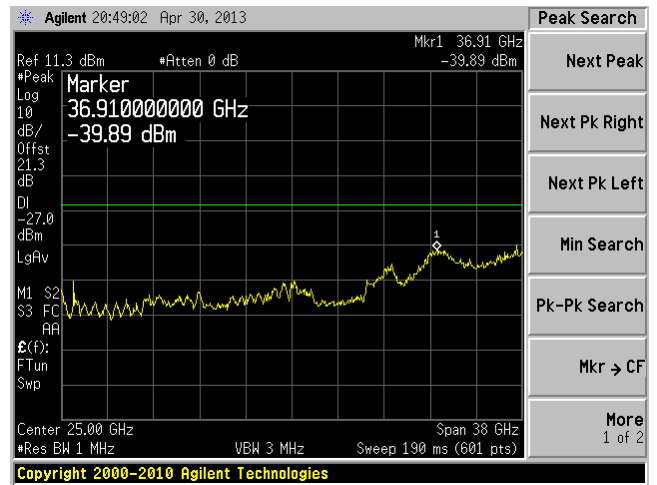
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



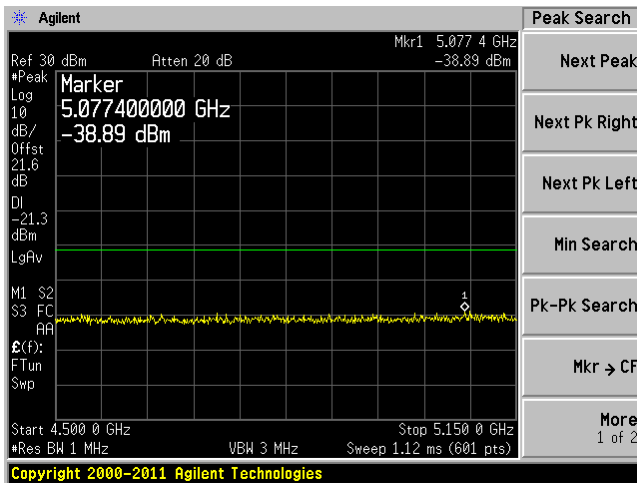
Chain 1, Plot: 30 MHz – 6 GHz



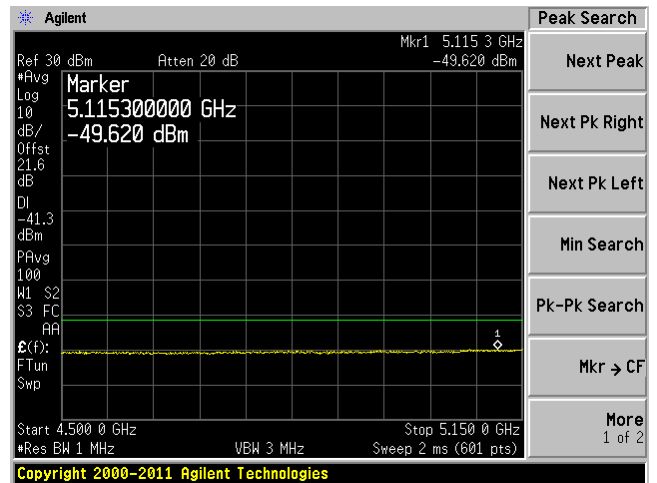
Chain 1, Plot: 6 GHz – 44 GHz



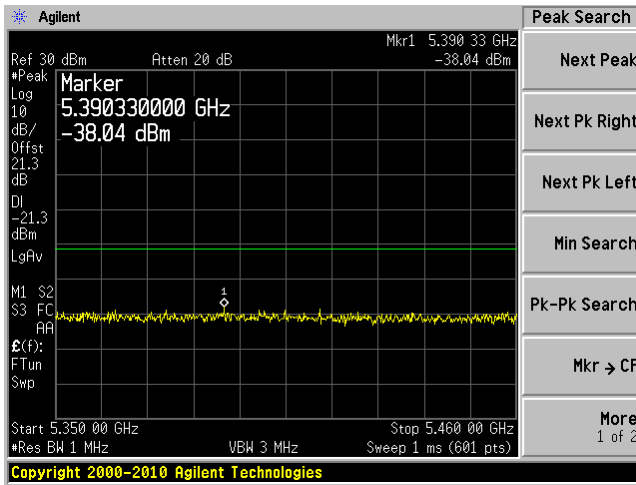
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict Band) Peak



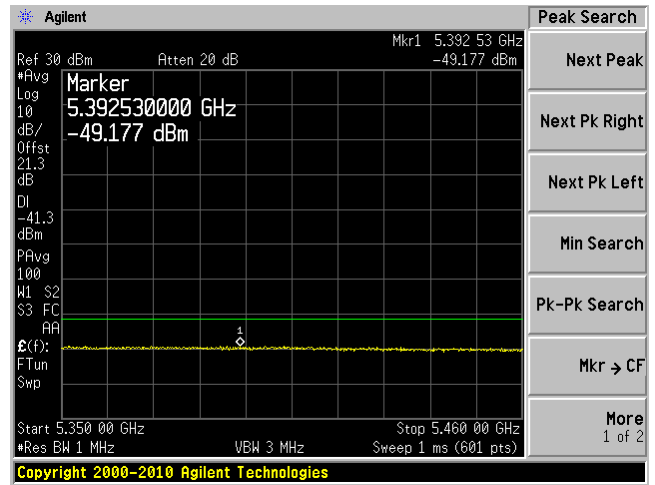
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict band) Ave



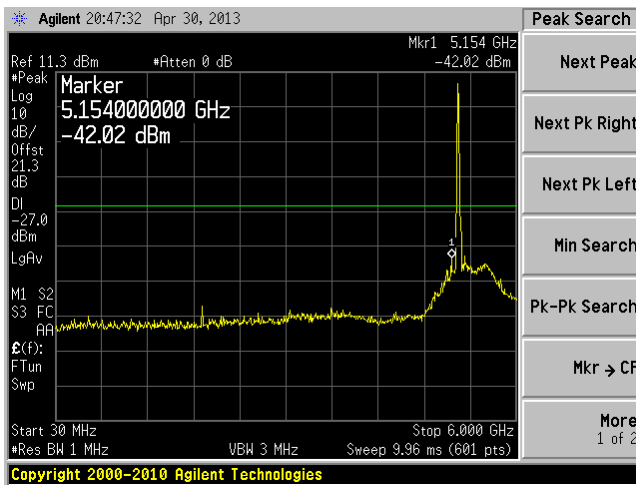
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



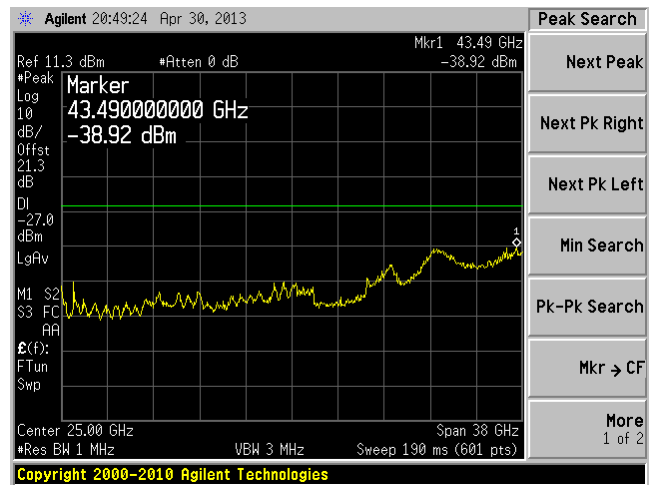
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



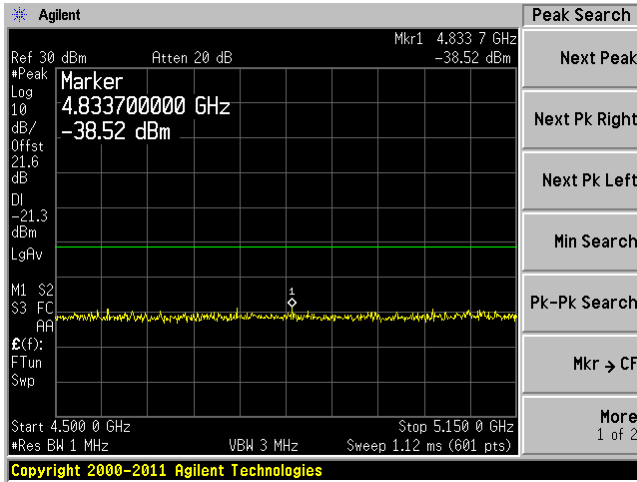
Chain 2, Plot: 30 MHz – 6 GHz



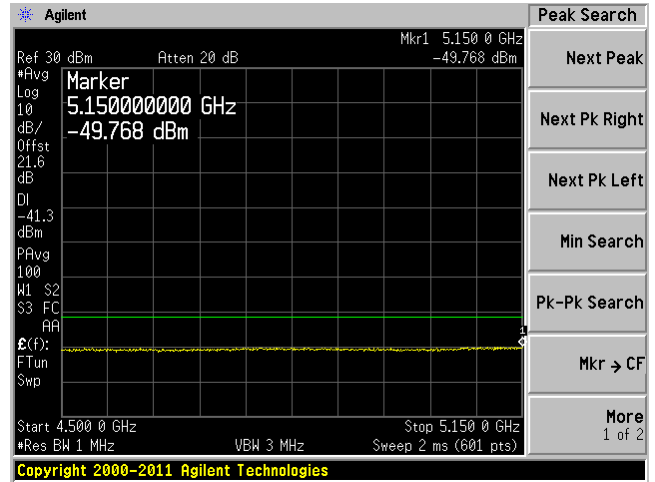
Chain 2, Plot: 6 GHz – 44 GHz



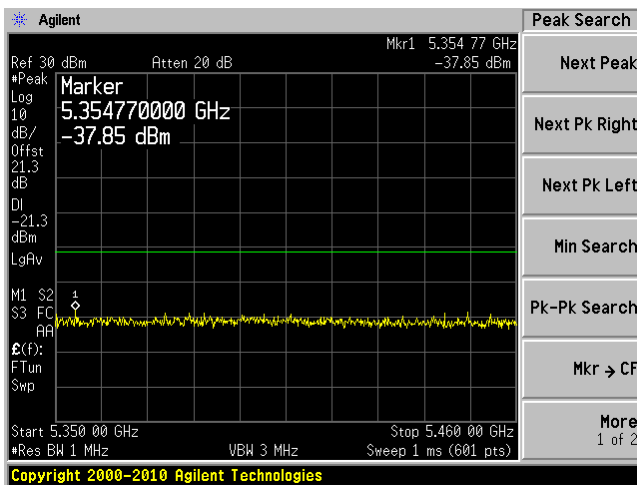
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



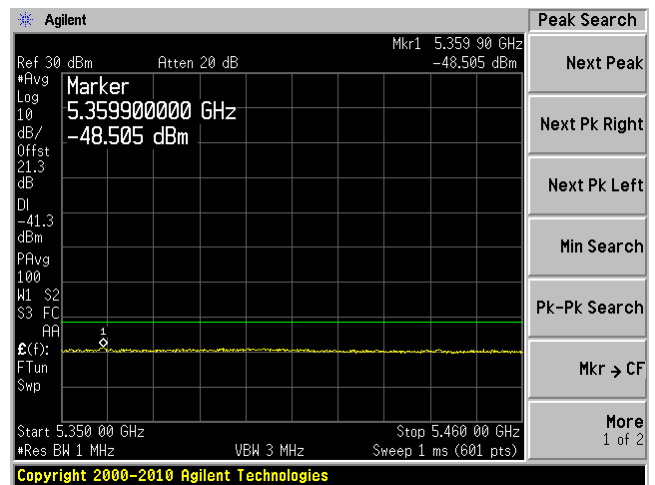
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak

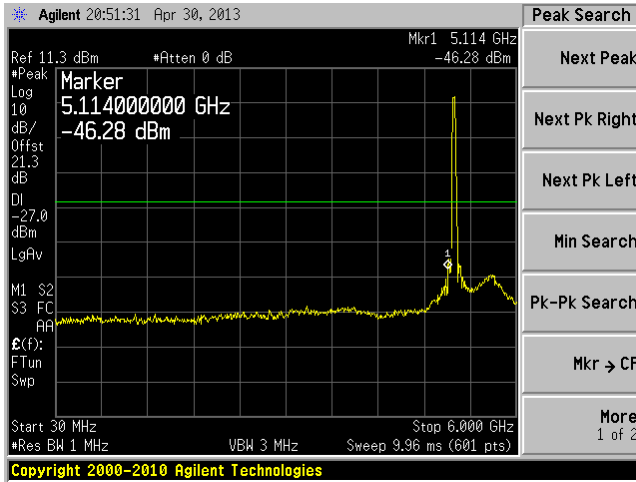


Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave

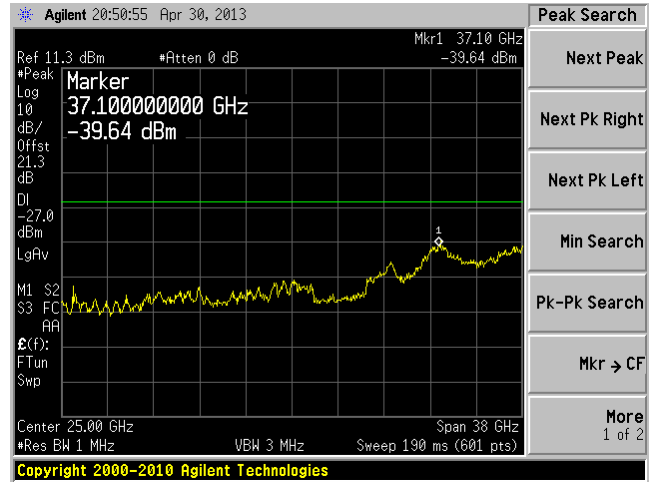


### 802.11n HT40, Low Channel

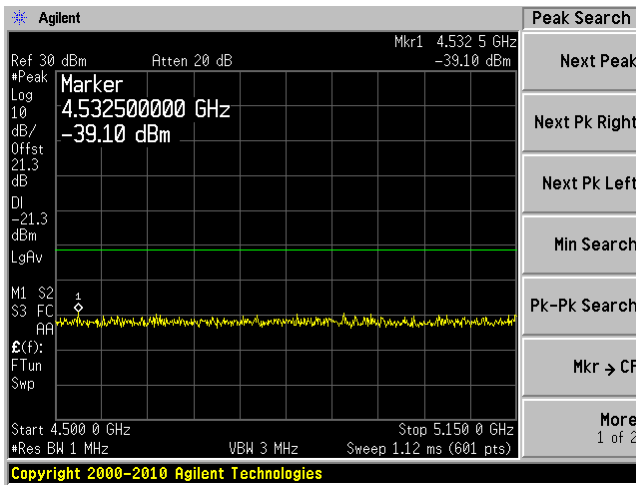
Chain 0, Plot: 30 MHz – 6 GHz



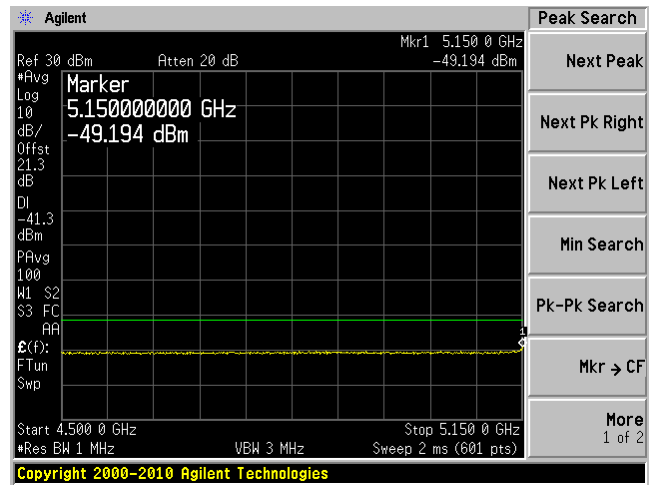
Chain 0, Plot: 6 GHz – 44 GHz



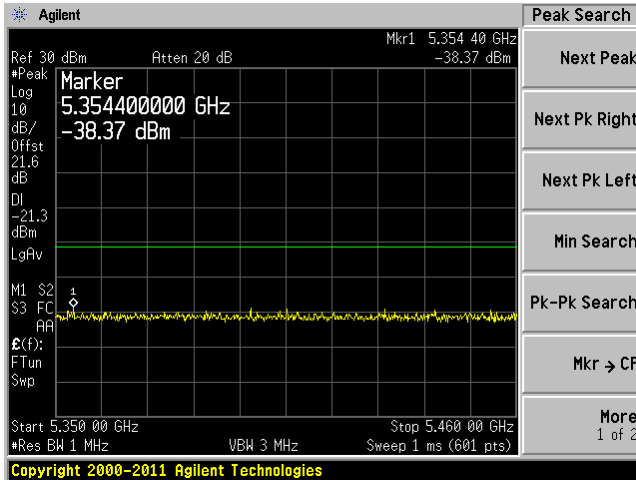
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



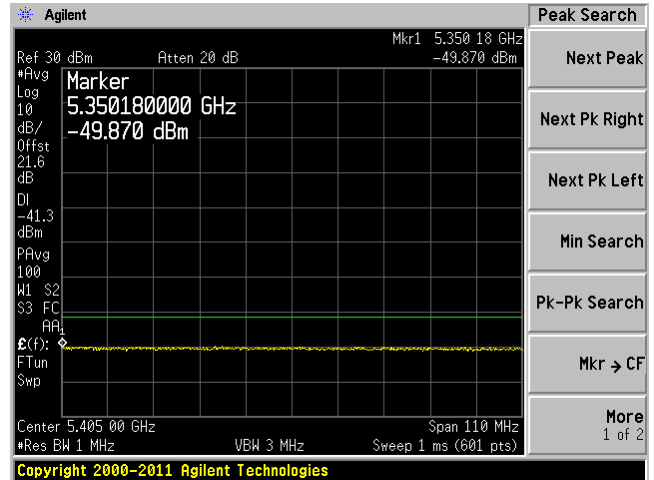
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



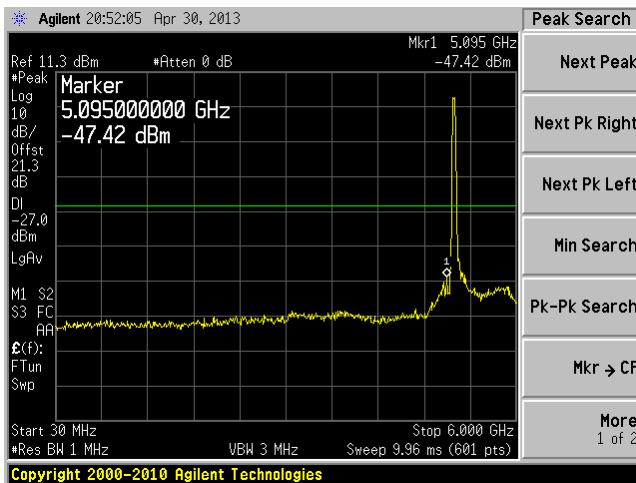
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



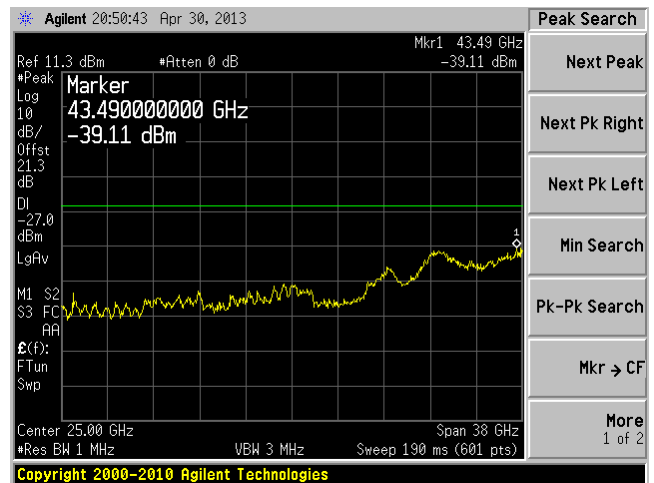
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



Chain 1, Plot: 30 MHz – 6 GHz

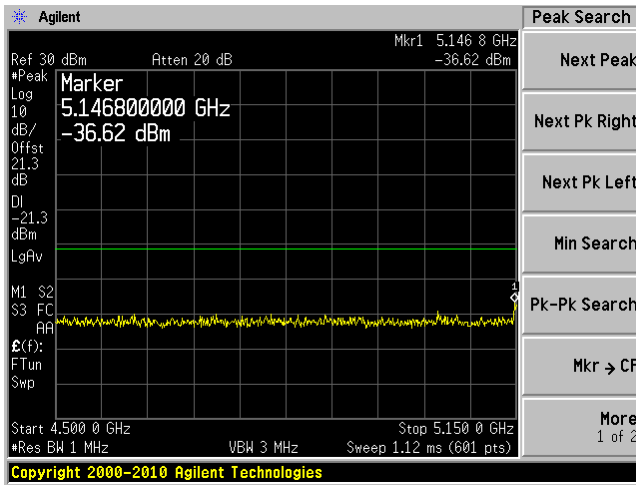


Chain 1, Plot: 6 GHz – 44 GHz

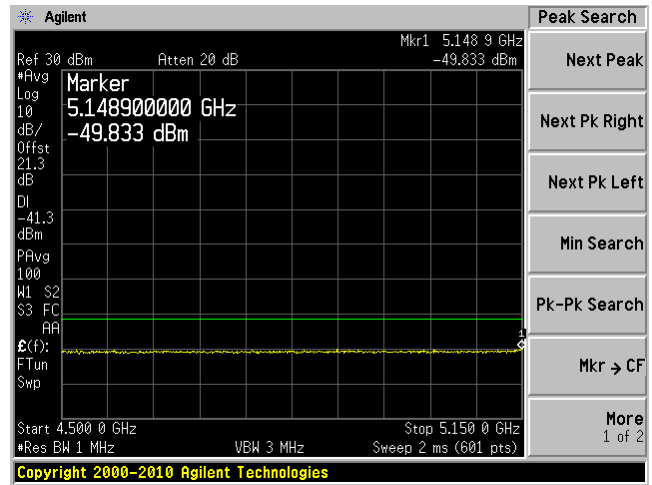




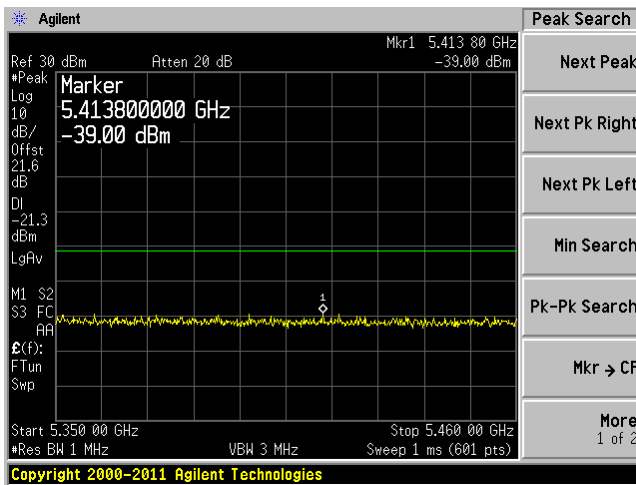
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



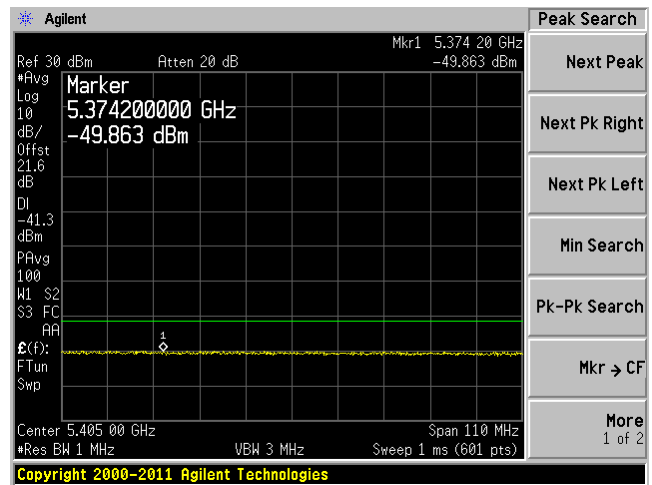
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



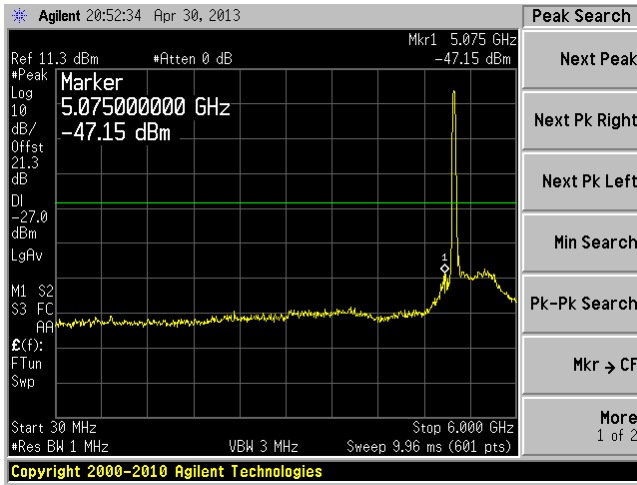
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



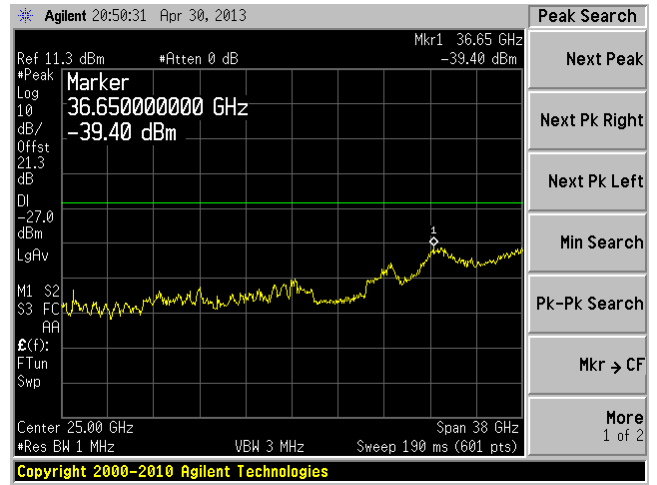
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



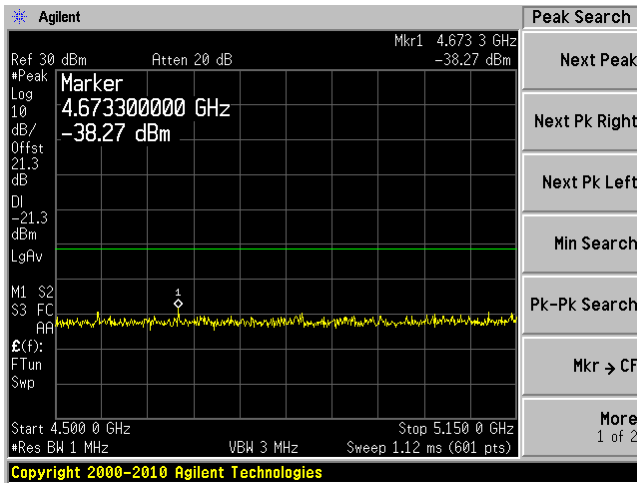
Chain 2, Plot: 30 MHz – 6 GHz



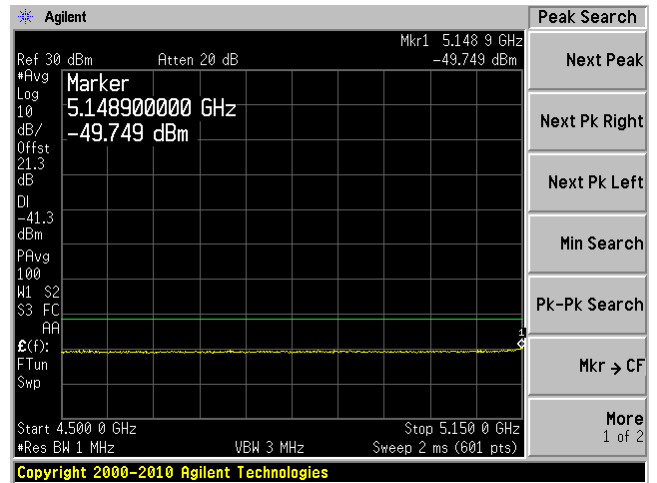
Chain 2, Plot: 6 GHz – 44 GHz



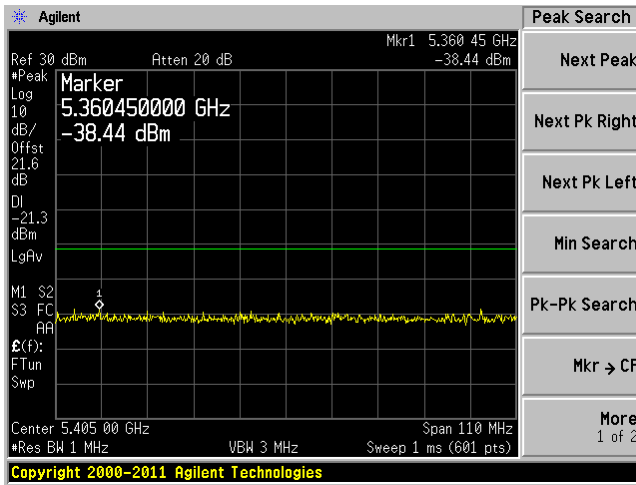
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict Band) Peak



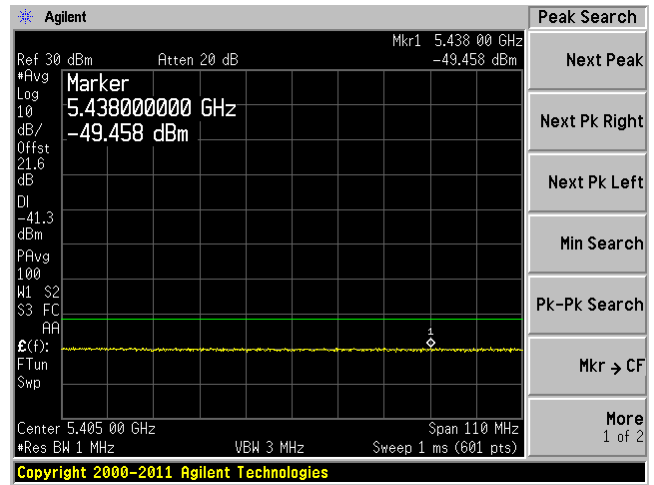
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict band) Ave



Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak

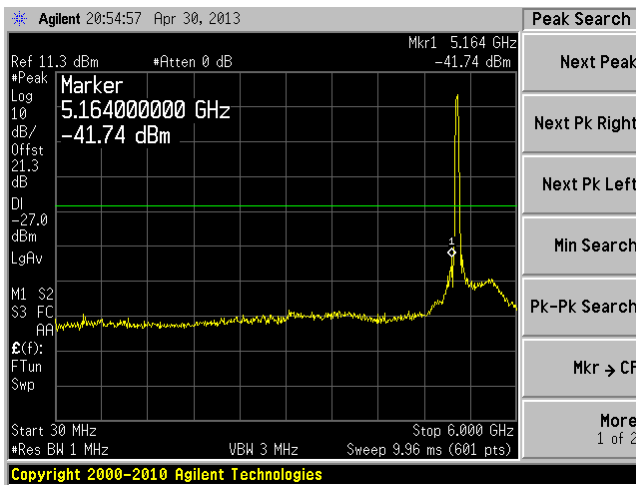


Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave

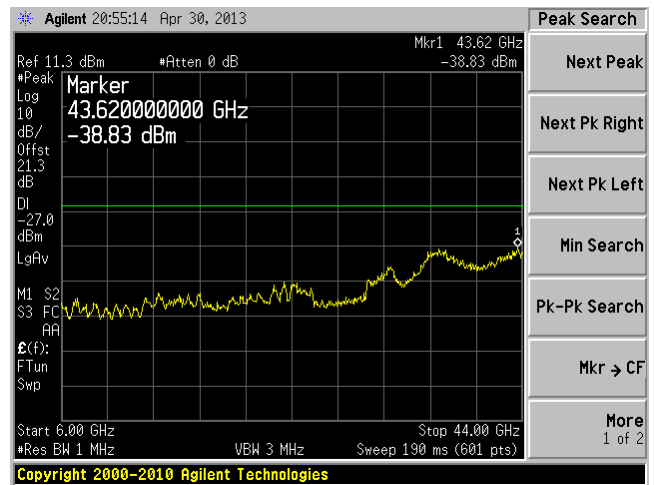


### 802.11n HT40, High Channel

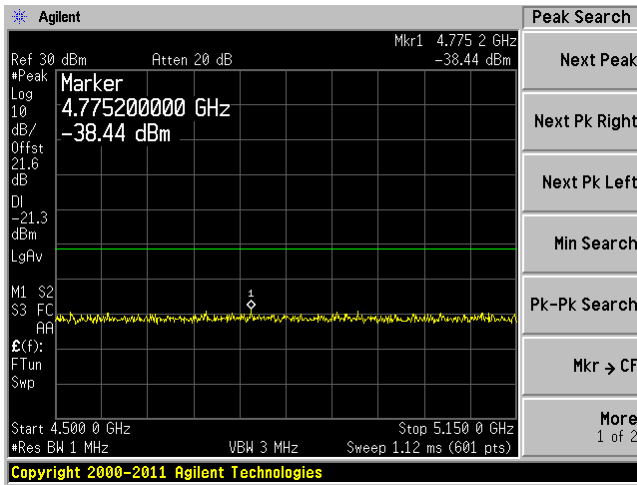
Chain 0, Plot: 30 MHz – 6 GHz



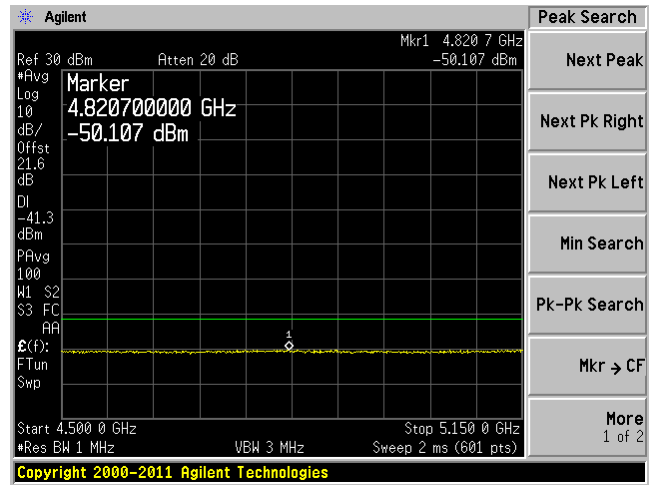
Chain 0, Plot: 6 GHz – 44 GHz



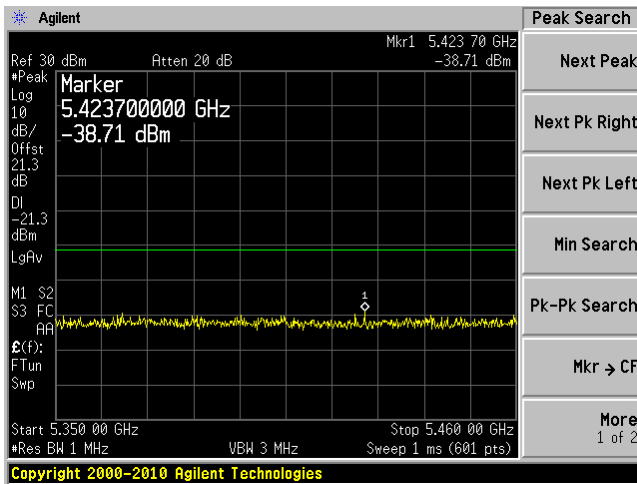
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



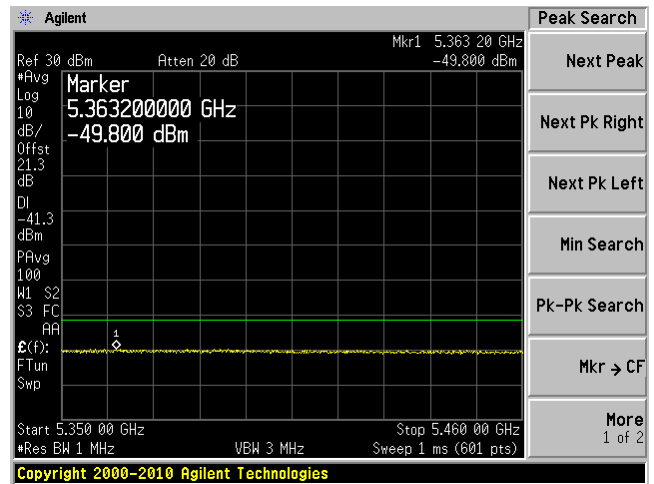
Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



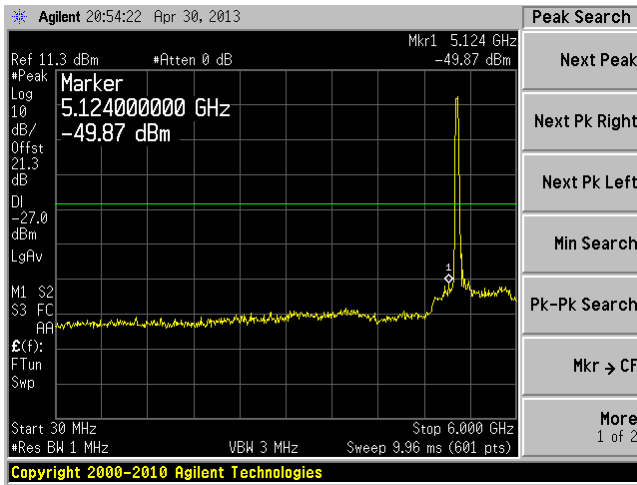
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



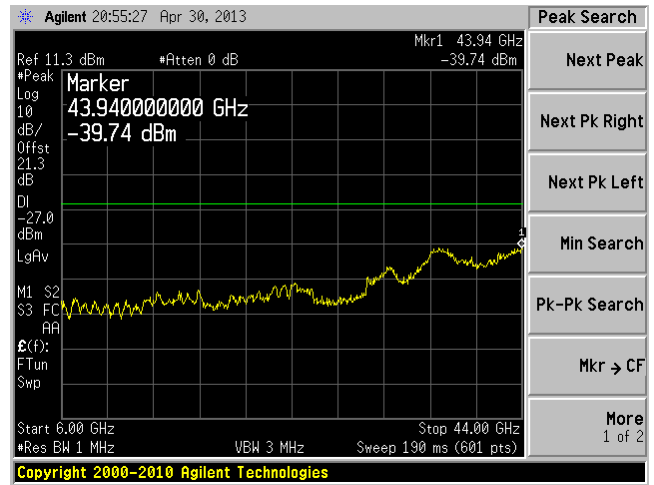
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



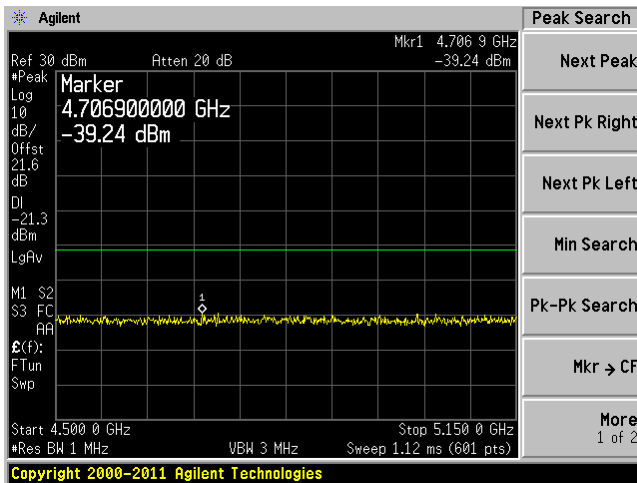
Chain 1, Plot: 30 MHz – 6 GHz



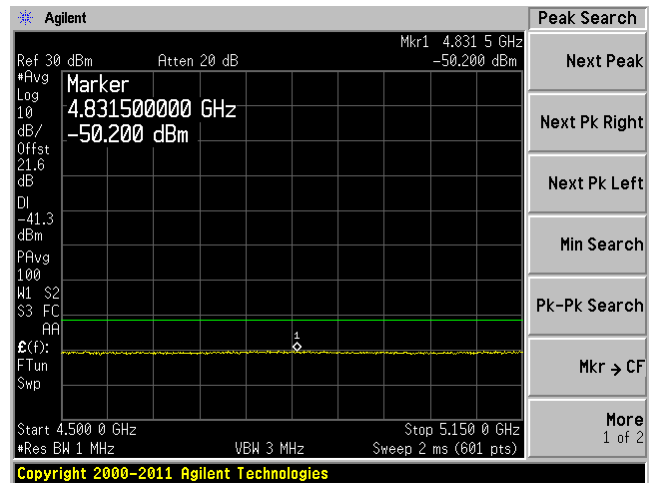
Chain 1, Plot: 6 GHz – 44 GHz



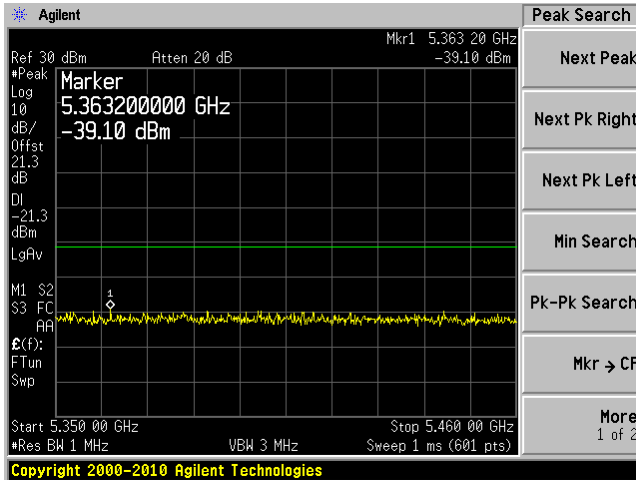
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict Band) Peak



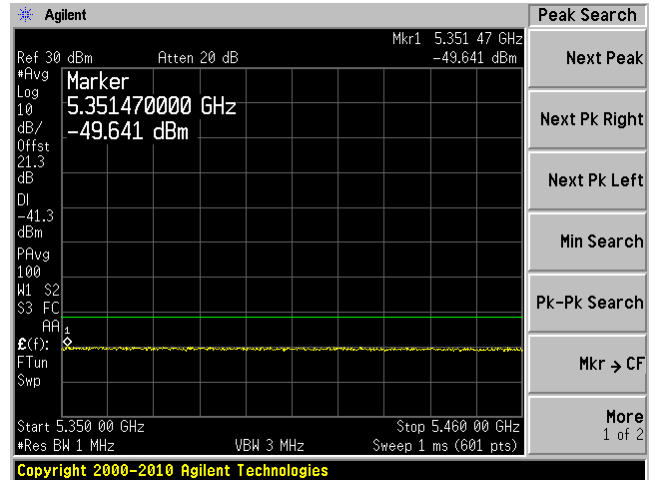
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict band) Ave



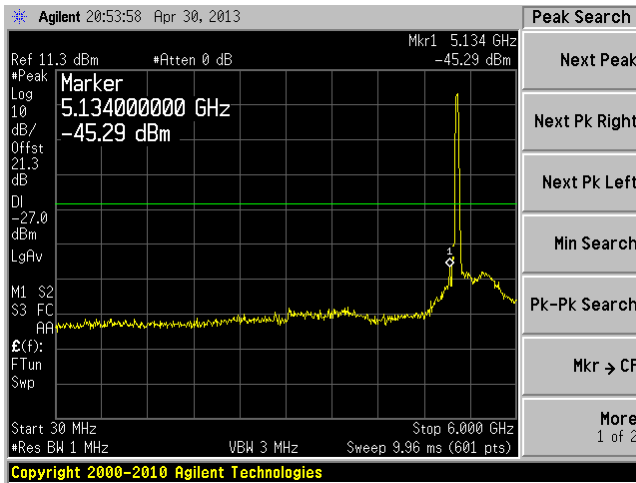
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



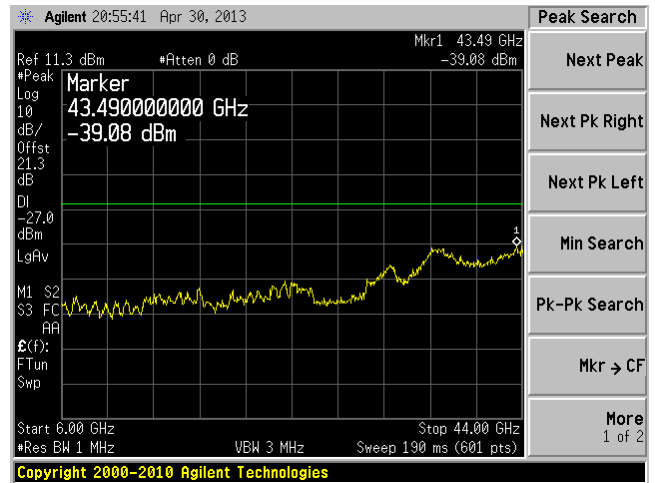
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



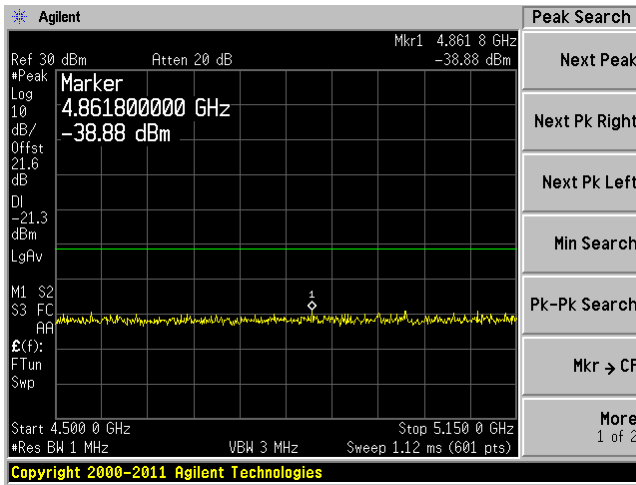
Chain 2, Plot: 30 MHz – 6 GHz



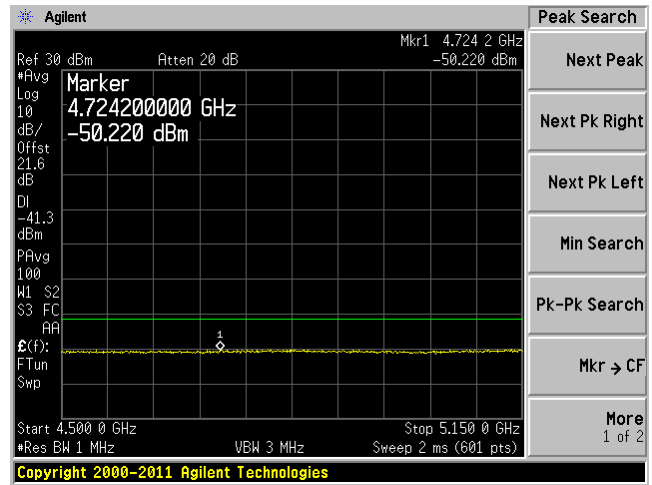
Chain 2, Plot: 6 GHz – 44 GHz



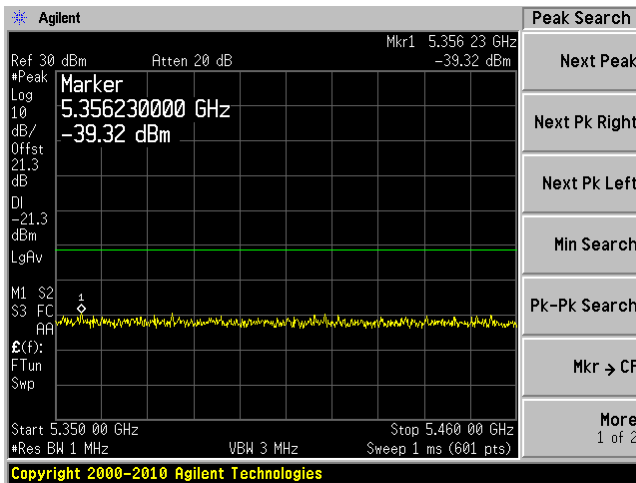
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



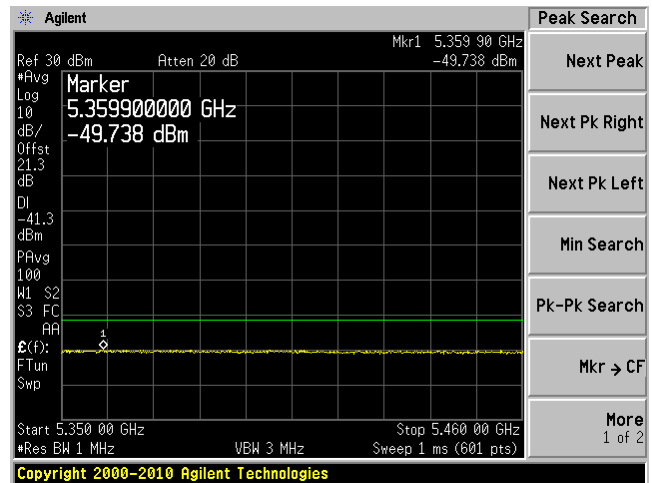
Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak

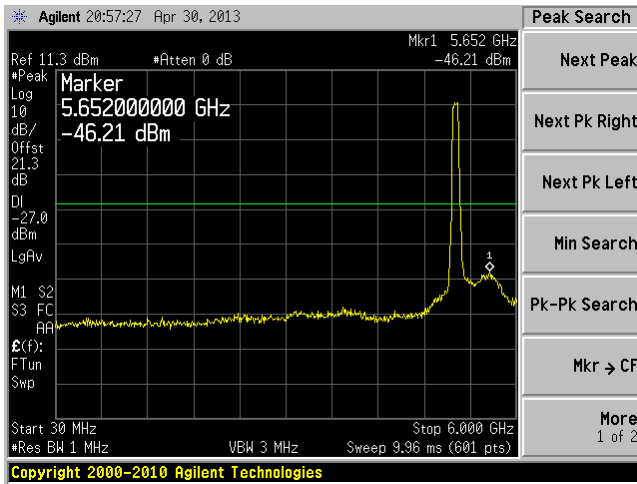


Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave

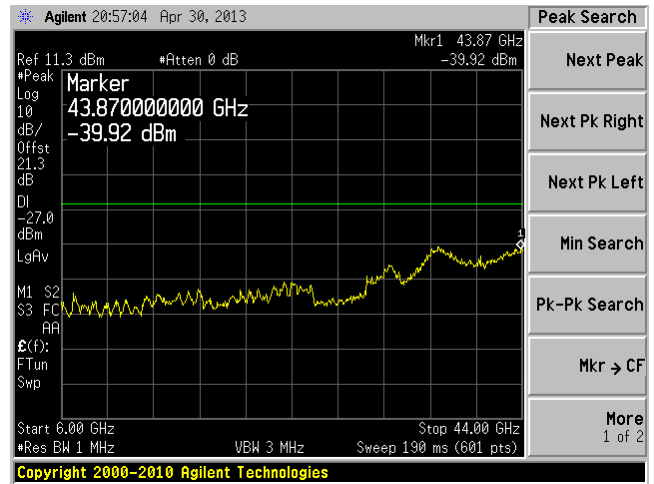


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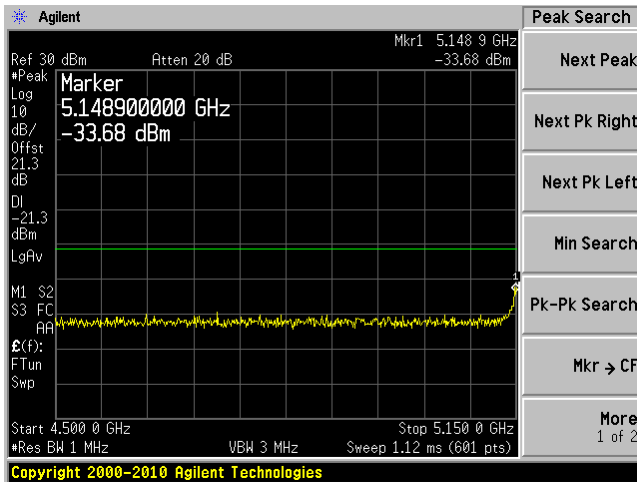
Chain 0, Plot: 30 MHz – 6 GHz



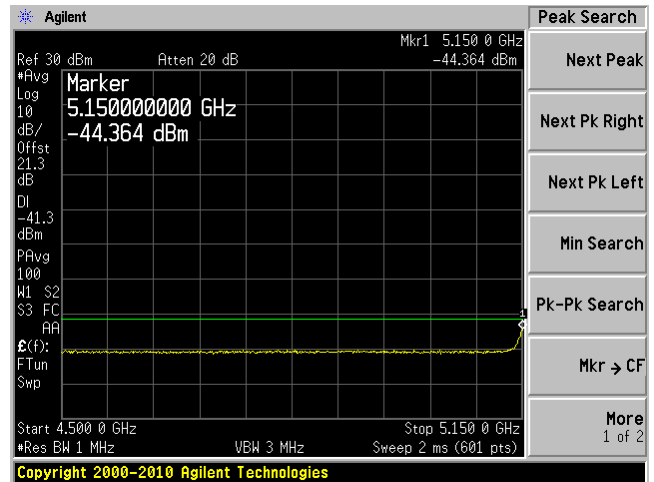
Chain 0, Plot: 6 GHz – 44 GHz



Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak

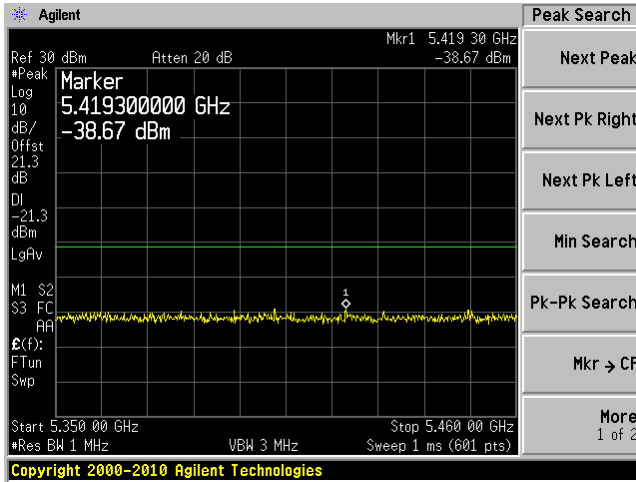


Chain 0, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave

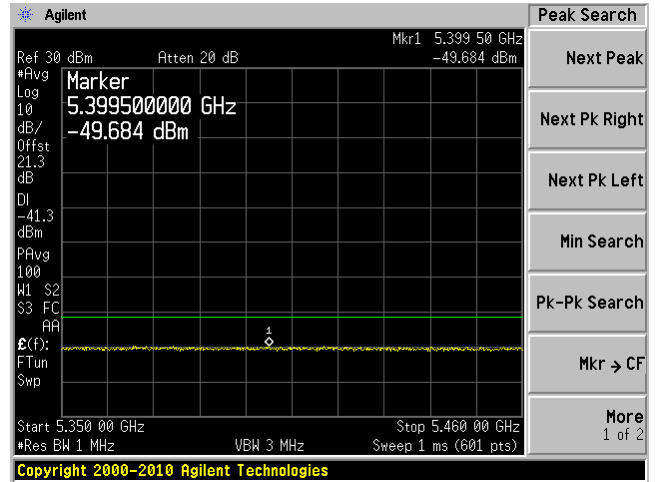




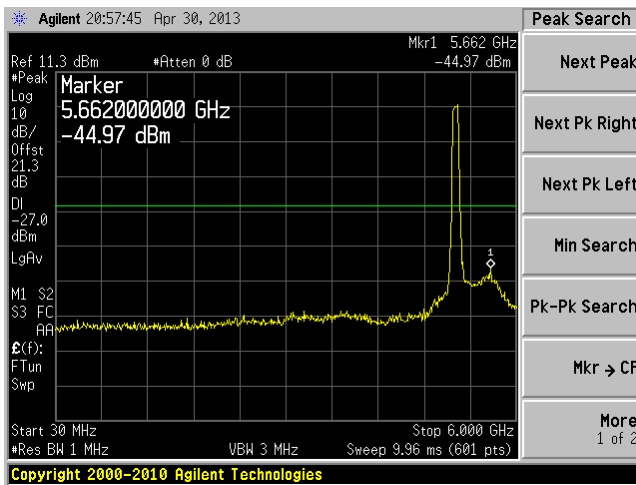
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



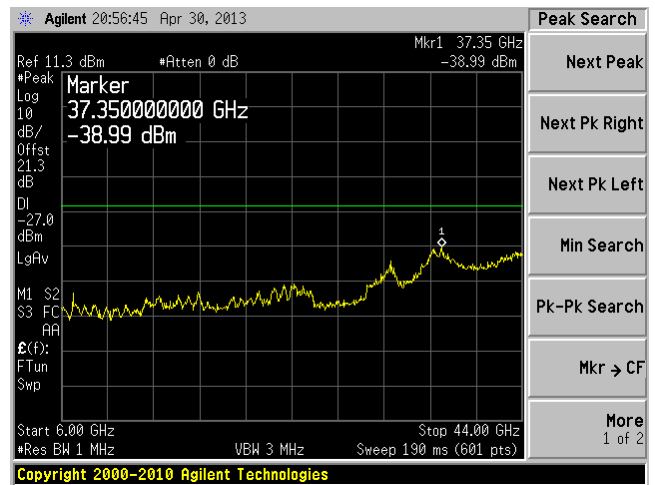
Chain 0, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



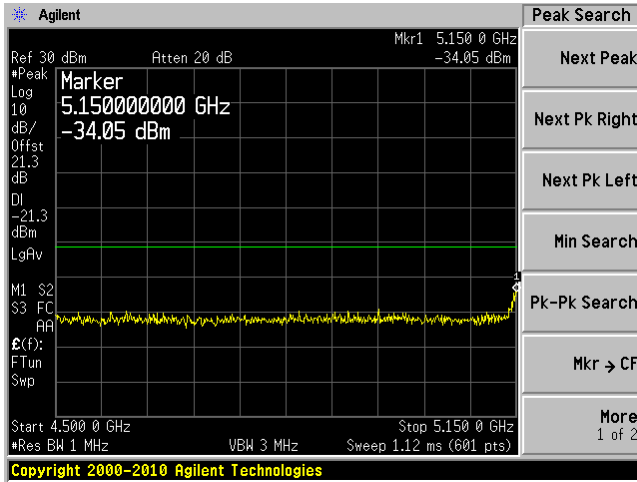
Chain 1, Plot: 30 MHz – 6 GHz



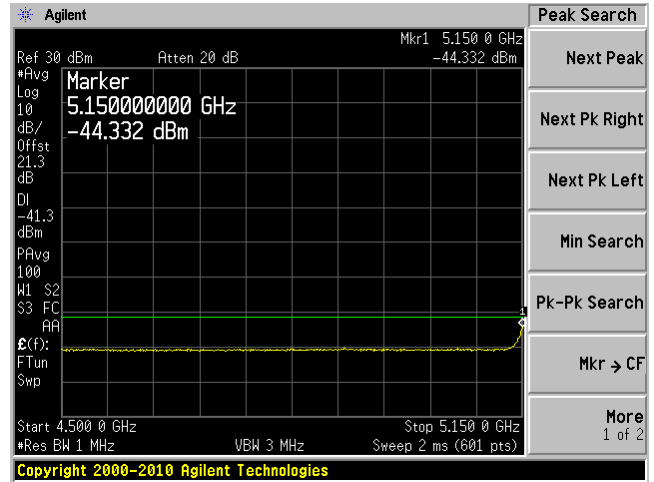
Chain 1, Plot: 6 GHz – 44 GHz



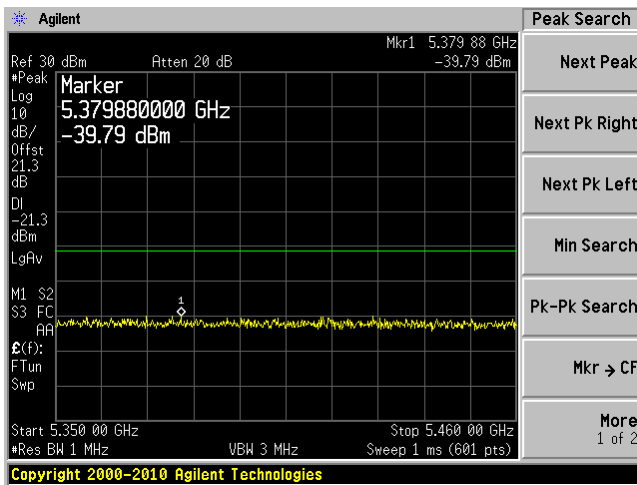
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict Band)  
Peak



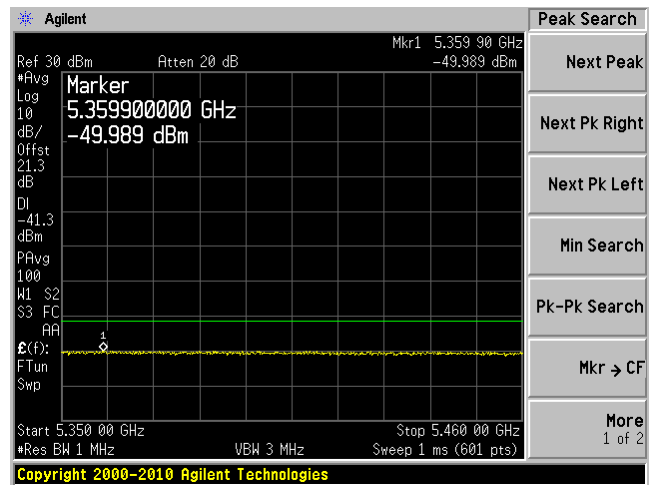
Chain 1, Plot: 4.5 GHz – 5.15 GHz (restrict band)  
Ave



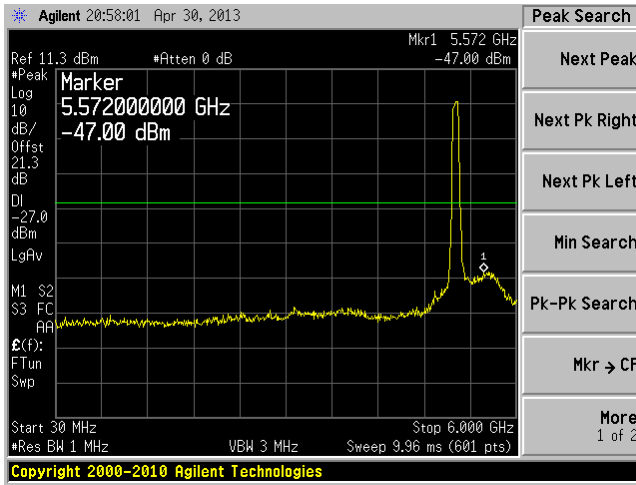
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak



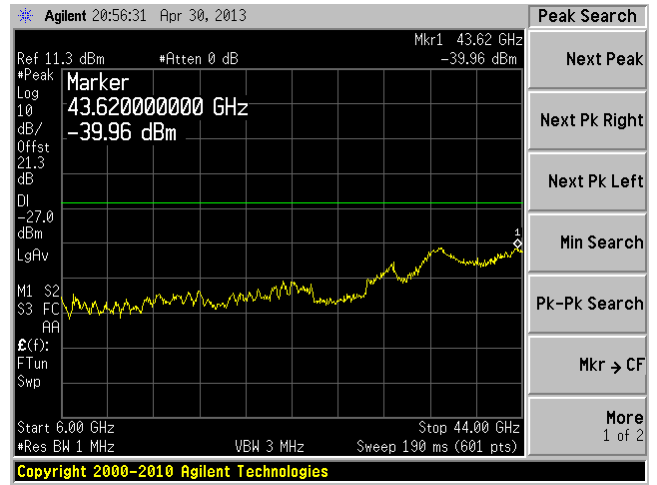
Chain 1, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave



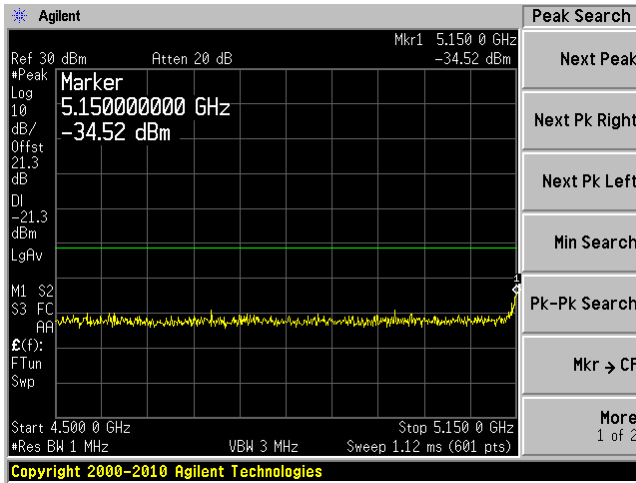
Chain 2, Plot: 30 MHz – 6 GHz



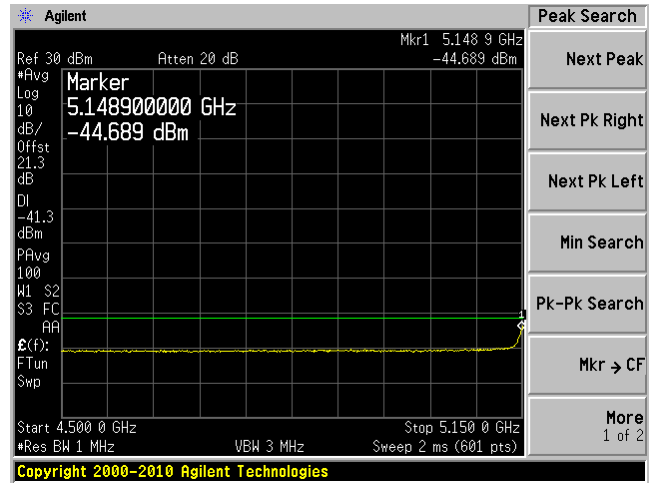
Chain 2, Plot: 6 GHz – 44 GHz



Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict Band) Peak



Chain 2, Plot: 4.5 GHz – 5.15 GHz (restrict band) Ave



Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict Band)  
Peak

Chain 2, Plot: 5.35 GHz – 5.46 GHz (restrict band)  
Ave

