Lab Code: 200167-0

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

For

Ruckus Wireless, Inc.

880 West Maude Avenue, Suite 101,

Sunnyvale, CA 94085, USA

FCC ID: S9G-MPE5N33A
IC: 5912A-MPE5N33A

Report Type:	**Product Type:**
Original Report	802.11 a/n Wireless Module

Test Engineers:	Quinn Jiang
Report Number:	R1110211-407
Report Date:	2012-01-29
Reviewed By:	Victor Zhang EMC/RF Lead
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1110211-W52	Original Report	2012-01-29

1 General Description

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 model: *MPE5N33A, FCC ID: S9G-MPE5N33A; IC: 5912A-MPE5N33A* or the "EUT" as referred to in this report. The EUT is a 5 GHz 802.11a/n wireless module.

1.2 Mechanical Description of EUT

The "EUT" measures approximately 6.*9cm (L) x 3.9cm (W) x 1.0cm (H)*, and weighs approximately 16.*0*g.

The test data gathered are from typical production sample, serial number: 114321113005 and 115121086007 were provided by the manufacturer.

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/IC rules for Conducted Emissions, Occupied Bandwidth, Maximum Peak Output Power, Power Spectral Density, Radiated and Conducted Spurious Emissions, and Band Edge.

1.4 Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS with FCC ID: S9G-MPE5N33A
IC RSS-210 with IC: 5912A-MPE5N33A

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 CISPR16-4-2:2003, 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.

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

1.7 Test Facility

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

The test 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 22:2005 + A1:2005 + A2:2006 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz. The facility also complies with the test methods and procedures set forth in ANSI C63.4-2003 & TIA/EIA-603.

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.: R-3729, C-4176, G-469, and T-1206. 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 a National Institute of Standards and Technology (NIST) accredited laboratory under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2001670.htm

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2003.

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

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 software used, 3CDaemon Version 2.0, Putty Version 0.60.0.0, and Snoop Art version 2.18.2 were provided by client and verified by Quinn Jiang to comply with the standard requirements being tested against.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Special Accessories

Manufacturer	Description	Model No.	Serial No.
Atheros Communications	Module Supporting Board	HPCB D1 94V-0	PB92-021-D0897

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Dell	Laptop	Latitude E5420	CHZMLQ1

2.6 EUT Internal Configuration

NA: Only the module card was tested the s/n was in the section 1.2.

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	Band Edges	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	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^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

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

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

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

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

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

4.2 MPE Prediction

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

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

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

4.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	16.30
Maximum peak output power at antenna input terminal (mW):	42.66
Prediction distance (cm):	20
Prediction frequency (MHz):	5180
Maximum Antenna Gain, typical (dBi):	3.0
Maximum Antenna Gain (numeric):	1.995
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0169
Power density of prediction frequency at 20.0 cm (W/m^2):	0.169
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	10

The device 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.

As per 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 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

5.2 Antenna List

Antenna model	5 GHz Antenna Gain (dBi)
FAB 100-11204-001 REV 4	3.0

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 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 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.

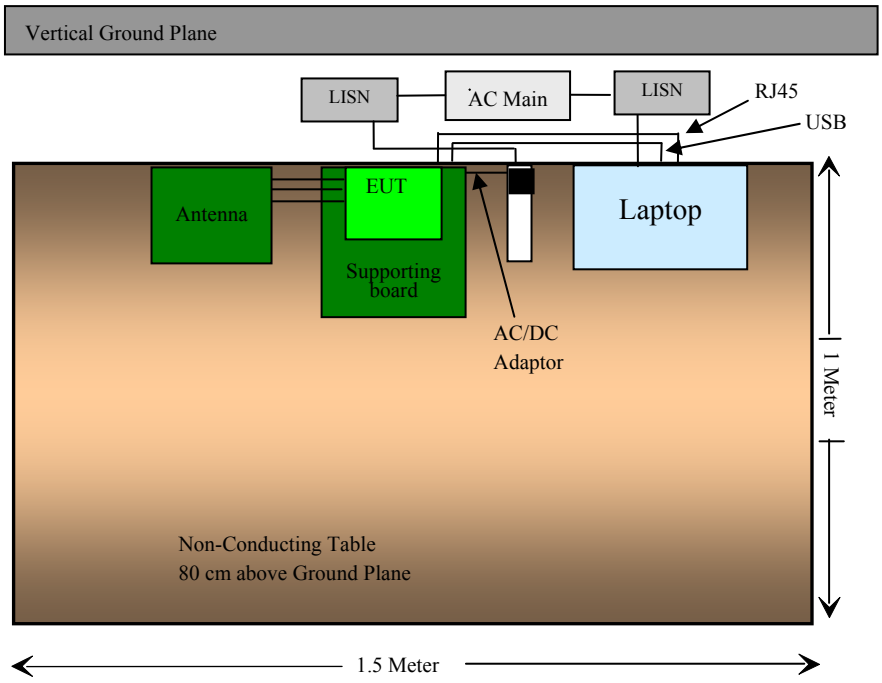
6.3 Test Procedure

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



6.5 Corrected Amplitude & Margin Calculation

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

CA = Ai + AF + CL + Atten – Ga

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

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

Margin = Corrected Amplitude - Limit

6.6 Test Equipment List and Details

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

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

6.7 Test Environmental Conditions

Temperature:	18~23 °C
Relative Humidity:	36~45 %
ATM Pressure:	101-102 kPa

The testing was performed by Quinn Jiang on 11-28-2011 to 11-29-2011 in 5 meter chamber 3.

6.8 Summary of Test Results

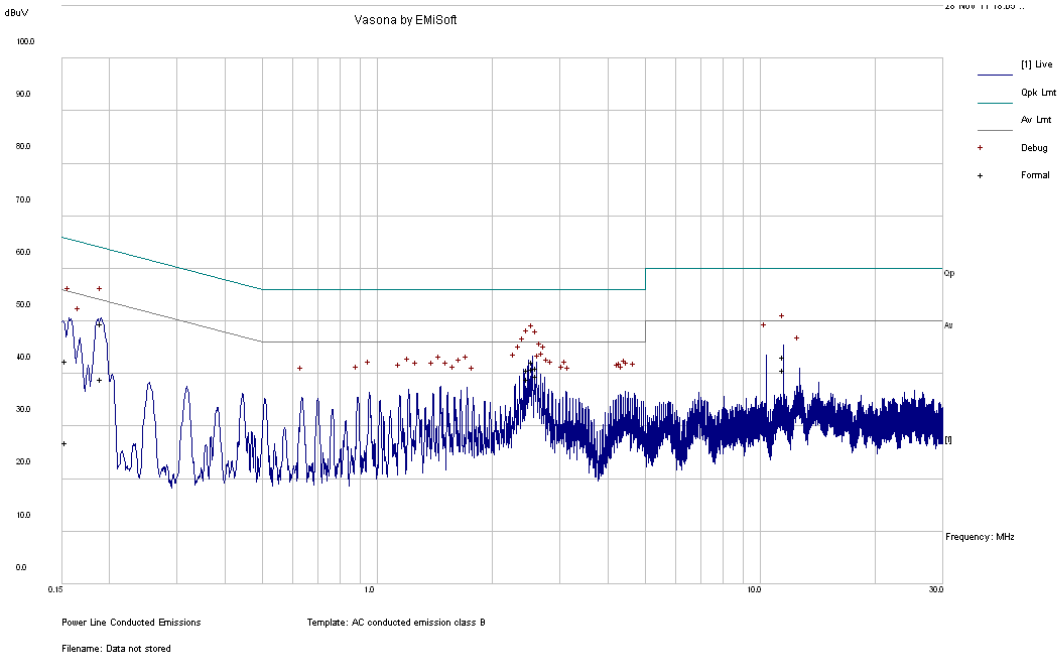
According to the recorded data in following table, the EUT complied with the FCC/IC standard's conducted emissions limits, with the margin reading of:

Connection: 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-5.08	2.539565	Line	0.15 to 30

6.9 Conducted Emissions Test Plots and Data

5180 MHz

120 V, 60 Hz – Line



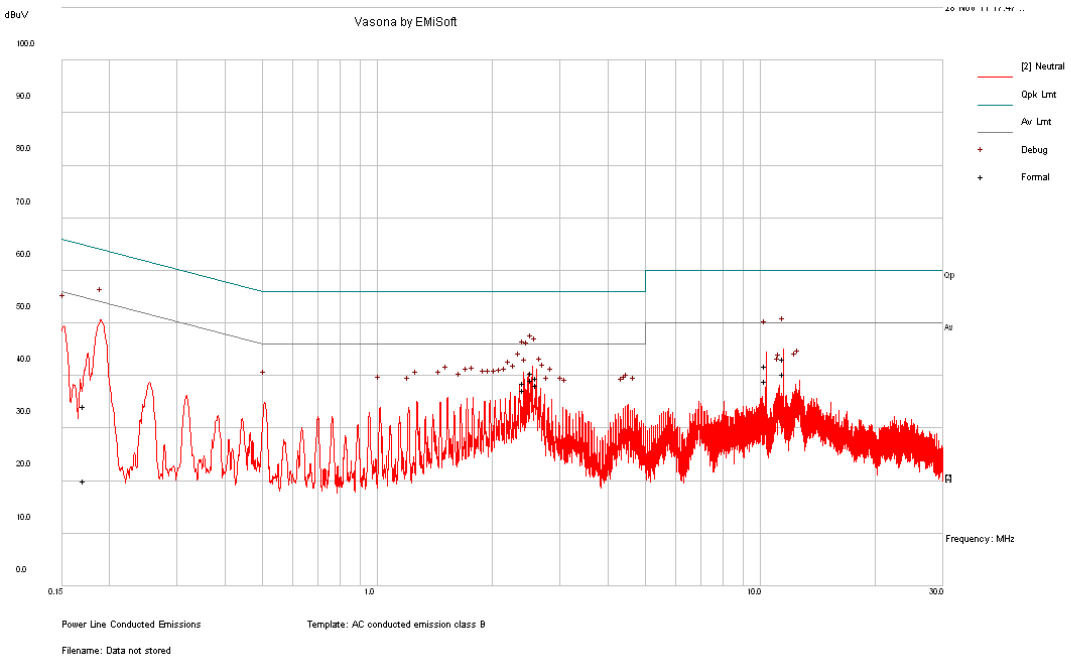
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
2.539565	42.16	Line	56	-13.84
0.190191	49.5	Line	64.03	-14.53
2.476079	40.66	Line	56	-15.34
2.602744	41.18	Line	56	-14.82
11.49602	43.19	Line	60	-16.81
0.154065	42.5	Line	65.78	-23.27

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
2.539565	40.92	Line	46	-5.08
0.190191	39.08	Line	54.03	-14.95
2.476079	39.07	Line	46	-6.93
2.602744	39.57	Line	46	-6.43
11.49602	40.74	Line	50	-9.26
0.154065	26.9	Line	55.78	-28.88

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.172119	34.11	Neutral	64.86	-30.75
2.538902	40.5	Neutral	56	-15.5
2.602226	39.65	Neutral	56	-16.35
11.4913	43.3	Neutral	60	-16.7
2.413198	38.6	Neutral	56	-17.4
10.34428	41.88	Neutral	60	-18.12

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.172119	20.03	Neutral	54.86	-34.82
2.538902	39.2	Neutral	46	-6.8
2.602226	38.19	Neutral	46	-7.81
11.4913	40.41	Neutral	50	-9.59
2.413198	37.19	Neutral	46	-8.81
10.34428	38.94	Neutral	50	-11.06

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 C63.4-2003. 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:

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

Above 1000 MHz:

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

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:

CA = Ai + CL + 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:

Margin = Corrected Amplitude - Limit

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2011-03-21
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A0020106-3	2011-06-29
EMCO	Horn antenna	3115	9511-4627	2011-10-03
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2011-06-09
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2011-05-09

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

7.6 Test Environmental Conditions

Temperature:	18~23 °C
Relative Humidity:	36~45 %
ATM Pressure:	101-102 kPa

The testing was performed by Quinn Jiang on 2011-11-01 and 2011-28-2011 to 11-29-2011 in 5 meter chamber 3.

7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15, Subpart C, section 15.205, 15.209 and 15.407 & IC RSS-210, RSS-Gen standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-4.47	399.987	Horizontal	30 MHz-1 GHz

Above 1 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-	-	-	Above 1 GHz

Note: All the Restricted Band Frequencies are more than 20 dB below the margin

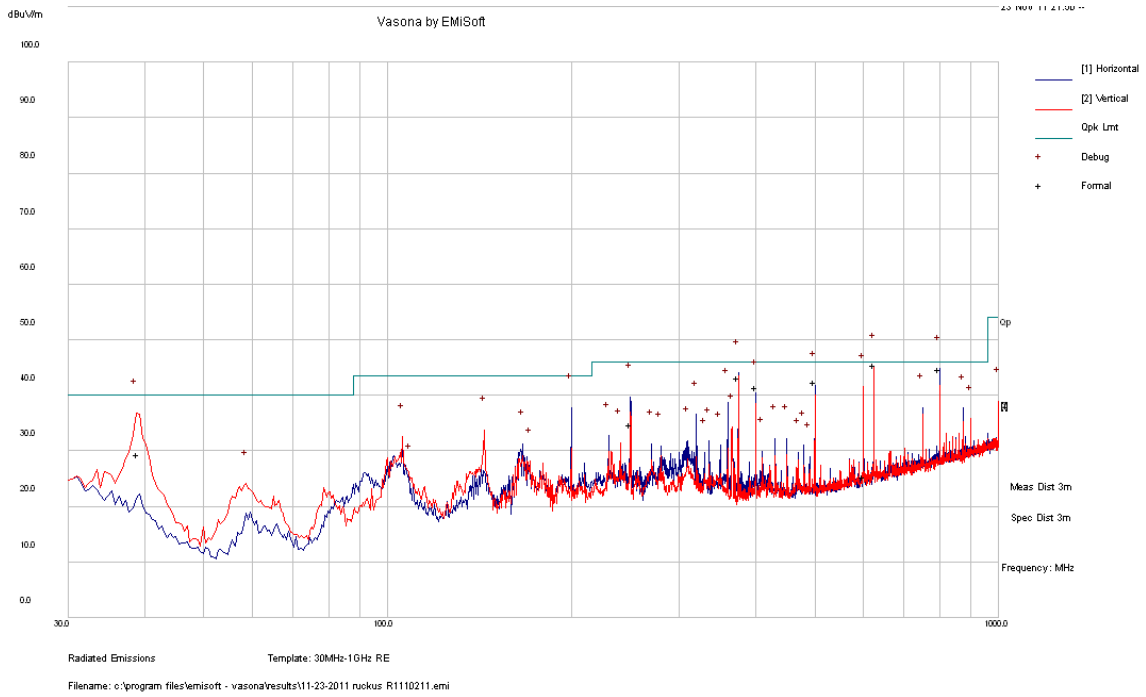
Please refer to the following table and plots for specific test result details

7.8 Radiated Emissions Test Result Data

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

5.2 GHz Band

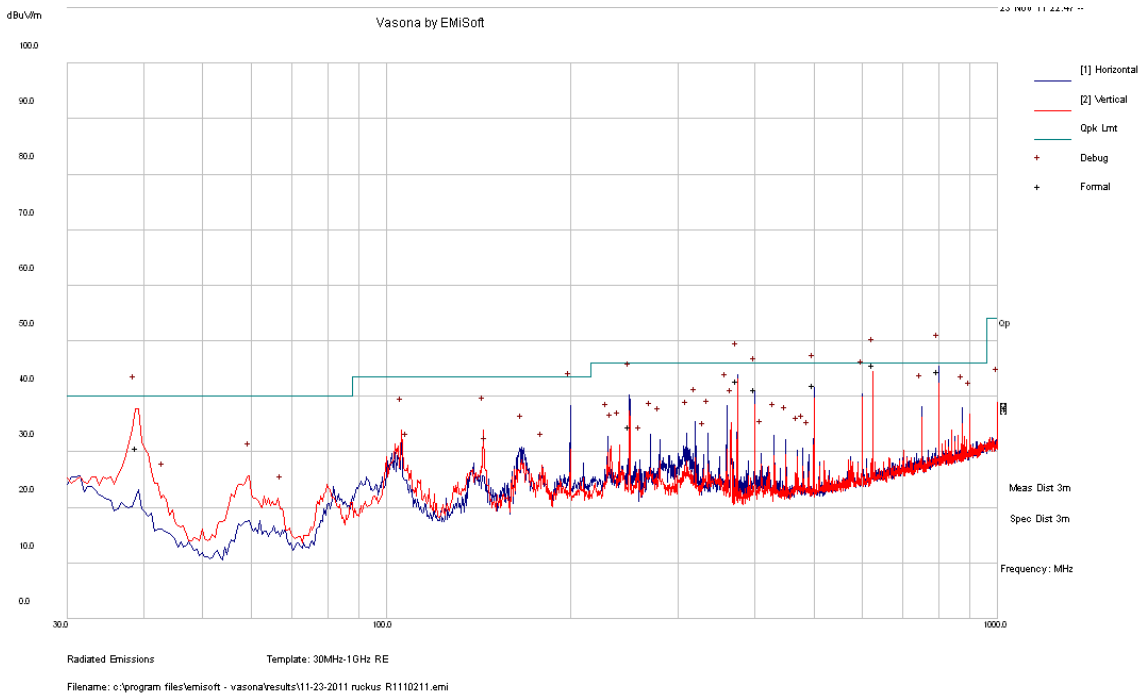
802.11n20 mode (5180 MHz)



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
399.987	41.53	99	H	316	46	-4.47
249.9433	34.86	130	H	230	46	-11.14

802.11n40 mode 5190 MHz



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
399.999	41.38	99	H	314	46	-4.62
249.952	34.58	165	H	223	46	-11.42

(2) Radiated Emission at 3 meters, above 1 GHz

5.2 GHz Band

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											
-	-	-	-	-	-	-	-	-	-	-	-
Middle Channel 5200 MHz measured at 3 meters											
-	-	-	-	-	-	-	-	-	-	-	-
High Channel 5240 MHz measured at 3 meters											
-	-	-	-	-	-	-	-	-	-	-	-

Note: All the Restricted Band Frequencies are more than 20 dB below the margin

802.11n20 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											
-	-	-	-	-	-	-	-	-	-	-	-
Middle Channel 5200 MHz measured at 3 meters											
-	-	-	-	-	-	-	-	-	-	-	-
High Channel 5240 MHz measured at 3 meters											
-	-	-	-	-	-	-	-	-	-	-	-

Note: All the Restricted Band Frequencies are more than 20 dB below the margin

802.11n40 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 5190 MHz, measured at 3 meters											
-	-	-	-	-	-	-	-	-	-	-	-
High Channel 5230 MHz measured at 3 meters											
-	-	-	-	-	-	-	-	-	-	-	-

Note: All the Restricted Band Frequencies are more than 20 dB below the margin

(3) Radiated Emission in the Restricted Band

802.11a Mode

Low Channel 5180 MHz, measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
5150	34.660	200	123	V	33.3	4.56	0.0	72.520	74	-1.480	peak
5150	33.170	213	127	H	33.3	4.56	0.0	71.030	74	-2.970	peak
5150	12.960	200	123	V	33.3	4.56	0.0	50.820	54	-3.180	Ave
5150	12.780	213	127	H	33.3	4.56	0.0	50.640	54	-3.360	Ave

802.11n20 Mode

Low Channel 5180 MHz, measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
5150	35.300	117	119	V	33.3	4.56	0.0	73.160	74	-0.840	peak
5150	29.050	202	119	H	33.3	4.56	0.0	66.910	74	-7.090	peak
5150	12.920	117	119	V	33.3	4.56	0.0	50.780	54	-3.220	Ave
5150	8.140	202	119	H	33.3	4.56	0.0	46.000	54	-8.000	Ave

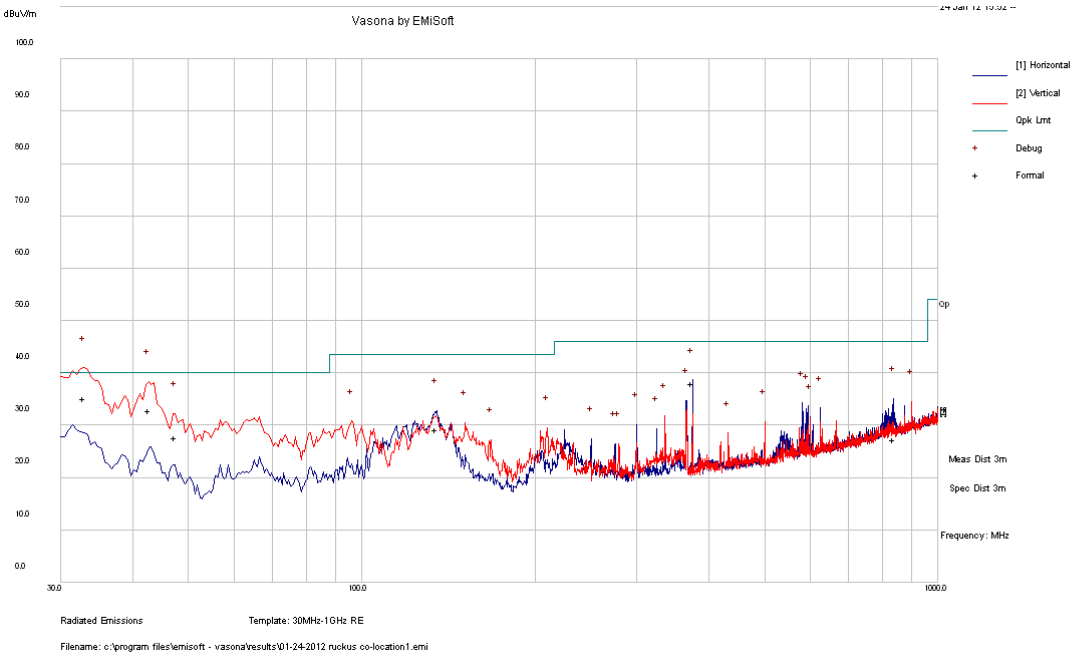
802.11n40 Mode

Low Channel 5190 MHz, measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
5150	34.280	159	124	V	33.3	4.56	0.0	72.140	74	-1.860	peak
5150	31.390	156	122	H	33.3	4.56	0.0	69.250	74	-4.750	peak
5150	15.230	159	124	V	33.3	4.56	0.0	53.090	54	-0.910	Ave
5150	14.220	156	122	H	33.3	4.56	0.0	52.080	54	-1.920	Ave

(4) Co-location with 2.4 GHz module (FCC ID: S9G-MPE2N33A) and Ruckus 2.4/5 GHz Snoop Dogg antenna

2.4 GHz: 2462 MHz; 5.2 GHz: 5180 MHz



30-1000 MHz:

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
32.941	35.21	134	V	138	40	-4.79
42.8035	32.91	99	V	340	40	-7.09
374.9945	38.06	99	H	120	46	-7.94
47.54275	27.59	101	V	89	40	-12.41
134.7765	29.29	201	H	272	43.5	-14.21
837.0075	27.28	113	H	88	46	-18.72

Above 1 GHz:

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

Note: All the Restricted Band Frequencies are more than 20 dB below the margin

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
Agilent	Spectrum Analyzer	E4446A	US44300386	2011-08-11

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

8.4 Test Environmental Conditions

Temperature:	21~25 °C
Relative Humidity:	38~50 %
ATM Pressure:	101.2-102 kPa

The testing was performed by Quinn Jiang on 11-12-2011 to 11-16-2011 in RF site.

8.5 Test Results

802.11a mode

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (kHz)	Results
Chain J10					
Low	5180	21.531	16.5536	> 500	Compliant
Middle	5200	21.685	16.5464	> 500	Compliant
High	5240	21.669	16.5538	> 500	Compliant
Chain J8					
Low	5180	21.365	16.5264	> 500	Compliant
Middle	5200	21.333	16.5315	> 500	Compliant
High	5240	21.322	16.5315	> 500	Compliant
Chain J6					
Low	5180	20.353	16.4760	> 500	Compliant
Middle	5200	20.607	16.5960	> 500	Compliant
High	5240	20.831	16.5936	> 500	Compliant

802.11n20 mode

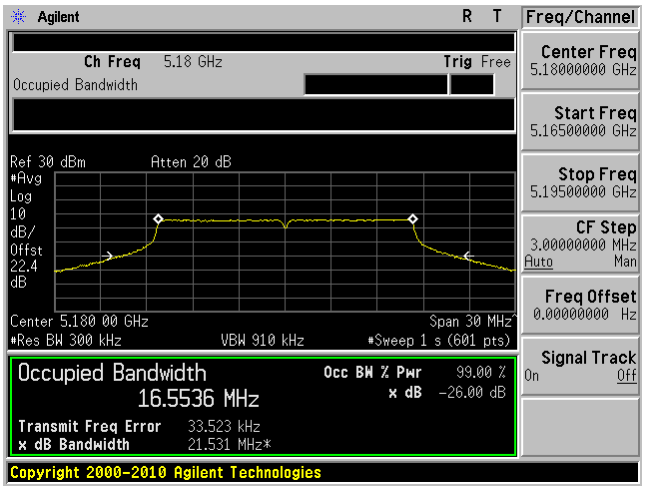
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (kHz)	Results
Chain J10					
Low	5180	22.282	17.7724	> 500	Compliant
Middle	5200	22.250	17.7653	> 500	Compliant
High	5240	22.389	17.7696	> 500	Compliant
Chain 8					
Low	5180	22.030	17.7309	> 500	Compliant
Middle	5200	22.569	17.7215	> 500	Compliant
High	5240	22.357	17.7004	> 500	Compliant
Chain J6					
Low	5180	21.537	17.7029	> 500	Compliant
Middle	5200	21.717	17.7531	> 500	Compliant
High	5240	21.759	17.7365	> 500	Compliant

802.11n40 mode

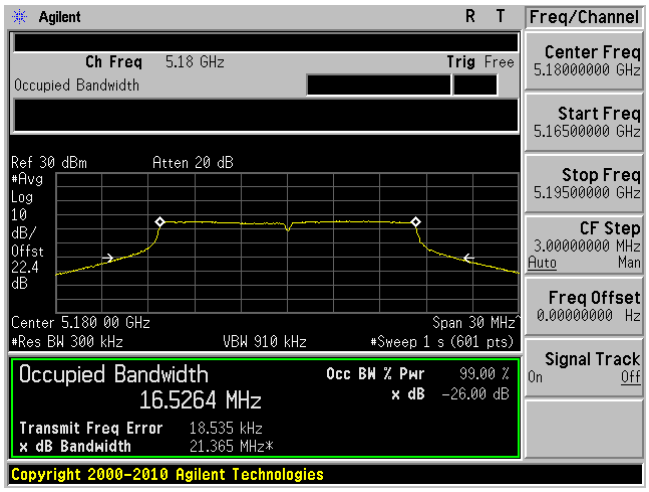
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (kHz)	Results
Chain 10					
Low	5190	42.234	36.3353	> 500	Compliant
High	5230	42.200	36.2712	> 500	Compliant
Chain 8					
Low	5190	42.192	36.2872	> 500	Compliant
High	5230	41.938	36.3396	> 500	Compliant
Chain 6					
Low	5190	41.258	36.3375	> 500	Compliant
High	5230	42.511	36.2556	> 500	Compliant

5150-5250 MHz

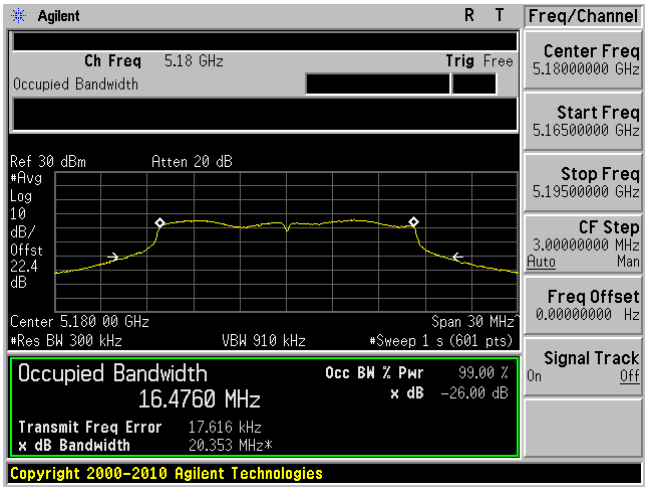
802.11a mode, Low Channel, Chain J10



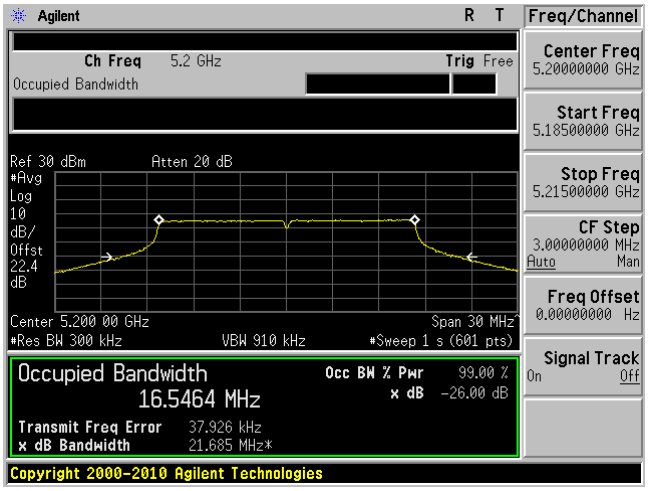
802.11a mode, Low Channel, Chain J8



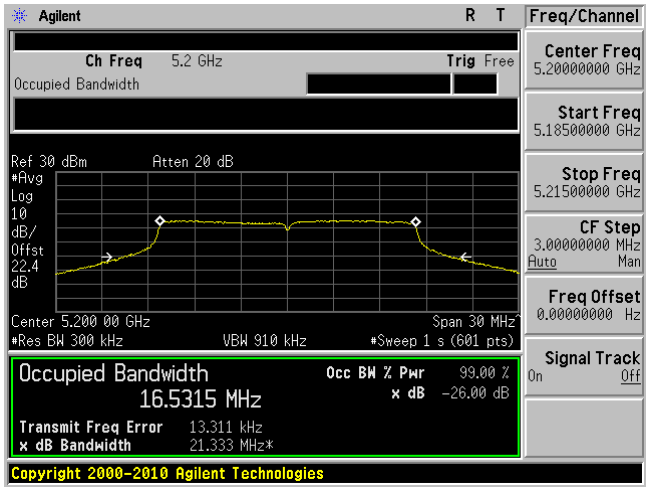
802.11a mode, Low Channel, Chain J6



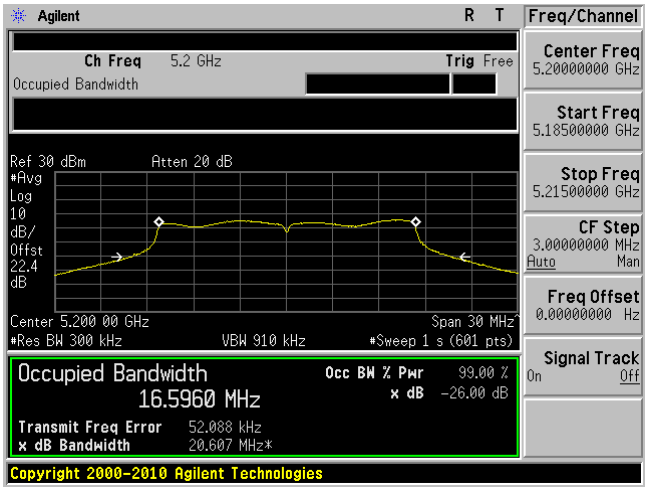
802.11a mode, Middle Channel, Chain J10



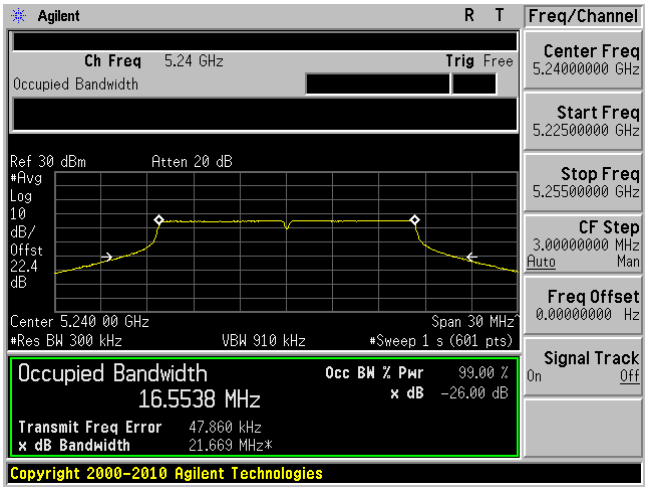
802.11a mode, Middle Channel, Chain J8



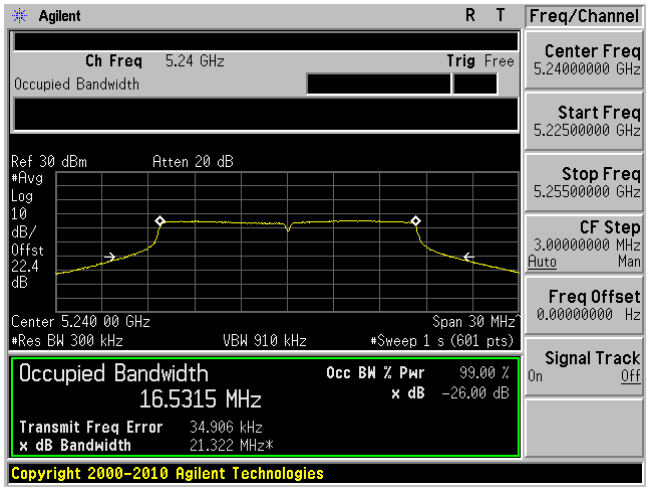
802.11a mode, Middle Channel, Chain J6



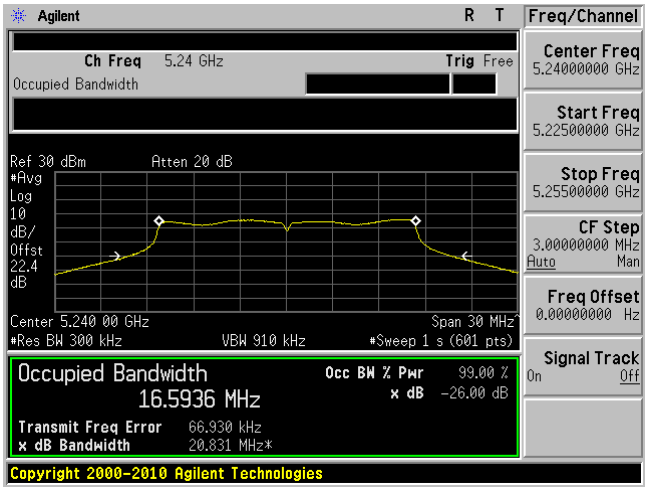
802.11a mode, High Channel, Chain J10



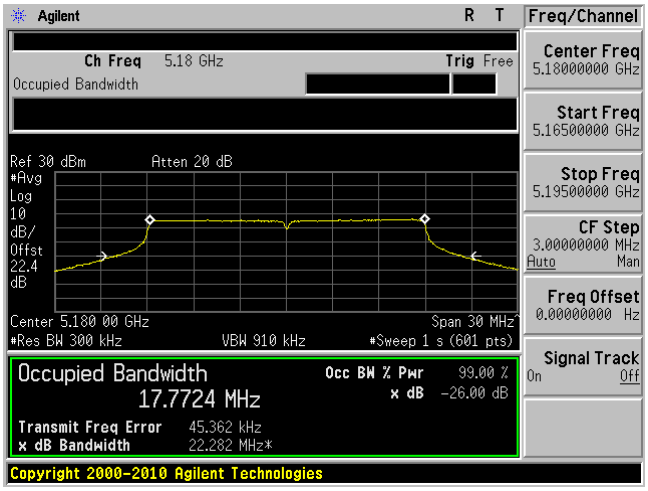
802.11a mode, High Channel, Chain J8



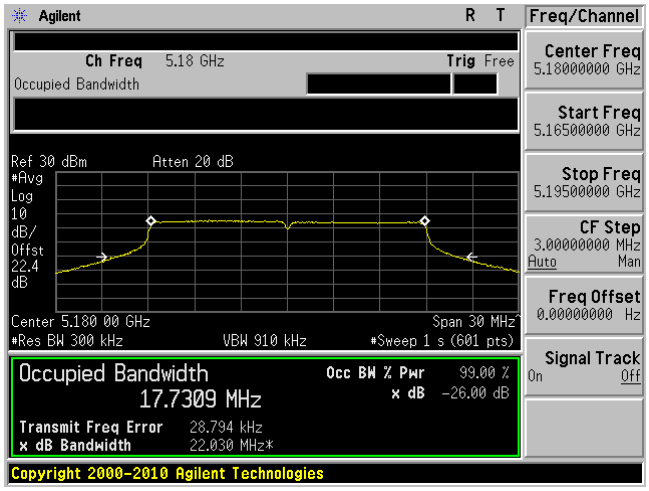
802.11a mode, High Channel, Chain J6



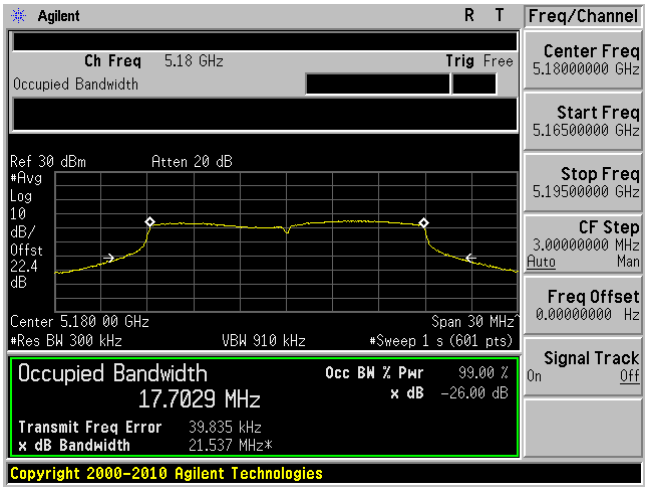
802.11n20 mode, Low Channel, Chain J10



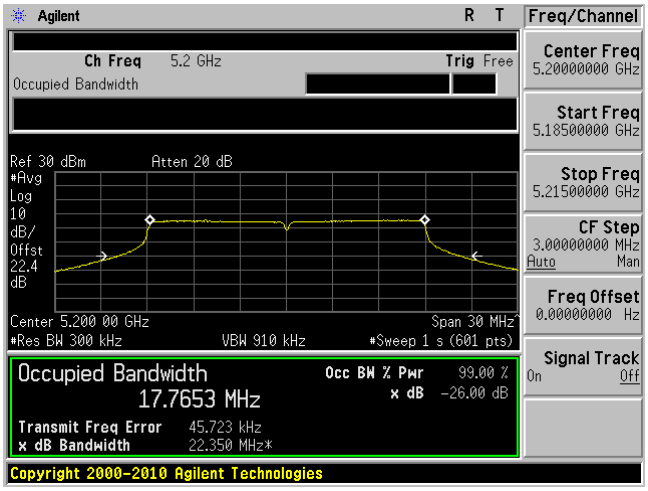
802.11n20 mode, Low Channel, Chain J8



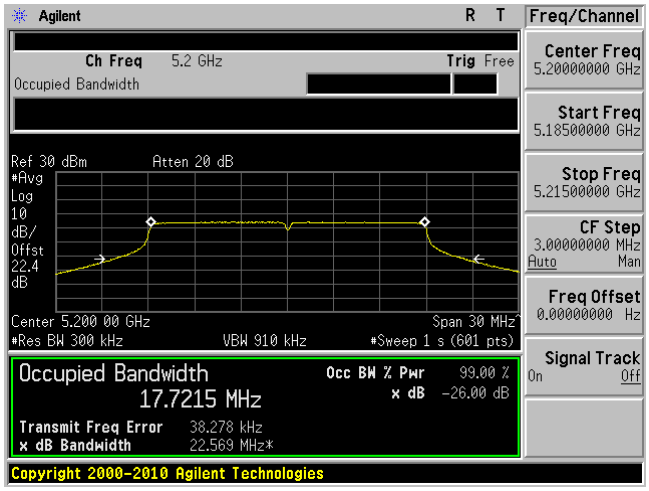
802.11n20 mode, Low Channel, Chain J6



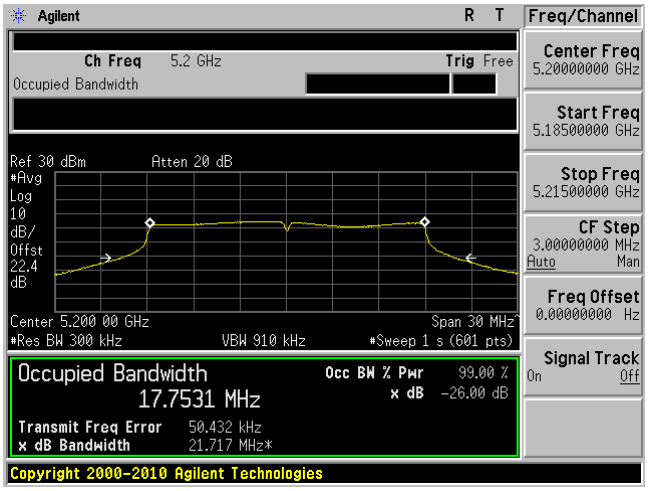
802.11n20 mode, Middle Channel, Chain J10



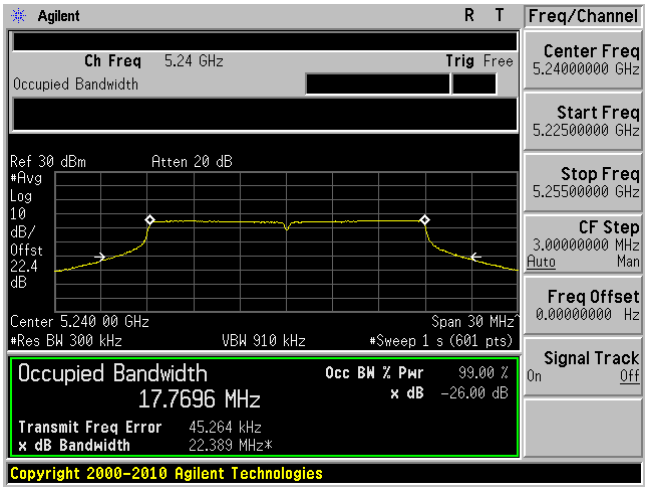
802.11n20 mode, Middle Channel, Chain J8



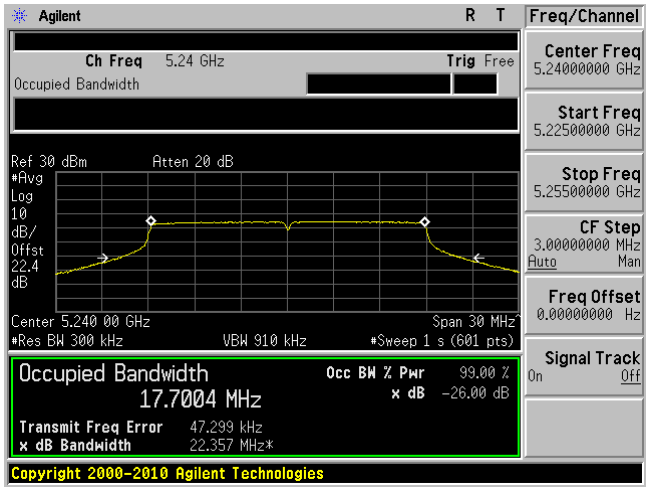
802.11n20 mode, Middle Channel, Chain J6



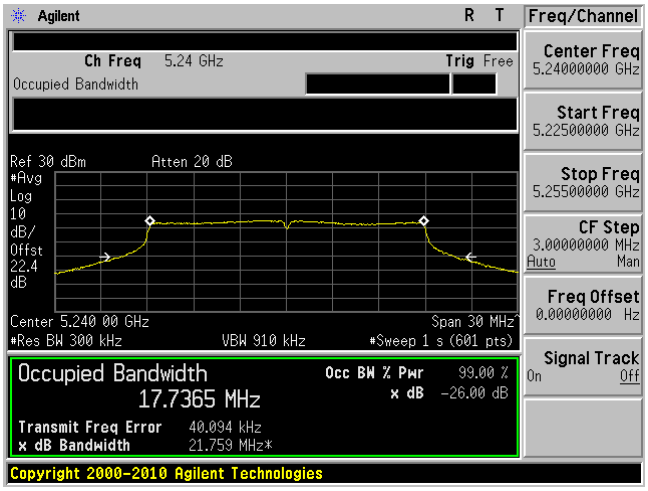
802.11n20 mode, High Channel, Chain J10



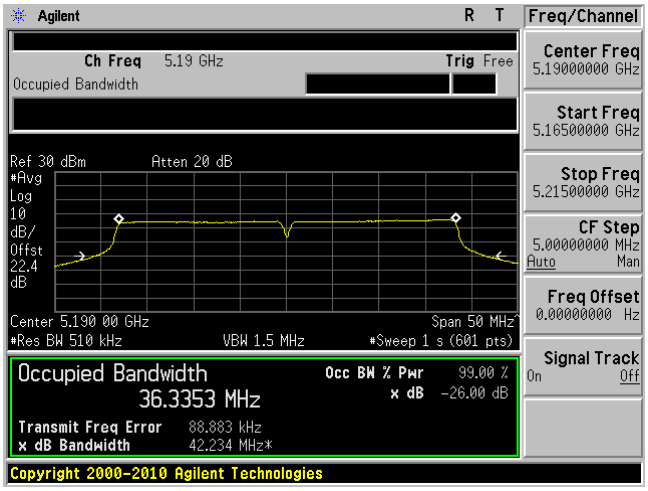
802.11n20 mode, High Channel, Chain J8



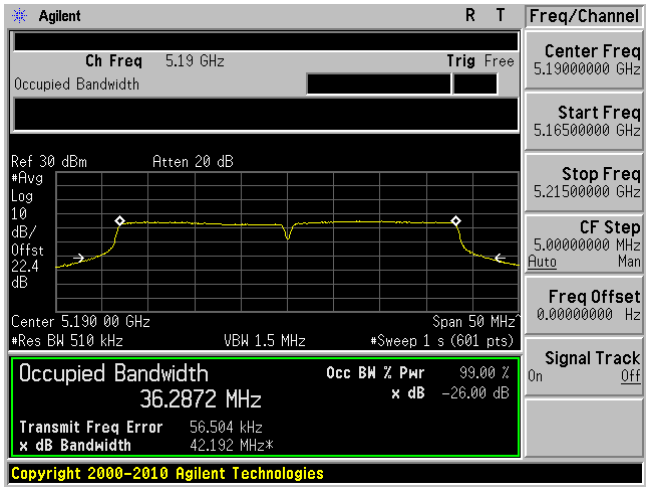
802.11n20 mode, High Channel, Chain J6



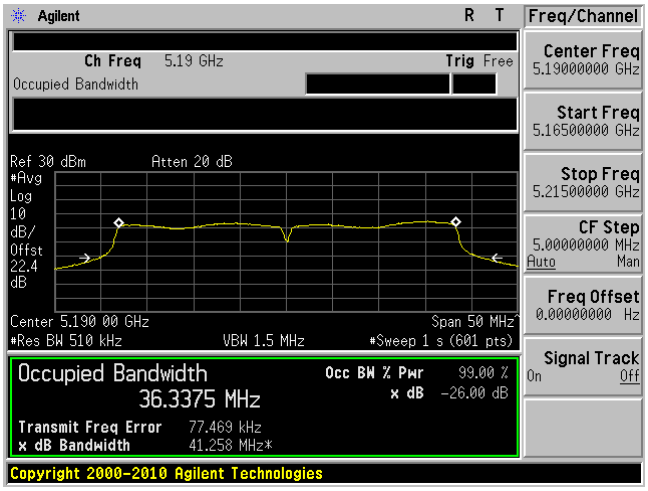
802.11n40 mode, Low Channel, Chain J10



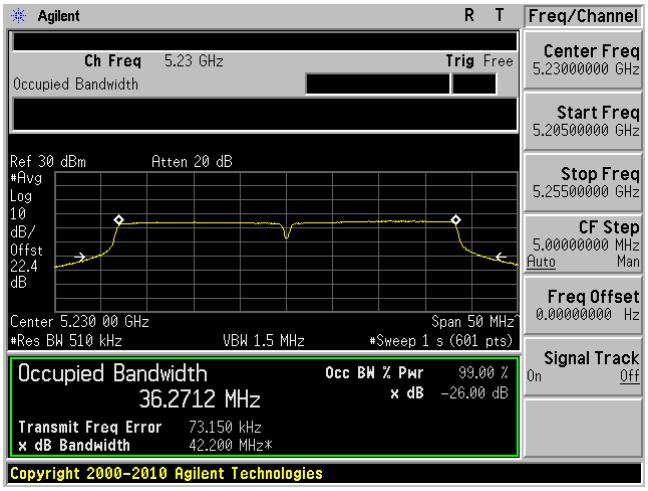
802.11n40 mode, Low Channel, Chain J8



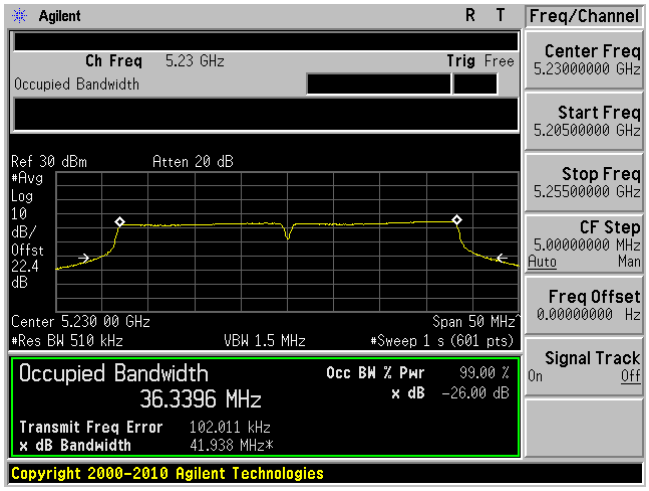
802.11n40 mode, Low Channel, Chain J6



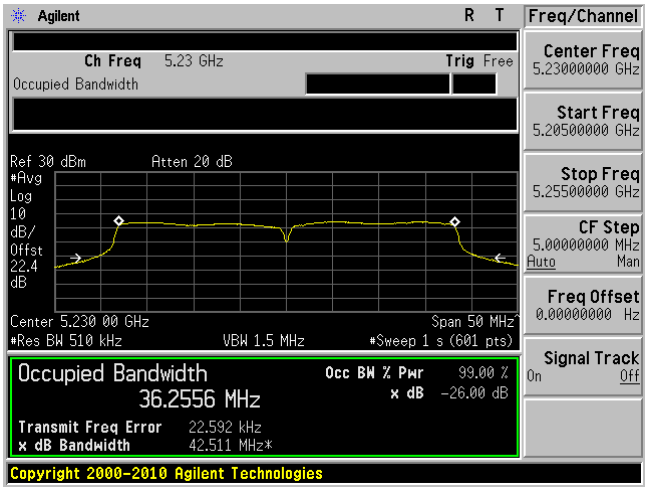
802.11n40 mode, High Channel, Chain J10



802.11n40 mode, High Channel, Chain J8



802.11n40 mode, High Channel, Chain J6



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)

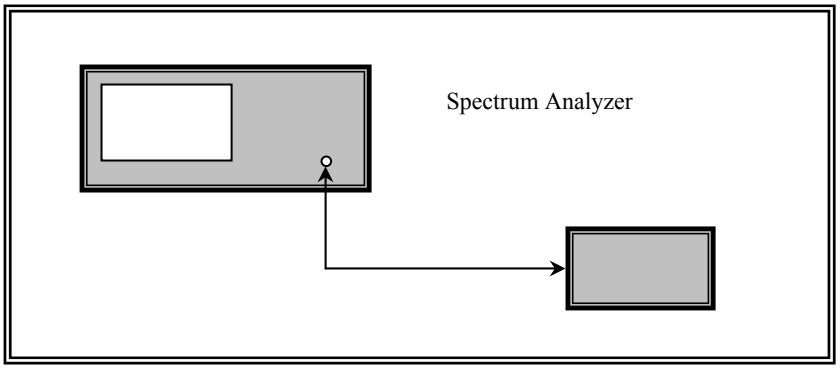
(1) For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting 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.

2) 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 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 §9.2: (1) For the band 5150-5250 MHz, the maximum equivalent isotropically radiated power (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

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
Agilent	Spectrum Analyzer	E4446A	US44300386	2011-08-11

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

9.4 Test Environmental Conditions

Temperature:	21~25 °C
Relative Humidity:	38~50 %
ATM Pressure:	101.2-102 kPa

The testing was performed by Quinn Jiang on 11-12-2011 to 11-16-2011 in RF site.

9.5 Test Results

Channel	Frequency (MHz)	TX Chain J10 Power (dBm)	TX Chain J8 Power (dBm)	TX Chain J6 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)	Power Setting
802.11a mode								
Low	5180	12.06	11.8	10.51	16.28	17	-0.72	9.5
Middle	5200	11.64	11.32	10.54	15.96	17	-1.04	9.5
High	5240	11.33	11.27	10.99	15.97	17	-1.03	10
802.11n20 mode								
Low	5180	12.08	11.83	10.53	16.30	17	-0.70	9.5
Middle	5200	11.53	11.23	10.64	15.92	17	-1.08	9.5
High	5240	11.38	11.23	11.48	16.14	17	-0.86	10
802.11n40 mode								
Low	5190	11.92	11.62	10.43	16.14	17	-0.86	9
High	5230	11.45	11.3	10.8	15.96	17	-1.04	9.5

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 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15–5.25 GHz band. For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 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.

10.2 Measurement Procedure

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

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2011-08-11

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

10.4 Test Environmental Conditions

Temperature:	21~25 °C
Relative Humidity:	38~50 %
ATM Pressure:	101.2-102 kPa

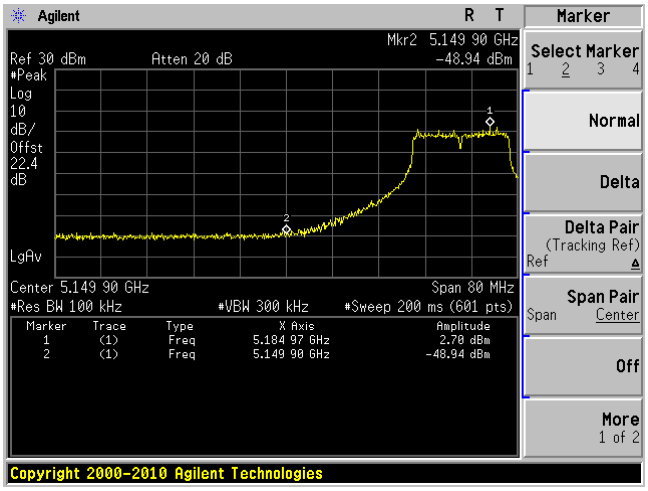
The testing was performed by Quinn Jiang on 11-12-2011 to 11-16-2011 in RF site.

10.5 Test Results

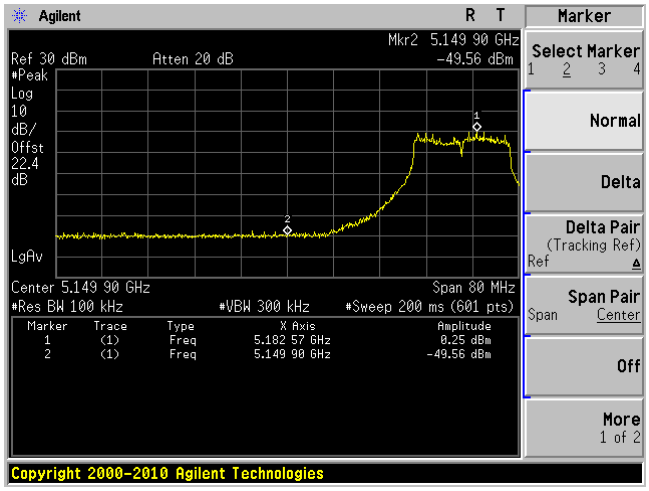
Please refer to following pages for plots of band edge.

5150-5250 MHz

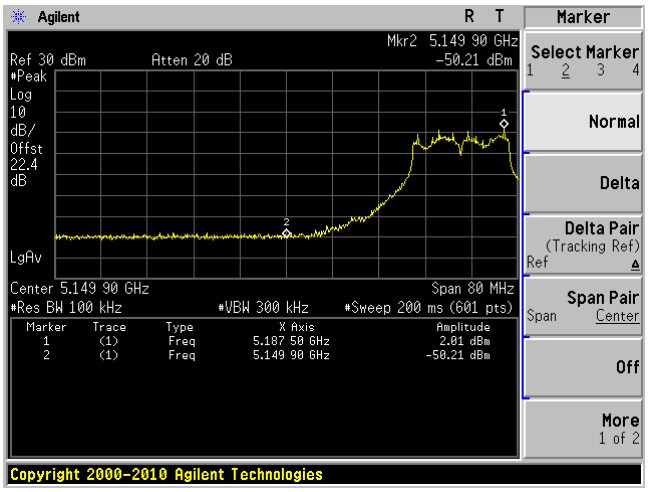
802.11a mode, Lowest Channel, Chain J10



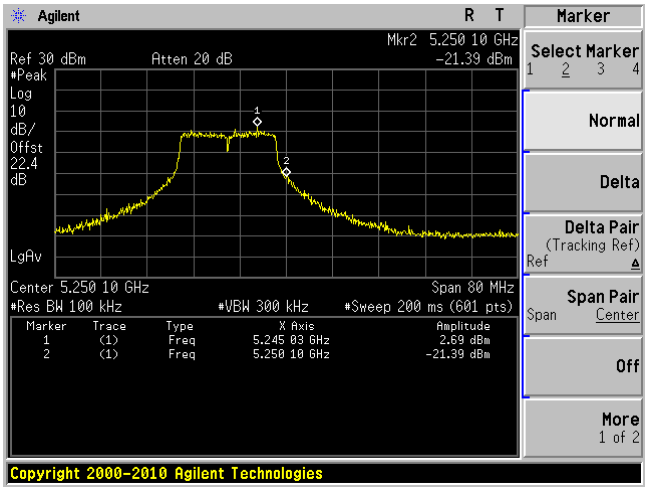
802.11a mode, Lowest Channel, Chain J8



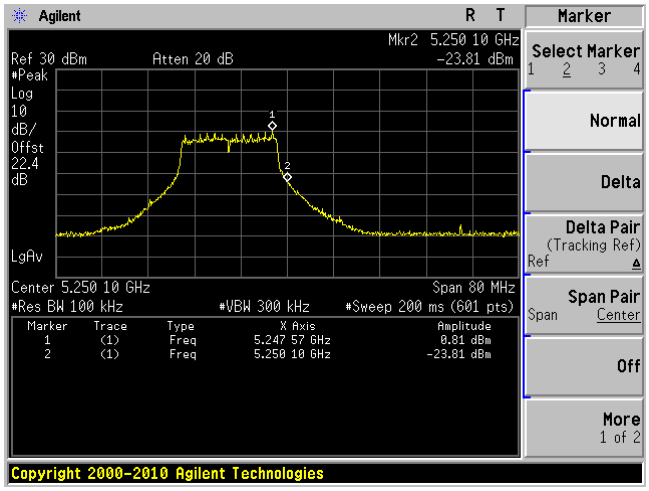
802.11a mode, Lowest Channel, Chain J6



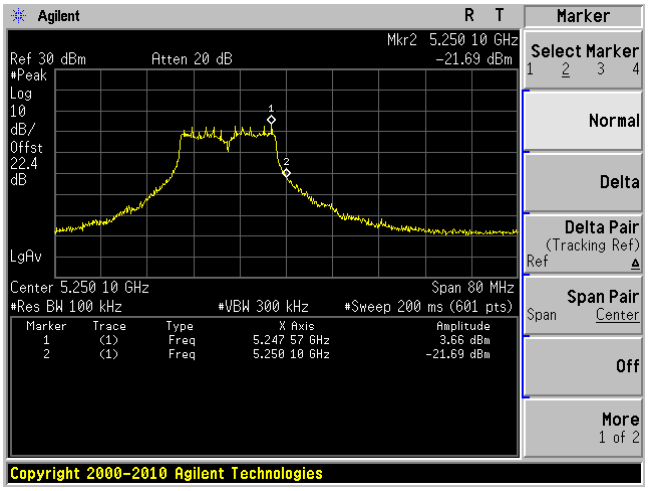
802.11a mode, Highest Channel, Chain J10



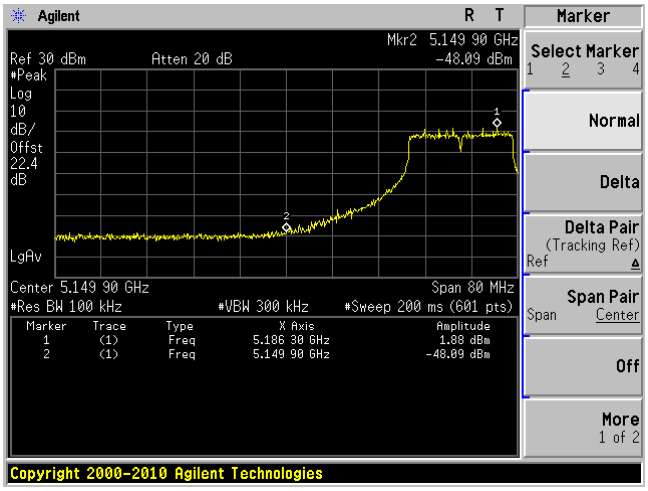
802.11a mode, Highest Channel, Chain J8



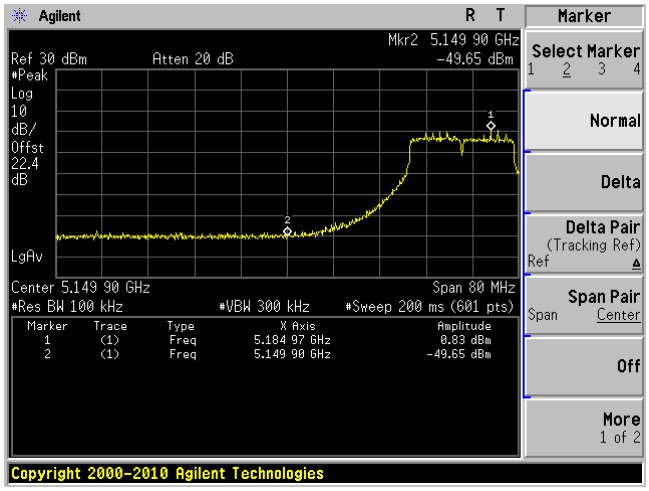
802.11a mode, Highest Channel, Chain J6



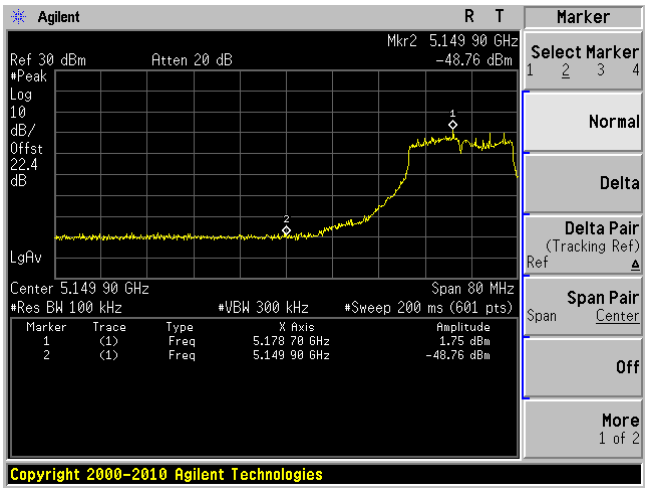
802.11n20 mode, Lowest Channel, Chain J10



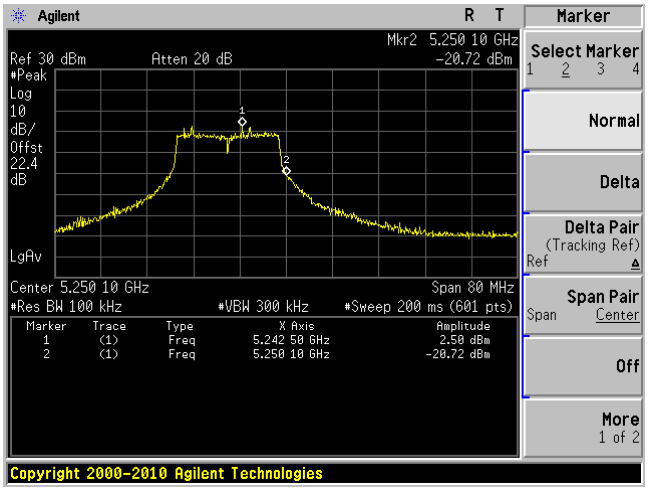
802.11n20 mode, Lowest Channel, Chain J8



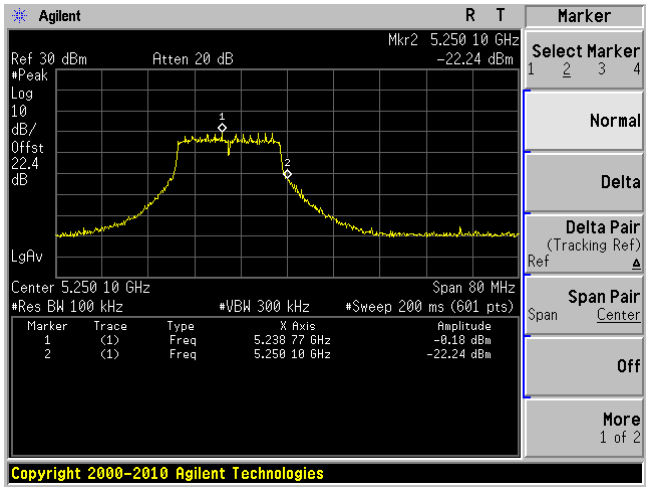
802.11n20 mode, Lowest Channel, Chain J6



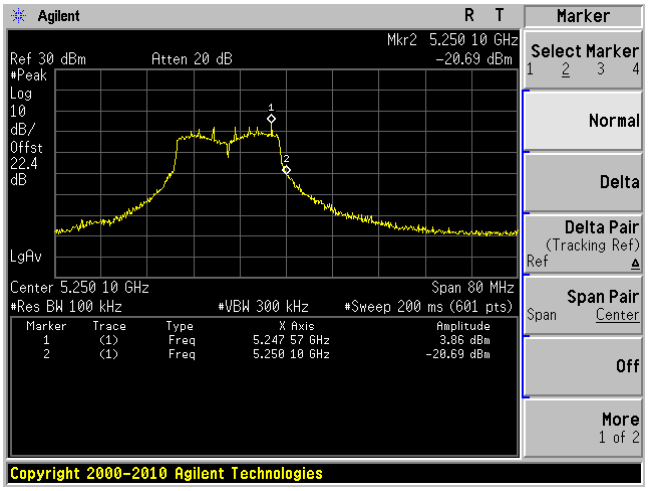
802.11n20 mode, Highest Channel, Chain J10



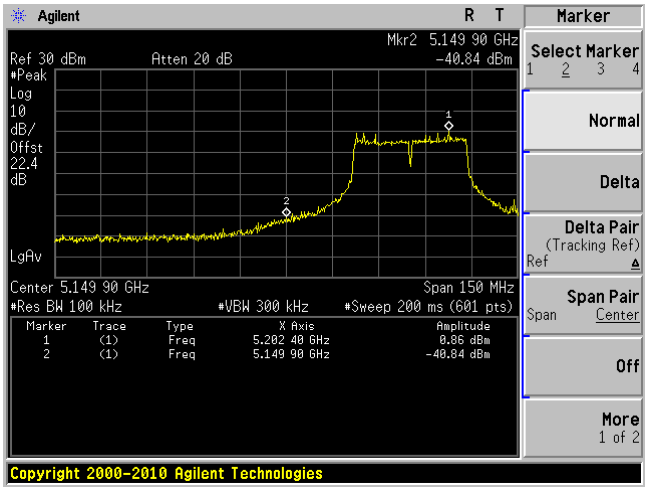
802.11n20 mode, Highest Channel, Chain J8



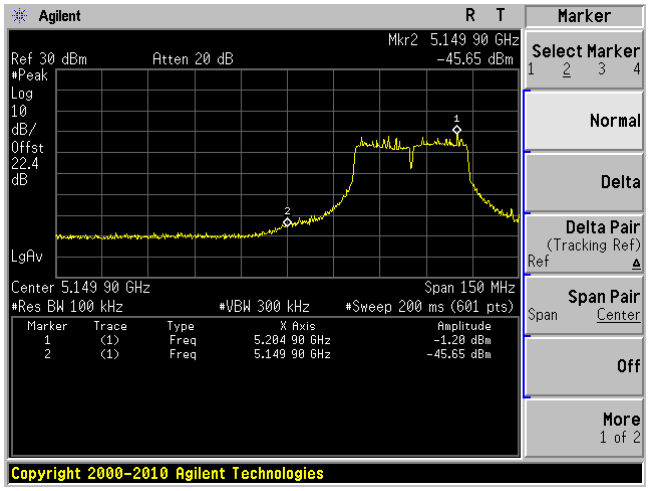
802.11n20 mode, Highest Channel, Chain J6



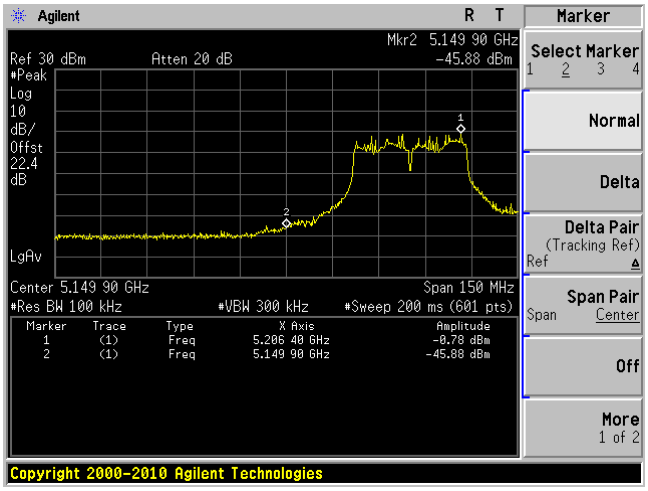
802.11n40 mode, Lowest Channel, Chain J10



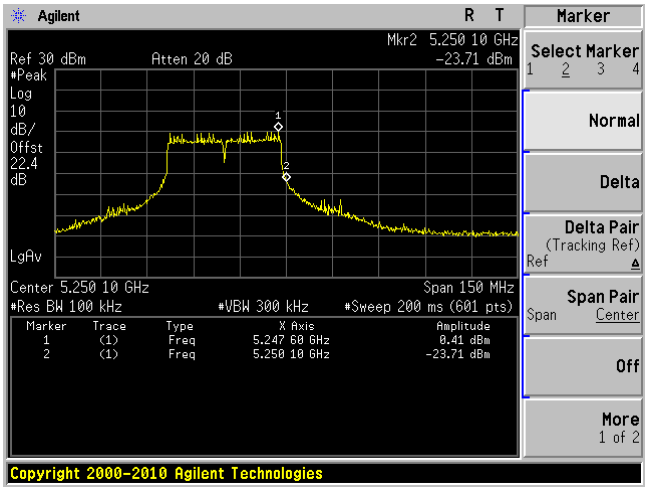
802.11n40 mode, Lowest Channel, Chain J8



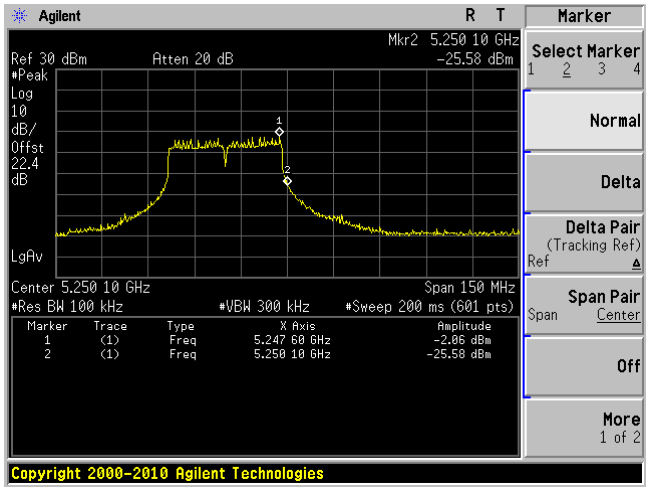
802.11n40 mode, Lowest Channel, Chain J6



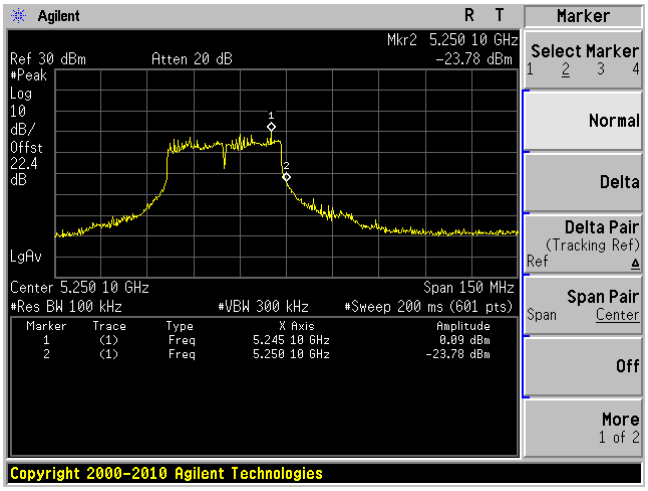
802.11n40 mode, Highest Channel, Chain J10



802.11n40 mode, Highest Channel, Chain J8



802.11n40 mode, Highest Channel, Chain J6



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)

(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.

2) 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 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 § 9.2: (1) For the band 5150-5250 MHz, the maximum equivalent isotropically radiated power (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

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

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2011-08-11

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

11.4 Test Environmental Conditions

Temperature:	21~25 °C
Relative Humidity:	38~50 %
ATM Pressure:	101.2-102 kPa

The testing was performed by Quinn Jiang on 11-12-2011 to 11-16-2011 in RF site.

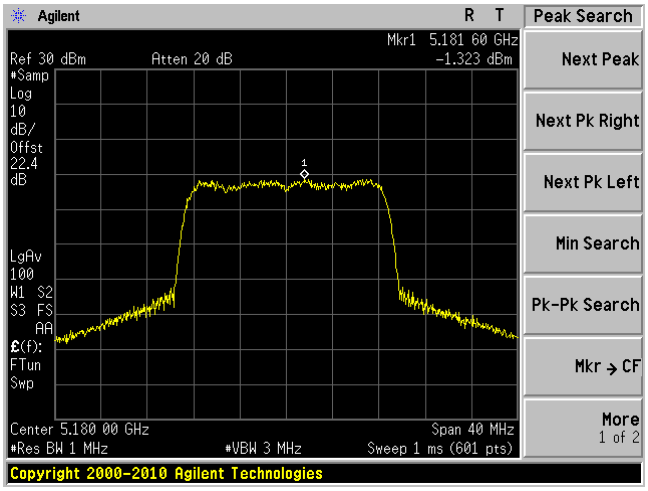
11.5 Test Results

Channel	Frequency (MHz)	TX Chain J10 PSD (dBm)	TX Chain J8 PSD (dBm)	TX Chain J6 PSD (dBm)	Total Power PSD (dBm)	Limit (dBm/MHz)	Margin (dB)
802.11a mode							
Low	5180	-1.323	-0.832	-1.187	3.66	4	-0.34
Middle	5200	-1.545	-0.978	-1.19	3.54	4	-0.46
High	5240	-1.652	-1.185	-1.269	3.41	4	-0.59
802.11n20 mode							
Low	5180	-1.072	-0.888	-1.466	3.64	4	-0.36
Middle	5200	-1.277	-1.28	-1.481	3.43	4	-0.57
High	5240	-1.793	-1.876	-1.668	2.99	4	-1.01
802.11n40 mode							
Low	5190	-3.577	-3.565	-5.387	0.67	4	-3.33
High	5230	-4.51	-4.308	-4.707	0.27	4	-3.73

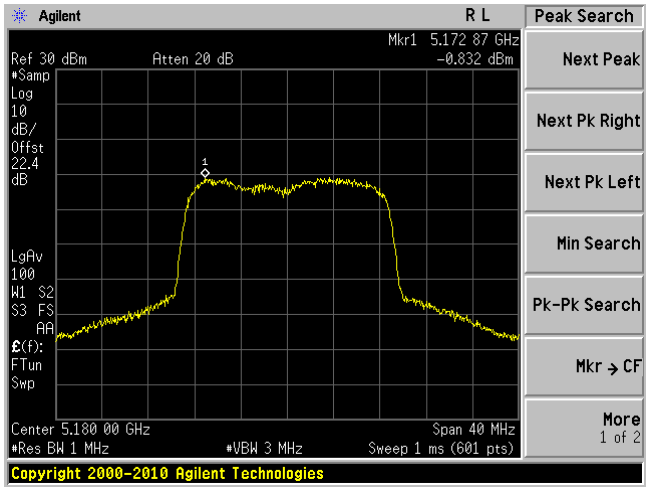
Please refer to the following plots.

5150 – 5250 MHz

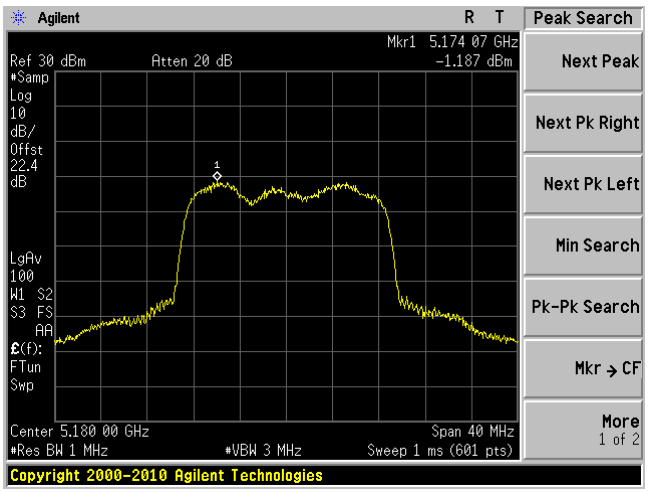
802.11a mode, Low Channel, Chain J10



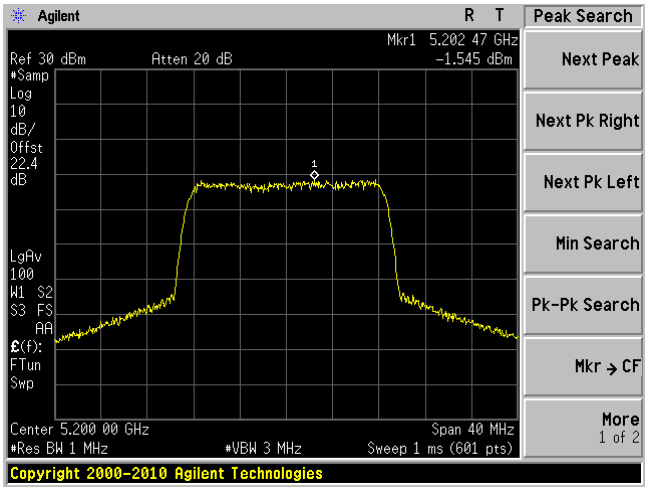
802.11a mode, Low Channel, Chain J8



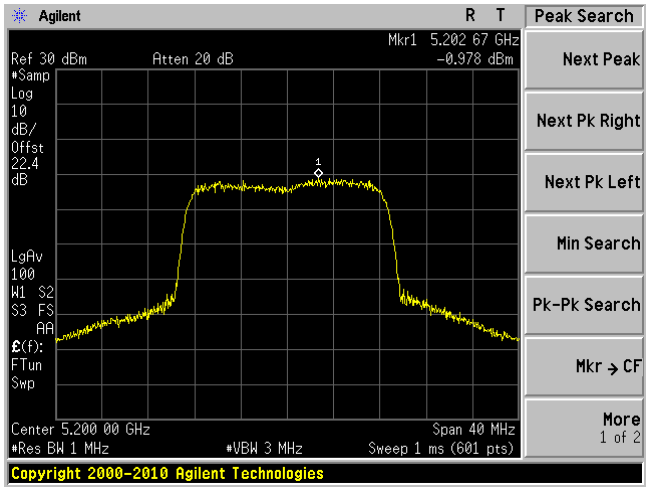
802.11a mode, Low Channel, Chain J6



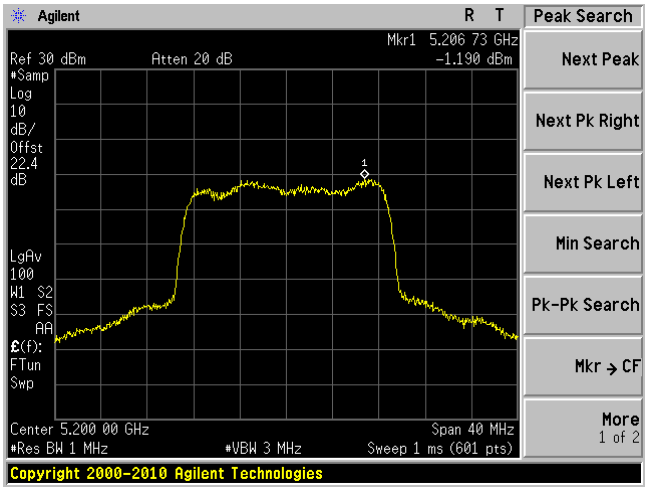
802.11a mode, Middle Channel, Chain J10



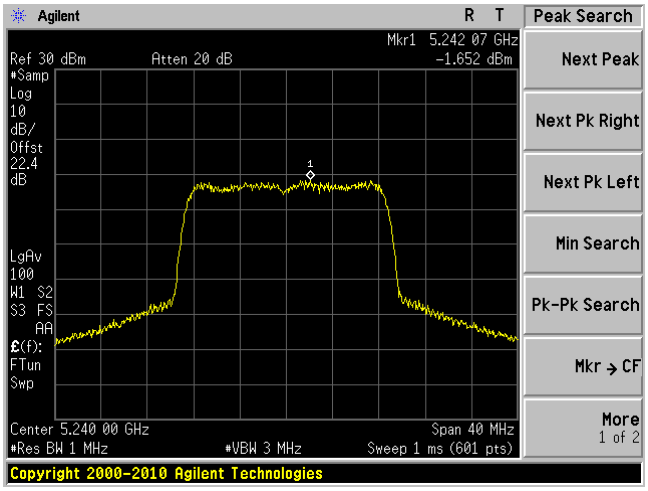
802.11a mode, Middle Channel, Chain J8



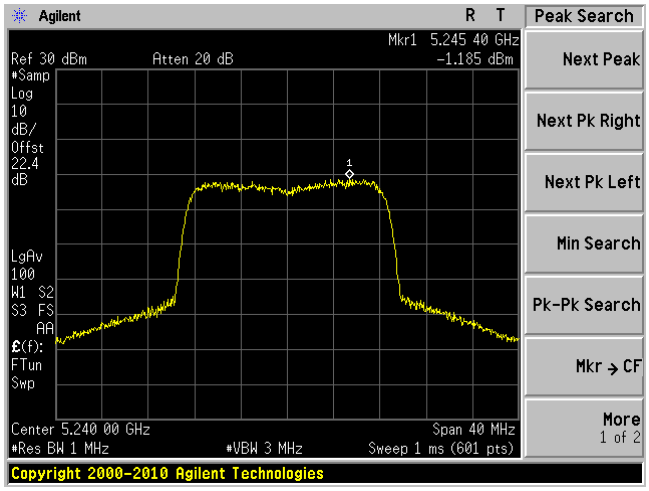
802.11a mode, Middle Channel, Chain J6



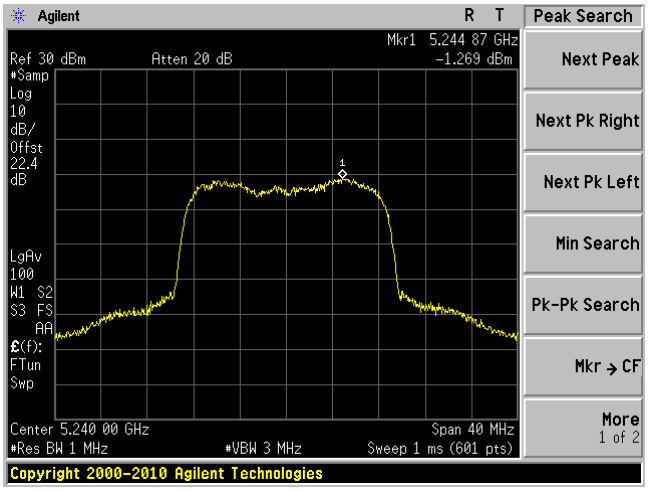
802.11a mode, High Channel, Chain J10



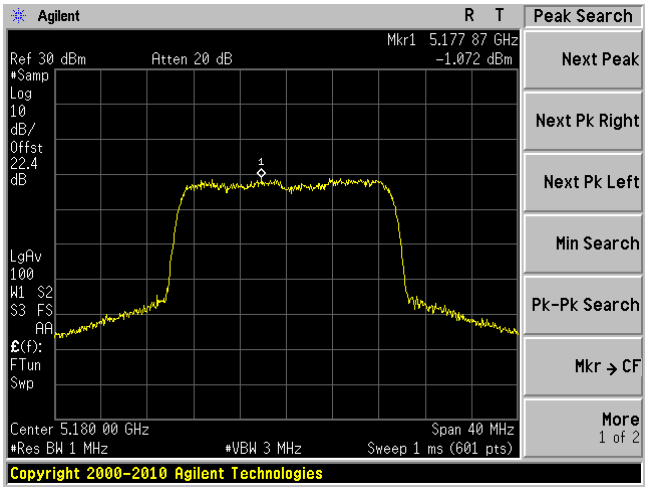
802.11a mode, High Channel, Chain J8



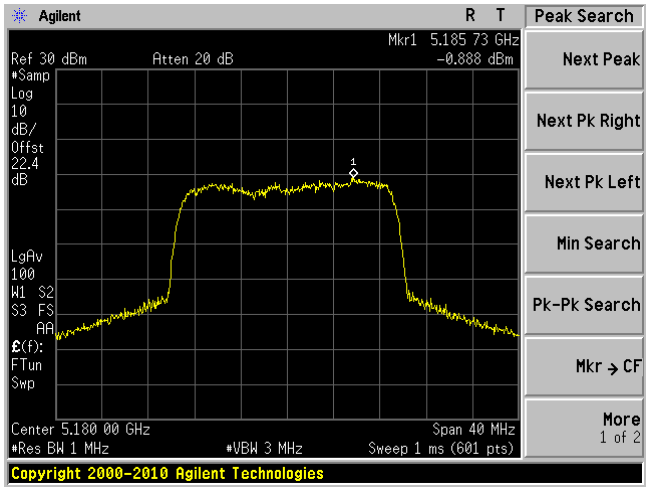
802.11a mode, High Channel, Chain J6



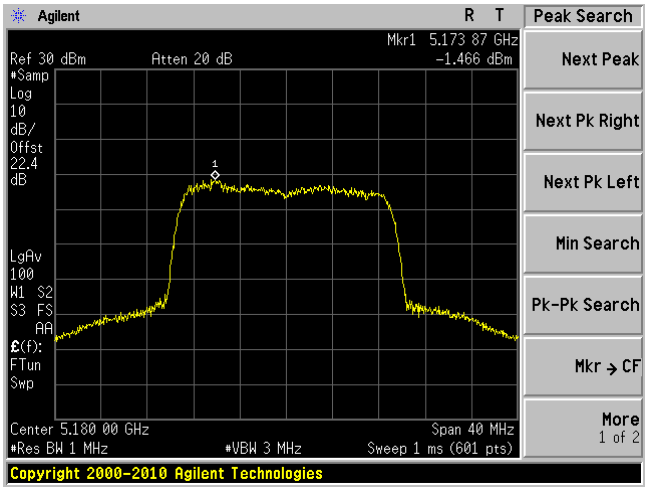
802.11n20 mode, Low Channel, Chain J10



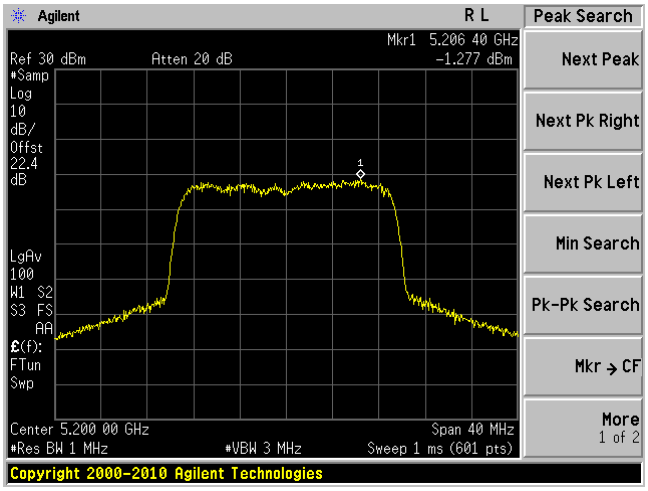
802.11n20 mode, Low Channel, Chain J8



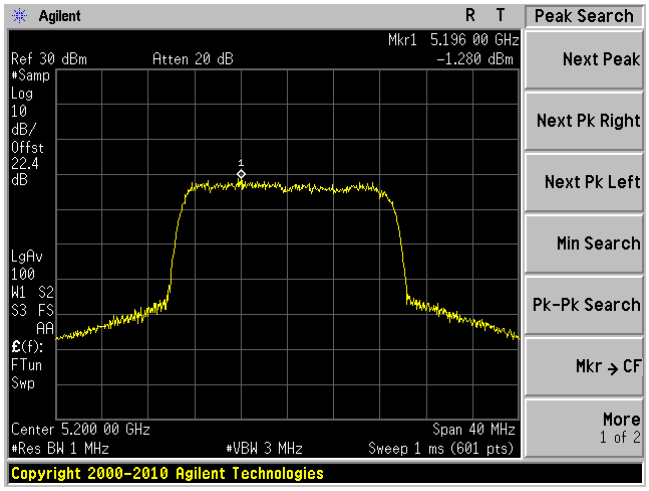
802.11n20 mode, Low Channel, Chain J6



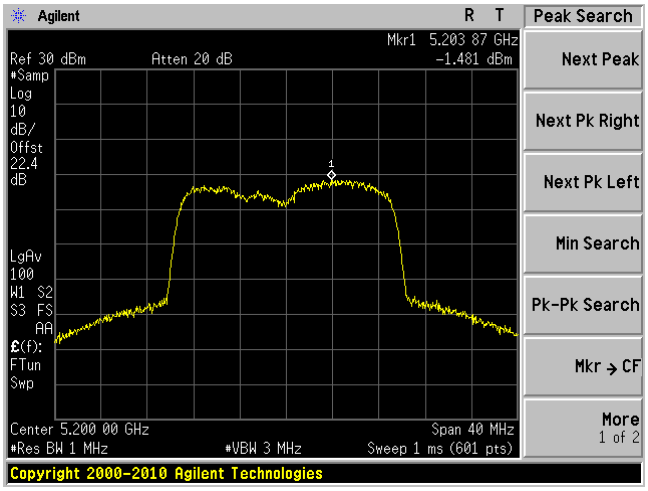
802.11n20 mode, Middle Channel, Chain J10



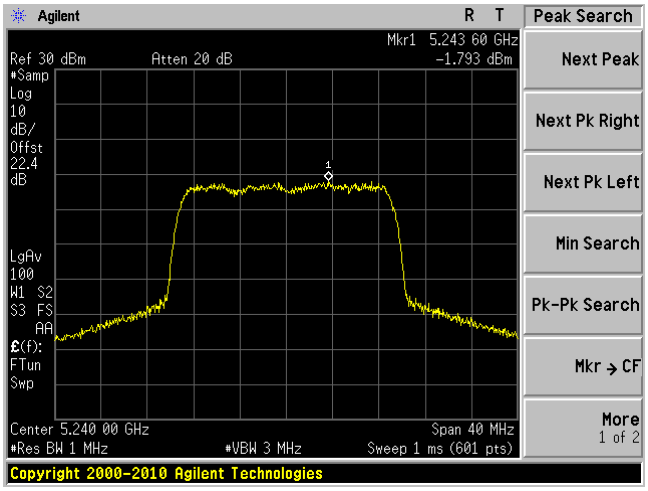
802.11n20 mode, Middle Channel, Chain J8



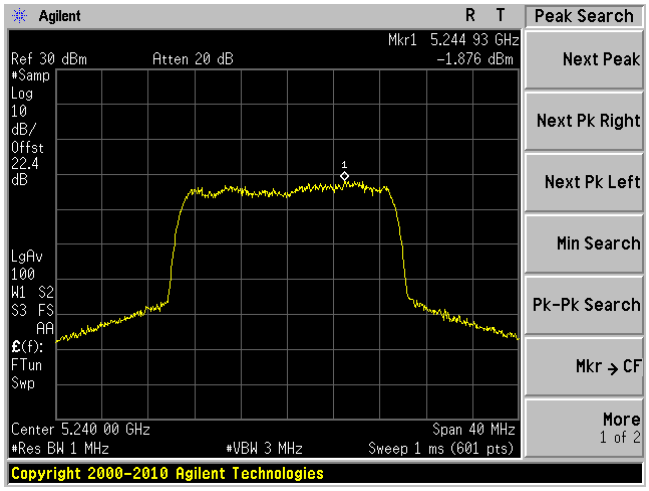
802.11n20 mode, Middle Channel, Chain J6



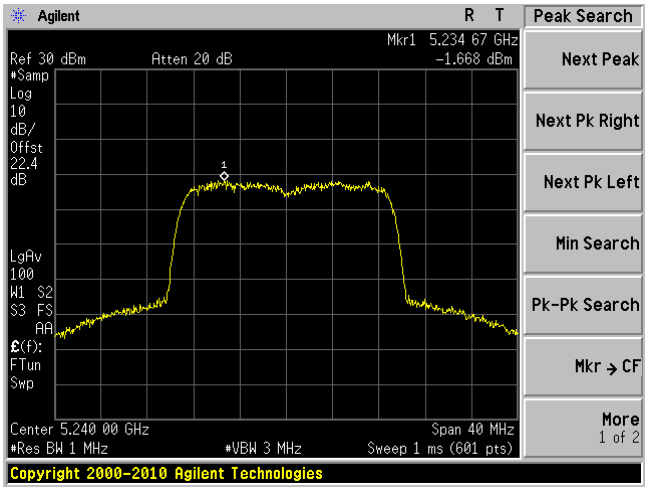
802.11n20 mode, High Channel, Chain J10



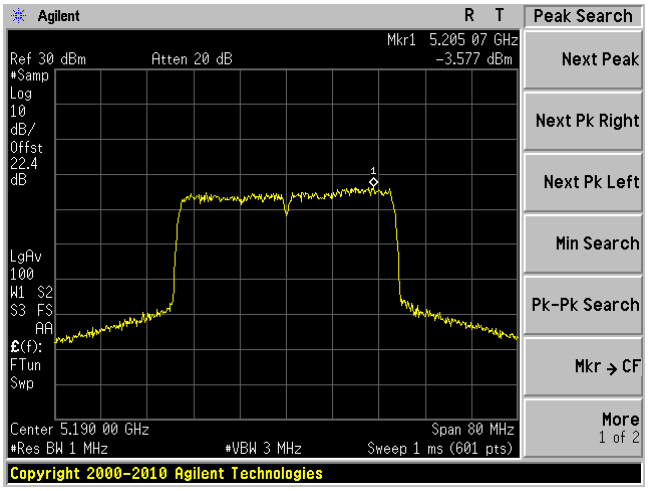
802.11n20 mode, High Channel, Chain J8



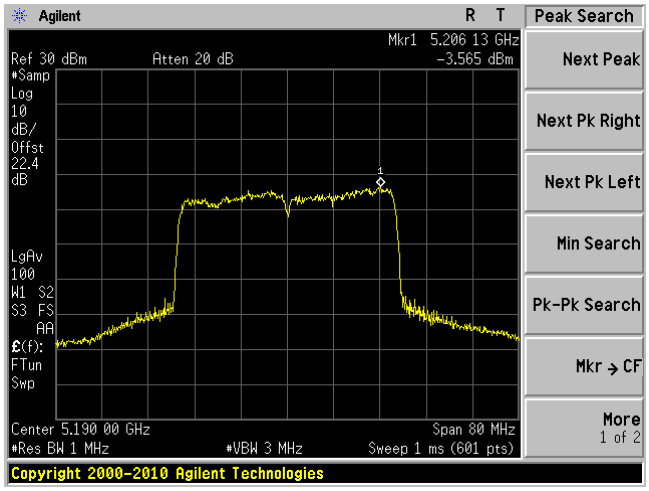
802.11n20 mode, High Channel, Chain J6



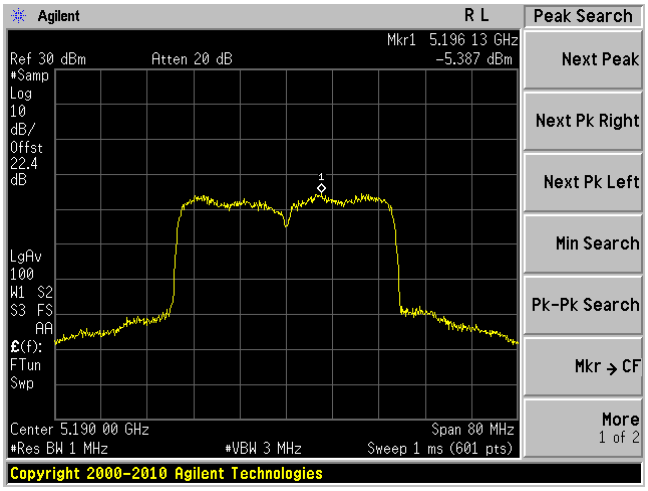
802.11n40 mode, Low Channel, Chain J10



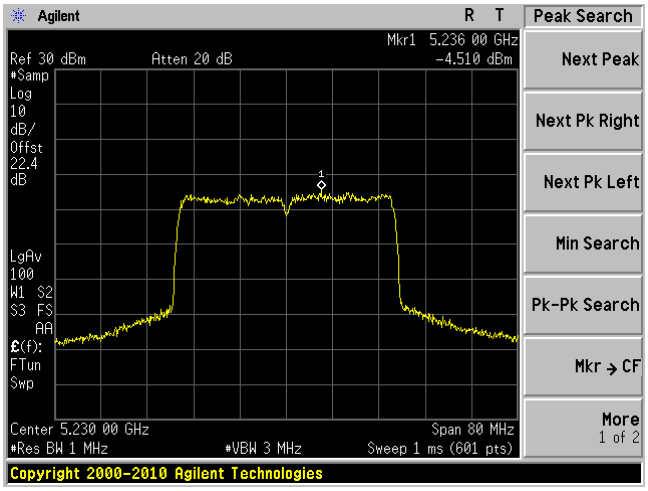
802.11n40 mode, Low Channel, Chain J8



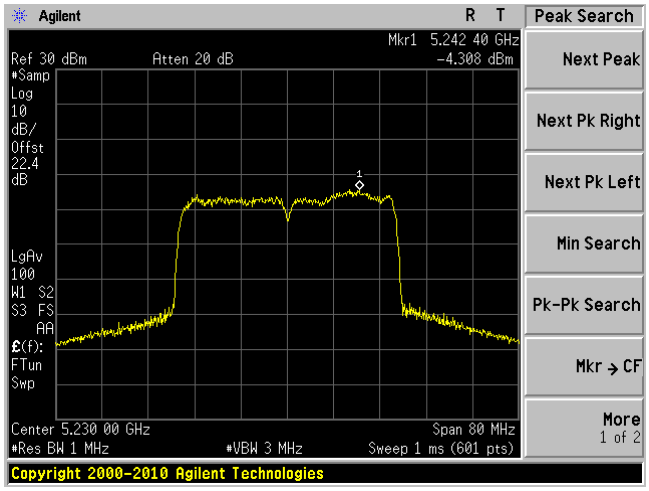
802.11n40 mode, Low Channel, Chain J6



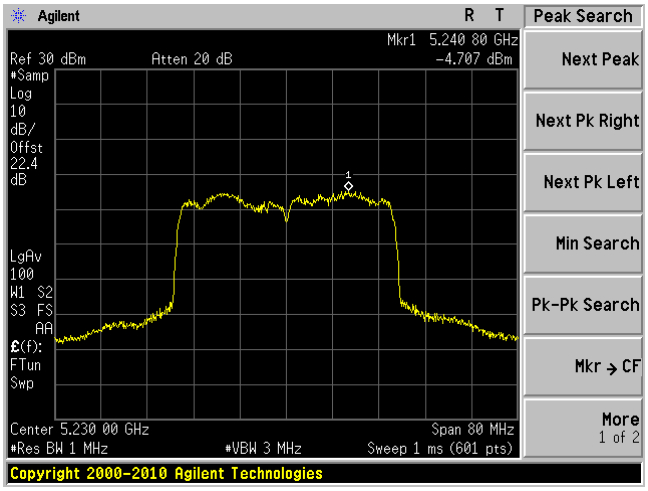
802.11n40 mode, High Channel, Chain J10



802.11n40 mode, High Channel, Chain J8



802.11n40 mode, High Channel, Chain J6



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 ≤ 13 dB for all frequencies across the emission bandwidth. Submit a plot.

1st Trace:
• Set RBW = 1 MHz, VBW ≥ 3 MHz with peak detector and maxhold settings.

2nd Trace:
• create the 2nd trace using the settings described in the setion "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
Agilent	Spectrum Analyzer	E4446A	US44300386	2011-08-11

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

12.4 Test Environmental Conditions

Temperature:	21~25 °C
Relative Humidity:	38~50 %
ATM Pressure:	101.2-102 kPa

The testing was performed by Quinn Jiang on 11-12-2011 to 11-16-2011 in RF site.

12.5 Test Results

Channel	Frequency (MHz)	TX Chain J10 PER (dB)	TX Chain J8 PER (dB)	TX Chain J6 PER (dB)	Limit (dB)
802.11a mode					
Low	5180	10.462	10.462	9.810	13
Middle	5200	10.313	10.509	9.638	
High	5240	10.500	11.000	9.600	
802.11n20 mode					
Low	5180	10.267	10.318	9.218	13
Middle	5200	9.358	9.296	10.493	
High	5240	10.689	10.473	9.541	
802.11n40 mode					
Low	5190	9.951	9.712	9.888	13
High	5230	10.271	10.212	9.971	

13 IC RSS-210 §2.3 & RSS-Gen §6 - Receiver Spurious Radiated Emissions

13.1 Applicable Standard

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

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

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

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

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

According to RSS-Gen §6.1, Table 2, the radiated limit of receiver spurious emissions

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 C63.4-2003.

13.3 Test Procedure

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

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

13.4 Corrected Amplitude & Margin Calculation

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

CA = Ai + AF + CL + Atten – Ga

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

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

Margin = Corrected Amplitude - Limit

13.5 Test Equipment Lists and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2011-06-29
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2011-03-21
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
EMCO	Horn antenna	3115	9511-4627	2011-10-03
Agilent	Spectrum Analyzer	E4440A	MY44303352	2011-05-10
HP	Pre Amplifier	8449B	3147A00400	2011-02-03

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

13.6 Test Environmental Conditions

Temperature:	18~23 °C
Relative Humidity:	36~45 %
ATM Pressure:	101-102 kPa

The testing was performed by Quinn Jiang on 11-28-2011 to 11-29-2011 in 5 meter chamber 3.

13.7 Summary of Test Results

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

Unwanted Emissions and Receiving Spurious Emission, (30-1000 MHz):

30-1000 MHz:

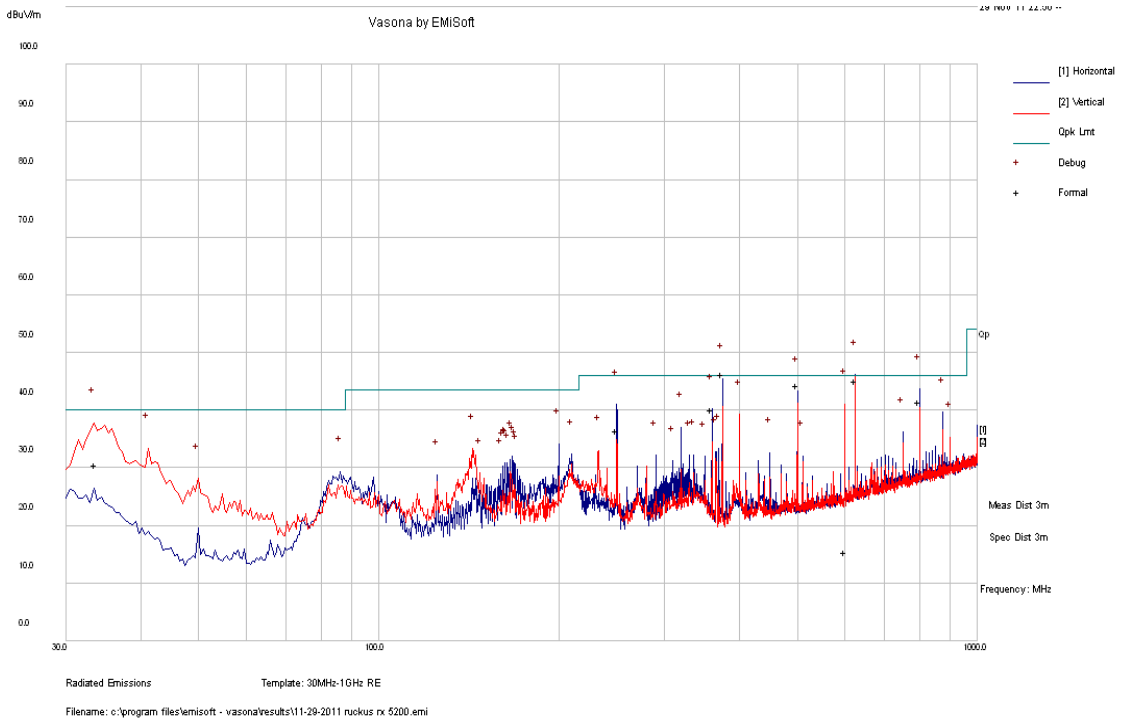
Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-5.9	359.988	Horizontal	30 to 1000

Above 1GHz:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-16.39	17916.38	Horizontal	Above 1 GHz

13.8 Radiated Emissions Test Result Data

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



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
33.62975	30.6	137	V	196	40	-9.4
799.9745	41.51	102	H	197	46	-4.49
500.0115	44.29	161	H	215	46	-1.71
600.5173	15.5	102	V	87	46	-30.5
249.9543	36.41	111	H	132	46	-9.59
359.988	40.1	100	H	229	46	-5.9

Note: 799.9845 MHz and 500 MHz are Digital Emissions from the supporting board.

(2) Radiated Emission at 3 meters, above 1 GHz

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
17916.38	37.61	178	H	2	54	-16.39
14760.38	35.71	131	V	179	54	-18.29
2142.94	27.54	100	V	180	54	-26.46
2153.528	23.53	115	V	122	54	-30.47
2209.114	22.51	201	V	207	54	-31.49
2147.047	22.47	286	V	308	54	-31.53

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

14.1 Applicable Standard

For FCC §15.407(b) and IC RSS-210 §A9.2, For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15–5.25 GHz band. For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

14.2 Measurement Procedure

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

14.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2011-08-11

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

14.4 Test Environmental Conditions

Temperature:	21~25 °C
Relative Humidity:	38~50 %
ATM Pressure:	101.2-102 kPa

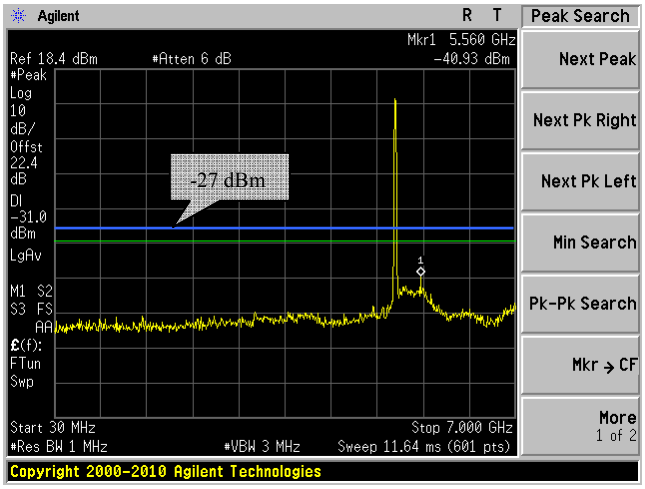
The testing was performed by Quinn Jiang on 11-12-2011 to 11-16-2011 in RF site.

14.5 Test Results

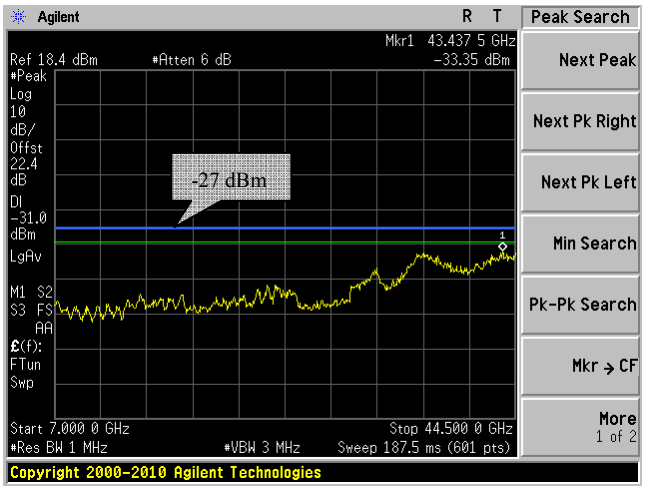
Please refer to following plots of spurious emissions.

5150 – 5250 MHz

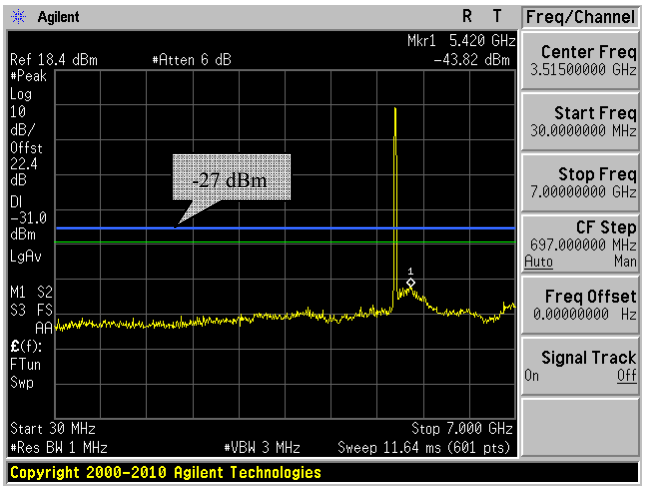
802.11a mode, Low Channel, Chain J10
30MHz – 7GHz



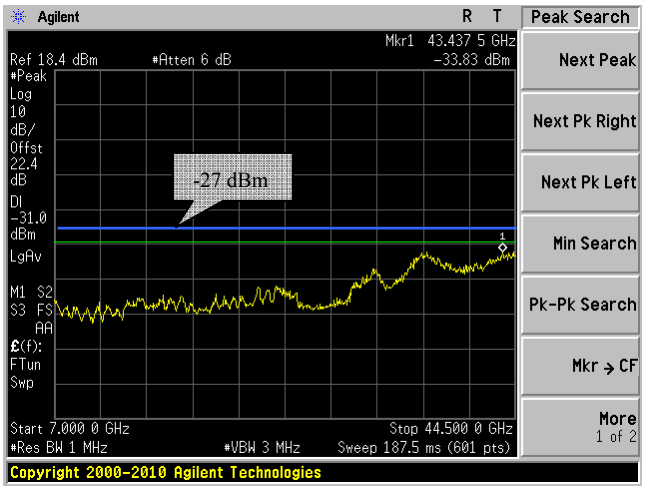
802.11a mode, Low Channel, Chain J10
7G – 44.5 GHz



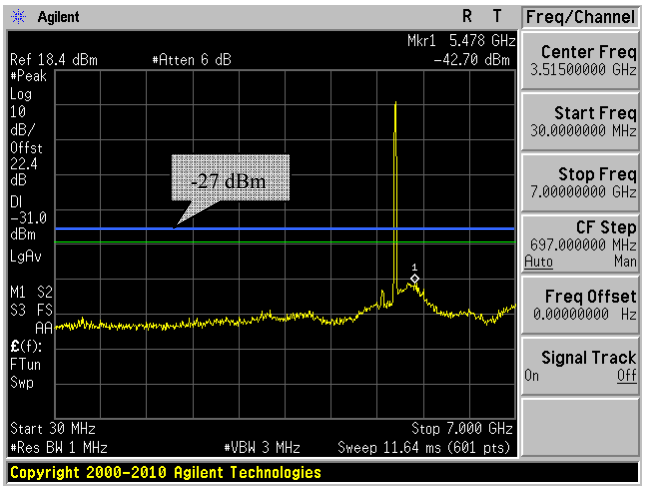
802.11a mode, Low Channel, Chain J8
30MHz – 7GHz



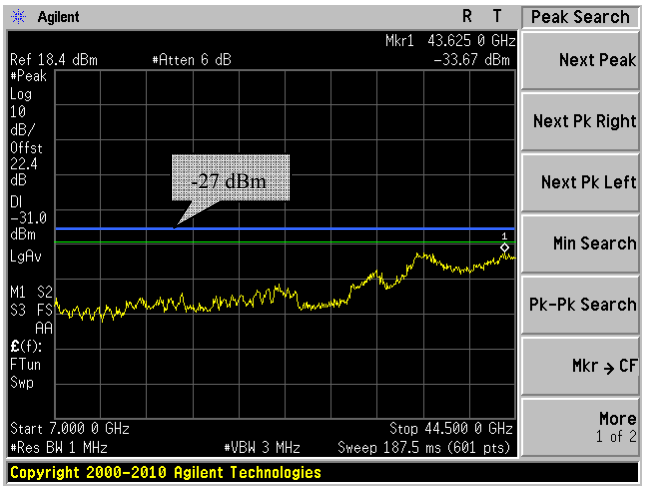
802.11a mode, Low Channel, Chain J8
7G – 44.5 GHz



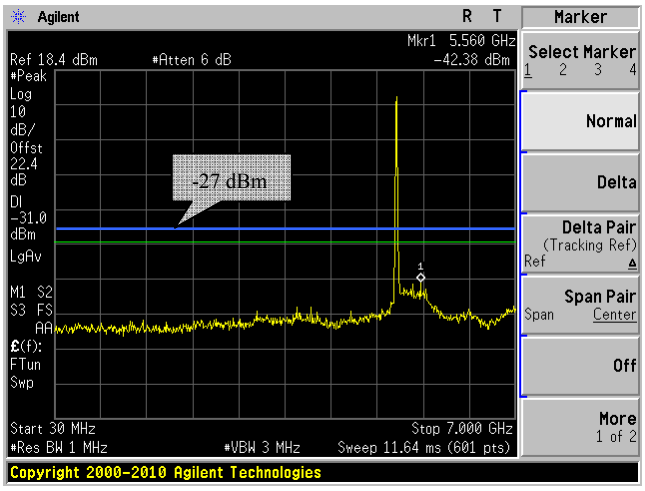
802.11a mode, Low Channel, Chain J6
30MHz – 7GHz



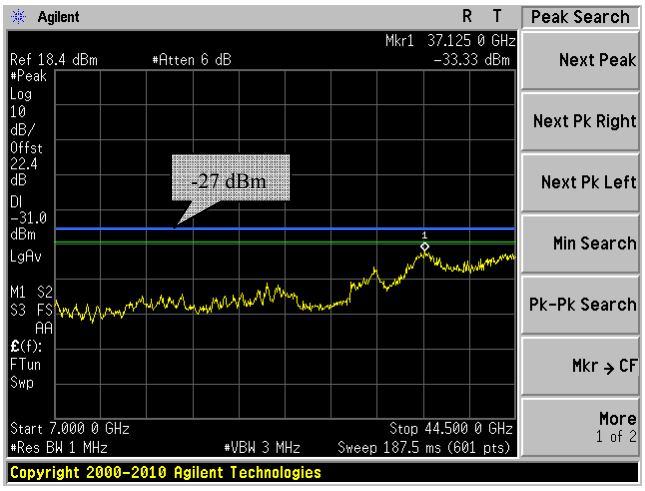
802.11a mode, Low Channel, Chain J6
7G – 44.5 GHz



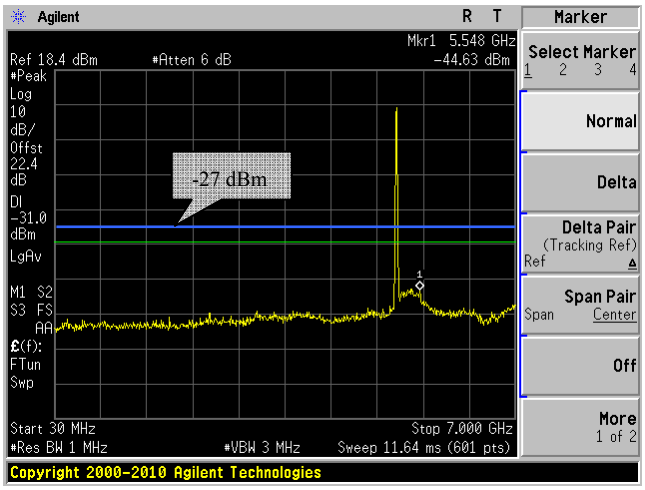
802.11a mode, Middle Channel, Chain J10
30MHz – 7GHz



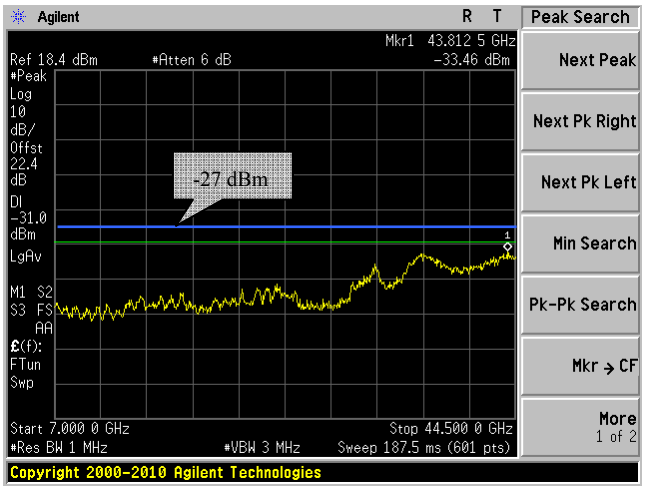
802.11a mode, Middle Channel, Chain J10
7G – 44.5 GHz



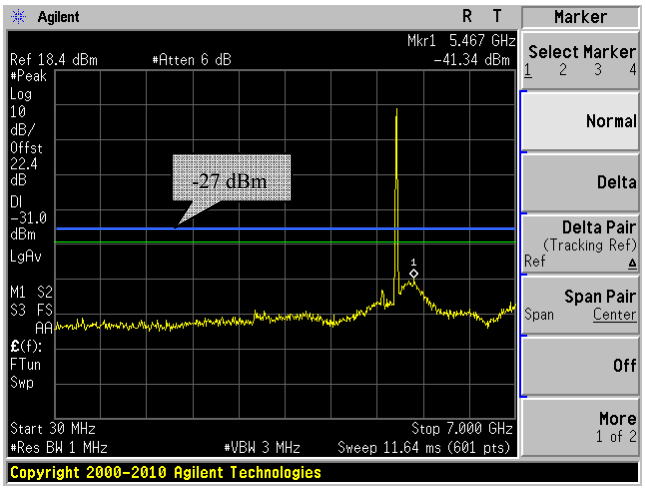
802.11a mode, Middle Channel, Chain J8
30MHz – 7GHz



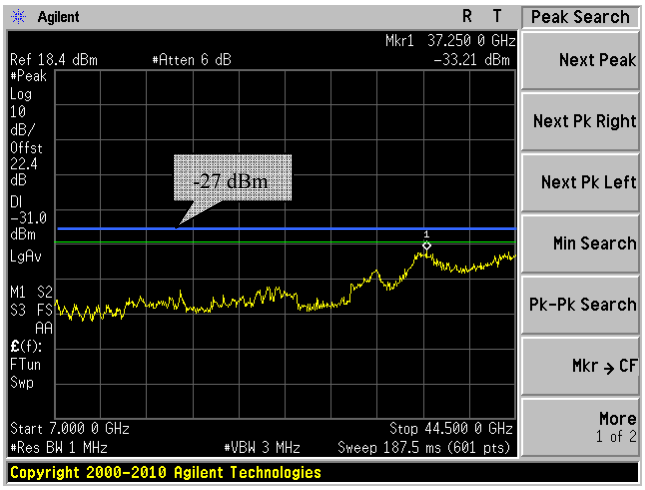
802.11a mode, Middle Channel, Chain J8
7G – 44.5 GHz



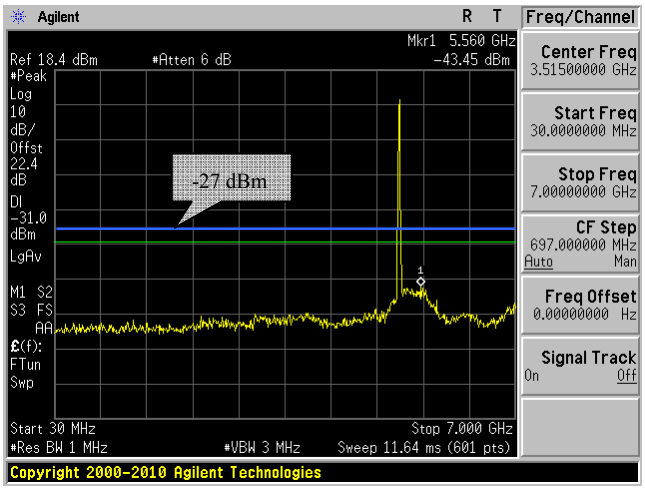
802.11a mode, Middle Channel, Chain J6
30MHz – 7GHz



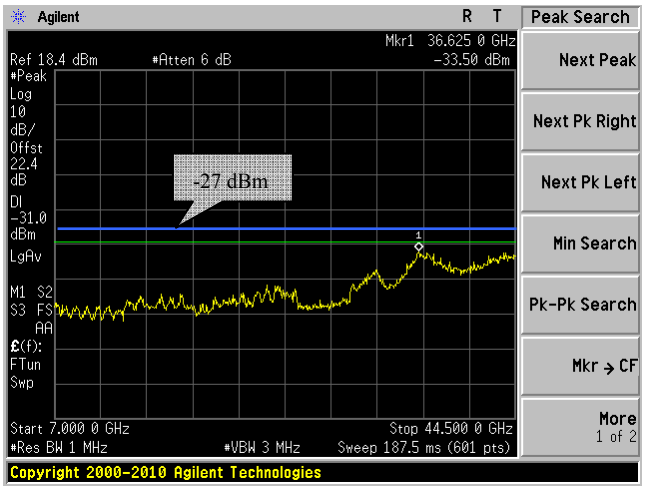
802.11a mode, Middle Channel, Chain J6
7G – 44.5 GHz



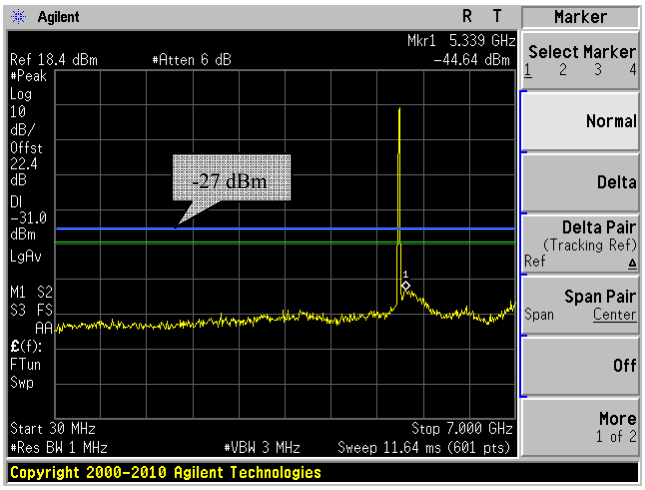
802.11a mode, High Channel, Chain J10
30MHz – 7GHz



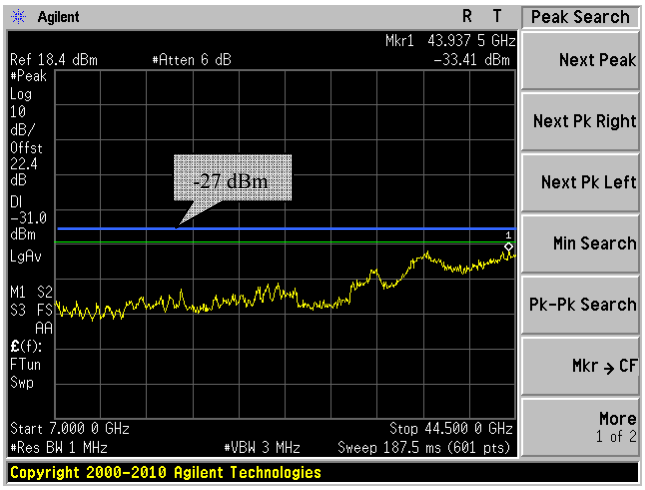
802.11a mode, High Channel, Chain J10
7G – 44.5 GHz



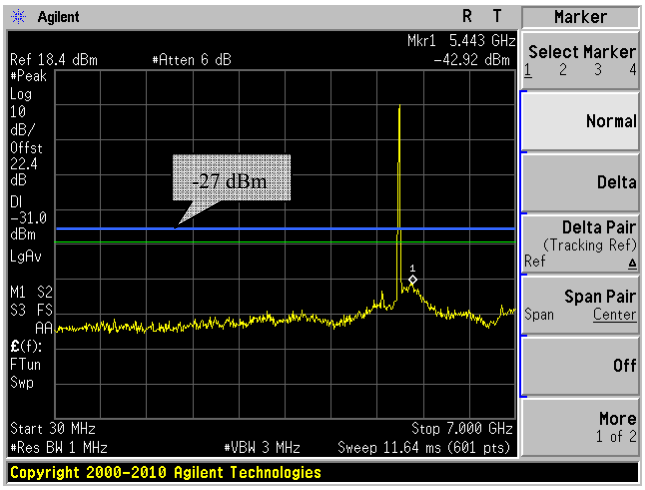
802.11a mode, High Channel, Chain J8
30MHz – 7GHz



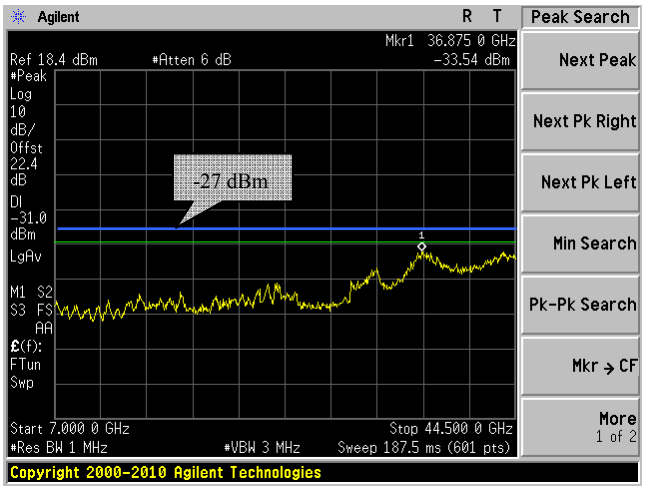
802.11a mode, High Channel, Chain J8
7G – 44.5 GHz



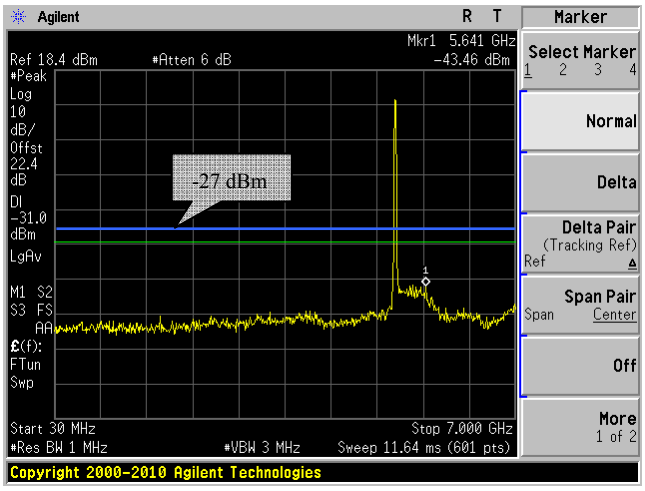
802.11a mode, High Channel, Chain J6
30MHz – 7GHz



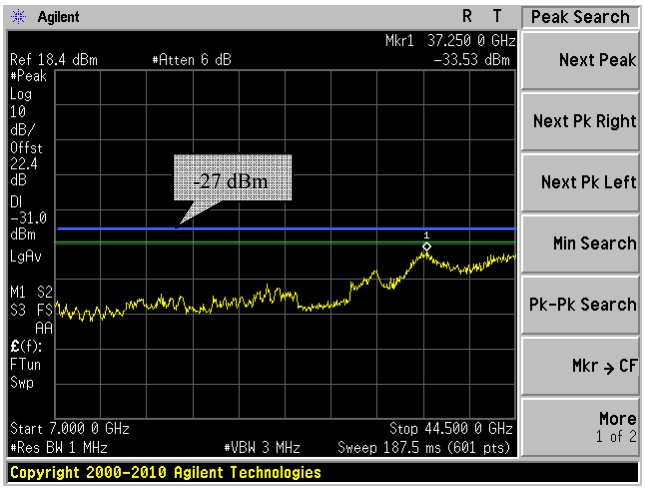
802.11a mode, High Channel, Chain J6
7G – 44.5 GHz



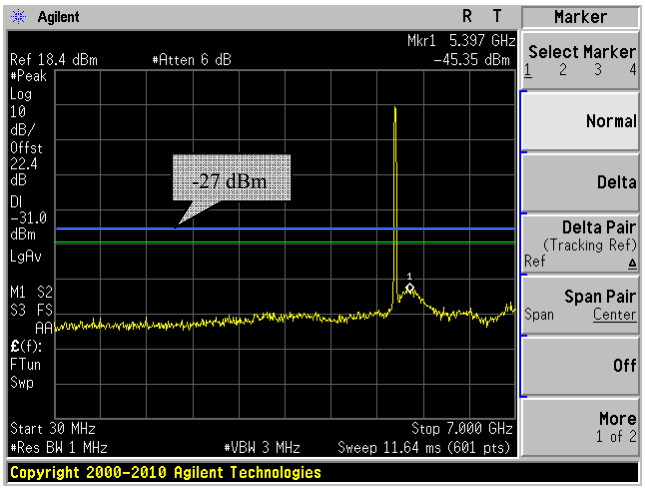
802.11n20 mode, Low Channel, Chain J10
30MHz – 7GHz



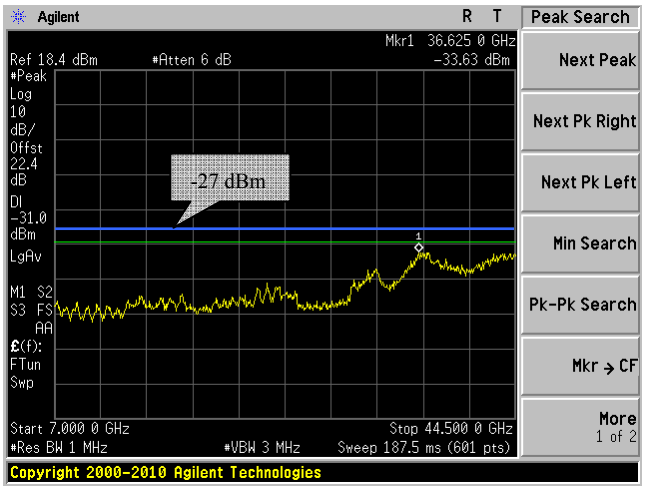
802.11n20 mode, Low Channel, Chain J10
7G – 44.5 GHz



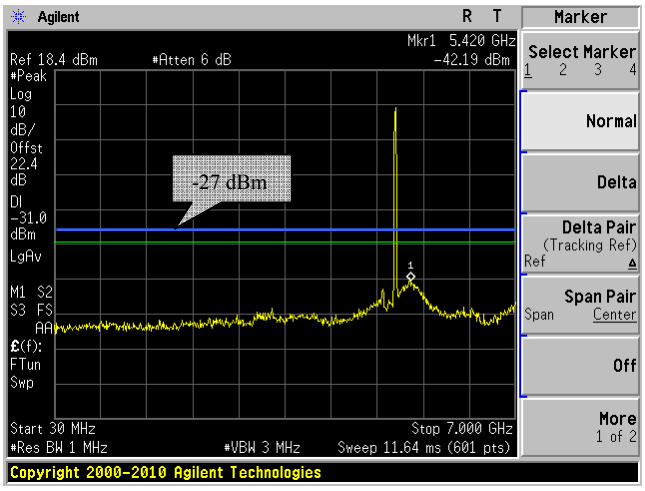
802.11n20 mode, Low Channel, Chain J8
30MHz – 7GHz



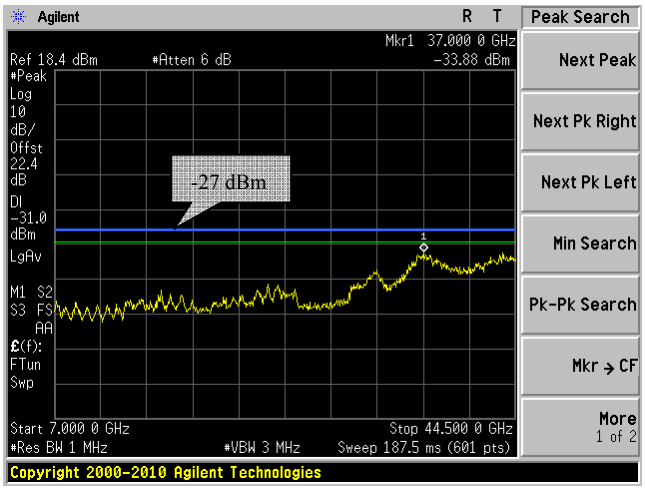
802.11n20 mode, Low Channel, Chain J8
7G – 44.5 GHz



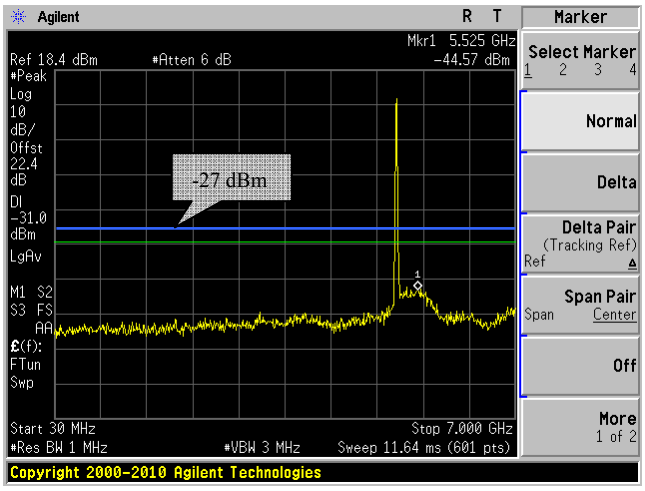
802.11n20 mode, Low Channel, Chain J6
30MHz – 7GHz



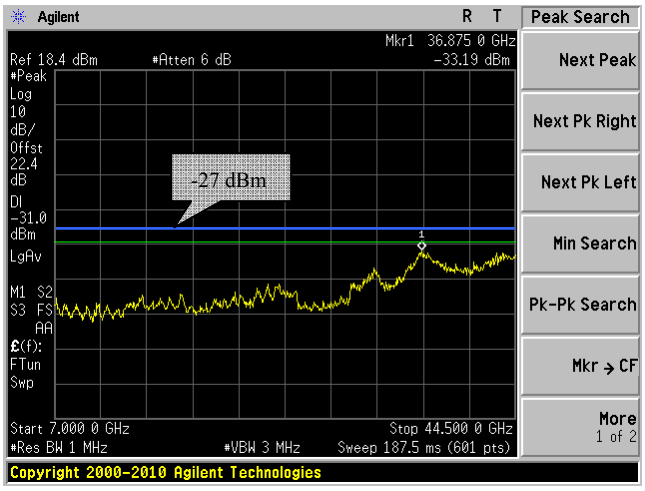
802.11n20 mode, Low Channel, Chain J6
7G – 44.5 GHz



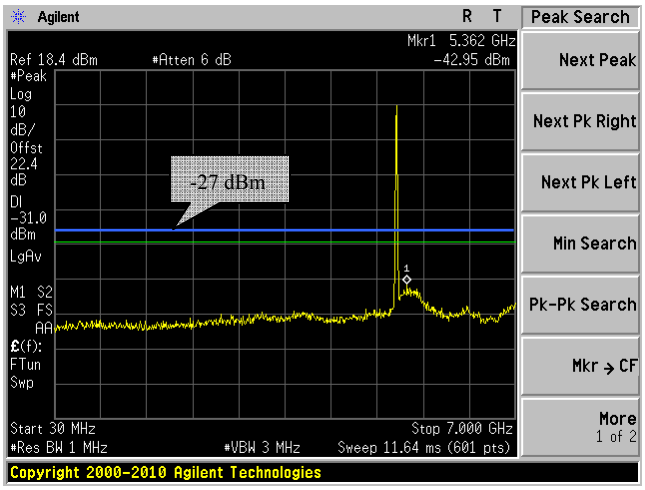
802.11n20 mode, Middle Channel, Chain J10
30MHz – 7GHz



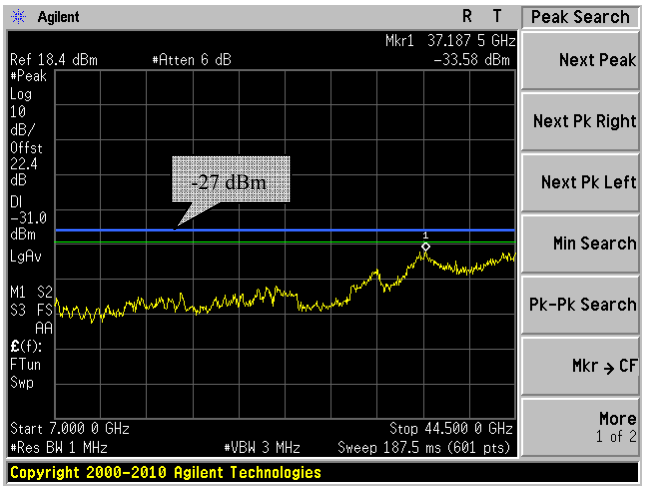
802.11n20 mode, Middle Channel, Chain J10
7G – 44.5 GHz



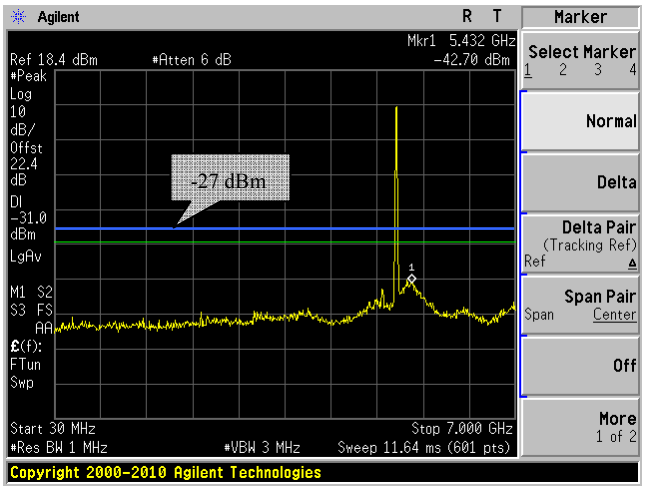
802.11n20 mode, Middle Channel, Chain J8
30MHz – 7GHz



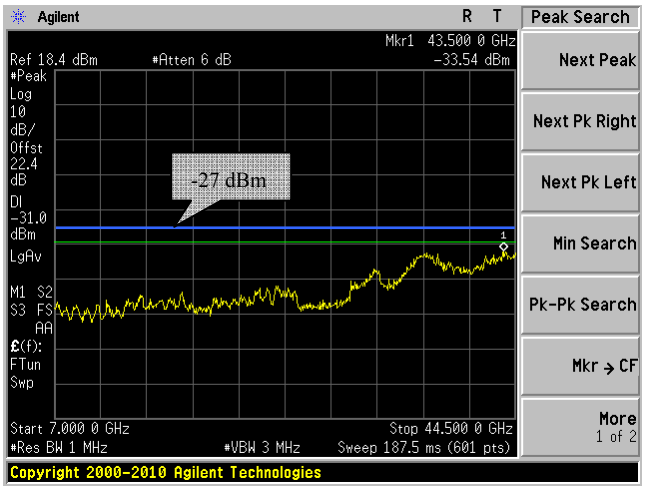
802.11n20 mode, Middle Channel, Chain J8
7G – 44.5 GHz



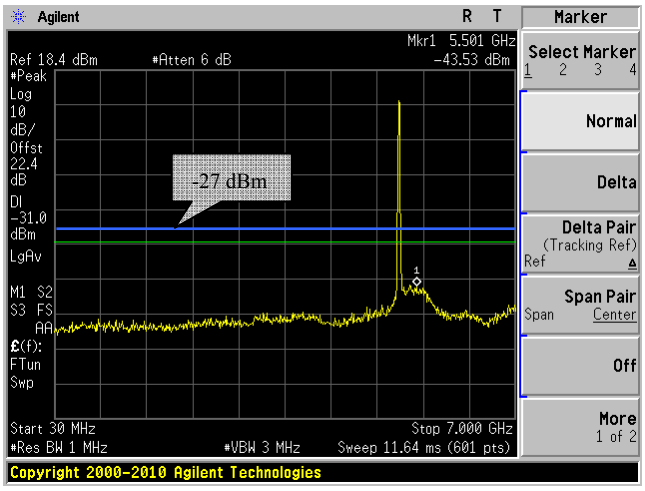
802.11n20 mode, Middle Channel, Chain J6
30MHz – 7GHz



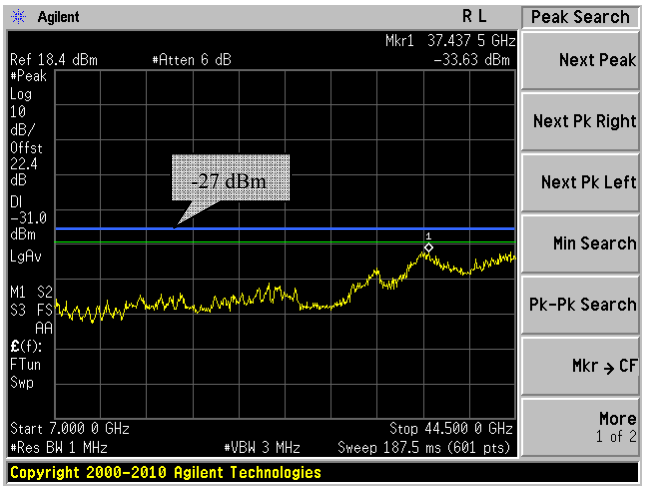
802.11n20 mode, Middle Channel, Chain J6
7G – 44.5 GHz



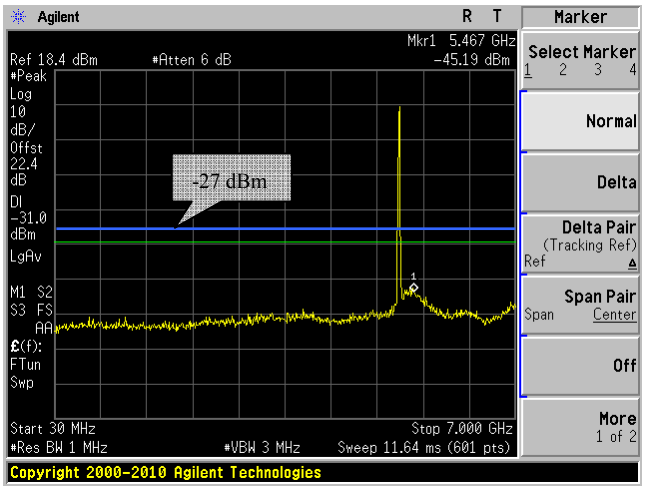
802.11n20 mode, High Channel, Chain J10
30MHz – 7GHz



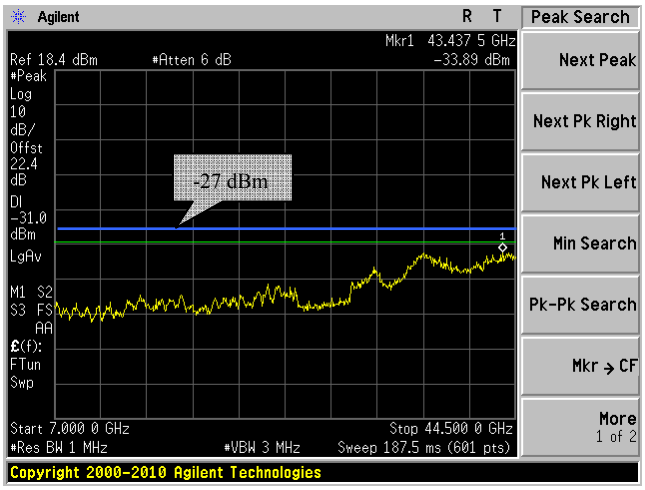
802.11n20 mode, High Channel, Chain J10
7G – 44.5 GHz



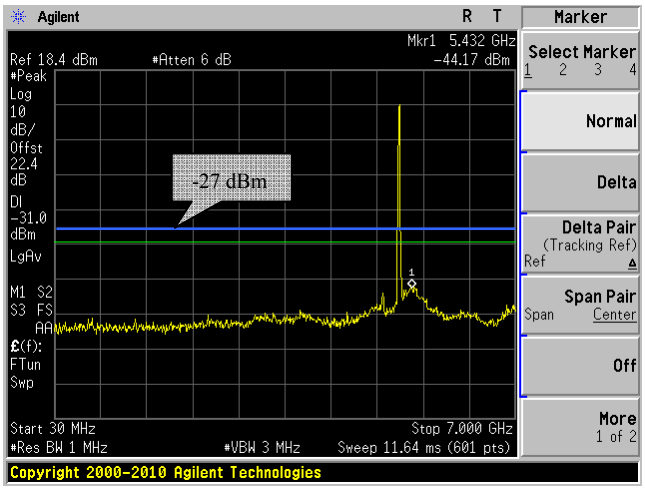
802.11n20 mode, High Channel, Chain J8
30MHz – 7GHz



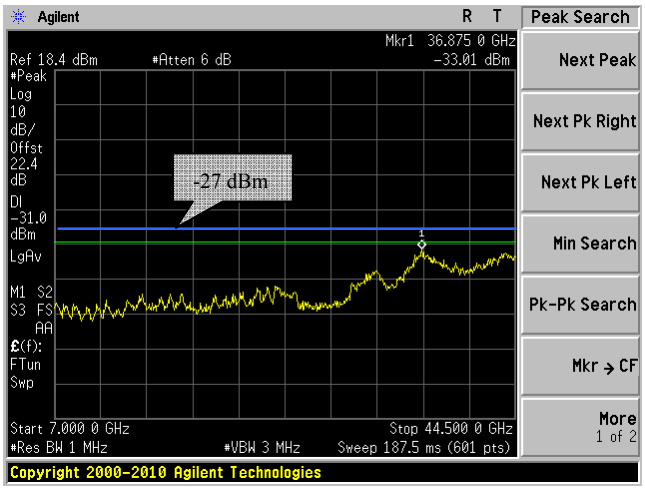
802.11n20 mode, High Channel, Chain J8
7G – 44.5 GHz



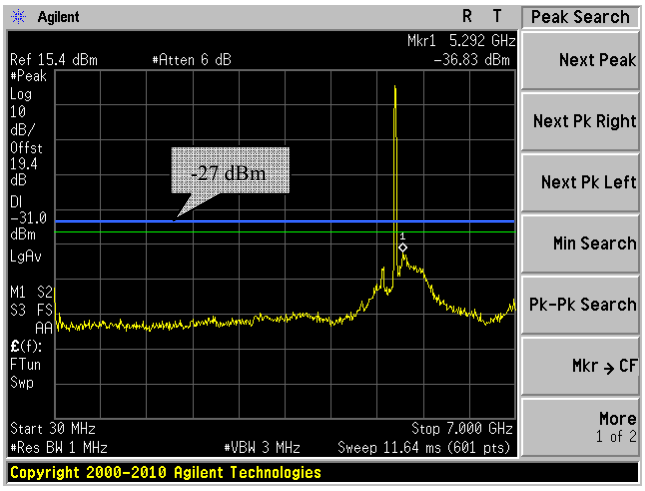
802.11n20 mode, High Channel, Chain J6
30MHz – 7GHz



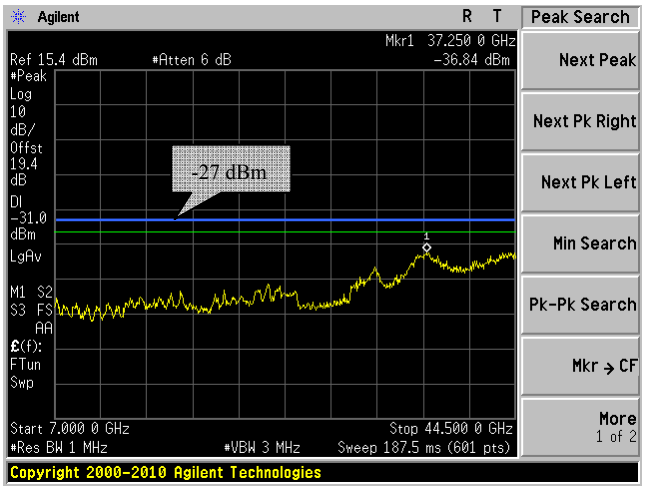
802.11n20 mode, High Channel, Chain J6
7G – 44.5 GHz



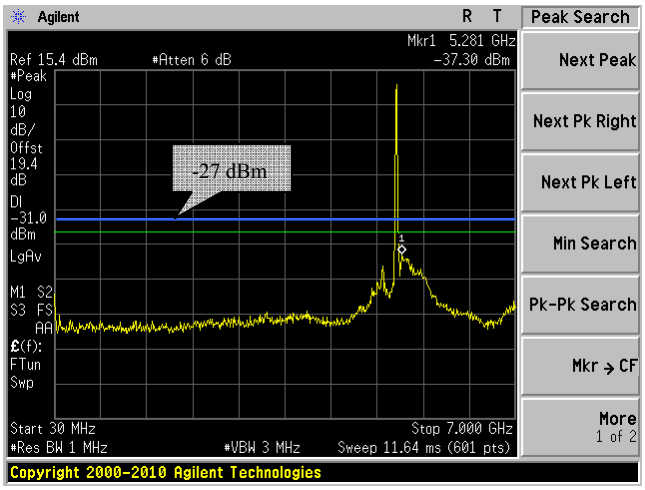
802.11n20 mode, Low Channel, Chain J10, J8, J6
30MHz – 7GHz



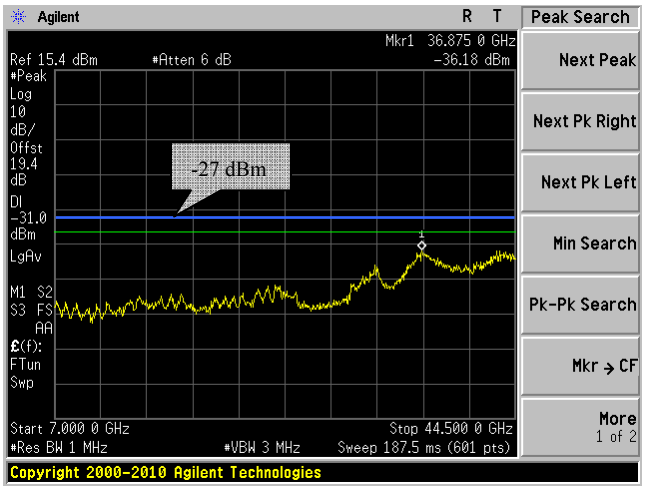
802.11n20 mode, Low Channel, Chain J10, J8, J6
7G – 44.5 GHz



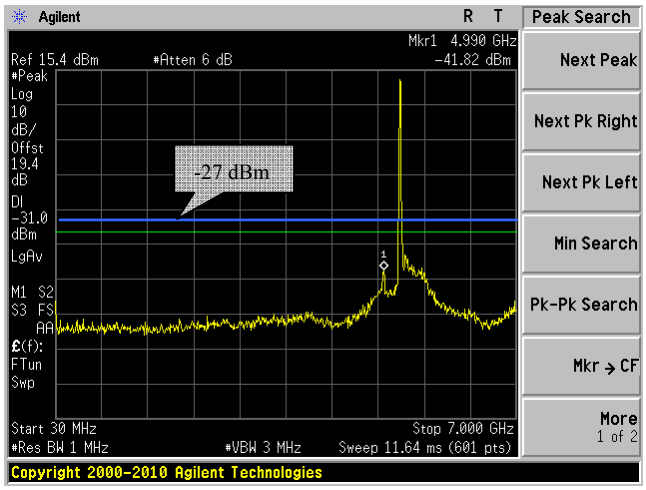
802.11n20 mode, Middle Channel, Chain J10, J8, J6
30MHz – 7GHz



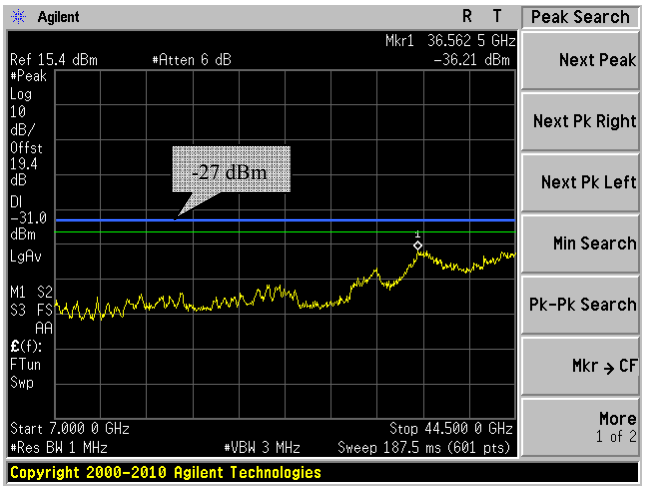
802.11 n20 mode, Middle Channel, Chain J10, J8, J6
7G – 44.5 GHz



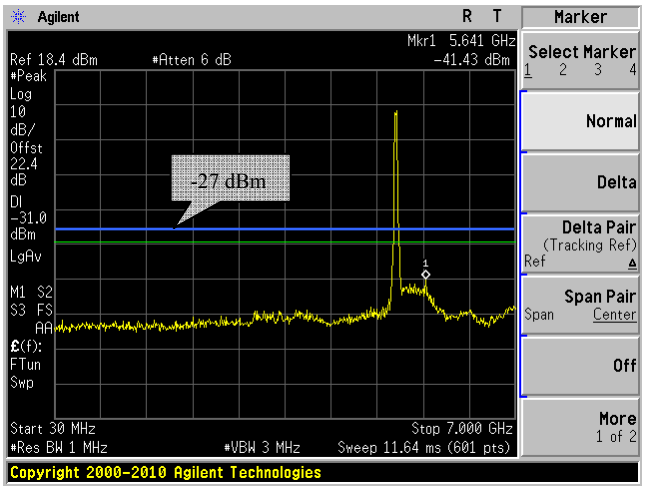
802.11n20 mode, High Channel, Chain J10, J8, J6
30MHz – 7GHz



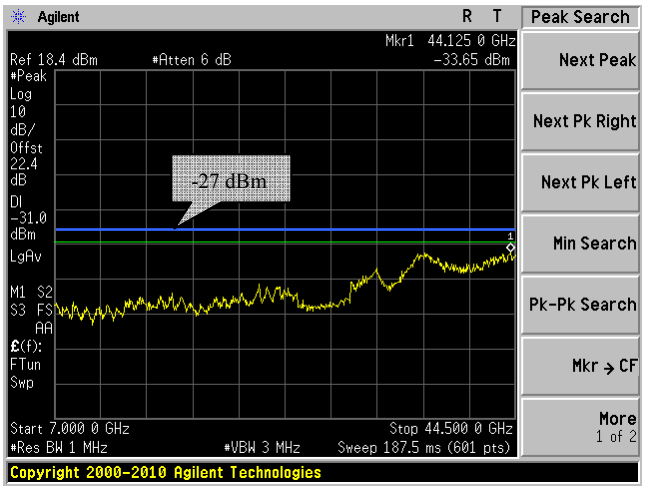
802.11n20 mode, High Channel, Chain J10, J8, J6
7G – 44.5 GHz



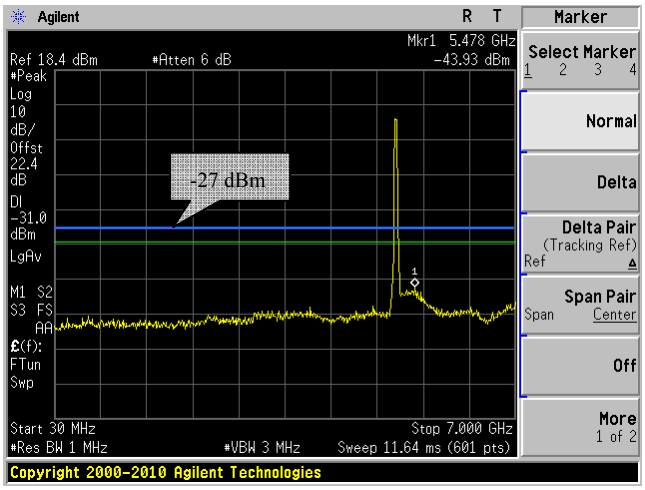
802.11n40 mode, Low Channel, Chain J10
30MHz – 7GHz



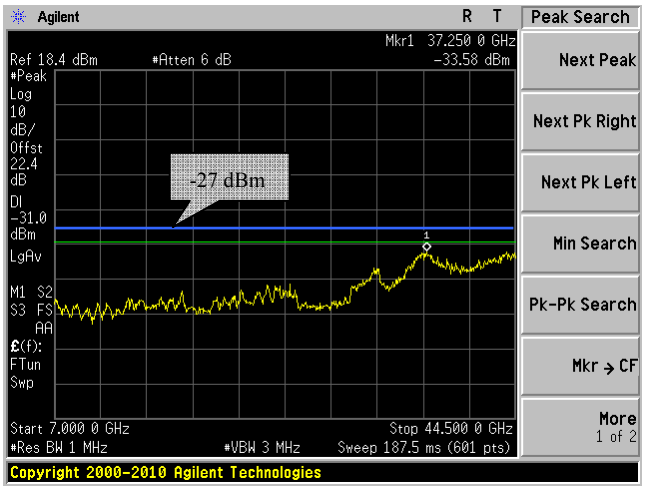
802.11n40 mode, Low Channel, Chain J10
7G – 44.5 GHz



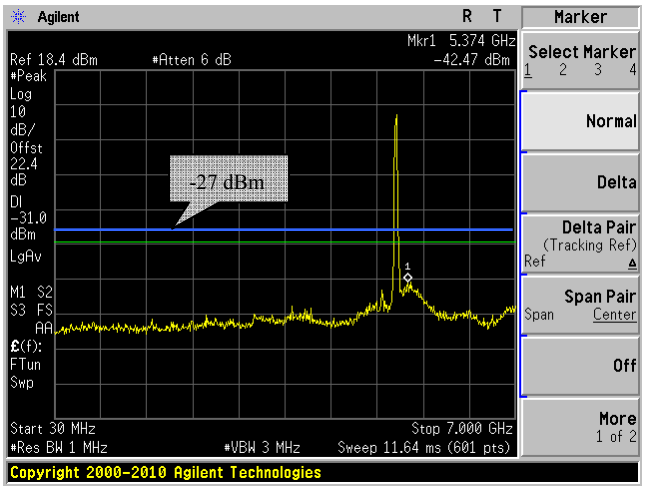
802.11n40 mode, Low Channel, Chain J8
30MHz – 7GHz



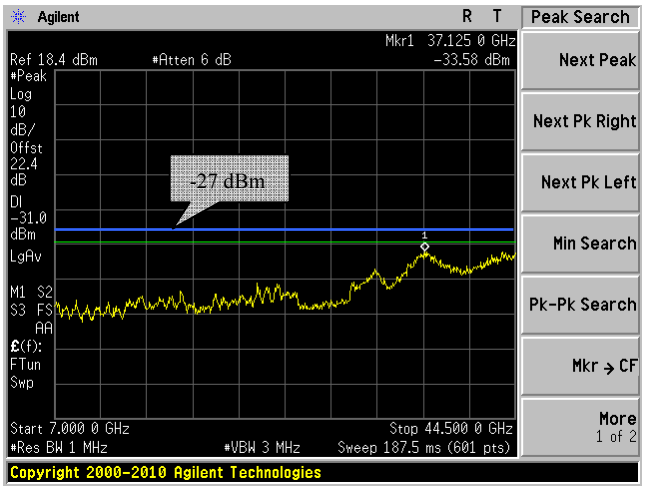
802.11n40 mode, Low Channel, Chain J8
7G – 44.5 GHz



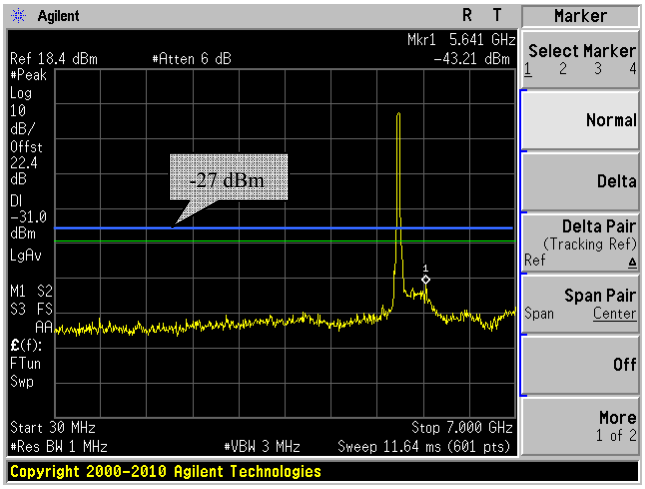
802.11n40 mode, Low Channel, Chain J6
30MHz – 7GHz



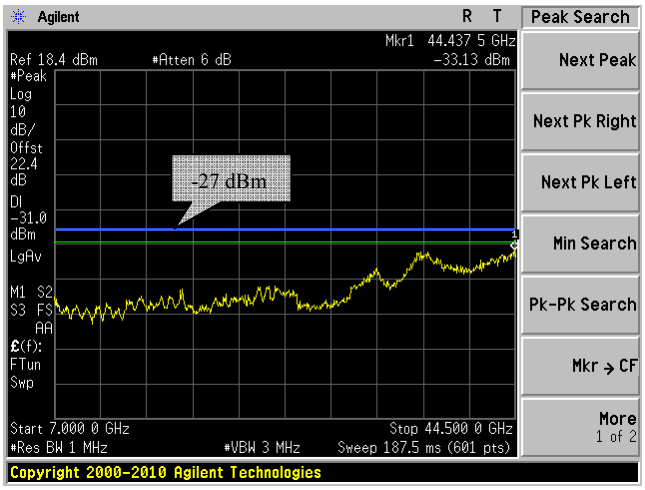
802.11n40 mode, Low Channel, Chain J6
7G – 44.5 GHz



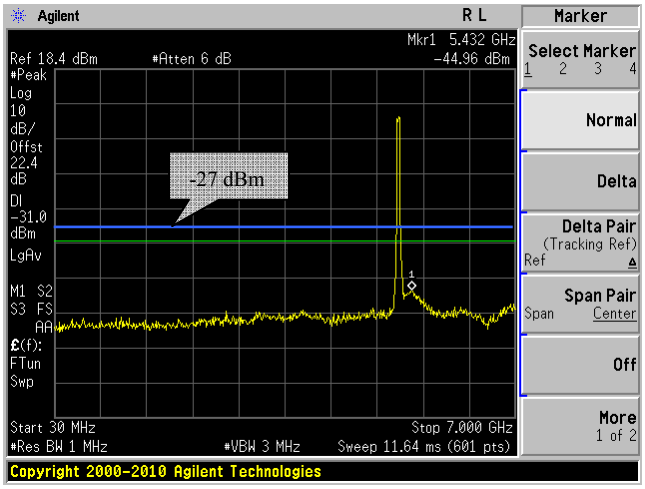
802.11n40 mode, High Channel, Chain J10
30MHz – 7GHz



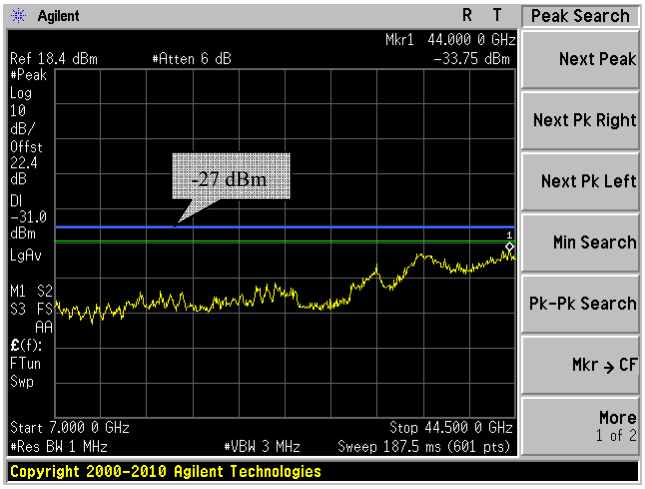
802.11n40 mode, High Channel, Chain J10
7G – 44.5 GHz



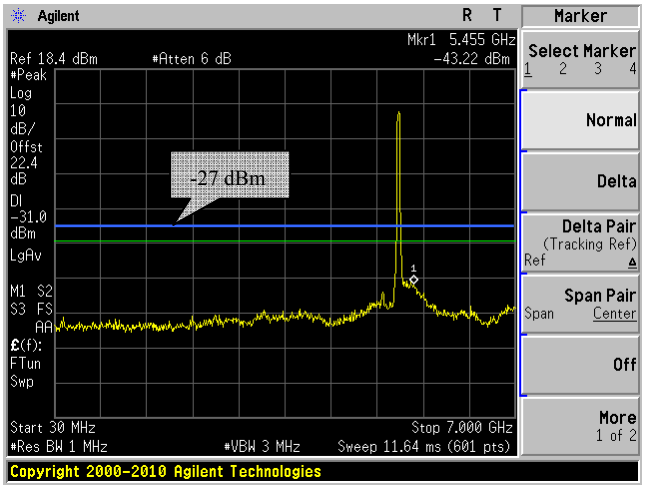
802.11n40 mode, High Channel, Chain J8
30MHz – 7GHz



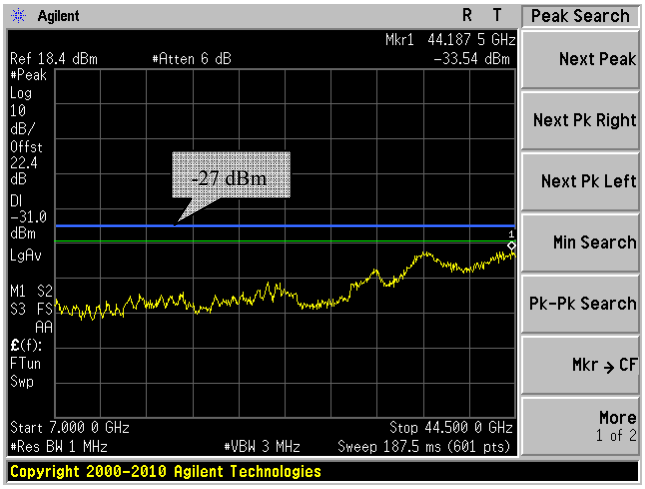
802.11n40 mode, High Channel, Chain J8
7G – 44.5 GHz



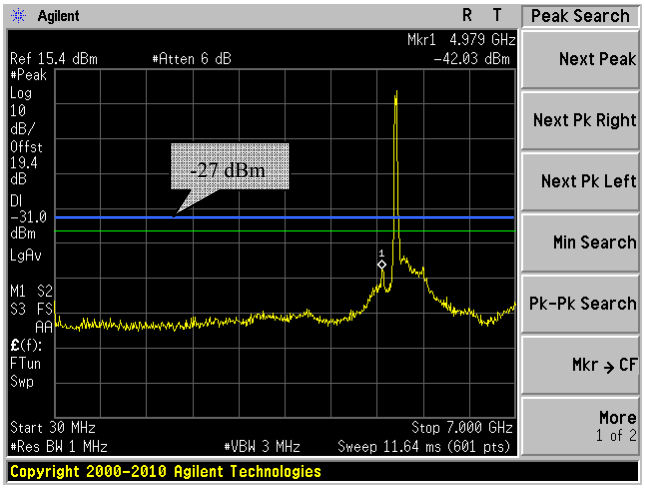
802.11n40 mode, High Channel, Chain J6
30MHz – 7GHz



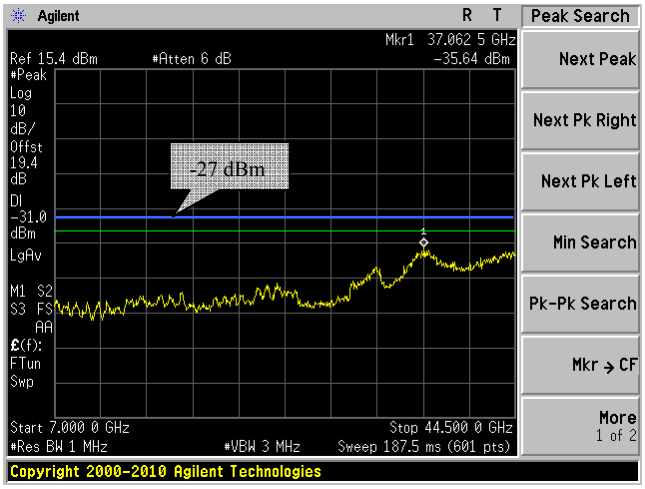
802.11n40 mode, High Channel, Chain J6
7G – 44.5 GHz



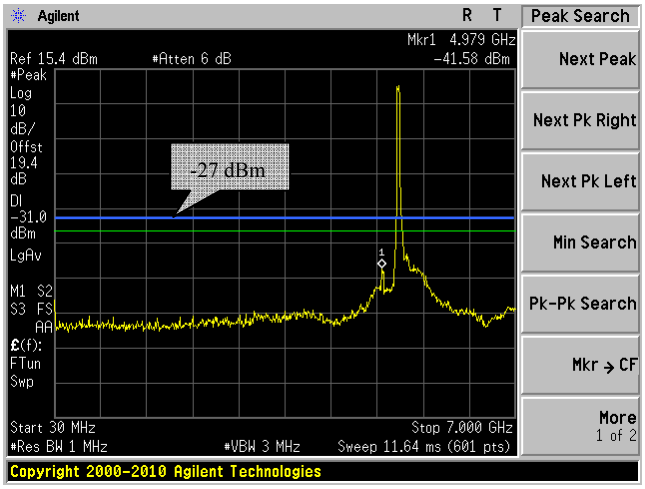
802.11n40 mode, Low Channel, Chain J10, J8, J6
30MHz – 7GHz



802.11n40 mode, Low Channel, Chain J10, J8, J6
7G – 44.5 GHz



802.11n40 mode, High Channel, Chain J10, J8, J6
30MHz – 7GHz



802.11n40 mode, High Channel, Chain J10, J8, J6
7G – 44.5 GHz