Lab Code: 200167-0

FCC PART 15.247

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-W58
Report Date:	2012-02-01
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-W58	Original Report	2012-02-01

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 5GHz 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, provided by the manufacturer.

1.3 Objective

This report is prepared on behalf of *Ruckus Wireless, Inc.,* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commissions rules and IC RSS-210 Issue 8, Dec 2010.

The objective is to determine compliance with FCC/IC rules for Antenna Requirements, Radiated Spurious Emissions with additional antennas.

1.4 Related Submittal(s)/Grant(s)

FCC Part 15.407 NII with FCC ID: S9G-MPE5N33A
IC RSS-210 with IC: 5912A-MPE5N33A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in 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 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, 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.: 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 System 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

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §15.247(i), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.2	Antenna Requirement	Compliant
FCC §15.207(a) IC RSS-Gen §7.2.4	AC Power Line Conducted Emissions	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	Compliant
FCC §15.205 IC RSS-210 §2.2	Restricted Bands	Compliant
FCC §15.209, §15.247 IC RSS-210 §A8.5	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) IC RSS-210 §A8.2	6 dB Emission Bandwidth	Compliant
FCC §15.247(b)(3) IC RSS-210 §A8.4	Maximum Peak Output Power	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(e) IC RSS-210 §A8.2 (b)	Power Spectral Density	Compliant
IC §RSS-210 §2.3 RSS-Gen §6	Receiver Spurious Emission	Compliant

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

4.1 Applicable Standard

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

Limits for General Population/Uncontrolled Exposure

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

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

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

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

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

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

4.2 MPE Prediction

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

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

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

4.3 MPE Results

Maximum peak output power at antenna input terminal (dBm):	23.81
Maximum peak output power at antenna input terminal (mW):	240.44
Prediction distance (cm):	20
Prediction frequency (MHz):	5745
Maximum Antenna Gain, typical (dBi):	3
Maximum Antenna Gain (numeric):	1.995
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.095
Power density of prediction frequency at 20.0 cm (W/m^2):	0.95
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	10

The device is compliance with the FCC/IC MPE limit for the 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 Standard

As per FCC §15.207 & 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 *	56 to 46 *
0.5-5	56	46
5-30	60	50

Decreases with the logarithm of the frequency.

6.2 Test Setup

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

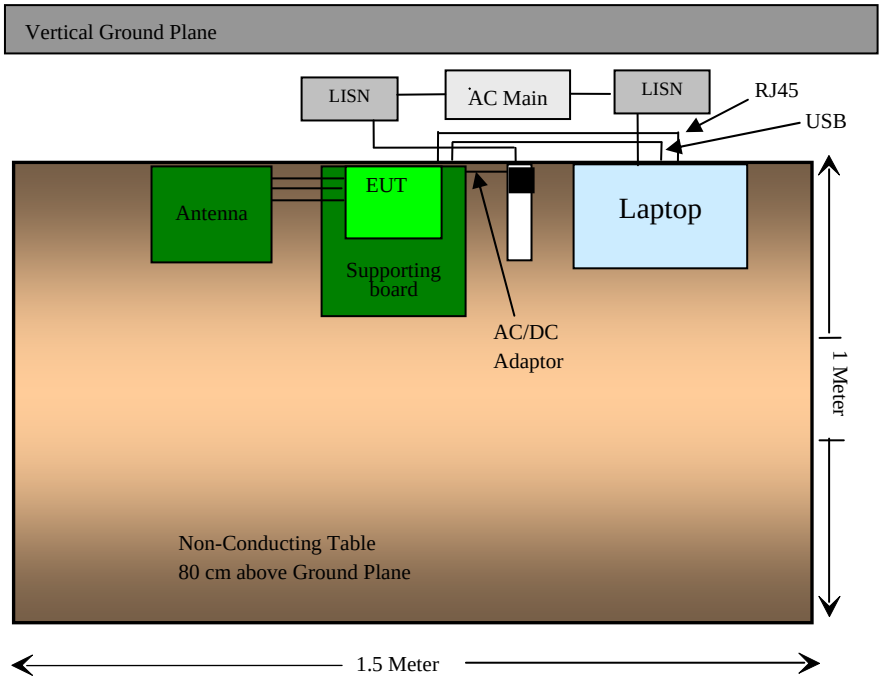
6.3 Test Procedure

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 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

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

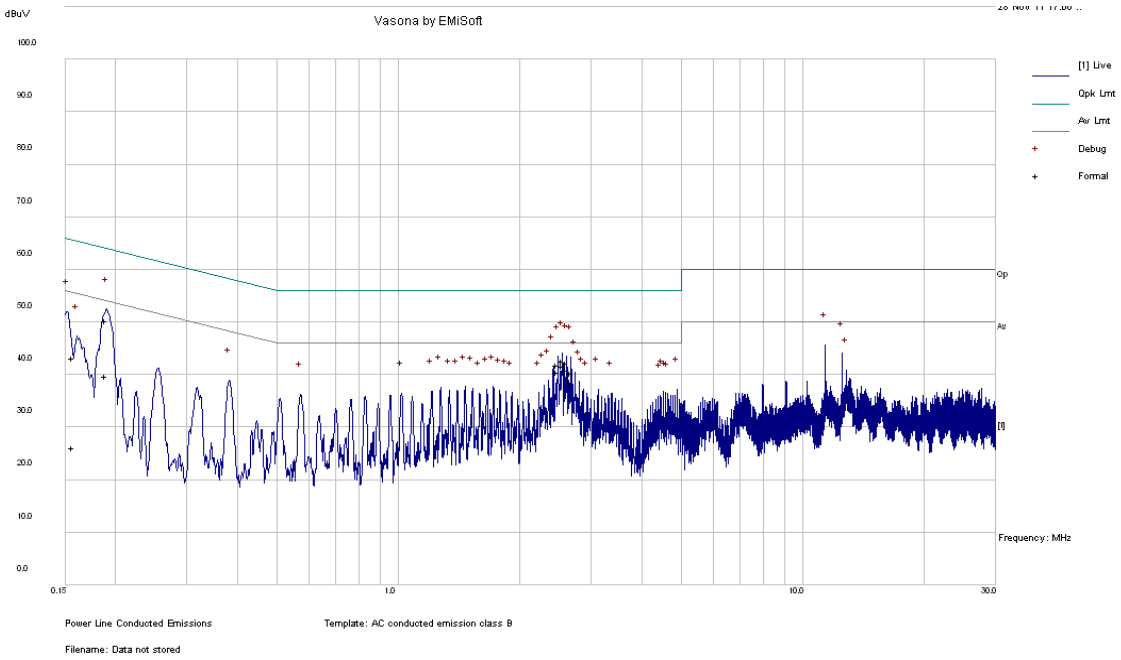
According to the recorded data in following table, the EUT complied with the FCC/IC standard's conducted emissions limits, with the margin reading of:

Connection: 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-4.34	2.540451	Line	0.15 to 30

6.9 Conducted Emissions Test Plots and Data

802.11 n20: 5745 MHz

120 V, 60 Hz – Line



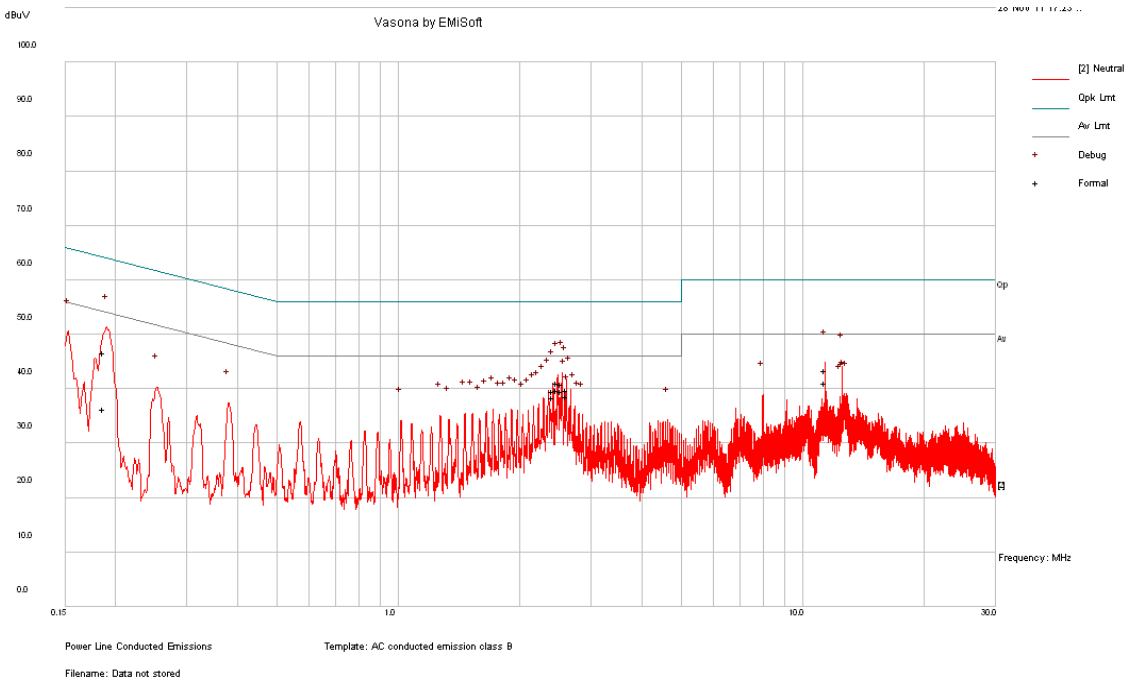
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.189129	50.31	Line	64.07	-13.76
2.540451	42.65	Line	56	-13.35
2.604181	42.22	Line	56	-13.78
2.475874	41.89	Line	56	-14.11
2.666781	40.42	Line	56	-15.58
0.156888	43.17	Line	65.63	-22.45

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.189129	39.84	Line	54.07	-14.23
2.540451	41.66	Line	46	-4.34
2.604181	40.92	Line	46	-5.08
2.475874	40.49	Line	46	-5.51
2.666781	38.68	Line	46	-7.32
0.156888	26.12	Line	55.63	-29.51

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.186789	46.66	Neutral	64.18	-17.52
2.535767	40.93	Neutral	56	-15.07
2.474538	41.01	Neutral	56	-14.99
2.601668	39.82	Neutral	56	-16.18
2.410894	39.48	Neutral	56	-16.52
11.37235	43.35	Neutral	60	-16.65

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.186789	36.37	Neutral	54.18	-17.8
2.535767	39.65	Neutral	46	-6.35
2.474538	39.68	Neutral	46	-6.32
2.601668	38.59	Neutral	46	-7.41
2.410894	38.35	Neutral	46	-7.65
11.37235	41.17	Neutral	50	-8.83

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

7.1 Applicable Standard

For §15.247(d) and IC RSS-210 § A8.5 in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

7.2 Measurement Procedure

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

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	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.

7.4 Test Environmental Conditions

Temperature:	21~24 °C
Relative Humidity:	38~45 %
ATM Pressure:	101.2-102 kPa

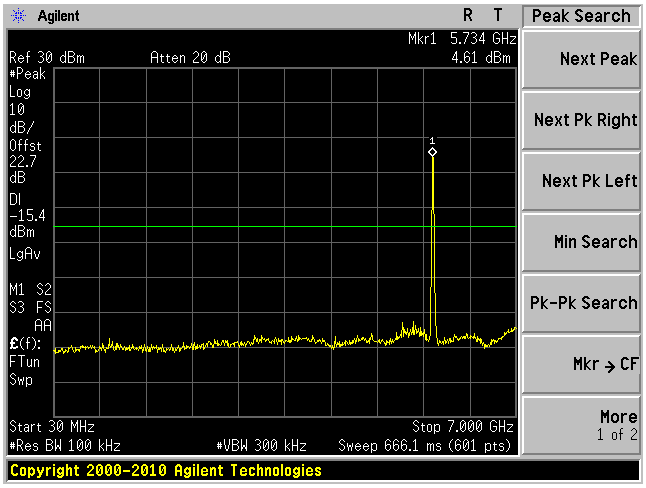
The testing was performed by Quinn Jiang on 11-12-2011 to 11-14-2011 in RF site.

7.5 Test Results

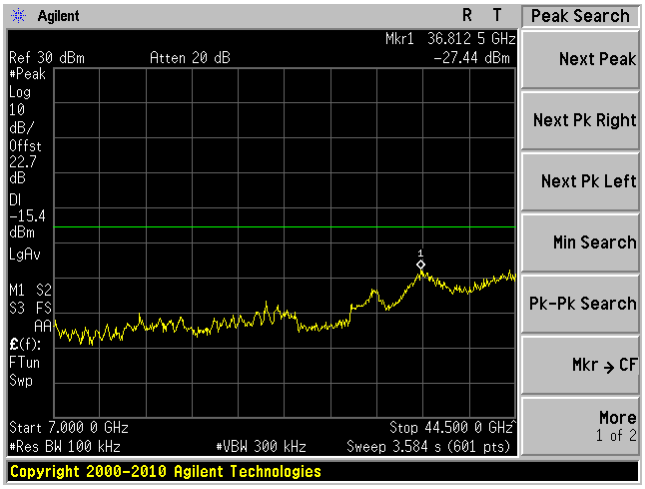
Please refer to following plots.

5725 – 5845 MHz

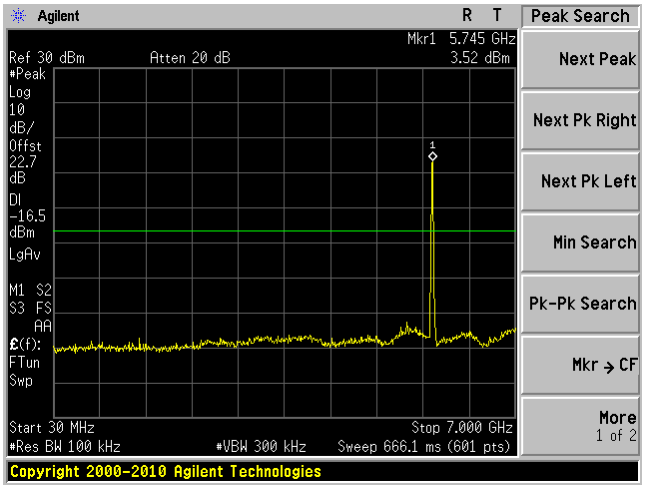
802.11a mode, Low Channel, Chain J10
30MHz – 7GHz



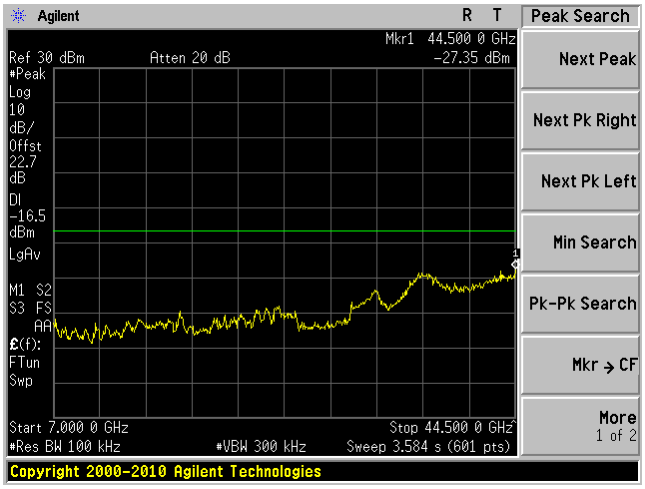
802.11a mode, Low Channel, Chain J10
7G – 44.5 GHz



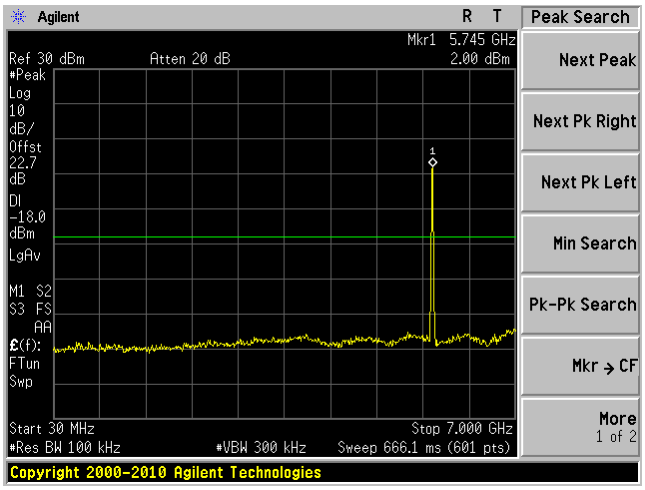
802.11a mode, Low Channel, Chain J8
30MHz – 7GHz



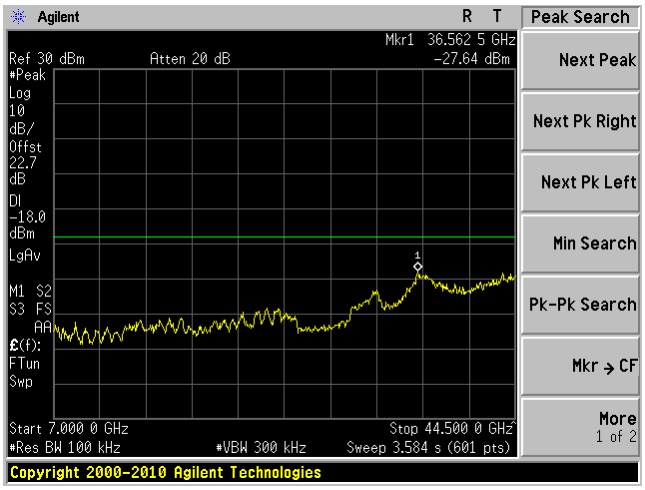
802.11a mode, Low Channel, Chain J8
7G – 44.5 GHz



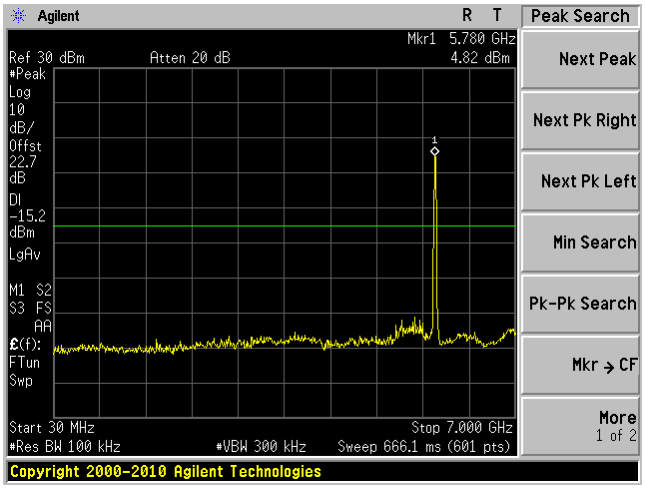
802.11a mode, Low Channel, Chain J6
30MHz – 7GHz



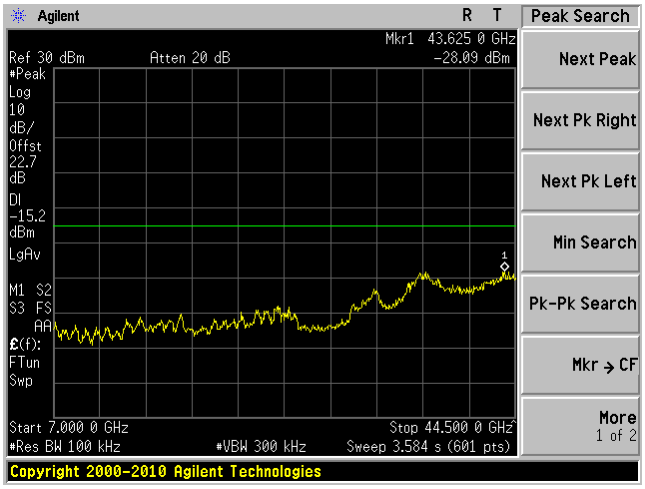
802.11a mode, Low Channel, Chain J6
7G – 44.5 GHz



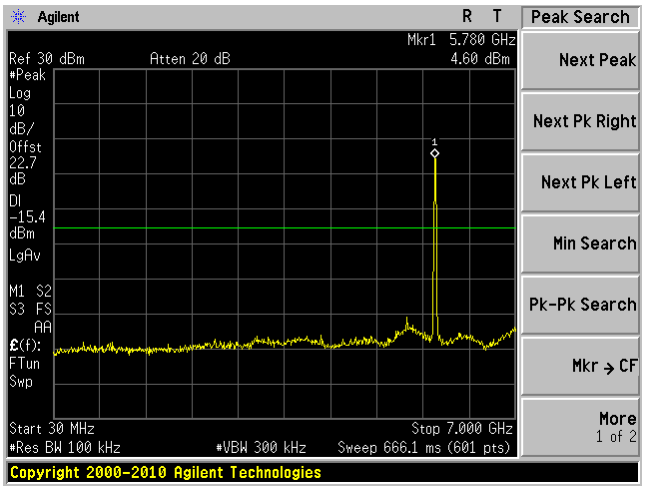
802.11a mode, Middle Channel, Chain J10
30MHz – 7GHz



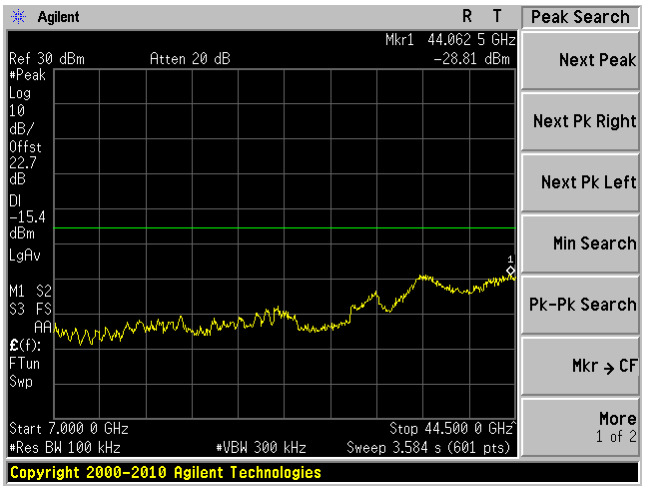
802.11a mode, Middle Channel, Chain J10
7G – 44.5 GHz



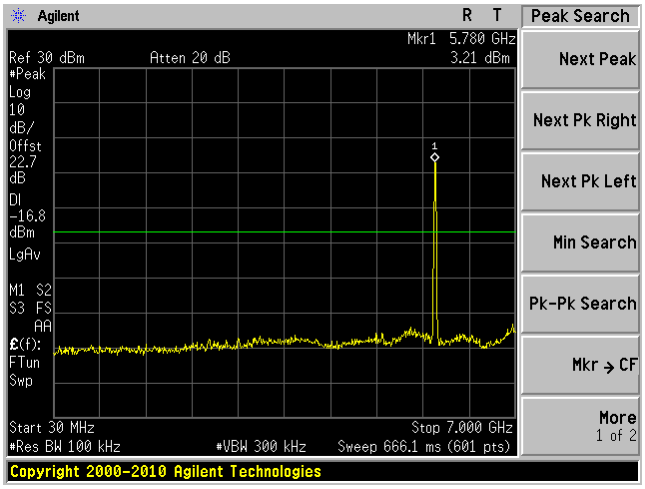
802.11a mode, Middle Channel, Chain J8
30MHz – 7GHz



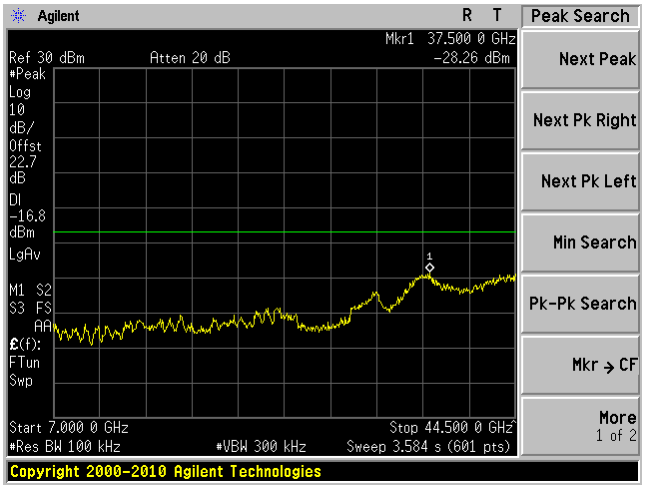
802.11a mode, Middle Channel, Chain J8
7G – 44.5 GHz



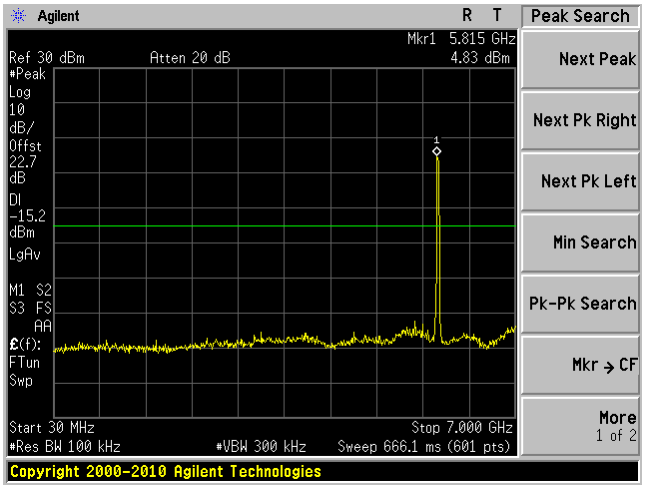
802.11a mode, High Channel, Chain J6
30MHz – 7GHz



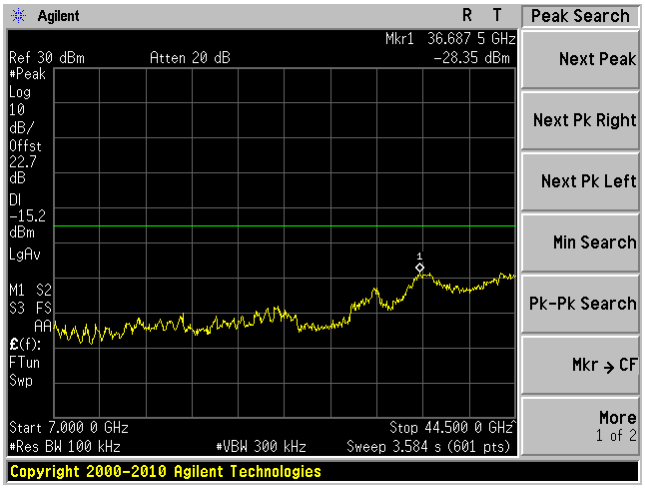
802.11a mode, High Channel, Chain J6
7G – 44.5 GHz



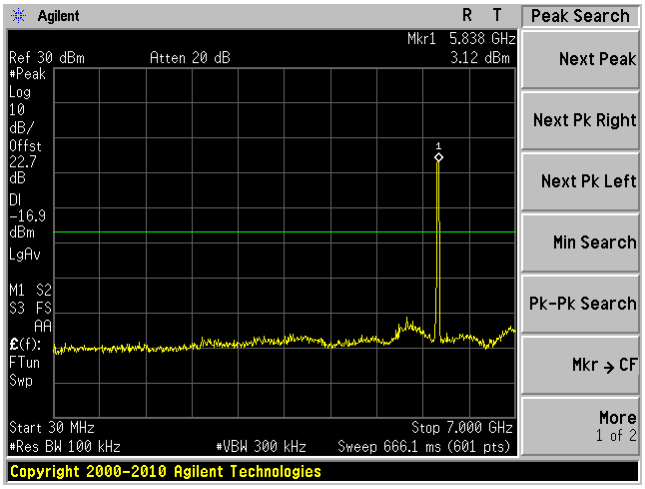
802.11a mode, High Channel, Chain J10
30MHz – 7GHz



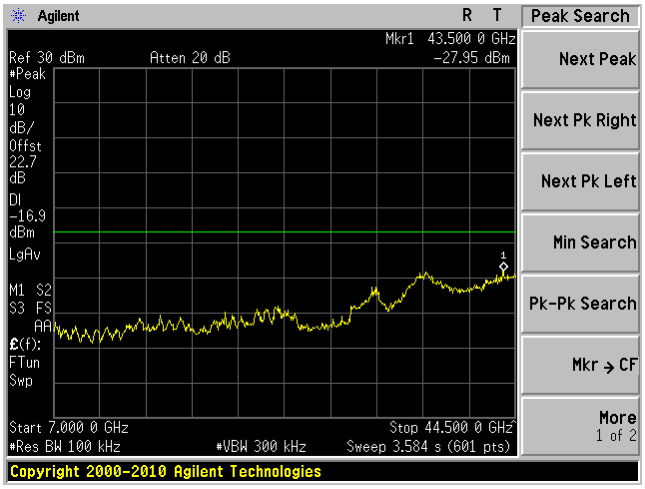
802.11a mode, High Channel, Chain J10
7G – 44.5 GHz



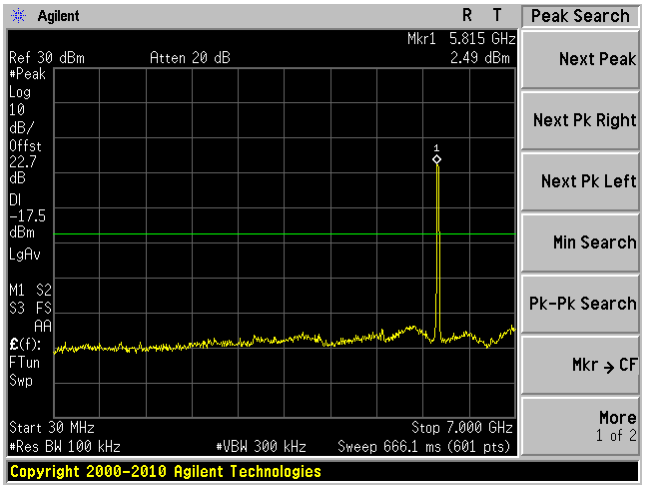
802.11a mode, High Channel, Chain J8
30MHz – 7GHz



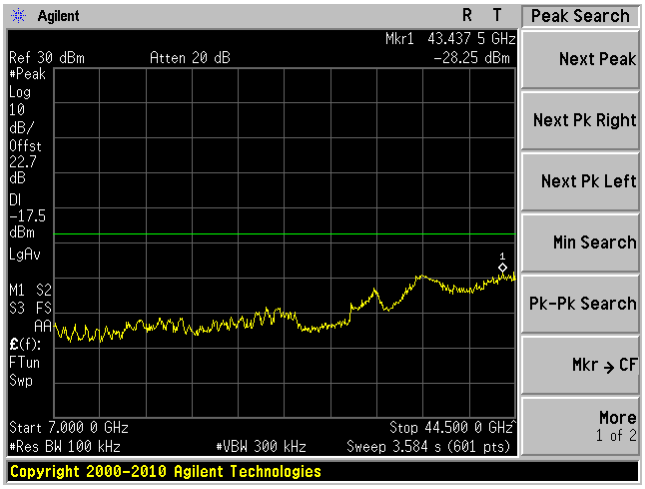
802.11a mode, High Channel, Chain J8
7G – 44.5 GHz



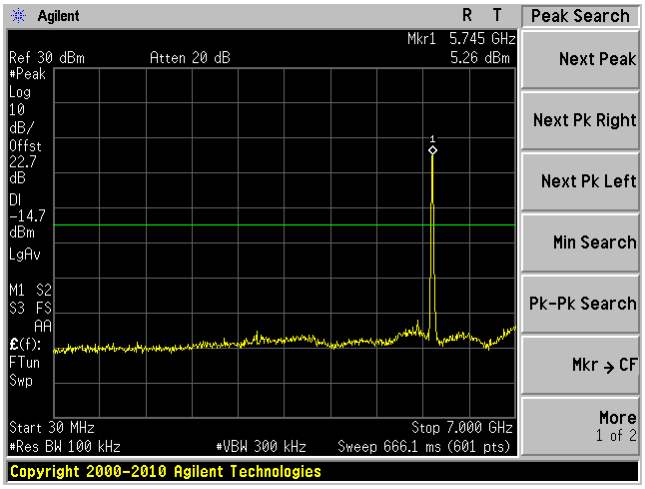
802.11a mode, High Channel, Chain J6
30MHz – 7GHz



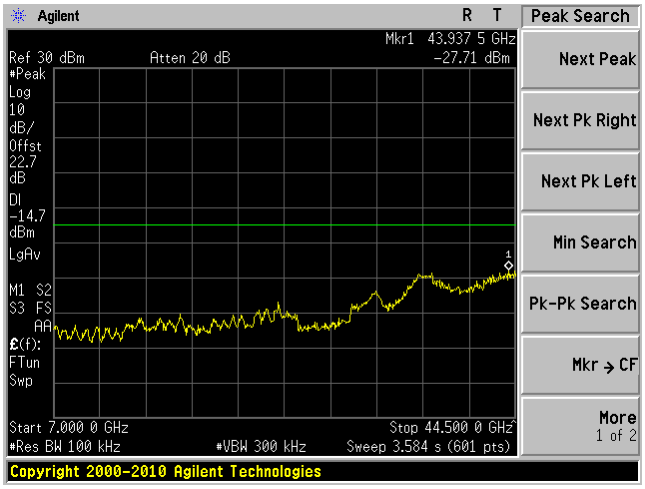
802.11a mode, High Channel, Chain J6
7G – 44.5 GHz



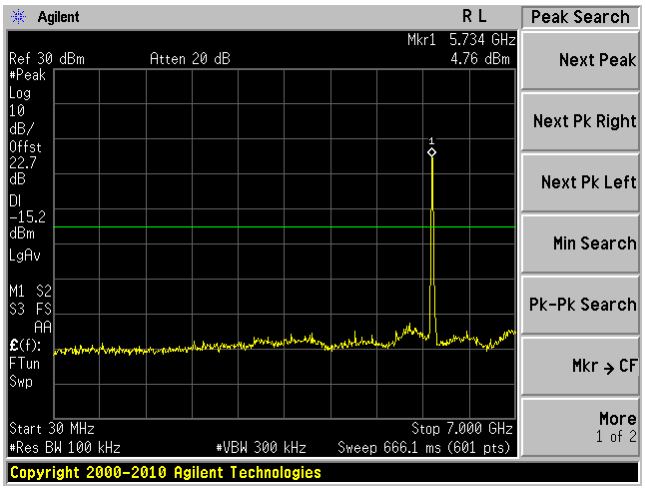
802.11n20 mode, Low Channel, Chain J10
30MHz – 7GHz



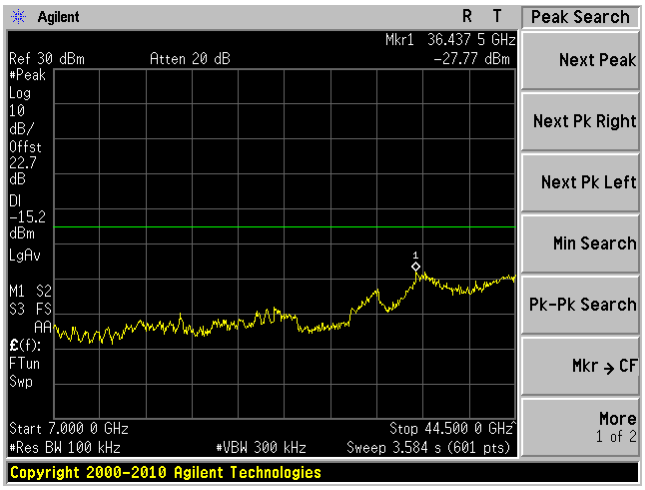
802.11n20 mode, Low Channel, Chain J10
7G – 44.5 GHz



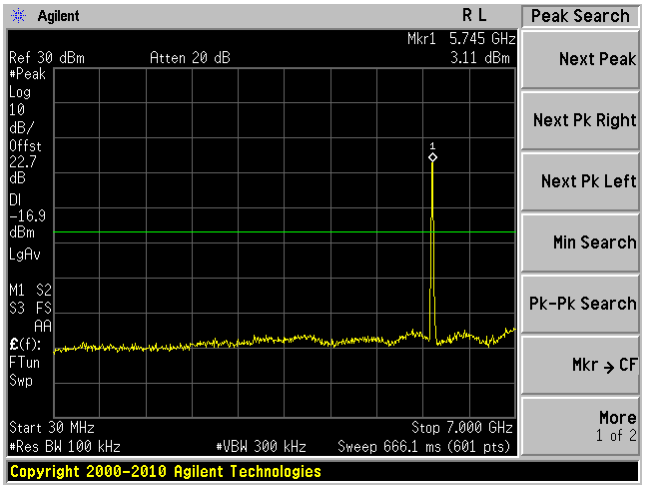
802.11n20 mode, Low Channel, Chain J8
30MHz – 7GHz



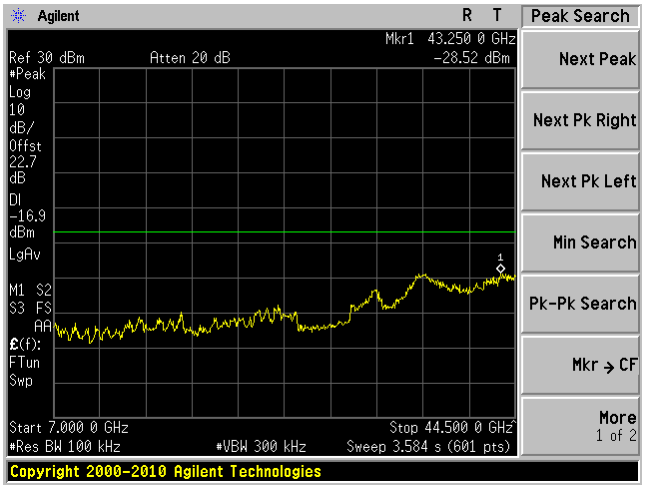
802.11n20 mode, Low Channel, Chain J8
7G – 44.5 GHz



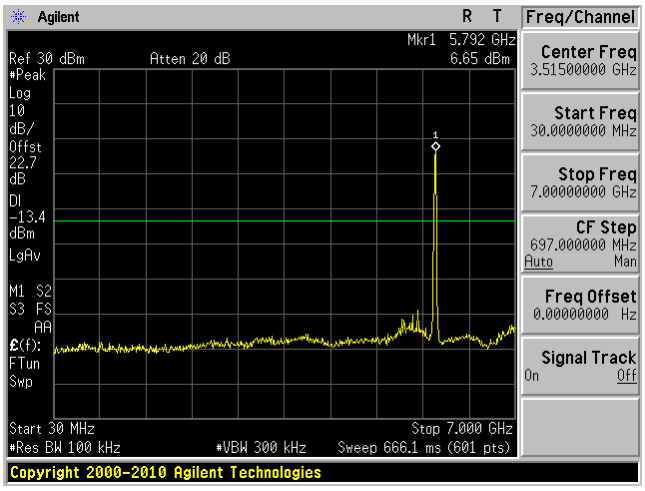
802.11n20 mode, Low Channel, Chain J6
30MHz – 7GHz



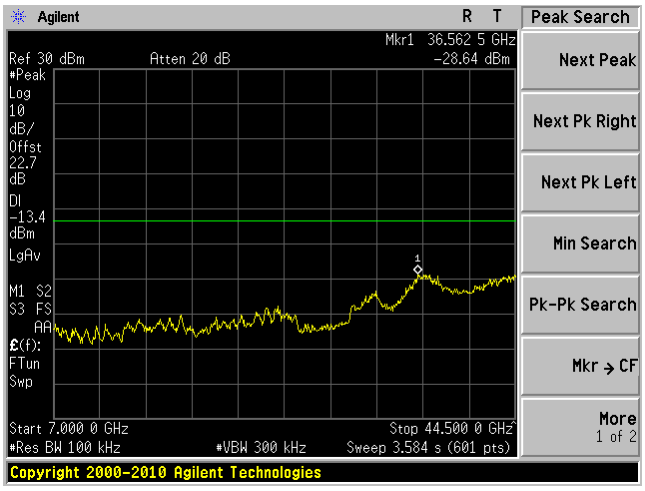
802.11n20 mode, Low Channel, Chain J6
7G – 44.5 GHz



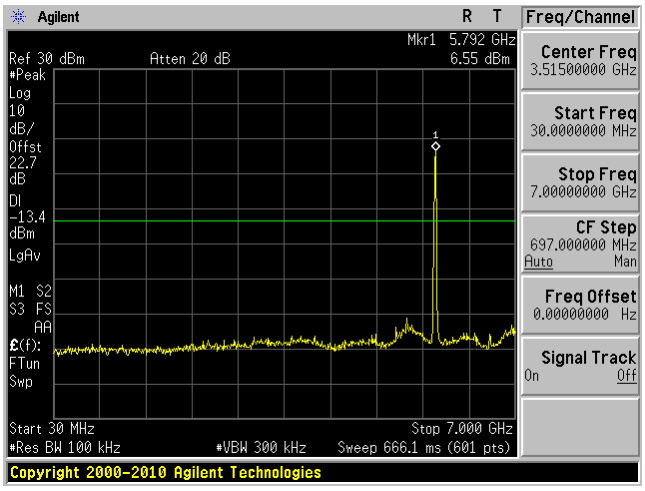
802.11n20 mode, Middle Channel, Chain J10
30MHz – 7GHz



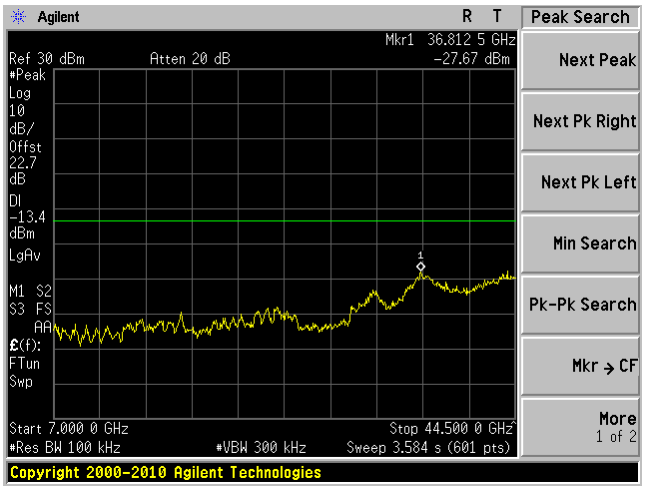
802.11n20 mode, Middle Channel, Chain J10
7G – 44.5 GHz



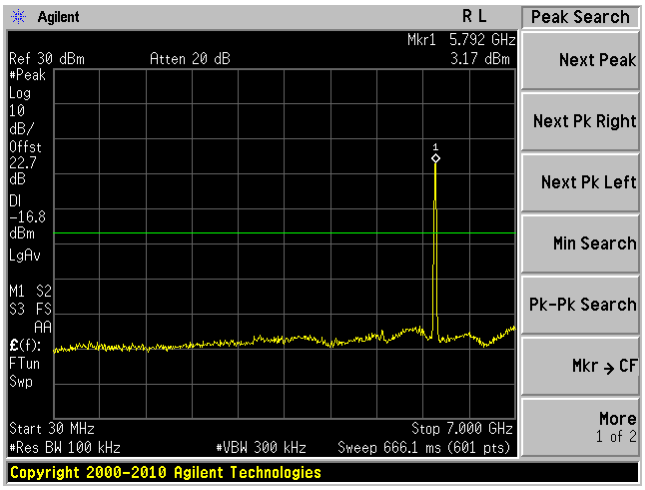
802.11n20 mode, Middle Channel, Chain J8
30MHz – 7GHz



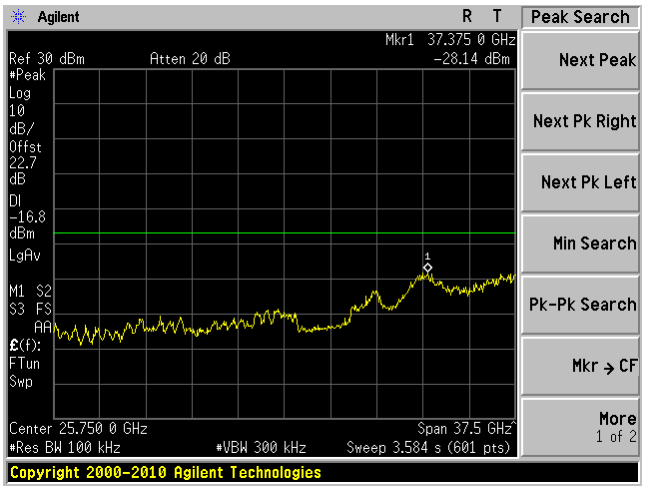
802.11n20 mode, Middle Channel, Chain J8
7G – 44.5 GHz



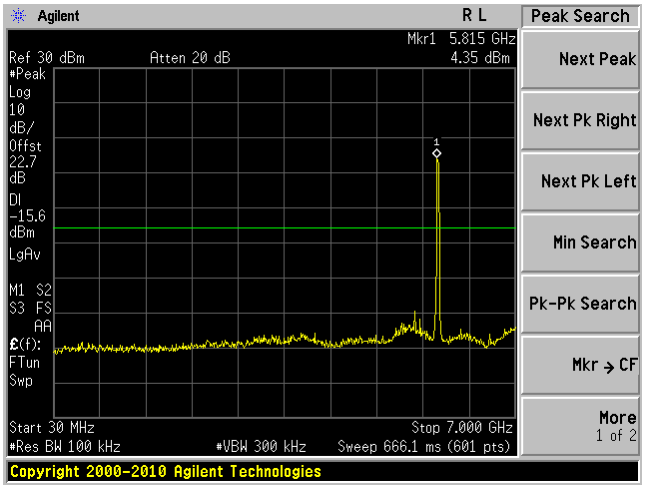
802.11 n20 mode, Middle Channel, Chain J6
30MHz – 7GHz



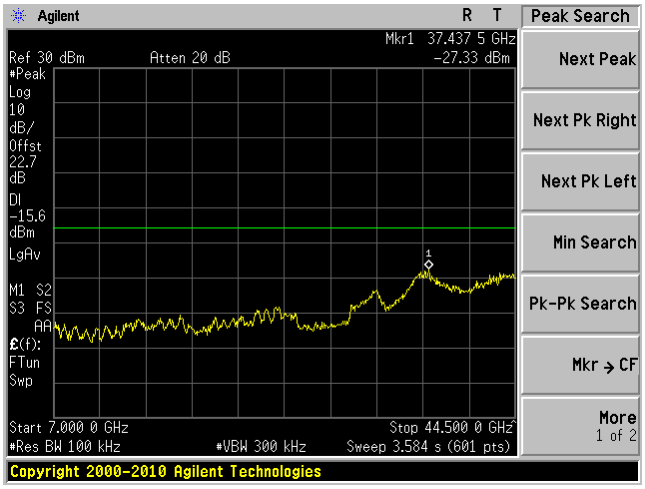
802.11 n20 mode, Middle Channel, Chain J6
7G – 44.5 GHz



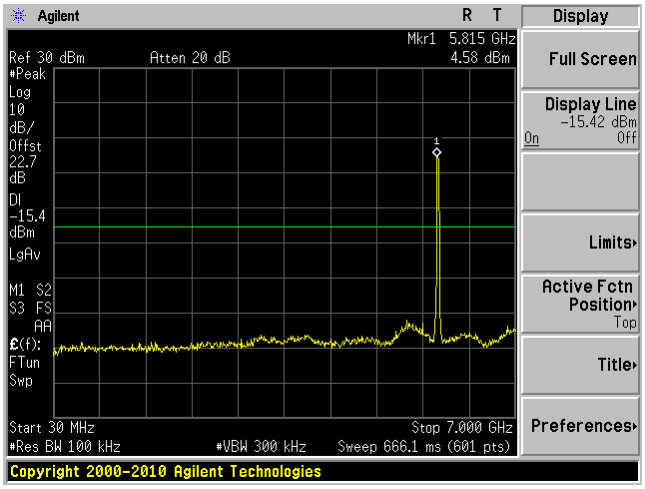
802.11n20 mode, High Channel, Chain J10
30MHz – 7GHz



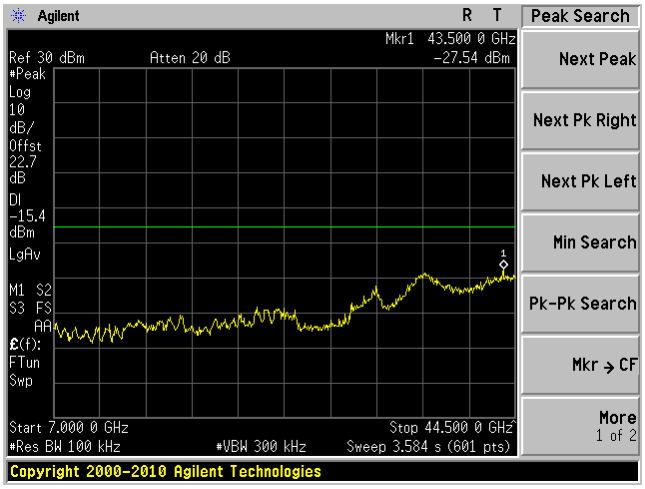
802.11n20 mode, High Channel, J10
7G – 44.5 GHz



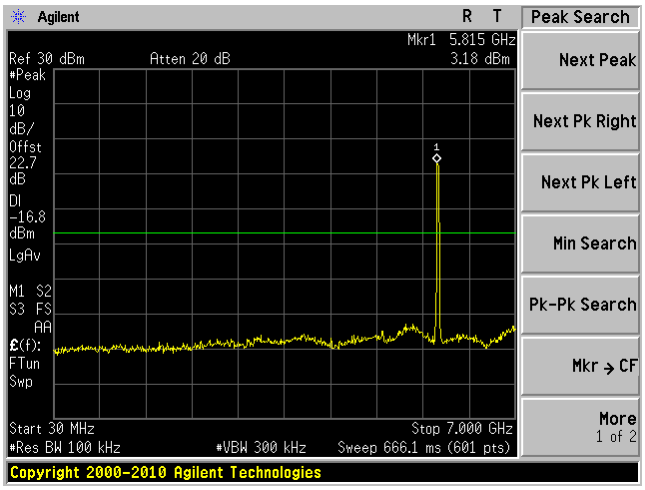
802.11n20 mode, High Channel, Chain J8
30MHz – 7GHz



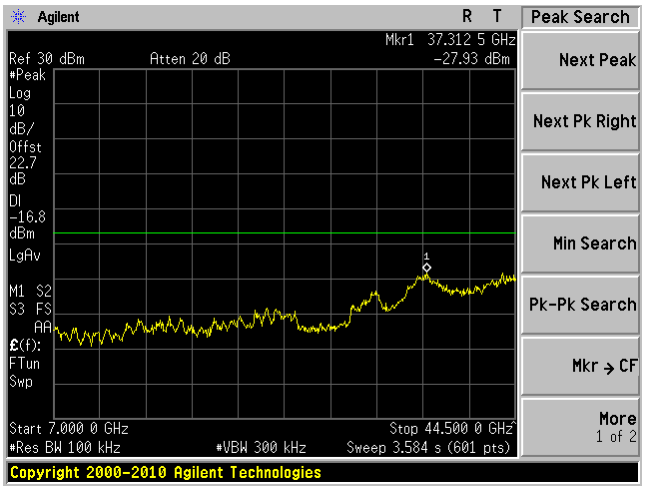
802.11n20 mode, High Channel, Chain J8
7G – 44.5 GHz



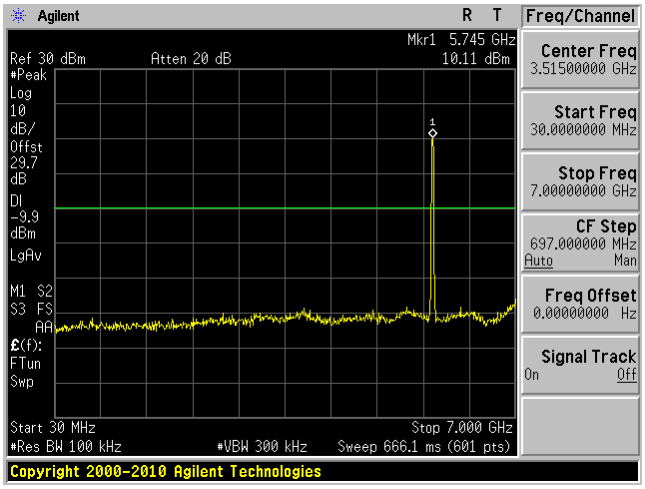
802.11n20 mode, High Channel, Chain J6
30MHz – 7GHz



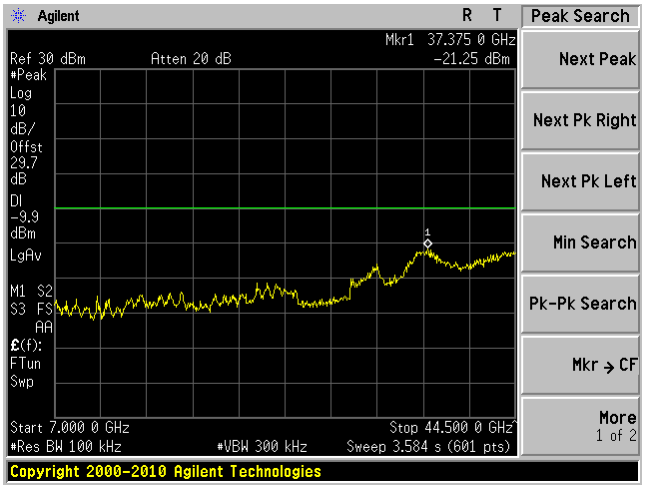
802.11n20 mode, High Channel, Chain J6
7G – 44.5 GHz



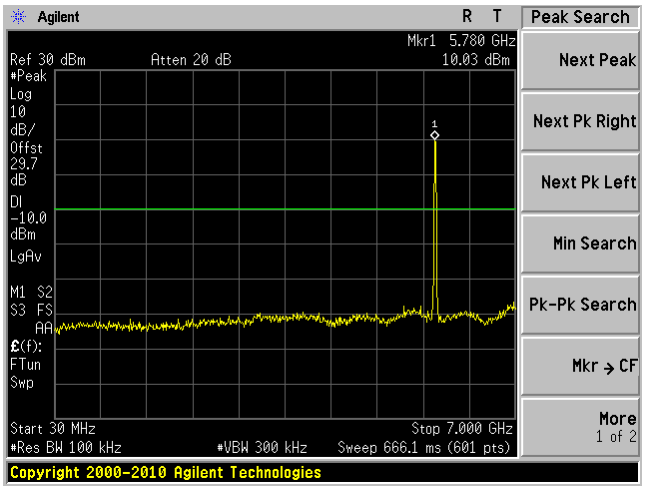
802.11n20 mode, Low Channel, Chain J10, J8, J6
30MHz – 7GHz



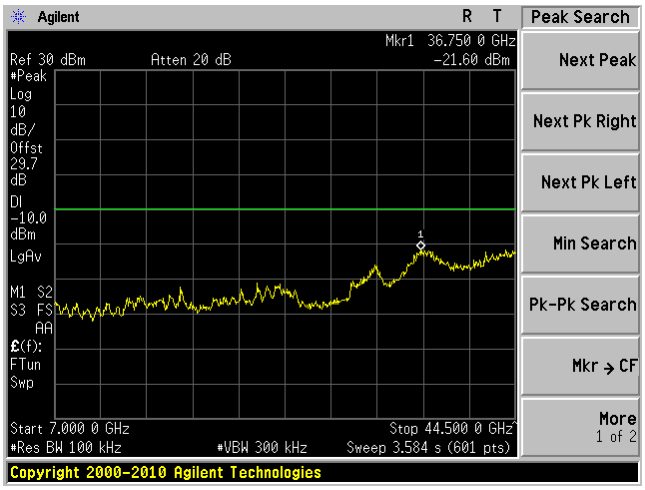
802.11n20 mode, Low Channel, Chain J10, J8, J6
7G – 44.5 GHz



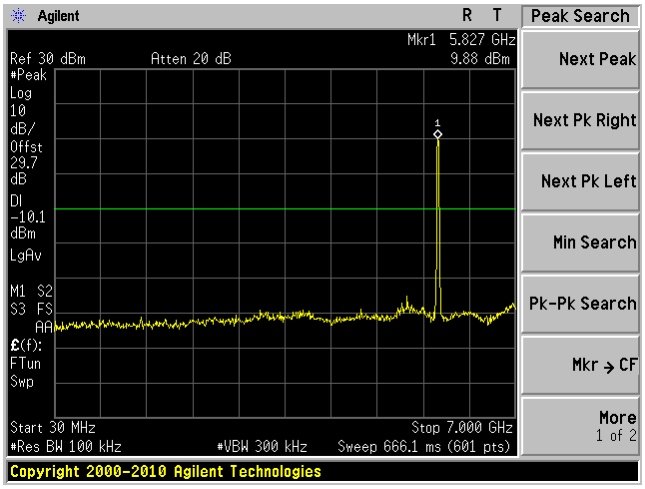
802.11n20 mode, Middle Channel, Chain J10, J8, J6
30MHz – 7GHz



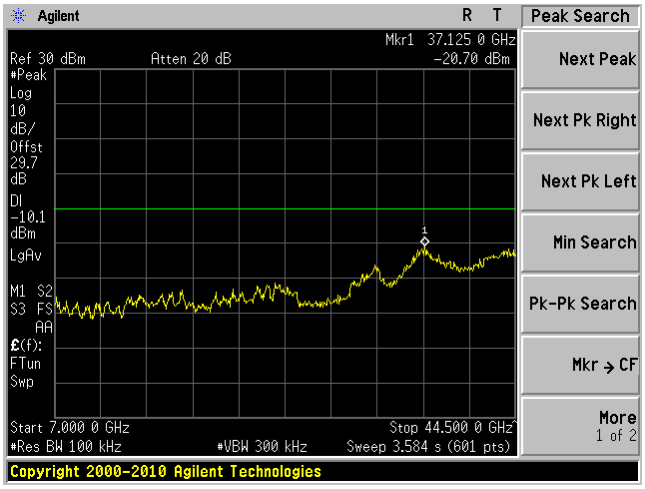
802.11n20 mode, Middle Channel, Chain J10, J8, J6
7G – 44.5 GHz



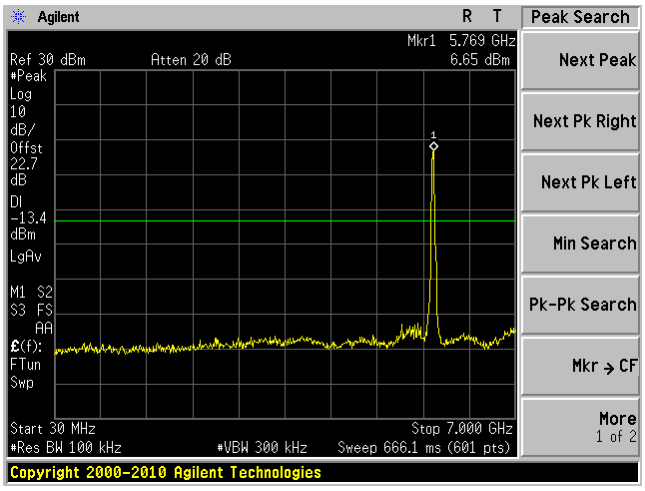
802.11n20 mode, High Channel, Chain J10, J8, J6
30MHz – 7GHz



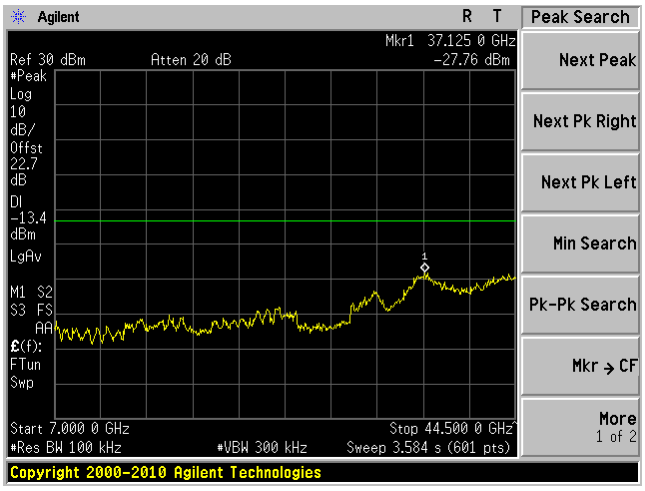
802.11n20 mode, High Channel, Chain J10, J8, J6
7G – 44.5 GHz



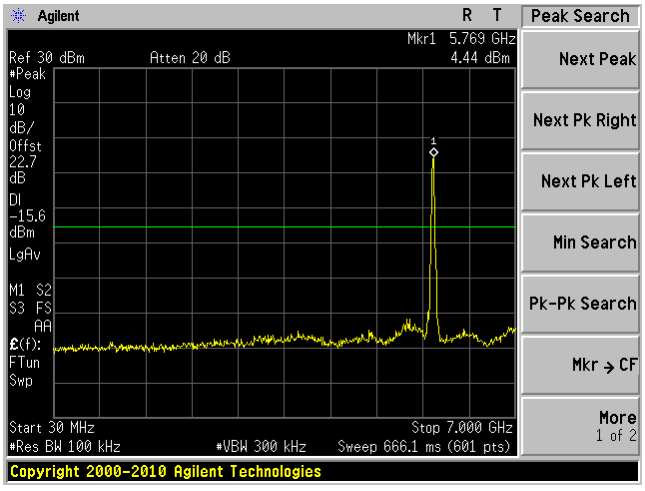
802.11n40 mode, Low Channel, Chain J10
30MHz – 7GHz



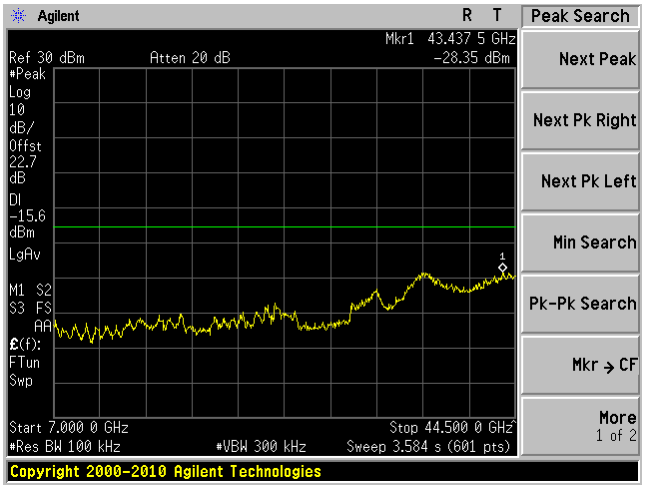
802.11n40 mode, Low Channel, Chain J10
7G – 44.5 GHz



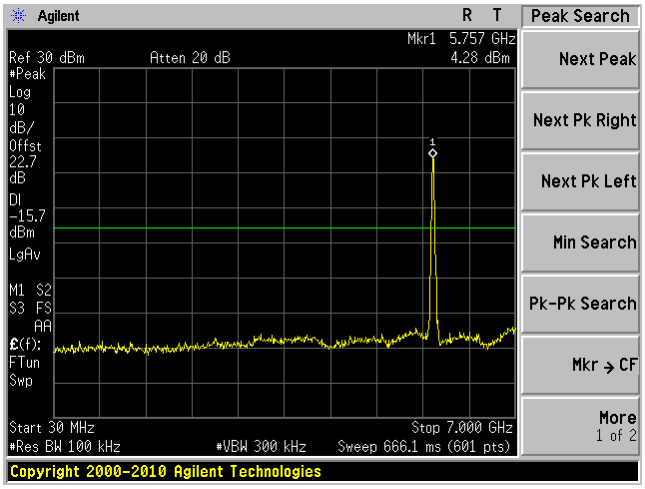
802.11n40 mode, Low Channel, Chain J8
30MHz – 7GHz



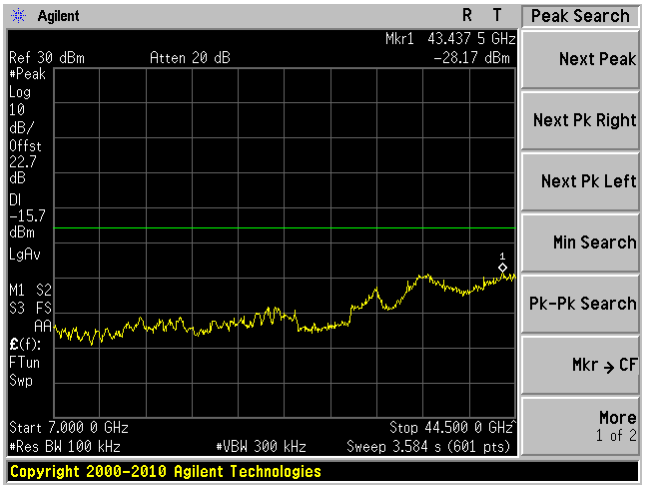
802.11n40 mode, Low Channel, Chain J8
7G – 44.5 GHz



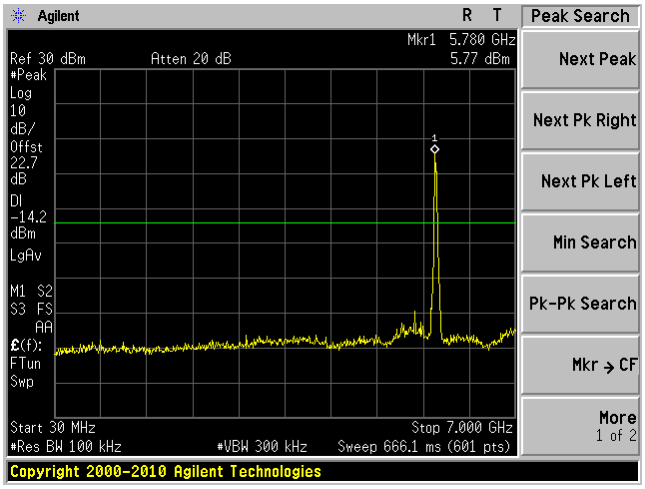
802.11n40 mode, Low Channel, Chain J6
30MHz – 7GHz



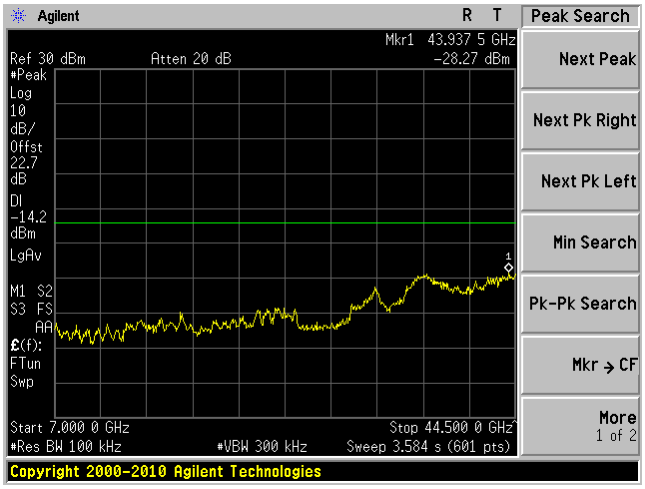
802.11n40 mode, Low Channel, Chain J6
7G – 44.5 GHz



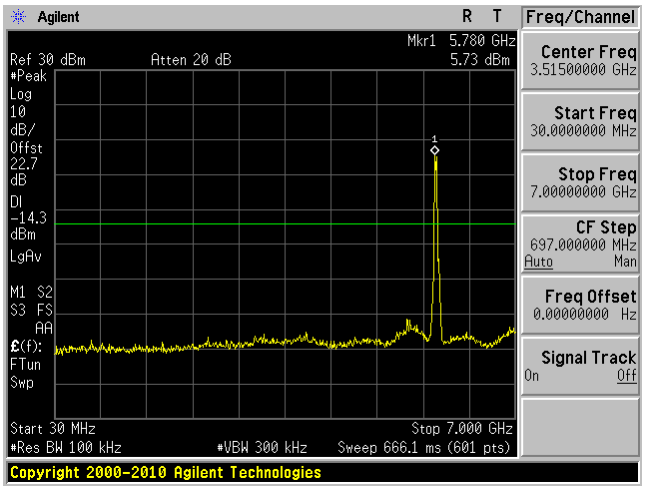
802.11n40 mode, High Channel, Chain J10
30MHz – 7GHz



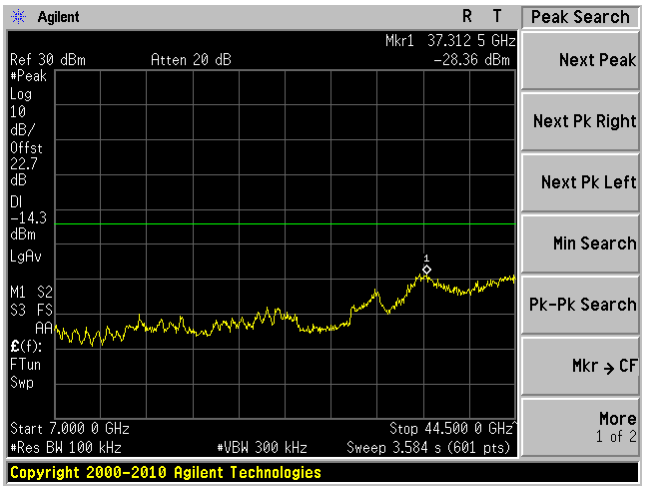
802.11n40 mode, High Channel, Chain J10
7G – 44.5 GHz



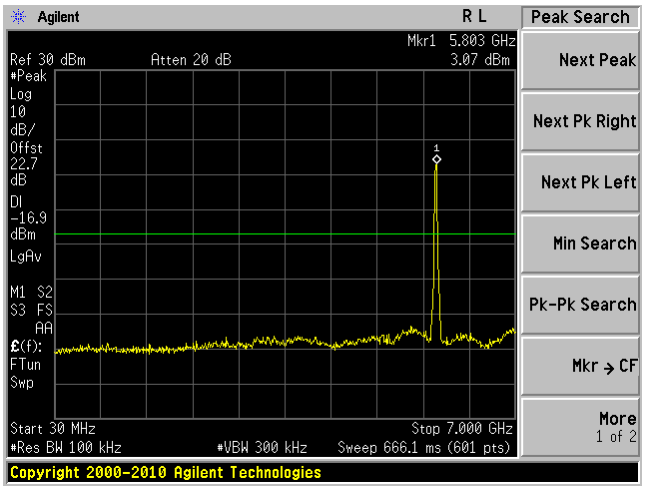
802.11 n40 mode, High Channel, Chain J8
30MHz – 7GHz



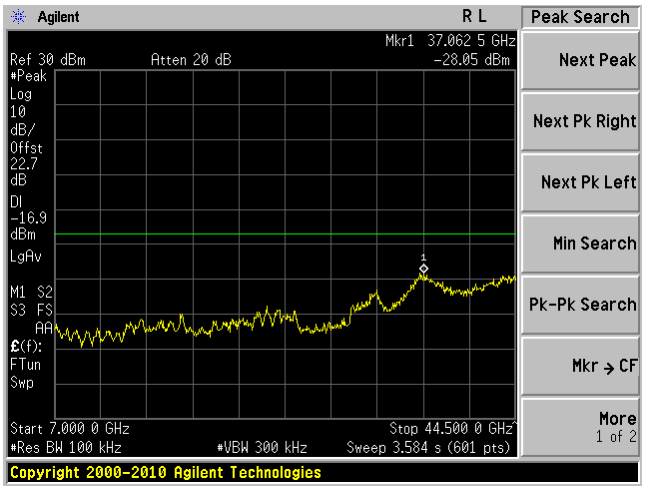
802.11 n40 mode, High Channel, Chain J8
7G – 44.5 GHz



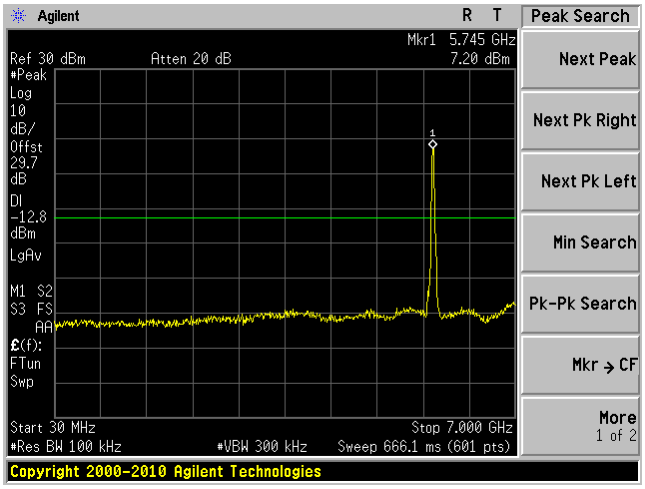
802.11n40 mode, High Channel, Chain J6
30MHz – 7GHz



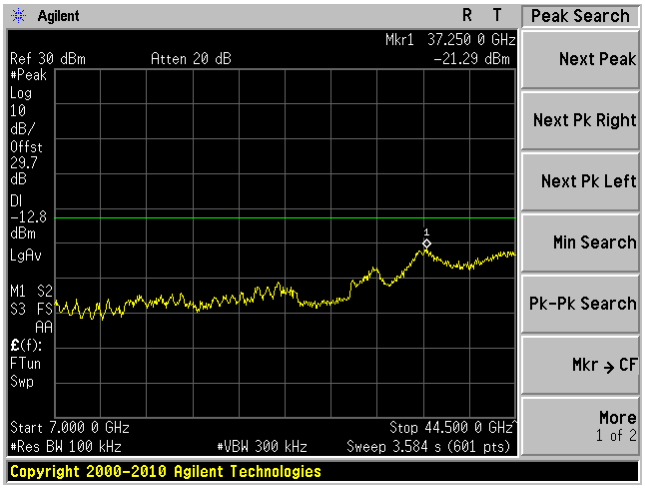
802.11n40 mode, High Channel, Chain J6
7G – 44.5 GHz



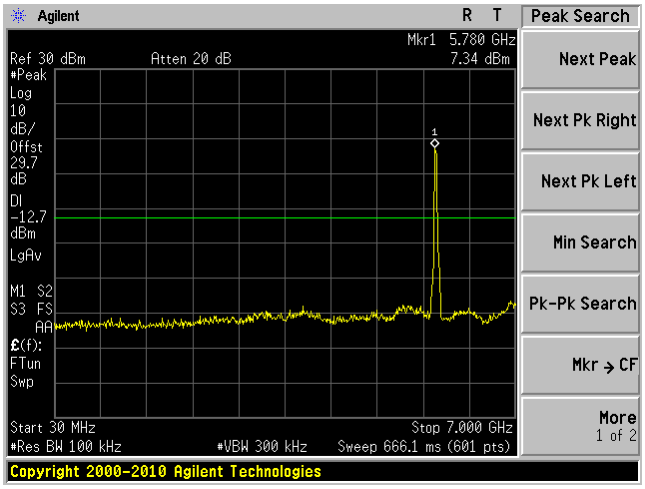
802.11n40 mode, Low Channel, Chain J10, J8, J6
30MHz – 7GHz



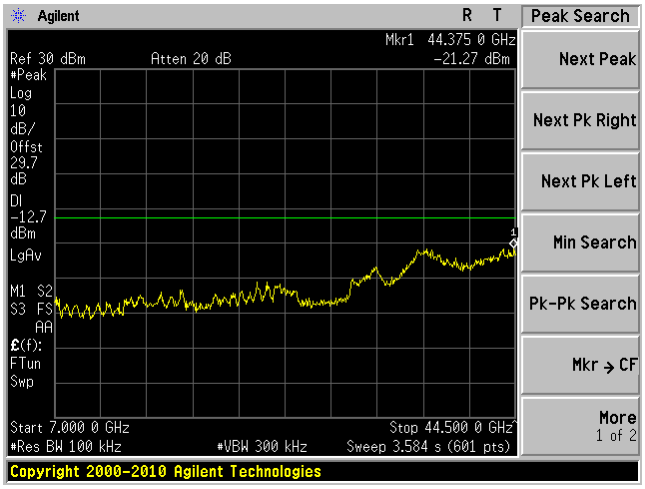
802.11n40 mode, Low Channel, Chain J10, J8, J6
7G – 44.5 GHz



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



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



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

8.1 Applicable Standard

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

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

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

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

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

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

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

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C and IC RSS-210 limits.

8.3 EUT Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15C and IC RSS-210 limits.

The spacing between the peripherals was 10 centimeters.

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

8.4 Test Procedure

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

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

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

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

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

Above 1000 MHz:

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

8.5 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 the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, the Corrected Amplitude (CA) of 40.3 dBuV/m = indicated Amplitude reading (Ai) 32.5 dBuV + Antenna Factor (AF) 23.5dB + Cable Loss (CL) 3.7 dB + Attenuator (Atten) 10 dB - Amplifier Gain (Ga) 29.4 dB

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

Margin = Corrected Amplitude - Limit

8.6 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
ARA	Horn antenna	DRG-118	1132	2010-11-29[1]
Hewlett Packard	Pre amplifier	8447D	2944A06639	2011-06-09
Mini-Circuits	Pre Amplifier	ZVA-183-S	570400946	2011-05-09

Note[1]: radiated emission above 1GHz was done on 2011-10-28 to 2011-11-01.

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

8.7 Test Environmental Conditions

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

The testing was performed by Quinn Jiang on 2011-10-28 to 2011-11-01 and 2011-28-2011 to 11-29-2011 in 5 meter chamber 3.

8.8 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 15.247 & 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)**	**Range**
-4.22	399.9975	Horizontal	30 MHz - 1 GHz

Above 1GHz:

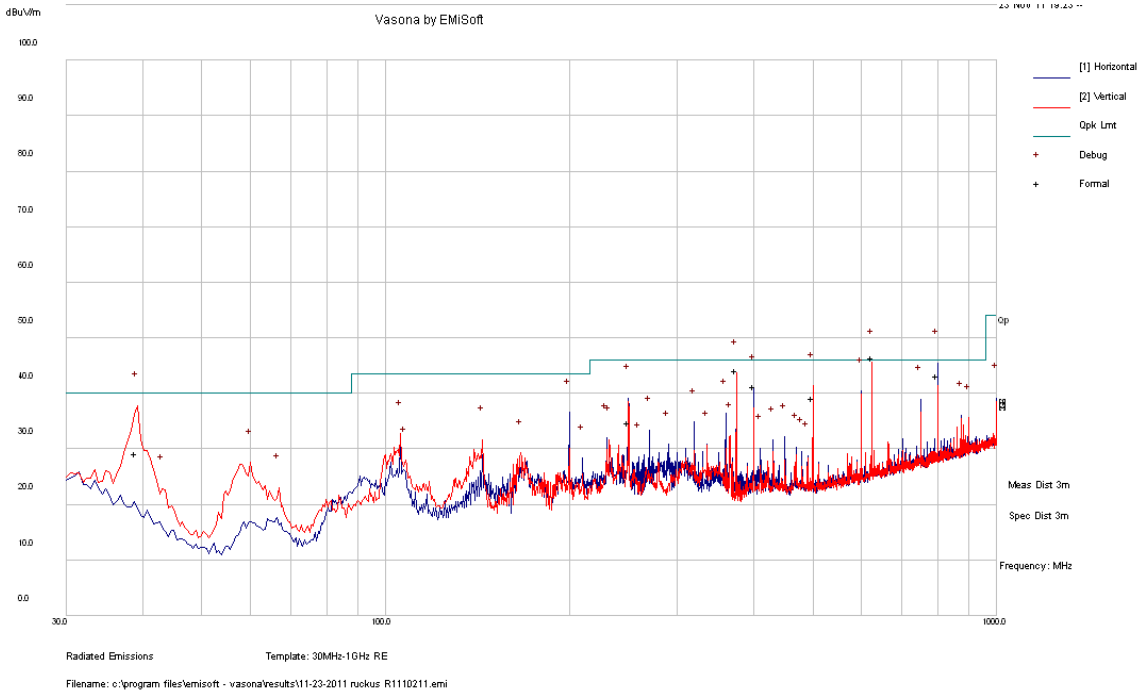
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range**
-0.37	11571	Horizontal	1 GHz - 40GHz

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

8.9 Radiated Emissions Test Result Data

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

802.11n20 mode (5745 MHz)

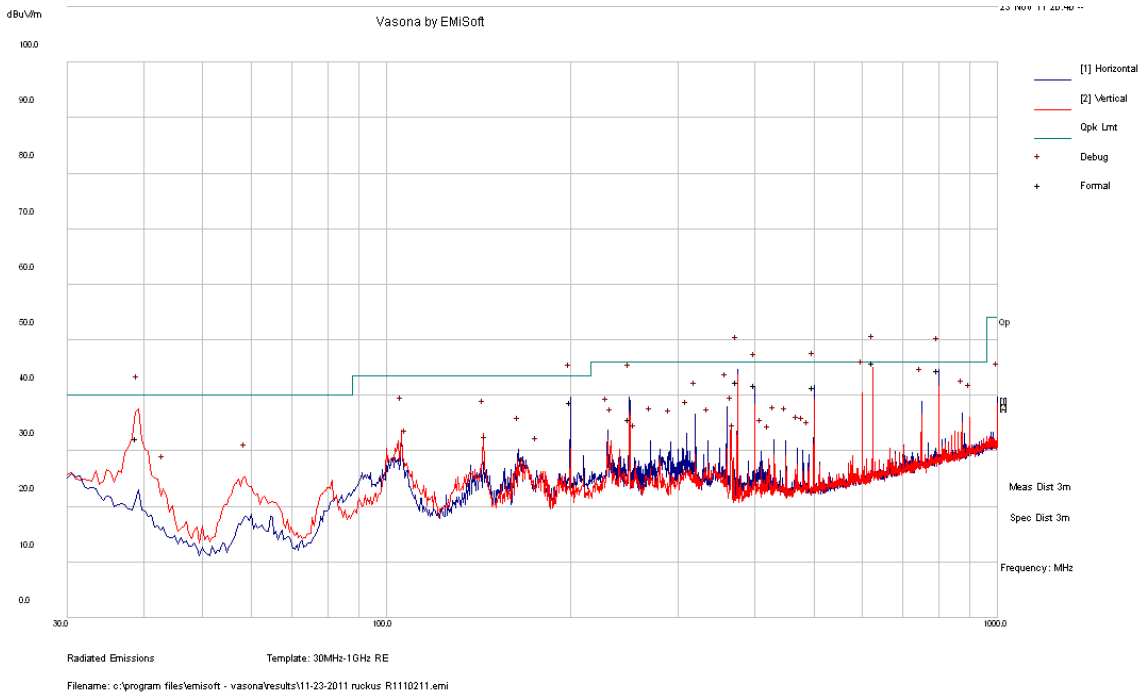


Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
399.996	41.31	227	H	200	46	-4.69
249.9453	34.83	116	H	244	46	-11.17

Note: other emissions are from the supporting board/equipments.

802.11n40 mode (5755 MHz)



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
399.9975	41.78	204	H	199	46	-4.22
249.9525	35.74	99	H	232	46	-10.26

Note: other emissions are from the supporting board/equipments.

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

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 5745 MHz, measured at 3 meters											
5440	49.8	213	129	V	34.4	5.76	27.145	62.823	74	-11.177	Peak
5400	46.06	140	130	H	34.4	5.76	27.145	59.083	74	-14.917	Peak
5440	38.200	213	129	V	34.4	5.76	27.145	51.223	54	-2.777	Ave
5400	37.000	140	130	H	34.4	5.76	27.145	50.023	54	-3.977	Ave
11491	41.41	344	102	V	40.538	9.94	27.9	63.988	74	-10.012	Peak
11491	42.06	159	169	H	40.538	9.94	27.9	64.638	74	-9.362	Peak
11491	25.54	344	102	V	40.538	9.94	27.9	48.118	54	-5.882	Ave
11491	26.64	159	169	H	40.538	9.94	27.9	49.218	54	-4.782	Ave
Middle Channel 5785 MHz measured at 3 meters											
5400	51.280	220	123	V	33.9	5.76	27.145	63.84	74	-10.160	Peak
5400	49.16	208	122	H	33.9	5.76	27.145	61.72	74	-12.280	Peak
5400	38.700	220	123	V	33.9	5.76	27.145	51.26	54	-2.740	Ave
5400	38.180	208	122	H	33.9	5.76	27.145	50.74	54	-3.260	Ave
11571	42.37	272	145	V	40.538	9.94	27.9	64.95	74	-9.05	Peak
11571	47	270	166	H	40.538	9.94	27.9	69.58	74	-4.42	Peak
11571	26.42	272	145	V	40.538	9.94	27.9	49.00	54	-5.00	Ave
11571	31.05	270	166	H	40.538	9.94	27.9	53.63	54	-0.37	Ave
High Channel 5825 MHz measured at 3 meters											
5400	49.9	227	112	V	34.4	5.76	27.145	62.92	74	-11.08	Peak
5400	46	206	125	H	34.4	5.76	27.145	59.02	74	-14.98	Peak
5400	40.50	227	112	V	34.4	5.76	27.145	53.52	54	-0.48	Ave
5400	36.92	206	125	H	34.4	5.76	27.145	49.94	54	-4.06	Ave
11648	41.18	302	145	V	40.65	9.94	27.9	63.89	74	-10.11	Peak
11648	43.6	280	145	H	40.65	9.94	27.9	66.31	74	-7.69	Peak
11648	25.7	302	145	V	40.65	9.94	27.9	48.41	54	-5.59	Ave
11648	28.02	280	145	H	40.65	9.94	27.9	50.73	54	-3.27	Ave

Note: 5400 MHz are Digital Emissions
Note: 5400 with Antenna factor 33.9 dB was tested using 3115 horn antenna
Note: 5400 with Antenna factor 34.4 dB was tested using DRG-118 horn antenna

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 5745 MHz, measured at 3 meters											
5400	50.350	223	124	V	33.9	5.76	27.145	62.910	74	-11.090	Peak
5400	47.86	209	122	H	33.9	5.76	27.145	60.420	74	-13.580	Peak
5400	39.090	223	124	V	33.9	5.76	27.145	51.650	54	-2.350	Ave
5400	36.020	209	122	H	33.9	5.76	27.145	48.580	54	-5.420	Ave
11490	41.75	53	200	V	40.538	9.94	27.9	64.328	74	-9.672	Peak
11490	45.67	360	162	H	40.538	9.94	27.9	68.248	74	-5.752	Peak
11490	27.06	53	200	V	40.538	9.94	27.9	49.638	54	-4.362	Ave
11490	30.06	360	162	H	40.538	9.94	27.9	52.638	54	-1.362	Ave
Middle Channel 5785 MHz measured at 3 meters											
5400	51.540	222	124	V	33.9	5.76	27.145	64.100	74	-9.900	Peak
5400	48.07	209	123	H	33.9	5.76	27.145	60.630	74	-13.370	Peak
5400	40.780	222	124	V	33.9	5.76	27.145	53.340	54	-0.660	Ave
5400	37.290	209	123	H	33.9	5.76	27.145	49.850	54	-4.150	Ave
11567	41.04	180	175	V	40.538	9.94	27.9	63.62	74	-10.38	peak
11567	42.25	69	176	H	40.538	9.94	27.9	64.83	74	-9.17	Peak
11567	26.34	180	175	V	40.538	9.94	27.9	48.92	54	-5.08	Ave
11567	28.15	69	176	H	40.538	9.94	27.9	50.73	54	-3.27	Ave
High Channel 5825 MHz measured at 3 meters											
5400	51.850	217	123	V	33.9	5.76	27.145	64.410	74	-9.590	Peak
5400	49.11	208	123	H	33.9	5.76	27.145	61.670	74	-12.330	Peak
5400	40.370	217	123	V	33.9	5.76	27.145	52.930	54	-1.070	Ave
5400	38.210	208	123	H	33.9	5.76	27.145	50.770	54	-3.230	Ave
11648	40.34	128	100	V	40.65	9.94	27.9	63.05	74	-10.95	Peak
11648	42.17	357	170	H	40.65	9.94	27.9	64.88	74	-9.12	Peak
11648	25.48	128	100	V	40.65	9.94	27.9	48.19	54	-5.81	Ave
11648	28.6	357	170	H	40.65	9.94	27.9	51.31	54	-2.69	Ave

Note: 5400 MHz are Digital Emissions
Note: 5400 with Antenna factor 33.9 dB was tested using 3115 horn antenna
Note: 5400 with Antenna factor 34.4 dB was tested using DRG-118 horn antenna

802.11n40

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 5755 MHz, measured at 3 meters											
5400	48.280	224	126	V	33.9	5.76	27.145	60.840	74	-13.160	Peak
5400	48.55	209	122	H	33.9	5.76	27.145	61.110	74	-12.890	Peak
5400	37.050	224	126	V	33.9	5.76	27.145	49.610	54	-4.390	Ave
5400	36.510	209	122	H	33.9	5.76	27.145	49.070	54	-4.930	Ave
11511	40.88	357	159	V	40.538	9.94	27.9	63.46	74	-10.54	Peak
11511	38.01	129	100	H	40.538	9.94	27.9	60.59	74	-13.41	Peak
11511	26.31	357	159	V	40.538	9.94	27.9	48.89	54	-5.11	Ave
11511	23.86	129	100	H	40.538	9.94	27.9	46.44	54	-7.56	Ave
Middle Channel 5795 MHz measured at 3 meters											
5400	52.280	223	111	V	33.9	5.76	27.145	64.840	74	-9.160	Peak
5400	49.29	208	124	H	33.9	5.76	27.145	61.850	74	-12.150	Peak
5400	40.780	223	111	V	33.9	5.76	27.145	53.340	54	-0.660	Ave
5400	35.950	208	124	H	33.9	5.76	27.145	48.510	54	-5.490	Ave
11587	38.78	221	168	V	40.65	9.94	27.9	61.49	74	-12.51	Peak
11587	41.24	97	169	H	40.65	9.94	27.9	63.95	74	-10.05	Peak
11587	23.91	221	168	V	40.65	9.94	27.9	46.62	54	-7.38	Ave
11587	26.7	97	169	H	40.65	9.94	27.9	49.41	54	-4.59	Ave

Note: 5400 MHz are Digital Emissions
Note: 5400 with Antenna factor 33.9 dB was tested using 3115 horn antenna
Note: 5400 with Antenna factor 34.4 dB was tested using DRG-118 horn antenna

(3) Spurious Emissions in the Restricted Bands

802.11a mode

Low Channel 5745 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)	
5440	49.8	213	129	V	34.4	5.76	27.145	62.823	74	-11.177	Peak
5400	46.06	140	130	H	34.4	5.76	27.145	59.083	74	-14.917	Peak
5440	38.200	213	129	V	34.4	5.76	27.145	51.223	54	-2.777	Ave
5400	37.000	140	130	H	34.4	5.76	27.145	50.023	54	-3.977	Ave

802.11n20 mode

Low Channel 5745 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)	
5400	50.350	223	124	V	33.9	5.76	27.145	62.910	74	-11.090	Peak
5400	47.86	209	122	H	33.9	5.76	27.145	60.420	74	-13.580	Peak
5400	39.090	223	124	V	33.9	5.76	27.145	51.650	54	-2.350	Ave
5400	36.020	209	122	H	33.9	5.76	27.145	48.580	54	-5.420	Ave

802.11 n40 mode

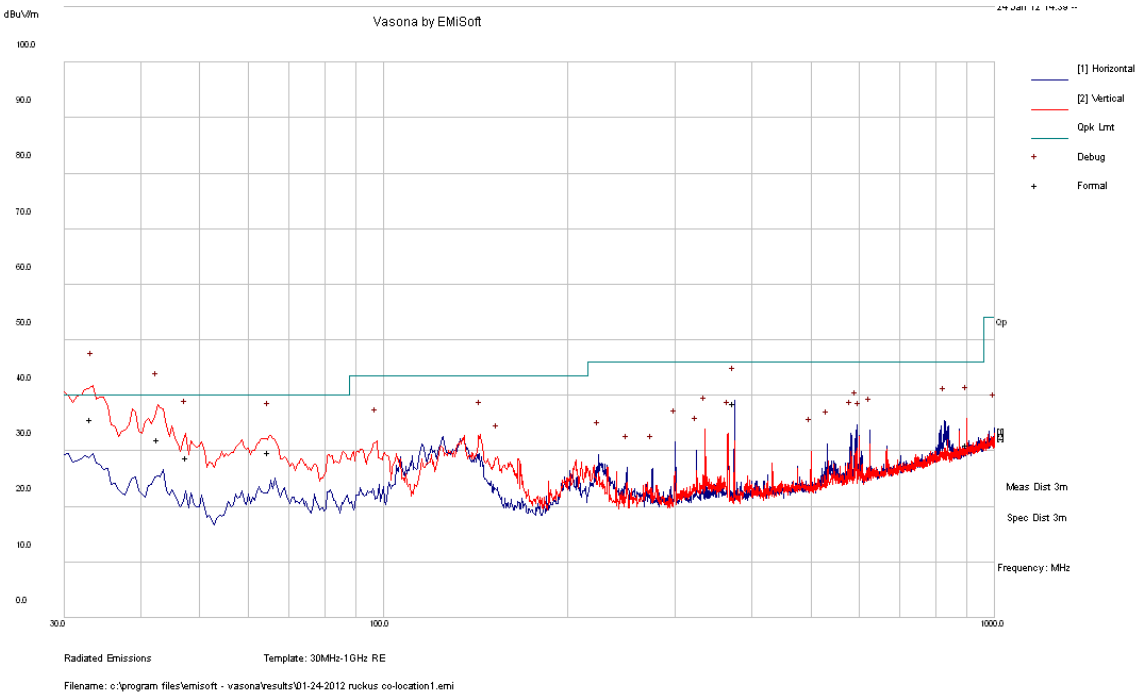
Low Channel 5755 MHz, measured at 3 meters

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)	
5400	48.280	224	126	V	33.9	5.76	27.145	60.840	74	-13.160	Peak
5400	48.55	209	122	H	33.9	5.76	27.145	61.110	74	-12.890	Peak
5400	37.050	224	126	V	33.9	5.76	27.145	49.610	54	-4.390	Ave
5400	36.510	209	122	H	33.9	5.76	27.145	49.070	54	-4.930	Ave

Note: 5400 MHz are Digital Emissions
Note: 5400 with Antenna factor 33.9 dB was tested using 3115 horn antenna
Note: 5400 with Antenna factor 34.4 dB was tested using DRG-118 horn antenna

(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; 5.8 GHz: 5745 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)
33.2095	35.78	132	V	190	40	-4.22
42.803	32.06	135	V	28	40	-7.94
47.56975	28.92	117	V	39	40	-11.08
374.9943	38.68	99	H	130	46	-7.32
64.7805	29.85	110	V	8	40	-10.15
899.962	31.15	99	V	117	46	-14.85

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

9 FCC §15.247(a)(2) & IC RSS-210 §A8.2 – 6 dB & 99% Emission Bandwidth

9.1 Applicable Standard

According to FCC §15.247(a)(2) and IC RSS-210 §A8.2 (a), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	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:	21~24 °C
Relative Humidity:	38~45 %
ATM Pressure:	101.2-102 kPa

The testing was performed by Quinn Jiang on 11-12-2011 to 11-14-2011 in RF site.

802.11a mode

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (kHz)	Results
Chain J10					
Low	5745	16.670	16.5465	> 500	Compliant
Middle	5785	16.690	16.6121	> 500	Compliant
High	5825	16.688	16.5835	> 500	Compliant
Chain J8					
Low	5745	16.701	16.5527	> 500	Compliant
Middle	5785	16.674	16.5595	> 500	Compliant
High	5825	16.704	16.5469	> 500	Compliant
Chain J6					
Low	5745	16.720	16.5449	> 500	Compliant
Middle	5785	16.706	16.5577	> 500	Compliant
High	5825	16.706	16.5396	> 500	Compliant

802.11n 20 mode

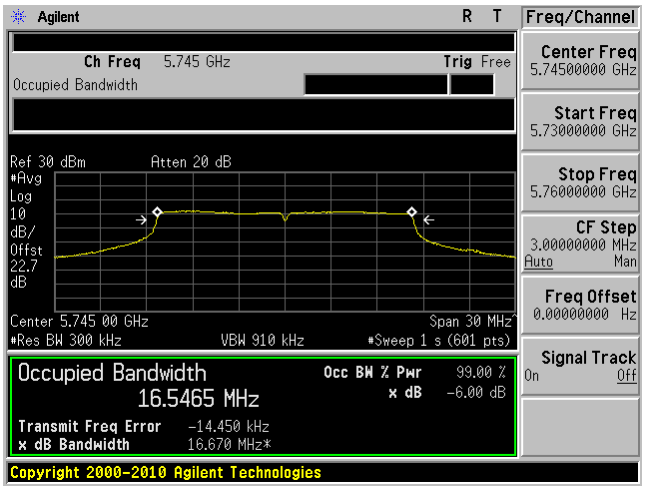
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (kHz)	Results
Chain J10					
Low	5745	17.960	17.8279	> 500	Compliant
Middle	5785	17.894	17.7990	> 500	Compliant
High	5825	19.939	17.7983	> 500	Compliant
Chain J8					
Low	5745	17.934	17.7626	> 500	Compliant
Middle	5785	17.934	17.7659	> 500	Compliant
High	5825	17.932	17.7644	> 500	Compliant
Chain J6					
Low	5745	17.942	17.7256	> 500	Compliant
Middle	5785	17.926	17.7363	> 500	Compliant
High	5825	17.921	17.7585	> 500	Compliant

802.11n40 mode

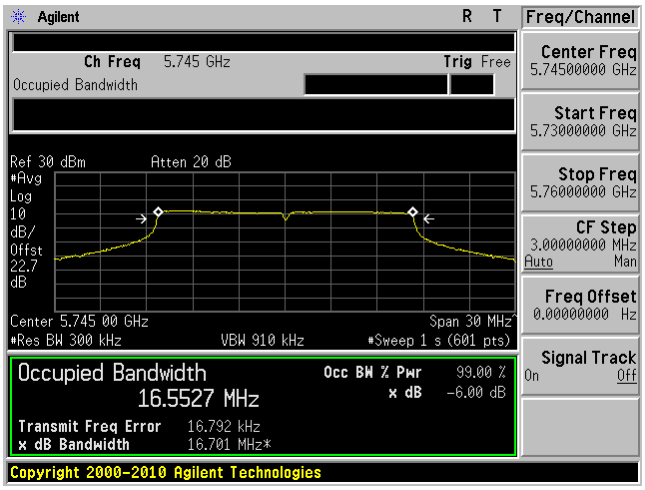
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (kHz)	Results
Chain J10					
Low	5755	36.818	36.3995	> 500	Compliant
High	5795	36.733	36.3732	> 500	Compliant
Chain J8					
Low	5755	36.779	36.3355	> 500	Compliant
High	5795	36.828	36.3234	> 500	Compliant
Chain J6					
Low	5755	36.790	36.3517	> 500	Compliant
High	5795	36.801	36.3282	> 500	Compliant

5725 MHz – 5845 MHz

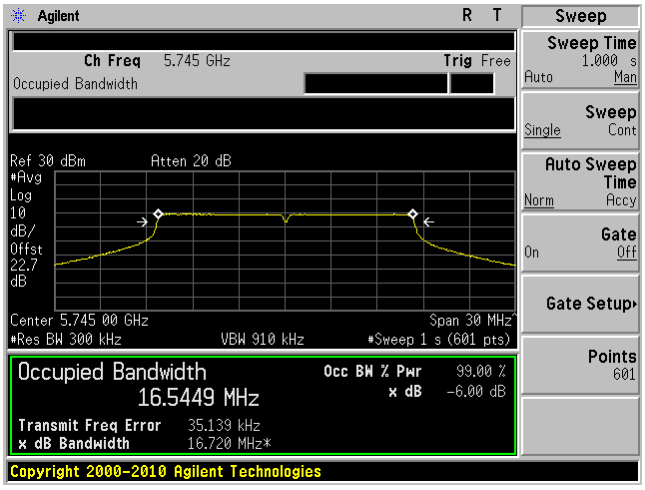
802.11a mode, Low Channel, Chain J10



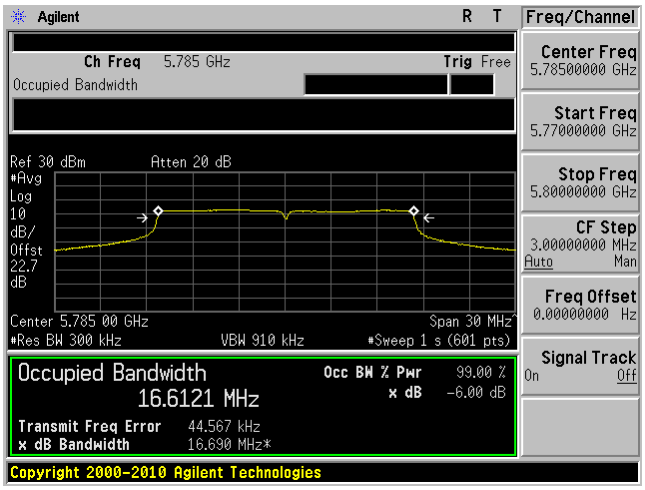
802.11 a mode, Low Channel, Chain J8



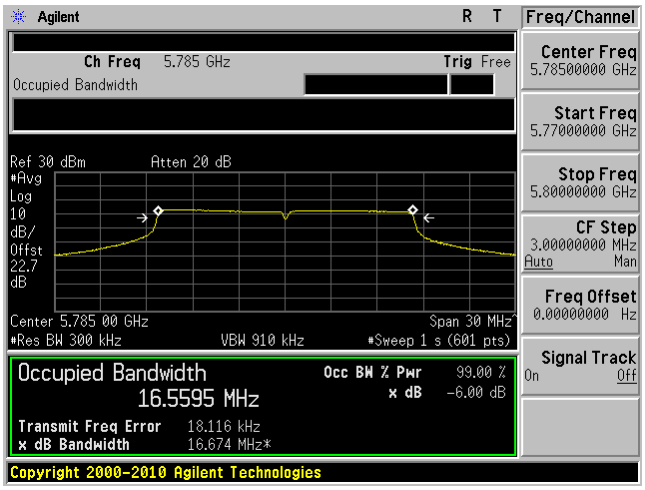
802.11a mode, Low Channel, Chain J6



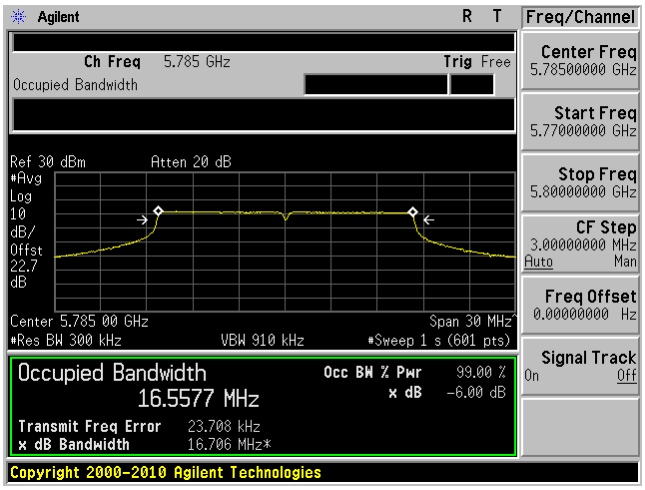
802.11a mode, Mid Channel, Chain J10



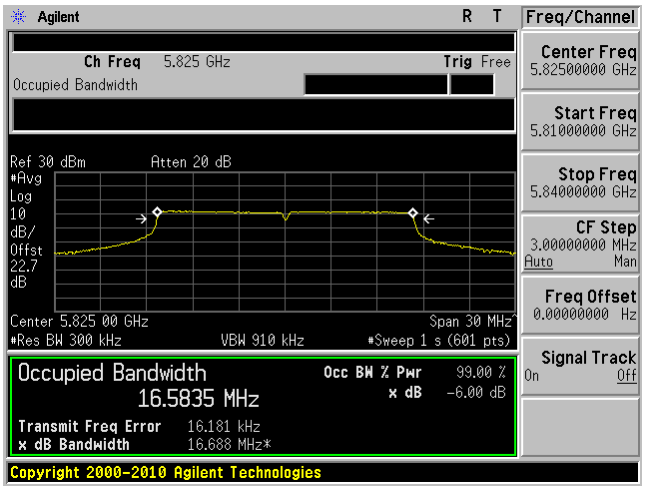
802.11a mode, Mid Channel, Chain J8



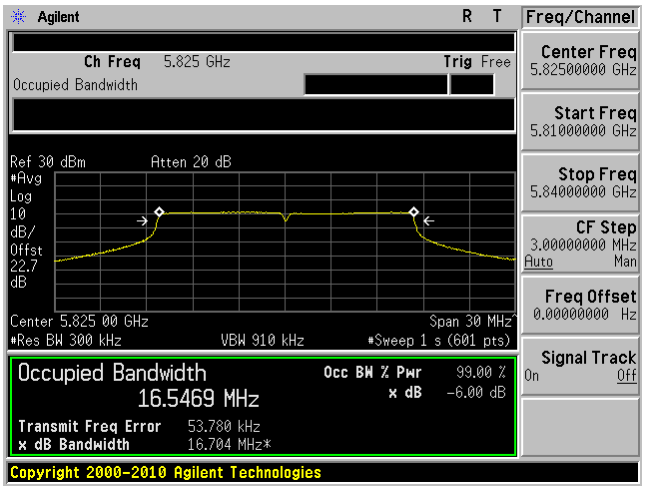
802.11a mode, Mid Channel, Chain J6



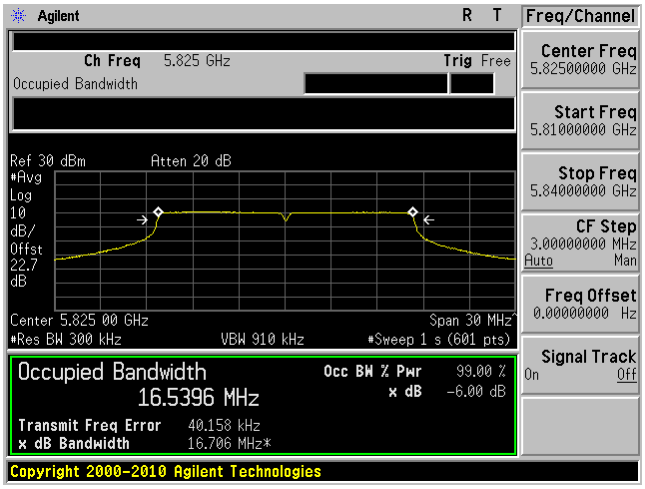
802.11a mode, High Channel, Chain J10



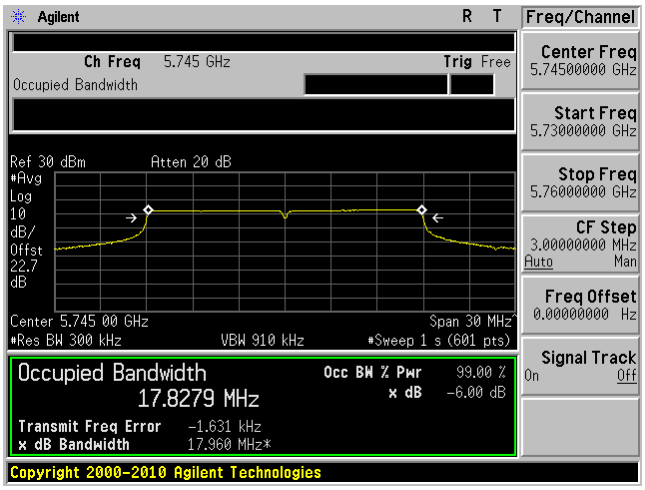
802.11a mode, High Channel, Chain J8



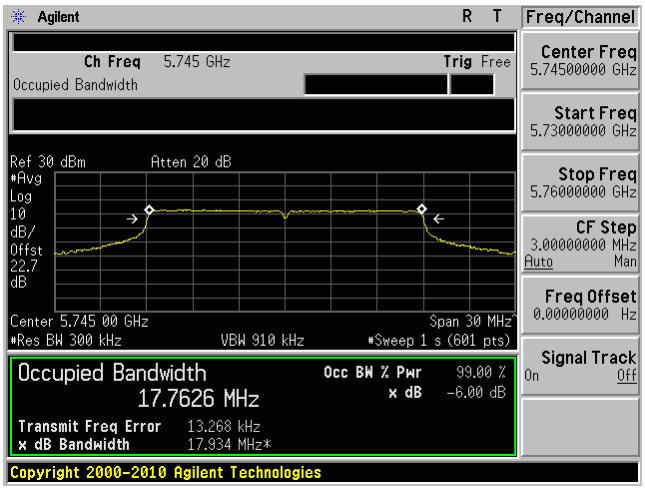
802.11a mode, High Channel, Chain J6



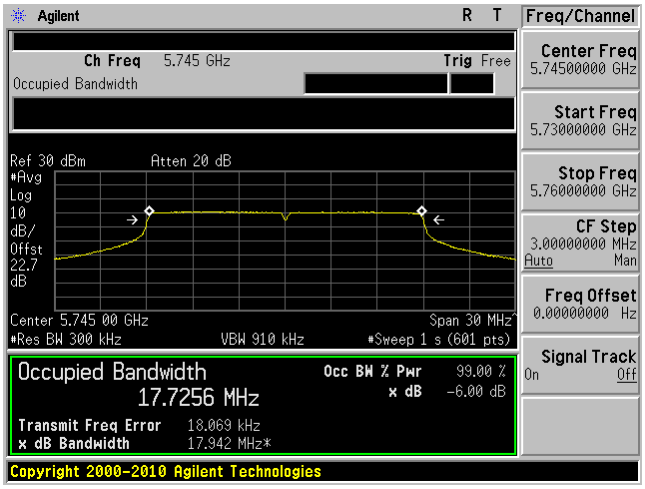
802.11n20 mode, Low Channel, Chain J10



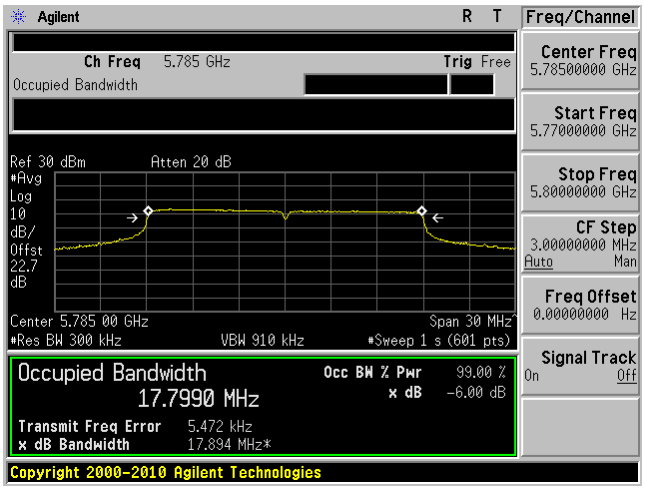
802.11n20 mode, Low Channel, Chain J8



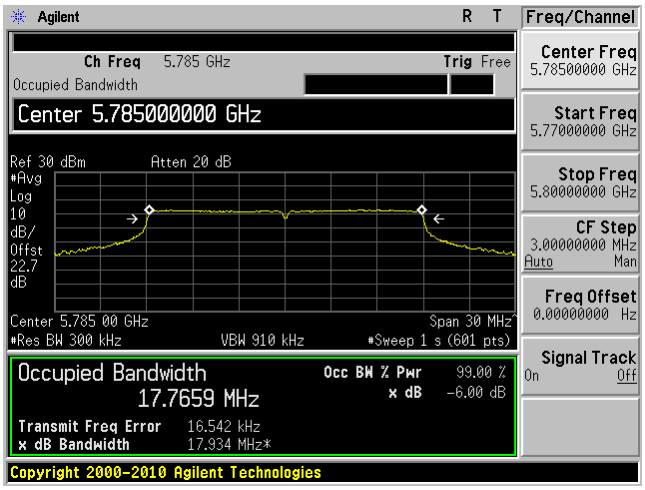
802.11n20 mode, Low Channel, Chain J6



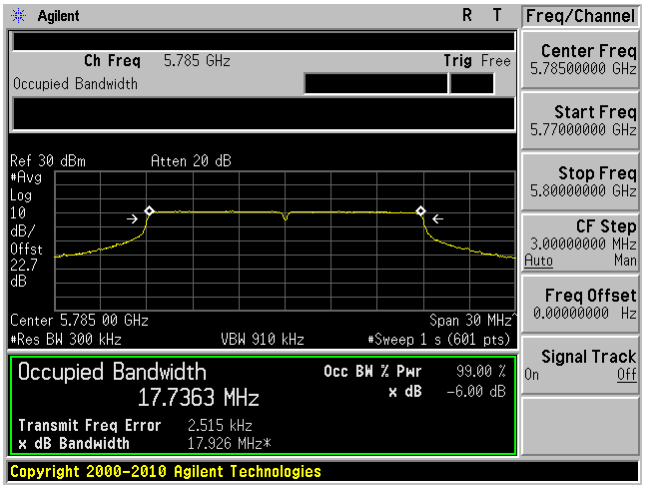
802.11n20 mode, Middle Channel, Chain J10



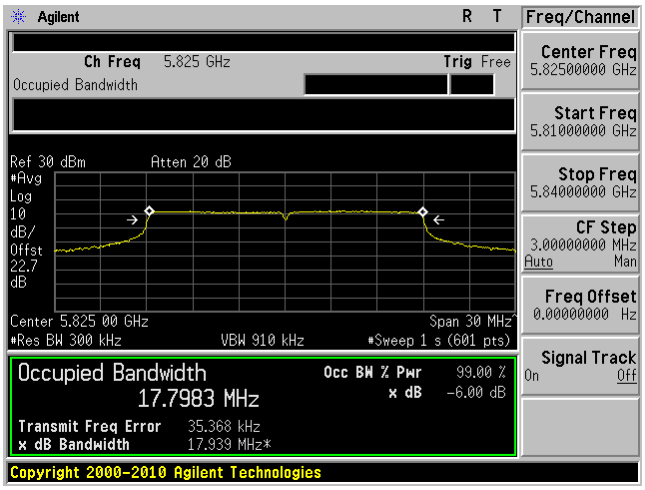
802.11n20 mode, Middle Channel, Chain J8



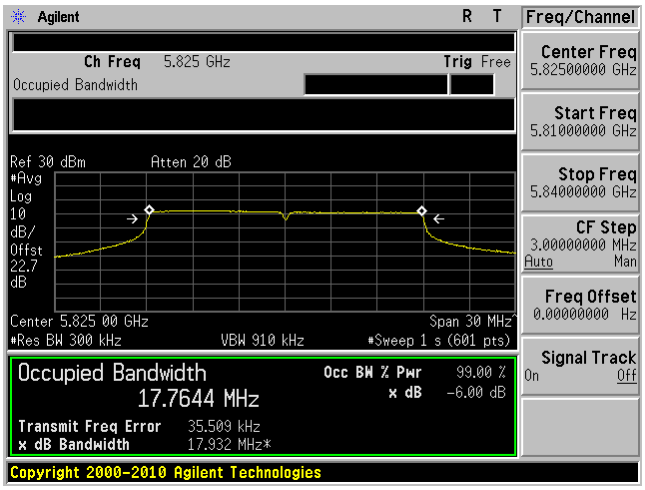
802.11n20 mode, Middle Channel, Chain J6



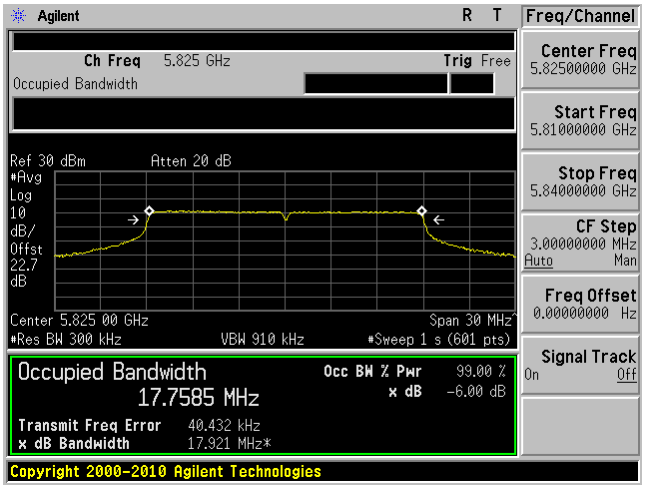
802.11n20 mode, High Channel, Chain J10



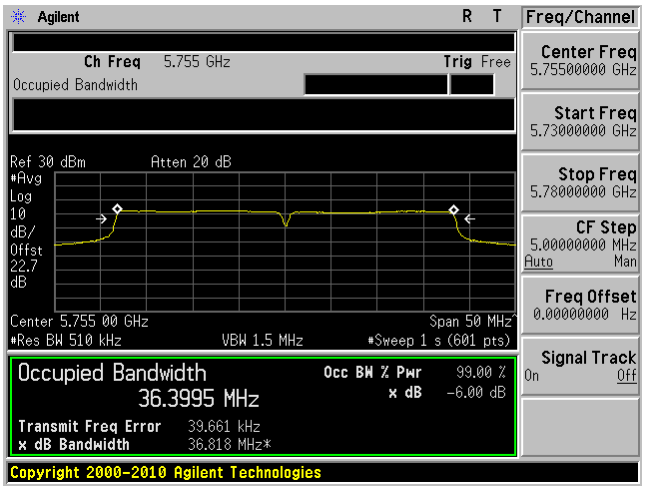
802.11 n 20 mode, High Channel, Chain J8



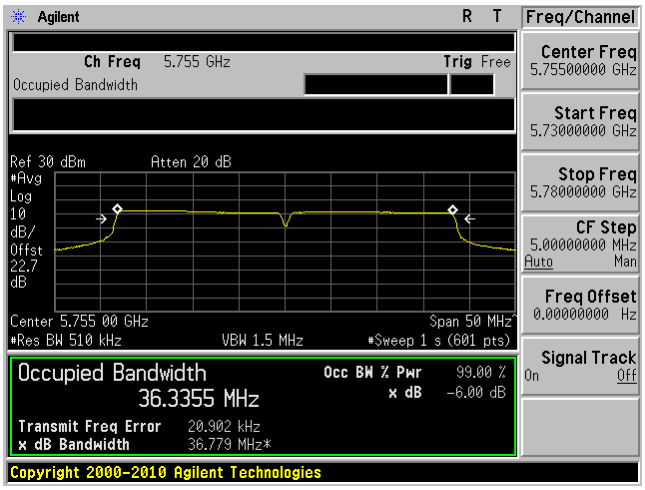
802.11n20 mode, High Channel, Chain J6



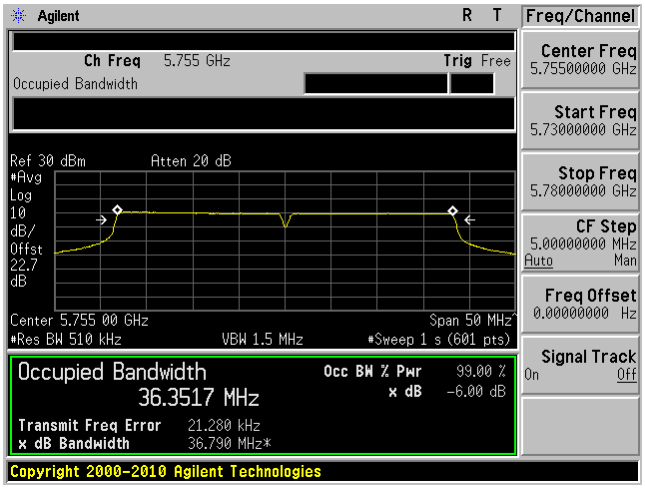
802.11n40 mode, Low Channel, Chain J10



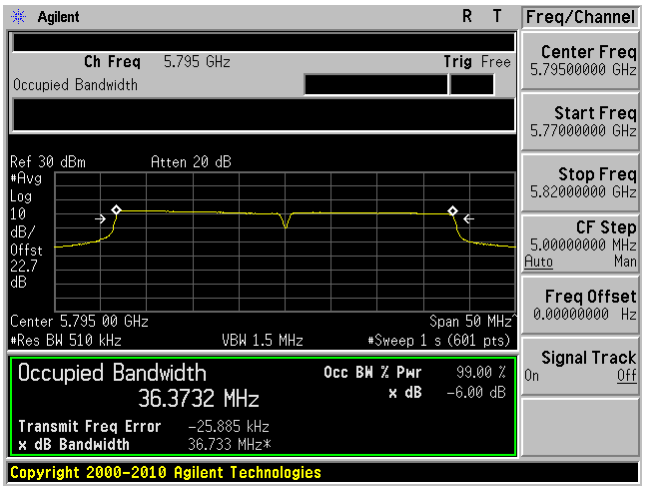
802.11n40 mode, Low Channel, Chain J8



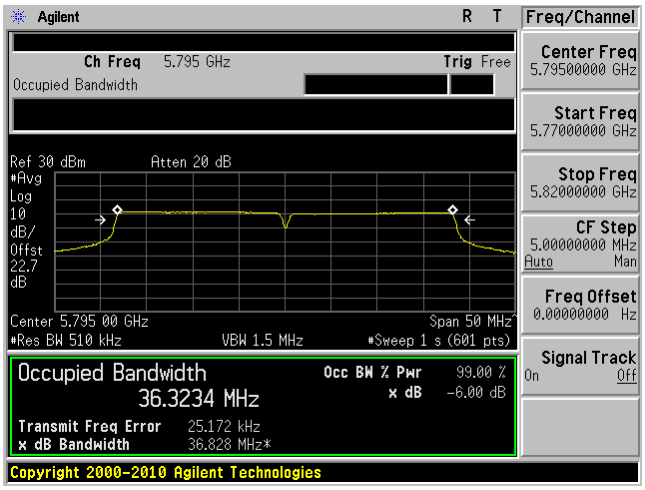
802.11n40 mode, Low Channel, Chain J6



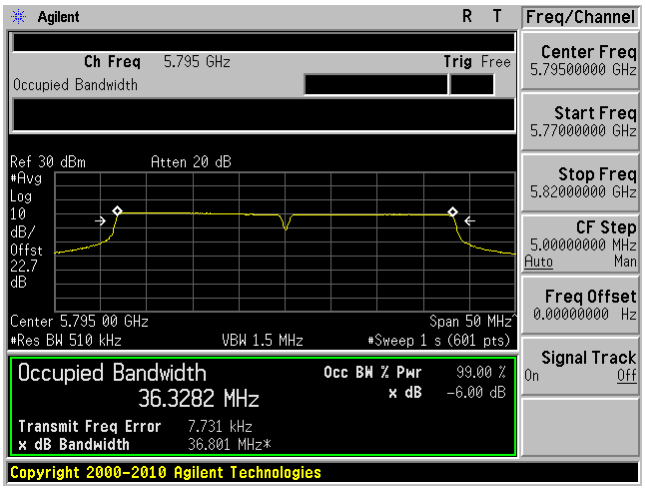
802.11n40 mode, High Channel, Chain J10



802.11n 40 mode, High Channel, Chain J8



802.11n40 mode, High Channel, Chain J6



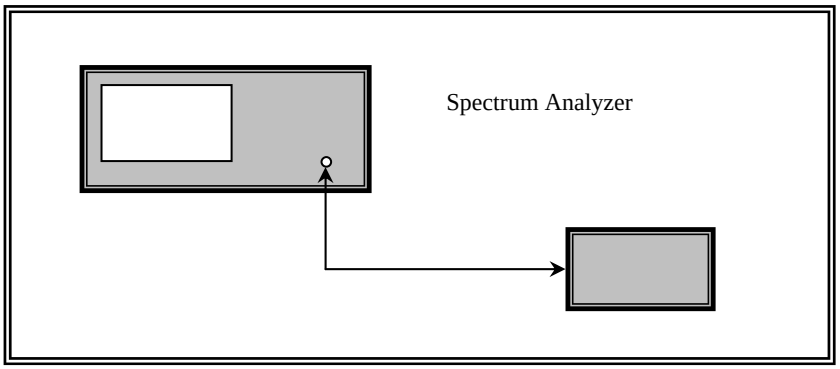
10 FCC §15.247(b) & IC RSS-210 §A8.4 - Peak Output Power Measurement

10.1 Applicable Standard

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

10.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.



10.3 Test Equipment List and Details

Manufacturers	Description	Models	Serial Numbers	Calibration Dates
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:	21~24 °C
Relative Humidity:	38~45 %
ATM Pressure:	101.2-102 kPa

The testing was performed by Quinn Jiang on 11-12-2011 to 11-14-2011 in RF site.

10.5 Test Results

5.8 GHz Band, 802.11a mode

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
Low	5745	18.04	17.99	16.38	22.31	30	-7.69	19
Middle	5785	19.12	18.45	18.07	23.34	30	-6.66	21
High	5825	18	17.93	16.98	22.43	30	-7.57	20

5.8 GHz Band, 802.11n20 mode

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
Low	5745	19.59	19.29	18.07	23.81	30	-6.19	21
Middle	5785	19.14	19.03	18.05	23.54	30	-6.46	21
High	5825	18.83	18.9	18.07	23.39	30	-6.61	21

5.8 GHz Band, 802.11n40 mode

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
Low	5755	19.56	19.23	17.9	23.73	30	-6.27	21
High	5795	18.88	18.87	17.78	23.31	30	-6.69	21

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

11.1 Applicable Standard

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

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

11.2 Measurement Procedure

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

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	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:	21~24 °C
Relative Humidity:	38~45 %
ATM Pressure:	101.2-102 kPa

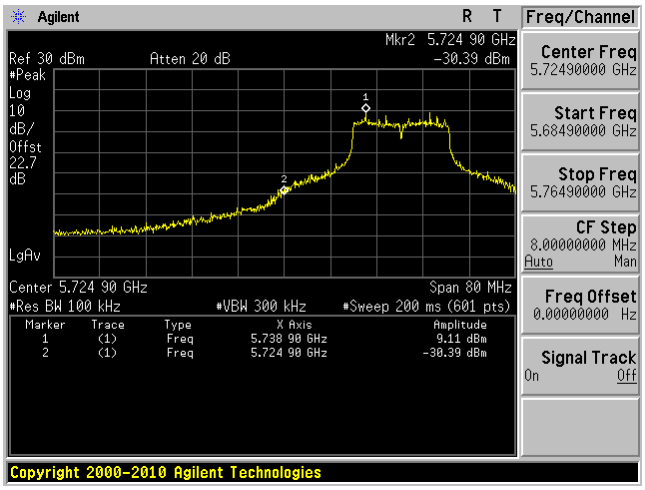
The testing was performed by Quinn Jiang on 11-12-2011 to 11-14-2011 in RF site.

11.5 Test Results

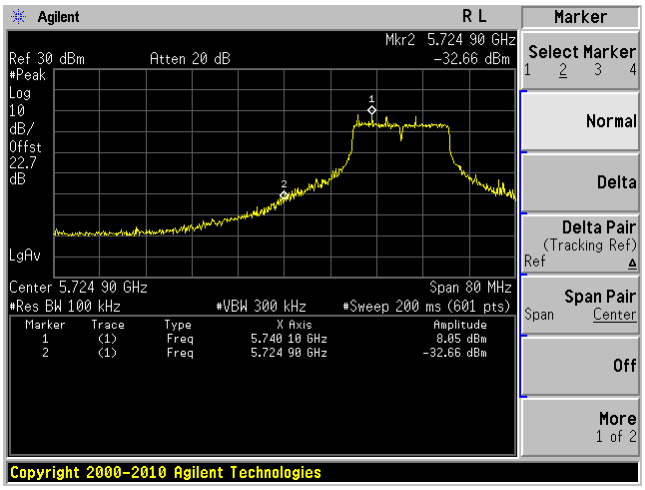
Please refer to following pages for plots of band edge.

5725 – 5845 MHz

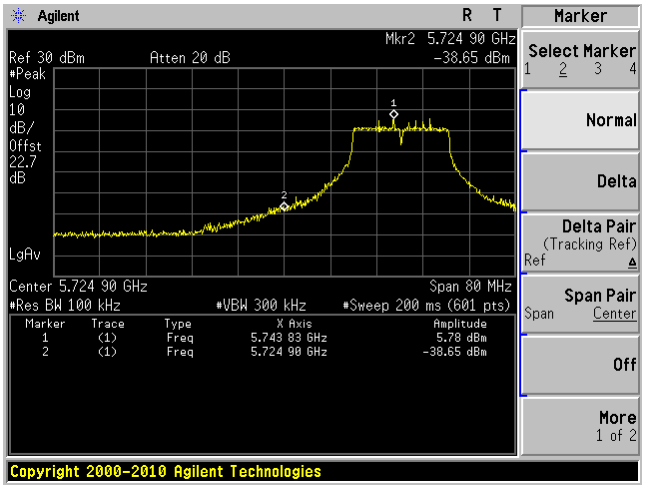
802.11a mode, Lowest Channel, Chain J10



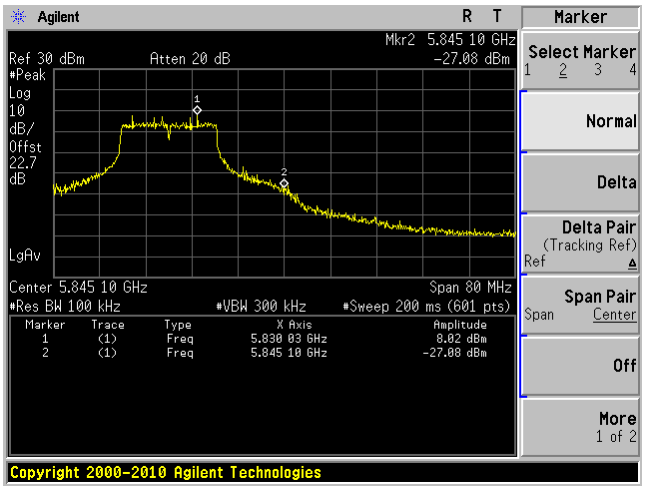
802.11a mode, Lowest Channel, Chain J8



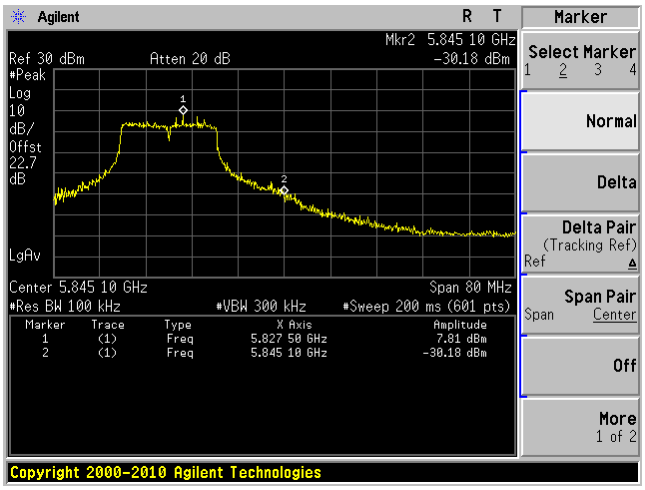
802.11 a mode, Lowest Channel, Chain J6



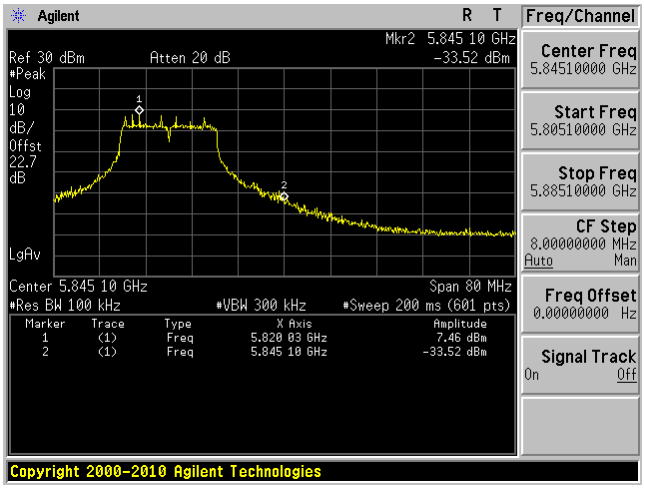
802.11a mode, Highest Channel, Chain J10



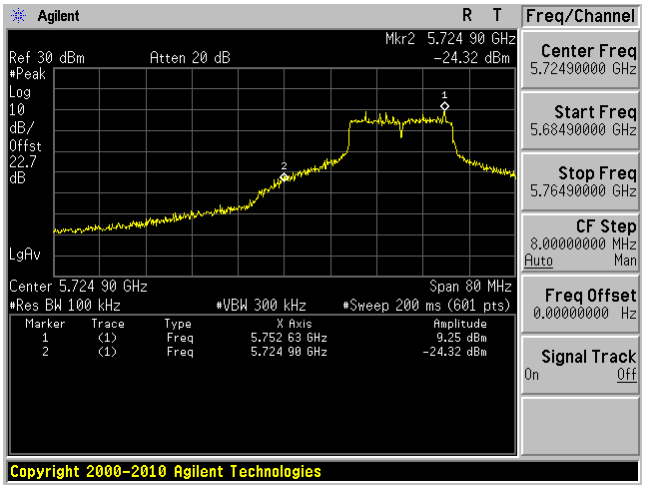
802.11a mode, Highest Channel, Chain J8



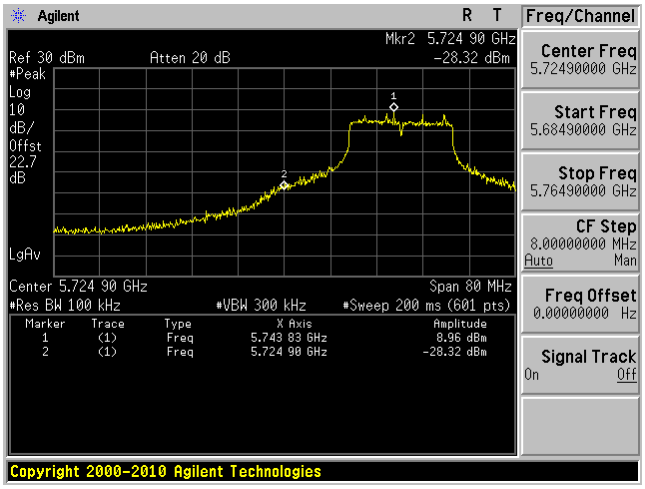
802.11a mode, Highest Channel, Chain J6



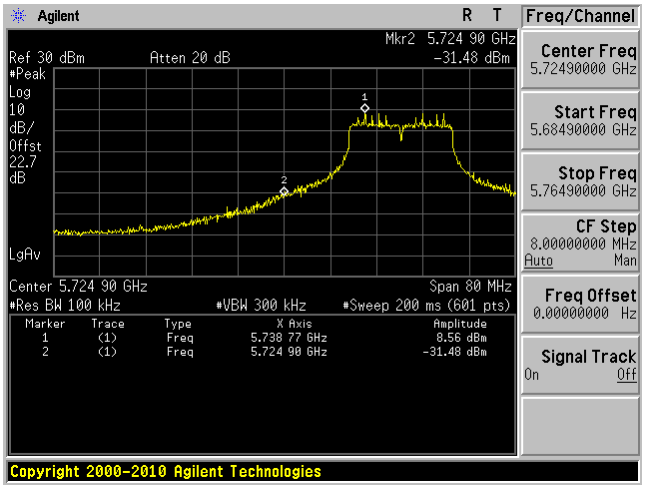
802.11n20 mode, Lowest Channel, Chain J10



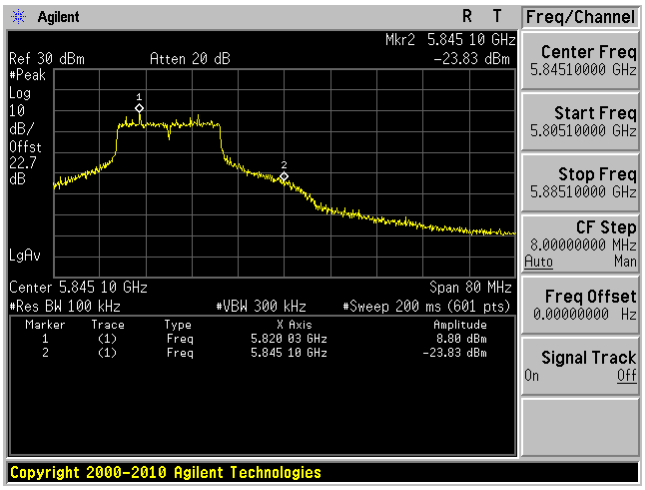
802.11n20 mode, Lowest Channel, Chain J8



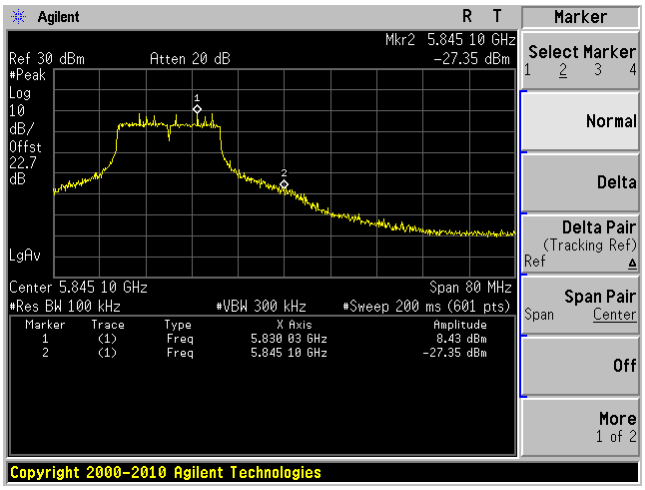
802.11n20 mode, Lowest Channel, Chain J6



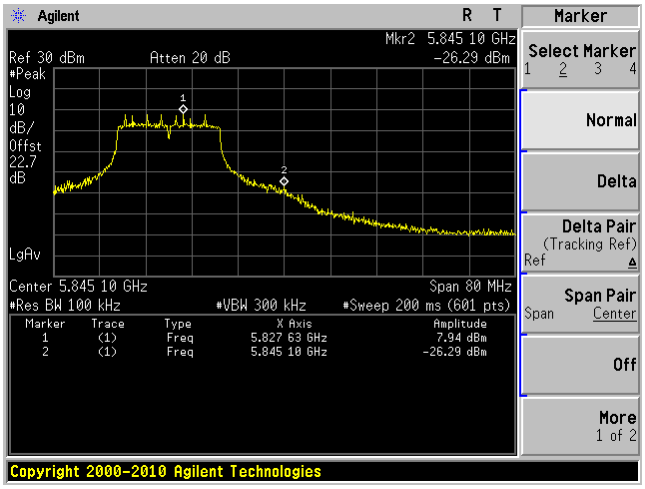
802.11n20 mode, Highest Channel, Chain J10



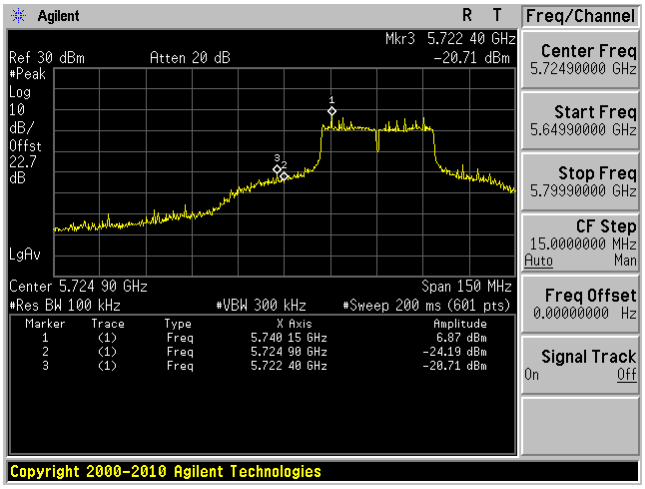
802.11n20 mode, Highest Channel, Chain J8



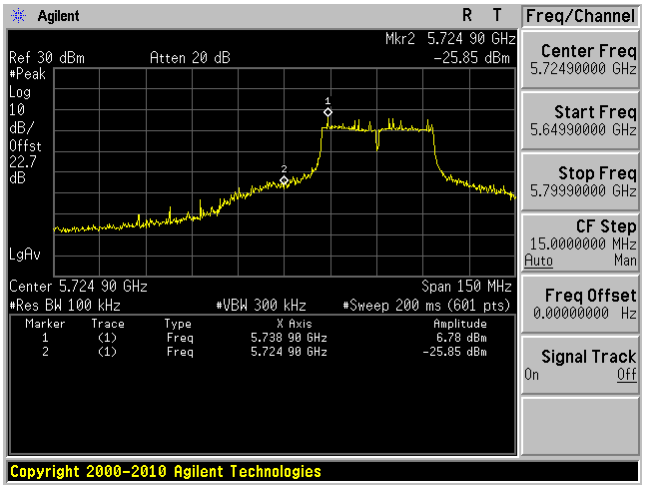
802.11n20 mode, Highest Channel, Chain J6



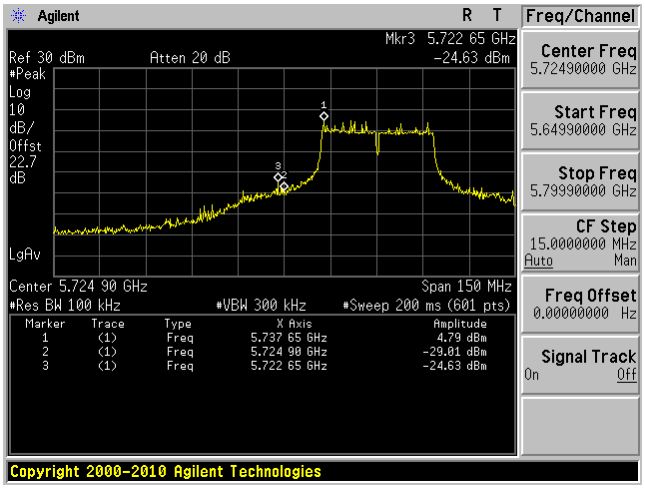
802.11n40 mode, Lowest Channel, Chain J10



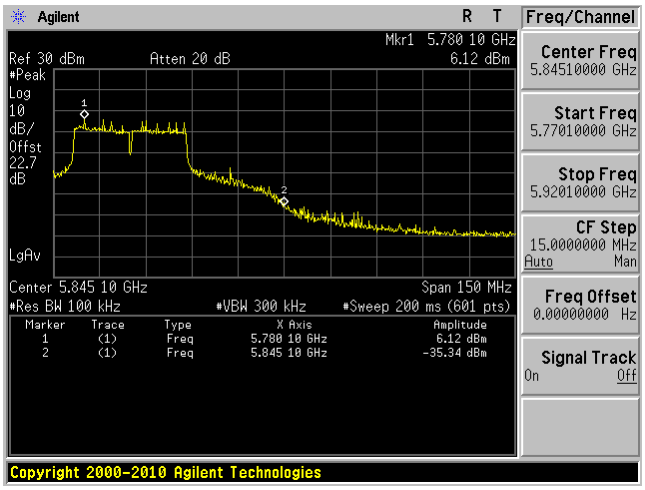
802.11n40 mode, Lowest Channel, Chain J8



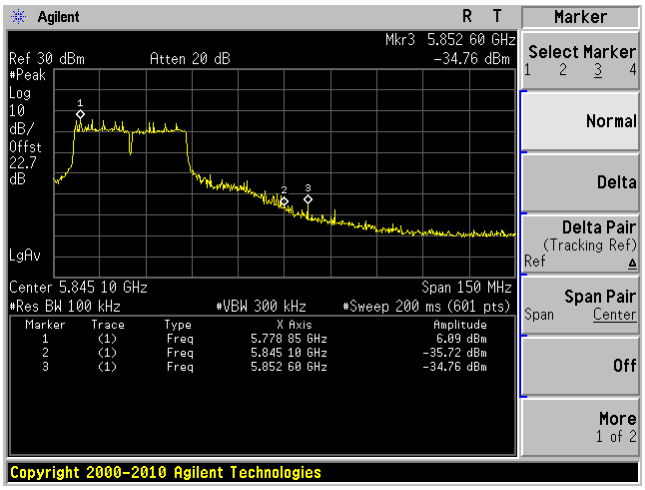
802.11n40 mode, Lowest Channel, Chain J6



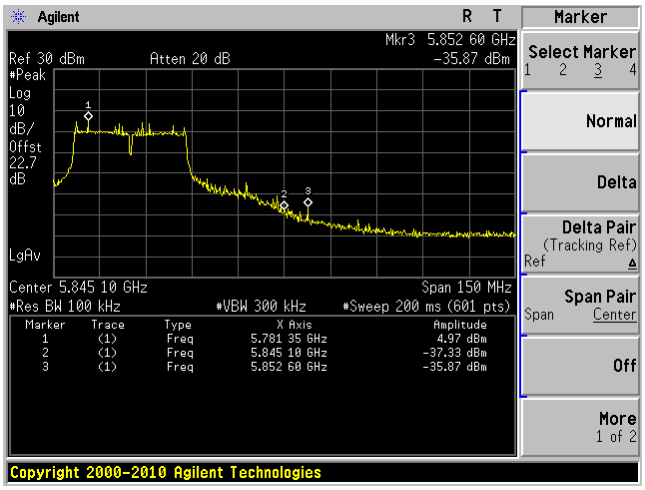
802.11n40 mode, Highest Channel, Chain J10



802.11n40 mode, Highest Channel, Chain J8



802.11n40 mode, Highest Channel, Chain J6



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

12.1 Applicable Standard

According to FCC §15.247 (e) and IC RSS-210 §A8.2 (b) , for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

12.2 Measurement Procedure

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

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	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:	21~24 °C
Relative Humidity:	38~45 %
ATM Pressure:	101.2-102 kPa

The testing was performed by Quinn Jiang on 11-12-2011 to 11-14-2011 in RF site.

12.5 Test Results

5725-5845 MHz

802.11 a mode

Channel	Frequency (MHz)	TX Chain J10 PSD (dBm)	TX Chain J8 PSD (dBm)	TX Chain J6 PSD (dBm)	Total PSD (dBm)	Limit (dBm/3kHz)	Margin (dB)	Power Setting
Low	5745	-12.03	-12.06	-14.34	-7.91	8	-15.91	19
Middle	5785	-11.49	-12.14	-13.64	-7.56	8	-15.56	21
High	5825	-12.11	-12	-13.07	-7.60	8	-15.6	20

802.11 n 20 mode

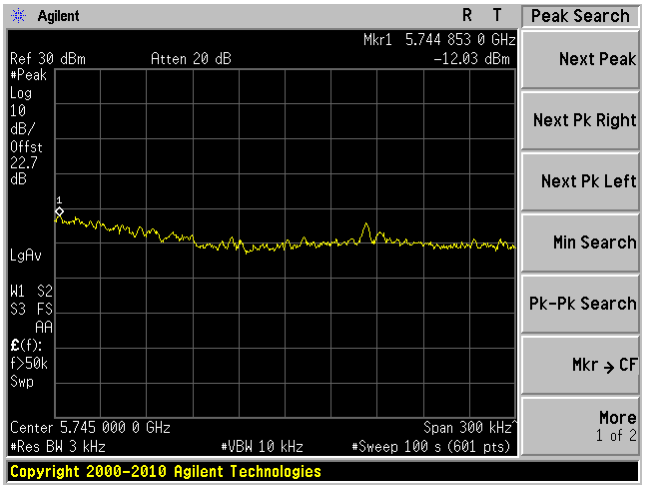
Channel	Frequency (MHz)	TX Chain J10 PSD (dBm)	TX Chain J8 PSD (dBm)	TX Chain J6 PSD (dBm)	Total PSD (dBm)	Limit (dBm/3kHz)	Margin (dB)	Power Setting
Low	5745	-9	-9.77	-10.6	-4.96	8	-12.96	21
Middle	5785	-10.68	-10.57	-11.03	-5.98	8	-13.98	21
High	5825	-11.75	-11.72	-12.05	-7.07	8	-15.07	21

802.11 n 40 mode

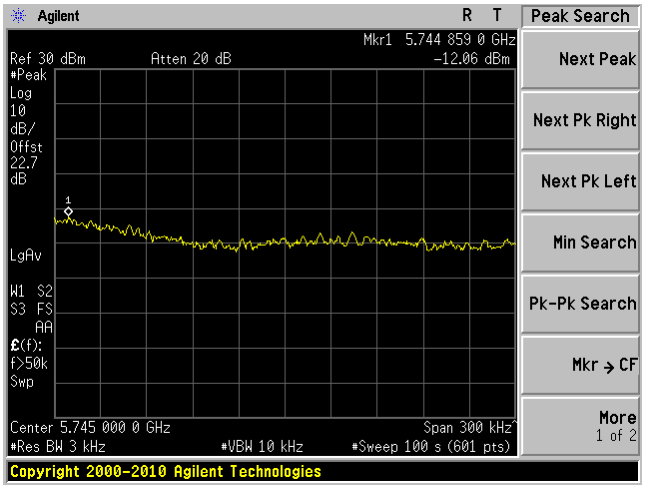
Channel	Frequency (MHz)	TX Chain J10 PSD (dBm)	TX Chain J8 PSD (dBm)	TX Chain J6 PSD (dBm)	Total PSD (dBm)	Limit (dBm/3kHz)	Margin (dB)	Power Setting
Low	5755	-18.9	-19.98	-18.77	-14.41	8	-22.41	21
High	5795	-19.88	-18.7	-19.36	-14.52	8	-22.52	21

5725 – 5845 MHz

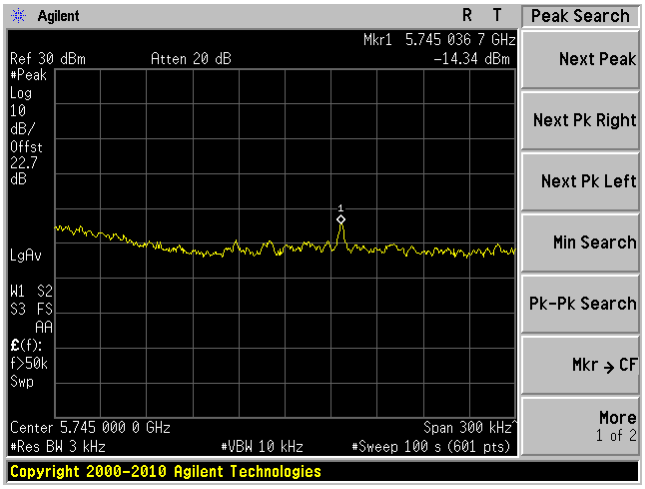
802.11a mode, Low Channel, Chain J10



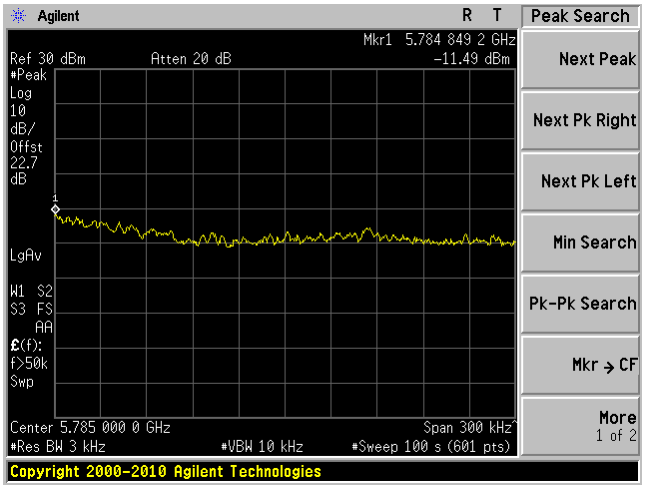
802.11a mode, Low Channel, Chain J8



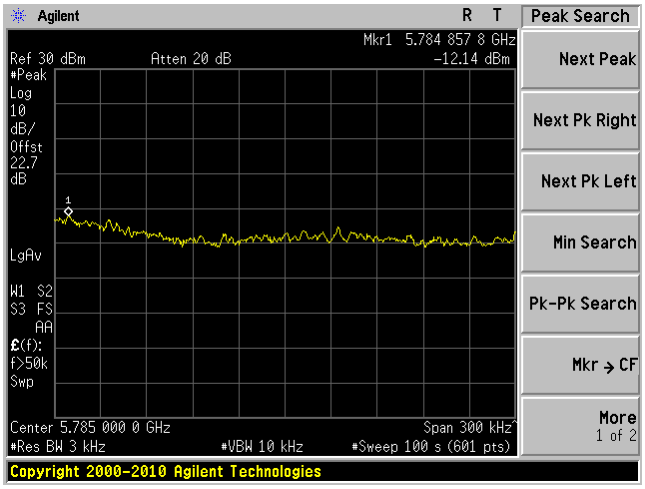
802.11a mode, Low Channel, Chain J6



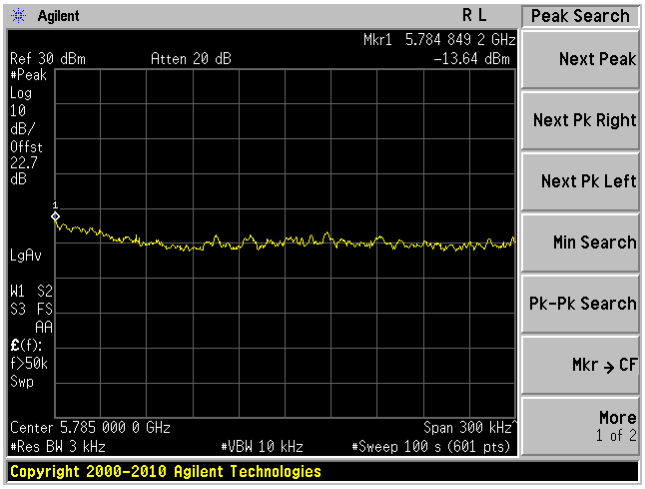
802.11a mode, Middle Channel, Chain J10



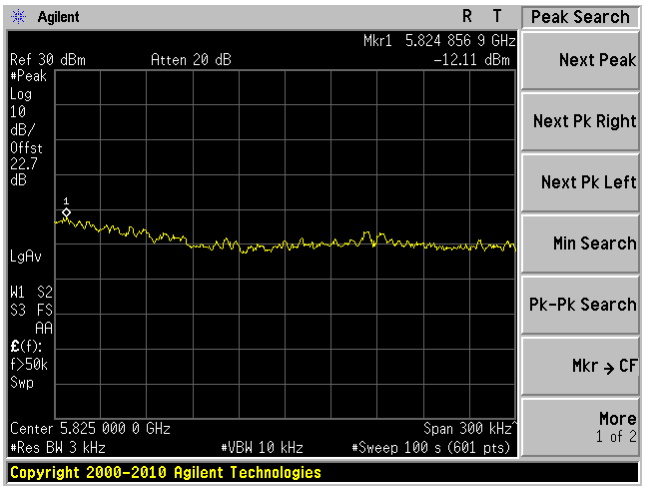
802.11a mode, Middle Channel, Chain J8



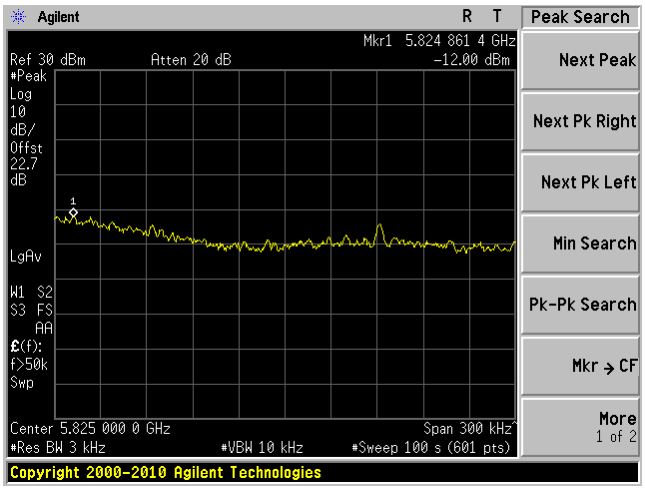
802.11a mode, Middle Channel, Chain J6



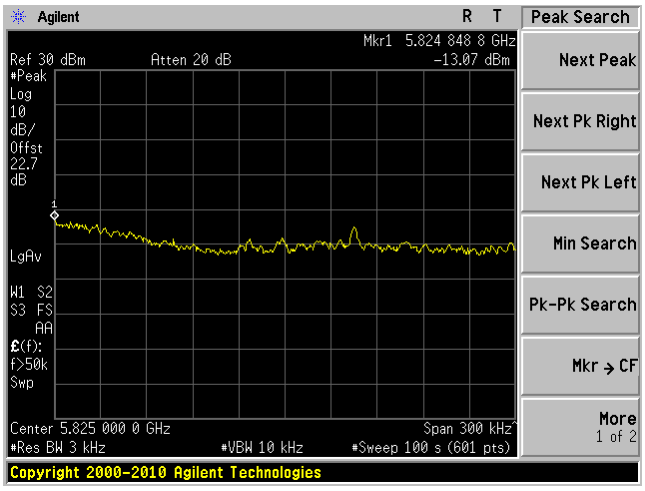
802.11a mode, High Channel, Chain J10



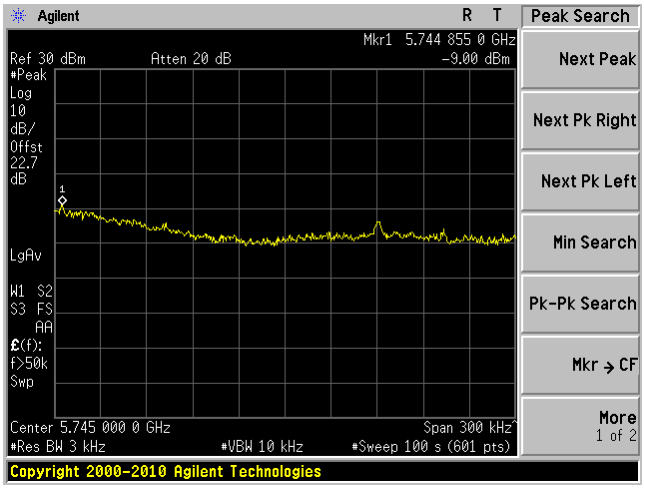
802.11a mode, High Channel, Chain J8



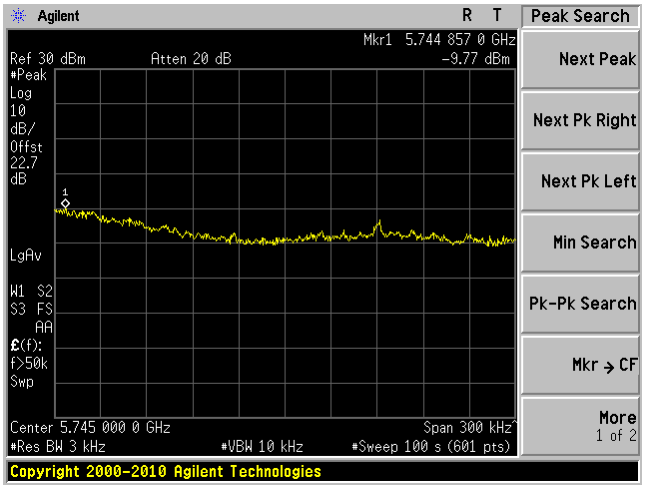
802.11a mode, High Channel, Chain J6



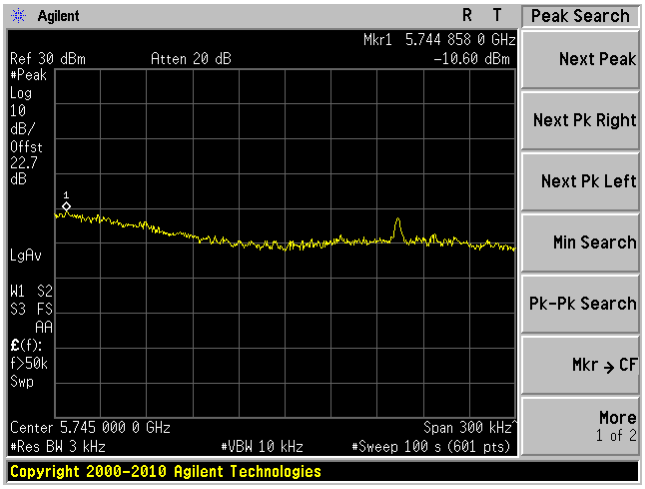
802.11n20 mode, Low Channel, Chain J10



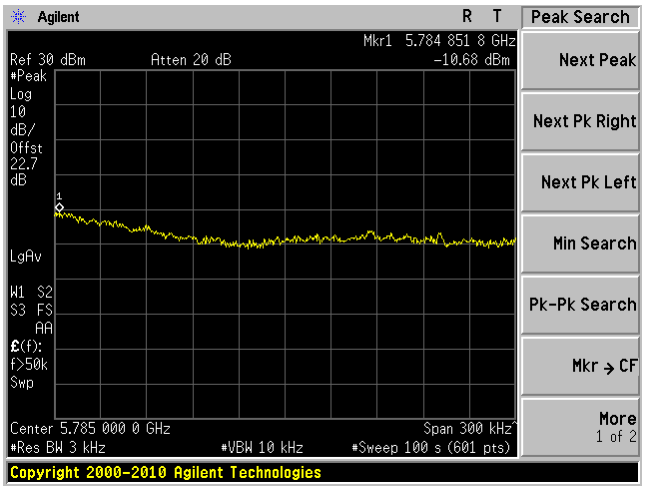
802.11n20 mode, Low Channel, Chain J8



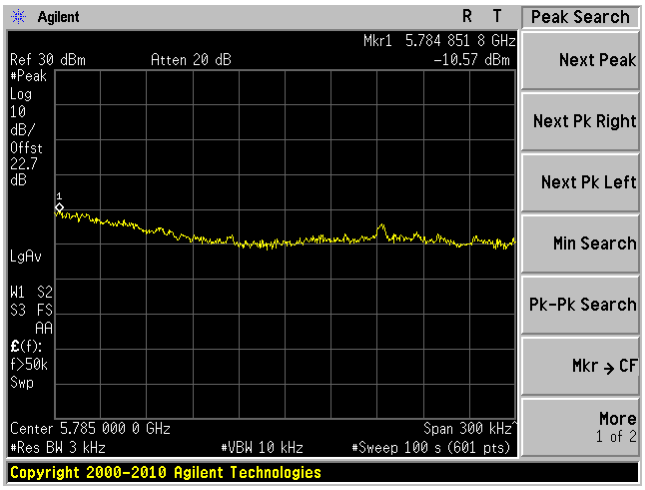
802.11n20 mode, Low Channel, Chain J6



802.11n20 mode, Middle Channel, Chain J10



802.11n20 mode, Middle Channel, Chain J8



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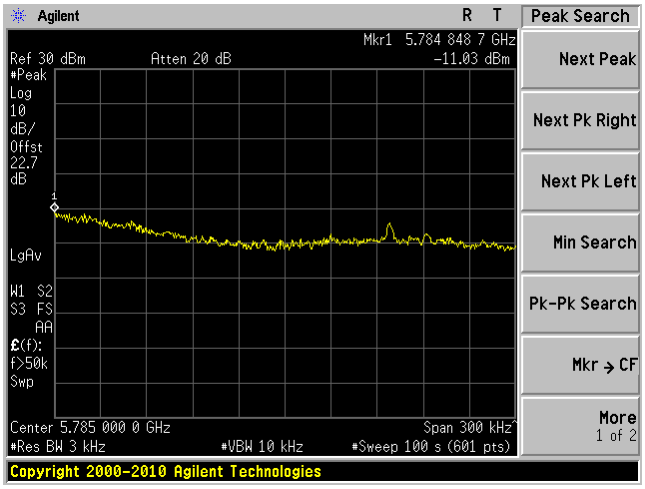
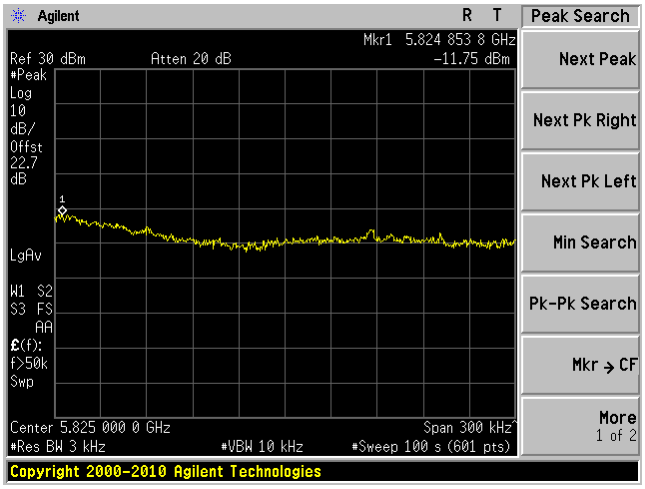
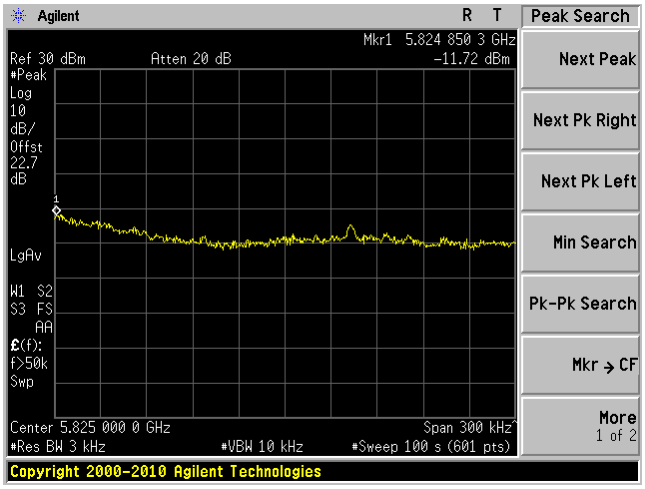


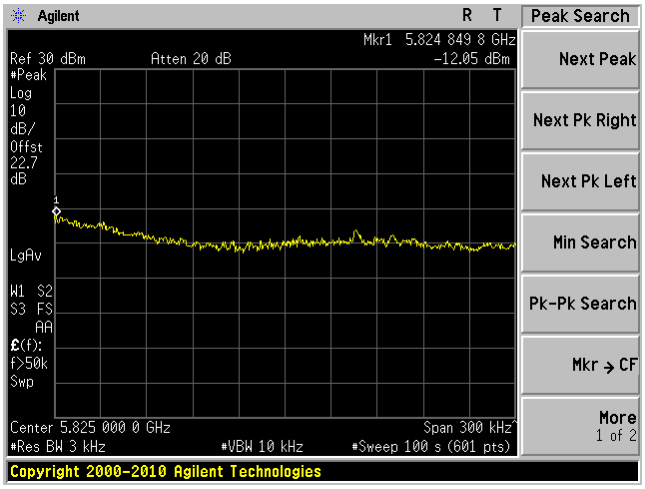
802.11 n20 mode, High Channel, Chain J10



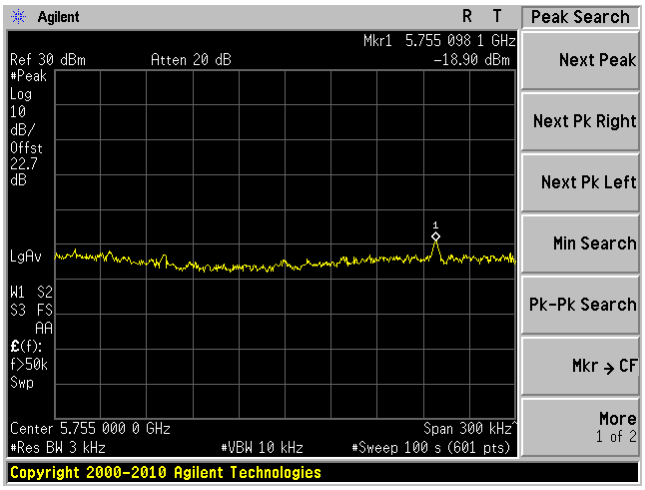
802.11 n20 mode, High Channel, Chain J8



802.11 n20 mode, High Channel, Chain J6



802.11n40 mode, Low Channel, Chain J10



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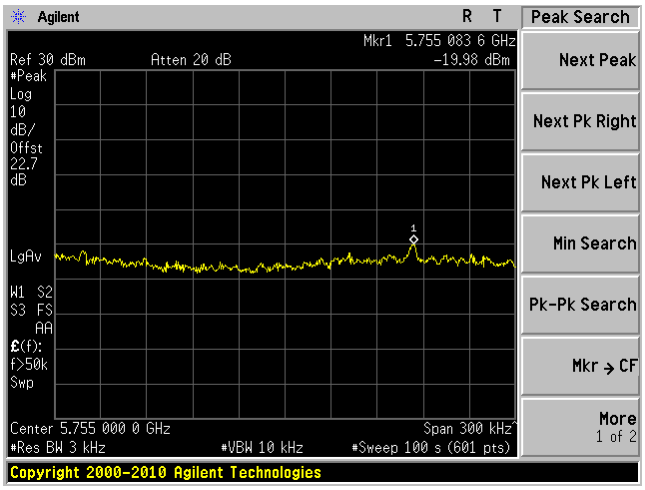
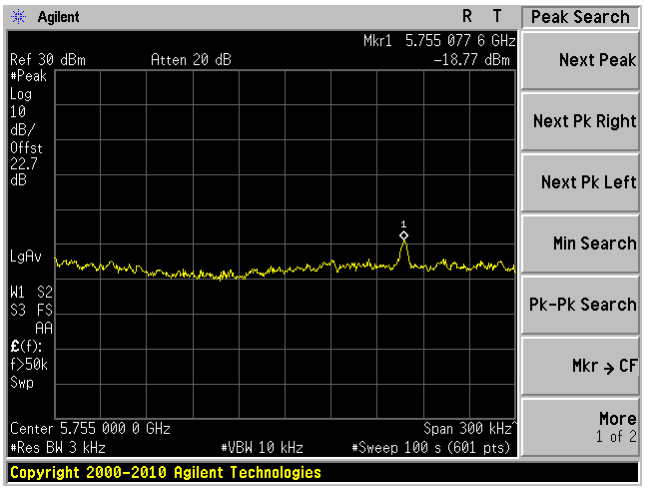
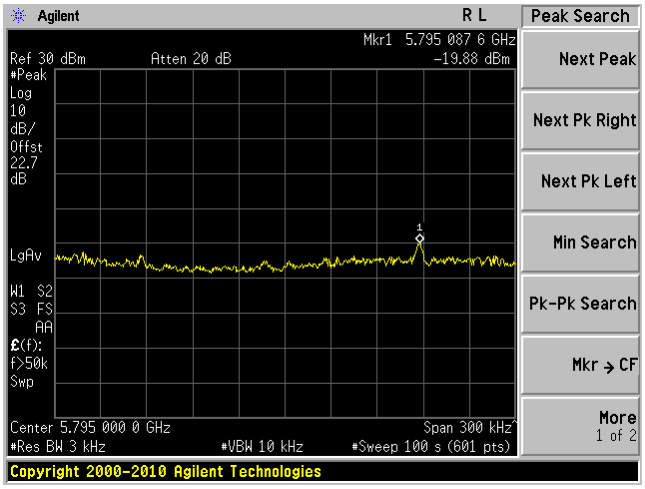


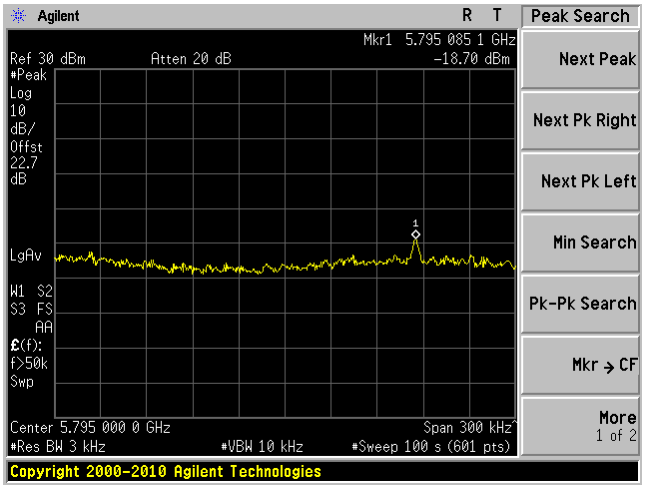
802.11n40 mode, Low Channel, Chain J6



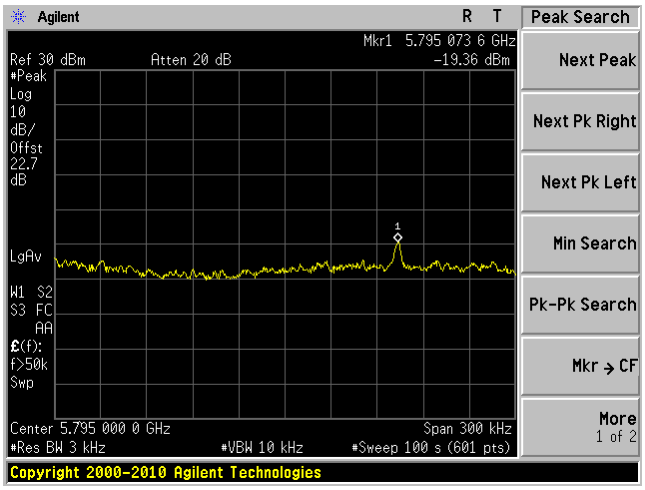
802.11n40 mode, High Channel, Chain J10



802.11n40 mode, High Channel, Chain J8



802.11n40 mode, High Channel, Chain J6



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	PSA Series 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/RSS-Gen, with the closest margins from the limit listed below:

30-1000 MHz:

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-5.1	749.9765	Horizontal	30 to 1000

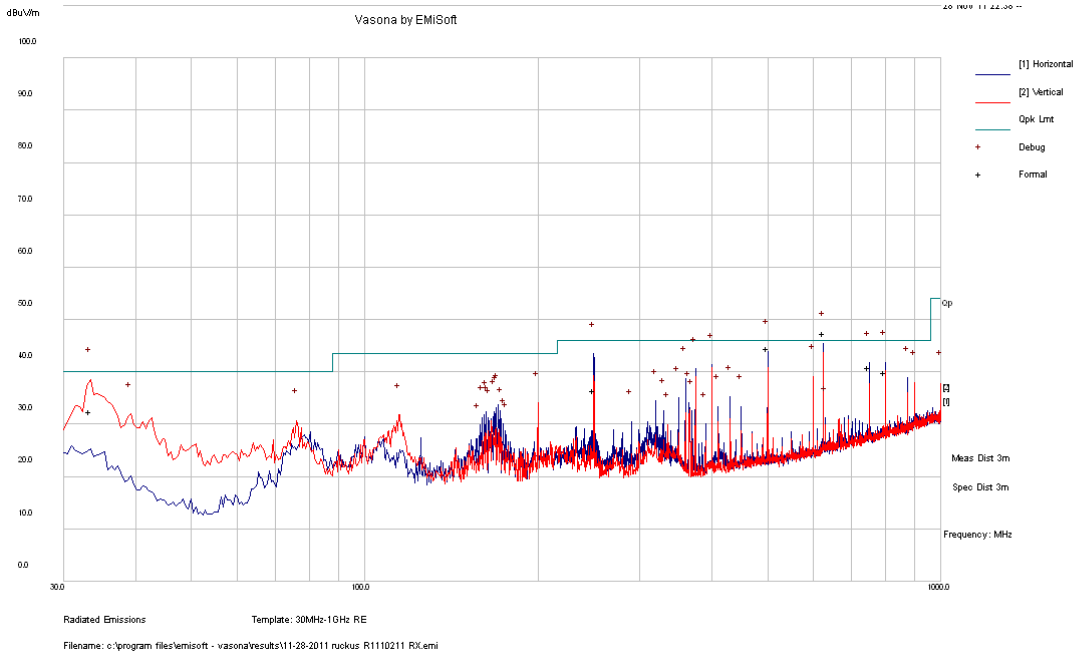
Above 1 GHz

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (GHz)**
-10.89	1599.92	Vertical	Above 1 GHz

13.8 Test Results

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

5.8 GHz Band

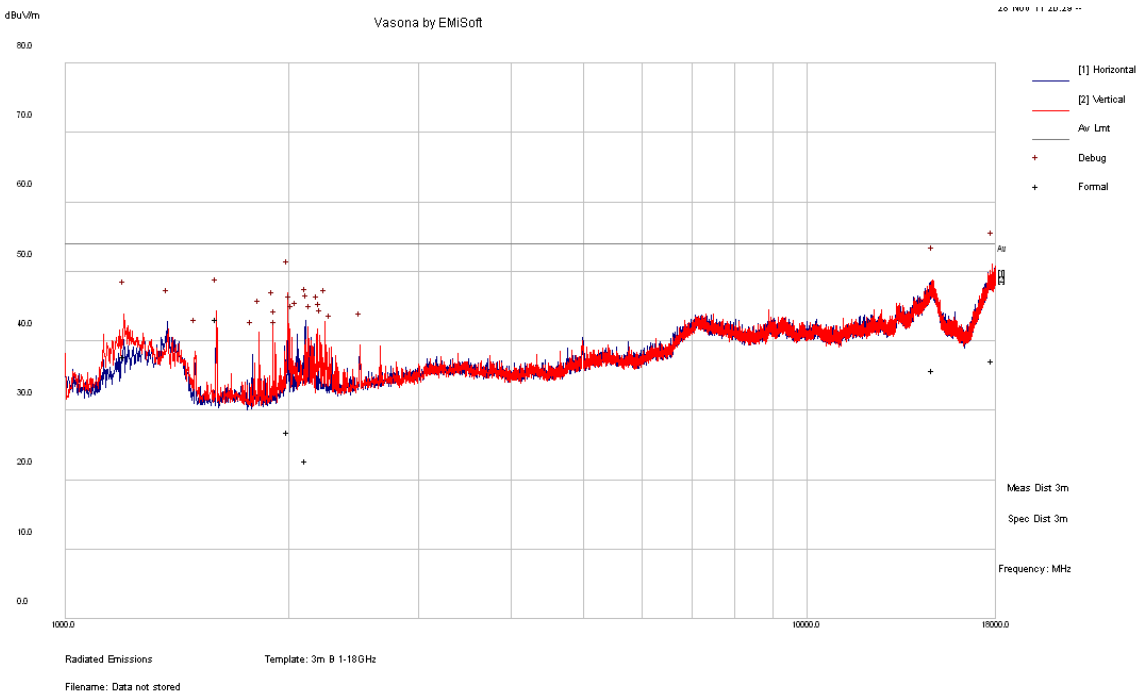


Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
33.27925	32.48	112	V	59	40	-7.52
500.005	44.47	156	H	14	46	-1.53
249.9518	36.48	147	H	175	46	-9.52
799.973	40.01	102	H	8	46	-5.99
749.9765	40.9	100	H	149	46	-5.1

Note: 625 MHz, 500 MHz and 375 MHz are Digital Emissions from the supporting board.

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



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
17817.23	37.17	232	V	124	54	-16.83
14809.27	35.79	255	V	307	54	-18.21
1996.656	26.96	148	V	209	54	-27.04
1599.92	43.11	194	V	286	54	-10.89
1199.814	37.79	102	V	131	54	-16.21
2110.964	22.75	302	H	218	54	-31.25