FCC PART 15.407
TEST AND MEASUREMENT REPORT

For

Actiontec Electronics, Inc.

760 North Mary Avenue,

Sunnyvale, CA 94085, USA

FCC ID: LNQWCB3000

Report Type:	Product Type:
Amended Report	Multi-LAN Network Adapter

Prepared By:	Wei Sun
Report Number:	R1212106A-407
Report Date:	2013-02-04
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1212106-407	Original Report	2013-02-01
1	R1212106A-407	Update Power Supply Information on page 9	2013-02-04

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Actiontec Electronics, Inc*., and their product *FCC ID: LNQWCB3000*, model: *WCB3000* or the "EUT" as referred to in this report. The EUT is a Multi-LAN network adapter with Coax with 802.11 a/b/g/n functionality that operates in 2400-2483.5 MHz, 5150-5250 MHz and 5725-5850 MHz band.

1.2 Mechanical Description of EUT

The EUT measures approximately 16.51 cm (L) x 12.7 cm (W) x 3.18 cm (H) and weighs 0.3 kg.

The test data gathered are from typical production sample provided by the manafatureur, serial number: 1212106, assigned by BACL Sunnyvale.

1.3 Objective

This report is prepared on behalf of*Actiontec Electronics, Inc., in* accordance with FCC CFR47 §15.407.

The objective is to add additional antenna with class II permissive change on the original application by determine compliance with FCC rules for Antenna Requirements, Conducted Emissions, Occupied Bandwidth, Output Power, Power Spectral Density, Radiated and Conducted Spurious Emissions, and Band Edge. Please refer to the detail antenna list in the antenna requirement section.

1.4 Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS with FCC ID: LNQWCB3000.

1.5 Test Methodology

FCC CFR 47 Part2, Part15.407, ANSI C63.4-2003

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.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

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

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

2 EUT Test Configuration

2.1 Justification

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

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

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

2.2 EUT Exercise Software

The softwares used for test were Tera Term and MP Test, provided by Actiontec Electronics, Inc., and were verified by Wei Sun to comply with the standard requirements being tested against.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Special Accessories

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

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Laptop	Latitude E5420	-
Dell	Laptop	Latitude D600	CN-0X2034-48643-3A6-8307

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
Actiontec Electronic, Inc	Main PCB Board	WCB300-4B	23900020

2.7 Interface Ports and Cables

Cable Description	Length (m)	To	From
RJ 45 Cable x2	3m	LAPTOP	EUT

2.8 Power Supply List and Details

Manufacturer	Description	Model	Part Number
AcBel	AC/DC Power Adapter	WAC010	WC1002CD0LKA

3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.407(f), §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207	AC Power Line Conducted Emissions	Compliant
§15.209(a), 15.407(b)	Spurious Radiated Emissions	Compliant
§15.407(a)	26 dB and 99% Emission Bandwidth	Compliant
§407(a)(1)	Peak Output Power Measurement	Compliant
§2.1051, §15.407(b)	Band Edges	Compliant
§15.407(a)(1)	Power Spectral Density	Compliant
§15.407(a)(6)	Peak Excursion Ratio	Compliant
§2.1051, §15.407(b)	Spurious Emissions at Antenna Terminals	Compliant

4 FCC §15.407(f), §2.1091 - 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

4.2 MPE Prediction

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

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

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

4.3 MPE Results

W52 Band:

Maximum peak output power at antenna input terminal (dBm):	16.99
Maximum peak output power at antenna input terminal (mW):	50
Prediction distance (cm):	20
Prediction frequency (MHz):	5240
Maximum Antenna Gain, typical (dBi):	1.7
Maximum Antenna Gain (numeric):	1.48
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.015
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

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

5 FCC §15.203 – 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.

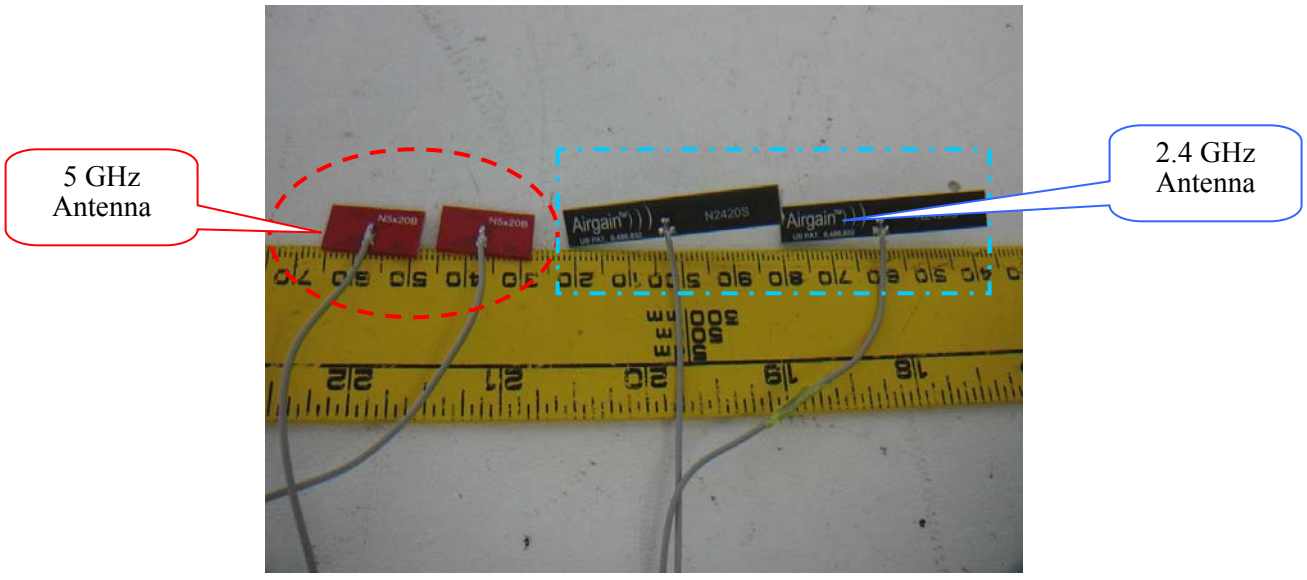
And according to FCC §15.247 (b)(4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2 Antenna List

Manufacturers	Models/Name	Antenna Gain (dBi) @ 2.4 GHz
Airgain x2	N2420S	1.8

Manufacturers	Models/Name	Antenna Gain (dBi) @ 5.2 GHz
Airgain x2	N5x20B	1.7

The antenna consists of non-standard (UFL) connectors with less 6 dBi gain; therefore, it complies with the antenna requirement. Please refer to the photos below.



6 FCC §15.207 - AC Power Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 Conducted limits:

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

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

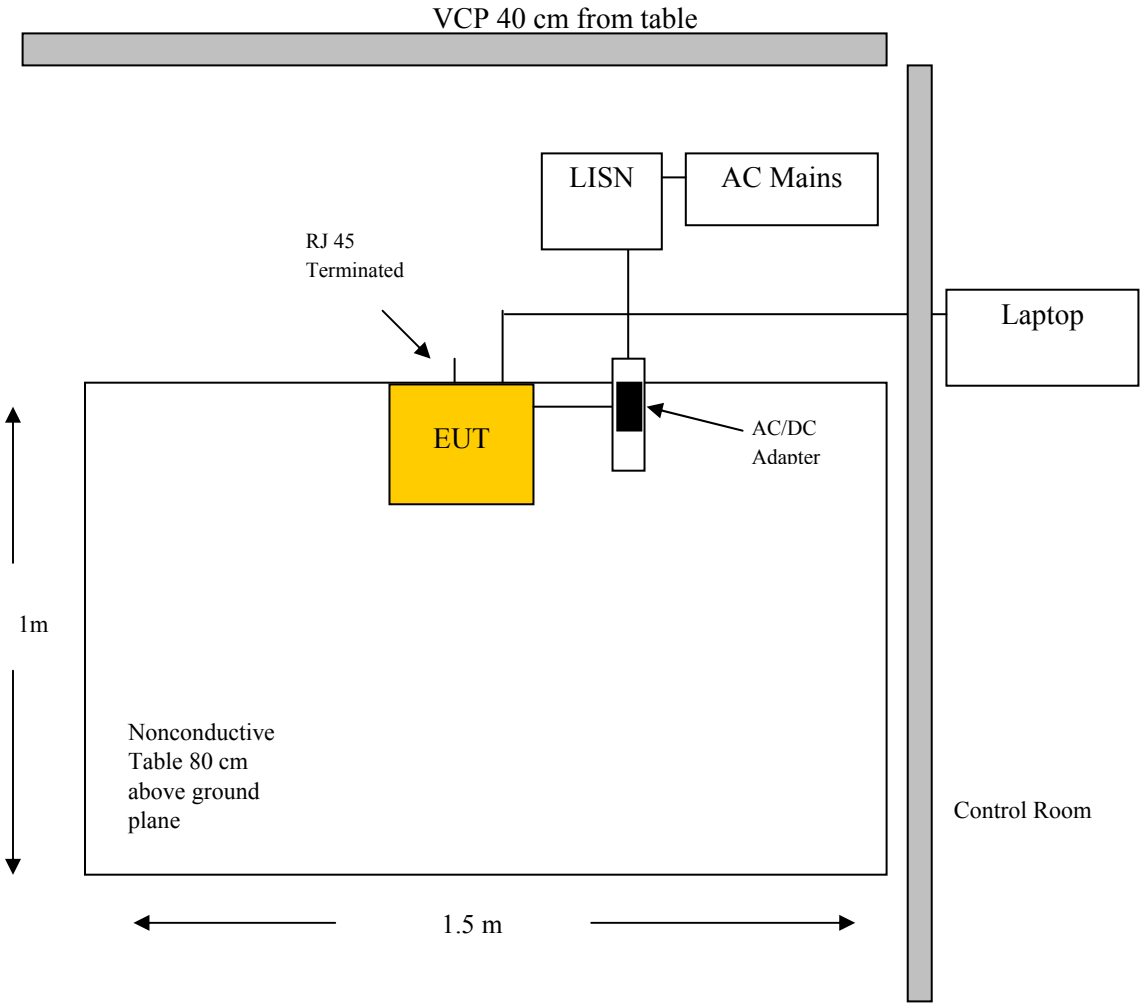
6.3 Test Procedure

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	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2012-04-18	1 year
Solar Electronics	LISN	9252-R-24-BNC	511205	2012-06-25	1 year
TTE	Filter, High Pass	H9962-150K-50-21378	K7133	2012-05-30	1 year

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

6.7 Test Environmental Conditions

Temperature:	21 ºC
Relative Humidity:	51%
ATM Pressure:	101.42 kPa

The testing was performed by Wei Sun on 2013-01-16 in 5 m chamber 3.

6.8 Summary of Test Results

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

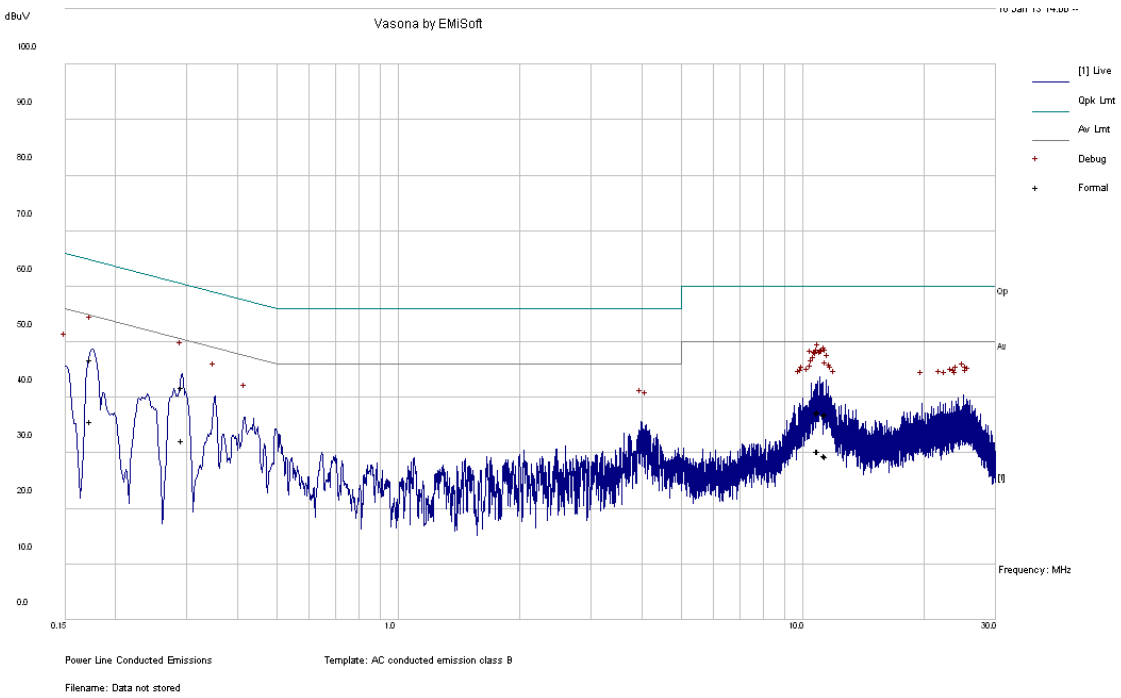
Transmitting Mode: Worst case with 5.2 GHz operating:

Connection: 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-17.9	0.17391	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

Worst case: A mode, High Chanel for 5.2GHz Band

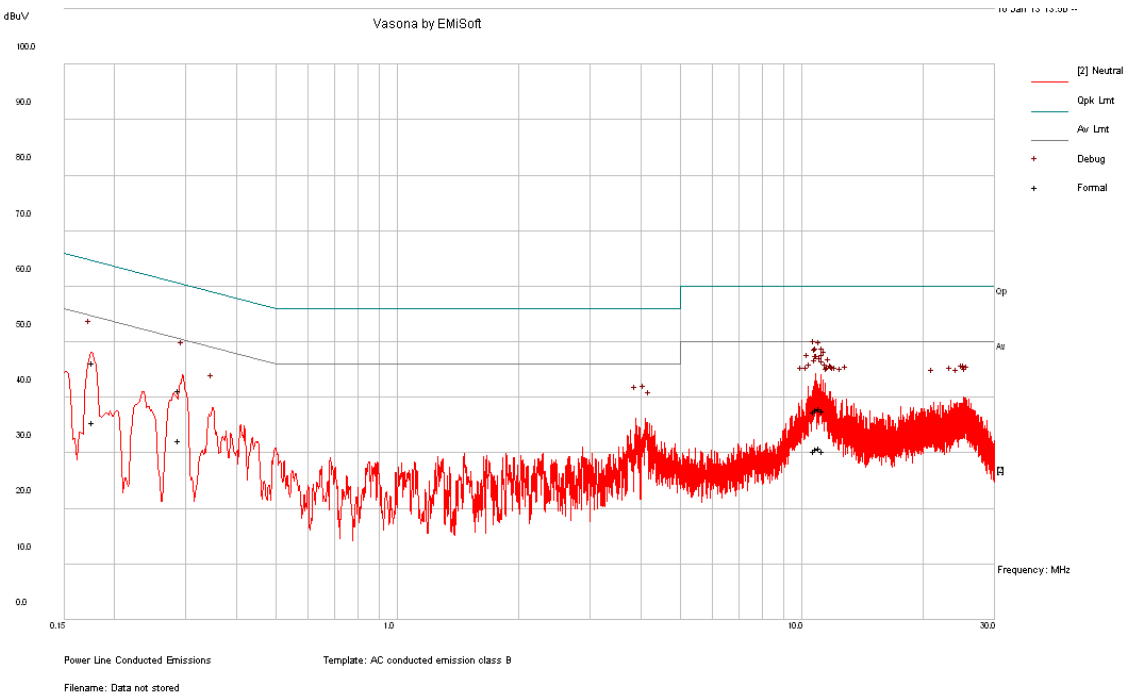
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.17391	46.87	Line	64.77	-17.9	QP
10.97016	37.51	Line	60	-22.49	QP
0.293236	41.82	Line	60.43	-18.61	QP
11.37273	36.83	Line	60	-23.17	QP
10.89645	37.35	Line	60	-22.65	QP
11.42836	37	Line	60	-23	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.17391	35.76	Line	54.77	-19.02	Ave.
10.97016	30.36	Line	50	-19.64	Ave.
0.293236	32.32	Line	50.43	-18.11	Ave.
11.37273	29.6	Line	50	-20.4	Ave.
10.89645	30.32	Line	50	-19.68	Ave.
11.42836	29.37	Line	50	-20.63	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
10.77802	37.4	Neutral	60	-22.6	QP
11.12467	38.01	Neutral	60	-21.99	QP
0.28999	41.35	Neutral	60.52	-19.17	QP
0.177366	46.31	Neutral	64.61	-18.3	QP
11.32271	37.63	Neutral	60	-22.37	QP
10.89367	37.85	Neutral	60	-22.15	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
10.77802	30.43	Neutral	50	-19.57	Ave.
11.12467	30.97	Neutral	50	-19.03	Ave.
0.28999	32.32	Neutral	50.52	-18.2	Ave.
0.177366	35.6	Neutral	54.61	-19.01	Ave.
11.32271	30.4	Neutral	50	-19.6	Ave.
10.89367	30.77	Neutral	50	-19.23	Ave.

7 FCC §15.209 & §15.407(b) - 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): 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		

AsPer FCC §15.407(b)(1), For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. The specification used was the FCC 15C/15E and 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	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 year
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year
Sunol Science Corp	Horn Antenna	DHR-118	A052704	2012-02-24	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2012-03-22	1 year

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

7.6 Test Environmental Conditions

Temperature:	21-23 °C
Relative Humidity:	42-45 %
ATM Pressure:	101-102 kPa

The testing was performed by Wei Sun on 2013-01-13 in 5 meter chamber 3.

7.7 Summary of Test Results

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

5150-5250 MHz

Mode: A mode middle channel			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-4.78	250	Vertical	Below 1 GHz

Mode: N40 mode low channel			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-5.82	20760	Vertical	Above 1 GHz

7.8 Radiated Emissions Test Result Data

1) Radiated Emission at 3 meters, 5150-5250 MHz Band

802.11a Mode Low Channel

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel, 5180 MHz, measured at 3 meters											
5180	63.83	160	142	H	33.77	4.52	0	102.12	-	-	Fund/Peak
5180	61.24	81	113	V	33.77	4.52	0	99.53	-	-	Fund/Peak
5180	53.87	160	142	H	33.77	4.52	0	92.16	-	-	Fund/Ave
5180	51.49	81	113	V	33.77	4.52	0	89.78	-	-	Fund/Ave
10360	36.29	127	100	H	39.12	6.14	26.98	54.57	88.23	-33.66	Harm/Peak
10360	36.42	112	100	V	39.12	6.14	26.98	54.7	88.23	-33.53	Harm/Peak
10360	20.99	127	100	H	39.12	6.14	26.98	39.27	68.23	-28.96	Harm/Ave
10360	21.1	112	100	V	39.12	6.14	26.98	39.38	68.23	-28.85	Harm/Ave
15540	28	0	100	H	39.19	7.47	25.92	48.74	74	-25.26	Harm/Peak
15540	28	0	100	V	39.19	7.47	25.92	48.74	74	-25.26	Harm/Peak
15540	17	0	100	H	39.19	7.47	25.92	37.74	54	-16.26	Harm/Ave
15540	17	0	100	V	39.19	7.47	25.92	37.74	54	-16.26	Harm/Ave
20720	28	0	100	H	46.47	9.28	25.33	58.42	74	-15.58	Harm/Peak
20720	28	0	100	V	46.47	9.28	25.33	58.42	74	-15.58	Harm/Peak
20720	17	0	100	H	46.47	9.28	25.33	47.42	54	-6.58	Harm/Ave
20720	17	0	100	V	46.47	9.28	25.33	47.42	54	-6.58	Harm/Ave
5150	22	0	100	H	33.77	4.52	0	60.29	74	-13.71	Spur/Peak
5150	22	0	100	V	33.77	4.52	0	60.29	74	-13.71	Spur/Peak
5150	9	0	100	H	33.77	4.52	0	47.29	54	-6.71	Spur/Ave
5150	9	0	100	V	33.77	4.52	0	47.29	54	-6.71	Spur/Ave
250	49.39	249	108	V	12.1	0.86	21.21	41.14	46	-4.86	Spur/QP

802.11a Mode Middle Channel

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel, 5200 MHz, measured at 3 meters											
5200	62.3	147	100	H	33.77	4.52	0	100.59	-	-	Fund/Peak
5200	59.08	261	100	V	33.77	4.52	0	97.37	-	-	Fund/Peak
5200	52.8	147	100	H	33.77	4.52	0	91.09	-	-	Fund/Ave
5200	49.28	261	100	V	33.77	4.52	0	87.57	-	-	Fund/Ave
10400	35.77	125	100	H	39.12	6.14	26.97	54.06	88.23	-34.17	Harm/Peak
10400	35.49	113	100	V	39.12	6.14	26.97	53.78	88.23	-34.45	Harm/Peak
10400	20.61	125	100	H	39.12	6.14	26.97	38.9	68.23	-29.33	Harm/Ave
10400	21.04	113	100	V	39.12	6.14	26.97	39.33	68.23	-28.9	Harm/Ave
15600	28	0	100	H	39.15	7.47	25.92	48.7	74	-25.3	Harm/Peak
15600	28	0	100	V	39.15	7.47	25.92	48.7	74	-25.3	Harm/Peak
15600	17	0	100	H	39.15	7.47	25.92	37.7	54	-16.3	Harm/Ave
15600	17	0	100	V	39.15	7.47	25.92	37.7	54	-16.3	Harm/Ave
20800	28	0	100	H	46.47	9.36	25.33	58.5	74	-15.5	Harm/Peak
20800	28	0	100	V	46.47	9.36	25.33	58.5	74	-15.5	Harm/Peak
20800	17	0	100	H	46.47	9.36	25.33	47.5	54	-6.5	Harm/Ave
20800	17	0	100	V	46.47	9.36	25.33	47.5	54	-6.5	Harm/Ave
250	49.47	249	109	V	12.1	0.86	21.21	41.22	46	-4.78	Spur/QP

802.11a Mode High Channel

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel, 5240 MHz, measured at 3 meters											
5240	64.02	144	100	H	33.77	4.52	0	102.31	-	-	Fund/Peak
5240	60.08	79	116	V	33.77	4.52	0	98.37	-	-	Fund/Peak
5240	53.99	144	100	H	33.77	4.52	0	92.28	-	-	Fund/Ave
5240	50.69	79	116	V	33.77	4.52	0	88.98	-	-	Fund/Ave
10480	36.01	127	100	H	39.2	6.14	26.93	54.42	88.23	-33.81	Harm/Peak
10480	35.82	112	100	V	39.2	6.14	26.93	54.23	88.23	-34	Harm/Peak
10480	20.55	127	100	H	39.2	6.14	26.93	38.96	68.23	-29.27	Harm/Ave
10480	20.87	112	100	V	39.2	6.14	26.93	39.28	68.23	-28.95	Harm/Ave
15720	28	0	100	H	39.09	7.47	25.97	48.59	74	-25.41	Harm/Peak
15720	28	0	100	V	39.09	7.47	25.97	48.59	74	-25.41	Harm/Peak
15720	17	0	100	H	39.09	7.47	25.97	37.59	54	-16.41	Harm/Ave
15720	17	0	100	V	39.09	7.47	25.97	37.59	54	-16.41	Harm/Ave
20960	28	0	100	H	46.47	9.36	25.33	58.5	74	-15.5	Harm/Peak
20960	28	0	100	V	46.47	9.36	25.33	58.5	74	-15.5	Harm/Peak
20960	17	0	100	H	46.47	9.36	25.33	47.5	54	-6.5	Harm/Ave
20960	17	0	100	V	46.47	9.36	25.33	47.5	54	-6.5	Harm/Ave
5350	22	0	100	H	34	4.59	0	60.59	74	-13.41	Spur/Peak
5350	22	0	100	V	34	4.59	0	60.59	74	-13.41	Spur/Peak
5350	9	0	100	H	34	4.59	0	47.59	54	-6.41	Spur/Ave
5350	9	0	100	V	34	4.59	0	47.59	54	-6.41	Spur/Ave
250	49.31	245	108	V	12.1	0.86	21.21	41.06	46	-4.94	Spur/QP

802.11n-HT20 Mode Low Channel

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel, 5180 MHz, measured at 3 meters											
5180	64.82	159	149	H	33.77	4.52	0	103.11	-	-	Fund/Peak
5180	62.55	80	118	V	33.77	4.52	0	100.84	-	-	Fund/Peak
5180	54.51	159	149	H	33.77	4.52	0	92.8	-	-	Fund/Ave
5180	52.14	80	118	V	33.77	4.52	0	90.43	-	-	Fund/Ave
10360	38.61	127	100	H	39.12	6.14	26.98	56.89	88.23	-31.34	Harm/Peak
10360	38.71	112	100	V	39.12	6.14	26.98	56.99	88.23	-31.24	Harm/Peak
10360	22.44	127	100	H	39.12	6.14	26.98	40.72	68.23	-27.51	Harm/Ave
10360	22.6	112	100	V	39.12	6.14	26.98	40.88	68.23	-27.35	Harm/Ave
15540	28	0	100	H	39.19	7.47	25.92	48.74	74	-25.26	Harm/Peak
15540	28	0	100	V	39.19	7.47	25.92	48.74	74	-25.26	Harm/Peak
15540	17	0	100	H	39.19	7.47	25.92	37.74	54	-16.26	Harm/Ave
15540	17	0	100	V	39.19	7.47	25.92	37.74	54	-16.26	Harm/Ave
20720	28	0	100	H	46.47	9.28	25.33	58.42	74	-15.58	Harm/Peak
20720	28	0	100	V	46.47	9.28	25.33	58.42	74	-15.58	Harm/Peak
20720	17	0	100	H	46.47	9.28	25.33	47.42	54	-6.58	Harm/Ave
20720	17	0	100	V	46.47	9.28	25.33	47.42	54	-6.58	Harm/Ave
5150	22	0	100	H	33.77	4.52	0	60.29	74	-13.71	Spur/Peak
5150	22	0	100	V	33.77	4.52	0	60.29	74	-13.71	Spur/Peak
5150	9	0	100	H	33.77	4.52	0	47.29	54	-6.71	Spur/Ave
5150	9	0	100	V	33.77	4.52	0	47.29	54	-6.71	Spur/Ave
250	49.17	249	111	V	12.1	0.86	21.21	40.92	46	-5.08	Spur/QP

802.11n-HT20 Mode Middle Channel

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel, 5200 MHz, measured at 3 meters											
5200	62.9	146	100	H	33.77	4.52	0	101.19	-	-	Fund/Peak
5200	60.13	261	168	V	33.77	4.52	0	98.42	-	-	Fund/Peak
5200	52.86	146	100	H	33.77	4.52	0	91.15	-	-	Fund/Ave
5200	50.11	261	168	V	33.77	4.52	0	88.4	-	-	Fund/Ave
10400	37.72	127	100	H	39.12	6.14	26.97	56.01	88.23	-32.22	Harm/Peak
10400	37.56	112	100	V	39.12	6.14	26.97	55.85	88.23	-32.38	Harm/Peak
10400	21.78	127	100	H	39.12	6.14	26.97	40.07	68.23	-28.16	Harm/Ave
10400	21.83	112	100	V	39.12	6.14	26.97	40.12	68.23	-28.11	Harm/Ave
15600	28	0	100	H	39.15	7.47	25.92	48.7	74	-25.3	Harm/Peak
15600	28	0	100	V	39.15	7.47	25.92	48.7	74	-25.3	Harm/Peak
15600	17	0	100	H	39.15	7.47	25.92	37.7	54	-16.3	Harm/Ave
15600	17	0	100	V	39.15	7.47	25.92	37.7	54	-16.3	Harm/Ave
20800	28	0	100	H	46.47	9.36	25.33	58.5	74	-15.5	Harm/Peak
20800	28	0	100	V	46.47	9.36	25.33	58.5	74	-15.5	Harm/Peak
20800	17	0	100	H	46.47	9.36	25.33	47.5	54	-6.5	Harm/Ave
20800	17	0	100	V	46.47	9.36	25.33	47.5	54	-6.5	Harm/Ave
250	49.39	247	111	V	12.1	0.86	21.21	41.14	46	-4.86	Spur/QP

802.11n-HT20 Mode High Channel

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel, 5240 MHz, measured at 3 meters											
5240	63.76	145	100	H	33.77	4.52	0	102.05	-	-	Fund/Peak
5240	60.93	80	111	V	33.77	4.52	0	99.22	-	-	Fund/Peak
5240	53.54	145	100	H	33.77	4.52	0	91.83	-	-	Fund/Ave
5240	50.63	80	111	V	33.77	4.52	0	88.92	-	-	Fund/Ave
10480	37.18	127	100	H	39.2	6.14	26.93	55.59	88.23	-32.64	Harm/Peak
10480	37.07	112	100	V	39.2	6.14	26.93	55.48	88.23	-32.75	Harm/Peak
10480	21.21	127	100	H	39.2	6.14	26.93	39.62	68.23	-28.61	Harm/Ave
10480	21.39	112	100	V	39.2	6.14	26.93	39.8	68.23	-28.43	Harm/Ave
15720	28	0	100	H	39.09	7.47	25.97	48.59	74	-25.41	Harm/Peak
15720	28	0	100	V	39.09	7.47	25.97	48.59	74	-25.41	Harm/Peak
15720	17	0	100	H	39.09	7.47	25.97	37.59	54	-16.41	Harm/Ave
15720	17	0	100	V	39.09	7.47	25.97	37.59	54	-16.41	Harm/Ave
20960	28	0	100	H	46.47	9.36	25.33	58.5	74	-15.5	Harm/Peak
20960	28	0	100	V	46.47	9.36	25.33	58.5	74	-15.5	Harm/Peak
20960	17	0	100	H	46.47	9.36	25.33	47.5	54	-6.5	Harm/Ave
20960	17	0	100	V	46.47	9.36	25.33	47.5	54	-6.5	Harm/Ave
5350	22	0	100	H	34	4.59	0	60.59	74	-13.41	Spur/Peak
5350	22	0	100	V	34	4.59	0	60.59	74	-13.41	Spur/Peak
5350	9	0	100	H	34	4.59	0	47.59	54	-6.41	Spur/Ave
5350	9	0	100	V	34	4.59	0	47.59	54	-6.41	Spur/Ave
250	49.19	247	111	V	12.1	0.86	21.21	40.94	46	-5.06	Spur/QP

802.11n-HT40 Mode Low Channel

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel, 5190 MHz, measured at 3 meters											
5190	64.77	239	155	H	33.78	4.55	0	103.1	-	-	Fund/Peak
5190	62.32	119	111	V	33.78	4.55	0	100.65	-	-	Fund/Peak
5190	54.51	159	155	H	33.78	4.55	0	92.84	-	-	Fund/Ave
5190	52.14	119	111	V	33.78	4.55	0	90.47	-	-	Fund/Ave
10380	38.32	149	100	H	37.72	7.02	26.9	56.16	88.23	-32.07	Harm/Peak
10380	38.63	107	100	V	37.72	7.02	26.9	56.47	88.23	-31.76	Harm/Peak
10380	22.05	149	100	H	37.72	7.02	26.9	39.89	68.23	-28.34	Harm/Ave
10380	22.11	107	100	V	37.72	7.02	26.9	39.95	68.23	-28.28	Harm/Ave
15570	28	0	100	H	37.64	8.4	26	48.04	74	-25.96	Harm/Peak
15570	28	0	100	V	37.64	8.4	26	48.04	74	-25.96	Harm/Peak
15570	17	0	100	H	37.64	8.4	26	37.04	54	-16.96	Harm/Ave
15570	17	0	100	V	37.64	8.4	26	37.04	54	-16.96	Harm/Ave
20760	28	0	100	H	46.76	9.75	25.33	62.18	74	-14.82	Harm/Peak
20760	28	0	100	V	46.76	9.75	25.33	62.18	74	-14.82	Harm/Peak
20760	17	0	100	H	46.76	9.75	25.33	51.18	54	-5.82	Harm/Ave
20760	17	0	100	V	46.76	9.75	25.33	51.18	54	-5.82	Harm/Ave
5150	22	0	100	H	33.77	4.52	0	60.29	74	-13.71	Spur/Peak
5150	22	0	100	V	33.77	4.52	0	60.29	74	-13.71	Spur/Peak
5150	9	0	100	H	33.77	4.52	0	47.29	54	-6.71	Spur/Ave
5150	9	0	100	V	33.77	4.52	0	47.29	54	-6.71	Spur/Ave
250	48.77	259	100	V	12.1	0.86	21.21	40.52	46	-5.48	Spur/QP

802.11n-HT40 Mode High Channel

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel, 5230 MHz, measured at 3 meters											
5230	64.58	123	100	H	33.78	4.55	0	102.91	-	-	Fund/Peak
5230	61.41	57	100	V	33.78	4.55	0	99.74	-	-	Fund/Peak
5230	53.54	123	100	H	33.78	4.55	0	91.87	-	-	Fund/Ave
5230	51.81	57	100	V	33.78	4.55	0	90.14	-	-	Fund/Ave
10460	37.99	139	100	H	37.93	7	26.93	55.99	88.23	-32.24	Harm/Peak
10460	37.73	155	100	V	37.93	7	26.93	55.73	88.23	-32.5	Harm/Peak
10460	21.54	155	100	H	37.93	7	26.93	39.54	68.23	-28.69	Harm/Ave
10460	21.39	112	100	V	37.93	7	26.93	39.39	68.23	-28.84	Harm/Ave
15690	28	0	100	H	37.64	8.44	25.97	48.11	74	-25.89	Harm/Peak
15690	28	0	100	V	37.64	8.44	25.97	48.11	74	-25.89	Harm/Peak
15690	17	0	100	H	37.64	8.44	25.97	37.11	54	-16.89	Harm/Ave
15690	17	0	100	V	37.64	8.44	25.97	37.11	54	-16.89	Harm/Ave
20920	28	0	100	H	46.47	9.81	25.33	58.95	74	-15.05	Harm/Peak
20920	28	0	100	V	46.47	9.81	25.33	58.95	74	-15.05	Harm/Peak
20920	17	0	100	H	46.47	9.81	25.33	47.95	54	-6.05	Harm/Ave
20920	17	0	100	V	46.47	9.81	25.33	47.95	54	-6.05	Harm/Ave
5350	22	0	100	H	33.8	4.71	0	60.51	74	-13.49	Spur/Peak
5350	22	0	100	V	33.8	4.71	0	60.51	74	-13.49	Spur/Peak
5350	9	0	100	H	33.8	4.71	0	47.51	54	-6.49	Spur/Ave
5350	9	0	100	V	33.8	4.71	0	47.51	54	-6.49	Spur/Ave
250	48.21	260	123	V	12.1	0.86	21.21	39.96	46	-6.04	Spur/QP

2) Co-location with 2.4 GHz and 5 GHz

Worst Case: 2.4 GHz: 802.11b, Middle Channel, 2437 MHz; 5.2GHz: 802.11a, Middle Channel, 5200MHz

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
4874	42.08	39	100	H	32.86	4.1	27.75	51.29	74	-22.71	Peak
4874	41.97	128	115	V	32.86	4.1	27.75	51.18	74	-22.82	Peak
4874	34.83	128	100	H	32.86	4.1	27.75	44.04	54	-9.96	Ave
4874	37.09	100	115	V	32.86	4.1	27.75	46.3	54	-7.7	Ave
10400	34.36	137	100	H	39.12	6.14	26.97	52.65	74	-21.35	Peak
10400	36.85	99	100	V	39.12	6.14	26.97	55.14	74	-18.86	Peak
10400	20.56	99	100	H	39.12	6.14	26.97	38.85	54	-15.15	Ave
10400	25.6	113	100	V	39.12	6.14	26.97	43.89	54	-10.11	Ave
250	49.24	228	100	V	12.1	0.86	21.21	40.99	46	-5.01	QP

8 FCC §15.407(a) – 26 dB & 99% Emission Bandwidth

8.1 Applicable Standard

FCC §15.407(a).

8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 26 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year

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

8.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	43 %
ATM Pressure:	101.1 kPa

The testing was performed by Wei Sun on 2013-01-04 in RF site.

8.5 Test Results

Please refer to the following tables and plots.

5150-5250 MHz Band

802.11a mode

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)
Chain J0			
Low	5180	21.383	16.4842
Middle	5200	21.259	16.4368
High	5240	21.088	16.4564
Chain J1			
Low	5180	21.818	16.5021
Middle	5200	20.781	16.4014
High	5240	20.956	16.4439

802.11n-HT20 mode

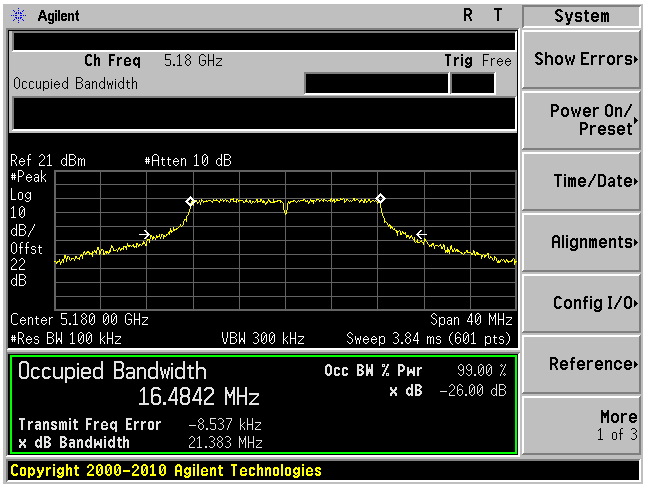
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)
Chain J0			
Low	5180	20.960	17.6605
Middle	5200	21.657	17.6492
High	5240	21.839	17.6446
Chain J1			
Low	5180	21.419	17.6413
Middle	5200	21.678	17.6075
High	5240	21.906	17.7464

802.11n-HT40 mode

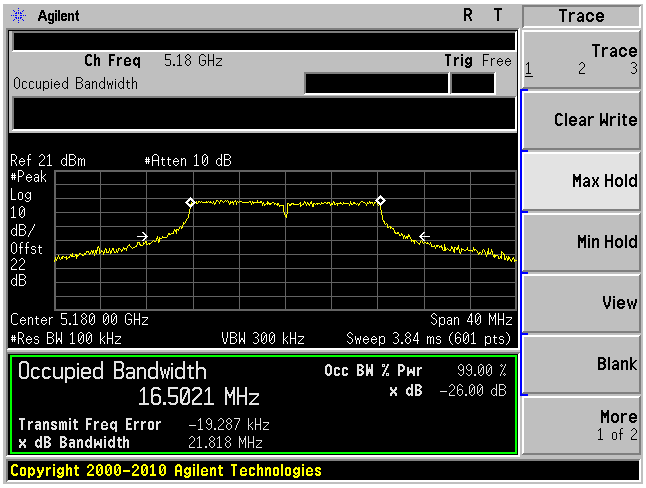
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)
Chain J0			
Low	5190	39.283	35.9117
High	5230	39.149	35.9625
Chain J1			
Low	5190	38.960	35.9776
High	5230	43.168	36.0850

5150-5250 MHz Band

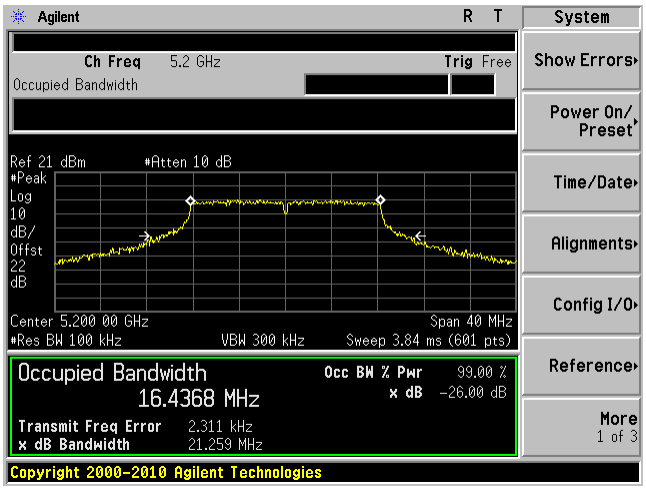
802.11a mode, 5180 MHz, Chain J0



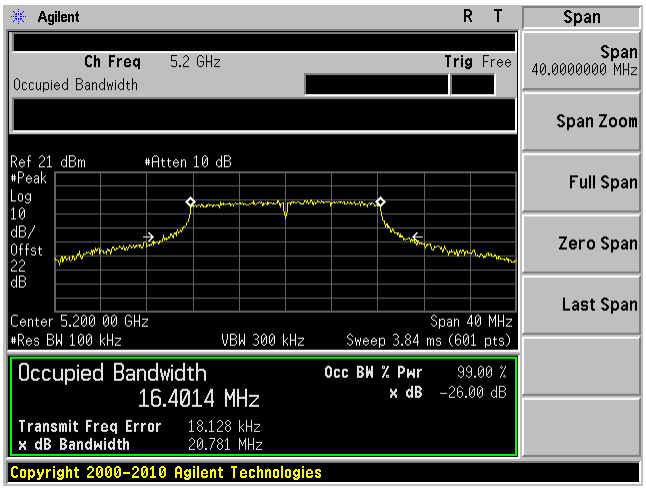
802.11a mode, 5180 MHz, Chain J1



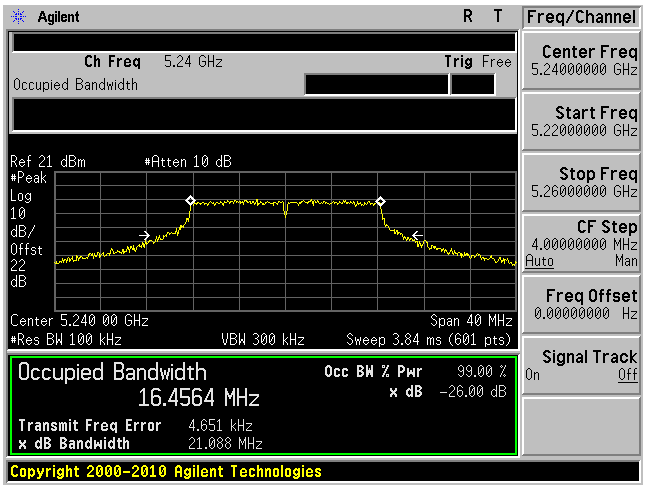
802.11a mode, 5200 MHz, Chain J0



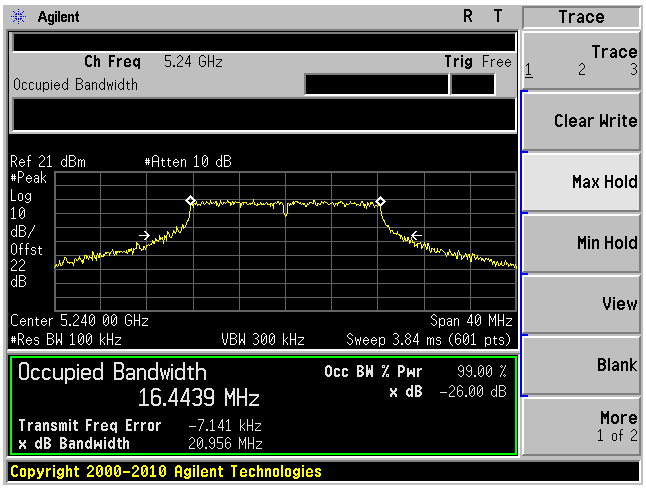
802.11a mode, 5200 MHz, Chain J1



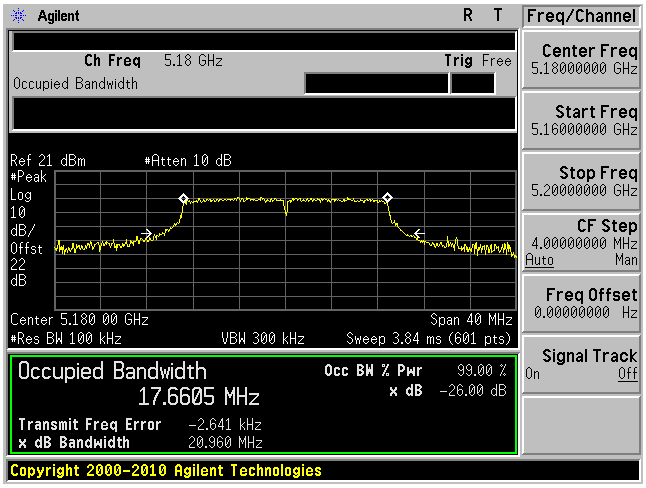
802.11a mode, 5240 MHz, Chain J0



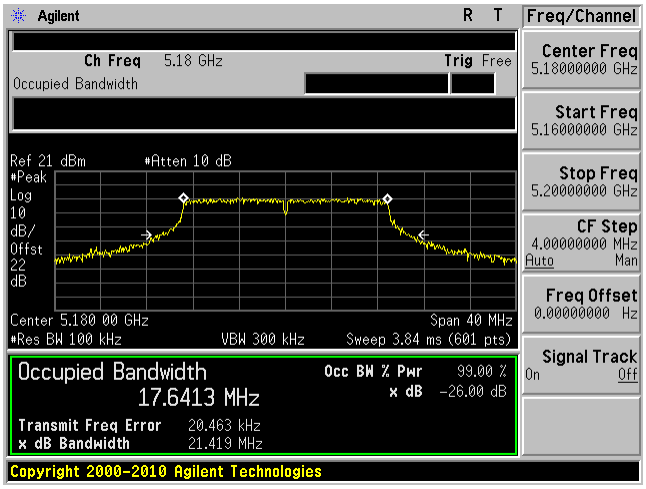
802.11a mode, 5240 MHz, Chain J1



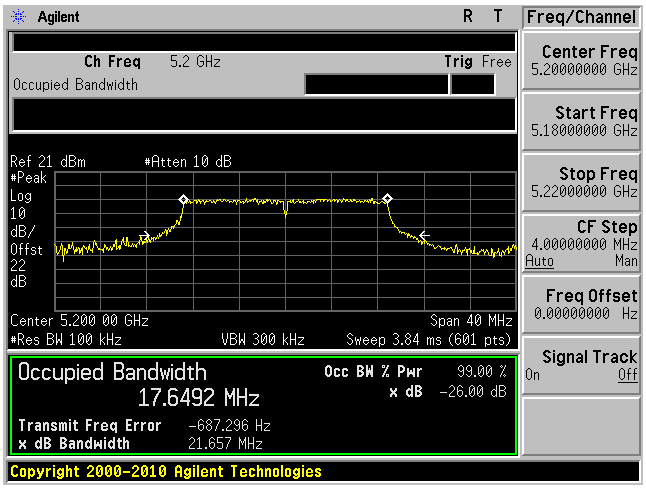
802.11n-HT20 mode, 5180 MHz, Chain J0



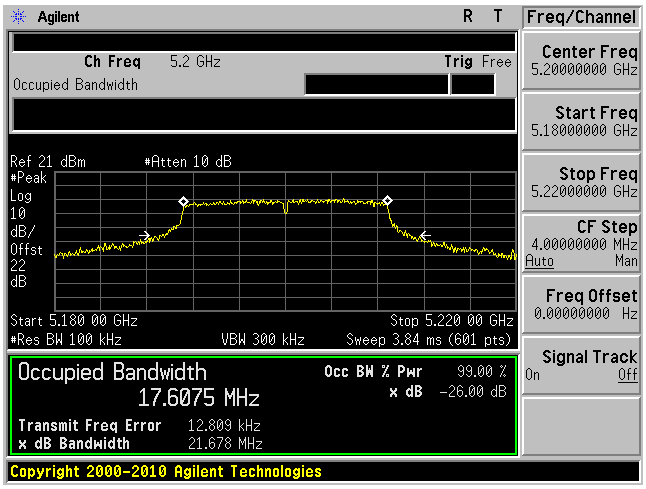
802.11n-HT20 mode, 5180 MHz, Chain J1



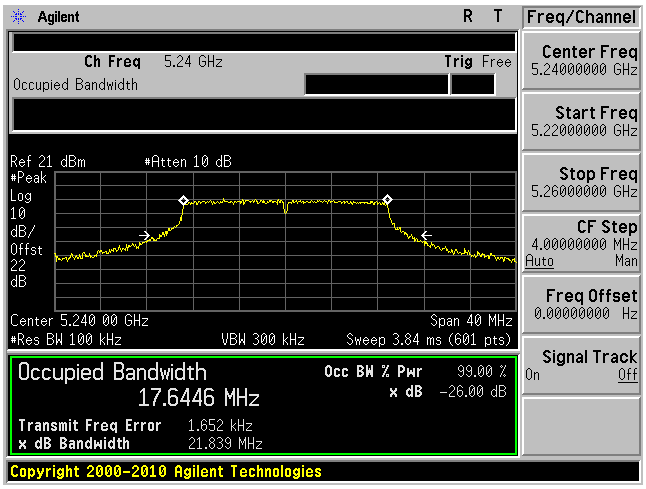
802.11n-HT20 mode, 5200 MHz, Chain J0



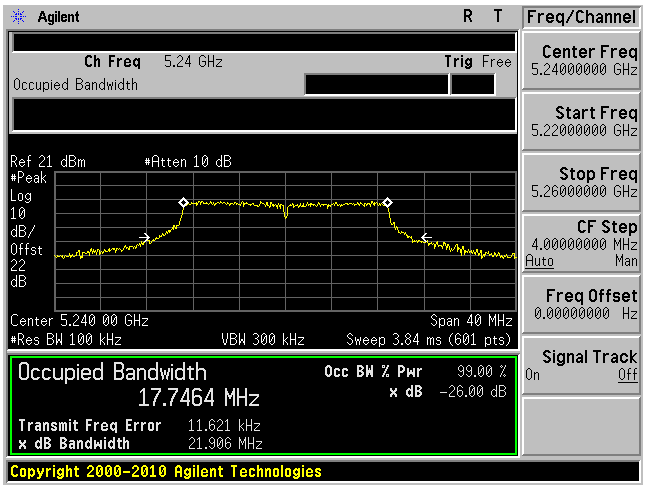
802.11n-HT20 mode, 5200 MHz, Chain J1



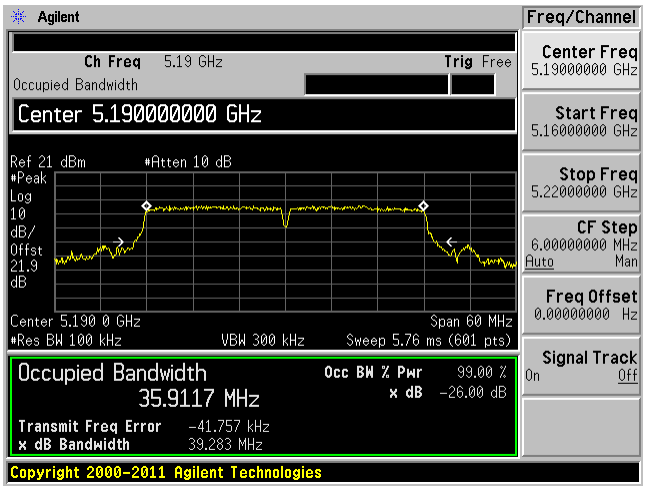
802.11n-HT20 mode, 5240 MHz, Chain J0



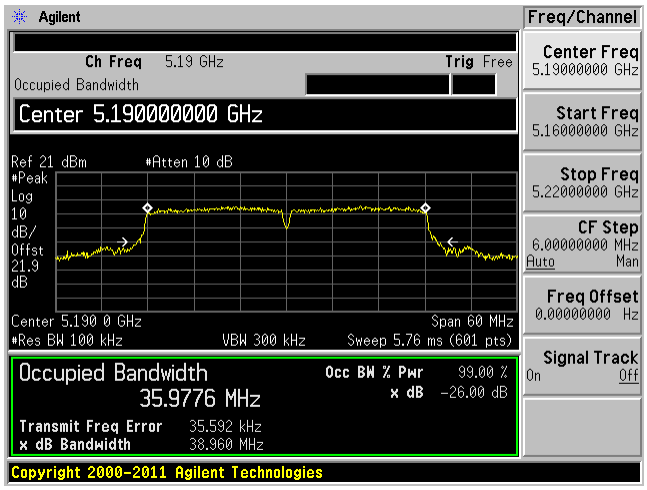
802.11n-HT20 mode, 5240 MHz, Chain J1



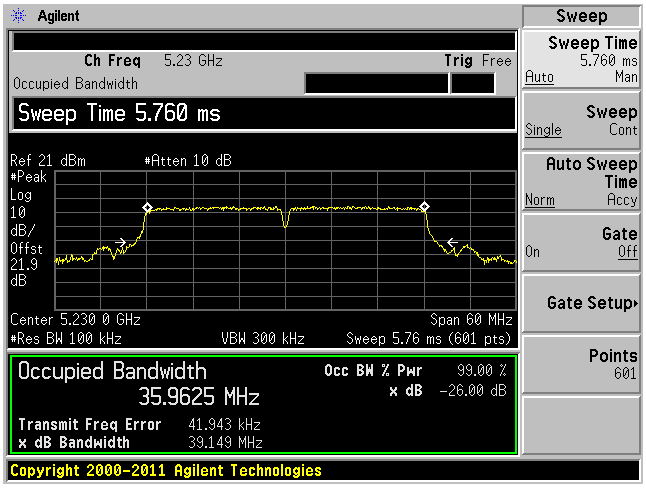
802.11n-HT40 mode, 5190 MHz, Chain J0



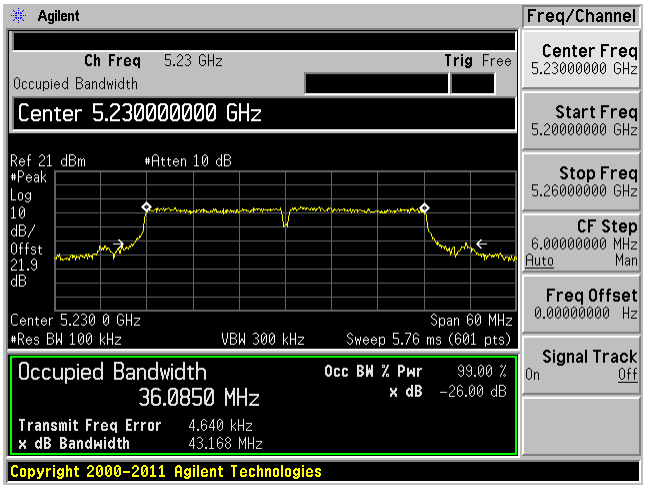
802.11n-HT40 mode, 5190 MHz, Chain J1



802.11n-HT40 mode, 5230 MHz, Chain J0



802.11n-HT40 mode, 5230 MHz, Chain J1



9 FCC §407(a)(1) - Peak Output Power Measurement

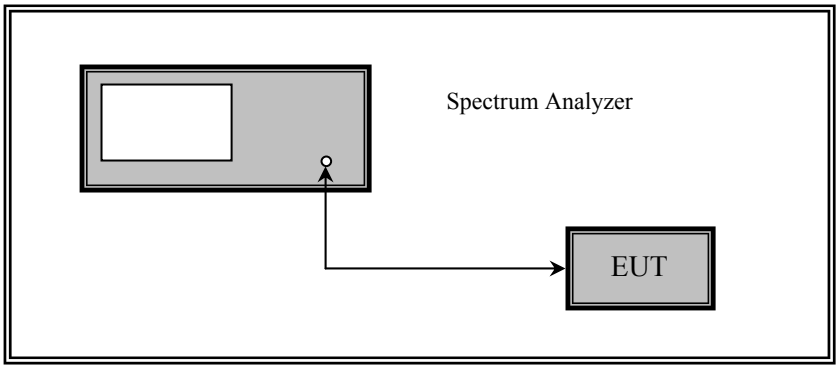
9.1 Applicable Standard

According to FCC §15.407(a)(1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 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.

9.2 Measurement Procedure

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



9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year

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

9.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	43 %
ATM Pressure:	101.5 kPa

The testing was performed by Wei Sun on 2013-01-04 in RF site.

9.5 Test Results

5150-5250 MHz Band:

802.11a mode

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	14.63	13.08	16.93	17	0.07
Middle	5200	14.41	13.38	16.94	17	0.06
High	5240	14.64	13.20	16.99	17	0.01

802.11n-HT20 mode

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	14.54	13.01	16.85	17	0.15
Middle	5200	14.62	12.99	16.89	17	0.11
High	5240	14.61	13.23	16.98	17	0.02

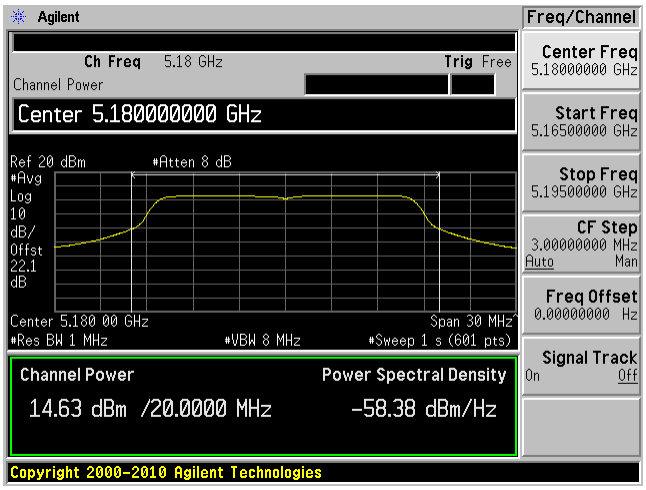
802.11n-HT40 mode

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	14.56	13.01	16.59	17	0.41
High	5230	14.61	13.17	16.96	17	0.04

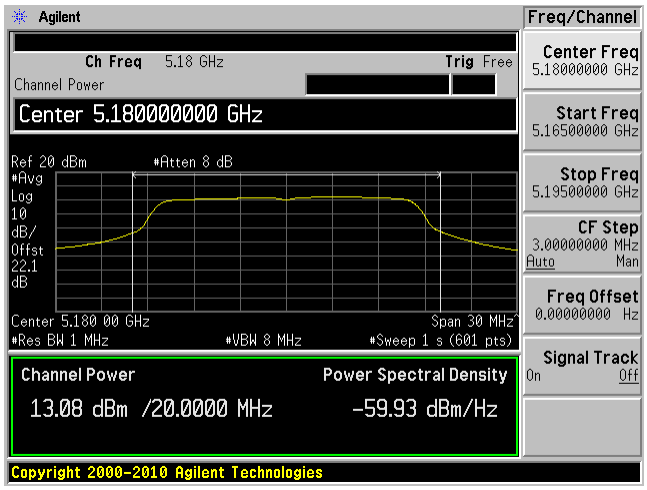
5150-5250 MHz Band

802.11a mode

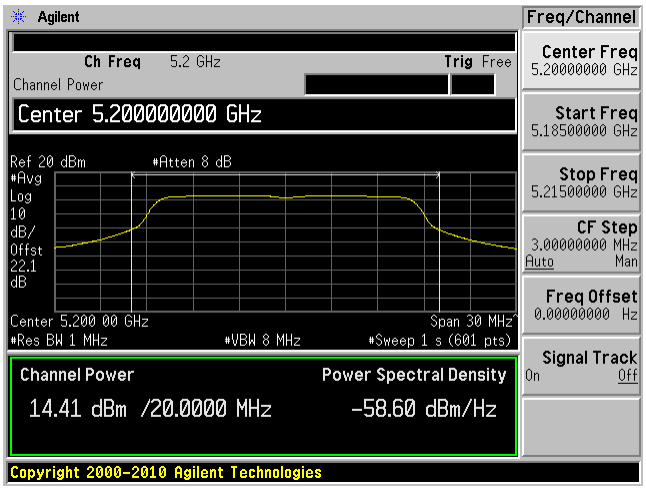
802.11a mode, 5180 MHz, Chain J0



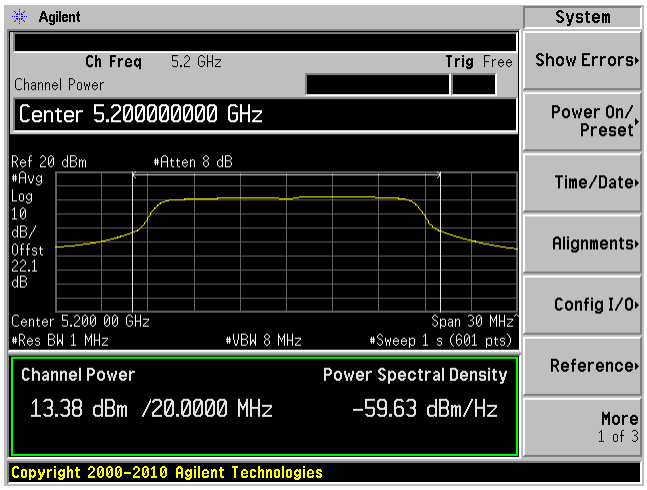
802.11a mode, 5180 MHz, Chain J1



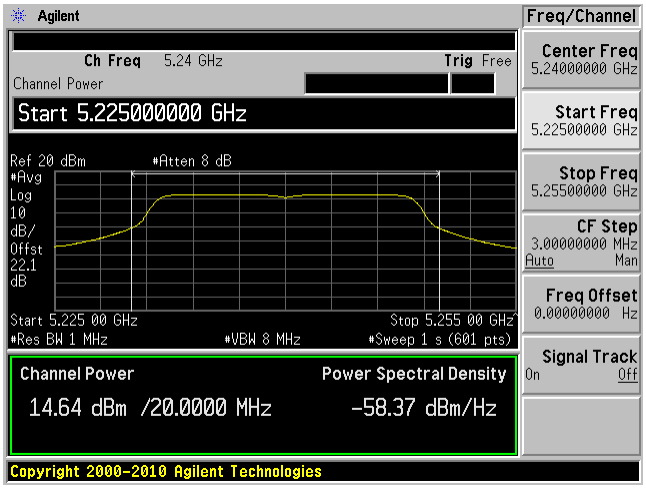
802.11a mode, 5200 MHz, Chain J0



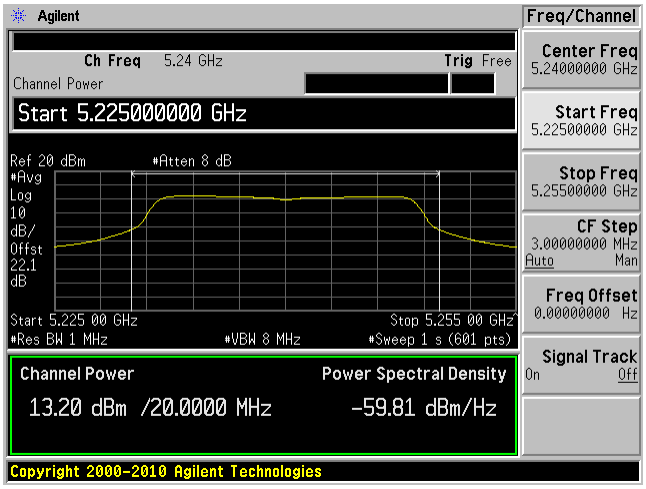
802.11a mode, 5200 MHz, Chain J1



802.11a mode, 5240 MHz, Chain J0

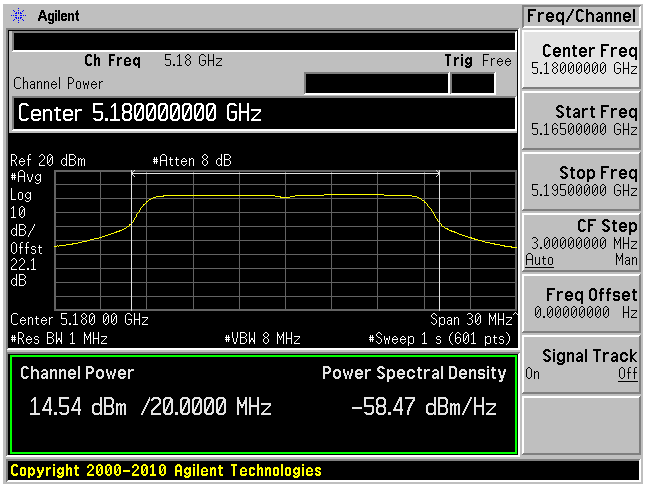


802.11a mode, 5240 MHz, Chain J1

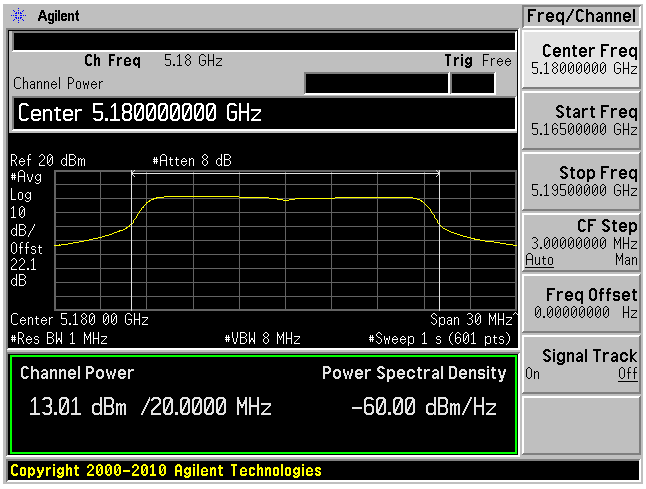


802.11n-HT20 mode

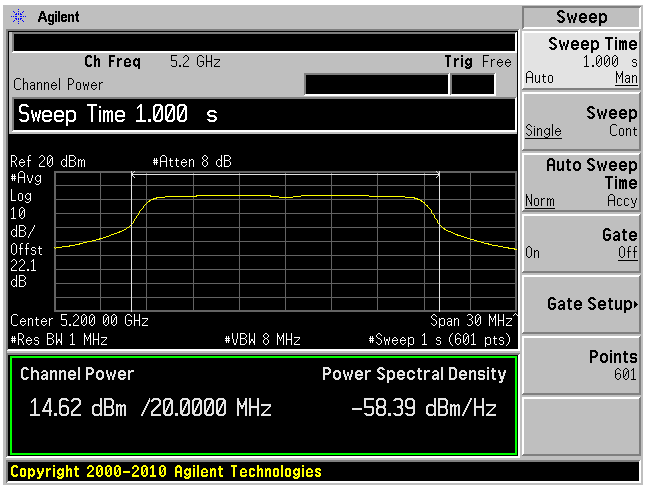
802.11n-HT20 mode, 5180 MHz, Chain J0



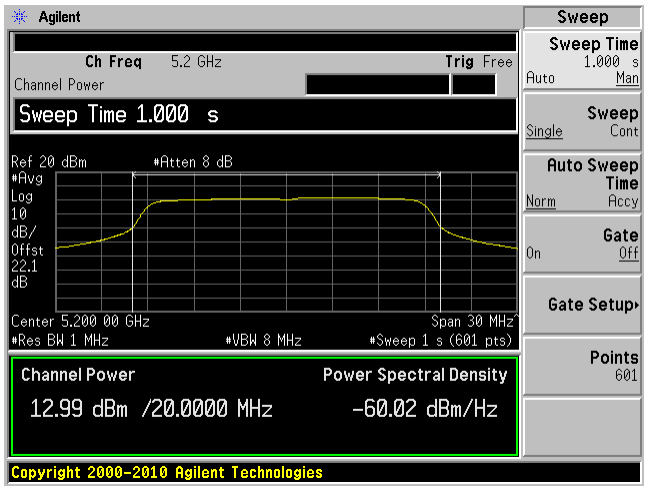
802.11n-HT20 mode, 5180 MHz, Chain J1



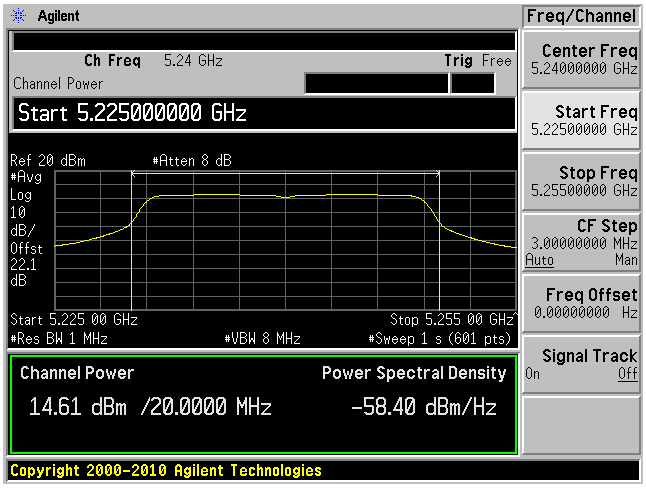
802.11n-HT20 mode, 5200 MHz, Chain J0



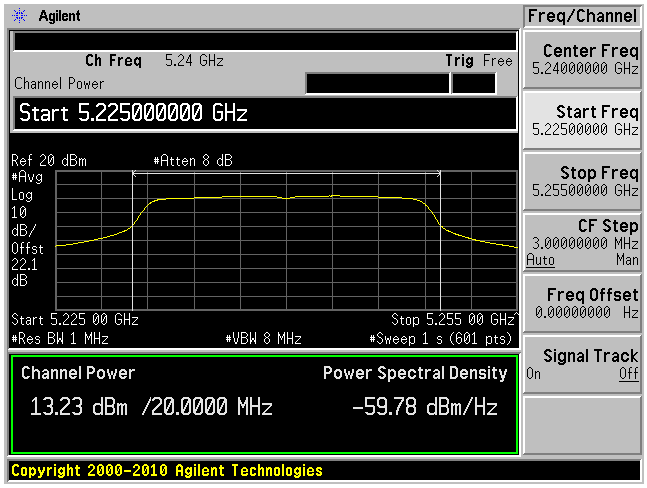
802.11n-HT20 mode, 5200 MHz, Chain J1



802.11n-HT20 mode, 5240 MHz, Chain J0

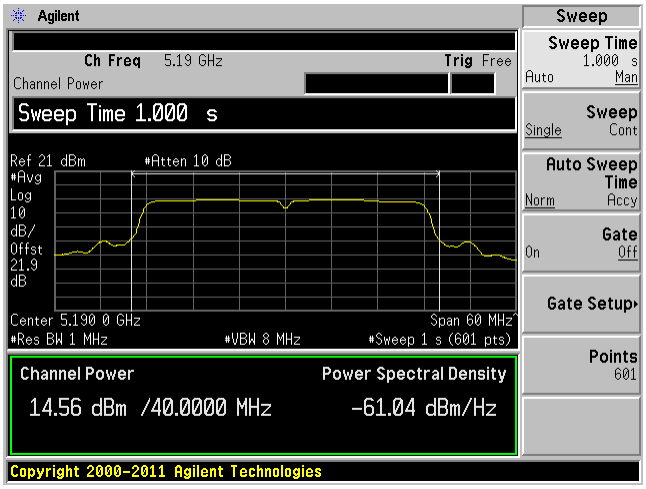


802.11n-HT20 mode, 5240 MHz, Chain J1

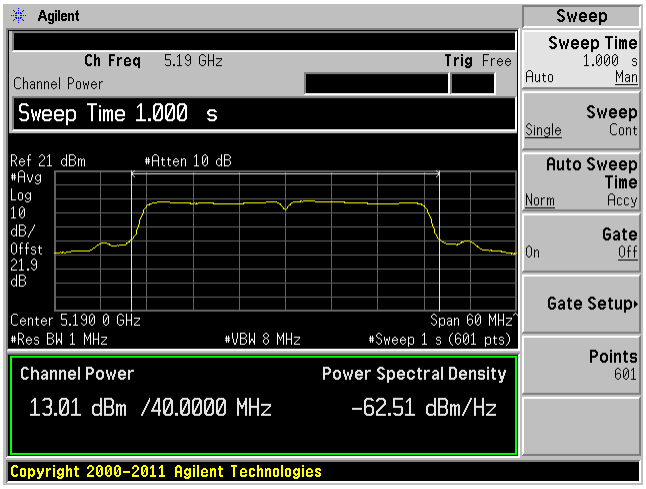


802.11n-HT40 mode

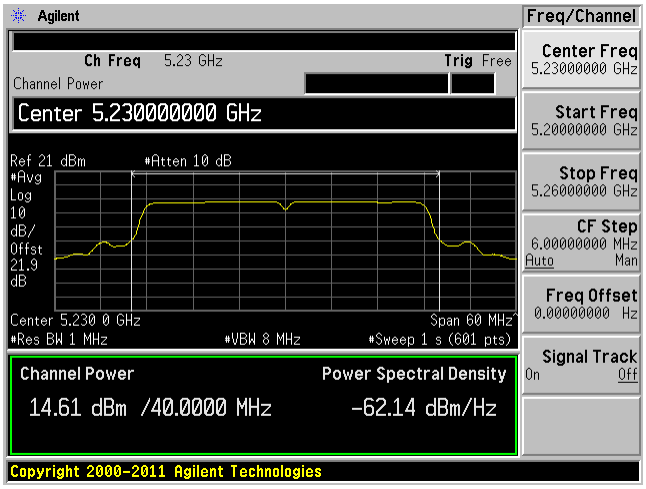
802.11n-HT40 mode, 5190 MHz, Chain J0



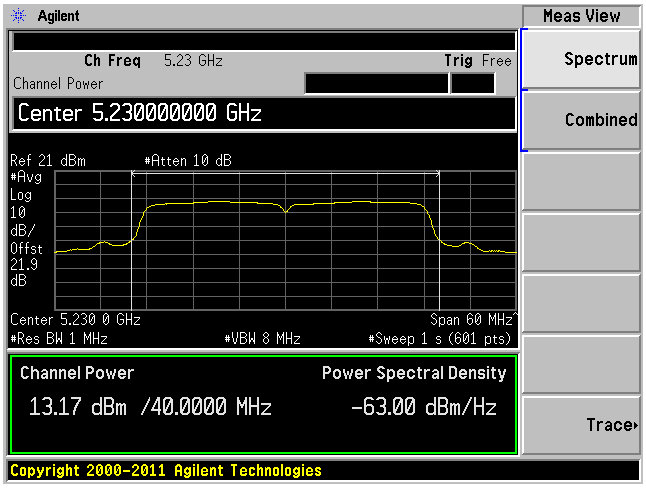
802.11n-HT40 mode, 5190 MHz, Chain J1



802.11n-HT40 mode, 5230 MHz, Chain J0



802.11n-HT40 mode, 5230 MHz, Chain J1



10 FCC §15.407(b) - Out of Band Emissions

10.1 Applicable Standard

According to FCC §15.407(b)

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

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 RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
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	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year

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

10.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	44 %
ATM Pressure:	101.2 kPa

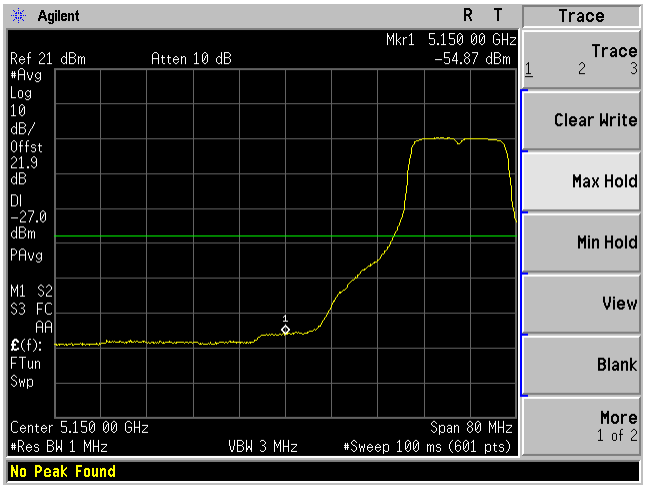
The testing was performed by Wei Sun on 2012-12-22 in RF site.

10.5 Test Results

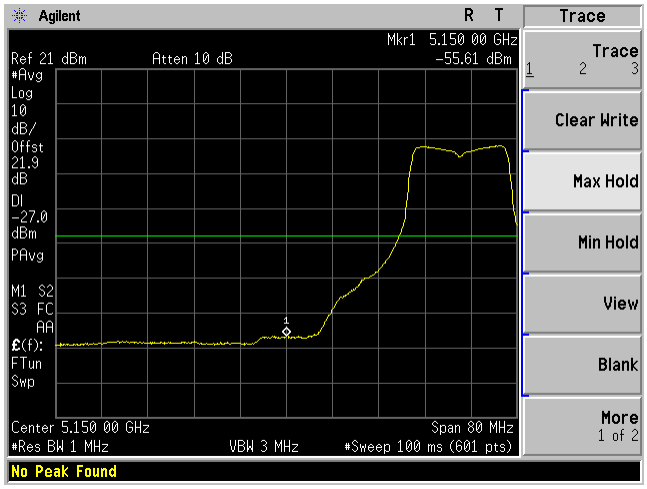
Please refer to following plots.

5150-5250 MHz Band

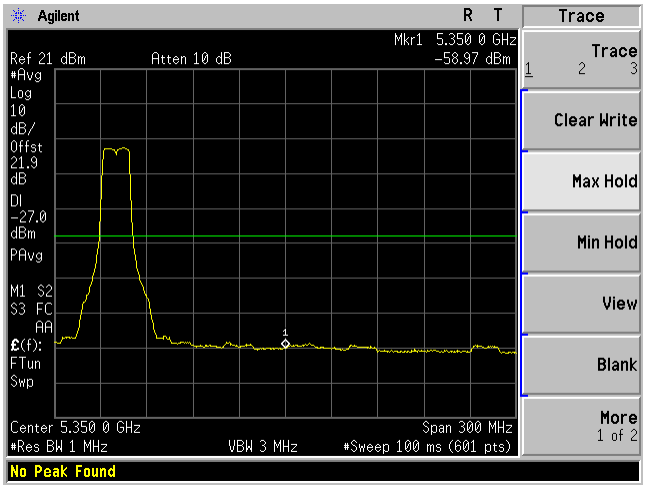
802.11a mode, Lowest Channel, Chain J0



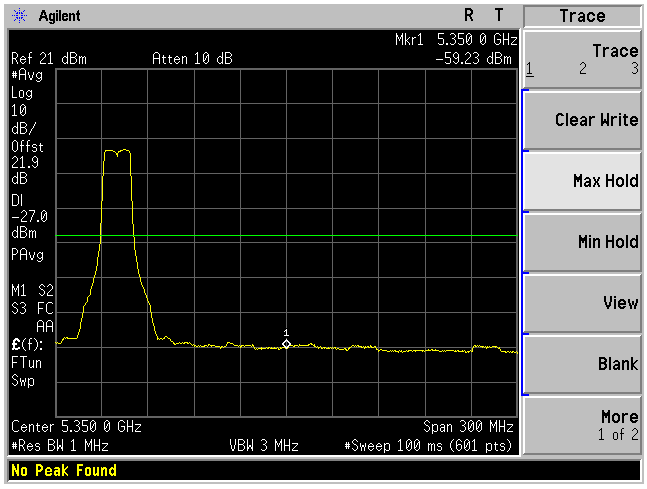
802.11a mode, Lowest Channel, Chain J1



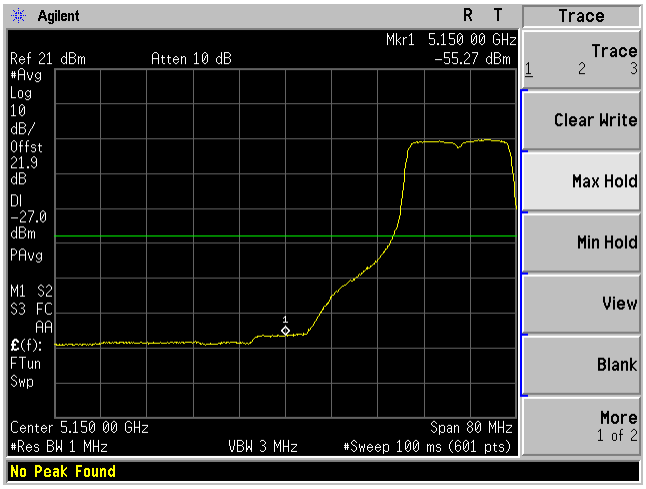
802.11a mode, Highest Channel, Chain J0



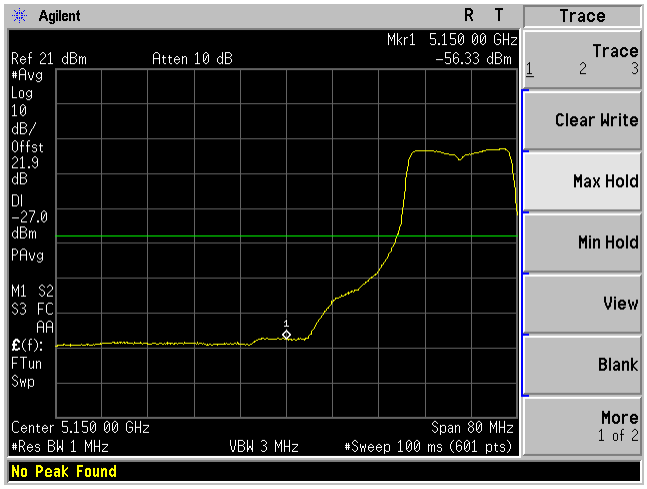
802.11a mode, Highest Channel, Chain J1



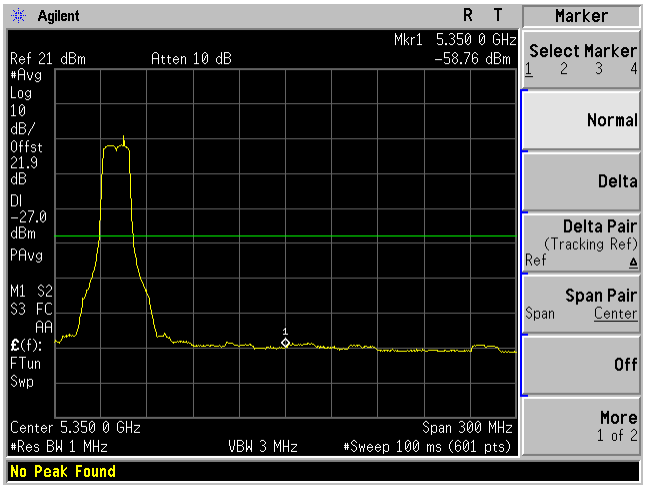
802.11n-HT20 mode, Lowest Channel, Chain J0



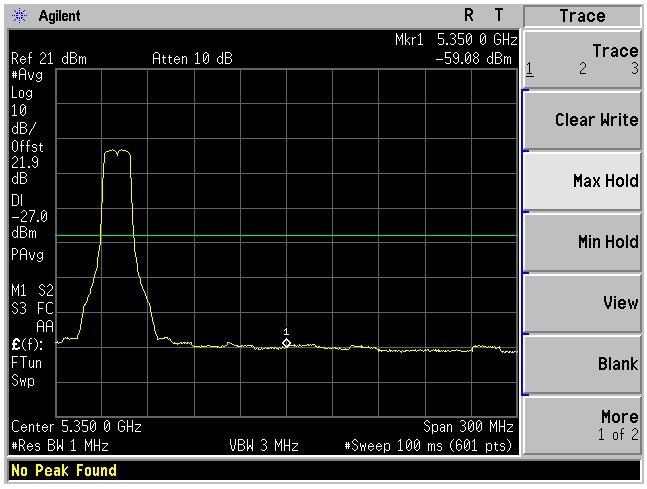
802.11n-HT20 mode, Lowest Channel, Chain J1



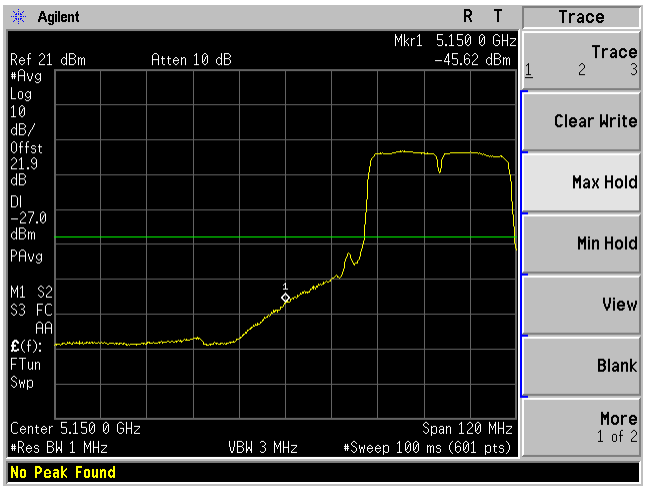
802.11n-HT20 mode, Highest Channel, Chain J0



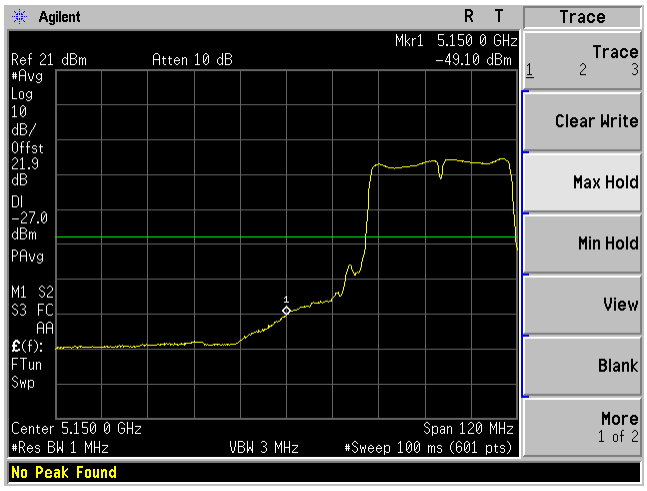
802.11n-HT20 mode, Highest Channel, Chain J1



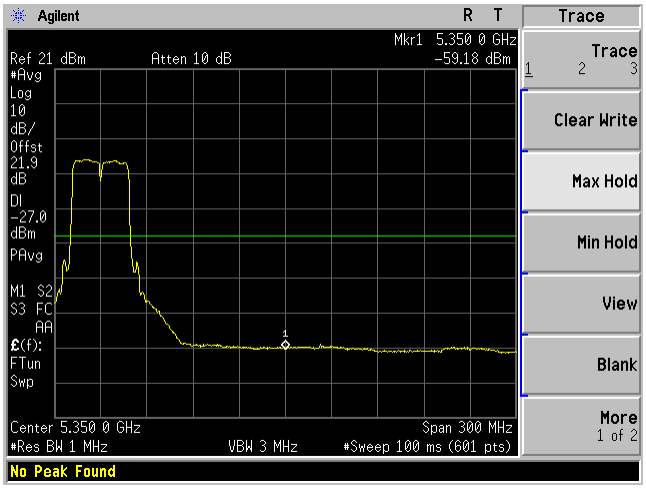
802.11n-HT40 mode, Lowest Channel, Chain J0



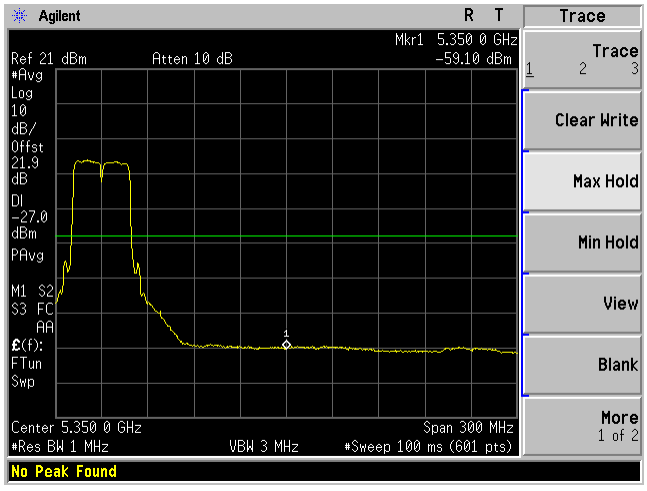
802.11n-HT40 mode, Lowest Channel, Chain J1



802.11n-HT40 mode, Highest Channel, Chain J0



802.11n-HT40 mode, Highest Channel, Chain J1



11 FCC §15.407(a)(1) - Power Spectral Density

11.1 Applicable Standard

According to FCC §15.407(a)(1)

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

11.2 Measurement Procedure

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

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year

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

11.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	43 %
ATM Pressure:	101.5 kPa

The testing was performed by Wei Sun on 2012-12-21 in RF site.

11.5 Test Results

5150-5250 MHz Band

802.11a mode

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	-3.49	-2.31	0.15	4	3.85
Middle	5200	-3.71	-2.78	-0.21	4	4.21
High	5240	-5.45	-7.37	-3.30	4	7.30

802.11n-HT20 mode

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	-1.53	-3.38	0.65	4	3.35
Middle	5200	-3.23	-3.34	-0.28	4	4.28
High	5240	-5.53	-7.09	-3.23	4	4.47

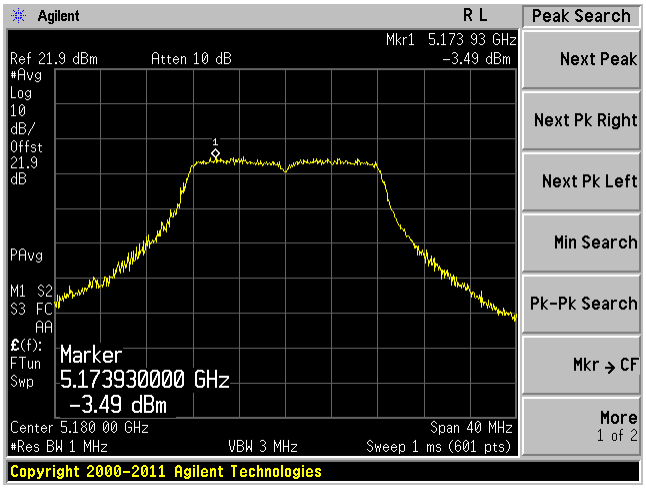
802.11n-HT40 mode

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J8 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	-4.26	-6.40	-2.19	4	6.19
High	5230	-8.98	-9.28	-6.13	4	10.13

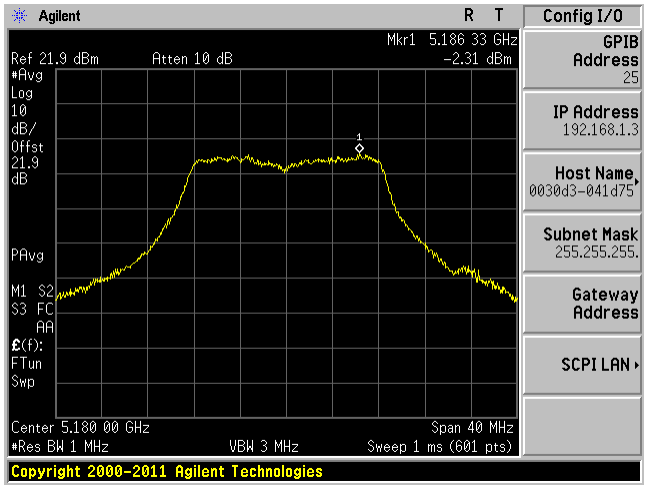
Please refer to the following plots.

802.11a mode

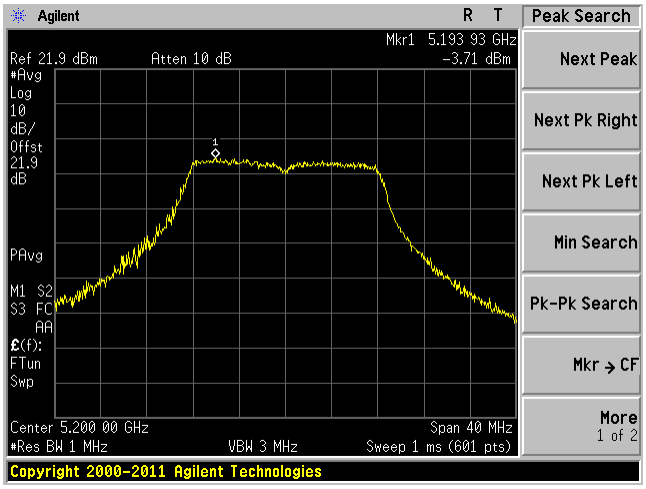
802.11a mode, 5180 MHz, Chain J0



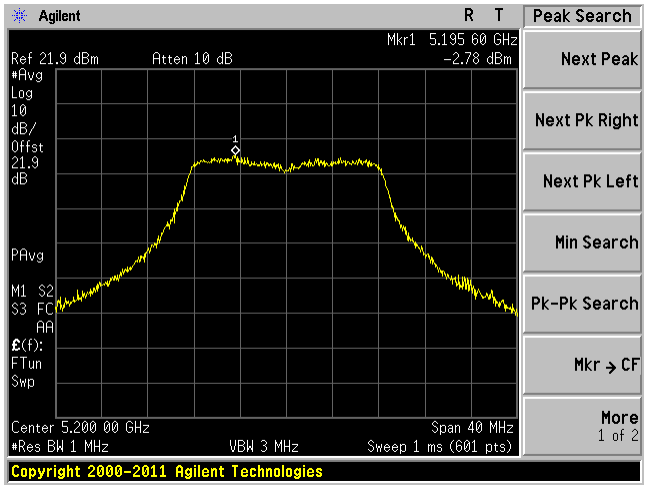
802.11a mode, 5180 MHz, Chain J1



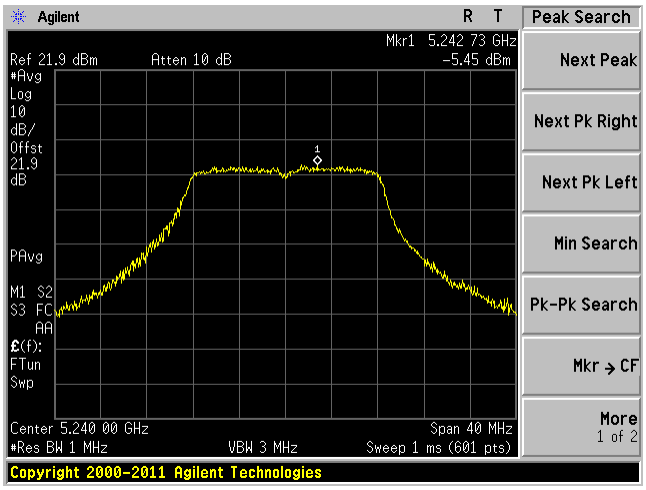
802.11a mode, 5200 MHz, Chain J0



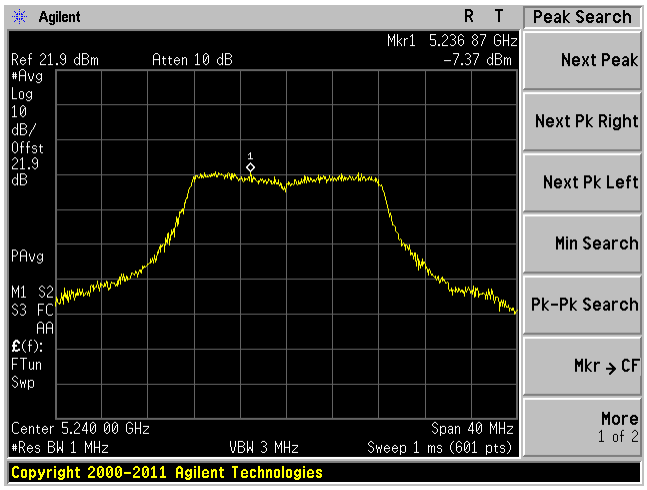
802.11a mode, 5200 MHz, Chain J1



802.11a mode, 5240 MHz, Chain J0

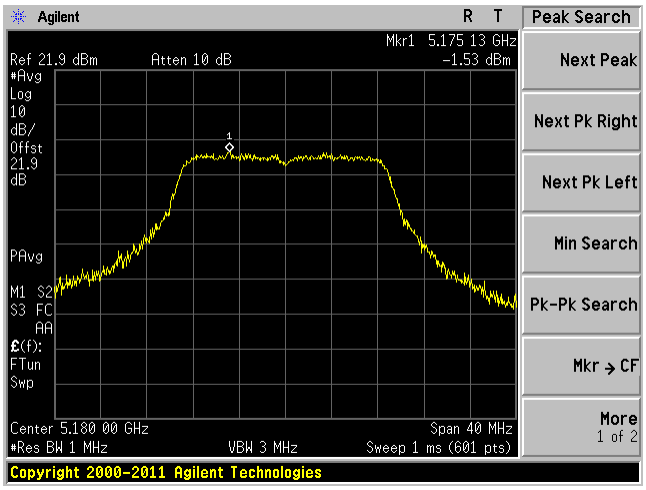


802.11a mode, 5240 MHz, Chain J1

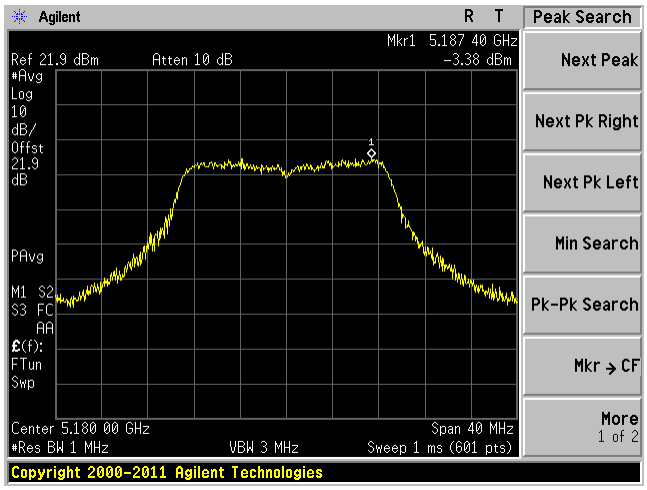


802.11n-HT20 mode

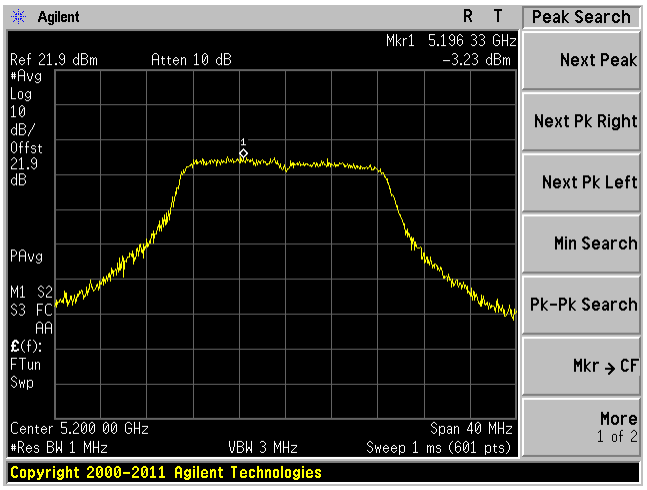
802.11n-HT20 mode, 5180 MHz, Chain J0



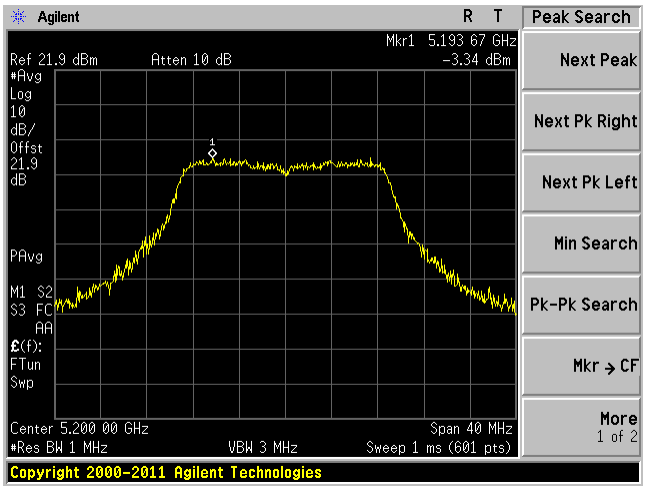
802.11n-HT20 mode, 5180 MHz, Chain J1



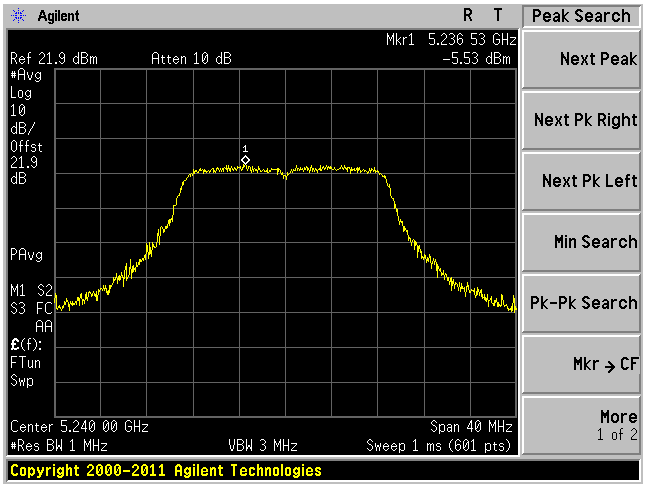
802.11n-HT20 mode, 5200 MHz, Chain J0



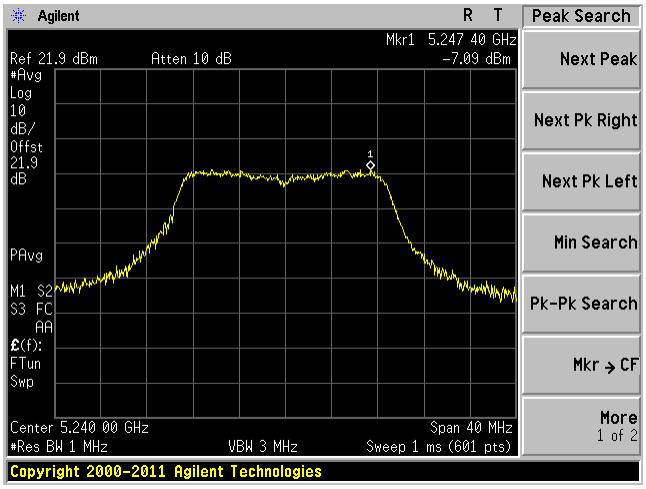
802.11n-HT20 mode, 5200 MHz, Chain J1



802.11n-HT20 mode, 5240 MHz, Chain J0

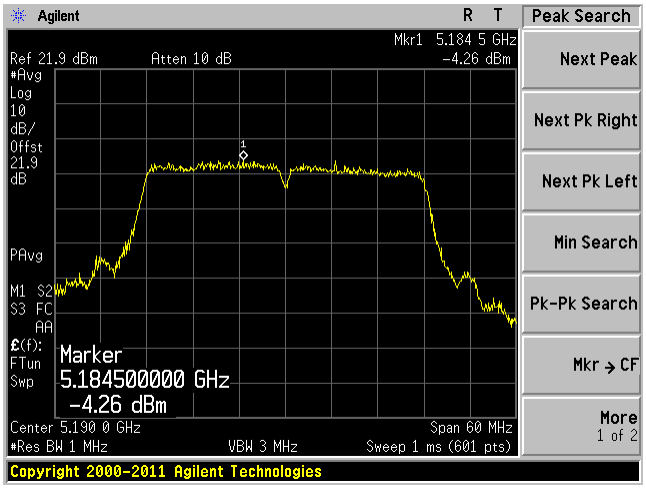


802.11n-HT20 mode, 5240 MHz, Chain J1

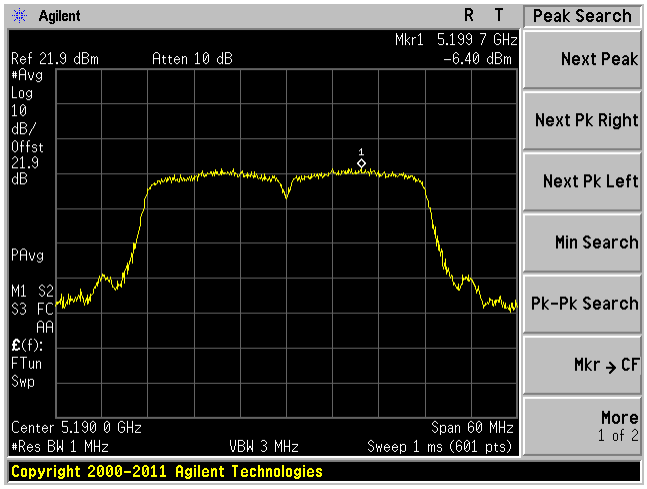


802.11n-HT40 mode

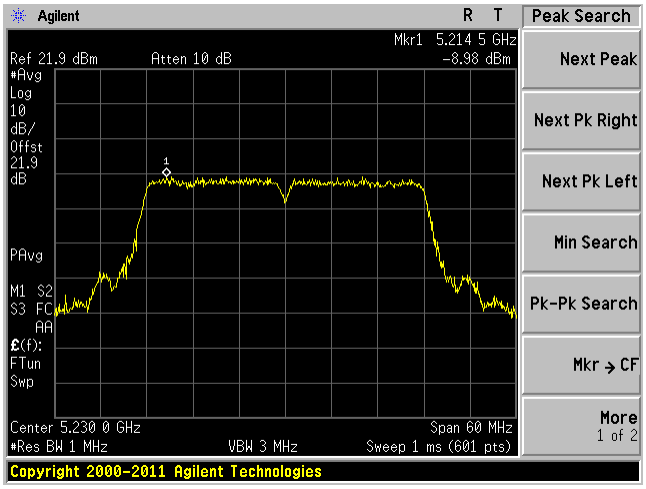
802.11n-HT40 mode, 5190 MHz, Chain J0



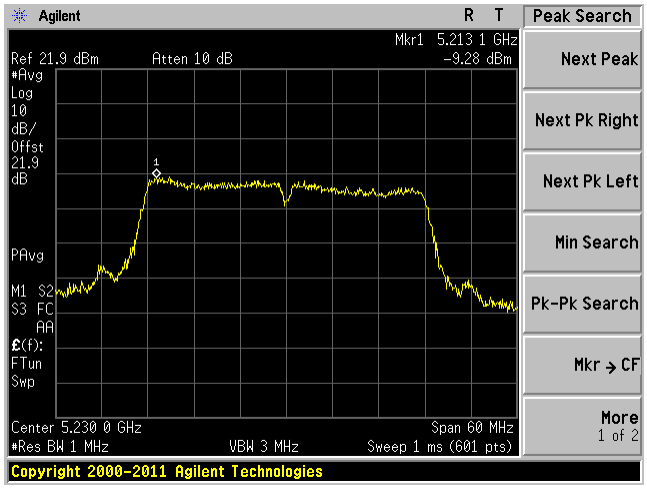
802.11n-HT40 mode, 5190 MHz, Chain J1



802.11n-HT40 mode, 5230 MHz, Chain J0



802.11n-HT40 mode, 5230 MHz, Chain J1



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	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year

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

12.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	44 %
ATM Pressure:	101.2 kPa

The testing was performed by Jeffrey Wu on 2012-12-21 in RF site.

12.5 Test Results

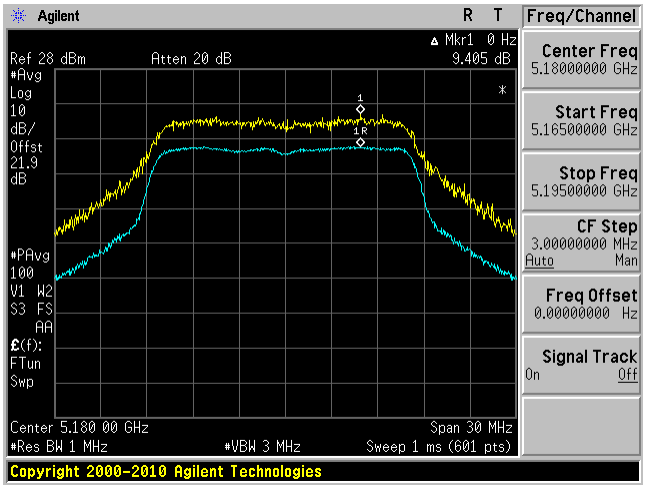
Please refer to the following tables and plots.

5150-5250 MHz Band

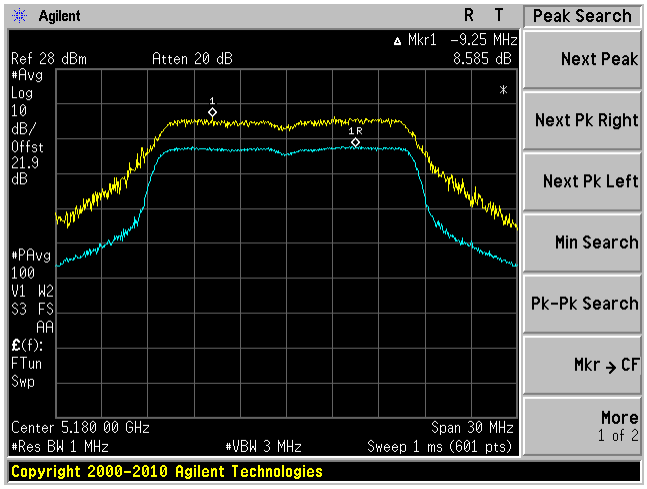
Channel	Frequency (MHz)	TX Chain J0 PER (dB)	TX Chain J1 PER (dB)	Limit (dB)
802.11a mode				
Low	5180	9.405	8.585	13
Middle	5200	9.151	8.251	
High	5240	8.649	8.854	
802.11n-HT20 mode				
Low	5180	8.712	7.938	13
Middle	5200	8.301	8.201	
High	5240	8.377	8.130	
802.11n-HT40 mode				
Low	5190	9.477	8.243	13
High	5230	9.521	8.122	

5150-5250 MHz Band

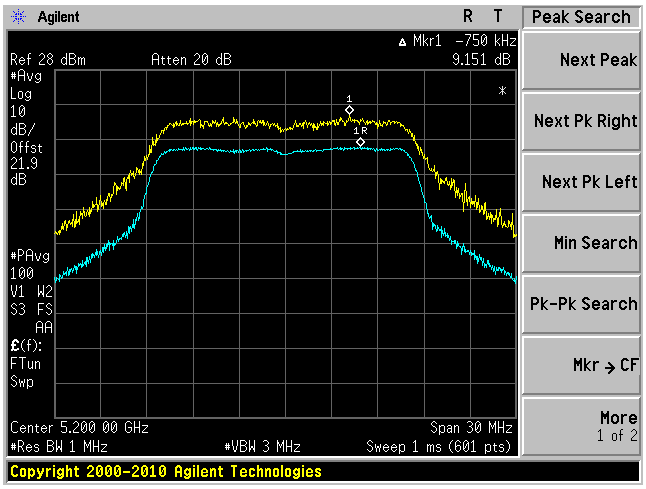
802.11a mode, 5180 MHz, Chain J0



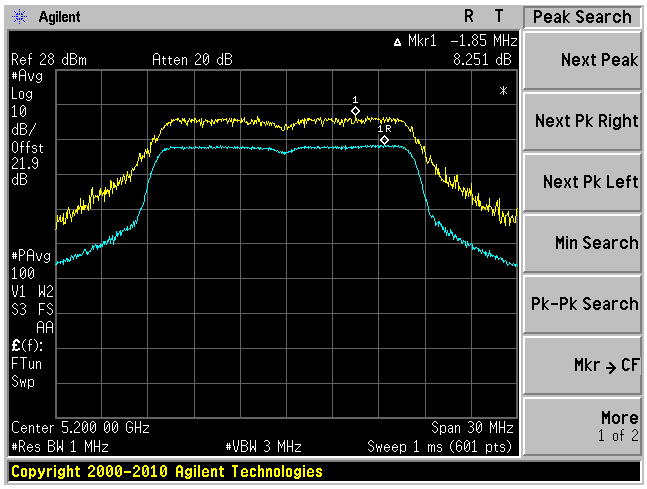
802.11a mode, 5180 MHz, Chain J1



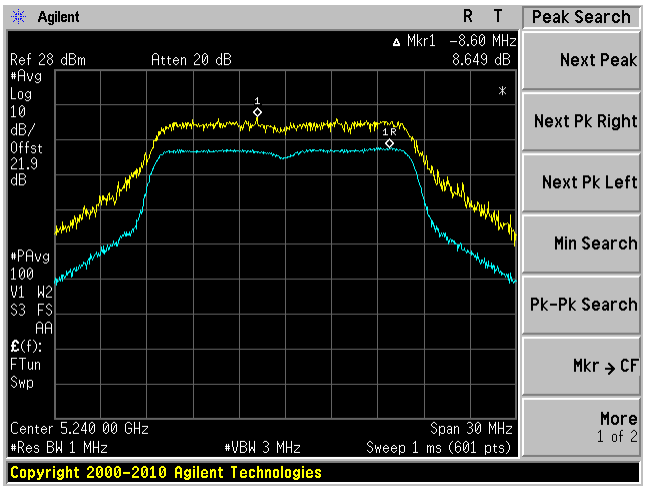
802.11a mode, 5200 MHz, Chain J0



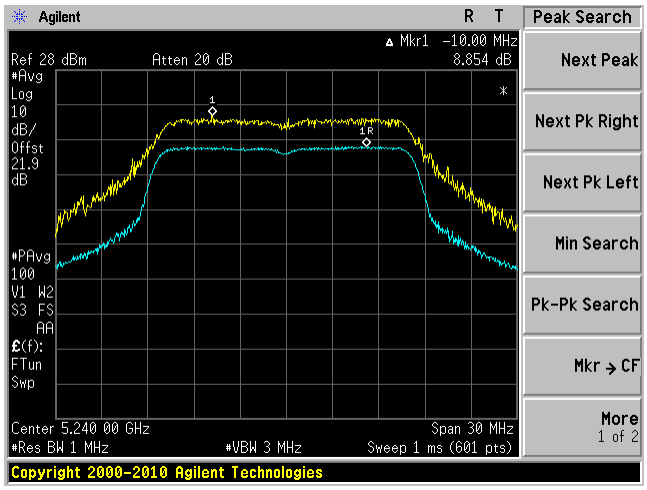
802.11a mode, 5200 MHz, Chain J1



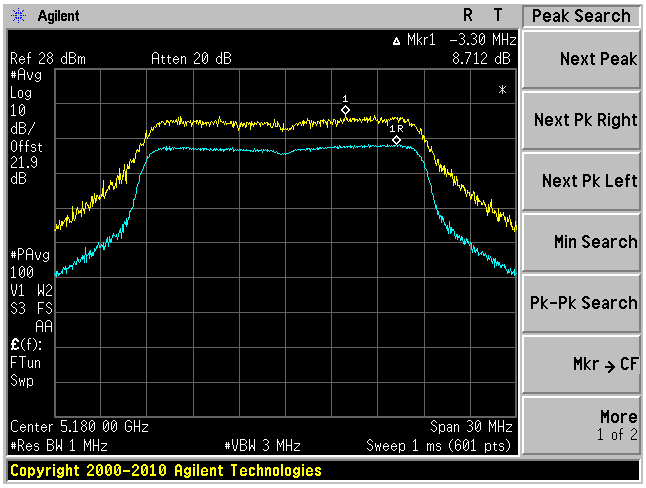
802.11a mode, 5240 MHz, Chain J0



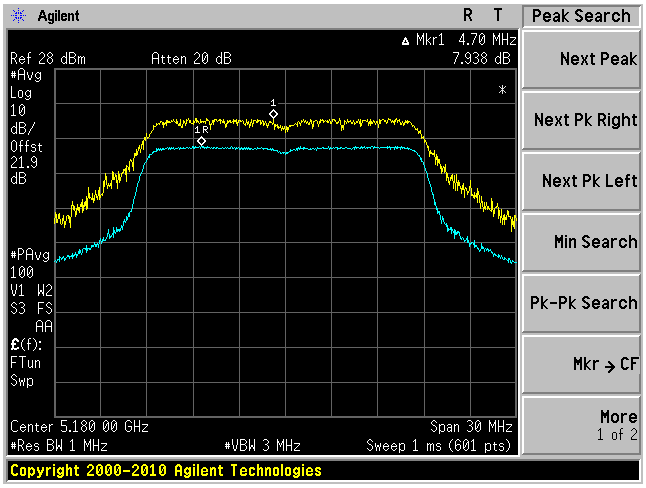
802.11a mode, 5240 MHz, Chain J1



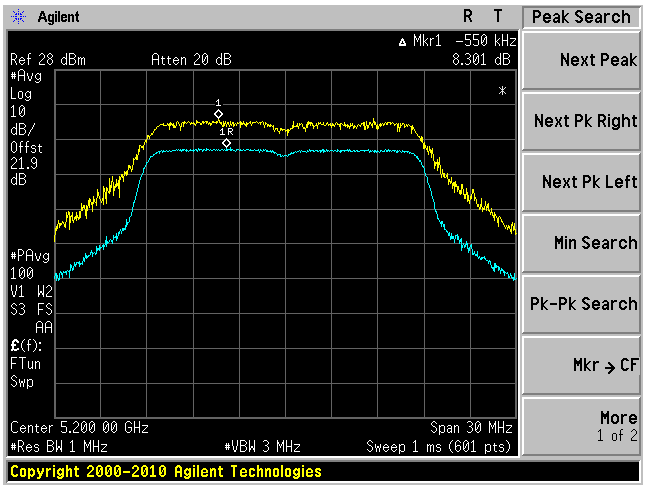
802.11n-HT20 mode, 5180 MHz, Chain J0



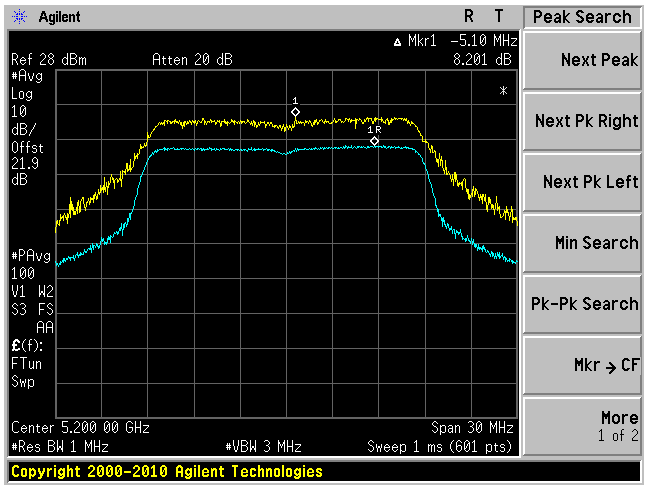
802.11n-HT20 mode, 5180 MHz, Chain J1



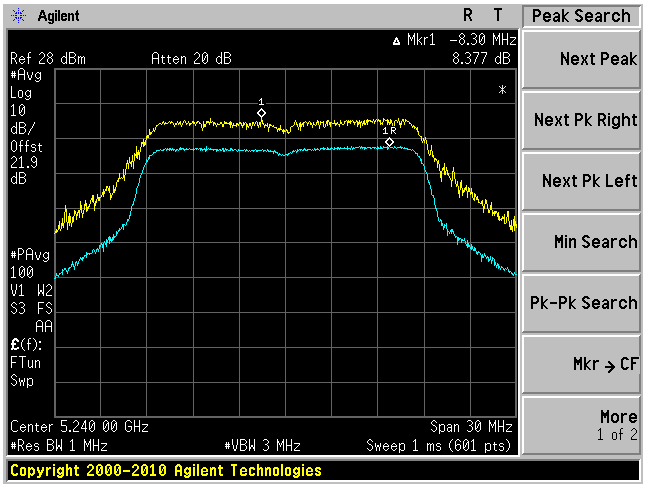
802.11n-HT20 mode, 5200 MHz, Chain J0



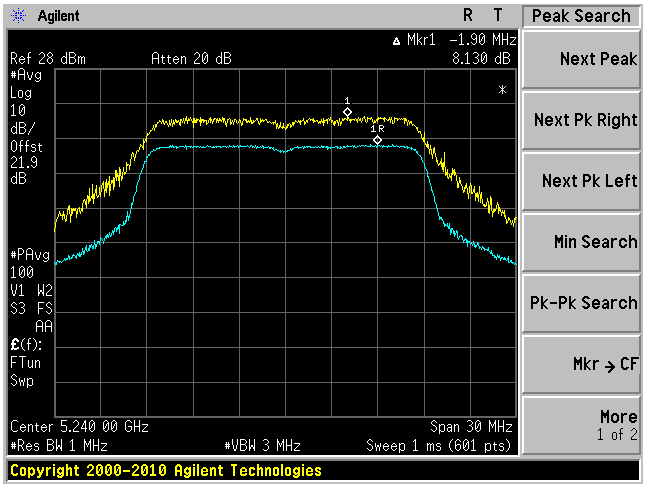
802.11n-HT20 mode, 5200 MHz, Chain J1



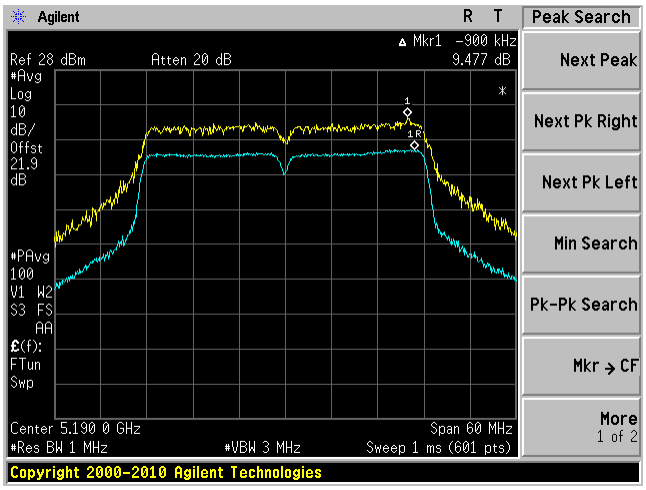
802.11n-HT20 mode, 5240 MHz, Chain J0



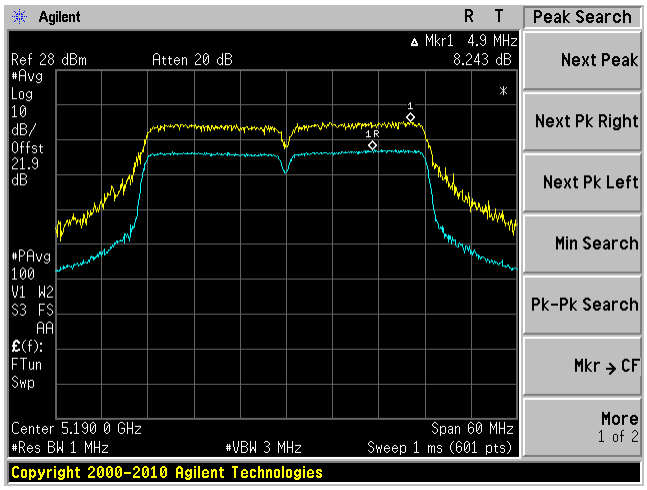
802.11n-HT20 mode, 5240 MHz, Chain J1



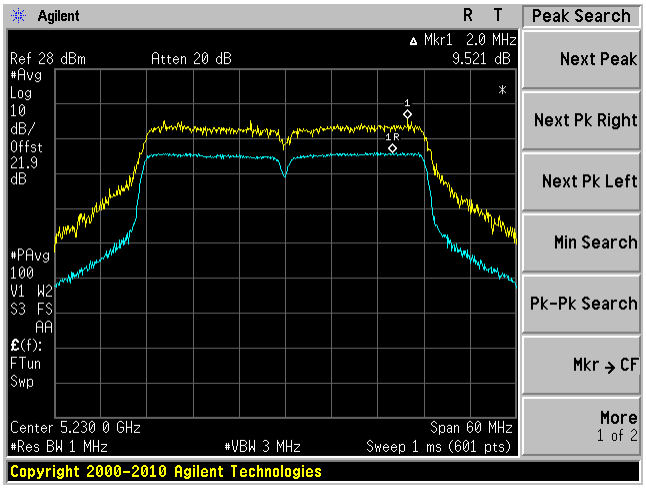
802.11n-HT40, 5190 MHz, Chain J0



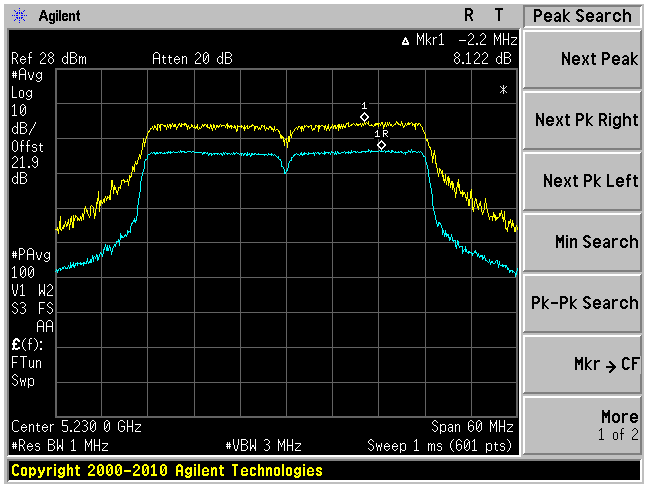
802.11n-HT40 mode, 5190 MHz, Chain J1



802.11n-HT40 mode, 5230 MHz, Chain J0



802.11n-HT40 mode, 5230 MHz, Chain J1



13 FCC §15.407(b) - Spurious Emissions at Antenna Terminals

13.1 Applicable Standard

According to FCC §15.407(b)

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

13.2 Measurement Procedure

4) Procedure for Unwanted Emissions Measurements Below 1000 MHz.
a) Follow the requirements in section G)3), "General Requirements for Unwanted Emissions Measurements".
b) Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

6) Procedures for Average Unwanted Emissions Measurements above 1000 MHz.
a) Follow the requirements in section G)3), "General Requirements for Unwanted Emissions Measurements".
b) Average emission levels shall be measured using one of the following two methods.
c) Method AD (Average Detection): Primary method
(i) RBW = 1 MHz.
(ii) VBW ≥ 3 MHz.
(iii) Detector = RMS, if span/(# of points in sweep) ≤ RBW/2. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.
(iv) Averaging type = power (i.e., RMS)
• As an alternative, the detector and averaging type may be set for linear voltage averaging. Some analyzers require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
(v) Sweep time = auto.
(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces should be averaged.
(vii) If tests are performed with the EUT transmitting at a duty cycle less than 98 percent, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
• If power averaging (RMS) mode was used in step (iv) above, the correction factor is10 log(1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.
• If linear voltage averaging mode was used in step (iv) above, the correction factor is 20 log(1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.

13.3 Test Equipment List and Details

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

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

13.4 Test Environmental Conditions

Temperature:	24 °C
Relative Humidity:	44 %
ATM Pressure:	101.3kPa

The testing was performed by Wei Sun on 2013-01-04 in RF site.

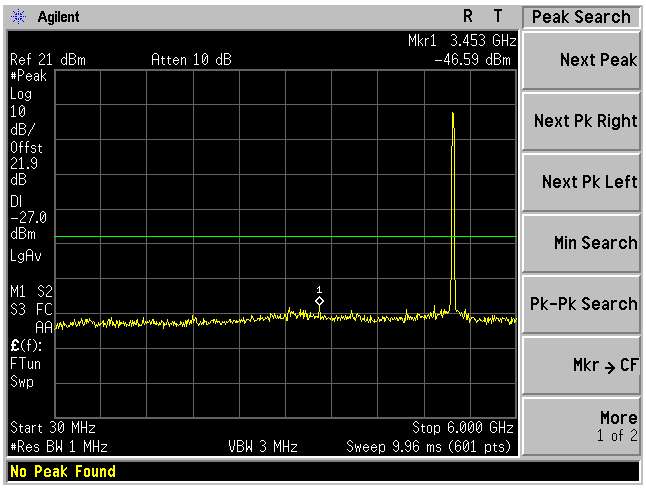
13.5 Test Results

Please refer to following plots of spurious emissions.

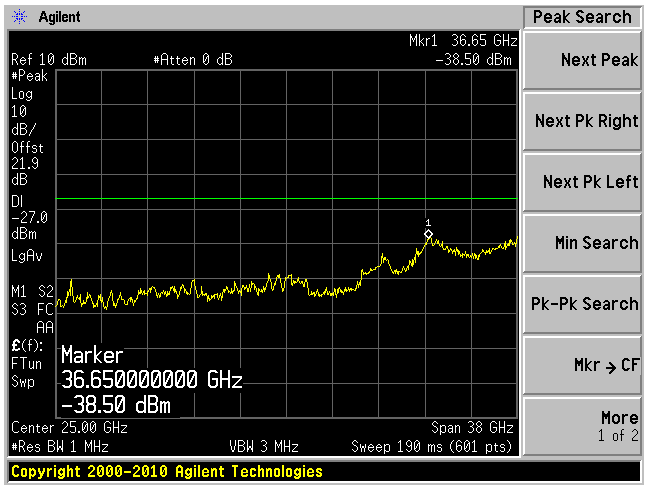
5150-5250 MHz Band

802.11 a mode, Low Channel 5180 MHz

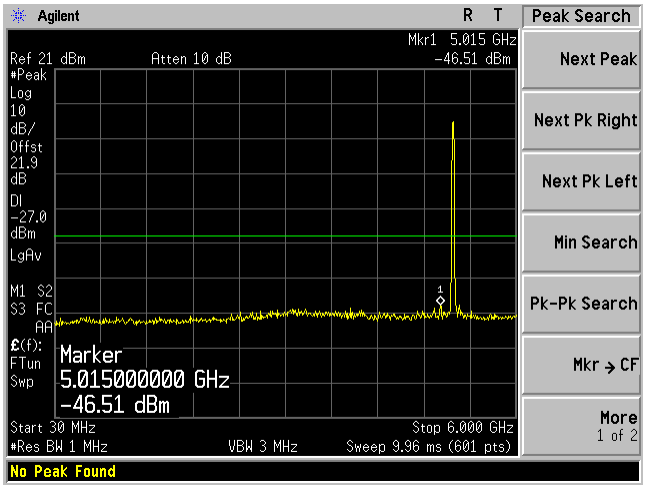
Chain J0 1



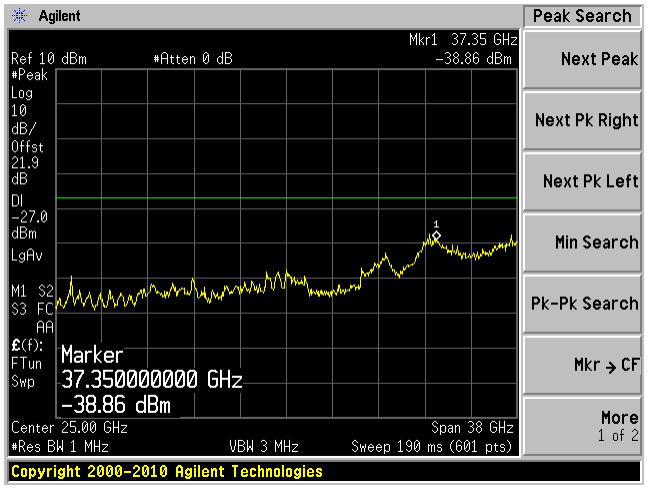
Chain J0 2



Chain J1 1

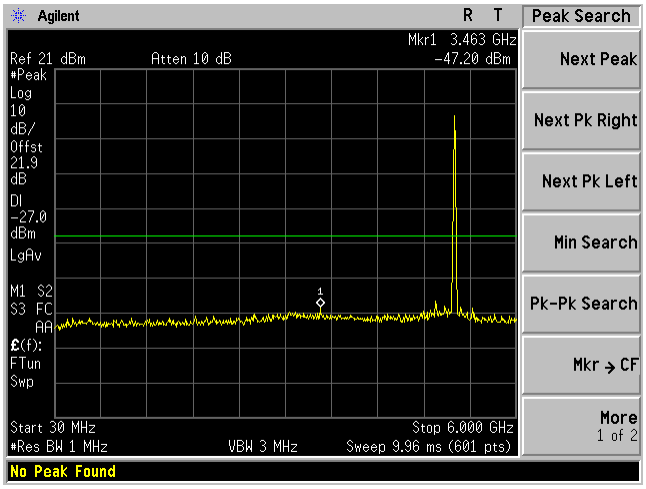


Chain J1 2

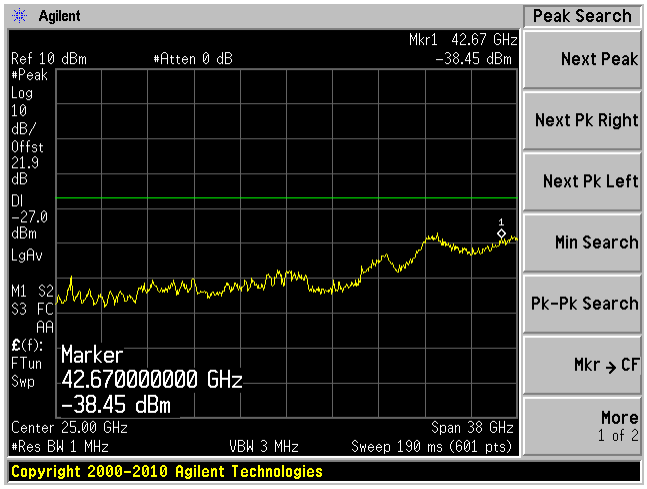


802.11a mode, Middle Channel 5200 MHz

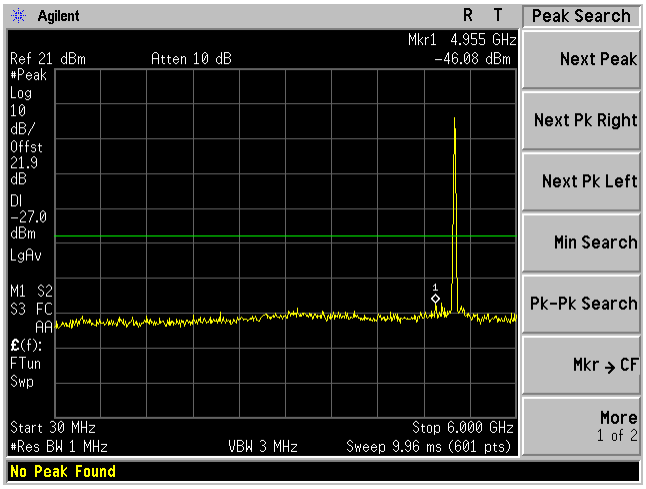
Chain J0 1



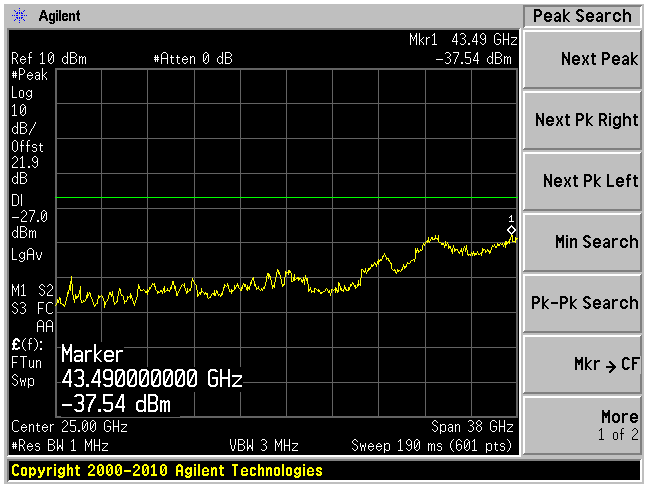
Chain J0 2



Chain J1 1

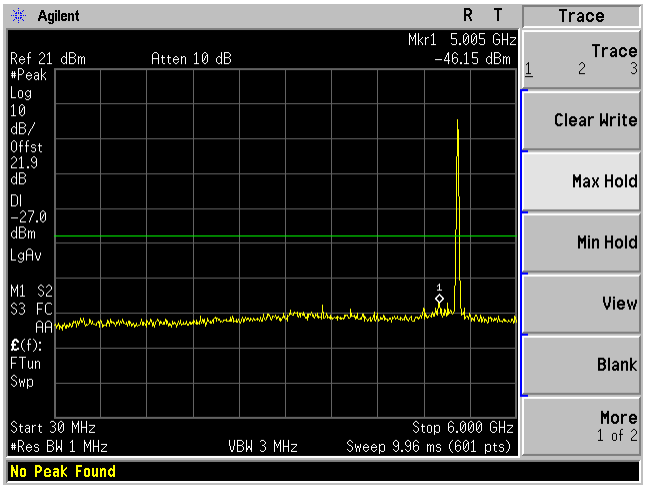


Chain J1 2

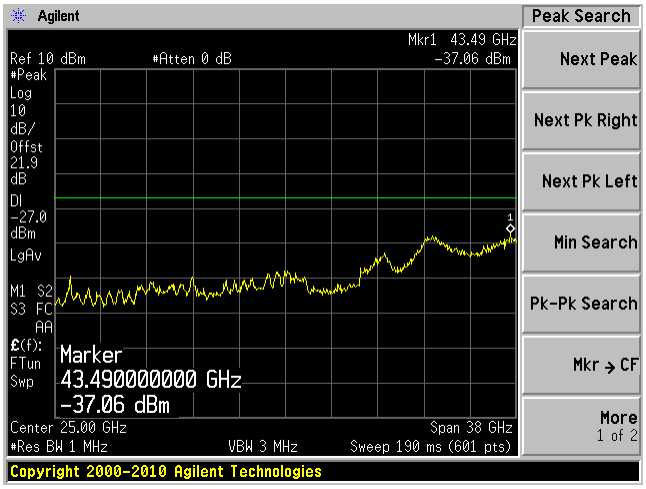


802.11a mode, High Channel 5240 MHz

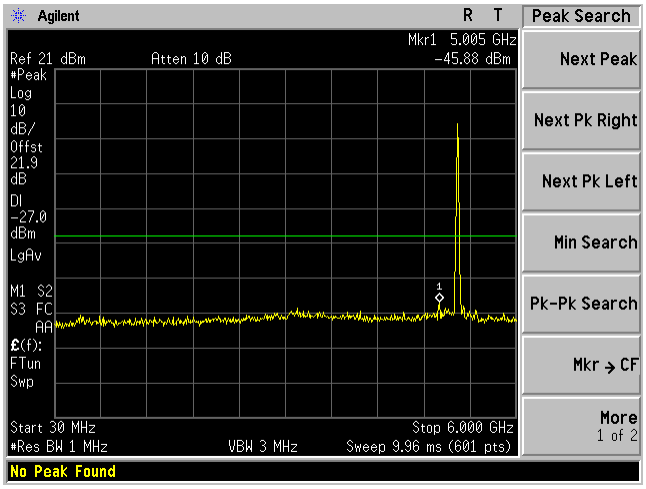
Chain J0 1



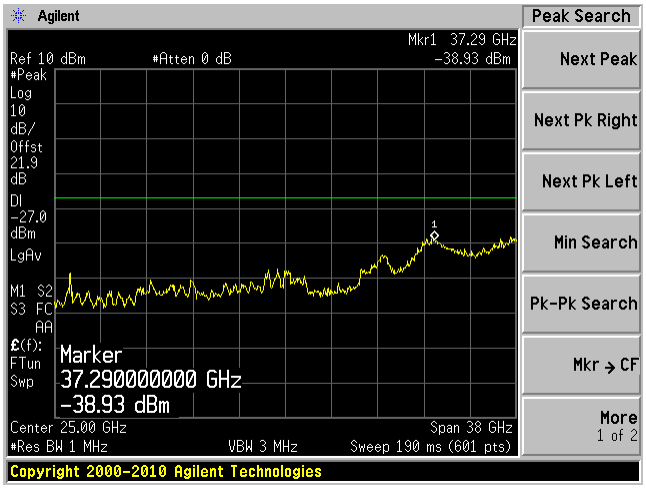
Chain J0 2



Chain J1 1

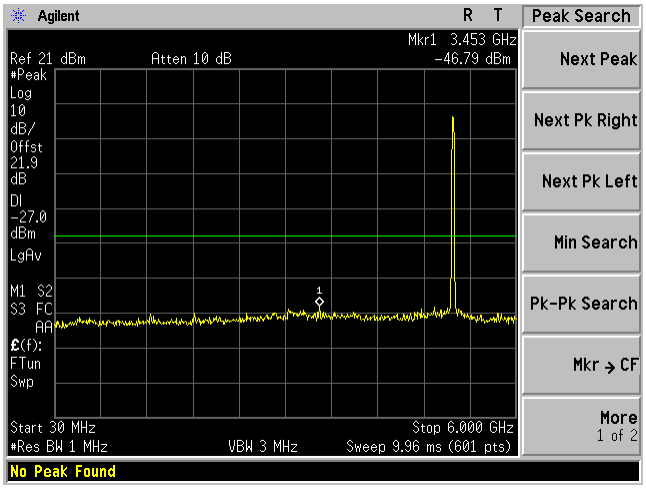


Chain J1 2

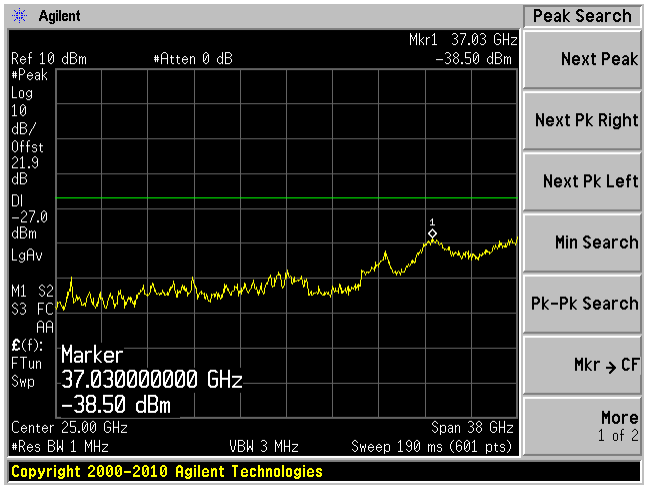


802.11n-HT20 mode, Low channel 5180 MHz

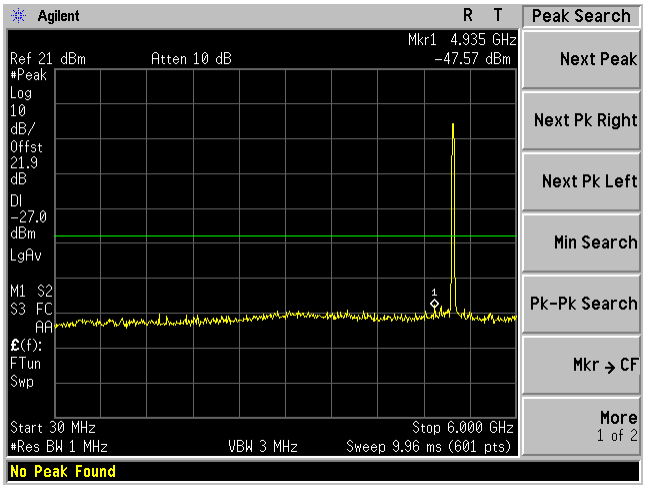
Chain J0 1



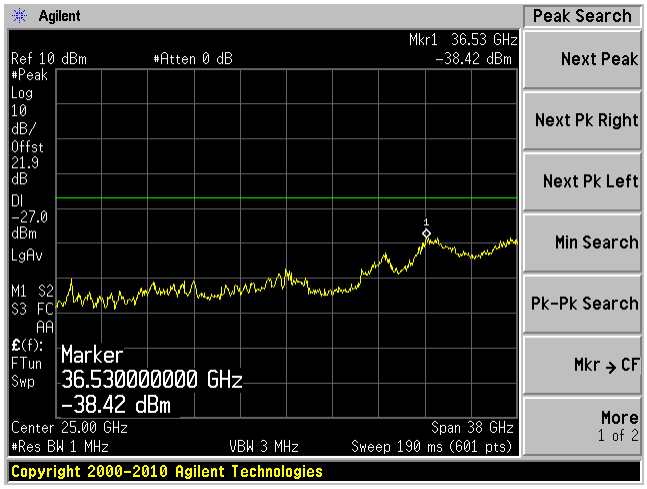
Chain J0 2



Chain J1 1

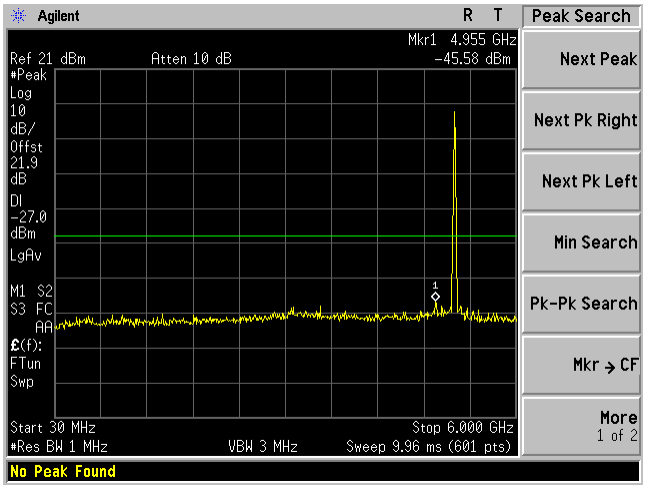


Chain J1 2

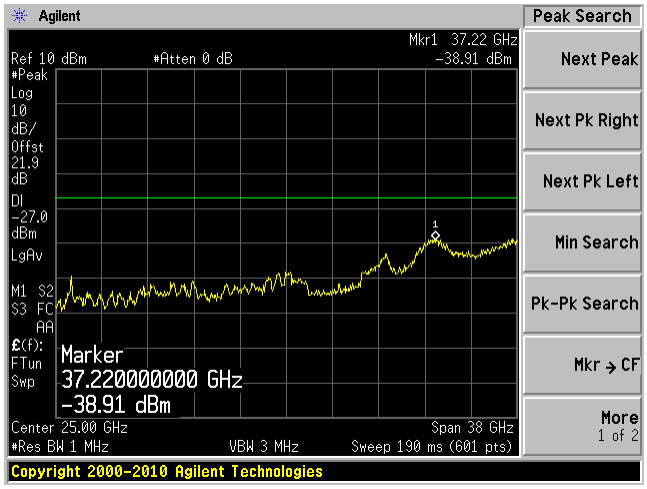


802.11n-HT20 mode, Middle Channel 5200 MHz

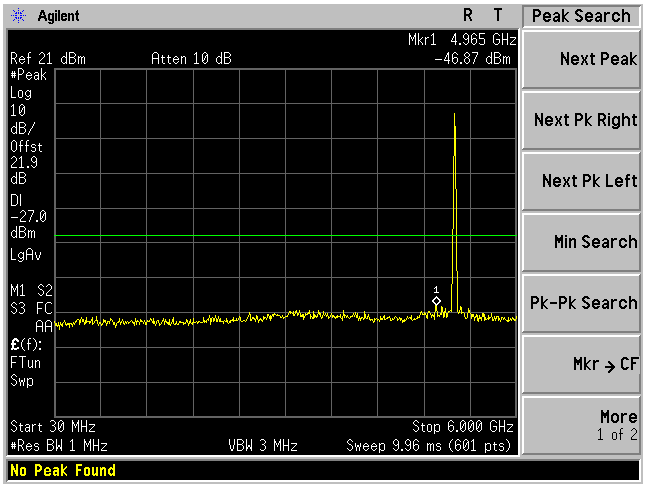
Chain J0 1



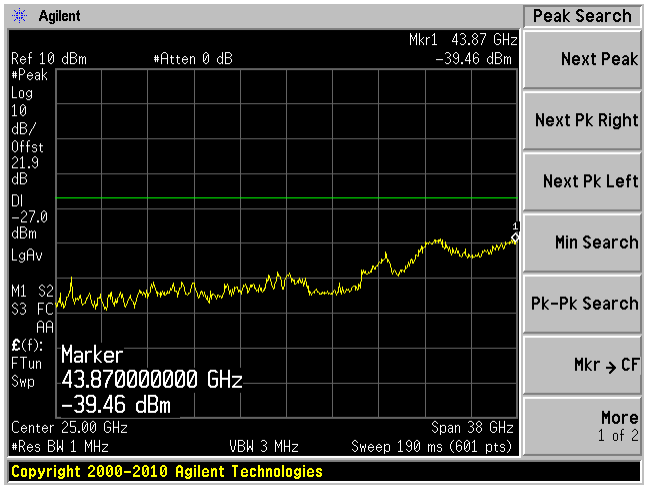
Chain J0 2



Chain J1 1

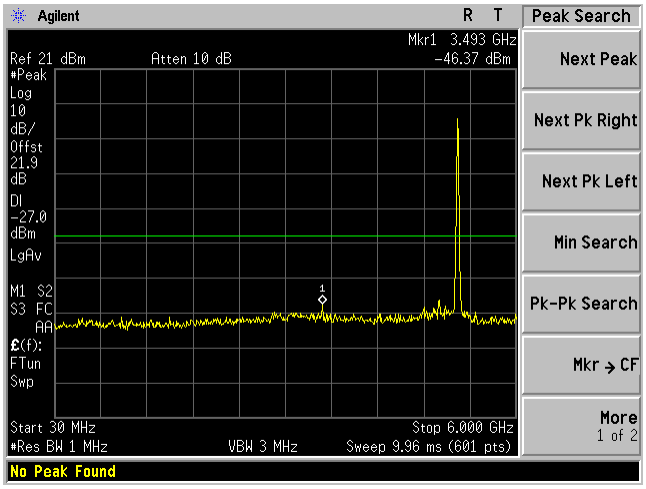


Chain J1 2

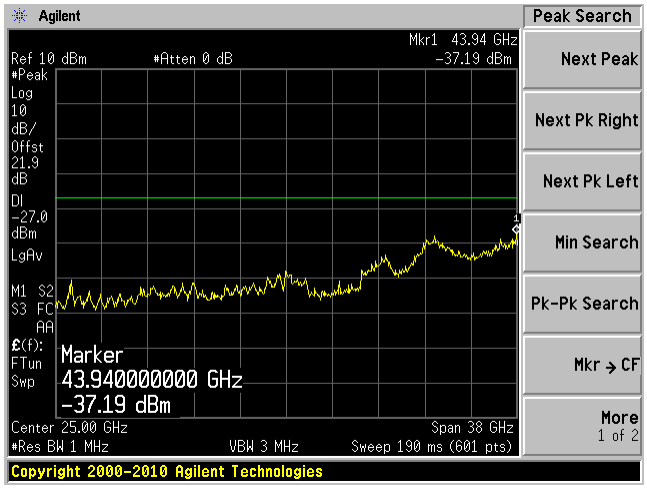


802.11n-HT20 mode, High Channel 5240

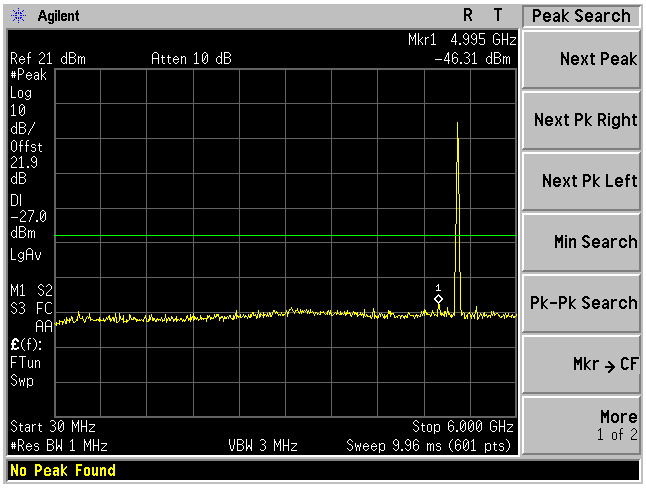
Chain J0 1



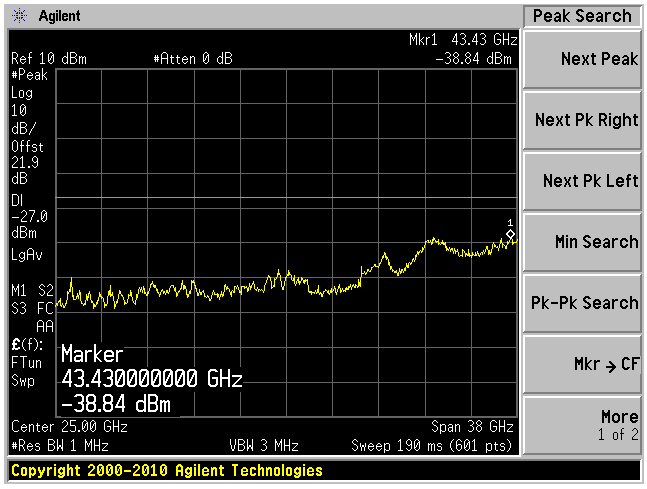
Chain J0 2



Chain J1 1

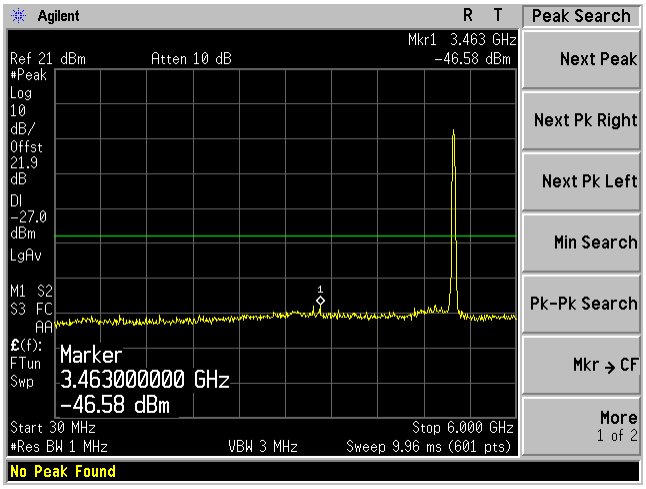


Chain J1 2

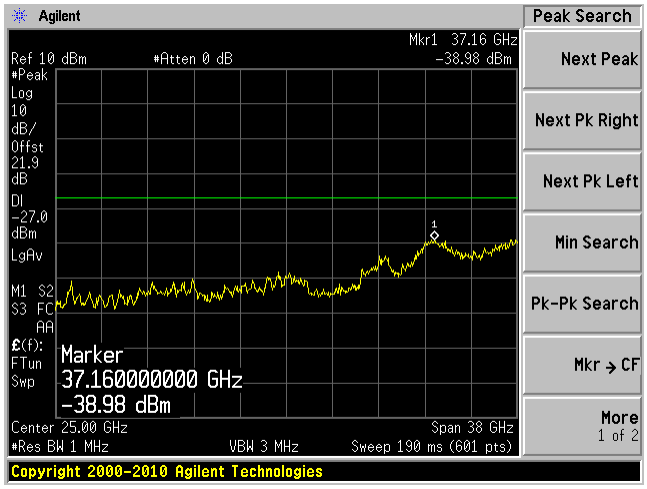


802.11n-HT40 mode, Low channel 5190 MHz

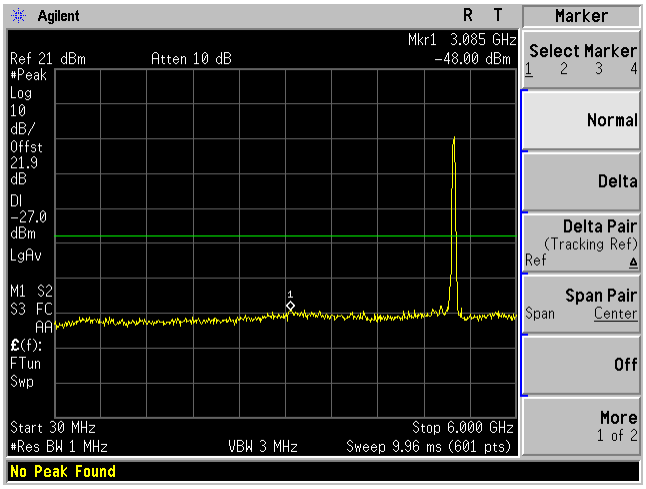
Chain J0 1



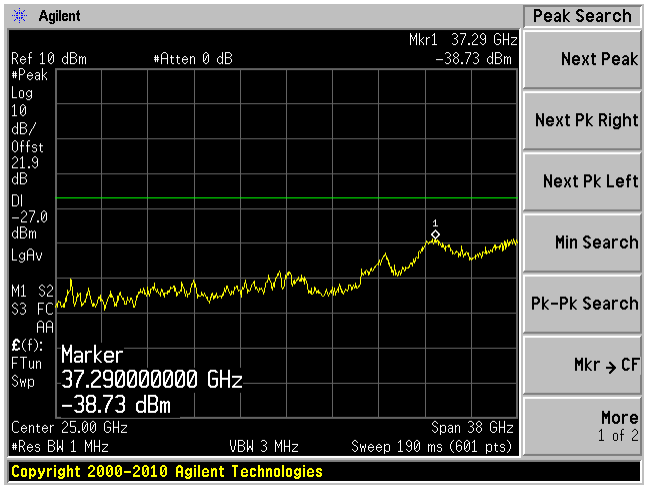
Chain J0 2



Chain J1 1

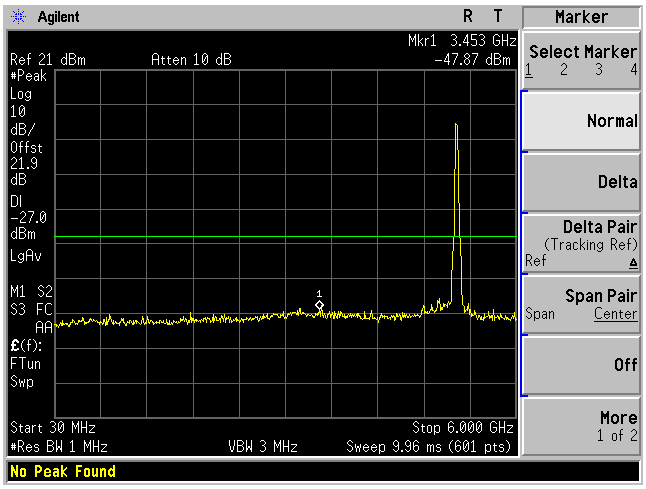


Chain J1 2

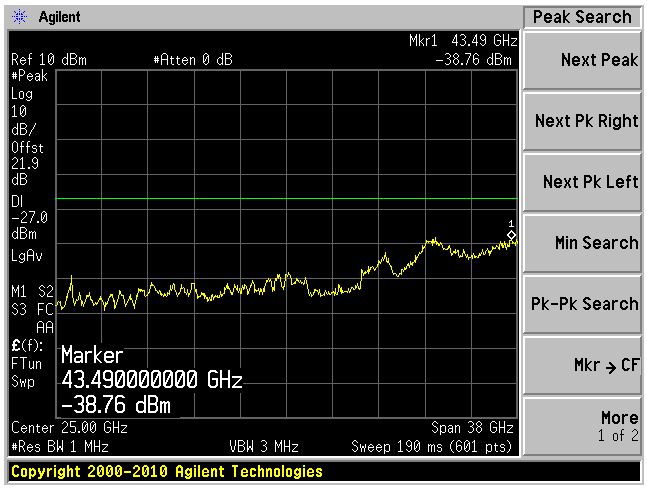


802.11n-HT40 mode, High Channel 5230 MHz

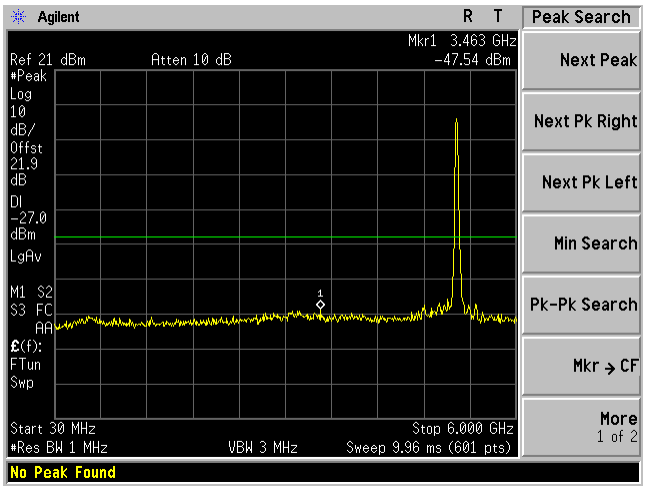
Chain J0 1



Chain J0 2



Chain J1 1



Chain J1 2