FCC PART 15.407
TEST AND MEASUREMENT REPORT

For

Tropos Networks, Inc.

555 Del Rey Ave., Sunnyvale, CA 94085, USA

FCC ID: P9J-645801

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

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Report Number:	R1409231-407 W52W58 Rev A
Report Date:	2015-04-06
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TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1409231-407 W52W58	Original Report	2014-12-31
1	R1409231-407 W52W58 Rev A	Updated comments from FCC	2015-04-06

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Tropos Networks, Inc.,* and their product model: Bluefin 5G*, FCC ID: P9J-645801* or the "EUT" (Equipment under Test) as referred to in this report. The EUT is a 2x2 MIMO 802.11a/n Wi-Fi module operates in 5 GHz UNII bands.

1.2 Mechanical Description of EUT

The EUT measures approximately 7.2 cm (L) x 5.0cm (W) x 0.1 cm (H) and weighs 15g.

The test data gathered are from typical production sample, serial number: 301317 assigned by client.

1.3 Objective

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

The objective is to determine compliance with FCC rules for Antenna Requirments, AC Line Conducted Emissions, Occupied Bandwidth, Maximum Peak Output Power, Power Spectral Density, Radiated and Conducted Spurious Emissions, and Band Edge.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2009, 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 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v01: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2: 2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

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

Bay area compliance Laboratories Corp. (BACL) is:
1- An independent Commercial Test Laboratory accredited to **ISO 17025: 2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminares and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65: 1996** by **A2LA** to certify:
1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.
2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.
3. Radio Communication Equipment for Singapore.
4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.
5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).
6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s),Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

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

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

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

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

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

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2009 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v01

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.
The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

The test utility used was *Atheros Radio Test 2* and was provided by *Tropos Networks, Inc.,* and was verified by Isaac Aguilar to comply with the standard requirements being tested against.

2.3 Equipment Modifications

N/A

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	E5430	7x4v3x1
DELL	laptop	E5430	8w4v3x1

2.6 EUT Internal Configuration Details

N/A

2.7 Interface Ports and Cables

Cable Description	Length (m)	To	From
RF Cable	< 1	Module Antenna Port	Spectrum Analyzer
CAT5e	< 1	Moldue RJ-45	Laptop

2.8 Power Supply List and Details

Manufacturer	Description	Model	Serial Number
Cincon Electronics	POE 48V 1.2A	TR60A-POE-L	007653

3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.407(f), §2.1091	RF Exposure	Calculation
§15.203	Antenna Requirement	Compliant
§15.207	AC Power Line Conducted Emissions	Compliant
§15.209(a), §15.407(b)	Spurious Emissions	Compliant
§15.407(a)	Emission Bandwidth	Compliant
§15.407(a)(1)(i) §15.407(a)(3)	Output Power	Compliant
§2.1051, §15.407(b)	Undesirable Emissions	Compliant
§15.407(a)(1)(i) §15.407(a)(3)	Power Spectral Density	Compliant
§15.407(a)(1)(i)	EIRP for above 30 degree	Calculation

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

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

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

5.2 GHz Band:

Maximum peak output power at antenna input terminal (dBm):	27.9
Maximum peak output power at antenna input terminal (mW):	616.59
Prediction distance (cm):	20
Prediction frequency (MHz):	5200
Maximum Antenna Gain, typical (dBi):	8
Maximum Antenna Gain (numeric):	6.31
Power density of prediction frequency at 20 cm (mW/cm^2):	0.774
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

5.8 GHz Band:

Maximum peak output power at antenna input terminal (dBm):	27.98
Maximum peak output power at antenna input terminal (mW):	628.06
Prediction distance (cm):	20
Prediction frequency (MHz):	5785
Maximum Antenna Gain, typical (dBi):	8
Maximum Antenna Gain (numeric):	6.31
Power density of prediction frequency at 20 cm (mW/cm^2):	0.788
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 §15.407 (a)(1) and (2), If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

And according to FCC §15.407 (a)(1) (iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

And according to FCC §15.407 (a)(3) , However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.2 Antenna List

Manufacturers	Antenna Type/Pattern	Antenna Gain (dBi) @ 5GHz
SmartAnt	Omni-Type	8

Note: The power setting was controlled by manufacture with different antenna configuration. The power setting of the different antenna will be set with the corresponded value and no more then the level reported.

The 8 dBi patch antenna consist of MMCX connectors with greater than 6 dBi gain; therefore, the output power and power spectral density limit shall be reduced by 2 dB to comply with the antenna requirement.

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 *	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 C63.4-2009 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 EUT was connected with LISN-1 which provided 120 V/60 Hz AC power.

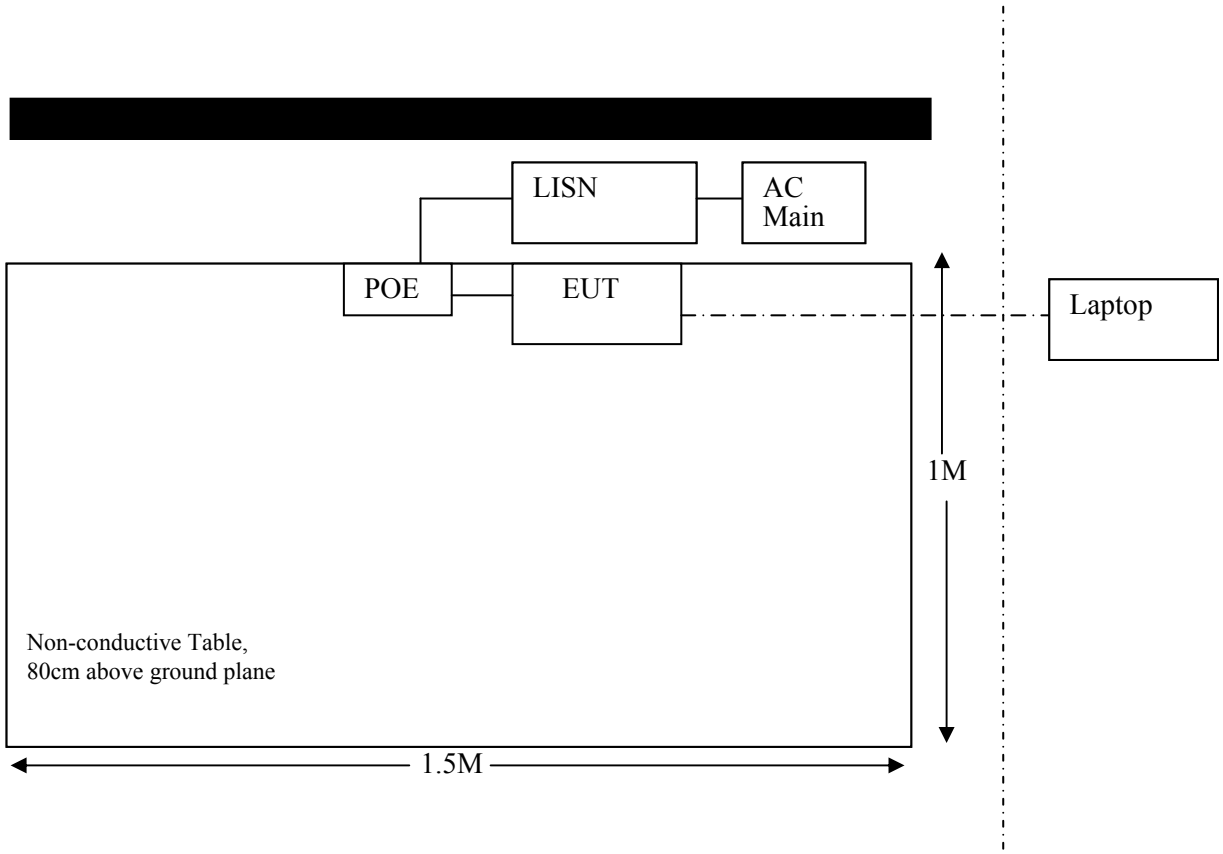
6.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1.

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	100337	2013-10-28	1 year
Solar Electronics	LISN	9252-50-R-24-N	511205	2013-10-25	1 year
TTE	Filter, High Pass	H962-150k-50-21378	K7133	2014-01-30	1 year

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

6.7 Test Environmental Conditions

Temperature:	22-24º C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Cipher Chu on 2014-10-05 in 5m chamber3.

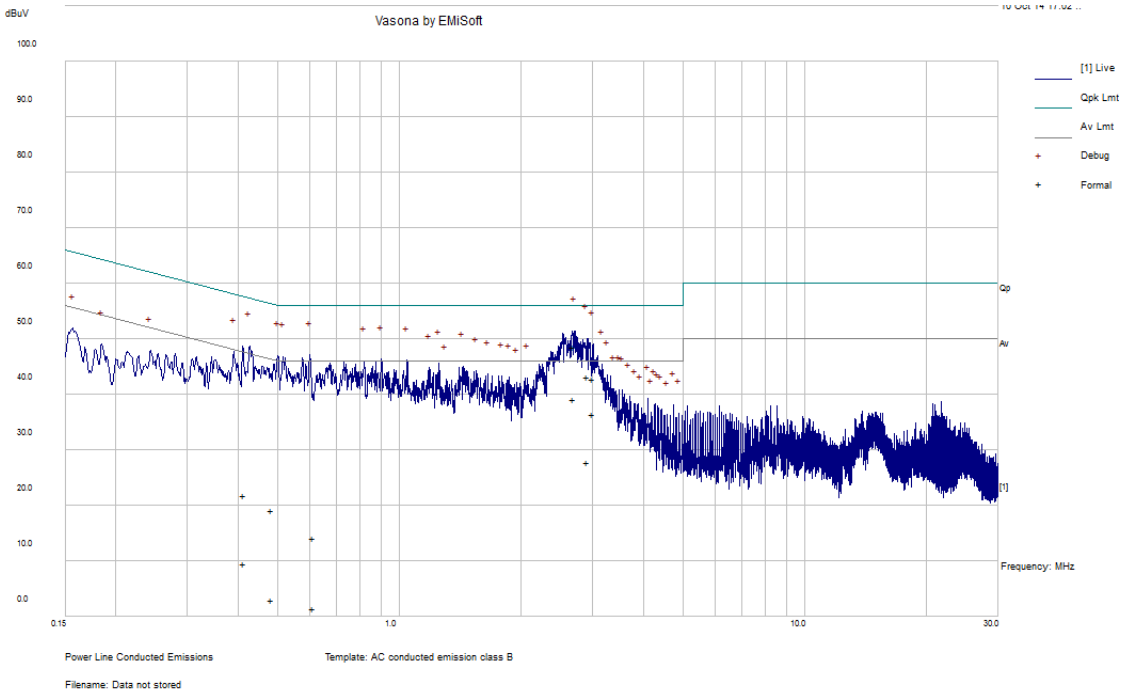
6.8 Summary of Test Results

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

Connection: Connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-3.87	1.982061	Neutral	0.15-30

6.9 Conducted Emissions Test Plots and Data

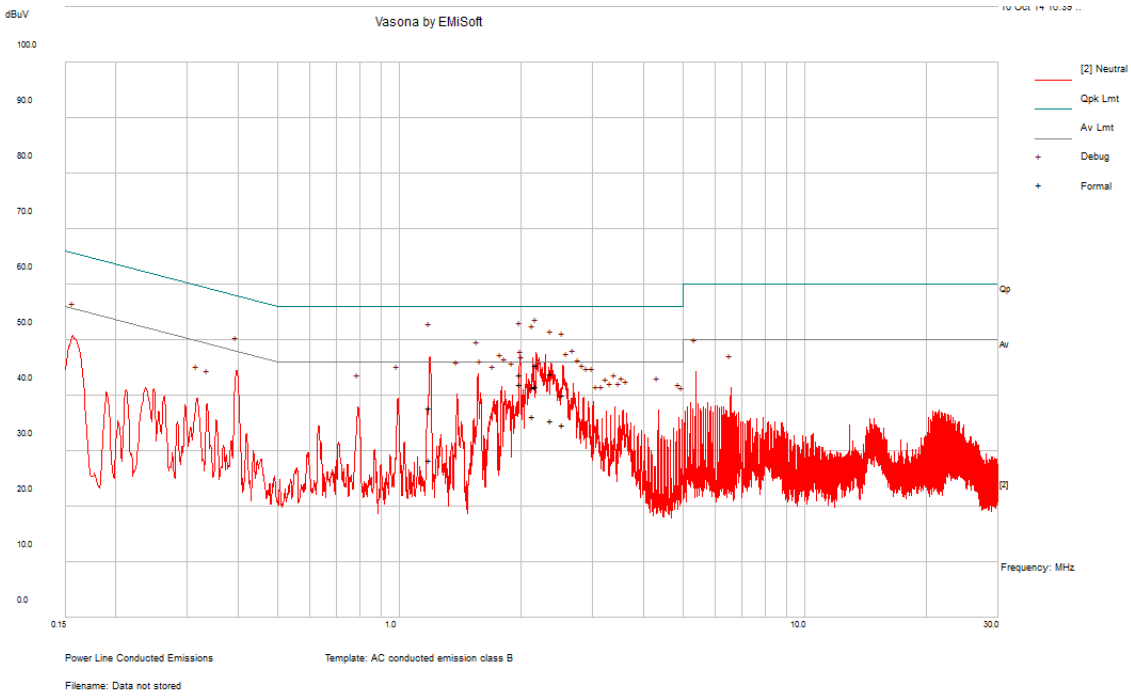
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
2.688608	48.62	Line	56	-7.38	QP
2.909799	43.13	Line	56	-12.87	QP
3.001127	42.77	Line	56	-13.23	QP
0.414771	21.94	Line	57.55	-35.61	QP
0.61437	14.2	Line	56	-41.8	QP
0.485397	19.25	Line	56.25	-37	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
2.688608	39.13	Line	46	-6.87	Ave.
2.909799	27.79	Line	46	-18.21	Ave.
3.001127	36.46	Line	46	-9.54	Ave.
0.414771	9.51	Line	47.55	-38.05	Ave.
0.61437	1.51	Line	46	-44.49	Ave.
0.485397	2.94	Line	46.25	-43.31	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
2.182031	45.55	Neutral	56	-10.45	QP
1.982061	43.82	Neutral	56	-12.18	QP
1.18848	37.75	Neutral	56	-18.25	QP
2.137459	41.46	Neutral	56	-14.54	QP
2.37174	43.99	Neutral	56	-12.01	QP
2.525873	40.04	Neutral	56	-15.96	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
2.182031	41.57	Neutral	46	-4.43	Ave.
1.982061	42.13	Neutral	46	-3.87	Ave.
1.18848	28.43	Neutral	46	-17.57	Ave.
2.137459	36.24	Neutral	46	-9.76	Ave.
2.37174	35.56	Neutral	46	-10.44	Ave.
2.525873	34.7	Neutral	46	-11.3	Ave.

7 FCC §15.209 & §15.407(b) – Radiated Spurious Emissions

7.1 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 e.i.r.p. of −27 dBm/MHz.

For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.

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		

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 15 Subpart E 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

The measurements are base on FCC KDB 789033 D02 General UNII Test Procedures New Rules v01: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
Section G: Unwanted emissions measurement as well as ANSI C63.4: 2009 as described below:

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 10 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 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

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2013-10-28	1 year
Agilent	Spectrum Analyzer	E4440A	MY44303352	2013-10-16	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2013-10-18	1 year
EMCO	Horn Antenna	3115	9511-4627	2013-10-17	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2013-10-08	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2013-10-09	1 year

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

7.6 Test Environmental Conditions

Temperature:	20-23° C
Relative Humidity:	51-59 %
ATM Pressure:	101.1-101.8 kPa

The testing was performed by Cipher Chu on 2014-10-01 to 2014-10-15 at 5m chamber 3.

7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15.407 standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-6.02	51.2585	Vertical	20 MHz bandwidth ,Middle

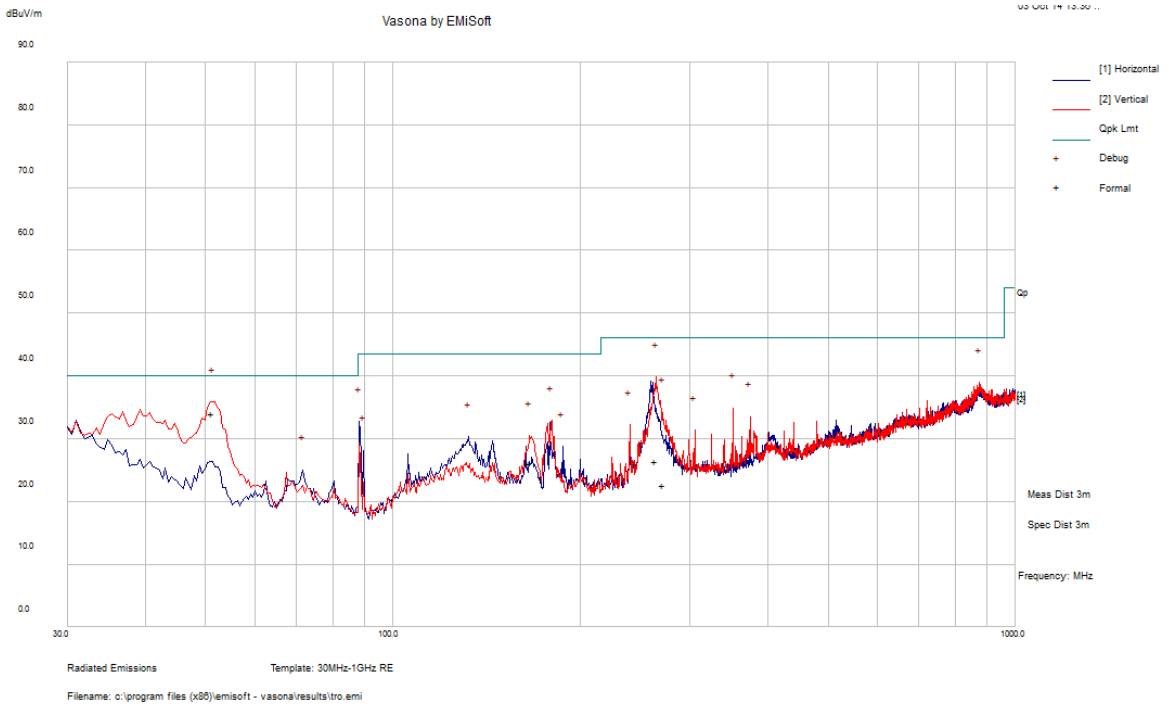
1-40 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-0.007	5150	Vertical	40 MHz bandwidth , Low

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

7.8 Radiated Emissions Test Data

1) 30 MHz–1 GHz, Quasi-Peak Measurements



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comments (PK/QP/Ave.)
51.2585	33.98	103	V	96	40	-6.02	QP
264.5628	26.41	181	V	55	46	-19.59	QP
271.4175	22.63	150	V	39	46	-23.37	QP
165.919	26	130	V	236	43.5	-17.5	QP

2) 1–40 GHz, Measured at 3 meters

5.2 GHz Band:

20 MHz Bandwidth

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	73.4	278	100	V	35.083	4.52	0	113.003	N/A	N/A	Peak/Fund
5180	63.24	57	100	H	35.083	4.52	0	102.843	N/A	N/A	Peak/Fund
5180	60.73	278	100	V	35.083	4.52	0	100.333	N/A	N/A	Ave/Fund
5180	49.04	57	100	H	35.083	4.52	0	88.643	N/A	N/A	Ave/Fund
5150	28.14	278	100	V	35.083	4.52	0	67.743	74	-6.257	Peak
5150	27.2	57	100	H	35.083	4.52	0	66.803	74	-7.197	Peak
5150	13.39	278	100	V	35.083	4.52	0	52.993	54	-1.007	Ave
5150	13.2	57	100	H	35.083	4.52	0	52.803	54	-1.197	Ave
10360	45.97	0	100	V	39.641	7.42	36.3	56.731	74	-17.269	Peak
10360	46.26	0	100	H	39.641	7.42	36.3	57.021	74	-16.979	Peak
10360	31.46	0	100	V	39.641	7.42	36.3	42.221	54	-11.779	Ave
10360	31.56	0	100	H	39.641	7.42	36.3	42.321	54	-11.679	Ave
15540	43.8	0	100	V	39.337	8.26	34	57.397	74	-16.603	Peak
15540	42.82	0	100	H	39.337	8.26	34	56.417	74	-17.583	Peak
15540	28.52	0	100	V	39.337	8.26	34	42.117	54	-11.883	Ave
15540	28.55	0	100	H	39.337	8.26	34	42.147	54	-11.853	Ave
20720	35.96	0	100	V	48.128	8.26	32.5	59.848	74	-14.152	Peak
20720	35.68	0	100	H	48.128	8.26	32.5	59.568	74	-14.432	Peak
20720	21.51	0	100	V	48.128	8.26	32.5	45.398	54	-8.602	Ave
20720	21.68	0	100	H	48.128	8.26	32.5	45.568	54	-8.432	Ave
Middle Channel 5200 MHz, measured at 3 meters											
5200	75.85	275	100	V	35.083	4.52	0	115.453	N/A	N/A	Peak/Fund
5200	63.27	63	100	H	35.083	4.52	0	102.873	N/A	N/A	Peak/Fund
5200	63.51	275	100	V	35.083	4.52	0	103.113	N/A	N/A	Ave/Fund
5200	48.29	63	100	H	35.083	4.52	0	87.893	N/A	N/A	Ave/Fund
10400	45.49	0	100	V	39.641	7.42	36.3	56.251	74	-17.749	Peak
10400	45.44	0	100	H	39.641	7.42	36.3	56.201	74	-17.799	Peak
10400	31.47	0	100	V	39.641	7.42	36.3	42.231	54	-11.769	Ave
10400	31.31	0	100	H	39.641	7.42	36.3	42.071	54	-11.929	Ave
15600	43	0	100	V	39.337	8.26	34	56.597	74	-17.403	Peak
15600	42.98	0	100	H	39.337	8.26	34	56.577	74	-17.423	Peak
15600	28.58	0	100	V	39.337	8.26	34	42.177	54	-11.823	Ave
15600	28.51	0	100	H	39.337	8.26	34	42.107	54	-11.893	Ave
20800	36.28	0	100	V	48.128	8.26	32.5	60.168	74	-13.832	Peak
20800	36.27	0	100	H	48.128	8.26	32.5	60.158	74	-13.842	Peak
20800	21.93	0	100	V	48.128	8.26	32.5	45.818	54	-8.182	Ave
20800	21.91	0	100	H	48.128	8.26	32.5	45.798	54	-8.202	Ave

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	77.67	273	100	V	35.083	4.52	0	117.273	N/A	N/A	Peak/Fund
5240	65.91	230	100	H	35.083	4.52	0	105.513	N/A	N/A	Peak/Fund
5240	64.26	273	100	V	35.083	4.52	0	103.863	N/A	N/A	Ave/Fund
5240	52.3	230	100	H	35.083	4.52	0	91.903	N/A	N/A	Ave/Fund
10480	46.16	0	100	V	39.641	7.42	36.3	56.921	74	-17.079	Peak
10480	46.06	0	100	H	39.641	7.42	36.3	56.821	74	-17.179	Peak
10480	32.38	0	100	V	39.641	7.42	36.3	43.141	54	-10.859	Ave
10480	32.18	0	100	H	39.641	7.42	36.3	42.941	54	-11.059	Ave
15720	42.31	0	100	V	39.337	8.26	34	55.907	74	-18.093	Peak
15720	42.52	0	100	H	39.337	8.26	34	56.117	74	-17.883	Peak
15720	28.67	0	100	V	39.337	8.26	34	42.267	54	-11.733	Ave
15720	28.75	0	100	H	39.337	8.26	34	42.347	54	-11.653	Ave
20960	36.73	0	100	V	48.128	8.26	32.5	60.618	74	-13.382	Peak
20960	36.71	0	100	H	48.128	8.26	32.5	60.598	74	-13.402	Peak
20960	22.67	0	100	V	48.128	8.26	32.5	46.558	54	-7.442	Ave
20960	22.86	0	100	H	48.128	8.26	32.5	46.748	54	-7.252	Ave

40 MHz Bandwidth

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	77.25	274	100	V	35.083	4.52	0	116.853	N/A	N/A	Peak/Fund
5190	61.11	68	100	H	35.083	4.52	0	100.713	N/A	N/A	Peak/Fund
5190	61.95	274	100	V	35.083	4.52	0	101.553	N/A	N/A	Ave/Fund
5190	46.56	68	100	H	35.083	4.52	0	86.163	N/A	N/A	Ave/Fund
5150	28.71	274	100	V	35.083	4.52	0	68.313	74	-5.687	Peak
5150	26.93	68	100	H	35.083	4.52	0	66.533	74	-7.467	Peak
5150	14.39	274	100	V	35.083	4.52	0	53.993	54	-0.007	Ave
5150	13.14	68	100	H	35.083	4.52	0	52.743	54	-1.257	Ave
10380	45.73	0	100	V	39.641	7.42	36.3	56.491	74	-17.509	Peak
10380	45.21	0	100	H	39.641	7.42	36.3	55.971	74	-18.029	Peak
10380	32	0	100	V	39.641	7.42	36.3	42.761	54	-11.239	Ave
10380	31.88	0	100	H	39.641	7.42	36.3	42.641	54	-11.359	Ave
15570	39.87	0	100	V	39.337	8.26	34	53.467	74	-20.533	Peak
15570	39.06	0	100	H	39.337	8.26	34	52.657	74	-21.343	Peak
15570	26.11	0	100	V	39.337	8.26	34	39.707	54	-14.293	Ave
15570	25.86	0	100	H	39.337	8.26	34	39.457	54	-14.543	Ave
20760	35.11	0	100	V	48.128	8.26	32.5	58.998	74	-15.002	Peak
20760	35.51	0	100	H	48.128	8.26	32.5	59.398	74	-14.602	Peak
20760	20.4	0	100	V	48.128	8.26	32.5	44.288	54	-9.712	Ave
20760	20.46	0	100	H	48.128	8.26	32.5	44.348	54	-9.652	Ave
High Channel 5230 MHz, measured at 3 meters											
5230	75.97	277	100	V	35.083	4.52	0	115.573	N/A	N/A	Peak/Fund
5230	60.88	66	100	H	35.083	4.52	0	100.483	N/A	N/A	Peak/Fund
5230	60.93	277	100	V	35.083	4.52	0	100.533	N/A	N/A	Ave/Fund
5230	46.21	66	100	H	35.083	4.52	0	85.813	N/A	N/A	Ave/Fund
10460	46.55	0	100	V	39.641	7.42	36.3	57.311	74	-16.689	Peak
10460	46.47	0	100	H	39.641	7.42	36.3	57.231	74	-16.769	Peak
10460	32.25	0	100	V	39.641	7.42	36.3	43.011	54	-10.989	Ave
10460	32.23	0	100	H	39.641	7.42	36.3	42.991	54	-11.009	Ave
15690	39.11	0	100	V	39.337	8.26	34	52.707	74	-21.293	Peak
15690	39.07	0	100	H	39.337	8.26	34	52.667	74	-21.333	Peak
15690	25.08	0	100	V	39.337	8.26	34	38.677	54	-15.323	Ave
15690	25.07	0	100	H	39.337	8.26	34	38.667	54	-15.333	Ave
20920	36.91	0	100	V	48.128	8.26	32.5	60.798	74	-13.202	Peak
20920	36.77	0	100	H	48.128	8.26	32.5	60.658	74	-13.342	Peak
20920	22.94	0	100	V	48.128	8.26	32.5	46.828	54	-7.172	Ave
20920	22.88	0	100	H	48.128	8.26	32.5	46.768	54	-7.232	Ave

5.8 GHz Band:

20 MHz Bandwidth

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 5745 MHz, measured at 3 meters											
5745	87.76	139	100	V	34.831	4.84	0	127.431	N/A	N/A	Peak/Fund
5745	75.69	139	120	H	34.831	4.84	0	115.361	N/A	N/A	Peak/Fund
5745	63.62	139	100	V	34.831	4.84	0	103.291	N/A	N/A	Ave/Fund
5745	53.77	139	120	H	34.831	4.84	0	93.441	N/A	N/A	Ave/Fund
11490	43.63	0	100	V	40.361	7.4	34.8	56.591	74	-17.409	Peak
11490	43.12	0	100	H	40.361	7.4	34.8	56.081	74	-17.919	Peak
11490	29.02	0	100	V	40.361	7.4	34.8	41.981	54	-12.019	Ave
11490	28.89	0	100	H	40.361	7.4	34.8	41.851	54	-12.149	Ave
17235	43.68	0	100	V	46.936	8.26	33.4	65.476	74	-8.524	Peak
17235	43.73	0	100	H	46.936	8.26	33.4	65.526	74	-8.474	Peak
17235	30.17	0	100	V	46.936	8.26	33.4	51.966	54	-2.034	Ave
17235	30.24	0	100	H	46.936	8.26	33.4	52.036	54	-1.964	Ave
22980	35.24	0	100	V	48.128	9.04	31.9	60.508	74	-13.492	Peak
22980	34.17	0	100	H	48.128	9.04	31.9	59.438	74	-14.562	Peak
22980	20.76	0	100	V	48.128	9.04	31.9	46.028	54	-7.972	Ave
22980	19.61	0	100	H	48.128	9.04	31.9	44.878	54	-9.122	Ave
Middle Channel 5785 MHz, measured at 3 meters											
5785	86.43	138	115	V	34.959	4.84	0	126.229	N/A	N/A	Peak/Fund
5785	74.34	134	124	H	34.959	4.84	0	114.139	N/A	N/A	Peak/Fund
5785	62.58	138	115	V	34.959	4.84	0	102.379	N/A	N/A	Ave/Fund
5785	52.55	134	124	H	34.959	4.84	0	92.349	N/A	N/A	Ave/Fund
11570	43.89	0	100	V	40.361	7.4	34.8	56.851	74	-17.149	Peak
11570	43.77	0	100	H	40.361	7.4	34.8	56.731	74	-17.269	Peak
11570	28.88	0	100	V	40.361	7.4	34.8	41.841	54	-12.159	Ave
11570	28.67	0	100	H	40.361	7.4	34.8	41.631	54	-12.369	Ave
17355	43.98	0	100	V	46.936	8.26	33.4	65.776	74	-8.224	Peak
17355	43.84	0	100	H	46.936	8.26	33.4	65.636	74	-8.364	Peak
17355	29.87	0	100	V	46.936	8.26	33.4	51.666	54	-2.334	Ave
17355	29.73	0	100	H	46.936	8.26	33.4	51.526	54	-2.474	Ave
23140	35.83	0	100	V	48.128	9.04	31.9	61.098	74	-12.902	Peak
23140	35.28	0	100	H	48.128	9.04	31.9	60.548	74	-13.452	Peak
23140	20.71	0	100	V	48.128	9.04	31.9	45.978	54	-8.022	Ave
23140	20.6	0	100	H	48.128	9.04	31.9	45.868	54	-8.132	Ave

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 5825 MHz, measured at 3 meters											
5825	84.3	140	110	V	34.959	4.84	0	124.099	N/A	N/A	Peak/Fund
5825	72.61	135	124	H	34.959	4.84	0	112.409	N/A	N/A	Peak/Fund
5825	61.01	140	110	V	34.959	4.84	0	100.809	N/A	N/A	Ave/Fund
5825	51.03	135	124	H	34.959	4.84	0	90.829	N/A	N/A	Ave/Fund
11650	43.06	0	100	V	40.361	7.4	34.8	56.021	74	-17.979	Peak
11650	43.08	0	100	H	40.361	7.4	34.8	56.041	74	-17.959	Peak
11650	28.85	0	100	V	40.361	7.4	34.8	41.811	54	-12.189	Ave
11650	28.64	0	100	H	40.361	7.4	34.8	41.601	54	-12.399	Ave
17475	43.68	0	100	V	46.936	8.26	33.4	65.476	74	-8.524	Peak
17475	43.58	0	100	H	46.936	8.26	33.4	65.376	74	-8.624	Peak
17475	29.78	0	100	V	46.936	8.26	33.4	51.576	54	-2.424	Ave
17475	29.47	0	100	H	46.936	8.26	33.4	51.266	54	-2.734	Ave
23300	36.07	0	100	V	48.128	9.04	31.9	61.338	74	-12.662	Peak
23300	35.61	0	100	H	48.128	9.04	31.9	60.878	74	-13.122	Peak
23300	21.07	0	100	V	48.128	9.04	31.9	46.338	54	-7.662	Ave
23300	20.76	0	100	H	48.128	9.04	31.9	46.028	54	-7.972	Ave

40 MHz Bandwidth

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 5755 MHz, measured at 3 meters											
5755	78.76	138	100	V	34.831	4.84	0	118.431	N/A	N/A	Peak/Fund
5755	66.24	134	128	H	34.831	4.84	0	105.911	N/A	N/A	Peak/Fund
5755	64.32	138	100	V	34.831	4.84	0	103.991	N/A	N/A	Ave/Fund
5755	52.41	134	128	H	34.831	4.84	0	92.081	N/A	N/A	Ave/Fund
11510	46.28	0	100	V	40.361	7.4	34.8	59.241	74	-14.759	Peak
11510	45.92	0	100	H	40.361	7.4	34.8	58.881	74	-15.119	Peak
11510	31.98	0	100	V	40.361	7.4	34.8	44.941	54	-9.059	Ave
11510	31.5	0	100	H	40.361	7.4	34.8	44.461	54	-9.539	Ave
17265	45.99	0	100	V	46.936	8.26	33.4	67.786	74	-6.214	Peak
17265	45.46	0	100	H	46.936	8.26	33.4	67.256	74	-6.744	Peak
17265	31.66	0	100	V	46.936	8.26	33.4	53.456	54	-0.544	Ave
17265	30.84	0	100	H	46.936	8.26	33.4	52.636	54	-1.364	Ave
23020	36.93	0	100	V	48.128	9.04	31.9	62.198	74	-11.802	Peak
23020	36.77	0	100	H	48.128	9.04	31.9	62.038	74	-11.962	Peak
23020	22.57	0	100	V	48.128	9.04	31.9	47.838	54	-6.162	Ave
23020	21.66	0	100	H	48.128	9.04	31.9	46.928	54	-7.072	Ave
High Channel 5795 MHz, measured at 3 meters											
5795	78.36	135	100	V	34.831	4.84	0	118.031	N/A	N/A	Peak/Fund
5795	66.99	136	138	H	34.831	4.84	0	106.661	N/A	N/A	Peak/Fund
5795	64.19	135	100	V	34.831	4.84	0	103.861	N/A	N/A	Ave/Fund
5795	53.4	136	138	H	34.831	4.84	0	93.071	N/A	N/A	Ave/Fund
11590	45.71	0	100	V	40.361	7.4	34.8	58.671	74	-15.329	Peak
11590	45.83	0	100	H	40.361	7.4	34.8	58.791	74	-15.209	Peak
11590	30.37	0	100	V	40.361	7.4	34.8	43.331	54	-10.669	Ave
11590	31.17	0	100	H	40.361	7.4	34.8	44.131	54	-9.869	Ave
17385	45.64	0	100	V	46.936	8.26	33.4	67.436	74	-6.564	Peak
17385	45.31	0	100	H	46.936	8.26	33.4	67.106	74	-6.894	Peak
17385	32.09	0	100	V	46.936	8.26	33.4	53.886	54	-0.114	Ave
17385	31.77	0	100	H	46.936	8.26	33.4	53.566	54	-0.434	Ave
23180	35.77	0	100	V	48.128	9.04	31.9	61.038	74	-12.962	Peak
23180	35.08	0	100	H	48.128	9.04	31.9	60.348	74	-13.652	Peak
23180	22.11	0	100	V	48.128	9.04	31.9	47.378	54	-6.622	Ave
23180	21.83	0	100	H	48.128	9.04	31.9	47.098	54	-6.902	Ave

8 FCC §15.407(a) & §15.407(e) – Emission Bandwidth

8.1 Applicable Standard

FCC §15.407(a) and FCC §15.407(e)

8.2 Measurement Procedure

The measurements are base on FCC KDB 789033 D02 General UNII Test Procedures New Rules v01: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices section C: Bandwidth Measurement and section D: 99 Percent Occupied Bandwidth

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2013-10-16	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:	23 °C
Relative Humidity:	43 %
ATM Pressure:	101.3 kPa

The testing was performed by Cipher Chu on 2014-10-01 to 2014-10-15 at the RF Site.

Note: Normal transmission is worst case.

8.5 Test Results

Please refer to the following tables and plots

5.2 GHz Band:

Radio Mode	Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)
802.11a	Chain J0			
	Low	5180	29.617	16.9931
	Middle	5200	28.252	16.7812
	High	5240	29.983	16.8417
	Chain J1			
	Low	5180	22.205	16.5539
	Middle	5200	28.257	16.7842
	High	5240	23.420	16.6330
802.11n-HT20	Chain J0			
	Low	5180	21.744	17.6839
	Middle	5200	21.433	17.7051
	High	5240	21.780	17.6751
	Chain J1			
	Low	5180	22.466	17.6522
	Middle	5200	22.537	17.7044
	High	5240	22.781	17.7151
802.11n-HT40	Chain J0			
	Low	5270	44.364	36.2517
	High	5310	50.235	36.3734
	Chain J1			
	Low	5270	54.108	36.4948
	High	5310	59.818	36.4222

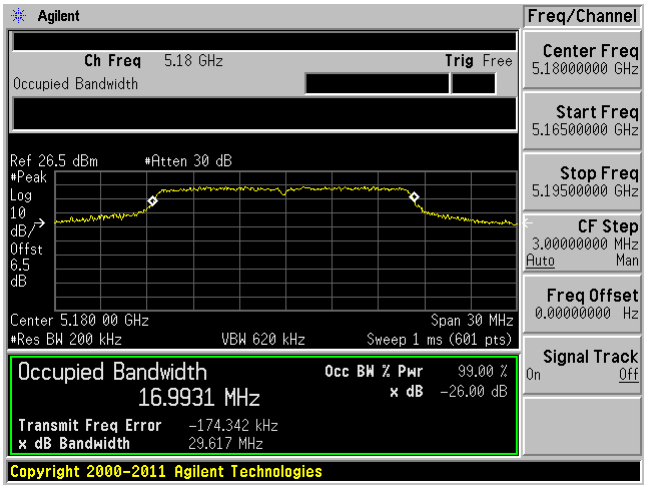
5.8 GHz Band:

Radio Mode	Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	6 dB Emission Bandwidth Limit (MHz)
802.11a	Chain J0				
	Low	5745	16.369	16.4259	0.5
	Middle	5785	16.484	16.4450	0.5
	High	5825	16.395	16.4137	0.5
	Chain J1				
	Low	5745	16.422	16.4637	0.5
	Middle	5785	16.361	16.4296	0.5
	High	5825	16.417	16.4559	0.5
802.11n-HT20	Chain J0				
	Low	5745	17.573	17.6142	0.5
	Middle	5785	17.573	17.6227	0.5
	High	5825	17.633	17.6173	0.5
	Chain J1				
	Low	5745	17.233	17.6080	0.5
	Middle	5785	17.193	17.6286	0.5
	High	5825	17.219	17.6133	0.5
802.11n-HT40	Chain J0				
	Low	5755	36.045	36.1297	0.5
	High	5795	36.358	36.0924	0.5
	Chain J1				
	Low	5755	35.840	35.9985	0.5
	High	5795	34.495	36.0657	0.5

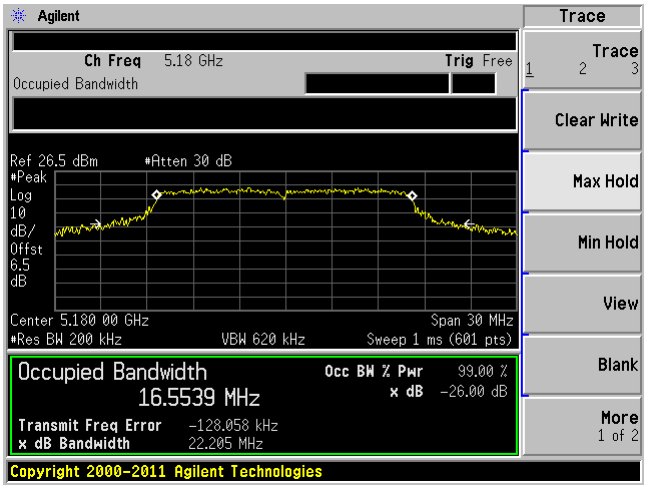
5.2 GHz Band:

802.11a mode

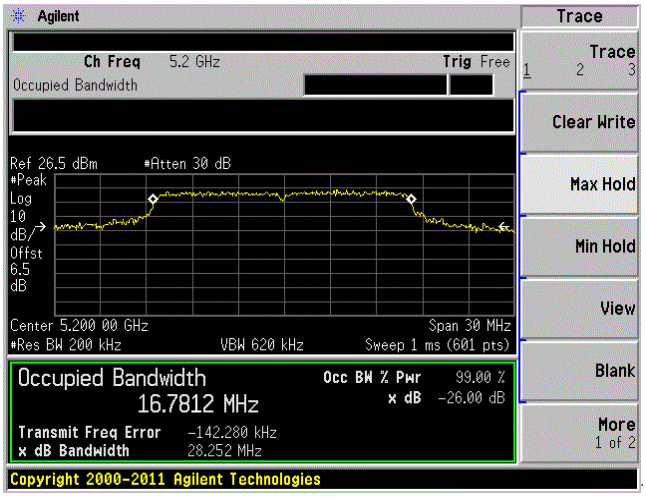
802.11a mode, 5180 MHz, Chain J0



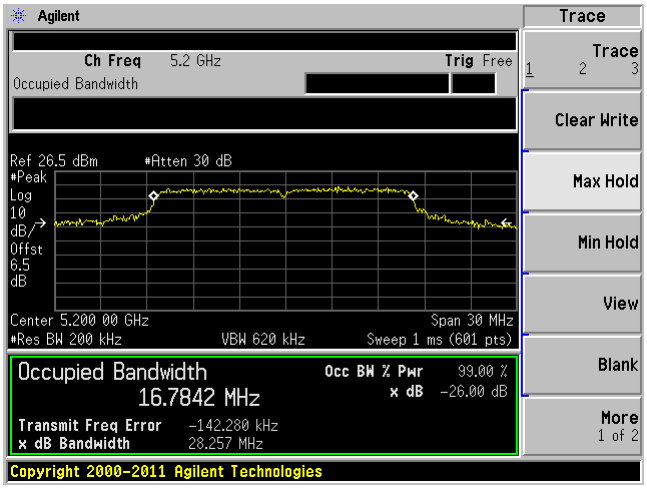
802.11a mode, 5180 MHz, Chain J1



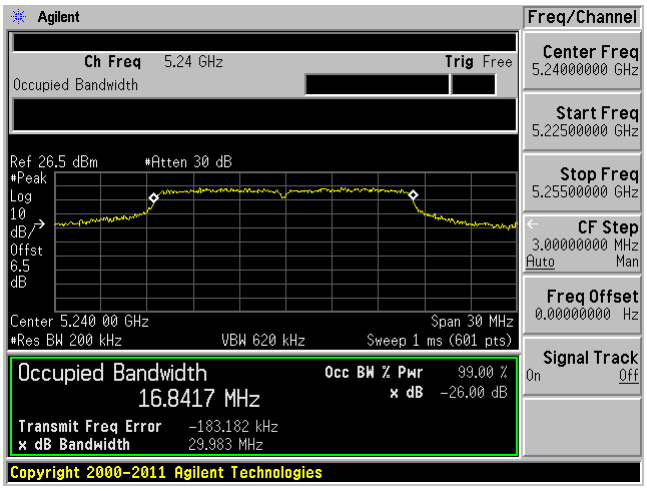
802.11a mode, 5200 MHz, Chain J0



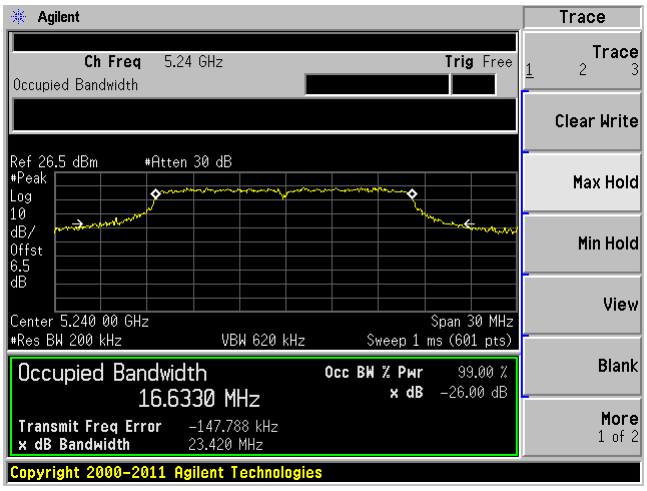
802.11a mode, 5200 MHz, Chain J1



802.11a mode, 5240 MHz, Chain J0

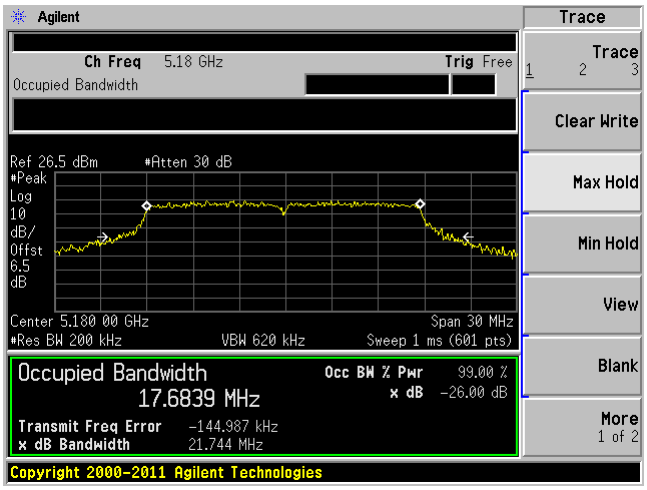


802.11a mode, 5240 MHz, Chain J1

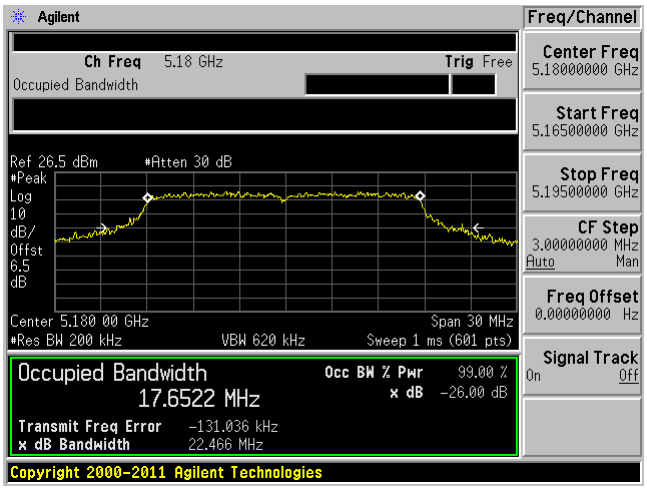


802.11n-HT20 mode

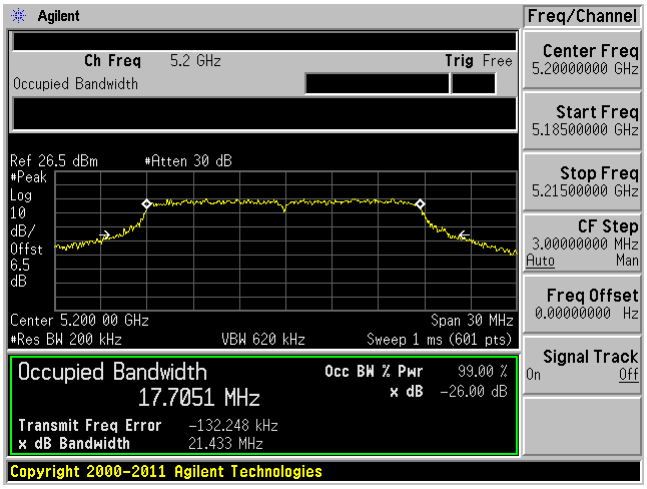
802.11n-HT20 mode, 5180 MHz, Chain J0



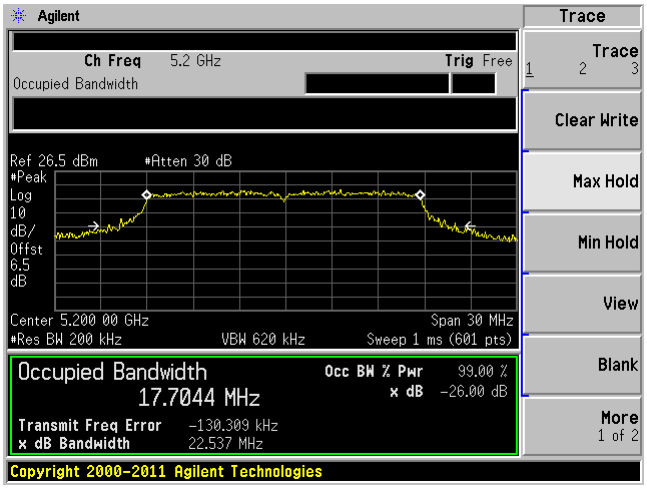
802.11n-HT20 mode, 5180 MHz, Chain J1



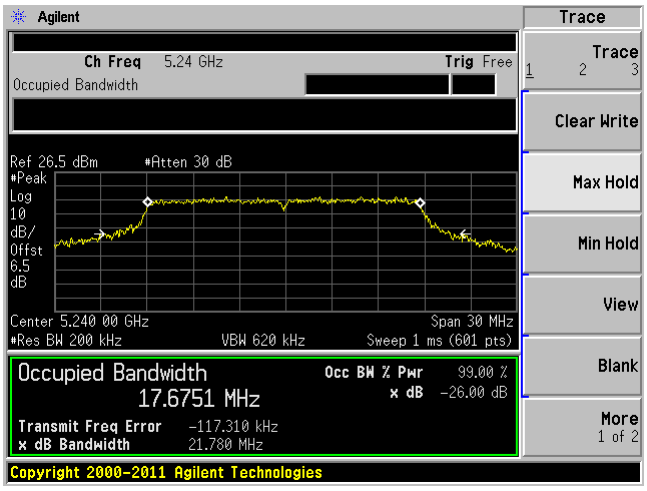
802.11n-HT20 mode, 5200 MHz, Chain J0



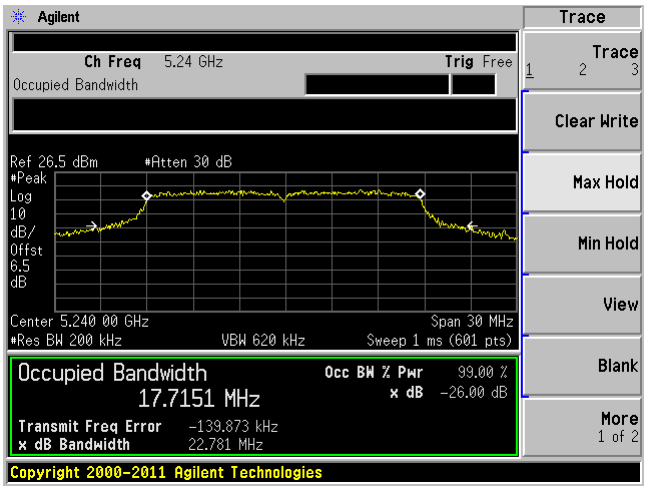
802.11n-HT20 mode, 5200 MHz, Chain J1



802.11n-HT20 mode, 5240 MHz, Chain J0

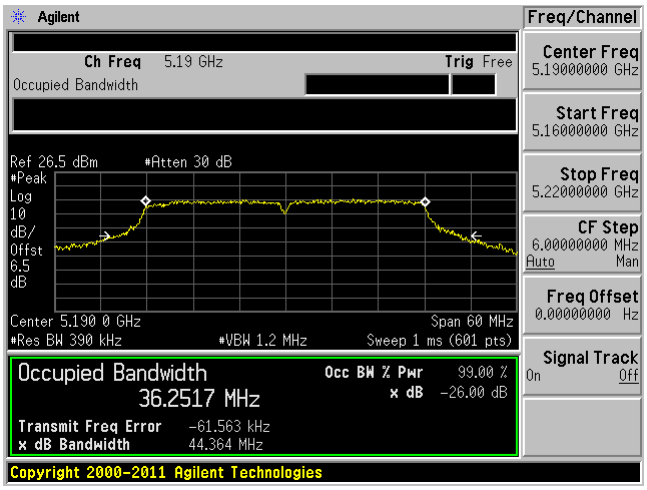


802.11n-HT20 mode, 5240 MHz, Chain J1

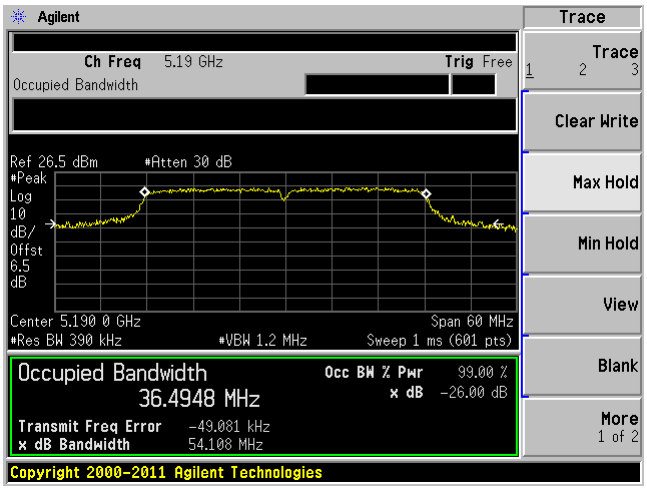


802.11n-HT40 mode

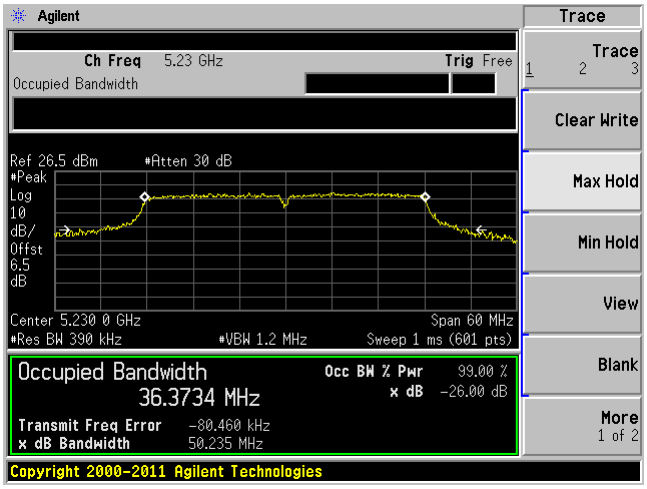
802.11n-HT40 mode, 5270 MHz, Chain J0



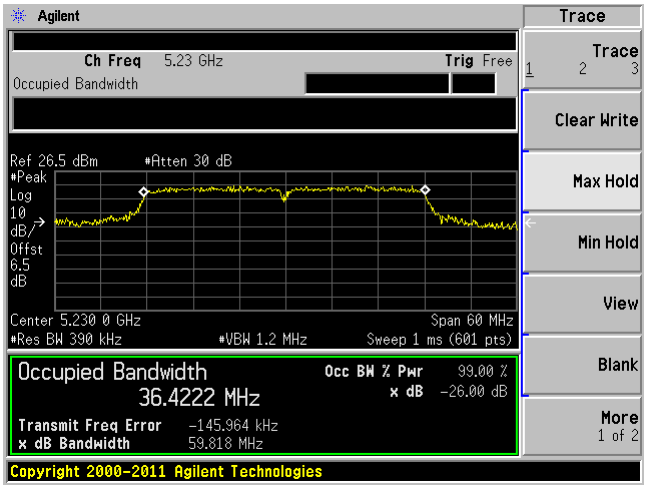
802.11n-HT40 mode, 5270 MHz, Chain J1



802.11n-HT40 mode, 5310 MHz, Chain J0



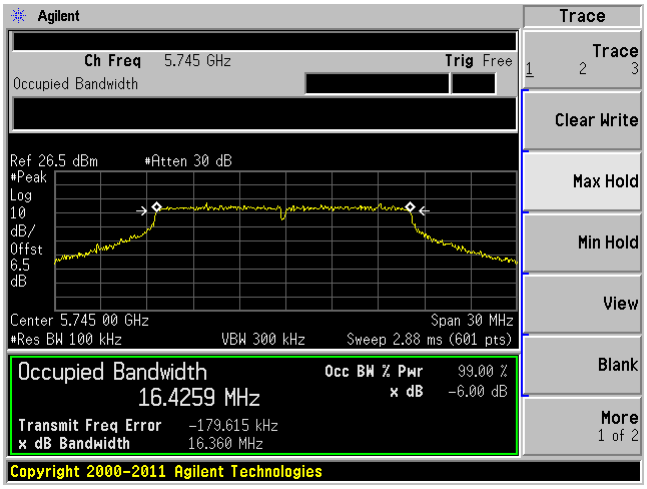
802.11n-HT40 mode, 5310 MHz, Chain J1



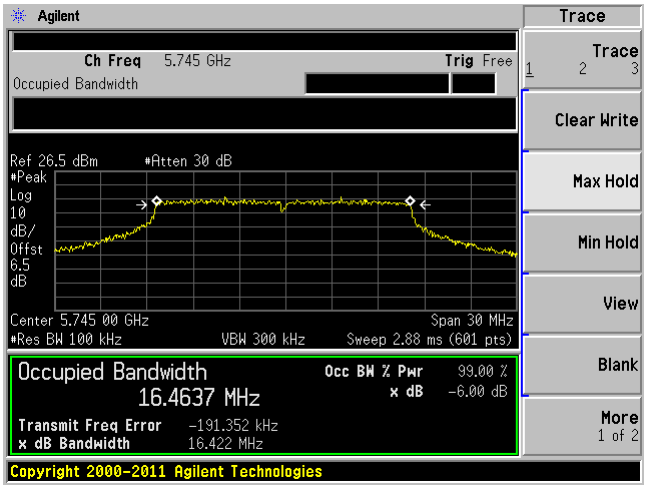
5.8 GHz Band:

802.11a mode

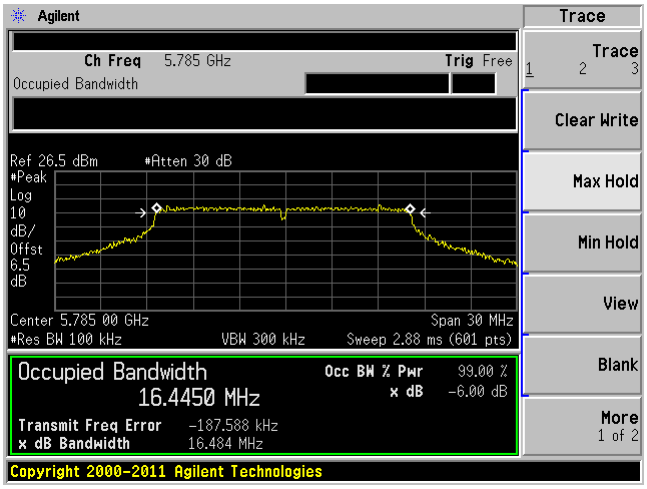
802.11a mode, 5745 MHz, Chain J0



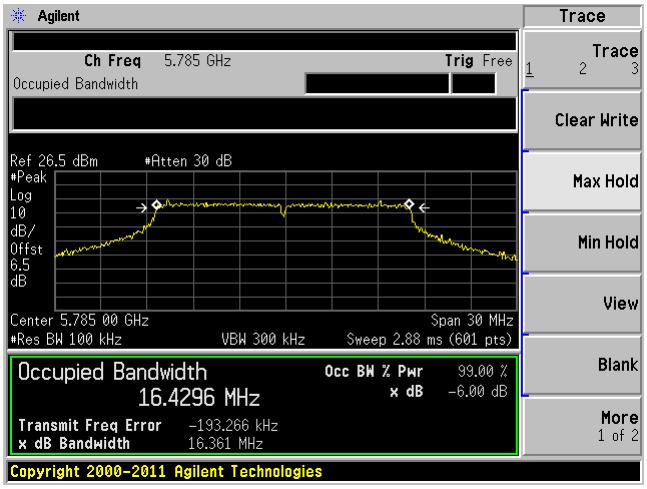
802.11a mode, 5745 MHz, Chain J1



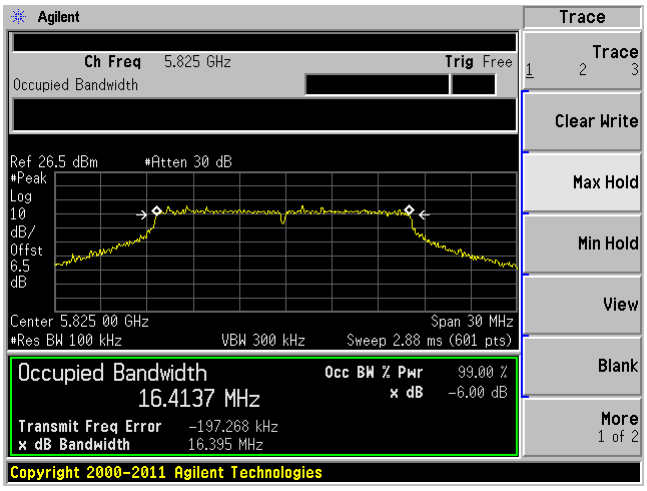
802.11a mode, 5785 MHz, Chain J0



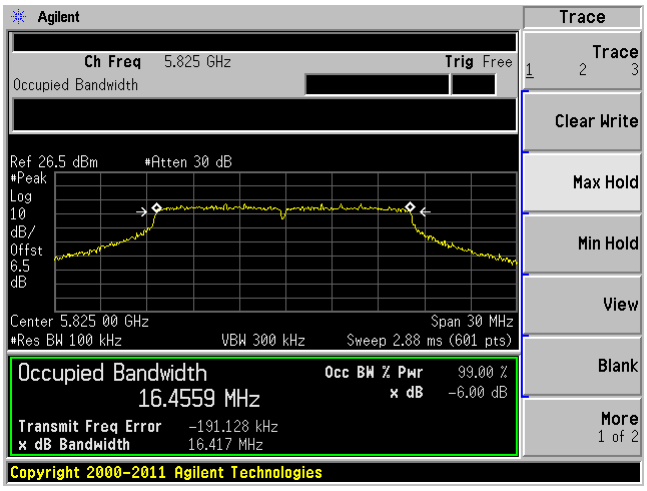
802.11a mode, 5785 MHz, Chain J1



802.11a mode, 5825 MHz, Chain J0

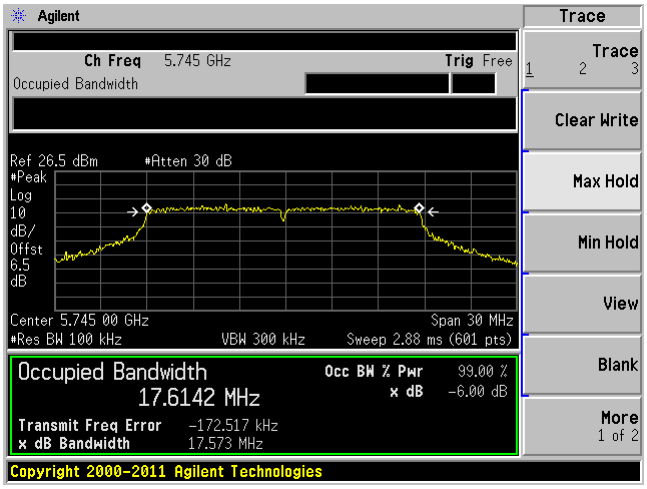


802.11a mode, 5825 MHz, Chain J1

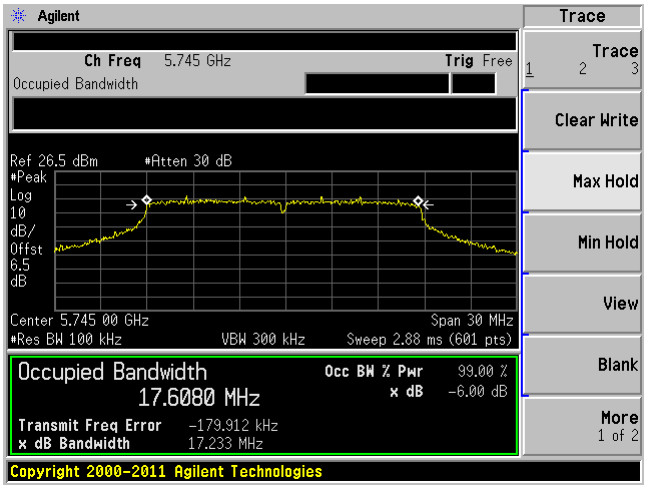


802.11n-HT20 mode

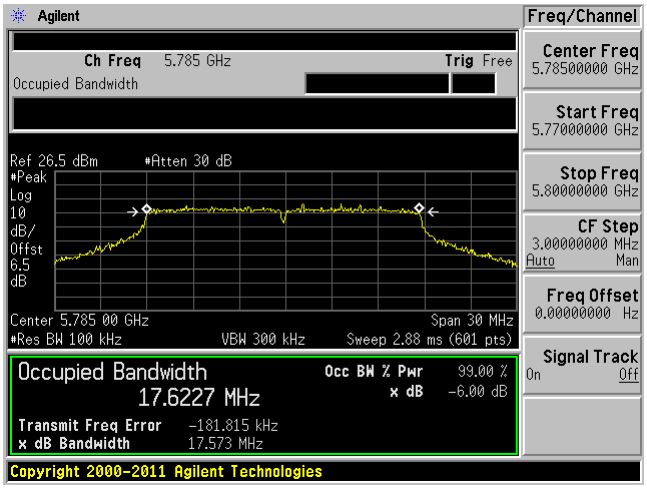
802.11n-HT20 mode, 5745 MHz, Chain J0



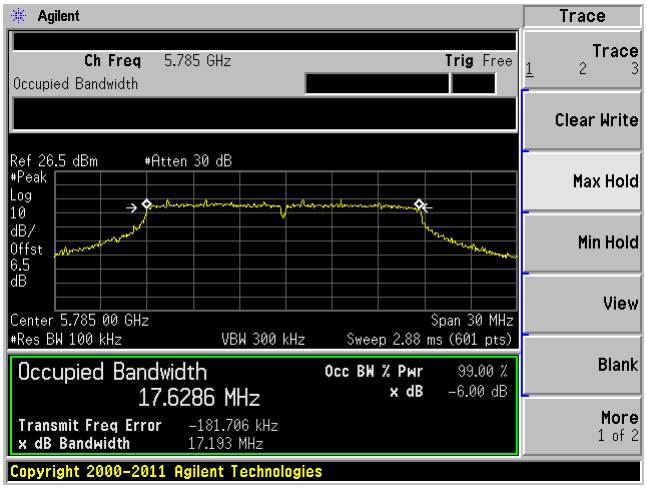
802.11n-HT20 mode, 5745 MHz, Chain J1



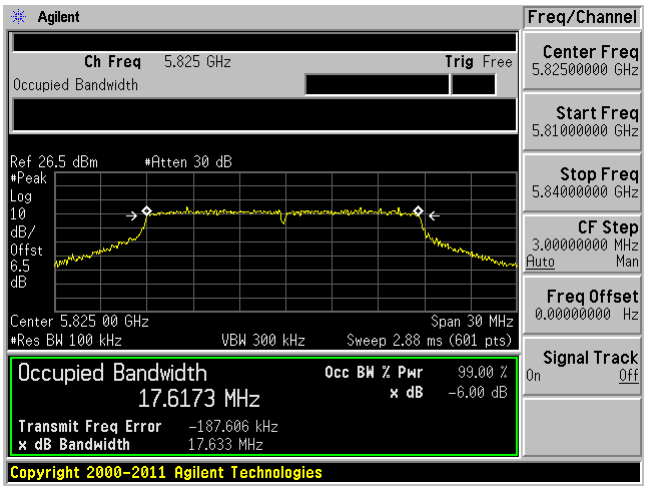
802.11n-HT20 mode, 5785 MHz, Chain J0



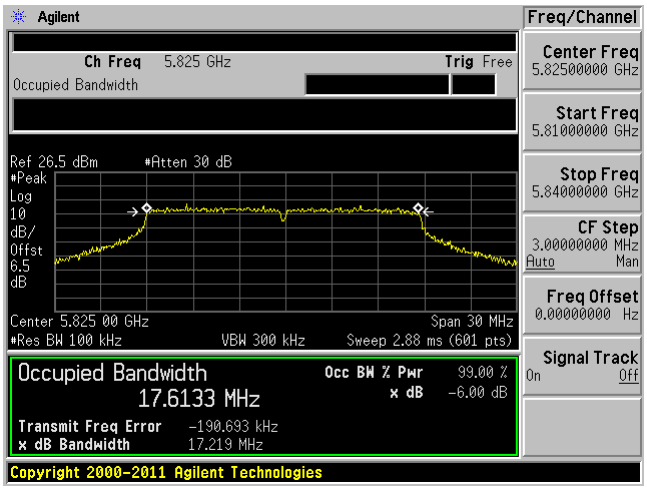
802.11n-HT20 mode, 5785 MHz, Chain J1



802.11n-HT20 mode, 5825 MHz, Chain J0

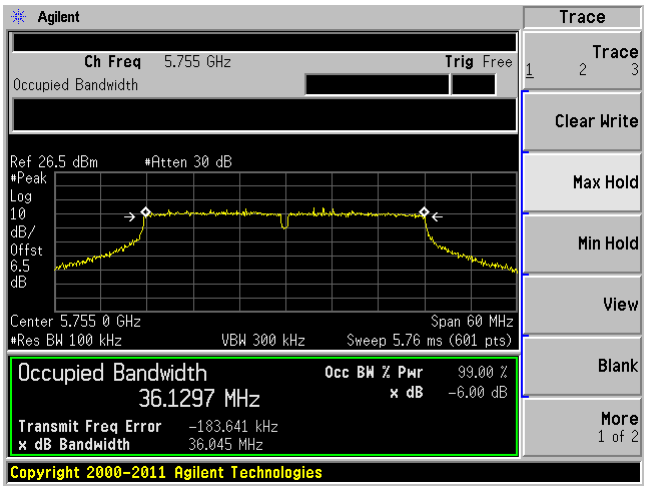


802.11n-HT20 mode, 5825 MHz, Chain J1

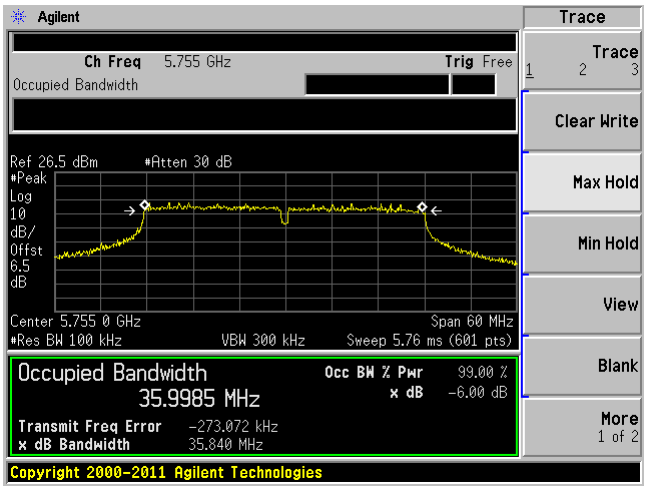


802.11n-HT40 mode

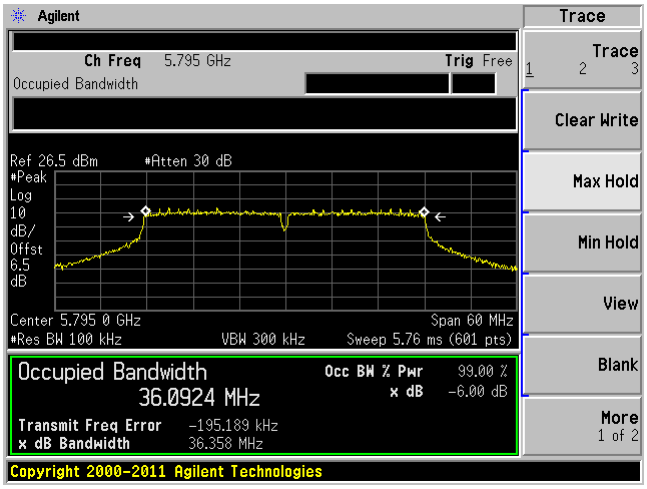
802.11n-HT40 mode, 5755 MHz, Chain J0



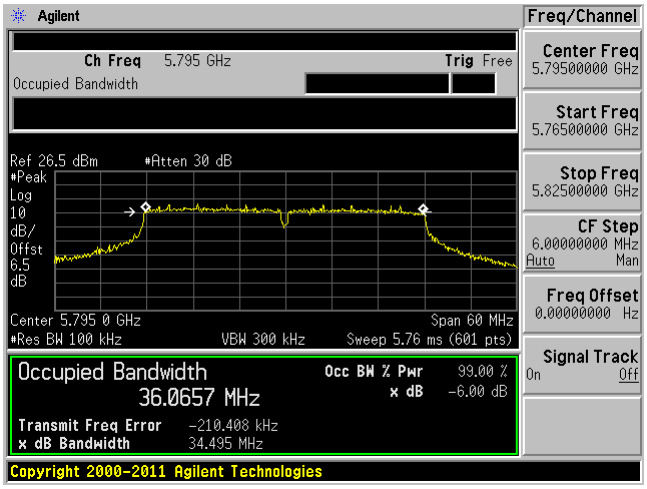
802.11n-HT40 mode, 5755 MHz, Chain J1



802.11n-HT40 mode, 5795 MHz, Chain J0



802.11n-HT40 mode, 5795 MHz, Chain J1



9 FCC §15.407(a)(1) & §15.407 (a)(3) - Output Power

9.1 Applicable Standards

According to FCC §15.407(a)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

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

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

9.2 Measurement Procedure

The measurements are base on FCC KDB 789033 D02 General UNII Test Procedures New Rules v01: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices section E: Maximum conducted output power

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2013-10-16	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:	21-23 °C
Relative Humidity:	43-48 %
ATM Pressure:	101.1-101.3 kPa

The testing was performed by Cipher Chu on 2014-10-01 to 2014-10-15 at the RF Site.

9.5 Test Results

5.2 GHz Band

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
802.11a						
Low	5180	24.57	24.71	27.65	28	-0.35
Middle	5200	24.96	24.81	27.90	28	-0.10
High	5240	24.89	24.68	27.80	28	-0.20
802.11n-HT20						
Low	5180	24.39	24.84	27.63	28	-0.37
Middle	5200	24.72	24.78	27.76	28	-0.24
High	5240	24.46	24.26	27.37	28	-0.63
802.11n-HT40						
Low	5190	24.71	24.98	27.86	28	-0.14
High	5230	24.87	24.74	27.82	28	-0.18

5.8 GHz Band

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
802.11a						
Low	5745	24.82	24.56	27.70	28.00	-0.30
Middle	5785	24.74	24.86	27.81	28.00	-0.19
High	5825	24.57	24.76	27.68	28.00	-0.32
802.11n-HT20						
Low	5745	24.69	24.89	27.80	28.00	-0.20
Middle	5785	24.78	25.15	27.98	28.00	-0.02
High	5825	24.68	24.77	27.74	28.00	-0.26
802.11n-HT40						
Low	5755	24.98	24.79	27.90	28.00	-0.10
High	5795	24.89	24.59	27.75	28.00	-0.25

The 8 dBi patch antenna consist of MMCX connectors with greater than 6 dBi gain; therefore, the output power and power spectral density limit shall be reduced by 2 dB to comply with the antenna requirement.

10 FCC §15.407(a)(1)(i) - EIRP at Elevation Angle Above 30 Degree

10.1 Applicable Standard

According to FCC §15.407(a)(1)(i)
(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

10.2 Measurement Procedure

The measurements are base on FCC KDB 789033 D02 General UNII Test Procedures New Rules v01: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices section H: Measurement of emission at elevation angle higher than 30 degrees from horizon

In addition to the emission limits specified in § 15.407(a)(1)(i), if the access point is an outdoor Point-toMultipoint device operating in the band 5.15-5.25 GHz, the rules require that the maximum EIRP at any elevation angle above 30° not exceed 125 mW (21 dBm) as measured from the horizon. This restriction leads to a general requirement for the antenna pattern: if the EIRP within 3-dB elevation beamwidth of any radiation lobe is higher than 125 mW, this lobe must be controlled, either mechanically or electrically, so that the 3-dB elevation beamwidth of this lobe is below 30° elevation angle relative to horizon.
For the purposes of compliance, information for all the antenna types must be included in the filing. In order for antennas to be considered of similar type, the antenna patterns must also be similar as well as other characteristics of the antenna.
Note: For the sake of clarity, we define the elevation angle where 0° is horizontal and 90° is straight-up.

1. **For fixed infrastructure, not electrically or mechanically steerable beam antenna**

a) If elevation plane radiation pattern is available:
   i. Determine the device intended mounting elevation angle and define 0° reference angle on the elevation plane radiation pattern
   ii. Indicate any radiation pattern between 30° and 90° which has highest gain.
   iii. Calculate the EIRP based on this highest gain and conducted output power.
   iv. Compare to the limit of 125 mW to find compliance.
   v. Include the elevation pattern data in the application filing with the test report to show how the calculations are made.

Note: For MIMO devices, take the maximum gain of each antenna and apply the guidance in KDB 662911 for calculating the overall gain including directional gain for maximum EIRP calculation.

b) If elevation plane radiation pattern is not available, but the antenna type (such as dipole omnidirectional, Yagi, parabolic, or sector antenna) has symmetrical elevation plane pattern referenced at main beam and all lobes on the main beam elevation plane have highest gains, then the following measurement method is acceptable to determine compliance:
   i. Determine the device's intended mounting elevation angle referenced to the horizon.
   ii. Rotate EUT antenna by 90° around the main beam axis in horizontal position to transform measurement in elevation angle into azimuth angle and define 0° reference angle based on device's intended mounting elevation angle.
   iii. Move test antenna along the horizontal arc, or rotate the turn table with EUT antenna placed at the center, between 30° and 90° relative to the 0° reference angle, and then continuing down

from 90° to 30° on the other side of the pattern, while maintaining the test antenna pointing with constant distance to the EUT antenna and search for the spot which has the highest measured emission. Both horizontal and vertical polarization shall be investigated to find out the maximum radiated emission level. Note: the moving of test antenna along the horizontal arc, or rotating the turn table, shall be performed in angular step size as small as possible but not larger than 3°

iv. Calculate the EIRP based on the highest measured emission and compare to the limit of 125 mW to determine compliance.

v. The antenna pattern measurements should be included in the filing.

2. For All Other Types of Antenna For all other types of antenna (such as patch antenna, array antenna, antennas with irregular shape of radiators, etc.) which have any combination of following characteristics:

- Asymmetrical, complex radiation patterns
- 2-D or 3-D steerable beam
- Portable/mobile, not fixed infrastructure device

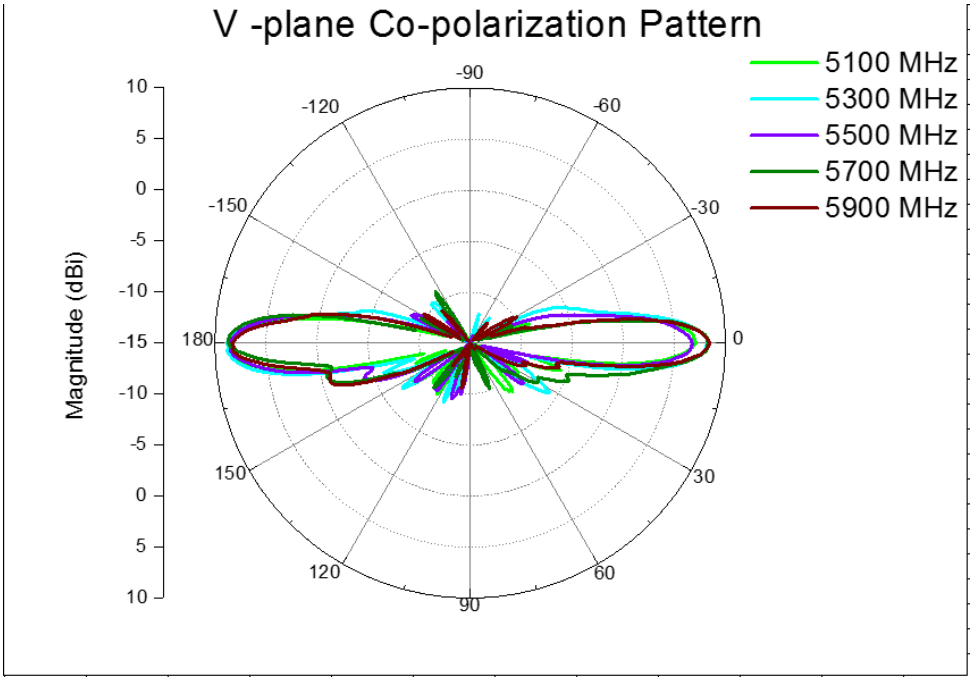
Provide following information in the report:

a) Describe what type of antenna is used.
b) Determine by calculation, measurement or simulation, all radiation lobes/beams, which have EIRP higher than 125 mW within 3-dB elevation beamwidth.
c) Provide an explanation of how those antenna beams are controlled to be kept below 30° elevation angle. The explanation should include installation instruction of the device, mechanical control, electro-mechanical control or software algorithm, if the beams are electrically controlled by software.

10.3 Test Result

The Client declared that antenna been used for this device is **fixed infrastructure, not electrically or mechanically steerable beam antenna.** Therefore, the method (1) (a) was used for the calculation**.**

Please refer the antenna pattern and data list below.



Degree	Antenna Gain (dBi)		
	5.1 GHz	5.2 GHz	5.3 GHz
30	-18.2971	-16.0941	-13.9251
31	-18.4371	-18.4851	-15.4131
32	-19.3301	-21.6401	-17.3601
33	-20.2591	-23.5421	-16.0441
34	-23.0391	-20.5931	-15.4001
35	-24.6161	-18.8031	-15.0431
36	-26.2591	-17.2441	-14.3471
37	-24.0751	-15.9561	-13.7371
38	-22.4261	-15.1011	-13.5081
39	-20.4331	-15.3101	-13.3701
40	-20.7841	-16.1821	-13.5991
41	-19.9801	-15.8231	-14.4721
42	-19.5151	-16.3321	-15.5831
43	-19.3891	-16.0991	-17.0931
44	-19.3441	-16.1951	-17.3691
45	-19.0081	-15.3741	-16.3671
46	-17.7281	-14.8281	-15.5221
47	-17.6011	-13.7391	-14.6761
48	-18.0251	-13.1761	-14.6501
49	-17.5281	-13.2141	-13.5831
50	-17.6321	-13.8391	-13.5601

51	-18.1281	-13.7911	-12.2601
52	-20.6211	-13.8741	**-11.9101**
53	-22.6731	-13.3991	-12.6831
54	-26.9161	-15.6411	-13.2091
55	-26.2471	-17.4301	-13.6491
56	-27.5531	-18.4511	-14.6621
57	-27.1191	-20.4781	-17.3571
58	-24.9991	-22.5301	-20.3941
59	-22.7911	-21.6681	-23.6461
60	-22.1481	-22.8951	-27.3031
61	-20.5451	-20.6751	-29.2291
62	-19.9621	-19.7051	-27.0681
63	-19.6581	-19.7711	-22.4921
64	-18.9291	-18.4191	-21.1841
65	-18.8251	-17.0791	-21.8081
66	-17.4101	-17.3141	-19.7971
67	-16.9331	-16.2791	-16.6011
68	-16.2611	-14.9721	-14.9581
69	-15.1851	-13.7071	-14.0161
70	-14.8501	-13.4251	-13.4101
71	-14.8841	-13.8001	-12.9801
72	-15.1181	-13.8591	-12.3511
73	-15.3391	-13.8801	-12.1091
74	-15.3901	-15.3661	-13.3731
75	-16.5591	-17.8771	-14.5241
76	-17.7091	-18.7701	-15.7241
77	-19.1021	-19.0081	-17.7261
78	-19.9631	-20.9621	-19.0631
79	-19.3551	-23.3071	-19.9871
80	-19.4311	-22.9511	-18.0421
81	-19.2491	-22.0051	-17.7181
82	-19.1221	-21.7111	-19.3911
83	-19.0451	-22.1701	-17.9991
84	-20.5051	-23.2201	-18.0251
85	-22.7871	-25.3551	-18.1231
86	-25.3291	-29.6001	-20.9331
87	-28.5161	-37.7351	-22.4861
88	-29.3401	-35.9181	-23.9841
89	-27.2891	-36.5101	-24.9901
90	-30.2901	-35.4251	-26.3951

Based on the antenna pattern and the antenna gain from 30 degree to 90 degree, the highest antenna gain from 30 degree to 90 degree is -11.9101 dBi. The maximum conducted output power is 27.98 dBm.

The EIRP above 30 degree = 27.98+ (-11.9101) = 16.0699 dBm which is lower than 125 mW (21 dBm). So the EIRP emission for elevation plane above 30 degree is under the limit.

11 FCC §15.407(a)(1) & (a)(3)- Power Spectral Density

11.1 Applicable Standard

According to FCC §15.407(a)(1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

According to FCC §15.407(a)(3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

11.2 Measurement Procedure

The measurements are base on FCC KDB 789033 D02 General UNII Test Procedures New Rules v01: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices section F: Maximum power spectral density (PPSD)

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2013-10-16	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:	21-23 °C
Relative Humidity:	43-48 %
ATM Pressure:	101.1-101.3 kPa

The testing was performed by Cipher Chu on 2014-10-01 to 2014-10-15 at the RF Site.

11.5 Test Results

5.2 GHz Band

Channel	Frequency (MHz)	TX Chain J0 PSD (dBm)	TX Chain J1 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
802.11a mode						
Low	5180	11.194	12.06	14.66	15	-0.34
Middle	5200	10.222	11.397	13.86	15	-1.14
High	5240	9.124	11.687	13.60	15	-1.40
802.11n-HT20 mode						
Low	5180	10.763	10.133	13.47	15	-1.53
Middle	5200	9.869	10.929	13.44	15	-1.56
High	5240	9.781	10.323	13.07	15	-1.93
802.11n-HT40 mode						
Low	5190	6.318	8.893	10.80	15	-4.20
High	5230	6.294	8.375	10.47	15	-4.53

The 8 dBi patch antenna consist of MMCX connectors with greater than 6 dBi gain; therefore, the output power and power spectral density limit shall be reduced by 2 dB to comply with the antenna requirement.

5.8 GHz Band

Channel	Frequency (MHz)	TX Chain J0 PSD (dBm)	TX Chain J1 PSD (dBm)	Total PSD (dBm)	Factor	Limit (dBm)	Margin (dB)
Low	5745	4.267	4.463	7.38	6.99	28	-13.63
Middle	5785	3.291	4.114	6.73	6.99	28	-14.28
High	5825	4.653	5.18	7.93	6.99	28	-13.08
802.11n-HT20 mode							
Low	5745	3.925	4.011	6.98	6.99	28	-14.03
Middle	5785	3.962	3.755	6.87	6.99	28	-14.14
High	5825	4.06	3.911	7.00	6.99	28	-14.01
802.11n-HT40 mode							
Low	5755	0.672	0.663	3.68	6.99	28	-17.33
High	5795	0.33	2.666	4.66	6.99	28	-16.35

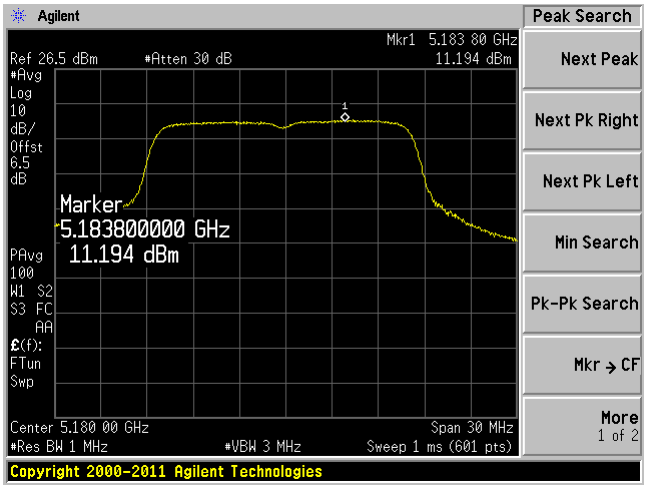
The 8 dBi patch antenna consist of MMCX connectors with greater than 6 dBi gain; therefore, the output power and power spectral density limit shall be reduced by 2 dB to comply with the antenna requirement.

Please refer to the following plots.

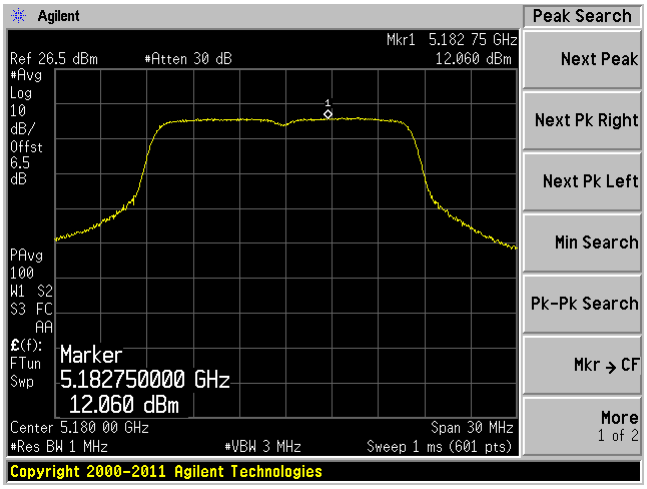
5.2 GHz Band:

802.11a mode

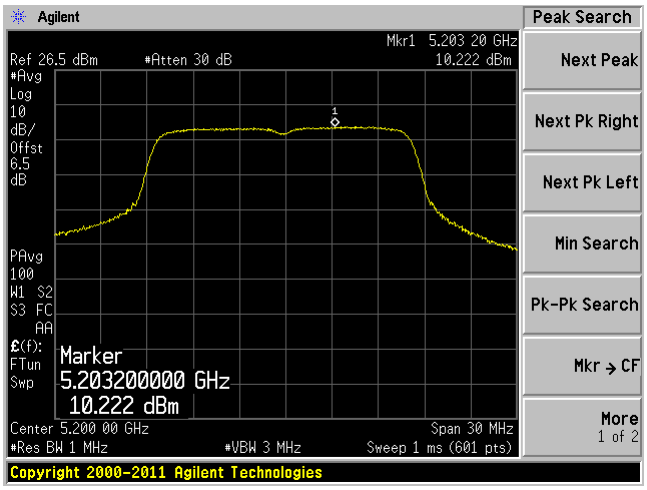
802.11a mode, 5180 MHz, Chain J0



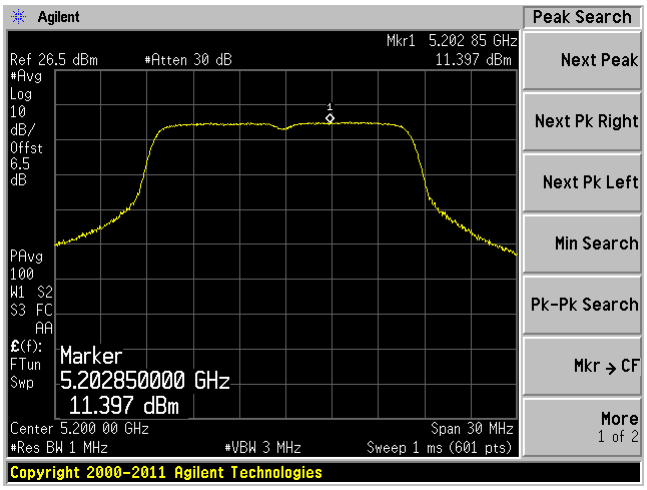
802.11a mode, 5180 MHz, Chain J1



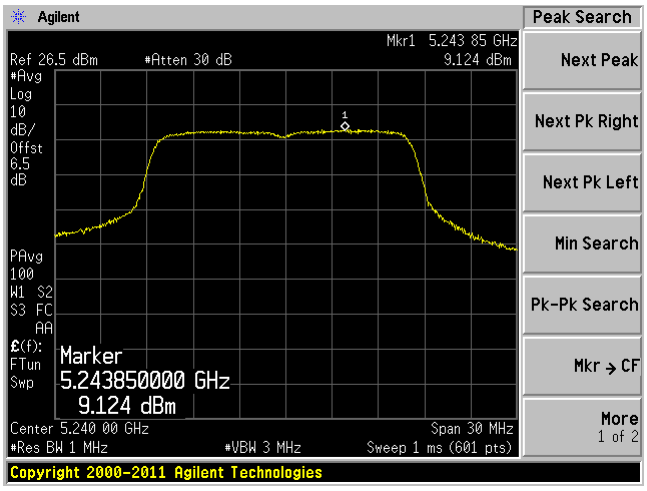
802.11a mode, 5200 MHz, Chain J0



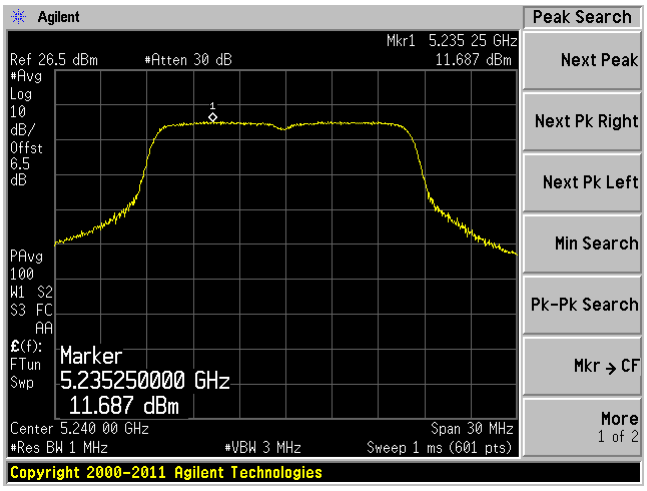
802.11a mode, 5200 MHz, Chain J1



802.11a mode, 5240 MHz, Chain J0

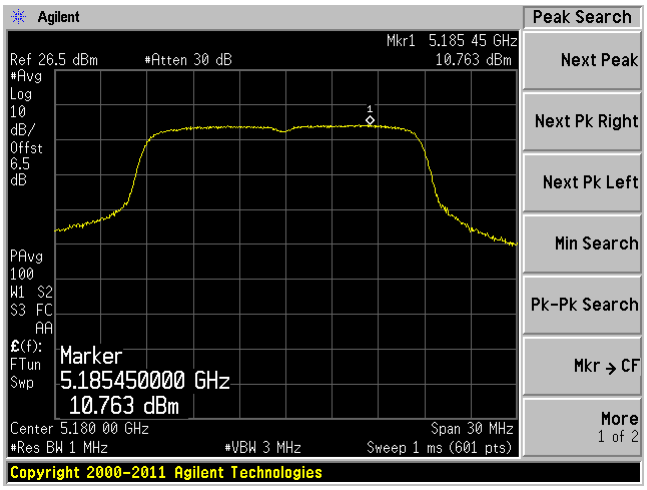


802.11a mode, 5240 MHz, Chain J1

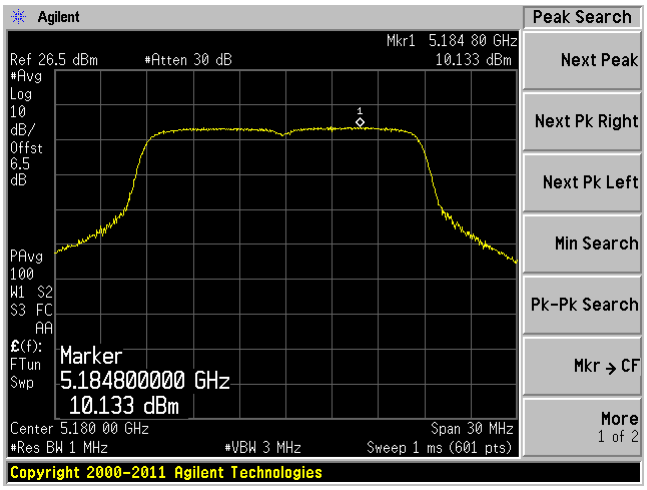


802.11n-HT20 mode

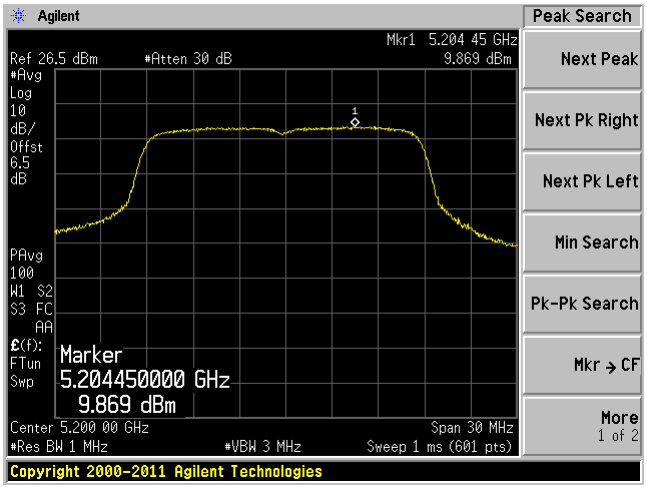
802.11n-HT20 mode, 5180 MHz, Chain J0



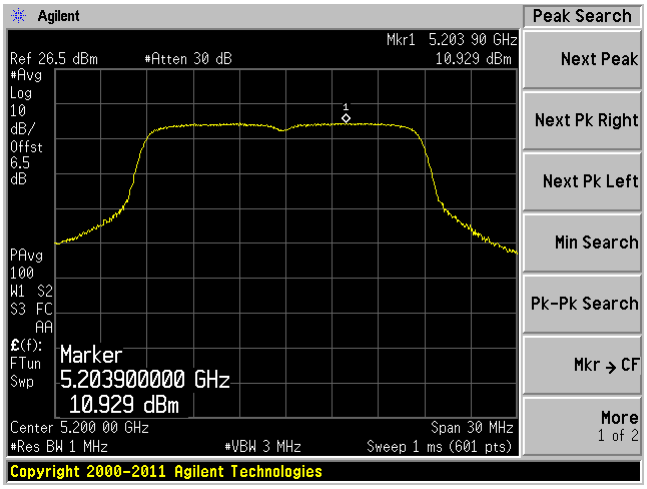
802.11n-HT20 mode, 5180 MHz, Chain J1



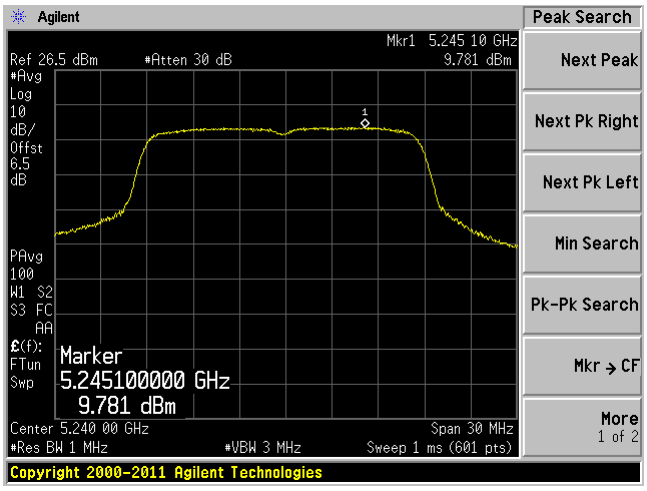
802.11n-HT20 mode, 5200 MHz, Chain J0



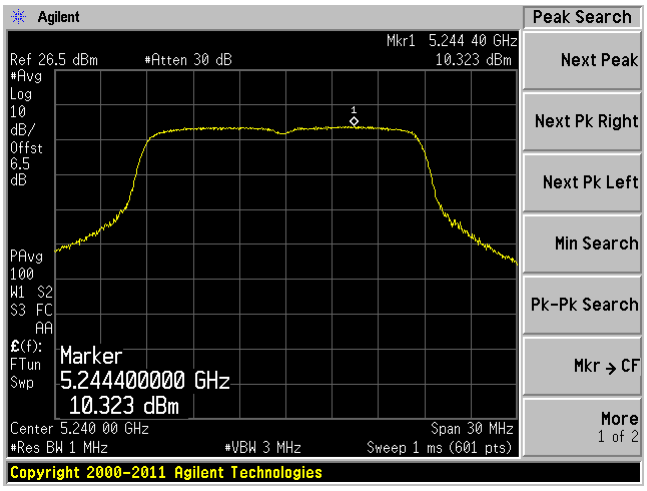
802.11n-HT20 mode, 5200 MHz, Chain J1



802.11n-HT20 mode, 5240 MHz, Chain J0

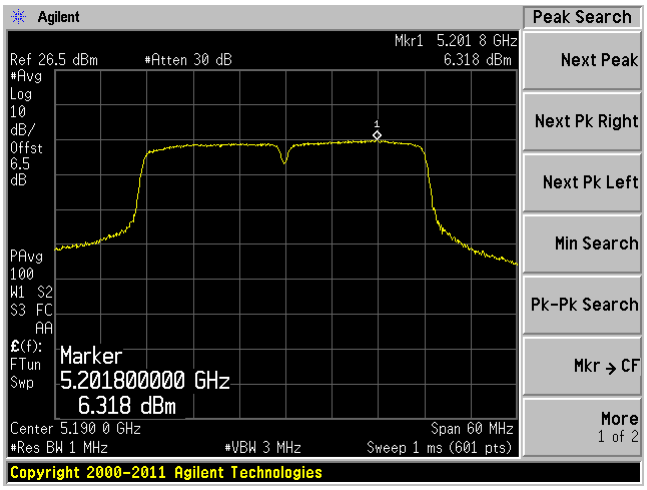


802.11n-HT20 mode, 5240 MHz, Chain J1

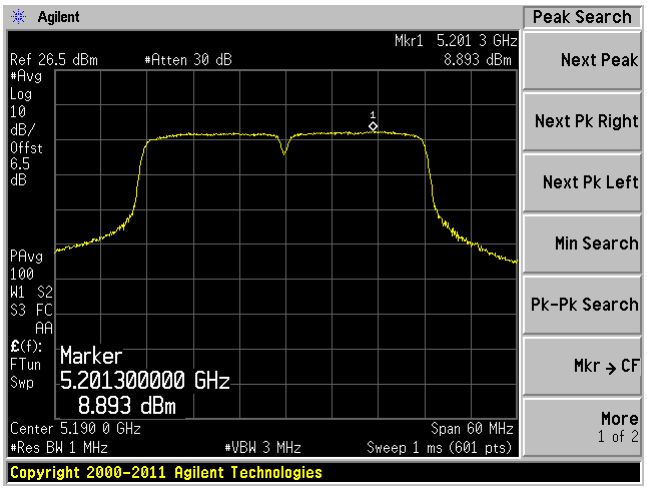


802.11n-HT40 mode

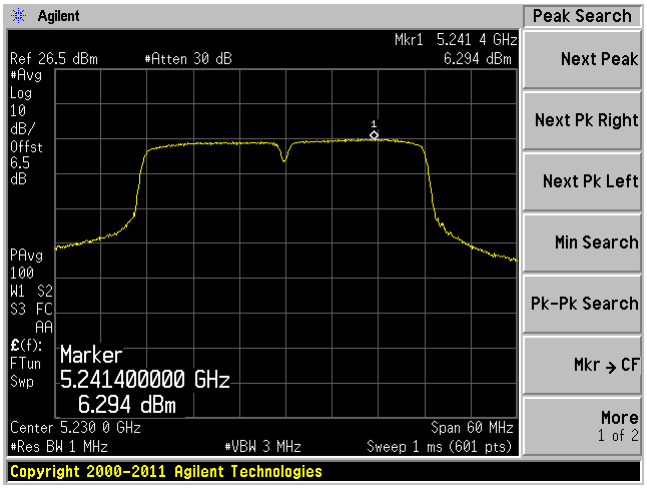
802.11n-HT40 mode, 5270 MHz, Chain J0



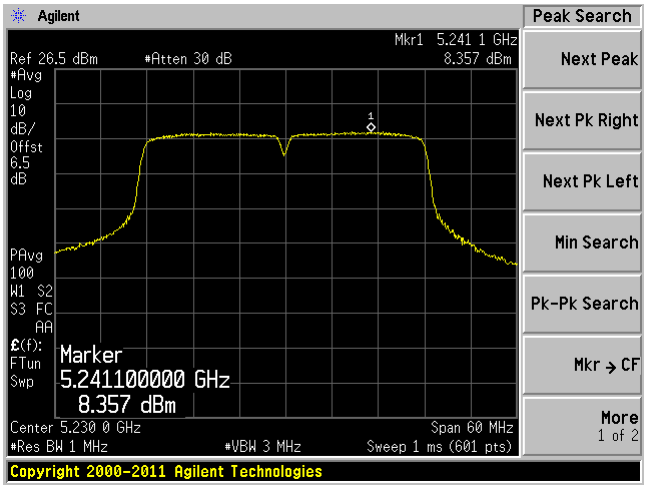
802.11n-HT40 mode, 5270 MHz, Chain J1



802.11n-HT40 mode, 5310 MHz, Chain J0



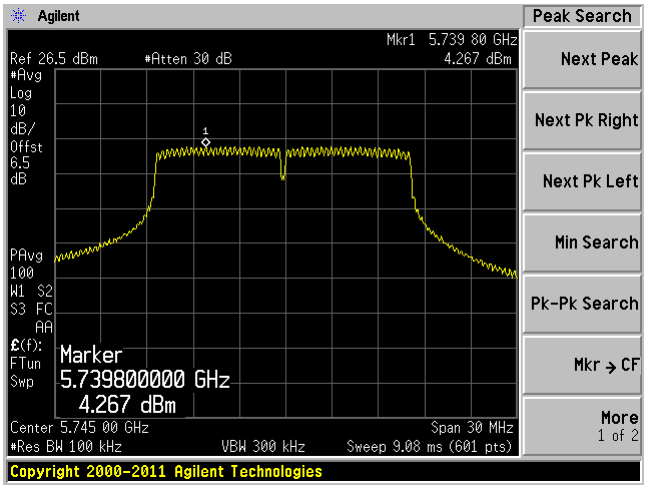
802.11n-HT40 mode, 5310 MHz, Chain J1



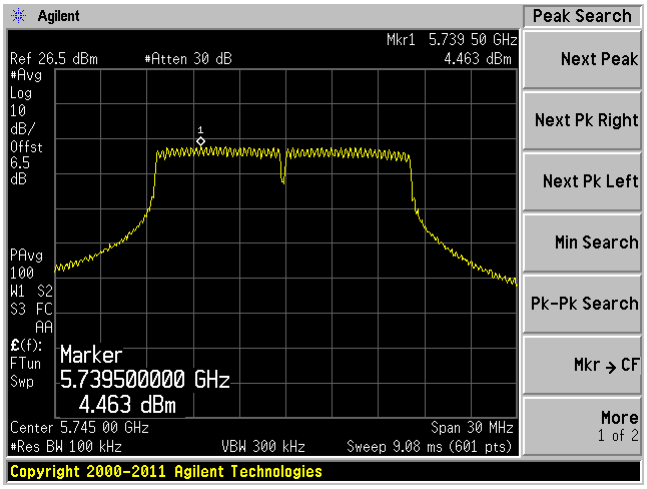
5.8 GHz Band:

802.11a mode

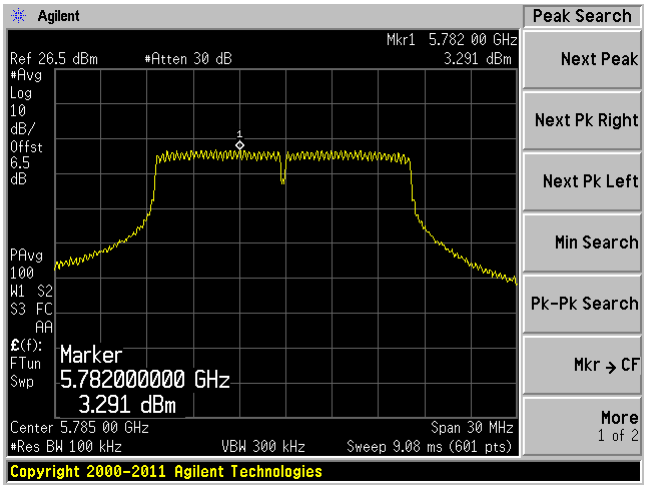
802.11a mode, 5745 MHz, Chain J0



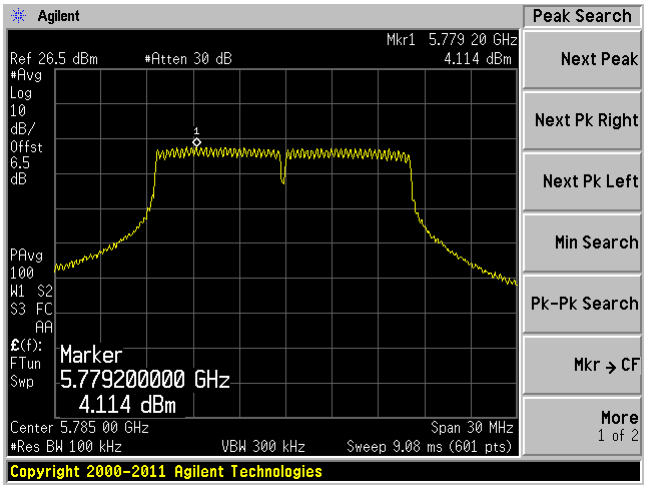
802.11a mode, 5745 MHz, Chain J1



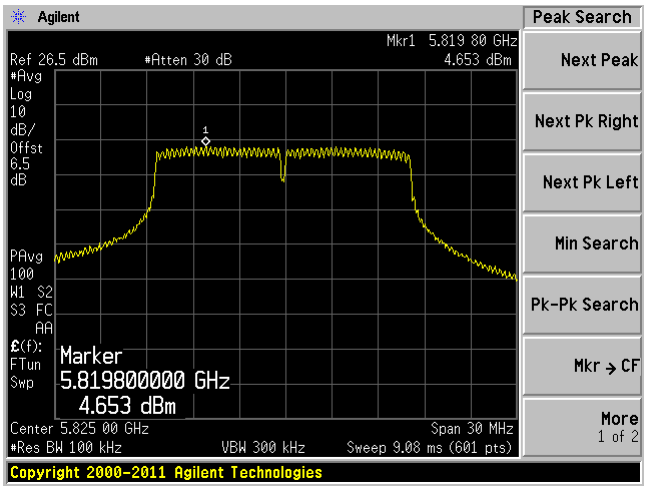
802.11a mode, 5785 MHz, Chain J0



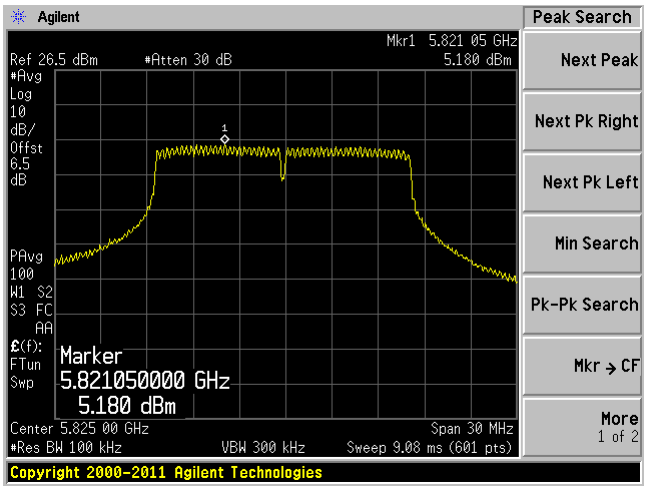
802.11a mode, 5785 MHz, Chain J1



802.11a mode, 5825 MHz, Chain J0

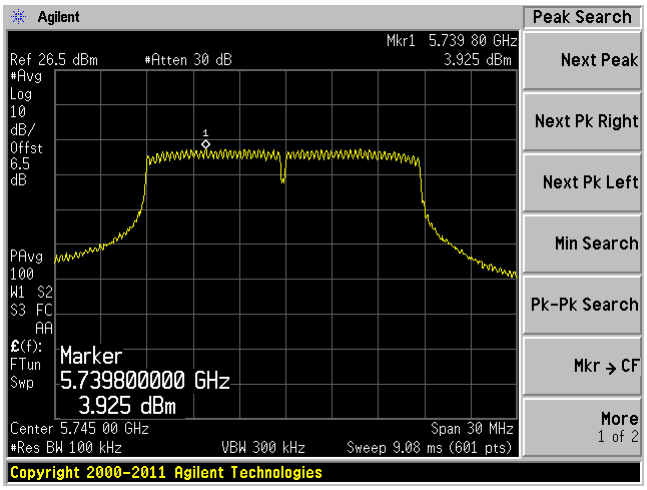


802.11a mode, 5825 MHz, Chain J1

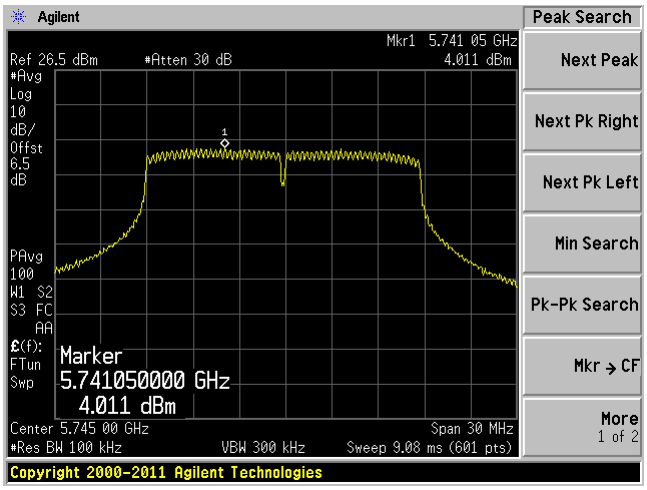


802.11n-HT20 mode

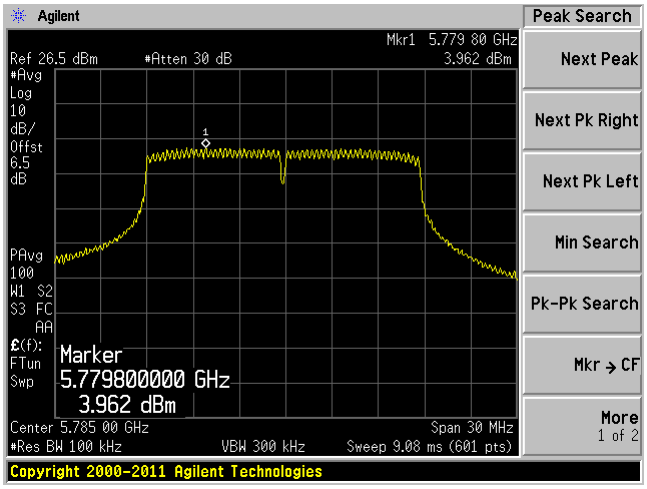
802.11n-HT20 mode, 5745 MHz, Chain J0



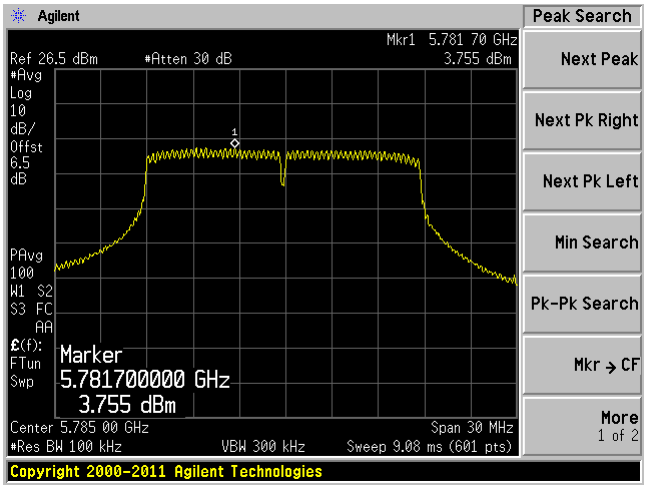
802.11n-HT20 mode, 5745 MHz, Chain J1



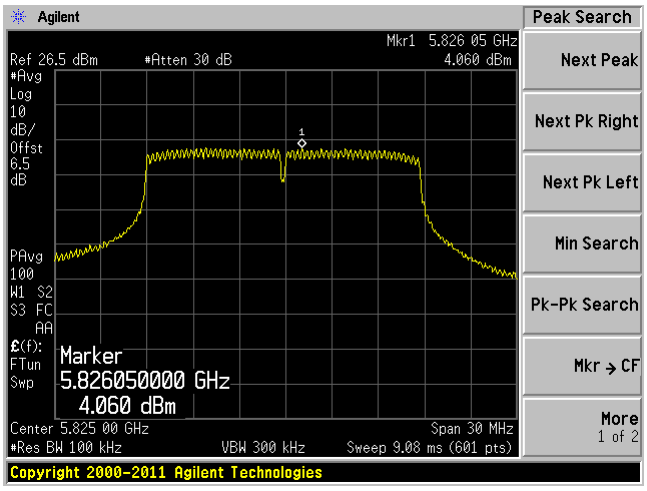
802.11n-HT20 mode, 5785 MHz, Chain J0



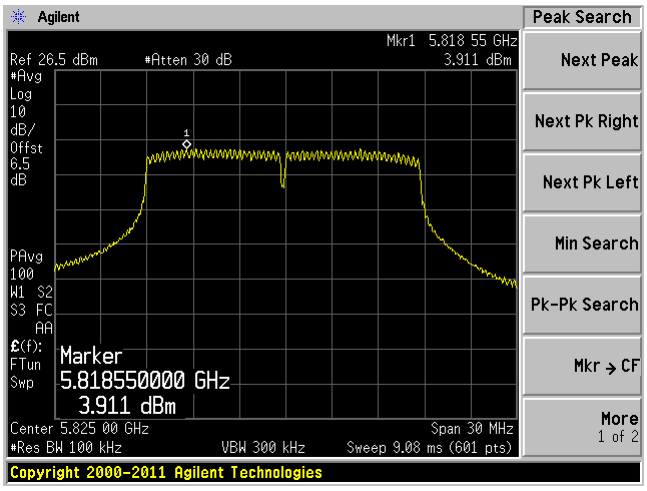
802.11n-HT20 mode, 5785 MHz, Chain J1



802.11n-HT20 mode, 5825 MHz, Chain J0

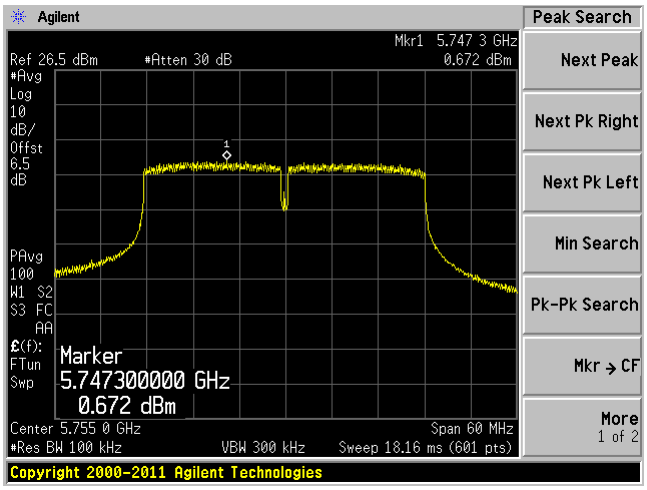


802.11n-HT20 mode, 5825 MHz, Chain J1

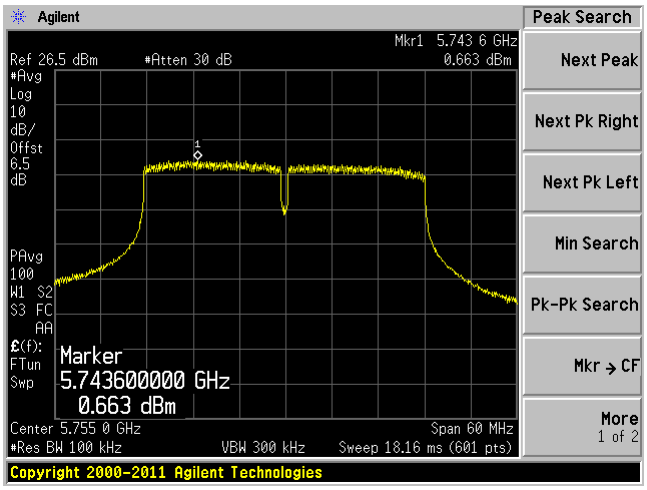


802.11n-HT40 mode

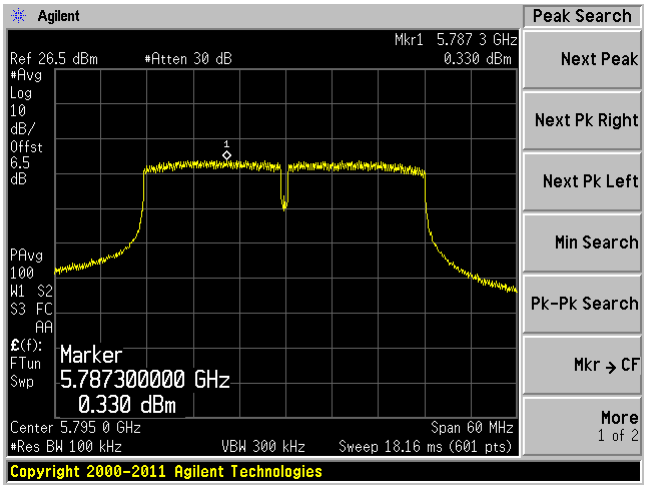
802.11n-HT40 mode, 5755 MHz, Chain J0



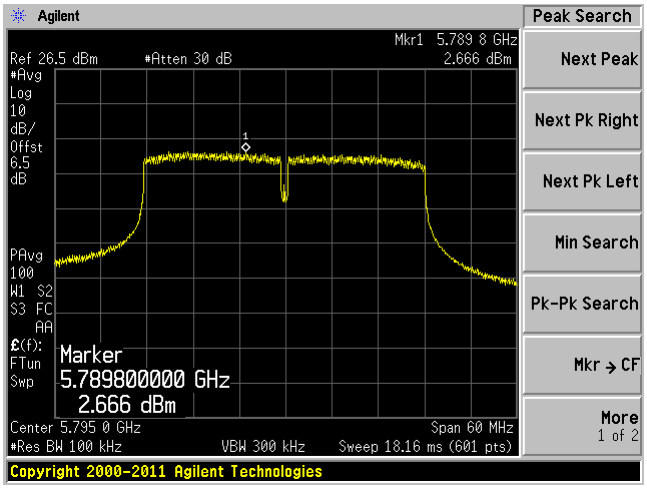
802.11n-HT40 mode, 5755 MHz, Chain J1



802.11n-HT40 mode, 5795 MHz, Chain J0



802.11n-HT40 mode, 5795 MHz, Chain J1



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

12.1 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 e.i.r.p. of −27 dBm/MHz.

For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.

12.2 Measurement Procedure

The measurements are base on FCC KDB 789033 D02 General UNII Test Procedures New Rules v01: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices section G: Unwanted emissions measurement

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2013-10-16	1 year

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

12.4 Test Environmental Conditions

Temperature:	22-24 °C
Relative Humidity:	42-45 %
ATM Pressure:	101-102 kPa

The testing was performed by Cipher Chu on 2014-10-01 to 2014-10-15 at the RF Site.

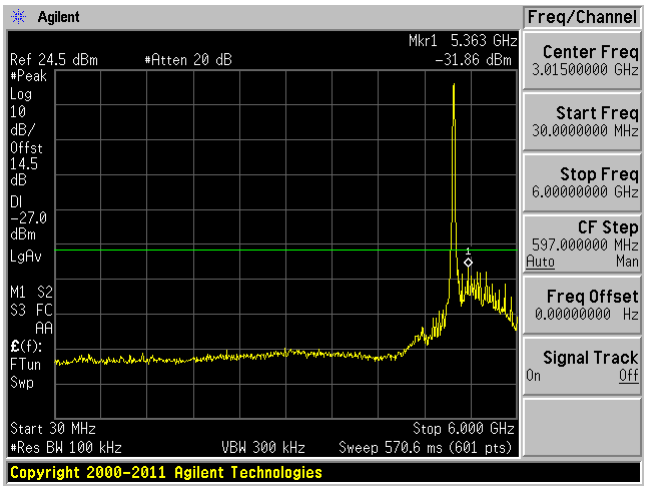
12.5 Test Results

Please refer to following plots of spurious emissions.

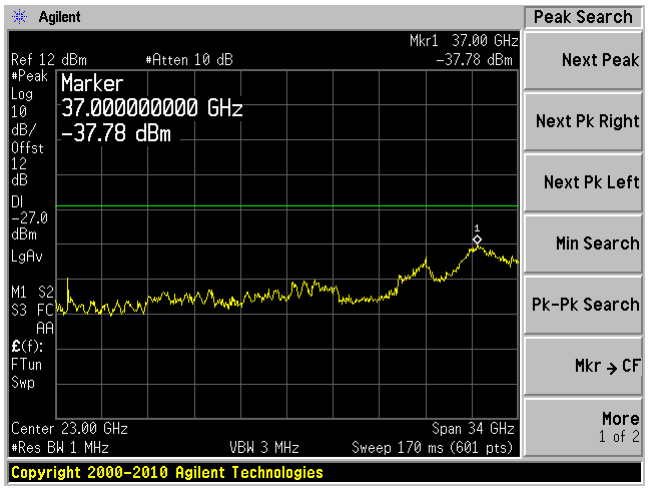
(1) 5.2 GHz Band Conducted Spurious Emissions:

802.11a, Low Channel, 5180 MHz

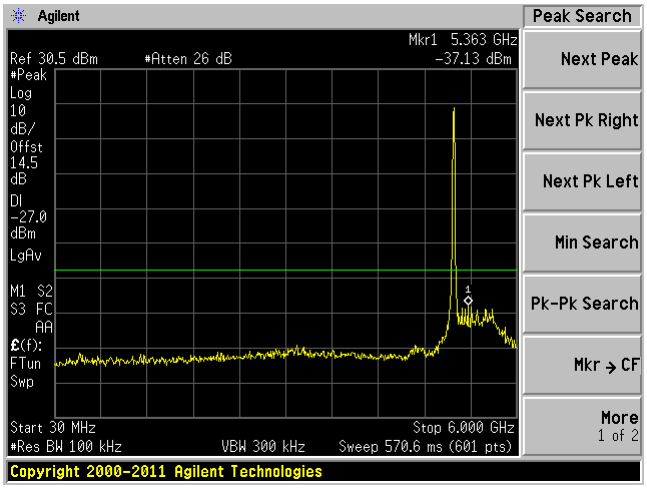
Chain J0, Plot: 30 MHz – 6 GHz



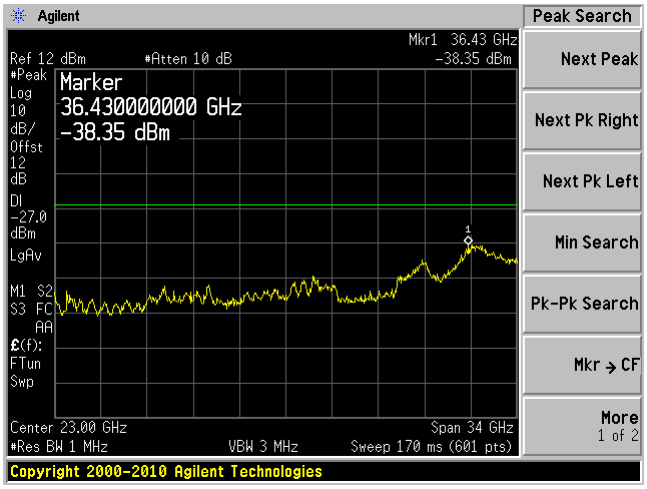
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

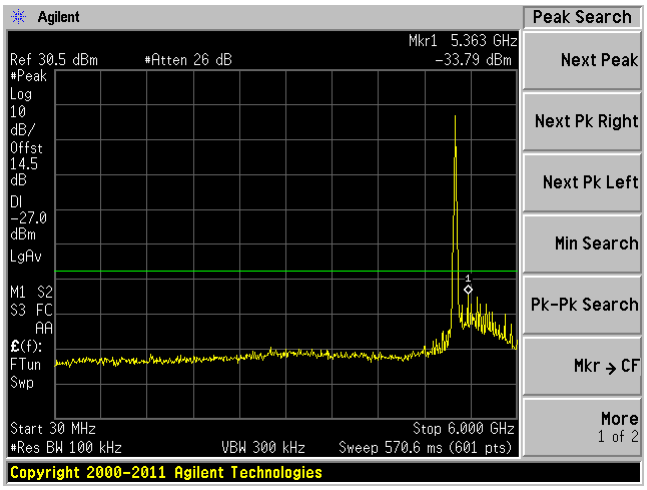


Chain J1, Plot: 6 GHz – 40 GHz

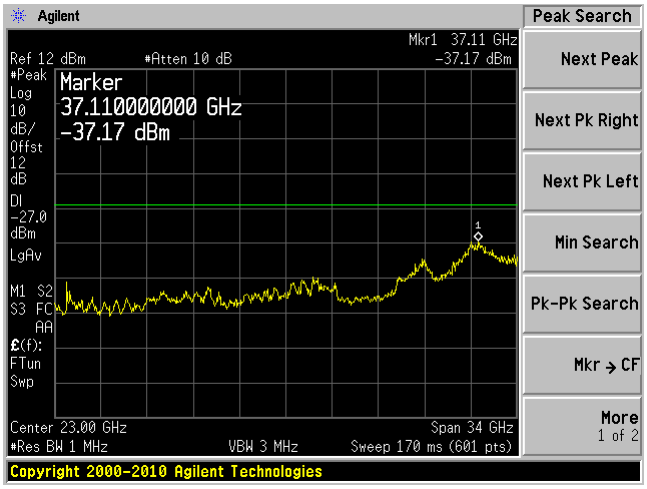


802.11a, Middle Channel, 5200 MHz

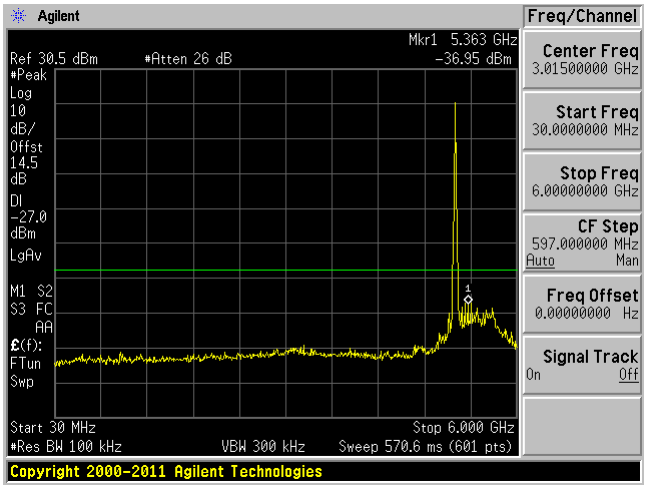
Chain J0, Plot: 30 MHz – 6 GHz



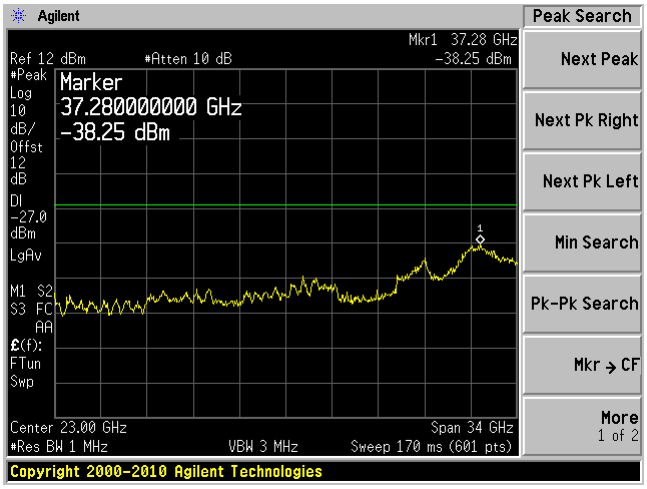
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

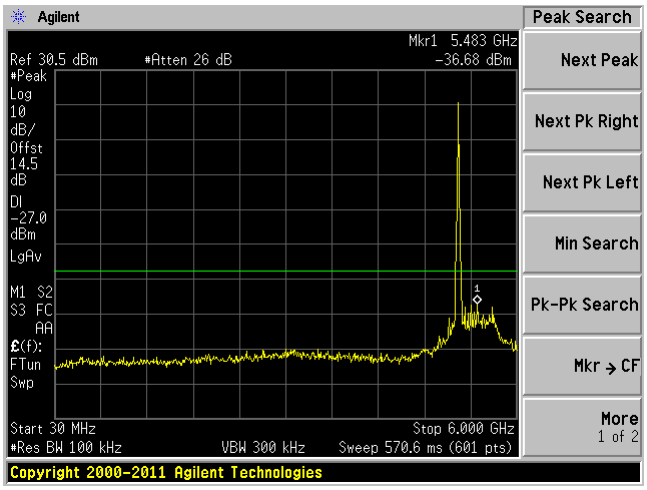


Chain J1, Plot: 6 GHz – 40 GHz

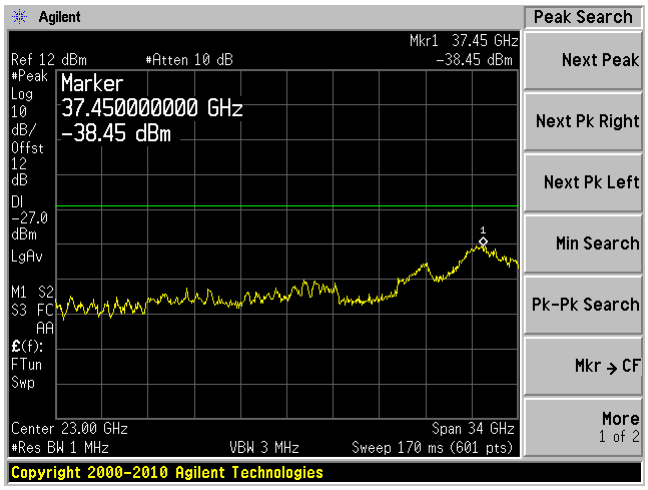


802.11a, High Channel, 5240 MHz

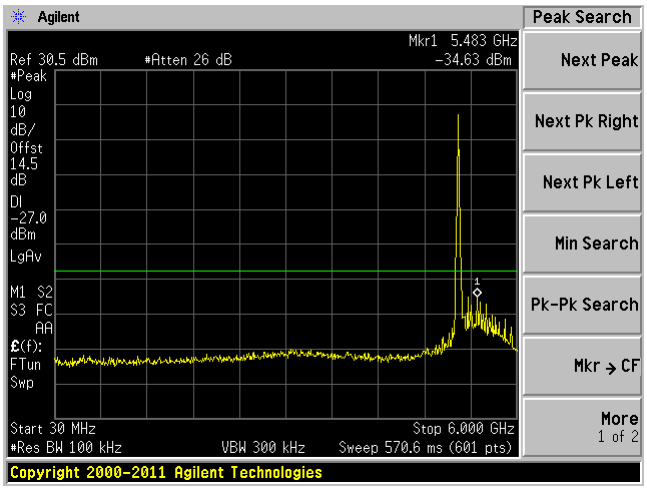
Chain J0, Plot: 30 MHz – 6 GHz



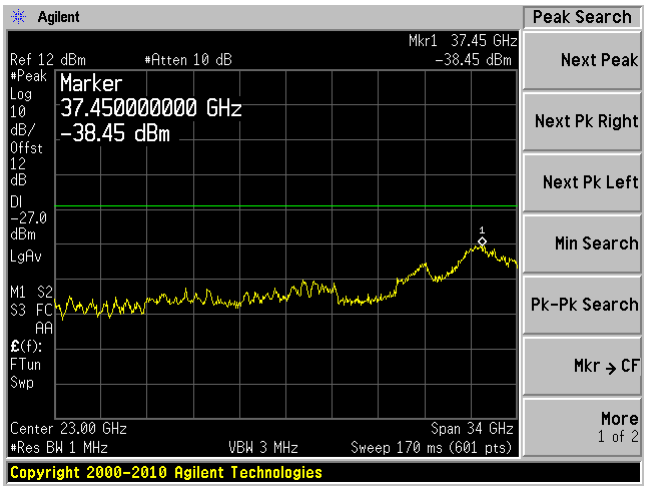
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

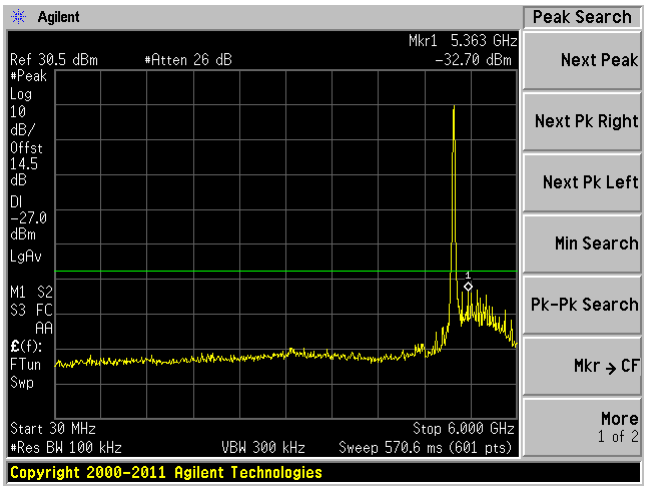


Chain J1, Plot: 6 GHz – 40 GHz

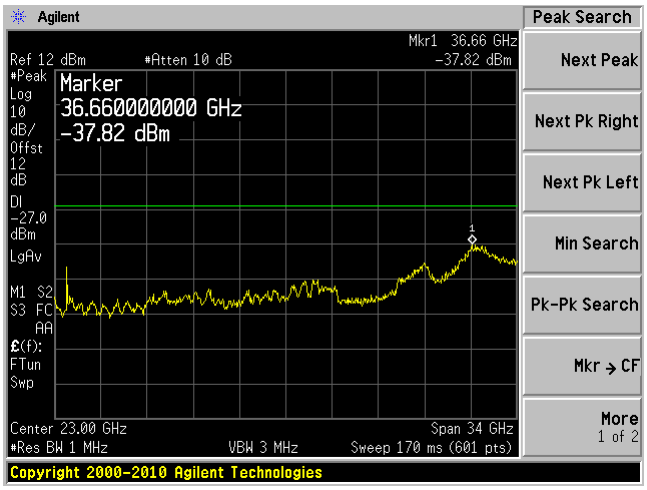


802.11n-HT 20, Low Channel 5180 MHz

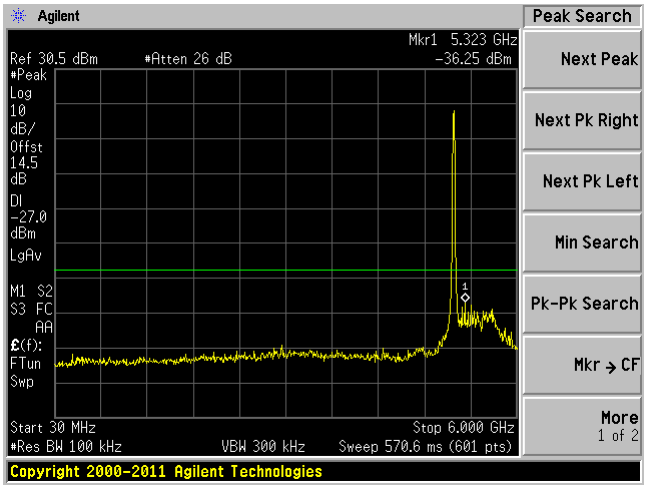
Chain J0, Plot: 30 MHz – 6 GHz



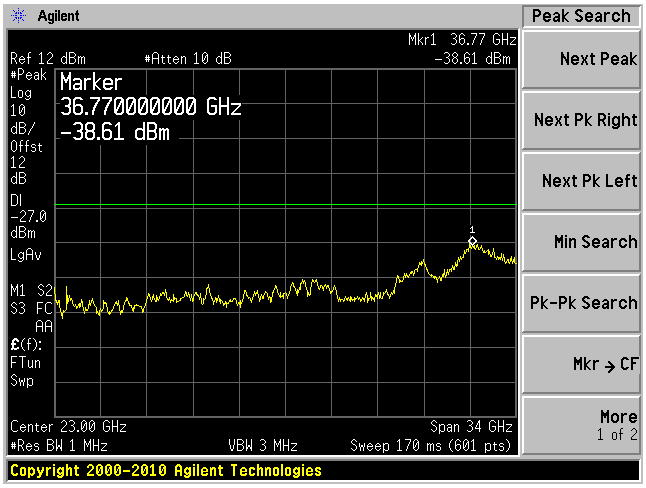
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

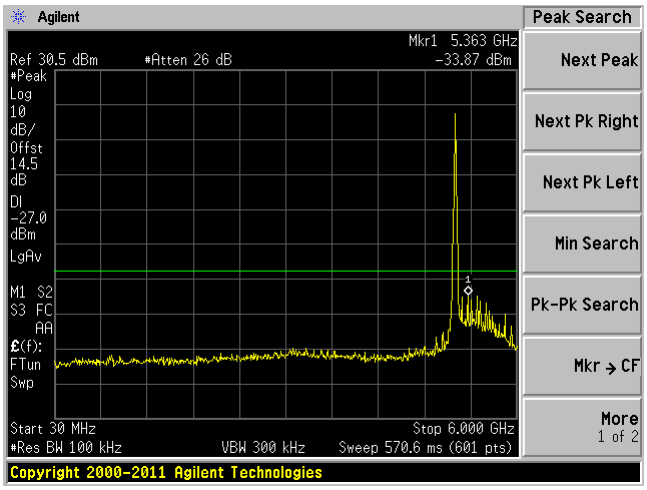


Chain J1, Plot: 6 GHz – 40 GHz

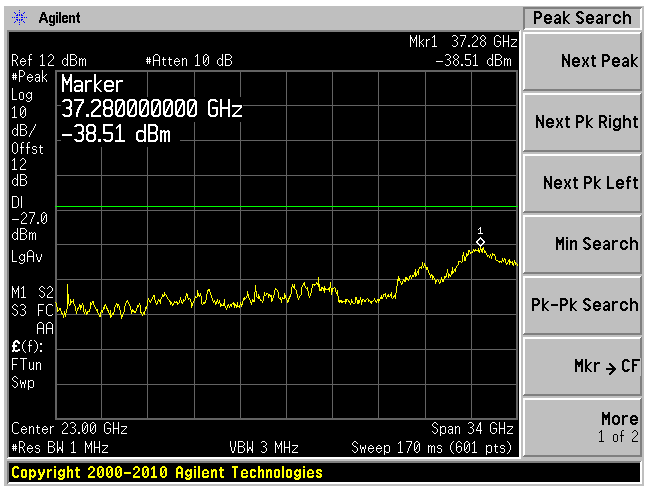


802.11n-HT20, Middle Channel 5200 MHz

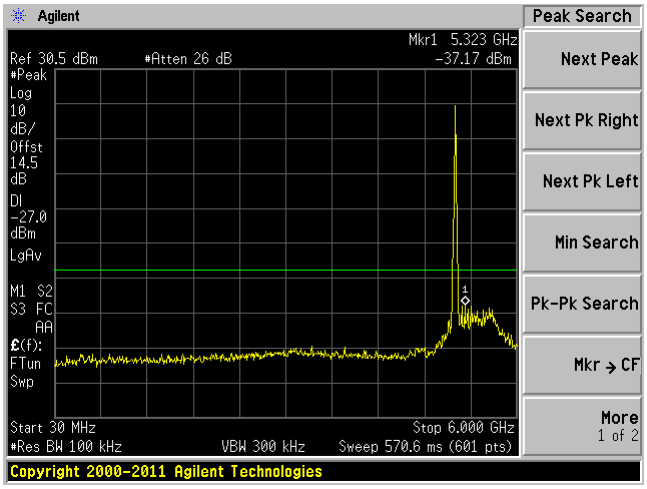
Chain J0, Plot: 30 MHz – 6 GHz



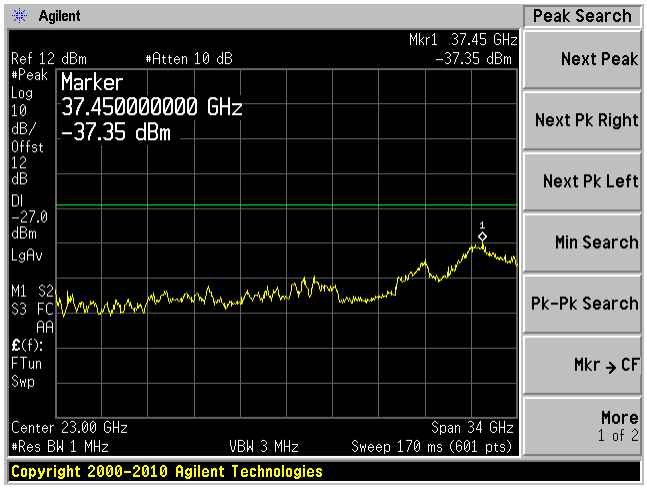
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

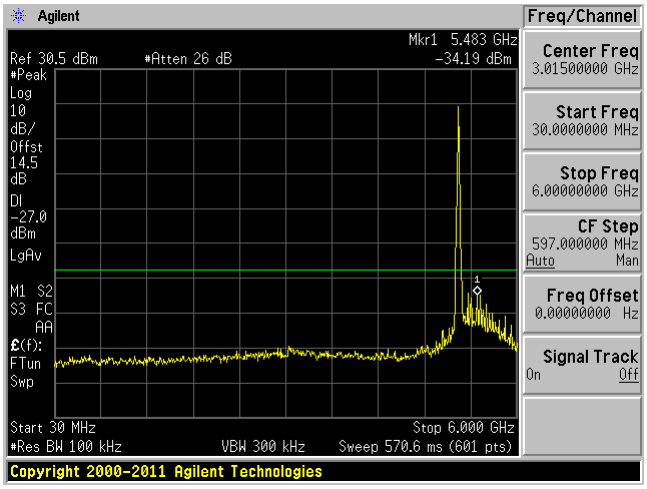


Chain J1, Plot: 6 GHz – 40 GHz

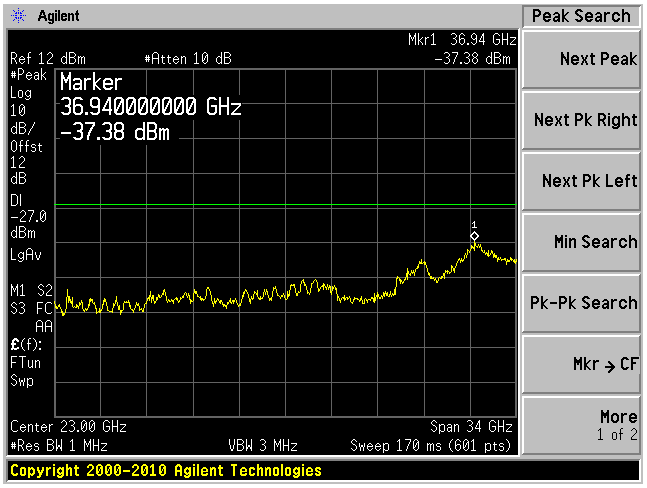


802.11n-HT20, High Channel 5240 MHz

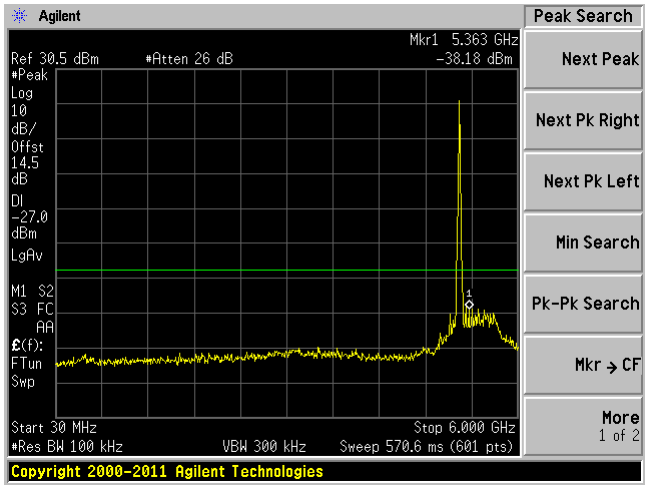
Chain J0, Plot: 30 MHz – 6 GHz



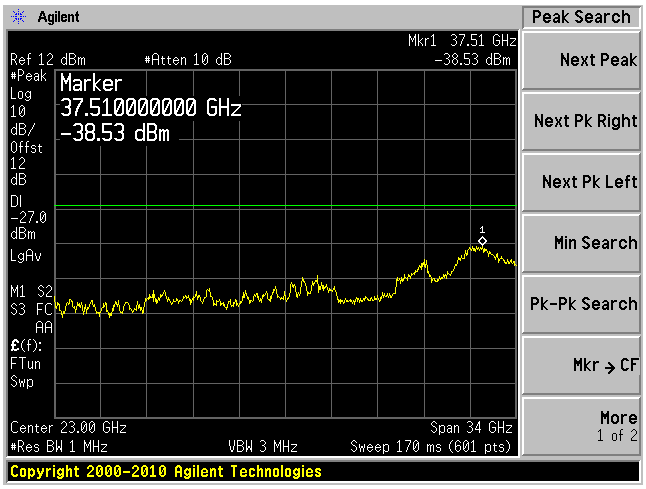
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

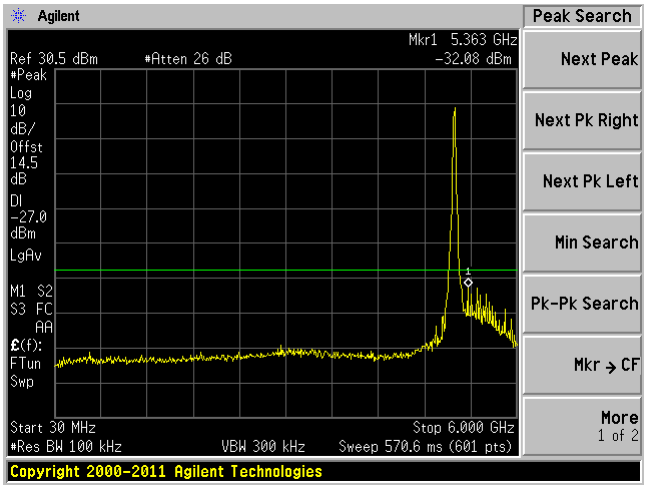


Chain J1, Plot: 6 GHz – 40 GHz

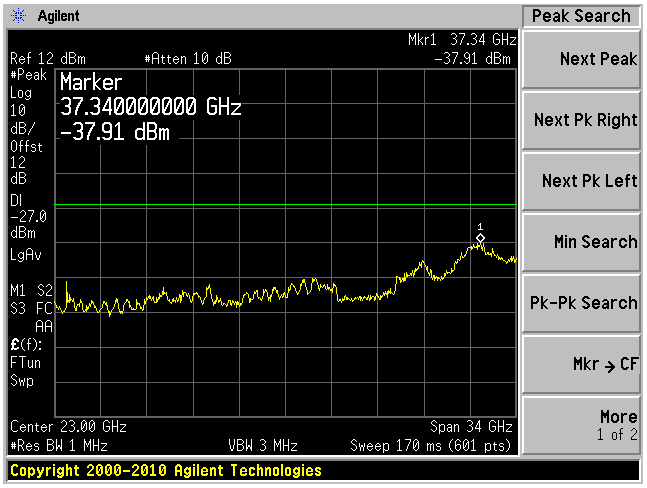


802.11n-HT40, Low Channel 5190 MHz

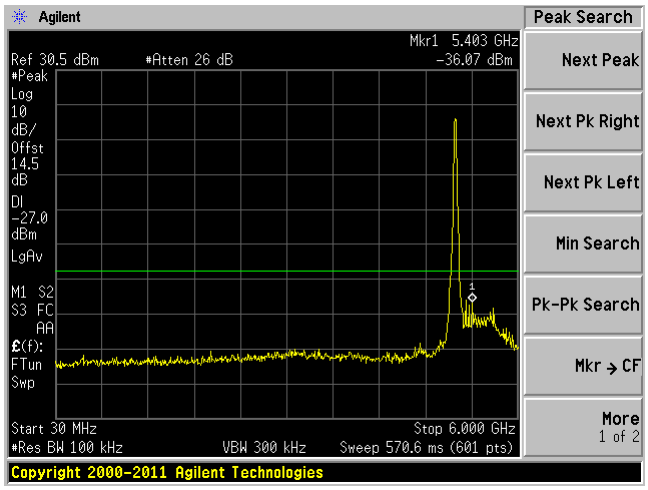
Chain J0, Plot: 30 MHz – 6 GHz



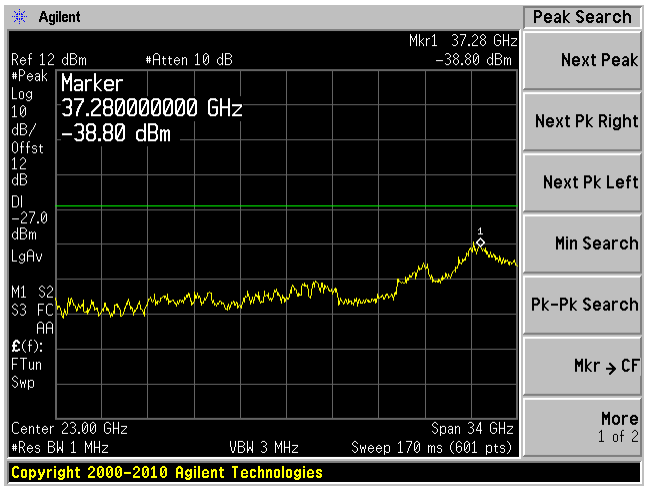
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

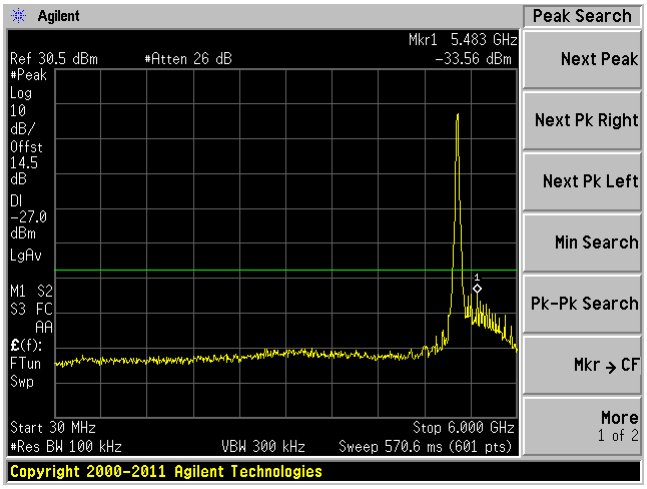


Chain J1, Plot: 6 GHz – 40 GHz

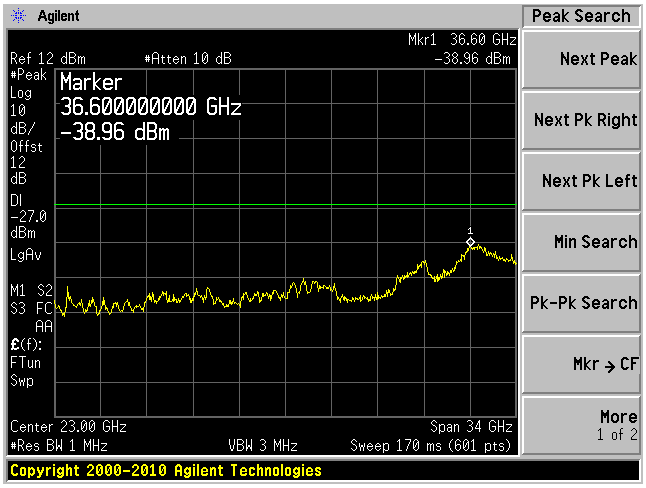


802.11n-HT40, High Channel 5230 MHz

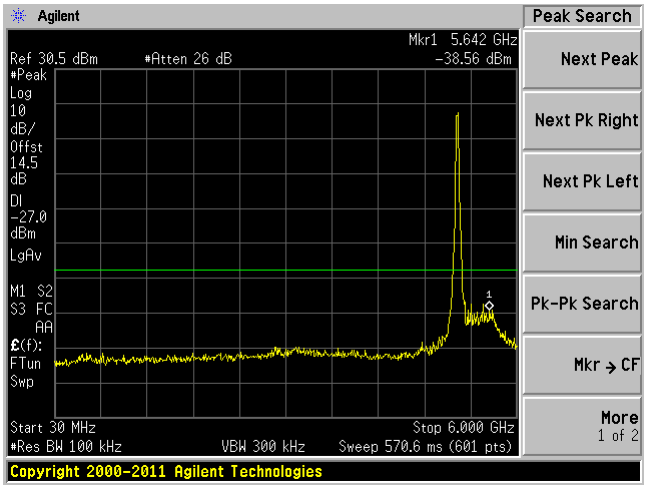
Chain J0, Plot: 30 MHz – 6 GHz



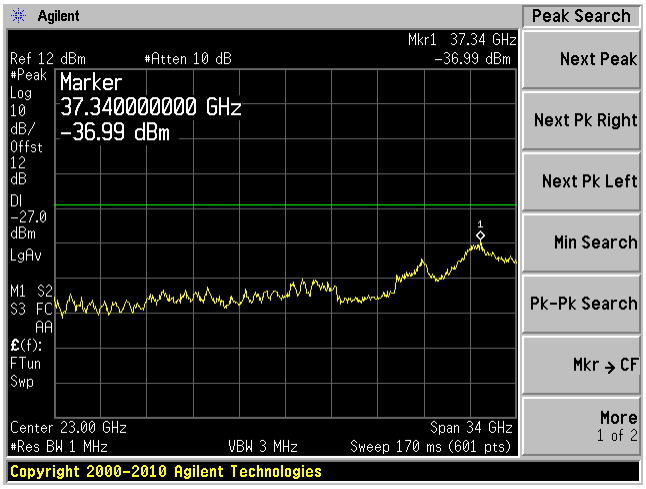
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

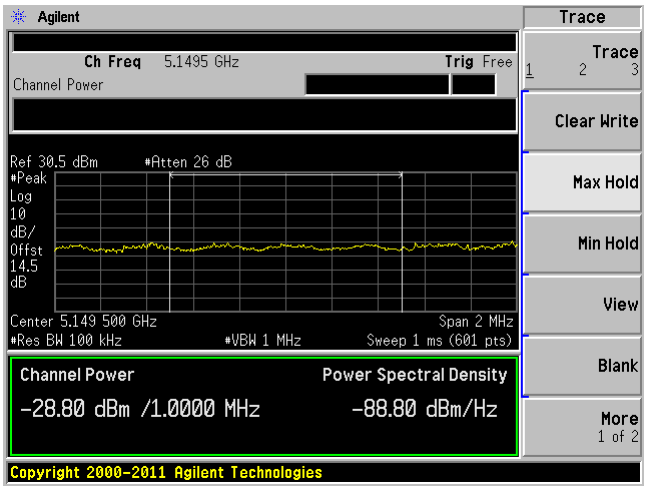


Chain J1, Plot: 6 GHz – 40 GHz

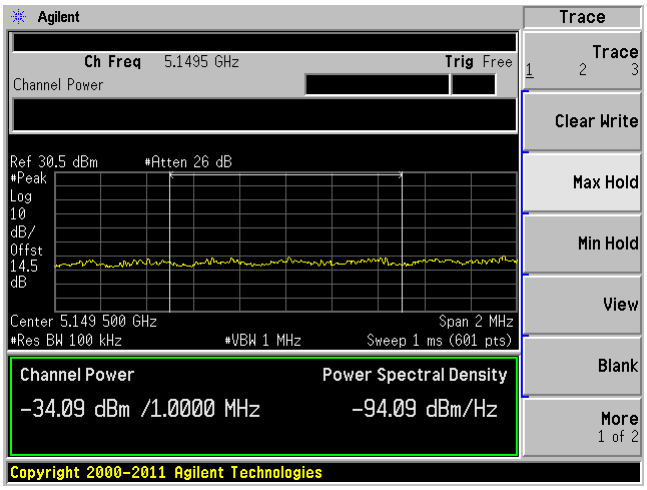


(2) 5.2 GHz Band Edge :

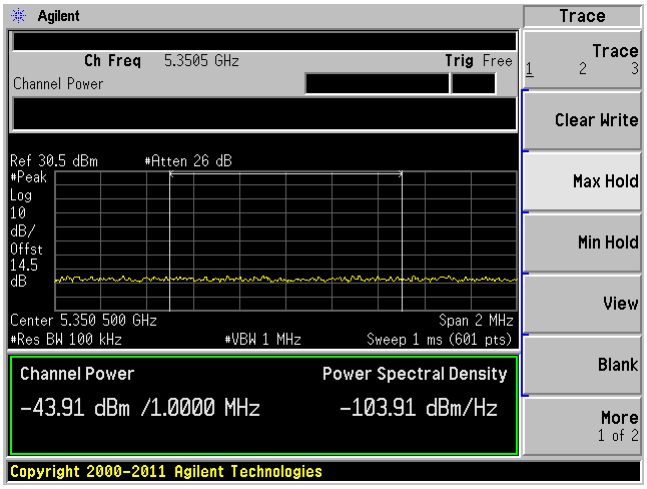
802.11a mode, 5180 MHz, Chain J0



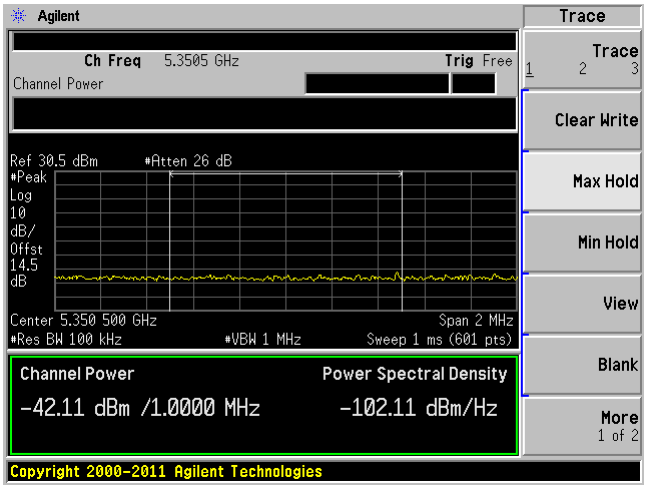
802.11a mode, 5180 MHz, Chain J1



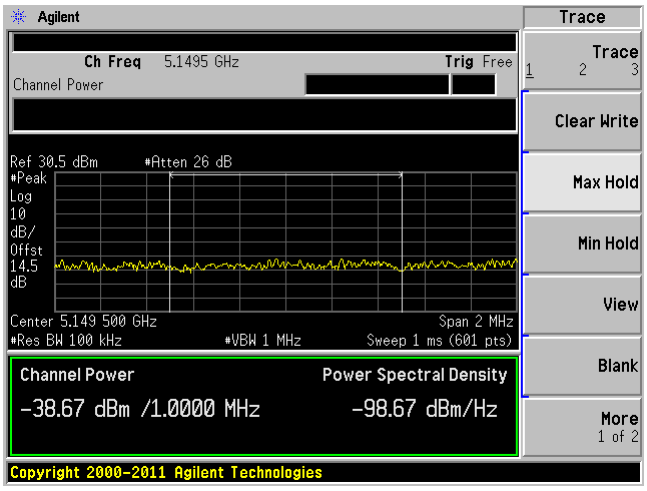
802.11a mode, 5240 MHz, Chain J0



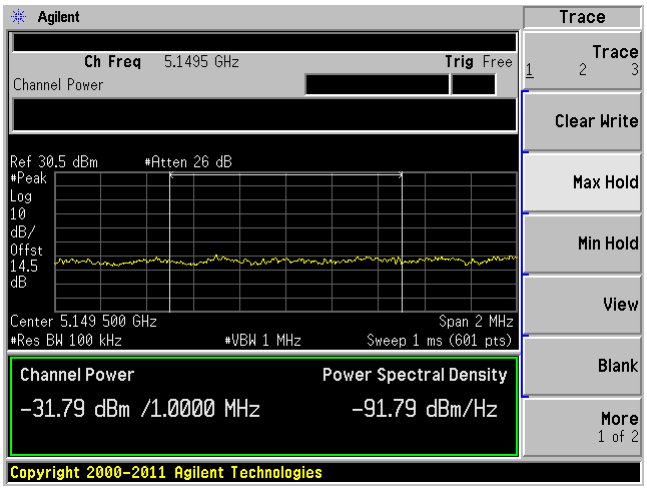
802.11a mode, 5240 MHz, Chain J1



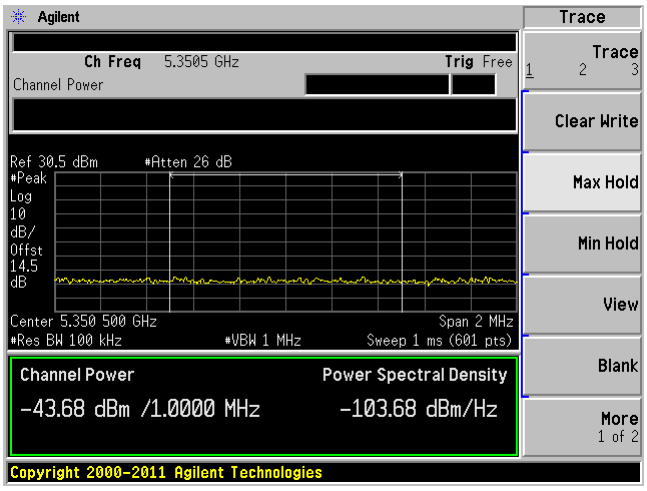
802.11n-HT20 mode, 5180 MHz, Chain J0



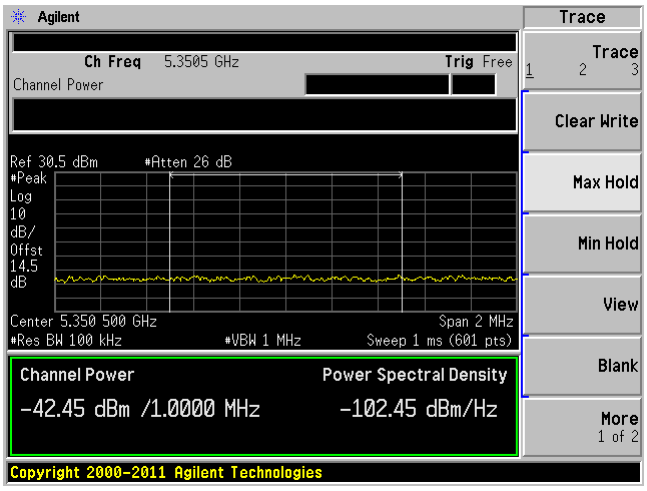
802.11n-HT20 mode, 5180 MHz, Chain J1



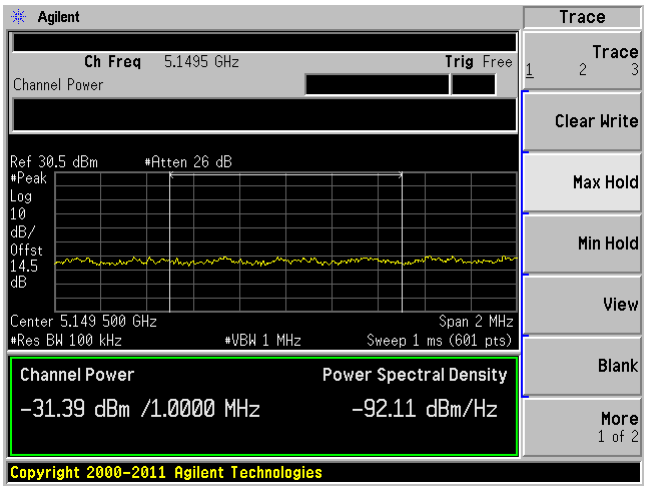
802.11n-HT20 mode, 5240 MHz, Chain J0



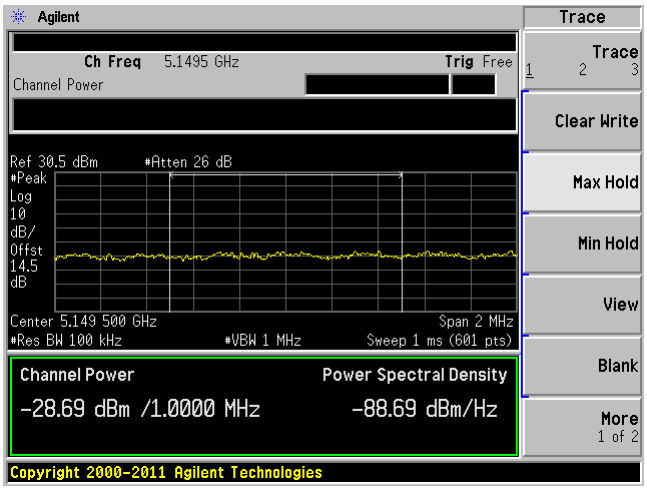
802.11n-HT20 mode, 5240 MHz, Chain J1



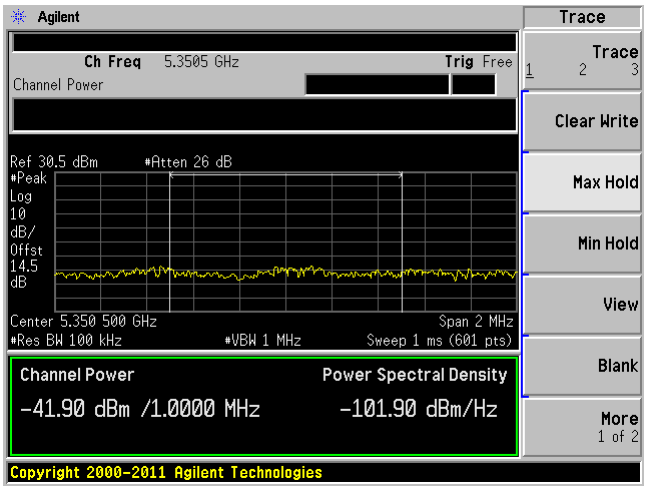
802.11n-HT40 mode, 5270 MHz, Chain J0



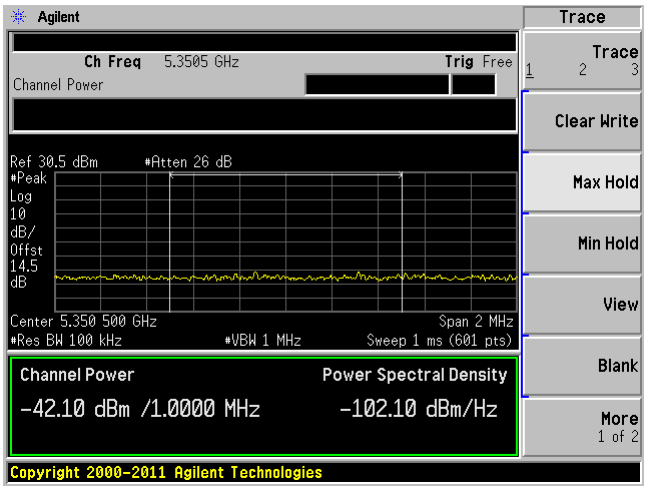
802.11n-HT40 mode, 5270 MHz, Chain J1



802.11n-HT40 mode, 5310 MHz, Chain J0



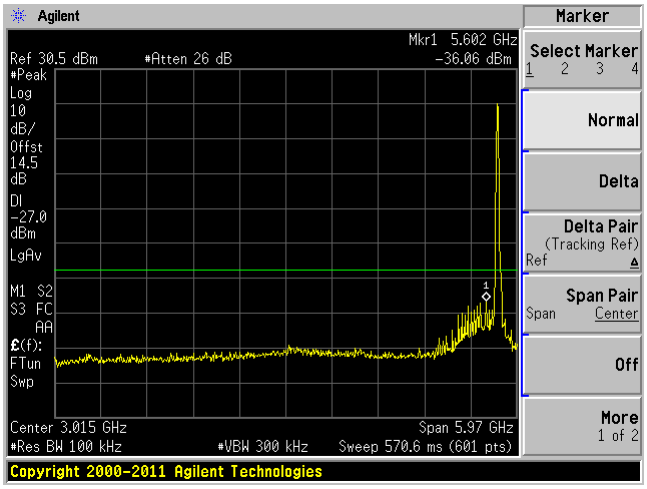
802.11n-HT40 mode, 5310 MHz, Chain J1



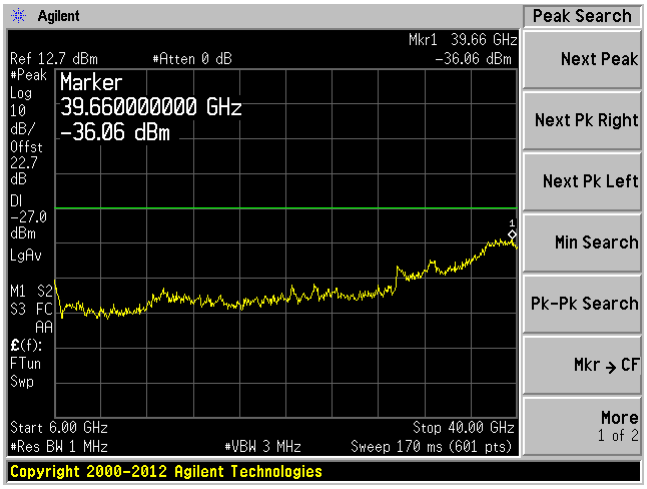
(3) 5.8 GHz Band Conducted Spurious Emissions:

802.11a, Low Channel, 5745 MHz

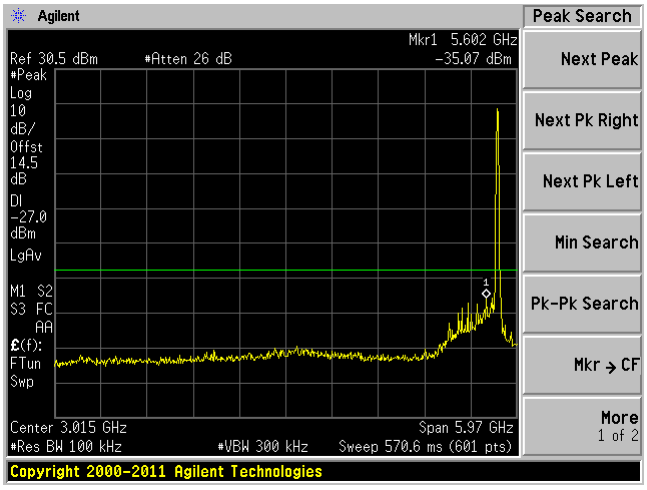
Chain 0, Plot: 30 MHz – 6 GHz



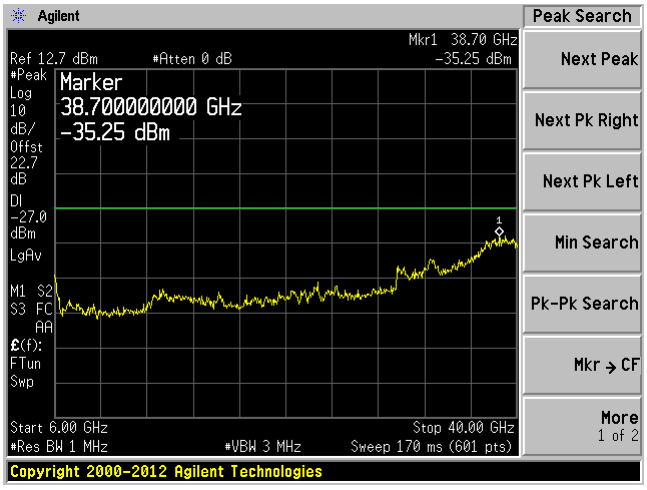
Chain 0, Plot: 6 GHz – 40 GHz



Chain 1, Plot: 30 MHz – 6 GHz

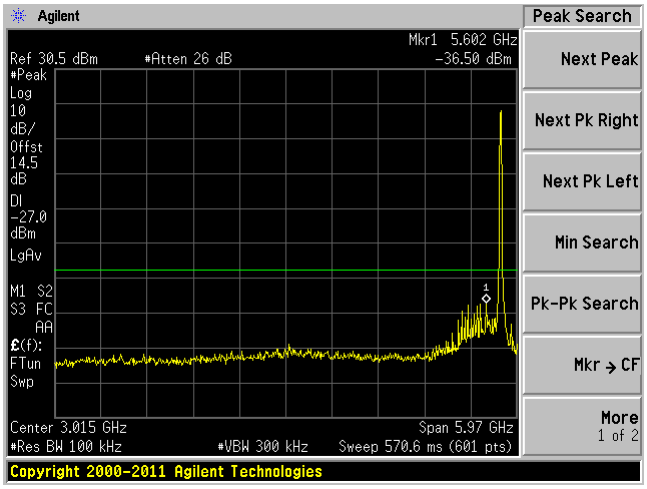


Chain 1, Plot: 6 GHz – 40 GHz

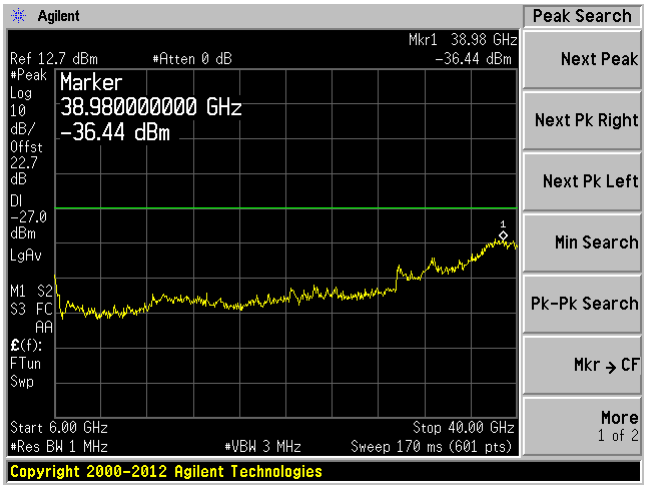


802.11a, Middle Channel, 5785 MHz

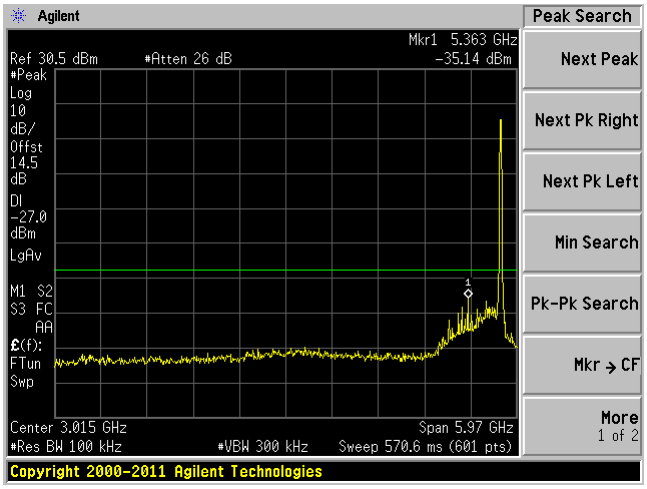
Chain 0, Plot: 30 MHz – 6 GHz



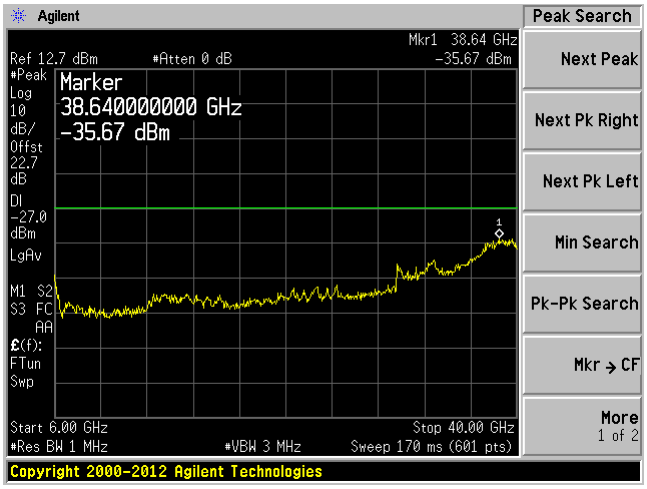
Chain 0, Plot: 6 GHz – 40 GHz



Chain 1, Plot: 30 MHz – 6 GHz

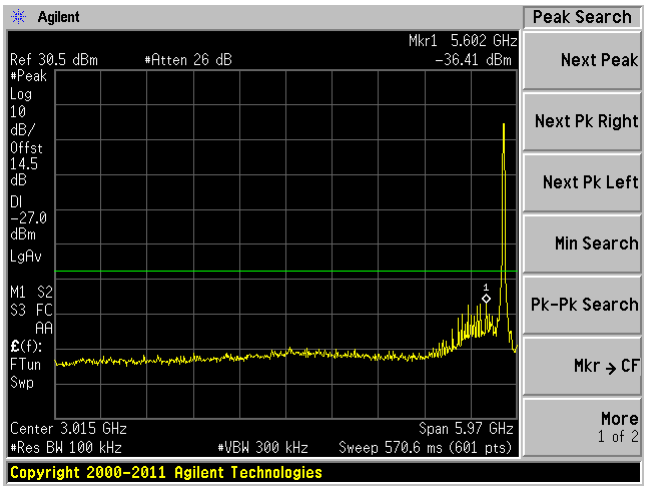


Chain 1, Plot: 6 GHz – 40 GHz

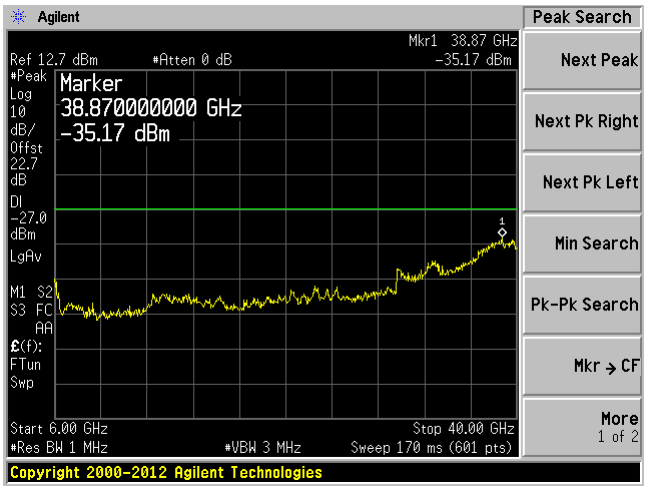


802.11a, High Channel, 5825 MHz

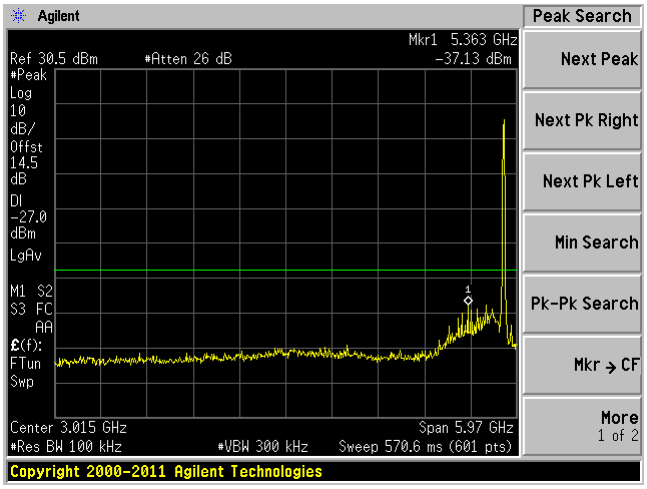
Chain 0, Plot: 30 MHz – 6 GHz



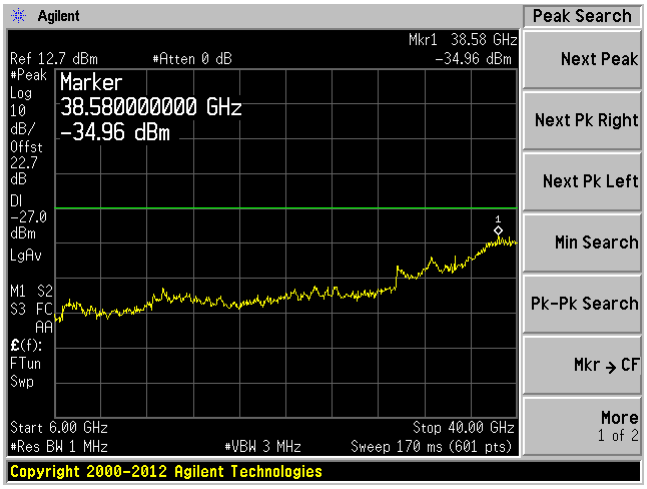
Chain 0, Plot: 6 GHz – 40 GHz



Chain 1, Plot: 30 MHz – 6 GHz

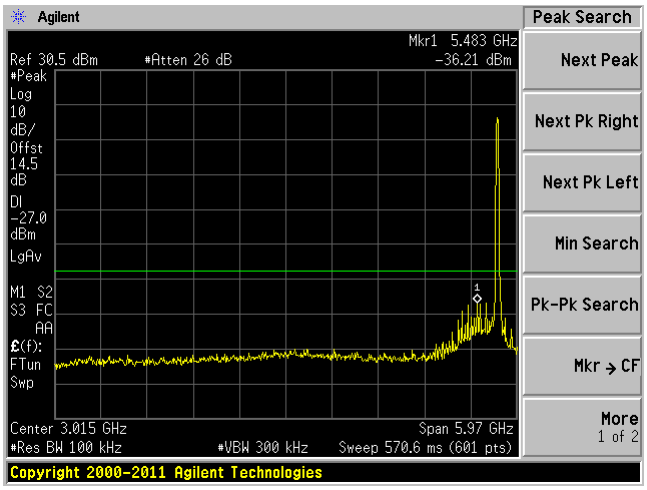


Chain 1, Plot: 6 GHz – 40 GHz

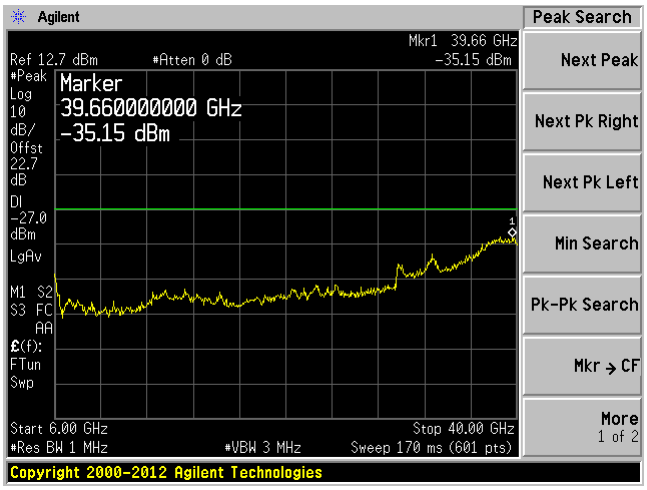


802.11n-HT20, Low Channel 5745 MHz

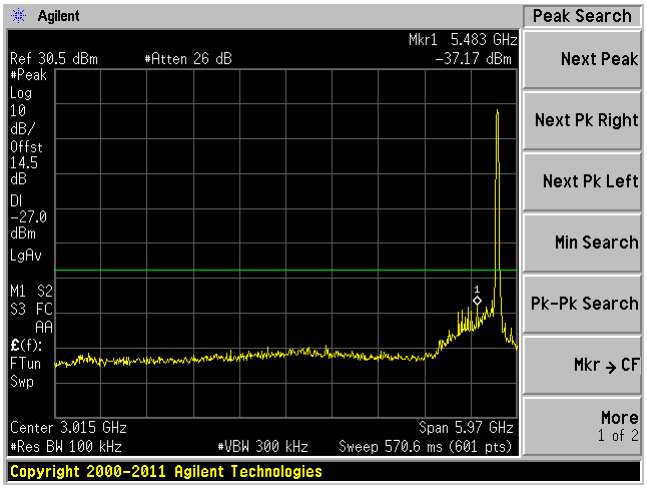
Chain 0, Plot: 30 MHz – 6 GHz



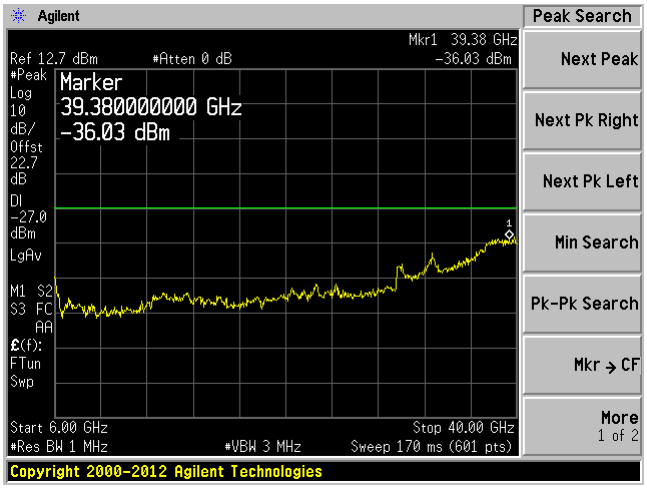
Chain 0, Plot: 6 GHz – 40 GHz



Chain 1, Plot: 30 MHz – 6 GHz

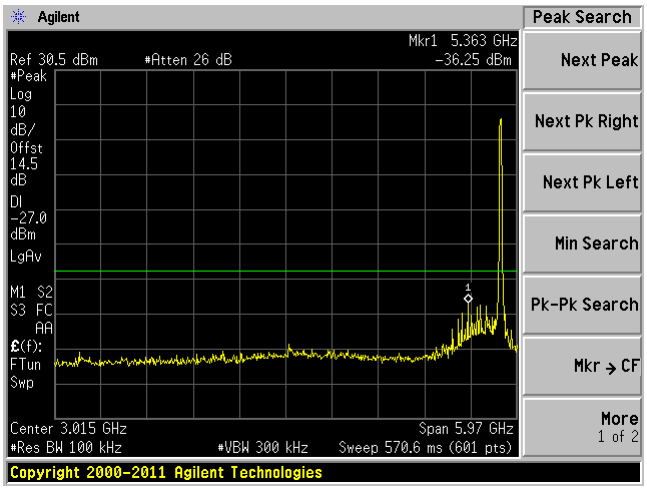


Chain 1, Plot: 6 GHz – 40 GHz

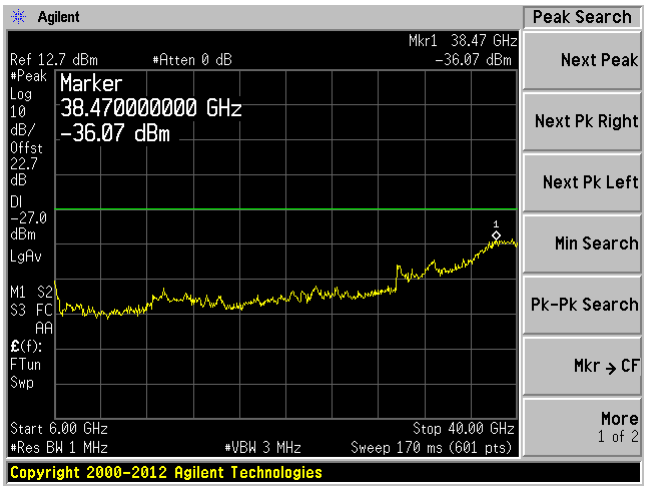


802.11n-HT20, Middle Channel 5785 MHz

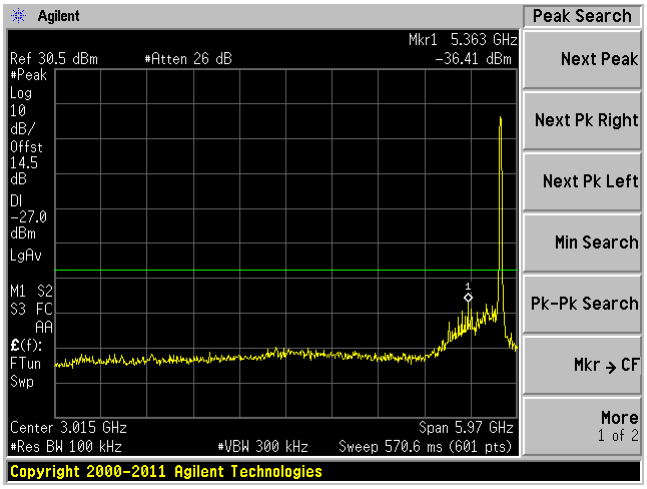
Chain 0, Plot: 30 MHz – 6 GHz



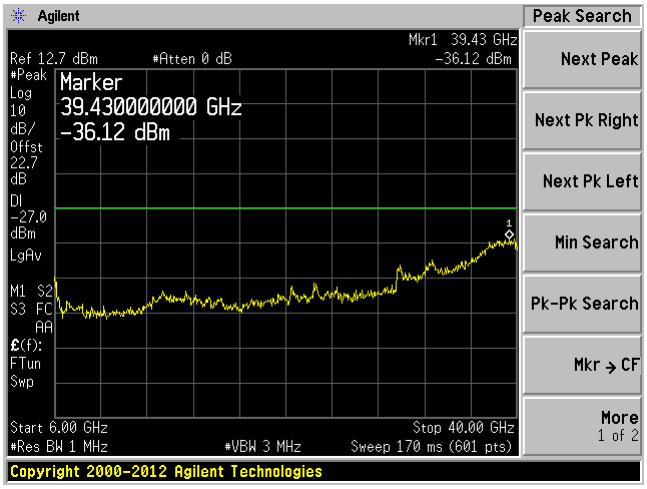
Chain 0, Plot: 6 GHz – 40 GHz



Chain 1, Plot: 30 MHz – 6 GHz

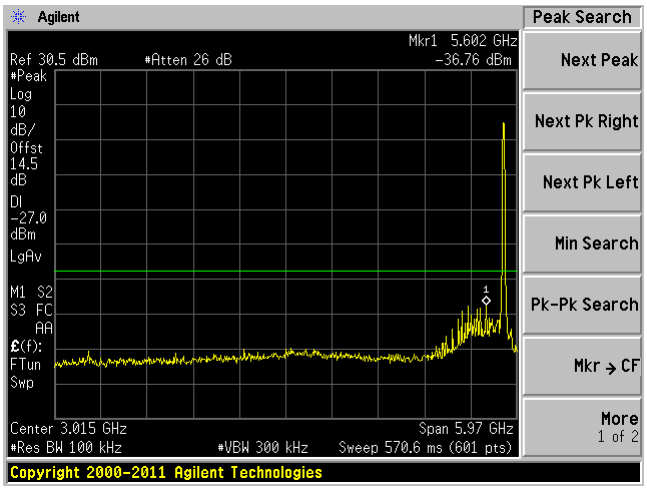


Chain 1, Plot: 6 GHz – 40 GHz

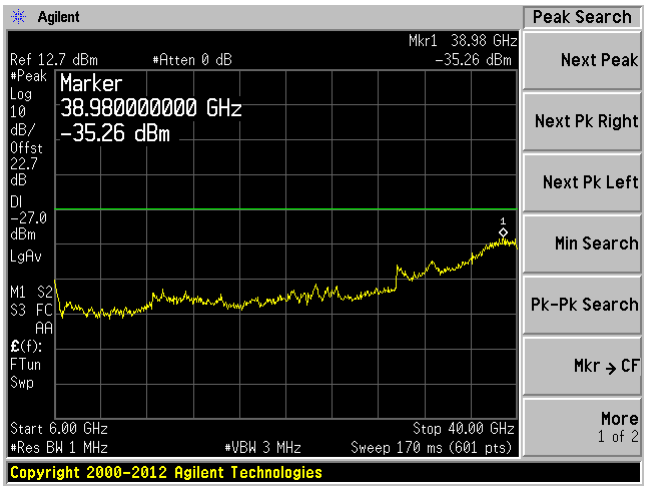


802.11n-HT20, High Channel 5825 MHz

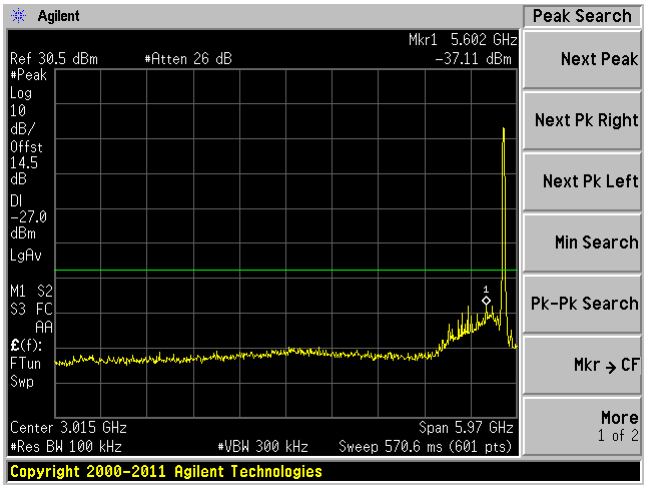
Chain 0, Plot: 30 MHz – 6 GHz



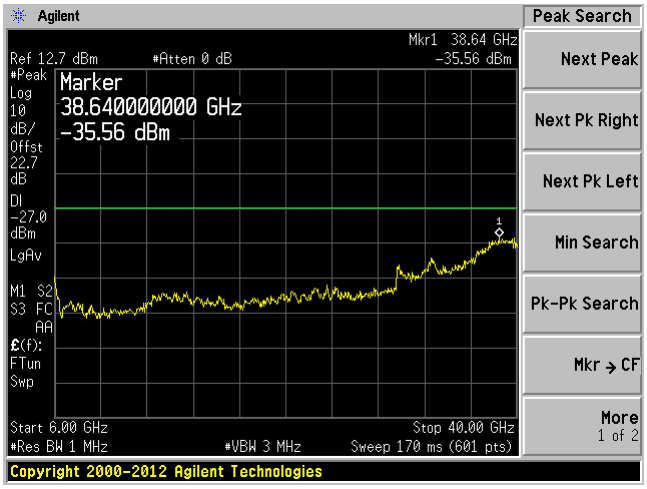
Chain 0, Plot: 6 GHz – 40 GHz



Chain 1, Plot: 30 MHz – 6 GHz

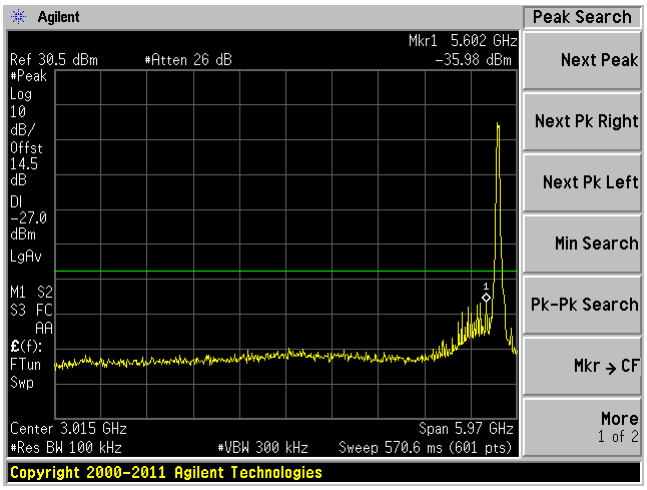


Chain 1, Plot: 6 GHz – 40 GHz

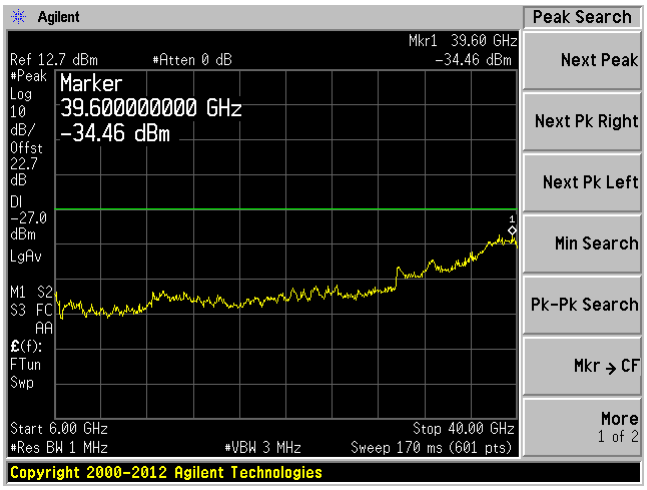


802.11n-HT40, Low Channel 5755 MHz

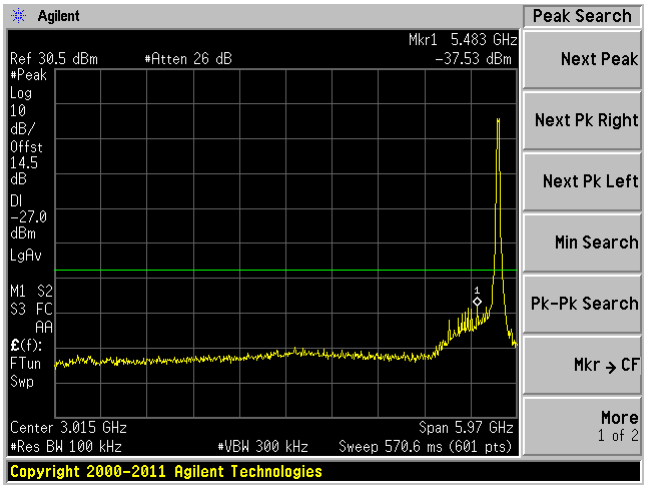
Chain 0, Plot: 30 MHz – 6 GHz



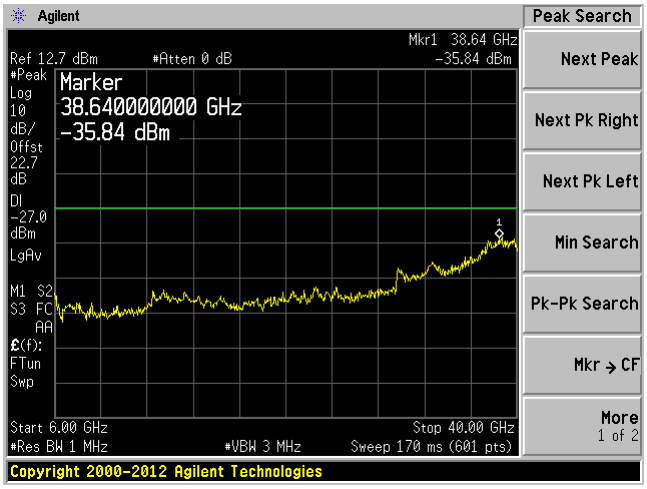
Chain 0, Plot: 6 GHz – 40 GHz



Chain 1, Plot: 30 MHz – 6 GHz

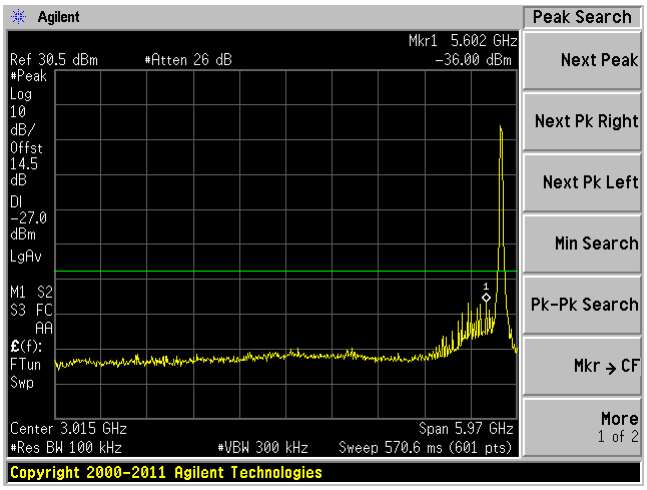


Chain 1, Plot: 6 GHz – 40 GHz

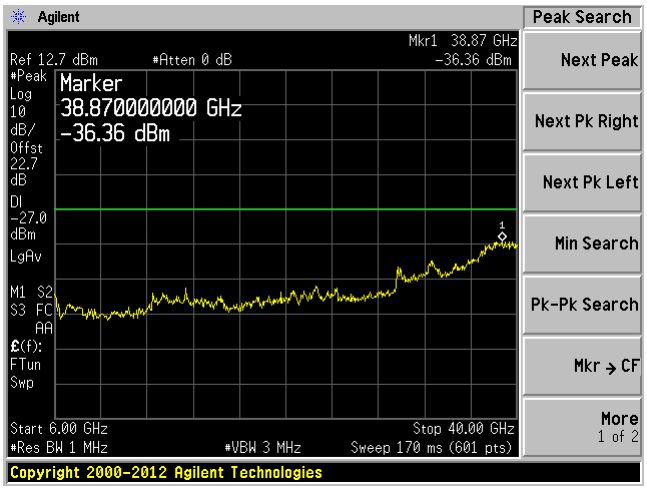


802.11n-HT40, High Channel 5795 MHz

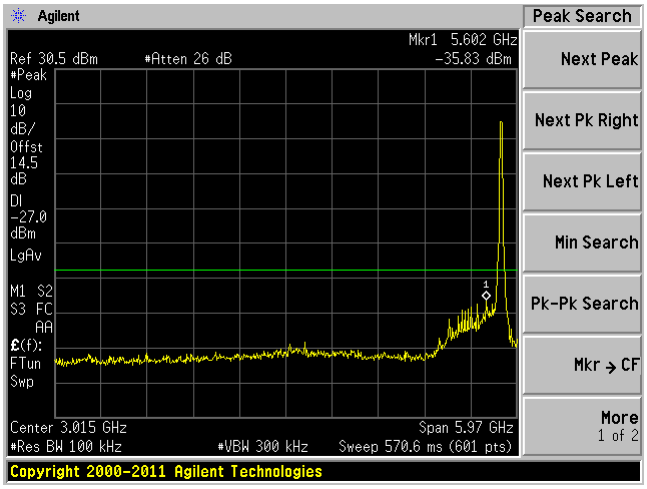
Chain 0, Plot: 30 MHz – 6 GHz



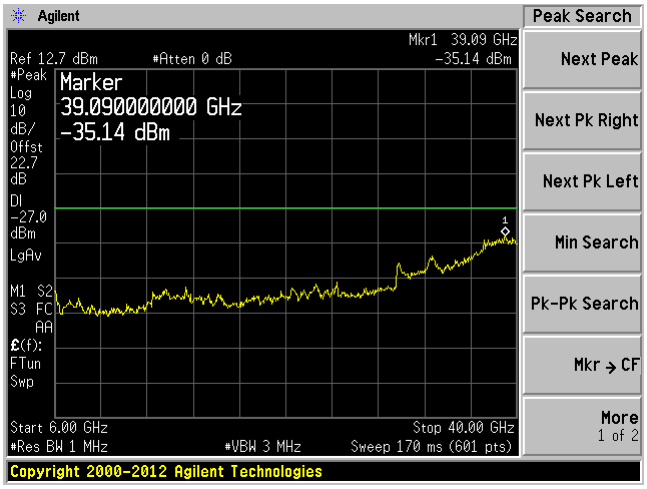
Chain 0, Plot: 6 GHz – 40 GHz



Chain 1, Plot: 30 MHz – 6 GHz



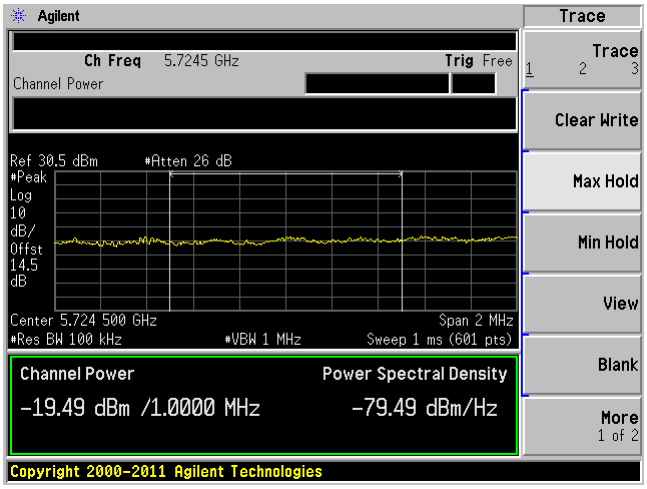
Chain 1, Plot: 6 GHz – 40 GHz



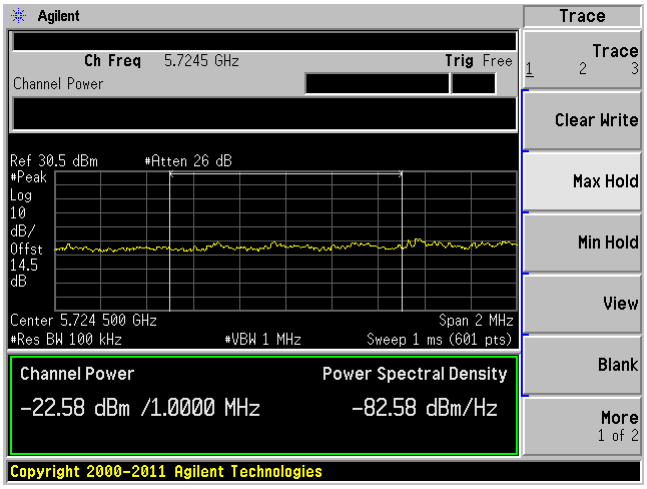
(4) 5.8 GHz Band Edge:

-17 dBm/MHz :

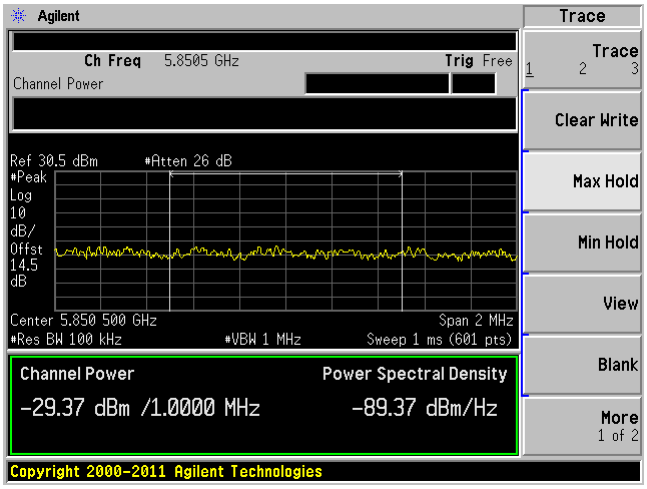
802.11a mode, 5745 MHz, Chain J0



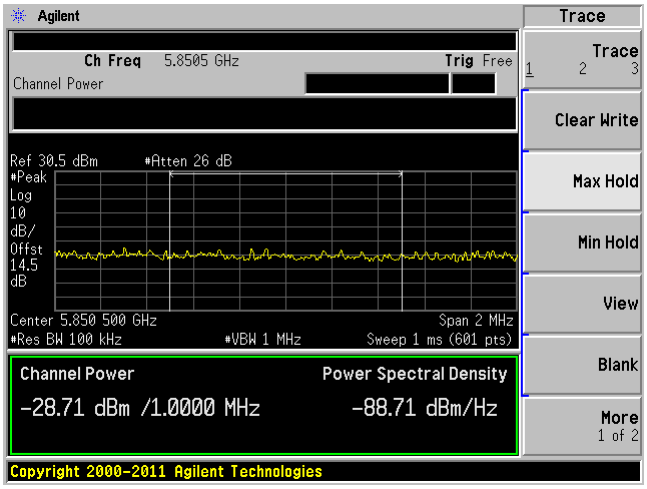
802.11a mode, 5745 MHz, Chain J1



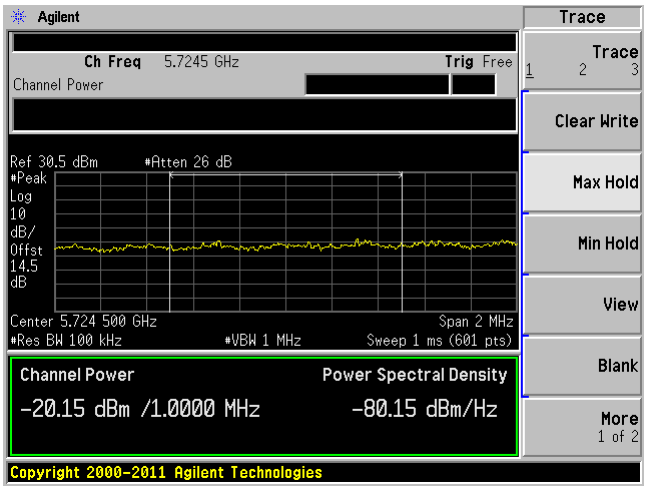
802.11a mode, 5825 MHz, Chain J0



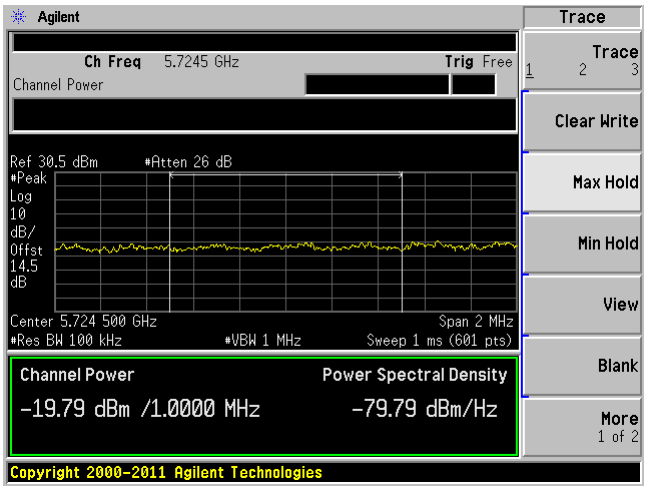
802.11a mode, 5825 MHz, Chain J1



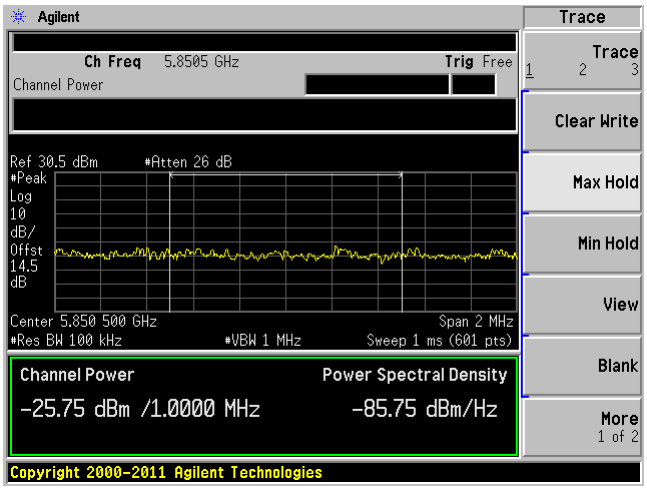
802.11n-HT20 mode, 5745 MHz, Chain J0



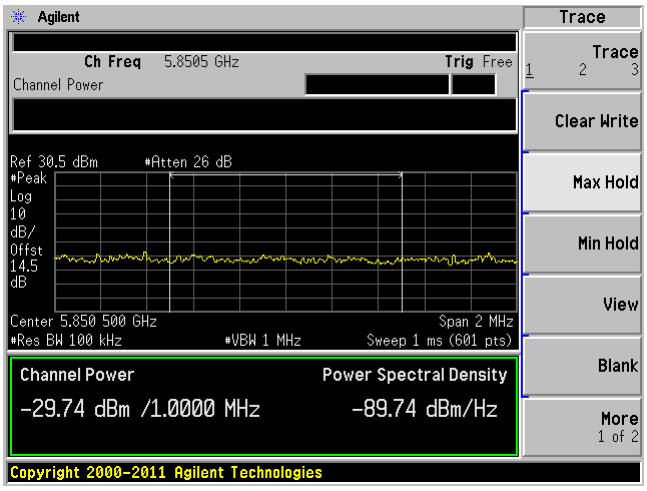
802.11n-HT20 mode, 5745 MHz, Chain J1



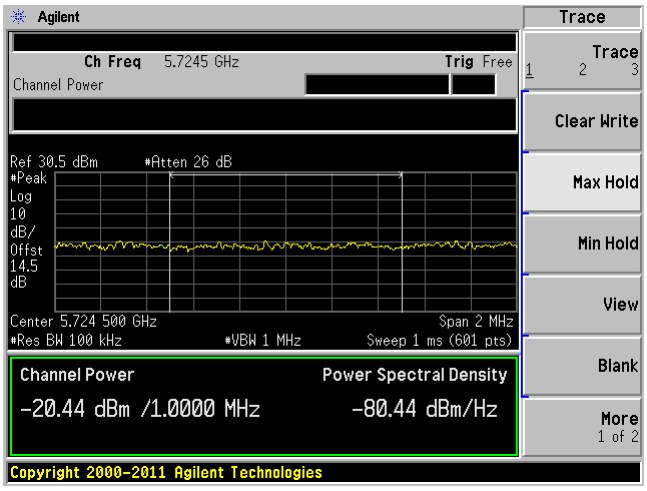
802.11n-HT20 mode, 5825 MHz, Chain J0



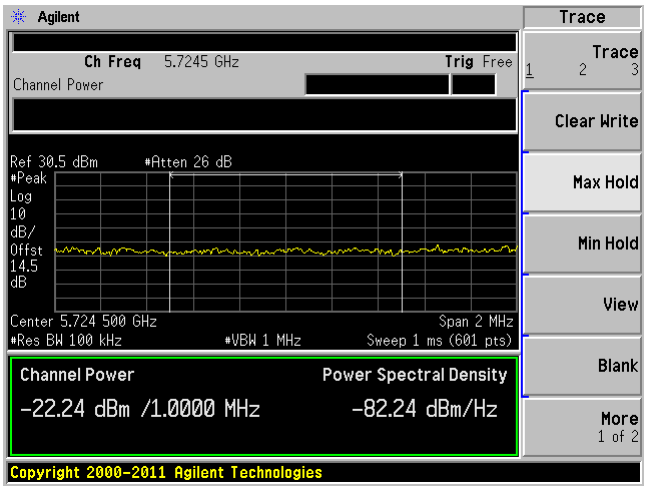
802.11n-HT20 mode, 5825 MHz, Chain J1



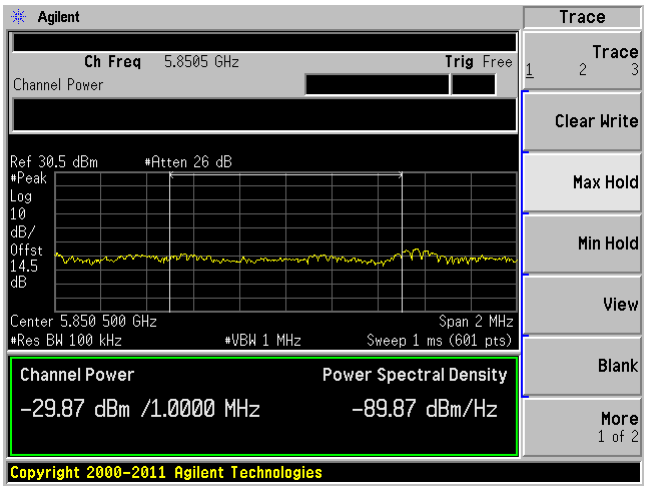
802.11n-HT40 mode, 5755 MHz, Chain J0



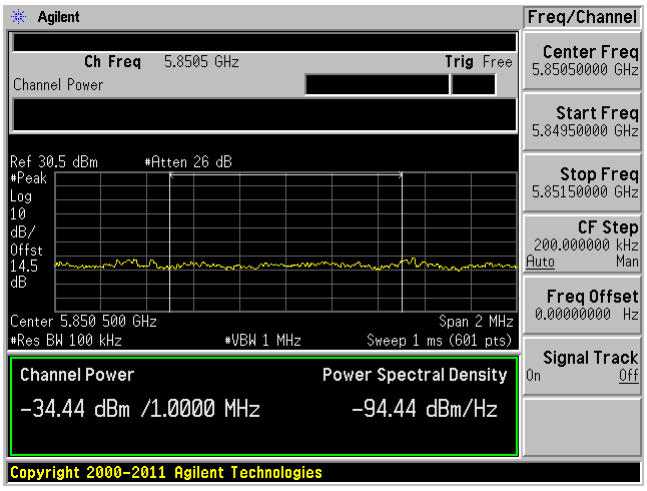
802.11n-HT40 mode, 5755 MHz, Chain J1



802.11n-HT40 mode, 5795 MHz, Chain J0

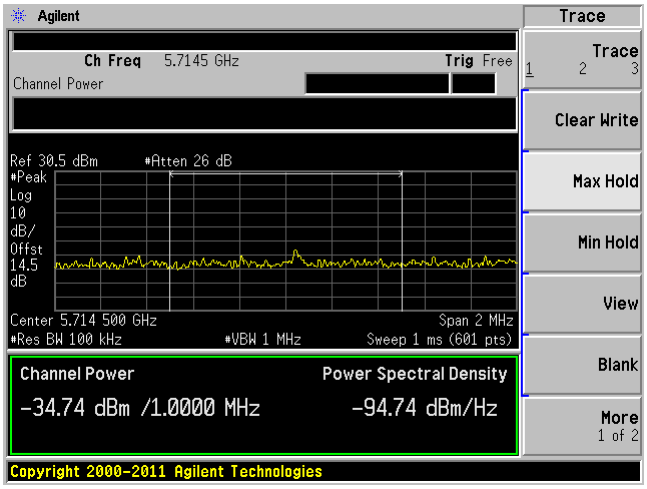


802.11n-HT40 mode, 5795 MHz, Chain J1

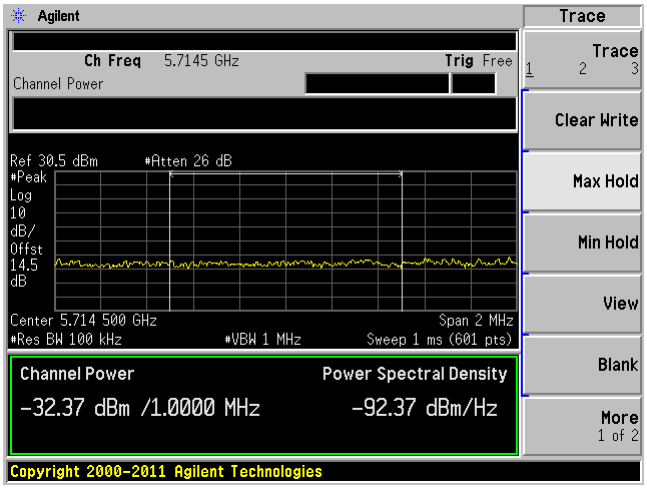


-27 dBm/MHz:

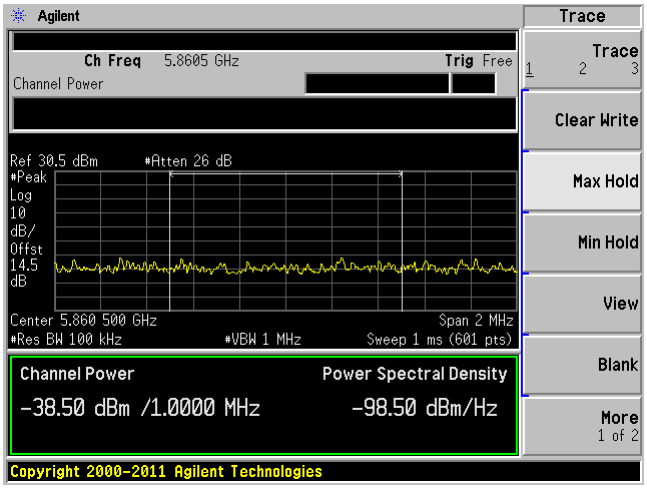
802.11a mode, 5745 MHz, Chain J0



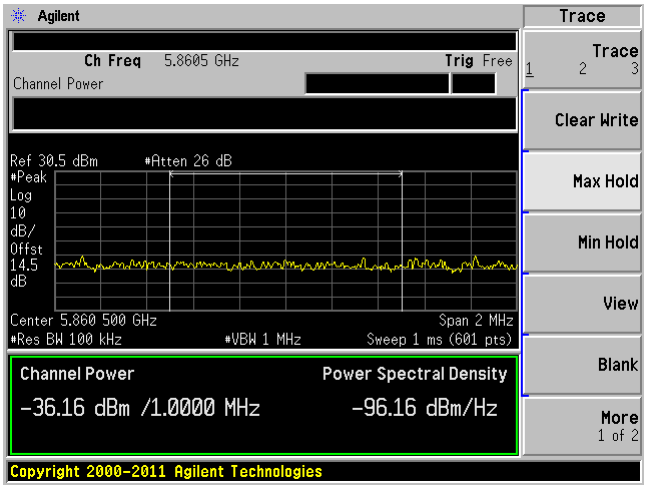
802.11a mode, 5745 MHz, Chain J1



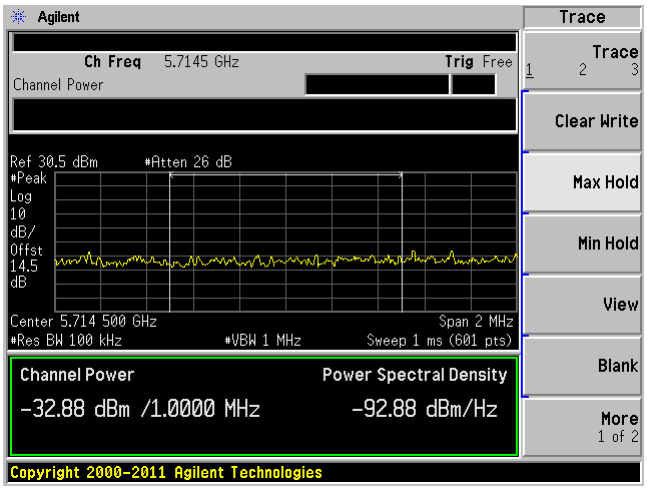
802.11a mode, 5825 MHz, Chain J0



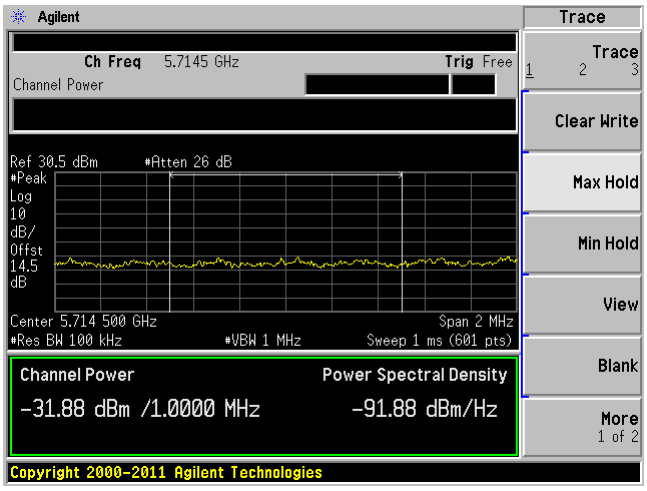
802.11a mode, 5825 MHz, Chain J1



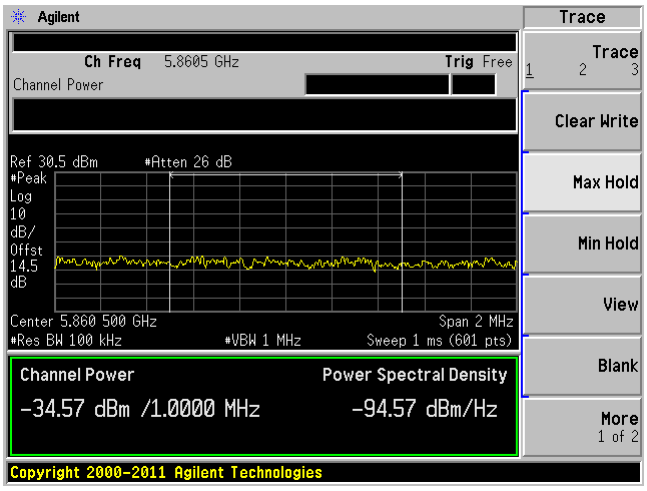
802.11n-HT20 mode, 5745 MHz, Chain J0



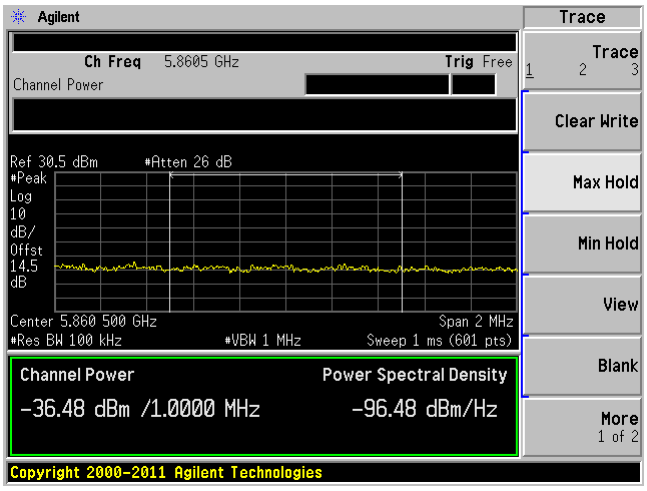
802.11n-HT20 mode, 5745 MHz, Chain J1



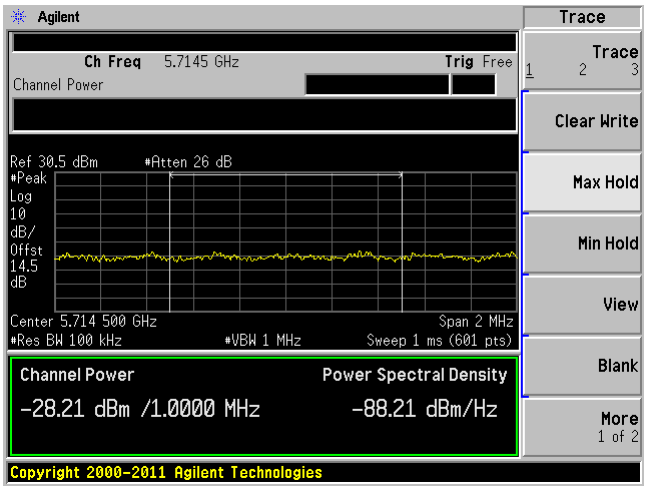
802.11n-HT20 mode, 5825 MHz, Chain J0



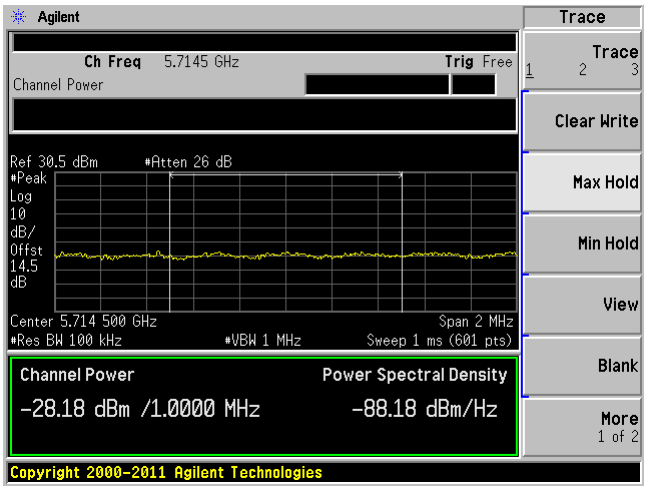
802.11n-HT20 mode, 5825 MHz, Chain J1



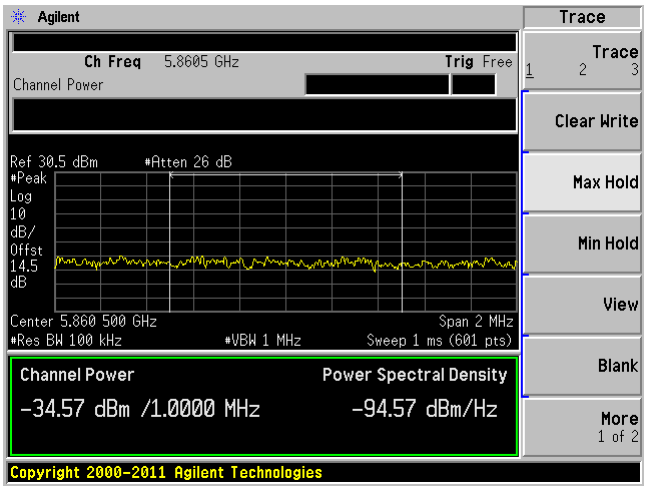
802.11n-HT40 mode, 5755 MHz, Chain J0



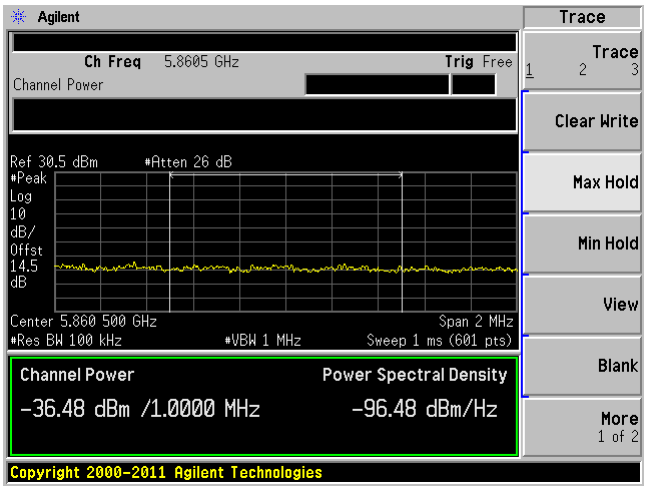
802.11n-HT40 mode, 5755 MHz, Chain J1



802.11n-HT40 mode, 5795 MHz, Chain J0



802.11n-HT40 mode, 5795 MHz, Chain J1



Note: The 8 dBi antenna gain was considered, adding in the offset.