FCC PART 15, SUBPART C
IC RSS-210, ISSUE 8, DECEMBER 2010

TEST AND MEASUREMENT REPORT

For

Exalt Communications, Inc.

580 Division Street,

Campbell, CA 95008, USA

FCC ID: TTM-105P25U
IC: 6254A-105P25U

Report Type:	**Product Type:**
Original Report	802.11 WLAN Module

Prepared By: Jeffrey Wu

Report Number: R1302222-247

Report Date: 2013-06-17

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1302222-247	Original Report	2013-06-17

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Exalt Communications, Inc*., and their product, FCC: TTM-105P25U and IC: 6254A-105P25U, model: eMIMO, which will henceforth be referred to as the EUT "Equipment Under Test." The EUT is an 802.11 WLAN module and operates on 4940-4990 MHz, 5250-5350 MHz, 5470-5725 MHz, 5725-5825 MHz UNII bands and 5725-5850 MHz ISM band. 5 and 10 MHz mode of 4940-4990 MHz band cannot transmit both chains simultaneously and will not operate on 5725-5825 MHz UNII band.

1.2 Mechanical Description of EUT

The EUT measures approximately 12.7 cm (L) x 11.4 cm (W) x 1.6 cm (H) and weighs 102.0g.

The test data gathered are from a production sample provided by the manufacturer, Serial Number:PE15139027, assigned by BACL.

1.3 Objective

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

The objective is to determine compliance with FCC Part 15.247 and IC RSS-210 rules for Output Power, Antenna Requirements, 6 dB Bandwidth, and power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emissions, Conducted and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

FCC Part 15.407 NII with FCC ID: TTM-105P25U; IC: 6254A-105P25U
FCC Part 90 TNB with FCC ID: TTM-105P25U; IC: 6254A-105P25U

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.

1.6 Measurement Uncertainty

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

Based on CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility

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

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

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

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

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b3678l6b

2 System Test Configuration

2.1 Justification

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

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

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

2.2 EUT Exercise Software

The test utility used was cart.exe was provided by Exalt Communications, Inc., and was verified Jeffrey Wu to comply with the standard requirements being tested against.

2.3 Special Equipment

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

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
DELL	Laptop	Latitude E5420	-

2.6 EUT Internal Configuration Details

N/A, EUT is a module. Please refer to section 1.2 for serial number

2.7 Interface Ports and Cables

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

2.8 Power Supply List and Details

Manufacturer	Description	Model	Serial Number
PowerDsine	POE Adapter	PD-3501G/AC	-

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §15.247(i), §2.1091 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.2	Antenna Requirement	Compliant
FCC §15.207(a) IC RSS-Gen §7.2.4	AC Line Conducted Emissions	Compliant
FCC §15.247 (d) IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	Compliant
FCC §15.205 IC RSS-210 §2.2	Restricted Bands	Compliant
FCC §15.209, §15.247 (d) IC RSS-210 §A8.5	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) IC RSS-210 §A8.2	6 dB Emission Bandwidth	Compliant
FCC §15.247(b)(3) IC RSS-210 §A8.4	Maximum Peak Output Power	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(e) IC RSS-210 §A8.2(b)	Power Spectral Density	Compliant
IC RSS-210 §2.3 & RSS-Gen §6.1	Receiver Spurious Emission	Compliant

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

4.1 Applicable Standard

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

Limits for General Population/Uncontrolled Exposure

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

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

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

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

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

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

4.2 MPE Prediction

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

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

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

4.3 MPE Results

PTP at Highest Power Setting

Maximum peak output power at antenna input terminal (dBm):	27.93
Maximum peak output power at antenna input terminal (mW):	620.87
Prediction distance (cm):	180
Prediction frequency (MHz):	5745
Maximum Effective Antenna Gain, typical (dBi):	28
Maximum Antenna Gain (numeric):	630.96
Power density of prediction frequency at 180.0 cm (mW/cm^2):	0.9621
Power density of prediction frequency at 180.0 cm (W/m^2):	9.621
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	10

Note: the maximum effective gain is 28 dBi (antenna gain + cable loss)

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 180 cm is 0.9621 mW/cm^2 (9.621W/m^2). Limit is 1.0 mW/cm^2 (10 W/m^2).

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

5.1 Applicable Standard

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

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

According to IC RSS-Gen §7.1.2: Transmitter Antenna

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

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

5.2 Result

The EUT consists of non-standard antenna connectors, and antenna gain varies from 5 dBi to 37.9 dBi. Manufacture will control the effective gain (antenna + cable loss) be equal or less than 9 dBi and 28 dBi, which depends on the point to point or point to multiple point operation output power. Professional installation is needed to ensure the product complies with legal restrictions; therefore, it complies with the antenna requirement

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 than the level reported. Please see attached antenna list for detail information.

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

6.1 Applicable Standards

As per FCC §15.207 and IC RSS-Gen §7.2.4 Conducted limits:

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

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 *	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 and IC RSS-Gen §7.2.4 limits.

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

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

6.3 Test Procedure

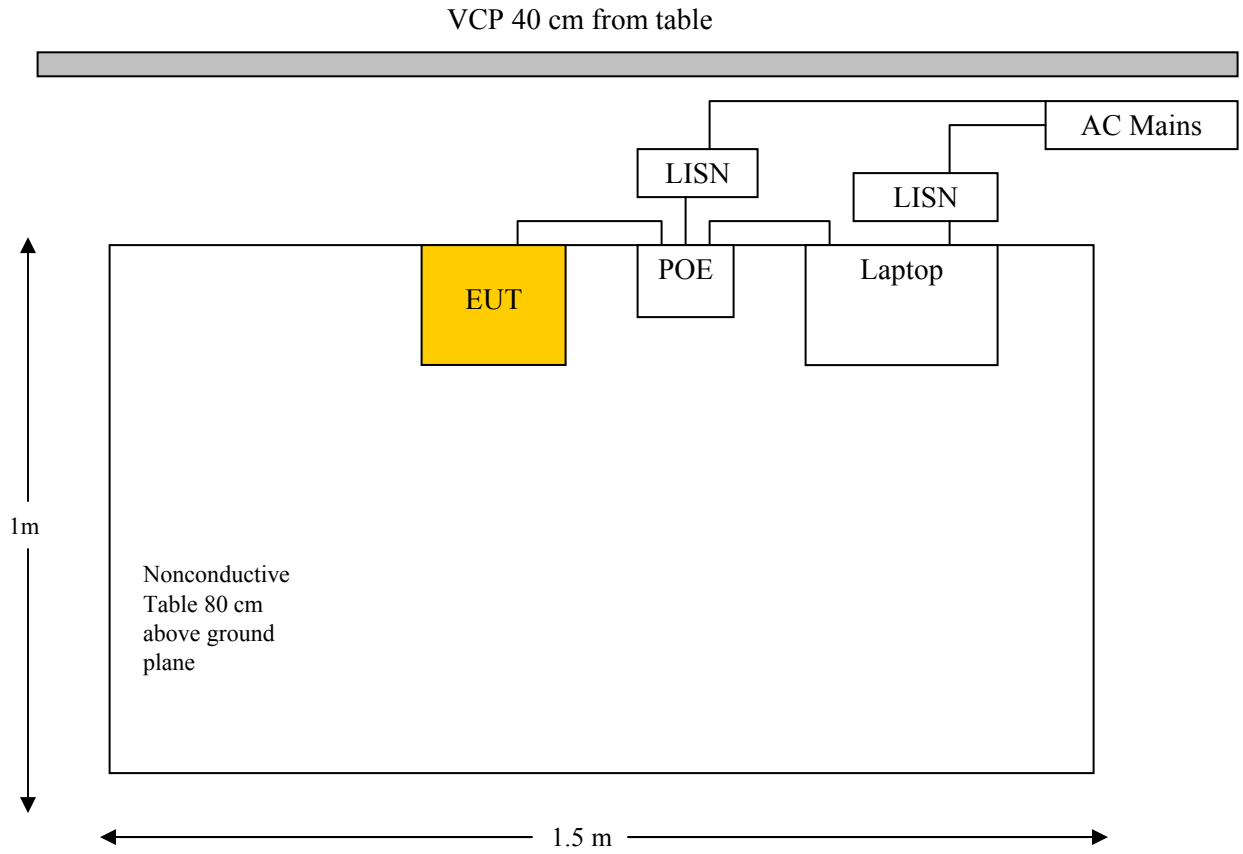
During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-2.

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

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

6.4 Test Setup Block Diagram

POE



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	2013-03-28	1 year
Solar Electronics	LISN	9252-50-R-24-N	511205	2012-06-25	1 year
TTE	Filter, High Pass	H962-150k-50-21378	K7133	2012-05-30	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:	22ºC
Relative Humidity:	38%
ATM Pressure:	102.1 kPa

The testing was performed by Jeffrey Wu on 2013-03-13 in 5 m chamber3.

6.8 Summary of Test Results

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

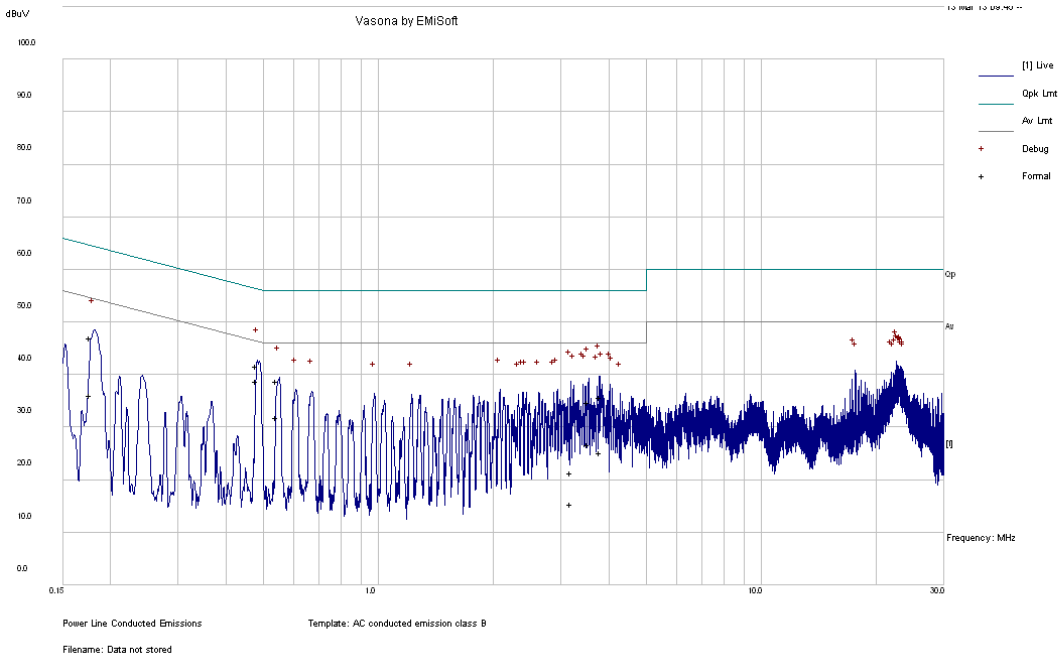
Transmitting Mode: 5745 MHz

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-7.60	0.480345	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

Transmitting Mode: 5745 MHz

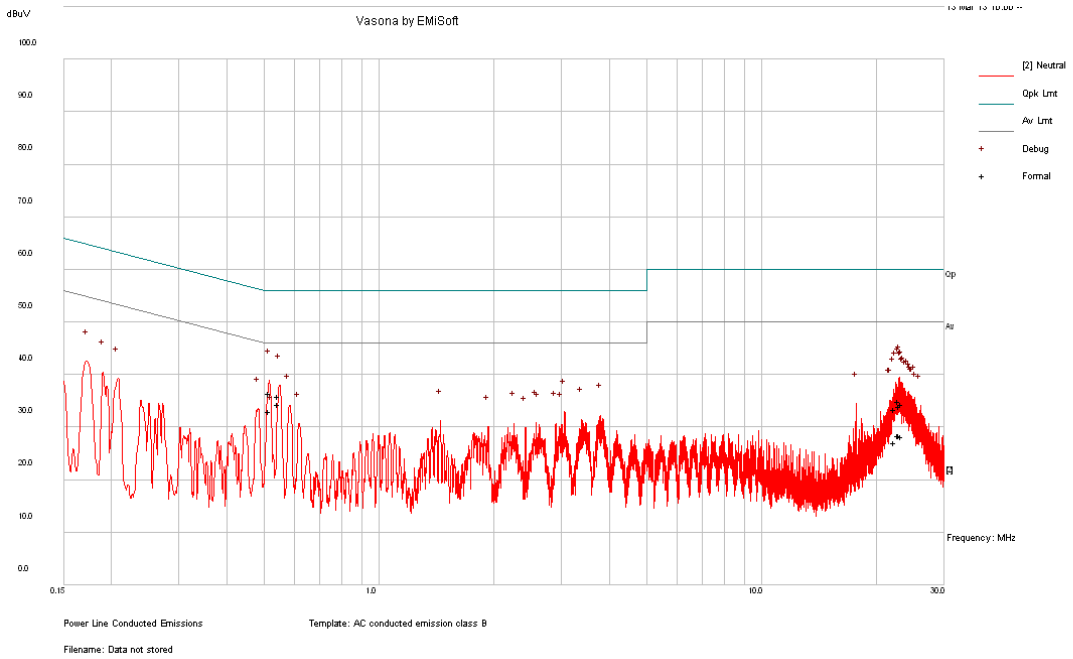
120 V, 60 Hz – Line, POE Adaptor



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.480345	41.75	Line	56.33	-14.58	QP
0.544638	38.71	Line	56	-17.29	QP
0.176775	47.05	Line	64.64	-17.59	QP
3.795921	35.75	Line	56	-20.25	QP
3.539424	34.75	Line	56	-21.25	QP
3.190614	21.41	Line	56	-34.59	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.480345	38.73	Line	46.33	-7.60	Ave.
0.544638	31.84	Line	46	-14.16	Ave.
0.176775	36.16	Line	54.64	-18.48	Ave.
3.539424	26.66	Line	46	-19.34	Ave.
3.795921	25.24	Line	46	-20.76	Ave.
3.190614	15.43	Line	46	-30.57	Ave.

120 V, 60 Hz – Neutral, POE Adaptor



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.517875	36.50	Neutral	56	-19.50	QP
0.545955	35.95	Neutral	56	-20.05	QP
22.77151	34.89	Neutral	60	-25.11	QP
23.25104	34.35	Neutral	60	-25.65	QP
22.9323	34.10	Neutral	60	-25.90	QP
22.35332	33.48	Neutral	60	-26.52	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.545955	34.31	Neutral	46	-11.69	Ave.
0.517875	33.14	Neutral	46	-12.86	Ave.
22.77151	28.55	Neutral	50	-21.45	Ave.
22.9323	28.36	Neutral	50	-21.64	Ave.
23.25104	28.21	Neutral	50	-21.79	Ave.
22.35332	27.16	Neutral	50	-22.84	Ave.

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

7.1 Applicable Standard

For FCC §15.247(d) and IC RSS-210 §A8.5 in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

7.2 Measurement Procedure

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

7.3 Test Equipment List and Details

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

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

7.4 Test Environmental Conditions

Temperature:	20-24 °C
Relative Humidity:	34-40 %
ATM Pressure:	101-103kPa

The testing was performed by Jeffrey Wu from 2013-03-11 to 2013-05-10 at RF site.

7.5 Test Results

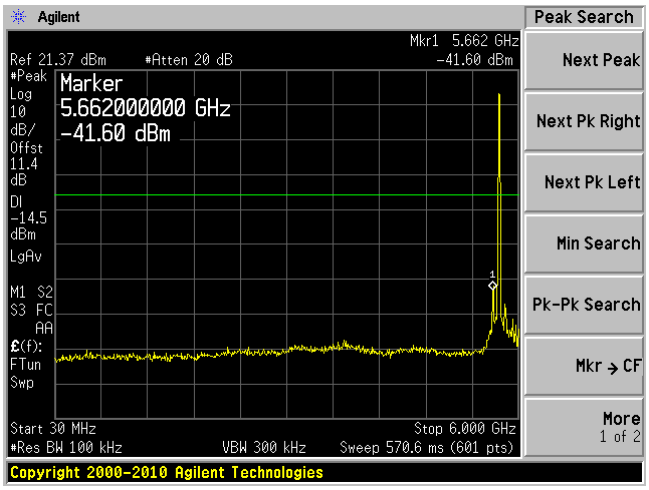
Please refer to the following plots of spurious emissions.

For restrict band data, the limit was set with High Power output with High Antenna Gain.

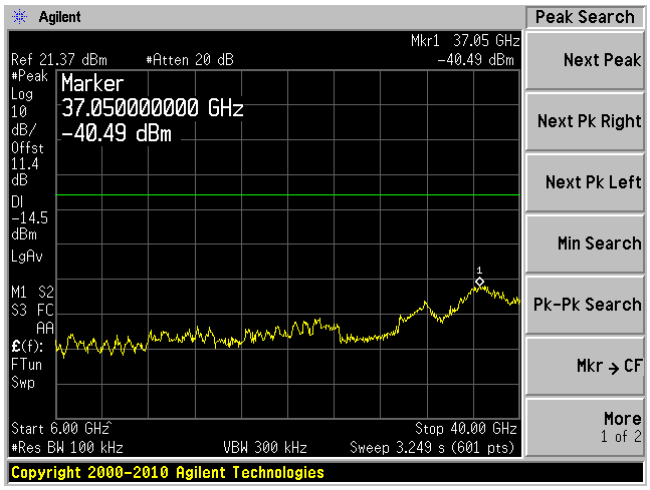
5725-5845 MHz

5 MHz mode, Low Channel 5745.5 MHz

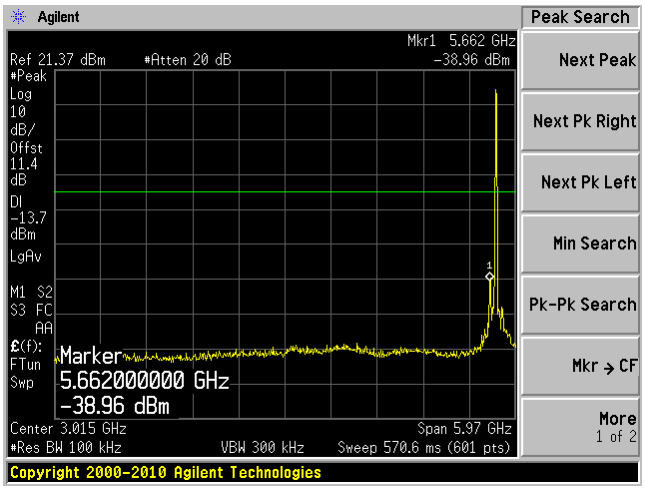
Chain J0, Plot: 30 MHz – 6 GHz



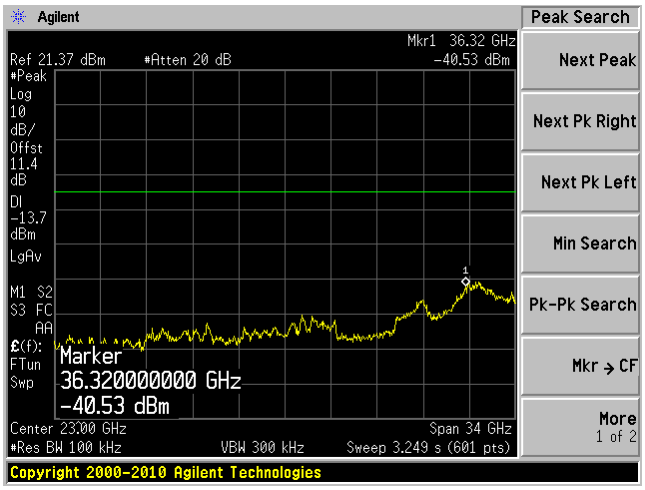
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

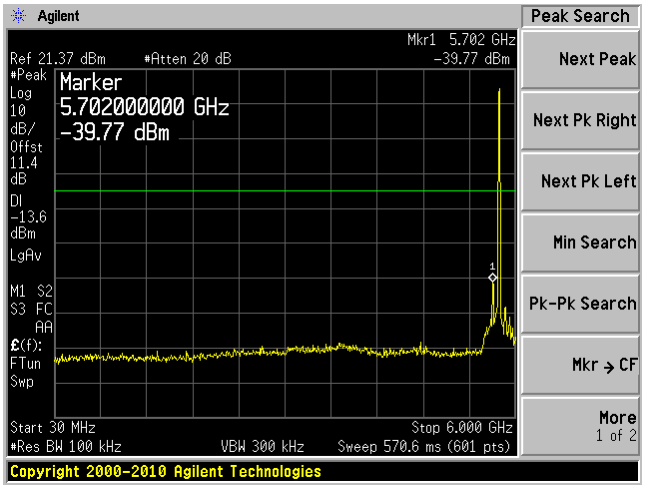


Chain J1, Plot: 6 GHz – 40 GHz

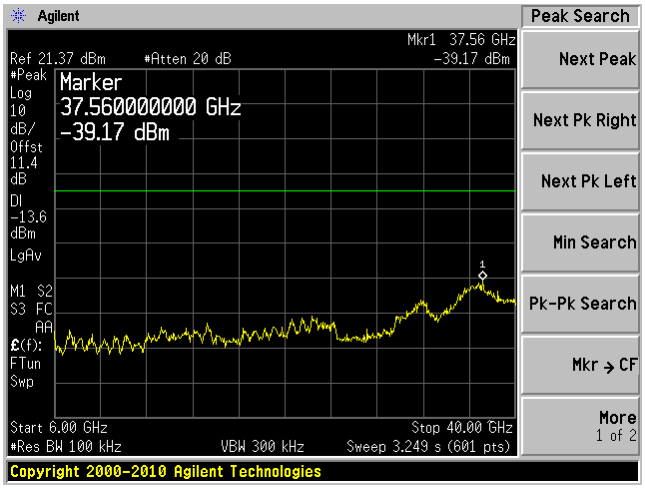


5 MHz mode, Middle Channel 5785.5 MHz

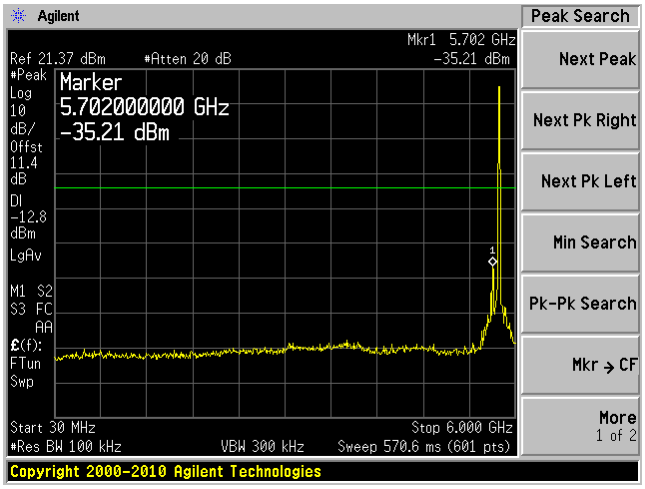
Chain J0, Plot: 30 MHz – 6 GHz



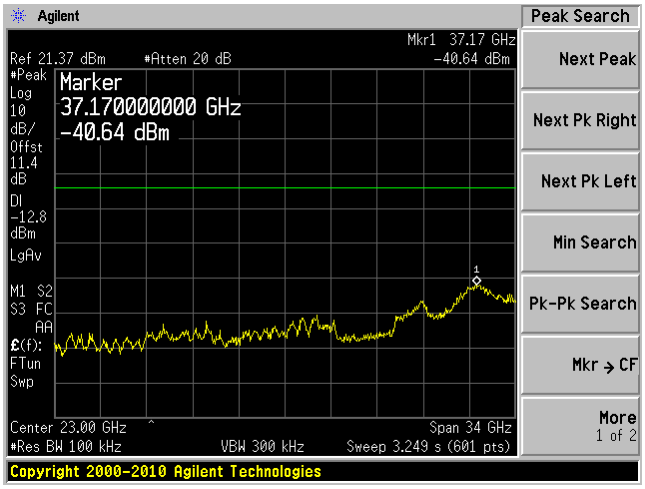
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

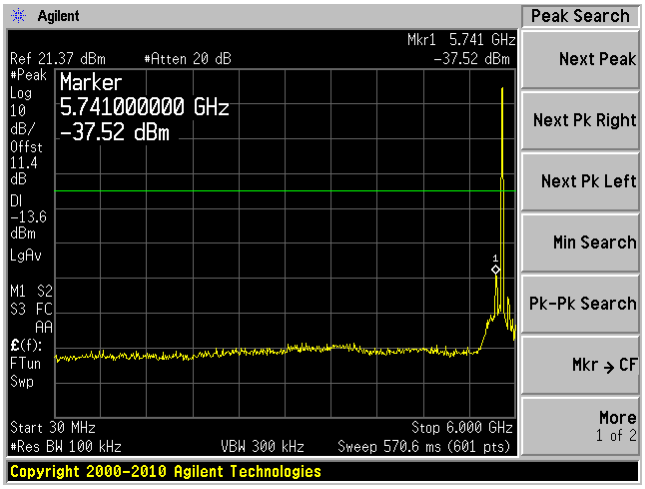


Chain J1, Plot: 6 GHz – 40 GHz

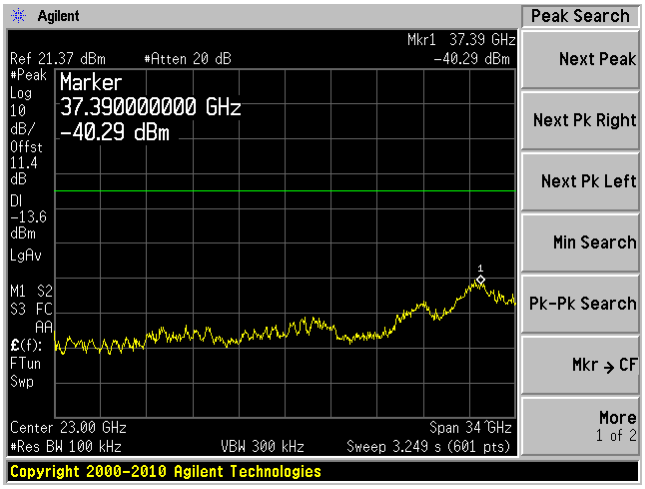


5 MHz mode, High Channel 5825.5 MHz

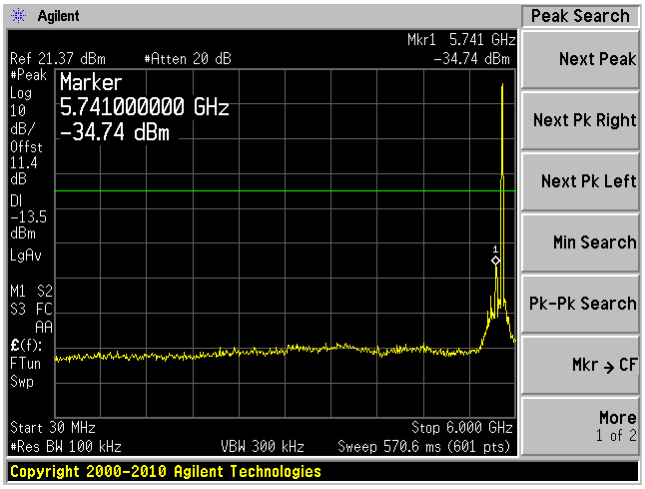
Chain J0, Plot: 30 MHz – 6 GHz



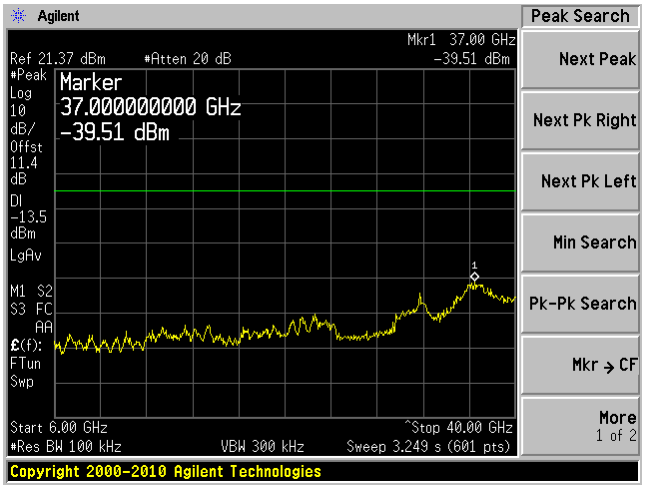
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

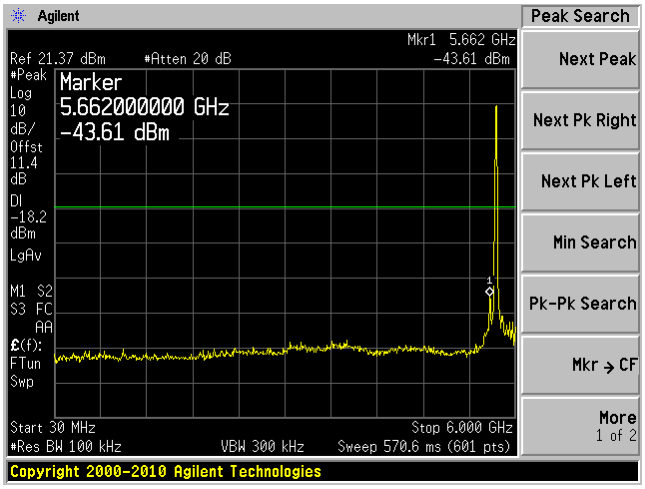


Chain J1, Plot: 6 GHz – 40 GHz

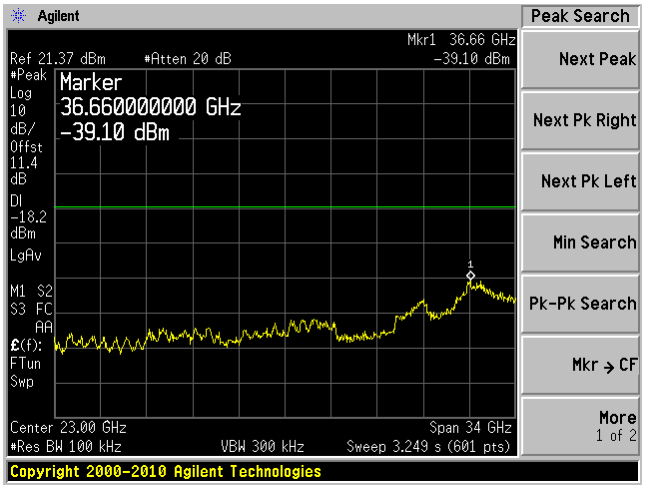


10 MHz mode, Low Channel 5745 MHz

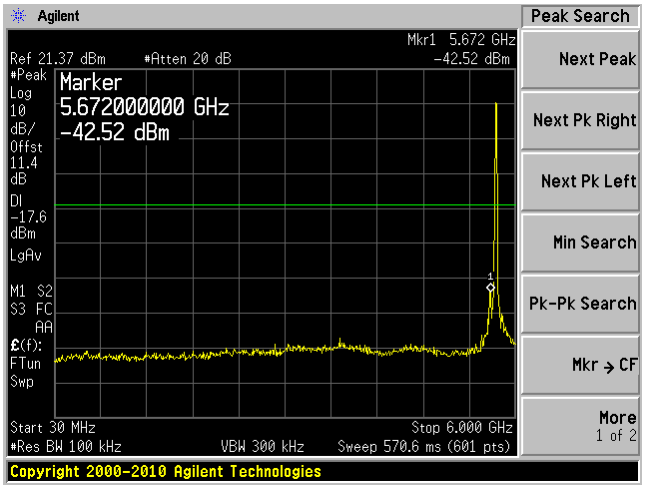
Chain J0, Plot: 30 MHz – 6 GHz



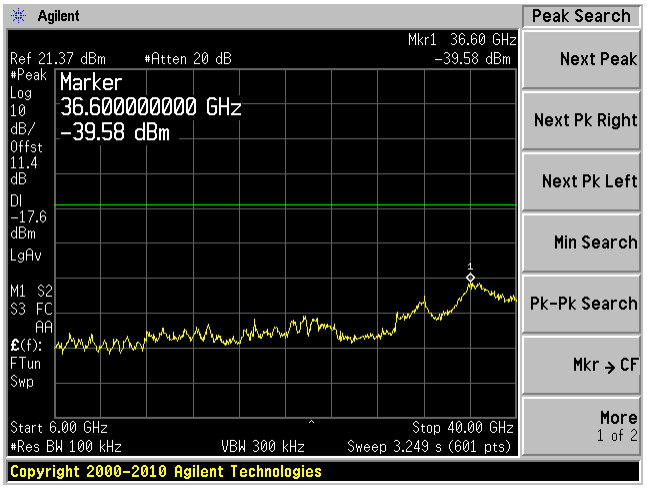
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

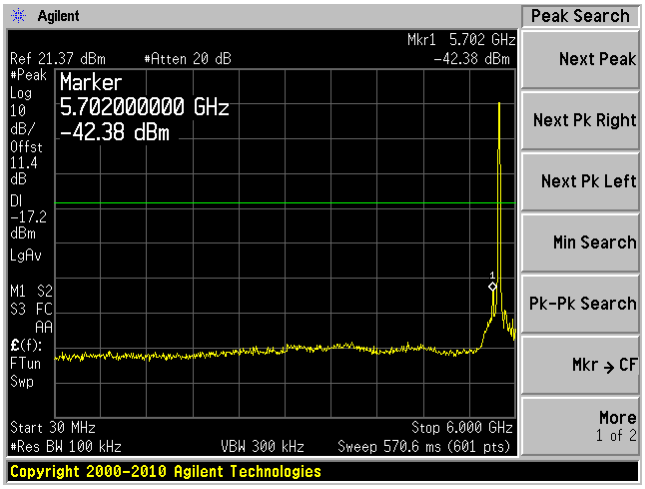


Chain J1, Plot: 6 GHz – 40 GHz

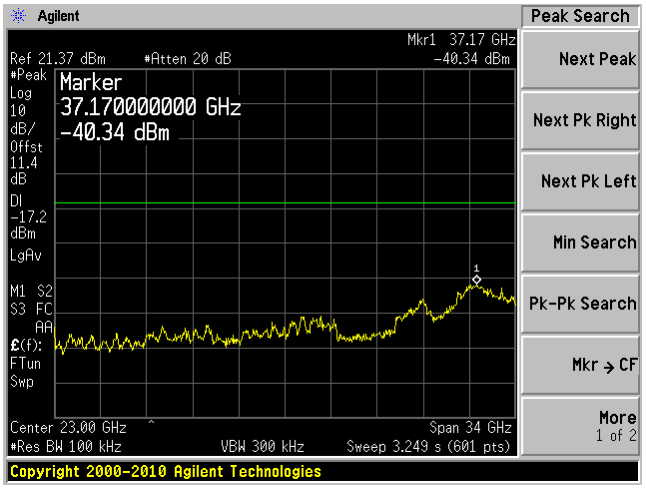


10 MHz mode, Middle Channel 5785 MHz

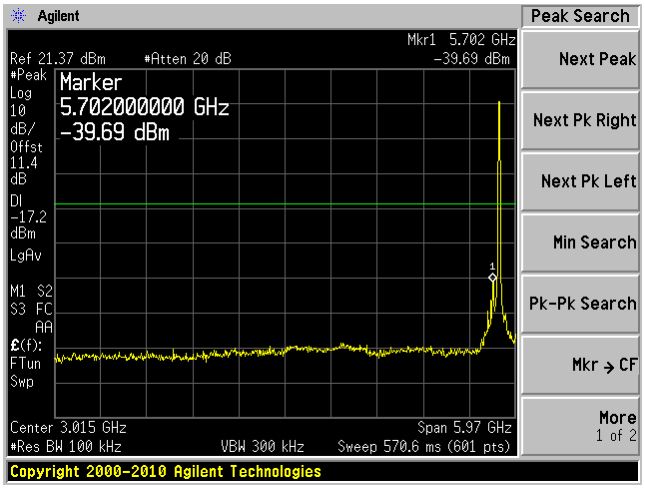
Chain J0, Plot: 30 MHz – 6 GHz



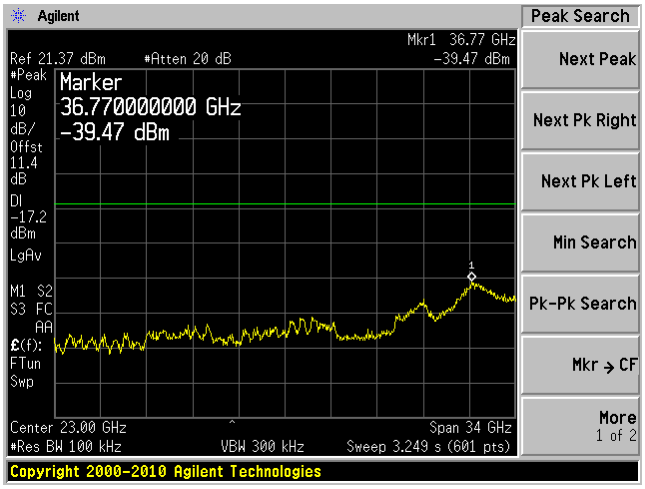
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

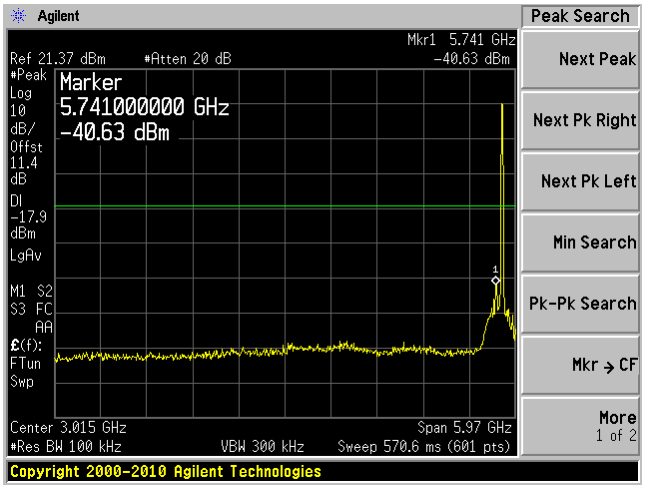


Chain J1, Plot: 6 GHz – 40 GHz

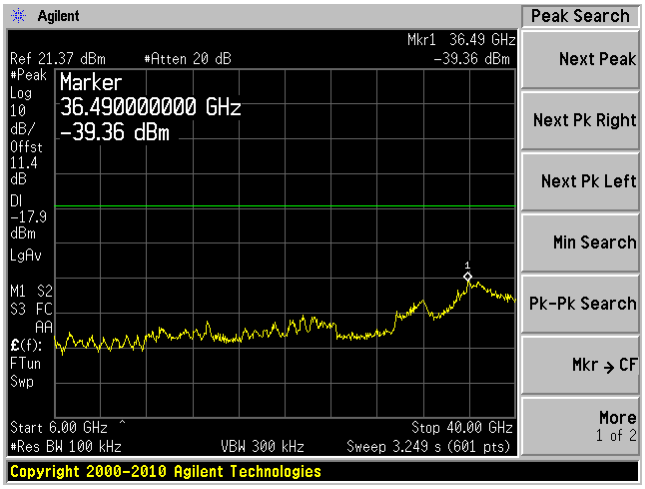


10 MHz mode, High Channel 5825 MHz

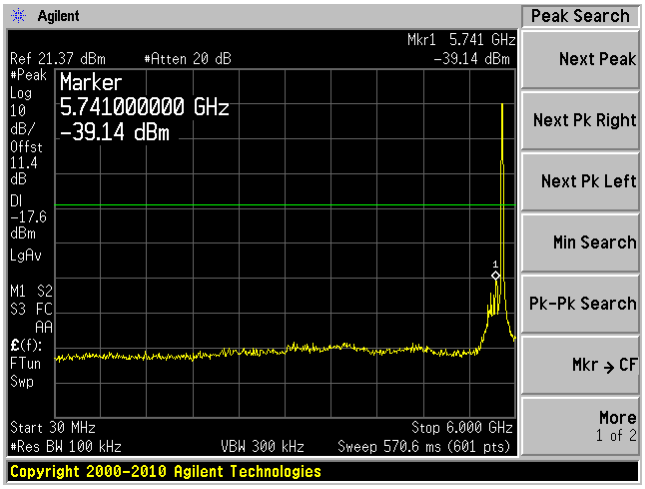
Chain J0, Plot: 30 MHz – 6 GHz



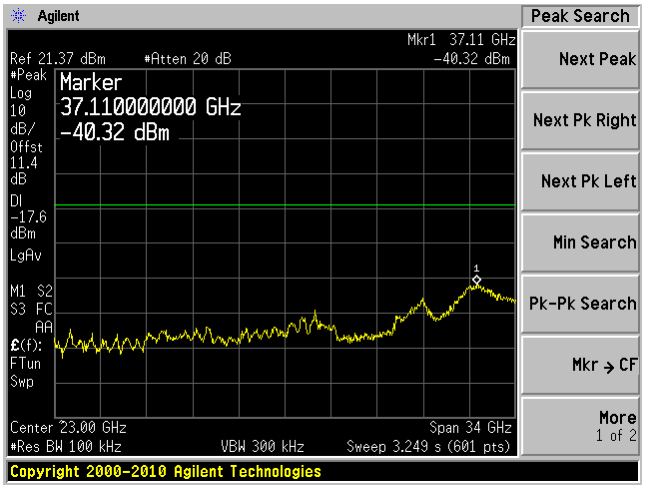
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

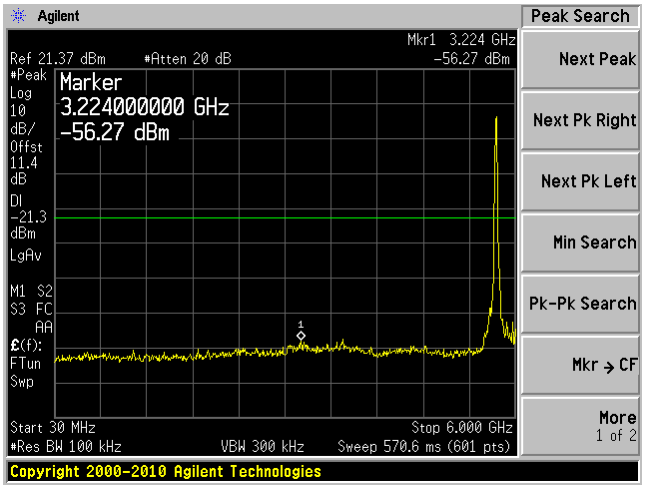


Chain J1, Plot: 6 GHz – 40 GHz

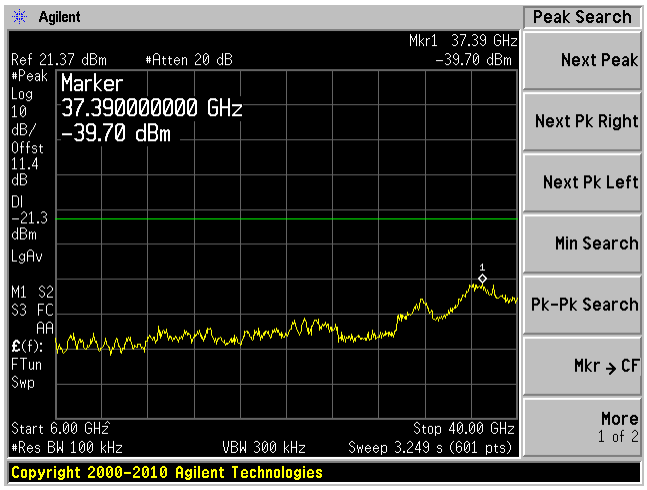


802.11a, Low Channel 5745 MHz

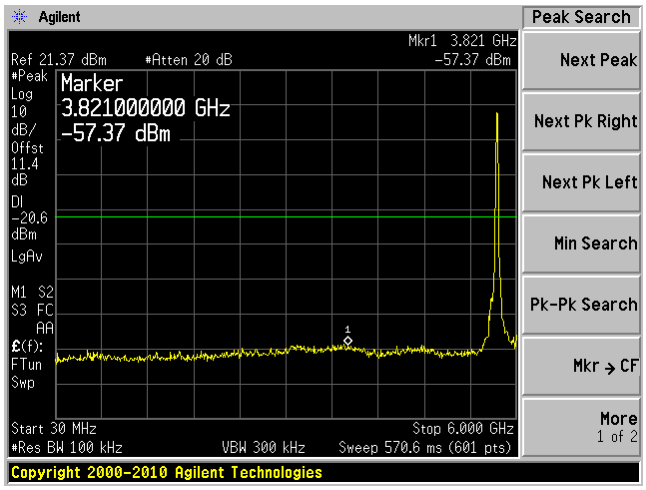
Chain J0, Plot: 30 MHz – 6 GHz



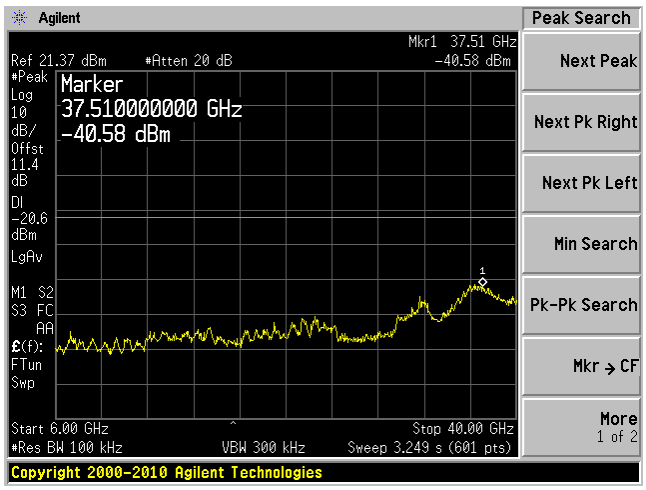
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

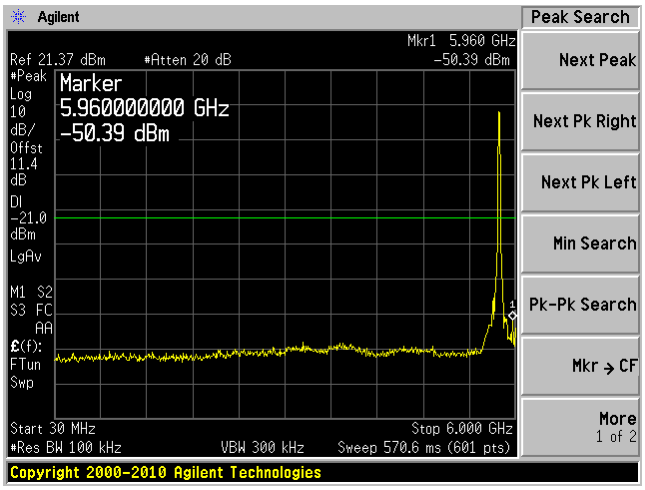


Chain J1, Plot: 6 GHz – 40 GHz

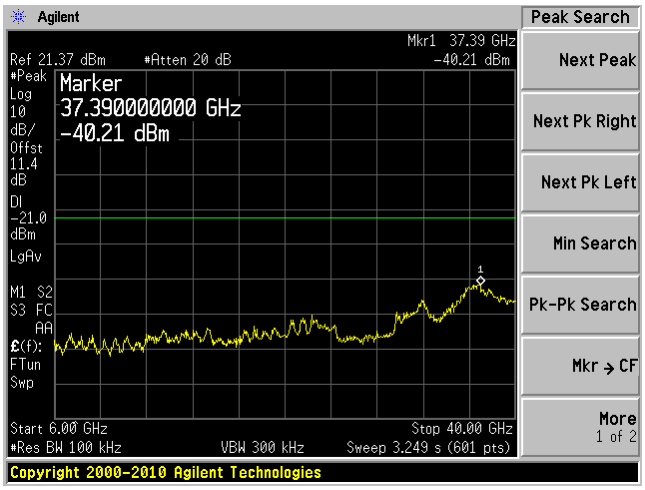


802.11a, Middle Channel 5785 MHz

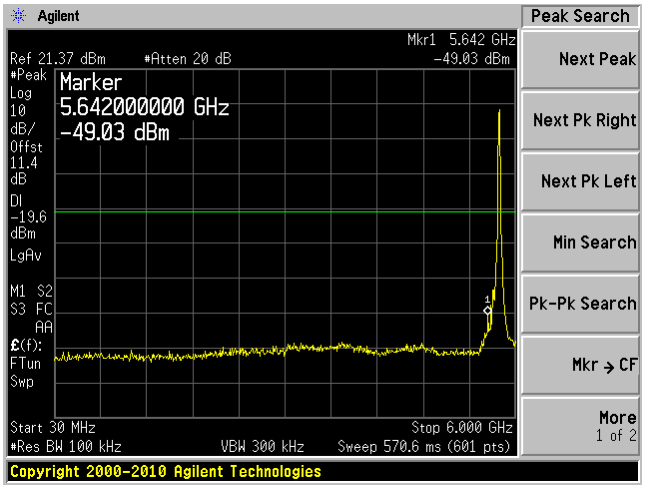
Chain J0, Plot: 30 MHz – 6 GHz



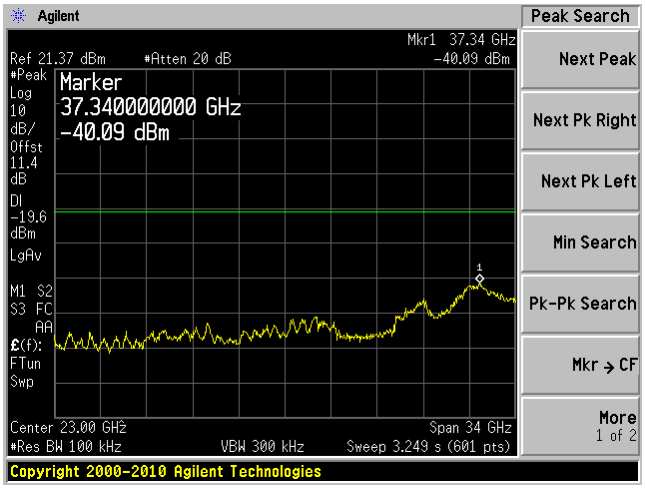
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

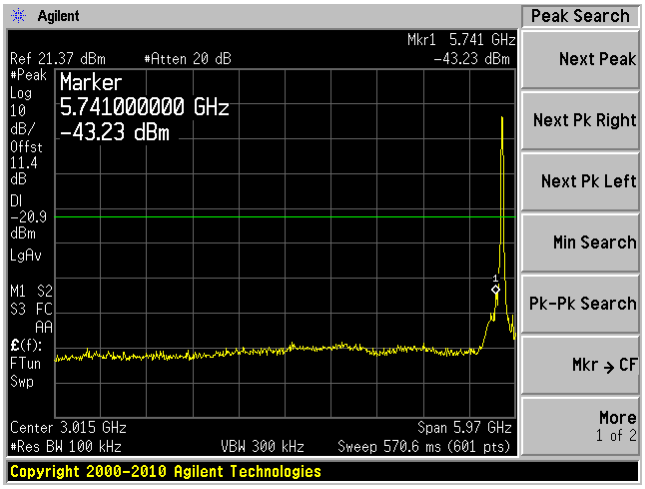


Chain J1, Plot: 6 GHz – 40 GHz

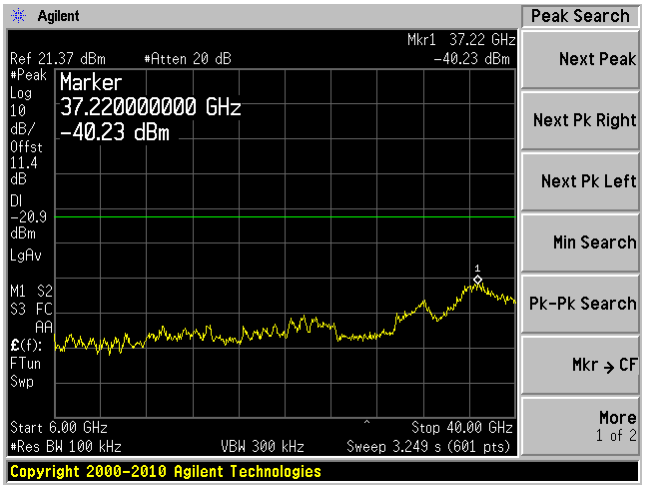


802.11a, High Channel 5825 MHz

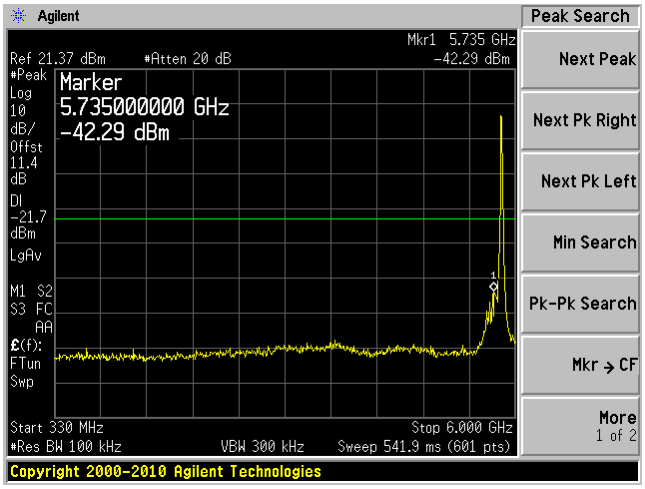
Chain J0, Plot: 30 MHz – 6 GHz



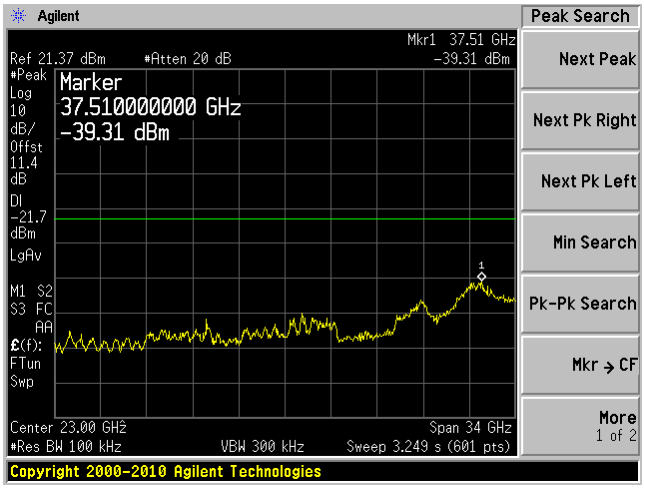
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

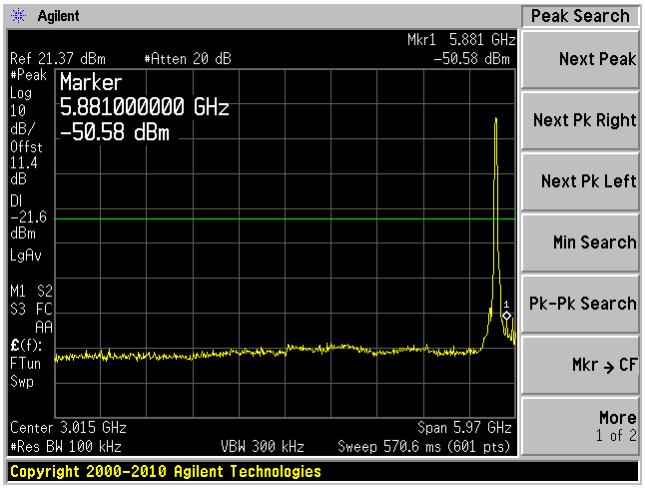


Chain J1, Plot: 6 GHz – 40 GHz

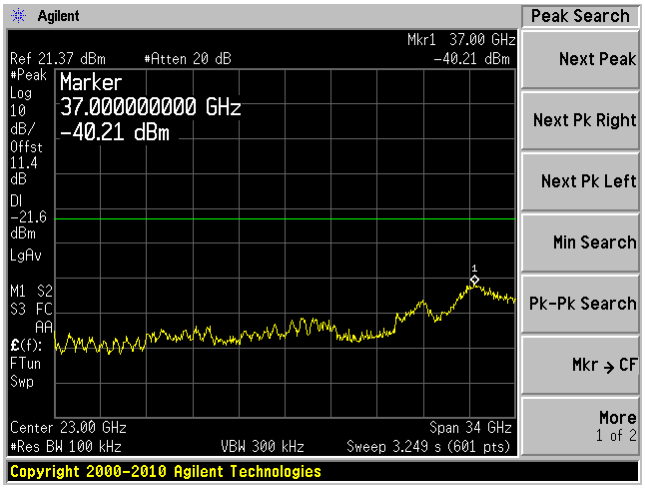


802.11n HT20, Low Channel 5745 MHz

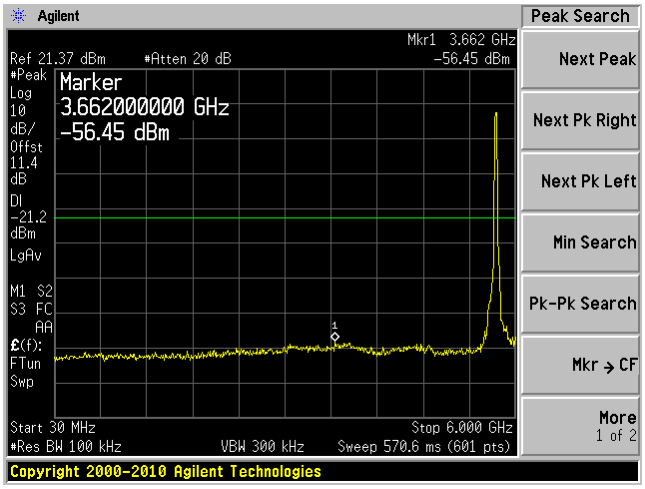
Chain J0, Plot: 30 MHz – 6 GHz



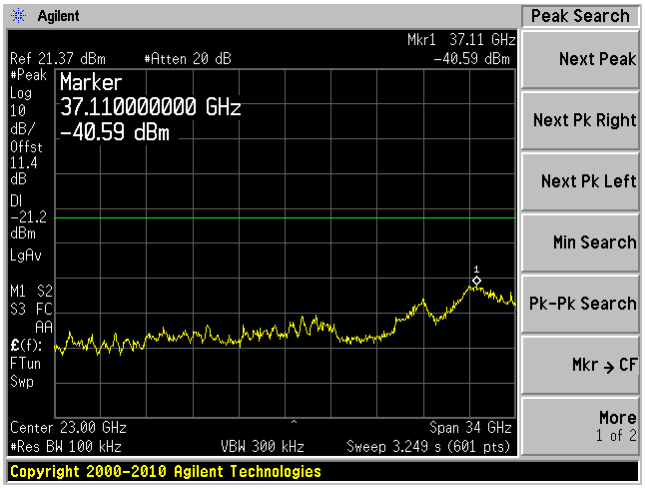
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

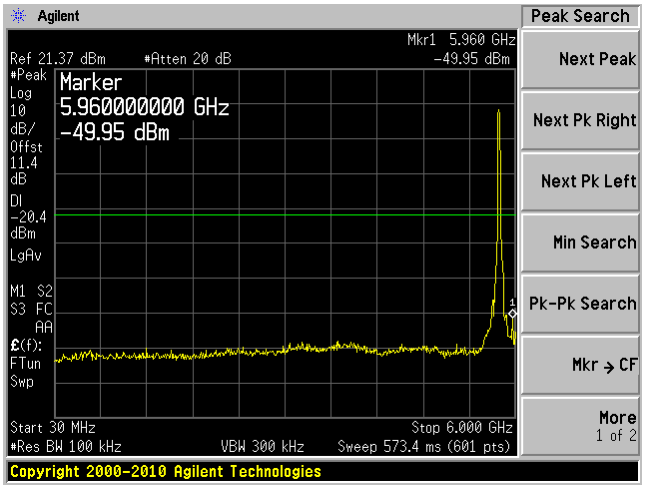


Chain J1, Plot: 6 GHz – 40 GHz

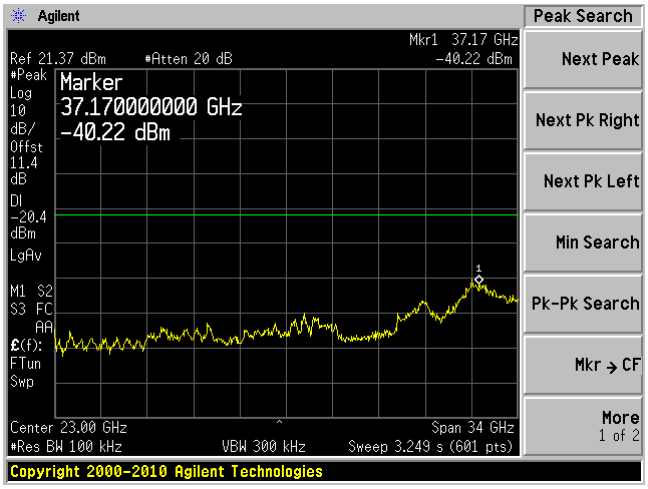


802.11n HT20, Middle Channel 5785 MHz

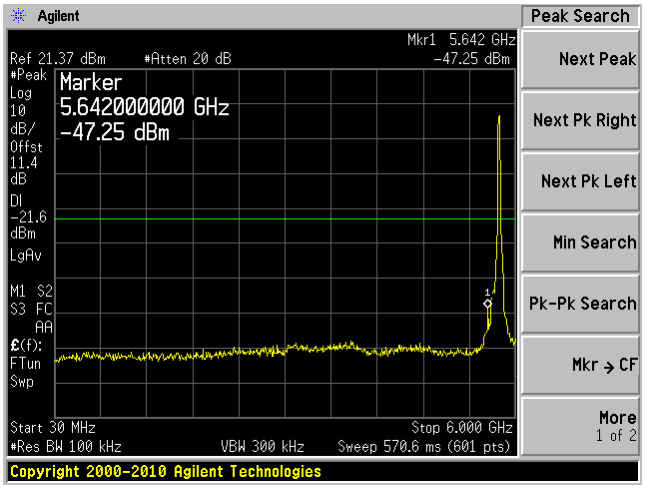
Chain J0, Plot: 30 MHz – 6 GHz



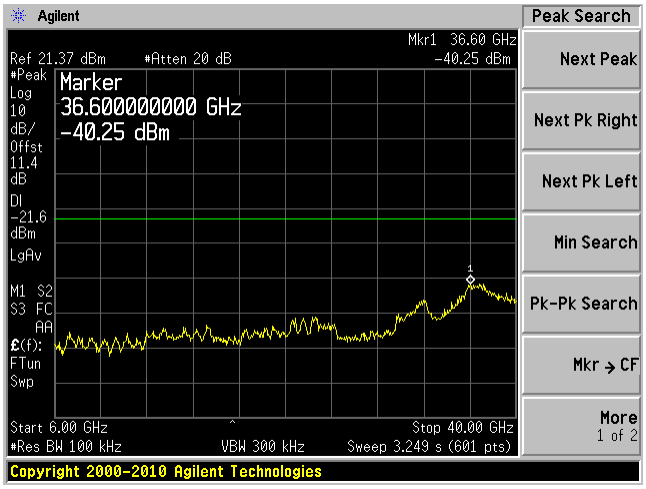
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

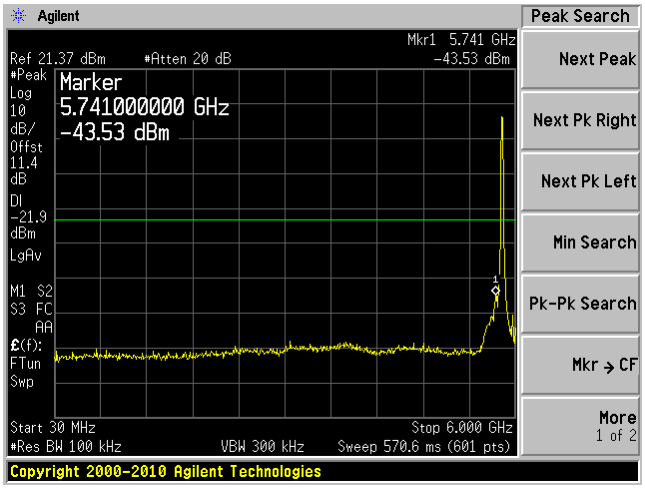


Chain J1, Plot: 6 GHz – 40 GHz

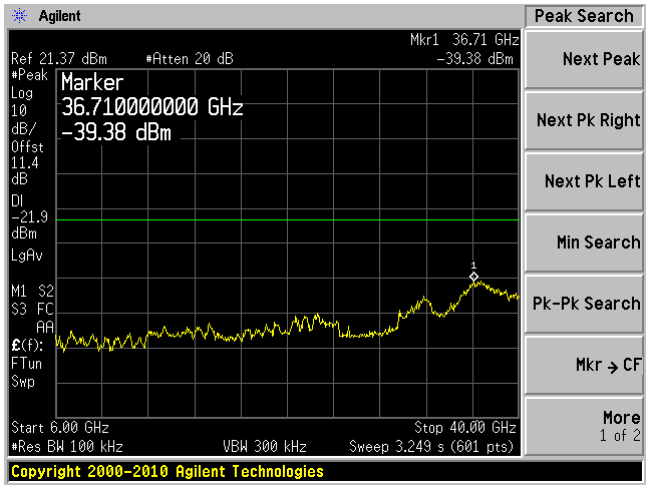


802.11n HT20, High Channel 5825 MHz

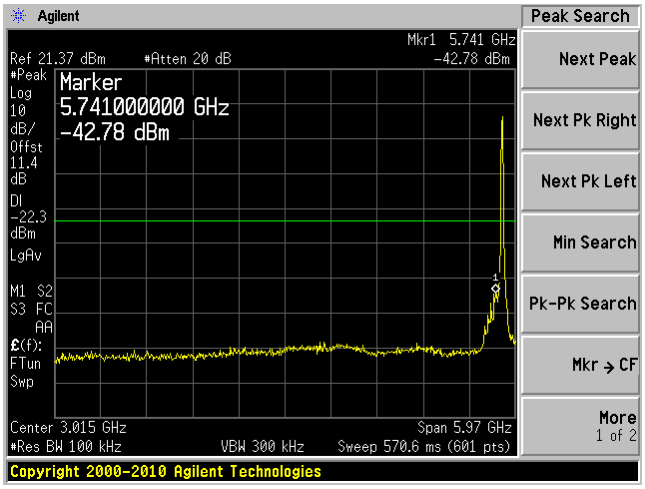
Chain J0, Plot: 30 MHz – 6 GHz



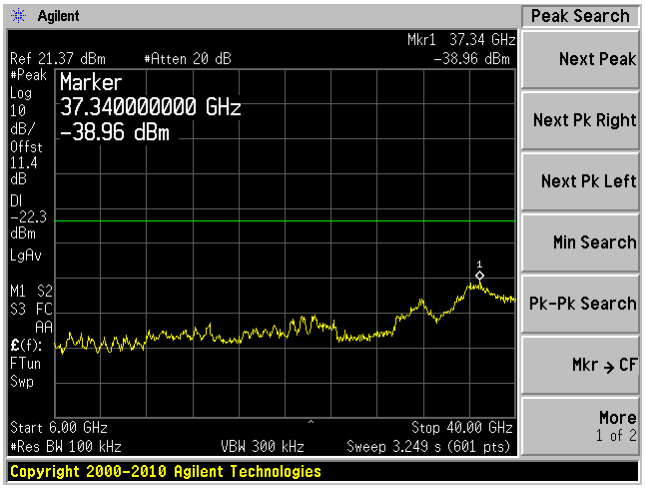
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

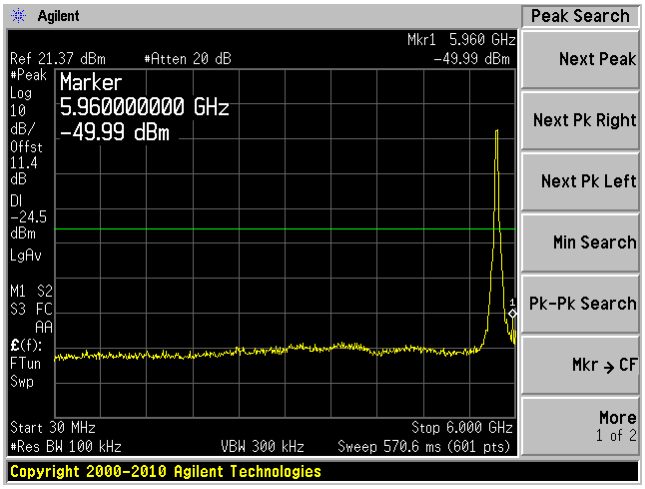


Chain J1, Plot: 6 GHz – 40 GHz

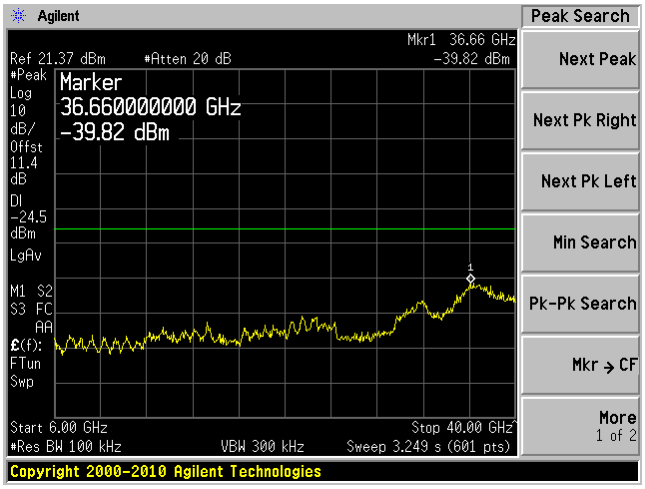


802.11n HT40, Low Channel 5755 MHz

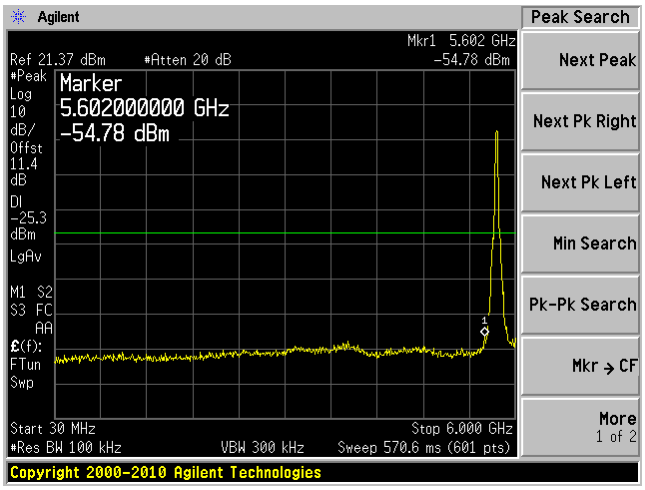
Chain J0, Plot: 30 MHz – 6 GHz



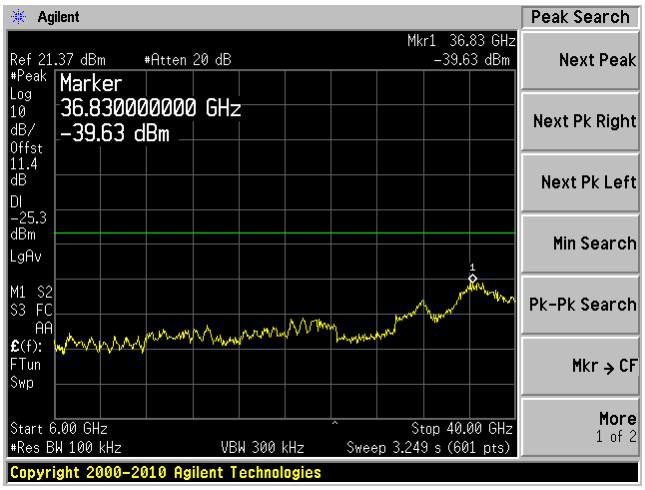
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz

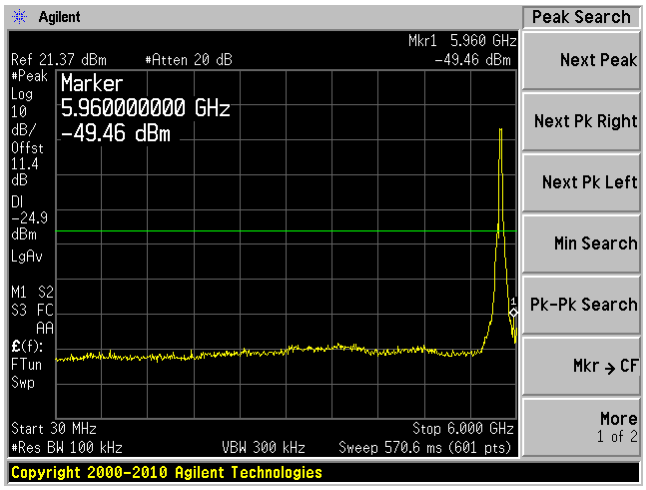


Chain J1, Plot: 6 GHz – 40 GHz

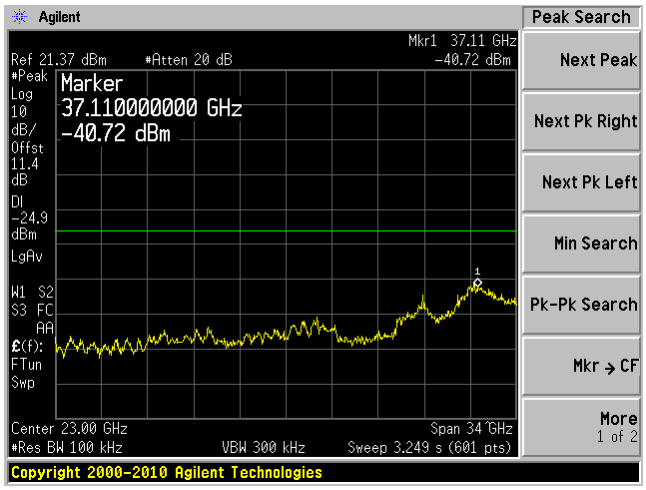


802.11n HT40, High Channel 5795 MHz

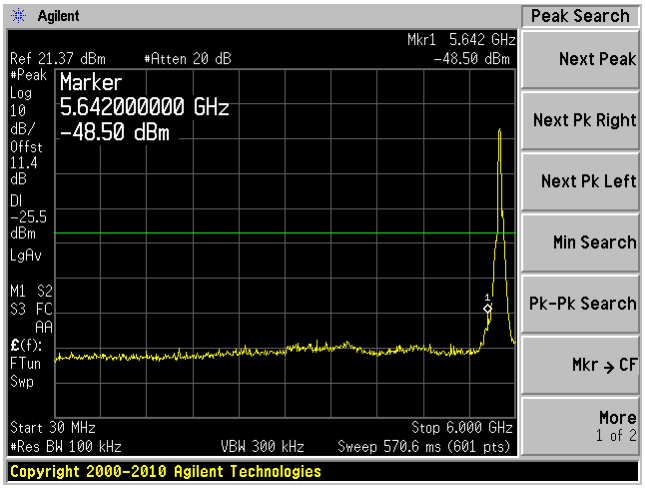
Chain J0, Plot: 30 MHz – 6 GHz



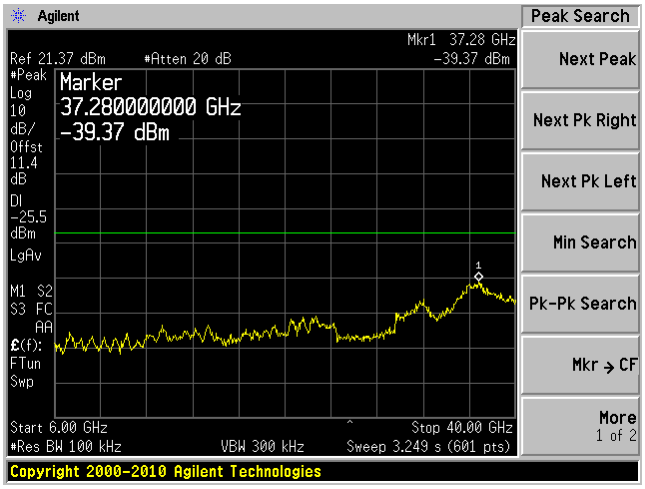
Chain J0, Plot: 6 GHz – 40 GHz



Chain J1, Plot: 30 MHz – 6 GHz



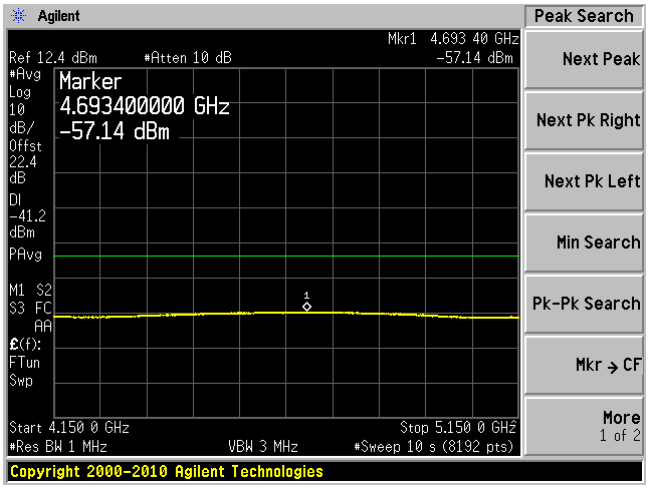
Chain J1, Plot: 6 GHz – 40 GHz



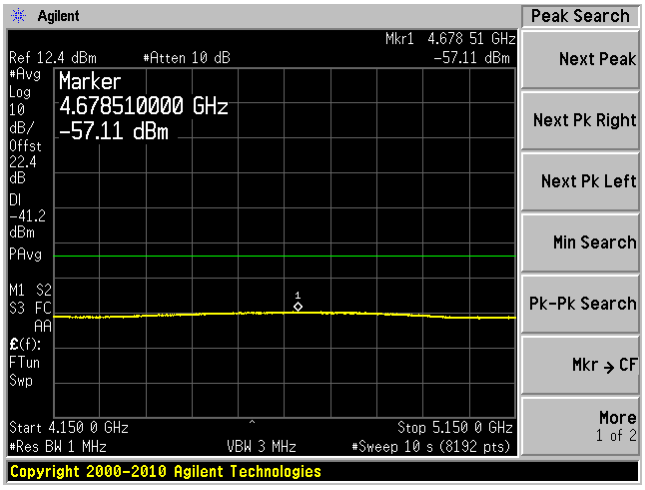
Restrict Band 4500 MHz to 5150 MHz

5 MHz mode, Low Channel 5745.5 MHz

Chain J0

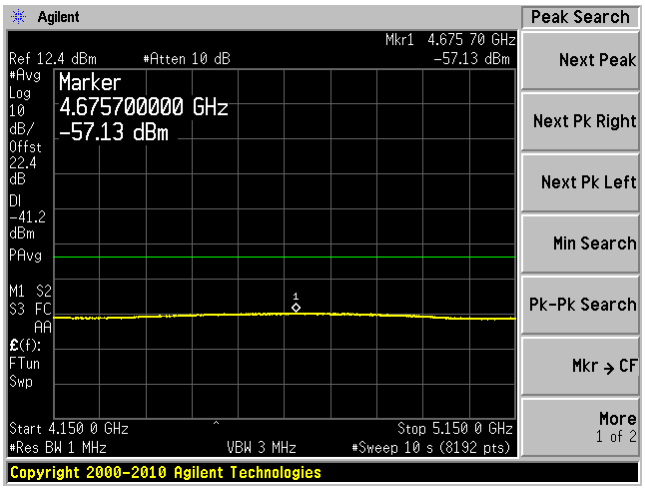


Chain J1

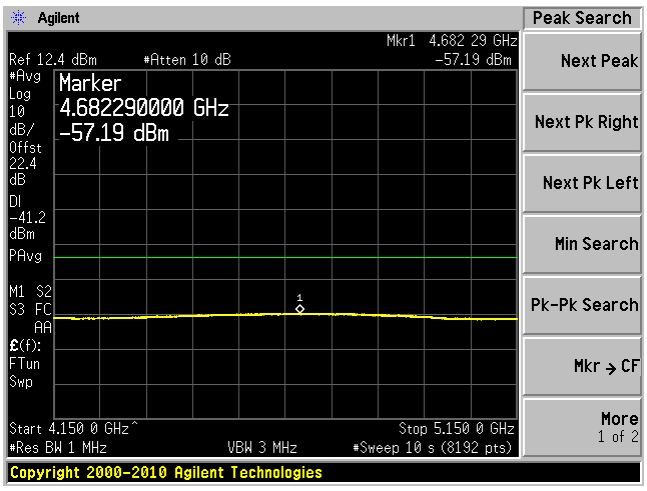


5 MHz mode, Middle Channel 5785.5 MHz

Chain J0

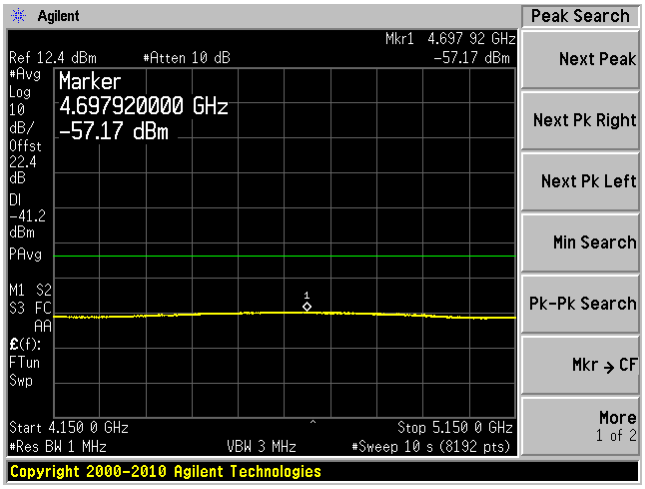


Chain J1

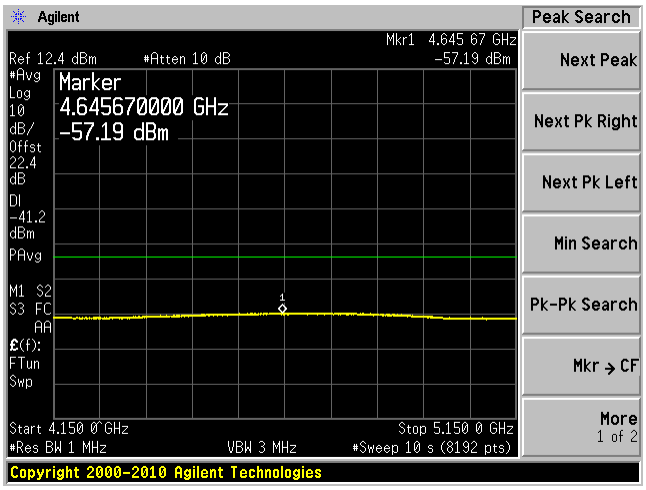


5 MHz mode, High Channel 5825.5 MHz

Chain J0

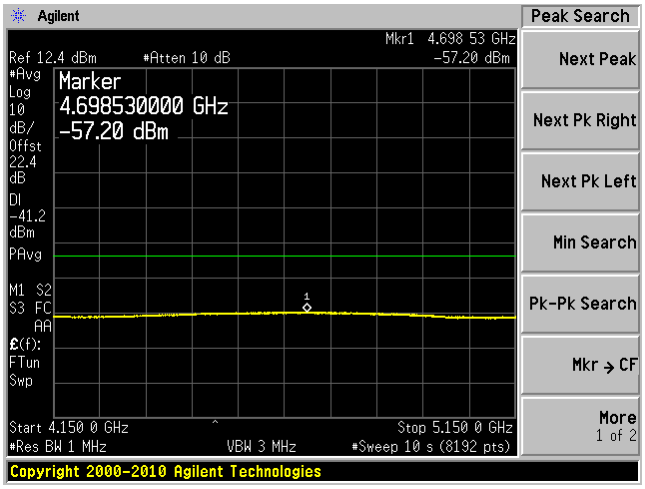


Chain J1

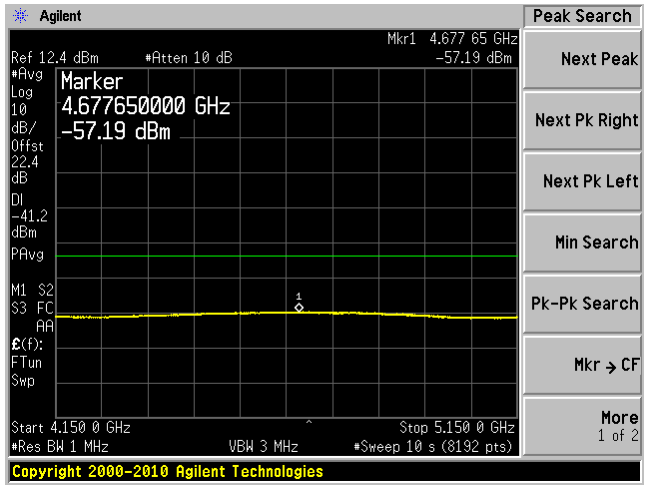


10 MHz mode, Low Channel 5745 MHz

Chain J0

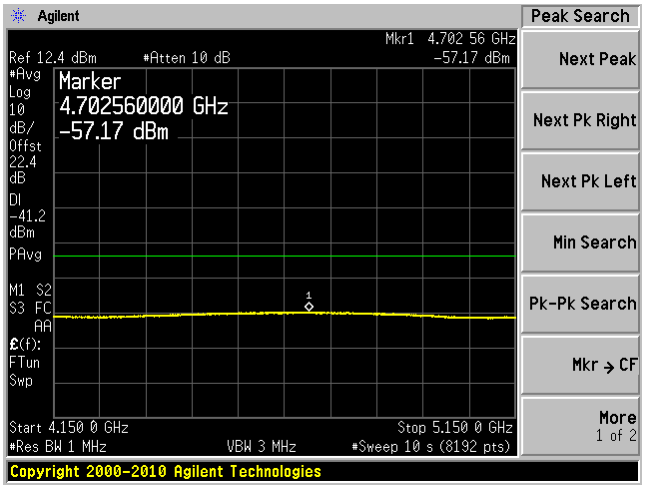


Chain J1

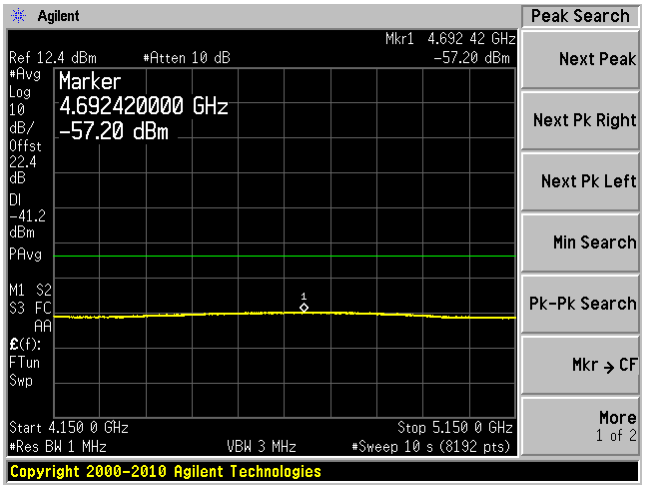


10 MHz mode, Middle Channel 5785 MHz

Chain J0

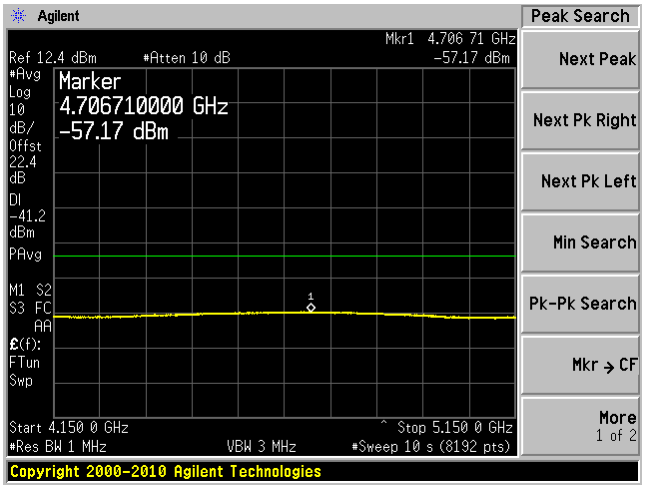


Chain J1

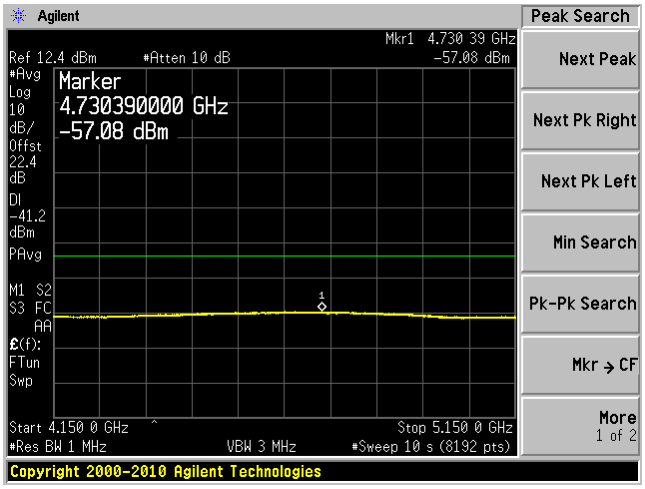


10 MHz mode, High Channel 5825 MHz

Chain J0

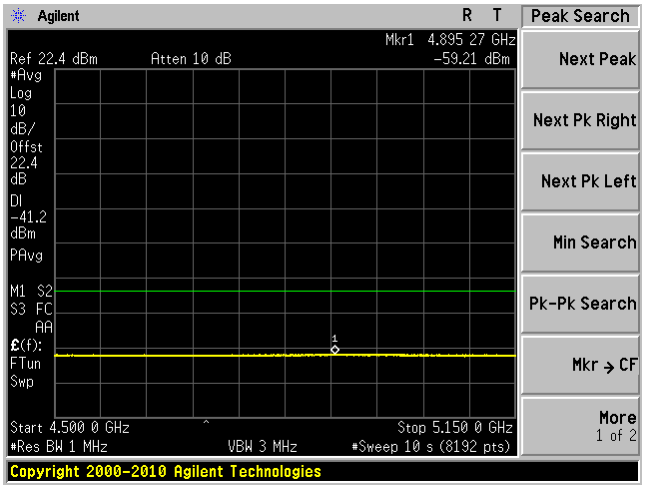


Chain J1

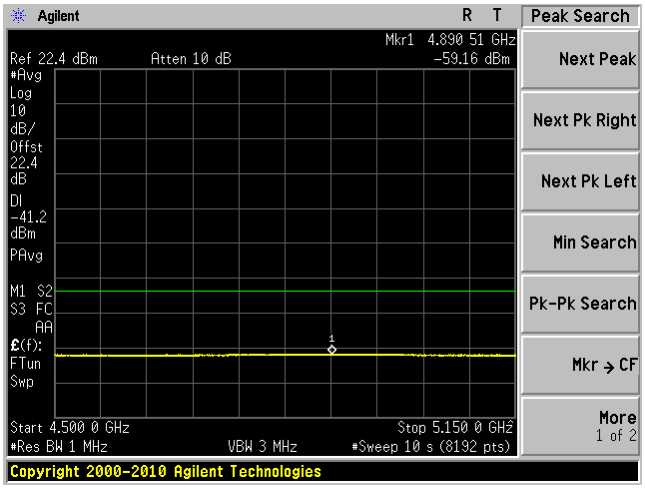


802.11a, Low Channel 5745 MHz

Chain J0

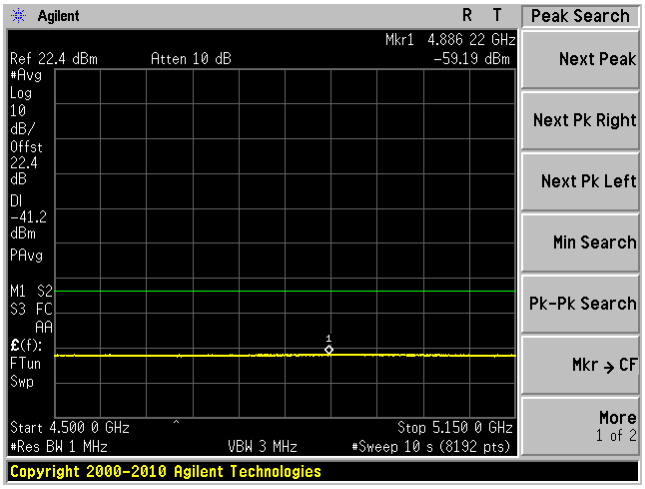


Chain J1



802.11a, Middle Channel 5785 MHz

Chain J0



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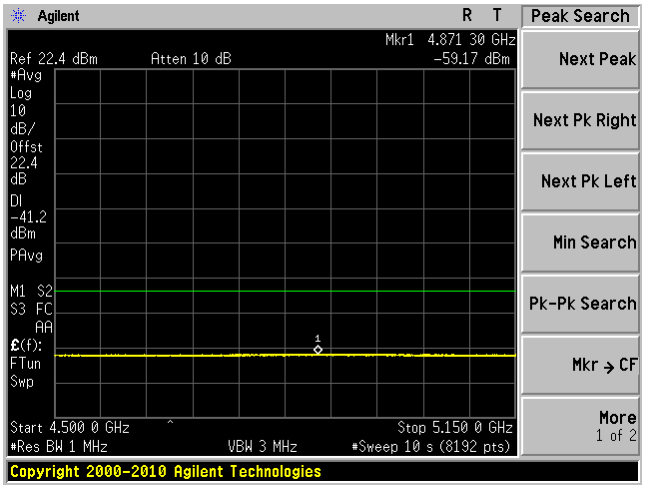
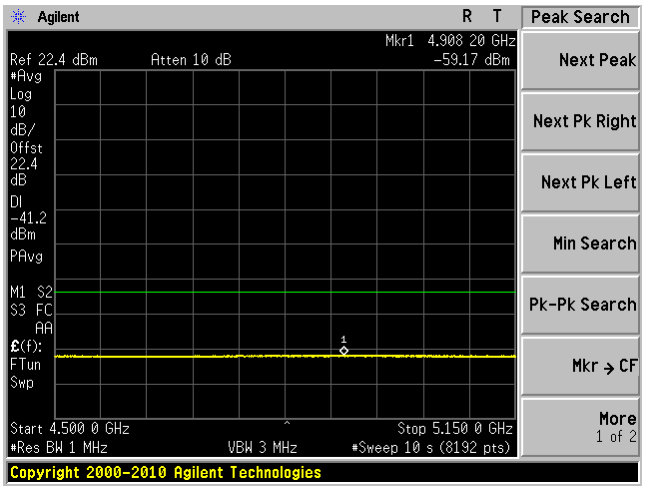
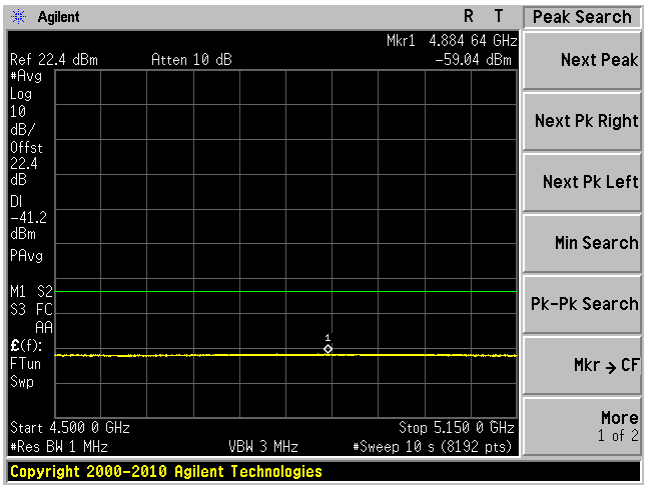


802.11a, High Channel 5825 MHz

Chain J0

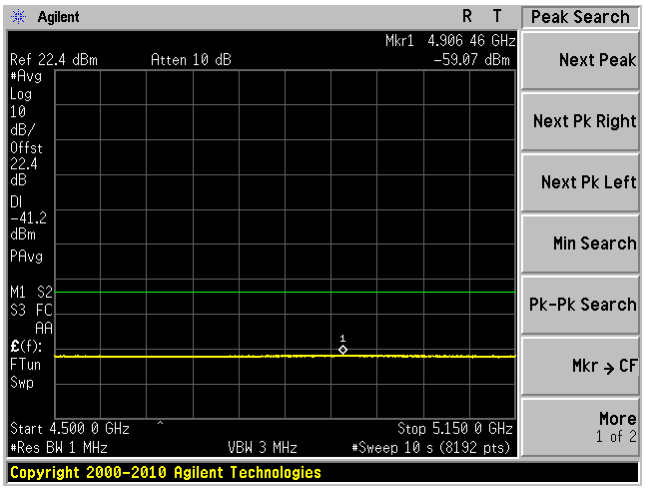


Chain J1

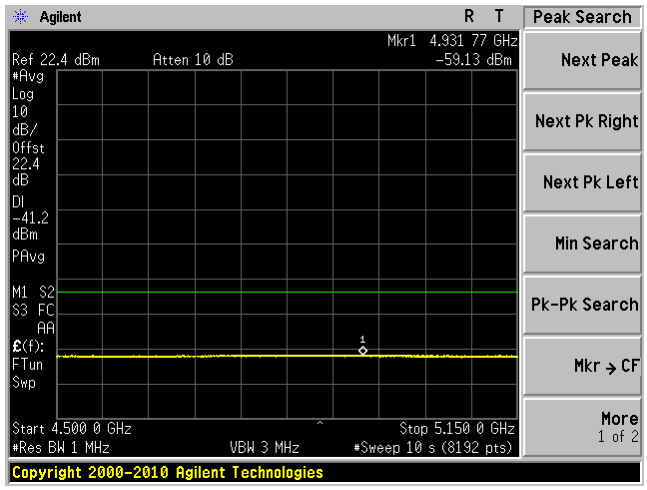


802.11n HT20, Low Channel 5745 MHz

Chain J0

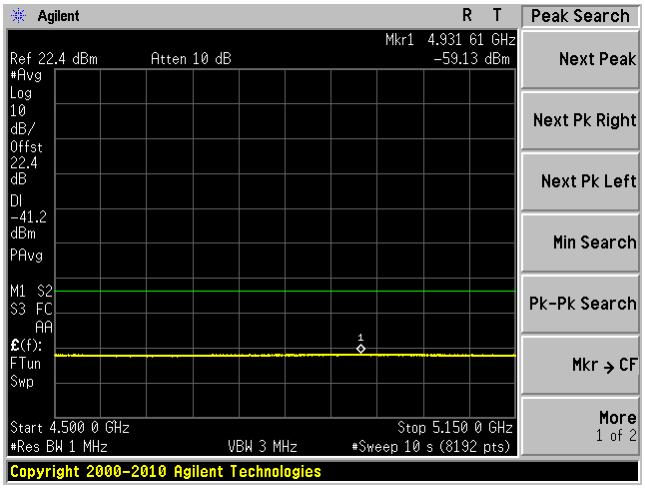


Chain J1



802.11n HT20, Middle Channel 5785 MHz

Chain J0



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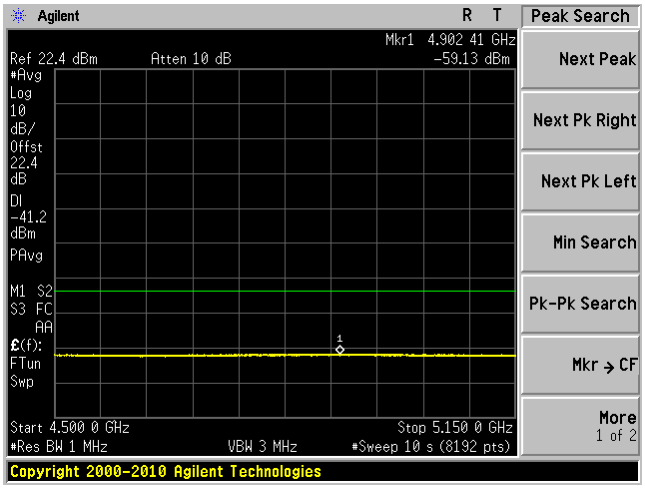
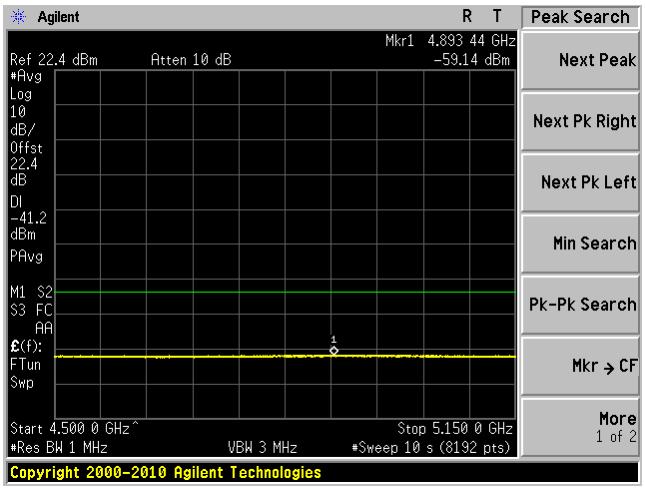
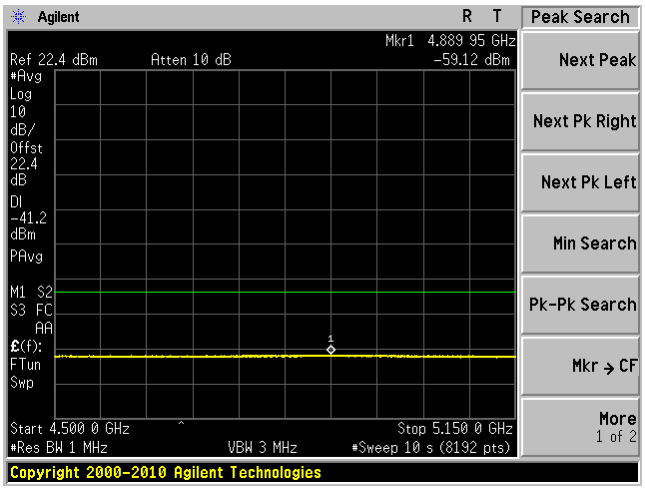


802.11n HT20, High Channel 5825 MHz

Chain J0

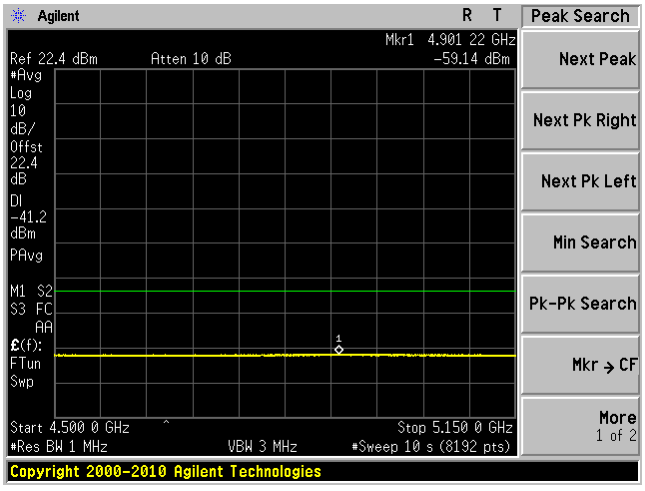


Chain J1



802.11n HT40, Low Channel 5755 MHz

Chain J0



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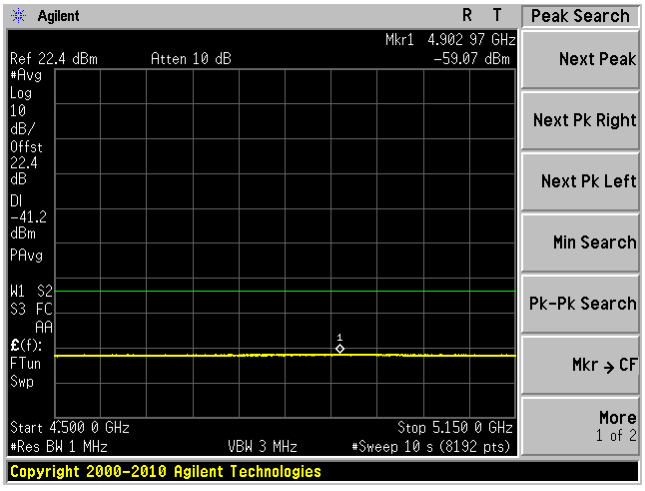
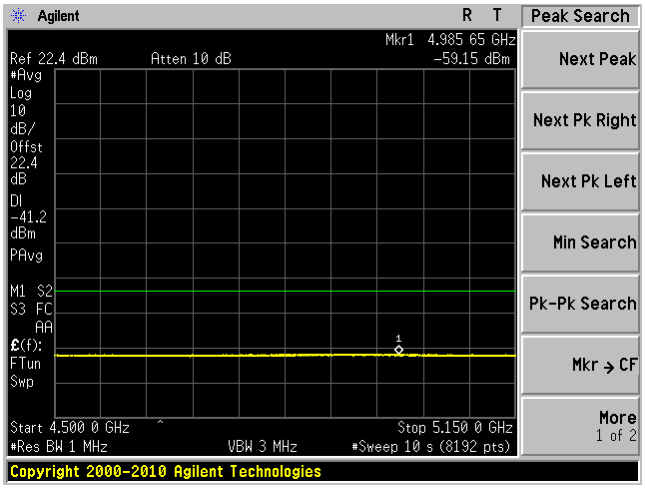
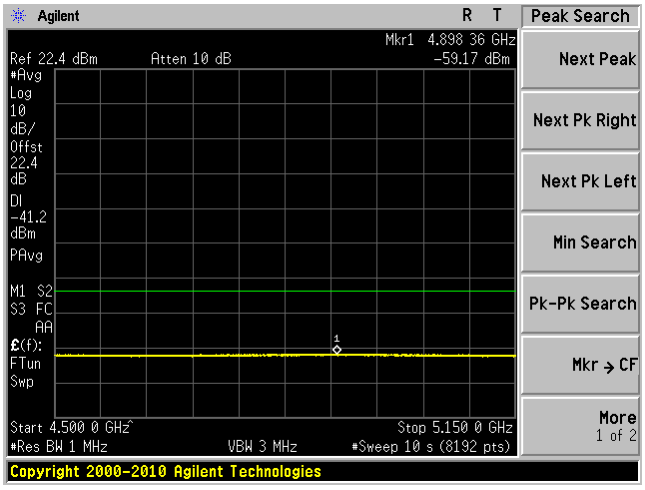


802.11n HT40, High Channel 5795 MHz

Chain J0



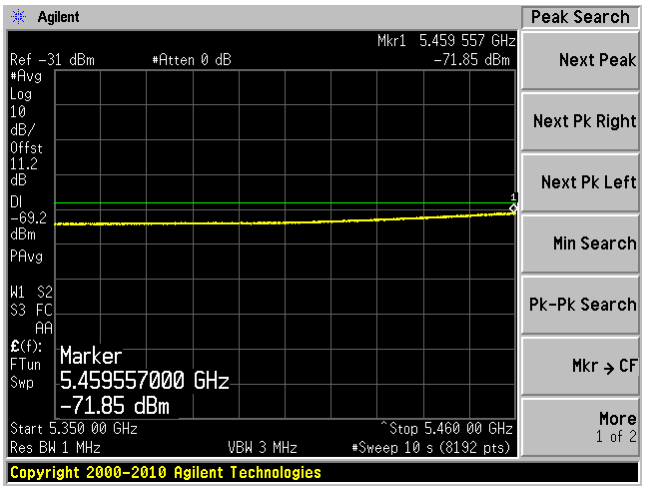
Chain J1



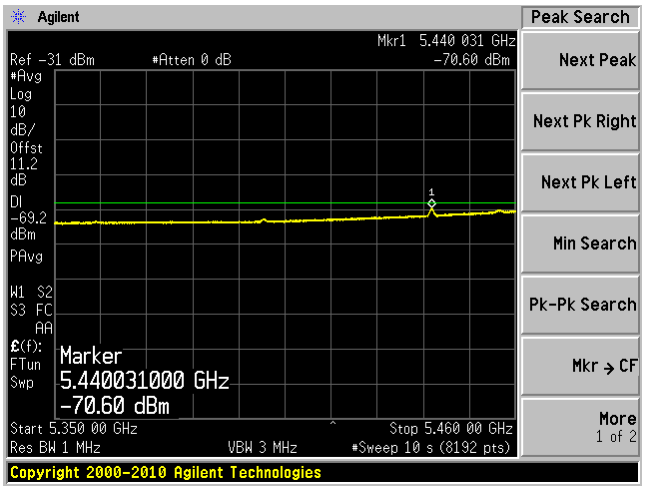
Restrict Band 5350 MHz to 5460 MHz

5 MHz mode, Low Channel 5745.5 MHz

Chain J0

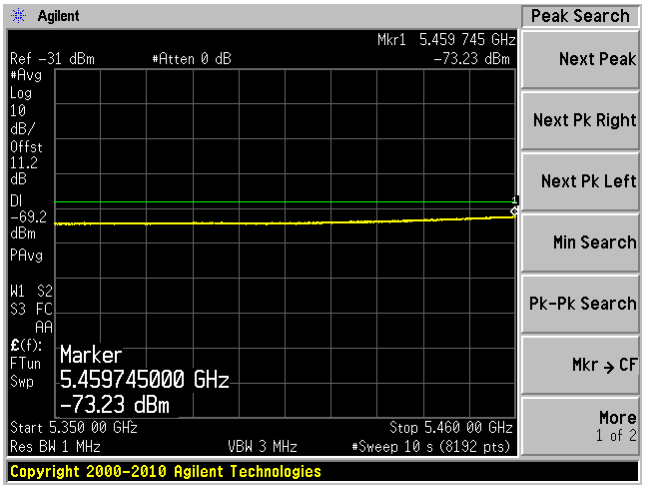


Chain J1

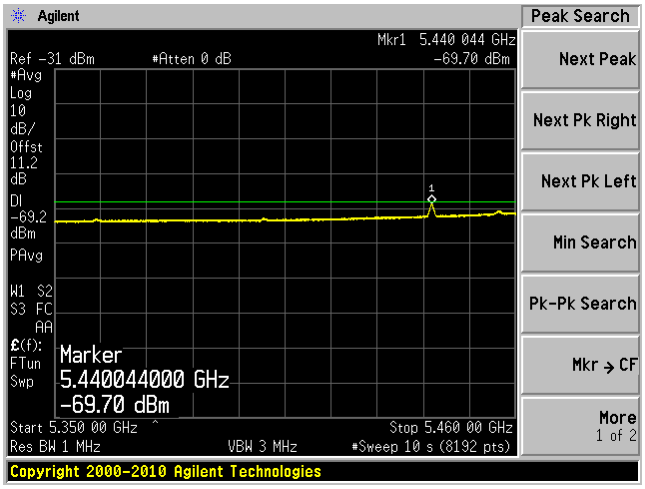


5 MHz mode, Middle Channel 5785.5 MHz

Chain J0

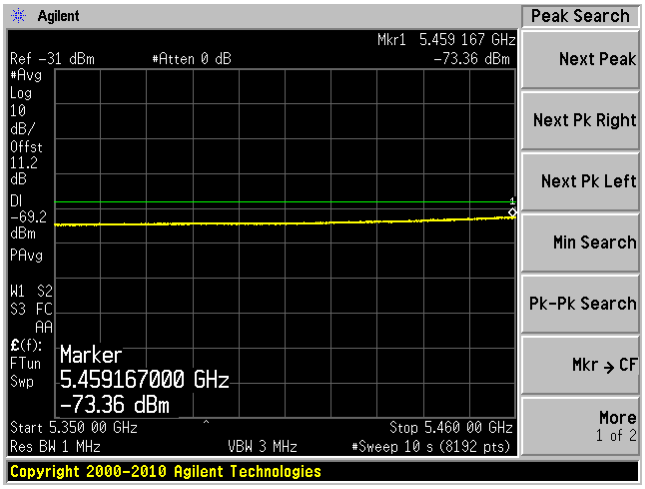


Chain J1

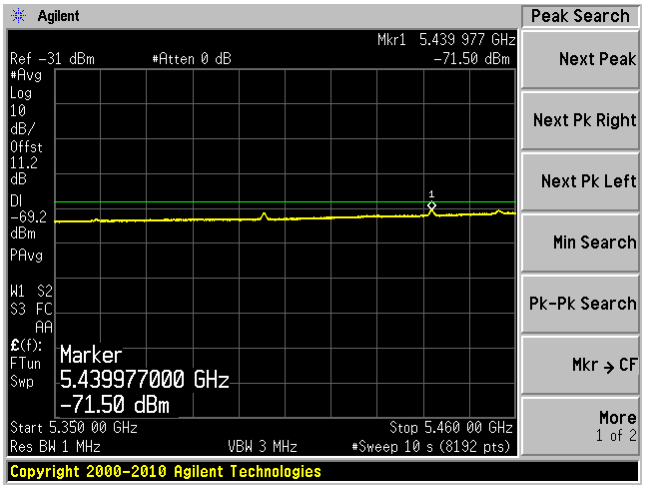


5 MHz mode, High Channel 5825.5 MHz

Chain J0

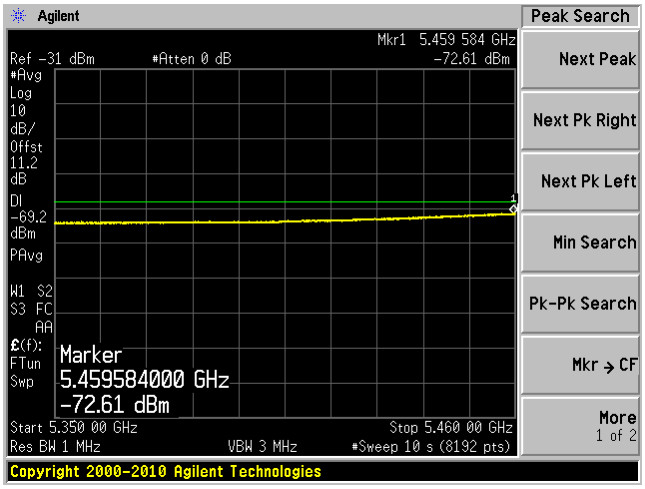


Chain J1

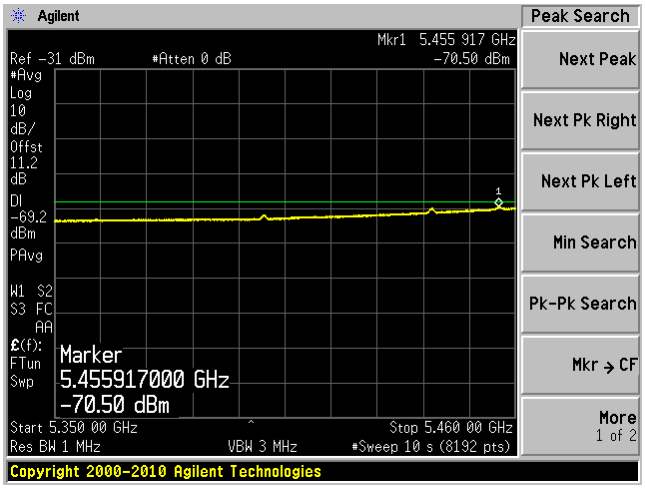


10 MHz mode, Low Channel 5745 MHz

Chain J0

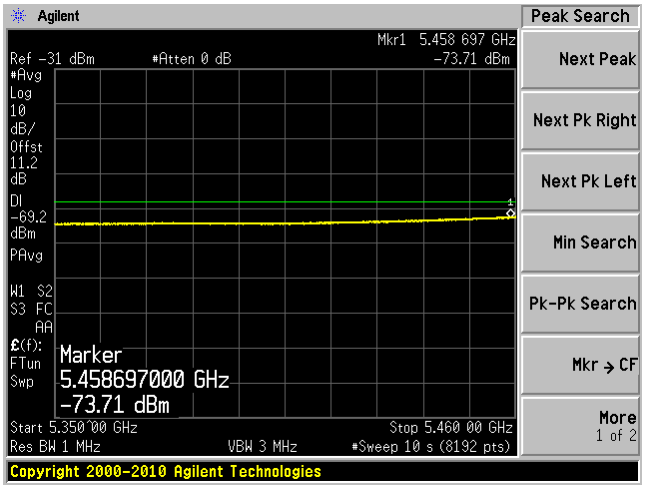


Chain J1

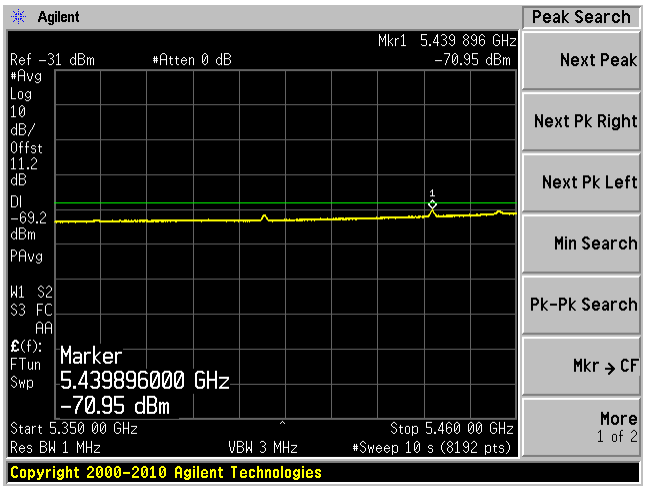


10 MHz mode, Middle Channel 5785 MHz

Chain J0

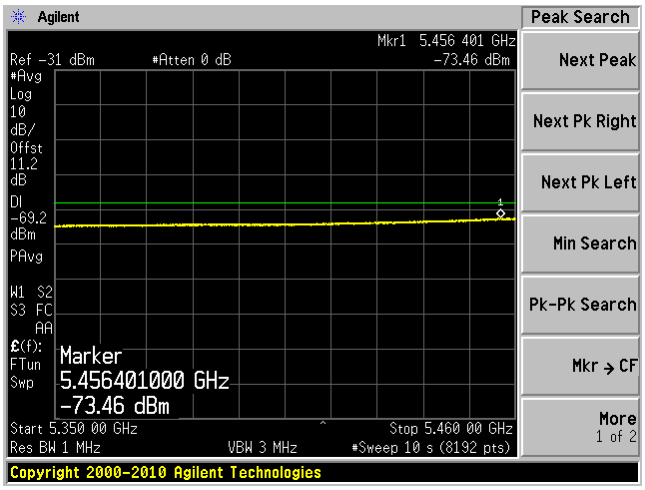


Chain J1

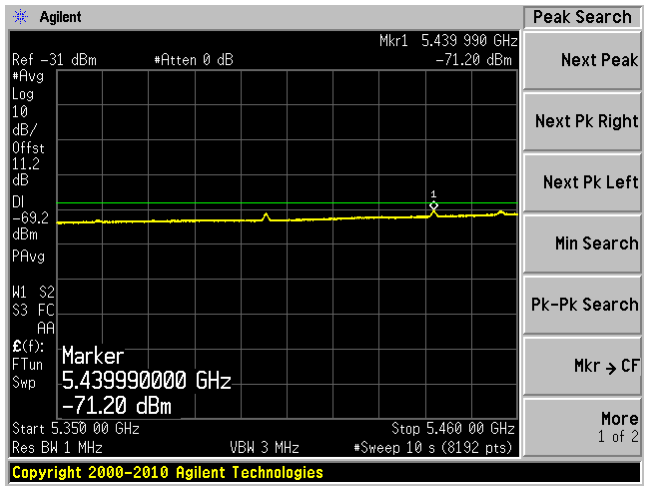


10 MHz mode, High Channel 5825 MHz

Chain J0

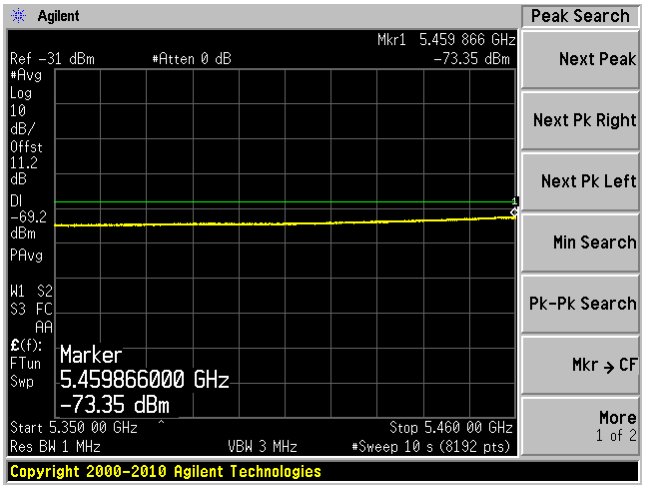


Chain J1

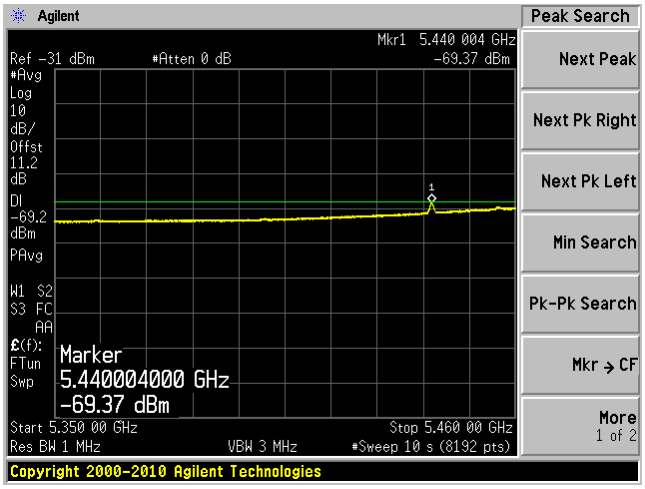


802.11a, Low Channel 5745 MHz

Chain J0

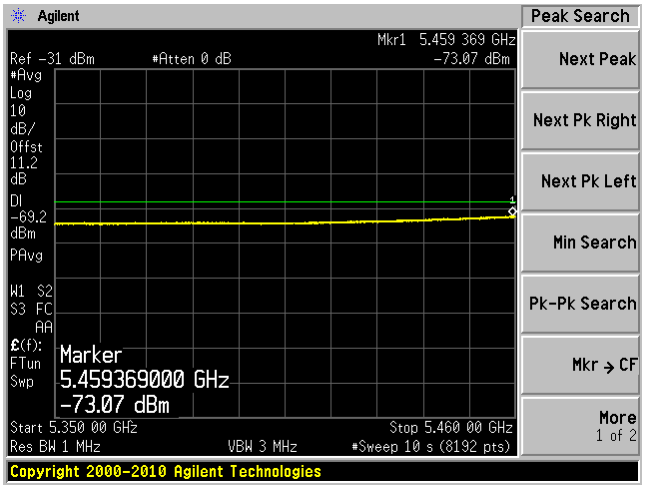


Chain J1

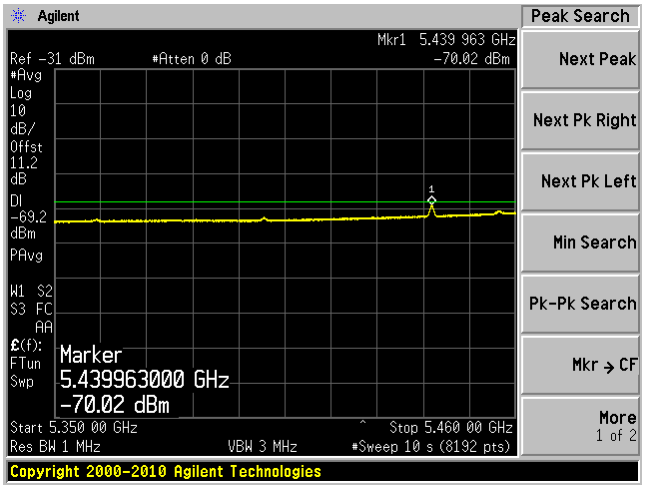


802.11a, Middle Channel 5785 MHz

Chain J0

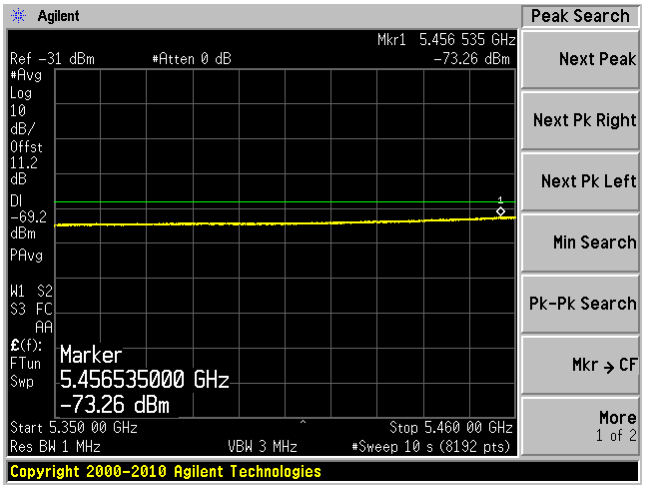


Chain J1

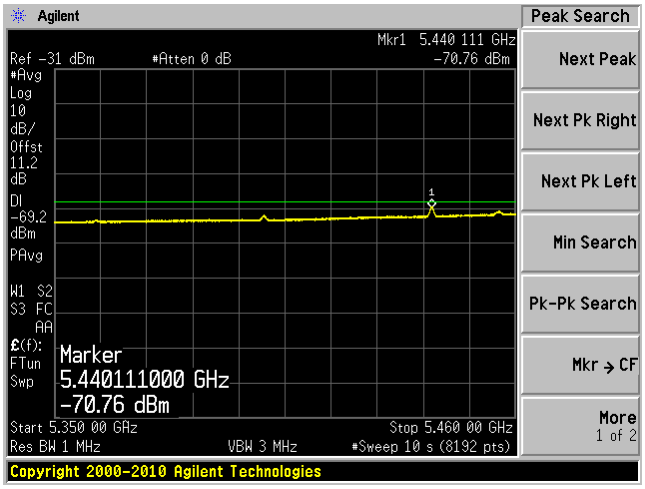


802.11a, High Channel 5825 MHz

Chain J0

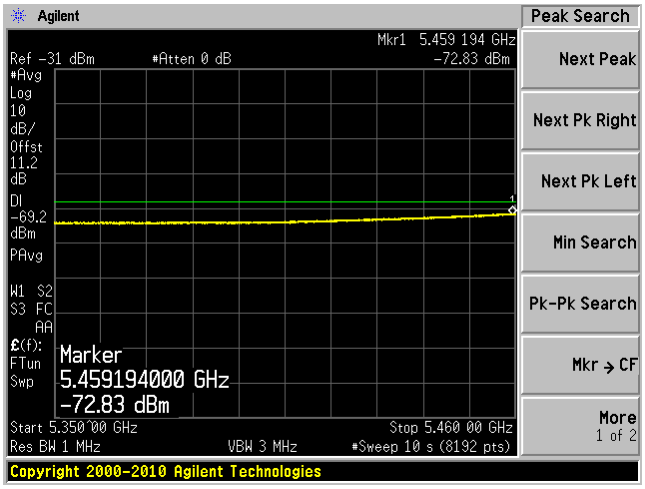


Chain J1

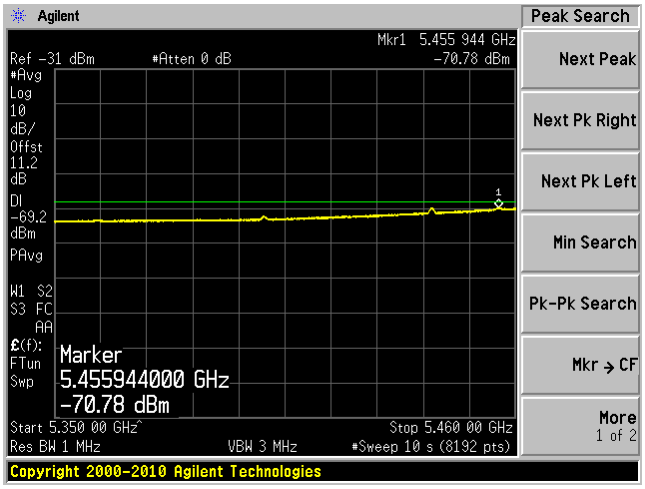


802.11n HT20, Low Channel 5745 MHz

Chain J0

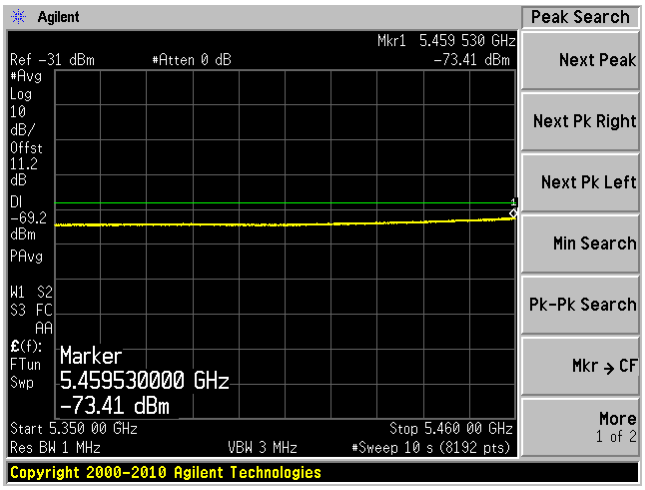


Chain J1

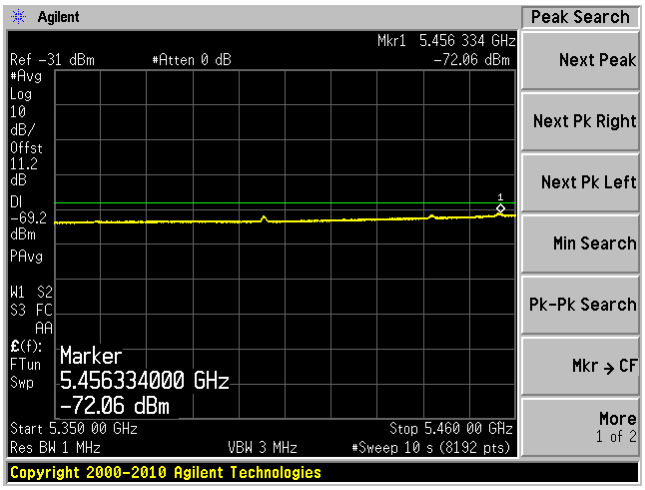


802.11n HT20, Middle Channel 5785 MHz

Chain J0

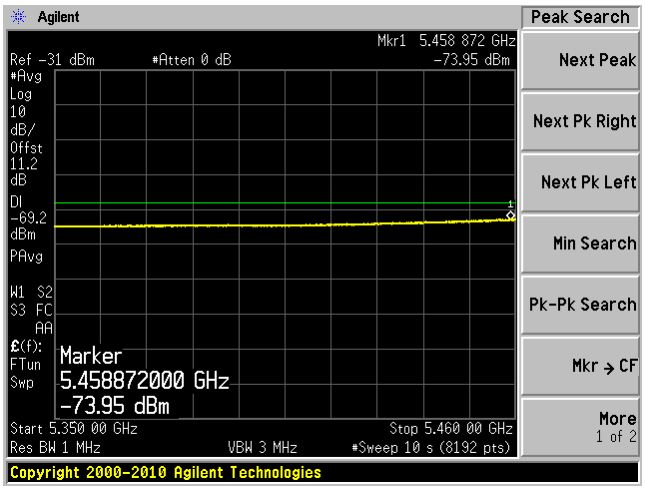


Chain J1

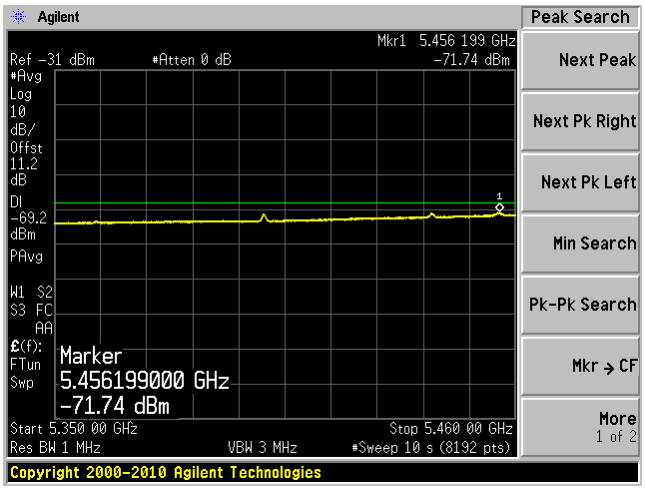


802.11n HT20, High Channel 5825 MHz

Chain J0

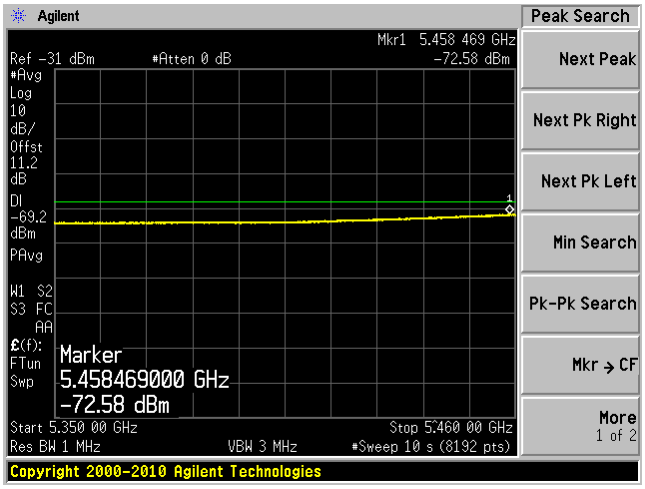


Chain J1

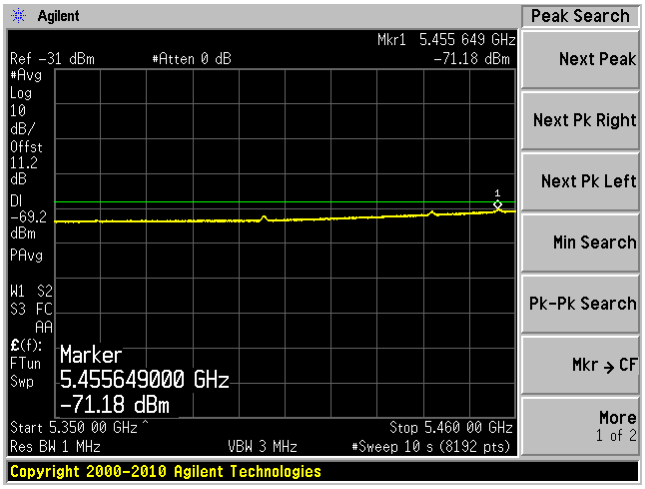


802.11n HT40, Low Channel 5755 MHz

Chain J0

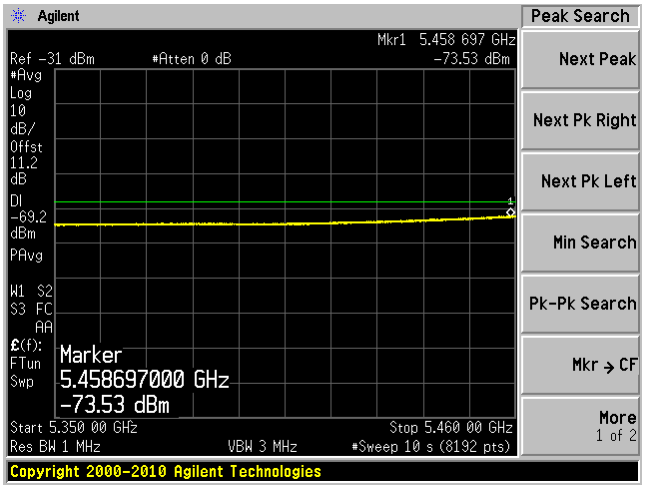


Chain J1

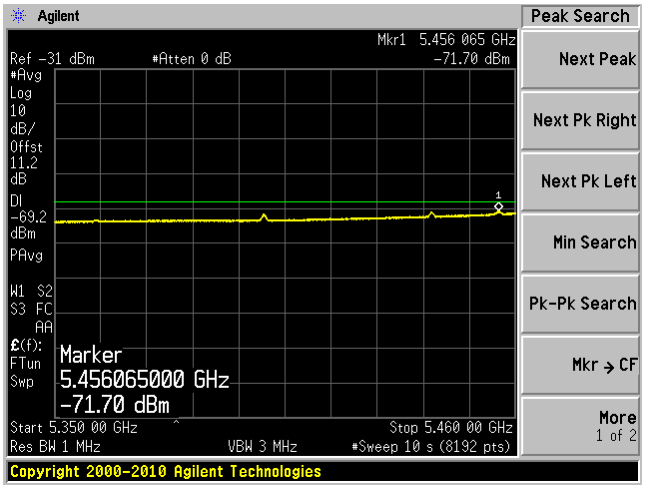


802.11n HT40, High Channel 5795 MHz

Chain J0



Chain J1



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

8.1 Applicable Standard

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

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

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

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

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

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

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

As per IC RSS-210 A8.5 Out-of-band Emissions, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

8.2 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 C and IC RSS-210 limits.

The spacing between the peripherals was 3 centimeters.

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

8.3 Test Procedure

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

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

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

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

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

Above 1000 MHz:

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

8.4 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

8.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 year
Agilent	Spectrum Analyzer	E4440A	US42221851	2013-03-05	1 year
EMCO	Horn Antenna	3115	9511-4627	2012-10-17	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2013-03-28	1 year

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

8.6 Test Environmental Conditions

Temperature:	21-24°C
Relative Humidity:	43-46%
ATM Pressure:	101-103kPa

The testing was performed by Jeffrey Wu from 2013-03-12 to 2013-05-07 at 5 meter 3.

8.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C and IC RSS-210 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**
-2.49	51.80575	Vertical	802.11a 20 MHz mode Low Channel

1-40 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-4.728	17475	Horizontal	801.11 a 20 MHz mode High Channel

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

Note: Termination method was used

8.8 Radiated Emissions Results

1) 30 MHz – 1 GHz, Measured at 3 meters

5 MHz mode, Low Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
32.66625	30.2	138	V	109	40	-9.80
42.1355	28.66	101	V	189	40	-11.34
400.0203	28.99	100	V	142	46	-17.01
108.796	25.44	135	V	228	43.5	-18.06
77.20325	17.49	139	H	360	40	-22.51
148.0953	20.49	242	V	209	43.5	-23.01

5 MHz mode, Middle Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
40.69775	29.44	179	V	36	40	-10.56
32.641	27.41	179	V	124	40	-12.59
108.8198	25.03	110	V	234	43.5	-18.47
233.4748	16.95	123	H	235	46	-29.05
607.0453	14.04	188	V	353	46	-31.96
600.4483	13.72	348	V	318	46	-32.28

5 MHz mode, High Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
41.13	30.81	100	V	351	40	-9.19
32.61125	28.16	127	V	203	40	-11.84
79.47525	26.78	278	V	25	40	-13.22
111.6118	28.05	100	V	203	43.5	-15.45
600.195	19.39	100	V	303	46	-26.61
280.1228	18.93	162	H	262	46	-27.07

10 MHz mode, Low Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
40.349	36.48	100	V	302	40	-3.52
32.66775	31.00	113	V	65	40	-9.00
108.794	22.47	172	V	170	43.5	-21.03
607.3268	14.32	361	V	324	46	-31.68
600.1938	14.12	156	V	360	46	-31.88
115.9843	9.03	322	V	169	43.5	-34.47

10 MHz mode, Middle Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
77.20925	33.03	276	V	319	40	-6.97
41.00225	29.12	103	V	330	40	-10.88
108.3588	26.51	116	V	201	43.5	-16.99
607.1293	14.34	208	V	154	46	-31.66
600.1948	14.24	225	V	332	46	-31.76
235.381	12.64	145	H	66	46	-33.36

10 MHz mode, High Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
32.3325	30.94	100	V	15	40	-9.06
40.991	28.56	100	V	269	40	-11.44
110.749	31.80	101	V	148	43.5	-11.70
174.949	29.83	105	V	47	43.5	-13.67
600.138	18.87	114	V	313	46	-27.13
606.9403	17.48	100	V	356	46	-28.52

802.11a mode, Low Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
51.80575	37.51	126	V	347	40	-2.49
74.5645	33.30	121	V	157	40	-6.70
77.20875	29.49	402	H	19	40	-10.51
106.699	32.92	100	V	250	43.5	-10.58
134.3748	29.01	100	V	0	43.5	-14.49
111.5665	27.25	100	V	81	43.5	-16.25

802.11a mode, Middle Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
51.834	36.11	102	V	252	40	-3.89
94.36725	37.38	107	V	281	43.5	-6.12
74.56575	33.45	104	V	146	40	-6.55
106.7033	33.61	106	V	320	43.5	-9.89
77.194	29.09	313	H	4	40	-10.91
134.3698	28.55	113	V	13	43.5	-14.95

802.11a mode, High Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
51.79775	36.9	129	V	348	40	-3.10
74.54825	35.99	100	V	30	40	-4.01
98.4435	36.27	100	V	182	43.5	-7.23
106.6923	33.45	107	V	308	43.5	-10.05
77.19825	29.28	240	H	10	40	-10.72
141.1838	28.26	135	V	330	43.5	-15.24

802.11n HT20 mode, Low Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
32.6205	37.12	120	V	126	40	-2.88
41.151	26.32	124	V	124	40	-13.68
108.8178	34.48	99	V	76	43.5	-9.02
148.092	25.32	194	H	266	43.5	-18.18
242.7443	18.6	178	H	300	46	-27.4
600.1618	18.92	100	V	327	46	-27.08

802.11n HT20 mode, Middle Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
32.5905	36.12	100	V	66	40	-3.88
40.8475	27.05	118	V	211	40	-12.95
108.8185	34.47	140	V	74	43.5	-9.03
174.9745	32.89	99	V	26	43.5	-10.61
244.3133	21.95	99	H	251	46	-24.05
600.0083	23.52	117	V	305	46	-22.48

802.11n HT20 mode, High Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
32.11475	31.24	147	V	73	40	-8.76
40.667	30.5	114	V	230	40	-9.50
108.8115	35.3	116	V	0	43.5	-8.20
281.805	17.25	129	H	24	46	-28.75
399.996	27.18	118	V	0	46	-18.82
600.2753	18.9	100	V	325	46	-27.10

802.11n HT40 mode, Low Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
51.81025	36.49	100	V	335	40	-3.51
74.5435	36.51	103	V	118	40	-3.49
76.55075	33.44	108	V	123	40	-6.56
94.13675	33.17	107	V	166	43.5	-10.33
104.7213	32.47	100	V	168	43.5	-11.03
142.678	28.31	103	V	358	43.5	-15.19

802.11n HT40 mode, High Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
51.81025	36.35	136	V	11	40	-3.65
74.56325	36.84	108	V	228	40	-3.16
76.55125	33.55	112	V	122	40	-6.45
98.4505	35.34	99	V	150	43.5	-8.16
111.6023	27.61	100	V	155	43.5	-15.89
141.1858	29.29	101	V	288	43.5	-14.21

2) 1–40 GHz, Measured at 3 meters

Note: all emissions were under the noise floor.

5 MHz Mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5745.5 MHz, measured at 3 meters											
11491	30.52	0	100	V	39.0	6.20	26.94	48.827	74	-25.173	Peak
11491	30.54	0	100	H	39.0	6.20	26.94	48.847	74	-25.153	Peak
11491	15.87	0	100	V	39.0	6.20	26.94	34.177	54	-19.823	Ave
11491	16.16	0	100	H	39.0	6.20	26.94	34.467	54	-19.533	Ave
17236.5	31.27	0	100	V	44.1	8.31	25.9	57.733	74	-16.267	Peak
17236.5	31.6	0	100	H	44.1	8.31	25.9	58.063	74	-15.937	Peak
17236.5	16.98	0	100	V	44.1	8.31	25.9	43.443	54	-10.557	Ave
17236.5	16.96	0	100	H	44.1	8.31	25.9	43.423	54	-10.577	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 5785.5 MHz, measured at 3 meters											
11571	30.93	0	100	V	39.2	6.20	27.0	49.343	74	-24.657	Peak
11571	30.22	0	100	H	39.2	6.20	27.0	48.633	74	-25.367	Peak
11571	16.05	0	100	V	39.2	6.20	27.0	34.463	54	-19.537	Ave
11571	15.942	0	100	H	39.2	6.20	27.0	34.355	54	-19.645	Ave
17356.5	32.41	0	100	V	45.3	8.49	25.9	60.351	74	-13.649	Peak
17356.5	31.7	0	100	H	45.3	8.49	25.9	59.641	74	-14.359	Peak
17356.5	18.19	0	100	V	45.3	8.49	25.9	46.131	54	-7.869	Ave
17356.5	18.09	0	100	H	45.3	8.49	25.9	46.031	54	-7.969	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 5825.5 MHz, measured at 3 meters											
11651	31.12	0	100	V	39.3	6.20	27.0	49.634	74	-24.366	Peak
11651	31.81	0	100	H	39.3	6.20	27.0	50.324	74	-23.676	Peak
11651	16	0	100	V	39.3	6.20	27.0	34.514	54	-19.486	Ave
11651	16.29	0	100	H	39.3	6.20	27.0	34.804	54	-19.196	Ave
17476.5	31.38	0	100	H	46.8	8.49	25.7	60.922	74	-13.078	Peak
17476.5	32.24	0	100	V	46.8	8.49	25.7	61.782	74	-12.218	Peak
17476.5	15.98	0	100	H	46.8	8.49	25.7	45.522	54	-8.478	Ave
17476.5	15.98	0	100	V	46.8	8.49	25.7	45.522	54	-8.478	Ave

10 MHz Mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5745 MHz, measured at 3 meters											
11490	33.56	0	100	V	39.0	6.20	26.94	51.867	74	-22.133	Peak
11490	32.4	0	100	H	39.0	6.20	26.94	50.707	74	-23.293	Peak
11490	16.11	0	100	V	39.0	6.20	26.94	34.417	54	-19.583	Ave
11490	16.21	0	100	H	39.0	6.20	26.94	34.517	54	-19.483	Ave
17235	31.39	0	100	V	44.1	8.31	25.9	57.853	74	-16.147	Peak
17235	31.25	0	100	H	44.1	8.31	25.9	57.713	74	-16.287	Peak
17235	17.01	0	100	V	44.1	8.31	25.9	43.473	54	-10.527	Ave
17235	17.04	0	100	H	44.1	8.31	25.9	43.503	54	-10.497	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 5785 MHz, measured at 3 meters											
11570	31.42	0	100	V	39.2	6.20	27.0	49.833	74	-24.167	Peak
11570	31.67	0	100	H	39.2	6.20	27.0	50.083	74	-23.917	Peak
11570	17.06	0	100	V	39.2	6.20	27.0	35.473	54	-18.527	Ave
11570	17.04	0	100	H	39.2	6.20	27.0	35.453	54	-18.547	Ave
17355	31.58	0	100	V	45.3	8.49	25.9	59.521	74	-14.479	Peak
17355	31.38	0	100	H	45.3	8.49	25.9	59.321	74	-14.679	Peak
17355	17.664	0	100	V	45.3	8.49	25.9	45.605	54	-8.395	Ave
17355	16.53	0	100	H	45.3	8.49	25.9	44.471	54	-9.529	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 5825 MHz, measured at 3 meters											
11650	31.76	0	100	V	39.3	6.20	27.0	50.274	74	-23.726	Peak
11650	31.84	0	100	H	39.3	6.20	27.0	50.354	74	-23.646	Peak
11650	17.96	0	100	V	39.3	6.20	27.0	36.474	54	-17.526	Ave
11650	16.51	0	100	H	39.3	6.20	27.0	35.024	54	-18.976	Ave
17475	30.8	0	100	H	46.8	8.49	25.7	60.342	74	-13.658	Peak
17475	31.25	0	100	V	46.8	8.49	25.7	60.792	74	-13.208	Peak
17475	16.27	0	100	H	46.8	8.49	25.7	45.812	54	-8.188	Ave
17475	16.27	0	100	V	46.8	8.49	25.7	45.812	54	-8.188	Ave

802.11a Mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5745 MHz, measured at 3 meters											
11490	33.84	0	100	V	39.0	6.20	26.94	52.147	74	-21.853	Peak
11490	33.27	0	100	H	39.0	6.20	26.94	51.577	74	-22.423	Peak
11490	18.55	0	100	V	39.0	6.20	26.94	36.857	54	-17.143	Ave
11490	17.95	0	100	H	39.0	6.20	26.94	36.257	54	-17.743	Ave
17235	37.38	0	100	V	44.1	8.31	25.9	63.843	74	-10.157	Peak
17235	37.02	0	100	H	44.1	8.31	25.9	63.483	74	-10.517	Peak
17235	21.32	0	100	V	44.1	8.31	25.9	47.783	54	-6.217	Ave
17235	21.35	0	100	H	44.1	8.31	25.9	47.813	54	-6.187	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 5785 MHz, measured at 3 meters											
11570	34.29	0	100	V	39.2	6.20	27.0	52.703	74	-21.297	Peak
11570	33.03	0	100	H	39.2	6.20	27.0	51.443	74	-22.557	Peak
11570	17.62	0	100	V	39.2	6.20	27.0	36.033	54	-17.967	Ave
11570	17.59	0	100	H	39.2	6.20	27.0	36.003	54	-17.997	Ave
17355	36.68	0	100	V	45.3	8.49	25.9	64.621	74	-9.379	Peak
17355	36.44	0	100	H	45.3	8.49	25.9	64.381	74	-9.619	Peak
17355	20.81	0	100	V	45.3	8.49	25.9	48.751	54	-5.249	Ave
17355	20.82	0	100	H	45.3	8.49	25.9	48.761	54	-5.239	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 5825 MHz, measured at 3 meters											
11650	33	0	100	V	39.3	6.20	27.0	51.514	74	-22.486	Peak
11650	32.67	0	100	H	39.3	6.20	27.0	51.184	74	-22.816	Peak
11650	17.37	0	100	V	39.3	6.20	27.0	35.884	54	-18.116	Ave
11650	17.47	0	100	H	39.3	6.20	27.0	35.984	54	-18.016	Ave
17475	34.95	0	100	H	46.8	8.49	25.7	64.492	74	-9.508	Peak
17475	35.23	0	100	V	46.8	8.49	25.7	64.772	74	-9.228	Peak
17475	19.73	0	100	H	46.8	8.49	25.7	49.272	54	-4.728	Ave
17475	19.71	0	100	V	46.8	8.49	25.7	49.252	54	-4.748	Ave

802.11n HT20 Mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5745 MHz, measured at 3 meters											
11490	32.4	0	100	V	39.0	6.20	26.94	50.707	74	-23.293	Peak
11490	30.97	0	100	H	39.0	6.20	26.94	49.277	74	-24.723	Peak
11490	16.14	0	100	V	39.0	6.20	26.94	34.447	54	-19.553	Ave
11490	16.012	0	100	H	39.0	6.20	26.94	34.319	54	-19.681	Ave
17235	31.77	0	100	V	44.1	8.31	25.9	58.233	74	-15.767	Peak
17235	31.85	0	100	H	44.1	8.31	25.9	58.313	74	-15.687	Peak
17235	17.084	0	100	V	44.1	8.31	25.9	43.547	54	-10.453	Ave
17235	17.05	0	100	H	44.1	8.31	25.9	43.513	54	-10.487	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Middle Channel 5785 MHz, measured at 3 meters											
11570	33.51	0	100	V	39.2	6.20	27.0	51.923	74	-22.077	Peak
11570	31.95	0	100	H	39.2	6.20	27.0	50.363	74	-23.637	Peak
11570	16.81	0	100	V	39.2	6.20	27.0	35.223	54	-18.777	Ave
11570	16.42	0	100	H	39.2	6.20	27.0	34.833	54	-19.167	Ave
17355	31.48	0	100	V	45.3	8.49	25.9	59.421	74	-14.579	Peak
17355	31.55	0	100	H	45.3	8.49	25.9	59.491	74	-14.509	Peak
17355	16.47	0	100	V	45.3	8.49	25.9	44.411	54	-9.589	Ave
17355	16.53	0	100	H	45.3	8.49	25.9	44.471	54	-9.529	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 5825 MHz, measured at 3 meters											
11650	32.93	0	100	V	39.3	6.20	27.0	51.444	74	-22.556	Peak
11650	31.19	0	100	H	39.3	6.20	27.0	49.704	74	-24.296	Peak
11650	16.57	0	100	V	39.3	6.20	27.0	35.084	54	-18.916	Ave
11650	16.42	0	100	H	39.3	6.20	27.0	34.934	54	-19.066	Ave
17475	31.03	0	100	V	46.8	8.49	25.7	60.572	74	-13.428	Peak
17475	30.98	0	100	H	46.8	8.49	25.7	60.522	74	-13.478	Peak
17475	16.31	0	100	V	46.8	8.49	25.7	45.852	54	-8.148	Ave
17475	16.29	0	100	H	46.8	8.49	25.7	45.832	54	-8.168	Ave

802.11n HT40 Mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5755 MHz, measured at 3 meters											
11510	33.66	0	100	V	39.0	6.20	26.99	51.917	74	-22.083	Peak
11510	32.8	0	100	H	39.0	6.20	26.99	51.057	74	-22.943	Peak
11510	18.91	0	100	V	39.0	6.20	26.99	37.167	54	-16.833	Ave
11510	18.88	0	100	H	39.0	6.20	26.99	37.137	54	-16.863	Ave
17265	37.54	0	100	V	44.1	8.49	25.9	64.183	74	-9.817	Peak
17265	37.47	0	100	H	44.1	8.49	25.9	64.113	74	-9.887	Peak
17265	22.35	0	100	V	44.1	8.49	25.9	48.993	54	-5.007	Ave
17265	22.31	0	100	H	44.1	8.49	25.9	48.953	54	-5.047	Ave

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 5795 MHz, measured at 3 meters											
11590	33.45	0	100	V	39.2	6.20	27.0	51.864	74	-22.136	Peak
11590	33.12	0	100	H	39.2	6.20	27.0	51.534	74	-22.466	Peak
11590	17.54	0	100	V	39.2	6.20	27.0	35.954	54	-18.046	Ave
11590	17.65	0	100	H	39.2	6.20	27.0	36.064	54	-17.936	Ave
17385	35.11	0	100	V	45.3	8.49	25.8	63.081	74	-10.919	Peak
17385	36.23	0	100	H	45.3	8.49	25.8	64.201	74	-9.799	Peak
17385	20.84	0	100	V	45.3	8.49	25.8	48.811	54	-5.189	Ave
17385	20.86	0	100	H	45.3	8.49	25.8	48.831	54	-5.169	Ave

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

9.1 Applicable Standard

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

9.2 Measurement Procedure

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

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-10-16	1 year

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

9.4 Test Environmental Conditions

Temperature:	21-22 °C
Relative Humidity:	34-38 %
ATM Pressure:	101-102kPa

The testing was performed by Jeffrey Wu from 2013-03-11 to 2013-05-06 at RF site.

9.5 Test Results

Please refer to the following tables and plots.

5 MHz mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz) J0	6 dB Emission Bandwidth (MHz) J1	99% Emission Bandwidth (MHz) J0	99% Emission Bandwidth (MHz) J1	Limit (MHz)	Results
Low	5745.5	4.2112	4.1803	4.130	4.125	> 0.5	Compliant
Middle	5785.5	4.2448	4.1617	4.145	4.126	> 0.5	Compliant
High	5825.5	4.2362	4.1611	4.149	4.127	> 0.5	Compliant

10 MHz mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz) J0	6 dB Emission Bandwidth (MHz) J1	99% Emission Bandwidth (MHz) J0	99% Emission Bandwidth (MHz) J1	Limit (MHz)	Results
Low	5745	8.2224	8.1958	8.237	8.218	> 0.5	Compliant
Middle	5785	8.2995	8.2336	8.241	8.250	> 0.5	Compliant
High	5825	8.2792	8.1982	8.248	8.204	> 0.5	Compliant

802.11a mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz) J0	6 dB Emission Bandwidth (MHz) J1	99% Emission Bandwidth (MHz) J0	99% Emission Bandwidth (MHz) J1	Limit (MHz)	Results
Low	5745	16.5429	16.4960	16.485	16.507	> 0.5	Compliant
Middle	5785	16.6022	16.5165	16.509	16.487	> 0.5	Compliant
High	5825	16.6119	16.5244	16.551	16.515	> 0.5	Compliant

802.11n HT20 mode:

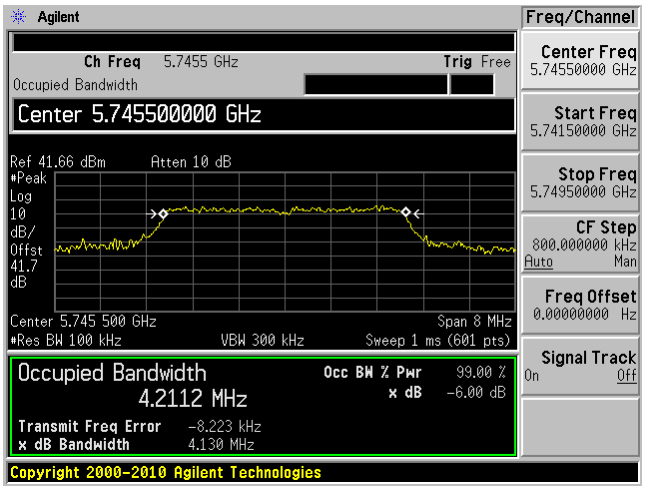
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz) J0	6 dB Emission Bandwidth (MHz) J1	99% Emission Bandwidth (MHz) J0	99% Emission Bandwidth (MHz) J1	Limit (MHz)	Results
Low	5745	17.6914	17.6423	17.721	17.704	> 0.5	Compliant
Middle	5785	17.7339	17.7168	17.725	17.699	> 0.5	Compliant
High	5825	17.7756	17.7169	17.765	17.720	> 0.5	Compliant

802.11n HT40 mode:

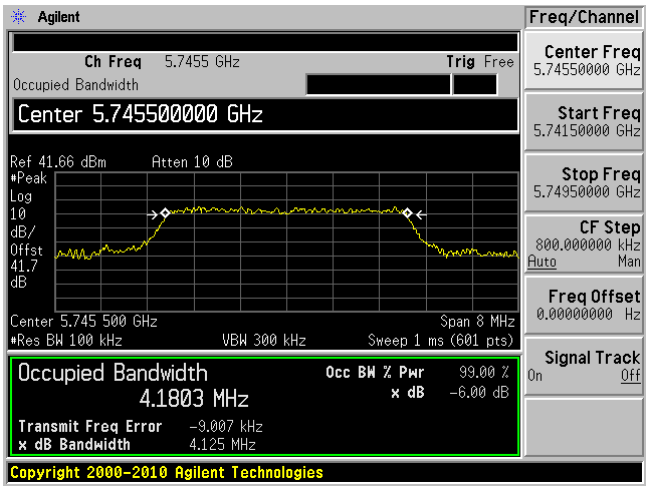
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz) J0	6 dB Emission Bandwidth (MHz) J1	99% Emission Bandwidth (MHz) J0	99% Emission Bandwidth (MHz) J1	Limit (MHz)	Results
Low	5755	36.6236	36.4982	36.294	36.001	> 0.5	Compliant
High	5795	36.7297	36.5868	36.332	36.408	> 0.5	Compliant

5 MHz mode

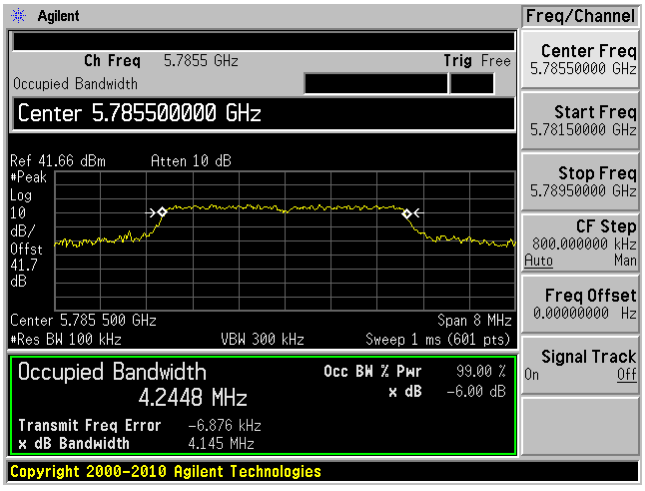
Low channel: 5745.5 MHz Chain J0



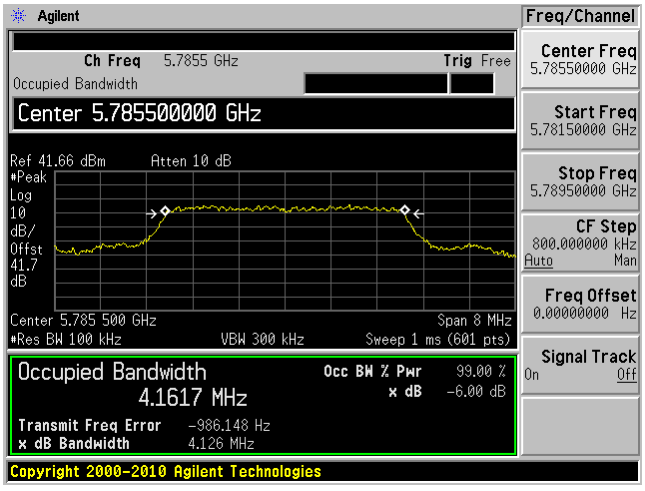
Low channel: 5745.5 MHz Chain J1



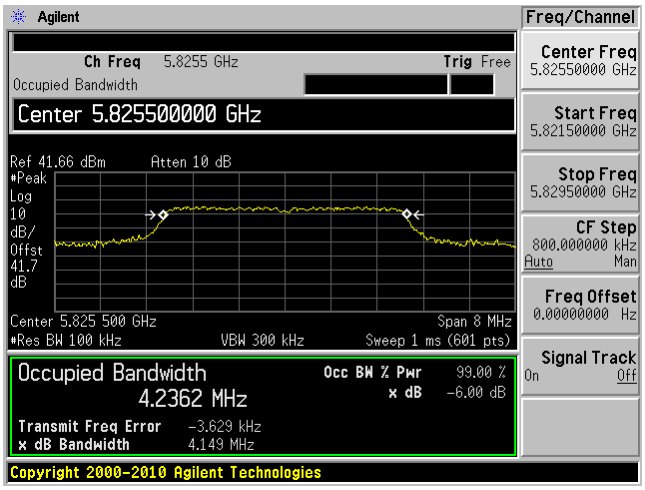
Middle channel: 5785.5 MHz Chain J0



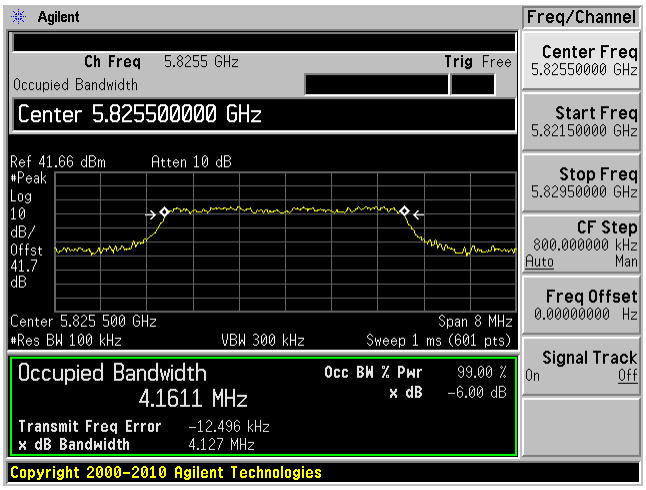
Middle channel: 5785.5 MHz Chain J1



High channel: 5825.5 MHz Chain J0

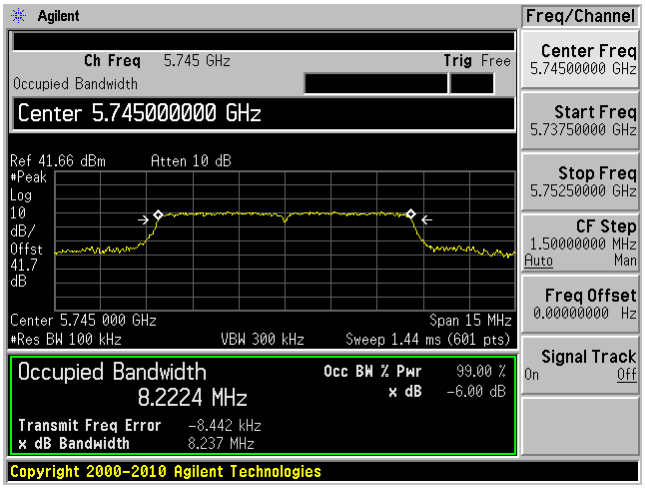


High channel: 5825.5 MHz Chain J1

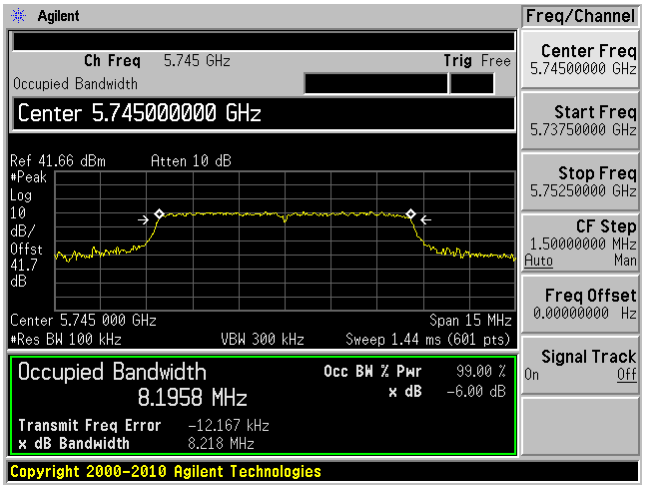


10 MHz mode

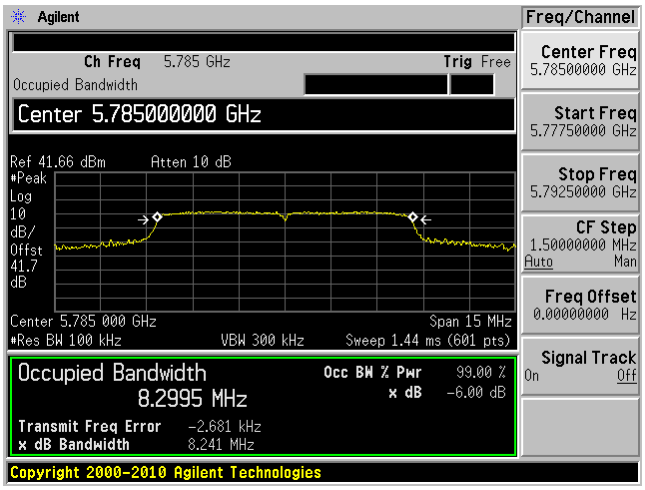
Low channel: 5745 MHz Chain J0



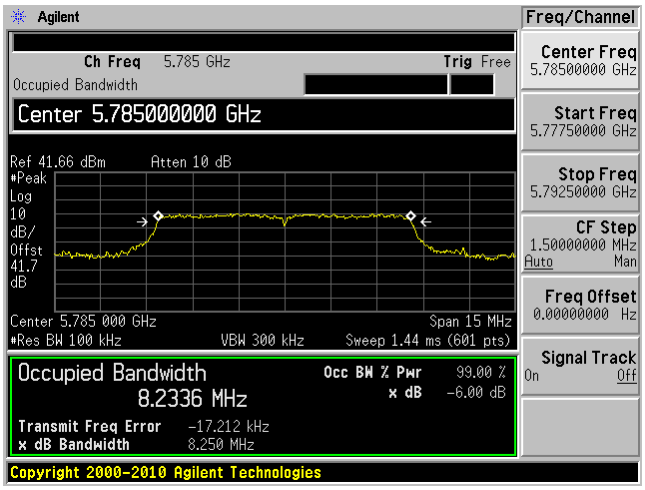
Low channel: 5745 MHz Chain J1



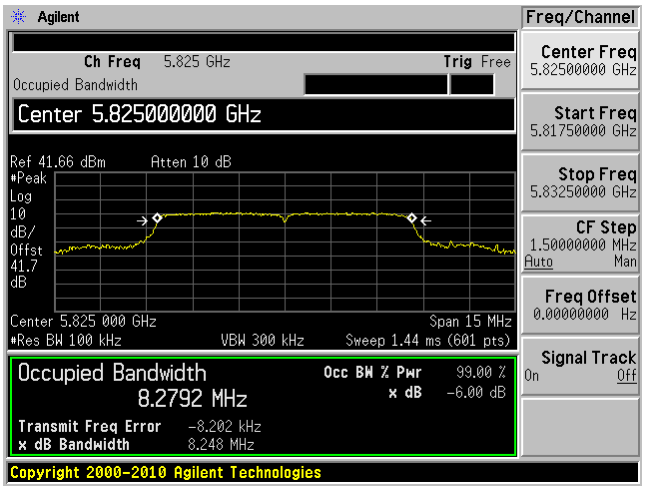
Middle channel: 5785 MHz Chain J0



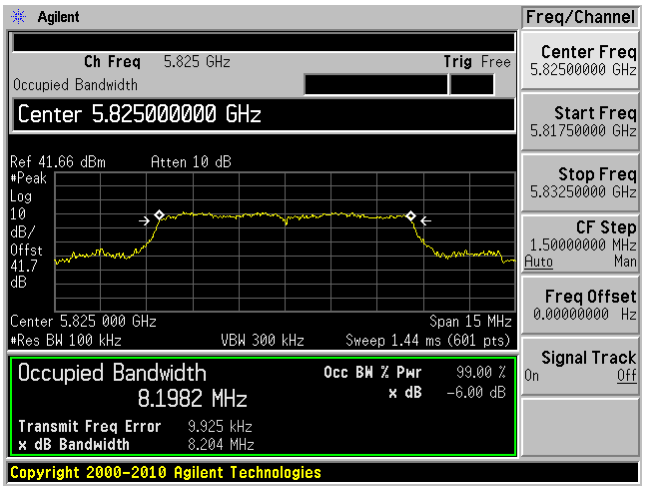
Middle channel: 5785 MHz Chain J1



High channel: 5785 MHz Chain J0

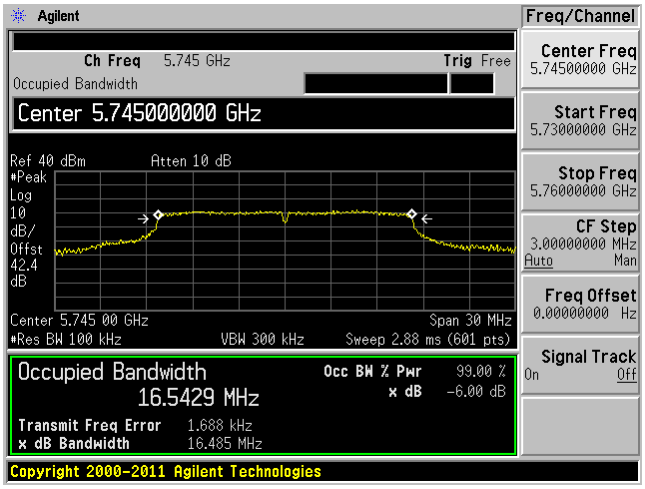


High channel: 5785 MHz Chain J1

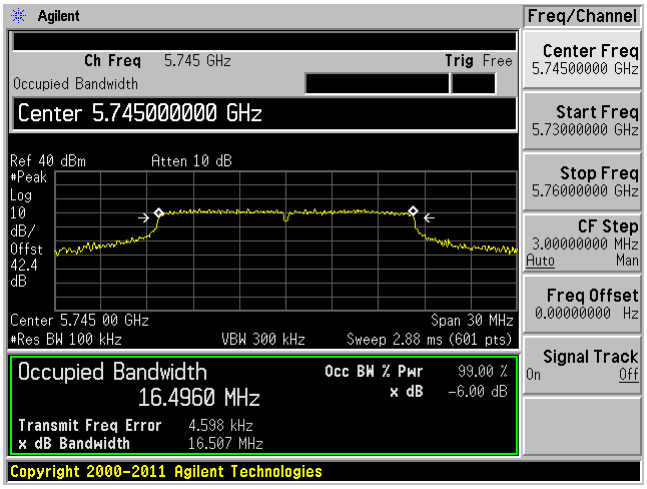


802.11a mode

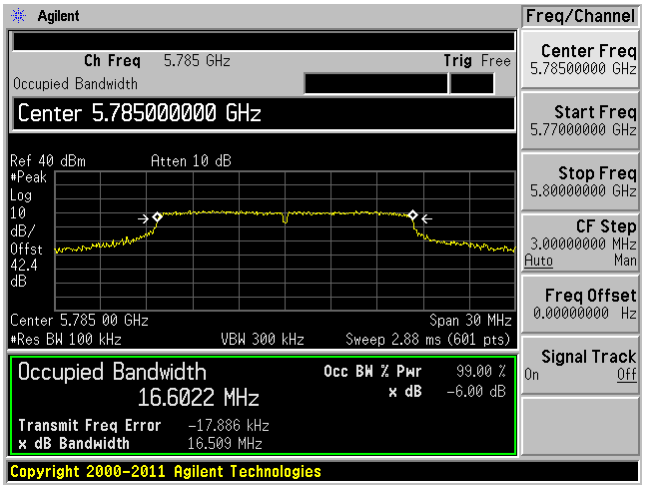
Low channel: 5745 MHz Chain J0



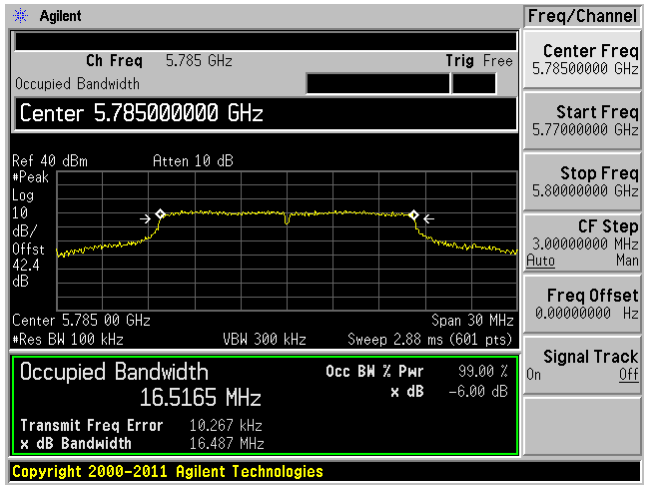
Low channel: 5745 MHz Chain J1



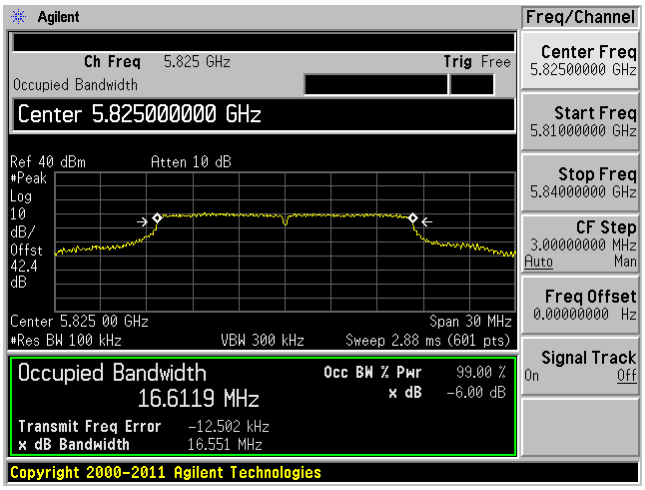
Middle channel: 5785 MHz Chain J0



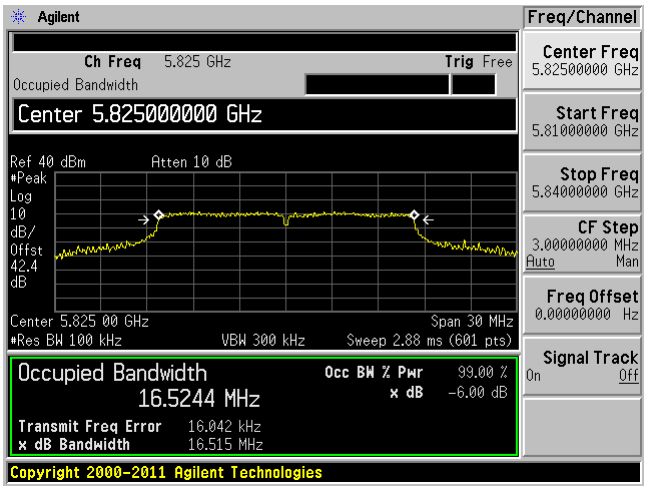
Middle channel: 5785 MHz Chain J1



High channel: 5825 MHz Chain J0

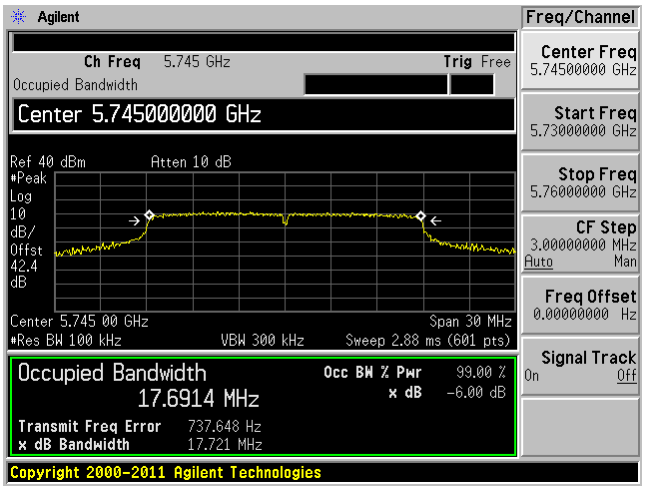


High channel: 5825 MHz Chain J1

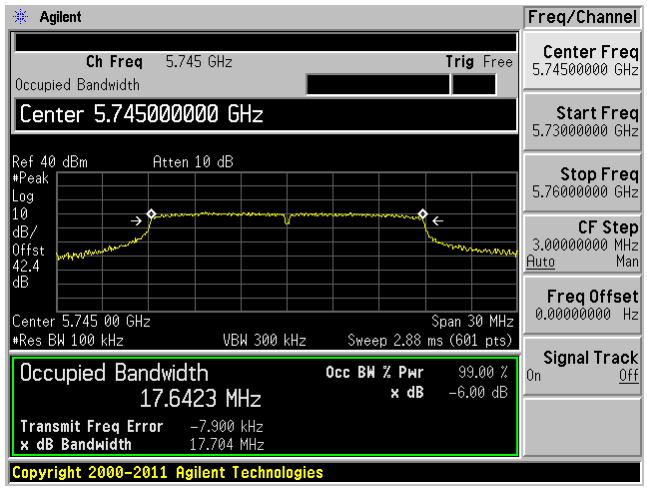


802.11n HT20 mode

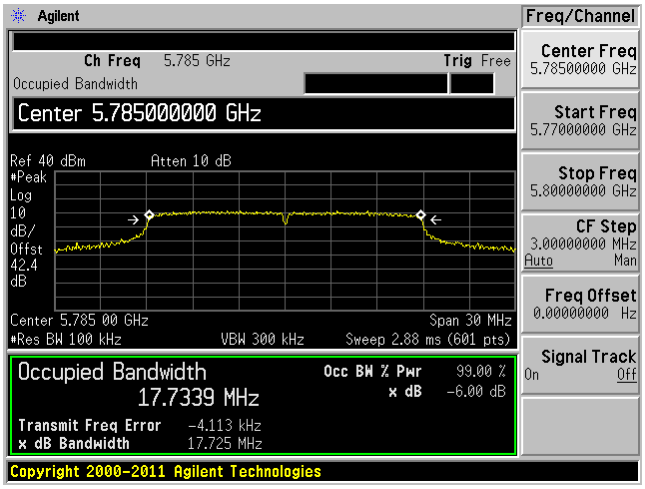
Low channel: 5745 MHz Chain J0



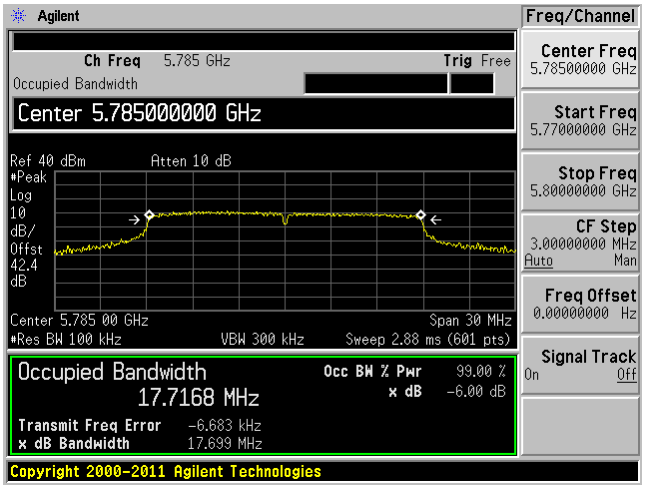
Low channel: 5745 MHz Chain J1



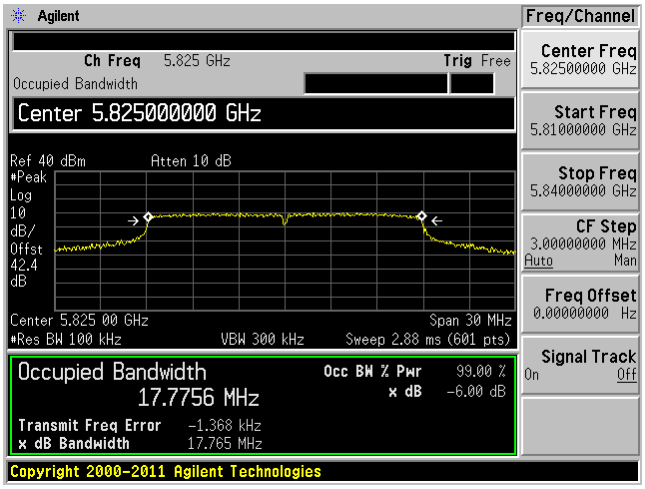
Middle channel: 5785 MHz Chain J0



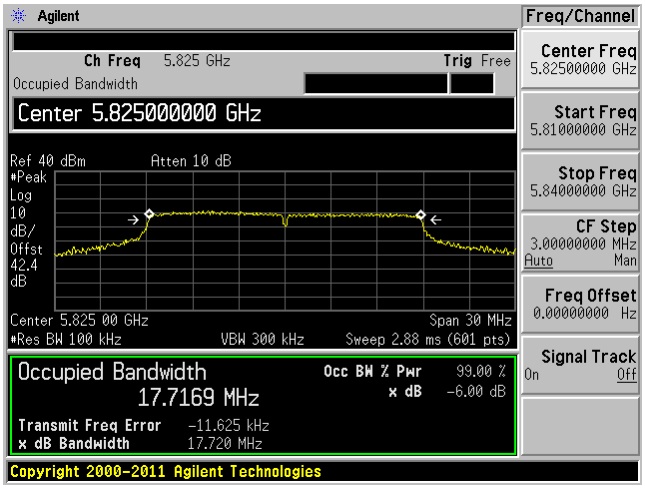
Middle channel: 5785 MHz Chain J1



High channel: 5825 MHz Chain J0

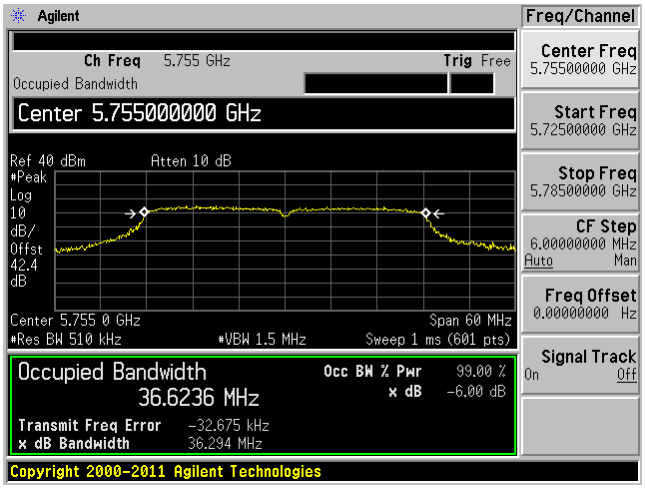


High channel: 5825 MHz Chain J1

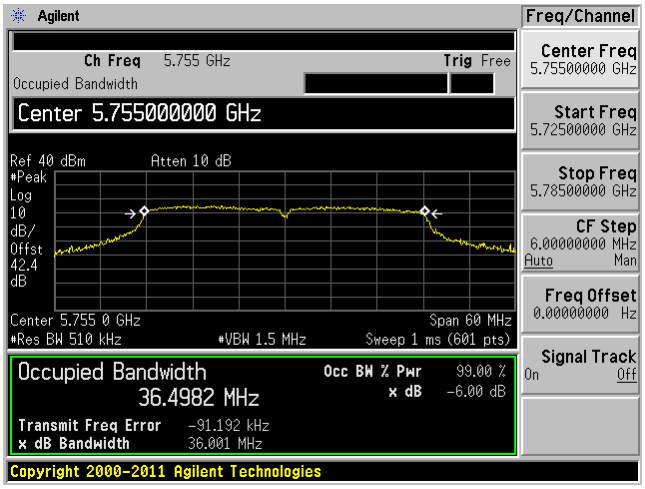


802.11n HT40 mode

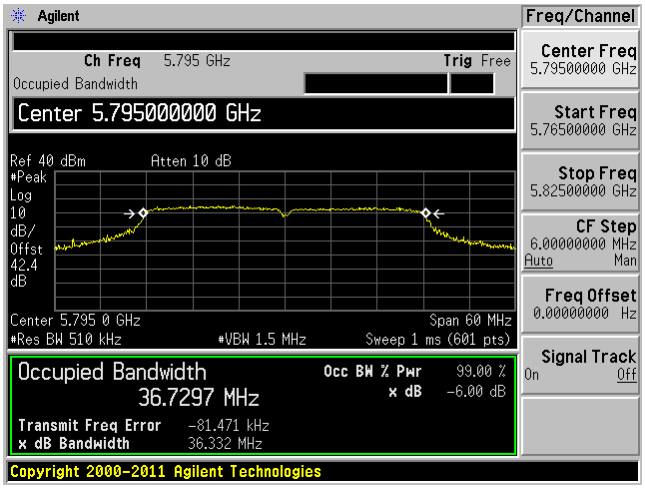
Low channel: 5755 MHz Chain J0



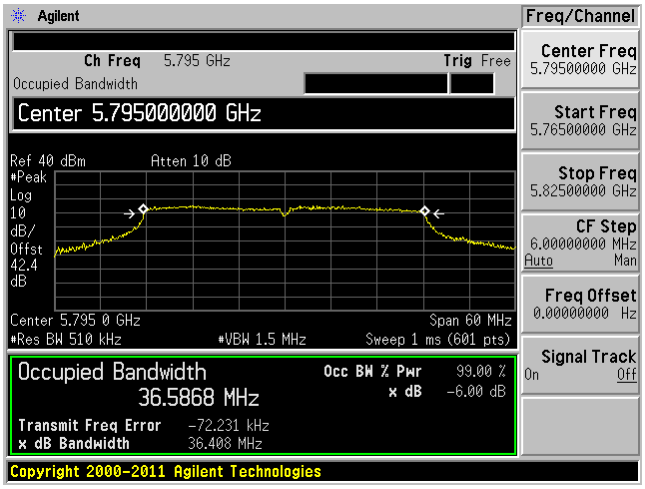
Low channel: 5755 MHz Chain J1



High channel: 5795 MHz Chain J0



High channel: 5795 MHz Chain J1



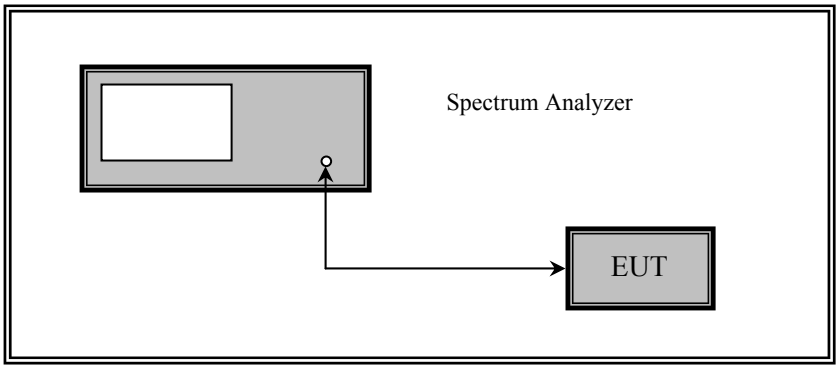
10 FCC §15.247(b) & IC RSS-210 §A8.4 – Peak Output Power Measurement

10.1 Applicable Standard

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

10.2 Measurement Procedure

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



10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-10-16	1 year

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

10.4 Test Environmental Conditions

Temperature:	21-22 °C
Relative Humidity:	34-38 %
ATM Pressure:	101-102kPa

The testing was performed by Jeffrey Wu from 2013-03-11 to 2013-05-06 at RF site.

10.5 Test Results

Point to Point with 9 dBi and 28 dBi Antennas (effective gain)

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
5 MHz mode						
Low	5745.5	24.85	24.99	27.93	30	-2.07
Middle	5785.5	24.99	24.55	27.79	30	-2.21
High	5825.5	24.93	24.53	27.74	30	-2.26
10 MHz mode						
Low	5745	24.55	24.67	27.62	30	-2.38
Middle	5785	25.02	24.78	27.91	30	-2.09
High	5825	25.00	24.55	27.79	30	-2.21
802.11a mode						
Low	5745	24.66	24.43	27.56	30	-2.44
Middle	5785	24.93	24.52	27.74	30	-2.26
High	5825	24.13	24.64	27.40	30	-2.60
802.11n HT20 mode						
Low	5745	24.59	24.67	27.64	30	-2.36
Middle	5785	25.01	24.39	27.72	30	-2.28
High	5825	24.08	24.35	27.23	30	-2.77
802.11n HT40 mode						
Low	5755	24.31	24.21	27.27	30	-2.73
High	5795	24.52	24.26	27.40	30	-2.60

Note: For point to point operation, the effective antenna gain (actual gain + cable loss) is controlled equal to or below 9 dBi and 28 dBi, and ensures the unit complies with local regulations. Since the FCC 15.247 regulations states that systems operating in the 5725-5850 MHz band that are used exclusive for fixed, point-to point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power. In this case, the peak output power limit is 30 dBm. The product will be installed by professional and sets proper output power with antennas with different gain to meet local regulations.

Point to Multiple Point with 9 dBi Antenna (effective gain)

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
5 MHz mode						
Low	5745.5	23.55	23.39	26.48	27	-0.52
Middle	5785.5	23.39	24.09	26.76	27	-0.24
High	5825.5	23.67	23.24	26.47	27	-0.53
10 MHz mode						
Low	5745	23.22	23.2	26.22	27	-0.78
Middle	5785	23.52	22.10	25.88	27	-1.12
High	5825	23.57	22.82	26.22	27	-0.78
802.11a mode						
Low	5745	23.06	23.2	26.14	27	-0.86
Middle	5785	23.62	23.01	26.34	27	-0.66
High	5825	23.48	22.90	26.21	27	-0.79
802.11n HT20 mode						
Low	5745	23.37	23.28	26.34	27	-0.66
Middle	5785	23.52	22.30	25.96	27	-1.04
High	5825	23.61	22.79	26.23	27	-0.77
802.11n HT40 mode						
Low	5755	23.05	22.97	26.02	27	-0.98
High	5795	23.68	23.17	26.44	27	-0.56

Note: Product operates under point to multiple point condition with 9 dBi effective gain antenna; the power limit should not exceed 27 dBm. Since the 9 dBi effective gain antenna exceeds 6 dBi by 3 dBi, thus, the power should be reduced by 3 dBm. Therefore, the peak output power limit is 27 dBm. The product will be installed by professional and sets proper output power with antennas with different gain to meet local regulations.

Point to Multiple Point with 28 dBi antenna (maximum effective gain)

Channel	Frequency (MHz)	TX Chain J0 Power (dBm)	TX Chain J1 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
5 MHz mode						
Low	5745.5	4.36	4.65	7.52	8	-0.48
Middle	5785.5	4.98	4.54	7.78	8	-0.22
High	5825.5	5.23	3.70	7.54	8	-0.46
10 MHz mode						
Low	5745	4.2	4.55	7.39	8	-0.61
Middle	5785	4.76	4.30	7.55	8	-0.45
High	5825	5.29	3.83	7.63	8	-0.37
802.11a mode						
Low	5745	4.3	4.68	7.50	8	-0.50
Middle	5785	4.97	4.61	7.80	8	-0.20
High	5825	5.26	3.80	7.60	8	-0.40
802.11n HT20 mode						
Low	5745	4.6	4.95	7.79	8	-0.21
Middle	5785	4.65	4.51	7.59	8	-0.41
High	5825	5.14	3.61	7.45	8	-0.55
802.11n HT40 mode						
Low	5755	4.58	5.15	7.88	8	-0.12
High	5795	4.61	4.06	7.35	8	-0.65

Note: Product operates under point to multiple point condition with 28 dBi effective gain antenna; the power limit should not exceed 8 dBm. Since the 28 dBi effective gain antenna exceeds 6 dBi by 22 dBi, thus, the power should be reduced by 22 dBm. Therefore, the peak output power limit is 8 dBm. The product will be installed by professional and sets proper output power with antennas with different gain to meet local regulations.

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

11.1 Applicable Standard

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

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

11.2 Measurement Procedure

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

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-10-16	1 year

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

11.4 Test Environmental Conditions

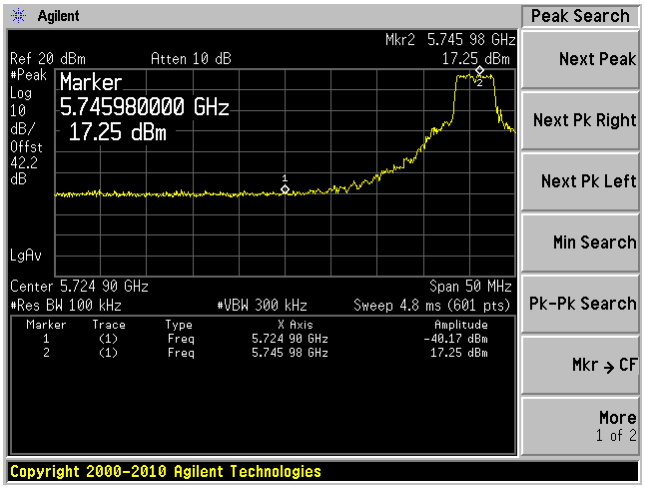
Temperature:	21-22 °C
Relative Humidity:	34-38 %
ATM Pressure:	101-102kPa

The testing was performed by Jeffrey Wu from 2013-03-11 to 2013-05-10 at RF site.

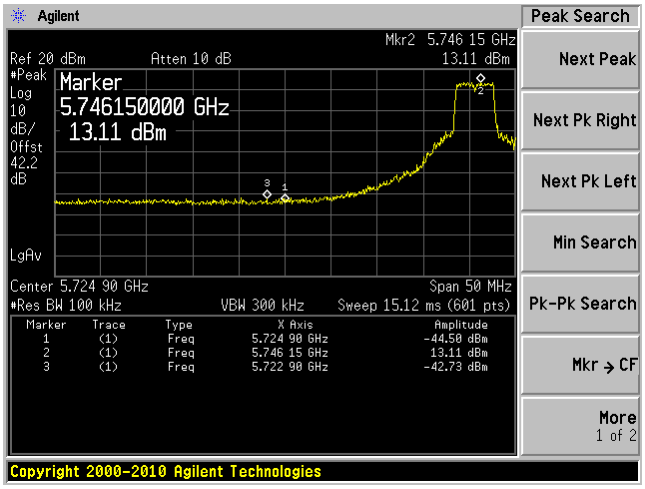
11.5 Test Results

Please refer to following pages for plots of band edge.

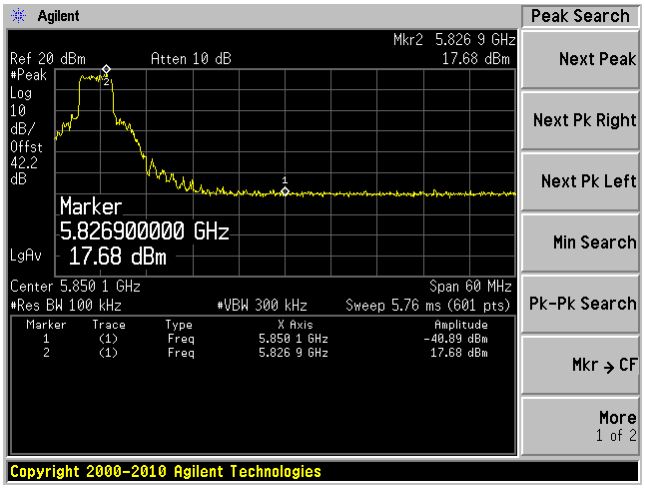
5 MHz mode, Chain J0 Low Band Edge



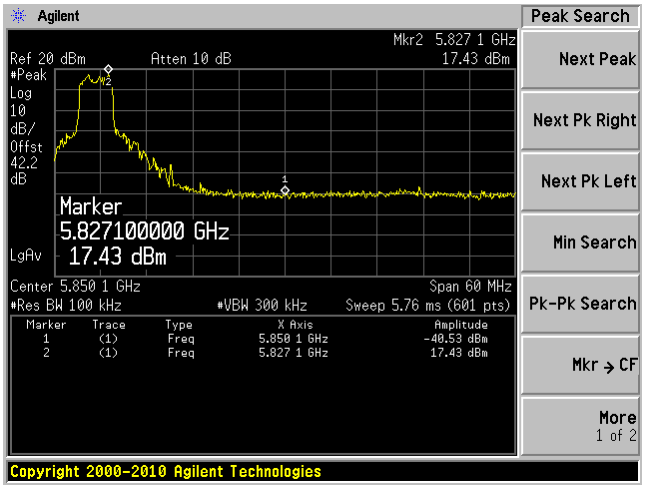
5 MHz mode, Chain J1 Low Band Edge



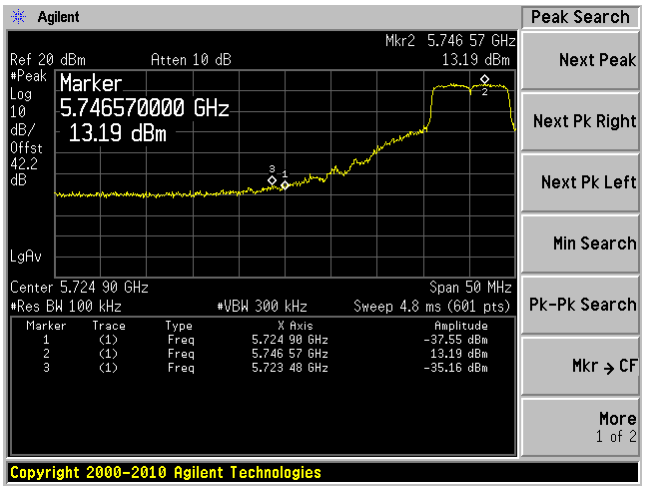
5 MHz mode, Chain J0 High Band Edge



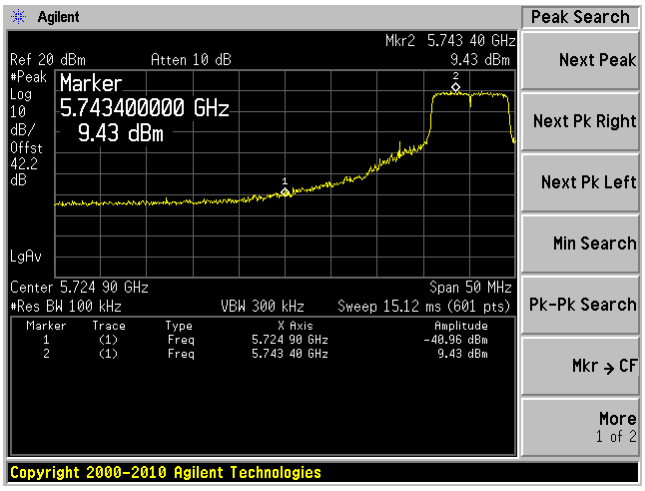
5 MHz mode, Chain J1 High Band Edge



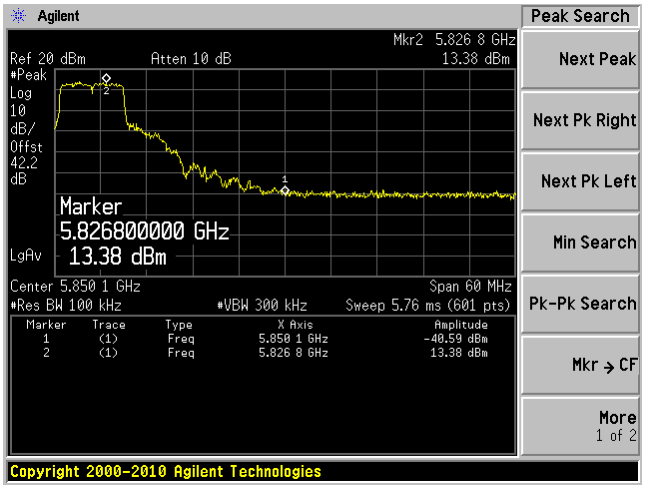
10 MHz mode, Chain J0 Low Band Edge



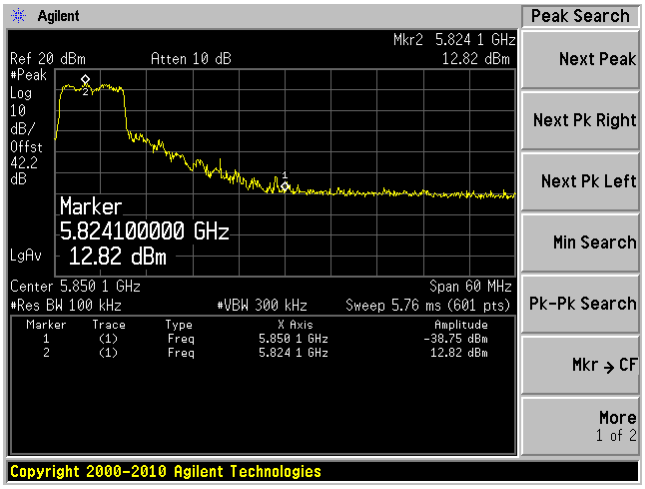
10 MHz mode, Chain J1 Low Band Edge



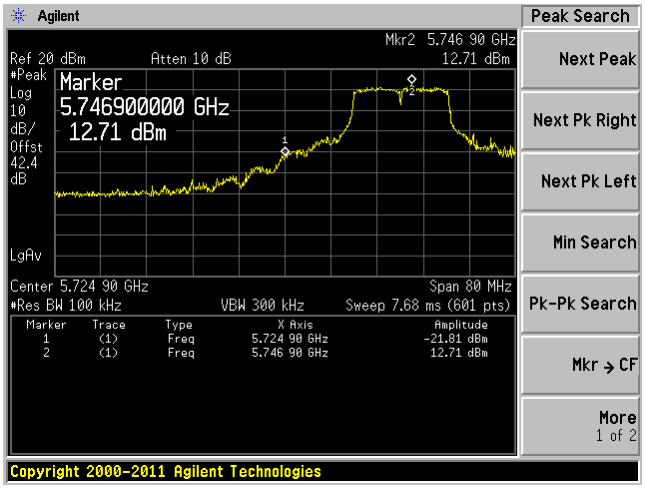
10 MHz mode, Chain J0 High Band Edge



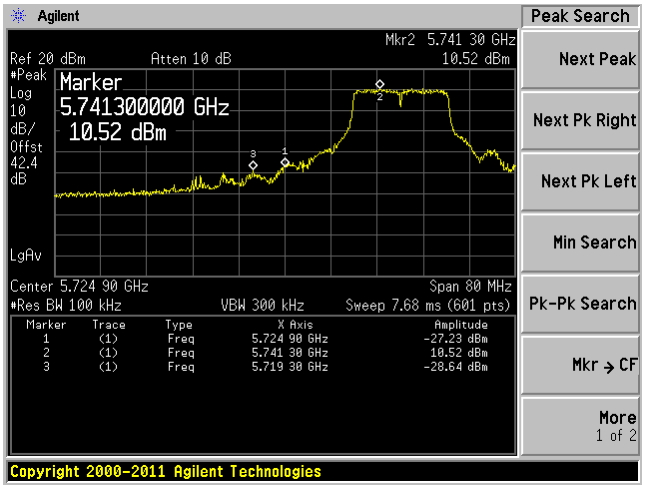
10 MHz mode, Chain J1 High Band Edge



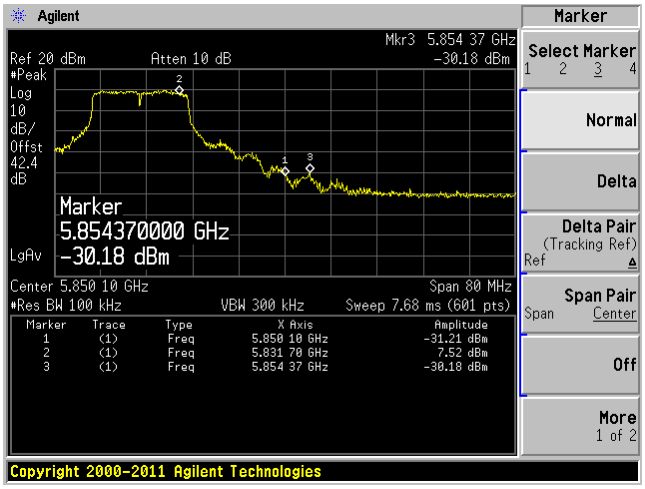
802.11a, Chain J0 Low Band Edge



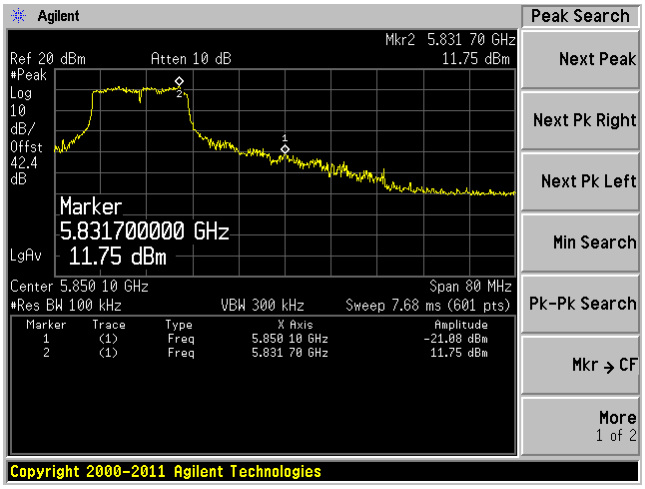
802.11a, Chain J1 Low Band Edge



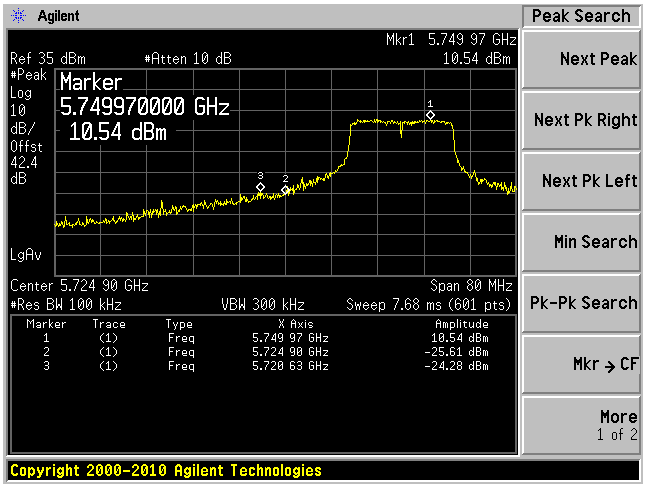
802.11a, Chain J0 High Band Edge



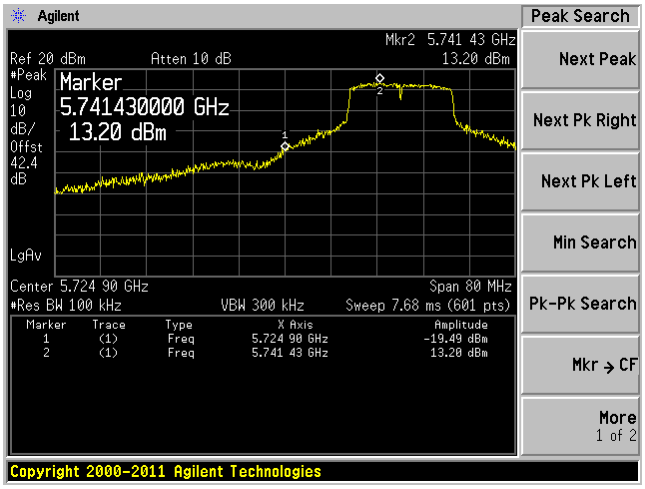
802.11a, Chain J1 High Band Edge



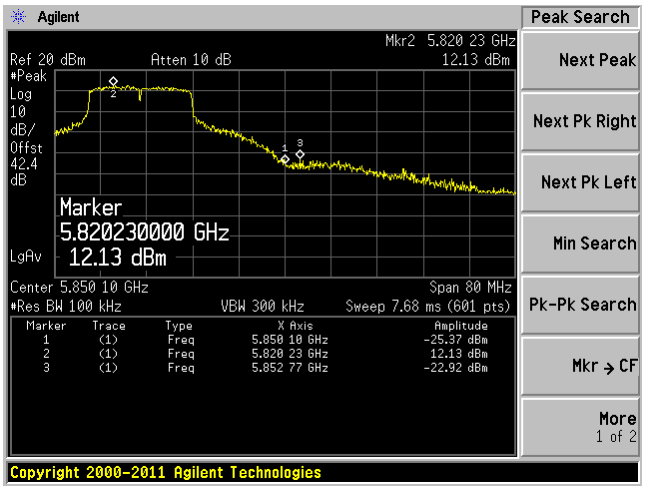
802.11n HT20, Chain J0 Low Band Edge



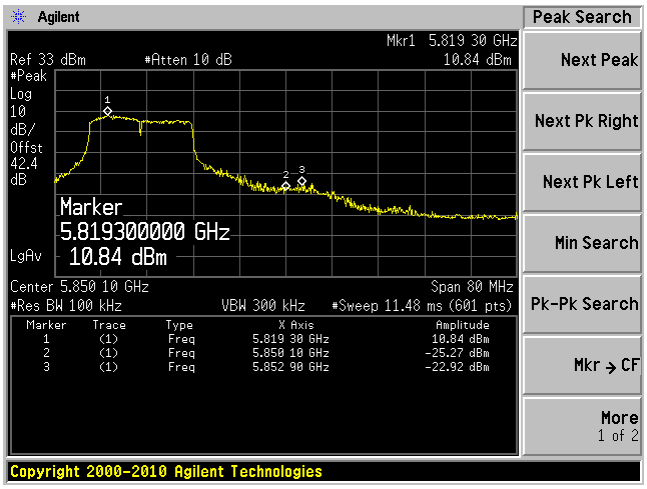
802.11n HT20, Chain J1 Low Band Edge



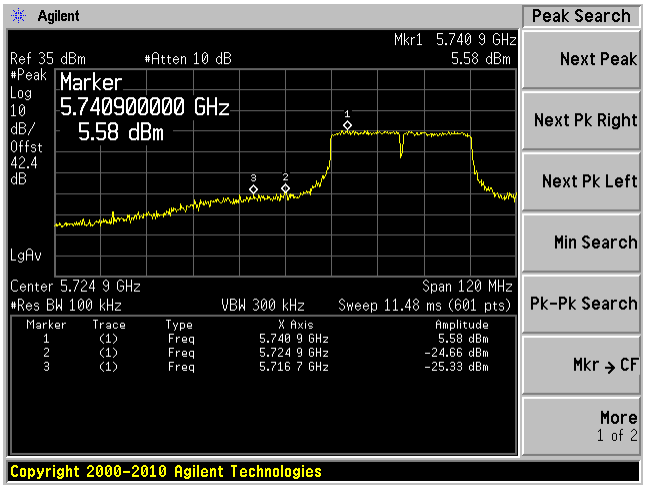
802.11n HT20, Chain J0 High Band Edge



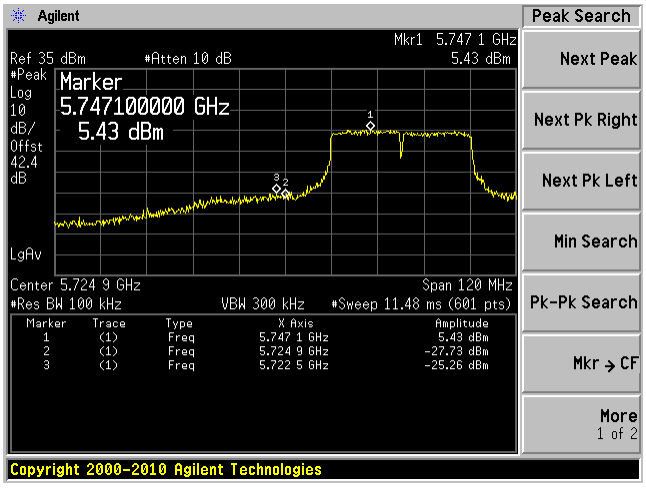
802.11n HT20, Chain J1 High Band Edge



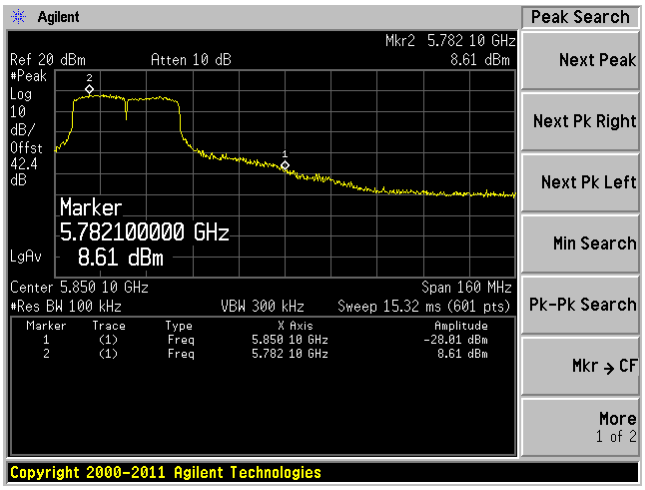
802.11n HT40, Chain J0 Low Band Edge



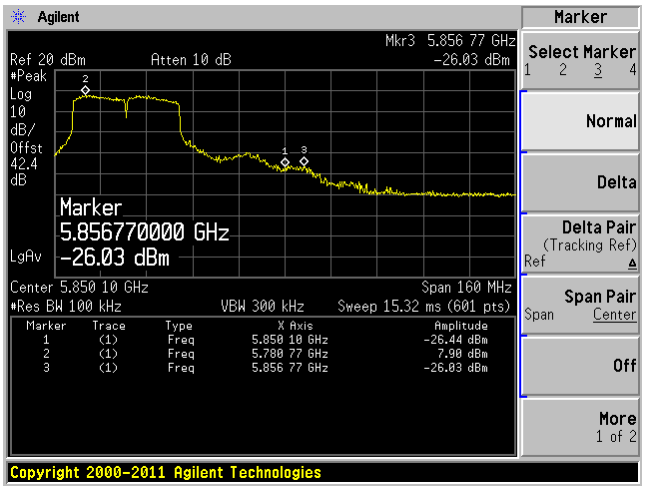
802.11n HT40, Chain J1 Low Band Edge



802.11n HT40, Chain J0 High Band Edge



802.11n HT40, Chain J1 High Band Edge



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

12.1 Applicable Standard

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

12.2 Measurement Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 3 kHz to 100Khz
3. Set the VBW ≥ 3X RBW.
4. Set the span to 1.5 times the DTS bandwidth
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level within the RBW
10. The resulting peak PSD level must be ≤ 8 dBm.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2012-10-16	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:	21-22 °C
Relative Humidity:	34-38 %
ATM Pressure:	101-102kPa

The testing was performed by Jeffrey Wu from 2013-03-11 to 2013-05-06 at RF site.

12.5 Test Results

** Note: For point to point operation, the effective antenna gain (actual gain + cable loss) is controlled below 9 dBi and 28 dBi, and ensures the unit complies with local regulations. Since the FCC 15.247 regulations states that systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power. In this case, the peak power spectral density limit is 8 dBm.

For point to point operation, the effective antenna gain (actual gain + cable loss) is controlled below 9 dBi and 28 dBi, and ensures the unit complies with local regulations. Since the FCC 15.247 regulations state that systems operating in the 5725-5850 MHz band if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the international radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In this case, the peak power spectral density limit is -14 dBm for 28 dBi effective gain antenna, and 5 dBm for 9 dBi effective gain antenna. The product will be installed by professional and sets proper output power with antennas with different gain to meet local regulations.

Note: the limit was adjusted using the PTMP mode (worst case)

Low Power Setting

Channel	Frequency (MHz)	TX Chain J0 PSD (dBm)	TX Chain J1 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
5 MHz mode						
Low	5745.5	-17.01	-17.46	-14.22	-14	-0.22
Middle	5785.5	-17.05	-17.18	-14.10	-14	-0.10
High	5825.5	-17.24	-17.5	-14.36	-14	-0.36
10 MHz mode						
Low	5745	-17.63	-17.83	-14.72	-14	-0.72
Middle	5785	-17.44	-17.51	-14.46	-14	-0.46
High	5825	-17.18	-17.2	-14.18	-14	-0.18
802.11a mode						
Low	5745	-19.73	-19.93	-16.82	-14	-2.82
Middle	5785	-19.04	-19.01	-16.01	-14	-2.01
High	5825	-19.89	-18.73	-16.26	-14	-2.26
802.11n HT20 mode						
Low	5745	-20.34	-20.16	-17.24	-14	-3.24
Middle	5785	-18.96	-18.6	-15.77	-14	-1.77
High	5825	-18.61	-19.25	-15.91	-14	-1.91
802.11n HT40 mode						
Low	5755	-23.65	-23.26	-20.44	-14	-6.44
High	5795	-22.39	-22.56	-19.46	-14	-5.46

High Power Setting

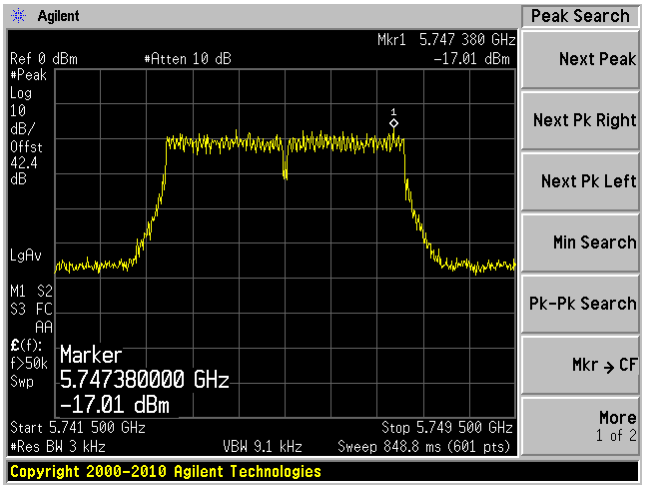
Channel	Frequency (MHz)	TX Chain J0 PSD (dBm)	TX Chain J1 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
5 MHz mode						
Low	5745.5	1.61	1.61	4.62	5	-0.38
Middle	5785.5	2.03	1.63	4.84	5	-0.16
High	5825.5	1.77	1.92	4.86	5	-0.14
10 MHz mode						
Low	5745	1.62	2.00	4.82	5	-0.18
Middle	5785	1.86	1.86	4.87	5	-0.13
High	5825	1.92	1.77	4.86	5	-0.14
802.11a mode						
Low	5745	0.02	-0.61	2.73	5	-2.27
Middle	5785	-0.22	-0.14	2.83	5	-2.17
High	5825	-0.15	0.83	3.38	5	-1.62
802.11n HT20 mode						
Low	5745	-1.52	-1.3	1.60	5	-3.4
Middle	5785	1.43	1.38	4.42	5	-0.58
High	5825	-0.98	0.28	2.71	5	-2.29
802.11n HT40 mode						
Low	5755	-3.72	-3.06	-0.37	5	-5.37
High	5795	-3.13	-2.79	0.05	5	-4.95

Please refer to the following plots for detailed test results:

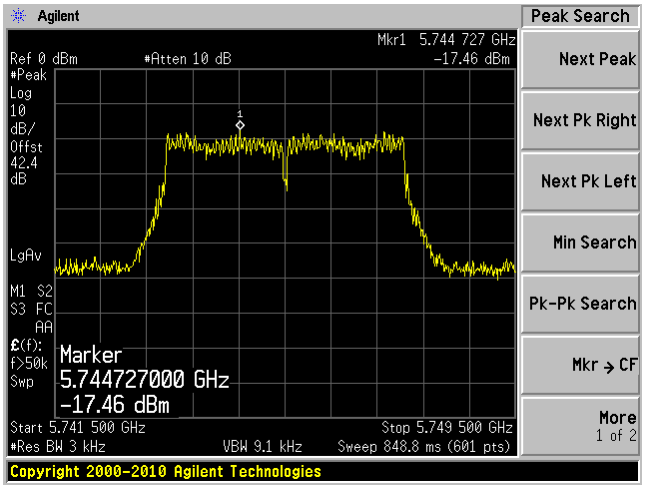
Low Power Setting

5MHz mode

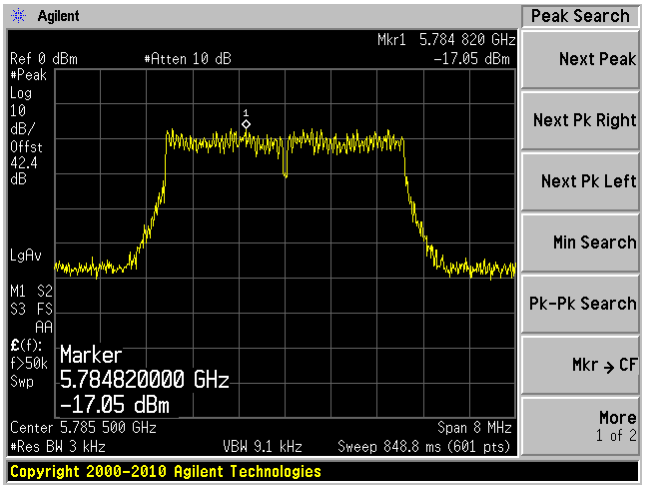
Low channel J0: 5745.5 MHz



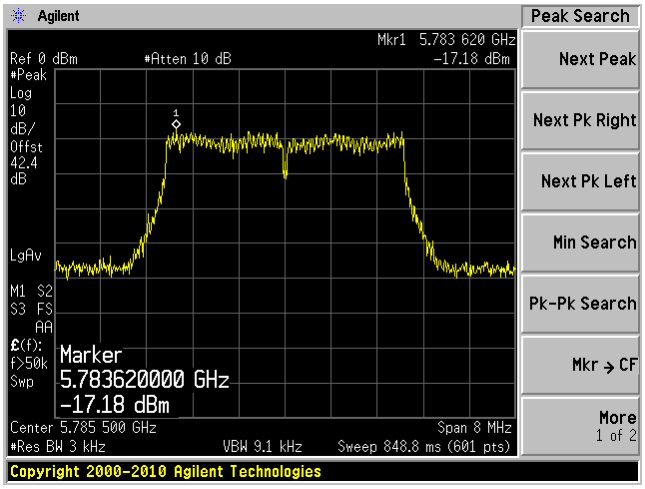
Low channel J1: 5745.5 MHz



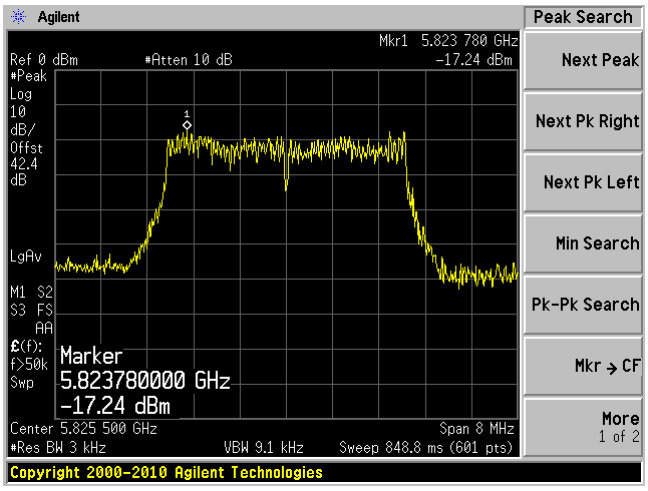
Middle channel J0: 5785.5 MHz



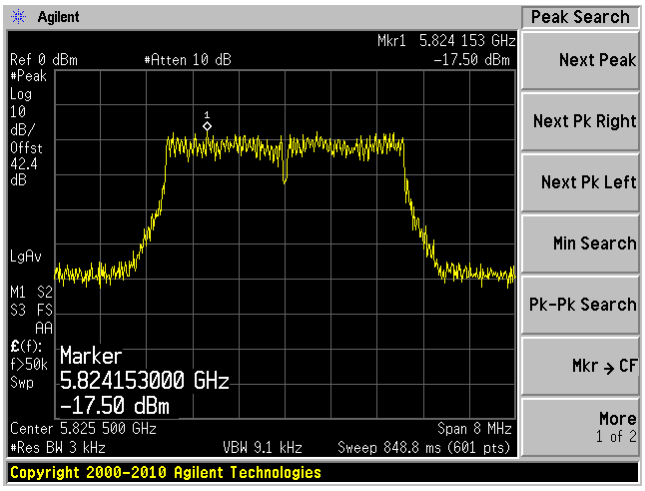
Middle channel J1: 5785.5 MHz



High channel J0: 5825.5 MHz

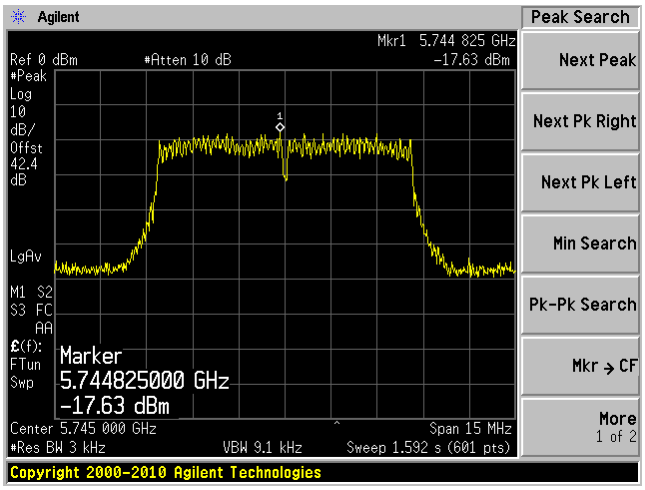


High channel J1: 5825.5 MHz

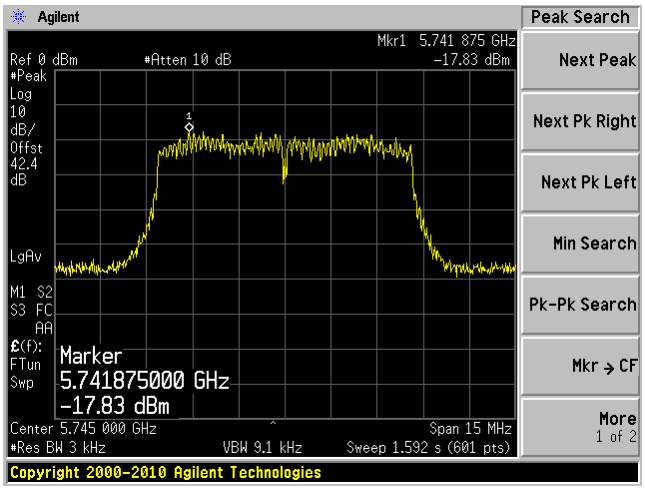


10 MHz mode

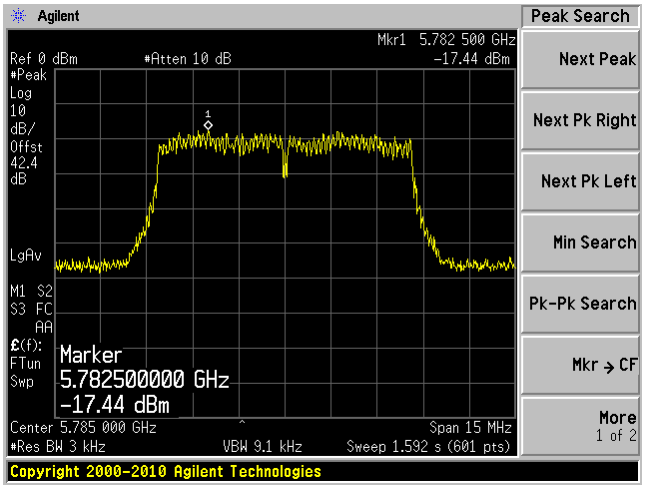
Low channel J0: 5745 MHz



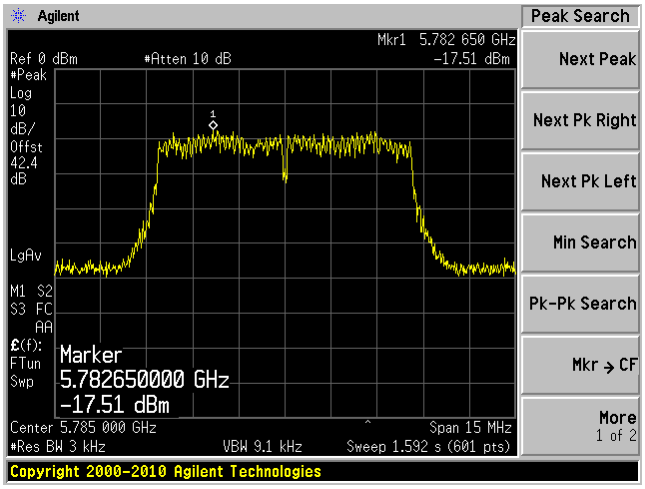
Low channel J1: 5745 MHz



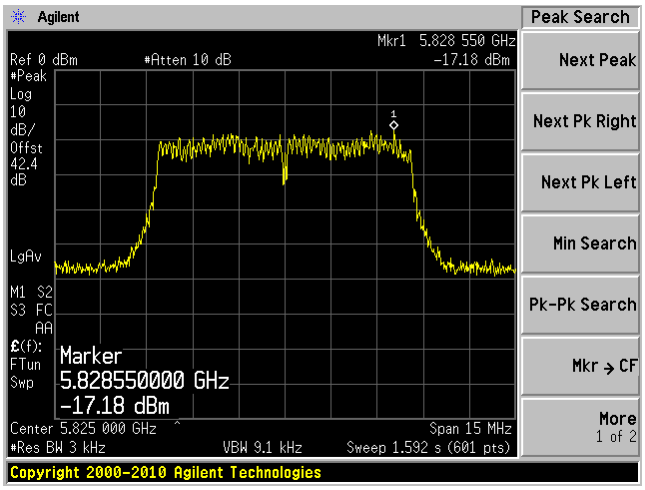
Middle channel J0: 5785 MHz



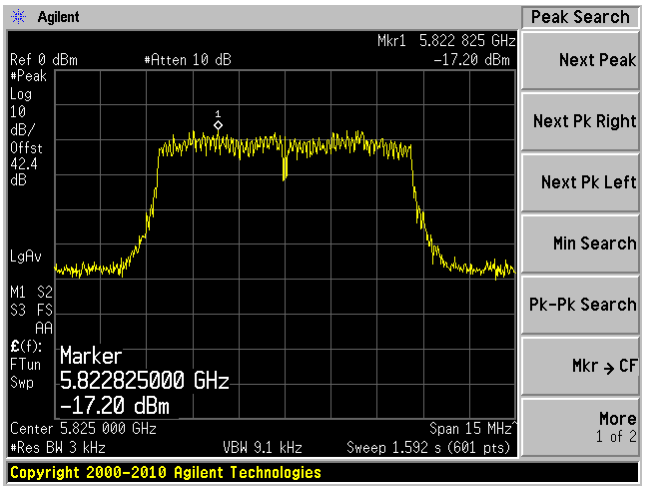
Middle channel J1: 5785 MHz



High channel J0: 5825 MHz

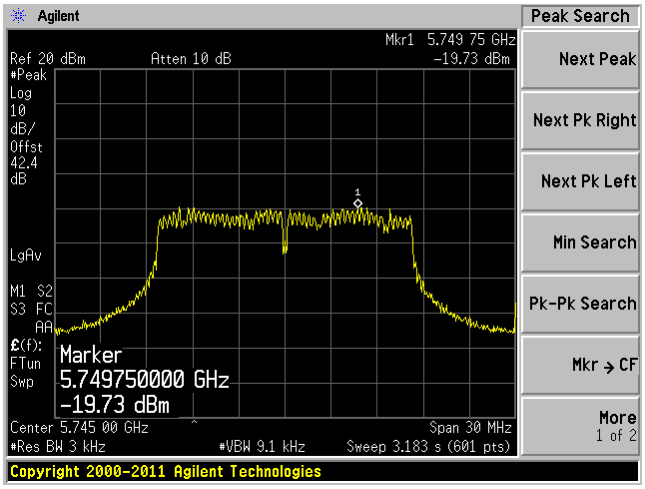


High channel J1: 5825 MHz

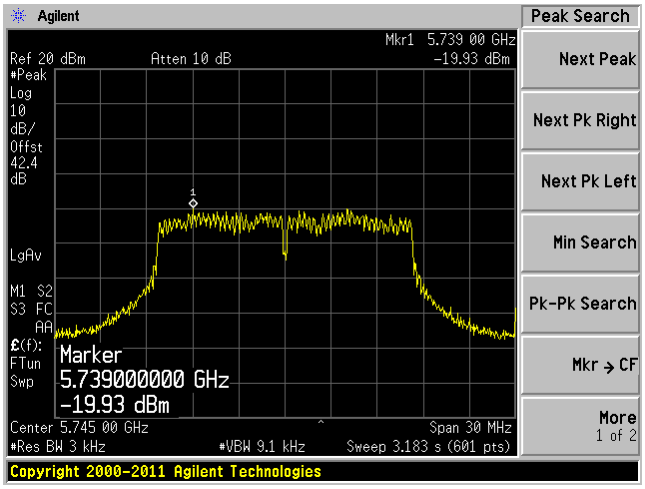


802.11a mode

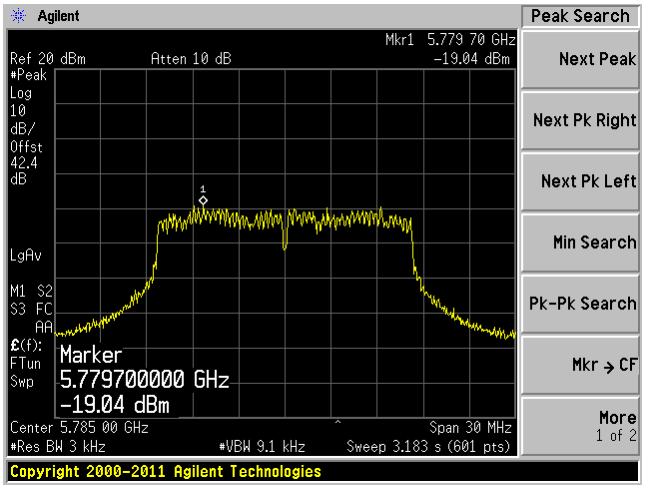
Low channel J0: 5745 MHz



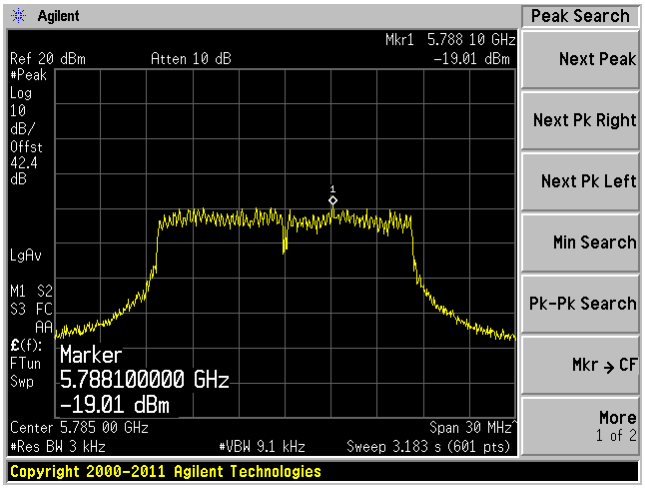
Low channel J1: 5745 MHz



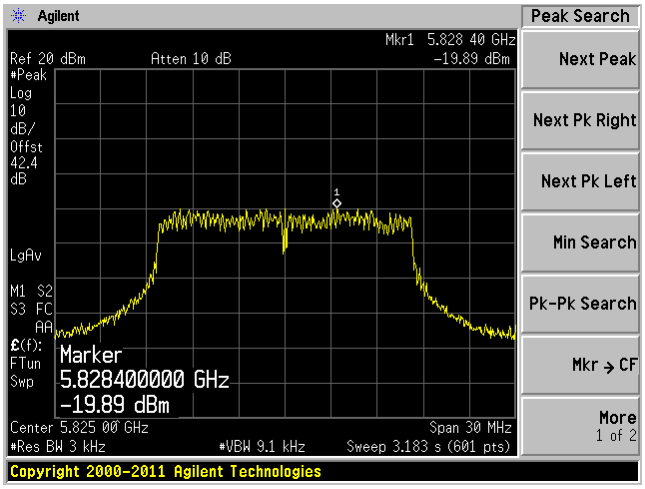
Middle channel J0: 5785 MHz



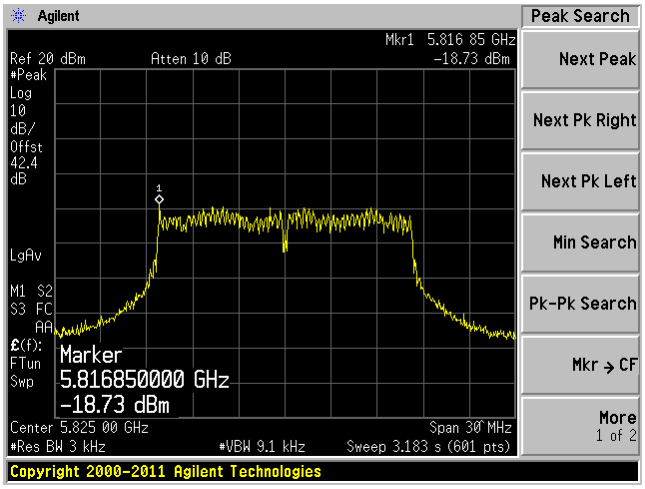
Middle channel J1: 5785 MHz



High channel J0: 5825 MHz

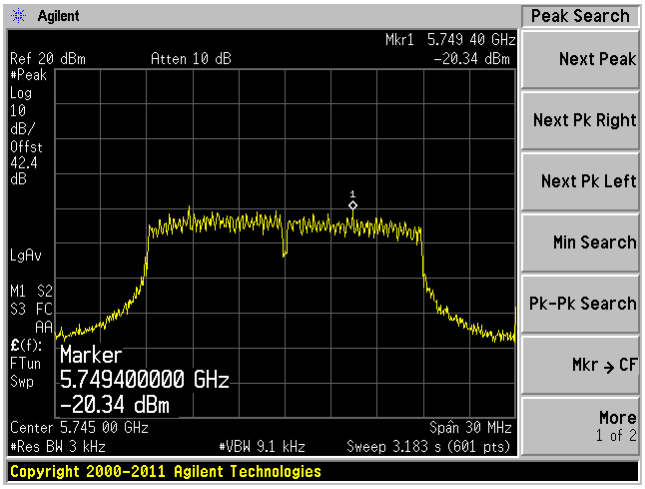


High channel J1: 5825 MHz

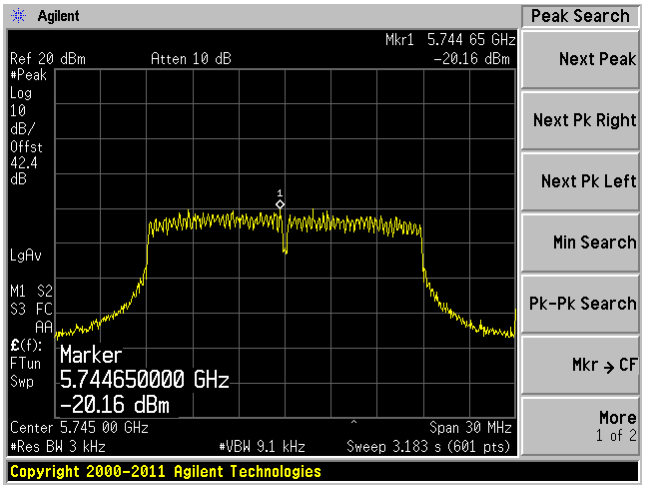


802.11n HT20 mode

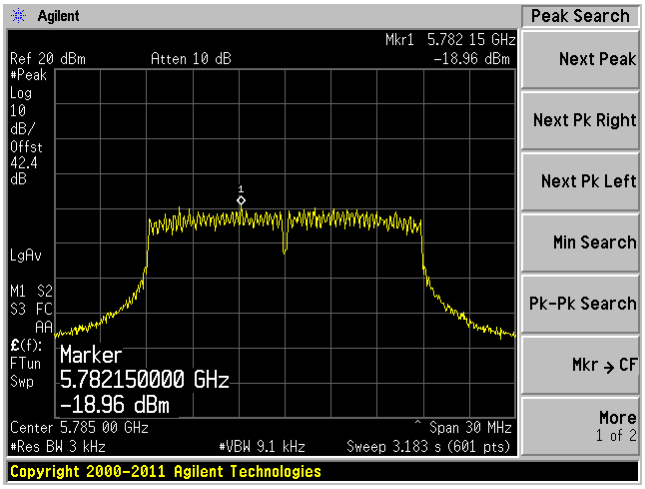
Low channel J0: 5745 MHz



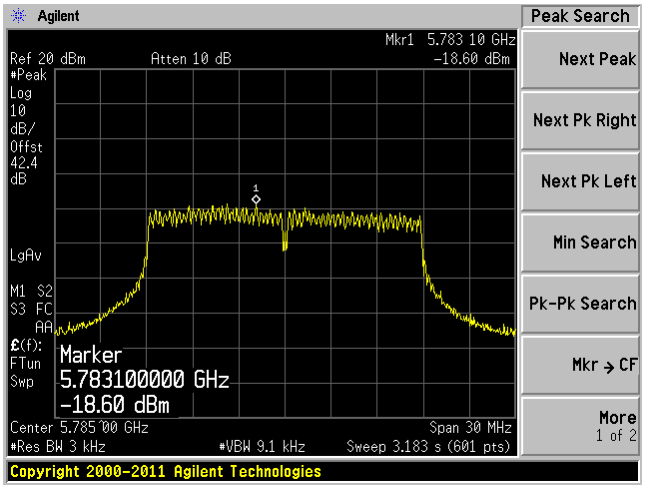
Low channel J1: 5745 MHz



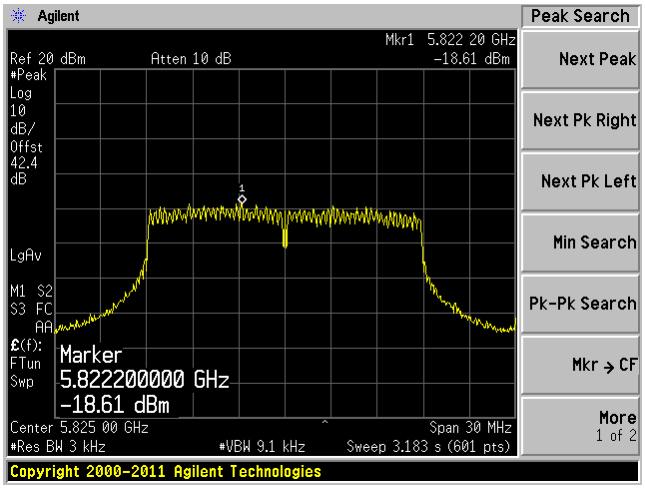
Middle channel J0: 5785 MHz



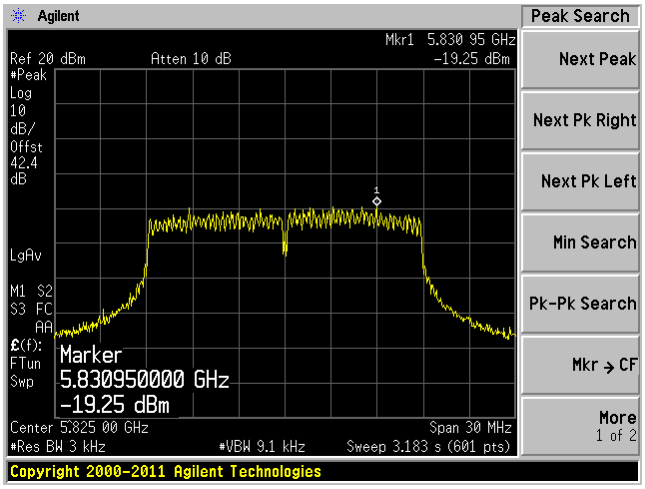
Middle channel J1: 5785 MHz



High channel J0: 5825 MHz

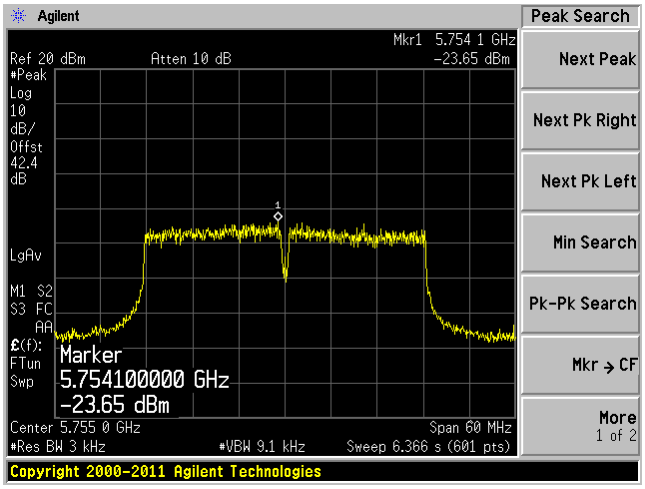


High channel J1: 5825 MHz

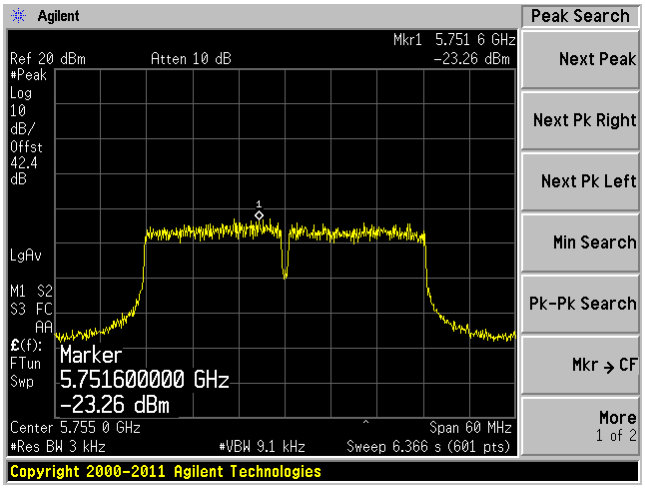


802.11n HT40 mode

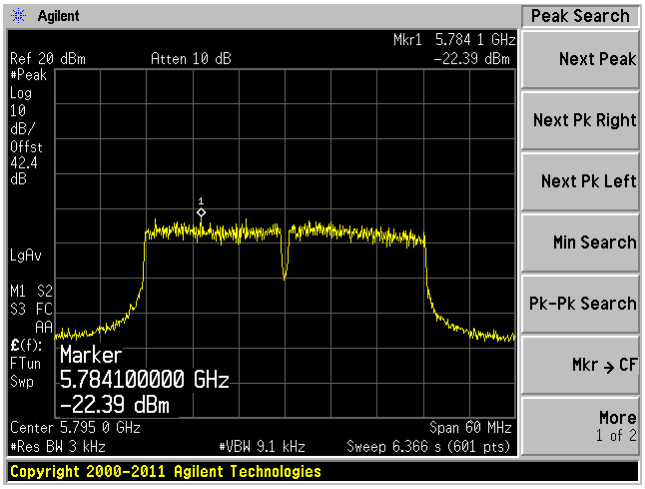
Low channel J0: 5755 MHz



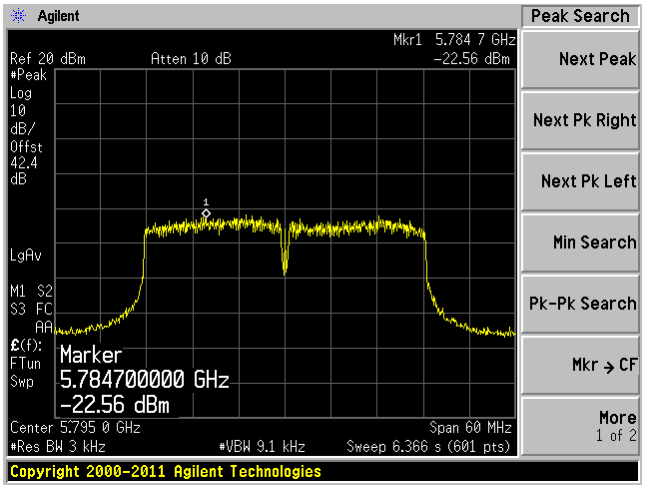
Low channel J1: 5755 MHz



High channel J0: 5795 MHz



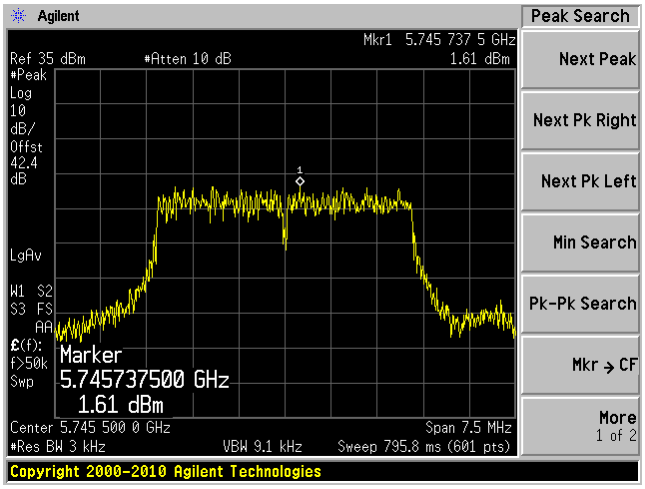
High channel J1: 5795 MHz



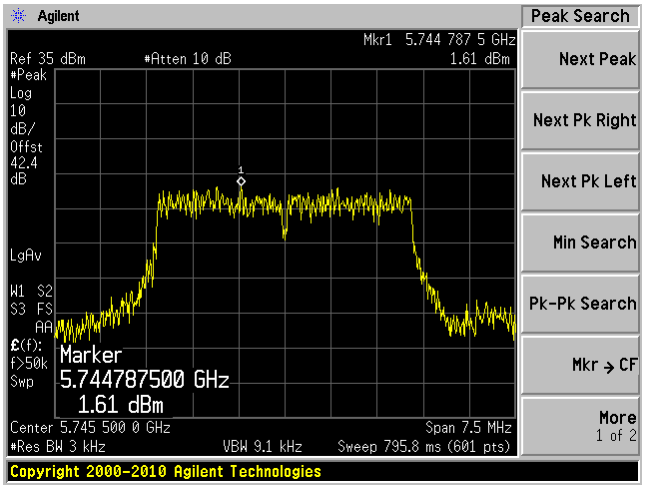
High Power Setting

5MHz mode

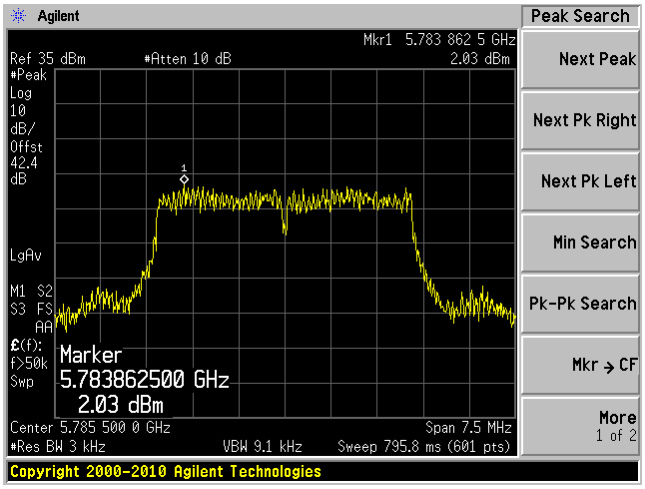
Low channel J0: 5745.5 MHz



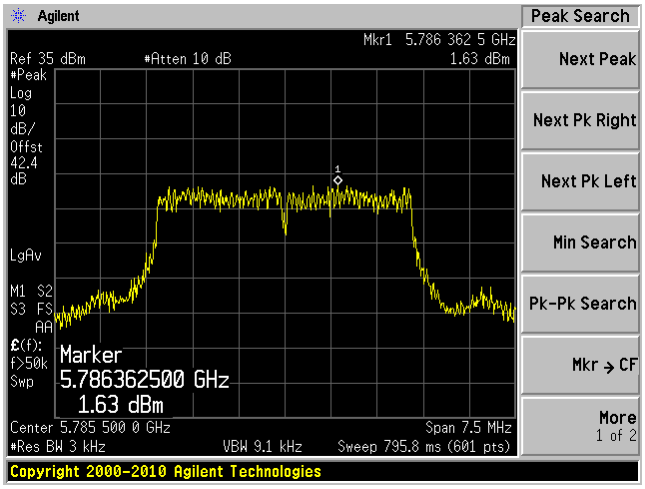
Low channel J1: 5745.5 MHz



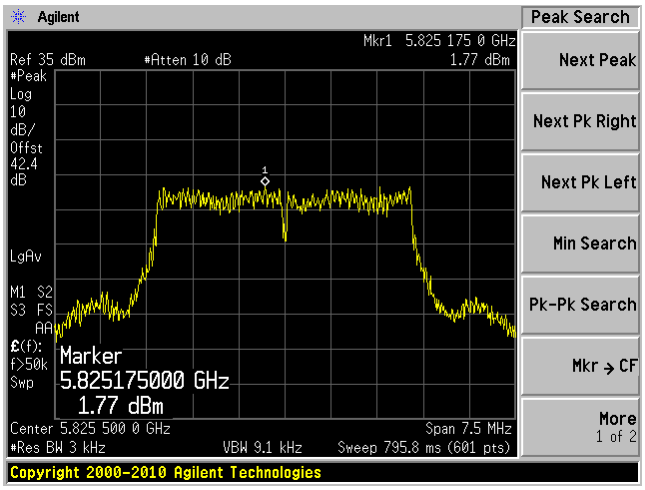
Middle channel J0: 5785.5 MHz



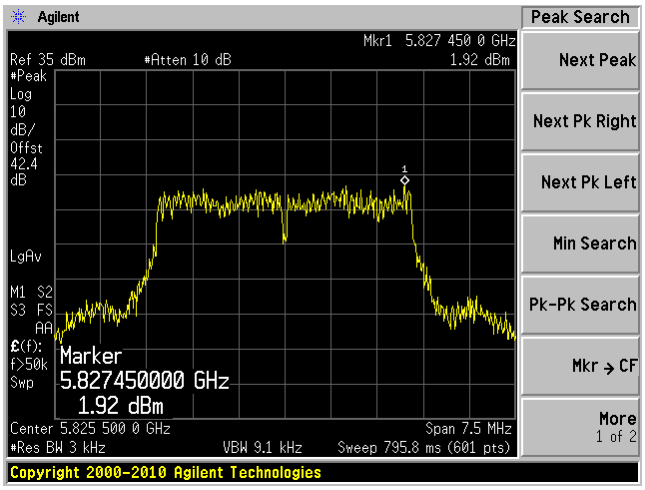
Middle channel J1: 5785.5 MHz



High channel J0: 5825.5 MHz

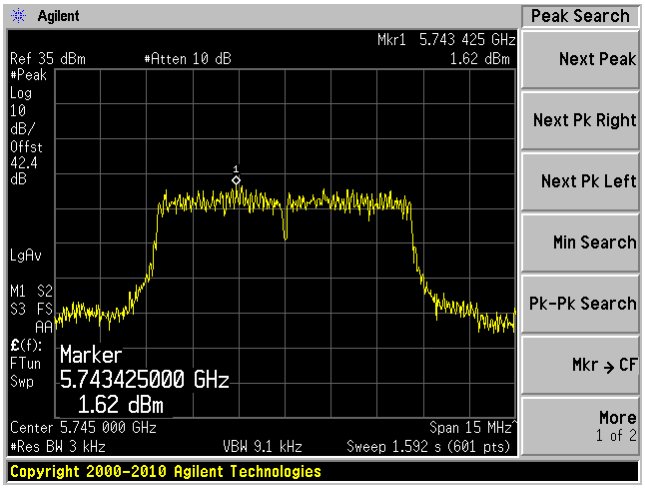


High channel J1: 5825.5 MHz

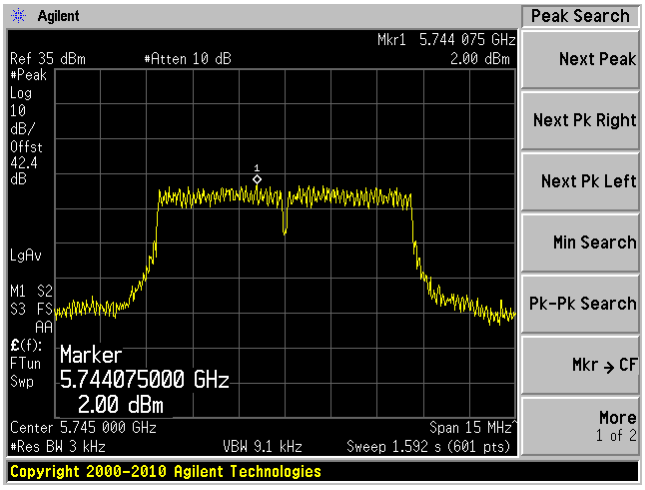


10 MHz mode

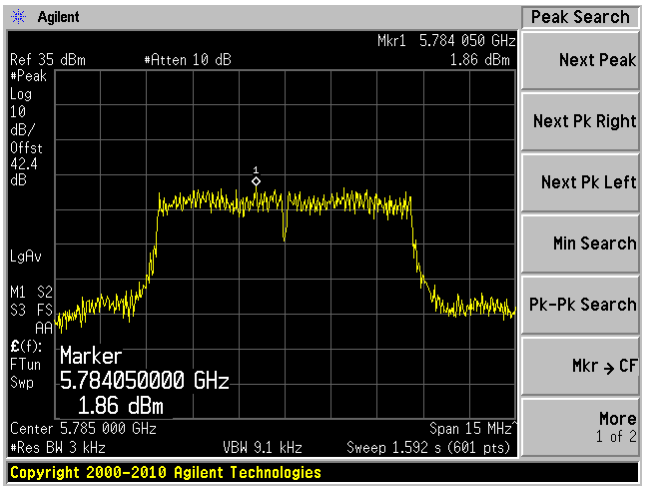
Low channel J0: 5745 MHz



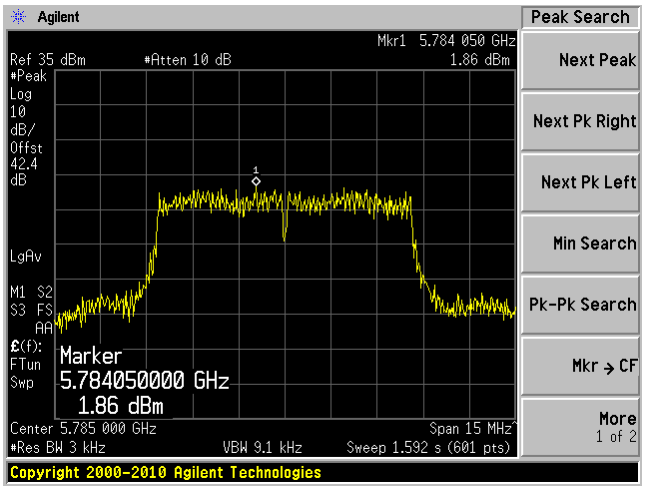
Low channel J1: 5745 MHz



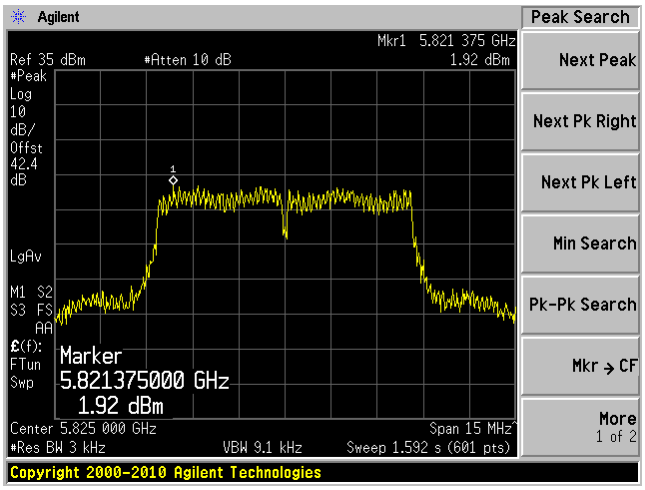
Middle channel J0: 5785 MHz



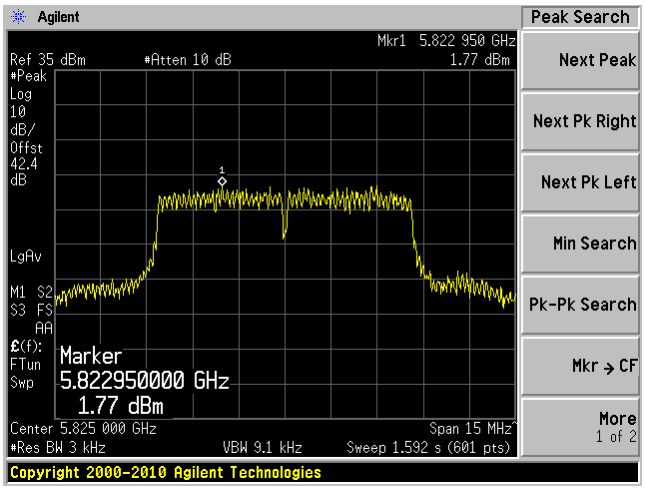
Middle channel J1: 5785 MHz



High channel J0: 5825 MHz

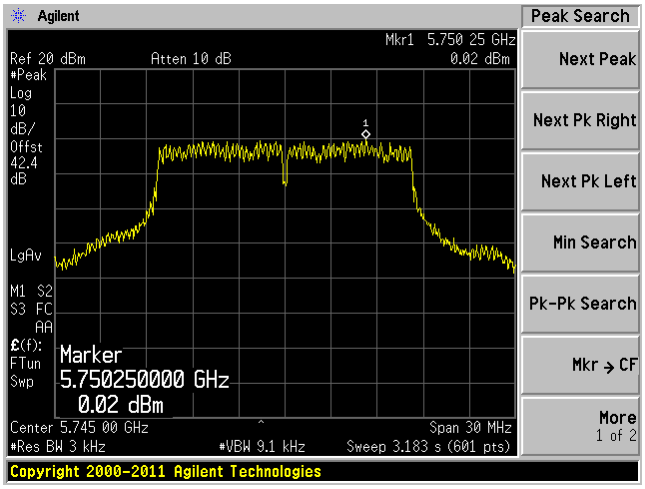


High channel J1: 5825 MHz

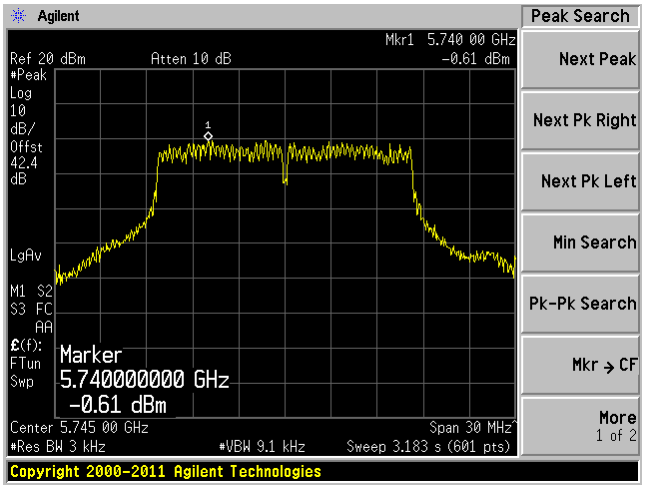


802.11a mode

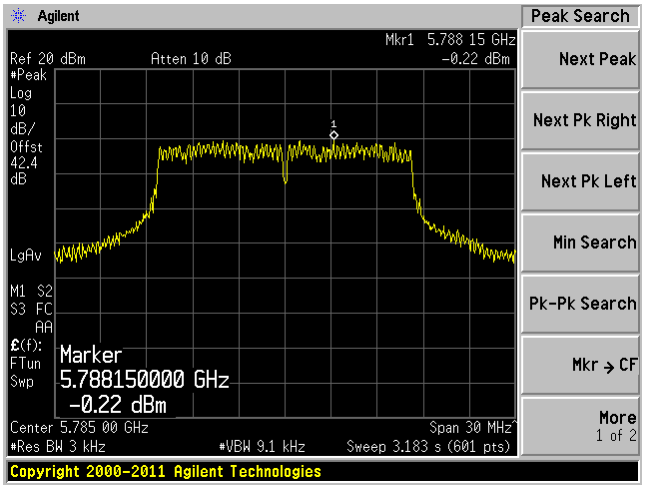
Low channel J0: 5745 MHz



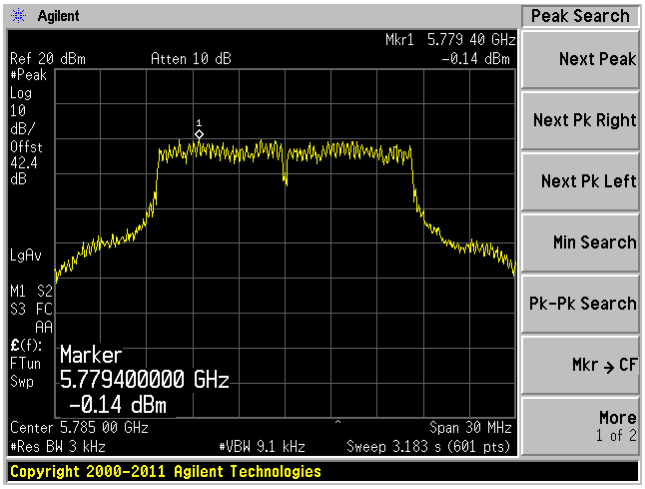
Low channel J1: 5745 MHz



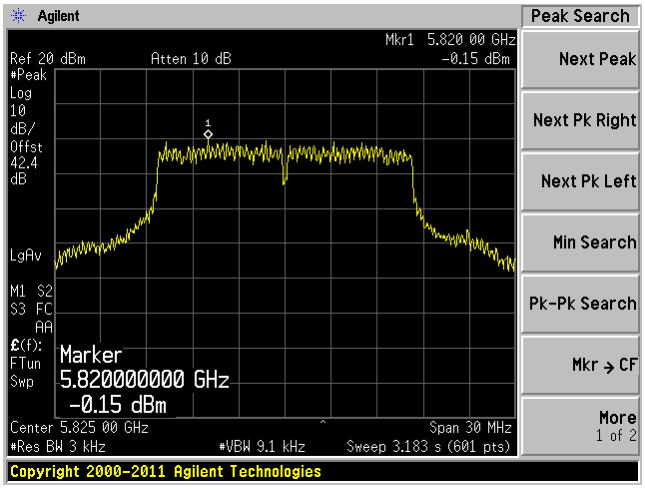
Middle channel J0: 5785 MHz



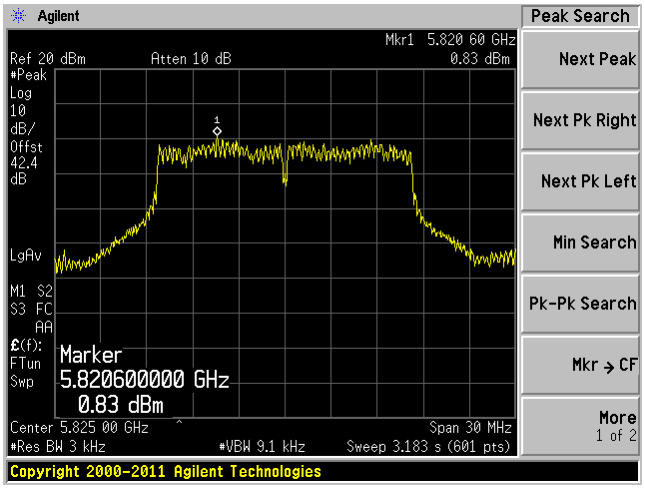
Middle channel J1: 5785 MHz



High channel J0: 5825 MHz

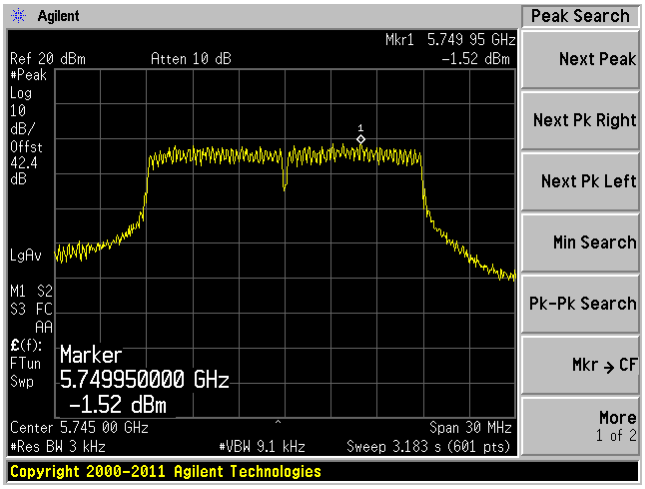


High channel J1: 5825 MHz

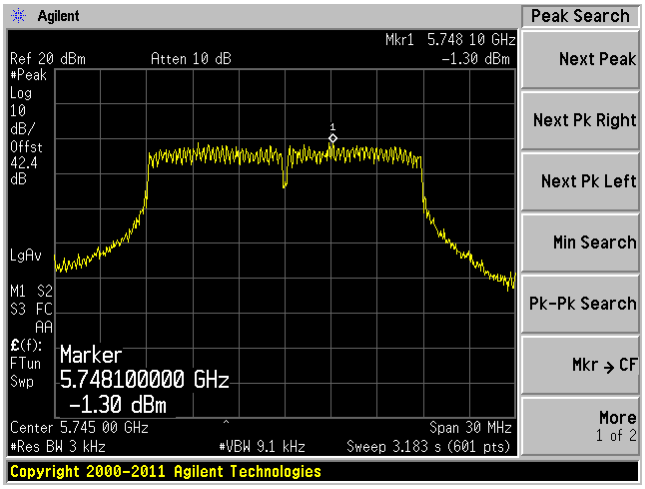


802.11n HT20 mode

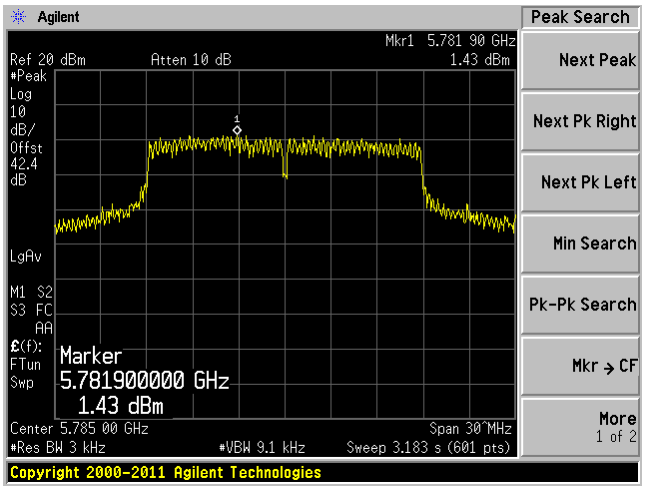
Low channel J0: 5745 MHz



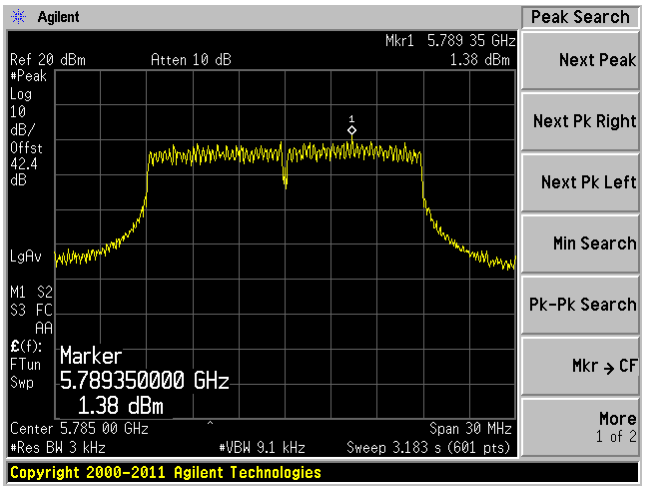
Low channel J1: 5745 MHz



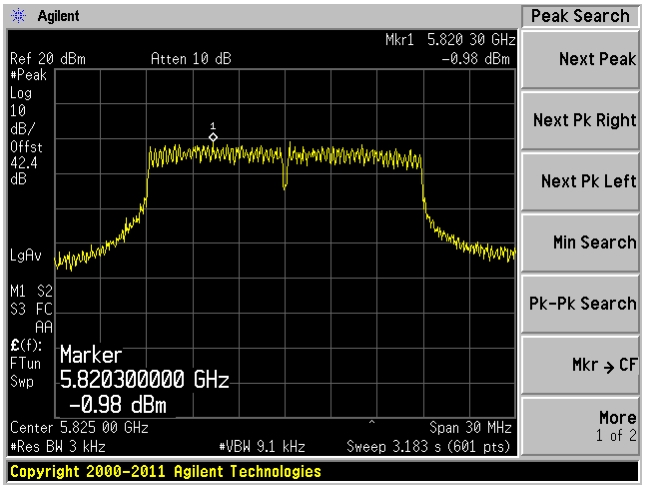
Middle channel J0: 5785 MHz



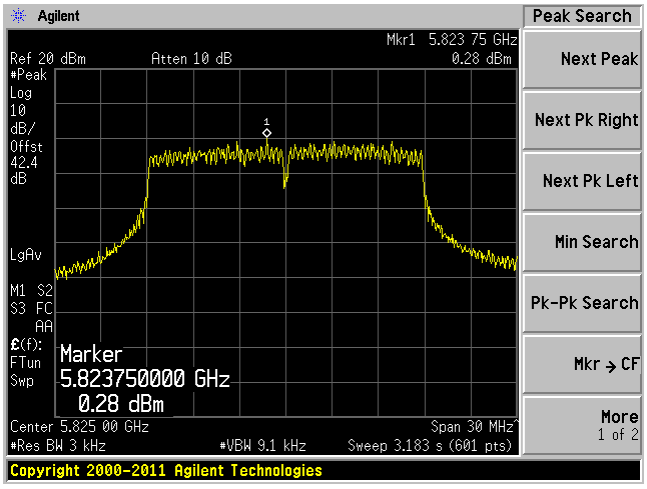
Middle channel J1: 5785 MHz



High channel J0: 5825 MHz

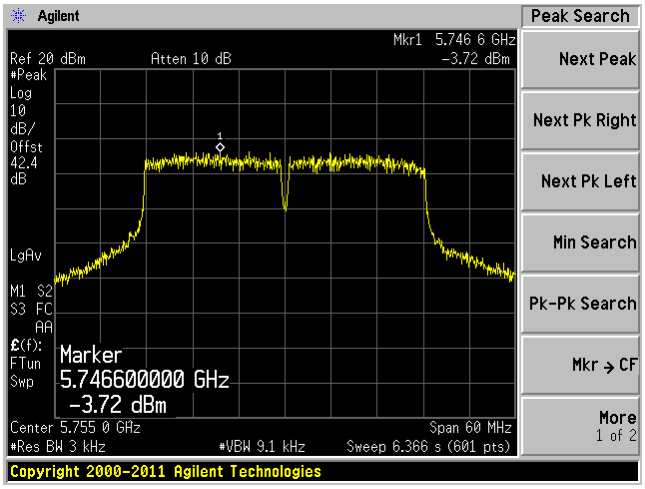


High channel J1: 5825 MHz

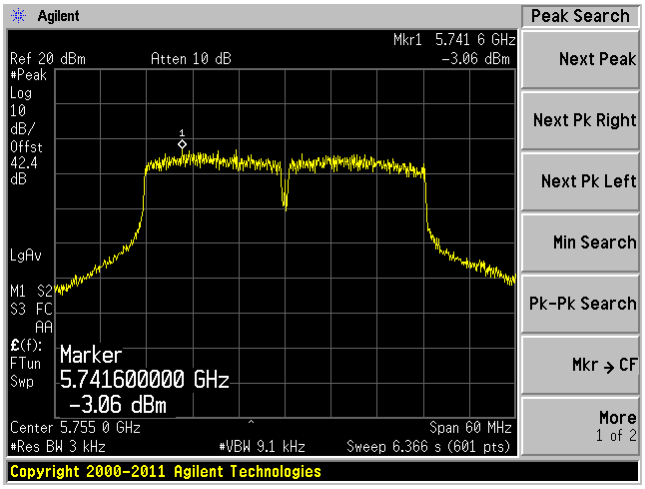


802.11n HT40 mode

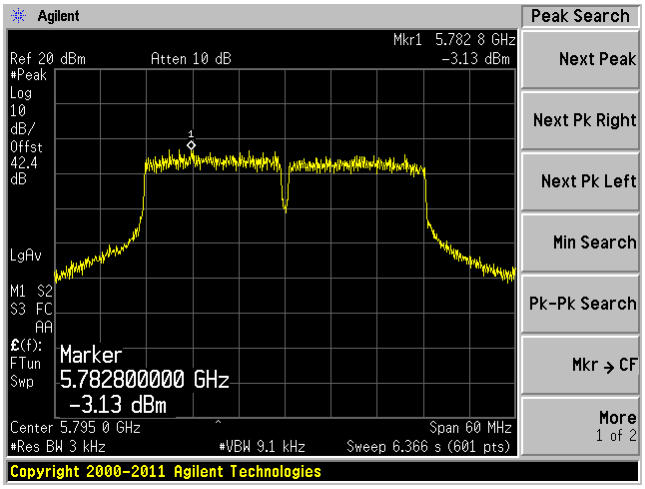
Low channel J0: 5755 MHz



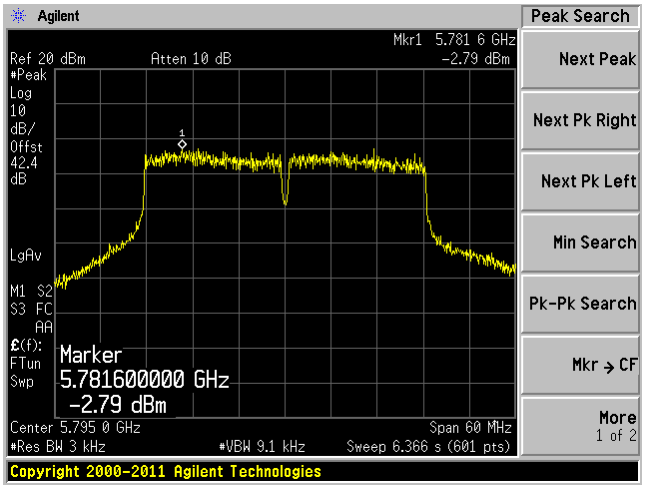
Low channel J1: 5755 MHz



High channel J0: 5795 MHz



High channel J1: 5795 MHz



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

13.1 Applicable Standard

According to RSS-Gen §6.1, Tables 2 show the general field strength limits of receiver spurious emissions

Table 2: Radiated Limits of Receiver Spurious Emissions

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

13.2 EUT Setup

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

13.3 Test Procedure

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

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

13.4 Corrected Amplitude & Margin Calculation

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

CA = Ai + AF + CL + Atten – Ga

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

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

Margin = Corrected Amplitude - Limit

13.5 Test Equipment Lists and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 year
Agilent	Spectrum Analyzer	E4440A	US42221851	2013-03-05	1 year
EMCO	Horn Antenna	3115	9511-4627	2012-10-17	1 year
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2013-03-28	1 year

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

13.6 Test Environmental Conditions

Temperature:	21°C
Relative Humidity:	45 %
ATM Pressure:	101.2kPa

The testing was performed by Jeffrey Wu on 2012-03-13 at 5 meter 3.

13.7 Summary of Test Results

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

Mode: Receiving			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-3.69	45.2345	Vertical	30-18000

13.8 Test Results

1) 30-1000 MHz, Measured at 3 meter

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (QP/Ave.)
39.4225	35.55	100	V	336	40	-4.45	QP
51.82275	35.51	109	V	34	40	-4.49	QP
74.57325	27.25	149	V	138	40	-12.75	QP
45.2345	36.31	124	V	265	40	-3.69	QP
106.714	39.06	113	V	285	43.5	-4.44	QP
452.8138	34.15	100	V	192	46	-11.85	QP

2) Above 1 GHz Measured at 3 meters

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
7750	55.074	103	V	125	74	-18.926	Peak
7750	55.634	101	H	34	74	-18.366	Peak
7750	40.370	102	V	125	54	-13.630	Ave
7750	40.350	101	H	34	54	-13.650	Ave
11520	58.287	102	V	108	74	-15.713	Peak
11520	58.307	104	H	26	74	-15.693	Peak
11520	43.647	102	V	108	54	-10.353	Ave
11520	43.647	104	H	26	54	-10.353	Ave
13312	63.795	104	V	38	74	-10.205	Peak
13312	63.625	100	H	0	74	-10.375	Peak
13312	48.985	104	V	38	54	-5.015	Ave
13312	48.975	100	H	0	54	-5.025	Ave