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

For

## Ruckus Wireless, Inc.

350 West Java Drive,

Sunnyvale, CA 94089, USA

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

| **Report Type:** | **Product Type:** |
|---|---|
| CIIPC | 802.11 a/n Wireless Module |

| | |
|---|---|
| **Test Engineers:** | Ning Ma |
| **Report Number:** | R1206071-407 W52 |
| **Report Date:** | 2012-10-15 |
| **Reviewed By:** | Victor Zhang<br>EMC/RF Lead |

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## DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|---|---|---|---|
| 0 | R1206071-407W52 | CIIPC report | 2012-10-15 |

# 1 General Description

## 1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Ruckus Wireless, Inc*., and their product model: *MPE5N33A, with FCC ID: S9G-MPE5N33A, IC: 5912A-MPE5N33A* which will henceforth be referred to as the EUT (Equipment Under Test). The EUT is a dual band Wireless 802.11b/g/n wireless module.

## 1.2 Mechanical Description of EUT

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

*The test data gathered are from typical production sample, serial number: 203, provided by the manufacturer.*

## 1.3 Objective

This report is prepared on behalf of *Ruckus Wireless, Inc., in* accordance with FCC CFR47 §15.407 and IC RSS-210 Issue 8, Dec 2010.

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

## 1.4 Related Submittal(s)/Grant(s)

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

## 1.5 Test Methodology

FCC CFR 47 Part2, Part15.407 and IC RSS-210 Issue 8, Dec 2010.

## 1.6 Measurement Uncertainty

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

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

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

## 1.7 Test Facility

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

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

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

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

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

# 2 EUT Test Configuration

## 2.1 Justification

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

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

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

## 2.2 EUT Exercise Software

The software used, Art version 2.18.2 were provided by client and verified by Ning Ma to comply with the standard requirements being tested against.

## 2.3 Equipment Modifications

No modifications were made to the EUT.

## 2.4 Special Accessories

| Manufacturer | Description | Model No. | Serial No. |
|---|---|---|---|
| Atheros Communications | Module Supporting Board | 250-01865-020 | PB92-020 |

## 2.5 Local Support Equipment

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

## 2.6 EUT Internal Configuration

NA: Only the module card was tested.

# 3 Summary of Test Results

| FCC & IC Rules | Description of Test | Result |
|---|---|---|
| FCC §15.407(f), §2.1091<br>IC RSS-102 | RF Exposure | Compliant |
| FCC §15.203<br>IC RSS-Gen §7.1.2 | Antenna Requirement | Compliant |
| FCC §15.207<br>IC RSS-Gen §7.2.4 | AC Power Line Conducted Emissions | NA [1] |
| FCC §15.209(a), 15.407(b)<br>IC RSS-210 §A9.2 | Spurious Radiated Emissions | Compliant |
| FCC §15.407(a)<br>IC RSS-210 §A9.2 | 26 dB and 99% Emission Bandwidth | NA [1] |
| FCC §407(a)(1)<br>IC RSS-210 §A9.2 | Peak Output Power Measurement | Compliant[2] |
| FCC §2.1051, §15.407(b)<br>IC RSS-210 §A9.2 | Band Edges | Compliant[2] |
| FCC §15.407(a)(1)<br>IC RSS-210 §A9.2 | Power Spectral Density | Compliant[2] |
| FCC §15.407(a)(6) | Peak Excursion Ratio | Compliant[2] |
| IC RSS-210 §2.3<br>IC RSS-Gen §6 | Receiver Spurious Radiated Emissions | Compliant |
| FCC §2.1051, §15.407(b)<br>IC RSS-210 §A9.2 | Spurious Emissions at Antenna Terminals | NA [1] |

Note: [1] Share with original application report results. (FCC ID: S9G-MPE5N33A)
[2] The 5 dBi antenna result share with original application report result. (FCC ID: S9G-MPE5N33A)

# 4 FCC §15.407(f), §2.1091 & IC RSS-102 - RF Exposure

## 4.1 Applicable Standard

According to FCC §15.407(f) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

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

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

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

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

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

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

## 4.2 MPE Prediction

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

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

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

## 4.3 MPE Results

**Antenna gain is 12 dBi**

**5150-5250 MHz**

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 10.79 |
| Maximum peak output power at antenna input terminal (mW): | 11.99 |
| Prediction distance (cm): | 20 |
| Prediction frequency (MHz): | 5230 |
| Maximum Antenna Gain, typical (dBi): | 12 |
| Maximum Antenna Gain (numeric): | 15.85 |
| Power density of prediction frequency at 20.0 cm ($mW/cm^2$): | 0.038 |
| Power density of prediction frequency at 20.0 cm ($W/m^2$): | 0.38 |
| 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 |

**Antenna gain is 15 dBi**

**5150-5250 MHz**

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 7.56 |
| Maximum peak output power at antenna input terminal (mW): | 5.7 |
| Prediction distance (cm): | 20 |
| Prediction frequency (MHz): | 5190 |
| Maximum Antenna Gain, typical (dBi): | 15 |
| Maximum Antenna Gain (numeric): | 31.62 |
| Power density of prediction frequency at 20.0 cm ($mW/cm^2$): | 0.036 |
| Power density of prediction frequency at 20.0 cm ($W/m^2$): | 0.36 |
| MPE limit for uncontrolled exposure at prediction frequency ($mW/cm^2$): | 1.0 |
| MPE limit for uncontrolled exposure at prediction frequency ($W/m^2$): | 10 |

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

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

## 5.1 Applicable Standard

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

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

As per IC RSS-Gen §7.1.2: Transmitter Antenna

A transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.
When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

## 5.2 Antenna List

| Manufacturer | Model | Gain |
|---|---|---|
| Ruckus | ZoneFlex 7982 Omni | 3 |
| Ruckus | Corfu Omni | 3 |
| MARS | ME-WE2458-3H | 5 |
| Laird | AT-0536-HP | 5 |
| Larson Antenna | AT-0636-VP | 5 |
| Ruckus | TBolts3 | 8 |
| Ruckus | TBolts2 | 15 |
| MARS | AT-1212-DP | 12 |

# 6 FCC §15.209, §15.407(b) & IC RSS-210 §A9.2 - Spurious Radiated Emissions

## 6.1 Applicable Standard

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

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

| Frequency (MHz) | Field Strength (micro volts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 - 0.490 | 2400/F(kHz) | 300 |
| 0.490 - 1.705 | 24000/F(kHz) | 30 |
| 1.705 - 30.0 | 30 | 30 |
| 30 - 88 | 100 Note 1 | 3 |
| 88 - 216 | 150 Note 1 | 3 |
| 216 - 960 | 200 Note 1 | 3 |
| Above 960 | 500 | 3 |

Note 1: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

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

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

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

## 6.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. The specification used was the FCC 15C/15E and IC RSS-210/RSS-Gen limits.

The spacing between the peripherals was 10 centimeters.

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

## 6.3 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

## 6.4 Corrected Amplitude & Margin Calculation

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

CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

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

Margin = Corrected Amplitude - Limit

## 6.5 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Rohde & Schwarz | EMI Test Receiver | ESCI 1166.5950K03 | 100338 | 2011-09-14 | 1 year |
| Agilent | Spectrum Analyzer | E4446A | US44300386 | 2011-08-11 | 1 year |
| Sunol Science Corp | System Controller | SC99V | 122303-1 | N/R | - |
| Sunol Science Corp | Combination Antenna | JB3 | A0020106-3 | 2012-06-29 | 1 year |
| EMCO | Horn antenna | 3115 | 9511-4627 | 2012-10-03 | 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 |

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

## 6.6 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22 °C |
| **Relative Humidity:** | 43.5 % |
| **ATM Pressure:** | 101-102 kPa |

*The testing was performed by Ning Ma on 2012-06-27 in 5 meter chamber 3.*

## 6.7 Summary of Test Results

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

5150-5250 MHz

| **Mode: Transmitting** | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Channel, Range** |
| -2.287 | 5150 | Vertical | Above 1 GHz |

## 6.8 Radiated Emissions Test Result Data

**Radiated Emission at 3 meters (Antenna Port terminated with high power setting)**

**5150-5250 MHz Band**

**802.11a Mode**

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC/IC | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 5180 MHz, measured at 3 meters | | | | | | | | | | | |
| 10360 | 30.52 | 0 | 100 | V | 38.031 | 6.13 | 27.62 | 47.061 | 88.2 | -41.13 | Peak |
| 10360 | 30.75 | 0 | 100 | H | 38.031 | 6.13 | 27.62 | 47.291 | 88.2 | -40.909 | Peak |
| 10360 | 17.4 | 0 | 100 | V | 38.031 | 6.13 | 27.62 | 33.941 | 68.2 | -34.259 | Ave |
| 10360 | 17.41 | 0 | 100 | H | 38.031 | 6.13 | 27.62 | 33.951 | 68.2 | -34.249 | Ave |
| 15540 | 32.21 | 0 | 100 | V | 38.227 | 7.47 | 25.59 | 52.317 | 74 | -21.683 | Peak |
| 15540 | 32.01 | 0 | 100 | H | 38.227 | 7.47 | 25.59 | 52.117 | 74 | -21.883 | Peak |
| 15540 | 18.3 | 0 | 100 | V | 38.227 | 7.47 | 25.59 | 38.407 | 54 | -15.593 | Ave |
| 15540 | 18.33 | 0 | 100 | H | 38.227 | 7.47 | 25.59 | 38.437 | 54 | -15.563 | Ave |
| 4980 | 41.73 | 73 | 100 | V | 33.062 | 4.21 | 27.51 | 51.492 | 74 | -22.508 | Peak |
| 4980 | 41.22 | 65 | 112 | H | 33.062 | 4.21 | 27.51 | 50.982 | 74 | -23.018 | Peak |
| 4980 | 21.07 | 73 | 100 | V | 33.062 | 4.21 | 27.51 | 30.832 | 54 | -23.168 | Ave |
| 4980 | 20.89 | 65 | 112 | H | 33.062 | 4.21 | 27.51 | 30.652 | 54 | -23.348 | Ave |
| 1600 | 58.65 | 327 | 100 | V | 25.279 | 2.31 | 27.49 | 58.749 | 74 | -15.251 | Peak |
| 1600 | 54.73 | 46 | 113 | H | 25.279 | 2.31 | 27.49 | 54.829 | 74 | -19.171 | Peak |
| 1600 | 42.17 | 327 | 100 | V | 25.279 | 2.31 | 27.49 | 42.269 | 54 | -11.731 | Ave |
| 1600 | 42.63 | 46 | 113 | H | 25.279 | 2.31 | 27.49 | 42.729 | 54 | -11.271 | Ave |
| 5150 | 27.75 | 0 | 100 | V | 33.323 | 4.38 | 0 | 65.453 | 74 | -8.547 | Peak |
| 5150 | 27.21 | 0 | 100 | H | 33.323 | 4.38 | 0 | 64.913 | 74 | -9.087 | Peak |
| 5150 | 14.01 | 0 | 100 | V | 33.323 | 4.38 | 0 | 51.713 | 54 | -2.287 | Ave |
| 5150 | 13.12 | 0 | 100 | H | 33.323 | 4.38 | 0 | 50.823 | 54 | -3.177 | Ave |
| 250.05 | 25.47 | 261 | 100 | V | 12.3 | 11.37 | 12.9 | 36.24 | 46 | -9.76 | QP |

| 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 5200 MHz, measured at 3 meters | | | | | | | | | | | |
| 10400 | 31.97 | 0 | 100 | V | 38.031 | 6.14 | 27.74 | 48.401 | 88.2 | -39.799 | Peak |
| 10400 | 32.22 | 0 | 100 | H | 38.031 | 6.14 | 27.74 | 48.651 | 88.2 | -39.549 | Peak |
| 10400 | 17.26 | 0 | 100 | V | 38.031 | 6.14 | 27.74 | 33.691 | 68.2 | -34.509 | Ave |
| 10400 | 17.28 | 0 | 100 | H | 38.031 | 6.14 | 27.74 | 33.711 | 68.2 | -34.489 | Ave |
| 15600 | 32.15 | 0 | 100 | V | 37.915 | 7.47 | 25.57 | 51.965 | 74 | -22.035 | Peak |
| 15600 | 31.75 | 0 | 100 | H | 37.915 | 7.47 | 25.57 | 51.565 | 74 | -22.435 | Peak |
| 15600 | 17.83 | 0 | 100 | V | 37.915 | 7.47 | 25.57 | 37.645 | 54 | -16.355 | Ave |
| 15600 | 17.88 | 0 | 100 | H | 37.915 | 7.47 | 25.57 | 37.695 | 54 | -16.305 | Ave |
| 1600 | 57.47 | 322 | 100 | V | 25.279 | 2.31 | 27.49 | 57.569 | 74 | -16.431 | Peak |
| 1600 | 56.88 | 356 | 100 | H | 25.279 | 2.31 | 27.49 | 56.979 | 74 | -17.021 | Peak |
| 1600 | 44.03 | 322 | 100 | V | 25.279 | 2.31 | 27.49 | 44.129 | 54 | -9.871 | Ave |
| 1600 | 43.54 | 356 | 100 | H | 25.279 | 2.31 | 27.49 | 43.639 | 54 | -10.361 | Ave |
| 4980 | 40.98 | 72 | 100 | V | 33.062 | 4.21 | 27.51 | 50.742 | 74 | -23.258 | Peak |
| 4980 | 41.06 | 310 | 100 | H | 33.062 | 4.21 | 27.51 | 50.822 | 74 | -23.178 | Peak |
| 4980 | 20.92 | 72 | 100 | V | 33.062 | 4.21 | 27.51 | 30.682 | 54 | -23.318 | Ave |
| 4980 | 20.52 | 310 | 100 | H | 33.062 | 4.21 | 27.51 | 30.282 | 54 | -23.718 | Ave |
| 250.05 | 29.81 | 255 | 100 | V | 12.3 | 11.37 | 12.9 | 40.58 | 46 | -5.42 | QP |

| 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 5240 MHz, measured at 3 meters | | | | | | | | | | | |
| 10400 | 31.78 | 0 | 100 | V | 38.031 | 6.14 | 27.74 | 48.211 | 88.2 | 48.211 | Peak |
| 10400 | 31.57 | 0 | 100 | H | 38.031 | 6.14 | 27.74 | 48.001 | 88.2 | 48.001 | Peak |
| 10400 | 17.29 | 0 | 100 | V | 38.031 | 6.14 | 27.74 | 33.721 | 68.2 | 33.721 | Ave |
| 10400 | 17.28 | 0 | 100 | H | 38.031 | 6.14 | 27.74 | 33.711 | 68.2 | 33.711 | Ave |
| 15720 | 32.98 | 0 | 100 | V | 37.612 | 7.71 | 25.57 | 52.732 | 74 | -21.268 | Peak |
| 15720 | 32.03 | 0 | 100 | H | 37.612 | 7.71 | 25.57 | 51.782 | 74 | -22.218 | Peak |
| 15720 | 17.84 | 0 | 100 | V | 37.612 | 7.71 | 25.57 | 37.592 | 54 | -16.408 | Ave |
| 15720 | 17.85 | 0 | 100 | H | 37.612 | 7.71 | 25.57 | 37.602 | 54 | -16.398 | Ave |
| 1600 | 57.32 | 322 | 100 | V | 25.279 | 2.31 | 27.49 | 57.419 | 74 | -16.581 | Peak |
| 1600 | 56.53 | 94 | 100 | H | 25.279 | 2.31 | 27.49 | 56.629 | 74 | -17.371 | Peak |
| 1600 | 42.92 | 322 | 100 | V | 25.279 | 2.31 | 27.49 | 43.019 | 54 | -10.981 | Ave |
| 1600 | 41.9 | 94 | 100 | H | 25.279 | 2.31 | 27.49 | 41.999 | 54 | -12.001 | Ave |
| 4980 | 41.39 | 73 | 100 | V | 33.062 | 4.21 | 27.51 | 51.152 | 74 | -22.848 | Peak |
| 4980 | 41.27 | 310 | 100 | H | 33.062 | 4.21 | 27.51 | 51.032 | 74 | -22.968 | Peak |
| 4980 | 21.01 | 73 | 100 | V | 33.062 | 4.21 | 27.51 | 30.772 | 54 | -23.228 | Ave |
| 4980 | 20.53 | 310 | 100 | H | 33.062 | 4.21 | 27.51 | 30.292 | 54 | -23.708 | Ave |
| 5350 | 27.61 | 0 | 100 | V | 33.659 | 4.59 | 0 | 65.859 | 74 | -8.141 | Peak |
| 5350 | 27.65 | 0 | 100 | H | 33.659 | 4.59 | 0 | 65.899 | 74 | -8.101 | Peak |
| 5350 | 12.98 | 0 | 100 | V | 33.659 | 4.59 | 0 | 51.229 | 54 | -2.771 | Ave |
| 5350 | 13.02 | 0 | 100 | H | 33.659 | 4.59 | 0 | 51.269 | 54 | -2.731 | Ave |
| 250.05 | 26.71 | 255 | 100 | V | 12.3 | 11.37 | 12.9 | 37.48 | 46 | -8.52 | QP |

**802.11 n 40 Mode**

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC/IC | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 5190 MHz, measured at 3 meters | | | | | | | | | | | |
| 10380 | 31.54 | 0 | 100 | V | 38.031 | 6.13 | 27.62 | 48.081 | 88.2 | -40.119 | Peak |
| 10380 | 30.98 | 0 | 100 | H | 38.031 | 6.13 | 27.62 | 47.521 | 88.2 | -40.679 | Peak |
| 10380 | 17.11 | 0 | 100 | V | 38.031 | 6.13 | 27.62 | 33.651 | 68.2 | -34.549 | Ave |
| 10380 | 17.1 | 0 | 100 | H | 38.031 | 6.13 | 27.62 | 33.641 | 68.2 | -34.559 | Ave |
| 15570 | 32.03 | 0 | 100 | V | 37.915 | 7.47 | 25.59 | 51.825 | 74 | -22.175 | Peak |
| 15570 | 32.58 | 0 | 100 | H | 37.915 | 7.47 | 25.66 | 52.305 | 74 | -21.695 | Peak |
| 15570 | 17.89 | 0 | 100 | V | 37.915 | 7.47 | 25.66 | 37.615 | 54 | -16.385 | Ave |
| 15570 | 17.88 | 0 | 100 | H | 37.915 | 7.47 | 25.66 | 37.605 | 54 | -16.395 | Ave |
| 4980 | 40.87 | 73 | 100 | V | 33.062 | 4.21 | 27.51 | 50.632 | 74 | -23.368 | Peak |
| 4980 | 41.35 | 310 | 100 | H | 33.062 | 4.21 | 27.51 | 51.112 | 74 | -22.888 | Peak |
| 4980 | 20.87 | 73 | 100 | V | 33.062 | 4.21 | 27.51 | 30.632 | 54 | -23.368 | Ave |
| 4980 | 20.59 | 310 | 100 | H | 33.062 | 4.21 | 27.51 | 30.352 | 54 | -23.648 | Ave |
| 1600 | 58.13 | 323 | 100 | V | 25.279 | 2.31 | 27.49 | 58.229 | 74 | -15.771 | Peak |
| 1600 | 56.44 | 95 | 100 | H | 25.279 | 2.31 | 27.49 | 56.539 | 74 | -17.461 | Peak |
| 1600 | 43.07 | 323 | 100 | V | 25.279 | 2.31 | 27.49 | 43.169 | 54 | -10.831 | Ave |
| 1600 | 41.89 | 95 | 100 | H | 25.279 | 2.31 | 27.49 | 41.989 | 54 | -12.011 | Ave |
| 5150 | 27.07 | 0 | 100 | V | 33.323 | 4.38 | 0 | 64.773 | 74 | -9.227 | Peak |
| 5150 | 27.5 | 0 | 100 | H | 33.323 | 4.38 | 0 | 65.203 | 74 | -8.797 | Peak |
| 5150 | 13.11 | 0 | 100 | V | 33.323 | 4.38 | 0 | 50.813 | 54 | -3.187 | Ave |
| 5150 | 13.05 | 0 | 100 | H | 33.323 | 4.38 | 0 | 50.753 | 54 | -3.247 | Ave |
| 250.05 | 25.88 | 282 | 100 | V | 12.3 | 11.37 | 12.9 | 36.65 | 46 | -9.35 | QP |

| 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 5230 MHz, measured at 3 meters | | | | | | | | | | | |
| 10460 | 31.86 | 0 | 100 | V | 38.061 | 6.14 | 27.83 | 48.231 | 88.2 | -39.969 | Peak |
| 10460 | 31.9 | 0 | 100 | H | 38.061 | 6.14 | 27.83 | 48.271 | 88.2 | -39.929 | Peak |
| 10460 | 17.3 | 0 | 100 | V | 38.061 | 6.14 | 27.83 | 33.671 | 68.2 | -34.529 | Ave |
| 10460 | 17.53 | 0 | 100 | H | 38.061 | 6.14 | 27.83 | 33.901 | 68.2 | -34.299 | Ave |
| 15690 | 31.87 | 0 | 100 | V | 37.612 | 7.71 | 25.46 | 51.732 | 74 | -22.268 | Peak |
| 15690 | 32.65 | 0 | 100 | H | 37.612 | 7.71 | 25.46 | 52.512 | 74 | -21.488 | Peak |
| 15690 | 17.95 | 0 | 100 | V | 37.612 | 7.71 | 25.46 | 37.812 | 54 | -16.188 | Ave |
| 15690 | 17.86 | 0 | 100 | H | 37.612 | 7.71 | 25.46 | 37.722 | 54 | -16.278 | Ave |
| 1600 | 57.88 | 323 | 100 | V | 25.279 | 2.31 | 27.49 | 57.979 | 74 | -16.021 | Peak |
| 1600 | 56.68 | 95 | 100 | H | 25.279 | 2.31 | 27.49 | 56.779 | 74 | -17.221 | Peak |
| 1600 | 41.22 | 323 | 100 | V | 25.279 | 2.31 | 27.49 | 41.319 | 54 | -12.681 | Ave |
| 1600 | 42.1 | 95 | 100 | H | 25.279 | 2.31 | 27.49 | 42.199 | 54 | -11.801 | Ave |
| 4980 | 40.74 | 73 | 100 | V | 33.062 | 4.21 | 27.51 | 50.502 | 74 | -23.498 | Peak |
| 4980 | 41.62 | 310 | 100 | H | 33.062 | 4.21 | 27.51 | 51.382 | 74 | -22.618 | Peak |
| 4980 | 20.95 | 73 | 100 | V | 33.062 | 4.21 | 27.51 | 30.712 | 54 | -23.288 | Ave |
| 4980 | 20.75 | 310 | 100 | H | 33.062 | 4.21 | 27.51 | 30.512 | 54 | -23.488 | Ave |
| 5350 | 27.47 | 0 | 100 | V | 33.659 | 4.59 | 0 | 65.719 | 74 | -8.281 | Peak |
| 5350 | 27.88 | 0 | 100 | H | 33.659 | 4.59 | 0 | 66.129 | 74 | -7.871 | Peak |
| 5350 | 12.97 | 0 | 100 | V | 33.659 | 4.59 | 0 | 51.219 | 54 | -2.781 | Ave |
| 5350 | 13.05 | 0 | 100 | H | 33.659 | 4.59 | 0 | 51.299 | 54 | -2.701 | Ave |
| 250.05 | 27.16 | 273 | 100 | V | 12.3 | 11.37 | 12.9 | 37.93 | 46 | -8.07 | QP |

# 7 FCC §407(a)(1) & IC RSS-210 §A9.2 - Peak Output Power Measurement

## 7.1 Applicable Standard

**According to FCC §15.407(a)(1)**

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

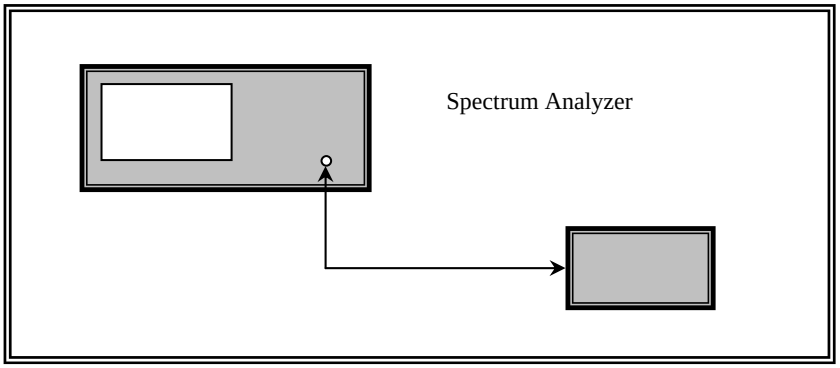
For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm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

**According to IC RSS-210 §A9.2:**

For the 5.15–5.35 GHz, 5.47-5.6 GHz, and 5.650–5.725 GHz bands, the maximum conducted output power shall not exceed 250 mW or 11 dBm + 10 log B, whichever power is less. The power spectral density shall not exceed 11 dBm in any 1 megahertz band. The maximum e.i.r.p shall not exceed 1.0W or 17 + 10 10B, dbm, whichever is less. B is the 99% emission bandwidth in MHz.

## 7.2 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.



## 7.3 Test Equipment List and Details

| Manufacturers | Description | Models | Serial Numbers | Calibration Dates | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4446A | US44300386 | 2012-08-11 | 1 year |

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

## 7.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 26 °C |
| **Relative Humidity:** | 43 % |
| **ATM Pressure:** | 101.5 kPa |

*The testing was performed by Ning Ma on 2012-06-28 in RF site.*

| | |
|---|---|
| **Temperature:** | 24 °C |
| **Relative Humidity:** | 41.8 % |
| **ATM Pressure:** | 101.1 kPa |

*The testing was performed by Ning Ma on 2012-10-04 in RF site*

## 7.5 Test Results

**Antenna gain 12 dBi**

**5150-5250 MHz**

**802.11 a mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Max Power (dBm) | Limit (dBm) | Margin (dB) | Power Level |
|---|---|---|---|---|---|---|---|---|
| Low | 5180 | 8.53 | 7.47 | 9.03 | 9.03 | 11 | -1.97 | 10.5 |
| Middle | 5200 | 8.52 | 7.95 | 8.78 | 8.78 | 11 | -2.22 | 10.5 |
| High | 5240 | 8.82 | 7.93 | 9.33 | 9.33 | 11 | -1.67 | 10 |

**802.11 n 20 mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) | Power Level |
|---|---|---|---|---|---|---|---|---|
| Low | 5180 | 4.26 | 3.41 | 4.85 | 8.98 | 11 | -2.02 | 6 |
| Middle | 5200 | 4.17 | 3.38 | 4.71 | 8.89 | 11 | -2.11 | 6 |
| High | 5240 | 5.18 | 4.17 | 5.43 | 9.73 | 11 | -1.27 | 6 |

**802.11 n 40 mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) | Power Level |
|---|---|---|---|---|---|---|---|---|
| Low | 5190 | 5.83 | 5.23 | 6.82 | 10.78 | 11 | -0.22 | 7.5 |
| High | 5230 | 6.4 | 5.27 | 6.31 | 10.79 | 11 | -0.21 | 7.5 |

**Antenna gain 15 dBi**

**5150-5250 MHz**

**802.11 a mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Max Power (dBm) | Limit (dBm) | Margin (dB) | Power Level |
|---|---|---|---|---|---|---|---|---|
| Low | 5180 | 5.68 | 4.39 | 4.73 | 5.68 | 8 | -2.32 | 6 |
| Middle | 5200 | 5.87 | 4.39 | 5.49 | 5.87 | 8 | -2.13 | 6 |
| High | 5240 | 5.67 | 4.2 | 5.21 | 5.67 | 8 | -2.33 | 5.5 |

**802.11 n 20 mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) | Power Level |
|---|---|---|---|---|---|---|---|---|
| Low | 5180 | 1.78 | 0.22 | 1.42 | 5.96 | 8 | -2.04 | 2 |
| Middle | 5200 | 2.08 | 0.12 | 1.38 | 6.04 | 8 | -1.96 | 2 |
| High | 5240 | 2.41 | 0.1 | 1.67 | 6.27 | 8 | -1.73 | 2 |

**802.11 n 40 mode**

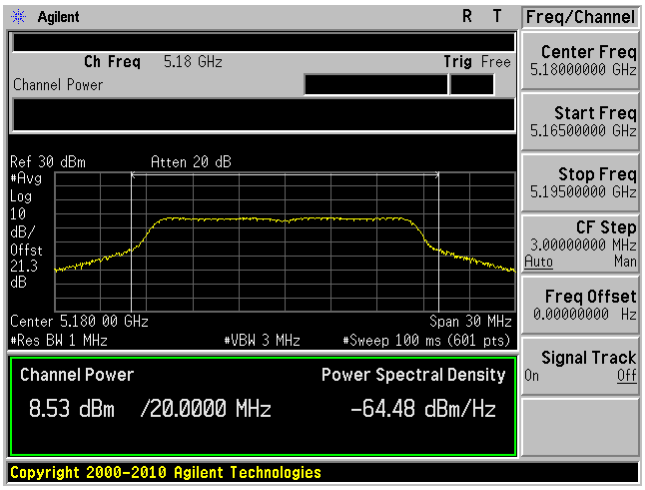
| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) | Power Level |
|---|---|---|---|---|---|---|---|---|
| Low | 5190 | 3.06 | 2.14 | 3.12 | 7.56 | 8 | -0.44 | 7.5 |
| High | 5230 | 3.44 | 1.39 | 2.93 | 7.44 | 8 | -0.56 | 7.5 |

**Antenna gain is 12 dBi**

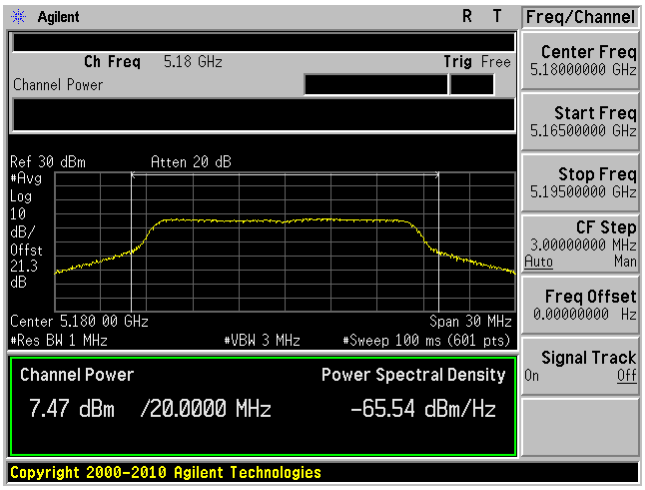
**5150-5250 MHz**

**802.11 a mode**

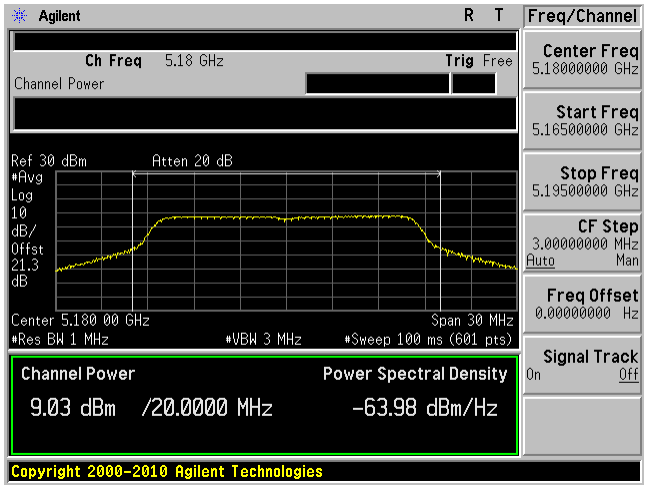
802.11a mode, 5180 MHz, Chain J10



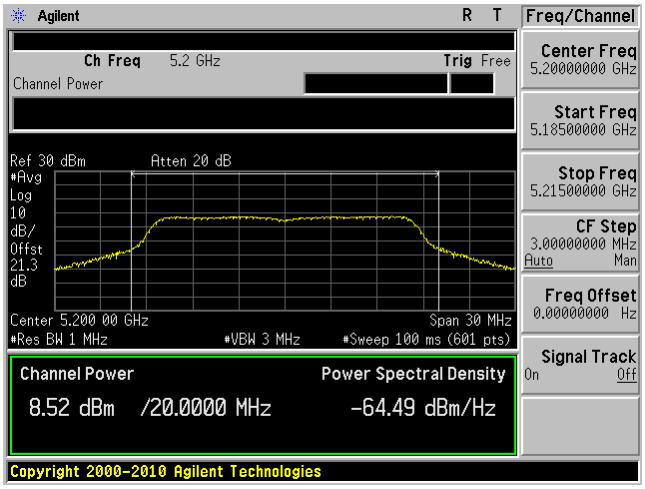

802.11a mode, 5180 MHz, Chain J8



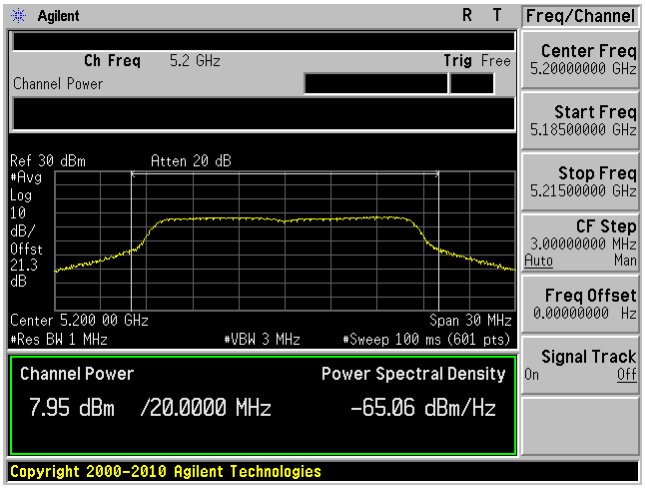

802.11a mode, 5180 MHz, Chain J6



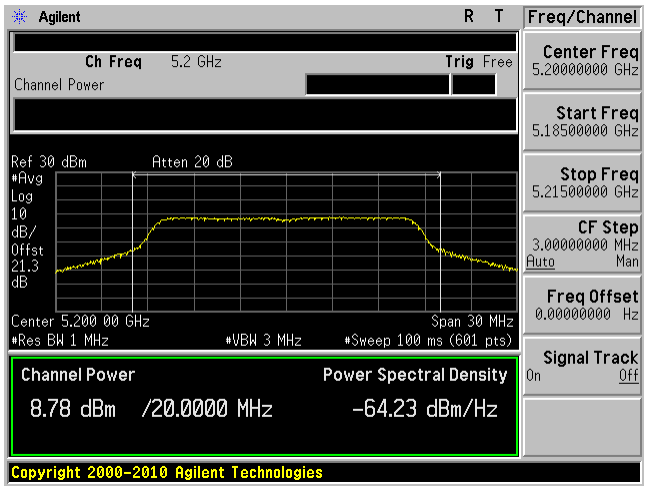
802.11a mode, 5200 MHz, Chain J10



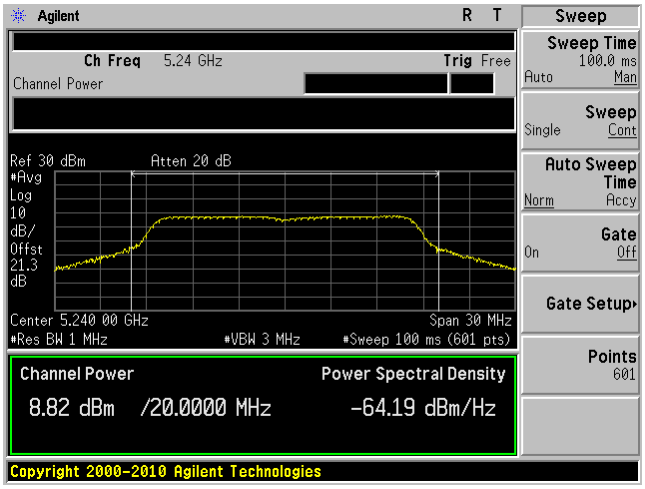

802.11a mode, 5200 MHz, Chain J8



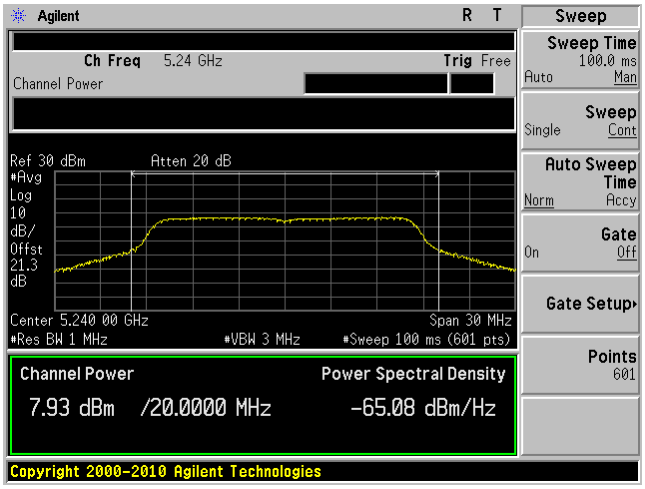

802.11a mode, 5200 MHz, Chain J6



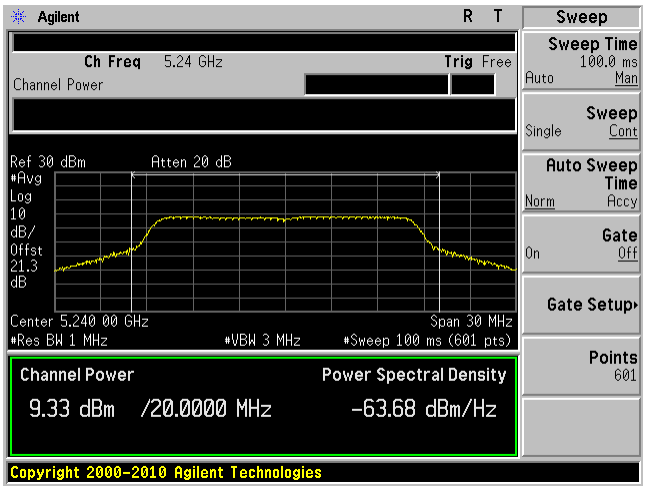
802.11a mode, 5240 MHz, Chain J10




802.11a mode, 5240 MHz, Chain J8

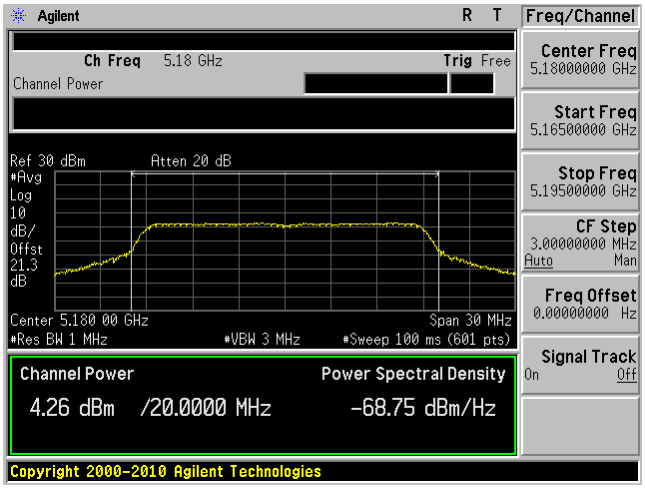



802.11a mode, 5240 MHz, Chain J6

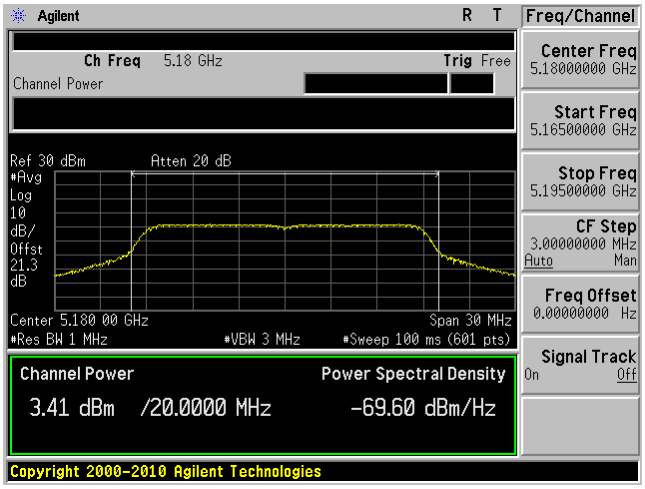


**802.11 n 20 mode**

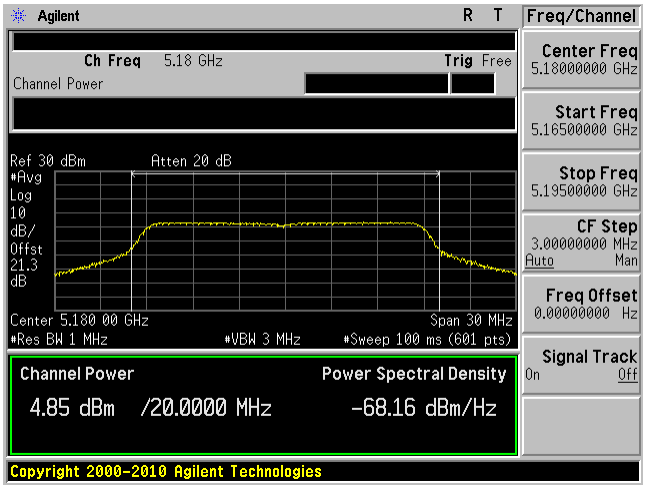
802.11n 20 mode, 5180 MHz, Chain J10



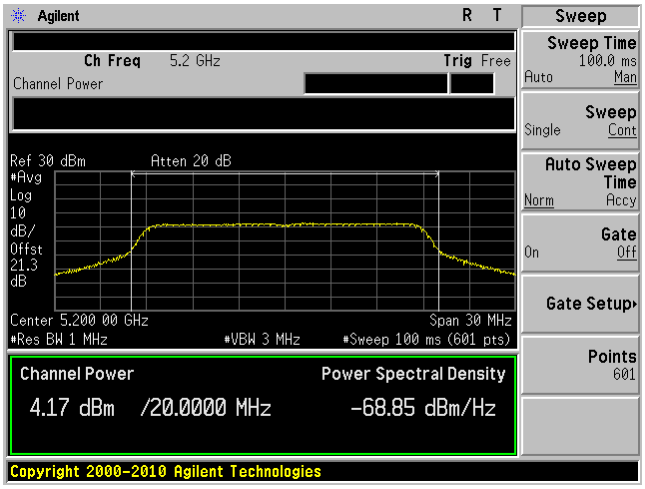

802.11n 20 mode, 5180 MHz, Chain J8



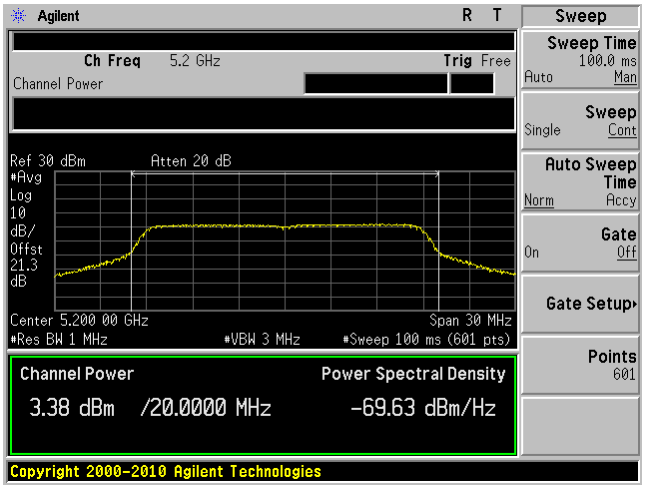

802.11n 20 mode, 5180 MHz, Chain J6



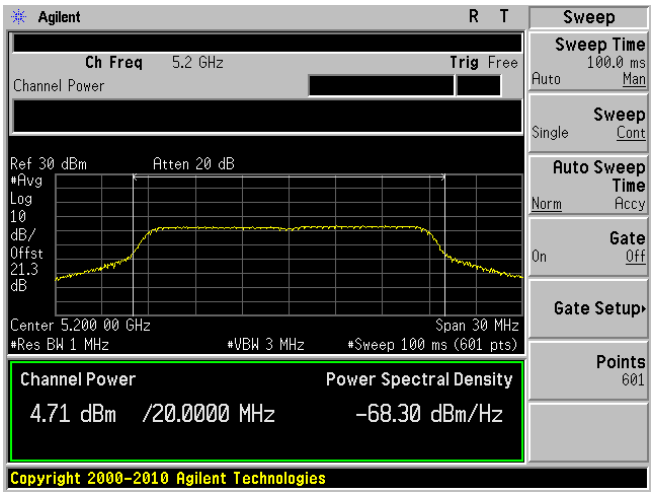
802.11n 20 mode, 5200 MHz, Chain J10



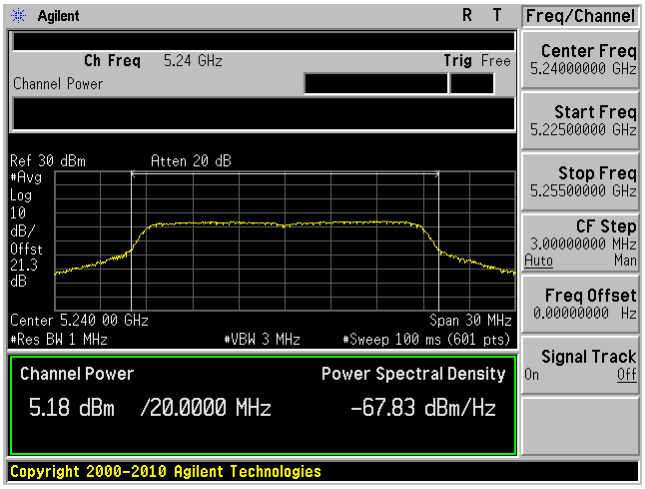

802.11n 20 mode, 5200 MHz, Chain J8



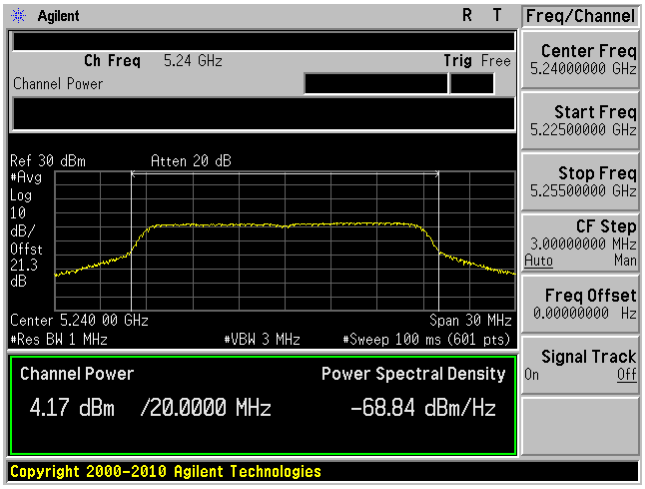

802.11n 20 mode, 5200 MHz, Chain J6



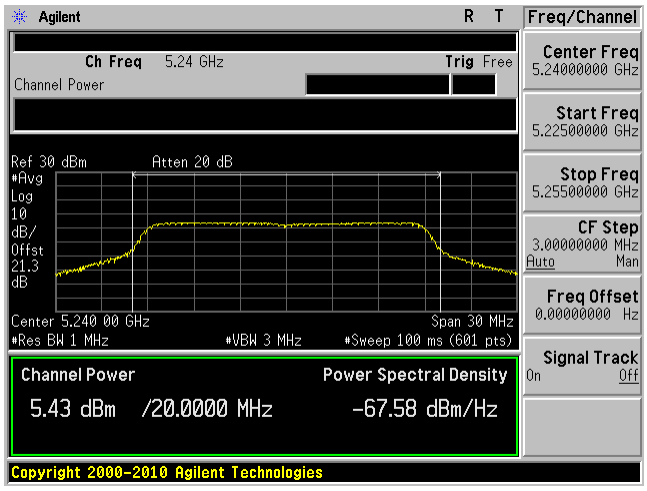
802.11n 20 mode, 5240 MHz, Chain J10




802.11n 20 mode, 5240 MHz, Chain J8

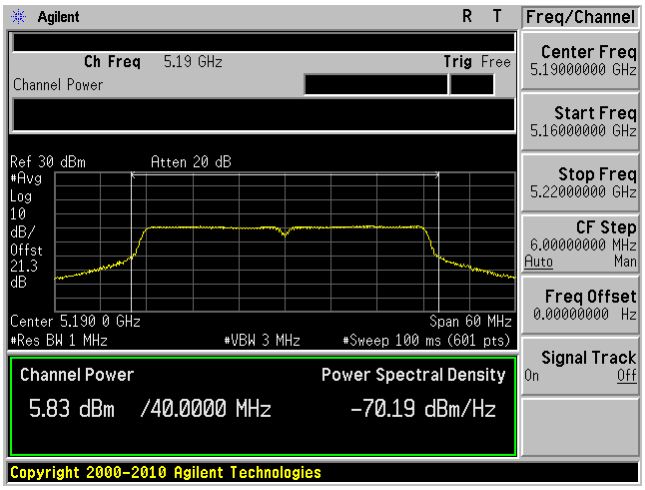



802.11n 20 mode, 5240 MHz, Chain J6

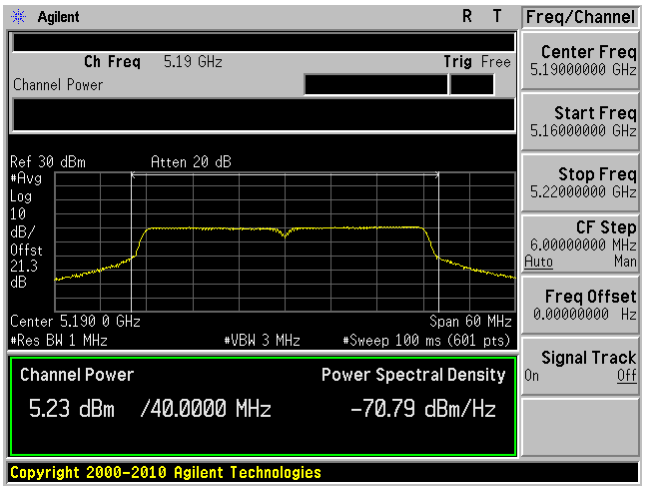


**802.11 n 40 mode**

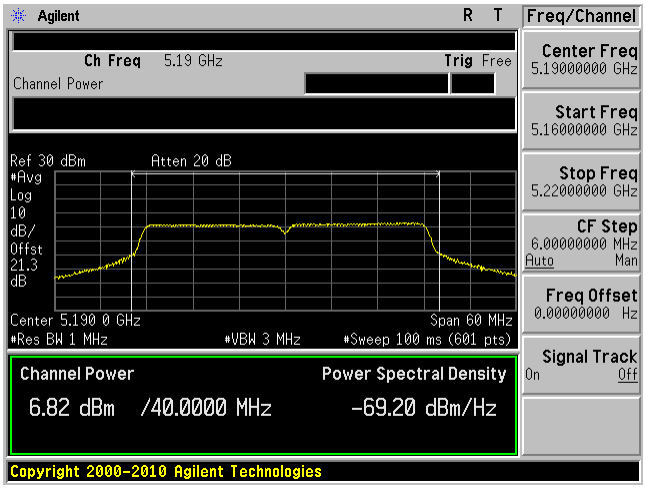
802.11n 40 mode, 5190 MHz, Chain J10



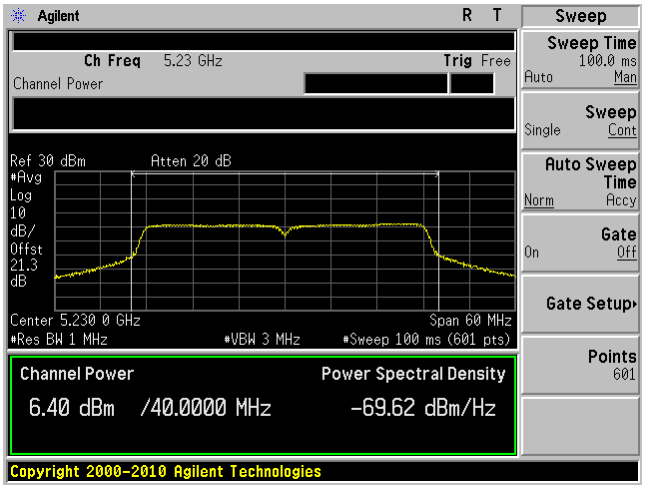

802.11n 40 mode, 5190 MHz, Chain J8



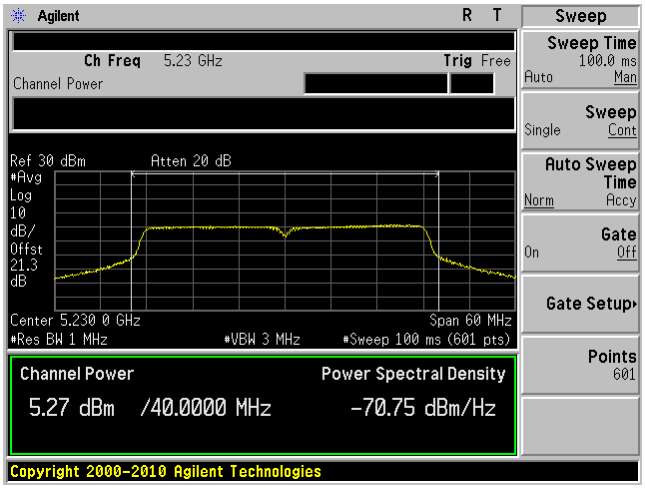

802.11n 40 mode, 5190 MHz, Chain J6



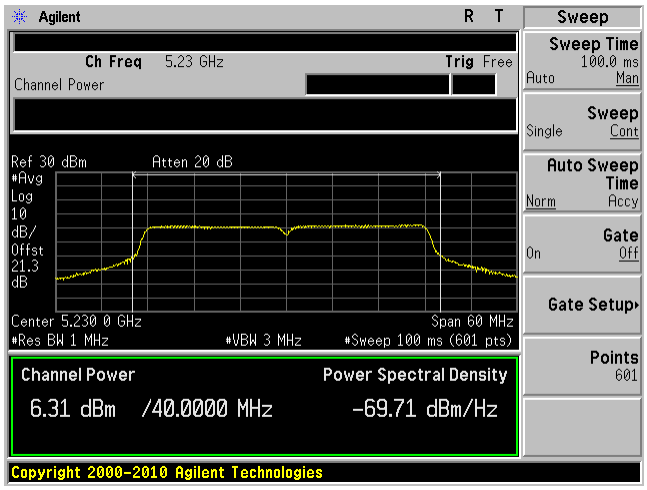
802.11n 40 mode, 5230 MHz, Chain J10




802.11n 40 mode, 5230 MHz, Chain J8




802.11n 40 mode, 5230 MHz, Chain J6

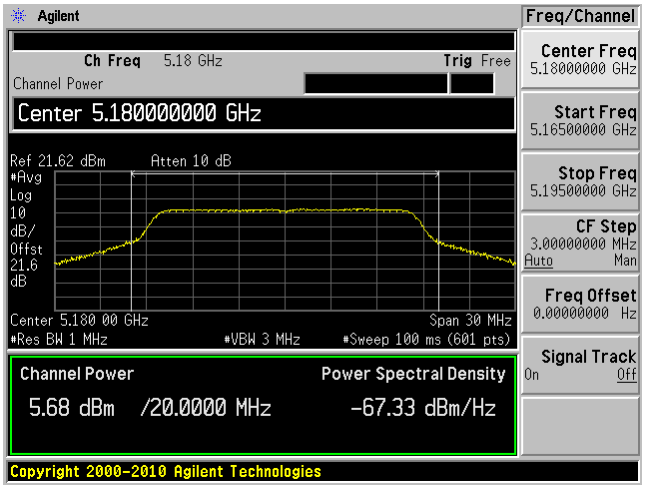


**Antenna gain is 15 dBi**

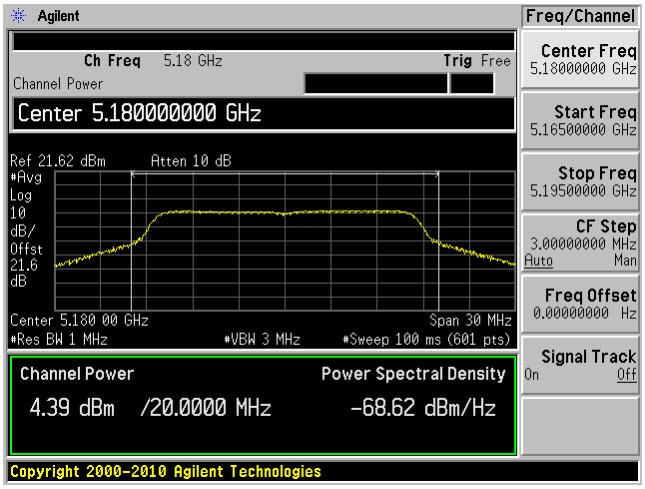
**5150-5250 MHz**

**802.11 a mode**

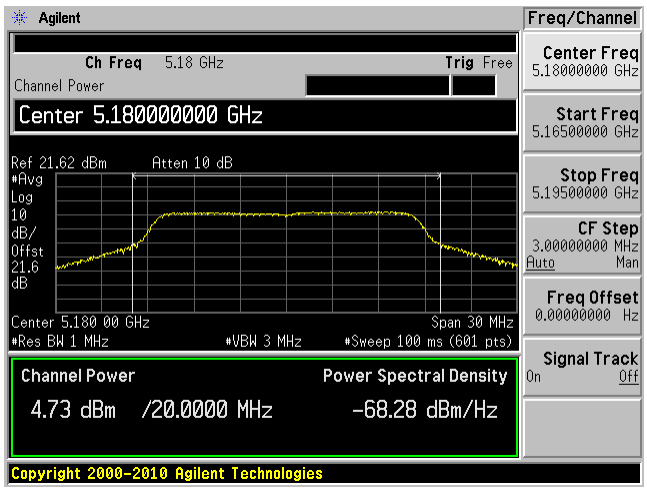
802.11a mode, 5180 MHz, Chain J10



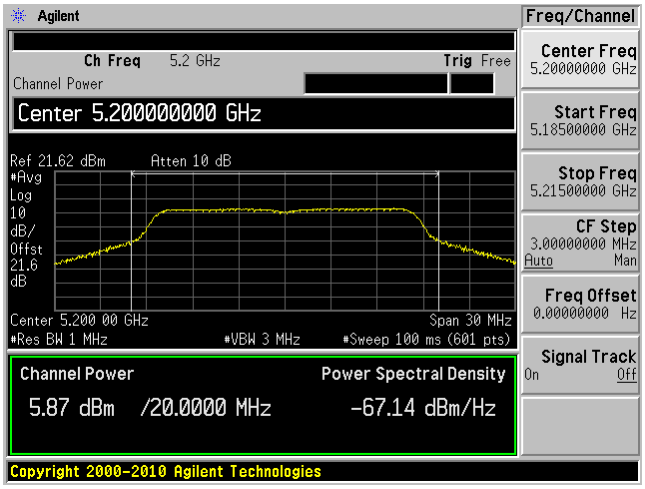

802.11a mode, 5180 MHz, Chain J8



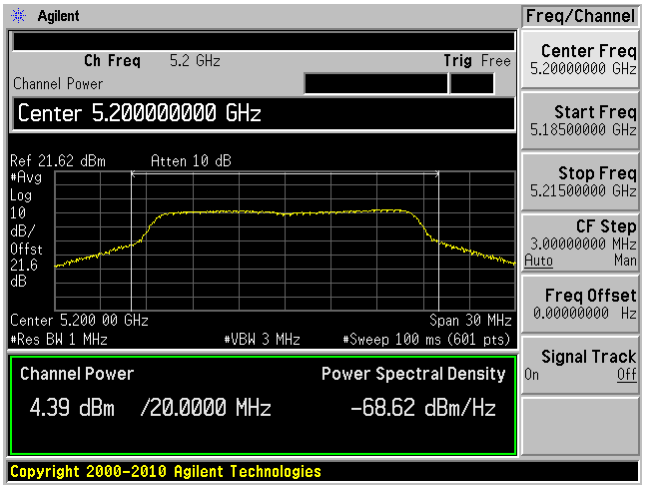

802.11a mode, 5180 MHz, Chain J6



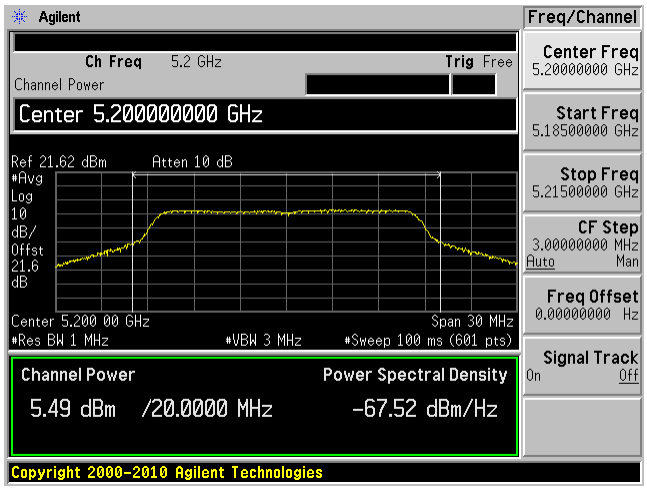
802.11a mode, 5200 MHz, Chain J10



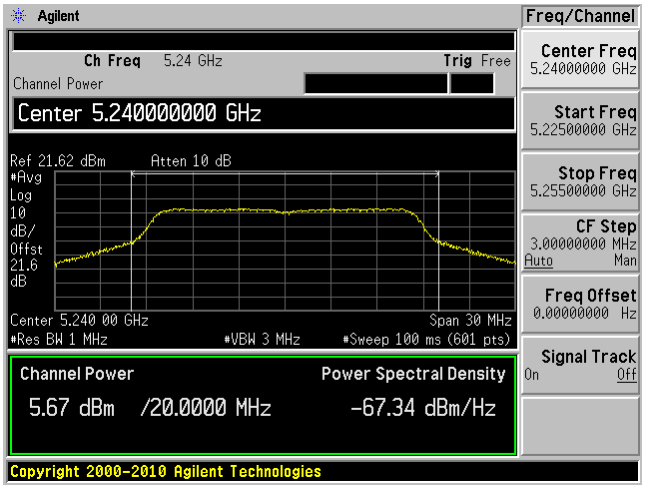

802.11a mode, 5200 MHz, Chain J8



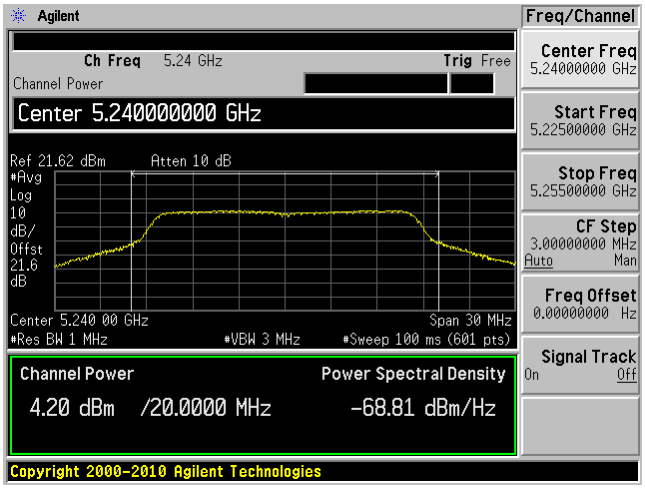

802.11a mode, 5200 MHz, Chain J6



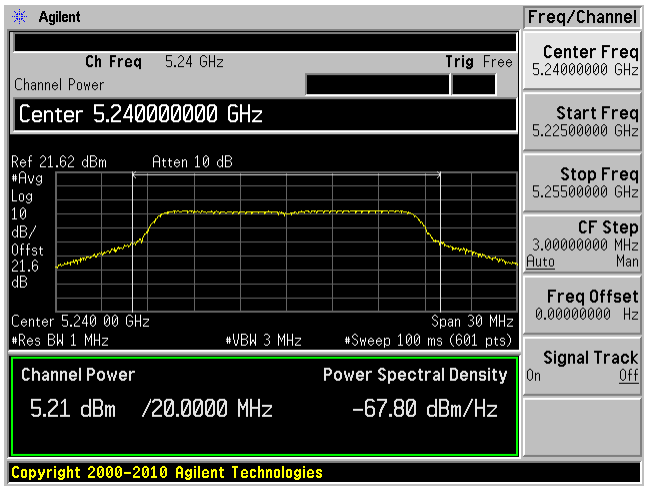
802.11a mode, 5240 MHz, Chain J10




802.11a mode, 5240 MHz, Chain J8

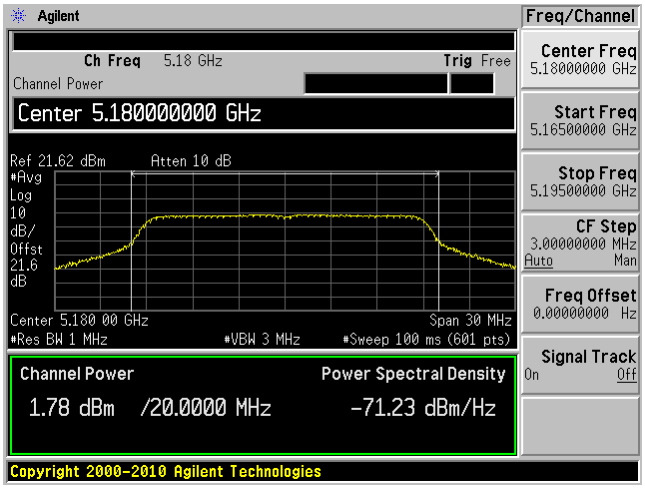



802.11a mode, 5240 MHz, Chain J6

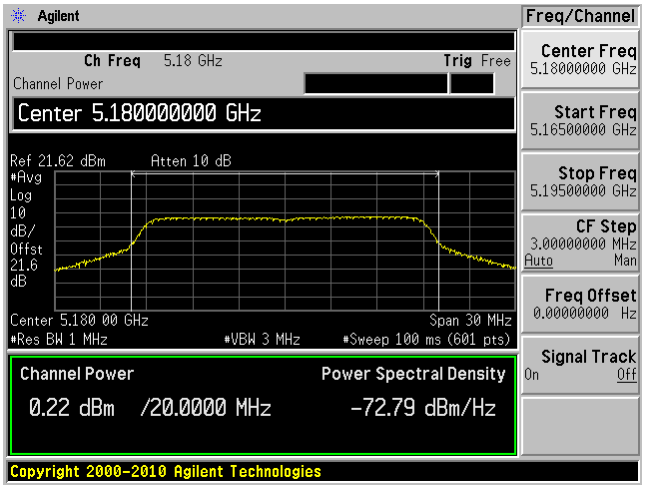


**802.11 n 20 mode**

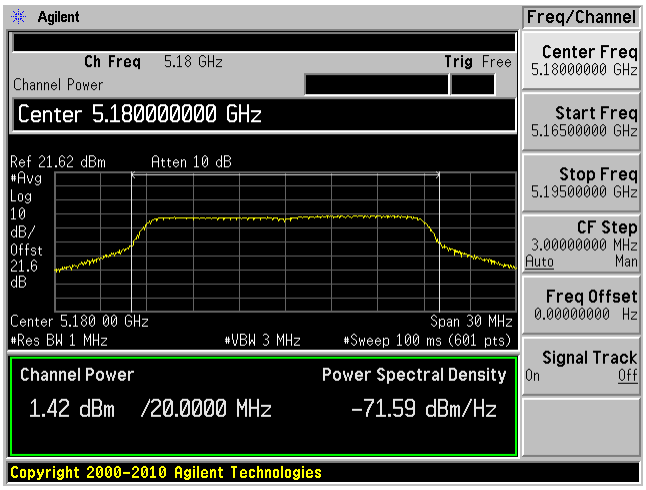
802.11n 20 mode, 5180 MHz, Chain J10



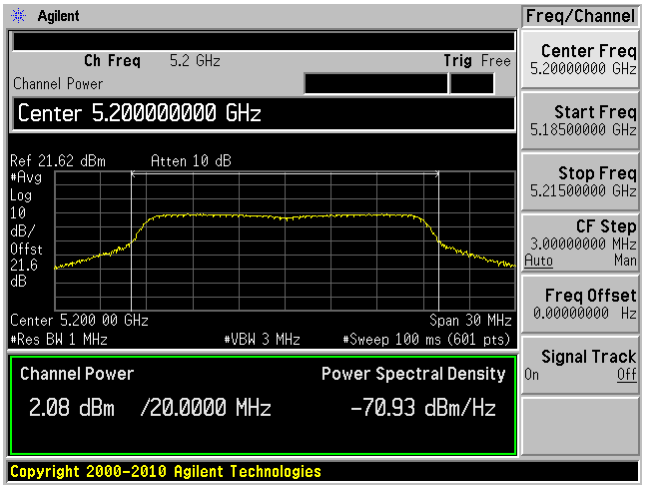

802.11n 20 mode, 5180 MHz, Chain J8



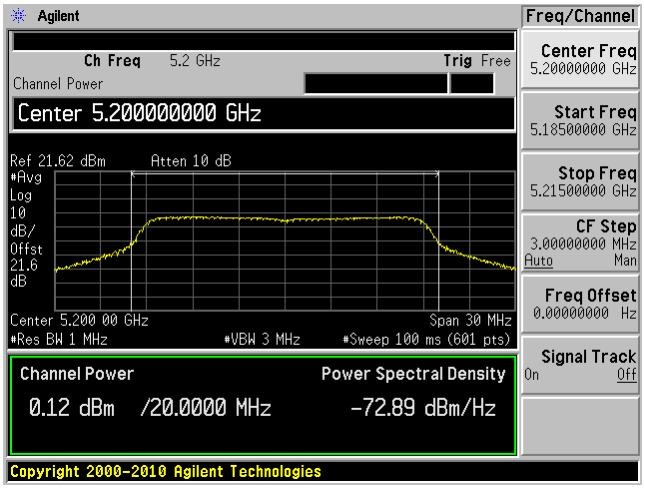

802.11n 20 mode, 5180 MHz, Chain J6



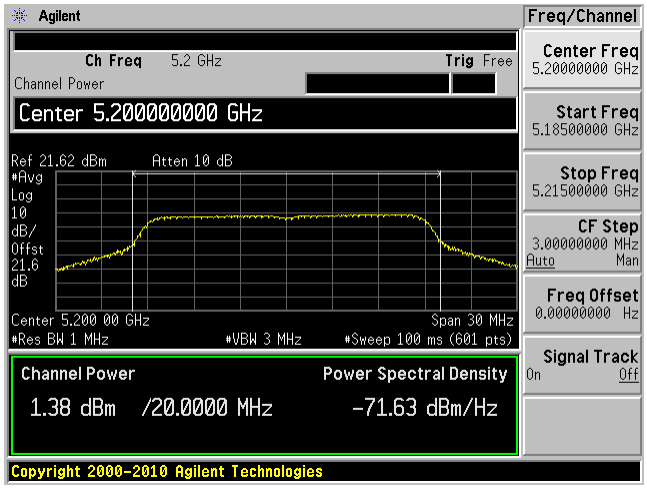
802.11n 20 mode, 5200 MHz, Chain J10



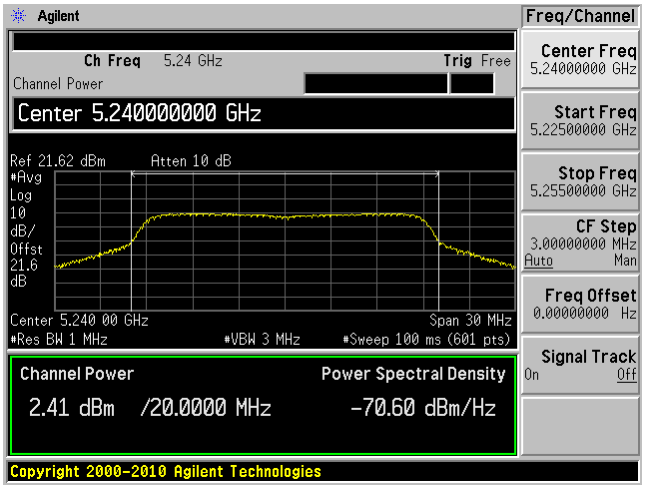

802.11n 20 mode, 5200 MHz, Chain J8



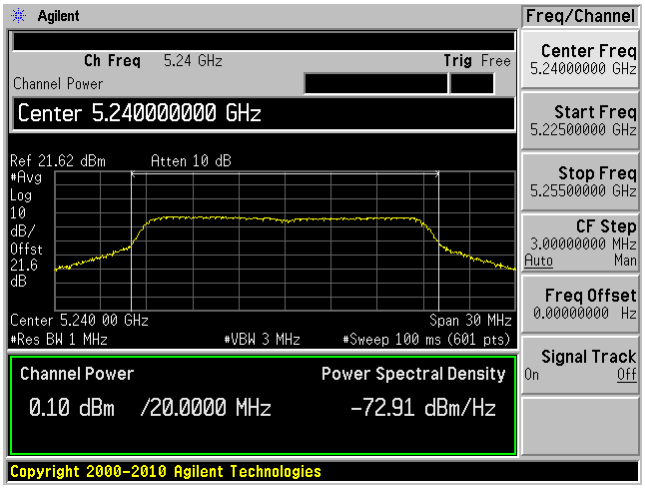

802.11n 20 mode, 5200 MHz, Chain J6



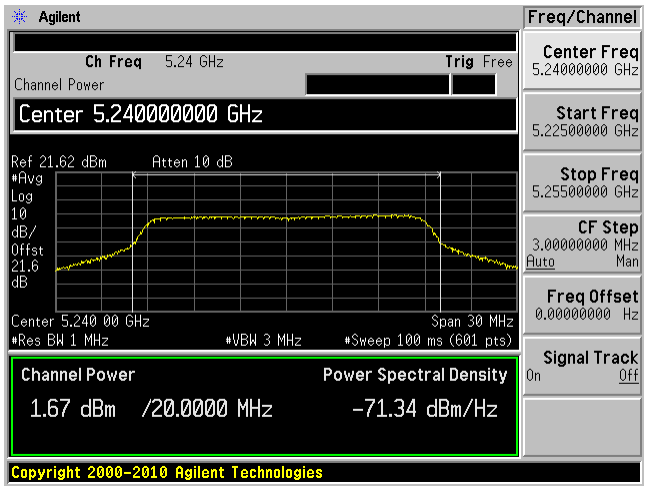
802.11n 20 mode, 5240 MHz, Chain J10




802.11n 20 mode, 5240 MHz, Chain J8

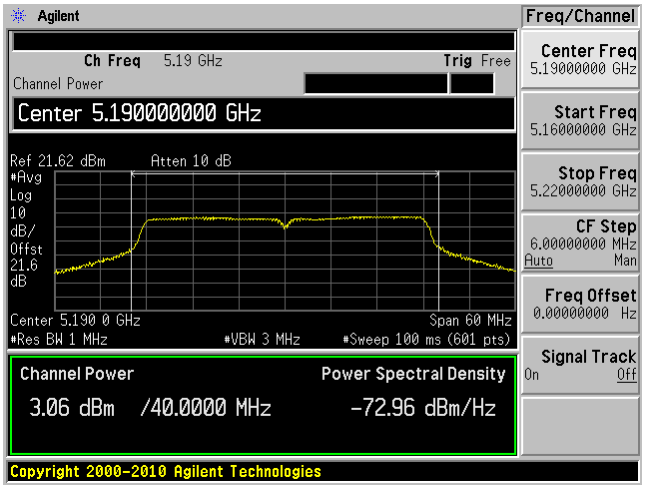



802.11n 20 mode, 5240 MHz, Chain J6

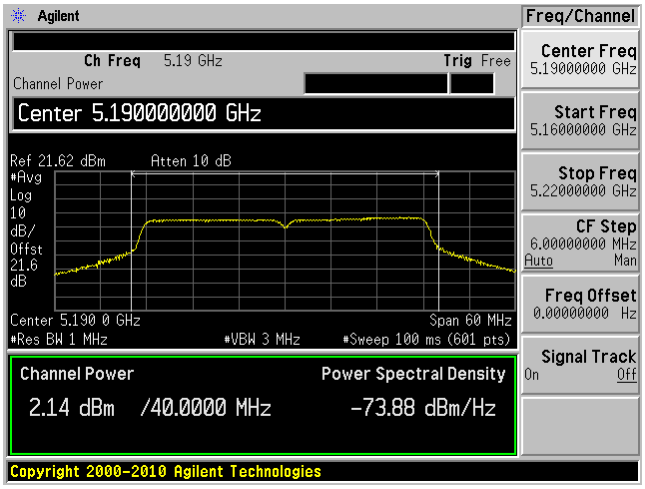


**802.11 n 40 mode**

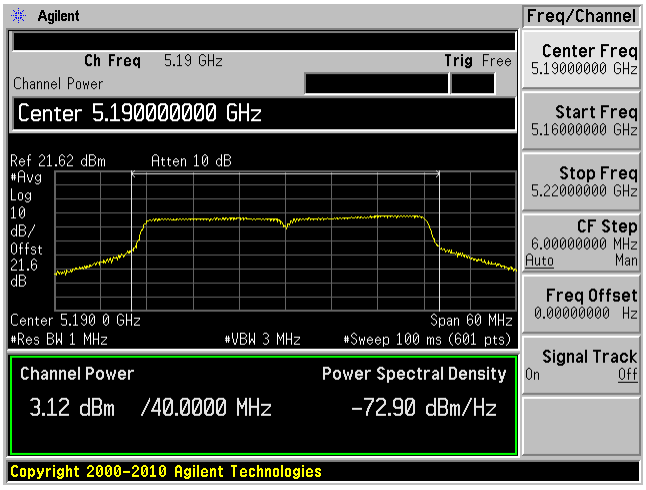
802.11n 40 mode, 5190 MHz, Chain J10



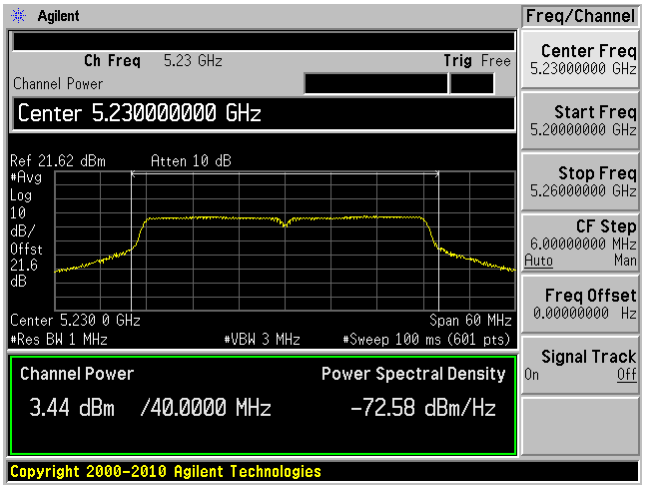

802.11n 40 mode, 5190 MHz, Chain J8



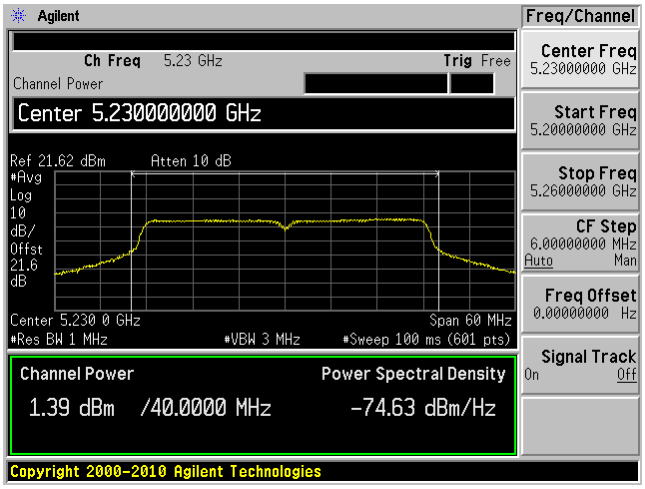

802.11n 40 mode, 5190 MHz, Chain J6



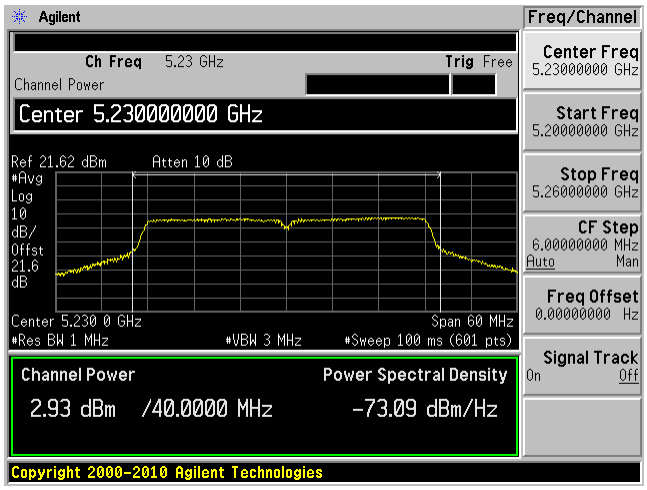
802.11n 40 mode, 5230 MHz, Chain J10




802.11n 40 mode, 5230 MHz, Chain J8




802.11n 40 mode, 5230 MHz, Chain J6



# 8 FCC §15.407(b) & IC RSS-210 §A9.2 - Out of Band Emissions

## 8.1 Applicable Standard

**According to FCC §15.407(b)**

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

For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz

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

## 8.2 Measurement Procedure

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

## 8.3 Test Equipment List and Details

| Manufacturers | Description | Models | Serial Numbers | Calibration Dates | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | US45303156 | 2012-08-22 | 1 year |

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

## 8.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 43.5 % |
| **ATM Pressure:** | 101.6 kPa |

*The testing was performed by Ning Ma on 2012-06-30 in RF site.*

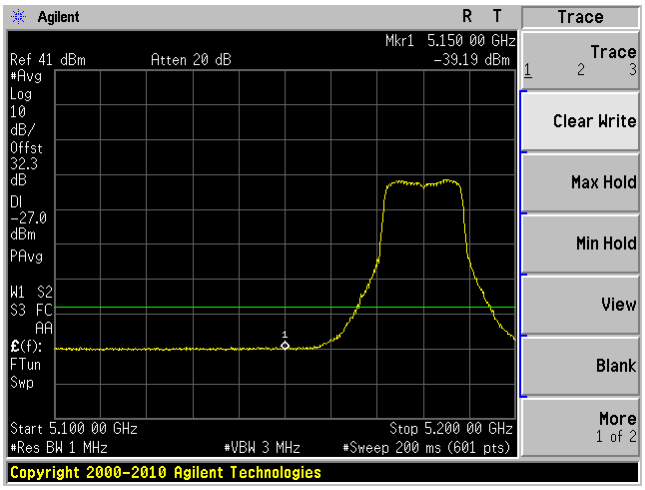
## 8.5 Test Results

Please refer to following pages for plots of band edge.

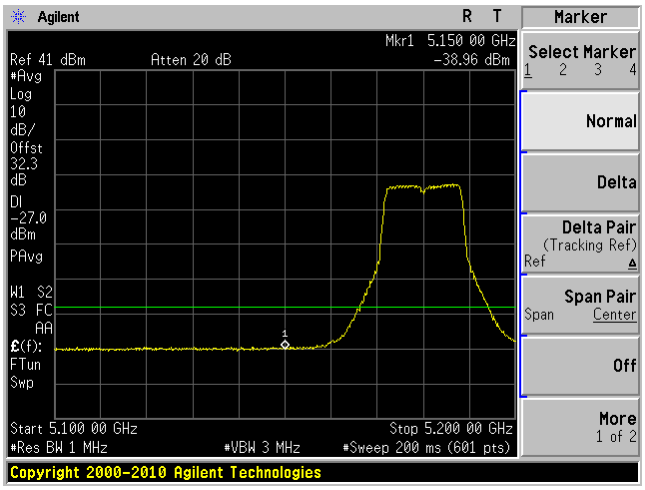
**Antenna Gain 12 dBi**

**5150-5250 MHz**

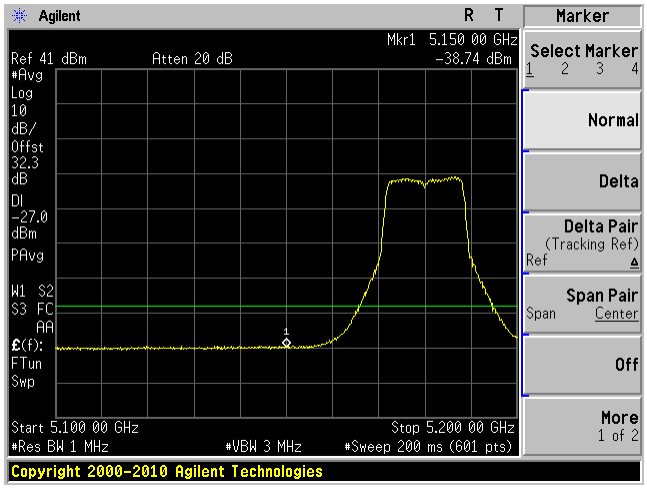
802.11a mode, Lowest Channel, Chain J10



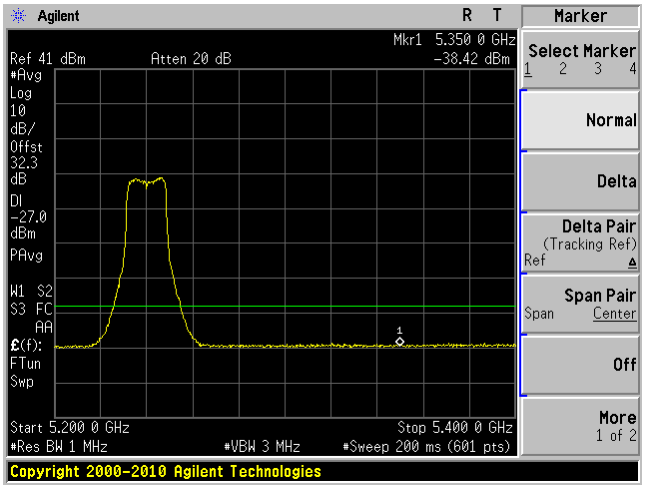

802.11a mode, Lowest Channel, Chain J8



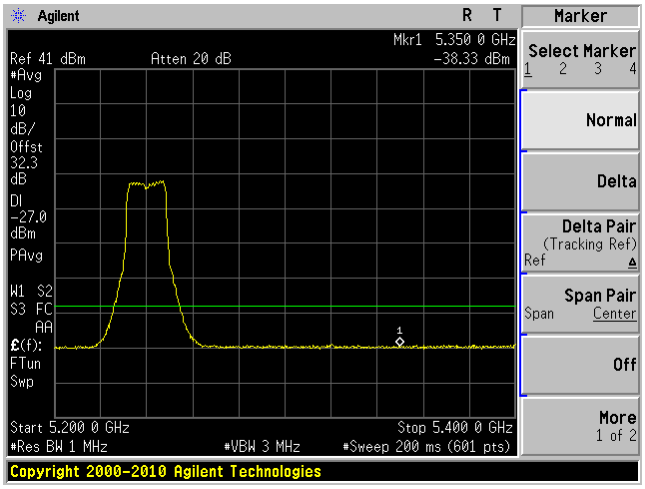

802.11a mode, Lowest Channel, Chain J6



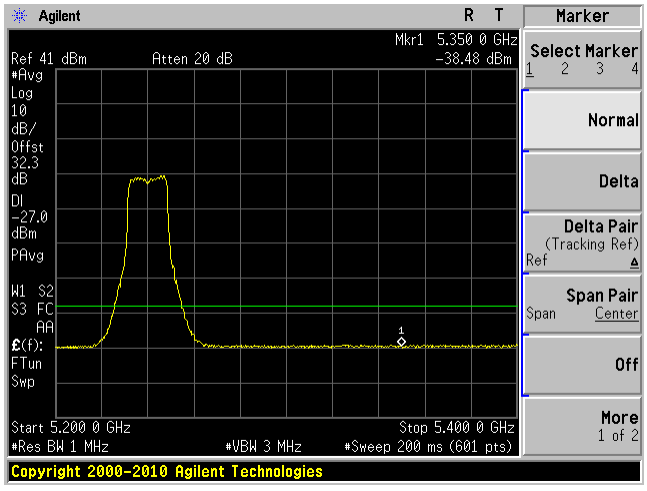
802.11a mode, Highest Channel, Chain J10



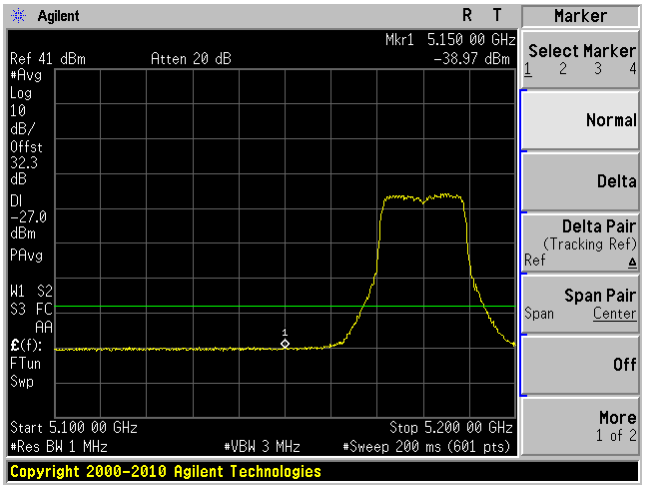

802.11a mode, Highest Channel, Chain J8



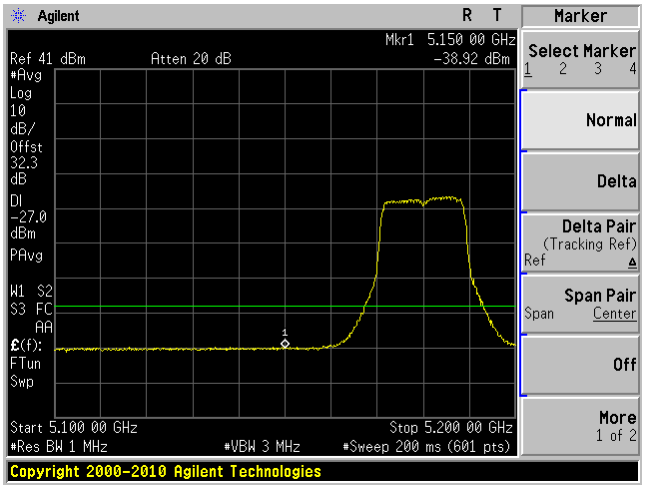

802.11a mode, Highest Channel, Chain J6



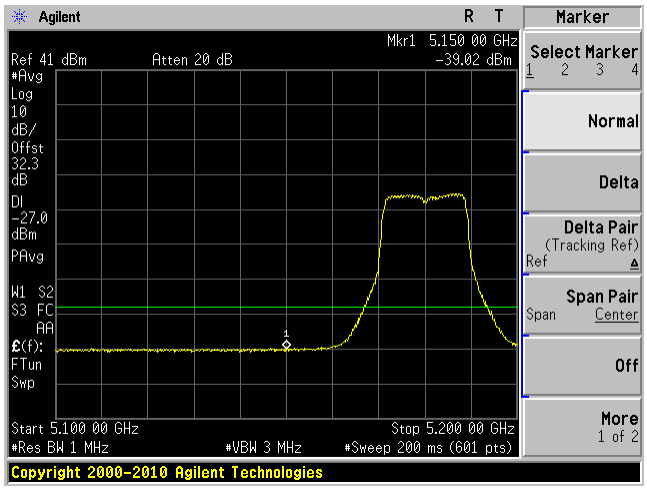
802.11n HT20 mode, Lowest Channel, Chain J10



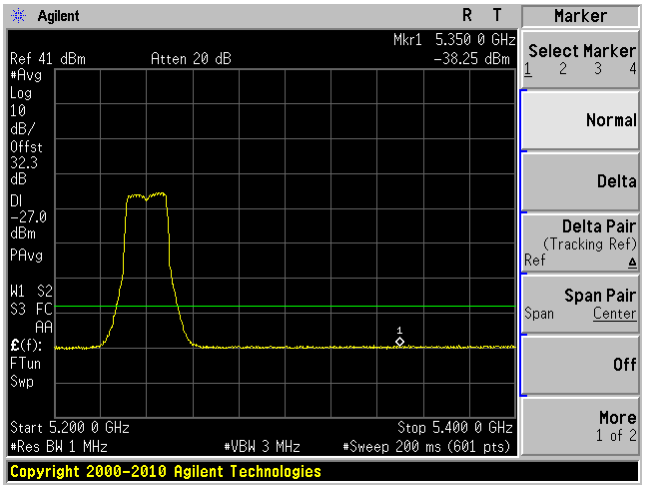

802.11n HT20 mode, Lowest Channel, Chain J8



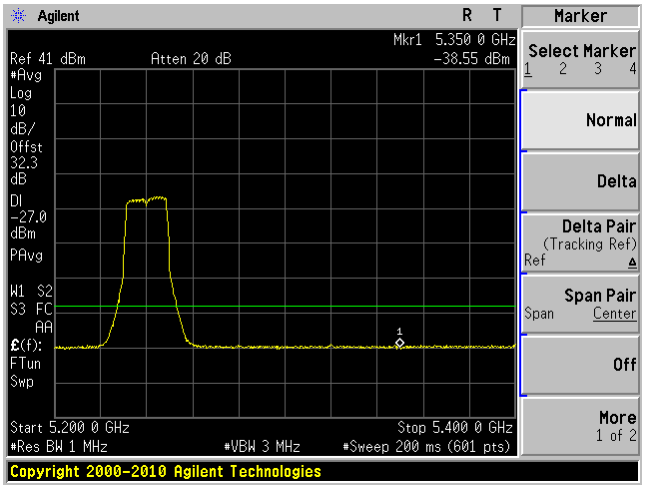

802.11n HT20 mode, Lowest Channel, Chain J6



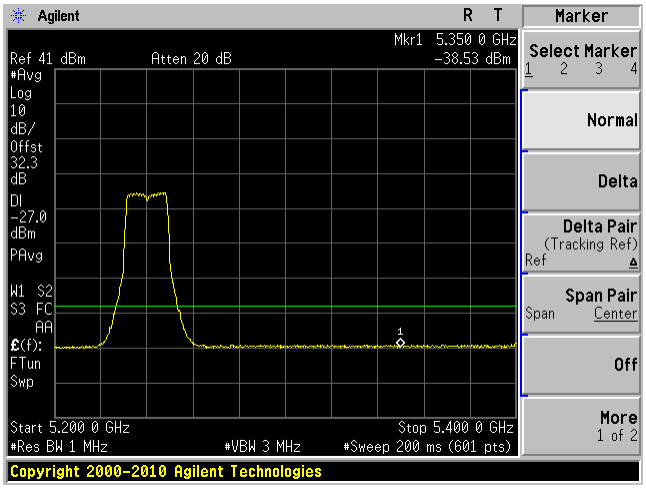
802.11n HT20 mode, Highest Channel, Chain J10



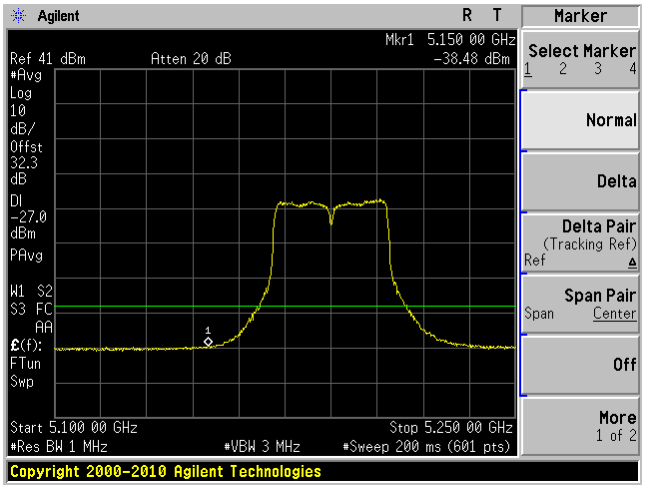

802.11n HT20 mode, Highest Channel, Chain J8



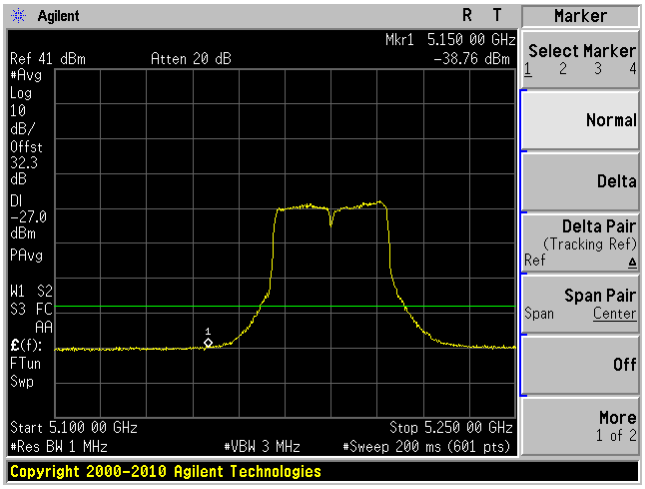

802.11n HT20 mode, Highest Channel, Chain J6



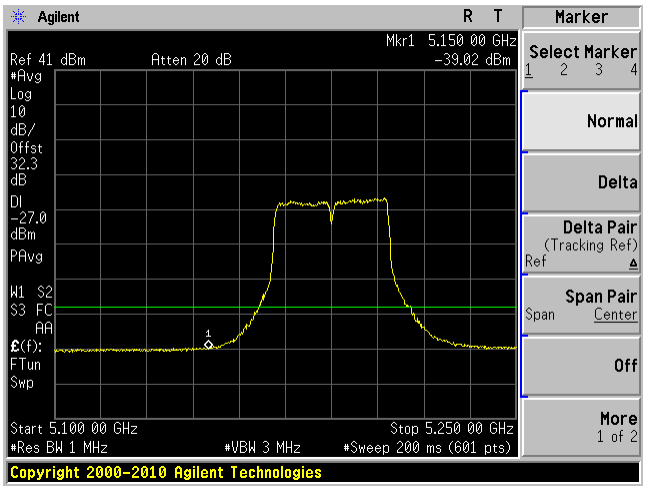
802.11n HT40 mode, Lowest Channel, Chain J10



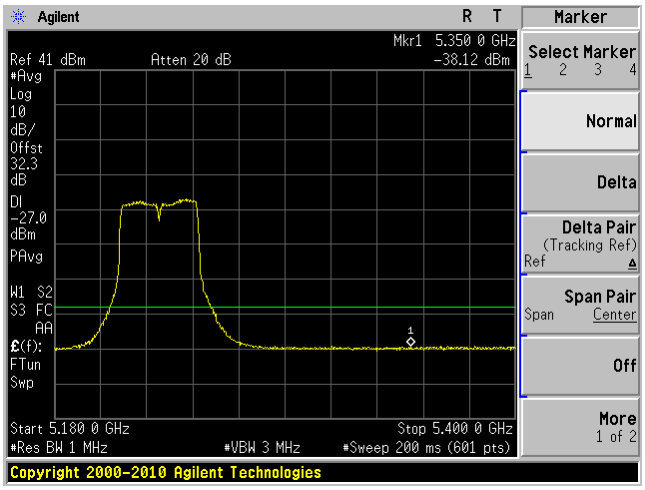

802.11n HT40 mode, Lowest Channel, Chain J8



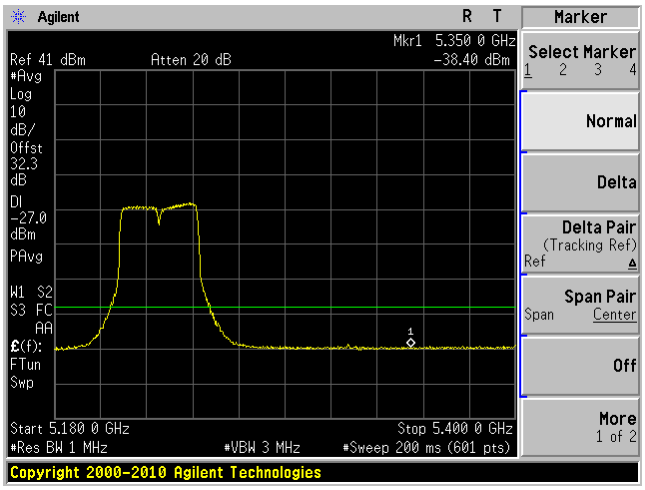

802.11n HT40 mode, Lowest Channel, Chain J6



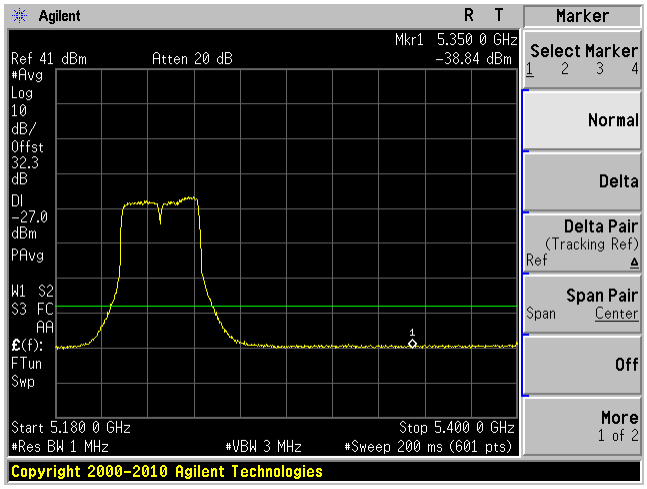
802.11n HT40 mode, Highest Channel, Chain J10




802.11n HT40 mode, Highest Channel, Chain J8




802.11n HT40 mode, Highest Channel, Chain J6



# 9 FCC §15.407(a)(1) & IC RSS-210 §A9.2 - Power Spectral Density

## 9.1 Applicable Standard

**According to FCC §15.407(a)(1)**

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

**According to IC RSS-210 §A9.2:**

5150-5250MHz the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10 B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

## 9.2 Measurement Procedure

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

## 9.3 Test Equipment List and Details

| Manufacturers | Description | Models | Serial Numbers | Calibration Dates | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | US45303156 | 2012-08-22 | 1 year |

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

## 9.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 43.5 % |
| **ATM Pressure:** | 101.6 kPa |

*The testing was performed by Ning Ma on 2012-06-30 in RF site*

| | |
|---|---|
| **Temperature:** | 24 °C |
| **Relative Humidity:** | 41.8 % |
| **ATM Pressure:** | 101.1 kPa |

*The testing was performed by Ning Ma on 2012-10-04 in RF site*

## 9.5 Test Results

**Antenna Gain 12 dBi**

**5150-5250 MHz**

**802.11 a mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Max Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5180 | -2.541 | -3.601 | -2.373 | -2.373 | -2 | -0.373 |
| Middle | 5200 | -2.784 | -3.159 | -2.145 | -2.145 | -2 | -0.145 |
| High | 5240 | -2.793 | -2.359 | -2.328 | -2.328 | -2 | -0.328 |

**802.11 n 20 mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5180 | -6.873 | -8.457 | -6.547 | -2.44 | -2 | -0.44 |
| Middle | 5200 | -7.442 | -8.194 | -6.47 | -2.54 | -2 | -0.54 |
| High | 5240 | -6.491 | -7.409 | -6.577 | -2.04 | -2 | -0.04 |

**802.11 n 40 mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5190 | -7.5810 | -8.367 | -6.511 | -2.65 | -2 | -0.65 |
| High | 5230 | -8.2580 | -8.09 | -6.943 | -2.95 | -2 | -0.95 |

**Antenna Gain 15 dBi**

**5150-5250 MHz**

**802.11 a mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Max Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5180 | -5.061 | -6.749 | -5.699 | -5.061 | -5 | -0.061 |
| Middle | 5200 | -5.026 | -6.326 | -5.33 | -5.026 | -5 | -0.026 |
| High | 5240 | -5.479 | -6.86 | -6.072 | -5.479 | -5 | -0.479 |

**802.11 n 20 mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5180 | -9.73 | -10.916 | -10.224 | -5.49 | -5 | -0.49 |
| Middle | 5200 | -9.205 | -11.049 | -9.543 | -5.09 | -5 | -0.09 |
| High | 5240 | -9.288 | -11.325 | -9.552 | -5.19 | -5 | -0.19 |

**802.11 n 40 mode**

| Channel | Frequency (MHz) | TX Chain J10 Power (dBm) | TX Chain J8 Power (dBm) | TX Chain J6 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5190 | -10.919 | -12.061 | -10.32 | -6.27 | -5 | -1.27 |
| High | 5230 | -10.794 | -12.536 | -10.894 | -6.57 | -5 | -1.57 |

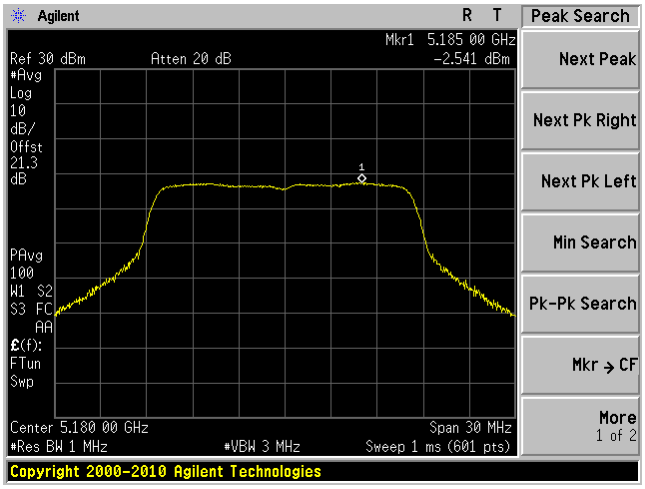
Please refer to the following plots.

**Antenna Gain 12 dBi**

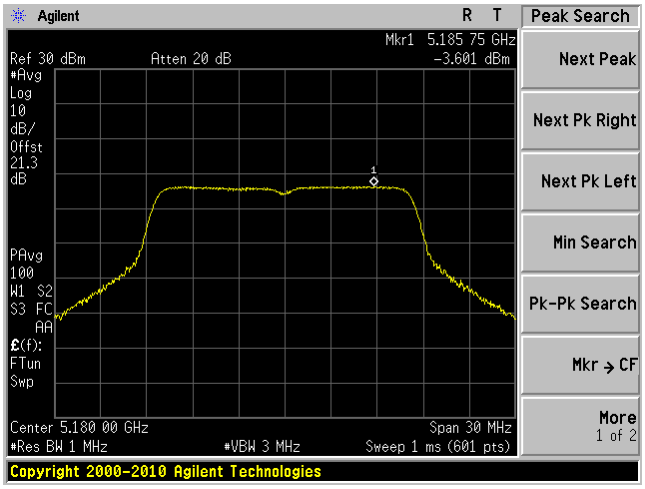
**5150-5250 MHz**

**802.11 a mode**

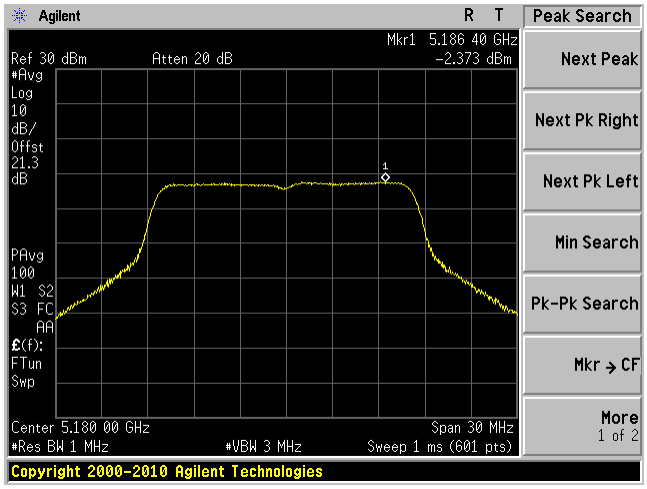
802.11a mode, 5180 MHz, Chain J10



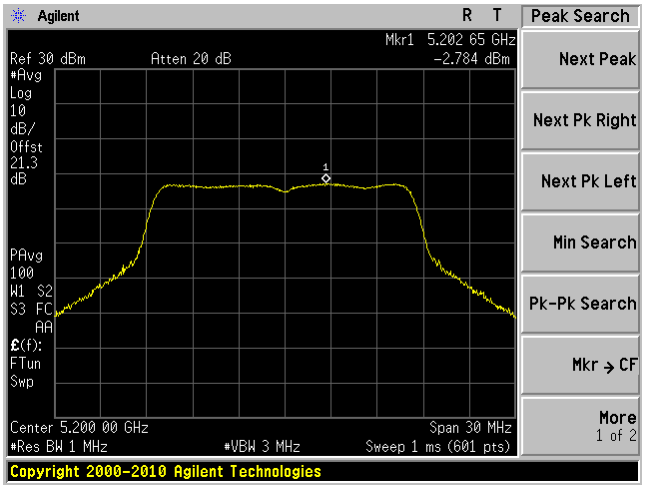

802.11a mode, 5180 MHz, Chain J8



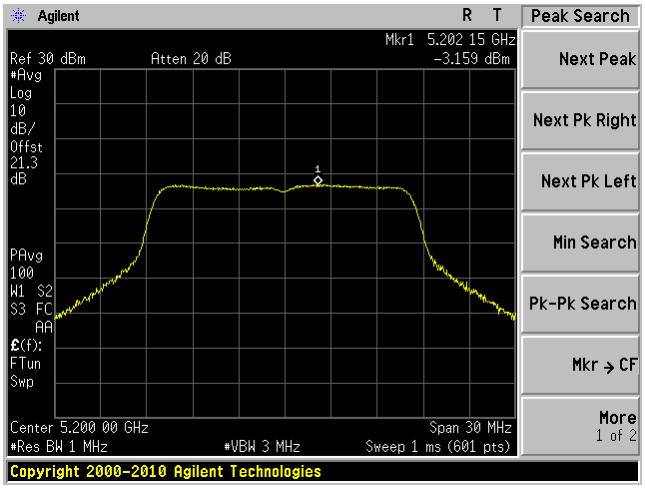

802.11a mode, 5180 MHz, Chain J6



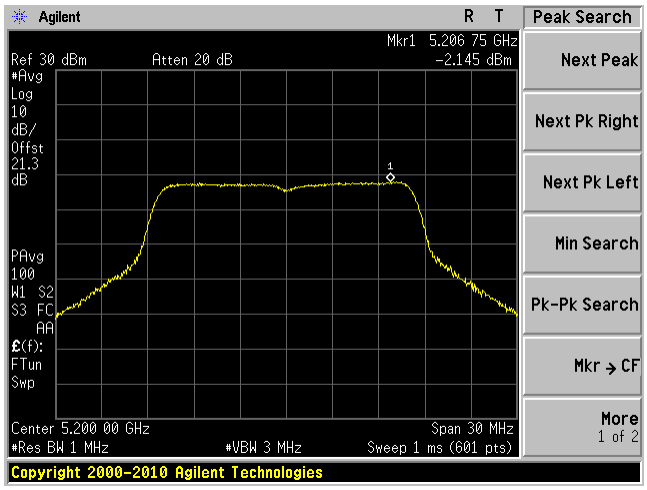
802.11a mode, 5200 MHz, Chain J10



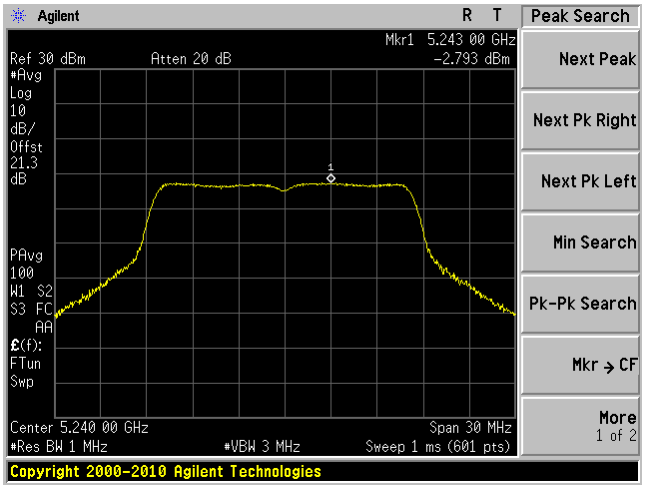

802.11a mode, 5200 MHz, Chain J8



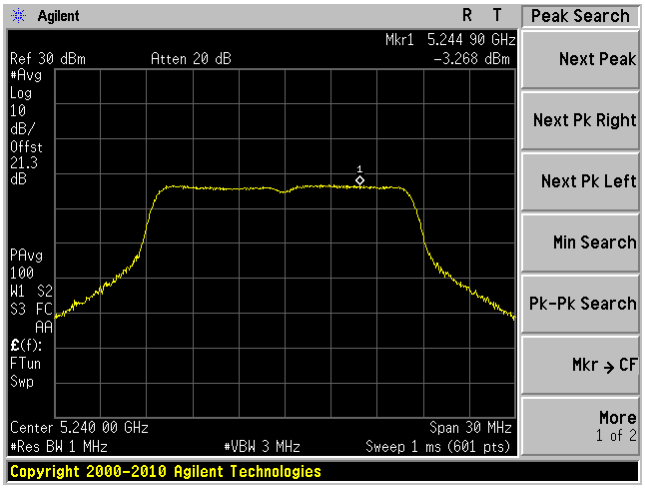

802.11a mode, 5200 MHz, Chain J6



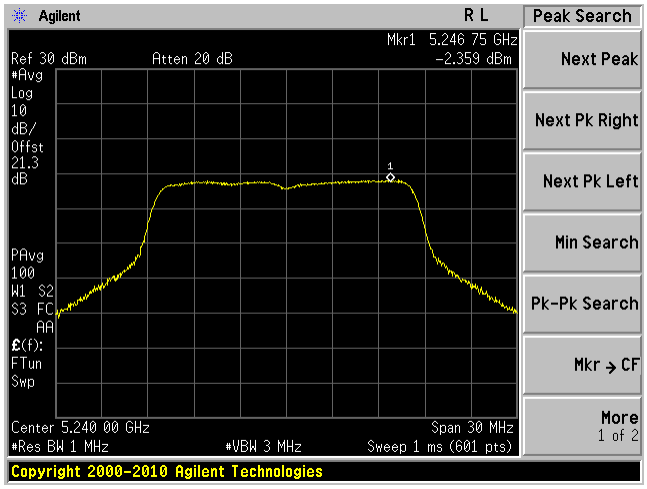
802.11a mode, 5240 MHz, Chain J10




802.11a mode, 5240 MHz, Chain J8

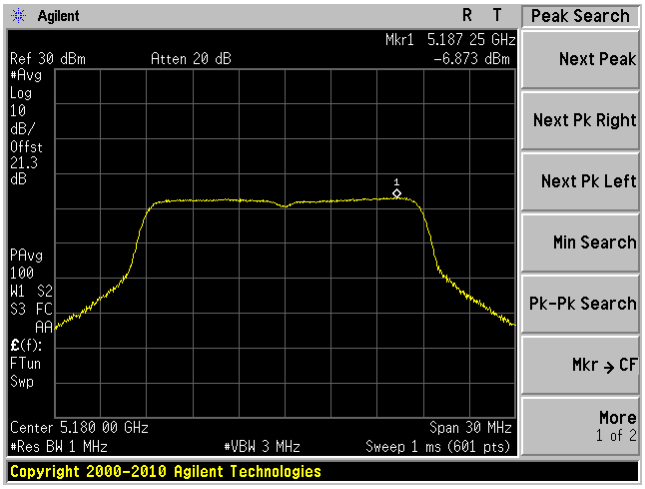



802.11a mode, 5240 MHz, Chain J6

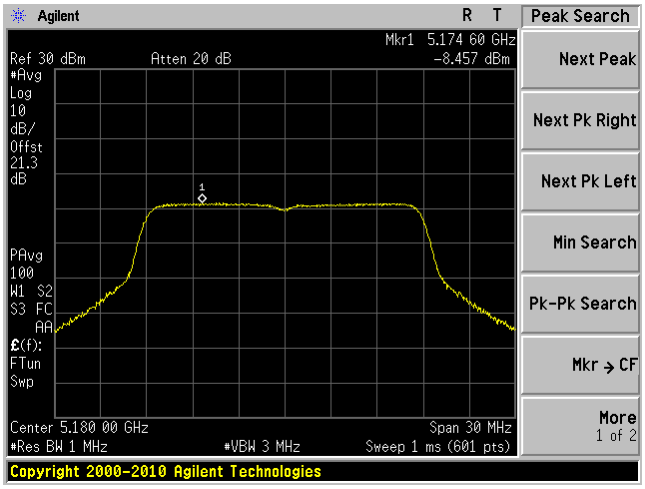


**802.11 n 20 mode**

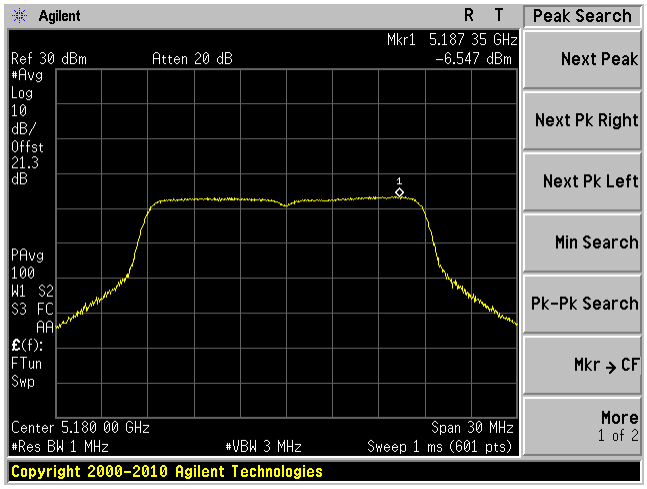
802.11n 20 mode, 5180 MHz, Chain J10



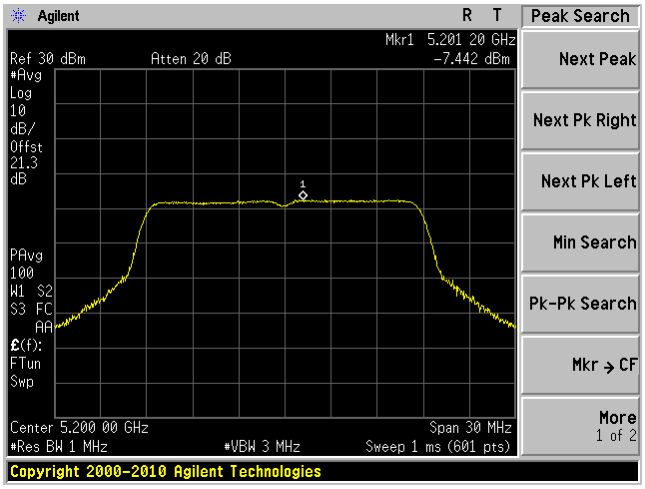

802.11n 20 mode, 5180 MHz, Chain J8



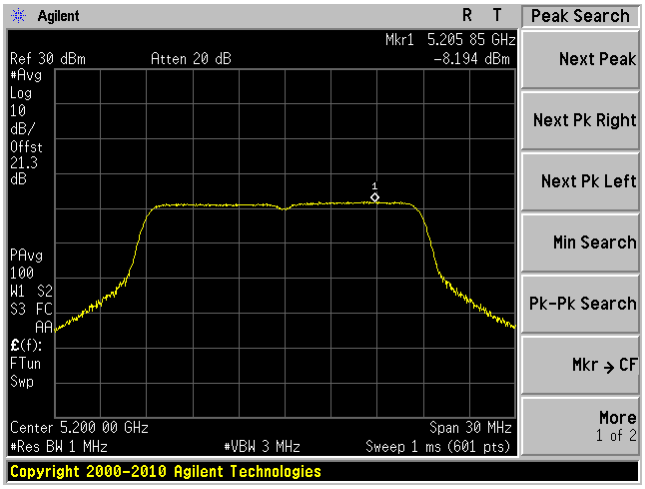

802.11n 20 mode, 5180 MHz, Chain J6



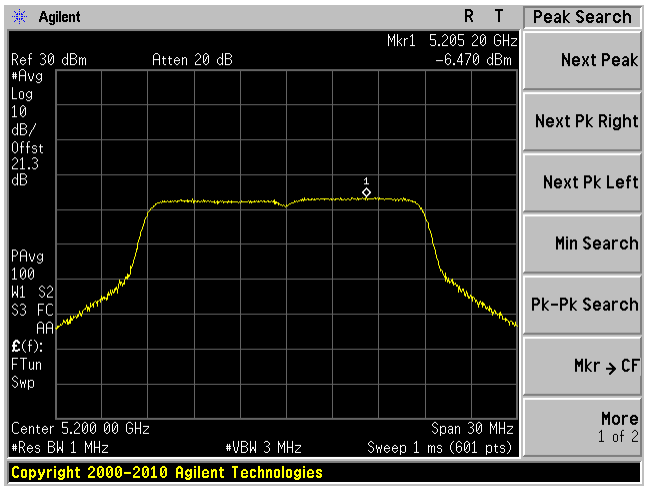
802.11n 20 mode, 5200 MHz, Chain J10



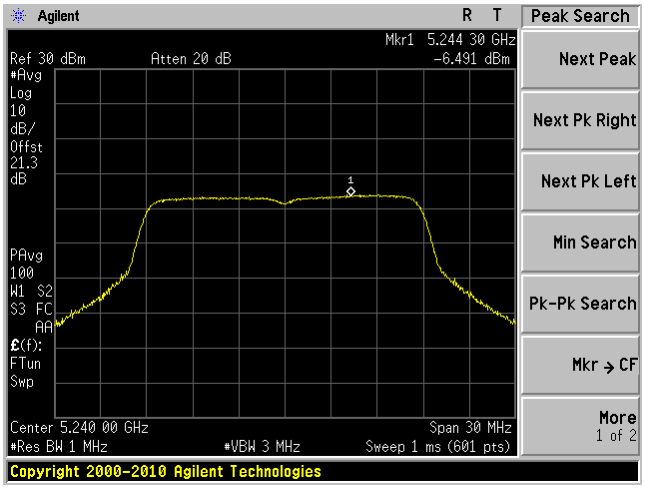

802.11n 20 mode, 5200 MHz, Chain J8



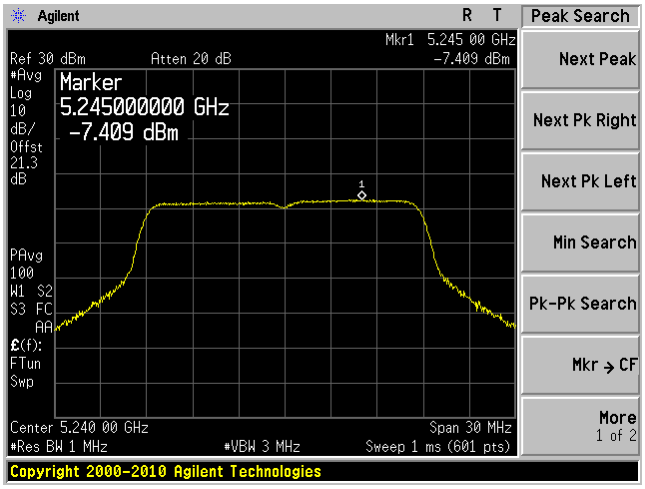

802.11n 20 mode, 5200 MHz, Chain J6



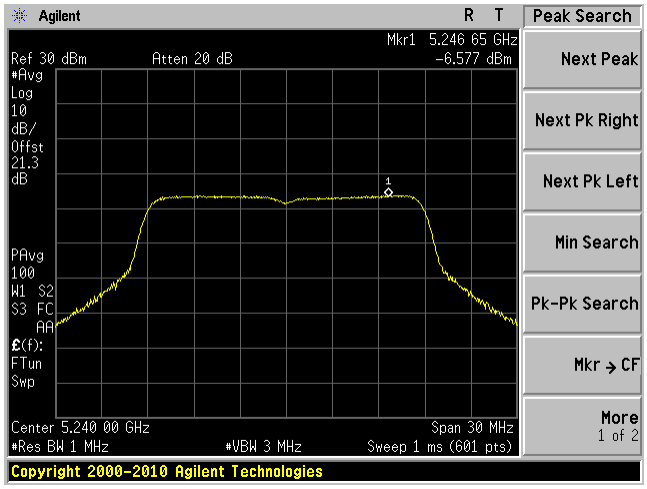
802.11n 20 mode, 5240 MHz, Chain J10




802.11n 20 mode, 5240 MHz, Chain J8

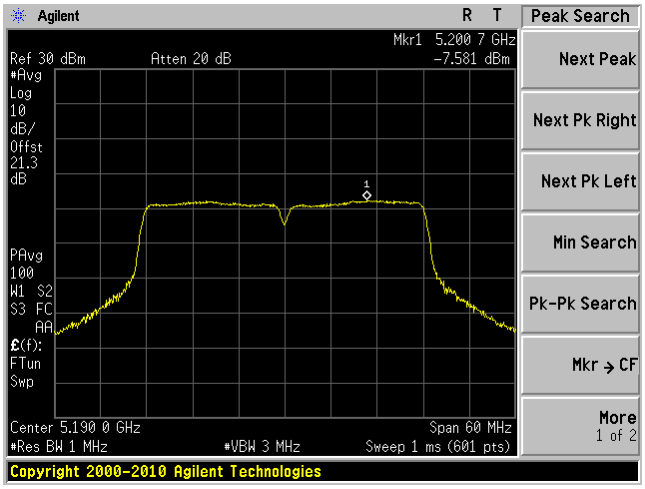



802.11n 20 mode, 5240 MHz, Chain J6

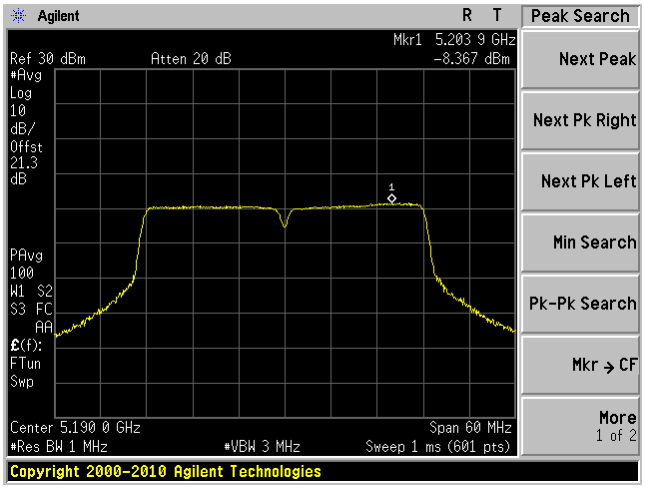


**802.11 n 40 mode**

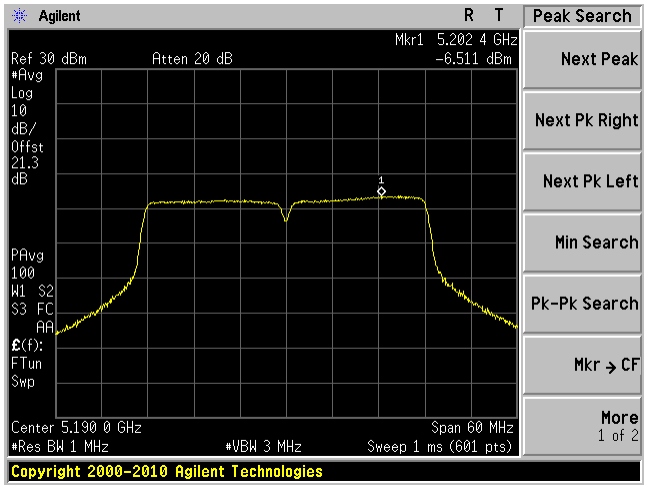
802.11n 40 mode, 5190 MHz, Chain J10



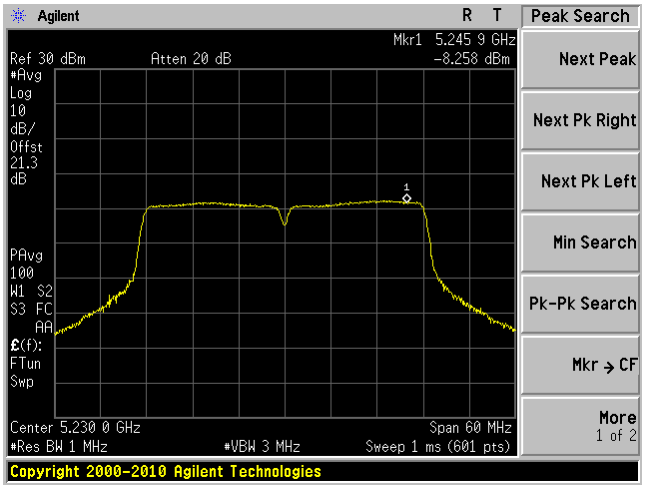

802.11n 40 mode, 5190 MHz, Chain J8



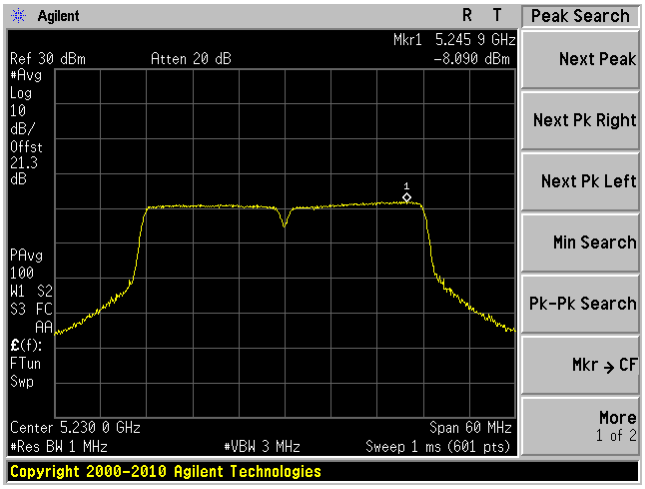

802.11n 40 mode, 5190 MHz, Chain J6



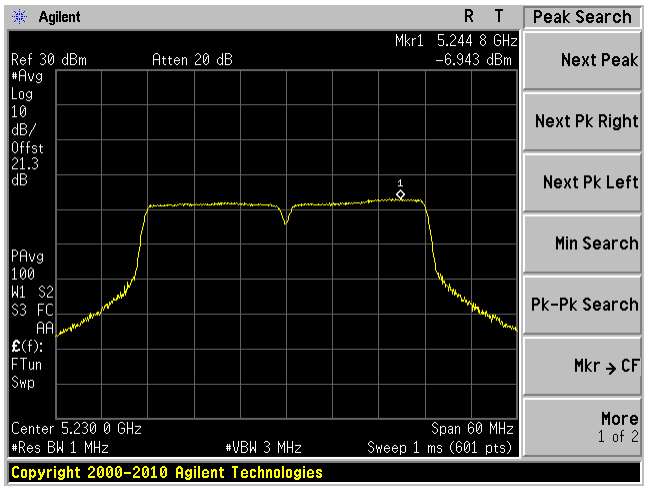
802.11n 40 mode, 5230 MHz, Chain J10




802.11n 40 mode, 5230 MHz, Chain J8




802.11n 40 mode, 5230 MHz, Chain J6

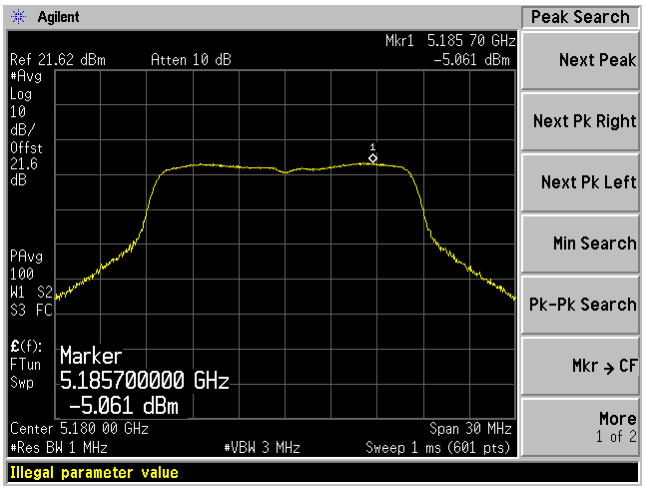


**Antenna Gain 15 dBi**

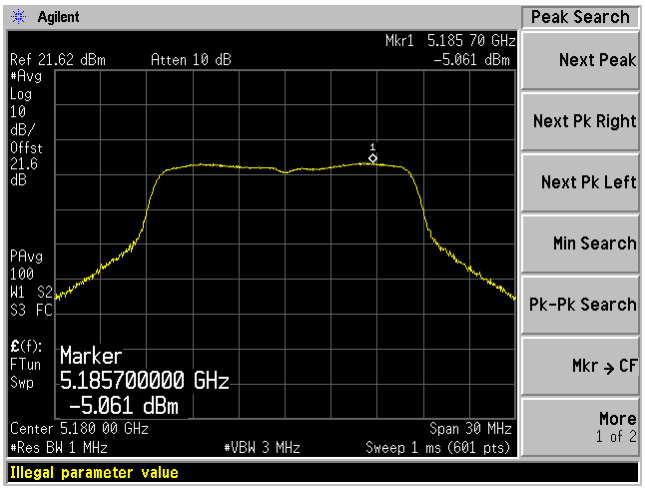
**5150-5250 MHz**

**802.11 a mode**

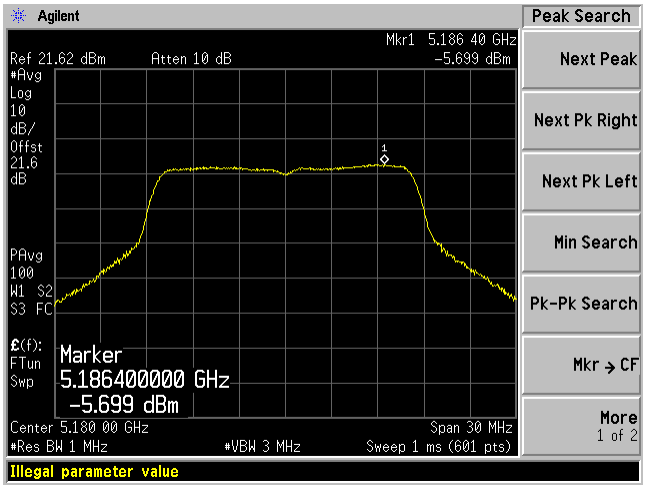
802.11a mode, 5180 MHz, Chain J10



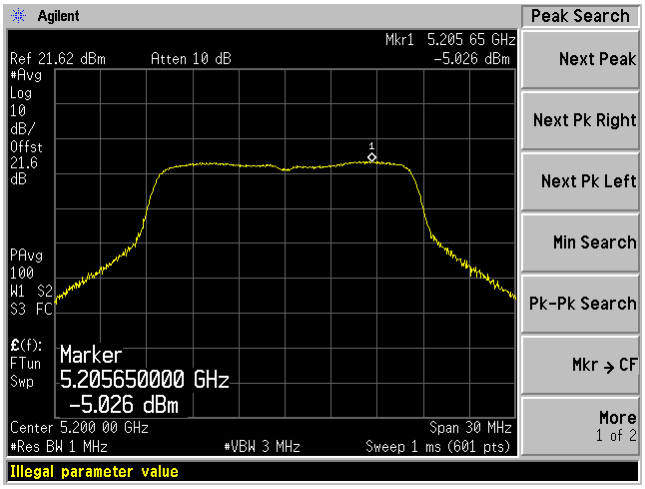

802.11a mode, 5180 MHz, Chain J8



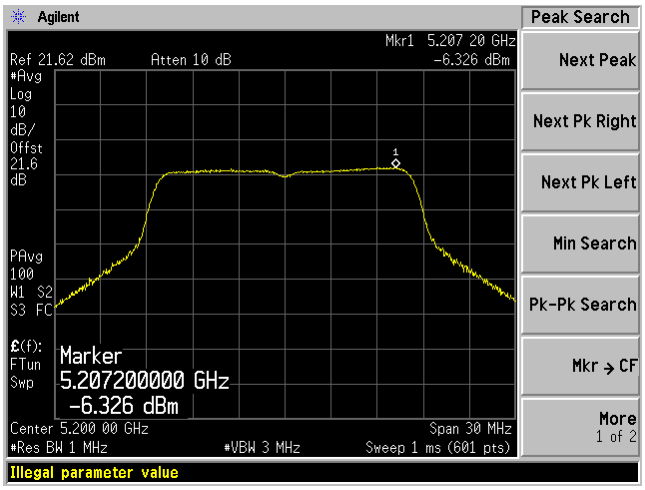

802.11a mode, 5180 MHz, Chain J6



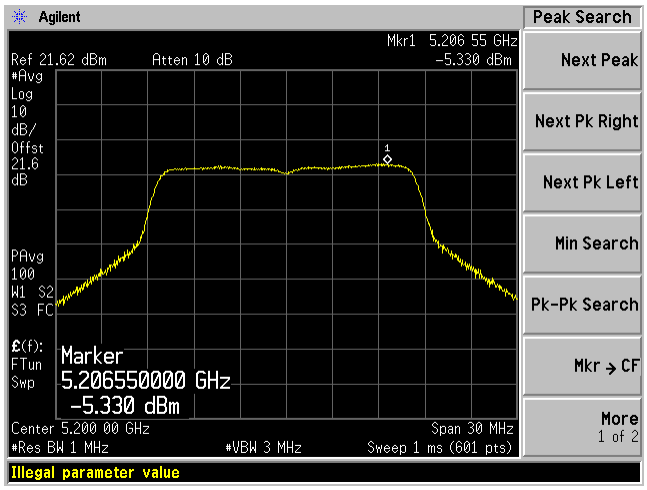
802.11a mode, 5200 MHz, Chain J10



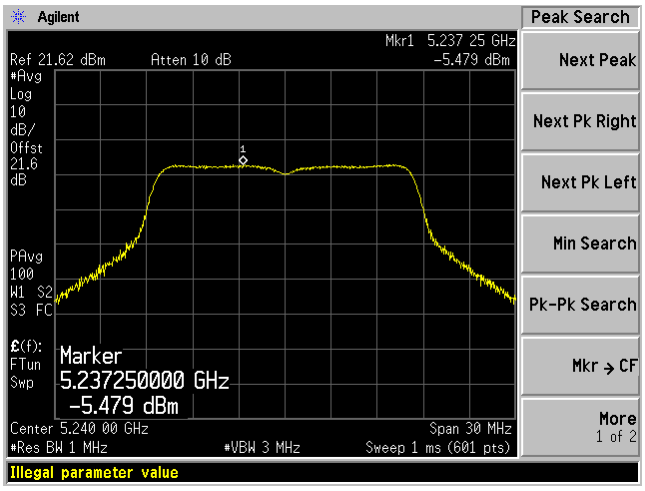

802.11a mode, 5200 MHz, Chain J8



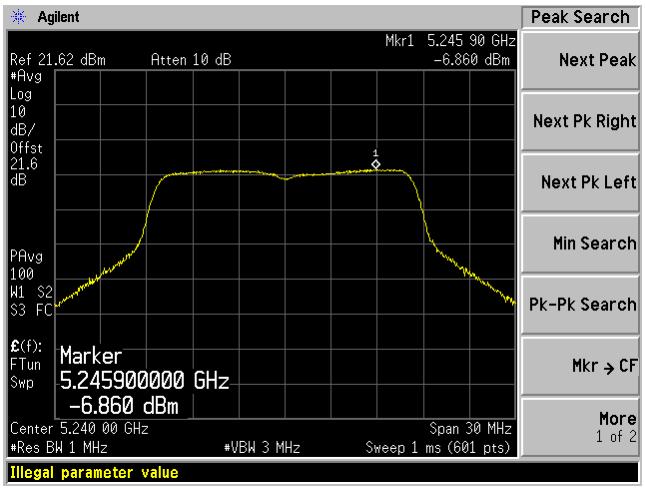

802.11a mode, 5200 MHz, Chain J6



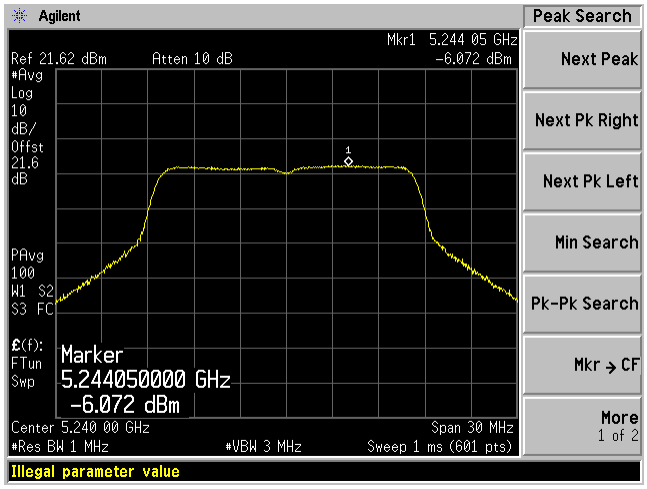
802.11a mode, 5240 MHz, Chain J10




802.11a mode, 5240 MHz, Chain J8

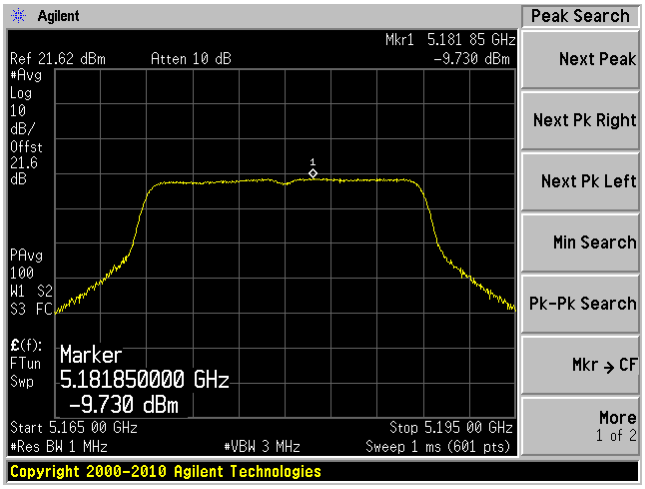



802.11a mode, 5240 MHz, Chain J6

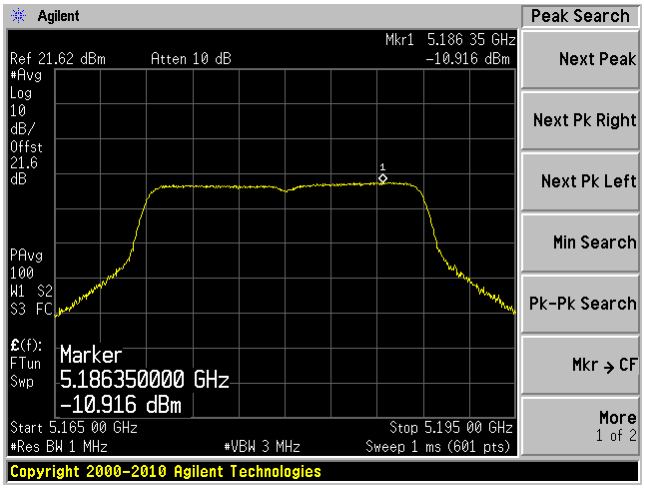


**802.11 n 20 mode**

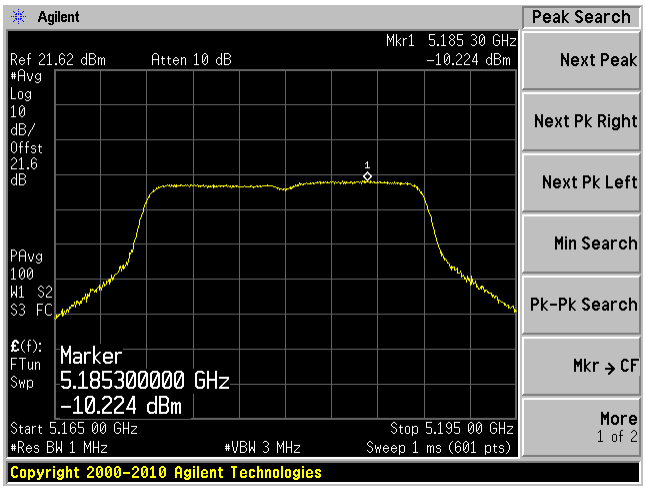
802.11n 20 mode, 5180 MHz, Chain J10



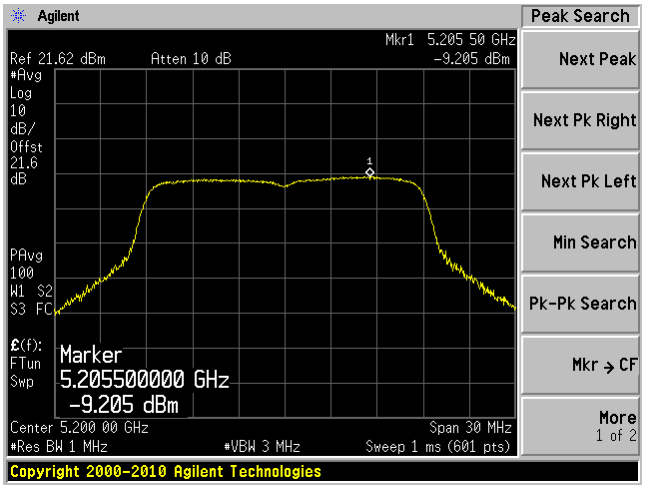

802.11n 20 mode, 5180 MHz, Chain J8



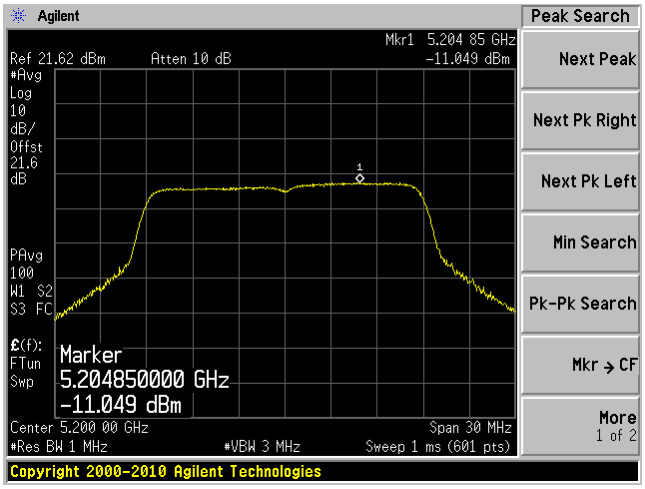

802.11n 20 mode, 5180 MHz, Chain J6



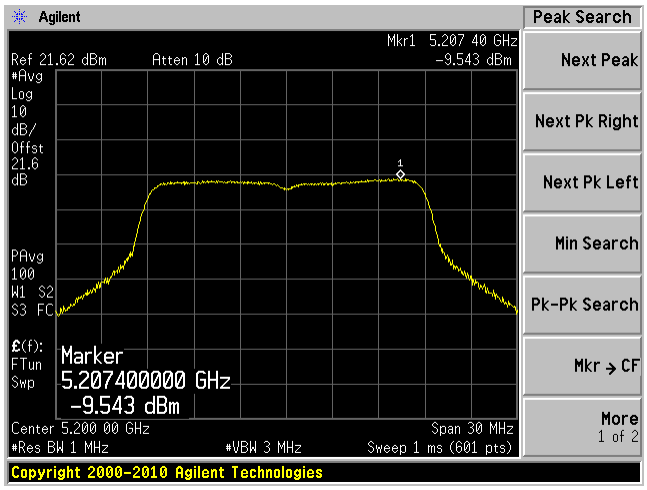
802.11n 20 mode, 5200 MHz, Chain J10



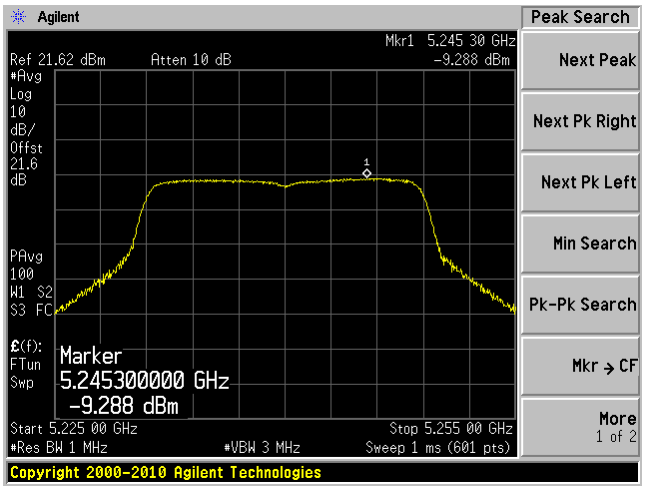

802.11n 20 mode, 5200 MHz, Chain J8



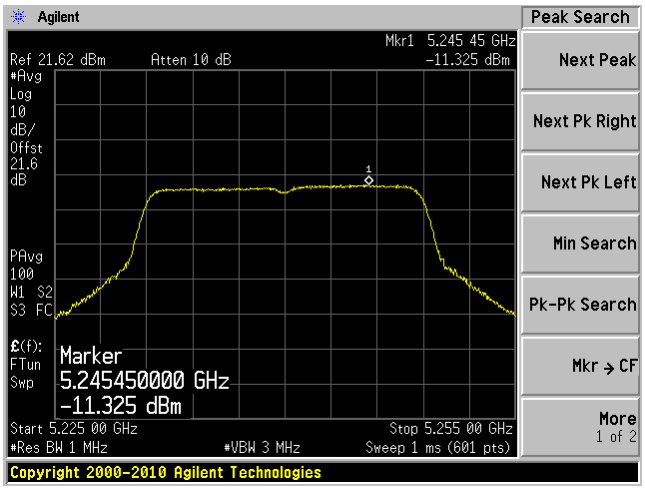

802.11n 20 mode, 5200 MHz, Chain J6



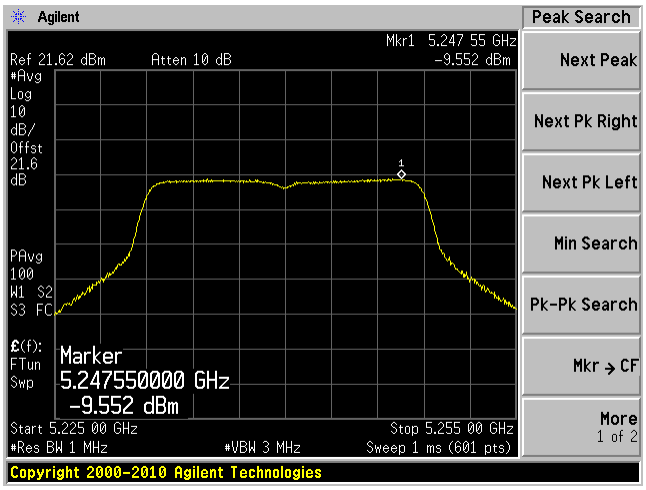
802.11n 20 mode, 5240 MHz, Chain J10




802.11n 20 mode, 5240 MHz, Chain J8

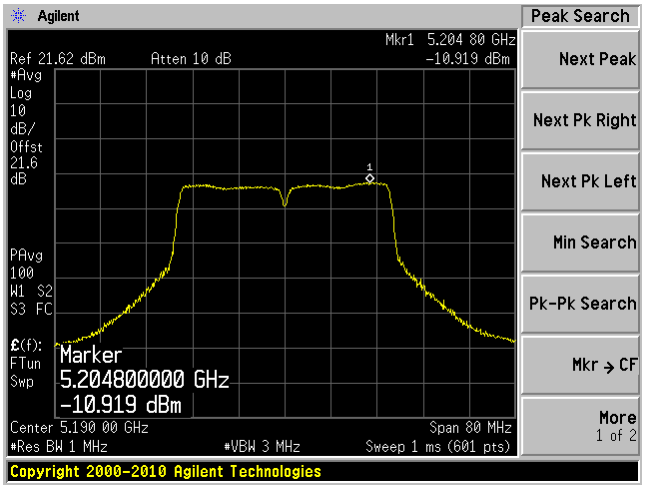



802.11n 20 mode, 5240 MHz, Chain J6

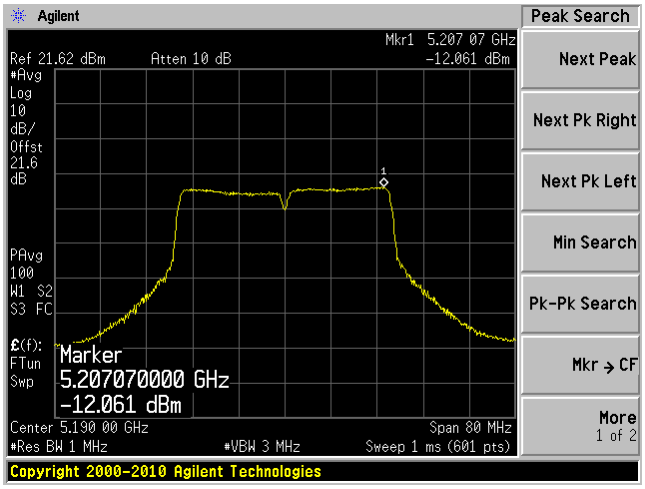


**802.11 n 40 mode**

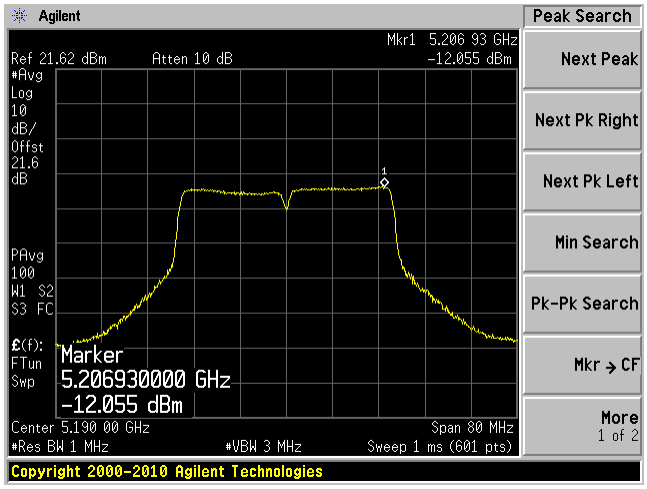
802.11n 40 mode, 5190 MHz, Chain J10



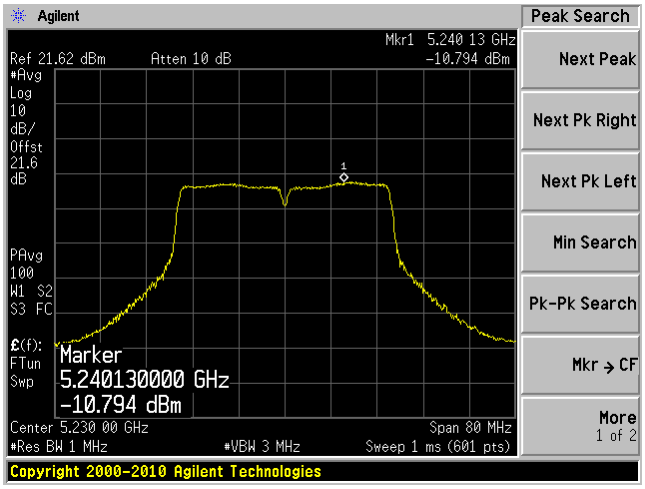

802.11n 40 mode, 5190 MHz, Chain J8



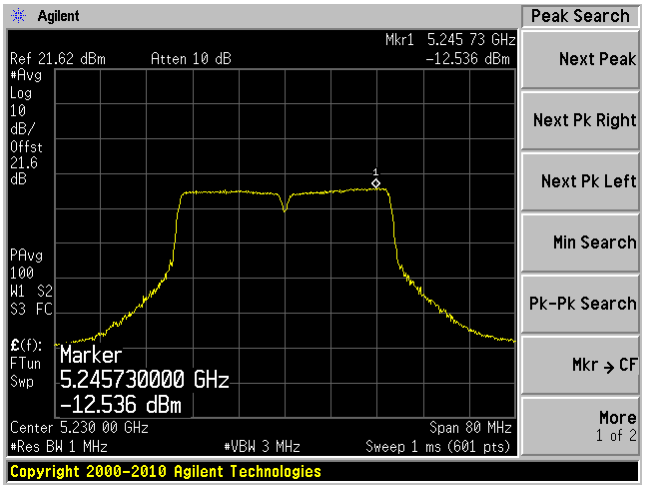

802.11n 40 mode, 5190 MHz, Chain J6



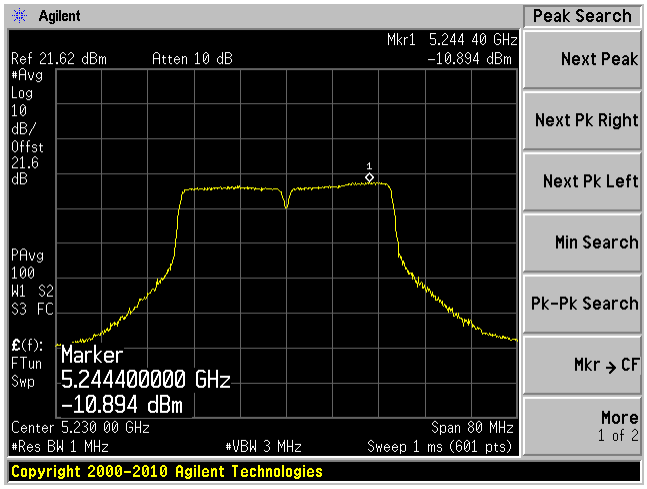
802.11n 40 mode, 5230 MHz, Chain J10




802.11n 40 mode, 5230 MHz, Chain J8




802.11n 40 mode, 5230 MHz, Chain J6



# 10 FCC §15.407(a)(6) – Peak Excursion Ratio

## 10.1 Applicable Standard

According to FCC §15.407(a) (6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

## 10.2 Test Procedure

Set the spectrum analyzer span to view the entire emission bandwidth.
The largest difference between the following two traces must be ≤ 13 dB for all frequencies across the emission bandwidth. Submit a plot.

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

2nd Trace:
• create the 2nd trace using the settings described in the setion "FCC §15.407(a)(1)(2) – CONDUCTED TRANSMITTER OUTPUT POWER".

## 10.3 Test Equipment List and Details

| Manufacturers | Description | Models | Serial Numbers | Calibration Dates | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | US45303156 | 2012-08-22 | 1 year |

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

## 10.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 43.5 % |
| **ATM Pressure:** | 101.6 kPa |

*The testing was performed by Ning Ma on 2012-06-30 in RF site*

## 10.5 Test Results

**Antenna Gain 12 dBi**

**5150-5250 MHz**

| Channel | Frequency (MHz) | TX Chain c0 PER (dB) | TX Chain c1 PER (dB) | TX Chain c2 PER (dB) | Limit (dB) |
|---|---|---|---|---|---|
| 802.11a mode | | | | | |
| Low | 5180 | 9.663 | 10.553 | 10.525 | 13 |
| Middle | 5200 | 9.284 | 10.64 | 11.821 | |
| High | 5240 | 8.99 | 10.834 | 10.627 | |
| 802.11n HT20 mode | | | | | |
| Low | 5180 | 9.297 | 9.817 | 10.029 | 13 |
| Middle | 5200 | 9.455 | 9.861 | 10.598 | |
| High | 5240 | 9.721 | 9.83 | 9.454 | |
| 802.11n HT40 mode | | | | | |
| Low | 5190 | 10.175 | 10.929 | 10.746 | 13 |
| High | 5230 | 9.708 | 11.076 | 10.867 | |

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

## 11.1 Applicable Standard

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

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

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

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

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

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

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

## 11.2 EUT Setup

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

## 11.3 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.

## 11.4 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

## 11.5 Test Equipment Lists and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Rohde & Schwarz | EMI Test Receiver | ESCI 1166.5950K03 | 100338 | 2011-09-14 | 1 year |
| Agilent | Spectrum Analyzer | E4446A | US44300386 | 2011-08-11 | 1 year |
| Sunol Science Corp | System Controller | SC99V | 122303-1 | N/R | - |
| Sunol Science Corp | Combination Antenna | JB3 | A0020106-3 | 2011-06-29 | 1 year |
| EMCO | Horn antenna | 3115 | 9511-4627 | 2011-10-03 | 1 year |
| Hewlett Packard | Pre-amplifier | 8447D | 2944A06639 | 2011-06-09 | 1 year |
| Mini-Circuits | Pre-amplifier | ZVA-183-S | 570400946 | 2012-05-09 | 1 year |

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

## 11.6 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 20~24 °C |
| **Relative Humidity:** | 37~45 % |
| **ATM Pressure:** | 101-102 kPa |

*The testing was performed by Quinn Jiang on 2012-05-01 and 2012-05-08 in 5 meter chamber 3.*

## 11.7 Summary of Test Results

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

Unwanted Emissions and Receiving Spurious Emission, (30MHz - 40 GHz):

5150-5350 MHz Band

| **Mode: Receiving** | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Range (MHz)** |
| -1.433 | 1200 | Vertical | Above 1 GHz |

## 11.8 Radiated Emissions Test Result Data

**Radiated Emission at 3 meters**

**5150-5250 MHz Band**

| **Frequency (MHz)** | **S.A. Reading (dBµV)** | **Turntable Azimuth (degrees)** | **Test Antenna** | | | **Cable Loss (dB)** | **Pre-Amp. (dB)** | **Cord. Reading (dBµV/m)** | **FCC/IC** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Height (cm)** | **Polarity (H/V)** | **Factor (dB/m)** | | | | **Limit (dBµV/m)** | **Margin (dB)** |
| 1200 | 51.6 | 264 | 161 | V | 25.257 | 2 | 27.29 | 51.567 | 54 | -2.433 |
| 1200 | 52.6 | 198 | 100 | H | 25.257 | 2 | 27.29 | 52.567 | 54 | -1.433 |
| 2800 | 41.69 | 291 | 100 | V | 28.449 | 3.2 | 27.58 | 45.759 | 54 | -8.241 |
| 2800 | 37.41 | 35 | 100 | H | 28.449 | 3.2 | 27.58 | 41.479 | 54 | -12.521 |
| 2000 | 45.07 | 292 | 100 | V | 27.184 | 2.65 | 27.53 | 47.374 | 54 | -6.626 |
| 2000 | 43.8 | 345 | 100 | H | 27.184 | 2.65 | 27.53 | 46.104 | 54 | -7.896 |
| 250 | 27.34 | 255 | 100 | V | 12.3 | 11.37 | 12.9 | 38.11 | 46 | -7.89 |

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

## 12.1 Applicable Standard

**According to FCC §15.407(b)**

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

For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz

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

## 12.2 Measurement Procedure

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

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

emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
• If power averaging (RMS) mode was used in step (iv) above, the correction factor is10 log(1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.
• If linear voltage averaging mode was used in step (iv) above, the correction factor is 20 log(1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.

## 12.3 Test Equipment List and Details

| Manufacturers | Description | Models | Serial Numbers | Calibration Dates | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | US45303156 | 2012-08-22 | 1 year |

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

## 12.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 40.3 % |
| **ATM Pressure:** | 101.8 kPa |

*The testing was performed by Ning Ma on 2012-07-05 in RF site.*

## 12.5 Test Results

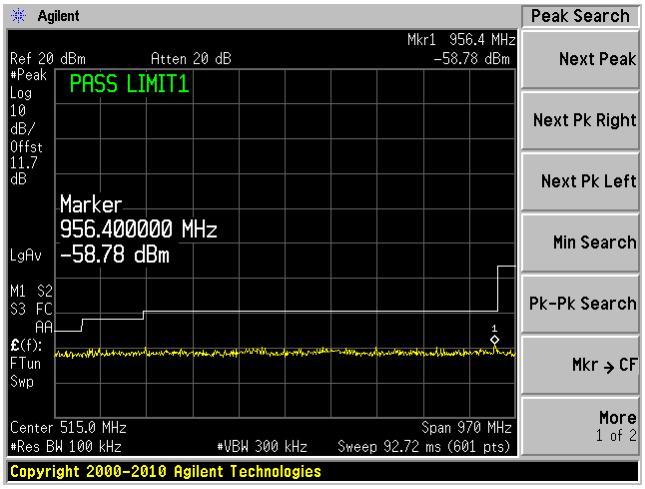
Please refer to following plots of spurious emissions.

**5150-5250 MHz**

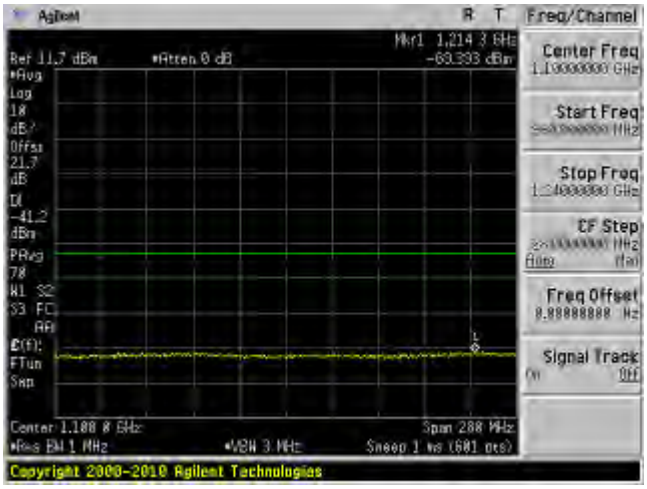
**Antenna gain 12 dBi**

**802.11 a mode**

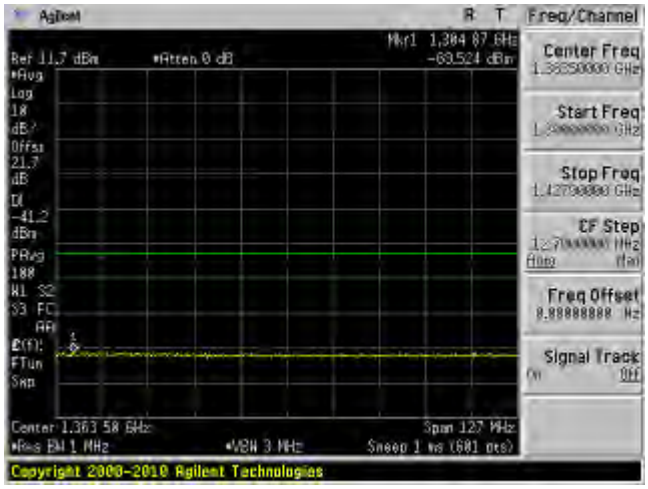
802.11a mode, 5180 MHz, Chain J10 1



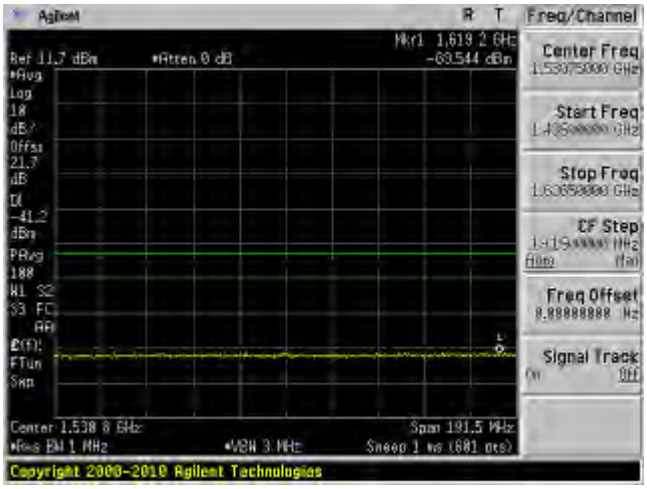

802.11a mode, 5180 MHz, Chain J10 2



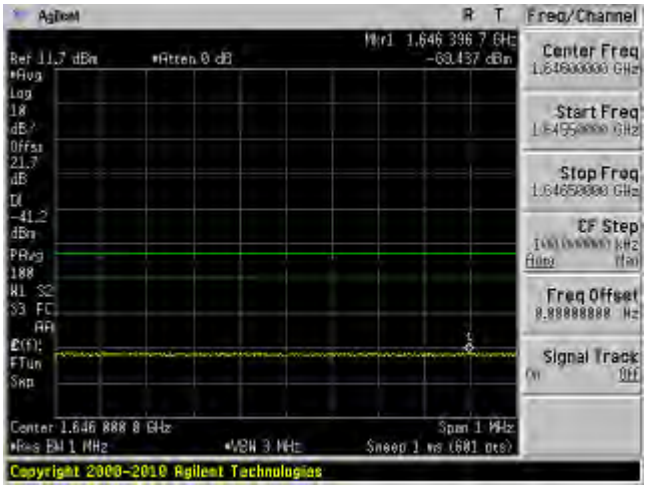

802.11a mode, 5180 MHz, Chain J10 3



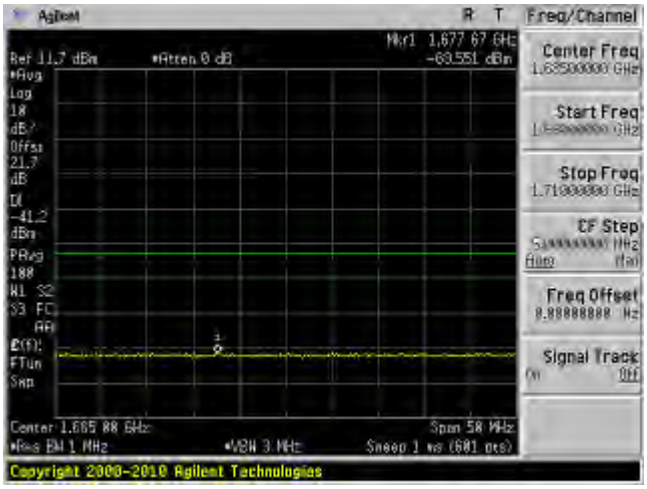

802.11a mode, 5180 MHz, Chain J10 4



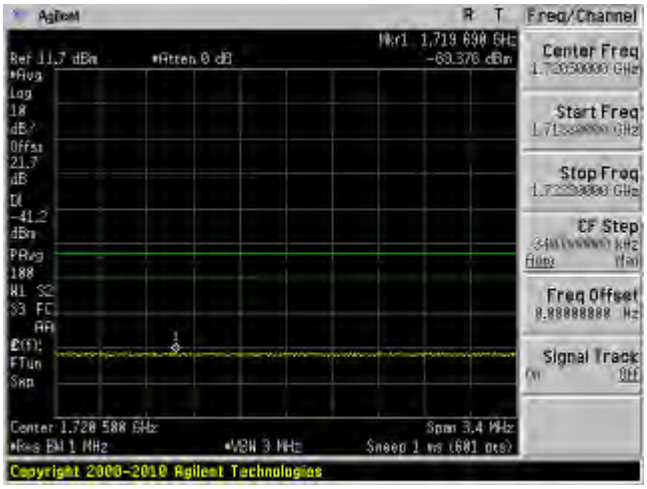
802.11a mode, 5180 MHz, Chain J10 5



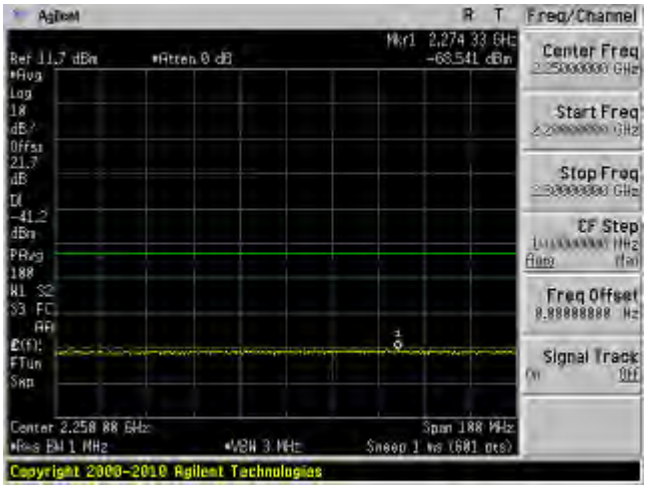

802.11a mode,5180 MHz, Chain J10 6



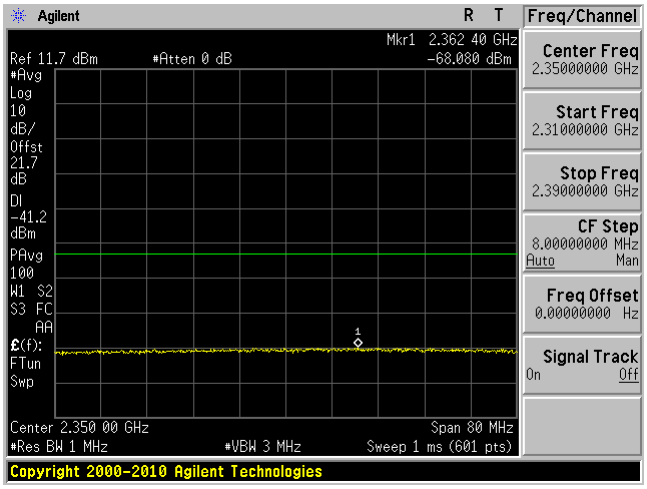

802.11a mode, 5180 MHz, Chain J10 7



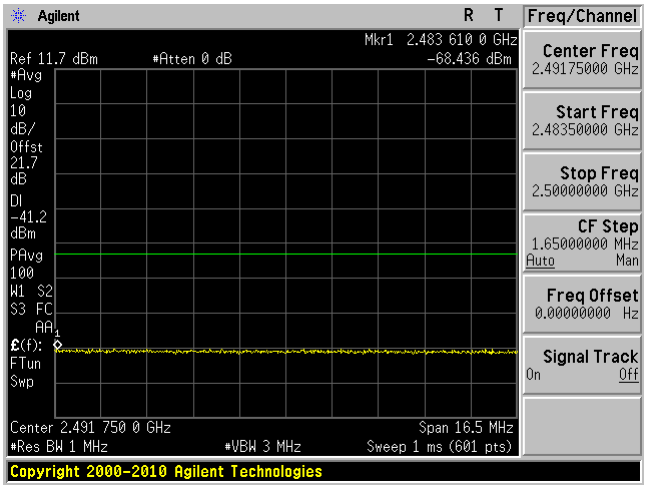

802.11a mode, 5180 MHz, Chain J10 8



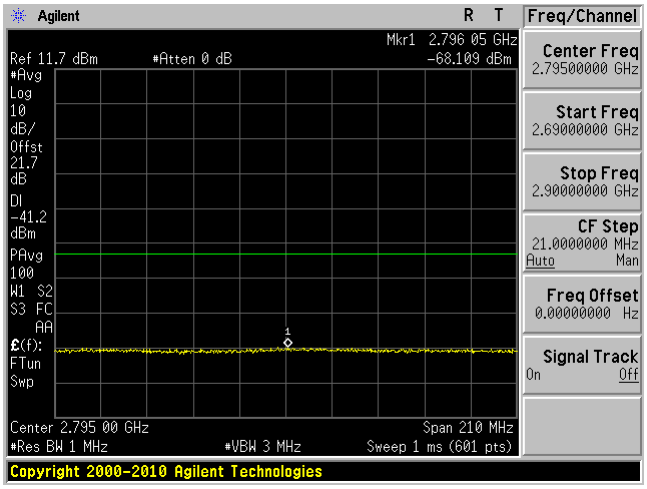
802.11a mode, 5180 MHz, Chain J10 9



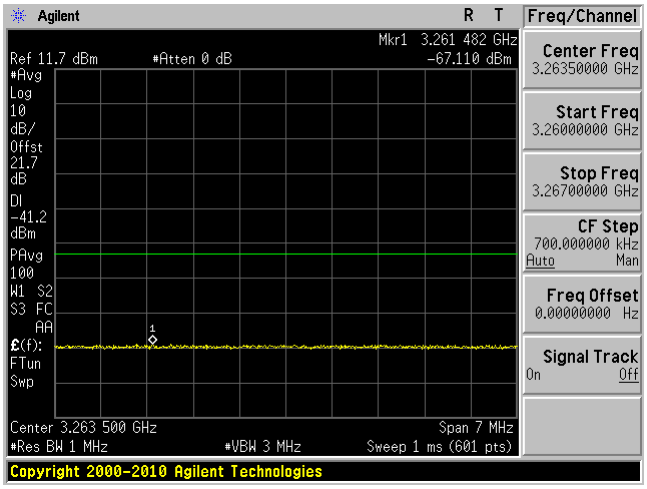

802.11a mode, 5180 MHz, Chain J10 10



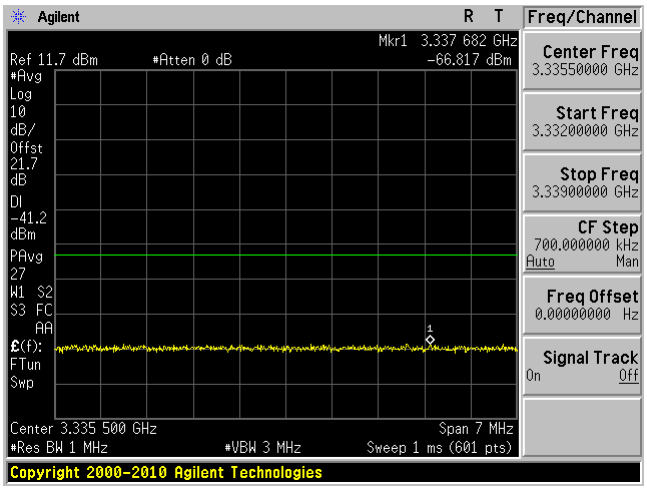

802.11a mode, 5180 MHz, Chain J10 11



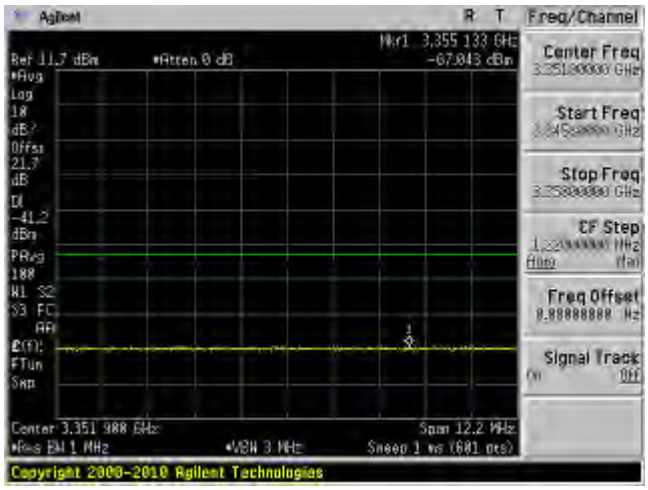

802.11a mode, 5180 MHz, Chain J10 12



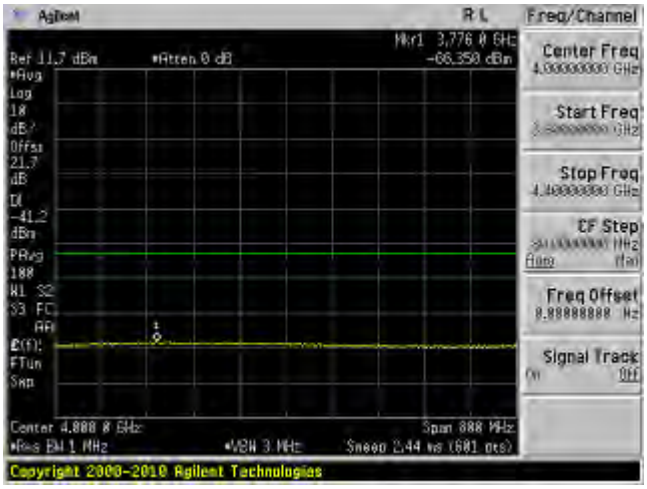
802.11a mode, 5180 MHz, Chain J10 13



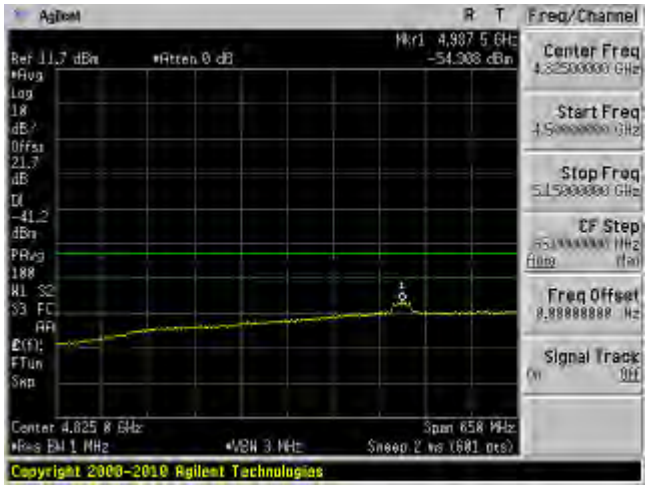

802.11a mode, 5180 MHz, Chain J10 14



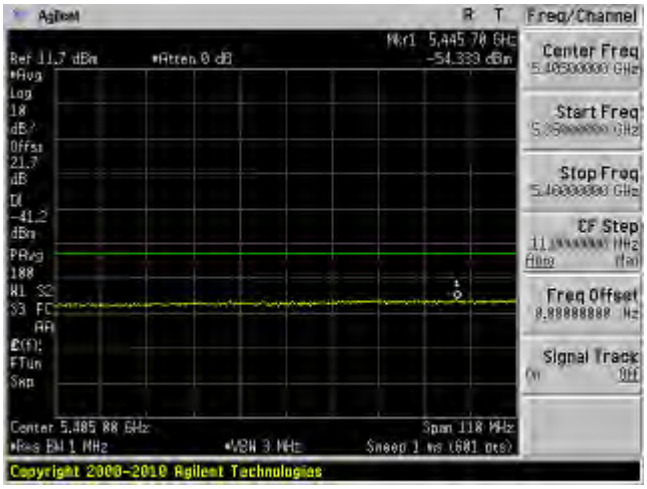

802.11a mode, 5180 MHz, Chain J10 15



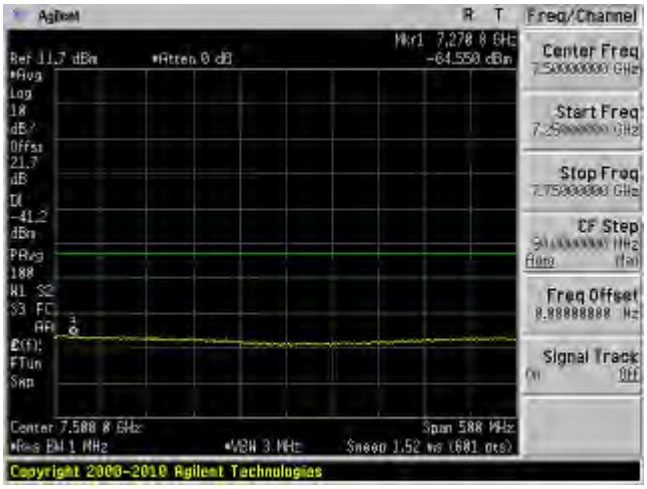

802.11a mode, 5180 MHz, Chain J10 16



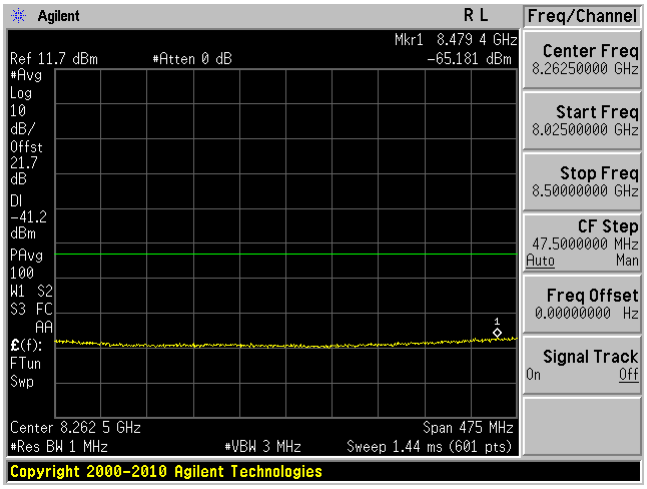
802.11a mode, 5180 MHz, Chain J10 17



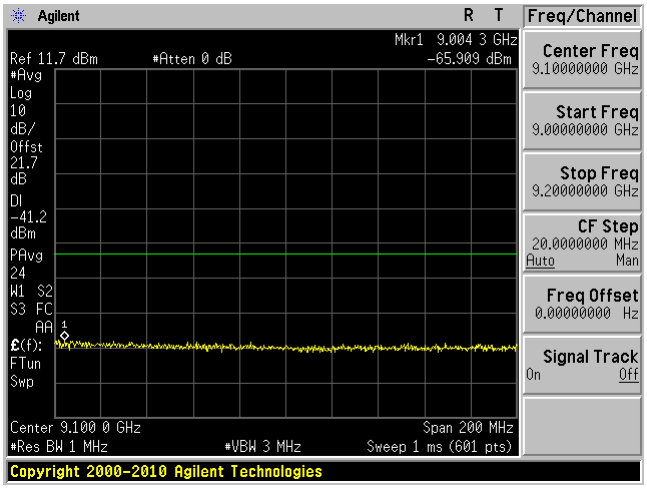

802.11a mode, 5180 MHz, Chain J10 18



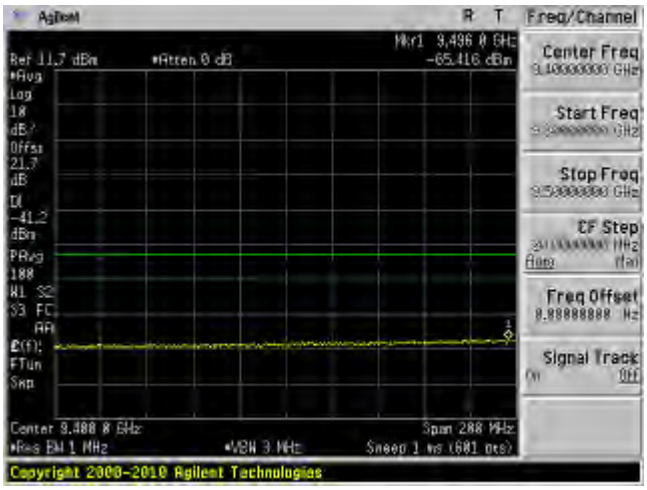

802.11a mode, 5180 MHz, Chain J10 19



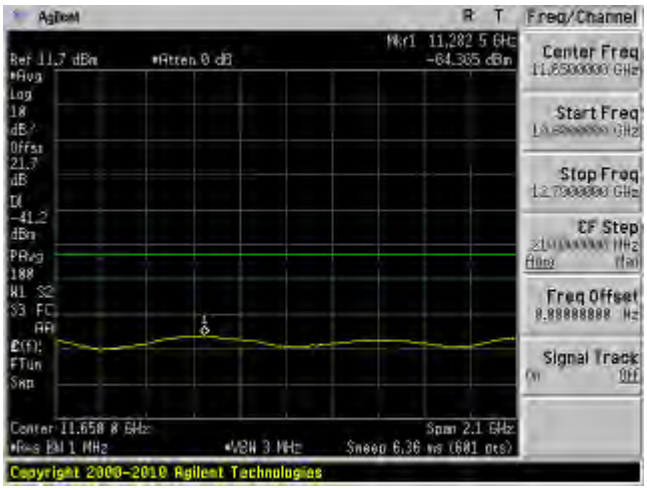

802.11a mode, 5180 MHz, Chain J10 20



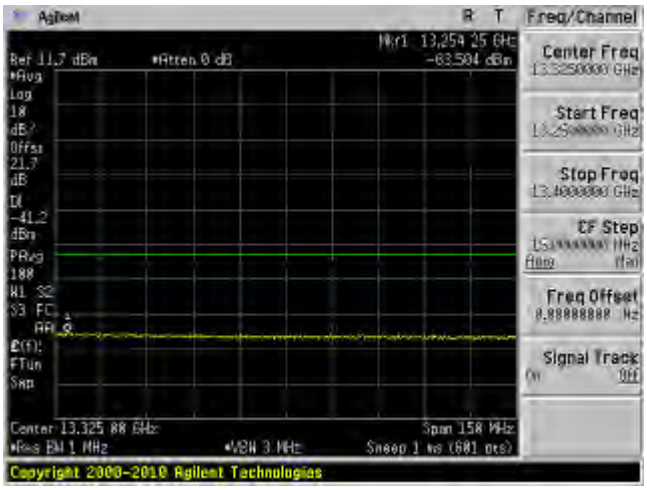
802.11a mode, 5180 MHz, Chain J10 21



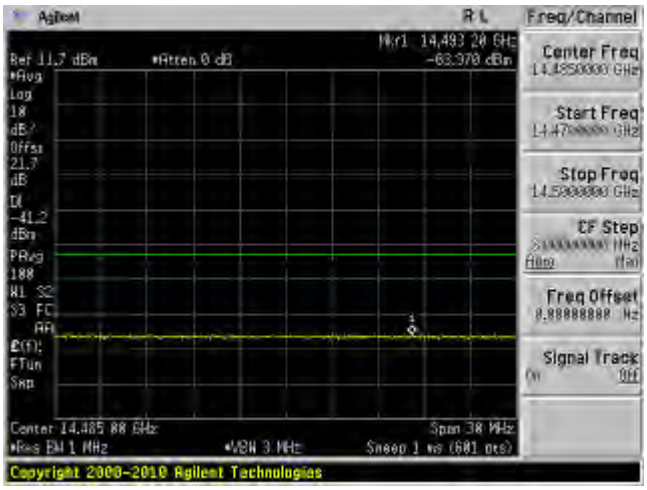

802.11a mode, 5180 MHz, Chain J10 22



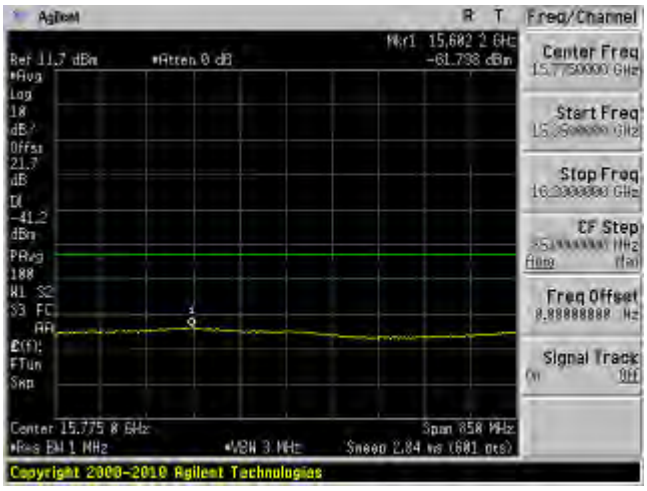

802.11a mode, 5180 MHz, Chain J10 23



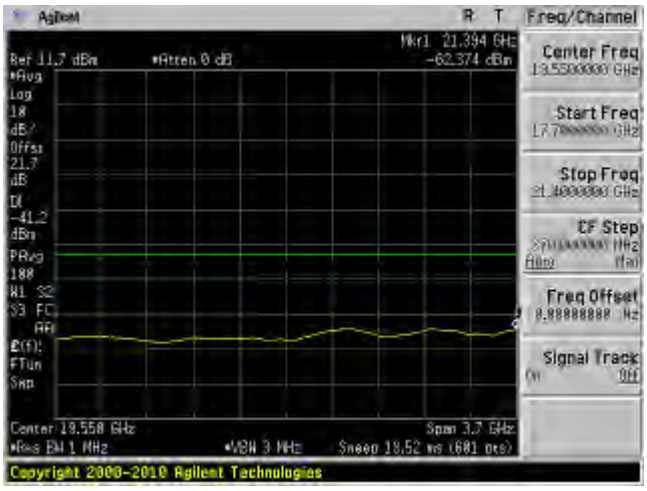

802.11a mode, 5180 MHz, Chain J10 24



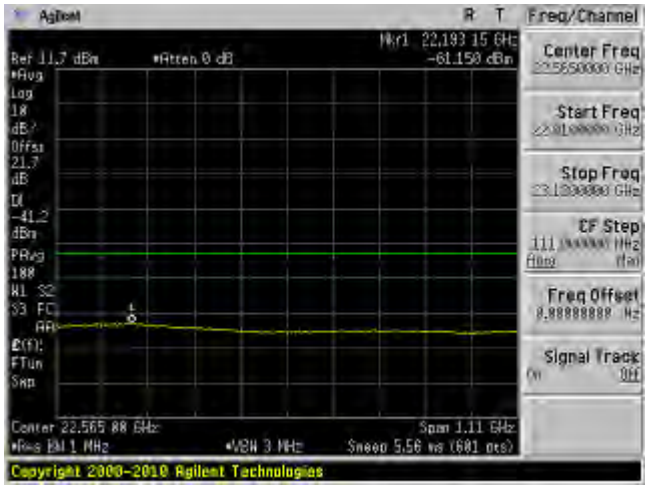
802.11a mode, 5180 MHz, Chain J10 25



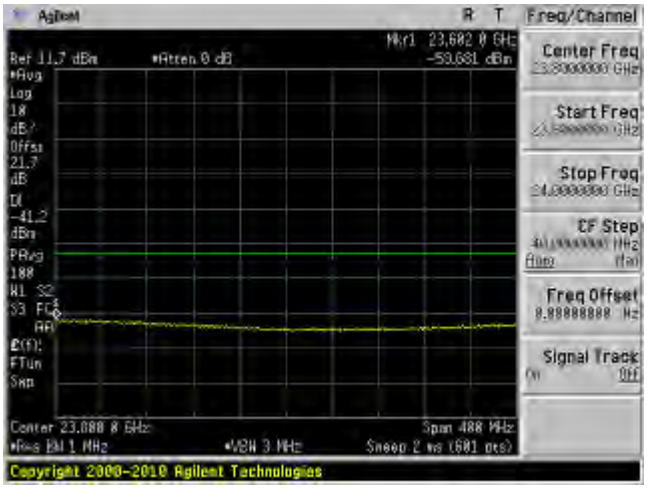

802.11a mode, 5180 MHz, Chain J10 26



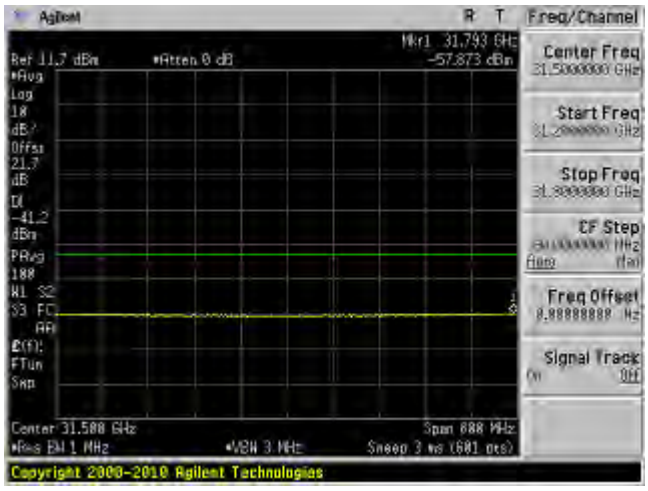

802.11a mode, 5180 MHz, Chain J10 27



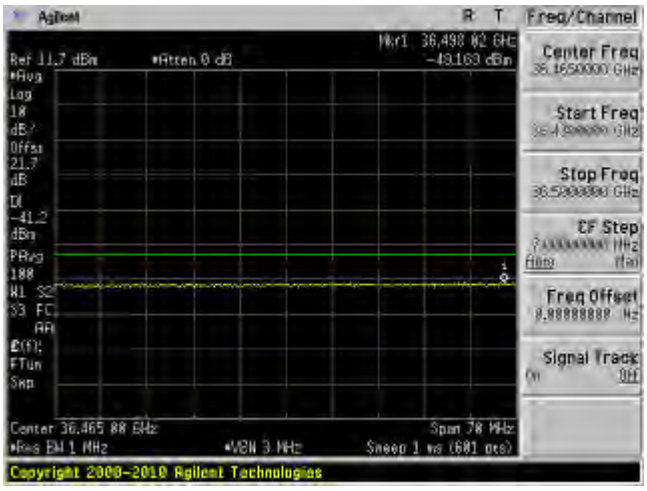

802.11a mode, 5180 MHz, Chain J10 28



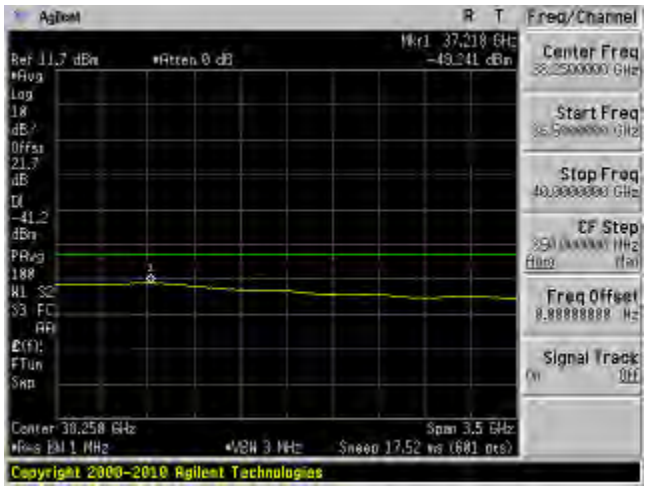
802.11a mode, 5180 MHz, Chain J10 29



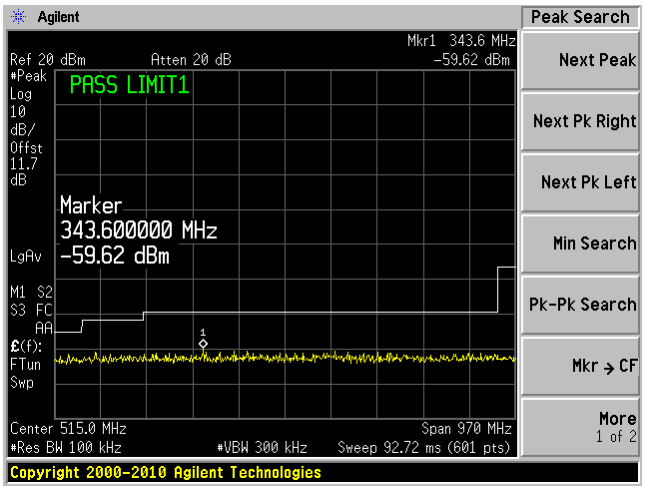

802.11a mode, 5180 MHz, Chain J10 30



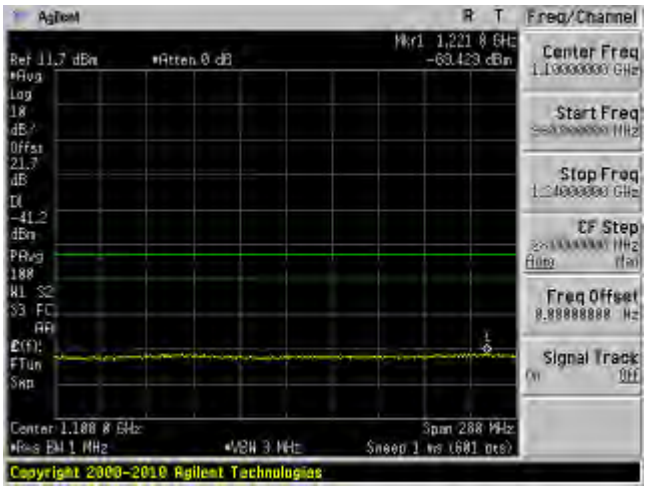

802.11a mode, 5180 MHz, Chain J10 31



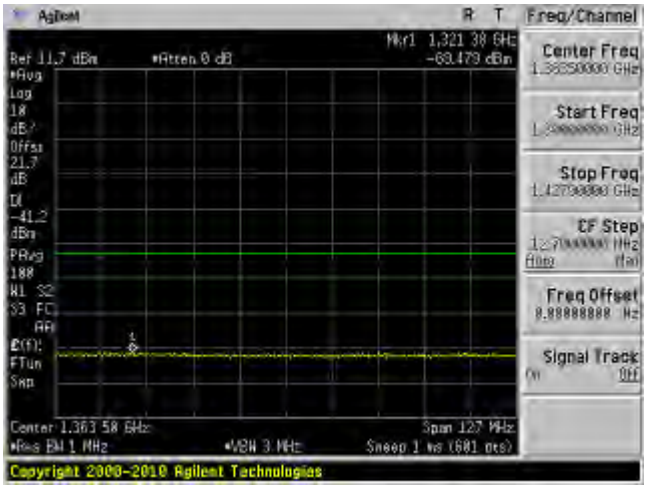
802.11a mode, 5180 MHz, Chain J8 1



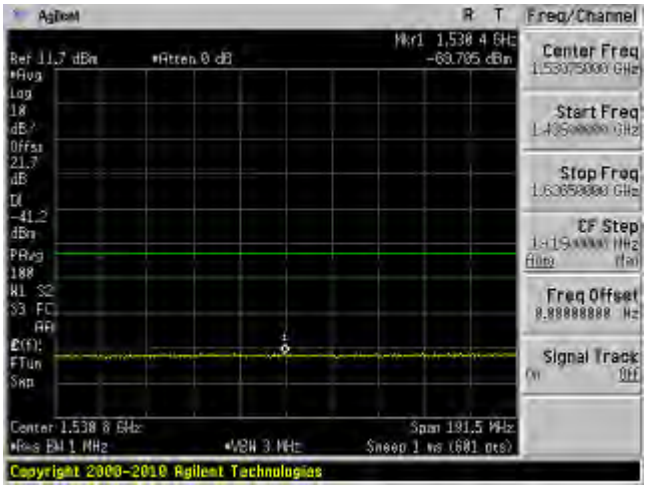

802.11a mode, 5180 MHz, Chain J8 2



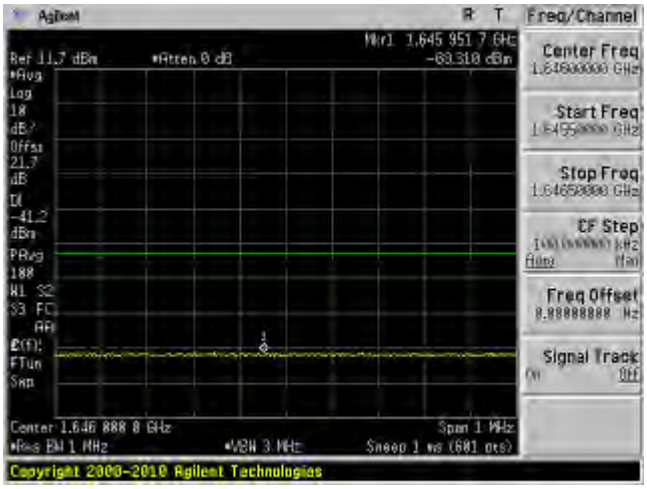

802.11a mode, 5180 MHz, Chain J8 3



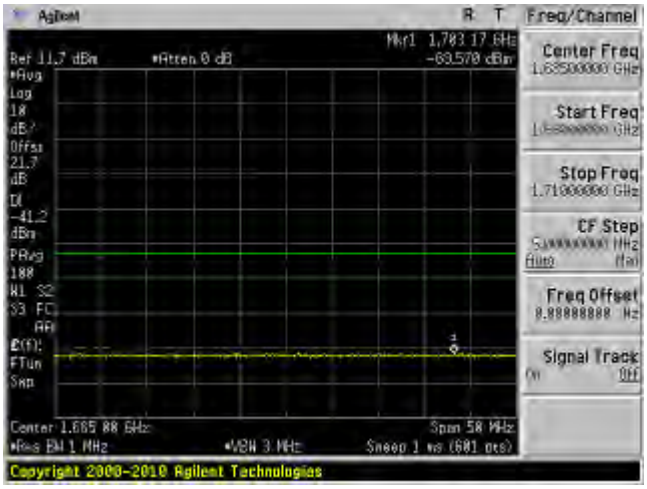

802.11a mode, 5180 MHz, Chain J8 4



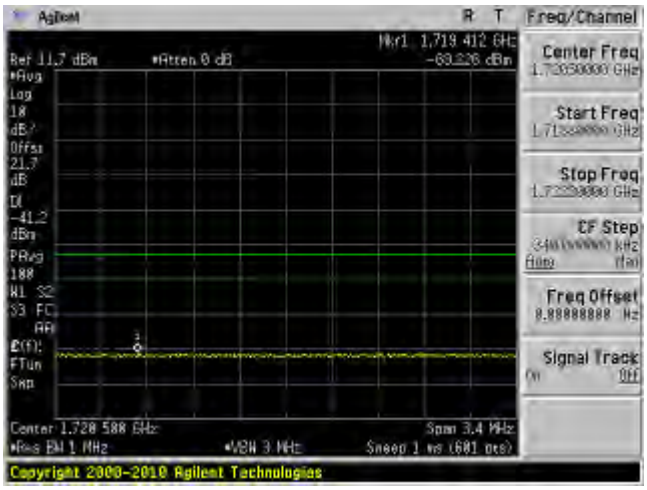
802.11a mode, 5180 MHz, Chain J8 5



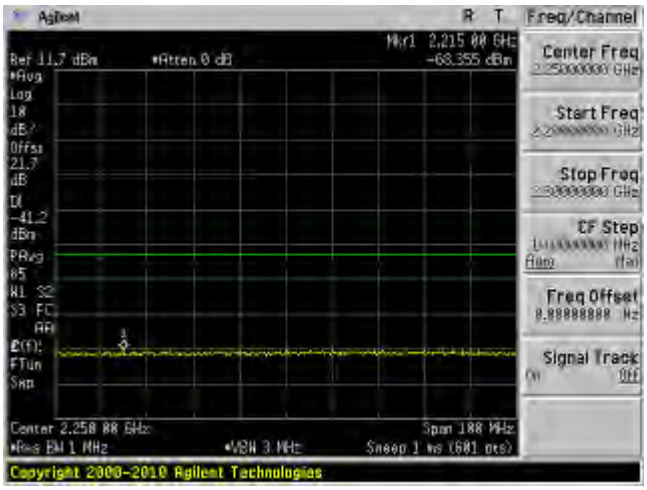

802.11a mode, 5180 MHz, Chain J8 6



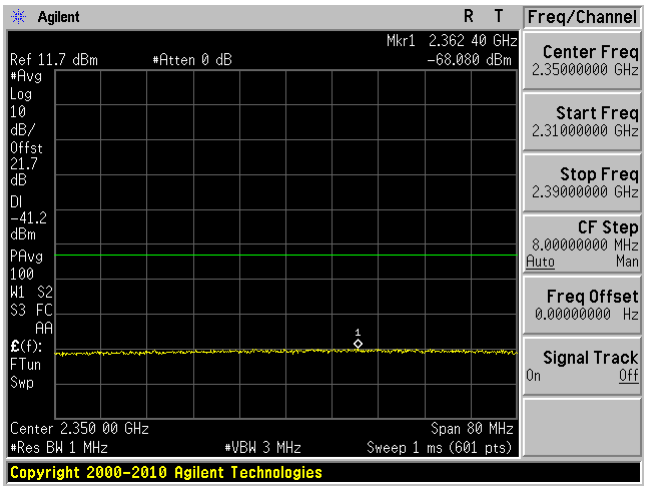

802.11a mode, 5180 MHz, Chain J8 7



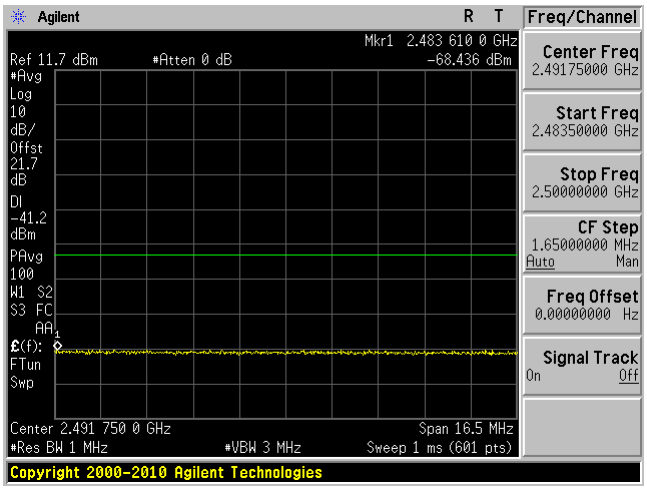

802.11a mode, 5180 MHz, Chain J8 8



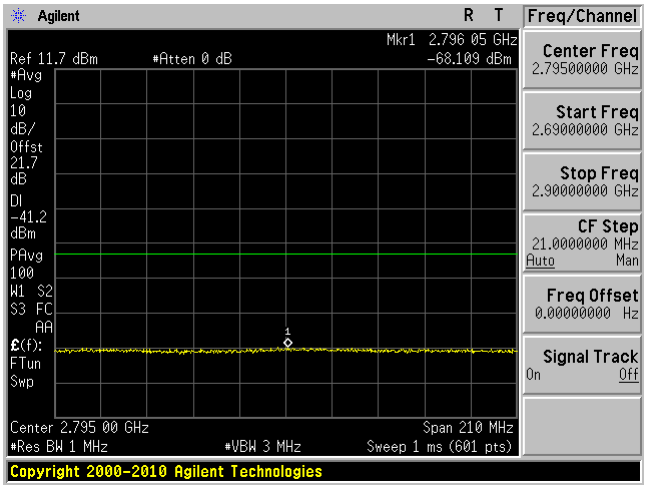
802.11a mode, 5180 MHz, Chain J8 9



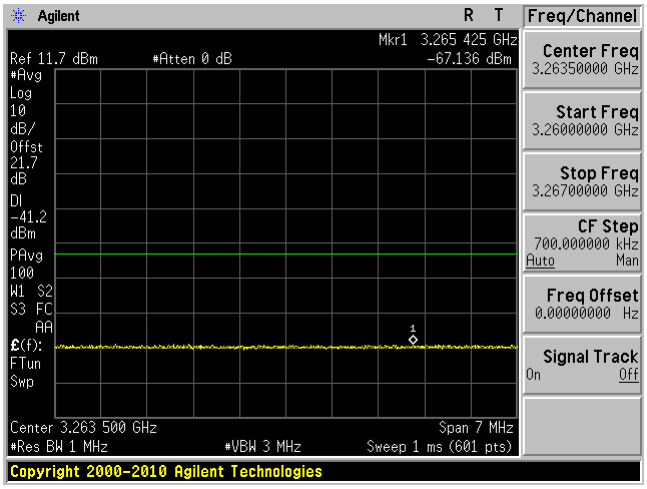

802.11a mode, 5180 MHz, Chain J8 10



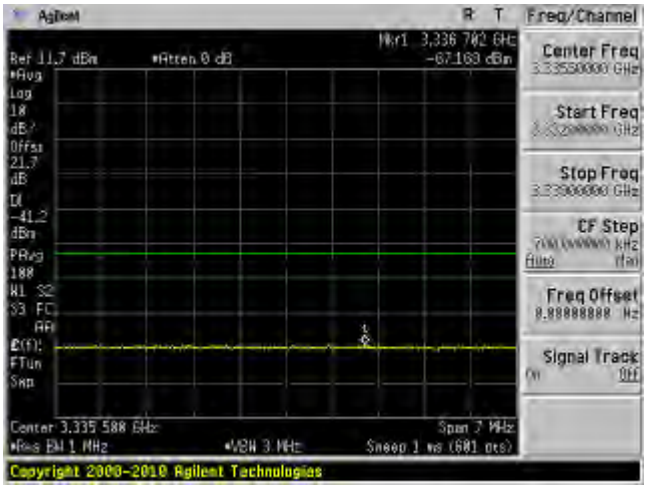

802.11a mode, 5180 MHz, Chain J8 11



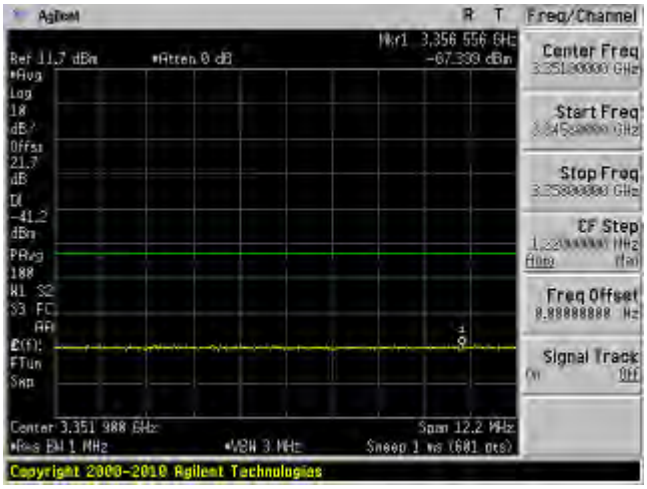

802.11a mode, 5180 MHz, Chain J8 12



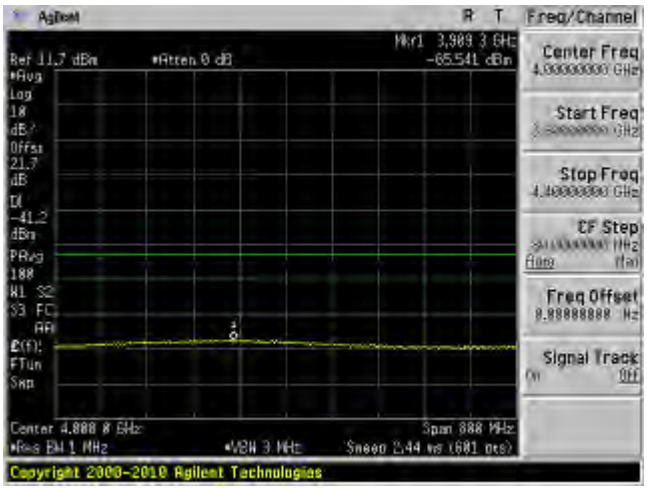
802.11a mode, 5180 MHz, Chain J8 13



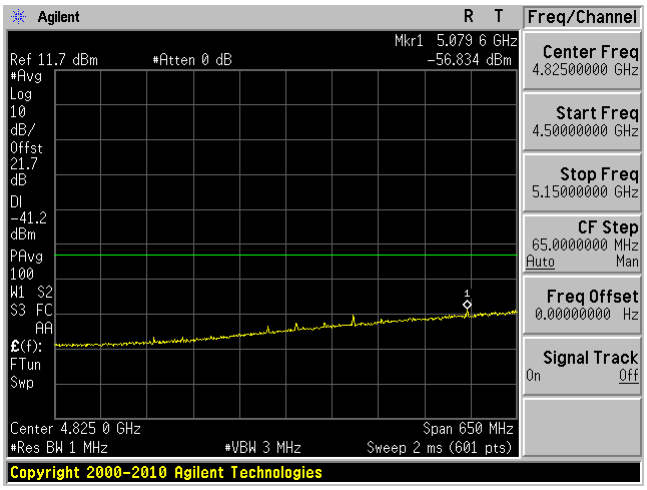

802.11a mode, 5180 MHz, Chain J8 14



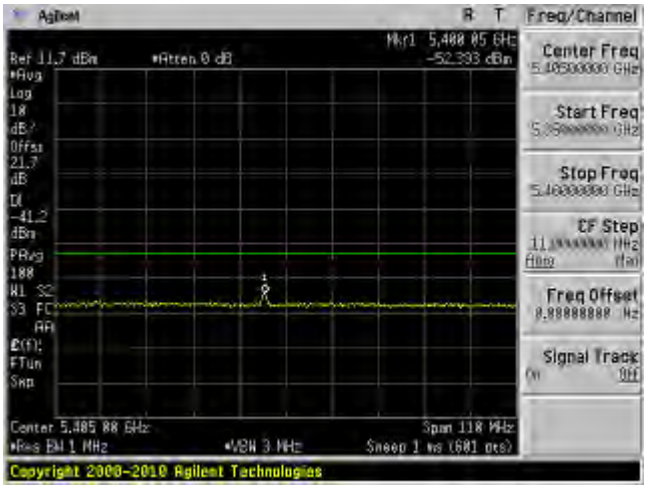

802.11a mode, 5180 MHz, Chain J8 15



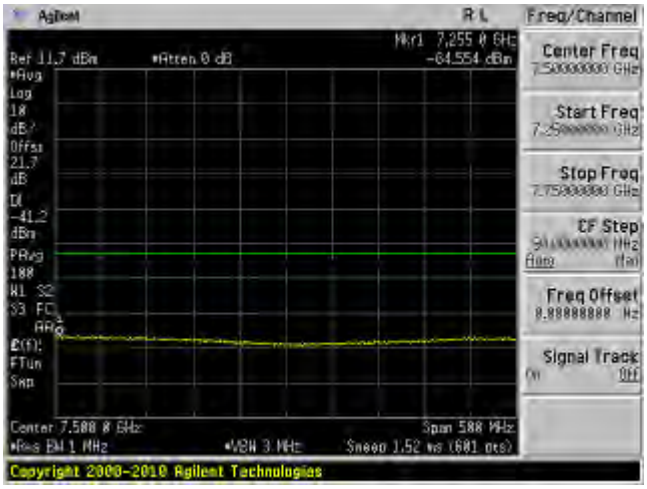

802.11a mode, 5180 MHz, Chain J8 16



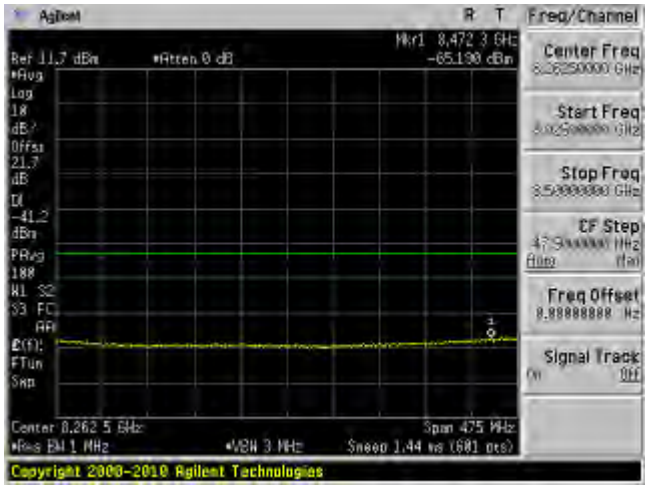
802.11a mode, 5180 MHz, Chain J8 17



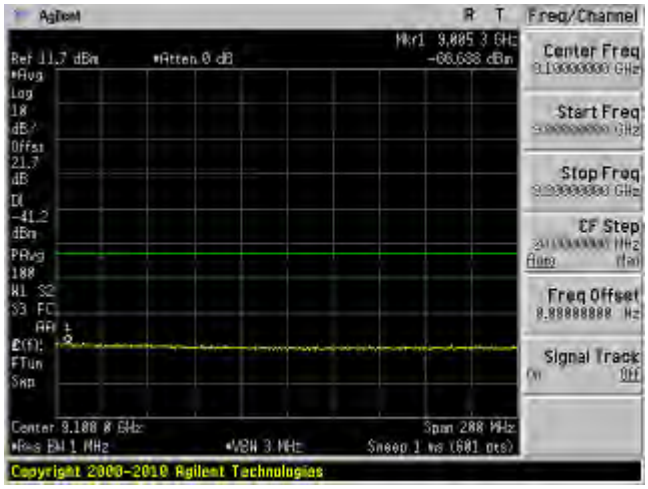

802.11a mode, 5180 MHz, Chain J8 18



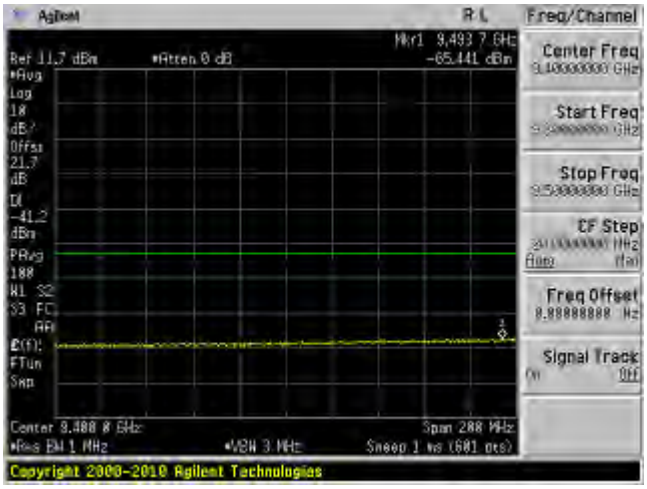

802.11a mode, 5180 MHz, Chain J8 19



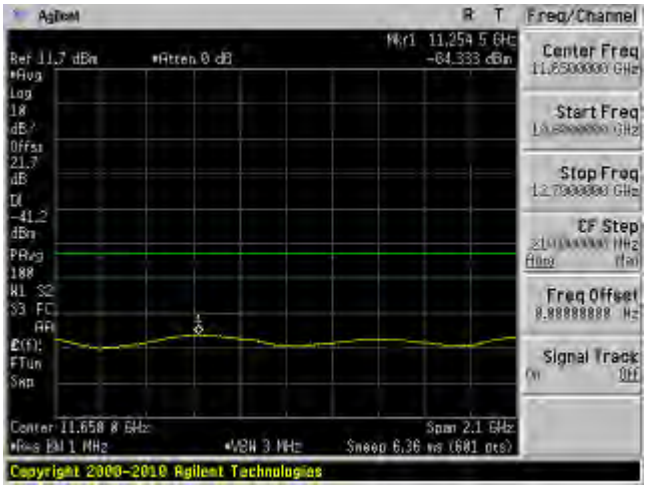

802.11a mode, 5180 MHz, Chain J8 20



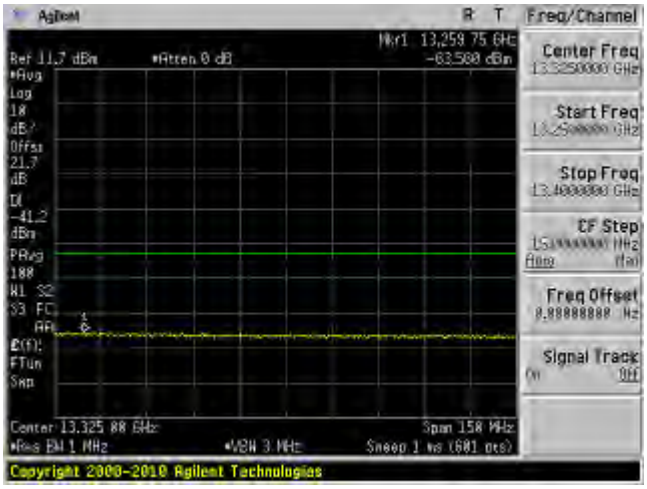
802.11a mode, 5180 MHz, Chain J8 21



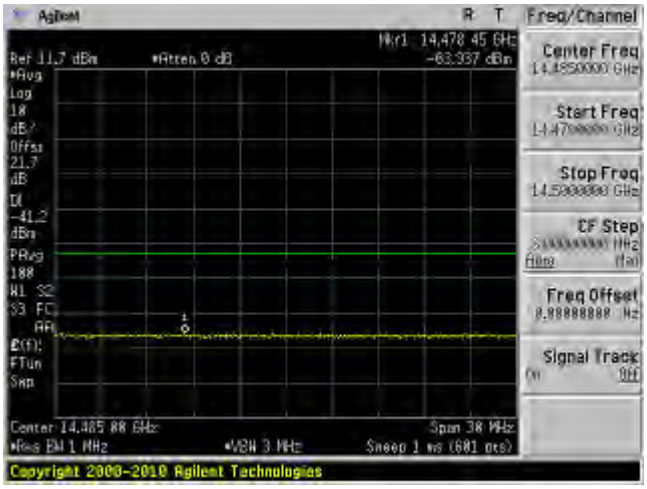

802.11a mode, 5180 MHz, Chain J8 22



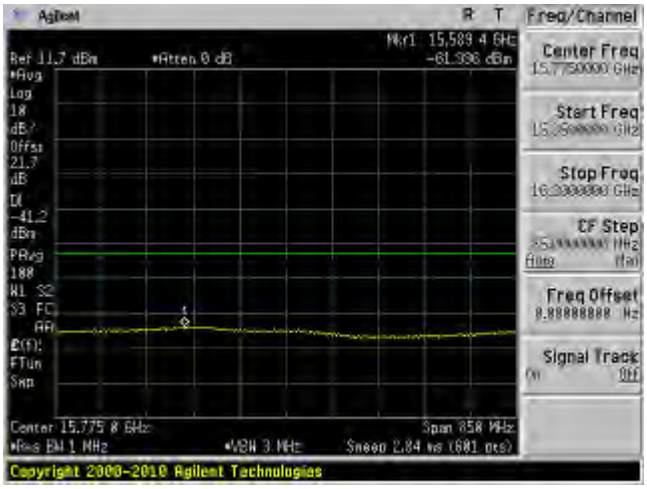

802.11a mode, 5180 MHz, Chain J8 23



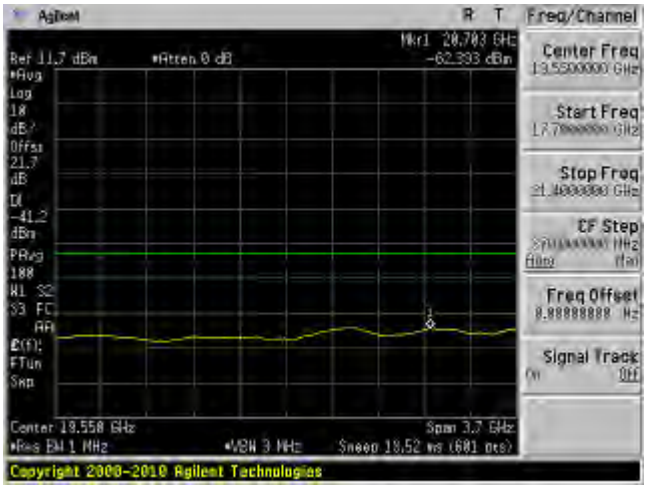

802.11a mode, 5180 MHz, Chain J8 24



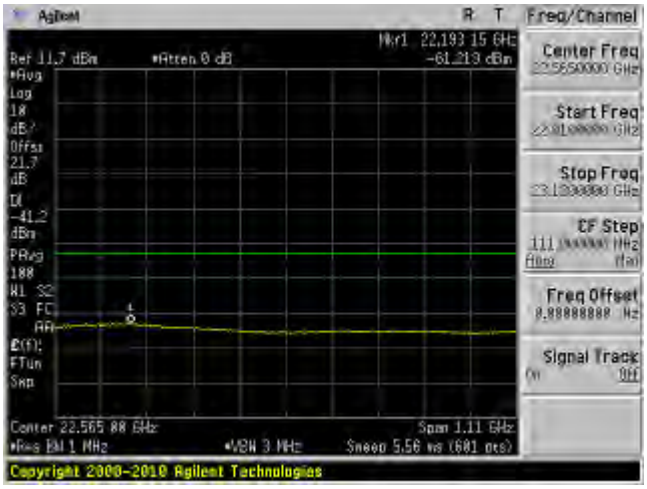
802.11a mode, 5180 MHz, Chain J8 25



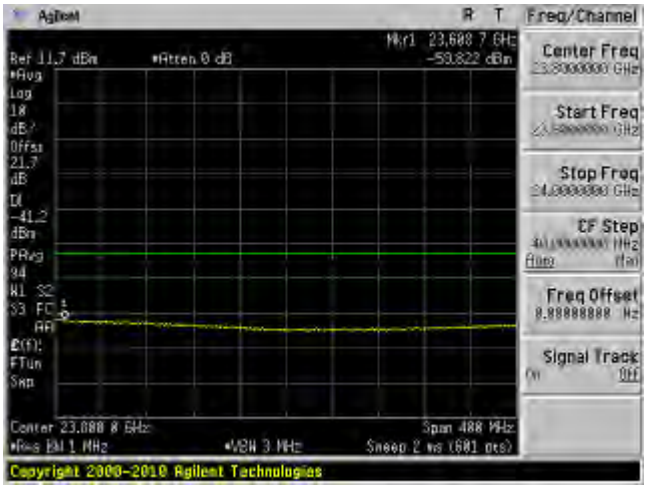

802.11a mode, 5180 MHz, Chain J8 26



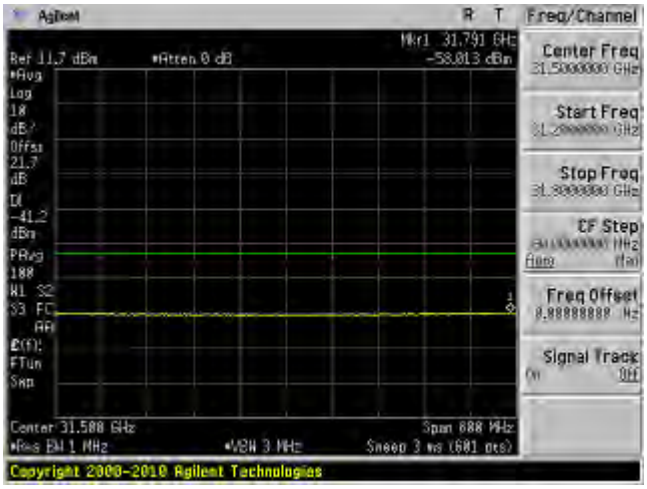

802.11a mode, 5180 MHz, Chain J8 27



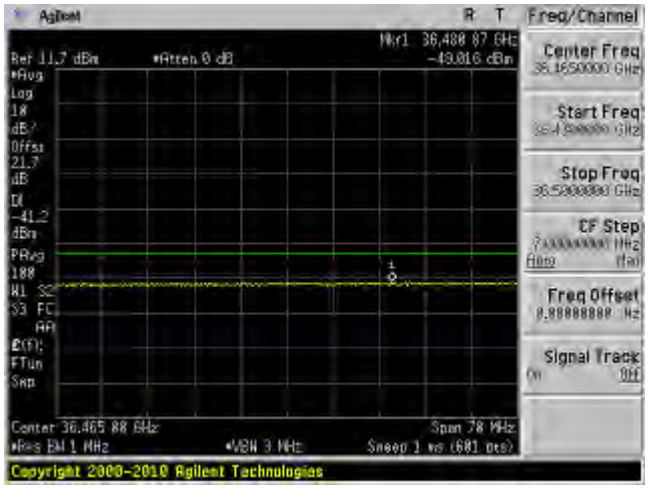

802.11a mode, 5180 MHz, Chain J8 28



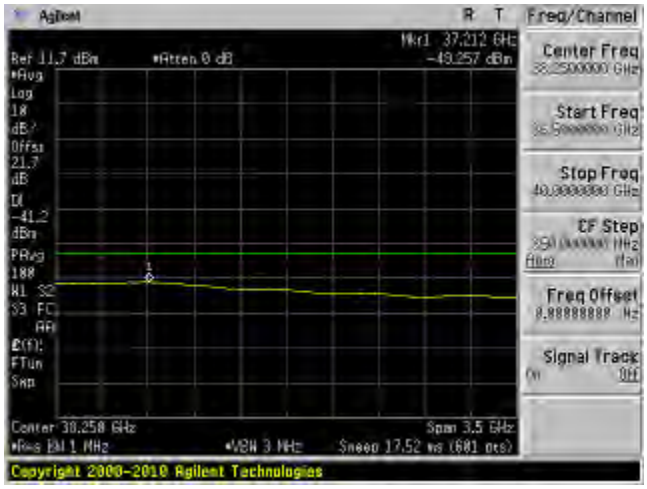
802.11a mode, 5180 MHz, Chain J8 29



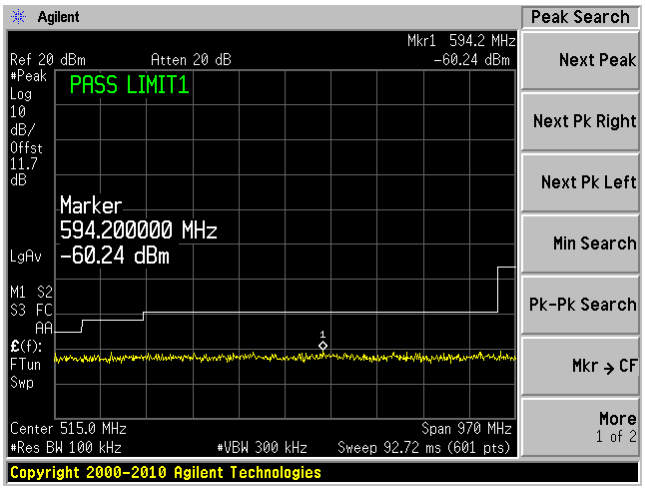

802.11a mode, 5180 MHz, Chain J8 30



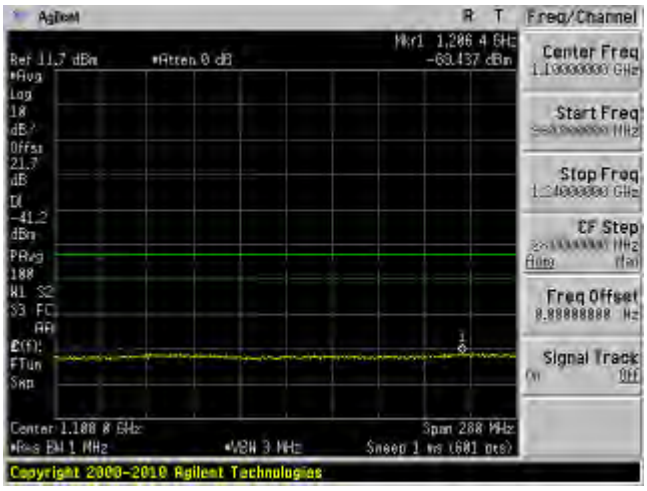

802.11a mode, 5180 MHz, Chain J8 31



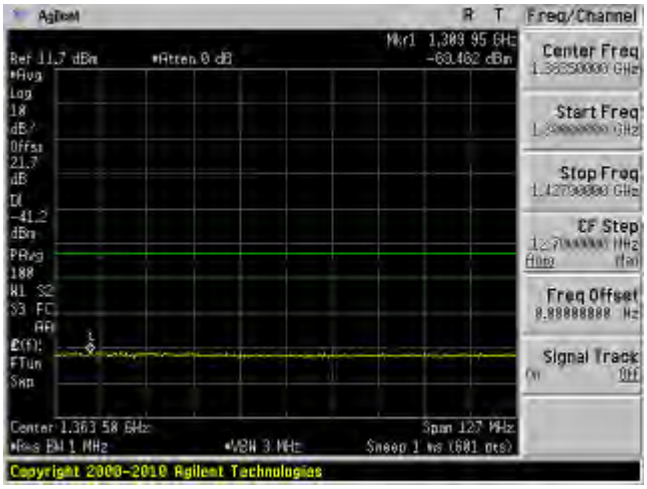
802.11a mode, 5180 MHz, Chain J6 1



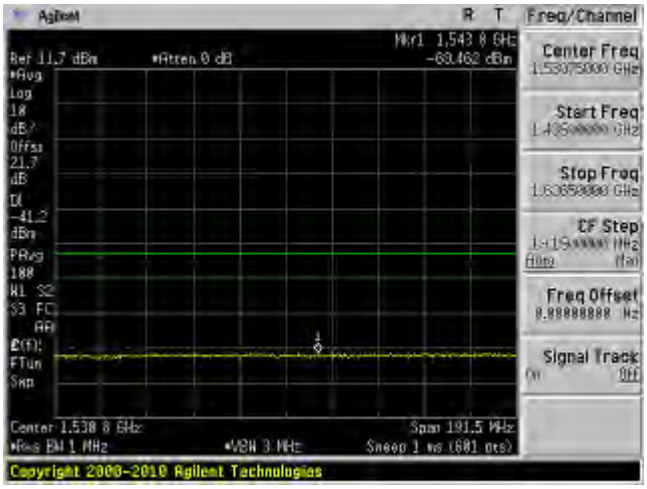

802.11a mode, 5180 MHz, Chain J6 2



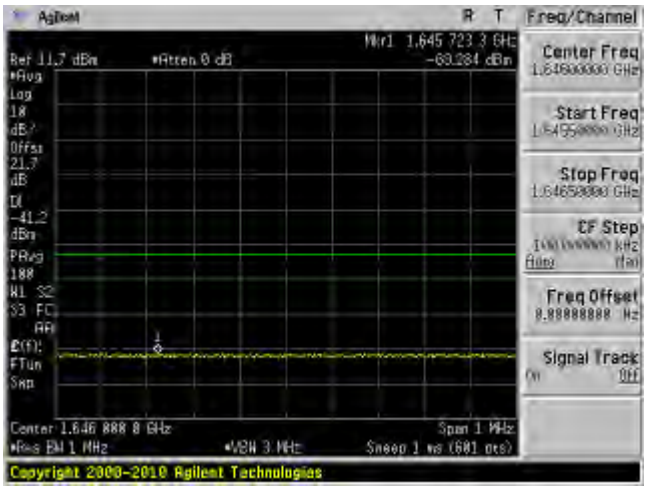

802.11a mode, 5180 MHz, Chain J6 3



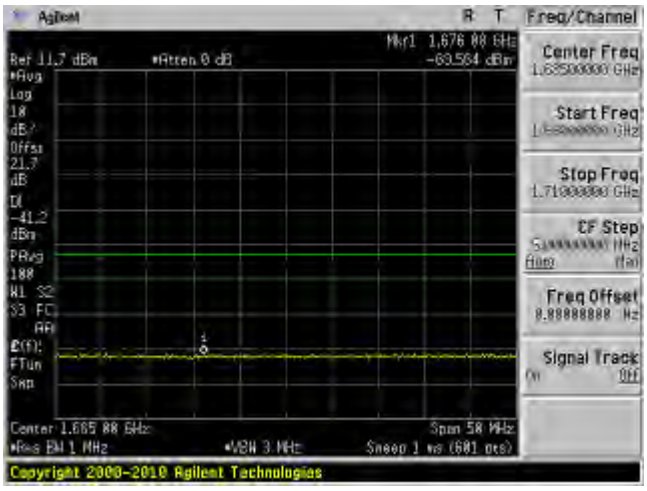

802.11a mode, 5180 MHz, Chain J6 4



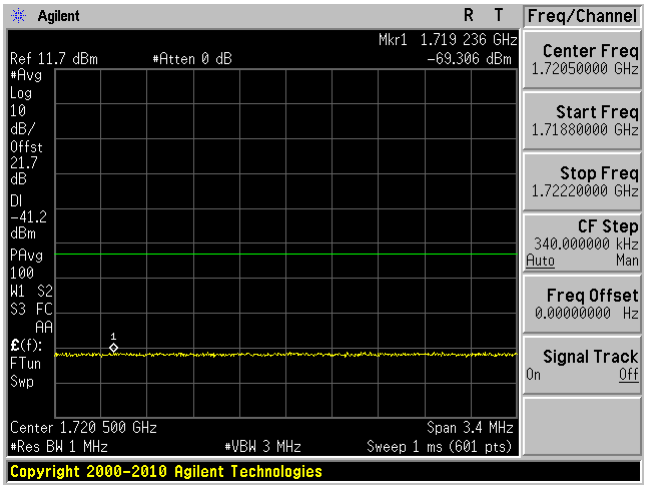
802.11a mode, 5180 MHz, Chain J6 5



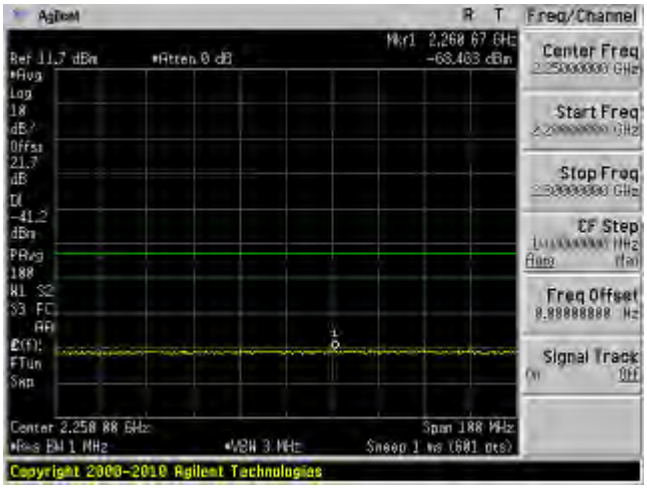

802.11a mode, 5180 MHz, Chain J6 6



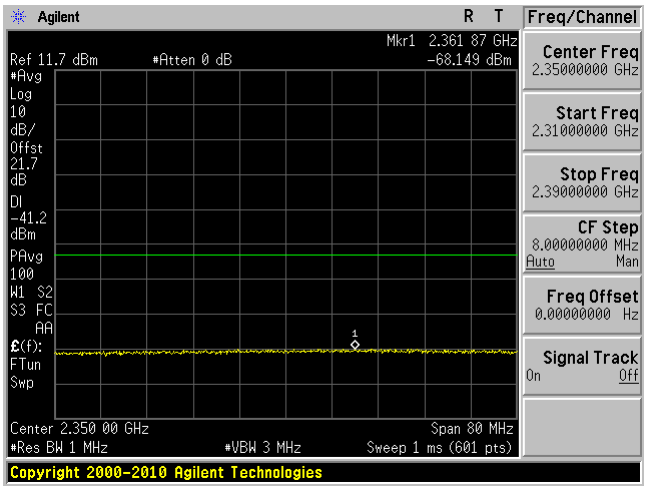

802.11a mode, 5180 MHz, Chain J6 7



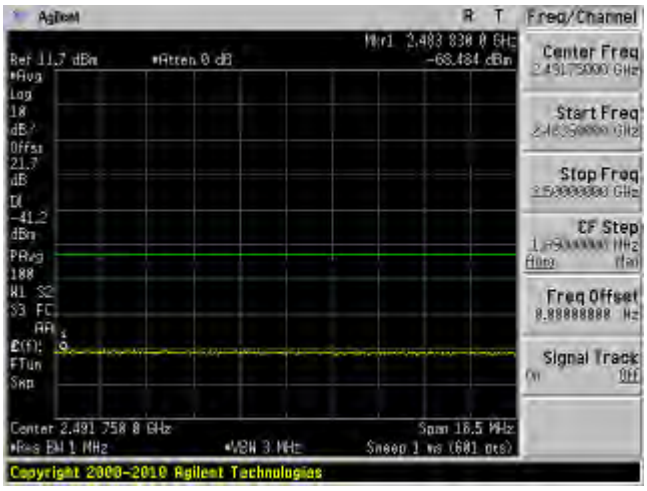

802.11a mode, 5180 MHz, Chain J6 8



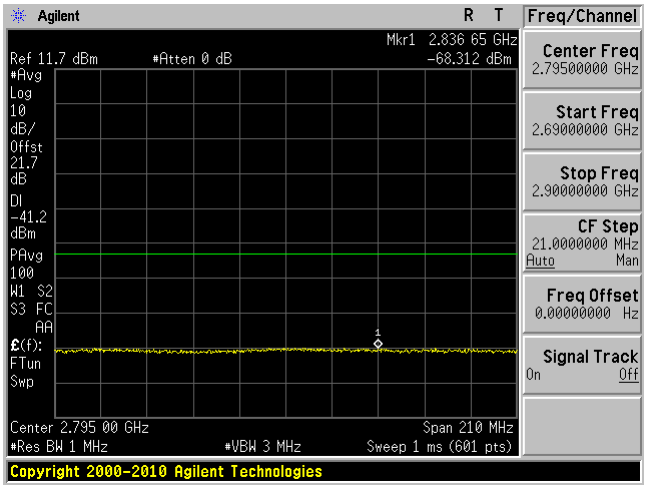
802.11a mode, 5180 MHz, Chain J6 9



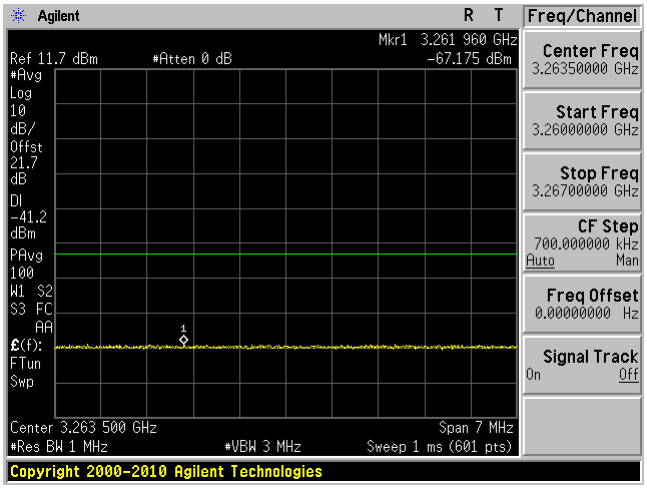

802.11a mode, 5180 MHz, Chain J6 10



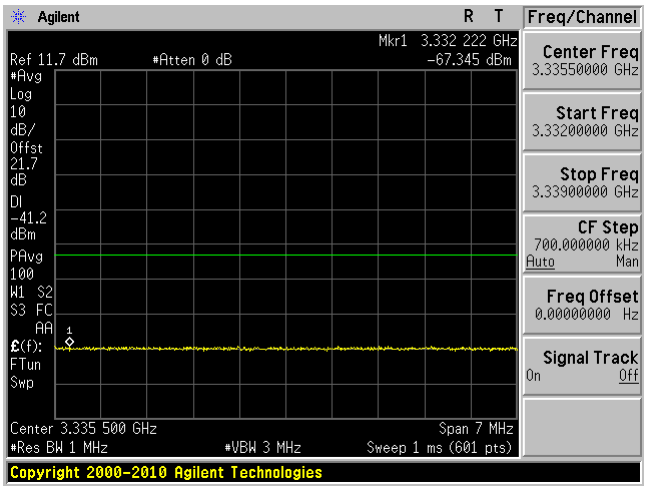

802.11a mode, 5180 MHz, Chain J6 11



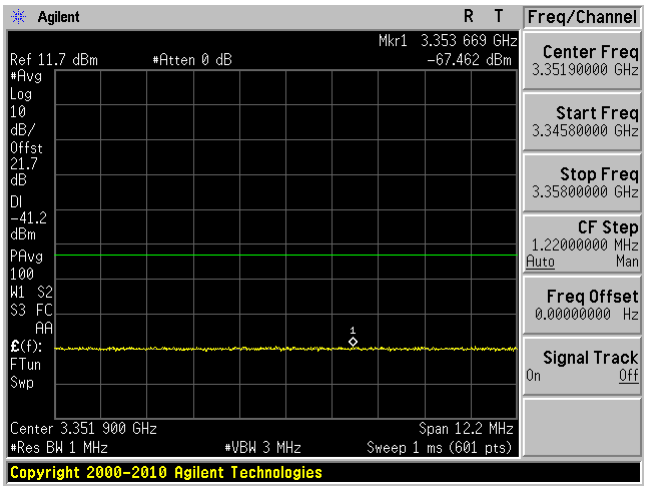

802.11a mode, 5180 MHz, Chain J6 12



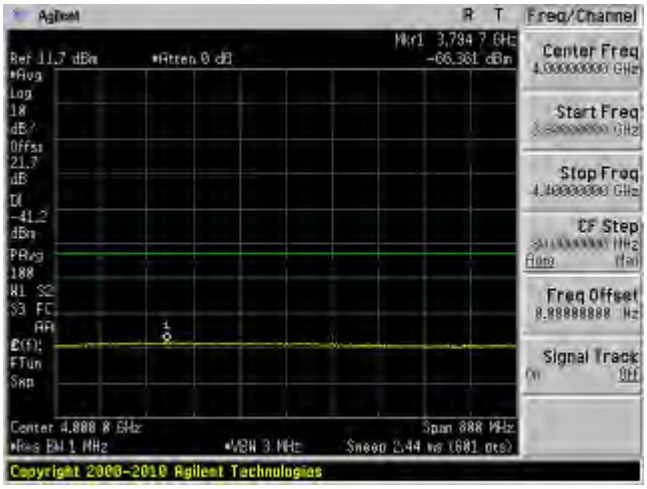
802.11a mode, 5180 MHz, Chain J6 13



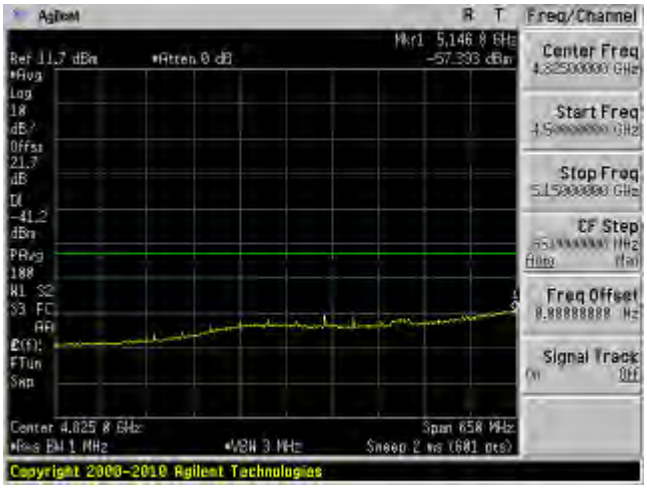

802.11a mode, 5180 MHz, Chain J6 14



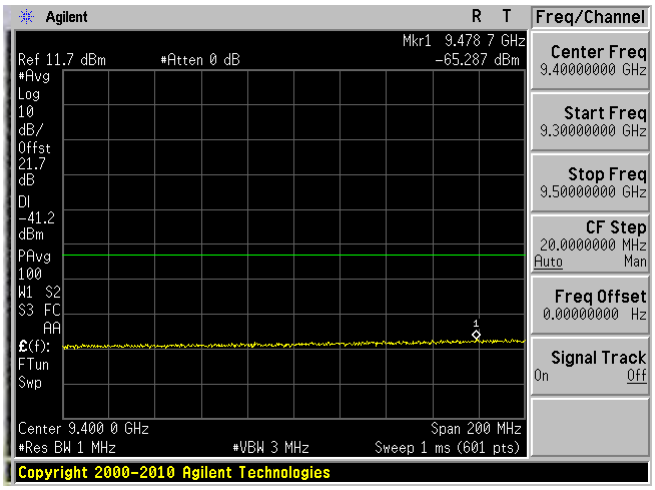

802.11a mode, 5180 MHz, Chain J6 15



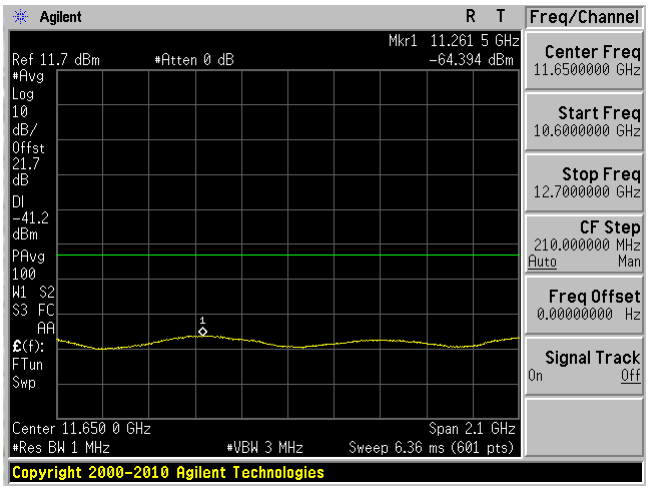

802.11a mode, 5180 MHz, Chain J6 16



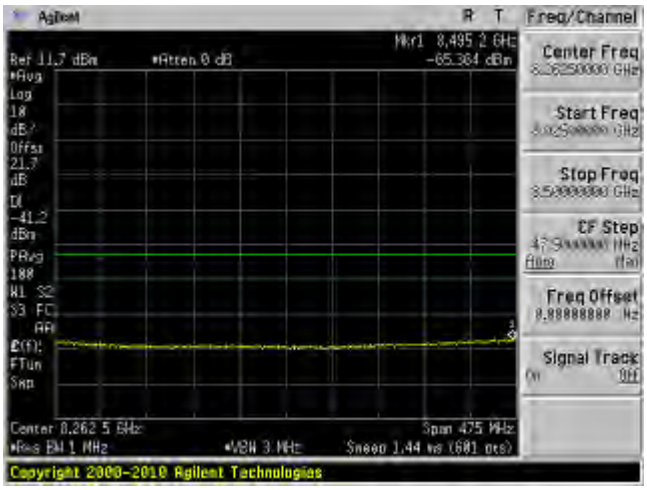
802.11a mode, 5180 MHz, Chain J6 17



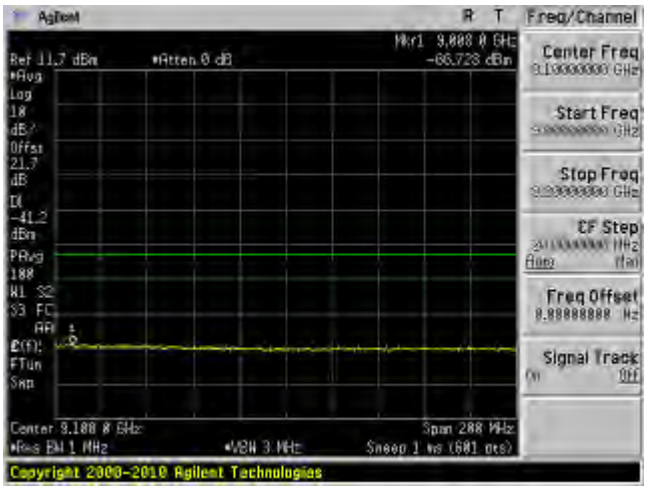

802.11a mode, 5180 MHz, Chain J6 18



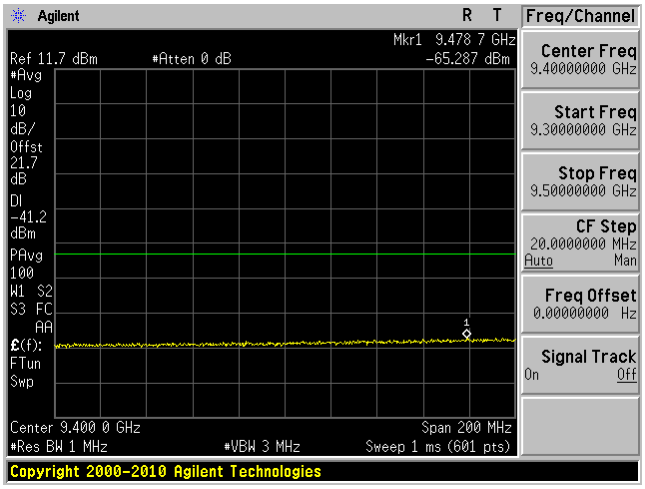

802.11a mode, 5180 MHz, Chain J6 19



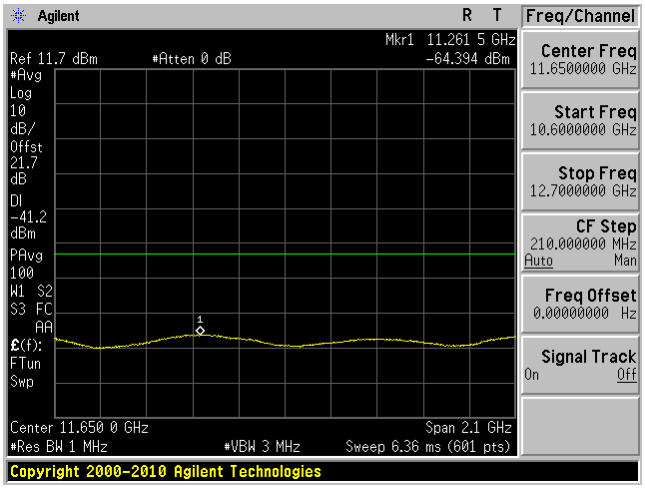

802.11a mode, 5180 MHz, Chain J6 20



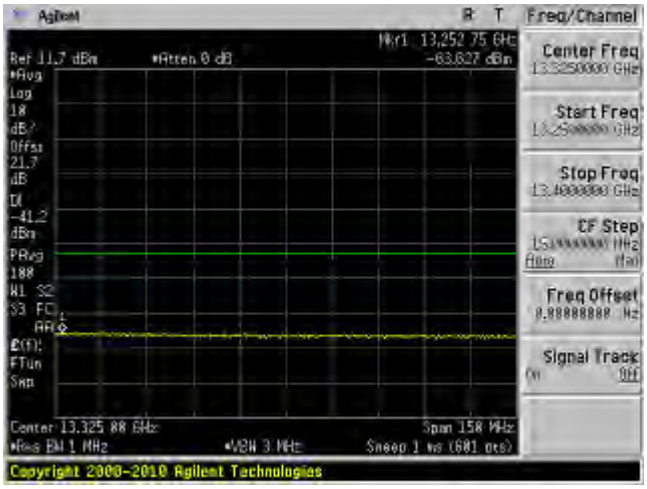
802.11a mode, 5180 MHz, Chain J6 21



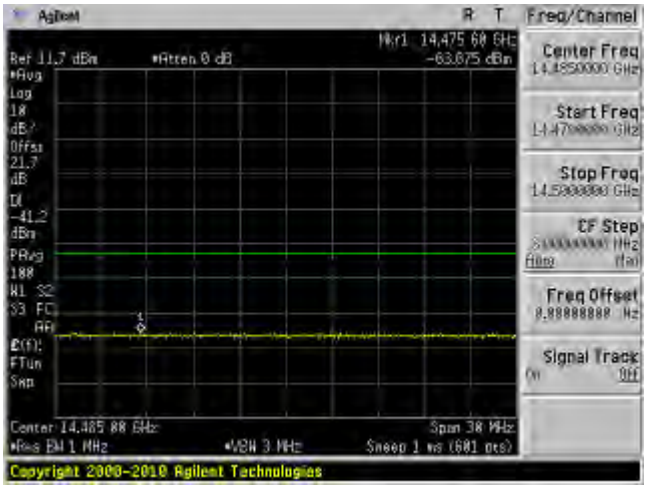

802.11a mode, 5180 MHz, Chain J6 22



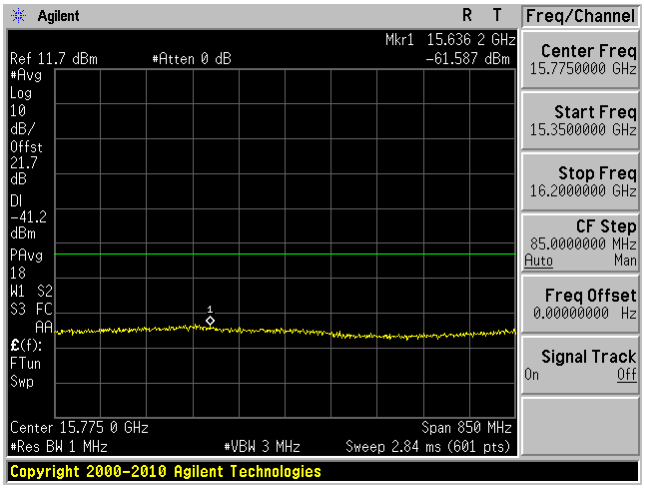

802.11a mode, 5180 MHz, Chain J6 23



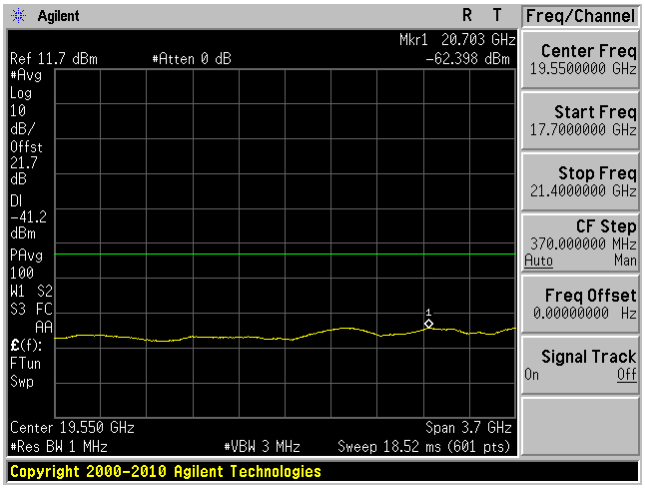

802.11a mode, 5180 MHz, Chain J6 24



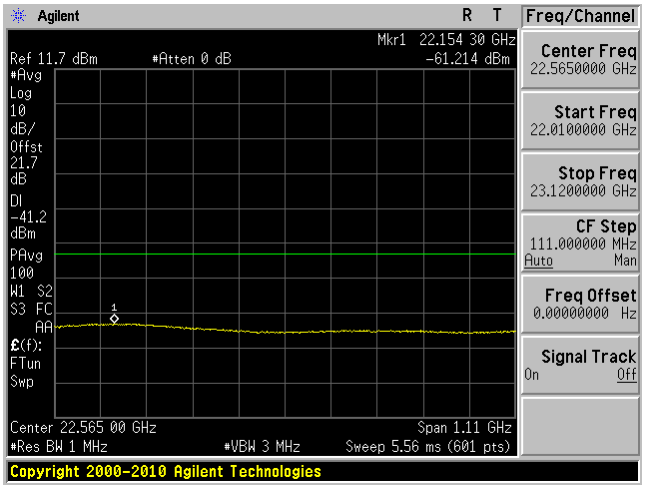
802.11a mode, 5180 MHz, Chain J6 25



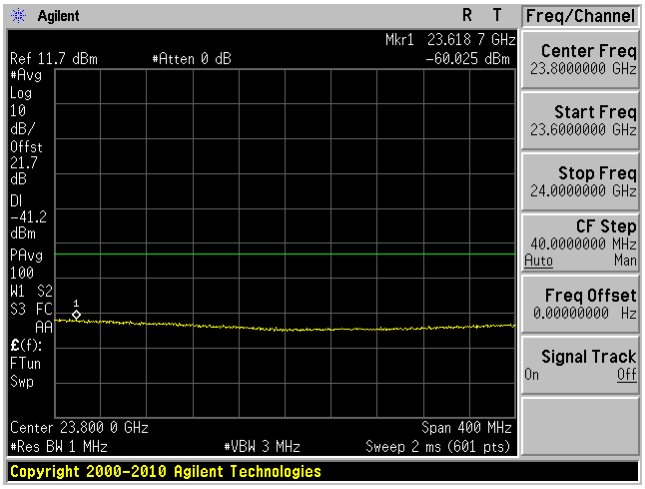

802.11a mode, 5180 MHz, Chain J6 26



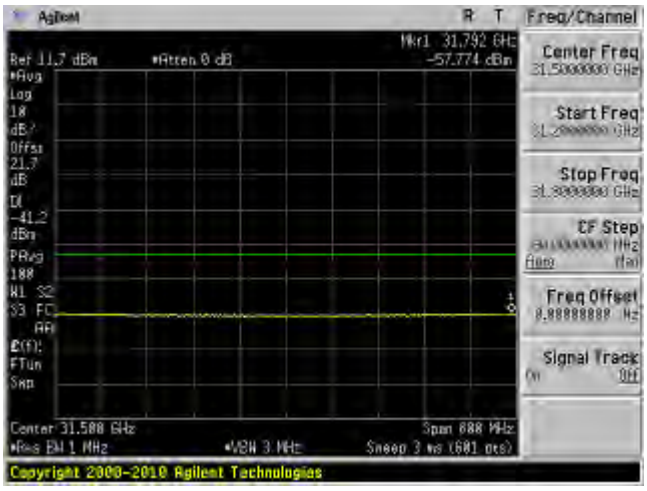

802.11a mode, 5180 MHz, Chain J6 27



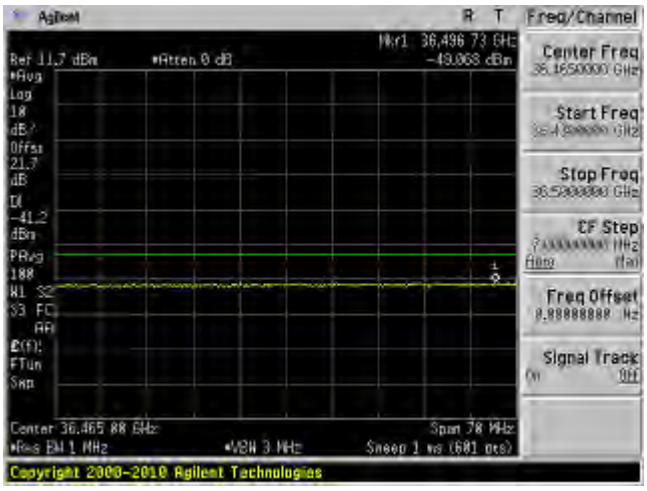

802.11a mode, 5180 MHz, Chain J6 28



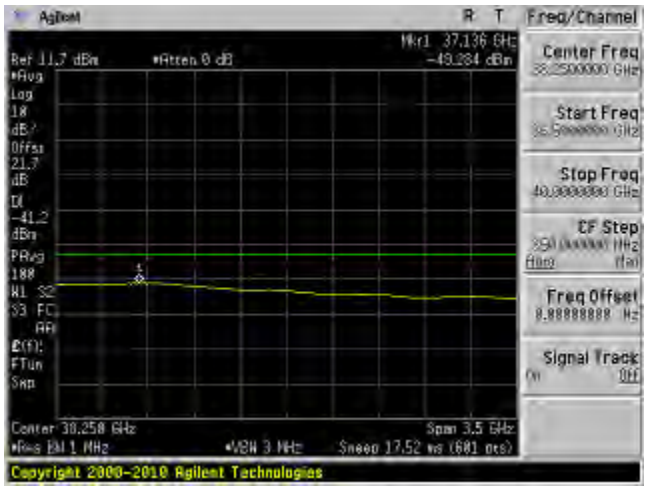
802.11a mode, 5180 MHz, Chain J8 29



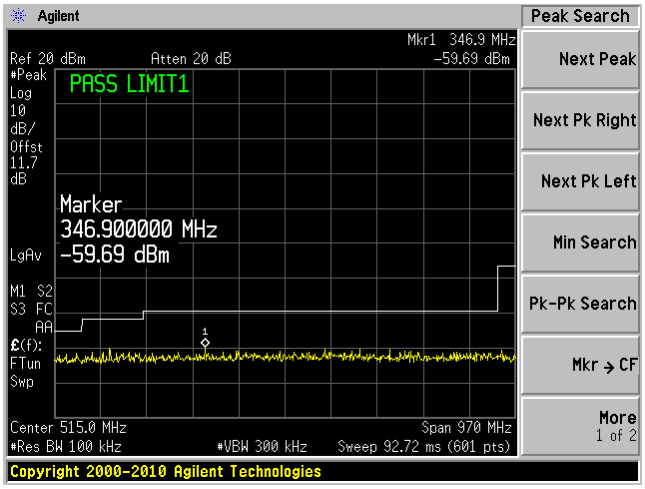

802.11a mode, 5180 MHz, Chain J8 30



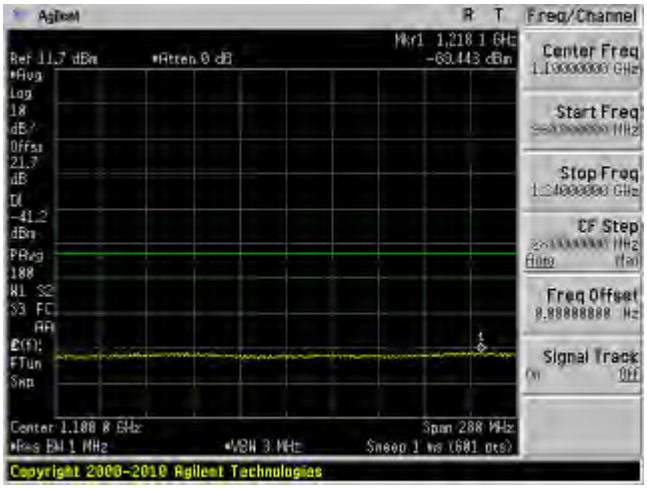

802.11a mode, 5180 MHz, Chain J8 31



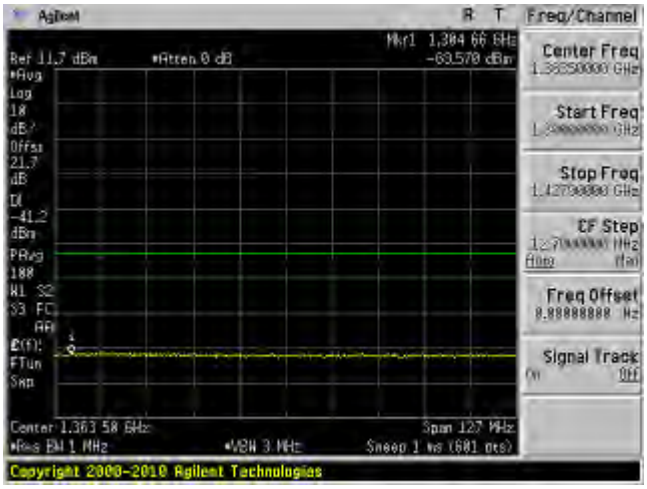
802.11 a mode, 52000 MHz, Chain J10 1



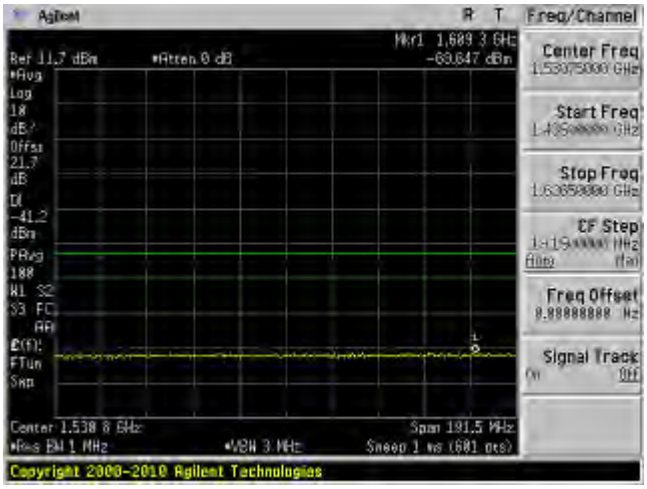

802.11n 20 mode, 5200 MHz, Chain J10 2



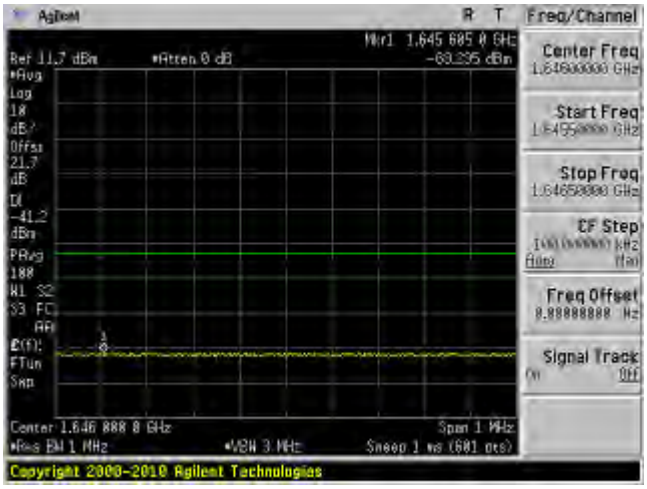

802.11a mode, 5200 MHz, Chain J10 3



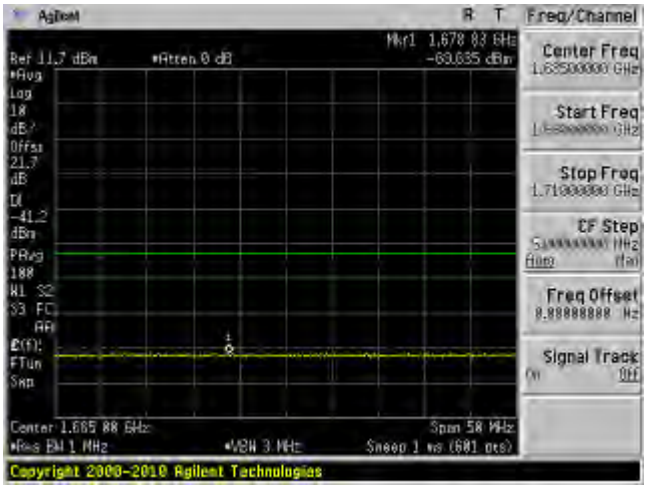

802.11a mode, 5200 MHz, Chain J10 4



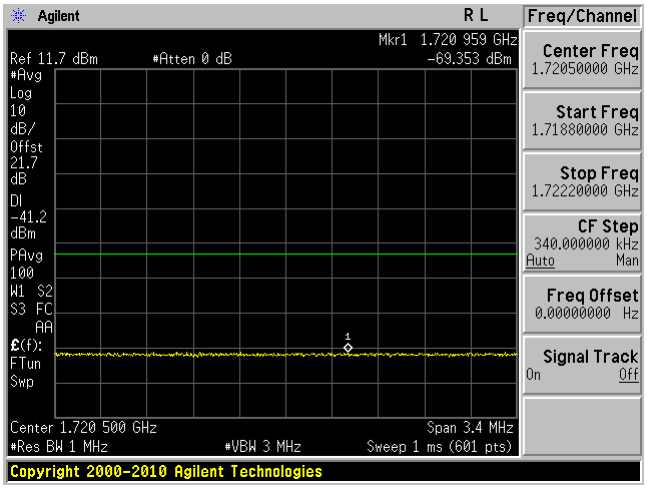
802.11a mode, 5200 MHz, Chain J10 5



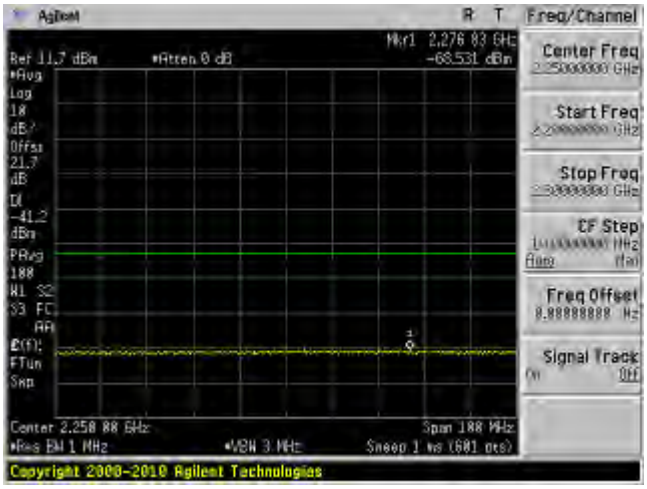

802.11a mode, 5200 MHz, Chain J10 6



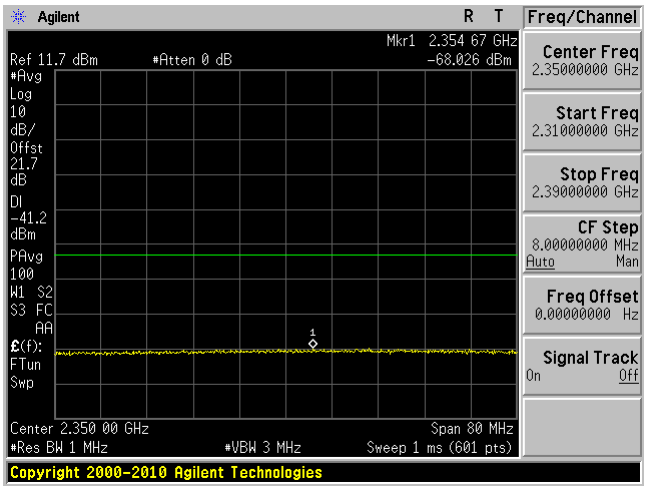

802.11a mode, 5200 MHz, Chain J10 7



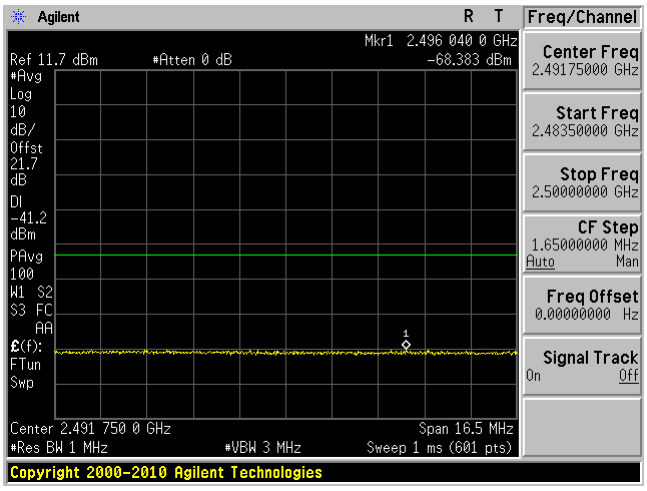

802.11a mode, 5200 MHz, Chain J10 8



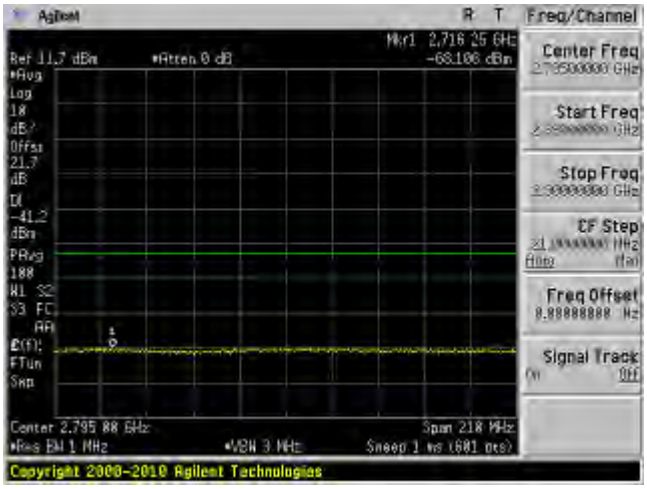
802.11a mode, 5200 MHz, Chain J10 9



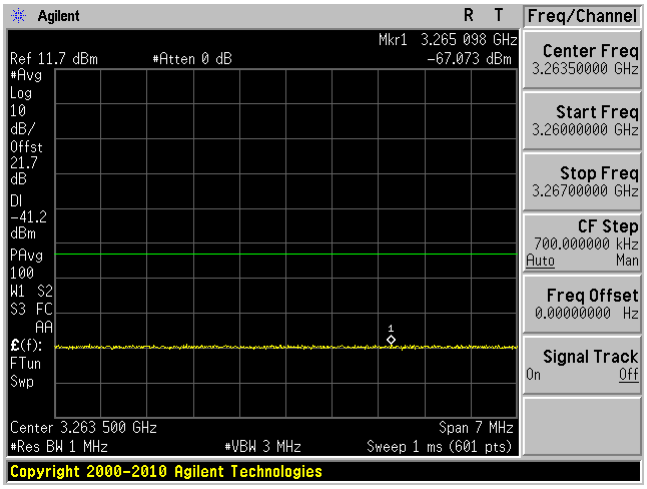

802.11a mode, 5200 MHz, Chain J10 10



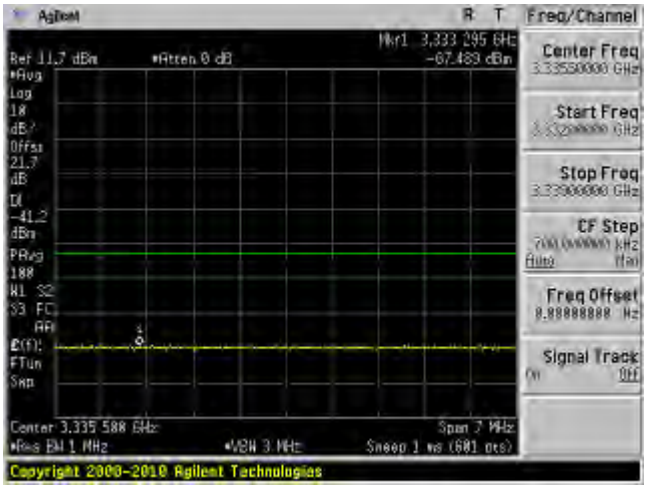

802.11a mode, 5200 MHz, Chain J10 11



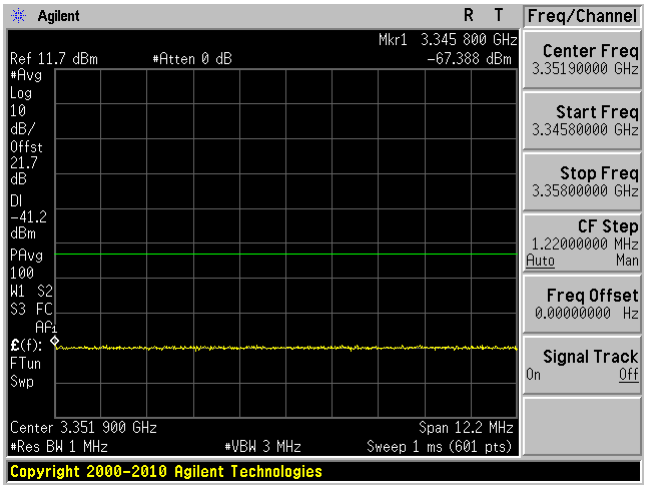

802.11a mode, 5200 MHz, Chain J10 12



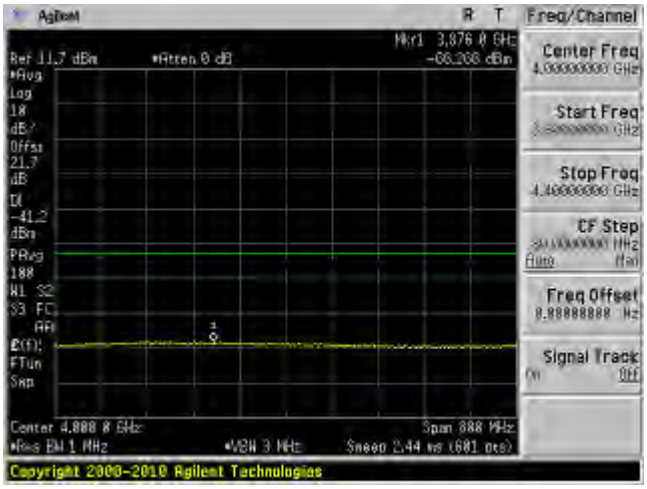
802.11a mode, 5200 MHz, Chain J10 13




802.11a mode, 5200 MHz, Chain J10 14




802.11a mode, 5200 MHz, Chain J10 15




802.11a mode, 5200 MHz, Chain J10 16