# FCC PART 15.407

# TEST AND MEASUREMENT REPORT

For

## Aerohive Network, Inc.

330 Gibraltar Drive,

Sunnyvale, CA 94089, USA

**FCC ID: WBV-AP230**

| **Report Type:** Class II Permissive Change | **Product Type:** 802.11 a/b/g/n/ac Wireless Access Point |
|---|---|

| | |
|---|---|
| **Prepared By:** | Jin Yang<br>Test Engineer |
| **Report Number:** | R16033114-407 |
| **Report Date:** | 2016-05-04 |
| **Reviewed By:** | Bo Li<br>RF Supervisor |

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* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*" (Rev.2)

# TABLE OF CONTENTS


**1 GENERAL DESCRIPTION ..... 5**

1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) ..... 5
1.2 MECHANICAL DESCRIPTION OF EUT ..... 5
1.3 OBJECTIVE ..... 5
1.4 RELATED SUBMITTAL(S)/GRANT(S) ..... 5
1.5 TEST METHODOLOGY ..... 5
1.6 MEASUREMENT UNCERTAINTY ..... 5
1.7 TEST FACILITY ..... 6

**2 EUT TEST CONFIGURATION ..... 8**

2.1 JUSTIFICATION ..... 8
2.2 EUT EXERCISE SOFTWARE ..... 8
2.3 EQUIPMENT MODIFICATIONS ..... 8
2.4 LOCAL SUPPORT EQUIPMENT ..... 8
2.5 EUT INTERNAL CONFIGURATION DETAILS ..... 8
2.6 SUPPORT EQUIPMENT ..... 8
2.7 INTERFACE PORTS AND CABLING ..... 9

**3 SUMMARY OF TEST RESULTS ..... 10**

**4 FCC §2.1091 & §15.407(F) - RF EXPOSURE ..... 11**

4.1 APPLICABLE STANDARDS ..... 11
4.2 MPE PREDICTION ..... 11
4.3 MPE RESULTS ..... 11

**5 FCC §15.203 - ANTENNA REQUIREMENTS ..... 14**

5.1 APPLICABLE STANDARDS ..... 14
5.2 ANTENNA LIST ..... 14

**6 FCC §15.207 - AC POWER LINE CONDUCTED EMISSIONS ..... 15**

6.1 APPLICABLE STANDARDS ..... 15
6.2 TEST SETUP ..... 15
6.3 TEST PROCEDURE ..... 15
6.4 TEST SETUP BLOCK DIAGRAM ..... 16
6.5 CORRECTED AMPLITUDE & MARGIN CALCULATION ..... 16
6.6 TEST EQUIPMENT LIST AND DETAILS ..... 17
6.7 TEST ENVIRONMENTAL CONDITIONS ..... 17
6.8 SUMMARY OF TEST RESULTS ..... 17
6.9 CONDUCTED EMISSIONS TEST PLOTS AND DATA ..... 18

**7 FCC §15.205, §15.209 & §15.407(B) - SPURIOUS RADIATED EMISSIONS ..... 20**

7.1 APPLICABLE STANDARD ..... 20
7.2 TEST SETUP ..... 21
7.3 TEST PROCEDURE ..... 21
7.4 CORRECTED AMPLITUDE & MARGIN CALCULATION ..... 22
7.5 TEST EQUIPMENT LIST AND DETAILS ..... 22
7.6 TEST ENVIRONMENTAL CONDITIONS ..... 23
7.7 SUMMARY OF TEST RESULTS ..... 23
7.8 RADIATED EMISSIONS TEST RESULT DATA ..... 24

**8 FCC §15.407- 26 DB & 99% OCCUPIED BANDWIDTH ..... 35**

8.1 APPLICABLE STANDARDS ..... 35
8.2 MEASUREMENT PROCEDURE ..... 35
8.3 TEST EQUIPMENT LIST AND DETAILS ..... 35
8.4 TEST ENVIRONMENTAL CONDITIONS ..... 35
8.5 TEST RESULTS ..... 36

**9 FCC §407(A) - OUTPUT POWER ..... 49**

9.1 APPLICABLE STANDARDS ..... 49
9.2 MEASUREMENT PROCEDURE ..... 49
9.3 TEST EQUIPMENT LIST AND DETAILS ..... 49
9.4 TEST ENVIRONMENTAL CONDITIONS ..... 49
9.5 TEST RESULTS ..... 49

**10 FCC §15.407(A) - POWER SPECTRAL DENSITY ..... 64**

10.1 APPLICABLE STANDARDS ..... 64
10.2 MEASUREMENT PROCEDURE ..... 64
10.3 TEST EQUIPMENT LIST AND DETAILS ..... 64
10.4 TEST ENVIRONMENTAL CONDITIONS ..... 65
10.5 TEST RESULTS ..... 65

**11 §15.407(B) - OUT OF BAND EMISSIONS ..... 92**

11.1 APPLICABLE STANDARDS ..... 92
11.2 MEASUREMENT PROCEDURE ..... 92
11.3 TEST EQUIPMENT LIST AND DETAILS ..... 93
11.4 TEST ENVIRONMENTAL CONDITIONS ..... 93
11.5 TEST RESULTS ..... 93

**12 EXHIBIT A - FCC EQUIPMENT LABELING REQUIREMENTS ..... 131**

12.1 FCC ID LABEL REQUIREMENTS ..... 131
12.2 FCC LABEL CONTENTS AND LOCATION ..... 131

**13 EXHIBIT B - TEST SETUP PHOTOGRAPHS ..... 132**

13.1 RADIATED EMISSION BELOW 1 GHZ FRONT VIEW ..... 132
13.2 RADIATED EMISSION BELOW 1 GHZ REAR VIEW ..... 132
13.3 RADIATED EMISSION ABOVE 1 GHZ FRONT VIEW ..... 133
13.4 RADIATED EMISSION ABOVE 1 GHZ REAR VIEW ..... 133
13.5 AC LINE CONDUCTED EMISSIONS FRONT VIEW ..... 134
13.6 AC LINE CONDUCTED EMISSIONS SIDE VIEW ..... 134

**14 EXHIBIT C - EUT PHOTOGRAPHS ..... 135**

14.1 EUT – FRONT VIEW ..... 135
14.2 EUT – BACK VIEW ..... 135
14.3 EUT – TOP VIEW ..... 136
14.4 EUT – BOTTOM VIEW ..... 136
14.5 EUT – LEFT VIEW ..... 137
14.6 EUT – RIGHT VIEW ..... 137
14.7 EUT – POE ADAPTER ..... 138
14.8 EUT – OPEN CASE VIEW 1 ..... 138
14.9 EUT – OPEN CASE VIEW 2 ..... 139
14.10 EUT – MAINBOARD VIEW 1 ..... 139
14.11 EUT – MAINBOARD VIEW 2 ..... 140
14.12 EUT – MAINBOARD VIEW 3 ..... 140

# DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|---|---|---|---|
| 0 | R16033114-407 | CIIPC Report | 2016-05-04 |

# 1 General Description

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

This test and measurement report was prepared on behalf of *Aerohive Network, Inc*., and their product model: *AP230, FCC ID: WBV-AP230* or the "EUT" as referred to in this report. The EUT is a 3x3 MIMO 802.11 a/b/g/n/ac Access Point.

## 1.2 Mechanical Description of EUT

The EUT measures approximately 185 mm (L) x 185 mm (W) x 50 mm (H) and weighs 0.75 kg.
*The test data gathered are from typical production sample, serial number: R160331144-1 assigned by BACL*

## 1.3 Objective

This report is prepared on behalf of *Aerohive Network, Inc.* in accordance with FCC CFR47 §15.407.
The objective is to determine compliance with FCC Part 15.407 rules for Output Power, Antenna Requirements, AC Line Conducted Emissions, Emission Bandwidth, Power spectral density, Conducted and Radiated Spurious Emissions.

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

FCC Part 15, Subpart E, Equipment NII with FCC ID: *WBV-AP230*
FCC Part 15, Subpart C, Equipment DTS with FCC ID: *WBV-AP230*

## 1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz, and FCC KDB 789033 D02 General UNII Test Procedure New Rules v01r01.

## 1.6 Measurement Uncertainty

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

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

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

## 1.7 Test Facility

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

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

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

4- A Product Certification Body accredited to **ISO Guide 65: 1996** by **A2LA** to certify:

Bay Area Compliance Laboratories Corp. (BACL) is:

**A-** ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3279.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

**B-** ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.03)*** to certify

- For the USA (Federal Communications Commission):
  1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
  1 All Scope 1-Licence-Exempt Radio Frequency Devices;
  2 All Scope 2-Licensed Personal Mobile Radio Services;
  3 All Scope 3-Licensed General Mobile & Fixed Radio Services;
  4 All Scope 4-Licensed Maritime & Aviation Radio Services;
  5 All Scope 5-Licensed Fixed Microwave Radio Services
  6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.

- For Singapore (Info-Communications Development Authority (IDA)):
  1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  1 All Radio Equipment, per KHCA 10XX-series Specifications;
  2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

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 C63.10-2013 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r01.

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 by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

## 2.2 EUT Exercise Software

The test utility used was PuTTy, the software was verified by *Jin Yang* to comply with the standard requirements being tested against.

## 2.3 Equipment Modifications

N/A

## 2.4 Local Support Equipment

| Manufacturer | Description | Model |
|---|---|---|
| Dell | Laptop | Latitude D630 |

## 2.5 EUT Internal Configuration Details

| Manufacturer | Description | Model |
|---|---|---|
| Broadcom | CPU | BCM53016A1 |
| SK hynic | RAM | H5TQ2G63FFR-PBC |

## 2.6 Support Equipment

| Manufacturer | Description | Model |
|---|---|---|
| PowerDsine | POE DC Power | PD-3501G/AC |

## 2.7 Interface Ports and Cabling

| Cable Description | Length (m) | To | From |
|---|---|---|---|
| USB Cable | <1M | Laptop | EUT |

# 3 Summary of Test Results

| FCC Rules | Description of Test | Result |
|---|---|---|
| §2.1091, §15.407(f) | RF Exposure | Compliant |
| §15.203 | Antenna Requirement | Compliant |
| §15.207 | AC Power Line Conducted Emissions | Compliant |
| §15.205, §15.209, §15.407(b) | Spurious Radiated Emissions | Compliant |
| §15.407(e) | Emission Bandwidth | Compliant |
| §407(a) | Output Power | Compliant |
| §15.407(b) | Band Edges | Compliant |
| §15.407(a)(5) | Power Spectral Density | Compliant |
| §15.407(b) | Spurious Emissions at Antenna Terminals | Compliant |
| §15.407(h) | Dynamic Frequency Selection (DFS) | N/A[1] |

Note[1]: DFS is not required for 5.2 GHz band.

# 4 FCC §2.1091 & §15.407(f) - RF Exposure

## 4.1 Applicable Standards

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

Limits for General Population/Uncontrolled Exposure

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

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

## 4.2 MPE Prediction

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

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

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

## 4.3 MPE Results

### 5.2 GHz Band

**Non-Beamforming**

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 24.83 |
| Maximum peak output power at antenna input terminal (mW): | 304.0885 |
| Prediction distance (cm): | 25 |
| Prediction frequency (MHz): | 5230 |
| Maximum Antenna Gain, typical (dBi): | 11.13 |
| Maximum Antenna Gain (numeric): | 12.9718 |
| Power density of prediction frequency at 25.0 cm ($mW/cm^2$): | 0.5025 |
| FCC MPE limit for uncontrolled exposure at prediction frequency ($mW/cm^2$): | 1.0 |

**Beamforming**

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 24.28 |
| Maximum peak output power at antenna input terminal (mW): | 267.9168 |
| Prediction distance (cm): | 25 |
| Prediction frequency (MHz): | 5230 |
| Maximum Antenna Gain, typical (dBi): | 11.13 |
| Maximum Antenna Gain (numeric): | 12.9718 |
| Power density of prediction frequency at 25.0 cm (mW/cm$^2$): | 0.4425 |
| FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm$^2$): | 1.0 |

The device is compliant with the requirement MPE limit for uncontrolled exposure at the distance of 25 cm.

**Co-location Evaluation:**

2.4 GHz and 5 GHz bands can transmit simultaneously. Per FCC KDB 447498, when RF sources have difference frequencies, the fraction of the FCC power density limit shall be determined and the sum of all fractional components shall be less than 1. Please refer 2.4GHz WiFi data with original application report results. (FCC ID: WBV-AP230).

**2.4 GHz Wi-Fi, Non-Beamforming**

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 26.71 |
| Maximum peak output power at antenna input terminal (mW): | 468.8134 |
| Prediction distance (cm): | 25 |
| Prediction frequency (MHz): | 2437 |
| Maximum Antenna Gain, typical (dBi): | 8.87 |
| Maximum Antenna Gain (numeric): | 7.709 |
| Power density of prediction frequency at 25.0 cm (mW/cm$^2$): | 0.4602 |
| FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm$^2$): | 1.0 |

**2.4 GHz Wi-Fi, Beamforming**

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 26.8 |
| Maximum peak output power at antenna input terminal (mW): | 478.6301 |
| Prediction distance (cm): | 25 |
| Prediction frequency (MHz): | 2437 |
| Maximum Antenna Gain, typical (dBi): | 8.87 |
| Maximum Antenna Gain (numeric): | 7.709 |
| Power density of prediction frequency at 25.0 cm (mW/cm$^2$): | 0.47 |
| FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm$^2$): | 1.0 |

| Frequency Band | Max Conducted Power (dBm) | Evaluated Distance (cm) | Worst-Case MPE ($mW/cm^2$) | MPE Limit ($mW/cm^2$) | Worst-Case MPE Ratios | Sum of MPE Ratios | Limit |
|---|---|---|---|---|---|---|---|
| Non-Beamforming | | | | | | | |
| 2.4 GHz | 26.71 | 25 | 0.4602 | 1.0 | 46.02 % | 96.27 % | 100 % |
| 5.2 GHz | 24.83 | 25 | 0.5025 | 1.0 | 50.25 % | | |
| Beamforming | | | | | | | |
| 2.4 GHz | 26.8 | 25 | 0.47 | 1.0 | 47 % | 91.25 % | 100 % |
| 5.2 GHz | 24.28 | 25 | 0.4425 | 1.0 | 44.25 % | | |

The device is compliant with the requirement MPE limit for uncontrolled exposure at the distance of 25 cm.

# 5 FCC §15.203 - Antenna Requirements

## 5.1 Applicable Standards

According to FCC §15.203:

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

And according to FCC §15.407, if transmitting antennas of directional gain greater than 6 dBi are used, the corresponding measurement such as power, PSD, etc. shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## 5.2 Antenna List

The antennas used by the EUT are permanent attached antennas.

| Antenna Chain | Antenna Gain (dBi) @ 5.2 GHz |
|---|---|
| Chain 4 | 6.24 |
| Chain 5 | 6.13 |
| Chain 6 | 6.7 |

# 6 FCC §15.207 - AC Power Line Conducted Emissions

## 6.1 Applicable Standards

As per FCC §15.207

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

| Frequency of Emission (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56 Note 1 | 56 to 46 Note 1 |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

*Note 1 Decreases with the logarithm of the frequency.*

## 6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.10-2013 measurement procedure. The specification used was FCC §15.207 limits.

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

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

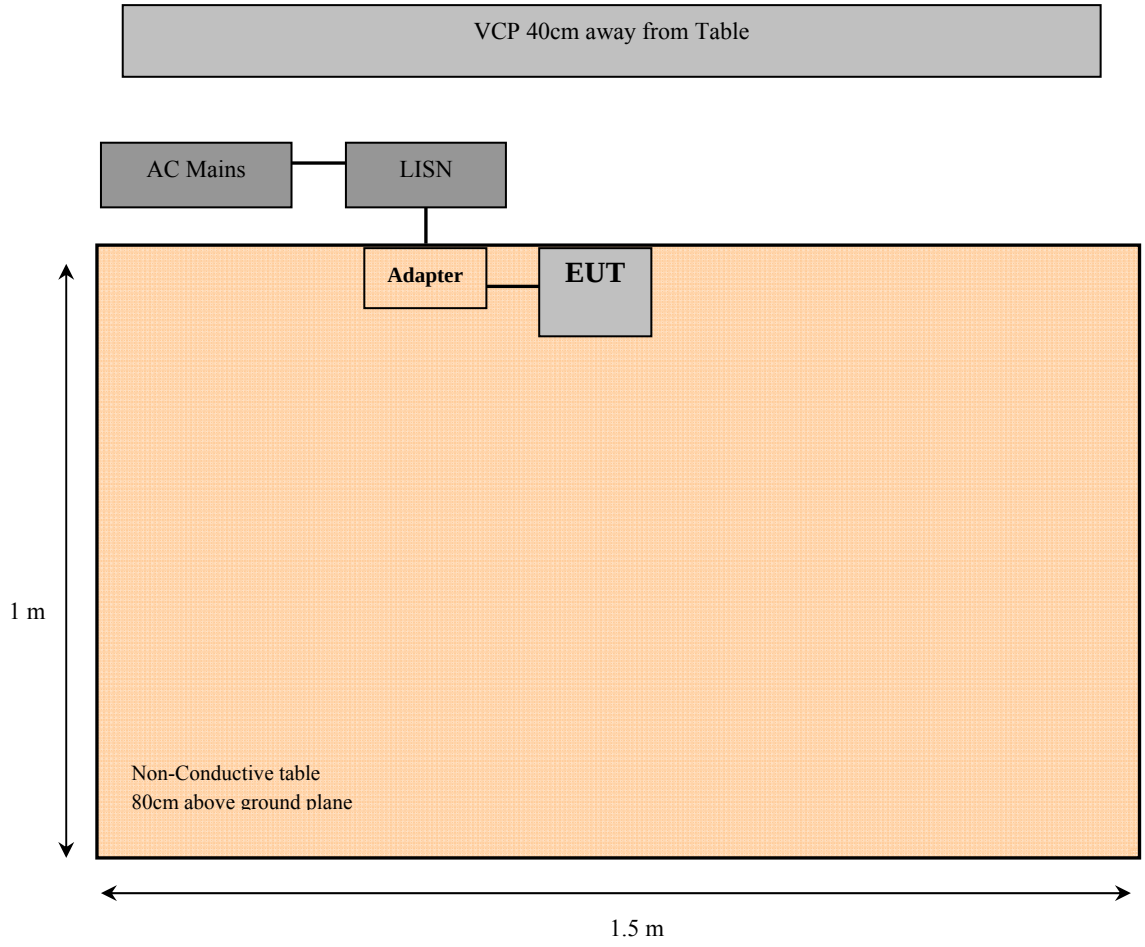
## 6.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cords of support equipment were connected to LISN-2.

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

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

## 6.4 Test Setup Block Diagram




## 6.5 Corrected Amplitude & Margin Calculation

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

CA = Ai + CL + Atten

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

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

Margin = Corrected Amplitude - Limit

## 6.6 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Rohde & Schwarz | Receiver, EMI Test | ESCI 1166.5950K03 | 100044 | 2015-07-23 | 1 year |
| Rohde & Schwarz | Impulse Limiter | ESH3-Z2 | 101963 | 2015-07-15 | 1year |
| Keysight Technologies | RF Limiter | 11867A | MY42242932 | 2015-12-15 | 1year |
| Solar Electronics Company | High Pass Filter | Type 7930-100 | 7930150204 | 2016-03-09 | 1 Year |
| FCC | LISN | FCC-LISN-50-2-10-CISPR16 1PA ANSI 14 | 160130 | 2016-04-12 | 1 year |
| Suirong | 30 ft conductive emission cable | LMR 400 | - | 2016-03-05 | 1 year |

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

## 6.7 Test Environmental Conditions

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

*The testing was performed by Jin Yang on 2016-04-18 at 5 meter 3.*

## 6.8 Summary of Test Results

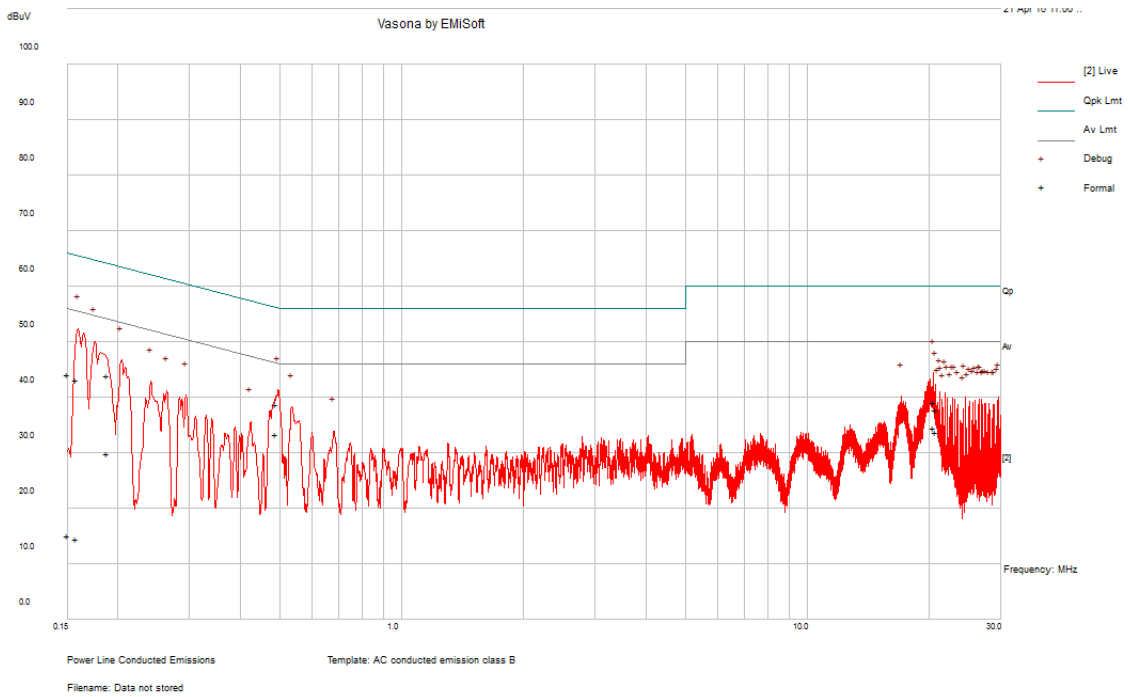
According to the recorded data in following table, the EUT complied with the FCC Part 15.207 conducted emissions limits, with the margin reading of:

| **Connection: AC/DC adapter connected to 120 V/60 Hz, AC** | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Conductor Mode (Live/Neutral)** | **Range (MHz)** |
| -12.69 | 0.490149 | Live | 0.15-30 |

## 6.9 Conducted Emissions Test Plots and Data

Note: EUT was configured to co-located mode with 2.4 GHz and 5 GHz activated while testing.

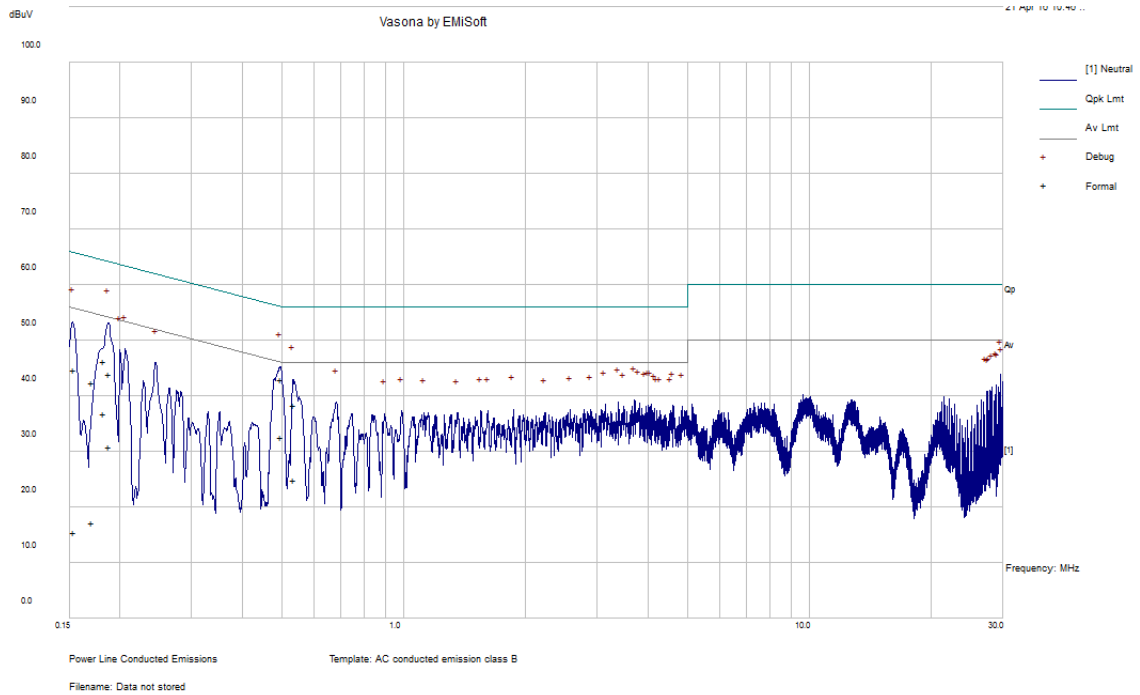
**120 V, 60 Hz – Line**




| Frequency (MHz) | Corrected Amplitude (dBµV) | Conductor (Line/Neutral) | Limit (dBµV) | Margin (dB) | Detector (QP/Ave.) |
|---|---|---|---|---|---|
| 0.15051 | 44.19 | Line | 65.97 | -21.78 | QP |
| 0.158163 | 43.15 | Line | 65.56 | -22.41 | QP |
| 0.490149 | 38.82 | Line | 56.17 | -17.35 | QP |
| 20.45641 | 39.08 | Line | 60 | -20.92 | QP |
| 0.188508 | 43.97 | Line | 64.1 | -20.13 | QP |
| 20.69472 | 37.89 | Line | 60 | -22.11 | QP |

| Frequency (MHz) | Corrected Amplitude (dBµV) | Conductor (Line/Neutral) | Limit (dBµV) | Margin (dB) | Detector (QP/Ave.) |
|---|---|---|---|---|---|
| 0.15051 | 15.1 | Line | 55.97 | -40.87 | Ave |
| 0.158163 | 14.54 | Line | 55.56 | -41.02 | Ave |
| 0.490149 | 33.48 | Line | 46.17 | -12.69 | Ave |
| 20.45641 | 34.61 | Line | 50 | -15.39 | Ave |
| 0.188508 | 29.98 | Line | 54.1 | -24.12 | Ave |
| 20.69472 | 33.69 | Line | 50 | -16.31 | Ave |

## 120 V, 60 Hz – Neutral




| Frequency (MHz) | Corrected Amplitude (dBµV) | Conductor (Line/Neutral) | Limit (dBµV) | Margin (dB) | Detector (QP/Ave.) |
|---|---|---|---|---|---|
| 0.498012 | 42.97 | Neutral | 56.03 | -13.06 | QP |
| 0.170382 | 42.49 | Neutral | 64.94 | -22.45 | QP |
| 0.154023 | 44.72 | Neutral | 65.78 | -21.06 | QP |
| 0.535317 | 38.46 | Neutral | 56 | -17.54 | QP |
| 0.188628 | 43.88 | Neutral | 64.1 | -20.21 | QP |
| 0.182925 | 46.26 | Neutral | 64.35 | -18.1 | QP |

| Frequency (MHz) | Corrected Amplitude (dBµV) | Conductor (Line/Neutral) | Limit (dBµV) | Margin (dB) | Detector (QP/Ave.) |
|---|---|---|---|---|---|
| 0.498012 | 32.72 | Neutral | 46.03 | -13.32 | Ave |
| 0.170382 | 17.29 | Neutral | 54.94 | -37.65 | Ave |
| 0.154023 | 15.59 | Neutral | 55.78 | -40.19 | Ave |
| 0.535317 | 25 | Neutral | 46 | -21 | Ave |
| 0.188628 | 31 | Neutral | 54.1 | -23.1 | Ave |
| 0.182925 | 36.81 | Neutral | 54.35 | -17.54 | Ave |

# 7 FCC §15.205, §15.209 & §15.407(b) - Spurious Radiated Emissions

## 7.1 Applicable Standard

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 §15.209: 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 Part 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 e.i.r.p. of −27 dBm/MHz.

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

(3) For transmitters operating in the 5.47 -5.725 GHz band: All emissions outside of the 5.47-5725 GHz band shall not exceed an ei.r.p. of -27 dBm/MHz.

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

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

## 7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15.407 limits.

The spacing between the peripherals was 10 centimeters.

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

## 7.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords were 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 or 1.5 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 = 3MHz / Sweep = 100ms

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

## 7.4 Corrected Amplitude & Margin Calculation

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

CA = Ai + AF + CL + Atten – Ga

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

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

Margin = Corrected Amplitude - Limit

## 7.5 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Rohde & Schwarz | Receiver, EMI Test | ESCI 1166.5950K03 | 100044 | 2015-07-23 | 1 year |
| Agilent | Analyzer, Spectrum | E4440A | MY44303352 | 2015-06-22 | 1 year |
| Sunol Science Corp | System Controller | SC99V | 011003-1 | N/R | N/R |
| Sunol Sciences | Antenna, Biconi-Log | JB3 | A020106-2 | 2015-07-11 | 2 years |
| EMCO | Antenna, Horn | 3115 | 9511-4627 | 2016-01-28 | 2 years |
| Agilent | Amplifier, Pre | 8447D | 2944A10187 | 2015-06-09 | 1 year |
| Suirong | 30 ft conductive emission cable | LMR 400 | - | 2016-03-05 | 1 year |
| - | SMA cable | - | C0002 | Each time[1] | N/A |
| IW Microwave | High Frequency Cable | DC-1438 | SPS-2303-3840-SPS | 2016-01-18 | 1 year |
| IW | AOBOR Hi frequency Co AX CabelCable | DC 1531 | KPS-1501A3960KPS | 2015-08-10 | 1 Year |
| Hewlett-Packard | 5 ft N-type RF cable | - | 1268 | 2015-05-15 | 1 year |
| Hewlett | Pre-Amplifier | 8449B | 3008A01978 | 2015-09-02 | 1year |
| Wisewave | Antenna, Horn | ARH-4223-02 | 10555-02 | 2013-09-20 | 3 year |
| Wisewave | Antenna, Horn | ARH-2823-02 | 10555-02 | 2013-09-20 | 3 year |
| Wisewave | Amplifier, Low Noise | ALN-33144030-01 | 11424-01 | 2015-04-28 | 1 year |
| Wisewave | Amplifier, Low Noise | ALN-22093530-01 | 12263-01 | 2015-04-28 | 1 year |

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

## 7.6 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22-24 ºC |
| **Relative Humidity:** | 40-41 % |
| **ATM Pressure:** | 103.1-104.1 kPa |

*The testing was performed by Jin Yang from 2016-04-18 at 5 meter 3.*

## 7.7 Summary of Test Results

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

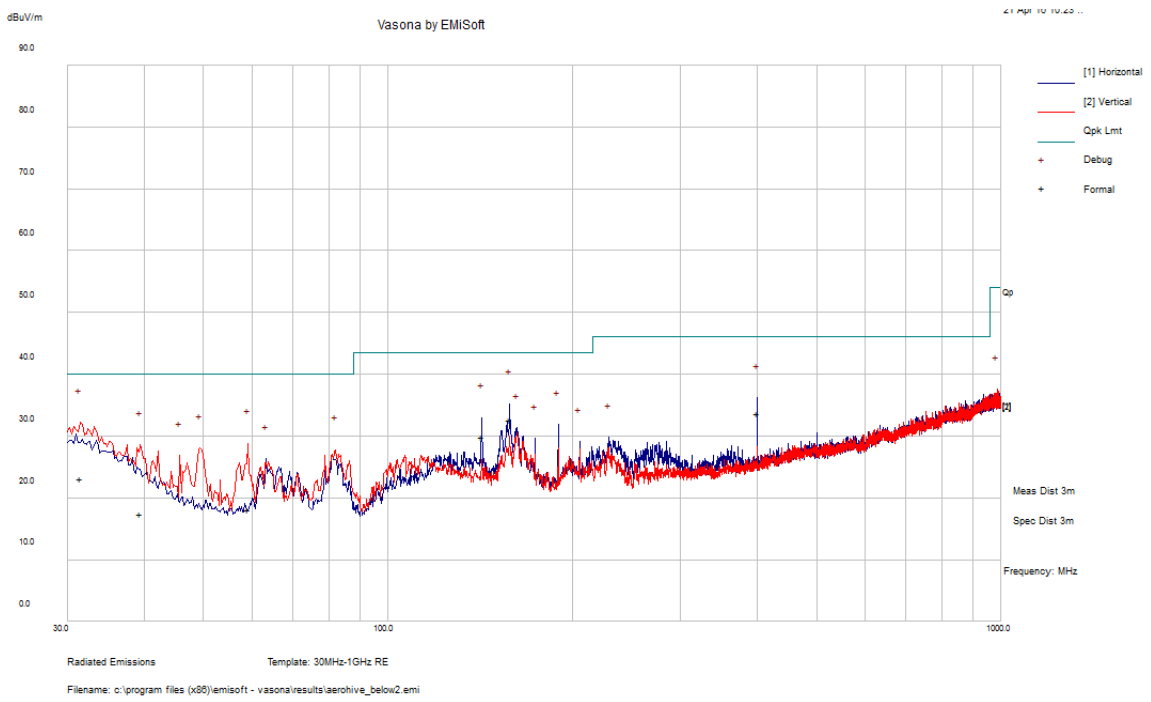
**Note:** After pre-testing, the non-beamforming mode is the worst case. Therefore the report only includes the test results of non-beamforming mode.

| **Mode: Transmitting** | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Mode, Channel** |
| -2.01 | 15690 | Horizontal | Co-location |

## 7.8 Radiated Emissions Test Result Data

### 1) 30 MHz – 1 GHz

Note: EUT was configured to co-located mode with 2.4 GHz and 5 GHz activated while testing.




| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|
| 31.50875 | 23.06 | 265 | V | 212 | 40 | -16.94 | Pass |
| 157.9575 | 32.63 | 279 | H | 16 | 43.5 | -10.87 | Pass |
| 399.999 | 33.65 | 102 | H | 44 | 46 | -12.35 | Pass |
| 142.2123 | 29.85 | 178 | H | 58 | 43.5 | -13.65 | Pass |
| 59.2815 | 18.06 | 128 | V | 172 | 40 | -21.94 | Pass |
| 39.4725 | 17.48 | 244 | V | 32 | 40 | -22.52 | Pass |

**2) 1–40 GHz**

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 | | Comments (PK/Ave.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 5180 MHz | | | | | | | | | | | |
| 5180 | 70.9 | 223 | 143 | V | 33.915 | 8.114 | - | 112.929 | - | - | Peak |
| 5180 | 63.42 | 161 | 164 | H | 33.947 | 8.114 | - | 105.481 | - | - | Peak |
| 5180 | 58.51 | 223 | 143 | V | 33.915 | 8.114 | - | 100.539 | - | - | Ave |
| 5180 | 53.1 | 161 | 164 | H | 33.947 | 8.114 | - | 95.161 | - | - | Ave |
| 5150 | 55.95 | 223 | 143 | V | 33.915 | 8.114 | 36.51 | 61.469 | 74 | -12.531 | Peak |
| 5150 | 52.49 | 161 | 164 | H | 33.947 | 8.114 | 36.51 | 58.041 | 74 | -15.959 | Peak |
| 5150 | 40.34 | 223 | 143 | V | 33.915 | 8.114 | 36.51 | 45.859 | 54 | -8.141 | Ave |
| 5150 | 37.55 | 161 | 164 | H | 33.947 | 8.114 | 36.51 | 43.101 | 54 | -10.899 | Ave |
| 10360 | 47.78 | 228 | 161 | V | 39.459 | 11.836 | 36.68 | 62.395 | 74 | -11.605 | Peak |
| 10360 | 47.1 | 160 | 165 | H | 39.525 | 11.836 | 36.68 | 61.781 | 74 | -12.219 | Peak |
| 10360 | 33.24 | 228 | 161 | V | 39.459 | 11.836 | 36.68 | 47.855 | 54 | -6.145 | Ave |
| 10360 | 32.78 | 160 | 165 | H | 39.525 | 11.836 | 36.68 | 47.461 | 54 | -6.539 | Ave |
| 15540 | 47.34 | 0 | 100 | V | 38.991 | 14.876 | 36.01 | 65.197 | 74 | -8.803 | Peak |
| 15540 | 47.17 | 0 | 100 | H | 39.08 | 14.876 | 36.01 | 65.116 | 74 | -8.884 | Peak |
| 15540 | 32.45 | 0 | 100 | V | 38.991 | 14.876 | 36.01 | 50.307 | 54 | -3.693 | Ave |
| 15540 | 32.47 | 0 | 100 | H | 39.08 | 14.876 | 36.01 | 50.416 | 54 | -3.584 | Ave |
| Middle Channel 5220 MHz | | | | | | | | | | | |
| 5220 | 69.91 | 184 | 154 | V | 33.915 | 8.114 | - | 111.939 | - | - | Peak |
| 5220 | 64.08 | 137 | 175 | H | 33.947 | 8.114 | - | 106.141 | - | - | Peak |
| 5220 | 59.37 | 184 | 154 | V | 33.915 | 8.114 | - | 101.399 | - | - | Ave |
| 5220 | 53.66 | 137 | 175 | H | 33.947 | 8.114 | - | 95.721 | - | - | Ave |
| 10440 | 47.71 | 0 | 100 | V | 39.459 | 11.836 | 36.63 | 62.38 | 74 | -11.63 | Peak |
| 10440 | 46.90 | 0 | 100 | H | 39.525 | 11.836 | 36.63 | 61.63 | 74 | -12.37 | Peak |
| 10440 | 33.01 | 0 | 100 | V | 39.459 | 11.836 | 36.63 | 47.68 | 54 | -6.33 | Ave |
| 10440 | 33.21 | 0 | 100 | H | 39.525 | 11.836 | 36.63 | 47.94 | 54 | -6.06 | Ave |
| 15660 | 48.03 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 65.79 | 74 | -8.21 | Peak |
| 15660 | 48.25 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 66.06 | 74 | -7.94 | Peak |
| 15660 | 33.44 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 51.20 | 54 | -2.80 | Ave |
| 15660 | 33.66 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 51.47 | 54 | -2.53 | Ave |

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments (PK/Ave.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| High channel 5240 MHz | | | | | | | | | | | |
| 5240 | 70.31 | 219 | 155 | V | 33.915 | 8.114 | - | 112.339 | - | - | Peak |
| 5240 | 63.3 | 165 | 152 | H | 33.947 | 8.114 | - | 105.361 | - | - | Peak |
| 5240 | 59.66 | 219 | 155 | V | 33.915 | 8.114 | - | 101.689 | - | - | Ave |
| 5240 | 52.43 | 165 | 152 | H | 33.947 | 8.114 | - | 94.491 | - | - | Ave |
| 5350 | 53.02 | 219 | 155 | V | 34.34 | 8.29 | 36.51 | 59.14 | 74 | -14.86 | Peak |
| 5350 | 47.53 | 165 | 152 | H | 34.38 | 8.29 | 36.51 | 53.69 | 74 | -20.31 | Peak |
| 5350 | 39.26 | 219 | 155 | V | 34.34 | 8.29 | 36.51 | 45.38 | 54 | -8.62 | Ave |
| 5350 | 34.00 | 165 | 152 | H | 34.38 | 8.29 | 36.51 | 40.16 | 54 | -13.84 | Ave |
| 10480 | 46.65 | 0 | 100 | V | 39.477 | 11.836 | 36.63 | 61.33 | 74 | -12.67 | Peak |
| 10480 | 47.50 | 0 | 100 | H | 39.49 | 11.836 | 36.63 | 62.20 | 74 | -11.80 | Peak |
| 10480 | 32.55 | 0 | 100 | V | 39.477 | 11.836 | 36.63 | 47.23 | 54 | -6.77 | Ave |
| 10480 | 32.78 | 0 | 100 | H | 39.49 | 11.836 | 36.63 | 47.48 | 54 | -6.52 | Ave |
| 15720 | 46.79 | 0 | 100 | V | 38.858 | 14.972 | 35.97 | 64.65 | 74 | -9.35 | Peak |
| 15720 | 47.51 | 0 | 100 | H | 38.907 | 14.972 | 35.97 | 65.42 | 74 | -8.58 | Peak |
| 15720 | 33.08 | 0 | 100 | V | 38.858 | 14.972 | 35.97 | 50.94 | 54 | -3.06 | Ave |
| 15720 | 33.31 | 0 | 100 | H | 38.907 | 14.972 | 35.97 | 51.22 | 54 | -2.78 | Ave |

802.11n20 mode

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments (PK/Ave.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 5180 MHz | | | | | | | | | | | |
| 5180 | 70.61 | 221 | 148 | V | 33.915 | 8.114 | - | 112.639 | - | - | Peak |
| 5180 | 64.47 | 161 | 166 | H | 33.947 | 8.114 | - | 106.531 | - | - | Peak |
| 5180 | 59.23 | 221 | 148 | V | 33.915 | 8.114 | - | 101.259 | - | - | Ave |
| 5180 | 53.6 | 161 | 166 | H | 33.947 | 8.114 | - | 95.661 | - | - | Ave |
| 5150 | 57.45 | 221 | 148 | V | 33.915 | 8.114 | 36.51 | 62.969 | 74 | -11.031 | Peak |
| 5150 | 52.23 | 161 | 166 | H | 33.947 | 8.114 | 36.51 | 57.781 | 74 | -16.219 | Peak |
| 5150 | 39.7 | 221 | 148 | V | 33.915 | 8.114 | 36.51 | 45.219 | 54 | -8.781 | Ave |
| 5150 | 37.11 | 161 | 166 | H | 33.947 | 8.114 | 36.51 | 42.661 | 54 | -11.339 | Ave |
| 10360 | 47.23 | 221 | 148 | V | 39.459 | 11.836 | 36.68 | 61.845 | 74 | -12.155 | Peak |
| 10360 | 47.12 | 161 | 166 | H | 39.525 | 11.836 | 36.68 | 61.801 | 74 | -12.199 | Peak |
| 10360 | 32.42 | 221 | 148 | V | 39.459 | 11.836 | 36.68 | 47.035 | 54 | -6.965 | Ave |
| 10360 | 32.15 | 161 | 166 | H | 39.525 | 11.836 | 36.68 | 46.831 | 54 | -7.169 | Ave |
| 15540 | 46.88 | 0 | 100 | V | 38.991 | 14.876 | 36.01 | 64.737 | 74 | -9.263 | Peak |
| 15540 | 47.1 | 0 | 100 | H | 39.08 | 14.876 | 36.01 | 65.046 | 74 | -8.954 | Peak |
| 15540 | 32.21 | 0 | 100 | V | 38.991 | 14.876 | 36.01 | 50.067 | 54 | -3.933 | Ave |
| 15540 | 32.38 | 0 | 100 | H | 39.08 | 14.876 | 36.01 | 50.326 | 54 | -3.674 | Ave |
| Middle Channel 5220 MHz | | | | | | | | | | | |
| 5220 | 70.46 | 188 | 146 | V | 33.915 | 8.114 | - | 112.489 | - | - | Peak |
| 5220 | 64.5 | 158 | 168 | H | 33.947 | 8.114 | - | 106.561 | - | - | Peak |
| 5220 | 59.42 | 188 | 146 | V | 33.915 | 8.114 | - | 101.449 | - | - | Ave |
| 5220 | 53.08 | 158 | 168 | H | 33.947 | 8.114 | - | 95.141 | - | - | Ave |
| 10440 | 46.84 | 188 | 146 | V | 39.459 | 11.836 | 36.63 | 61.51 | 74 | -12.50 | Peak |
| 10440 | 47.12 | 158 | 168 | H | 39.525 | 11.836 | 36.63 | 61.85 | 74 | -12.15 | Peak |
| 10440 | 33.05 | 188 | 146 | V | 39.459 | 11.836 | 36.63 | 47.72 | 54 | -6.29 | Ave |
| 10440 | 32.78 | 158 | 168 | H | 39.525 | 11.836 | 36.63 | 47.51 | 54 | -6.49 | Ave |
| 15660 | 48.16 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 65.92 | 74 | -8.08 | Peak |
| 15660 | 47.53 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 65.34 | 74 | -8.66 | Peak |
| 15660 | 33.41 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 51.17 | 54 | -2.83 | Ave |
| 15660 | 33.48 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 51.29 | 54 | -2.71 | Ave |

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments (PK/Ave.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| High channel 5240 MHz | | | | | | | | | | | |
| 5240 | 71.21 | 219 | 169 | V | 33.915 | 8.114 | - | 113.239 | - | - | Peak |
| 5240 | 64.1 | 139 | 186 | H | 33.947 | 8.114 | - | 106.161 | - | - | Peak |
| 5240 | 59.19 | 219 | 169 | V | 33.915 | 8.114 | - | 101.219 | - | - | Ave |
| 5240 | 53.18 | 139 | 186 | H | 33.947 | 8.114 | - | 95.241 | - | - | Ave |
| 5350 | 52.58 | 219 | 169 | V | 34.34 | 8.29 | 36.51 | 58.70 | 74 | -15.30 | Peak |
| 5350 | 47.98 | 139 | 186 | H | 34.38 | 8.29 | 36.51 | 54.14 | 74 | -19.86 | Peak |
| 5350 | 38.79 | 219 | 169 | V | 34.34 | 8.29 | 36.51 | 44.91 | 54 | -9.09 | Ave |
| 5350 | 34.15 | 139 | 186 | H | 34.38 | 8.29 | 36.51 | 40.31 | 54 | -13.69 | Ave |
| 10480 | 46.58 | 219 | 169 | V | 39.477 | 11.836 | 36.63 | 61.26 | 74 | -12.74 | Peak |
| 10480 | 46.69 | 139 | 186 | H | 39.49 | 11.836 | 36.63 | 61.39 | 74 | -12.61 | Peak |
| 10480 | 32.42 | 219 | 169 | V | 39.477 | 11.836 | 36.63 | 47.10 | 54 | -6.90 | Ave |
| 10480 | 32.74 | 139 | 186 | H | 39.49 | 11.836 | 36.63 | 47.44 | 54 | -6.56 | Ave |
| 15720 | 46.82 | 0 | 100 | V | 38.858 | 14.972 | 35.97 | 64.68 | 74 | -9.32 | Peak |
| 15720 | 47.11 | 0 | 100 | H | 38.907 | 14.972 | 35.97 | 65.02 | 74 | -8.98 | Peak |
| 15720 | 33.28 | 0 | 100 | V | 38.858 | 14.972 | 35.97 | 51.14 | 54 | -2.86 | Ave |
| 15720 | 33.01 | 0 | 100 | H | 38.907 | 14.972 | 35.97 | 50.92 | 54 | -3.08 | Ave |

802.11n40 mode

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments (PK/Ave.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 5190 MHz | | | | | | | | | | | |
| 5190 | 64.63 | 184 | 166 | V | 33.915 | 8.114 | - | 106.659 | - | - | Peak |
| 5190 | 64.25 | 234 | 150 | H | 33.947 | 8.114 | - | 106.311 | - | - | Peak |
| 5190 | 53.35 | 184 | 166 | V | 33.915 | 8.114 | - | 95.379 | - | - | Ave |
| 5190 | 52.18 | 234 | 150 | H | 33.947 | 8.114 | - | 94.241 | - | - | Ave |
| 5150 | 57.38 | 184 | 166 | V | 33.915 | 8.114 | 36.51 | 62.899 | 74 | -11.101 | Peak |
| 5150 | 56.24 | 234 | 150 | H | 33.947 | 8.114 | 36.51 | 61.791 | 74 | -12.209 | Peak |
| 5150 | 40.93 | 184 | 166 | V | 33.915 | 8.114 | 36.51 | 46.449 | 54 | -7.551 | Ave |
| 5150 | 39.24 | 234 | 150 | H | 33.947 | 8.114 | 36.51 | 44.791 | 54 | -9.209 | Ave |
| 10380 | 47.16 | 0 | 100 | V | 39.459 | 11.836 | 36.63 | 61.825 | 74 | -12.175 | Peak |
| 10380 | 47.53 | 0 | 100 | H | 39.525 | 11.836 | 36.63 | 62.261 | 74 | -11.739 | Peak |
| 10380 | 33.11 | 0 | 100 | V | 39.459 | 11.836 | 36.63 | 47.775 | 54 | -6.225 | Ave |
| 10380 | 32.93 | 0 | 100 | H | 39.525 | 11.836 | 36.63 | 47.661 | 54 | -6.339 | Ave |
| 15570 | 47.63 | 0 | 100 | V | 38.882 | 14.876 | 36.01 | 65.378 | 74 | -8.622 | Peak |
| 15570 | 47.18 | 0 | 100 | H | 38.951 | 14.876 | 36.01 | 64.997 | 74 | -9.003 | Peak |
| 15570 | 32.56 | 0 | 100 | V | 38.882 | 14.876 | 36.01 | 50.308 | 54 | -3.692 | Ave |
| 15570 | 32.61 | 0 | 100 | H | 38.951 | 14.876 | 36.01 | 50.427 | 54 | -3.573 | Ave |
| High Channel 5230 MHz | | | | | | | | | | | |
| 5230 | 65.89 | 178 | 166 | V | 33.915 | 8.114 | - | 107.919 | - | - | Peak |
| 5230 | 64.42 | 213 | 159 | H | 33.947 | 8.114 | - | 106.481 | - | - | Peak |
| 5230 | 53.95 | 178 | 166 | V | 33.915 | 8.114 | - | 95.979 | - | - | Ave |
| 5230 | 52.6 | 213 | 159 | H | 33.947 | 8.114 | - | 94.661 | - | - | Ave |
| 5350 | 47.95 | 178 | 166 | V | 34.34 | 8.29 | 36.51 | 54.07 | 74 | -19.93 | Peak |
| 5350 | 47.23 | 213 | 159 | H | 34.38 | 8.29 | 36.51 | 53.39 | 74 | -20.61 | Peak |
| 5350 | 34.73 | 178 | 166 | V | 34.34 | 8.29 | 36.51 | 40.85 | 54 | -13.15 | Ave |
| 5350 | 33.83 | 213 | 159 | H | 34.38 | 8.29 | 36.51 | 39.99 | 54 | -14.01 | Ave |
| 10460 | 47.62 | 0 | 100 | V | 39.477 | 11.836 | 36.63 | 62.30 | 74 | -11.70 | Peak |
| 10460 | 47.23 | 0 | 100 | H | 39.49 | 11.836 | 36.63 | 61.93 | 74 | -12.07 | Peak |
| 10460 | 32.85 | 0 | 100 | V | 39.477 | 11.836 | 36.63 | 47.53 | 54 | -6.47 | Ave |
| 10460 | 32.76 | 0 | 100 | H | 39.49 | 11.836 | 36.63 | 47.46 | 54 | -6.54 | Ave |
| 15690 | 47.64 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 65.40 | 74 | -8.60 | Peak |
| 15690 | 47.80 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 65.61 | 74 | -8.39 | Peak |
| 15690 | 33.17 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 50.93 | 54 | -3.07 | Ave |
| 15690 | 33.24 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 51.05 | 54 | -2.95 | Ave |

802.11ac20 mode

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments (PK/Ave.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 5180 MHz | | | | | | | | | | | |
| 5180 | 70.41 | 220 | 151 | V | 33.915 | 8.114 | - | 112.439 | - | - | Peak |
| 5180 | 64.13 | 162 | 157 | H | 33.947 | 8.114 | - | 106.191 | - | - | Peak |
| 5180 | 58.85 | 220 | 151 | V | 33.915 | 8.114 | - | 100.879 | - | - | Ave |
| 5180 | 53.22 | 162 | 157 | H | 33.947 | 8.114 | - | 95.281 | - | - | Ave |
| 5150 | 53.99 | 220 | 151 | V | 33.915 | 8.114 | 36.51 | 59.509 | 74 | -14.491 | Peak |
| 5150 | 50.55 | 162 | 157 | H | 33.947 | 8.114 | 36.51 | 56.101 | 74 | -17.899 | Peak |
| 5150 | 39.67 | 220 | 151 | V | 33.915 | 8.114 | 36.51 | 45.189 | 54 | -8.811 | Ave |
| 5150 | 36.16 | 162 | 157 | H | 33.947 | 8.114 | 36.51 | 41.711 | 54 | -12.289 | Ave |
| 10360 | 47.2 | 0 | 100 | V | 39.459 | 11.836 | 36.68 | 61.815 | 74 | -12.185 | Peak |
| 10360 | 47.88 | 0 | 100 | H | 39.525 | 11.836 | 36.68 | 62.561 | 74 | -11.439 | Peak |
| 10360 | 35.23 | 0 | 100 | V | 39.459 | 11.836 | 36.68 | 49.845 | 54 | -4.155 | Ave |
| 10360 | 35.23 | 0 | 100 | H | 39.525 | 11.836 | 36.68 | 49.911 | 54 | -4.089 | Ave |
| 15540 | 47.16 | 0 | 100 | V | 38.991 | 14.876 | 36.01 | 65.017 | 74 | -8.983 | Peak |
| 15540 | 47.52 | 0 | 100 | H | 39.08 | 14.876 | 36.01 | 65.466 | 74 | -8.534 | Peak |
| 15540 | 33.18 | 0 | 100 | V | 38.991 | 14.876 | 36.01 | 51.037 | 54 | -2.963 | Ave |
| 15540 | 33.23 | 0 | 100 | H | 39.08 | 14.876 | 36.01 | 51.176 | 54 | -2.824 | Ave |
| Middle Channel 5220 MHz | | | | | | | | | | | |
| 5220 | 70.28 | 235 | 118 | V | 33.915 | 8.114 | - | 112.309 | - | - | Peak |
| 5220 | 64.06 | 159 | 160 | H | 33.947 | 8.114 | - | 106.121 | - | - | Peak |
| 5220 | 59.26 | 235 | 118 | V | 33.915 | 8.114 | - | 101.289 | - | - | Ave |
| 5220 | 52.55 | 159 | 160 | H | 33.947 | 8.114 | - | 94.611 | - | - | Ave |
| 10440 | 47.68 | 0 | 100 | V | 39.459 | 11.836 | 36.63 | 62.35 | 74 | -11.66 | Peak |
| 10440 | 47.63 | 0 | 100 | H | 39.525 | 11.836 | 36.63 | 62.36 | 74 | -11.64 | Peak |
| 10440 | 35.27 | 0 | 100 | V | 39.459 | 11.836 | 36.63 | 49.94 | 54 | -4.06 | Ave |
| 10440 | 35.30 | 0 | 100 | H | 39.525 | 11.836 | 36.63 | 50.03 | 54 | -3.97 | Ave |
| 15660 | 48.16 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 65.92 | 74 | -8.08 | Peak |
| 15660 | 47.97 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 65.78 | 74 | -8.22 | Peak |
| 15660 | 33.47 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 51.23 | 54 | -2.77 | Ave |
| 15660 | 33.86 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 51.67 | 54 | -2.33 | Ave |

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments (PK/Ave.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| High channel 5240 MHz | | | | | | | | | | | |
| 5240 | 71.01 | 224 | 158 | V | 33.915 | 8.114 | - | 113.039 | - | - | Peak |
| 5240 | 63.99 | 161 | 178 | H | 33.947 | 8.114 | - | 106.051 | - | - | Peak |
| 5240 | 61.74 | 224 | 158 | V | 33.915 | 8.114 | - | 103.769 | - | - | Ave |
| 5240 | 54.85 | 161 | 178 | H | 33.947 | 8.114 | - | 96.911 | - | - | Ave |
| 5350 | 51.75 | 224 | 158 | V | 34.34 | 8.29 | 36.51 | 57.87 | 74 | -16.13 | Peak |
| 5350 | 46.91 | 161 | 178 | H | 34.38 | 8.29 | 36.51 | 53.07 | 74 | -20.93 | Peak |
| 5350 | 41.66 | 224 | 158 | V | 34.34 | 8.29 | 36.51 | 47.78 | 54 | -6.22 | Ave |
| 5350 | 36.35 | 161 | 178 | H | 34.38 | 8.29 | 36.51 | 42.51 | 54 | -11.49 | Ave |
| 10480 | 46.62 | 0 | 100 | V | 39.477 | 11.836 | 36.63 | 61.30 | 74 | -12.70 | Peak |
| 10480 | 45.90 | 0 | 100 | H | 39.49 | 11.836 | 36.63 | 60.60 | 74 | -13.40 | Peak |
| 10480 | 34.01 | 0 | 100 | V | 39.477 | 11.836 | 36.63 | 48.69 | 54 | -5.31 | Ave |
| 10480 | 34.05 | 0 | 100 | H | 39.49 | 11.836 | 36.63 | 48.75 | 54 | -5.25 | Ave |
| 15720 | 41.22 | 0 | 100 | V | 38.858 | 14.972 | 35.97 | 59.08 | 74 | -14.92 | Peak |
| 15720 | 42.27 | 0 | 100 | H | 38.907 | 14.972 | 35.97 | 60.18 | 74 | -13.82 | Peak |
| 15720 | 32.88 | 0 | 100 | V | 38.858 | 14.972 | 35.97 | 50.74 | 54 | -3.26 | Ave |
| 15720 | 32.94 | 0 | 100 | H | 38.907 | 14.972 | 35.97 | 50.85 | 54 | -3.15 | Ave |

802.11ac40 mode

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments (PK/Ave.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low Channel 5190 MHz | | | | | | | | | | | |
| 5190 | 63.68 | 230 | 111 | V | 33.915 | 8.114 | - | 105.709 | - | - | Peak |
| 5190 | 62.48 | 182 | 134 | H | 33.947 | 8.114 | - | 104.541 | - | - | Peak |
| 5190 | 55.31 | 230 | 111 | V | 33.915 | 8.114 | - | 97.339 | - | - | Ave |
| 5190 | 53.4 | 182 | 134 | H | 33.947 | 8.114 | - | 95.461 | - | - | Ave |
| 5150 | 57.05 | 230 | 111 | V | 33.915 | 8.114 | 36.51 | 62.569 | 74 | -11.431 | Peak |
| 5150 | 56.29 | 182 | 134 | H | 33.947 | 8.114 | 36.51 | 61.841 | 74 | -12.159 | Peak |
| 5150 | 42.12 | 230 | 111 | V | 33.915 | 8.114 | 36.51 | 47.639 | 54 | -6.361 | Ave |
| 5150 | 41.29 | 182 | 134 | H | 33.947 | 8.114 | 36.51 | 46.841 | 54 | -7.159 | Ave |
| 10380 | 47.38 | 230 | 111 | V | 39.459 | 11.836 | 36.63 | 62.045 | 74 | -11.955 | Peak |
| 10380 | 47.12 | 182 | 134 | H | 39.525 | 11.836 | 36.63 | 61.851 | 74 | -12.149 | Peak |
| 10380 | 32.48 | 230 | 111 | V | 39.459 | 11.836 | 36.63 | 47.145 | 54 | -6.855 | Ave |
| 10380 | 33.24 | 182 | 134 | H | 39.525 | 11.836 | 36.63 | 47.971 | 54 | -6.029 | Ave |
| 15570 | 47.61 | 0 | 100 | V | 38.882 | 14.876 | 36.01 | 65.358 | 74 | -8.642 | Peak |
| 15570 | 47.44 | 0 | 100 | H | 38.951 | 14.876 | 36.01 | 65.257 | 74 | -8.743 | Peak |
| 15570 | 32.22 | 0 | 100 | V | 38.882 | 14.876 | 36.01 | 49.968 | 54 | -4.032 | Ave |
| 15570 | 32.69 | 0 | 100 | H | 38.951 | 14.876 | 36.01 | 50.507 | 54 | -3.493 | Ave |
| High Channel 5230 MHz | | | | | | | | | | | |
| 5230 | 64.32 | 234 | 118 | V | 33.915 | 8.114 | - | 106.349 | - | - | Peak |
| 5230 | 63.61 | 184 | 135 | H | 33.947 | 8.114 | - | 105.671 | - | - | Peak |
| 5230 | 55.83 | 234 | 118 | V | 33.915 | 8.114 | - | 97.859 | - | - | Ave |
| 5230 | 54.76 | 184 | 135 | H | 33.947 | 8.114 | - | 96.821 | - | - | Ave |
| 5350 | 47.48 | 234 | 118 | V | 34.34 | 8.29 | 36.51 | 53.60 | 74 | -20.40 | Peak |
| 5350 | 46.77 | 184 | 135 | H | 34.38 | 8.29 | 36.51 | 52.93 | 74 | -21.07 | Peak |
| 5350 | 37.58 | 234 | 118 | V | 34.34 | 8.29 | 36.51 | 43.70 | 54 | -10.30 | Ave |
| 5350 | 36.48 | 184 | 135 | H | 34.38 | 8.29 | 36.51 | 42.64 | 54 | -11.36 | Ave |
| 10460 | 47.25 | 234 | 118 | V | 39.477 | 11.836 | 36.63 | 61.93 | 74 | -12.07 | Peak |
| 10460 | 47.32 | 184 | 135 | H | 39.49 | 11.836 | 36.63 | 62.02 | 74 | -11.98 | Peak |
| 10460 | 32.71 | 234 | 118 | V | 39.477 | 11.836 | 36.63 | 47.39 | 54 | -6.61 | Ave |
| 10460 | 32.80 | 184 | 135 | H | 39.49 | 11.836 | 36.63 | 47.50 | 54 | -6.50 | Ave |
| 15690 | 47.58 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 65.34 | 74 | -8.66 | Peak |
| 15690 | 47.23 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 65.04 | 74 | -8.96 | Peak |
| 15690 | 33.25 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 51.01 | 54 | -2.99 | Ave |
| 15690 | 32.89 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 50.70 | 54 | -3.30 | Ave |

802.11ac80 mode

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments (PK/Ave.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| 5210 MHz | | | | | | | | | | | |
| 5210 | 65.53 | 340 | 111 | V | 33.851 | 5.26 | - | 104.641 | - | - | Peak |
| 5210 | 66.28 | 341 | 103 | H | 33.84 | 5.26 | - | 105.38 | - | - | Peak |
| 5210 | 53.15 | 340 | 111 | V | 33.851 | 5.26 | - | 92.261 | - | - | Ave |
| 5210 | 52.77 | 341 | 103 | H | 33.84 | 5.26 | - | 91.87 | - | - | Ave |
| 5350 | 50.10 | 340 | 111 | V | 34.17 | 5.60 | 36.51 | 53.36 | 74 | -20.64 | Peak |
| 5350 | 49.28 | 341 | 103 | H | 34.18 | 5.60 | 36.51 | 52.55 | 74 | -21.45 | Peak |
| 5350 | 36.87 | 340 | 111 | V | 34.17 | 5.60 | 36.51 | 40.13 | 54 | -13.87 | Ave |
| 5350 | 34.86 | 341 | 103 | H | 34.18 | 5.60 | 36.51 | 38.13 | 54 | -15.87 | Ave |
| 10420 | 47.30 | 0 | 100 | V | 38.22 | 9.72 | 36.63 | 58.61 | 74 | -15.39 | Peak |
| 10420 | 47.21 | 0 | 100 | H | 38.211 | 9.72 | 36.63 | 58.51 | 74 | -15.49 | Peak |
| 10420 | 33.42 | 0 | 100 | V | 38.22 | 9.72 | 36.63 | 44.73 | 54 | -9.27 | Ave |
| 10420 | 33.52 | 0 | 100 | H | 38.211 | 9.72 | 36.63 | 44.82 | 54 | -9.18 | Ave |
| 15630 | 48.86 | 0 | 100 | V | 37.82 | 11.86 | 35.97 | 62.57 | 74 | -11.43 | Peak |
| 15630 | 48.23 | 0 | 100 | H | 37.751 | 11.86 | 35.97 | 61.87 | 74 | -12.13 | Peak |
| 15630 | 35.06 | 0 | 100 | V | 37.82 | 11.86 | 35.97 | 48.77 | 54 | -5.23 | Ave |
| 15630 | 34.87 | 0 | 100 | H | 37.751 | 11.86 | 35.97 | 48.51 | 54 | -5.49 | Ave |
| 5150 | 64.35 | 340 | 111 | V | 33.851 | 5.26 | 36.51 | 66.951 | 74 | -7.049 | Peak |
| 5150 | 65.29 | 341 | 103 | H | 33.84 | 5.26 | 36.51 | 67.88 | 74 | -6.12 | Peak |
| 5150 | 47.41 | 340 | 111 | V | 33.851 | 5.26 | 36.51 | 50.011 | 54 | -3.989 | Ave |
| 5150 | 46.07 | 341 | 103 | H | 33.84 | 5.26 | 36.51 | 48.66 | 54 | -5.34 | Ave |

Co-location Configuration

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC | | Comments (PK/Ave.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| 2437MHz n20 mode & 5230MHz n40 mode | | | | | | | | | | | |
| 10460 | 47.91 | 230 | 124 | V | 39.477 | 11.836 | 36.63 | 62.59 | 74 | -11.41 | Peak |
| 10460 | 47.11 | 185 | 176 | H | 39.49 | 11.836 | 36.63 | 61.81 | 74 | -12.19 | Peak |
| 10460 | 33.27 | 230 | 124 | V | 39.477 | 11.836 | 36.63 | 47.95 | 54 | -6.05 | Ave |
| 10460 | 33.02 | 185 | 176 | H | 39.49 | 11.836 | 36.63 | 47.72 | 54 | -6.28 | Ave |
| 15690 | 48.39 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 66.15 | 74 | -7.85 | Peak |
| 15690 | 48.12 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 65.93 | 74 | -8.07 | Peak |
| 15690 | 34.11 | 0 | 100 | V | 38.858 | 14.876 | 35.97 | 51.87 | 54 | -2.13 | Ave |
| 15690 | 34.18 | 0 | 100 | H | 38.907 | 14.876 | 35.97 | 51.99 | 54 | -2.01 | Ave |
| 4874 | 48.24 | 192 | 116 | V | 33.321 | 7.75 | 36.63 | 52.68 | 74 | -21.32 | Peak |
| 4874 | 48.31 | 341 | 158 | H | 33.354 | 7.75 | 36.63 | 52.78 | 74 | -21.22 | Peak |
| 4874 | 33.18 | 192 | 116 | V | 33.321 | 7.75 | 36.63 | 37.62 | 54 | -16.38 | Ave |
| 4874 | 33.51 | 341 | 158 | H | 33.354 | 7.75 | 36.63 | 37.98 | 54 | -16.02 | Ave |
| 7311 | 46.86 | 0 | 100 | V | 37.324 | 9.855 | 36.42 | 57.62 | 74 | -16.38 | Peak |
| 7311 | 47.29 | 0 | 100 | H | 37.356 | 9.855 | 36.42 | 58.08 | 74 | -15.92 | Peak |
| 7311 | 32.58 | 0 | 100 | V | 37.324 | 9.855 | 36.42 | 43.34 | 54 | -10.66 | Ave |
| 7311 | 33.04 | 0 | 100 | H | 37.356 | 9.855 | 36.42 | 43.83 | 54 | -10.17 | Ave |

Note 1: Any emissions above 18 GHz are 20 dB below the limit.

# 8 FCC §15.407- 26 dB & 99% Occupied Bandwidth

## 8.1 Applicable Standards

FCC§15.407

## 8.2 Measurement Procedure

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

## 8.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4440A | MY44303352 | 2015-06-22 | 1 year |
| - | 20 dB attenuator | - | - | Each time[1] | N/A |

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
***Statement of Traceability: BACL Corp.*** *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

## 8.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22-24 ºC |
| **Relative Humidity:** | 40-41 % |
| **ATM Pressure:** | 103.1-104.1 kPa |

*The testing was performed by Jin Yang on 2016-04-15 at RF site.*

## 8.5 Test Results

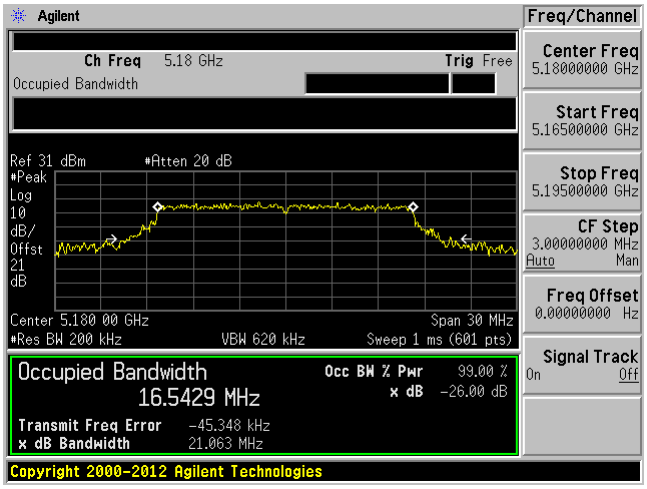
| Channel | Frequency (MHz) | 99% OBW (MHz) | | |
|---|---|---|---|---|
| | | Chain 4 | Chain 5 | Chain 6 |
| 802.11a mode | | | | |
| 36 | 5180 | 16.5429 | - | - |
| 44 | 5220 | 16.7070 | - | - |
| 48 | 5240 | 16.6789 | - | - |
| 802.11n20 mode | | | | |
| 36 | 5180 | 17.7345 | 17.7547 | 17.7215 |
| 44 | 5220 | 17.7265 | 17.7006 | 17.7089 |
| 48 | 5240 | 17.7437 | 17.6858 | 17.7321 |
| 802.11n40 mode | | | | |
| 38 | 5190 | 36.1620 | 36.2467 | 36.2555 |
| 46 | 5230 | 36.2443 | 36.2459 | 36.2663 |
| 802.11ac20 mode | | | | |
| 36 | 5180 | 17.7114 | 17.7051 | 17.7443 |
| 44 | 5220 | 17.6969 | 17.7619 | 17.7001 |
| 48 | 5240 | 17.6838 | 17.7178 | 17.6793 |
| 802.11ac40 mode | | | | |
| 38 | 5190 | 36.2111 | 36.1390 | 36.1631 |
| 46 | 5230 | 36.3625 | 36.4090 | 36.3741 |
| 802.11ac80 mode | | | | |
| 42 | 5210 | 75.6162 | 75.5390 | 75.5187 |

**Note:** 802.11a mode only transmits signal through antenn 4.

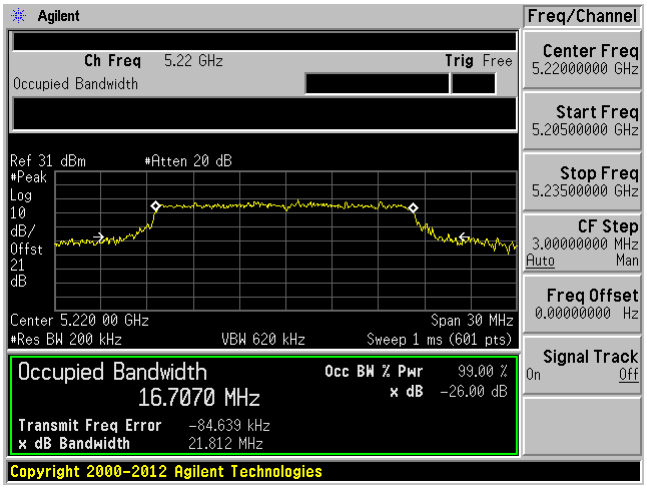
Please refer to the following plots.

802.11a mode

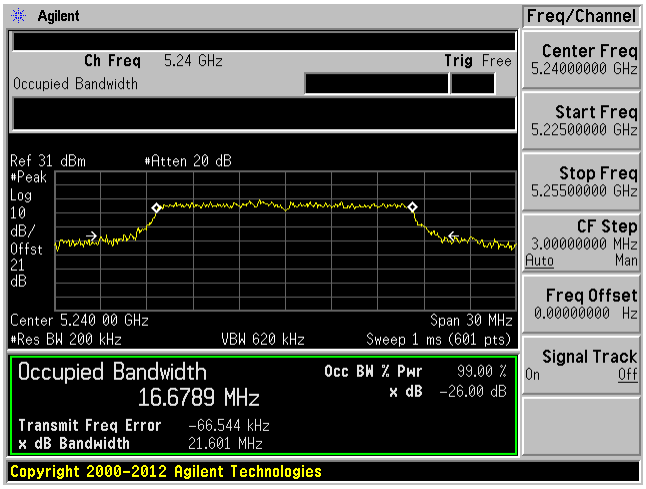
802.11a mode Low Channel 5180MHz




802.11a mode Middle Channel 5220MHz

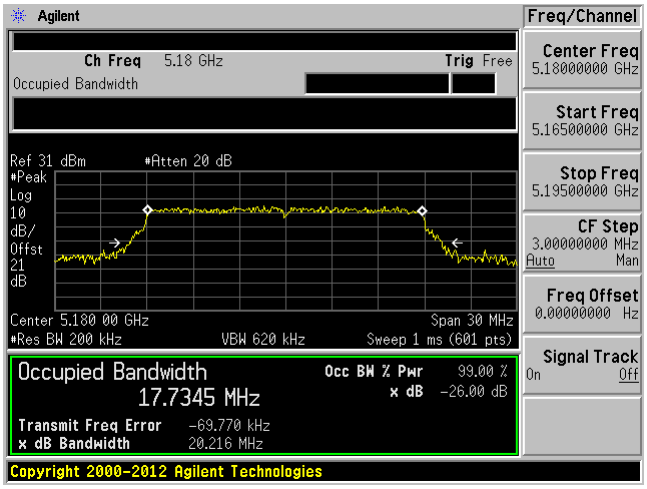



802.11a mode High Channel 5240MHz

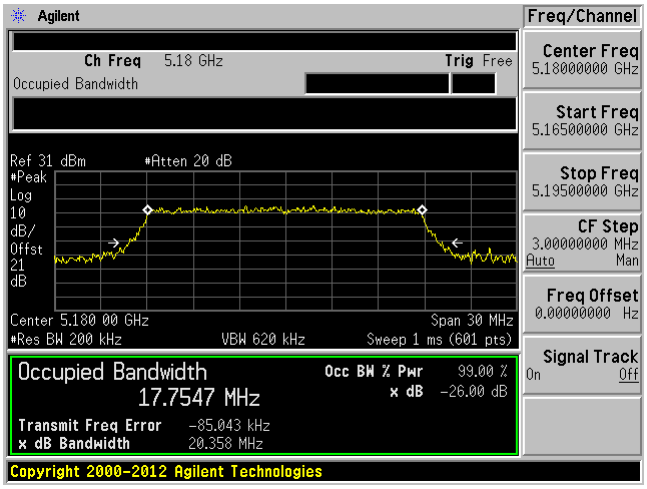


802.11n20 mode Low Channel 5180MHz

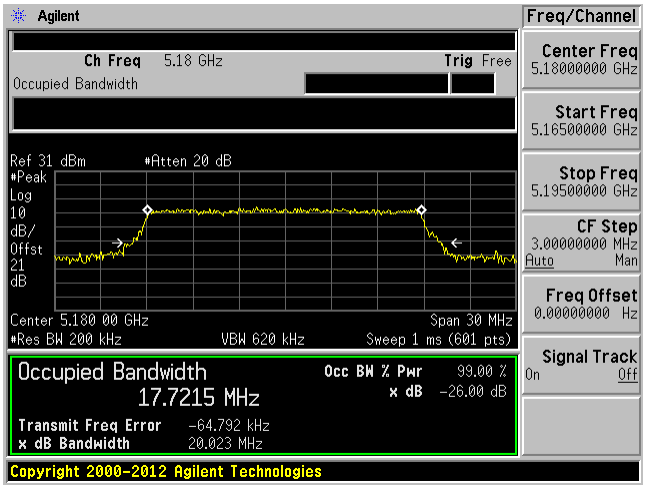
Chain #4




Chain #5

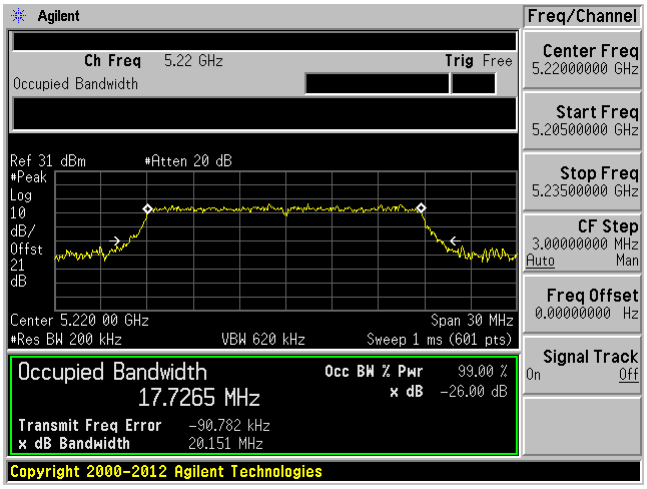



Chain #6

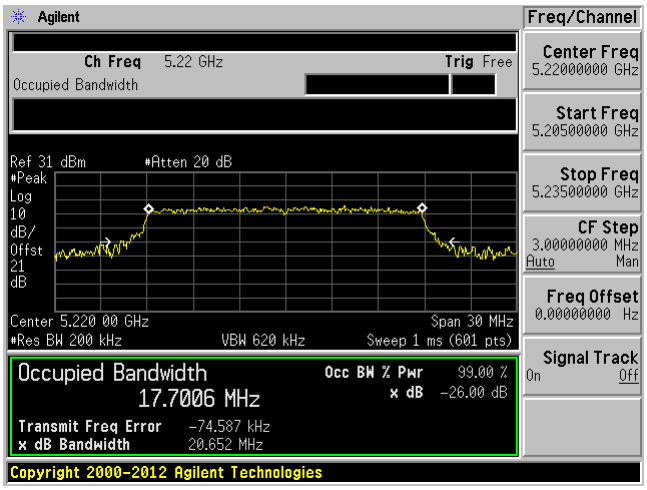


802.11n20 mode Middle Channel 5220MHz

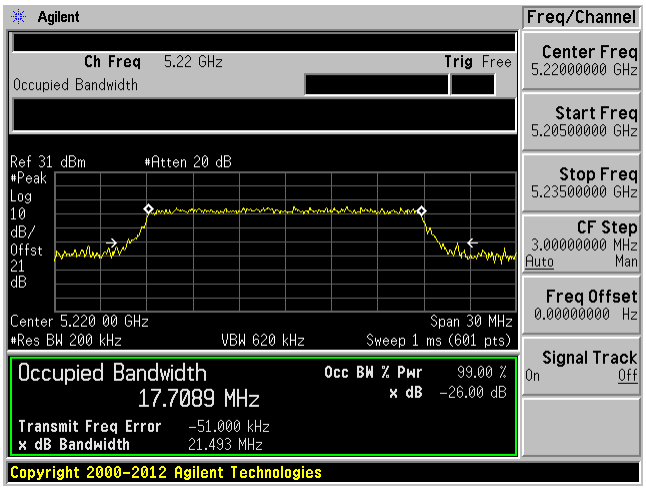
Chain #4




Chain #5

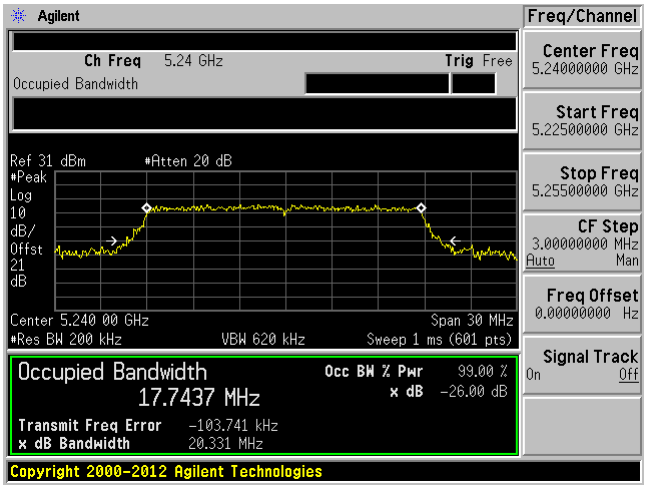



Chain #6

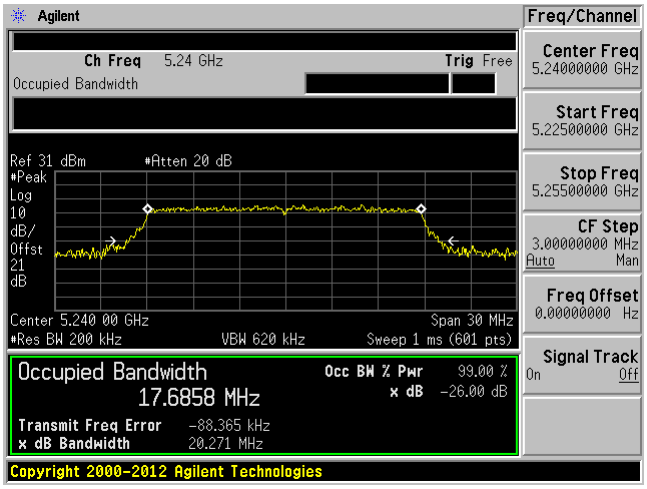


802.11n20 mode High Channel 5240MHz

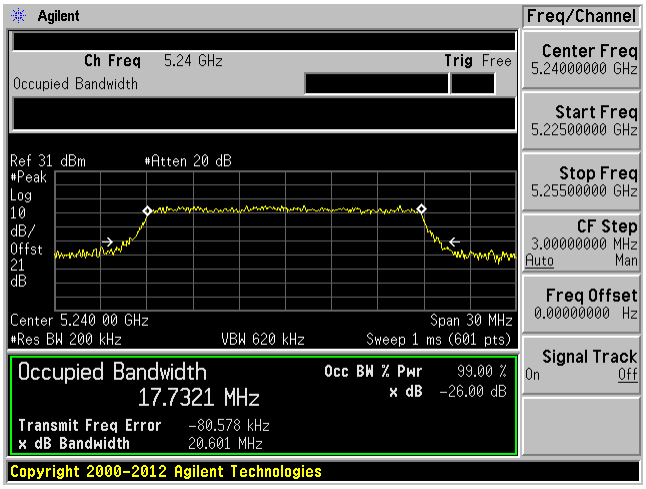
Chain #4




Chain #5

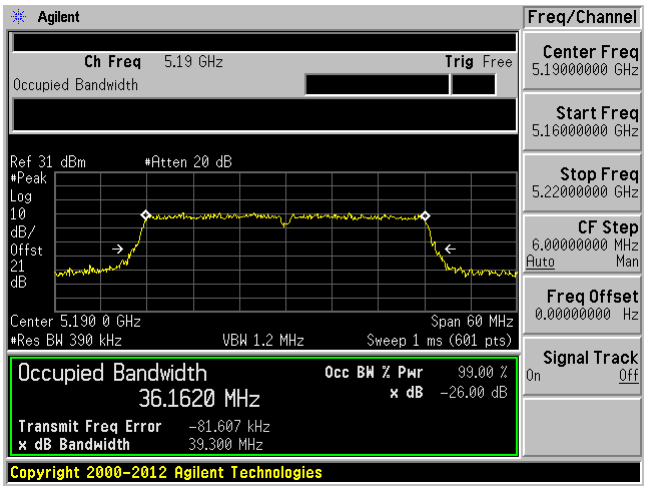



Chain #6

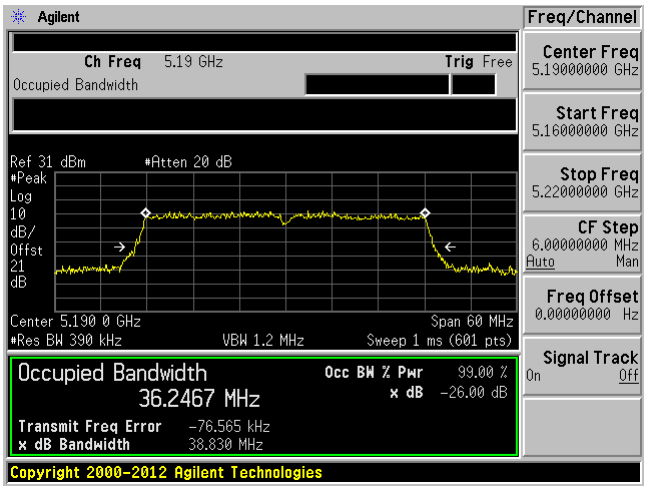


802.11n40 mode Low Channel 5190MHz

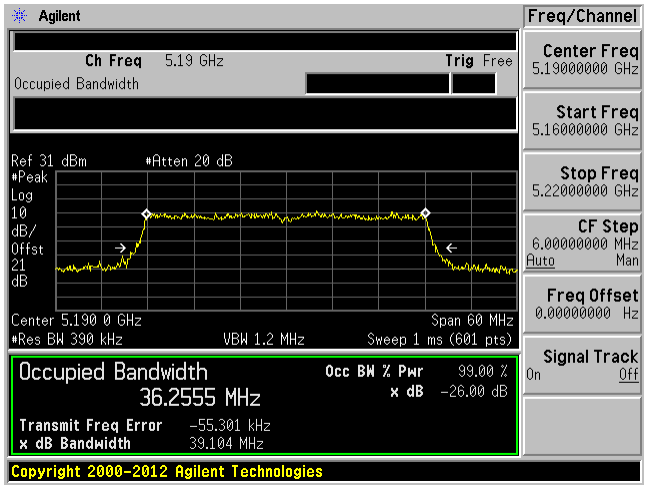
Chain #4




Chain #5

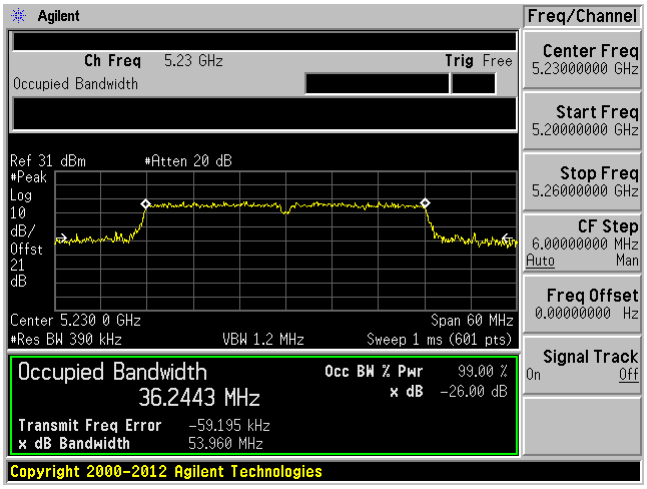



Chain #6

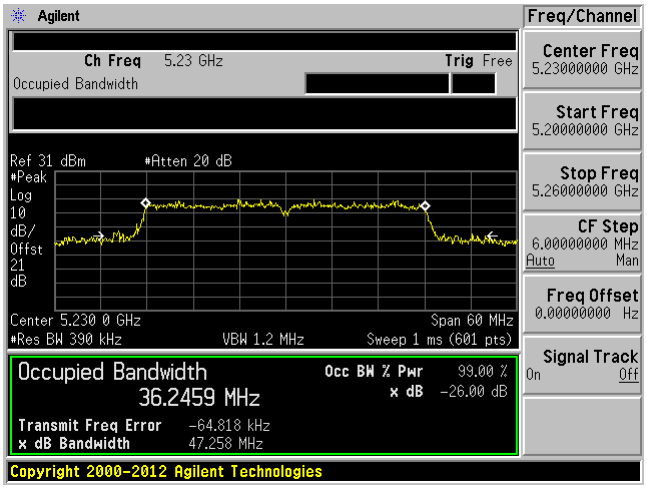


802.11n40 mode High Channel 5230MHz

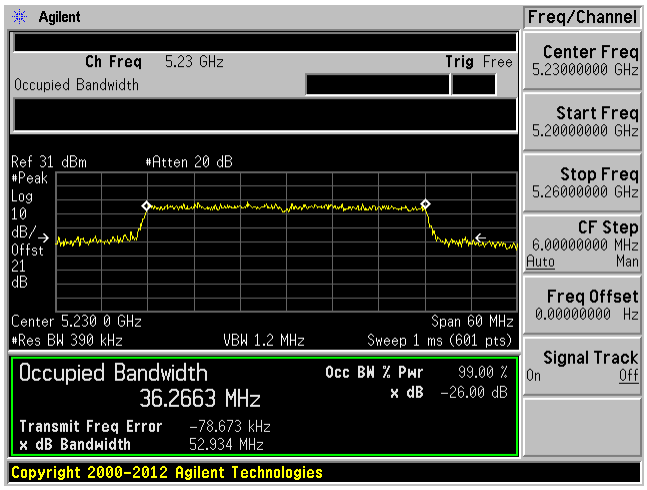
Chain #4




Chain #5

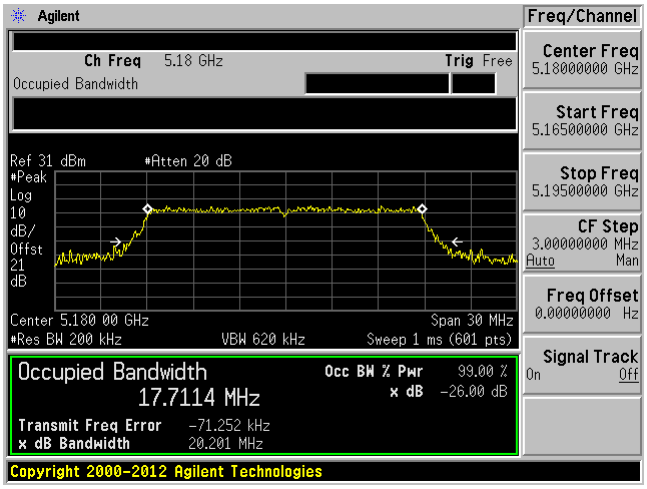



Chain #6

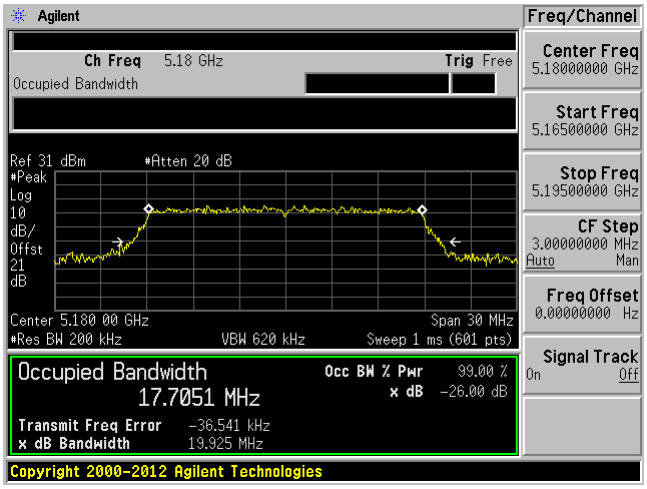


802.11ac20 mode Low Channel 5180MHz

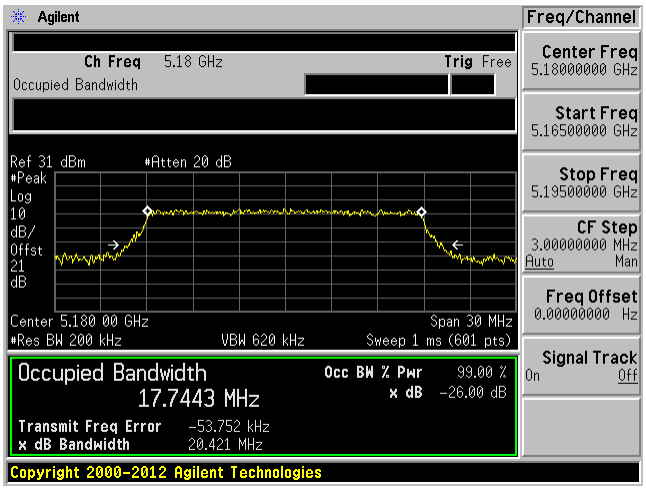
Chain #4




Chain #5

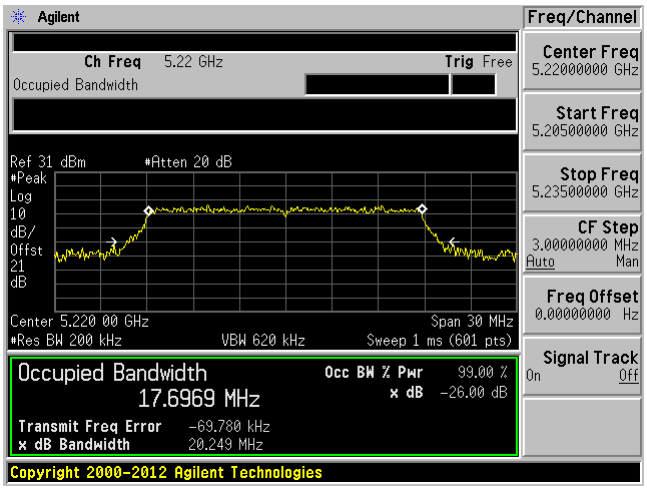



Chain #6

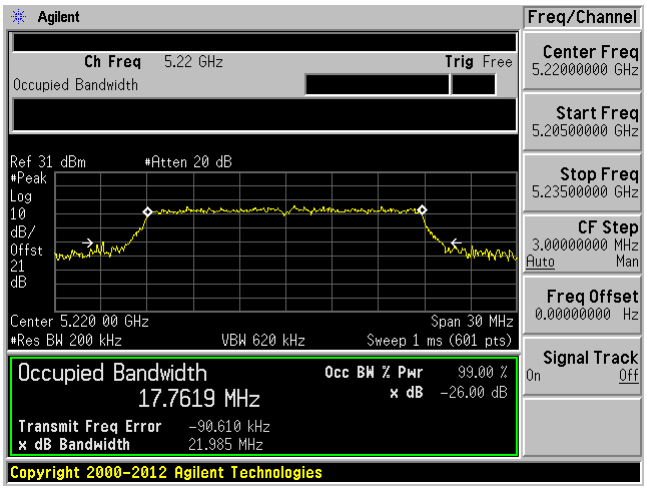


802.11ac20 mode Middle Channel 5220MHz

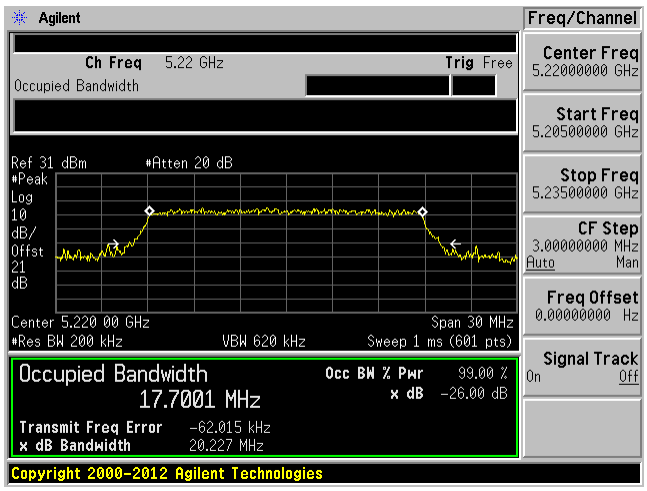
Chain #4




Chain #5

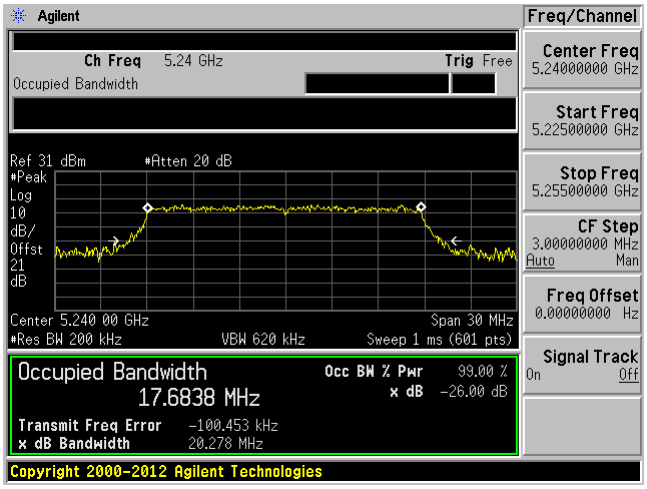



Chain #6

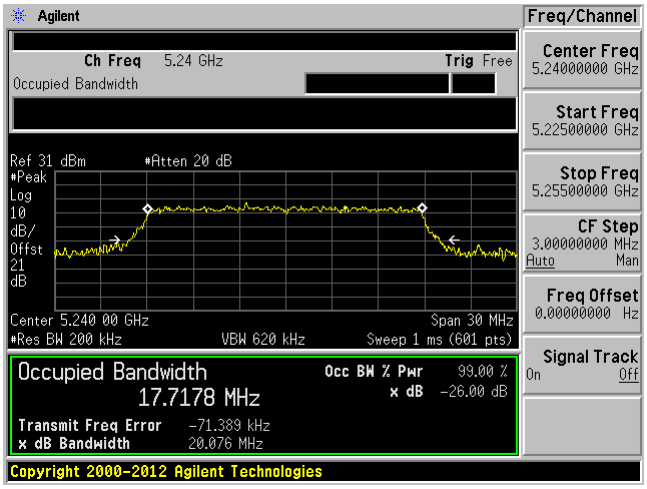


802.11ac20 mode High Channel 5240MHz

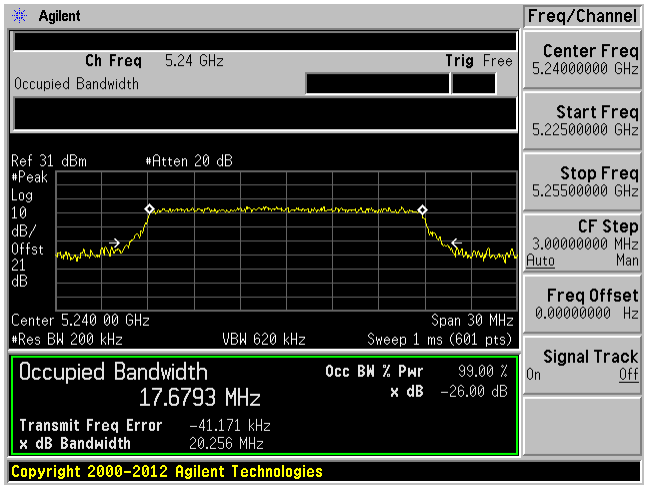
Chain #4




Chain #5

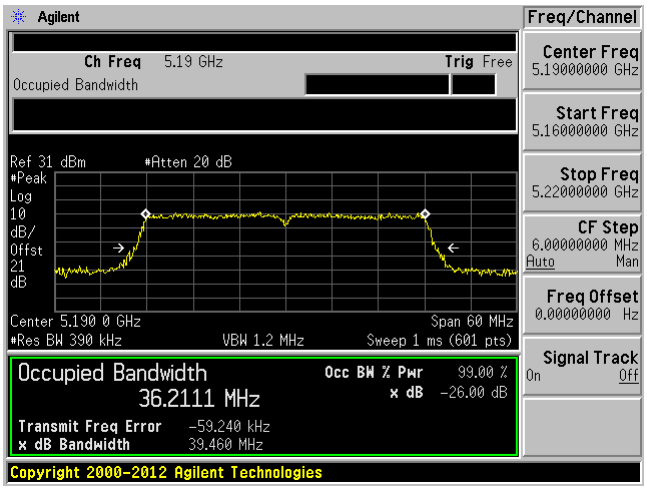



Chain #6

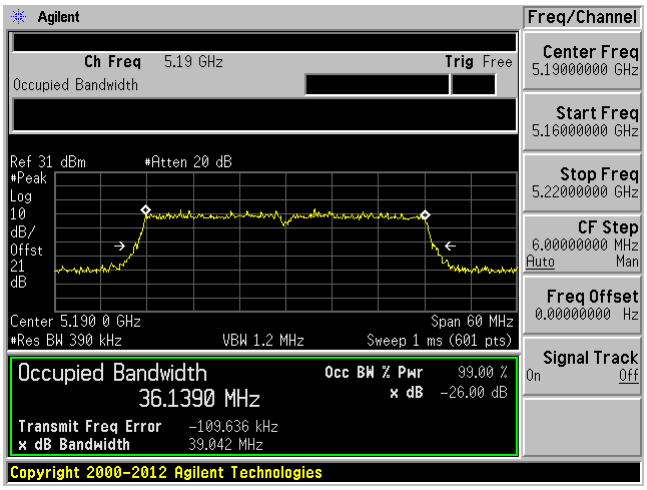


802.11ac40 mode Low Channel 5190MHz

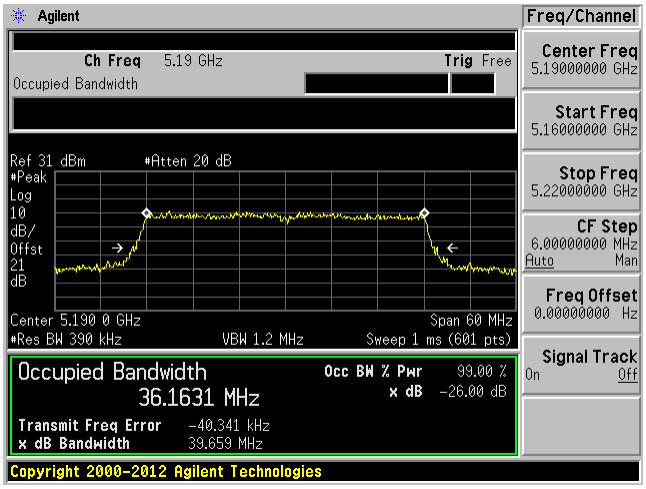
Chain #4




Chain #5

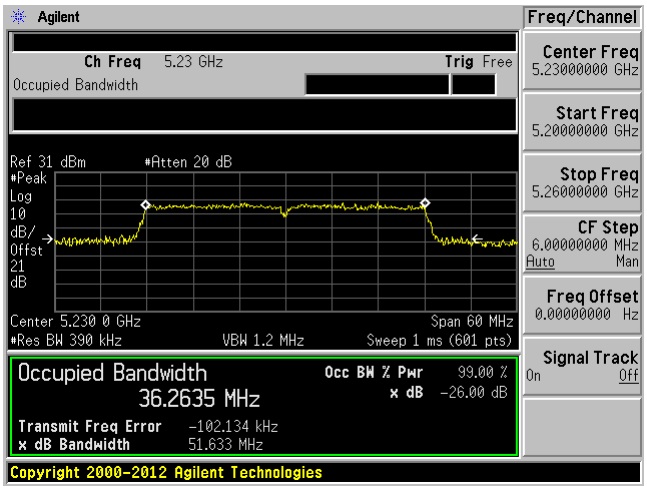



Chain #6

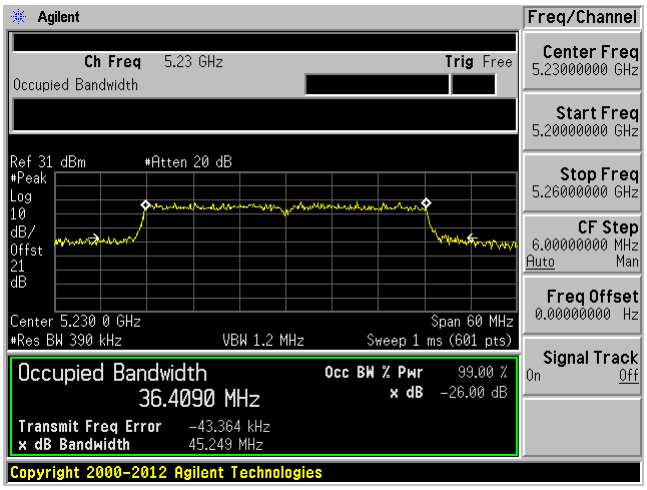


802.11ac40 mode High Channel 5230MHz

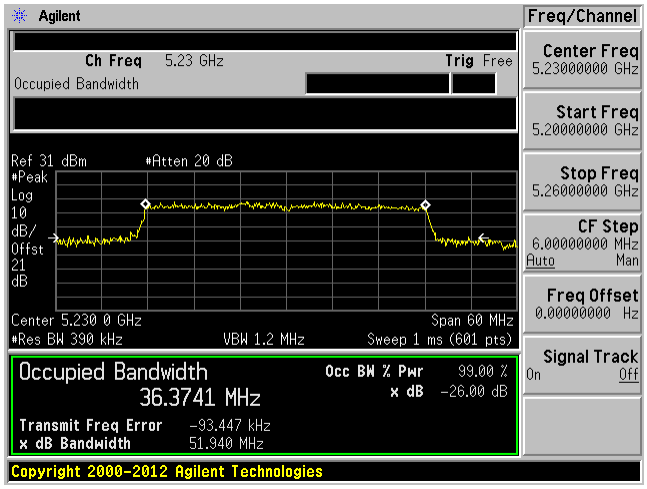
Chain #4




Chain #5

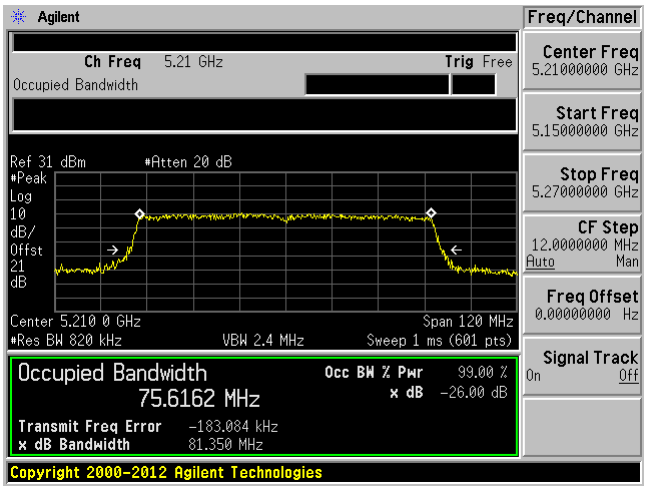



Chain #6

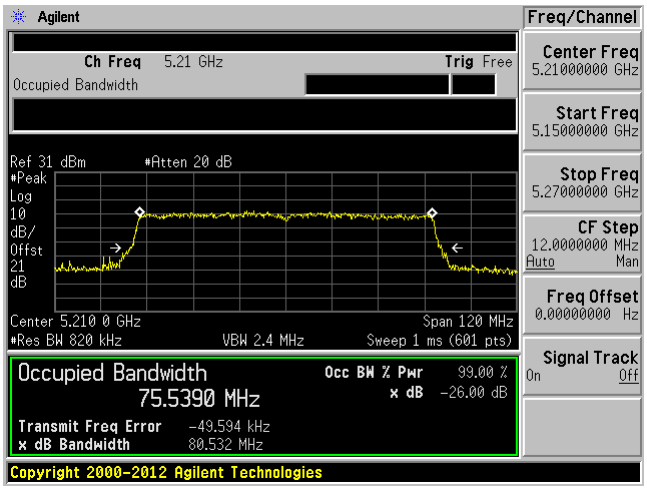


802.11ac80 mode 5210MHz

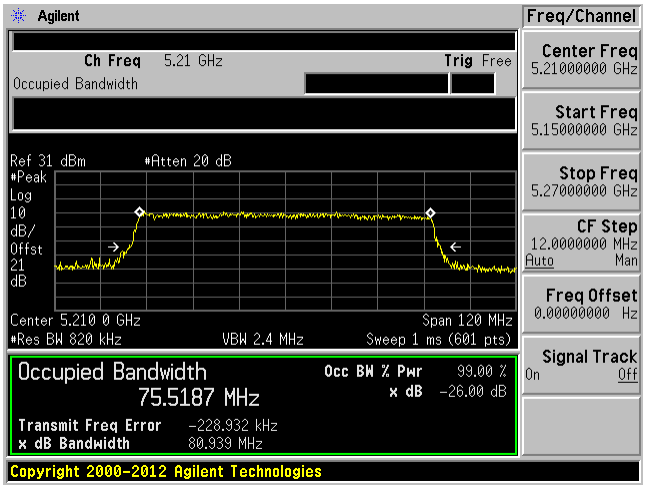
Chain #4




Chain #5




Chain #6



# 9 FCC §407(a) - Output Power

## 9.1 Applicable Standards

According to FCC §15.407(a):

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

## 9.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a power meter.

## 9.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| ETS- Lingerin | Power Sensor | 7002-006 | 160097 | 2014-10-21 | 2 years |
| Agilent | Analyzer, Spectrum | E4440A | MY44303352 | 2015-06-22 | 1 year |
| - | 20dB attenuator | - | - | Each time[1] | N/A |

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
***Statement of Traceability: BACL Corp.*** *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

## 9.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22º C |
| **Relative Humidity:** | 42 % |
| **ATM Pressure:** | 102.7 KPa |

*The testing was performed by Jin Yang on 2016-04-15in RF site.*

## 9.5 Test Results

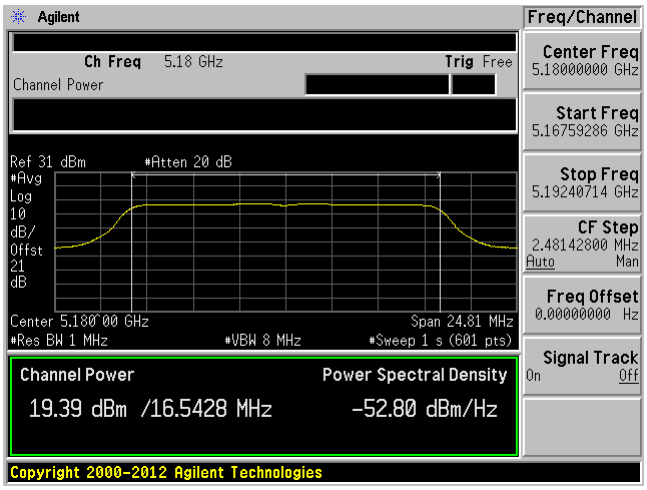
Note: Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \ldots + 10^{G_N/20})^2 / N_{ANT}]$ dBi =11.13dBi
Note: 802.11a mode only transmits signal through antenna 4, and the antenna gain for chain 4 is greater than 6dBi, therefore, the limit is reduced by amount exceed 6dBi.

## Non-Beamforming

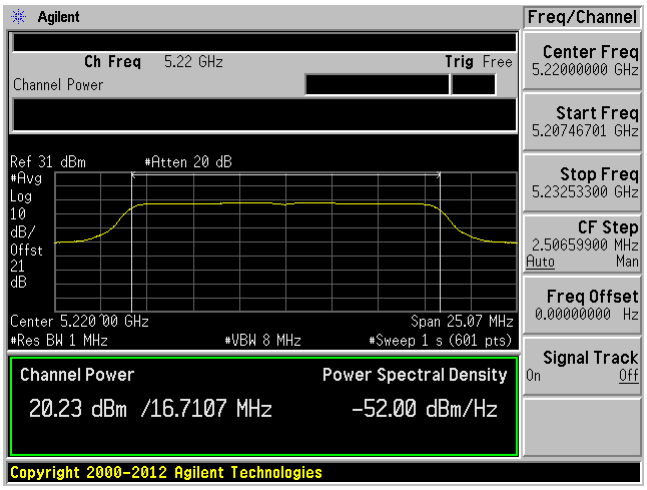
| Mode | Channel | Frequency MHz | Chain # | Conducted Output Power (dBm) | Total Power (dBm) | Limit (dBm) | Comment |
|---|---|---|---|---|---|---|---|
| 802.11a | 36 | 5180 | 4 | 19.39 | - | 29.76 | Pass |
| | 44 | 5220 | 4 | 20.23 | - | 29.76 | Pass |
| | 48 | 5240 | 4 | 20.3 | - | 29.76 | Pass |
| 802.11n20 | 36 | 5180 | 4 | 17.58 | 21.97 | 24.87 | Pass |
| | | | 5 | 17.22 | | | Pass |
| | | | 6 | 16.75 | | | Pass |
| | 44 | 5220 | 4 | 18.07 | 22.77 | 24.87 | Pass |
| | | | 5 | 18.21 | | | Pass |
| | | | 6 | 17.7 | | | Pass |
| | 48 | 5240 | 4 | 18.56 | 22.92 | 24.87 | Pass |
| | | | 5 | 18.12 | | | Pass |
| | | | 6 | 17.71 | | | Pass |
| 802.11ac20 | 36 | 5180 | 4 | 17.48 | 21.91 | 24.87 | Pass |
| | | | 5 | 17.18 | | | Pass |
| | | | 6 | 16.73 | | | Pass |
| | 44 | 5220 | 4 | 18.54 | 22.91 | 24.87 | Pass |
| | | | 5 | 18.15 | | | Pass |
| | | | 6 | 17.69 | | | Pass |
| | 48 | 5240 | 4 | 18.5 | 22.89 | 24.87 | Pass |
| | | | 5 | 18.09 | | | Pass |
| | | | 6 | 17.74 | | | Pass |
| 802.11n40 | 38 | 5190 | 4 | 13 | 17.73 | 24.87 | Pass |
| | | | 5 | 13.34 | | | Pass |
| | | | 6 | 12.49 | | | Pass |
| | 46 | 5230 | 4 | 20.35 | 24.83 | 24.87 | Pass |
| | | | 5 | 20.01 | | | Pass |
| | | | 6 | 19.8 | | | Pass |
| 802.11ac40 | 38 | 5190 | 4 | 13.42 | 17.89 | 24.87 | Pass |
| | | | 5 | 13.34 | | | Pass |
| | | | 6 | 12.54 | | | Pass |
| | 46 | 5230 | 4 | 20.37 | 24.76 | 24.87 | Pass |
| | | | 5 | 19.84 | | | Pass |
| | | | 6 | 19.73 | | | Pass |
| 802.11ac80 | 42 | 5210 | 4 | 12.12 | 16.93 | 24.87 | Pass |
| | | | 5 | 12.47 | | | Pass |
| | | | 6 | 11.87 | | | Pass |

802.11a mode

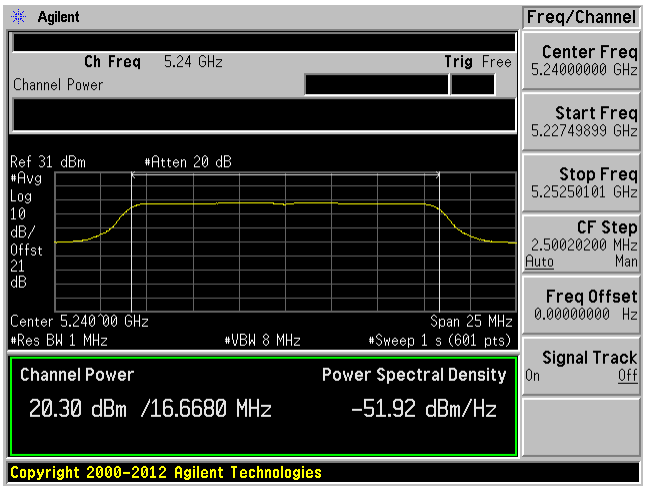
802.11a mode Low Channel 5180MHz




802.11a mode Middle Channel 5220MHz

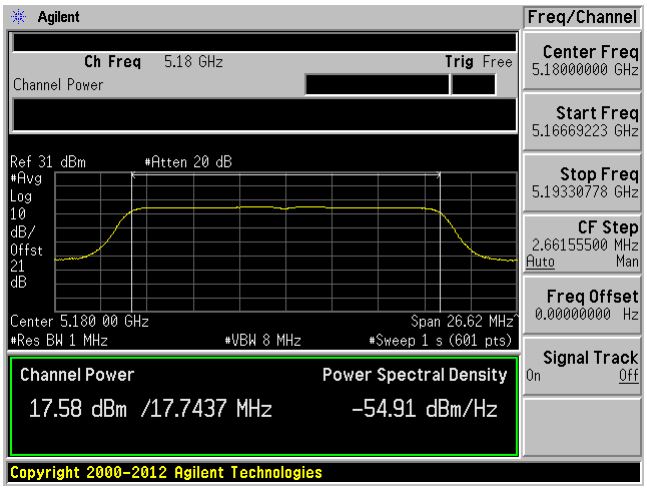



802.11a mode High Channel 5240MHz

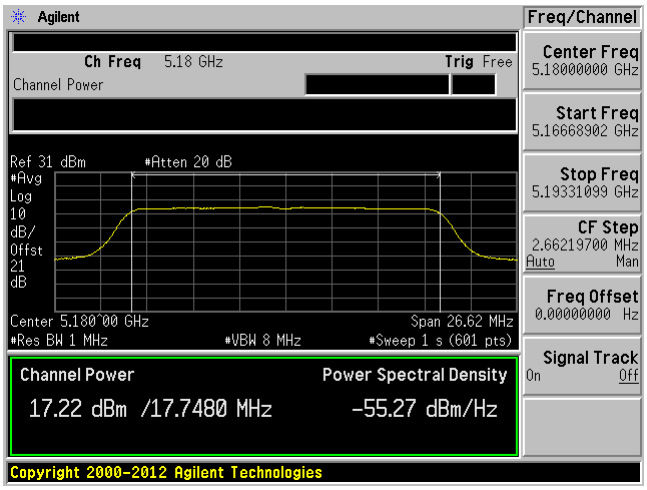


802.11n20 mode Low Channel 5180MHz

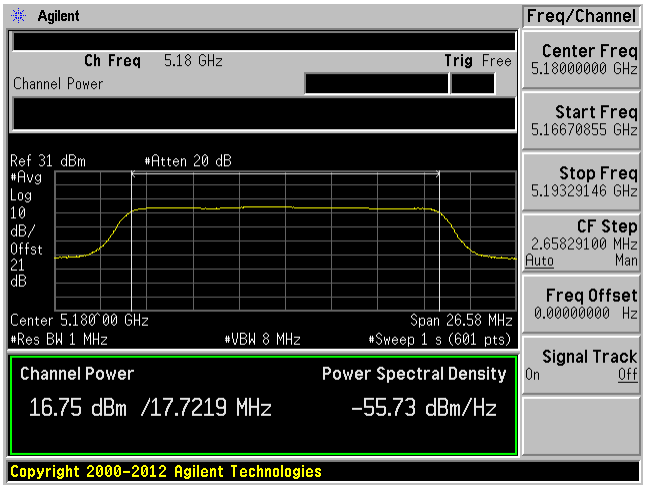
Chain #4




Chain #5

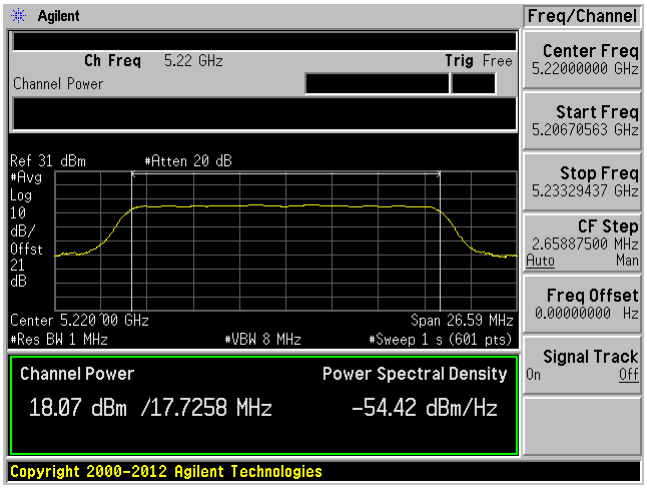



Chain #6

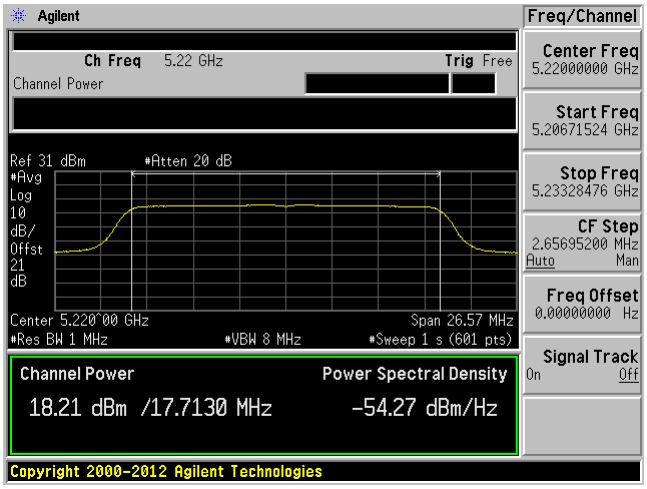


802.11n20 mode Middle Channel 5220MHz

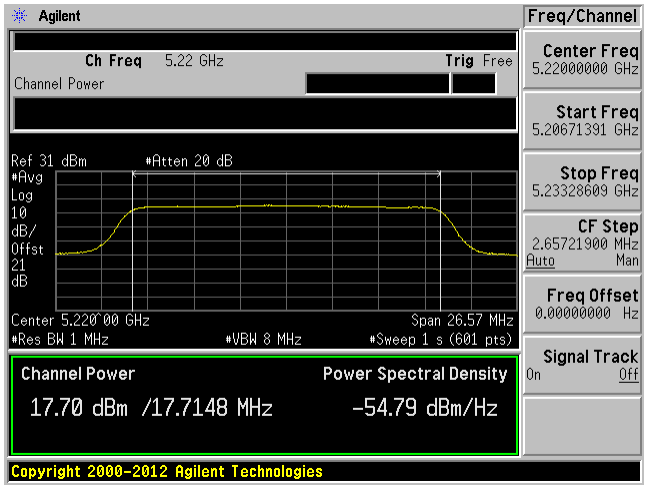
Chain #4




Chain #5

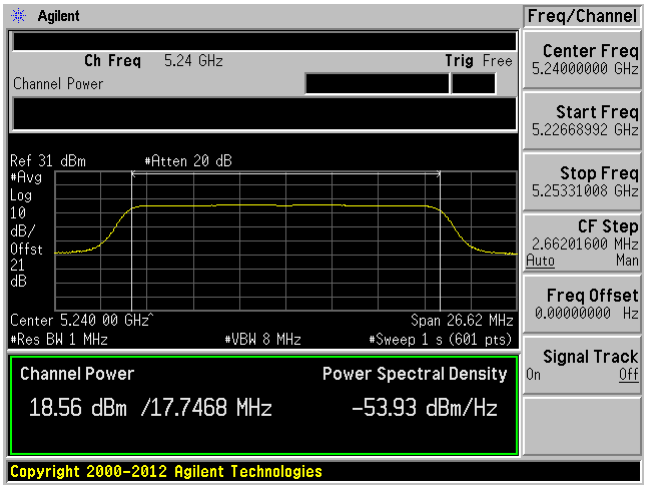



Chain #6

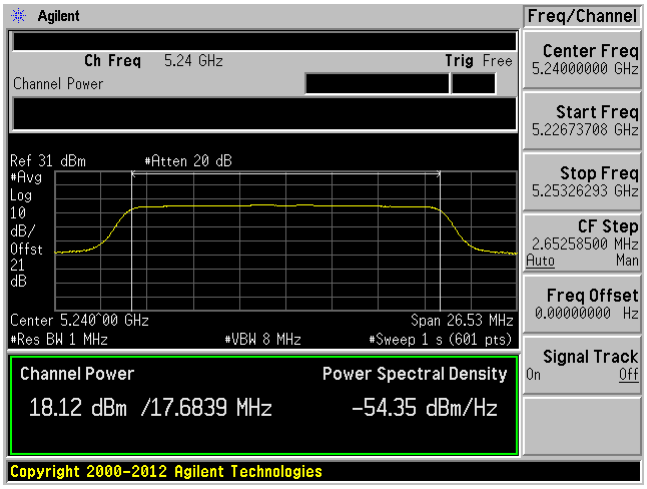


802.11n20 mode High Channel 5240MHz

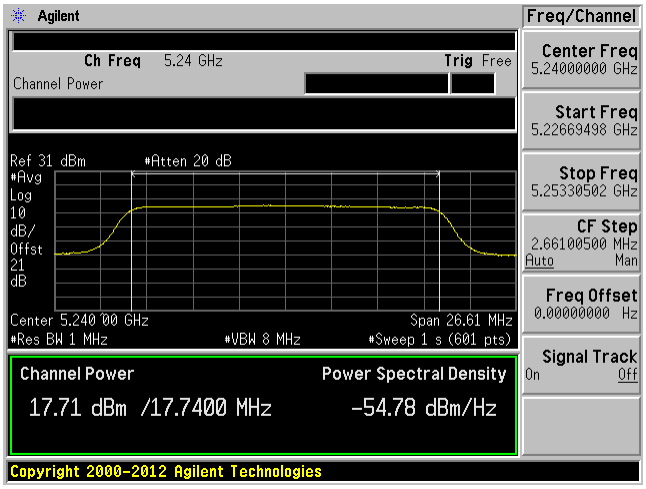
Chain #4




Chain #5

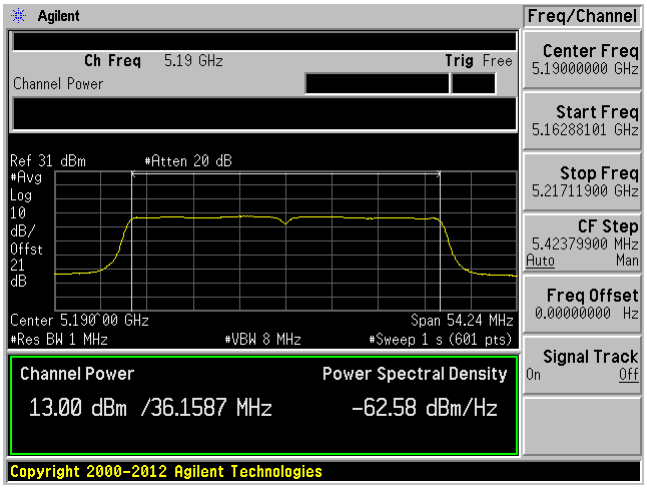



Chain #6

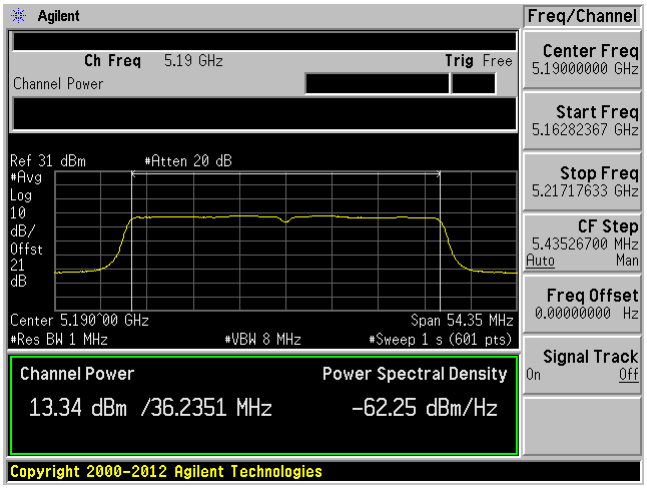


802.11n40 mode Low Channel 5190MHz

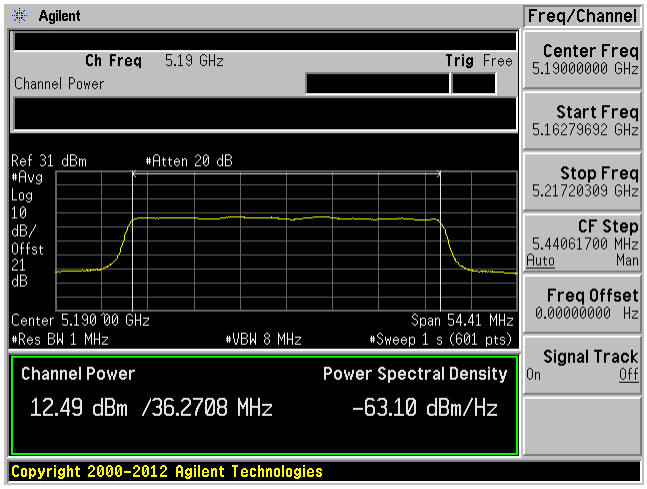
Chain #4




Chain #5

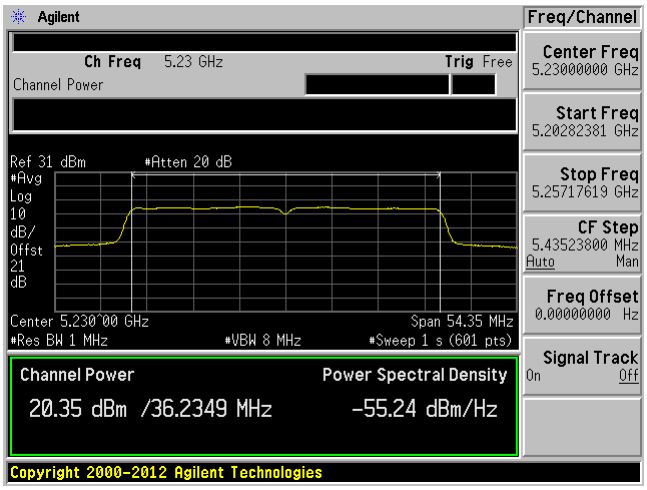



Chain #6

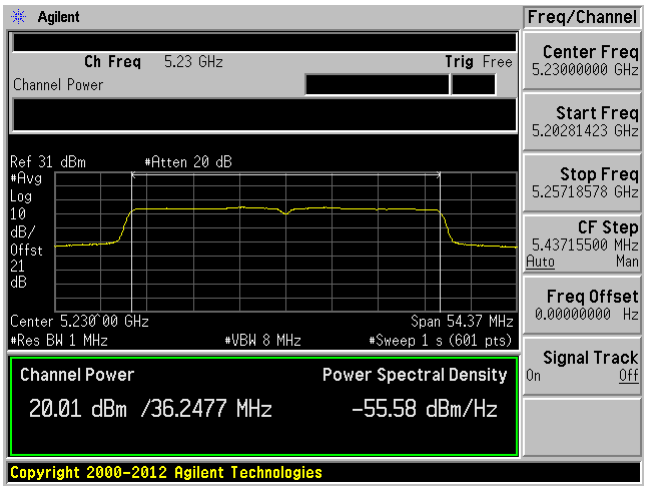


802.11n40 mode High Channel 5230MHz

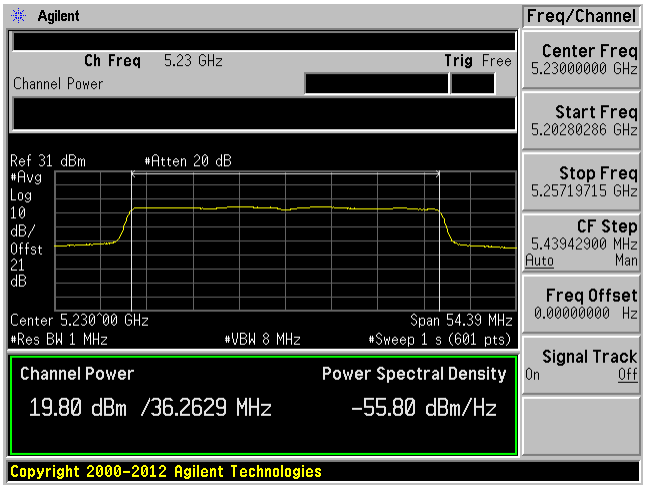
Chain #4




Chain #5

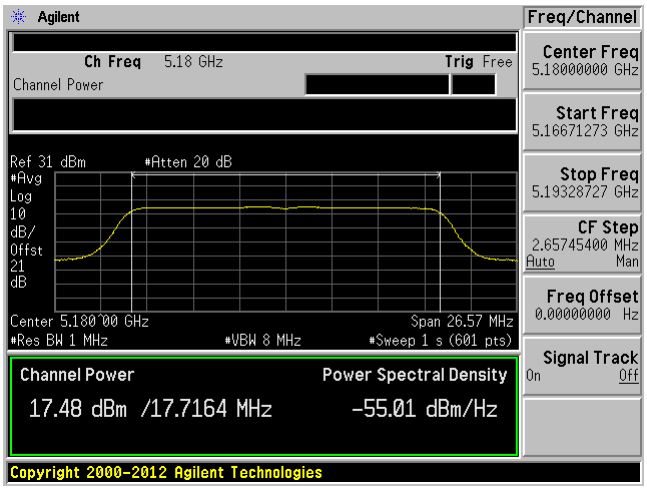



Chain #6

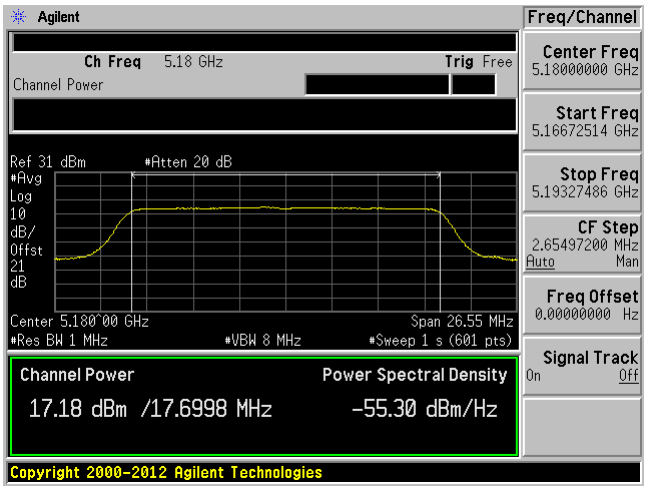


802.11ac20 mode Low Channel 5180MHz

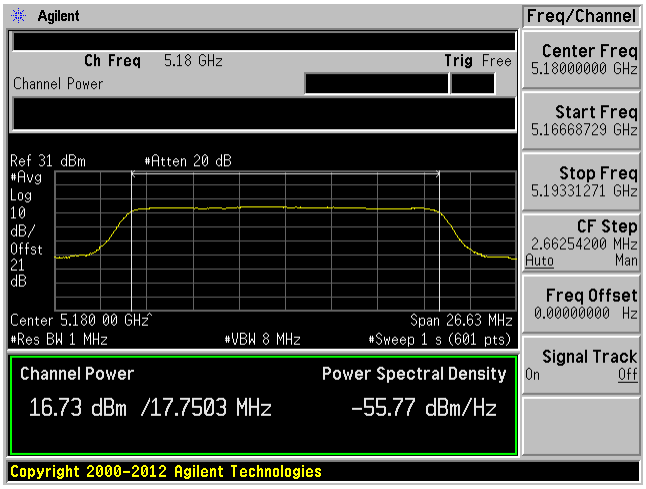
Chain #4




Chain #5

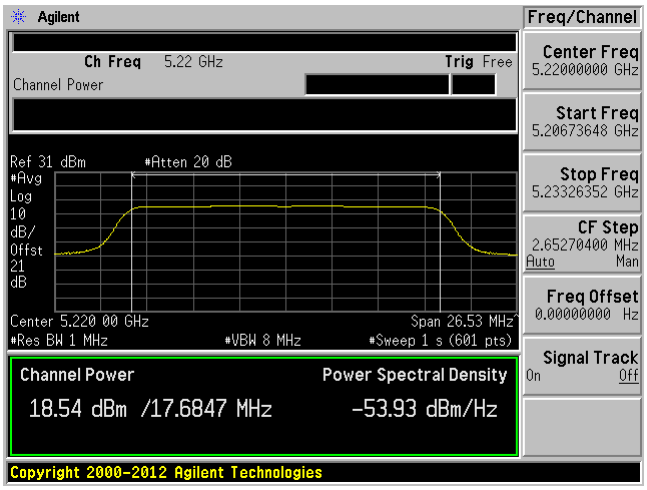



Chain #6

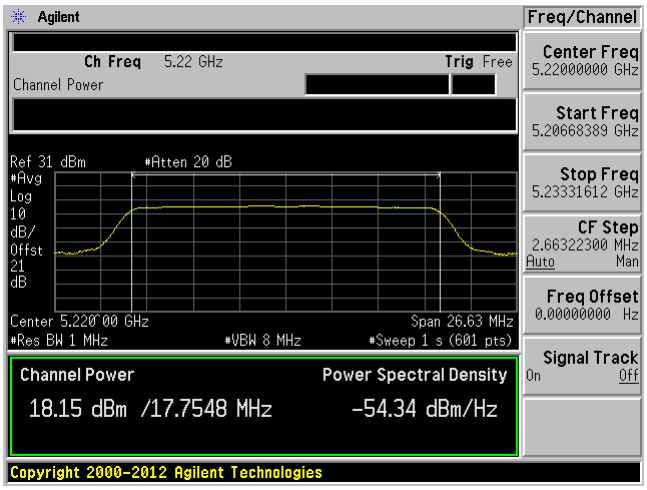


802.11ac20 mode Middle Channel 5220MHz

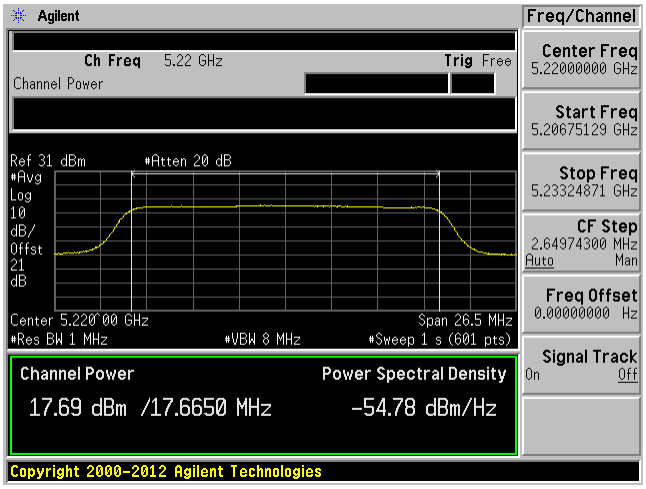
Chain #4




Chain #5

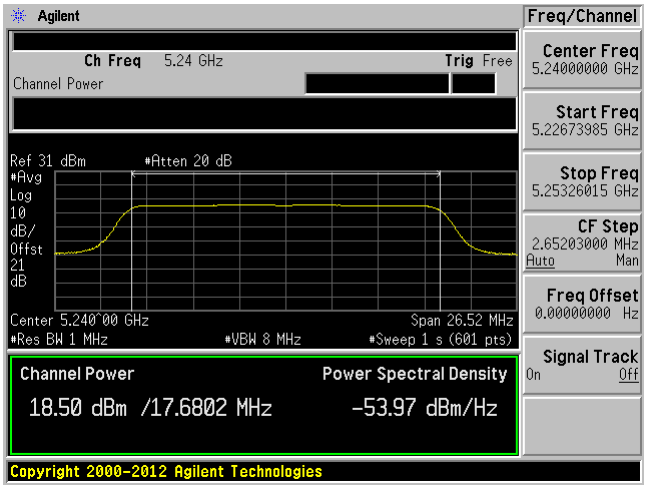



Chain #6

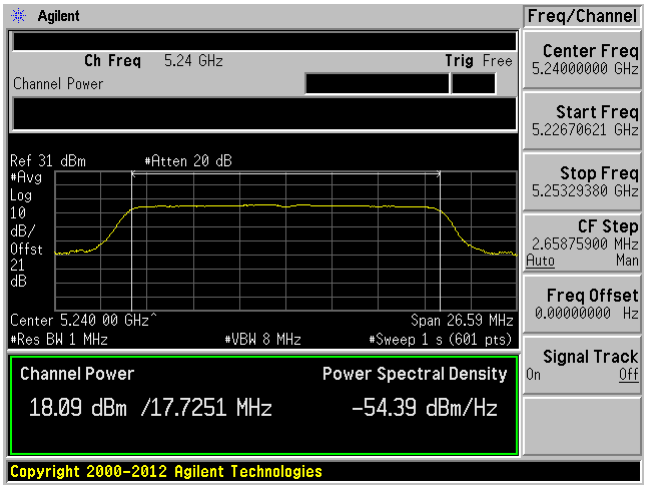


802.11ac20 mode High Channel 5240MHz

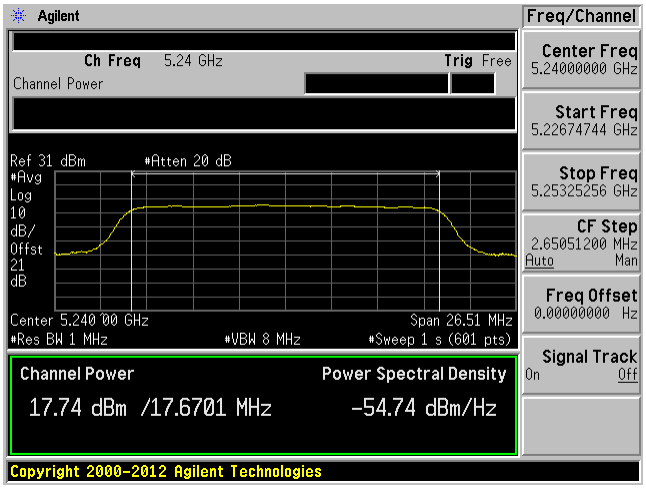
Chain #4




Chain #5

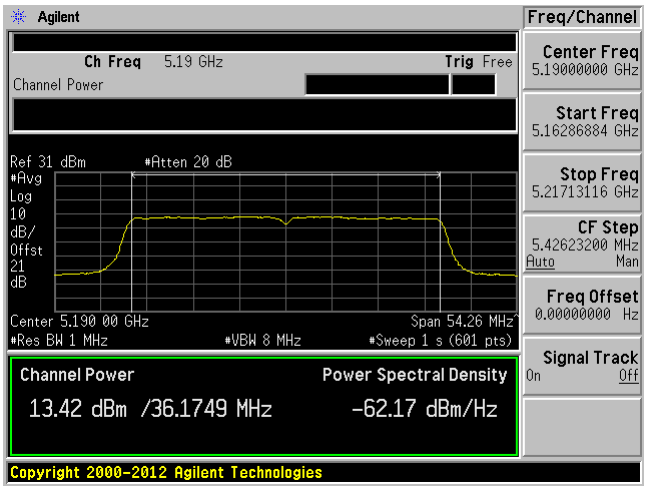



Chain #6

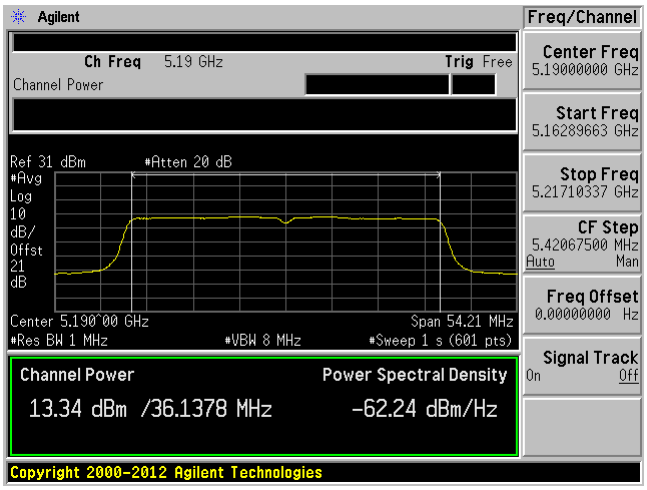


802.11ac40 mode Low Channel 5190MHz

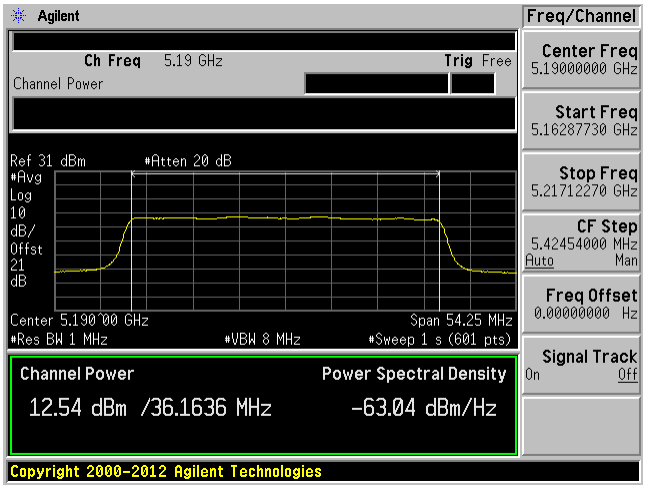
Chain #4




Chain #5

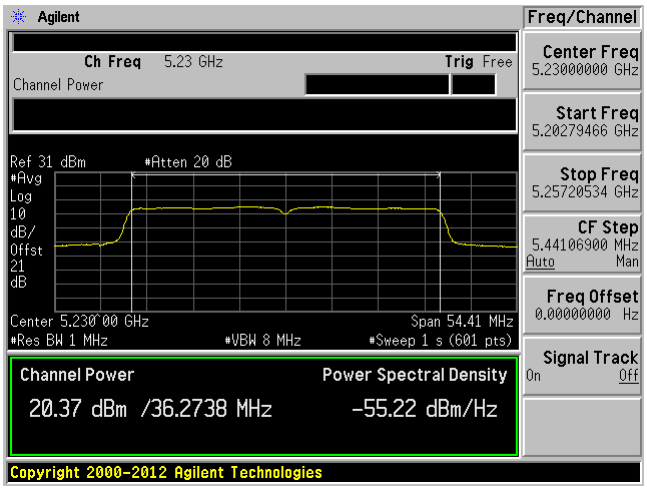



Chain #6

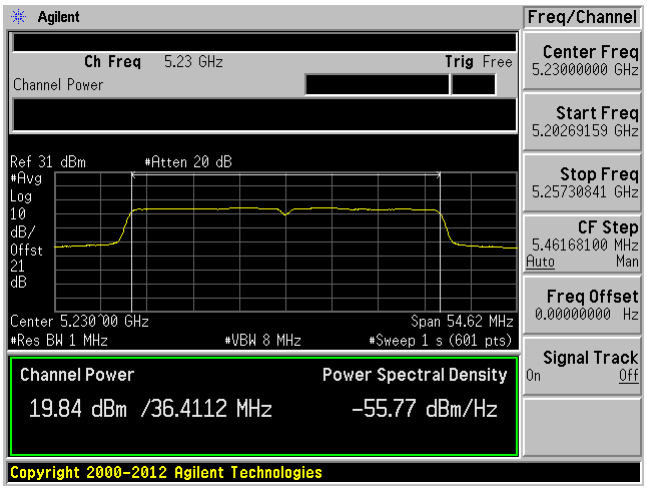


802.11ac40 mode High Channel 5230MHz

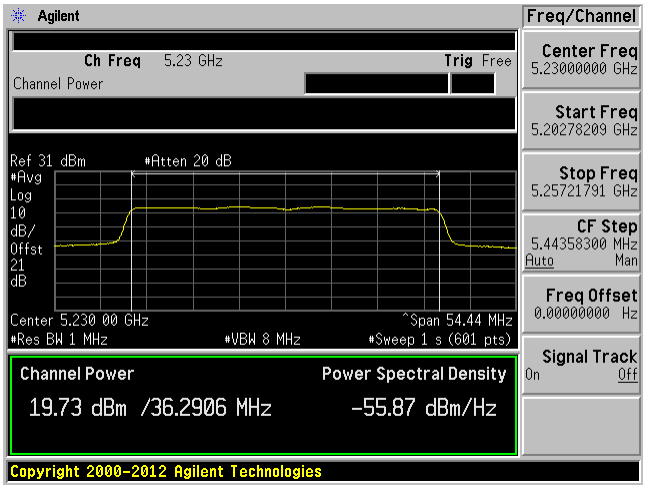
Chain #4




Chain #5

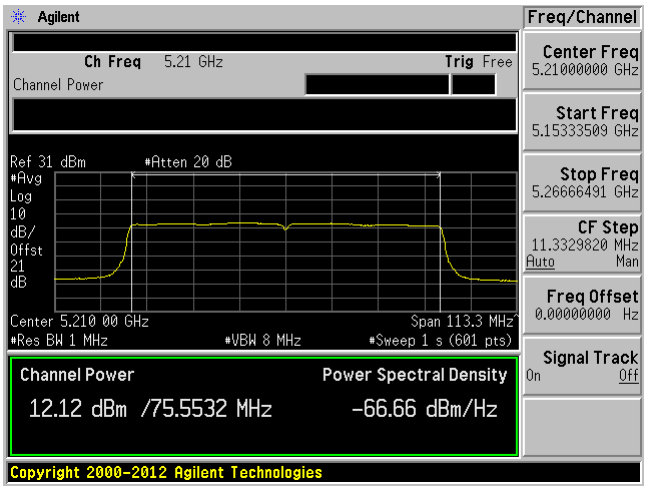



Chain #6

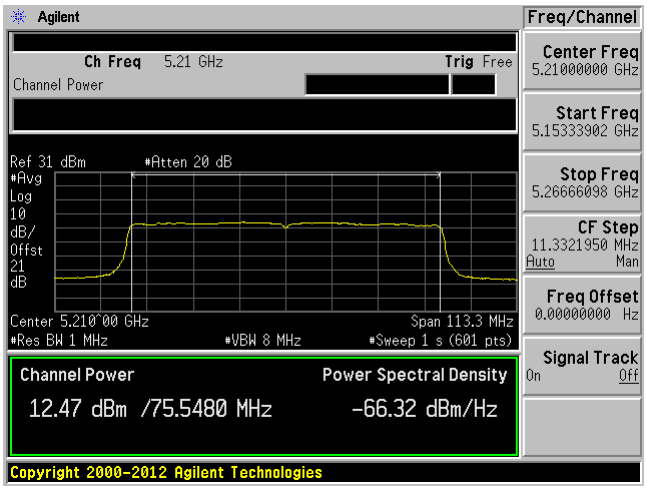


802.11ac80 mode 5210MHz

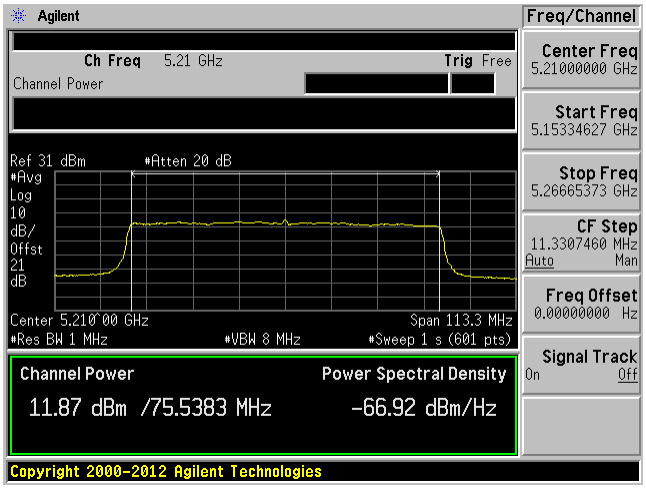
Chain #4




Chain #5




Chain #6



## Beamforming

| Mode | Channel | Frequency MHz | Chain # | Conducted Output Power (dBm) | Total Power (dBm) | Limit (dBm) | Comment |
|---|---|---|---|---|---|---|---|
| 802.11a | 36 | 5180 | 4 | 19.11 | - | 29.76 | Pass |
| | 44 | 5220 | 4 | 20.04 | - | 29.76 | Pass |
| | 48 | 5240 | 4 | 19.95 | - | 29.76 | Pass |
| 802.11n20 | 36 | 5180 | 4 | 17.16 | 21.61 | 24.87 | Pass |
| | | | 5 | 16.9 | | | Pass |
| | | | 6 | 16.43 | | | Pass |
| | 44 | 5220 | 4 | 18 | 22.31 | 24.87 | Pass |
| | | | 5 | 17.5 | | | Pass |
| | | | 6 | 17.06 | | | Pass |
| | 48 | 5240 | 4 | 18.07 | 22.36 | 24.87 | Pass |
| | | | 5 | 17.55 | | | Pass |
| | | | 6 | 17.08 | | | Pass |
| 802.11ac20 | 36 | 5180 | 4 | 17.13 | 21.53 | 24.87 | Pass |
| | | | 5 | 16.84 | | | Pass |
| | | | 6 | 16.26 | | | Pass |
| | 44 | 5220 | 4 | 17.88 | 22.27 | 24.87 | Pass |
| | | | 5 | 17.45 | | | Pass |
| | | | 6 | 17.15 | | | Pass |
| | 48 | 5240 | 4 | 17.99 | 22.38 | 24.87 | Pass |
| | | | 5 | 17.7 | | | Pass |
| | | | 6 | 17.08 | | | Pass |
| 802.11n40 | 38 | 5190 | 4 | 12.88 | 17.38 | 24.87 | Pass |
| | | | 5 | 12.8 | | | Pass |
| | | | 6 | 12.1 | | | Pass |
| | 46 | 5230 | 4 | 19.92 | 24.25 | 24.87 | Pass |
| | | | 5 | 19.41 | | | Pass |
| | | | 6 | 19.07 | | | Pass |
| 802.11ac40 | 38 | 5190 | 4 | 12.88 | 17.44 | 24.87 | Pass |
| | | | 5 | 12.88 | | | Pass |
| | | | 6 | 12.21 | | | Pass |
| | 46 | 5230 | 4 | 19.87 | 24.28 | 24.87 | Pass |
| | | | 5 | 19.53 | | | Pass |
| | | | 6 | 19.09 | | | Pass |
| 802.11ac80 | 42 | 5210 | 4 | 11.59 | 16.43 | 24.87 | Pass |
| | | | 5 | 11.92 | | | Pass |
| | | | 6 | 11.44 | | | Pass |

# 10 FCC §15.407(a) - Power Spectral Density

## 10.1 Applicable Standards

According to FCC §15.407(a):

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

## 10.2 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.

## 10.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4440A | MY44303352 | 2015-06-22 | 1 year |
| - | 20dB attenuator | - | - | Each time[1] | N/A |

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
***Statement of Traceability: BACL Corp.*** *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

## 10.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22-24 ºC |
| **Relative Humidity:** | 40-41 % |
| **ATM Pressure:** | 103.1-104.1 kPa |

*The testing was performed by Jin Yang on 2016-04-15 at RF site.*

## 10.5 Test Results

Note: Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \ldots + 10^{G_N/20})^2 / N_{ANT}]$ dBi =11.13dBi

Note: 802.11a mode only transmits signal through antenna 4, and the antenna gain for chain 4 is greater than 6dBi, therefore, the limit is reduced by amount exceed 6 dBi.

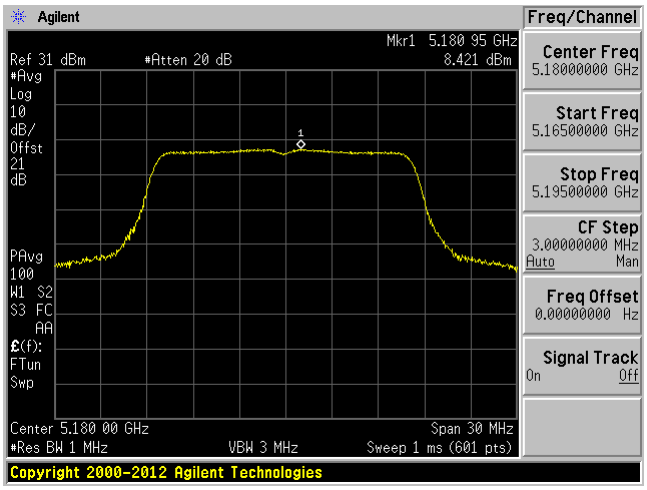
**Non-Beamforming**

| Mode | Channel | Frequency MHz | Chain # | PSD (dBm/MHz) | Total PSD (dBm/MHz) | Limit (dBm/MHz) | Comment |
|---|---|---|---|---|---|---|---|
| 802.11a | 36 | 5180 | 4 | 8.421 | - | 16.76 | Pass |
| | 44 | 5220 | 4 | 9.057 | - | 16.76 | Pass |
| | 48 | 5240 | 4 | 9.248 | - | 16.76 | Pass |
| 802.11n20 | 36 | 5180 | 4 | 6.404 | 10.69 | 11.87 | Pass |
| | | | 5 | 5.976 | | | Pass |
| | | | 6 | 5.306 | | | Pass |
| | 44 | 5220 | 4 | 6.871 | 11.66 | 11.87 | Pass |
| | | | 5 | 7.003 | | | Pass |
| | | | 6 | 6.79 | | | Pass |
| | 48 | 5240 | 4 | 7.075 | 11.72 | 11.87 | Pass |
| | | | 5 | 7.114 | | | Pass |
| | | | 6 | 6.631 | | | Pass |
| 802.11ac20 | 36 | 5180 | 4 | 5.943 | 10.55 | 11.87 | Pass |
| | | | 5 | 5.972 | | | Pass |
| | | | 6 | 5.388 | | | Pass |
| | 44 | 5220 | 4 | 7.164 | 11.72 | 11.87 | Pass |
| | | | 5 | 6.936 | | | Pass |
| | | | 6 | 6.749 | | | Pass |
| | 48 | 5240 | 4 | 7.213 | 11.71 | 11.87 | Pass |
| | | | 5 | 6.985 | | | Pass |
| | | | 6 | 6.605 | | | Pass |
| 802.11n40 | 38 | 5190 | 4 | -1.41 | 3.55 | 11.87 | Pass |
| | | | 5 | -0.522 | | | Pass |
| | | | 6 | -1.851 | | | Pass |
| | 46 | 5230 | 4 | 6.09 | 10.62 | 11.87 | Pass |
| | | | 5 | 5.924 | | | Pass |
| | | | 6 | 5.498 | | | Pass |
| 802.11ac40 | 38 | 5190 | 4 | -1.015 | 3.75 | 11.87 | Pass |
| | | | 5 | -0.621 | | | Pass |
| | | | 6 | -1.462 | | | Pass |
| | 46 | 5230 | 4 | 6.084 | 10.61 | 11.87 | Pass |
| | | | 5 | 5.836 | | | Pass |
| | | | 6 | 5.579 | | | Pass |
| 802.11ac80 | 42 | 5210 | 4 | -5.24 | -0.05 | 11.87 | Pass |
| | | | 5 | -4.921 | | | Pass |
| | | | 6 | -4.36 | | | Pass |

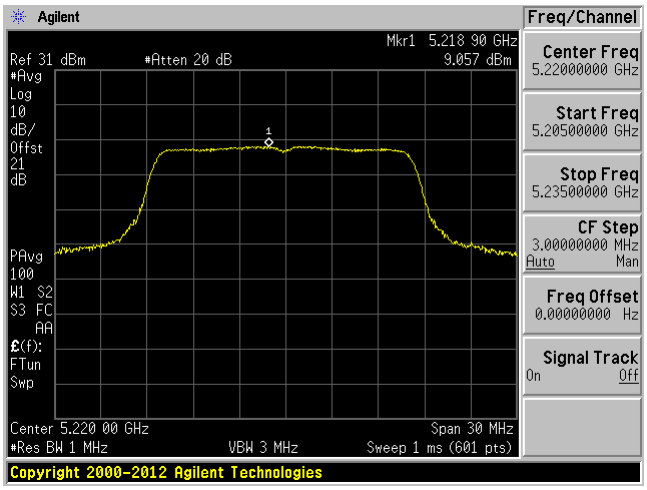
Please refer to the following plots.

802.11a mode

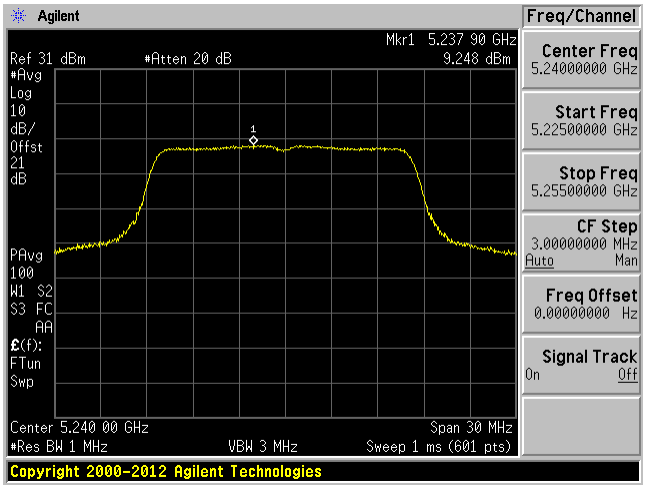
802.11a mode Low Channel 5180MHz




802.11a mode Middle Channel 5220MHz

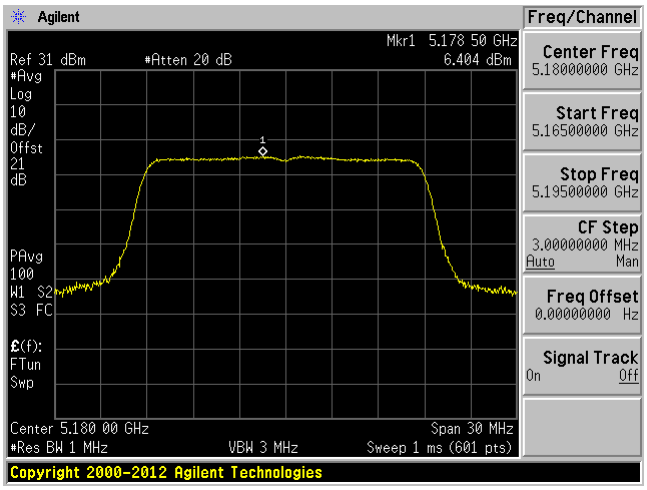



802.11a mode High Channel 5240MHz

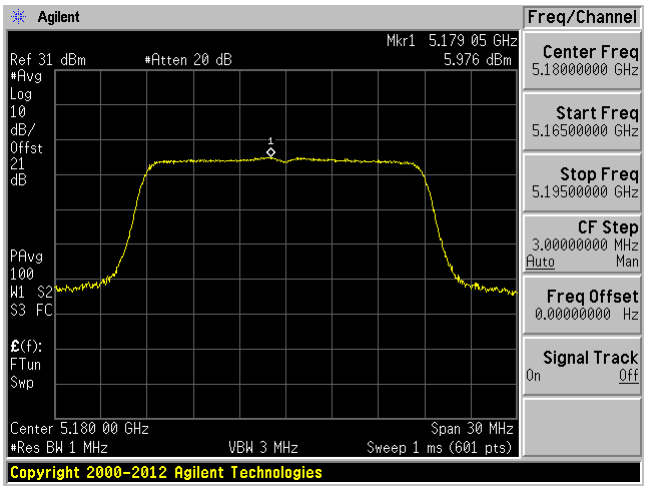


802.11n20 mode Low Channel 5180MHz

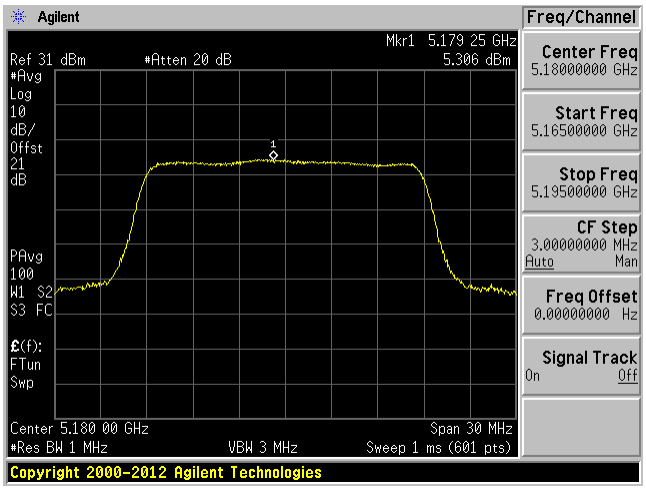
Chain #4




Chain #5

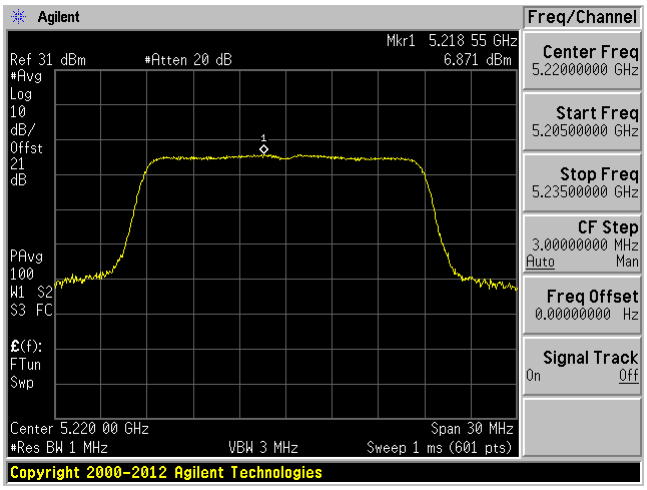



Chain #6

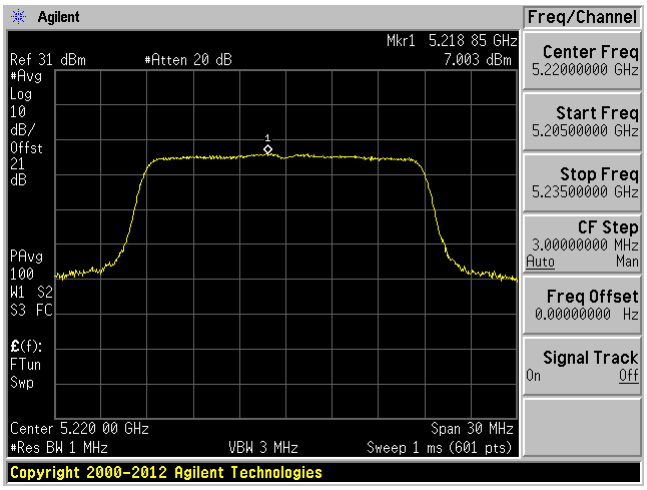


802.11n20 mode Middle Channel 5220MHz

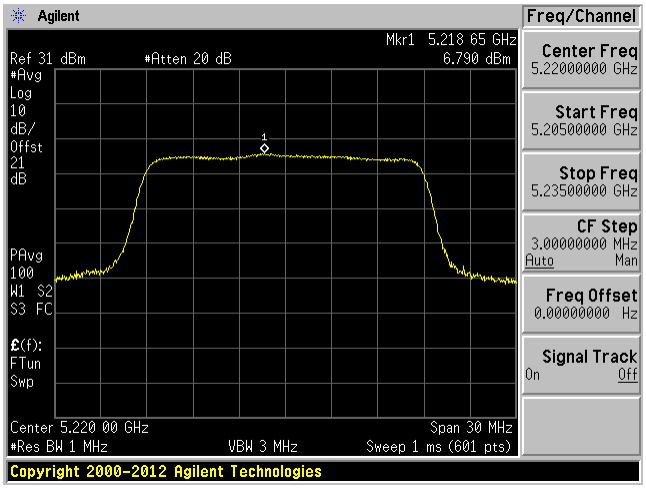
Chain #4




Chain #5

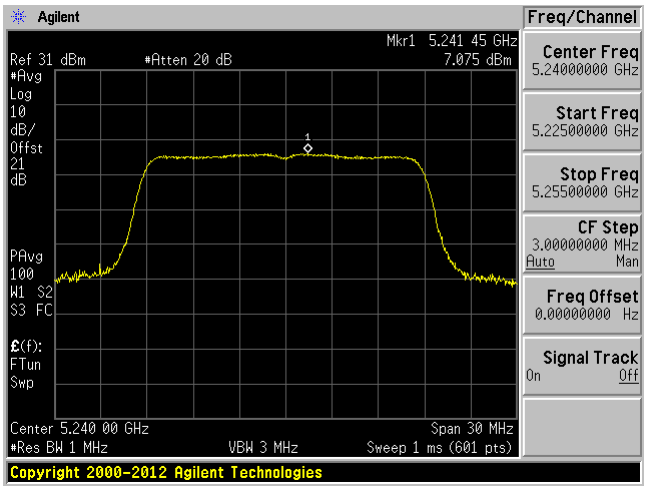



Chain #6

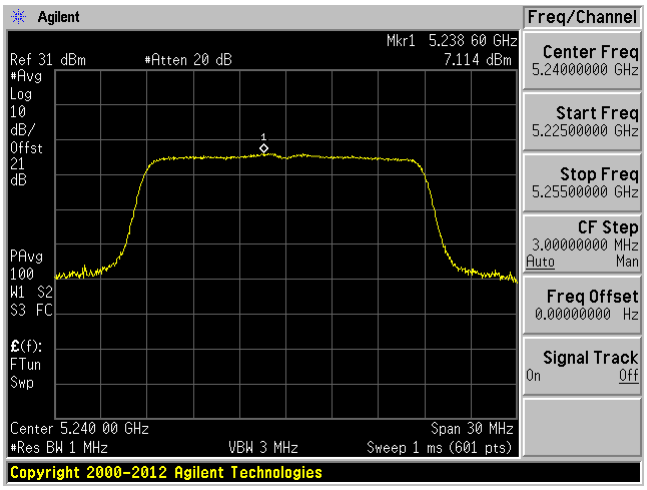


802.11n20 mode High Channel 5240MHz

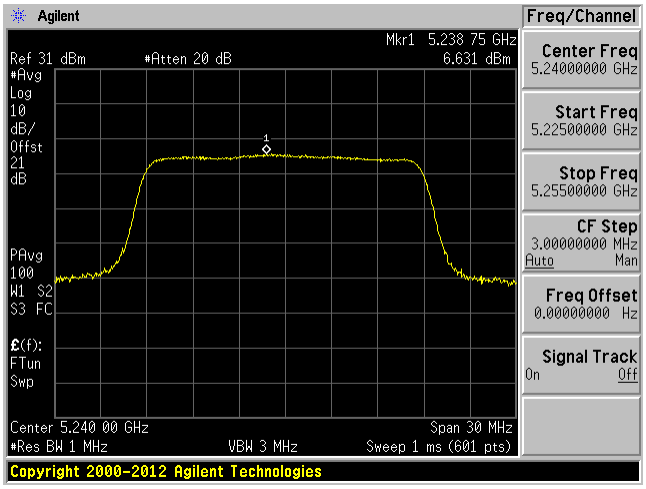
Chain #4




Chain #5

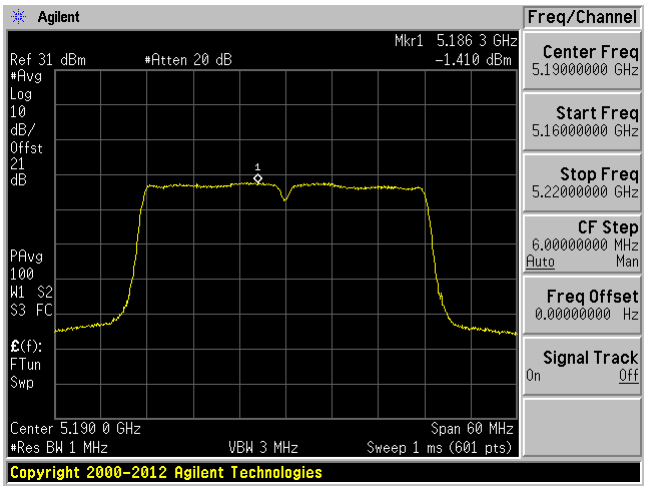



Chain #6

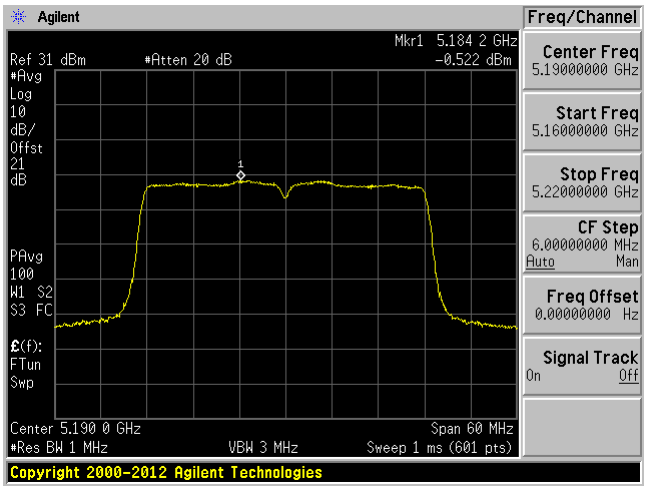


802.11n40 mode Low Channel 5190MHz

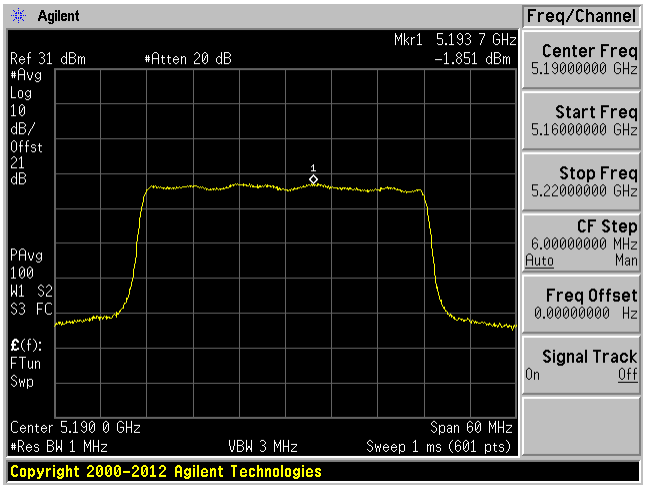
Chain #4




Chain #5

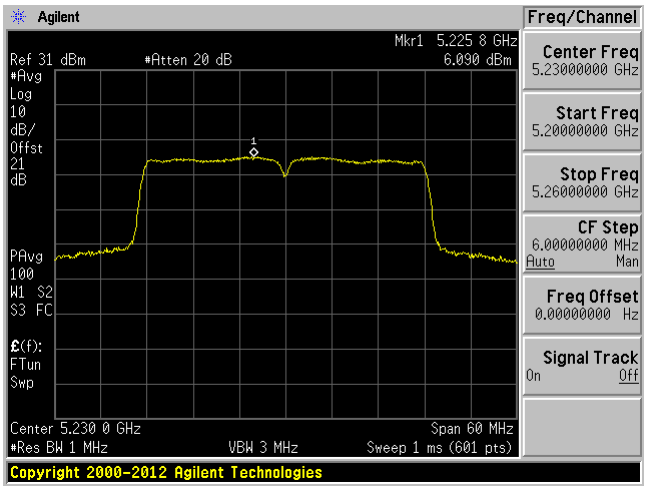



Chain #6

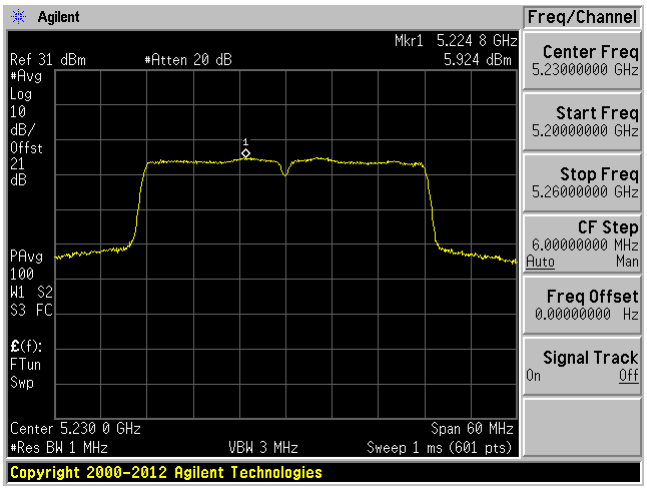


802.11n40 mode High Channel 5230MHz

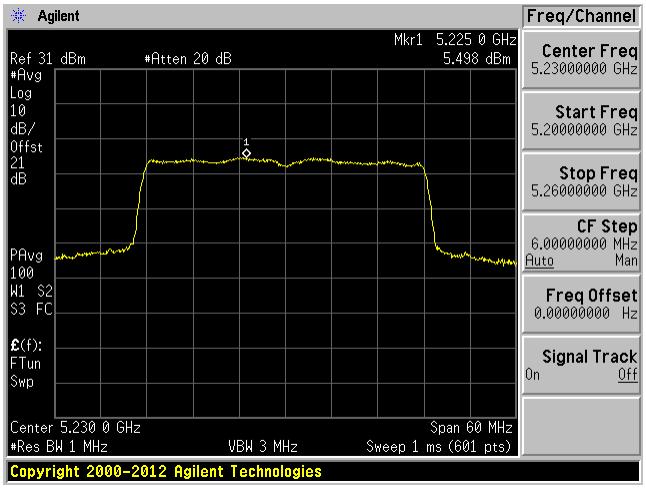
Chain #4




Chain #5

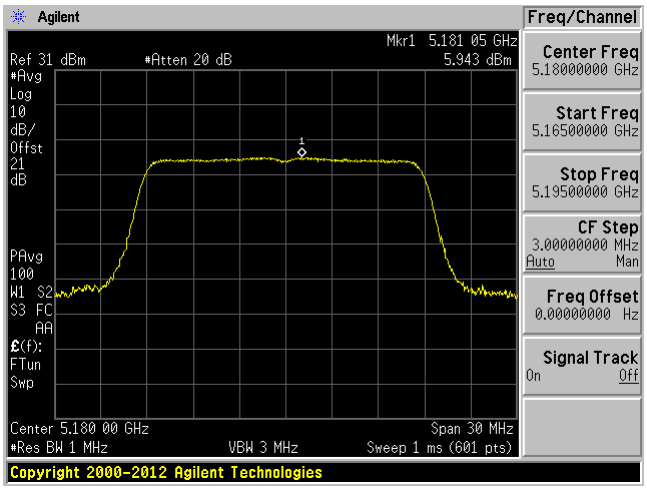



Chain #6

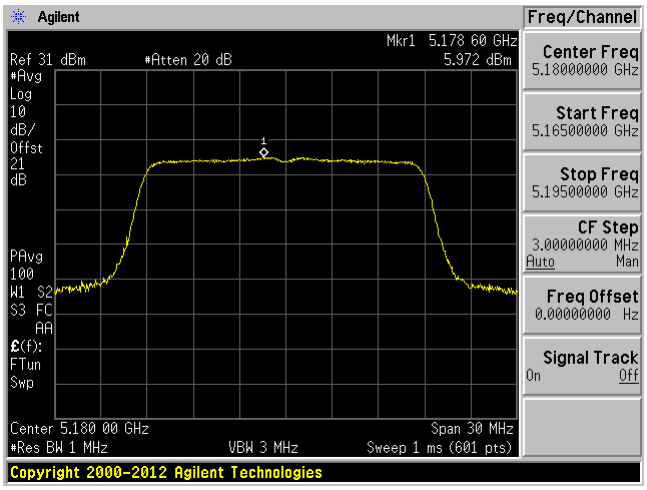


802.11ac20 mode Low Channel 5180MHz

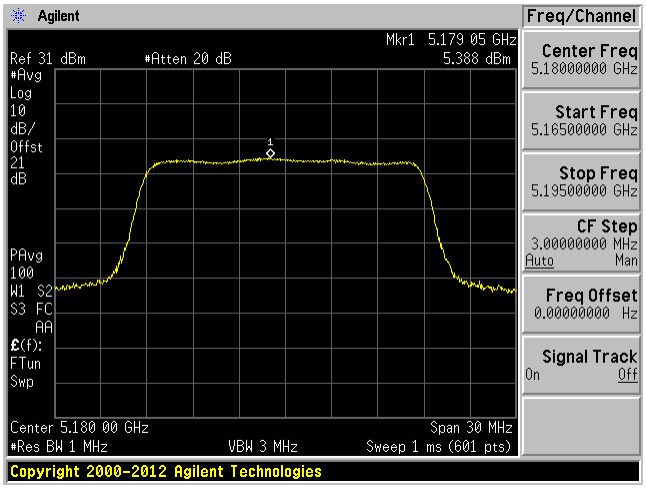
Chain #4




Chain #5

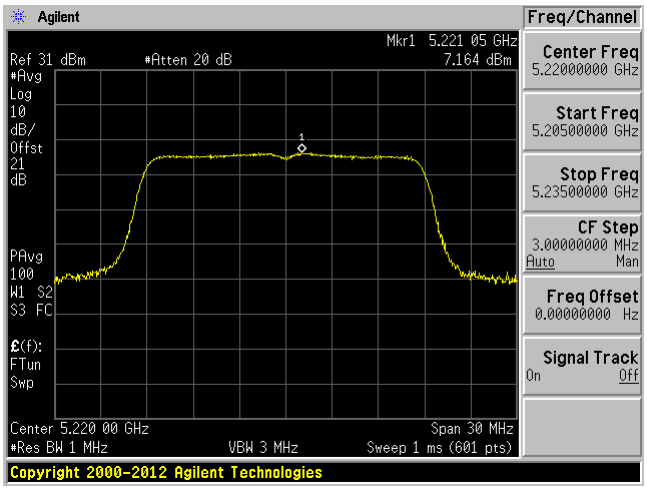



Chain #6

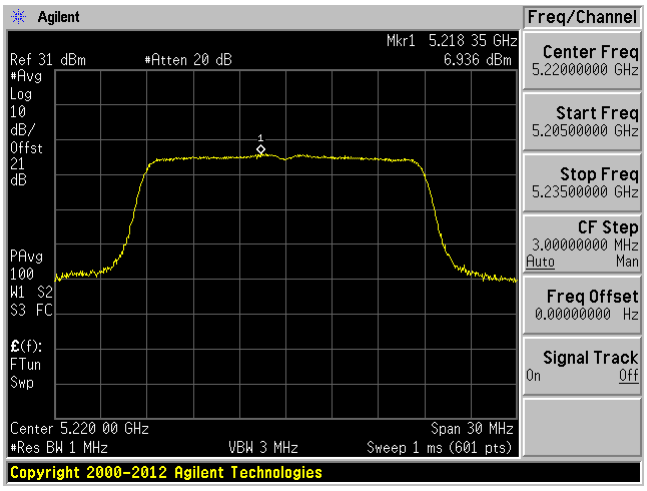


802.11ac20 mode Middle Channel 5220MHz

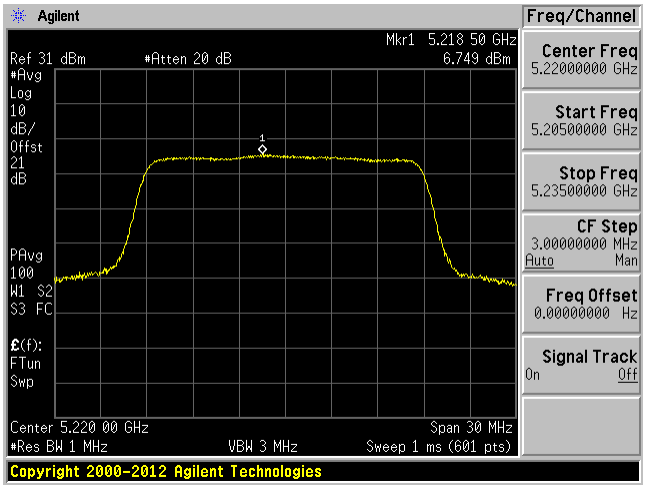
Chain #4




Chain #5

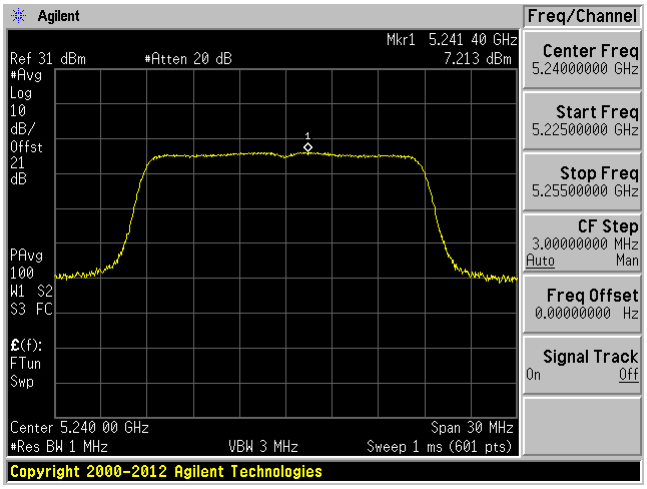



Chain #6

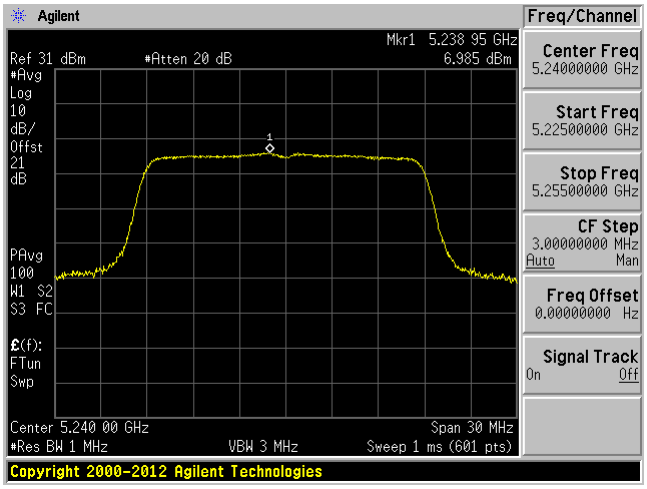


802.11ac20 mode High Channel 5240MHz

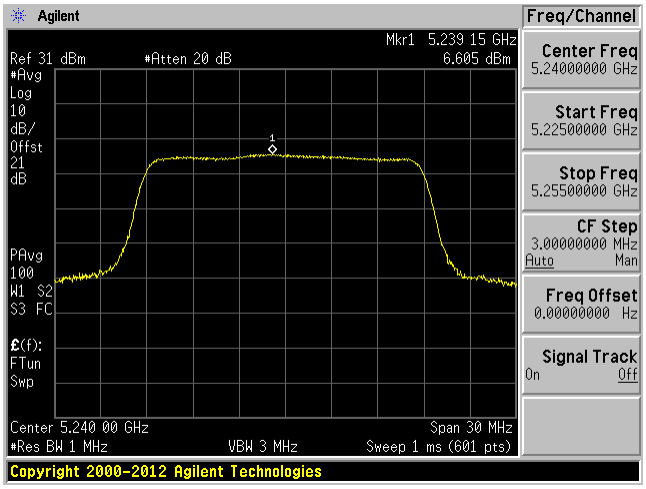
Chain #4




Chain #5

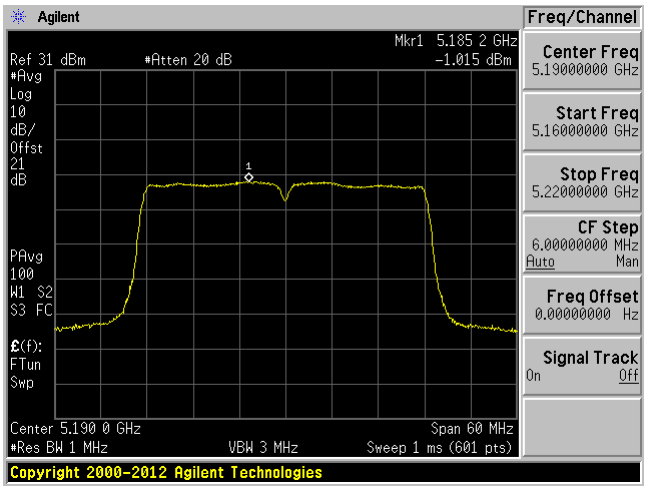



Chain #6

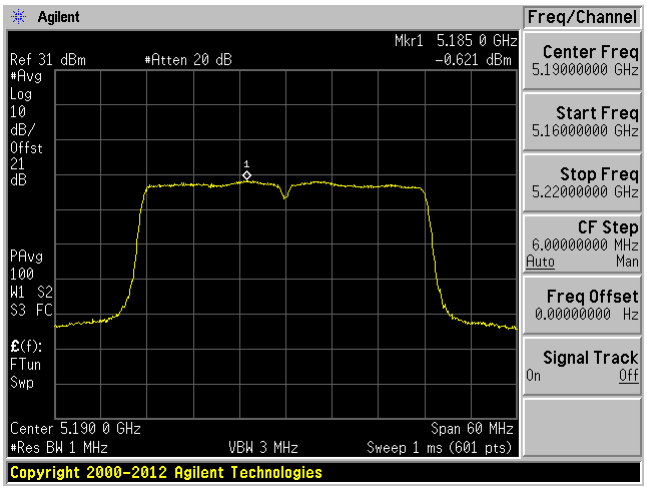


802.11ac40 mode Low Channel 5190MHz

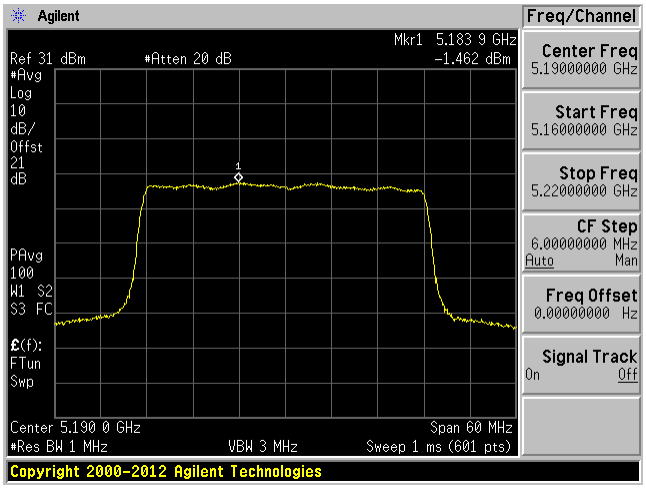
Chain #4




Chain #5

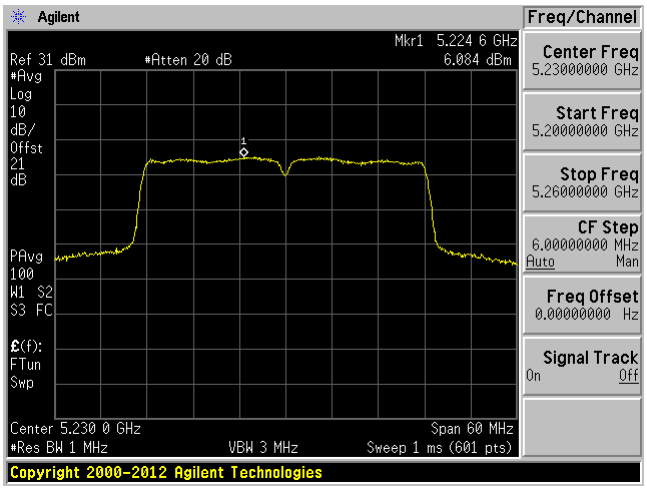



Chain #6

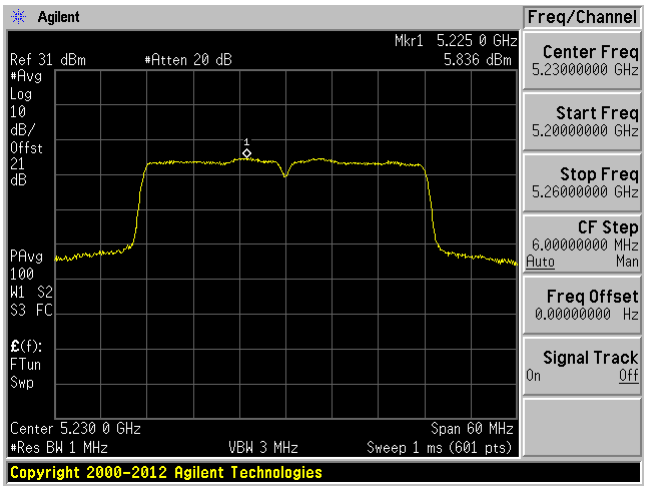


802.11ac40 mode High Channel 5230MHz

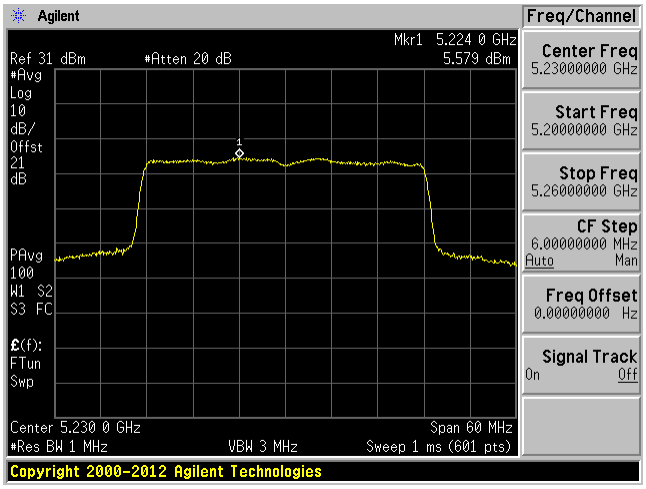
Chain #4




Chain #5

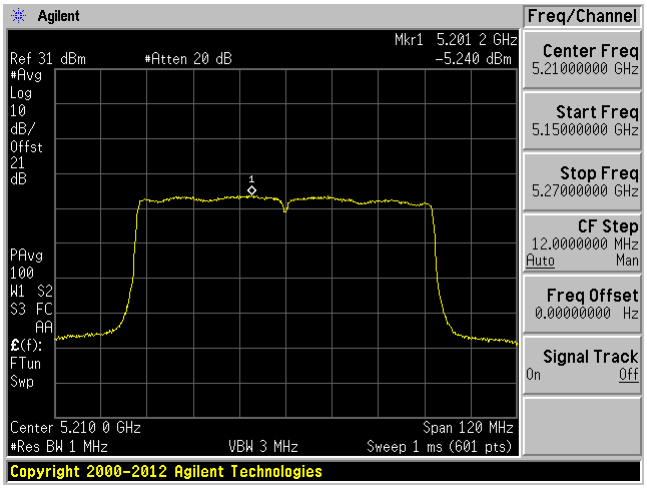



Chain #6

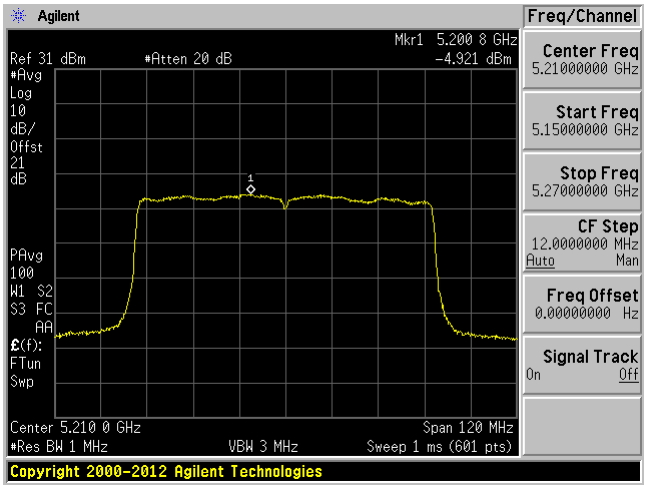


802.11ac80 mode 5210MHz

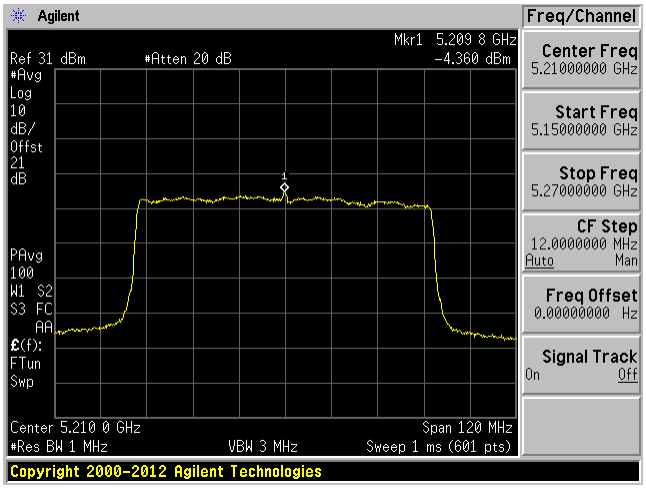
Chain #4




Chain #5




Chain #6



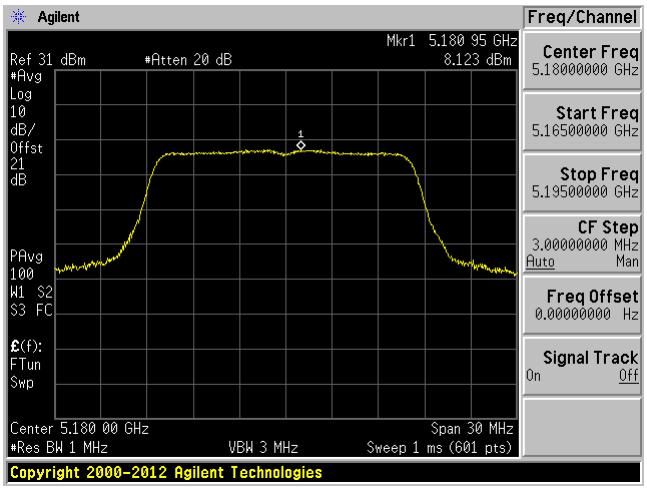
**Beamforming**

| Mode | Channel | Frequency MHz | Chain # | PSD (dBm/MHz) | Total PSD (dBm/MHz) | Limit (dBm/MHz) | Comment |
|---|---|---|---|---|---|---|---|
| 802.11a | 36 | 5180 | 4 | 8.123 | - | 16.76 | Pass |
| | 44 | 5220 | 4 | 8.926 | - | 16.76 | Pass |
| | 48 | 5240 | 4 | 8.894 | - | 16.76 | Pass |
| 802.11n20 | 36 | 5180 | 4 | 6.001 | 10.46 | 11.87 | Pass |
| | | | 5 | 5.797 | | | Pass |
| | | | 6 | 5.221 | | | Pass |
| | 44 | 5220 | 4 | 6.432 | 11.07 | 11.87 | Pass |
| | | | 5 | 6.481 | | | Pass |
| | | | 6 | 5.951 | | | Pass |
| | 48 | 5240 | 4 | 6.699 | 11.02 | 11.87 | Pass |
| | | | 5 | 6.205 | | | Pass |
| | | | 6 | 5.802 | | | Pass |
| 802.11ac20 | 36 | 5180 | 4 | 5.763 | 10.33 | 11.87 | Pass |
| | | | 5 | 5.678 | | | Pass |
| | | | 6 | 5.203 | | | Pass |
| | 44 | 5220 | 4 | 6.7 | 11.08 | 11.87 | Pass |
| | | | 5 | 6.385 | | | Pass |
| | | | 6 | 5.798 | | | Pass |
| | 48 | 5240 | 4 | 6.647 | 11.08 | 11.87 | Pass |
| | | | 5 | 6.374 | | | Pass |
| | | | 6 | 5.874 | | | Pass |
| 802.11n40 | 38 | 5190 | 4 | -1.257 | 3.12 | 11.87 | Pass |
| | | | 5 | -1.379 | | | Pass |
| | | | 6 | -2.423 | | | Pass |
| | 46 | 5230 | 4 | 5.809 | 10.14 | 11.87 | Pass |
| | | | 5 | 5.437 | | | Pass |
| | | | 6 | 4.8 | | | Pass |
| 802.11ac40 | 38 | 5190 | 4 | -1.322 | 3.29 | 11.87 | Pass |
| | | | 5 | -1.319 | | | Pass |
| | | | 6 | -1.836 | | | Pass |
| | 46 | 5230 | 4 | 5.486 | 10.19 | 11.87 | Pass |
| | | | 5 | 5.735 | | | Pass |
| | | | 6 | 5.016 | | | Pass |
| 802.11ac80 | 42 | 5210 | 4 | -5.902 | -0.67 | 11.87 | Pass |
| | | | 5 | -5.366 | | | Pass |
| | | | 6 | -5.104 | | | Pass |

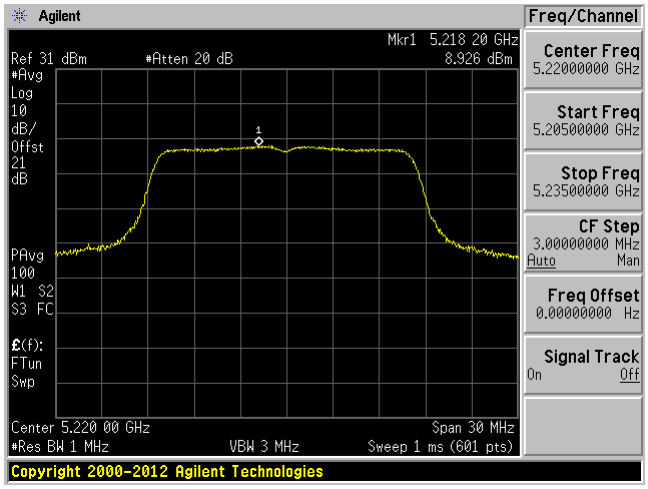
Please refer to the following plots.

802.11a mode

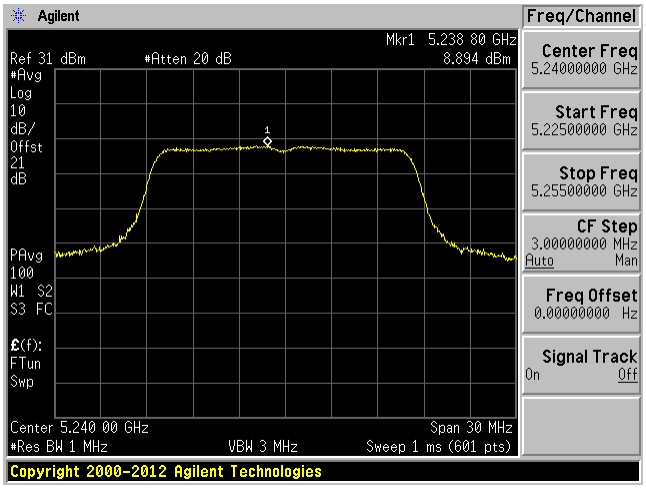
802.11a mode Low Channel 5180MHz




802.11a mode Middle Channel 5220MHz

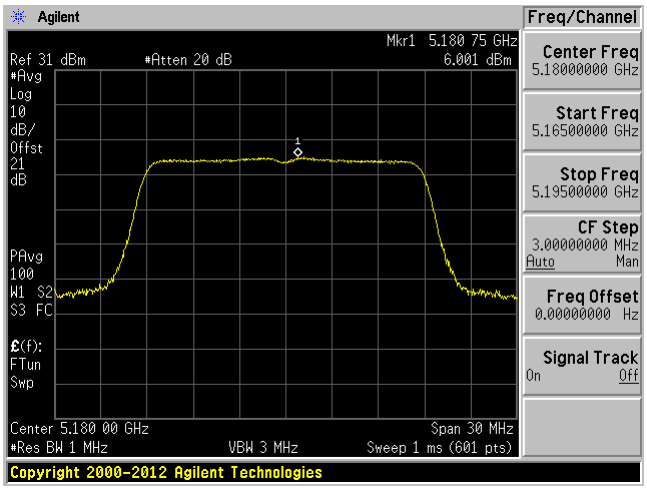



802.11a mode High Channel 5240MHz

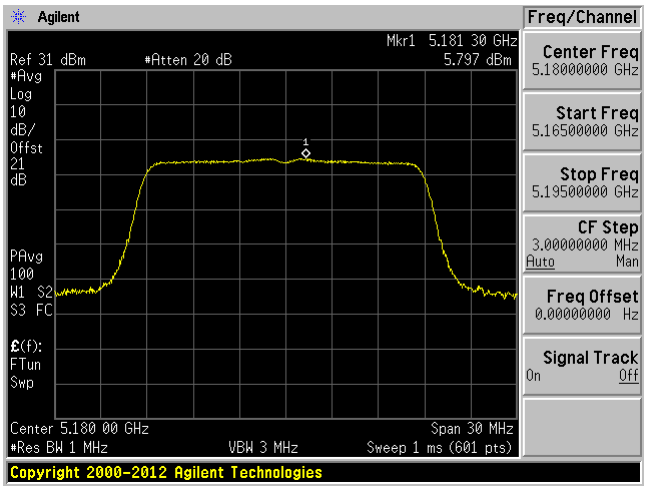


802.11n20 mode Low Channel 5180MHz

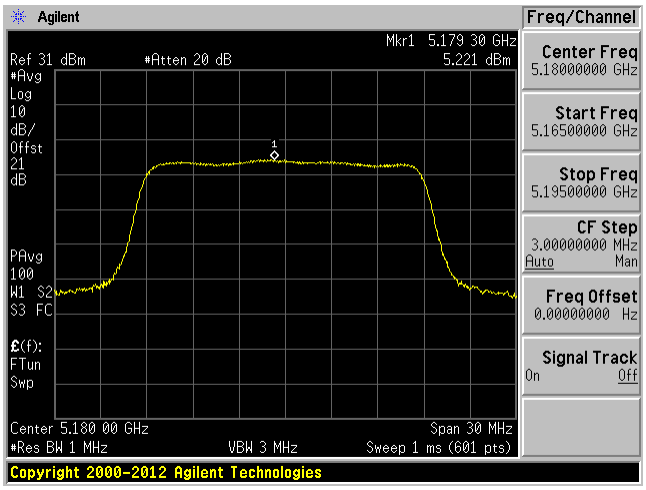
Chain #4




Chain #5

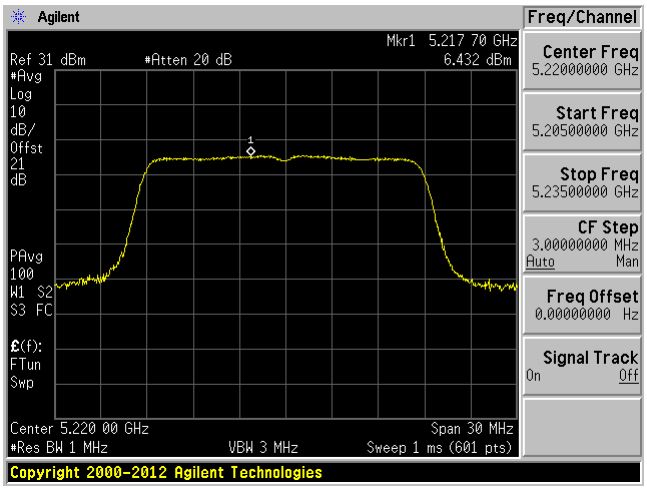



Chain #6

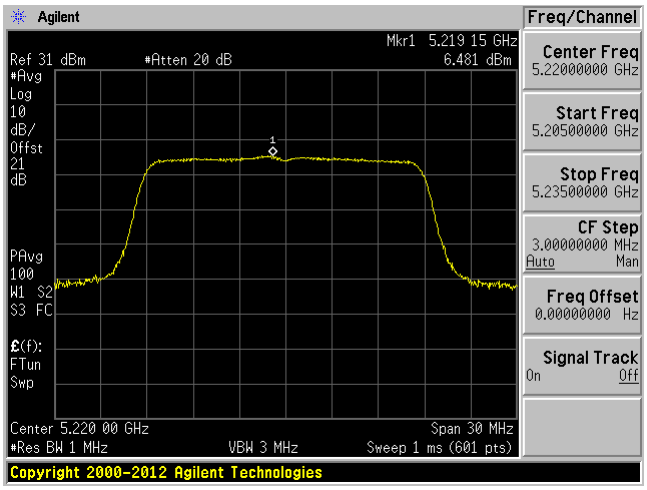


802.11n20 mode Middle Channel 5220MHz

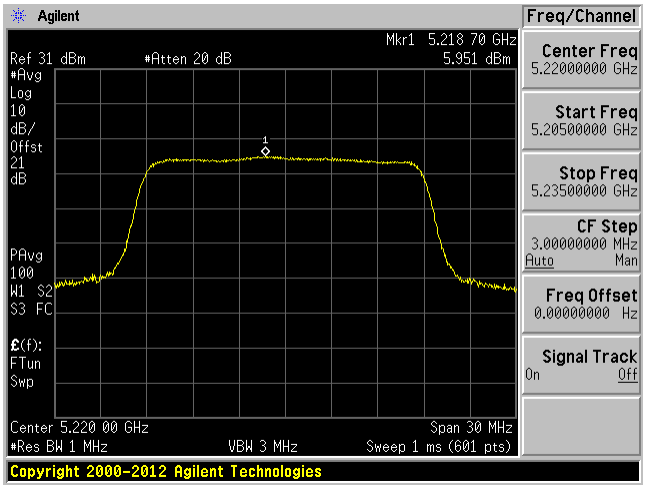
Chain #4




Chain #5

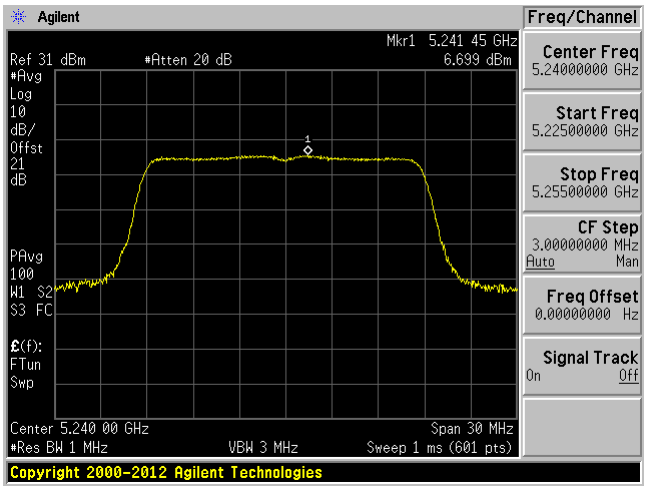



Chain #6

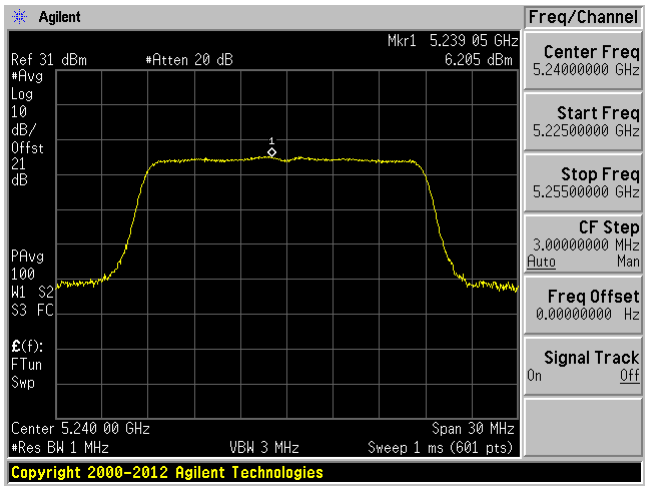


802.11n20 mode High Channel 5240MHz

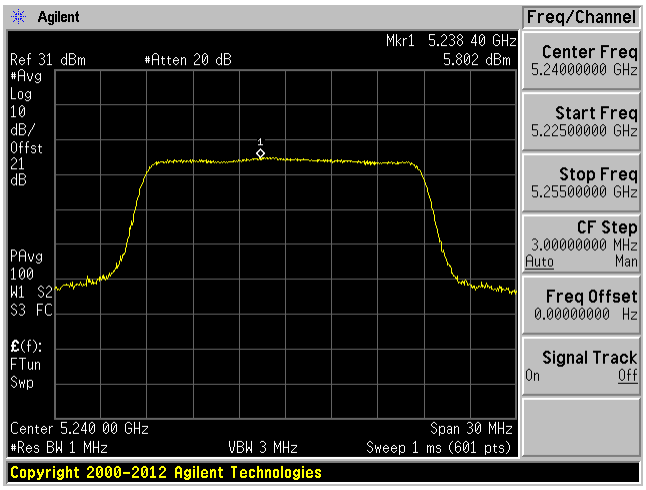
Chain #4




Chain #5

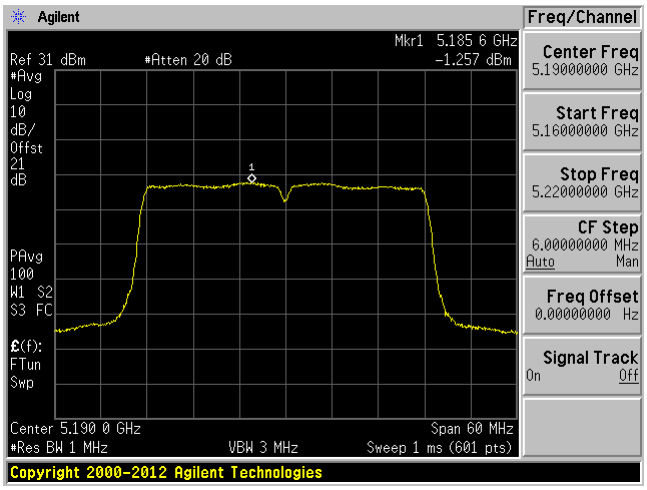



Chain #6

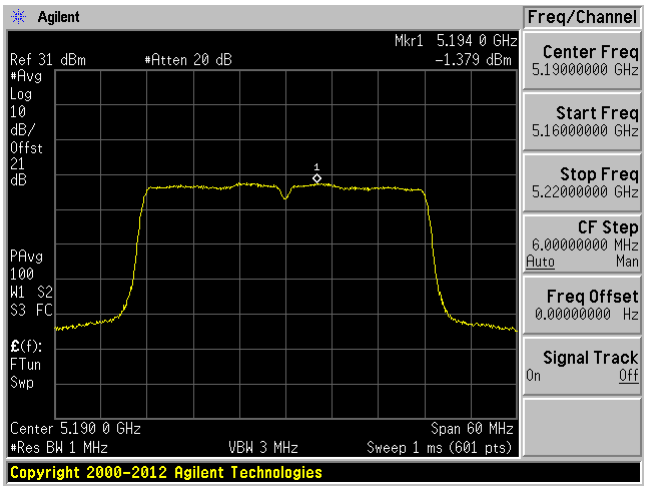


802.11n40 mode Low Channel 5190MHz

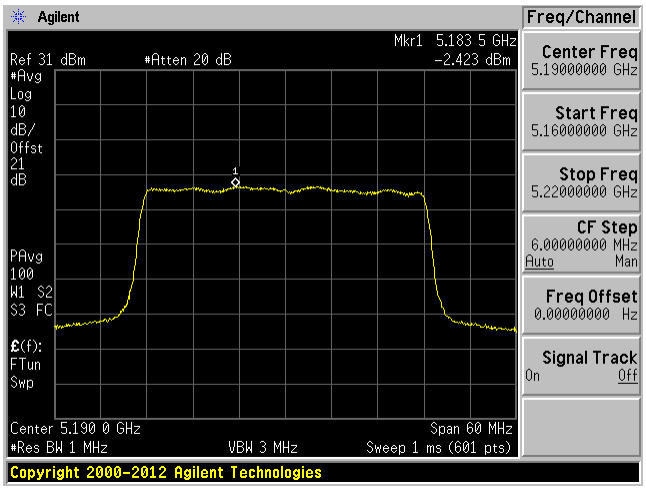
Chain #4




Chain #5

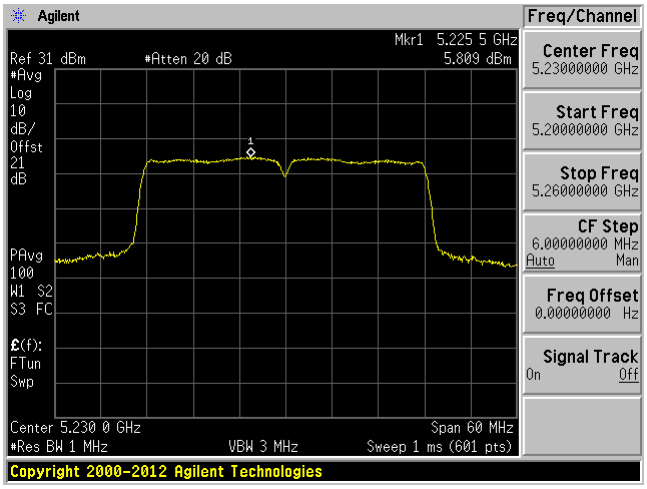



Chain #6

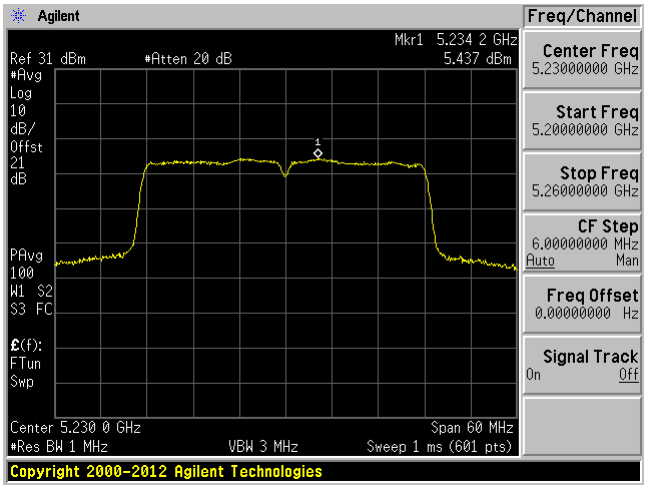


802.11n40 mode High Channel 5230MHz

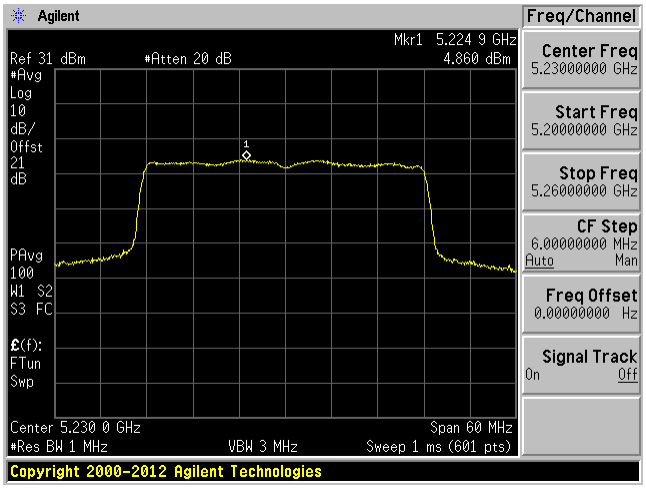
Chain #4




Chain #5

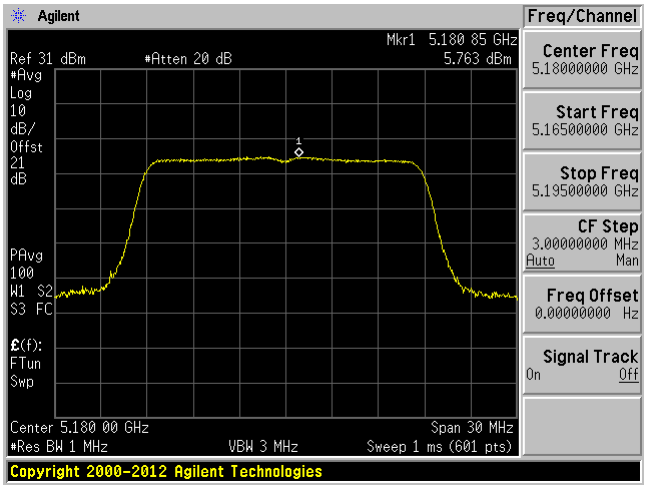



Chain #6

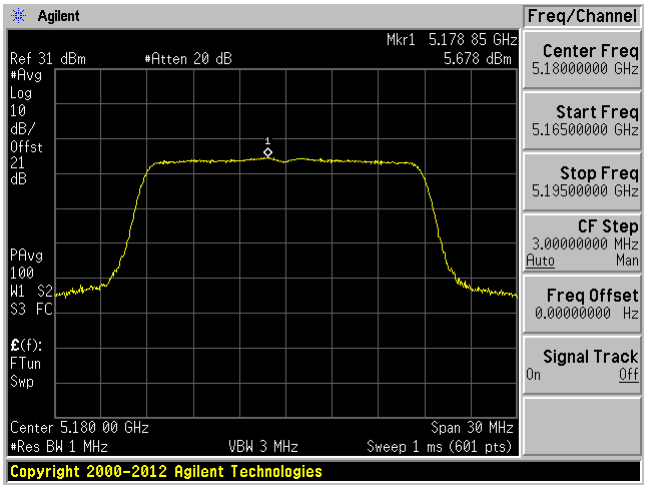


802.11ac20 mode Low Channel 5180MHz

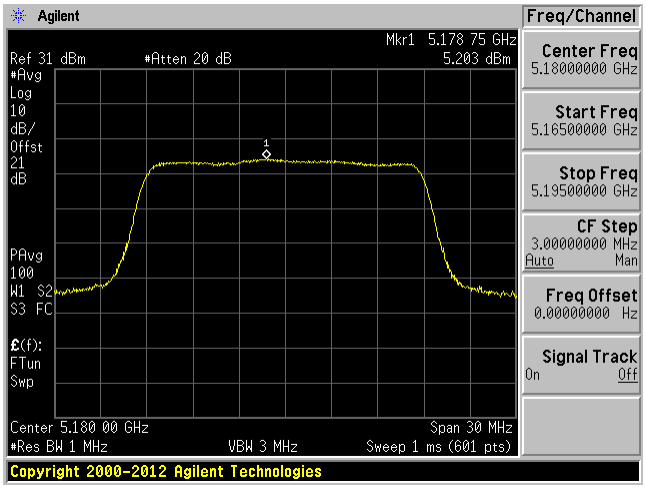
Chain #4




Chain #5

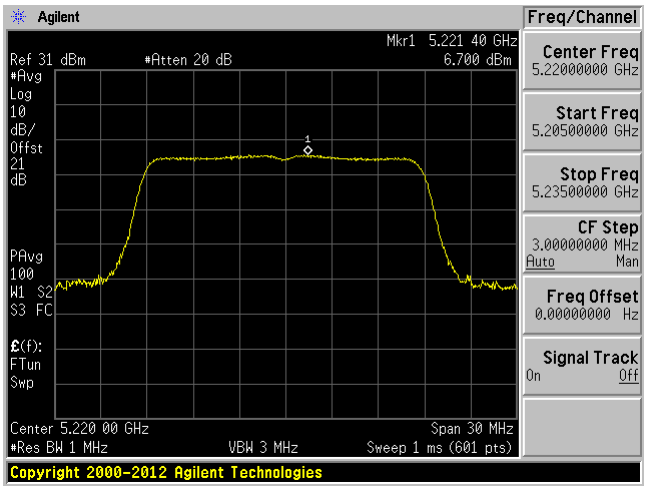



Chain #6

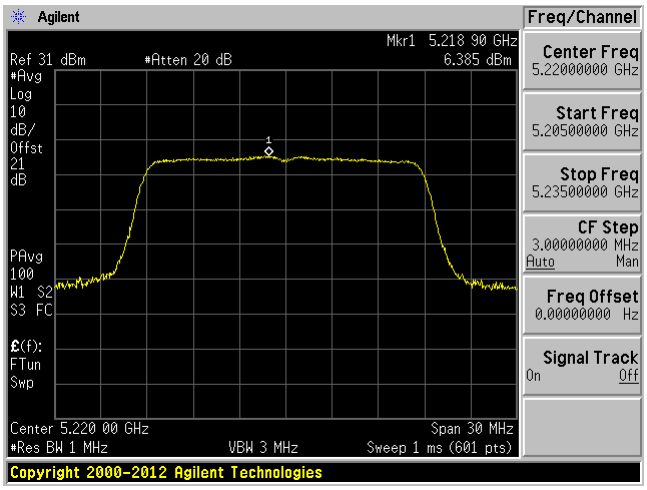


802.11ac20 mode Middle Channel 5220MHz

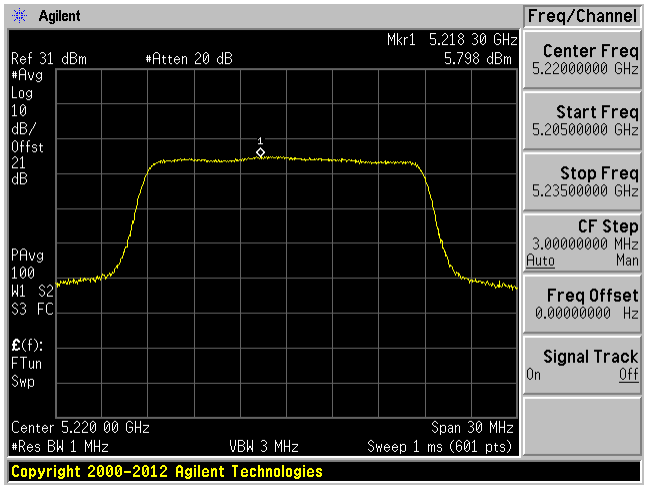
Chain #4




Chain #5

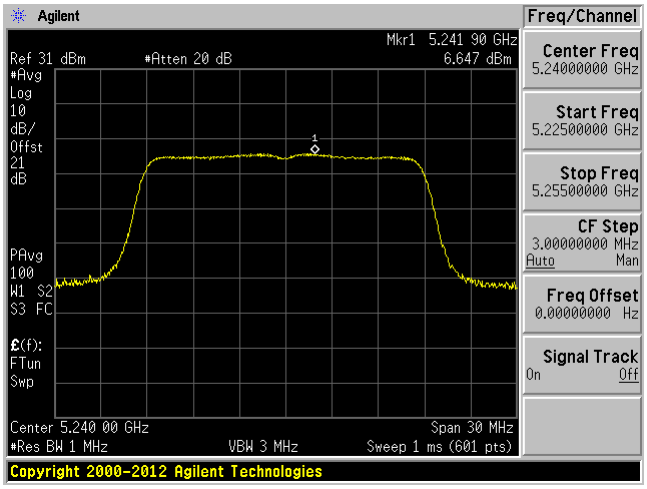



Chain #6



802.11ac20 mode High Channel 5240MHz

Chain #4

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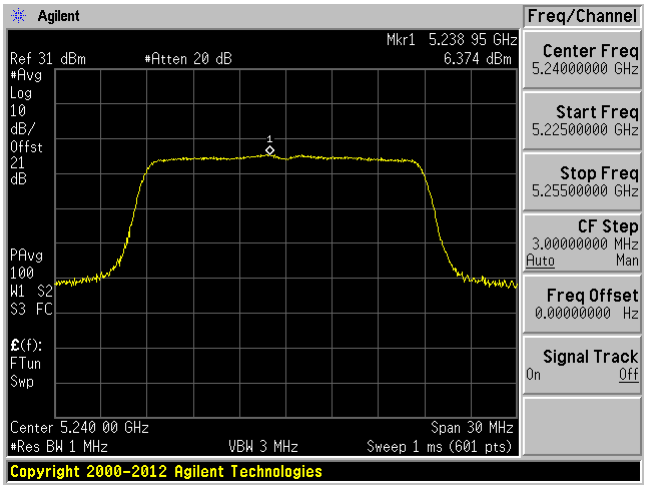


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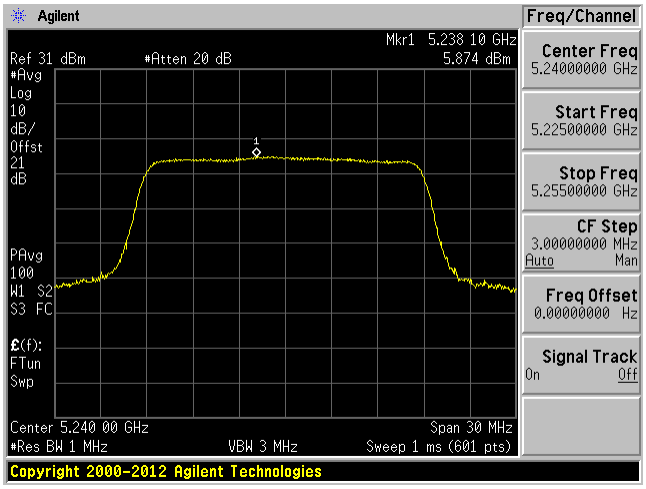
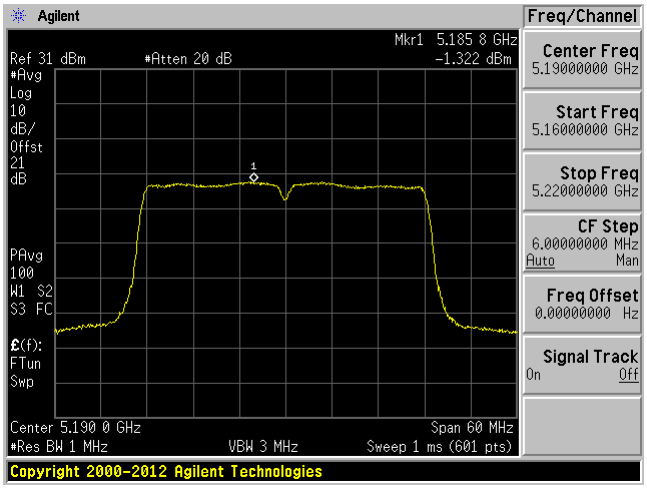


802.11ac40 mode Low Channel 5190MHz

Chain #4

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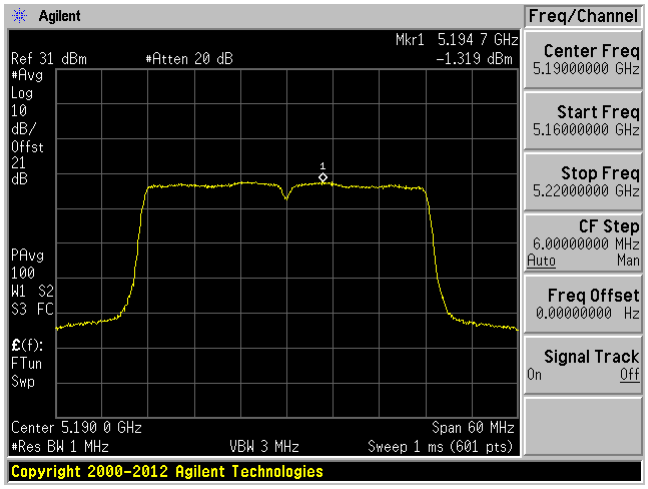


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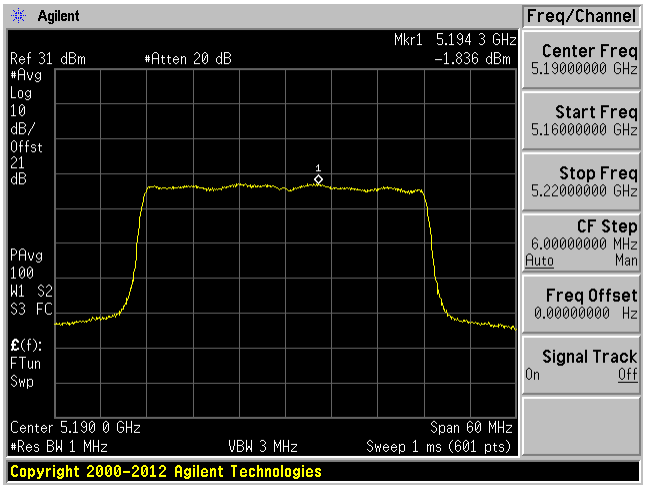
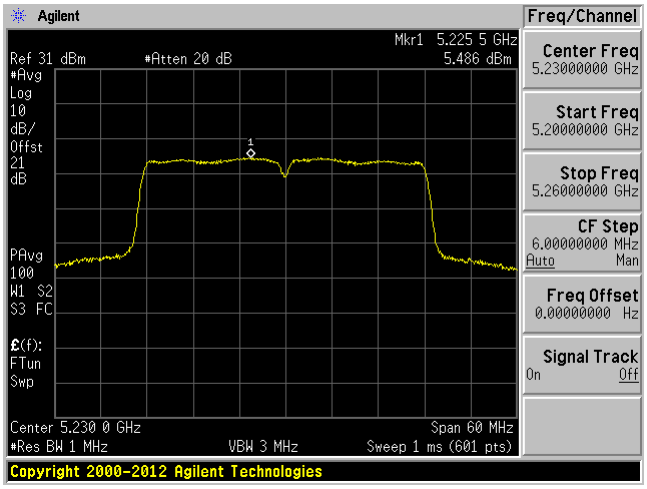
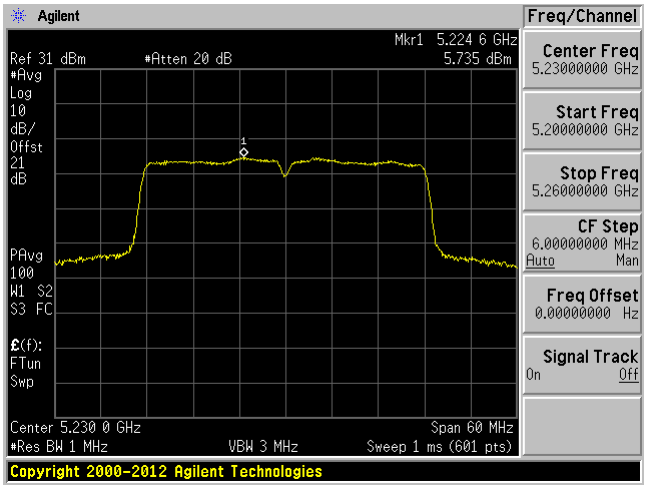


802.11ac40 mode High Channel 5230MHz

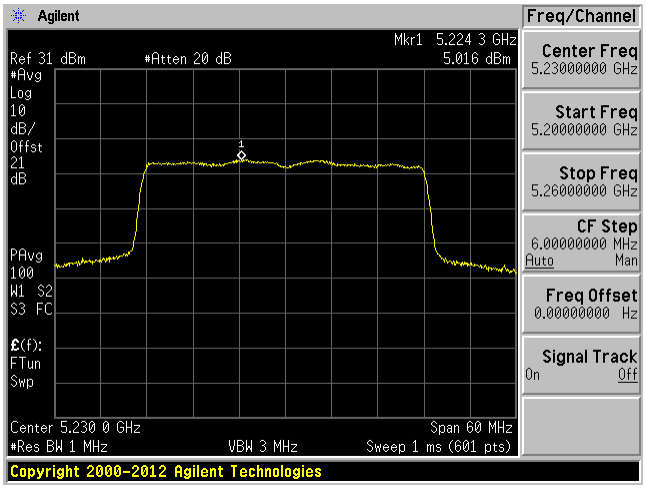
Chain #4




Chain #5

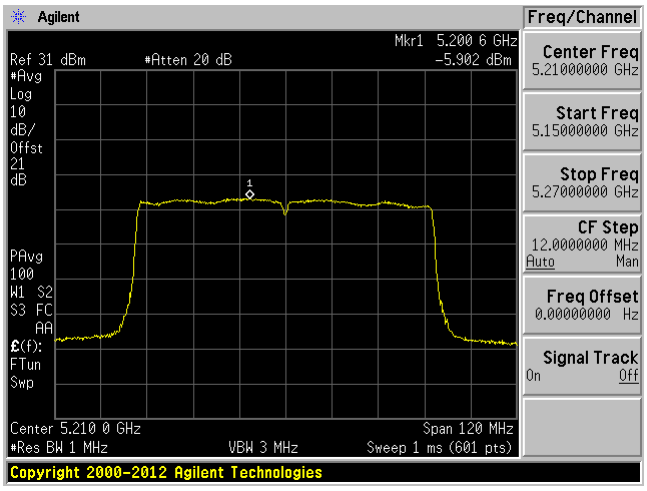



Chain #6

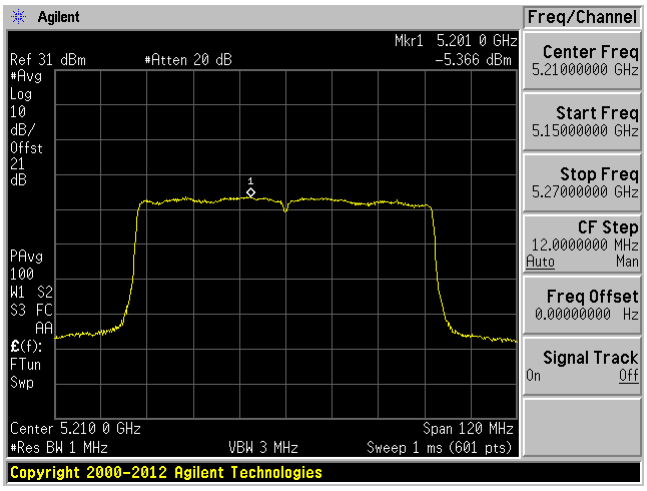


802.11ac80 mode 5210MHz

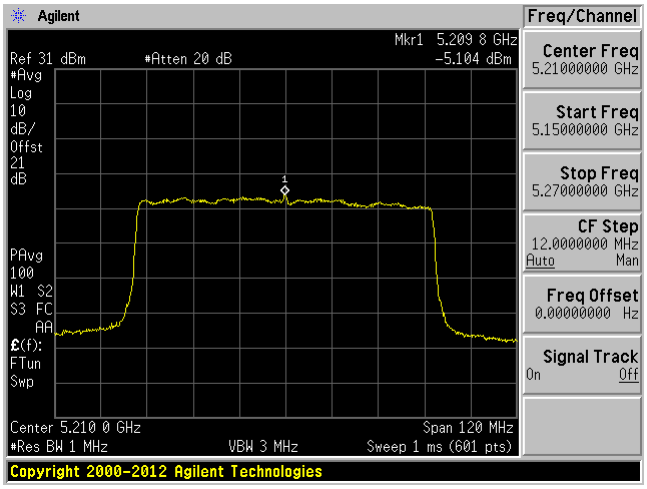
Chain #4




Chain #5




Chain #6



# 11 §15.407(b) - Out of Band Emissions

## 11.1 Applicable Standards

According to FCC §15.407(b):

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

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

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

For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.
The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

The provisions of §15.205 apply to intentional radiators operating under this section.

## 11.2 Measurement Procedure

Add a correction factor (antenna gain+ Attenuator loss+cable loss) to the offset of the spectrum analyzer.
Integration Method

1. For peak emissions measurements, follow the procedures described in section H)5), “Procedures for Peak Unwanted Emissions Measurements above 1000 MHz”, except for the following changes:

- Set RBW = 100 kHz
- Set VBW = 3RBW
- Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured. CAUTION: You must ensure that the spectrum analyzer or EMI receiver is set for peak-detection and max-hold for this measurement.

2. For average emissions measurements, follow the procedures described in section H)6), “Procedures for Average Unwanted Emissions Measurements above 1000 MHz”, except for the following changes:

- Set RBW = 100 kHz
- Set VBW = 3RBW
- Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured.

## 11.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4440A | MY44303352 | 2015-06-22 | 1 year |
| - | 20dB attenuator | - | - | Each time[1] | N/A |
| Rohde & Schwarz | Signal Analyzer | FSQ26 | 200749 | 2016-03-24 | 1 year |

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
***Statement of Traceability: BACL Corp.*** *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

## 11.4 Test Environmental Conditions

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

*The testing was performed by Jin Yang on 2016-04-15 at RF site.*

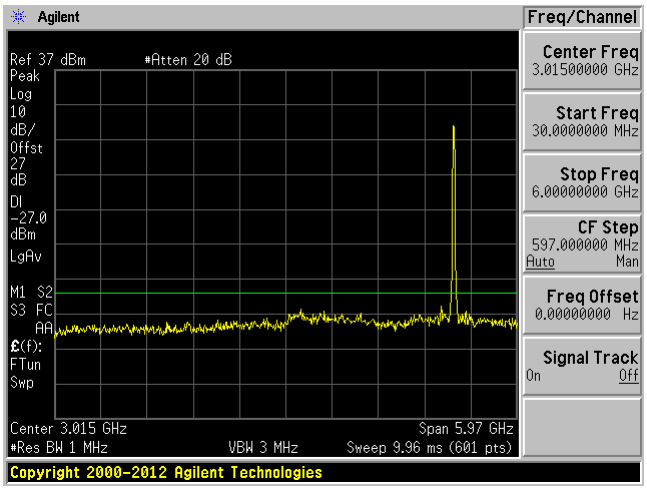
## 11.5 Test Results

**Note 1:** After pre-testing, the non-beamforming mode is the worst case; therefore the report only includes the test results of non-beamforming mode.
**Note 2:** 802.11a mode only transmits signal through antenna 4.

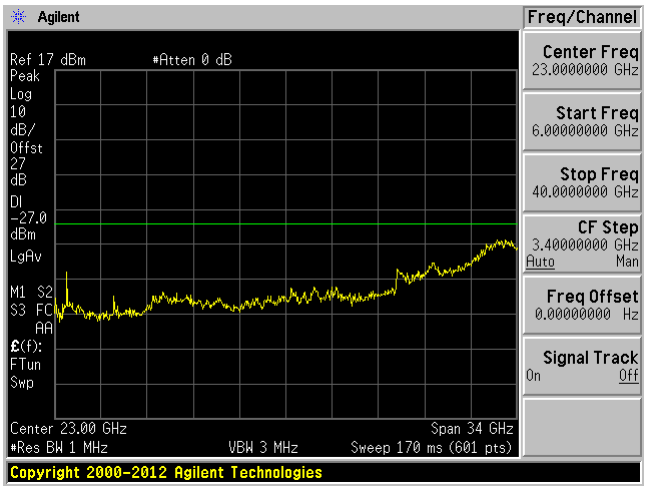
## 1) Out-of-band spurious emission

### 802.11a mode chain 4

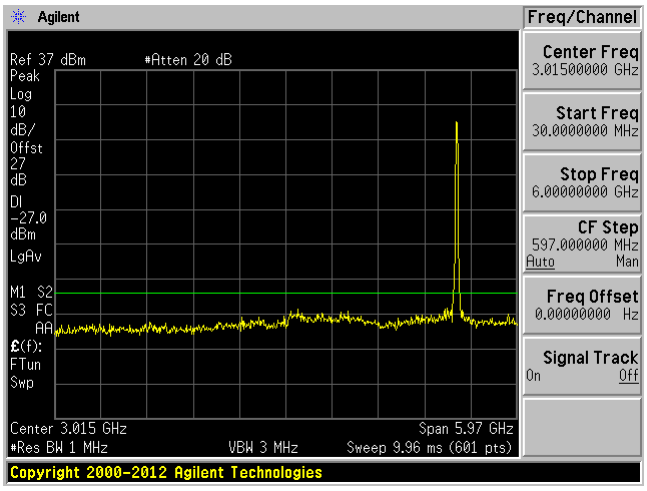
Low Channel 5180MHz (30MHz-6GHz)



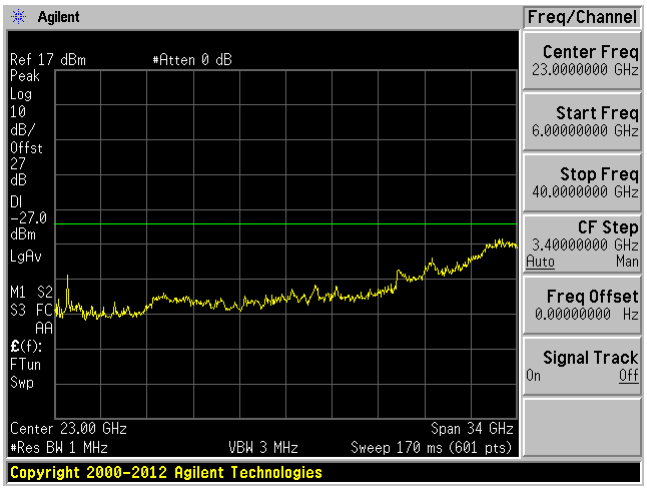

Low Channel 5180 MHz (6-40GHz)



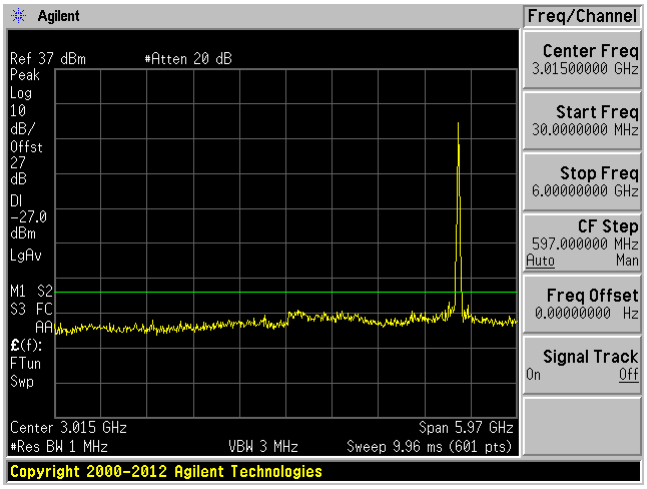

Middle Channel 5220MHz (30MHz-6GHz)



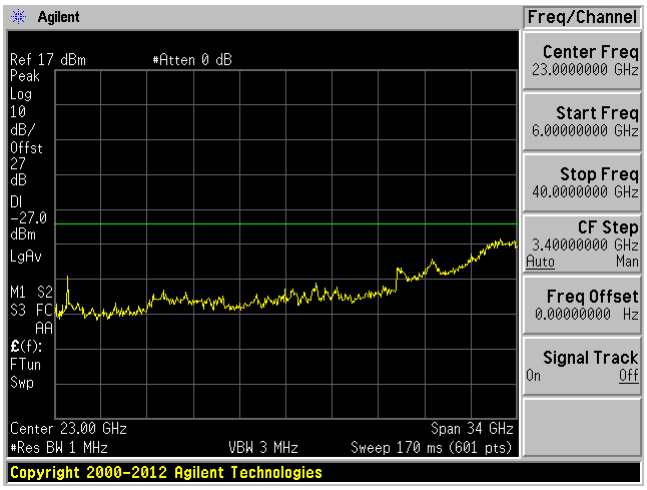

Middle Channel 5220 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

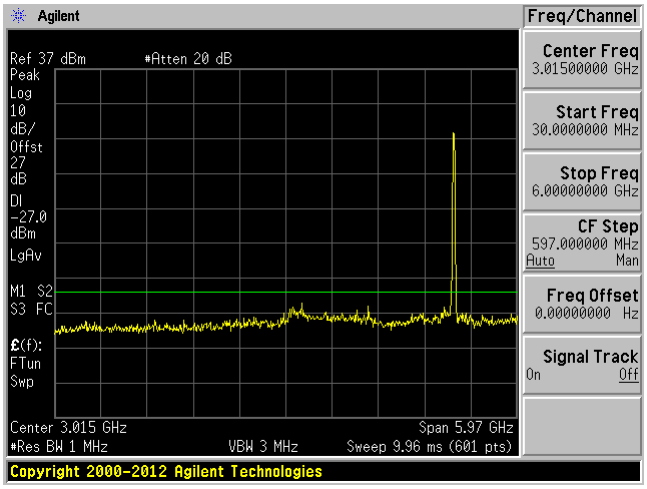



High Channel 5240 MHz (6-40GHz)

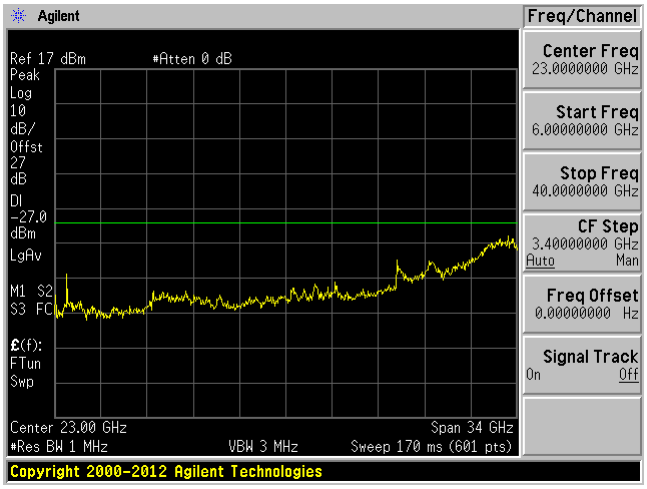


**802.11n20 mode chain 4**

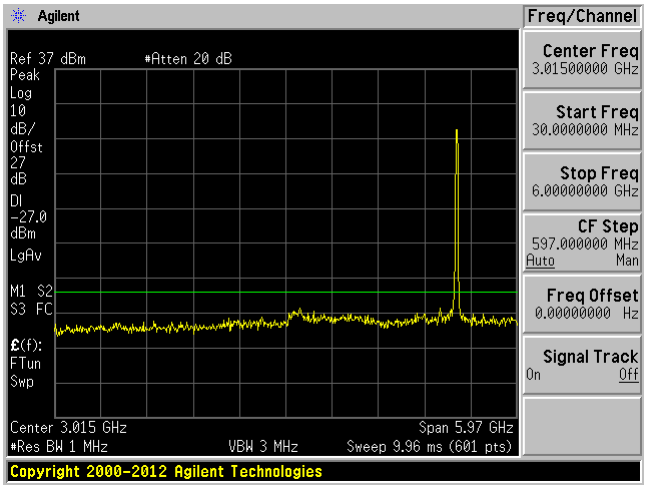
Low Channel 5180MHz (30MHz-6GHz)



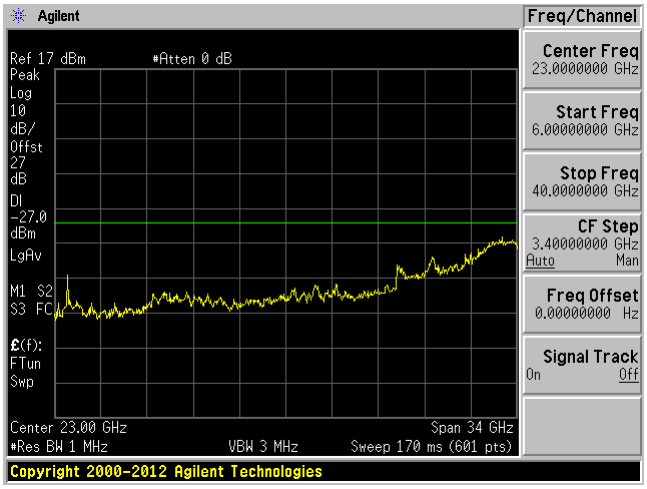

Low Channel 5180 MHz (6-40GHz)



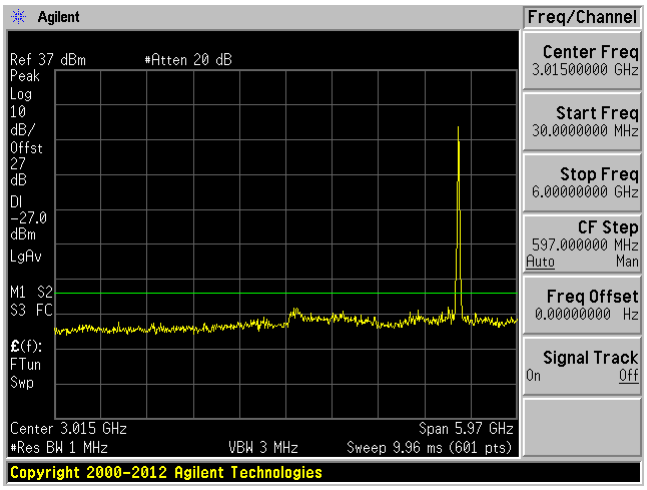

Middle Channel 5220MHz (30MHz-6GHz)



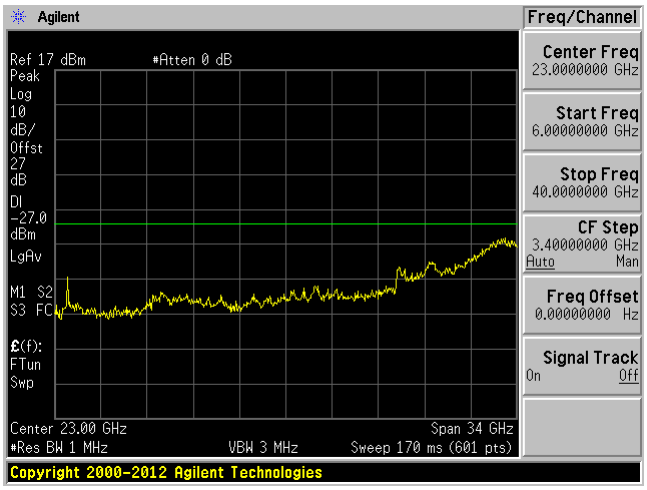

Middle Channel 5220 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

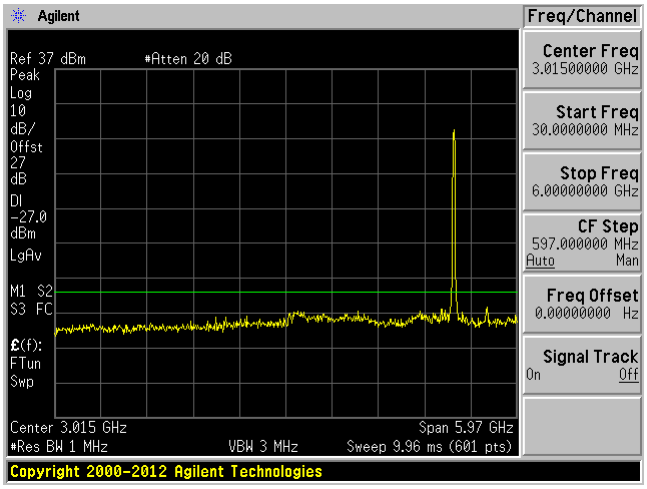



High Channel 5240 MHz (6-40GHz)

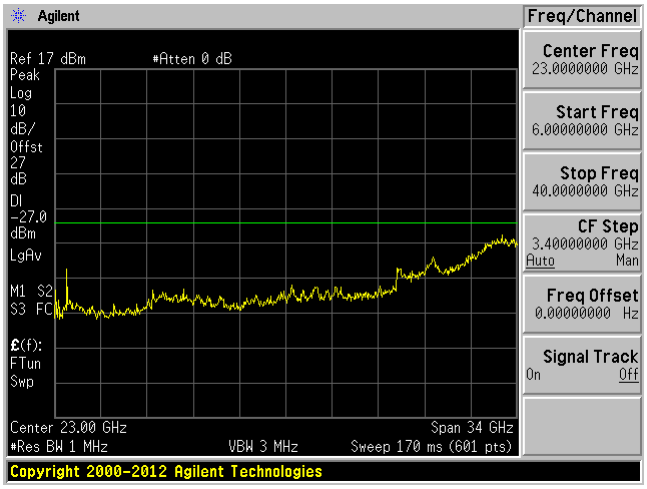



**802.11n20 mode chain 5**

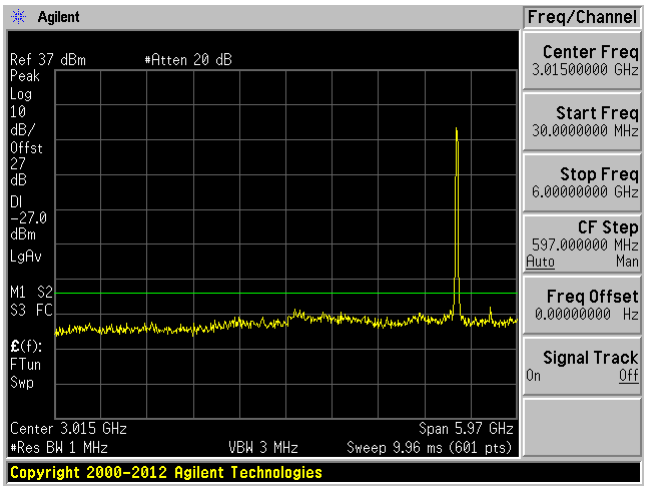
Low Channel 5180MHz (30MHz-6GHz)



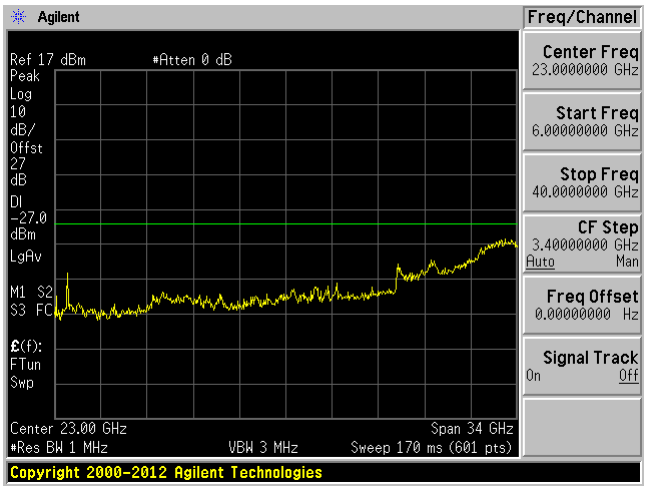

Low Channel 5180 MHz (6-40GHz)



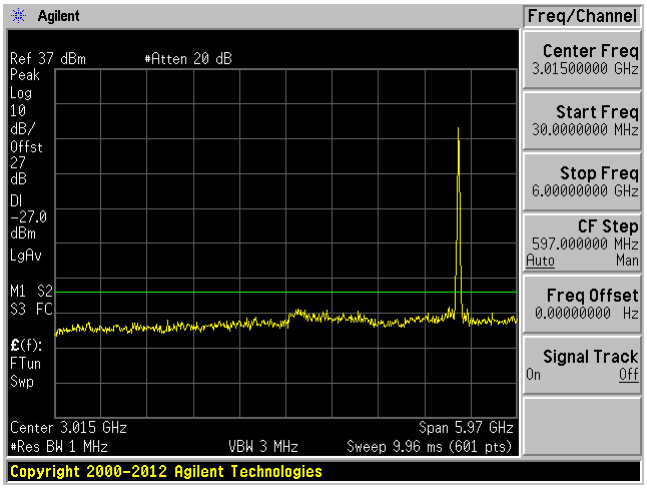
Middle Channel 5220MHz (30MHz-7GHz)



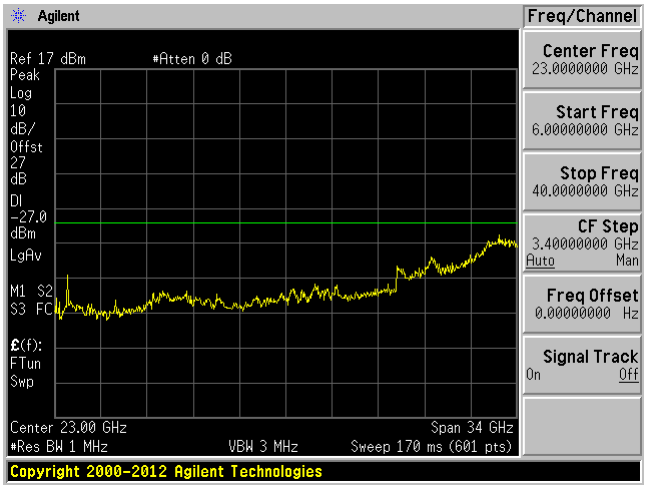

Middle Channel 5220 MHz (7-40GHz)




High Channel 5240MHz (30MHz-6GHz)

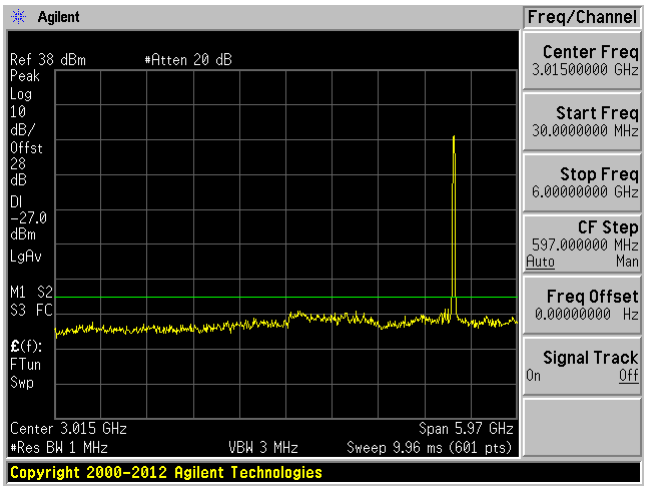



High Channel 5240 MHz (6-40GHz)

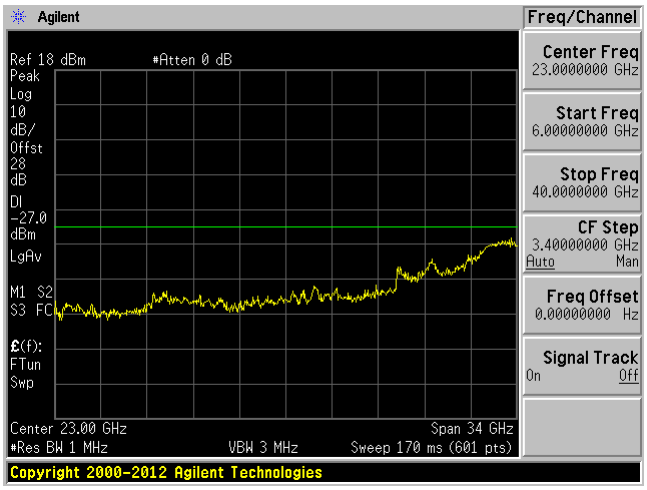


**802.11n20 mode chain 6**

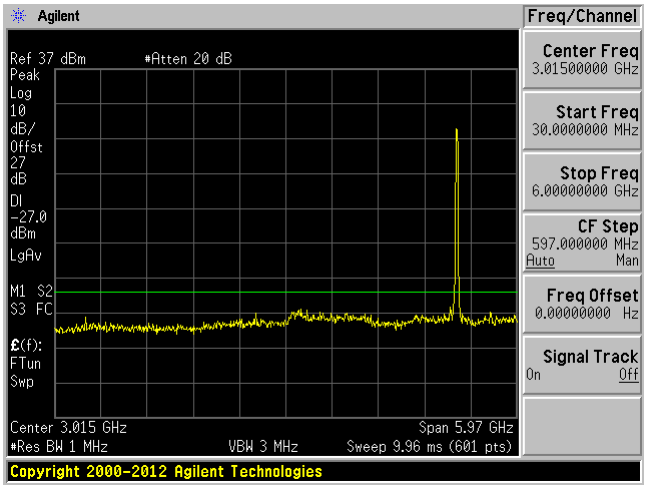
Low Channel 5180MHz (30MHz-6GHz)



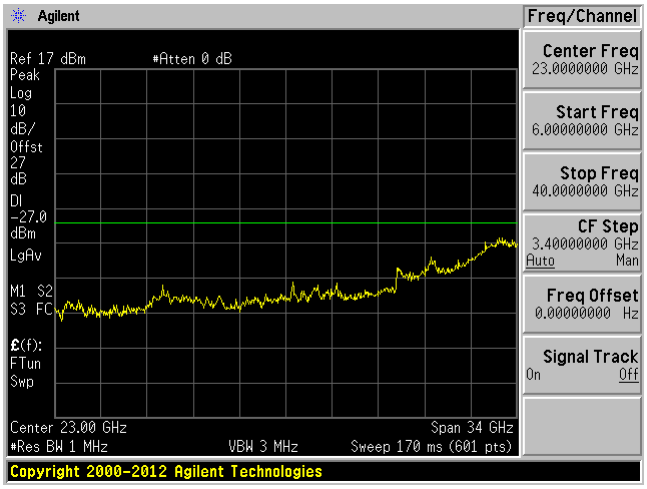

Low Channel 5180 MHz (6-40GHz)



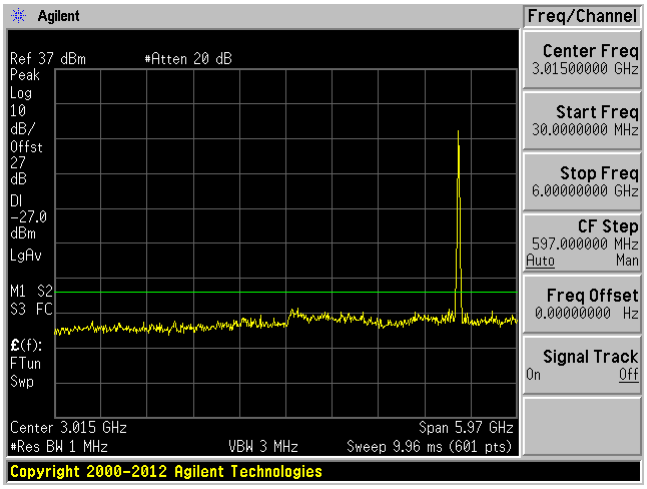

Middle Channel 5220MHz (30MHz-6GHz)



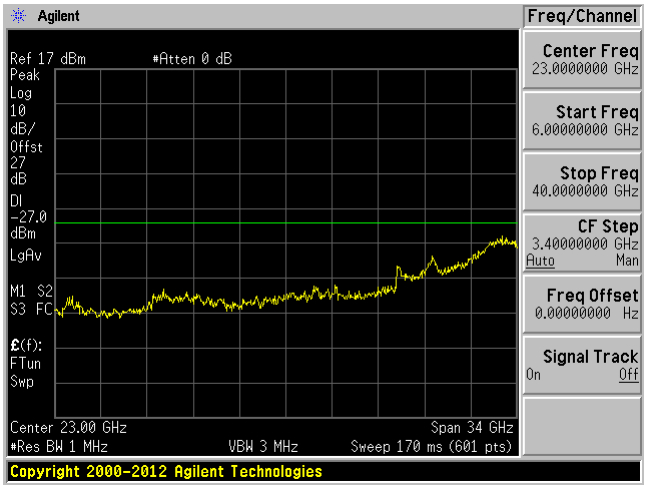

Middle Channel 5220 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

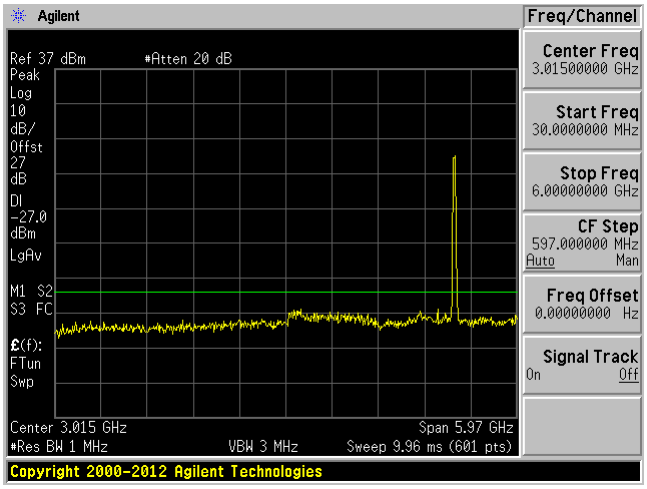



High Channel 5240 MHz (6-40GHz)

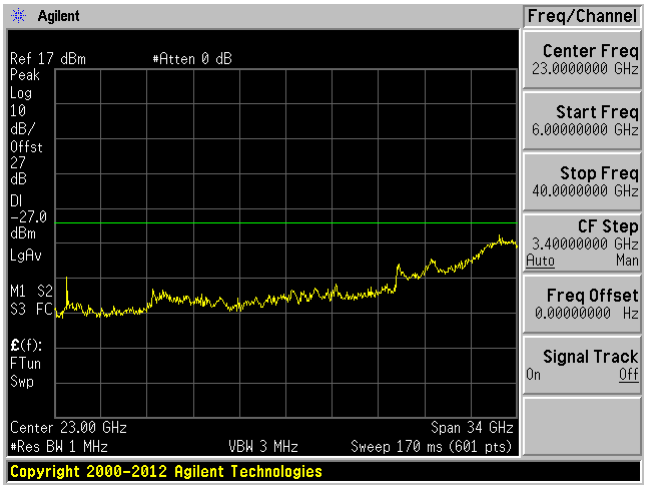


**802.11n40 mode chain 4**

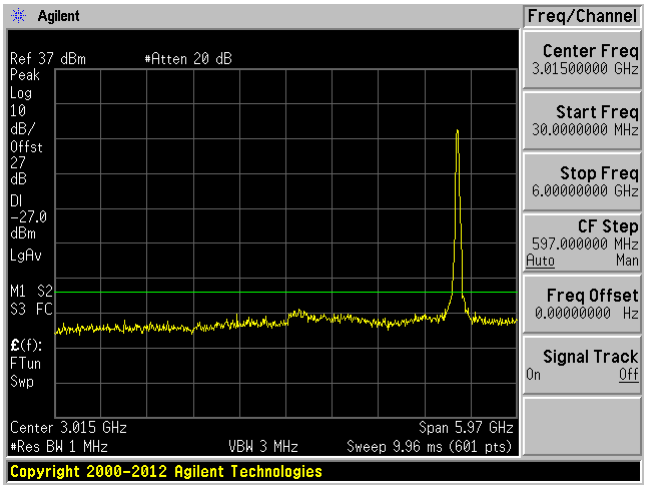
Low Channel 5190MHz (30MHz-6GHz)



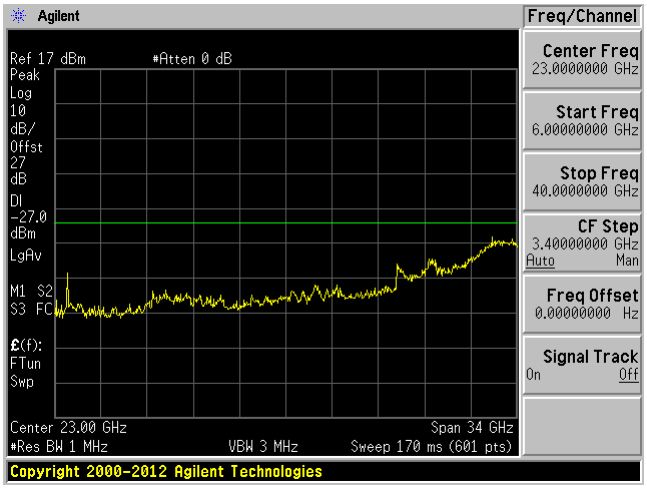

Low Channel 5190 MHz (6-40GHz)




High Channel 5230MHz (30MHz-6GHz)

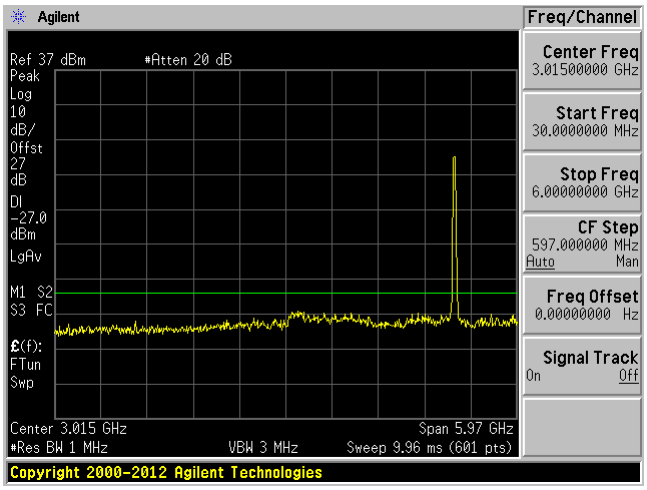



High Channel 5230 MHz (6-40GHz)

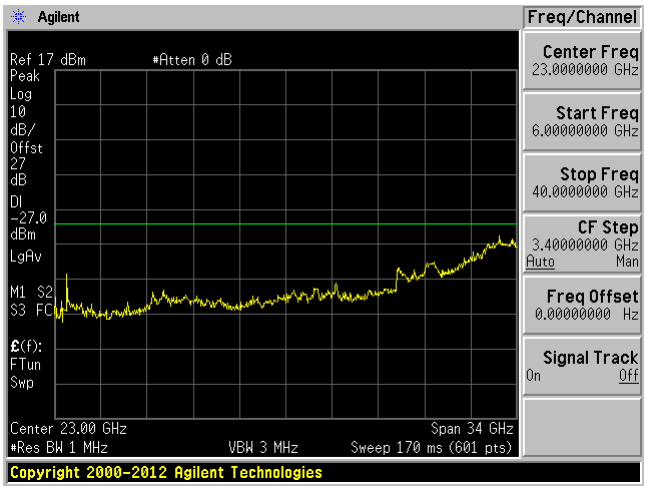


**802.11n40 mode chain 5**

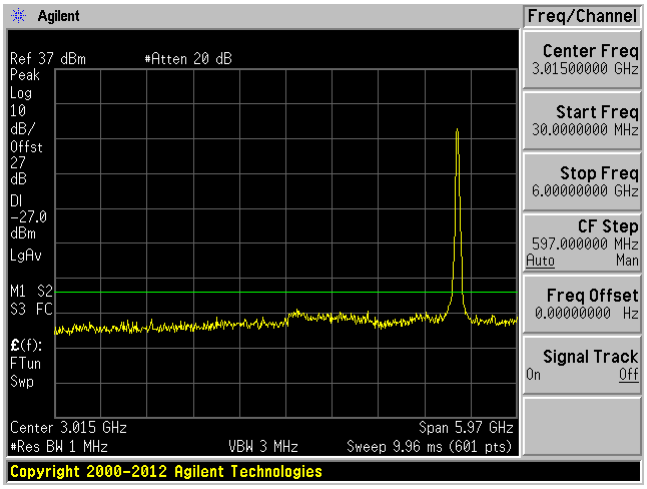
Low Channel 5190MHz (30MHz-6GHz)



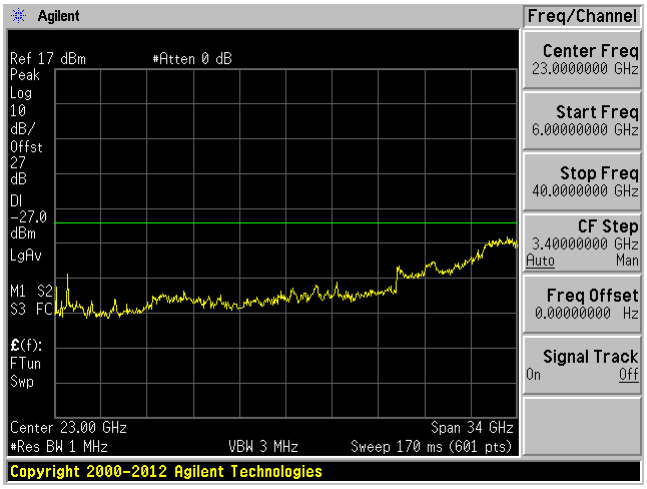

Low Channel 5190 MHz (6-40GHz)




High Channel 5230MHz (30MHz-6GHz)

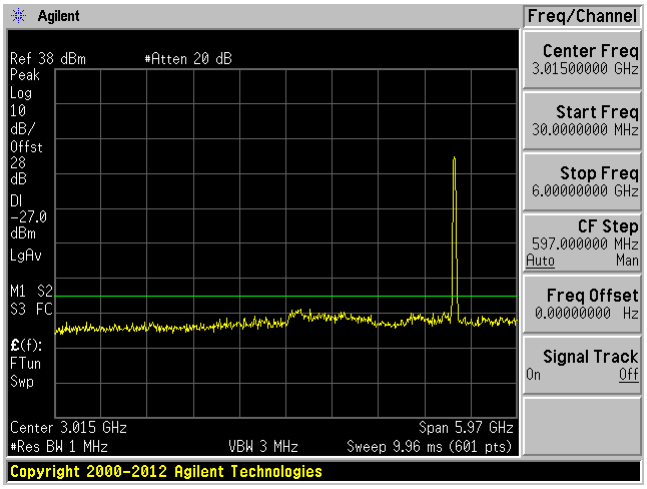



High Channel 5230 MHz (6-40GHz)

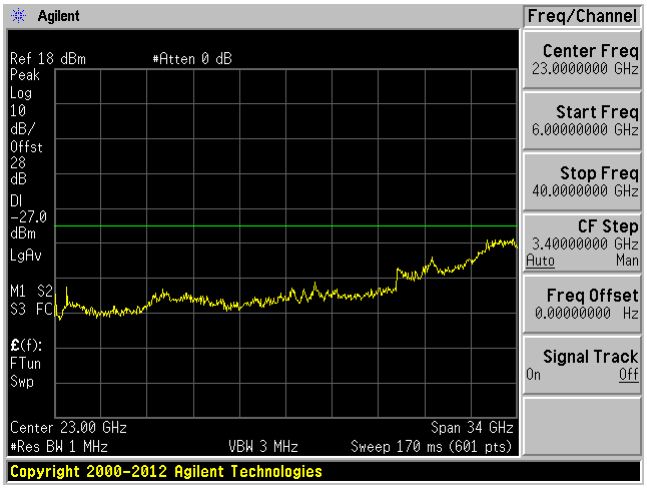


**802.11n40 mode chain 6**

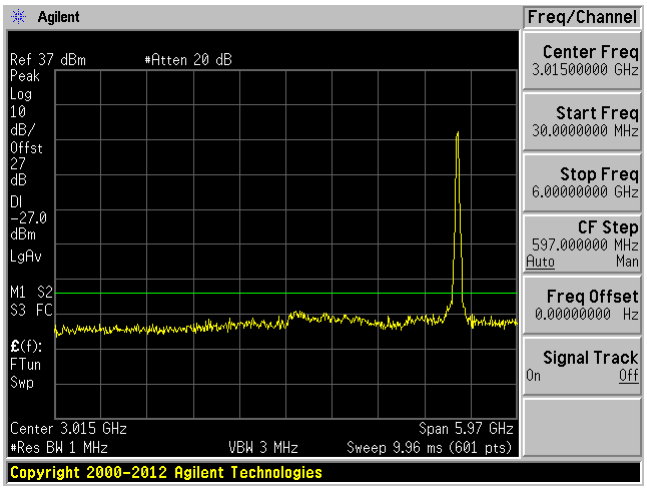
Low Channel 5190MHz (30MHz-6GHz)



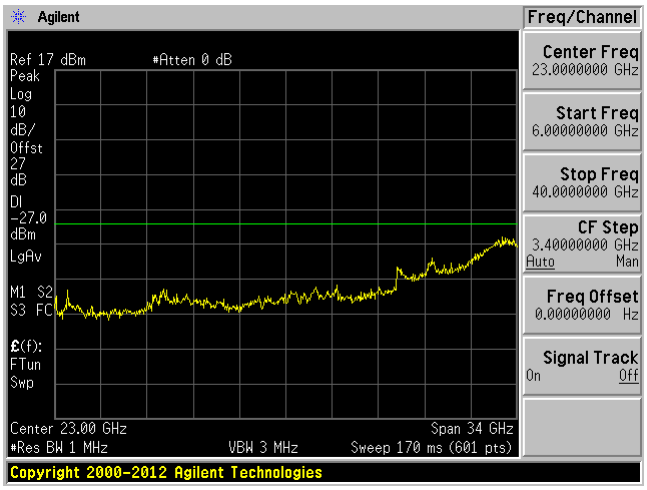

Low Channel 5190 MHz (6-40GHz)




High Channel 5230MHz (30MHz-6GHz)

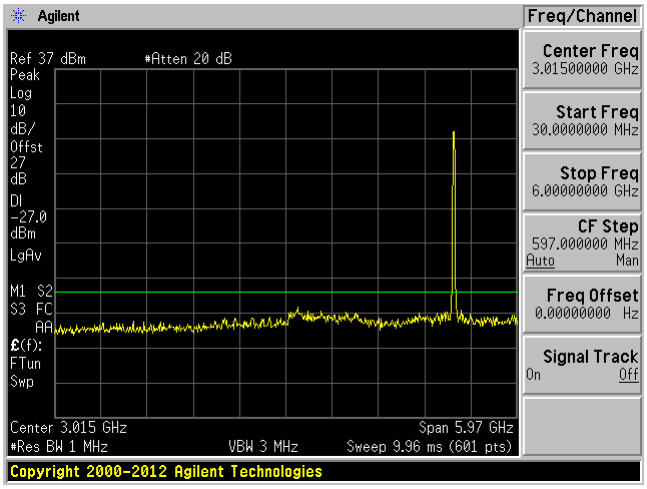



High Channel 5230 MHz (6-40GHz)

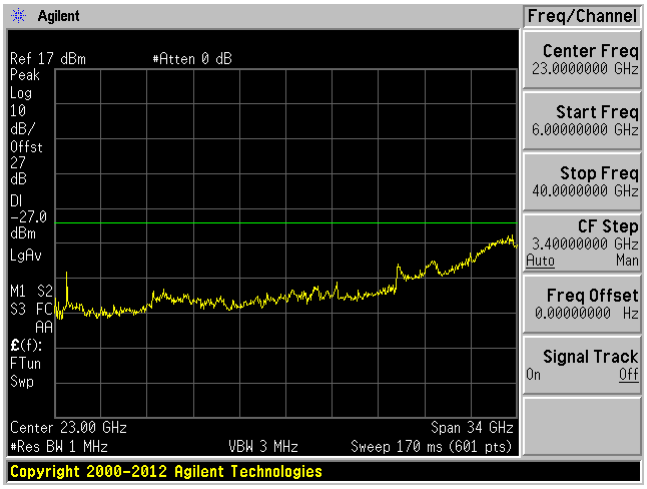


## 802.11ac20 mode chain 4

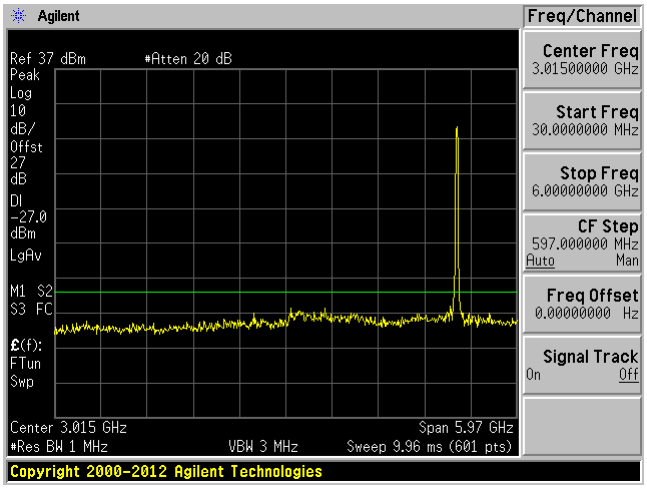
Low Channel 5180MHz (30MHz-6GHz)



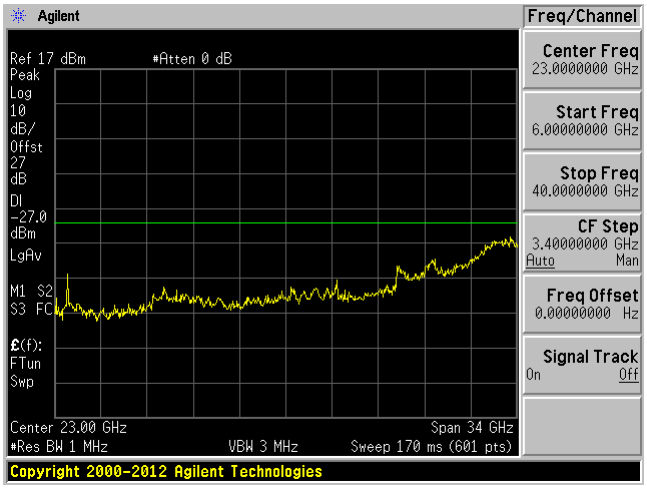

Low Channel 5180 MHz (6-40GHz)



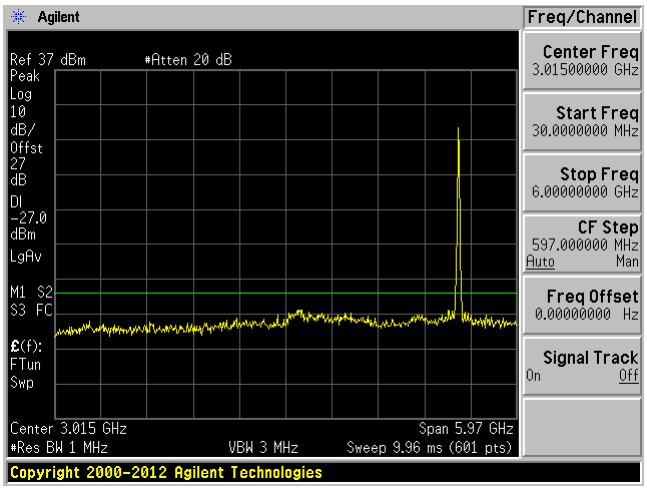

Middle Channel 5220MHz (30MHz-6GHz)



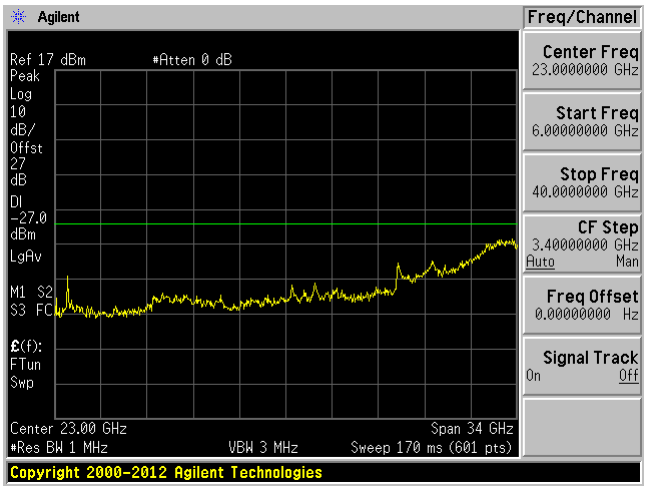

Middle Channel 5220 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

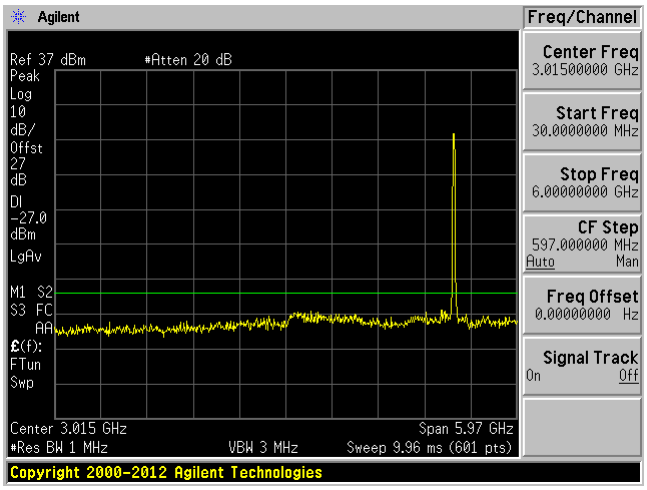



High Channel 5240 MHz (6-40GHz)

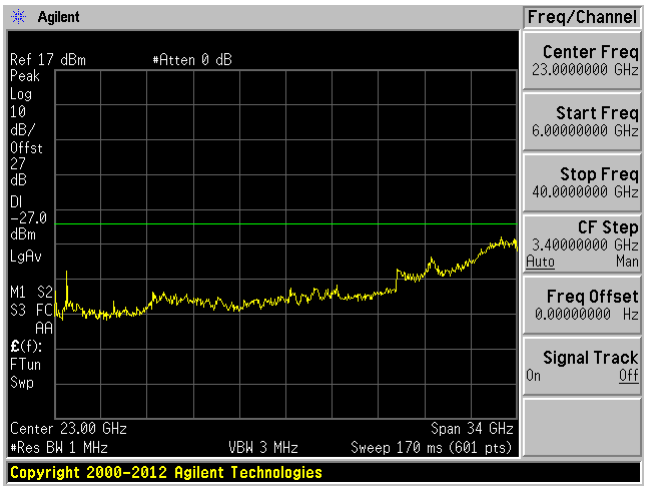



**802.11ac20 mode chain 5**

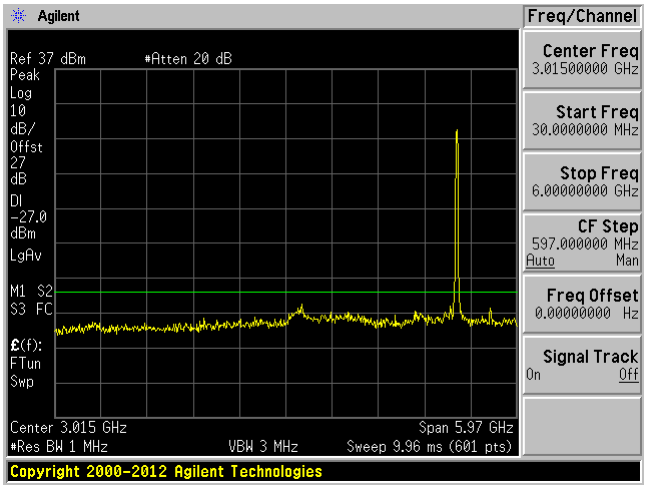
Low Channel 5180MHz (30MHz-6GHz)



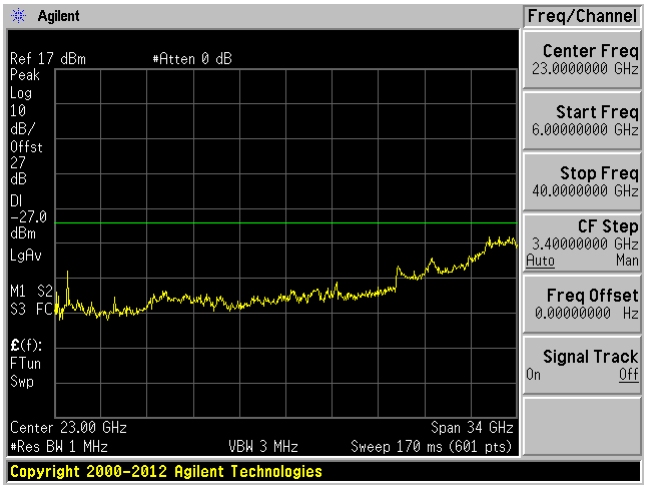

Low Channel 5180 MHz (6-40GHz)



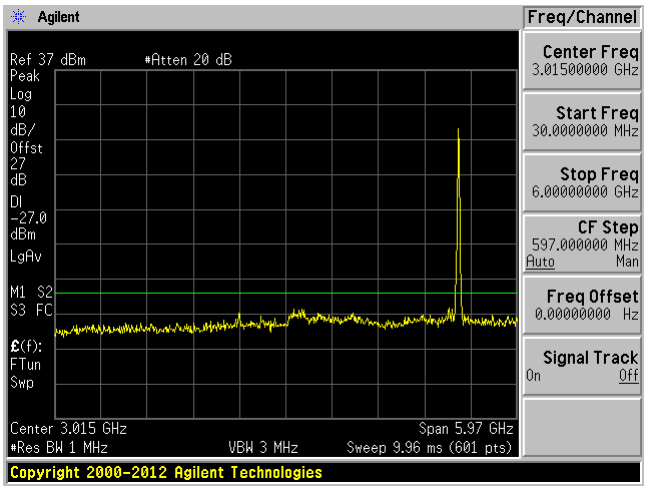
Middle Channel 5220MHz (30MHz-6GHz)



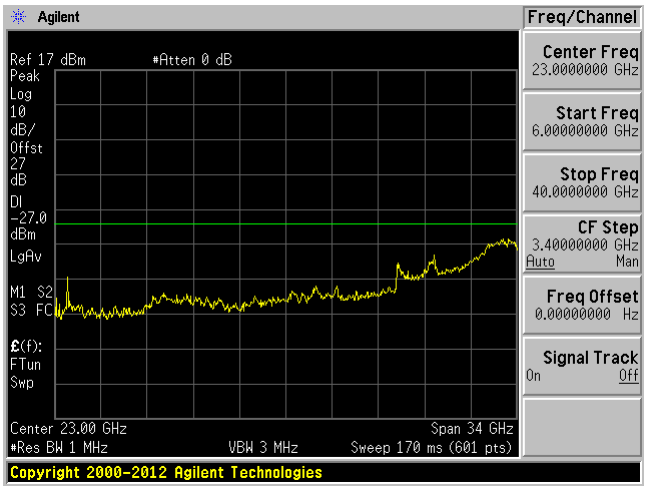

Middle Channel 5220 MHz (6-40GHz)




High Channel 5240MHz (30MHz-6GHz)

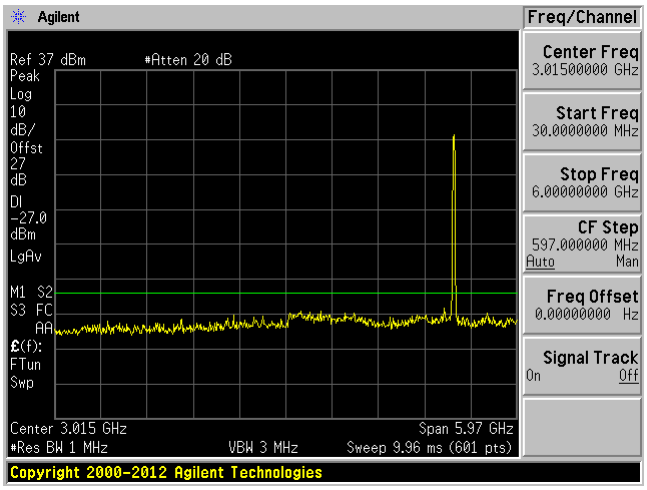



High Channel 5240 MHz (6-40GHz)

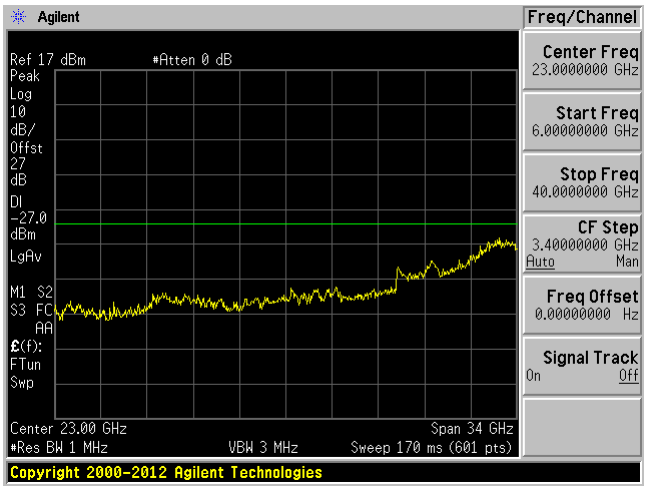


**802.11ac20 mode chain 6**

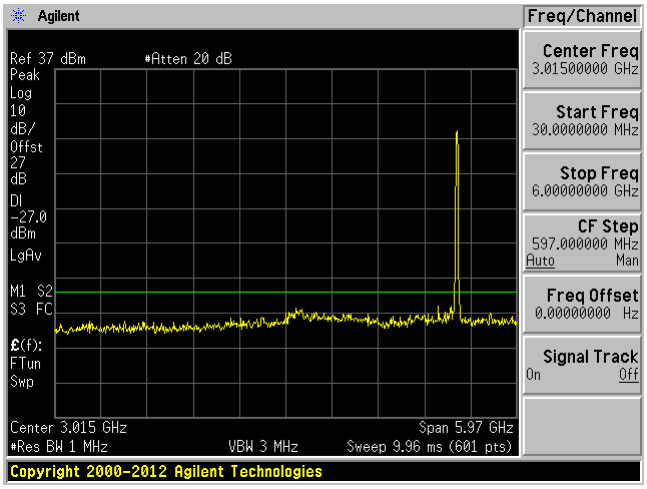
Low Channel 5180MHz (30MHz-6GHz)



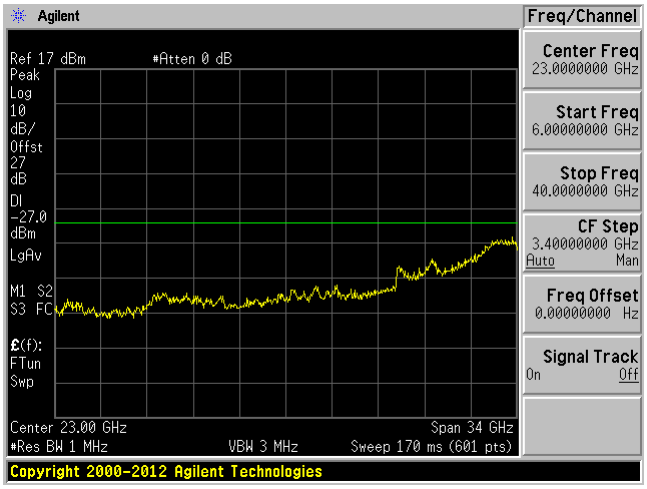

Low Channel 5180 MHz (6-40GHz)



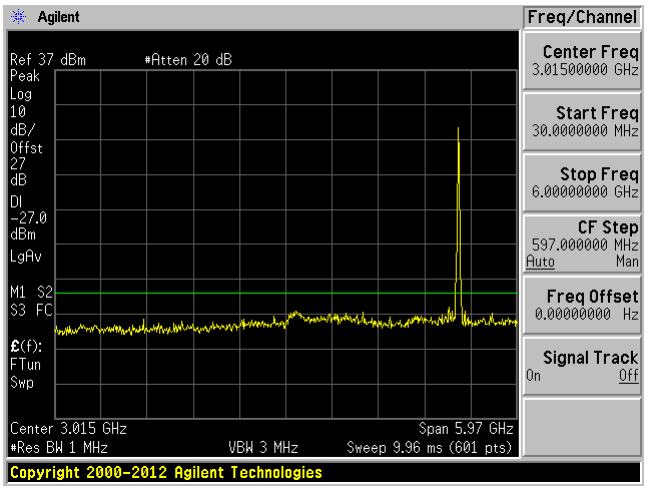

Middle Channel 5220MHz (30MHz-6GHz)



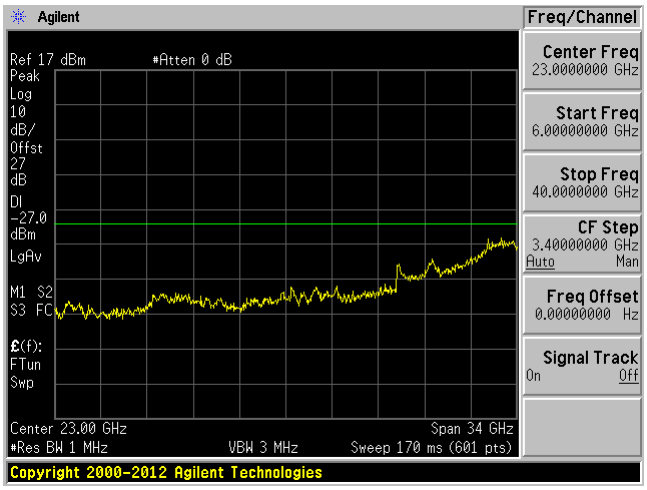

Middle Channel 5220 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

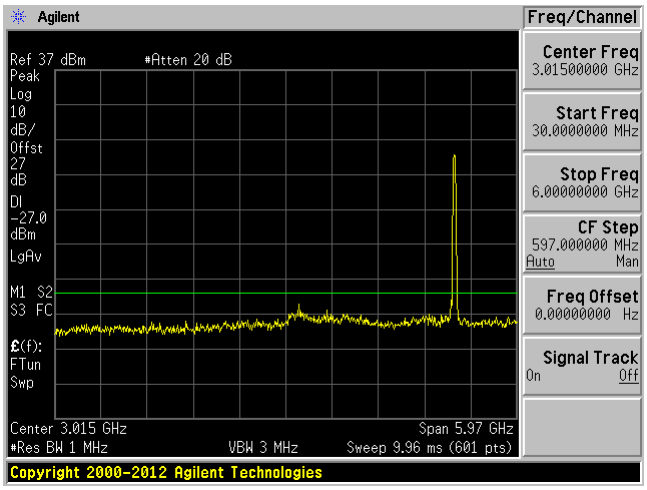



High Channel 5240 MHz (6-40GHz)

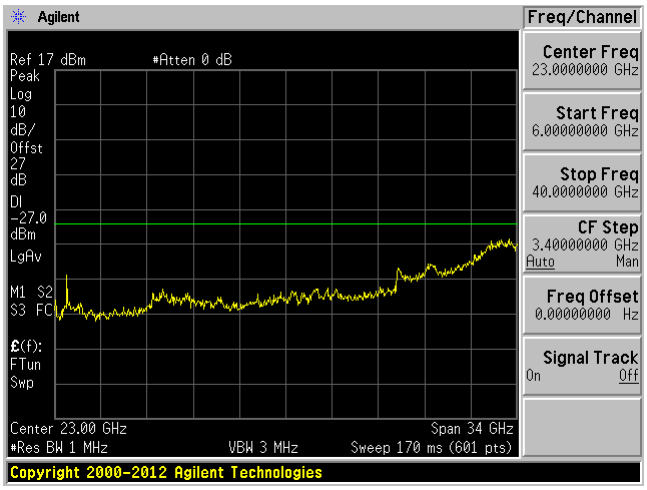


**802.11ac40 mode chain 4**

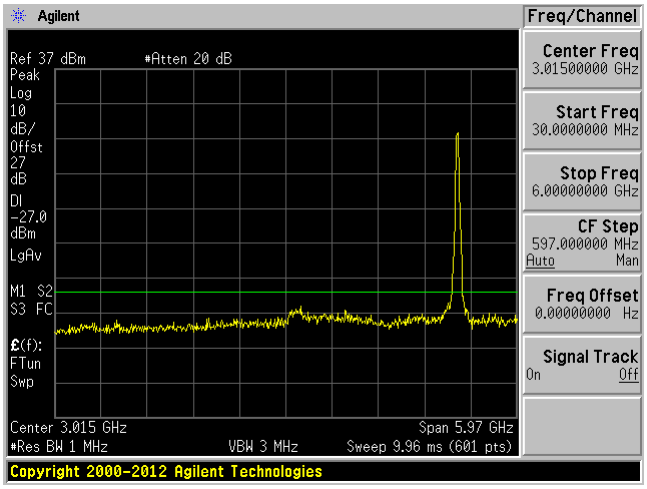
Low Channel 5190MHz (30MHz-6GHz)



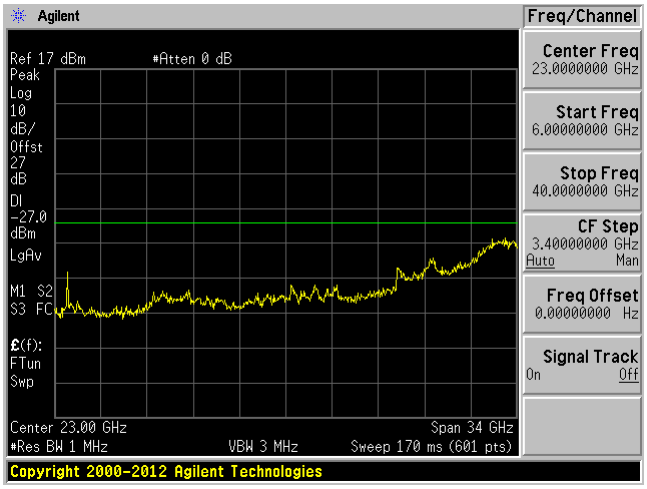

Low Channel 5190 MHz (6-40GHz)




High Channel 5230MHz (30MHz-6GHz)

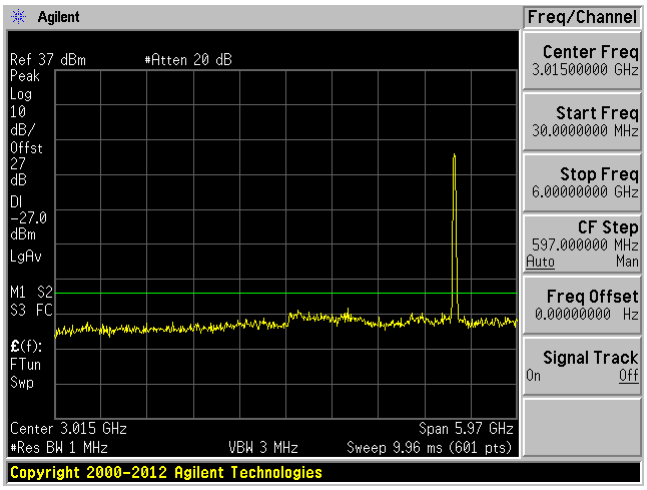



High Channel 5230 MHz (6-40GHz)

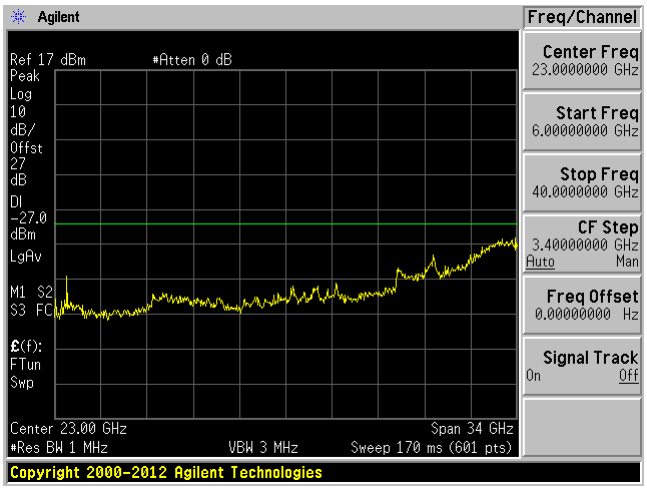


## 802.11ac40 mode chain 5

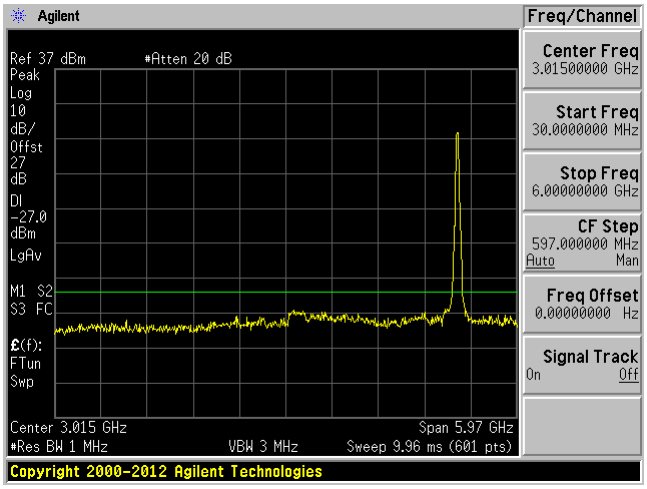
Low Channel 5190MHz (30MHz-6GHz)



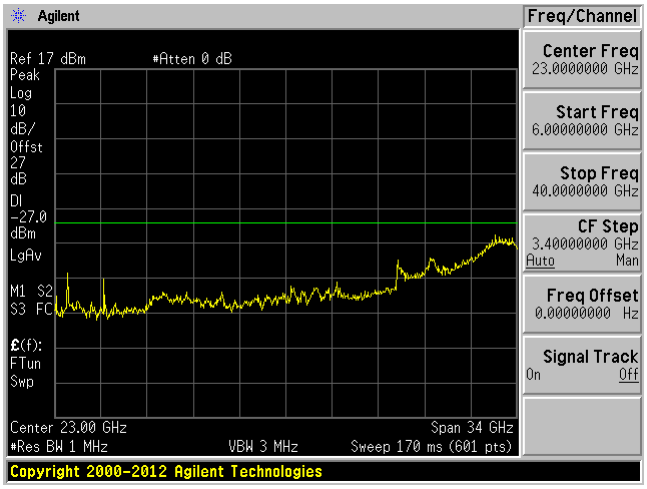

Low Channel 5190 MHz (6-40GHz)




High Channel 5230MHz (30MHz-6GHz)

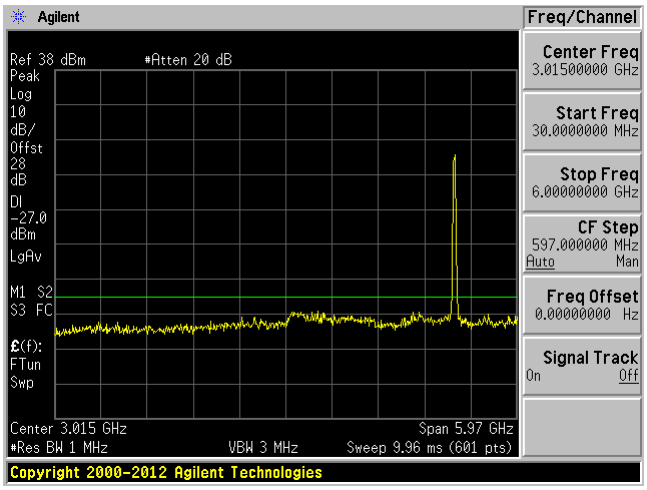



High Channel 5230 MHz (6-40GHz)

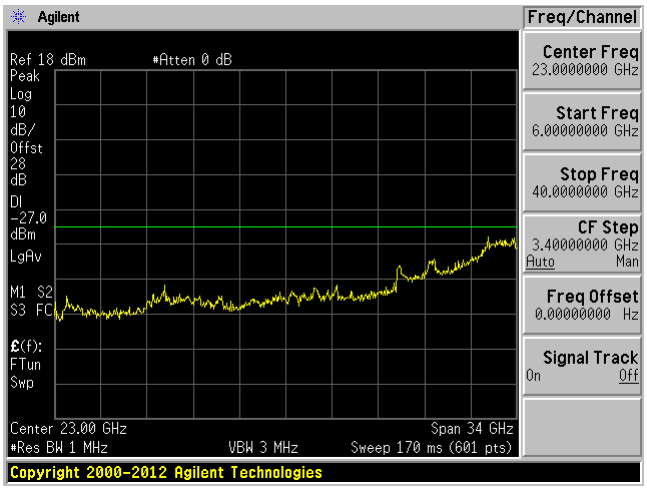


**802.11ac40 mode chain 6**

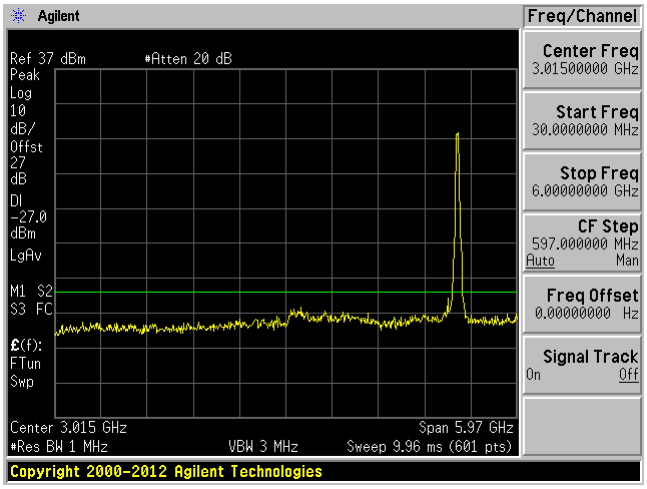
Low Channel 5190MHz (30MHz-6GHz)



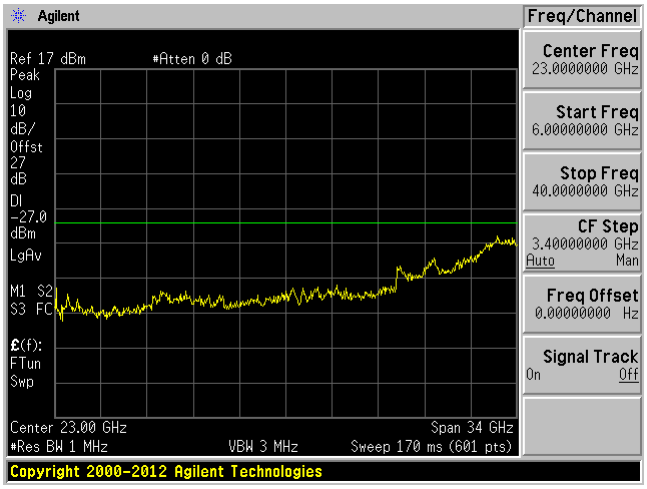

Low Channel 5190 MHz (6-40GHz)




High Channel 5230MHz (30MHz-6GHz)

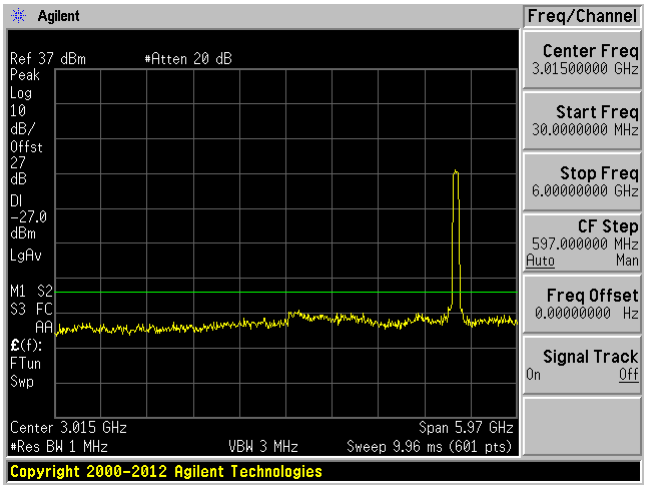



High Channel 5230 MHz (6-40GHz)

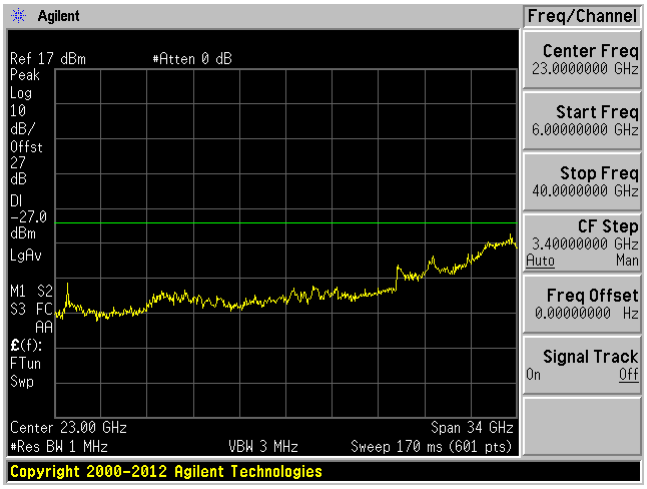


## 802.11ac80 mode chain 4

5210 MHz (30MHz-6GHz)

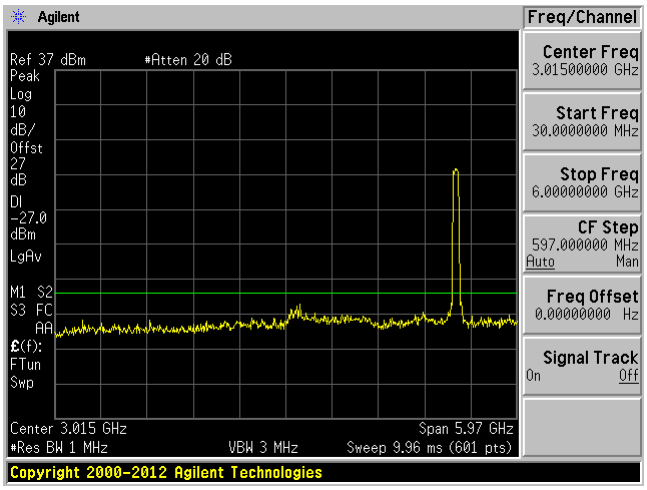



5210 MHz (6GHz – 40GHz)

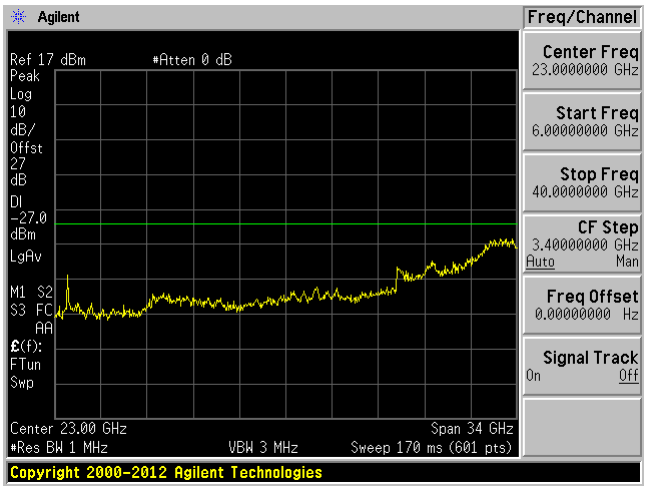



## 802.11ac80 mode chain 5

5210 MHz (30MHz-6GHz)

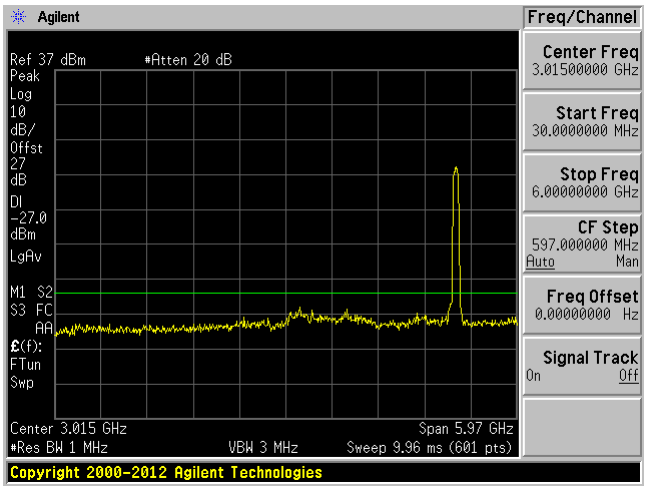



5210 MHz (6GHz – 40GHz)

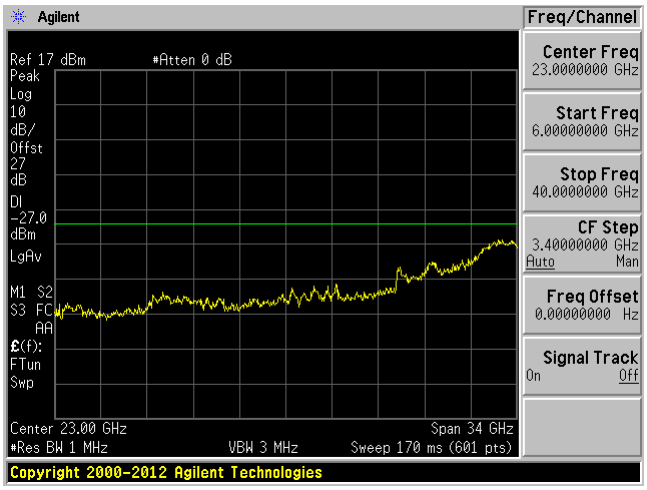


**802.11ac80 mode chain 6**

5210 MHz (30MHz-6GHz)



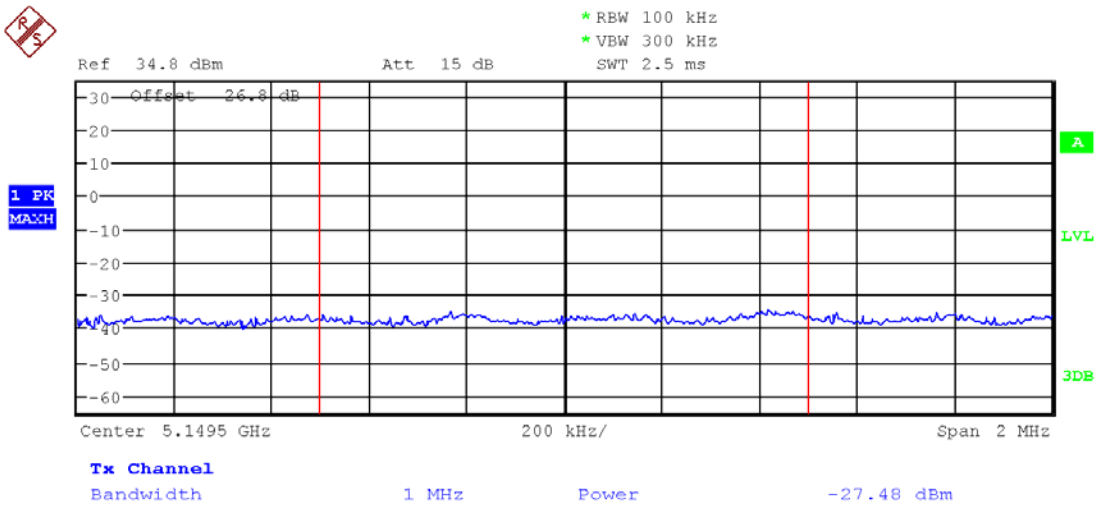

5210 MHz (6GHz – 40GHz)



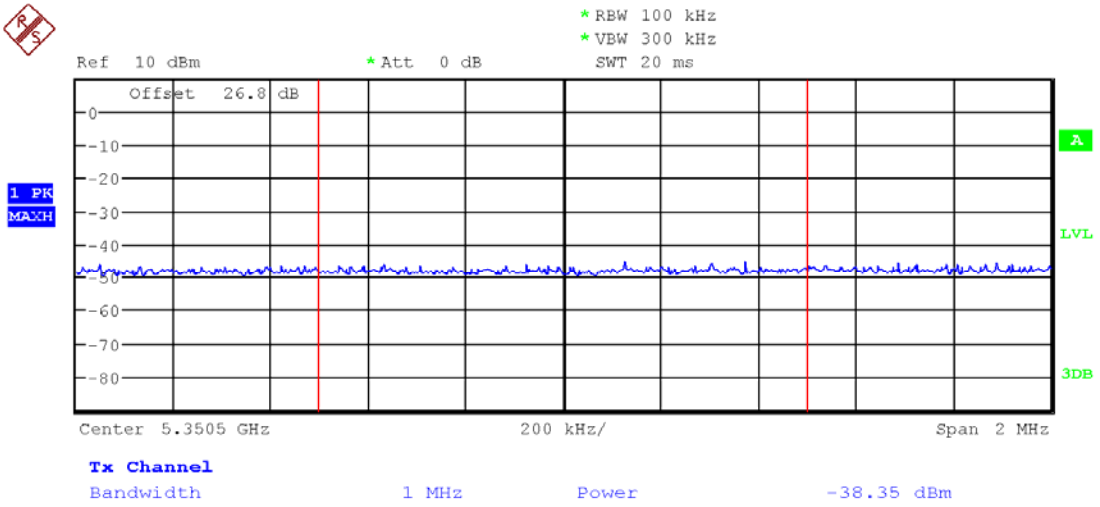
## 2) Band Edge Emissions

| Mode | Channel | Band Edge (Lower /Upper) | Chain #4 (dBm/MHz) | Chain #5 (dBm/MHz) | Chain #6 (dBm/MHz) | Max/Total (dBm/MHz) | Limit (dBm/MHz) | Comment |
|---|---|---|---|---|---|---|---|---|
| 802.11a | 36 | Lower | -27.48 | - | - | -27.48 | -27 | Pass |
| | 48 | Upper | -38.35 | - | - | -38.35 | -27 | Pass |
| 802.11n20 | 36 | Lower | -32.03 | -31.94 | -32.86 | -27.49 | -27 | Pass |
| | 48 | Upper | -39.39 | -40.65 | -41.78 | -35.73 | -27 | Pass |
| 802.11ac20 | 36 | Lower | -32.19 | -34.9 | -33.13 | -28.50 | -27 | Pass |
| | 48 | Upper | -39.53 | -40.19 | -42.31 | -35.75 | -27 | Pass |
| 802.11n40 | 38 | Lower | -32.84 | -32.58 | -31.64 | -27.55 | -27 | Pass |
| | 46 | Upper | -37.13 | -38.19 | -39.15 | -33.31 | -27 | Pass |
| 802.11ac40 | 38 | Lower | -33.4 | -32.11 | -31.75 | -27.59 | -27 | Pass |
| | 46 | Upper | -37.29 | -37.99 | -38.97 | -33.26 | -27 | Pass |
| 802.11ac80 | 42 | Lower | -32.62 | -32 | -31.65 | -27.30 | -27 | Pass |
| | | Upper | -44.44 | -44.77 | -45.77 | -40.19 | -27 | Pass |

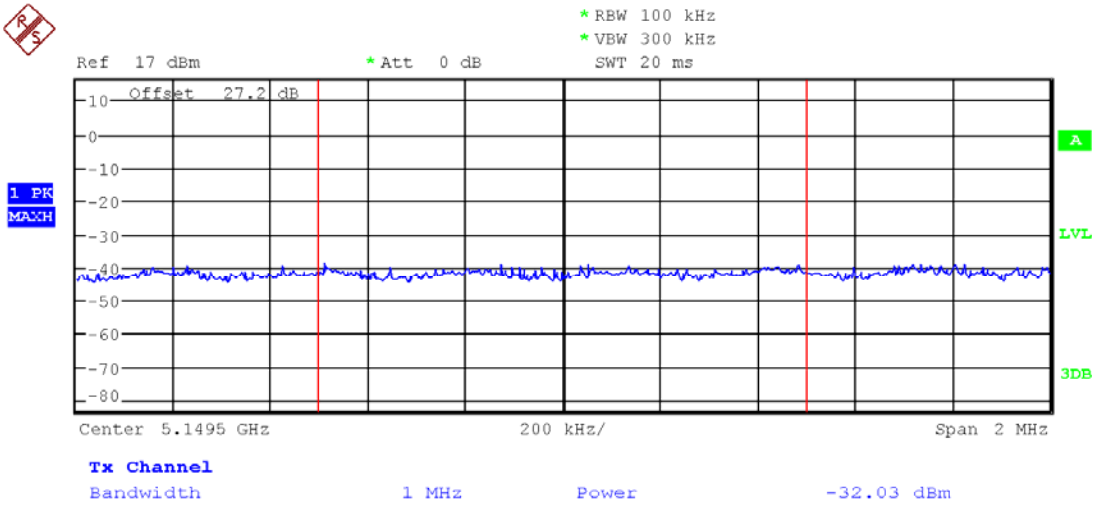
**802.11a mode chain 4 Low Channel**



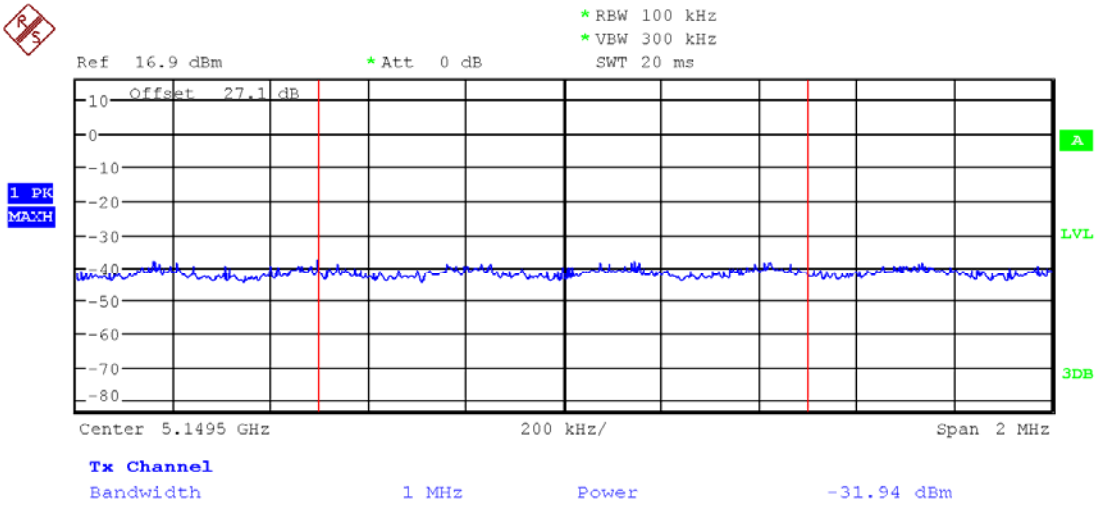

**802.11a mode chain 4 High Channel**



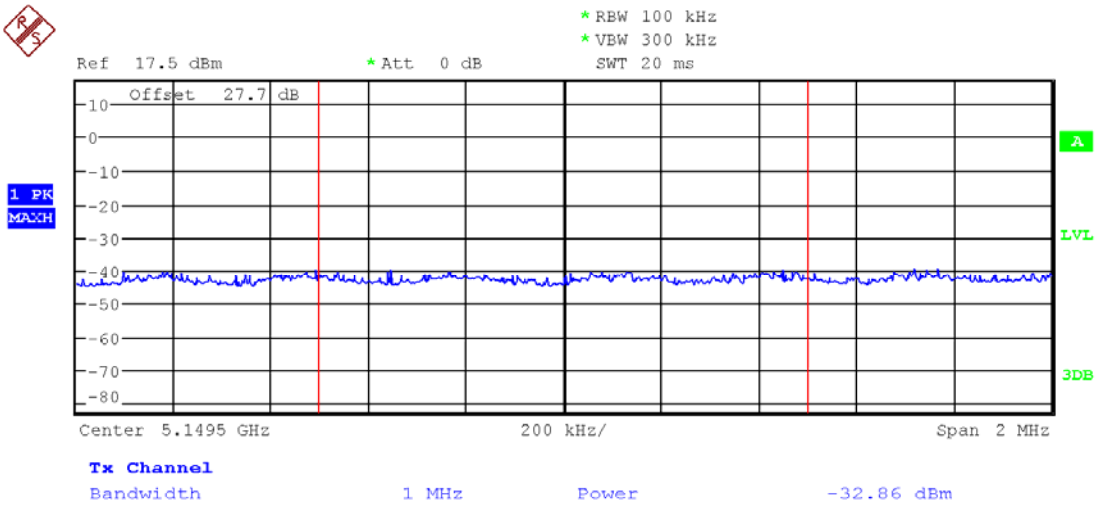
**802.11n20 mode chain 4 Low Channel**



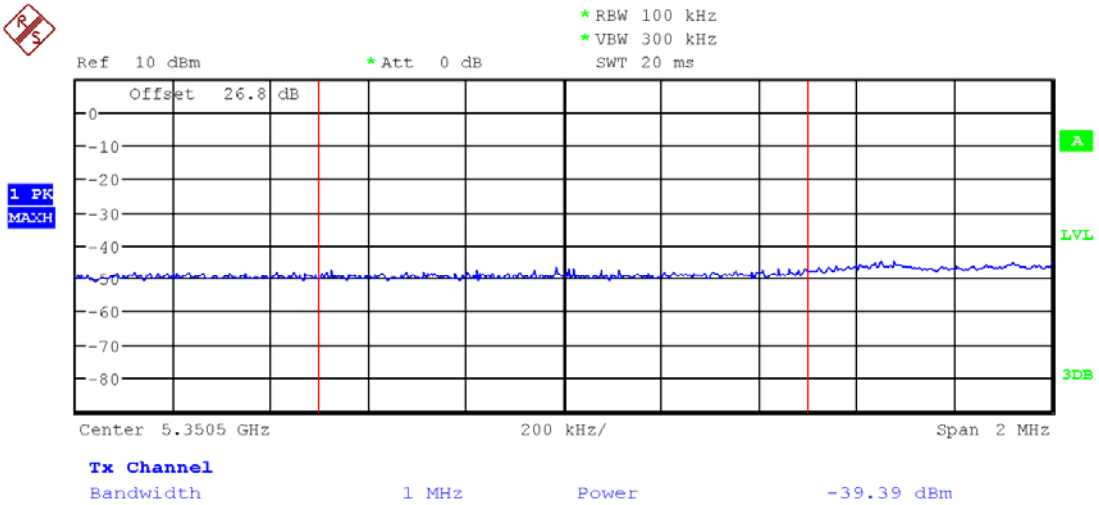

**802.11n20 mode chain 5 Low Channel**



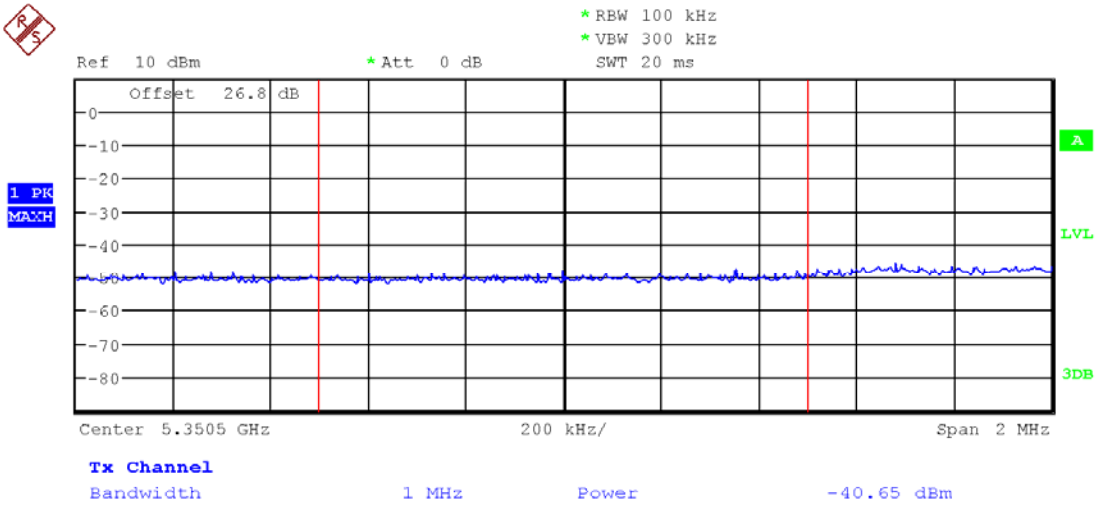
**802.11n20 mode chain 6 Low Channel**



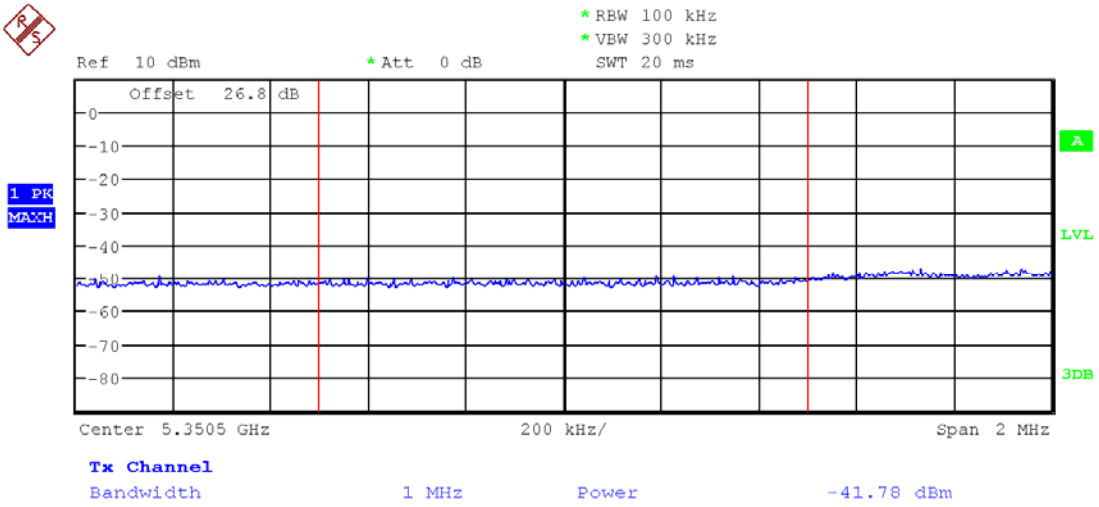

**802.11n20 mode chain 4 High Channel**



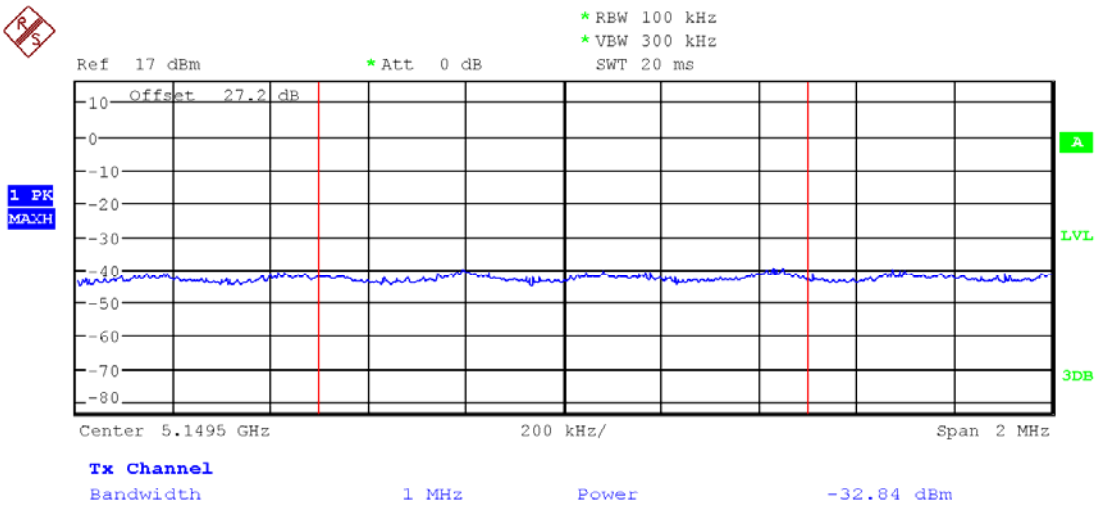
**802.11n20 mode chain 5 High Channel**



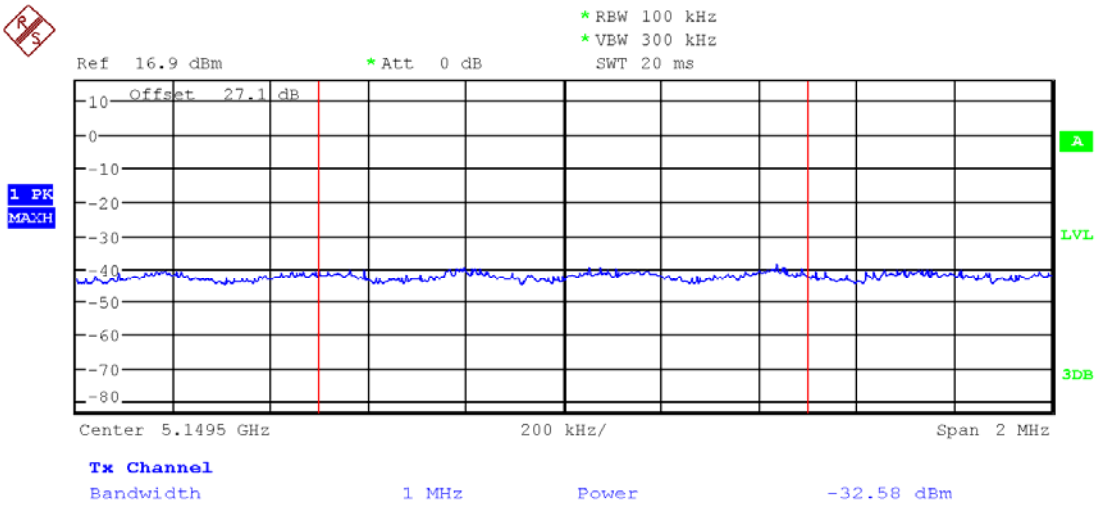

**802.11n20 mode chain 6 High Channel**



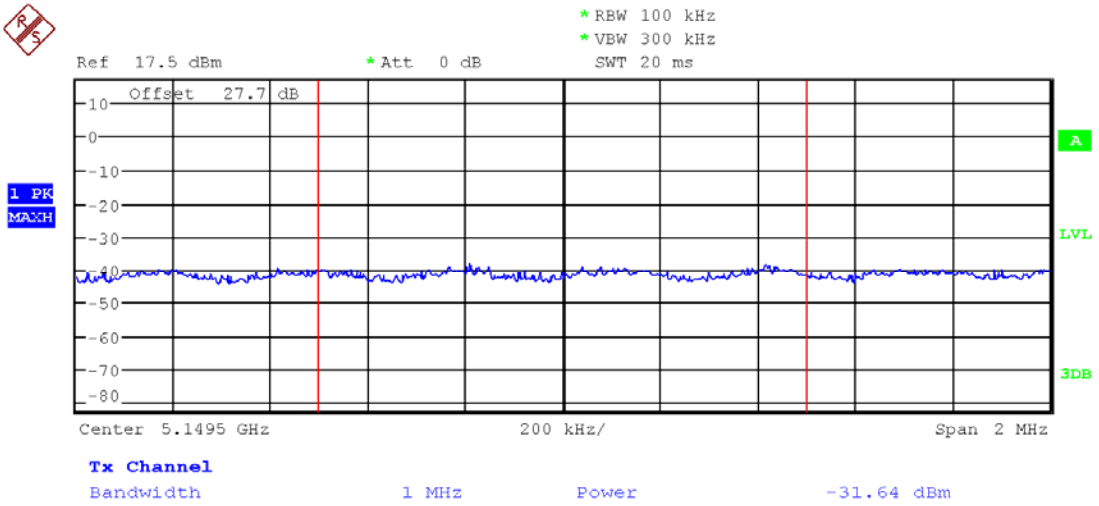
**802.11n40 mode chain 4 Low Channel**



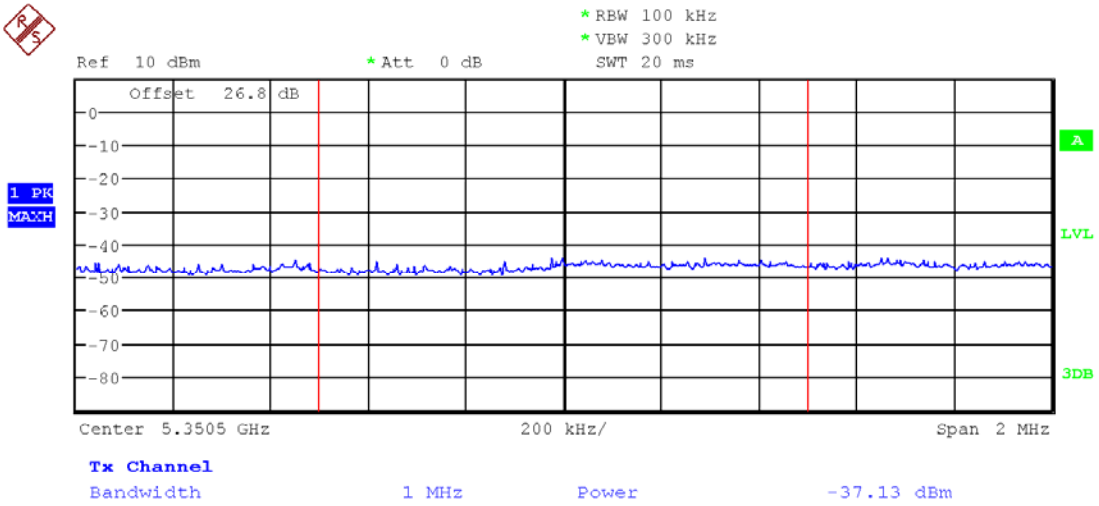

**802.11n40 mode chain 5 Low Channel**



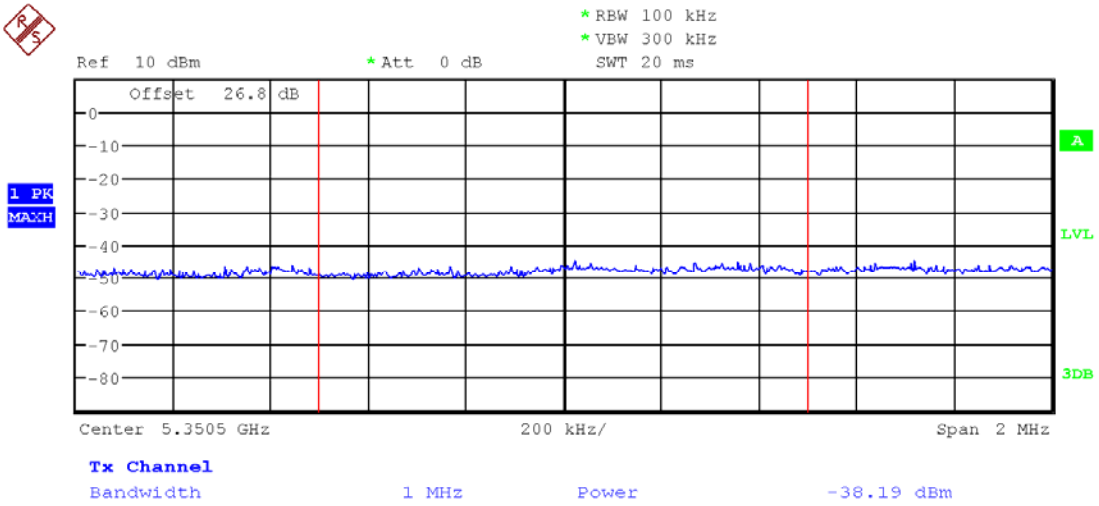
**802.11n40 mode chain 6 Low Channel**



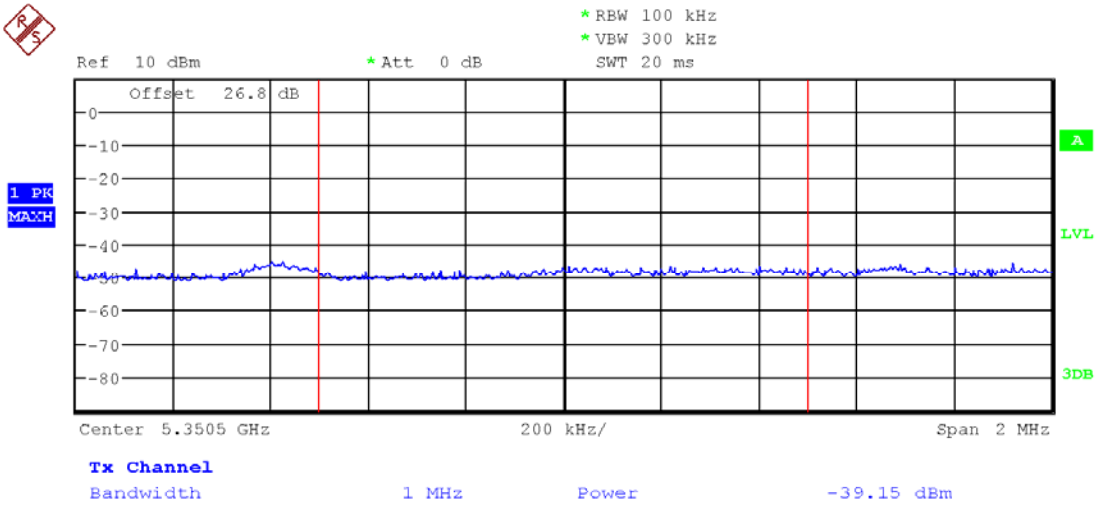

**802.11n40 mode chain 4 High Channel**



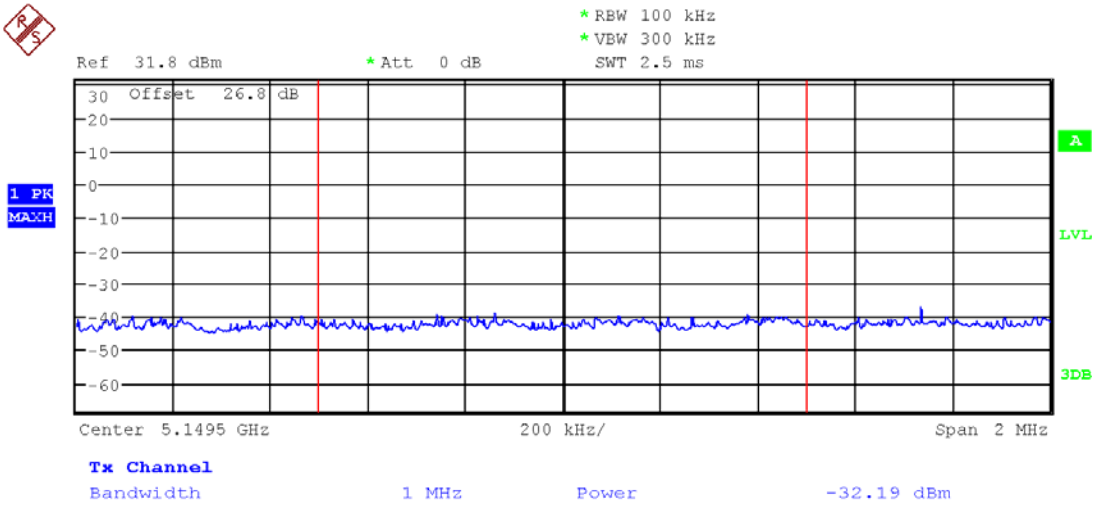
**802.11n40 mode chain 5 High Channel**



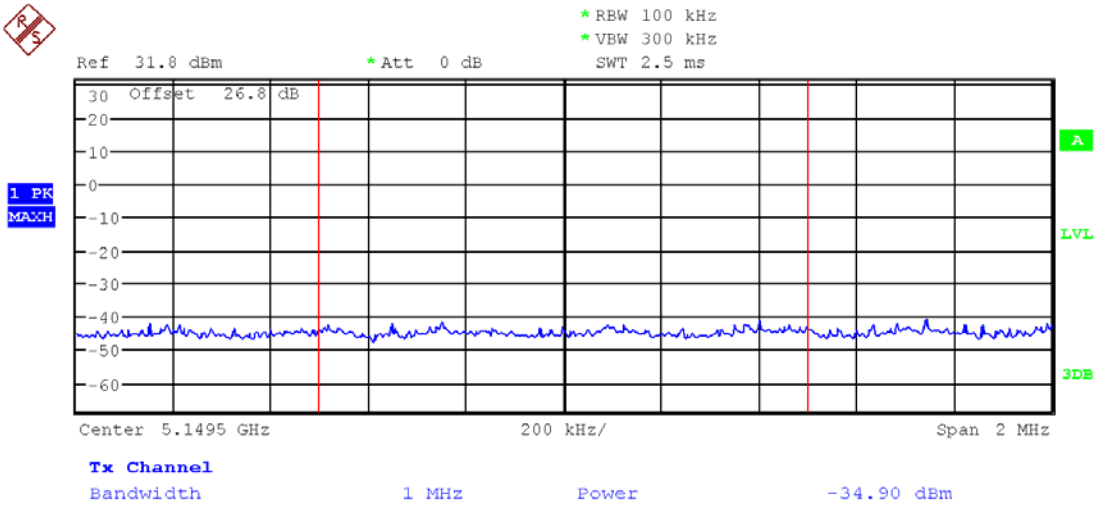

**802.11n40 mode chain 6 High Channel**



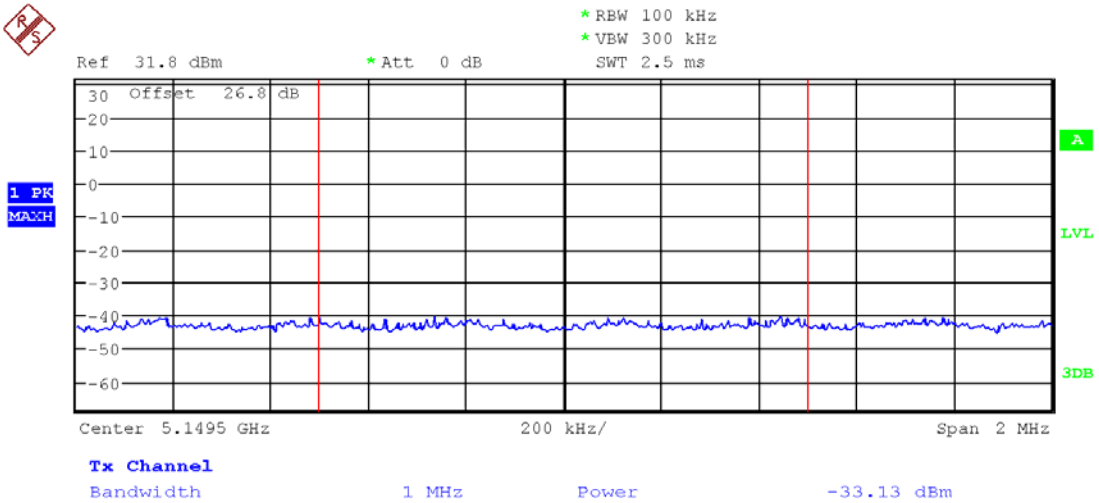
**802.11ac20 mode chain 4 Low Channel**



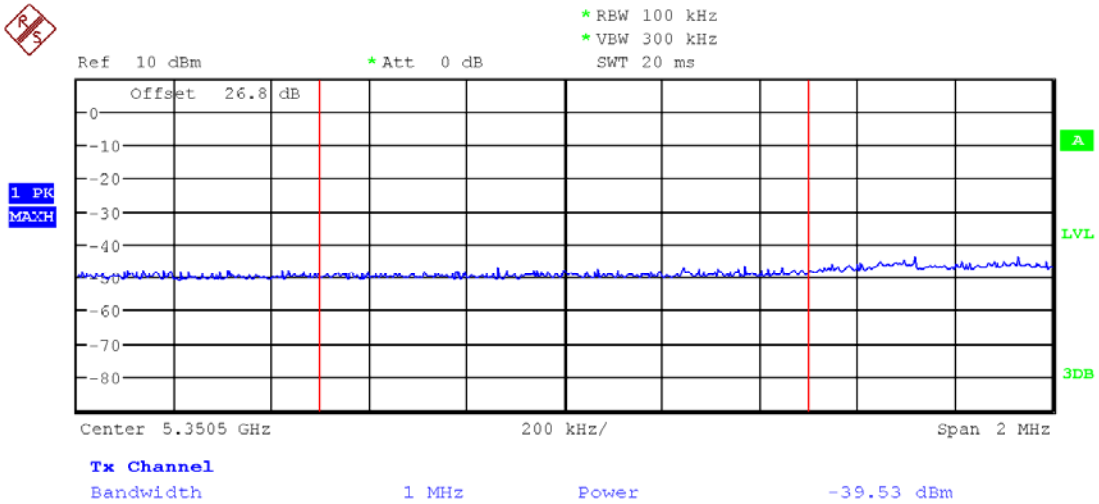

**802.11ac20 mode chain 5 Low Channel**



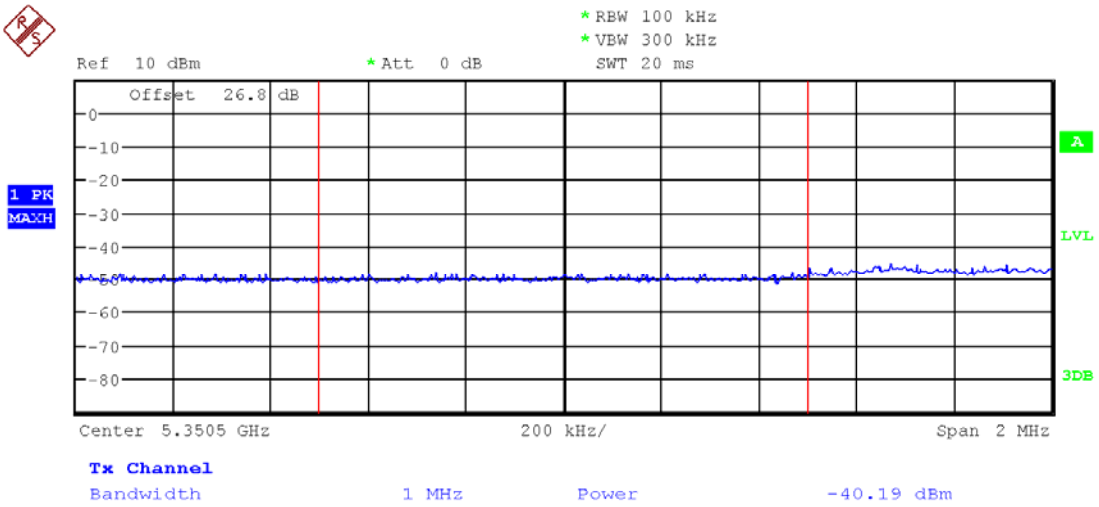
**802.11ac20 mode chain 6 Low Channel**



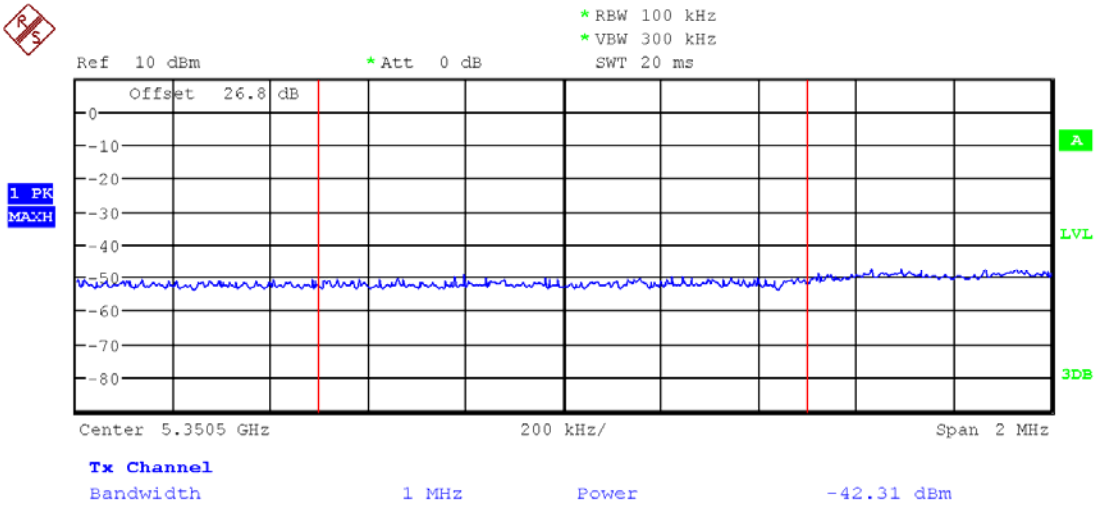

**802.11ac20 mode chain 4 High Channel**



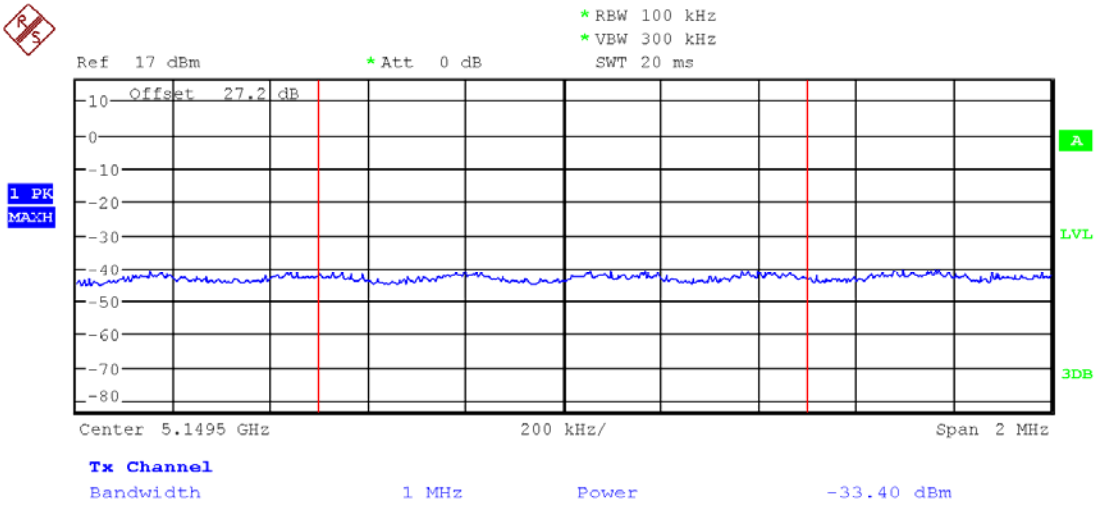
**802.11ac20 mode chain 5 High Channel**



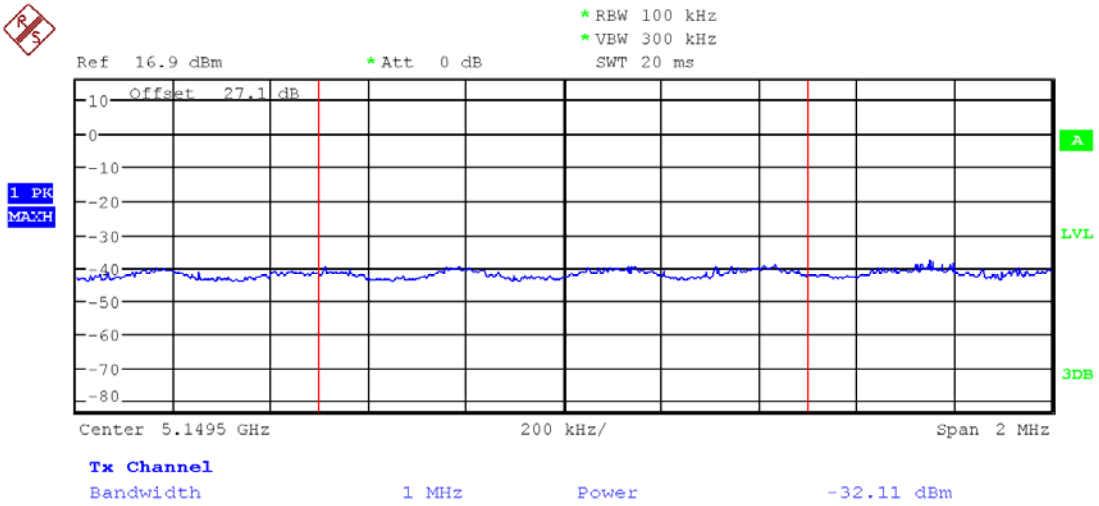

**802.11ac20 mode chain 6 High Channel**



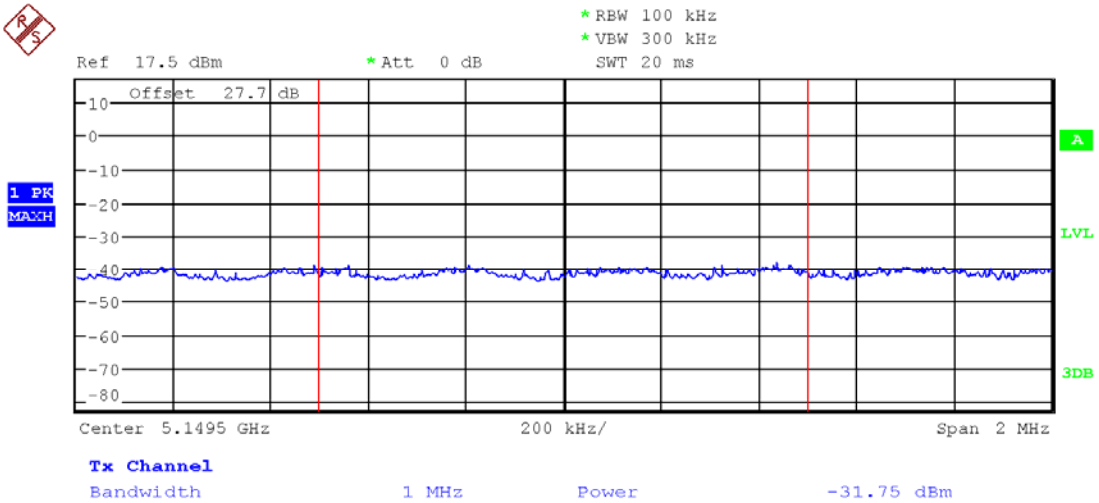
**802.11ac40 mode chain 4 Low Channel**



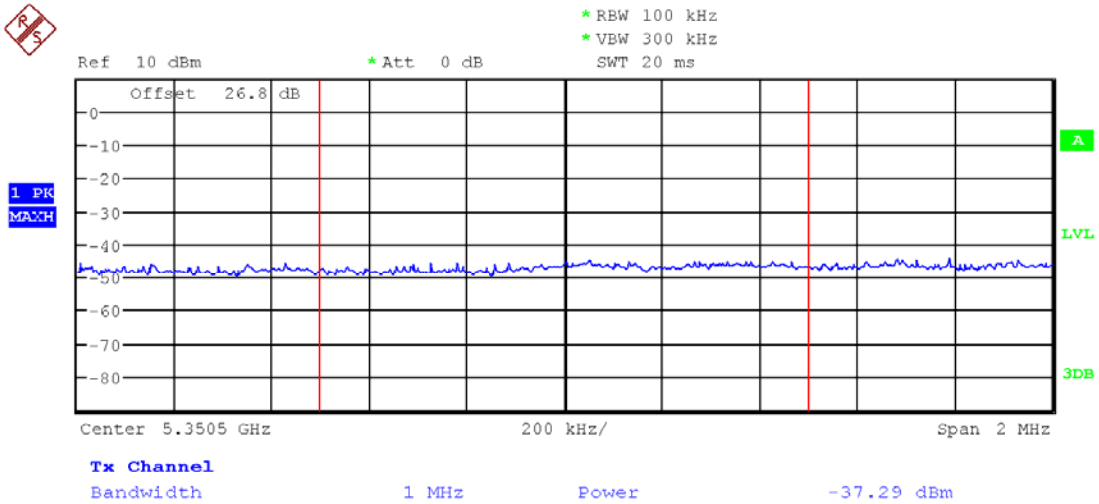

**802.11ac40 mode chain 5 Low Channel**



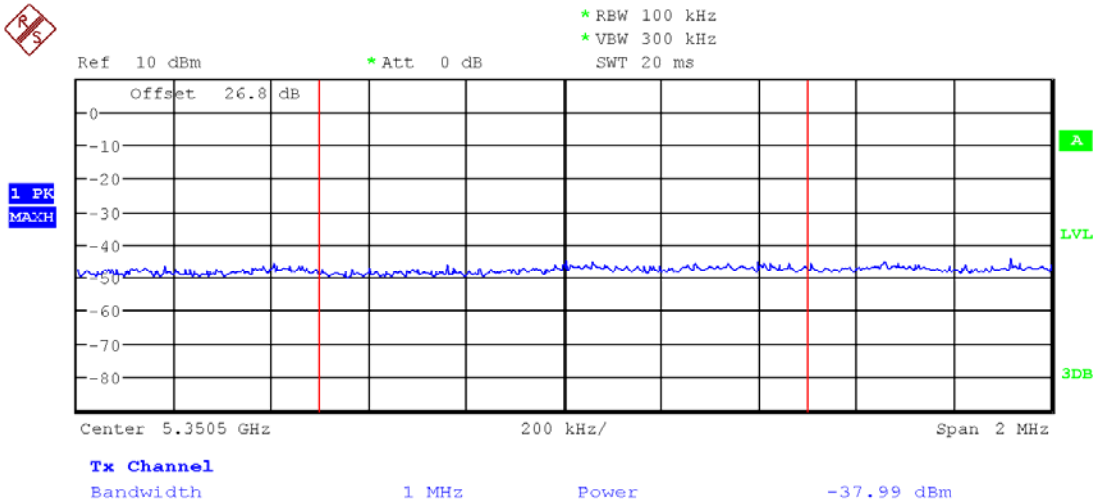
**802.11ac40 mode chain 6 Low Channel**



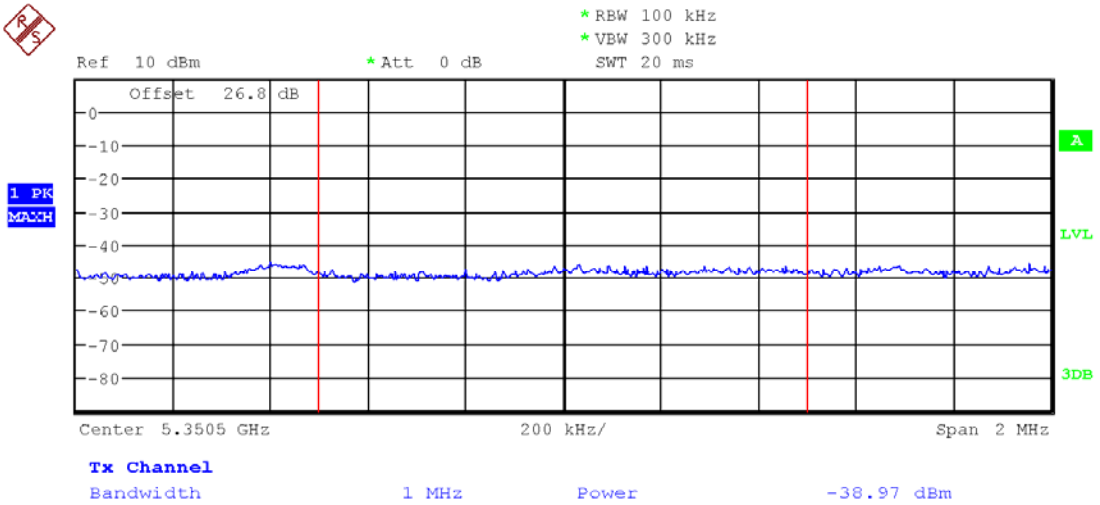

**802.11ac40 mode chain 4 High Channel**



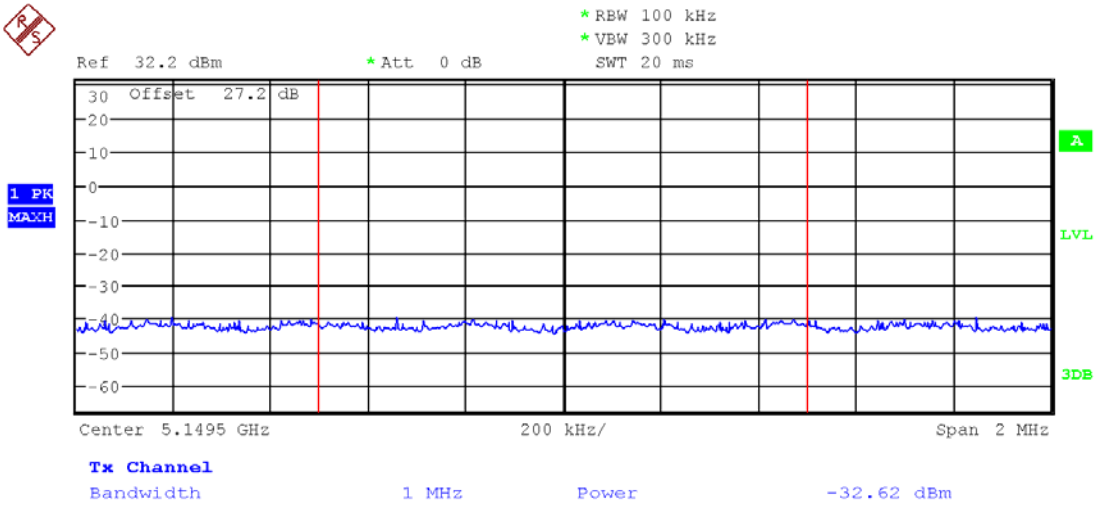
**802.11ac40 mode chain 5 High Channel**



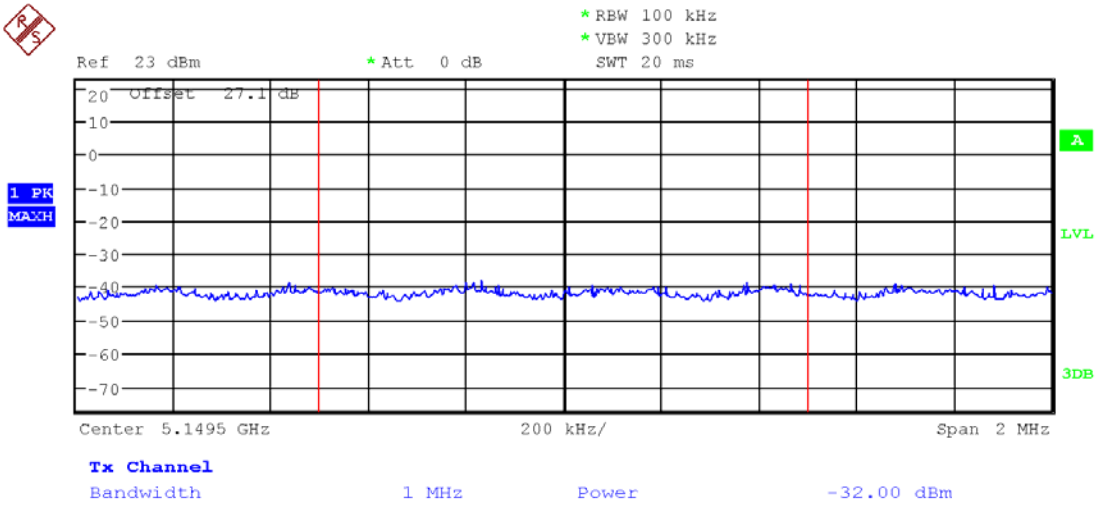

**802.11ac40 mode chain 6 High Channel**



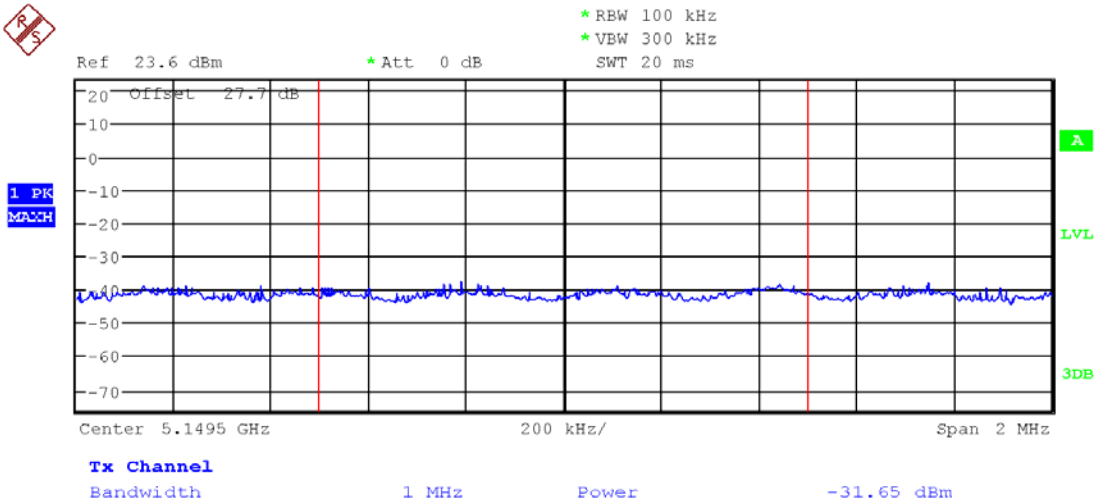
**802.11ac80 mode chain 4 Low Edge**



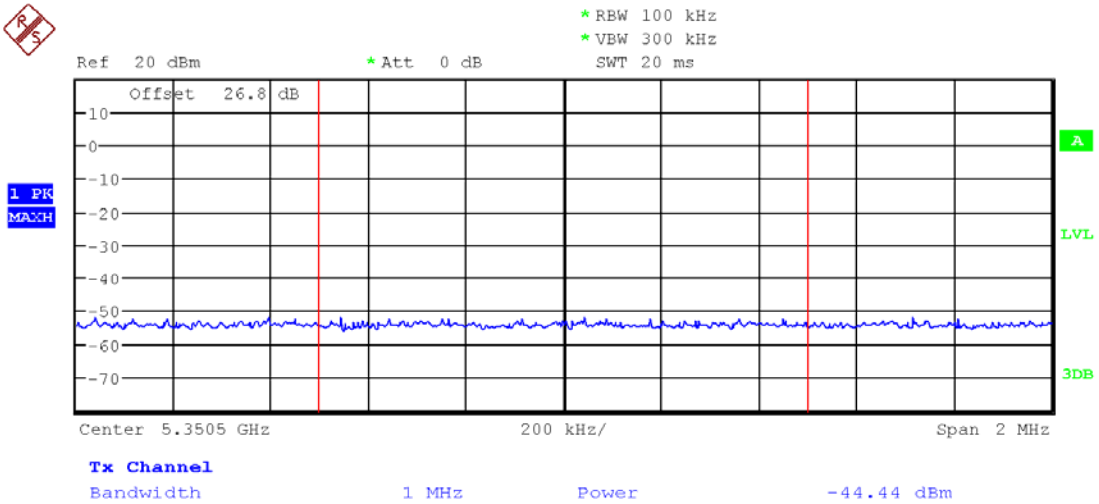

**802.11ac80 mode chain 5 Low Edge**



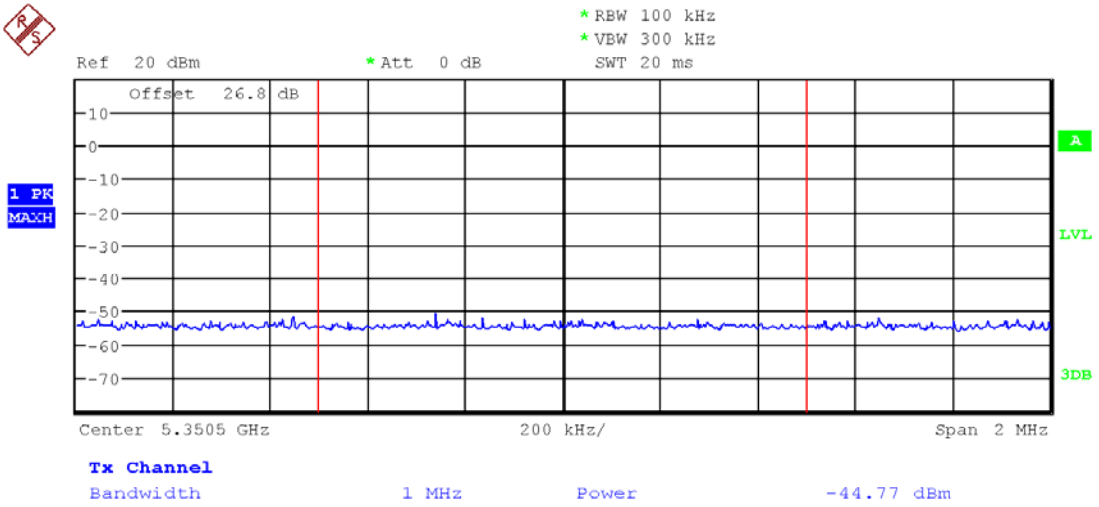
**802.11ac80 mode chain 6 Low Edge**



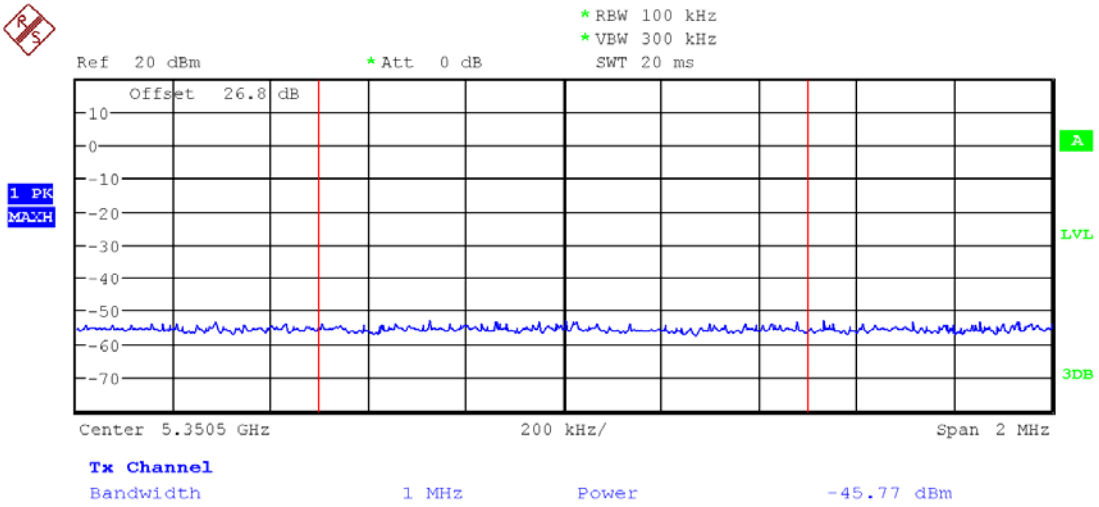

**802.11ac80 mode chain 4 High Edge**



**802.11ac80 mode chain 5 High Edge**




**802.11ac80 mode chain 6 High Edge**




Note: Antenna gain has been considered for the out-of-band and band edge measurements.