



FCC PART 15.407  
ISED C RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

**Roku, Inc.**

150 Winchester Circle,  
Los Gatos, CA 95032, USA

**FCC ID: TC2-R1017**  
**IC: 5959A-R1017**

|                                                                                                                                            |                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <b>Report Type:</b><br>Original Report                                                                                                     | <b>Model:</b><br>3800X                                                               |
| <b>Prepared By:</b><br>Vincent Licata<br>Test Engineer                                                                                     |  |
| <b>Report Number:</b><br>R1706264-407                                                                                                      |                                                                                      |
| <b>Report Date:</b><br>2017-08-28                                                                                                          |                                                                                      |
| <b>Reviewed By:</b><br>Jin Yang<br>RF Engineer                                                                                             |  |
| Bay Area Compliance Laboratories Corp.<br>1274 Anvilwood Avenue,<br>Sunnyvale, CA 94089, USA<br>Tel: (408) 732-9162<br>Fax: (408) 732-9164 |                                                                                      |

**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by A2LA\*, NIST, or any agency of the Federal Government.

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

## TABLE OF CONTENTS

|          |                                                                                                |           |
|----------|------------------------------------------------------------------------------------------------|-----------|
| <b>1</b> | <b>GENERAL DESCRIPTION.....</b>                                                                | <b>5</b>  |
| 1.1      | PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....                                        | 5         |
| 1.2      | OBJECTIVE.....                                                                                 | 5         |
| 1.3      | RELATED SUBMITTAL(S)/GRANT(S) .....                                                            | 5         |
| 1.4      | TEST METHODOLOGY .....                                                                         | 5         |
| 1.5      | MEASUREMENT UNCERTAINTY .....                                                                  | 6         |
| 1.6      | TEST FACILITY REGISTRATIONS .....                                                              | 6         |
| 1.7      | TEST FACILITY ACCREDITATIONS.....                                                              | 6         |
| <b>2</b> | <b>EUT TEST CONFIGURATION.....</b>                                                             | <b>9</b>  |
| 2.1      | JUSTIFICATION.....                                                                             | 9         |
| 2.2      | EUT EXERCISE SOFTWARE.....                                                                     | 9         |
| 2.3      | DUTY CYCLE CORRECTION FACTOR.....                                                              | 10        |
| 2.4      | EQUIPMENT MODIFICATIONS .....                                                                  | 14        |
| 2.5      | LOCAL SUPPORT EQUIPMENT .....                                                                  | 14        |
| 2.6      | SUPPORT EQUIPMENT .....                                                                        | 14        |
| 2.7      | INTERFACE PORTS AND CABLING .....                                                              | 14        |
| <b>3</b> | <b>SUMMARY OF TEST RESULTS.....</b>                                                            | <b>15</b> |
| <b>4</b> | <b>FCC §2.1091, §15.407(F) &amp; ISEDC RSS-102 - RF EXPOSURE.....</b>                          | <b>16</b> |
| 4.1      | APPLICABLE STANDARDS .....                                                                     | 16        |
| 4.2      | MPE PREDICTION .....                                                                           | 17        |
| 4.3      | MPE RESULTS .....                                                                              | 17        |
| 4.4      | RF EXPOSURE EVALUATION EXEMPTION FOR ISEDC .....                                               | 17        |
| <b>5</b> | <b>FCC §15.203 AND ISEDC RSS-GEN §8.3 - ANTENNA REQUIREMENTS .....</b>                         | <b>18</b> |
| 5.1      | APPLICABLE STANDARDS .....                                                                     | 18        |
| 5.2      | ANTENNA LIST .....                                                                             | 19        |
| <b>6</b> | <b>FCC §15.207 &amp; ISEDC RSS-GEN §8.8 - AC POWER LINE CONDUCTED EMISSIONS.....</b>           | <b>20</b> |
| 6.1      | APPLICABLE STANDARDS .....                                                                     | 20        |
| 6.2      | TEST SETUP .....                                                                               | 20        |
| 6.3      | TEST PROCEDURE .....                                                                           | 20        |
| 6.4      | TEST SETUP BLOCK DIAGRAM.....                                                                  | 21        |
| 6.5      | CORRECTED AMPLITUDE AND MARGIN CALCULATION .....                                               | 21        |
| 6.6      | TEST EQUIPMENT LIST AND DETAILS .....                                                          | 22        |
| 6.7      | TEST ENVIRONMENTAL CONDITIONS.....                                                             | 22        |
| 6.8      | SUMMARY OF TEST RESULTS.....                                                                   | 22        |
| 6.9      | CONDUCTED EMISSIONS TEST PLOTS AND DATA .....                                                  | 23        |
| <b>7</b> | <b>FCC §15.209, §15.407(B) &amp; ISEDC RSS-247 §6.2 - SPURIOUS RADIATED EMISSIONS .....</b>    | <b>25</b> |
| 7.1      | APPLICABLE STANDARD .....                                                                      | 25        |
| 7.2      | TEST SETUP .....                                                                               | 27        |
| 7.3      | TEST PROCEDURE .....                                                                           | 27        |
| 7.4      | CORRECTED AMPLITUDE AND MARGIN CALCULATION .....                                               | 27        |
| 7.5      | TEST EQUIPMENT LIST AND DETAILS .....                                                          | 28        |
| 7.6      | TEST ENVIRONMENTAL CONDITIONS.....                                                             | 28        |
| 7.7      | SUMMARY OF TEST RESULTS.....                                                                   | 28        |
| 7.8      | RADIATED EMISSIONS TEST RESULT DATA .....                                                      | 29        |
| <b>8</b> | <b>FCC §15.407(E) &amp; ISEDC RSS-247 §6.2 - 6 DB, 26 DB, AND 99% OCCUPIED BANDWIDTH .....</b> | <b>36</b> |

|           |                                                                              |            |
|-----------|------------------------------------------------------------------------------|------------|
| 8.1       | APPLICABLE STANDARDS .....                                                   | 36         |
| 8.2       | MEASUREMENT PROCEDURE .....                                                  | 36         |
| 8.3       | TEST EQUIPMENT LIST AND DETAILS .....                                        | 36         |
| 8.4       | TEST ENVIRONMENTAL CONDITIONS.....                                           | 36         |
| 8.5       | TEST RESULTS .....                                                           | 36         |
| <b>9</b>  | <b>FCC §407(A) &amp; ISED RSS-247 §6.2 - OUTPUT POWER.....</b>               | <b>69</b>  |
| 9.1       | APPLICABLE STANDARDS .....                                                   | 69         |
| 9.2       | MEASUREMENT PROCEDURE .....                                                  | 70         |
| 9.3       | TEST EQUIPMENT LIST AND DETAILS .....                                        | 70         |
| 9.4       | TEST ENVIRONMENTAL CONDITIONS.....                                           | 70         |
| 9.5       | TEST RESULTS .....                                                           | 71         |
| <b>10</b> | <b>FCC §15.407(A) &amp; ISED RSS-247 §6.2 - POWER SPECTRAL DENSITY .....</b> | <b>74</b>  |
| 10.1      | APPLICABLE STANDARDS .....                                                   | 74         |
| 10.2      | MEASUREMENT PROCEDURE .....                                                  | 75         |
| 10.3      | TEST EQUIPMENT LIST AND DETAILS .....                                        | 75         |
| 10.4      | TEST ENVIRONMENTAL CONDITIONS.....                                           | 76         |
| 10.5      | TEST RESULTS .....                                                           | 76         |
| <b>11</b> | <b>FCC §15.407(B) &amp; ISED RSS-247 §6.2 - OUT OF BAND EMISSIONS.....</b>   | <b>101</b> |
| 11.1      | APPLICABLE STANDARDS .....                                                   | 101        |
| 11.2      | MEASUREMENT PROCEDURE .....                                                  | 102        |
| 11.3      | TEST EQUIPMENT LIST AND DETAILS .....                                        | 102        |
| 11.4      | TEST ENVIRONMENTAL CONDITIONS.....                                           | 102        |
| 11.5      | TEST RESULTS .....                                                           | 103        |
| <b>12</b> | <b>ANNEX A (INFORMATIVE) - A2LA ELECTRICAL TESTING CERTIFICATE .....</b>     | <b>143</b> |

**DOCUMENT REVISION HISTORY**

| Revision Number | Report Number | Description of Revision | Date of Revision |
|-----------------|---------------|-------------------------|------------------|
| 0               | R1706264-407  | Original Report         | 2017-08-28       |

## **1 General Description**

---

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

This test and measurement report was prepared on behalf of *Roku, Inc.*, and their product model: 3800X, Serial number: KPQ1QNH, FCC ID: TC2-R1017, IC: 5959A-R1017 or the “EUT” as referred to in this report.

### **1.2 Objective**

This report is prepared on behalf of *Roku, Inc* in accordance with FCC CFR47 §15.407 and ISED RSS-247 Issue 2, February 2017.

The objective is to determine compliance with FCC Part 15.407 and ISED RSS-247 rules for Output Power, Antenna Requirements, AC Line Conducted Emissions, Emission Bandwidth, Power spectral density, Conducted and Radiated Spurious Emissions.

### **1.3 Related Submittal(s)/Grant(s)**

FCC Part 15, Subpart C, Equipment DTS with FCC ID: TC2-R1017, IC: 5959A-R1017 Report: R1706264-247  
FCC Part 15, Subpart E, Equipment NII with FCC ID: TC2-RCB14, IC: 5959A-RCB14 Report: R1706263-407  
FCC Part 15, Subpart C, Equipment DTS with FCC ID: TC2-RCB14, IC: 5959A-RCB14 Report: R1706263-247

### **1.4 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 v01r04.

## 1.5 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.

| Parameter                         | Measurement uncertainty |
|-----------------------------------|-------------------------|
| Occupied Channel Bandwidth        | ±5 %                    |
| RF output power, conducted        | ±0.57 dB                |
| Power Spectral Density, conducted | ±1.48dB                 |
| Unwanted Emissions, conducted     | ±1.57dB                 |
| All emissions, radiated           | ±4.0 dB                 |
| AC power line Conducted Emission  | ±2.0 dB                 |
| Temperature                       | ±2 ° C                  |
| Humidity                          | ±5 %                    |
| DC and low frequency voltages     | ±1.0 %                  |
| Time                              | ±2 %                    |
| Duty Cycle                        | ±3 %                    |

## 1.6 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

## 1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

**A- An independent, 3<sup>rd</sup>-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 and Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime and 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

**C- A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.01) to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:**

- 1 Electronics and Office Equipment:
  - for Telephony (ver. 3.0)
  - for Audio/Video (ver. 3.0)
  - for Battery Charging Systems (ver. 1.1)
  - for Set-top Boxes and Cable Boxes (ver. 4.1)
  - for Televisions (ver. 6.1)
  - for Computers (ver. 6.0)
  - for Displays (ver. 6.0)

- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)
- 2 Commercial Food Service Equipment
  - for Commercial Dishwashers (ver. 2.0)
  - for Commercial Ice Machines (ver. 2.0)
  - for Commercial Ovens (ver. 2.1)
  - for Commercial Refrigerators and Freezers
- 3 Lighting Products
  - For Decorative Light Strings (ver. 1.5)
  - For Luminaires (including sub-components) and Lamps (ver. 1.2)
  - For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
  - For Integral LED Lamps (ver. 1.4)
- 4 Heating, Ventilation, and AC Products
  - for Residential Ceiling Fans (ver. 3.0)
  - for Residential Ventilating Fans (ver. 3.2)
- 5 Other
  - For Water Coolers (ver. 3.0)

**D- A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:**

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I and Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - o EMC Directive 2004/108/EC US-EU EMC and Telecom MRA CAB
  - o Radio and Teleterminal Equipment (RandTTE) Directive 1995/5/EC US -EU EMC and Telecom MRA CAB
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I and Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I and Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - o ENERGY STAR Recognized Test Laboratory – US EPA
  - o Telecommunications Certification Body (TCB) – US FCC;
- Vietnam: APEC Tel MRA -Phase I;

## 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 v01r04.

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 firmware used was Putty provided by *Roku, Inc.*, the software is comply with the standard requirements being tested against.

| Modulation | Channel | Frequency (MHz) | Power Setting |
|------------|---------|-----------------|---------------|
| 802.11a    | 36      | 5180            | 48            |
|            | 40      | 5200            | 48            |
|            | 48      | 5240            | 48            |
|            | 149     | 5745            | 63            |
|            | 157     | 5785            | 63            |
|            | 165     | 5825            | 63            |
| 802.11n20  | 36      | 5180            | 46            |
|            | 40      | 5200            | 46            |
|            | 48      | 5240            | 46            |
|            | 149     | 5745            | 63            |
|            | 157     | 5785            | 63            |
|            | 165     | 5825            | 63            |
| 802.11ac20 | 36      | 5180            | 46            |
|            | 40      | 5200            | 46            |
|            | 48      | 5240            | 46            |
|            | 149     | 5745            | 63            |
|            | 157     | 5785            | 63            |
|            | 165     | 5825            | 63            |

\*Data rates tested:

802.11a mode: 6Mbps

802.11n HT20: MCS0

802.11ac VHT20: MCS0

### 2.3 Duty Cycle Correction Factor

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r04 section B:

All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum-power transmission duration, T, are required for each tested mode of operation.

| Radio Mode | Duty Cycle (%) | Duty Cycle Correction Factor (dB) |
|------------|----------------|-----------------------------------|
| 802.11a    | 100            | 0                                 |
| 802.11n20  | 100            | 0                                 |
| 802.11ac20 | 100            | 0                                 |

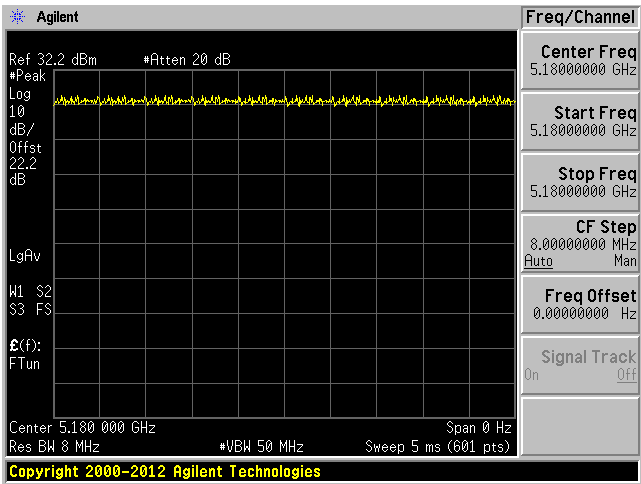
Note:

Duty Cycle Correction Factor =  $10 \cdot \log(1/\text{duty cycle})$

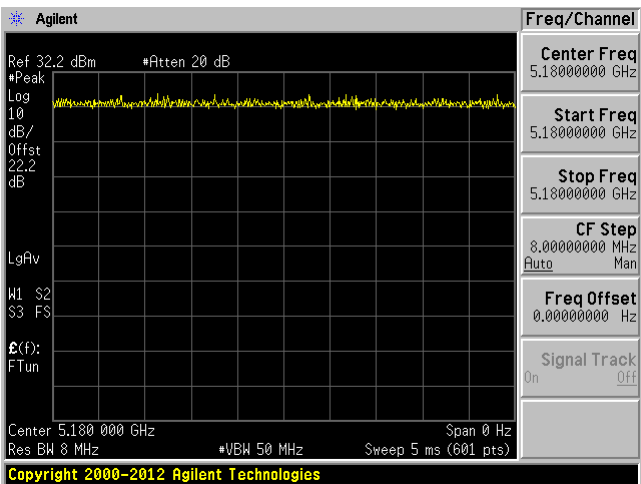
Please refer to the following plots.

Port A

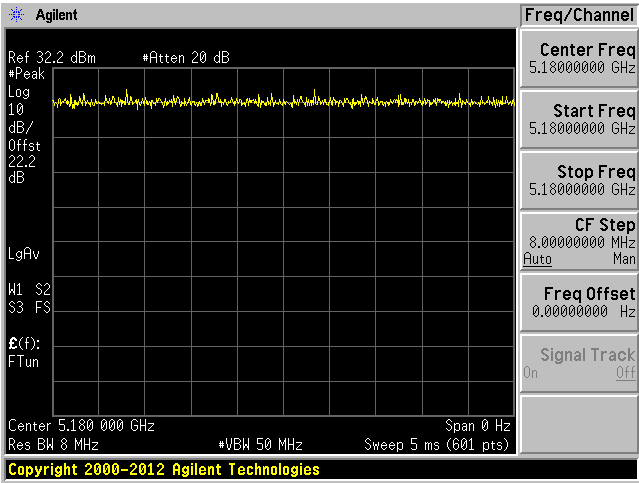
802.11a mode



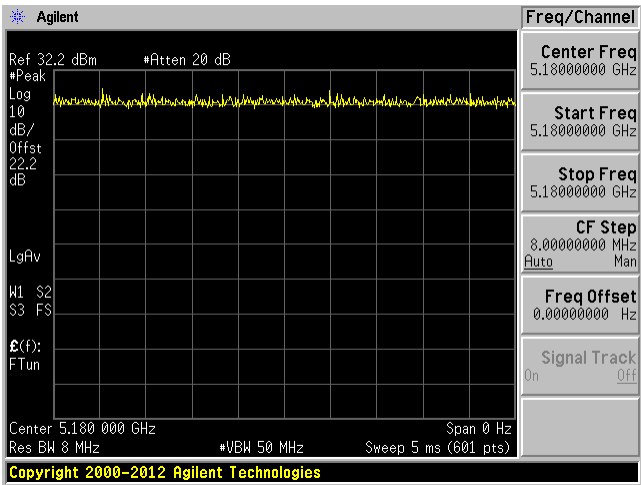
802.11n20 mode



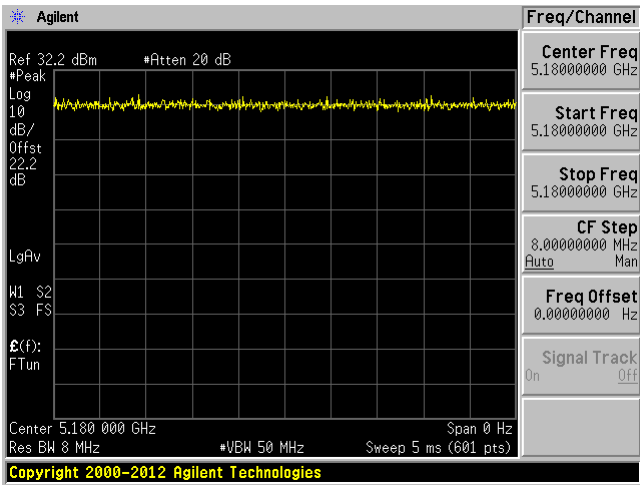
802.11n20 mode MIMO



802.11ac20 mode

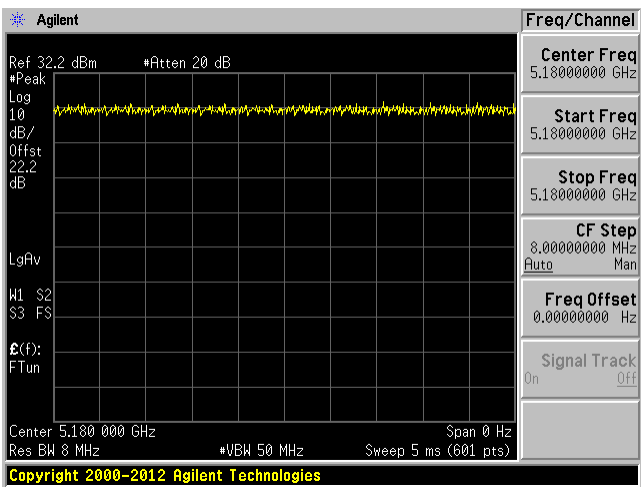


802.11ac20 mode MIMO

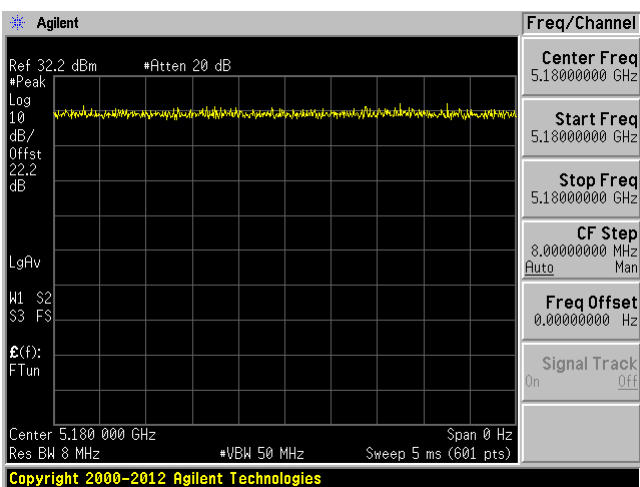


Port B

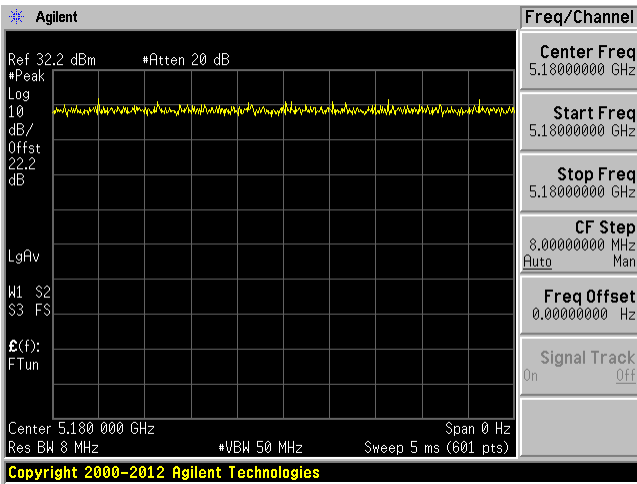
802.11a mode



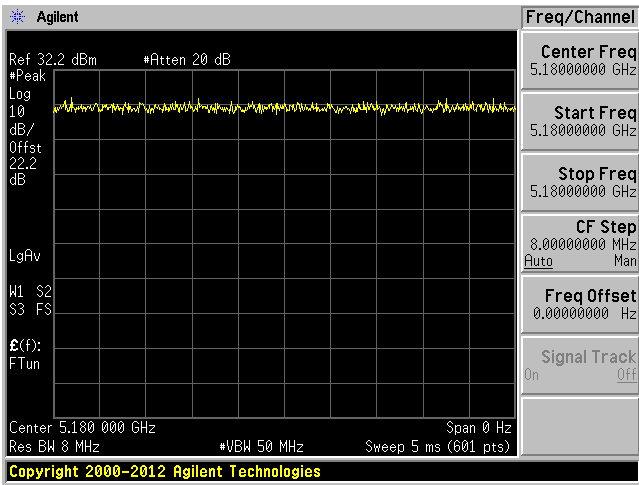
802.11n20 mode



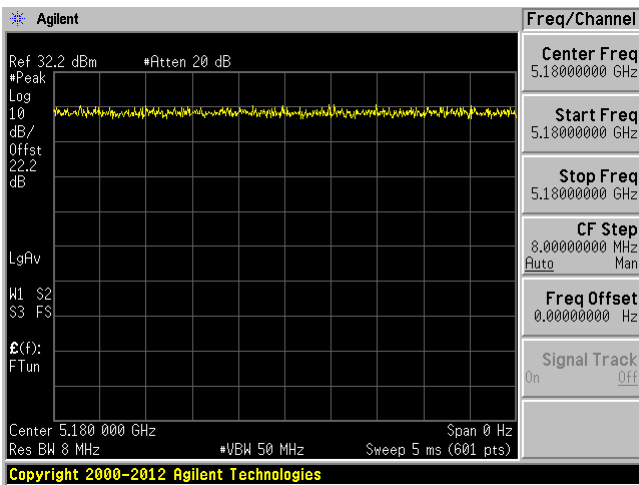
802.11n20 mode MIMO



802.11ac20 mode



802.11ac20 mode MIMO



## 2.4 Equipment Modifications

No equipment modifications were made to EUT.

## 2.5 Local Support Equipment

| Manufacturer | Description | Model          |
|--------------|-------------|----------------|
| Dell         | Laptop      | Latitude E6410 |

## 2.6 Support Equipment

| Manufacturer | Description | Model   |
|--------------|-------------|---------|
| Roku         | Debug Board | Unknown |

## 2.7 Interface Ports and Cabling

| Cable Description        | Length (m) | To     | From |
|--------------------------|------------|--------|------|
| USB 2.0 A-Male to B-Male | 2 m        | Laptop | EUT  |
| RF Cable                 | < 1 m      | EUT    | PSA  |

### 3 Summary of Test Results

| FCC and ISED Rules                                               | Description of Test                     | Result    |
|------------------------------------------------------------------|-----------------------------------------|-----------|
| FCC §2.1091, §15.407(f),<br>ISED RSS-102                         | RF Exposure                             | Compliant |
| FCC §15.203<br>ISED RSS-Gen §8.3                                 | Antenna Requirement                     | Compliant |
| FCC §15.207<br>ISED RSS-Gen §8.8                                 | AC Power Line Conducted Emissions       | Compliant |
| FCC §2.1053, §15.205,<br>§15.209, 15.407(b)<br>ISED RSS-247 §6.2 | Spurious Radiated Emissions             | Compliant |
| FCC §15.407(e)<br>ISED RSS-Gen §6.2                              | Emission Bandwidth                      | Compliant |
| FCC §407(a)<br>ISED RSS-247 §6.2                                 | Output Power                            | Compliant |
| FCC §2.1051, §15.407(b)<br>ISED RSS-247 §6.2                     | Band Edges                              | Compliant |
| FCC §15.407(a)<br>ISED RSS-247 §6.2                              | Power Spectral Density                  | Compliant |
| FCC §2.1051, §15.407(b)<br>ISED RSS-247 §6.2                     | Spurious Emissions at Antenna Terminals | Compliant |

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

### 4.1 Applicable Standards

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

#### Limits for General Population/Uncontrolled Exposure

| Frequency Range (MHz)                               | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | 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 <sup>2</sup> )             | 30                       |
| 30-300                                              | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300-1500                                            | /                             | /                             | f/1500                              | 30                       |
| 1500-100,000                                        | /                             | /                             | 1.0                                 | 30                       |

f = frequency in MHz

\* = Plane-wave equivalent power density

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

According to ISED RSS-102 Issue 5:

#### 2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz<sup>6</sup> and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $4.49/f^{0.5}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $1.31 \times 10^{-2} f^{0.6834}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

## 4.2 MPE Prediction

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

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

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

## 4.3 MPE Results

### W52 band:

|                                                                                             |               |
|---------------------------------------------------------------------------------------------|---------------|
| <u>Maximum peak output power at antenna input terminal (dBm):</u>                           | <u>15.24</u>  |
| <u>Maximum peak output power at antenna input terminal (mW):</u>                            | <u>33.42</u>  |
| <u>Prediction distance (cm):</u>                                                            | <u>20</u>     |
| <u>Prediction frequency (MHz):</u>                                                          | <u>5180</u>   |
| <u>Maximum Antenna Gain, typical (dBi):</u>                                                 | <u>4.8</u>    |
| <u>Maximum Antenna Gain (numeric):</u>                                                      | <u>3.02</u>   |
| <u>Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>):</u>                | <u>0.0201</u> |
| <u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u> | <u>1.0</u>    |

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0201 mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

### W58 band:

|                                                                                             |               |
|---------------------------------------------------------------------------------------------|---------------|
| <u>Maximum peak output power at antenna input terminal (dBm):</u>                           | <u>19.29</u>  |
| <u>Maximum peak output power at antenna input terminal (mW):</u>                            | <u>84.92</u>  |
| <u>Prediction distance (cm):</u>                                                            | <u>20</u>     |
| <u>Prediction frequency (MHz):</u>                                                          | <u>5785</u>   |
| <u>Maximum Antenna Gain, typical (dBi):</u>                                                 | <u>4.8</u>    |
| <u>Maximum Antenna Gain (numeric):</u>                                                      | <u>3.02</u>   |
| <u>Power density of prediction frequency at 20.0 cm (mW/cm<sup>2</sup>):</u>                | <u>0.0510</u> |
| <u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm<sup>2</sup>):</u> | <u>1.0</u>    |

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0510 mW/cm<sup>2</sup>. Limit is 1.0 mW/cm<sup>2</sup>.

## 4.4 RF exposure evaluation exemption for ISED

**W52 band:**  $15.24 + 4.8 \text{ dBi} = 20.04 \text{ dBm} < 1.31 \times 10^{-2} f^{0.6834} = 4.525 \text{ W} = 36.56 \text{ dBm}$

**W58 band:**  $19.29 + 4.8 \text{ dBi} = 24.09 \text{ dBm} < 1.31 \times 10^{-2} f^{0.6834} = 4.880 \text{ W} = 36.88 \text{ dBm}$

Therefore the RF exposure is not required.

## 5 FCC §15.203 and ISEDC RSS-Gen §8.3 - 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 §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to ISEDC RSS-Gen §8.3: Transmitter Antenna

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the license-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

License-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the license-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.<sup>9</sup> When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

## 5.2 Antenna List

The antennas used by the EUT are permanent attached antennas.

| Antenna usage | Frequency Range (MHz) | Maximum Antenna Gain (dBi) |
|---------------|-----------------------|----------------------------|
| Wi-Fi         | 2400-2432             | -1.0                       |
| Wi-Fi         | 2437-2452             | -1.6                       |
| Wi-Fi         | 2457-2500             | -1.4                       |
| Wi-Fi         | 5150-5250             | 4.8                        |
| Wi-Fi         | 5725-5850             | 4.8                        |

## 6 FCC §15.207 & ISEDC RSS-Gen §8.8 - AC Power Line Conducted Emissions

### 6.1 Applicable Standards

As per FCC §15.207 and ISEDC RSS GEN §8.8

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  $\mu$ H/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<br>(MHz) | Conducted Limit (dBuV)    |                           |
|--------------------------------|---------------------------|---------------------------|
|                                | Quasi-Peak                | Average                   |
| 0.15-0.5                       | 66 to 56 <sup>Note1</sup> | 56 to 46 <sup>Note2</sup> |
| 0.5-5                          | 56                        | 46                        |
| 5-30                           | 60                        | 50                        |

*Note1: Decreases with the logarithm of the frequency.*

*Note2: A linear average detector is required*

### 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 and and ISEDC RSS GEN §8.8.

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.

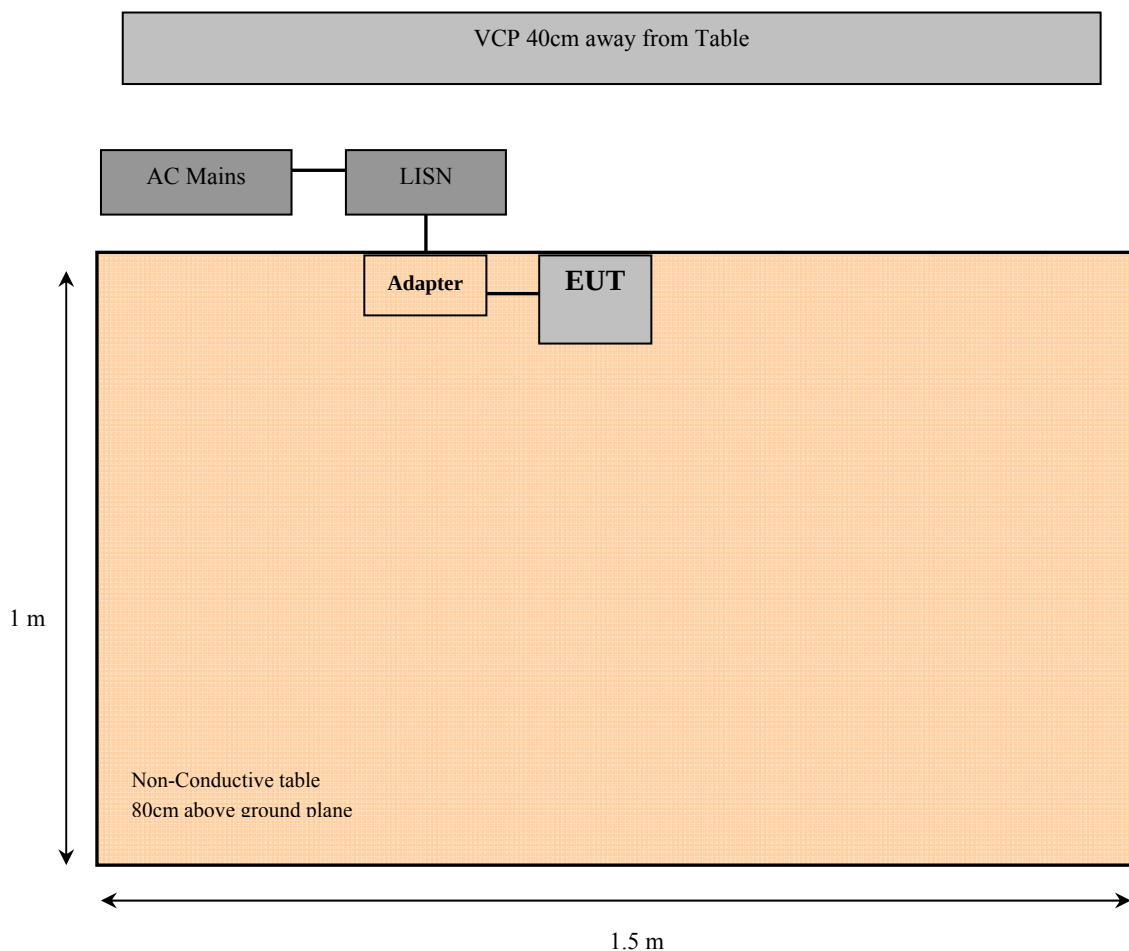
### 6.3 Test Procedure

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 and Margin Calculation

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

$$CA = A_i + CL + \text{Atten}$$

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:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

## 6.6 Test Equipment List and Details

| Manufacturer              | Description                     | Model No.                   | Serial No. | Calibration Date | Calibration Interval |
|---------------------------|---------------------------------|-----------------------------|------------|------------------|----------------------|
| Rohde and Schwarz         | Receiver, EMI Test              | ESCI 1166.5950K03           | 100338     | 2016-02-04       | 2 years              |
| Rohde and Schwarz         | Impulse Limiter                 | ESH3-Z2                     | 101964     | 2017-07-25       | 1 year               |
| Keysight Technologies     | RF Limiter                      | 11867A                      | MY42242931 | 2017-01-12       | 1 year               |
| Solar Electronics Company | High Pass Filter                | Type 7930-100               | 7930150204 | 2017-03-13       | 1 year               |
| Suirong                   | 30 ft conductive emission cable | LMR 400                     | -          | N/R              | N/A                  |
| FCC                       | LISN                            | FCC-LISN-50-25-2-10-CISPR16 | 160129     | 2017-04-24       | 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:       | 23° C      |
| Relative Humidity: | 42 %       |
| ATM Pressure:      | 101.31 kPa |

The testing was performed by Vincent Licata on 2017-08-18 at chamber 5m 3 test site.

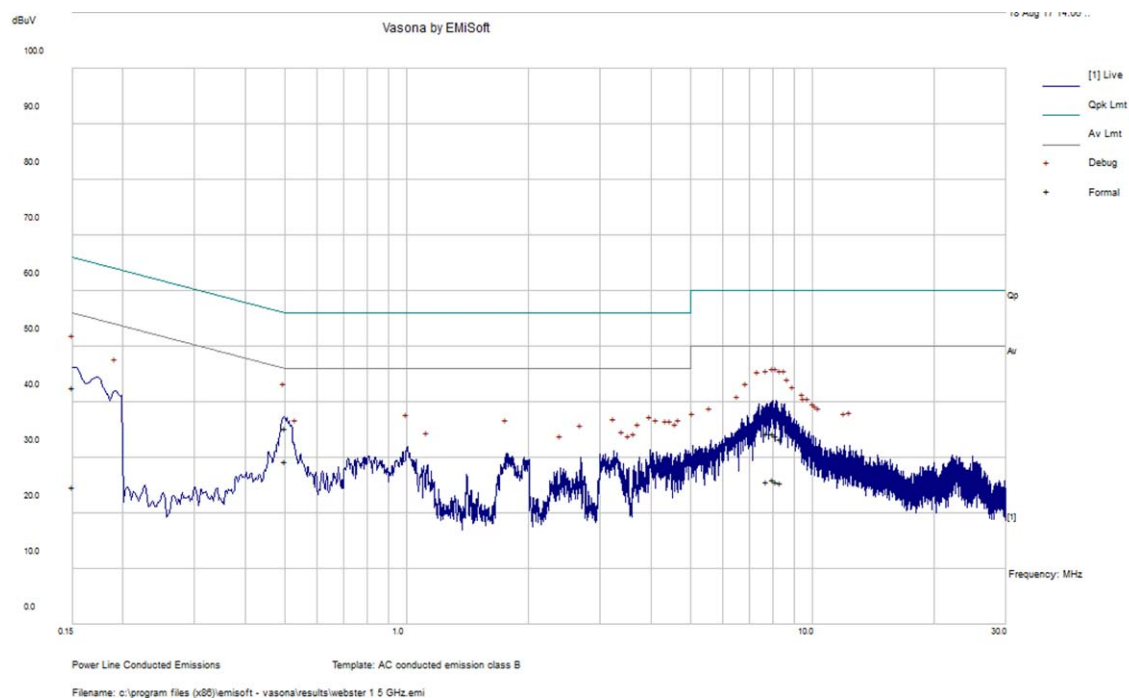
## 6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Part 15 and RSS-Gen standards 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 (Line/Neutral) | Range (MHz) |
| -16.69                                                 | 0.501495        | Line                          | 0.5-5       |

## 6.9 Conducted Emissions Test Plots and Data

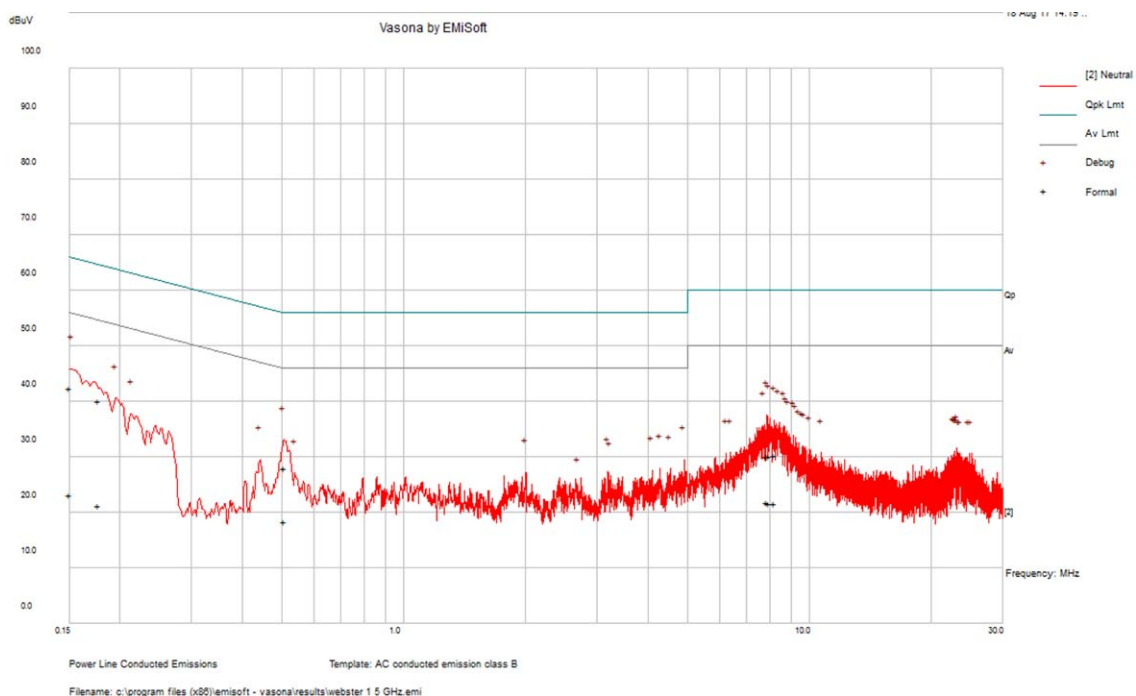
### 120 V, 60 Hz – Line



Note: testing was prefomed at worst case.

| Frequency (MHz) | Corrected Amplitude (dBμV) | Conductor (Line/Neutral) | Limit (dBμV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.501495        | 35.23                      | Line                     | 56           | -20.77      | QP                 |
| 0.150182        | 42.68                      | Line                     | 65.99        | -23.31      | QP                 |
| 8.132313        | 33.9                       | Line                     | 60           | -26.1       | QP                 |
| 8.016774        | 34.29                      | Line                     | 60           | -25.71      | QP                 |
| 7.731751        | 34.33                      | Line                     | 60           | -25.67      | QP                 |
| 8.352688        | 33.48                      | Line                     | 60           | -26.52      | QP                 |

| Frequency (MHz) | Corrected Amplitude (dBμV) | Conductor (Live/Neutral) | Limit (dBμV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.501495        | 29.31                      | Line                     | 46           | -16.69      | Ave.               |
| 0.150182        | 24.74                      | Line                     | 55.99        | -31.25      | Ave.               |
| 8.132313        | 25.76                      | Line                     | 50           | -24.24      | Ave.               |
| 8.016774        | 26.17                      | Line                     | 50           | -23.83      | Ave.               |
| 7.731751        | 25.67                      | Line                     | 50           | -24.33      | Ave.               |
| 8.352688        | 25.57                      | Line                     | 50           | -24.43      | Ave.               |

**120 V, 60 Hz – Neutral**

| Frequency (MHz) | Corrected Amplitude (dBμV) | Conductor (Line/Neutral) | Limit (dBμV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.150642        | 42.41                      | Neutral                  | 65.96        | -23.56      | QP                 |
| 7.863817        | 30.22                      | Neutral                  | 60           | -29.78      | QP                 |
| 0.508597        | 27.99                      | Neutral                  | 56           | -28.01      | QP                 |
| 7.96641         | 30.18                      | Neutral                  | 60           | -29.82      | QP                 |
| 0.176862        | 40.18                      | Neutral                  | 64.63        | -24.45      | QP                 |
| 8.194136        | 30.34                      | Neutral                  | 60           | -29.66      | QP                 |

| Frequency (MHz) | Corrected Amplitude (dBμV) | Conductor (Line/Neutral) | Limit (dBμV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.150642        | 23.26                      | Neutral                  | 55.96        | -32.7       | Ave.               |
| 7.863817        | 21.78                      | Neutral                  | 50           | -28.22      | Ave.               |
| 0.508597        | 18.4                       | Neutral                  | 46           | -27.6       | Ave.               |
| 7.96641         | 21.77                      | Neutral                  | 50           | -28.23      | Ave.               |
| 0.176862        | 21.36                      | Neutral                  | 54.63        | -33.27      | Ave.               |
| 8.194136        | 21.69                      | Neutral                  | 50           | -28.31      | Ave.               |

## 7 FCC §15.209, §15.407(b) & ISEDC RSS-247 §6.2 - 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 e.i.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 not 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.

As per ISSED RSS-247 §6.2

For transmitters operating in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, any unwanted emissions that fall into the band 5250- 5350 MHz must be 26 dBc, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth, above 5.25 GHz. Otherwise, the transmission is considered as intentional and the devices shall implement dynamic frequency selection (DFS) and transmitter power control (TPC) as per the requirements for the band 5250-5350 MHz

For devices with both operating frequencies and channel bandwidths contained within the band 5250-5350 MHz, the device shall comply with the following:

1. All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. if the equipment is intended for outdoor use; or
2. All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and any emissions within the band 5150-5250 MHz shall meet the power spectral density limits of Section 6.2.1. The device shall be labelled "for indoor use only."

For devices with operating frequencies in the band 5250-5350 MHz but having a channel bandwidth that overlaps the band 5150-5250 MHz, the devices' unwanted emission shall not exceed -27 dBm/MHz e.i.r.p. outside the band 5150-5350 MHz and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device shall be labelled "for indoor use only."

For transmitters operating in the band 5470-5725 MHz, emissions outside the band shall not exceed -27 dBm/MHz e.i.r.p.

For the band 5725-5850 MHz, emissions at frequencies from the band edges to 10 MHz above or below the band edges shall not exceed -17 dBm/MHz e.i.r.p. For emissions at frequencies more than 10 MHz above or below the band edges, the emissions power shall not exceed -27 dBm/MHz.

## 7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15.407 and ISEDC RSS-247 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:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000 MHz:

- (1) Peak:  $\text{RBW} = 1\text{MHz} / \text{VBW} = 3\text{MHz} / \text{Sweep} = 100\text{ms}$
- (2) Average:  $\text{RBW} = 1\text{MHz} / \text{VBW} = 10\text{Hz} / \text{Sweep} = \text{Auto}$

## 7.4 Corrected Amplitude and 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:

$$\text{CA} = \text{Ai} + \text{AF} + \text{CL} + \text{Atten} - \text{Ga}$$

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:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

## 7.5 Test Equipment List and Details

| Manufacturer      | Description                    | Model No.         | Serial No.       | Calibration Date       | Calibration Interval |
|-------------------|--------------------------------|-------------------|------------------|------------------------|----------------------|
| Rohde and Schwarz | Receiver, EMI Test             | ESCI 1166.5950K03 | 100338           | 2016-02-04             | 2 years              |
| Agilent           | Analyzer, Spectrum             | E4446A            | US44300386       | 2017-04-20             | 1 year               |
| Sunol Sciences    | System Controller              | SC99V             | 011003-1         | N/R                    | N/A                  |
| Sunol Sciences    | Antenna, Biconi-Log            | JB3               | A020106-2        | 2015-07-11             | 26 Months            |
| EMCO              | Antenna, Horn                  | 3115              | 9511-4627        | 2016-01-28             | 2 years              |
| Agilent           | Amplifier, Pre                 | 8447D             | 2944A10187       | 2017-03-13             | 1 year               |
| IW                | AOBOR Hi frequency Co AX Cable | DC 1531           | KPS-1501A3960KPS | 2016-08-05             | 1 year               |
| -                 | SMA cable                      | -                 | C0002            | Each time <sup>1</sup> | N/A                  |
| -                 | N-Type Cable                   | -                 | C00012           | Each time <sup>1</sup> | N/A                  |
| -                 | N-Type Cable                   | -                 | C00014           | Each time <sup>1</sup> | N/A                  |
| Agilent           | Pre-Amplifier                  | 8449B             | 3147A00400       | 2017-06-15             | 1 year               |
| Sunol Sciences    | Antenna, Horn                  | DRH-118           | A052704          | 2017-03-27             | 2 years              |
| A.R.A.            | Antenna, Horn                  | DRG-118/A         | 1132             | 2015-09-21             | 2 years              |
| Vasona            | Test software                  | V6.0 build 11     | 10400213         | N/R                    | N/R                  |

Note<sup>1</sup>: cables and attenuators included in the test set-up will be checked each time before testing.

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

## 7.6 Test Environmental Conditions

|                           |                 |
|---------------------------|-----------------|
| <b>Temperature:</b>       | 22-24 °C        |
| <b>Relative Humidity:</b> | 40-41 %         |
| <b>ATM Pressure:</b>      | 103.1-104.1 kPa |

The testing was performed by Vincent Licata 2017-08-14 to 2017-08-15 in 5m chamber 3.

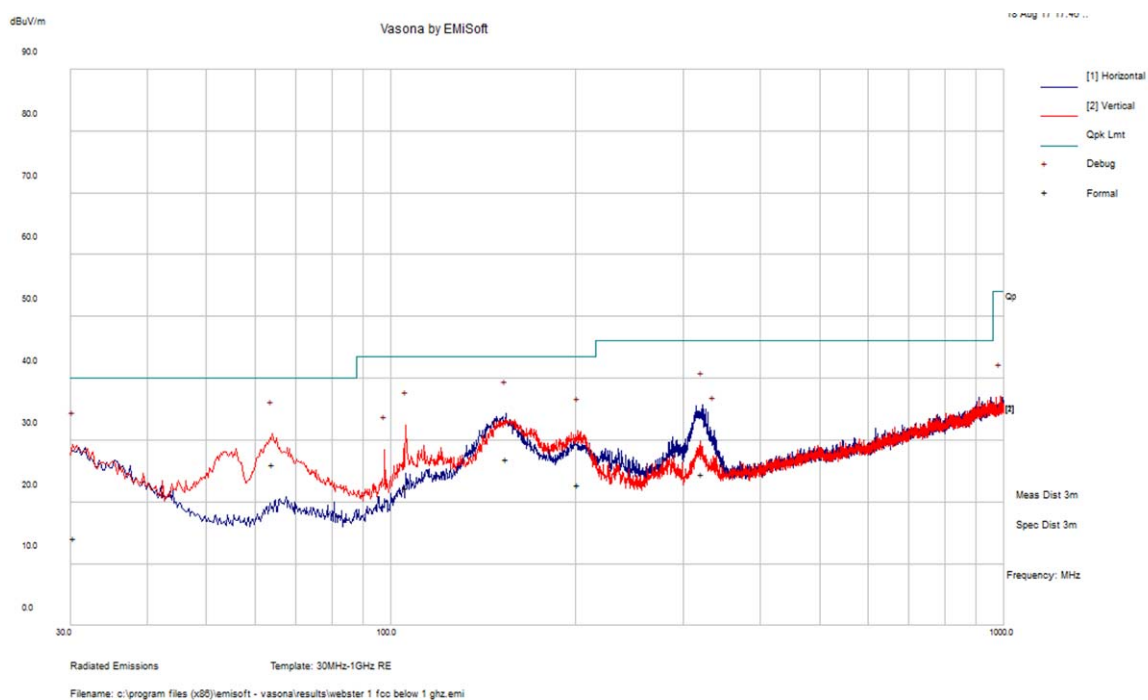
## 7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15.407 and RSS-247 standards' radiated emissions limits, and had the worst margin of:

| Mode: Transmitting |                 |                                    |               |
|--------------------|-----------------|------------------------------------|---------------|
| Margin (dB)        | Frequency (MHz) | Polarization (Horizontal/Vertical) | Mode, Channel |
| -0.92              | 5875            | Horizontal                         | Ac20, 5825    |

## 7.8 Radiated Emissions Test Result Data

### 1) 30 MHz – 1 GHz



| Frequency (MHz) | Corrected Amplitude (dBμV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBμV/m) | Margin (dB) | Comments (PK/QP/Ave.) |
|-----------------|------------------------------|---------------------|------------------------|-----------------------------|----------------|-------------|-----------------------|
| 64.0325         | 26                           | 127                 | V                      | 359                         | 40             | -14         | QP                    |
| 154.0983        | 26.87                        | 100                 | V                      | 174                         | 43.5           | -16.63      | QP                    |
| 321.796         | 24.57                        | 106                 | H                      | 35                          | 46             | -21.43      | QP                    |
| 30.3465         | 14.11                        | 233                 | V                      | 114                         | 40             | -25.89      | QP                    |
| 105.6203        | 22.19                        | 101                 | V                      | 355                         | 43.5           | -21.31      | QP                    |
| 201.7455        | 22.72                        | 118                 | H                      | 263                         | 43.5           | -20.78      | QP                    |

Note: Only six emissions were present because all of the other emissions were 20 dB below the limit.

**2) 1-40 GHz**

After pre-scan, the worst case was selected in the following tables.

**5150 - 5250 MHz**

802.11a mode

| Frequency<br>(MHz)      | S.A.<br>Reading<br>(dBμV) | Turntable<br>Azimuth<br>(degrees) | Test Antenna   |                   |                  | Cable<br>Loss<br>(dB) | Pre-<br>Amp.<br>(dB) | Cord.<br>Reading<br>(dBμV/m) | FCC/ISED          |                | Comments<br>(PK/Ave.) |
|-------------------------|---------------------------|-----------------------------------|----------------|-------------------|------------------|-----------------------|----------------------|------------------------------|-------------------|----------------|-----------------------|
|                         |                           |                                   | Height<br>(cm) | Polarity<br>(H/V) | Factor<br>(dB/m) |                       |                      |                              | Limit<br>(dBμV/m) | Margin<br>(dB) |                       |
| Low Channel 5180 MHz    |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5180                    | 69.98                     | 43                                | 113            | H                 | 33.61            | 6.88                  | 0.00                 | 110.47                       | -                 | -              | PK                    |
| 5180                    | 60.67                     | 43                                | 113            | H                 | 33.61            | 6.88                  | 0.00                 | 101.16                       | -                 | -              | AV                    |
| 5180                    | 65.75                     | 101                               | 287            | V                 | 33.61            | 6.88                  | 0.00                 | 106.24                       | -                 | -              | PK                    |
| 5180                    | 58.11                     | 101                               | 287            | V                 | 33.61            | 6.88                  | 0.00                 | 98.60                        | -                 | -              | AV                    |
| 5150                    | 60.54                     | 43                                | 113            | H                 | 33.61            | 6.45                  | 38.54                | 62.06                        | 74.00             | -11.94         | PK                    |
| 5150                    | 48.92                     | 43                                | 113            | H                 | 33.61            | 6.45                  | 38.54                | 50.44                        | 54.00             | -3.56          | AV                    |
| 5150                    | 55.82                     | 101                               | 287            | V                 | 33.61            | 6.45                  | 38.54                | 57.34                        | 74.00             | -16.66         | PK                    |
| 5150                    | 44.20                     | 101                               | 287            | V                 | 33.61            | 6.45                  | 38.54                | 45.72                        | 54.00             | -8.28          | AV                    |
| 10360                   | 43.80                     | 209                               | 136            | H                 | 38.25            | 14.04                 | 38.33                | 57.76                        | 68.20             | -10.44         | PK                    |
| 10360                   | 32.79                     | 209                               | 136            | H                 | 38.25            | 14.04                 | 38.33                | 46.75                        | 54.00             | -7.25          | AV                    |
| 15540                   | 40.85                     | 105                               | 360            | H                 | 39.41            | 14.47                 | 36.99                | 57.74                        | 68.20             | -10.46         | PK                    |
| 15540                   | 30.43                     | 105                               | 360            | H                 | 39.41            | 14.47                 | 36.99                | 47.32                        | 54.00             | -6.68          | AV                    |
| Middle Channel 5200 MHz |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5200                    | 69.57                     | 110                               | 133            | H                 | 33.61            | 6.88                  | 0.00                 | 110.06                       | -                 | -              | PK                    |
| 5200                    | 60.83                     | 110                               | 133            | H                 | 33.61            | 6.88                  | 0.00                 | 101.32                       | -                 | -              | AV                    |
| 5200                    | 65.14                     | 0                                 | 156            | V                 | 33.61            | 6.88                  | 0.00                 | 105.63                       | -                 | -              | PK                    |
| 5200                    | 58.42                     | 0                                 | 156            | V                 | 33.61            | 6.88                  | 0.00                 | 98.91                        | -                 | -              | AV                    |
| 10400                   | 43.19                     | 360                               | 100            | H                 | 38.25            | 14.24                 | 38.21                | 57.47                        | 68.20             | -10.73         | PK                    |
| 10400                   | 33.95                     | 360                               | 100            | H                 | 38.25            | 14.24                 | 38.21                | 48.23                        | 54.00             | -5.77          | AV                    |
| 15600                   | 40.67                     | 162                               | 100            | H                 | 39.41            | 14.87                 | 36.99                | 57.96                        | 68.20             | -10.24         | PK                    |
| 15600                   | 31.84                     | 162                               | 100            | H                 | 39.41            | 14.87                 | 36.99                | 49.13                        | 54.00             | -4.87          | AV                    |
| High Channel 5240 MHz   |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5240                    | 68.97                     | 62                                | 140            | H                 | 33.61            | 7.35                  | 0.00                 | 109.93                       | -                 | -              | PK                    |
| 5240                    | 61.57                     | 62                                | 140            | H                 | 33.61            | 7.35                  | 0.00                 | 102.53                       | -                 | -              | AV                    |
| 5240                    | 64.23                     | 170                               | 100            | V                 | 33.61            | 7.35                  | 0.00                 | 105.19                       | -                 | -              | PK                    |
| 5240                    | 56.78                     | 170                               | 100            | V                 | 33.61            | 7.35                  | 0.00                 | 97.74                        | -                 | -              | AV                    |
| 10480                   | 44.57                     | 40                                | 139            | H                 | 38.33            | 14.24                 | 38.21                | 58.93                        | 68.20             | -9.27          | PK                    |
| 10480                   | 33.05                     | 40                                | 139            | H                 | 38.33            | 14.24                 | 38.21                | 47.41                        | 54.00             | -6.59          | AV                    |
| 15720                   | 40.19                     | 157                               | 113            | H                 | 38.91            | 14.87                 | 38.99                | 54.98                        | 68.20             | -13.22         | PK                    |
| 15720                   | 31.20                     | 157                               | 113            | H                 | 38.91            | 14.87                 | 38.99                | 45.99                        | 54.00             | -8.01          | AV                    |

## 802.11 n20 mode

| Frequency<br>(MHz)      | S.A.<br>Reading<br>(dBμV) | Turntable<br>Azimuth<br>(degrees) | Test Antenna   |                   |                  | Cable<br>Loss<br>(dB) | Pre-<br>Amp.<br>(dB) | Cord.<br>Reading<br>(dBμV/m) | FCC/ISED          |                | Comments<br>(PK/Ave.) |
|-------------------------|---------------------------|-----------------------------------|----------------|-------------------|------------------|-----------------------|----------------------|------------------------------|-------------------|----------------|-----------------------|
|                         |                           |                                   | Height<br>(cm) | Polarity<br>(H/V) | Factor<br>(dB/m) |                       |                      |                              | Limit<br>(dBμV/m) | Margin<br>(dB) |                       |
| Low Channel 5180 MHz    |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5180                    | 68.19                     | 212                               | 229            | H                 | 33.61            | 6.88                  | 0.00                 | 108.68                       | -                 | -              | PK                    |
| 5180                    | 60.70                     | 212                               | 229            | H                 | 33.61            | 6.88                  | 0.00                 | 101.19                       | -                 | -              | AV                    |
| 5180                    | 65.20                     | 177                               | 100            | V                 | 33.61            | 6.88                  | 0.00                 | 105.69                       | -                 | -              | PK                    |
| 5180                    | 57.83                     | 177                               | 100            | V                 | 33.61            | 6.88                  | 0.00                 | 98.32                        | -                 | -              | AV                    |
| 5150                    | 56.47                     | 212                               | 229            | H                 | 33.61            | 6.45                  | 38.54                | 57.99                        | 74.00             | -16.01         | PK                    |
| 5150                    | 45.52                     | 212                               | 229            | H                 | 33.61            | 6.45                  | 38.54                | 47.04                        | 54.00             | -6.96          | AV                    |
| 5150                    | 54.27                     | 177                               | 100            | V                 | 33.61            | 6.45                  | 38.54                | 55.79                        | 74.00             | -18.21         | PK                    |
| 5150                    | 43.16                     | 177                               | 100            | V                 | 33.61            | 6.45                  | 38.54                | 44.68                        | 54.00             | -9.32          | AV                    |
| 10360                   | 45.05                     | 13                                | 140            | H                 | 38.25            | 14.04                 | 38.33                | 59.01                        | 68.20             | -9.19          | PK                    |
| 10360                   | 32.79                     | 13                                | 140            | H                 | 38.25            | 14.04                 | 38.33                | 46.75                        | 54.00             | -7.25          | AV                    |
| 15540                   | 41.77                     | 100                               | 360            | H                 | 39.41            | 14.47                 | 36.99                | 58.66                        | 68.20             | -9.54          | PK                    |
| 15540                   | 30.99                     | 100                               | 360            | H                 | 39.41            | 14.47                 | 36.99                | 47.88                        | 54.00             | -6.12          | AV                    |
| Middle Channel 5200 MHz |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5200                    | 67.84                     | 206                               | 193            | H                 | 33.61            | 6.88                  | 0.00                 | 108.33                       | -                 | -              | PK                    |
| 5200                    | 60.55                     | 206                               | 193            | H                 | 33.61            | 6.88                  | 0.00                 | 101.04                       | -                 | -              | AV                    |
| 5200                    | 64.06                     | 162                               | 154            | V                 | 33.61            | 6.88                  | 0.00                 | 104.55                       | -                 | -              | PK                    |
| 5200                    | 56.31                     | 162                               | 154            | V                 | 33.61            | 6.88                  | 0.00                 | 96.80                        | -                 | -              | AV                    |
| 10400                   | 43.57                     | 130                               | 132            | H                 | 38.25            | 14.24                 | 38.21                | 57.85                        | 68.20             | -10.35         | PK                    |
| 10400                   | 32.63                     | 130                               | 132            | H                 | 38.25            | 14.24                 | 38.21                | 46.91                        | 54.00             | -7.09          | AV                    |
| 15600                   | 41.29                     | 0                                 | 100            | H                 | 39.41            | 14.87                 | 36.99                | 58.58                        | 68.20             | -9.62          | PK                    |
| 15600                   | 30.70                     | 0                                 | 100            | H                 | 39.41            | 14.87                 | 36.99                | 47.99                        | 54.00             | -6.01          | AV                    |
| High Channel 5240 MHz   |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5240                    | 67.37                     | 41                                | 138            | H                 | 33.61            | 7.35                  | 0.00                 | 108.33                       | -                 | -              | PK                    |
| 5240                    | 59.91                     | 41                                | 138            | H                 | 33.61            | 7.35                  | 0.00                 | 100.87                       | -                 | -              | AV                    |
| 5240                    | 63.54                     | 173                               | 100            | V                 | 33.61            | 7.35                  | 0.00                 | 104.50                       | -                 | -              | PK                    |
| 5240                    | 56.28                     | 173                               | 100            | V                 | 33.61            | 7.35                  | 0.00                 | 97.24                        | -                 | -              | AV                    |
| 10480                   | 44.16                     | 0                                 | 100            | H                 | 38.33            | 14.24                 | 38.21                | 58.52                        | 68.20             | -9.68          | PK                    |
| 10480                   | 32.46                     | 0                                 | 100            | H                 | 38.33            | 14.24                 | 38.21                | 46.82                        | 54.00             | -7.18          | AV                    |
| 15720                   | 40.71                     | 0                                 | 100            | H                 | 38.91            | 14.87                 | 38.99                | 55.50                        | 68.20             | -12.70         | PK                    |
| 15720                   | 30.42                     | 0                                 | 100            | H                 | 38.91            | 14.87                 | 38.99                | 45.21                        | 54.00             | -8.79          | AV                    |

## 802.11ac20 mode

| Frequency<br>(MHz)      | S.A.<br>Reading<br>(dBμV) | Turntable<br>Azimuth<br>(degrees) | Test Antenna   |                   |                  | Cable<br>Loss<br>(dB) | Pre-<br>Amp.<br>(dB) | Cord.<br>Reading<br>(dBμV/m) | FCC/ISED          |                | Comments<br>(PK/Ave.) |
|-------------------------|---------------------------|-----------------------------------|----------------|-------------------|------------------|-----------------------|----------------------|------------------------------|-------------------|----------------|-----------------------|
|                         |                           |                                   | Height<br>(cm) | Polarity<br>(H/V) | Factor<br>(dB/m) |                       |                      |                              | Limit<br>(dBμV/m) | Margin<br>(dB) |                       |
| Low Channel 5180 MHz    |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5180                    | 68.21                     | 212                               | 286            | H                 | 33.61            | 6.88                  | 0.00                 | 108.70                       | -                 | -              | PK                    |
| 5180                    | 59.62                     | 212                               | 286            | H                 | 33.61            | 6.88                  | 0.00                 | 100.11                       | -                 | -              | AV                    |
| 5180                    | 64.79                     | 176                               | 102            | V                 | 33.61            | 6.88                  | 0.00                 | 105.28                       | -                 | -              | PK                    |
| 5180                    | 56.92                     | 176                               | 102            | V                 | 33.61            | 6.88                  | 0.00                 | 97.41                        | -                 | -              | AV                    |
| 5150                    | 57.42                     | 212                               | 286            | H                 | 33.61            | 6.45                  | 38.54                | 58.94                        | 74.00             | -15.06         | PK                    |
| 5150                    | 45.15                     | 212                               | 286            | H                 | 33.61            | 6.45                  | 38.54                | 46.67                        | 54.00             | -7.33          | AV                    |
| 5150                    | 55.36                     | 176                               | 102            | V                 | 33.61            | 6.45                  | 38.54                | 56.88                        | 74.00             | -17.12         | PK                    |
| 5150                    | 43.89                     | 176                               | 102            | V                 | 33.61            | 6.45                  | 38.54                | 45.41                        | 54.00             | -8.59          | AV                    |
| 10360                   | 44.10                     | 261                               | 226            | H                 | 38.25            | 14.04                 | 38.33                | 58.06                        | 68.20             | -10.14         | PK                    |
| 10360                   | 33.26                     | 261                               | 226            | H                 | 38.25            | 14.04                 | 38.33                | 47.22                        | 54.00             | -6.78          | AV                    |
| 15540                   | 42.39                     | 270                               | 100            | H                 | 39.41            | 14.47                 | 36.99                | 59.28                        | 68.20             | -8.92          | PK                    |
| 15540                   | 31.48                     | 270                               | 100            | H                 | 39.41            | 14.47                 | 36.99                | 48.37                        | 54.00             | -5.63          | AV                    |
| Middle Channel 5200 MHz |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5200                    | 68.43                     | 163                               | 201            | H                 | 33.61            | 6.88                  | 0.00                 | 108.92                       | -                 | -              | PK                    |
| 5200                    | 56.85                     | 163                               | 201            | H                 | 33.61            | 6.88                  | 0.00                 | 97.34                        | -                 | -              | AV                    |
| 5200                    | 63.96                     | 153                               | 262            | V                 | 33.61            | 6.88                  | 0.00                 | 104.45                       | -                 | -              | PK                    |
| 5200                    | 56.84                     | 153                               | 262            | V                 | 33.61            | 6.88                  | 0.00                 | 97.33                        | -                 | -              | AV                    |
| 10400                   | 44.36                     | 189                               | 120            | H                 | 38.25            | 14.24                 | 38.21                | 58.64                        | 68.20             | -9.56          | PK                    |
| 10400                   | 32.87                     | 189                               | 120            | H                 | 38.25            | 14.24                 | 38.21                | 47.15                        | 54.00             | -6.85          | AV                    |
| 15600                   | 41.09                     | 0                                 | 100            | H                 | 39.41            | 14.87                 | 36.99                | 58.38                        | 68.20             | -9.82          | PK                    |
| 15600                   | 30.11                     | 0                                 | 100            | H                 | 39.41            | 14.87                 | 36.99                | 47.40                        | 54.00             | -6.60          | AV                    |
| High Channel 5240 MHz   |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5240                    | 68.95                     | 275                               | 119            | H                 | 33.61            | 7.35                  | 0.00                 | 109.91                       | -                 | -              | PK                    |
| 5240                    | 60.20                     | 275                               | 119            | H                 | 33.61            | 7.35                  | 0.00                 | 101.16                       | -                 | -              | AV                    |
| 5240                    | 63.60                     | 294                               | 291            | V                 | 33.61            | 7.35                  | 0.00                 | 104.56                       | -                 | -              | PK                    |
| 5240                    | 56.10                     | 294                               | 291            | V                 | 33.61            | 7.35                  | 0.00                 | 97.06                        | -                 | -              | AV                    |
| 10480                   | 43.96                     | 360                               | 100            | H                 | 38.33            | 14.24                 | 38.21                | 58.32                        | 68.20             | -9.88          | PK                    |
| 10480                   | 32.77                     | 360                               | 100            | H                 | 38.33            | 14.24                 | 38.21                | 47.13                        | 54.00             | -6.87          | AV                    |
| 15720                   | 41.12                     | 152                               | 103            | H                 | 38.91            | 14.87                 | 38.99                | 55.91                        | 68.20             | -12.29         | PK                    |
| 15720                   | 30.91                     | 152                               | 103            | H                 | 38.91            | 14.87                 | 38.99                | 45.70                        | 54.00             | -8.30          | AV                    |

## 5725 - 5850 MHz

802.11a mode

| Frequency<br>(MHz)      | S.A.<br>Reading<br>(dBμV) | Turntable<br>Azimuth<br>(degrees) | Test Antenna   |                   |                  | Cable<br>Loss<br>(dB) | Pre-<br>Amp.<br>(dB) | Cord.<br>Reading<br>(dBμV/m) | FCC/ISED          |                | Comments<br>(PK/Ave.) |
|-------------------------|---------------------------|-----------------------------------|----------------|-------------------|------------------|-----------------------|----------------------|------------------------------|-------------------|----------------|-----------------------|
|                         |                           |                                   | Height<br>(cm) | Polarity<br>(H/V) | Factor<br>(dB/m) |                       |                      |                              | Limit<br>(dBμV/m) | Margin<br>(dB) |                       |
| Low Channel 5745 MHz    |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5745                    | 68.47                     | 315                               | 300            | H                 | 34.07            | 8.87                  | 0.00                 | 111.41                       | -                 | -              | PK                    |
| 5745                    | 60.51                     | 315                               | 300            | H                 | 34.07            | 8.87                  | 0.00                 | 103.45                       | -                 | -              | AV                    |
| 5745                    | 63.66                     | 150                               | 294            | V                 | 33.97            | 8.87                  | 0.00                 | 106.50                       | -                 | -              | PK                    |
| 5745                    | 56.24                     | 150                               | 294            | V                 | 33.97            | 8.87                  | 0.00                 | 99.08                        | -                 | -              | AV                    |
| 5700                    | 47.21                     | 316                               | 300            | H                 | 34.07            | 9.79                  | 36.16                | 54.91                        | 68.23             | -13.32         | PK                    |
| 5700                    | 45.20                     | 186                               | 294            | V                 | 33.97            | 9.79                  | 36.16                | 52.81                        | 68.23             | -15.43         | PK                    |
| 5720                    | 59.71                     | 316                               | 300            | H                 | 34.07            | 9.79                  | 36.16                | 67.41                        | 105.20            | -37.79         | PK                    |
| 5720                    | 54.35                     | 186                               | 294            | V                 | 33.97            | 9.79                  | 36.16                | 61.96                        | 105.20            | -43.25         | PK                    |
| 5725                    | 71.93                     | 316                               | 300            | H                 | 34.07            | 9.79                  | 36.16                | 79.63                        | 110.80            | -31.17         | PK                    |
| 5725                    | 67.05                     | 186                               | 294            | V                 | 33.97            | 9.79                  | 36.16                | 74.66                        | 110.80            | -36.15         | PK                    |
| 11490                   | 44.09                     | 0                                 | 100            | H                 | 38.96            | 17.14                 | 37.80                | 62.39                        | 74.00             | -11.61         | PK                    |
| 11490                   | 32.31                     | 0                                 | 100            | H                 | 38.96            | 17.14                 | 37.80                | 50.61                        | 54.00             | -3.39          | AV                    |
| 11490                   | 43.73                     | 0                                 | 100            | V                 | 38.96            | 17.14                 | 37.80                | 62.03                        | 74.00             | -11.97         | PK                    |
| 11490                   | 32.06                     | 0                                 | 100            | V                 | 38.96            | 17.14                 | 37.80                | 50.36                        | 54.00             | -3.64          | AV                    |
| Middle Channel 5785 MHz |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5785                    | 68.12                     | 313                               | 300            | H                 | 34.17            | 8.88                  | 0.00                 | 111.17                       | -                 | -              | PK                    |
| 5785                    | 60.63                     | 313                               | 300            | H                 | 34.17            | 8.88                  | 0.00                 | 103.68                       | -                 | -              | AV                    |
| 5785                    | 63.23                     | 150                               | 275            | V                 | 34.04            | 8.88                  | 0.00                 | 106.15                       | -                 | -              | PK                    |
| 5785                    | 55.76                     | 150                               | 275            | V                 | 34.04            | 8.88                  | 0.00                 | 98.68                        | -                 | -              | AV                    |
| 11570                   | 44.97                     | 337                               | 100            | H                 | 39.10            | 16.99                 | 37.80                | 63.26                        | 74.00             | -10.74         | PK                    |
| 11570                   | 32.45                     | 337                               | 100            | H                 | 39.10            | 16.99                 | 37.80                | 50.74                        | 54.00             | -3.26          | AV                    |
| 11570                   | 44.16                     | 0                                 | 100            | V                 | 39.10            | 16.99                 | 37.80                | 62.45                        | 74.00             | -11.55         | PK                    |
| 11570                   | 32.34                     | 0                                 | 100            | V                 | 39.10            | 16.99                 | 37.80                | 50.63                        | 54.00             | -3.37          | AV                    |
| High Channel 5825 MHz   |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5825                    | 68.24                     | 313                               | 110            | H                 | 34.24            | 8.88                  | 0.00                 | 111.36                       | -                 | -              | PK                    |
| 5825                    | 60.46                     | 313                               | 110            | H                 | 34.24            | 8.88                  | 0.00                 | 103.58                       | -                 | -              | AV                    |
| 5825                    | 65.96                     | 150                               | 300            | V                 | 34.14            | 8.88                  | 0.00                 | 108.98                       | -                 | -              | PK                    |
| 5825                    | 58.51                     | 150                               | 300            | V                 | 34.14            | 8.88                  | 0.00                 | 101.53                       | -                 | -              | AV                    |
| 5850                    | 56.83                     | 311                               | 100            | H                 | 34.24            | 9.82                  | 36.24                | 64.65                        | 68.23             | -3.58          | PK                    |
| 5850                    | 50.09                     | 44                                | 300            | V                 | 34.14            | 9.82                  | 36.24                | 57.81                        | 68.23             | -10.42         | PK                    |
| 11650                   | 44.35                     | 0                                 | 100            | H                 | 39.33            | 16.06                 | 37.80                | 61.94                        | 74.00             | -12.06         | PK                    |
| 11650                   | 32.16                     | 0                                 | 100            | H                 | 39.33            | 16.06                 | 37.80                | 49.75                        | 54.00             | -4.25          | AV                    |
| 11650                   | 43.52                     | 0                                 | 100            | V                 | 39.33            | 16.06                 | 37.80                | 61.11                        | 74.00             | -12.89         | PK                    |
| 11650                   | 31.80                     | 0                                 | 100            | V                 | 39.33            | 16.06                 | 37.80                | 49.39                        | 54.00             | -4.61          | AV                    |

## 802.11n20 mode

| Frequency<br>(MHz)      | S.A.<br>Reading<br>(dBμV) | Turntable<br>Azimuth<br>(degrees) | Test Antenna   |                   |                  | Cable<br>Loss<br>(dB) | Pre-<br>Amp.<br>(dB) | Cord.<br>Reading<br>(dBμV/m) | FCC/ISED          |                | Comments<br>(PK/Ave.) |
|-------------------------|---------------------------|-----------------------------------|----------------|-------------------|------------------|-----------------------|----------------------|------------------------------|-------------------|----------------|-----------------------|
|                         |                           |                                   | Height<br>(cm) | Polarity<br>(H/V) | Factor<br>(dB/m) |                       |                      |                              | Limit<br>(dBμV/m) | Margin<br>(dB) |                       |
| Low Channel 5745 MHz    |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5745                    | 70.72                     | 147                               | 100            | H                 | 34.07            | 8.87                  | 0.00                 | 113.66                       | -                 | -              | PK                    |
| 5745                    | 63.22                     | 147                               | 100            | H                 | 34.07            | 8.87                  | 0.00                 | 106.16                       | -                 | -              | AV                    |
| 5745                    | 63.40                     | 183                               | 300            | V                 | 33.97            | 8.87                  | 0.00                 | 106.24                       | -                 | -              | PK                    |
| 5745                    | 55.98                     | 183                               | 300            | V                 | 33.97            | 8.87                  | 0.00                 | 98.82                        | -                 | -              | AV                    |
| 5700                    | 52.91                     | 150                               | 100            | H                 | 34.07            | 9.79                  | 36.16                | 60.61                        | 68.23             | -7.62          | PK                    |
| 5700                    | 44.72                     | 294                               | 292            | V                 | 33.97            | 9.79                  | 36.16                | 52.33                        | 68.23             | -15.91         | PK                    |
| 5720                    | 61.07                     | 150                               | 100            | H                 | 34.07            | 9.79                  | 36.16                | 68.77                        | 105.20            | -36.43         | PK                    |
| 5720                    | 53.05                     | 294                               | 292            | V                 | 33.97            | 9.79                  | 36.16                | 60.66                        | 105.20            | -44.55         | PK                    |
| 5725                    | 76.14                     | 150                               | 100            | H                 | 34.07            | 9.79                  | 36.16                | 83.84                        | 110.80            | -26.96         | PK                    |
| 5725                    | 66.68                     | 294                               | 292            | V                 | 33.97            | 9.79                  | 36.16                | 74.29                        | 110.80            | -36.52         | PK                    |
| 11490                   | 43.95                     | 83                                | 100            | H                 | 38.96            | 17.14                 | 37.80                | 62.25                        | 74.00             | -11.75         | PK                    |
| 11490                   | 32.04                     | 83                                | 100            | H                 | 38.96            | 17.14                 | 37.80                | 50.34                        | 54.00             | -3.66          | AV                    |
| 11490                   | 44.01                     | 0                                 | 100            | V                 | 38.96            | 17.14                 | 37.80                | 62.31                        | 74.00             | -11.69         | PK                    |
| 11490                   | 32.08                     | 0                                 | 100            | V                 | 38.96            | 17.14                 | 37.80                | 50.38                        | 54.00             | -3.62          | AV                    |
| Middle Channel 5785 MHz |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5785                    | 68.26                     | 150                               | 100            | H                 | 34.17            | 8.88                  | 0.00                 | 111.31                       | -                 | -              | PK                    |
| 5785                    | 60.84                     | 150                               | 100            | H                 | 34.17            | 8.88                  | 0.00                 | 103.89                       | -                 | -              | AV                    |
| 5785                    | 60.89                     | 286                               | 300            | V                 | 34.04            | 8.88                  | 0.00                 | 103.81                       | -                 | -              | PK                    |
| 5785                    | 53.04                     | 286                               | 300            | V                 | 34.04            | 8.88                  | 0.00                 | 95.96                        | -                 | -              | AV                    |
| 11570                   | 45.96                     | 0                                 | 100            | H                 | 39.10            | 16.99                 | 37.80                | 64.25                        | 74.00             | -9.75          | PK                    |
| 11570                   | 32.49                     | 0                                 | 100            | H                 | 39.10            | 16.99                 | 37.80                | 50.78                        | 54.00             | -3.22          | AV                    |
| 11570                   | 44.02                     | 0                                 | 100            | V                 | 39.10            | 16.99                 | 37.80                | 62.31                        | 74.00             | -11.69         | PK                    |
| 11570                   | 32.05                     | 0                                 | 100            | V                 | 39.10            | 16.99                 | 37.80                | 50.34                        | 54.00             | -3.66          | AV                    |
| High Channel 5825 MHz   |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5825                    | 68.56                     | 149                               | 100            | H                 | 34.24            | 8.88                  | 0.00                 | 111.68                       | -                 | -              | PK                    |
| 5825                    | 61.15                     | 149                               | 100            | H                 | 34.24            | 8.88                  | 0.00                 | 104.27                       | -                 | -              | AV                    |
| 5825                    | 68.08                     | 203                               | 300            | V                 | 34.14            | 8.88                  | 0.00                 | 111.10                       | -                 | -              | PK                    |
| 5825                    | 60.55                     | 203                               | 300            | V                 | 34.14            | 8.88                  | 0.00                 | 103.57                       | -                 | -              | AV                    |
| 5850                    | 66.81                     | 149                               | 100            | H                 | 34.24            | 9.82                  | 36.24                | 74.63                        | 110.80            | -36.17         | PK                    |
| 5850                    | 57.23                     | 286                               | 300            | V                 | 34.14            | 9.82                  | 36.24                | 64.95                        | 110.80            | -45.85         | PK                    |
| 5855                    | 61.85                     | 149                               | 100            | H                 | 34.24            | 9.82                  | 36.24                | 69.67                        | 105.20            | -35.53         | PK                    |
| 5855                    | 51.38                     | 286                               | 300            | V                 | 34.14            | 9.82                  | 36.24                | 59.10                        | 105.20            | -46.10         | PK                    |
| 5875                    | 47.34                     | 149                               | 100            | H                 | 34.24            | 9.82                  | 36.24                | 55.16                        | 68.23             | -13.07         | PK                    |
| 5875                    | 44.63                     | 286                               | 300            | V                 | 34.14            | 9.82                  | 36.24                | 52.35                        | 68.23             | -15.88         | PK                    |
| 11650                   | 47.44                     | 0                                 | 100            | H                 | 39.33            | 16.06                 | 37.80                | 65.03                        | 74.00             | -8.97          | PK                    |
| 11650                   | 33.39                     | 0                                 | 100            | H                 | 39.33            | 16.06                 | 37.80                | 50.98                        | 54.00             | -3.02          | AV                    |
| 11650                   | 44.09                     | 0                                 | 100            | V                 | 39.33            | 16.06                 | 37.80                | 61.68                        | 74.00             | -12.32         | PK                    |
| 11650                   | 31.76                     | 0                                 | 100            | V                 | 39.33            | 16.06                 | 37.80                | 49.35                        | 54.00             | -4.65          | AV                    |

## 802.11ac20 mode

| Frequency<br>(MHz)      | S.A.<br>Reading<br>(dBμV) | Turntable<br>Azimuth<br>(degrees) | Test Antenna   |                   |                  | Cable<br>Loss<br>(dB) | Pre-<br>Amp.<br>(dB) | Cord.<br>Reading<br>(dBμV/m) | FCC/ISED          |                | Comments<br>(PK/Ave.) |
|-------------------------|---------------------------|-----------------------------------|----------------|-------------------|------------------|-----------------------|----------------------|------------------------------|-------------------|----------------|-----------------------|
|                         |                           |                                   | Height<br>(cm) | Polarity<br>(H/V) | Factor<br>(dB/m) |                       |                      |                              | Limit<br>(dBμV/m) | Margin<br>(dB) |                       |
| Low Channel 5745 MHz    |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5745                    | 67.91                     | 149                               | 100            | H                 | 34.07            | 8.87                  | 0.00                 | 110.85                       | -                 | -              | PK                    |
| 5745                    | 60.33                     | 149                               | 100            | H                 | 34.07            | 8.87                  | 0.00                 | 103.27                       | -                 | -              | AV                    |
| 5745                    | 61.45                     | 186                               | 277            | V                 | 33.97            | 8.87                  | 0.00                 | 104.29                       | -                 | -              | PK                    |
| 5745                    | 53.82                     | 186                               | 277            | V                 | 33.97            | 8.87                  | 0.00                 | 96.66                        | -                 | -              | AV                    |
| 5700                    | 58.59                     | 150                               | 100            | H                 | 34.07            | 9.79                  | 36.16                | 66.29                        | 68.23             | -1.94          | PK                    |
| 5700                    | 52.31                     | 292                               | 286            | V                 | 33.97            | 9.79                  | 36.16                | 59.92                        | 68.23             | -8.31          | PK                    |
| 5720                    | 68.11                     | 150                               | 100            | H                 | 34.07            | 9.79                  | 36.16                | 75.81                        | 105.20            | -29.39         | PK                    |
| 5720                    | 60.07                     | 292                               | 286            | V                 | 33.97            | 9.79                  | 36.16                | 67.68                        | 105.20            | -37.53         | PK                    |
| 5725                    | 79.54                     | 150                               | 100            | H                 | 34.07            | 9.79                  | 36.16                | 87.24                        | 110.80            | -23.56         | PK                    |
| 5725                    | 71.45                     | 292                               | 286            | V                 | 33.97            | 9.79                  | 36.16                | 79.06                        | 110.80            | -31.75         | PK                    |
| 11490                   | 45.56                     | 0                                 | 100            | H                 | 38.96            | 17.14                 | 37.80                | 63.86                        | 74.00             | -10.14         | PK                    |
| 11490                   | 32.59                     | 0                                 | 100            | H                 | 38.96            | 17.14                 | 37.80                | 50.89                        | 54.00             | -3.11          | AV                    |
| 11490                   | 44.03                     | 0                                 | 100            | V                 | 38.96            | 17.14                 | 37.80                | 62.33                        | 74.00             | -11.67         | PK                    |
| 11490                   | 31.43                     | 0                                 | 100            | V                 | 38.96            | 17.14                 | 37.80                | 49.73                        | 54.00             | -4.27          | AV                    |
| Middle Channel 5785 MHz |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5785                    | 70.35                     | 146                               | 100            | H                 | 34.17            | 8.88                  | 0.00                 | 113.40                       | -                 | -              | PK                    |
| 5785                    | 62.64                     | 146                               | 100            | H                 | 34.17            | 8.88                  | 0.00                 | 105.69                       | -                 | -              | AV                    |
| 5785                    | 62.32                     | 186                               | 273            | V                 | 34.04            | 8.88                  | 0.00                 | 105.24                       | -                 | -              | PK                    |
| 5785                    | 54.56                     | 186                               | 273            | V                 | 34.04            | 8.88                  | 0.00                 | 97.48                        | -                 | -              | AV                    |
| 11570                   | 46.54                     | 351                               | 100            | H                 | 39.10            | 16.99                 | 37.80                | 64.83                        | 74.00             | -9.17          | PK                    |
| 11570                   | 33.65                     | 351                               | 100            | H                 | 39.10            | 16.99                 | 37.80                | 51.94                        | 54.00             | -2.06          | AV                    |
| 11570                   | 44.24                     | 0                                 | 300            | V                 | 39.10            | 16.99                 | 37.80                | 62.53                        | 74.00             | -11.47         | PK                    |
| 11570                   | 32.21                     | 0                                 | 300            | V                 | 39.10            | 16.99                 | 37.80                | 50.50                        | 54.00             | -3.50          | AV                    |
| High Channel 5825 MHz   |                           |                                   |                |                   |                  |                       |                      |                              |                   |                |                       |
| 5825                    | 71.82                     | 146                               | 100            | H                 | 34.24            | 8.88                  | 0.00                 | 114.94                       | -                 | -              | PK                    |
| 5825                    | 63.72                     | 146                               | 100            | H                 | 34.24            | 8.88                  | 0.00                 | 106.84                       | -                 | -              | AV                    |
| 5825                    | 62.73                     | 186                               | 298            | V                 | 34.14            | 8.88                  | 0.00                 | 105.75                       | -                 | -              | PK                    |
| 5825                    | 54.64                     | 186                               | 298            | V                 | 34.14            | 8.88                  | 0.00                 | 97.66                        | -                 | -              | AV                    |
| 5850                    | 75.66                     | 147                               | 100            | H                 | 34.24            | 9.82                  | 36.24                | 83.48                        | 110.80            | -27.32         | PK                    |
| 5850                    | 67.07                     | 185                               | 295            | V                 | 34.14            | 9.82                  | 36.24                | 74.79                        | 110.80            | -36.01         | PK                    |
| 5855                    | 72.56                     | 147                               | 100            | H                 | 34.24            | 9.82                  | 36.24                | 80.38                        | 105.20            | -24.82         | PK                    |
| 5855                    | 64.21                     | 185                               | 295            | V                 | 34.14            | 9.82                  | 36.24                | 71.93                        | 105.20            | -33.27         | PK                    |
| <b>5875</b>             | <b>59.49</b>              | <b>147</b>                        | <b>100</b>     | <b>H</b>          | <b>34.24</b>     | <b>9.82</b>           | <b>36.24</b>         | <b>67.31</b>                 | <b>68.23</b>      | <b>-0.92</b>   | <b>PK</b>             |
| 5875                    | 50.48                     | 185                               | 295            | V                 | 34.14            | 9.82                  | 36.24                | 58.20                        | 68.23             | -10.03         | PK                    |
| 11650                   | 48.28                     | 0                                 | 100            | H                 | 39.33            | 16.06                 | 37.80                | 65.87                        | 74.00             | -8.13          | PK                    |
| 11650                   | 35.50                     | 0                                 | 100            | H                 | 39.33            | 16.06                 | 37.80                | 53.09                        | 54.00             | -0.91          | AV                    |
| 11650                   | 44.45                     | 0                                 | 100            | V                 | 39.33            | 16.06                 | 37.80                | 62.04                        | 74.00             | -11.96         | PK                    |
| 11650                   | 32.25                     | 0                                 | 100            | V                 | 39.33            | 16.06                 | 37.80                | 49.84                        | 54.00             | -4.16          | AV                    |

## 8 FCC §15.407(e) & ISEDC RSS-247 §6.2 - 6 dB, 26 dB, and 99% Occupied Bandwidth

### 8.1 Applicable Standards

As per FCC §15.407(e) and ISEDC RSS-247 6.2.4(1): for equipment operating in the band 5725 – 5850 MHz, the minimum 6 dB bandwidth of U-NII devices shall be 500 kHz.

### 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 6 or 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 | E4446A    | US44300386 | 2017-04-20             | 1 year               |
| -            | 20 dB attenuator   | -         | -          | Each time <sup>1</sup> | N/A                  |
| -            | RF cable           | -         | -          | Each time <sup>1</sup> | N/A                  |

Note<sup>1</sup>: 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 °C        |
| Relative Humidity: | 40-41 %         |
| ATM Pressure:      | 103.1-104.1 kPa |

*The testing was performed by Vincent Licata on 2017-08-15 at RF site.*

### 8.5 Test Results

Please refer to the following tables and plots.

## 5150 - 5250 MHz

| Antenna Port    | Channel | Frequency (MHz) | 99% OBW (kHz) | 26 dB OBW (kHz) |
|-----------------|---------|-----------------|---------------|-----------------|
| 802.11 a mode   |         |                 |               |                 |
| A               | 36      | 5180            | 16465.3       | 20441           |
|                 | 40      | 5200            | 16491.5       | 21226           |
|                 | 48      | 5240            | 16445.2       | 20079           |
| B               | 36      | 5180            | 16451.4       | 19769           |
|                 | 40      | 5200            | 16469.4       | 19589           |
|                 | 48      | 5240            | 16473.0       | 19174           |
| 802.11n20 mode  |         |                 |               |                 |
| A               | 36      | 5180            | 17584.2       | 20240           |
|                 | 40      | 5200            | 17573.4       | 20742           |
|                 | 48      | 5240            | 17596.1       | 20307           |
| A MIMO          | 36      | 5180            | 17558.4       | 20297           |
|                 | 40      | 5200            | 17564.3       | 20460           |
|                 | 48      | 5240            | 17577.5       | 20531           |
| B               | 36      | 5180            | 17560.4       | 20534           |
|                 | 40      | 5200            | 17590.6       | 20625           |
|                 | 48      | 5240            | 17540.2       | 20298           |
| B MIMO          | 36      | 5180            | 17607.5       | 20731           |
|                 | 40      | 5200            | 17570.6       | 20640           |
|                 | 48      | 5240            | 17546.6       | 20526           |
| 802.11ac20 mode |         |                 |               |                 |
| A               | 36      | 5180            | 17578.5       | 20476           |
|                 | 40      | 5200            | 17592.2       | 19912           |
|                 | 48      | 5240            | 17570.8       | 20581           |
| A MIMO          | 36      | 5180            | 17602.0       | 20573           |
|                 | 40      | 5200            | 17575.1       | 20700           |
|                 | 48      | 5240            | 17580.3       | 20617           |
| B               | 36      | 5180            | 17569.7       | 20320           |
|                 | 40      | 5200            | 17547.8       | 20034           |
|                 | 48      | 5240            | 17597.8       | 20239           |
| B MIMO          | 36      | 5180            | 17586.5       | 20597           |
|                 | 40      | 5200            | 17585.5       | 20158           |
|                 | 48      | 5240            | 17569.3       | 20382           |

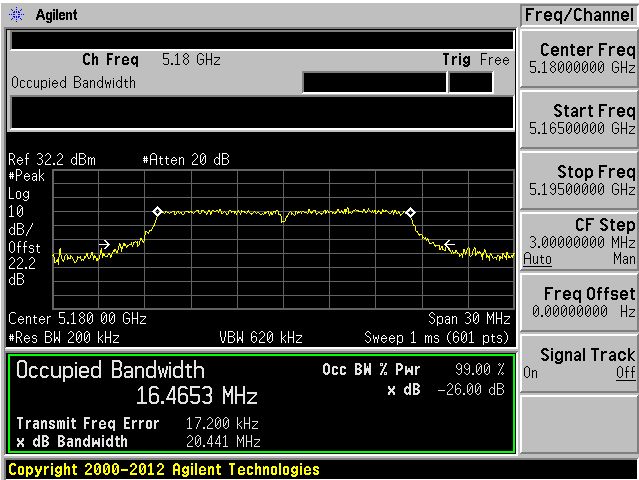
## 5725 - 5850 MHz

| Antenna Port    | Channel | Frequency (MHz) | 99% OBW (kHz) | 6 dB OBW (kHz) |
|-----------------|---------|-----------------|---------------|----------------|
| 802.11 a mode   |         |                 |               |                |
| A               | 149     | 5745            | 23930.2       | 16530          |
|                 | 157     | 5785            | 23336.2       | 16553          |
|                 | 165     | 5825            | 23722.3       | 16501          |
| B               | 149     | 5745            | 16873.7       | 16482          |
|                 | 157     | 5785            | 16791.3       | 16479          |
|                 | 165     | 5825            | 16813.4       | 16517          |
| 802.11n20 mode  |         |                 |               |                |
| A               | 149     | 5745            | 25972.0       | 17708          |
|                 | 157     | 5785            | 24778.5       | 17676          |
|                 | 165     | 5825            | 23299.0       | 17733          |
| A MIMO          | 149     | 5745            | 21855.3       | 17691          |
|                 | 157     | 5785            | 21171.8       | 17711          |
|                 | 165     | 5825            | 21071.0       | 17769          |
| B               | 149     | 5745            | 17916.6       | 17710          |
|                 | 157     | 5785            | 17848.5       | 17713          |
|                 | 165     | 5825            | 17910.3       | 17641          |
| B MIMO          | 149     | 5745            | 17824.6       | 17708          |
|                 | 157     | 5785            | 17765.3       | 17712          |
|                 | 165     | 5825            | 17765.2       | 17612          |
| 802.11ac20 mode |         |                 |               |                |
| A               | 149     | 5745            | 24540.9       | 17708          |
|                 | 157     | 5785            | 23915.3       | 17682          |
|                 | 165     | 5825            | 24848.1       | 17694          |
| A MIMO          | 149     | 5745            | 21429.2       | 17724          |
|                 | 157     | 5785            | 20641.9       | 17778          |
|                 | 165     | 5825            | 21658.2       | 17680          |
| B               | 149     | 5745            | 17846.9       | 17677          |
|                 | 157     | 5785            | 17906.6       | 17603          |
|                 | 165     | 5825            | 17818.3       | 17700          |
| B MIMO          | 149     | 5745            | 17790.5       | 17708          |
|                 | 157     | 5785            | 17767.0       | 17733          |
|                 | 165     | 5825            | 17779.5       | 17694          |

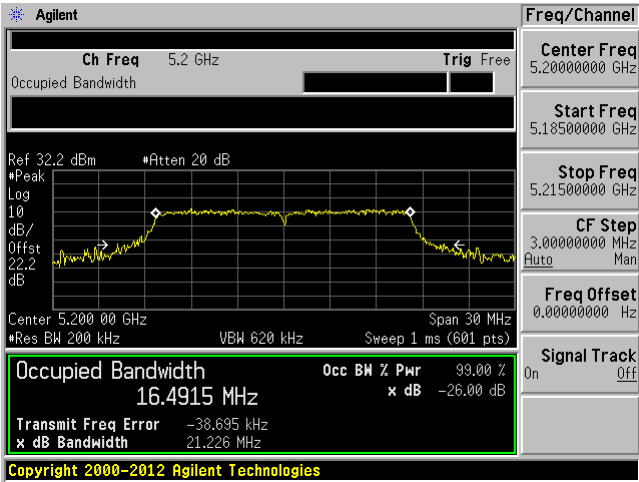
5150 – 5250 MHz

802.11a mode Port A 99% OBW

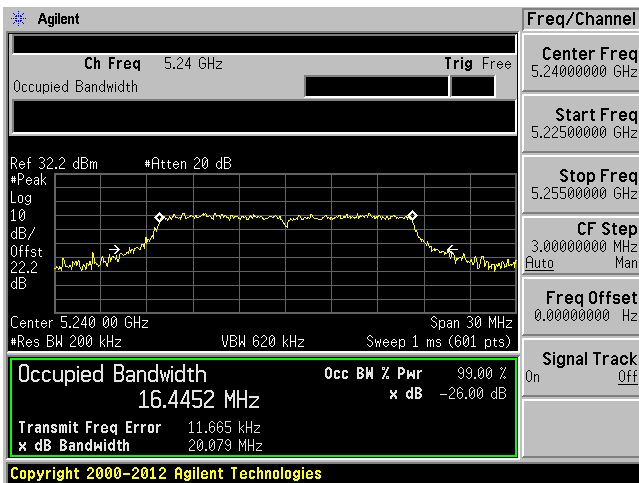
5180 MHz



5200 MHz

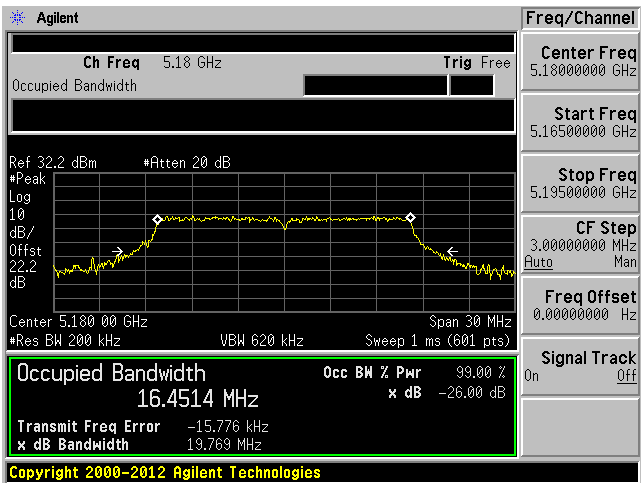


5240 MHz

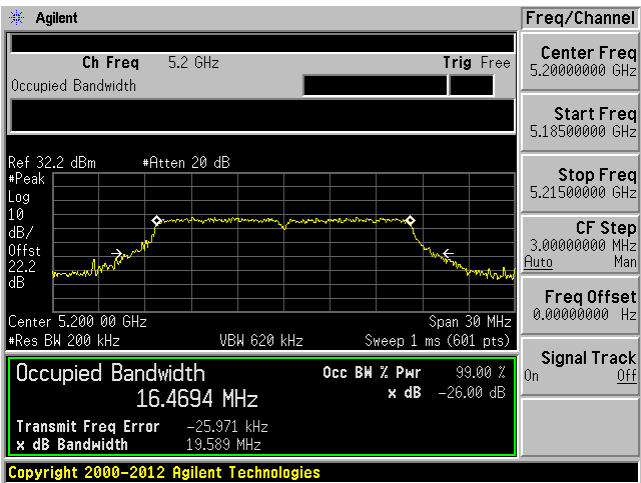


802.11a mode Port B 99% OBW

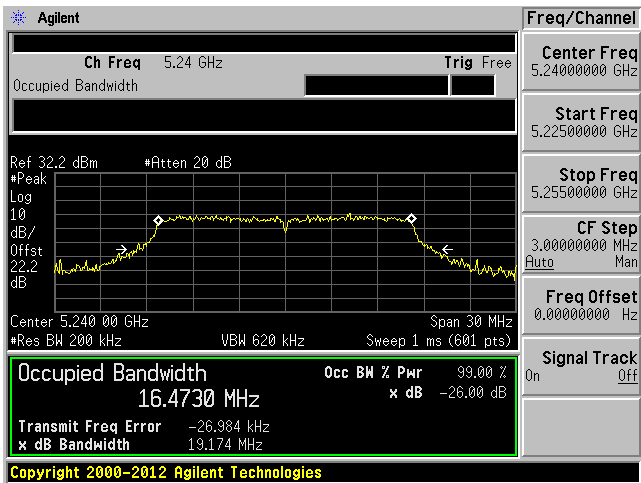
5180 MHz



5200 MHz

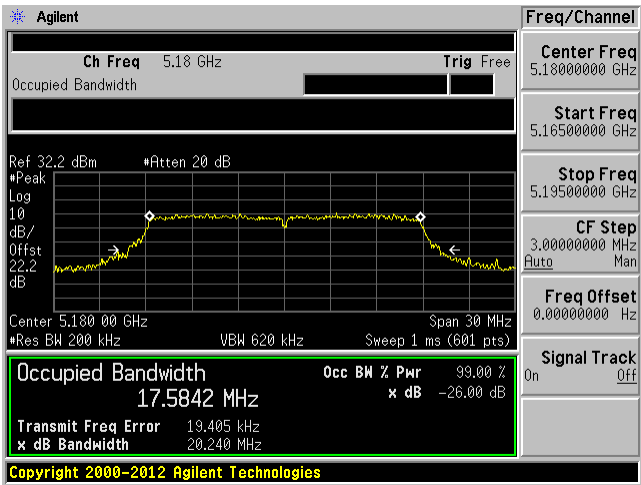


5240 MHz

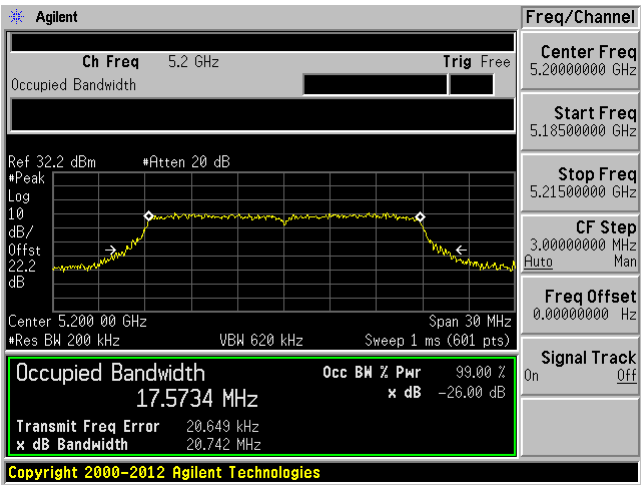


802.11n20 mode Port A 99% OBW

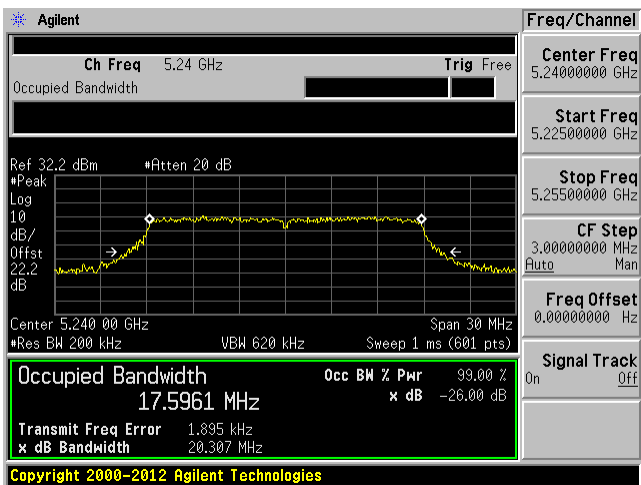
5180 MHz



5200 MHz

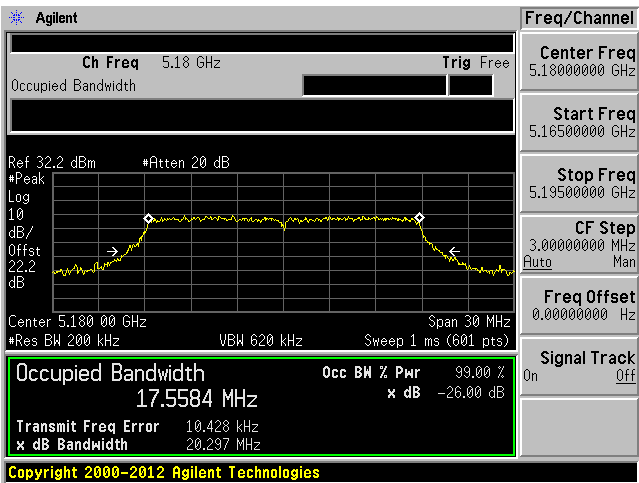


5240 MHz

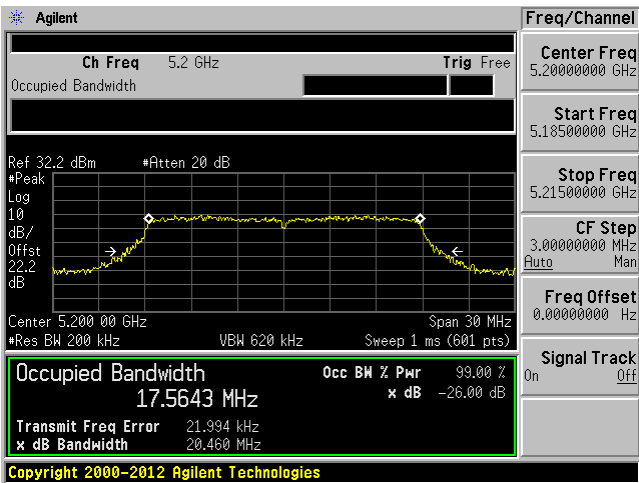


802.11n20 mode Port A MIMO 99% OBW

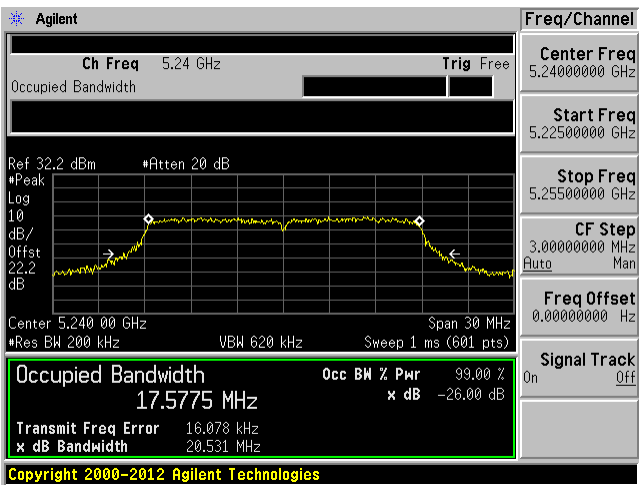
5180 MHz



5200 MHz

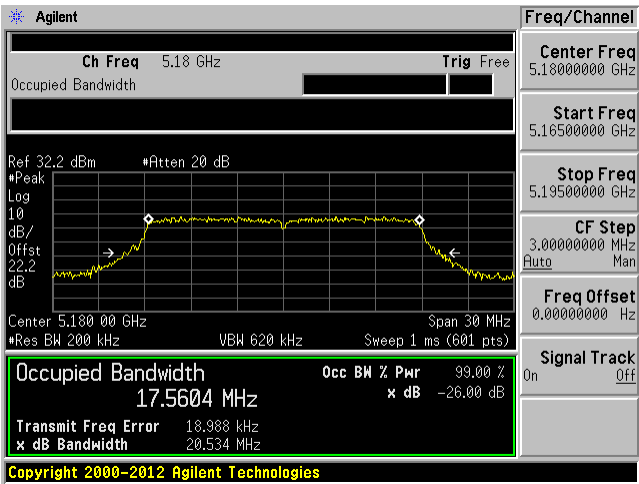


5240 MHz

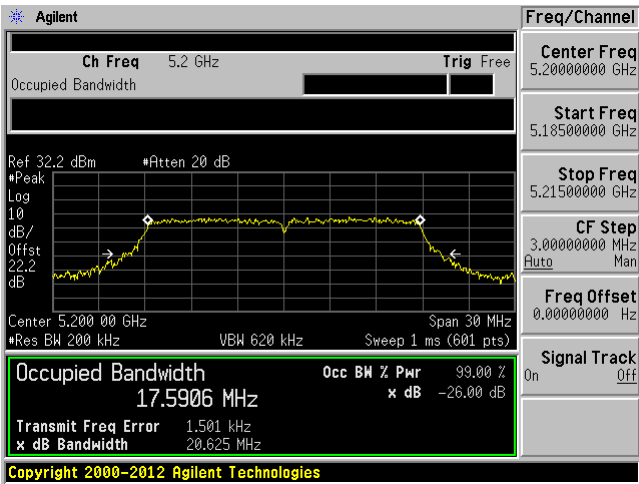


802.11n20 mode Port B 99% OBW

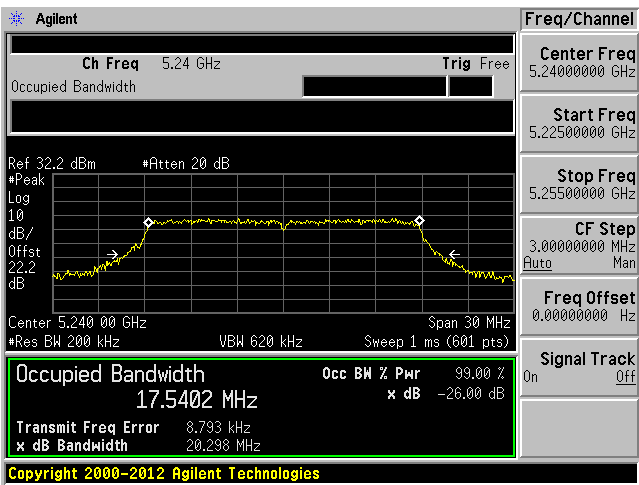
5180 MHz



5200 MHz

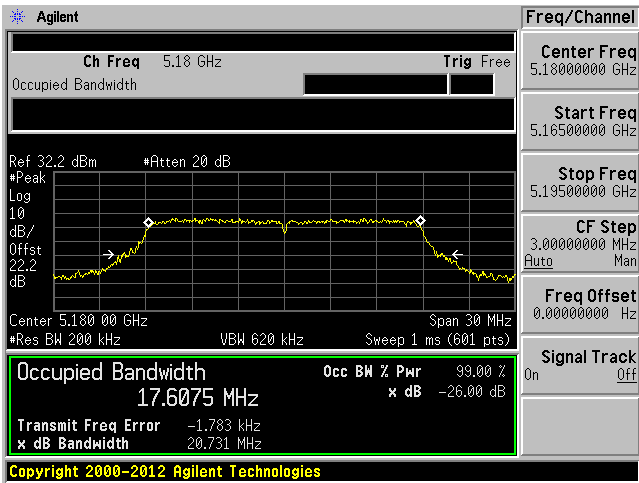


5240 MHz

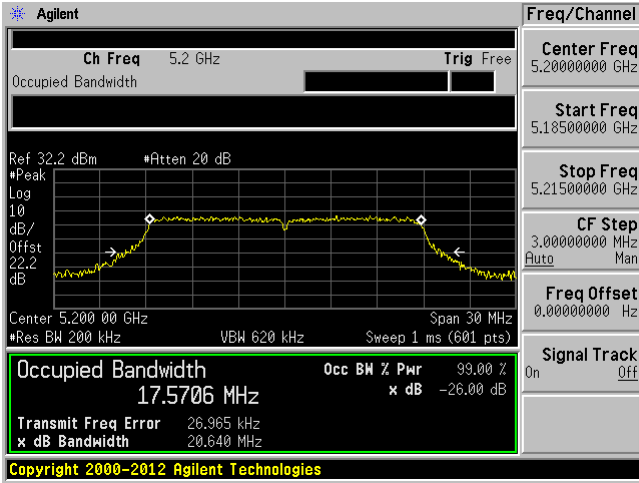


802.11n20 mode Port B MIMO 99% OBW

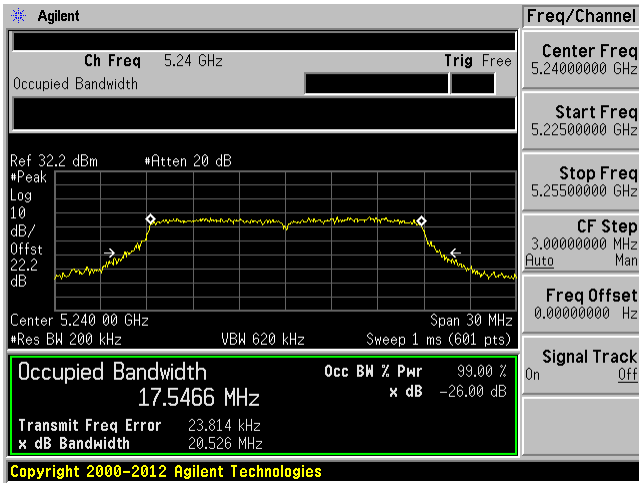
5180 MHz



5200 MHz

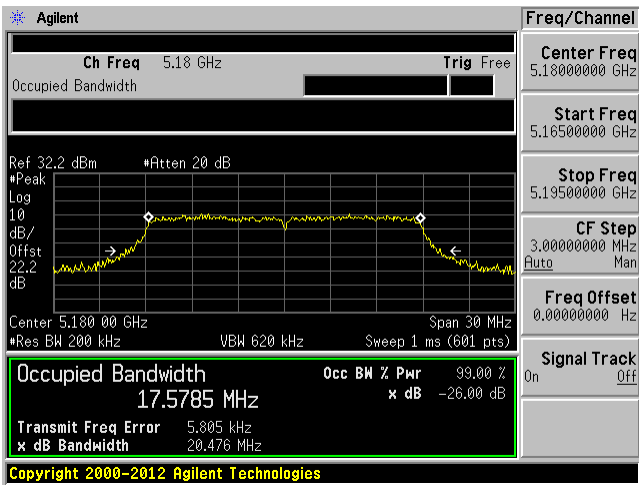


5240 MHz

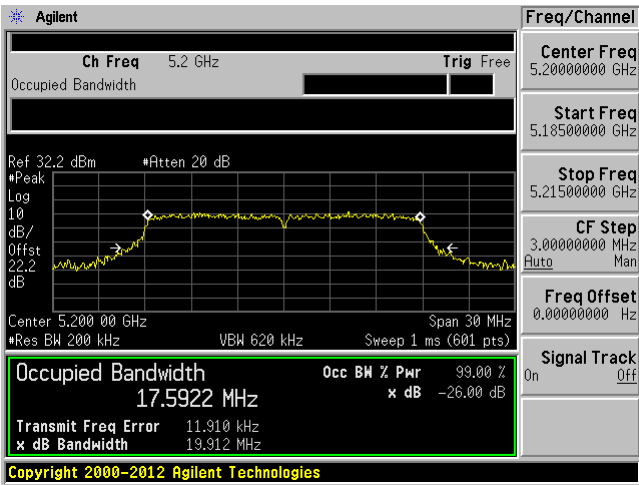


802.11ac20 mode Port A 99% OBW

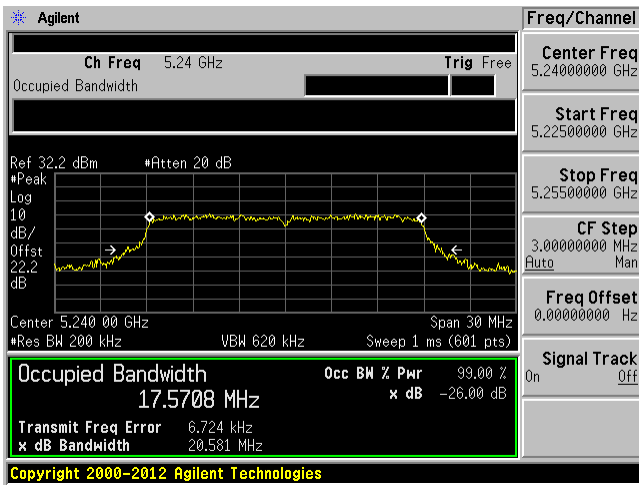
5180 MHz



5200 MHz

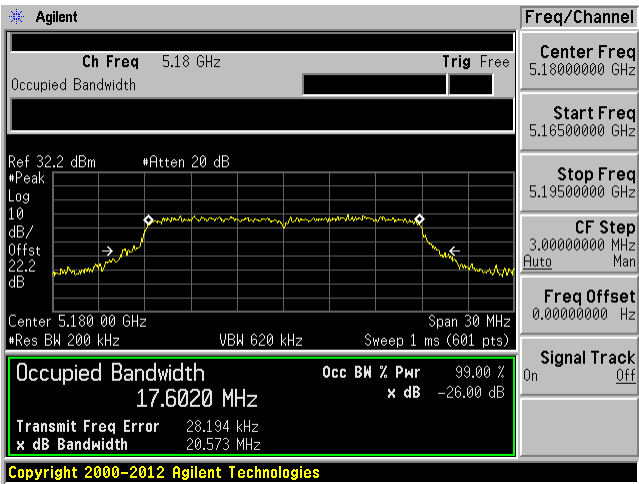


5240 MHz

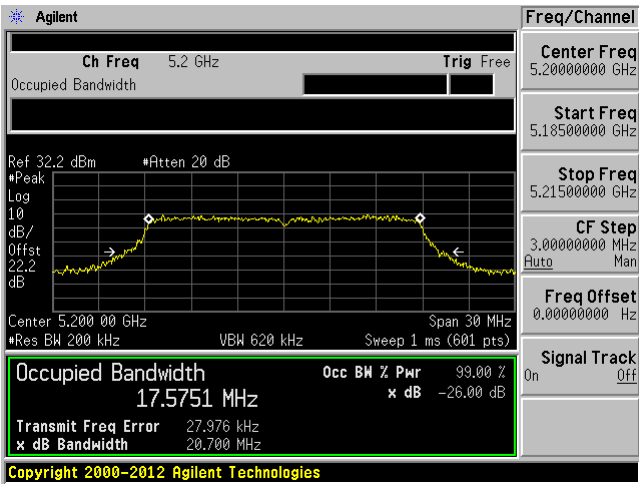


802.11ac20 mode Port A MIMO 99% OBW

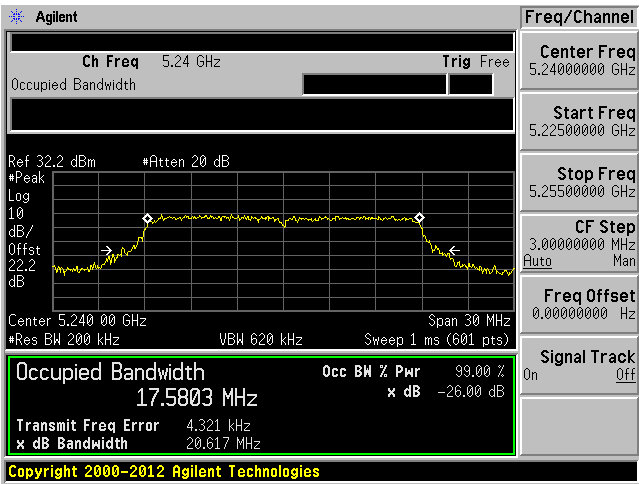
5180 MHz



5200 MHz

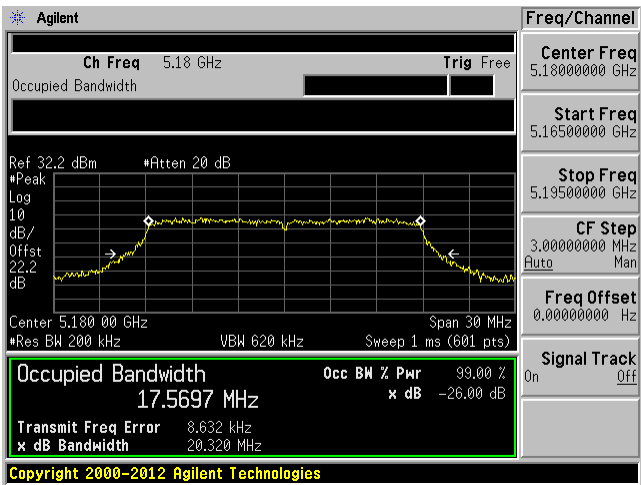


5240 MHz

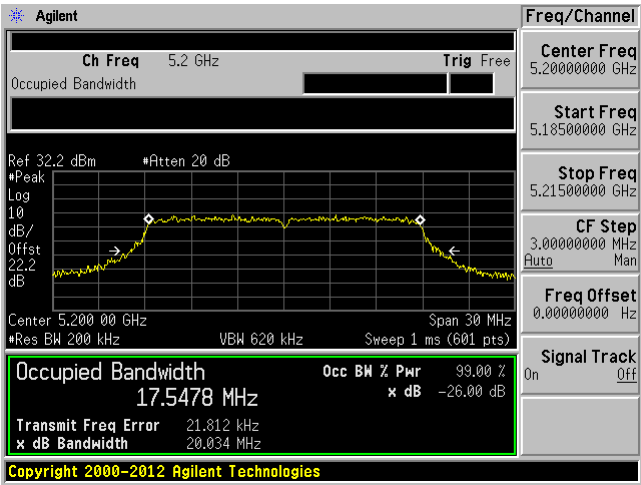


802.11ac20 mode Port B 99% OBW

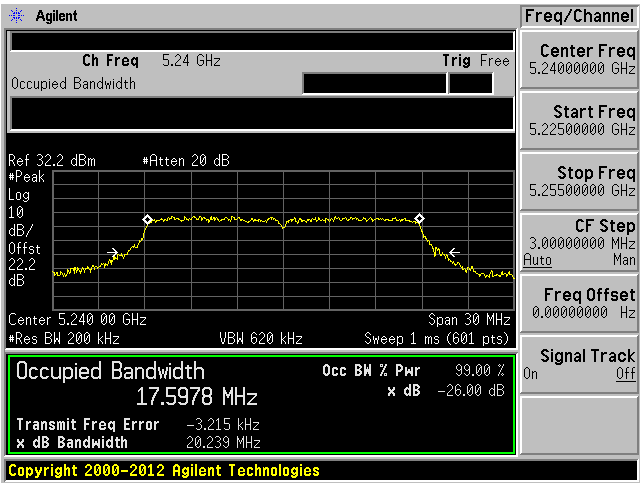
5180 MHz



5200 MHz

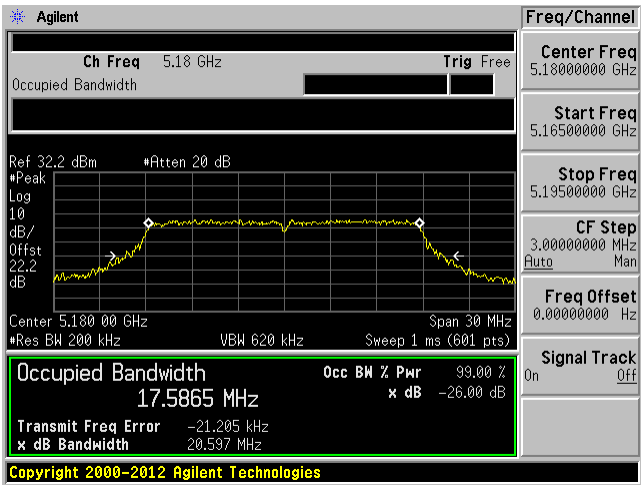


5240 MHz

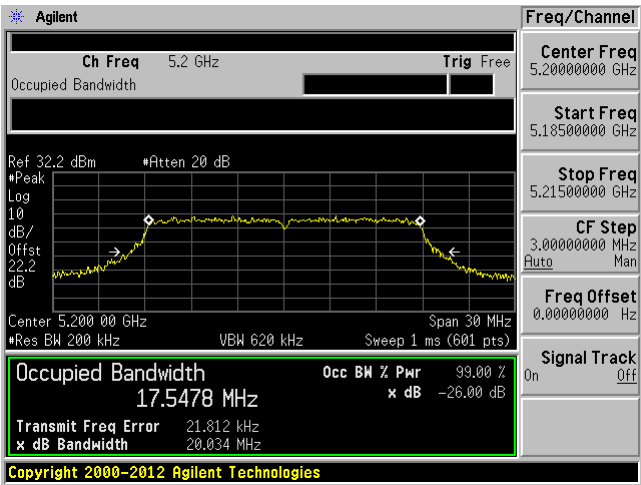


802.11ac20 mode Port B MIMO 99% OBW

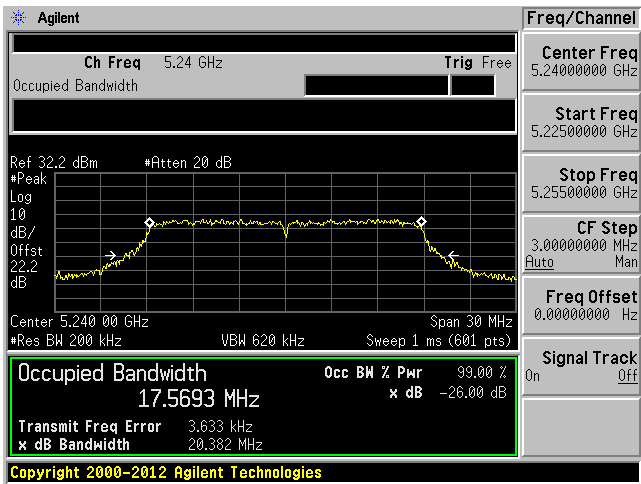
5180 MHz



5200 MHz



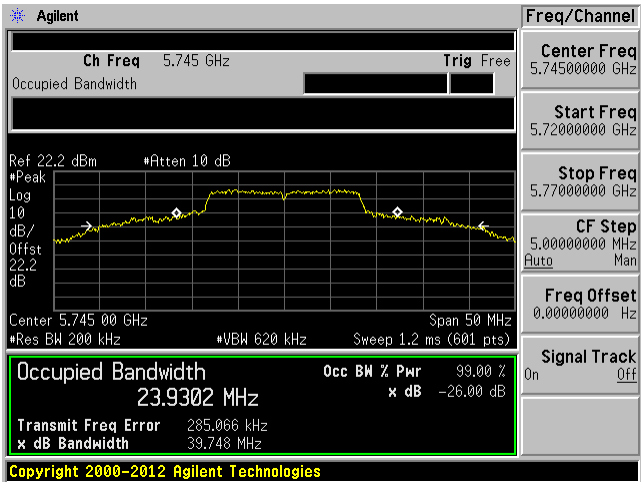
5240 MHz



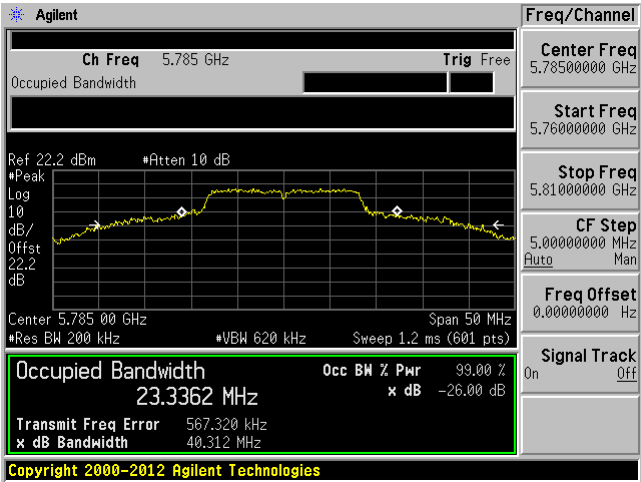
5725 - 5850 MHz

802.11a mode Port A 99% OBW

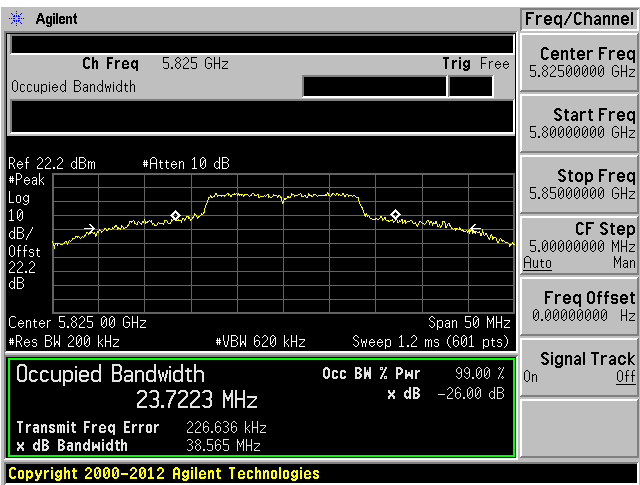
5745 MHz



5785 MHz

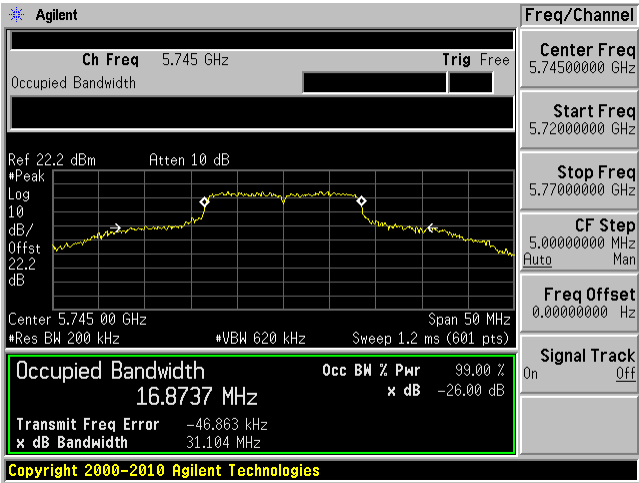


5825 MHz

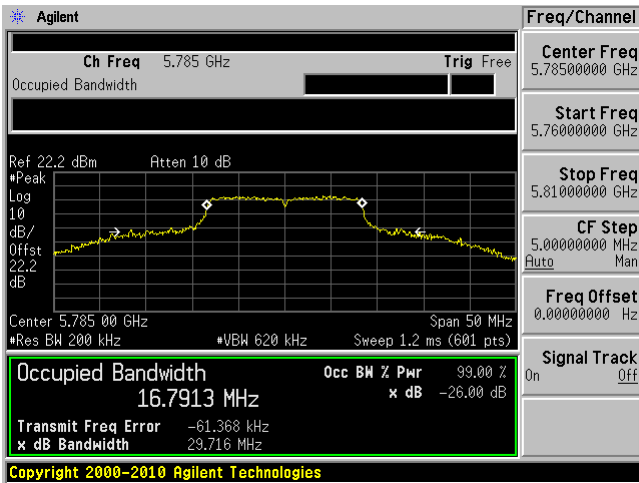


802.11a mode Port B 99% OBW

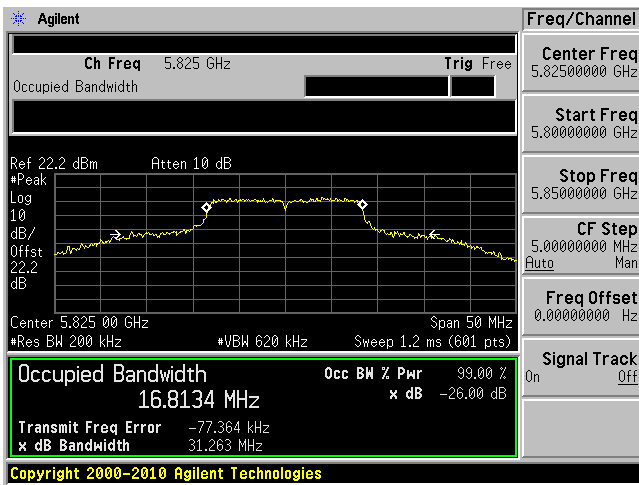
5745 MHz



5785 MHz

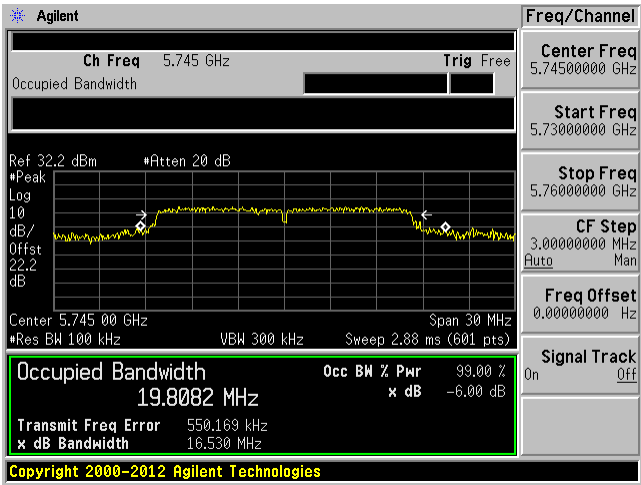


5825 MHz

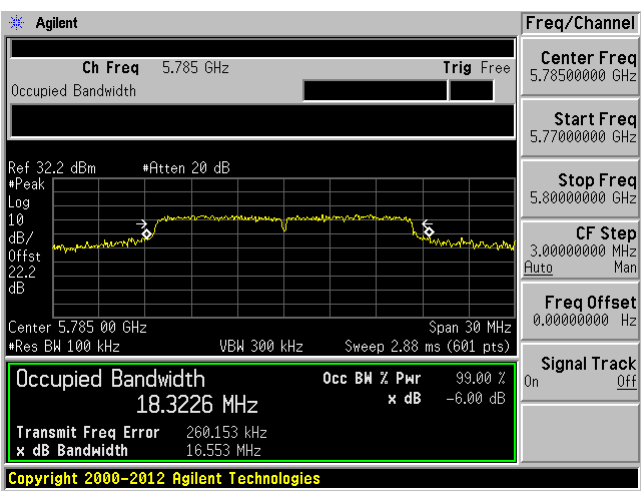


802.11a mode Port A 6dB OBW

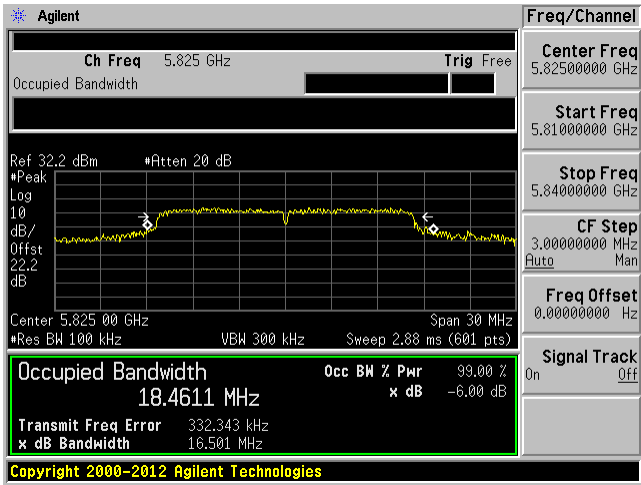
5745 MHz



5785 MHz

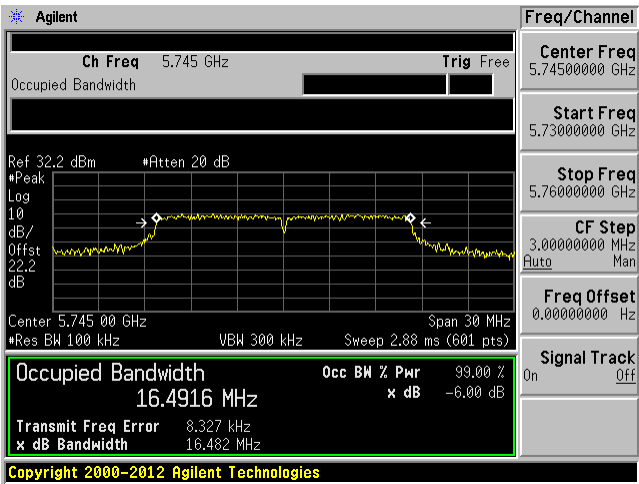


5825 MHz

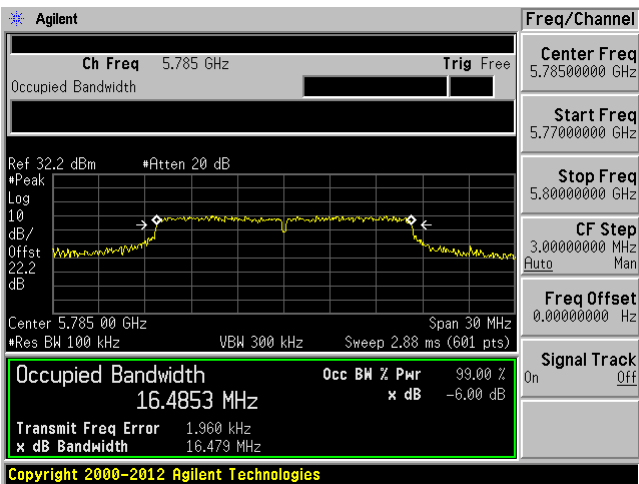


802.11a mode Port B 6 dB OBW

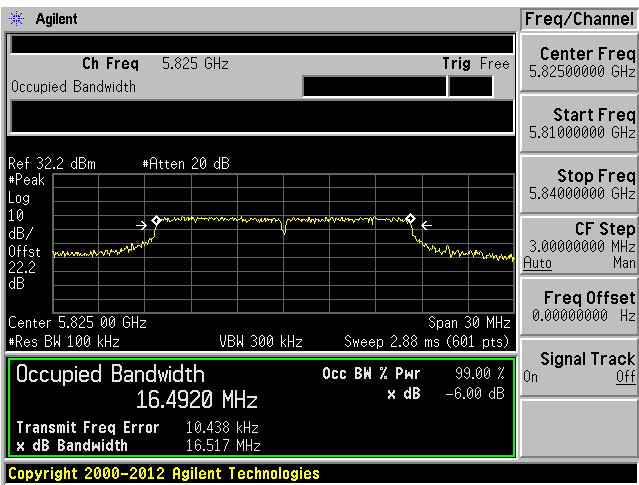
5745 MHz



5785 MHz

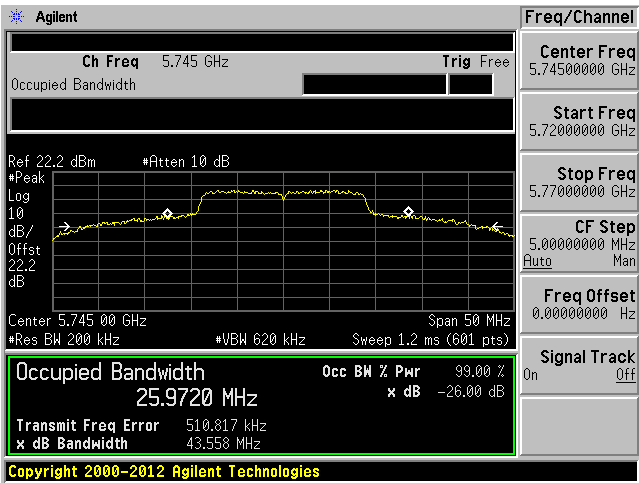


5825 MHz

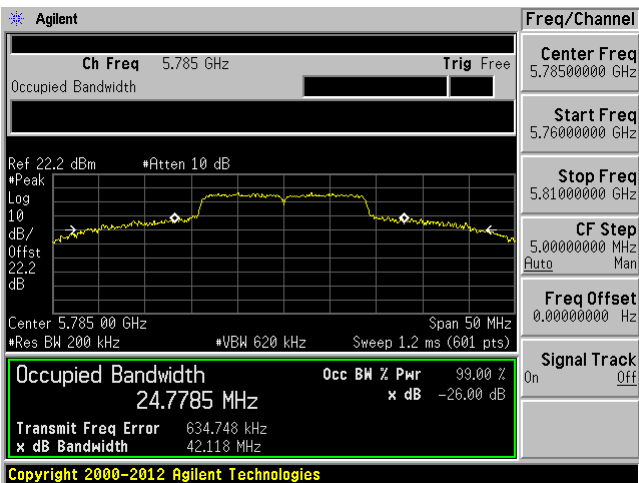


802.11n20 mode Port A 99% OBW

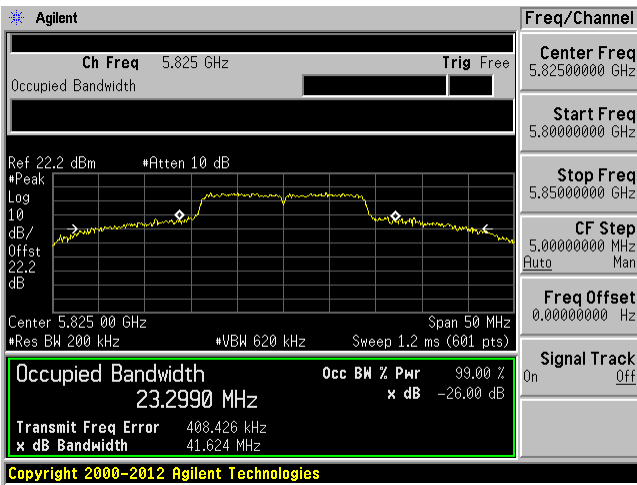
5745 MHz



5785 MHz

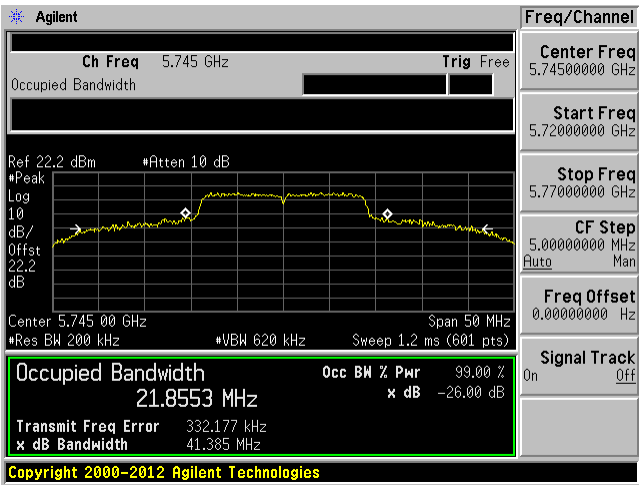


5825 MHz

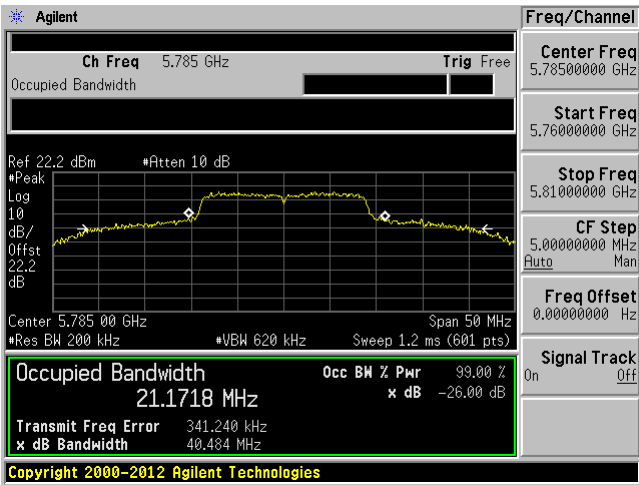


802.11n20 mode Port A MIMO 99% OBW

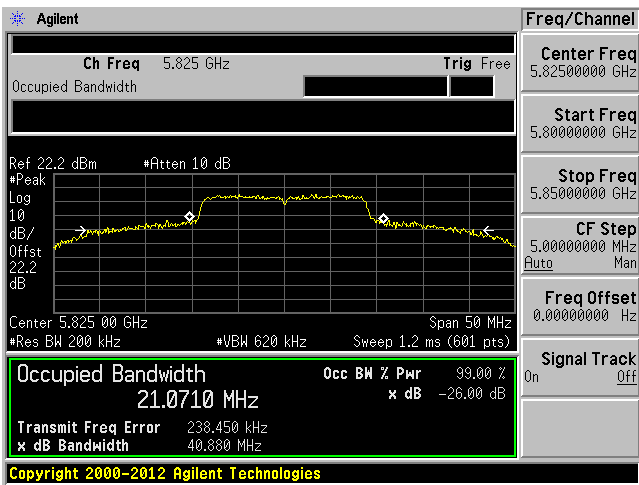
5745 MHz



5785 MHz

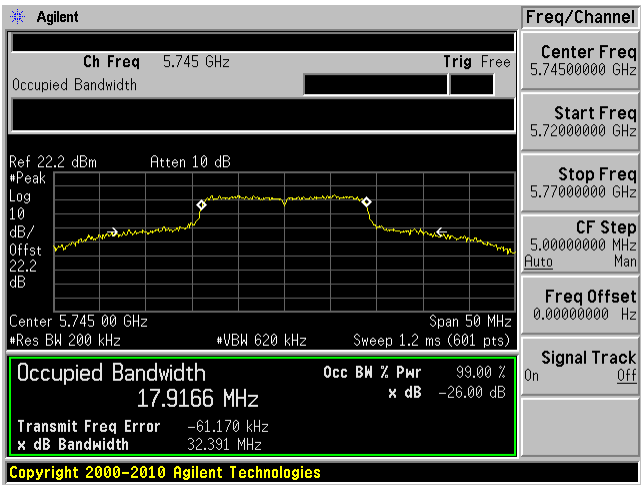


5825 MHz

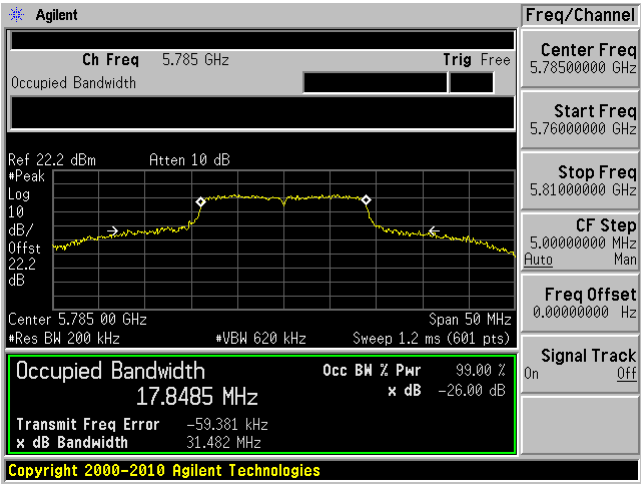


802.11n20 mode Port B 99% OBW

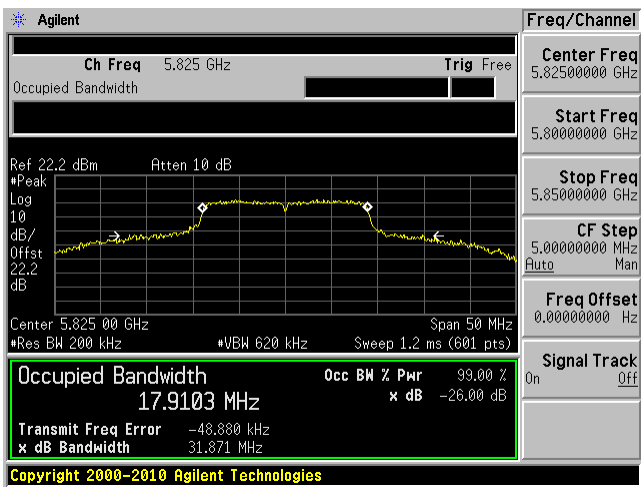
5745 MHz



5785 MHz

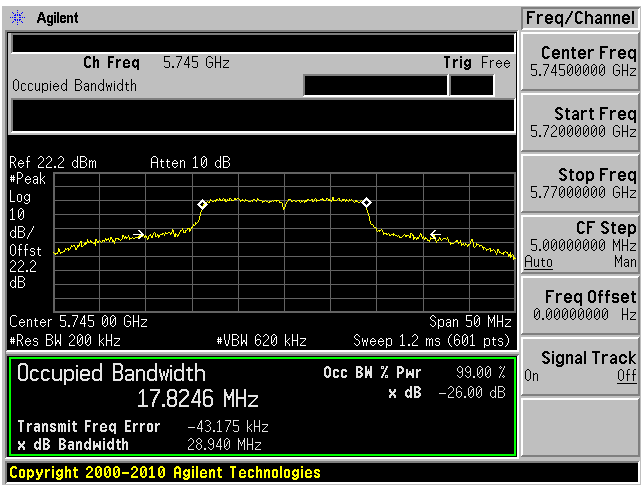


5825 MHz

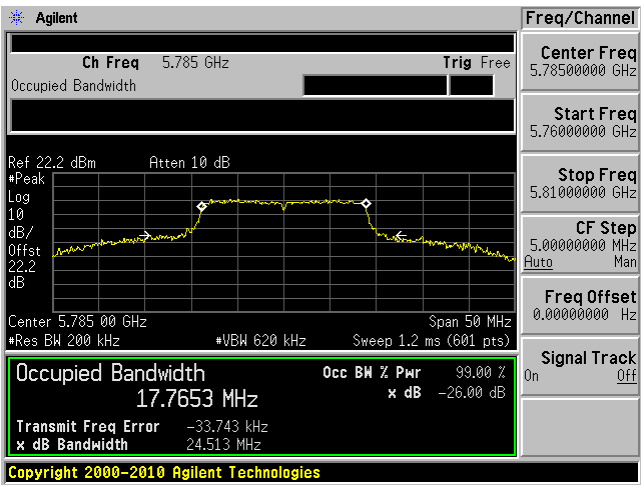


802.11n20 mode Port B MIMO 99% OBW

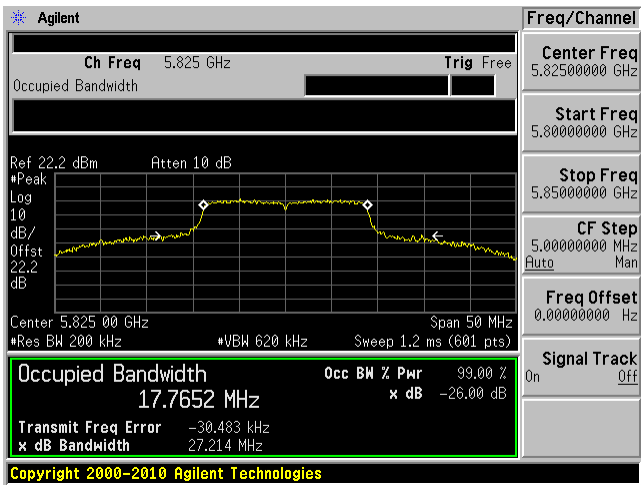
5745 MHz



5785 MHz

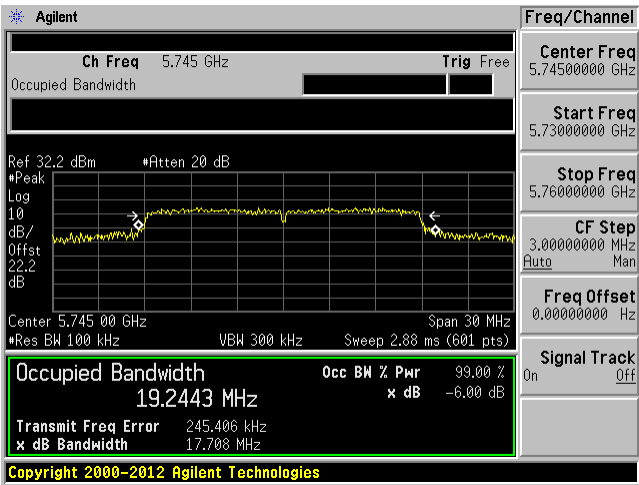


5825 MHz

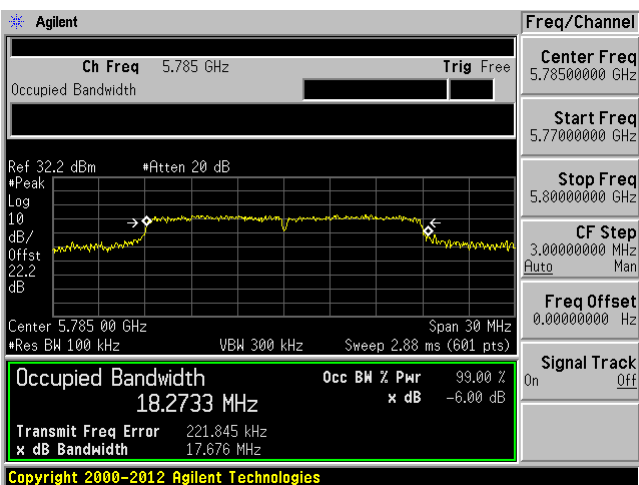


802.11n20 mode Port A 6dB OBW

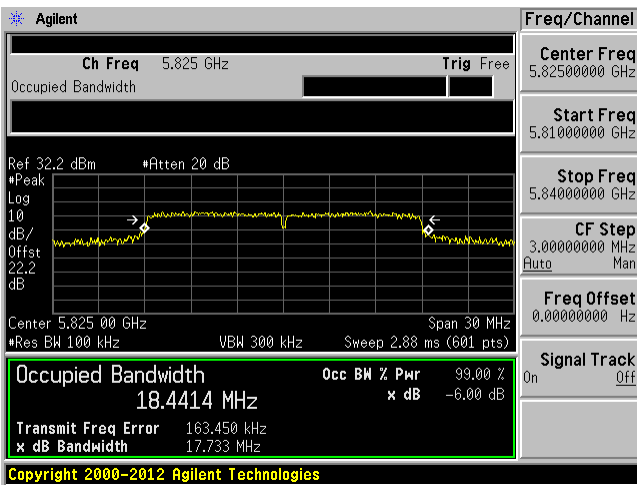
5745 MHz



5785 MHz

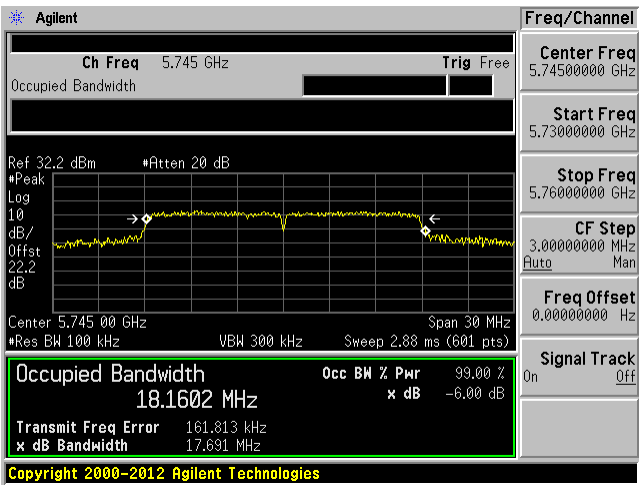


5825 MHz

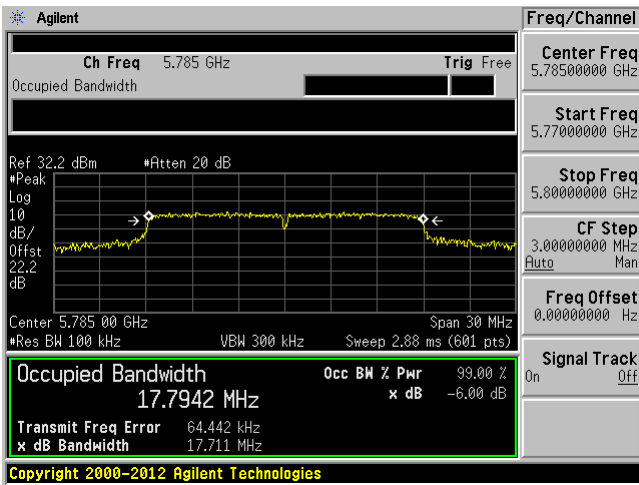


802.11n20 mode Port A MIMO 6 dB OBW

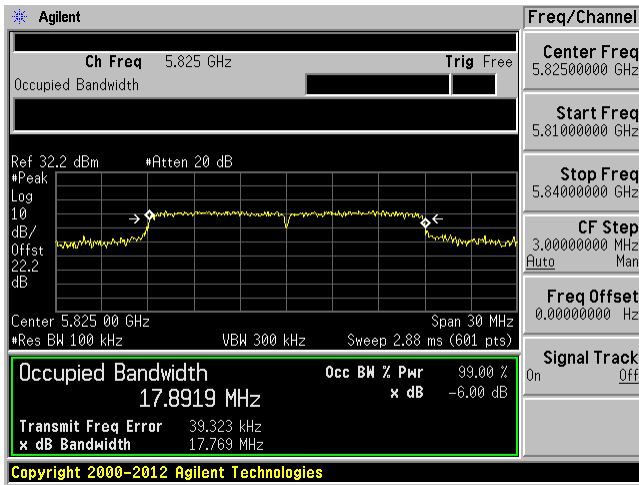
5745 MHz



5785 MHz

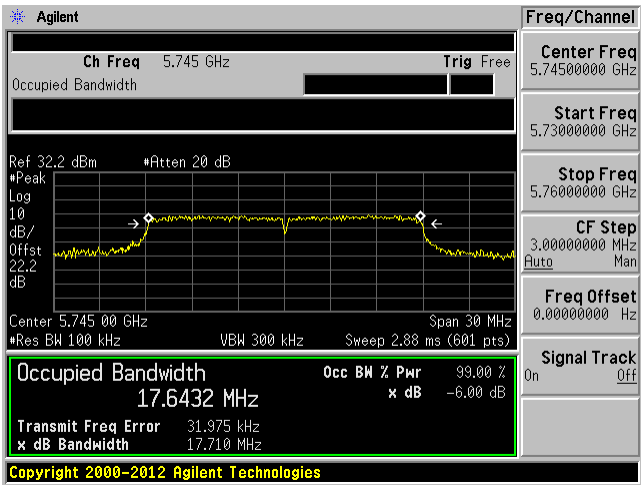


5825 MHz

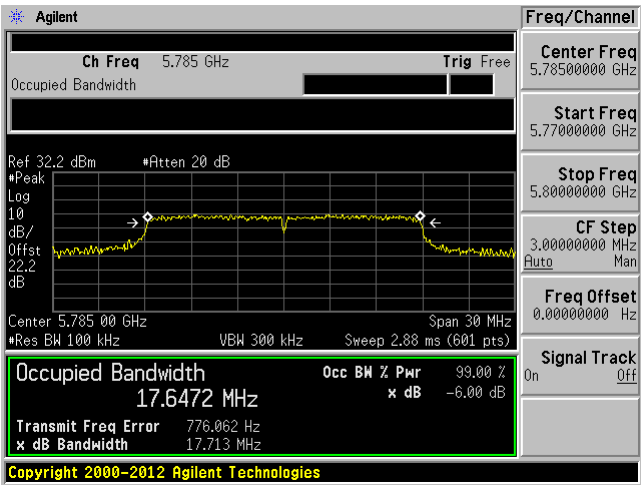


802.11n20 mode Port B 6 dB OBW

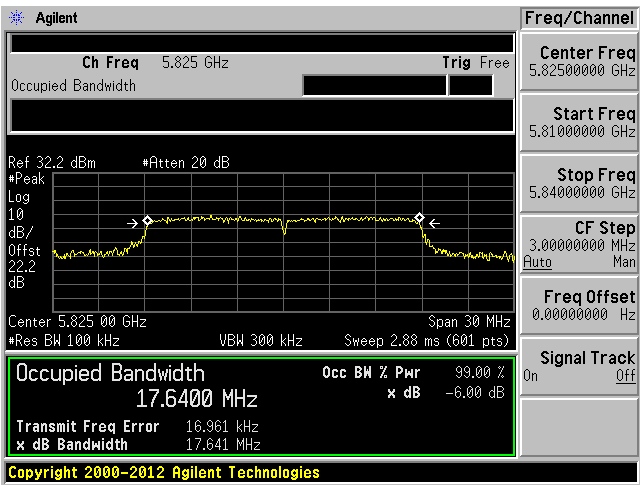
5745 MHz



5785 MHz

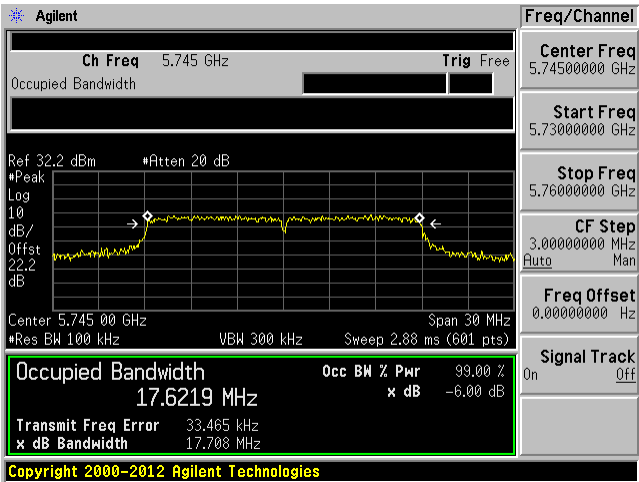


5825 MHz

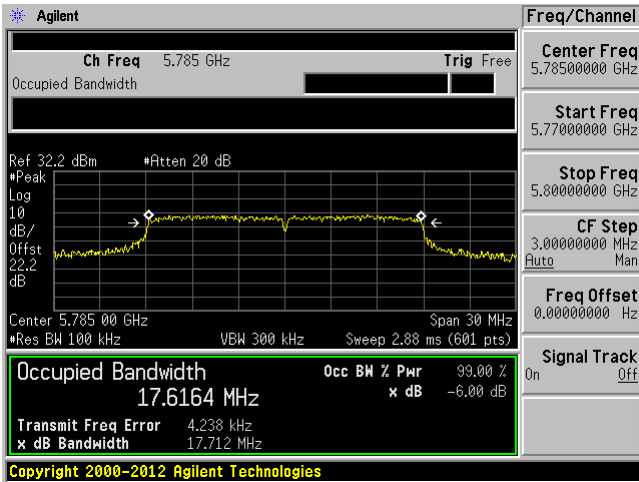


802.11n20 mode Port B MIMO 6 dB OBW

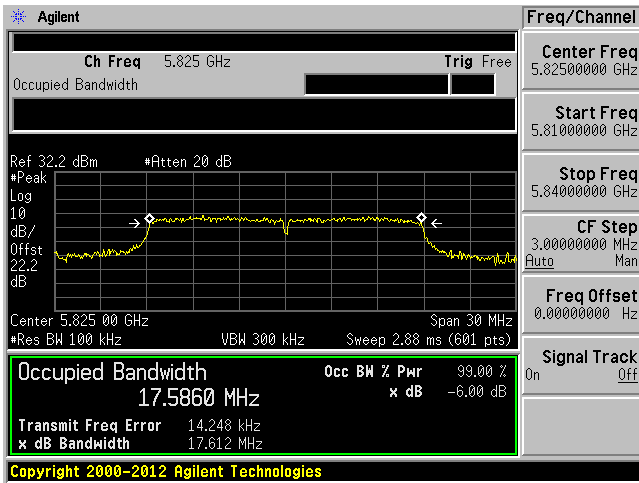
5745 MHz



5785 MHz

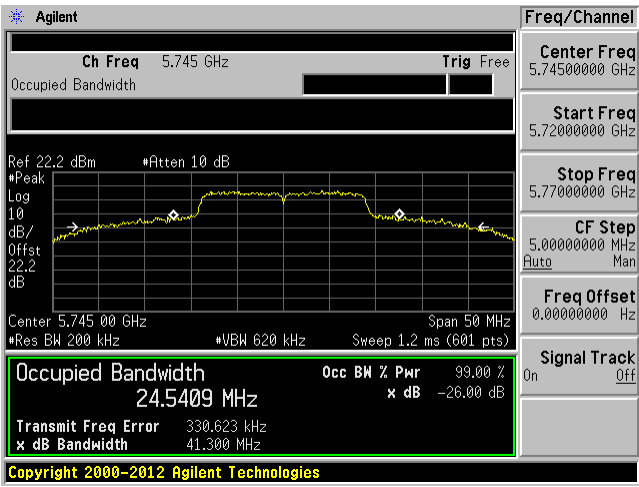


5825 MHz

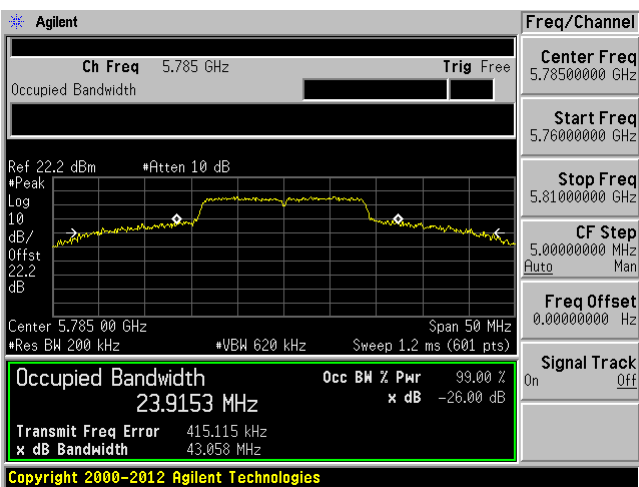


802.11ac20 mode Port A 99% OBW

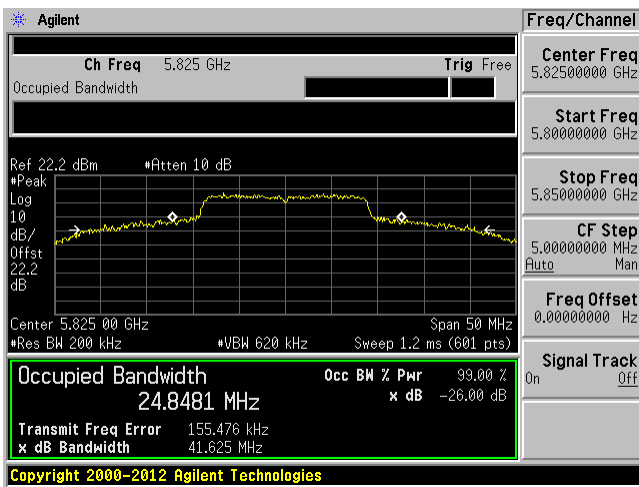
5745 MHz



5785 MHz

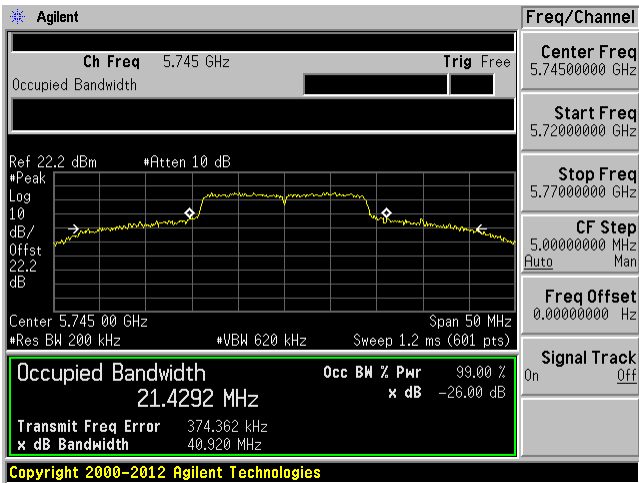


5825 MHz

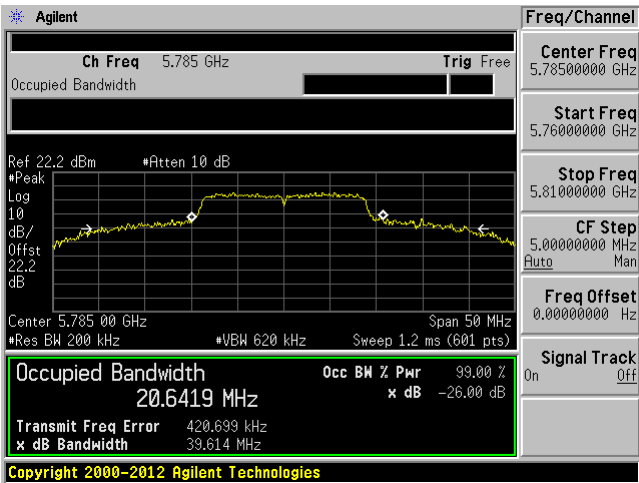


802.11ac20 mode Port A MIMO 99% OBW

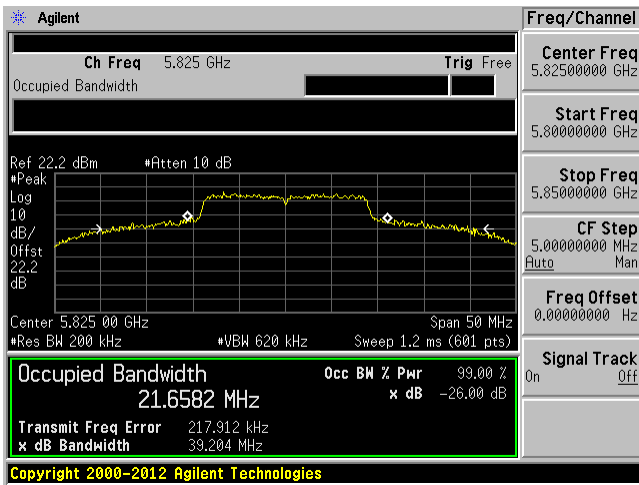
5745 MHz



5785 MHz

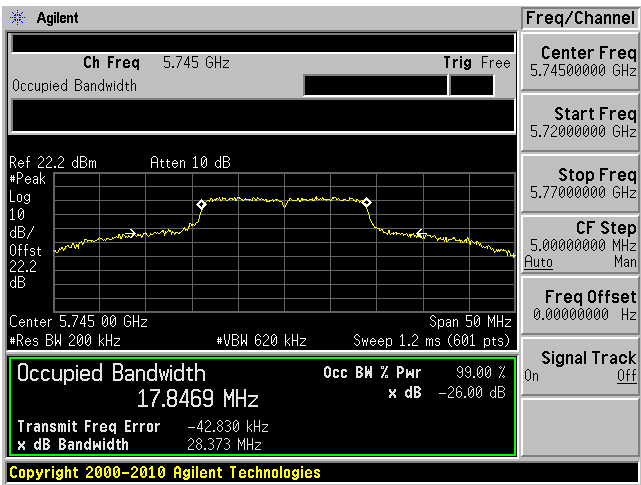


5825 MHz

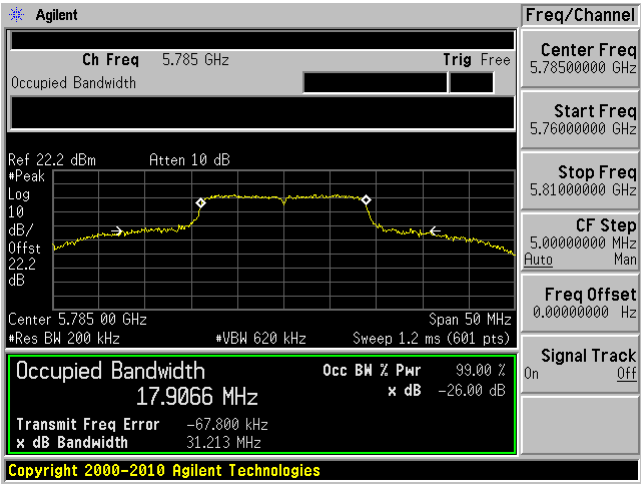


802.11ac20 mode Port B 99% OBW

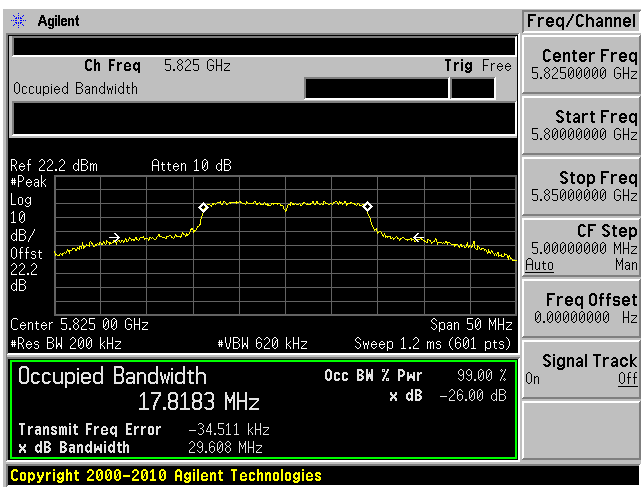
5745 MHz



5785 MHz

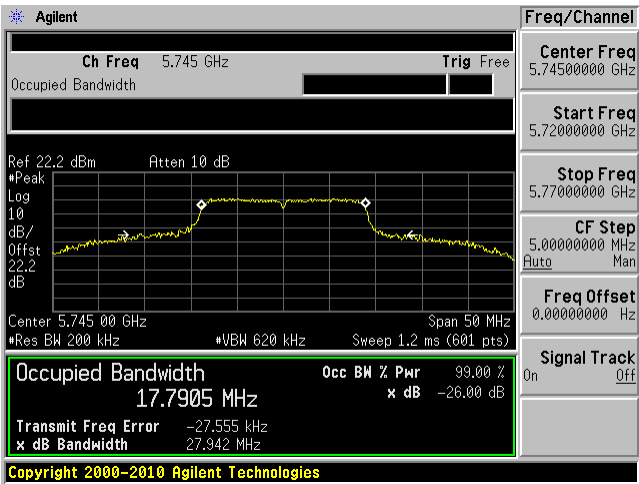


5825 MHz

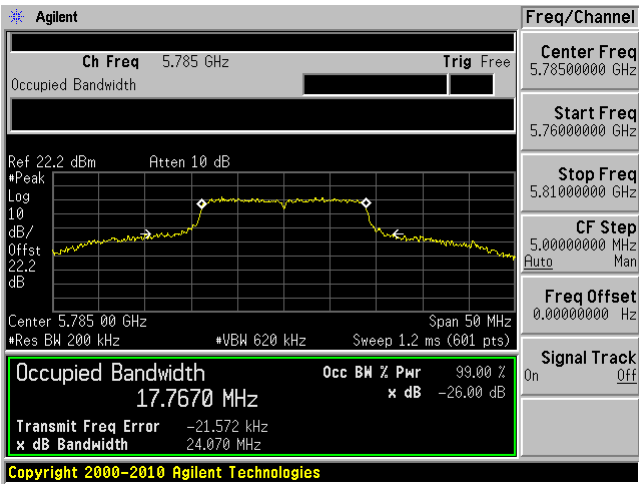


802.11ac20 mode Port B MIMO 99% OBW

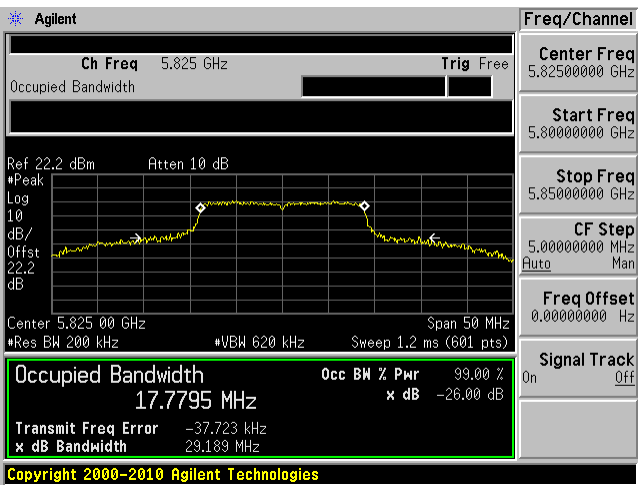
5745 MHz



5785 MHz

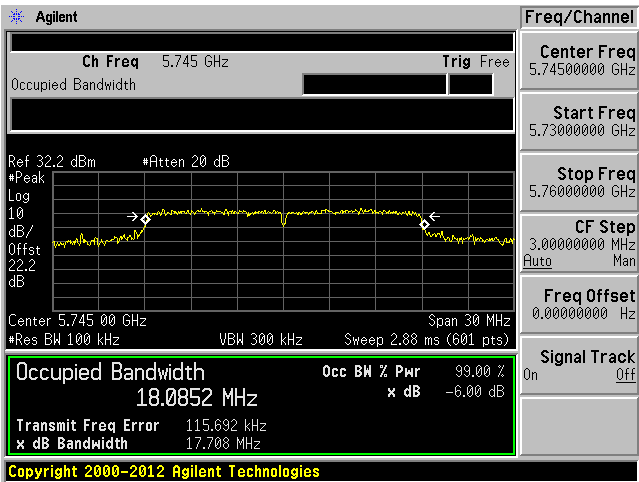


5825 MHz

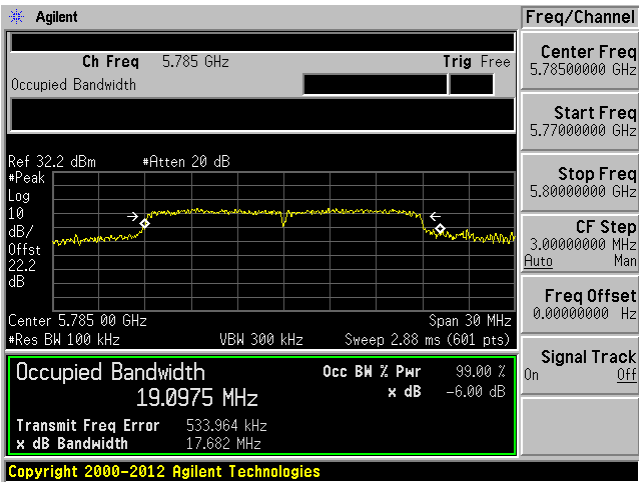


802.11ac20 mode Port A 6dB OBW

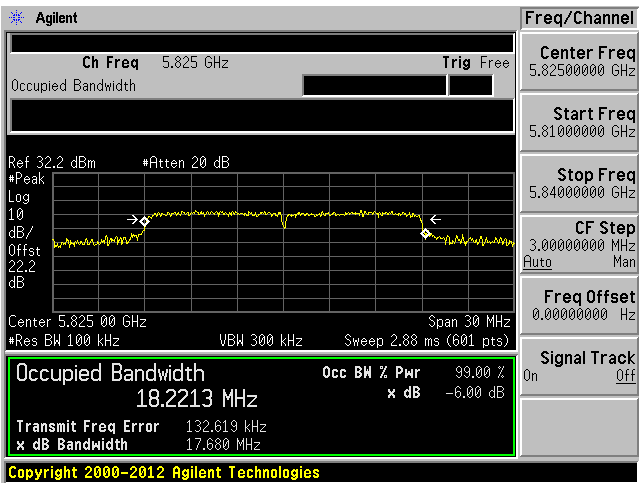
5745 MHz



5785 MHz

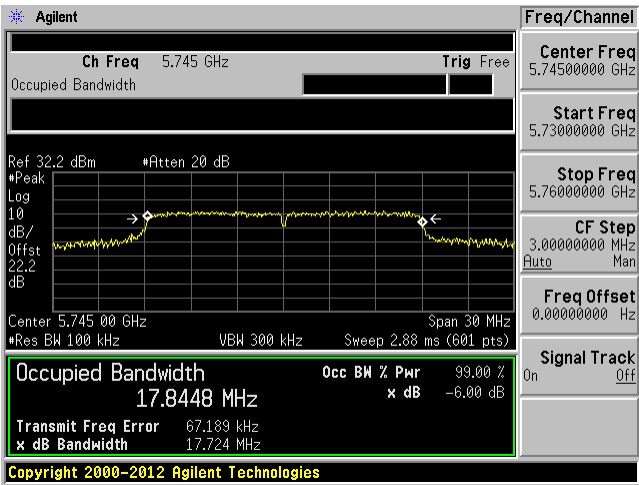


5825 MHz

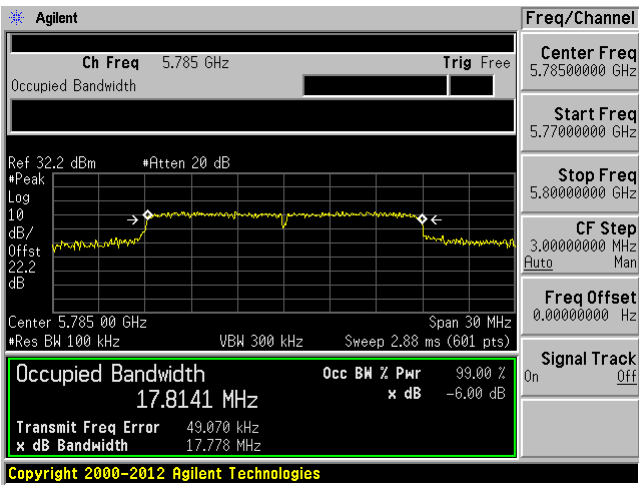


802.11ac20 mode Port A MIMO 6 dB OBW

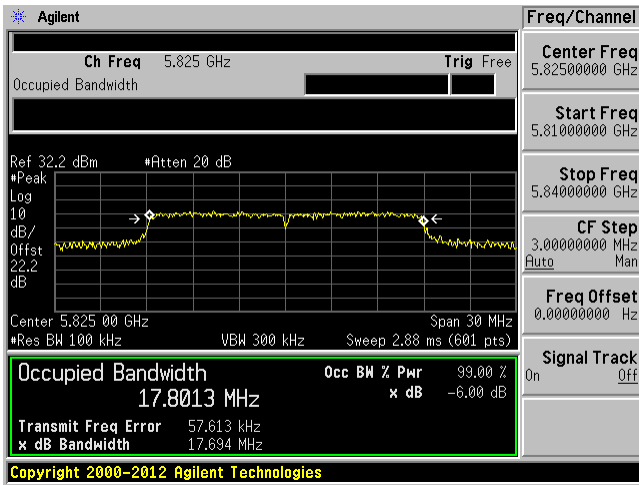
5745 MHz



5785 MHz

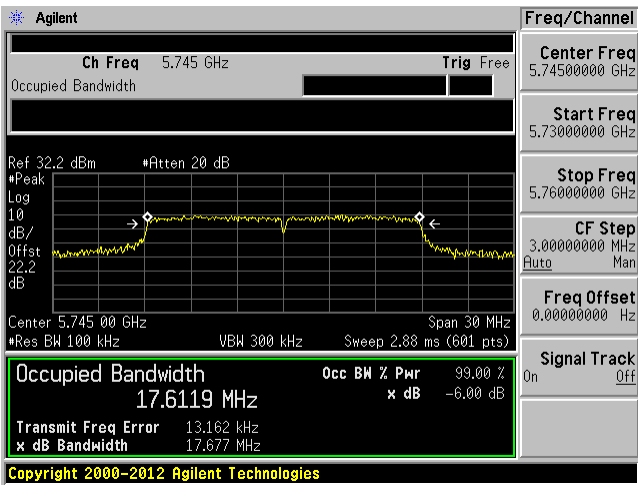


5825 MHz

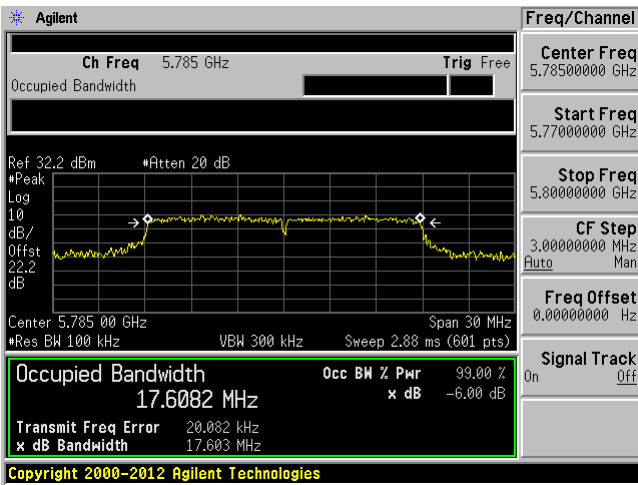


802.11ac20 mode Port B 6 dB OBW

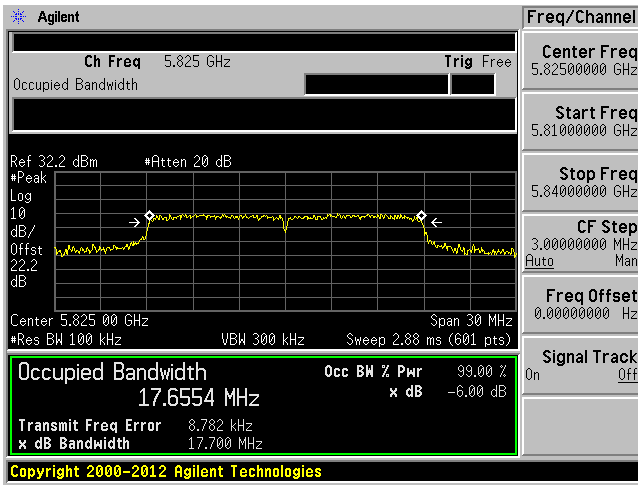
5745 MHz



5785 MHz

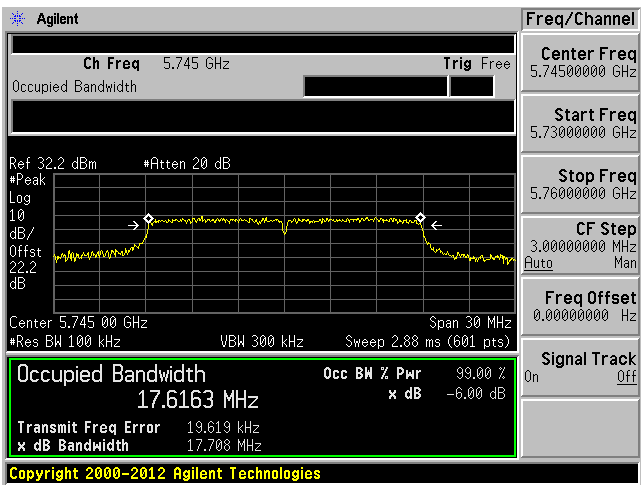


5825 MHz

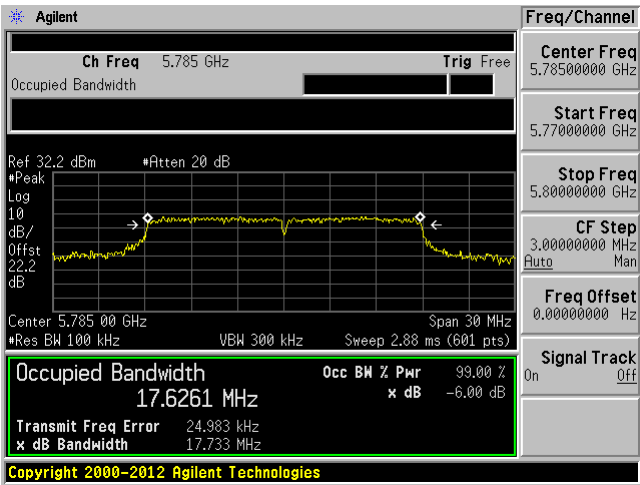


802.11ac20 mode Port B MIMO 6 dB OBW

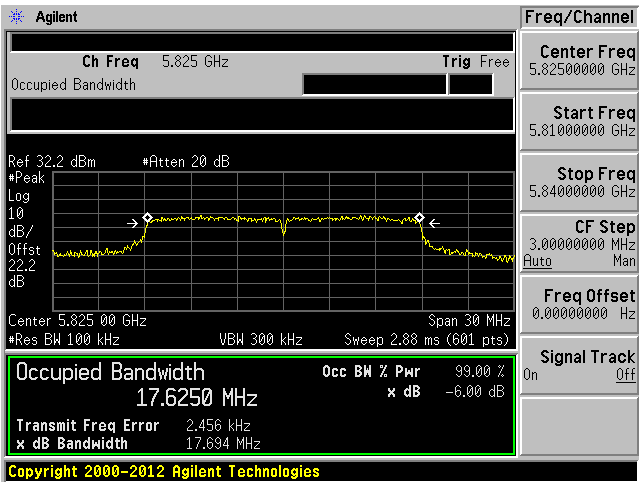
5745 MHz



5785 MHz



5825 MHz



## 9 FCC §407(a) & ISEDC RSS-247 §6.2 - Output Power

---

### 9.1 Applicable Standards

According to FCC §15.407(a):

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

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

According to ISEDC RSS-247 §6.2.1 for frequency band 5150-5250 MHz:

The maximum e.i.r.p. shall not exceed 200 mW or  $10 + 10 \log_{10} B$ , dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

According to ISEDC RSS-247 §6.2.2 for frequency band 5250-5350 MHz:

The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10} B$ , dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10} B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to ISEDC RSS-247 §6.2.3 for frequency band 5470-5600 MHz and 5650-5725 MHz:

The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10} B$ , dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10} B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to ISEDC RSS-247 §6.2.4 for frequency band 5725-5850 MHz:

The maximum conducted output power shall not exceed 1 W. The power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

## 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     | 2016-12-05             | 2 years              |
| -             | RF Cable         | -         | -          | Each time <sup>1</sup> | N/A                  |
| -             | 20 dB attenuator | -         | -          | Each time <sup>1</sup> | N/A                  |

Note<sup>1</sup>: 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:       | 23° C     |
| Relative Humidity: | 42 %      |
| ATM Pressure:      | 102.7 KPa |

The testing was performed by Vincent Licata on 2017-08-15 in RF site.

## 9.5 Test Results

### 5150 - 5250 MHz

#### FCC Results

| Frequency (MHz) | Mode       | TX Paths | Ant-a (dBm) | Ant-b (dBm) | Total Conducted Average Power (dBm) | FCC Limit (dBm) |
|-----------------|------------|----------|-------------|-------------|-------------------------------------|-----------------|
| 5180            | 802.11a    | 1        | 15.24       | -           | 15.24                               | 24              |
|                 | 802.11a    | 1        | -           | 12.64       | 12.64                               | 24              |
|                 | 802.11n20  | 1        | 14.25       | -           | 14.25                               | 24              |
|                 | 802.11n20  | 1        | -           | 11.43       | 11.43                               | 24              |
|                 | 802.11n20  | 2        | 12.63       | 9.78        | 14.45                               | 24              |
|                 | 802.11ac20 | 1        | 14.00       | -           | 14.00                               | 24              |
|                 | 802.11ac20 | 1        | -           | 11.73       | 11.73                               | 24              |
|                 | 802.11ac20 | 2        | 12.61       | 9.93        | 14.48                               | 24              |
| 5200            | 802.11a    | 1        | 15.04       | -           | 15.04                               | 24              |
|                 | 802.11a    | 1        | -           | 12.74       | 12.74                               | 24              |
|                 | 802.11n20  | 1        | 13.89       | -           | 13.89                               | 24              |
|                 | 802.11n20  | 1        | -           | 11.71       | 11.71                               | 24              |
|                 | 802.11n20  | 2        | 12.45       | 9.89        | 14.37                               | 24              |
|                 | 802.11ac20 | 1        | 14.16       | -           | 14.16                               | 24              |
|                 | 802.11ac20 | 1        | -           | 11.52       | 11.52                               | 24              |
|                 | 802.11ac20 | 2        | 12.64       | 9.91        | 14.50                               | 24              |
| 5240            | 802.11a    | 1        | 14.99       | -           | 14.99                               | 24              |
|                 | 802.11a    | 1        | -           | 12.42       | 12.42                               | 24              |
|                 | 802.11n20  | 1        | 14.73       | -           | 14.73                               | 24              |
|                 | 802.11n20  | 1        | -           | 11.51       | 11.51                               | 24              |
|                 | 802.11n20  | 2        | 12.98       | 9.73        | 14.66                               | 24              |
|                 | 802.11ac20 | 1        | 14.13       | -           | 14.13                               | 24              |
|                 | 802.11ac20 | 1        | -           | 11.45       | 11.45                               | 24              |
|                 | 802.11ac20 | 2        | 12.75       | 10.34       | 14.72                               | 24              |

**ISED Results**

| Frequency (MHz) | Mode       | TX Paths | Ant-a (dBm) | Ant-b (dBm) | Total Conducted Average Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | ISED Limit (dBm) |
|-----------------|------------|----------|-------------|-------------|-------------------------------------|--------------------|------------|------------------|
| 5180            | 802.11a    | 1        | 15.24       | -           | 15.24                               | 4.8                | 20.04      | 22.16            |
|                 | 802.11a    | 1        | -           | 12.64       | 12.64                               | 4.8                | 17.44      | 22.16            |
|                 | 802.11n20  | 1        | 14.25       | -           | 14.25                               | 4.8                | 19.05      | 22.44            |
|                 | 802.11n20  | 1        | -           | 11.43       | 11.43                               | 4.8                | 16.23      | 22.44            |
|                 | 802.11n20  | 2        | 12.63       | 9.78        | 14.45                               | 4.8                | 19.25      | 22.44            |
|                 | 802.11ac20 | 1        | 14.00       | -           | 14.00                               | 4.8                | 18.80      | 22.44            |
|                 | 802.11ac20 | 1        | -           | 11.73       | 11.73                               | 4.8                | 16.53      | 22.44            |
|                 | 802.11ac20 | 2        | 12.61       | 9.93        | 14.48                               | 4.8                | 19.28      | 22.44            |
| 5200            | 802.11a    | 1        | 15.04       | -           | 15.04                               | 4.8                | 19.84      | 22.16            |
|                 | 802.11a    | 1        | -           | 12.74       | 12.74                               | 4.8                | 17.54      | 22.16            |
|                 | 802.11n20  | 1        | 13.89       | -           | 13.89                               | 4.8                | 18.69      | 22.44            |
|                 | 802.11n20  | 1        | -           | 11.71       | 11.71                               | 4.8                | 16.51      | 22.44            |
|                 | 802.11n20  | 2        | 12.45       | 9.89        | 14.37                               | 4.8                | 19.17      | 22.44            |
|                 | 802.11ac20 | 1        | 14.16       | -           | 14.16                               | 4.8                | 18.96      | 22.44            |
|                 | 802.11ac20 | 1        | -           | 11.52       | 11.52                               | 4.8                | 16.32      | 22.44            |
|                 | 802.11ac20 | 2        | 12.64       | 9.91        | 14.50                               | 4.8                | 19.30      | 22.44            |
| 5240            | 802.11a    | 1        | 14.99       | -           | 14.99                               | 4.8                | 19.79      | 22.16            |
|                 | 802.11a    | 1        | -           | 12.42       | 12.42                               | 4.8                | 17.22      | 22.16            |
|                 | 802.11n20  | 1        | 14.73       | -           | 14.73                               | 4.8                | 19.53      | 22.44            |
|                 | 802.11n20  | 1        | -           | 11.51       | 11.51                               | 4.8                | 16.31      | 22.44            |
|                 | 802.11n20  | 2        | 12.98       | 9.73        | 14.66                               | 4.8                | 19.46      | 22.44            |
|                 | 802.11ac20 | 1        | 14.13       | -           | 14.13                               | 4.8                | 18.93      | 22.44            |
|                 | 802.11ac20 | 1        | -           | 11.45       | 11.45                               | 4.8                | 16.25      | 22.44            |
|                 | 802.11ac20 | 2        | 12.75       | 10.34       | 14.72                               | 4.8                | 19.52      | 22.44            |

## 5725 - 5850 MHz

| Frequency (MHz) | Mode       | TX Paths | Ant-a (dBm) | Ant-b (dBm) | Total Conducted Average Power (dBm) | FCC/ ISED Limit (dBm) |
|-----------------|------------|----------|-------------|-------------|-------------------------------------|-----------------------|
| 5745            | 802.11a    | 1        | 19.14       | -           | 19.14                               | 30                    |
|                 | 802.11a    | 1        | -           | 16.62       | 16.62                               | 30                    |
|                 | 802.11n20  | 1        | 18.93       | -           | 18.93                               | 30                    |
|                 | 802.11n20  | 1        | -           | 16.35       | 16.35                               | 30                    |
|                 | 802.11n20  | 2        | 17.65       | 14.28       | 19.29                               | 30                    |
|                 | 802.11ac20 | 1        | 19.21       | -           | 19.21                               | 30                    |
|                 | 802.11ac20 | 1        | -           | 15.67       | 15.67                               | 30                    |
|                 | 802.11ac20 | 2        | 17.67       | 14.12       | 19.26                               | 30                    |
| 5785            | 802.11a    | 1        | 19.29       | -           | 19.29                               | 30                    |
|                 | 802.11a    | 1        | -           | 15.46       | 15.46                               | 30                    |
|                 | 802.11n20  | 1        | 19.23       | -           | 19.23                               | 30                    |
|                 | 802.11n20  | 1        | -           | 15.19       | 15.19                               | 30                    |
|                 | 802.11n20  | 2        | 17.72       | 13.58       | 19.14                               | 30                    |
|                 | 802.11ac20 | 1        | 19          | -           | 19.00                               | 30                    |
|                 | 802.11ac20 | 1        | -           | 15.64       | 15.64                               | 30                    |
|                 | 802.11ac20 | 2        | 17.75       | 13.83       | 19.23                               | 30                    |
| 5825            | 802.11a    | 1        | 19.01       | -           | 19.01                               | 30                    |
|                 | 802.11a    | 1        | -           | 15.23       | 15.23                               | 30                    |
|                 | 802.11n20  | 1        | 18.82       | -           | 18.82                               | 30                    |
|                 | 802.11n20  | 1        | -           | 15.14       | 15.14                               | 30                    |
|                 | 802.11n20  | 2        | 17.36       | 13.27       | 18.79                               | 30                    |
|                 | 802.11ac20 | 1        | 19.26       | -           | 19.26                               | 30                    |
|                 | 802.11ac20 | 1        | -           | 14.77       | 14.77                               | 30                    |
|                 | 802.11ac20 | 2        | 17.77       | 13.08       | 19.04                               | 30                    |

## 10 FCC §15.407(a) & ISEDC RSS-247 §6.2 - Power Spectral Density

---

### 10.1 Applicable Standards

According to FCC §15.407(a):

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

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

According to ISEDC RSS-247 §6.2.1 for frequency band 5150-5250 MHz:

The maximum e.i.r.p. shall not exceed 200 mW or  $10 + 10 \log_{10} B$ , dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

According to ISEDC RSS-247 §6.2.2 for frequency band 5250-5350 MHz:

The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10} B$ , dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10} B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to ISEDC RSS-247 §6.2.3 for frequency band 5470-5600 MHz and 5650-5725 MHz:

The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10} B$ , dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10} B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to ISERC RSS-247 §6.2.4 for frequency band 5725-5850 MHz:

The maximum conducted output power shall not exceed 1 W. The power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

## 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  $\geq$  3 MHz.
- (iv) Number of points in sweep  $\geq$  2 Span / RBW. (This ensures that bin-to-bin spacing is  $\leq$  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  $\geq$  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 | E4446A    | US44300386 | 2017-04-20             | 1 year               |
| -            | RF Cable           | -         | -          | Each time <sup>1</sup> | N/A                  |
| -            | 20 dB attenuator   | -         | -          | Each time <sup>1</sup> | N/A                  |

Note<sup>1</sup>: 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

|                           |                 |
|---------------------------|-----------------|
| <b>Temperature:</b>       | 22-24 °C        |
| <b>Relative Humidity:</b> | 40-41 %         |
| <b>ATM Pressure:</b>      | 103.1-104.1 kPa |

The testing was performed by Vincent Licata on 2017-08-15 at RF site.

## 10.5 Test Results

### 5150 – 5250 MHz

#### FCC Results:

##### Antenna Port A

| Frequency (MHz) | Measured PSD (dBm/MHz) | FCC Limit (dBm/MHz) | Results |
|-----------------|------------------------|---------------------|---------|
| 802.11a mode    |                        |                     |         |
| 5180            | 4.744                  | 11                  | Pass    |
| 5200            | 4.890                  | 11                  | Pass    |
| 5240            | 4.006                  | 11                  | Pass    |
| 802.11n20 mode  |                        |                     |         |
| 5180            | 2.942                  | 11                  | Pass    |
| 5200            | 3.196                  | 11                  | Pass    |
| 5240            | 3.436                  | 11                  | Pass    |
| 802.11ac20 mode |                        |                     |         |
| 5180            | 2.795                  | 11                  | Pass    |
| 5200            | 3.773                  | 11                  | Pass    |
| 5240            | 3.253                  | 11                  | Pass    |

**Antenna Port B**

| Frequency (MHz) | Measured PSD (dBm/MHz) | FCC Limit (dBm/MHz) | Results |
|-----------------|------------------------|---------------------|---------|
| 802.11a mode    |                        |                     |         |
| 5180            | 1.863                  | 11                  | Pass    |
| 5200            | 1.231                  | 11                  | Pass    |
| 5240            | 2.227                  | 11                  | Pass    |
| 802.11n20 mode  |                        |                     |         |
| 5180            | 0.902                  | 11                  | Pass    |
| 5200            | 0.340                  | 11                  | Pass    |
| 5240            | 1.028                  | 11                  | Pass    |
| 802.11ac20 mode |                        |                     |         |
| 5180            | 0.630                  | 11                  | Pass    |
| 5200            | 0.942                  | 11                  | Pass    |
| 5240            | 0.408                  | 11                  | Pass    |

**Antenna Port A+B MIMO**

| Frequency (MHz) | PSD Port A (dBm/MHz) | PSD Port B (dBm/MHz) | Total PSD <sup>1</sup> (dBm/MHz) | FCC Limit (dBm/MHz) | Results |
|-----------------|----------------------|----------------------|----------------------------------|---------------------|---------|
| 802.11n20 mode  |                      |                      |                                  |                     |         |
| 5180            | 2.017                | -0.046               | 4.12                             | 11                  | Pass    |
| 5200            | 2.051                | -0.401               | 4.01                             | 11                  | Pass    |
| 5240            | 1.939                | -0.285               | 3.98                             | 11                  | Pass    |
| 802.11ac20 mode |                      |                      |                                  |                     |         |
| 5180            | 1.563                | -0.583               | 3.63                             | 11                  | Pass    |
| 5200            | 1.805                | -0.040               | 3.99                             | 11                  | Pass    |
| 5240            | 1.917                | -0.159               | 4.01                             | 11                  | Pass    |

Note 1: For Port A+B MIMO,  $PSD = 10 \cdot \log(10^{(Port A MIMO/10)} + 10^{(Port B MIMO/10)})$  dBm/MHz

**ISED Results:****Antenna Port A**

| Frequency (MHz) | Conducted PSD (dBm/MHz) | Antenna Gain (dBi) | EIRP PSD (dBm/MHz) | ISED Limit (dBm/MHz) | Results |
|-----------------|-------------------------|--------------------|--------------------|----------------------|---------|
| 802.11a mode    |                         |                    |                    |                      |         |
| 5180            | 4.744                   | 4.8                | 9.544              | 10                   | Pass    |
| 5200            | 4.890                   | 4.8                | 9.690              | 10                   | Pass    |
| 5240            | 4.006                   | 4.8                | 8.806              | 10                   | Pass    |
| 802.11n20 mode  |                         |                    |                    |                      |         |
| 5180            | 2.942                   | 4.8                | 7.742              | 10                   | Pass    |
| 5200            | 3.196                   | 4.8                | 7.996              | 10                   | Pass    |
| 5240            | 3.436                   | 4.8                | 8.236              | 10                   | Pass    |
| 802.11ac20 mode |                         |                    |                    |                      |         |
| 5180            | 2.795                   | 4.8                | 7.595              | 10                   | Pass    |
| 5200            | 3.773                   | 4.8                | 8.570              | 10                   | Pass    |
| 5240            | 3.253                   | 4.8                | 8.053              | 10                   | Pass    |

**Antenna Port B**

| Frequency (MHz) | Conducted PSD (dBm/MHz) | Antenna Gain (dBi) | EIRP PSD (dBm/MHz) | ISED Limit (dBm/MHz) | Results |
|-----------------|-------------------------|--------------------|--------------------|----------------------|---------|
| 802.11a mode    |                         |                    |                    |                      |         |
| 5180            | 1.863                   | 4.8                | 6.663              | 10                   | Pass    |
| 5200            | 1.231                   | 4.8                | 6.031              | 10                   | Pass    |
| 5240            | 2.227                   | 4.8                | 7.027              | 10                   | Pass    |
| 802.11n20 mode  |                         |                    |                    |                      |         |
| 5180            | 0.902                   | 4.8                | 5.702              | 10                   | Pass    |
| 5200            | 0.340                   | 4.8                | 5.140              | 10                   | Pass    |
| 5240            | 1.028                   | 4.8                | 5.828              | 10                   | Pass    |
| 802.11ac20 mode |                         |                    |                    |                      |         |
| 5180            | 0.630                   | 4.8                | 5.430              | 10                   | Pass    |
| 5200            | 0.942                   | 4.8                | 5.742              | 10                   | Pass    |
| 5240            | 0.408                   | 4.8                | 5.208              | 10                   | Pass    |

**Antenna Port A+B MIMO**

| Frequency (MHz) | PSD Port A (dBm/MHz) | PSD Port B (dBm/MHz) | Total PSD <sup>1</sup> (dBm/MHz) | Antenna Gain (dBi) | EIRP PSD <sup>2</sup> (dBm/MHz) | ISED Limit (dBm/MHz) |
|-----------------|----------------------|----------------------|----------------------------------|--------------------|---------------------------------|----------------------|
| 802.11n20 mode  |                      |                      |                                  |                    |                                 |                      |
| 5180            | 2.017                | -0.046               | 4.12                             | 4.8                | 8.92                            | 10                   |
| 5200            | 2.051                | -0.401               | 4.01                             | 4.8                | 8.81                            | 10                   |
| 5240            | 1.939                | -0.285               | 3.98                             | 4.8                | 8.78                            | 10                   |
| 802.11ac20 mode |                      |                      |                                  |                    |                                 |                      |
| 5180            | 1.563                | -0.583               | 3.63                             | 4.8                | 8.43                            | 10                   |
| 5200            | 1.805                | -0.040               | 3.99                             | 4.8                | 8.79                            | 10                   |
| 5240            | 1.917                | -0.159               | 4.01                             | 4.8                | 8.81                            | 10                   |

Note 1: For Port A+B MIMO, PSD =  $10 \cdot \log(10^{(\text{Port A MIMO}/10)} + 10^{(\text{Port B MIMO}/10)})$  dBm/MHz

Note 2: EIRP PSD (dBm/MHz) = Total PSD (dBm/MHz) + Antenna Gain (dBi)

**5725 - 5850 MHz****Antenna Port A**

| Frequency (MHz) | Measured PSD (dBm/100 kHz) | Corrected PSD (dBm/500 kHz) | FCC/ ISED Limit (dBm/500 kHz) | Results |
|-----------------|----------------------------|-----------------------------|-------------------------------|---------|
| 802.11a mode    |                            |                             |                               |         |
| 5745            | 0.470                      | 7.460                       | 30                            | Pass    |
| 5785            | -0.125                     | 6.865                       | 30                            | Pass    |
| 5825            | -0.080                     | 6.910                       | 30                            | Pass    |
| 802.11n20 mode  |                            |                             |                               |         |
| 5745            | 0.447                      | 7.437                       | 30                            | Pass    |
| 5785            | -0.691                     | 6.299                       | 30                            | Pass    |
| 5825            | -0.451                     | 6.539                       | 30                            | Pass    |
| 802.11ac20 mode |                            |                             |                               |         |
| 5745            | -0.592                     | 6.398                       | 30                            | Pass    |
| 5785            | -0.281                     | 6.709                       | 30                            | Pass    |
| 5825            | -0.707                     | 6.283                       | 30                            | Pass    |

**Antenna Port B**

| Frequency (MHz) | Measured PSD (dBm/100 kHz) | Corrected PSD (dBm/500 kHz) | FCC/ ISED Limit (dBm/500 kHz) | Results |
|-----------------|----------------------------|-----------------------------|-------------------------------|---------|
| 802.11a mode    |                            |                             |                               |         |
| 5745            | -3.989                     | 3.001                       | 30                            | Pass    |
| 5785            | -3.779                     | 3.211                       | 30                            | Pass    |
| 5825            | -4.125                     | 2.865                       | 30                            | Pass    |
| 802.11n20 mode  |                            |                             |                               |         |
| 5745            | -4.194                     | 2.796                       | 30                            | Pass    |
| 5785            | -3.917                     | 3.073                       | 30                            | Pass    |
| 5825            | -4.949                     | 2.041                       | 30                            | Pass    |
| 802.11ac20 mode |                            |                             |                               |         |
| 5745            | -4.040                     | 2.950                       | 30                            | Pass    |
| 5785            | -4.505                     | 2.485                       | 30                            | Pass    |
| 5825            | -4.148                     | 2.842                       | 30                            | Pass    |

**Antenna Port A+B MIMO**

| Frequency (MHz) | PSD Port A (dBm/100 kHz) | PSD Port B (dBm/100 kHz) | Total Measured PSD <sup>1</sup> (dBm/100 kHz) | Corrected PSD <sup>2</sup> (dBm/500 kHz) | FCC/ISED Limit (dBm/500 kHz) |
|-----------------|--------------------------|--------------------------|-----------------------------------------------|------------------------------------------|------------------------------|
| 802.11n20 mode  |                          |                          |                                               |                                          |                              |
| 5745            | -1.069                   | -5.914                   | 0.160                                         | 7.150                                    | 30                           |
| 5785            | -1.854                   | -5.562                   | -0.310                                        | 6.680                                    | 30                           |
| 5825            | -1.675                   | -6.113                   | -0.340                                        | 6.650                                    | 30                           |
| 802.11ac20 mode |                          |                          |                                               |                                          |                              |
| 5745            | -1.700                   | -5.507                   | -0.190                                        | 6.800                                    | 30                           |
| 5785            | -1.668                   | -5.741                   | -0.230                                        | 6.760                                    | 30                           |
| 5825            | -2.159                   | -5.736                   | -0.580                                        | 6.410                                    | 30                           |

Note 1: For Port A+B MIMO,  $PSD = 10 \cdot \log(10^{(Port A MIMO/10)} + 10^{(Port B MIMO/10)})$  dBm/100KHz

Note 2: For the 5725-5850 MHz band, the Corrected PSD (dBm/500 kHz) is equal to:

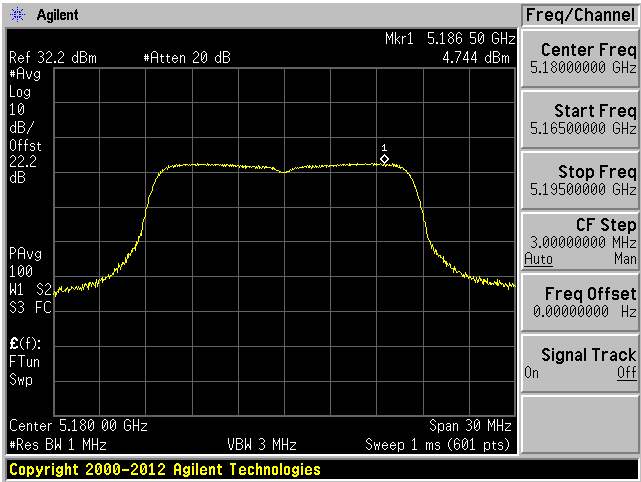
Corrected PSD (dBm/500 kHz) = PSD (dBm/100 kHz) + Duty Cycle Correction (dB) +  $10 \cdot \log(500 \text{ kHz}/100 \text{ kHz})$

Please refer to the following plots.

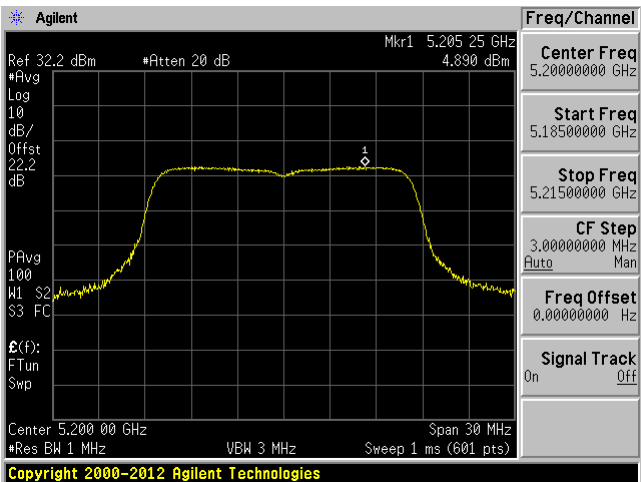
5150 – 5250 MHz

802.11a mode (Port A)

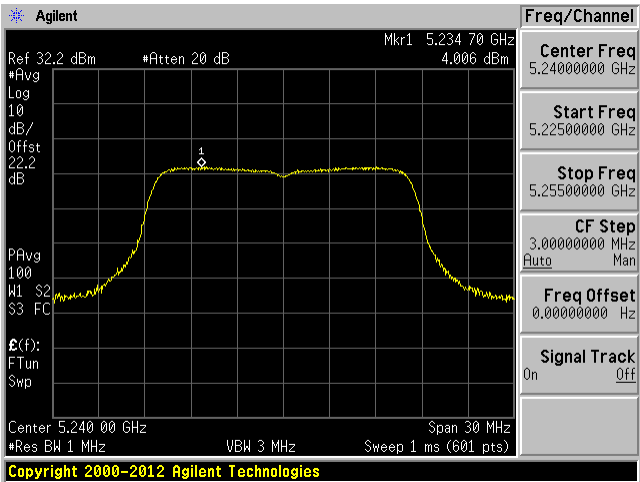
5180 MHz



5200 MHz

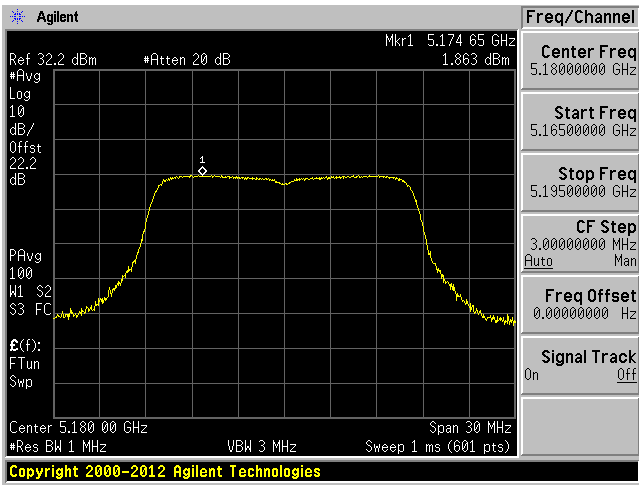


5240 MHz

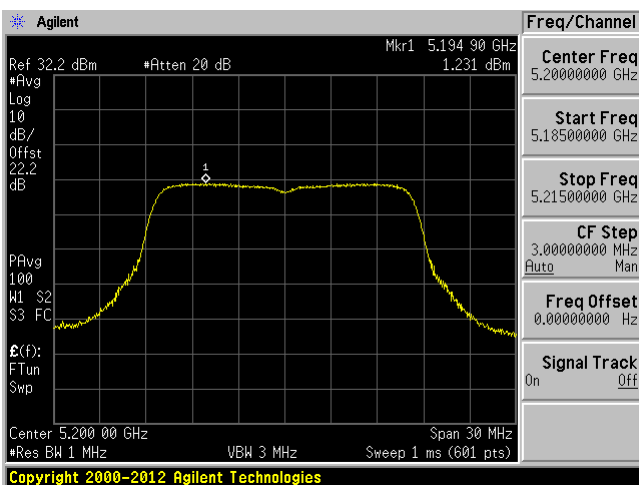


802.11a mode (Port B)

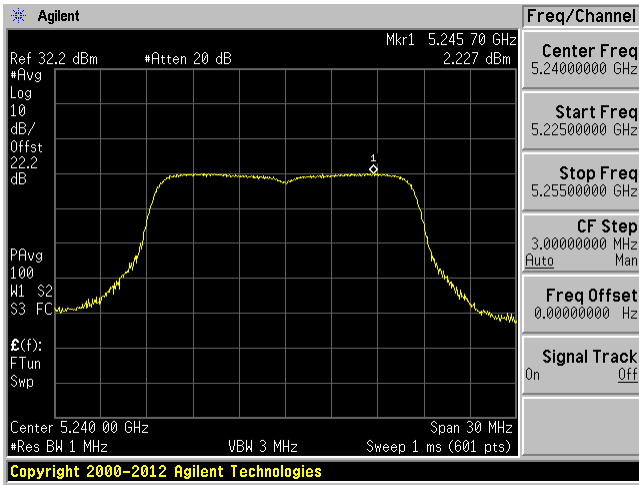
5180 MHz



5200 MHz

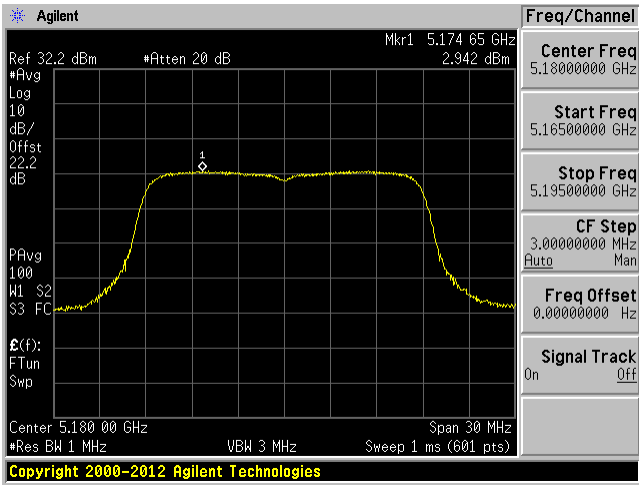


5240 MHz

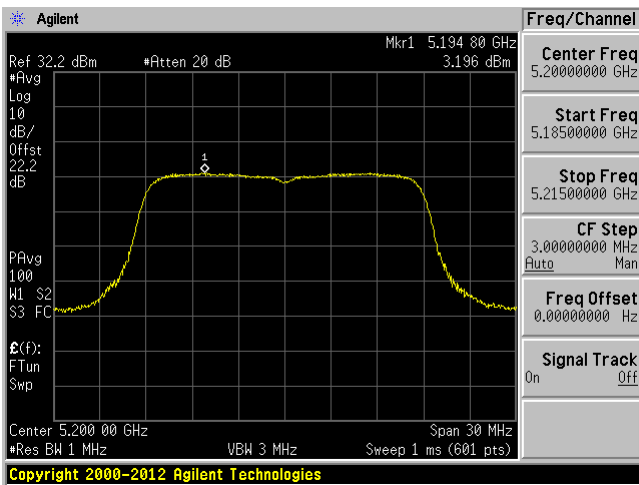


802.11n20 mode (Port A)

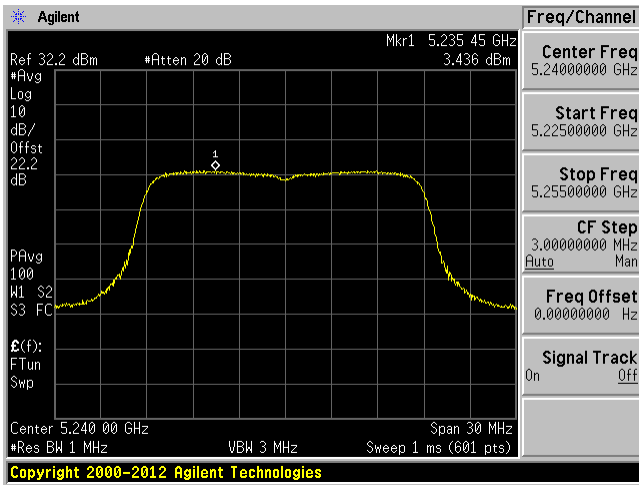
5180 MHz



5200 MHz

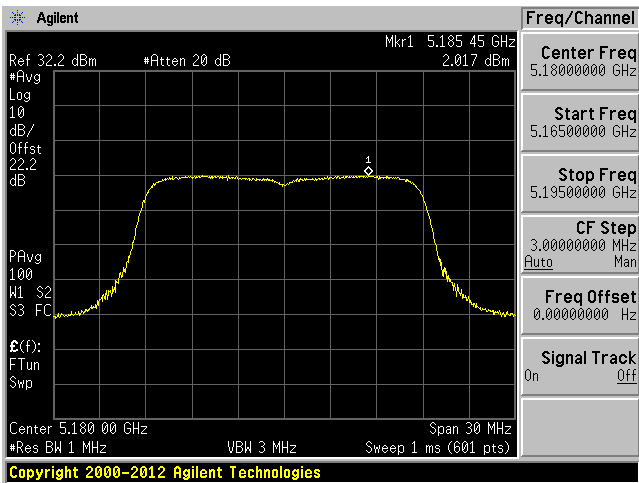


5240 MHz

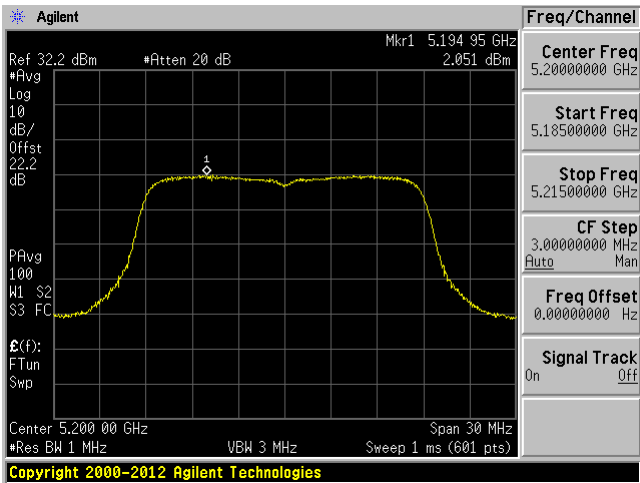


802.11n20 mode (Port A MIMO)

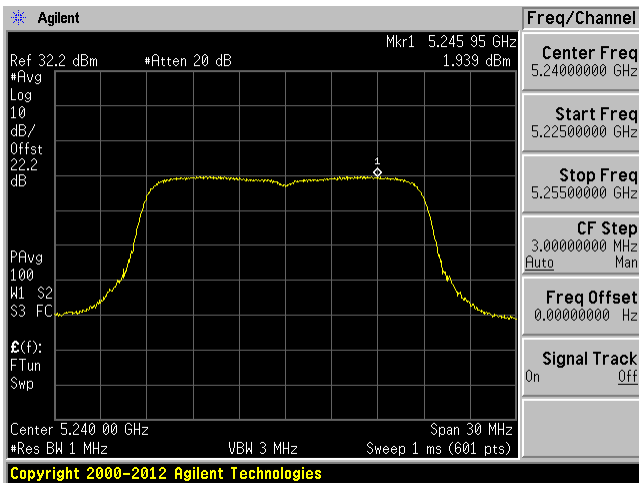
5180 MHz



5200 MHz

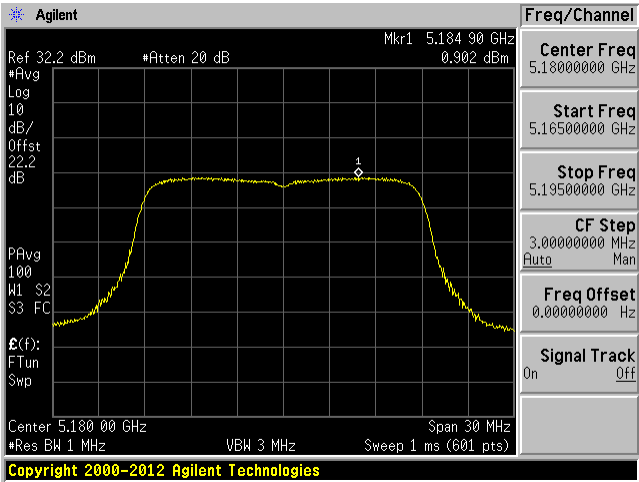


5240 MHz

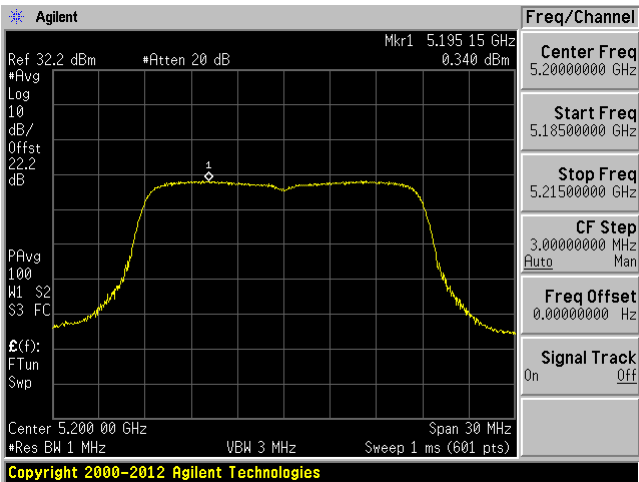


802.11n20 mode (Port B)

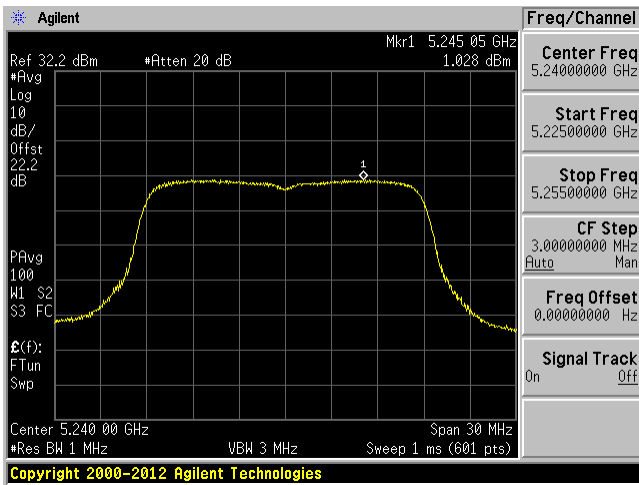
5180 MHz



5200 MHz

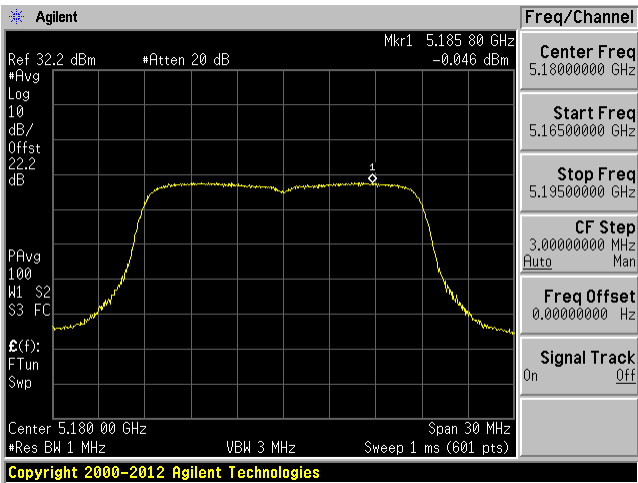


5240 MHz

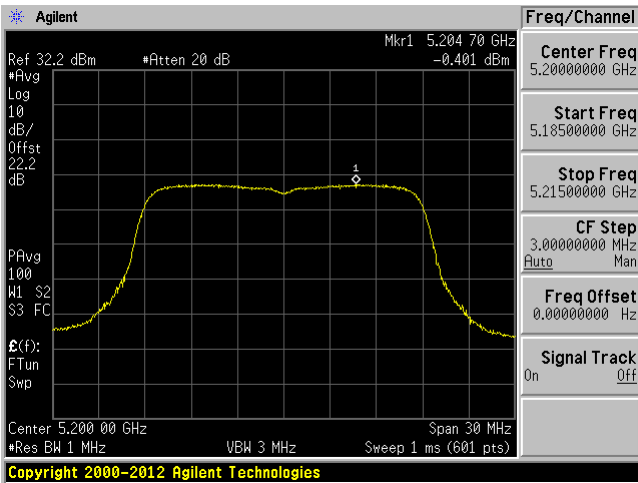


802.11n20 mode (Port B MIMO)

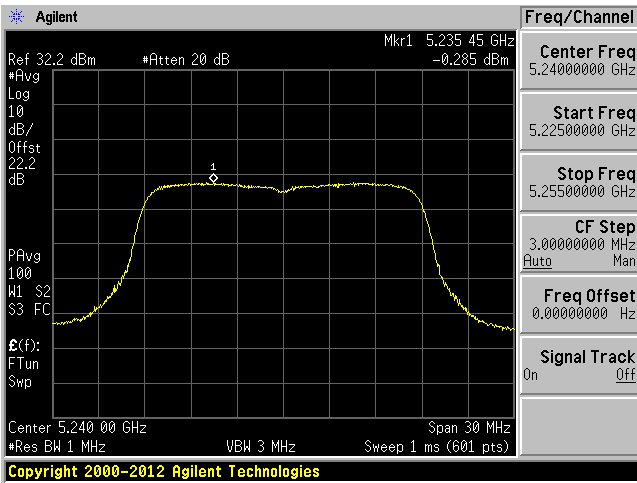
5180 MHz



5200 MHz

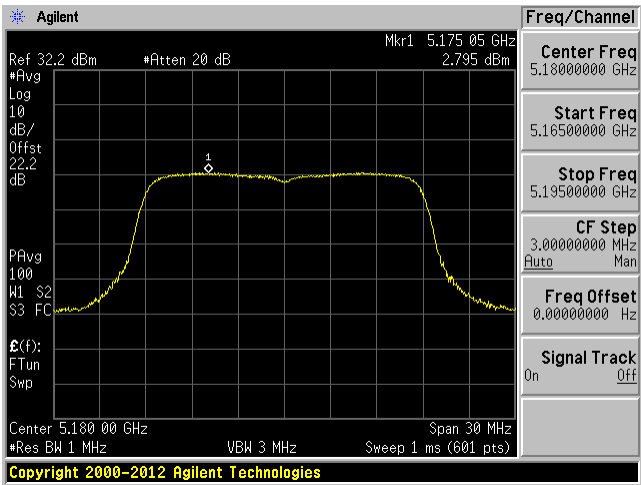


5240 MHz

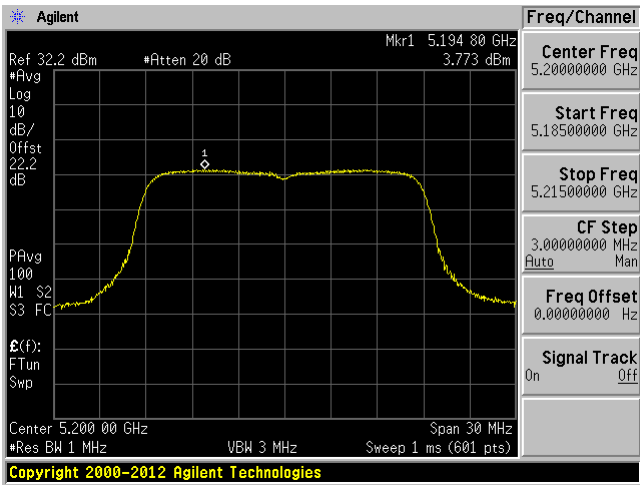


802.11ac20 mode (Port A)

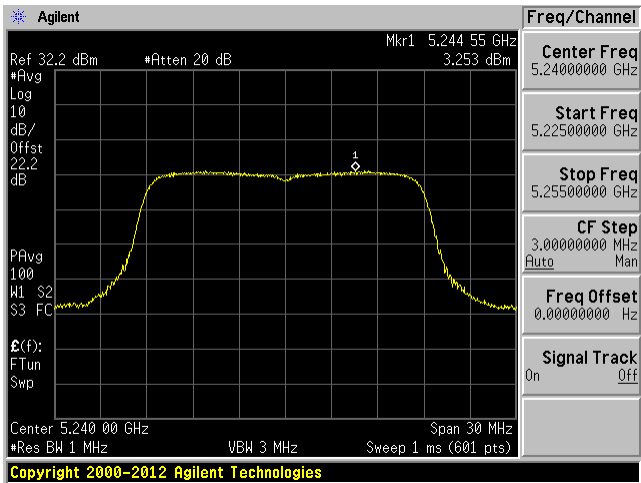
5180 MHz



5200 MHz

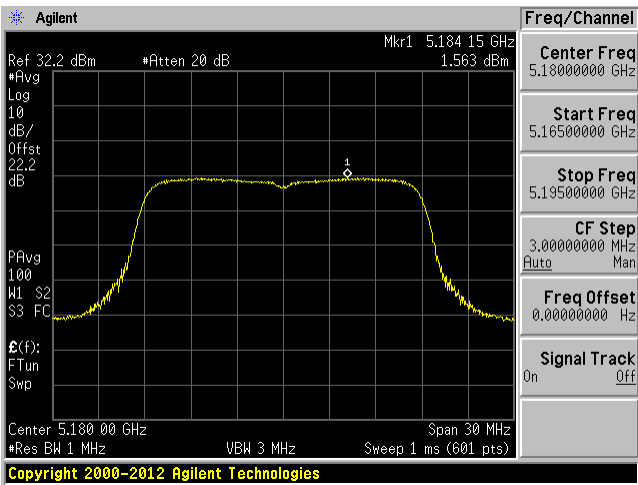


5240 MHz

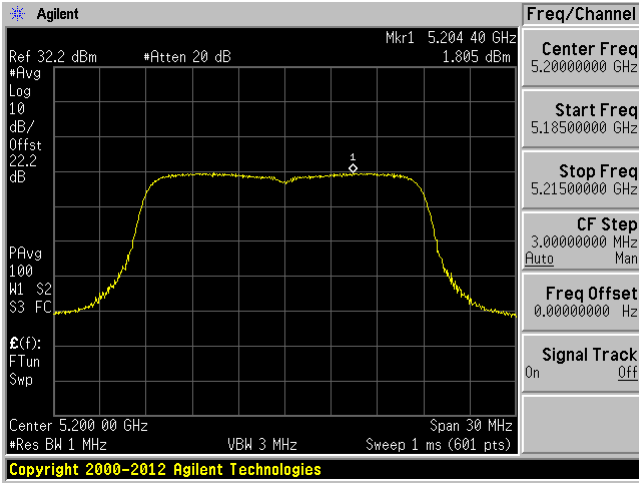


802.11ac20 mode (Port A MIMO)

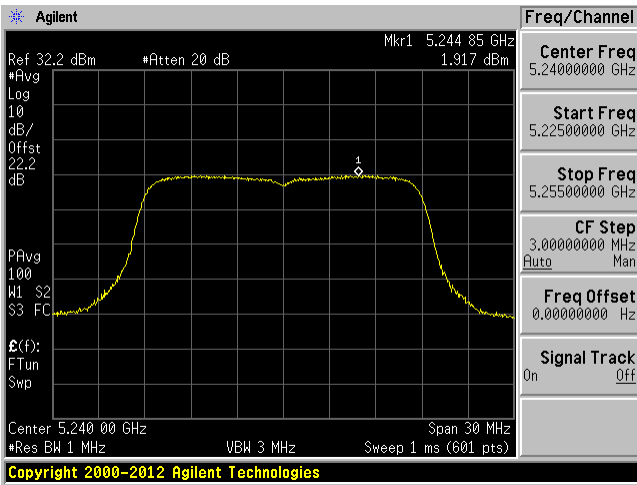
5180 MHz



5200 MHz

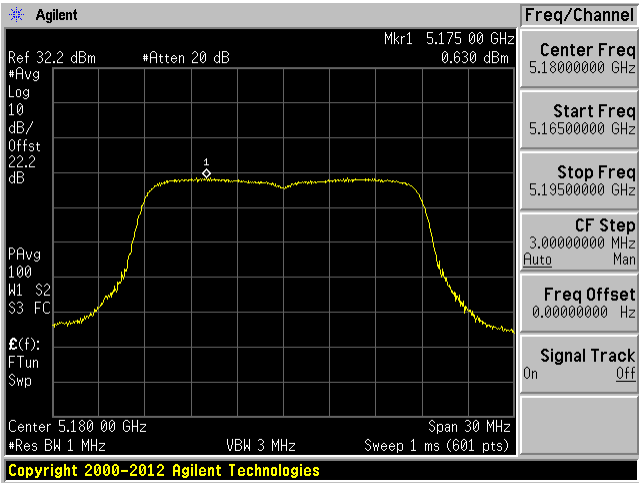


5240 MHz

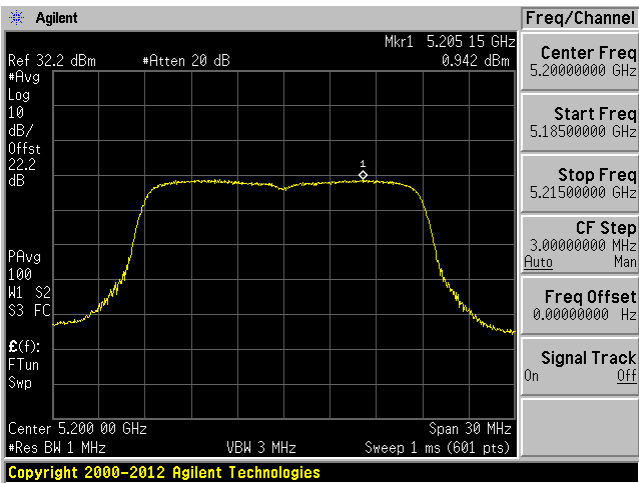


802.11ac20 mode (Port B)

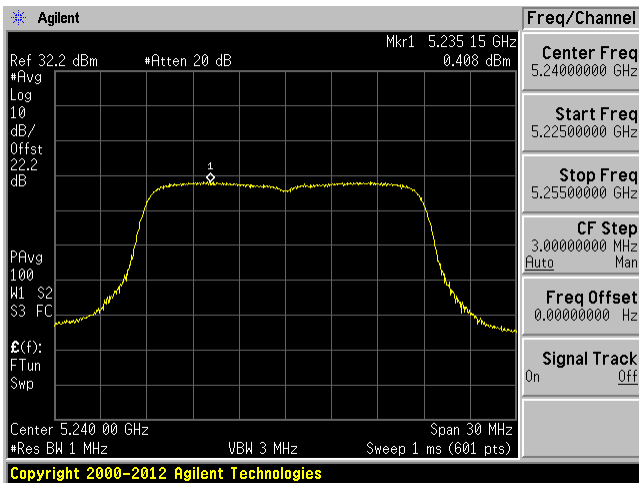
5180 MHz



5200 MHz

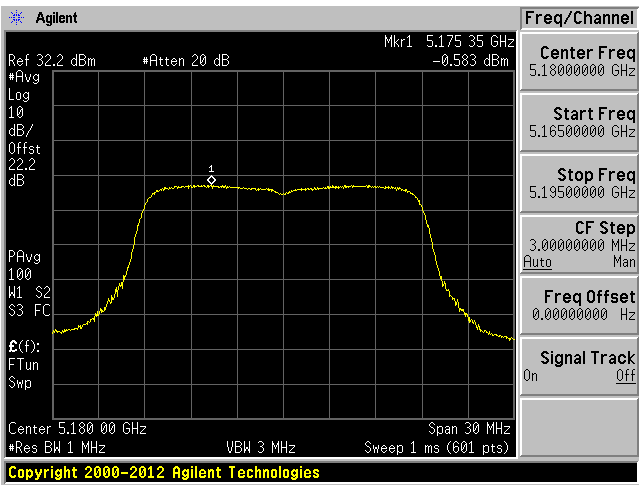


5240 MHz

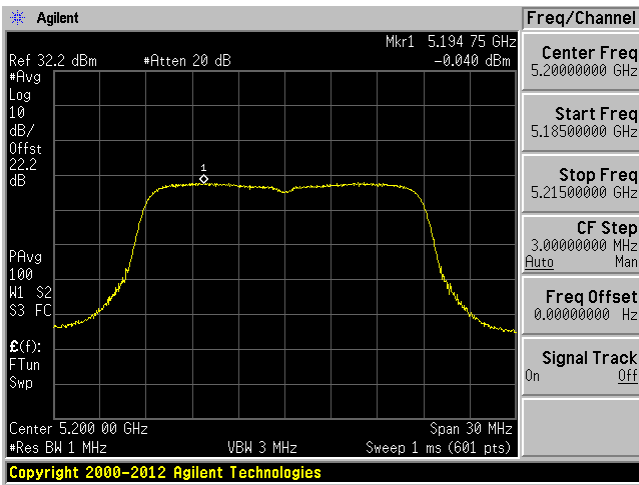


802.11ac20 mode (Port B MIMO)

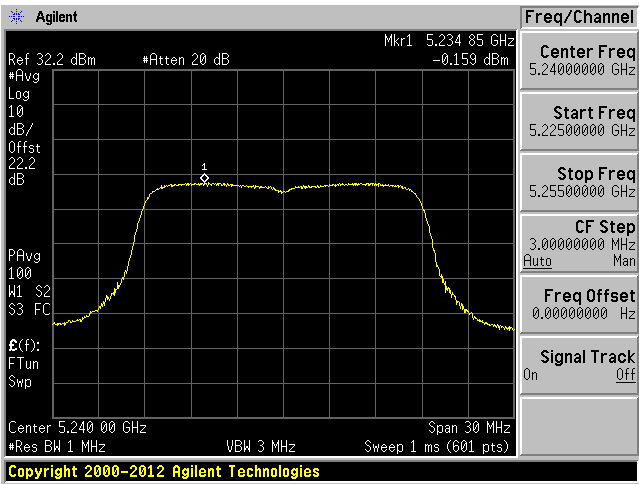
5180 MHz



5200 MHz



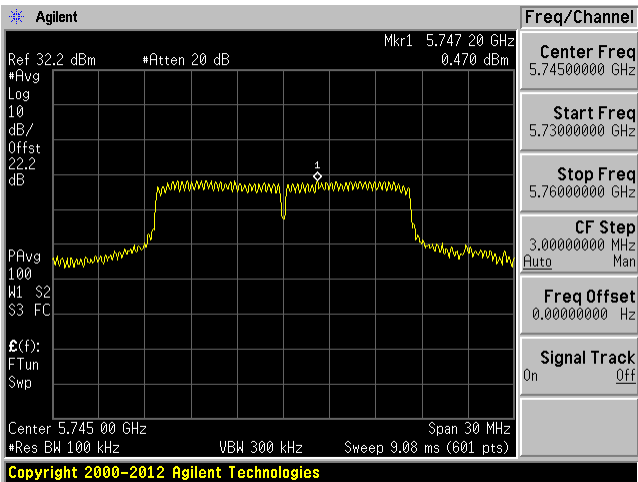
5240 MHz



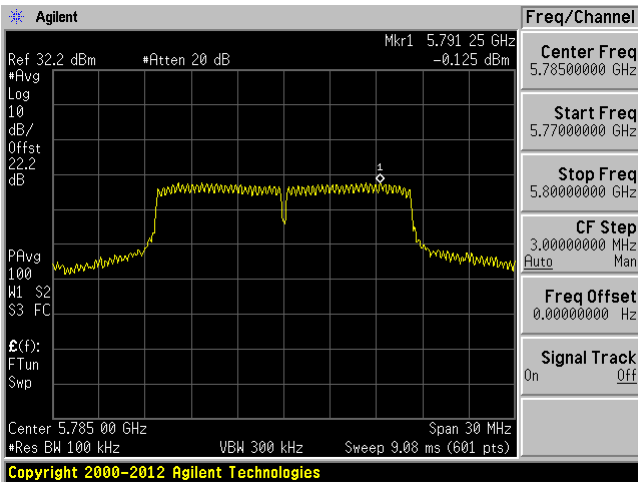
5725 – 5850 MHz

802.11a mode (Port A)

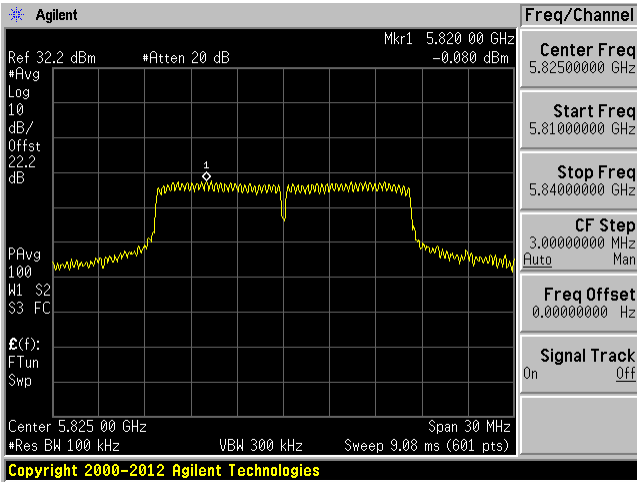
5745 MHz



5785 MHz

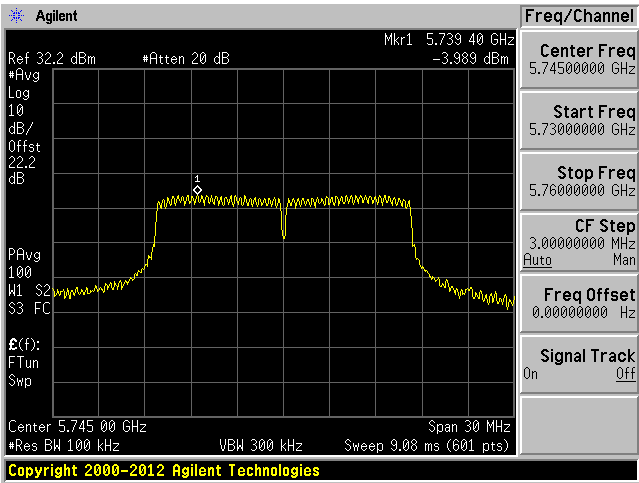


5825 MHz

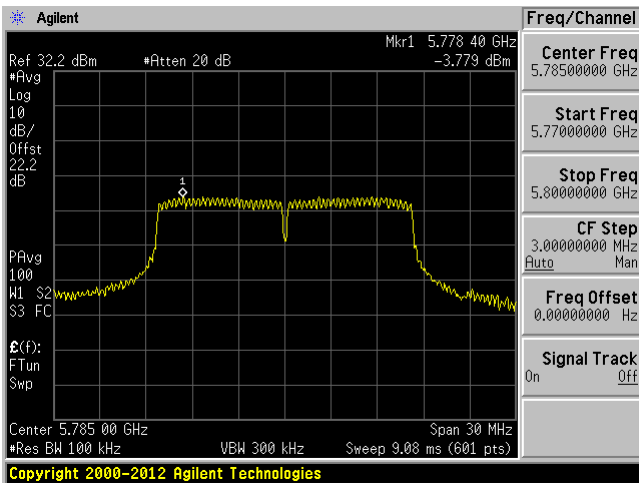


802.11a mode (Port B)

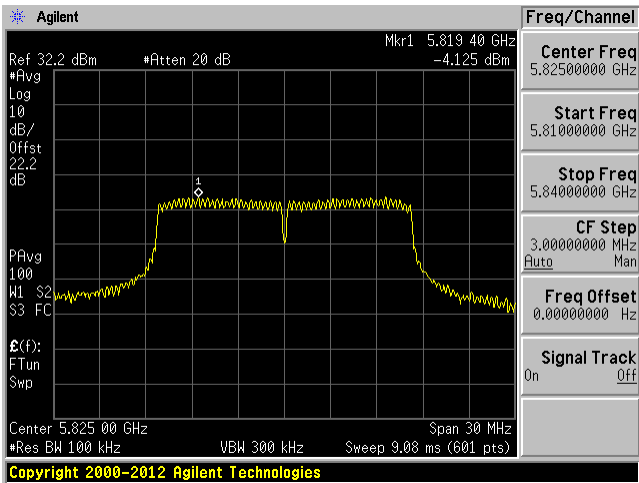
5745 MHz



5785 MHz

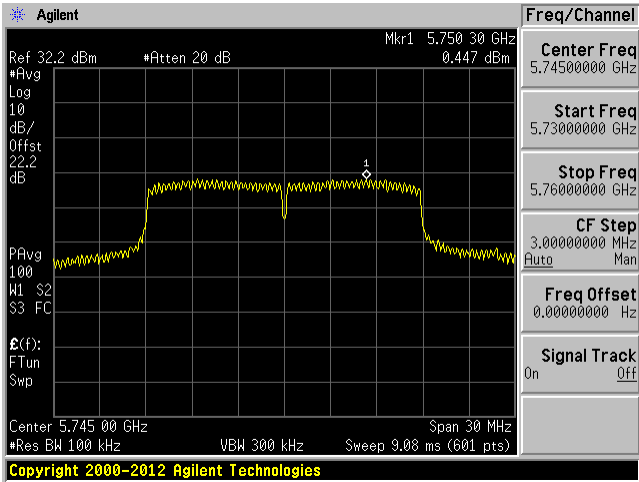


5825 MHz

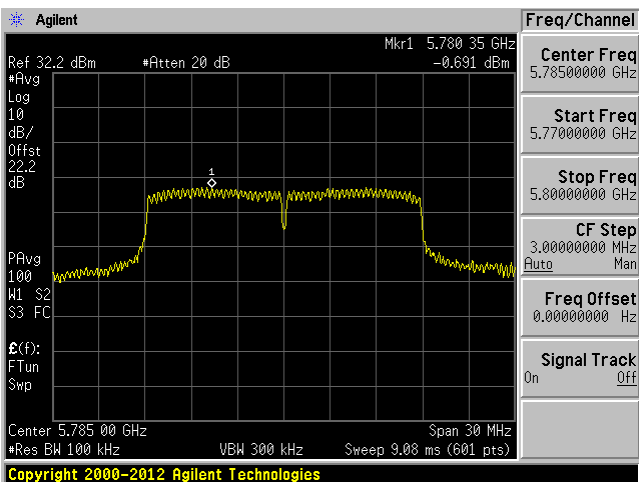


802.11n20 mode (Port A)

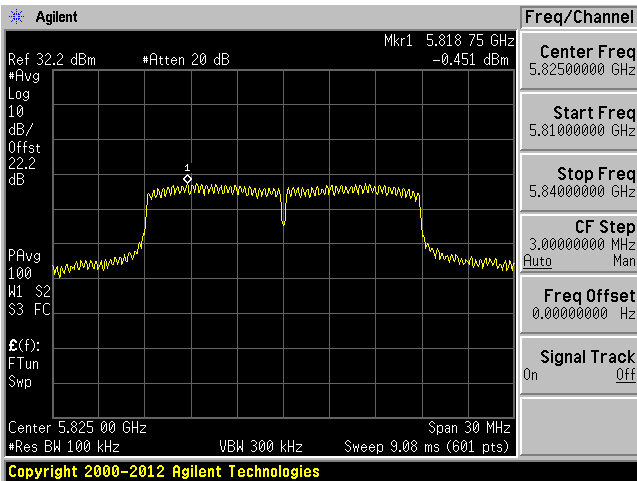
5745 MHz



5785 MHz

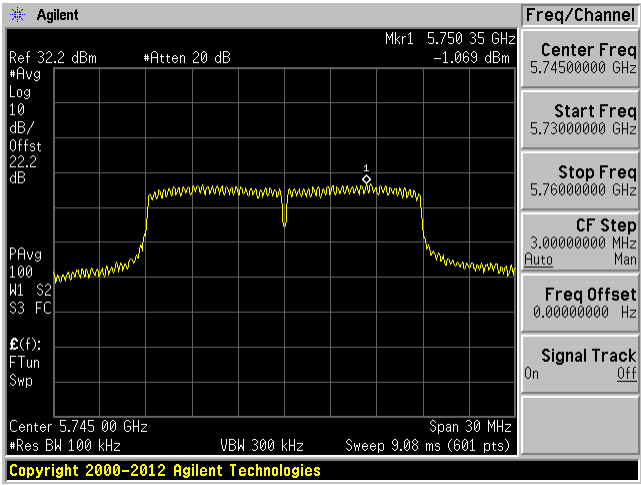


5825 MHz

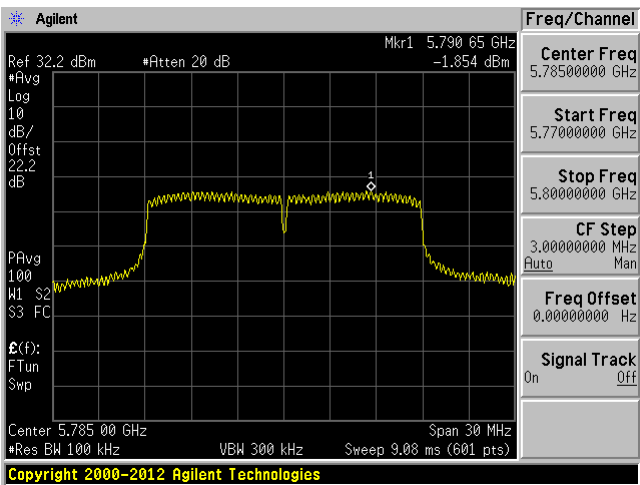


802.11n20 mode (Port A MIMO)

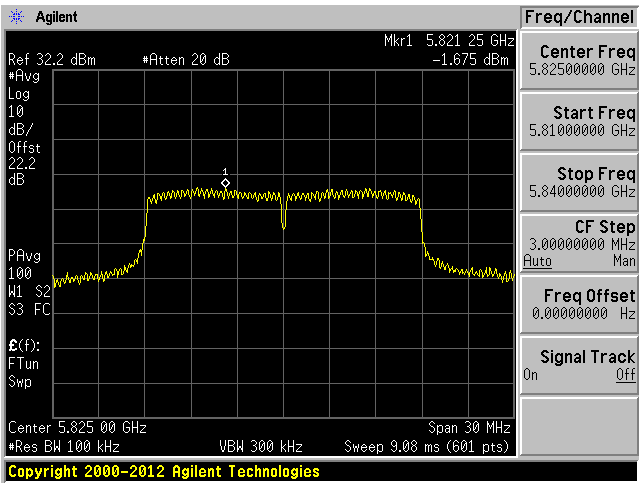
5745 MHz



5785 MHz

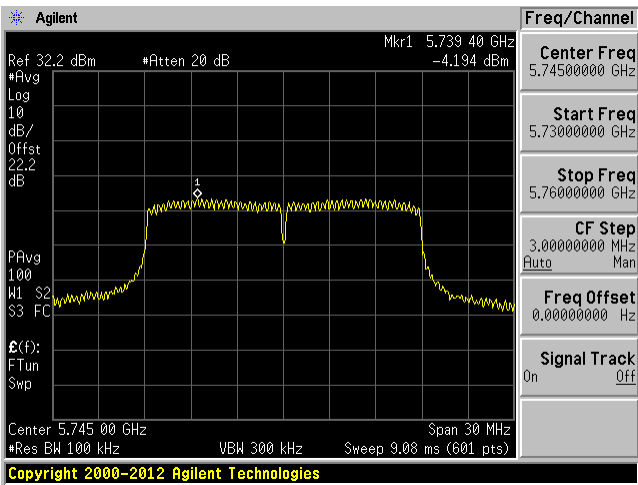


5825 MHz

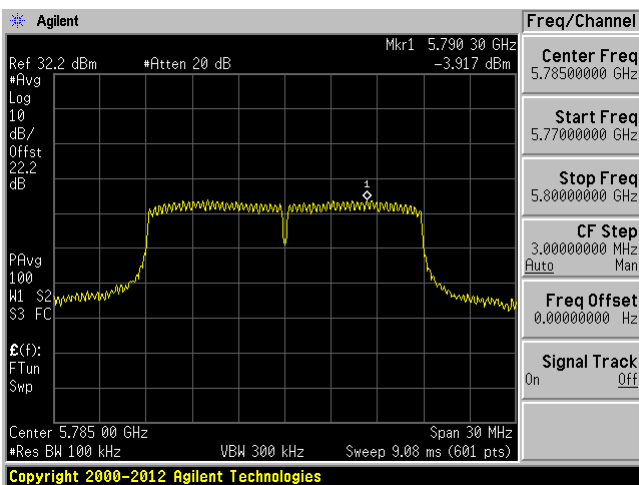


802.11n20 mode (Port B)

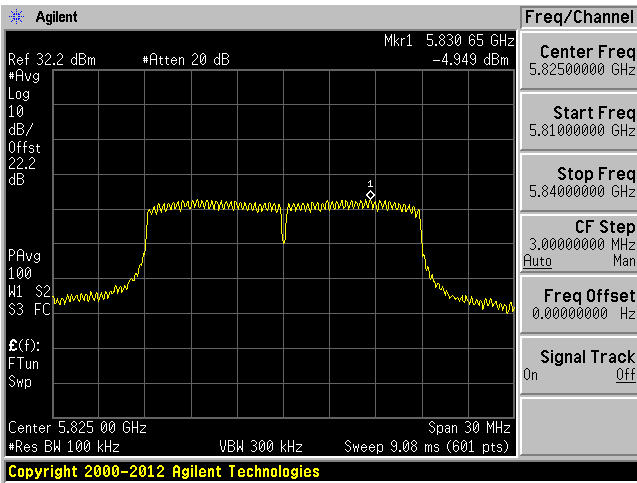
5745 MHz



5785 MHz

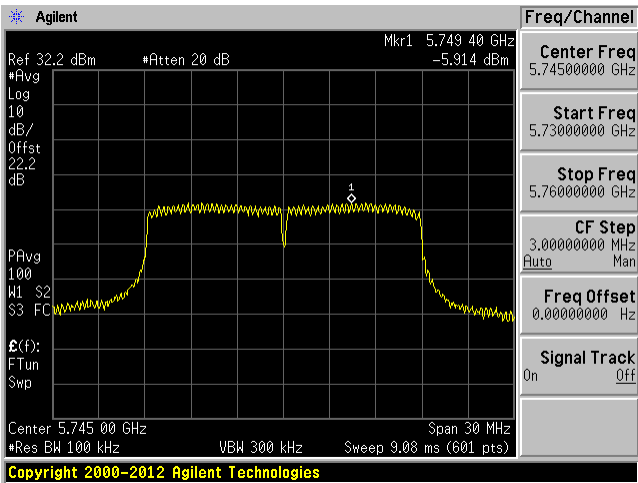


5825 MHz

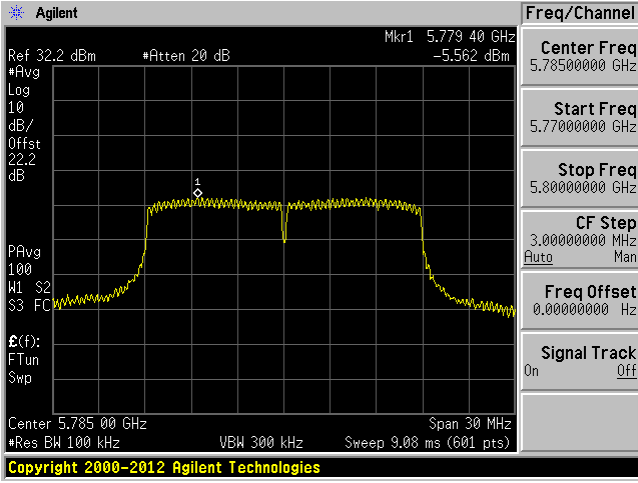


802.11n20 mode (Port B MIMO)

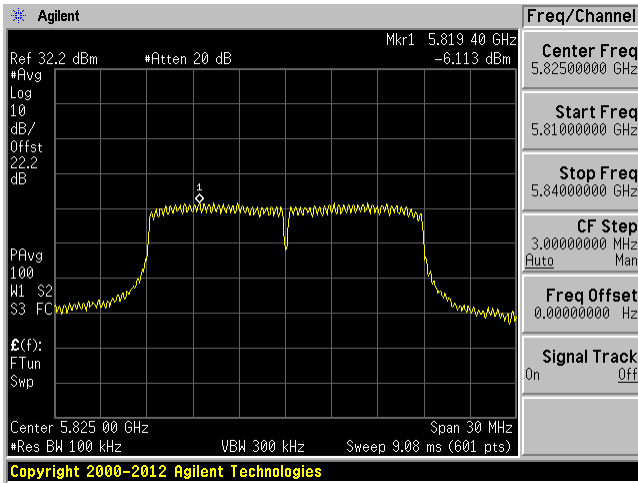
5745 MHz



5785 MHz

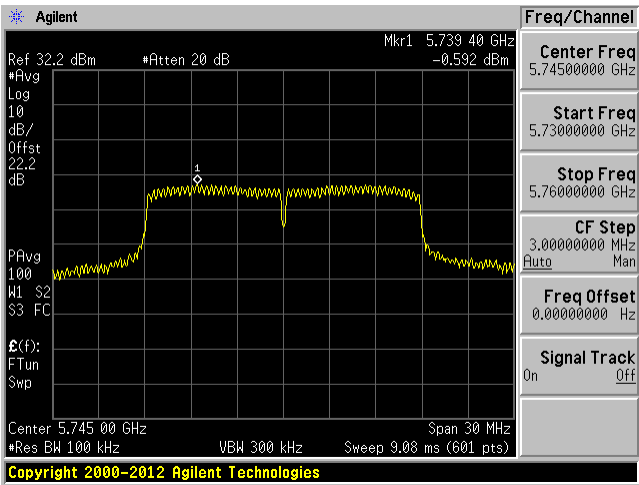


5825 MHz

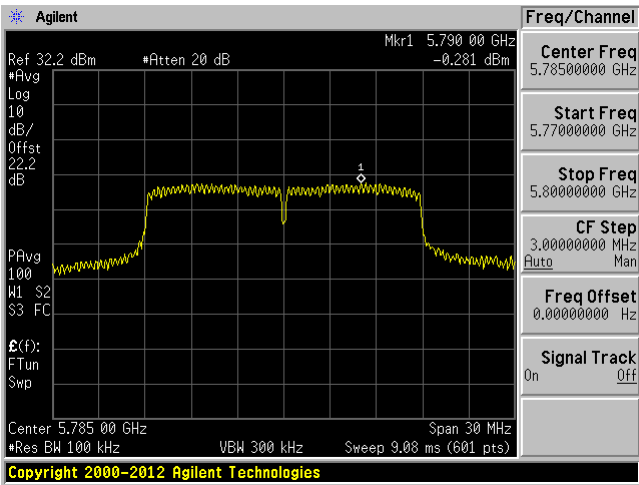


802.11ac20 mode (Port A)

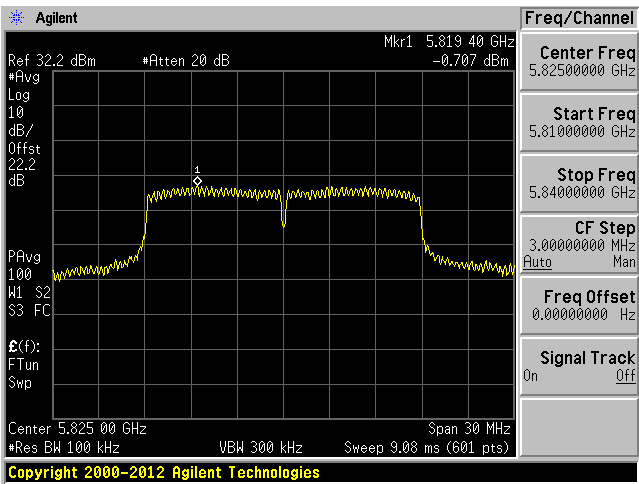
5745 MHz



5785 MHz

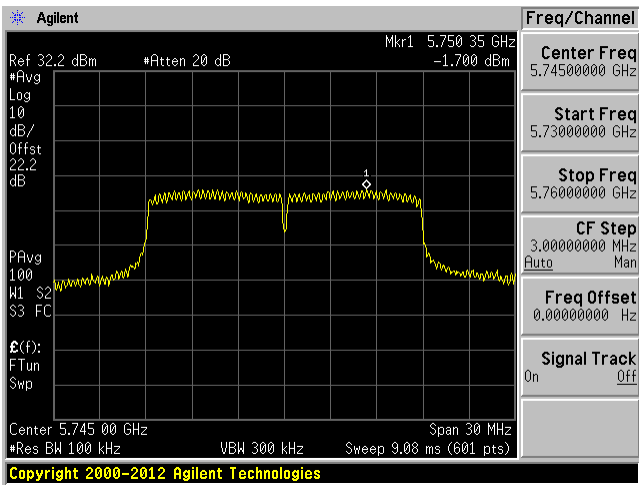


5825 MHz

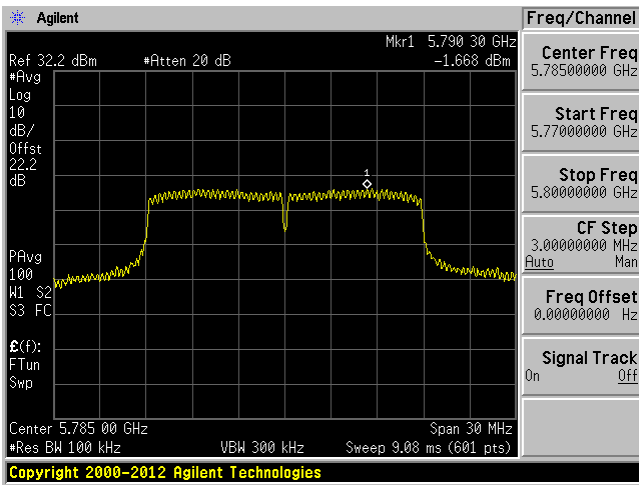


802.11ac20 mode (Port A MIMO)

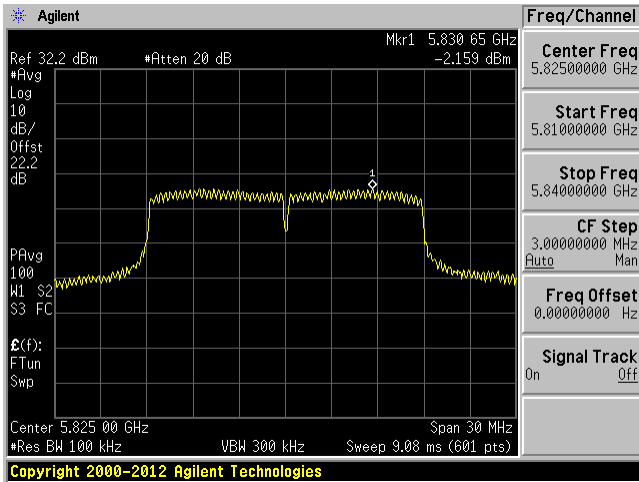
5745 MHz



5785 MHz

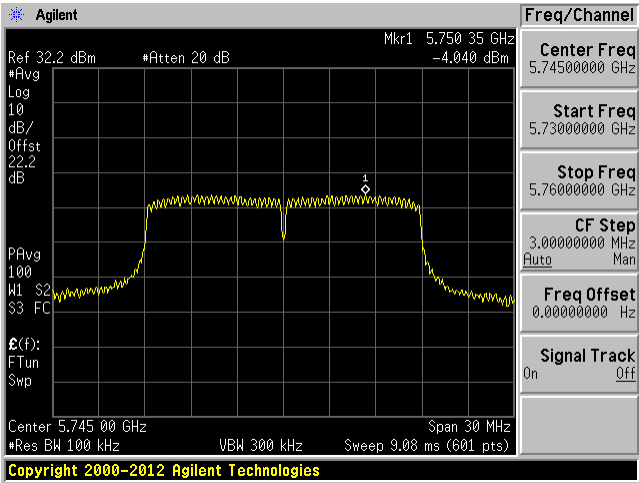


5825 MHz

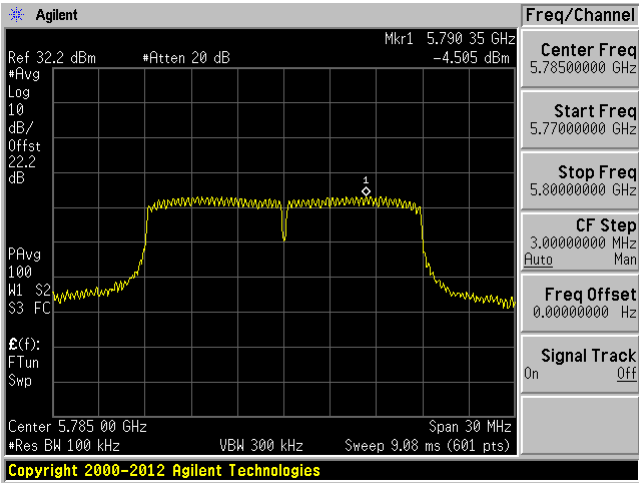


802.11ac20 mode (Port B)

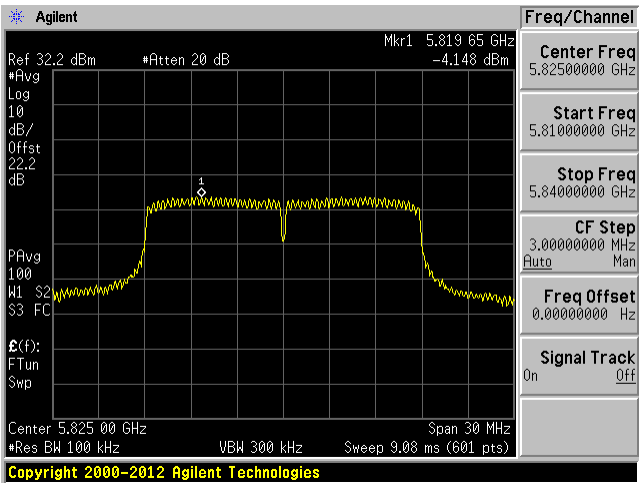
5745 MHz



5785 MHz

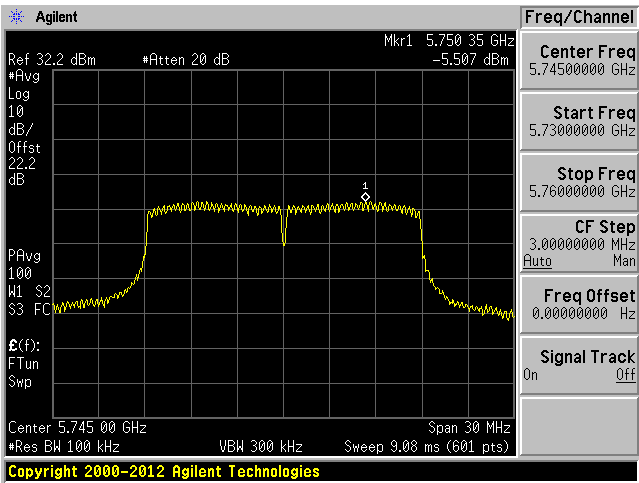


5825 MHz

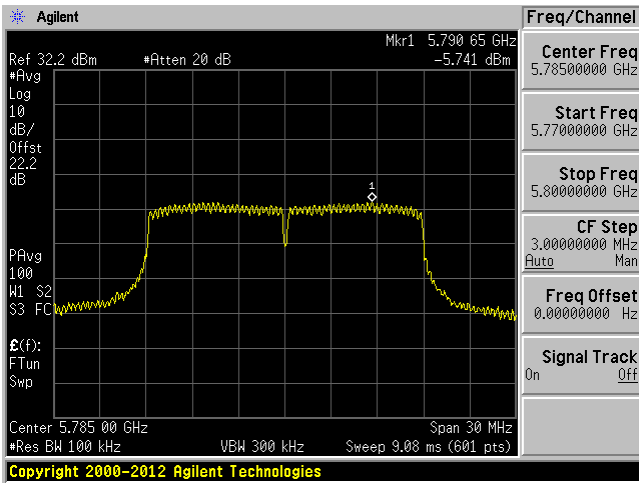


802.11ac20 mode (Port B MIMO)

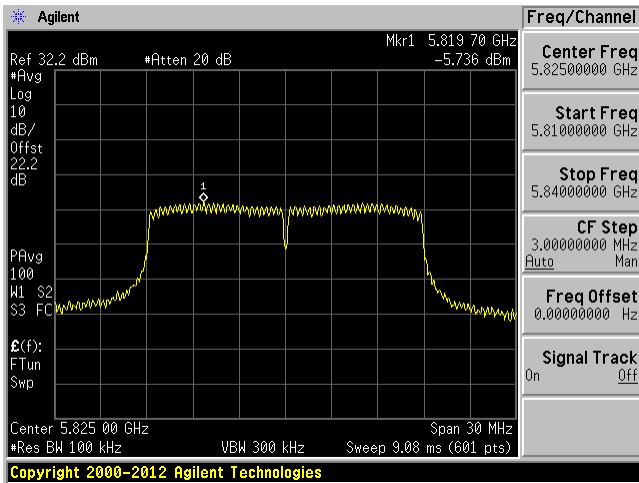
5745 MHz



5785 MHz



5825 MHz



## 11 FCC §15.407(b) & ISEDC RSS-247 §6.2 - 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 shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

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.

According to ISEDC RSS-247 §6.2.1 for devices operating in the frequency band 5150-5250 MHz:

For transmitters operating in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, any unwanted emissions that fall into the band 5250-5350 MHz must be 26 dBc, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth, above 5.25 GHz. Otherwise, the transmission is considered as intentional and the devices shall implement dynamic frequency selection (DFS) and transmitter power control (TPC) as per the requirements for the band 5250-5350 MHz.

According to ISEDC RSS-247 §6.2.2 for devices operating in the frequency band 5250-5350 MHz:

For devices with both operating frequencies and channel bandwidths contained within the band 5250-5350 MHz, the device shall comply with the following:

1. All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. if the equipment is intended for outdoor use; or
2. All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and any emissions within the band 5150-5250 MHz shall meet the power spectral density limits of Section 6.2.1. The device shall be labelled "for indoor use only."

For devices with operating frequencies in the band 5250-5350 MHz but having a channel bandwidth that overlaps the band 5150-5250 MHz, the devices' unwanted emission shall not exceed -27 dBm/MHz e.i.r.p. outside the band 5150-5350 MHz and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device shall be labelled "for indoor use only."

According to ISEDC RSS-247 §6.2.3 for devices operating in the frequency band 5470-5600 MHz and 5650-5725 MHz. Emissions outside the band 5470-5725 MHz shall not exceed -27 dBm/MHz e.i.r.p.

According to ISED RSS-247 §6.2.4 for devices operating in the frequency band 5725-5850 MHz:

For the band 5725-5850 MHz, emissions at frequencies from the band edges to 10 MHz above or below the band edges shall not exceed -17 dBm/MHz e.i.r.p.

For emissions at frequencies more than 10 MHz above or below the band edges, the emissions power shall not exceed -27 dBm/MHz.

## 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 | E4446A    | US44300386 | 2017-04-20             | 1 year               |
| -            | RF cable           | -         | -          | Each time <sup>1</sup> | N/A                  |
| -            | 20 dB attenuator   | -         | -          | Each time <sup>1</sup> | N/A                  |

Note<sup>1</sup>: 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:       | 22-24° C        |
| Relative Humidity: | 40-41 %         |
| ATM Pressure:      | 103.1-104.1 kPa |

The testing was performed by Vincent Licata 2017-08-15 at RF site.

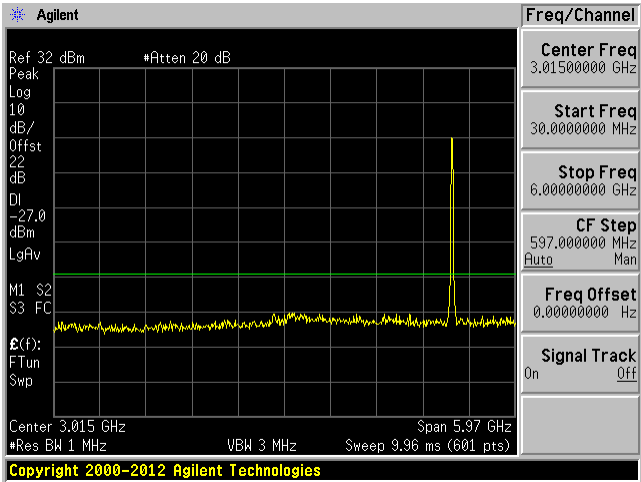
11.5 Test Results

Please refer to the following plots

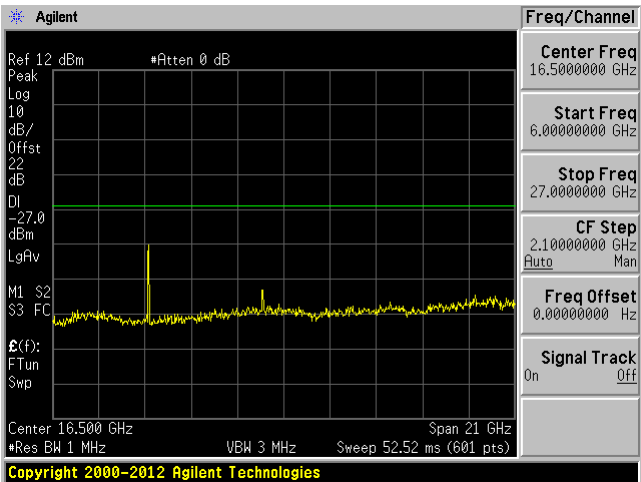
5150 - 5250 MHz

802.11a mode (Port A)

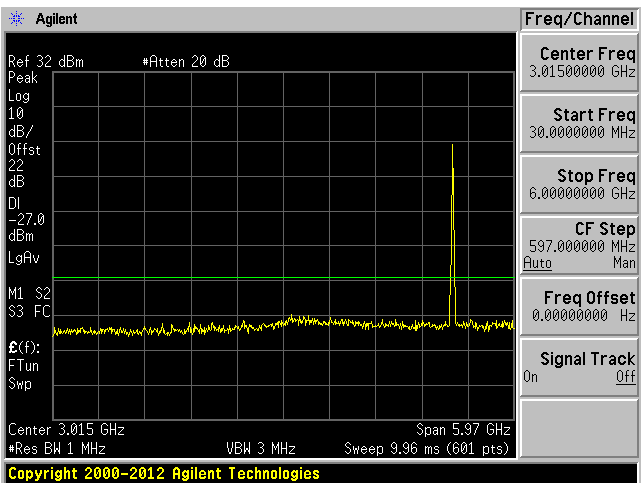
Low Channel 5180MHz (30MHz-6GHz)



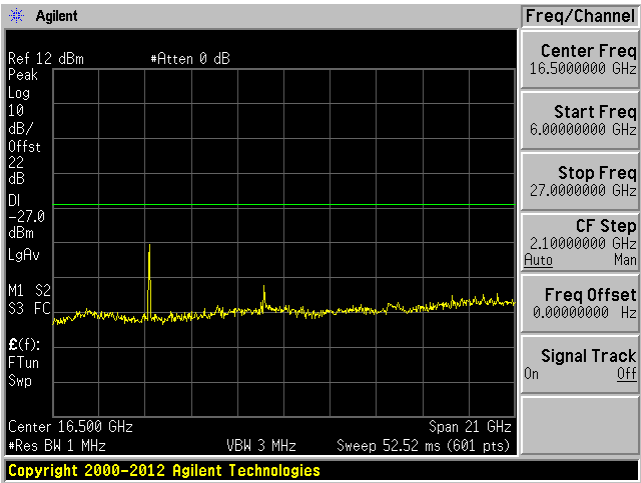
Low Channel 5180 MHz (6-40GHz)



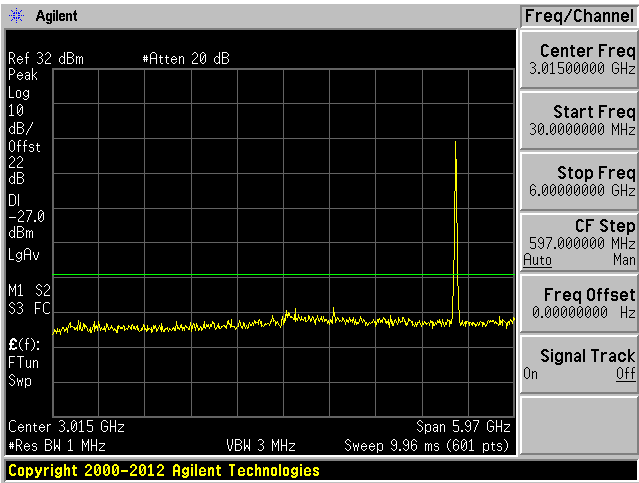
Middle Channel 5200MHz (30MHz-6GHz)



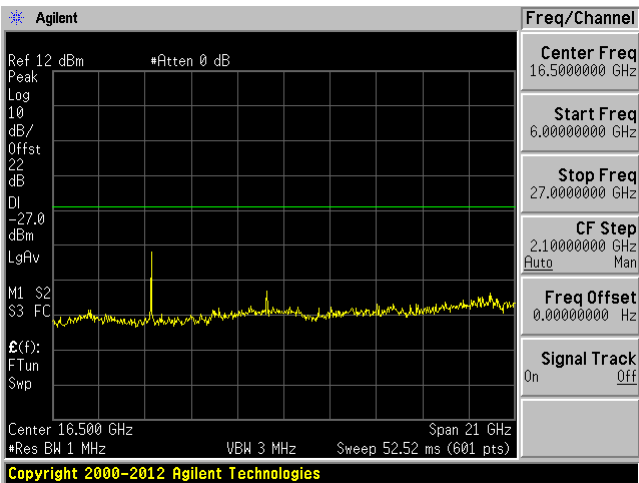
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

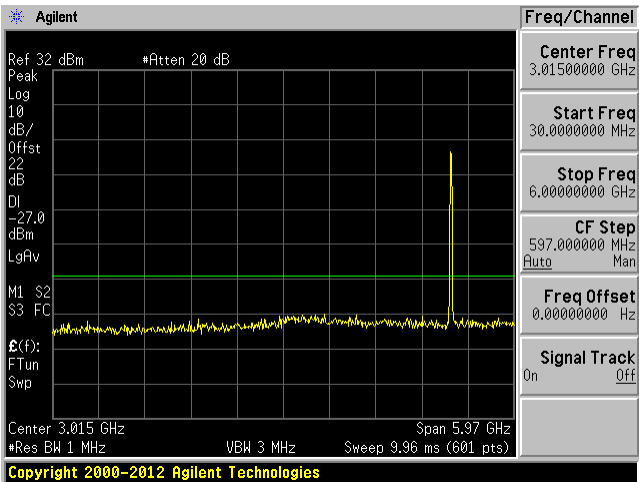


High Channel 5240 MHz (6-40GHz)

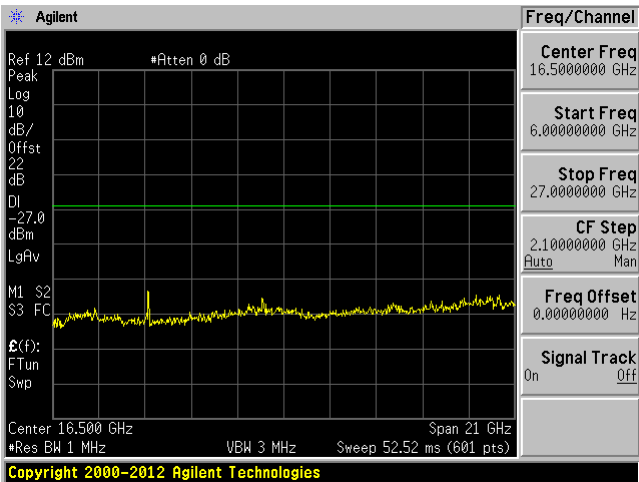


802.11a mode (Port B)

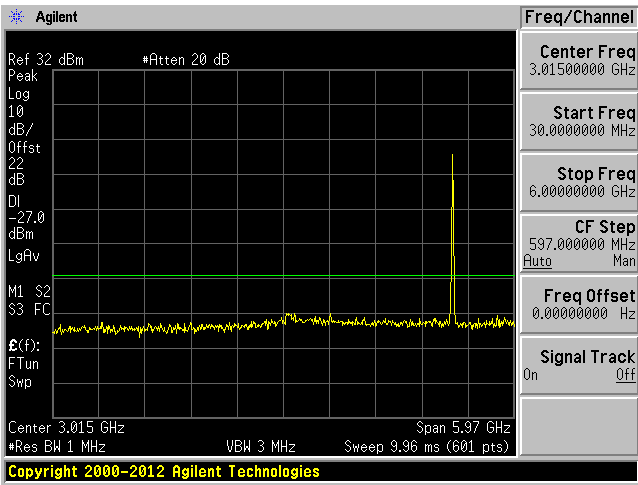
Low Channel 5180MHz (30MHz-6GHz)



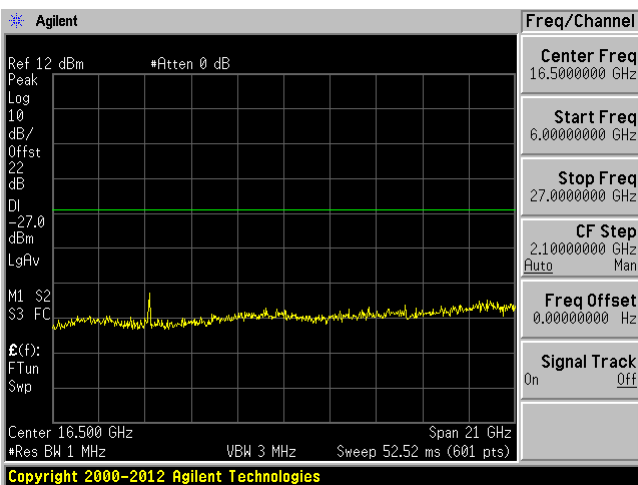
Low Channel 5180 MHz (6-40GHz)



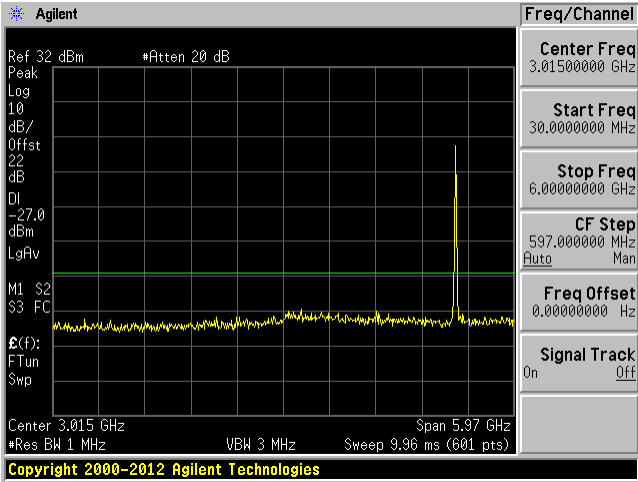
Middle Channel 5200MHz (30MHz-6GHz)



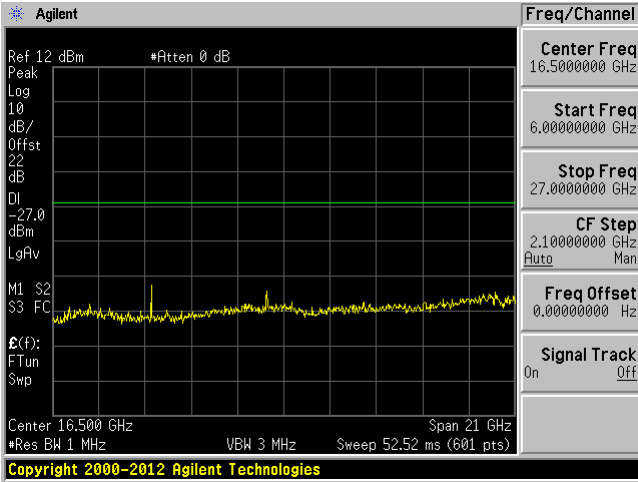
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

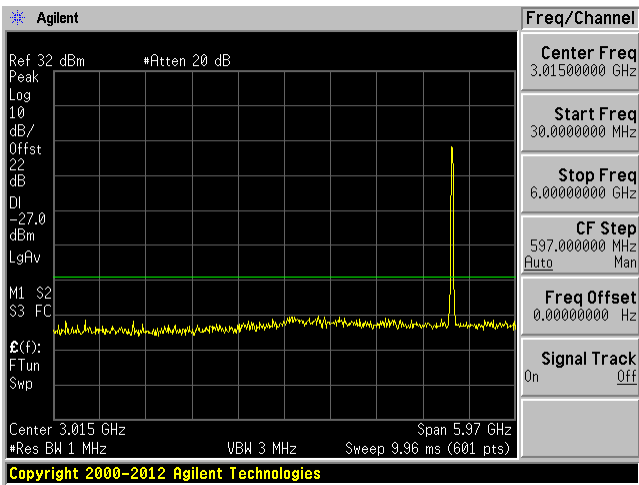


High Channel 5240 MHz (6-40GHz)

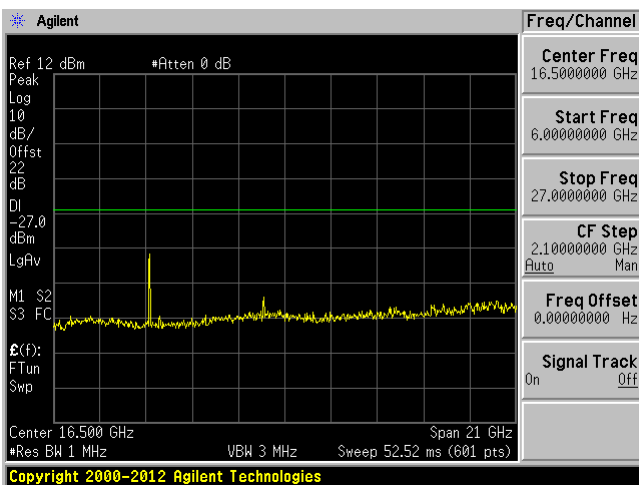


802.11n20 mode (Port A)

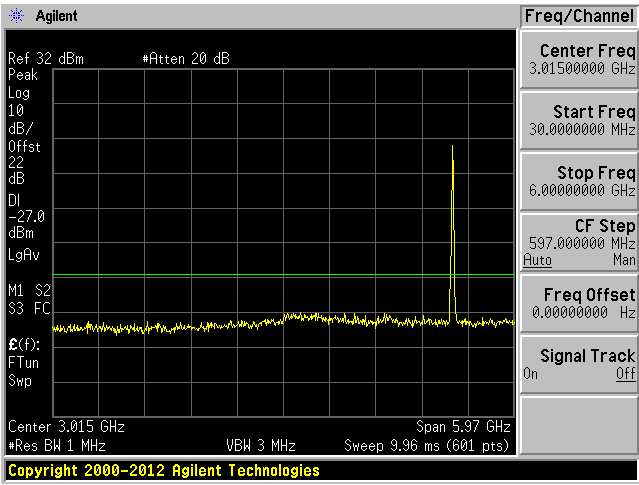
Low Channel 5180MHz (30MHz-6GHz)



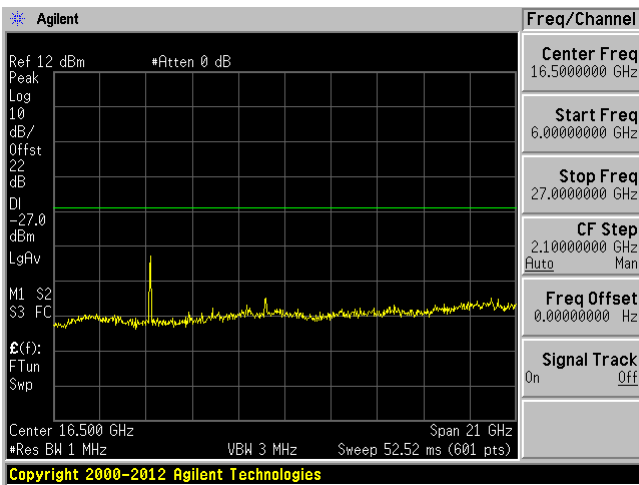
Low Channel 5180 MHz (6-40GHz)



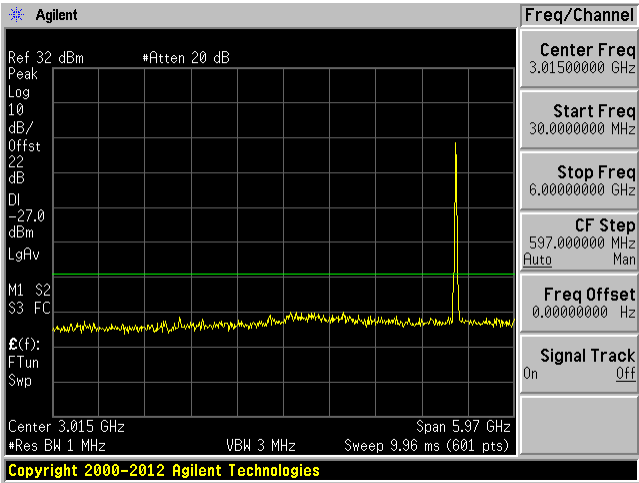
Middle Channel 5200MHz (30MHz-6GHz)



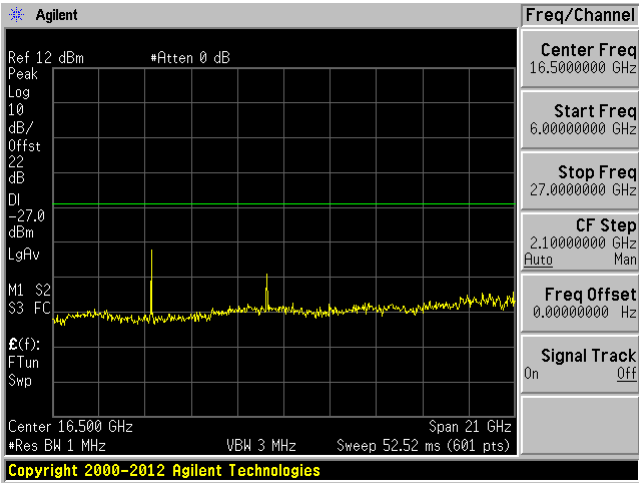
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

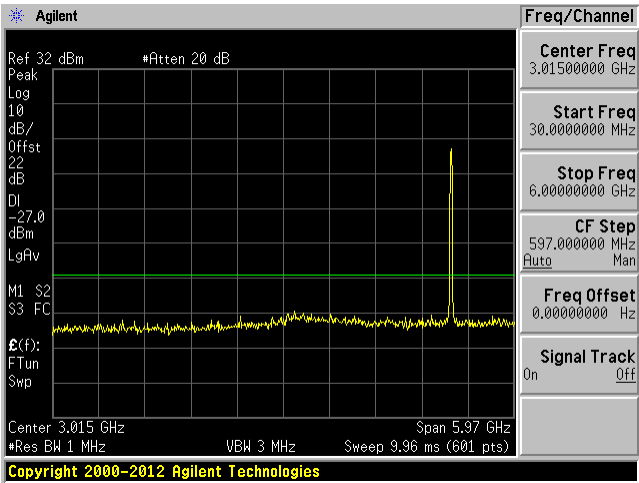


High Channel 5240 MHz (6-40GHz)

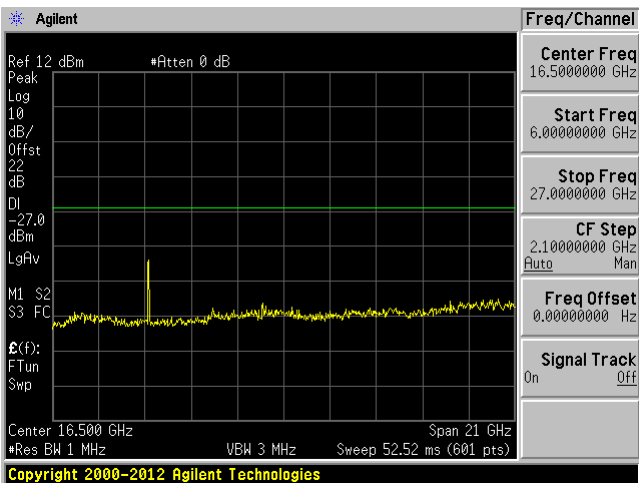


802.11n20 mode (Port A MIMO)

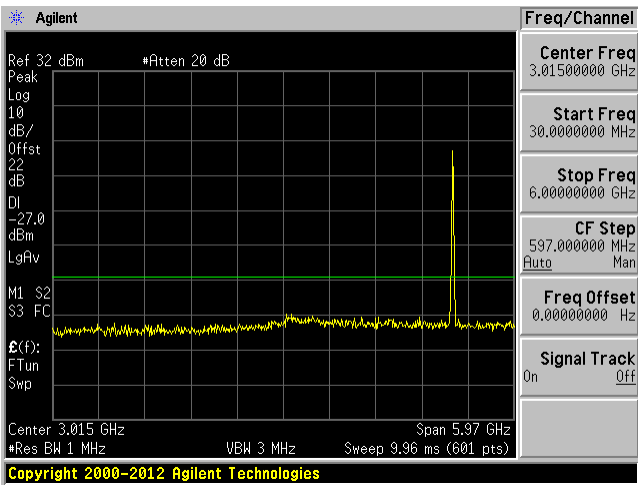
Low Channel 5180MHz (30MHz-6GHz)



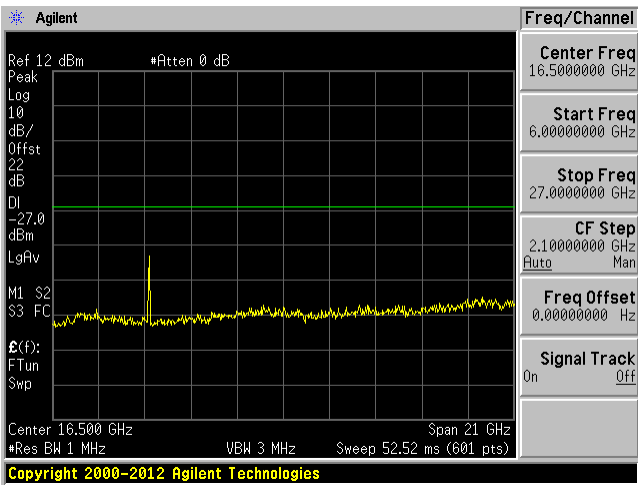
Low Channel 5180 MHz (6-40GHz)



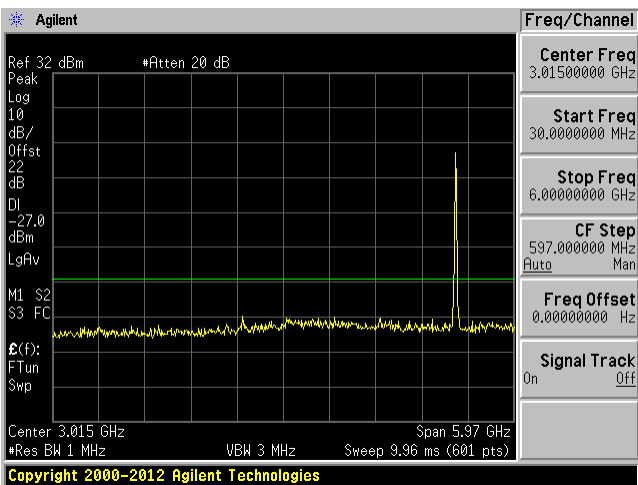
Middle Channel 5200MHz (30MHz-6GHz)



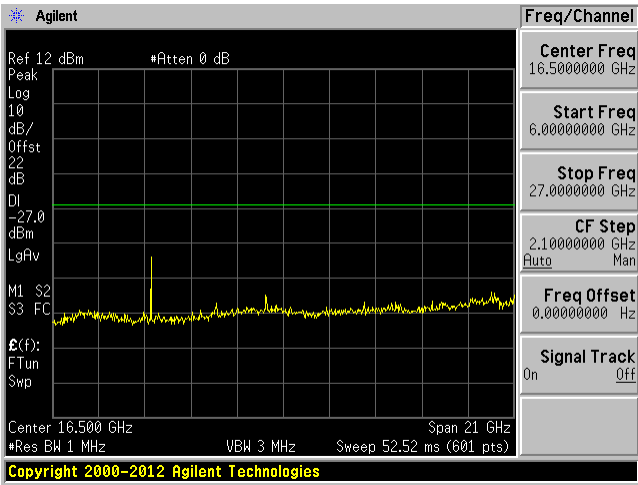
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

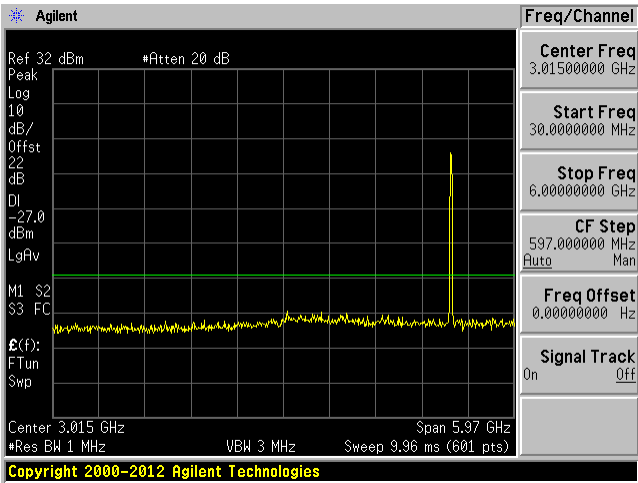


High Channel 5240 MHz (6-40GHz)

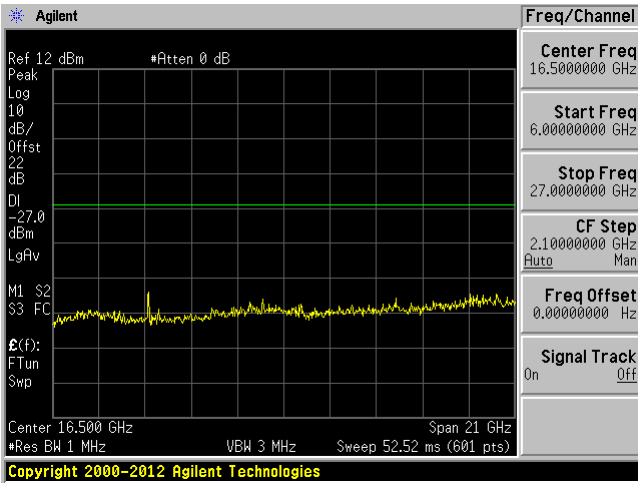


802.11n20 mode (Port B)

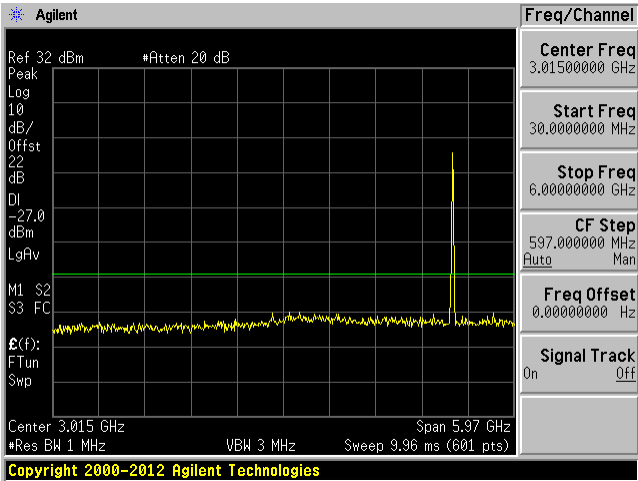
Low Channel 5180MHz (30MHz-6GHz)



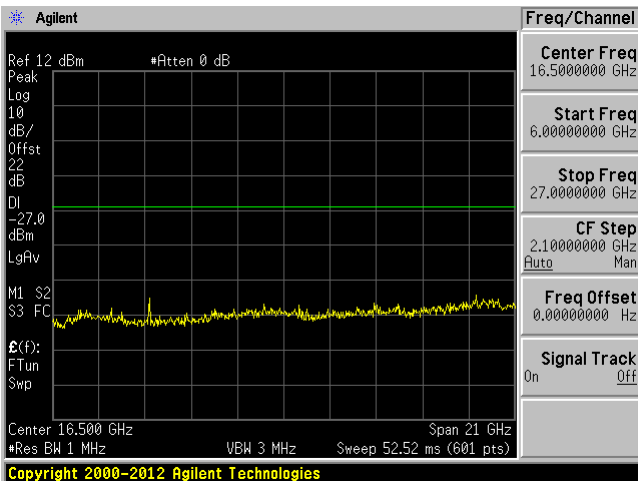
Low Channel 5180 MHz (6-40GHz)



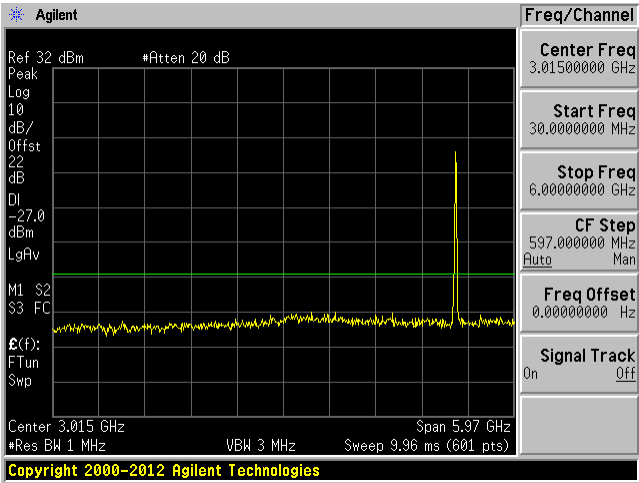
Middle Channel 5200MHz (30MHz-6GHz)



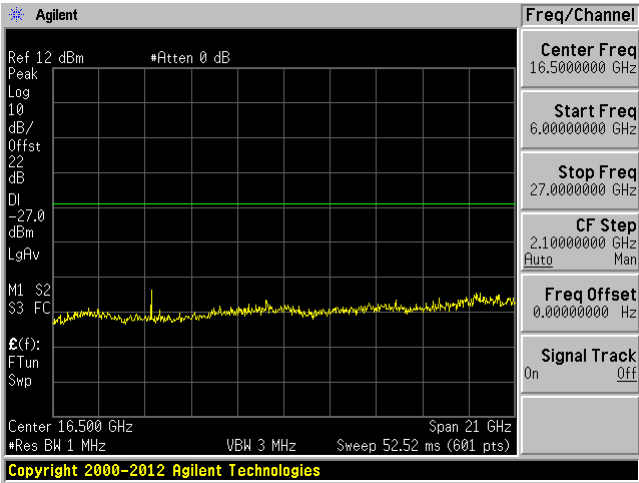
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

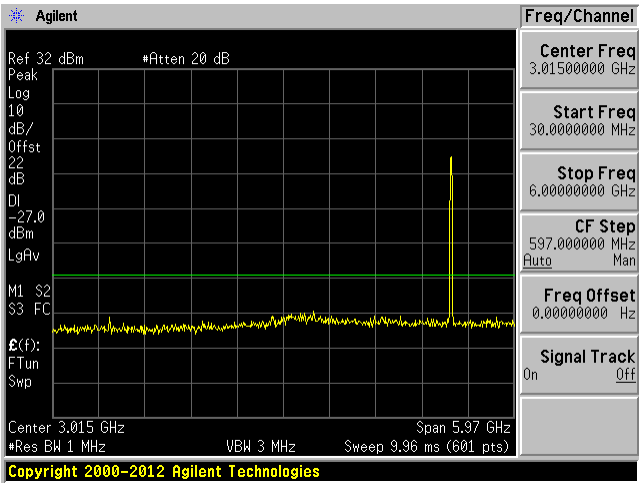


High Channel 5240 MHz (6-40GHz)

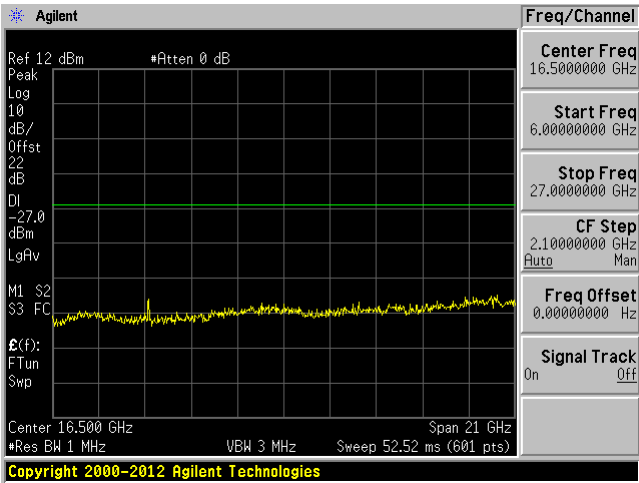


802.11n20 mode (Port B MIMO)

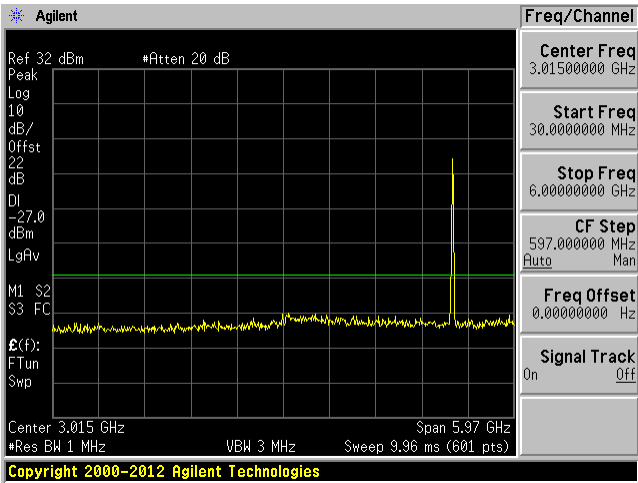
Low Channel 5180MHz (30MHz-6GHz)



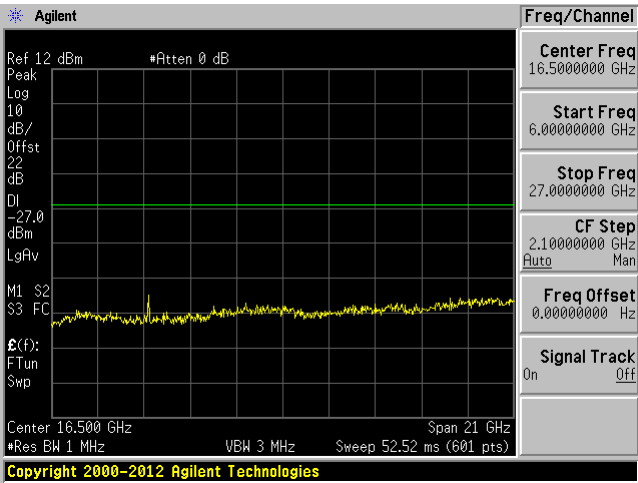
Low Channel 5180 MHz (6-40GHz)



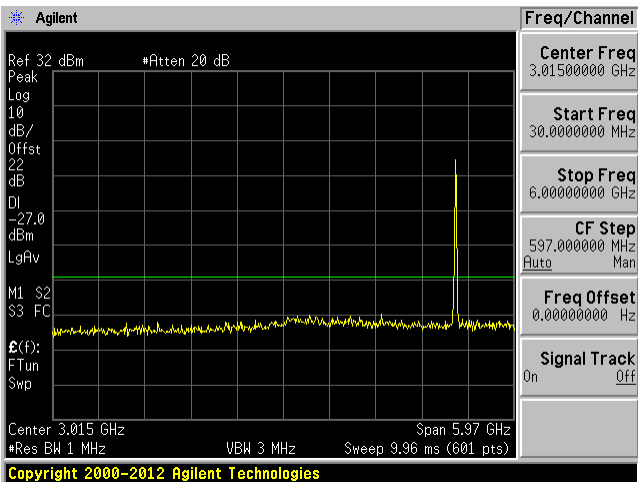
Middle Channel 5200MHz (30MHz-6GHz)



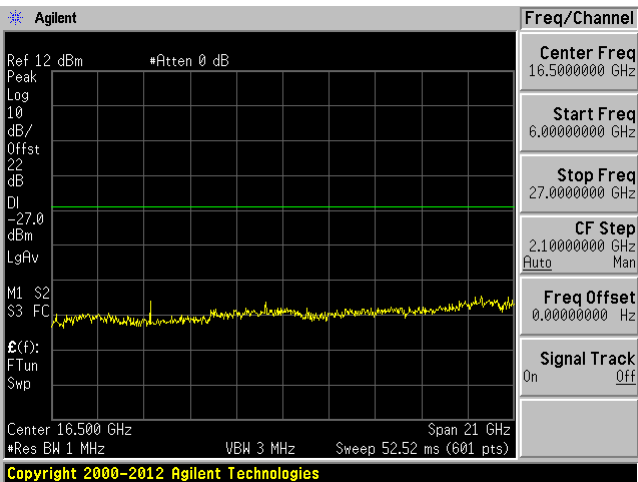
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

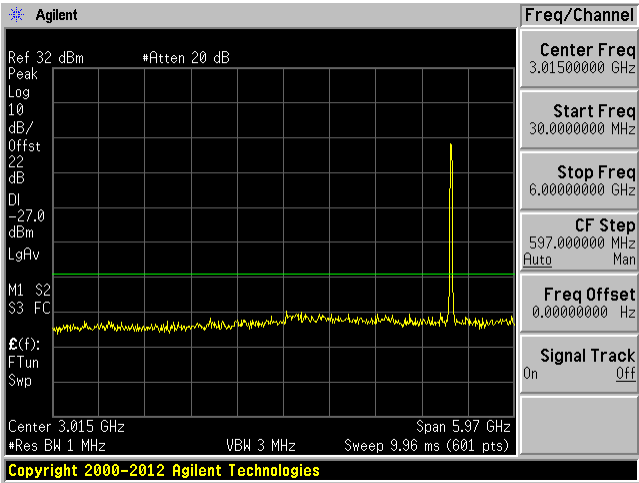


High Channel 5240 MHz (6-40GHz)

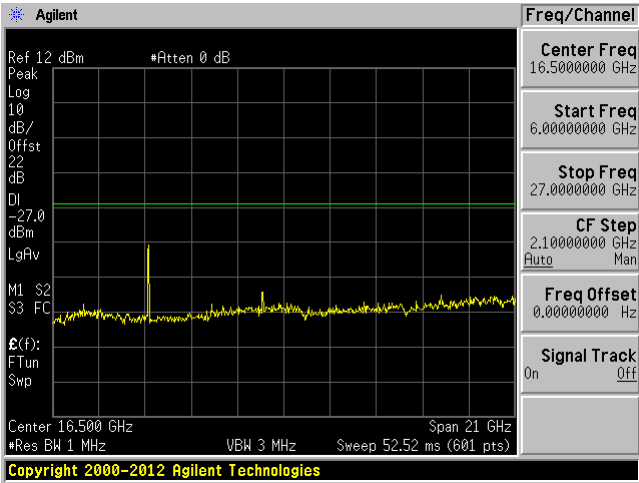


802.11ac20 mode (Port A)

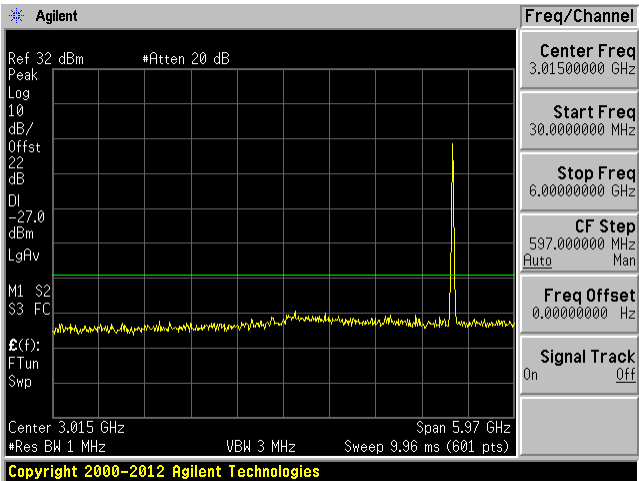
Low Channel 5180MHz (30MHz-6GHz)



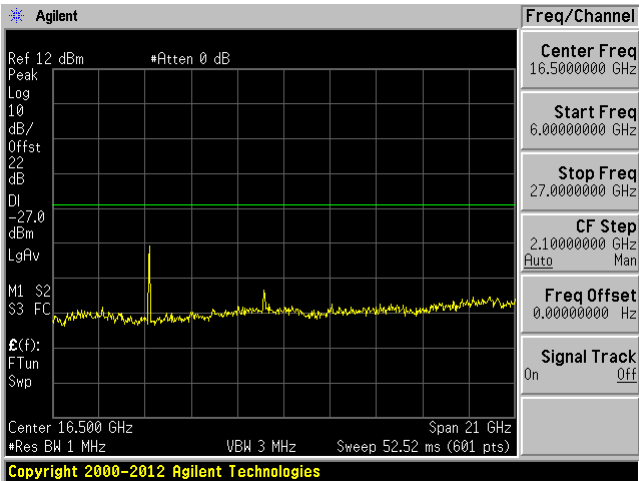
Low Channel 5180 MHz (6-40GHz)



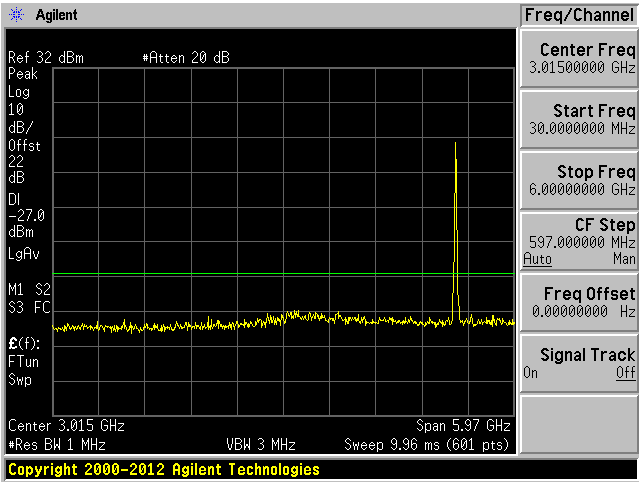
Middle Channel 5200MHz (30MHz-6GHz)



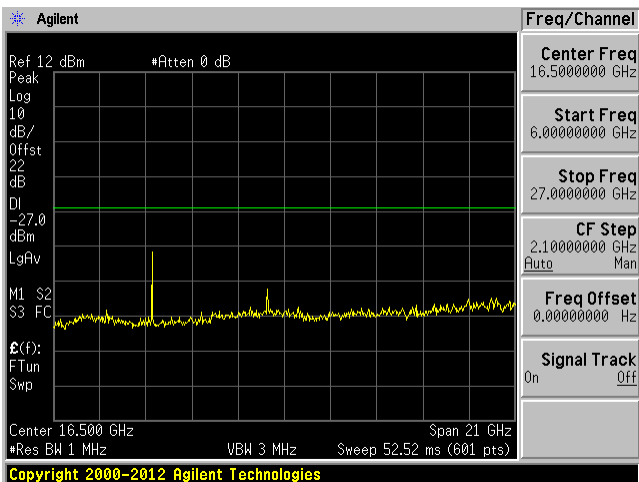
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

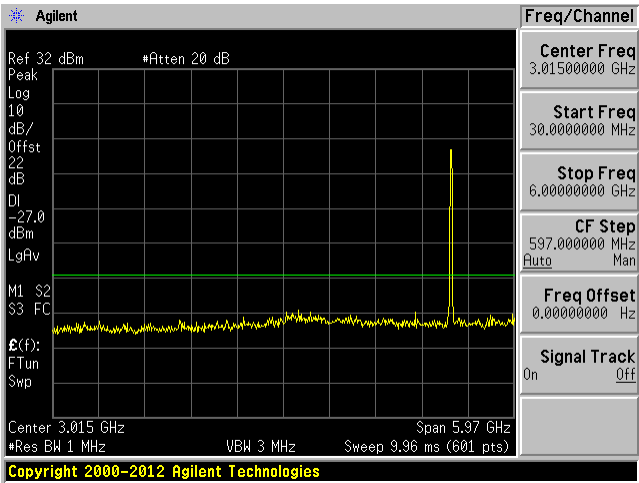


High Channel 5240 MHz (6-40GHz)

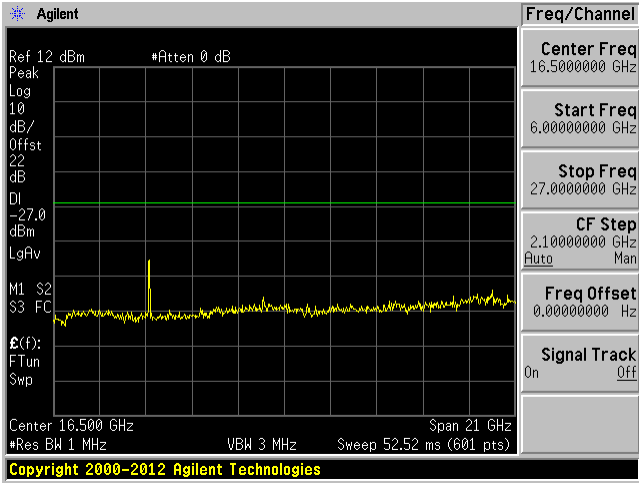


802.11ac20 mode (Port A MIMO)

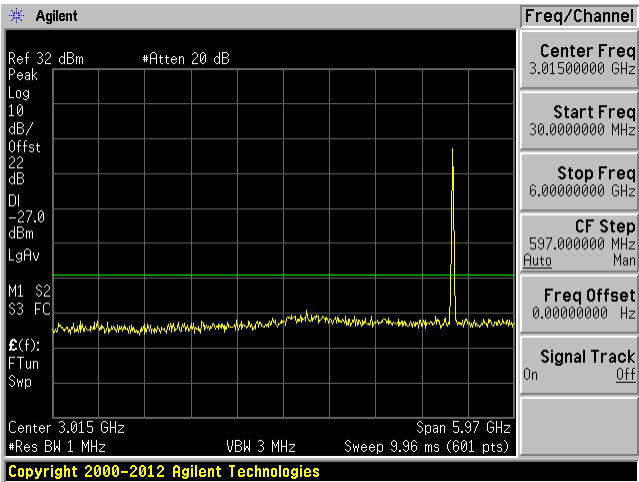
Low Channel 5180MHz (30MHz-6GHz)



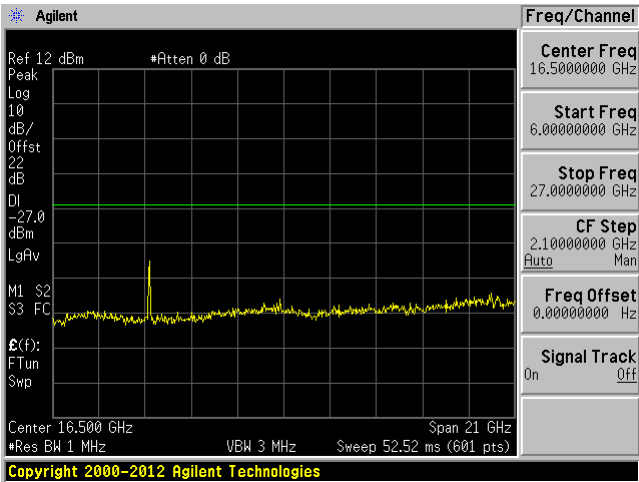
Low Channel 5180 MHz (6-40GHz)



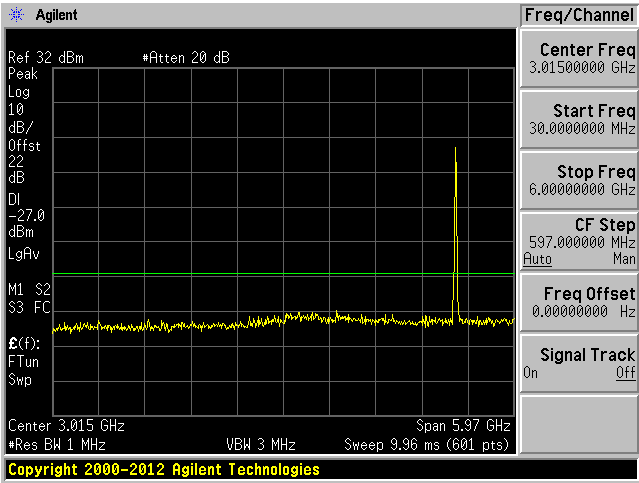
Middle Channel 5200MHz (30MHz-6GHz)



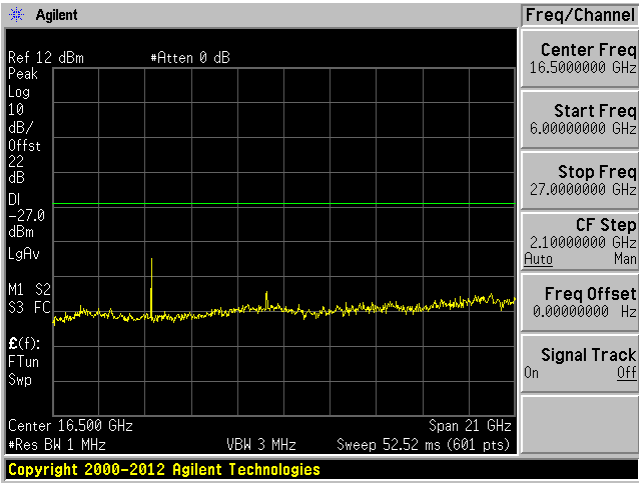
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

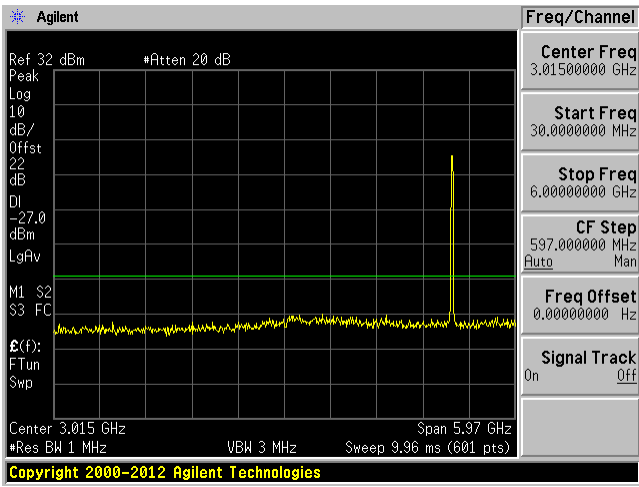


High Channel 5240 MHz (6-40GHz)

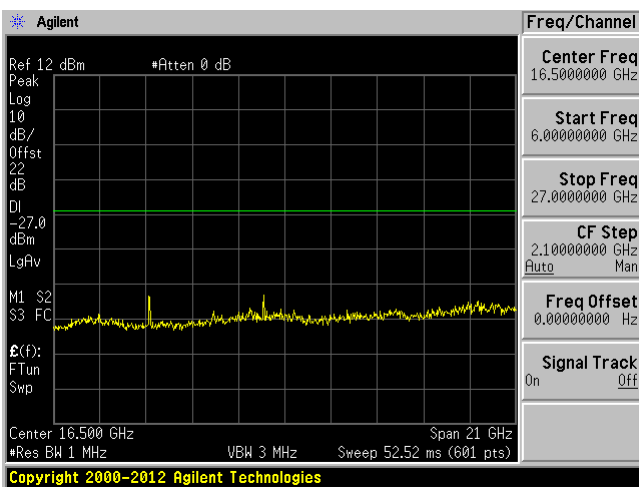


802.11ac20 mode (Port B)

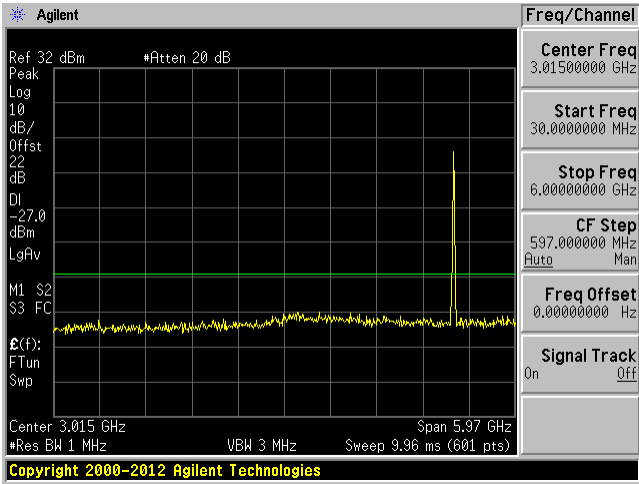
Low Channel 5180MHz (30MHz-6GHz)



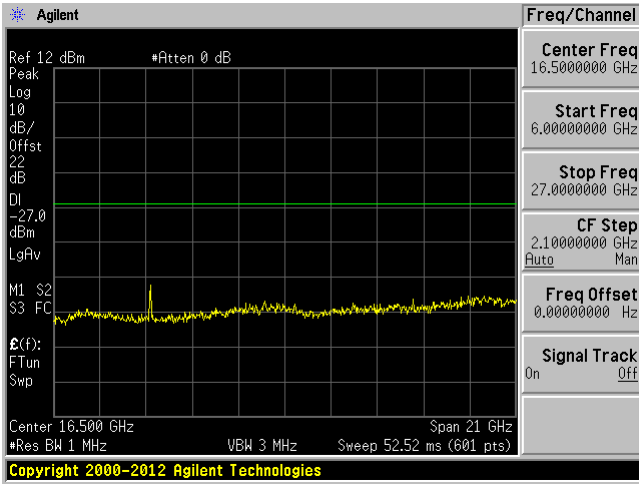
Low Channel 5180 MHz (6-40GHz)



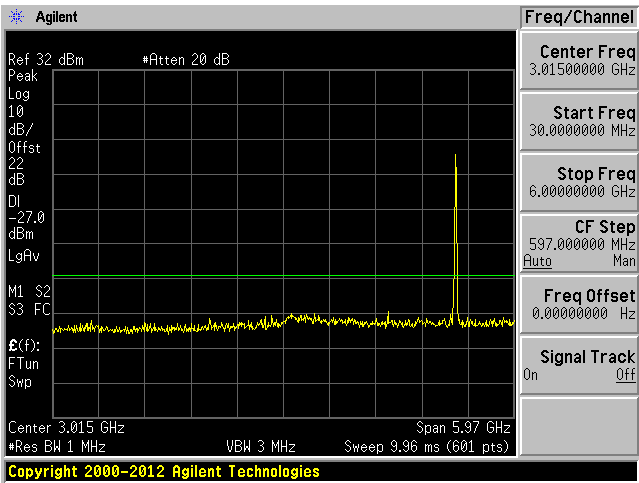
Middle Channel 5200MHz (30MHz-6GHz)



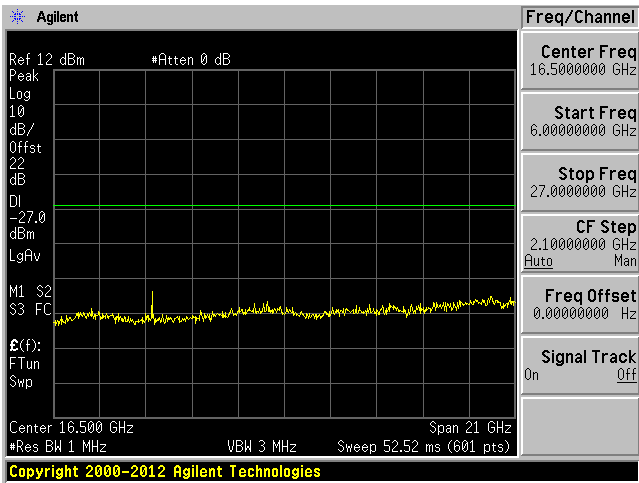
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

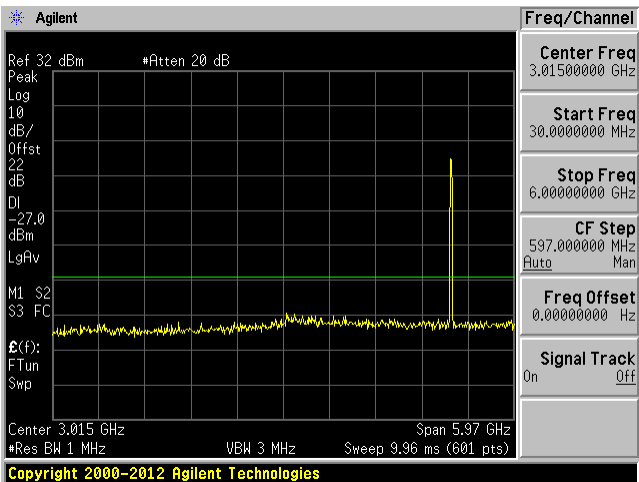


High Channel 5240 MHz (6-40GHz)

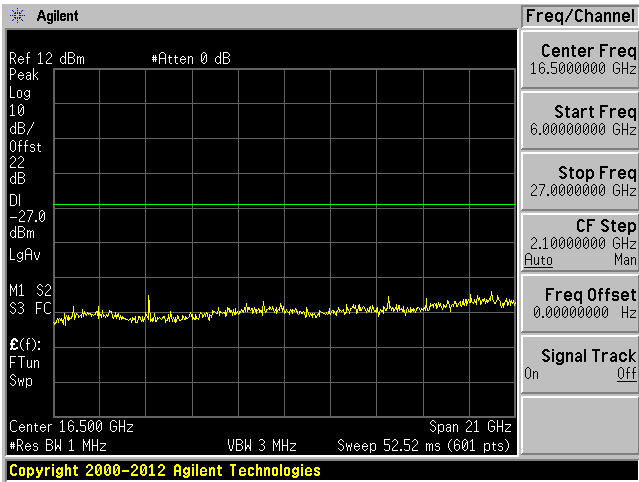


802.11ac20 mode (Port B MIMO)

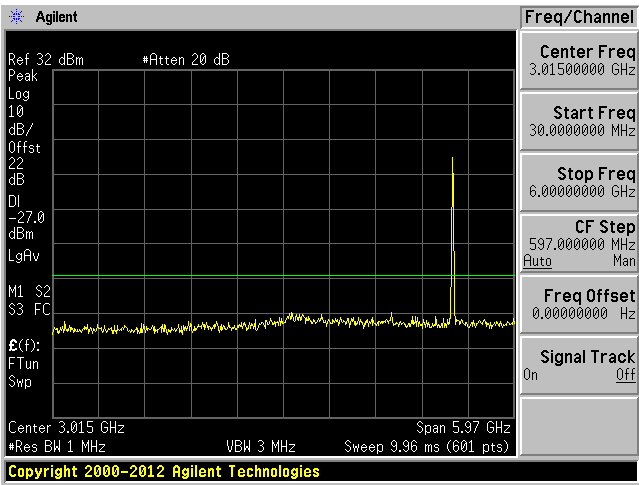
Low Channel 5180MHz (30MHz-6GHz)



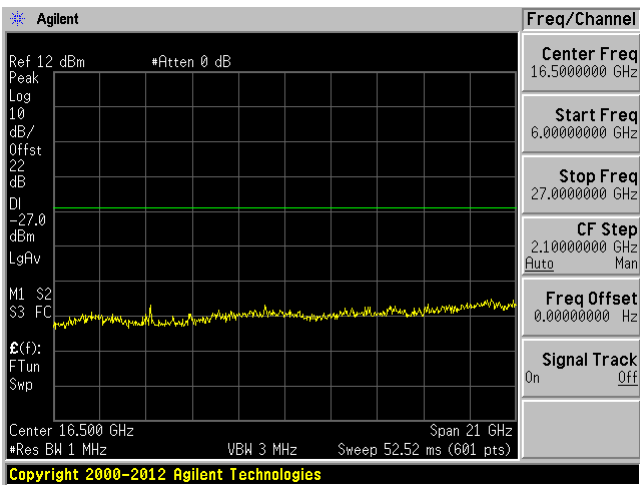
Low Channel 5180 MHz (6-40GHz)



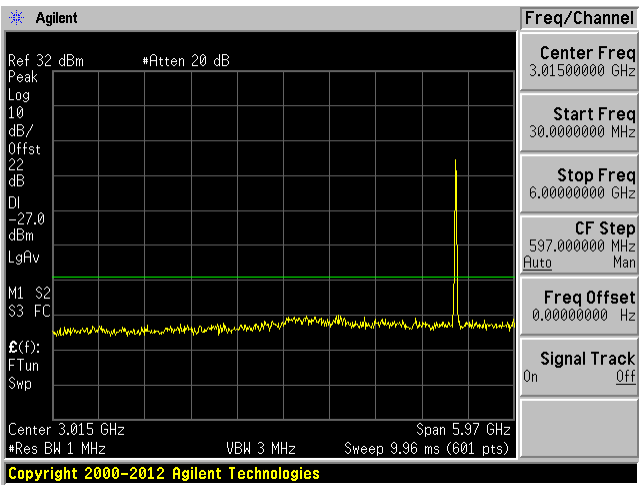
Middle Channel 5200MHz (30MHz-6GHz)



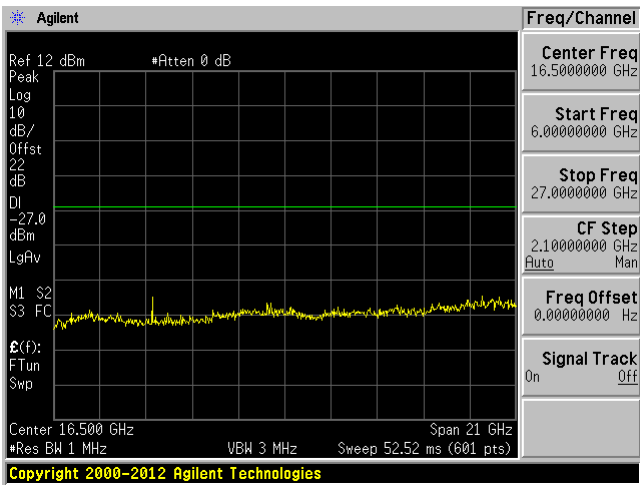
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)



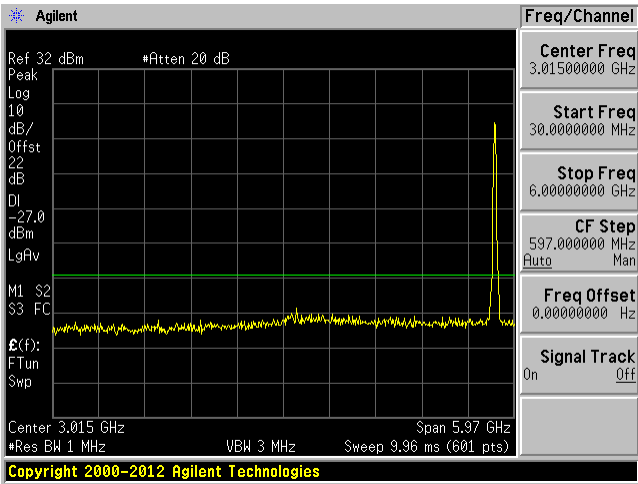
High Channel 5240 MHz (6-40GHz)



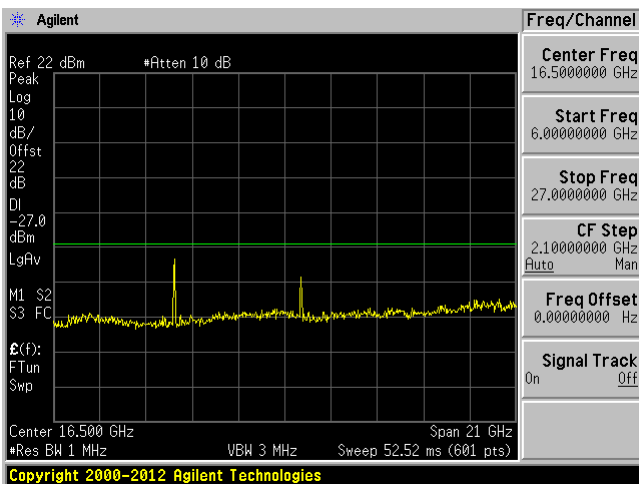
5725 - 5850 MHz

802.11a mode (Port A)

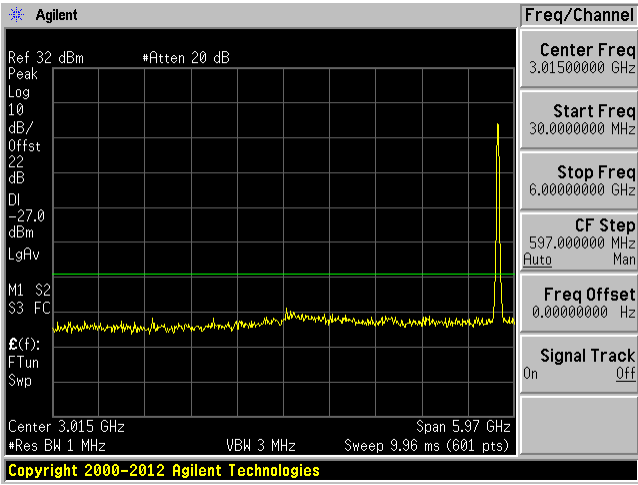
Low Channel 5745MHz (30MHz-6GHz)



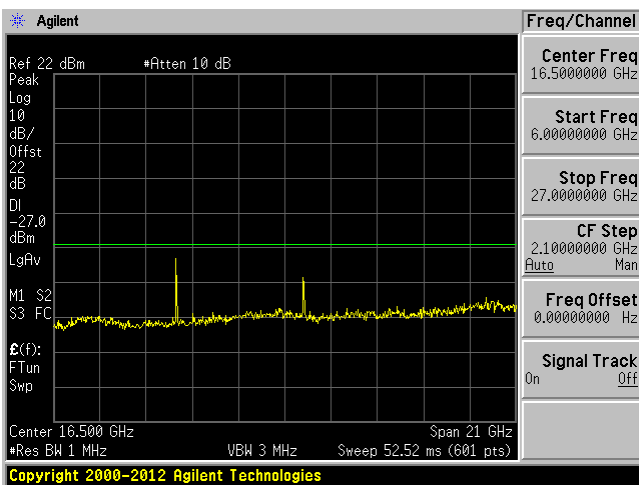
Low Channel 5745 MHz (6-40GHz)



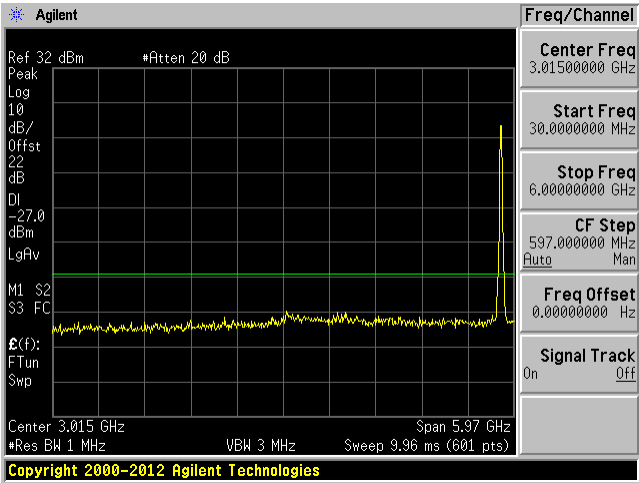
Middle Channel 5785MHz (30MHz-6GHz)



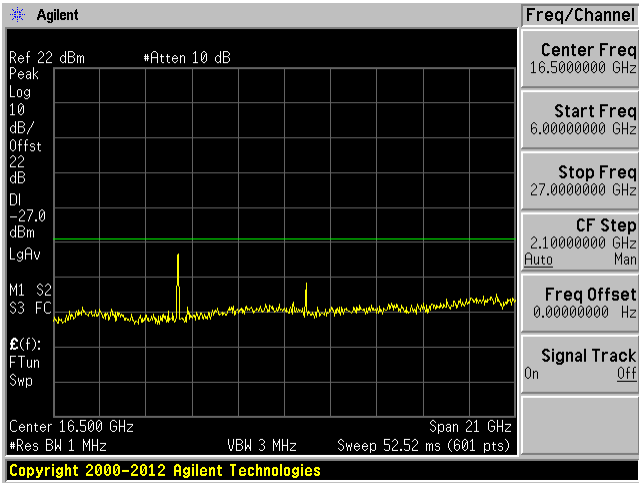
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

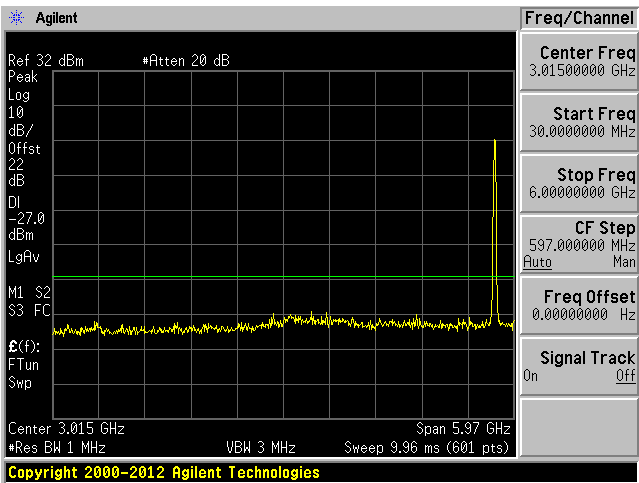


High Channel 5825 MHz (6-40GHz)

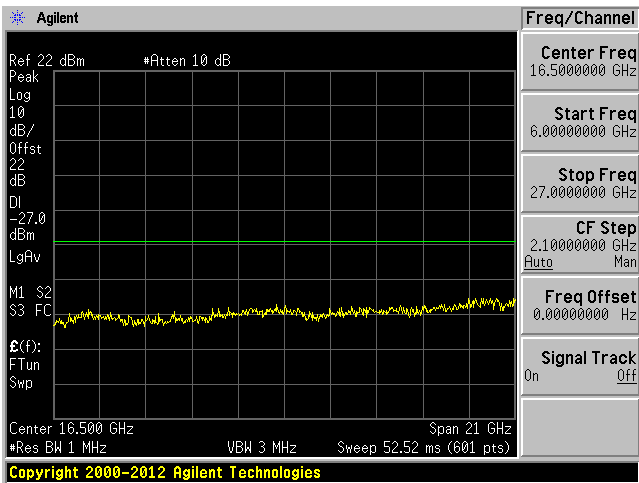


802.11a mode (Port B)

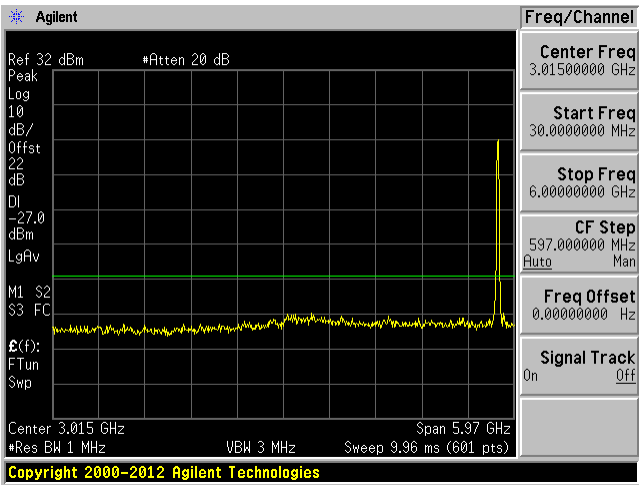
Low Channel 5745MHz (30MHz-6GHz)



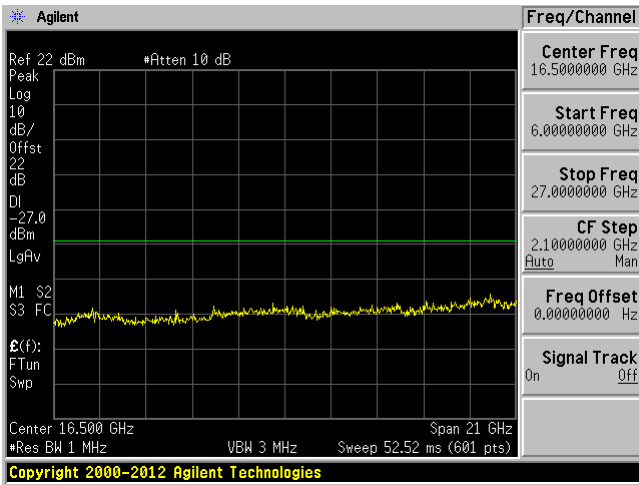
Low Channel 5745 MHz (6-40GHz)



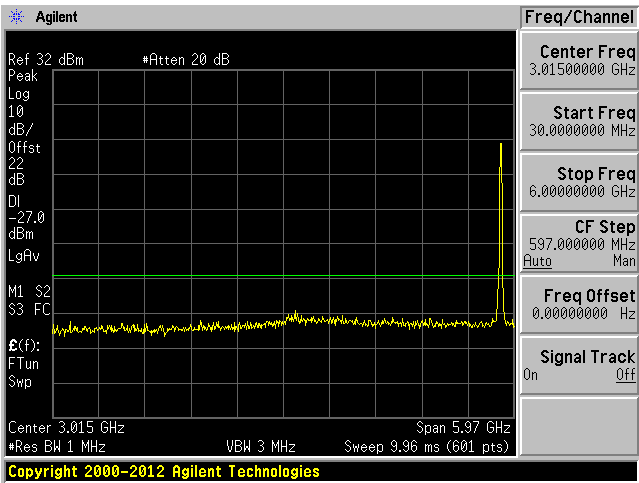
Middle Channel 5785MHz (30MHz-6GHz)



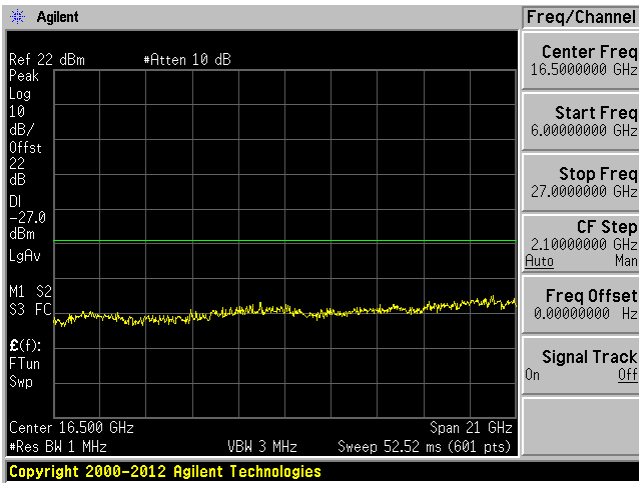
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

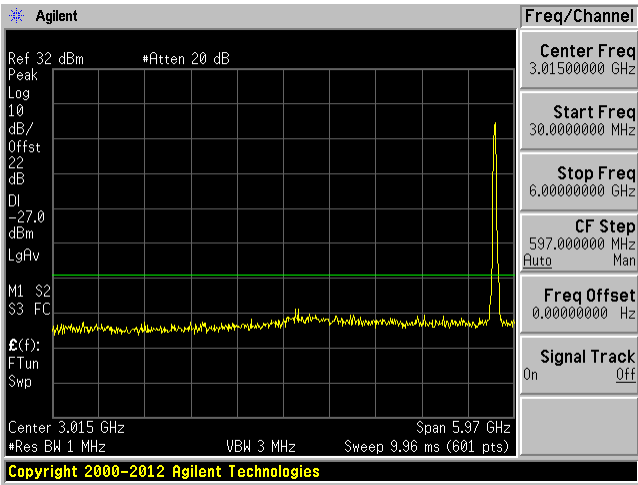


High Channel 5825 MHz (6-40GHz)

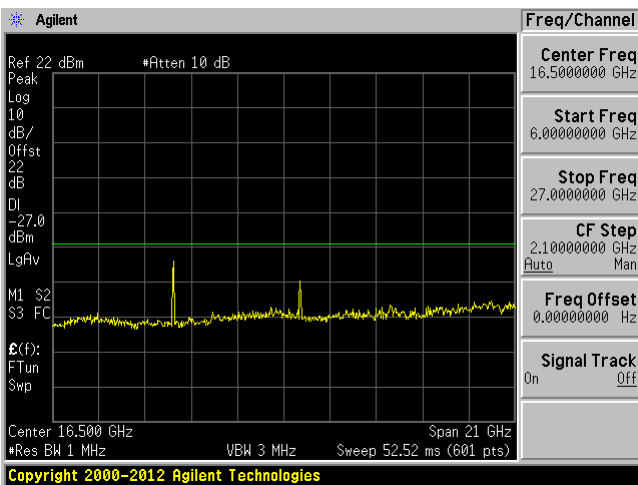


802.11n20 mode (Port A)

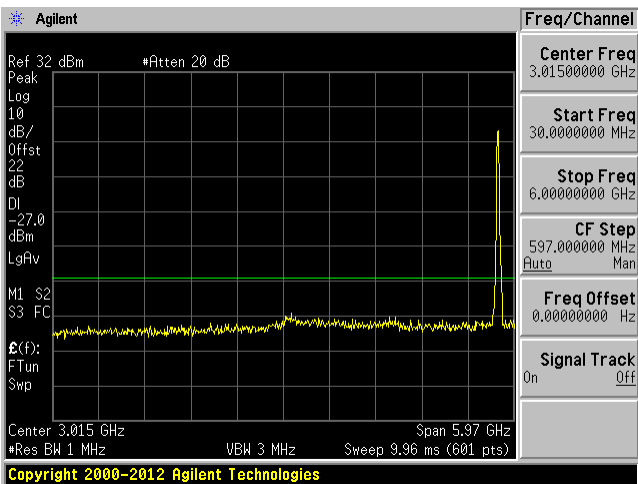
Low Channel 5745MHz (30MHz-6GHz)



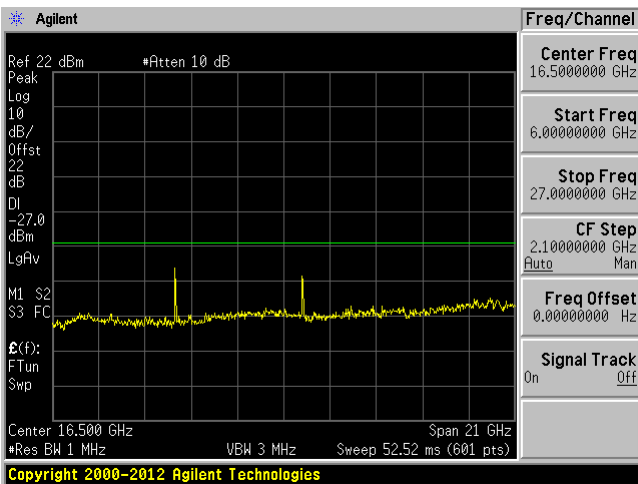
Low Channel 5745 MHz (6-40GHz)



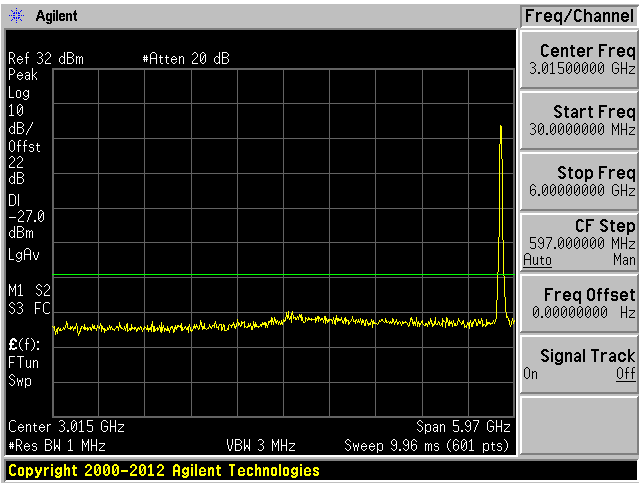
Middle Channel 5785MHz (30MHz-6GHz)



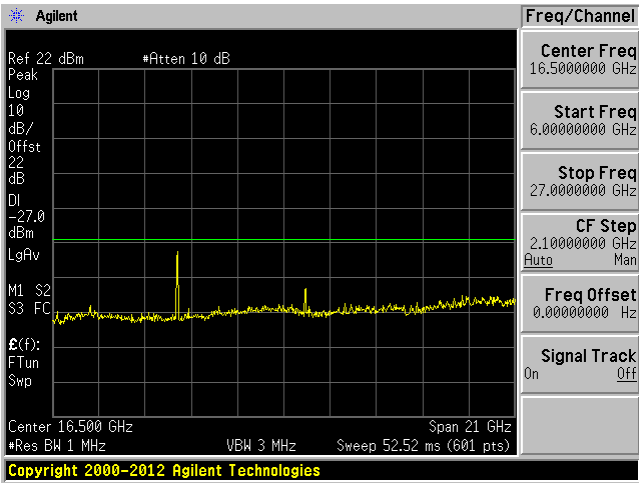
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

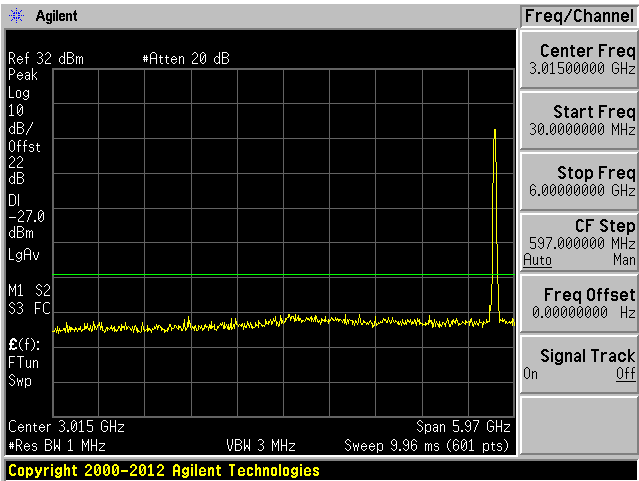


High Channel 5825 MHz (6-40GHz)

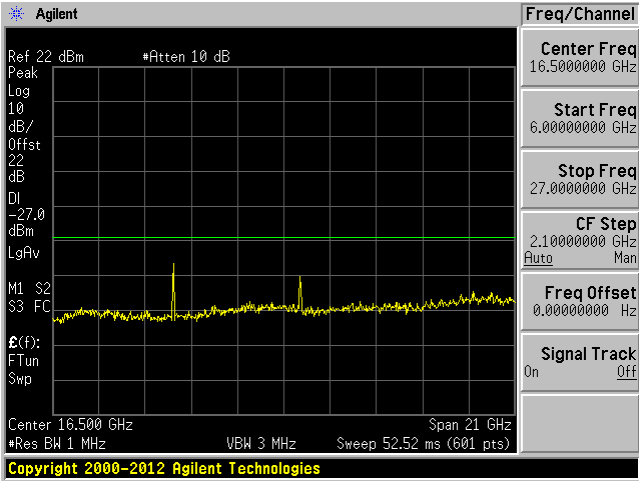


802.11n20 mode (Port A MIMO)

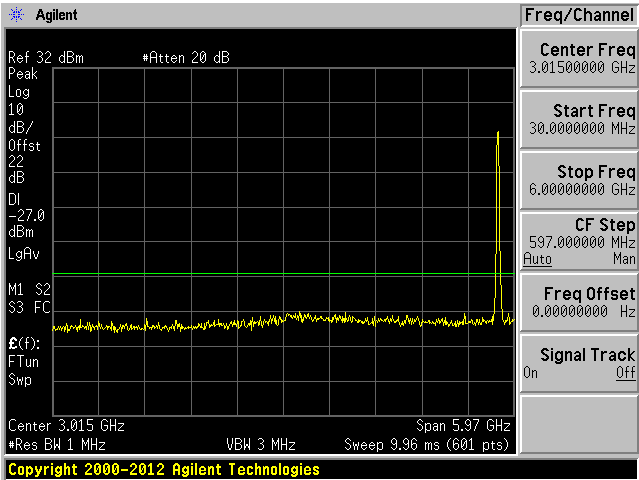
Low Channel 5745MHz (30MHz-6GHz)



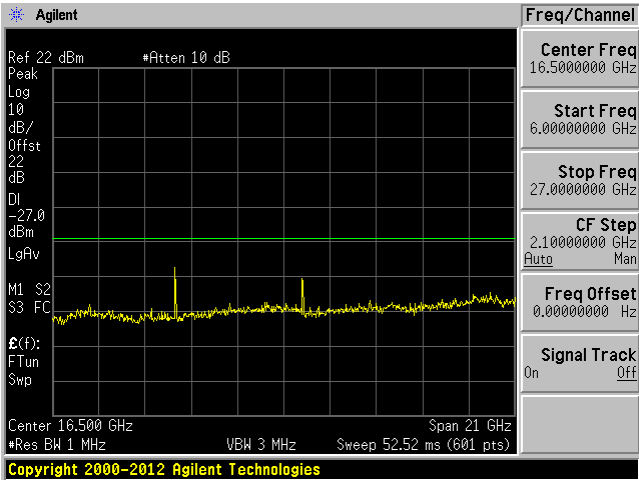
Low Channel 5745 MHz (6-40GHz)



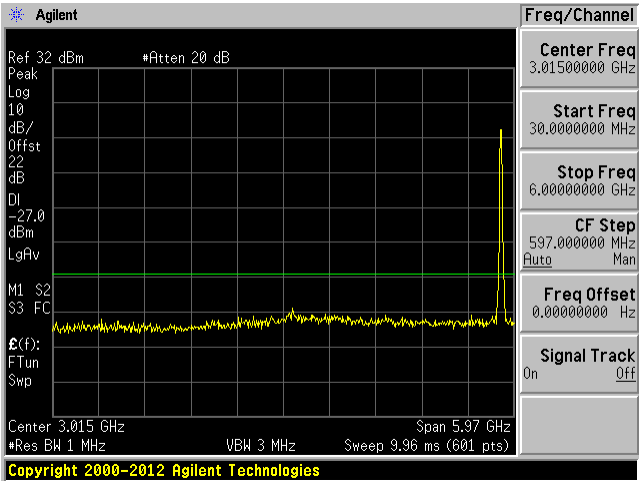
Middle Channel 5785MHz (30MHz-6GHz)



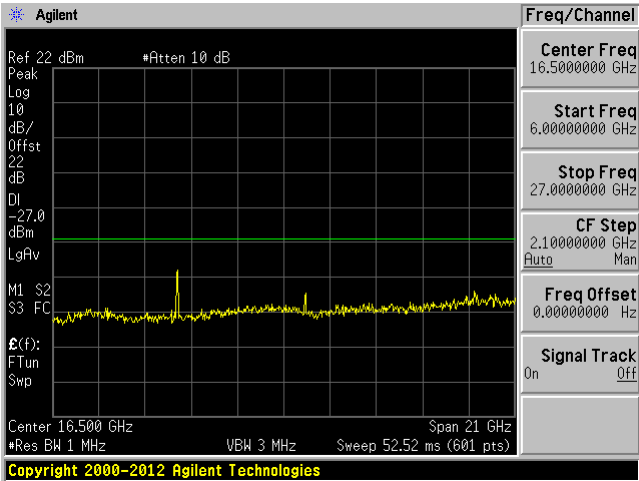
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

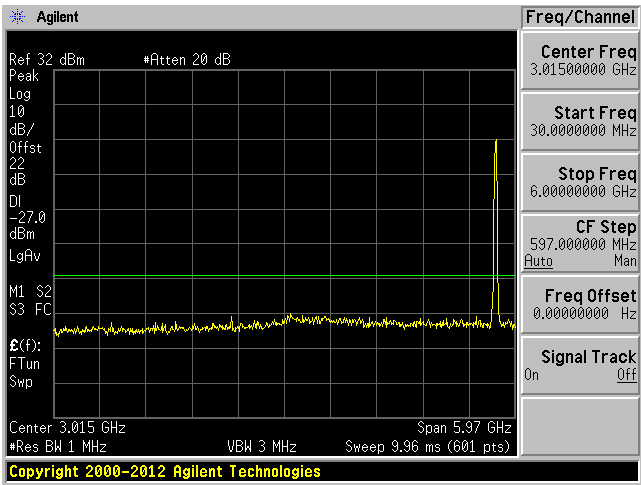


High Channel 5825 MHz (6-40GHz)

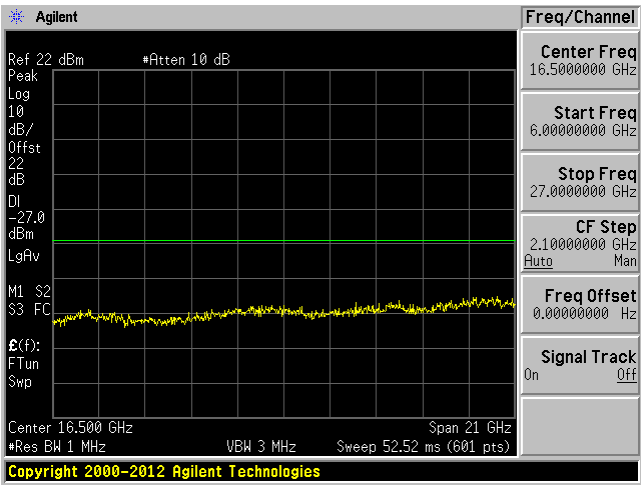


802.11n20 mode (Port B)

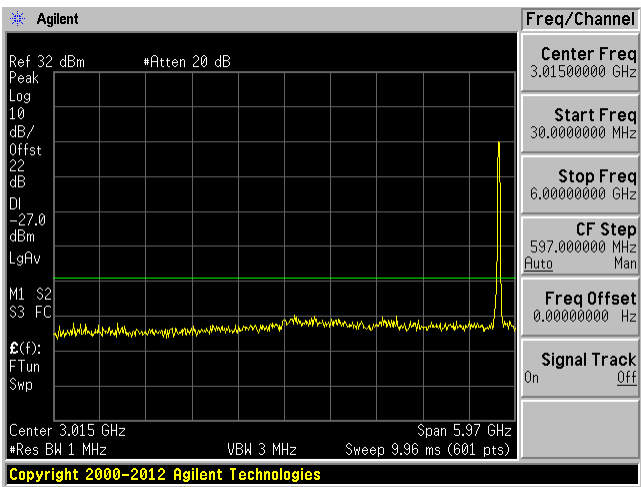
Low Channel 5745MHz (30MHz-6GHz)



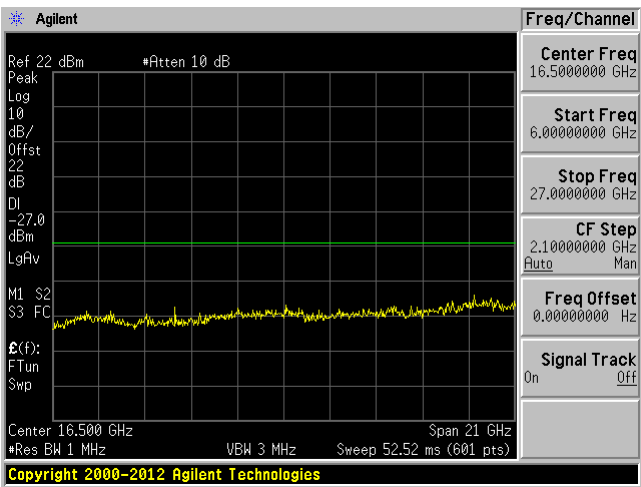
Low Channel 5745 MHz (6-40GHz)



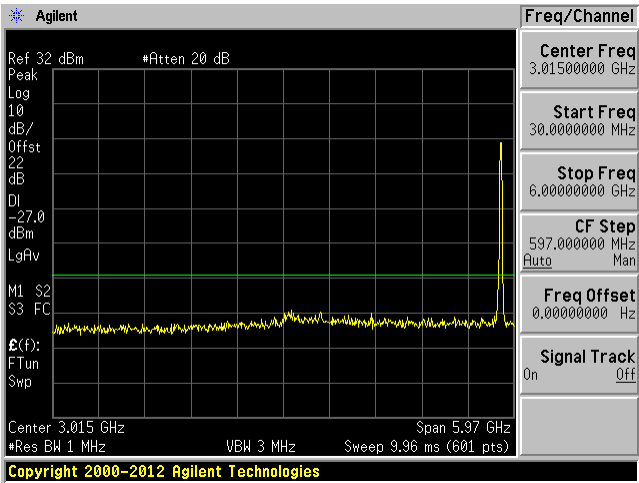
Middle Channel 5785MHz (30MHz-6GHz)



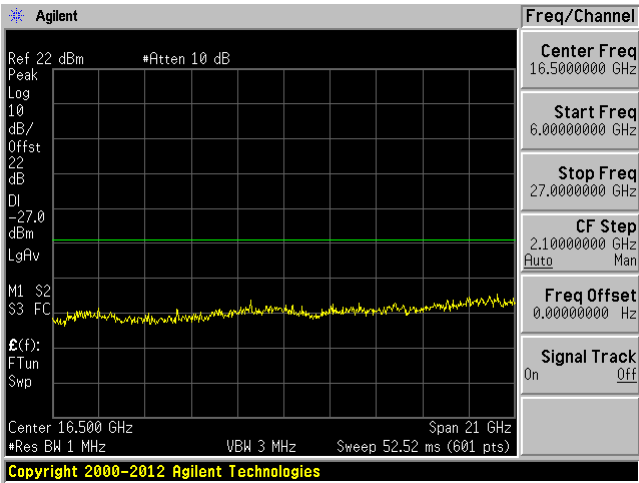
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

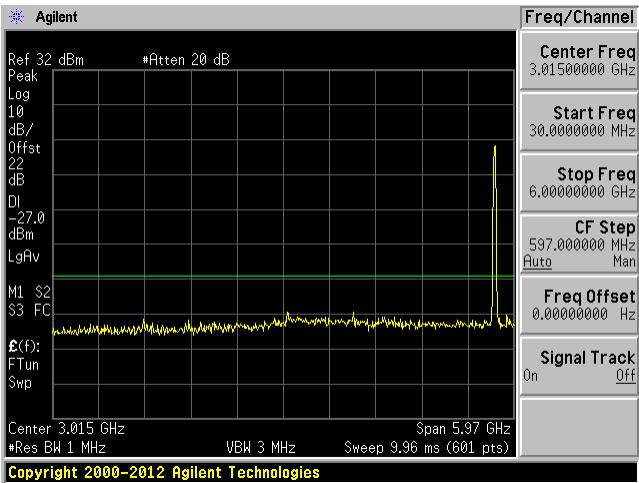


High Channel 5825 MHz (6-40GHz)

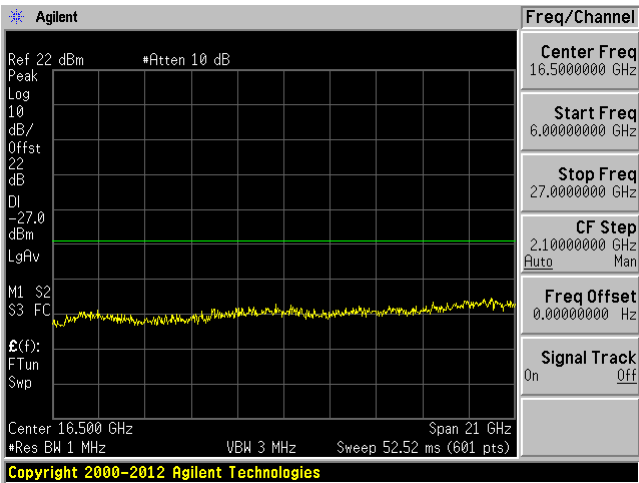


802.11n20 mode (Port B MIMO)

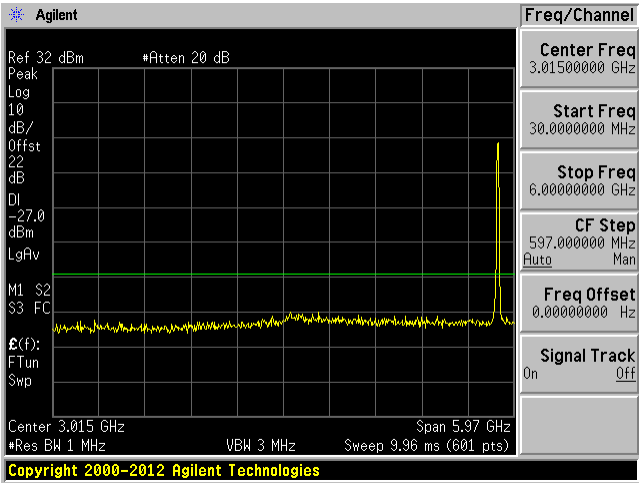
Low Channel 5745MHz (30MHz-6GHz)



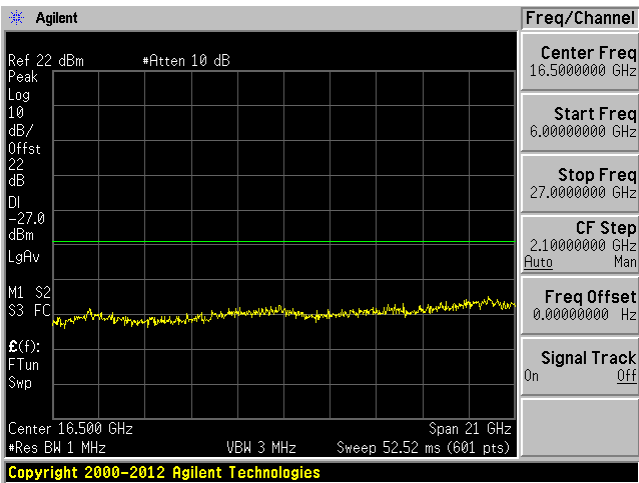
Low Channel 5745 MHz (6-40GHz)



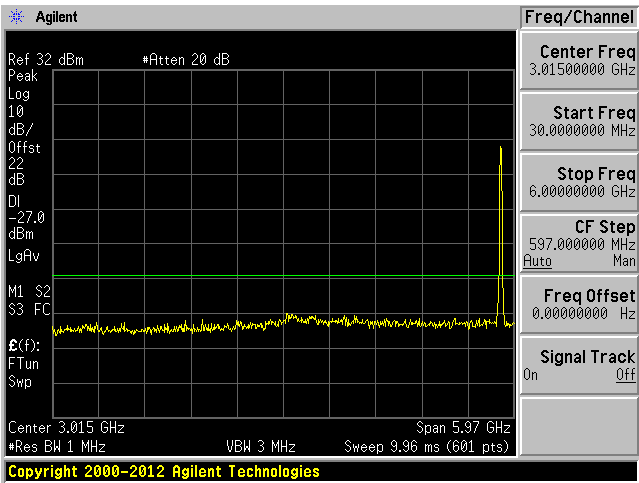
Middle Channel 5785MHz (30MHz-6GHz)



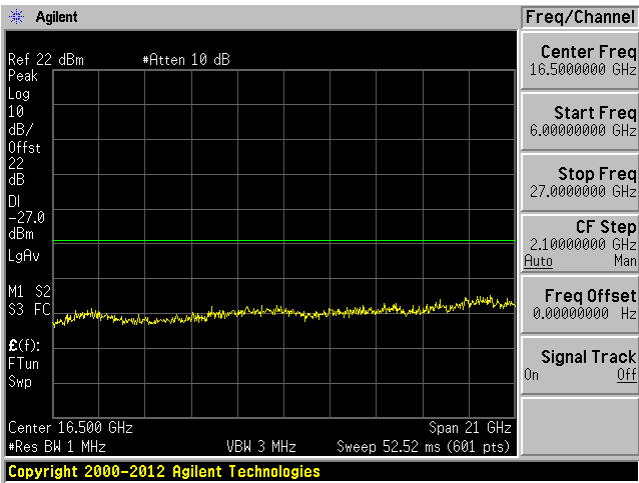
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

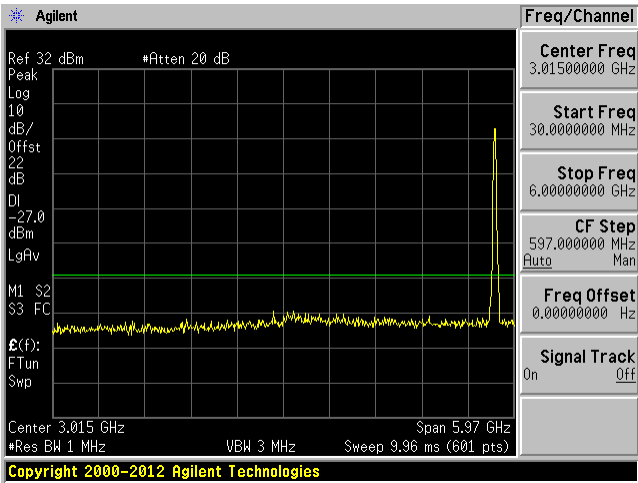


High Channel 5825 MHz (6-40GHz)

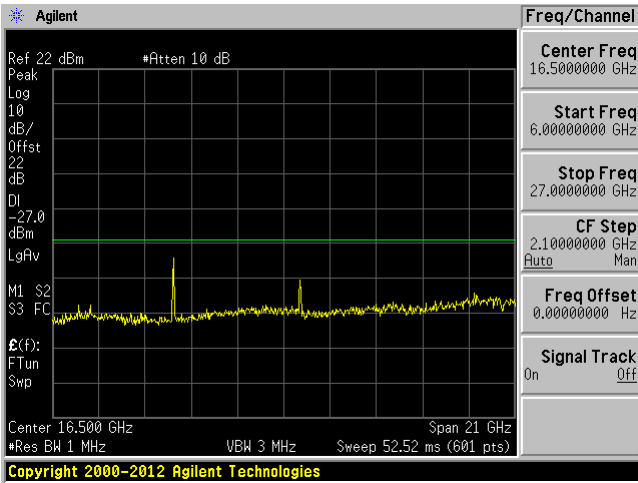


802.11ac20 mode (Port A)

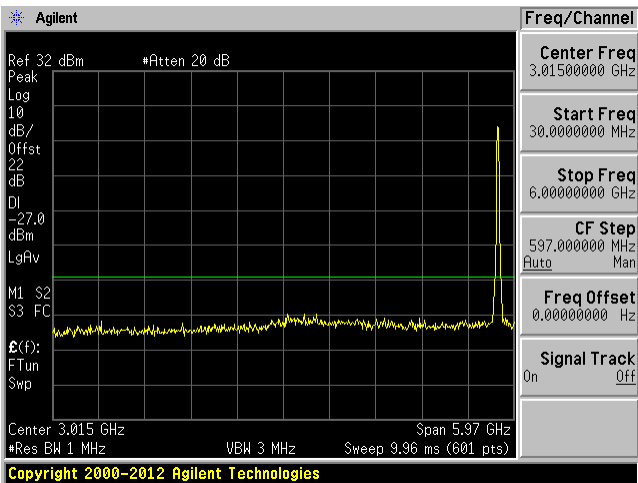
Low Channel 5745MHz (30MHz-6GHz)



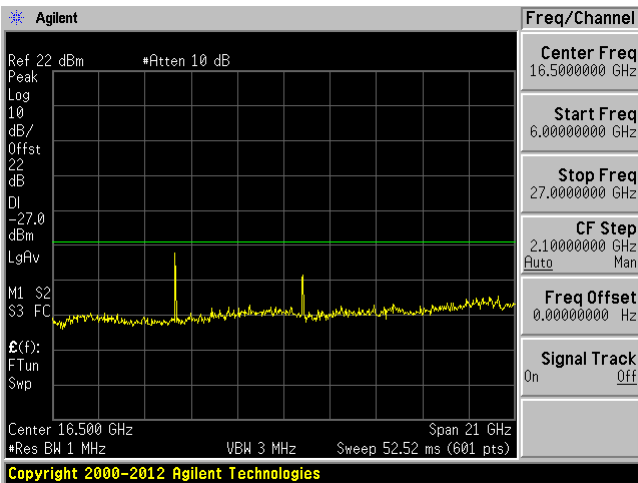
Low Channel 5745 MHz (6-40GHz)



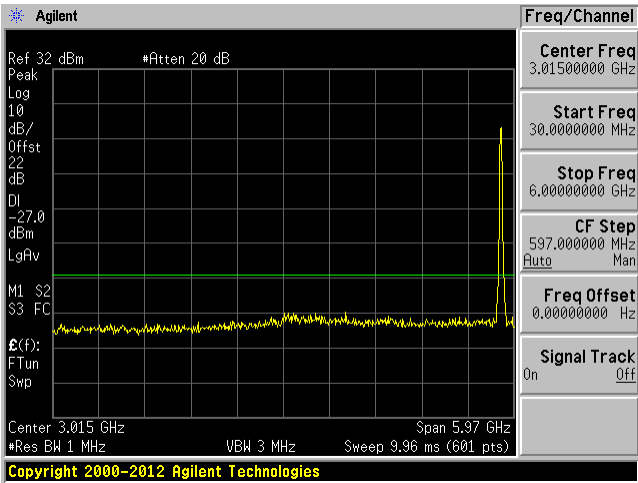
Middle Channel 5785MHz (30MHz-6GHz)



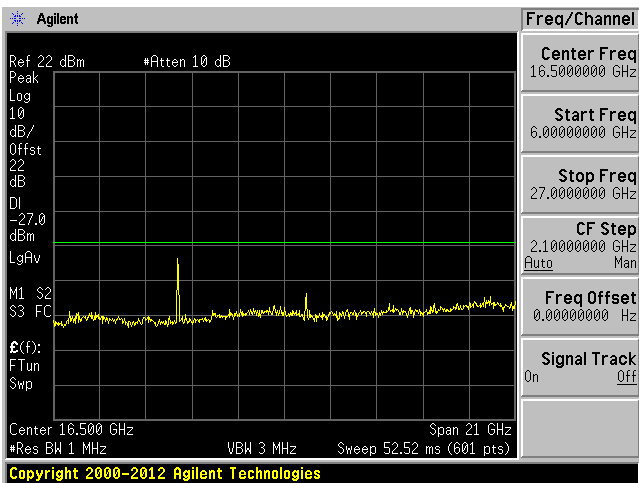
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

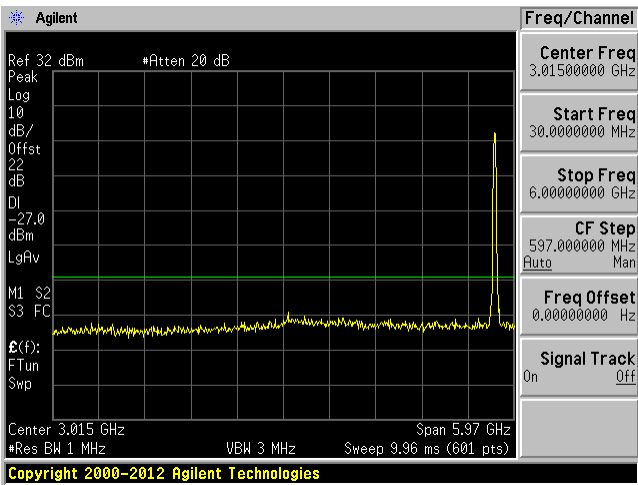


High Channel 5825 MHz (6-40GHz)

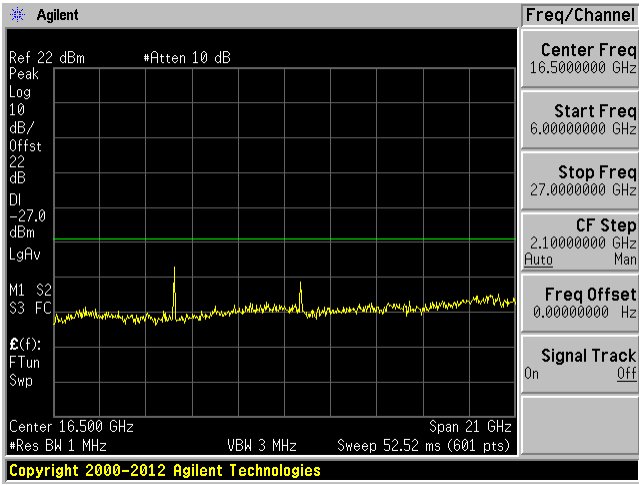


802.11ac20 mode (Port A MIMO)

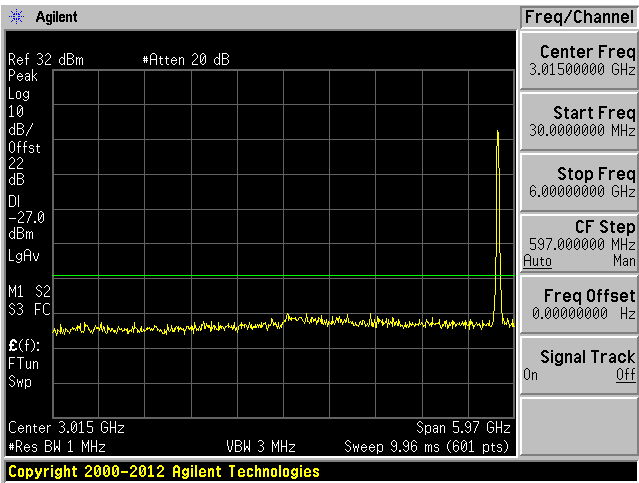
Low Channel 5745MHz (30MHz-6GHz)



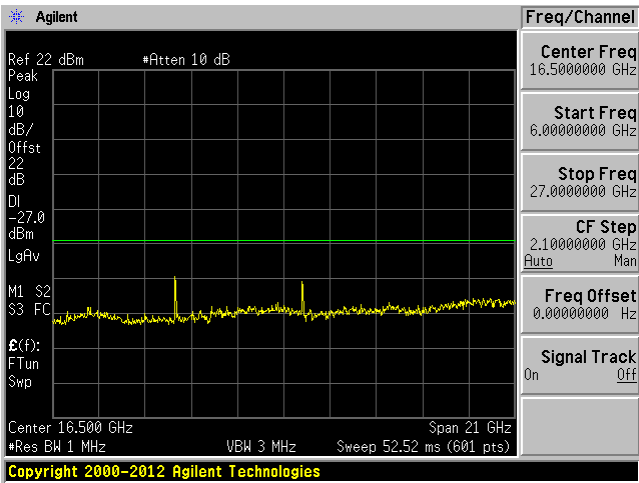
Low Channel 5745 MHz (6-40GHz)



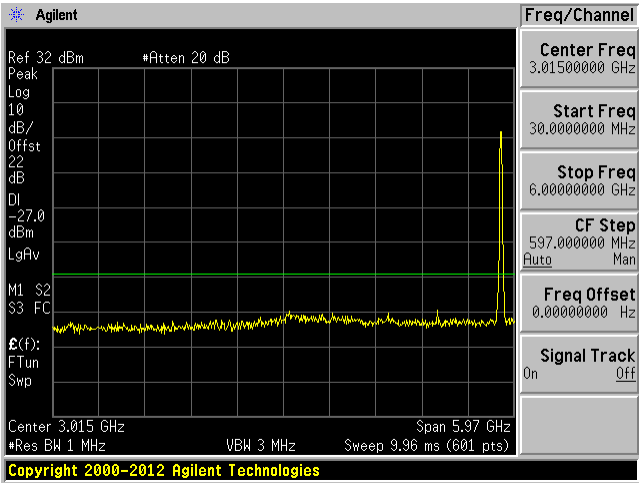
Middle Channel 5785MHz (30MHz-6GHz)



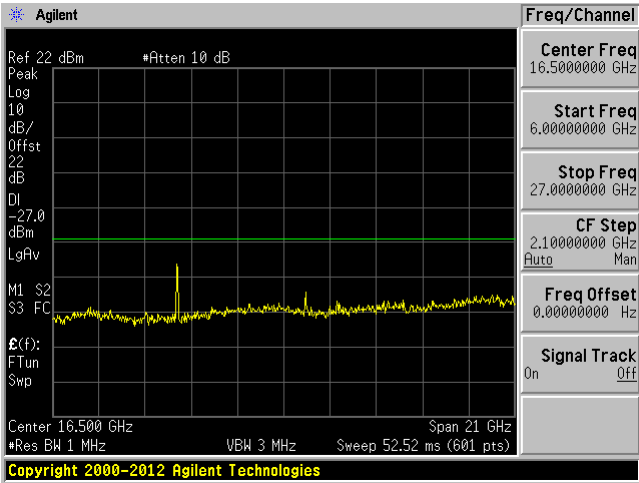
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

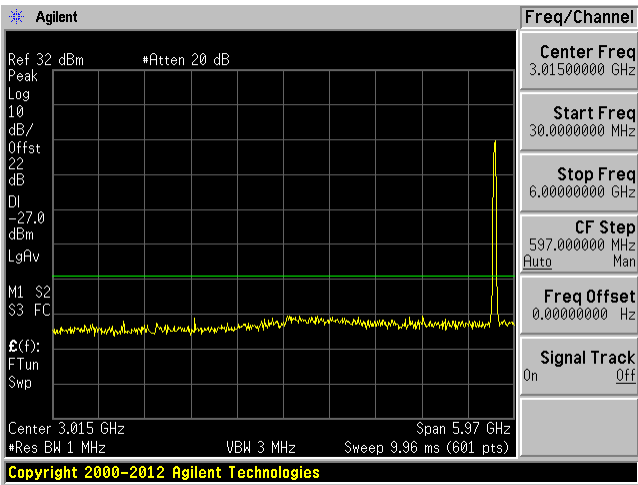


High Channel 5825 MHz (6-40GHz)

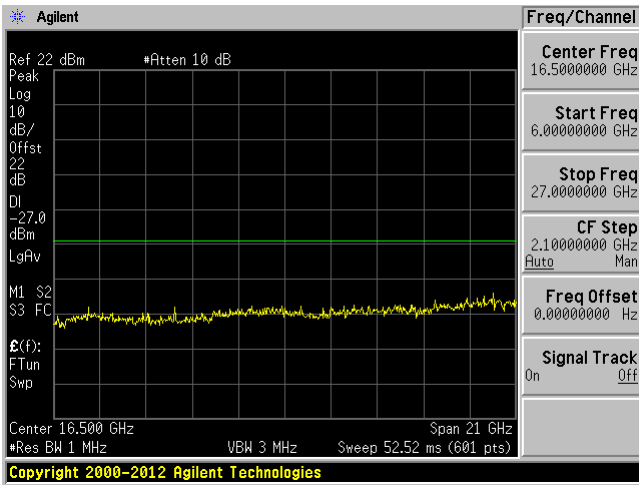


802.11ac20 mode (Port B)

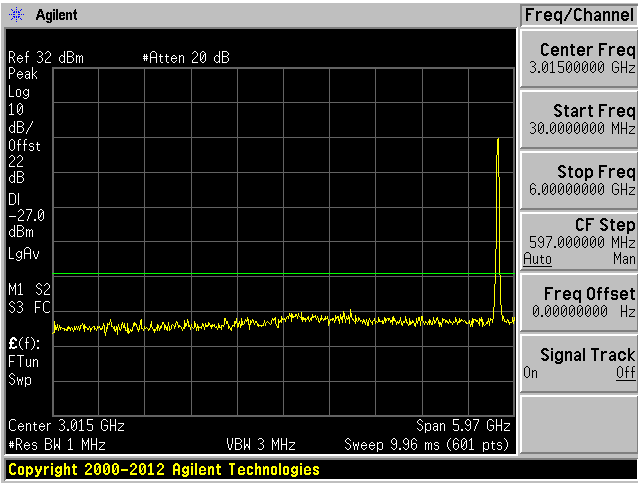
Low Channel 5745MHz (30MHz-6GHz)



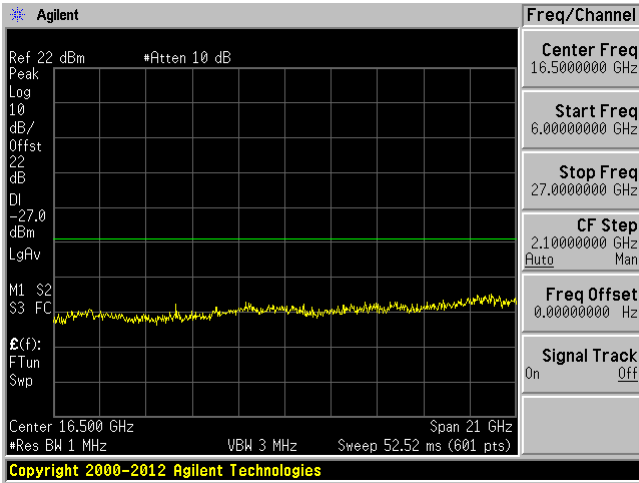
Low Channel 5745 MHz (6-40GHz)



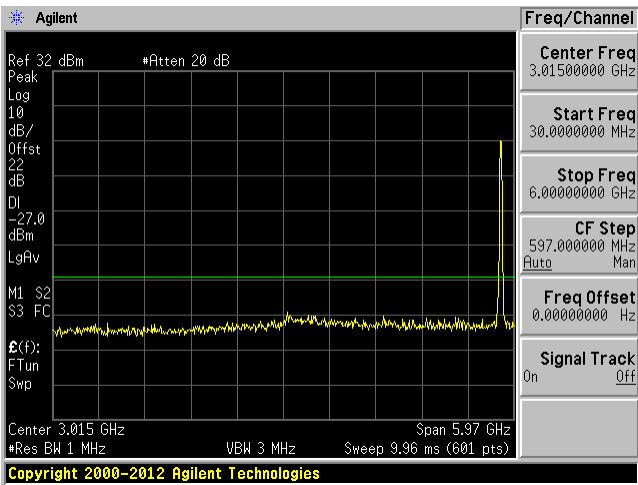
Middle Channel 5785MHz (30MHz-6GHz)



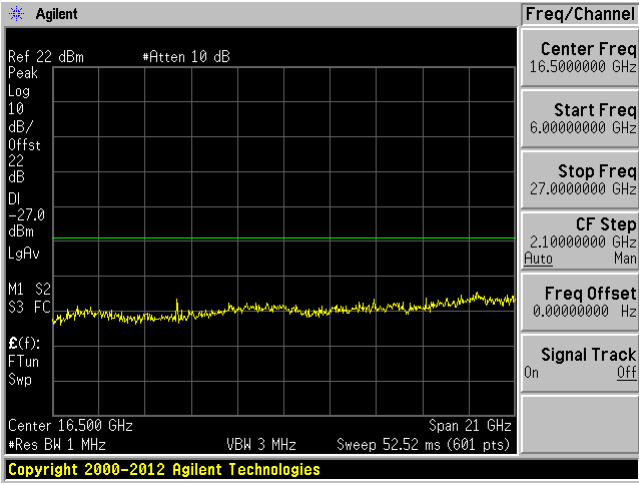
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

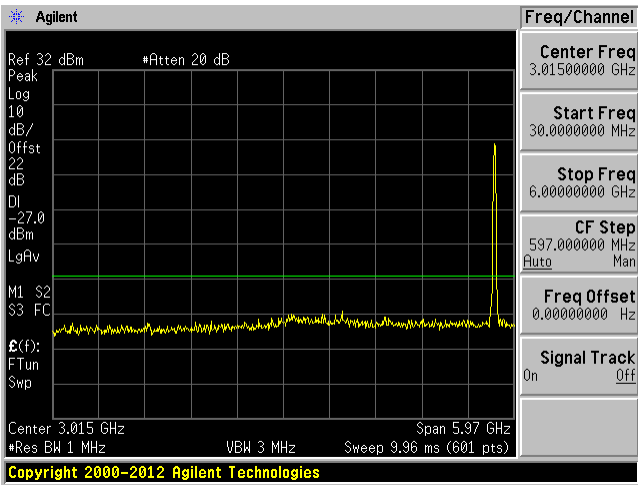


High Channel 5825 MHz (6-40GHz)

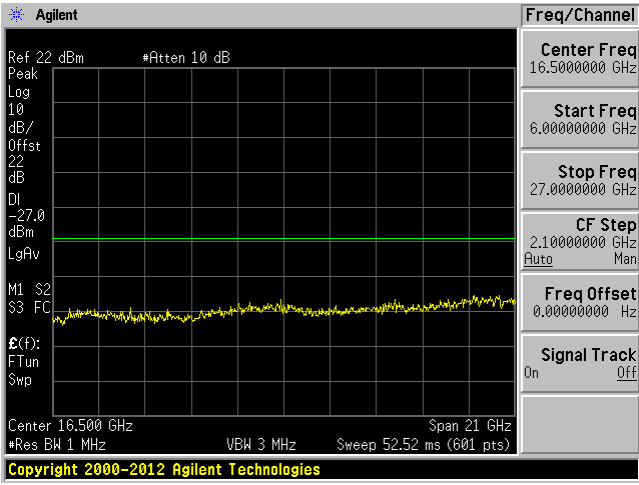


802.11ac20 mode (Port B MIMO)

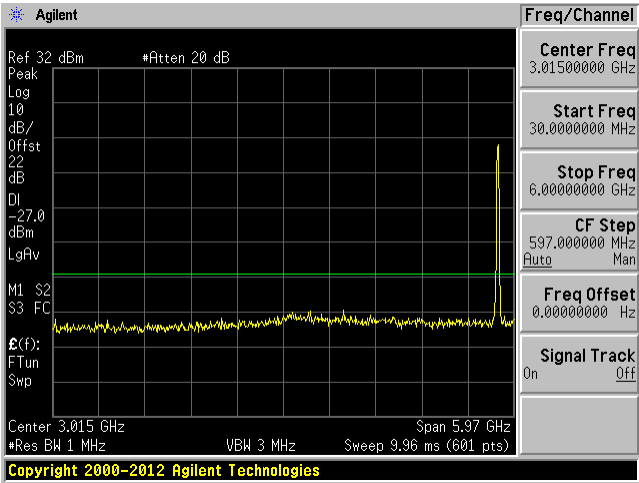
Low Channel 5745MHz (30MHz-6GHz)



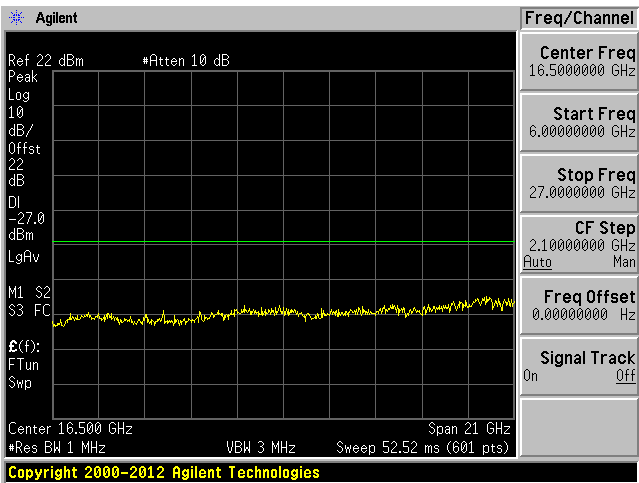
Low Channel 5745 MHz (6-40GHz)



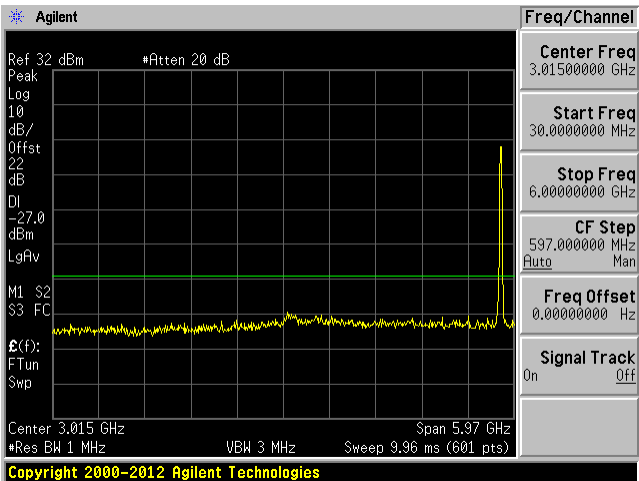
Middle Channel 5785MHz (30MHz-6GHz)



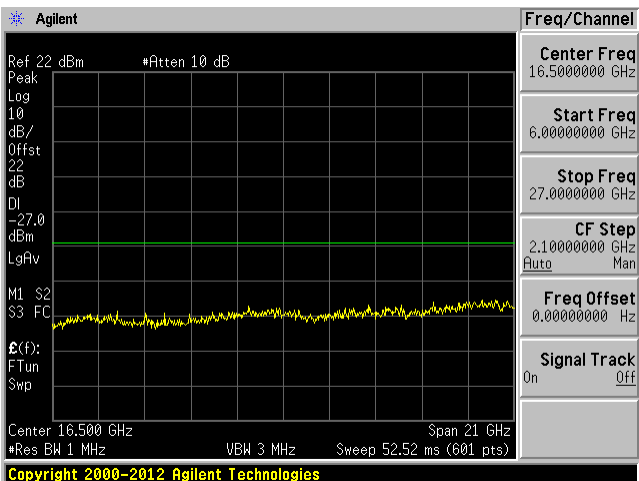
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)



High Channel 5825 MHz (6-40GHz)



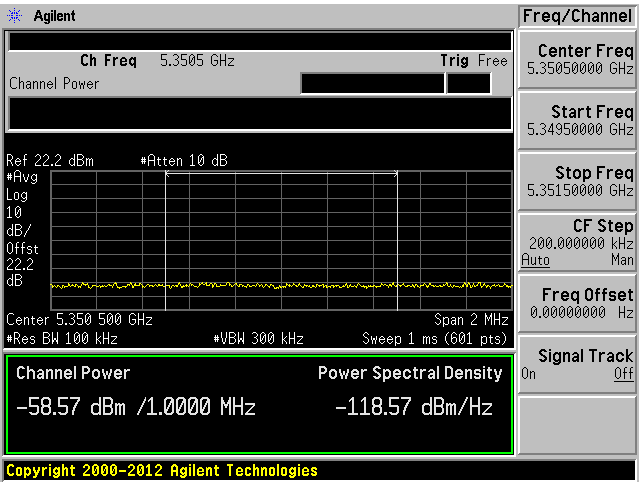
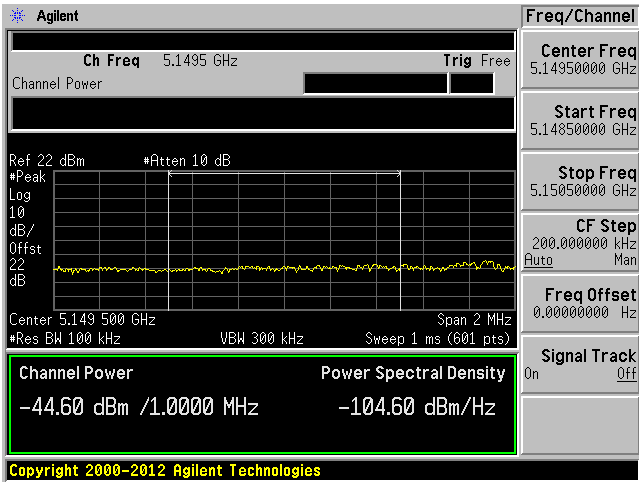
Band Edge Emissions

5150 - 5250 MHz

802.11a mode (Port A)

Low Channel: 5180 MHz

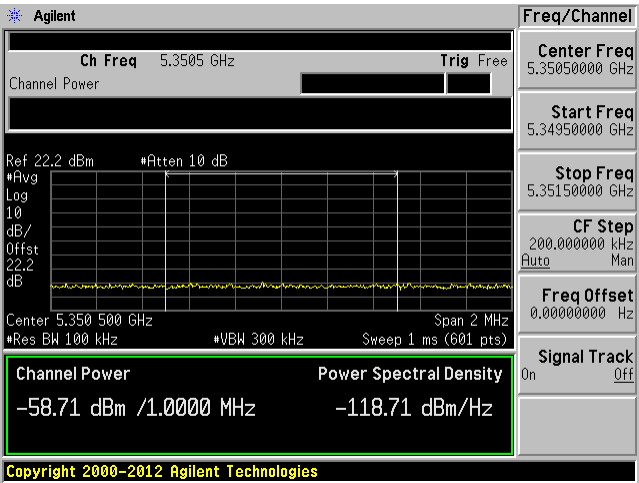
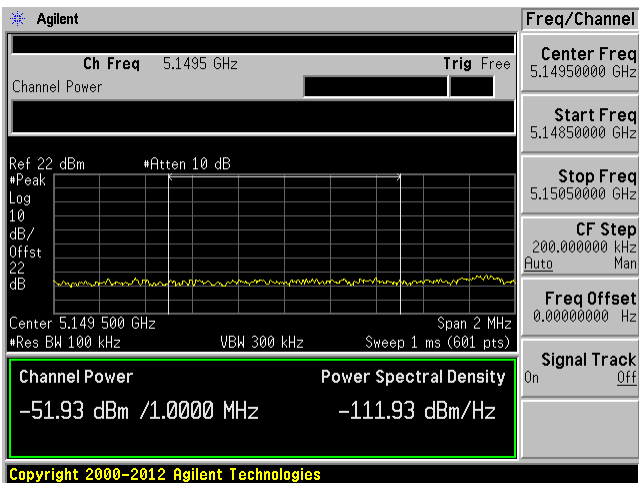
High channel: 5240 MHz



802.11a mode (Port B)

Low Channel: 5180 MHz

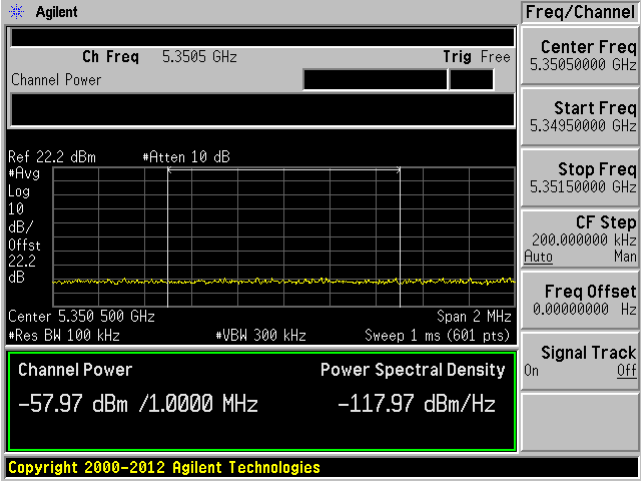
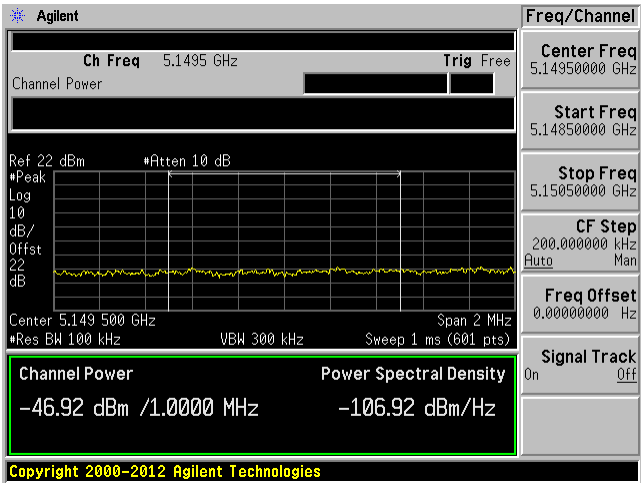
High channel: 5240 MHz



802.11n20 mode (Port A)

Low Channel: 5180 MHz

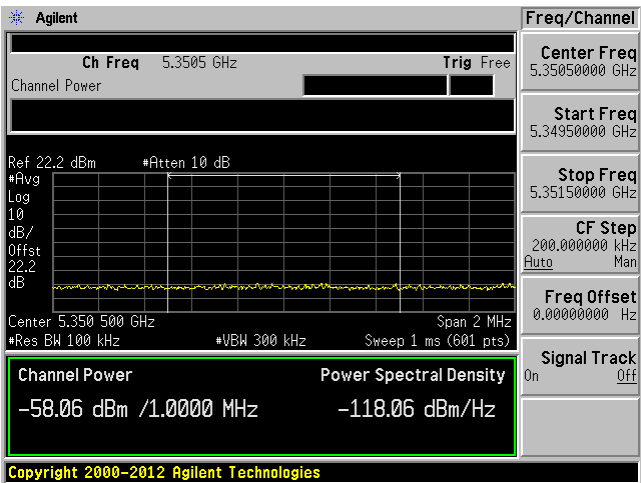
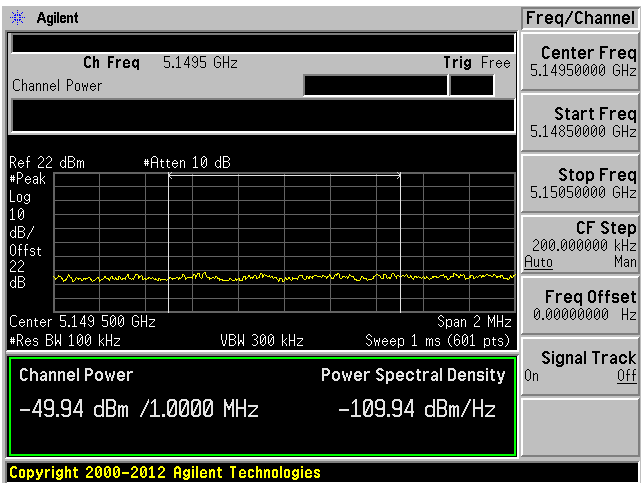
High channel: 5240 MHz



802.11n20 mode (Port A MIMO)

Low Channel: 5180 MHz

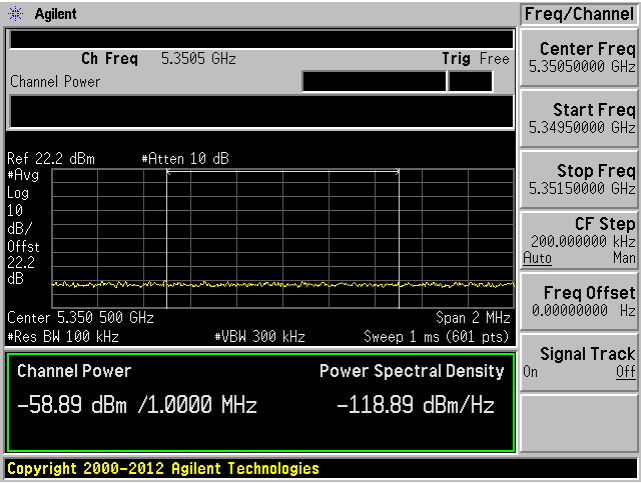
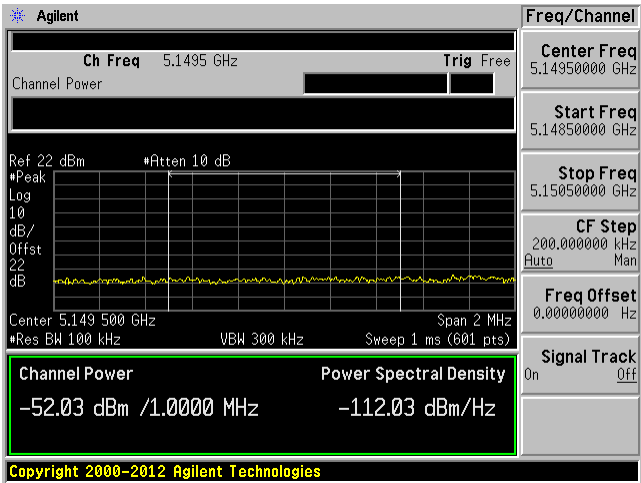
High channel: 5240 MHz



802.11n20 mode (Port B)

Low Channel: 5180 MHz

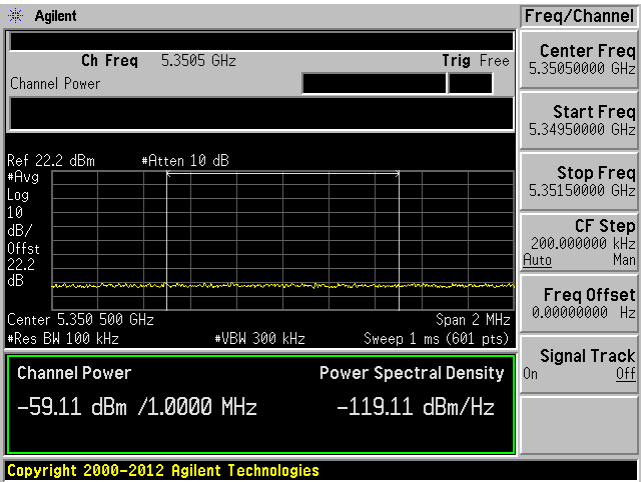
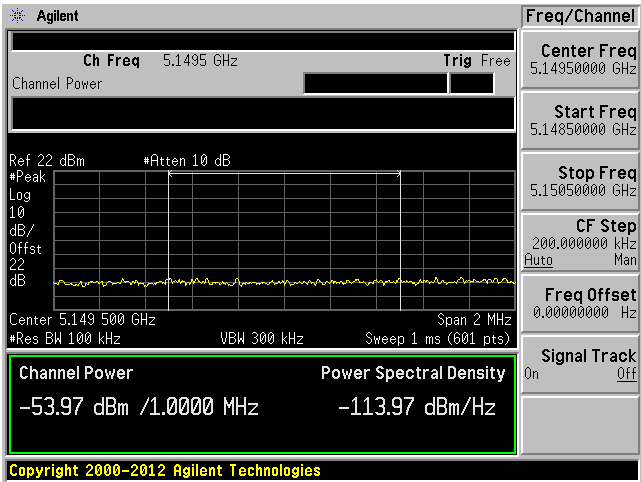
High channel: 5240 MHz



802.11n20 mode (Port B MIMO)

Low Channel: 5180 MHz

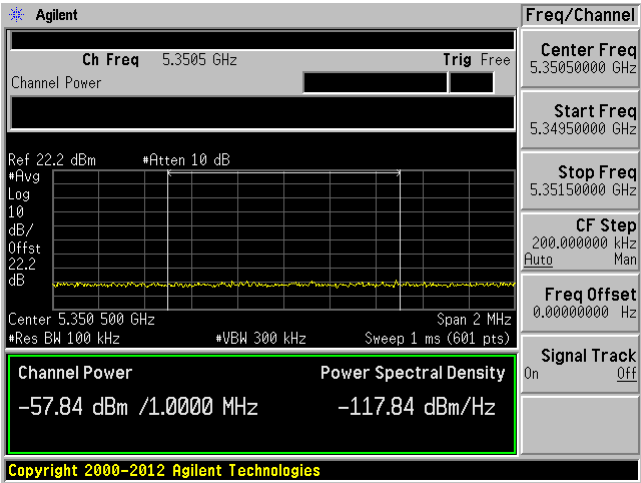
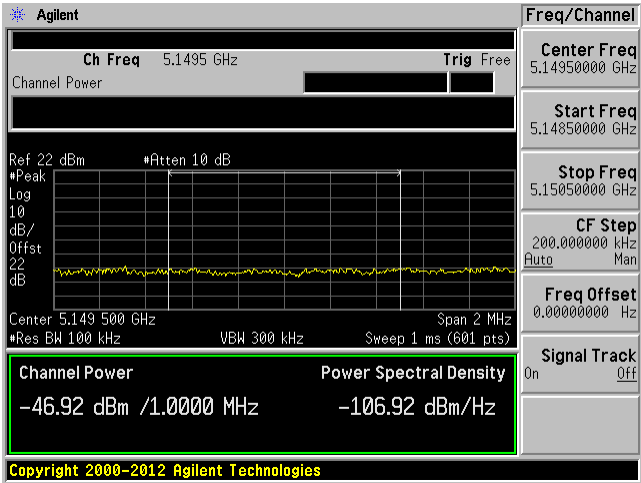
High channel: 5240 MHz



802.11ac20 mode (Port A)

Low Channel: 5180 MHz

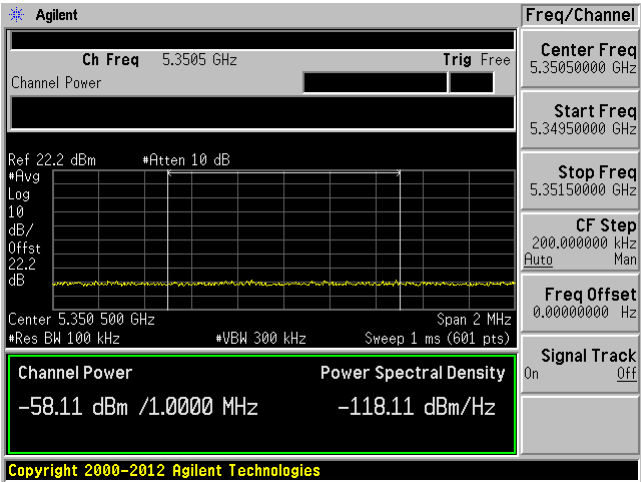
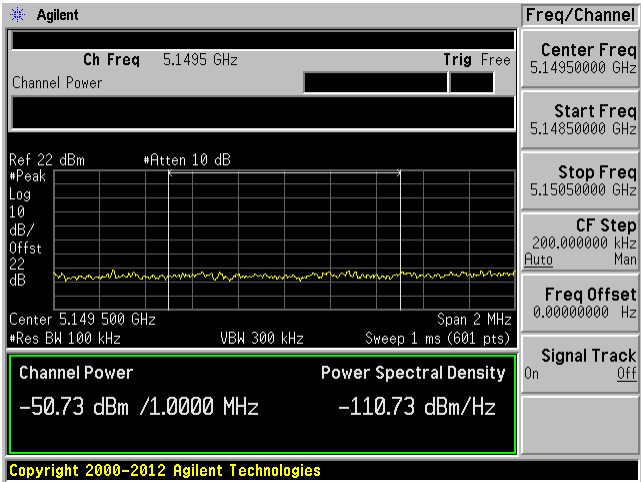
High channel: 5240 MHz



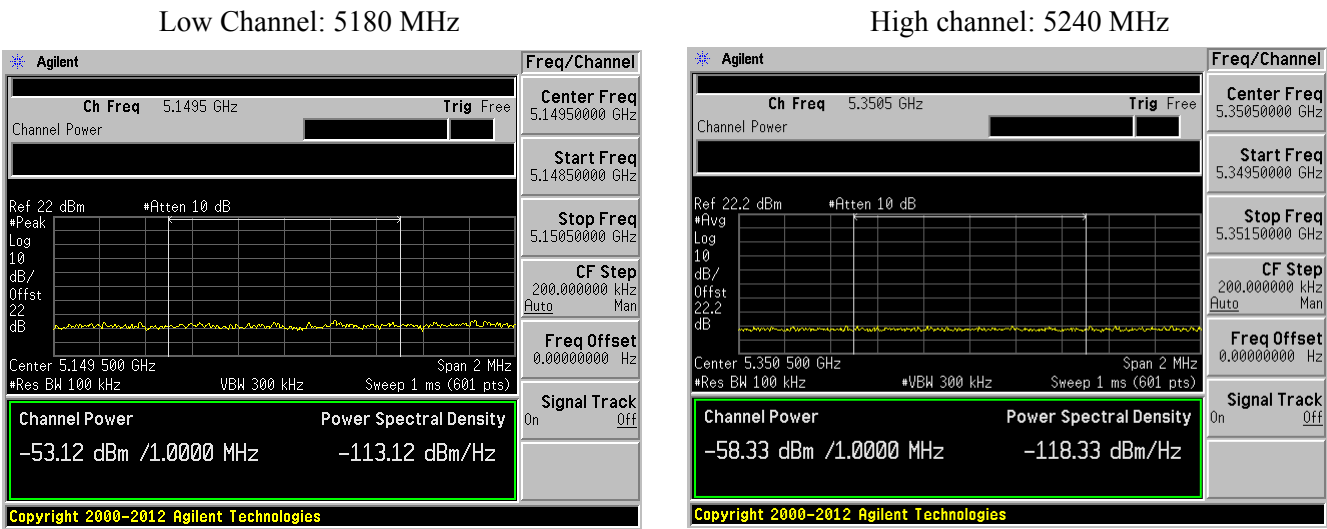
802.11ac20 mode (Port A MIMO)

Low Channel: 5180 MHz

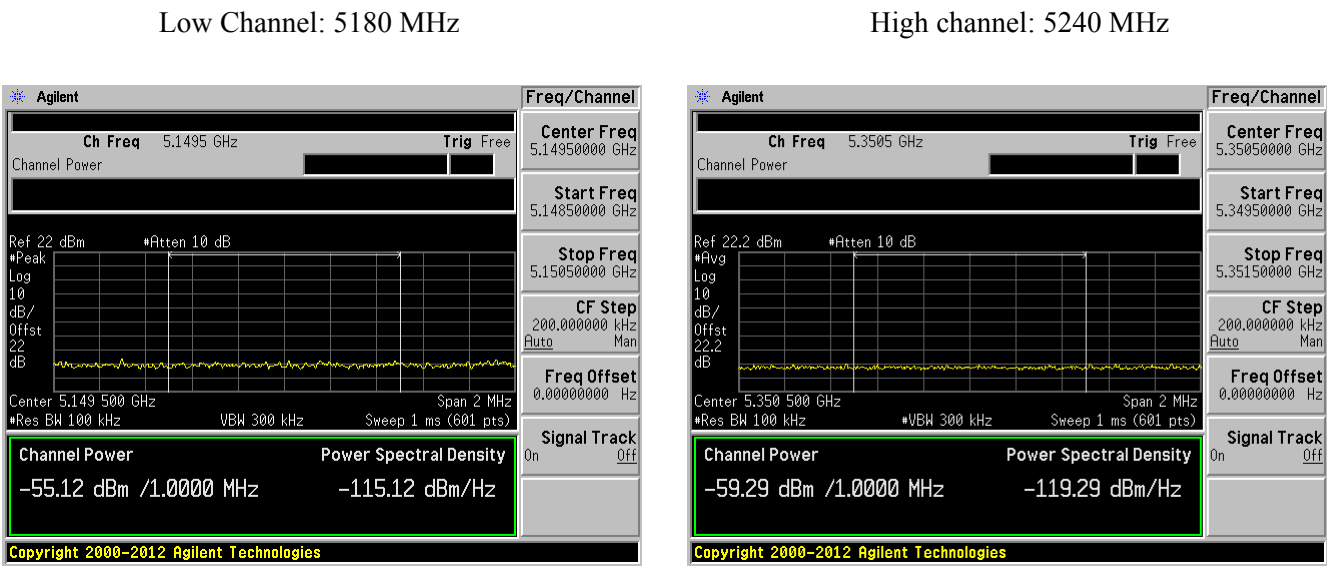
High channel: 5240 MHz



802.11ac20 mode (Port B)



802.11ac20 mode (Port B MIMO)



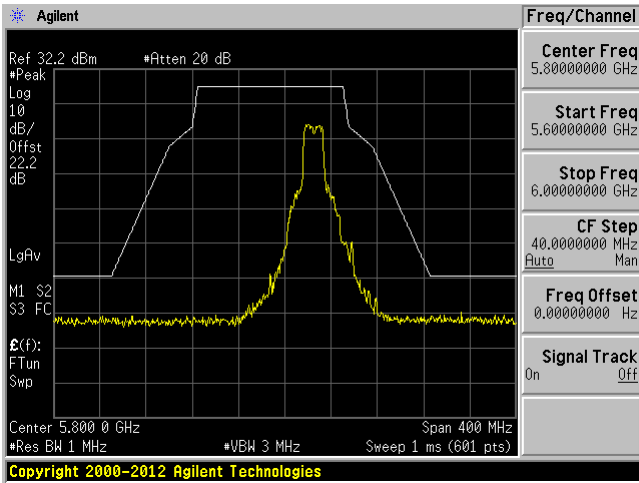
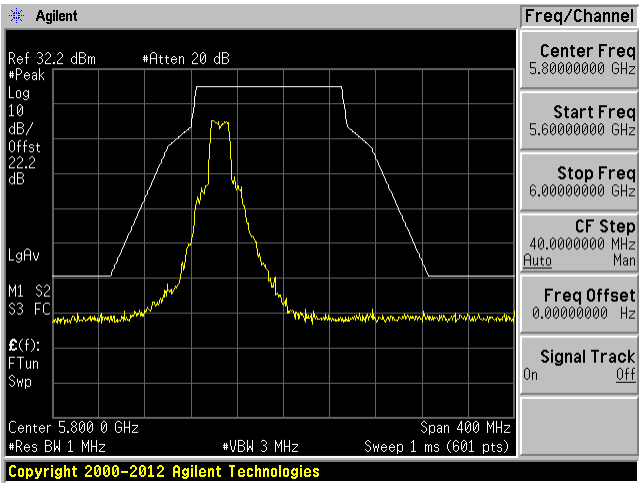
FCC Emission Mask

5725 - 5850 MHz

802.11a mode (Port A)

Low Channel: 5745 MHz

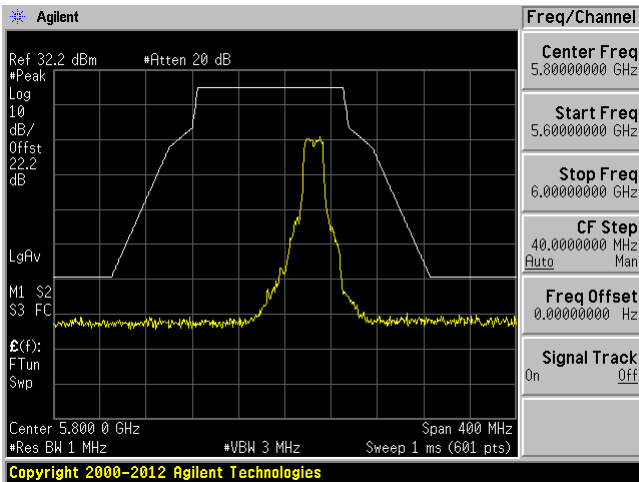
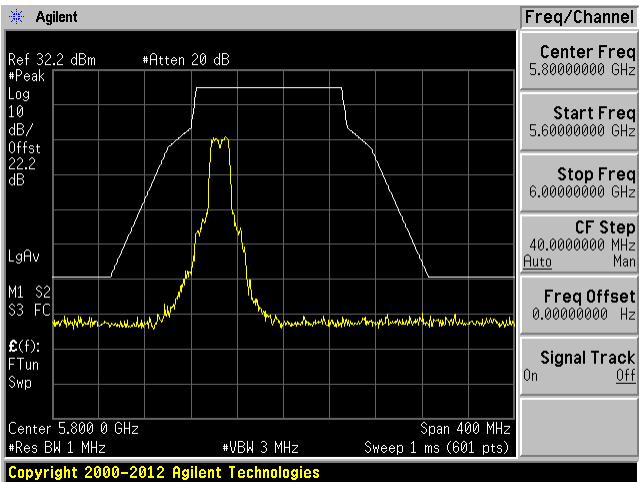
High Channel: 5825 MHz



802.11a mode (Port B)

Low Channel: 5745 MHz

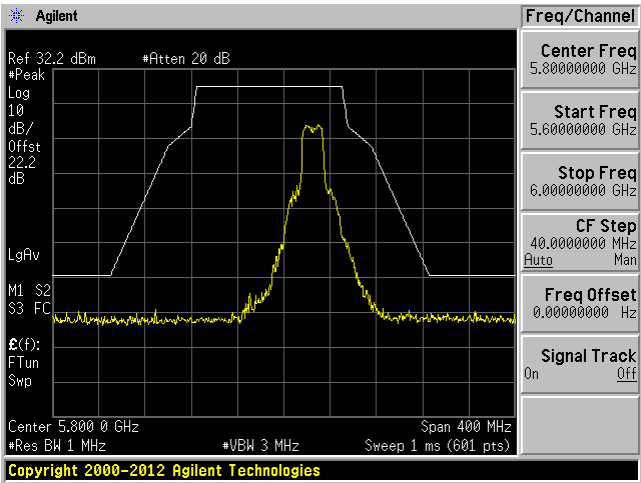
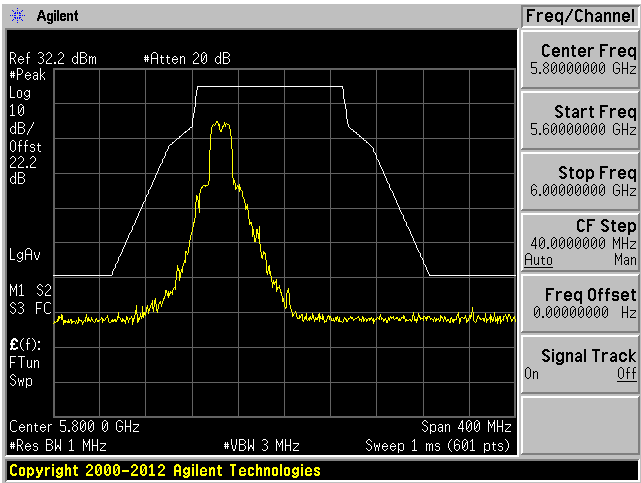
High channel: 5825 MHz



802.11n20 mode (Port A)

Low Channel: 5745 MHz

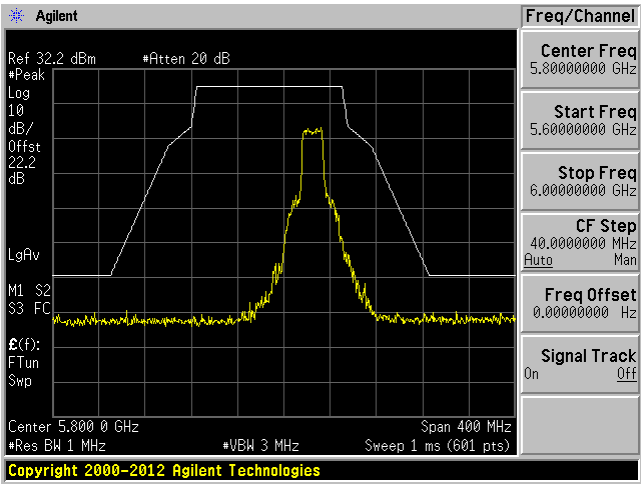
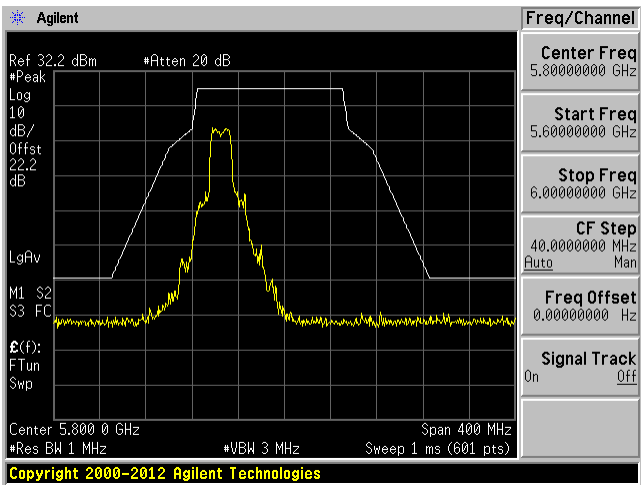
High Channel: 5825 MHz



802.11n20 mode (Port A MIMO)

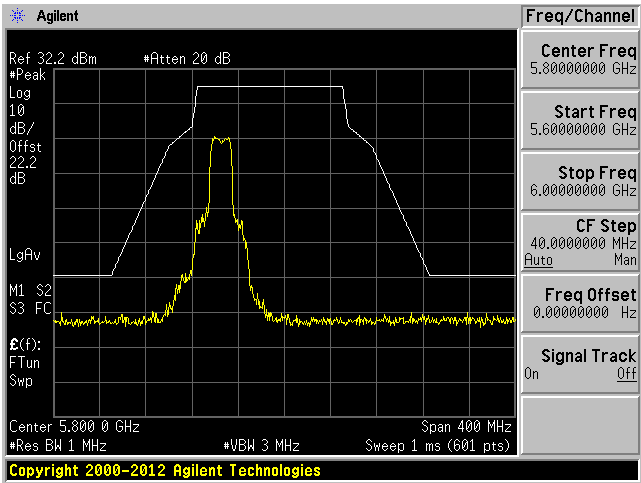
Low Channel: 5745 MHz

High channel: 5825 MHz

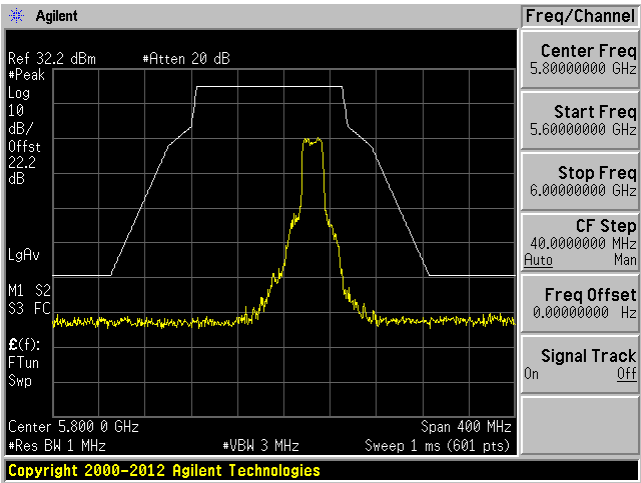


802.11n20 mode (Port B)

Low Channel: 5745 MHz

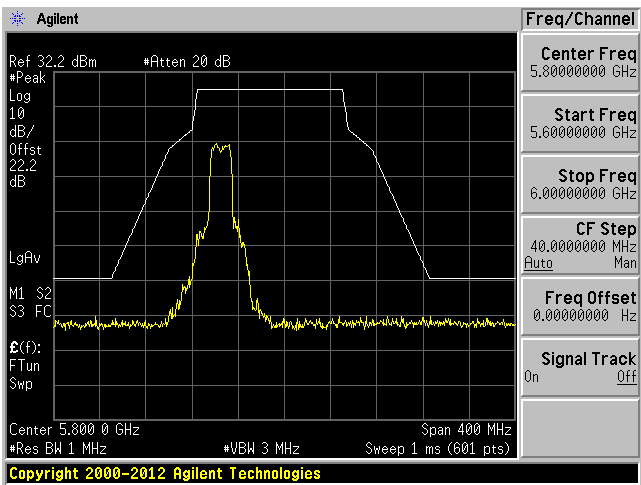


High Channel: 5825 MHz

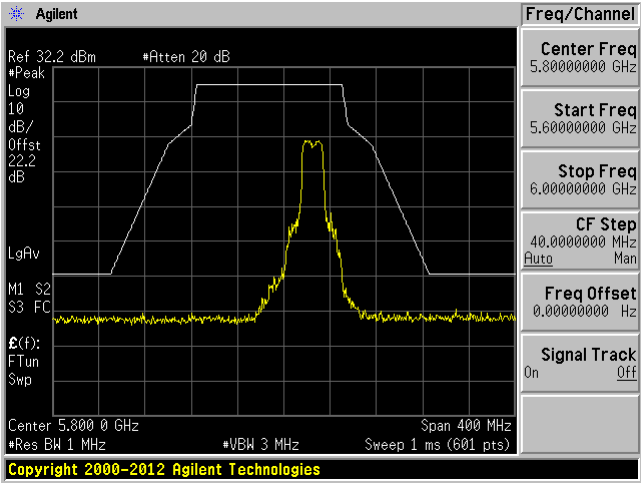


802.11n20 mode (Port B MIMO)

Low Channel: 5745 MHz



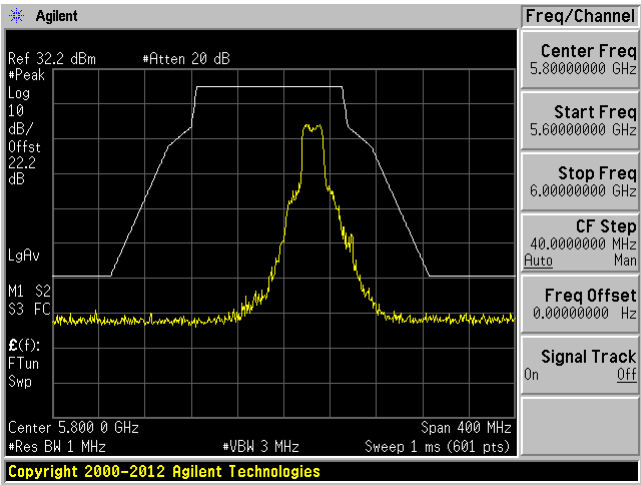
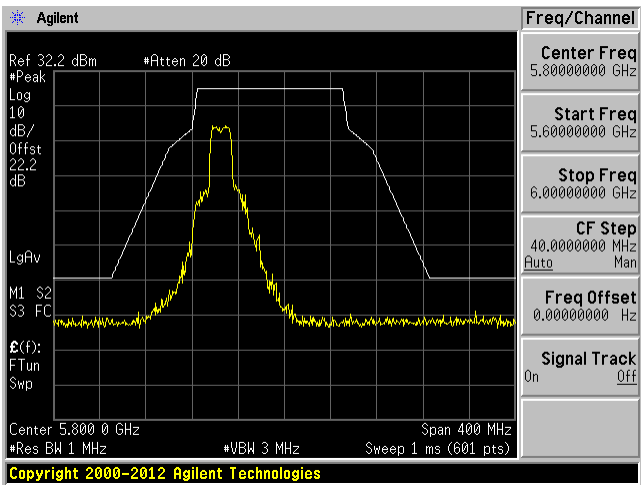
High channel: 5825 MHz



802.11ac20 mode (Port A)

Low Channel: 5745 MHz

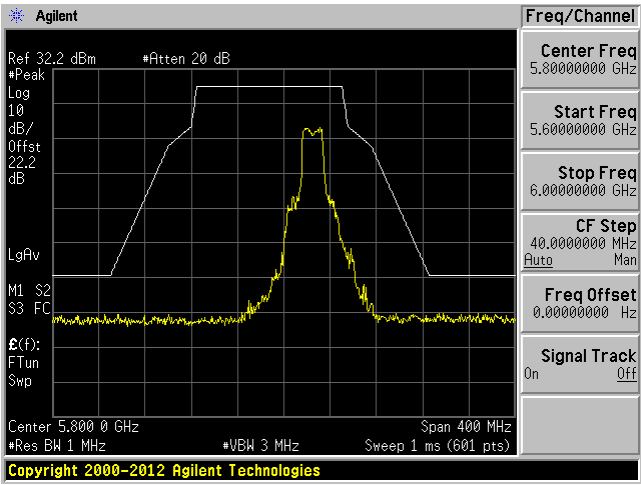
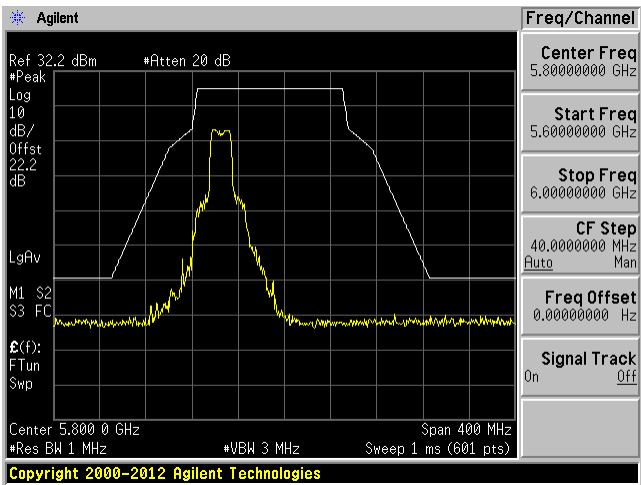
High Channel: 5825 MHz



802.11ac20 mode (Port A MIMO)

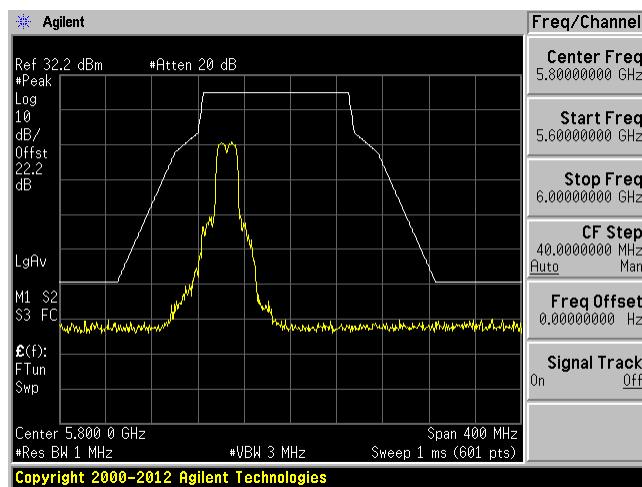
Low Channel: 5745 MHz

High channel: 5825 MHz

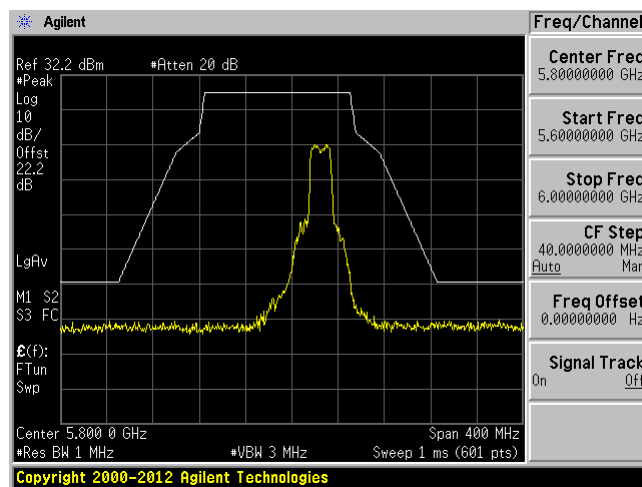


**802.11ac20 mode (Port B)**

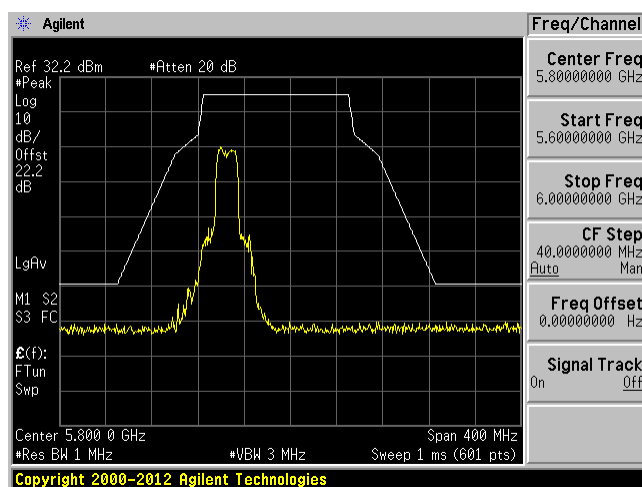
Low Channel: 5745 MHz



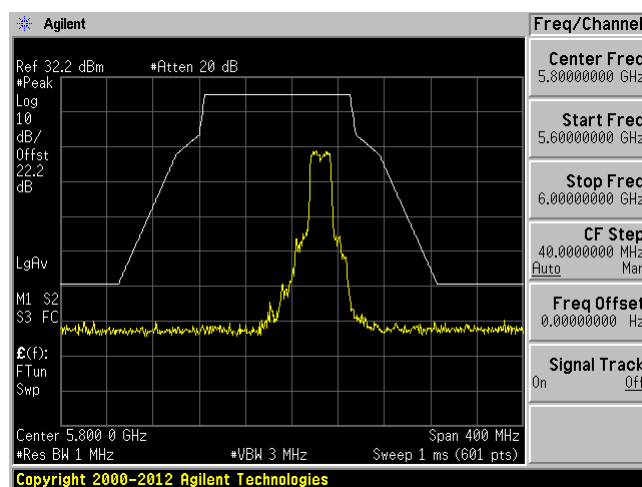
High Channel: 5825 MHz

**802.11ac20 mode (Port B MIMO)**

Low Channel: 5745 MHz



High channel: 5825 MHz



Note: The Band-edge plots at 5.2GHz and 5.8 GHz have been measured without accounting for antenna gain. On the other hand, because all the plots still have more than 10 dB margins, all the results still hold to complicit standards.

## 12 Annex A (Informative) - A2LA Electrical Testing Certificate



### Accredited Laboratory

A2LA has accredited

### BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

### Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of A2LA R222 - *Specific Requirements - EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 30<sup>th</sup> day of August 2016.

Senior Director of Quality & Communications  
For the Accreditation Council  
Certificate Number 3297.02  
Valid to September 30, 2018

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

--- END OF REPORT ---