



**FCC 47 CFR PART 15 SUBPART E**

**CERTIFICATION TEST REPORT**

**FOR**

**MODEL NUMBER: 1645**

**FCC ID: C3K1645**

**REPORT NUMBER: 14U19051-E2 REVISION. B**

**ISSUE DATE: MARCH 25, 2015**

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**NVLAP LAB CODE 200065-0**

Revision History

| Rev. | Issue Date | Revisions                                                                                                                                   | Revised By |
|------|------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------|
| --   | 01/26/15   | Initial Issue                                                                                                                               | C. Pang    |
| A    | 02/09/15   | Removed heading in page 1. Changed EUT description to Handheld Computing Device. Fixed orientation typo, and added 11a and 11ac data rates. | H. Lau     |
| B    | 3/25/2015  | Address TCB's Questions on Section 6,                                                                                                       | C. Pang    |

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** MICROSOFT CORPORATION  
ONE MICROSOFT WAY  
REDMOND, WA 98052, U.S.A.

**EUT DESCRIPTION:** HANDHELD COMPUTING DEVICE

**MODEL:** 1645

**SERIAL NUMBER:** 000200544952 (CONDUCTED); 000207544952 (RADIATED)

**DATE TESTED:** DECEMBER 17, 2014 – JANUARY 26, 2015

| APPLICABLE STANDARDS     |              |
|--------------------------|--------------|
| STANDARD                 | TEST RESULTS |
| CFR 47 Part 15 Subpart E | Pass         |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

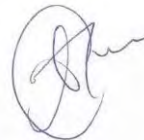
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For  
UL Verification Services Inc. By:



Chin Pang  
Senior Engineer  
UL Verification Services Inc.

Tested By:



Tina Chu  
Lab Technician  
UL Verification Services Inc.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, ANSI C63.10-2009.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street               | 47266 Benicia Street                          |
|------------------------------------|-----------------------------------------------|
| <input type="checkbox"/> Chamber A | <input type="checkbox"/> Chamber D            |
| <input type="checkbox"/> Chamber B | <input checked="" type="checkbox"/> Chamber E |
| <input type="checkbox"/> Chamber C | <input checked="" type="checkbox"/> Chamber F |
|                                    | <input checked="" type="checkbox"/> Chamber G |
|                                    | <input checked="" type="checkbox"/> Chamber H |

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned}\text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m}\end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER                             | UNCERTAINTY   |
|---------------------------------------|---------------|
| Conducted Disturbance, 0.15 to 30 MHz | $\pm 3.52$ dB |
| Radiated Disturbance, 30 to 1000 MHz  | $\pm 4.94$ dB |
| Radiated Disturbance, 1 to 6 GHz      | $\pm 3.86$ dB |
| Radiated Disturbance, 6 to 18 GHz     | $\pm 4.23$ dB |
| Radiated Disturbance, 18 to 26 GHz    | $\pm 5.30$ dB |
| Radiated Disturbance, 26 to 40 GHz    | $\pm 5.23$ dB |

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a handheld computing device with 802.11 2x2, a/b/g/n/ac WLAN and Bluetooth radios.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

| Frequency Range (MHz) | Mode 2TX       | Output Power (dBm) | Output Power (mW) |
|-----------------------|----------------|--------------------|-------------------|
| 5180 - 5240           | 802.11a        | 10.17              | 10.40             |
| 5180 - 5240           | 802.11n HT20   | 10.00              | 10.00             |
| 5190 - 5230           | 802.11n HT40   | 10.27              | 10.64             |
| 5210                  | 802.11ac VHT80 | 9.53               | 8.97              |
| 5260 - 5320           | 802.11a        | 10.17              | 10.40             |
| 5260 - 5320           | 802.11n HT20   | 10.16              | 10.38             |
| 5270 - 5310           | 802.11n HT40   | 10.15              | 10.35             |
| 5290                  | 802.11ac VHT80 | 9.61               | 9.14              |
| 5500 - 5700           | 802.11a        | 10.35              | 10.84             |
| 5500 - 5700           | 802.11n HT20   | 10.24              | 10.57             |
| 5510 - 5670           | 802.11n HT40   | 10.40              | 10.96             |
| 5530 - 5610           | 802.11ac VHT80 | 9.59               | 9.10              |
| 5745 - 5825           | 802.11a        | 10.40              | 10.96             |
| 5745 - 5825           | 802.11n HT20   | 10.11              | 10.26             |
| 5755 - 5795           | 802.11n HT40   | 10.44              | 11.07             |
| 5775                  | 802.11ac VHT80 | 9.29               | 8.49              |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integrated antenna with maximum gains as follows:

| Frequency Band (GHz) | Antenna Gain (dBi) |         |
|----------------------|--------------------|---------|
|                      | Chain 0            | Chain 1 |
| 5.15 - 5.25          | 3.1                | 3.6     |
| 5.25 - 5.35          | 2.9                | 3.5     |
| 5.47 - 5.725         | 3.3                | 2.5     |
| 5.725 -5.85          | 3.5                | 1.9     |

### 5.4. SOFTWARE

The test software used during testing was WIFI Tool v2.3.2

## **5.5. WORST-CASE CONFIGURATION AND MODE**

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, Z, it was determined that Y orientation was worst-case orientation for 2.4GHz band and Z orientation was worst-case orientation for 5GHz band; therefore, all final radiated testing was performed with the EUT in Y (Landscape) orientation for 2.4GHz band and Z (Portrait) orientation for 5.GHz band.

Worst-case data rates as provided by the client were:

802.11b mode: 1 Mbps  
802.11g mode: 6 Mbps  
802.11a mode: 6 Mbps  
802.11n HT20mode: MCS0  
802.11n HT40 mode: MCS0  
802.11ac mode: MCS0

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |             |                        |        |
|------------------------|--------------|-------------|------------------------|--------|
| Description            | Manufacturer | Model       | Serial Number          | FCC ID |
| Laptop                 | Lenovo       | E545        | 5399926                | DoC    |
| Laptop AC/DC adapter   | Lenovo       | ADLX65NCT2A | 11S36200293ZZ10049556A | DoC    |
| Headset                | N/A          | N/A         | N/A                    | N/A    |

### I/O CABLES (CONDUCTED TEST)

| I/O Cable List |             |                      |                |             |                  |                      |
|----------------|-------------|----------------------|----------------|-------------|------------------|----------------------|
| Cable No       | Port        | # of identical ports | Connector Type | Cable Type  | Cable Length (m) | Remarks              |
| 1              | Antenna     | 1                    | SMA            | Un-Shielded | 0.3              | To spectrum Analyzer |
| 2              | Ether cable | 1                    | RJ45- USB      | Shielded    | 3                | To EUT               |
| 3              | DC          | 1                    | DC             | Un-shielded | 0.8              | N/A                  |

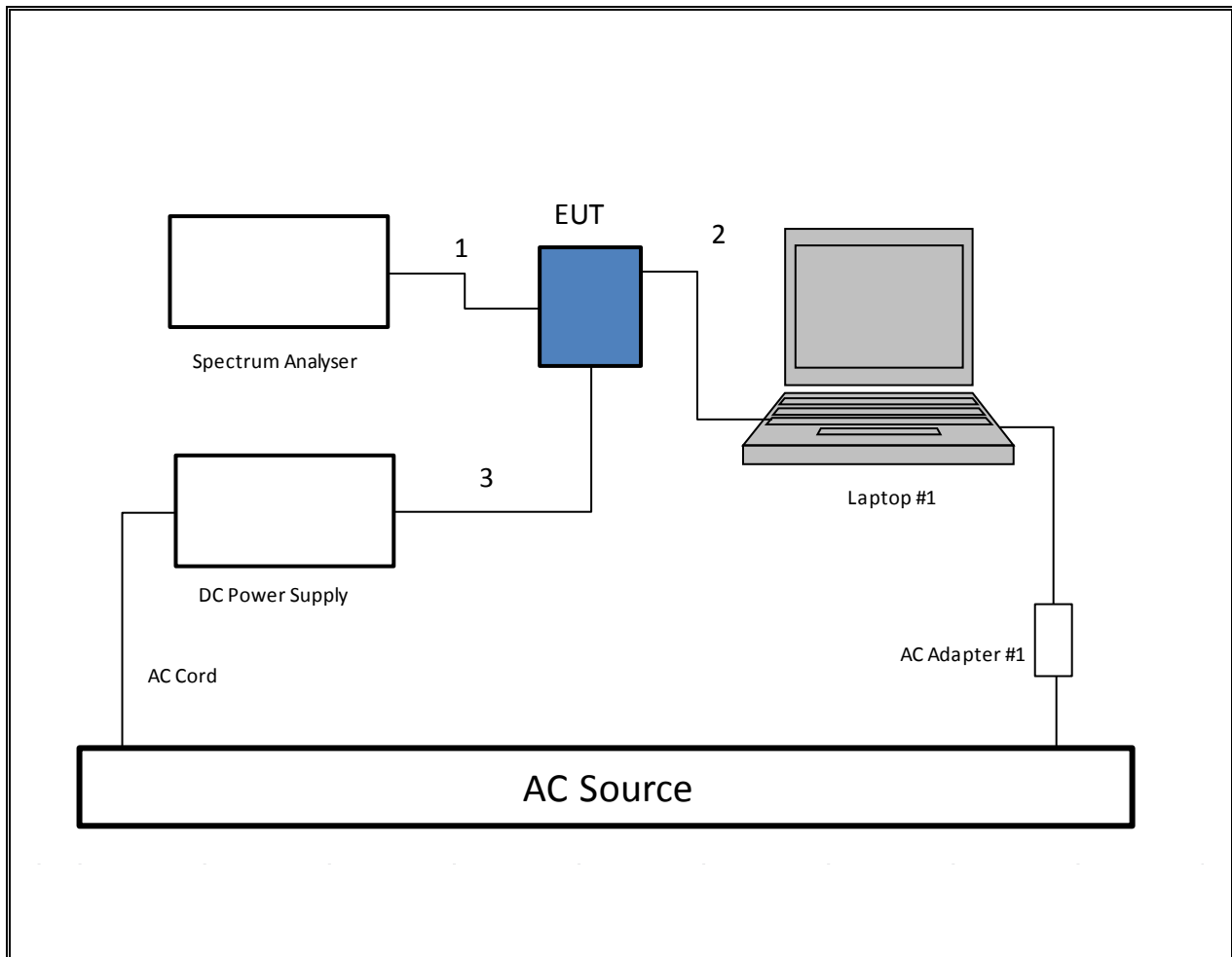
### I/O CABLES (BELOW 1GHZ & AC LINE CONDUCTED TESTS)

| I/O Cable List |            |                      |                |             |                  |         |
|----------------|------------|----------------------|----------------|-------------|------------------|---------|
| Cable No       | Port       | # of identical ports | Connector Type | Cable Type  | Cable Length (m) | Remarks |
| 1              | AC Main    | 1                    | 115VAC         | Un-Shielded | 1.2              | NA      |
| 2              | DC         | 1                    | DC             | Un-Shielded | 0.8              | NA      |
| 3              | Audio Jack | 1                    | Headset        | Un-shielded | 1                | N/A     |

### TEST SETUP- CONDUCTED PORT

The EUT was tested connected to a host Laptop via RJ45/USB cable and spectrum analyzer to antenna port. Test software exercised the EUT.

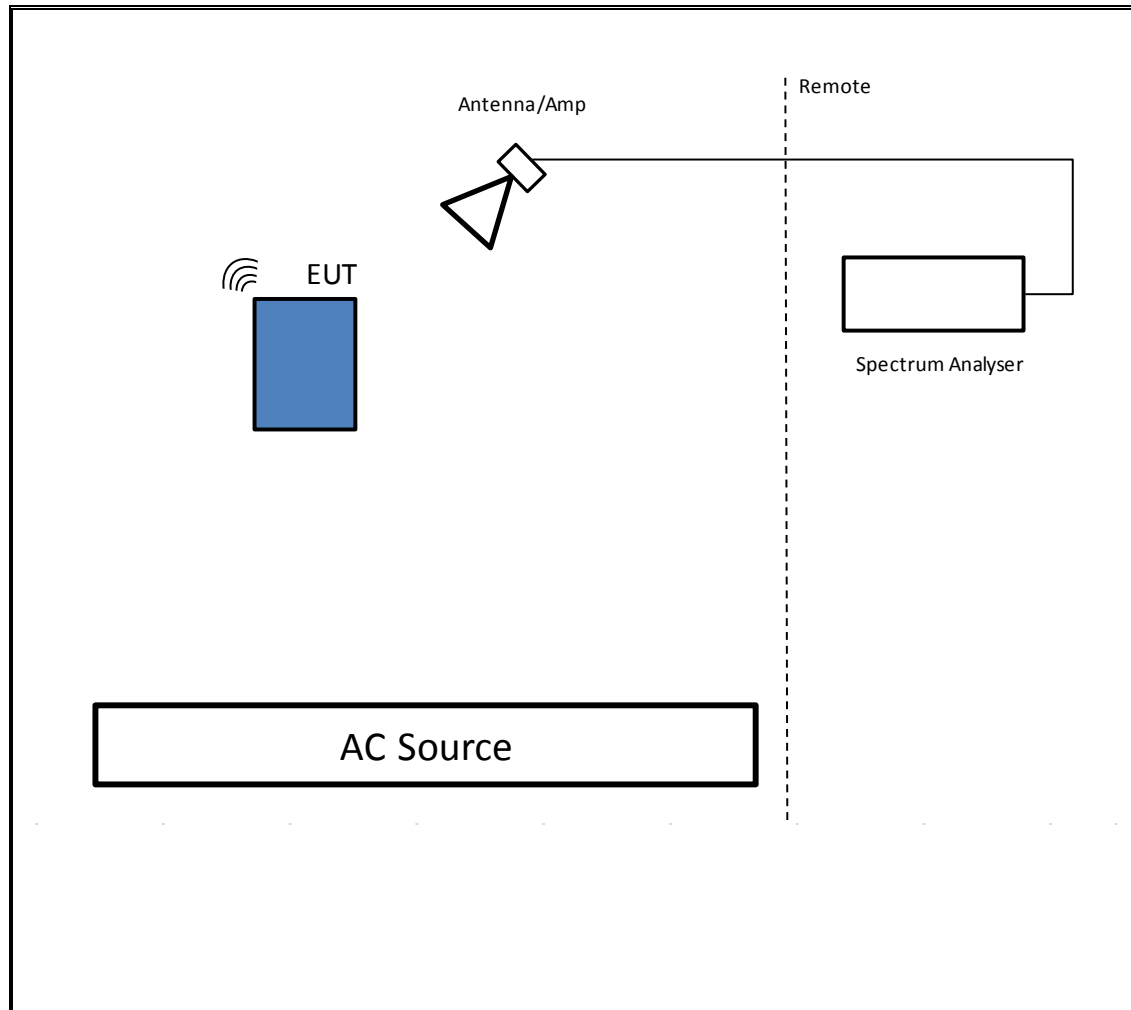
### SETUP DIAGRAM



**TEST SETUP- RADIATED-ABOVE 1 GHZ**

The EUT was tested battery powered. Test software exercised the EUT.

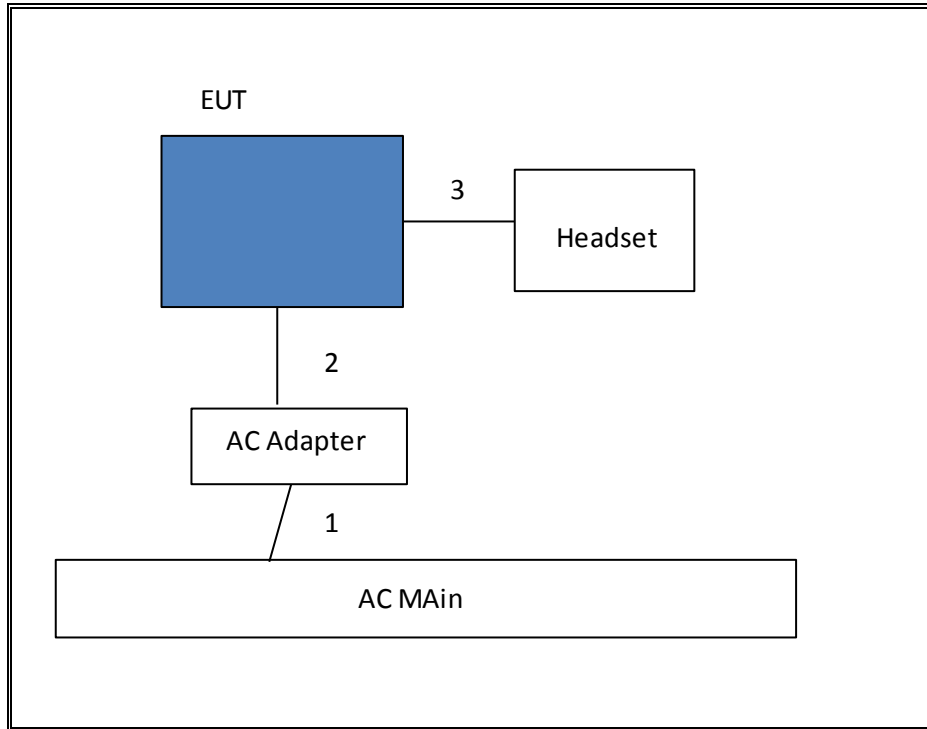
**SETUP DIAGRAM**



**TEST SETUP - BELOW 1GHZ & AC LINE CONDUCTED TESTS**

The EUT was tested with AC/DC power supply. Test software exercised the EUT.

**SETUP DIAGRAM**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| Test Equipment List                                |                 |                        |               |           |
|----------------------------------------------------|-----------------|------------------------|---------------|-----------|
| Description                                        | Manufacturer    | Model                  | Serial Number | Cal Due   |
| Antenna, Horn 1-18GHz                              | ETS Lindgren    | 3117                   | 143448        | 2/18/2015 |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz        | Sunol Sciences  | JB3                    | A022813-2     | 2/26/2015 |
| Antenna, Horn 18 to 26.5GHz                        | ARA             | MWH-1826               | 1049          | 12/17/15  |
| Horn Antenna, 40GHz                                | ARA             | MWH-2640/B             | 1029          | 7/15/2015 |
| Amplifier, 1 - 18GHz                               | Miteq           | AFS42-00101800-25-S-42 | 1782158       | 1/11/2016 |
| Amplifier, 10KHz to 1GHz, 32dB                     | Sonoma          | 310N                   | 323562        | 4/23/2015 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz               | Agilent         | N9030A                 | MY52350675    | 3/11/2015 |
| Antenna, Horn 1-18GHz                              | ETS Lindgren    | 3117                   | 00029310      | 3/20/2015 |
| Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum       | Agilent         | 8449B                  | 3008A04710    | 3/25/2015 |
| EMI Test Receiver 9KHz-7GHz                        | Rohde & Schwarz | ECSI7                  | N/A           | 9/16/2015 |
| LISN for Conducted Emissions CISPR-16              | FCC             | 50/250-25-2            | N/A           | 1/16/2016 |
| Power Cable, Line Conducted Emissions ANSI 63.4    | U L             | PG1                    | N/A           | 7/28/2015 |
| Amplifier, 26 - 40GHz                              | Miteq           | NSP4000-SP2            | 924343        | 9/3/2015  |
| Power Sensor, P - series, 50MHz to 18GHz, Wideband | Agilent         | N1921A                 | MY53260010    | 7/12/2015 |
| Amplifier, 1 - 18GHz                               | Miteq           | AFS42-00101800-25-S-42 | N/A           | 1/20/2016 |
| Amplifier, 10KHz to 1GHz, 32dB                     | Sonoma          | 310N                   | 185623        | 6/7/2015  |
| Spectrum Analyzer, PXA, 3Hz to 44GHz               | Agilent         | N9030A                 | MY53310972    | 05/08/15  |
| Power Meter, P-series single channel               | Agilent         | N1911A                 | MY53060011    | 4/9/2015  |

## 7. MEASUREMENT METHODS

26 dB Emission BW: KDB 789033 D02 v01r, Section C.

99% Occupied BW: KDB 789033 D02 v01, Section D.

Conducted Output Power: KDB 789033 D02 v01, Section E.2.b (Method SA-1).

Conducted Output Power: KDB 789033 D02 v01, Section E.2.d (Method SA-2).

Power Spectral Density: KDB 789033 D02 v01, Section F.

Unwanted emissions in restricted bands: KDB 789033 D02 v01, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v01, Sections G.3, G.4, and G.5.

## 8. ON TIME AND DUTY CYCLE

### LIMITS

None; for reporting purposes only.

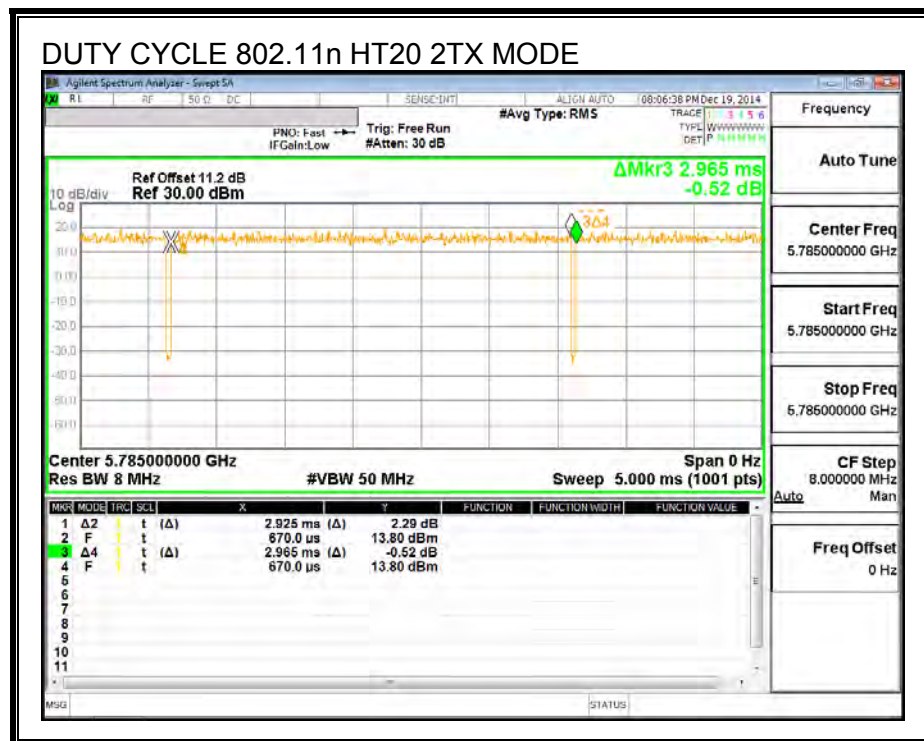
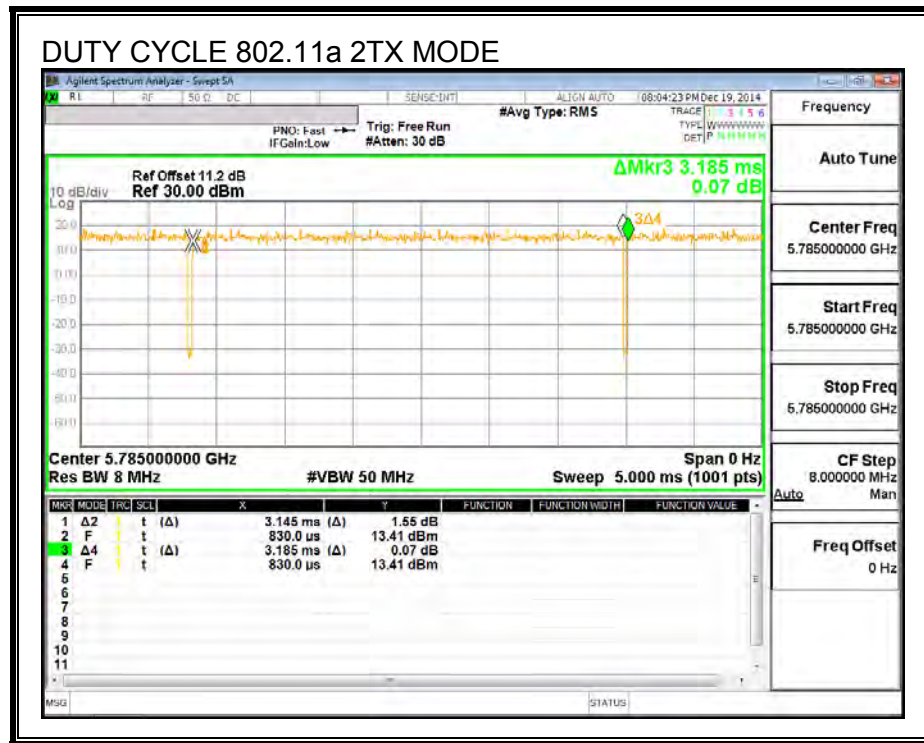
### PROCEDURE

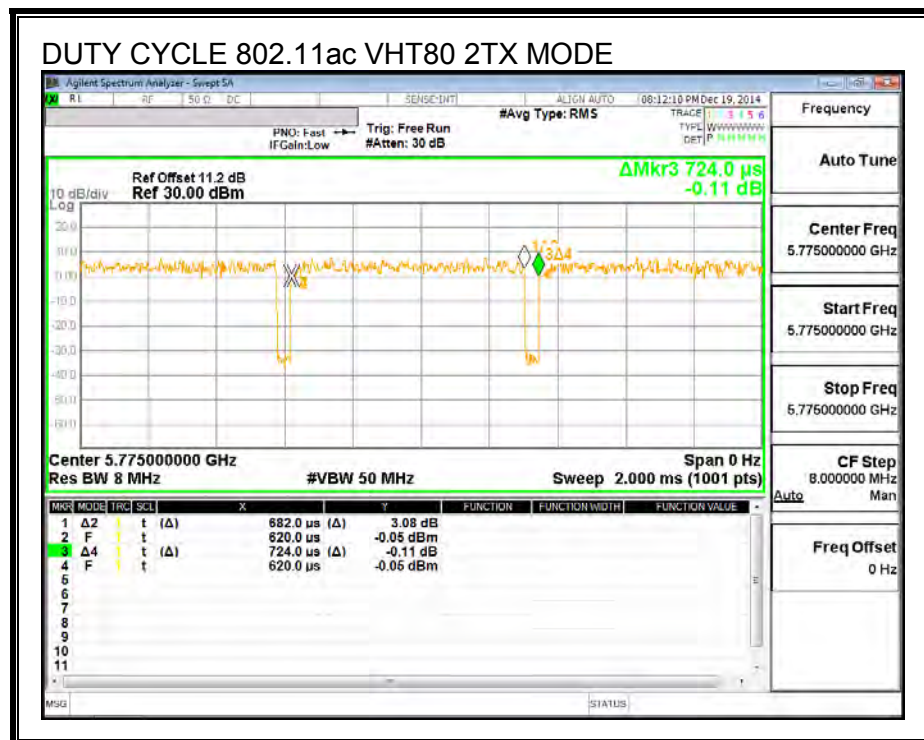
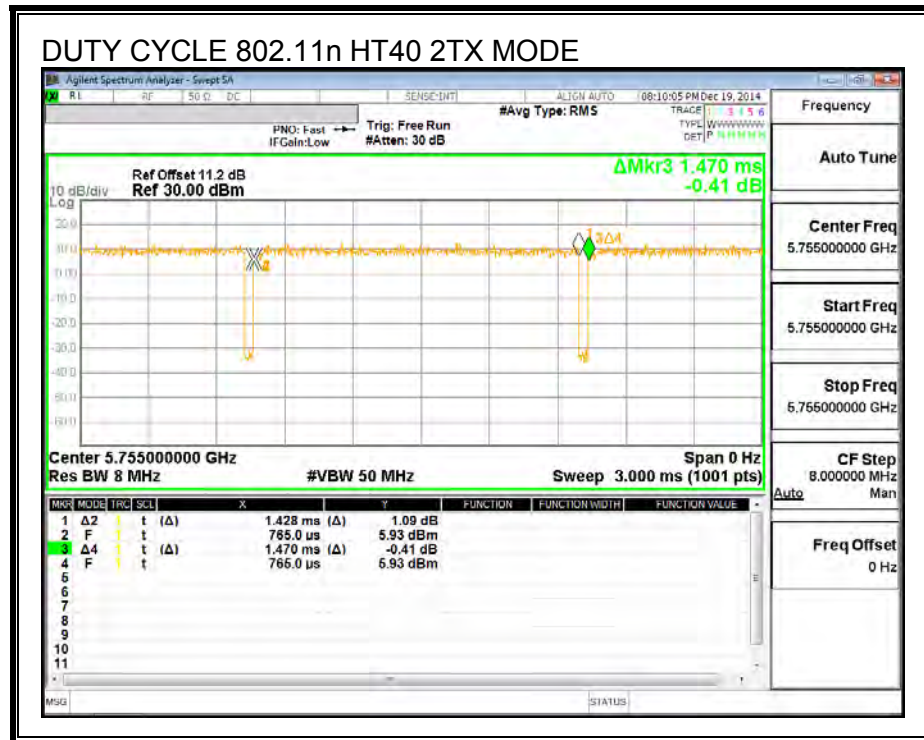
KDB 789033 Zero-Span Spectrum Analyzer Method.

### 8.1. ON TIME AND DUTY CYCLE RESULTS

| Mode               | ON Time<br>B<br>(msec) | Period<br>(msec) | Duty Cycle<br>x<br>(linear) | Duty<br>Cycle<br>(%) | Duty Cycle<br>Correction Factor<br>(dB) | 1/B<br>Minimum VBW<br>(kHz) |
|--------------------|------------------------|------------------|-----------------------------|----------------------|-----------------------------------------|-----------------------------|
| 802.11a 2TX        | 3.145                  | 3.185            | 0.987                       | 98.74%               | 0.00                                    | 0.010                       |
| 802.11n HT20 2TX   | 2.925                  | 2.965            | 0.987                       | 98.65%               | 0.00                                    | 0.010                       |
| 802.11n HT40 2TX   | 1.428                  | 1.470            | 0.971                       | 97.14%               | 0.13                                    | 0.700                       |
| 802.11ac VHT80 2TX | 0.682                  | 0.724            | 0.942                       | 94.20%               | 0.26                                    | 1.466                       |

## 8.2. DUTY CYCLE PLOTS





## 9. ANTENNA PORT TEST RESULTS

### 9.1. 802.11a MODE IN THE 5.2 GHz BAND

#### 9.1.1. 26 dB BANDWIDTH

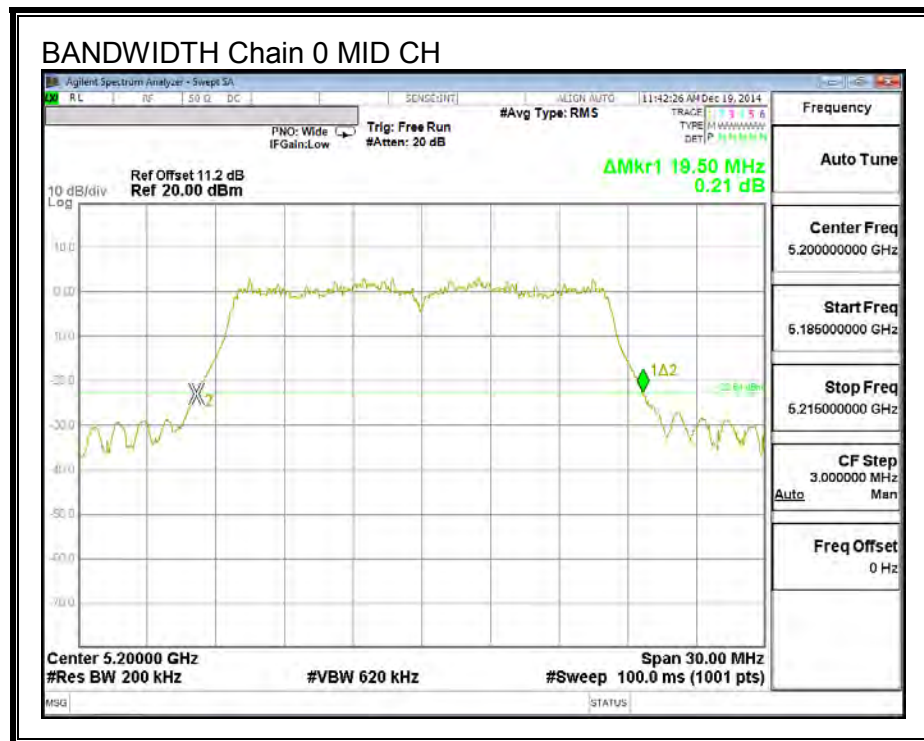
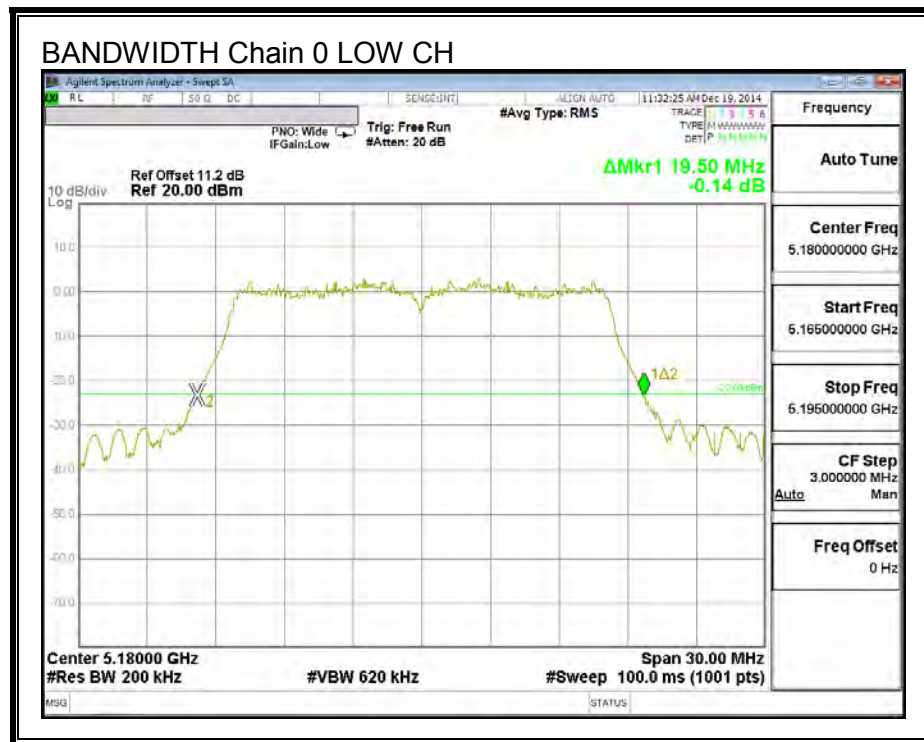
##### LIMITS

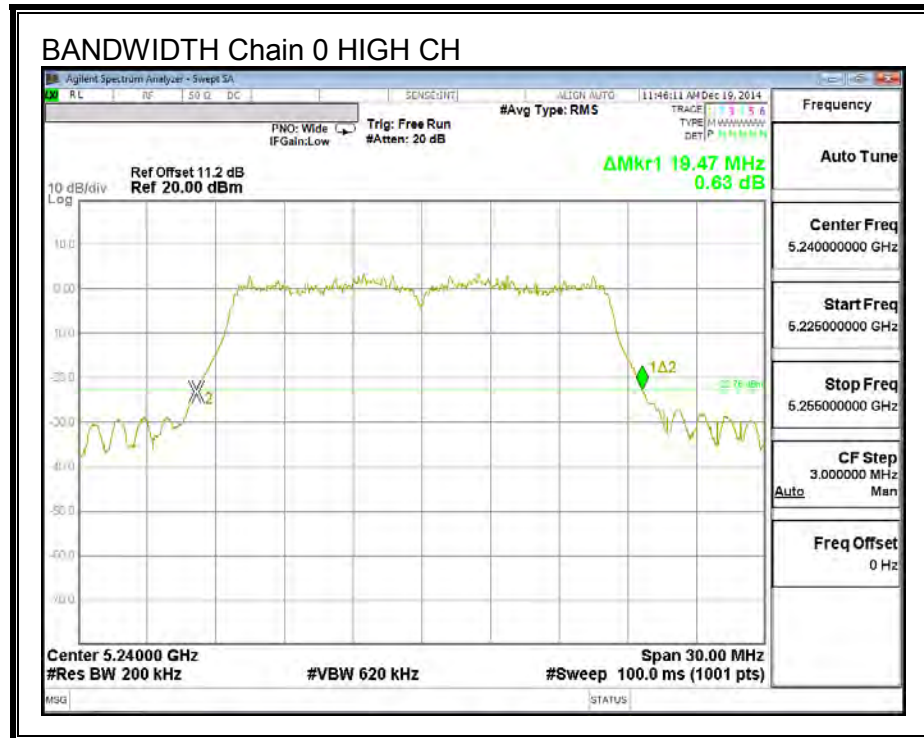
None; for reporting purposes only.

##### RESULTS

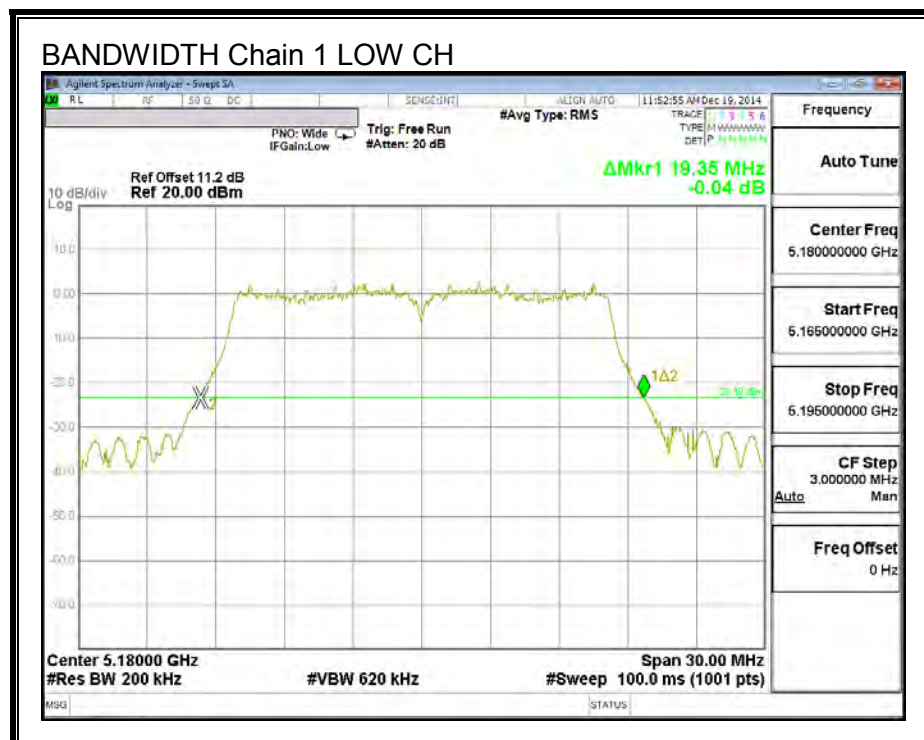
| Channel | Frequency<br>(MHz) | 26 dB BW<br>Chain 0<br>(MHz) | 26 dB BW<br>Chain 1<br>(MHz) |
|---------|--------------------|------------------------------|------------------------------|
| Low     | 5180               | 19.50                        | 19.35                        |
| Mid     | 5200               | 19.50                        | 19.38                        |
| High    | 5240               | 19.47                        | 19.38                        |

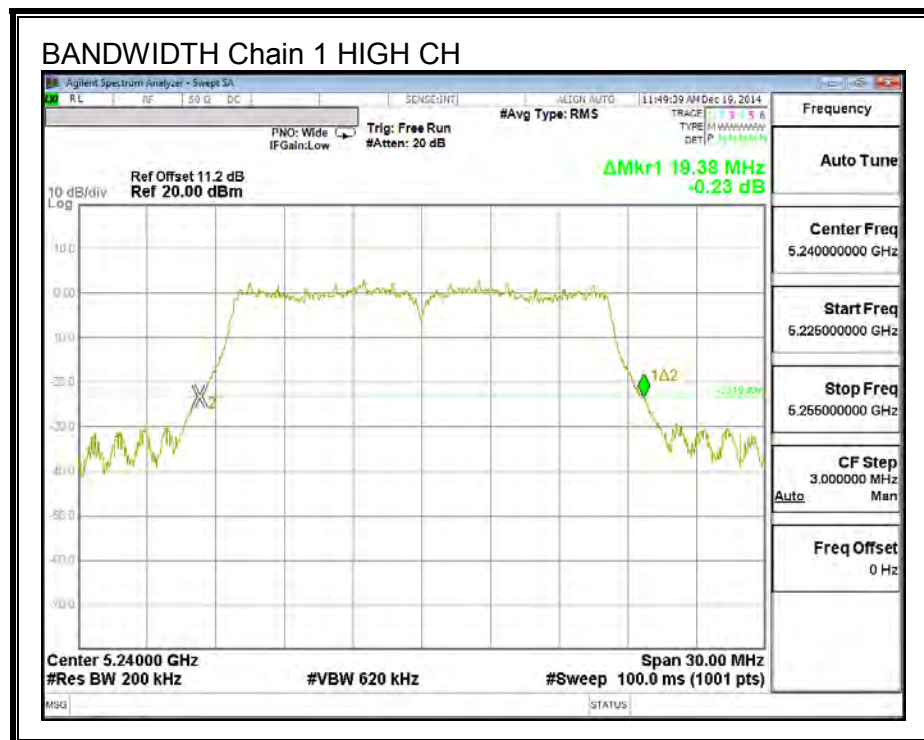
**26 dB BANDWIDTH, Chain 0**





**26 dB BANDWIDTH, Chain 1**





### 9.1.2. 99% BANDWIDTH

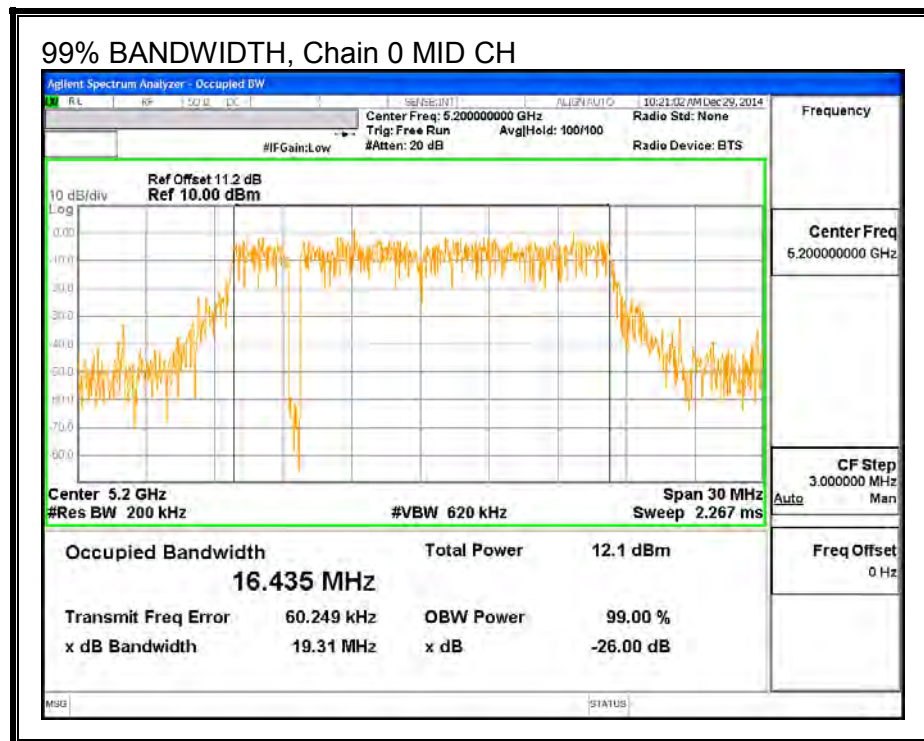
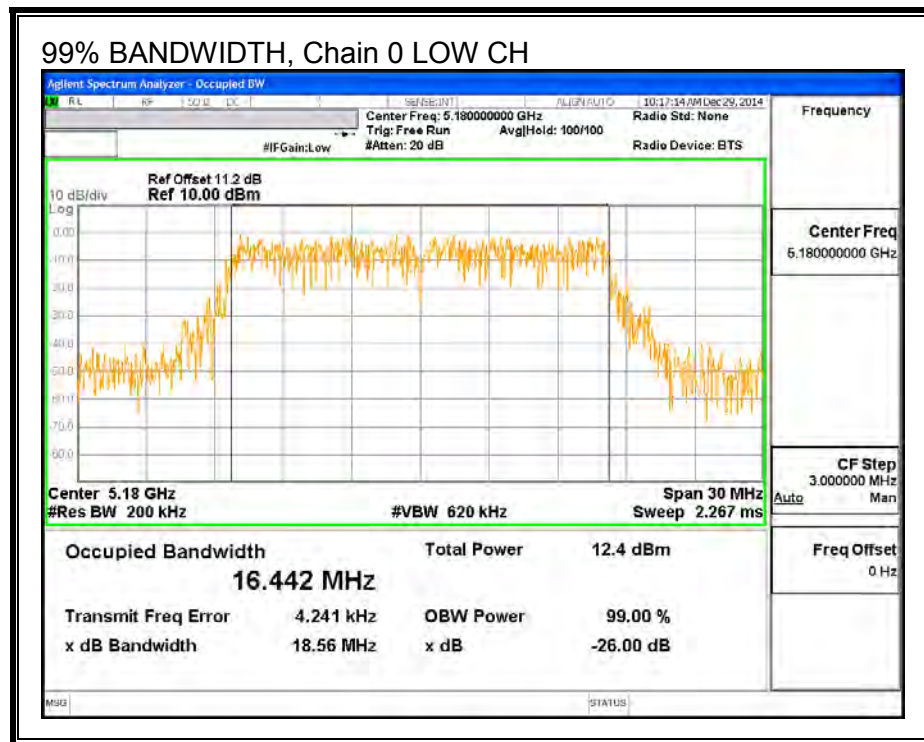
#### LIMITS

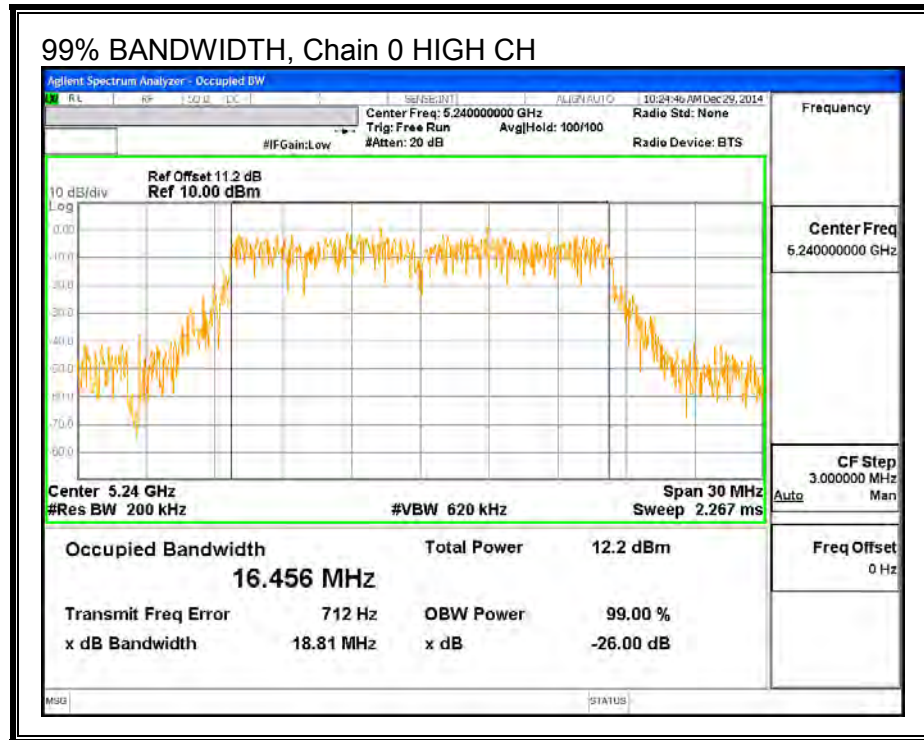
None; for reporting purposes only.

#### RESULTS

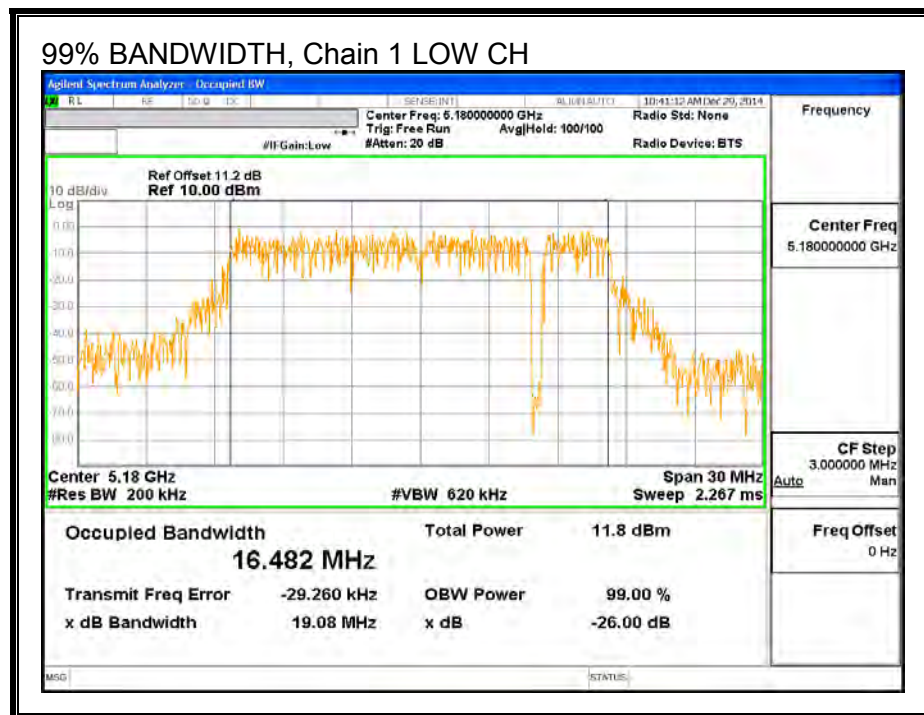
| Channel | Frequency<br>(MHz) | 99% BW<br>Chain 0<br>(MHz) | 99% BW<br>Chain 1<br>(MHz) |
|---------|--------------------|----------------------------|----------------------------|
| Low     | 5180               | 16.442                     | 16.482                     |
| Mid     | 5200               | 16.435                     | 16.337                     |
| High    | 5240               | 16.456                     | 16.502                     |

**99% BANDWIDTH, Chain 0**

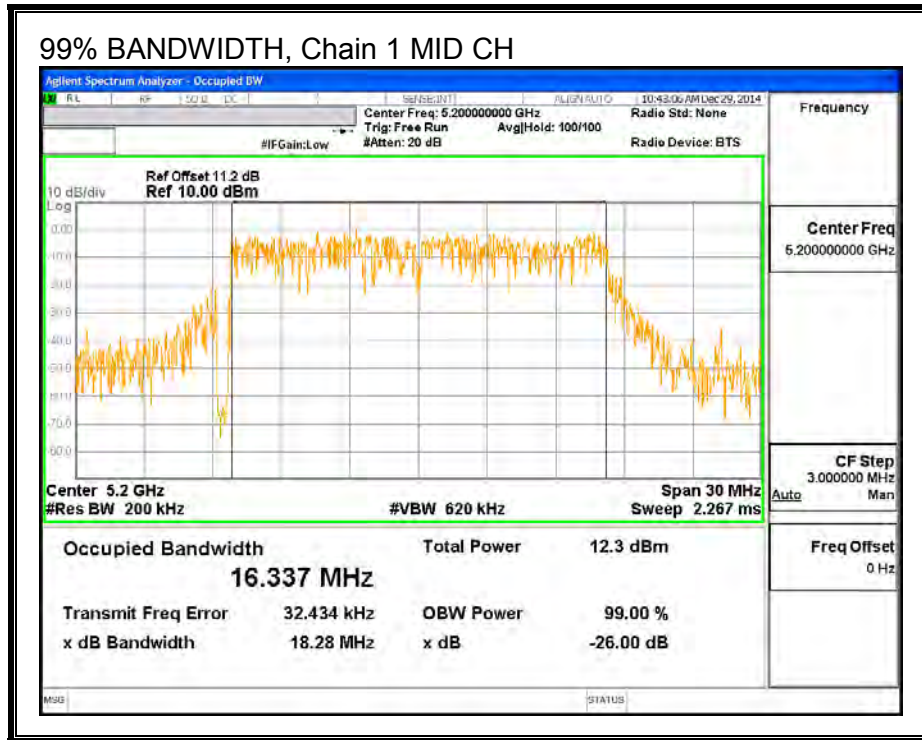




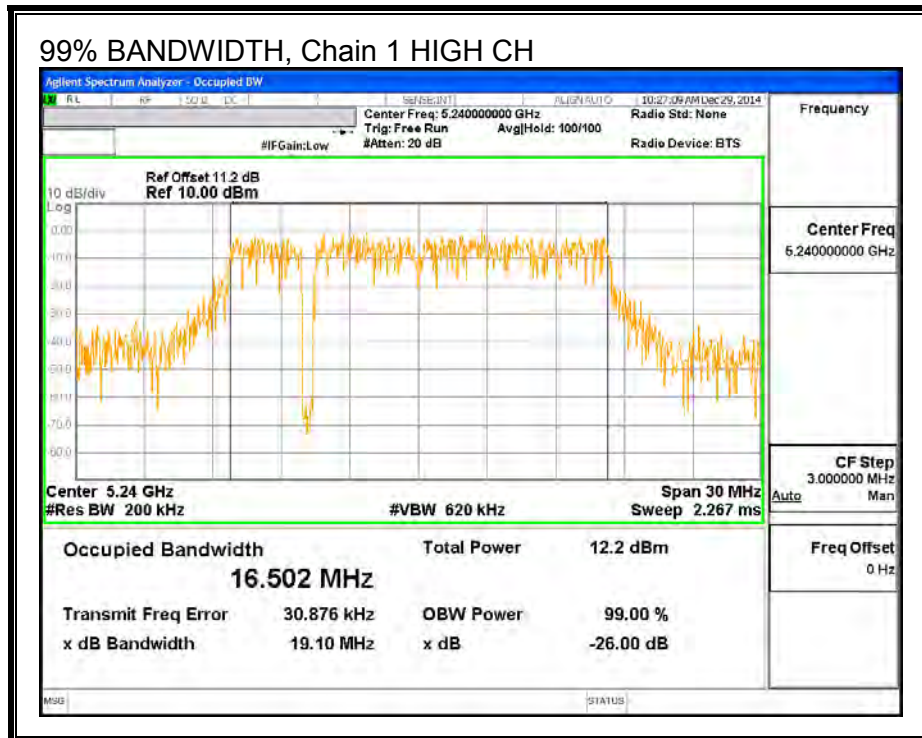
99% BANDWIDTH, Chain 1



### 99% BANDWIDTH, Chain 1 MID CH



### 99% BANDWIDTH, Chain 1 HIGH CH



### 9.1.3. OUTPUT POWER AND PSD

#### LIMITS

FCC §15.407 (a) (1)

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

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

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

(iv) 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.

### DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|-----------------------------------------------------|
| 3.1                                 | 3.6                                 | 3.36                                                |

### RESULTS

#### Antenna Gain and Limits

| Channel | Frequency<br>(MHz) | Directional<br>Gain<br>for Power<br>(dBi) | Directional<br>Gain<br>for PSD<br>(dBi) | Power<br>Limit<br>(dBm) | PSD<br>Limit<br>(dBm) |
|---------|--------------------|-------------------------------------------|-----------------------------------------|-------------------------|-----------------------|
| Low     | 5180               | 3.36                                      | 3.36                                    | 24.00                   | 11.00                 |
| Mid     | 5200               | 3.36                                      | 3.36                                    | 24.00                   | 11.00                 |
| High    | 5240               | 3.36                                      | 3.36                                    | 24.00                   | 11.00                 |

|                    |      |                                                |
|--------------------|------|------------------------------------------------|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PSD |
|--------------------|------|------------------------------------------------|

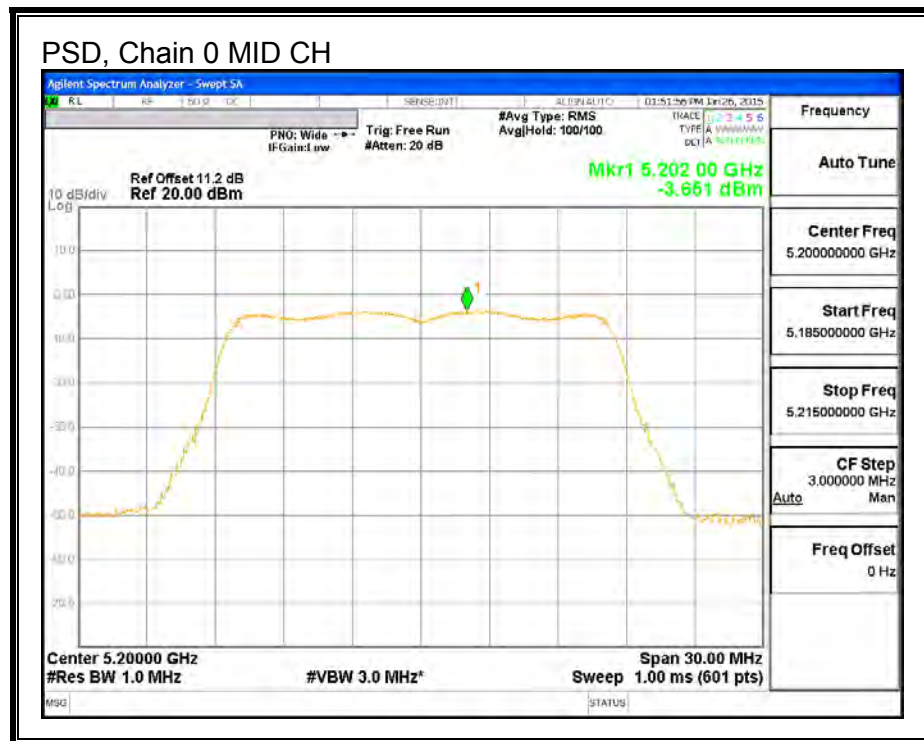
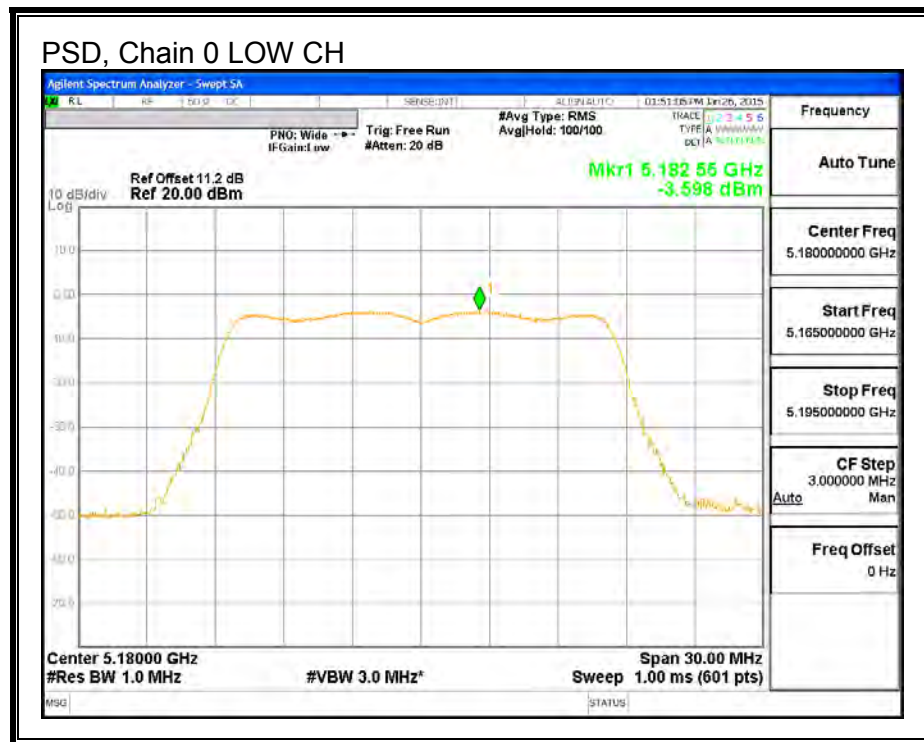
#### Output Power Results

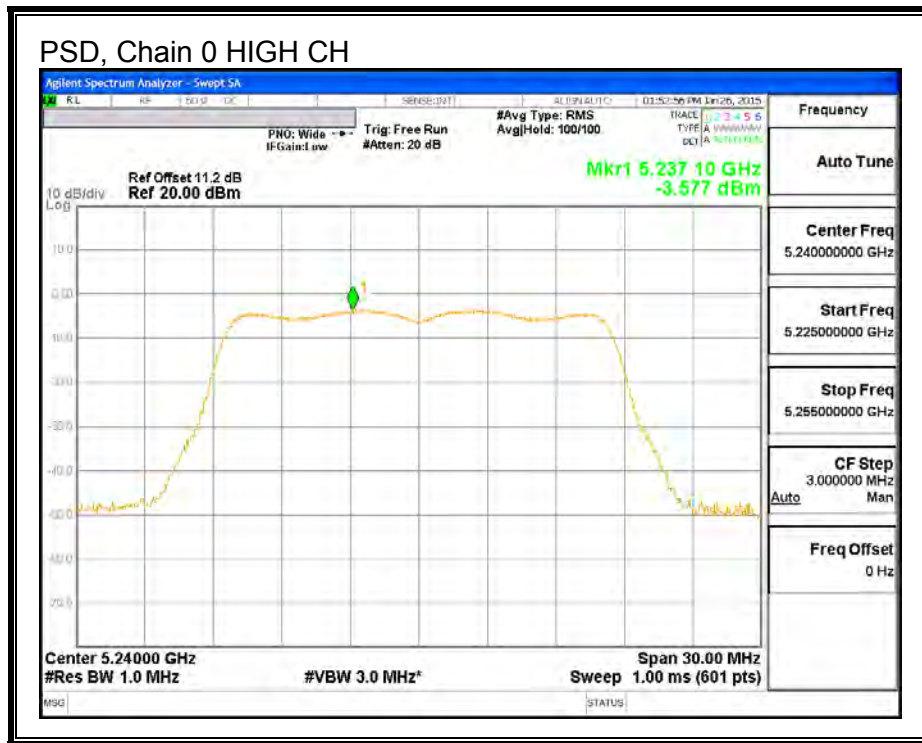
| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5180               | 6.93                              | 7.16                              | 10.06                             | 24.00                   | -13.94                  |
| Mid     | 5200               | 7.01                              | 6.95                              | 9.99                              | 24.00                   | -14.01                  |
| High    | 5240               | 7.20                              | 7.12                              | 10.17                             | 24.00                   | -13.83                  |

#### PSD Results

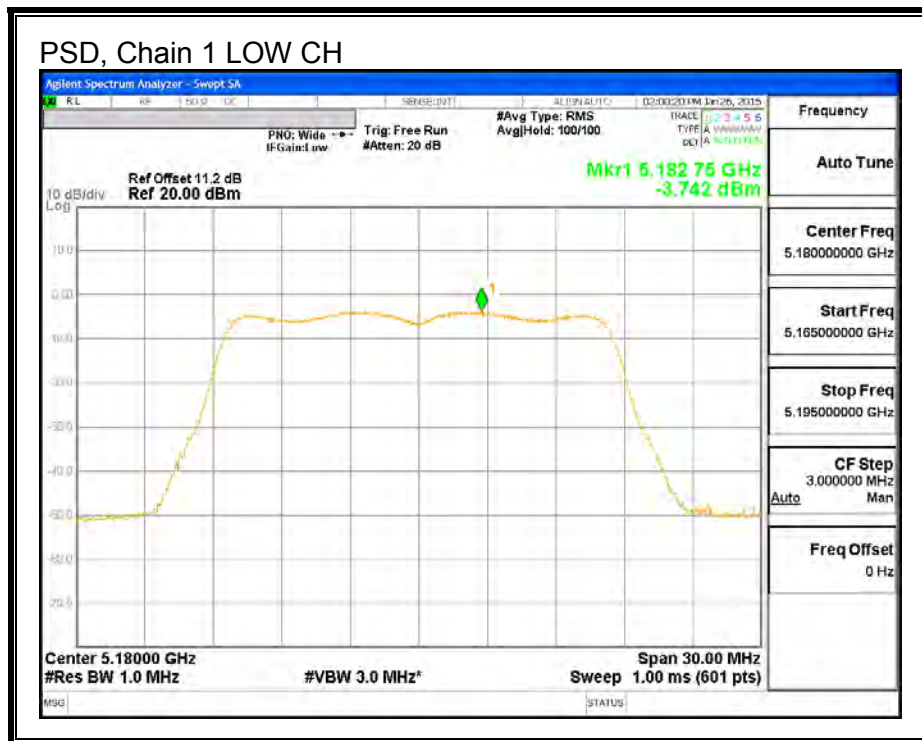
| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>PSD<br>(dBm) | Chain 1<br>Meas<br>PSD<br>(dBm) | Total<br>Corr'd<br>PSD<br>(dBm) | PSD<br>Limit<br>(dBm) | PSD<br>Margin<br>(dB) |
|---------|--------------------|---------------------------------|---------------------------------|---------------------------------|-----------------------|-----------------------|
| Low     | 5180               | -3.598                          | -3.742                          | -0.66                           | 11.00                 | -11.66                |
| Mid     | 5200               | -3.651                          | -4.103                          | -0.86                           | 11.00                 | -11.86                |
| High    | 5240               | -3.577                          | -4.351                          | -0.94                           | 11.00                 | -11.94                |

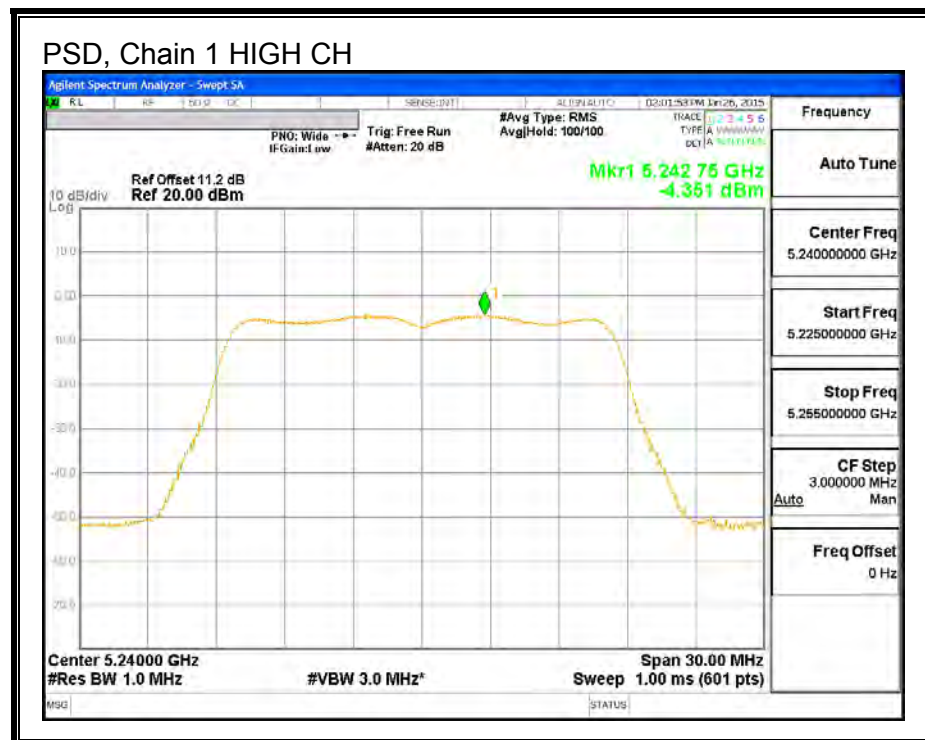
PSD, Chain 0





**PSD, Chain 1**





## 9.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

### 9.2.1. 26 dB BANDWIDTH

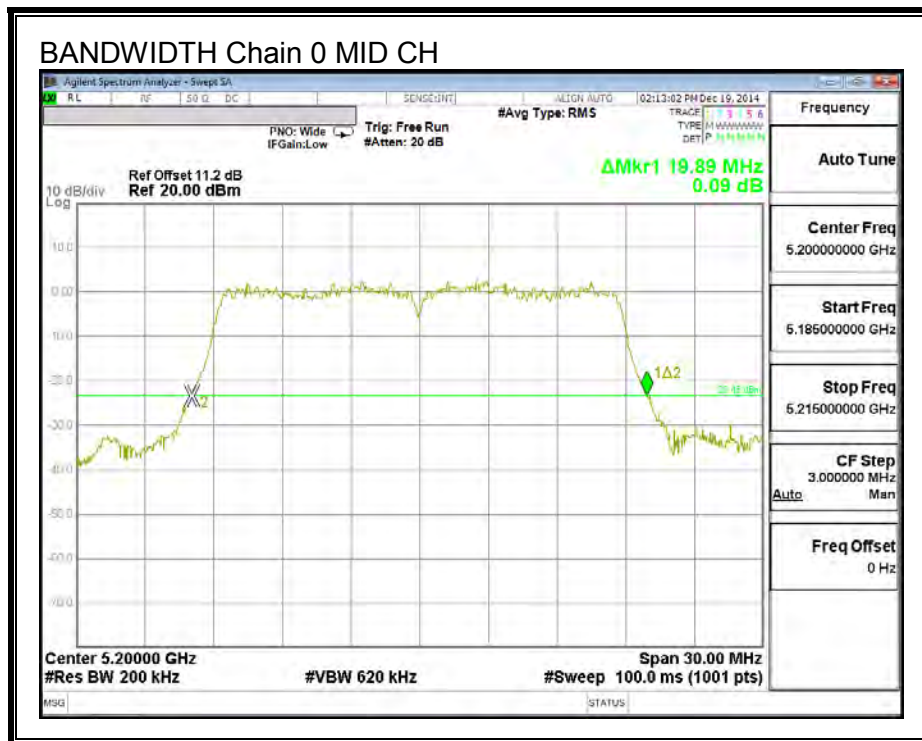
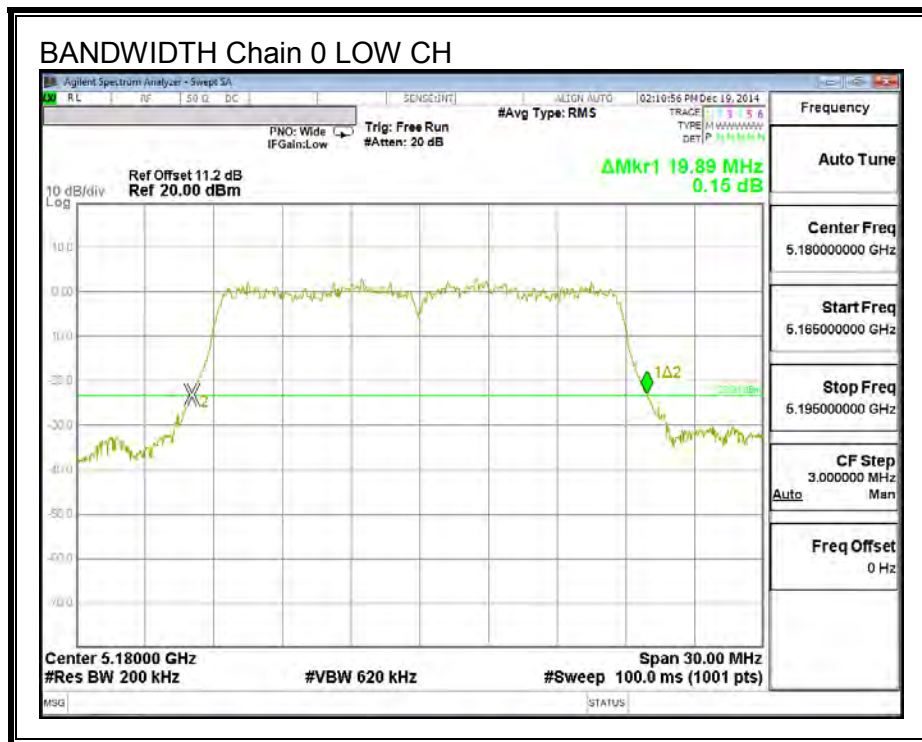
#### LIMITS

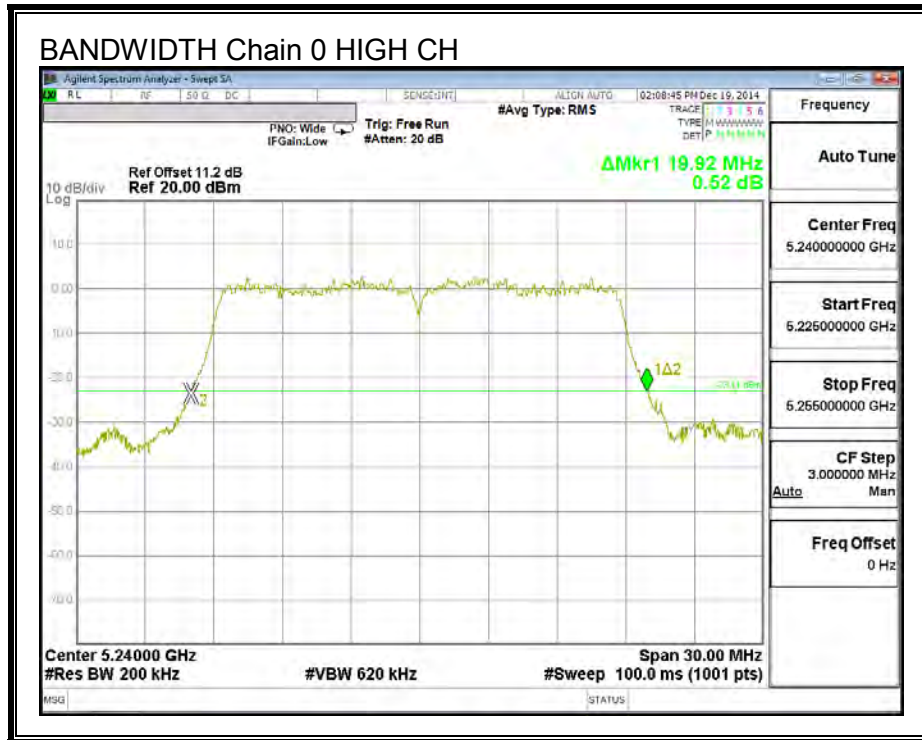
None; for reporting purposes only.

#### RESULTS

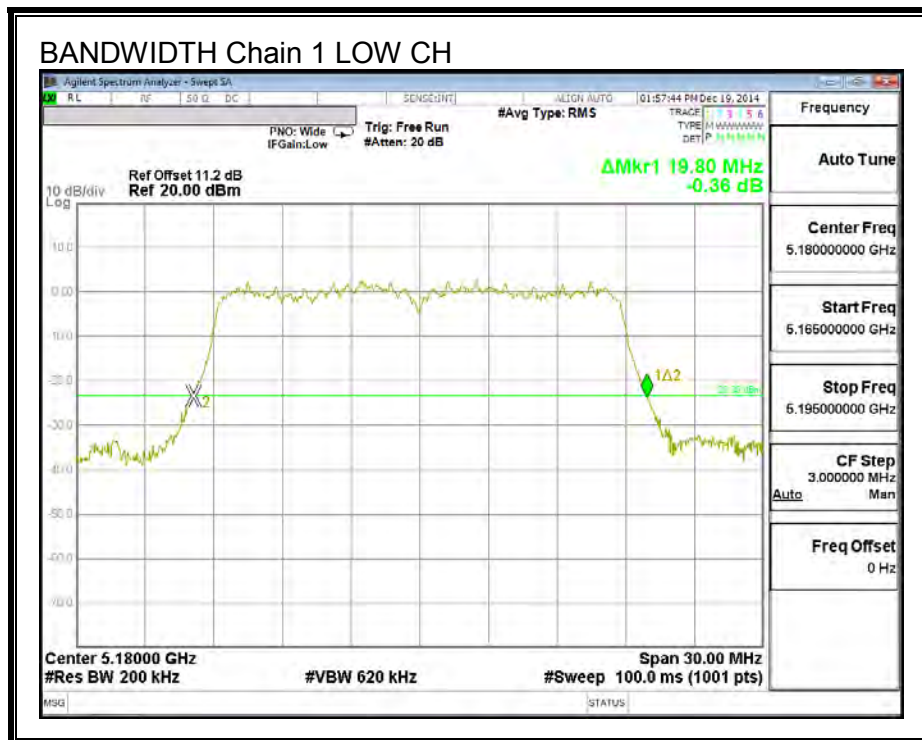
| Channel | Frequency<br>(MHz) | 26 dB BW<br>Chain 0<br>(MHz) | 26 dB BW<br>Chain 1<br>(MHz) |
|---------|--------------------|------------------------------|------------------------------|
| Low     | 5180               | 19.89                        | 19.80                        |
| Mid     | 5200               | 19.89                        | 19.80                        |
| High    | 5240               | 19.92                        | 19.80                        |

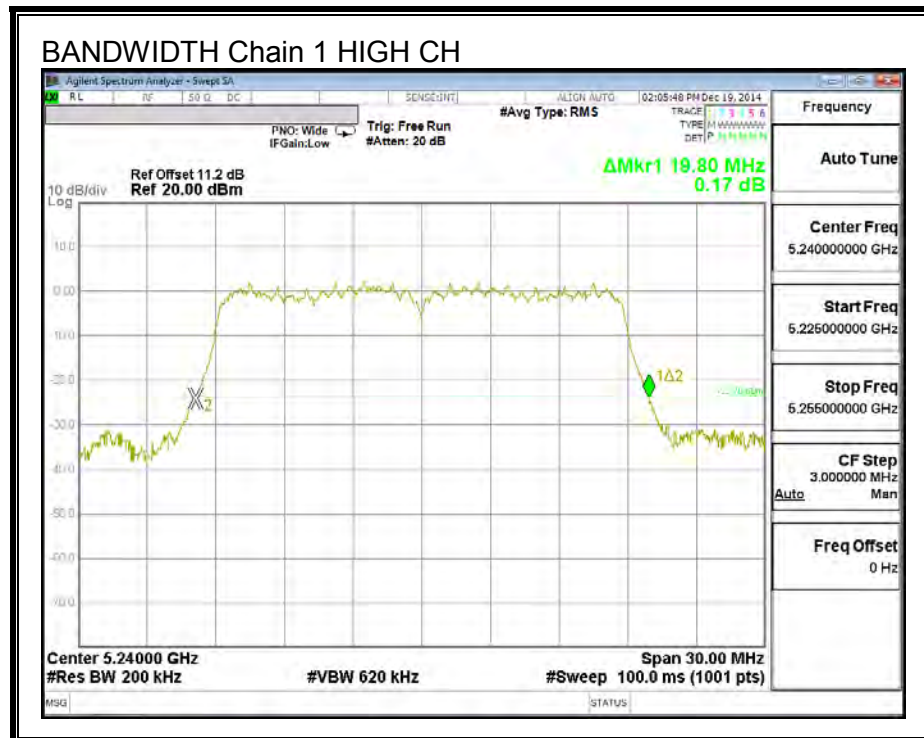
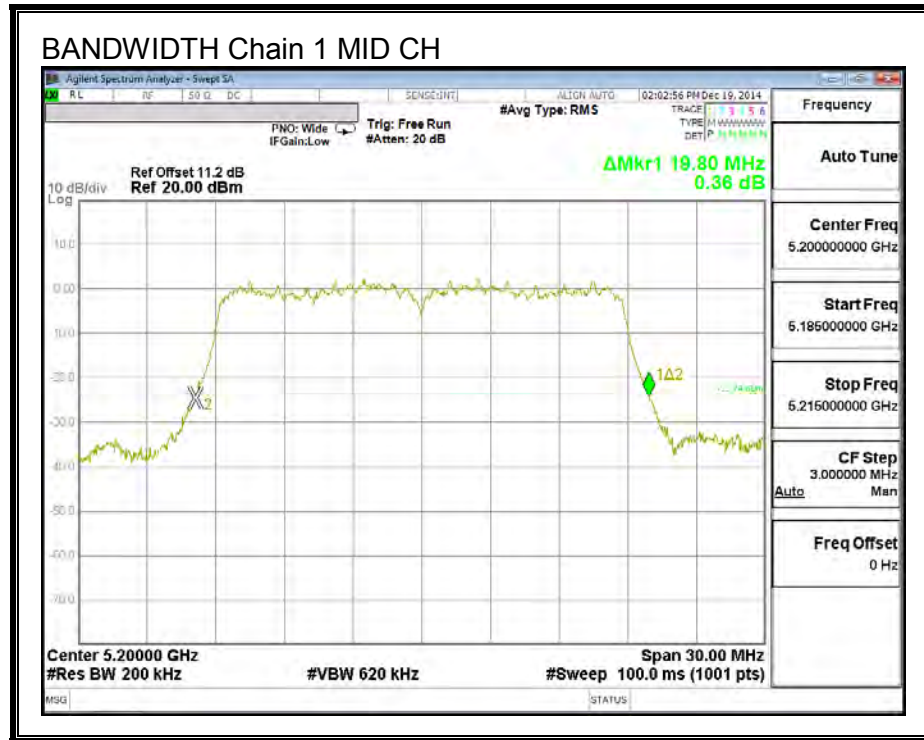
**26 dB BANDWIDTH, Chain 0**





**26 dB BANDWIDTH, Chain 1**





## 9.2.2. 99% BANDWIDTH

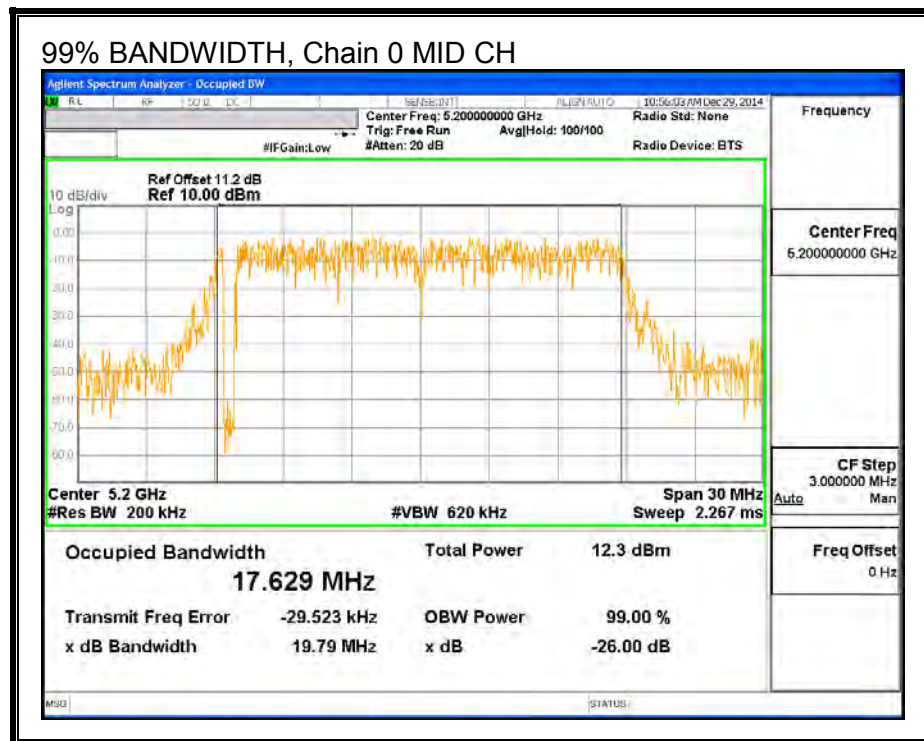
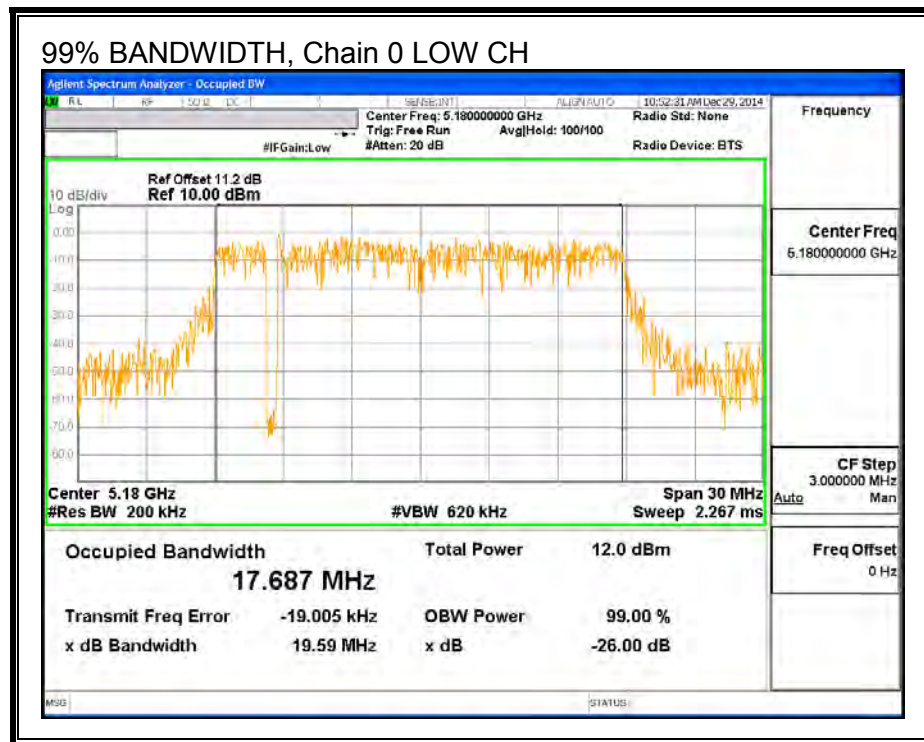
### LIMITS

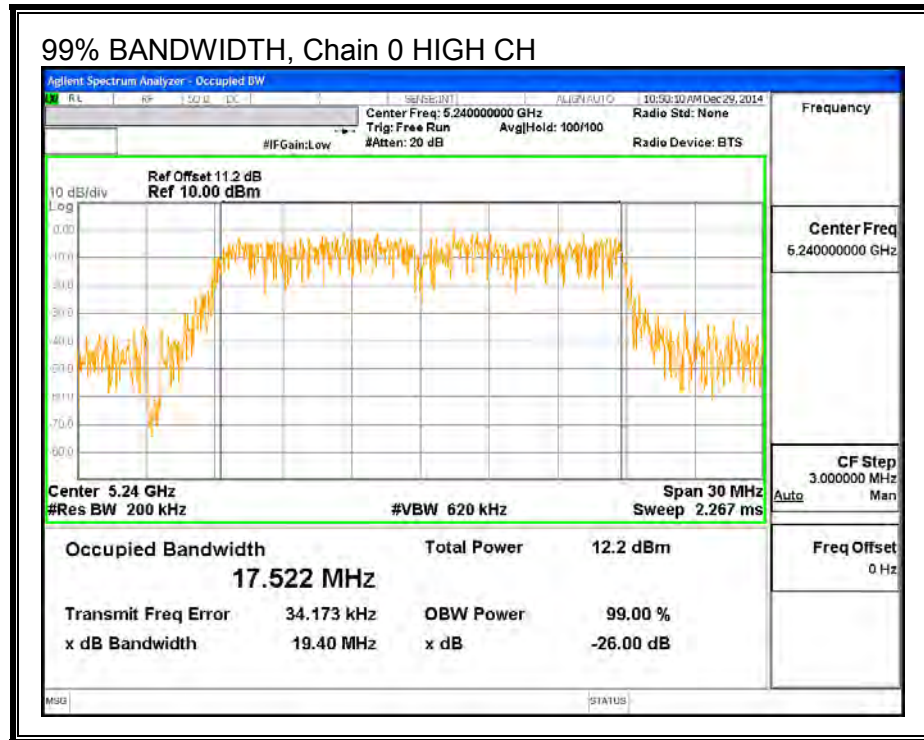
None; for reporting purposes only.

### RESULTS

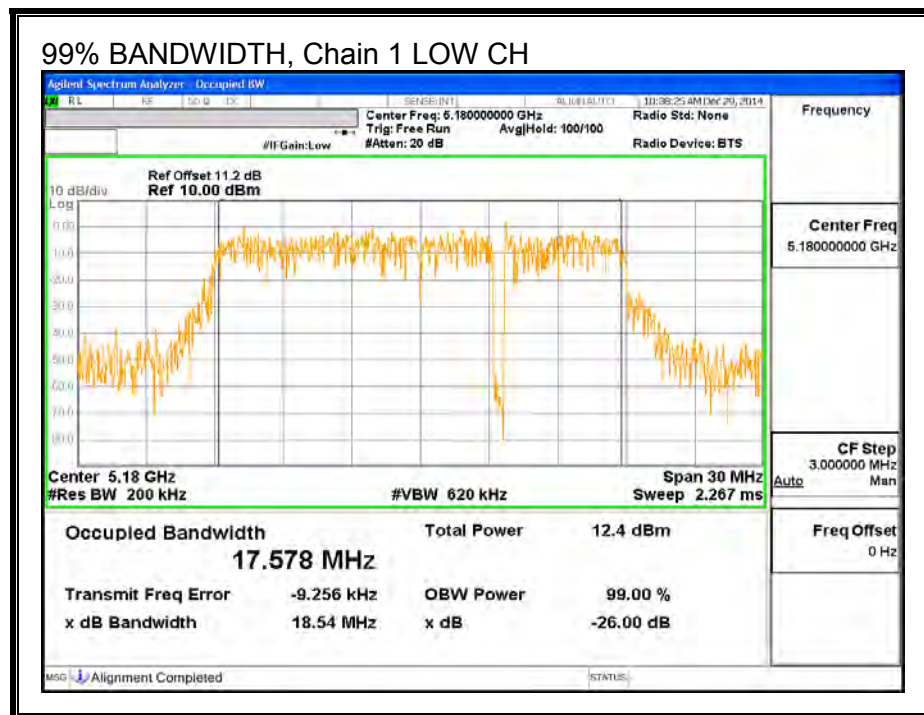
| Channel | Frequency<br>(MHz) | 99% BW<br>Chain 0<br>(MHz) | 99% BW<br>Chain 1<br>(MHz) |
|---------|--------------------|----------------------------|----------------------------|
| Low     | 5180               | 17.687                     | 17.578                     |
| Mid     | 5200               | 17.629                     | 17.501                     |
| High    | 5240               | 17.522                     | 17.517                     |

**99% BANDWIDTH, Chain 0**

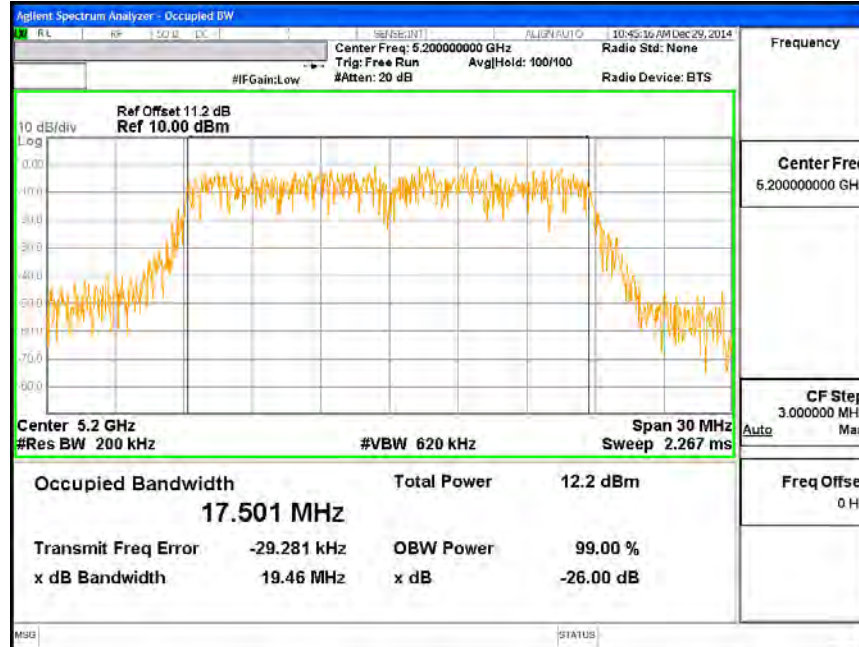




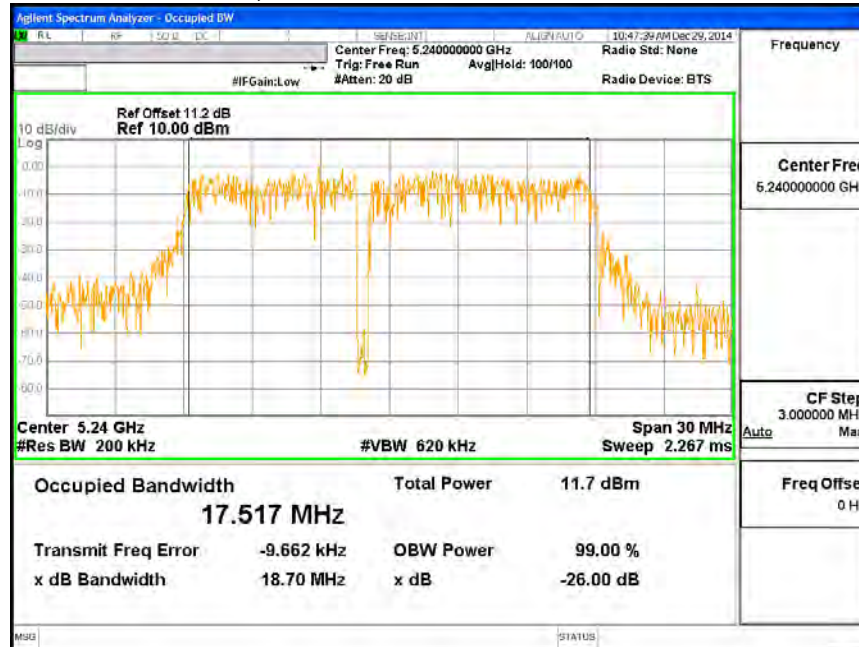
99% BANDWIDTH, Chain 1



99% BANDWIDTH, Chain 1 MID CH



99% BANDWIDTH, Chain 1 HIGH CH



### 9.2.3. OUTPUT POWER AND PSD

#### LIMITS

FCC §15.407 (a) (1)

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

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

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

(iv) 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.

# DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|-----------------------------------------------------|
| 3.1                                 | 3.6                                 | 3.36                                                |

## RESULTS

### Antenna Gain and Limits

| Channel | Frequency<br>(MHz) | Directional<br>Gain<br>for Power<br>(dBi) | Directional<br>Gain<br>for PSD<br>(dBi) | Power<br>Limit<br>(dBm) | PSD<br>Limit<br>(dBm) |
|---------|--------------------|-------------------------------------------|-----------------------------------------|-------------------------|-----------------------|
| Low     | 5180               | 3.36                                      | 3.36                                    | 24.00                   | 11.00                 |
| Mid     | 5200               | 3.36                                      | 3.36                                    | 24.00                   | 11.00                 |
| High    | 5240               | 3.36                                      | 3.36                                    | 24.00                   | 11.00                 |

|                    |      |                                                |
|--------------------|------|------------------------------------------------|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PSD |
|--------------------|------|------------------------------------------------|

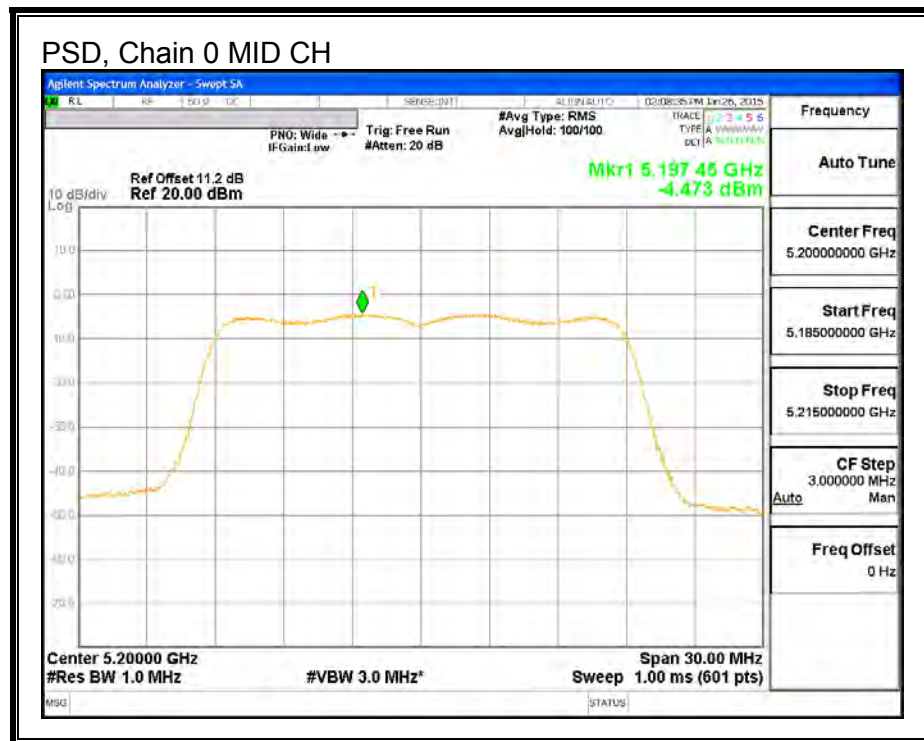
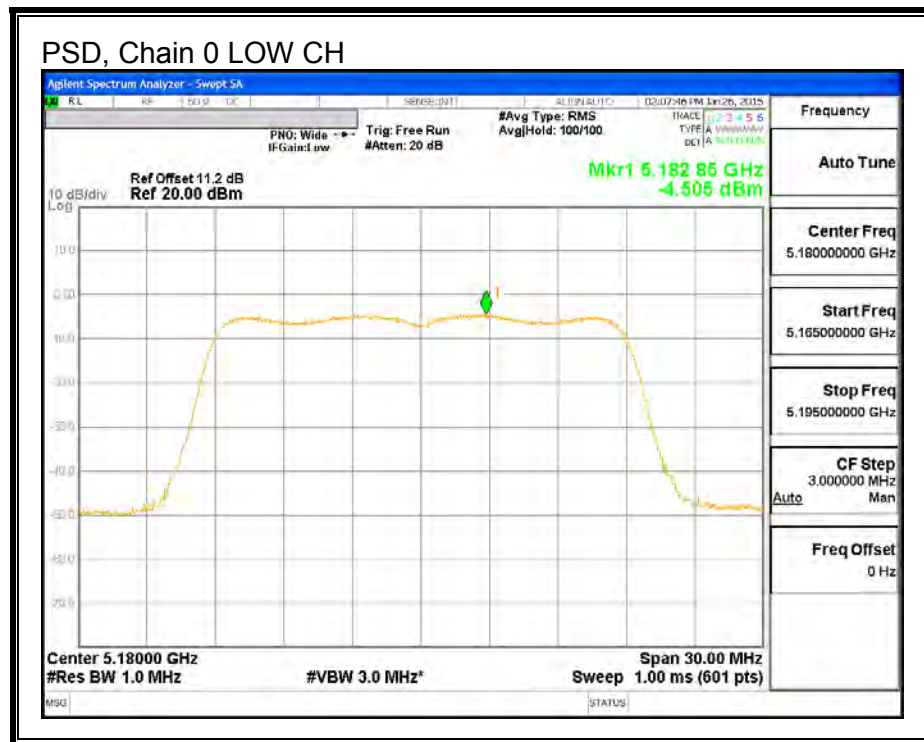
### Output Power Results

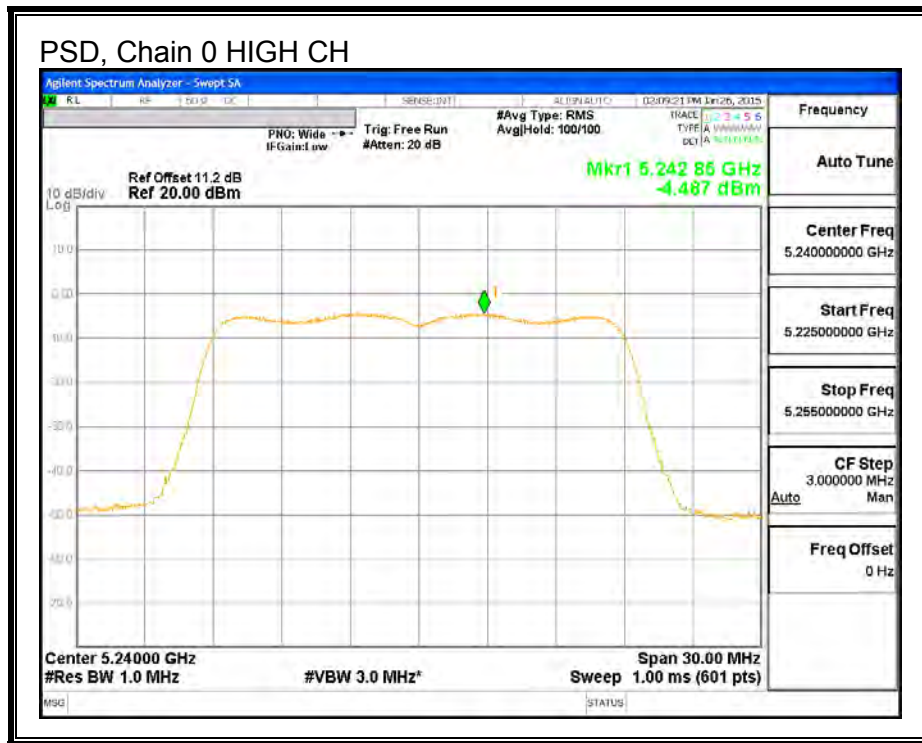
| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5180               | 6.90                              | 6.98                              | 9.95                              | 24.00                   | -14.05                  |
| Mid     | 5200               | 6.83                              | 7.08                              | 9.97                              | 24.00                   | -14.03                  |
| High    | 5240               | 6.90                              | 7.07                              | 10.00                             | 24.00                   | -14.00                  |

### PSD Results

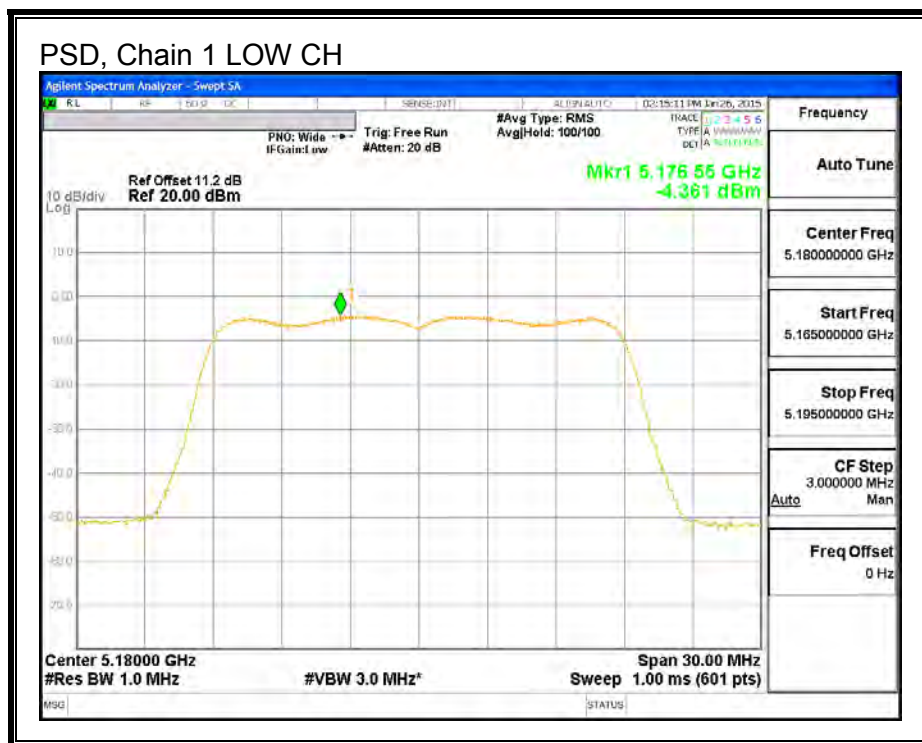
| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>PSD<br>(dBm) | Chain 1<br>Meas<br>PSD<br>(dBm) | Total<br>Corr'd<br>PSD<br>(dBm) | PSD<br>Limit<br>(dBm) | PSD<br>Margin<br>(dB) |
|---------|--------------------|---------------------------------|---------------------------------|---------------------------------|-----------------------|-----------------------|
| Low     | 5180               | -4.505                          | -4.361                          | -1.42                           | 11.00                 | -12.42                |
| Mid     | 5200               | -4.473                          | -4.082                          | -1.26                           | 11.00                 | -12.26                |
| High    | 5240               | -4.487                          | -4.551                          | -1.51                           | 11.00                 | -12.51                |

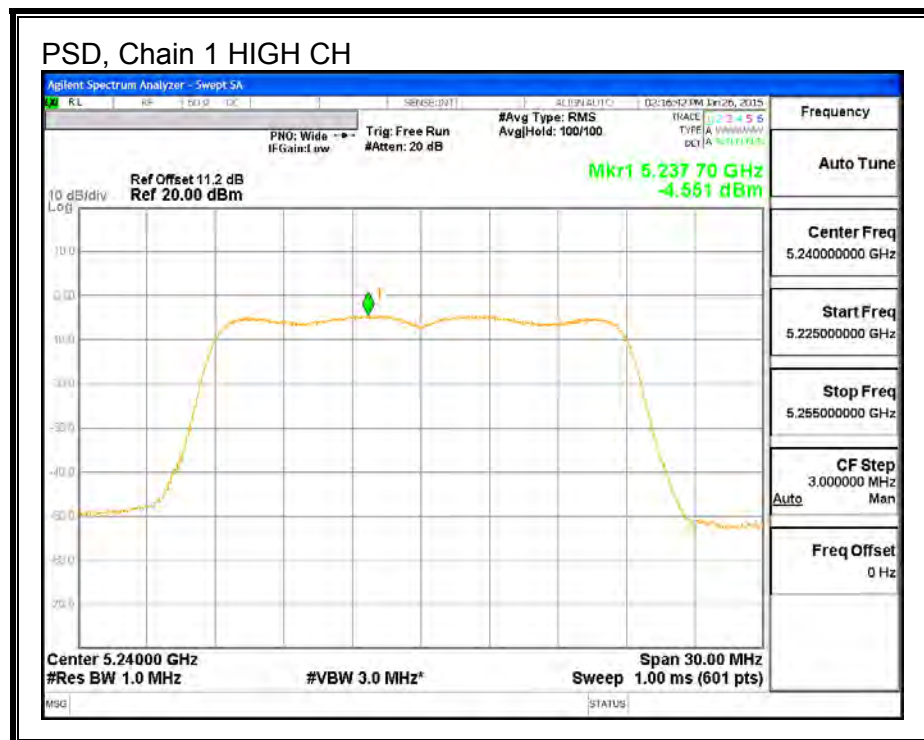
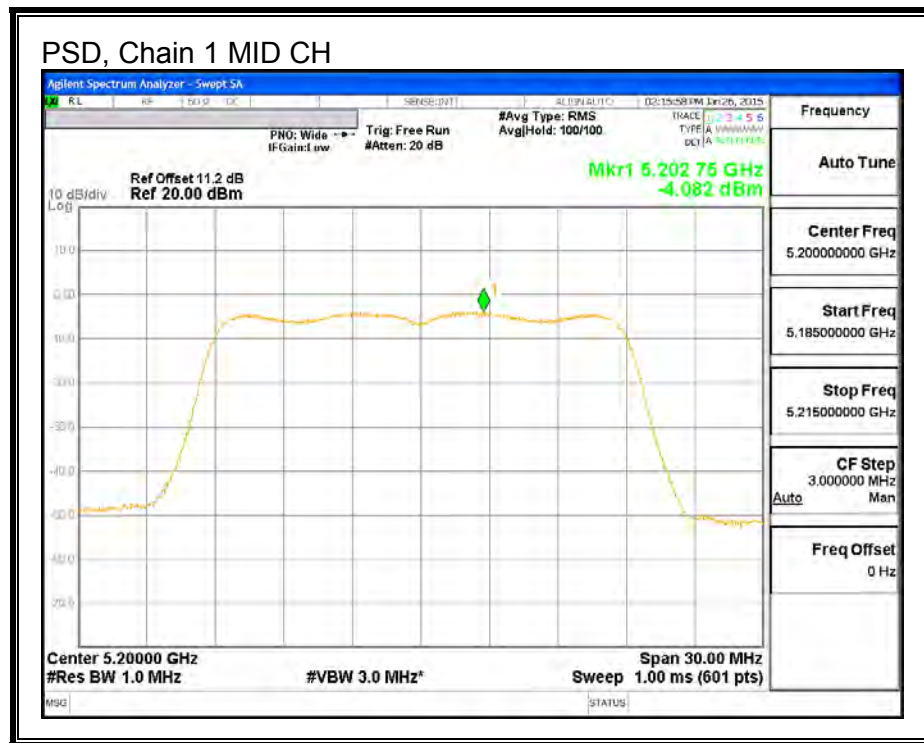
PSD, Chain 0





**PSD, Chain 1**





### 9.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

#### 9.3.1. 26 dB BANDWIDTH

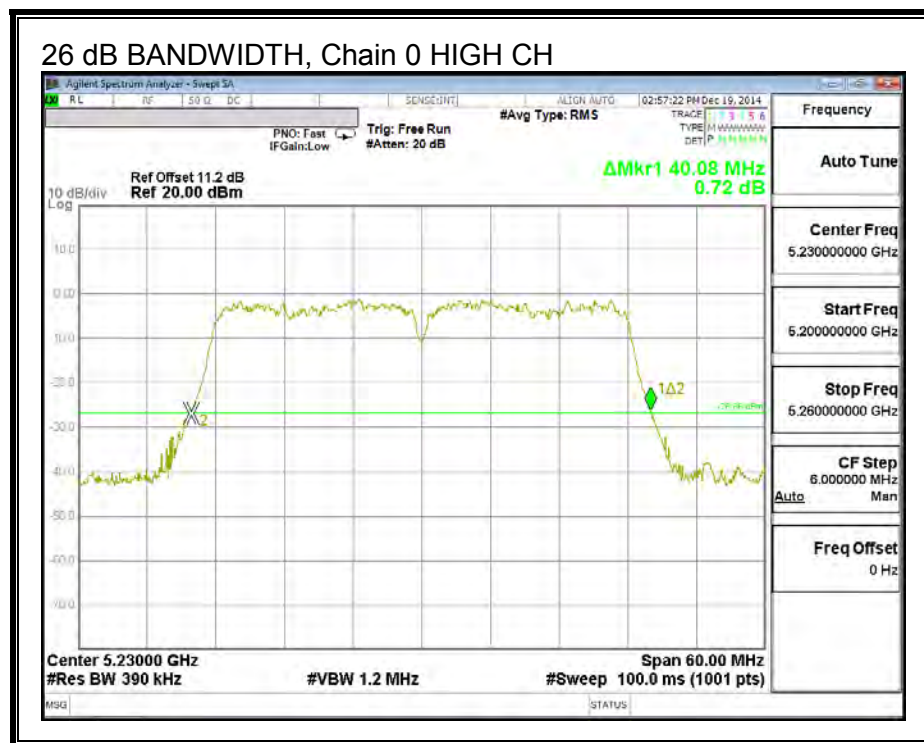
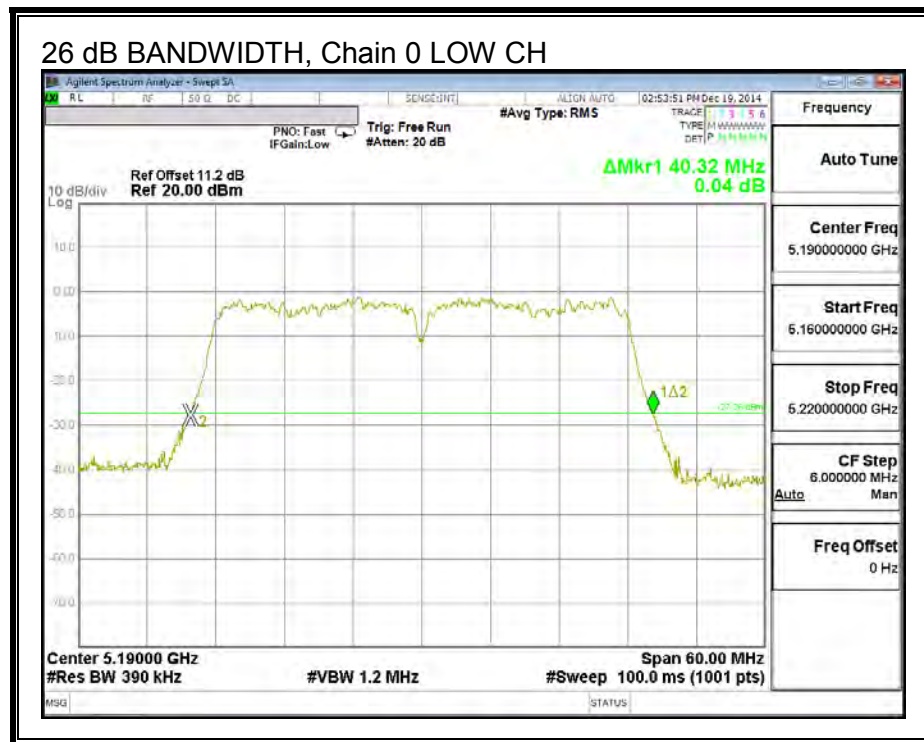
##### LIMITS

None; for reporting purposes only.

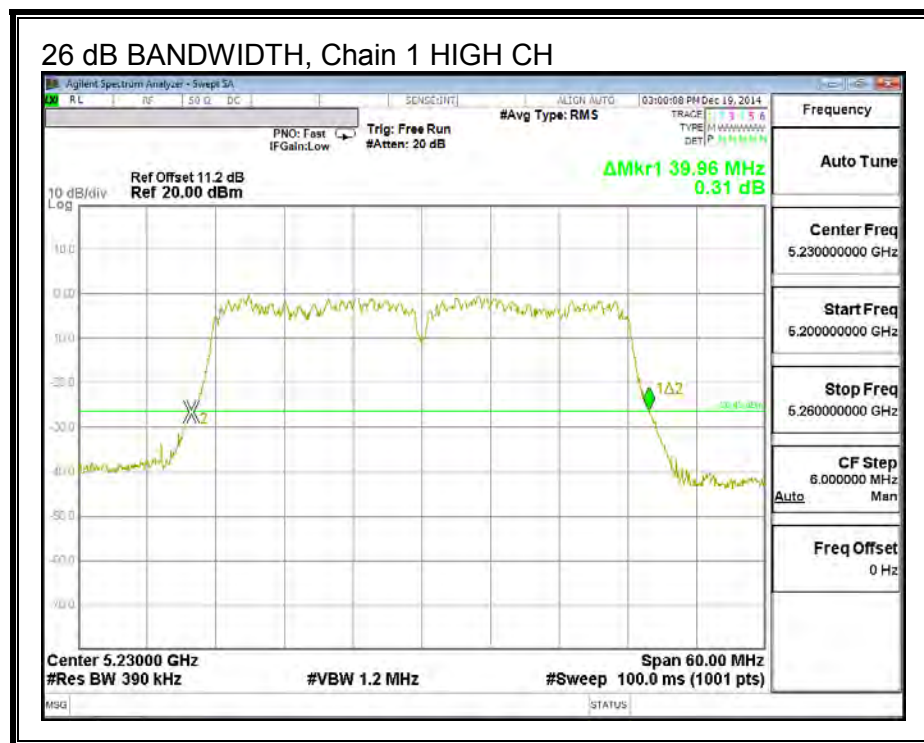
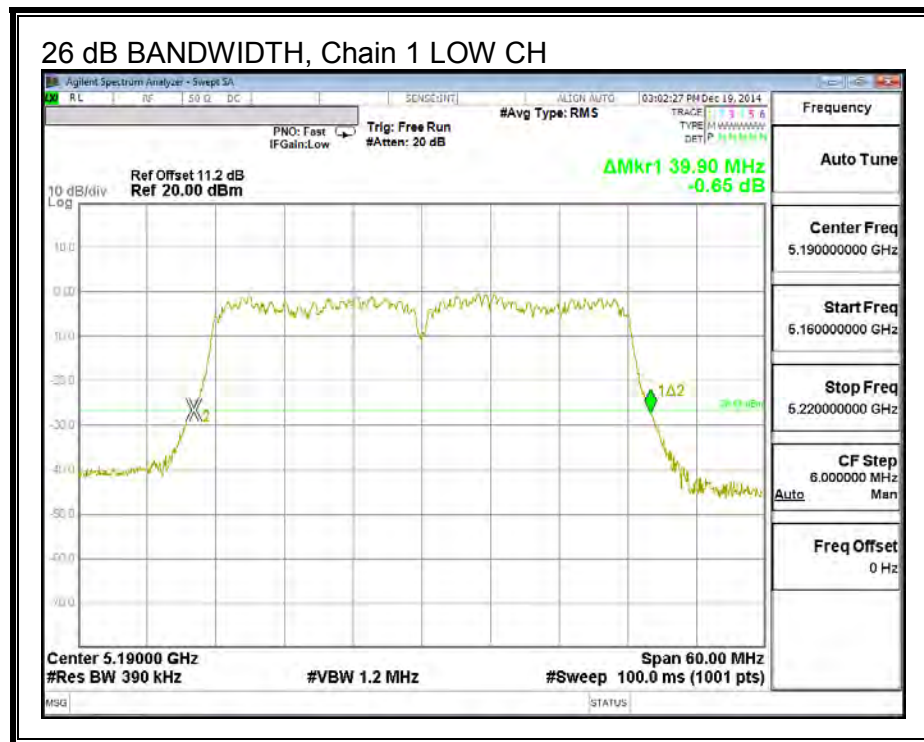
##### RESULTS

| Channel | Frequency<br>(MHz) | 26 dB BW<br>Chain 0<br>(MHz) | 26 dB BW<br>Chain 1<br>(MHz) |
|---------|--------------------|------------------------------|------------------------------|
| Low     | 5190               | 40.32                        | 39.90                        |
| High    | 5230               | 40.08                        | 39.96                        |

**26 dB BANDWIDTH, Chain 0**



**26 dB BANDWIDTH, Chain 1**



### 9.3.2. 99% BANDWIDTH

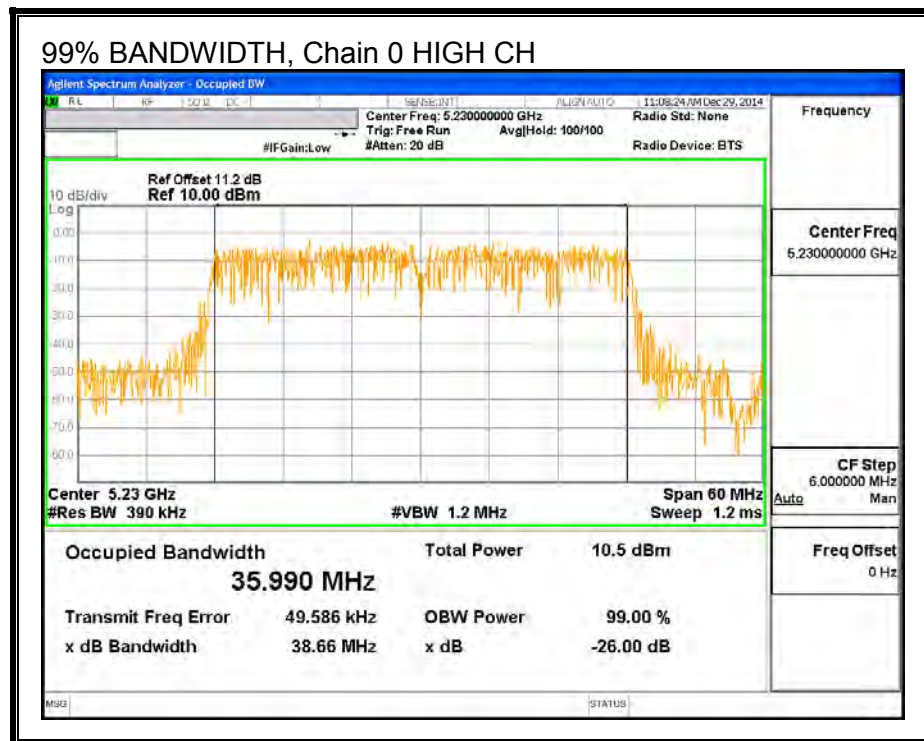
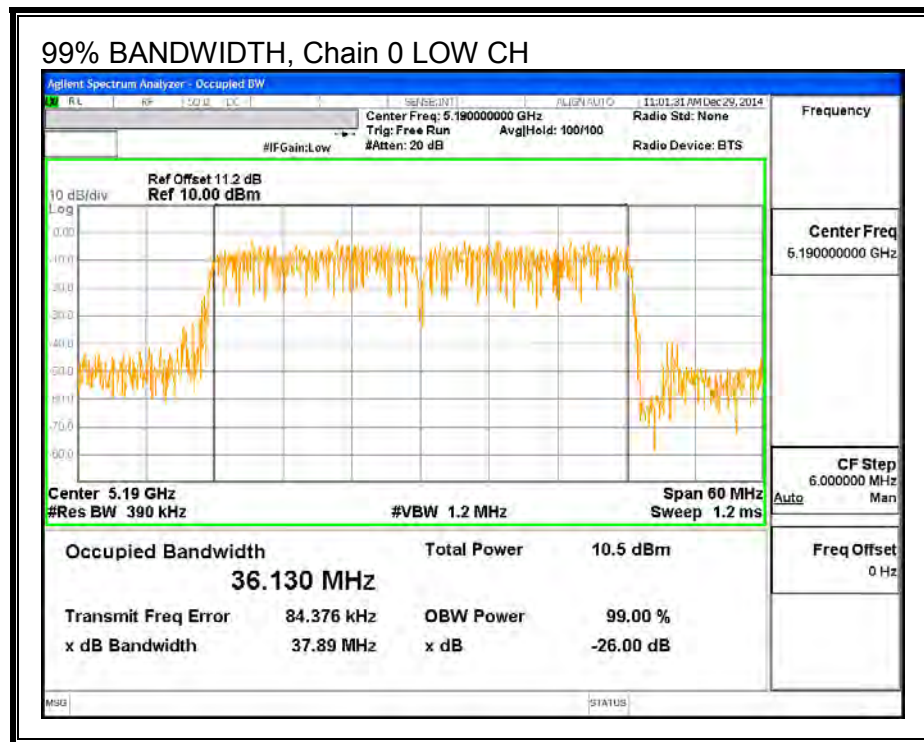
#### LIMITS

None; for reporting purposes only.

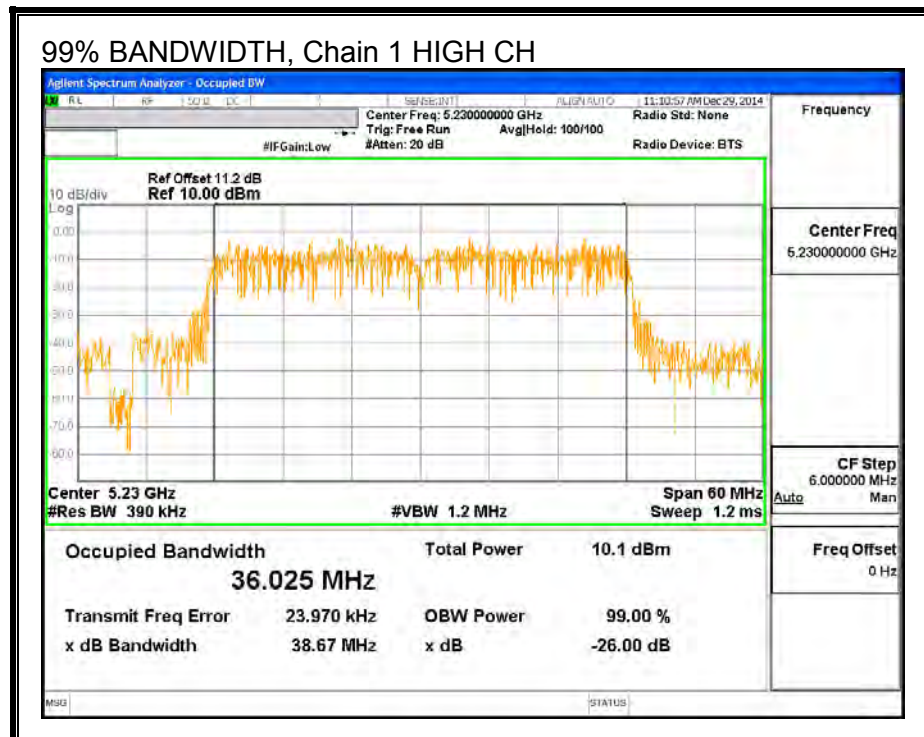
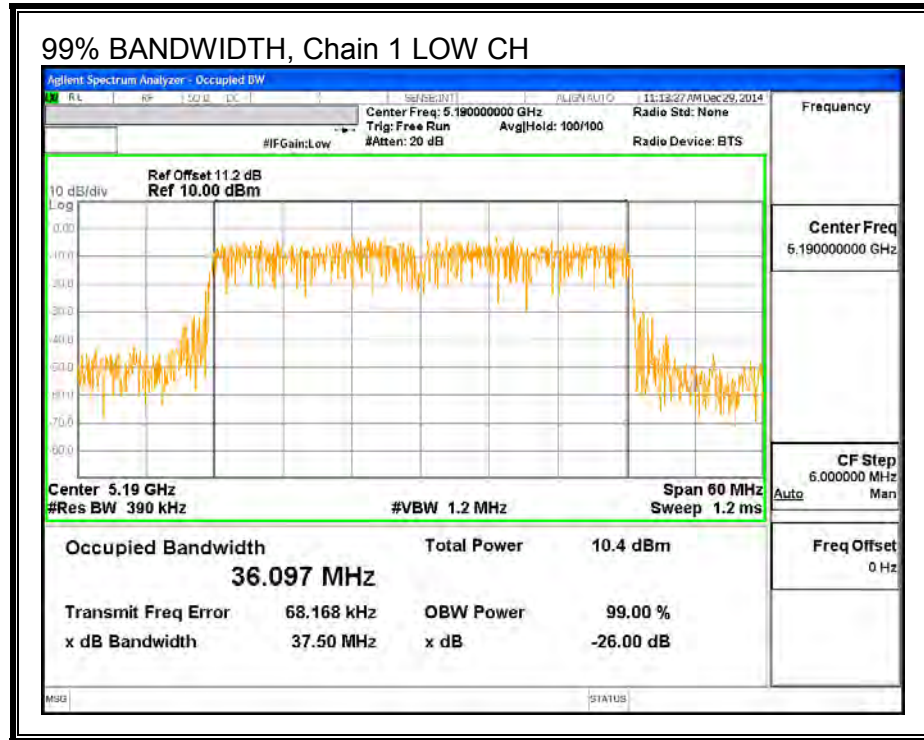
#### RESULTS

| Channel | Frequency<br>(MHz) | 99% BW<br>Chain 0<br>(MHz) | 99% BW<br>Chain 1<br>(MHz) |
|---------|--------------------|----------------------------|----------------------------|
| Low     | 5190               | 36.130                     | 36.097                     |
| High    | 5230               | 35.990                     | 36.025                     |

**99% BANDWIDTH, Chain 0**



**99% BANDWIDTH, Chain 1**



### 9.3.3. OUTPUT POWER AND PSD

#### LIMITS

FCC §15.407 (a) (1)

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

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

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

(iv) 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.

# DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|-----------------------------------------------------|
| 3.1                                 | 3.6                                 | 3.36                                                |

## RESULTS

### Antenna Gain and Limits

| Channel | Frequency<br>(MHz) | Directional<br>Gain<br>for Power<br>(dBi) | Directional<br>Gain<br>for PSD<br>(dBi) | Power<br>Limit<br>(dBm) | PSD<br>Limit<br>(dBm) |
|---------|--------------------|-------------------------------------------|-----------------------------------------|-------------------------|-----------------------|
| Low     | 5190               | 3.36                                      | 3.36                                    | 24.00                   | 11.00                 |
| High    | 5230               | 3.36                                      | 3.36                                    | 24.00                   | 11.00                 |

|                    |      |                                                |
|--------------------|------|------------------------------------------------|
| Duty Cycle CF (dB) | 0.13 | Included in Calculations of Corr'd Power & PSD |
|--------------------|------|------------------------------------------------|

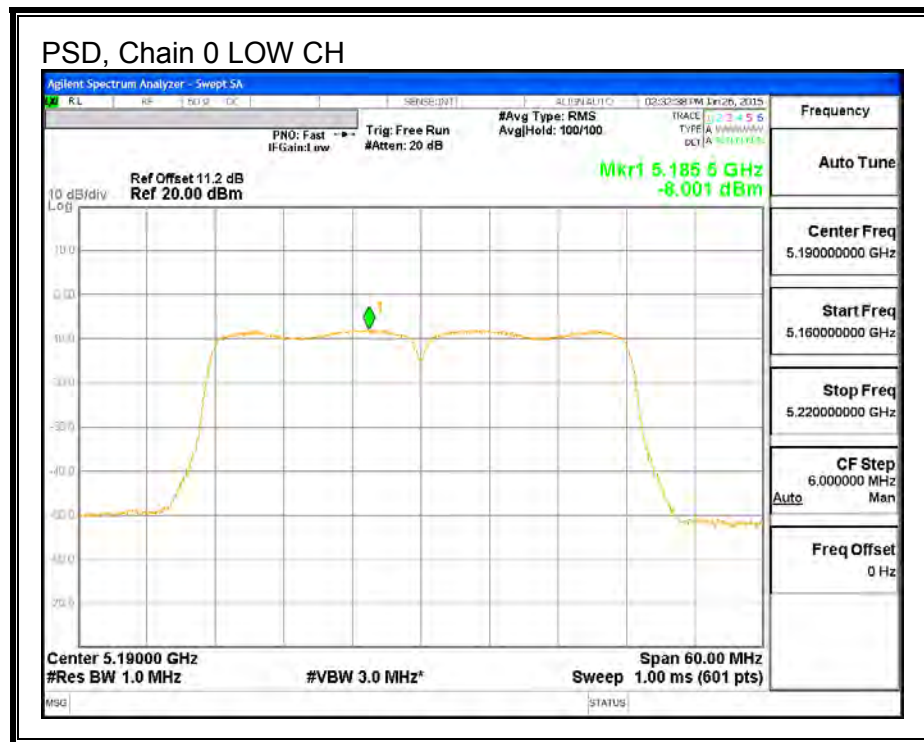
### Output Power Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5190               | 7.060                             | 7.200                             | 10.27                             | 24.00                   | -13.73                  |
| High    | 5230               | 7.280                             | 6.920                             | 10.24                             | 24.00                   | -13.76                  |

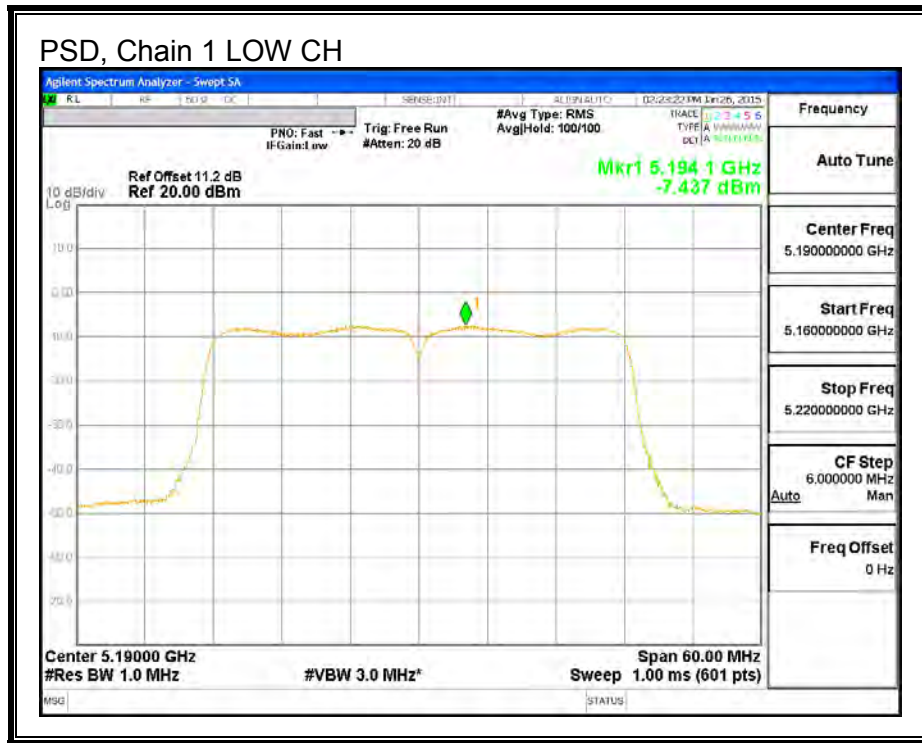
### PSD Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>PSD<br>(dBm) | Chain 1<br>Meas<br>PSD<br>(dBm) | Total<br>Corr'd<br>PSD<br>(dBm) | PSD<br>Limit<br>(dBm) | PSD<br>Margin<br>(dB) |
|---------|--------------------|---------------------------------|---------------------------------|---------------------------------|-----------------------|-----------------------|
| Low     | 5190               | -8.001                          | -7.437                          | -4.57                           | 11.00                 | -15.57                |
| High    | 5230               | -7.609                          | -7.880                          | -4.60                           | 11.00                 | -15.60                |

PSD, Chain 0



PSD, Chain 1



#### 9.4. 802.11ac VHT80MHz MODE IN THE 5.2 GHz BAND

##### 9.4.1. 26 dB BANDWIDTH

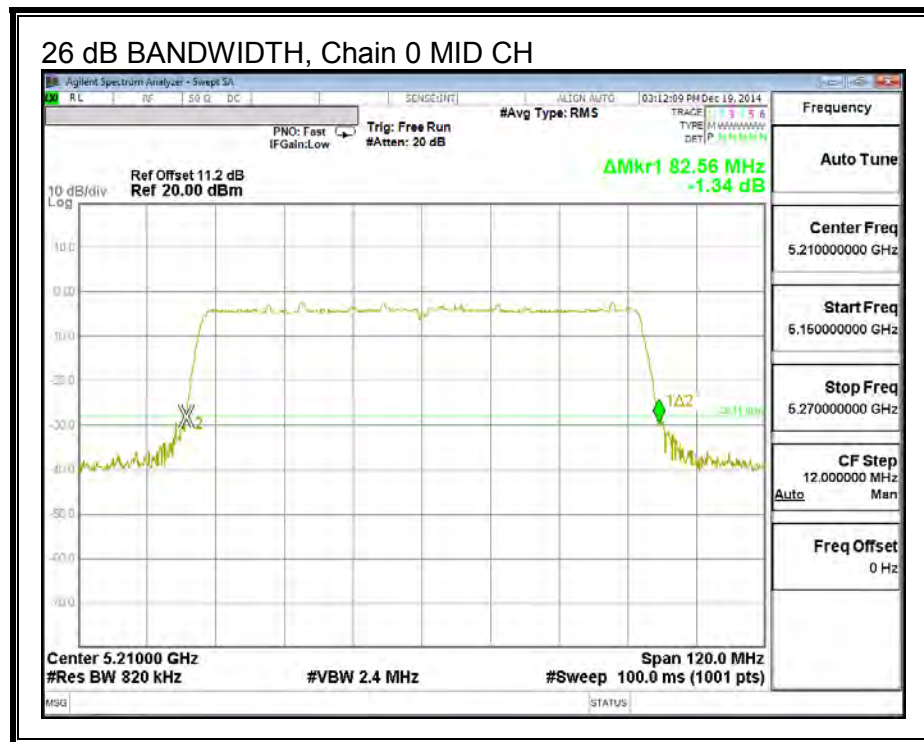
###### LIMITS

None; for reporting purposes only.

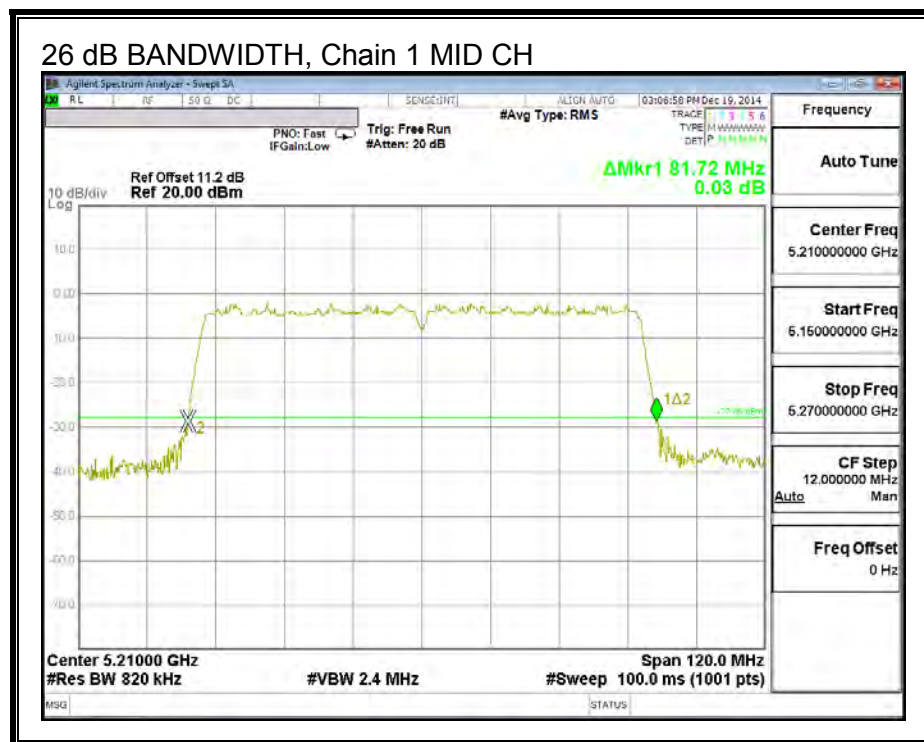
###### RESULTS

| Channel | Frequency<br>(MHz) | 26 dB BW<br>Chain 0<br>(MHz) | 26 dB BW<br>Chain 1<br>(MHz) |
|---------|--------------------|------------------------------|------------------------------|
| Mid     | 5210               | 82.56                        | 81.72                        |

**26 dB BANDWIDTH, Chain 0**



**26 dB BANDWIDTH, Chain 1**



#### 9.4.2. 99% BANDWIDTH

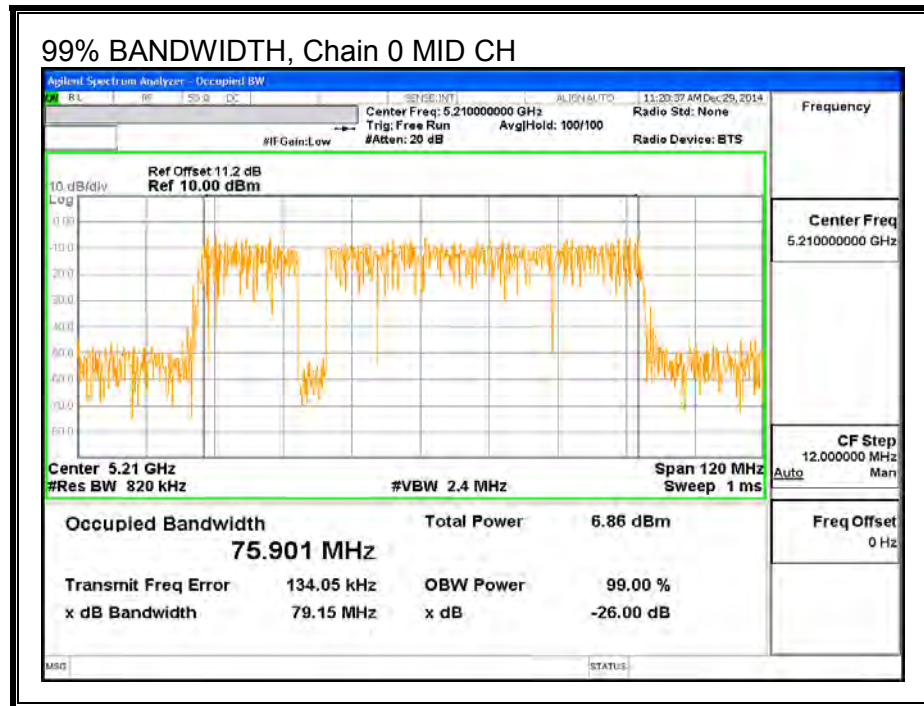
##### LIMITS

None; for reporting purposes only.

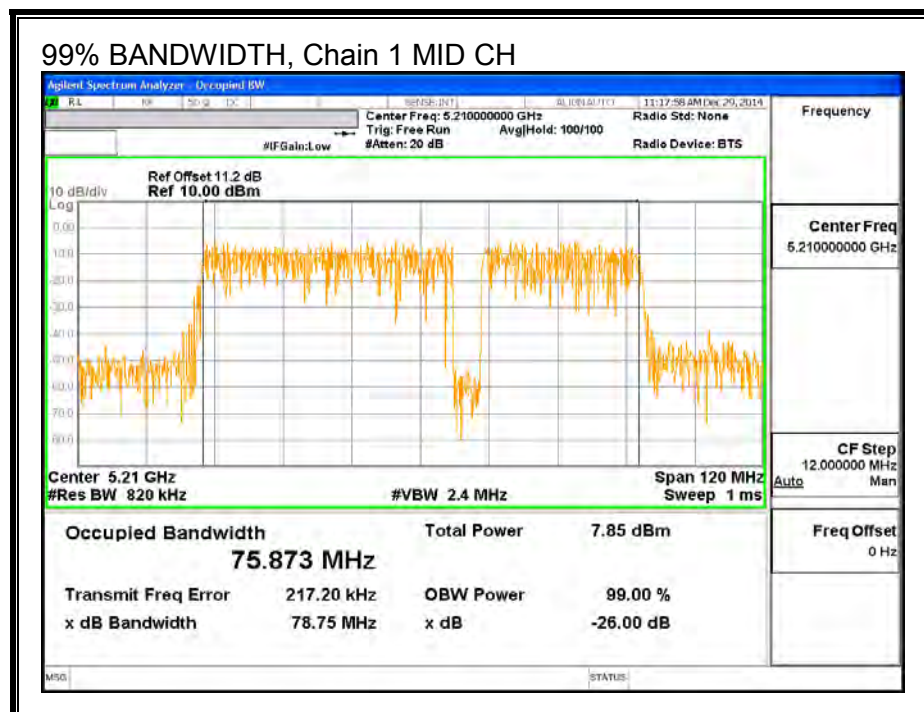
##### RESULTS

| Channel | Frequency<br>(MHz) | 99% BW<br>Chain 0<br>(MHz) | 99% BW<br>Chain 1<br>(MHz) |
|---------|--------------------|----------------------------|----------------------------|
| Mid     | 5210               | 75.901                     | 75.873                     |

**99% BANDWIDTH, Chain 0**



**99% BANDWIDTH, Chain 1**



### 9.4.3. OUTPUT POWER AND PSD

#### LIMITS

FCC §15.407 (a) (1)

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

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

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

(iv) 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.

# DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|-----------------------------------------------------|
| 3.1                                 | 3.6                                 | 3.36                                                |

## RESULTS

### Antenna Gain and Limits

| Channel | Frequency<br>(MHz) | Directional<br>Gain<br>for Power<br>(dBi) | Directional<br>Gain<br>for PSD<br>(dBi) | Power<br>Limit<br>(dBm) | PSD<br>Limit<br>(dBm) |
|---------|--------------------|-------------------------------------------|-----------------------------------------|-------------------------|-----------------------|
| Mid     | 5210               | 3.36                                      | 3.36                                    | 24.00                   | 11.00                 |

|                    |      |                                                |
|--------------------|------|------------------------------------------------|
| Duty Cycle CF (dB) | 0.26 | Included in Calculations of Corr'd Power & PSD |
|--------------------|------|------------------------------------------------|

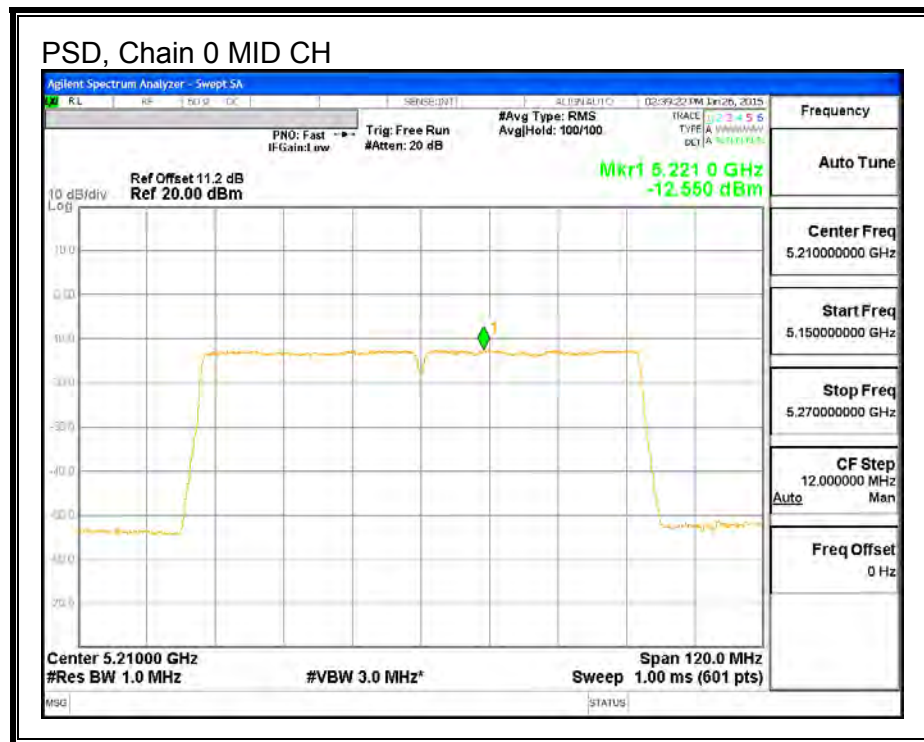
### Output Power Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Mid     | 5210               | 6.40                              | 6.12                              | 9.53                              | 24.00                   | -14.47                  |

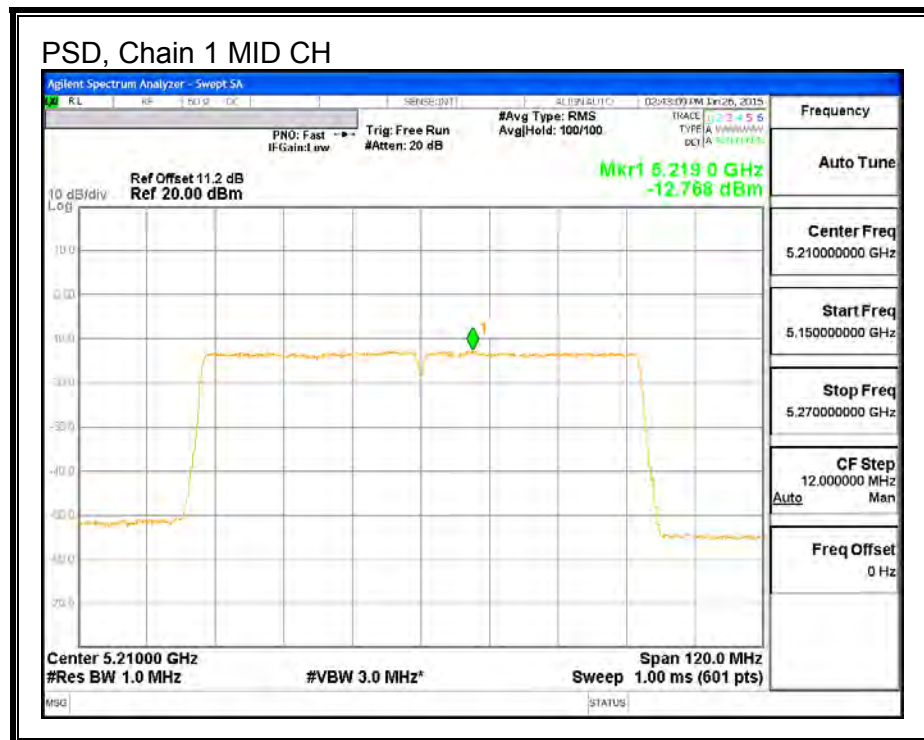
### PSD Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>PSD<br>(dBm) | Chain 1<br>Meas<br>PSD<br>(dBm) | Total<br>Corr'd<br>PSD<br>(dBm) | PSD<br>Limit<br>(dBm) | PSD<br>Margin<br>(dB) |
|---------|--------------------|---------------------------------|---------------------------------|---------------------------------|-----------------------|-----------------------|
| Mid     | 5210               | -12.550                         | -12.768                         | -9.39                           | 11.00                 | -20.39                |

PSD, Chain 0



PSD, Chain 1



## 9.5. 802.11a MODE IN THE 5.3 GHz BAND

### 9.5.1. 26 dB BANDWIDTH

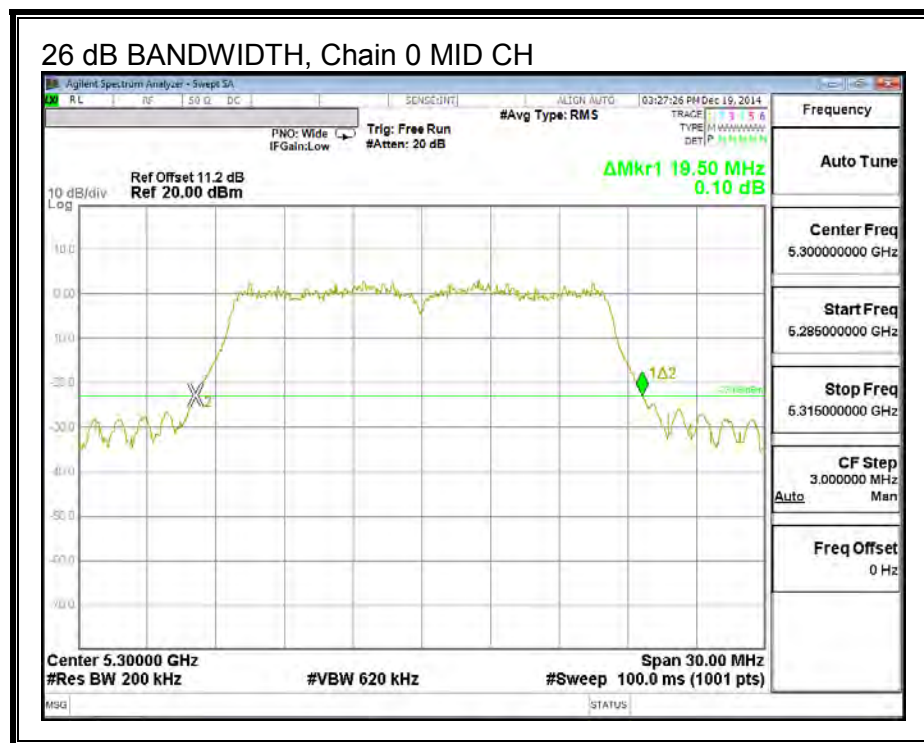
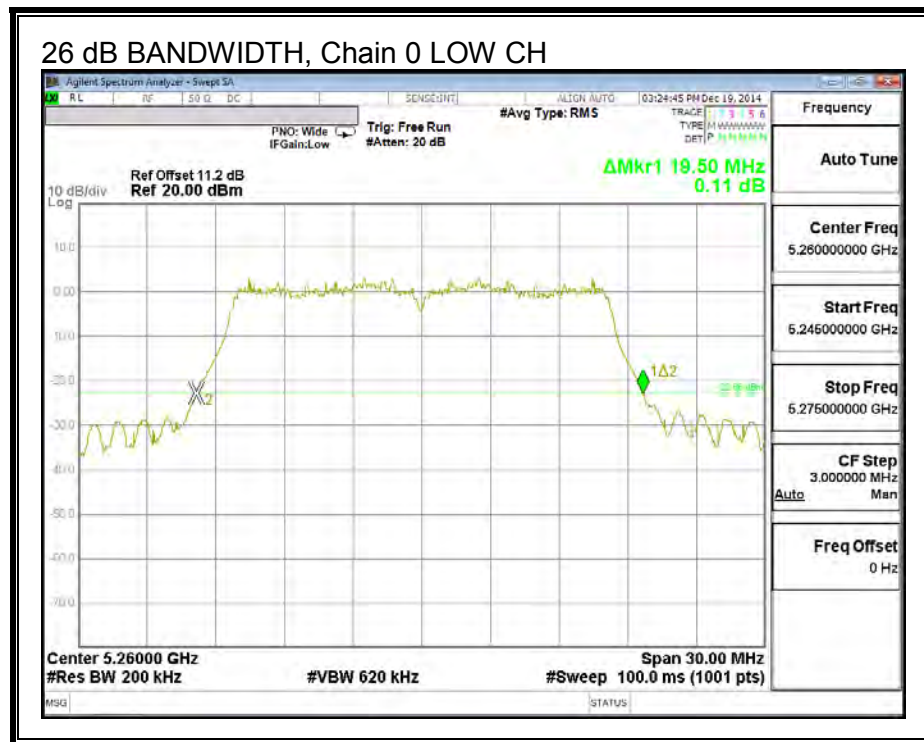
#### LIMITS

None; for reporting purposes only.

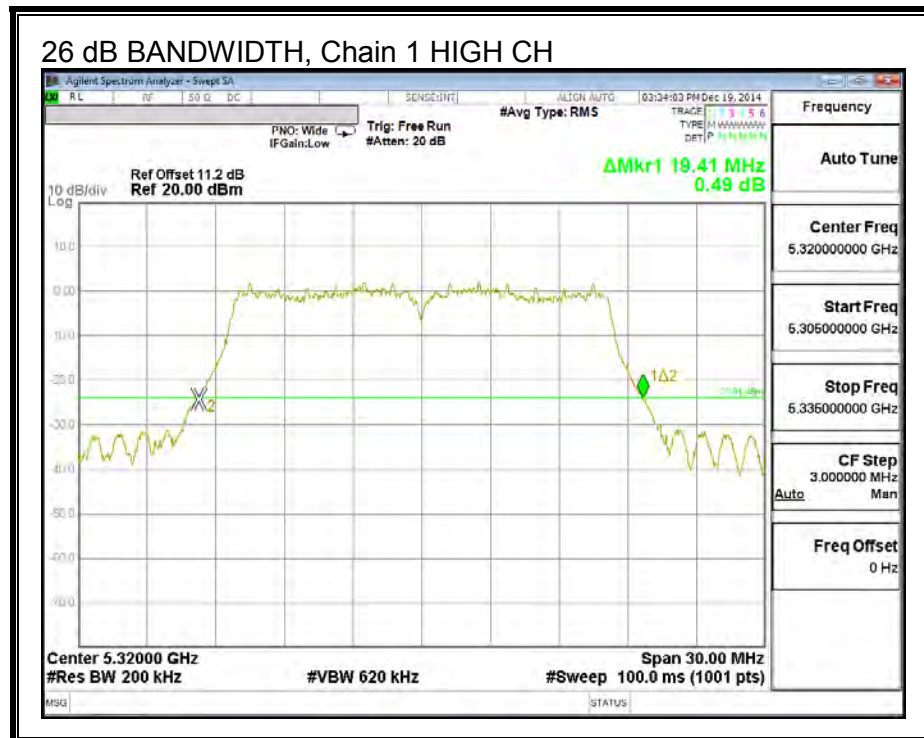
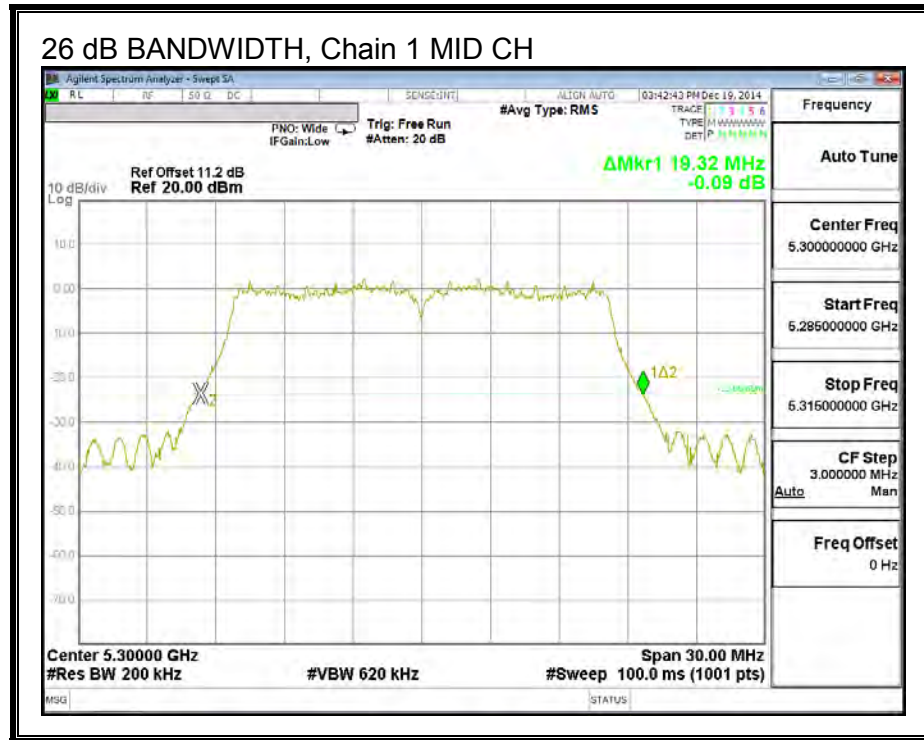
#### RESULTS

| Channel | Frequency<br>(MHz) | 26 dB BW<br>Chain 0<br>(MHz) | 26 dB BW<br>Chain 1<br>(MHz) |
|---------|--------------------|------------------------------|------------------------------|
| Low     | 5260               | 19.50                        | 19.38                        |
| Mid     | 5300               | 19.50                        | 19.32                        |
| High    | 5320               | 19.59                        | 19.41                        |

**26 dB BANDWIDTH, Chain 0**







## 9.5.2. 99% BANDWIDTH

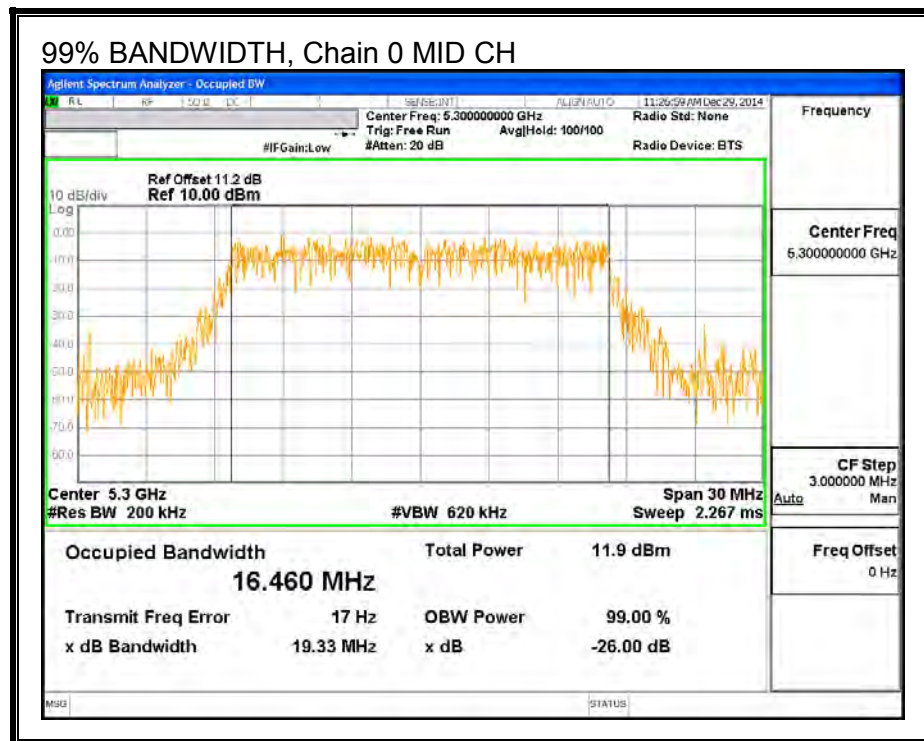
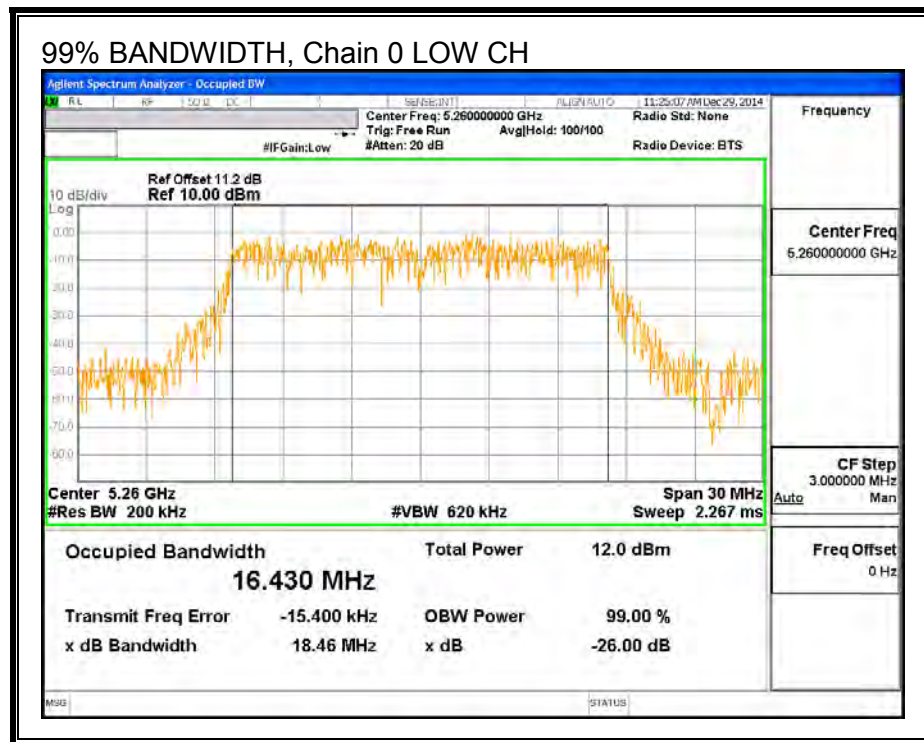
### LIMITS

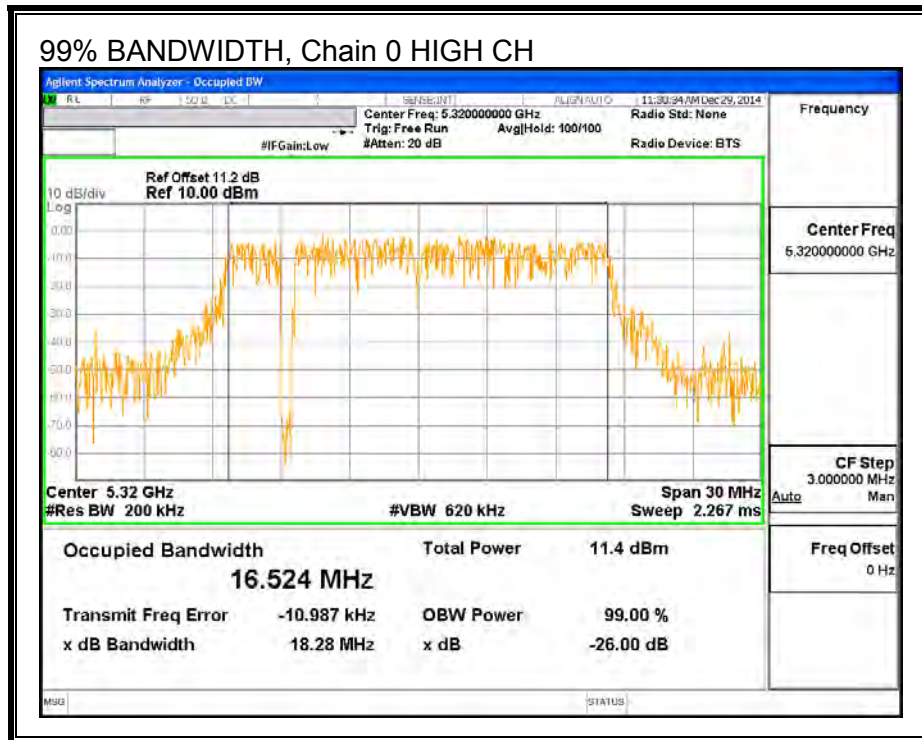
None; for reporting purposes only.

### RESULTS

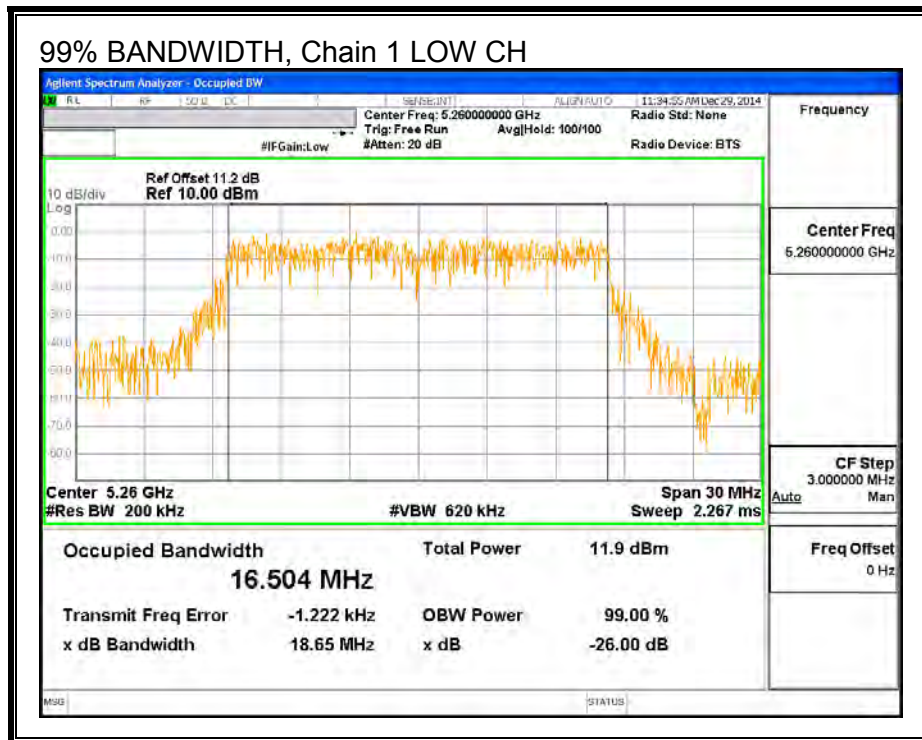
| Channel | Frequency<br>(MHz) | 99% BW<br>Chain 0<br>(MHz) | 99% BW<br>Chain 1<br>(MHz) |
|---------|--------------------|----------------------------|----------------------------|
| Low     | 5260               | 16.430                     | 16.504                     |
| Mid     | 5300               | 16.460                     | 16.522                     |
| High    | 5320               | 16.524                     | 16.370                     |

**99% BANDWIDTH, Chain 0**

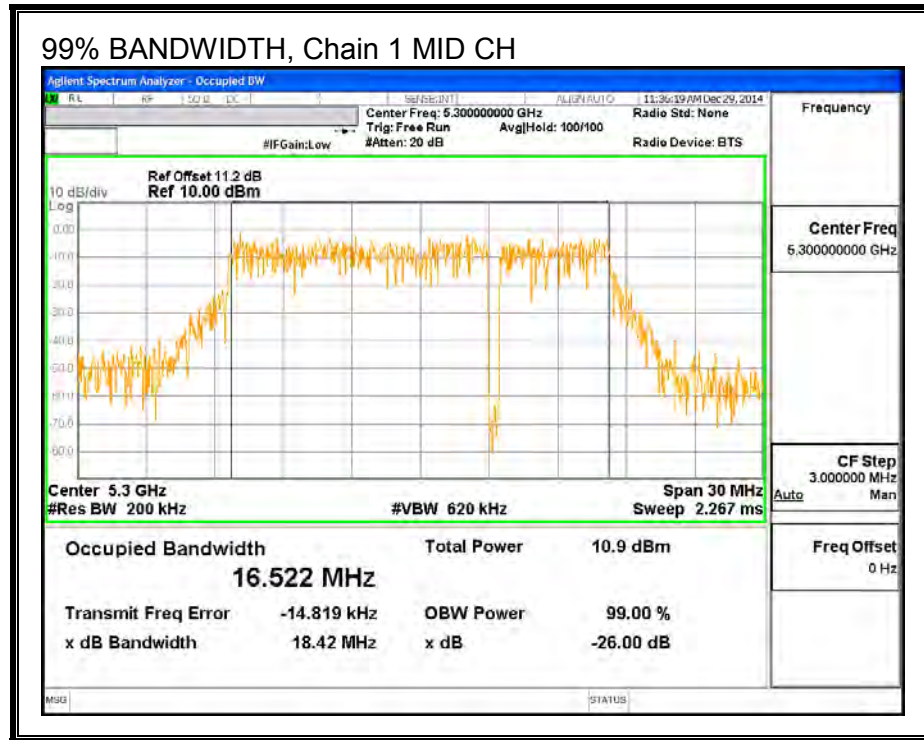




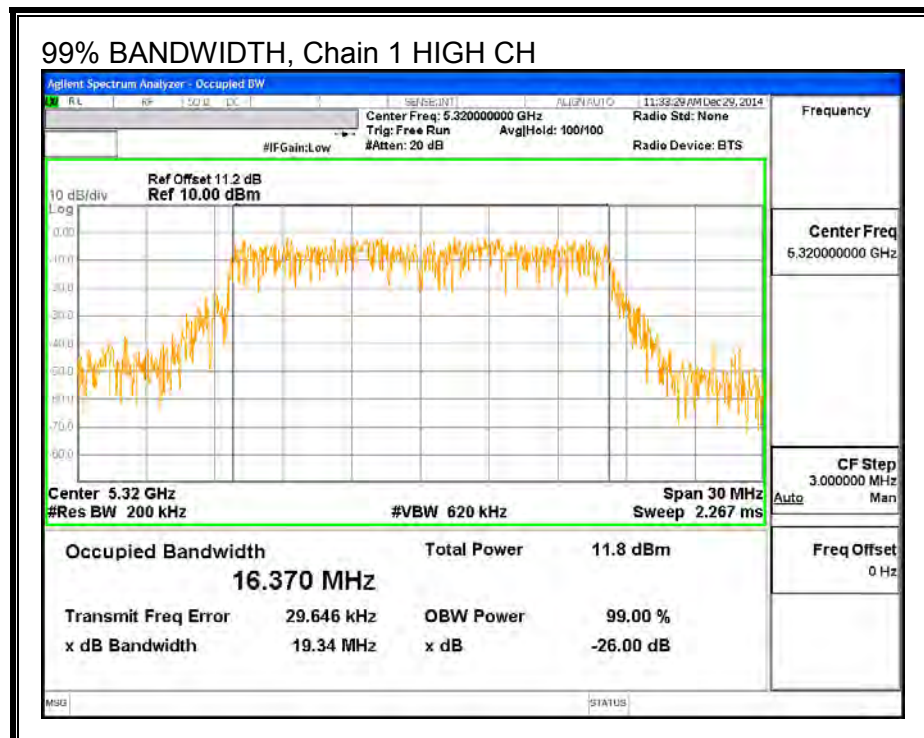
99% BANDWIDTH, Chain 1



99% BANDWIDTH, Chain 1 MID CH



99% BANDWIDTH, Chain 1 HIGH CH



### 9.5.3. OUTPUT POWER AND PSD

#### LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band 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 MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|-----------------------------------------------------|
| 2.9                                 | 3.5                                 | 3.21                                                |

## RESULTS

### Bandwidth, Antenna Gain and Limits

| Channel | Frequency<br>(MHz) | Min<br>26 dB<br>BW<br>(MHz) | Directional<br>Gain<br>for Power<br>(dBi) | Directional<br>Gain<br>for PSD<br>(dBi) | Power<br>Limit<br>(dBm) | PSD<br>Limit<br>(dBm) |
|---------|--------------------|-----------------------------|-------------------------------------------|-----------------------------------------|-------------------------|-----------------------|
| Low     | 5260               | 19.38                       | 3.21                                      | 3.21                                    | 23.87                   | 11.00                 |
| Mid     | 5300               | 19.32                       | 3.21                                      | 3.21                                    | 23.86                   | 11.00                 |
| High    | 5320               | 19.41                       | 3.21                                      | 3.21                                    | 23.88                   | 11.00                 |

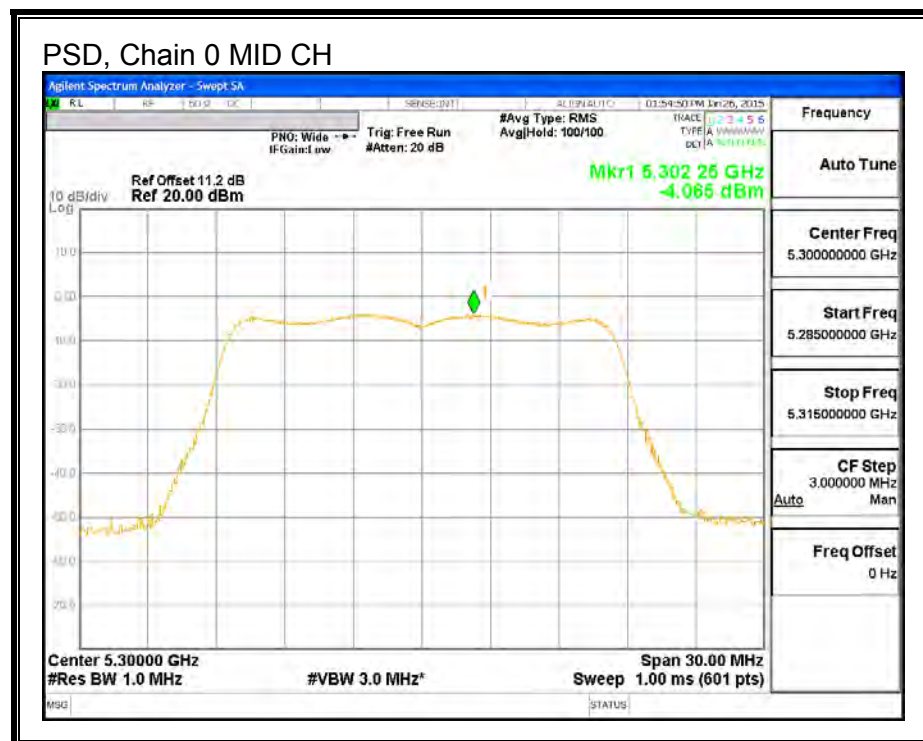
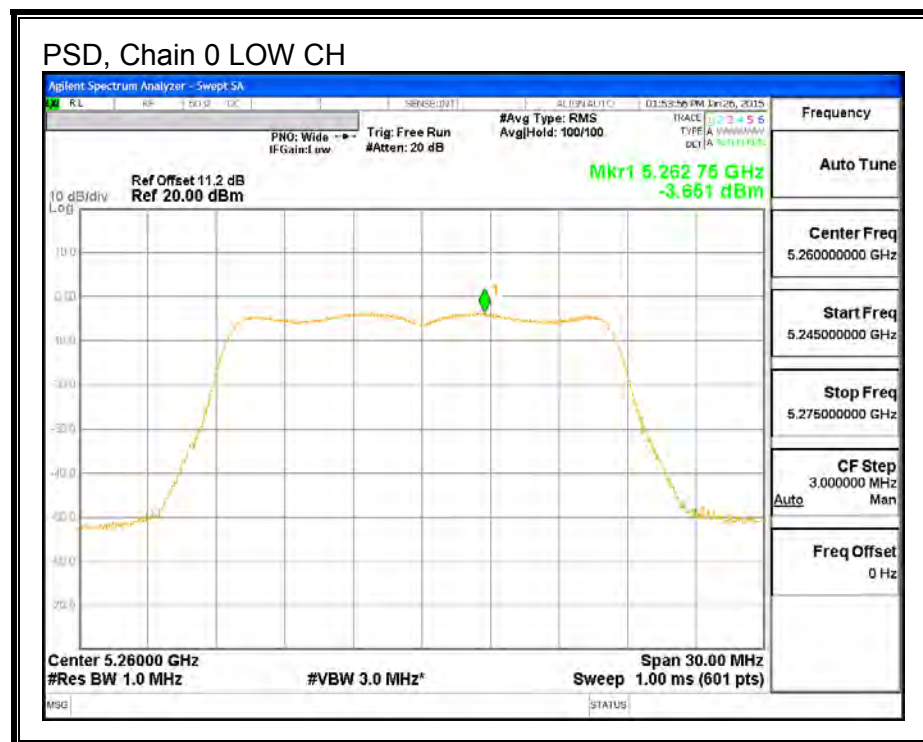
|                    |      |                                                |
|--------------------|------|------------------------------------------------|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PSD |
|--------------------|------|------------------------------------------------|

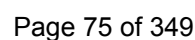
### Output Power Results

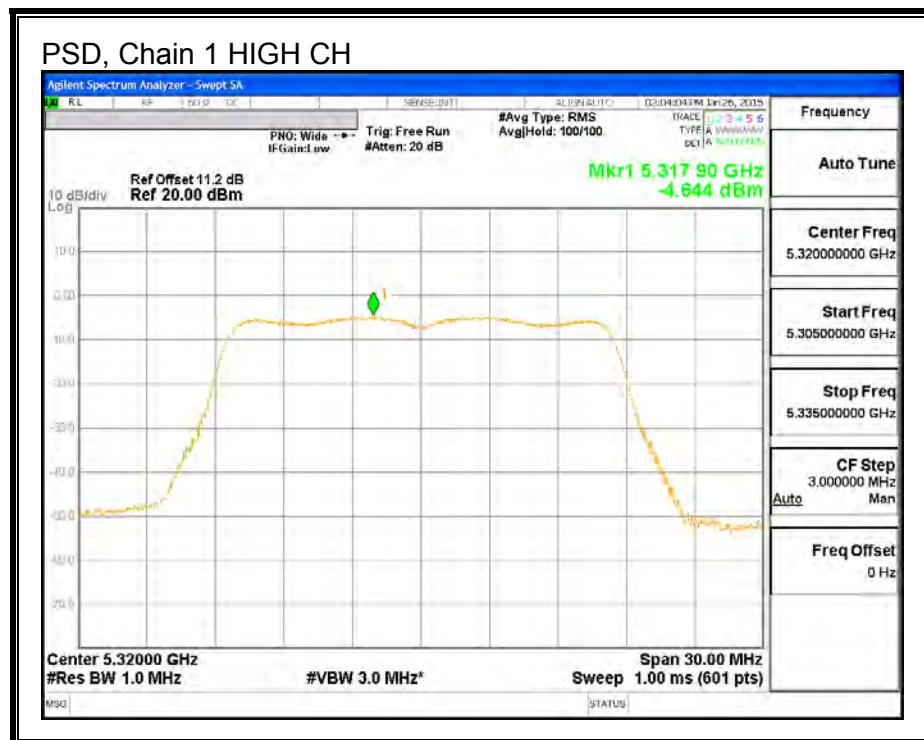
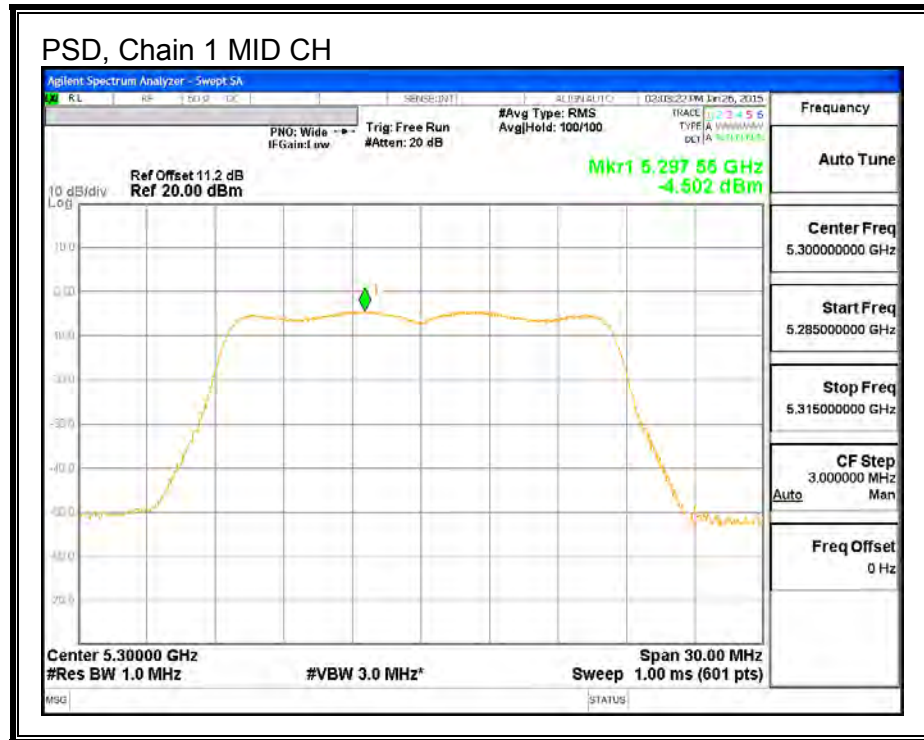
| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5260               | 7.24                              | 7.08                              | 10.17                             | 23.87                   | -13.70                  |
| Mid     | 5300               | 7.16                              | 6.96                              | 10.07                             | 23.86                   | -13.79                  |
| High    | 5320               | 7.35                              | 6.91                              | 10.15                             | 23.88                   | -13.73                  |

### PSD Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>PSD<br>(dBm) | Chain 1<br>Meas<br>PSD<br>(dBm) | Total<br>Corr'd<br>PSD<br>(dBm) | PSD<br>Limit<br>(dBm) | PSD<br>Margin<br>(dB) |
|---------|--------------------|---------------------------------|---------------------------------|---------------------------------|-----------------------|-----------------------|
| Low     | 5260               | -3.651                          | -4.451                          | -1.02                           | 11.00                 | -12.02                |
| Mid     | 5300               | -4.065                          | -4.502                          | -1.27                           | 11.00                 | -12.27                |
| High    | 5320               | -4.018                          | -4.644                          | -1.31                           | 11.00                 | -12.31                |







## 9.6. 802.11n HT20 MODE IN THE 5.2 GHz BAND

### 9.6.1. 26 dB BANDWIDTH

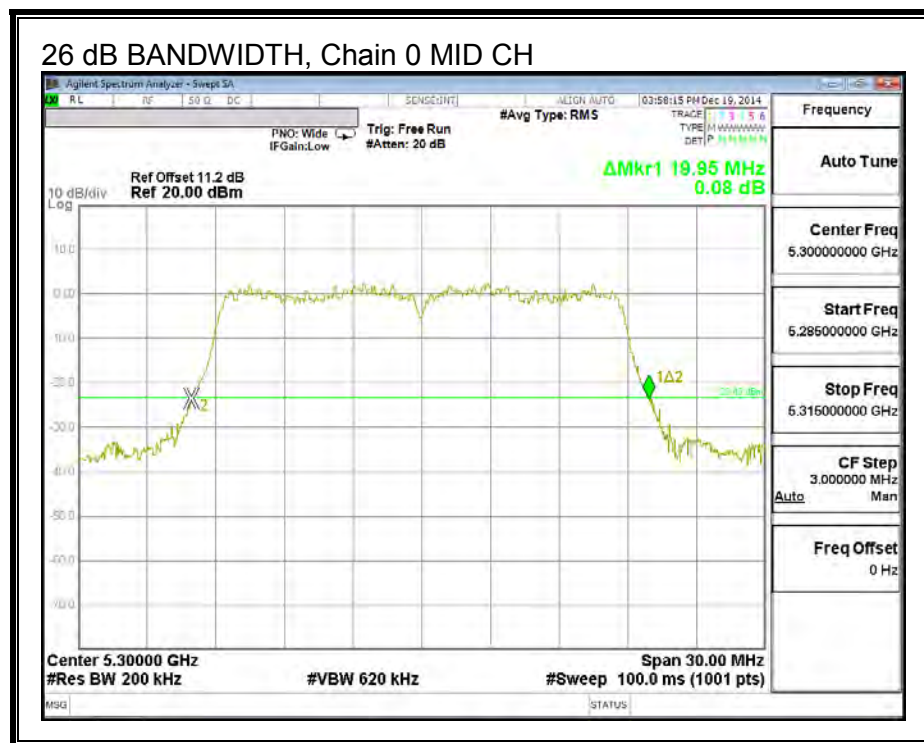
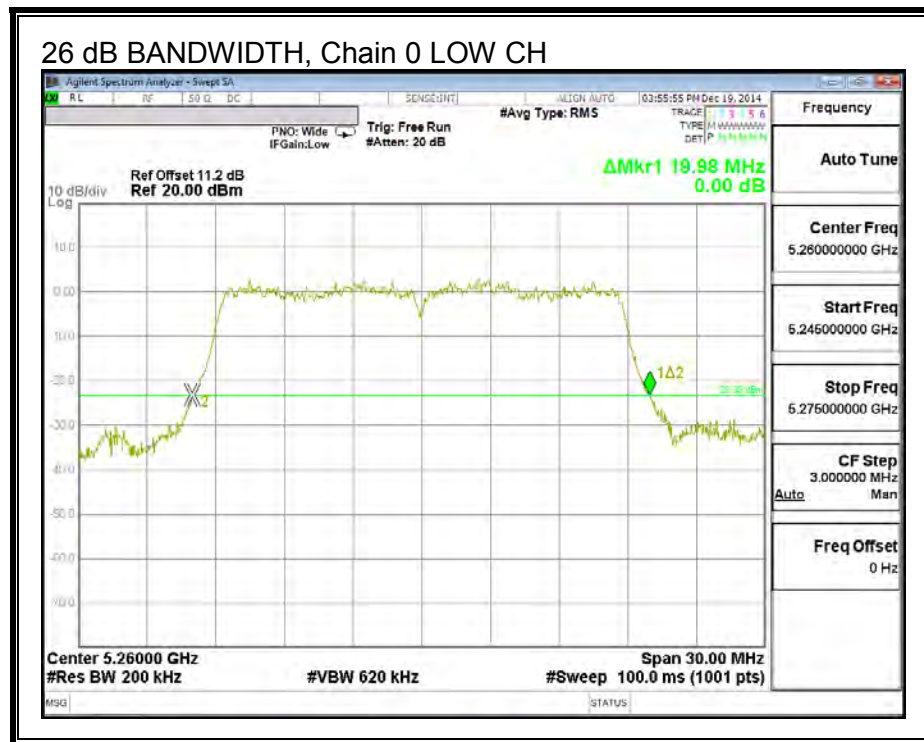
#### LIMITS

None; for reporting purposes only.

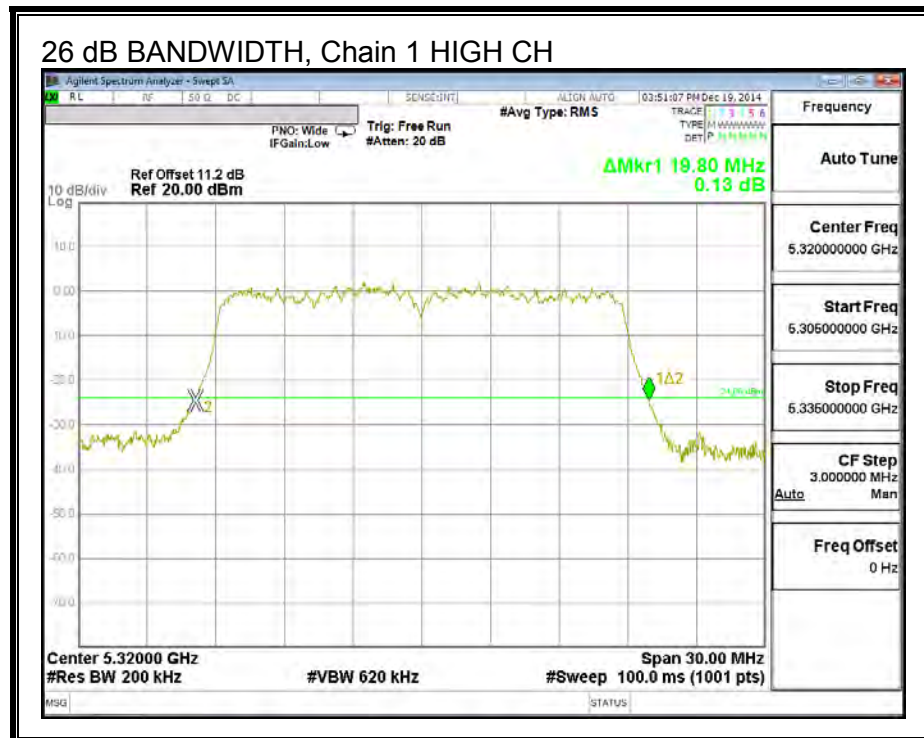
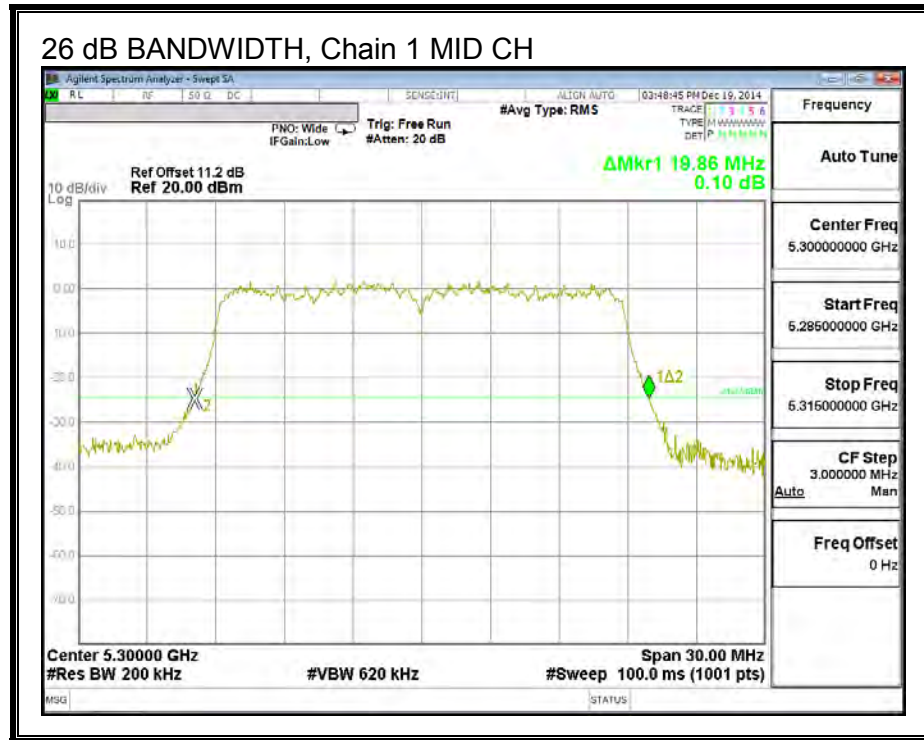
#### RESULTS

| Channel | Frequency<br>(MHz) | 26 dB BW<br>Chain 0<br>(MHz) | 26 dB BW<br>Chain 1<br>(MHz) |
|---------|--------------------|------------------------------|------------------------------|
| Low     | 5260               | 19.98                        | 19.74                        |
| Mid     | 5300               | 19.95                        | 19.86                        |
| High    | 5320               | 19.86                        | 19.80                        |

**26 dB BANDWIDTH, Chain 0**







## 9.6.2. 99% BANDWIDTH

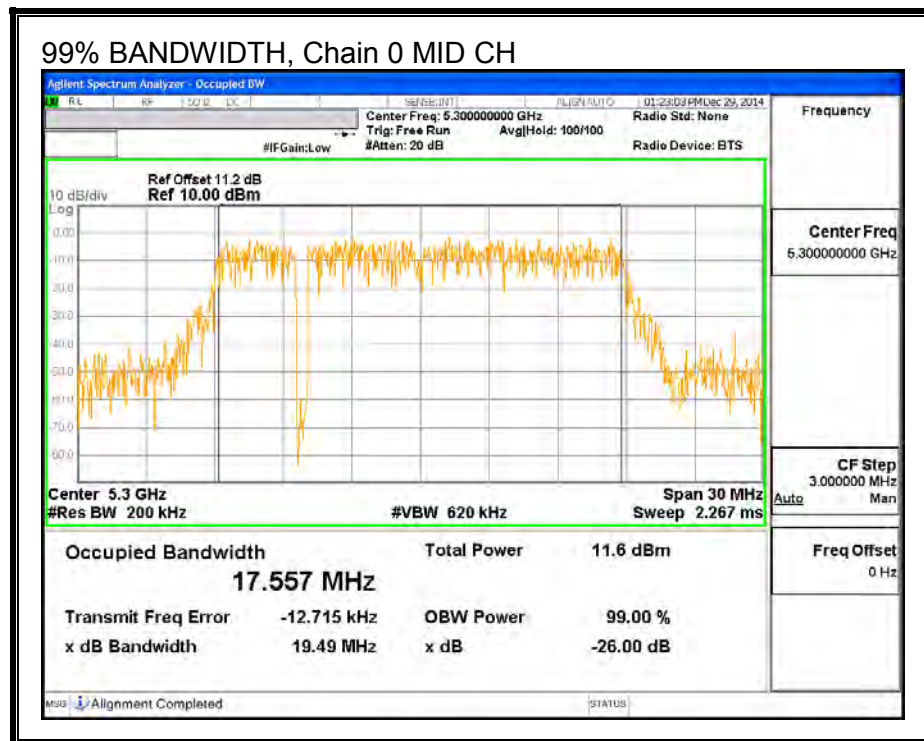
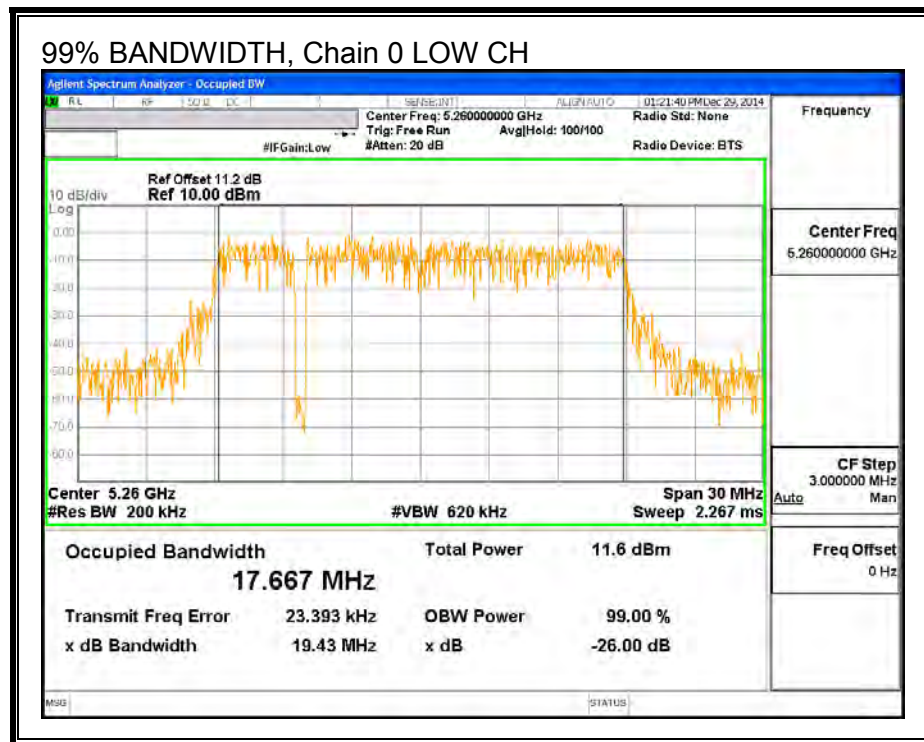
### LIMITS

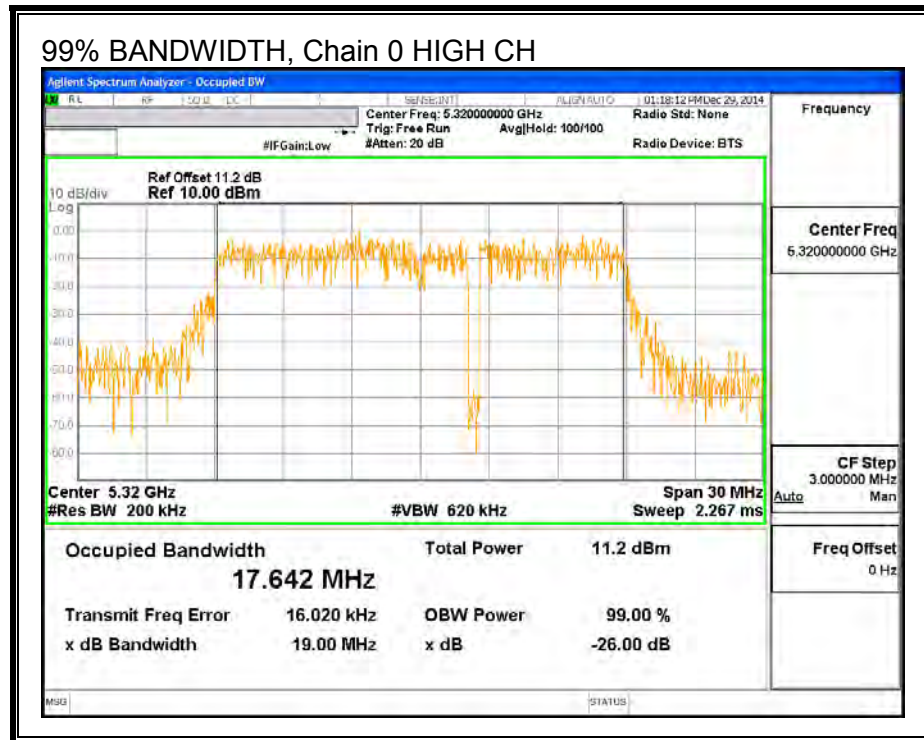
None; for reporting purposes only.

### RESULTS

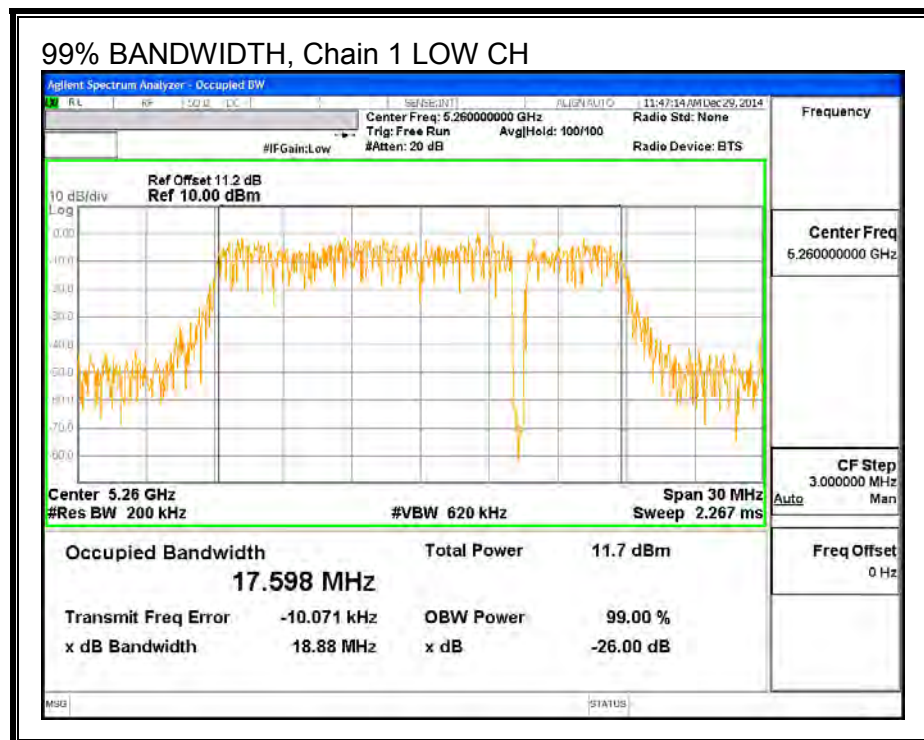
| Channel | Frequency<br>(MHz) | 99% BW<br>Chain 0<br>(MHz) | 99% BW<br>Chain 1<br>(MHz) |
|---------|--------------------|----------------------------|----------------------------|
| Low     | 5260               | 17.667                     | 17.598                     |
| Mid     | 5300               | 17.557                     | 17.588                     |
| High    | 5320               | 17.642                     | 17.565                     |

**99% BANDWIDTH, Chain 0**

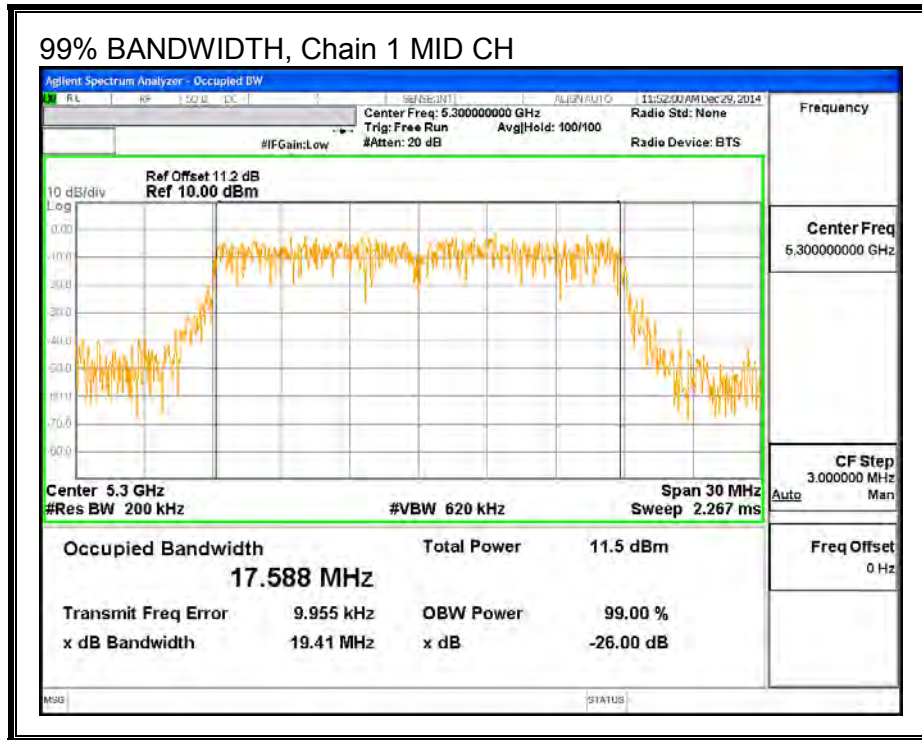




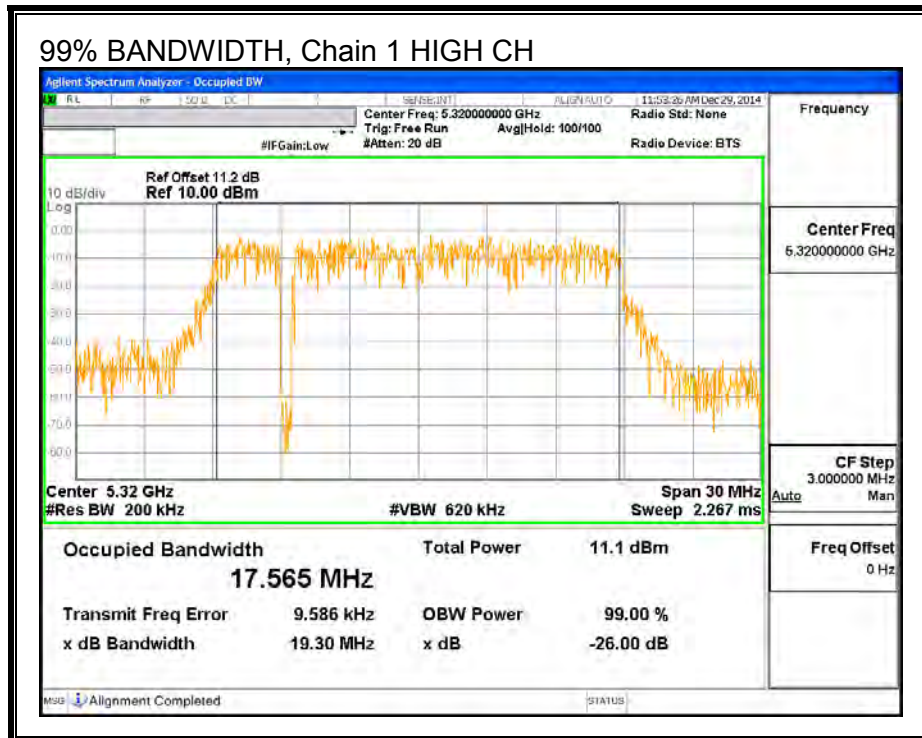
99% BANDWIDTH, Chain 1



### 99% BANDWIDTH, Chain 1 MID CH



### 99% BANDWIDTH, Chain 1 HIGH CH



### 9.6.3. OUTPUT POWER AND PSD

#### LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band 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 MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|-----------------------------------------------------|
| 2.9                                 | 3.5                                 | 3.21                                                |

## RESULTS

### Bandwidth, Antenna Gain and Limits

| Channel | Frequency<br>(MHz) | Min<br>26 dB<br>BW<br>(MHz) | Directional<br>Gain<br>for Power<br>(dBi) | Directional<br>Gain<br>for PSD<br>(dBi) | Power<br>Limit<br>(dBm) | PSD<br>Limit<br>(dBm) |
|---------|--------------------|-----------------------------|-------------------------------------------|-----------------------------------------|-------------------------|-----------------------|
| Low     | 5260               | 19.74                       | 3.21                                      | 3.21                                    | 23.95                   | 11.00                 |
| Mid     | 5300               | 19.86                       | 3.21                                      | 3.21                                    | 23.98                   | 11.00                 |
| High    | 5320               | 19.80                       | 3.21                                      | 3.21                                    | 23.97                   | 11.00                 |

|                    |      |                                                |
|--------------------|------|------------------------------------------------|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd Power & PSD |
|--------------------|------|------------------------------------------------|

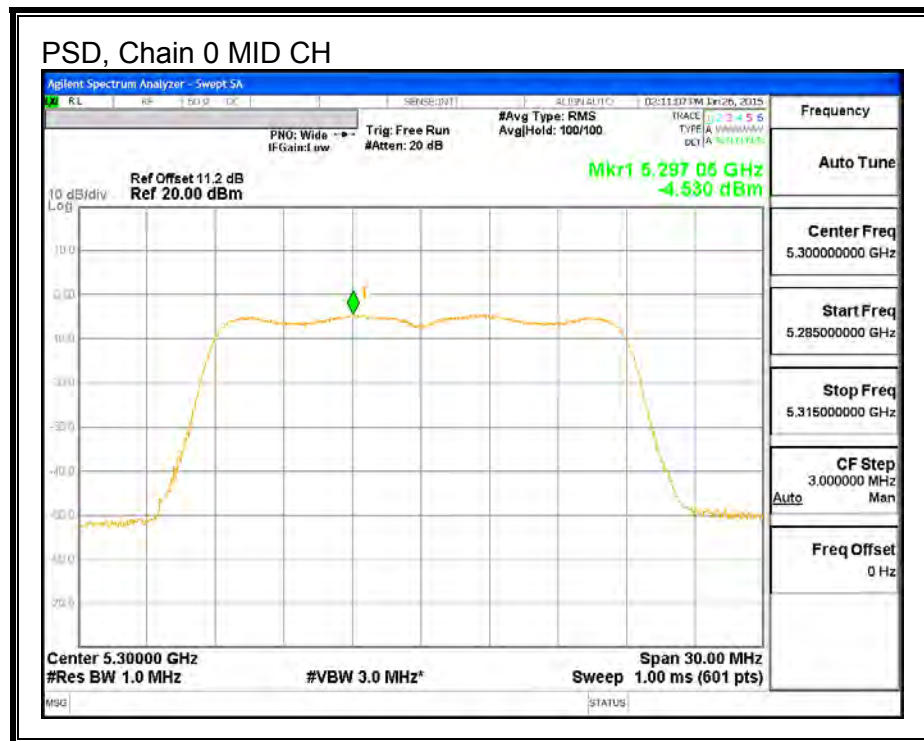
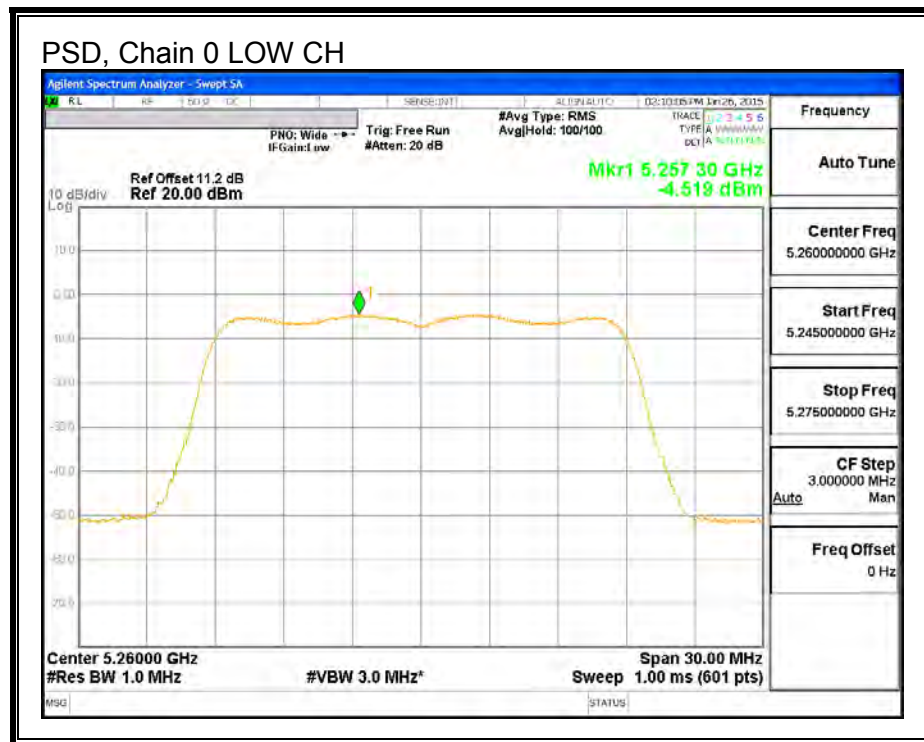
### Output Power Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5260               | 7.00                              | 7.03                              | 10.03                             | 23.95                   | -13.93                  |
| Mid     | 5300               | 7.35                              | 6.94                              | 10.16                             | 23.98                   | -13.82                  |
| High    | 5320               | 7.04                              | 6.68                              | 9.87                              | 23.97                   | -14.09                  |

### PSD Results

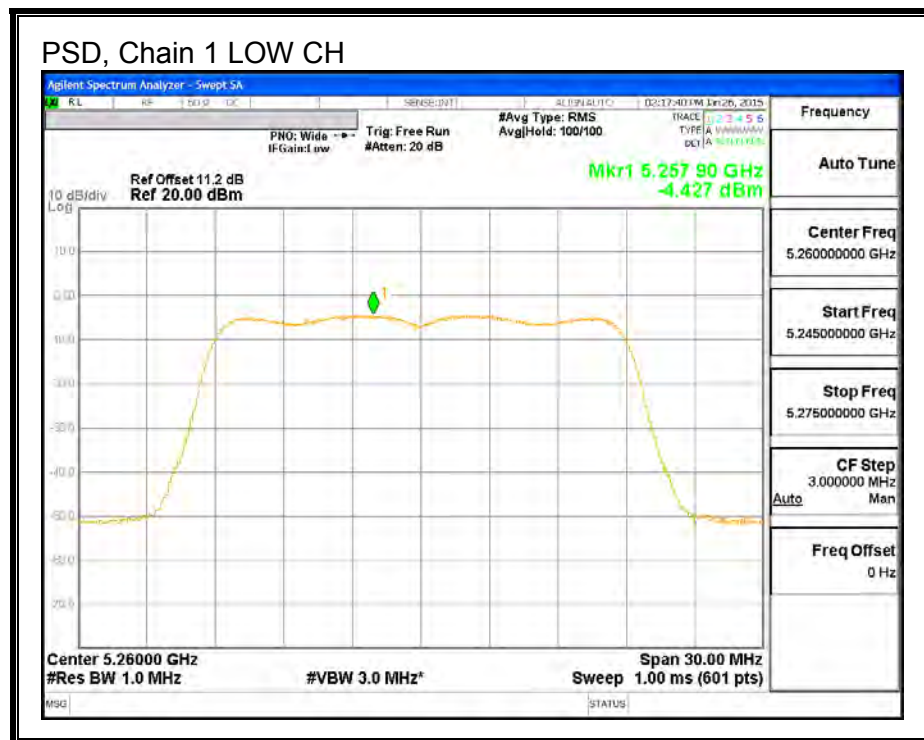
| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>PSD<br>(dBm) | Chain 1<br>Meas<br>PSD<br>(dBm) | Total<br>Corr'd<br>PSD<br>(dBm) | PSD<br>Limit<br>(dBm) | PSD<br>Margin<br>(dB) |
|---------|--------------------|---------------------------------|---------------------------------|---------------------------------|-----------------------|-----------------------|
| Low     | 5260               | -4.519                          | -4.427                          | -1.46                           | 11.00                 | -12.46                |
| Mid     | 5300               | -4.530                          | -4.761                          | -1.63                           | 11.00                 | -12.63                |
| High    | 5320               | -4.624                          | -4.943                          | -1.77                           | 11.00                 | -12.77                |

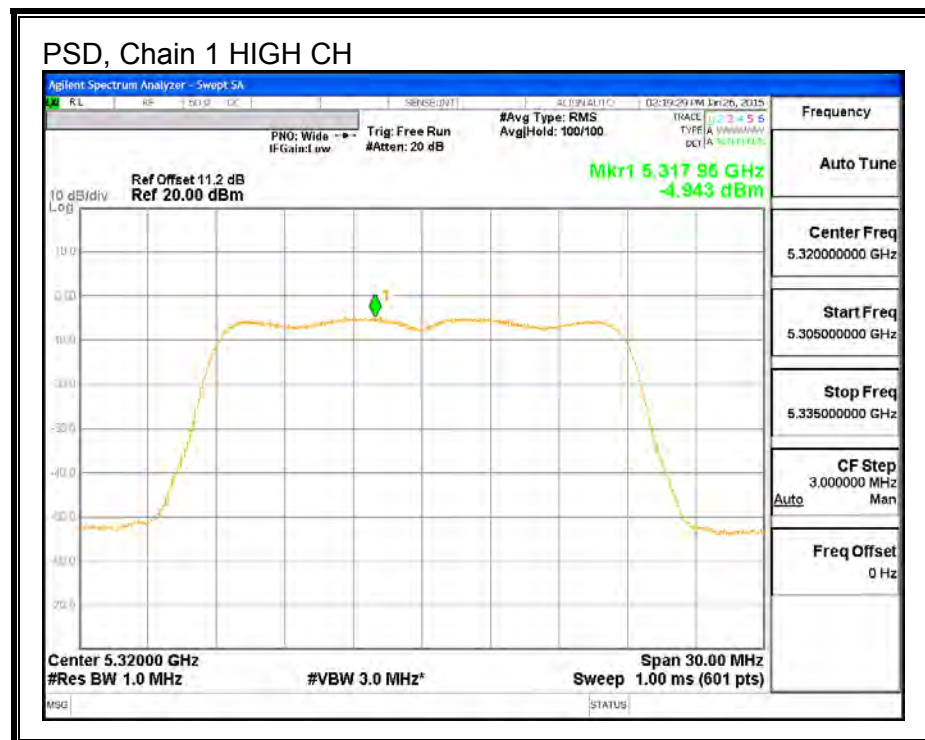
PSD, Chain 0





**PSD, Chain 1**





## 9.7. 802.11n HT40 MODE IN THE 5.3 GHz BAND

### 9.7.1. 26 dB BANDWIDTH

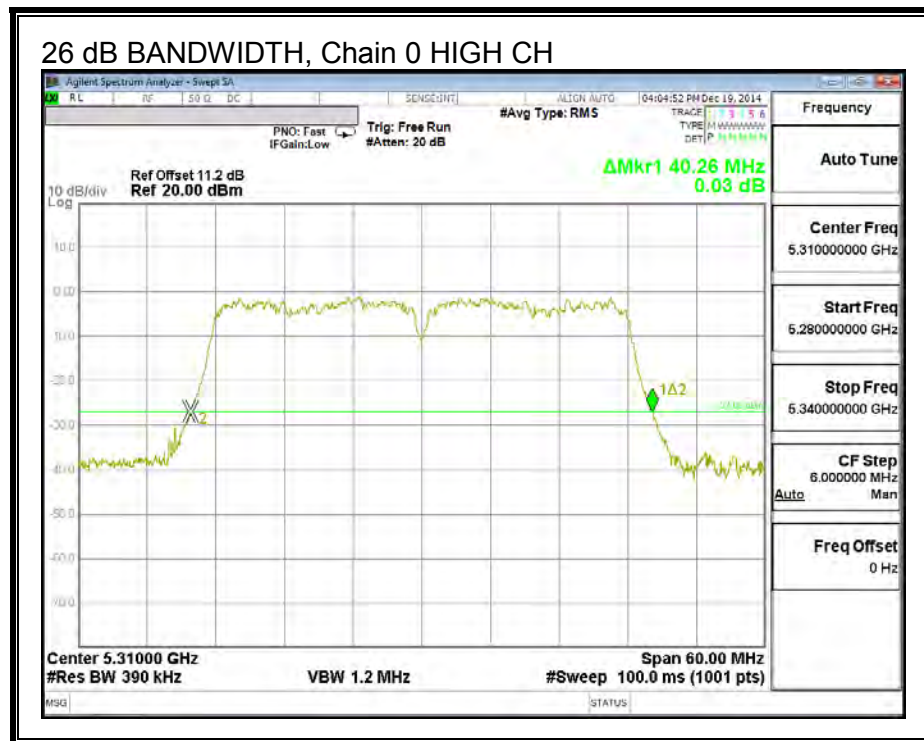
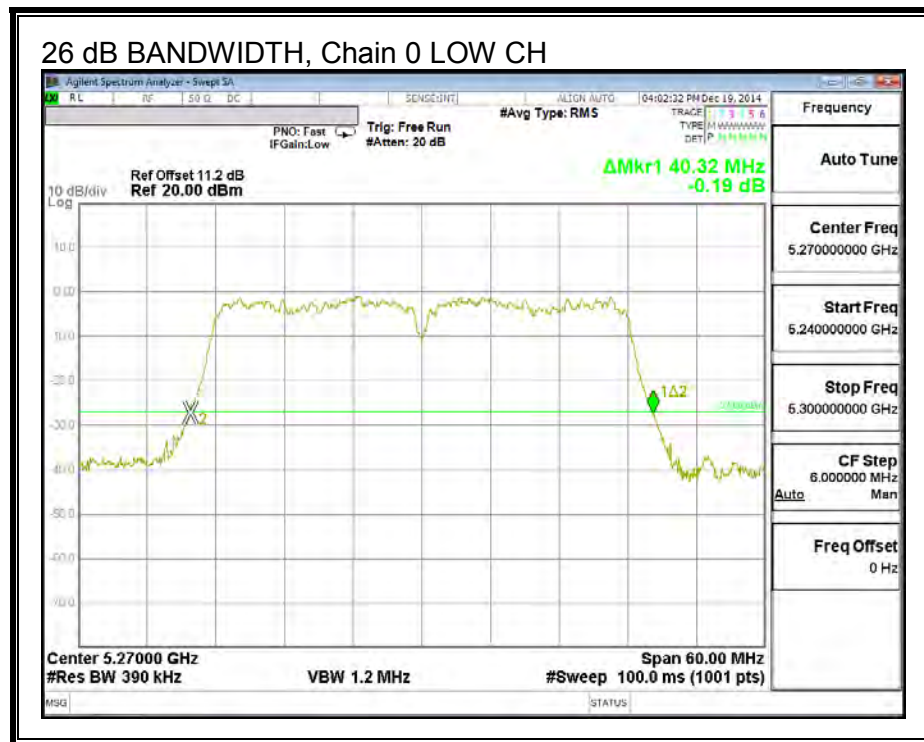
#### LIMITS

None; for reporting purposes only.

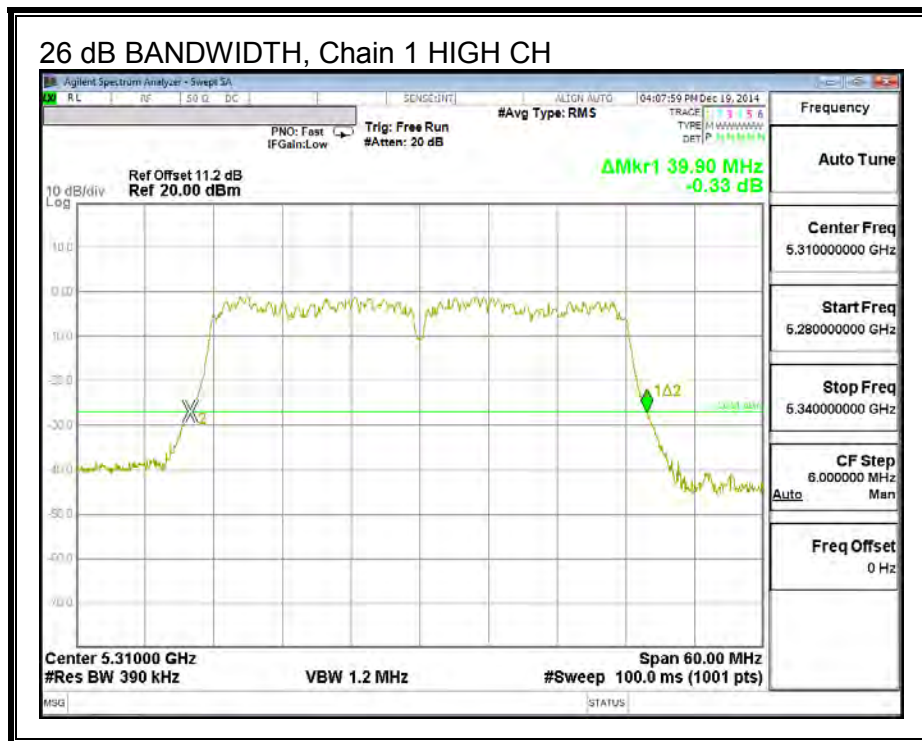
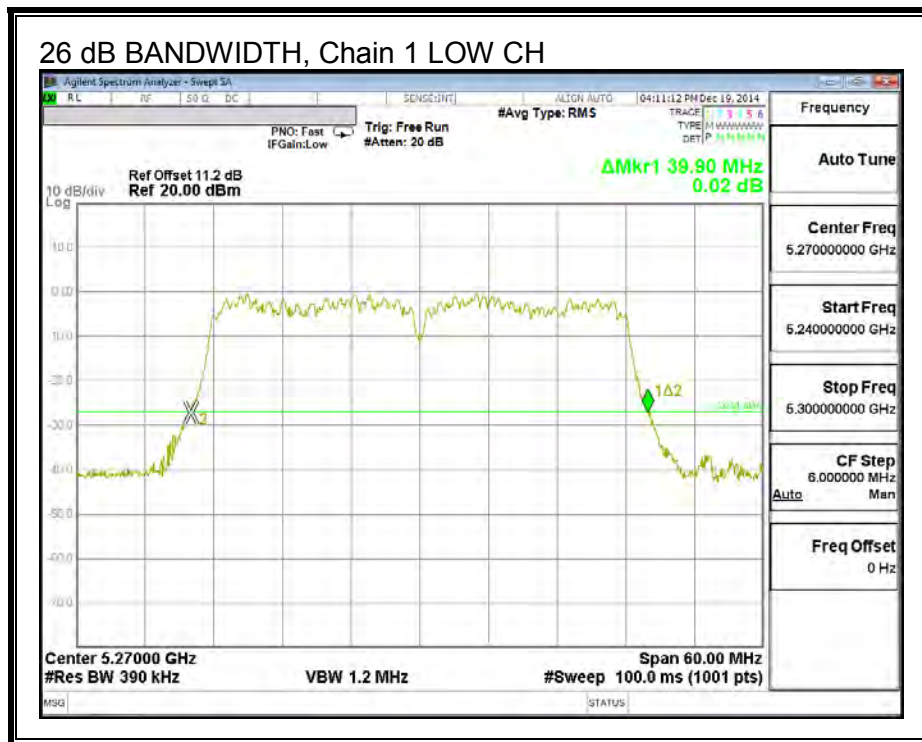
#### RESULTS

| Channel | Frequency<br>(MHz) | 26 dB BW<br>Chain 0<br>(MHz) | 26 dB BW<br>Chain 1<br>(MHz) |
|---------|--------------------|------------------------------|------------------------------|
| Low     | 5270               | 40.32                        | 39.90                        |
| High    | 5310               | 40.26                        | 39.90                        |

**26 dB BANDWIDTH, Chain 0**



**26 dB BANDWIDTH, Chain 1**



## 9.7.2. 99% BANDWIDTH

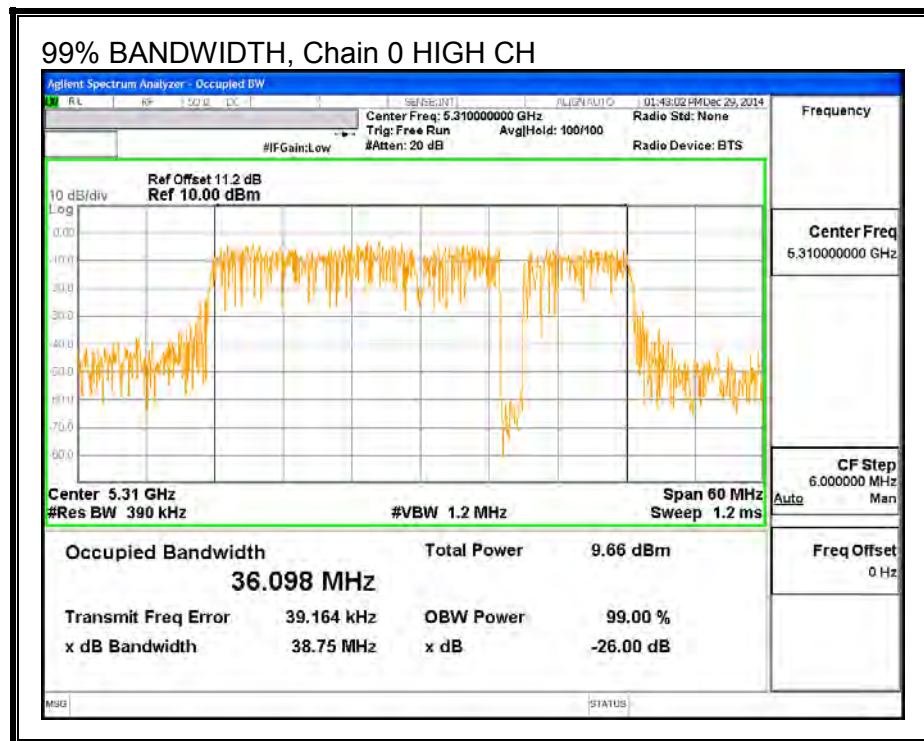
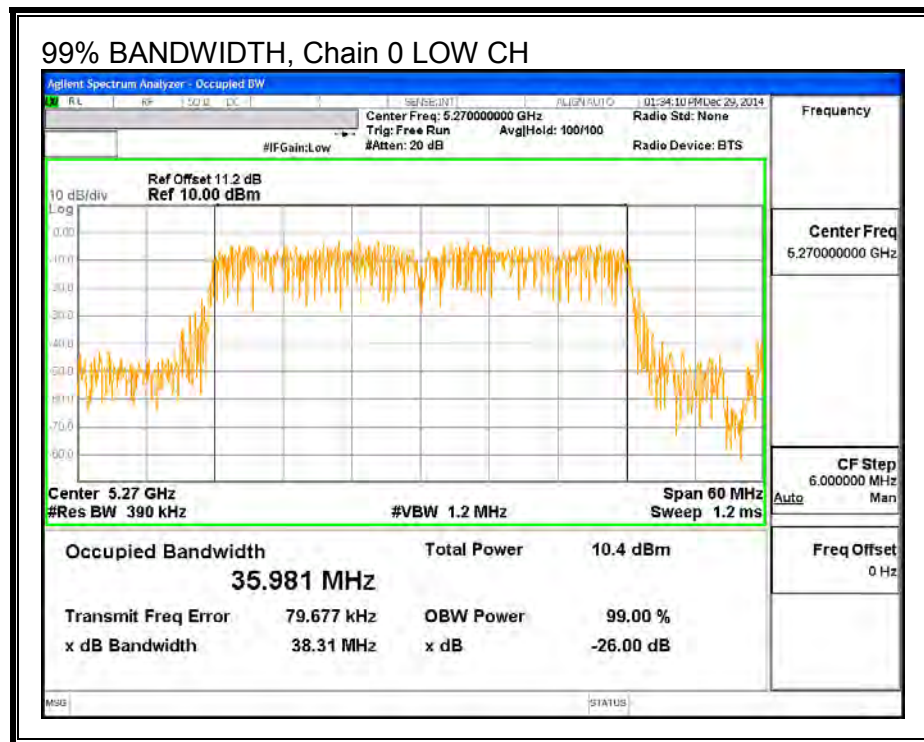
### LIMITS

None; for reporting purposes only.

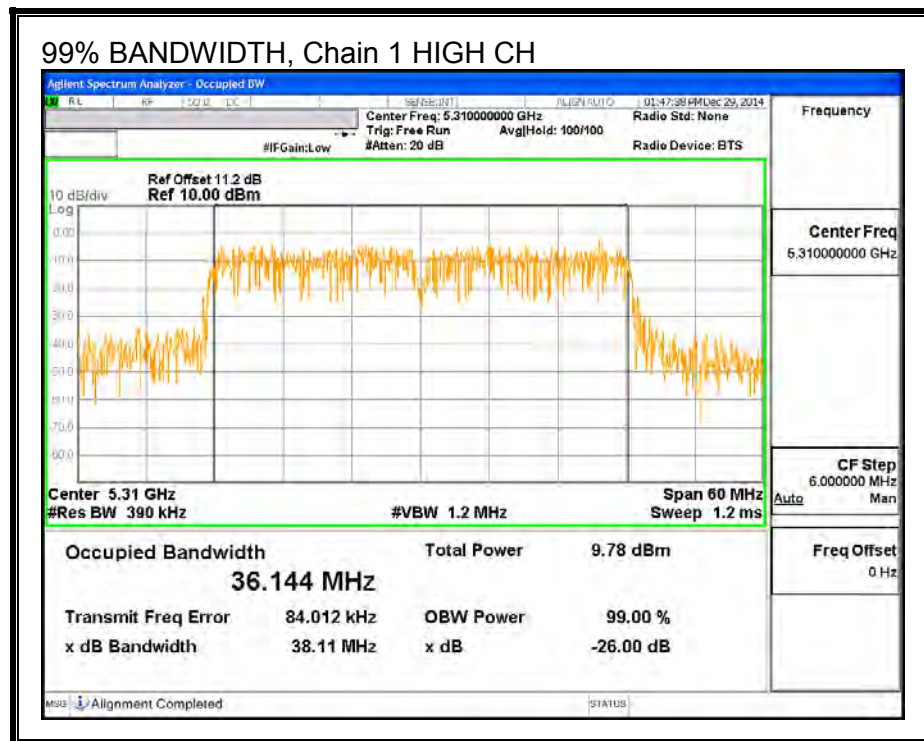
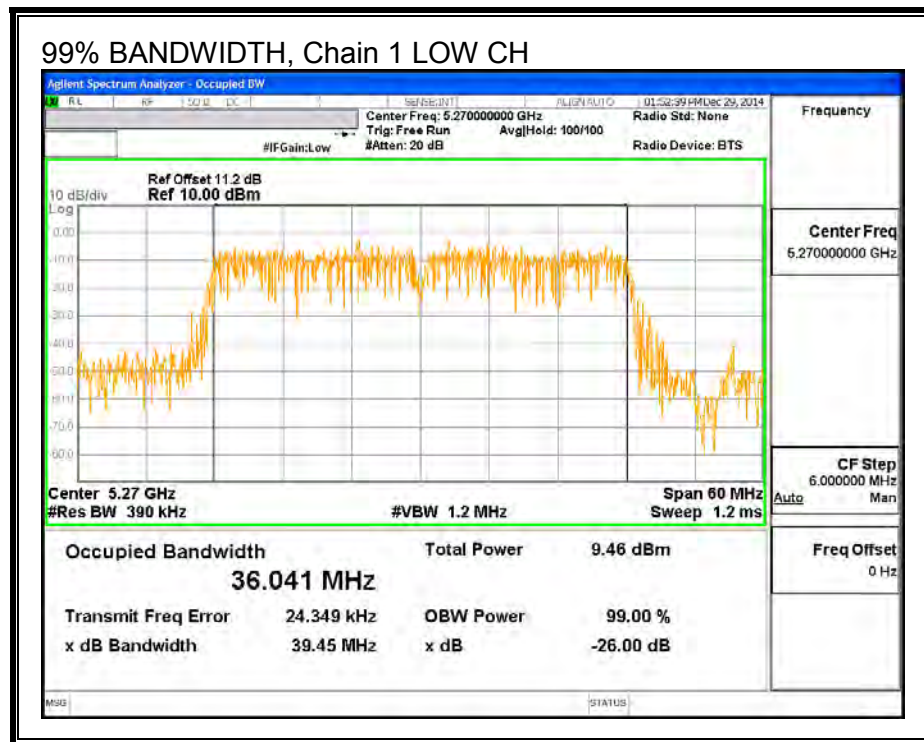
### RESULTS

| Channel | Frequency<br>(MHz) | 99% BW<br>Chain 0<br>(MHz) | 99% BW<br>Chain 1<br>(MHz) |
|---------|--------------------|----------------------------|----------------------------|
| Low     | 5270               | 35.981                     | 36.041                     |
| High    | 5310               | 36.098                     | 36.144                     |

**99% BANDWIDTH, Chain 0**



**99% BANDWIDTH, Chain 1**



### 9.7.3. OUTPUT POWER AND PSD

#### LIMITS

FCC §15.407 (a) (2)

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

#### DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

| Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) |
|-------------------------------------|-------------------------------------|-----------------------------------------------------|
| 2.9                                 | 3.5                                 | 3.21                                                |

## RESULTS

### Bandwidth, Antenna Gain and Limits

| Channel | Frequency<br>(MHz) | Min<br>26 dB<br>BW<br>(MHz) | Directional<br>Gain<br>for Power<br>(dBi) | Directional<br>Gain<br>for PSD<br>(dBi) | Power<br>Limit<br>(dBm) | PSD<br>Limit<br>(dBm) |
|---------|--------------------|-----------------------------|-------------------------------------------|-----------------------------------------|-------------------------|-----------------------|
| Low     | 5270               | 39.90                       | 3.21                                      | 3.21                                    | 24.00                   | 11.00                 |
| High    | 5310               | 39.90                       | 3.21                                      | 3.21                                    | 24.00                   | 11.00                 |

|                    |      |                                                |
|--------------------|------|------------------------------------------------|
| Duty Cycle CF (dB) | 0.13 | Included in Calculations of Corr'd Power & PSD |
|--------------------|------|------------------------------------------------|

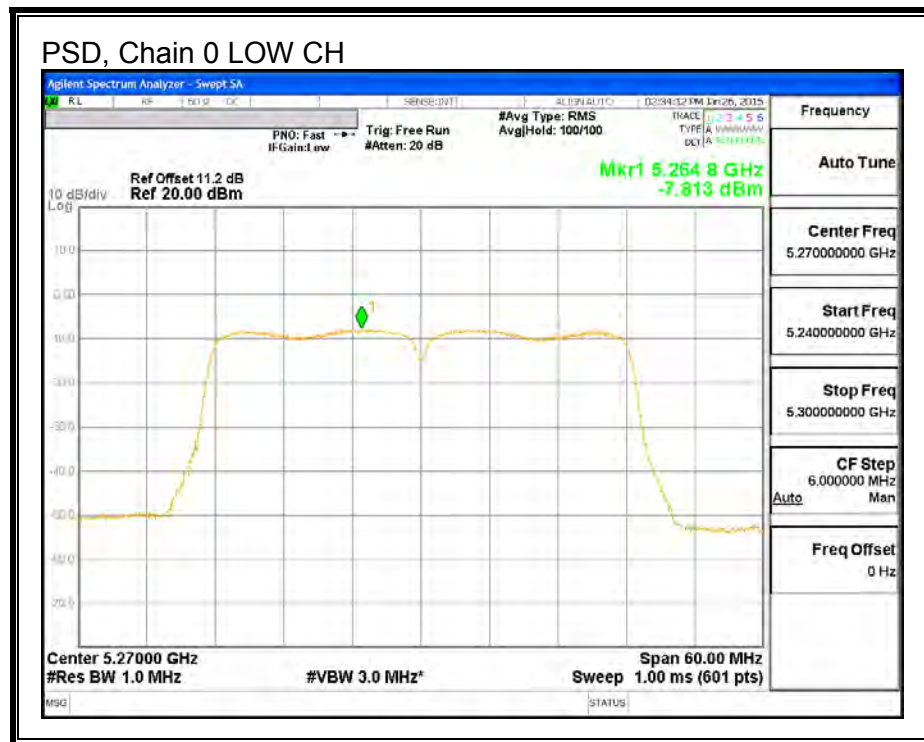
### Output Power Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5270               | 7.220                             | 6.780                             | 10.15                             | 24.00                   | -13.85                  |
| High    | 5310               | 7.010                             | 6.880                             | 10.09                             | 24.00                   | -13.91                  |

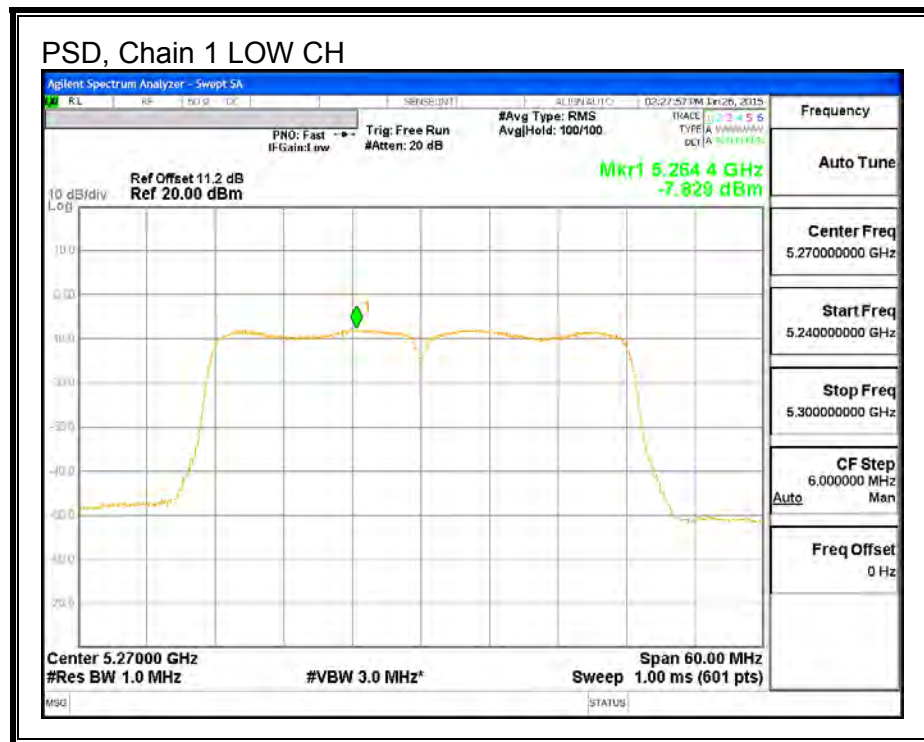
### PSD Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>PSD<br>(dBm) | Chain 1<br>Meas<br>PSD<br>(dBm) | Total<br>Corr'd<br>PSD<br>(dBm) | PSD<br>Limit<br>(dBm) | PSD<br>Margin<br>(dB) |
|---------|--------------------|---------------------------------|---------------------------------|---------------------------------|-----------------------|-----------------------|
| Low     | 5270               | -7.813                          | -7.829                          | -4.68                           | 11.00                 | -15.68                |
| High    | 5310               | -7.612                          | -8.319                          | -4.81                           | 11.00                 | -15.81                |

PSD, Chain 0



PSD, Chain 1



## 9.8. 802.11ac VHT80 MODE IN THE 5.3 GHz BAND

### 9.8.1. 26 dB BANDWIDTH

#### LIMITS

None; for reporting purposes only.

#### RESULTS

| Channel | Frequency<br>(MHz) | 26 dB BW<br>Chain 0<br>(MHz) | 26 dB BW<br>Chain 1<br>(MHz) |
|---------|--------------------|------------------------------|------------------------------|
| Mid     | 5290               | 82.20                        | 81.72                        |