# FCC 47 CFR PART 15 SUBPART E

for

**NovoConnect Wireless collaboration System**

**Model: NE3000, DS300**

**Brand: DELTA, VIVITEK**

**Test Report Number:**

**C170503Z01-RP1-4**

**Issued Date: July 10, 2017**

Issued for

**Delta Electronic Incorporated**

**3, Tungyuan Road Chungli Industrial Zone Taoyuan County 32063, Taiwan**

Issued by:

**Compliance Certification Services (Shenzhen) Inc.**
No.10-1 Mingkeda Logistics park, No.18, Huanguan South Rd.,
Guan Lan Town, Baoan District, Shenzhen, China
TEL: 86-755-28055000
FAX: 86-755-28055221
E-Mail: service@ccssz.com

A2LA ACCREDITED
Certificate Number: 2861.01

# Revision History

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|---|---|---|---|---|
| 00 | July 10, 2017 | Initial Issue | ALL | Nancy Fu |
| | | | | |
| | | | | |
| | | | | |

## TABLE OF CONTENTS

**1. TEST CERTIFICATION ..... 4**
**2. EUT DESCRIPTION ..... 5**
**3. TEST METHODOLOGY ..... 8**
3.1 EUT CONFIGURATION ..... 8
3.2 EUT EXERCISE ..... 8
3.3 GENERAL TEST PROCEDURES ..... 8
3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS ..... 9
3.5 DESCRIPTION OF TEST MODES ..... 10
**4. SETUP OF EQUIPMENT UNDER TEST ..... 12**
4.1 DESCRIPTION OF SUPPORT UNITS ..... 12
4.2 CONFIGURATION OF SYSTEM UNDER TEST ..... 12
**5. FACILITIES AND ACCREDITATIONS ..... 13**
5.1 FACILITIES ..... 13
5.2 EQUIPMENT ..... 13
5.3 ACCREDITATIONS ..... 13
5.4 MEASUREMENT UNCERTAINTY ..... 14
**6. FCC PART 15 REQUIREMENTS ..... 15**
6.1 26dB EMISSION BANDWIDTH ..... 15
6.2 6dB BANDWIDTH MEASUREMENT ..... 52
6.3 ANTENNA GAIN ..... 63
6.4 PEAK POWER ..... 66
6.5 BAND EDGES MEASUREMENT ..... 75
6.6 PEAK POWER SPECTAL DENSITY ..... 101
6.7 RADIATED UNDESIABLE EMISSION ..... 146
6.8 CONDUCTED UNDESIRABLE EMISSION ..... 206
6.9 POWERLINE CONDUCTED EMISSIONS ..... 225
6.10 FREQUENCY STABILITY ..... 231

# 1. TEST CERTIFICATION

| | |
|---|---|
| **Product** | NovoConnect Wireless collaboration System |
| **Model** | NE3000, DS300 |
| **Brand** | DELTA, VIVITEK |
| **Tested** | May 3~ July 10, 2017 |
| **Applicant** | **Delta Electronic Incorporated**<br>3, Tungyuan Road Chungli Industrial Zone Taoyuan County 32063, Taiwan |
| **Manufacturer** | **Delta Electronic Incorporated**<br>3, Tungyuan Road Chungli Industrial Zone Taoyuan County 32063, Taiwan |

| **APPLICABLE STANDARDS** | |
|---|---|
| **STANDARD** | **TEST RESULT** |
| FCC 47 CFR Part 15 Subpart E | No non-compliance noted |

**We hereby certify that:**

Compliance Certification Services (Shenzhen) Inc. tested the above equipment. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in **ANSI C63.10: 2013** and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.407、FCC 14-30.

The TEST RESULTS of this report relate only to the tested sample identified in this report.

***Approved by:*** ***Reviewed by:***

**Sunday Hu**
**Supervisor of EMC Dept.**
**Compliance Certification Services (Shenzhen) Inc.**

**Ruby Zhang**
**Supervisor of Report Dept.**
**Compliance Certification Services (Shenzhen) Inc.**

# 2. EUT DESCRIPTION

| | |
|---|---|
| **Product** | NovoConnect Wireless collaboration System |
| **Model Number** | NE3000, DS300 |
| **Brand** | DELTA, VIVITEK |
| **Model Discrepancy** | All models are identical to each other except their model name and appearance; and the model DS300 ships without remote control. |
| **Serial Number** | C170503Z01-RP1-4 |
| **Received Date** | May 3, 2017 |
| **Power Supply** | DC5V supplied by the adapter |
| **Adapter Manufacturer /Model No.** | Model: FJ-SW1260502000UU<br>I/P: AC100-240V, 50/60Hz, 0.4A Max<br>O/P: DC5V, 2000mA |
| **Frequency Range** | UNII Band I:<br>IEEE 802.11a, 802.11n HT20 : 5180MHz ~ 5240MHz;<br>IEEE 802.11n HT40: 5190MHz ~ 5230MHz<br>IEEE 802.11ac 80: 5210MHz<br>UNII Band II<br>IEEE 802.11a, 802.11n HT20 : 5260MHz ~ 5320MHz<br>IEEE 802.11n HT40: 5270MHz ~ 5310MHz<br>IEEE 802.11ac 80: 5290MHz<br>UNII Band III<br>IEEE 802.11a, 802.11n HT20 : 5500MHz ~ 5700MHz<br>IEEE 802.11n HT40: 5510MHz ~ 5670MHz<br>IEEE 802.11ac 80: 5530MHz<br>UNII Band IV<br>IEEE 802.11a, 802.11n HT20 : 5745MHz ~ 5825MHz<br>IEEE 802.11n HT40: 5755MHz ~ 5795MHz<br>IEEE 802.11ac 80: 5775MHz |
| **Transmit Power** | UNII Band I:<br>IEEE 802.11a: 18.54dBm (Antenna 0)<br>18.53dBm (Antenna 1)<br>IEEE 802.11n HT 20 MHz mode: 16.10dBm (Combine with Antenna 0 and Antenna 1)<br>IEEE 802.11n HT 40 MHz mode: 16.49dBm (Combine with Antenna 0 and Antenna 1)<br>IEEE 802.11ac 80: 15.54dBm (Combine with Antenna 0 and Antenna 1)<br>UNII Band II<br>IEEE 802.11a: 17.83dBm (Antenna 0)<br>17.93dBm (Antenna 1)<br>IEEE 802.11n HT 20 MHz mode: 15.93dBm (Combine with Antenna 0 and Antenna 1)<br>IEEE 802.11n HT 40 MHz mode: 16.27dBm (Combine with Antenna 0 and Antenna 1)<br>IEEE 802.11ac 80: 15.63dBm (Combine with Antenna 0 and Antenna 1)<br>UNII Band III<br>IEEE 802.11a: 17.56dBm (Antenna 0)<br>17.42dBm (Antenna 1)<br>IEEE 802.11n HT 20 MHz mode: 15.91dBm (Combine with Antenna 0 and Antenna 1)<br>IEEE 802.11n HT 40 MHz mode: 16.30dBm (Combine with Antenna 0 and Antenna 1)<br>IEEE 802.11ac 80: 15.30dBm (Combine with Antenna 0 and Antenna 1)<br>UNII Band IV<br>IEEE 802.11a: 17.37dBm (Antenna 0)<br>17.24dBm (Antenna 1)<br>IEEE 802.11n HT 20 MHz mode: 16.23dBm (Combine with Antenna 0 and Antenna 1) |

| | |
|---|---|
| | IEEE 802.11n HT 40 MHz mode: 16.24dBm (Combine with Antenna 0 and Antenna 1)<br>IEEE 802.11ac 80: 15.51dBm (Combine with Antenna 0 and Antenna 1) |
| **Modulation Technique** | OFDM (QPSK, BPSK, 16-QAM, 64-QAM) |
| **Transmit Data Rate** | IEEE 802.11a mode: 48, 36, 24, 18, 12, 9, 6Mbps<br>IEEE802.11n HT20MHz mode(800ns GI): 13,26,39,52,78,104,117,130Mbps<br>IEEE802.11n HT40MHz mode(800ns GI): 27,54,81,108,162,216,243,270Mbps<br>IEEE802.11ac 80 mode(800ns GI): 58.6,117,175.6,234,351,468,526.6, 585,702,780Mbps |
| **Number of Channels** | UNII Band I:<br>IEEE 802.11a, 802.11n HT20 : 4 Channels<br>IEEE 802.11n HT40 : 2 Channels<br>IEEE 802.11ac 80: 1 Channel<br>UNII Band II<br>IEEE 802.11a, 802.11n HT20 : 4 Channels<br>IEEE 802.11n HT40: 2 Channels<br>IEEE 802.11ac 80: 1 Channel<br>UNII Band III<br>IEEE 802.11a, 802.11n HT20 : 8 Channels<br>IEEE 802.11n HT 40 MHz mode: 3 Channels<br>IEEE 802.11ac 80: 1 Channels<br>UNII Band IV<br>IEEE 802.11a, 802.11n HT20 : 5 Channels<br>IEEE 802.11n HT 40 MHz mode: 2 Channels<br>IEEE 802.11ac 80: 1 Channel |
| **Antenna Specification** | Dipole Antenna with 3dBi gain (Max) |
| **Channels Spacing** | IEEE 802.11a, 802.11n HT20 : 20MHz<br>IEEE 802.11n HT40: 40MHz<br>IEEE 802.11ac 80: 80MHz |
| **Temperature Range** | 0°C ~ +40°C |
| **Hardware Version** | RMG0905 |
| **Software Version** | Build17 |

***Note:*** *1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*

**Operation Frequency:**

| UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII) | |
|---|---|
| **CHANNEL** | **MHz** |
| 36 | 5180 |
| 38 | 5190 |
| 40 | 5200 |
| 42 | 5210 |
| 44 | 5220 |
| 46 | 5230 |
| 48 | 5240 |
| 52 | 5260 |
| 54 | 5270 |
| 56 | 5280 |
| 58 | 5290 |
| 60 | 5300 |
| 62 | 5310 |
| 64 | 5320 |
| 100 | 5500 |
| 102 | 5510 |
| 104 | 5520 |
| 106 | 5530 |
| 108 | 5540 |
| 110 | 5550 |
| 112 | 5560 |
| 116 | 5580 |
| 132 | 5660 |
| 134 | 5670 |
| 136 | 5680 |
| 140 | 5700 |
| 149 | 5745 |
| 151 | 5755 |
| 153 | 5765 |
| 155 | 5775 |
| 157 | 5785 |
| 159 | 5795 |
| 161 | 5805 |
| 165 | 5825 |

*Remark:*

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **H79-017CF2** filing to comply with Section 15.407 of the FCC Part 15, Subpart E Rules and FCC 14-30.

# 3. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 Radiated testing was performed at an antenna to EUT distance 3 meters.
The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 Part 15.207, 15.209, 15.407 and FCC 14-30.
Radio testing was performed according to KDB DA 02-2138、KDB 789033 D02、KDB 905462 D06；

## 3.1 EUT CONFIGURATION

The EUT configuration for testing is installed for RF field strength measurement to meet the Commissions requirement, and is operated in a manner intended to generate the maximum emission in a continuous normal application.

## 3.2 EUT EXERCISE

The EUT is operated in the engineering mode to fix the TX frequency for the purposes of measurement.
According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

## 3.3 GENERAL TEST PROCEDURES

**Conducted Emissions**

The EUT is placed on the turntable, which is positioned at 0.8 m above the ground plane. According to the requirements in Section 6.2 of ANSI C63.10, the conducted emission from the EUT is measured in the frequency range between 0.15 MHz and 30MHz, using the CISPR Quasi-Peak detector mode.

**Radiated Emissions**

The EUT is placed on the turntable, which is 0.8 m (below 1GHz) /1.5m (Above 1GHz) above the ground plane. The turntable is then rotated for 360 degrees to determine the properorientation for the maximum emission level. The EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission level. And, each emission is to be maximized by changing the horizontal and vertical polarization of the receiving antenna. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.4 to Section 6.6 of ANSI C63.10.

## 3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown 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 | 399.9 - 410 | 4.5 - 5.15 |
| [1]0.495 - 0.505 | 16.69475 - 16.69525 | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960 - 1240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1300 - 1427 | 8.025 - 8.5 |
| 4.17725 - 4.17775 | 37.5 - 38.25 | 1435 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 73 - 74.6 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1660 - 1710 | 10.6 - 12.7 |
| 6.26775 - 6.26825 | 108 - 121.94 | 1718.8 - 1722.2 | 13.25 - 13.4 |
| 6.31175 - 6.31225 | 123 - 138 | 2200 - 2300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2310 - 2390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.52475 - | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.52525 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 156.7 - 156.9 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 162.0125 - 167.17 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 167.72 - 173.2 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 240 - 285 | 3600 - 4400 | ([2]) |
| 13.36 - 13.41 | 322 - 335.4 | | |

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

## 3.5 DESCRIPTION OF TEST MODES

The EUT is a 2x2 configuration spatial MIMO (2TX & 2RX) without beam forming function. Use Certification Tool 1.26 to to control the EUT for staying in continuous transmitting mode was programmed.

| Test Item | Test mode | Worse mode |
|---|---|---|
| Conducted Emission | **Mode 1:** Normal | ☒ |
| Radiated Emission | **Mode 1:** Continuously Transmitting | ☒ |

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

**UNII Band I:**

**IEEE 802.11a for 5180 ~ 5240MHz:**
Channel Low (5180MHz), Channel Mid (5200MHz) and Channel High (5240MHz) with 6Mbps data rate were chosen for full testing.

**IEEE 802.11n HT 20 MHz for 5180 ~ 5240MHz:**
Channel Low (5180MHz), Channel Mid (5200MHz) and Channel High (5240MHz) with 13Mbps data rate were chosen for full testing.

**IEEE 802.11n HT 40 MHz Channel for 5190 ~ 5230MHz:**
Channel Low (5190MHz) and Channel High (5230MHz) with 27Mbps data rate were chosen for full testing.

**IEEE 802.11ac 80 Channel for 5210MHz:**
Channel Low (5210MHz) with 27Mbps data rate were chosen for full testing.

**UNII Band II:**

**IEEE 802.11a for 5260 ~ 5320MHz:**
Channel Low (5260MHz), Channel Mid (5300MHz) and Channel High (5320MHz) with 6Mbps data rate were chosen for full testing.

**IEEE 802.11n HT 20 MHz for 5260 ~ 5320MHz:**
Channel Low (5260MHz), Channel Mid (5300MHz) and Channel High (5320MHz) with 13Mbps data rate were chosen for full testing.

**IEEE 802.11n HT 40 MHz Channel for 5270~ 5310MHz:**
Channel Low (5270MHz) and Channel High (5310MHz) with 27Mbps data rate were chosen for full testing.

**IEEE 802.11ac 80 Channel for 5290MHz:**
Channel Low (5290MHz) with 27Mbps data rate were chosen for full testing.

**UNII Band III:**

**IEEE 802.11a for 5500 ~ 5700MHz:**
Channel Low (5500MHz), Channel Mid (5580MHz) and Channel High (5700MHz) with 6Mbps data rate were chosen for full testing.

**IEEE 802.11n HT 20 MHz for 5500 ~ 5700MHz:**
Channel Low (5500MHz), Channel Mid (5580MHz) and Channel High (5700MHz) with 13Mbps data rate were chosen for full testing.

**IEEE 802.11n HT 40 MHz Channel for 5510~ 5670MHz:**
Channel Low (5510MHz) and Channel High (5670MHz) with 27Mbps data rate were chosen for full testing.

**IEEE 802.11ac 80 Channel for 5530MHz:**
Channel Low (5530MHz) with 27Mbps data rate were chosen for full testing.

**UNII Band IV:**

**IEEE 802.11a for 5745 ~ 5825MHz:**
Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 6Mbps data rate were chosen for full testing.

**IEEE 802.11n HT 20 MHz for 5745 ~ 5825MHz:**
Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 13Mbps data rate were chosen for full testing.

**IEEE 802.11n HT 40 MHz Channel for 5755~ 5795MHz:**
Channel Low (5755MHz) and Channel High (5795MHz) with 27Mbps data rate were chosen for full testing.

**IEEE 802.11ac 80 Channel for 5775MHz:**
Channel Low (5775MHz) with 27Mbps data rate were chosen for full testing.

# 4. SETUP OF EQUIPMENT UNDER TEST

## 4.1 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| No. | Equipment | Model No. | Serial No. | FCC ID | Brand | Data Cable | Power Cord |
|---|---|---|---|---|---|---|---|
| 1 | Notebook | Probook 5310M | N/A | DoC | HP | Shielded, 2.30m | Shielded 1.70m (AC Cable) Unshielded 1.80m (DC Cable) |
| 2 | PC | N/A | N/A | DoC | LENOVO | Shielded, 1.50m | Unshielded, 1.50m |
| 3 | Monitor | U3011T | CNOPH5NY7444 5097425L | DoC | DELL | Shielded, 1.50m | Unshielded, 1.50m |
| 4 | Printer | DESKJET D1668 | CB767-0008 | DoC | HP | Unshielded, 1.40m | N/A |
| 5 | Modem | DU-562M | ES1X268007883 | DoC | D-LINK | Unshielded, 1.40m | N/A |
| 6 | Keyboard | PR1101V | 539130-001 | DoC | DELL | Unshielded, 1.50m | N/A |
| 7 | Mouse 1 | KB212-B | CN09RRC447511 680996 | DoC | DELL | Unshielded, 1.45m | N/A |
| 8 | Mouse 2 | N/A | N/A | DoC | LENOVO | Unshielded, 1.45m | N/A |
| 9 | Earphone | N/A | N/A | DoC | OPPO | Unshielded, 2.20m | N/A |
| 10 | HDD | WDBACY3201AB K-PESN | WX61ABOU8031 | DoC | WD | Shielded, 0.50m | N/A |
| 11 | TF Card | N/A | N/A | DoC | SAMSUNG | N/A | N/A |

**Note:**

Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

## 4.2 CONFIGURATION OF SYSTEM UNDER TEST

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

# 5. FACILITIES AND ACCREDITATIONS

## 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at
**No.10-1 Mingkeda Logistics park, No.18, Huanguan South Rd., Guan Lan Town, Baoan District, Shenzhen, China**

The sites are constructed in conformance with the requirements of ANSI C63.10, ANSI C63.7 and CISPR Publication 22.

## 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.
Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.
Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

## 5.3 ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

| | |
|---|---|
| **USA** | **A2LA** |
| **China** | **CNAS** |

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

| | |
|---|---|
| **USA** | **FCC** |
| **Japan** | **VCCI(C-3478, R-3135, T-652, G-10624)** |
| **Canada** | **INDUSTRY CANADA** |

Copies of granted accreditation certificates are available for downloading from our web site, http://www.ccssz.com

## 5.4 MEASUREMENT UNCERTAINTY

| Parameter | Uncertainty |
|---|---|
| RF frequency | +/-1 * 10-5 |
| RF power conducted | +/- 1,5 dB |
| RF power radiated | +/- 6 dB |
| Spurious emissions, conducted | +/- 3 dB |
| Spurious emissions, radiated | +/- 6 dB |
| Humidity | +/- 5 % |
| Temperature | +/- 1°C |
| Time | +/-10 % |

***Remark:*** *This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.*

# 6. FCC PART 15 REQUIREMENTS

## 6.1 26dB EMISSION BANDWIDTH

### 6.1.1 LIMIT

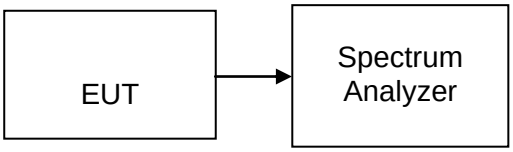
According to §15.403(c), for purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

### 6.1.2 MEASUREMENT EQUIPMENT USED

| Name of Equipment | Manufacturer | Model | Serial Number | Last Calibration | Due Calibration |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent | N9010A | MY52221469 | 02/21/2017 | 02/20/2018 |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

### 6.1.3 TEST CONFIGURATION




### 6.1.4TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low-loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW > 1%EBW, VBW > RBW, Span >26dB bandwidth, Detector = Peak, and Sweep = auto.
4. Mark the peak frequency and –26dB (upper and lower) frequency.
5. Repeat until all the rest channels were investigated.

### 6.1.5 TEST RESULTS

*No non-compliance noted*

**Test Data**

**Test mode: IEEE 802.11a mode / 5180 ~ 5240MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| Low | 5180 | 21.45 | 21.53 |
| Mid | 5200 | 21.53 | 21.56 |
| High | 5240 | 21.54 | 21.49 |

**Test mode: IEEE 802.11a mode / 5260 ~ 5320MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| Low | 5260 | 21.29 | 21.57 |
| Mid | 5300 | 21.60 | 21.55 |
| High | 5320 | 21.62 | 21.66 |

**Test mode: IEEE 802.11a mode / 5500 ~ 5700MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| Low | 5500 | 21.67 | 21.72 |
| Mid | 5580 | 21.41 | 21.68 |
| High | 5700 | 21.60 | 21.57 |

**Test mode: IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| Low | 5180 | 21.66 | 21.55 |
| Mid | 5200 | 21.61 | 21.73 |
| High | 5240 | 21.95 | 21.70 |

**Test mode: IEEE 802.11n HT 20 MHz mode / 5260 ~ 5320MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| Low | 5260 | 21.80 | 21.64 |
| Mid | 5300 | 21.60 | 21.60 |
| High | 5320 | 21.75 | 21.50 |

**Test mode: IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| Low | 5500 | 21.80 | 21.69 |
| Mid | 5580 | 21.77 | 21.62 |
| High | 5700 | 21.64 | 21.65 |

**Test mode: IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| Low | 5190 | 40.15 | 39.83 |
| High | 5230 | 39.85 | 39.72 |

**Test mode: IEEE 802.11n HT 40 MHz mode / 5270 ~ 5310MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| Low | 5270 | 40.18 | 39.66 |
| High | 5310 | 40.10 | 39.64 |

**Test mode: IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| Low | 5510 | 39.95 | 39.71 |
| Mid | 5550 | 39.83 | 39.74 |
| High | 5670 | 40.39 | 39.65 |

**Test mode: IEEE 802.11ac 80 mode / 5210MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| | 5210 | 81.64 | 81.78 |

**Test mode: IEEE 802.11ac 80 mode / 5290MHz**

| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| | 5290 | 82.14 | 81.74 |

**Test mode: IEEE 802.11ac 80 mode / 5530MHz**

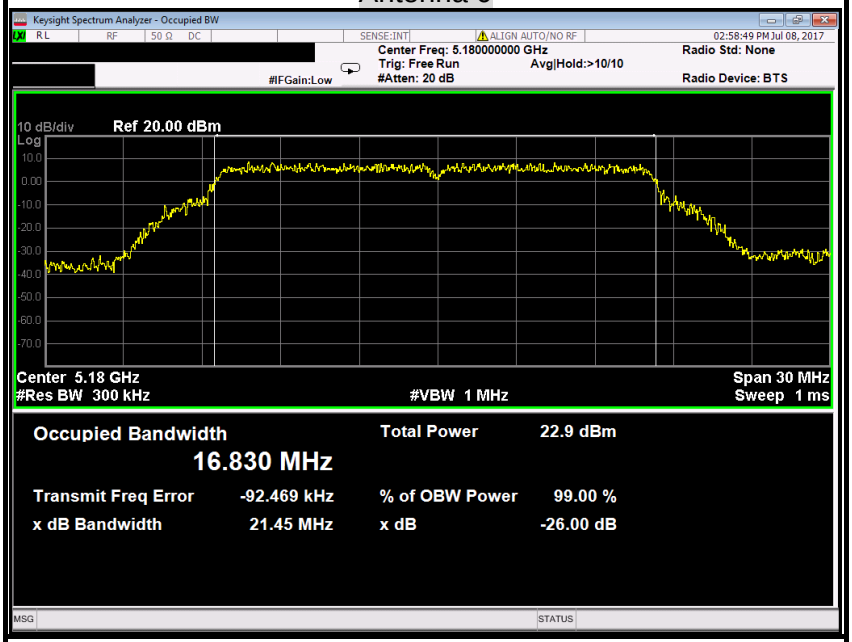
| Channel | Frequency (MHz) | 26dB Bandwidth(B) (MHz) | |
|---|---|---|---|
| | | Antenna 0 | Antenna 1 |
| | 5530 | 81.98 | 80.73 |

## Test Plot

**IEEE 802.11a mode / 5180 ~ 5240MHz**

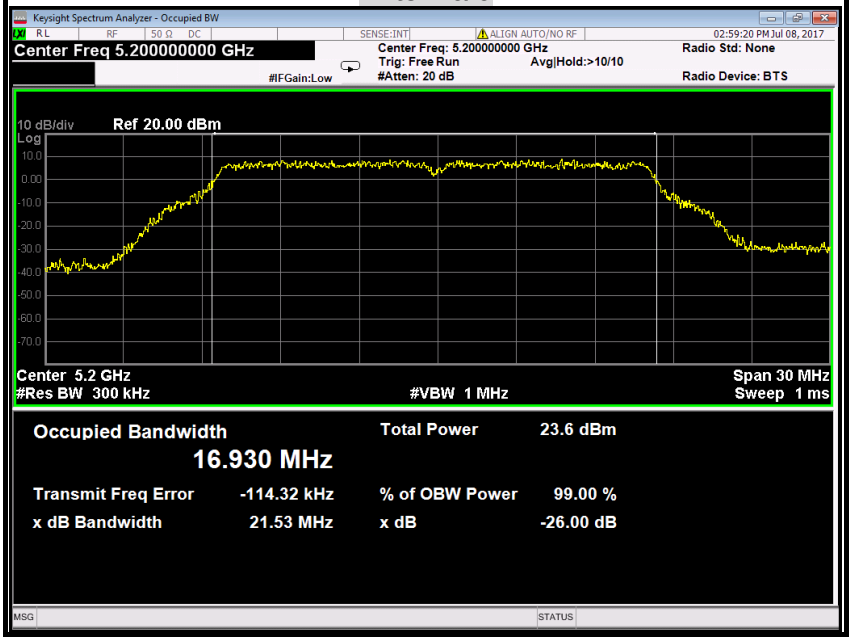
**26dB Bandwidth (CH Low)**

Antenna 0



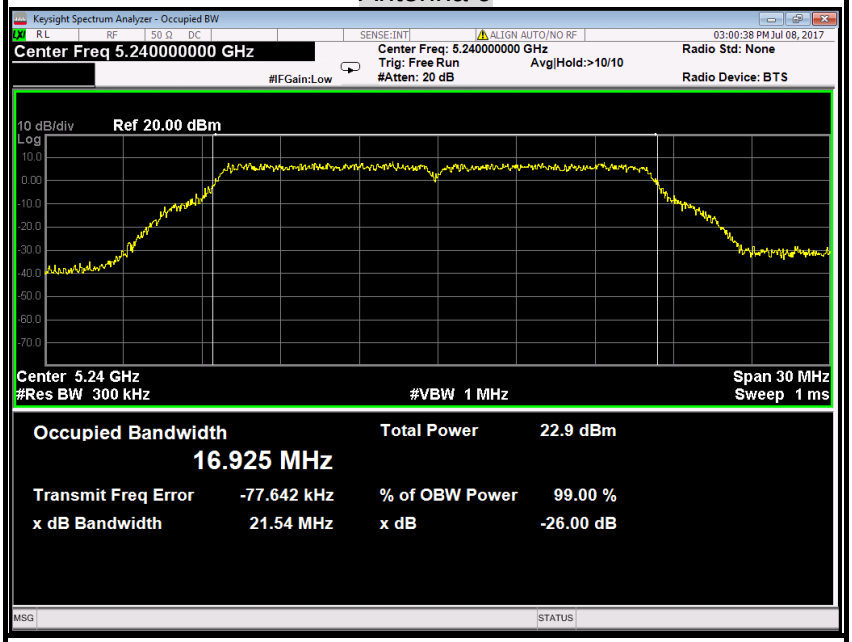

**26dB Bandwidth (CH Mid)**

Antenna 0



**26dB Bandwidth (CH High)**

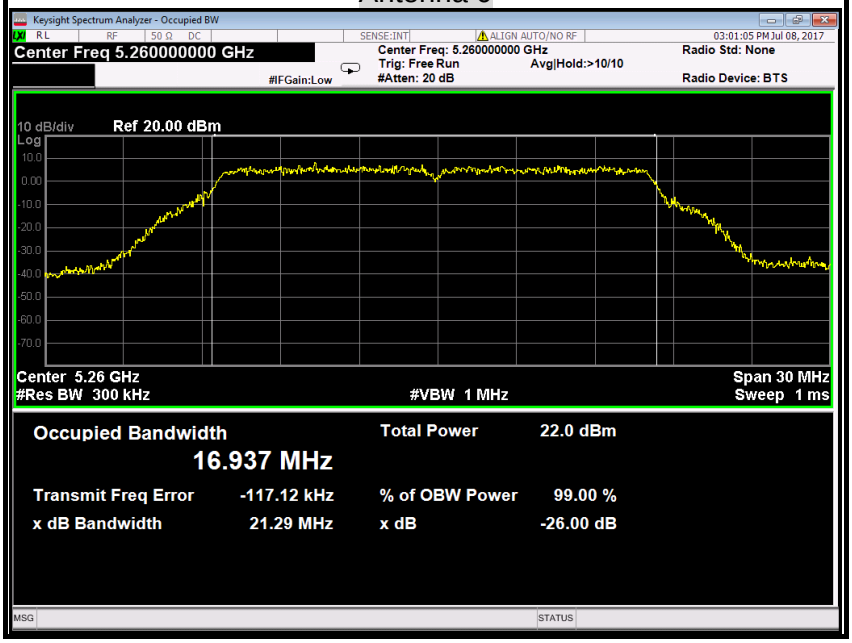
Antenna 0




**IEEE 802.11a mode / 5260~ 5320MHz**

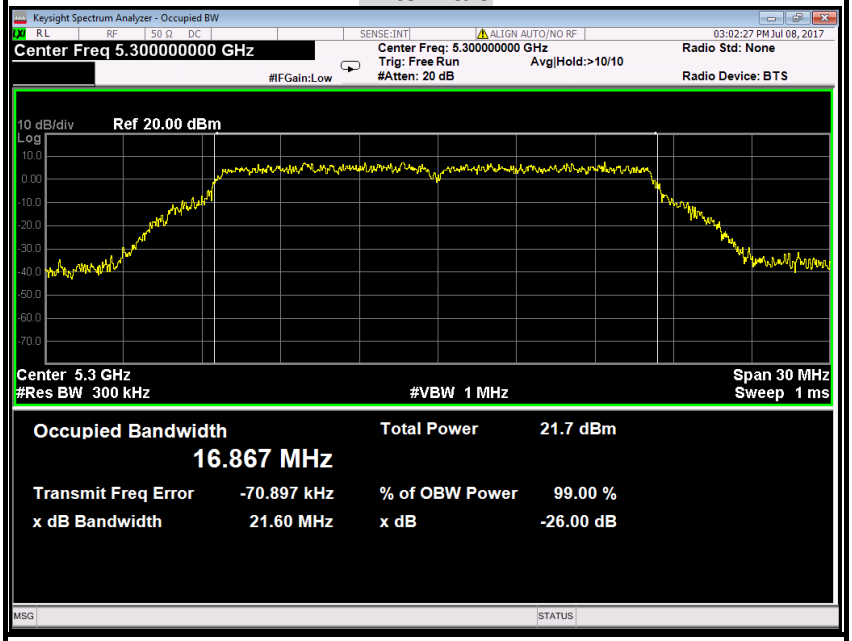
**26dB Bandwidth (CH Low)**

Antenna 0



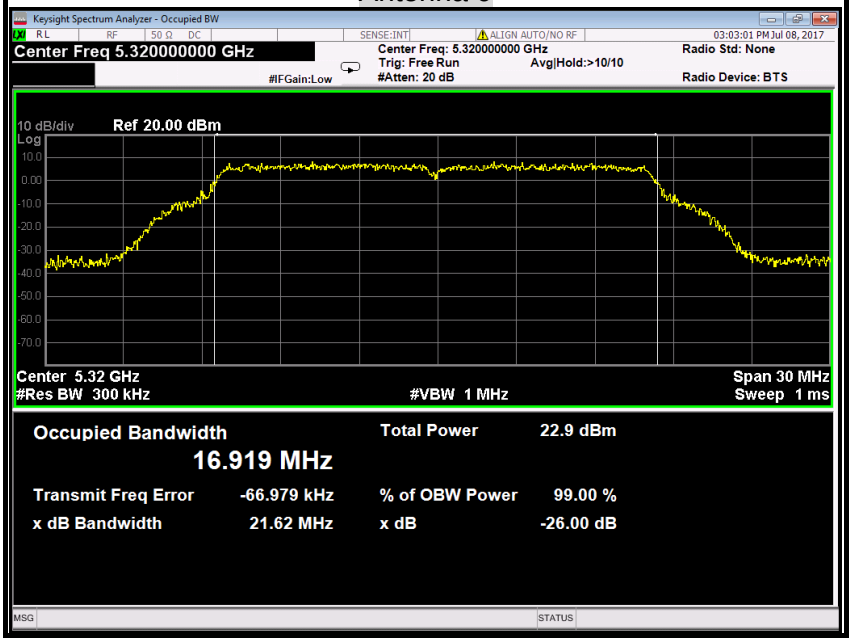
## 26dB Bandwidth (CH Mid)

Antenna 0




## 26dB Bandwidth (CH High)

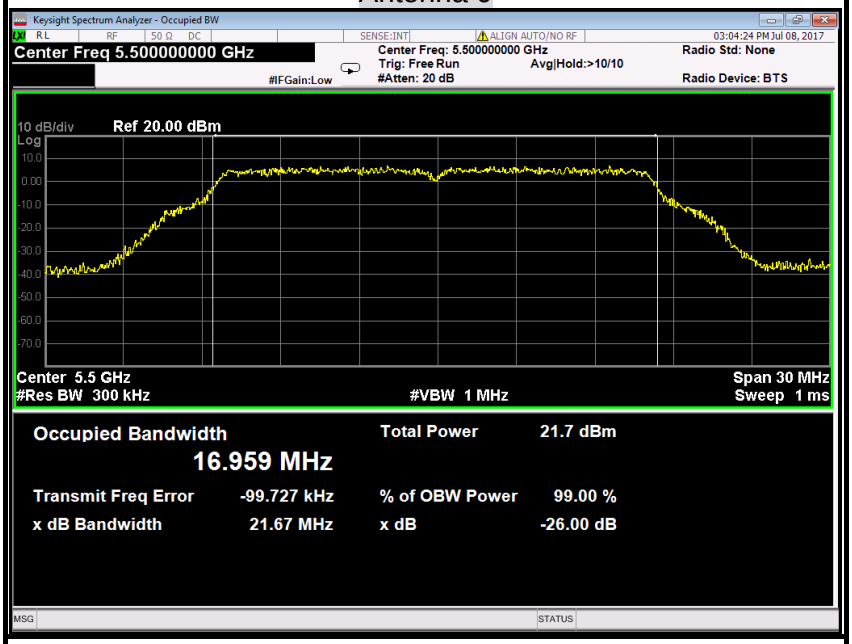
Antenna 0



**IEEE 802.11a mode / 5500 ~ 5700MHz**

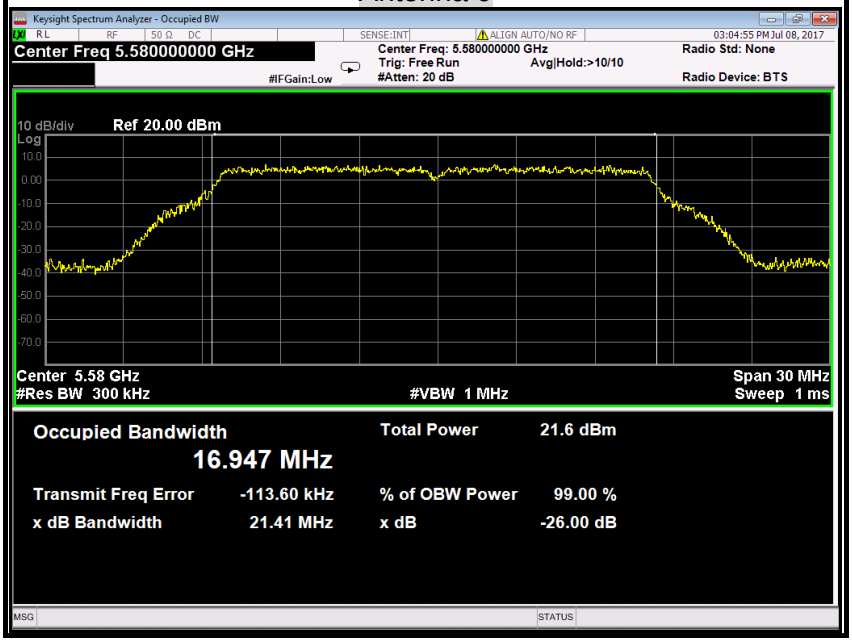
**26dB Bandwidth (CH Low)**

Antenna 0



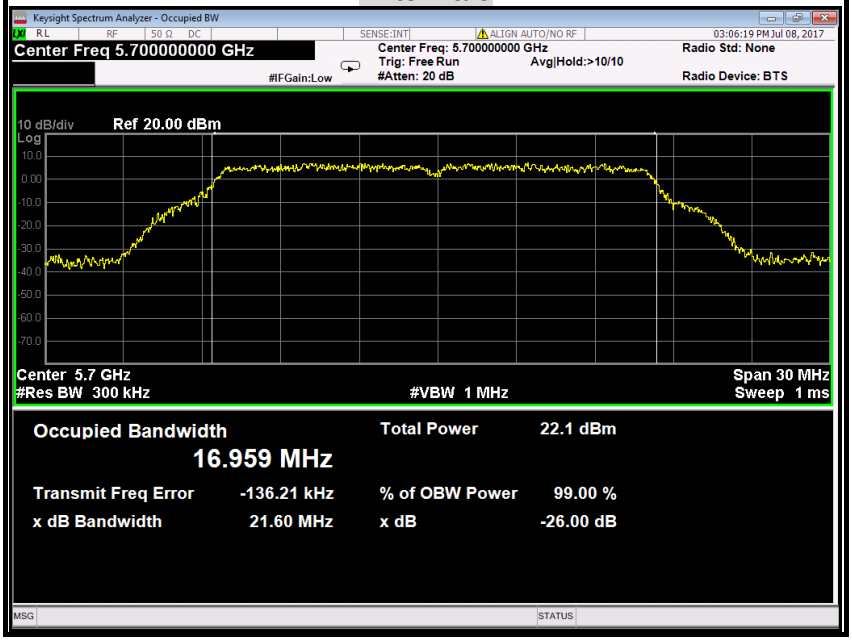

**26dB Bandwidth (CH Mid)**

Antenna 0



**26dB Bandwidth (CH High)**

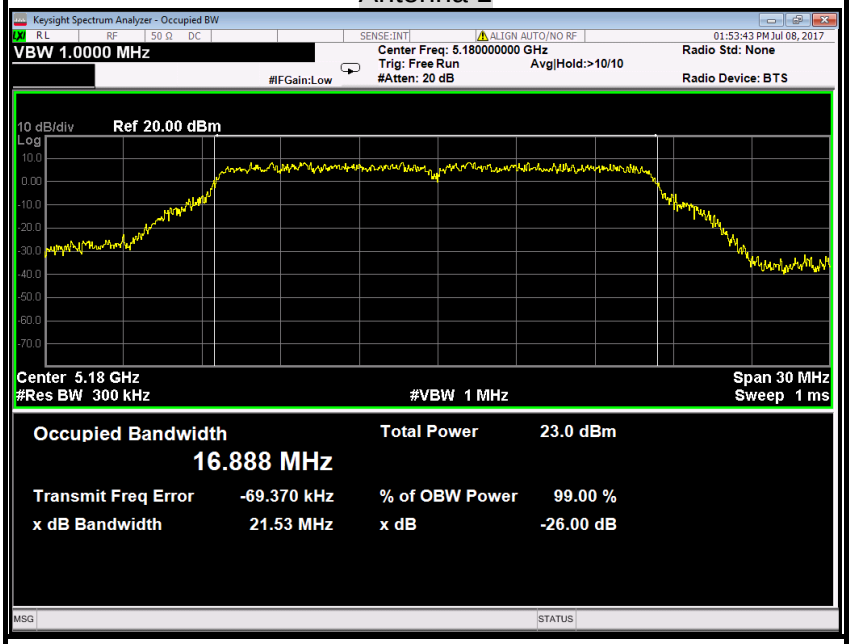
Antenna 0



**IEEE 802.11a mode / 5180 ~ 5240MHz**

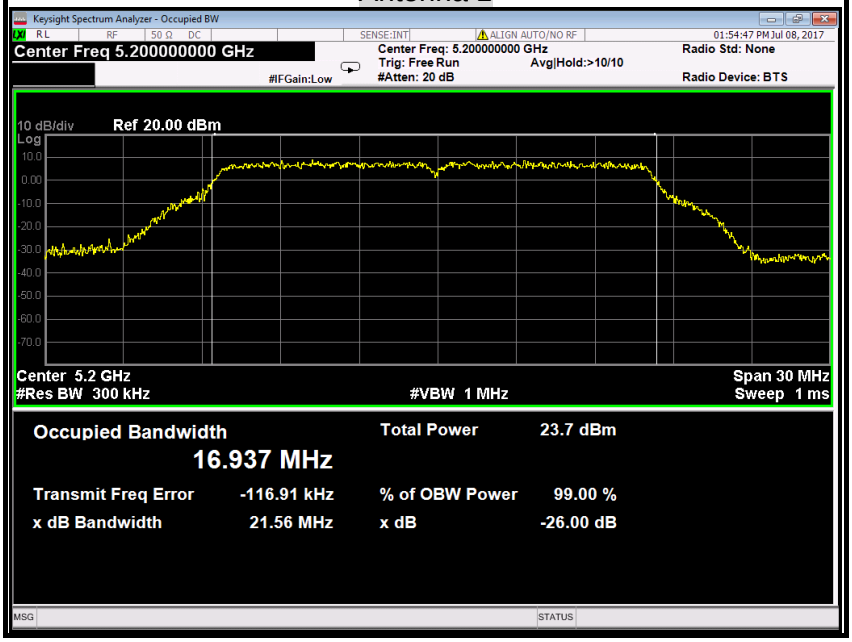
**26dB Bandwidth (CH Low)**

Antenna 1



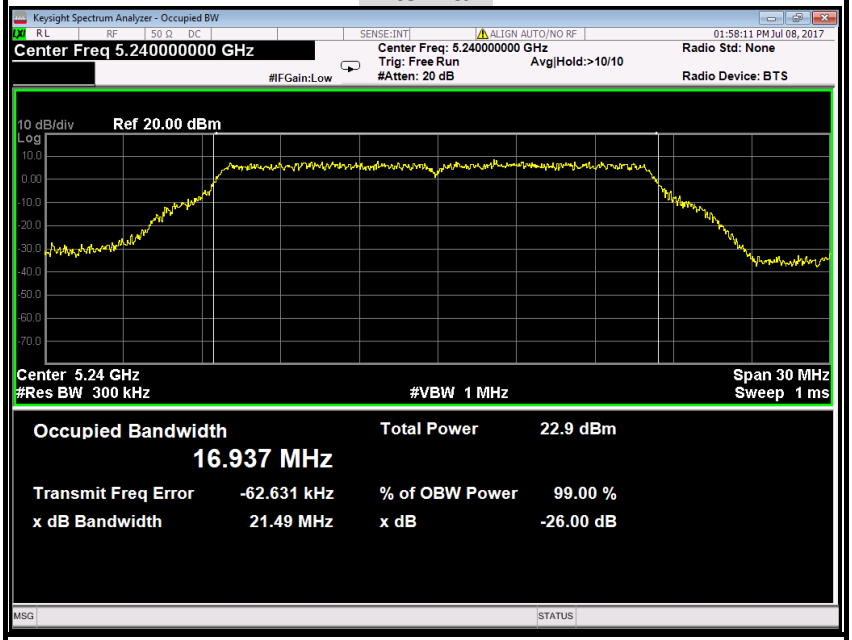

**26dB Bandwidth (CH Mid)**

Antenna 1



**26dB Bandwidth (CH High)**

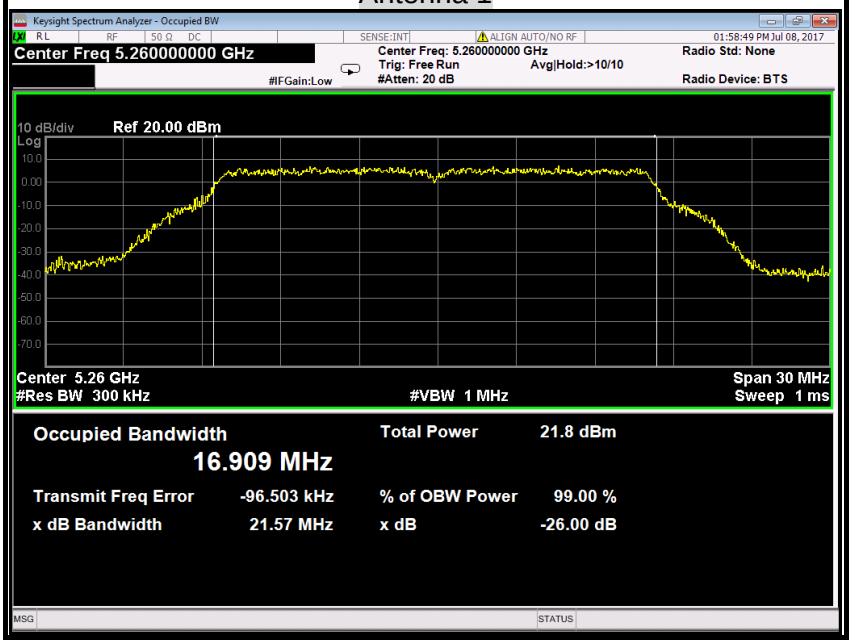
Antenna 1




**IEEE 802.11a mode / 5260~ 5320MHz**

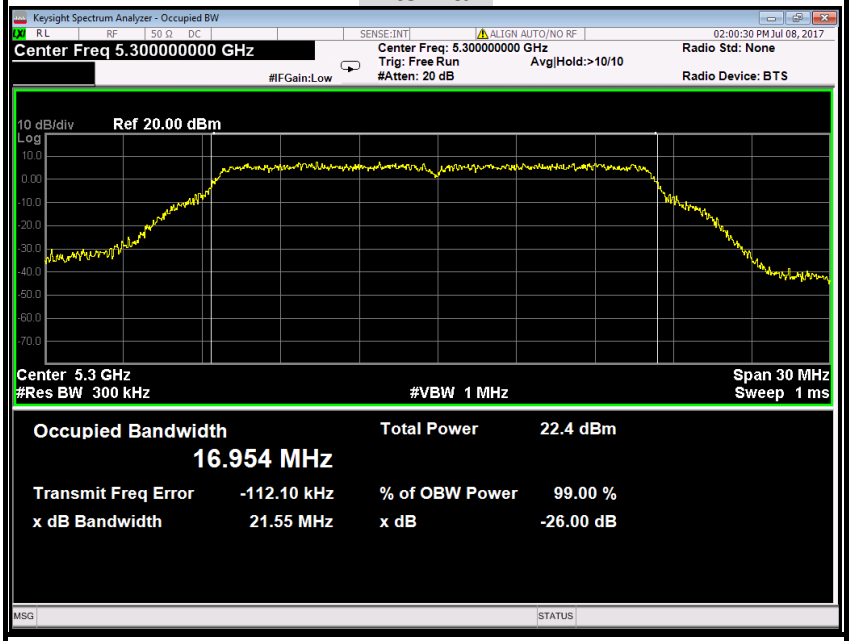
**26dB Bandwidth (CH Low)**

Antenna 1



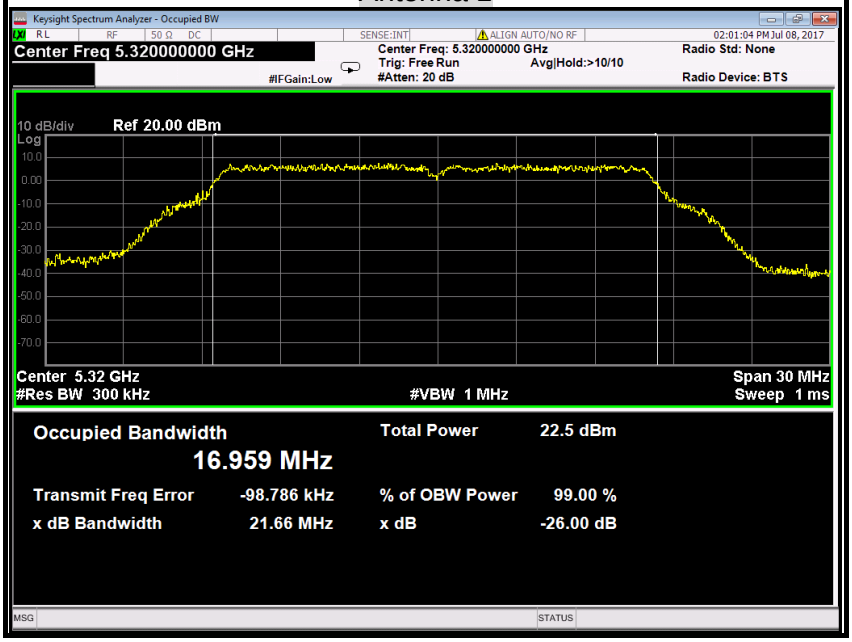
## 26dB Bandwidth (CH Mid)

Antenna 1




## 26dB Bandwidth (CH High)

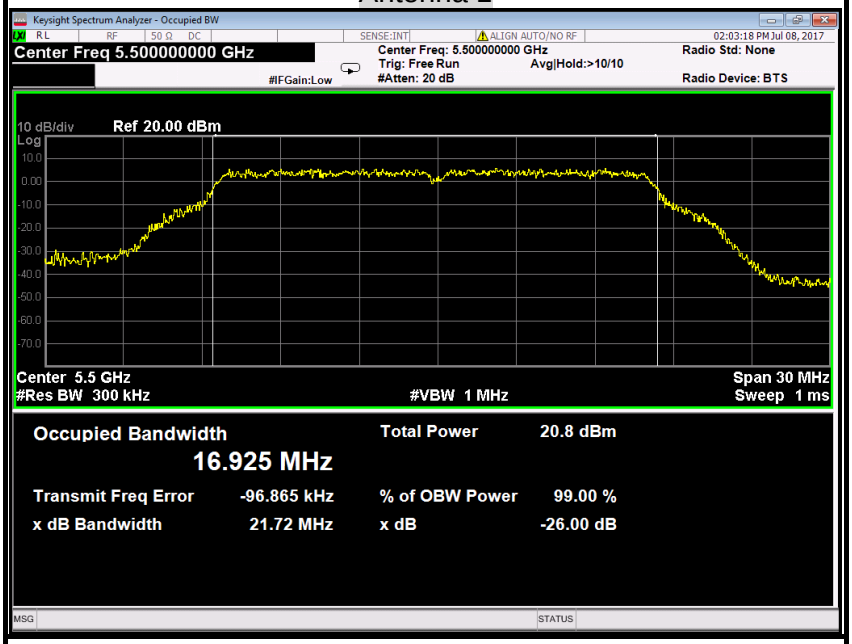
Antenna 1



**IEEE 802.11a mode / 5500 ~ 5700MHz**

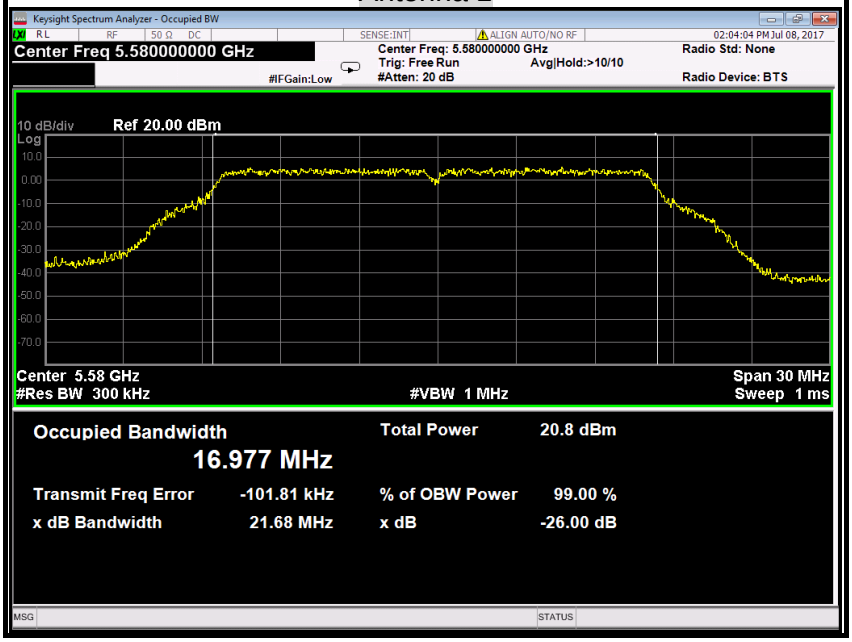
**26dB Bandwidth (CH Low)**

Antenna 1



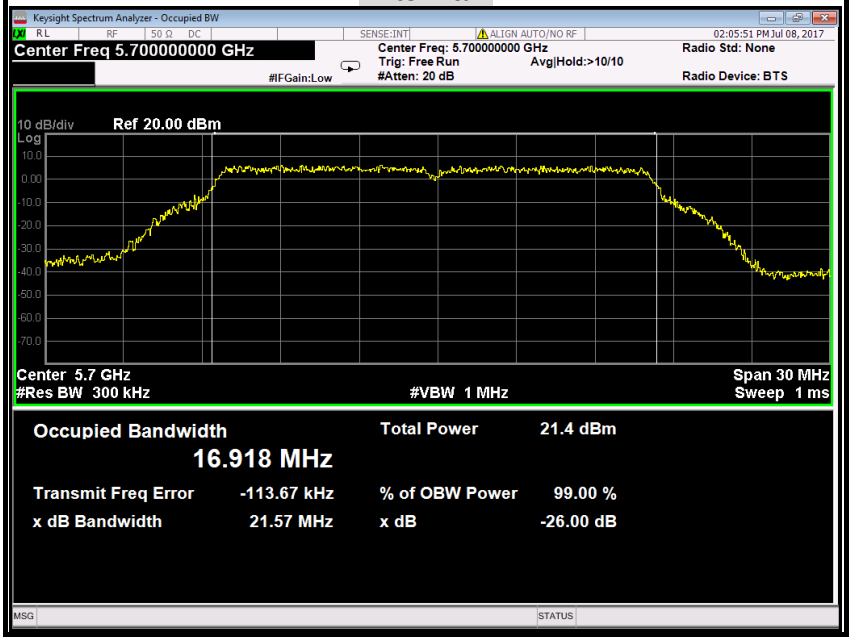

**26dB Bandwidth (CH Mid)**

Antenna 1



## 26dB Bandwidth (CH High)

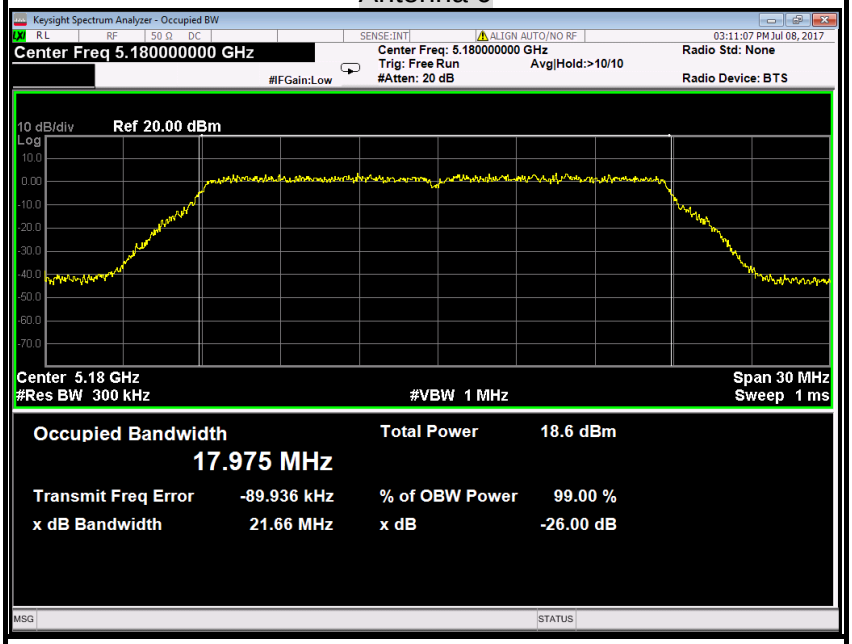
Antenna 1



**IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz**

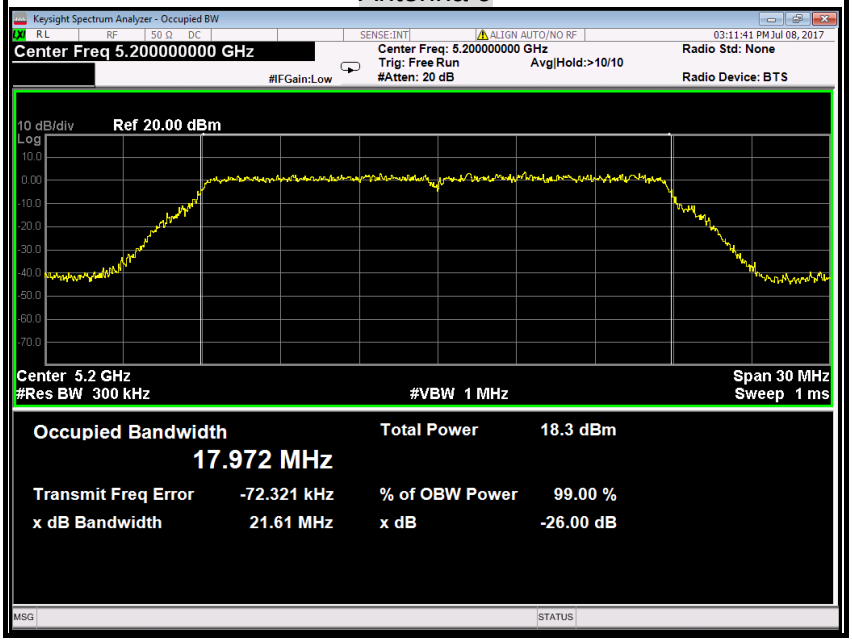
**26dB Bandwidth (CH Low)**

Antenna 0



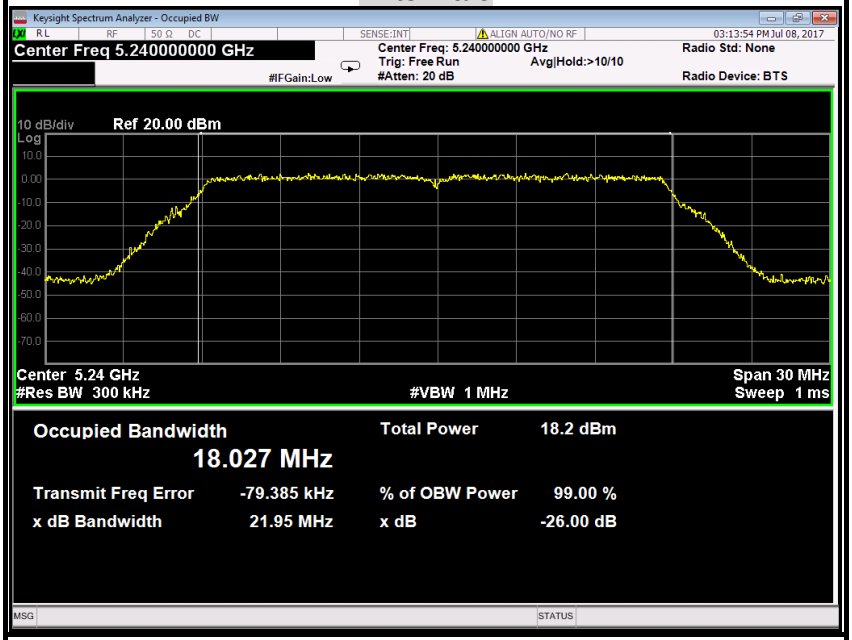

**26dB Bandwidth (CH Mid)**

Antenna 0



**26dB Bandwidth (CH High)**

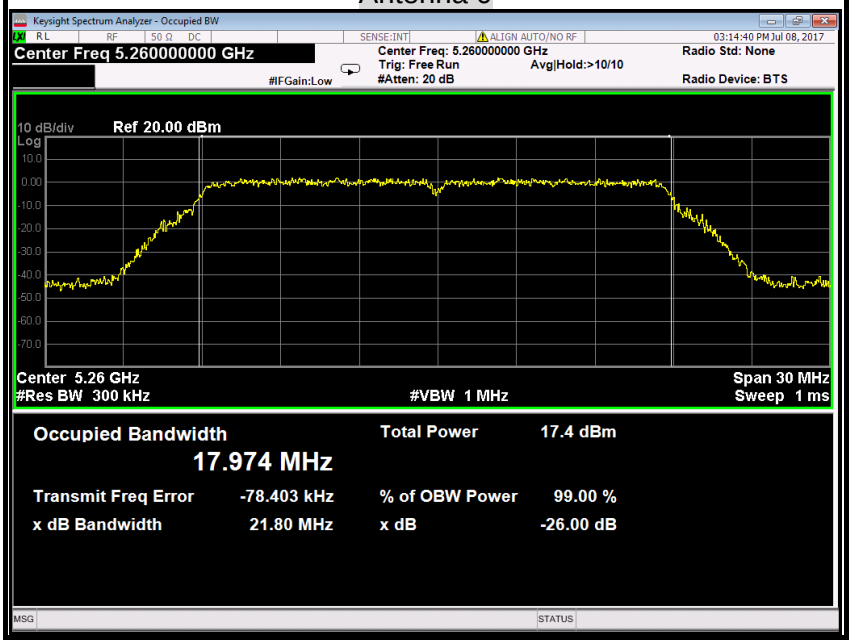
Antenna 0




**IEEE 802.11n HT 20 MHz mode / 5260~ 5320MHz**

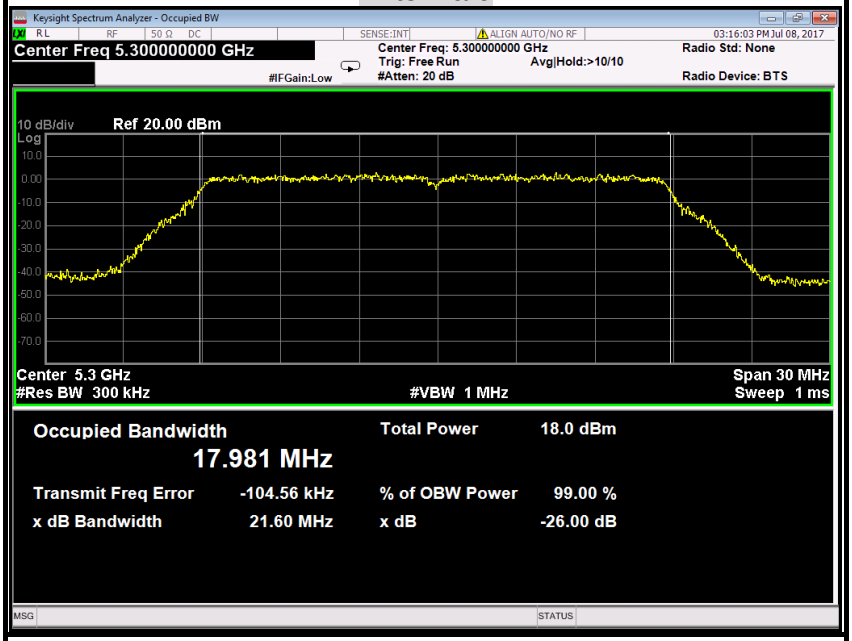
**26dB Bandwidth (CH Low)**

Antenna 0



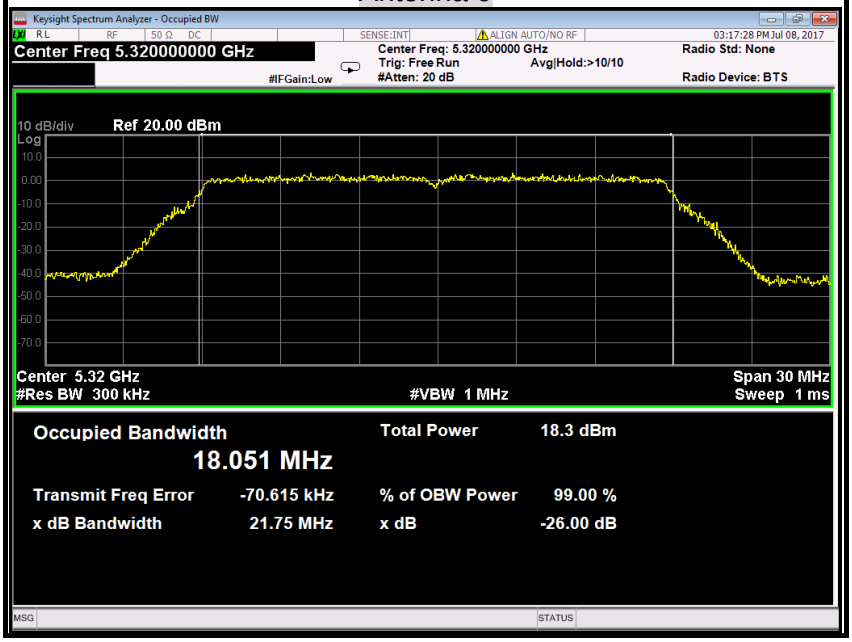
## 26dB Bandwidth (CH Mid)

Antenna 0




## 26dB Bandwidth (CH High)

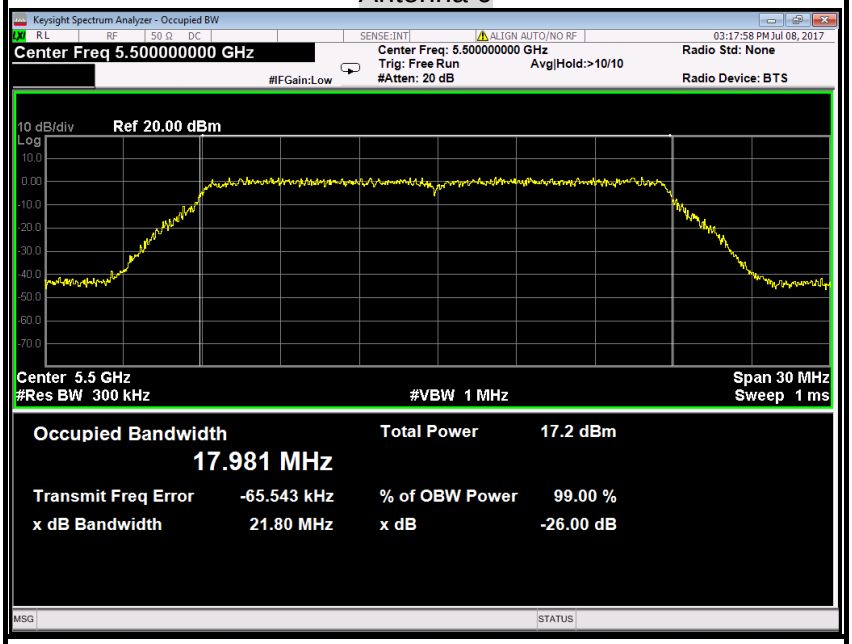
Antenna 0



**IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz**

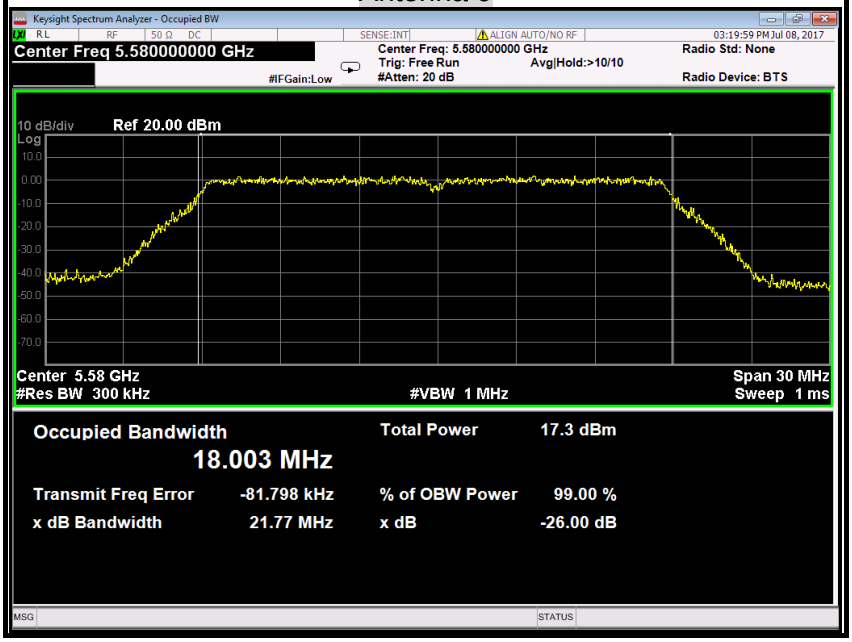
**26dB Bandwidth (CH Low)**

Antenna 0



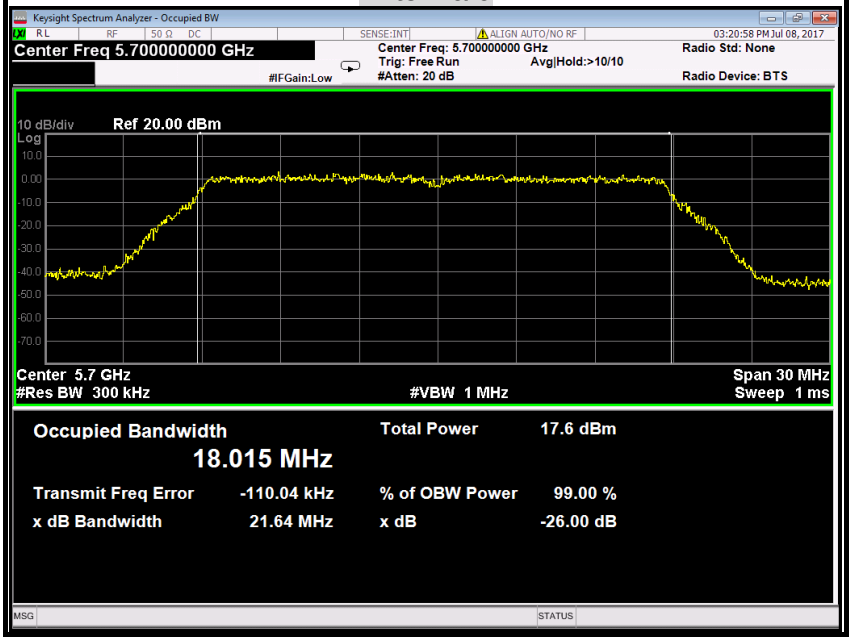

**26dB Bandwidth (CH Mid)**

Antenna 0



**26dB Bandwidth (CH High)**

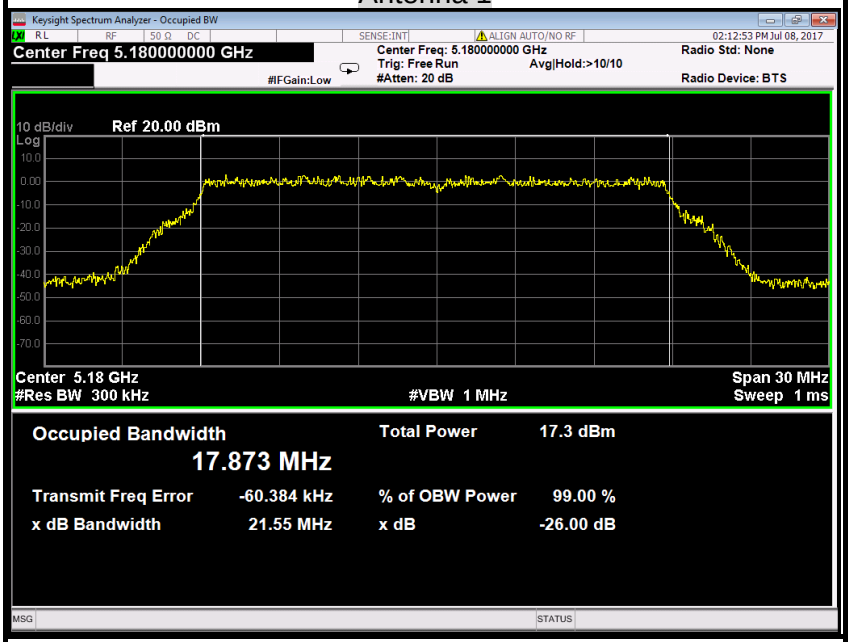
Antenna 0



**IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz**

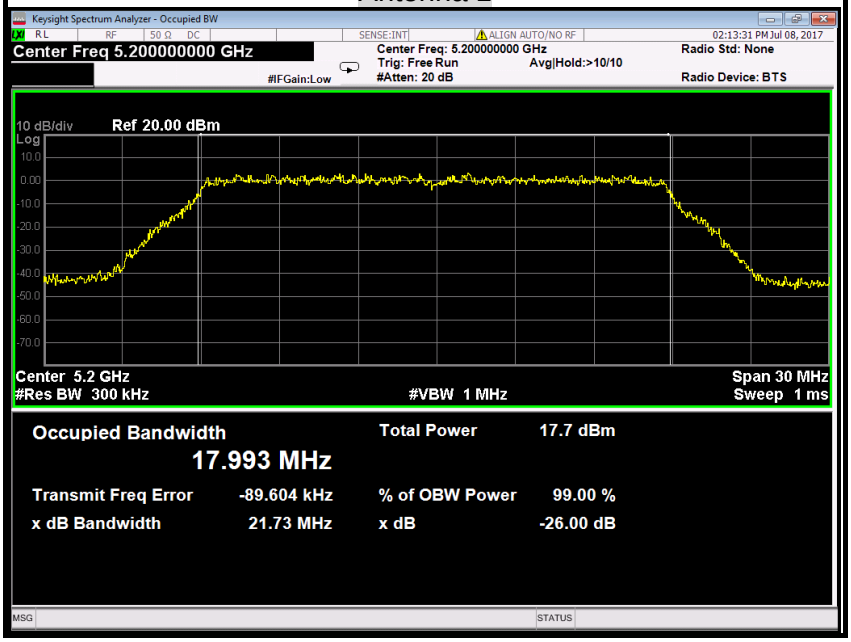
**26dB Bandwidth (CH Low)**

Antenna 1



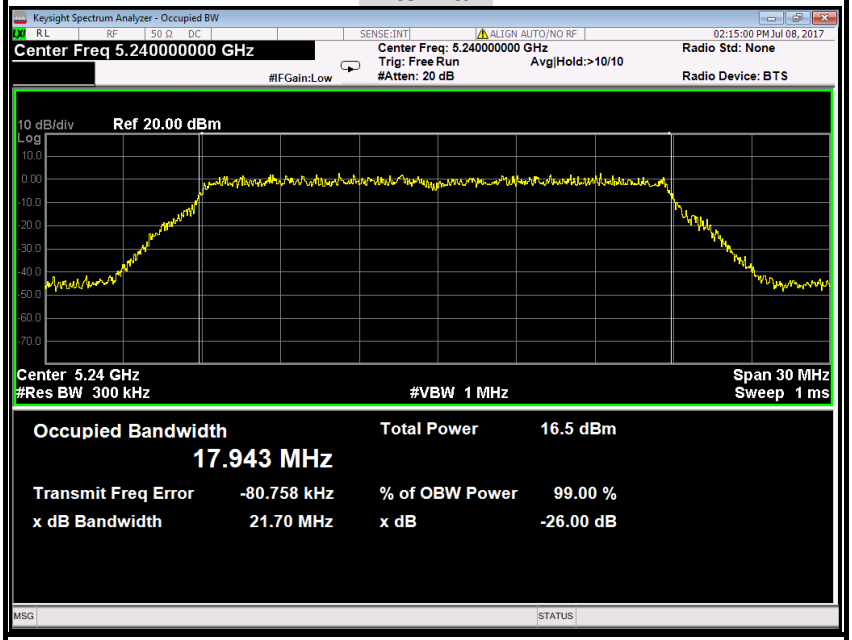

**26dB Bandwidth (CH Mid)**

Antenna 1



**26dB Bandwidth (CH High)**

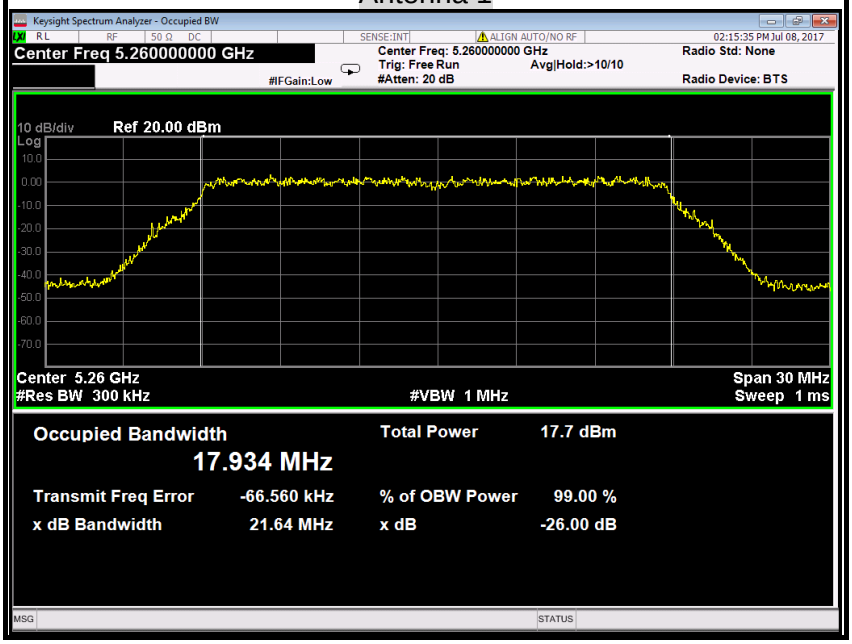
Antenna 1




**IEEE 802.11n HT 20 MHz mode / 5260~ 5320MHz**

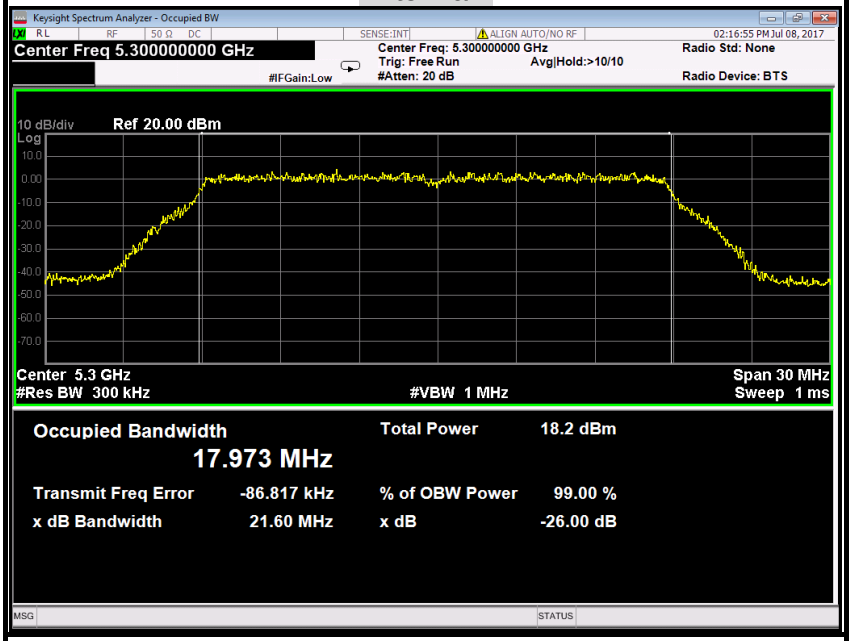
**26dB Bandwidth (CH Low)**

Antenna 1



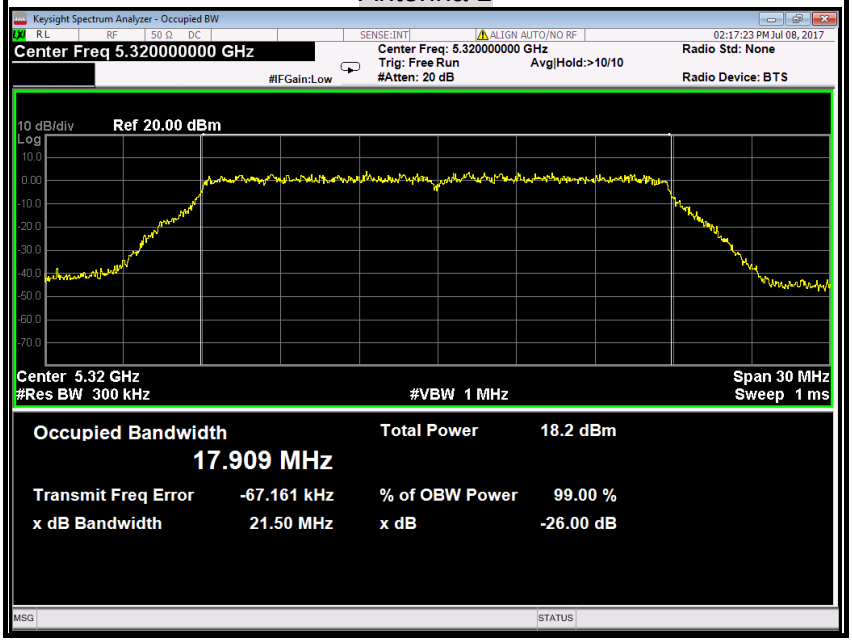
## 26dB Bandwidth (CH Mid)

Antenna 1




## 26dB Bandwidth (CH High)

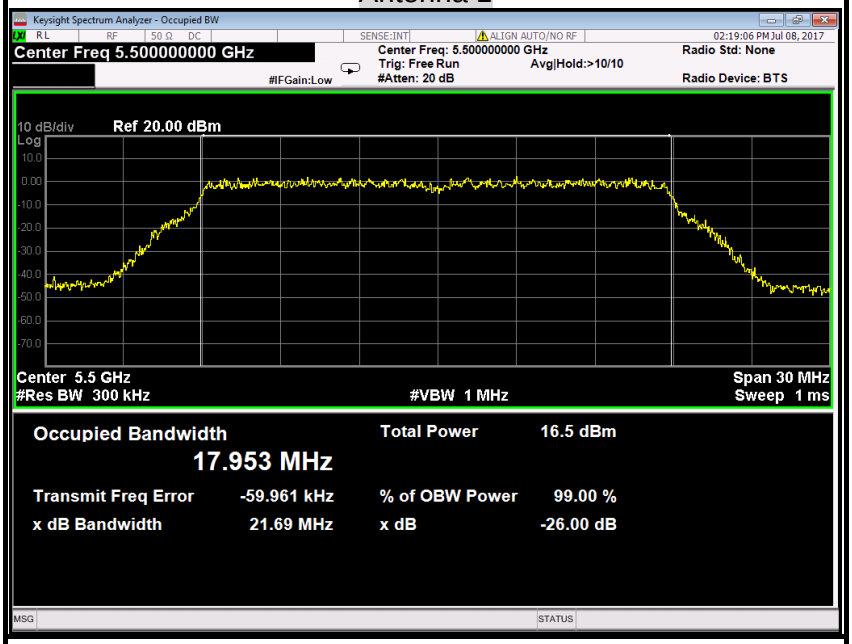
Antenna 1



**IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz**

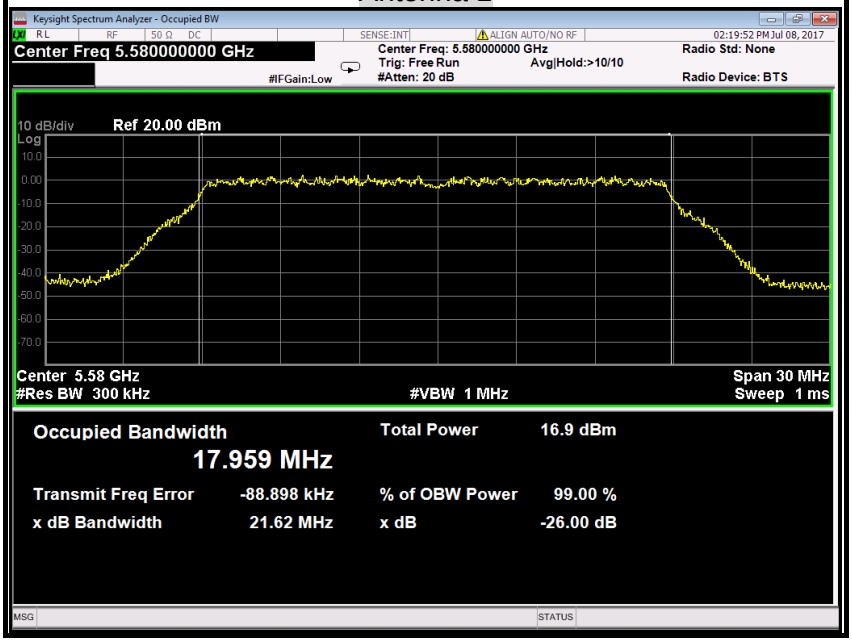
**26dB Bandwidth (CH Low)**

Antenna 1



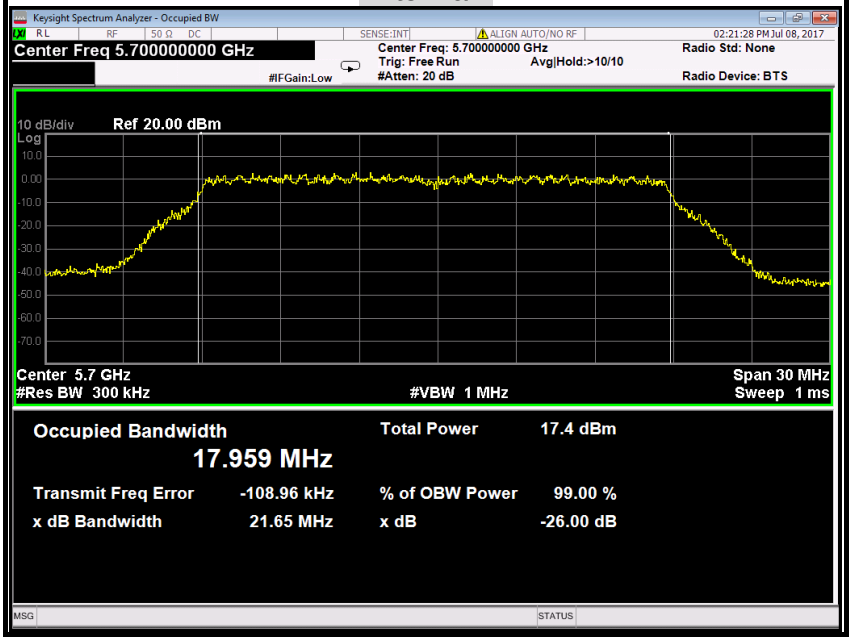

**26dB Bandwidth (CH Mid)**

Antenna 1



**26dB Bandwidth (CH High)**

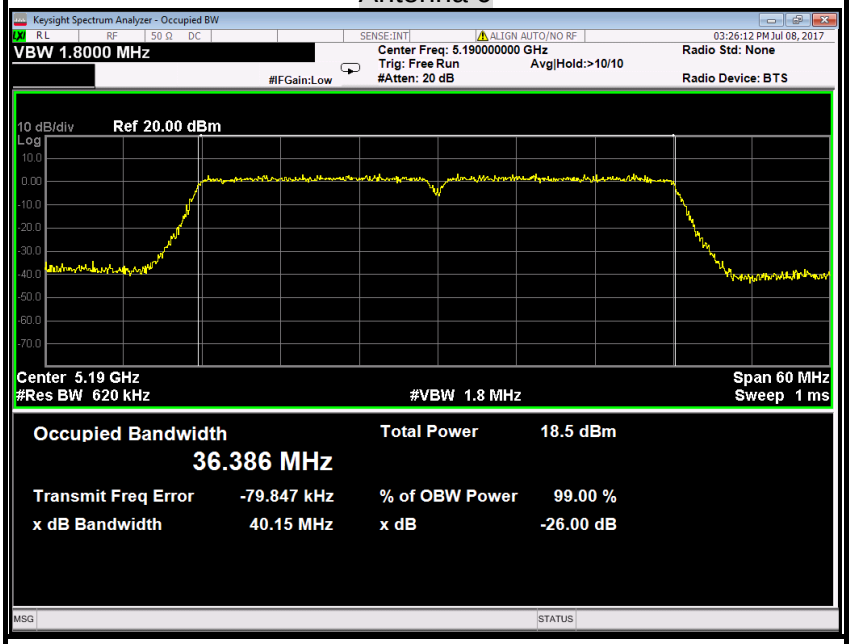
Antenna 1



**IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz**

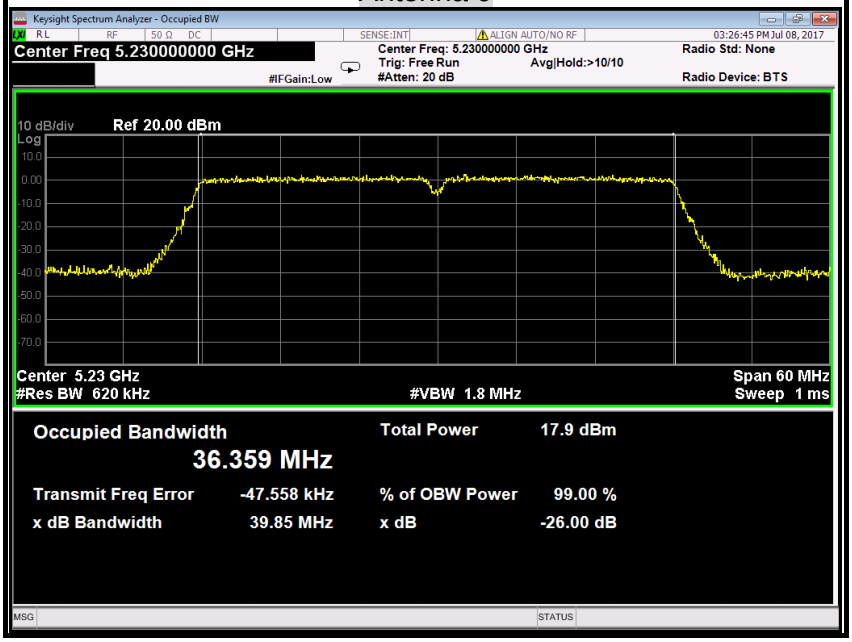
**26dB Bandwidth (CH Low)**

Antenna 0




**26dB Bandwidth (CH High)**

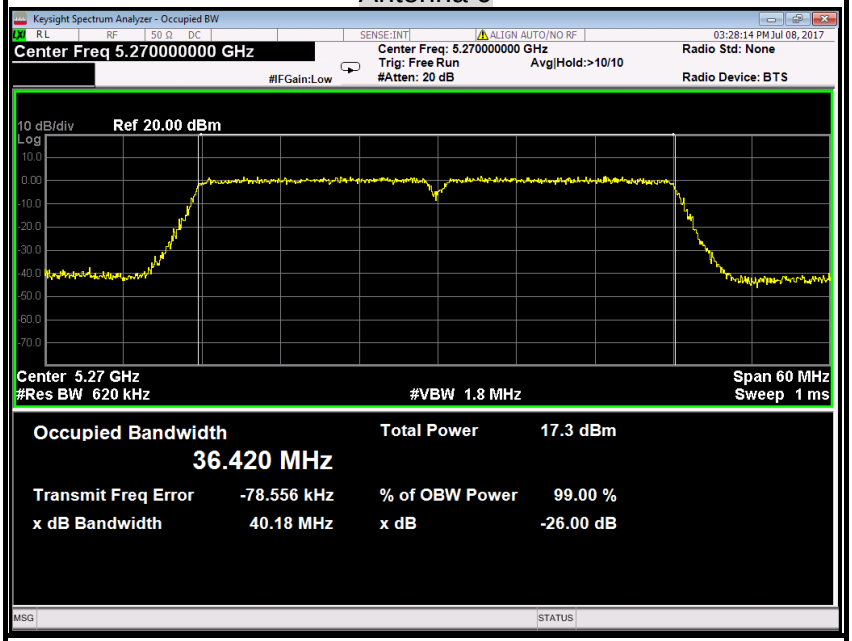
Antenna 0



**IEEE 802.11n HT 40 MHz mode / 5270 ~ 5310MHz**

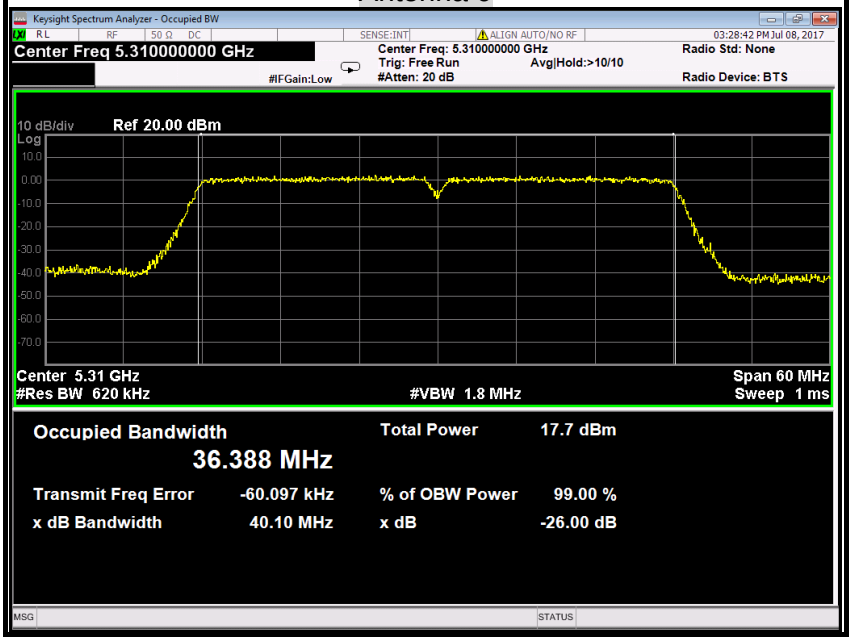
**26dB Bandwidth (CH Low)**

Antenna 0




**26dB Bandwidth (CH High)**

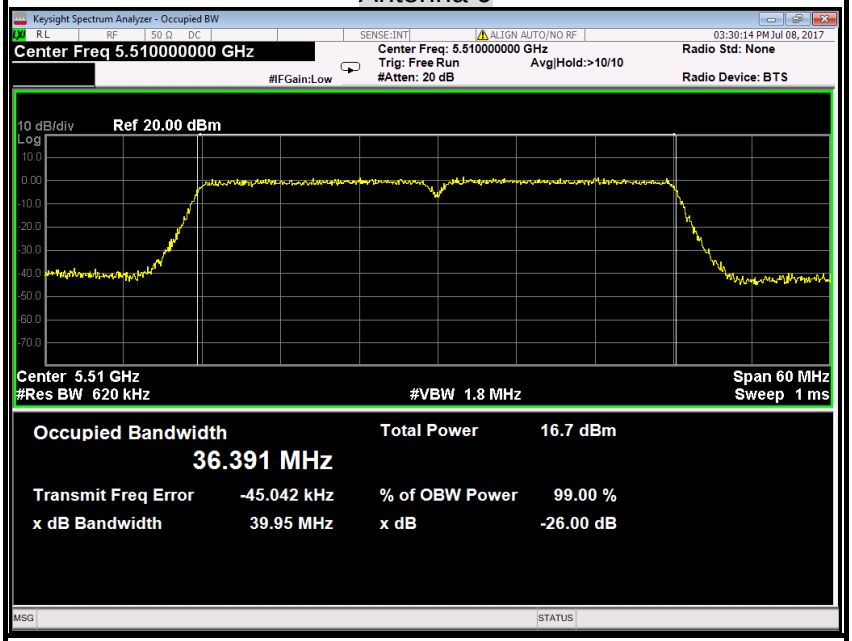
Antenna 0



**IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz**

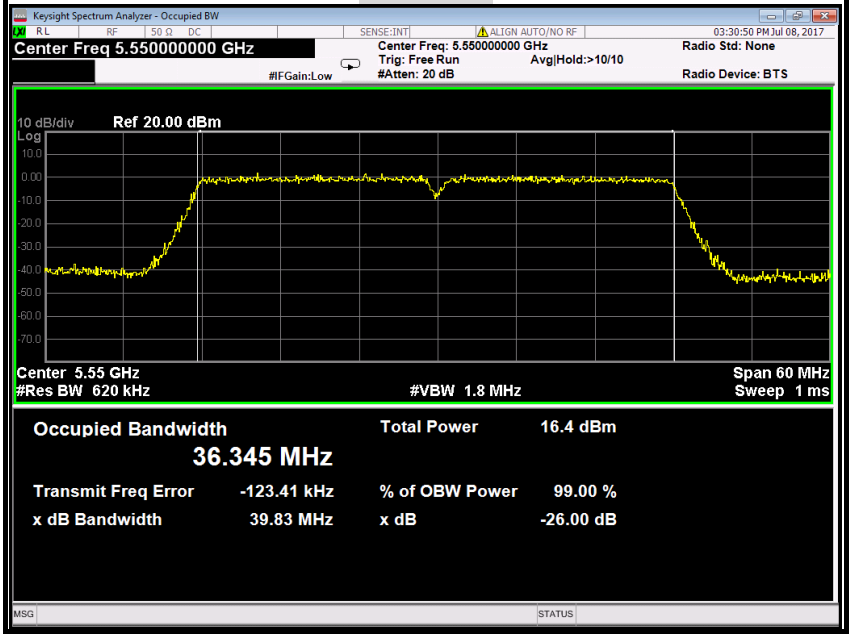
**26dB Bandwidth (CH Low)**

Antenna 0



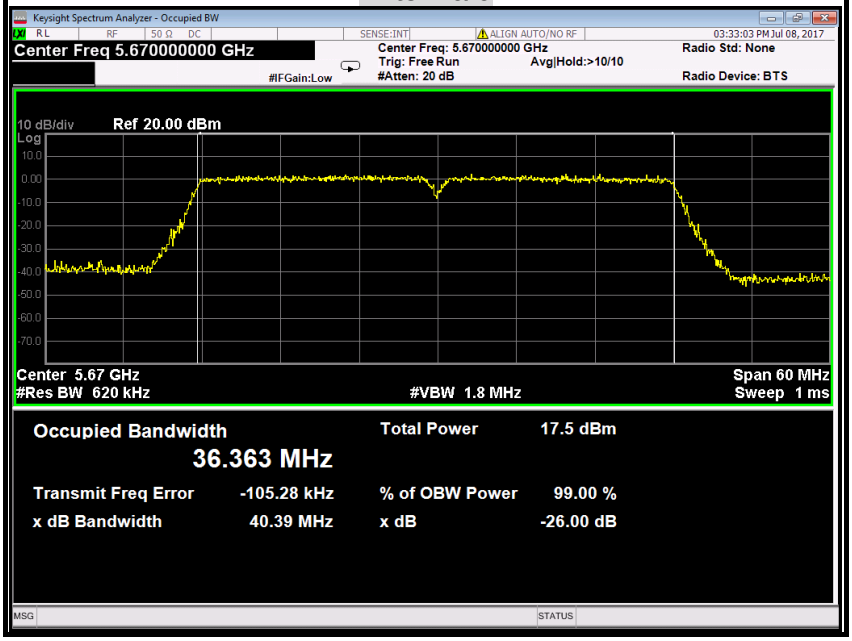

**26dB Bandwidth (CH Mid)**

Antenna 0



**26dB Bandwidth (CH High)**

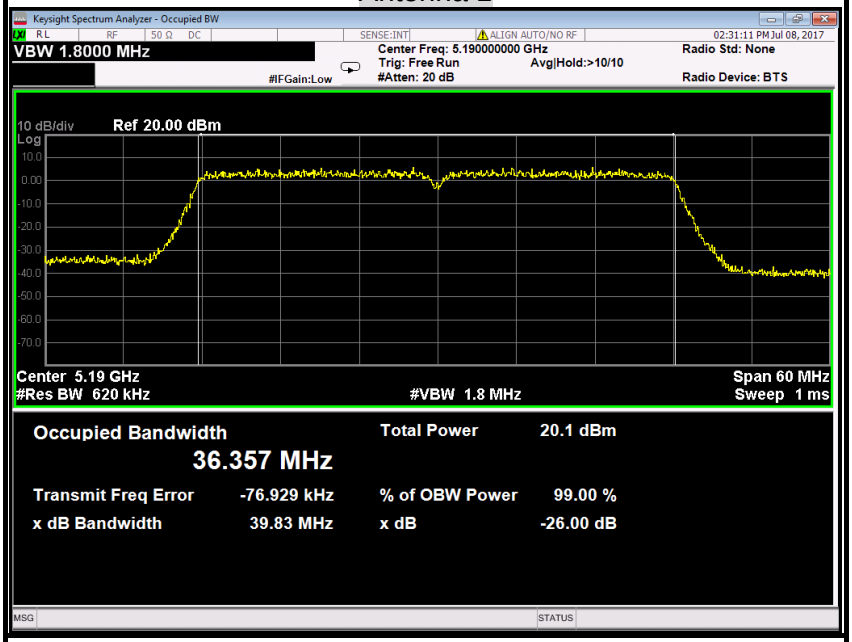
Antenna 0



**IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz**

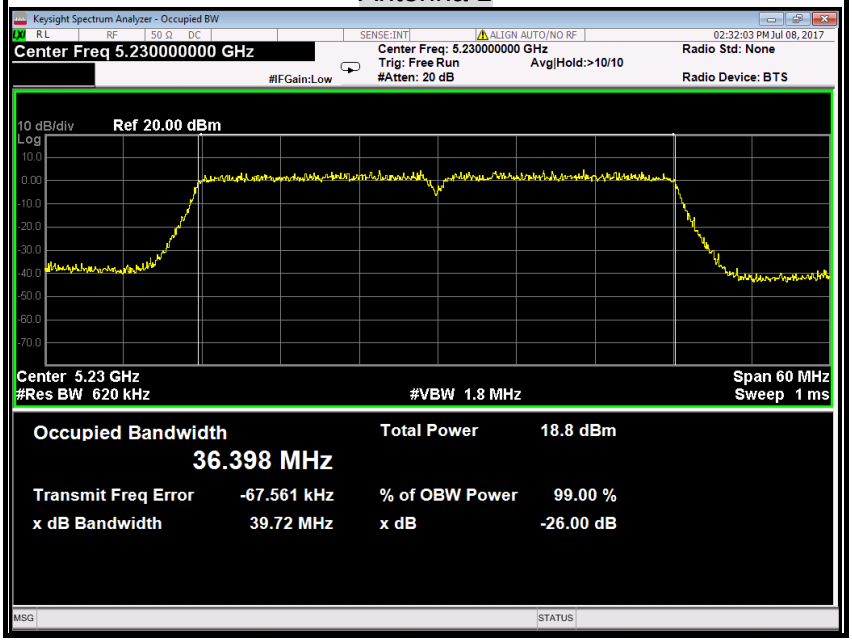
**26dB Bandwidth (CH Low)**

Antenna 1




**26dB Bandwidth (CH High)**

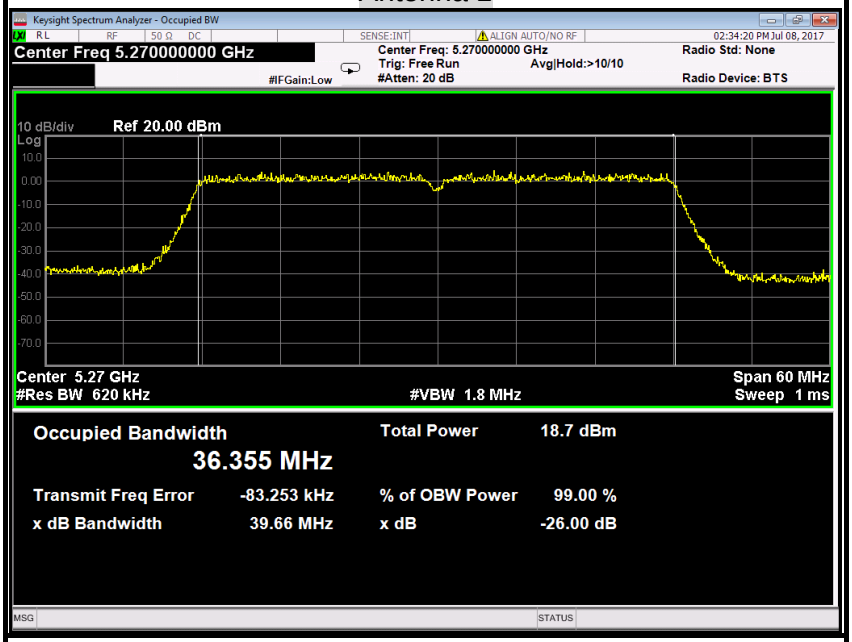
Antenna 1



**IEEE 802.11n HT 40 MHz mode / 5270 ~ 5310MHz**

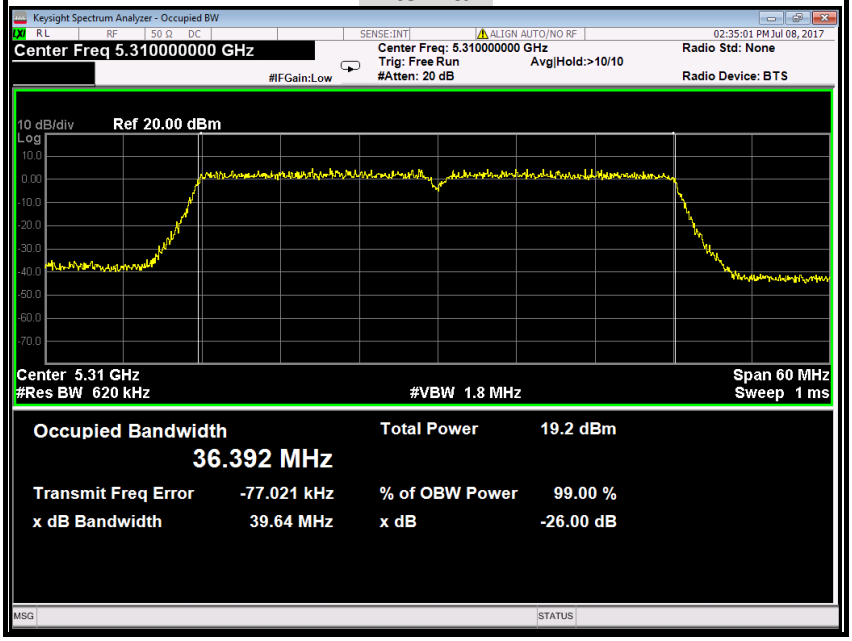
**26dB Bandwidth (CH Low)**

Antenna 1




**26dB Bandwidth (CH High)**

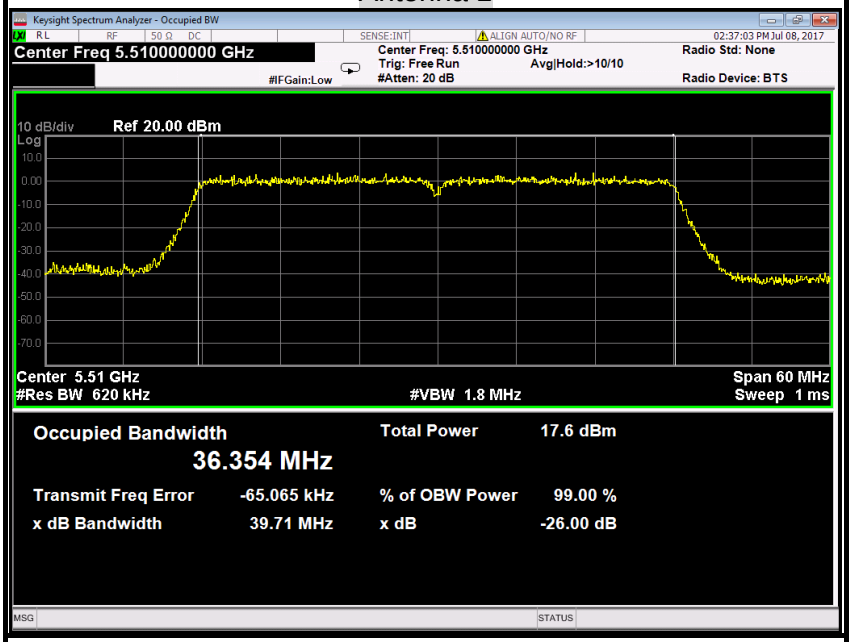
Antenna 1



## IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz

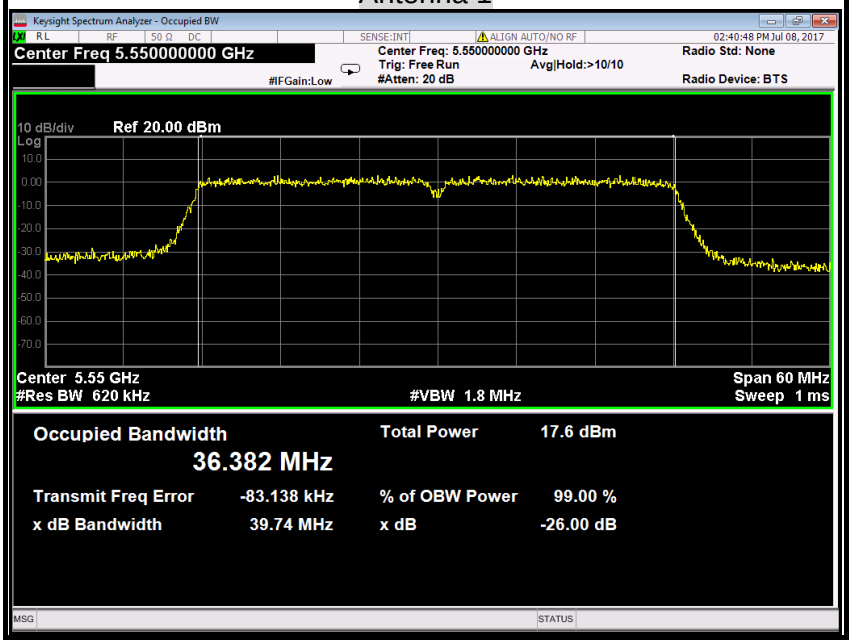
### 26dB Bandwidth (CH Low)

Antenna 1



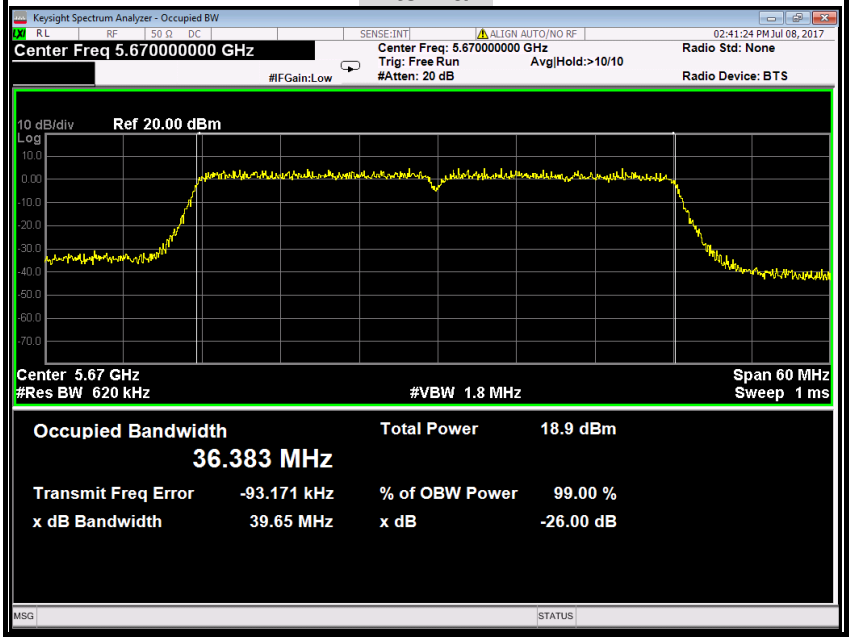

### 26dB Bandwidth (CH Mid)

Antenna 1



**26dB Bandwidth (CH High)**

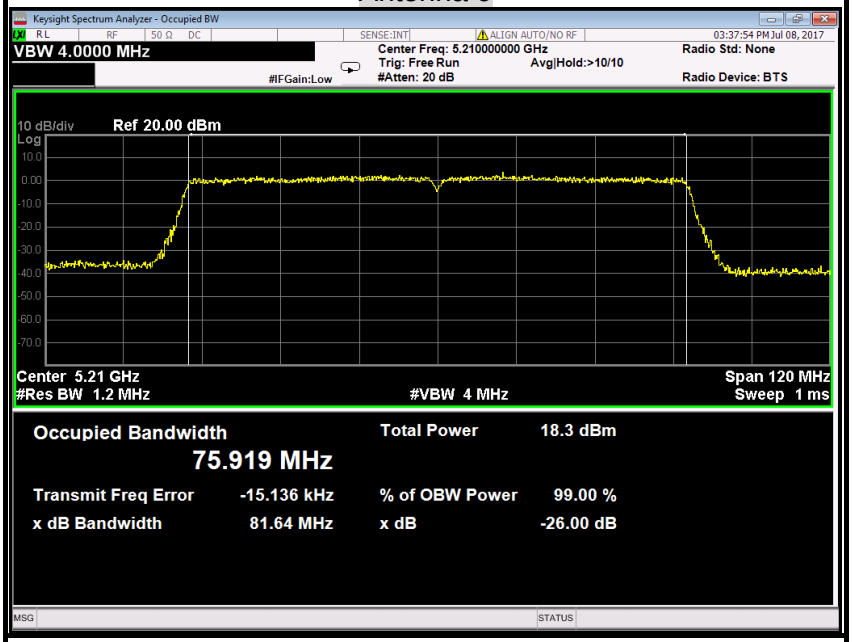
Antenna 1



**IEEE 802.11ac 80 mode / 5210MHz**

**26dB Bandwidth**

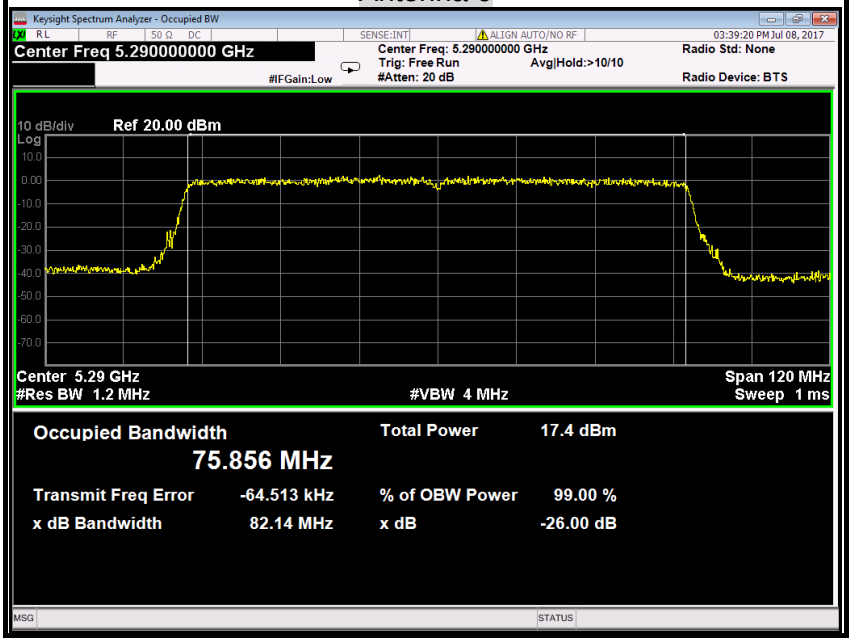
Antenna 0




**IEEE 802.11ac 80 mode / 5290MHz**

**26dB Bandwidth**

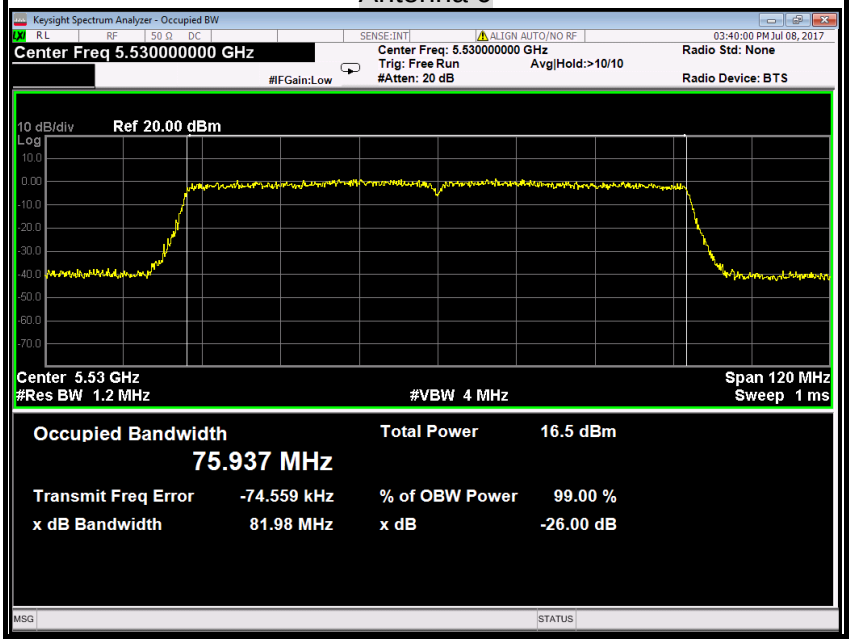
Antenna 0



**IEEE 802.11ac 80 mode / 5530MHz**

**26dB Bandwidth**

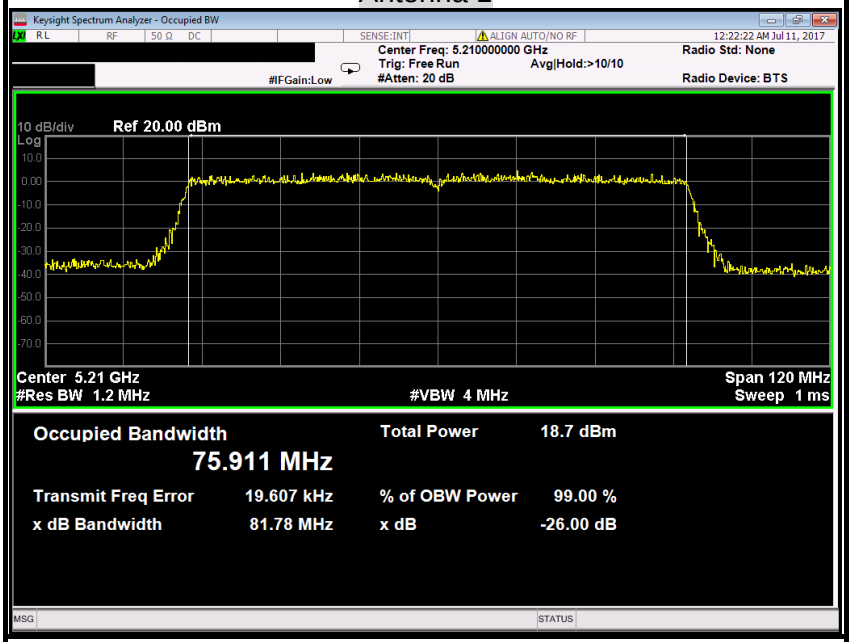
Antenna 0



**IEEE 802.11ac 80 mode / 5210MHz**

**26dB Bandwidth**

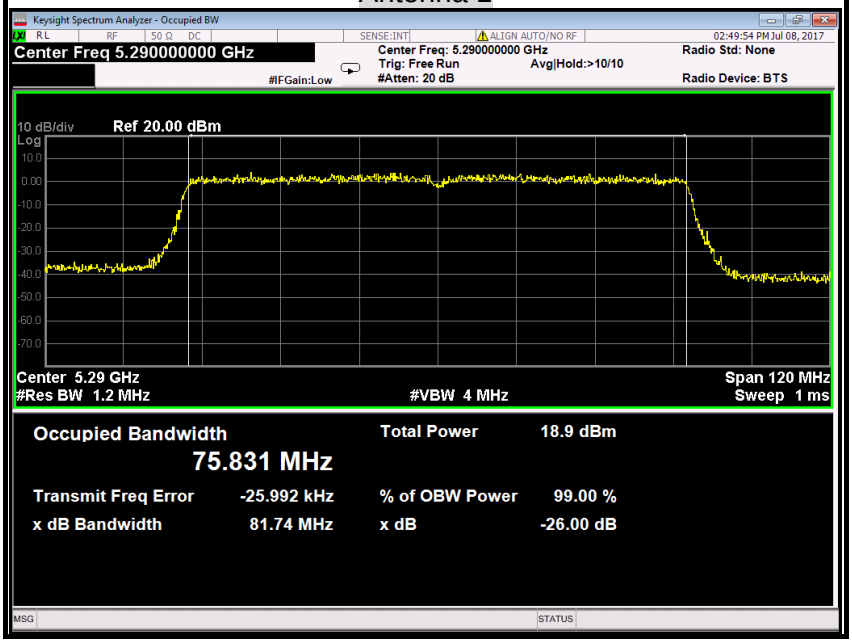
Antenna 1



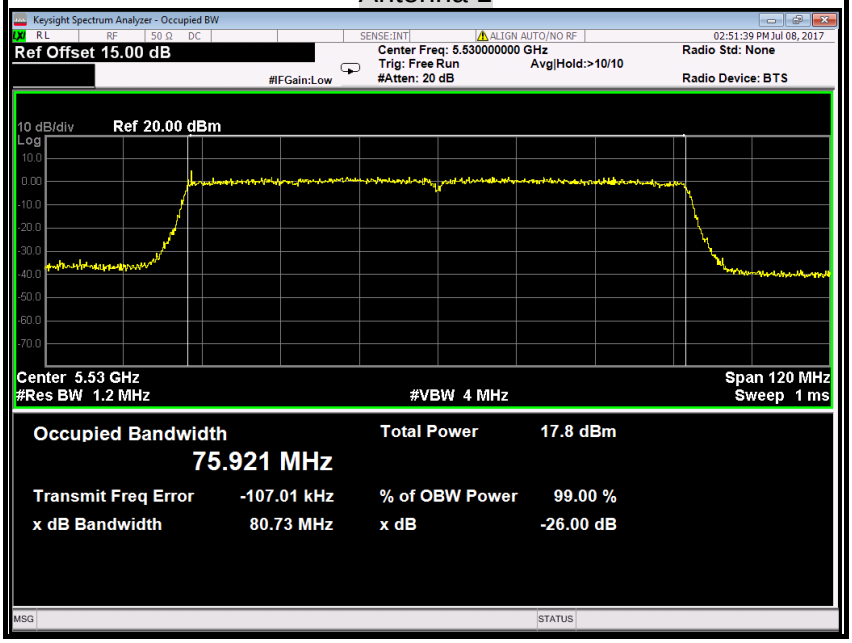

**IEEE 802.11ac 80 mode / 5290MHz**

**26dB Bandwidth**

Antenna 1



| IEEE 802.11ac 80 mode / 5530MHz |
|---|
| 26dB Bandwidth |
| Antenna 1 |



## 6.2 6dB BANDWIDTH MEASUREMENT

### 6.2.1 LIMITS

According to §15.407(e), Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

### 6.2.2 TEST INSTRUMENTS

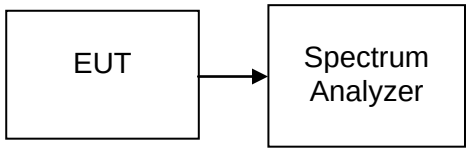
| Name of Equipment | Manufacturer | Model | Serial Number | Last Calibration | Calibration Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent | N9010A | MY52221469 | 02/21/2017 | 02/20/2018 |

### 6.2.3 TEST PROCEDURES (please refer to measurement standard)

8.1 Option 2:

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

### 6.2.4 TEST SETUP



### 6.2.5 TEST RESULTS

*No non-compliance noted*

**Test Data**

**Test mode: IEEE 802.11a mode / 5745 ~ 5825MHz**

| Channel | Frequency (MHz) | 6dB Bandwidth(B) (MHz) | | Limit (kHz) | Test Result |
|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | | |
| Low | 5745 | 16.40 | 16.34 | >500 | PASS |
| Mid | 5785 | 16.34 | 16.37 | | PASS |
| High | 5825 | 16.45 | 16.44 | | PASS |

**Test mode: IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz**

| Channel | Frequency (MHz) | 6dB Bandwidth(B) (MHz) | | Limit (kHz) | Test Result |
|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | | |
| Low | 5745 | 17.57 | 17.59 | >500 | PASS |
| Mid | 5785 | 17.58 | 17.58 | | PASS |
| High | 5825 | 17.57 | 17.59 | | PASS |

**Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz**

| Channel | Frequency (MHz) | 6dB Bandwidth(B) (MHz) | | Limit (kHz) | Test Result |
|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | | |
| Low | 5755 | 36.45 | 36.38 | >500 | PASS |
| High | 5795 | 36.35 | 36.34 | | PASS |

**Test mode: IEEE 802.11ac 80 mode / 5775MHz**

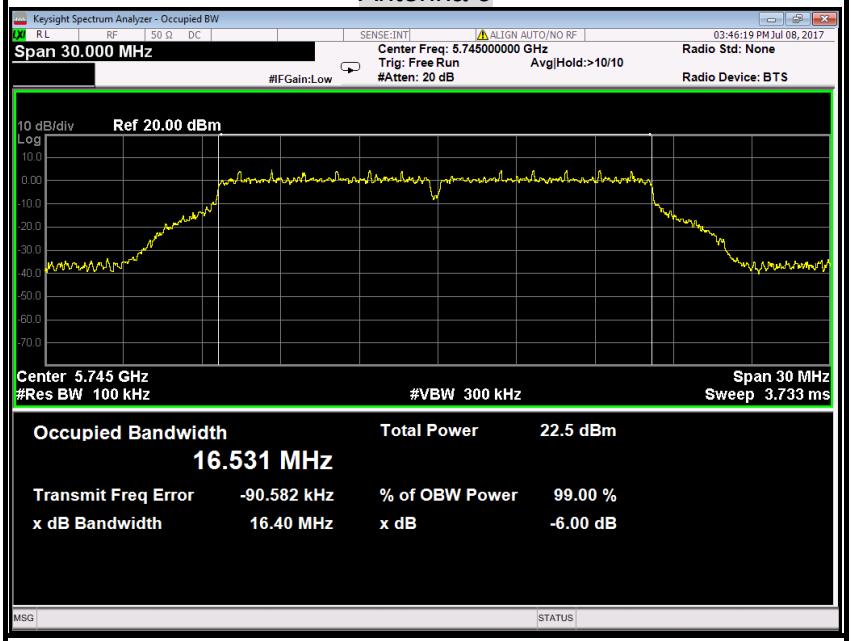
| Channel | Frequency (MHz) | 6dB Bandwidth(B) (MHz) | | Limit (kHz) | Test Result |
|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | | |
| | 5775 | 75.80 | 75.82 | >500 | PASS |

## Test Plot

**IEEE 802.11a mode / 5745 ~ 5825MHz**

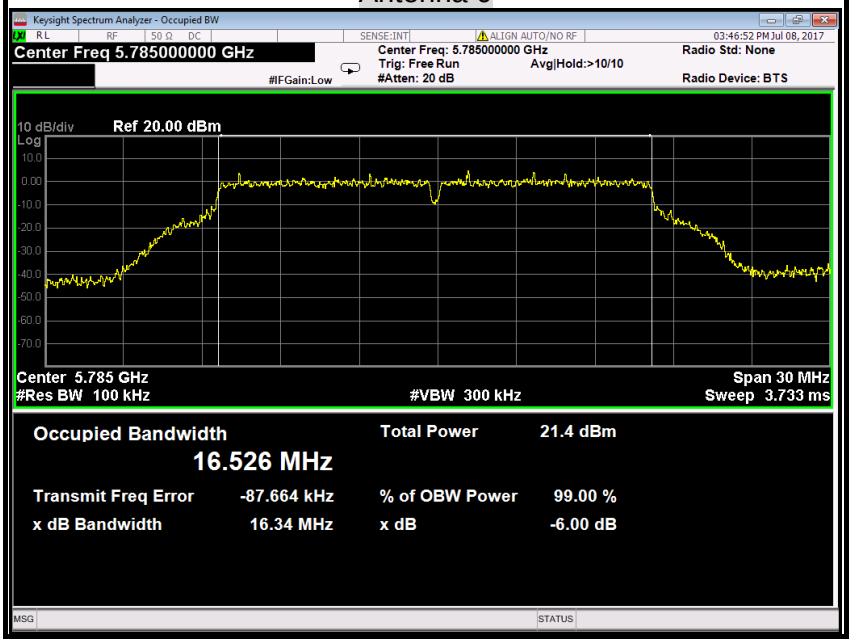
**6dB Bandwidth (CH Low)**

Antenna 0



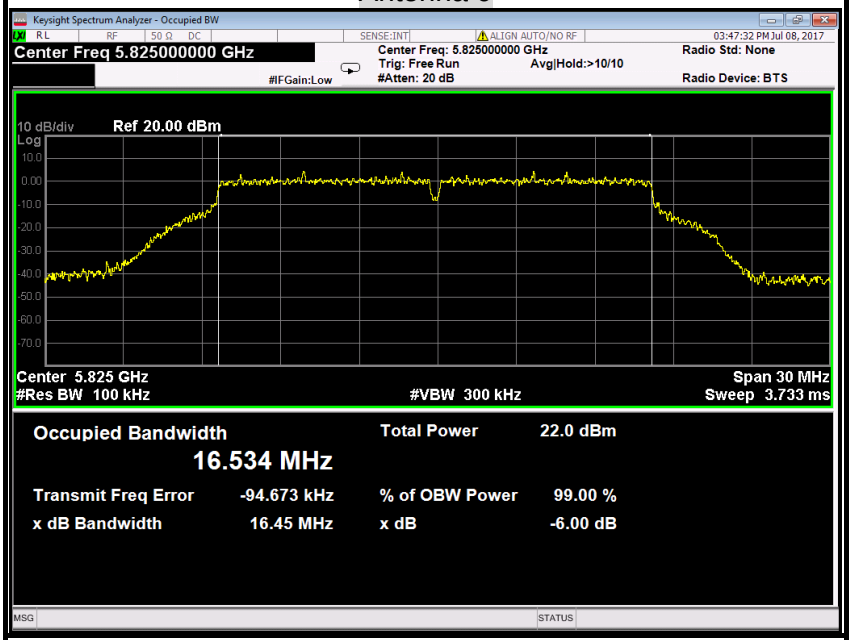

**6dB Bandwidth (CH Mid)**

Antenna 0



**6dB Bandwidth (CH High)**

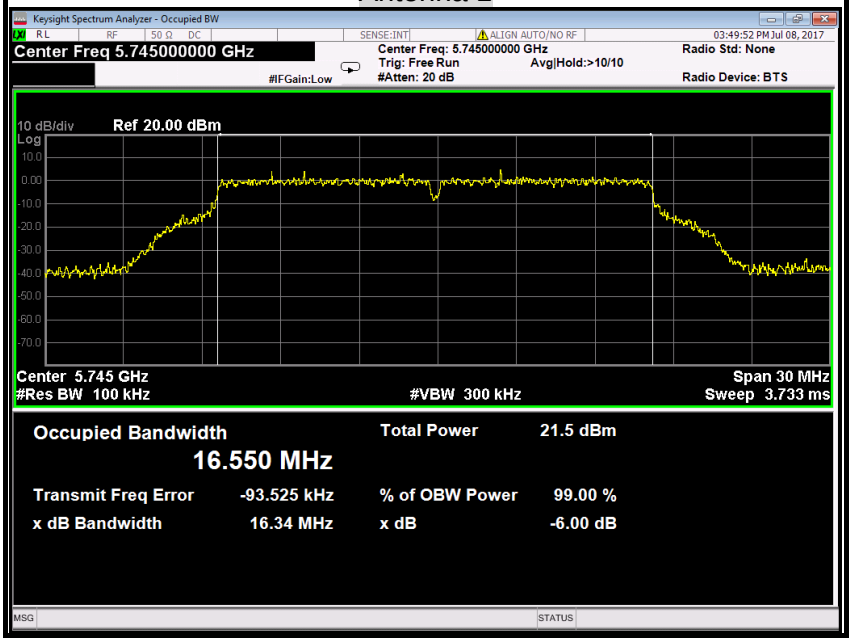
Antenna 0




**IEEE 802.11a mode / 5745 ~ 5825MHz**

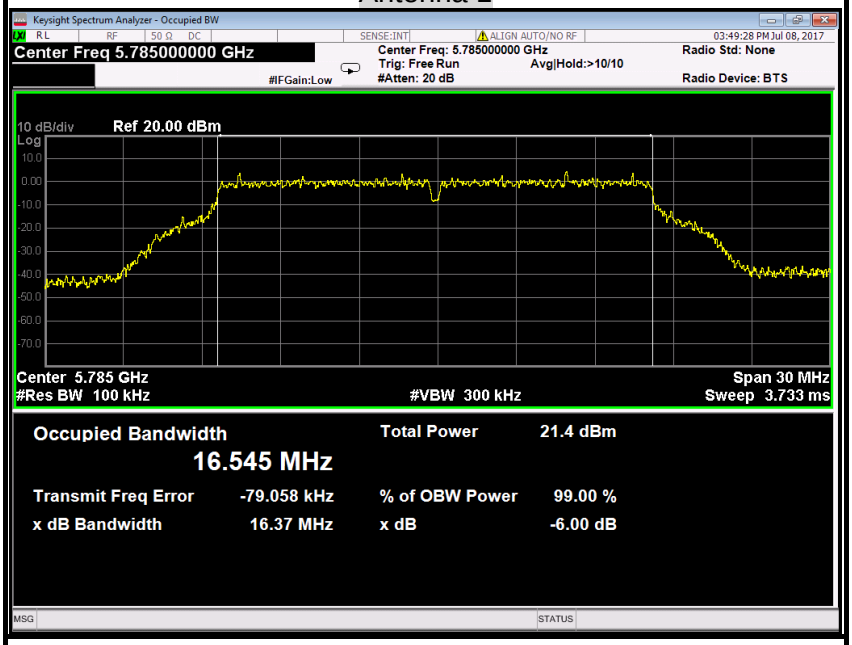
**6dB Bandwidth (CH Low)**

Antenna 1



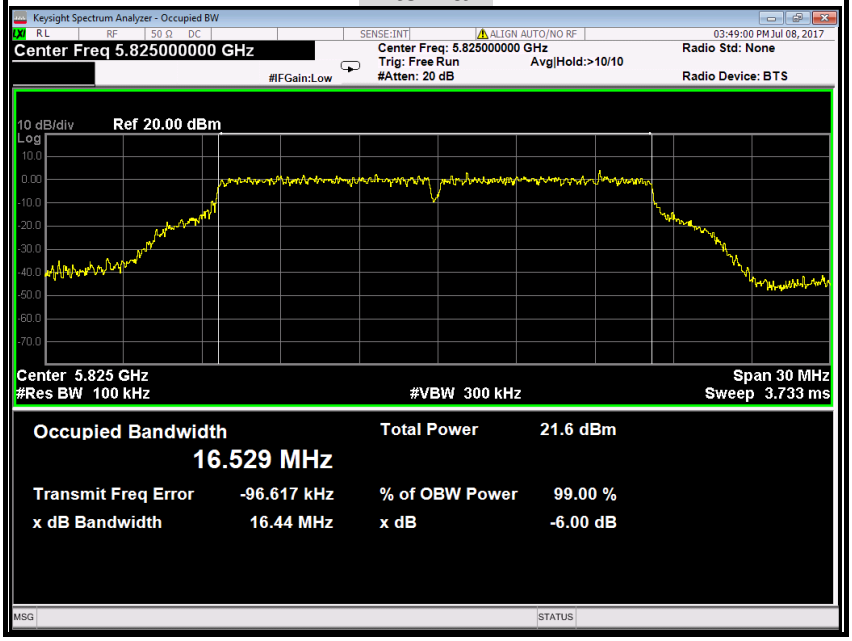
**6dB Bandwidth (CH Mid)**

Antenna 1




**6dB Bandwidth (CH High)**

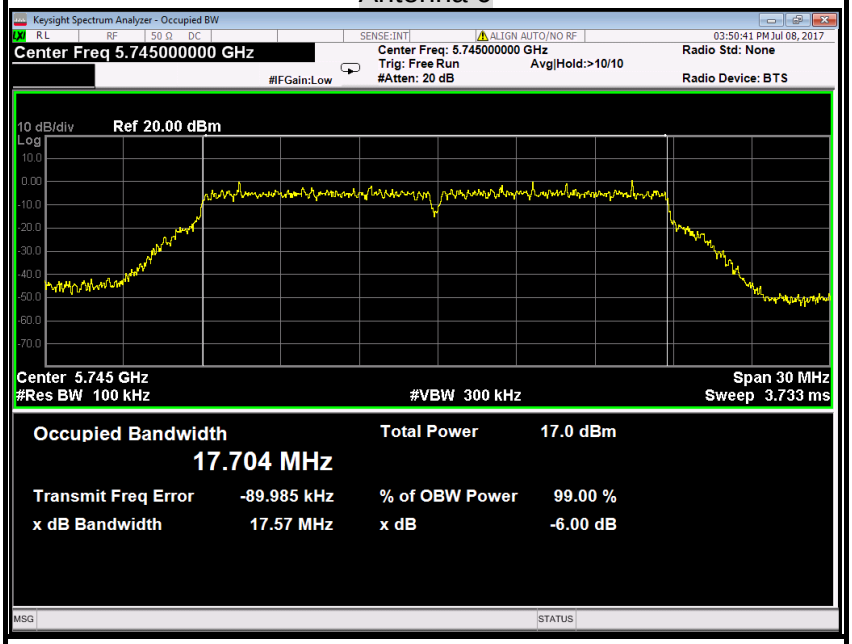
Antenna 1



**IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz**

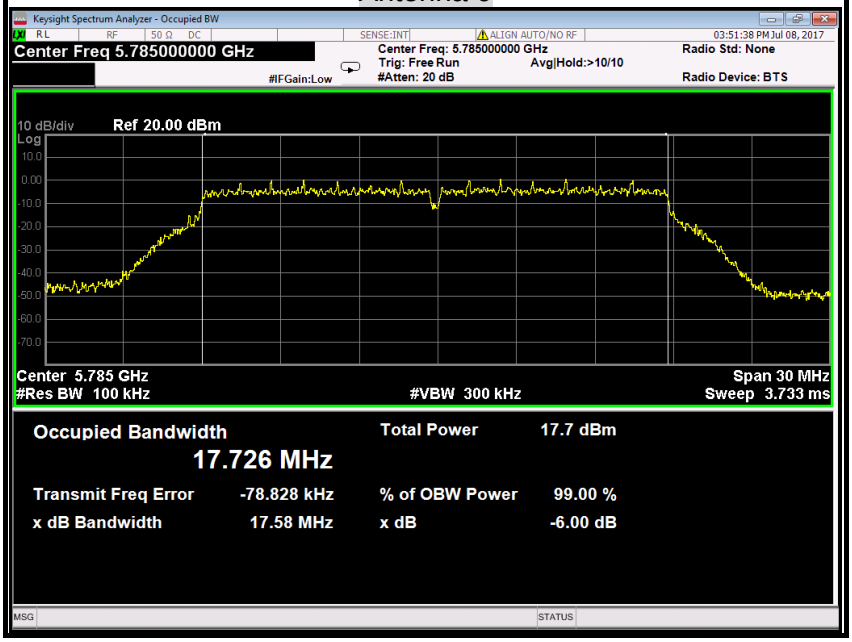
**6dB Bandwidth (CH Low)**

Antenna 0



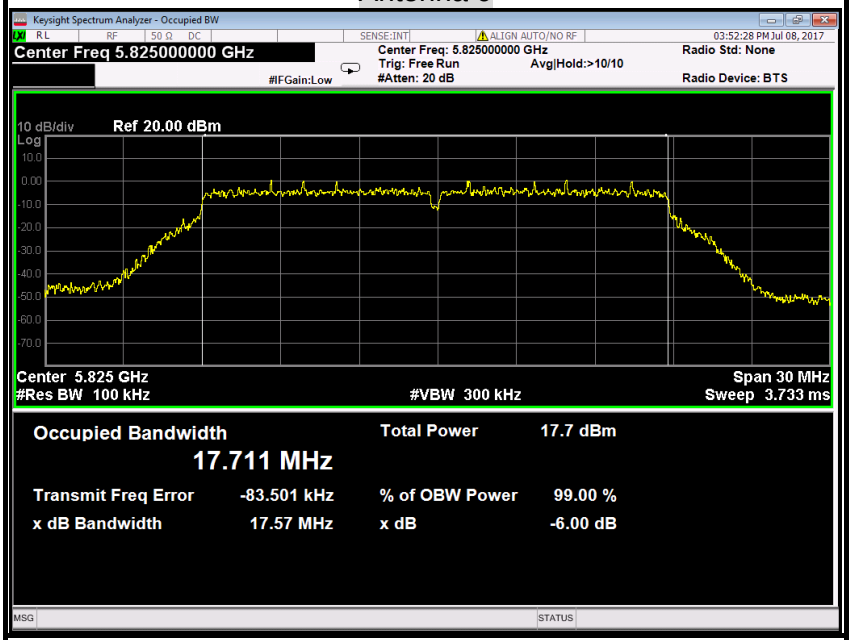

**6dB Bandwidth (CH Mid)**

Antenna 0



**6dB Bandwidth (CH High)**

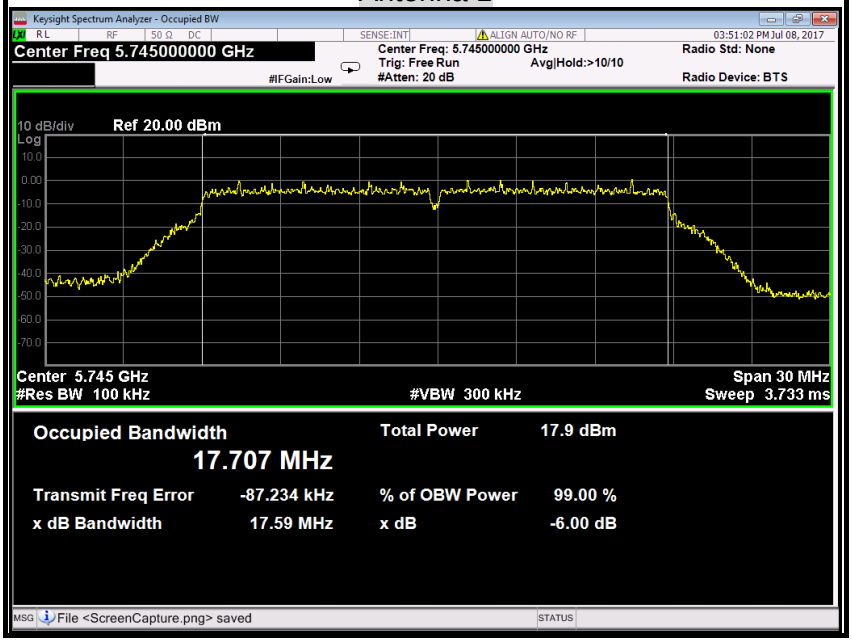
Antenna 0




**IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz**

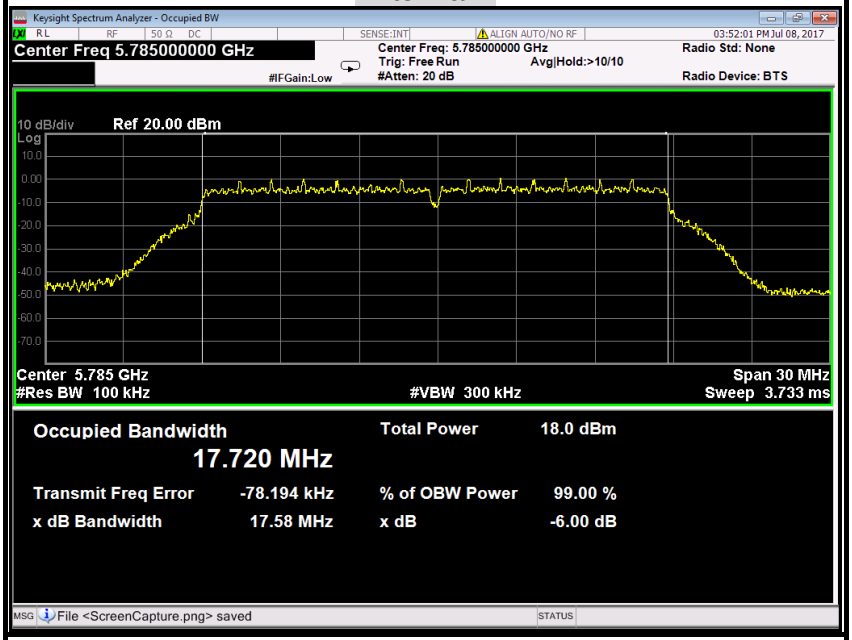
**6dB Bandwidth (CH Low)**

Antenna 1



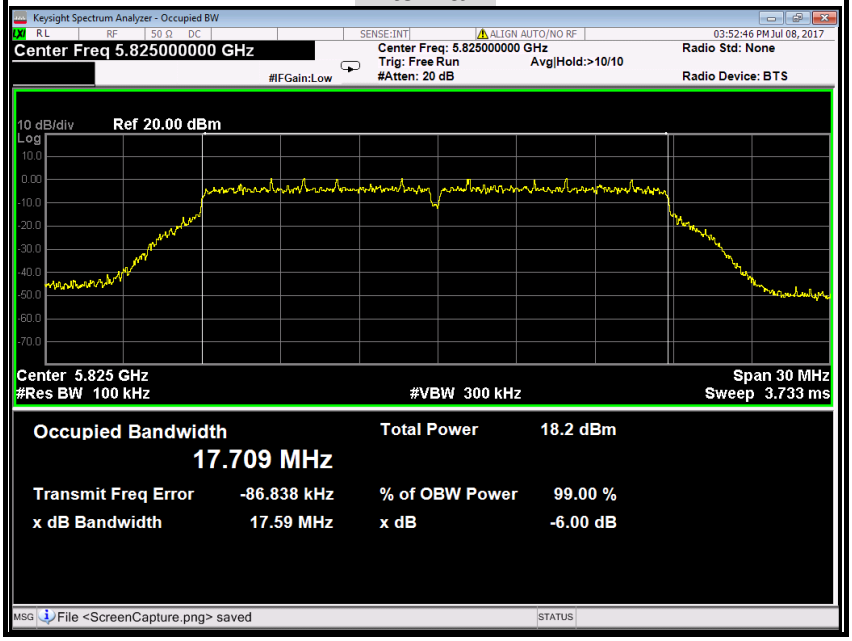
**6dB Bandwidth (CH Mid)**

Antenna 1




**6dB Bandwidth (CH High)**

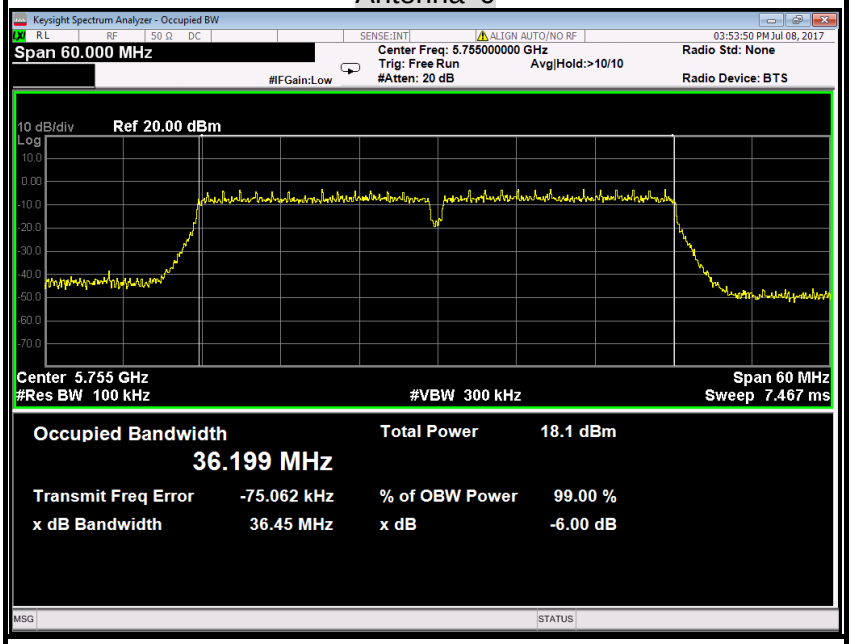
Antenna 1



**IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz**

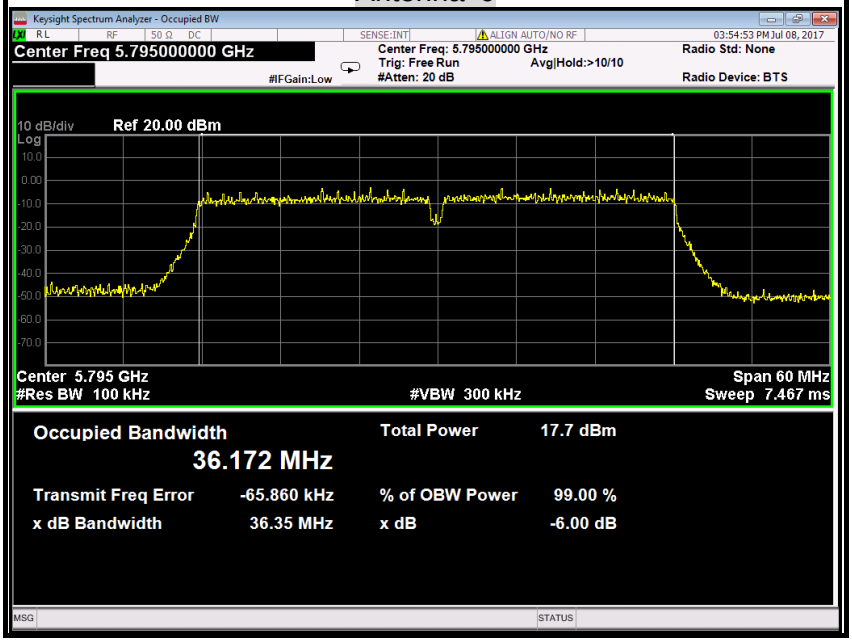
**6dB Bandwidth (CH Low)**

Antenna 0




**6dB Bandwidth (CH High)**

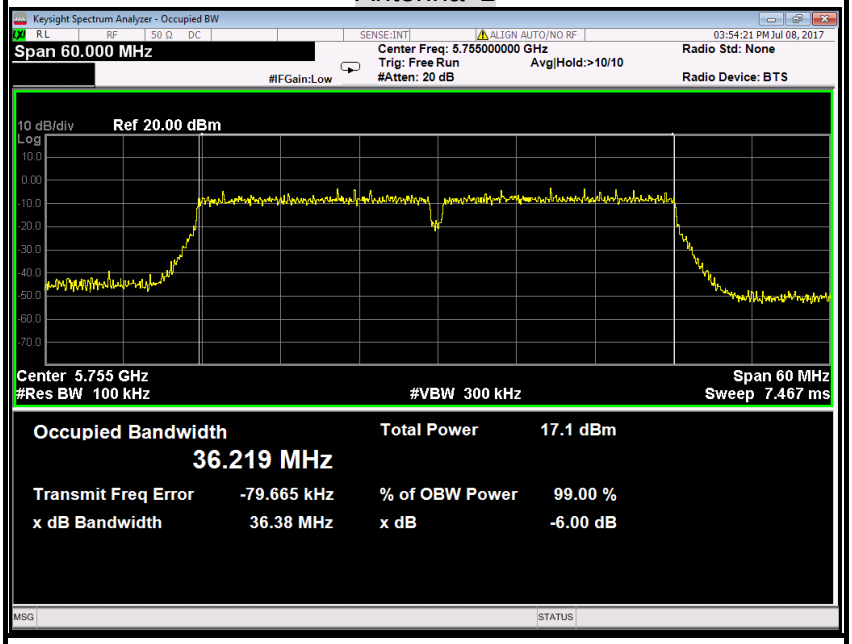
Antenna 0



**IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz**

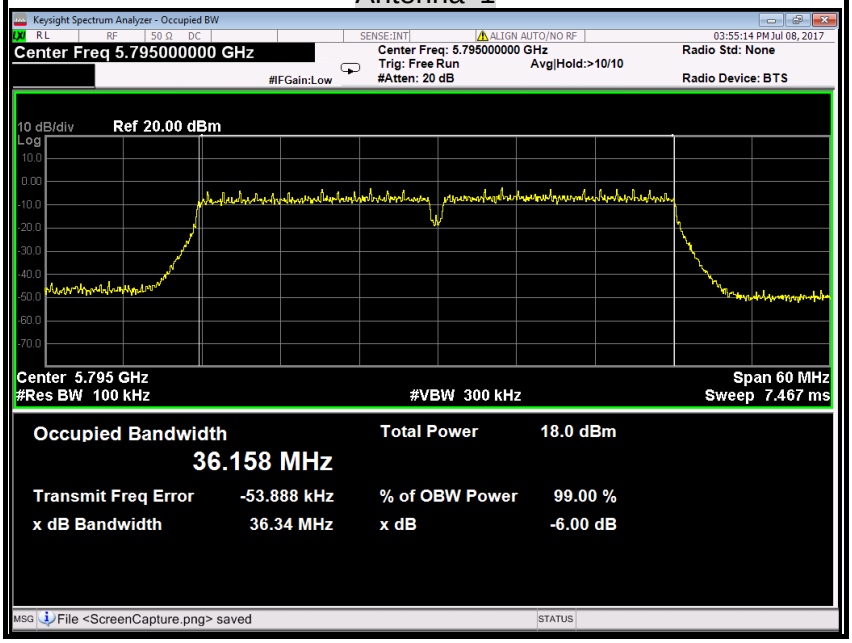
**6dB Bandwidth (CH Low)**

Antenna 1




**6dB Bandwidth (CH High)**

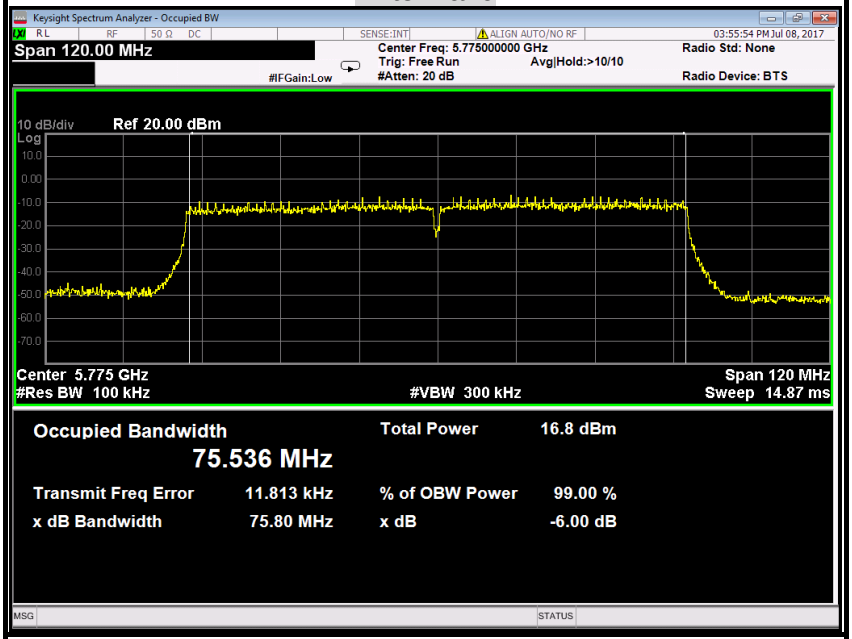
Antenna 1



**IEEE 802.11ac 80 MHz mode / 5775MHz**

**6dB Bandwidth**

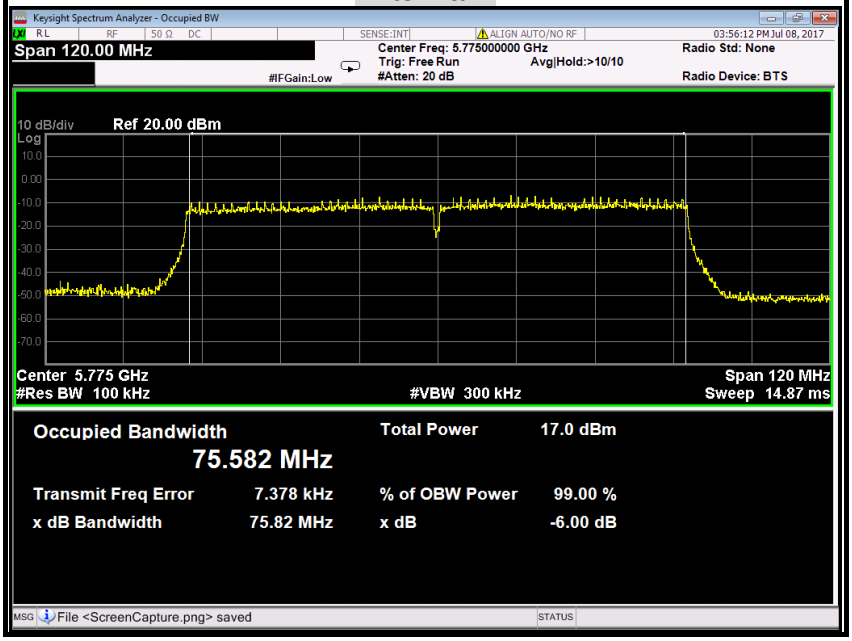
Antenna 0




**IEEE 802.11ac 80 MHz mode / 5775MHz**

**6dB Bandwidth**

Antenna 1



## 6.3 ANTENNA GAIN

## MEASUREMENT

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For UNII devices, the IEEE 802.11a mode is used.

## MEASUREMENT PARAMETERS

| Measurement parameter | |
|---|---|
| Detector | Peak |
| Sweep time | Auto |
| Resolution bandwidth | 3 MHz |
| Video bandwidth | 3 MHz |
| Trace-Mode | Max hold |

## LIMITS

| FCC | IC |
|---|---|
| Antenna Gain | |
| 6 dBi | |

# TEST RESULTS

## IEEE 802.11a mode

## Antenna 0

### IEEE 802.11a mode / 5180 ~ 5240MHz

| $T_{nom}$ | $V_{nom}$ | Lowest channel 5180MHz | Highest channel 5240MHz |
|---|---|---|---|
| Conducted power [dBm] Measured with OFDM modulation | | 6.28 | 5.73 |
| Radiated power [dBm] Measured with OFDM modulation | | 9.18 | 8.62 |
| Gain [dBi] Calculated | | 2.90 | 2.89 |
| Measurement uncertainty | | ± 1.5 dB (cond.) / ± 3 dB (rad.) | |

### IEEE 802.11a mode / 5260 ~ 5320MHz

| $T_{nom}$ | $V_{nom}$ | Lowest channel 5260MHz | Highest channel 5320MHz |
|---|---|---|---|
| Conducted power [dBm] Measured with OFDM modulation | | 5.19 | 4.91 |
| Radiated power [dBm] Measured with OFDM modulation | | 8.12 | 7.82 |
| Gain [dBi] Calculated | | 2.93 | 2.91 |
| Measurement uncertainty | | ± 1.5 dB (cond.) / ± 3 dB (rad.) | |

### IEEE 802.11a mode / 5500 ~ 5700MHz

| $T_{nom}$ | $V_{nom}$ | Lowest channel 5500MHz | Highest channel 5700MHz |
|---|---|---|---|
| Conducted power [dBm] Measured with OFDM modulation | | 4.91 | 5.14 |
| Radiated power [dBm] Measured with OFDM modulation | | 7.80 | 8.06 |
| Gain [dBi] Calculated | | 2.89 | 2.92 |
| Measurement uncertainty | | ± 1.5 dB (cond.) / ± 3 dB (rad.) | |

### IEEE 802.11a mode / 5745 ~ 5825MHz

| $T_{nom}$ | $V_{nom}$ | Lowest channel 5745MHz | Highest channel 5825MHz |
|---|---|---|---|
| Conducted power [dBm] Measured with OFDM modulation | | 5.02 | 5.06 |
| Radiated power [dBm] Measured with OFDM modulation | | 7.95 | 8.01 |
| Gain [dBi] Calculated | | 2.93 | 2.95 |
| Measurement uncertainty | | ± 1.5 dB (cond.) / ± 3 dB (rad.) | |

## Antenna 1

### IEEE 802.11a mode / 5180 ~ 5240MHz

| $T_{nom}$ | $V_{nom}$ | Lowest channel 5180MHz | Highest channel 5240MHz |
|---|---|---|---|
| Conducted power [dBm] Measured with OFDM modulation | | 6.25 | 6.24 |
| Radiated power [dBm] Measured with OFDM modulation | | 9.20 | 9.15 |
| Gain [dBi] Calculated | | 2.95 | 2.91 |
| Measurement uncertainty | | ± 1.5 dB (cond.) / ± 3 dB (rad.) | |

### IEEE 802.11a mode / 5260 ~ 5320MHz

| $T_{nom}$ | $V_{nom}$ | Lowest channel 5260MHz | Highest channel 5320MHz |
|---|---|---|---|
| Conducted power [dBm] Measured with OFDM modulation | | 5.08 | 4.86 |
| Radiated power [dBm] Measured with OFDM modulation | | 7.97 | 7.77 |
| Gain [dBi] Calculated | | 2.89 | 2.91 |
| Measurement uncertainty | | ± 1.5 dB (cond.) / ± 3 dB (rad.) | |

### IEEE 802.11a mode / 5500 ~ 5700MHz

| $T_{nom}$ | $V_{nom}$ | Lowest channel 5500MHz | Highest channel 5700MHz |
|---|---|---|---|
| Conducted power [dBm] Measured with OFDM modulation | | 4.80 | 5.14 |
| Radiated power [dBm] Measured with OFDM modulation | | 7.74 | 8.06 |
| Gain [dBi] Calculated | | 2.94 | 2.92 |
| Measurement uncertainty | | ± 1.5 dB (cond.) / ± 3 dB (rad.) | |

### IEEE 802.11a mode / 5745 ~ 5825MHz

| $T_{nom}$ | $V_{nom}$ | Lowest channel 5745MHz | Highest channel 5825MHz |
|---|---|---|---|
| Conducted power [dBm] Measured with OFDM modulation | | 4.96 | 4.94 |
| Radiated power [dBm] Measured with OFDM modulation | | 7.85 | 7.85 |
| Gain [dBi] Calculated | | 2.89 | 2.91 |
| Measurement uncertainty | | ± 1.5 dB (cond.) / ± 3 dB (rad.) | |

# 6.4 OUTPUT POWER

## 6.4.1 LIMIT

**According to §15.407(a)& FCC R&O FCC 14 - 30,**

(1) For the band 5.15-5.25 GHz.

(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. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. 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.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the 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.

(3) 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.

*Note to paragraph (a)(3): The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.*

**Specified Limit of the Output Power**

**Test mode: IEEE 802.11a mode / 5260 ~ 5320MHz**

| Channel | Frequency (MHz) | 26 dB Bandwidth (B) (MHz) | | 10*Log(B) (dB) | | 11 + 10*Log(B) (dBm) | | Maximum Conducted Output Power Limit (dBm) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 |
| Low | 5260 | 21.29 | 21.57 | 13.28 | 13.34 | 24.28 | 24.34 | 24.00 | 24.00 |
| Mid | 5300 | 21.60 | 21.55 | 13.34 | 13.33 | 24.34 | 24.33 | 24.00 | 24.00 |
| High | 5320 | 21.62 | 21.66 | 13.35 | 13.36 | 24.35 | 24.36 | 24.00 | 24.00 |

**Test mode: IEEE 802.11a mode / 5500 ~ 5700MHz**

| Channel | Frequency (MHz) | 26 dB Bandwidth (B) (MHz) | | 10*Log(B) (dB) | | 11 + 10*Log(B) (dBm) | | Maximum Conducted Output Power Limit (dBm) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 |
| Low | 5500 | 21.67 | 21.72 | 13.36 | 13.37 | 24.36 | 24.37 | 24.00 | 24.00 |
| Mid | 5580 | 21.41 | 21.68 | 13.31 | 13.36 | 24.31 | 24.36 | 24.00 | 24.00 |
| High | 5700 | 21.60 | 21.57 | 13.34 | 13.34 | 24.34 | 24.34 | 24.00 | 24.00 |

**Test mode: IEEE 802.11n HT 20 MHz mode / 5260 ~ 5320MHz**

| Channel | Frequency (MHz) | 26 dB Bandwidth (B) (MHz) | | 10*Log(B) (dB) | | 11 + 10*Log(B) (dBm) | | Maximum Conducted Output Power Limit (dBm) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 |
| Low | 5260 | 21.80 | 21.64 | 13.38 | 13.35 | 24.38 | 24.35 | 24.00 | 24.00 |
| Mid | 5300 | 21.60 | 21.60 | 13.34 | 13.34 | 24.34 | 24.34 | 24.00 | 24.00 |
| High | 5320 | 21.75 | 21.50 | 13.37 | 13.32 | 24.37 | 24.32 | 24.00 | 24.00 |

**Test mode: IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz**

| Channel | Frequency (MHz) | 26 dB Bandwidth (B) (MHz) | | 10*Log(B) (dB) | | 11 + 10*Log(B) (dBm) | | Maximum Conducted Output Power Limit (dBm) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 |
| Low | 5500 | 21.80 | 21.69 | 13.38 | 13.36 | 24.38 | 24.36 | 24.00 | 24.00 |
| Mid | 5580 | 21.77 | 21.62 | 13.38 | 13.35 | 24.38 | 24.35 | 24.00 | 24.00 |
| High | 5700 | 21.64 | 21.65 | 13.35 | 13.35 | 24.35 | 24.35 | 24.00 | 24.00 |

**IEEE 802.11n HT 40 MHz mode / 5270 ~ 5310MHz**

| Channel | Frequency (MHz) | 26 dB Bandwidth (B) (MHz) | | 10*Log(B) (dB) | | 11 + 10*Log(B) (dBm) | | Maximum Conducted Output Power Limit (dBm) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 |
| Low | 5270 | 40.18 | 39.66 | 16.04 | 15.98 | 27.04 | 26.98 | 24.00 | 24.00 |
| High | 5310 | 40.10 | 39.64 | 16.03 | 15.98 | 27.03 | 26.98 | 24.00 | 24.00 |

**IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz**

| Channel | Frequency (MHz) | 26 dB Bandwidth (B) (MHz) | | 10*Log(B) (dB) | | 11 + 10*Log(B) (dBm) | | Maximum Conducted Output Power Limit (dBm) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 |
| Low | 5510 | 39.95 | 39.71 | 16.02 | 15.99 | 27.02 | 26.99 | 24.00 | 24.00 |
| Mid | 5550 | 39.83 | 39.74 | 16.00 | 15.99 | 27.00 | 26.99 | 24.00 | 24.00 |
| High | 5670 | 40.39 | 39.65 | 16.06 | 15.98 | 27.06 | 26.98 | 24.00 | 24.00 |

**IEEE 802.11ac 80 mode / 5290MHz**

| Channel | Frequency (MHz) | 26 dB Bandwidth (B) (MHz) | | 10*Log(B) (dB) | | 11 + 10*Log(B) (dBm) | | Maximum Conducted Output Power Limit (dBm) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 |
| | 5290 | 82.14 | 81.74 | 16.00 | 19.12 | 30.15 | 30.12 | 24.00 | 24.00 |

**IEEE 802.11ac 80 mode / 5530MHz**

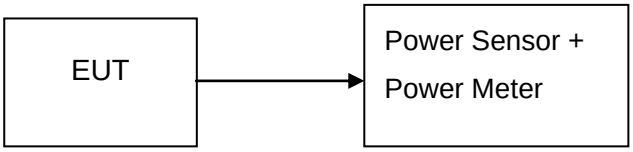
| Channel | Frequency (MHz) | 26 dB Bandwidth (B) (MHz) | | 10*Log(B) (dB) | | 11 + 10*Log(B) (dBm) | | Maximum Conducted Output Power Limit (dBm) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 |
| | 5530 | 81.98 | 80.73 | 16.00 | 19.07 | 30.14 | 30.07 | 24.00 | 24.00 |

### 6.4.2 MEASUREMENT EQUIPMENT USED

| Name of Equipment | Manufacturer | Model | Serial Number | Last Calibration | Calibration Due |
|---|---|---|---|---|---|
| Power Meter | Anritsu | ML2495A | 1204003 | 02/21/2017 | 02/20/2018 |
| Power Sensor | Anritsu | MA2411B | 1126150 | 02/21/2017 | 02/20/2018 |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

### 6.4.3 TEST CONFIGURATIONS




### 6.4.4 TEST PROCEDURE

The EUT was connected to a Power Meter through a 50Ω RF cable.

### 6.4.5 TEST RESULTS

*No non-compliance noted*

## 6.4.6 TEST DATA

**IEEE 802.11a mode / 5180 ~ 5240MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | AVG Output Power (W) | | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | | |
| Low | 5180 | 18.54 | 18.53 | 0.07145 | 0.07129 | 24.00 | PASS |
| Mid | 5200 | 18.27 | 18.24 | 0.06714 | 0.06668 | | PASS |
| High | 5240 | 18.02 | 18.53 | 0.06339 | 0.07129 | | PASS |

**IEEE 802.11a mode / 5260~ 5320MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | AVG Output Power (W) | | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | | |
| Low | 5260 | 17.48 | 17.36 | 0.05598 | 0.05445 | 24.00 | PASS |
| Mid | 5300 | 17.83 | 17.93 | 0.06067 | 0.06209 | | PASS |
| High | 5320 | 17.19 | 17.15 | 0.05236 | 0.05188 | | PASS |

**IEEE 802.11a mode / 5500 ~ 5700MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | AVG Output Power (W) | | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | | |
| Low | 5500 | 17.20 | 17.09 | 0.05248 | 0.05117 | 24.00 | PASS |
| Mid | 5580 | 17.56 | 17.37 | 0.05702 | 0.05458 | | PASS |
| High | 5700 | 17.43 | 17.42 | 0.05534 | 0.05521 | | PASS |

**IEEE 802.11a mode / 5745 ~ 5825MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | AVG Output Power (W) | | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Antenna 0 | Antenna 1 | | |
| Low | 5745 | 17.30 | 17.24 | 0.05370 | 0.05297 | 30.00 | PASS |
| Mid | 5785 | 17.37 | 17.17 | 0.05458 | 0.05212 | | PASS |
| High | 5825 | 17.35 | 17.23 | 0.05433 | 0.05284 | | PASS |

**IEEE 802.11n HT 20 MHz mode / 5180 ~ 5240MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| Low | 5180 | 13.11 | 13.07 | 16.10 | 0.04074 | 24.00 | PASS |
| Mid | 5200 | 12.88 | 12.85 | 15.88 | 0.03868 | | PASS |
| High | 5240 | 12.70 | 12.74 | 15.73 | 0.03741 | | PASS |

**IEEE 802.11n HT 20 MHz mode / 5260~ 5320MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| Low | 5260 | 12.79 | 12.45 | 15.63 | 0.03659 | 24.00 | PASS |
| Mid | 5300 | 12.85 | 12.98 | 15.93 | 0.03914 | | PASS |
| High | 5320 | 12.78 | 12.97 | 15.89 | 0.03878 | | PASS |

**IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| Low | 5500 | 12.58 | 12.38 | 15.49 | 0.03541 | 24.00 | PASS |
| Mid | 5580 | 12.85 | 12.95 | 15.91 | 0.03900 | | PASS |
| High | 5700 | 12.67 | 12.73 | 15.71 | 0.03724 | | PASS |

**IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| Low | 5745 | 13.44 | 12.98 | 16.23 | 0.04194 | 30.00 | PASS |
| Mid | 5785 | 12.96 | 12.74 | 15.86 | 0.03856 | | PASS |
| High | 5825 | 13.25 | 13.04 | 16.16 | 0.04127 | | PASS |

**IEEE 802.11n HT 40 MHz mode / 5190 ~ 5230MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| Low | 5190 | 13.52 | 13.43 | 16.49 | 0.04452 | 24.00 | PASS |
| High | 5230 | 13.18 | 13.41 | 16.31 | 0.04273 | | PASS |

**IEEE 802.11n HT 40 MHz mode / 5270 ~ 5310MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| Low | 5270 | 13.09 | 13.08 | 16.10 | 0.04069 | 24.00 | PASS |
| High | 5310 | 13.27 | 13.25 | 16.27 | 0.04237 | | PASS |

**IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| Low | 5510 | 13.07 | 12.99 | 16.04 | 0.04018 | 24.00 | PASS |
| Mid | 5550 | 12.91 | 12.87 | 15.90 | 0.03891 | | PASS |
| High | 5670 | 13.21 | 13.37 | 16.30 | 0.04267 | | PASS |

**IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| Low | 5755 | 13.32 | 13.14 | 16.24 | 0.04208 | 30.00 | PASS |
| High | 5795 | 13.15 | 13.05 | 16.11 | 0.04084 | | PASS |

**IEEE 802.11ac 80 mode / 5210MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| | 5210 | 12.44 | 12.61 | 15.54 | 0.03578 | 24.00 | PASS |

**IEEE 802.11ac 80 mode / 5290MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| | 5290 | 12.53 | 12.71 | 15.63 | 0.03657 | 24.00 | PASS |

**IEEE 802.11ac 80 mode / 5530MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| | 5530 | 12.39 | 12.18 | 15.30 | 0.03386 | 24.00 | PASS |

**IEEE 802.11ac 80 mode / 5775MHz**

| Channel | Frequency (MHz) | AVG Output Power (dBm) | | | AVG Output Power (W) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| | | Antenna 0 | Antenna 1 | Total | | | |
| | 5775 | 12.59 | 12.41 | 15.51 | 0.03557 | 30.00 | PASS |

## 6.5 BAND EDGES MEASUREMENT

### 6.5.1 LIMIT

According to §15.407(b)

(1) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

### 6.5.2 MEASUREMENT EQUIPMENT USED

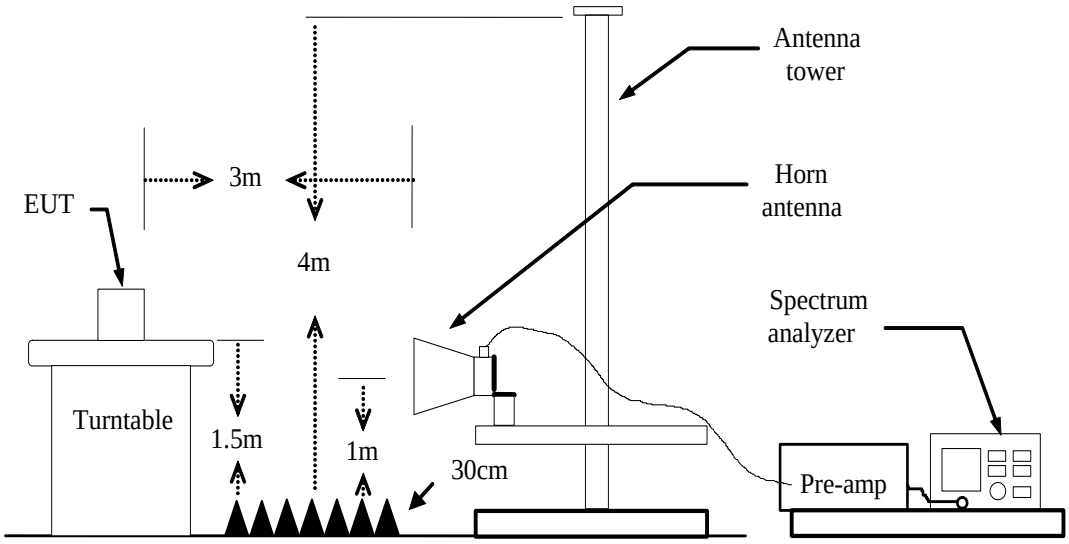
| Radiated Emission Test Site 966(2) | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model Number** | **Serial Number** | **Last Calibration** | **Due Calibration** |
| PSA Series Spectrum Analyzer | Agilent | N9010A | MY52221469 | 02/21/2017 | 02/20/2018 |
| EMI TEST RECEIVER | ROHDE&SCHWARZ | ESCI | 100783 | 02/21/2017 | 02/20/2018 |
| Amplifier | EMEC | EM330 | 060661 | 03/18/2017 | 03/17/2018 |
| High Noise Amplifier | Agilent | 8449B | 3008A01838 | 02/21/2017 | 02/20/2018 |
| Loop Antenna | COM-POWER | AL-130 | 121044 | 09/25/2016 | 09/24/2017 |
| Bilog Antenna | SCHAFFNER | CBL6143 | 5082 | 02/21/2017 | 02/20/2018 |
| Horn Antenna | SCHWARZBECK | BBHA9120 | D286 | 02/27/2017 | 02/27/2018 |
| Board-Band Horn Antenna | Schwarzbeck | BBHA 9170 | 9170-497 | 02/27/2017 | 02/27/2018 |
| Turn Table | N/A | N/A | N/A | N.C.R | N.C.R |
| Antenna Tower | SUNOL | TLT2 | N/A | N.C.R | N.C.R |
| Controller | Sunol Sciences | SC104V | 022310-1 | N.C.R | N.C.R |
| Controller | CT | N/A | N/A | N.C.R | N.C.R |
| Temp. / Humidity Meter | Anymetre | JR913 | N/A | 02/21/2017 | 02/20/2018 |
| Test S/W | FARAD | LZ-RF / CCS-SZ-3A2 | | | |

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The FCC Site Registration number is 101879.

3. N.C.R = No Calibration Required.

### 6.5.3 TEST CONFIGURATION




### 6.5.4 TEST PROCEDURE

1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=1 / VBW=3MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO / Detector=Peak
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

## 6.5.5 TEST RESULT

**IEEE 802.11a mode / 5500 ~ 5700MHz**

**Antenna 0:**

1. Operating Frequency: 5500-5700MHz
2. CH Low: 5500MHz, CH High: 5700MHz
3. 26dB bandwidth: CH Low: 21.67MHz, CH High: 21.60MHz
4. Frequency Range: 5489.1650MHz, 5710.8000MHz

**Antenna 1:**

1. Operating Frequency: 5500-5700MHz
2. CH Low: 5500MHz, CH High: 5700MHz
3. 26dB bandwidth: CH Low: 21.72MHz, CH High: 21.57MHz
4. Frequency Range: 5489.1400MHz, 5710.7850MHz

**IEEE 802.11a mode / 5745 ~ 5825MHz**

**Antenna 0:**

1. Operating Frequency: 5745-5825MHz
2. CH Low: 5745MHz, CH High: 5825MHz
3. 26dB bandwidth: CH Low: 21.51MHz, CH High: 21.42MHz
4. Frequency Range: 5734.2450MHz, 5835.7100MHz

**Antenna 1:**

1. Operating Frequency: 5745-5825MHz
2. CH Low: 5745MHz, CH High: 5825MHz
3. 26dB bandwidth: CH Low: 21.50MHz, CH High: 21.57MHz
4. Frequency Range: 5734.2500MHz, 5835.7850MHz

**IEEE 802.11n HT 20 MHz mode / 5500 ~ 5700MHz**

**Antenna 0:**

1. Operating Frequency: 5500-5700MHz
2. CH Low: 5500MHz, CH High: 5700MHz
3. 26dB bandwidth: CH Low: 21.80MHz, CH High: 21.64MHz
4. Frequency Range: 5489.1000MHz, 5710.8200MHz

**Antenna 1:**

1. Operating Frequency: 5500-5700MHz
2. CH Low: 5500MHz, CH High: 5700MHz
3. 26dB bandwidth: CH Low: 21.69MHz, CH High: 21.65MHz
4. Frequency Range: 5489.1550MHz, 5710.8250MHz

**IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz**

**Antenna 0:**

1. Operating Frequency: 5745-5825MHz
2. CH Low: 5745MHz, CH High: 5825MHz
3. 26dB bandwidth: CH Low: 21.56MHz, CH High: 21.80MHz
4. Frequency Range: 5734.2200MHz, 5835.9000MHz

**Antenna 1:**

1. Operating Frequency: 5745-5825MHz
2. CH Low: 5745MHz, CH High: 5825MHz
3. 26dB bandwidth: CH Low: 21.91MHz, CH High: 21.98MHz
4. Frequency Range: 5734.0450MHz, 5835.9900MHz

**IEEE 802.11n HT 40 MHz mode / 5510 ~ 5670MHz**

**Antenna 0:**

1. Operating Frequency: 5510-5670MHz
2. CH Low: 5510MHz, CH High: 5670MHz
3. 26dB bandwidth: CH Low: 39.95MHz, CH High: 40.39MHz
4. Frequency Range: 5490.0250MHz, 5690.1950MHz

**Antenna 1:**

1. Operating Frequency: 5510-5670MHz
2. CH Low: 5510MHz, CH High: 5670MHz
3. 26dB bandwidth: CH Low: 39.71MHz, CH High: 39.65MHz
4. Frequency Range: 5490.1450MHz, 5689.8250MHz

**IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz**

**Antenna 0:**

1. Operating Frequency: 5755-5795MHz
2. CH Low: 5755MHz, CH High: 5795MHz
3. 26dB bandwidth: CH Low: 40.11MHz, CH High: 40.26MHz
4. Frequency Range: 5734.9450MHz, 5815.1300MHz

**Antenna 1:**

1. Operating Frequency: 5755-5795MHz
2. CH Low: 5755MHz, CH High: 5795MHz
3. 26dB bandwidth: CH Low: 39.60MHz, CH High: 39.79MHz
4. Frequency Range: 5735.2000MHz, 5814.8950MHz

**IEEE 802.11ac 80 mode / 5530MHz**

**Antenna 0:**

1. Operating Frequency: 5530MHz
2. CH: 5530MHz
3. 26dB bandwidth: CH: 81.98MHz
4. Frequency Range: 5489.0100MHz, 5570.9900MHz

**Antenna 1:**

1. Operating Frequency: 5530MHz
2. CH: 5530MHz
3. 26dB bandwidth: CH: 80.73MHz
4. Frequency Range: 5489.6350MHz, 5570.3650MHz

**IEEE 802.11ac 80 mode / 5775MHz**

**Antenna 0:**

1. Operating Frequency: 5775MHz
2. CH: 5775MHz
3. 26dB bandwidth: CH: 81.76MHz
4. Frequency Range: 5734.1200MHz, 5815.8800MHz

**Antenna 1:**

1. Operating Frequency: 5775MHz
2. CH: 5775MHz
3. 26dB bandwidth: CH: 81.01MHz
4. Frequency Range: 5734.4950MHz, 5815.5050MHz

Because the mentioned conditions the Fundamental Frequency Range was far away from the restricted bands in the table published in 15.205, the test is not applicable.