



# FCC/ISED TEST REPORT

**Test report**  
**On Behalf of**  
**Shenzhen SEI Robotics Co., Ltd.**  
**For**  
**4K Set top box**  
**Model No.: IPA1114HDW-02,SN6BBAX(X=A TO Z) [for FCC]**  
**IPA1114HDW-02, SN6BBAO [for ISED]**

**FCC ID: 2AOVU-SN6BBAX**  
**IC: 25669-IPA1114HDW**

**Prepared for :** **Shenzhen SEI Robotics Co., Ltd.**  
501, Block A, Productivity Building #5 Hi-tech Middle 2nd Road, Nanshan District,  
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**Prepared By :** **Shenzhen HUAKE Testing Technology Co., Ltd.**  
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**Date of Test:** Nov 6, 2019~ Dec 17, 2019  
**Date of Report:** Dec 18, 2019  
**Report Number:** HK1910302722-E3



## TEST RESULT CERTIFICATION

**Applicant's name** ..... : **Shenzhen SEI Robotics Co., Ltd.**

Address ..... : 501, Block A, Productivity Building #5 Hi-tech Middle 2nd Road,  
Nanshan District, Shenzhen, China

**Manufacture's Name** ..... : **LIAN TECH Co., Ltd.**

Address ..... : Workshop CN-05-06, lot Cn-05, Van Trung Industrial Park, Viet Yen  
District, Bac Giang Province, Vietnam

**Product description**

Trade Mark ..... : eSTREAM4K

Product name ..... : 4K Set top box

Model and/or type reference : Refer to page1

**Standards**..... : FCC Rules and Regulations Part 15 Subpart E Section 15.407  
ANSI C63.10: 2013

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**Date of Test** ..... :

Date (s) of performance of tests..... : Nov 6, 2019~ Dec 17, 2019

Date of Issue ..... : Dec 18, 2019

Test Result..... : **Pass**

Testing Engineer : \_\_\_\_\_

(Gary Qian)

Technical Manager : \_\_\_\_\_

(Eden Hu)

Authorized Signatory : \_\_\_\_\_

(Jason Zhou)



## Revision History

| Revision | Issue Date   | Revisions     | Revised By |
|----------|--------------|---------------|------------|
| 000      | Dec 18, 2019 | Initial Issue | Jason Zhou |
|          |              |               |            |
|          |              |               |            |



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# 1. GENERAL INFORMATION

## 1.1. Description of Device (EUT)

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUT                          | : 4K Set top box                                                                                                                                                                                                                                                                                                                                                                                                    |
| Model Number                 | : Refer to page1                                                                                                                                                                                                                                                                                                                                                                                                    |
| Model Declaration            | : All the same except for the shape and color of cover.                                                                                                                                                                                                                                                                                                                                                             |
| Test Model                   | : IPA1114HDW-02                                                                                                                                                                                                                                                                                                                                                                                                     |
| Power Supply                 | : DC 5V by adapter                                                                                                                                                                                                                                                                                                                                                                                                  |
| Hardware version             | : SMB.207.05                                                                                                                                                                                                                                                                                                                                                                                                        |
| Software version             | : android9.0                                                                                                                                                                                                                                                                                                                                                                                                        |
| Bluetooth Version            | : V5.0+EDR                                                                                                                                                                                                                                                                                                                                                                                                          |
| Channel Number               | : 79 Channels for Bluetooth EDR(DSS)<br>: 40 Channels for Bluetooth BLE(DTS)                                                                                                                                                                                                                                                                                                                                        |
| Modulation Technology        | : GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth EDR(DSS)<br>: GFSK for Bluetooth BLE(DTS)                                                                                                                                                                                                                                                                                                                              |
| Data Rates                   | : Bluetooth EDR(DSS): 1~3Mbps;Bluetooth BLE(DTS): 1Mbps                                                                                                                                                                                                                                                                                                                                                             |
| WLAN                         | : Supported IEEE 802.11a/b/g/n/ac<br>IEEE 802.11b:2412-2462MHz<br>IEEE 802.11g:2412-2462MHz<br>IEEE 802.11n HT20:2412-2462MHz / 5180-5240MHz / 5745-5825MHz                                                                                                                                                                                                                                                         |
| WLAN FCC Operation Frequency | : IEEE 802.11n HT40: 5190-5230MHz / 5755-5795MHz<br>IEEE 802.11a: 5180-5240MHz / 5745-5825MHz<br>IEEE 802.11ac VHT20: 5180-5240MHz / 5745-5825MHz<br>IEEE 802.11ac VHT40: 5190-5230MHz / 5755-5795MHz<br>IEEE 802.11ac VHT80: 5210MHz / 5775MHz                                                                                                                                                                     |
| WLAN Channel Number          | : 11 Channels for 2412-2462MHz(IEEE 802.11b/g/n HT20)<br>4 Channels for 5180-5240MHz (IEEE 802.11a/ac VHT20/n HT20)<br>2 Channels for 5190-5230MHz (IEEE 802.11ac VHT40/n HT40)<br>: 1 Channels for 5210MHz (IEEE 802.11ac VHT80)<br>5 Channels for 5745-5825MHz(IEEE 802.11a/ac VHT20/n HT20)<br>2 Channels for 5755-5795MHz(IEEE 802.11ac VHT40/n HT40)<br>1 Channels for 5775MHz(IEEE 802.11ac VHT80)            |
| WLAN Modulation Technology   | : IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)<br>: IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)                                                                                                                                                                |
| Antenna Type And Gain        | : Three Antennas: Internal Antenna 1:<br>2.88 dBi(Max.), for TX/RX (WLAN 2.4G Band),<br>2.56 dBi(Max.), for TX/RX (WLAN 5.2G Band)<br>3.27 dBi(Max.), for TX/RX (WLAN 5.8G Band)<br>Internal Antenna 2:<br>2.83 dBi(Max.), for TX/RX (WLAN 2.4G Band),<br>6.39 dBi(Max.), for TX/RX (WLAN 5.2G Band)<br>5.93 dBi(Max.), for TX/RX (WLAN 5.8G Band)<br>Internal Antenna 3:<br>1.43 dBi(Max.), for TX/RX (Bluetooth), |
| Directional Gain             | : 5.87 dBi for MIMO(2.4G Band) 7.82dBi for MIMO(5.2G Band)<br>: 7.81 dBi for MIMO(5.8G Band)                                                                                                                                                                                                                                                                                                                        |

*Note: Antenna position refer to EUT Photos.*



## 1.2. Host System Configuration List and Details

| Manufacturer | Description | Model            | Serial Number | Certificate |
|--------------|-------------|------------------|---------------|-------------|
| SUNUN        | Adapter     | SA12V-050200U    | N/A           | N/A         |
| Aohai        | Adapter     | A912-050200W-US1 | N/A           | N/A         |

## 1.3. External I/O Port

| I/O Port Description | Quantity | Cable |
|----------------------|----------|-------|
| USB Port             | 2        | N/A   |
| HDMI Port            | 1        | N/A   |
| LAN Port             | 1        | N/A   |
| DC Port              | 1        | N/A   |
| OPTICAL Port         | 1        | N/A   |
| AV OUT Port          | 1        | N/A   |
| MICRO SD Port        | 1        | N/A   |

## 1.4. Description of Test Facility

Designation Number: CN1229

Test Firm Registration Number: 616276

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010

## 1.5. Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the HUAK quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.



## 1.6. Measurement Uncertainty

| Test Item              |   | Frequency Range | Uncertainty | Note |
|------------------------|---|-----------------|-------------|------|
| Radiation Uncertainty  | : | 9KHz~30MHz      | ±3.08dB     | (1)  |
|                        |   | 30MHz~1000MHz   | ±4.42dB     | (1)  |
|                        |   | 1GHz~40GHz      | ±4.06dB     | (1)  |
| Conduction Uncertainty | : | 150kHz~30MHz    | ±2.23dB     | (1)  |

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 1.7. Description of Test Modes

The EUT has been tested under operating condition.

Worst-case mode and channel used for 150 kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be **IEEE 802.11n HT20 mode (Low Channel)**.

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be **IEEE 802.11n HT20 mode (Low Channel)**.

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:

IEEE 802.11a Mode : 6 Mbps, OFDM.  
 IEEE 802.11ac VHT20 Mode: MCS0  
 IEEE 802.11n HT20 Mode: MCS0  
 IEEE 802.11ac VHT40 Mode: MCS0  
 IEEE 802.11n HT40 Mode: MCS0  
 IEEE 802.11ac VHT80 Mode: MCS0

### Antenna & Bandwidth

| Antenna        | Single (Port.1)          |                          |                          | Two (Port.1 + Port.2)               |                                     |                                     |
|----------------|--------------------------|--------------------------|--------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Bandwidth Mode | 20MHz                    | 40MHz                    | 80MHz                    | 20MHz                               | 40MHz                               | 80MHz                               |
| IEEE 802.11a   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            |
| IEEE 802.11n   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| IEEE 802.11ac  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |



## 2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen HUAKE Testing Technology Co., Ltd.

### 2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

### 2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure 789033 D02 General UNII Test Procedures New Rules v02r01 and KDB 6622911 are required to be used for this kind of FCC 15.407 UII device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E

### 2.3. General Test Procedures

#### 2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

#### 2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013



### 3. SYSTEM TEST CONFIGURATION

#### 3.1. Justification

The system was configured for testing in a continuous transmits condition.

#### 3.2. EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software(Ampak.apk) provided by application.

#### 3.3. Special Accessories

| No. | Equipment | Manufacturer | Model No.  | Serial No.   | Length | shielded/<br>unshielded | Notes |
|-----|-----------|--------------|------------|--------------|--------|-------------------------|-------|
| 1   | TV        | AOC          | 280LM00003 | JVVGJA000307 | /      | /                       | /     |

#### 3.4. Block Diagram/Schematics

Please refer to the related document

#### 3.5. Equipment Modifications

Shenzhen HUAKE Testing Technology Co., Ltd. has not done any modification on the EUT.

#### 3.6. Test Setup

Please refer to the test setup photo.



## 4. SUMMARY OF TEST RESULTS

| FCC Rules  | ISED Rules                     | Description of Test            | Result    |
|------------|--------------------------------|--------------------------------|-----------|
| §15.407(a) | RSS-247 6.2.4.1                | Maximum Conducted Output Power | Compliant |
| §15.407(a) | RSS-247 6.2.4.1                | Power Spectral Density         | Compliant |
| §15.407(e) | RSS-247 6.2.4.1                | 6dB Bandwidth                  | Compliant |
| §15.407(b) | RSS-247 6.2.4.2<br>RSS-Gen 8.9 | Radiated Emissions             | Compliant |
| §15.407(b) | RSS-247 6.2.4.2<br>RSS-Gen 8.9 | Band edge Emissions            | Compliant |
| §15.407(g) | RSS-Gen 8.11                   | Frequency Stability            | Note      |
| §15.207(a) | RSS-Gen 8.8                    | Line Conducted Emissions       | Compliant |
| §15.203    | /                              | Antenna Requirements           | Compliant |
| §2.1093    | RSS-102                        | RF Exposure                    | Compliant |

Note: The customer declared frequency stability is better than 20ppm which ensures that the signal remains in the allocated bands under all operational conditions stated in the user manual.

## 5. TEST RESULT

### 5.1. On Time and Duty Cycle

#### 5.1.1. Standard Applicable

None; for reporting purpose only.

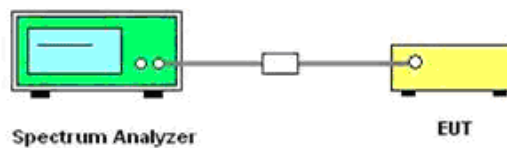
#### 5.1.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of the spectrum analyzer.

#### 5.1.3. Test Procedures

1. Set the Centre frequency of the spectrum analyzer to the transmitting frequency;
2. Set the span=0MHz, RBW=10MHz, VBW=10MHz, Sweep time=100ms;
3. Detector = peak;
4. Trace mode = Single hold.

#### 5.1.4. Test Setup Layout

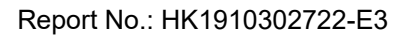


#### 5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 5.1.6. Test result

| Mode               | On Time Points | Total Sweep points | Duty Cycle (%) | Duty Cycle Correction Factor (dB) | 1/B Minimum VBW (KHz) |
|--------------------|----------------|--------------------|----------------|-----------------------------------|-----------------------|
| IEEE 802.11a       | 7839           | 8001               | 97.98          | -0.09                             | 0.010                 |
| IEEE 802.11n HT20  | 7828           | 8001               | 97.84          | -0.09                             | 0.010                 |
| IEEE 802.11ac HT20 | 7838           | 8001               | 97.96          | -0.09                             | 0.010                 |
| IEEE 802.11n HT40  | 7668           | 8001               | 95.84          | -0.18                             | 0.010                 |
| IEEE 802.11ac HT40 | 7664           | 8001               | 95.79          | -0.19                             | 0.010                 |
| IEEE 802.11ac HT80 | 7352           | 8001               | 91.89          | -0.37                             | 0.010                 |



## 5.2. Maximum Conducted Output Power Measurement

### 5.2.1. Standard Applicable

#### For 5725~5850MHz

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.

### 5.2.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of the power meter.

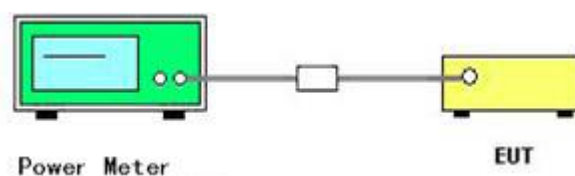
### 5.2.3. Test Procedures

The transmitter output (antenna port) was connected to the power meter.

According to KDB 789033 D02 Section 3 (a) Method PM (Measurement using an RF average power meter):

- (i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.
  - The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
  - At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
  - The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
- (ii) If the transmitter does not transmit continuously, measure the duty cycle,  $x$ , of the transmitter output signal as described in section II.B.
- (iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
- (iv) Adjust the measurement in dBm by adding  $10 \log (1/x)$  where  $x$  is the duty cycle (e.g.,  $10 \log (1/0.25)$  if the duty cycle is 25%).

### 5.2.4. Test Setup Layout





### 5.2.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 5.2.6. Test Result of Maximum Conducted Output Power

|               |           |                |                   |
|---------------|-----------|----------------|-------------------|
| Temperature   | 23.5℃     | Humidity       | 52.4%             |
| Test Engineer | Gary Qian | Configurations | IEEE 802.11a/n/ac |

| Test Mode           | Channel | Frequency (MHz) | Measured Conducted Average Power (dBm) |           |       | Duty Cycle factor (dB) | Report Conducted Average Power (dBm) |           |       | Limits (dBm) | Verdict |
|---------------------|---------|-----------------|----------------------------------------|-----------|-------|------------------------|--------------------------------------|-----------|-------|--------------|---------|
|                     |         |                 | Antenna 1                              | Antenna 2 | Sum   |                        | Antenna 1                            | Antenna 2 | Sum   |              |         |
| IEEE 802.11a        | 149     | 5745            | 9.502                                  | 9.375     | /     | 0.09                   | 9.59                                 | 9.47      | /     | 30           | PASS    |
|                     | 157     | 5785            | 9.934                                  | 9.564     | /     | 0.09                   | 10.02                                | 9.65      | /     |              |         |
|                     | 165     | 5825            | 10.215                                 | 10.081    | /     | 0.09                   | 10.31                                | 10.17     | /     |              |         |
| IEEE 802.11n HT20   | 149     | 5745            | 9.843                                  | 9.489     | 12.68 | 0.09                   | 9.93                                 | 9.58      | 12.77 | 28.19        | PASS    |
|                     | 157     | 5785            | 9.84                                   | 9.558     | 12.71 | 0.09                   | 9.93                                 | 9.65      | 12.80 |              |         |
|                     | 165     | 5825            | 10.25                                  | 10.006    | 13.14 | 0.09                   | 10.34                                | 10.10     | 13.23 |              |         |
| IEEE 802.11ac VHT20 | 149     | 5745            | 9.732                                  | 9.587     | 12.67 | 0.09                   | 9.82                                 | 9.68      | 12.76 | 28.19        | PASS    |
|                     | 157     | 5785            | 9.967                                  | 9.612     | 12.80 | 0.09                   | 10.06                                | 9.70      | 12.89 |              |         |
|                     | 165     | 5825            | 10.32                                  | 9.969     | 13.16 | 0.09                   | 10.41                                | 10.06     | 13.25 |              |         |
| IEEE 802.11n HT40   | 151     | 5755            | 9.309                                  | 8.947     | 12.14 | 0.18                   | 9.49                                 | 9.13      | 12.32 | 28.19        | PASS    |
|                     | 159     | 5795            | 9.404                                  | 9.199     | 12.31 | 0.18                   | 9.58                                 | 9.38      | 12.49 |              |         |
| IEEE 802.11ac VHT40 | 151     | 5755            | 9.19                                   | 9.141     | 12.18 | 0.19                   | 9.38                                 | 9.33      | 12.37 | 28.19        | PASS    |
|                     | 159     | 5795            | 9.412                                  | 9.362     | 12.40 | 0.19                   | 9.60                                 | 9.55      | 12.59 |              |         |
| IEEE 802.11ac VHT80 | 155     | 5775            | 0.785                                  | 0.626     | 3.72  | 0.37                   | 1.16                                 | 1.00      | 4.09  | 28.19        | PASS    |

#### Remark:

1. Measured output power at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;
4. For MIMO with CCD technology device:  

$$\text{Directional gain} = 10 \log[(10^{G1/10} + 10^{G2/10} + \dots + 10^{GN/10})/N_{ANT}] \text{ dBi, where antenna gains given by } G1, G2, \dots, GN \text{ dBi, } N_{ANT} \text{ is the antennas total Number}$$
5. limits= 24.0 – max(0, (Direction Gain – 6));
6. Report conducted average power = measured conducted average power + Duty Cycle factor;



## 5.3. Power Spectral Density Measurement

### 5.3.1. Standard Applicable

#### **For 5725~5850MHz**

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.

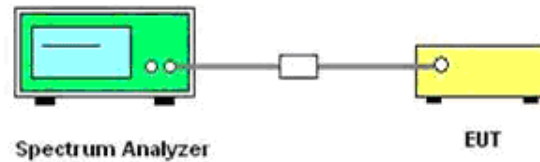
### 5.3.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

### 5.3.3. Test Procedures

1. The transmitter was connected directly to a Spectrum Analyzer through a directional couple.
2. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3. Set the RBW = 510 KHz.
4. Set the VBW  $\geq 3 \times \text{RBW}$
5. Span=Encompass the entire emissions bandwidth (EBW) of the signal
6. Detector = RMS.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. If measurement bandwidth of Maximum PSD is specified in 500 kHz, add  $10 \log (500 \text{ kHz}/\text{RBW})$  to the measured result, whereas RBW ( $< 500 \text{ kHz}$ ) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
11. If measurement bandwidth of Maximum PSD is specified in 1 MHz, add  $10 \log (1\text{MHz}/\text{RBW})$  to the measured result, whereas RBW ( $< 1 \text{ MHz}$ ) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
12. Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

### 5.3.4. Test Setup Layout



### 5.3.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 5.3.6. Test Result of Power Spectral Density

|               |           |                |              |
|---------------|-----------|----------------|--------------|
| Temperature   | 23.5℃     | Humidity       | 52.4%        |
| Test Engineer | Gary Qian | Configurations | 802.11a/n/ac |

| Test Mode           | Channel | Frequency (MHz) | Measured Conducted PSD (dBm/510KHz) |           |       | Duty Cycle factor (dB) | RBW factor (dB) | Report Max Conducted PSD (dBm/500KHz) | Limits (dBm/500KHz) | Verdict |
|---------------------|---------|-----------------|-------------------------------------|-----------|-------|------------------------|-----------------|---------------------------------------|---------------------|---------|
|                     |         |                 | Antenna 1                           | Antenna 2 | Sum   |                        |                 |                                       |                     |         |
| IEEE 802.11a        | 149     | 5745            | 3.409                               | 3.535     | /     | 0.09                   | 0.00            | 3.54                                  | 30                  | PASS    |
|                     | 157     | 5785            | 3.998                               | 4.082     | /     | 0.09                   | 0.00            | 4.08                                  |                     |         |
|                     | 165     | 5825            | 4.075                               | 3.994     | /     | 0.09                   | 0.00            | 4.08                                  |                     |         |
| IEEE 802.11n HT20   | 149     | 5745            | 4.336                               | 3.195     | 6.81  | 0.09                   | 0.00            | 6.81                                  | 28.19               | PASS    |
|                     | 157     | 5785            | 3.634                               | 3.644     | 6.65  | 0.09                   | 0.00            | 6.65                                  |                     |         |
|                     | 165     | 5825            | 3.963                               | 3.99      | 6.99  | 0.09                   | 0.00            | 6.99                                  |                     |         |
| IEEE 802.11ac VHT20 | 149     | 5745            | 3.767                               | 3.29      | 6.55  | 0.09                   | 0.00            | 6.55                                  | 28.19               | PASS    |
|                     | 157     | 5785            | 3.582                               | 3.559     | 6.58  | 0.09                   | 0.00            | 6.58                                  |                     |         |
|                     | 165     | 5825            | 3.718                               | 4.101     | 6.92  | 0.09                   | 0.00            | 6.92                                  |                     |         |
| IEEE 802.11n HT40   | 151     | 5755            | 0.323                               | -0.772    | 2.82  | 0.18                   | 0.00            | 2.82                                  | 28.19               | PASS    |
|                     | 159     | 5795            | 0.855                               | -0.069    | 3.43  | 0.18                   | 0.00            | 3.43                                  |                     |         |
| IEEE 802.11ac VHT40 | 151     | 5755            | 0.358                               | -0.357    | 3.03  | 0.19                   | 0.00            | 3.03                                  | 28.19               | PASS    |
|                     | 159     | 5795            | 0.075                               | -0.046    | 3.03  | 0.19                   | 0.00            | 3.03                                  |                     |         |
| IEEE 802.11ac VHT80 | 155     | 5775            | -4.016                              | -4.106    | -1.05 | 0.37                   | 0.00            | -0.68                                 | 28.19               | PASS    |

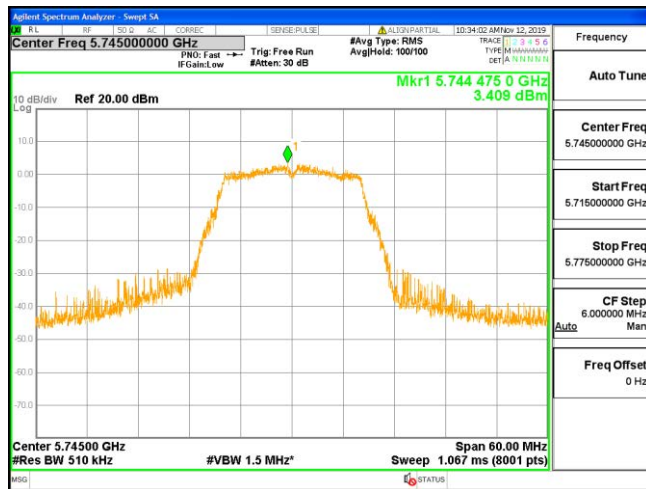
#### Remark:

1. Measured power spectrum density at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;
4. For MIMO with CCD technology device  
Directional gain =  $10 \log[(10^{G1/10} + 10^{G2/10} + \dots + 10^{GN/10})/N_{ANT}]$  dBi, where antenna gains given by  $G1, G2, \dots, GN$  dBi,  $N_{ANT}$  is the antennas total Number.
5. limits =  $24.0 - \max(0, (\text{Direction Gain} - 6))$ ;
6. Report conducted PSD = measured conducted PSD + Duty Cycle factor + RBW factor;
7. Please refer to following test plots;
8. Ignore RBW factor as the setting RBW is Approximate to 500KHz.

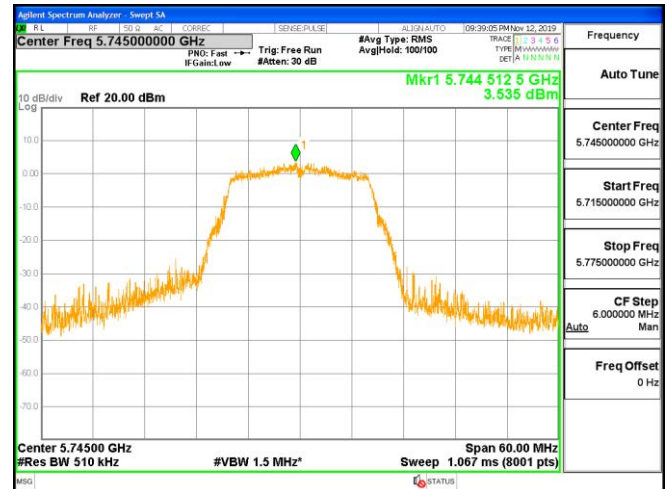


## Power Spectral Density IEEE 802.11a

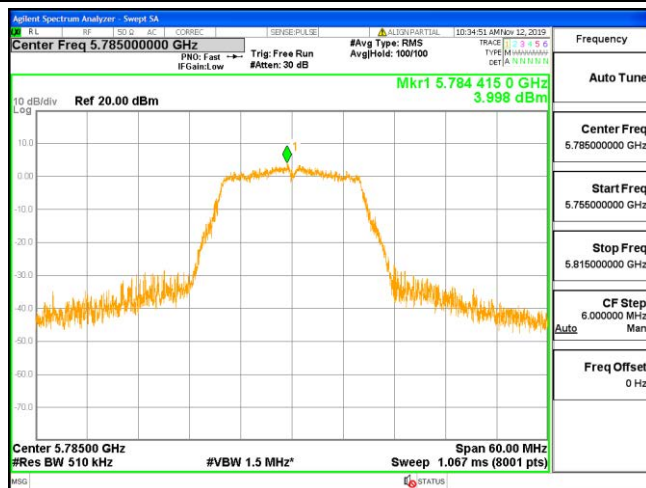
### Antenna Chain 1



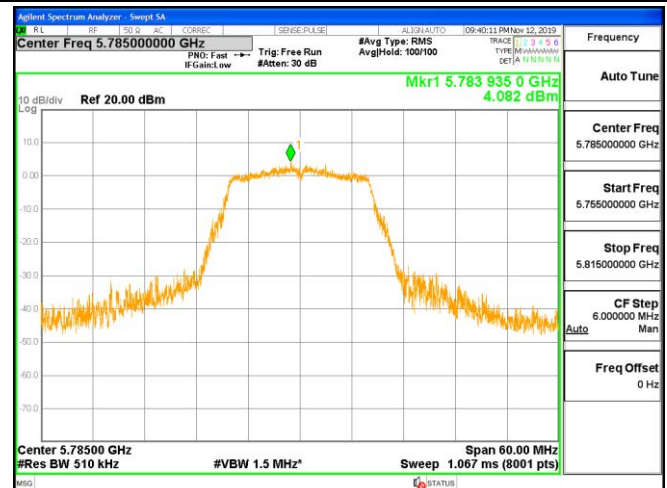
### Antenna Chain 2



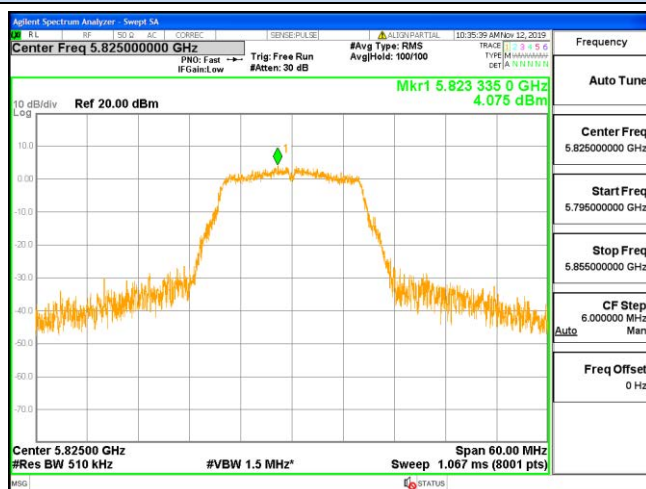
### Channel 149 / 5745 MHz



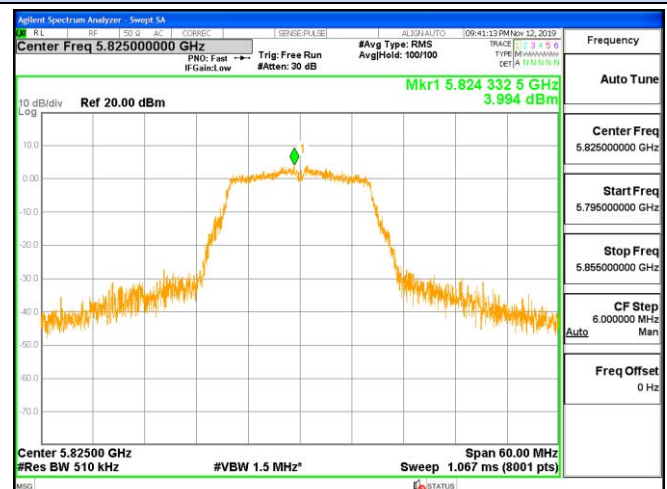
### Channel 149 / 5745 MHz



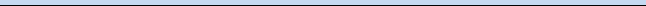
### Channel 157 / 5785 MHz



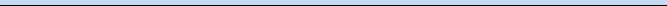
### Channel 157 / 5785 MHz



### Channel 165 / 5825 MHz



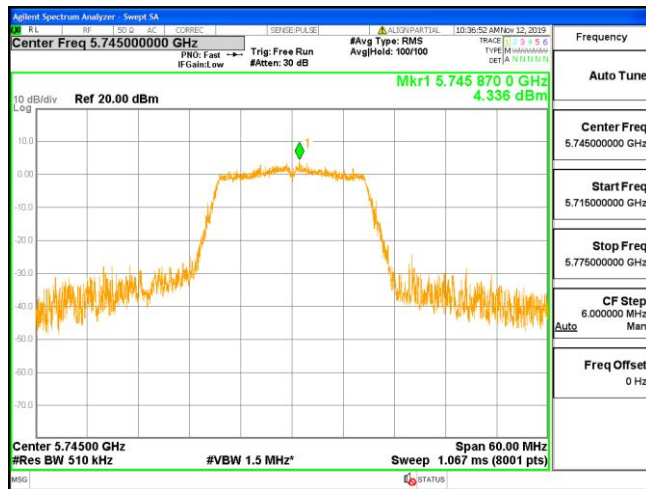
### Channel 165 / 5825 MHz



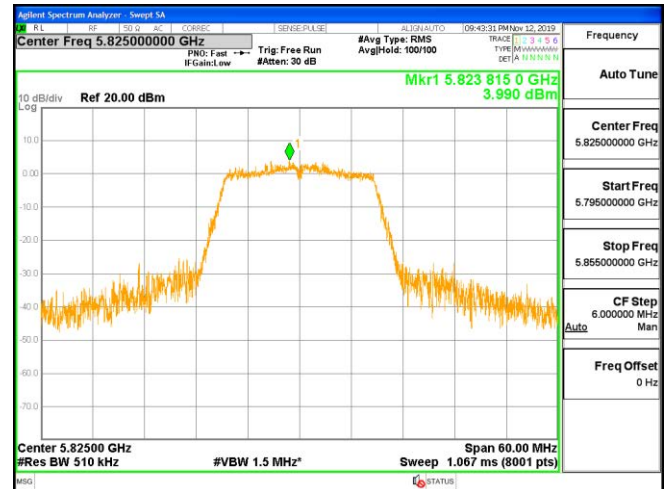


## Power Spectral Density IEEE 802.11n HT20

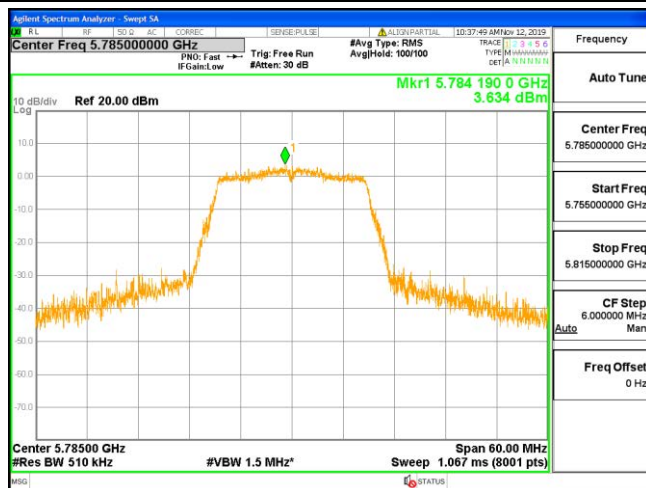
### Antenna Chain 1



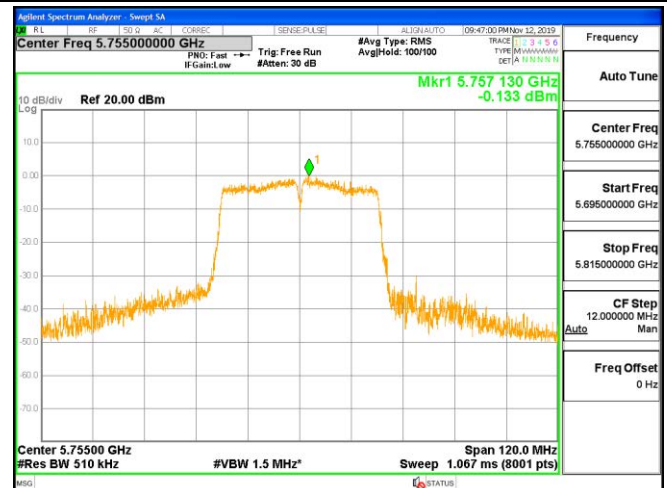
### Antenna Chain 2



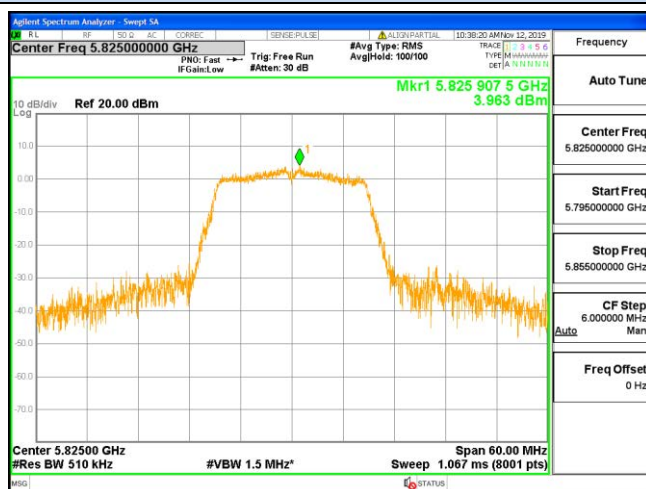
### Channel 149 / 5745 MHz



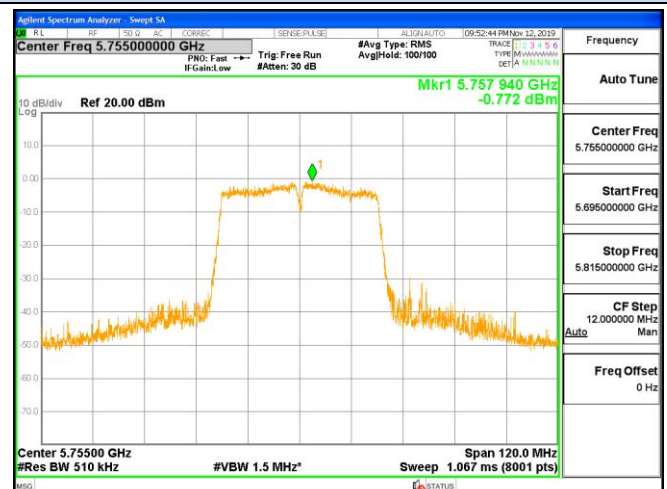
### Channel 149 / 5745 MHz



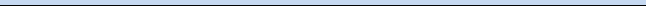
### Channel 157 / 5785 MHz



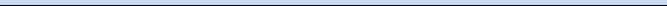
### Channel 157 / 5785 MHz



### Channel 165 / 5825 MHz



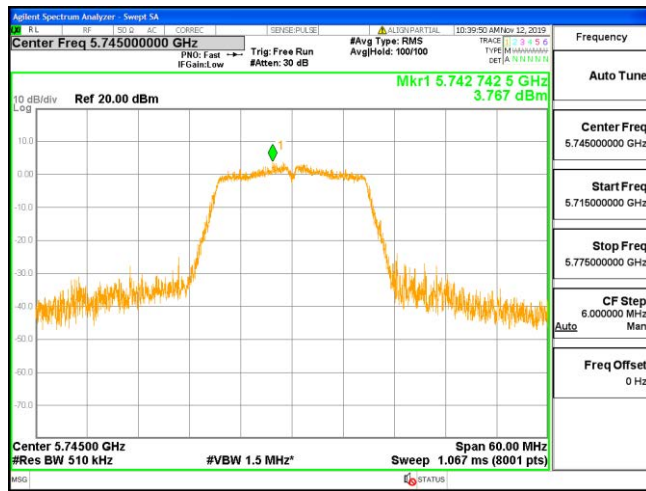
### Channel 165 / 5825 MHz



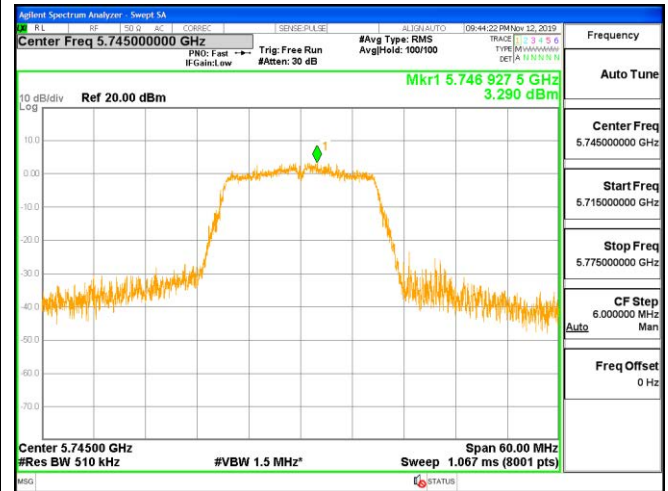


Power Spectral Density  
IEEE 802.11ac VHT20

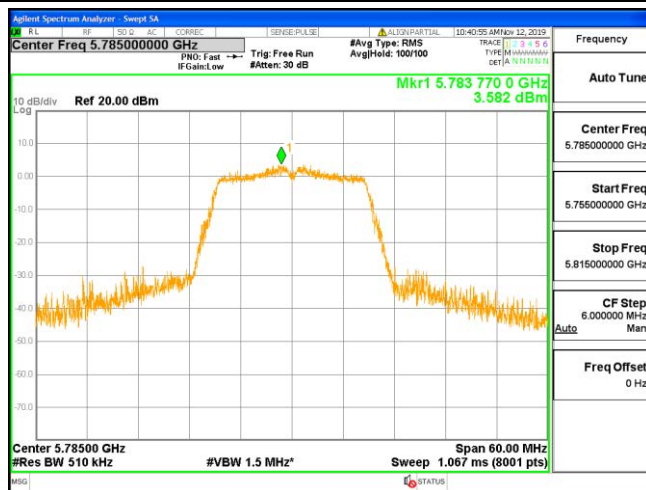
## Antenna Chain 1



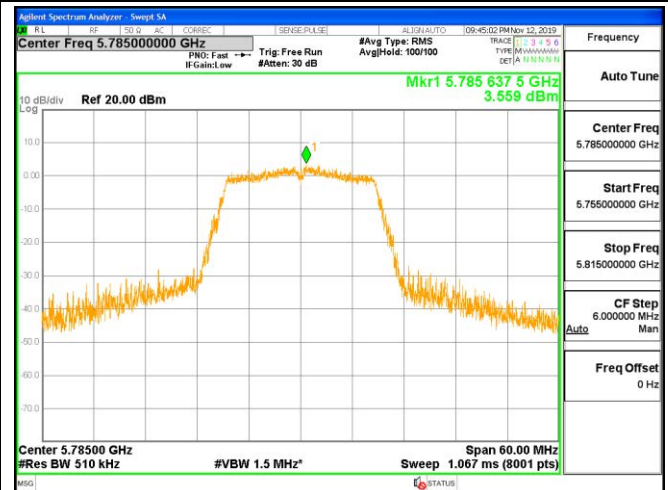
## Antenna Chain 2



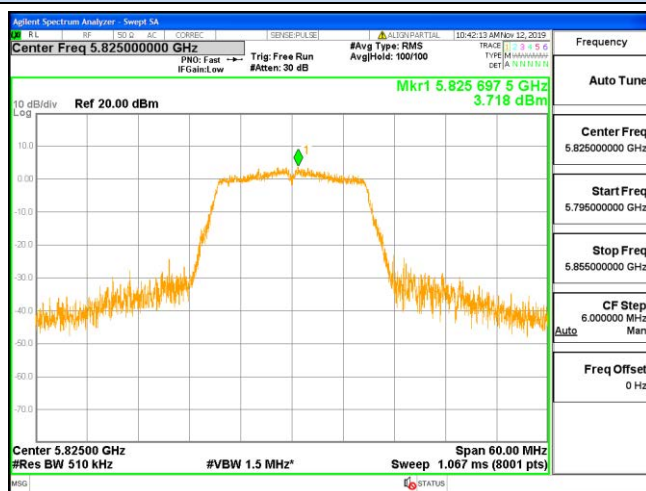
## Channel 149 / 5745 MHz



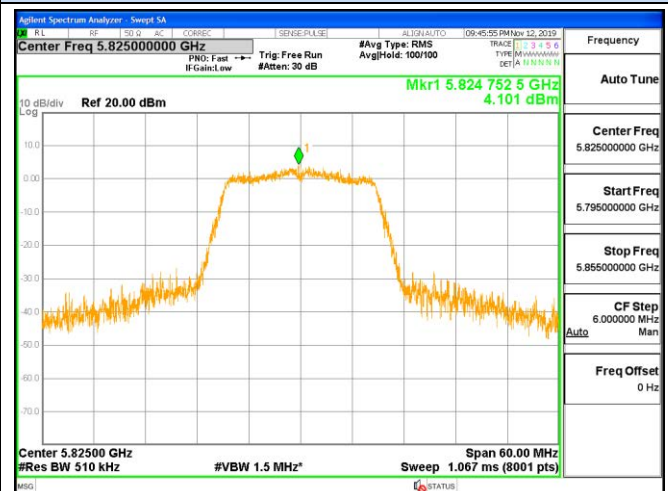
## Channel 149 / 5745 MHz



## Channel 157 / 5785 MHz



## Channel 157 / 5785 MHz



## Channel 165 / 5825 MHz



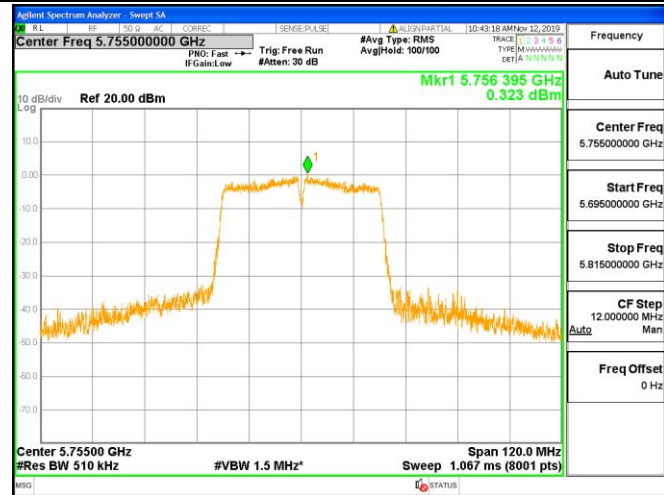
## Channel 165 / 5825 MHz



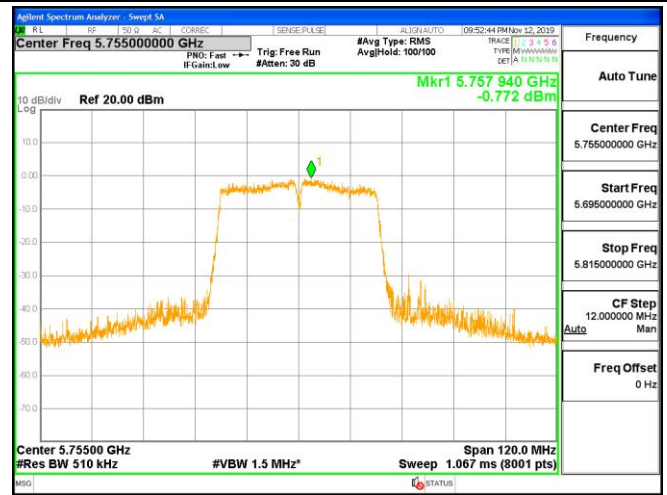


## Power Spectral Density IEEE 802.11n HT40

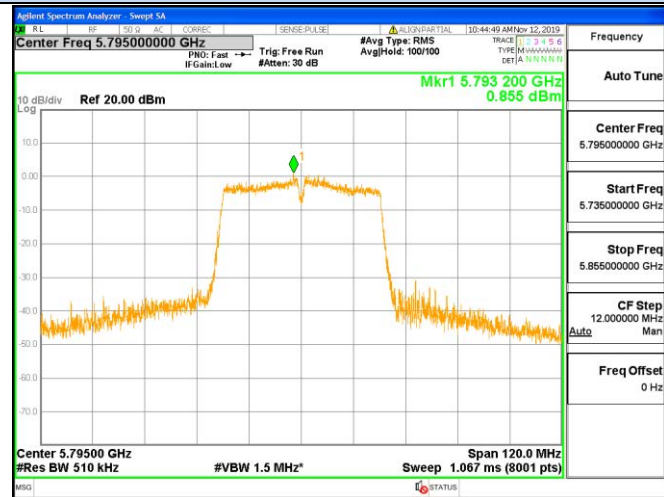
### Antenna Chain 1



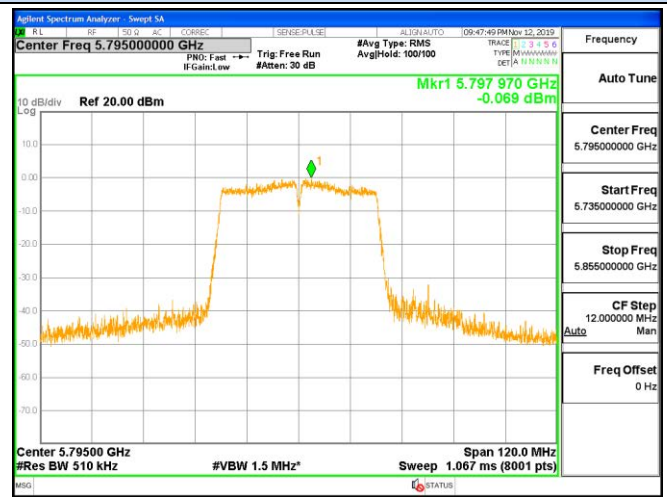
### Antenna Chain 2



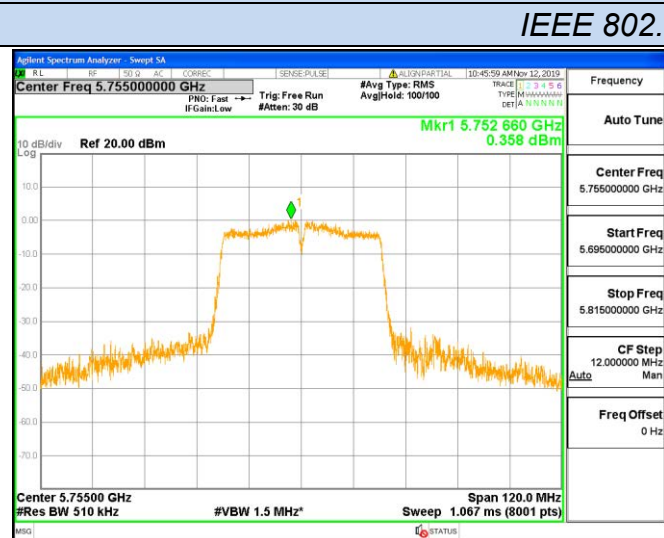
### Channel 151 / 5755 MHz



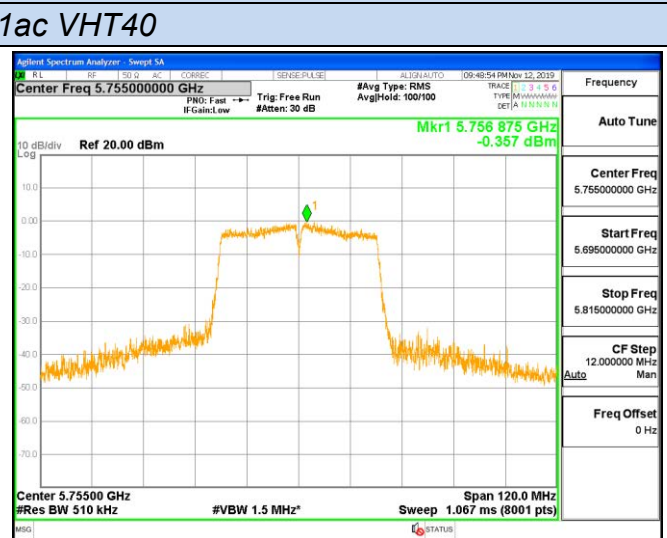
### Channel 151 / 5755 MHz



### Channel 159 / 5795 MHz



### Channel 159 / 5795 MHz



## IEEE 802.11ac VHT40

### Channel 151 / 5755 MHz



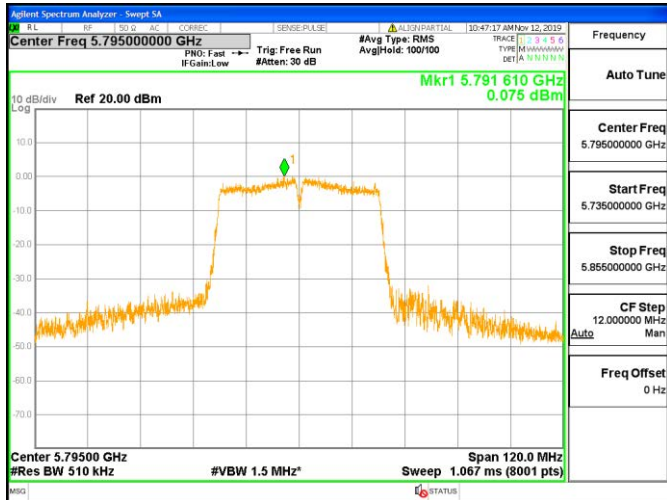
### Channel 151 / 5755 MHz



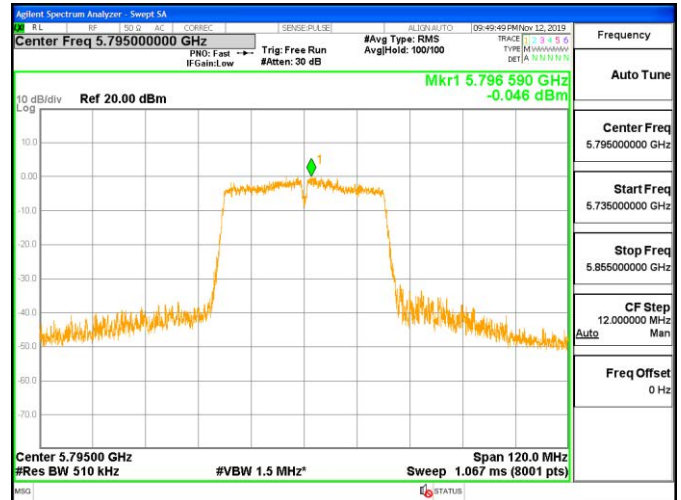


Power Spectral Density  
IEEE 802.11ac VHT40

## Antenna Chain 1



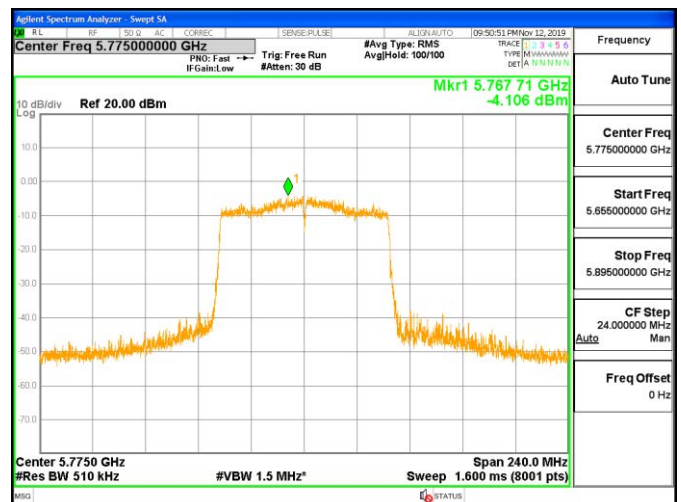
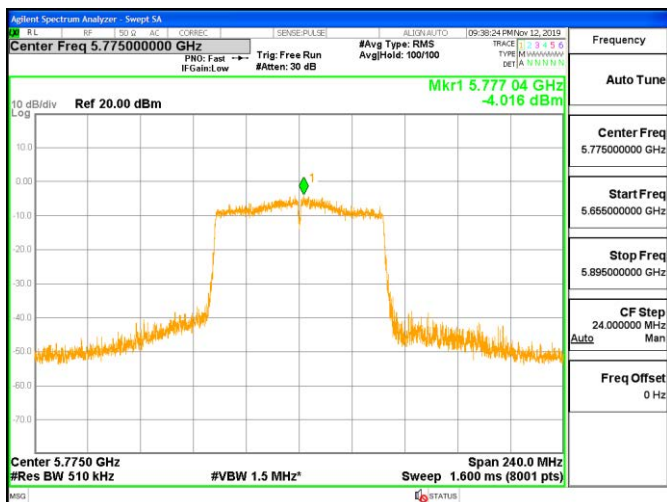
## Antenna Chain 2



## Channel 159 / 5795 MHz

## Channel 159 / 5795 MHz

## IEEE 802.11ac VHT80



## Channel 155 / 5775 MHz

## Channel 155 / 5775 MHz



## 5.4. 99% Occupied Bandwidth and 6dB Emission Bandwidth Measurement

### 5.4.1. Standard Applicable

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

### 5.4.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of the Spectrum Analyzer.

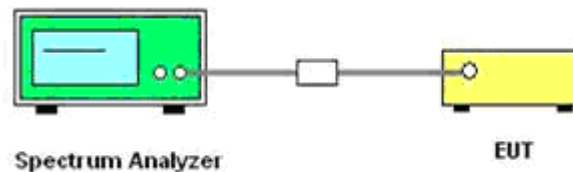
| Spectrum Parameter | Setting          |
|--------------------|------------------|
| Attenuation        | Auto             |
| Span               | > 26dB Bandwidth |
| Detector           | Peak             |
| Trace              | Max Hold         |
| Sweep Time         | 100ms            |

5

### 5.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. Set the RBW = 100 KHz
3. Set the VBW > RBW
4. Measured the spectrum width with power higher than 6dB below carrier.

### 5.4.4. Test Setup Layout



### 5.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 5.4.6. Test Result of 6dB Occupied Bandwidth

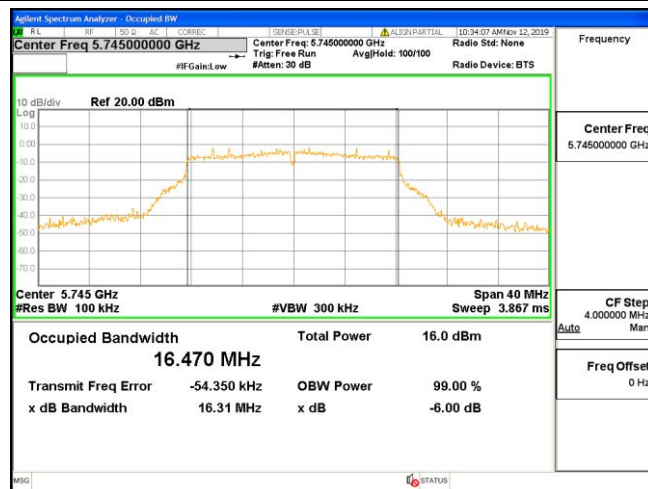
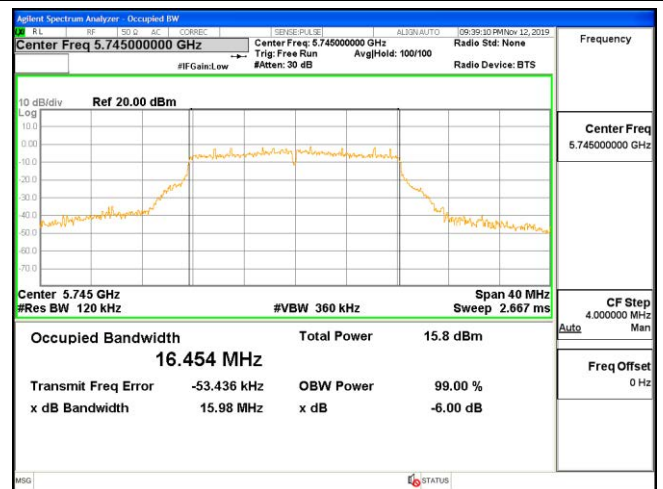
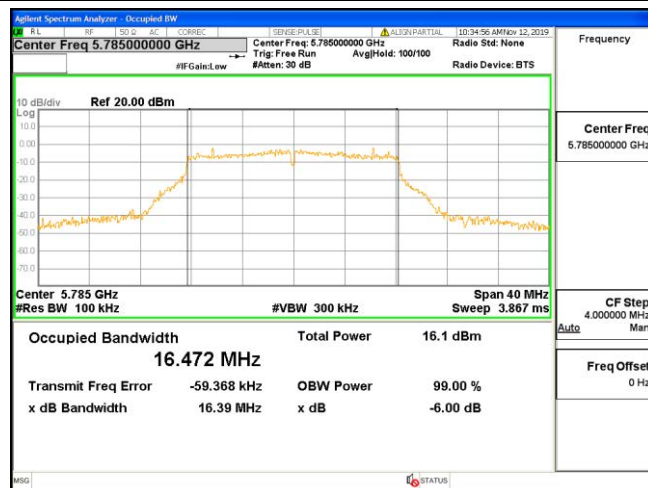
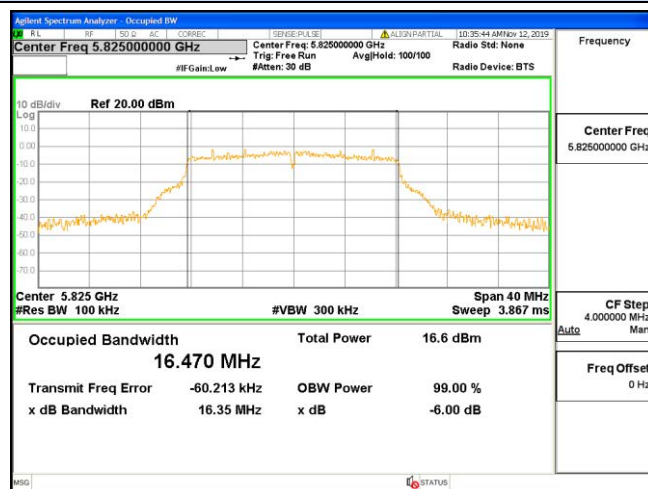
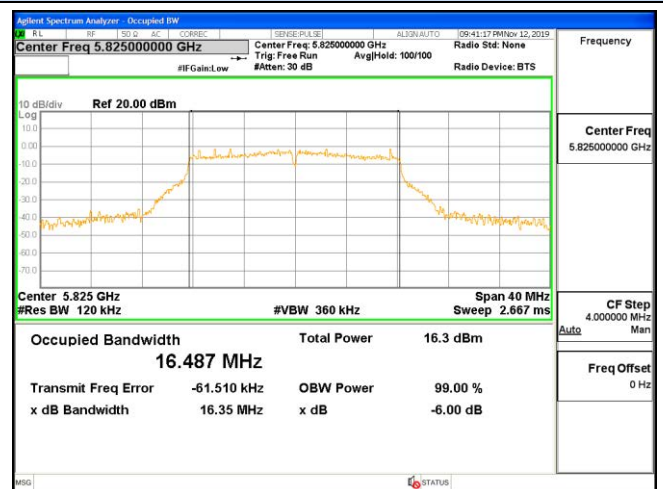
|               |           |                |                   |
|---------------|-----------|----------------|-------------------|
| Temperature   | 23.5°C    | Humidity       | 52.4%             |
| Test Engineer | Gary Qian | Configurations | IEEE 802.11a/n/ac |



| Test Mode           | Channel | Frequency (MHz) | 6dB Bandwidth (MHz) |           | 99% Bandwidth (MHz) |           | Limits (MHz) | Verdict |
|---------------------|---------|-----------------|---------------------|-----------|---------------------|-----------|--------------|---------|
|                     |         |                 | Antenna 1           | Antenna 2 | Antenna 1           | Antenna 2 |              |         |
| IEEE 802.11a        | 149     | 5745            | 16.31               | 15.98     | 17.077              | 17.126    | No Limit     | PASS    |
|                     | 157     | 5785            | 16.39               | 16.38     | 17.156              | 17.126    |              |         |
|                     | 163     | 5825            | 16.35               | 16.35     | 17.085              | 17.089    |              |         |
| IEEE 802.11n HT20   | 149     | 5745            | 17.58               | 17.39     | 18.166              | 18.186    | No Limit     | PASS    |
|                     | 157     | 5785            | 17.58               | 17.59     | 18.259              | 18.165    |              |         |
|                     | 163     | 5825            | 17.60               | 17.34     | 18.138              | 18.152    |              |         |
| IEEE 802.11ac VHT20 | 149     | 5745            | 17.57               | 17.61     | 18.221              | 18.194    | No Limit     | PASS    |
|                     | 157     | 5785            | 17.61               | 17.62     | 18.174              | 18.214    |              |         |
|                     | 163     | 5825            | 17.63               | 17.53     | 18.149              | 18.147    |              |         |
| IEEE 802.11n HT40   | 151     | 5755            | 36.28               | 36.35     | 36.364              | 36.480    | No Limit     | PASS    |
|                     | 159     | 5795            | 36.31               | 36.31     | 36.433              | 36.363    |              |         |
| IEEE 802.11ac VHT40 | 151     | 5755            | 36.02               | 36.29     | 36.310              | 36.451    | No Limit     | PASS    |
|                     | 159     | 5795            | 35.99               | 36.29     | 36.333              | 36.370    |              |         |
| IEEE 802.11ac VHT80 | 155     | 5775            | 75.37               | 75.67     | 75.617              | 75.748    | No Limit     | PASS    |

**Remark:**

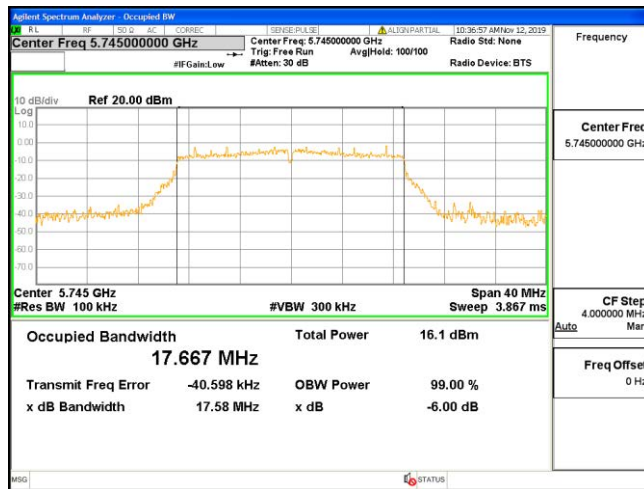
1. Measured 6dB bandwidth at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;
4. Please refer to following test plots;

**6dB Bandwidth**  
**IEEE 802.11a****Antenna Chain 1****Antenna Chain 2****Channel 149 / 5745 MHz****Channel 149 / 5745 MHz****Channel 157 / 5785 MHz****Channel 157 / 5785 MHz****Channel 165 / 5825 MHz****Channel 165 / 5825 MHz**

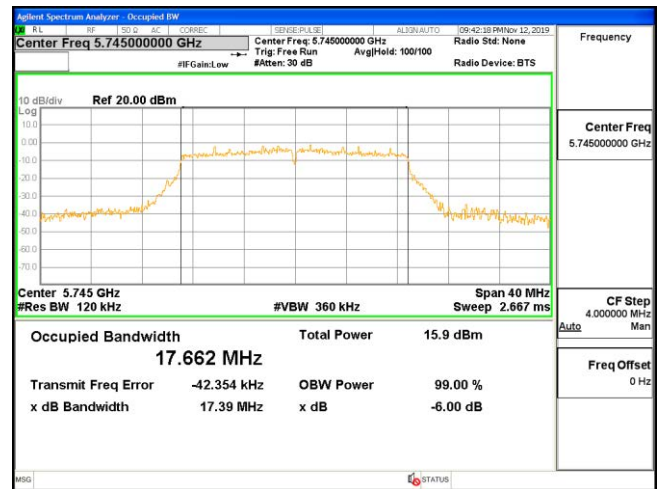


6dB Bandwidth  
IEEE 802.11n HT20

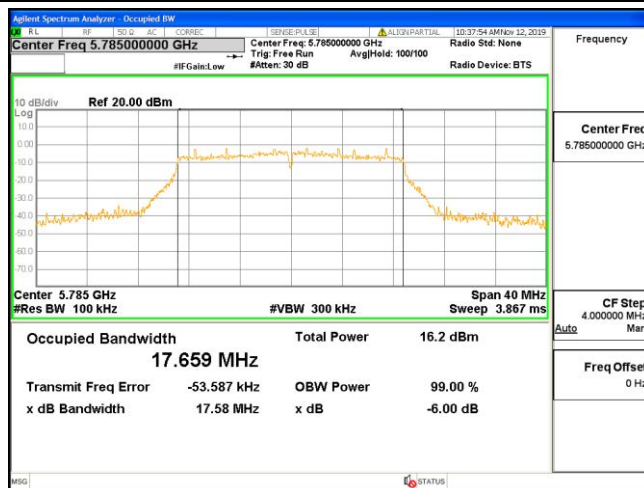
Antenna Chain 1



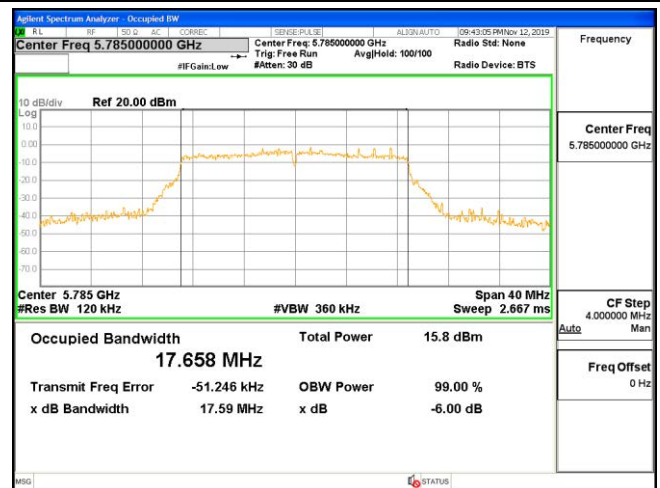
Antenna Chain 2



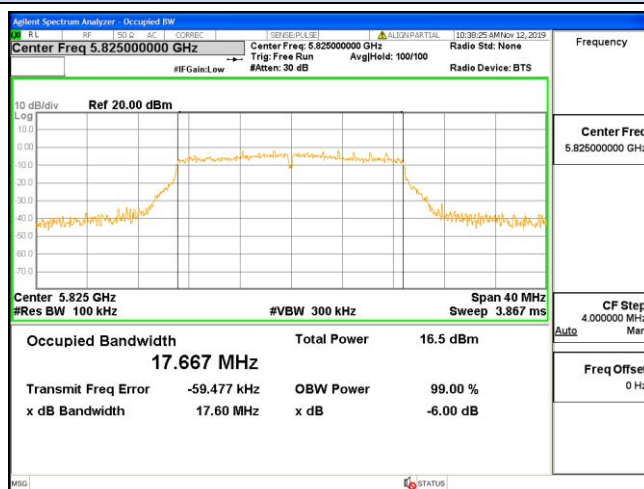
Channel 149 / 5745 MHz



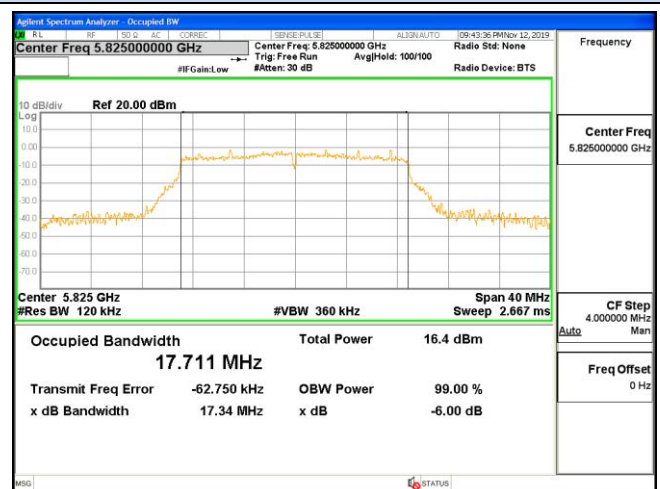
Channel 149 / 5745 MHz



Channel 157 / 5785 MHz



Channel 157 / 5785 MHz



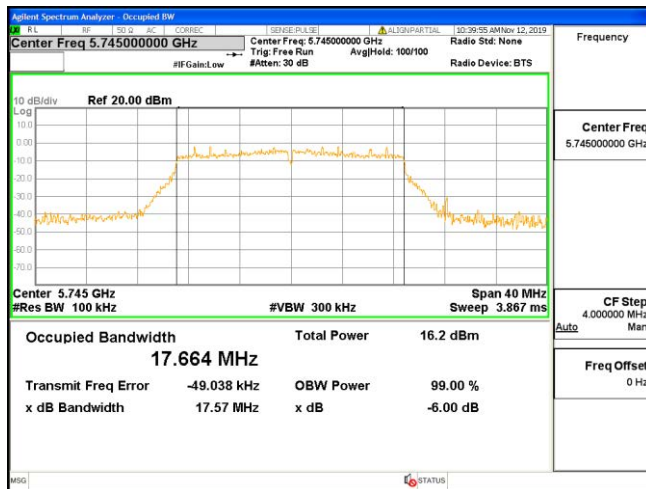
Channel 165 / 5825 MHz

Channel 165 / 5825 MHz

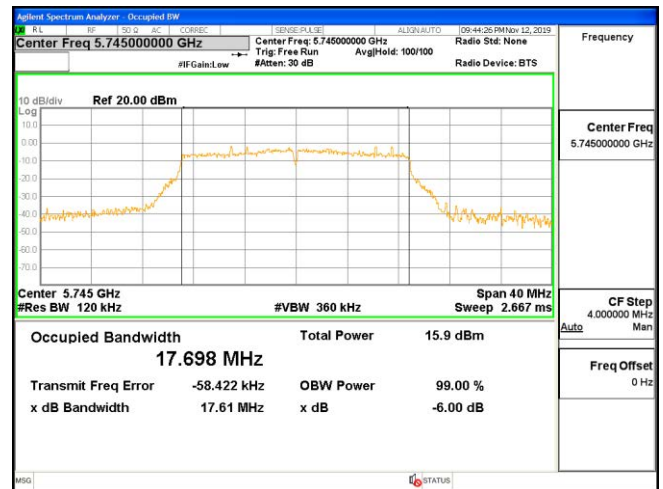


6dB Bandwidth  
IEEE 802.11ac VHT20

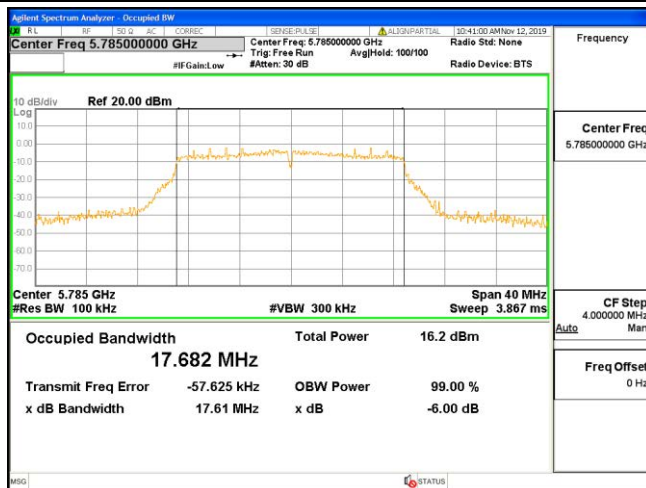
## Antenna Chain 1



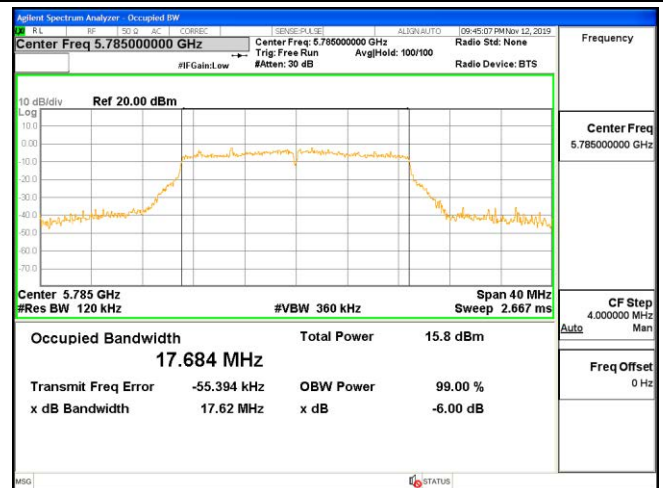
## Antenna Chain 2



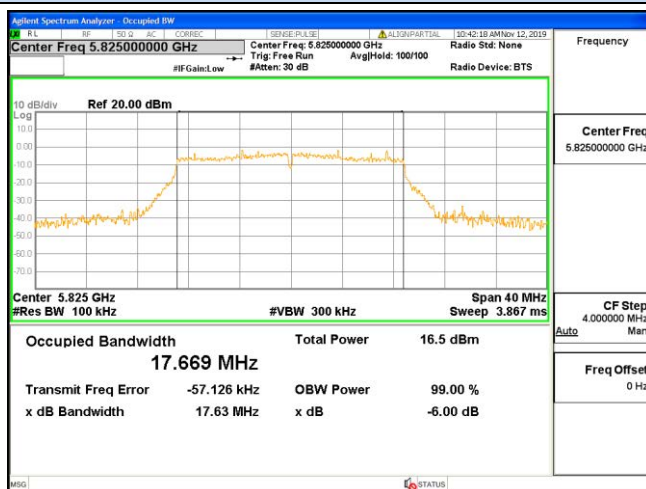
## Channel 149 / 5745 MHz



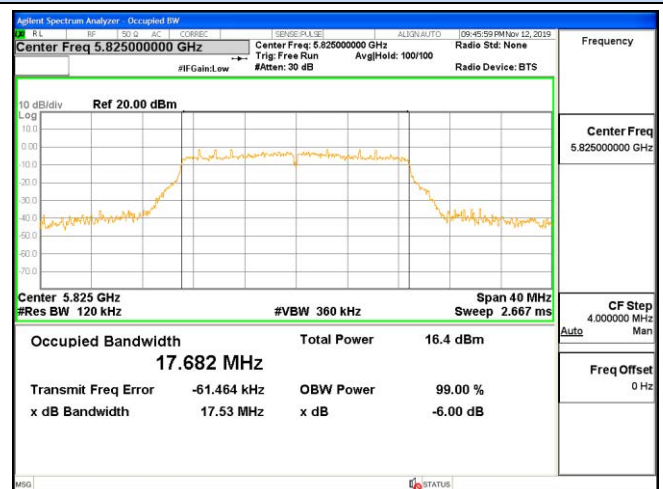
## Channel 149 / 5745 MHz



## Channel 157 / 5785 MHz



## Channel 157 / 5785 MHz



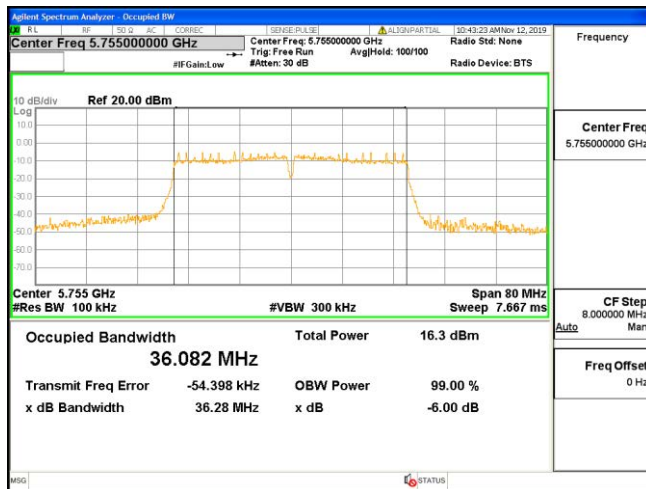
## Channel 165 / 5825 MHz

## Channel 165 / 5825 MHz

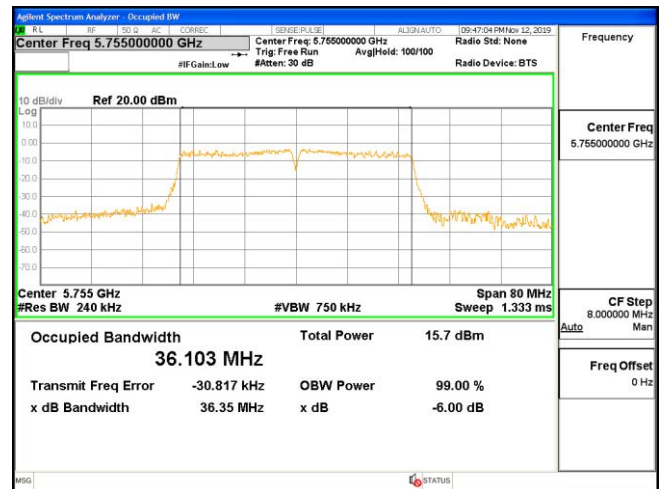


## 6dB Bandwidth IEEE 802.11n HT40

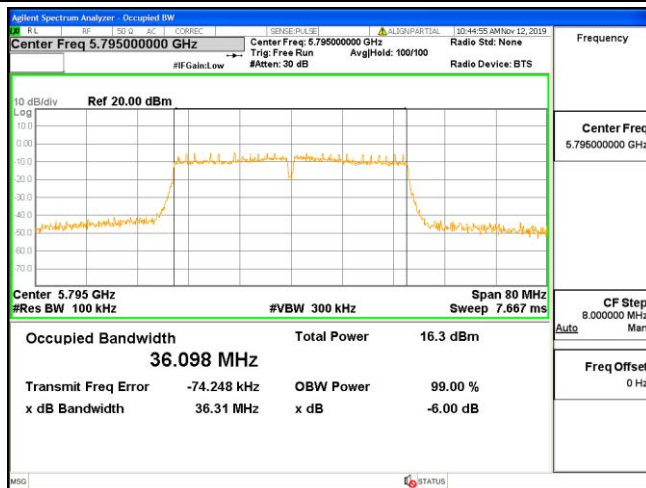
### Antenna Chain 1



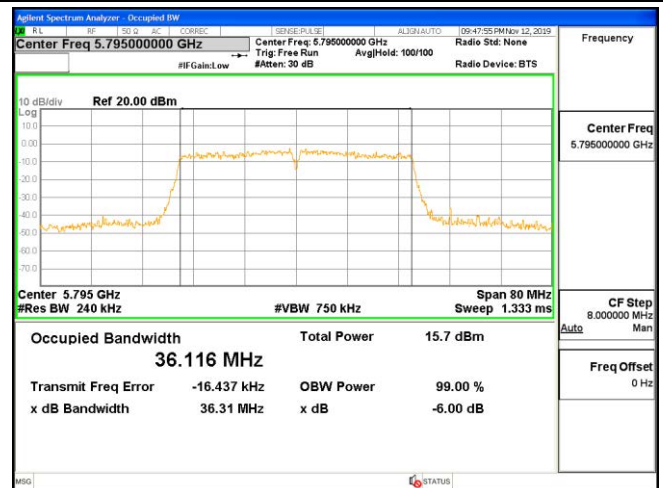
### Antenna Chain 2



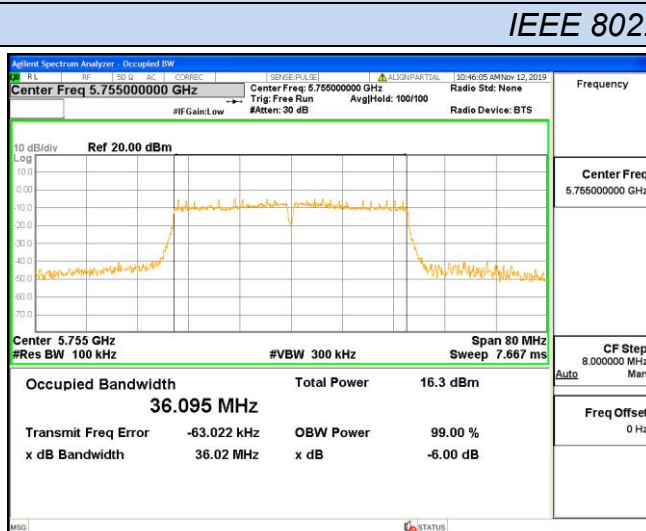
### Channel 151 / 5755 MHz



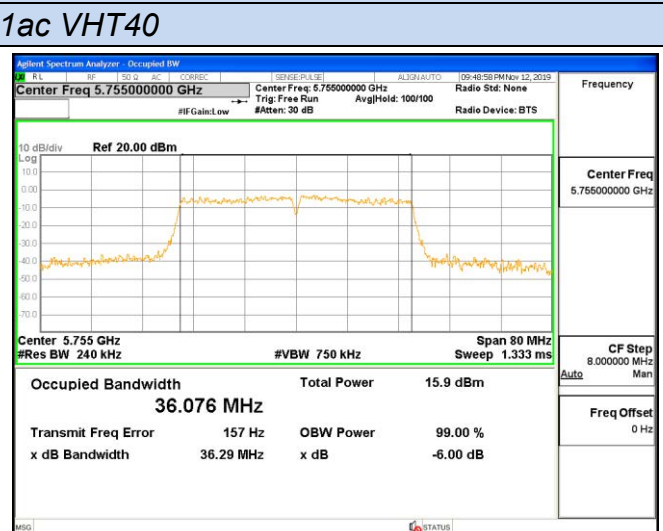
### Channel 151 / 5755 MHz



### Channel 159 / 5795 MHz



### Channel 159 / 5795 MHz



### Channel 151 / 5755 MHz

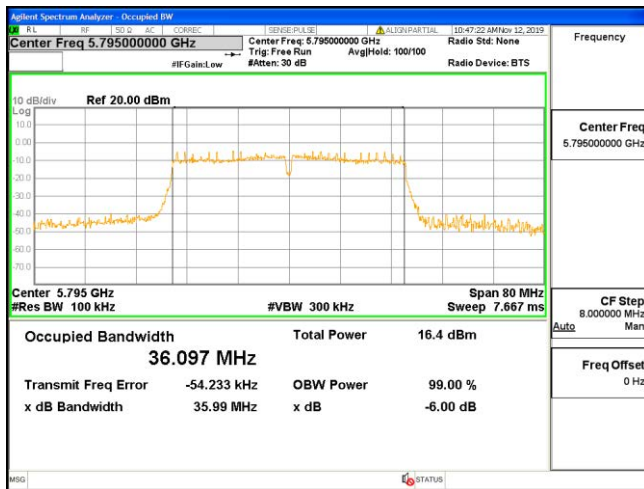
### Channel 151 / 5755 MHz



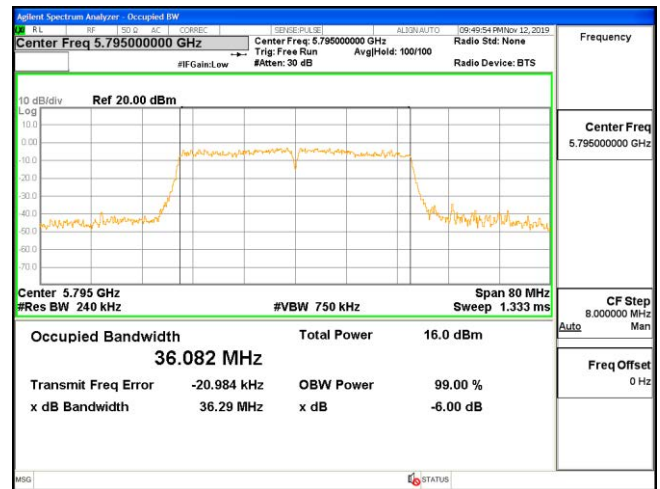
## 6dB Bandwidth

## IEEE 802.11ac VHT40

## Antenna Chain 1



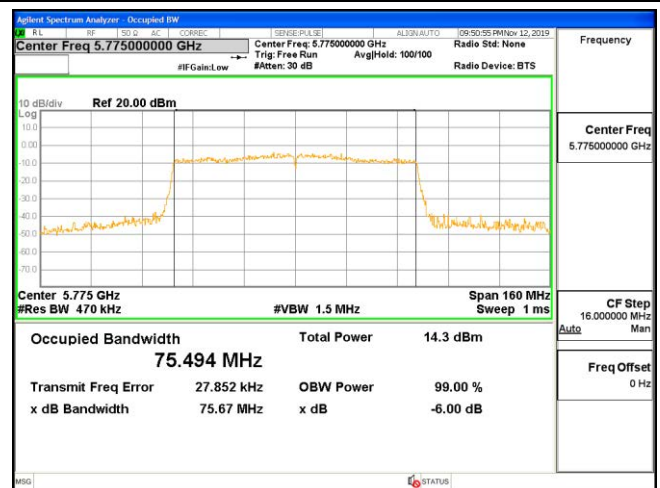
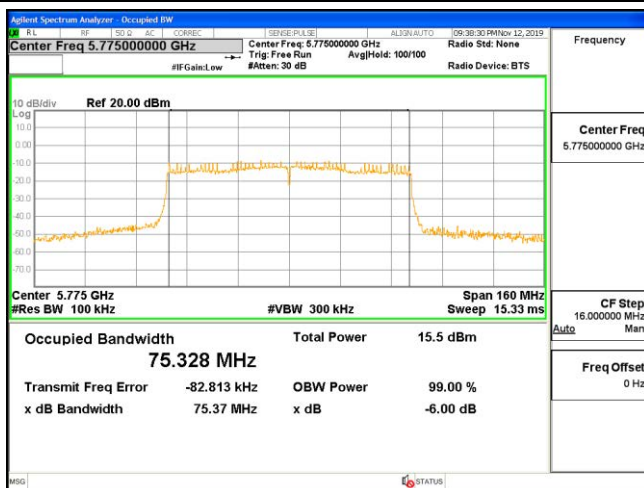
## Antenna Chain 2



## Channel 159 / 5795 MHz

## Channel 159 / 5795 MHz

## IEEE 802.11ac VHT80



## Channel 155 / 5775 MHz

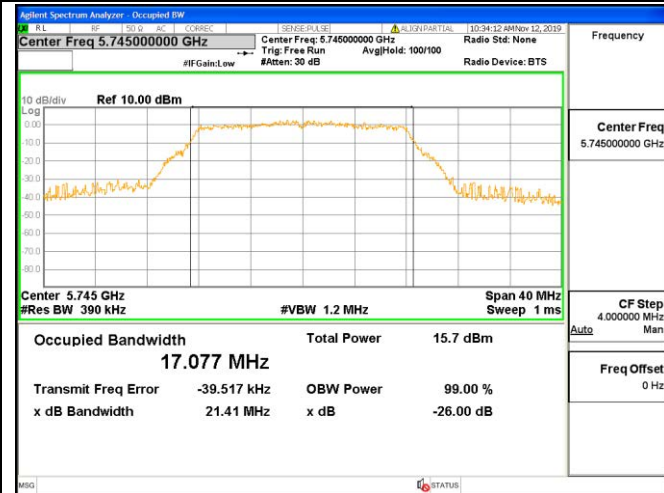
## Channel 155 / 5775 MHz



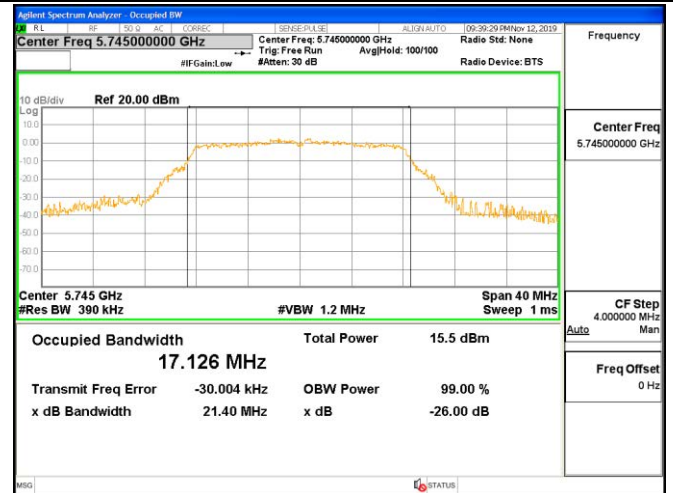
## 99% Occupied Bandwidth

## IEEE 802.11a

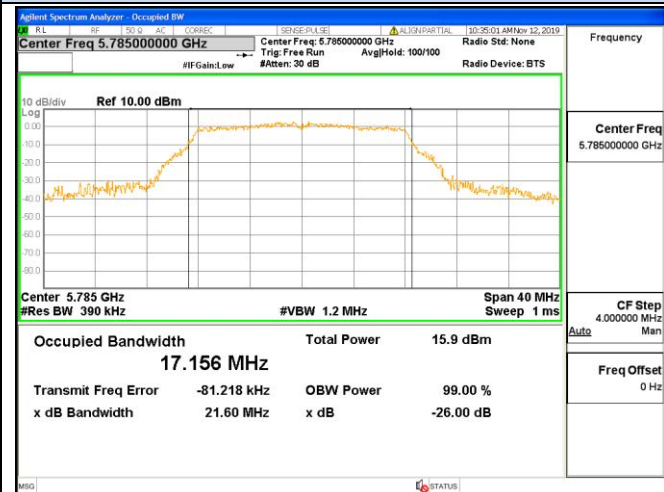
## Antenna Chain 1



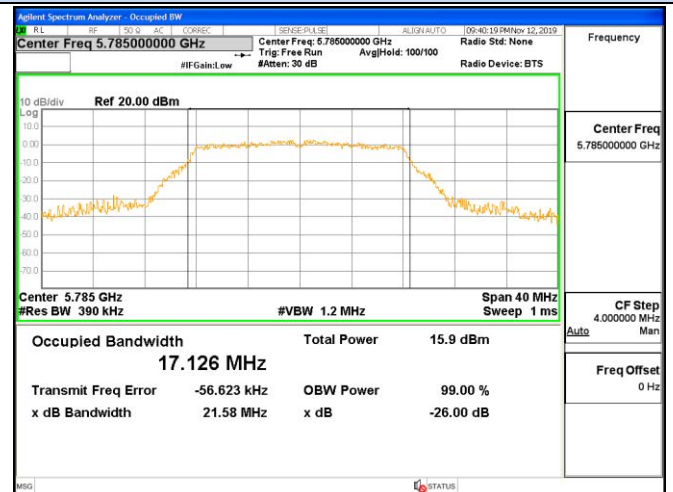
## Antenna Chain 2



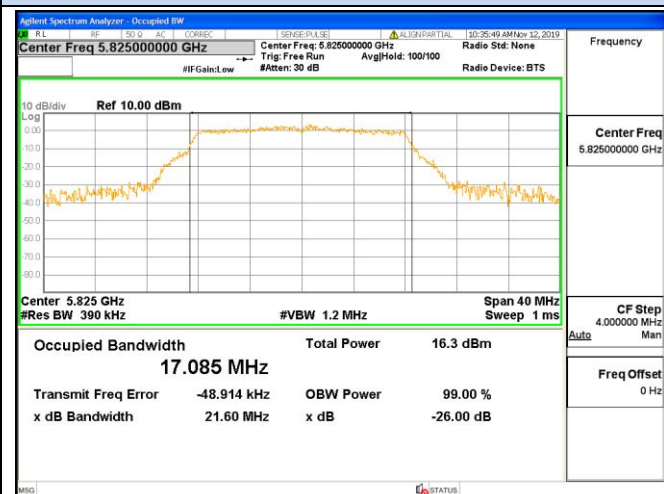
## Channel 149 / 5745 MHz



## Channel 149 / 5745 MHz



## Channel 157 / 5785 MHz



## Channel 157 / 5785 MHz



## Channel 165 / 5825 MHz

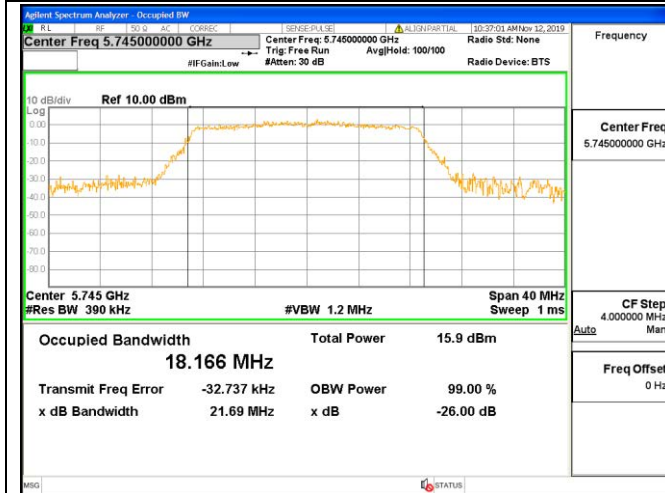
## Channel 165 / 5825 MHz



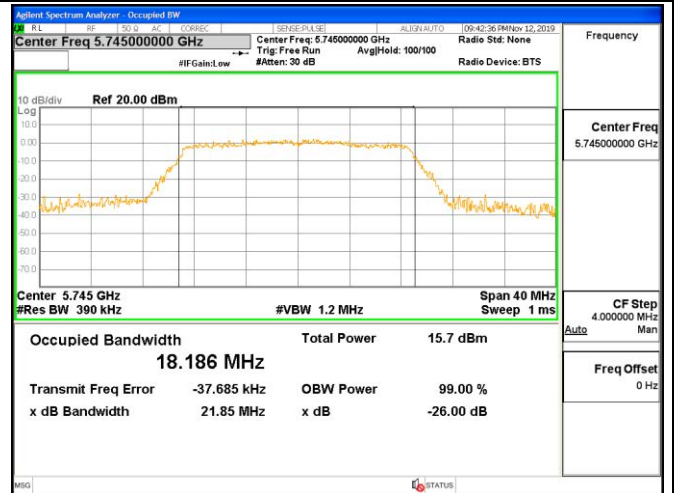
## 99% Occupied Bandwidth

## IEEE 802.11n HT20

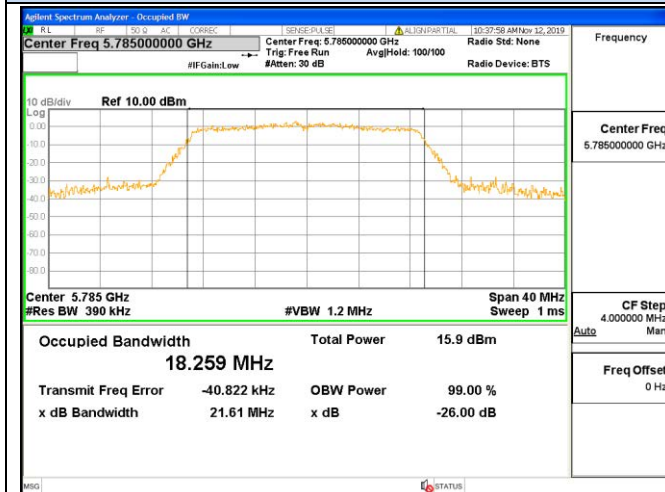
## Antenna Chain 1



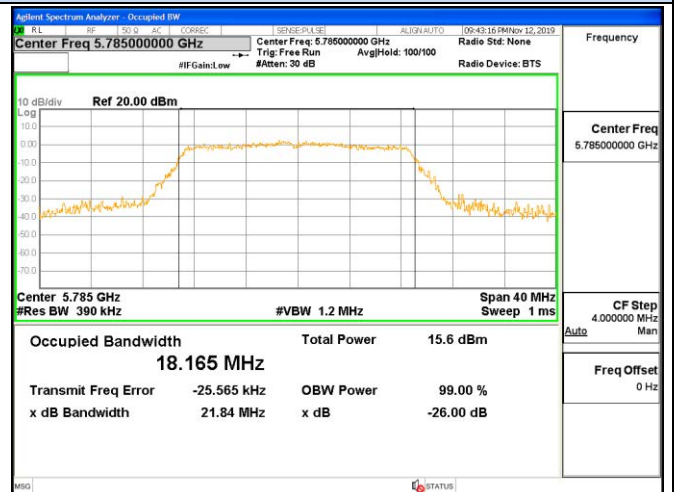
## Antenna Chain 2



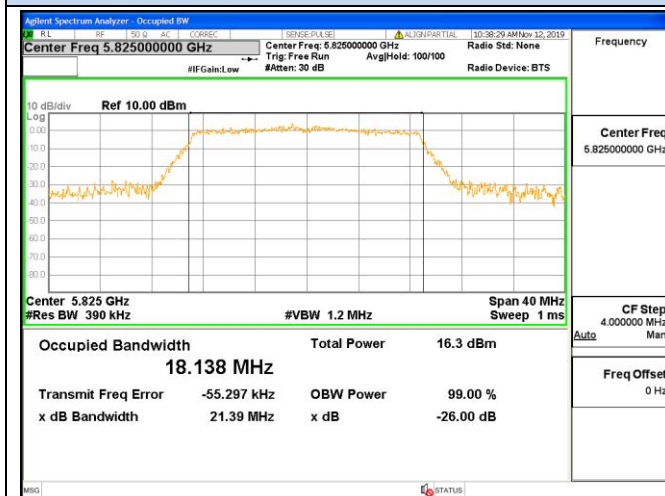
## Channel 149 / 5745 MHz



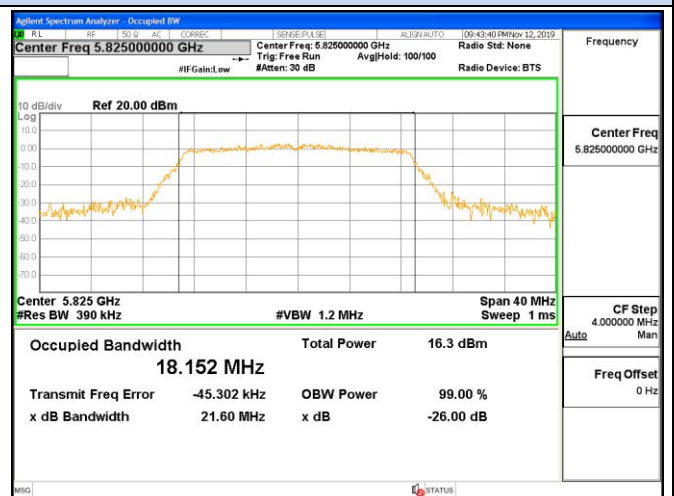
## Channel 149 / 5745 MHz



## Channel 157 / 5785 MHz



## Channel 157 / 5785 MHz



## Channel 165 / 5825 MHz

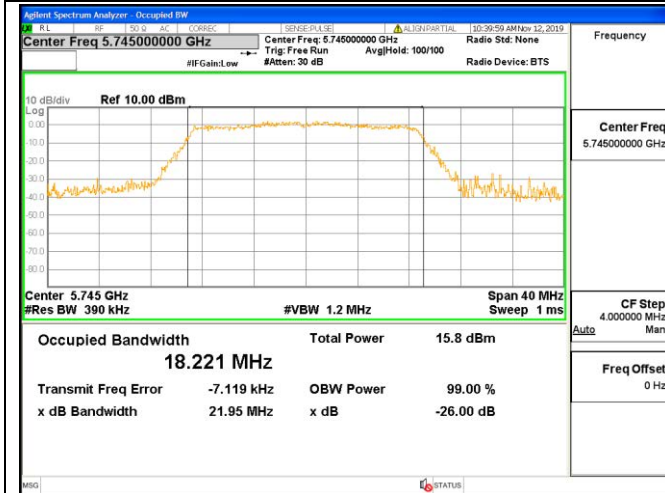
## Channel 165 / 5825 MHz



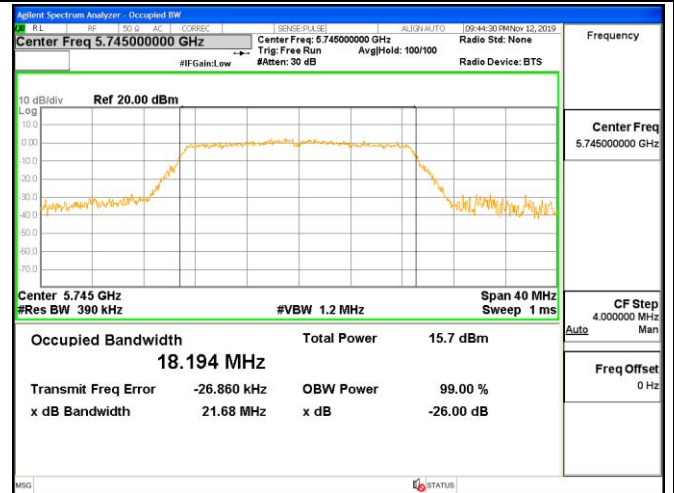
## 99% Occupied Bandwidth

## IEEE 802.11ac VHT20

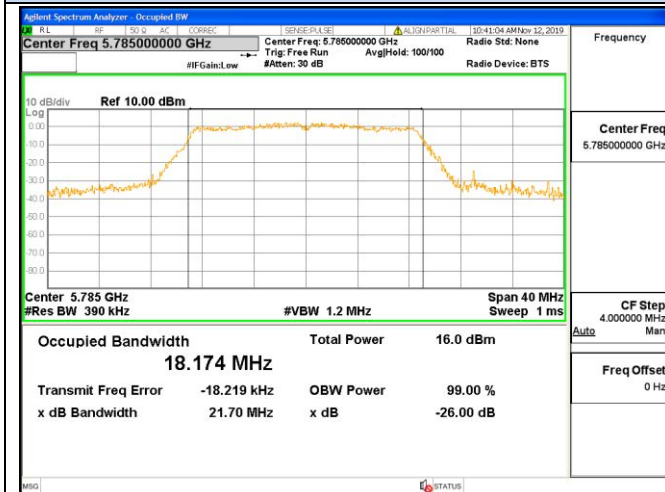
## Antenna Chain 1



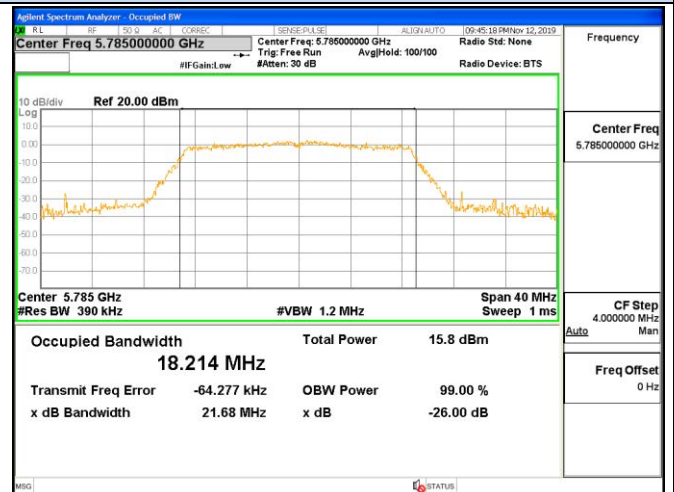
## Antenna Chain 2



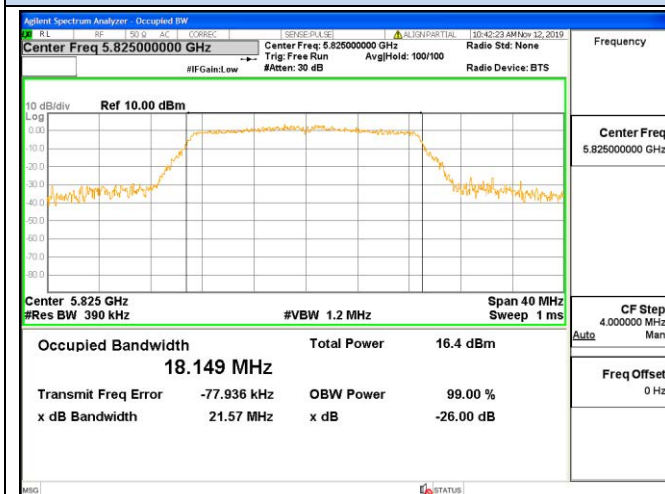
## Channel 149 / 5745 MHz



## Channel 149 / 5745 MHz



## Channel 157 / 5785 MHz



## Channel 157 / 5785 MHz



## Channel 165 / 5825 MHz



## Channel 165 / 5825 MHz

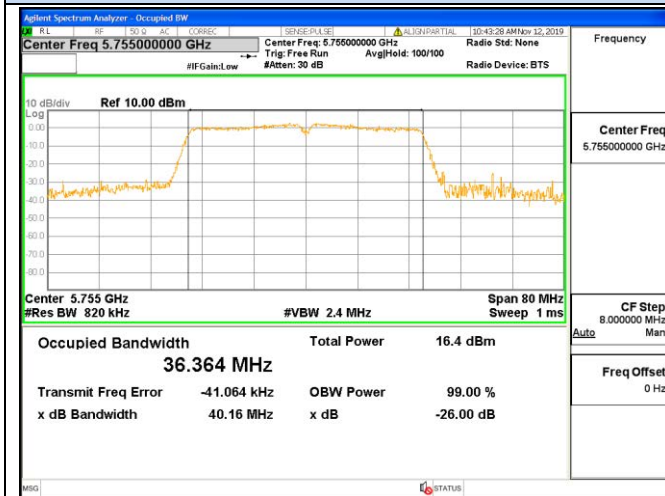




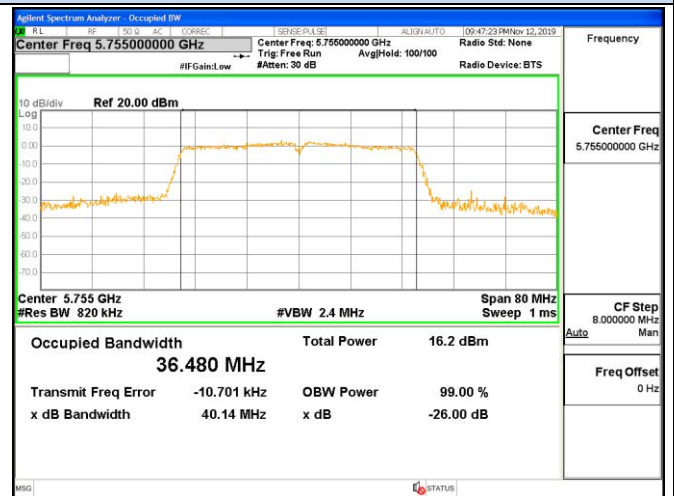
## 99% Occupied Bandwidth

## IEEE 802.11n HT40

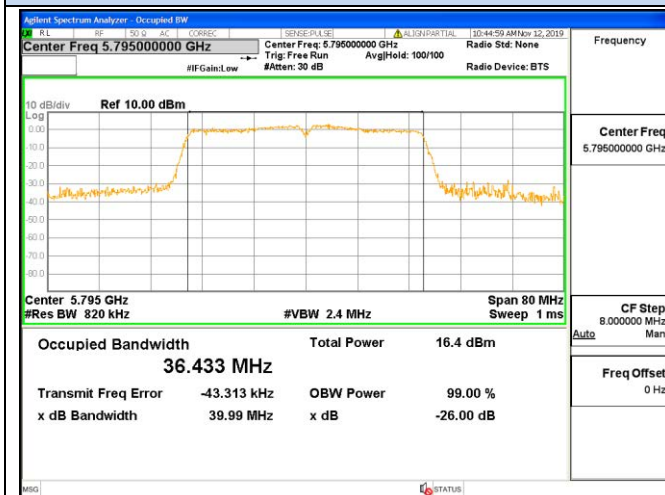
## Antenna Chain 1



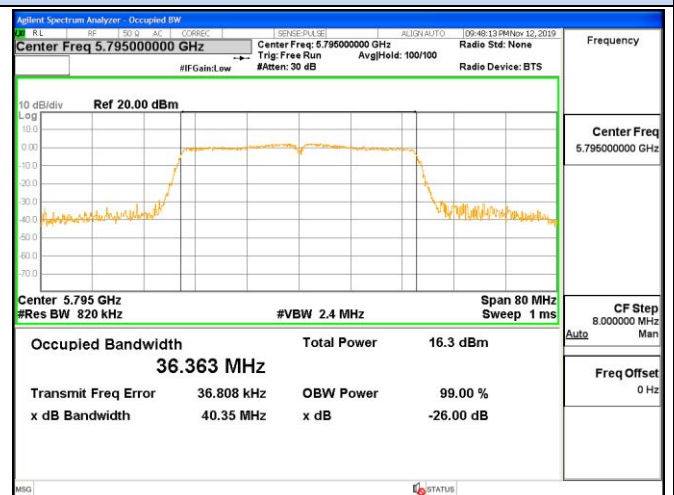
## Antenna Chain 2



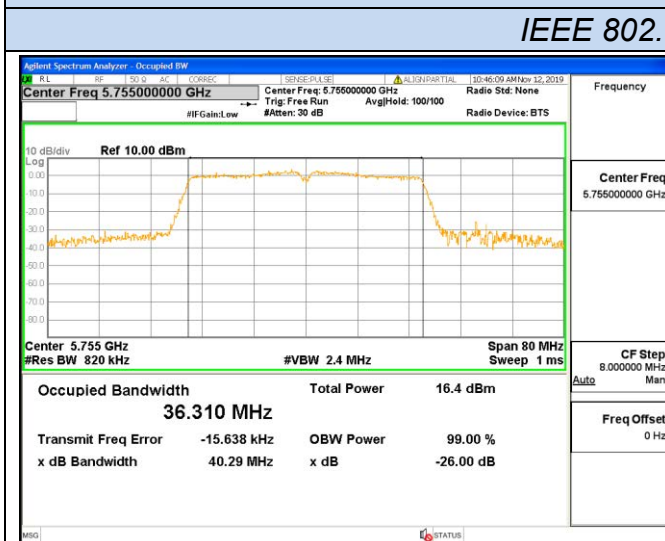
## Channel 151 / 5755 MHz



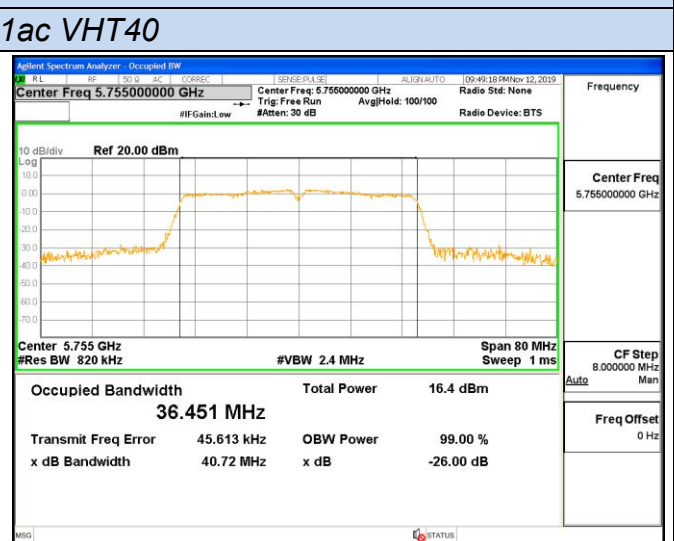
## Channel 151 / 5755 MHz



## Channel 159 / 5795 MHz

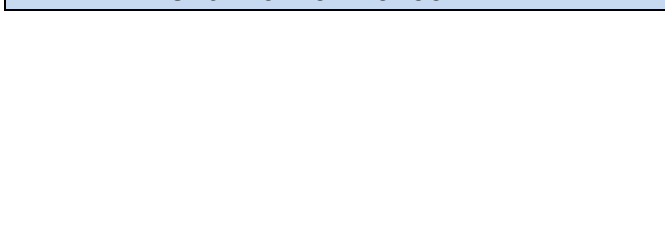


## Channel 159 / 5795 MHz

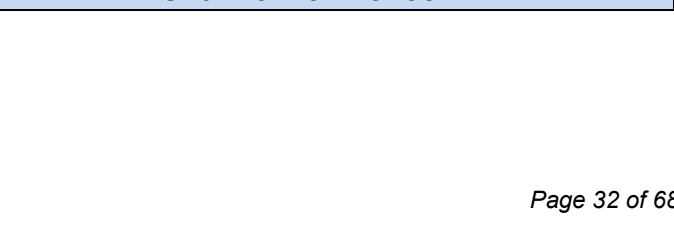


## IEEE 802.11ac VHT40

## Channel 151 / 5755 MHz



## Channel 151 / 5755 MHz

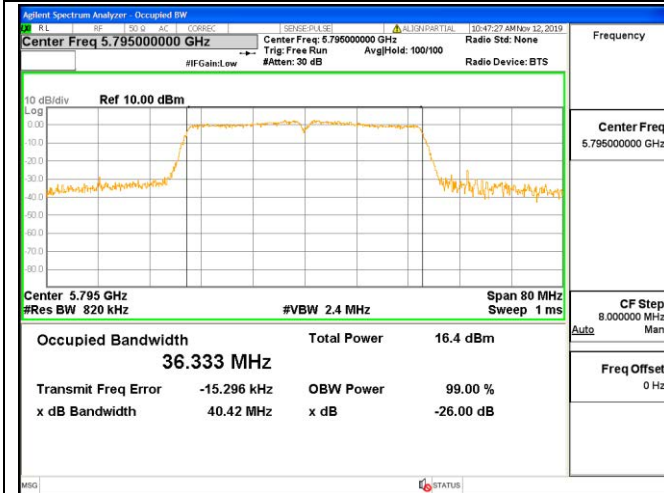




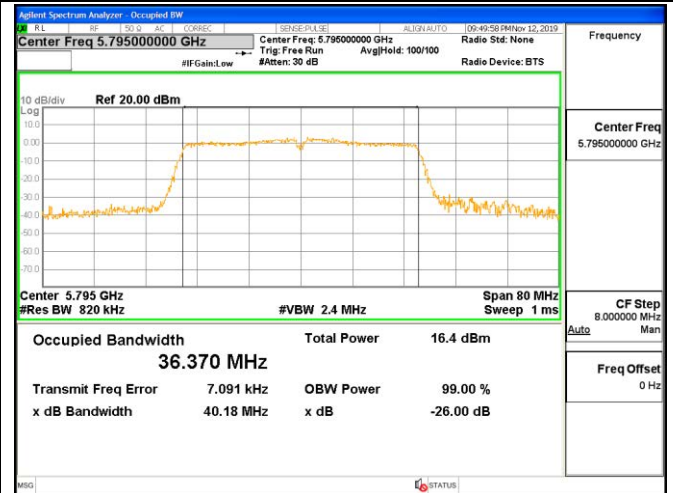
## 99% Occupied Bandwidth

## IEEE 802.11ac VHT40

## Antenna Chain 1



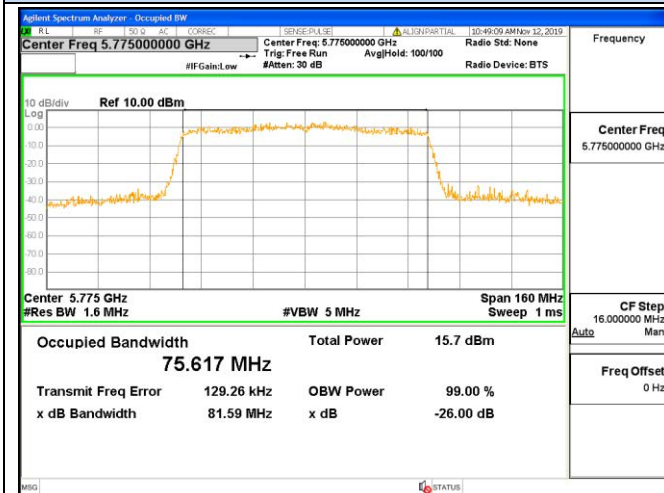
## Antenna Chain 2



## Channel 159 / 5795 MHz

## Channel 159 / 5795 MHz

## IEEE 802.11ac VHT80



## Channel 155 / 5775 MHz

## Channel 155 / 5775 MHz



## 5.5. Radiated Emissions Measurement

### 5.5.1. Standard Applicable

15.205 (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       | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675   | 156.7-156.9         | 2690-2900     | 22.01-23.12 |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267     | 23.6-24.0   |
| 12.29-12.293      | 167.72-173.2        | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025 | 240-285             | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725 | 322-335.4           | 3600-4400     | (\2\)       |
| 13.36-13.41       |                     |               |             |

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

\2\ Above 38.6

For transmitters operating in the 5.725-5.85 GHz band:

All emissions shall be limited to a level of -27 dBm/MHz(68.2dBuV/m at 3m) at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz(105.2dBuV/m at 3m) at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6(110.8dBuV/m at 3m) dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz(122.2dBuV/m at 3m) at the band edge.

In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|-------------------|-----------------------------------|-------------------------------|
| 0.009~0.490       | 2400/F(KHz)                       | 300                           |
| 0.490~1.705       | 24000/F(KHz)                      | 30                            |
| 1.705~30.0        | 30                                | 30                            |
| 30~88             | 100                               | 3                             |
| 88~216            | 150                               | 3                             |
| 216~960           | 200                               | 3                             |
| Above 960         | 500                               | 3                             |

### 5.5.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter                        | Setting                                           |
|-------------------------------------------|---------------------------------------------------|
| Attenuation                               | Auto                                              |
| Start Frequency                           | 1000 MHz                                          |
| Stop Frequency                            | 10 <sup>th</sup> carrier harmonic                 |
| RB / VB (Emission in restricted band)     | 1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average |
| RB / VB (Emission in non-restricted band) | 1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average |



| Receiver Parameter     | Setting                                    |
|------------------------|--------------------------------------------|
| Attenuation            | Auto                                       |
| Start ~ Stop Frequency | 9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG  |
| Start ~ Stop Frequency | 150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB/VB 120kHz/1MHz for QP   |

### 5.5.3. Test Procedures

#### 1) Sequence of testing 9 kHz to 30 MHz

##### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

##### Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

##### Final measurement:

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

## 2) Sequence of testing 30 MHz to 1 GHz

### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

### Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

### Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

### 3) Sequence of testing 1 GHz to 18 GHz

#### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

#### Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 2.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

#### Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

#### 4) Sequence of testing above 18 GHz

##### **Setup:**

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

##### **Premeasurement:**

- The antenna is moved spherical over the EUT in different polarizations of the antenna.

##### **Final measurement:**

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.