



# TEST REPORT

**APPLICANT** : Nanjing Juplink Intelligent Technologies Co., Ltd.

**PRODUCT NAME** : Dual-band Gigabit Router

**MODEL NAME** : RX4-1500

**BRAND NAME** : JupLink

**FCC ID** : 2AT9Z-RX4-1500

**STANDARD(S)** : 47 CFR Part 15 Subpart E

**RECEIPT DATE** : 2019-08-06

**TEST DATE** : 2019-08-07 to 2019-08-21

**ISSUE DATE** : 2019-09-02

Edited by: Bowers Zeng  
Bowers Zeng (Test Engineer)

Approved by: Anne Liu  
Anne Liu(Supervisor)

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| Change History |            |                   |
|----------------|------------|-------------------|
| Version        | Date       | Reason for change |
| 1.0            | 2019-09-02 | First edition     |
|                |            |                   |



# 1. Technical Information

**Note:** Provide by applicant.

## 1.1. Applicant and Manufacturer Information

|                              |   |
|------------------------------|---|
| <b>Applicant:</b>            | Nanjing Juplink Intelligent Technologies Co., Ltd.  |
| <b>Applicant Address:</b>    | No. 757, Dixiu Road, Binjiang Economic Development Zone, Jiangning District, Nanjing, China |
| <b>Manufacturer:</b>         | Sichuan Tianyi Comheart Telecom Co., Ltd.   |
| <b>Manufacturer Address:</b> | No. 198, Section 1, Xueshan Avenue, Dayi County, Chengdu, Sichuan, China                    |

## 1.2. Equipment Under Test (EUT) Description

|                                   |  |                               |
|-----------------------------------|--|-------------------------------|
| <b>Product Name:</b>              | Dual-band Gigabit Router                             |                               |
| <b>Serial No:</b>                 | (N/A, marked #1 by test site)                        |                               |
| <b>Hardware Version:</b>          | V1.0.0   |                               |
| <b>Software Version:</b>          | V1.0.1   |                               |
| <b>Modulation Type:</b>           | OFDM   |                               |
| <b>Modulation Mode:</b>           | 802.11a, 802.11n(HT20), 802.11n(HT40),802.11ac(HT80) |                               |
| <b>Operating Frequency Range:</b> | 5.180 GHz- 5.240 GHz;5.725GHz- 5.850GHz              |                               |
| <b>Channel Number:</b>            | Refer to 1.3   |                               |
| <b>Antenna Type:</b>              | External antenna                                     |                               |
| <b>Antenna Gain:</b>              | Ant 0:5dBi;Ant 1:5dBi                                |                               |
| <b>Accessory Information:</b>     | <b>AC Adapter</b>                                    |                               |
|                                   | <b>Brand Name:</b>                                   | Transin                       |
|                                   | <b>Model No:</b>                                     | TS-A012-120010Aq              |
|                                   | <b>Serial No:</b>                                    | (N/A, marked #1 by test site) |
|                                   | <b>Rated Output:</b>                                 | 12V=1A                        |
|                                   | <b>Rated Input:</b>                                  | 200-240V~50/60Hz              |

**Note 1:** The U-NII band is applicable to this report, another bands of operation (2.4GHz) is documented in a separate report.

**Note 2:** The EUT has two antennas and supports a MIMO function. Physically, the EUT provides two completed transmitters and two receivers for 802.11n and 802.11ac modulation mode.

Modulation Mode: TX Function



| Modulation Mode: | TX Function |
|------------------|-------------|
| 802.11a          | 1TX         |
| 802.11n          | 2TX         |
| 802.11ac         | 2TX         |

**Note 3:** According to KDB 662911 D01, the directional gain =  $GANT + 10\log(NANT)$  dBi, where GANT is the maximum antenna gain in dBi, NANT is the number of outputs.

**Note 4:** During test, the duty cycle of the EUT was setting to 100%.

**Note 5:** For conducted test item Maximum conducted output Power and Peak Power spectral density of each modulation mode, we recorded the test result of two antennas separately, for other conducted test items both of the two antennas were tested separately, we only recorded the worst test result(Ant 0) in this report.

**Note 6:** All radiation test items for 802.11n modulation mode operate at MIMO mode during the test. Other modulation mode operate at SISO mode, both of the two antennas were tested separately, we only recorded the worst test result(ANT0) in this report.

**Note 7:** For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



### 1.3. The channel number and frequency of EUT

| Frequency Range: 5180-5240MHz |            |                 |            |                 |
|-------------------------------|------------|-----------------|------------|-----------------|
| Bandwidth                     | Channel    | Frequency (MHz) | Channel    | Frequency (MHz) |
| 20MHz                         | <b>36</b>  | <b>5180</b>     | <b>40</b>  | <b>5200</b>     |
|                               | <b>44</b>  | <b>5220</b>     | <b>48</b>  | <b>5240</b>     |
| 40MHz                         | <b>38</b>  | <b>5190</b>     | <b>46</b>  | <b>5230</b>     |
| 80MHz                         | <b>42</b>  | <b>5210</b>     | /          | /               |
| Frequency Range: 5725-5850MHz |            |                 |            |                 |
| Bandwidth                     | Channel    | Frequency (MHz) | Channel    | Frequency (MHz) |
| 20MHz                         | <b>149</b> | <b>5745</b>     | 153        | 5765            |
|                               | <b>157</b> | <b>5785</b>     | 161        | 5805            |
|                               | <b>165</b> | <b>5825</b>     | /          | /               |
| 40MHz                         | <b>151</b> | <b>5755</b>     | <b>159</b> | <b>5795</b>     |
| 80MHz                         | <b>155</b> | <b>5775</b>     | /          | /               |

**Note 1:** The black bold channels were selected for test.



## 1.4. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart E for the EUT FCC ID Certification:

| No | Identity       | Document Title          |
|----|----------------|-------------------------|
| 1  | 47 CFR Part 15 | Radio Frequency Devices |

Test detailed items/section required by FCC rules and results are as below:

| No. | Section       | Description  | Test Date                    | Test Engineer | Result |
|-----|---------------|--|------------------------------|---------------|--------|
| 1   | 15.203        | Antenna Requirement                                | N/A                          | N/A           | PASS   |
| 2   | 15.407(a) (e) | Emission Bandwidth                                 | Aug 09, 2019                 | Elvis Wang    | PASS   |
| 3   | 15.407(a)     | Maximum conducted output Power                     | Aug 09, 2019                 | Elvis Wang    | PASS   |
| 4   | 15.407(a)     | Peak Power spectral density                        | Aug 09, 2019                 | Elvis Wang    | PASS   |
| 5   | 15.407(b)     | Restricted Frequency Bands                         | Aug 16, 2019<br>Aug 18, 2019 | Bowers Zeng   | PASS   |
| 6   | 15.407(g)     | Frequency Stability                                | Aug 09, 2019<br>Aug 09, 2019 | Elvis Wang    | PASS   |
| 7   | 15.207        | Conducted Emission                                 | Aug 08, 2019                 | Bowers Zeng   | PASS   |
| 8   | 15.407(b)     | Radiated Emission                                  | Aug 10, 2019<br>Aug 18, 2019 | Bowers Zeng   | PASS   |
| 9   | 15.407(c)     | Automatically discontinue transmission requirement | N/A                          | N/A           | PASS   |

**Note:** The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.10 2013 and KDB789033 D02 V02r01.

## 1.5. Environmental Conditions

During the measurement, the environmental conditions were within the listed ranges:

|                             |         |
|-----------------------------|---------|
| Temperature (°C):           | 15 - 35 |
| Relative Humidity (%):      | 30 -60  |
| Atmospheric Pressure (kPa): | 86-106  |



## 2. 47 CFR Part 15E Requirements

### 2.1. Antenna requirement

#### 2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

#### 2.1.2. Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

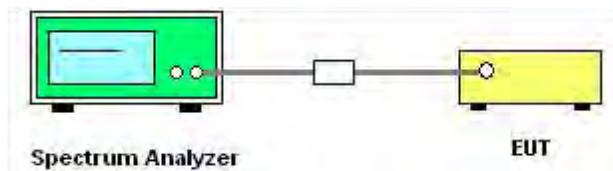
## 2.2. Emission Bandwidth

### 2.2.1. Requirement

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. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement. Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

### 2.2.2. Test Description

#### A. Test Setup:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

#### B. Test Procedure

1. KDB 789033 Section C) 1) Emission Bandwidth was used in order to prove compliance

- a) Set RBW = approximately 1% of the emission bandwidth.
- b) Set the VBW > RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Measure the maximum width of the emission that is 26 dB down from the peak of the emission.  
Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

2. KDB 789033 Section C) 2) minimum emission bandwidth for the band 5.725-5.85GHz was used in order to prove compliance.

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.





e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

**2.2.3. Test Result**

**802.11a Test mode**

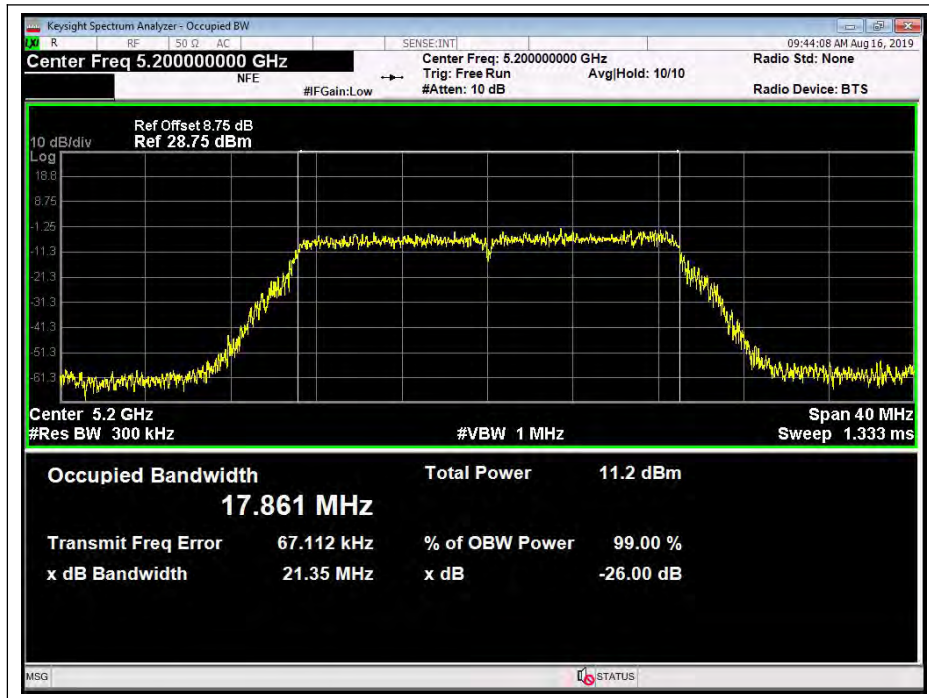
**A. Test Verdict:**

| Channel | Frequency (MHz) | ANTO<br>26 dB Bandwidth (MHz) |
|---------|-----------------|-------------------------------|
| 36      | 5180            | 21.39                         |
| 40      | 5200            | 21.35                         |
| 48      | 5240            | 21.54                         |
| Channel | Frequency (MHz) | ANTO<br>6dB Bandwidth (MHz)   |
| 149     | 5745            | 17.69                         |
| 157     | 5785            | 17.66                         |
| 165     | 5825            | 17.68                         |

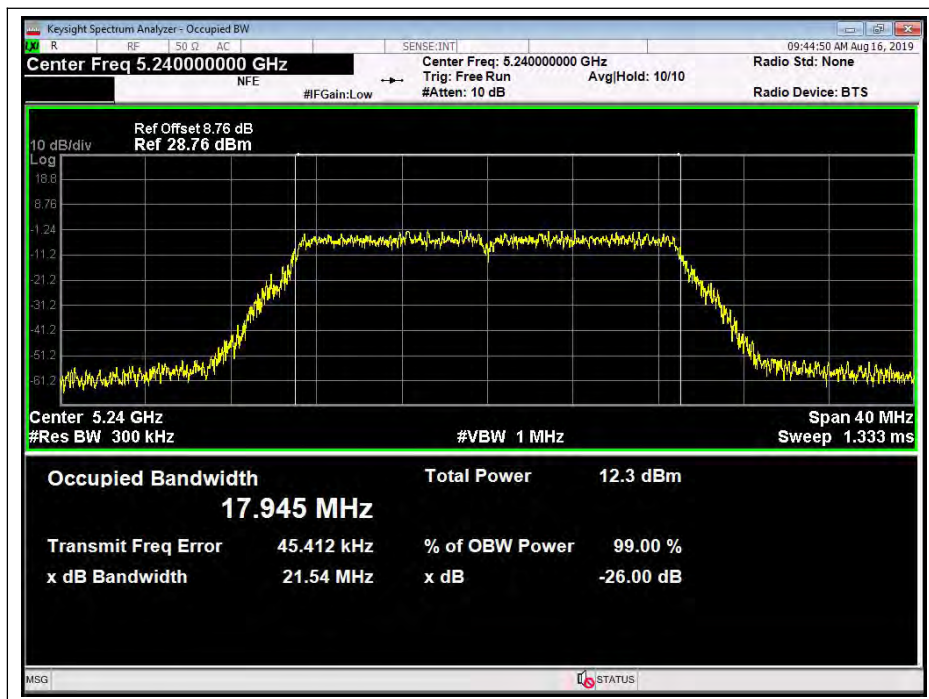
**B. Test Plots**



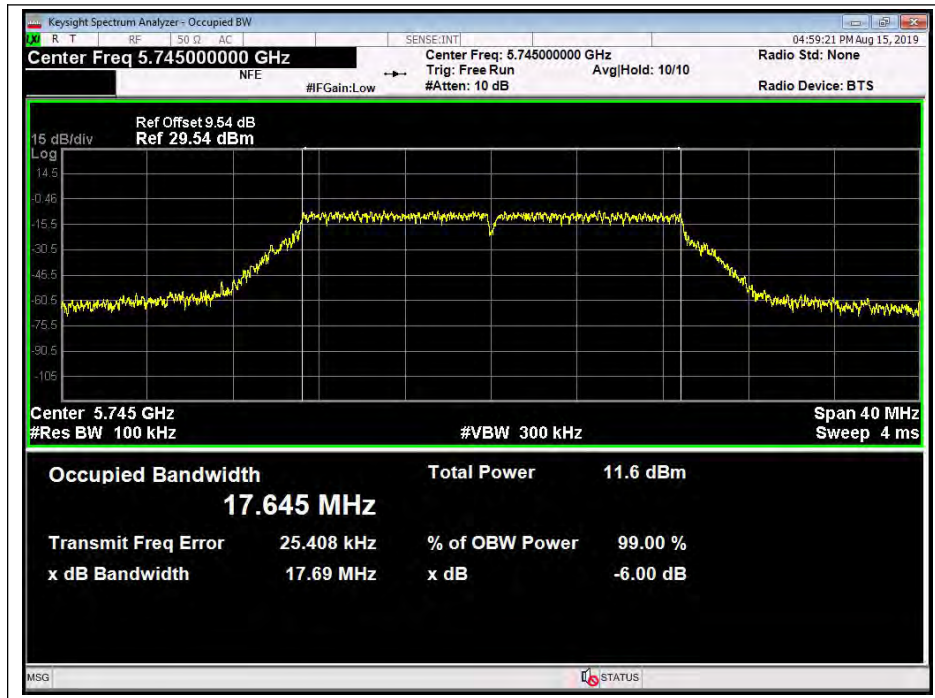
(Channel 36, 5180MHz, 802.11a)



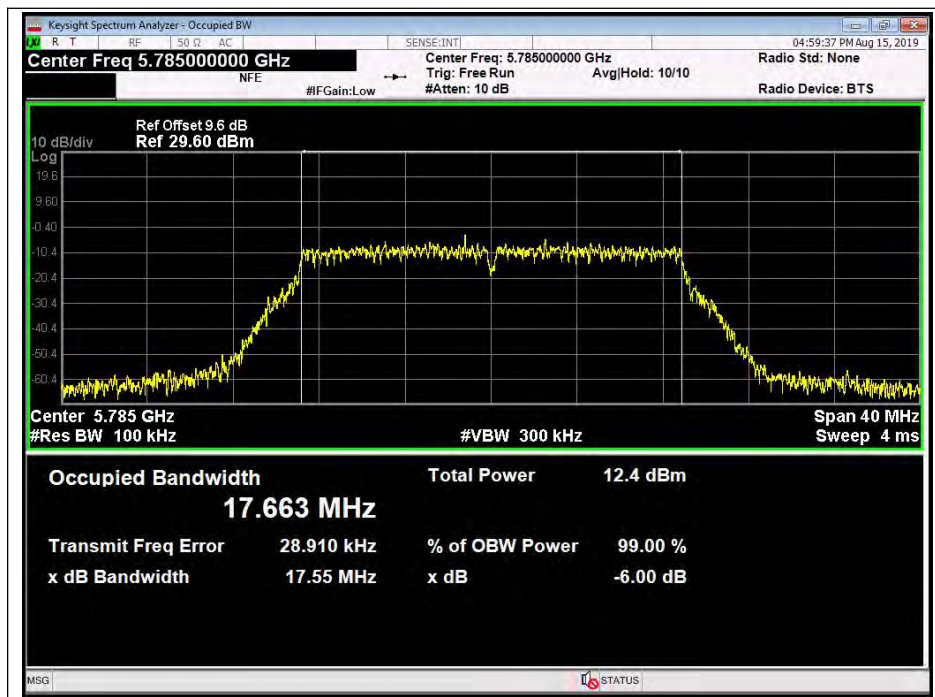
(Channel 40, 5200 MHz, 802.11a)



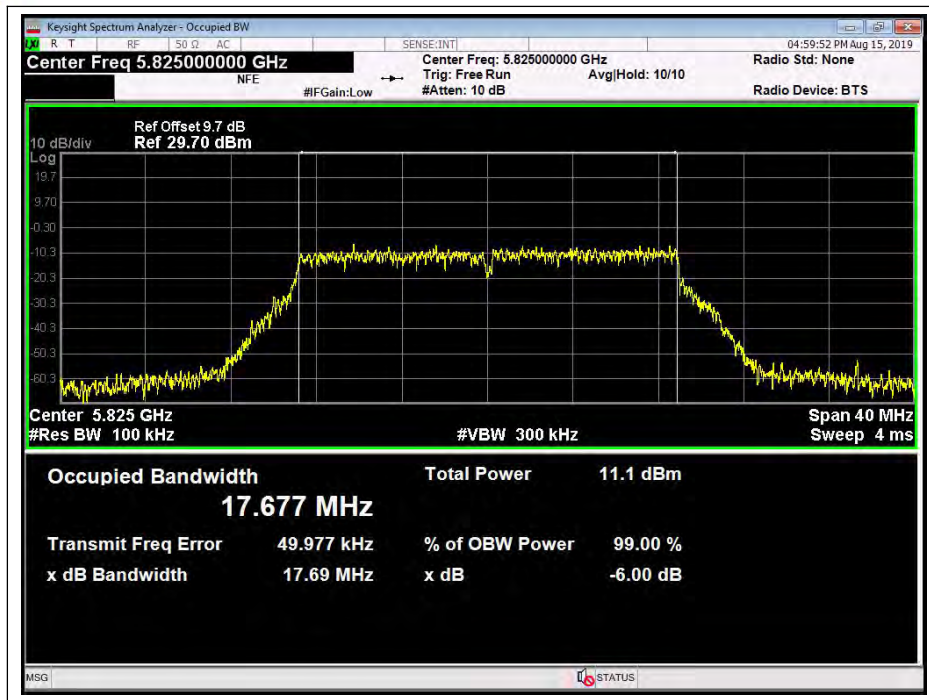
(Channel 48, 5240MHz, 802.11a)



(Channel 149, 5745MHz, 802.11a)



(Channel 157, 5785MHz, 802.11a)



(Channel 165, 5825MHz, 802.11a)

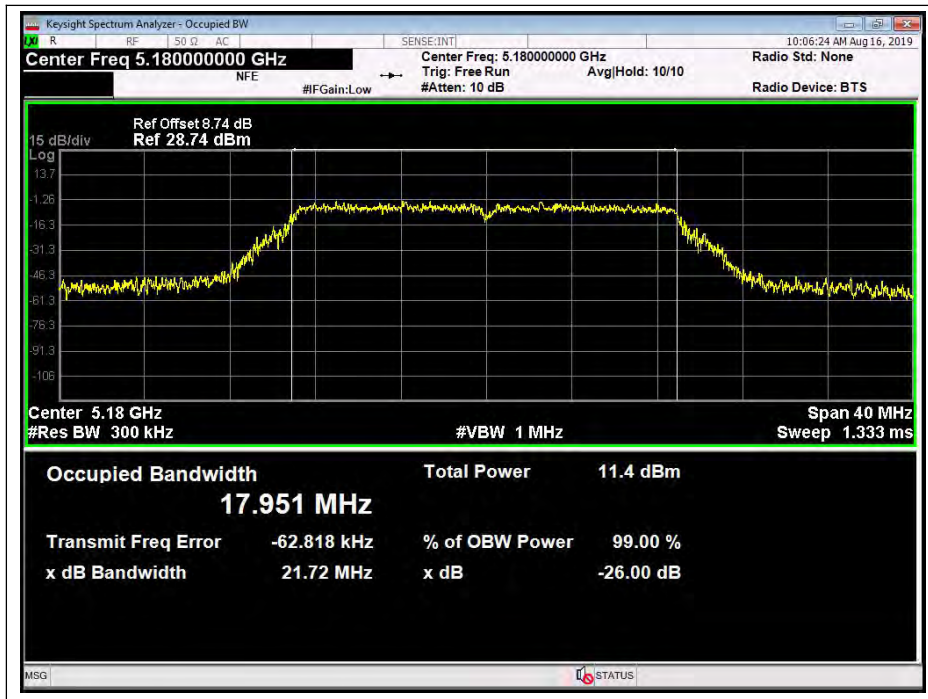
802.11n (HT20) Test mode

A. Test Verdict:

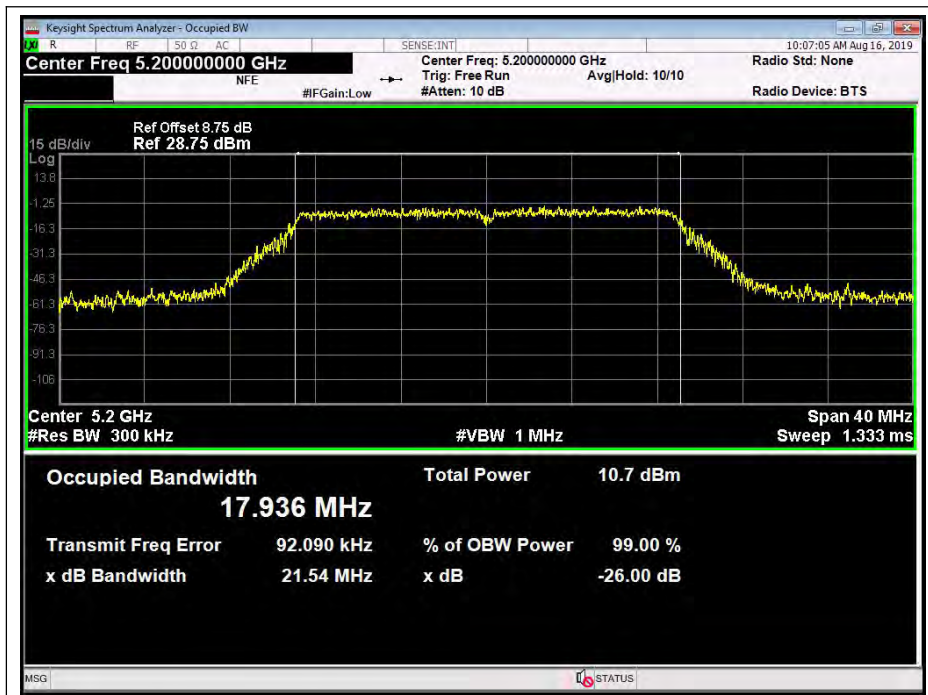
| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|-----------------|-----------------------|
| 36      | 5180            | 21.72                 |
| 40      | 5200            | 21.54                 |
| 48      | 5240            | 21.54                 |
| Channel | Frequency (MHz) | 6dB Bandwidth (MHz)   |
| 149     | 5745            | 17.62                 |
| 157     | 5785            | 17.55                 |
| 165     | 5825            | 17.78                 |



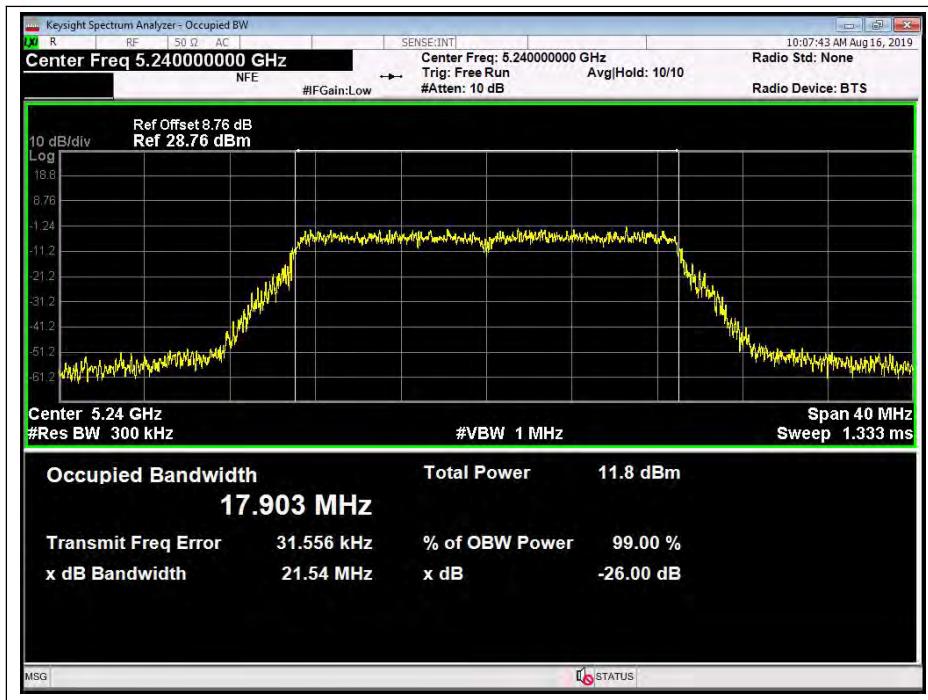
**B. Test Plots**



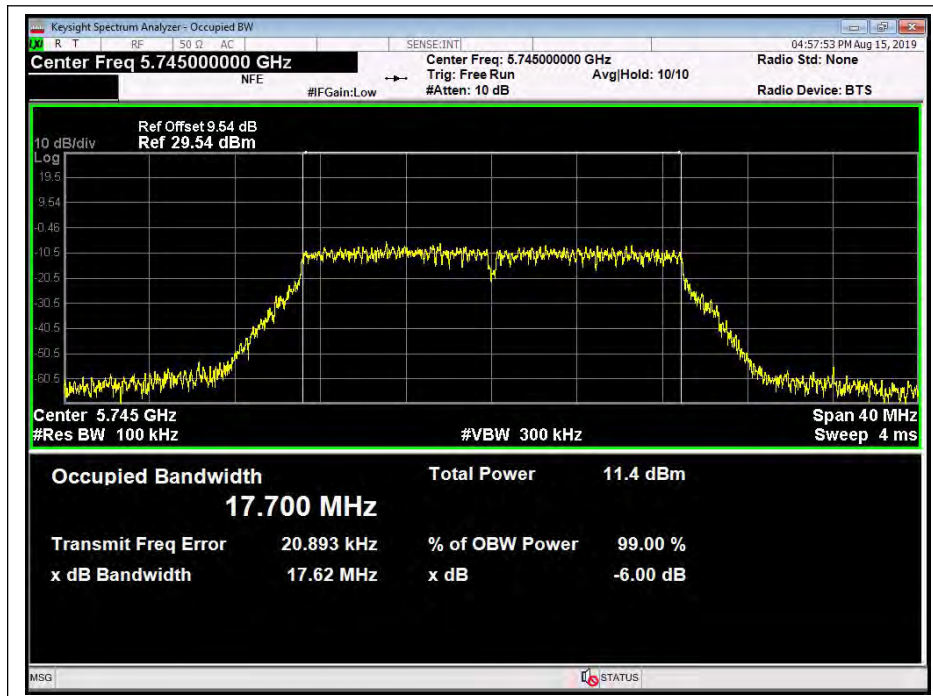
(Channel 36, 5180MHz, 802.11 n (HT20))



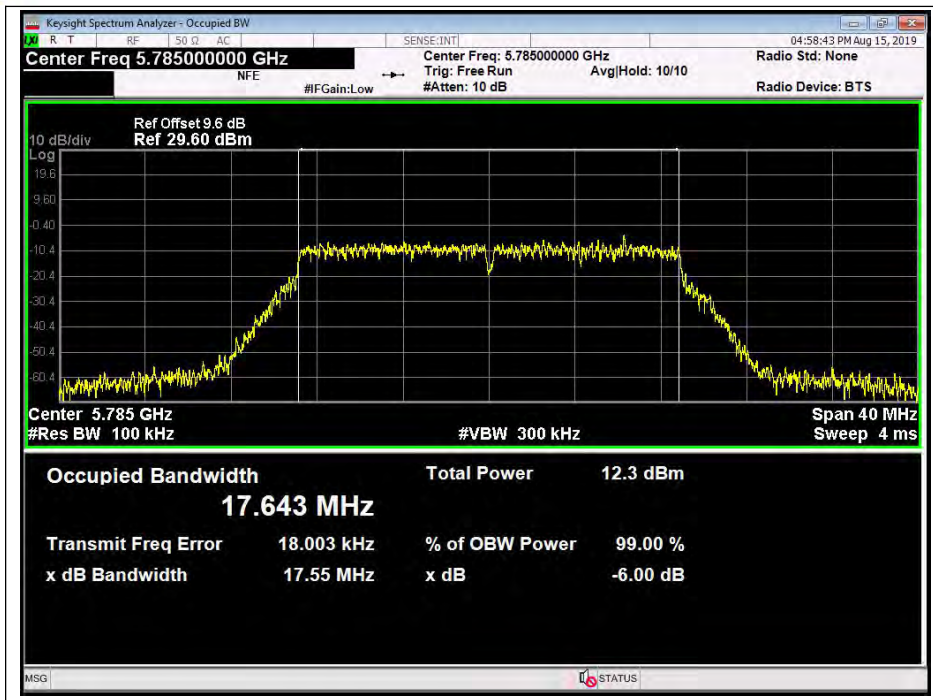
(Channel 40, 5200 MHz, 802.11 n (HT20))



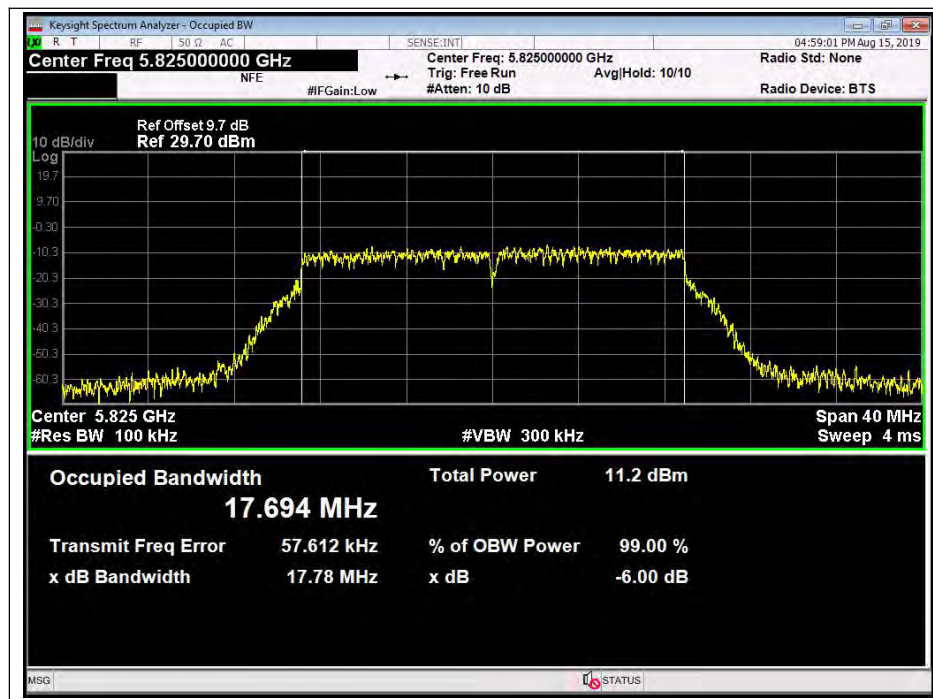
(Channel 48, 5240MHz, 802.11 n (HT20))



(Channel 149, 5745MHz, 802.11 n (HT20))



(Channel 157, 5785MHz, 802.11 n (HT20))



(Channel 165, 5825MHz, 802.11 n (HT20))

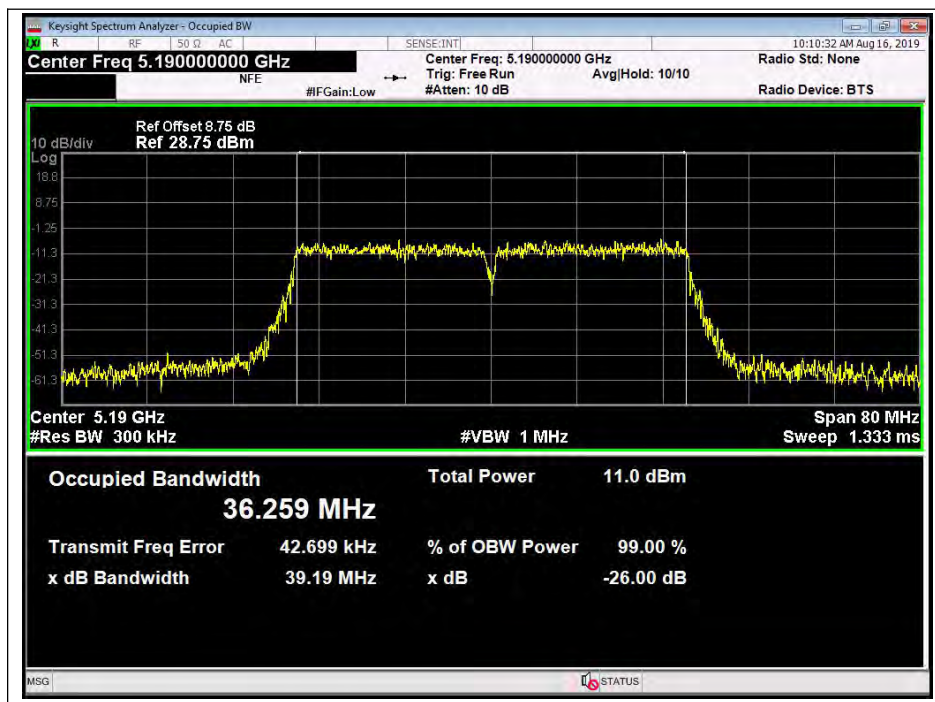


802.11n (HT40) Test mode

A. Test Verdict:

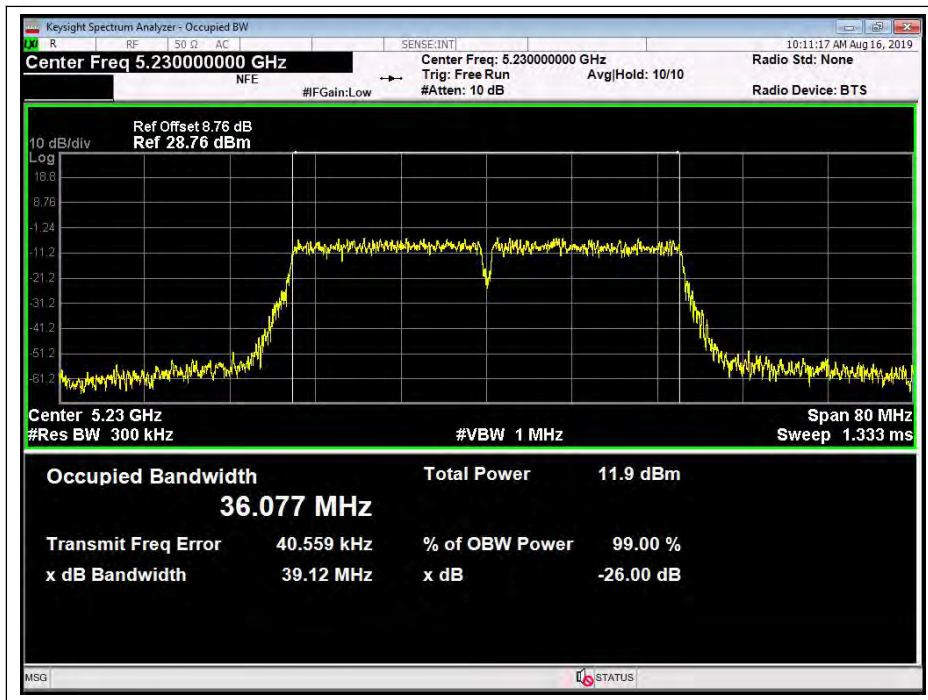
| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|-----------------|-----------------------|
| 38      | 5190            | 39.19                 |
| 46      | 5230            | 39.12                 |
| Channel | Frequency (MHz) | 6dB Bandwidth (MHz)   |
| 151     | 5755            | 36.33                 |
| 159     | 5795            | 35.71                 |

B. Test Plots

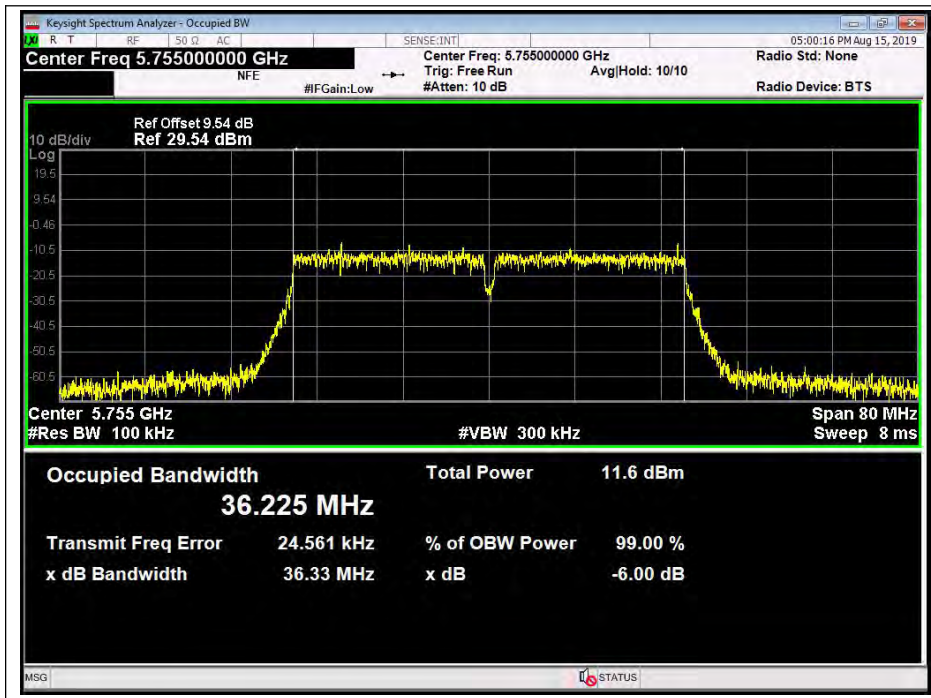


(Channel 38, 5190MHz, 802.11n (HT40))

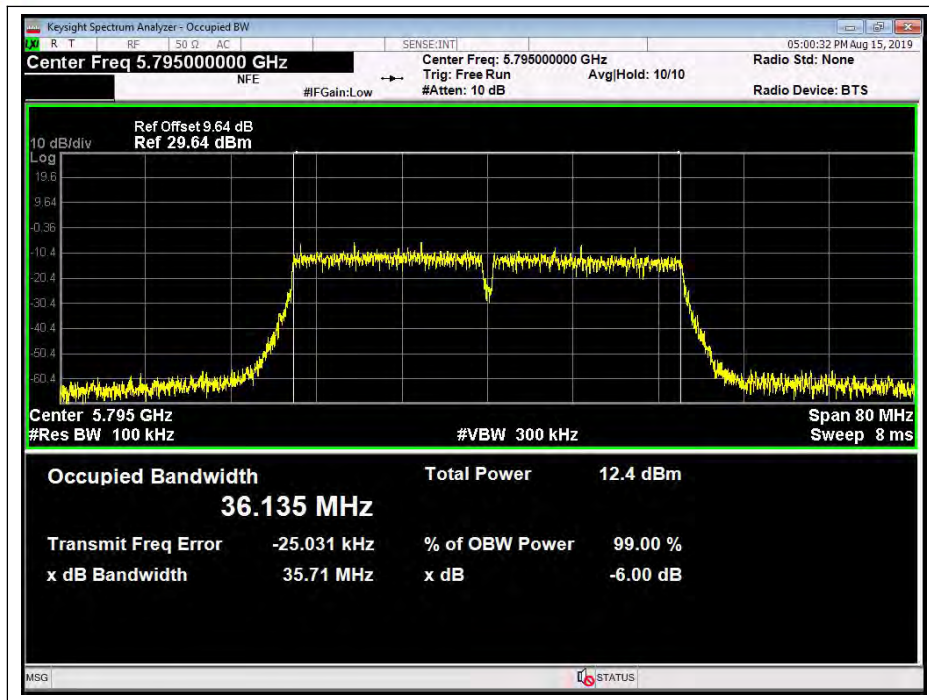




(Channel 46, 5230 MHz, 802.11n (HT40))



(Channel 151, 5755 MHz, 802.11n (HT40))



(Channel 159, 5795MHz, 802.11n (HT40))

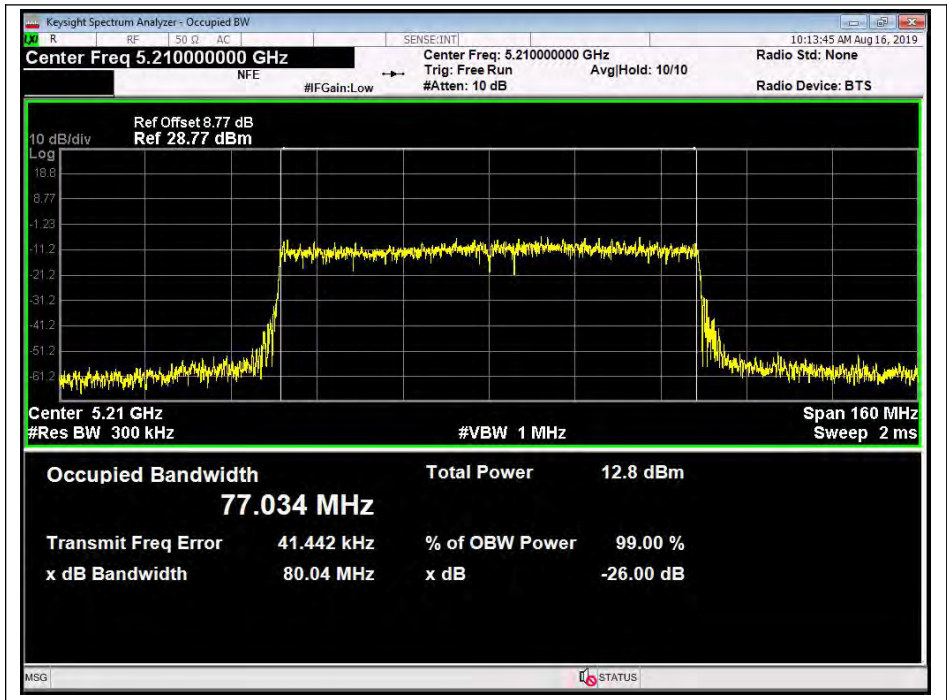
802.11ac (HT80) Test mode

C. Test Verdict:

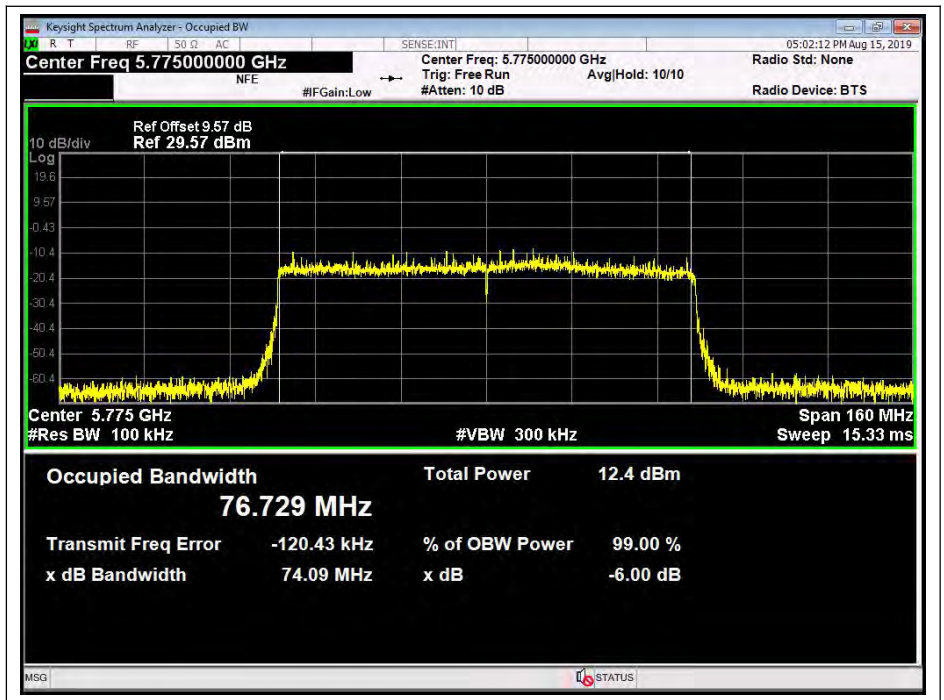
| Channel | Frequency (MHz) | 26 dB Bandwidth (MHz) |
|---------|-----------------|-----------------------|
| 42      | 5210            | 80.04                 |
| Channel | Frequency (MHz) | 6dB Bandwidth (MHz)   |
| 155     | 5775            | 74.09                 |



D. Test Plots



(Channel 42, 5210MHz, 802.11ac (HT80))



(Channel 155, 5775MHz, 802.11ac (HT80))

## 2.3. Maximum conducted output power

### 2.3.1. Requirement

(1) For 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.

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

(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.

If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

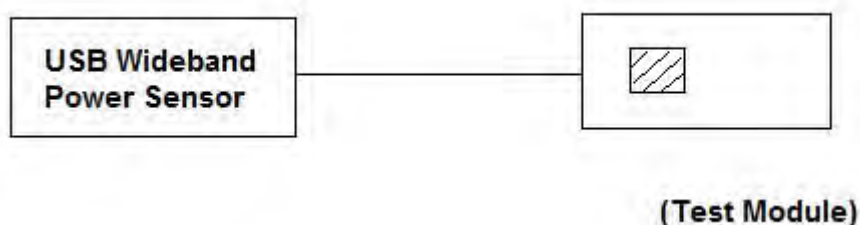
(4) According to KDB662911D01 Measure-and-sum technique, the conducted emission level (e.g., transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in units that are directly proportional to power.

(5) According to KDB 662911 D01, the directional gain =  $G_{\text{ANT}} + 10 \log(N_{\text{ANT}})$  dBi, where  $G_{\text{ANT}}$  is the antenna gain in dBi,  $N_{\text{ANT}}$  is the number of outputs.

### 2.3.2. Test Description

Section E) 3) of KDB 789033 defines a methodology using a USB Wideband Power Sensor.

#### A. Test Set:



The EUT (Equipment under the test) which is coupled to the USB Wideband Power Sensor; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in USB Wideband Power Sensor.



**2.3.3. Test Result**

**Duty Cycle Factor**

**ANT0**

| Mode        | Channel | Frequency (MHz) | T <sub>on</sub> (ms) | T <sub>(on+off)</sub> (ms) | Duty Cycle (%) | Duty Cycle Factor |
|-------------|---------|-----------------|----------------------|----------------------------|----------------|-------------------|
| 802.11 a    | 36      | 5180            | 100                  | 100                        | 100            | 0                 |
| 802.11 HT20 | 36      | 5180            | 100                  | 100                        | 100            | 0                 |
| 802.11 HT40 | 38      | 5190            | 100                  | 100                        | 100            | 0                 |
| 802.11 HT80 | 42      | 5210            | 100                  | 100                        | 100            | 0                 |

**ANT1**

| Mode        | Channel | Frequency (MHz) | T <sub>on</sub> (ms) | T <sub>(on+off)</sub> (ms) | Duty Cycle (%) | Duty Cycle Factor |
|-------------|---------|-----------------|----------------------|----------------------------|----------------|-------------------|
| 802.11 a    | 36      | 5180            | 100                  | 100                        | 100            | 0                 |
| 802.11 HT20 | 36      | 5180            | 100                  | 100                        | 100            | 0                 |
| 802.11 HT40 | 38      | 5190            | 100                  | 100                        | 100            | 0                 |
| 802.11 HT80 | 42      | 5210            | 100                  | 100                        | 100            | 0                 |

**802.11a Test mode**

| Channel | Frequency (MHz) | Average Output Power (dBm) |       | Limit |                      | Verdict |
|---------|-----------------|----------------------------|-------|-------|----------------------|---------|
|         |                 | ANT0                       | ANT1  | (dBm) | 11+10*log(EBW) (dBm) |         |
| 36      | 5180            | 12.38                      | 12.42 | 24    | 24.30                | PASS    |
| 40      | 5200            | 11.55                      | 11.59 |       | 24.29                |         |
| 48      | 5240            | 12.53                      | 12.57 |       | 24.33                |         |
| 149     | 5745            | 11.32                      | 11.90 | 30    |                      |         |
| 157     | 5785            | 11.23                      | 11.69 |       |                      |         |
| 165     | 5825            | 11.19                      | 11.00 |       |                      |         |

Note: Power limit is 24dBm or 11+10\*log(EBW)

**802.11n (HT20) Test mode**

| Channel | Frequency (MHz) | Average Output Power (dBm) |       |       | Limit |                      | Verdict |
|---------|-----------------|----------------------------|-------|-------|-------|----------------------|---------|
|         |                 | ANT0                       | ANT1  | Total | (dBm) | 11+10*log(EBW) (dBm) |         |
| 36      | 5180            | 13.04                      | 13.74 | 16.42 | 24    | 24.37                | PASS    |
| 40      | 5200            | 12.33                      | 13.50 | 15.96 |       | 24.33                |         |
| 48      | 5240            | 13.10                      | 13.32 | 16.22 |       | 24.33                |         |



| Channel | Frequency (MHz) | Average Output Power (dBm) |       |       | Limit |                      | Verdict |
|---------|-----------------|----------------------------|-------|-------|-------|----------------------|---------|
|         |                 | ANT0                       | ANT1  | Total | (dBm) | 11+10*log(EBW) (dBm) |         |
| 149     | 5745            | 14.09                      | 13.42 | 16.78 | 30    |                      |         |
| 157     | 5785            | 14.02                      | 13.39 | 16.73 |       |                      |         |
| 165     | 5825            | 13.86                      | 13.26 | 16.58 |       |                      |         |

Note: Power limit is 24dBm or 11+10\*log(EBW)

**802.11n (HT40) Test mode**

| Channel | Frequency (MHz) | Average Output Power (dBm) |       |       | Limit |                      | Verdict |
|---------|-----------------|----------------------------|-------|-------|-------|----------------------|---------|
|         |                 | ANT0                       | ANT1  | Total | (dBm) | 11+10*log(EBW) (dBm) |         |
| 38      | 5190            | 12.47                      | 13.75 | 16.17 | 24    | 26.93                | PASS    |
| 46      | 5230            | 13.45                      | 13.53 | 16.50 |       | 26.92                | PASS    |
| 151     | 5755            | 13.93                      | 13.36 | 16.67 | 30    |                      | PASS    |
| 159     | 5795            | 14.26                      | 13.31 | 16.82 |       |                      | PASS    |

Note: Power limit is 24dBm or 11+10\*log(EBW)

**802.11ac (HT80) Test mode**

| Channel | Frequency (MHz) | Average Output Power (dBm) |       |       | Limit |                      | Verdict |
|---------|-----------------|----------------------------|-------|-------|-------|----------------------|---------|
|         |                 | ANT0                       | ANT1  | Total | (dBm) | 11+10*log(EBW) (dBm) |         |
| 42      | 5210            | 13.75                      | 14.70 | 17.26 | 24    | 30.03                | PASS    |
| 149     | 5745            | 14.26                      | 13.31 | 16.82 | 30    |                      |         |

Note: Power limit is 24dBm or 11+10\*log(EBW)

**Note: The duty cycle factor has been compensated into the test result**

## 2.4. Peak Power spectral density

### 2.4.1. Requirement

(1) For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

(2) For the 5.25-5.35 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

(3) For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500KHz band.

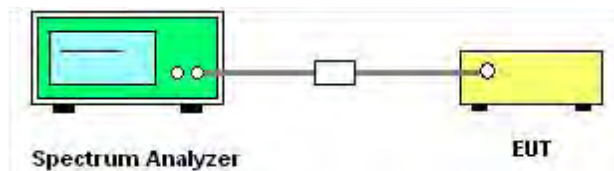
If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(4) According to KDB662911D01 Measure-and-sum technique, the conducted emission level (e.g., transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in units that are directly proportional to power.

(5) According to KDB 662911 D01, the directional gain =  $G_{ANT} + 10\log(N_{ANT})$  dBi, where  $G_{ANT}$  is the antenna gain in dBi,  $N_{ANT}$  is the number of outputs.

### 2.4.2. Test Description

#### A. Test Set:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

#### B. Test Procedure

KDB 789033 Section F) Maximum Power Spectral Density (PSD) Method SA-1 was used in order to prove compliance

- 1) Set span to encompass the entire 26-dB emission bandwidth
- 2) Set RBW = 1 MHz. Set VBW  $\geq$  3 MHz.
- 3) Number of points in sweep  $\geq$  2 Span / RBW. Sweep time = auto.
- 4) Detector = RMS (i.e., power averaging)
- 5) Trace average at least 100 traces in power averaging (i.e., RMS) mode
- 6) Record the max value



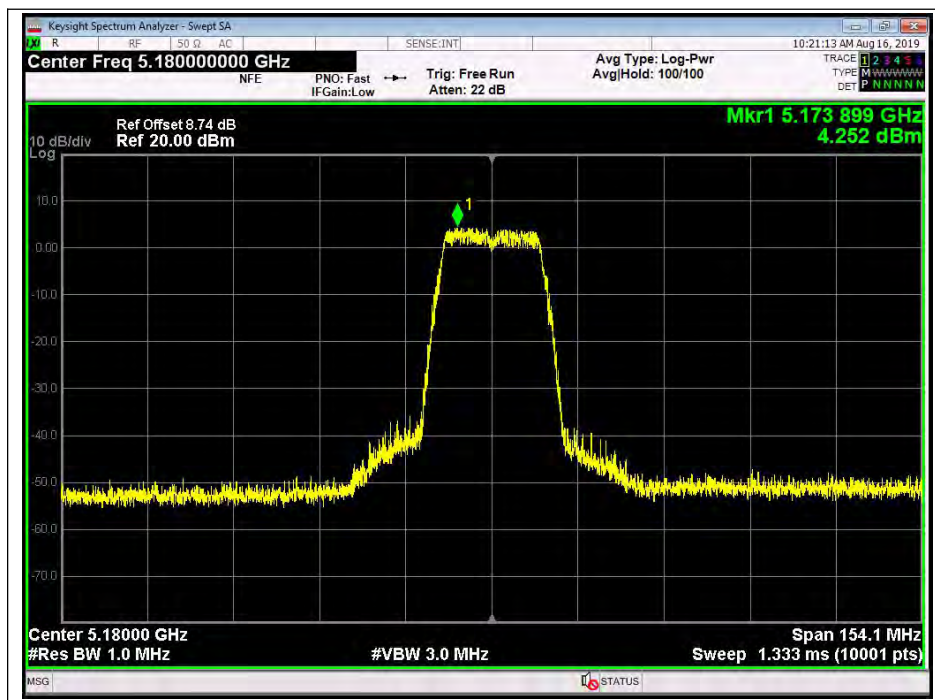
2.4.3. Test Result

802.11a Test mode

A. Test Verdict:

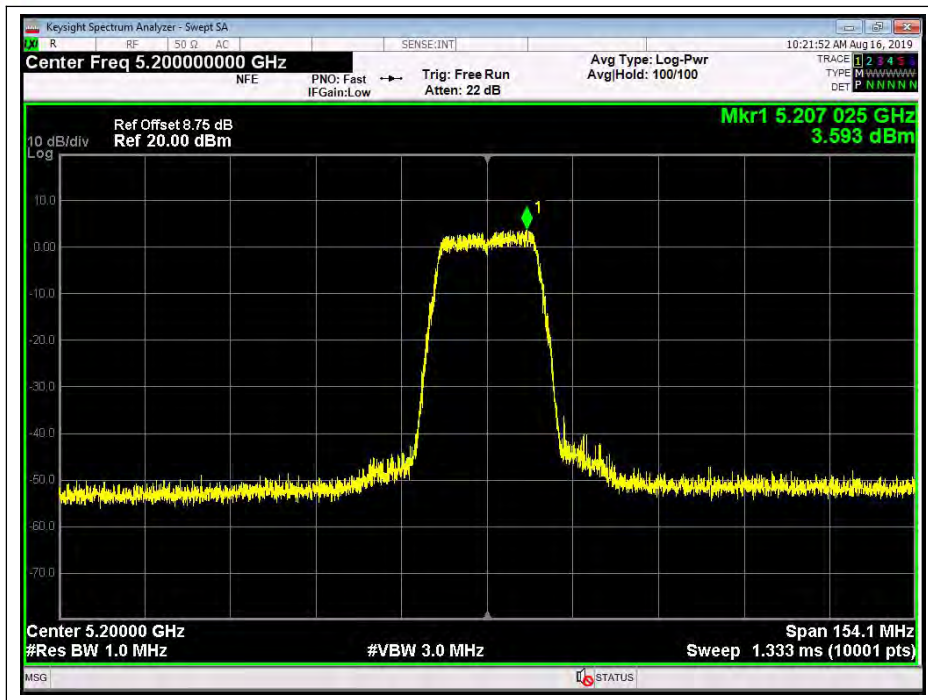
| Channel | Frequency (MHz) | Measured PPSD (dBm/MHz)   |       | Limit (dBm/MHz)    | Verdict |
|---------|-----------------|---------------------------|-------|--------------------|---------|
|         |                 | ANT0                      | ANT1  |                    |         |
| 36      | 5180            | 4.252                     | 5.033 | 11                 | PASS    |
| 40      | 5200            | 3.593                     | 4.313 |                    |         |
| 48      | 5240            | 4.655                     | 4.753 |                    |         |
| Channel | Frequency (MHz) | Measured PSD (dBm/500KHz) |       | Limit (dBm/500KHz) | Verdict |
|         |                 | ANT0                      | ANT1  |                    |         |
| 149     | 5745            | 0.592                     | 1.378 | 30                 | PASS    |
| 157     | 5785            | 2.020                     | 1.825 |                    |         |
| 165     | 5825            | 0.031                     | 0.931 |                    |         |

B. Test Plots

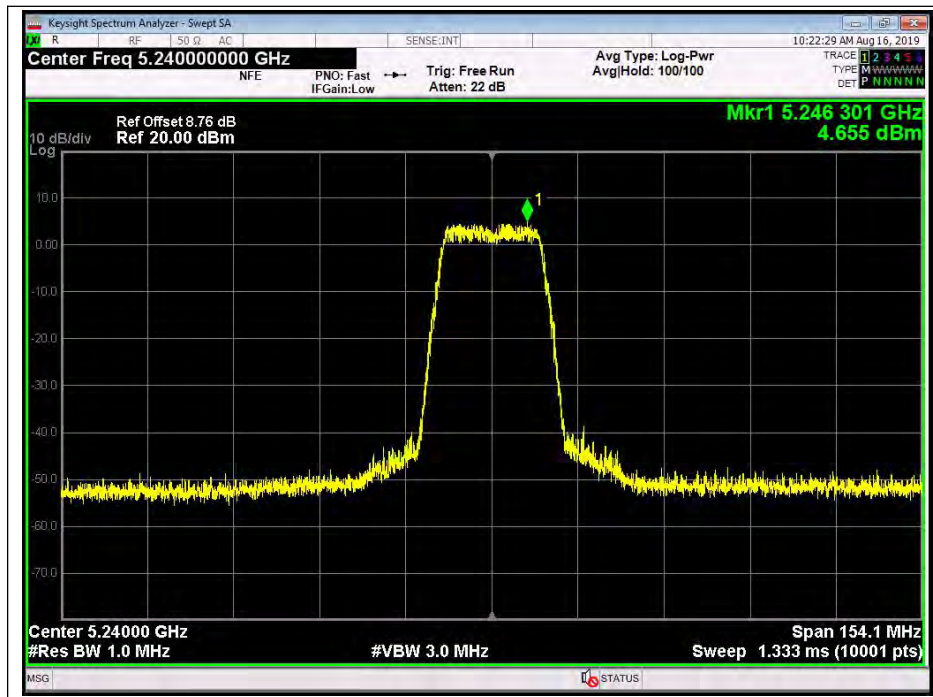


(Channel 36, 5180MHz, 802.11a,ANT0)

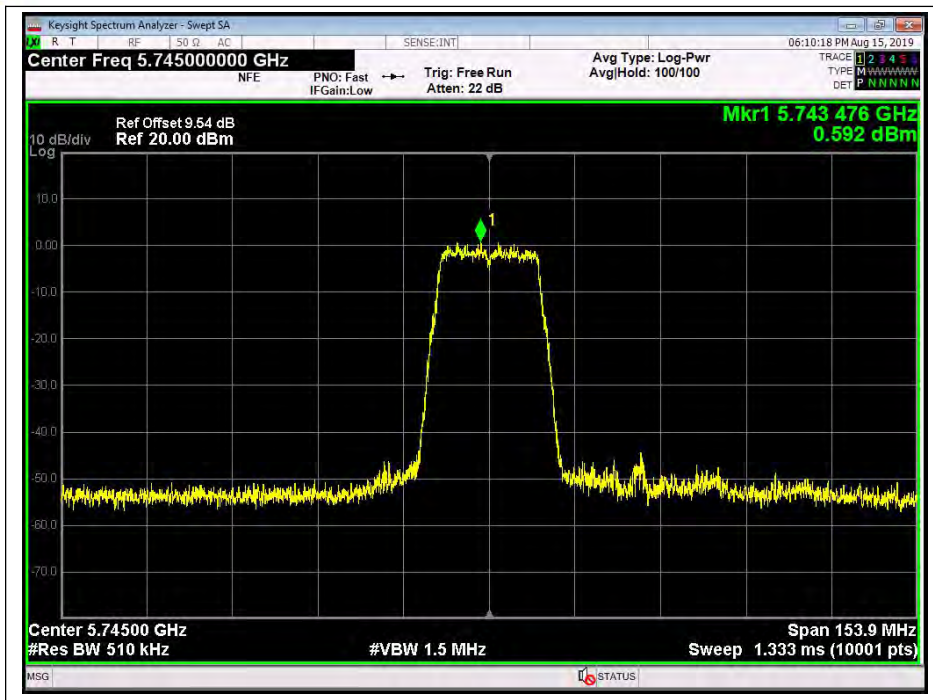




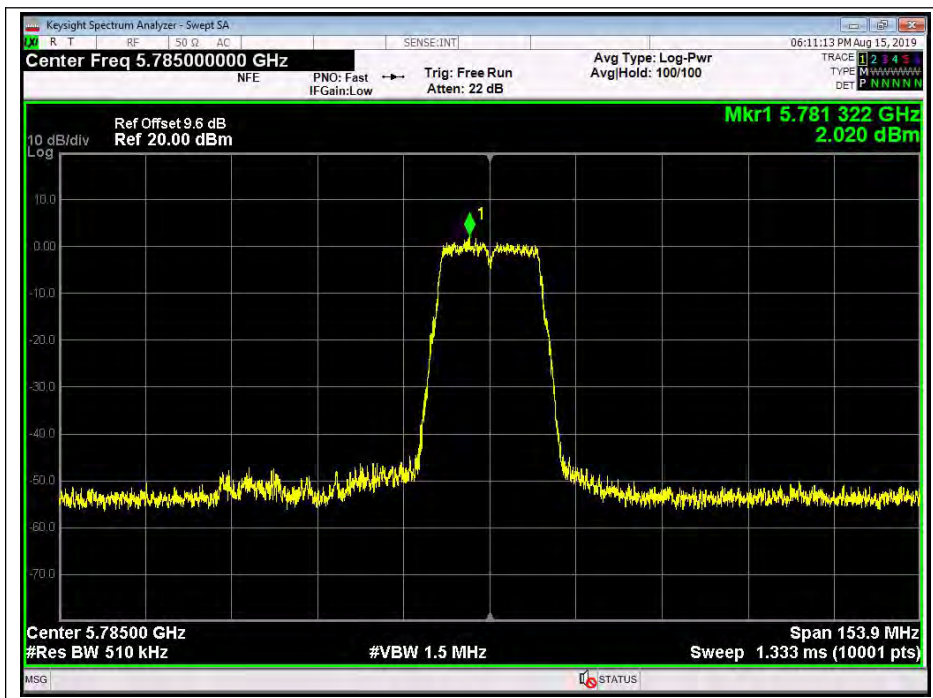
(Channel 40, 5200 MHz, 802.11a,ANT0)



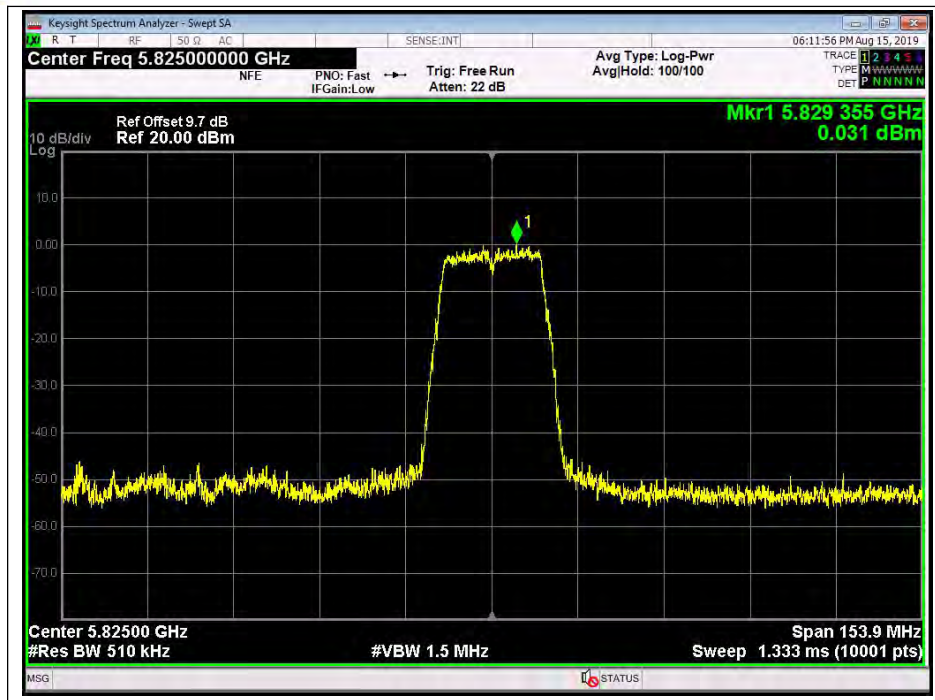
(Channel 48, 5240MHz, 802.11a,ANT0)



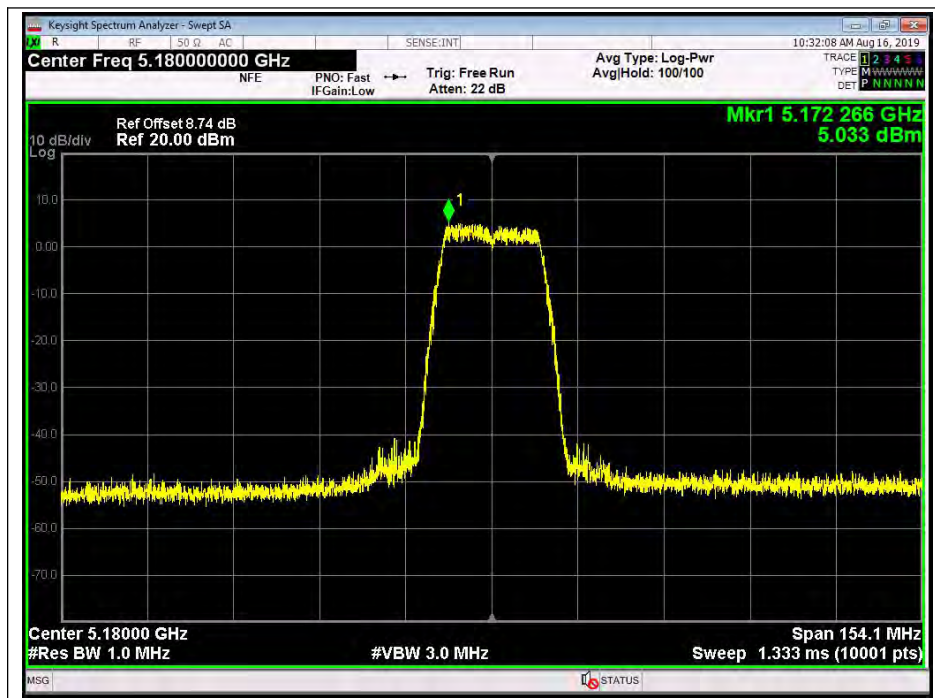
(Channel 149, 5745MHz, 802.11a,ANT0)



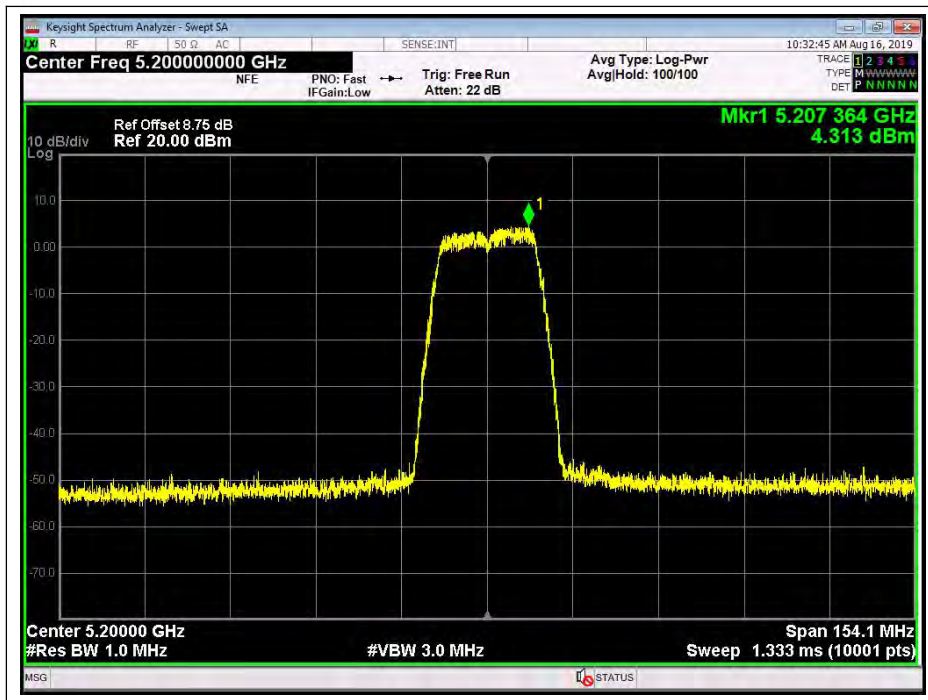
(Channel 157, 5785MHz, 802.11a,ANT0)



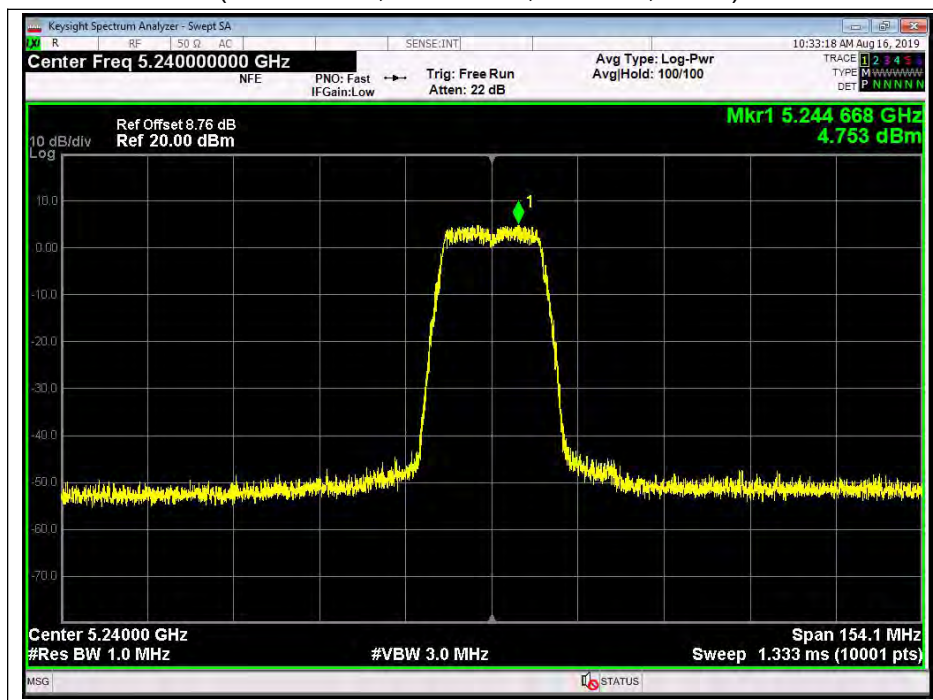
(Channel 165, 5825MHz, 802.11a,ANT0)



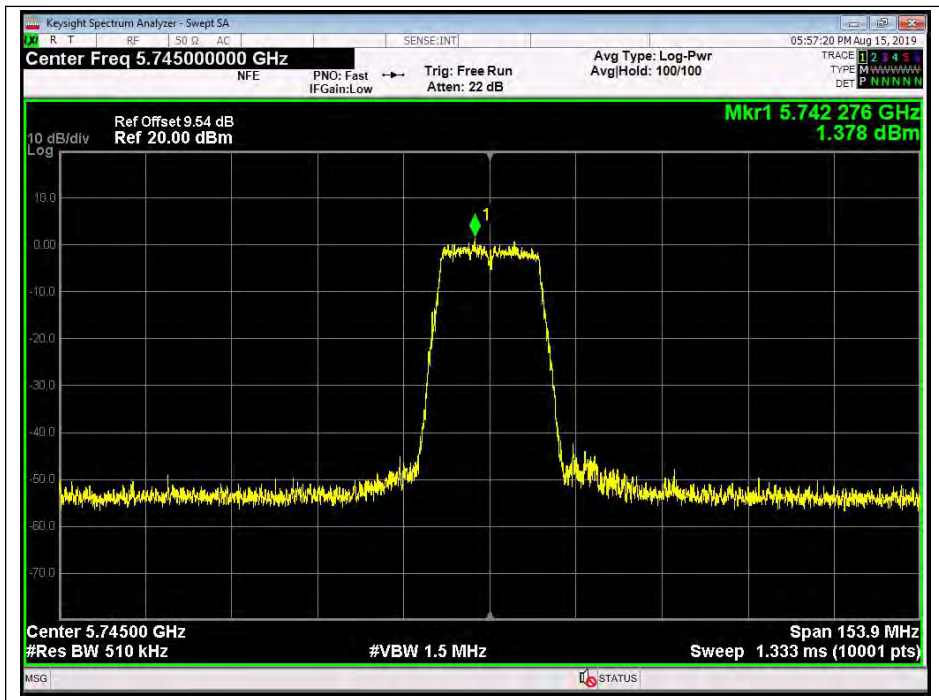
(Channel 36, 5180MHz, 802.11a,ANT1)



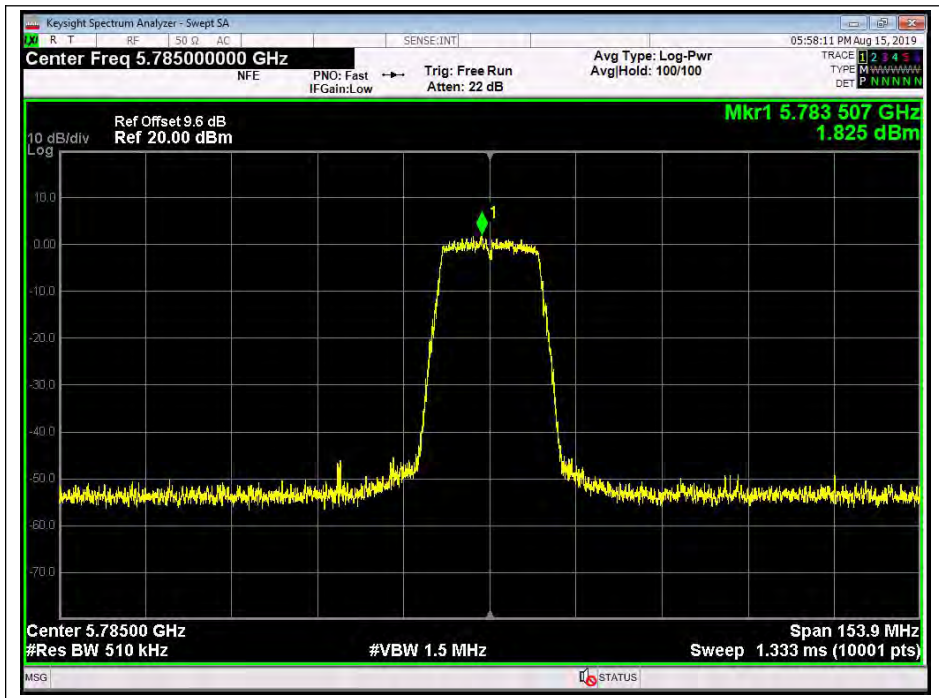
(Channel 40, 5200 MHz, 802.11a,ANT1)



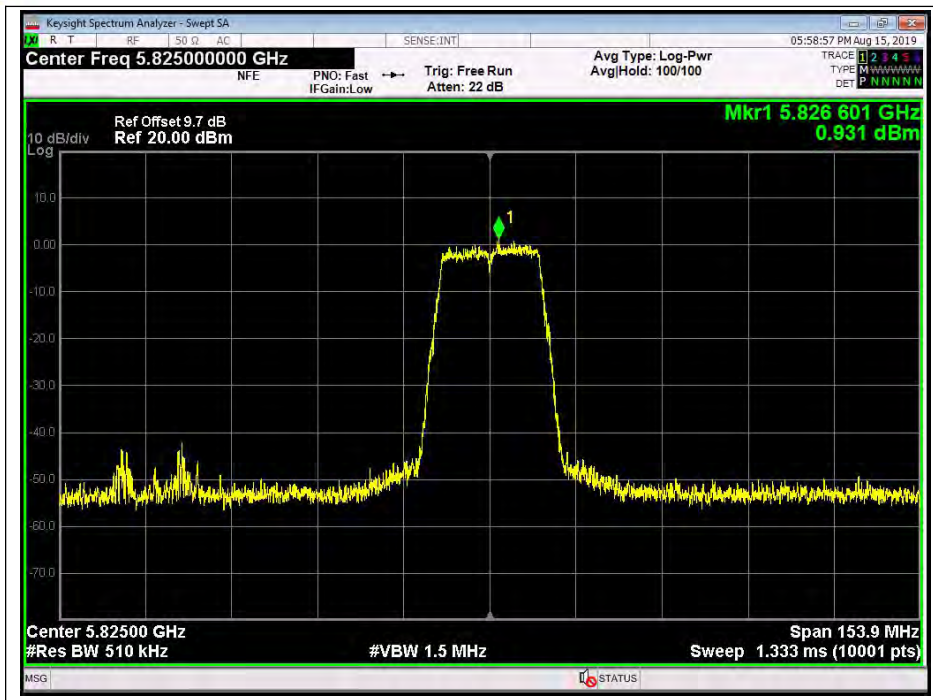
(Channel 48, 5240MHz, 802.11a,ANT1)



(Channel 149, 5745MHz, 802.11a,ANT1)



(Channel 157, 5785MHz, 802.11a,ANT1)



(Channel 165, 5825MHz, 802.11a,ANT1)

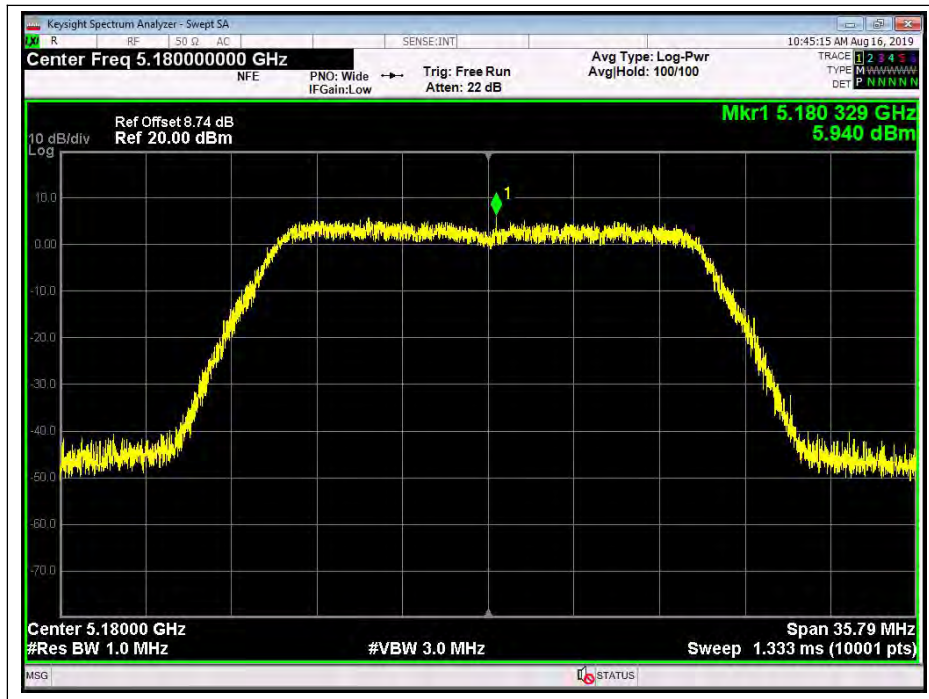
**802.11n (HT20) Test mode**

**A. Test Verdict:**

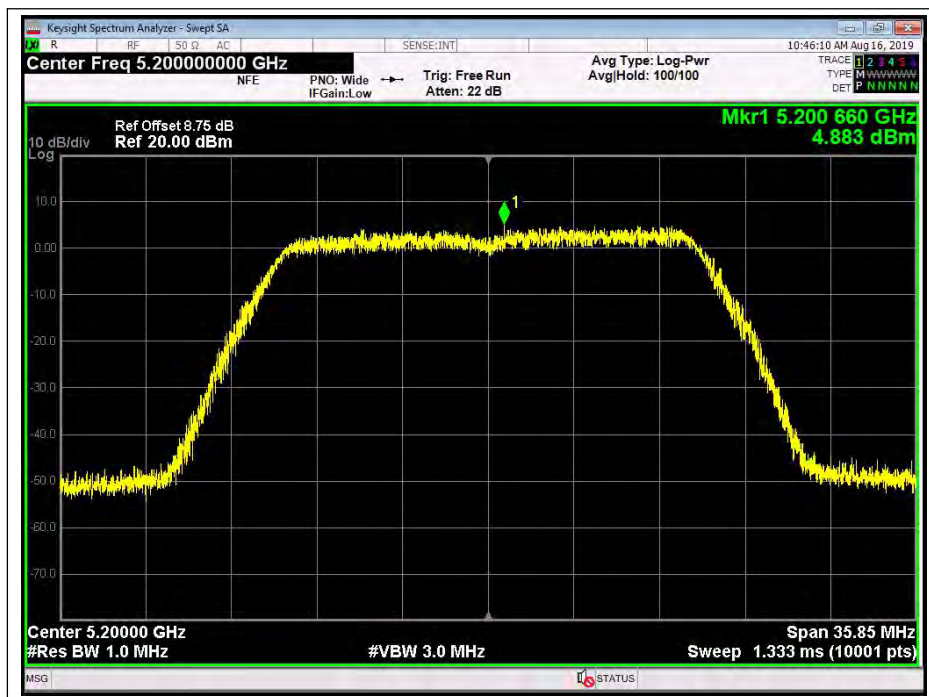
| Channel | Frequency (MHz) | Measured PSD (dBm/MHz)    |       |       | Limit (dBm/MHz)    | Verdict |
|---------|-----------------|---------------------------|-------|-------|--------------------|---------|
|         |                 | ANT0                      | ANT1  | Total |                    |         |
| 36      | 5180            | 5.940                     | 5.705 | 8.834 | 11                 | PASS    |
| 40      | 5200            | 4.883                     | 5.415 | 8.167 |                    |         |
| 48      | 5240            | 6.099                     | 5.829 | 8.976 |                    |         |
| Channel | Frequency (MHz) | Measured PSD (dBm/500KHz) |       |       | Limit (dBm/500KHz) | Verdict |
|         |                 | ANT0                      | ANT1  | Total |                    |         |
| 149     | 5745            | 1.441                     | 2.382 | 4.947 | 30                 | PASS    |
| 157     | 5785            | 3.609                     | 1.584 | 5.724 |                    |         |
| 165     | 5825            | 1.966                     | 1.244 | 4.630 |                    |         |



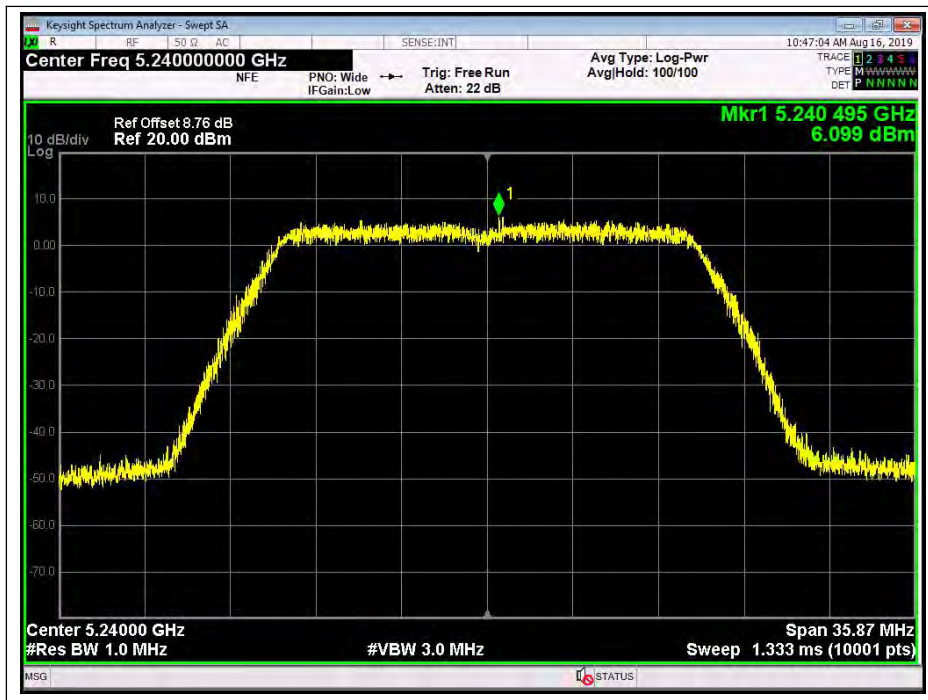
B. Test Plots



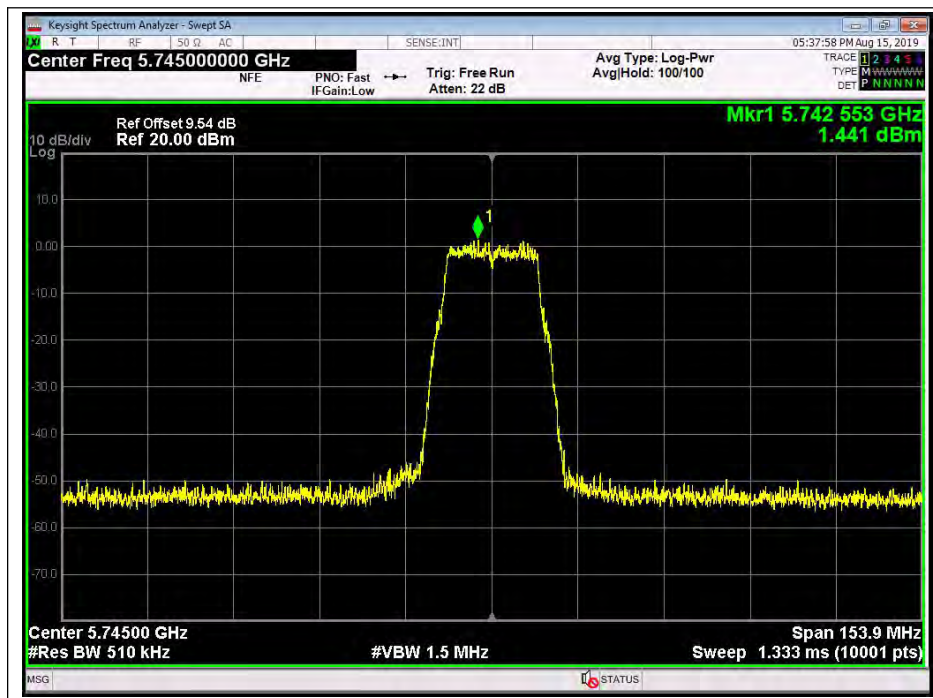
(Channel 36, 5180MHz, 802.11 n (HT20),ANT0)



(Channel 40, 5200 MHz, 802.11 n (HT20),ANT0)

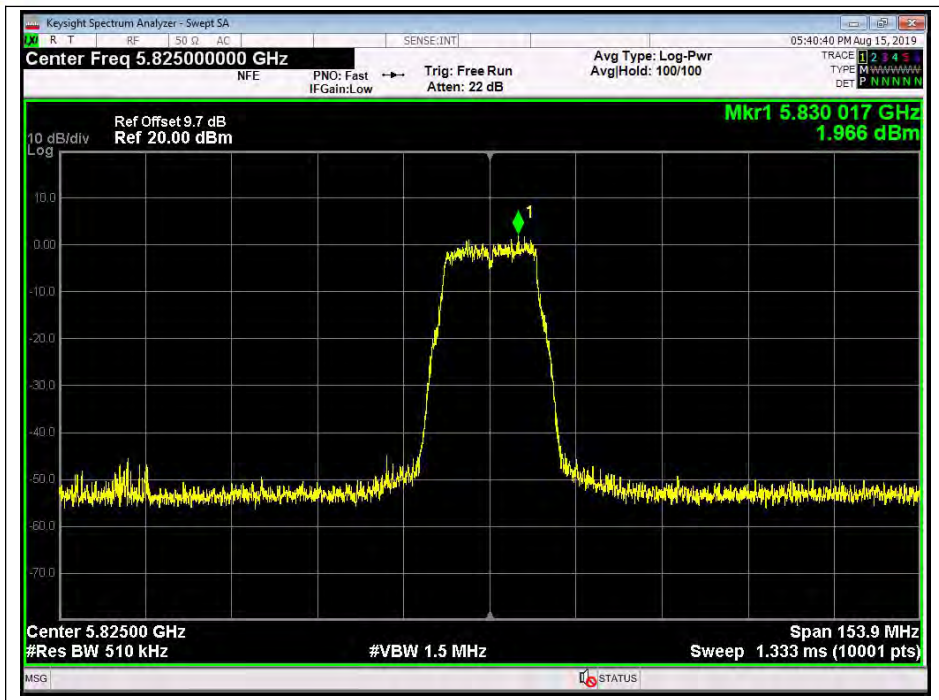


(Channel 48, 5240MHz, 802.11 n (HT20),ANT0)

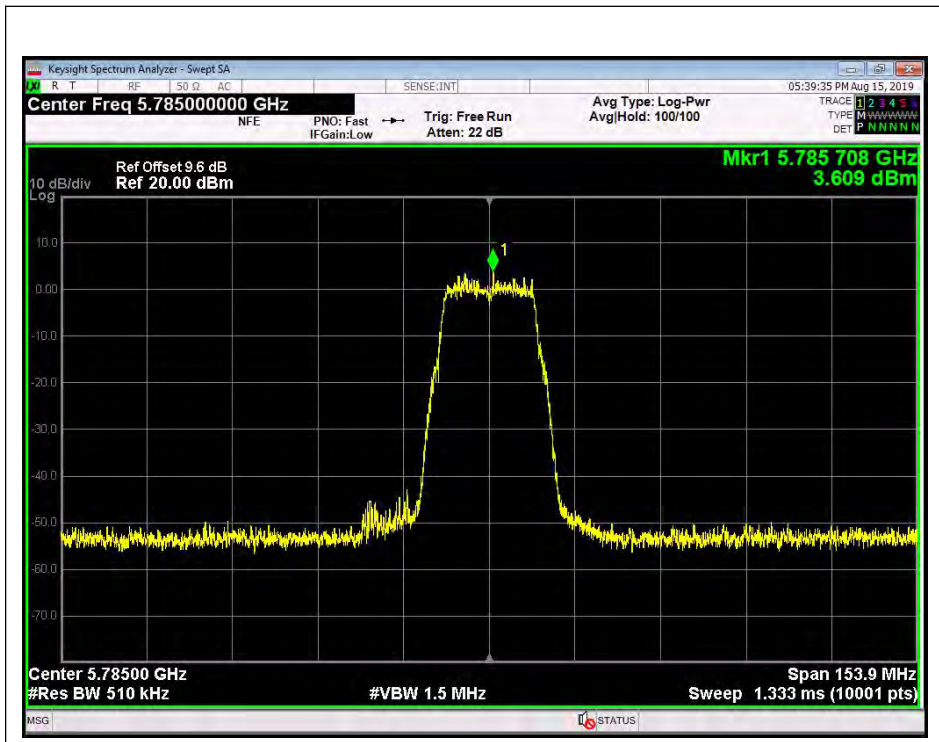


(Channel 149, 5745MHz, 802.11 n (HT20),ANT0)

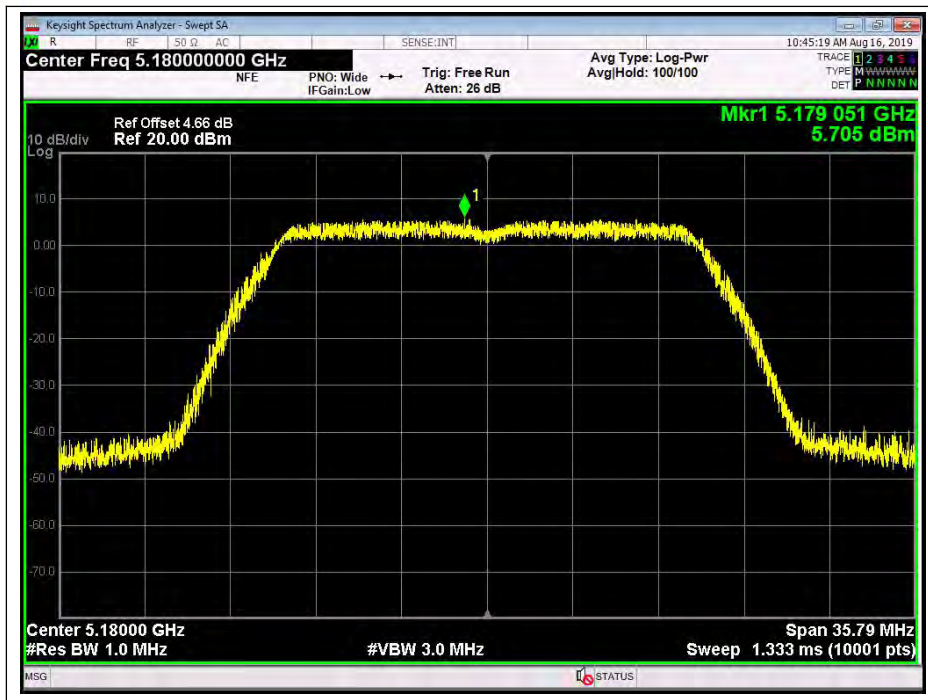




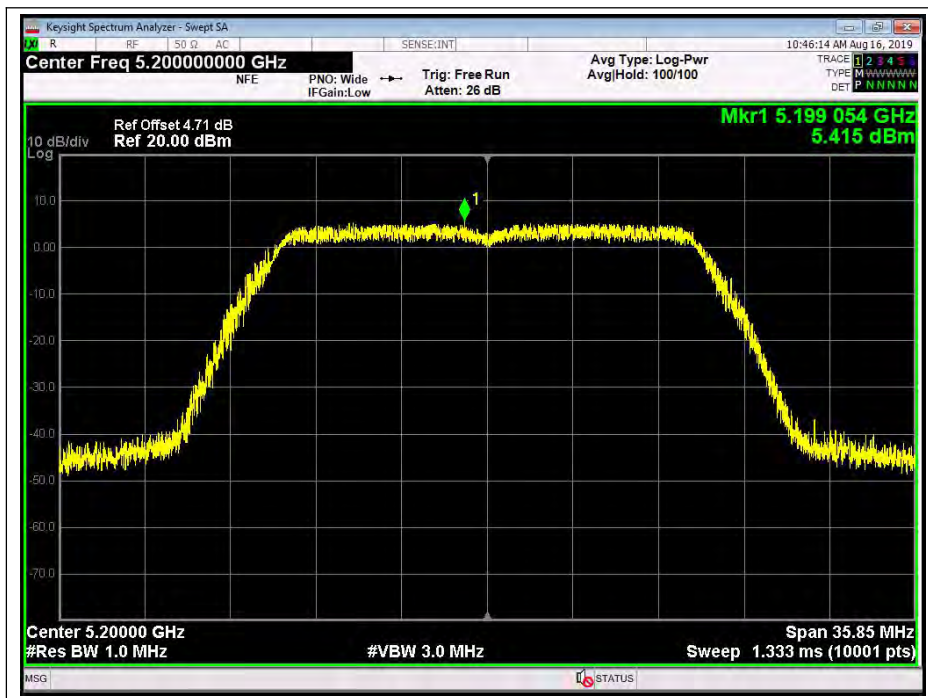
(Channel 157, 5785MHz, 802.11 n (HT20),ANT0)



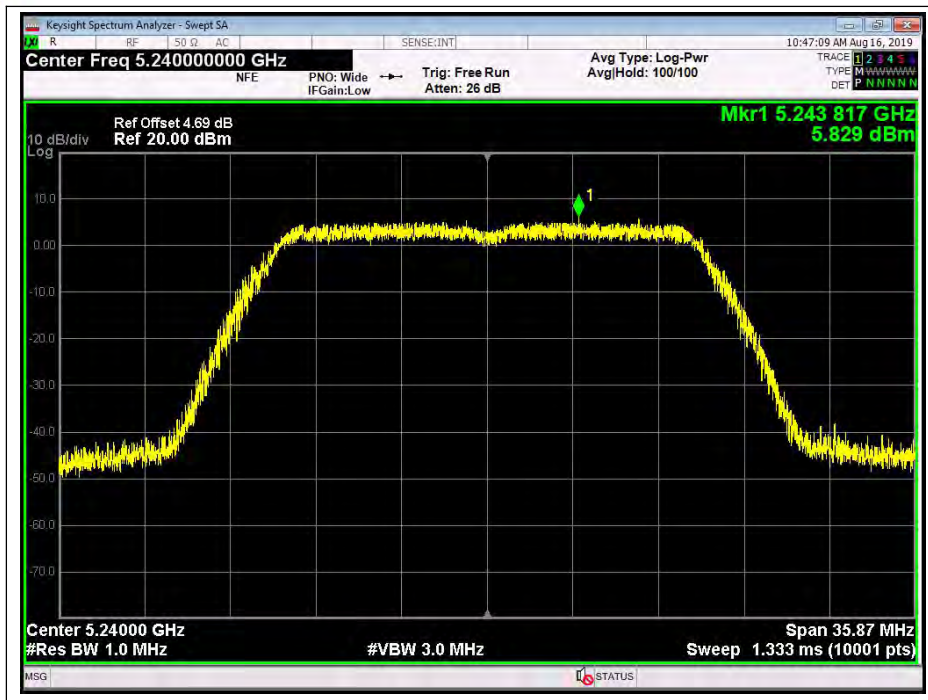
(Channel 165, 5825MHz, 802.11 n (HT20),ANT0)



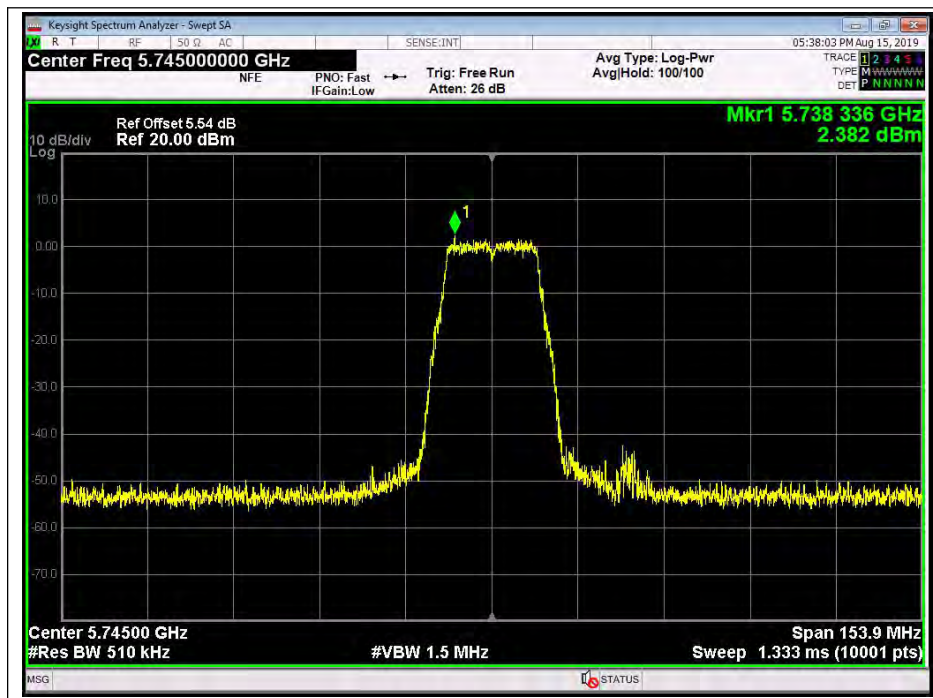
(Channel 36, 5180MHz, 802.11 n (HT20),ANT1)



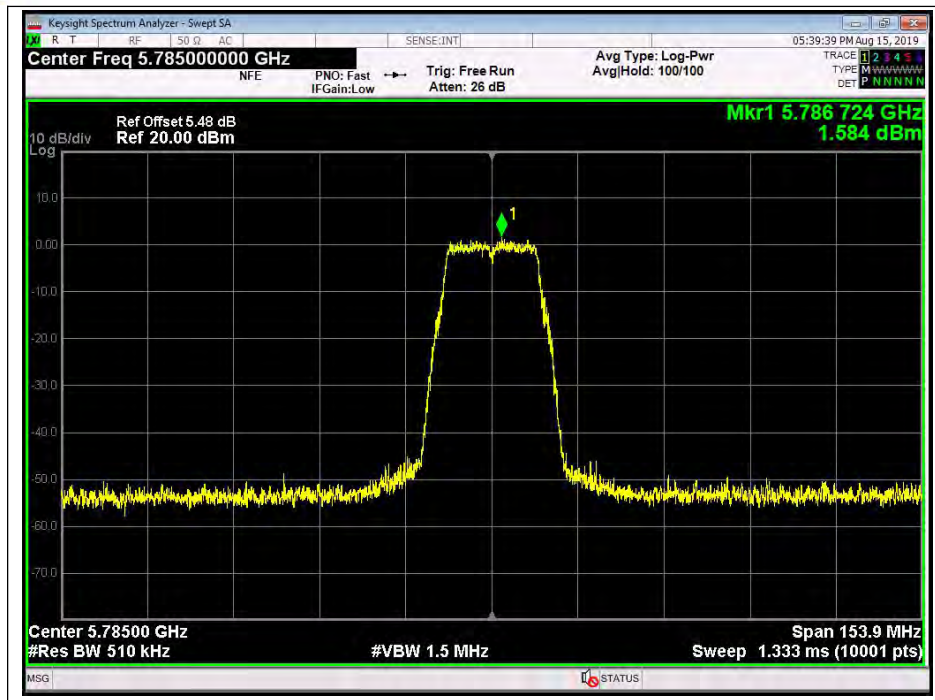
(Channel 40, 5200 MHz, 802.11 n (HT20),ANT1)



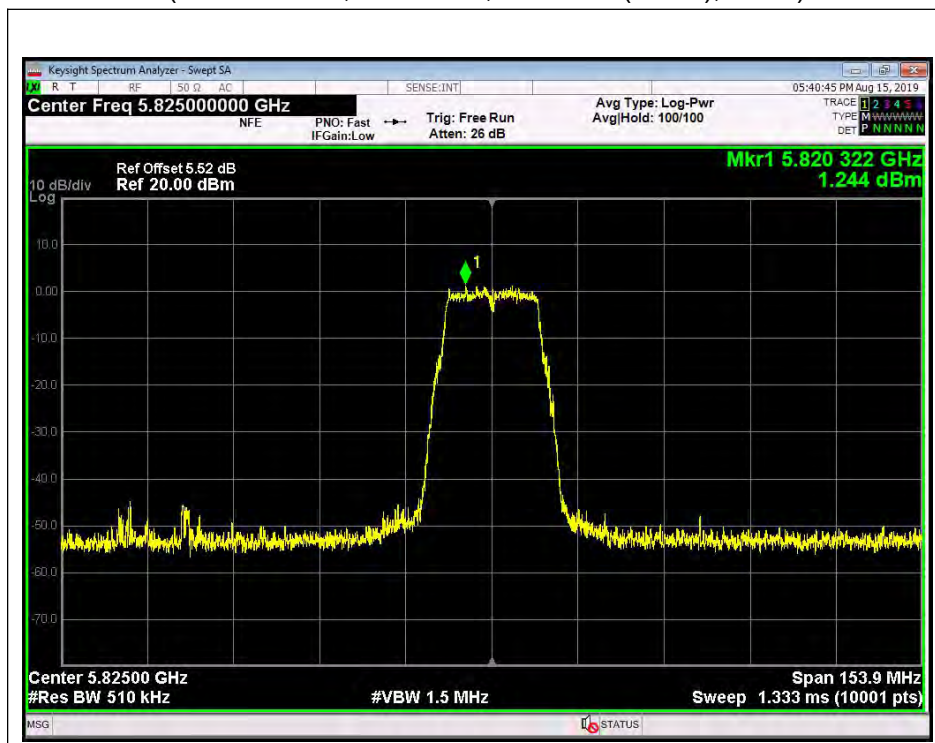
(Channel 48, 5240MHz, 802.11 n (HT20),ANT1)



(Channel 149, 5745MHz, 802.11 n (HT20),ANT1)



(Channel 157, 5785MHz, 802.11 n (HT20),ANT1)



(Channel 165, 5825MHz, 802.11 n (HT20),ANT1)

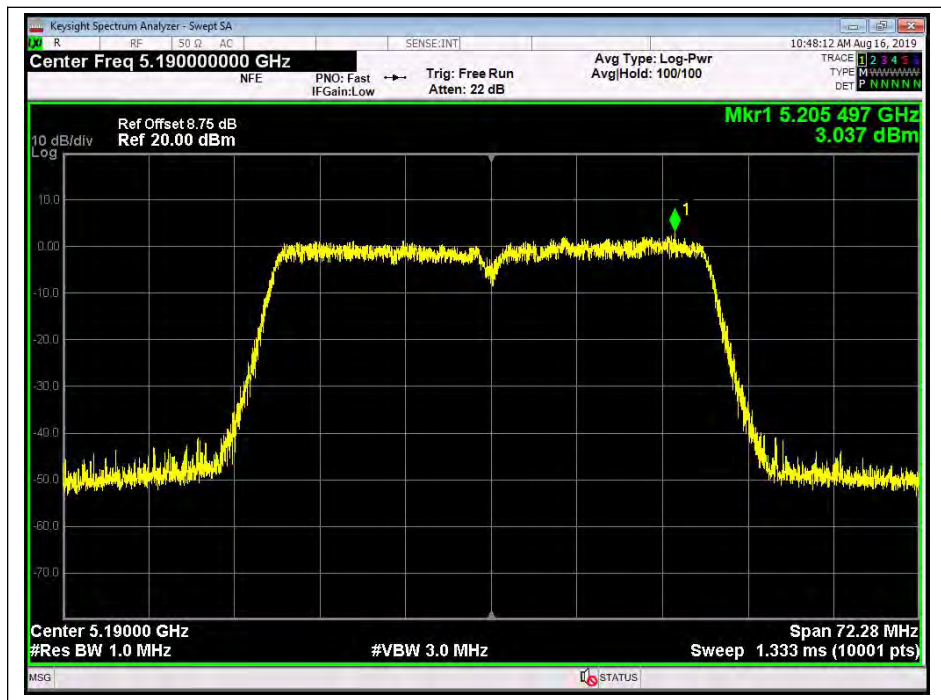


**802.11n (HT40) Test mode**

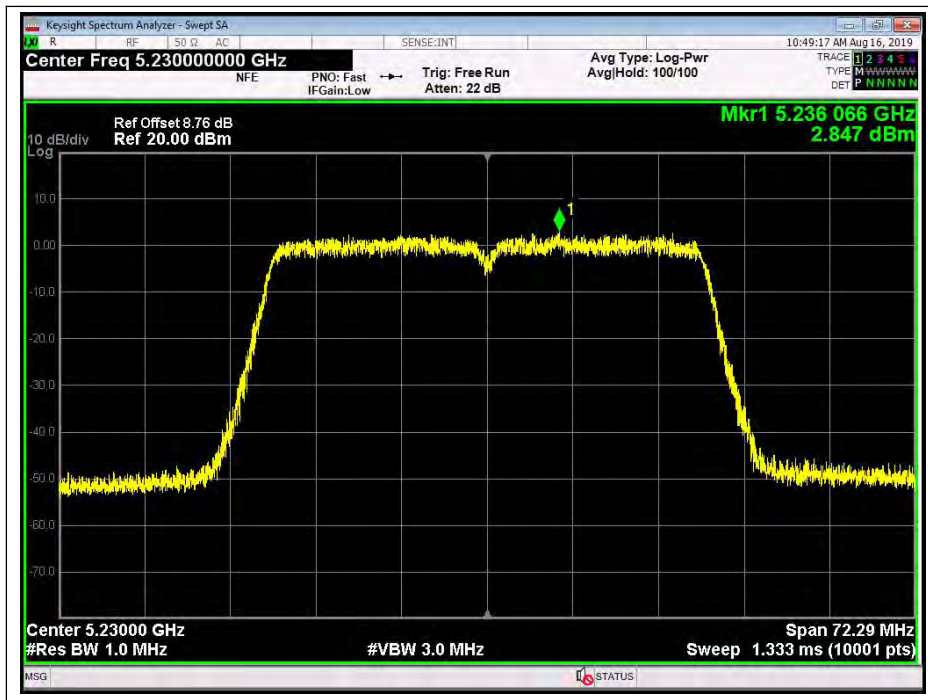
**A. Test Verdict:**

| Channel | Frequency (MHz) | Measured PSD (dBm/MHz)    |        |       | Limit (dBm/MHz)    | Verdict |
|---------|-----------------|---------------------------|--------|-------|--------------------|---------|
|         |                 | ANT0                      | ANT1   | Total |                    |         |
| 38      | 5190            | 3.037                     | 3.110  | 6.084 | 11                 | PASS    |
| 46      | 5230            | 2.847                     | 2.490  | 5.682 |                    |         |
| Channel | Frequency (MHz) | Measured PSD (dBm/500KHz) |        |       | Limit (dBm/500KHz) | Verdict |
|         |                 | ANT0                      | ANT1   | Total |                    |         |
| 151     | 5755            | -0.314                    | -0.981 | 2.376 | 30                 | PASS    |
| 159     | 5795            | 0.400                     | -1.385 | 2.609 |                    |         |

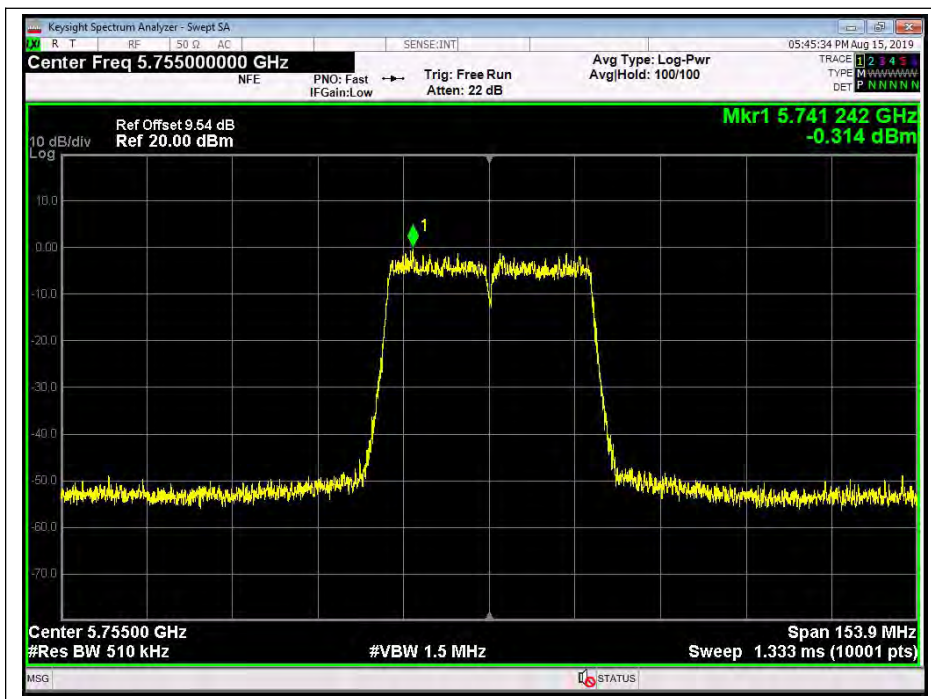
**B. Test Plots**



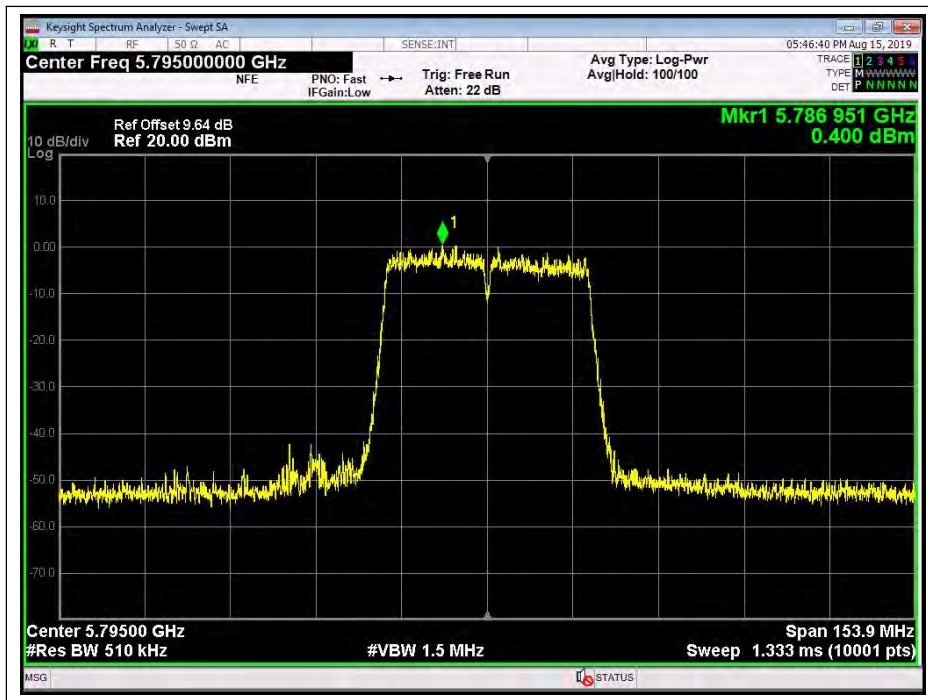
(Channel 38, 5190MHz, 802.11n (HT40),ANT0)



(Channel 46, 5230 MHz, 802.11n (HT40),ANT0)



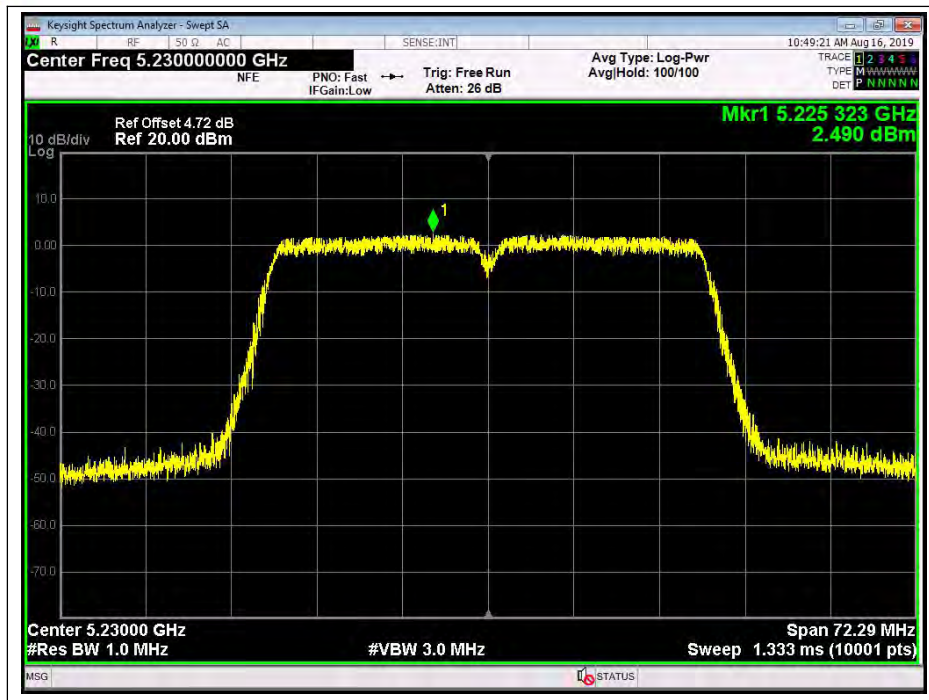
(Channel 151, 5755 MHz, 802.11n (HT40),ANT0)



(Channel 159, 5795MHz, 802.11n (HT40),ANT0)



(Channel 38, 5190MHz, 802.11n (HT40),ANT1)

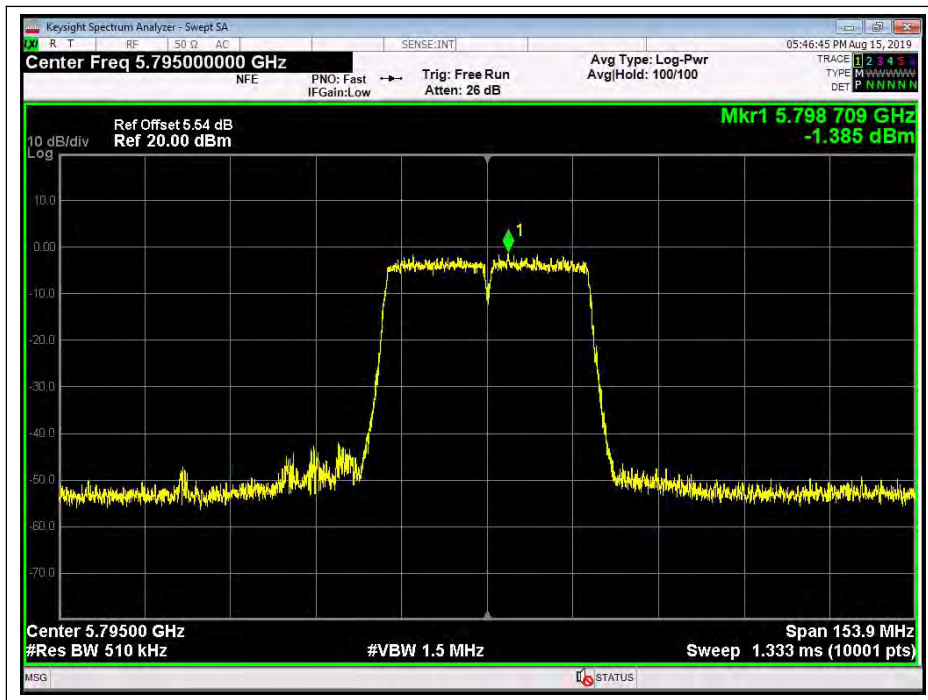


(Channel 46, 5230 MHz, 802.11n (HT40),ANT1)



(Channel 151, 5755 MHz, 802.11n (HT40),ANT1)





(Channel 159, 5795MHz, 802.11n (HT40),ANT1)



802.11ac (HT80) Test mode

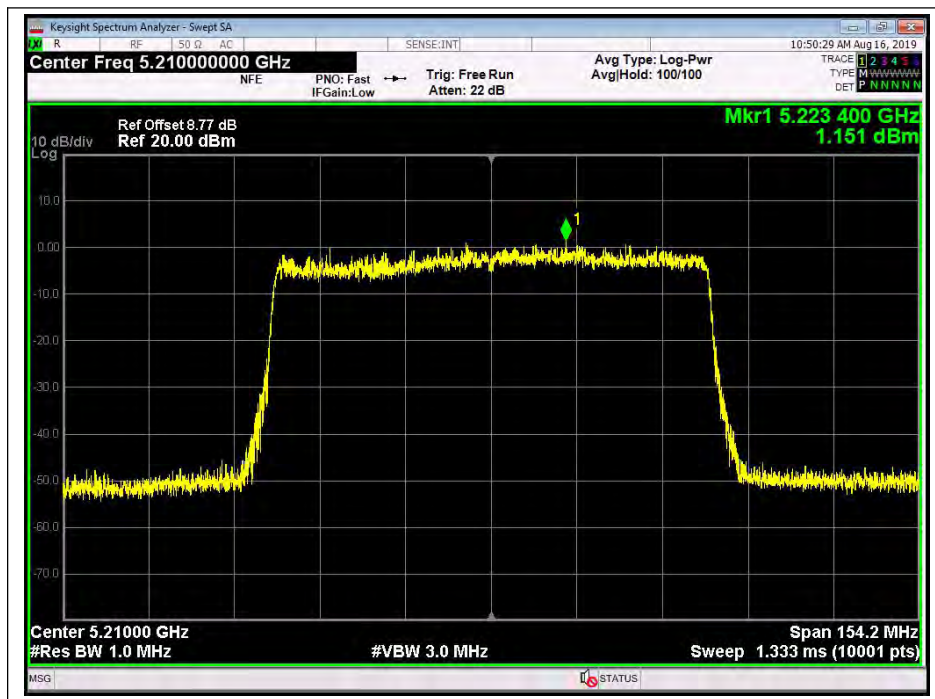
C. Test Verdict:

| Channel | Frequency (MHz) | Measured PSD (dBm/MHz) |       |       | Limit (dBm/MHz) | Verdict |
|---------|-----------------|------------------------|-------|-------|-----------------|---------|
|         |                 | ANT0                   | ANT1  | Total |                 |         |
| 42      | 5210            | 1.151                  | 1.906 | 4.555 | 11              | PASS    |

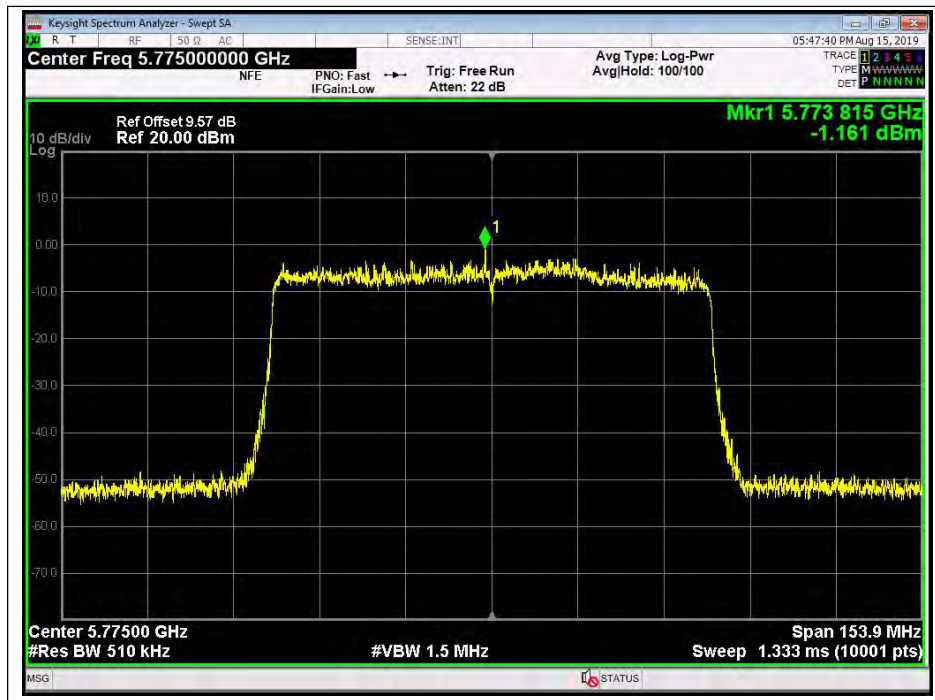
  

| Channel | Frequency (MHz) | Measured PSD (dBm/500KHz) |        |       | Limit (dBm/500KHz) | Verdict |
|---------|-----------------|---------------------------|--------|-------|--------------------|---------|
|         |                 | ANT0                      | ANT1   | Total |                    |         |
| 155     | 5775            | -1.161                    | -1.501 | 1.683 | 30                 | PASS    |

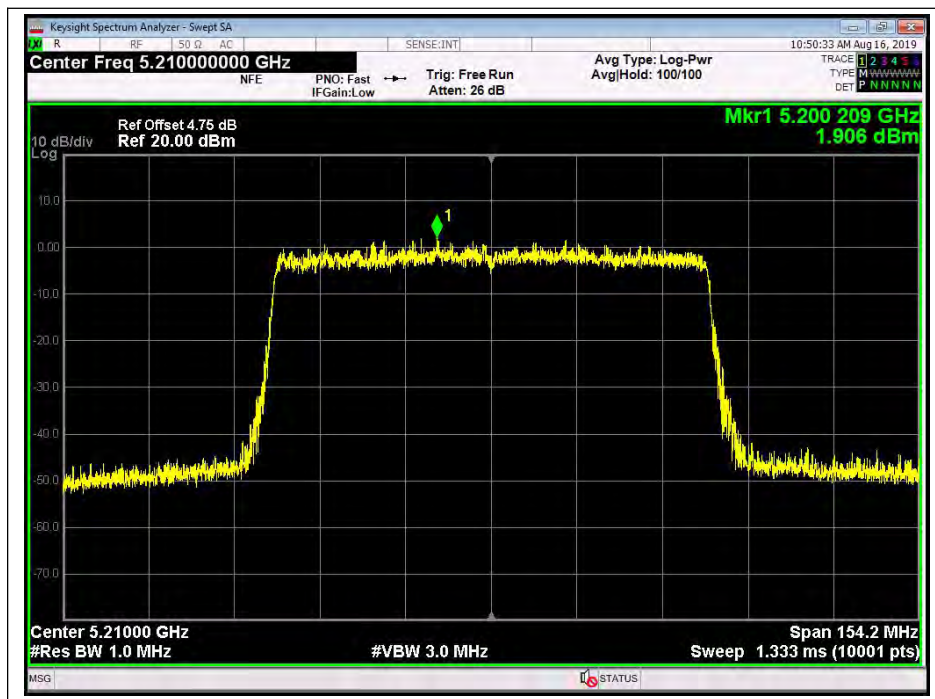
D. Test Plots



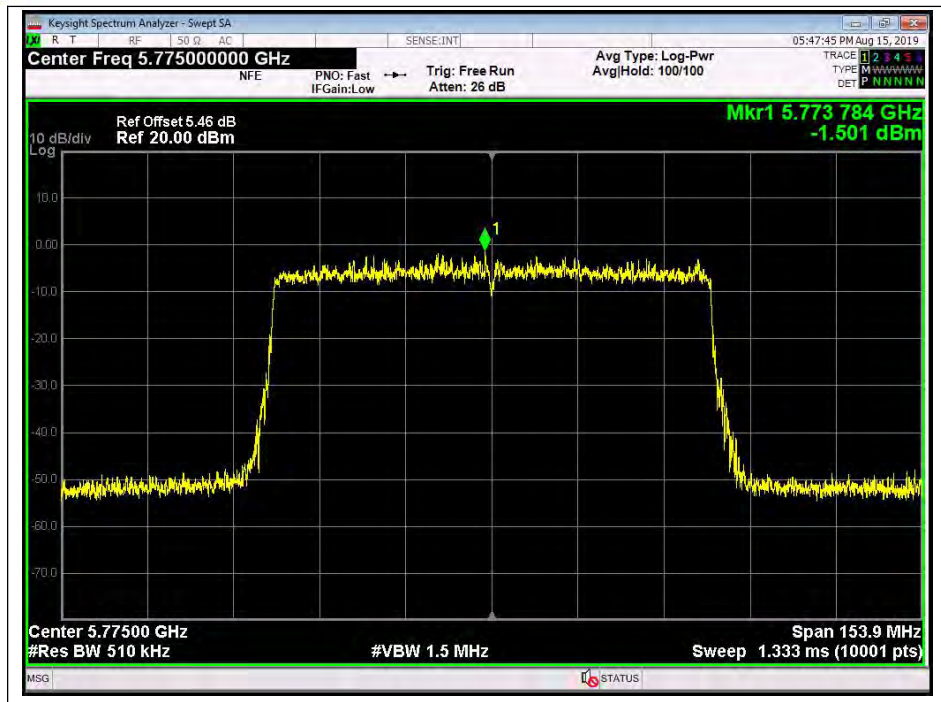
(Channel 42, 5210MHz, 802.11ac (HT80),ANT0)



(Channel 155, 5775MHz, 802.11ac (HT80),ANT0)



(Channel 42, 5210MHz, 802.11ac (HT80),ANT1)



(Channel 155, 5775MHz, 802.11ac (HT80),ANT1)

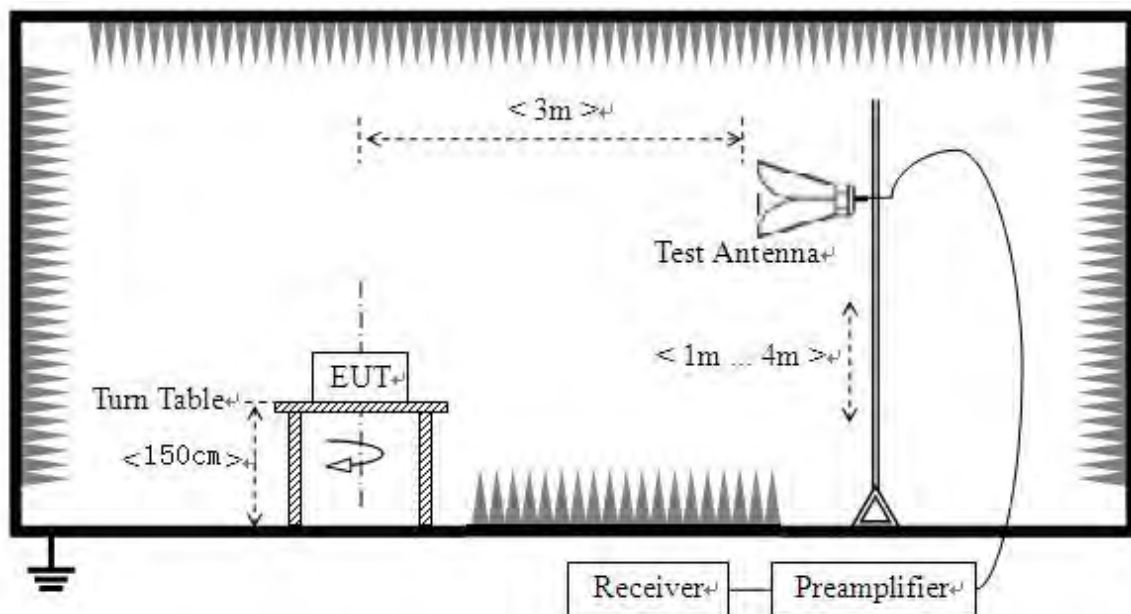
## 2.5. Restricted Frequency Bands

### 2.5.1. Requirement

According to FCC section 15.407(b)(7), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

### 2.5.2. Test Description

#### A. Test Setup



The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

KDB 789033 Section H) 3)5)6(d)) was used in order to prove compliance

For the Test Antenna:

Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.



- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

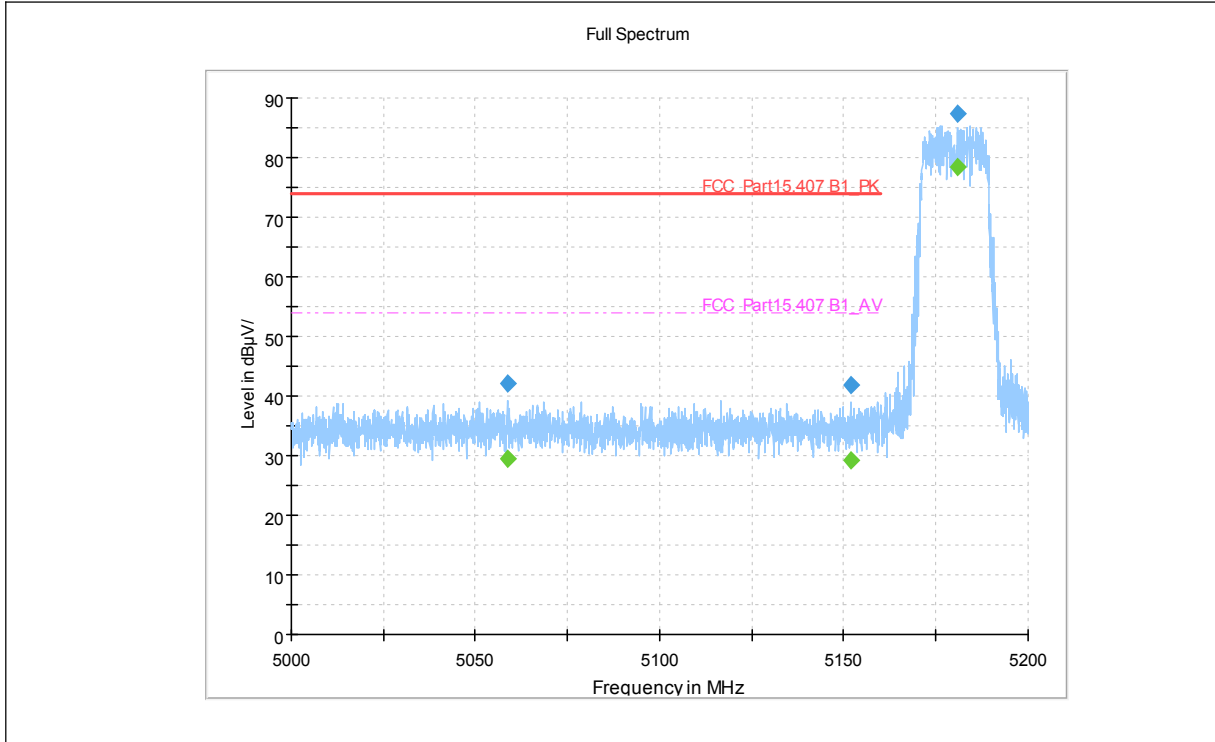
Note:

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasipeak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.
- 4. All modes of operation were investigated and the worst-case emissions are reported.



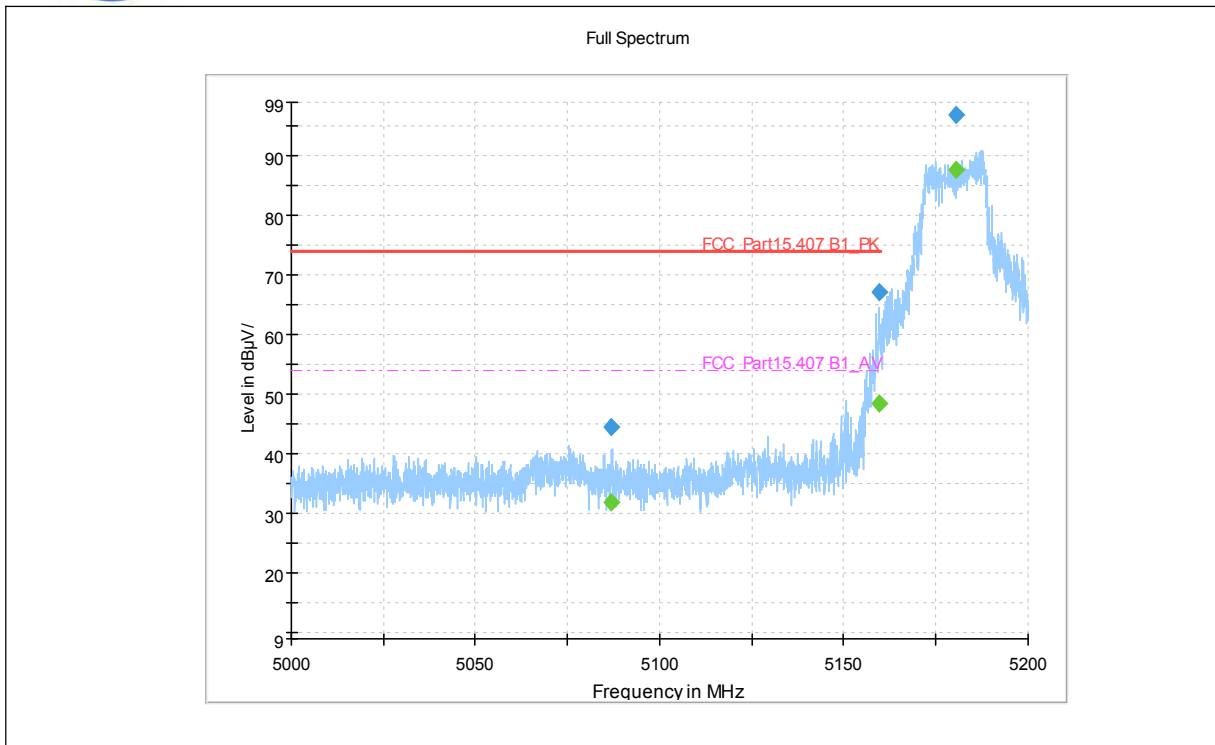
2.5.3. Test Result

802.11a Test mode



(802.11a\_5180MHz, Antenna Horizontal)

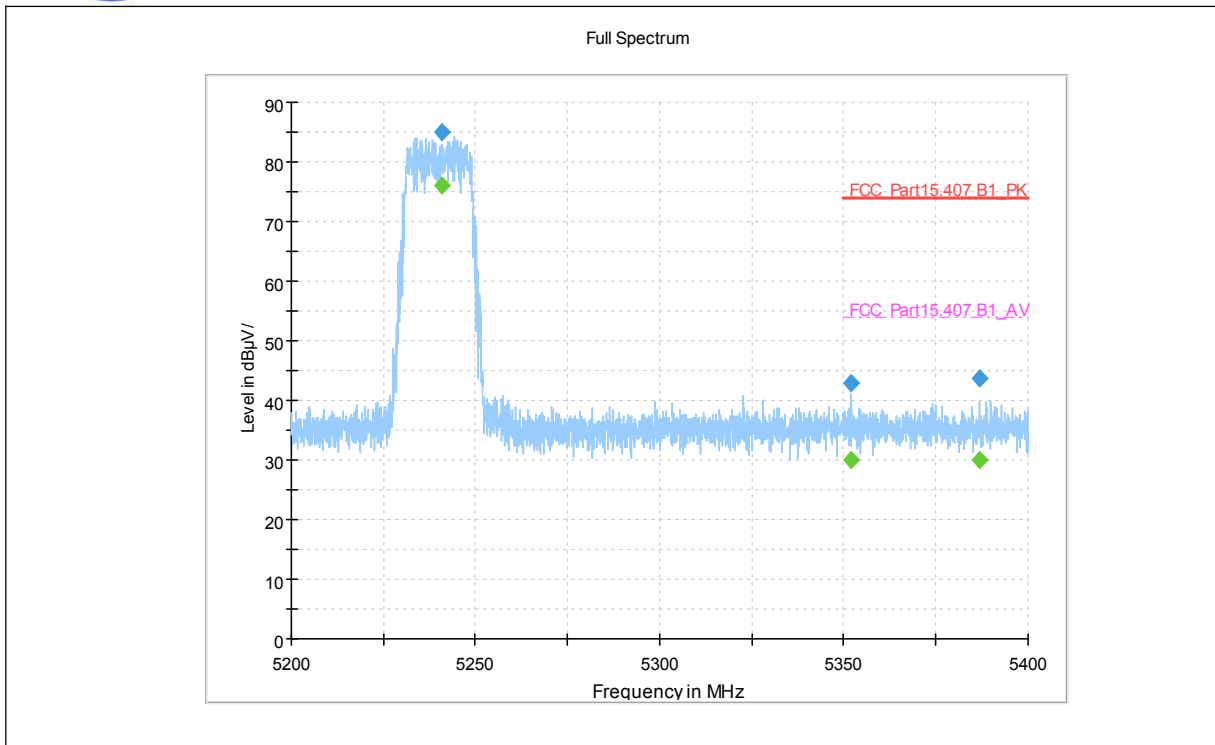
| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5058.600000     | 41.99            | ---              | 74.00          | 32.01       | H   | -2.9         |
| 5058.600000     | ---              | 29.36            | 54.00          | 24.64       | H   | -2.9         |
| 5151.800000     | 41.78            | ---              | 74.00          | 32.22       | H   | -3.3         |
| 5151.800000     | ---              | 29.31            | 54.00          | 24.69       | H   | -3.3         |
| 5180.950000     | ---              | 78.51            | ---            | ---         | H   | -3.1         |
| 5180.950000     | 87.38            | ---              | ---            | ---         | H   | -3.1         |



(802.11a \_5180MHz, Antenna Vertical)

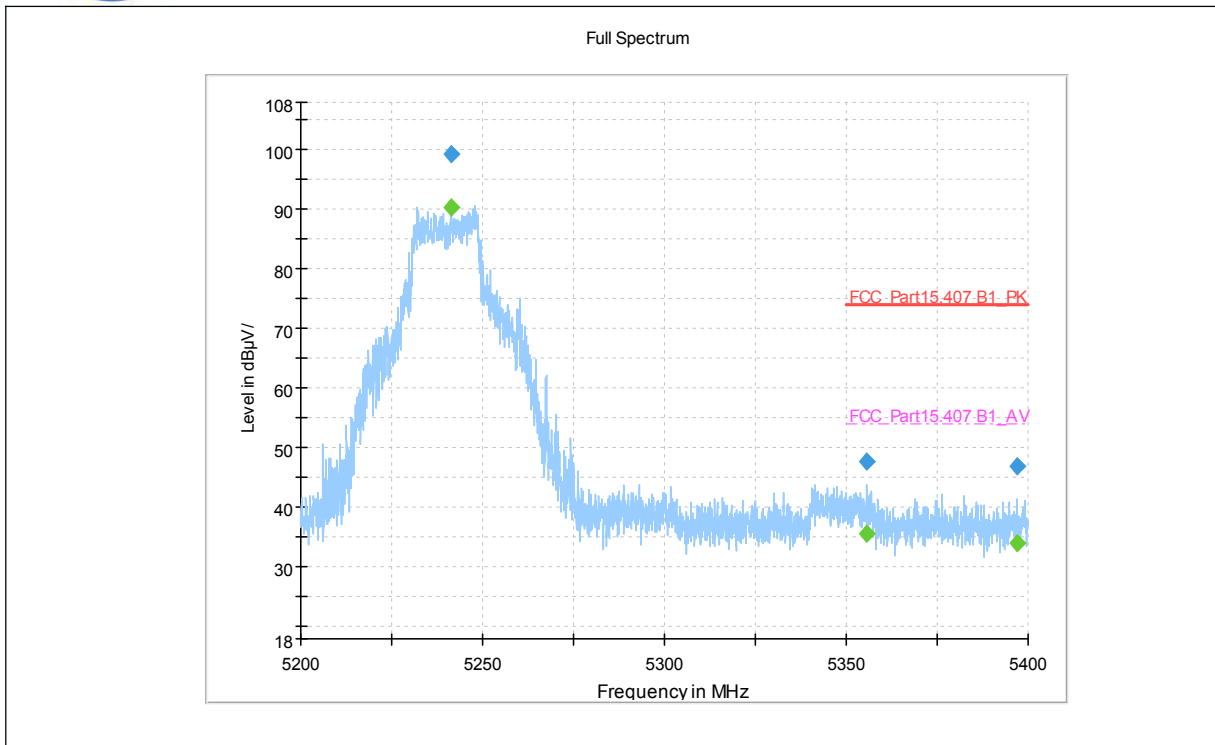
| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5087.000000     | 44.50            | ---              | 74.00          | 29.50       | V   | -3.0         |
| 5087.000000     | ---              | 31.83            | 54.00          | 22.17       | V   | -3.0         |
| 5159.450000     | 67.18            | ---              | 74.00          | 6.82        | V   | -3.2         |
| 5159.450000     | ---              | 48.50            | 54.00          | 5.50        | V   | -3.2         |
| 5180.250000     | ---              | 87.66            | ---            | ---         | V   | -3.1         |
| 5180.250000     | 96.81            | ---              | ---            | ---         | V   | -3.1         |





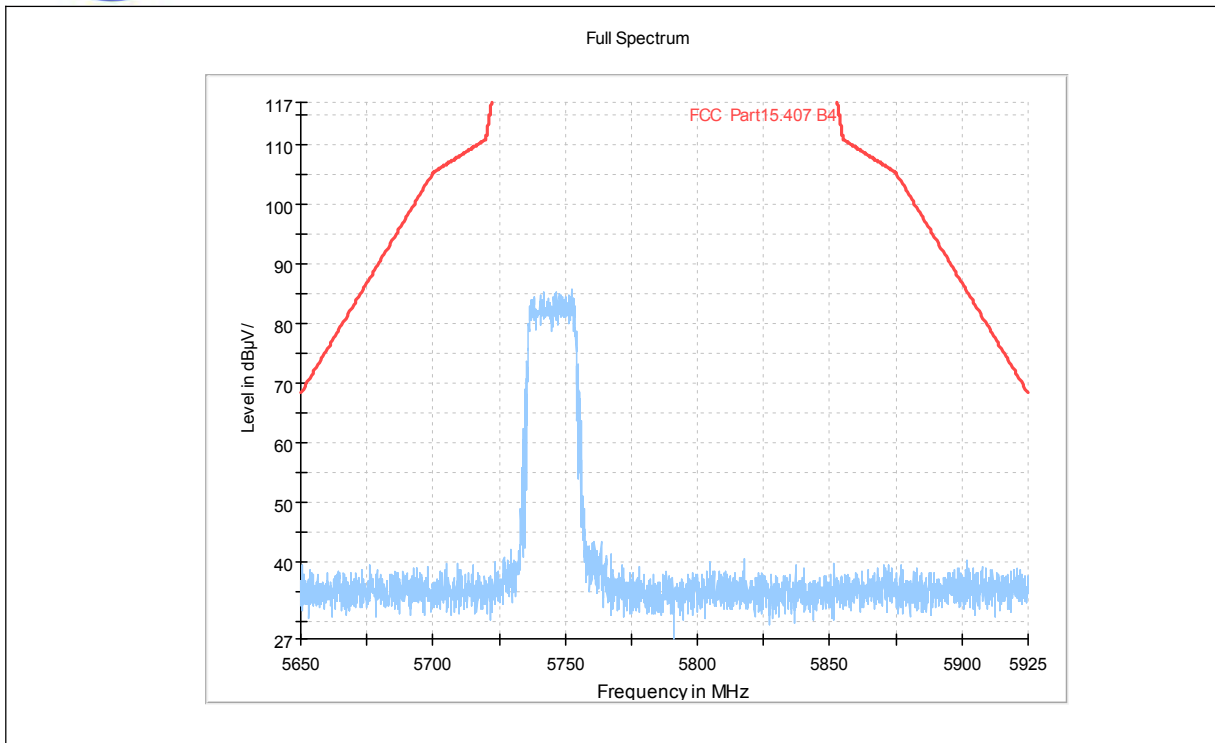
(802.11a \_5240MHz, Antenna Horizontal)

| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5240.900000     | ---              | 76.18            | ---            | ---         | H   | -3.1         |
| 5240.900000     | 85.08            | ---              | ---            | ---         | H   | -3.1         |
| 5352.100000     | 43.01            | ---              | 74.00          | 30.99       | H   | -2.5         |
| 5352.100000     | ---              | 30.03            | 54.00          | 23.97       | H   | -2.5         |
| 5386.900000     | 43.78            | ---              | 74.00          | 30.22       | H   | -2.4         |
| 5386.900000     | ---              | 30.00            | 54.00          | 24.00       | H   | -2.4         |

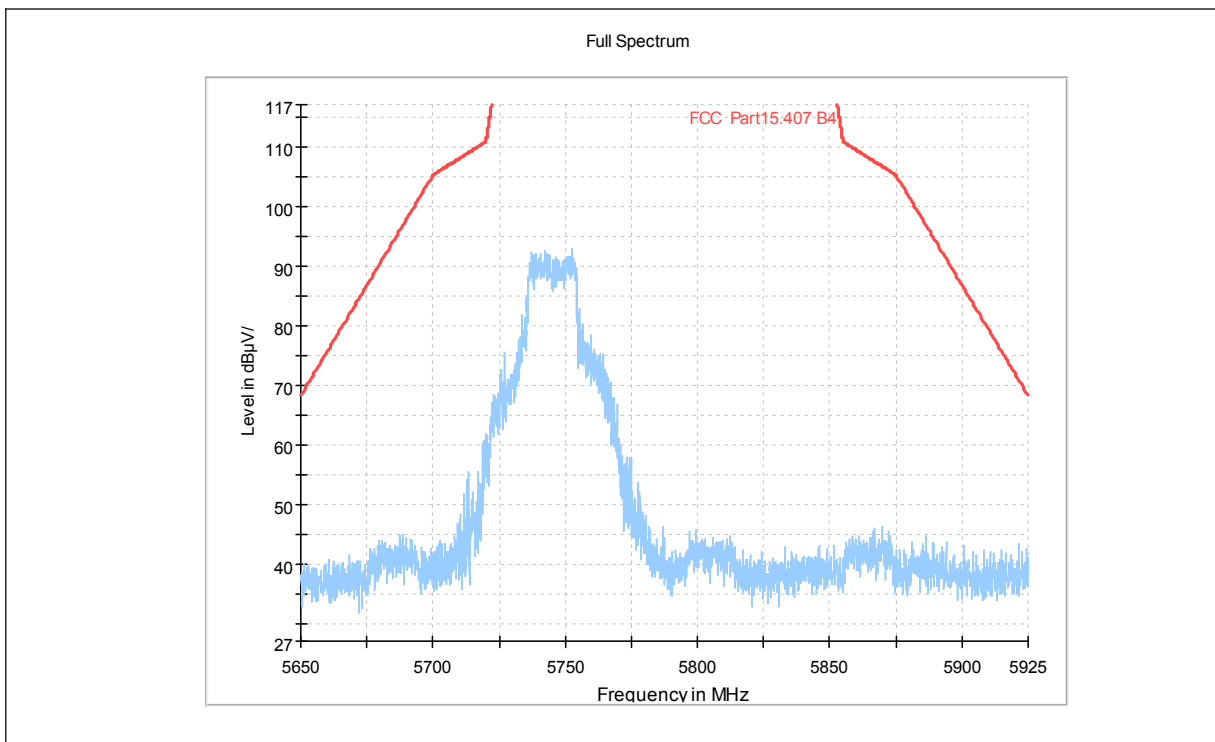


(802.11a \_5240MHz, Antenna Vertical)

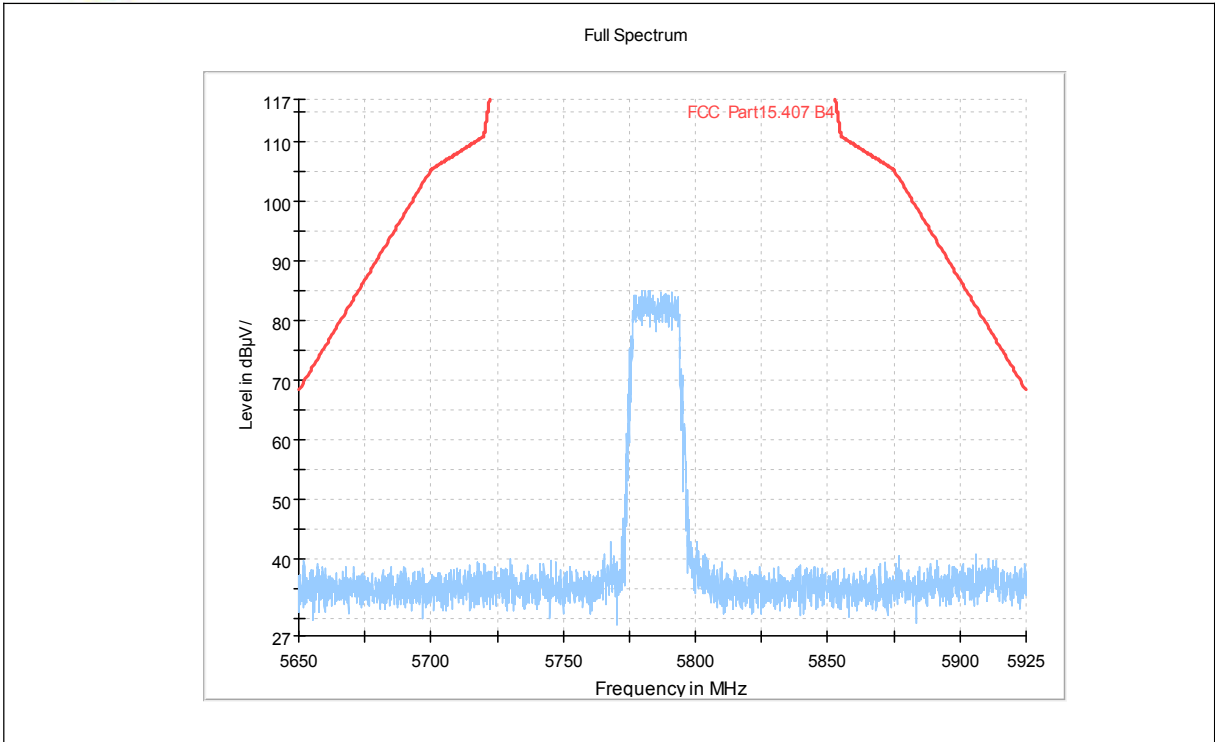
| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5241.200000     | ---              | 90.48            | ---            | ---         | V   | -3.1         |
| 5241.200000     | 99.38            | ---              | ---            | ---         | V   | -3.1         |
| 5355.750000     | 47.65            | ---              | 74.00          | 26.35       | V   | -2.5         |
| 5355.750000     | ---              | 35.68            | 54.00          | 18.32       | V   | -2.5         |
| 5396.900000     | 46.99            | ---              | 74.00          | 27.01       | V   | -2.5         |
| 5396.900000     | ---              | 34.12            | 54.00          | 19.88       | V   | -2.5         |



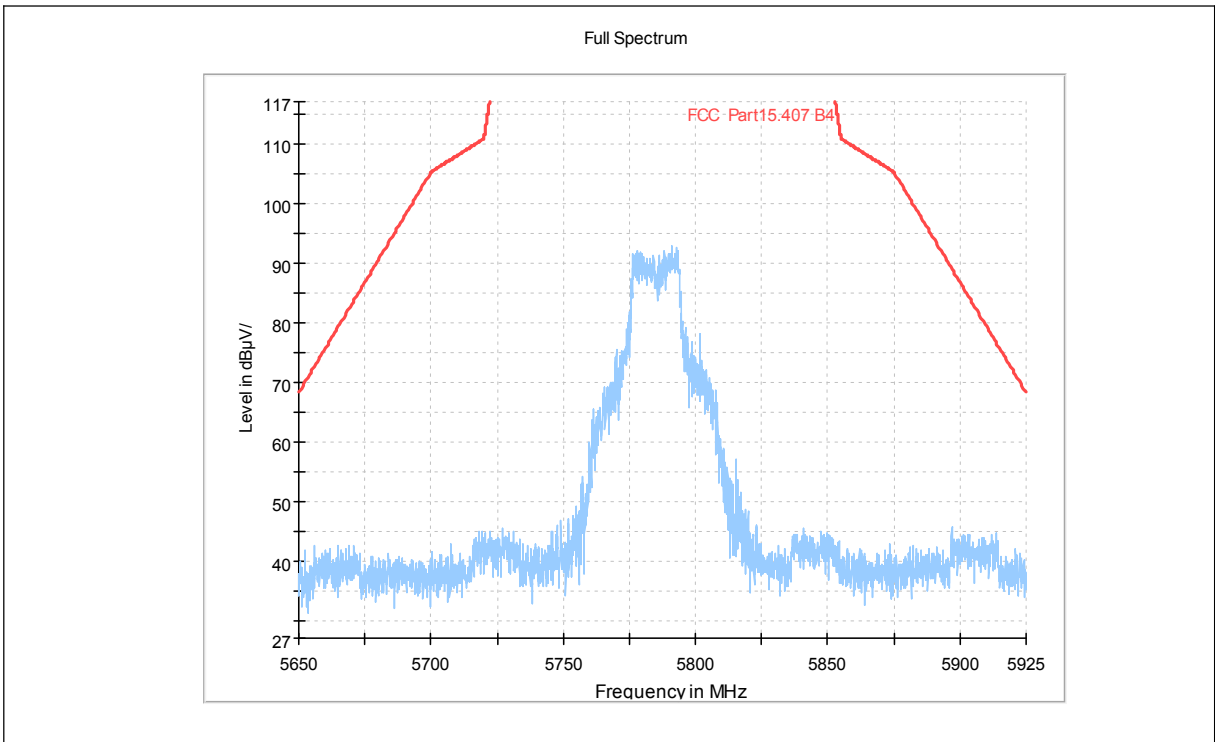
(802.11a \_5745MHz, Antenna Horizontal)



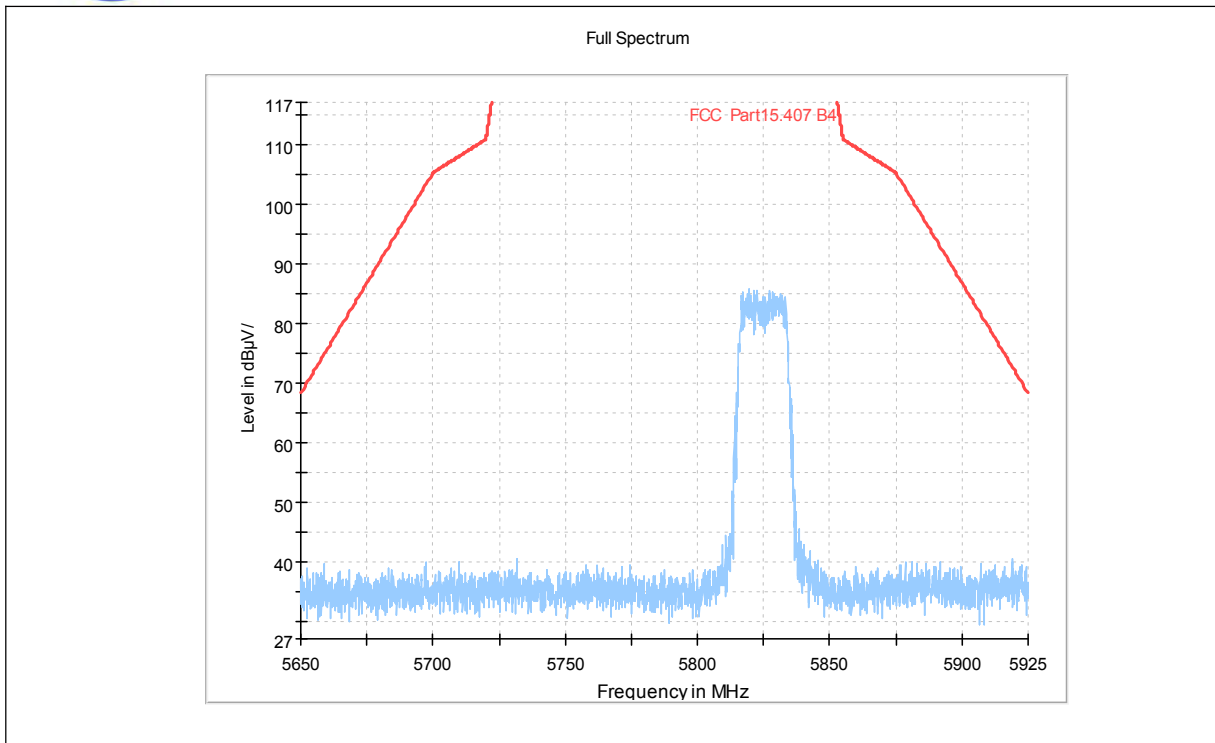
(802.11a \_5745MHz, Antenna Vertical)



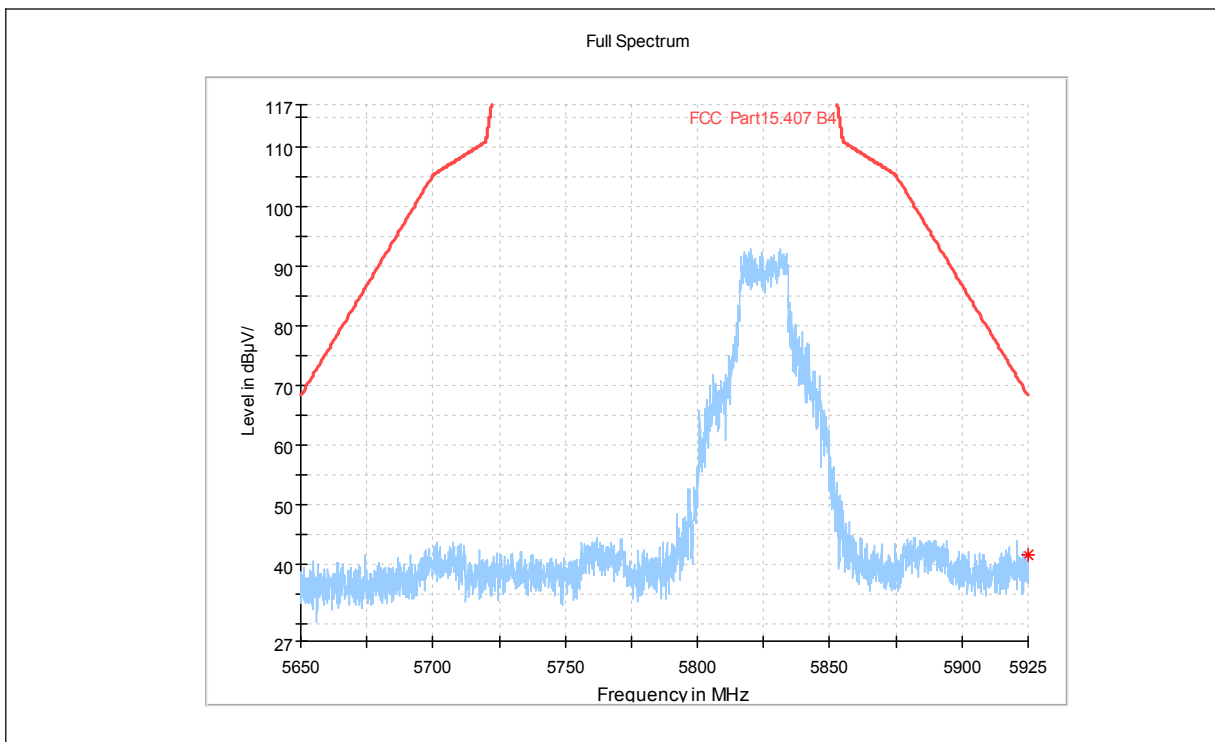
(802.11a \_5785MHz, Antenna Horizontal)



(802.11a \_5785MHz, Antenna Vertical)

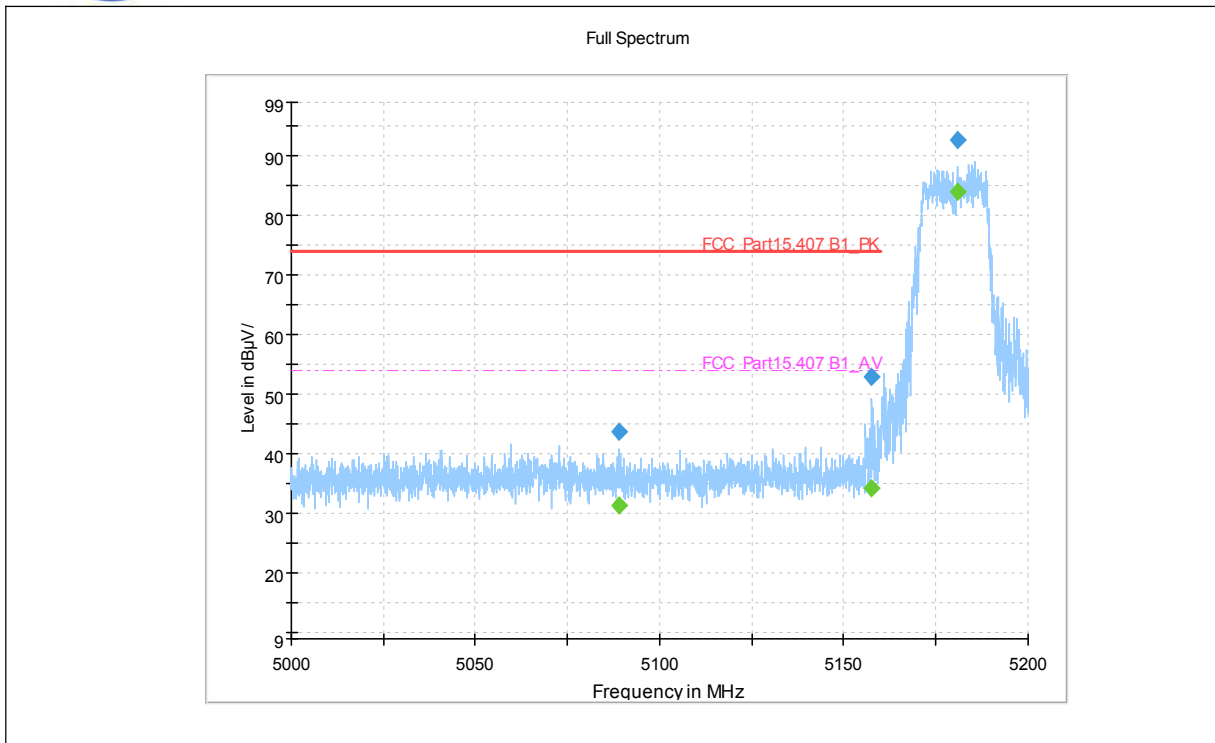


(802.11a \_5825MHz, Antenna Horizontal)



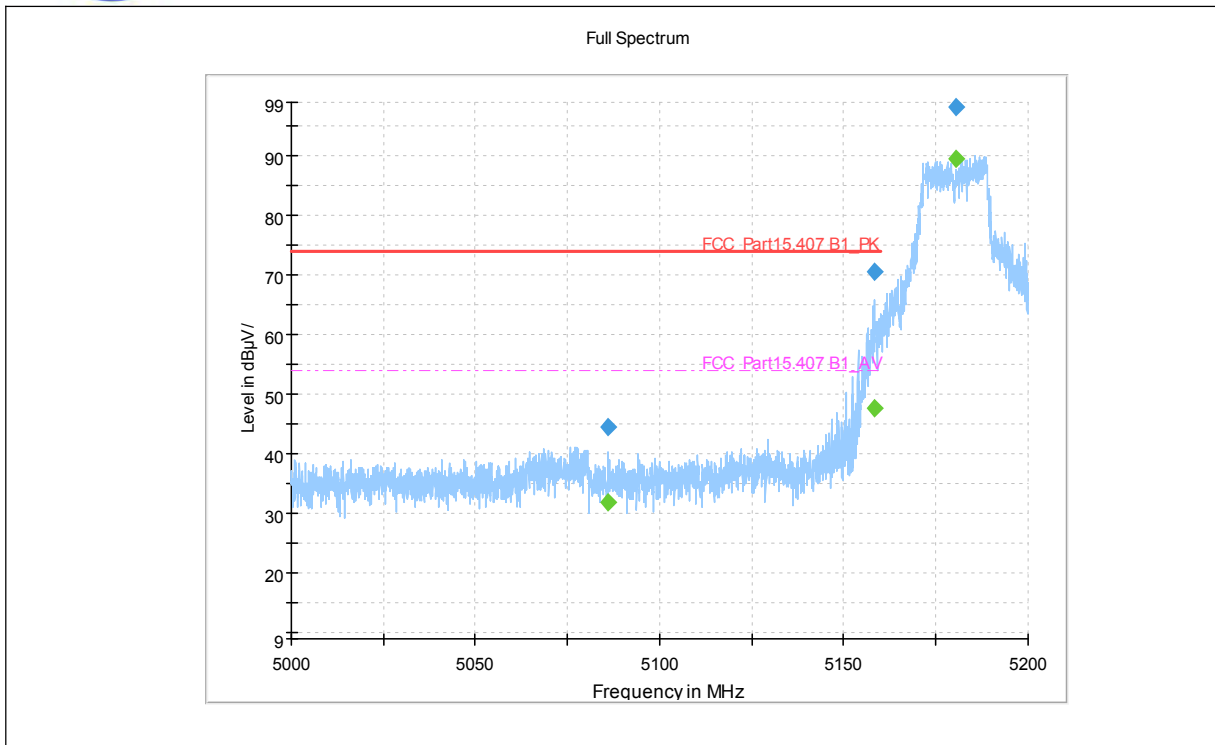
(802.11a \_5825MHz, Antenna Vertical)

**802.11n (HT20) Test mode**



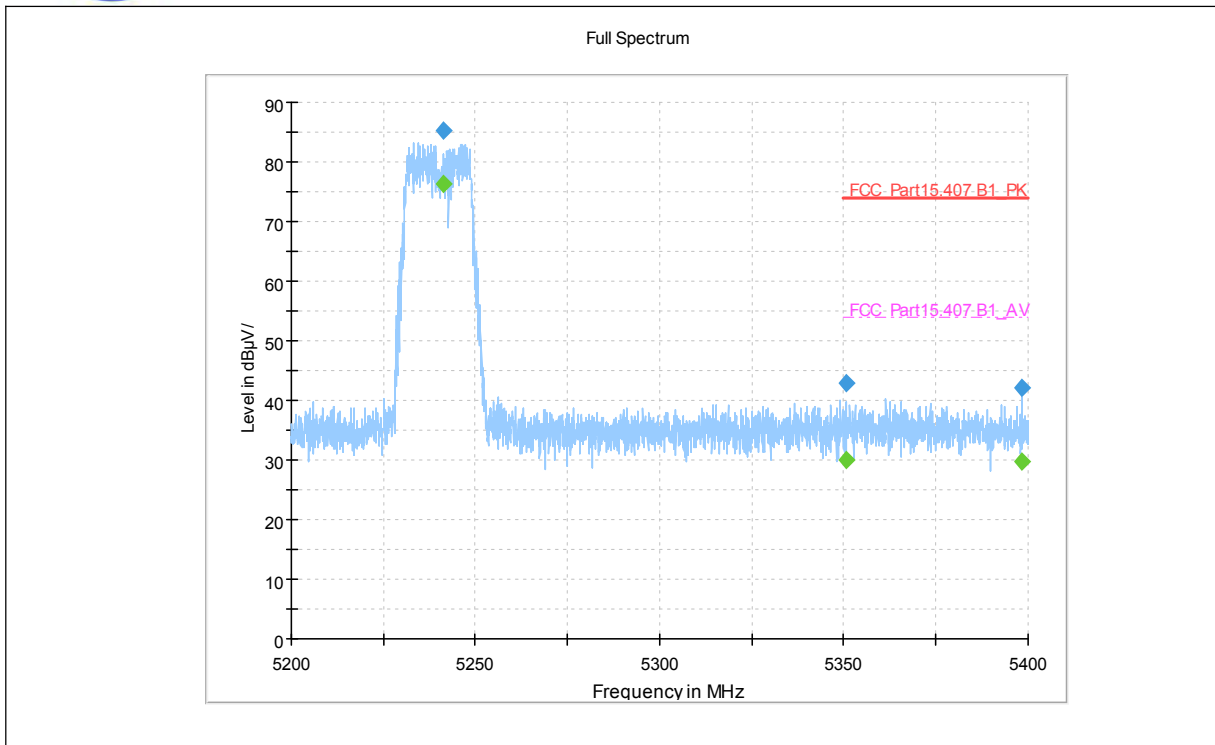
(802.11n (HT20) \_5180MHz, Antenna Horizontal)

| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5089.050000     | ---              | 31.42            | 54.00          | 22.58       | H   | -3.0         |
| 5089.050000     | 43.86            | ---              | 74.00          | 30.14       | H   | -3.0         |
| 5157.650000     | ---              | 34.21            | 54.00          | 19.79       | H   | -3.2         |
| 5157.650000     | 52.85            | ---              | 74.00          | 21.15       | H   | -3.2         |
| 5180.950000     | ---              | 84.01            | ---            | ---         | H   | -3.1         |
| 5180.950000     | 92.79            | ---              | ---            | ---         | H   | -3.1         |



(802.11n (HT20) \_5180MHz,, Antenna Vertical)

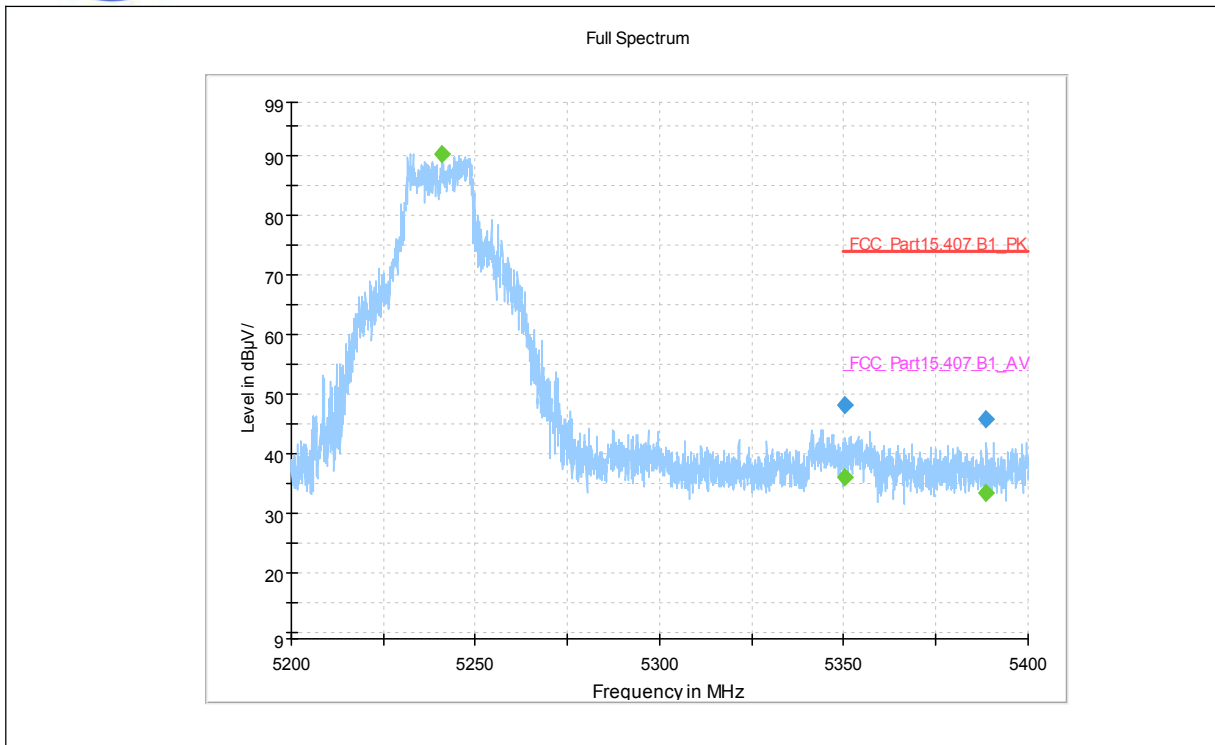
| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5086.050000     | 44.53            | ---              | 74.00          | 29.47       | V   | -3.0         |
| 5086.050000     | ---              | 31.82            | 54.00          | 22.18       | V   | -3.0         |
| 5158.300000     | 70.62            | ---              | 74.00          | 3.38        | V   | -3.2         |
| 5158.300000     | ---              | 47.66            | 54.00          | 6.34        | V   | -3.2         |
| 5180.550000     | ---              | 89.62            | ---            | ---         | V   | -3.1         |
| 5180.550000     | 98.20            | ---              | ---            | ---         | V   | -3.1         |



(802.11n (HT20) \_5240MHz, Antenna Horizontal)

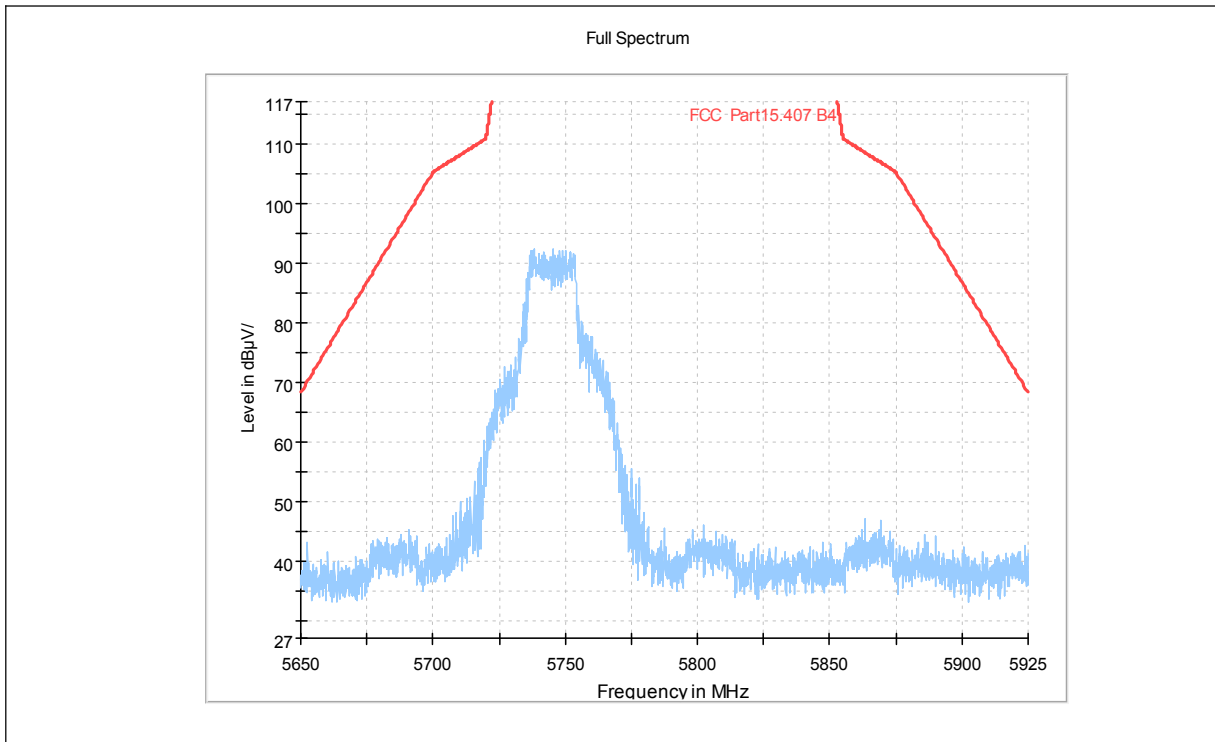
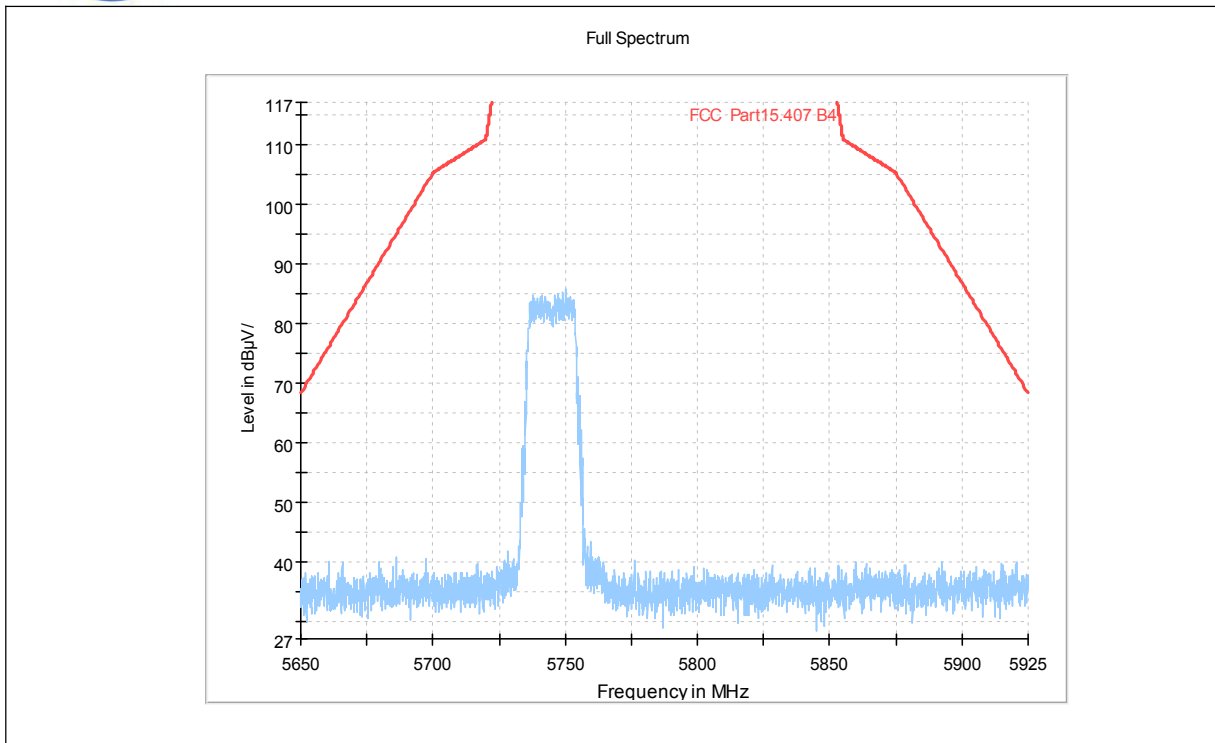
| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5241.150000     | ---              | 76.31            | ---            | ---         | H   | -3.1         |
| 5241.150000     | 85.38            | ---              | ---            | ---         | H   | -3.1         |
| 5350.650000     | 43.00            | ---              | 74.00          | 31.00       | H   | -2.5         |
| 5350.650000     | ---              | 29.96            | 54.00          | 24.04       | H   | -2.5         |
| 5398.200000     | 42.22            | ---              | 74.00          | 31.78       | H   | -2.5         |
| 5398.200000     | ---              | 29.75            | 54.00          | 24.25       | H   | -2.5         |

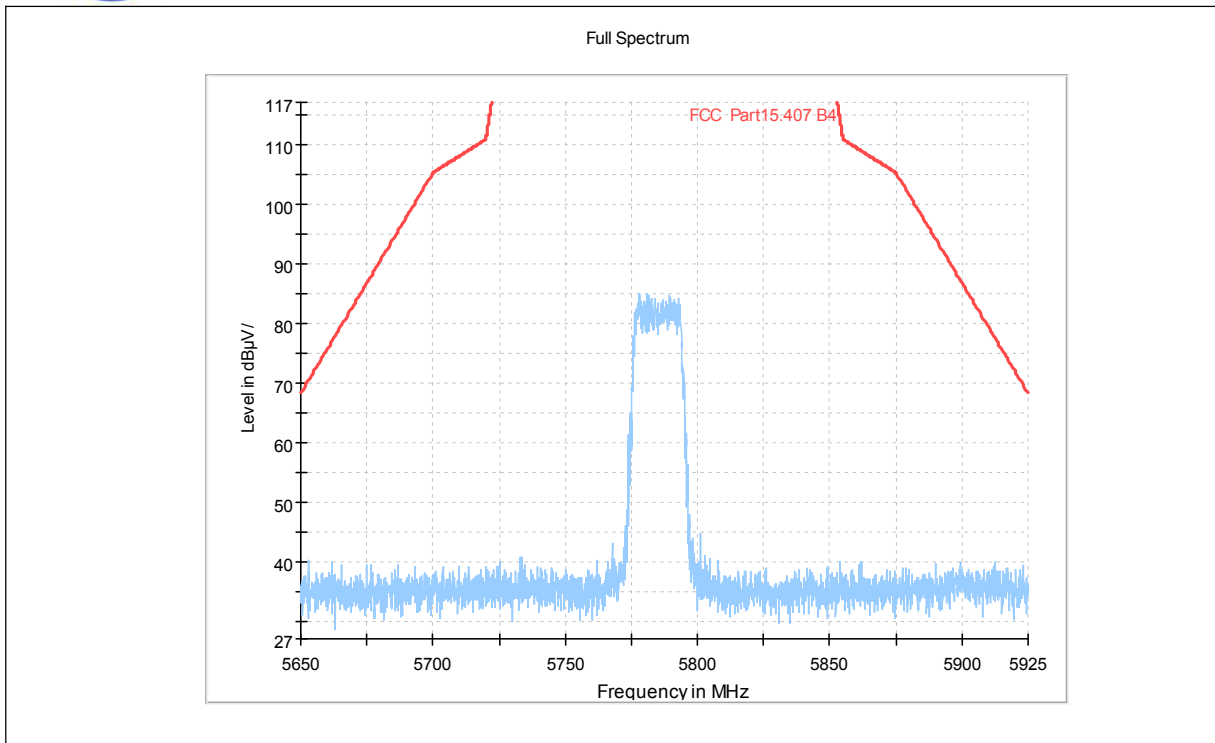




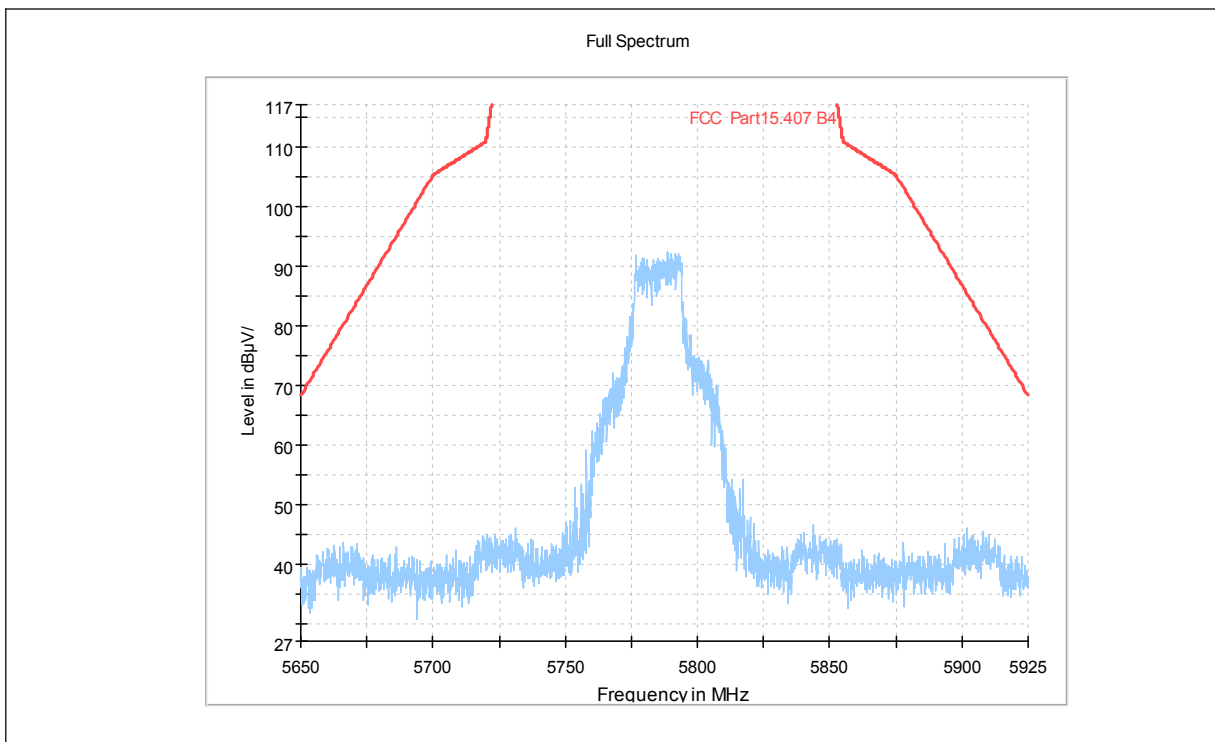
(802.11n (HT20) \_5240MHz, Antenna Vertical)

| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5240.700000     | ---              | 90.35            | ---            | ---         | V   | -3.1         |
| 5240.700000     | 99.14            | ---              | ---            | ---         | V   | -3.1         |
| 5350.250000     | ---              | 36.11            | 54.00          | 17.89       | V   | -2.5         |
| 5350.250000     | 48.10            | ---              | 74.00          | 25.90       | V   | -2.5         |
| 5388.700000     | ---              | 33.35            | 54.00          | 20.65       | V   | -2.4         |
| 5388.700000     | 45.87            | ---              | 74.00          | 28.13       | V   | -2.4         |

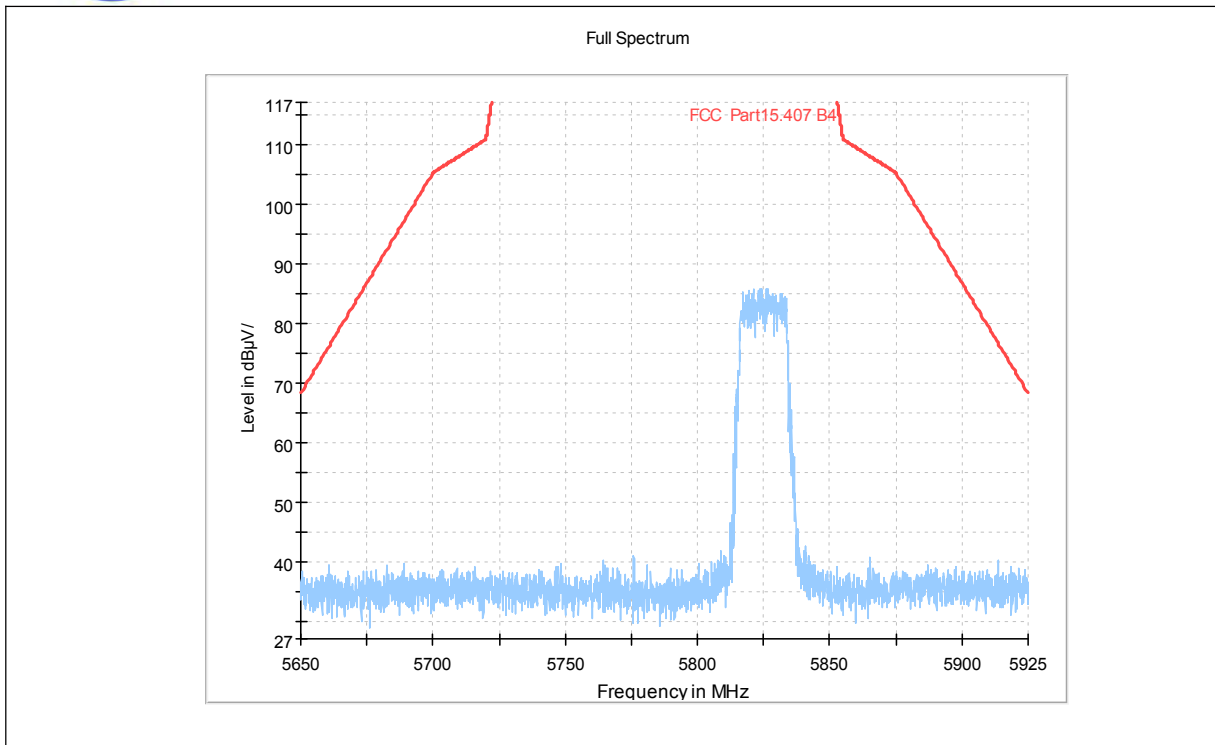




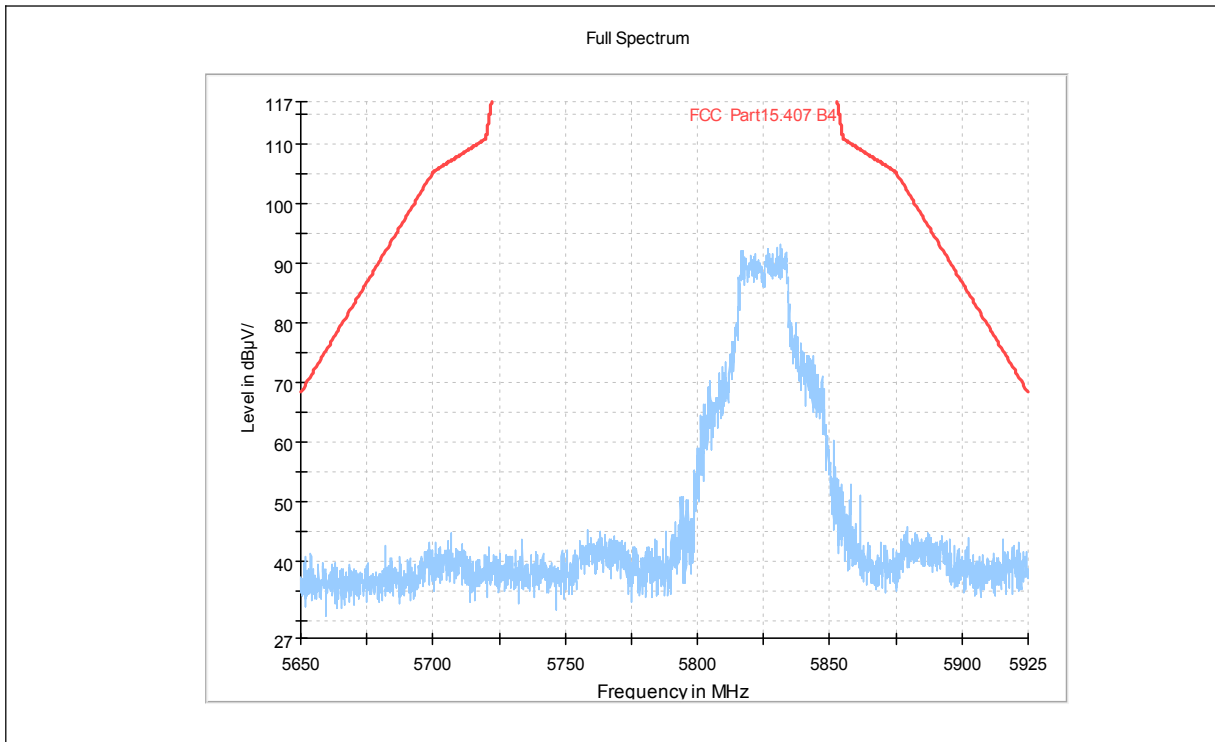
(802.11n(HT20)\_5785MHz, Antenna Horizontal)



(802.11n(HT20)\_5785MHz, Antenna Vertical)



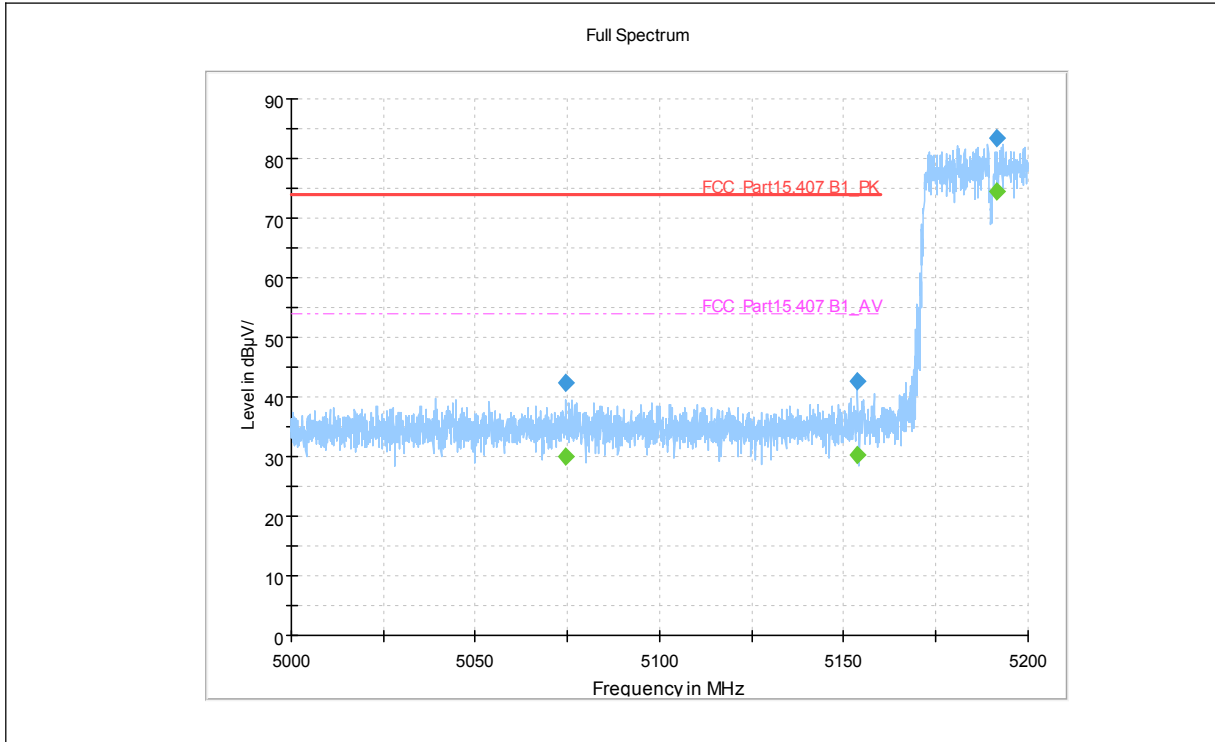
(802.11n(HT20)\_5825MHz, Antenna Horizontal)



(802.11n(HT20)\_5825MHz, Antenna Vertical)

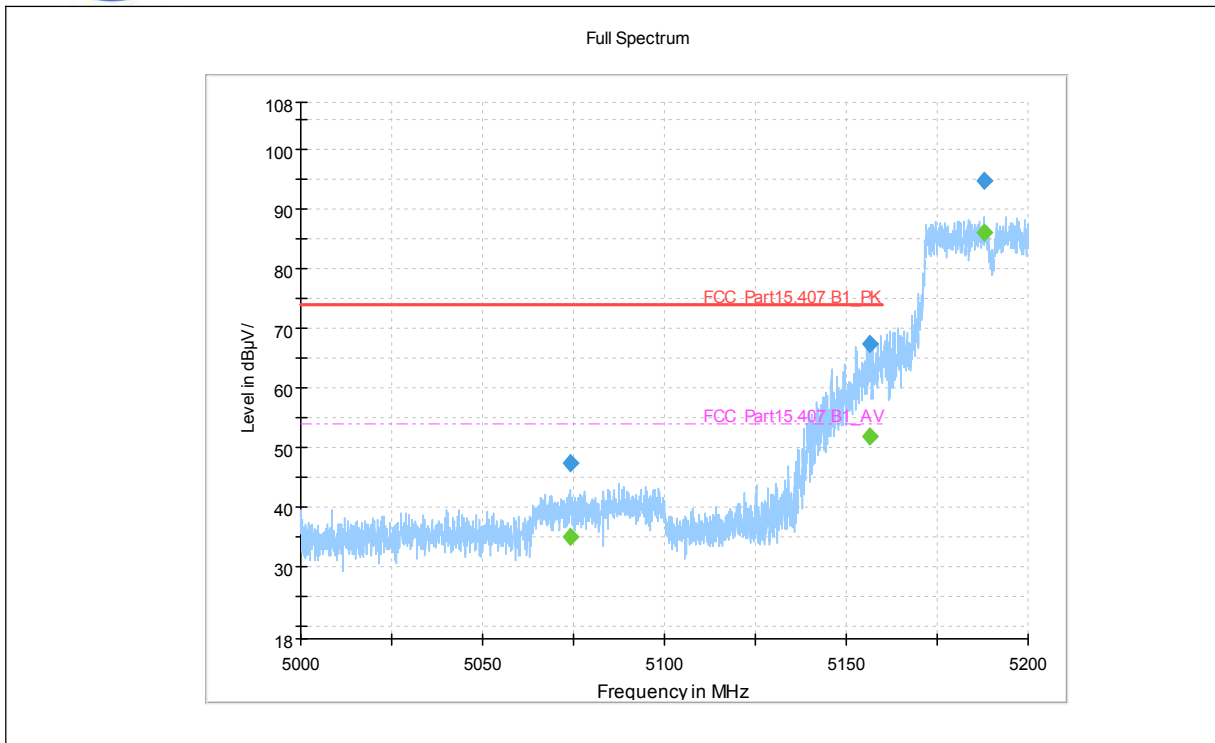


802.11n (HT40) Test mode



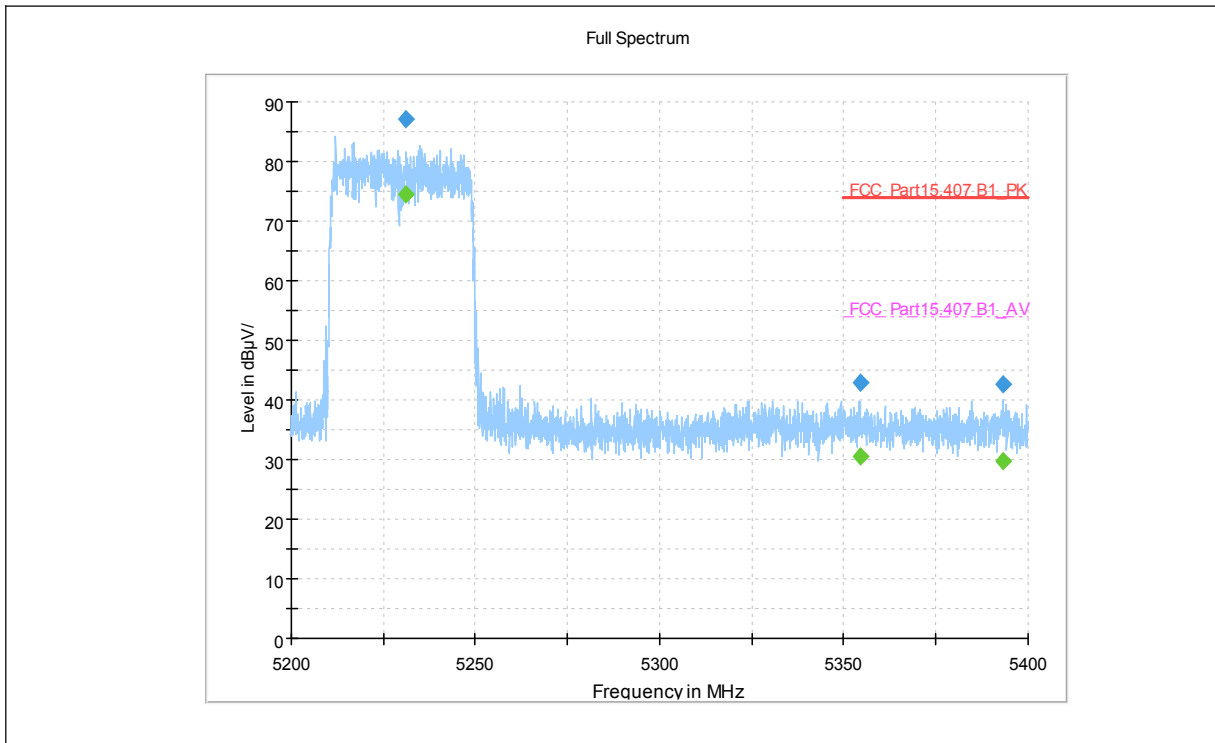
(802.11n (HT40) \_5190MHz, Antenna Horizontal)

| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5074.450000     | ---              | 30.00            | 54.00          | 24.00       | H   | -3.0         |
| 5074.450000     | 42.28            | ---              | 74.00          | 31.72       | H   | -3.0         |
| 5153.750000     | ---              | 30.13            | 54.00          | 23.87       | H   | -3.2         |
| 5153.750000     | 42.70            | ---              | 74.00          | 31.30       | H   | -3.2         |
| 5191.600000     | ---              | 74.47            | ---            | ---         | H   | -3.0         |
| 5191.600000     | 83.48            | ---              | ---            | ---         | H   | -3.0         |



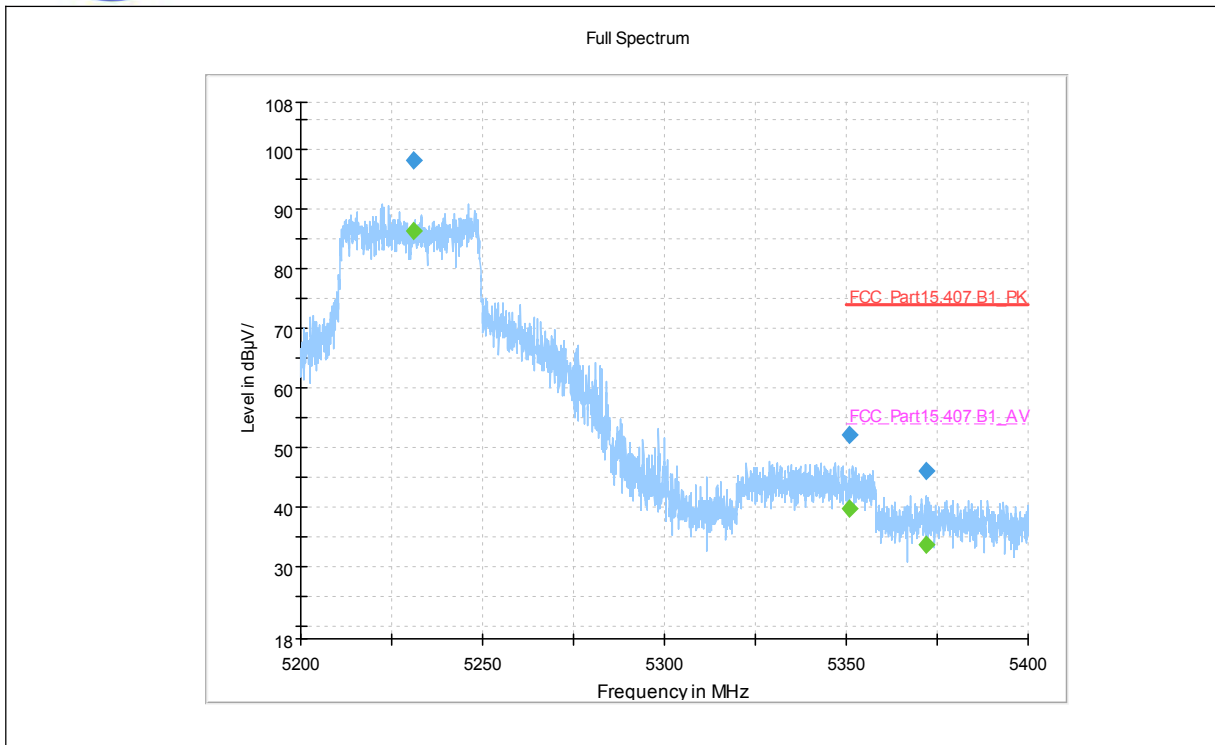
(802.11n (HT40) \_5190MHz, Antenna Vertical)

| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5074.100000     | ---              | 35.17            | 54.00          | 18.83       | V   | -3.0         |
| 5074.100000     | 47.42            | ---              | 74.00          | 26.58       | V   | -3.0         |
| 5156.300000     | ---              | 51.84            | 54.00          | 2.16        | V   | -3.2         |
| 5156.300000     | 67.40            | ---              | 74.00          | 6.60        | V   | -3.2         |
| 5188.000000     | ---              | 86.03            | ---            | ---         | V   | -3.1         |
| 5188.000000     | 94.80            | ---              | ---            | ---         | V   | -3.1         |



(802.11n (HT40) \_5230MHz, Antenna Horizontal)

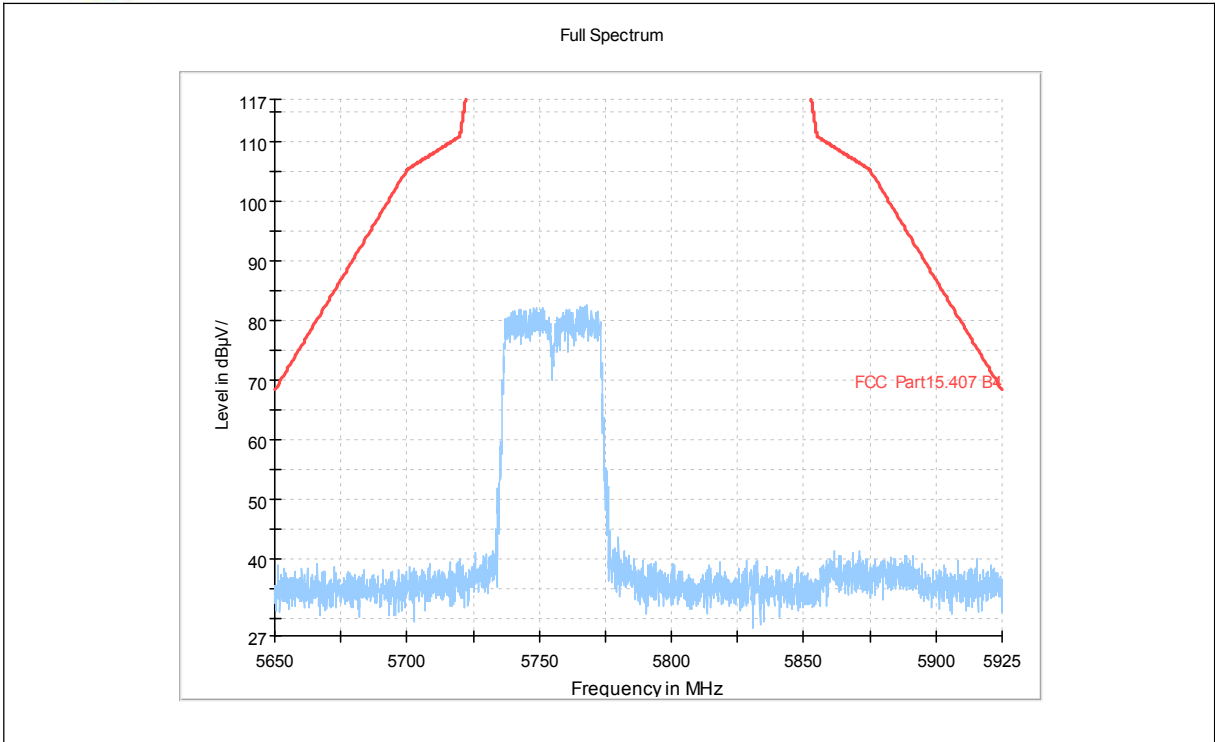
| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5231.150000     | 87.06            | ---              | ---            | ---         | H   | -3.0         |
| 5231.150000     | ---              | 74.54            | ---            | ---         | H   | -3.0         |
| 5354.300000     | 42.98            | ---              | 74.00          | 31.03       | H   | -2.5         |
| 5354.300000     | ---              | 30.40            | 54.00          | 23.60       | H   | -2.5         |
| 5393.250000     | ---              | 29.82            | 54.00          | 24.18       | H   | -2.4         |
| 5393.250000     | 42.60            | ---              | 74.00          | 31.40       | H   | -2.4         |



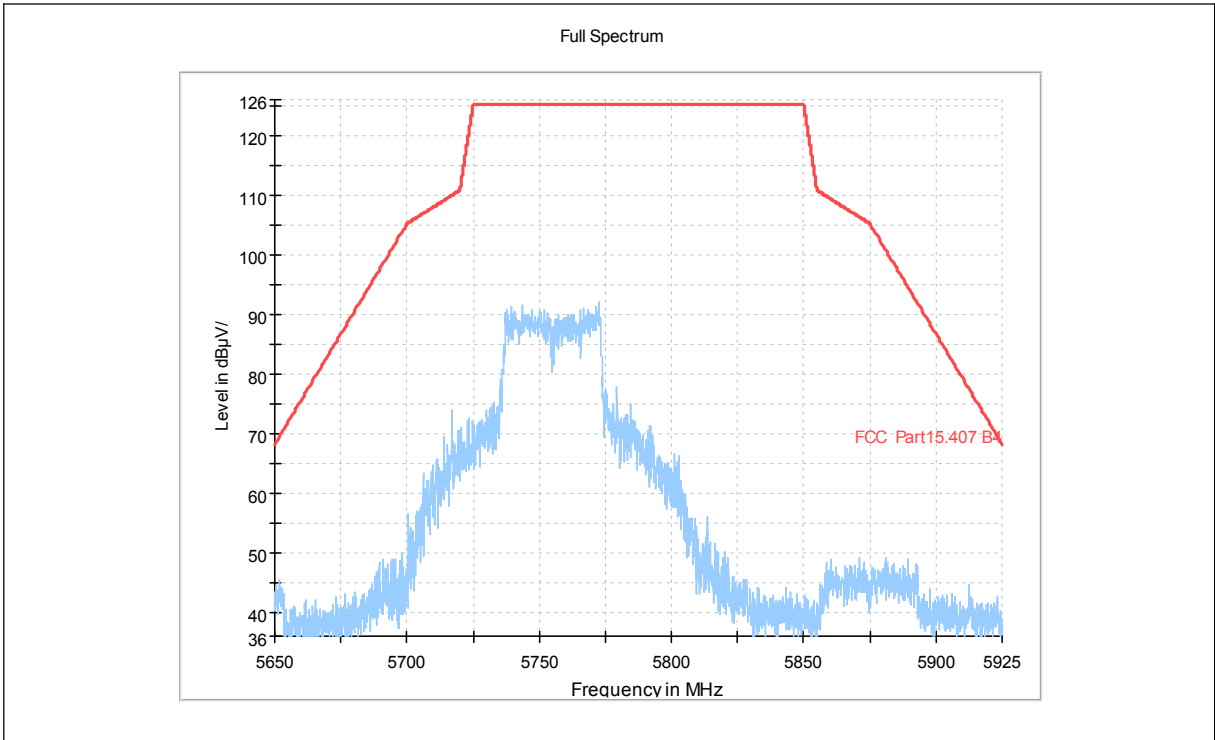
(802.11n (HT40) \_5230MHz, Antenna Vertical)

| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5230.900000     | 98.35            | ---              | ---            | ---         | V   | -3.0         |
| 5230.900000     | ---              | 86.32            | ---            | ---         | V   | -3.0         |
| 5350.700000     | 52.26            | ---              | 74.00          | 21.74       | V   | -2.5         |
| 5350.700000     | ---              | 39.71            | 54.00          | 14.29       | V   | -2.5         |
| 5371.950000     | ---              | 33.71            | 54.00          | 20.29       | V   | -2.3         |
| 5371.950000     | 46.12            | ---              | 74.00          | 27.88       | V   | -2.3         |

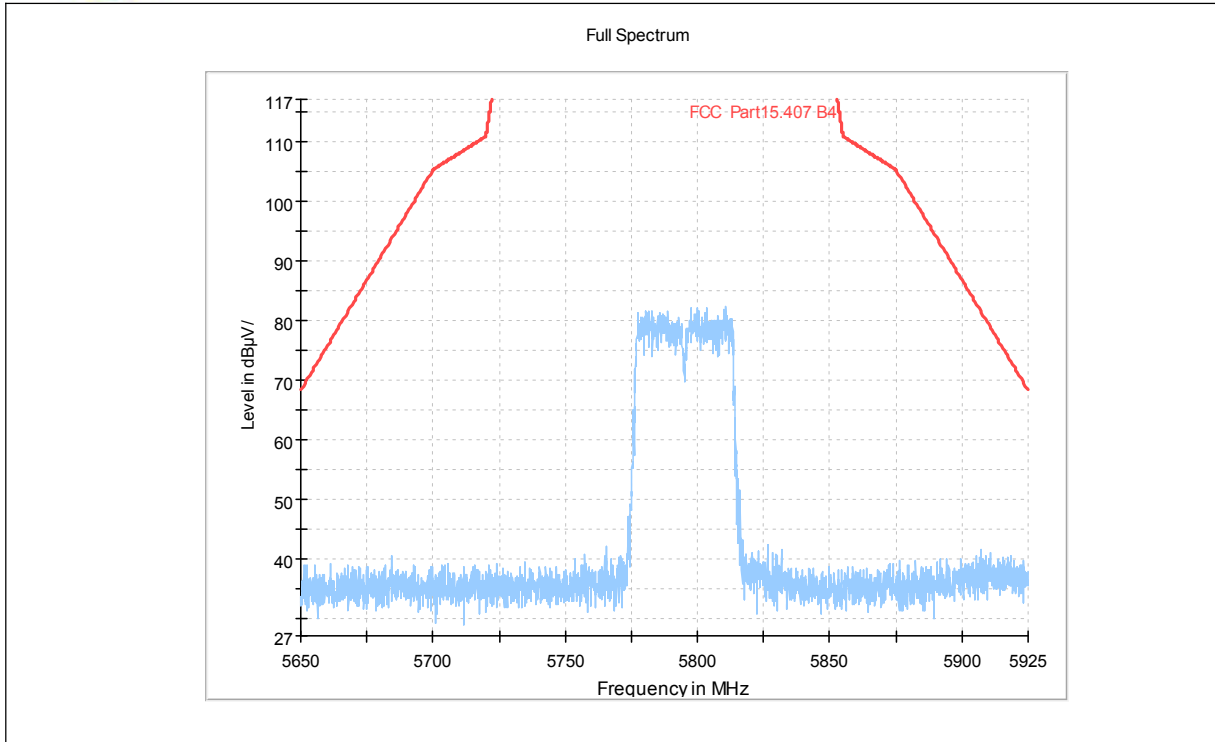




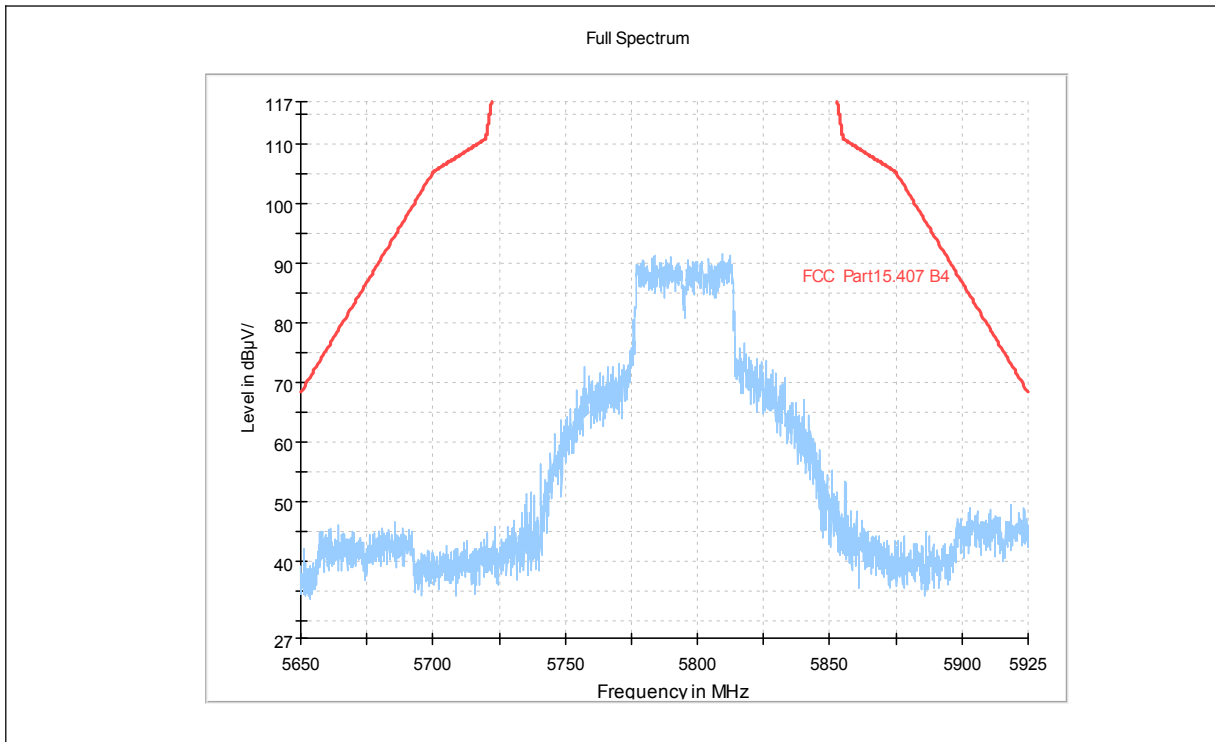
(802.11n(HT40)\_5755MHz, Antenna Horizontal)



(802.11n(HT40)\_5755MHz, Antenna Vertical)



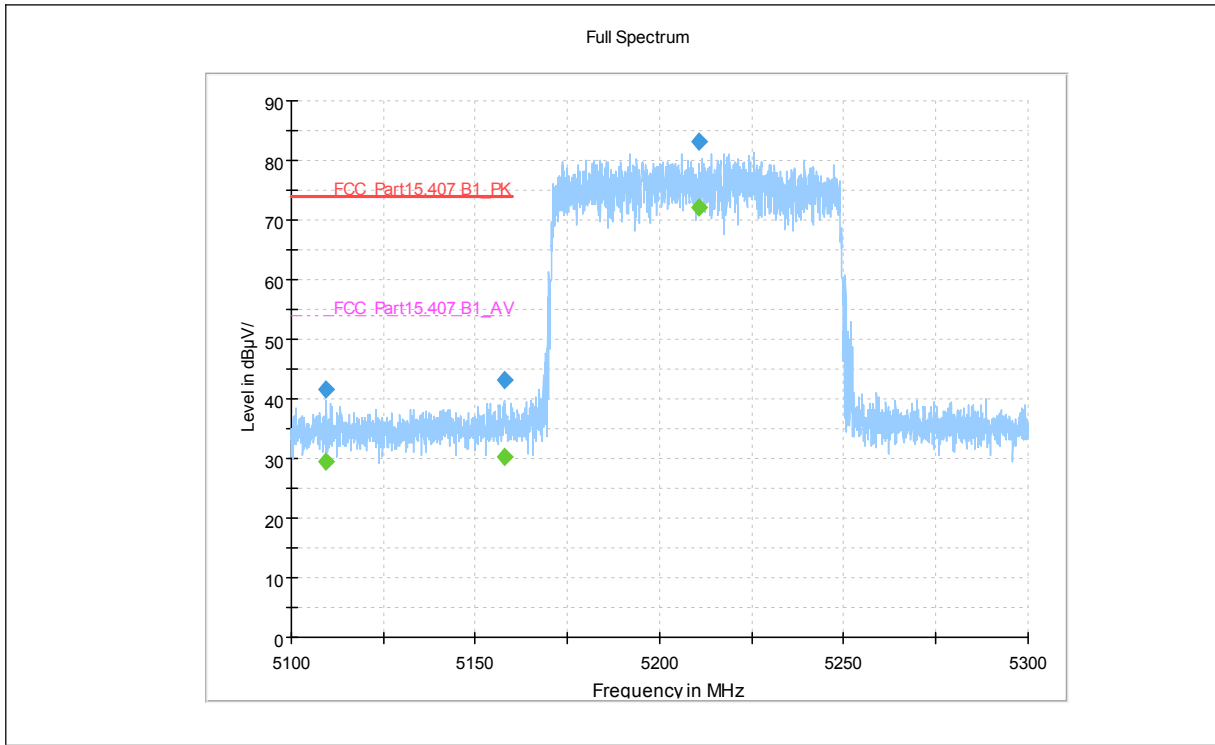
(802.11n(HT40)\_5795MHz, Antenna Horizontal)



(802.11n(HT40)\_5795MHz, Antenna Vertical)

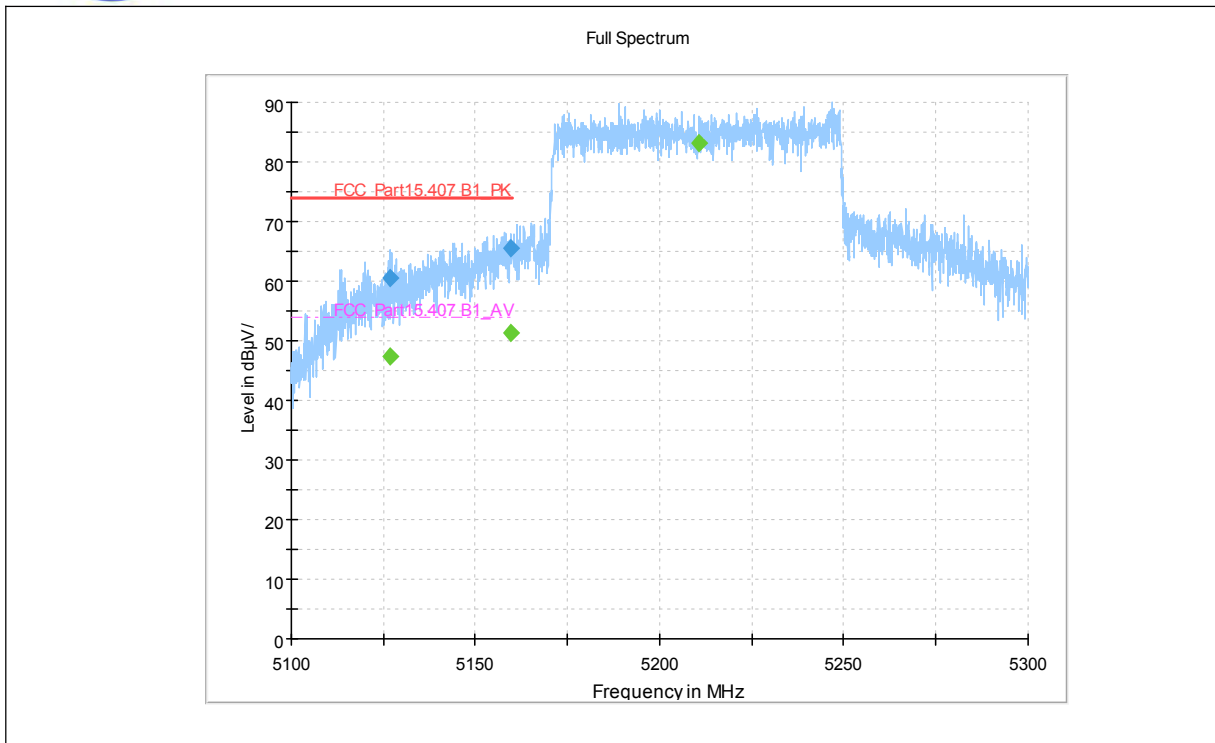


802.11ac (HT80) Test mode



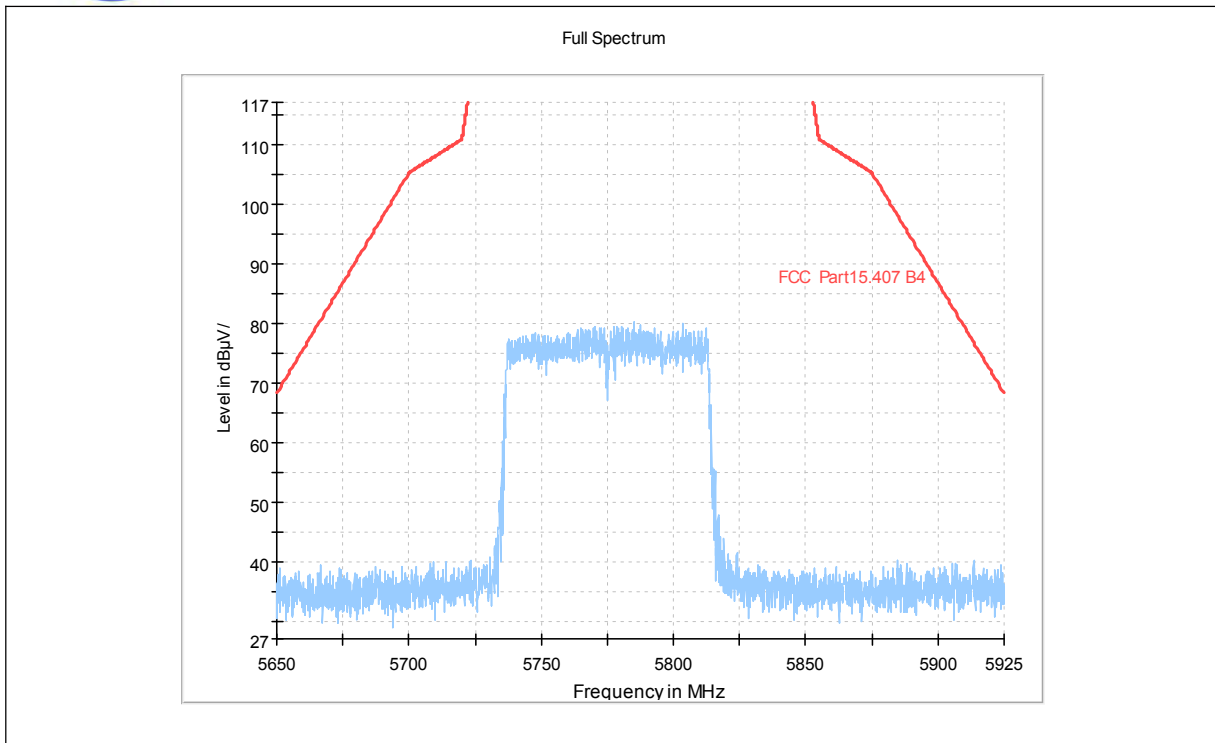
(802.11ac (HT80) \_5210MHz, Antenna Horizontal)

| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5109.500000     | ---              | 29.36            | 54.00          | 24.64       | H   | -3.1         |
| 5109.500000     | 41.46            | ---              | 74.00          | 32.54       | H   | -3.1         |
| 5157.700000     | ---              | 30.21            | 54.00          | 23.79       | H   | -3.2         |
| 5157.700000     | 43.26            | ---              | 74.00          | 30.74       | H   | -3.2         |
| 5210.800000     | ---              | 72.13            | ---            | ---         | H   | -3.0         |
| 5210.800000     | 83.28            | ---              | ---            | ---         | H   | -3.0         |

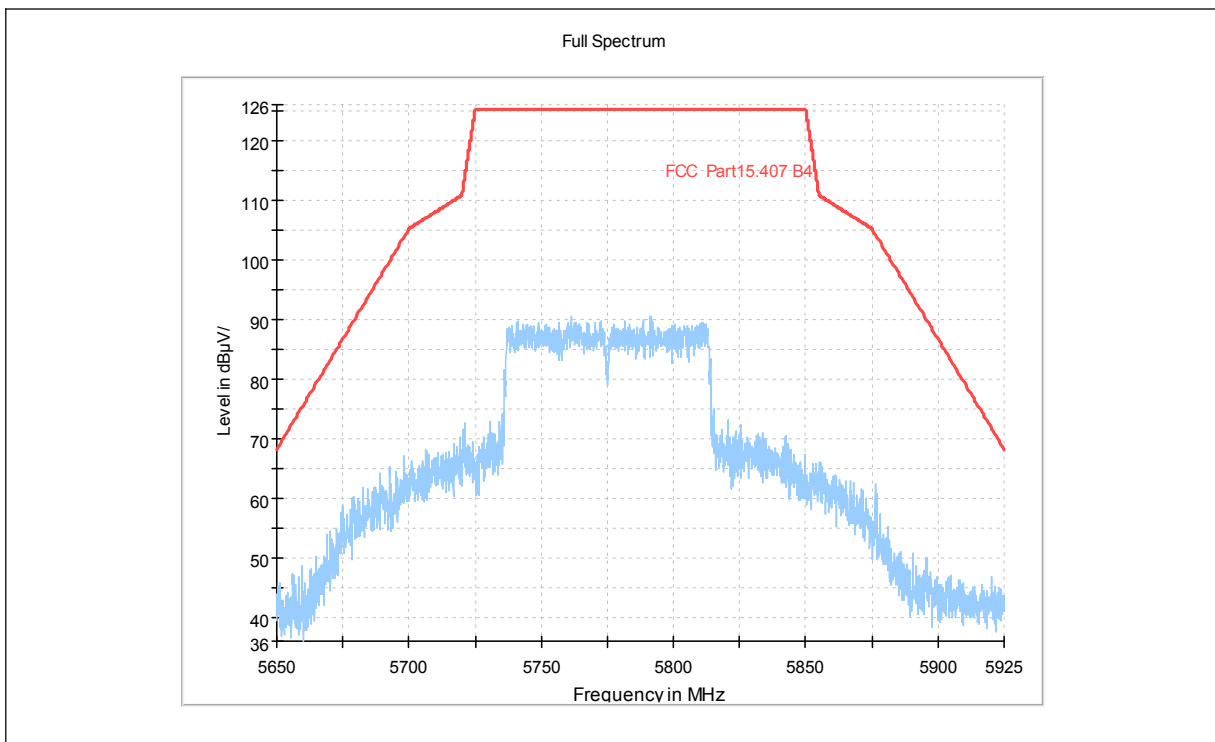


(802.11ac (HT80) \_5210MHz, Antenna Vertical)

| Frequency (MHz) | MaxPeak (dBµV/m) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB/m) |
|-----------------|------------------|------------------|----------------|-------------|-----|--------------|
| 5127.000000     | ---              | 47.37            | 54.00          | 6.63        | V   | -3.1         |
| 5127.000000     | 60.51            | ---              | 74.00          | 13.49       | V   | -3.1         |
| 5159.700000     | 65.46            | ---              | 74.00          | 8.54        | V   | -3.2         |
| 5159.700000     | ---              | 51.45            | 54.00          | 2.55        | V   | -3.2         |
| 5210.550000     | 94.10            | ---              | ---            | ---         | V   | -3.0         |
| 5210.550000     | ---              | 83.14            | ---            | ---         | V   | -3.0         |



(802.11ac(HT80)\_5775MHz, Antenna Horizontal)



(802.11ac(HT80)\_5775MHz, Antenna Vertical)