

### 3. 26 dB Bandwidth & 99 % Bandwidth

#### 3.1. Test Setup



#### 3.2. Limit

None; for reporting purpose only.

#### 3.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

##### 3.3.1. 26 dB Bandwidth

1. This measurement settings are specified in section C.1 of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set RBW: approximately 1 % of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. 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 %.

### 3.3.2. 99 % Bandwidth

#### 3.3.2.1 FCC

1. This measurement settings are specified in section D of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set center frequency to the nominal EUT channel center frequency.
3. Set span = 1.5 times to 5.0 times the OBW.
4. Set RBW = 1 % to 5 % of the OBW.
5. Set VBW  $\geq 3 \times$  RBW.
6. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
7. Use the 99 % power bandwidth function of the instrument (if available).
8. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99 % occupied bandwidth is the difference between these two frequencies.

In the result,

- DFS requirements are not applicable in the 5 150 MHz ~ 5 250 MHz.

#### 3.3.2.2 IC

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

**Note:** It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99 % emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99 % emission bandwidth).

### 3.4. Test result

Ambient temperature : (23 ± 1) °C  
Relative humidity : 47 % R.H.

#### Test mode: 11a

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | 26 dB Bandwidth (MHz) |        | 99 % Bandwidth (MHz) |        |
|---------|-----------------|-----|------------------|-----------------------|--------|----------------------|--------|
|         |                 |     |                  | ANT 1                 | ANT 2  | ANT 1                | ANT 2  |
| U-NII 1 | 5 180           | 36  | 6                | 21.129                | 21.129 | 17.019               | 17.019 |
|         | 5 220           | 44  |                  | 21.129                | 20.955 | 17.077               | 17.077 |
|         | 5 240           | 48  |                  | 21.071                | 21.303 | 17.077               | 17.077 |
| U-NII 3 | 5 745           | 149 |                  | 20.955                | 21.187 | 17.077               | 17.135 |
|         | 5 785           | 157 |                  | 21.071                | 20.839 | 17.135               | 17.135 |
|         | 5 825           | 165 |                  | 21.303                | 21.129 | 17.077               | 17.077 |

#### Test mode: 11n\_HT20

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | 26 dB Bandwidth (MHz) |        | 99 % Bandwidth (MHz) |        |
|---------|-----------------|-----|------------------|-----------------------|--------|----------------------|--------|
|         |                 |     |                  | ANT 1                 | ANT 2  | ANT 1                | ANT 2  |
| U-NII 1 | 5 180           | 36  | MCS8             | 21.476                | 21.418 | 18.119               | 17.887 |
|         | 5 220           | 44  |                  | 21.418                | 21.360 | 18.061               | 17.829 |
|         | 5 240           | 48  |                  | 21.650                | 21.303 | 18.119               | 17.829 |
| U-NII 3 | 5 745           | 149 |                  | 21.360                | 21.476 | 18.119               | 17.829 |
|         | 5 785           | 157 |                  | 21.360                | 21.245 | 18.119               | 17.829 |
|         | 5 825           | 165 |                  | 21.360                | 21.534 | 18.061               | 17.829 |

#### Test mode: 11n\_HT40

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | 26 dB Bandwidth (MHz) |        | 99 % Bandwidth (MHz) |        |
|---------|-----------------|-----|------------------|-----------------------|--------|----------------------|--------|
|         |                 |     |                  | ANT 1                 | ANT 2  | ANT 1                | ANT 2  |
| U-NII 1 | 5 190           | 38  | MCS8             | 40.174                | 39.479 | 36.237               | 36.237 |
|         | 5 230           | 46  |                  | 39.942                | 39.363 | 36.237               | 36.122 |
| U-NII 3 | 5 755           | 151 |                  | 40.058                | 39.595 | 36.237               | 36.122 |
|         | 5 795           | 159 |                  | 40.174                | 39.711 | 36.353               | 36.122 |

#### Test mode: 11ac\_VHT80

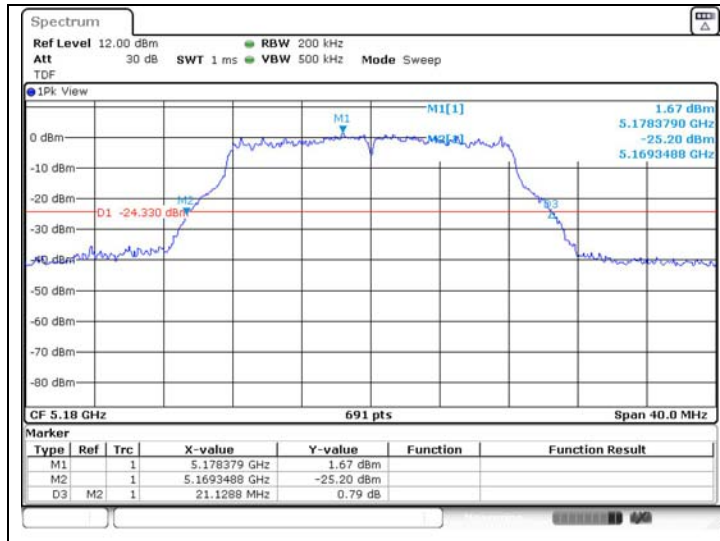
| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | 26 dB Bandwidth (MHz) |        | 99 % Bandwidth (MHz) |        |
|---------|-----------------|-----|------------------|-----------------------|--------|----------------------|--------|
|         |                 |     |                  | ANT 1                 | ANT 2  | ANT 1                | ANT 2  |
| U-NII 1 | 5 210           | 42  | MCS0             | 82.200                | 81.737 | 75.716               | 75.485 |
| U-NII 3 | 5 775           | 155 |                  | 81.968                | 81.968 | 75.716               | 75.485 |

### - Test plots

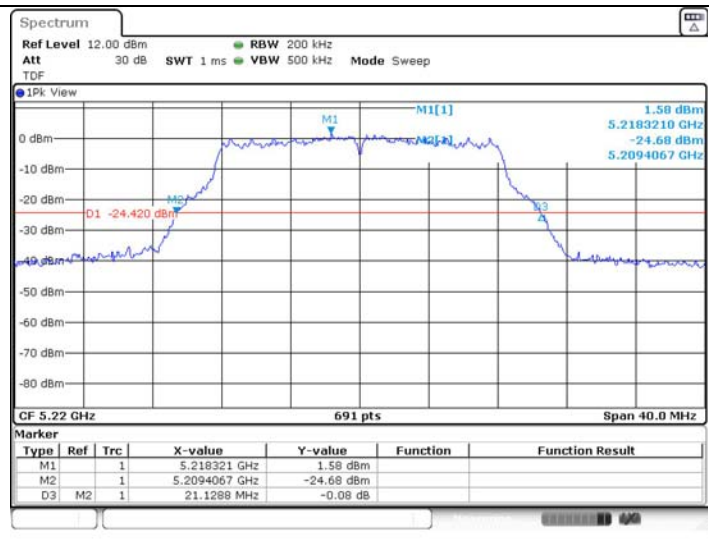
#### 26 dB Bandwidth

#### 802.11a (Band 1)\_ANT 1

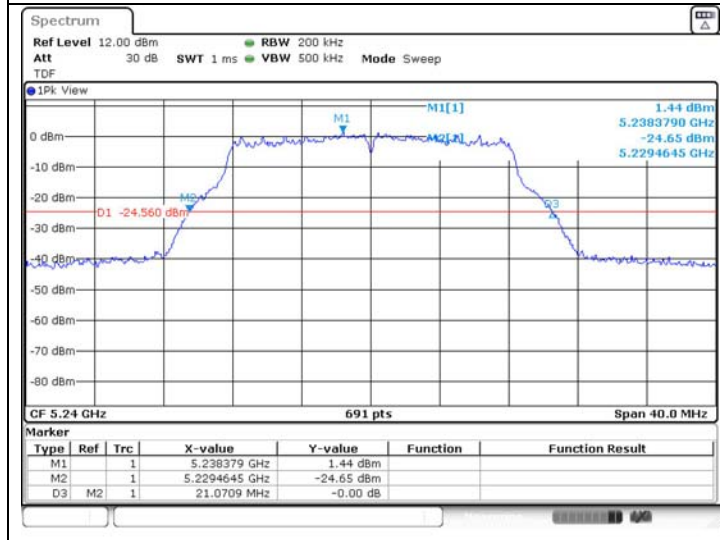
Low Channel  
(5 180 MHz)



Middle Channel  
(5 220 MHz)

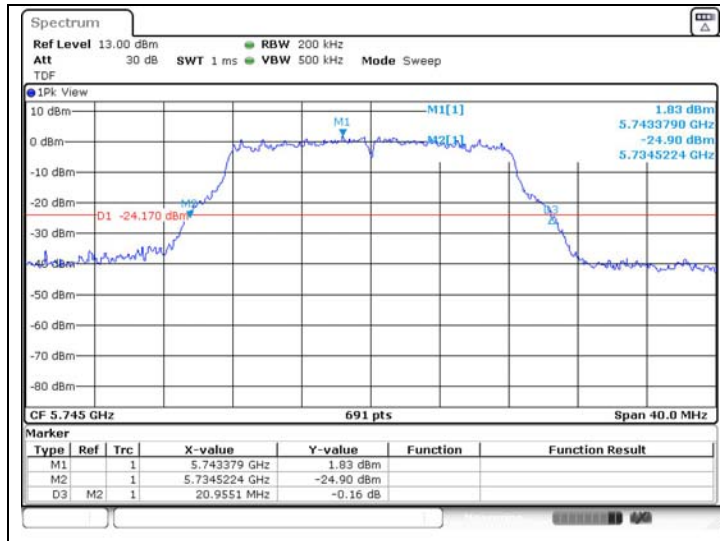


High Channel  
(5 240 MHz)

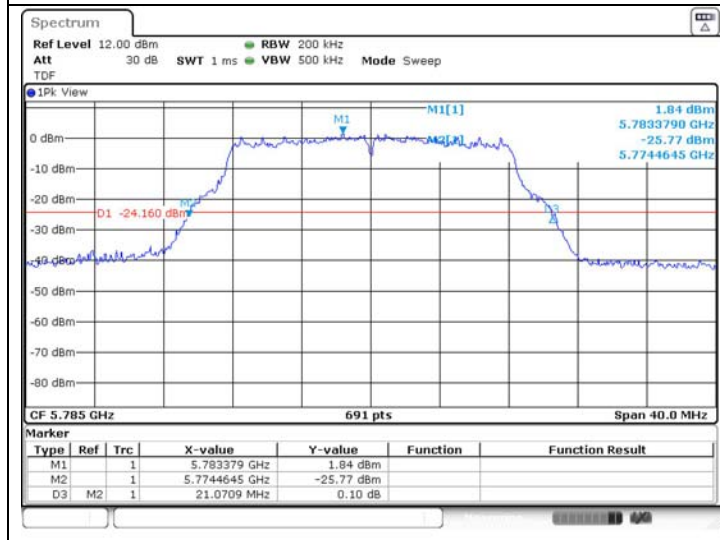


### 802.11a (Band 3)\_ANT 1

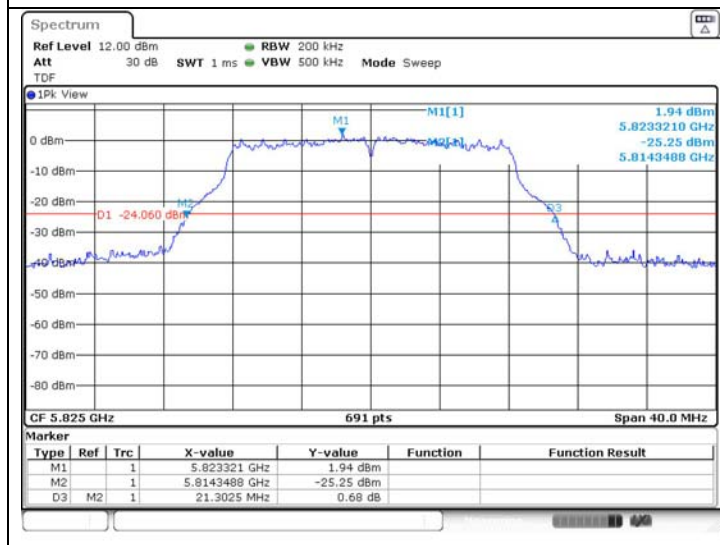
Low Channel  
 (5 745 MHz)



Middle Channel  
 (5 785 MHz)

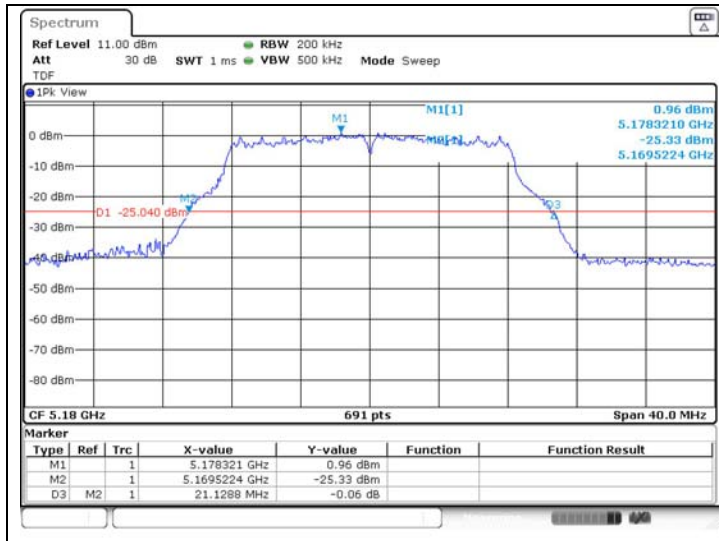


High Channel  
 (5 825 MHz)

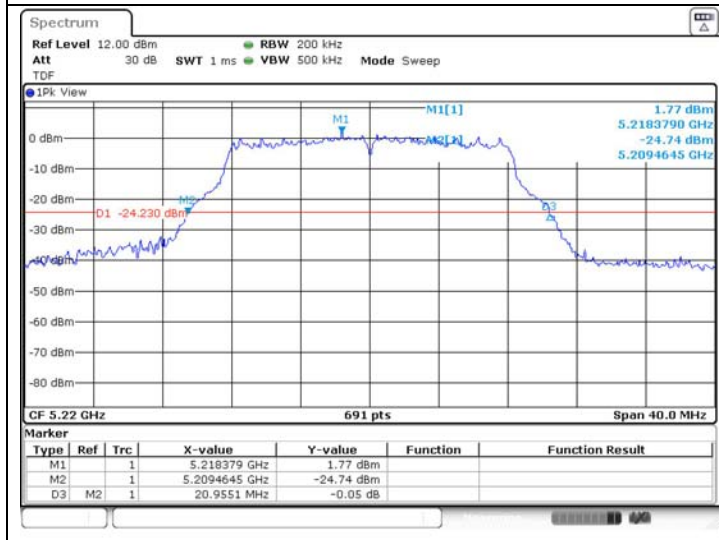


### 802.11a (Band 1)\_ANT 2

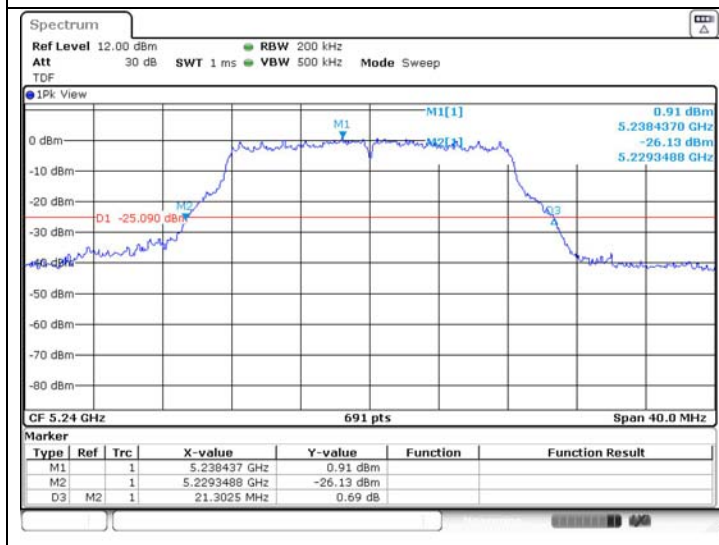
Low Channel  
 (5 180 MHz)



Middle Channel  
 (5 220 MHz)

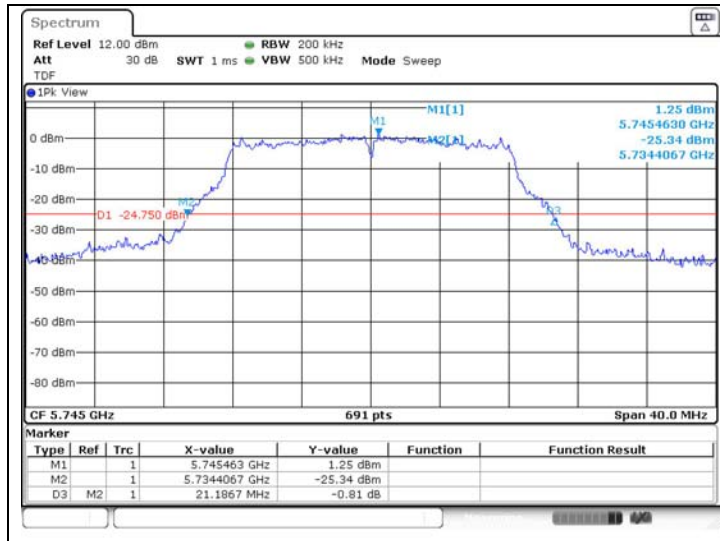


High Channel  
 (5 240 MHz)

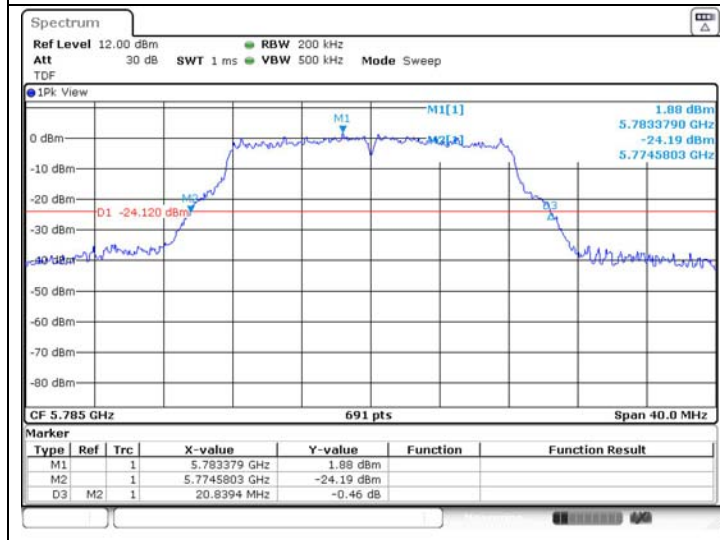


### 802.11a (Band 3)\_ANT 2

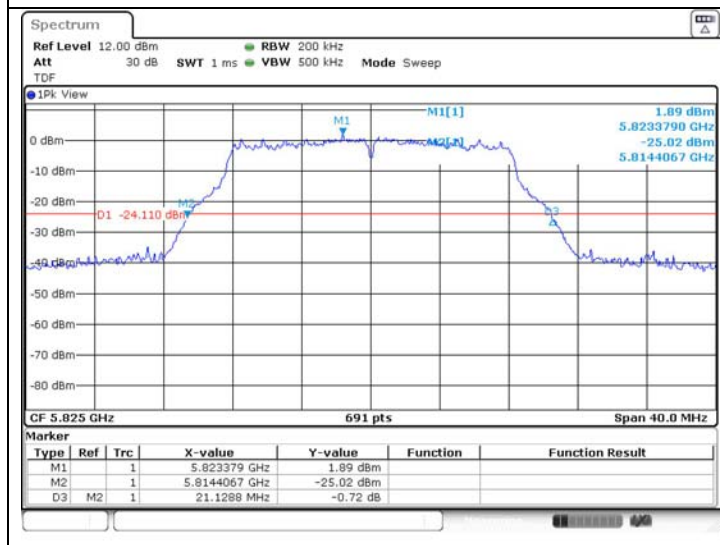
Low Channel  
 (5 745 MHz)



Middle Channel  
 (5 785 MHz)

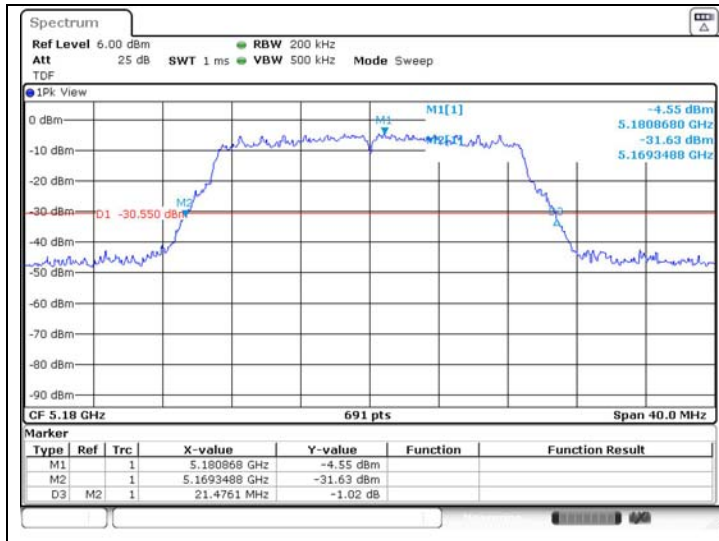


High Channel  
 (5 825 MHz)

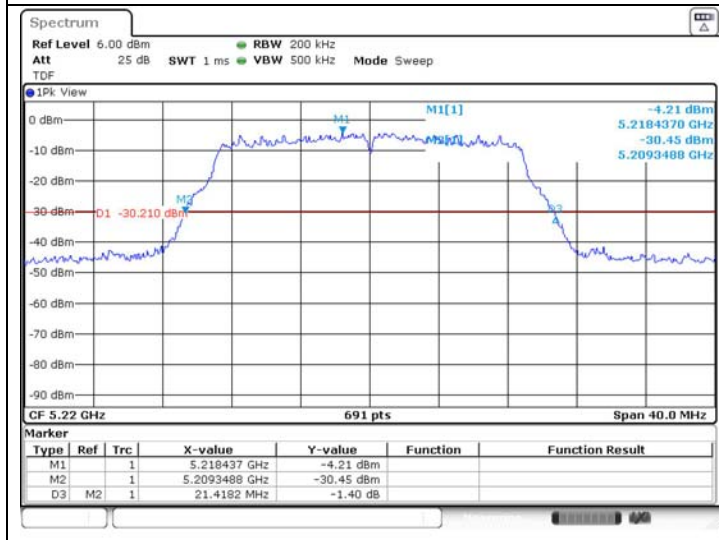


### 802.11n\_HT20 (Band 1)\_ANT 1

Low Channel  
(5 180 MHz)



Middle Channel  
(5 220 MHz)

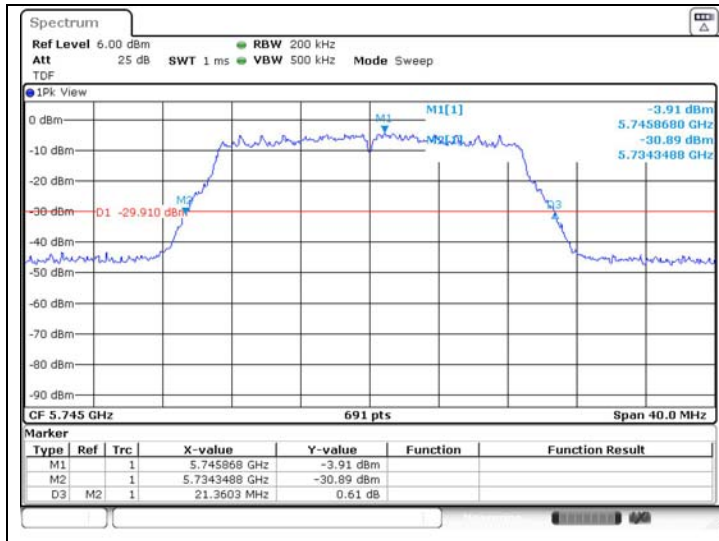


High Channel  
(5 240 MHz)

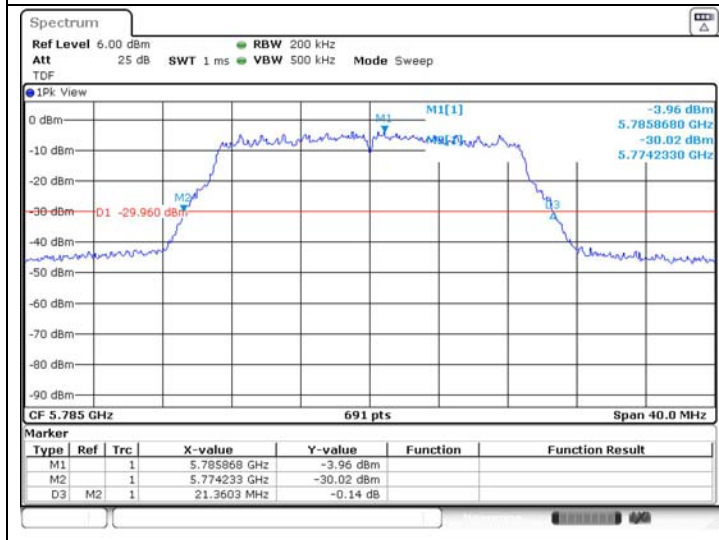


## 802.11n\_HT20 (Band 3)\_ANT 1

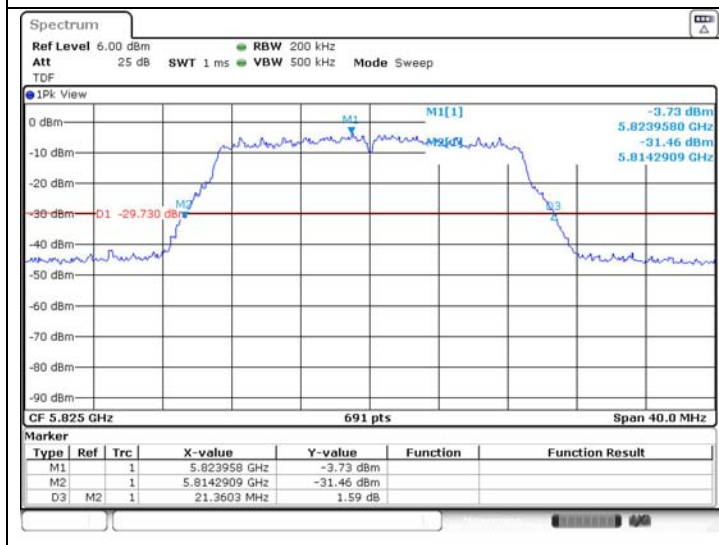
Low Channel  
(5 745 MHz)



Middle Channel  
(5 785 MHz)

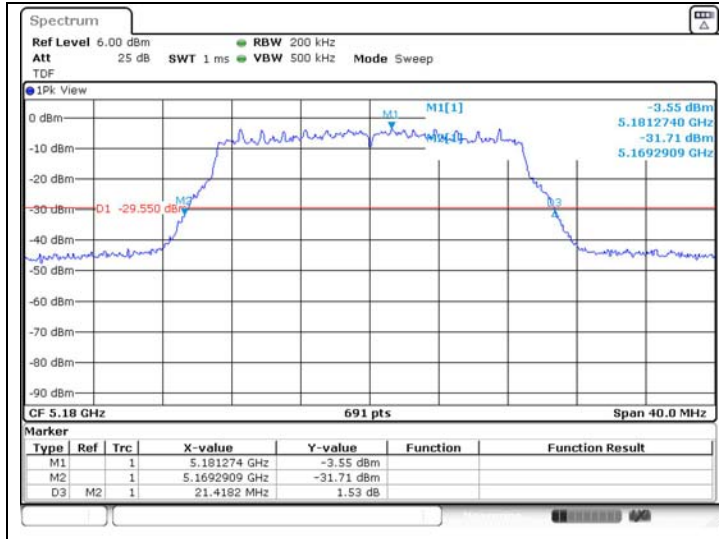


High Channel  
(5 825 MHz)

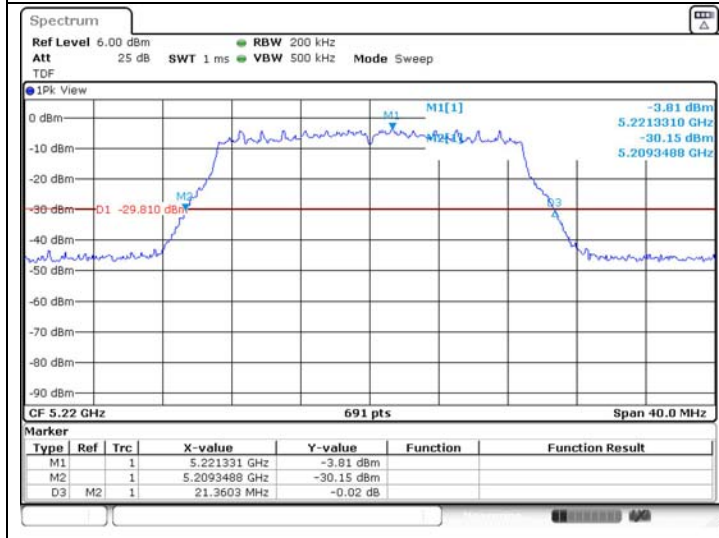


## 802.11n\_HT20 (Band 1)\_ANT 2

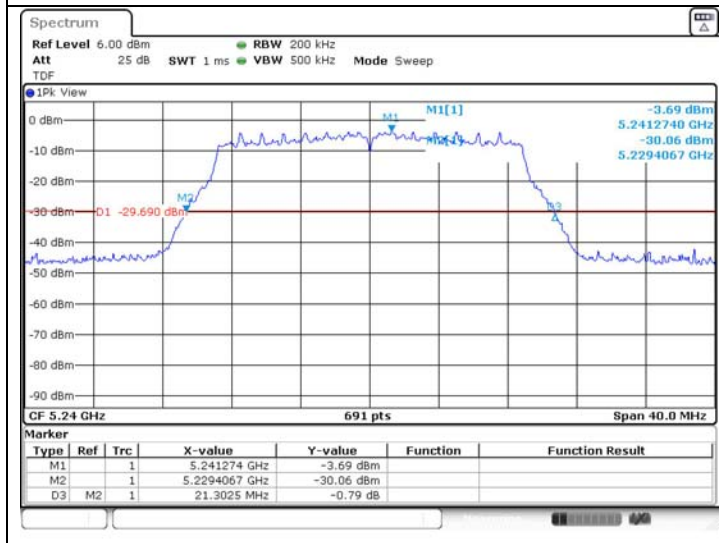
Low Channel  
(5 180 MHz)



Middle Channel  
(5 220 MHz)

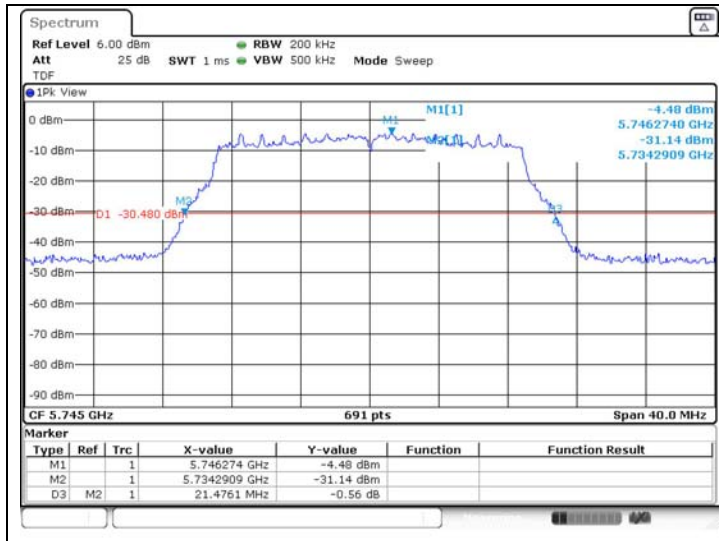


High Channel  
(5 240 MHz)

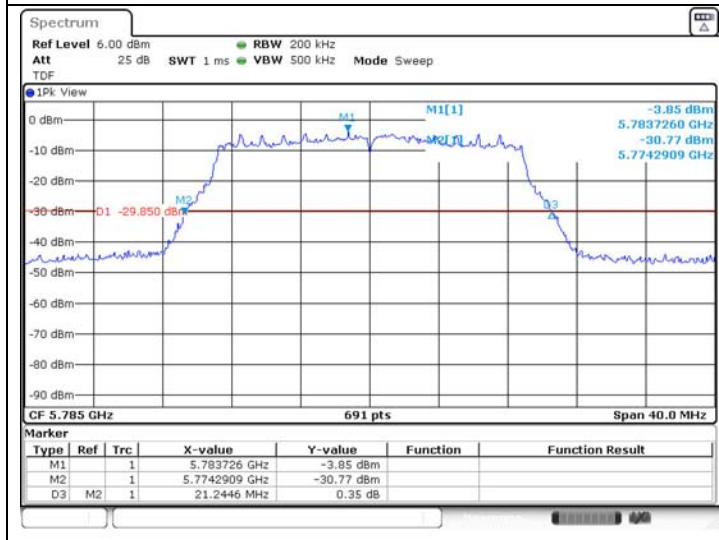


## 802.11n\_HT20 (Band 3)\_ANT 2

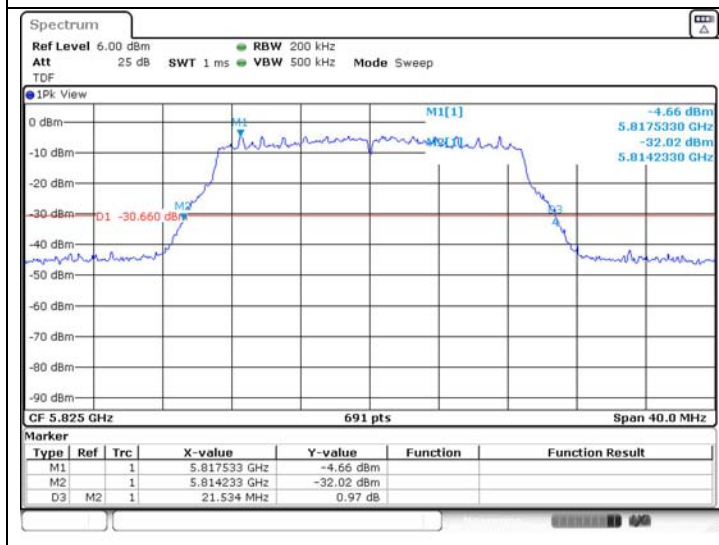
Low Channel  
(5 745 MHz)



Middle Channel  
(5 785 MHz)

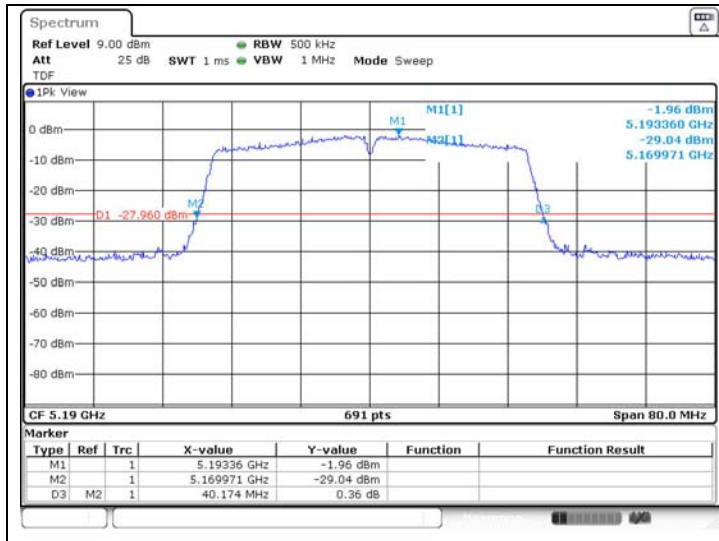


High Channel  
(5 825 MHz)

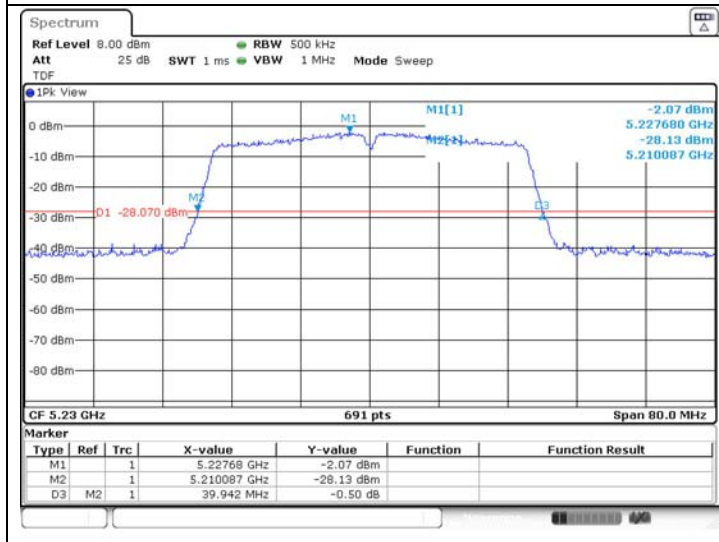


### 802.11n\_HT40 (Band 1)\_ANT 1

Low Channel  
 (5 190 MHz)

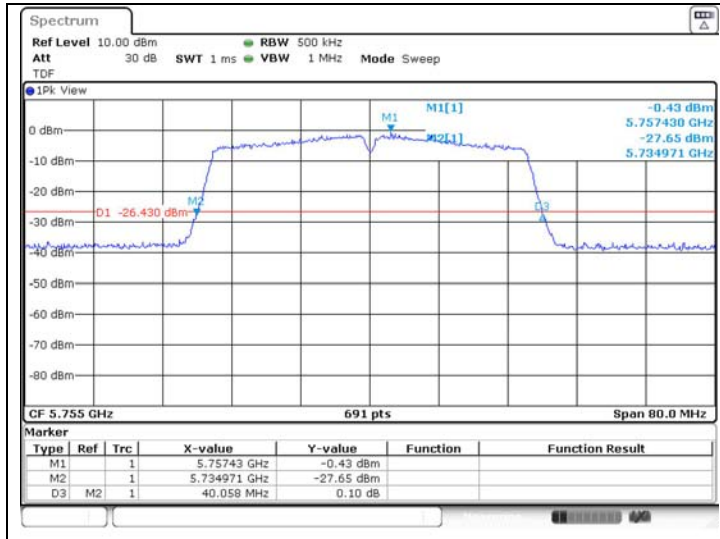


High Channel  
 (5 230 MHz)

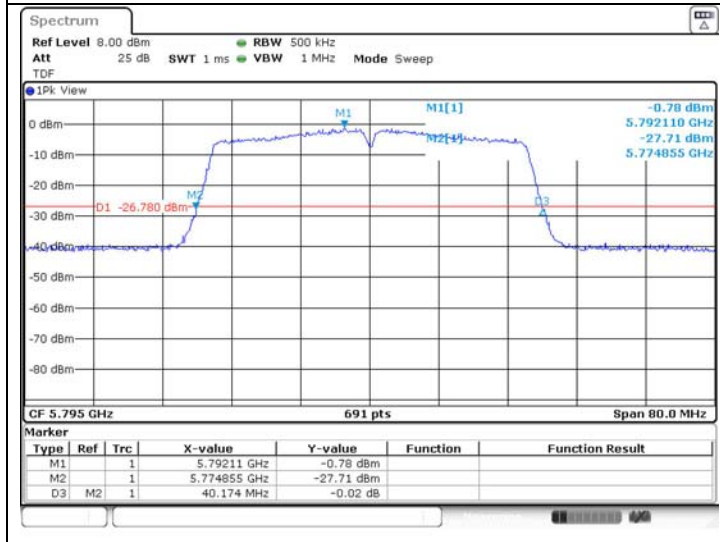


## 802.11n\_HT40 (Band 3)\_ANT 1

Low Channel  
(5 755 MHz)

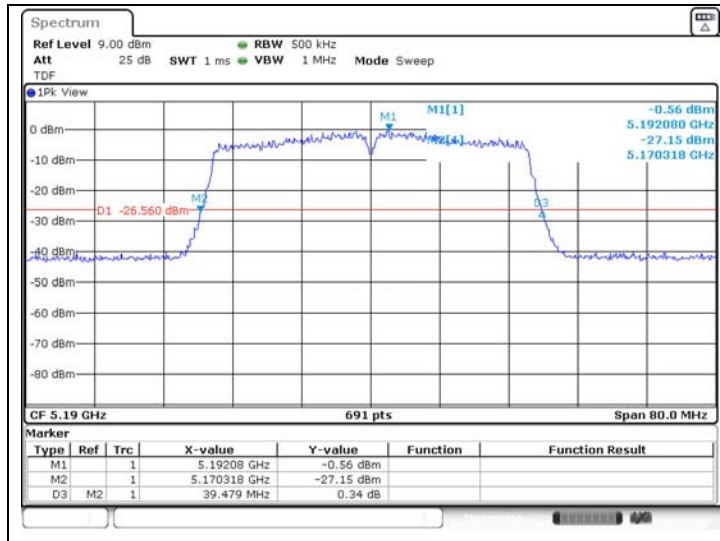


High Channel  
(5 795 MHz)

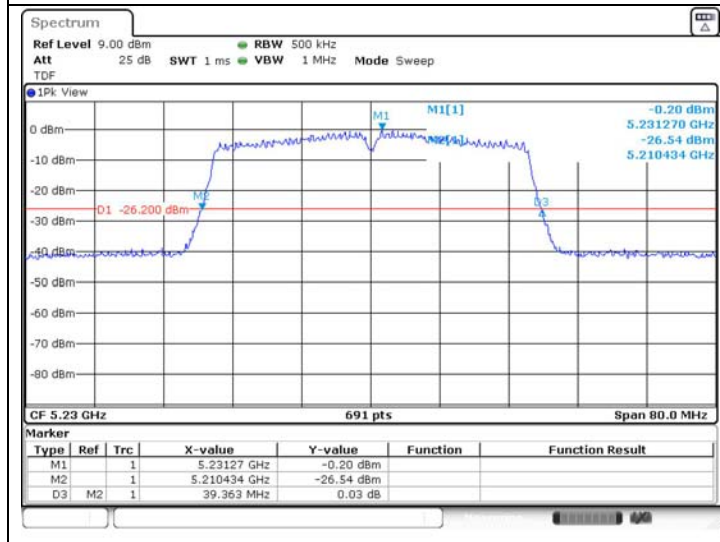


### 802.11n\_HT40 (Band 1)\_ANT 2

Low Channel  
(5 190 MHz)

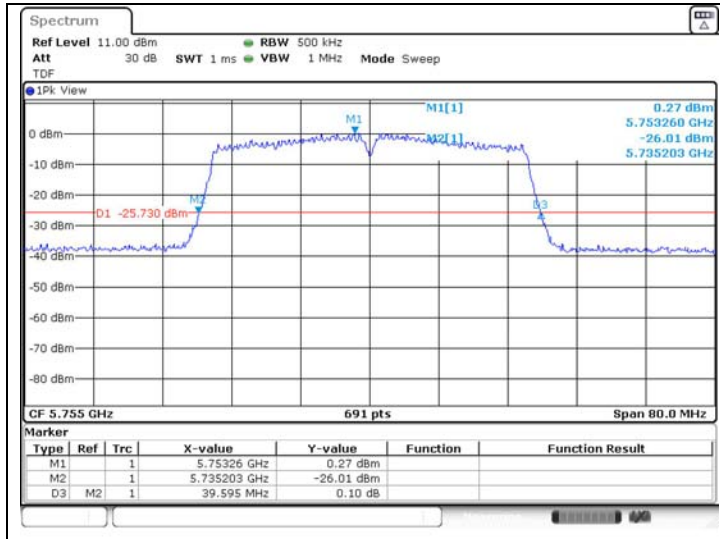


High Channel  
(5 230 MHz)

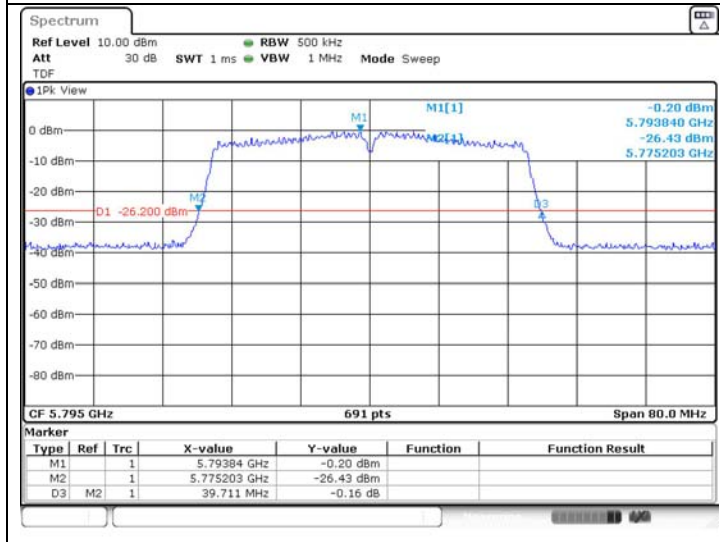


### 802.11n\_HT40 (Band 3)\_ANT 2

Low Channel  
(5 755 MHz)

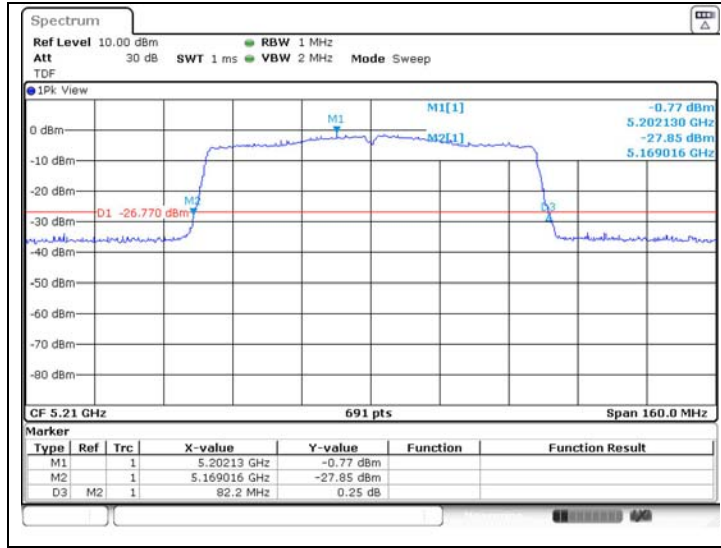


High Channel  
(5 795 MHz)



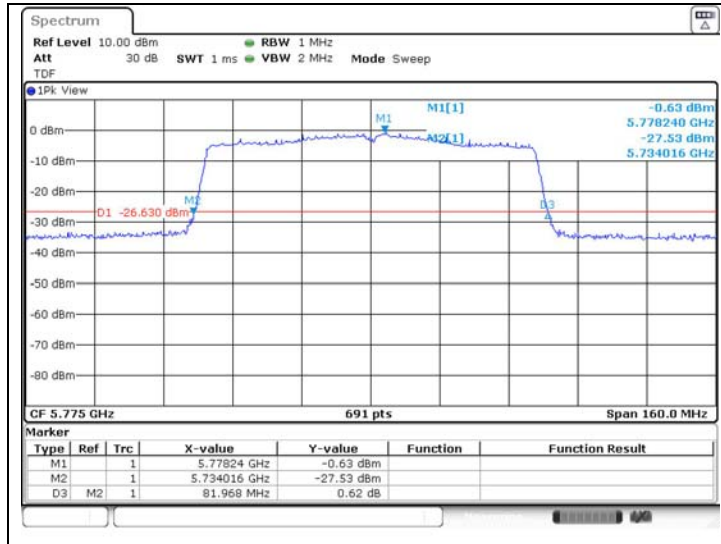
### 802.11ac\_VHT80 (Band 1)\_ANT 1

Middle Channel  
 (5 210 MHz)



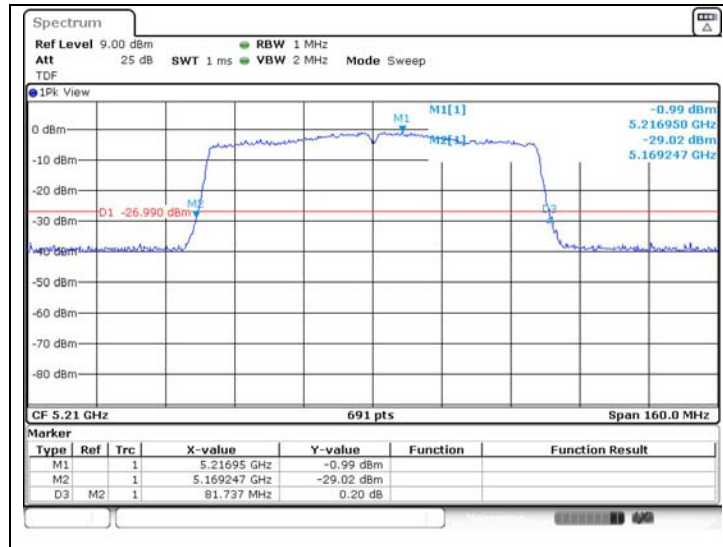
### 802.11ac\_VHT80 (Band 3)\_ANT 1

Middle Channel  
 (5 775 MHz)



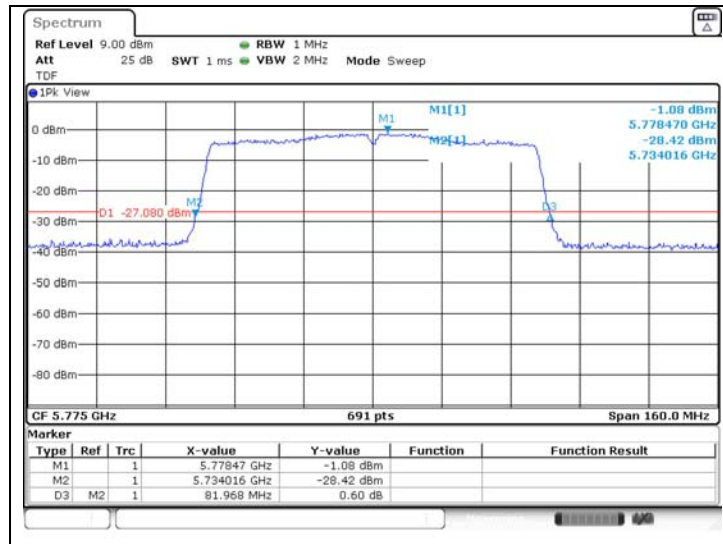
### 802.11ac\_VHT80 (Band 1)\_ANT 2

Middle Channel  
 (5 210 MHz)



### 802.11ac\_VHT80 (Band 3)\_ANT 2

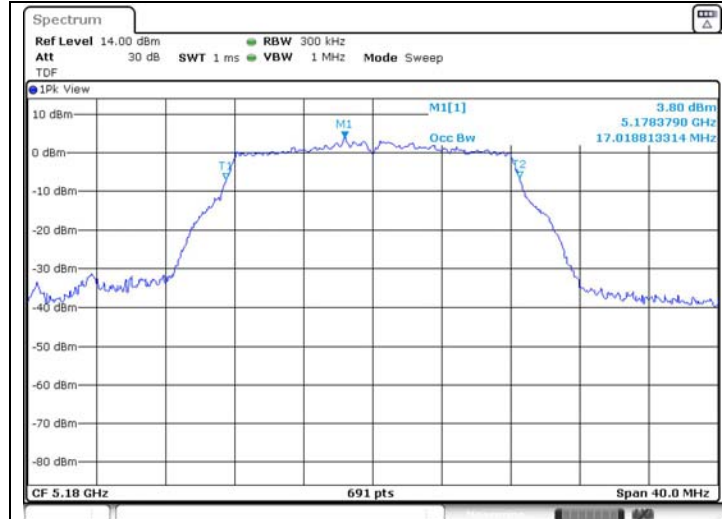
Middle Channel  
 (5 775 MHz)



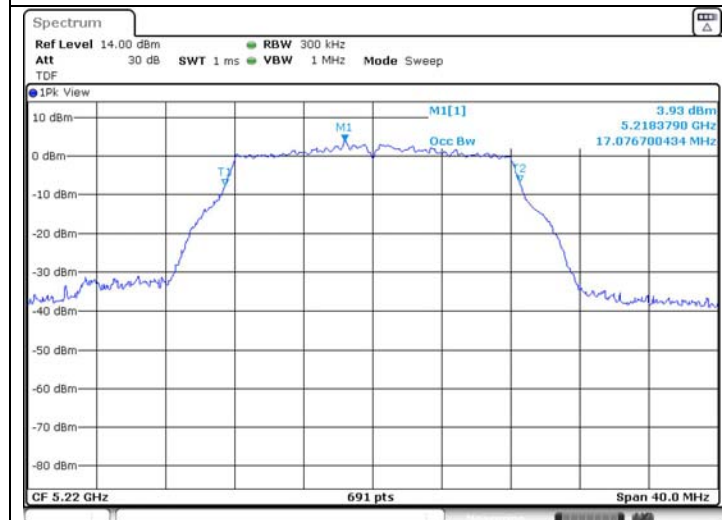
## 99 % Bandwidth

### 802.11a (Band 1)\_ANT 1

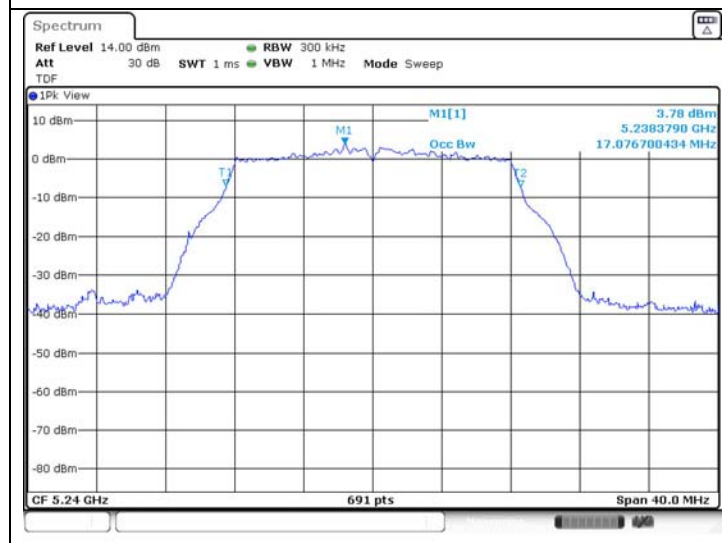
Low Channel  
 (5 180 MHz)



Middle Channel  
 (5 220 MHz)

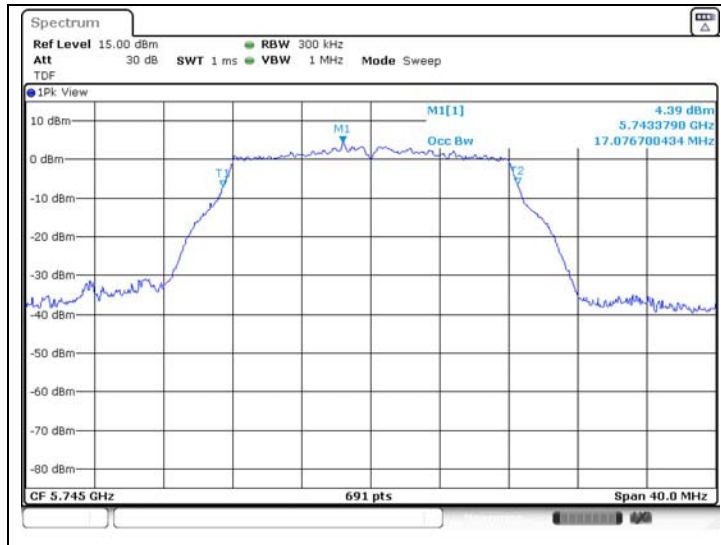


High Channel  
 (5 240 MHz)

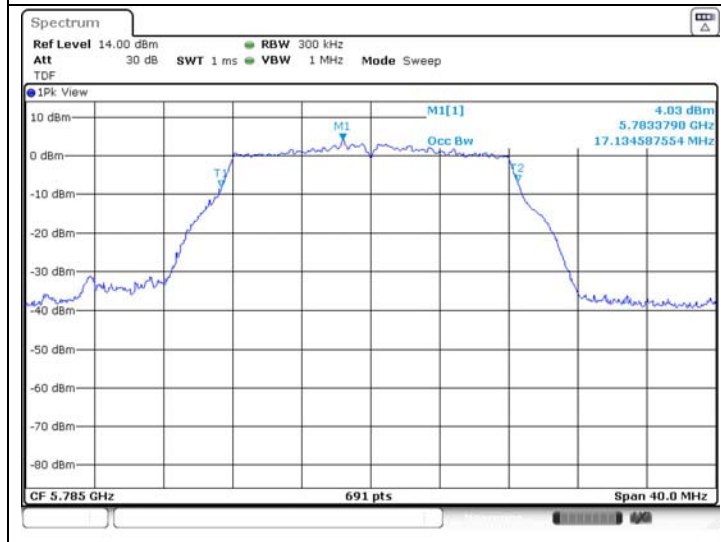


### 802.11a (Band 3)\_ANT 1

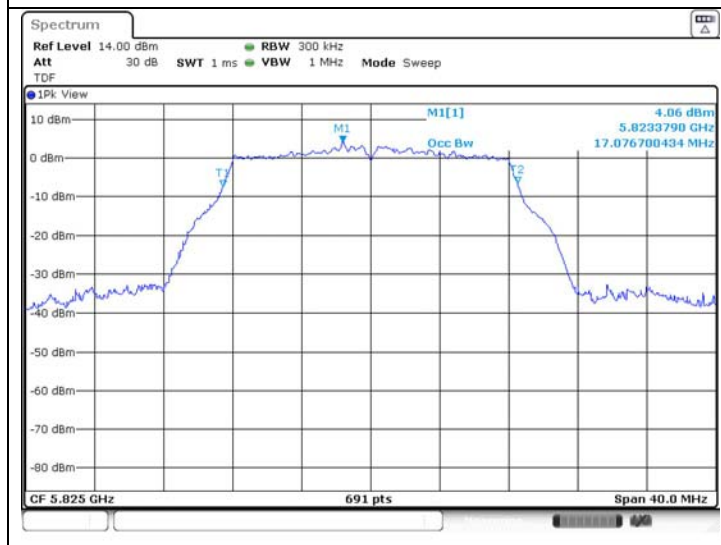
Low Channel  
 (5 745 MHz)



Middle Channel  
 (5 785 MHz)

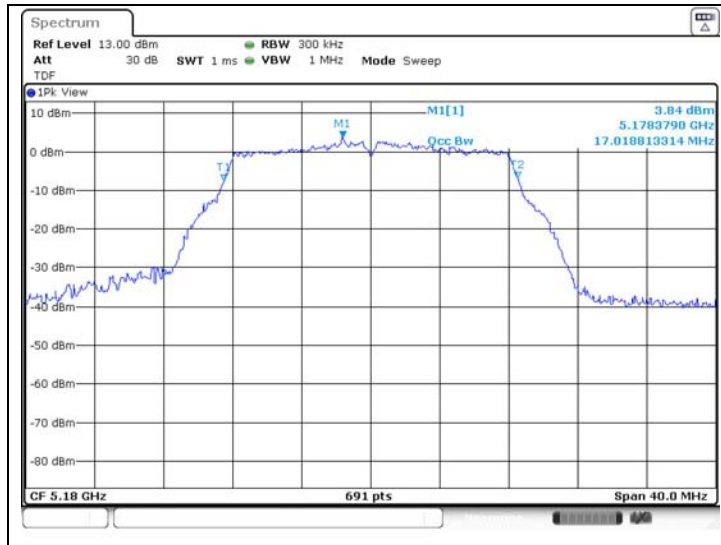


High Channel  
 (5 825 MHz)

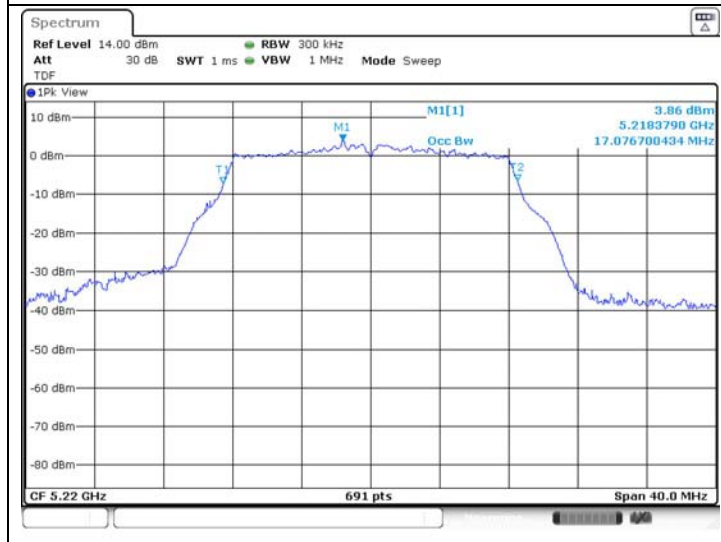


### 802.11a (Band 1)\_ANT 2

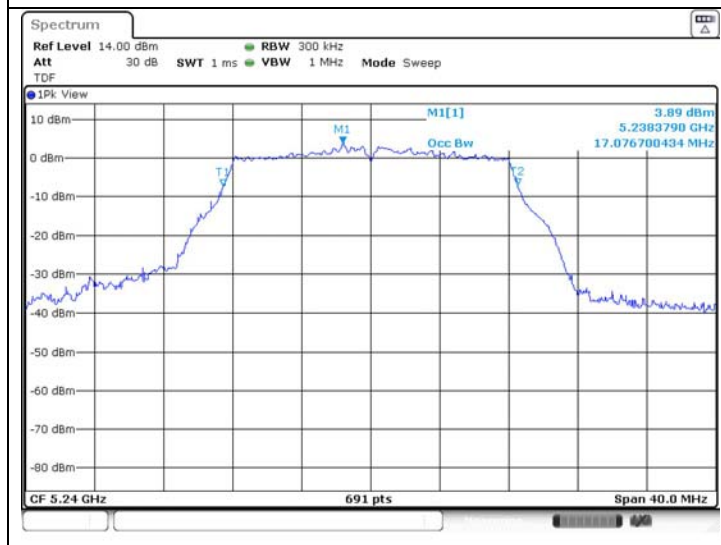
Low Channel  
 (5 180 MHz)



Middle Channel  
 (5 220 MHz)

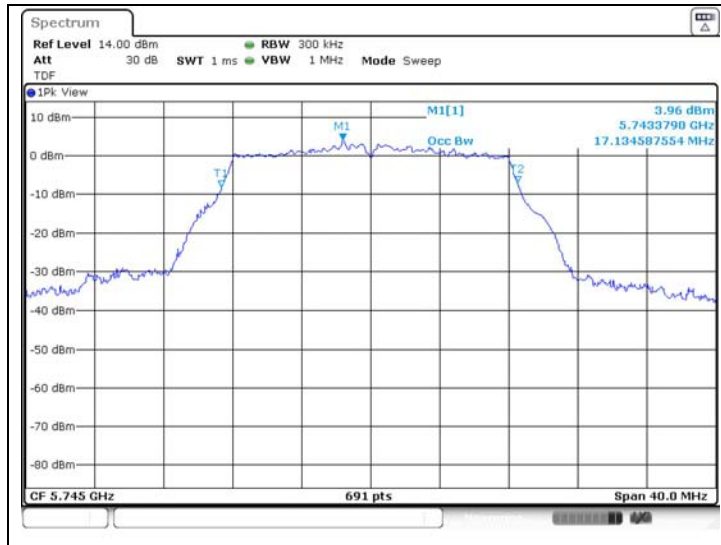


High Channel  
 (5 240 MHz)

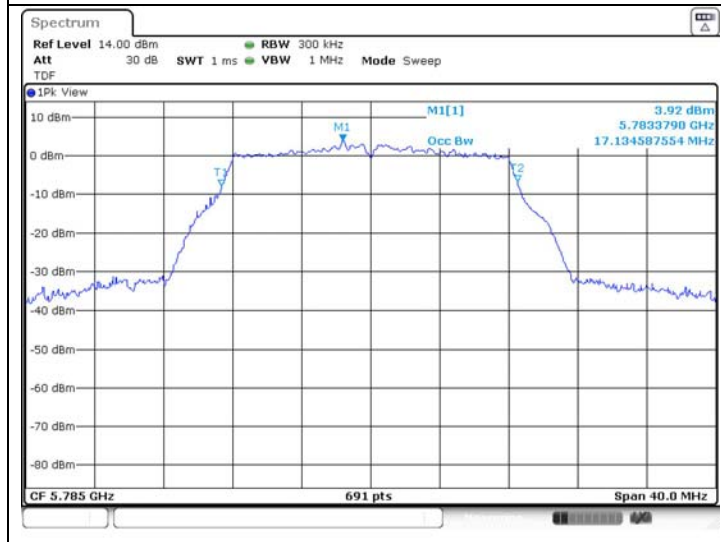


### 802.11a (Band 3)\_ANT 2

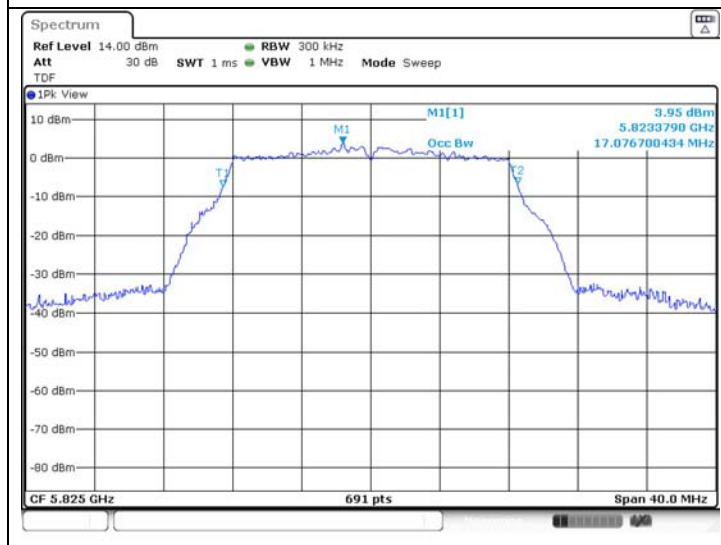
Low Channel  
 (5 745 MHz)



Middle Channel  
 (5 785 MHz)

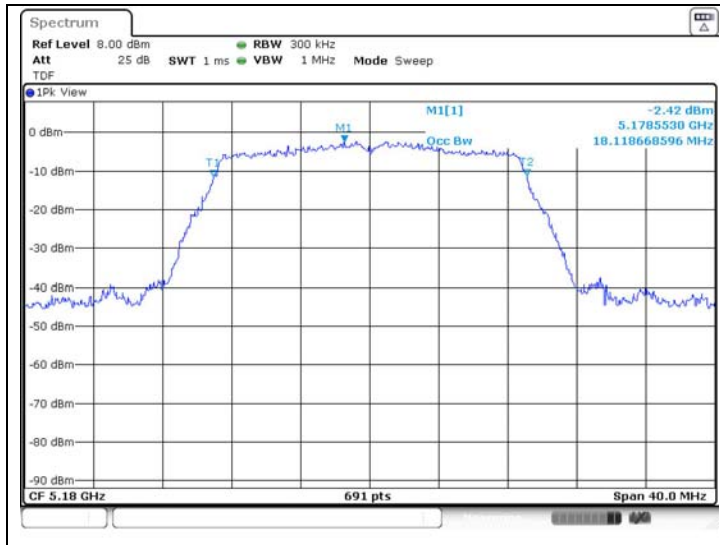


High Channel  
 (5 825 MHz)

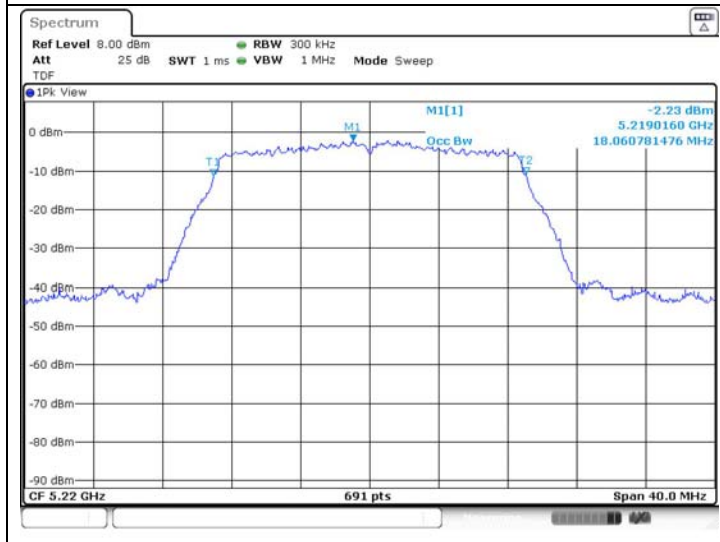


### 802.11n\_HT20 (Band 1)\_ANT 1

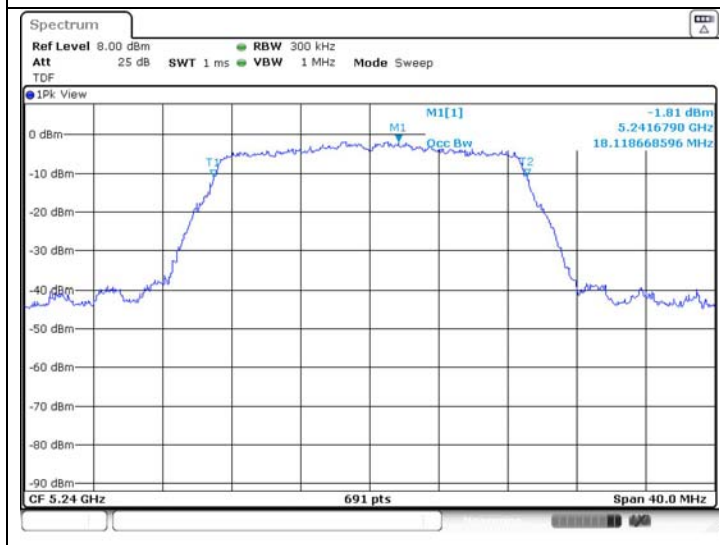
Low Channel  
(5 180 MHz)



Middle Channel  
(5 220 MHz)

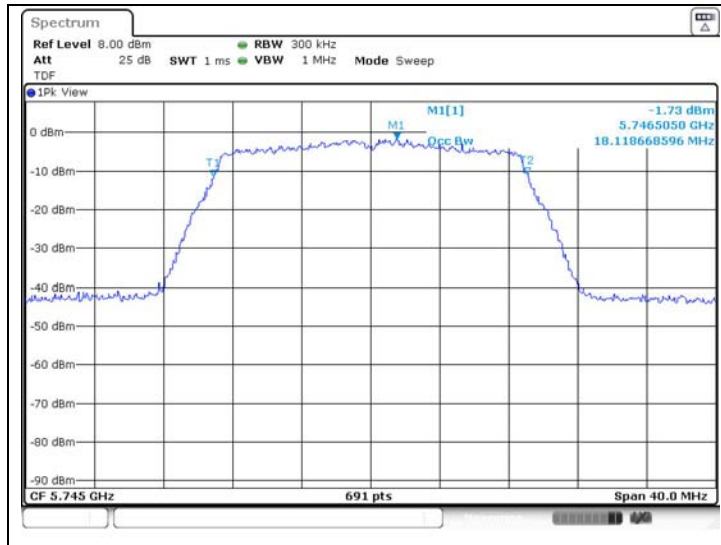


High Channel  
(5 240 MHz)

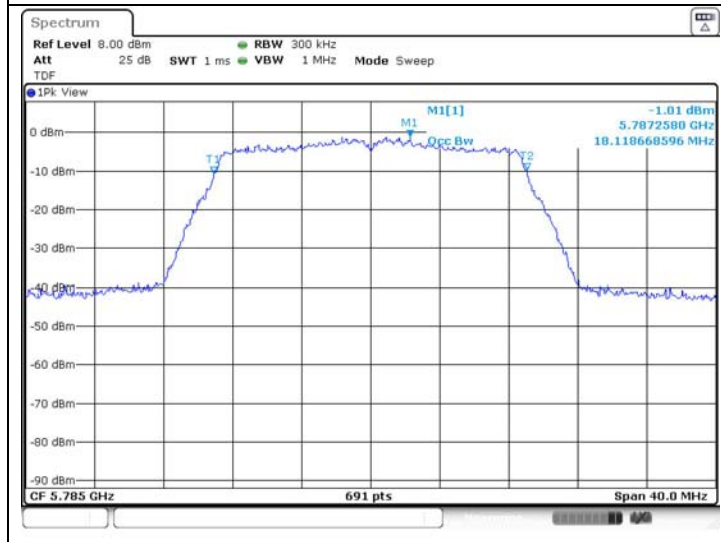


### 802.11n\_HT20 (Band 3)\_ANT 1

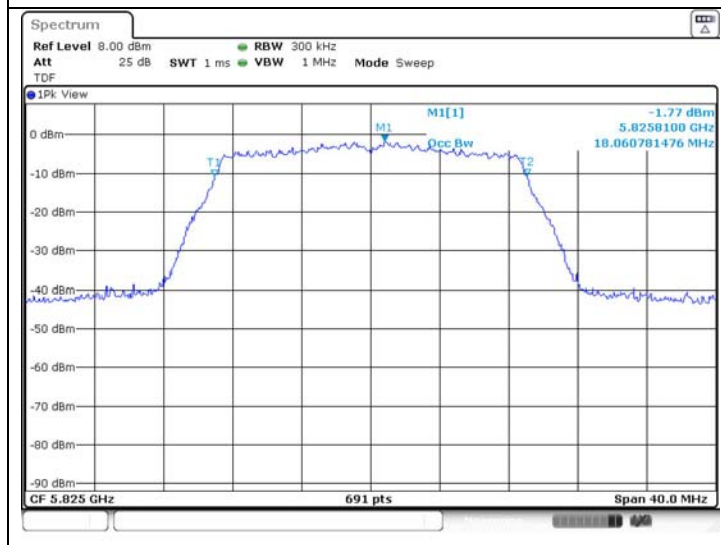
Low Channel  
(5 745 MHz)



Middle Channel  
(5 785 MHz)

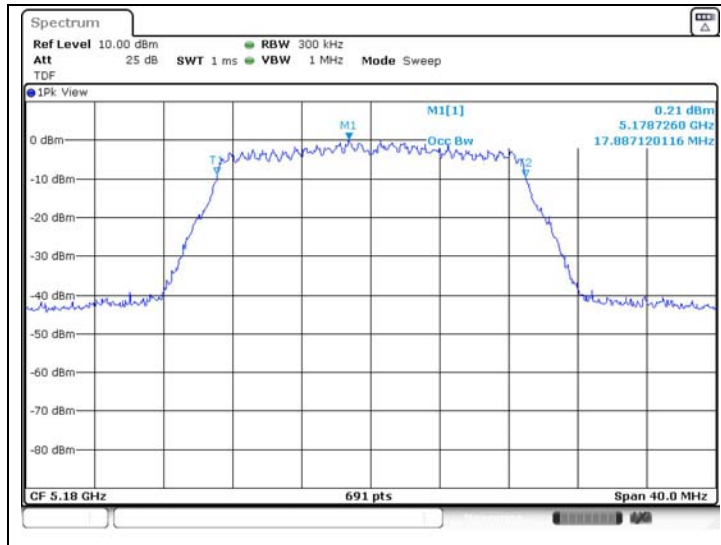


High Channel  
(5 825 MHz)

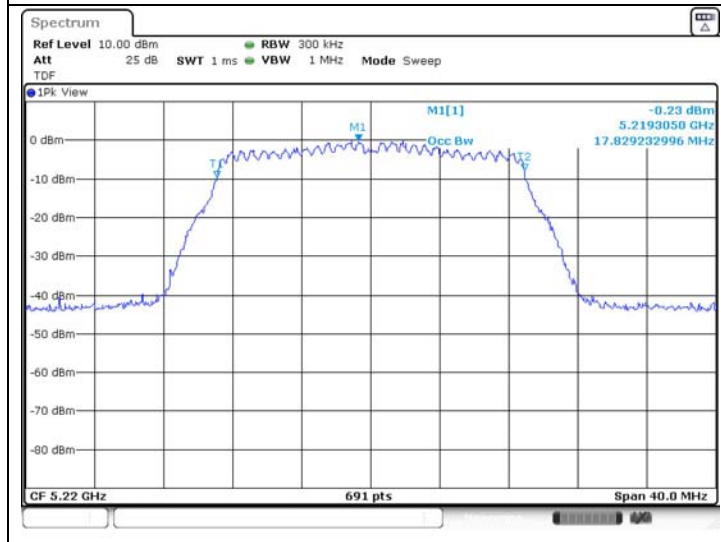


### 802.11n\_HT20 (Band 1)\_ANT 2

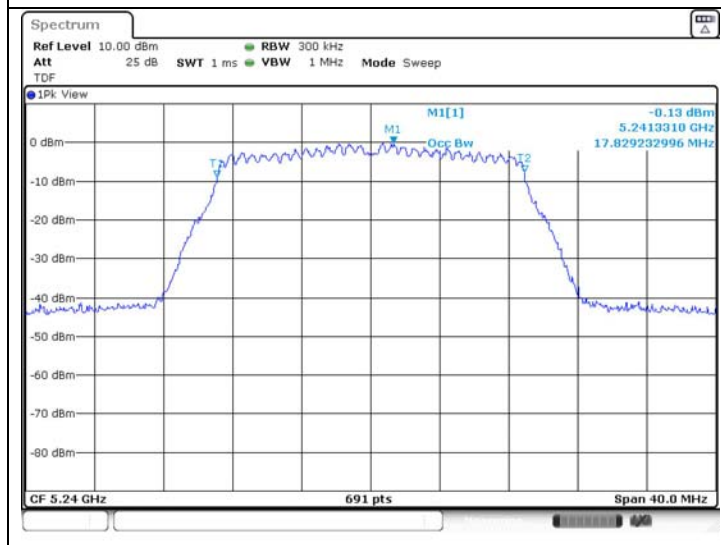
Low Channel  
 (5 180 MHz)



Middle Channel  
 (5 220 MHz)

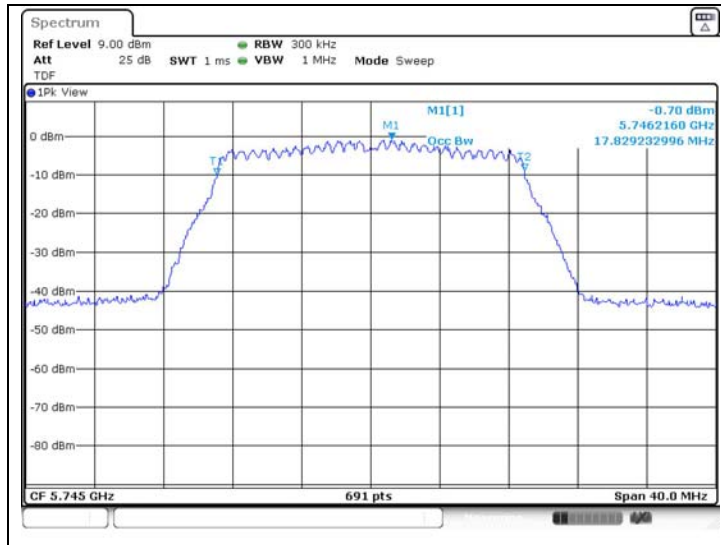


High Channel  
 (5 240 MHz)

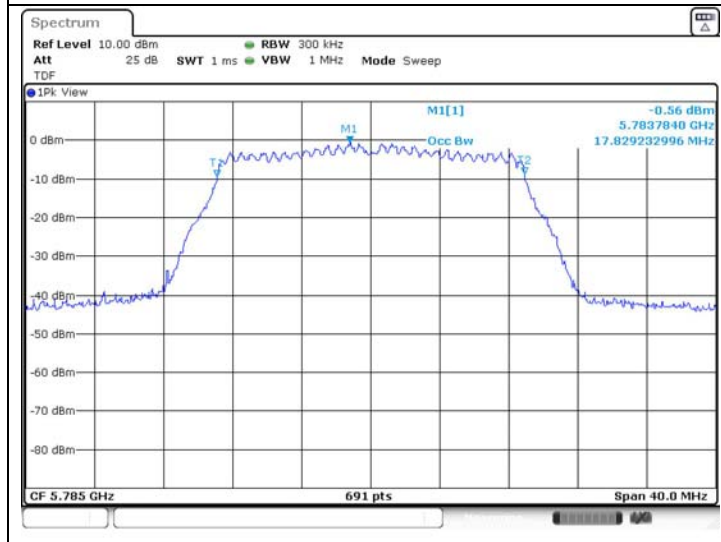


### 802.11n\_HT20 (Band 3)\_ANT 2

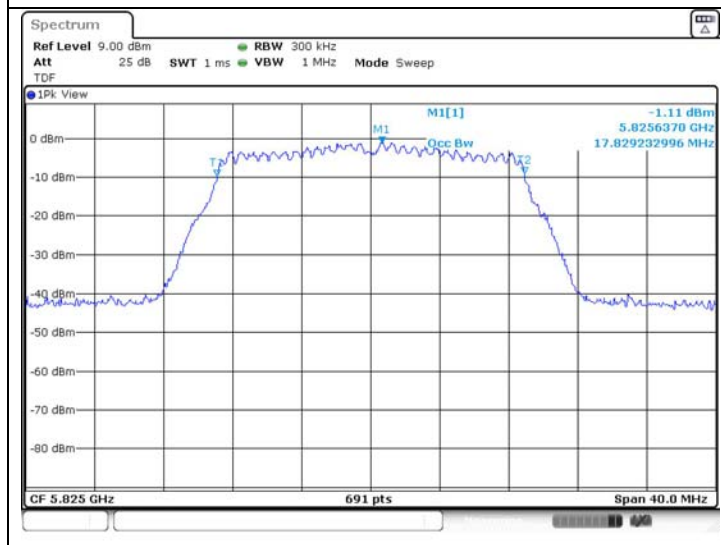
Low Channel  
(5 745 MHz)



Middle Channel  
(5 785 MHz)

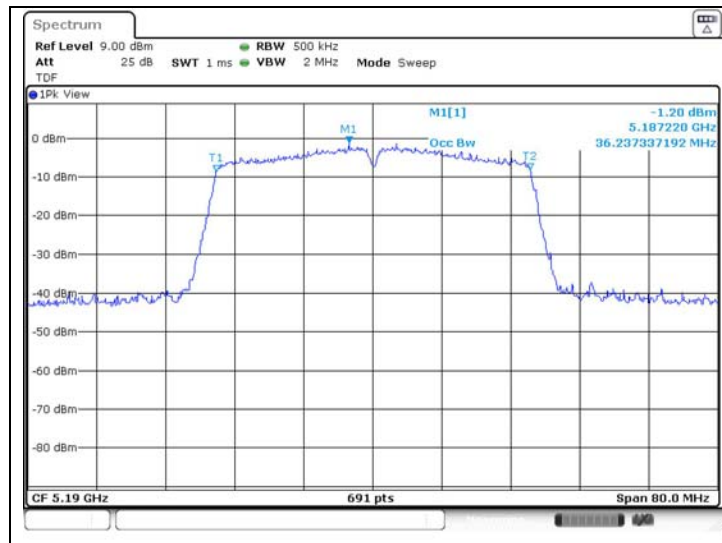


High Channel  
(5 825 MHz)

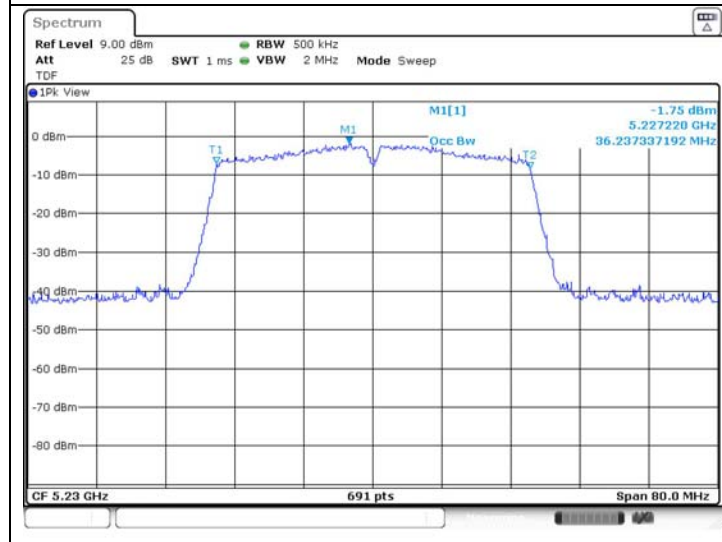


## 802.11n\_HT40 (Band 1)\_ANT 1

Low Channel  
(5 190 MHz)

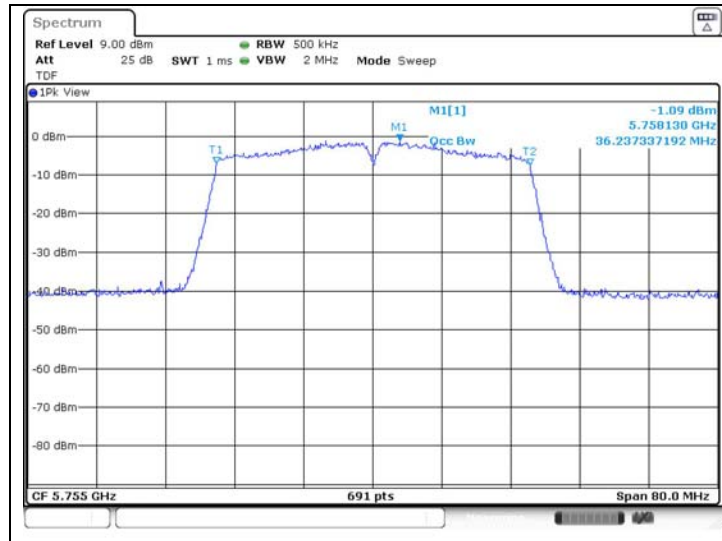


High Channel  
(5 230 MHz)

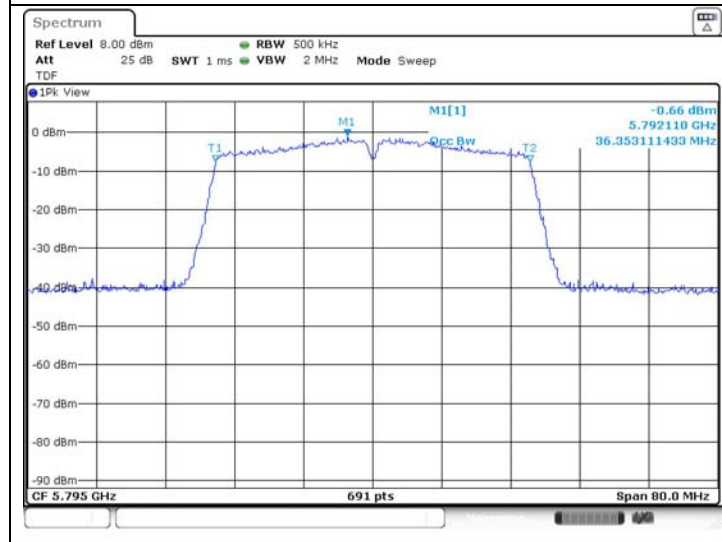


## 802.11n\_HT40 (Band 3)\_ANT 1

Low Channel  
(5 755 MHz)

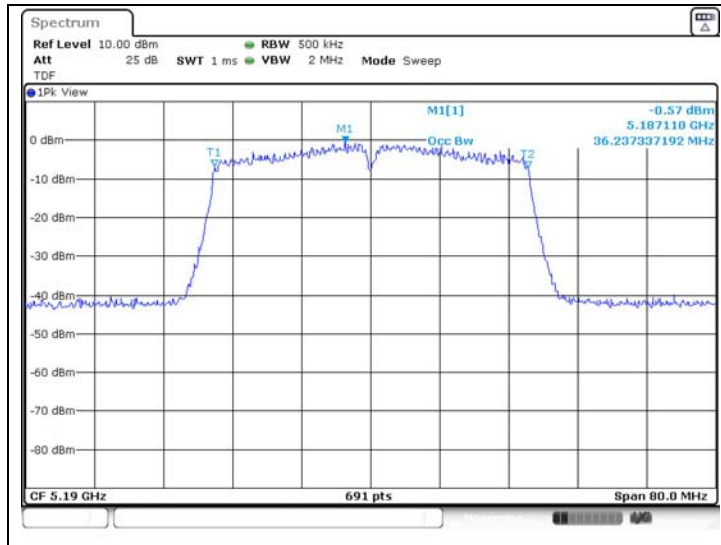


High Channel  
(5 795 MHz)

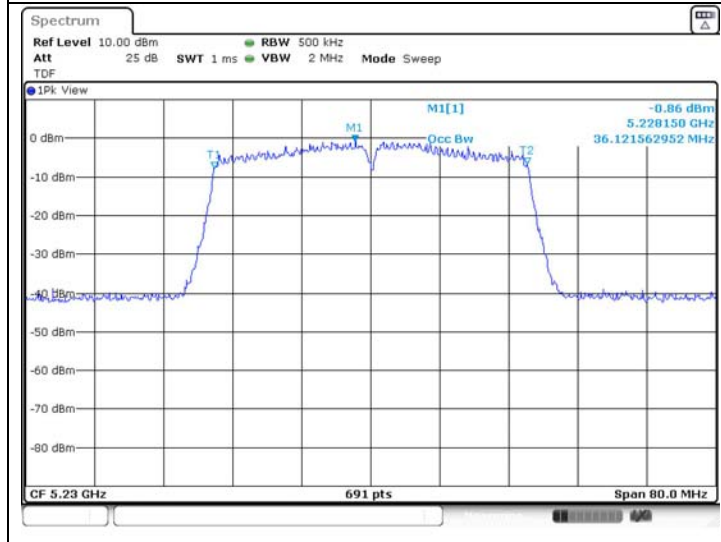


**802.11n\_HT40 (Band 1)\_ANT 2**

Low Channel  
 (5 190 MHz)

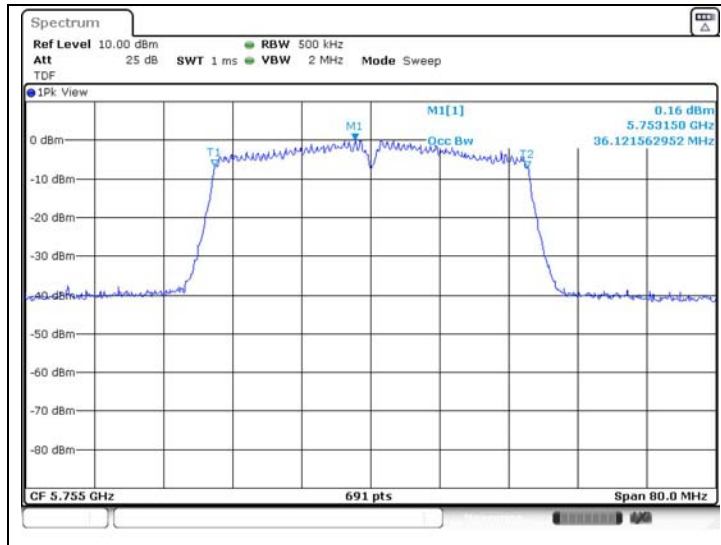


High Channel  
 (5 230 MHz)

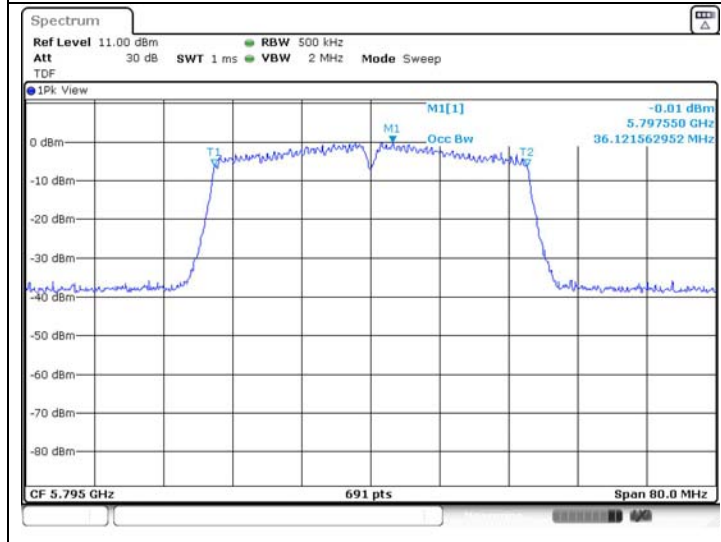


**802.11n\_HT40 (Band 3)\_ANT 2**

Low Channel  
 (5 755 MHz)

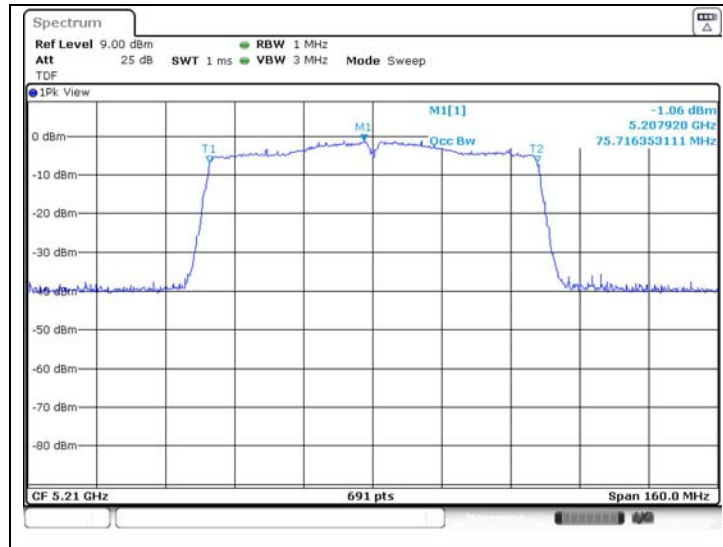


High Channel  
 (5 795 MHz)



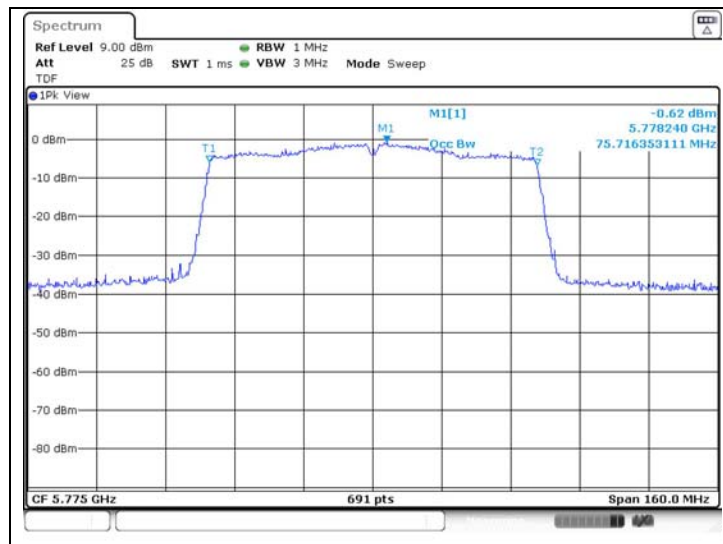
### 802.11ac\_VHT80 (Band 1)\_ANT 1

Middle Channel  
 (5 210 MHz)



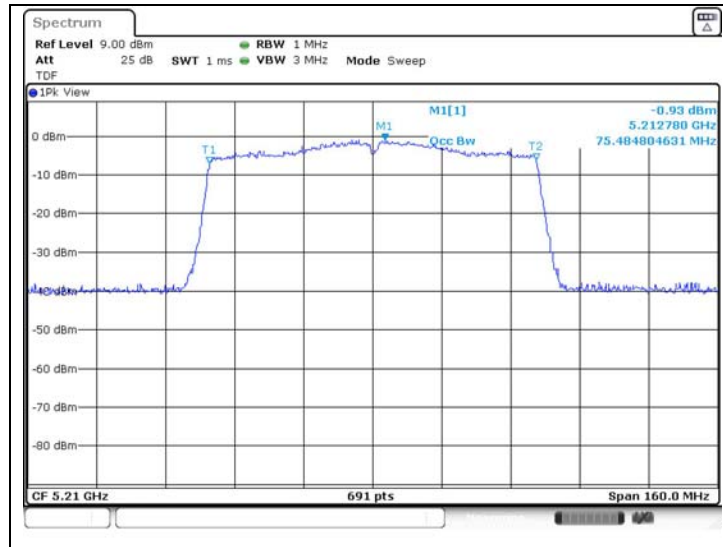
### 802.11ac\_VHT80 (Band 3)\_ANT 1

Middle Channel  
 (5 775 MHz)



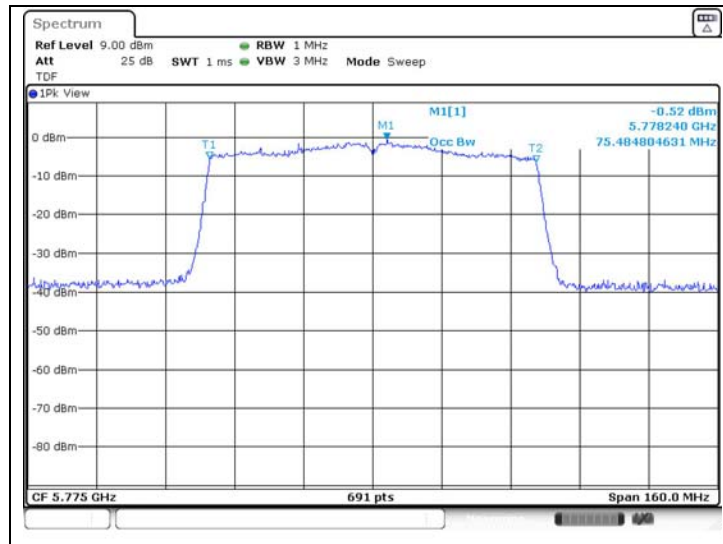
### 802.11ac\_VHT80 (Band 1)\_ANT 2

Middle Channel  
 (5 210 MHz)



### 802.11ac\_VHT80 (Band 3)\_ANT 2

Middle Channel  
 (5 775 MHz)



## 4. 6 dB Bandwidth

### 4.1. Test Setup



### 4.2. Limit

#### 4.2.1. FCC

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

#### 4.2.2. IC

According to RSS-247 Issue 2, 6.2.4.1, the minimum -6 dB Bandwidth shall be at least 500 kHz.

### 4.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

1. This measurement settings are specified in section C.2 of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set RBW = 100 kHz.
3. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. 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.

#### 4.4. Test result

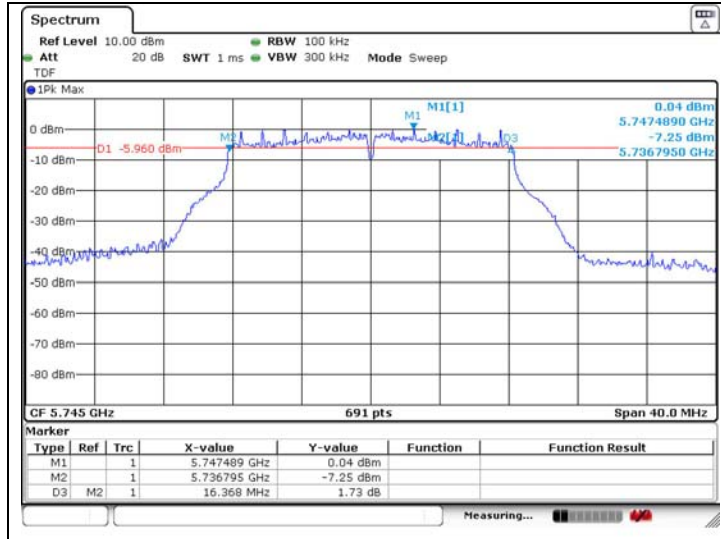
Ambient temperature : (23 ± 1) °C  
 Relative humidity : 47 % R.H.

| Band    | Mode       | Frequency (MHz) | Ch. | Data Rate (Mbps) | 6 dB Bandwidth (MHz) |        | Minimum Bandwidth (kHz) |
|---------|------------|-----------------|-----|------------------|----------------------|--------|-------------------------|
|         |            |                 |     |                  | ANT 1                | ANT 2  |                         |
| U-NII 3 | 11a        | 5 745           | 149 | 6                | 16.368               | 16.440 | 500                     |
|         |            | 5 785           | 157 |                  | 16.324               | 16.440 |                         |
|         |            | 5 825           | 165 |                  | 16.382               | 16.440 |                         |
|         | 11n_HT20   | 5 745           | 149 | MCS8             | 17.598               | 17.714 |                         |
|         |            | 5 785           | 157 |                  | 17.540               | 17.714 |                         |
|         |            | 5 825           | 165 |                  | 17.598               | 17.714 |                         |
|         | 11n_HT40   | 5 755           | 151 | MCS8             | 35.890               | 36.006 |                         |
|         |            | 5 795           | 159 |                  | 35.770               | 36.006 |                         |
|         | 11ac_VHT80 | 5 775           | 155 | MCS0             | 75.716               | 75.445 |                         |

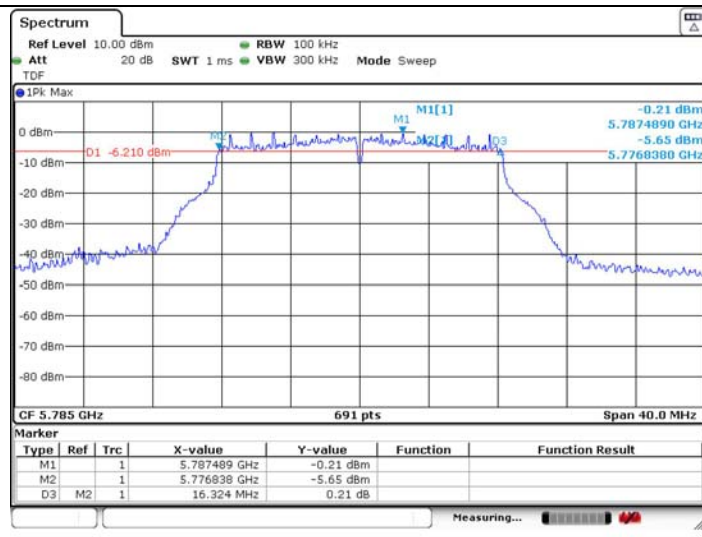
## - Test plots

### 802.11a (Band 3)\_ANT 1

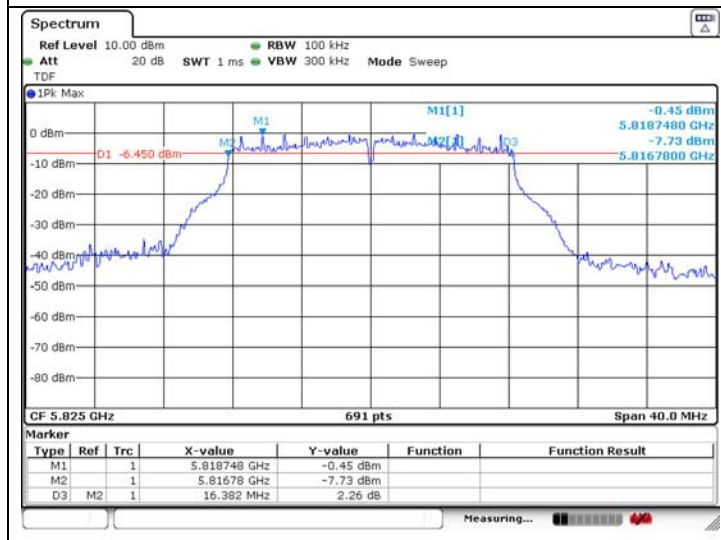
Low Channel  
(5 745 MHz)



Middle Channel  
(5 785 MHz)

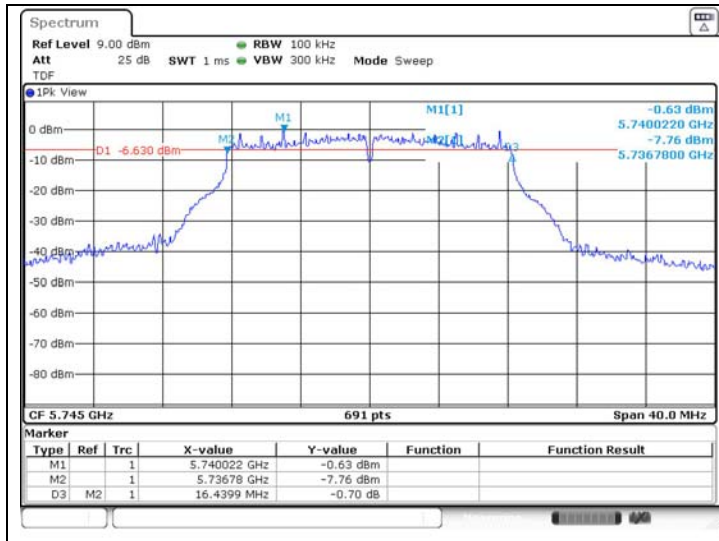


High Channel  
(5 825 MHz)

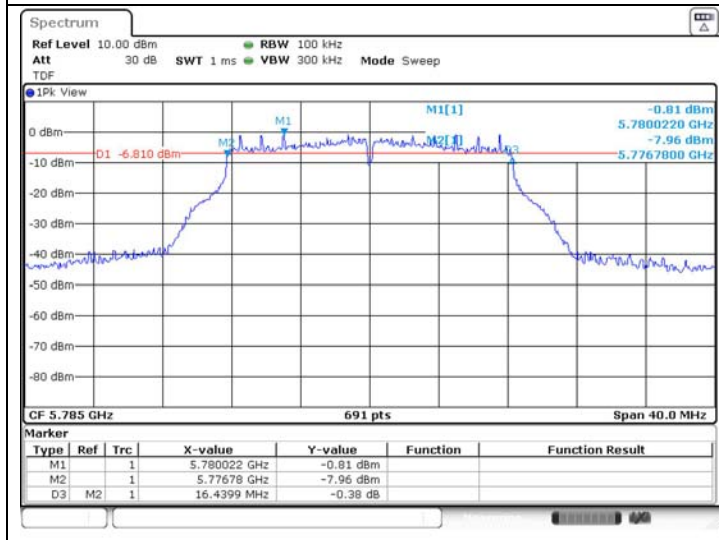


## 802.11a (Band 3)\_ANT 2

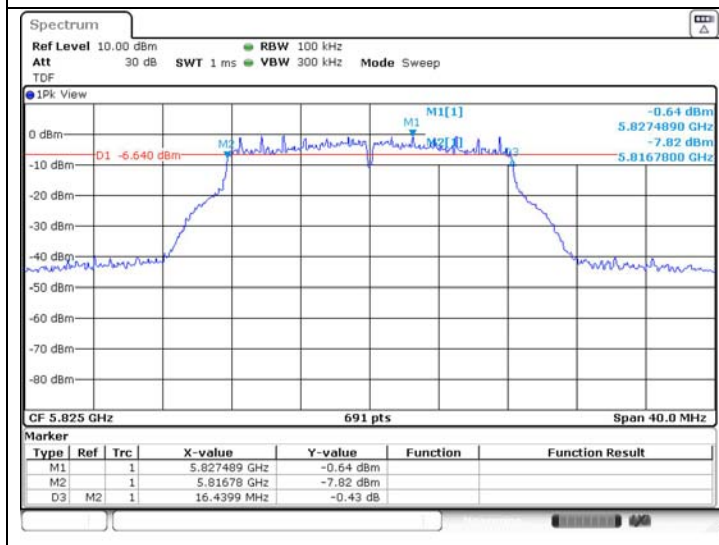
Low Channel  
(5 745 MHz)



Middle Channel  
(5 785 MHz)

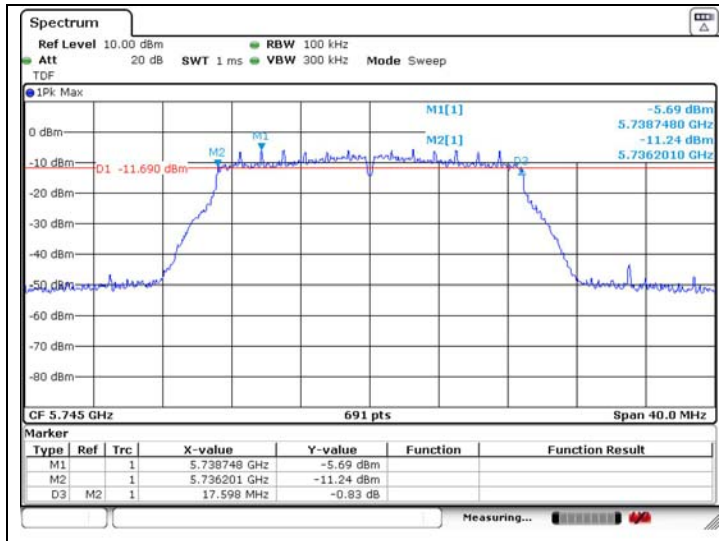


High Channel  
(5 825 MHz)

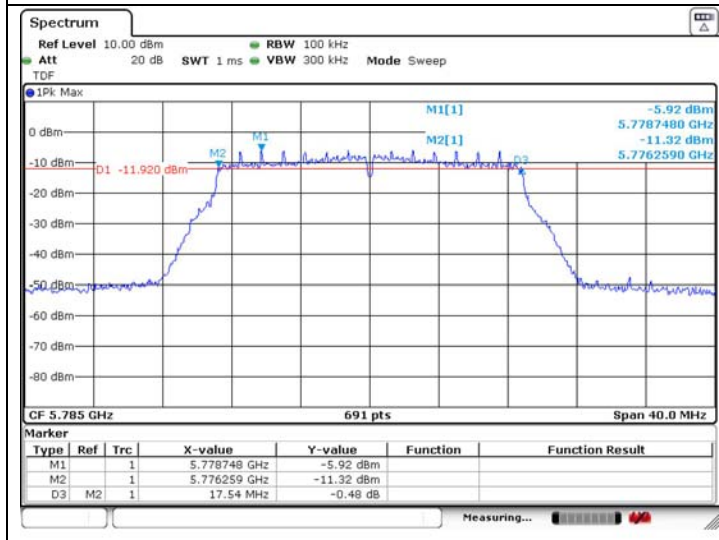


## 802.11n\_HT20 (Band 3)\_ANT 1

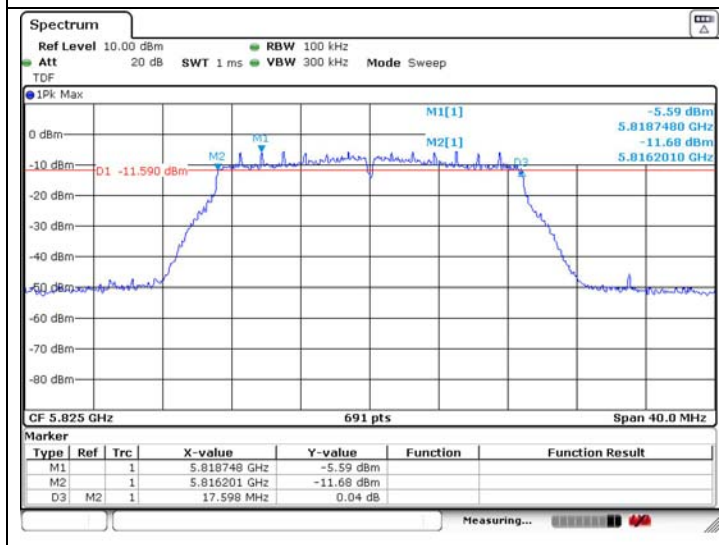
Low Channel  
(5 745 MHz)



Middle Channel  
(5 785 MHz)

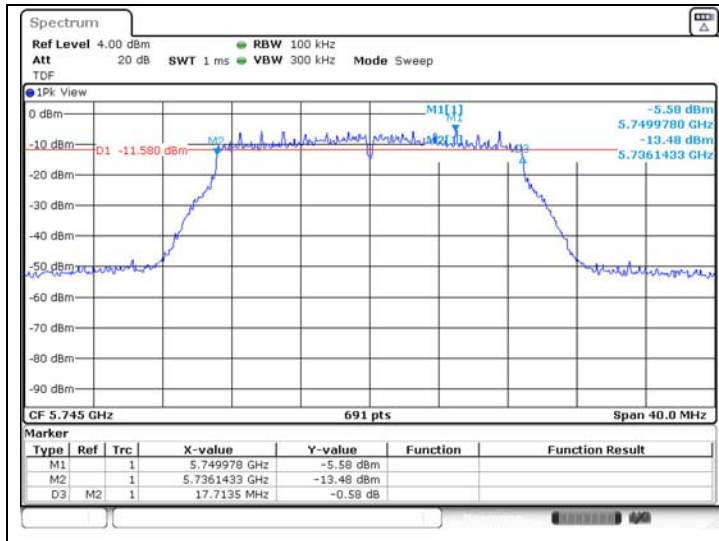


High Channel  
(5 825 MHz)

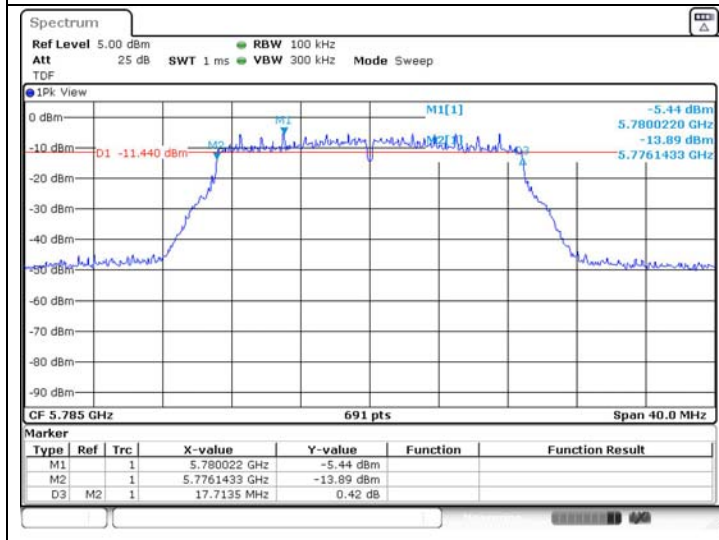


## 802.11n\_HT20 (Band 3)\_ANT 2

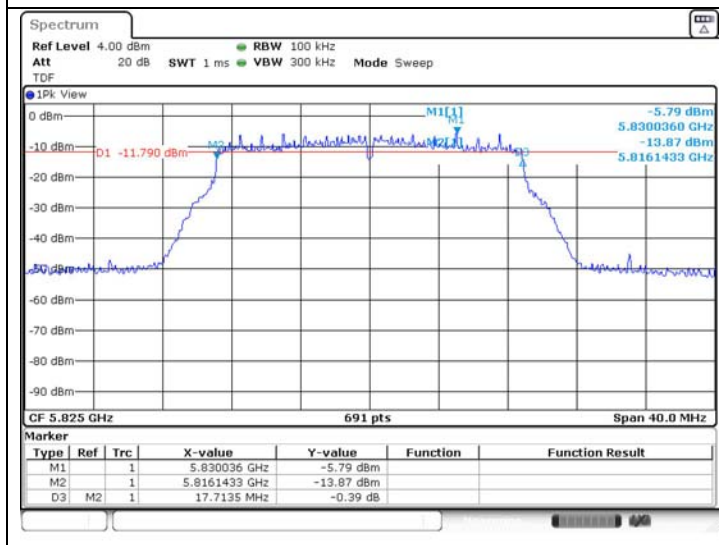
Low Channel  
(5 745 MHz)



Middle Channel  
(5 785 MHz)

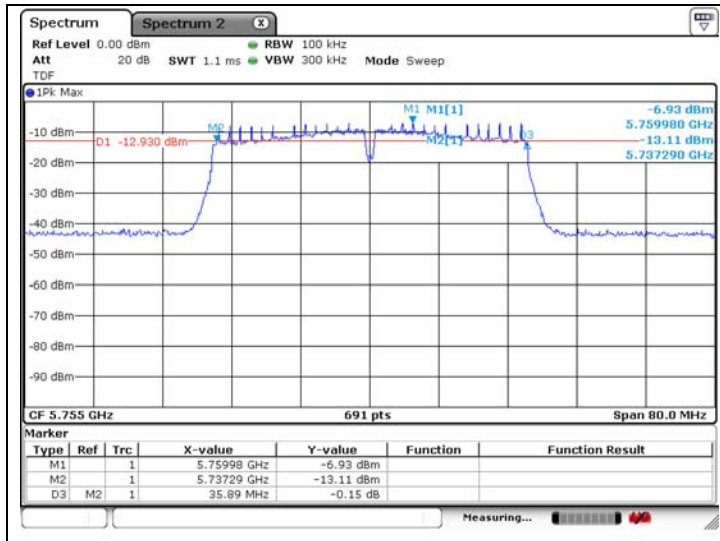


High Channel  
(5 825 MHz)

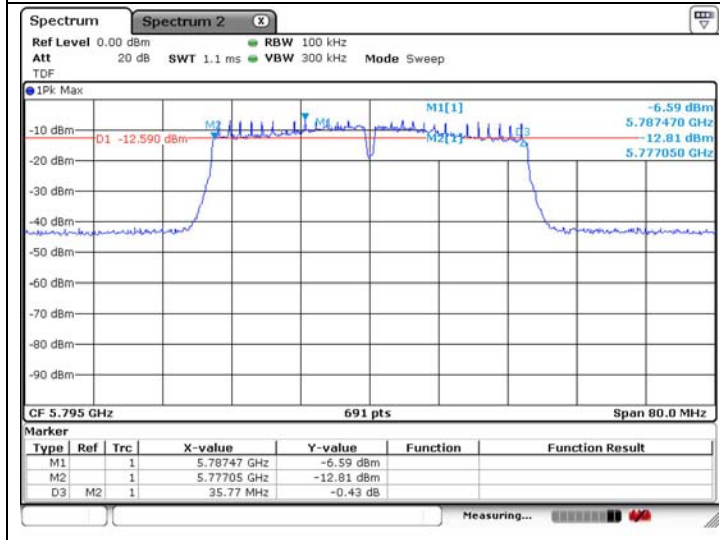


## 802.11n\_HT40 (Band 3)\_ANT 1

Low Channel  
(5 755 MHz)

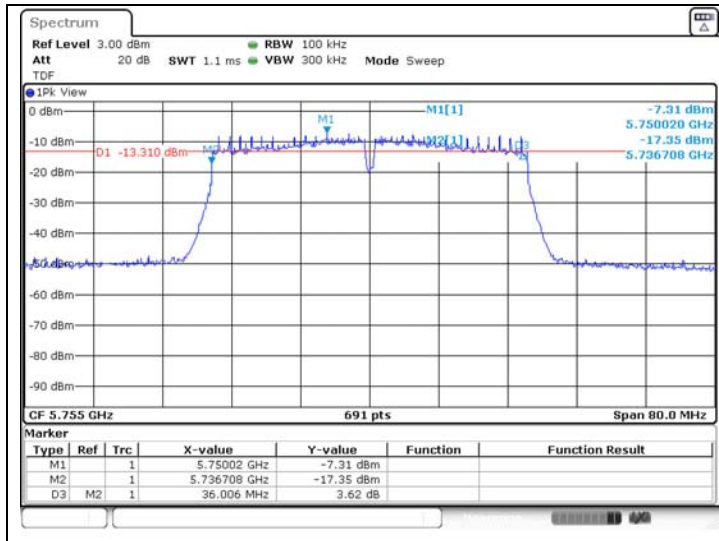


High Channel  
(5 795 MHz)

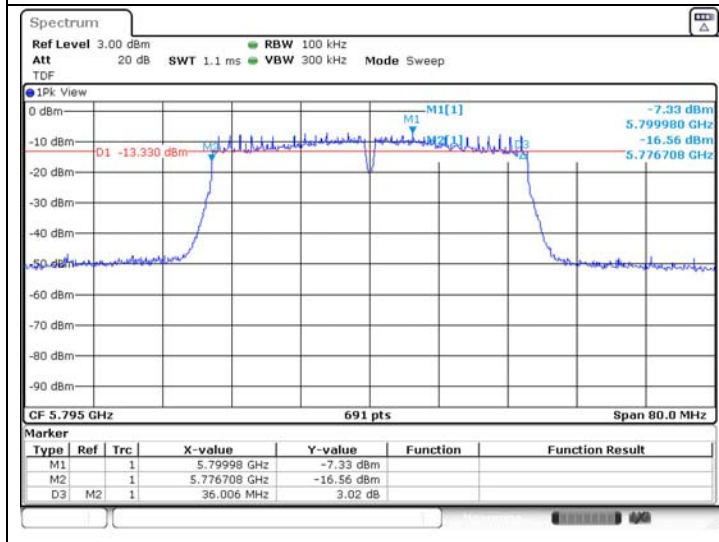


### 802.11n\_HT40 (Band 3)\_ANT 2

Low Channel  
(5 755 MHz)

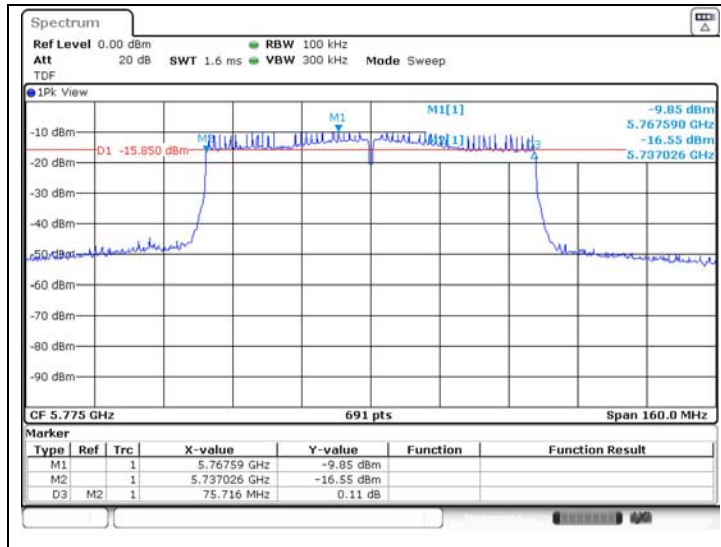


High Channel  
(5 795 MHz)



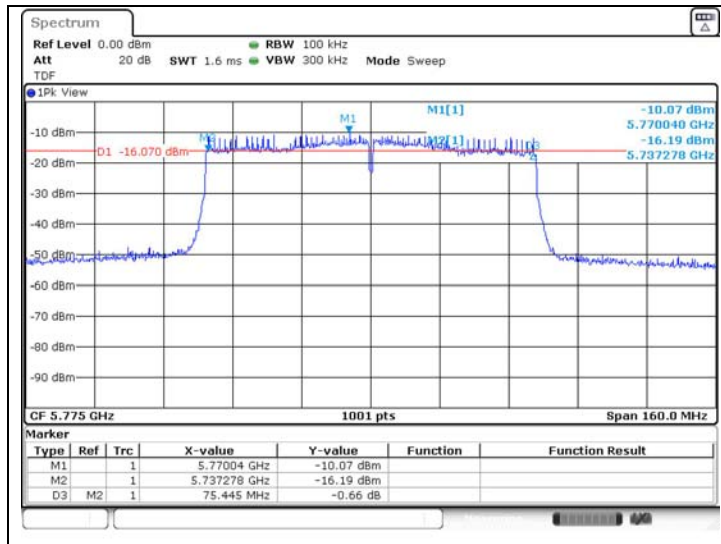
### 802.11ac\_VHT80 (Band 3)\_ANT 1

Middle Channel  
 (5 775 MHz)



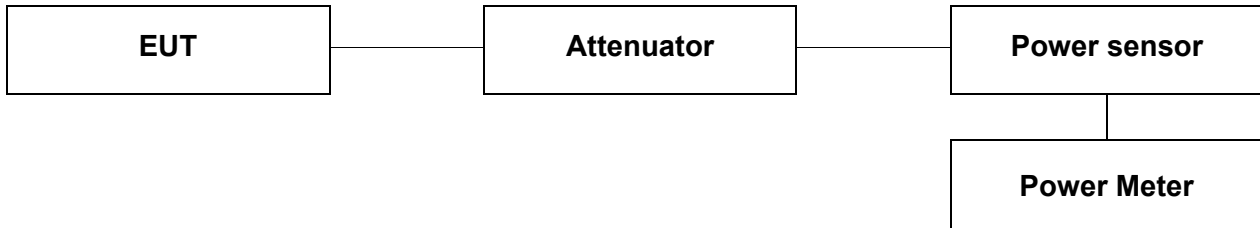
### 802.11ac\_VHT80 (Band 3)\_ANT 2

Middle Channel  
 (5 775 MHz)



## 5. Maximum Conducted Output Power

### 5.1. Test Setup



### 5.2. Limit

#### 5.2.1. FCC

According to 15.407(a)(1)(iv)

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 dB i. In addition, the maximum power spectral density shall not exceed 11 dB m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dB i 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 dB i.

According to 15.407(a)(3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dB m in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dB i 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 dB i. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dB i 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. IC**

According to RSS-247 Issue 2,

**6.2.1.1 Frequency band 5 150-5 250 MHz**

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or  $1.76 + 10 \log_{10} B$ , dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

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

**6.2.4.1 Frequency band 5 725-5 850 MHz**

For equipment operating in the band 5 725-5 850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz. The maximum conducted output power shall not exceed 1 W. The output 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 output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint<sup>3</sup> systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

### 5.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

1. This measurement settings are specified in section E.3.a of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. 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 consistent 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.
3. If the transmitter does not transmit continuously, measure the duty cycle,  $x$ , of the transmitter output signal as described in section II.B.
4. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
5. 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 %).

## 5.4. Test result

Ambient temperature : (23 ± 1) °C  
Relative humidity : 47 % R.H.

### Test mode: 11a\_ANT1

| Band    | Frequency (MHz) | Data Rate (Mbps) | Average Power (dB m) | Duty Cycle Correction Factor (dB) | Average Power Result (dB m) |
|---------|-----------------|------------------|----------------------|-----------------------------------|-----------------------------|
| U-NII 1 | 5 180           | 6                | 9.22                 | 0.28                              | 9.50                        |
|         | 5 220           |                  | 8.93                 |                                   | 9.21                        |
|         | 5 240           |                  | 8.84                 |                                   | 9.12                        |
| U-NII 3 | 5 745           |                  | 11.21                |                                   | 11.49                       |
|         | 5 785           |                  | 11.06                |                                   | 11.34                       |
|         | 5 825           |                  | 11.01                |                                   | 11.29                       |

| Band    | Frequency (MHz) | Data Rate (Mbps) | Average Power Result (dB m) | Antenna Gain (dB i) | E.I.R.P. (dB m) |
|---------|-----------------|------------------|-----------------------------|---------------------|-----------------|
| U-NII 1 | 5 180           | 6                | 9.50                        | 2.84                | 12.34           |
|         | 5 220           |                  | 9.21                        |                     | 12.05           |
|         | 5 240           |                  | 9.12                        |                     | 11.96           |

| Band    | FCC Limit       |                    |                |                  |                     |              |
|---------|-----------------|--------------------|----------------|------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 26 dB BW (MHz) | 11+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 1 | 5 180           | 23.98              |                |                  | 2.84                | 23.98        |
|         | 5 220           |                    |                |                  |                     |              |
|         | 5 240           |                    |                |                  |                     |              |
| U-NII 3 | 5 745           | 30                 |                |                  | 2.73                | 30           |
|         | 5 785           |                    |                |                  |                     |              |
|         | 5 825           |                    |                |                  |                     |              |

| Band    | IC Limit        |                    |               |                    |                     |              |
|---------|-----------------|--------------------|---------------|--------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 99 % BW (MHz) | 1.76+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 1 | 5 180           | 14.77              | 17.019        | 14.07              | 2.84                | 14.07        |
|         | 5 220           |                    | 17.077        | 14.08              |                     | 14.08        |
|         | 5 240           |                    | 17.077        | 14.08              |                     | 14.08        |

| Band    | IC Limit        |                    |               |                  |                     |              |
|---------|-----------------|--------------------|---------------|------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 99 % BW (MHz) | 11+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 3 | 5 745           | 30                 |               |                  | 2.73                | 30           |
|         | 5 785           |                    |               |                  |                     |              |
|         | 5 825           |                    |               |                  |                     |              |

**Test mode: 11a ANT2**

| Band    | Frequency (MHz) | Data Rate (Mbps) | Average Power (dB m) | Duty Cycle Correction Factor (dB) | Average Power Result (dB m) |
|---------|-----------------|------------------|----------------------|-----------------------------------|-----------------------------|
| U-NII 1 | 5 180           | 6                | 9.13                 | 0.28                              | 9.41                        |
|         | 5 220           |                  | 8.15                 |                                   | 8.43                        |
|         | 5 240           |                  | 8.82                 |                                   | 9.10                        |
| U-NII 3 | 5 745           |                  | 10.87                |                                   | 11.15                       |
|         | 5 785           |                  | 10.96                |                                   | 11.24                       |
|         | 5 825           |                  | 10.72                |                                   | 11.00                       |

| Band    | Frequency (MHz) | Data Rate (Mbps) | Average Power Result (dB m) | Antenna Gain (dB i) | E.I.R.P. (dB m) |
|---------|-----------------|------------------|-----------------------------|---------------------|-----------------|
| U-NII 1 | 5 180           | 6                | 9.41                        | 2.54                | 11.95           |
|         | 5 220           |                  | 8.43                        |                     | 10.97           |
|         | 5 240           |                  | 9.10                        |                     | 11.64           |

| Band    | FCC Limit       |                    |                |                  |                     |              |
|---------|-----------------|--------------------|----------------|------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 26 dB BW (MHz) | 11+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 1 | 5 180           | 23.98              |                |                  | 2.54                | 23.98        |
|         | 5 220           |                    |                |                  |                     |              |
|         | 5 240           |                    |                |                  |                     |              |
| U-NII 3 | 5 745           | 30                 |                |                  | 2.45                | 30           |
|         | 5 785           |                    |                |                  |                     |              |
|         | 5 825           |                    |                |                  |                     |              |

| Band    | IC Limit        |                    |               |                    |                     |              |
|---------|-----------------|--------------------|---------------|--------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 99 % BW (MHz) | 1.76+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 1 | 5 180           | 14.77              | 17.019        | 14.07              | 2.54                | 14.07        |
|         | 5 220           |                    | 17.077        | 14.08              |                     | 14.08        |
|         | 5 240           |                    | 17.077        | 14.08              |                     | 14.08        |

| Band    | IC Limit        |                    |               |                  |                     |              |
|---------|-----------------|--------------------|---------------|------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 99 % BW (MHz) | 11+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 3 | 5 745           | 30                 |               |                  | 2.45                | 30           |
|         | 5 785           |                    |               |                  |                     |              |
|         | 5 825           |                    |               |                  |                     |              |

**Test mode: 11n HT20**

| Band    | Frequency (MHz) | Data Rate (Mbps) | ANT 1 Average Power (dB m) | ANT 2 Average Power (dB m) | ANT 1+ANT 2 Average Power (dB m) |
|---------|-----------------|------------------|----------------------------|----------------------------|----------------------------------|
| U-NII 1 | 5 180           | MCS8             | 1.35                       | 2.66                       | 5.06                             |
|         | 5 220           |                  | 1.80                       | 1.84                       | 4.83                             |
|         | 5 240           |                  | 2.09                       | 2.18                       | 5.15                             |
| U-NII 3 | 5 745           |                  | 4.93                       | 5.22                       | 8.09                             |
|         | 5 785           |                  | 5.01                       | 5.05                       | 8.04                             |
|         | 5 825           |                  | 5.28                       | 4.98                       | 8.14                             |

| Band    | Frequency (MHz) | Data Rate (Mbps) | ANT 1+ANT 2 Average Power (dB m) | Duty Cycle Correction Factor (dB) | ANT 1 + ANT 2 Average Power Result (dB m) |
|---------|-----------------|------------------|----------------------------------|-----------------------------------|-------------------------------------------|
| U-NII 1 | 5 180           | MCS8             | 5.06                             | 0.61                              | 5.67                                      |
|         | 5 220           |                  | 4.83                             |                                   | 5.44                                      |
|         | 5 240           |                  | 5.15                             |                                   | 5.76                                      |
| U-NII 3 | 5 745           |                  | 8.09                             |                                   | 8.70                                      |
|         | 5 785           |                  | 8.04                             |                                   | 8.65                                      |
|         | 5 825           |                  | 8.14                             |                                   | 8.75                                      |

| Band    | Frequency (MHz) | Data Rate (Mbps) | ANT 1 + ANT 2 Average Power Result (dB m) | Antenna Gain (dB i) | ANT 1 + ANT 2 E.I.R.P. (dB m) |
|---------|-----------------|------------------|-------------------------------------------|---------------------|-------------------------------|
| U-NII 1 | 5 180           | MCS8             | 5.67                                      | 5.70                | 11.37                         |
|         | 5 220           |                  | 5.44                                      |                     | 11.14                         |
|         | 5 240           |                  | 5.76                                      |                     | 11.46                         |

| Band    | FCC Limit       |                    |                |                  |                     |              |
|---------|-----------------|--------------------|----------------|------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 26 dB BW (MHz) | 11+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 1 | 5 180           | 23.98              |                |                  | 5.70                | 23.98        |
|         | 5 220           |                    |                |                  |                     |              |
|         | 5 240           |                    |                |                  |                     |              |
| U-NII 3 | 5 745           | 30                 |                |                  | 5.60                | 30           |
|         | 5 785           |                    |                |                  |                     |              |
|         | 5 825           |                    |                |                  |                     |              |

| Band    | IC Limit        |                    |               |                    |                     |              |
|---------|-----------------|--------------------|---------------|--------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 99 % BW (MHz) | 1.76+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 1 | 5 180           | 14.77              | 17.887        | 14.29              | 5.70                | 14.29        |
|         | 5 220           |                    | 17.829        | 14.27              |                     | 14.27        |
|         | 5 240           |                    | 17.829        | 14.27              |                     | 14.27        |

| Band    | IC Limit        |                    |               |                  |                     |              |
|---------|-----------------|--------------------|---------------|------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 99 % BW (MHz) | 11+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 3 | 5 745           | 30                 |               |                  | 5.60                | 30           |
|         | 5 785           |                    |               |                  |                     |              |
|         | 5 825           |                    |               |                  |                     |              |

**Test mode: 11n HT40**

| Band    | Frequency (MHz) | Data Rate (Mbps) | ANT 1 Average Power (dB m) | ANT 2 Average Power (dB m) | ANT 1+ANT 2 Average Power (dB m) |
|---------|-----------------|------------------|----------------------------|----------------------------|----------------------------------|
| U-NII 1 | 5 190           | MCS8             | 3.30                       | 3.21                       | 6.27                             |
|         | 5 230           |                  | 3.77                       | 3.17                       | 6.49                             |
| U-NII 3 | 5 755           |                  | 5.53                       | 5.18                       | 8.37                             |
|         | 5 795           |                  | 5.53                       | 5.26                       | 8.41                             |

| Band    | Frequency (MHz) | Data Rate (Mbps) | ANT 1+ANT 2 Average Power (dB m) | Duty Cycle Correction Factor (dB) | ANT 1 + ANT 2 Average Power Result (dB m) |
|---------|-----------------|------------------|----------------------------------|-----------------------------------|-------------------------------------------|
| U-NII 1 | 5 190           | MCS8             | 6.27                             | 1.08                              | 7.35                                      |
|         | 5 230           |                  | 6.49                             |                                   | 7.57                                      |
| U-NII 3 | 5 755           |                  | 8.37                             |                                   | 9.45                                      |
|         | 5 795           |                  | 8.41                             |                                   | 9.49                                      |

| Band    | Frequency (MHz) | Data Rate (Mbps) | ANT 1 + ANT 2 Average Power Result (dB m) | Antenna Gain (dB i) | ANT 1 + ANT 2 E.I.R.P. (dB m) |
|---------|-----------------|------------------|-------------------------------------------|---------------------|-------------------------------|
| U-NII 1 | 5 190           | MCS8             | 7.35                                      | 5.70                | 13.05                         |
|         | 5 230           |                  | 7.57                                      |                     | 13.27                         |

| Band    | FCC Limit       |                    |                |                  |                     |              |
|---------|-----------------|--------------------|----------------|------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 26 dB BW (MHz) | 11+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 1 | 5 190           | 23.98              |                |                  | 5.70                | 23.98        |
|         | 5 230           |                    |                |                  |                     |              |
| U-NII 3 | 5 755           | 30                 |                |                  | 5.60                | 30           |
|         | 5 795           |                    |                |                  |                     |              |

| Band    | IC Limit        |                    |               |                    |                     |              |
|---------|-----------------|--------------------|---------------|--------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 99 % BW (MHz) | 1.76+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 1 | 5 755           | 14.77              | 36.237        | 17.35              | 5.70                | 14.77        |
|         | 5 795           |                    | 36.122        | 17.34              |                     | 14.77        |

| Band    | IC Limit        |                    |               |                  |                     |              |
|---------|-----------------|--------------------|---------------|------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 99 % BW (MHz) | 11+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 3 | 5 755           | 30                 |               |                  | 5.60                | 30           |
|         | 5 795           |                    |               |                  |                     |              |

**Test mode: 11ac\_VHT80**

| Band    | Frequency (MHz) | Data Rate (Mbps) | ANT 1 Average Power (dB m) | ANT 2 Average Power (dB m) | ANT 1+ANT 2 Average Power (dB m) |
|---------|-----------------|------------------|----------------------------|----------------------------|----------------------------------|
| U-NII 1 | 5 210           | MCS0             | 3.83                       | 3.35                       | 6.61                             |
| U-NII 3 | 5 775           |                  | 5.29                       | 4.75                       | 8.04                             |

| Band    | Frequency (MHz) | Data Rate (Mbps) | ANT 1+ANT 2 Average Power (dB m) | Duty Cycle Correction Factor (dB) | ANT 1 + ANT 2 Average Power Result (dB m) |
|---------|-----------------|------------------|----------------------------------|-----------------------------------|-------------------------------------------|
| U-NII 1 | 5 210           | MCS0             | 6.61                             | 1.16                              | 7.77                                      |
| U-NII 3 | 5 775           |                  | 8.04                             |                                   | 9.20                                      |

| Band    | Frequency (MHz) | Data Rate (Mbps) | ANT 1 + ANT 2 Average Power Result (dB m) | Antenna Gain (dB i) | ANT 1 + ANT 2 E.I.R.P. (dB m) |
|---------|-----------------|------------------|-------------------------------------------|---------------------|-------------------------------|
| U-NII 1 | 5 210           | MCS0             | 7.77                                      | 5.70                | 13.47                         |

| Band    | FCC Limit       |                    |                |                  |                     |              |
|---------|-----------------|--------------------|----------------|------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 26 dB BW (MHz) | 11+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 1 | 5 210           | 23.98              |                |                  | 5.70                | 23.98        |
| U-NII 3 | 5 775           | 30                 |                |                  | 5.60                | 30           |

| Band    | IC Limit        |                    |               |                    |                     |              |
|---------|-----------------|--------------------|---------------|--------------------|---------------------|--------------|
|         | Frequency (MHz) | Fixed Limit (dB m) | 99 % BW (MHz) | 1.76+10LogB (dB m) | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 1 | 5 775           | 14.77              | 75.485        | 20.54              | 5.70                | 14.77        |
| Band    | IC Limit        |                    |               |                    |                     |              |
|         | Frequency (MHz) | Fixed Limit (dB m) | 99 % BW (MHz) | 11+10LogB (dB m)   | Antenna Gain (dB i) | Limit (dB m) |
| U-NII 3 | 5 775           | 30                 |               |                    | 5.60                | 30           |

**Remark;**

Attenuator and cable offset was compensated in test program (R&S Power Viewer) before measuring.

According to KDB 662911 D01 v02r01, average power of each port (ANT 1+ANT 2) and antenna gain was combined by using below calculation.

Average power:  $10 \log \{10^{(\text{ANT 1 power} / 10)} + 10^{(\text{ANT 2 power} / 10)}\}$

Antenna gain:  $10 \log \{[10^{(\text{ANT 1 gain} / 20)} + 10^{(\text{ANT 2 gain} / 20)}]^{2 / 2}\}$

Average Power Result (dB m) = Average Power (dB m) + Duty Cycle Correction Factor (dB)

## 6. Peak Power Spectral Density

### 6.1. Test Setup



### 6.2. Limit

#### 6.2.1. FCC

According to 15.407(a)(1)(iv)

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. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to 15.407(a)(3)

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

**6.2.2. IC**

According to RSS-247 Issue 2,

**6.2.1.1 Frequency band 5 150-5 250 MHz**

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or  $1.76 + 10 \log_{10} B$ , dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

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

**6.2.4.1 Frequency band 5 725-5 850 MHz**

For equipment operating in the band 5 725-5 850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz. The maximum conducted output power shall not exceed 1 W. The output 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 output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint<sup>3</sup> systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

### 6.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

1. This measurement settings are specified in section F of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power...". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
3. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
4. Make the following adjustments to the peak value of the spectrum, if applicable:
  - a) **If Method SA-2 or SA-2 Alternative was used, add  $10 \log(1/x)$ , where  $x$  is the duty cycle, to the peak of the spectrum.**
  - b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
5. The result is the Maximum PSD over 1 MHz reference bandwidth.
6. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth ( $< 1$  MHz, or  $< 500$  kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
  - a) Set  $RBW \geq 1/T$ , where  $T$  is defined in section II.B.1.a).
  - b) Set  $VBW \geq 3$  RBW.
  - c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add  $10\log(500 \text{ kHz}/RBW)$  to the measured result, whereas  $RBW (< 500 \text{ kHz})$  is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
  - d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add  $10\log(1 \text{ MHz}/RBW)$  to the measured result, whereas  $RBW (< 1 \text{ MHz})$  is the reduced resolution bandwidth of spectrum analyzer set during measurement.
  - e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.
7. TDF function
  - Attenuator and cable offset was compensated before measuring.

## 6.4. Test result

Ambient temperature : (23 ± 1) °C  
Relative humidity : 47 % R.H.

### Test mode: 11a\_ANT1

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | Measured PPSD (dB m) | Duty Cycle Correction Factor (dB) | Final PPSD (dB m) | Limit (dB m/1 MHz)   |
|---------|-----------------|-----|------------------|----------------------|-----------------------------------|-------------------|----------------------|
| U-NII 1 | 5 180           | 36  | 6                | -1.75                | 0.28                              | -1.47             | 11                   |
|         | 5 220           | 44  |                  | -1.53                |                                   | -1.25             |                      |
|         | 5 240           | 48  |                  | -1.71                |                                   | -1.43             |                      |
| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | Measured PPSD (dB m) | Duty Cycle Correction Factor (dB) | Final PPSD (dB m) | Limit (dB m/500 kHz) |
| U-NII 3 | 5 745           | 149 | 6                | -1.54                | 0.28                              | -1.26             | 30                   |
|         | 5 785           | 157 |                  | -1.90                |                                   | -1.62             |                      |
|         | 5 825           | 165 |                  | -1.83                |                                   | -1.55             |                      |

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | Final PPSD (dB m) | Antenna Gain (dB i) | E.I.R.P. PPSD (dB m) | IC Limit (dB m/1 MHz) |
|---------|-----------------|-----|------------------|-------------------|---------------------|----------------------|-----------------------|
| U-NII 1 | 5 180           | 36  | 6                | -1.47             | 2.84                | 1.37                 | 10                    |
|         | 5 220           | 44  |                  | -1.25             |                     | 1.59                 |                       |
|         | 5 240           | 48  |                  | -1.43             |                     | 1.41                 |                       |

### Test mode: 11a\_ANT2

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | Measured PPSD (dB m) | Duty Cycle Correction Factor (dB) | Final PPSD (dB m) | Limit (dB m/1 MHz)   |
|---------|-----------------|-----|------------------|----------------------|-----------------------------------|-------------------|----------------------|
| U-NII 1 | 5 180           | 36  | 6                | -2.23                | 0.28                              | -1.95             | 11                   |
|         | 5 220           | 44  |                  | -2.17                |                                   | -1.89             |                      |
|         | 5 240           | 48  |                  | -1.93                |                                   | -1.65             |                      |
| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | Measured PPSD (dB m) | Duty Cycle Correction Factor (dB) | Final PPSD (dB m) | Limit (dB m/500 kHz) |
| U-NII 3 | 5 745           | 149 | 6                | -1.96                | 0.28                              | -1.68             | 30                   |
|         | 5 785           | 157 |                  | -1.90                |                                   | -1.62             |                      |
|         | 5 825           | 165 |                  | -2.06                |                                   | -1.78             |                      |

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | Final PPSD (dB m) | Antenna Gain (dB i) | E.I.R.P. PPSD (dB m) | IC Limit (dB m/1 MHz) |
|---------|-----------------|-----|------------------|-------------------|---------------------|----------------------|-----------------------|
| U-NII 1 | 5 180           | 36  | 6                | -1.95             | 2.54                | 0.59                 | 10                    |
|         | 5 220           | 44  |                  | -1.89             |                     | 0.65                 |                       |
|         | 5 240           | 48  |                  | -1.65             |                     | 0.89                 |                       |

**Test mode: 11n\_HT20**

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1 Measured PPSD (dB m) | ANT 2 Measured PPSD (dB m) | ANT 1+ANT 2 PPSD (dB m) |
|---------|-----------------|-----|------------------|----------------------------|----------------------------|-------------------------|
| U-NII 1 | 5 180           | 36  | MCS8             | -8.20                      | -6.97                      | -4.53                   |
|         | 5 220           | 44  |                  | -8.31                      | -7.07                      | -4.64                   |
|         | 5 240           | 48  |                  | -8.31                      | -7.32                      | -4.78                   |
| U-NII 3 | 5 745           | 149 |                  | -7.48                      | -7.84                      | -4.65                   |
|         | 5 785           | 157 |                  | -7.82                      | -8.09                      | -4.94                   |
|         | 5 825           | 165 |                  | -8.25                      | -7.86                      | -5.04                   |

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1+ANT 2 PPSD (dB m) | Duty Cycle Correction Factor (dB) | ANT 1+ANT 2 Final PPSD (dB m) | Limit (dB m/1 MHz)   |
|---------|-----------------|-----|------------------|-------------------------|-----------------------------------|-------------------------------|----------------------|
| U-NII 1 | 5 180           | 36  | MCS8             | -4.53                   | 0.61                              | -3.92                         | 11                   |
|         | 5 220           | 44  |                  | -4.64                   |                                   | -4.03                         |                      |
|         | 5 240           | 48  |                  | -4.78                   |                                   | -4.17                         |                      |
| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1+ANT 2 PPSD (dB m) | Duty Cycle Correction Factor (dB) | ANT 1+ANT 2 Final PPSD (dB m) | Limit (dB m/500 kHz) |
| U-NII 3 | 5 745           | 149 | MCS8             | -4.65                   | 0.61                              | -4.04                         | 30                   |
|         | 5 785           | 157 |                  | -4.94                   |                                   | -4.33                         |                      |
|         | 5 825           | 165 |                  | -5.04                   |                                   | -4.43                         |                      |

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1+ANT 2 Final PPSD (dB m) | Antenna Gain (dB i) | ANT 1+ANT 2 E.I.R.P. PPSD (dB m) | IC Limit (dB m/1 MHz) |
|---------|-----------------|-----|------------------|-------------------------------|---------------------|----------------------------------|-----------------------|
| U-NII 1 | 5 180           | 36  | MCS8             | -3.92                         | 5.70                | 1.78                             | 10                    |
|         | 5 220           | 44  |                  | -4.03                         |                     | 1.67                             |                       |
|         | 5 240           | 48  |                  | -4.17                         |                     | 1.53                             |                       |

**Test mode: 11n\_HT40**

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1 Measured PPSD (dB m) | ANT 2 Measured PPSD (dB m) | ANT 1+ANT 2 PPSD (dB m) |
|---------|-----------------|-----|------------------|----------------------------|----------------------------|-------------------------|
| U-NII 1 | 5 190           | 38  | MCS8             | -7.81                      | -8.05                      | -4.92                   |
|         | 5 230           | 46  |                  | -7.68                      | -8.49                      | -5.06                   |
| U-NII 3 | 5 755           | 151 |                  | -7.28                      | -11.39                     | -5.86                   |
|         | 5 795           | 159 |                  | -7.44                      | -11.31                     | -5.95                   |

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1+ANT 2 PPSD (dB m) | Duty Cycle Correction Factor (dB) | ANT 1+ANT 2 Final PPSD (dB m) | Limit (dB m/1 MHz)   |
|---------|-----------------|-----|------------------|-------------------------|-----------------------------------|-------------------------------|----------------------|
| U-NII 1 | 5 190           | 38  | MCS8             | -4.92                   | 1.08                              | -3.84                         | 11                   |
|         | 5 230           | 46  |                  | -5.06                   |                                   | -3.98                         |                      |
| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1+ANT 2 PPSD (dB m) | Duty Cycle Correction Factor (dB) | ANT 1+ANT 2 Final PPSD (dB m) | Limit (dB m/500 kHz) |
| U-NII 3 | 5 755           | 151 | MCS8             | -5.86                   | 1.08                              | -4.78                         | 30                   |
|         | 5 795           | 159 |                  | -5.95                   |                                   | -4.87                         |                      |

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1+ANT 2 Final PPSD (dB m) | Antenna Gain (dB i) | ANT 1+ANT 2 E.I.R.P. PPSD (dB m) | IC Limit (dB m/1 MHz) |
|---------|-----------------|-----|------------------|-------------------------------|---------------------|----------------------------------|-----------------------|
| U-NII 1 | 5 190           | 38  | MCS8             | -3.84                         | 5.70                | 1.86                             | 10                    |
|         | 5 230           | 46  |                  | -3.98                         |                     | 1.72                             |                       |

**Test mode: 11ac\_VHT80**

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1 Measured PPSD (dB m) | ANT 2 Measured PPSD (dB m) | ANT 1+ANT 2 PPSD (dB m) |
|---------|-----------------|-----|------------------|----------------------------|----------------------------|-------------------------|
| U-NII 1 | 5 210           | 42  | MCS0             | -14.02                     | -14.84                     | -11.40                  |
| U-NII 3 | 5 775           | 155 |                  | -13.57                     | -14.44                     | -10.97                  |

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1+ANT 2 PPSD (dB m) | Duty Cycle Correction Factor (dB) | ANT 1+ANT 2 Final PPSD (dB m) | Limit (dB m/1 MHz)   |
|---------|-----------------|-----|------------------|-------------------------|-----------------------------------|-------------------------------|----------------------|
| U-NII 1 | 5 210           | 42  | MCS0             | -11.40                  | 1.16                              | -10.24                        | 11                   |
| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1+ANT 2 PPSD (dB m) | Duty Cycle Correction Factor (dB) | ANT 1+ANT 2 Final PPSD (dB m) | Limit (dB m/500 kHz) |
| U-NII 3 | 5 775           | 155 | MCS0             | -10.97                  | 1.16                              | -9.81                         | 30                   |

| Band    | Frequency (MHz) | Ch. | Data Rate (Mbps) | ANT 1+ANT 2 Final PPSD (dB m) | Antenna Gain (dB i) | ANT 1+ANT 2 E.I.R.P. PPSD (dB m) | IC Limit (dB m/1 MHz) |
|---------|-----------------|-----|------------------|-------------------------------|---------------------|----------------------------------|-----------------------|
| U-NII 1 | 5 210           | 42  | MCS0             | -10.24                        | 5.70                | -4.54                            | 10                    |

**Remark;**

According to KDB 662911 D01 v02r01, power spectral density of each port (ANT 1+ANT 2) was combined by using below calculation.

PPSD:  $10 \log \{10^{(ANT\ 1\ PSD / 10)} + 10^{(ANT\ 2\ PSD / 10)}\}$

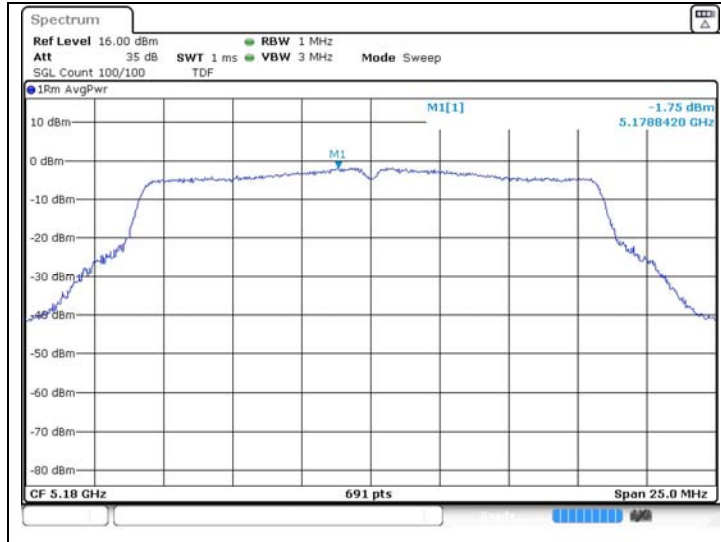
Antenna Gain:  $10 \log \{[10^{(ANT\ 1\ gain / 20)} + 10^{(ANT\ 2\ gain / 20)}]^{2 / 2}\}$

Final PPSD (dB m) = PPSD (dB m) + Duty Correction Correction Factor (dB)

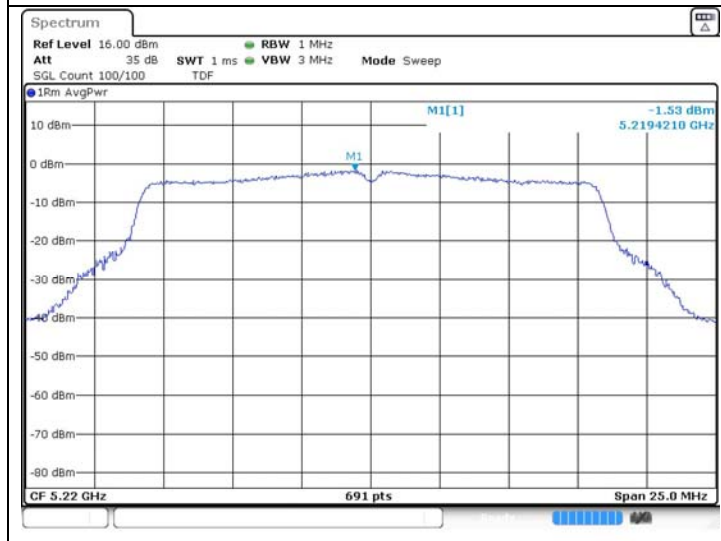
- Test plots

**OFDM: 802.11a (Band 1)\_ANT 1**

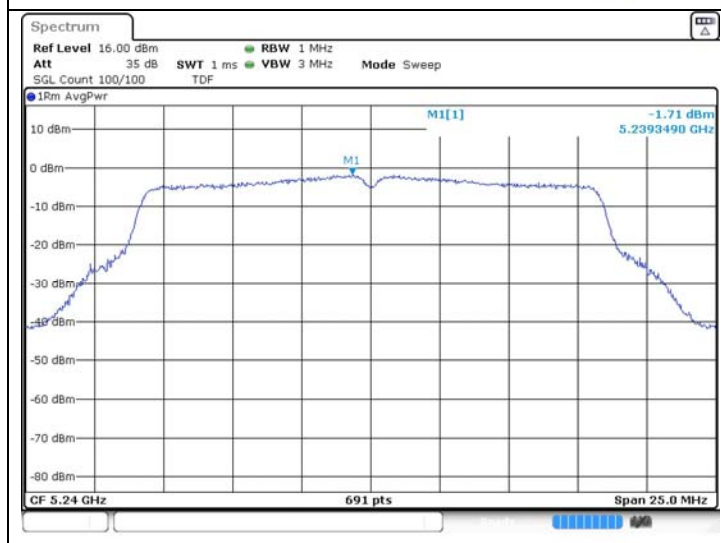
Low Channel  
(5 180 MHz)



Middle Channel  
(5 220 MHz)

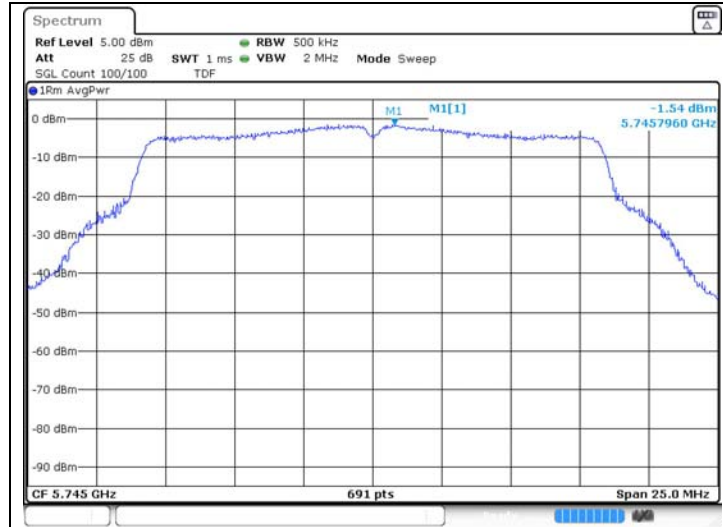


High Channel  
(5 240 MHz)

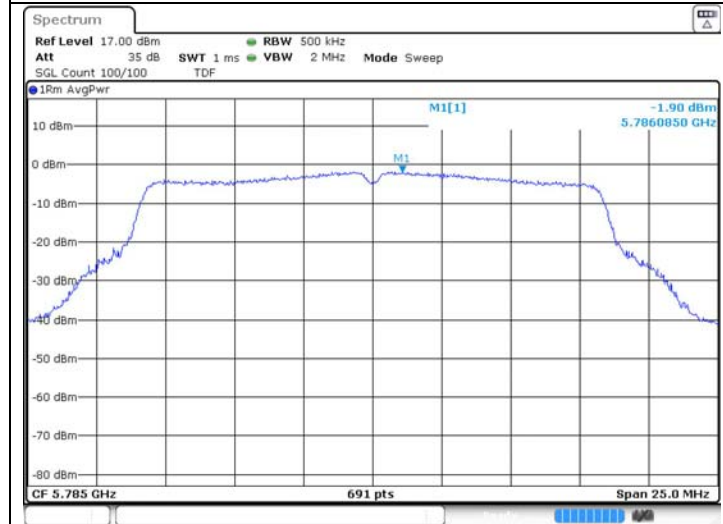


## OFDM: 802.11a (Band 3)\_ANT 1

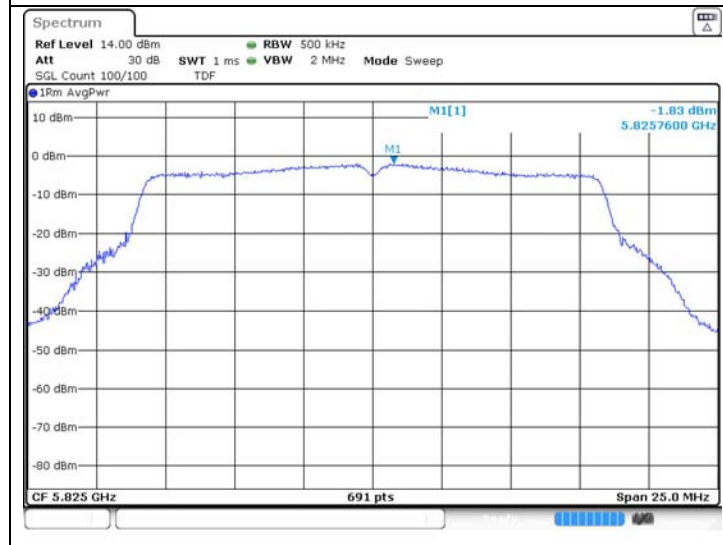
Low Channel  
(5 745 MHz)



Middle Channel  
(5 785 MHz)



High Channel  
(5 825 MHz)



**OFDM: 802.11a (Band 1)\_ANT 2**

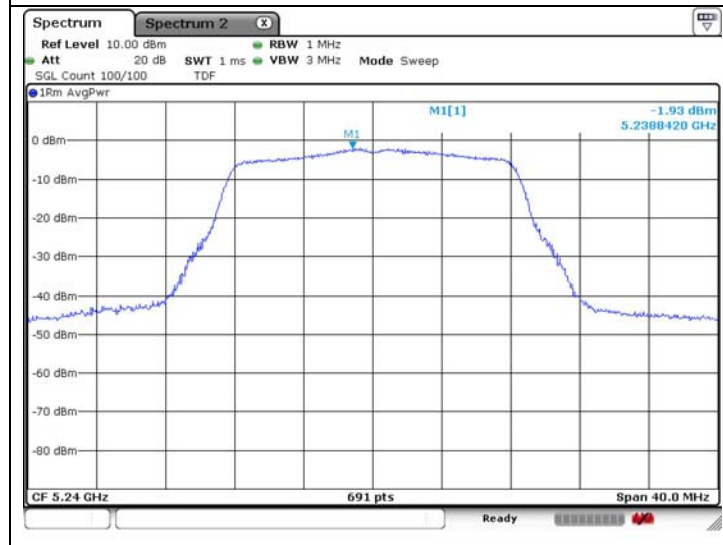
Low Channel  
 (5 180 MHz)



Middle Channel  
 (5 220 MHz)

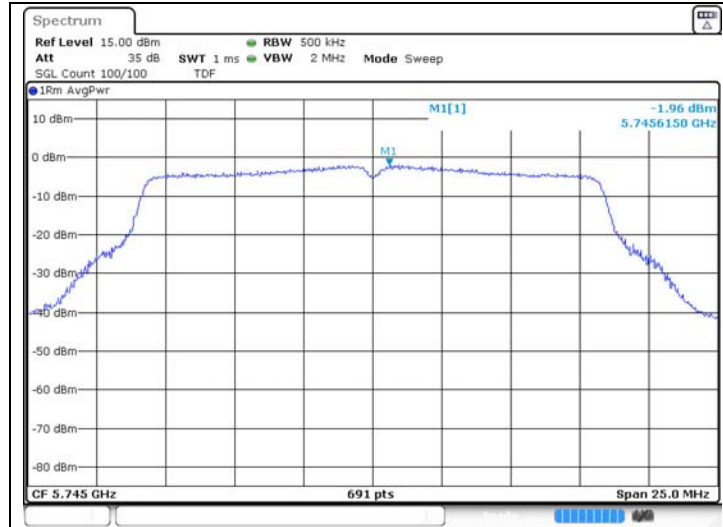


High Channel  
 (5 240 MHz)



**OFDM: 802.11a (Band 3)\_ANT 2**

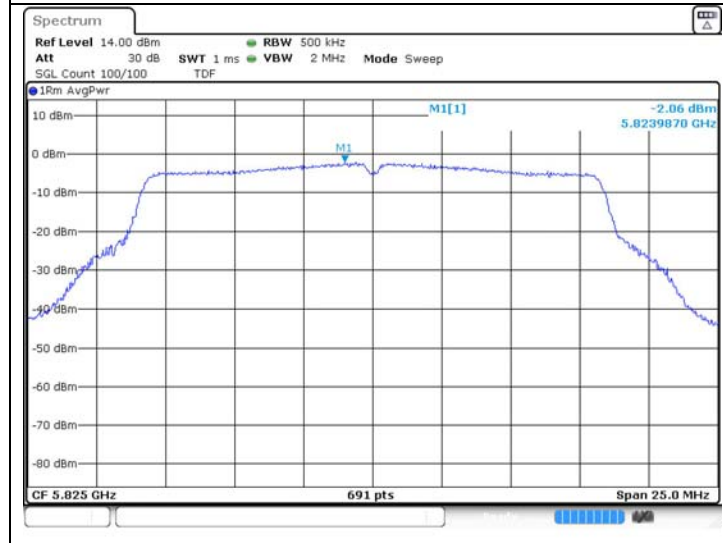
Low Channel  
 (5 745 MHz)



Middle Channel  
 (5 785 MHz)

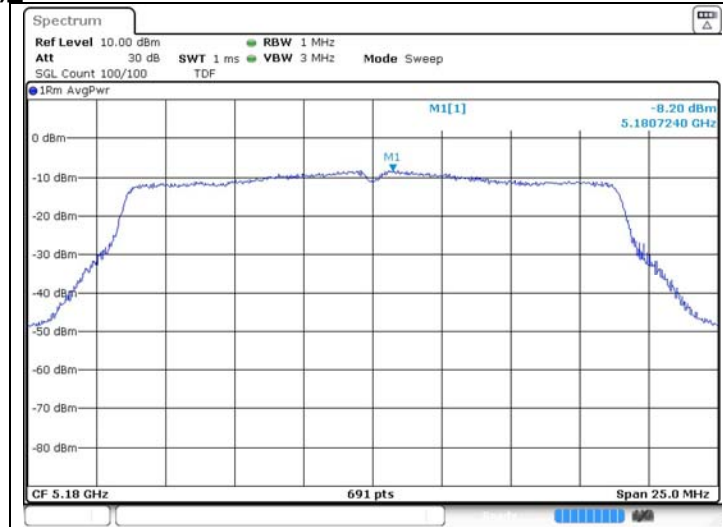


High Channel  
 (5 825 MHz)

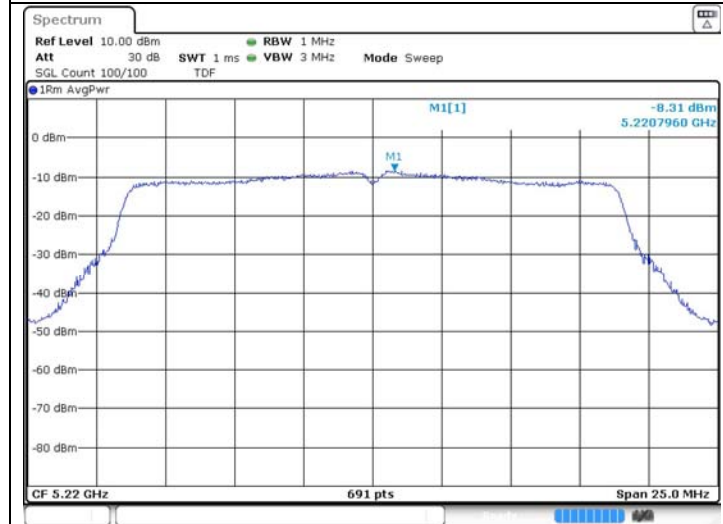


**OFDM: 802.11n\_HT20 (Band 1) ANT 1**

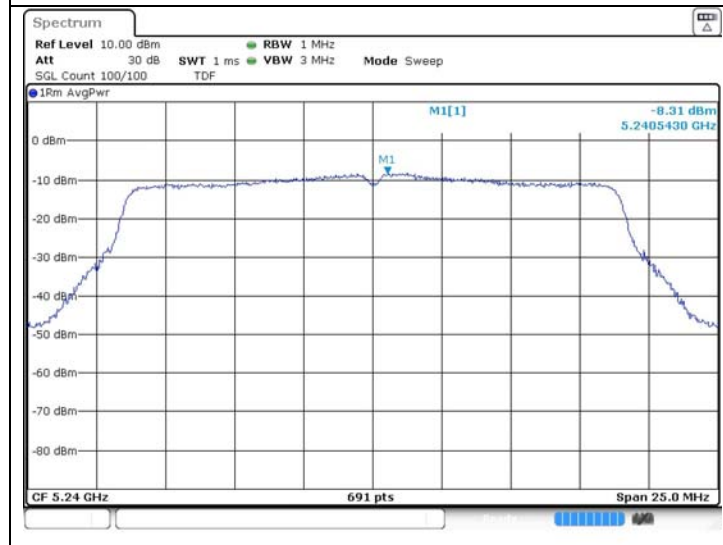
Low Channel  
(5 180 MHz)



Middle Channel  
(5 220 MHz)

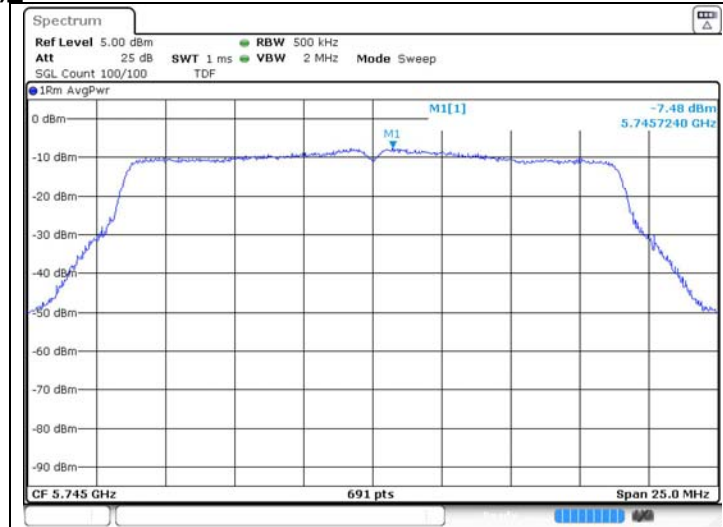


High Channel  
(5 240 MHz)



**OFDM: 802.11n\_HT20 (Band 3) ANT 1**

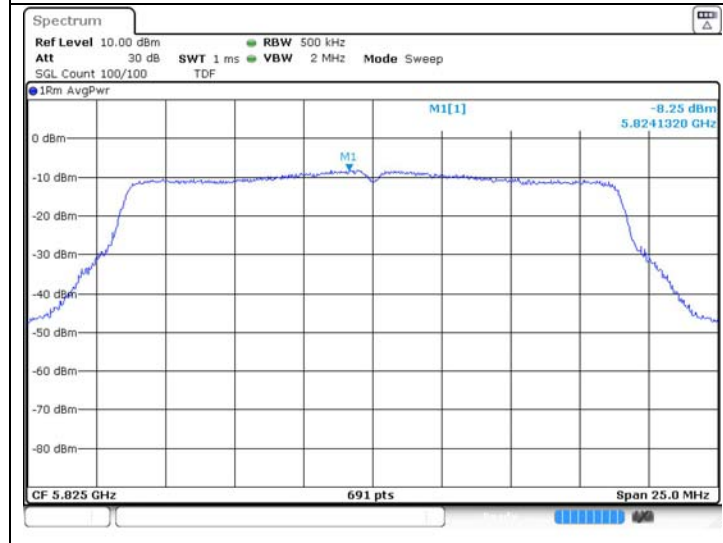
Low Channel  
 (5 745 MHz)



Middle Channel  
 (5 785 MHz)



High Channel  
 (5 825 MHz)



**OFDM: 802.11n\_HT20 (Band 1) ANT 2**

Low Channel  
 (5 180 MHz)



Middle Channel  
 (5 220 MHz)



High Channel  
 (5 240 MHz)



**OFDM: 802.11n\_HT20 (Band 3) ANT 2**

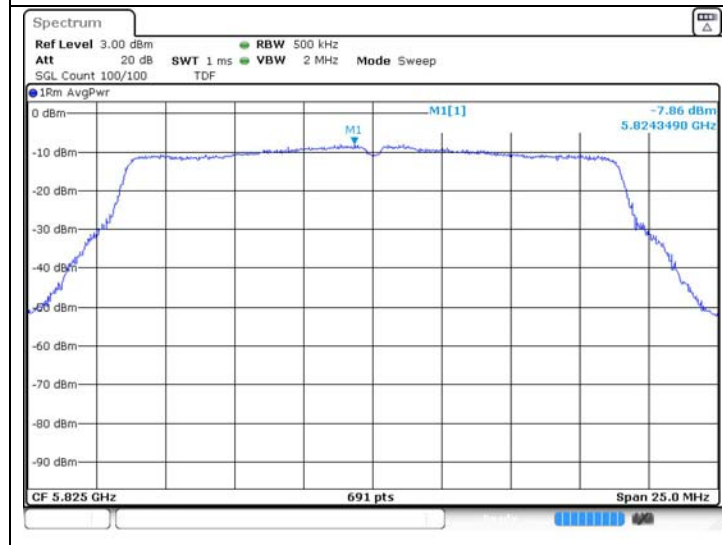
Low Channel  
(5 745 MHz)



Middle Channel  
(5 785 MHz)

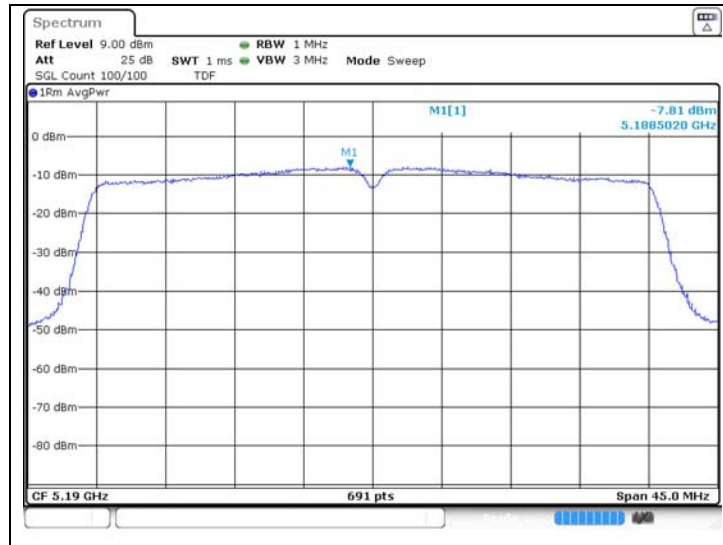


High Channel  
(5 825 MHz)

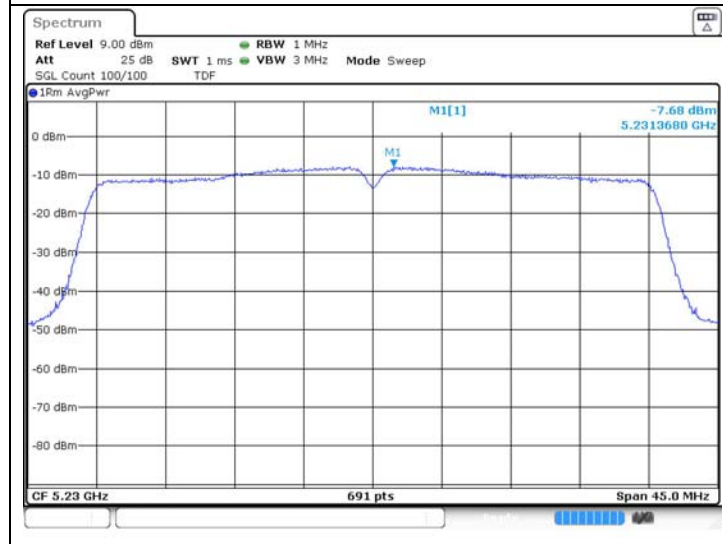


**OFDM: 802.11n\_HT40 (Band 1)\_ANT 1**

Low Channel  
 (5 190 MHz)

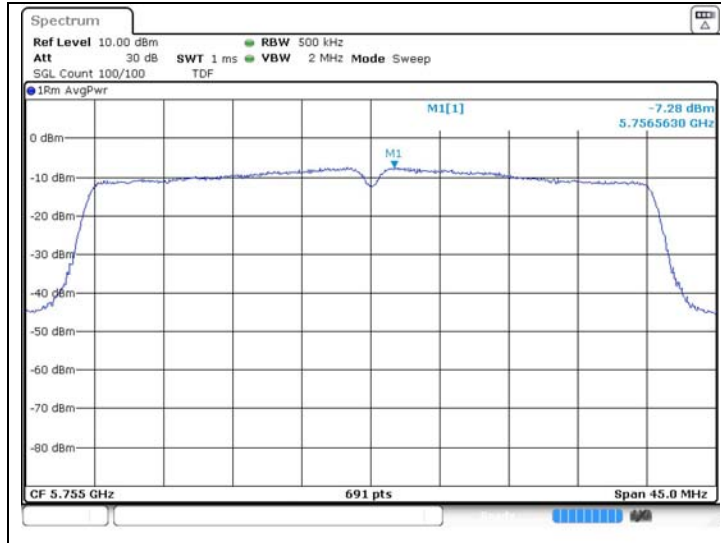


High Channel  
 (5 230 MHz)

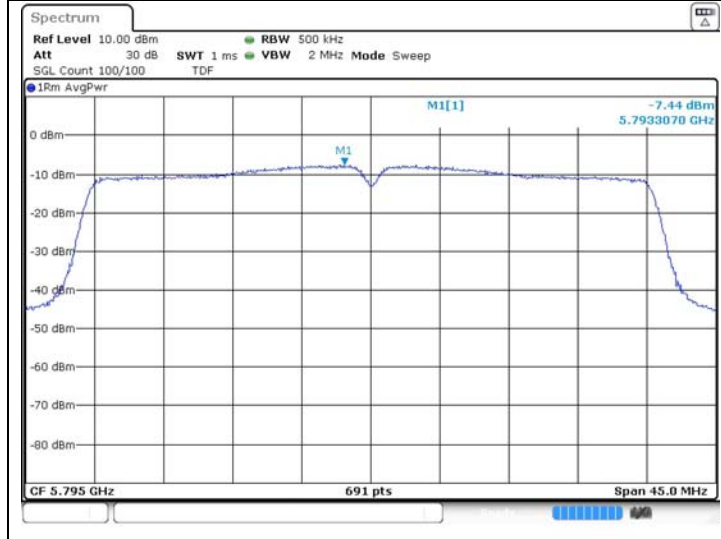


**OFDM: 802.11n\_HT40 (Band 3)\_ANT 1**

Low Channel  
(5 755 MHz)

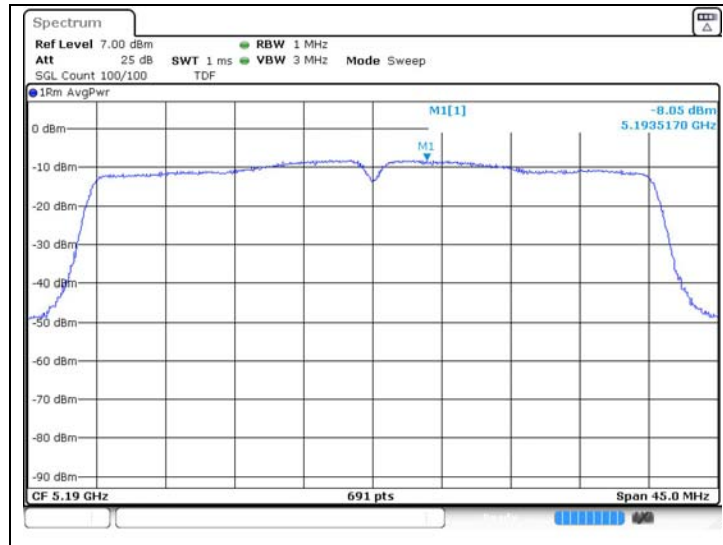


High Channel  
(5 795 MHz)

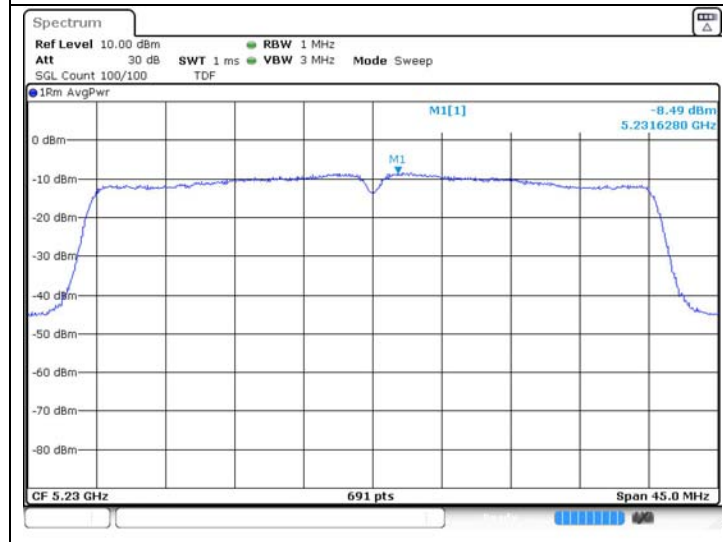


**OFDM: 802.11n\_HT40 (Band 1)\_ANT 2**

Low Channel  
(5 190 MHz)

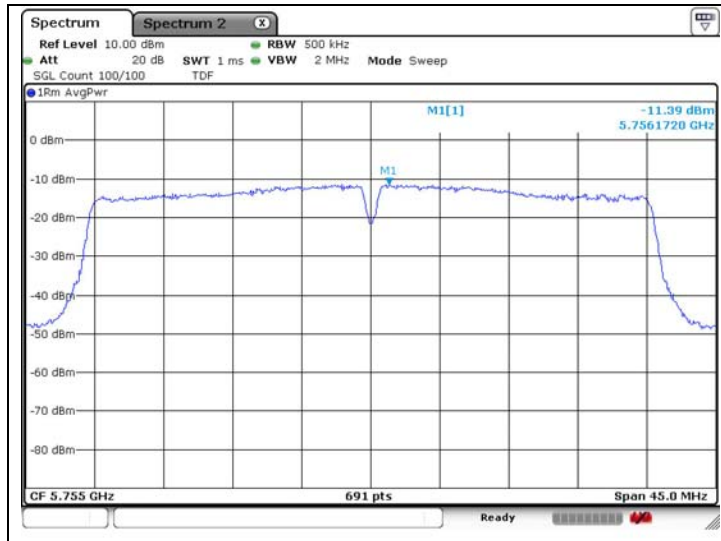


High Channel  
(5 230 MHz)

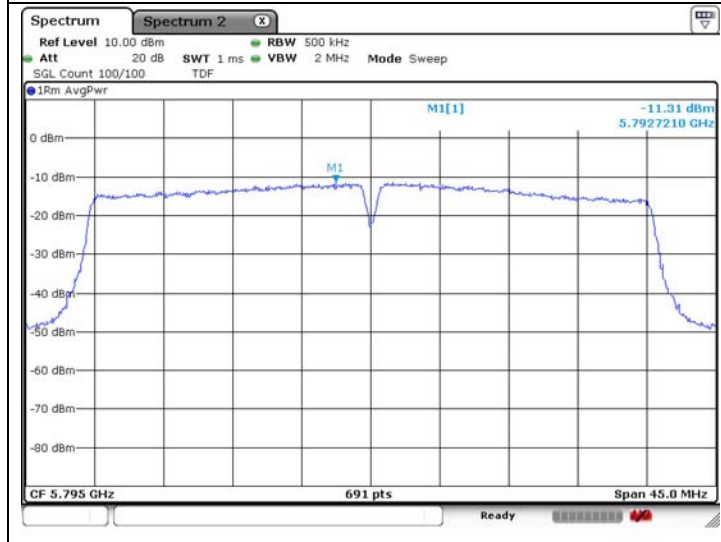


**OFDM: 802.11n\_HT40 (Band 3)\_ANT 2**

Low Channel  
 (5 755 MHz)

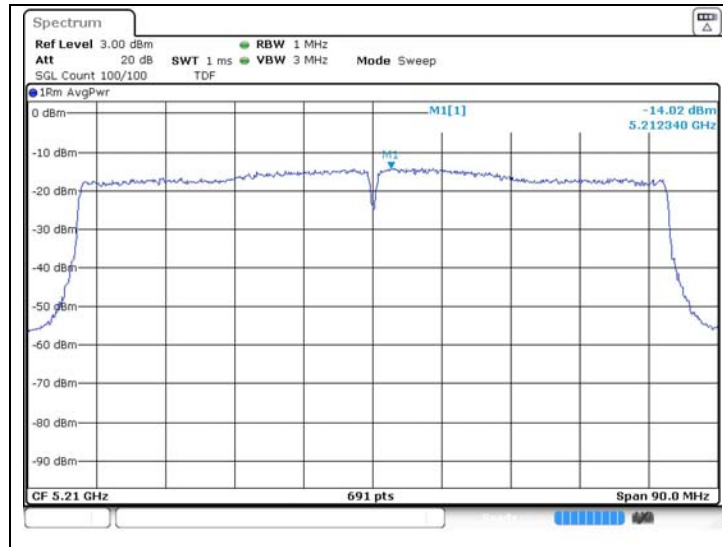


High Channel  
 (5 795 MHz)



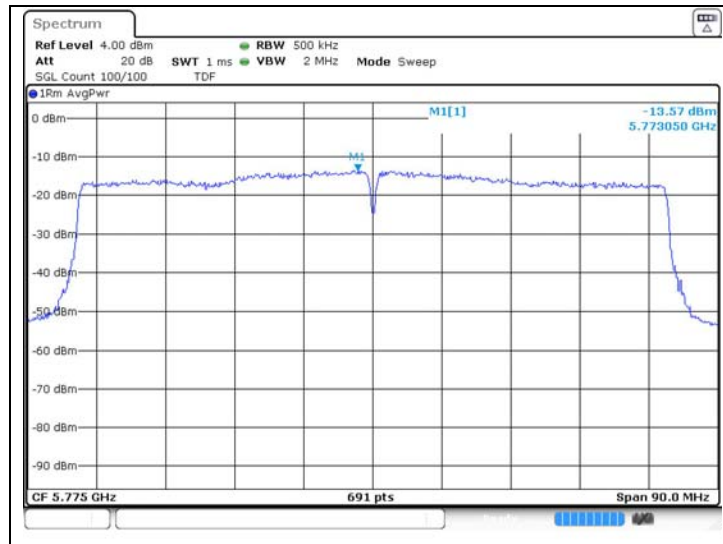
**OFDM: 802.11ac\_VHT80 (Band 1)\_ANT 1**

Middle Channel  
 (5 210 MHz)



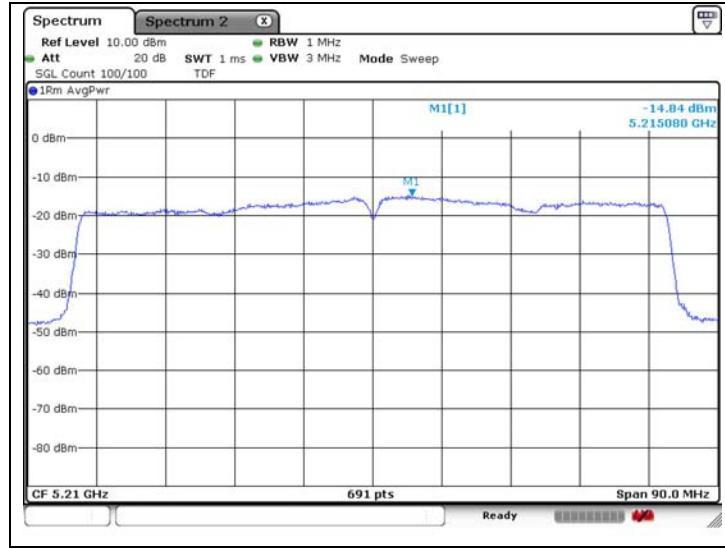
**OFDM: 802.11ac\_VHT80 (Band 3)\_ANT 1**

Middle Channel  
 (5 290 MHz)



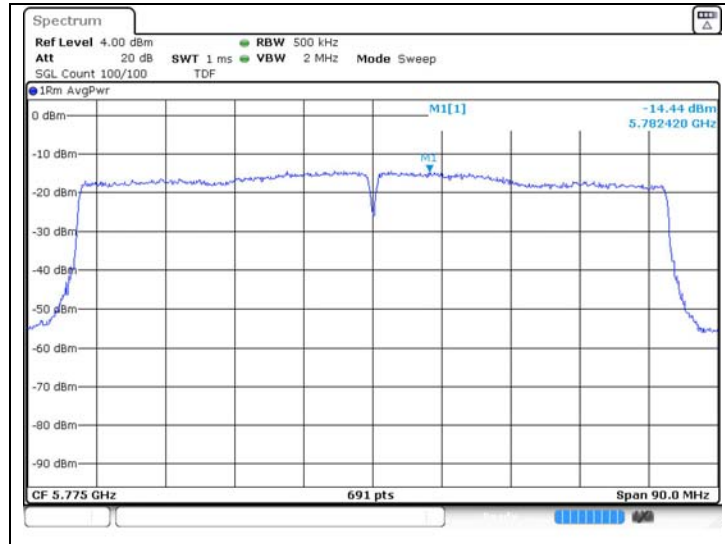
**OFDM: 802.11ac\_VHT80 (Band 1)\_ANT 2**

Middle Channel  
 (5 210 MHz)



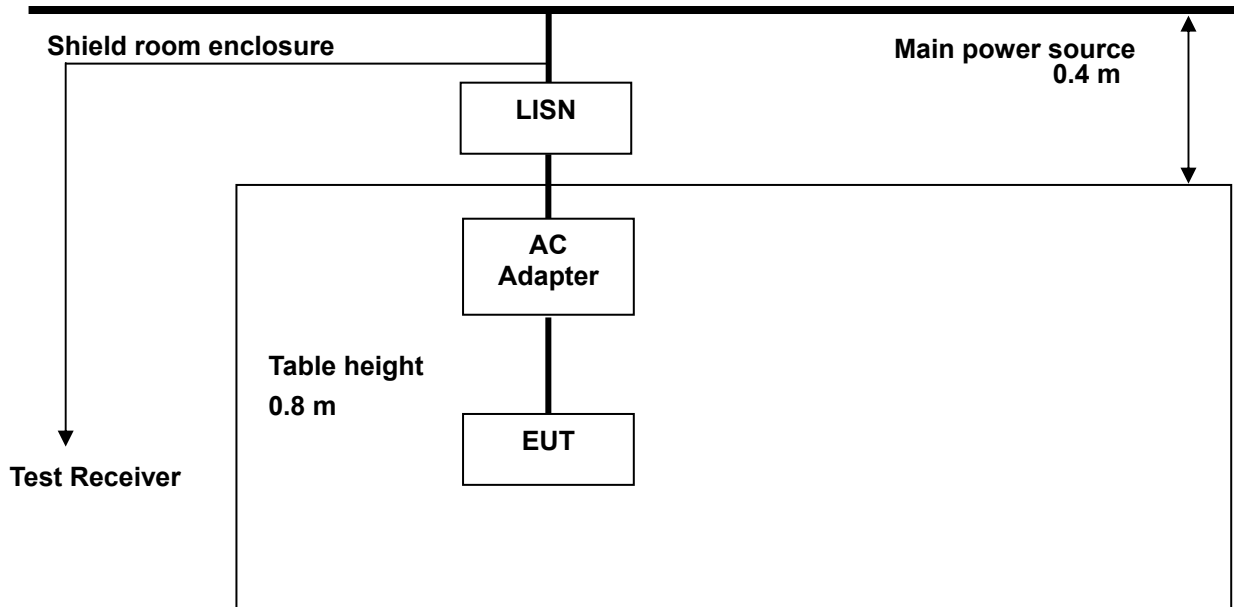
**OFDM: 802.11ac\_VHT80 (Band 3)\_ANT 2**

Middle Channel  
 (5 290 MHz)



## 7. AC Power Line Conducted Emission

### 7.1. Test Setup



### 7.2. Limit

#### 7.2.1. FCC

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H / 50 ohms line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15-0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5-5                       | 56                           | 46        |
| 5-30                        | 60                           | 50        |

\* Decreases with the logarithm of the frequency.

### 7.2.2. IC

RSS-Gen Issue 5, 8.8, Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50  $\mu$  H / 50  $\Omega$  line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

**Table 4 - AC power-line conducted emissions limits**

| Frequency (MHz) | Conducted limit (dB $\mu$ V) |                       |
|-----------------|------------------------------|-----------------------|
|                 | Quasi-peak                   | Average               |
| 0.15-0.5        | 66 to 56 <sup>1</sup>        | 56 to 46 <sup>1</sup> |
| 0.5-5           | 56                           | 46                    |
| 5-30            | 60                           | 50                    |

**Note 1:** The level decreases linearly with the logarithm of the frequency.

For an EUT with a permanent or detachable antenna operating between 150 kHz and 30 MHz, the AC power-line conducted emissions must be measured using the following configurations:

- (a) Perform the AC power-line conducted emissions test with the antenna connected to determine compliance with the limits of table 4 outside the transmitter's fundamental emission band.
- (b) Retest with a dummy load instead of the antenna to determine compliance with the limits of table 4 within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network that simulates the antenna in the fundamental frequency band.

### 7.3. Test Procedures

AC conducted emissions from the EUT were measured according to the dictates of ANSI C63.10-2013

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

## 7.4. Test Results

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Ambient temperature :  $(23 \pm 1) ^\circ\text{C}$   
Relative humidity : 47 % R.H.

Frequency range : 0.15 MHz - 30 MHz  
Measured Bandwidth : 9 kHz

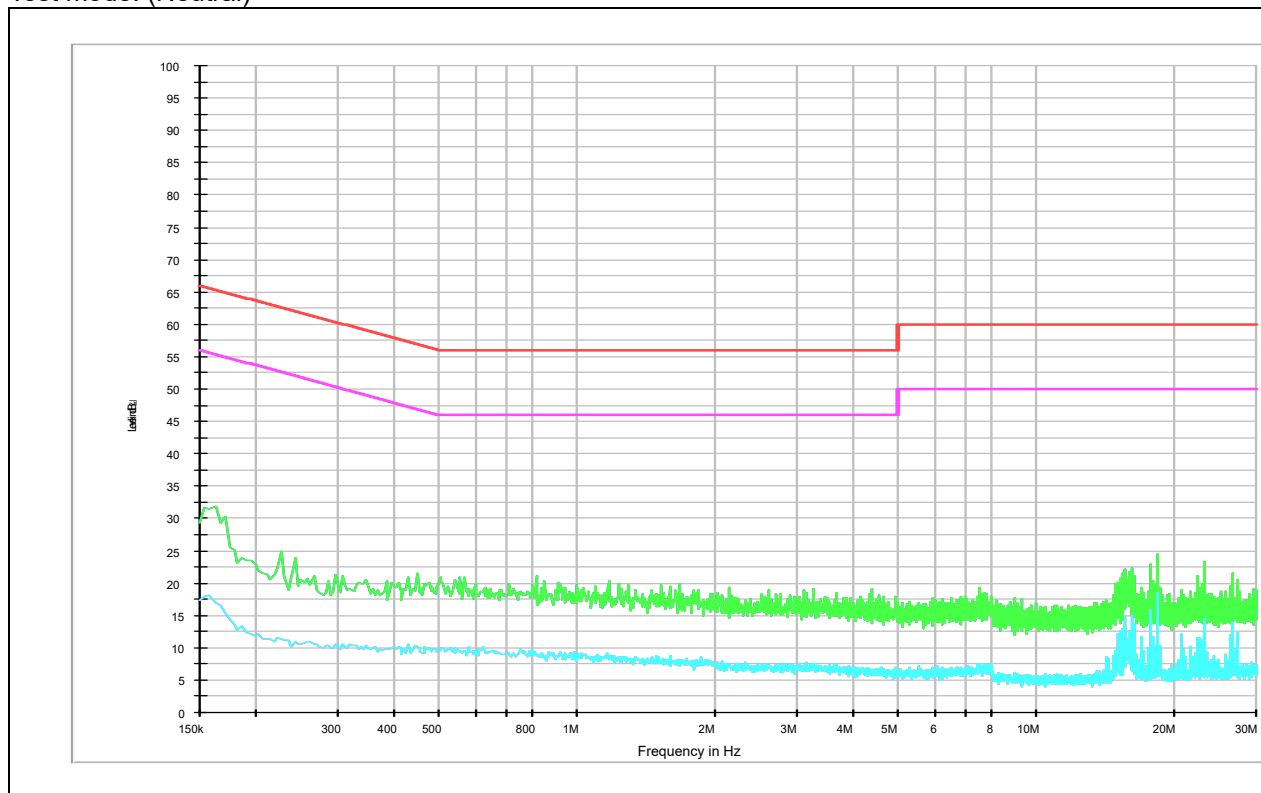
| FREQ.<br>(MHz) | LEVEL (dB $\mu$ V) |         | LINE | LIMIT (dB $\mu$ V) |         | MARGIN (dB) |         |
|----------------|--------------------|---------|------|--------------------|---------|-------------|---------|
|                | Q-Peak             | Average |      | Q-Peak             | Average | Q-Peak      | Average |
| 0.16           | 24.50              | 17.30   | N    | 65.46              | 55.46   | 40.96       | 38.16   |
| 0.23           | 16.80              | 11.20   | N    | 62.45              | 52.45   | 45.65       | 41.25   |
| 0.81           | 14.70              | 9.20    | N    | 56.00              | 46.00   | 41.30       | 36.80   |
| 15.56          | 19.10              | 13.50   | N    | 60.00              | 50.00   | 40.90       | 36.50   |
| 18.24          | 22.40              | 18.00   | N    | 60.00              | 50.00   | 37.60       | 32.00   |
| 23.13          | 20.60              | 16.10   | N    | 60.00              | 50.00   | 39.40       | 33.90   |
| 0.16           | 25.00              | 17.70   | H    | 65.46              | 55.46   | 40.46       | 37.76   |
| 0.19           | 19.00              | 12.90   | H    | 64.04              | 54.04   | 45.04       | 41.14   |
| 0.24           | 16.60              | 10.70   | H    | 62.10              | 52.10   | 45.50       | 41.40   |
| 15.62          | 21.40              | 16.40   | H    | 60.00              | 50.00   | 38.60       | 33.60   |
| 18.30          | 19.70              | 15.20   | H    | 60.00              | 50.00   | 40.30       | 34.80   |
| 26.61          | 20.40              | 15.50   | H    | 60.00              | 50.00   | 39.60       | 34.50   |

### Remark;

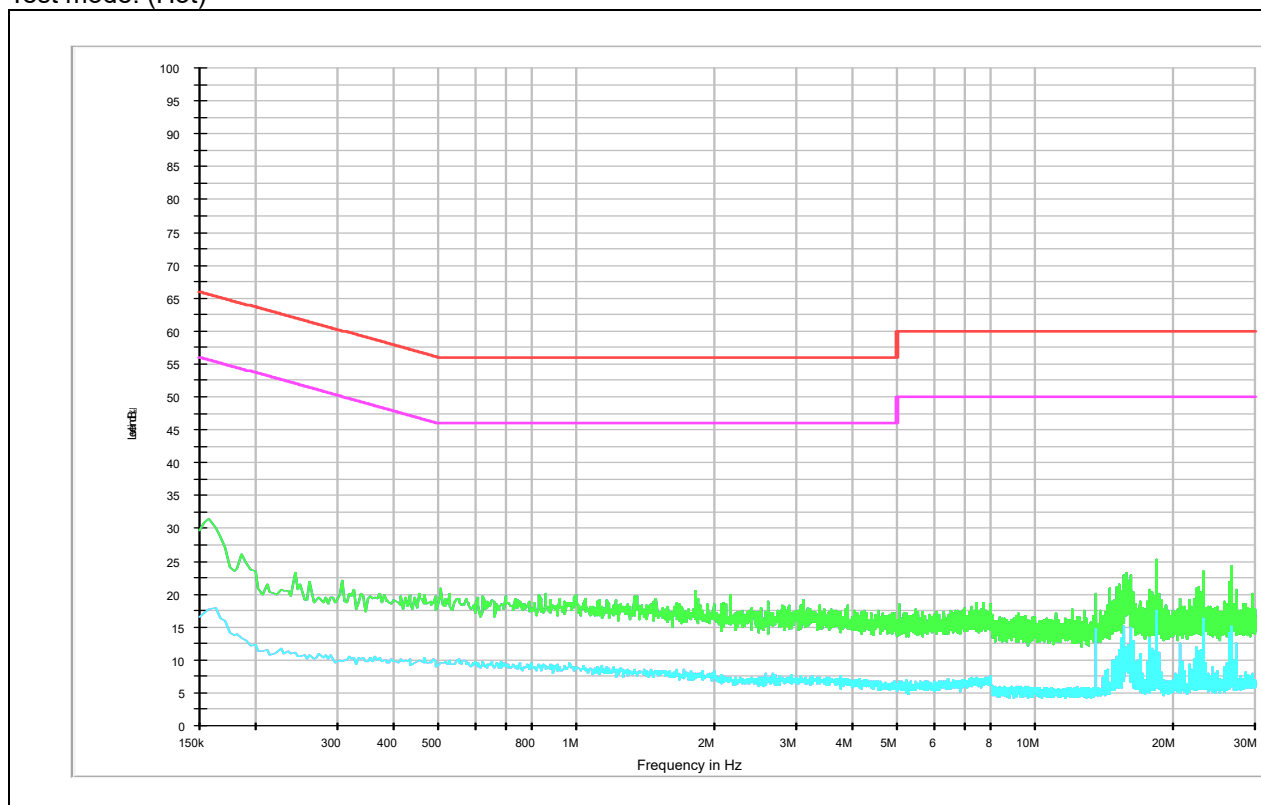
- Line (H): Hot, Line (N): Neutral.
- All modes of operation were investigated and the worst-case emissions were reported using **11a ANT1 (Band 3) / 6 Mbps / Low channel.**
- The limit for Class B device(s) from 150 kHz to 30 MHz are specified in Section of the Title 47 CFR.
- Traces shown in plot were made by using a peak detector and average detector.
- Deviations to the Specifications: None.

## - Test plots

Test mode: (Neutral)



Test mode: (Hot)



## 8. Antenna Requirement

### 8.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §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. And according to FCC 47 CFR Section §15.407 (a) if transmitting antennas of directional gain greater than 6 dB i are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dB i.

### 8.2. Antenna Connected Construction

Antenna used in this product is PCB & Cable Assembly antenna and peak max gain of antenna as below.

| Band           | 5 150 MHz – 5 250 MHz                      | 5 725 MHz – 5 850 MHz |
|----------------|--------------------------------------------|-----------------------|
| Mode           | 11a/n_HT20, HT40, 11ac_VHT20, VHT40, VHT80 |                       |
| ANT1 Gain      | 2.84 dB i                                  | 2.73 dB i             |
| ANT2 Gain      | 2.54 dB i                                  | 2.45 dB i             |
| ANT1+ANT2 Gain | 5.70 dB i                                  | 5.60 dB i             |

Unequal antenna gains, with equal transmit powers. For antenna gains given by  $G_1, G_2, \dots, G_N$  dB i

(i) If transmit signals are correlated, then

Directional gain =  $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$  dB i [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

- End of the Test Report -