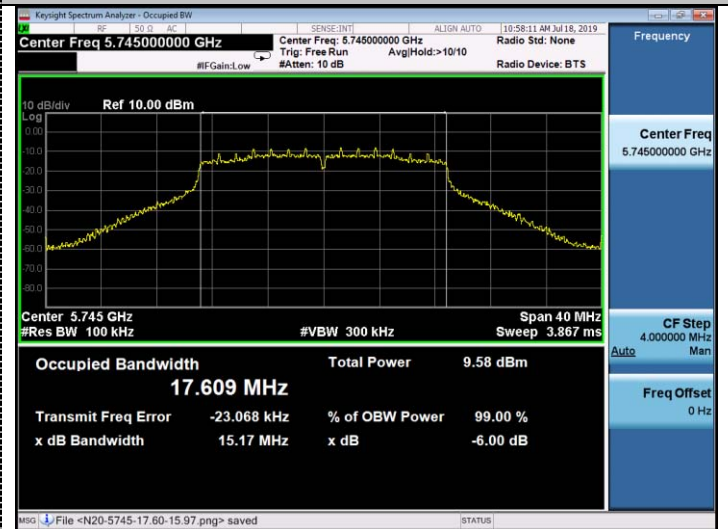


## 6dB and 99%Bandwidth Antenna 1

802.11a

802.11n HT20



CH149

CH149



CH157

CH157



CH165

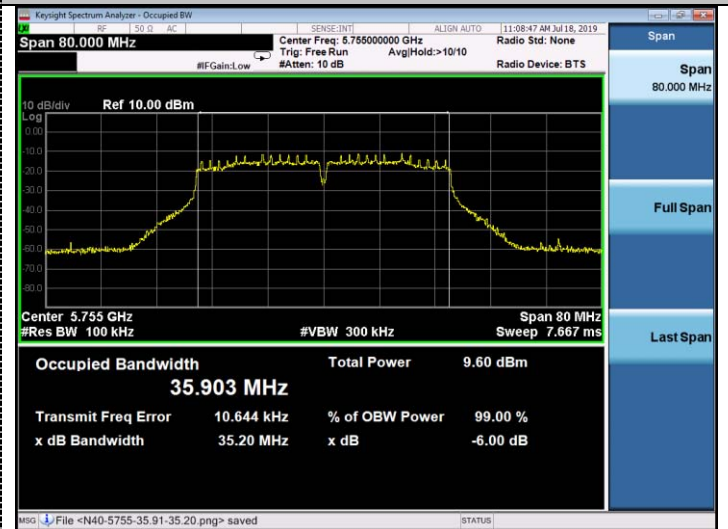
CH165

## 6dB and 99%Bandwidth Antenna 1

## 802.11ac20



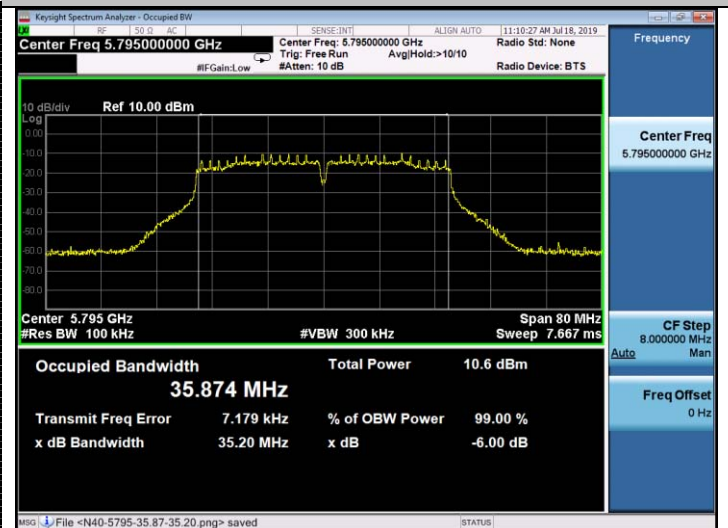
## 802.11n HT40



## CH149



## CH151



## CH157

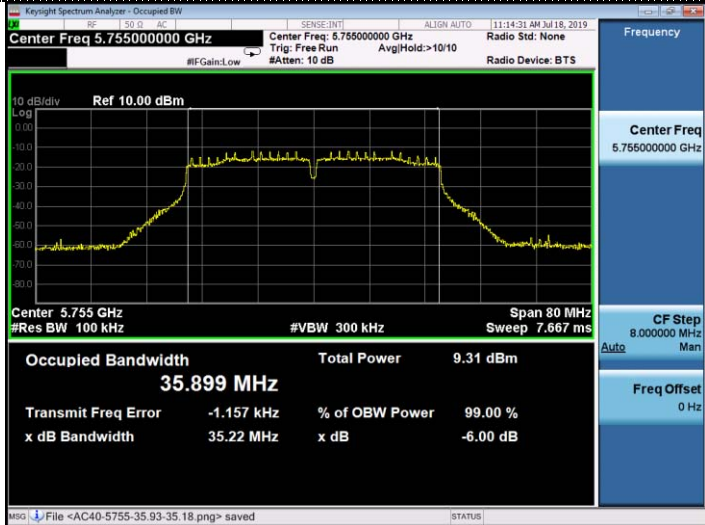


## CH159

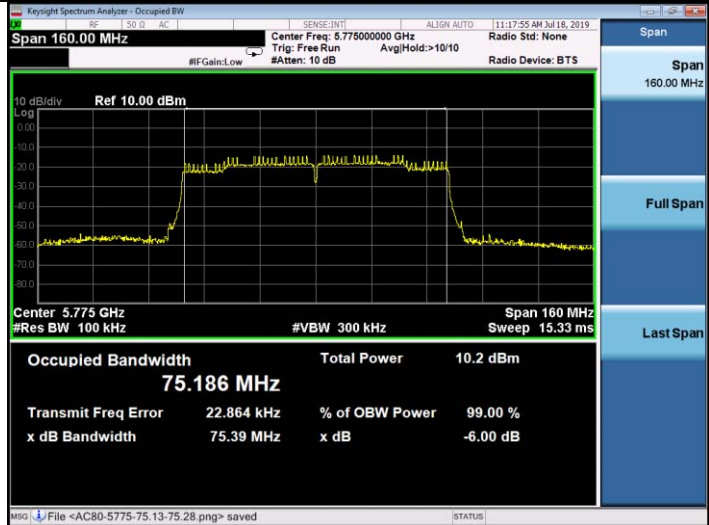
## CH165

6dB and 99%Bandwidth Antenna 1

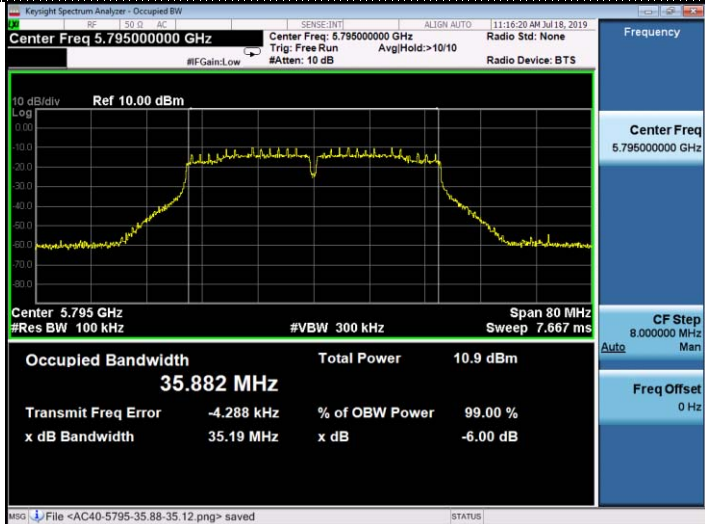
802.11ac40



802.11ac80



CH151



CH155

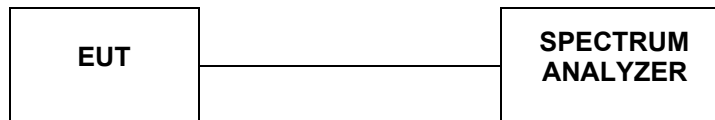


CH159



#### 4.7. 26dBc Bandwidth

##### TEST CONFIGURATION



##### TEST PROCEDURE

According to KDB789033 D02 General UNII Test Procedures New Rules v01 for one of the following procedures may be used for Emission Bandwidth (EBW) measurement:

- a. Set RBW = 300 kHz (approximately 1% of the emission bandwidth).
- b. Set the video bandwidth (VBW) = 1000 KHz (VBW > RBW)
- c. Detector = Peak.
- d. Trace mode = max hold.
- e. Sweep = auto couple.
- f. Allow the trace to stabilize
- g. Measure the maximum width of the emission that is 26 dB down from the maximum 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%.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

##### LIMIT

No Limits for 26dBc Bandwidth

##### TEST RESULTS

**Antenna 0**

| Type        | Channel | 99%Bandwidth (MHz) | 26dB Bandwidth (MHz) | Limit (KHz) | Result |
|-------------|---------|--------------------|----------------------|-------------|--------|
| 802.11a     | 149     | 16.693             | 23.37                | -           | Pass   |
|             | 157     | 16.690             | 22.81                |             |        |
|             | 165     | 16.616             | 23.04                |             |        |
| 802.11nHT20 | 149     | 17.729             | 23.62                | -           | Pass   |
|             | 157     | 17.758             | 22.47                |             |        |
|             | 165     | 17.739             | 23.37                |             |        |
| 802.11ac20  | 149     | 17.780             | 23.73                | -           | Pass   |
|             | 157     | 17.723             | 23.47                |             |        |
|             | 165     | 17.771             | 23.20                |             |        |
| 802.11n40   | 151     | 36.155             | 41.91                | -           | Pass   |
|             | 159     | 36.241             | 47.75                |             |        |
| 802.11ac40  | 151     | 36.124             | 42.89                | -           | Pass   |
|             | 159     | 36.124             | 42.56                |             |        |
| 802.11ac80  | 155     | 75.134             | 81.43                | -           | Pass   |

**Antenna 1**

| Type        | Channel | 99%Bandwidth (MHz) | 26dB Bandwidth (MHz) | Limit (KHz) | Result |
|-------------|---------|--------------------|----------------------|-------------|--------|
| 802.11a     | 149     | 16.717             | 23.94                | -           | Pass   |
|             | 157     | 16.685             | 23.10                |             |        |
|             | 165     | 16.724             | 24.00                |             |        |
| 802.11nHT20 | 149     | 17.807             | 24.49                | -           | Pass   |
|             | 157     | 17.816             | 23.33                |             |        |
|             | 165     | 17.790             | 23.79                |             |        |
| 802.11ac20  | 149     | 17.813             | 23.73                | -           | Pass   |
|             | 157     | 17.771             | 23.47                |             |        |
|             | 165     | 17.791             | 23.83                |             |        |
| 802.11n40   | 151     | 36.206             | 43.58                | -           | Pass   |
|             | 159     | 36.188             | 43.21                |             |        |
| 802.11ac40  | 151     | 36.123             | 42.89                | -           | Pass   |
|             | 159     | 36.147             | 43.11                |             |        |
| 802.11ac80  | 155     | 75.160             | 81.95                | -           | Pass   |

## 26dB and 99%Bandwidth Antenna 0

802.11a

802.11n HT20



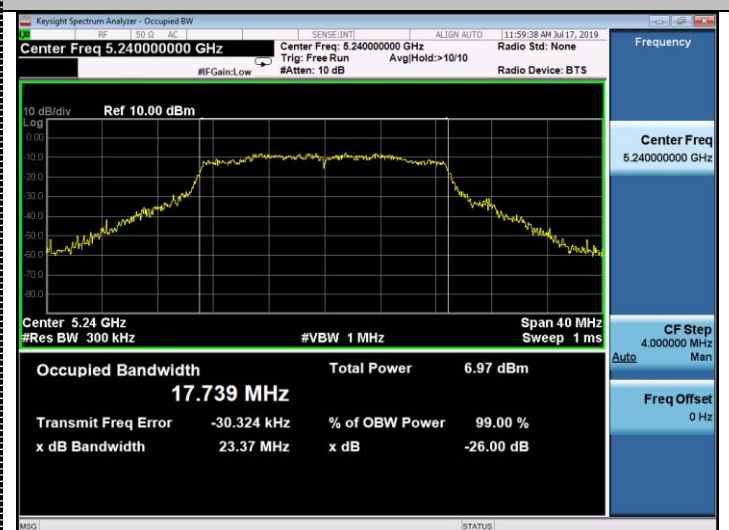
CH36

CH36



CH40

CH40



CH48

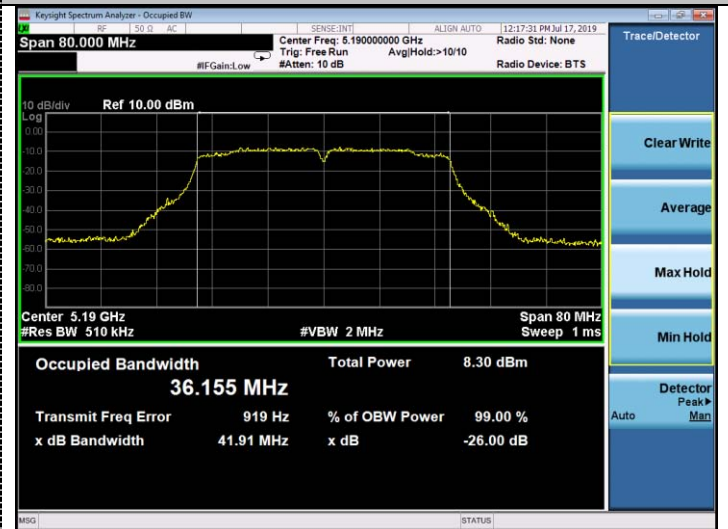
CH48

## 26dB and 99%Bandwidth Antenna 0

## 802.11ac20



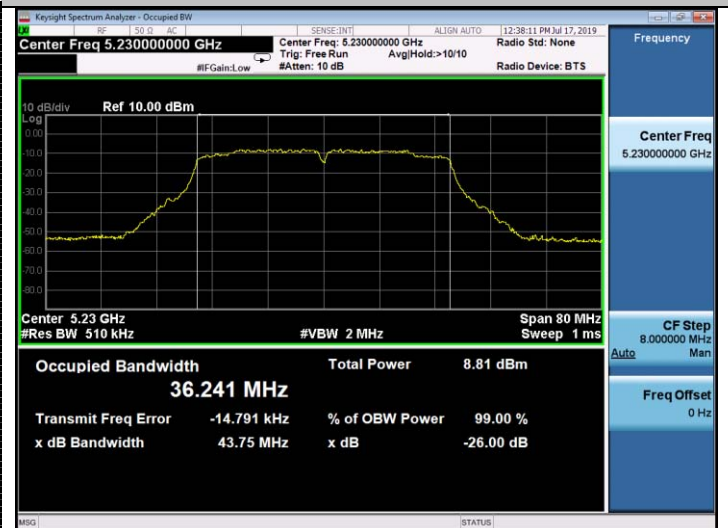
## 802.11n HT40



## CH36



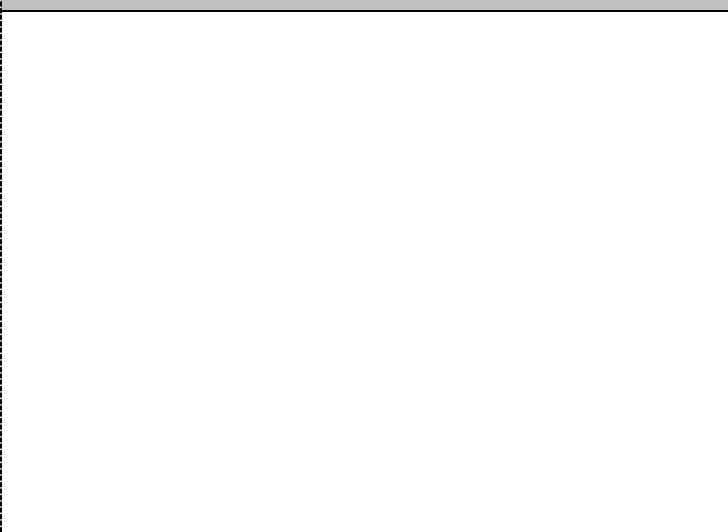
## CH38



## CH40



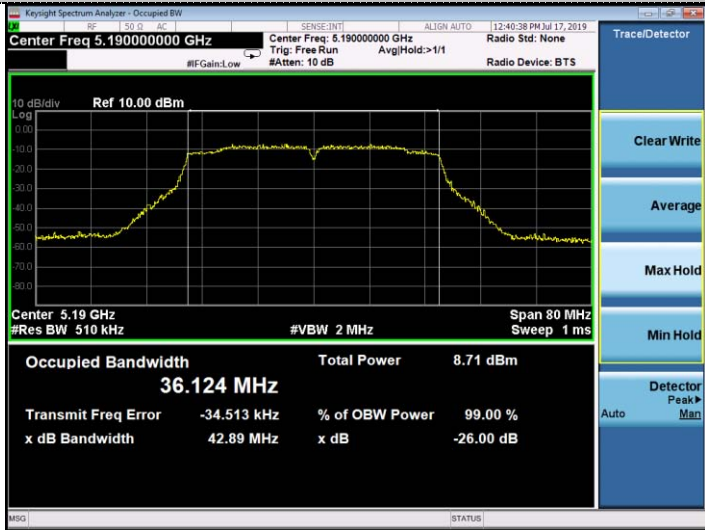
## CH46



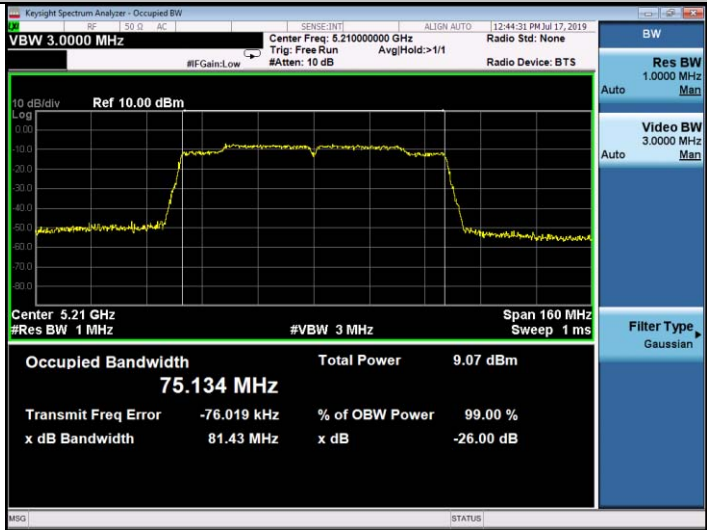
## CH48

26dB and 99%Bandwidth Antenna 0

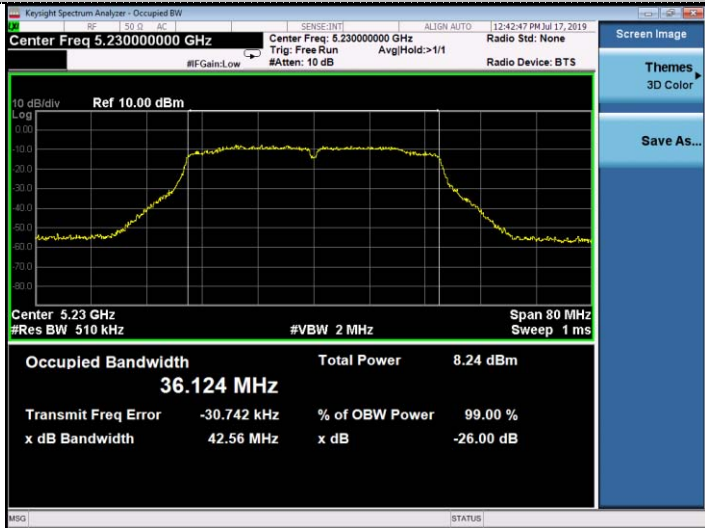
802.11ac40



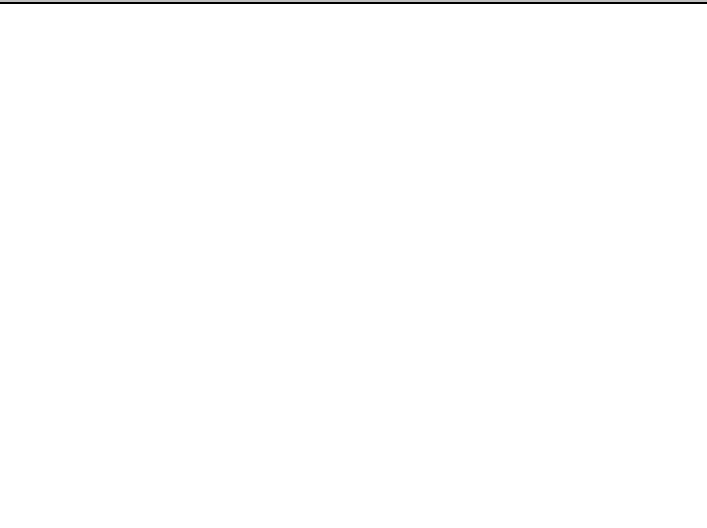
802.11ac80



CH38



CH42



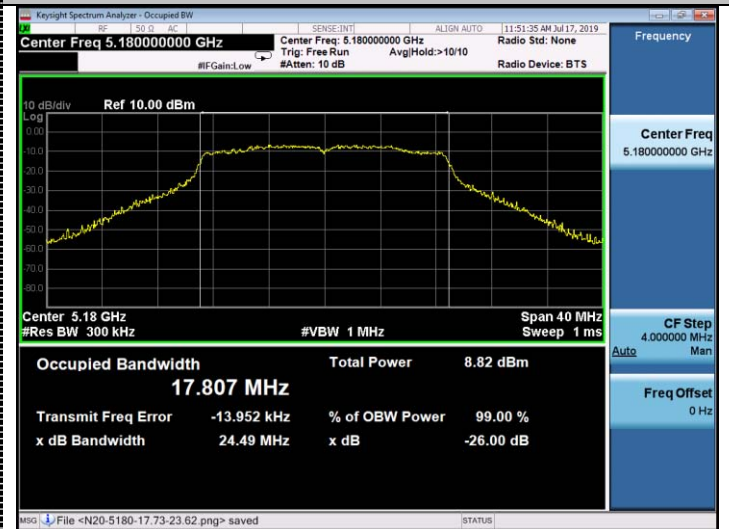
CH46



## 26dB and 99%Bandwidth Antenna 1

## 802.11a

## 802.11n HT20



## CH36

## CH36



## CH40

## CH40



## CH48

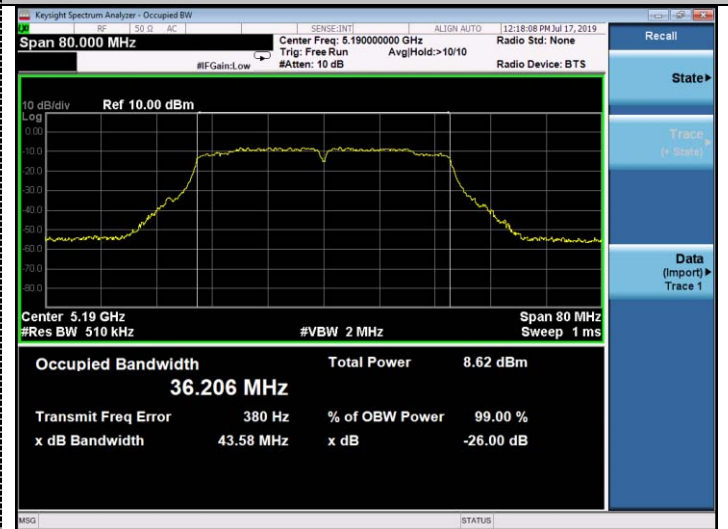
## CH48

## 26dB and 99%Bandwidth Antenna 1

## 802.11ac20



## 802.11n HT40



## CH36



## CH38



## CH40

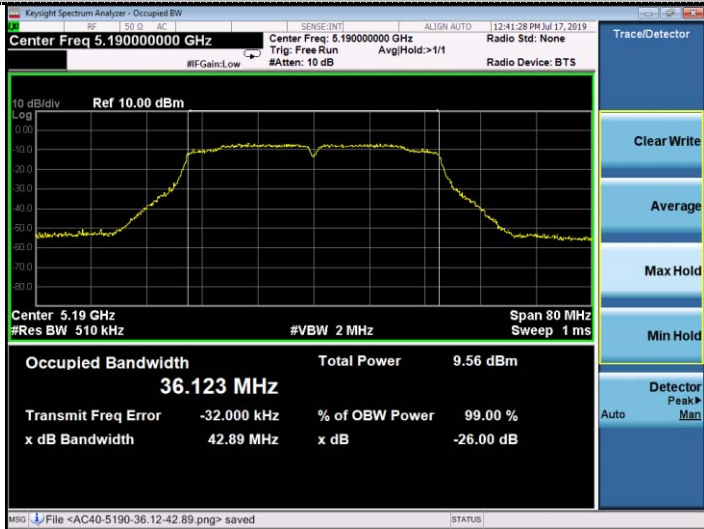


## CH46

## CH48

26dB and 99%Bandwidth Antenna 1

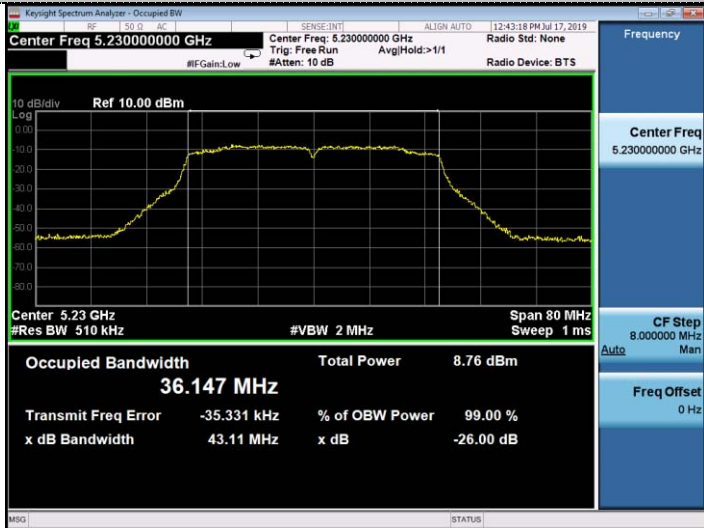
802.11ac40



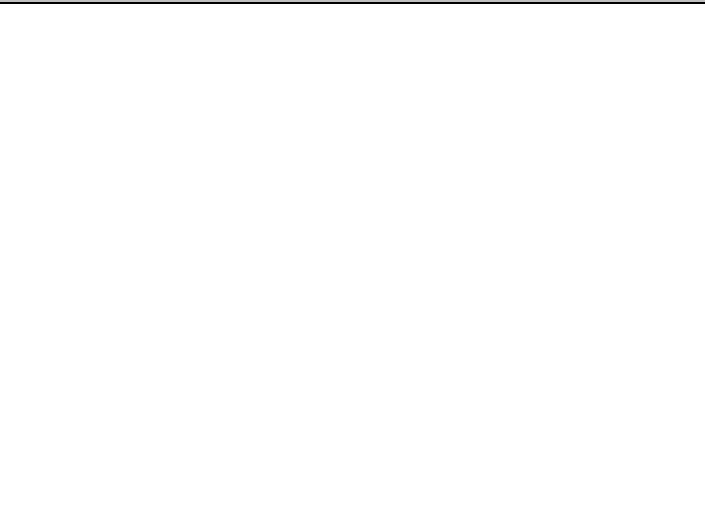
802.11ac80



CH38



CH42

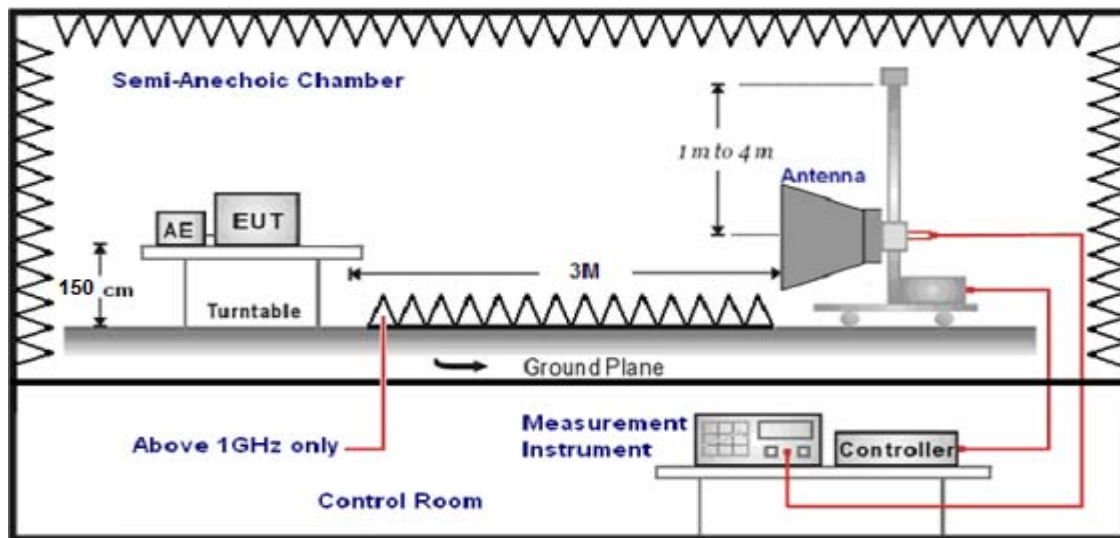


CH46



## 4.8. Band Edge Compliance

### TEST CONFIGURATION



### LIMIT

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequency (MHz) | Distance (Meters) | Radiated (dB $\mu$ V/m)                      | Radiated ( $\mu$ V/m) |
|-----------------|-------------------|----------------------------------------------|-----------------------|
| 0.009-0.49      | 3                 | $20\log(2400/F(\text{KHz})) + 40\log(300/3)$ | $2400/F(\text{KHz})$  |
| 0.49-1.705      | 3                 | $20\log(24000/F(\text{KHz})) + 40\log(30/3)$ | $24000/F(\text{KHz})$ |
| 1.705-30        | 3                 | $20\log(30) + 40\log(30/3)$                  | 30                    |
| 30-88           | 3                 | 40.0                                         | 100                   |
| 88-216          | 3                 | 43.5                                         | 150                   |
| 216-960         | 3                 | 46.0                                         | 200                   |
| Above 960       | 3                 | 54.0                                         | 500                   |

According to §15.407 (b): Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits

| Frequency (MHz) | EIRP Limit (dBm)                   | Equivalent Field Strength at 3m (dB $\mu$ V/m) |
|-----------------|------------------------------------|------------------------------------------------|
| 5150-5250       | -27                                | 68.2                                           |
| 5250-5350       | -27                                | 68.2                                           |
| 5470-5725       | -27                                | 68.2                                           |
| 5725-5850       | -27 (beyond 10MHz of the bandedge) | 68.2                                           |
|                 | -17 (within 10 MHz of band edge)   | 78.2                                           |

### TEST PROCEDURE

1. The EUT was placed on a turn table which is 1.5m above 1GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed..
5. The distance between test antenna and EUT as following table states:

| Test Frequency range | Test Antenna Type          | Test Distance |
|----------------------|----------------------------|---------------|
| 1GHz-18GHz           | Double Ridged Horn Antenna | 3             |

Setting test receiver/spectrum as following table states:

| Test Frequency range | Test Receiver/Spectrum Setting                                                                            | Detector |
|----------------------|-----------------------------------------------------------------------------------------------------------|----------|
| 1GHz-18GHz           | Peak Value: RBW=1MHz/VBW=3MHz,<br>Sweep time=Auto<br>Average Value: RBW=1MHz/VBW=10Hz,<br>Sweep time=Auto | Peak     |

### Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

|                           |                                            |
|---------------------------|--------------------------------------------|
| Where FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude    | AG = Amplifier Gain                        |
| AF = Antenna Factor       |                                            |

### TEST RESULTS

Remark:For radiated bandedge We measured at both mode, recorded worst case at **ant 0** 802.11 a mode;

#### For Radiated Bandedge Measurement

| 802.11 a/ Channel 36 :5180 MHz |                   |                       |                 |                 |                       |                     |             |          |              |
|--------------------------------|-------------------|-----------------------|-----------------|-----------------|-----------------------|---------------------|-------------|----------|--------------|
| Freq (MHz)                     | Read Level (dBμV) | Antenna Factor (dB/m) | PRM Factor (dB) | Cable Loss (dB) | Result Level (dBμV/m) | Limit Line (dBμV/m) | Margin (dB) | Detector | Polarization |
| 5148.26                        | 35.06             | 35.58                 | 29.04           | 8.28            | 49.88                 | 74                  | 24.12       | Peak     | Horizontal   |
| 5148.26                        | 23.95             | 35.58                 | 29.04           | 8.28            | 38.77                 | 54                  | 15.23       | AV       | Horizontal   |

| 802.11 a/ Channel 48 :5240 MHz |                   |                       |                 |                 |                       |                     |             |          |              |
|--------------------------------|-------------------|-----------------------|-----------------|-----------------|-----------------------|---------------------|-------------|----------|--------------|
| Freq (MHz)                     | Read Level (dBμV) | Antenna Factor (dB/m) | PRM Factor (dB) | Cable Loss (dB) | Result Level (dBμV/m) | Limit Line (dBμV/m) | Margin (dB) | Detector | Polarization |
| 5353.12                        | 35.66             | 35.42                 | 29.06           | 8.39            | 50.41                 | 74                  | 23.59       | Peak     | Horizontal   |
| 5353.12                        | 24.03             | 35.42                 | 29.06           | 8.39            | 38.78                 | 54                  | 15.22       | AV       | Horizontal   |

| 802.11 a/ Channel 149 :5745 MHz |                   |                       |                 |                 |                       |                     |             |          |              |
|---------------------------------|-------------------|-----------------------|-----------------|-----------------|-----------------------|---------------------|-------------|----------|--------------|
| Freq (MHz)                      | Read Level (dBμV) | Antenna Factor (dB/m) | PRM Factor (dB) | Cable Loss (dB) | Result Level (dBμV/m) | Limit Line (dBμV/m) | Margin (dB) | Detector | Polarization |
| 5686.35                         | 40.45             | 35.29                 | 29.13           | 8.65            | 55.26                 | 95.1                | 39.84       | Peak     | Horizontal   |

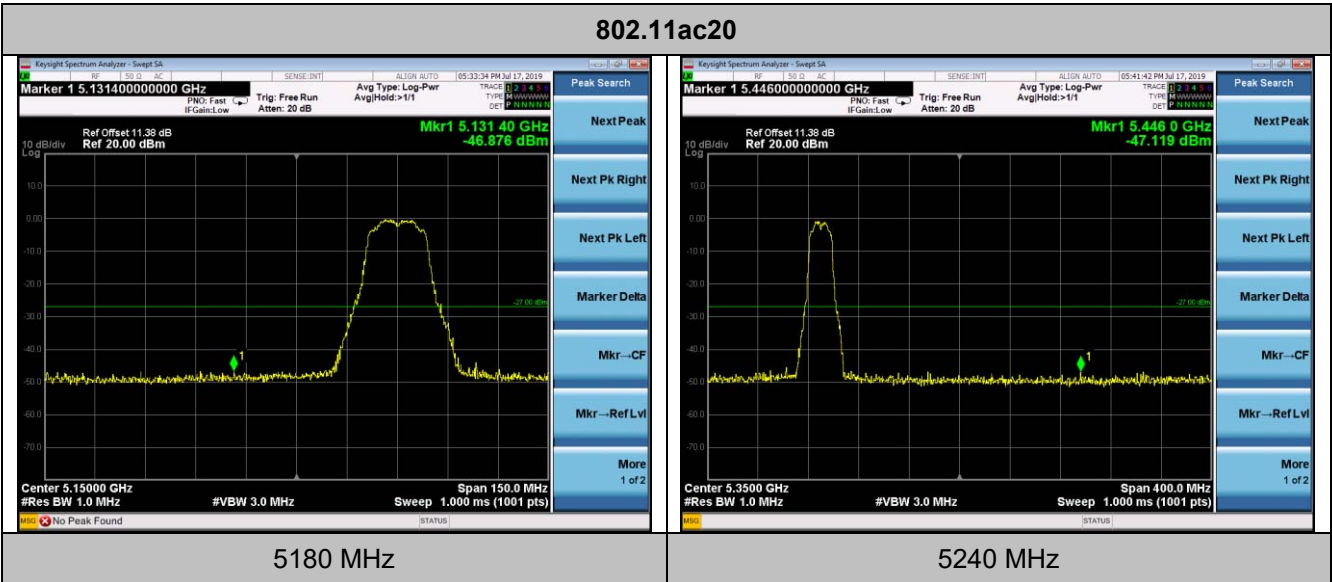
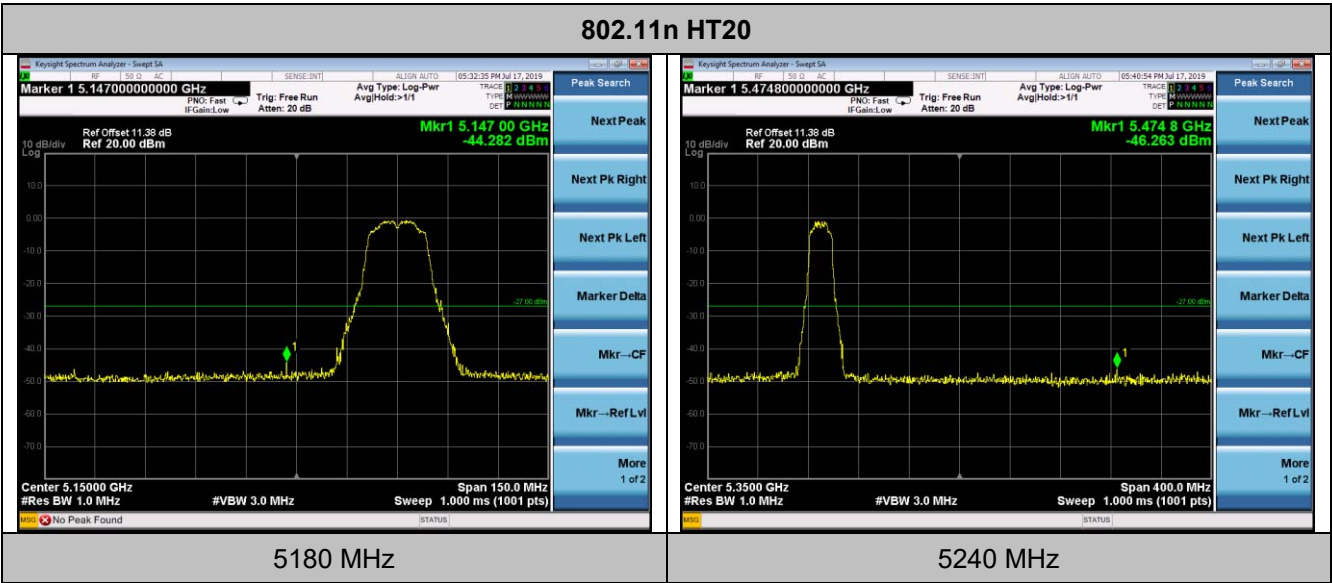
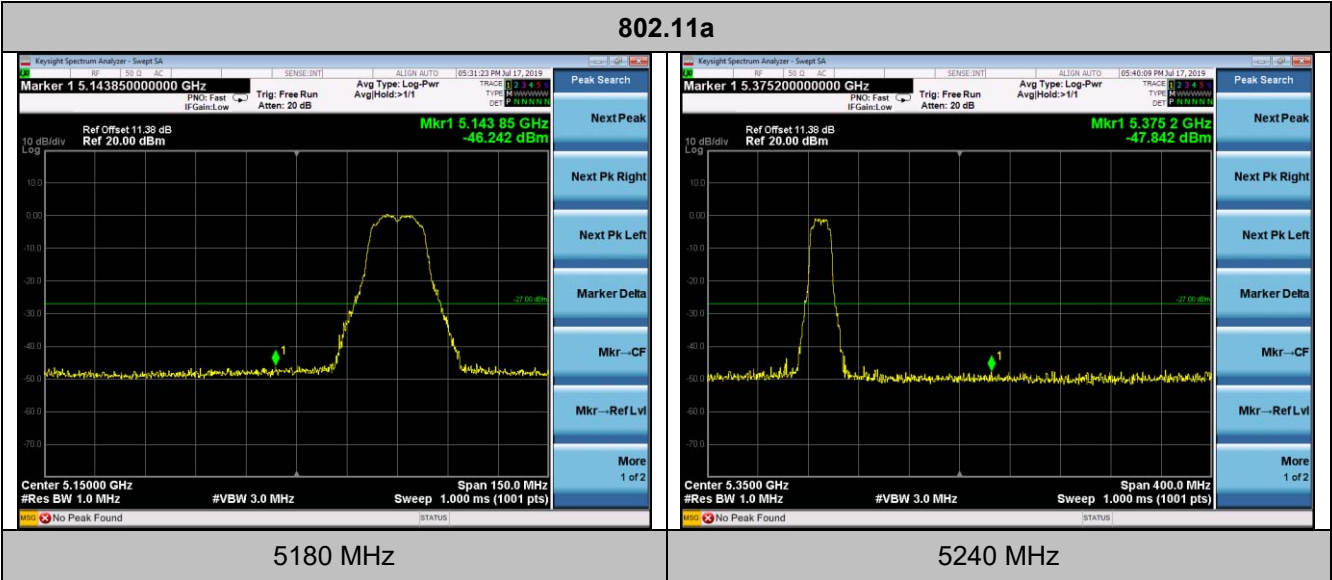
| 802.11 a/ Channel 165 :5825 MHz |                   |                       |                 |                 |                       |                     |             |          |              |
|---------------------------------|-------------------|-----------------------|-----------------|-----------------|-----------------------|---------------------|-------------|----------|--------------|
| Freq (MHz)                      | Read Level (dBμV) | Antenna Factor (dB/m) | PRM Factor (dB) | Cable Loss (dB) | Result Level (dBμV/m) | Limit Line (dBμV/m) | Margin (dB) | Detector | Polarization |
| 5859.26                         | 39.33             | 35.29                 | 29.18           | 8.8             | 54.24                 | 109.6               | 55.36       | Peak     | Horizontal   |

#### REMARKS:

1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. The other emission levels were very low against the limit.
3. The average measurement was not performed when the peak measured data under the limit of average detection.
4. Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=10Hz/Sweep time=Auto/Detector=Peak;

For Conducted Band edge Measurement  
The test results have included the antenna gain

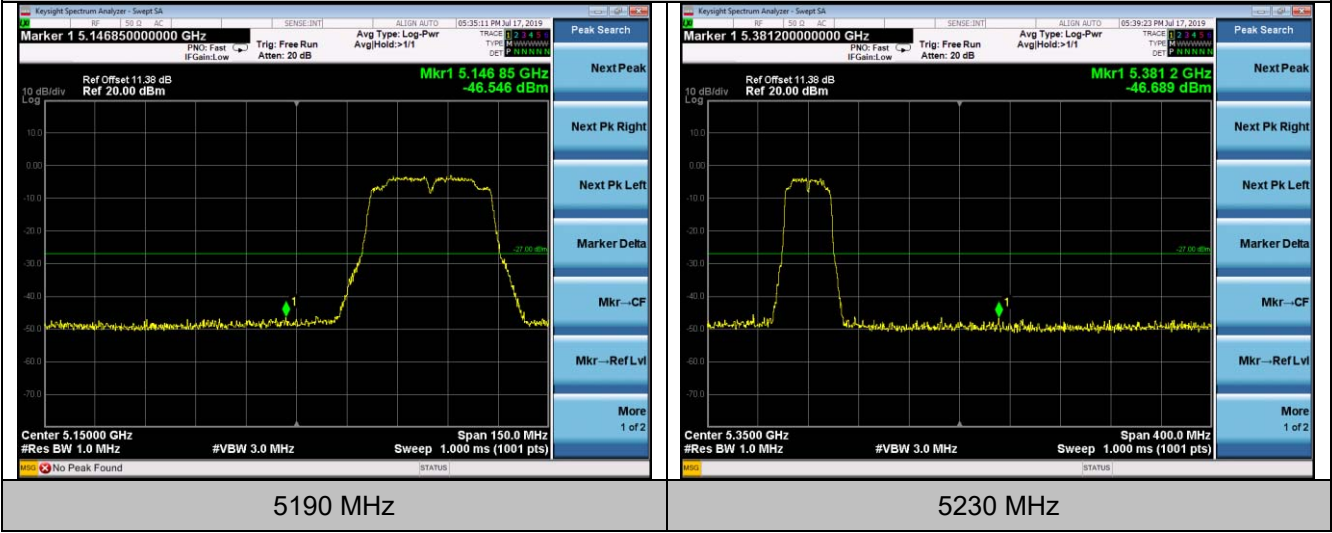
Antenna 0  
5150-5250MHz:



802.11n HT40



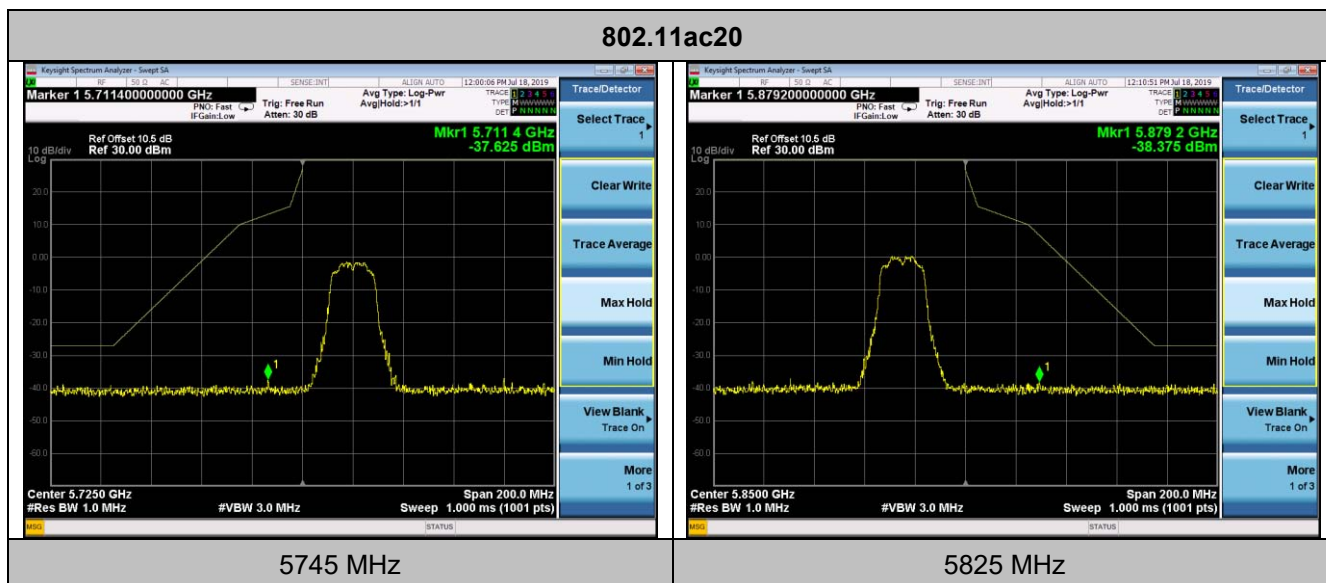
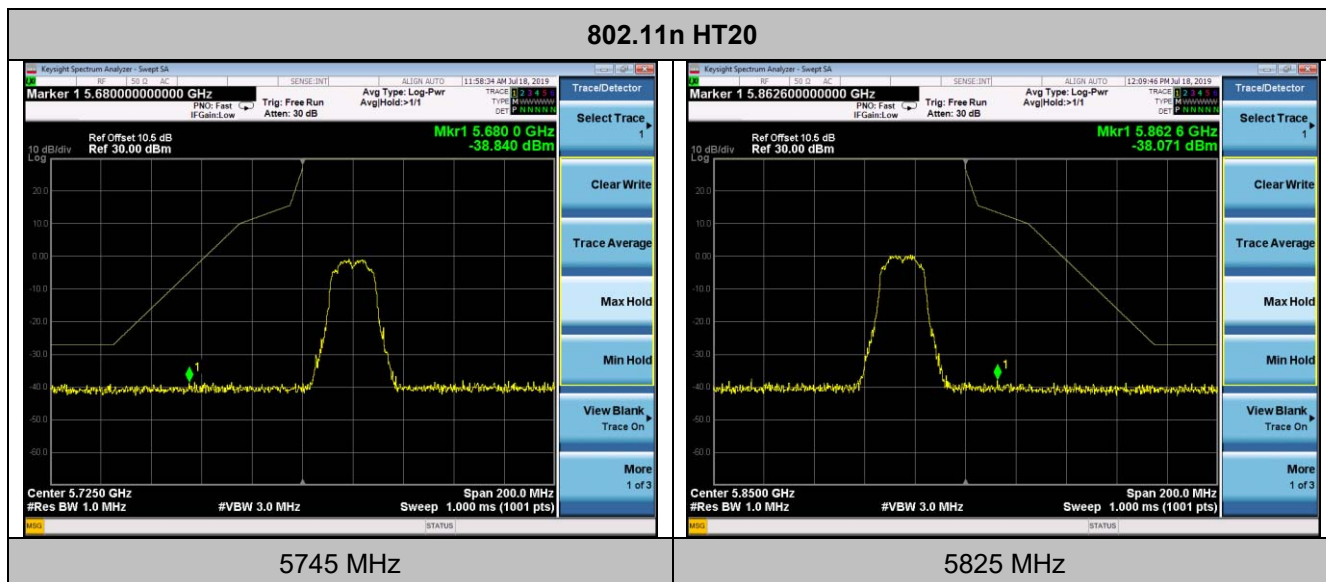
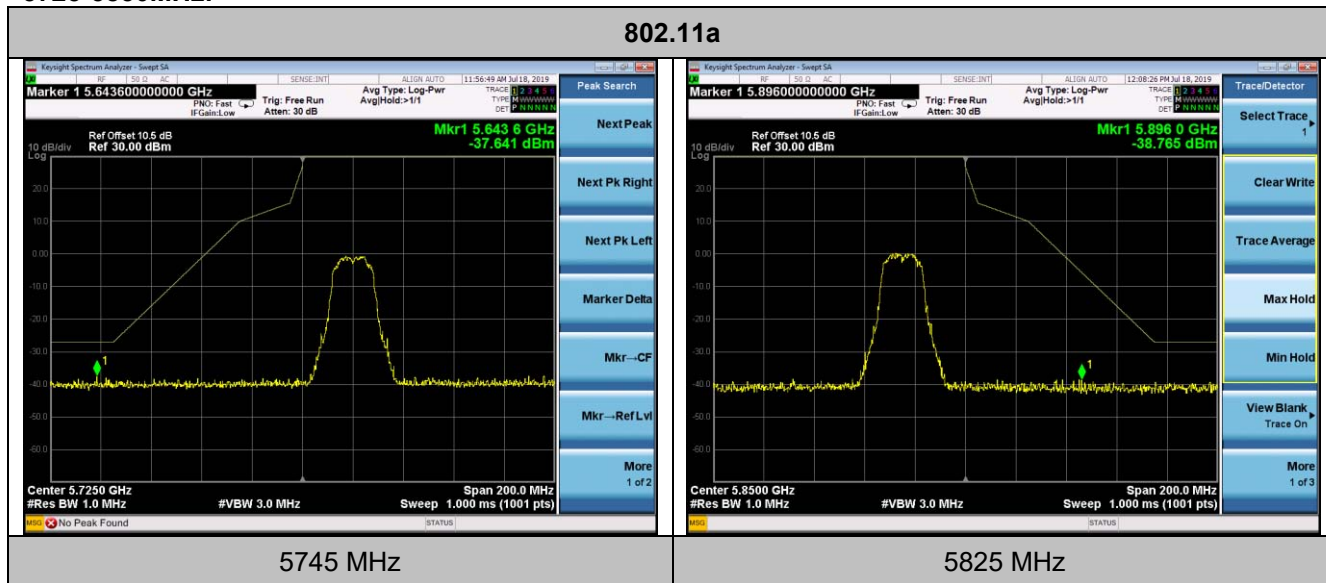
802.11ac40



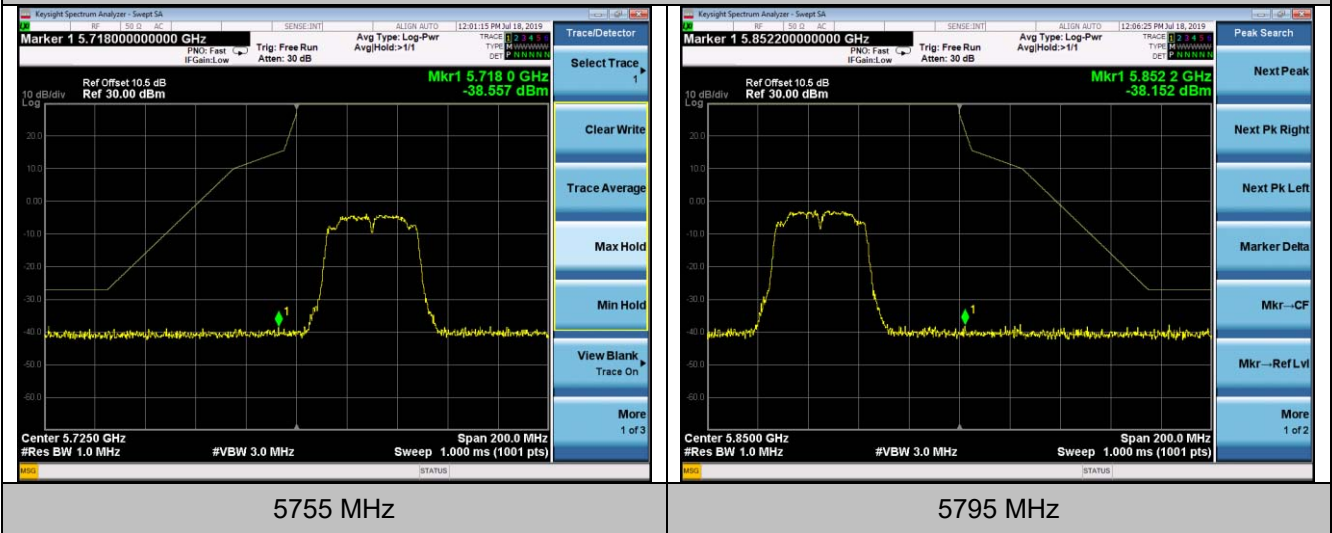
802.11ac80



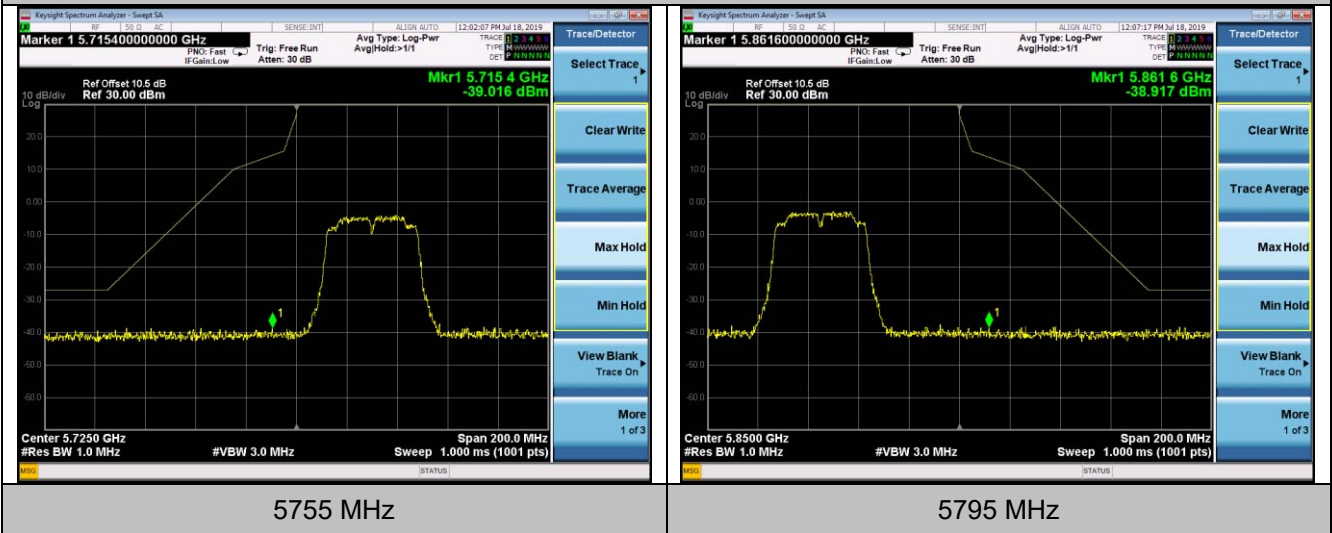
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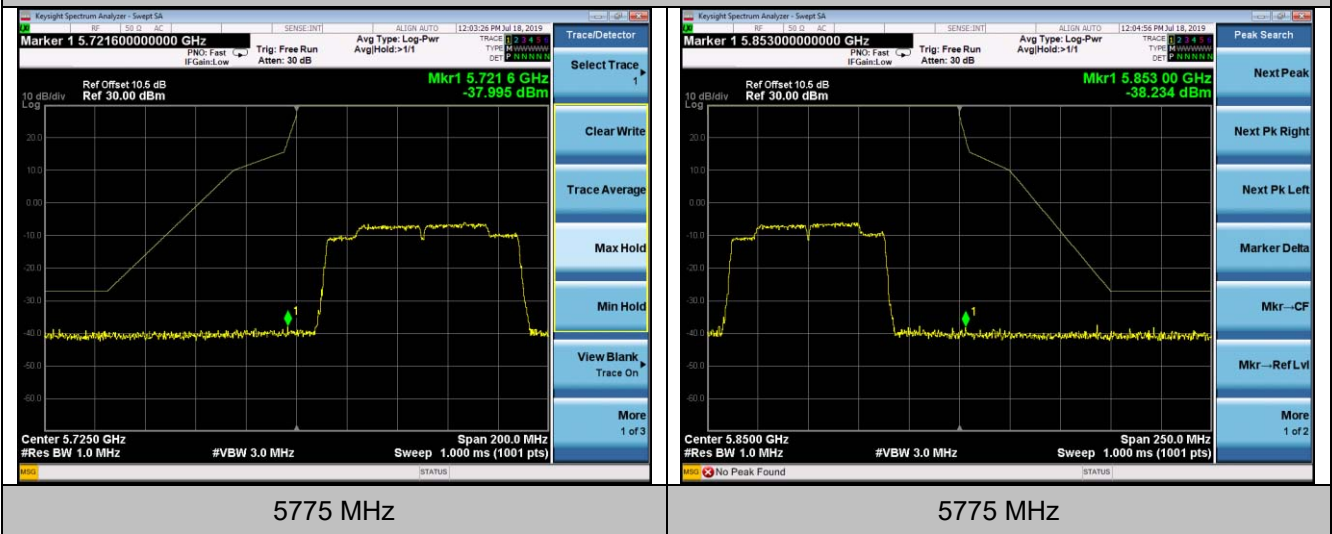
802.11n HT40



802.11ac40

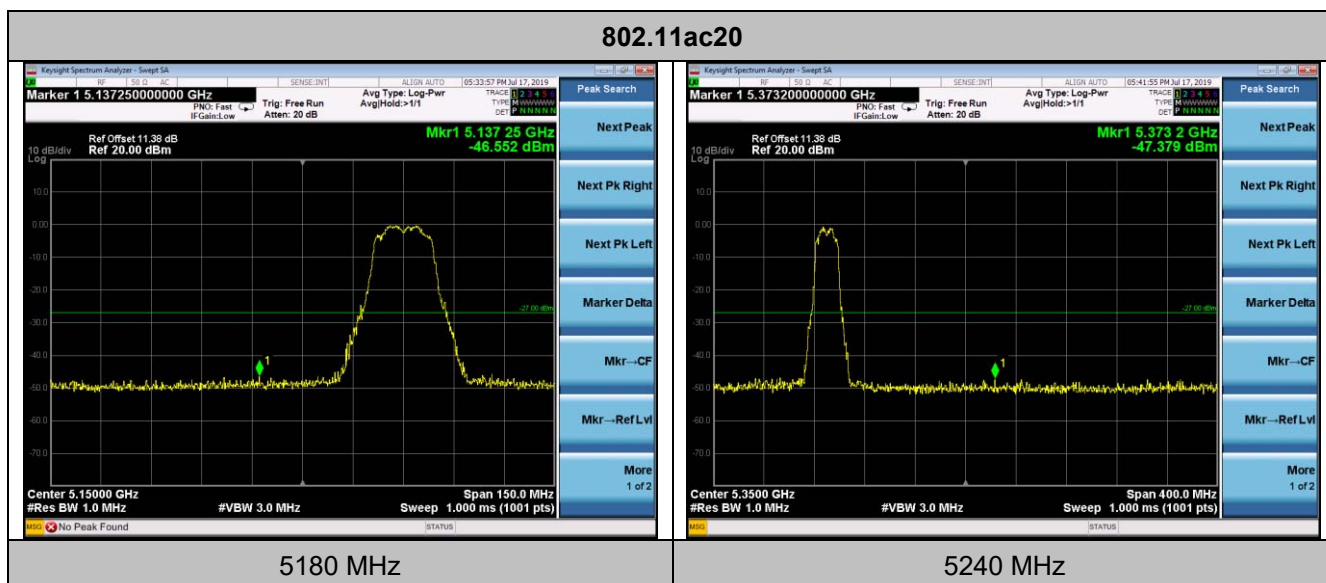
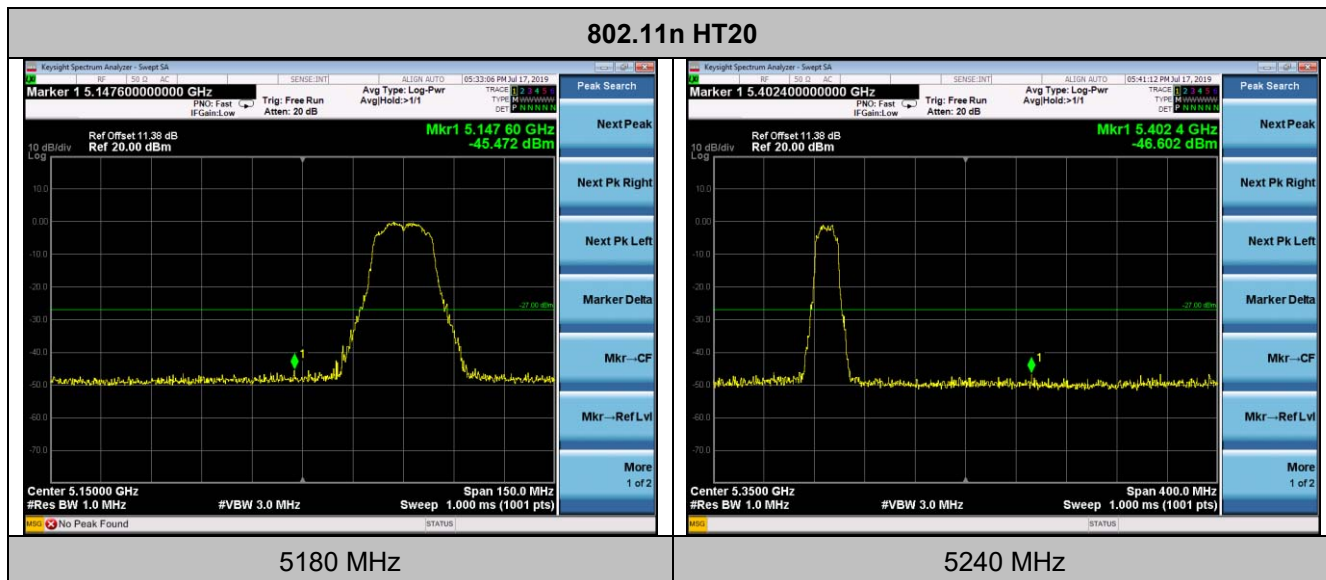
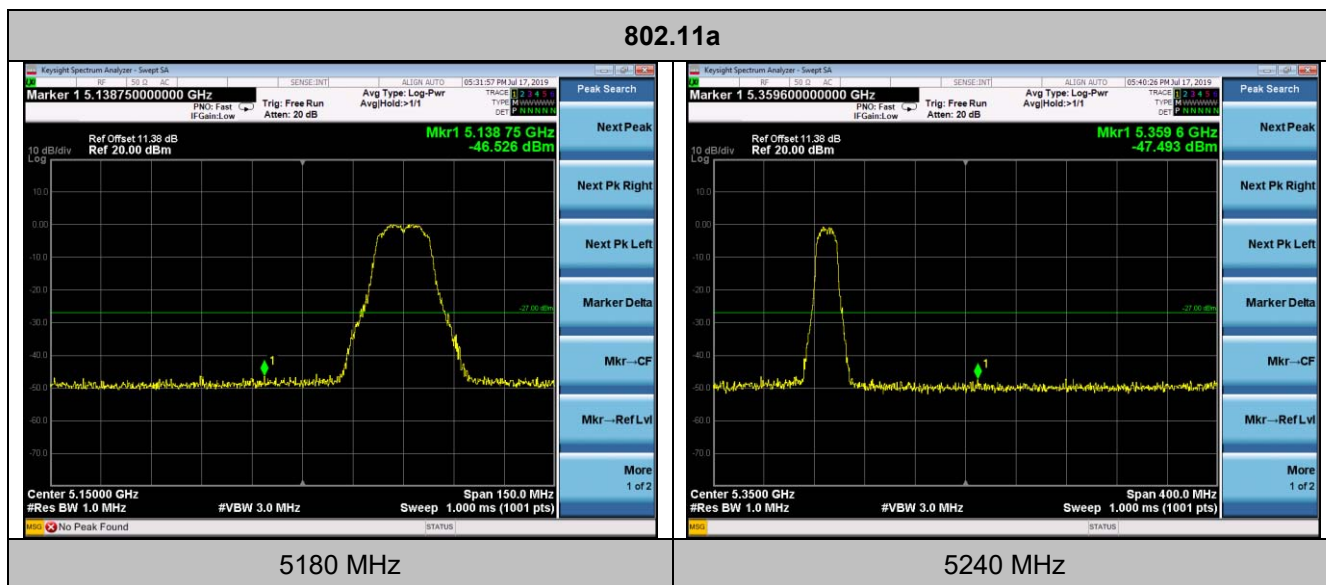


802.11ac80

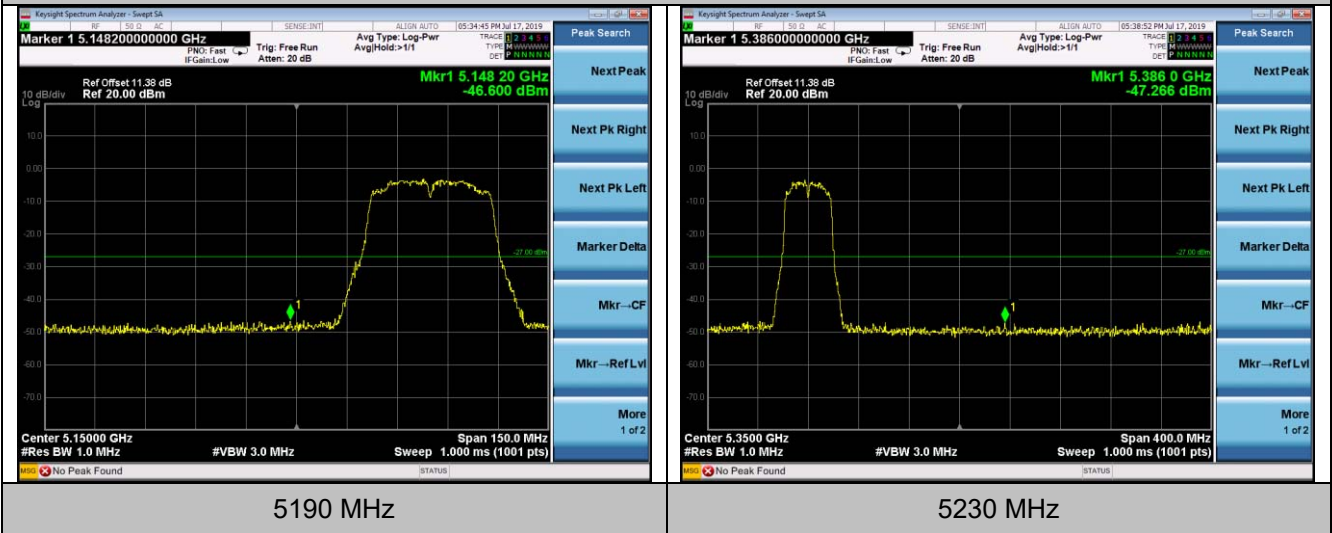


## Antenna 1

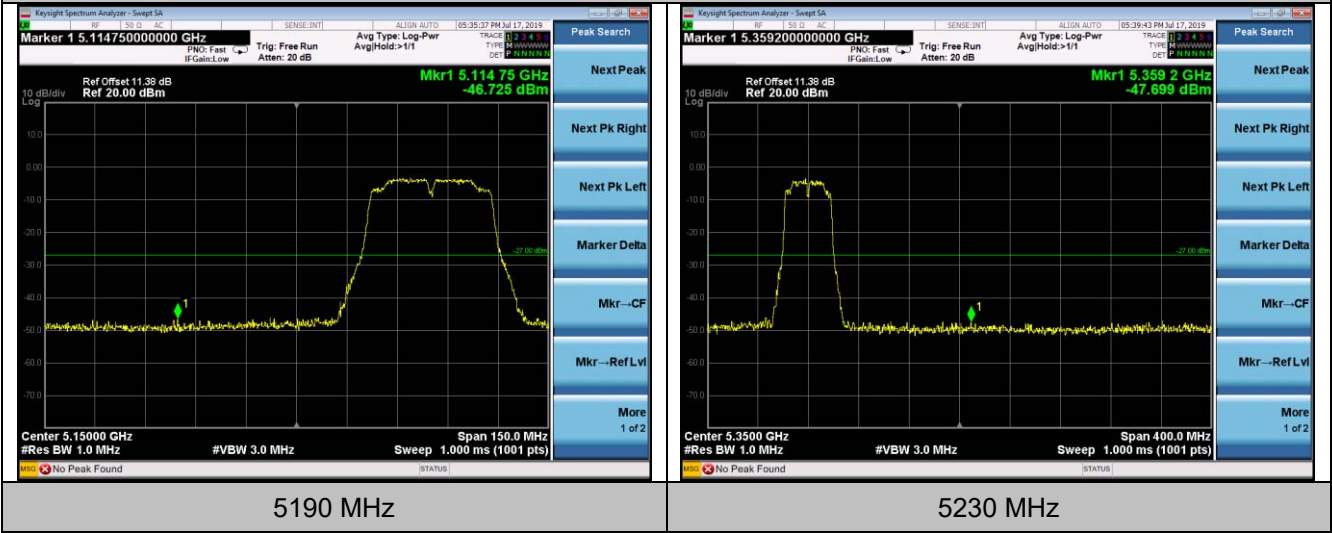
5150-5250MHz:



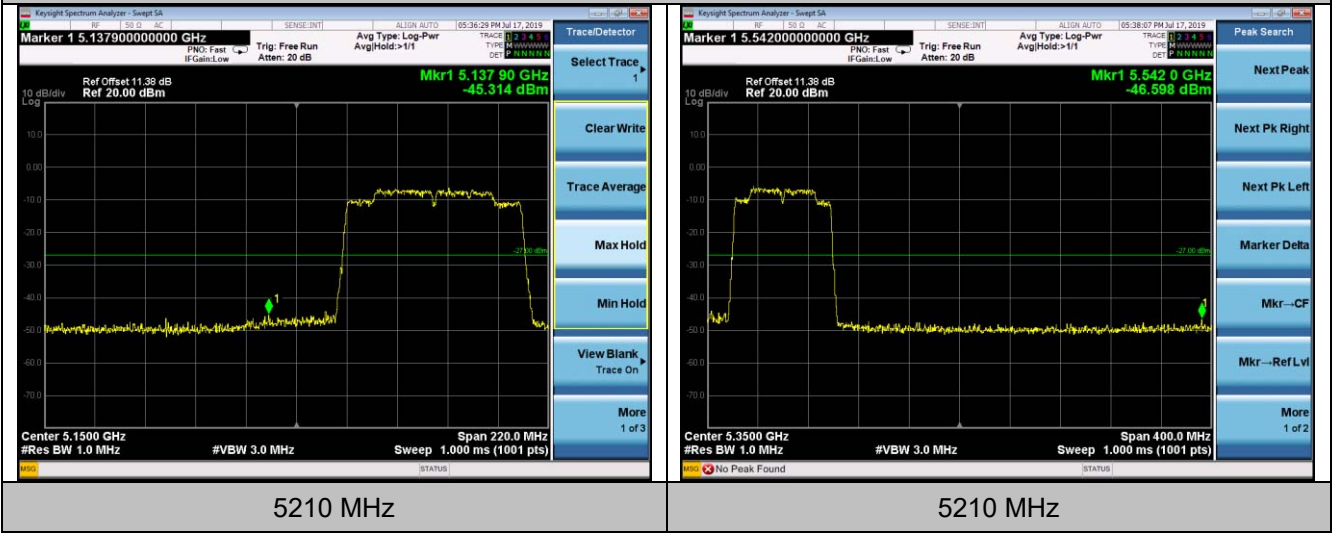
802.11n HT40



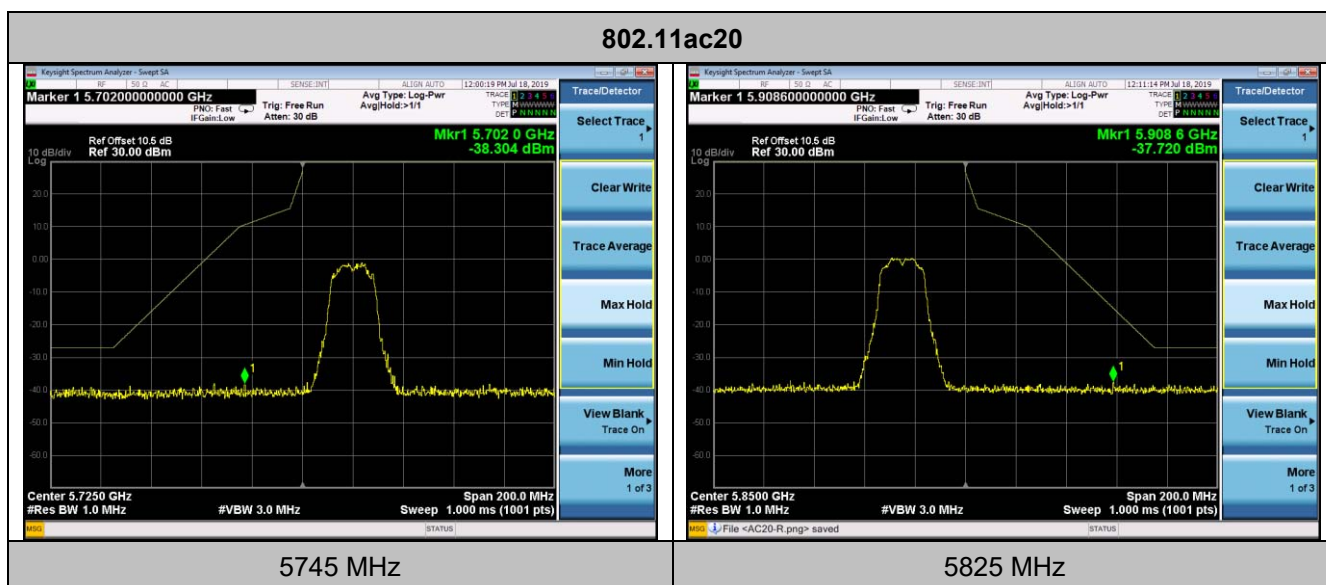
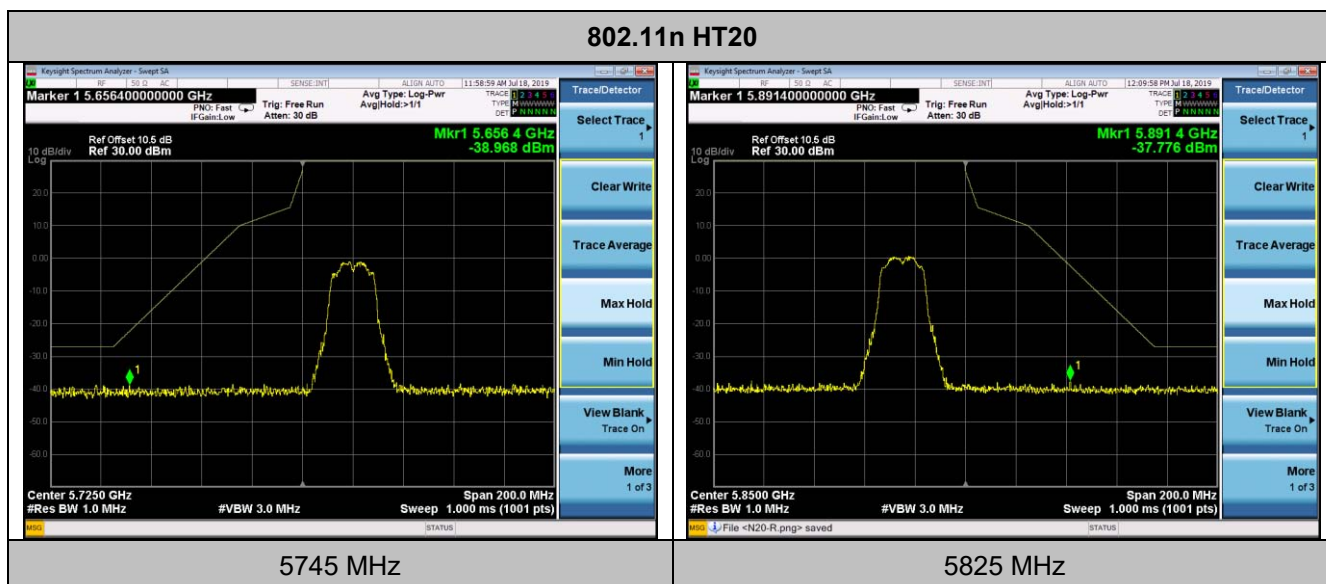
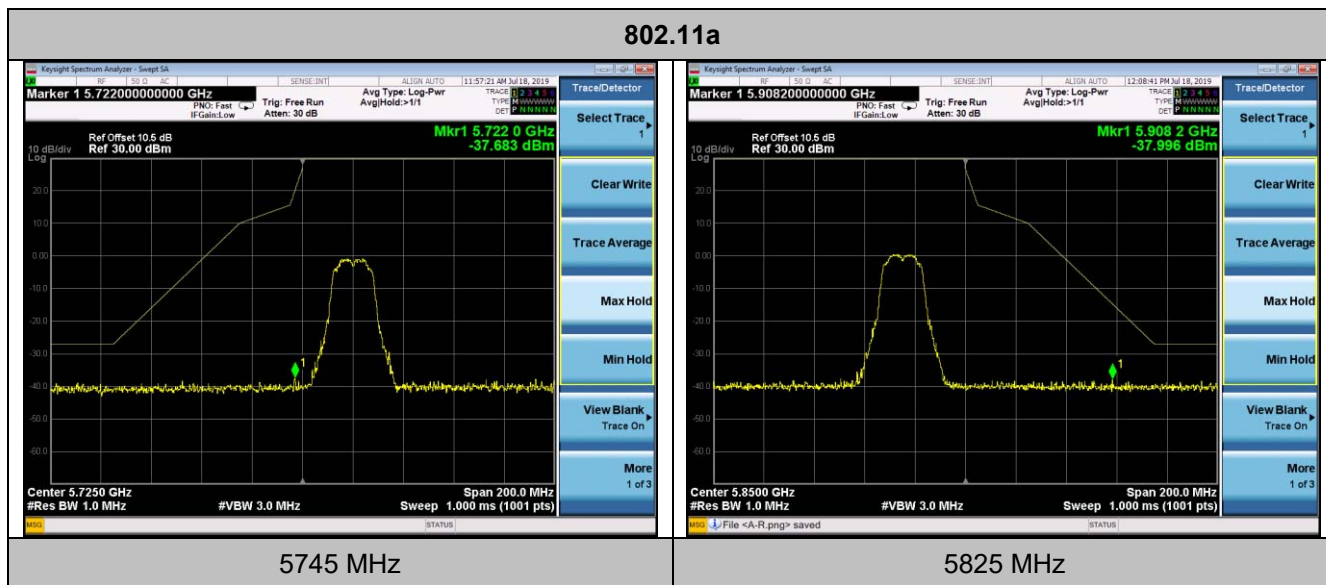
802.11ac40



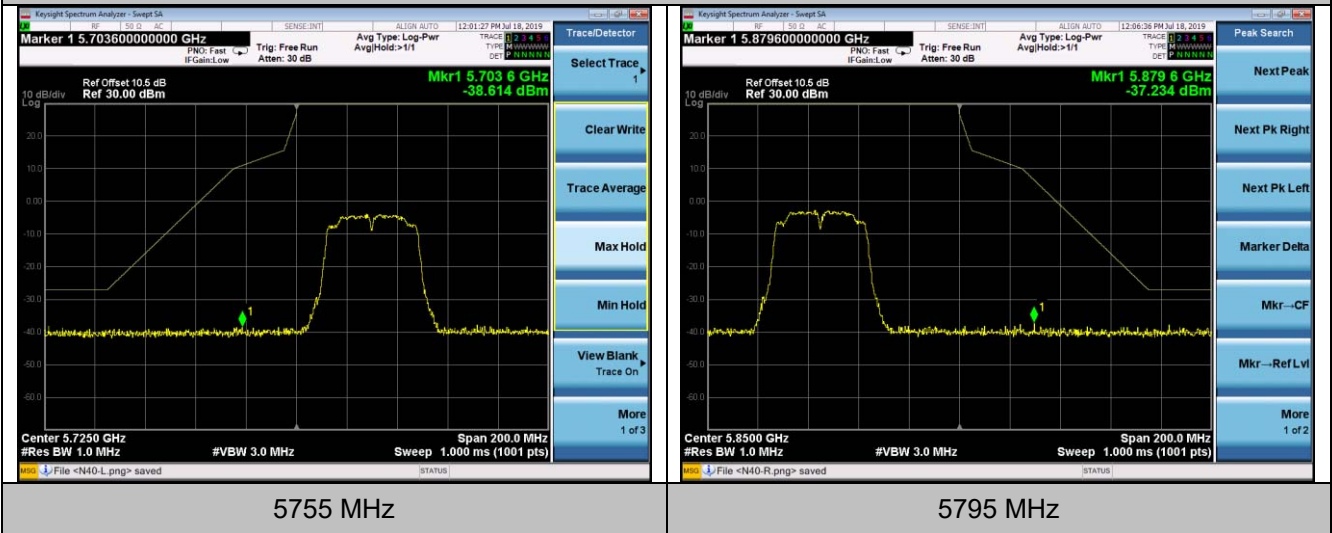
802.11ac80



5725-5850MHz:

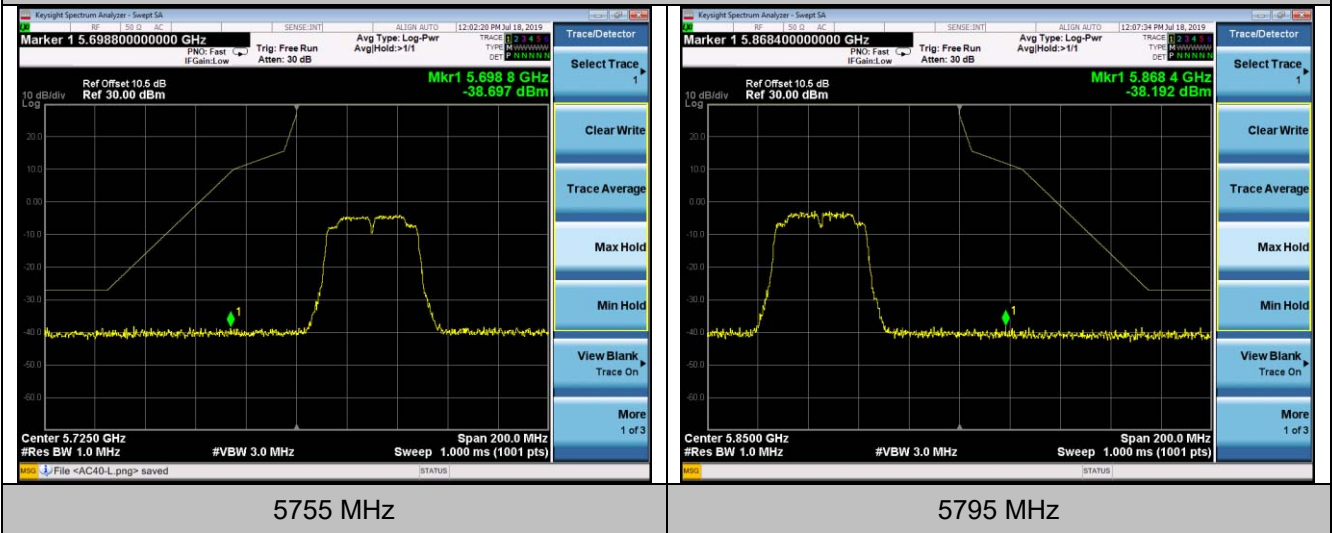


802.11n HT40



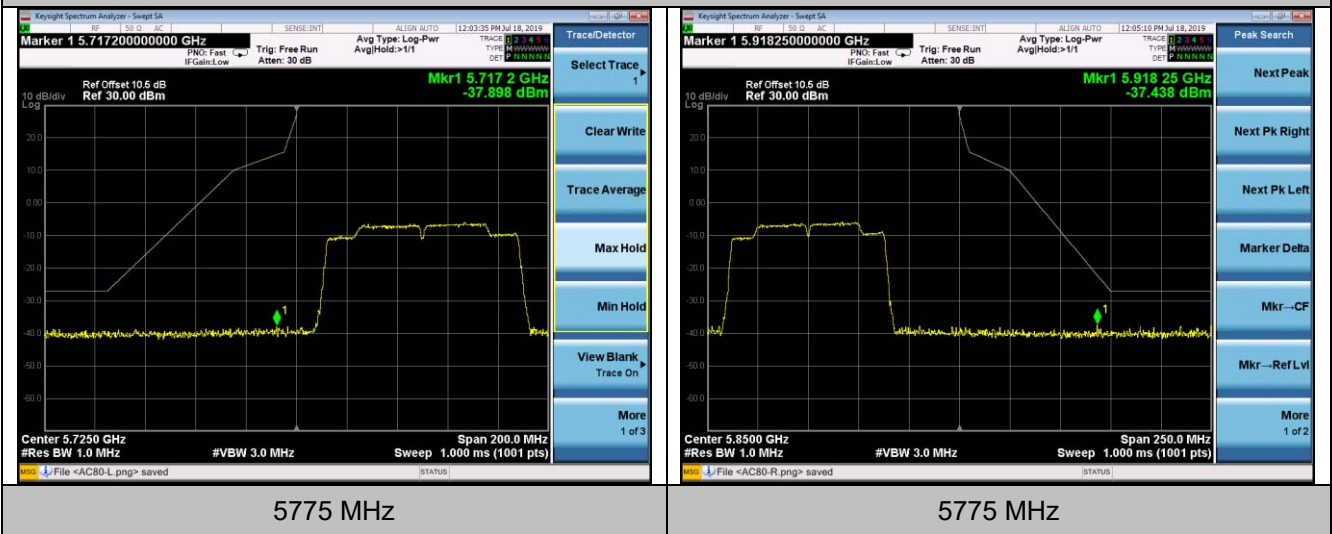
5795 MHz

802.11ac40



5795 MHz

802.11ac80



5775 MHz

## **4.9. Antenna Requirement**

### **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 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### **Antenna Information**

The antenna is FPC antenna, through the buckle stretched out, The directional gains of antenna used for transmitting is 0.88dBi.

Reference to the test report No. **GTS20190612005-1-1**

## 5. Test Setup Photos of the EUT

### Radiated Emission Test



Fig.1



Fig.2

Conducted Emission



Fig.3

## **6. External and Internal Photos of the EUT**

Reference to the test report No. GTS20190612005-1-1

.....**End of Report**.....