| | |
|---|---|
| 11N40/HCH |  |
| 11AC20/LCH |  |

| | |
|---|---|
| 11AC20/MCH |  |
| 11AC20/HCH |  |

| | |
|---|---|
| 11AC40/LCH |  |
| 11AC40/MCH |  |

| | |
|---|---|
| 11AC40/HCH |  |

| | |
|---|---|
| 11AC80/LCH |  |
| 11AC80/MCH |  |

| 11AC80/HCH |  |
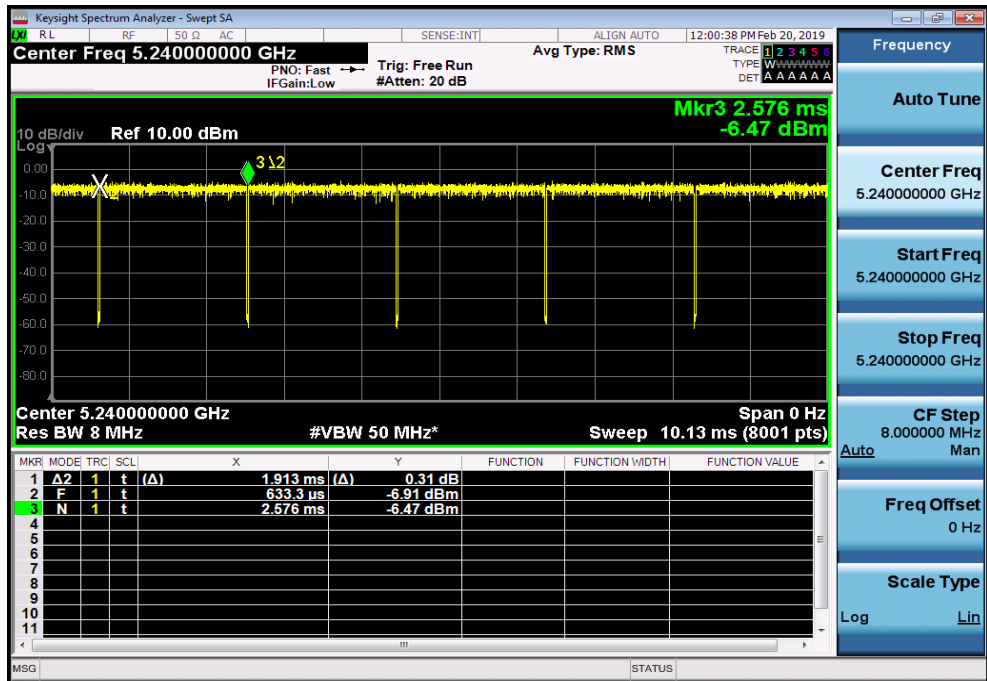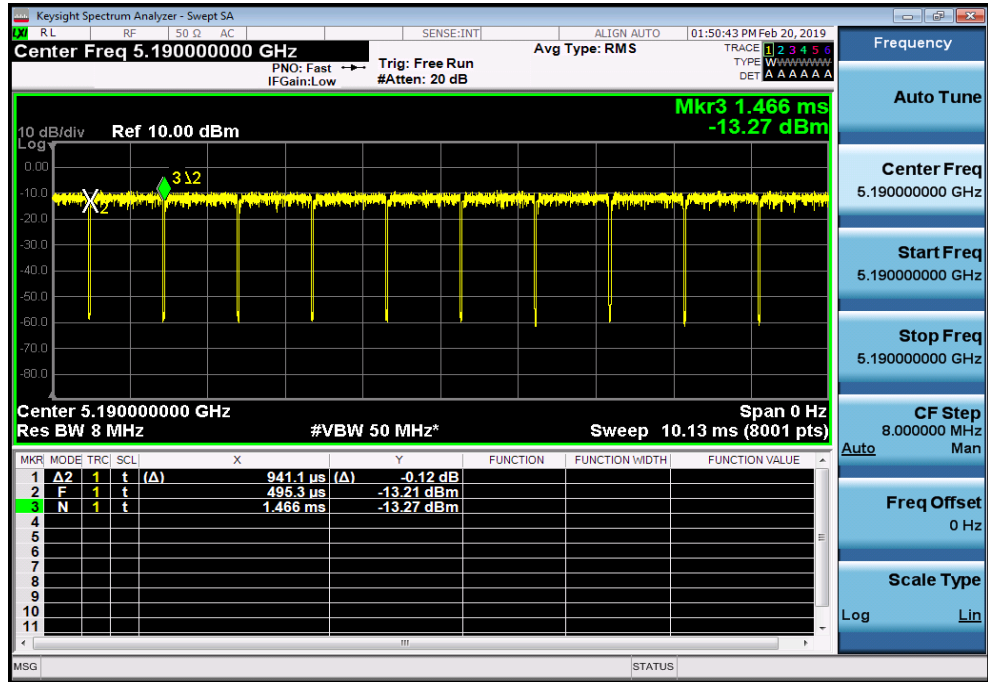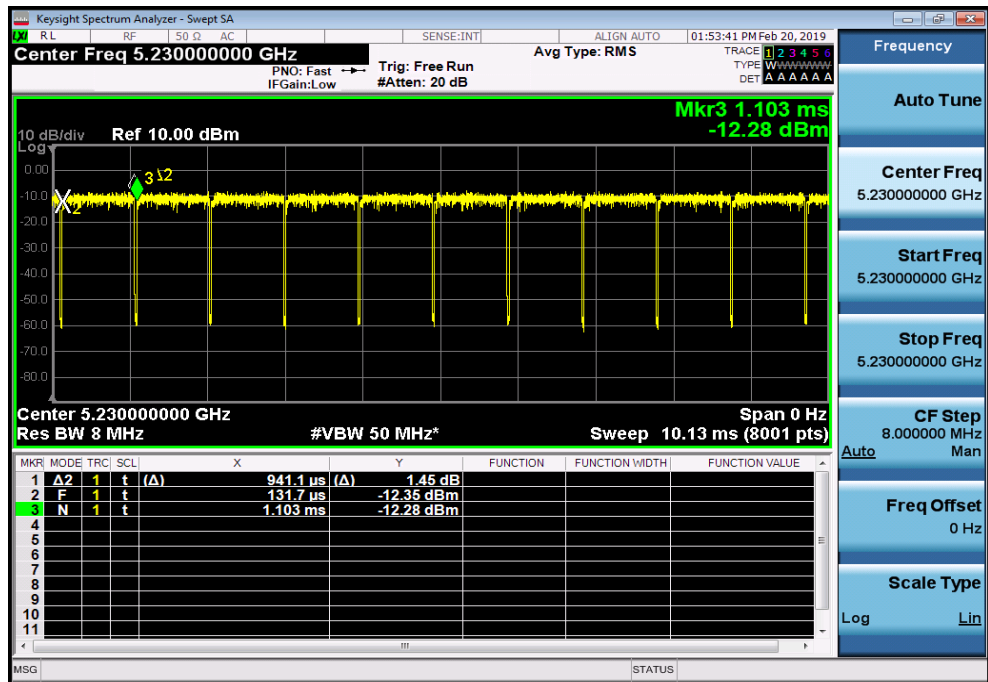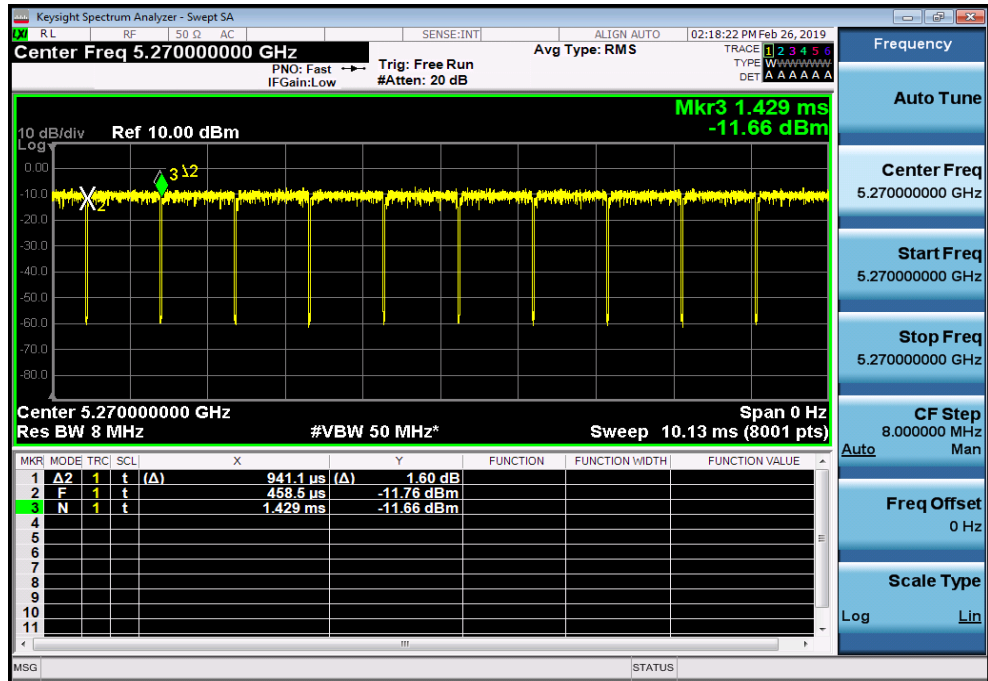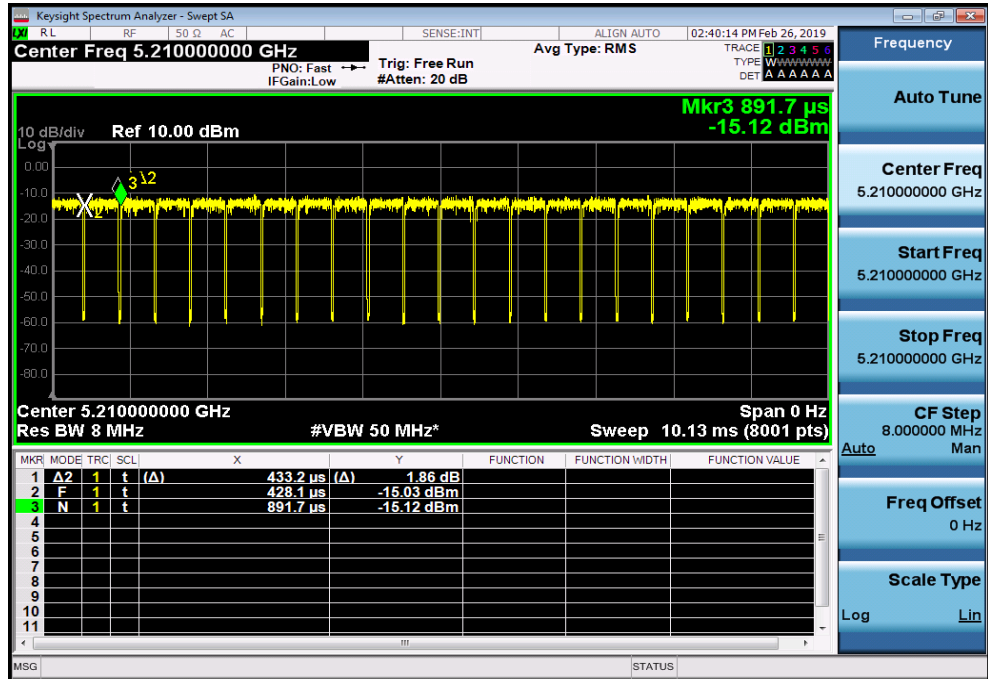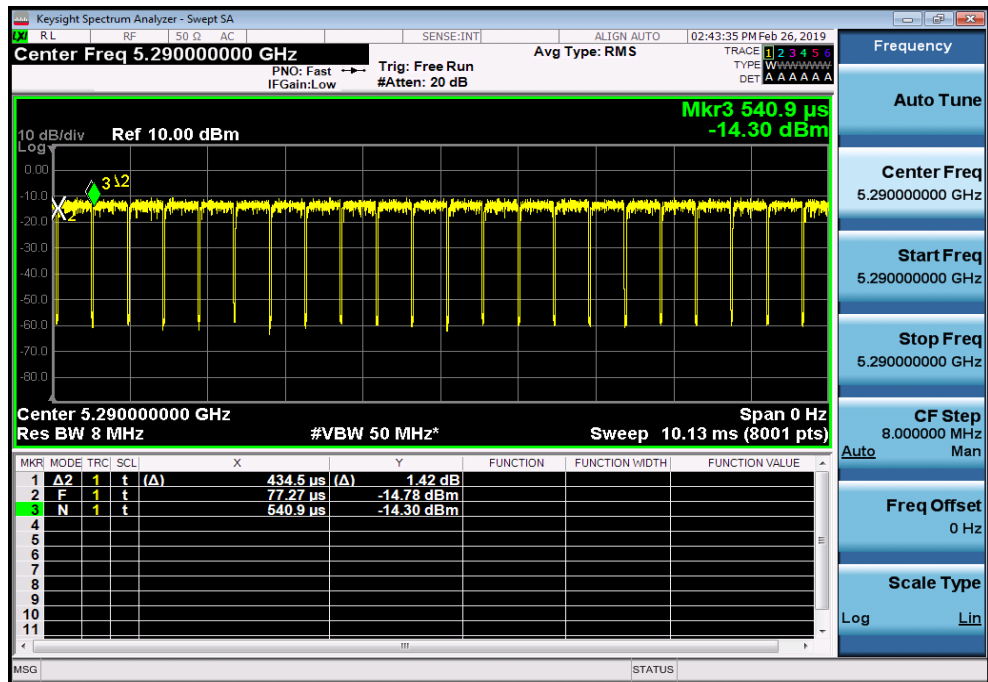
## 4.3 Power Spectral Density Measurement

### 4.3.1 Limits of Power Spectral Density

**FCC**

| Operztion Band | | EUT Category | Limit |
|---|---|---|---|
| U-NII-1 | | Access Point(Mater Device) | 17dBm/MHz |
| | | Fixed point-to-point Acess Ponit | |
| | √ | Mobile and portable clinet device | 11dBm/ MHz |
| U-NII-2A | √ | | 11dBm/ MHz |
| U-NII-2C | √ | | 11dBm/ MHz |
| U-NII-3 | √ | | 30dBm/500KHz |

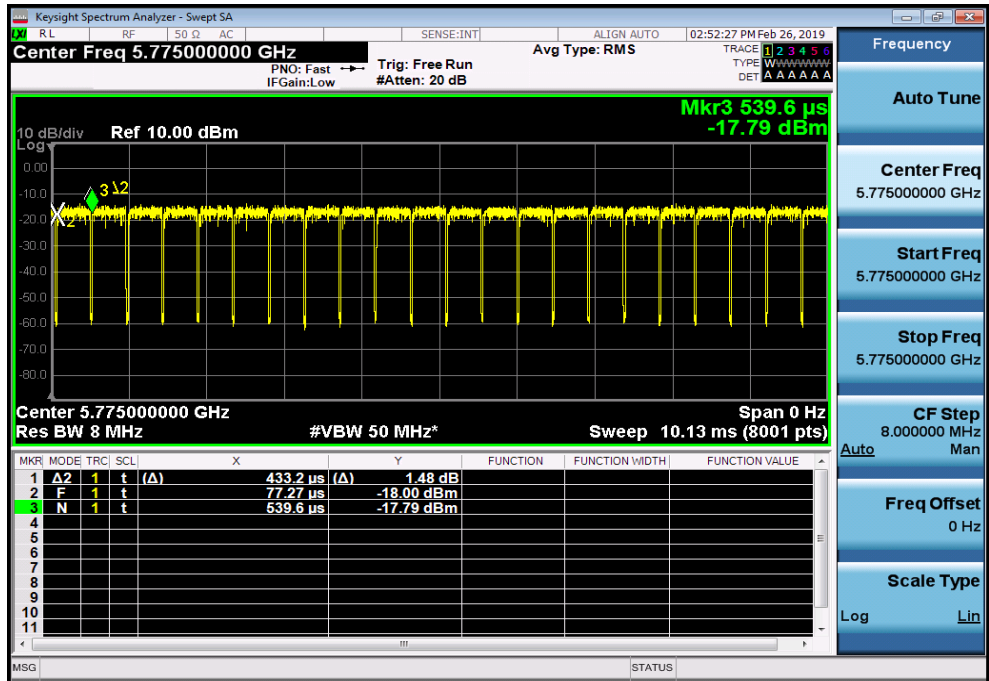If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 4.3.2 Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Spectrum.
4. Set RBW=1MHz, VBW=3MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging(SA-2 with theromission of procedure x, the integration with 26dB EBW bandwidth) ,record the max. reading and add 10 log(1/duty cycle).

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 RBWs less than 1 MHz, or 500 kHz, Set RBW=510KHz, VBW=1.5MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging(SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth) ,record the max. reading and add 10 log(0.5/duty cycle).
6. User the cursor on spectrum to peak search the highest level of trace.
7. Repeat above procedures until all default test channel (low, middle, and high) was complete.

### 4.3.3 Test Result of Power Spectral Density

**Result Table**

| Test Mode | Antenna | Channel | Meas.Level [dBm] | PSD [dBm/MHz] | Verdict |
|---|---|---|---|---|---|
| 11A | Ant1 | 5180 | 3.98 | 4.04 | PASS |
| 11A | Ant1 | 5200 | 4.24 | 4.30 | PASS |
| 11A | Ant1 | 5240 | 4.69 | 4.75 | PASS |
| 11A | Ant1 | 5260 | 4.40 | 4.46 | PASS |
| 11A | Ant1 | 5280 | 5.07 | 5.13 | PASS |
| 11A | Ant1 | 5320 | 4.49 | 4.55 | PASS |
| 11A | Ant1 | 5500 | -1.58 | -1.52 | PASS |
| 11A | Ant1 | 5580 | 5.76 | 5.82 | PASS |
| 11A | Ant1 | 5700 | 4.11 | 4.17 | PASS |
| **Test Mode** | **Antenna** | **Channel** | **Meas.Level [dBm]** | **PSD [dBm/500kHz]** | **Verdict** |
| 11A | Ant1 | 5745 | 0.32 | 0.38 | PASS |
| 11A | Ant1 | 5785 | -0.78 | -0.72 | PASS |
| 11A | Ant1 | 5825 | -0.58 | -0.52 | PASS |
| **Test Mode** | **Antenna** | **Channel** | **Meas.Level [dBm]** | **PSD [dBm/MHz]** | **Verdict** |
| 11N20SISO | Ant1 | 5180 | 2.65 | 2.72 | PASS |
| 11N20SISO | Ant1 | 5200 | 2.82 | 2.89 | PASS |
| 11N20SISO | Ant1 | 5240 | 3.85 | 3.92 | PASS |
| 11N20SISO | Ant1 | 5260 | 3.98 | 4.05 | PASS |
| 11N20SISO | Ant1 | 5280 | 3.88 | 3.95 | PASS |
| 11N20SISO | Ant1 | 5320 | 3.98 | 4.05 | PASS |
| 11N20SISO | Ant1 | 5500 | 3.60 | 3.67 | PASS |
| 11N20SISO | Ant1 | 5580 | 4.59 | 4.66 | PASS |
| 11N20SISO | Ant1 | 5700 | 3.18 | 3.25 | PASS |
| **Test Mode** | **Antenna** | **Channel** | **Meas.Level [dBm]** | **PSD [dBm/500kHz]** | **Verdict** |
| 11N20SISO | Ant1 | 5745 | -0.56 | -0.49 | PASS |
| 11N20SISO | Ant1 | 5785 | -1.80 | -1.73 | PASS |
| 11N20SISO | Ant1 | 5825 | -1.34 | -1.27 | PASS |

| Test Mode | Antenna | Channel | Meas.Level [dBm] | PSD [dBm/MHz] | Verdict |
|-----------|---------|---------|------------------|---------------|---------|
| 11N40SISO | Ant1 | 5190 | 0.02 | 0.16 | PASS |
| 11N40SISO | Ant1 | 5230 | 0.82 | 0.95 | PASS |
| 11N40SISO | Ant1 | 5270 | 0.37 | 0.50 | PASS |
| 11N40SISO | Ant1 | 5310 | 1.43 | 1.57 | PASS |
| 11N40SISO | Ant1 | 5510 | -0.18 | -0.04 | PASS |
| 11N40SISO | Ant1 | 5550 | 1.59 | 1.72 | PASS |
| 11N40SISO | Ant1 | 5670 | 0.19 | 0.32 | PASS |
| Test Mode | Antenna | Channel | Meas.Level [dBm] | PSD [dBm/500kHz] | Verdict |
| 11N40SISO | Ant1 | 5755 | -4.05 | -3.92 | PASS |
| 11N40SISO | Ant1 | 5795 | -4.92 | -4.78 | PASS |

| Test Mode | Antenna | Channel | Meas.Level [dBm] | PSD [dBm/MHz] | Verdict |
|-----------|---------|---------|------------------|---------------|---------|
| 11AC20SISO | Ant1 | 5180 | 2.516 | 2.586 | PASS |
| 11AC20SISO | Ant1 | 5200 | 3.055 | 3.125 | PASS |
| 11AC20SISO | Ant1 | 5240 | 3.939 | 4.009 | PASS |
| 11AC20SISO | Ant1 | 5260 | 3.762 | 3.832 | PASS |
| 11AC20SISO | Ant1 | 5280 | 4.189 | 4.249 | PASS |
| 11AC20SISO | Ant1 | 5320 | 4.029 | 4.009 | PASS |
| 11AC20SISO | Ant1 | 5500 | 3.688 | 3.758 | PASS |
| 11AC20SISO | Ant1 | 5580 | 4.745 | 4.815 | PASS |
| 11AC20SISO | Ant1 | 5700 | 3.491 | 3.561 | PASS |
| Test Mode | Antenna | Channel | Meas.Level [dBm] | PSD [dBm/500kHz] | Verdict |
| 11AC20SISO | Ant1 | 5745 | 5.487 | 5.557 | PASS |
| 11AC20SISO | Ant1 | 5785 | -1.667 | -1.597 | PASS |
| 11AC20SISO | Ant1 | 5825 | -0.797 | -0.727 | PASS |

| Test Mode | Antenna | Channel | Meas.Level [dBm] | PSD [dBm/MHz] | Verdict |
|---|---|---|---|---|---|
| 11AC40SISO | Ant1 | 5190 | -0.800 | -0.670 | PASS |
| 11AC40SISO | Ant1 | 5230 | 0.346 | 0.486 | PASS |
| 11AC40SISO | Ant1 | 5270 | 0.981 | 1.111 | PASS |
| 11AC40SISO | Ant1 | 5310 | 0.868 | 0.998 | PASS |
| 11AC40SISO | Ant1 | 5510 | 0.471 | 0.601 | PASS |
| 11AC40SISO | Ant1 | 5550 | 1.129 | 1.259 | PASS |
| 11AC40SISO | Ant1 | 5670 | -0.838 | -0.708 | PASS |
| **Test Mode** | **Antenna** | **Channel** | **Meas.Level [dBm]** | **PSD [dBm/500kHz]** | **Verdict** |
| 11AC40SISO | Ant1 | 5755 | -4.405 | -4.475 | PASS |
| 11AC40SISO | Ant1 | 5795 | -4.927 | -4.497 | PASS |

| Test Mode | Antenna | Channel | Meas.Level [dBm] | PSD [dBm/500kHz] | Verdict |
|---|---|---|---|---|---|
| 11AC80SISO | Ant1 | 5210 | -2.308 | -2.018 | PASS |
| 11AC80SISO | Ant1 | 5290 | -1.323 | -1.043 | PASS |
| 11AC80SISO | Ant1 | 5530 | -0.605 | -0.315 | PASS |
| 11AC80SISO | Ant1 | 5775 | -7.256 | -6.976 | PASS |

**Power Spectral Density Plot**

### Test Graph
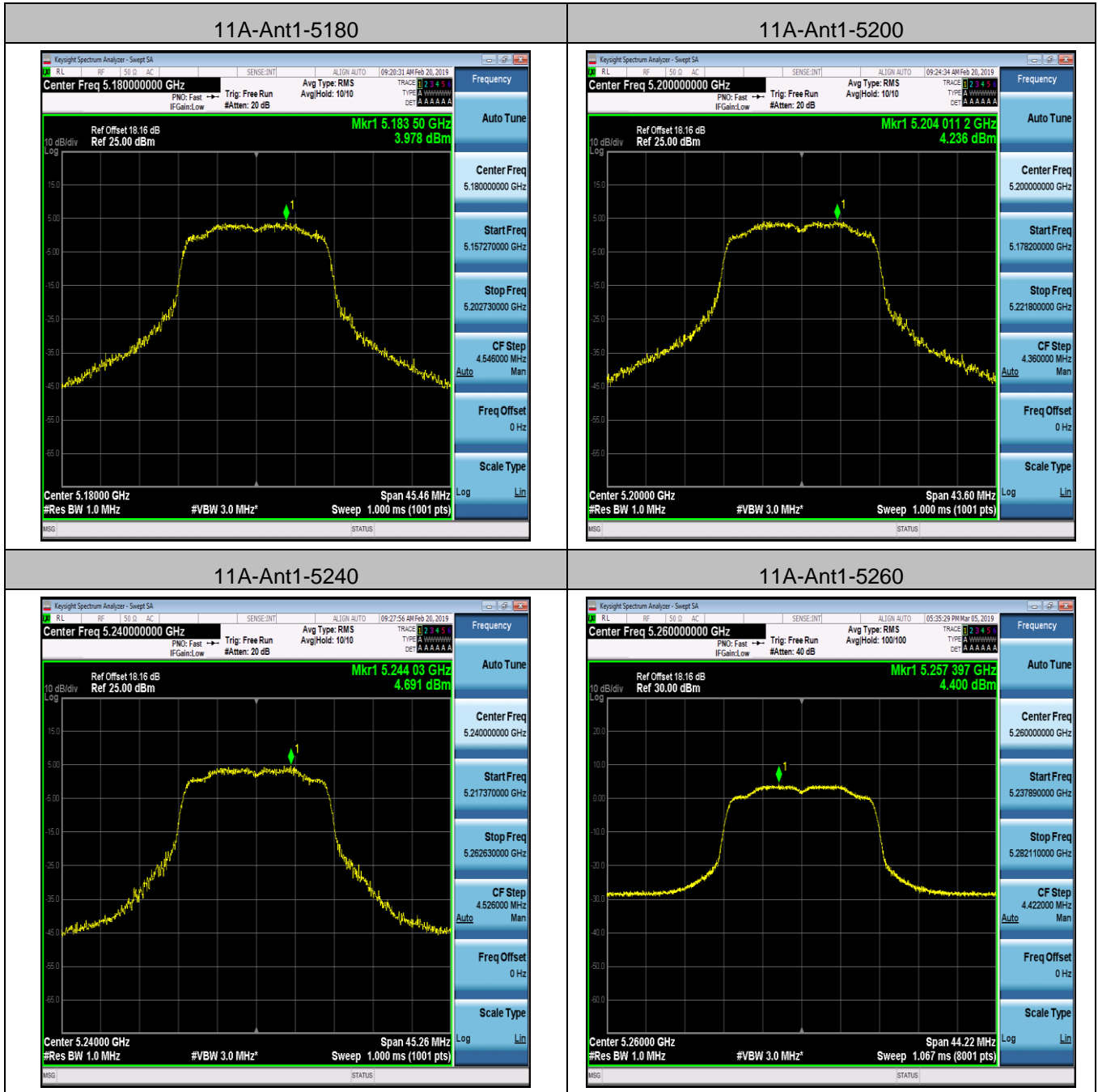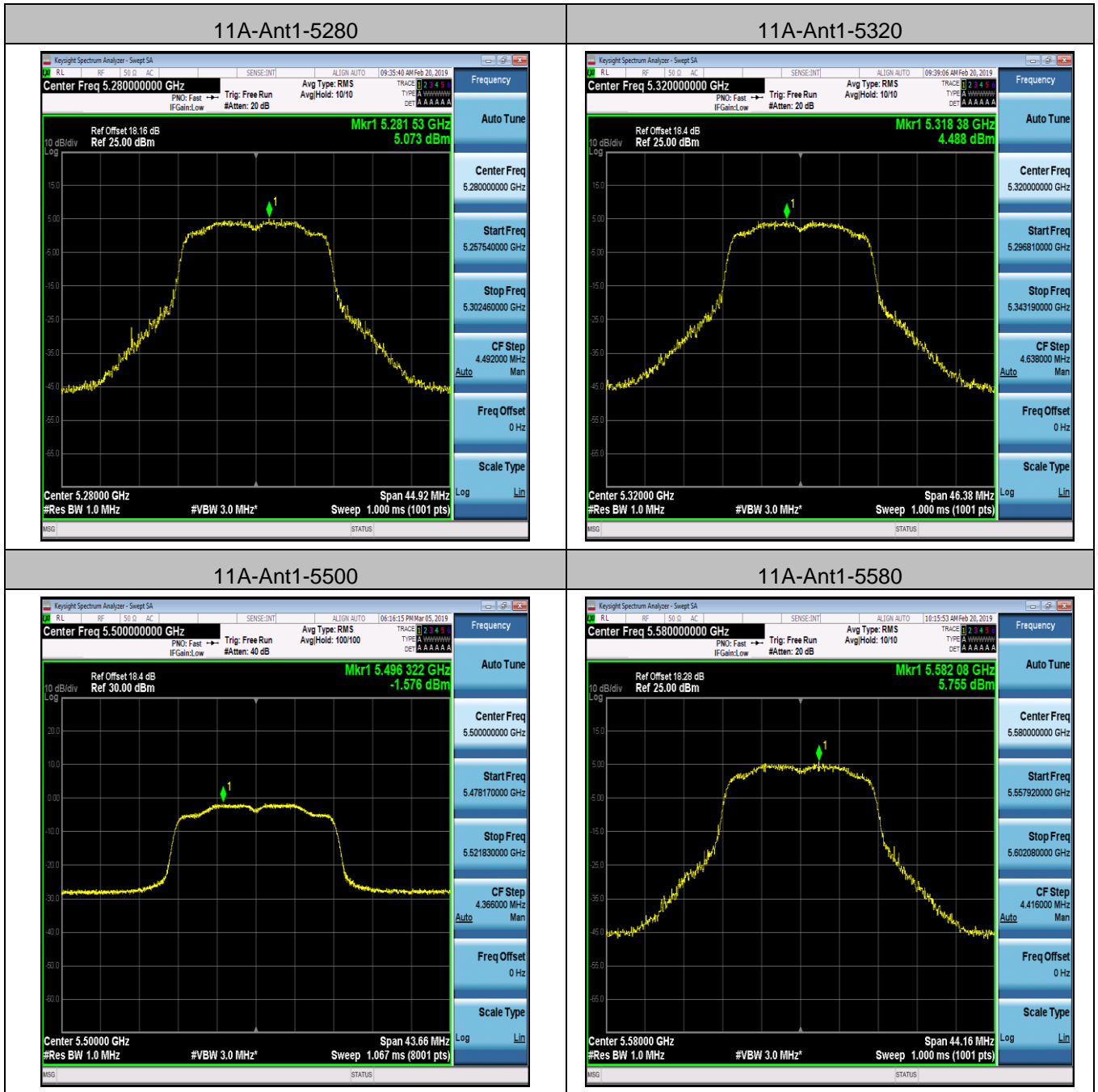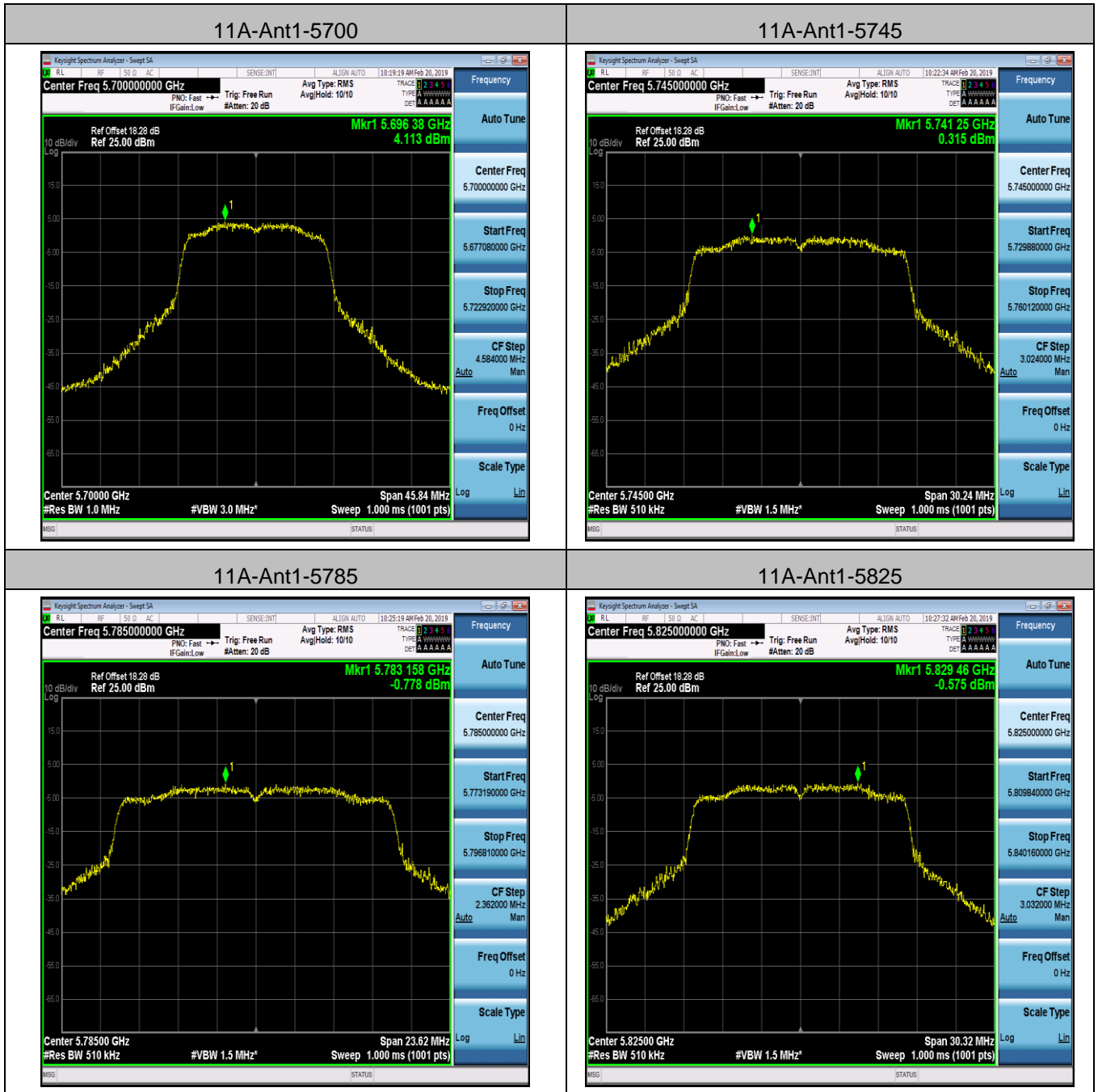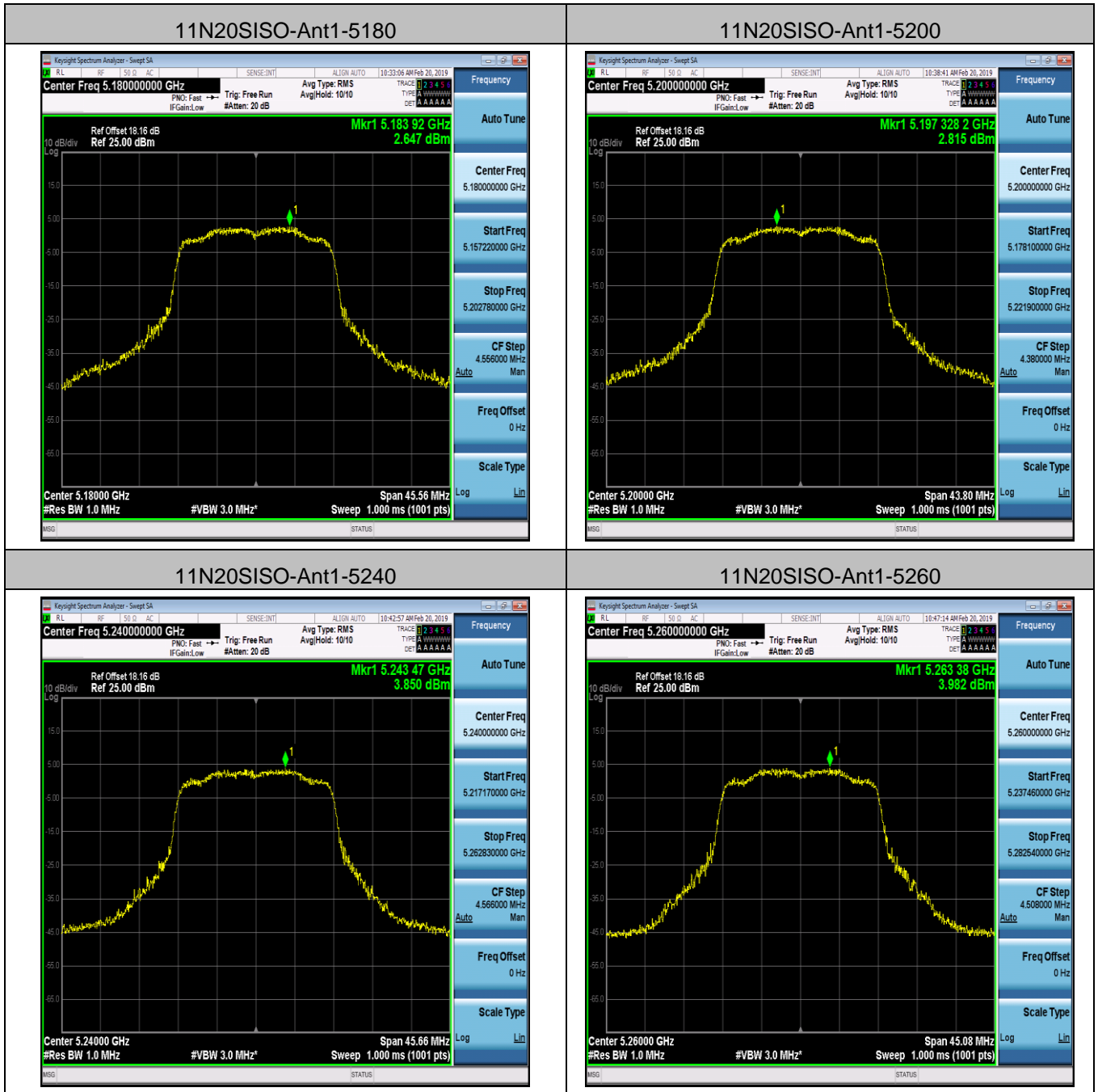
| 11A-Ant1-5180 | 11A-Ant1-5200 |
|---|---|
|  |  |

| 11A-Ant1-5240 | 11A-Ant1-5260 |
|---|---|
|  |  |

| 11A-Ant1-5280 | 11A-Ant1-5320 |
|---|---|
|  |  |

| 11A-Ant1-5500 | 11A-Ant1-5580 |
|---|---|
|  |  |

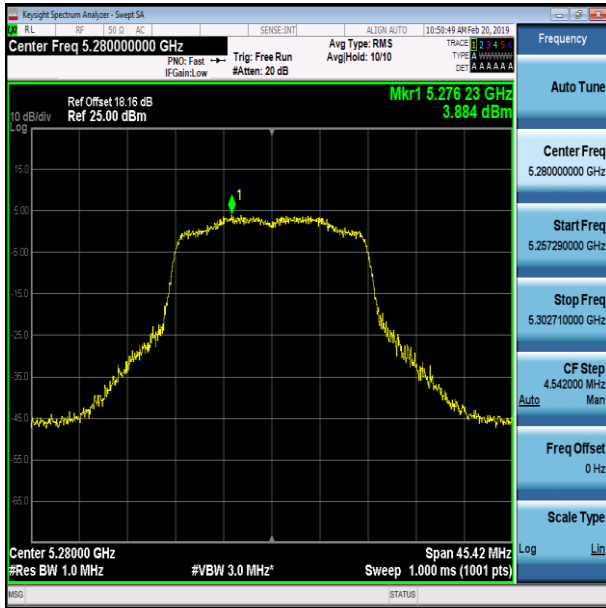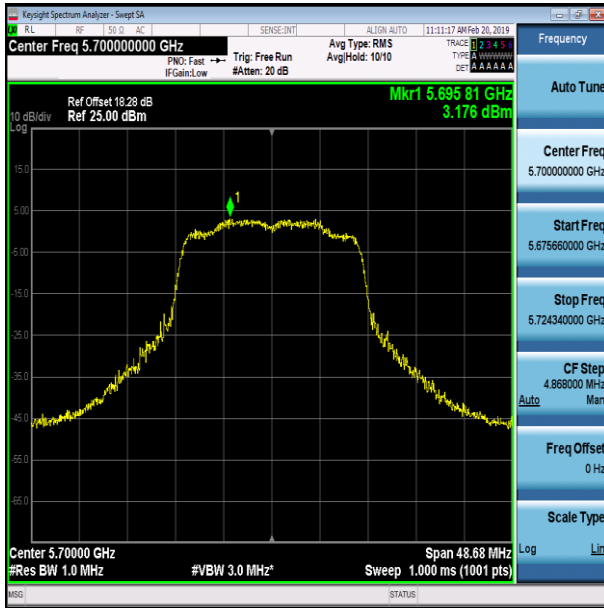| 11A-Ant1-5700 | 11A-Ant1-5745 |
|---|---|
|  |  |

| 11A-Ant1-5785 | 11A-Ant1-5825 |
|---|---|
|  |  |

| 11N20SISO-Ant1-5180 | 11N20SISO-Ant1-5200 |
|---|---|
|  |  |

| 11N20SISO-Ant1-5240 | 11N20SISO-Ant1-5260 |
|---|---|
|  |  |

| 11N20SISO-Ant1-5280 | 11N20SISO-Ant1-5320 |
|---|---|
|  |  |

| 11N20SISO-Ant1-5500 | 11N20SISO-Ant1-5580 |
|---|---|
|  |  |

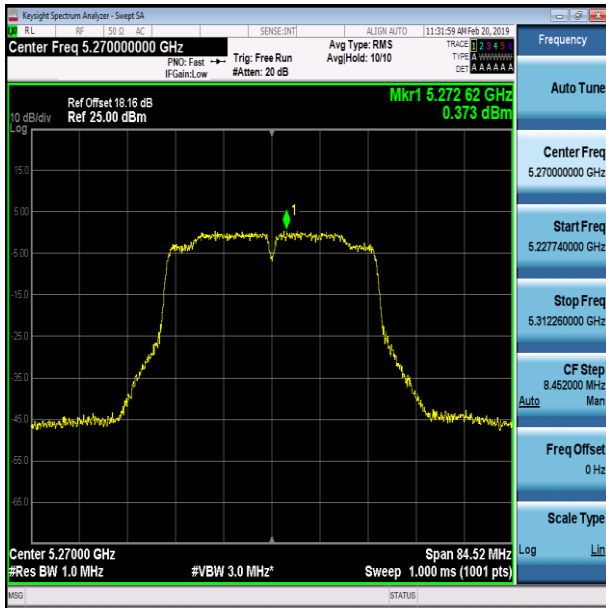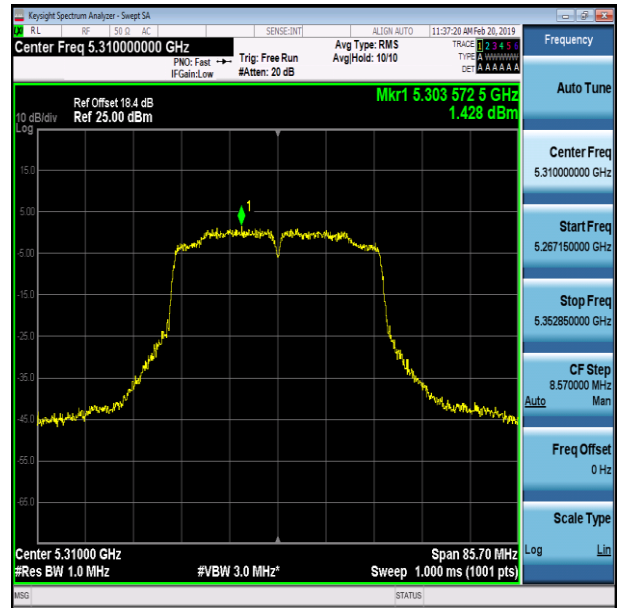| 11N20SISO-Ant1-5700 | 11N20SISO-Ant1-5745 |
|---|---|
|  |  |

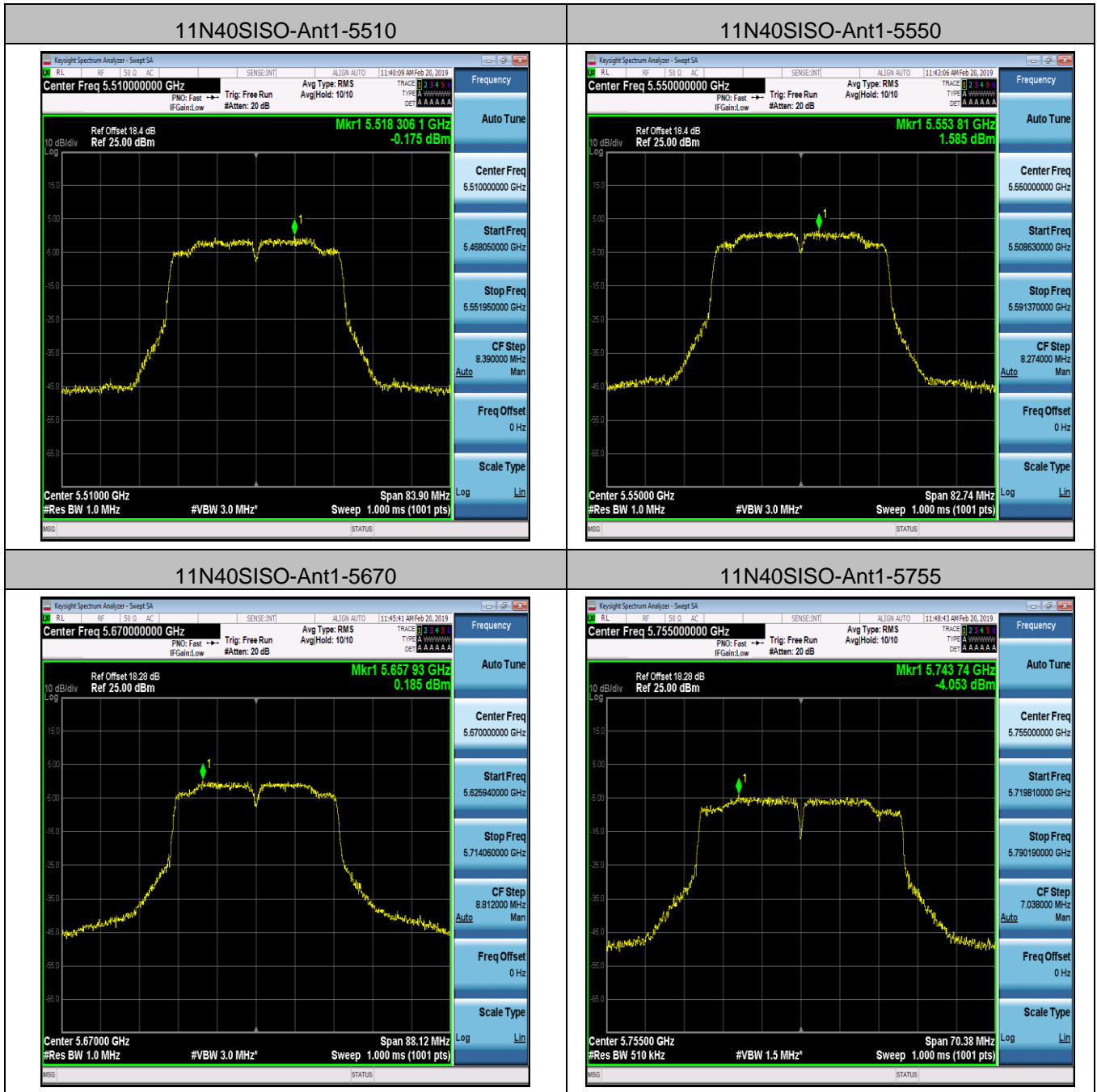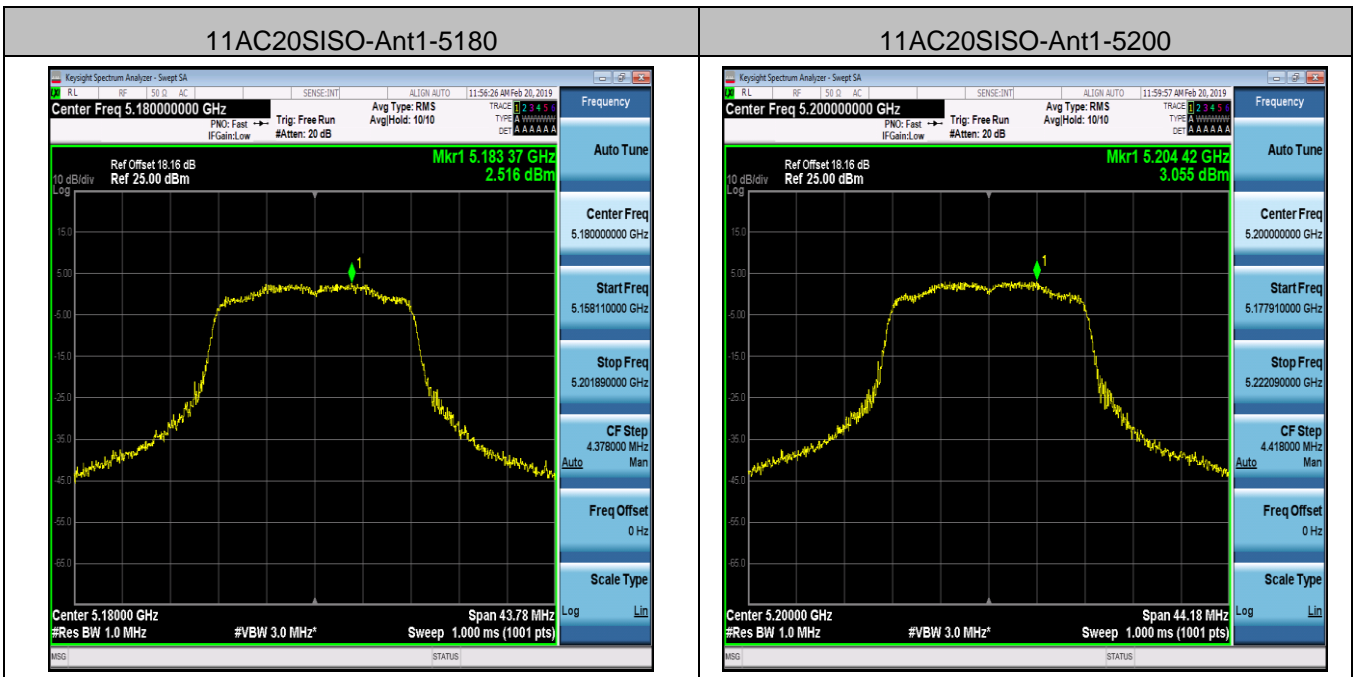| 11N20SISO-Ant1-5785 | 11N20SISO-Ant1-5825 |
|---|---|
|  |  |

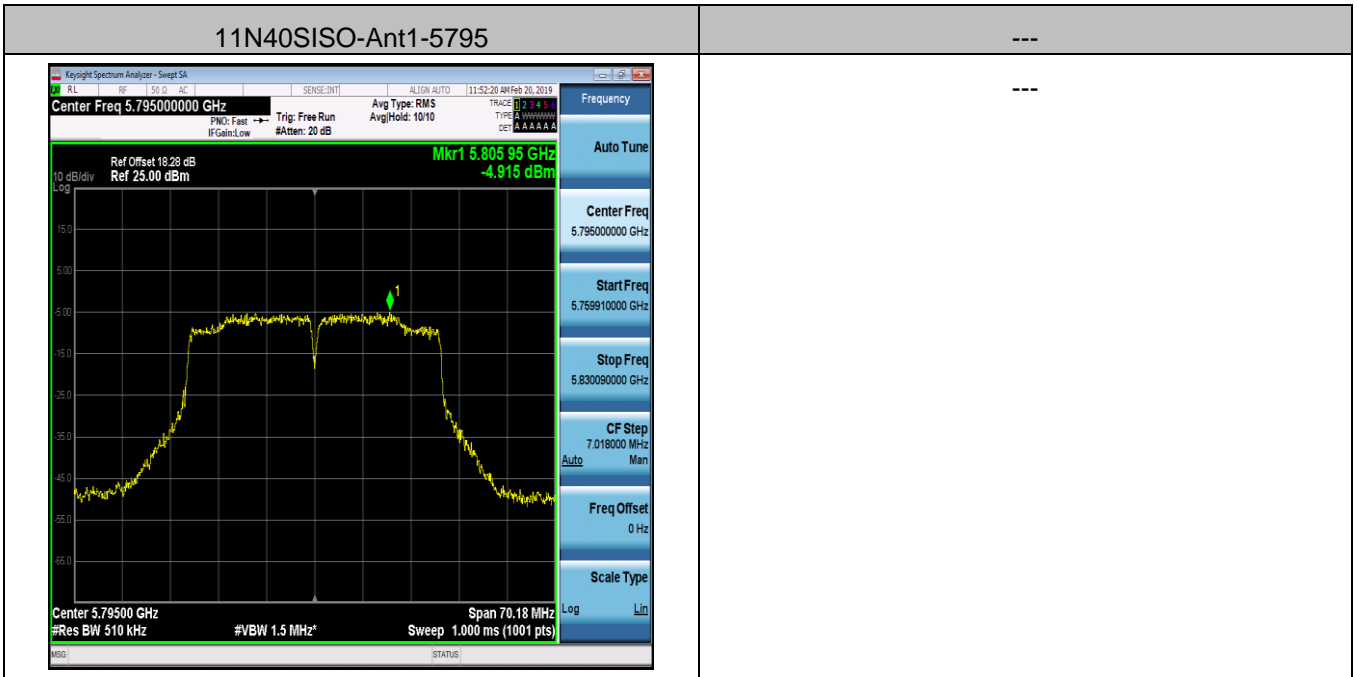| 11N40SISO-Ant1-5190 | 11N40SISO-Ant1-5230 |
|---|---|
|  |  |
| 11N40SISO-Ant1-5270 | 11N40SISO-Ant1-5310 |
|  |  |

| 11N40SISO-Ant1-5510 | 11N40SISO-Ant1-5550 |
|---|---|
|  |  |

| 11N40SISO-Ant1-5670 | 11N40SISO-Ant1-5755 |
|---|---|
|  |  |

| 11N40SISO-Ant1-5795 | --- |
|---|---|
|  | --- |

| 11AC20SISO-Ant1-5180 | 11AC20SISO-Ant1-5200 |
|---|---|
|  |  |

| 11AC20SISO-Ant1-5240 | 11AC20SISO-Ant1-5260 |
|---|---|
|  |  |

| 11AC20SISO-Ant1-5280 | 11AC20SISO-Ant1-5320 |
|---|---|
|  |  |

| 11AC20SISO-Ant1-5500 | 11AC20SISO-Ant1-5580 |
|---|---|

| 11AC20SISO-Ant1-5700 | 11AC20SISO-Ant1-5745 |
|---|---|

| 11AC20SISO-Ant1-5785 | 11AC20SISO-Ant1-5825 |
|---|---|
|  |  |

| 11AC40SISO-Ant1-5190 | 11AC40SISO-Ant1-5230 |
|---|---|
|  |  |

| 11AC40SISO-Ant1-5270 | 11AC40SISO-Ant1-5310 |
|---|---|
|  |  |

| 11AC40SISO-Ant1-5510 | 11AC40SISO-Ant1-5550 |
|---|---|
|  |  |

| 11AC40SISO-Ant1-5670 | 11AC40SISO-Ant1-5755 |
|---|---|
|  |  |

| 11AC40SISO-Ant1-5795 | --- |
|---|---|
|  | --- |

| 11AC80SISO-Ant1-5210 | 11AC80SISO-Ant1-5290 |
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| 11AC80SISO-Ant1-5530 | 11AC80SISO-Ant1-5775 |
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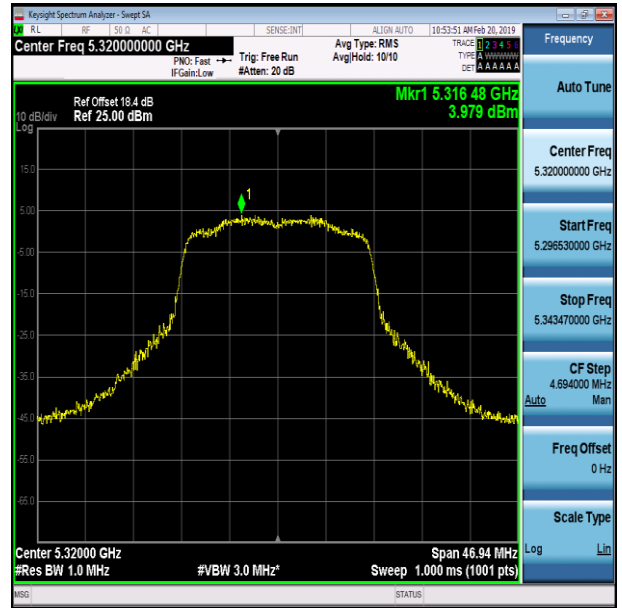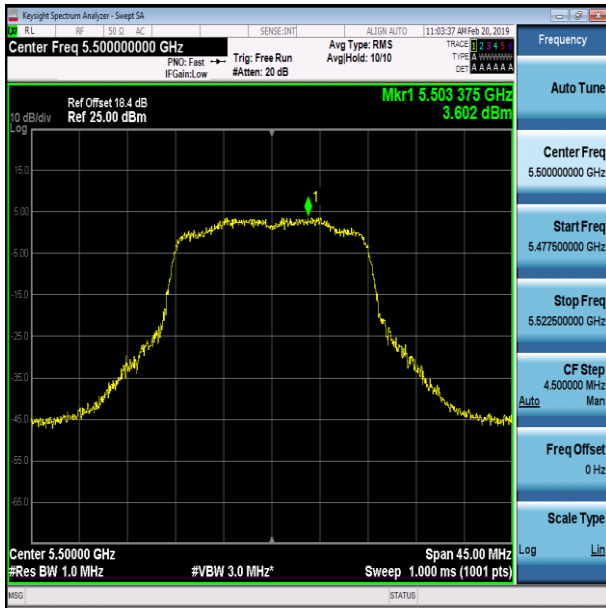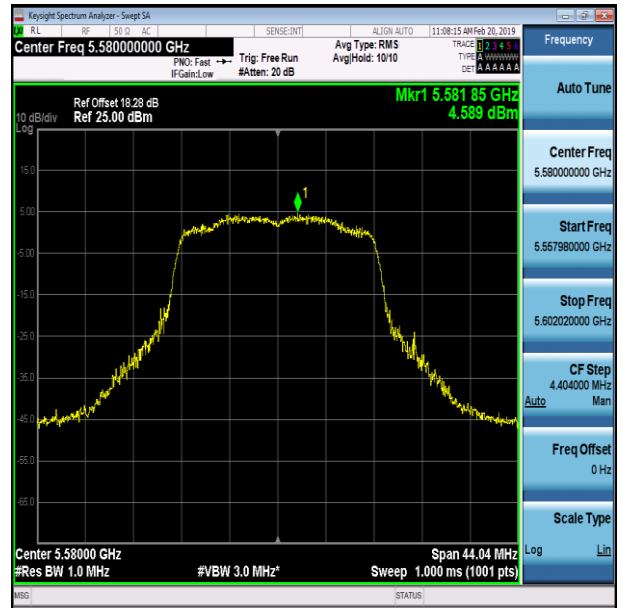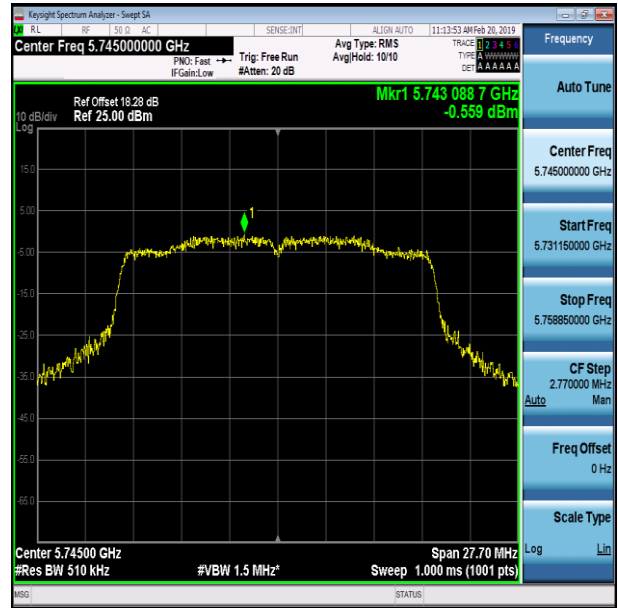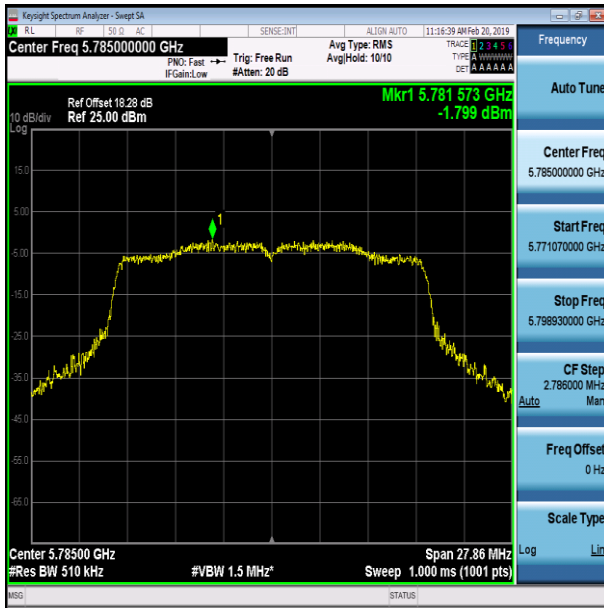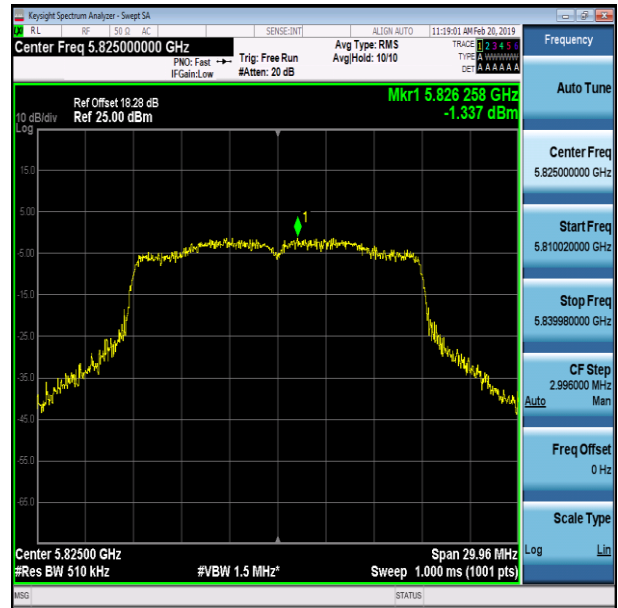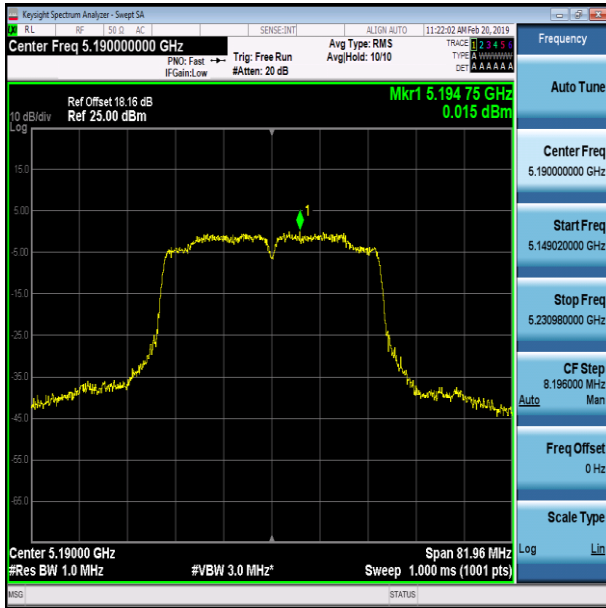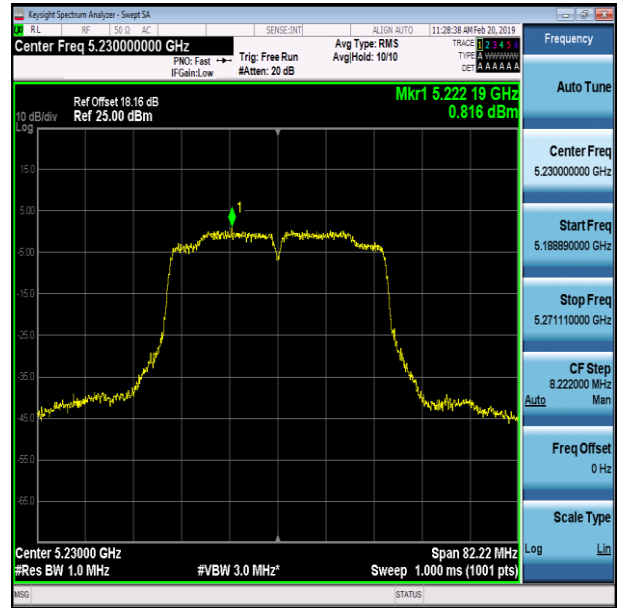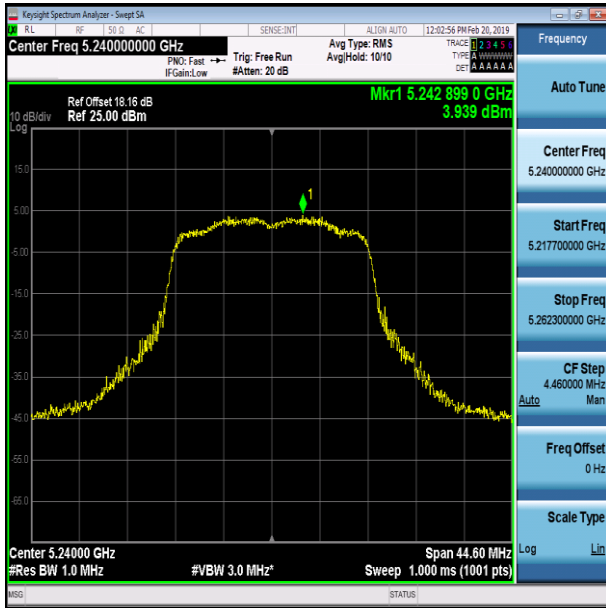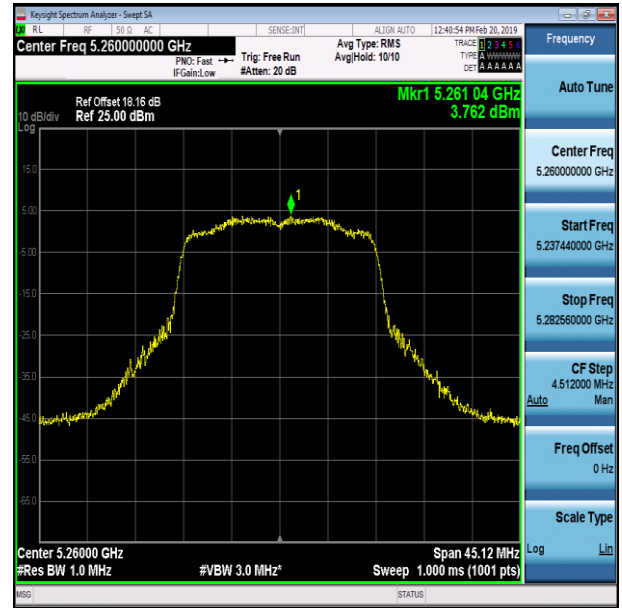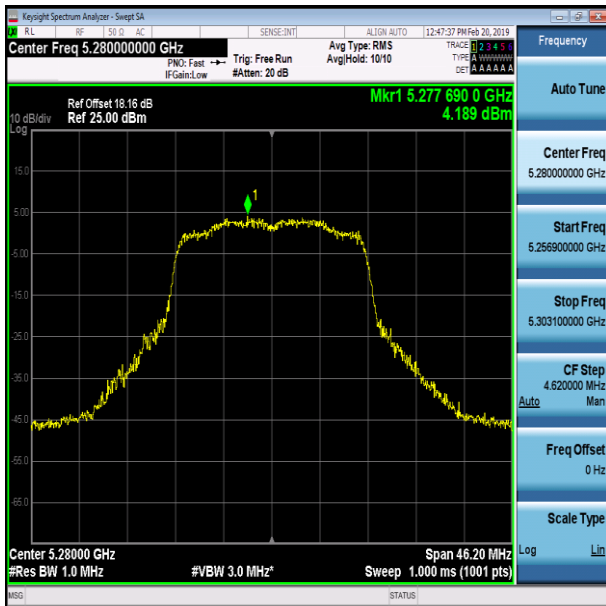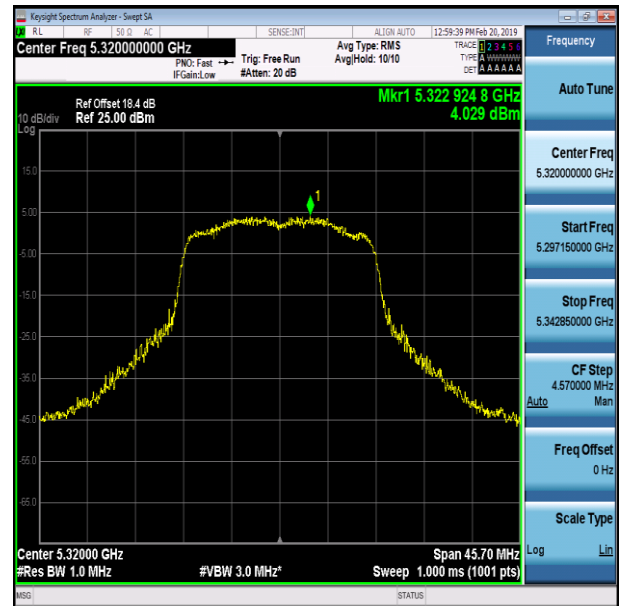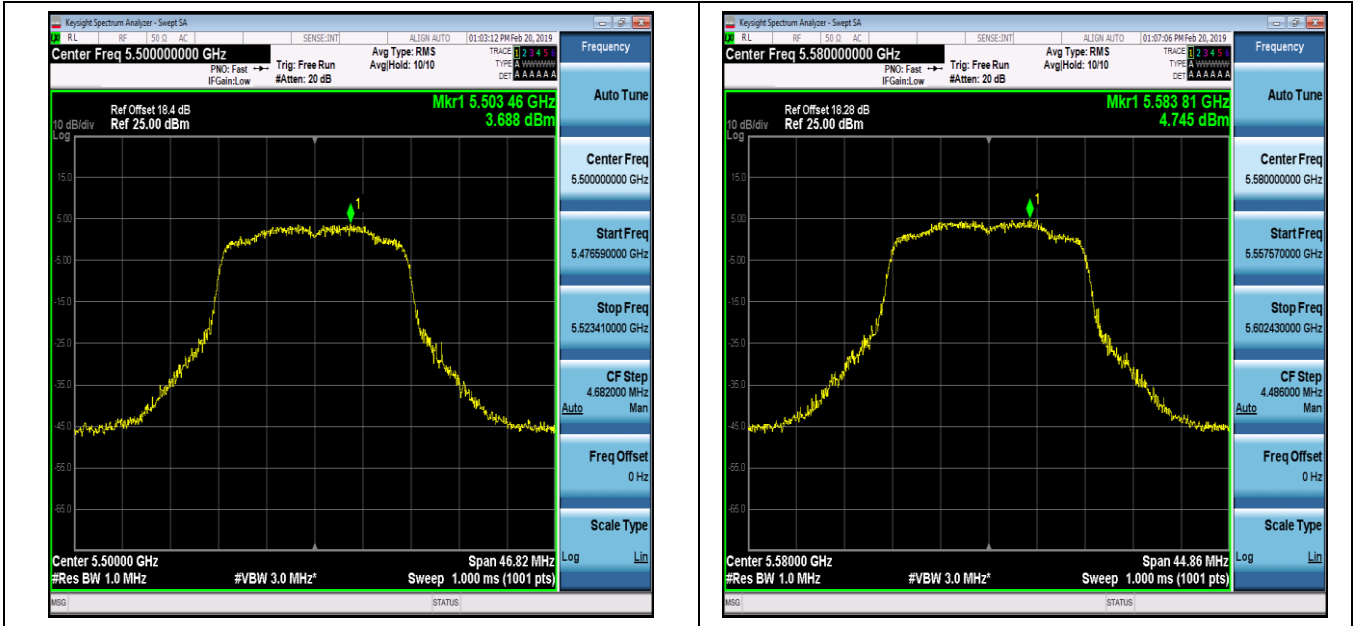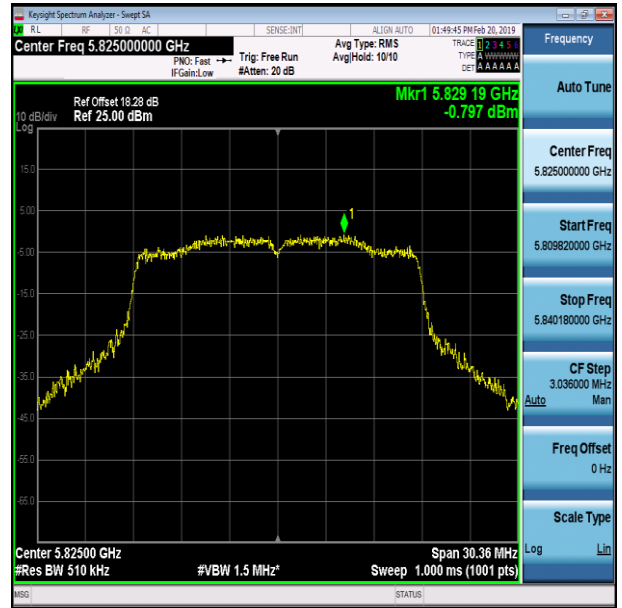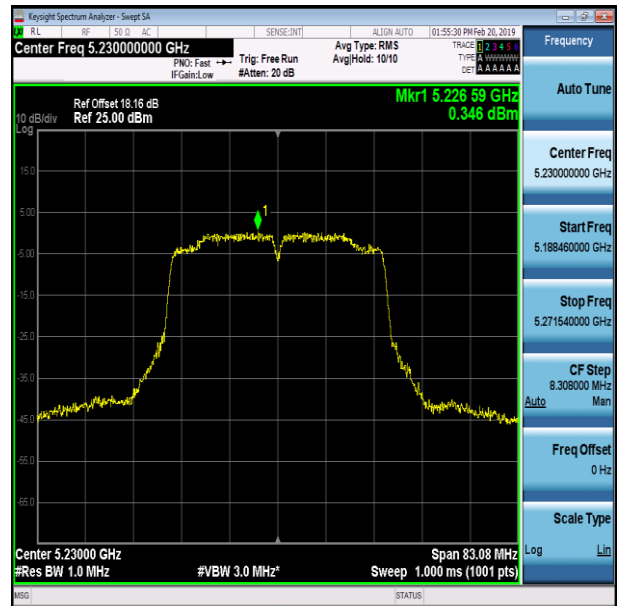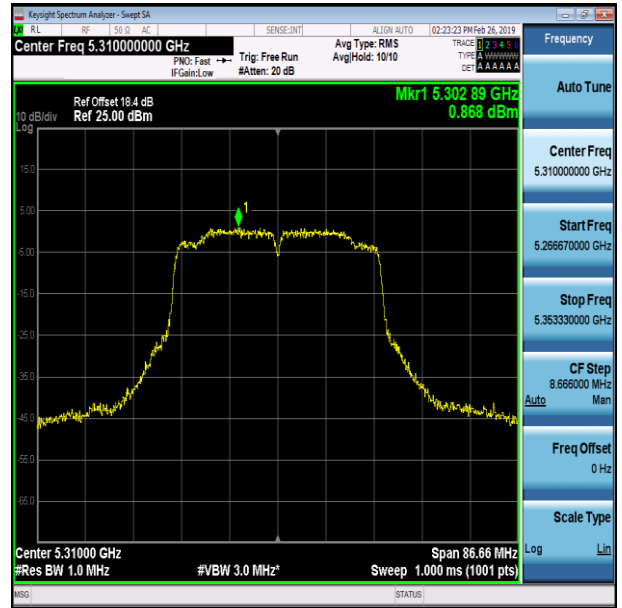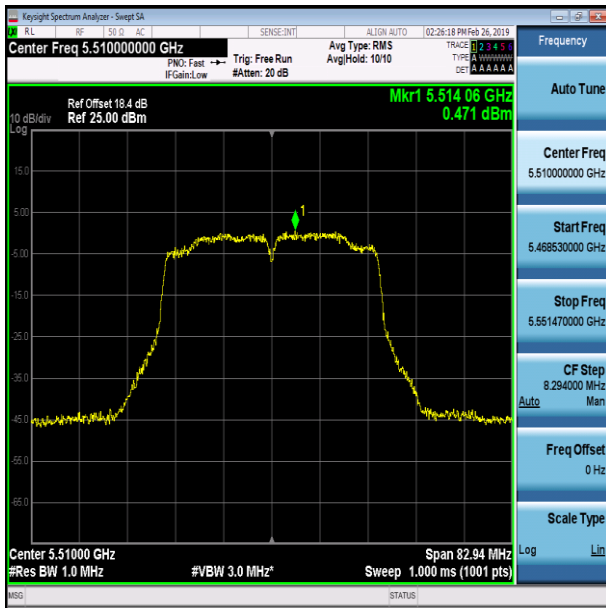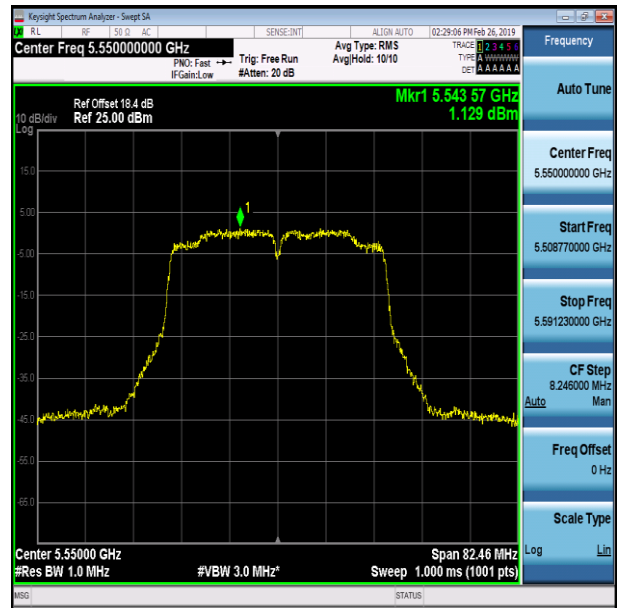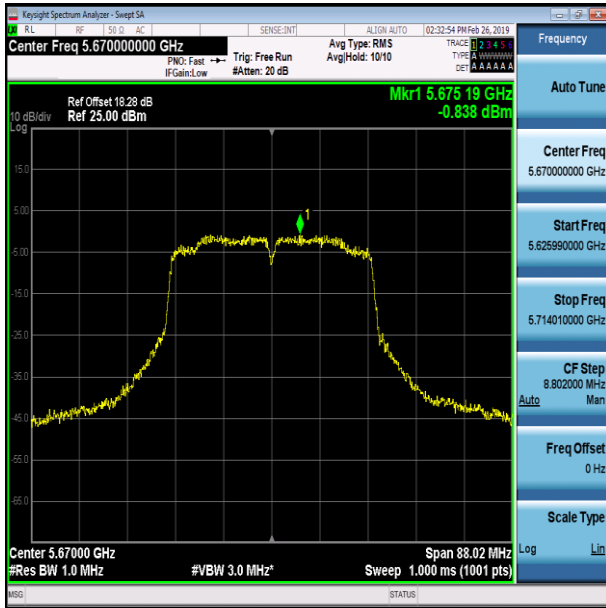
# 4.4 Unwanted Emissions Measurement

This section as specified in FCC Part 15.407(b) is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement. The unwanted emissions shall comply with 15.407(b)(1) to (6), and restricted bands per FCC Part15.205.

## 4.4.1  Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5600 MHz and 5650-5725MHz band: all emissions outside of the 5470-5600 MHz and 5650-5725MHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table

| Frequency<br>(MHz) | Field Strength<br>(microvolts/meter) | Measurement Distance<br>(meters) |
|---|---|---|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100 | 3 |
| 88 – 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

**Note:** The following formula is used to convert the EIRP to field strength.

$$E = \frac{1000000\sqrt{30P}}{3} \ \mu V/m, \text{ where P is the eirp (Watts)}$$

| EIRP (dBm) | Field Strength at 3m (dBμV/m) |
|---|---|
| -17 | 78.3 |
| -27 | 68.3 |

(3) KDB789033 D02 v02r01 G)2)c) As specified in 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in 15.407(b)(4)). However, an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit. For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge

## 4.4.2　Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   - RBW = 1 MHz
   - VBW $\geqslant$ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW $\geqslant$ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground..

3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.

4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.