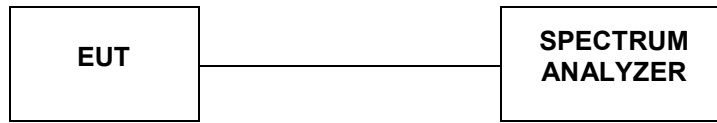


## 4.6. 6dB Bandwidth

### TEST CONFIGURATION



### TEST PROCEDURE

According to KDB789033 D02 General U-NII Test Procedures New Rules v02r01 for one of the following procedures may be used for section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize
- 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.

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

### LIMIT

For Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz

### TEST RESULTS

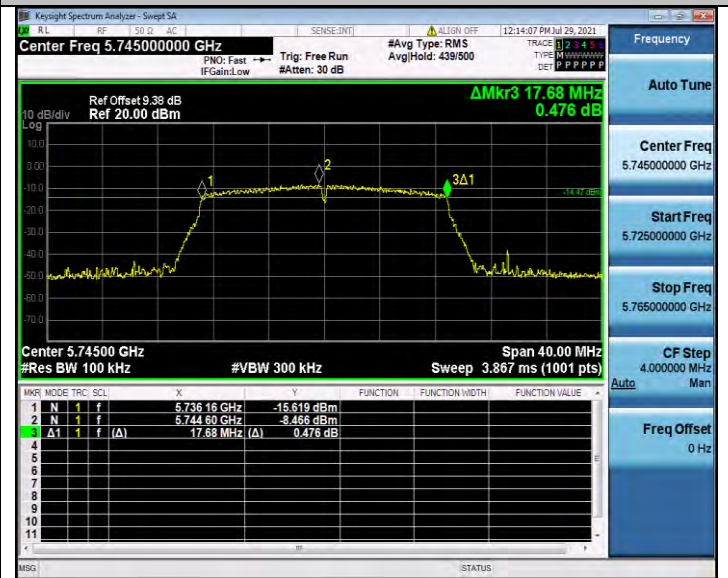
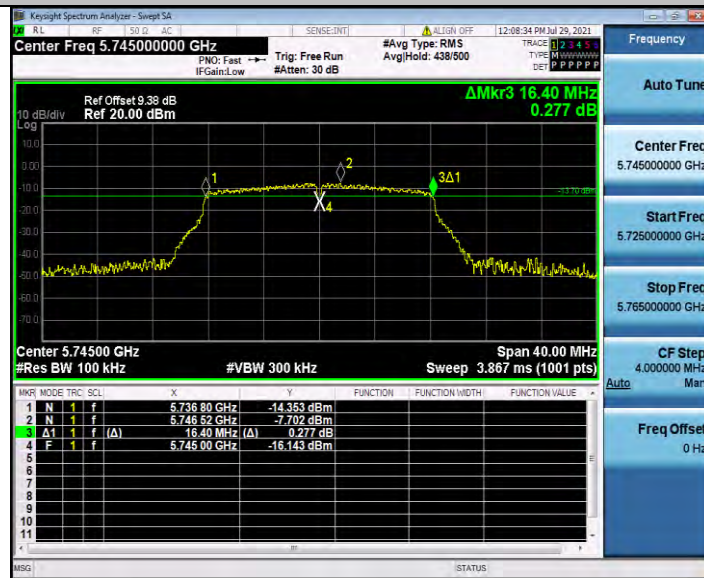
Temperature	23.6°C	Humidity	55.7%
Test Engineer	Oliver Ou	Configurations	IEEE 802.11a/n/ac

Type	Channel	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	16.400	>500	Pass
	157	16.400		
	165	16.400		
802.11nHT20	149	17.680	>500	Pass
	157	17.680		
	165	17.640		
802.11n40	151	36.240	>500	Pass
	159	36.240		
802.11ac20	149	17.680	>500	Pass
	157	17.640		
	165	17.680		
802.11ac40	151	36.480	>500	Pass
	159	36.000		
802.11ac80	155	76.320	>500	Pass

## 6dB Bandwidth

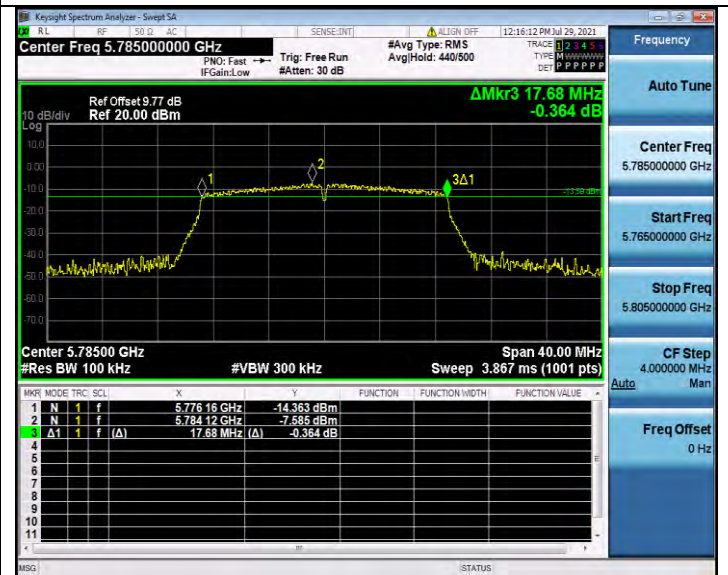
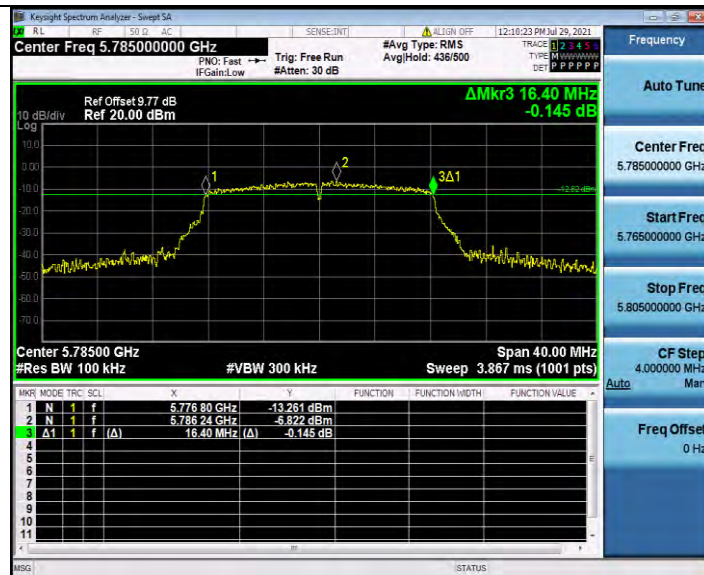
## 802.11a

## 802.11n HT20



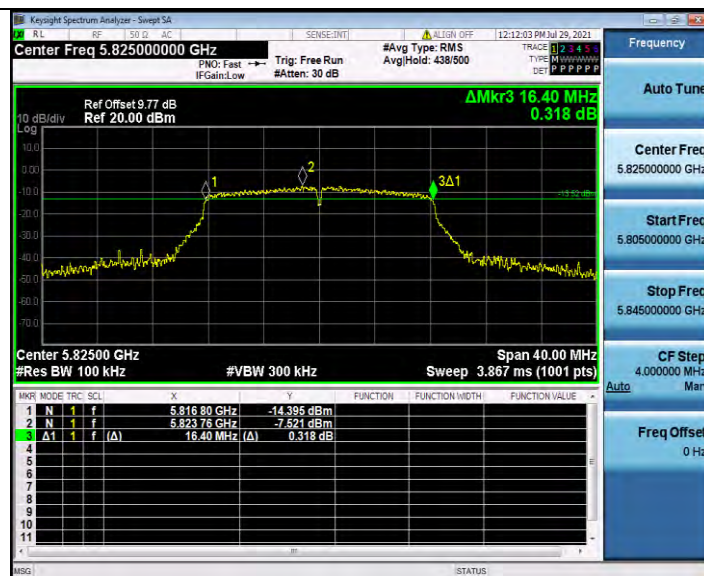
## CH149

## CH149



## CH157

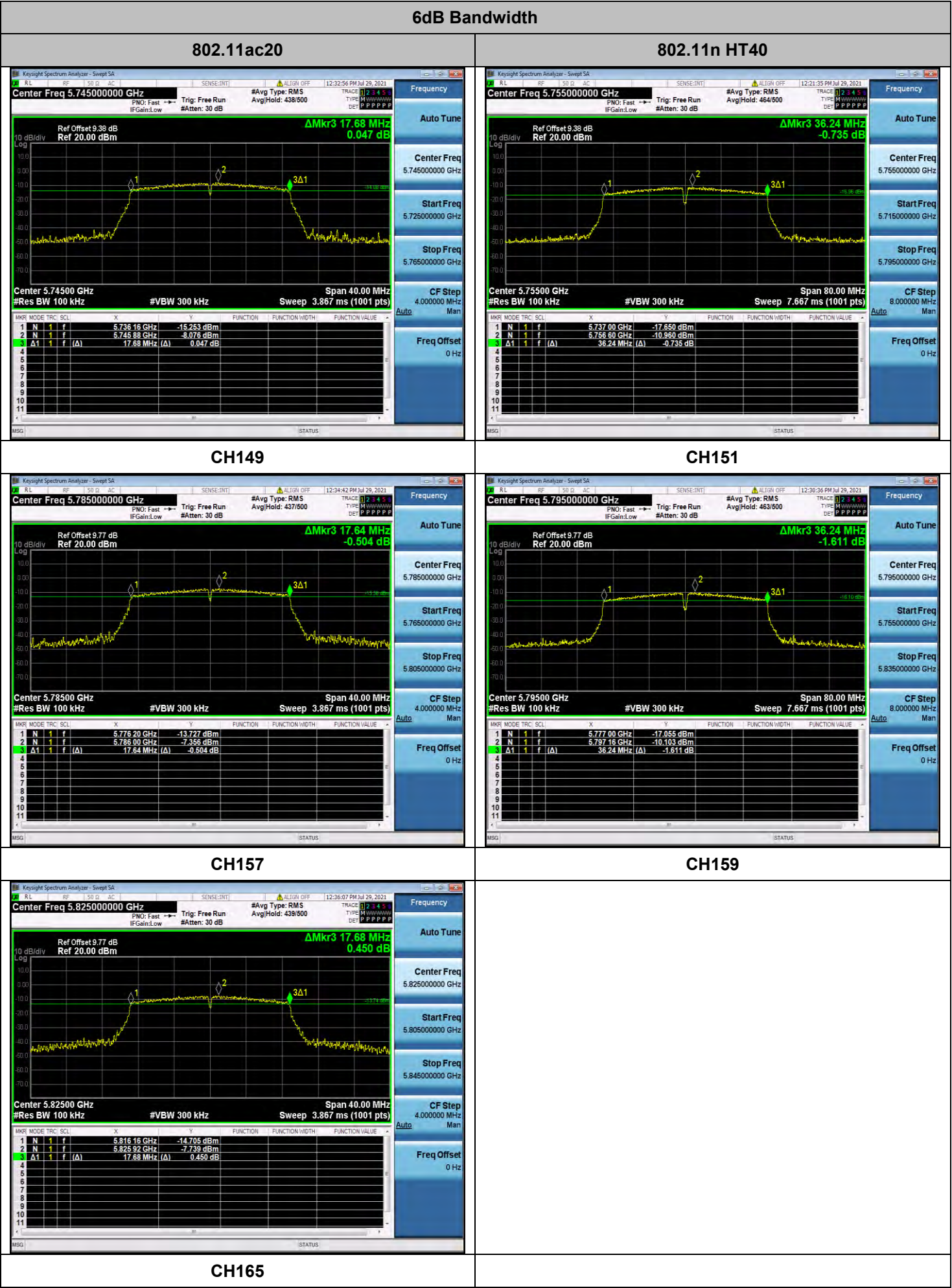
## CH157



## CH165

## CH165

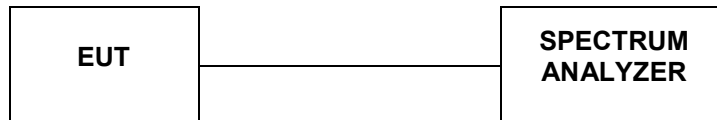






## 4.7. 26dBc Bandwidth

### TEST CONFIGURATION



### TEST PROCEDURE

According to KDB789033 D02 General U-NII Test Procedures New Rules v02r01 for one of the following procedures may be used for Emission Bandwidth (EBW) measurement:

- Set RBW = 220 kHz/430 kHz /820 kHz (approximately 1% of the emission bandwidth).
- Set the video bandwidth (VBW) = 3\* RBW)
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize
- 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

Temperature	23.6°C	Humidity	55.7%
Test Engineer	Oliver Ou	Configurations	IEEE 802.11a/n/ac

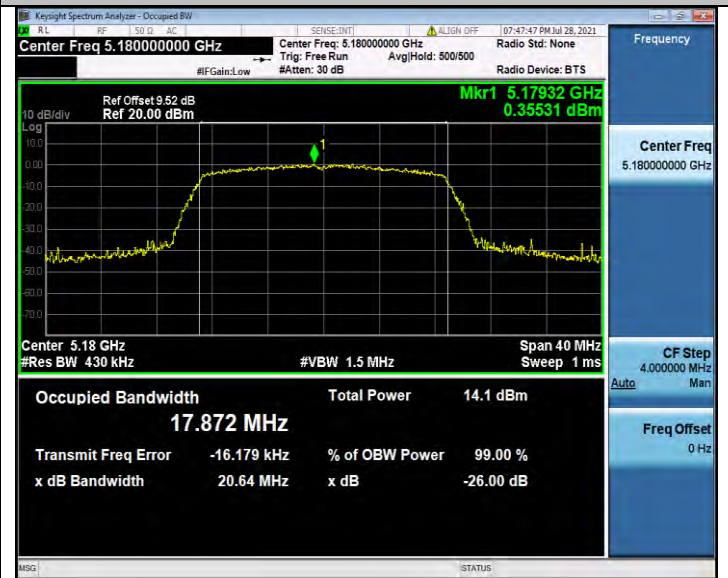
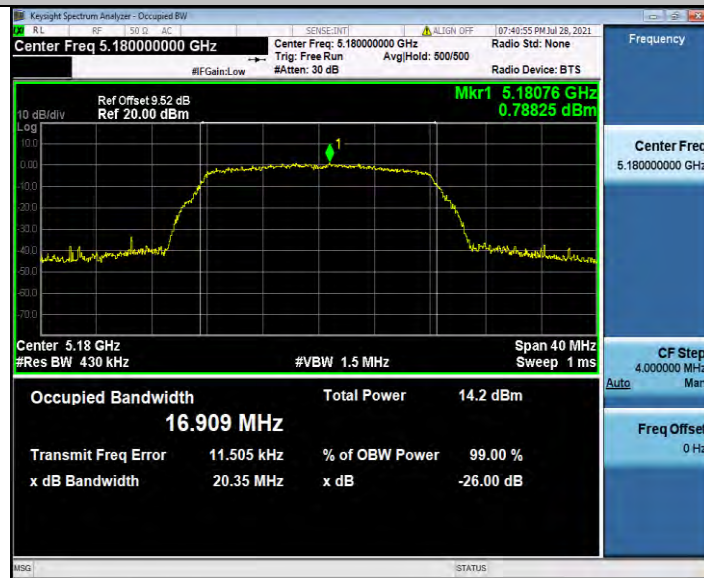
Type	Channel	99%Bandwidth (MHz)	26dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	36	16.909	20.040	-	Pass
	40	16.822	19.800		
	48	16.892	19.960		
802.11nHT20	36	17.872	20.360	-	Pass
	40	17.816	20.200		
	48	17.845	20.240		
802.11n40	38	36.289	40.400	-	Pass
	46	36.267	40.400		
802.11ac20	36	17.853	20.600	-	Pass
	40	17.819	20.440		
	48	17.851	20.120		
802.11ac40	38	36.344	40.640	-	Pass
	46	36.232	40.480		
802.11ac80	42	75.279	80.960	-	Pass



## 99%Bandwidth

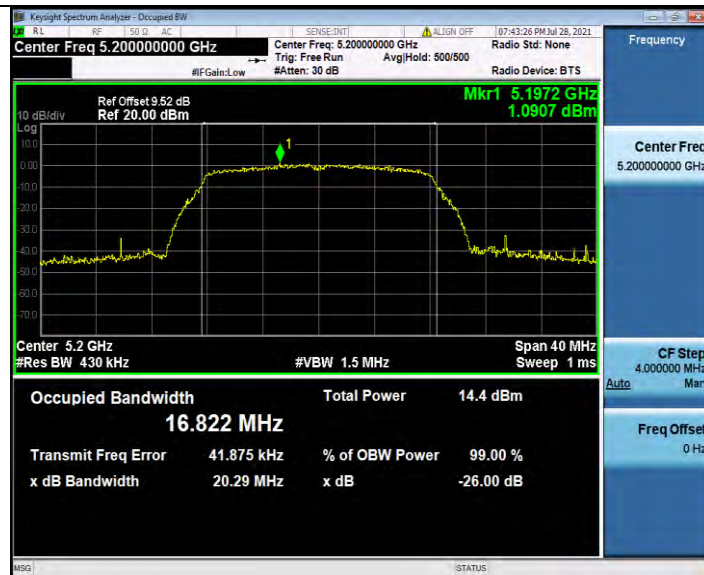
## 802.11a

## 802.11n HT20



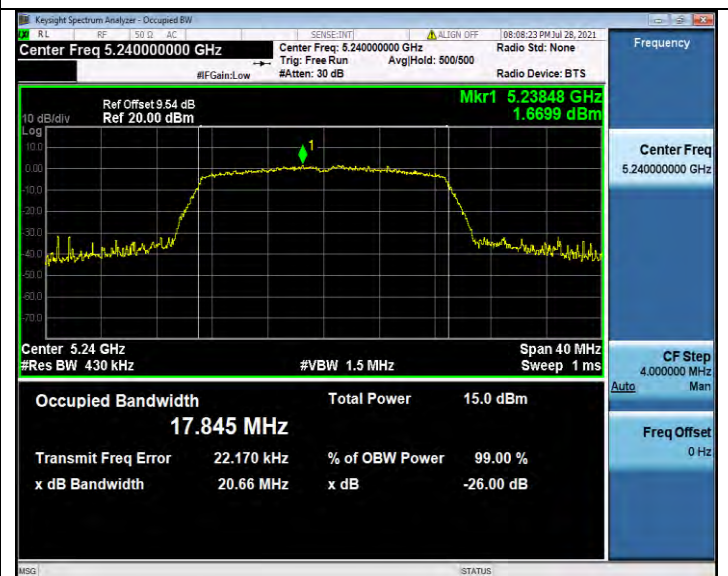
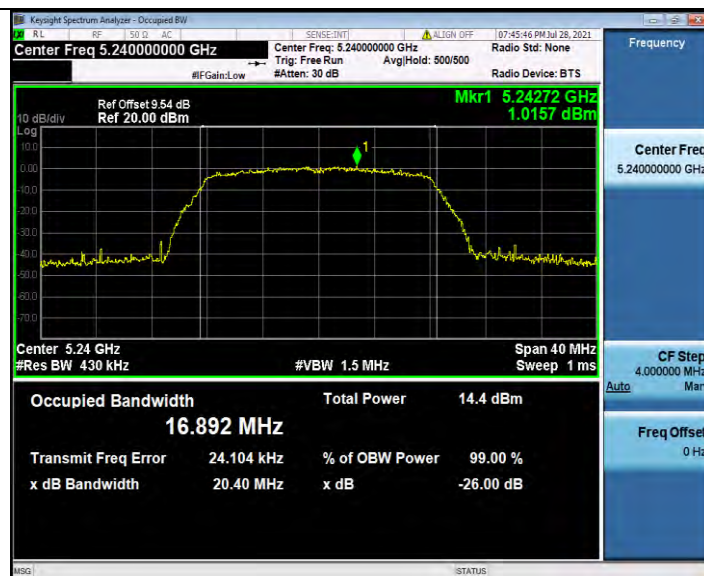
## CH36

## CH36



## CH40

## CH40

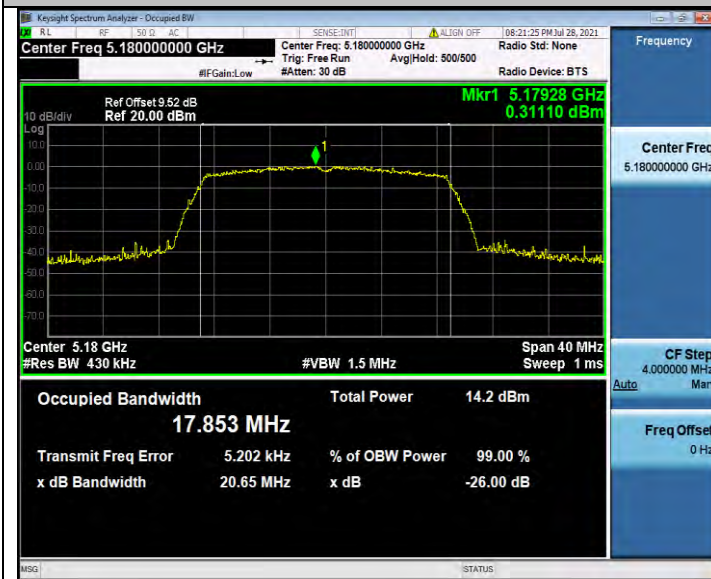


## CH48

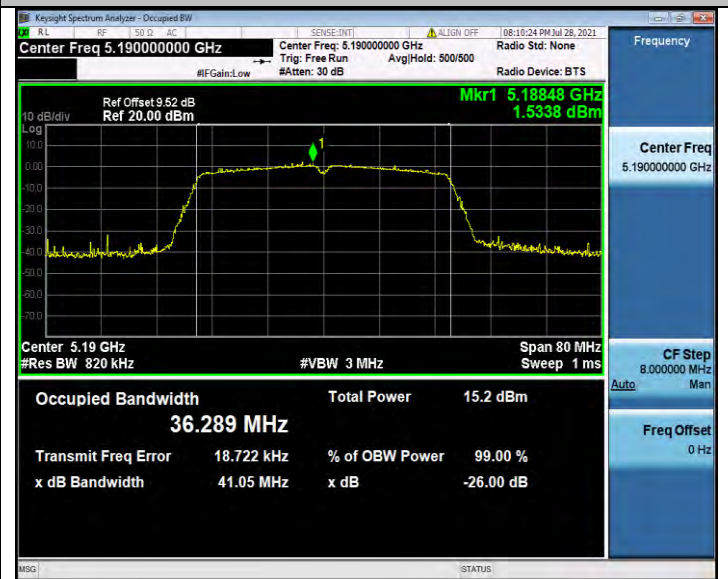
## CH48

## 99%Bandwidth

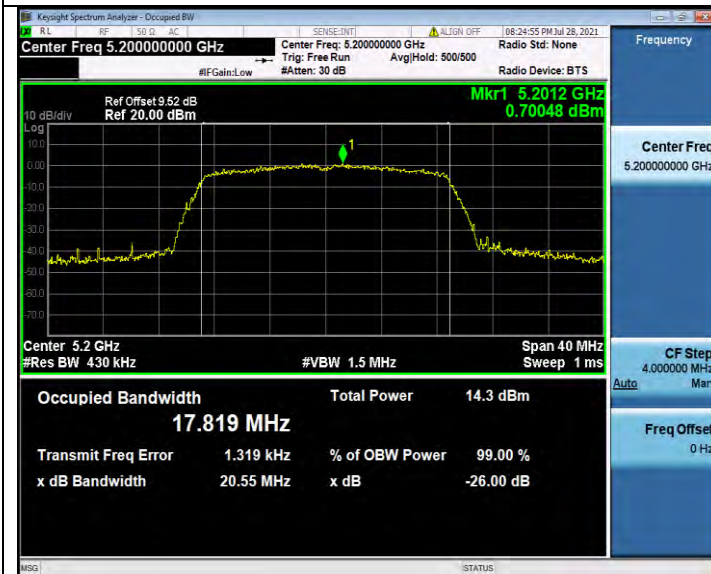
## 802.11ac20



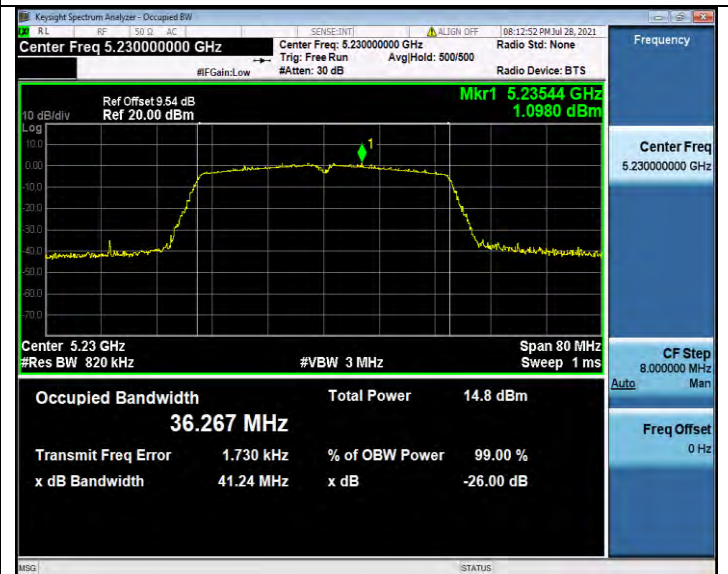
## 802.11n HT40



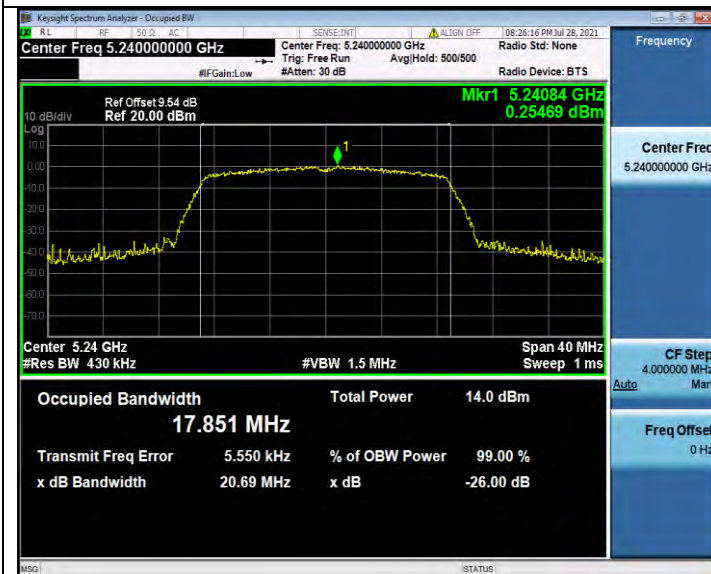
## CH36



## CH38



## CH40

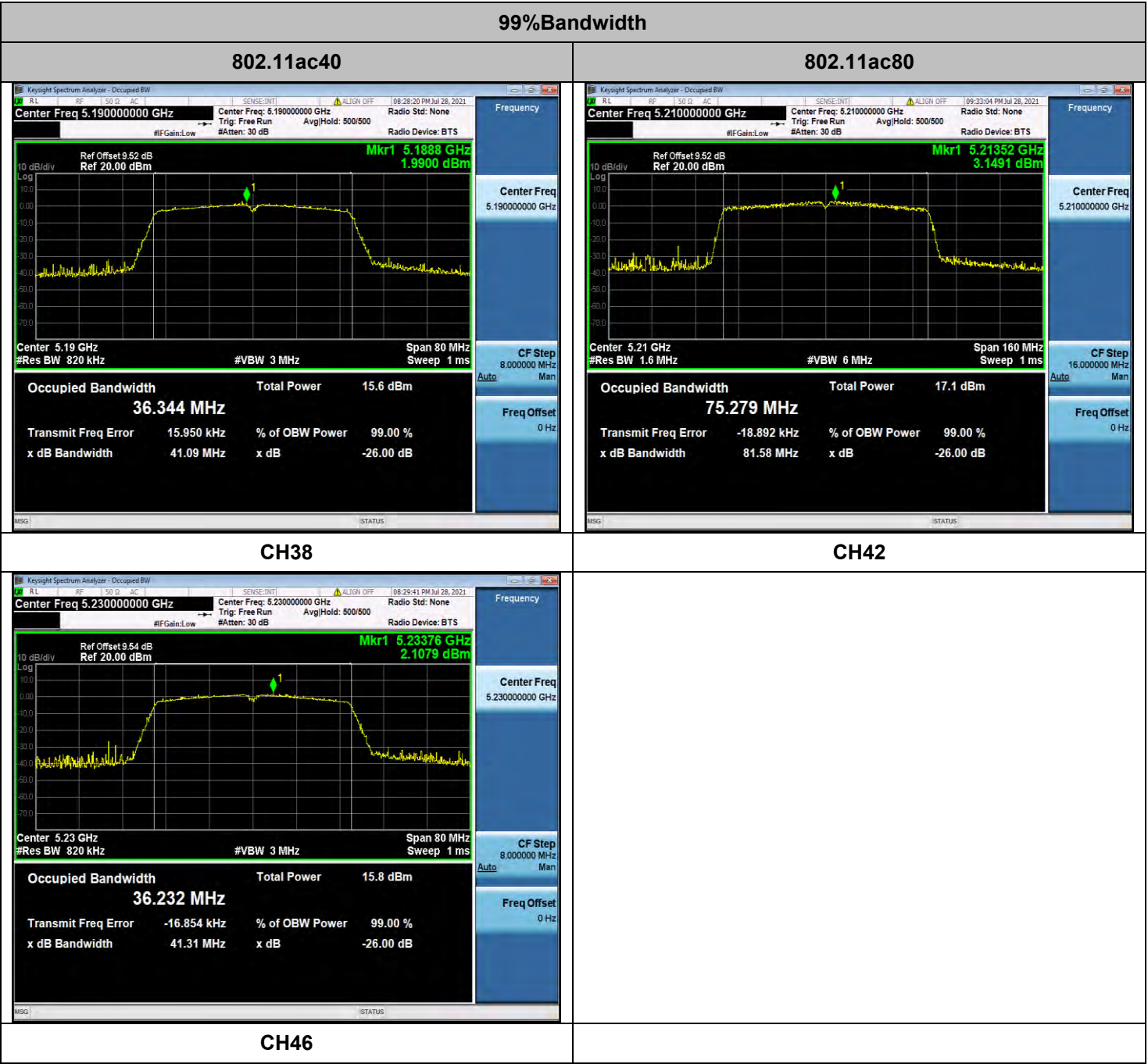


## CH46



## CH48

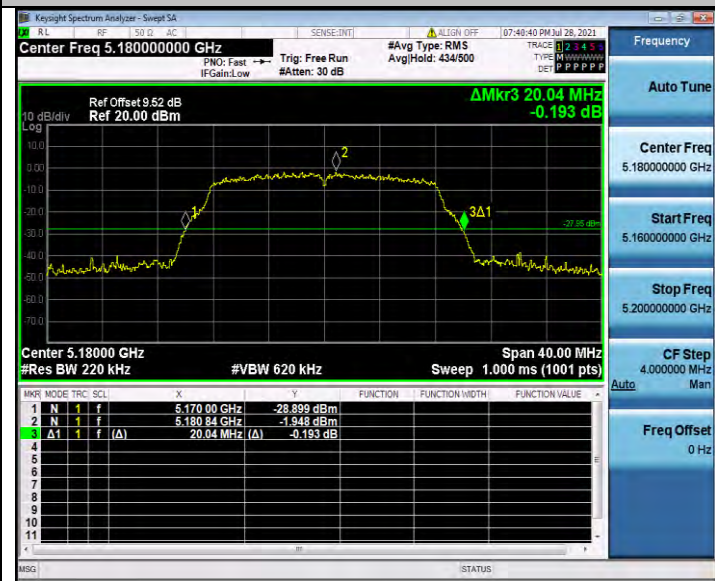




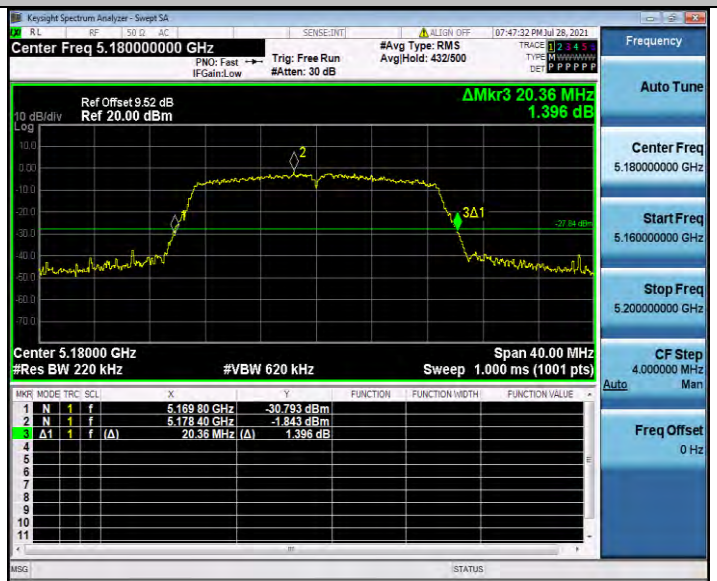


26dB Bandwidth

802.11a



802.11n HT20



CH36



CH36



CH40



CH40



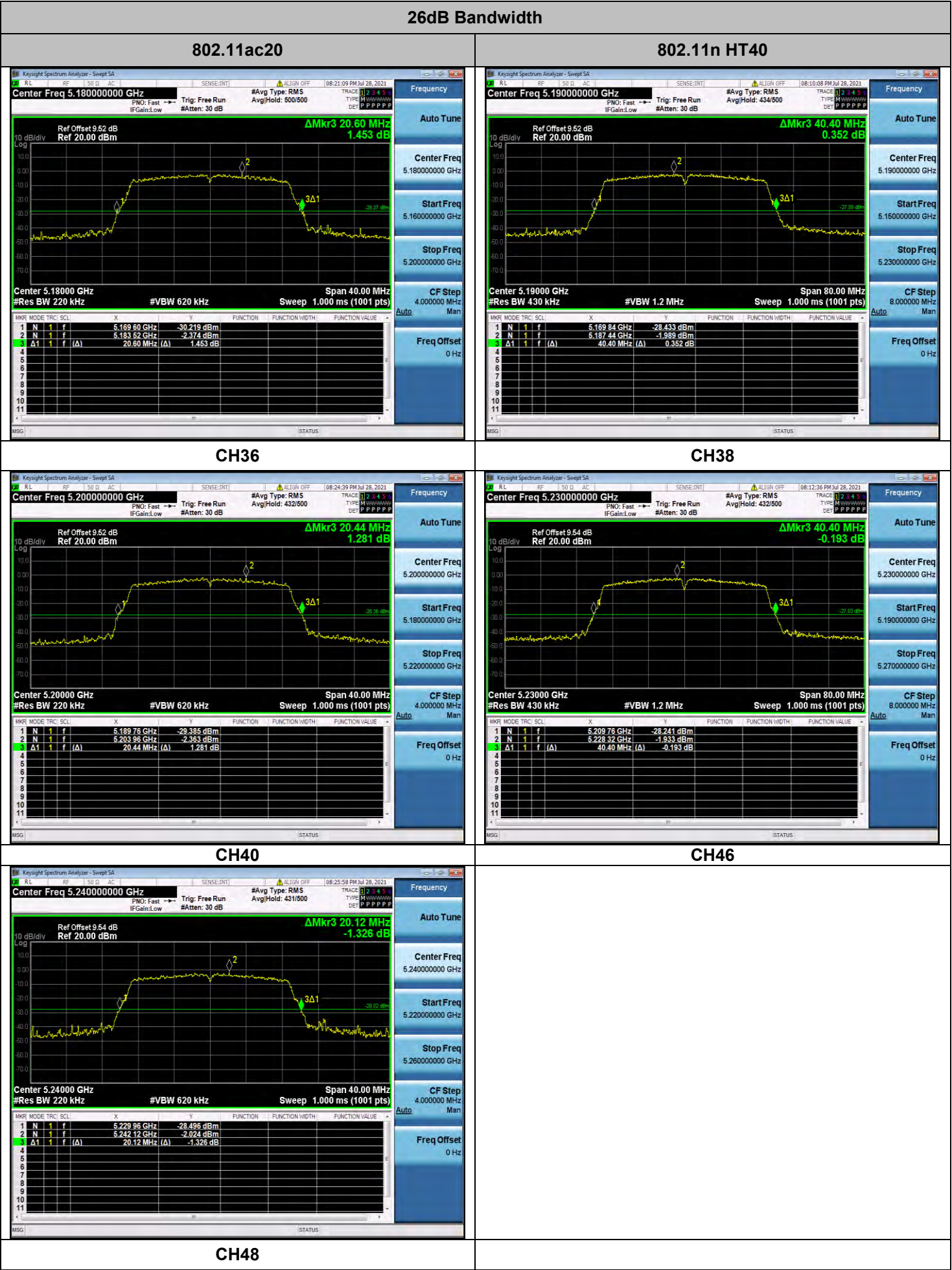
CH48

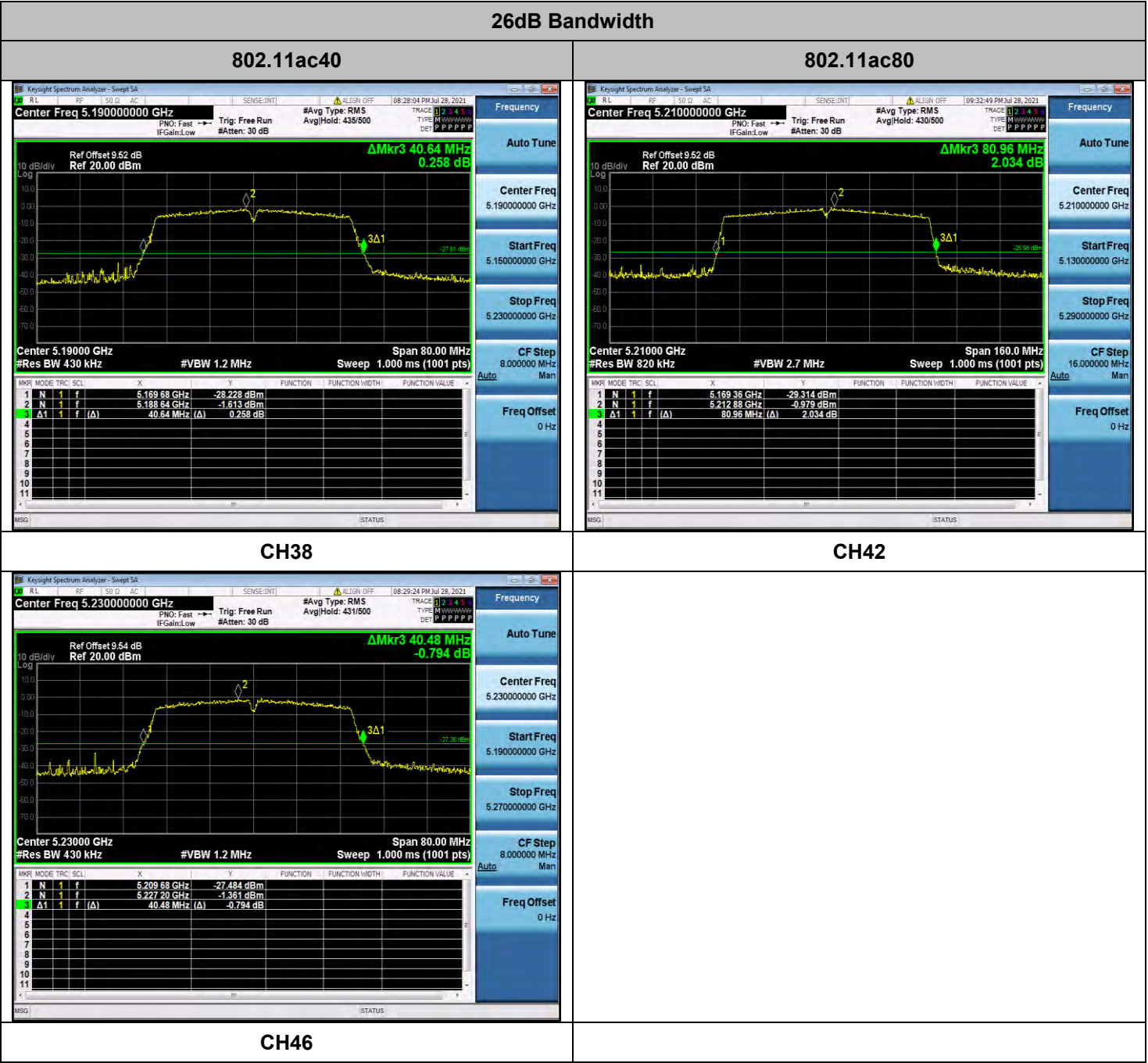


CH48





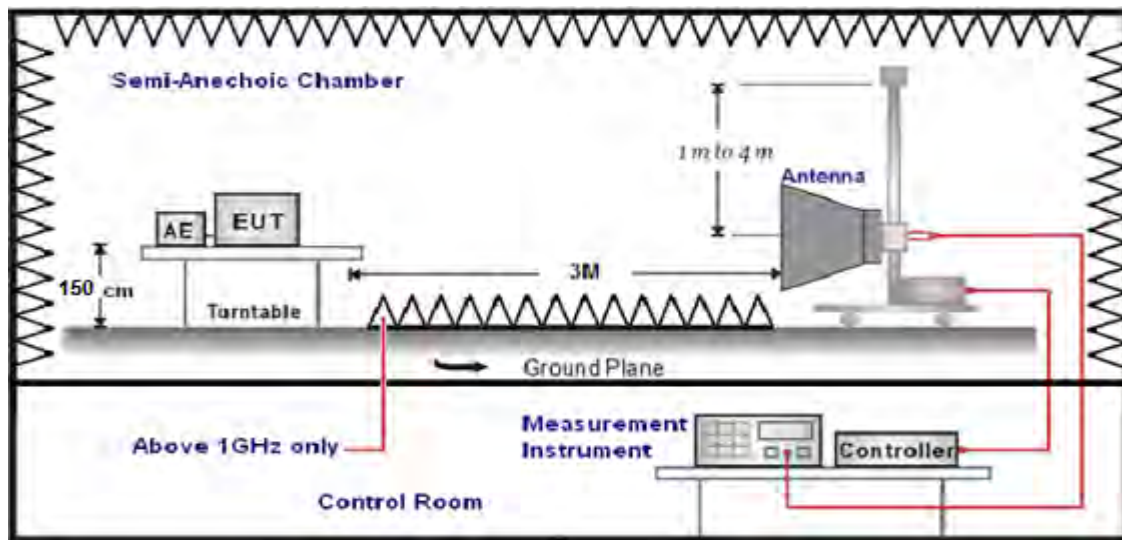






## 4.8. Band Edge Compliance

### 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 (dBμV/m)	Radiated (μV/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 (dBμV/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

6. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
1GHz-18GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, 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 in antenna 0's 802.11 ac20 mode;

## For Radiated Bandedge Measurement

Temperature	23.4℃	Humidity	54.5%
Test Engineer	Oliver Ou	Configurations	IEEE 802.11a/n/ac

802.11 ac20/ 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
4500.0	35.23	35.58	29.04	8.28	50.05	74.00	-23.95	Peak	Horizontal
4500.0	30.26	35.58	29.04	8.28	45.08	54.00	-8.92	AV	Horizontal
5150.0	39.22	35.58	29.04	8.28	54.04	74.00	-19.96	Peak	Horizontal
5150.0	30.58	35.58	29.04	8.28	45.40	54.00	-8.60	AV	Horizontal

802.11 ac20/ 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
5350.0	35.04	35.42	29.06	8.39	49.79	74.00	-24.21	Peak	Horizontal
5350.0	30.41	35.42	29.06	8.39	45.16	54.00	-8.84	AV	Horizontal
5460.0	39.01	35.42	29.06	8.39	53.76	74.00	-20.24	Peak	Horizontal
5460.0	30.47	35.42	29.06	8.39	45.22	54.00	-8.78	AV	Horizontal

802.11 ac20/ 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
5650.0	30.22	35.35	29.07	8.43	44.93	68.20	-23.27	Peak	Horizontal
5700.0	30.27	35.35	29.07	8.43	44.98	68.20	-23.22	Peak	Horizontal
5720.0	32.09	35.35	29.07	8.43	46.80	68.20	-21.40	Peak	Horizontal
5725.0	30.59	35.35	29.07	8.43	45.30	68.20	-22.90	Peak	Horizontal

802.11 ac20/ 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
5850.0	30.15	35.3	29.11	8.51	44.85	68.20	-23.35	Peak	Horizontal
5855.0	30.14	35.3	29.11	8.51	44.84	68.20	-23.36	Peak	Horizontal
5875.0	32.24	35.3	29.11	8.51	46.94	68.20	-21.26	Peak	Horizontal
5925.0	30.66	35.3	29.11	8.51	45.36	68.20	-22.84	Peak	Horizontal

## REMARKS:

1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. Margin value = Result Level-Limit value.
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;

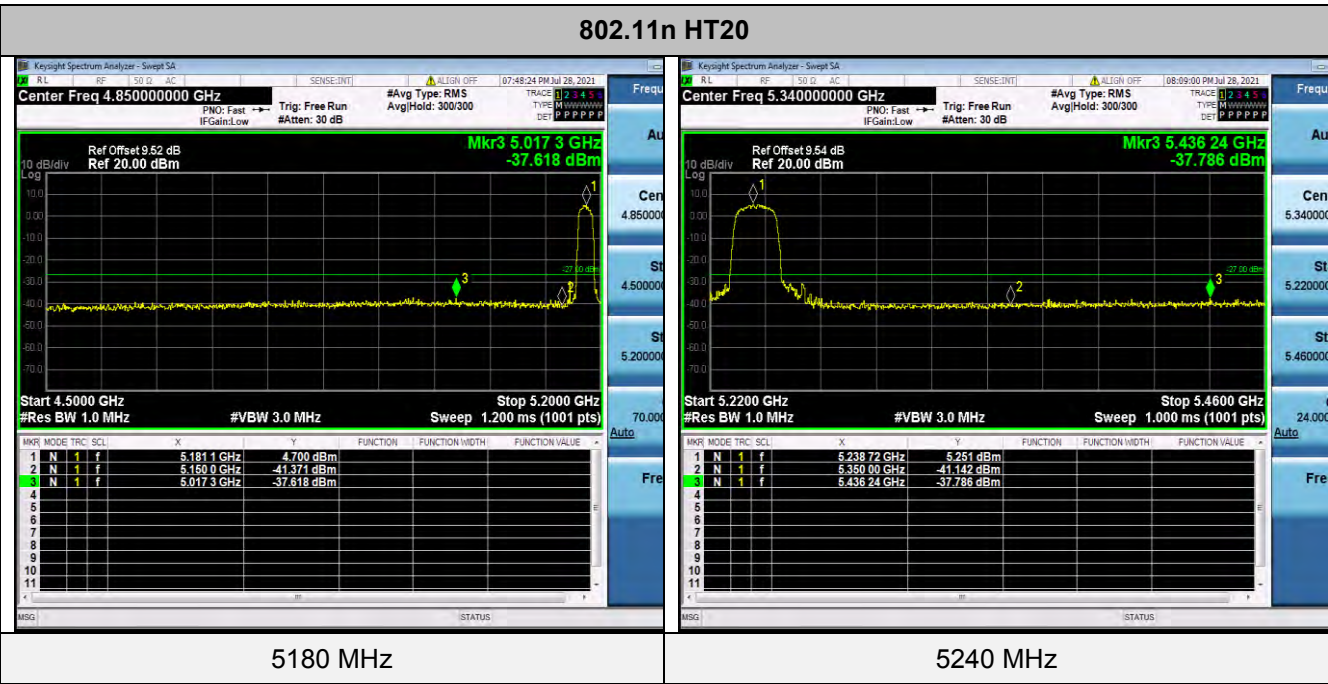
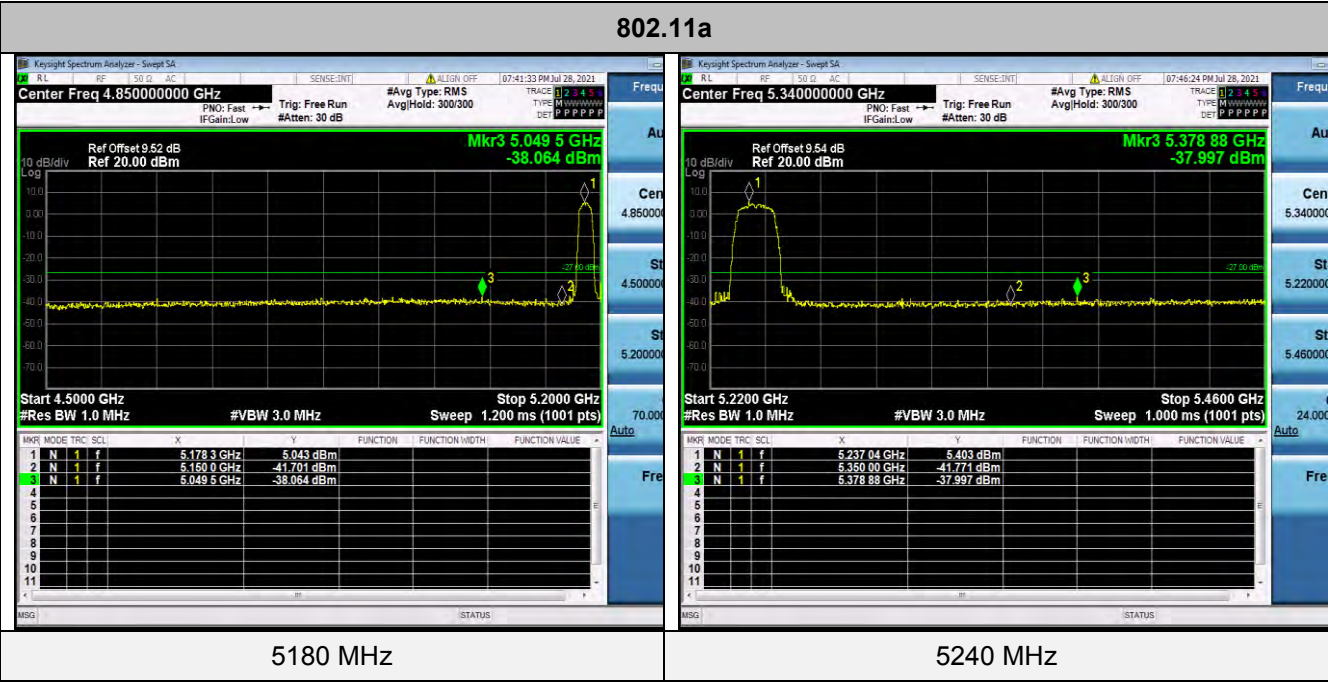


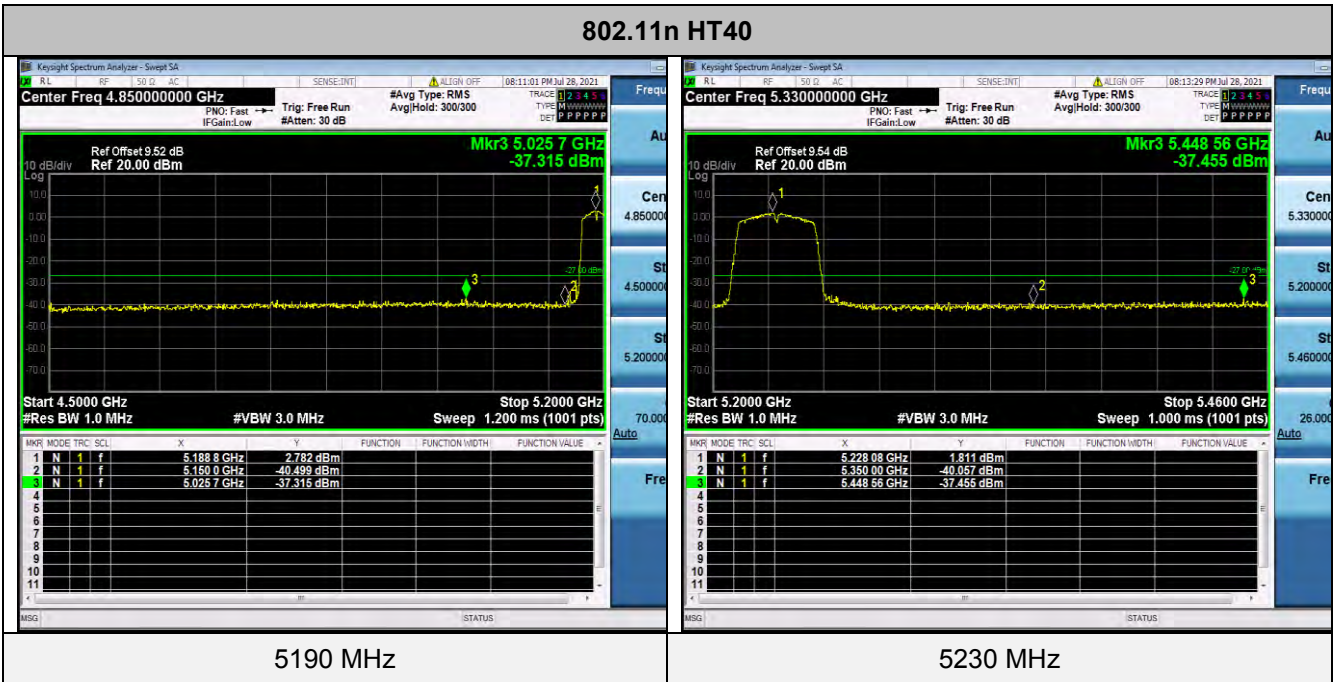
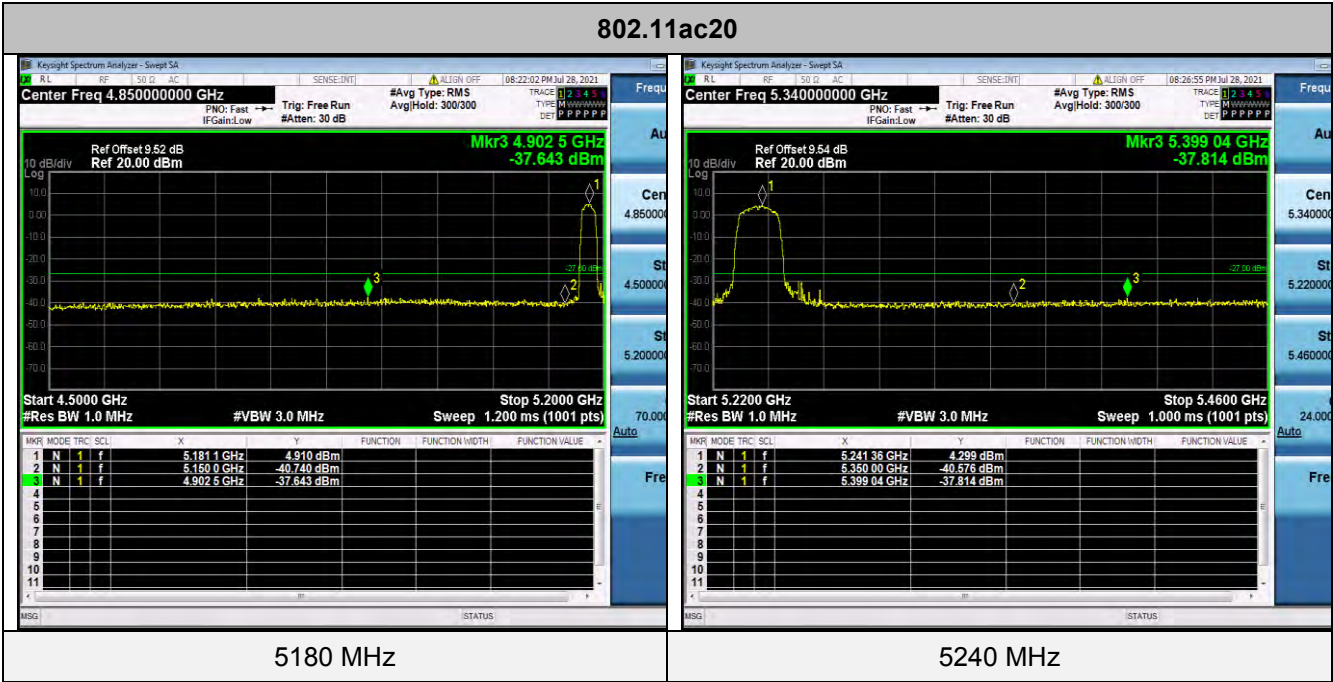
For Conducted Band edge Measurement

Temperature	23.6℃	Humidity	55.7%
Test Engineer	Oliver Ou	Configurations	IEEE 802.11a/n/ac

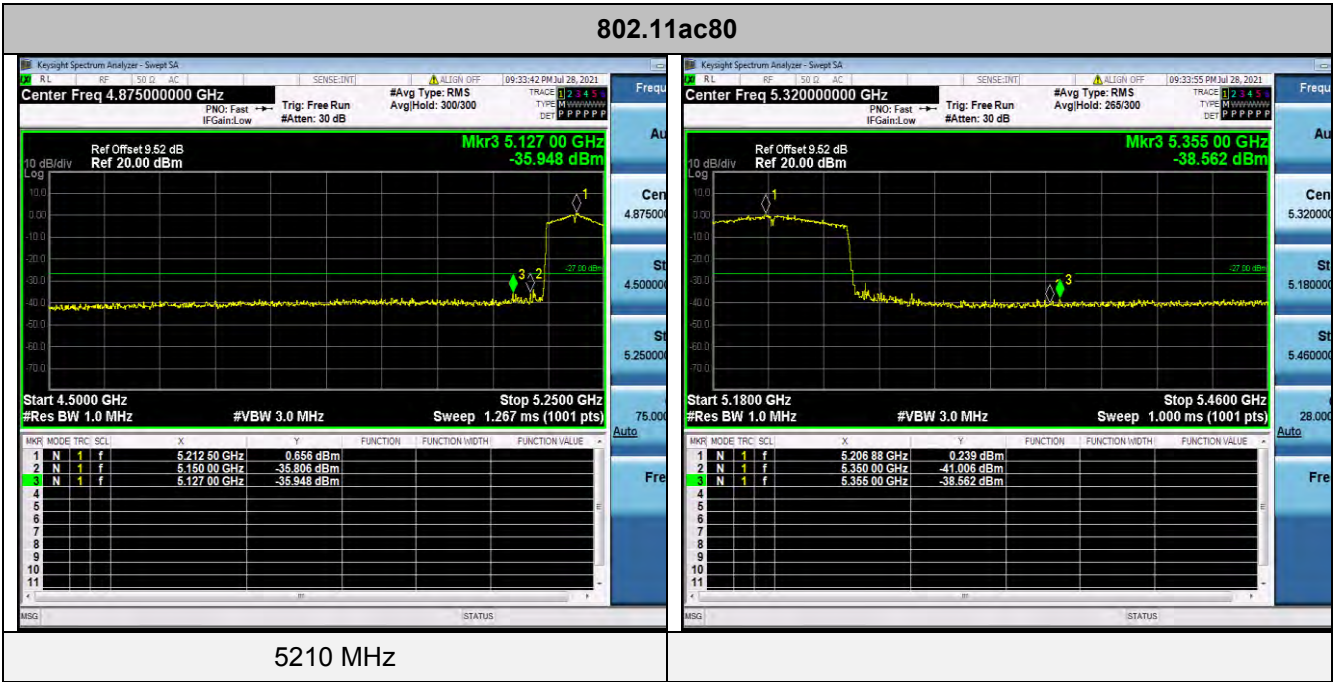
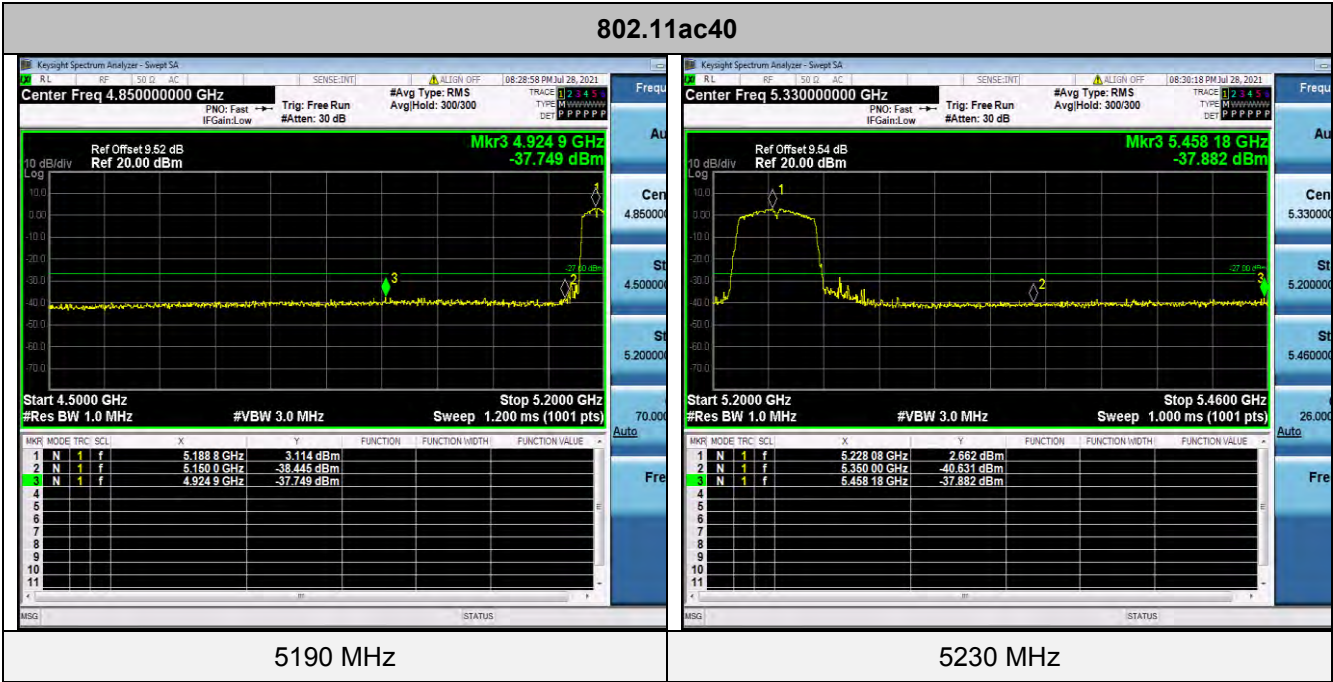
The test results have included the antenna gain

5150-5250MHz:



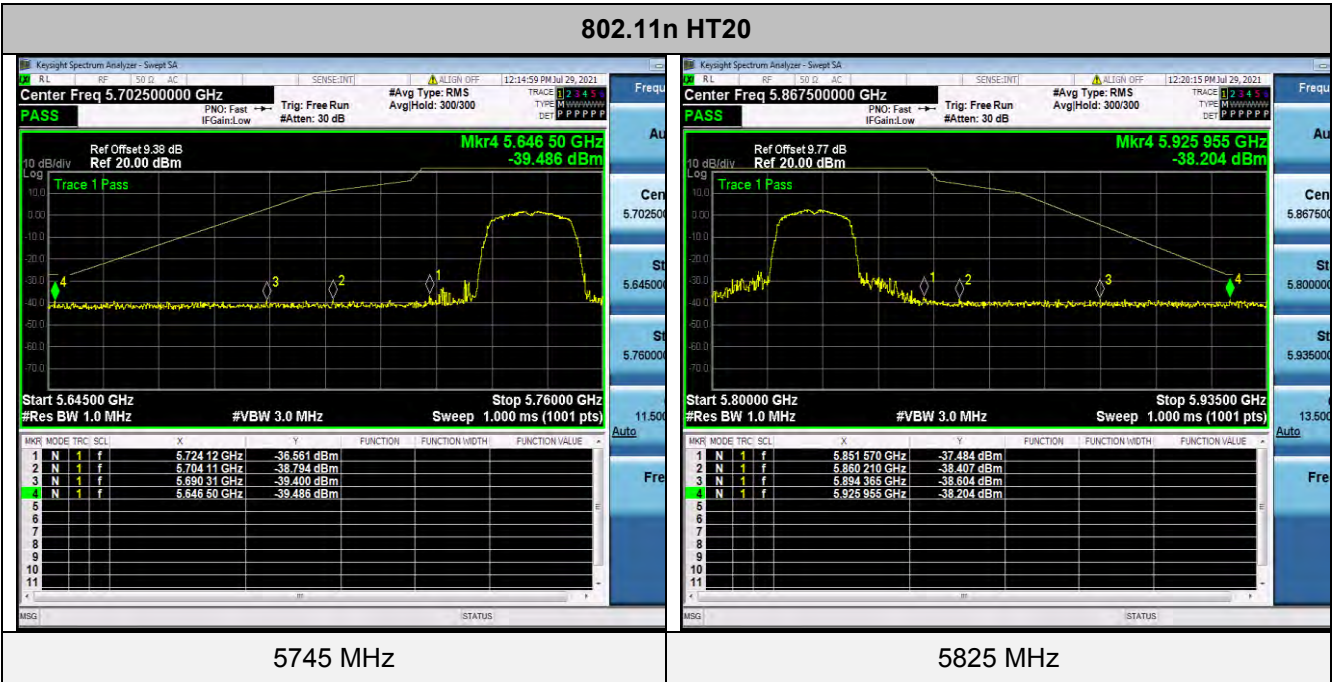
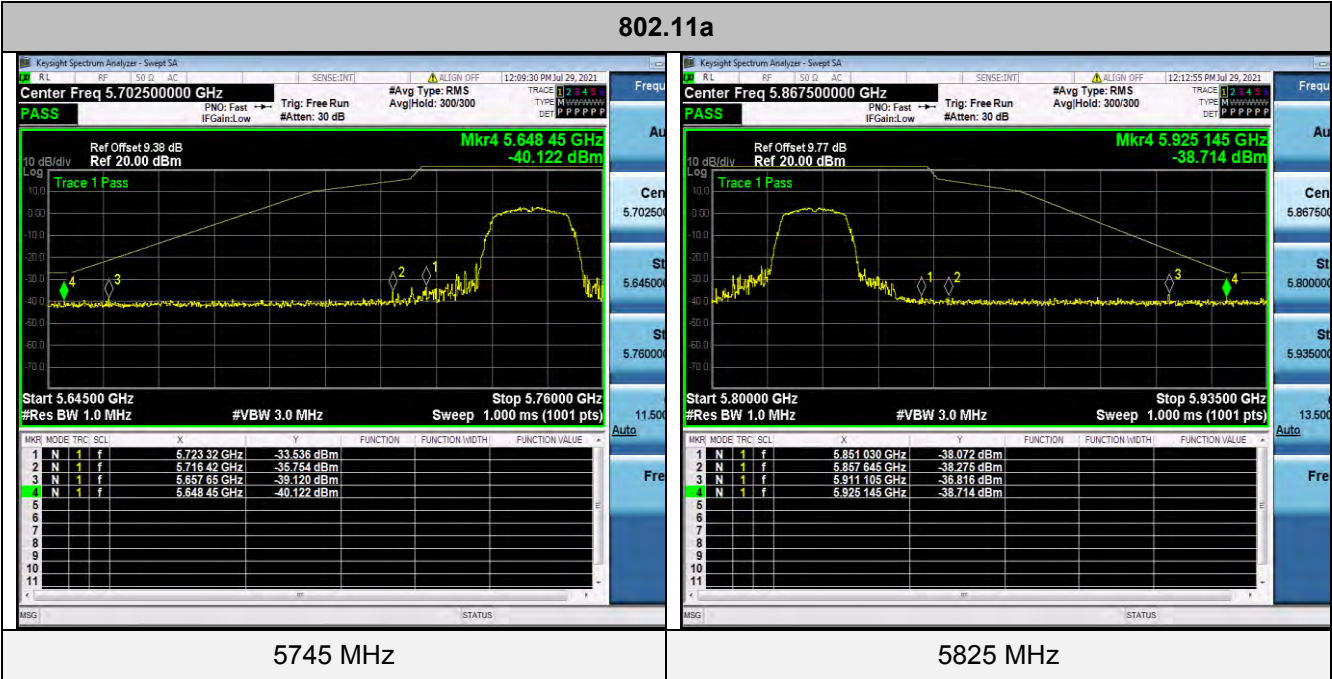


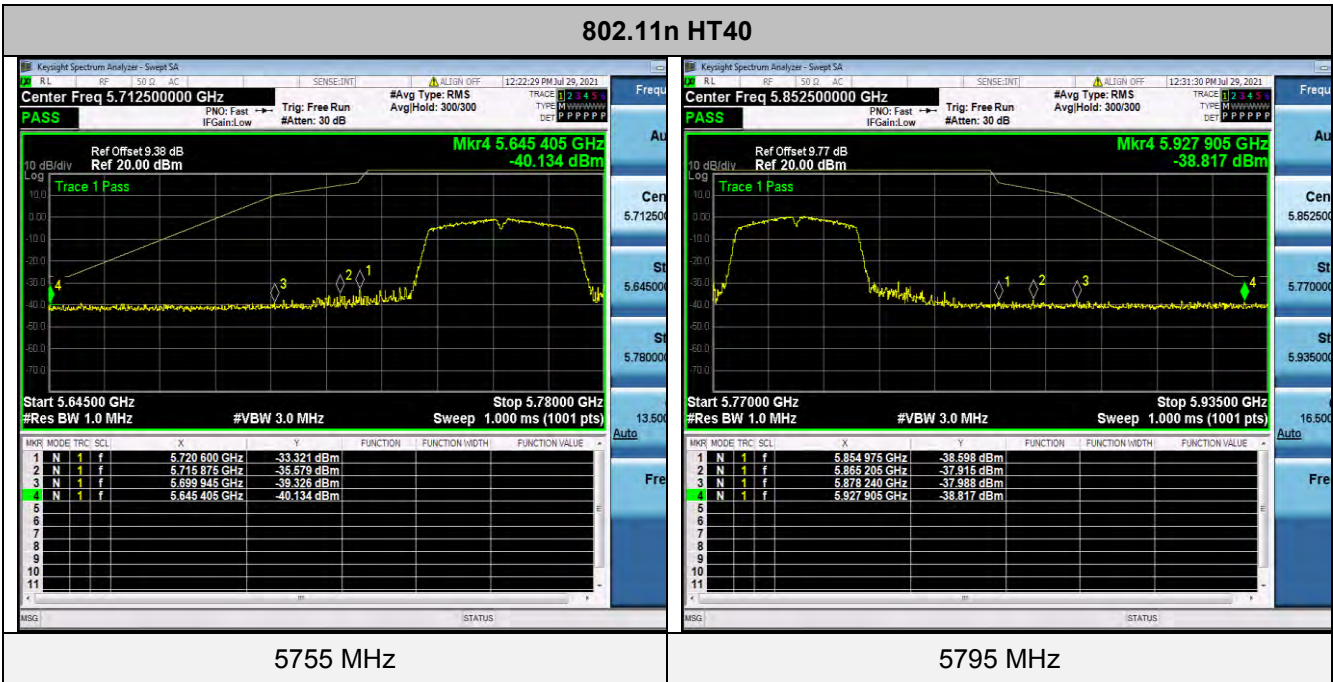




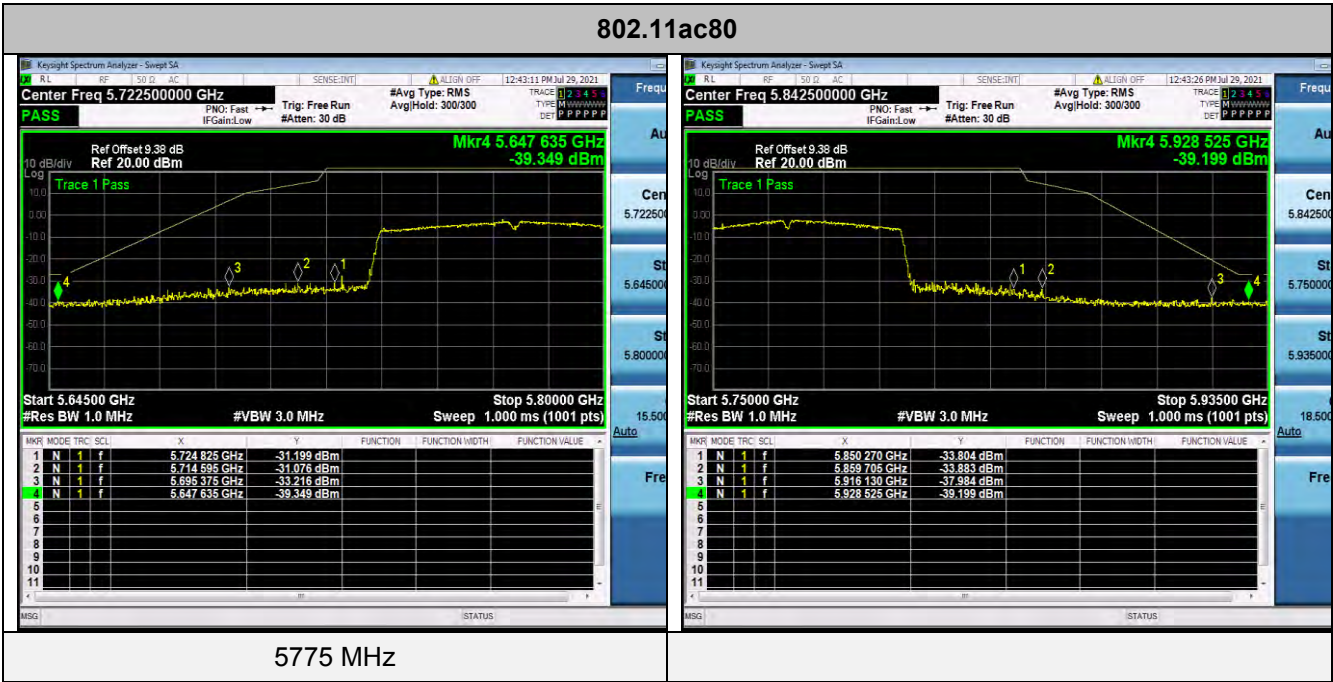
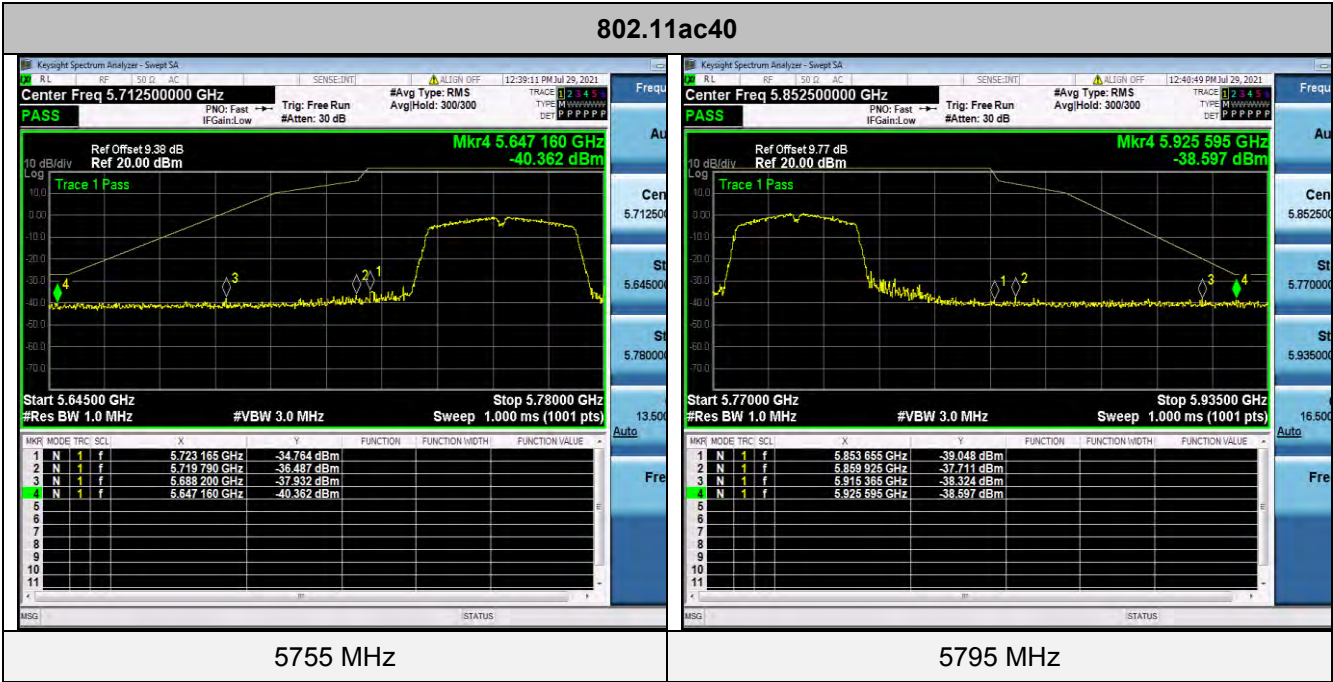


5725-5850MHz:











## 4.9. Frequency Stability

### Standard Applicable

According to FCC §15.407(g) "Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user manual."

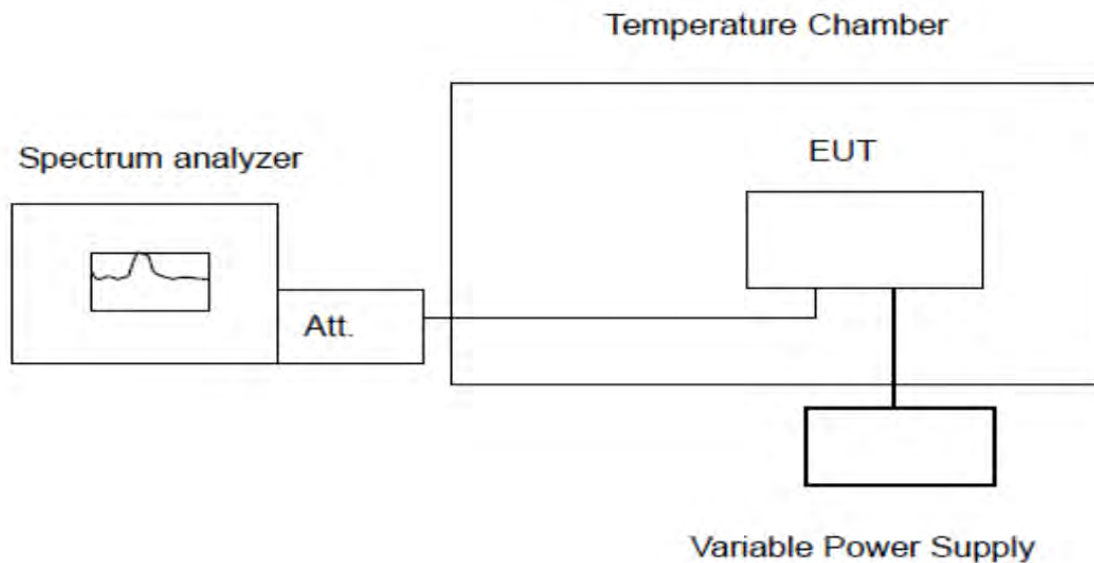
According to FCC §2.1055(a) "The frequency stability shall be measured with variation of ambient temperature as follows:"

(1) From  $-30^{\circ}$  to  $+50^{\circ}$  centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From  $-20^{\circ}$  to  $+50^{\circ}$  centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

(3) From  $0^{\circ}$  to  $+50^{\circ}$  centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

### Test Configuration



### Test Procedure

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20 degree operating frequency as reference frequency. Turn EUT off and set the chamber temperature to  $-30^{\circ}$  degree. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10 degree increased per stage until the highest temperature of  $+50^{\circ}$  degree reached.

**Test Results**

PASS

Remark:

1. Measured all conditions and recorded worst case.

IEEE 802.11a Mode / 5180 – 5240 MHz / 5180 MHz

Enviroment Temperature (Degree)	Voltage (V)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	DC 4.3V	5180.032399	5150 – 5250	PASS
20	DC 3.4V	5179.997568	5150 – 5250	PASS
50	DC 3.8V	5179.967608	5150 – 5250	PASS
40	DC 3.8V	5179.996530	5150 – 5250	PASS
30	DC 3.8V	5179.985941	5150 – 5250	PASS
20	DC 3.8V	5179.973125	5150 – 5250	PASS
10	DC 3.8V	5180.013828	5150 – 5250	PASS
0	DC 3.8V	5180.039874	5150 – 5250	PASS
-10	DC 3.8V	5179.990383	5150 – 5250	PASS
-20	DC 3.8V	5180.008122	5150 – 5250	PASS
-30	DC 3.8V	5180.004904	5150 – 5250	PASS

IEEE 802.11a Mode / 5180 – 5240 MHz / 5240 MHz

Enviroment Temperature (Degree)	Voltage (V)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	DC 4.3V	5240.015223	5150 – 5250	PASS
20	DC 3.4V	5240.036210	5150 – 5250	PASS
50	DC 3.8V	5239.977531	5150 – 5250	PASS
40	DC 3.8V	5239.981288	5150 – 5250	PASS
30	DC 3.8V	5239.996036	5150 – 5250	PASS
20	DC 3.8V	5240.000120	5150 – 5250	PASS
10	DC 3.8V	5240.002158	5150 – 5250	PASS
0	DC 3.8V	5240.013823	5150 – 5250	PASS
-10	DC 3.8V	5240.013353	5150 – 5250	PASS
-20	DC 3.8V	5240.003628	5150 – 5250	PASS
-30	DC 3.8V	5239.995927	5150 – 5250	PASS

IEEE 802.11a Mode / 5745 – 5825 MHz / 5745 MHz

Enviroment Temperature (Degree)	Voltage (V)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	DC 4.3V	5744.978161	5725 – 5850	PASS
20	DC 3.4V	5744.983690	5725 – 5850	PASS
50	DC 3.8V	5744.972425	5725 – 5850	PASS
40	DC 3.8V	5744.978067	5725 – 5850	PASS
30	DC 3.8V	5745.014575	5725 – 5850	PASS
20	DC 3.8V	5745.005041	5725 – 5850	PASS
10	DC 3.8V	5745.032489	5725 – 5850	PASS
0	DC 3.8V	5744.970722	5725 – 5850	PASS
-10	DC 3.8V	5745.012386	5725 – 5850	PASS
-20	DC 3.8V	5745.000055	5725 – 5850	PASS
-30	DC 3.8V	5745.019456	5725 – 5850	PASS

IEEE 802.11a Mode / 5745 – 5825 MHz / 5825 MHz

Enviroment Temperature (Degree)	Voltage (V)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	DC 4.3V	5824.999178	5725 – 5850	PASS
20	DC 3.4V	5825.035478	5725 – 5850	PASS
50	DC 3.8V	5824.996234	5725 – 5850	PASS
40	DC 3.8V	5825.014117	5725 – 5850	PASS
30	DC 3.8V	5825.043291	5725 – 5850	PASS
20	DC 3.8V	5825.033492	5725 – 5850	PASS
10	DC 3.8V	5825.005459	5725 – 5850	PASS
0	DC 3.8V	5824.988651	5725 – 5850	PASS
-10	DC 3.8V	5825.001271	5725 – 5850	PASS
-20	DC 3.8V	5824.966439	5725 – 5850	PASS
-30	DC 3.8V	5824.998215	5725 – 5850	PASS



#### **4.10. 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 PIFA Aantenna, through the buckle stretched out, The directional gains of antenna used for transmitting is 1.00dBi.

Reference to the Test Report: **GTS20210713002-1-1.**

## **5. TEST SETUP PHOTOS OF THE EUT**

Reference to the test report No. GTS20210713002-1-1.

## **6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT**

Reference to the test report No. GTS20210713002-1-1.

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