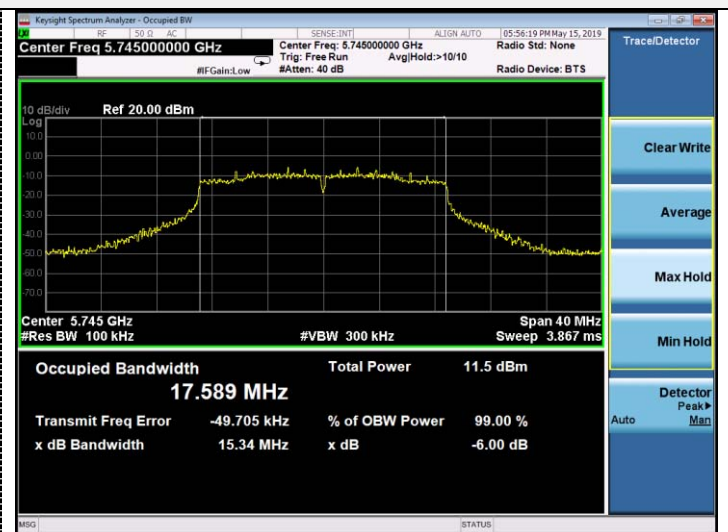


Antenna 2

802.11a



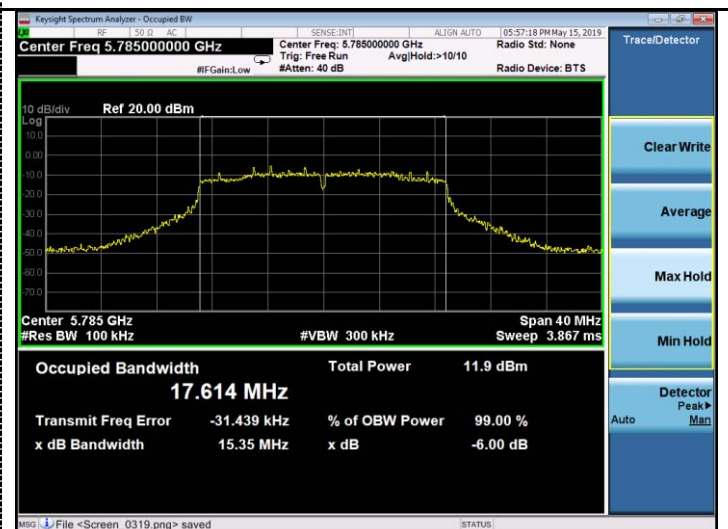
802.11n HT20



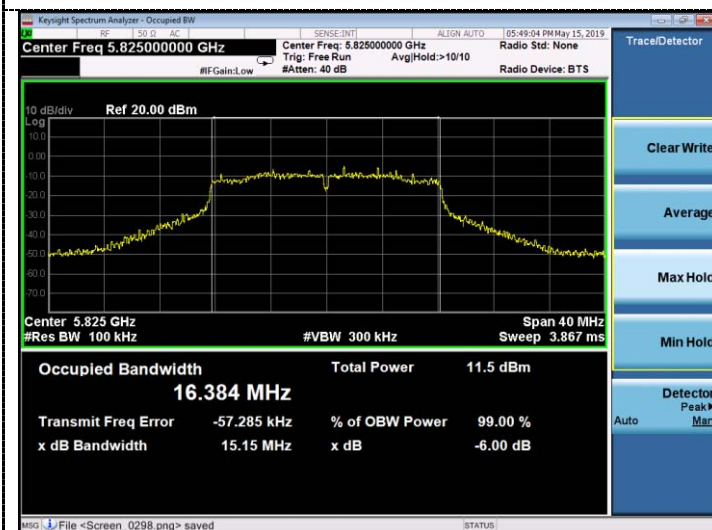
CH149



CH149



CH157



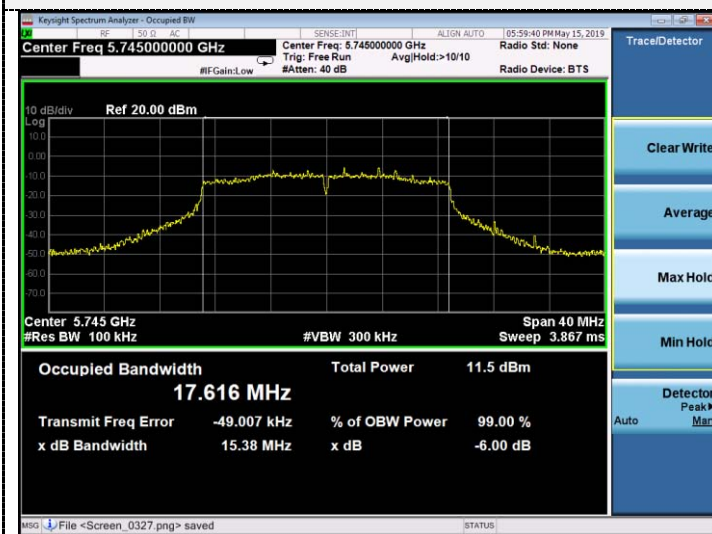
CH157



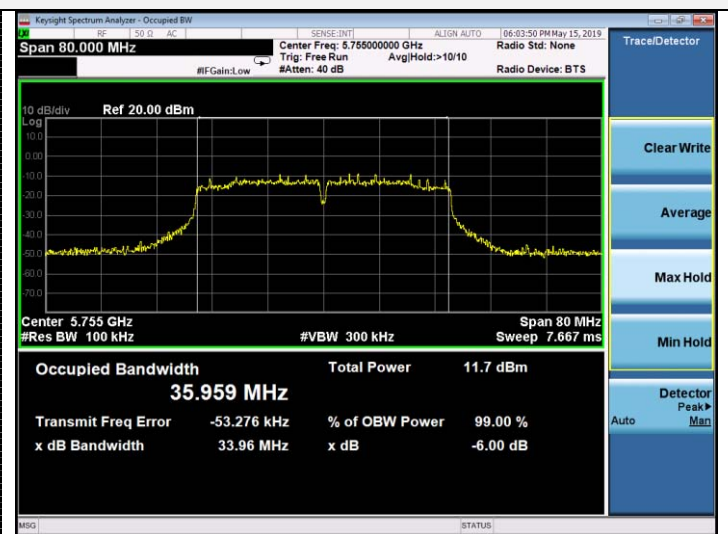
CH165

CH165

802.11ac20



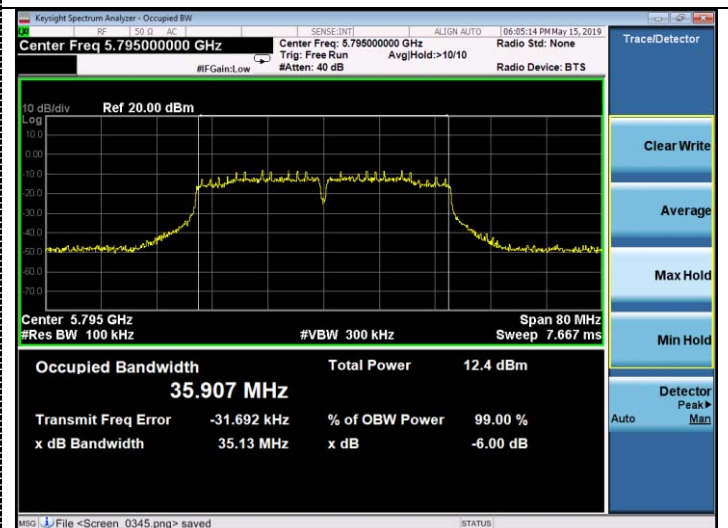
802.11n HT40



CH149



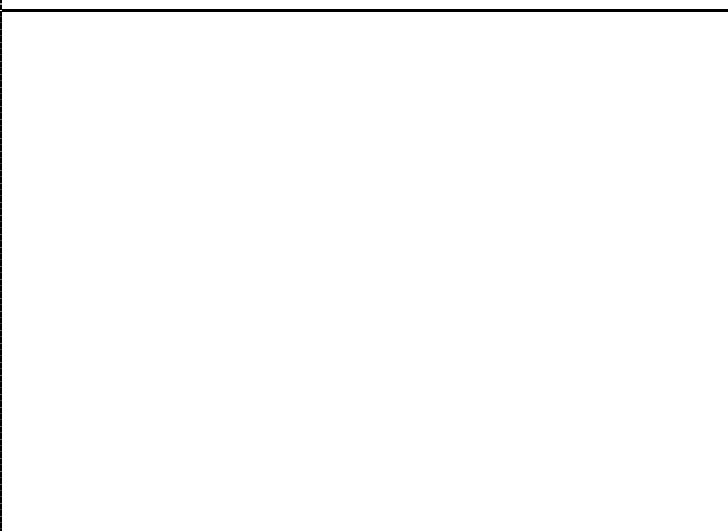
CH151



CH157

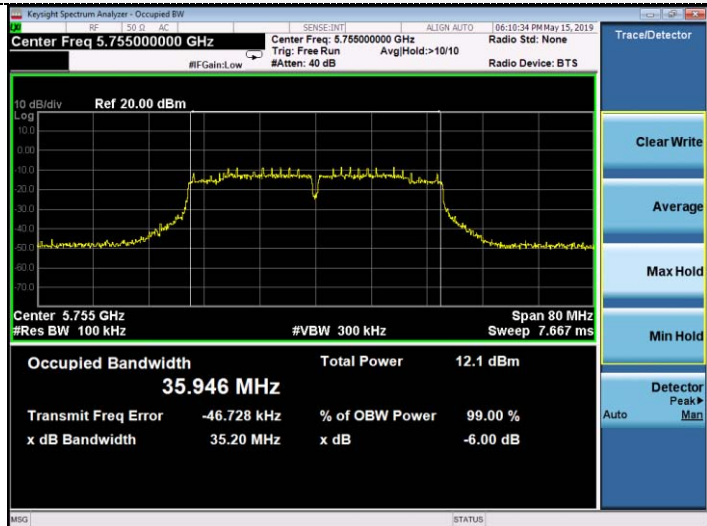


CH159

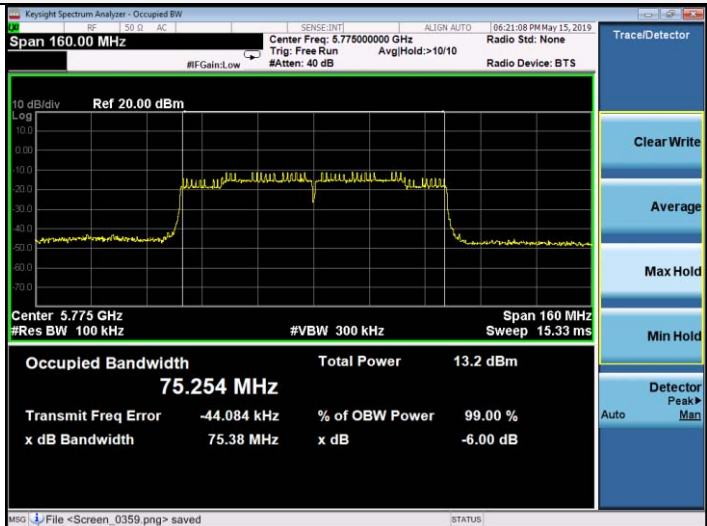


CH165

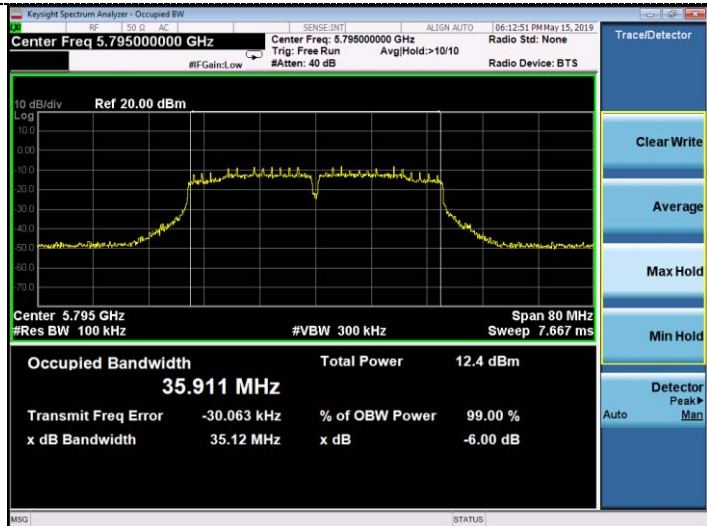
802.11ac40



802.11ac80



CH151



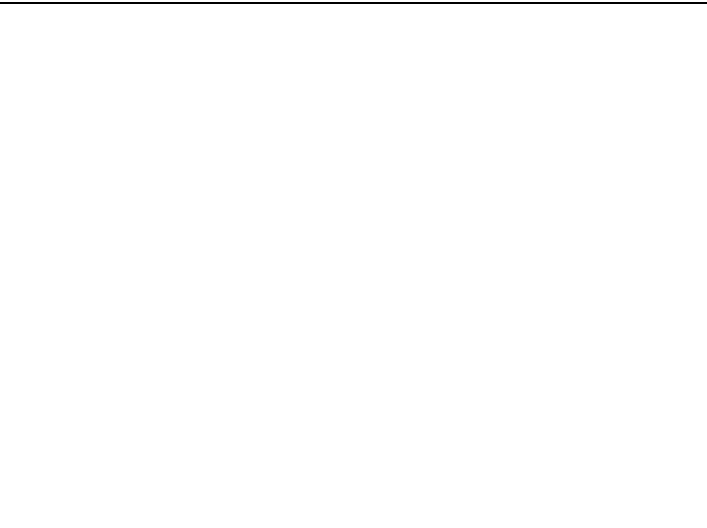
CH155



CH159

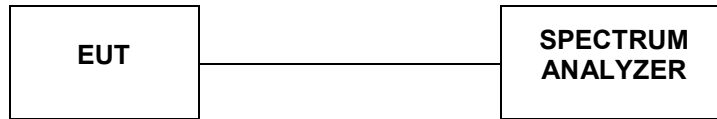


CH159



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 1

Type	Channel	99%Bandwidth (MHz)	26dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	16.460	21.35	-	Pass
	157	16.491	22.96		
	165	16.473	22.02		
802.11nHT20	149	17.684	22.51	-	Pass
	157	17.680	22.83		
	165	17.639	22.09		
802.11ac20	149	17.672	21.65	-	Pass
	157	17.681	21.95		
	165	17.673	22.61		
802.11n40	151	36.225	43.06	-	Pass
	159	36.092	42.79		
802.11ac40	151	36.134	42.83	-	Pass
	159	36.137	43.26		
802.11ac80	155	75.316	80.17	-	Pass

Antenna 2

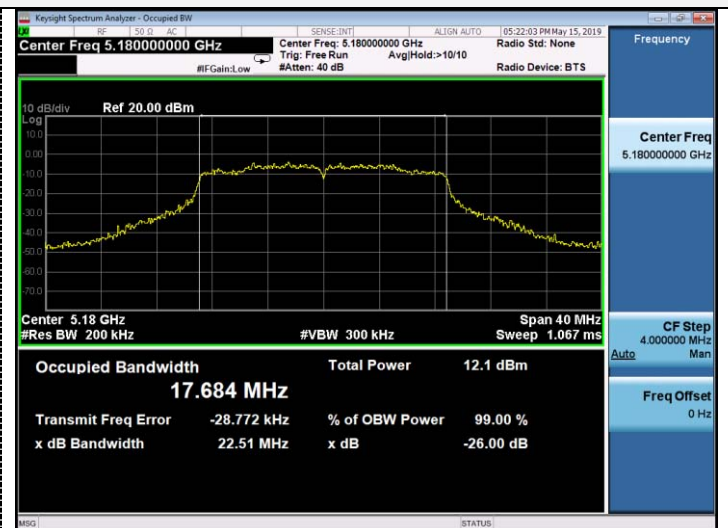
Type	Channel	99%Bandwidth (MHz)	26dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	16.502	23.15	-	Pass
	157	16.510	21.98		
	165	16.454	22.58		
802.11nHT20	149	17.647	21.99	-	Pass
	157	17.654	22.13		
	165	17.677	22.42		
802.11ac20	149	17.686	22.42	-	Pass
	157	17.662	23.16		
	165	17.703	22.36		
802.11n40	151	36.139	42.70	-	Pass
	159	36.096	42.86		
802.11ac40	151	36.096	42.53	-	Pass
	159	36.121	43.00		
802.11ac80	155	75.343	80.08	-	Pass

Antenna 1

802.11a



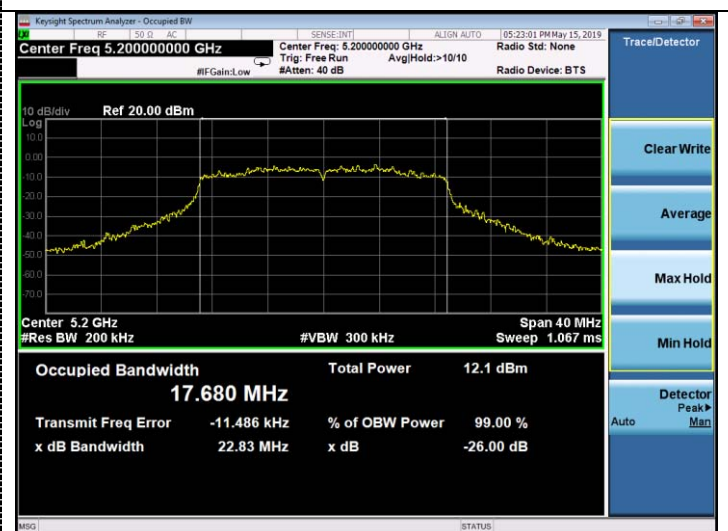
802.11n HT20



CH36



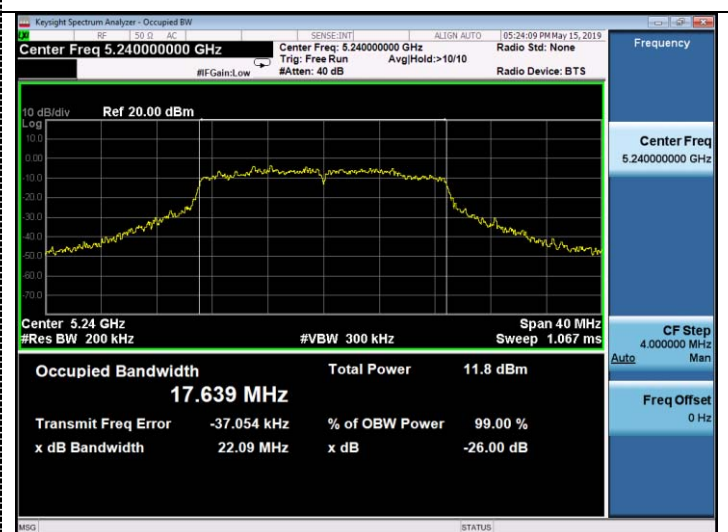
CH36



CH40



CH40



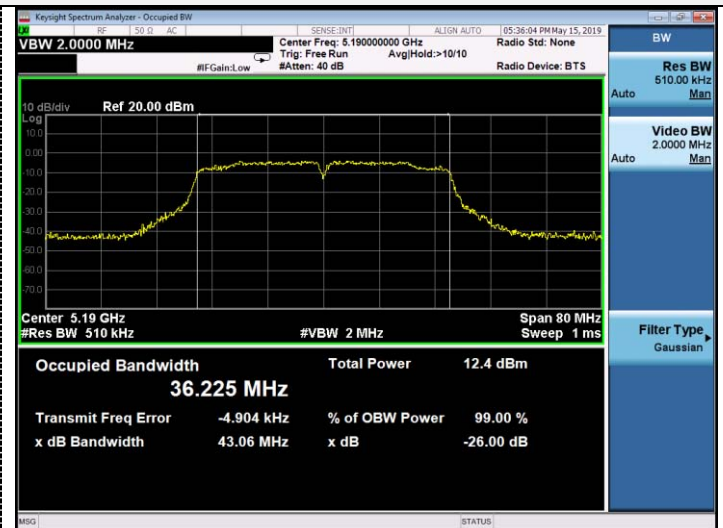
CH48

CH48

802.11ac20



802.11n HT40



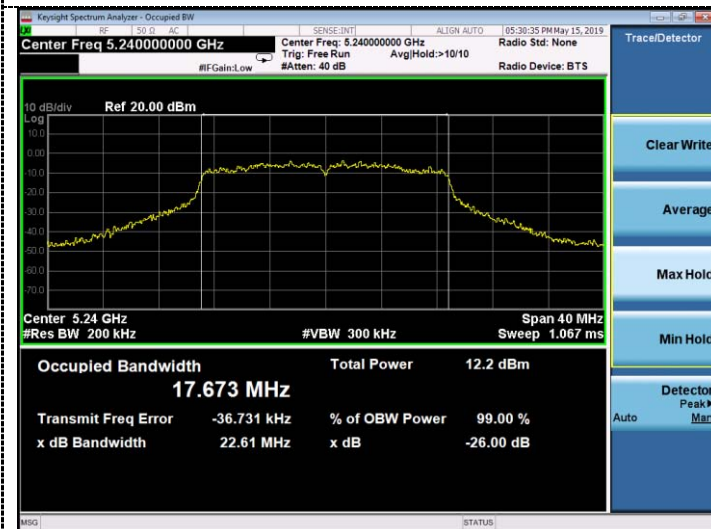
CH36



CH38



CH40



CH46

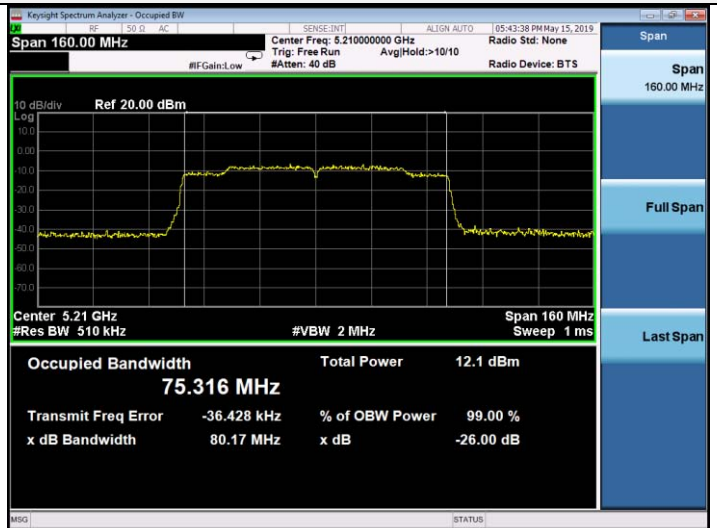


CH48

802.11ac40



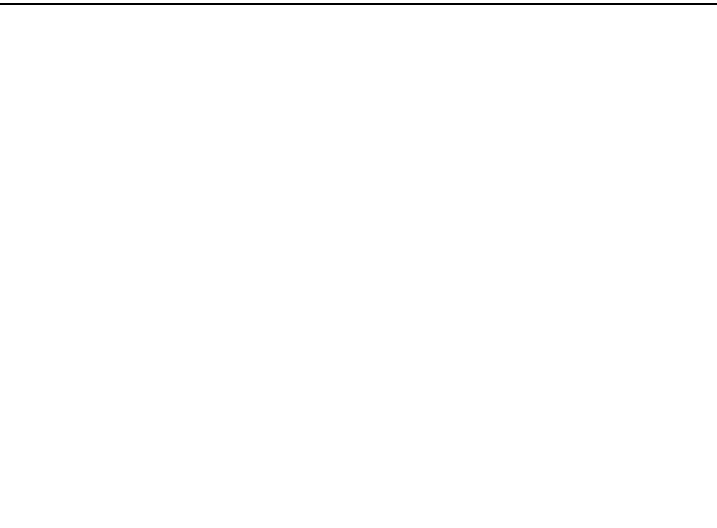
802.11ac80



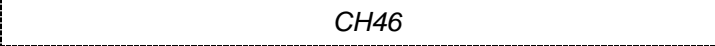
CH38



CH42



CH46



Antenna 2

802.11a



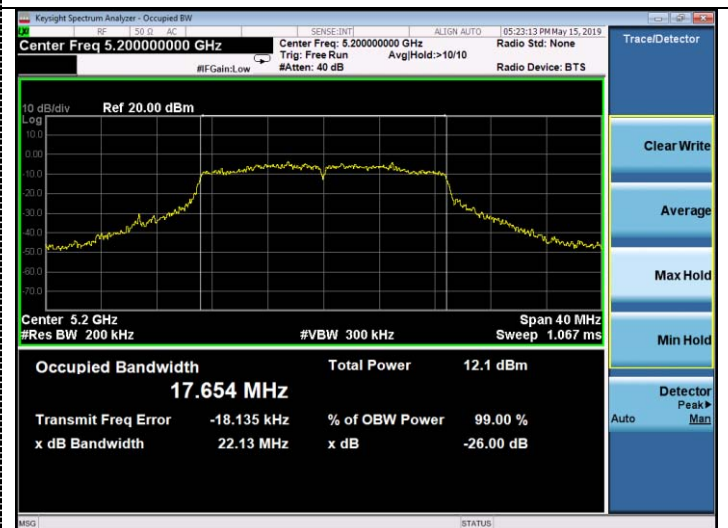
802.11n HT20



CH36



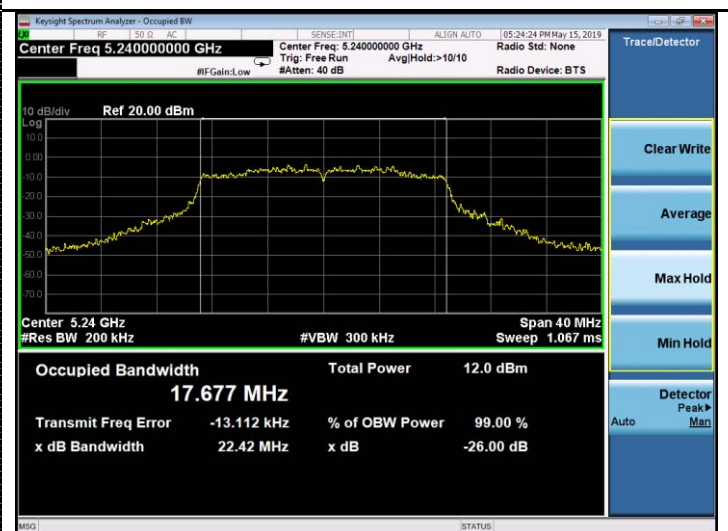
CH36



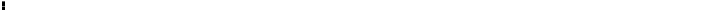
CH40



CH40



CH48



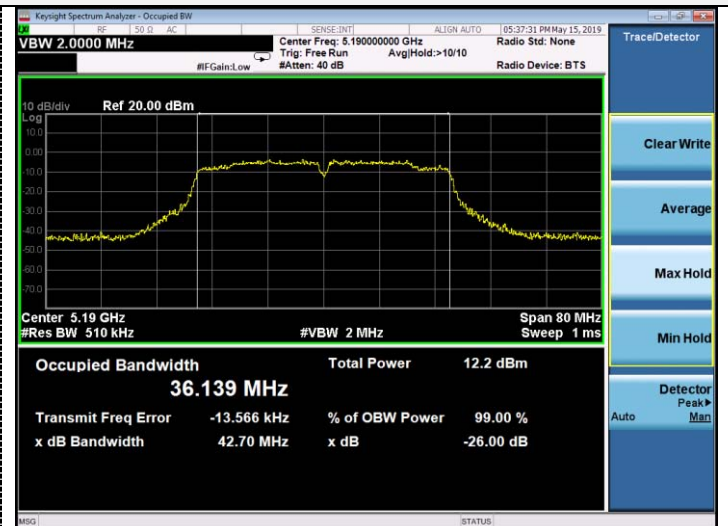
CH48



802.11ac20



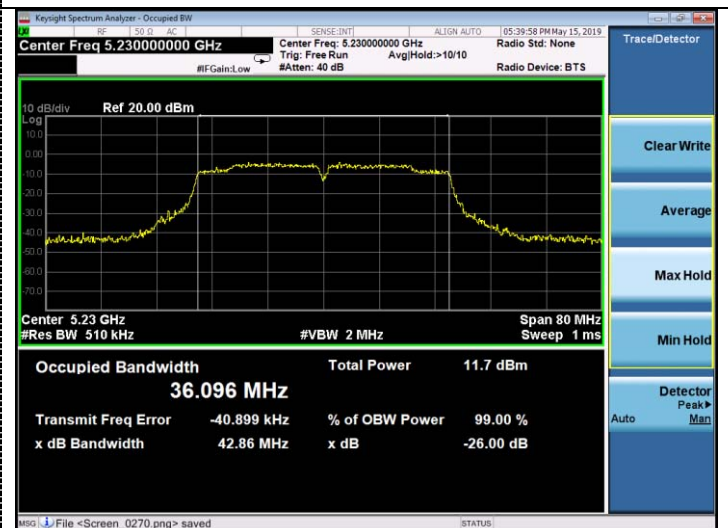
802.11n HT40



CH36



CH38



CH40



CH46

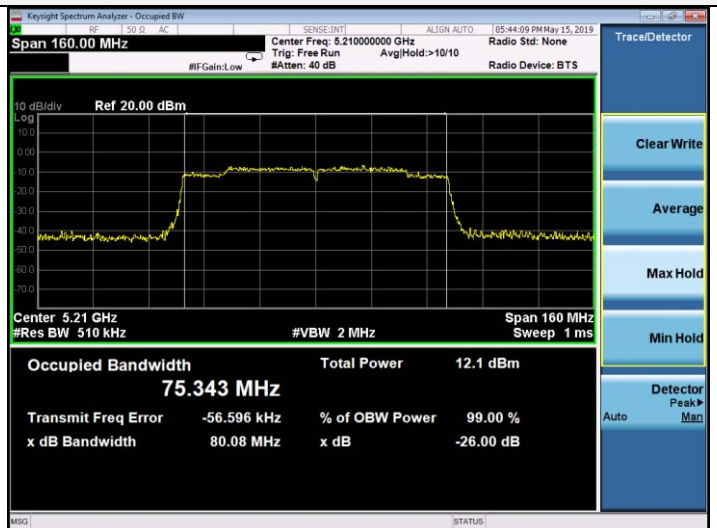


CH48

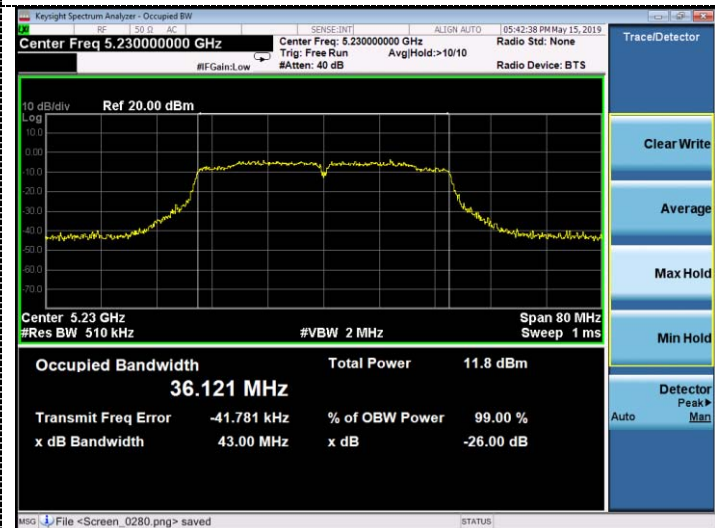
802.11ac40



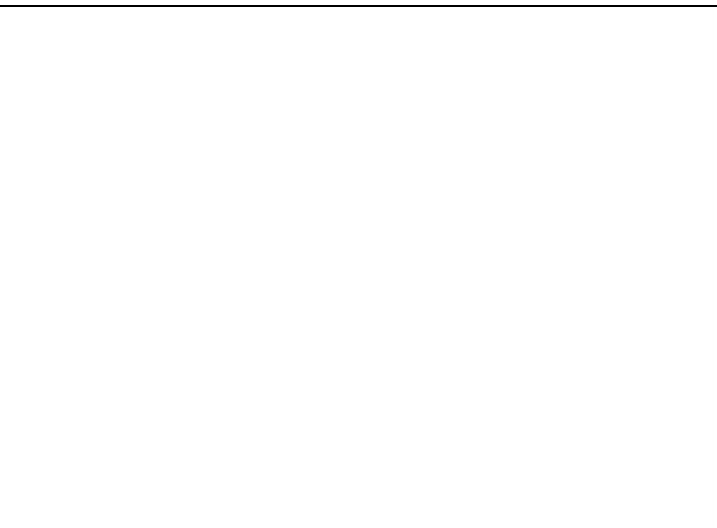
802.11ac80



CH38



CH42

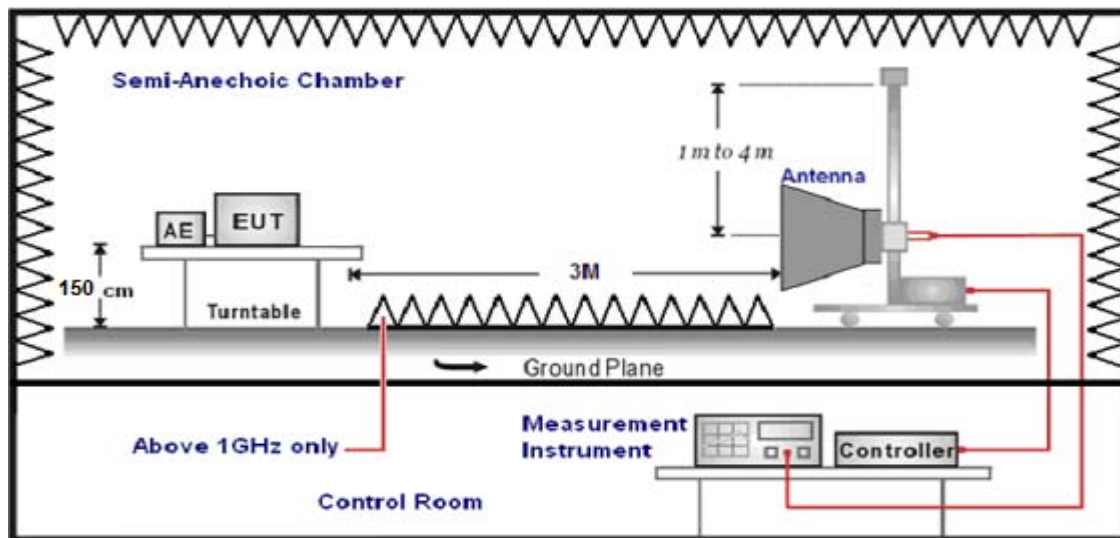


CH46



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 (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	68.3
5250-5350	-27	68.3
5470-5725	-27	68.3
5725-5850	-27 (beyond 10MHz of the bandedge)	68.3
	-17 (within 10 MHz of band edge)	78.3

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 at MIMO 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
5148.96	35.12	35.58	29.04	8.28	49.94	74	24.06	Peak	Horizontal
5148.96	24.19	35.58	29.04	8.28	39.01	54	14.99	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
5352.18	34.65	35.42	29.06	8.39	49.4	74	24.6	Peak	Horizontal
5352.18	25.38	35.42	29.06	8.39	40.13	54	13.87	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
5695.77	39.46	35.29	29.13	8.65	54.27	102.07	47.8	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
5851.12	40.28	35.29	29.18	8.8	55.19	120.01	64.82	Peak	Horizontal

REMARKS:

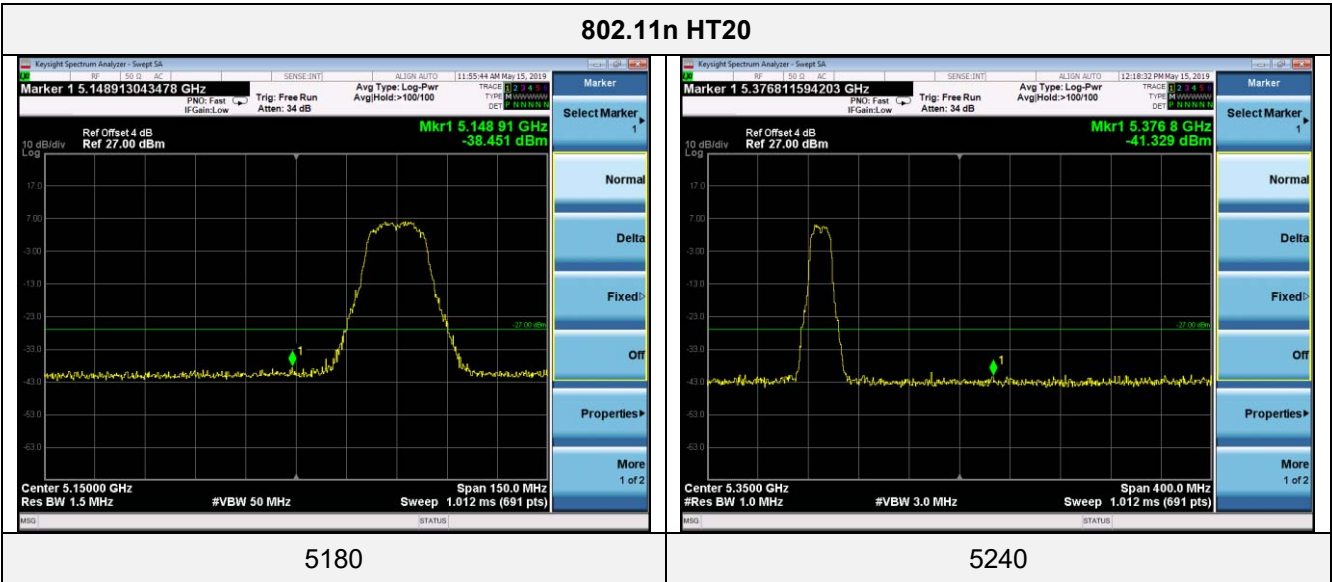
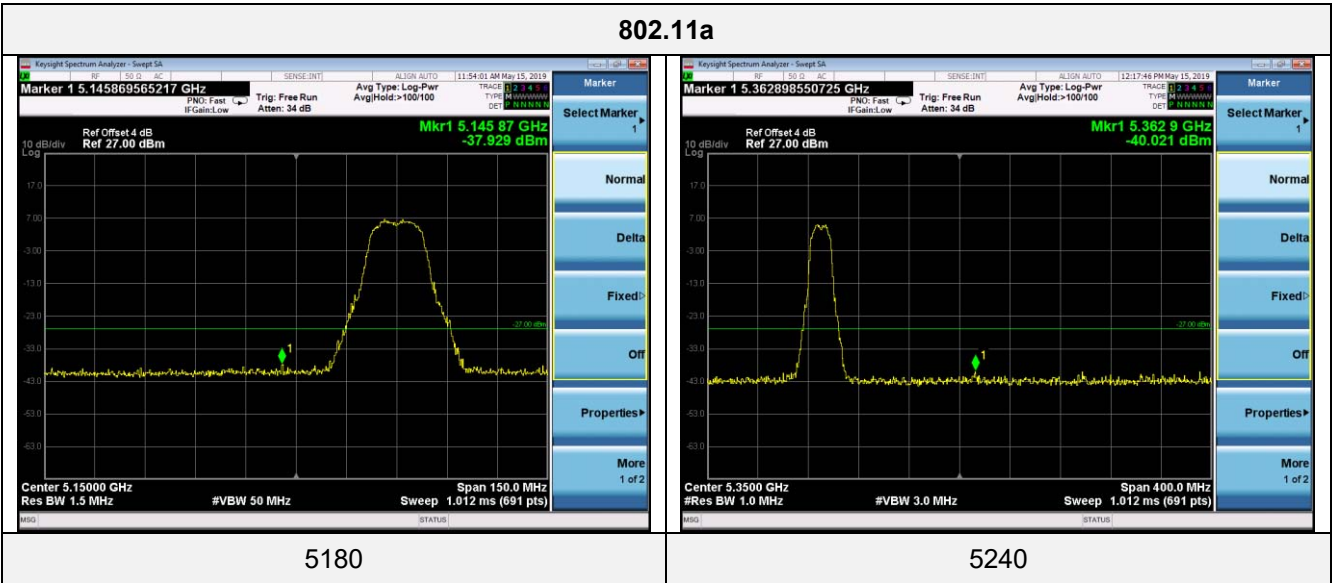
1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. The other emission levels were very low against the limit.
3. The average measurement was not performed when the peak measured data under the limit of average detection.
4. Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=10Hz/Sweep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

For Conducted Band edge Measurement

Note:each antenna port have 3dB margin from the limit,so the MIMO mode below the limit.

The test plot have included the antenna gain

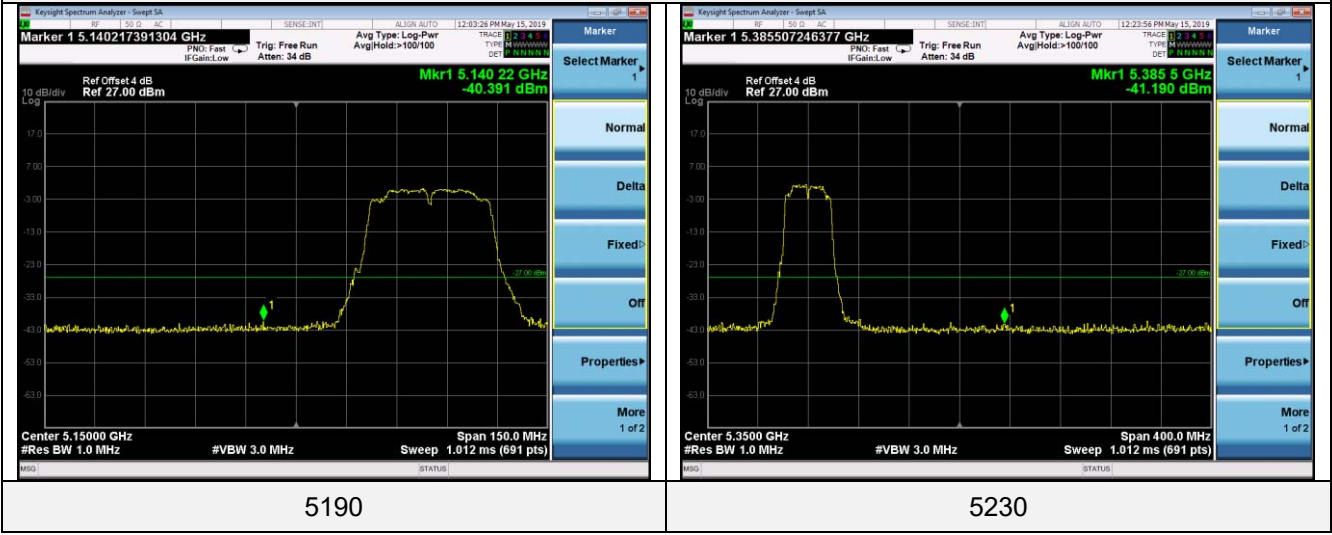
Antenna 1
5150-5250MHz:



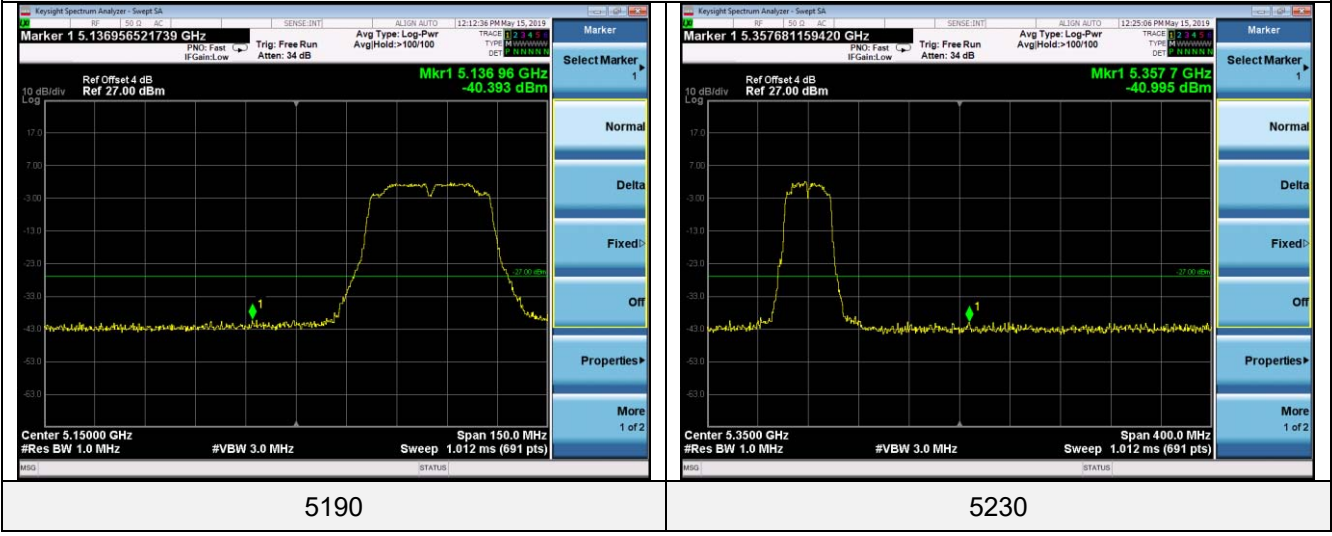
802.11ac20

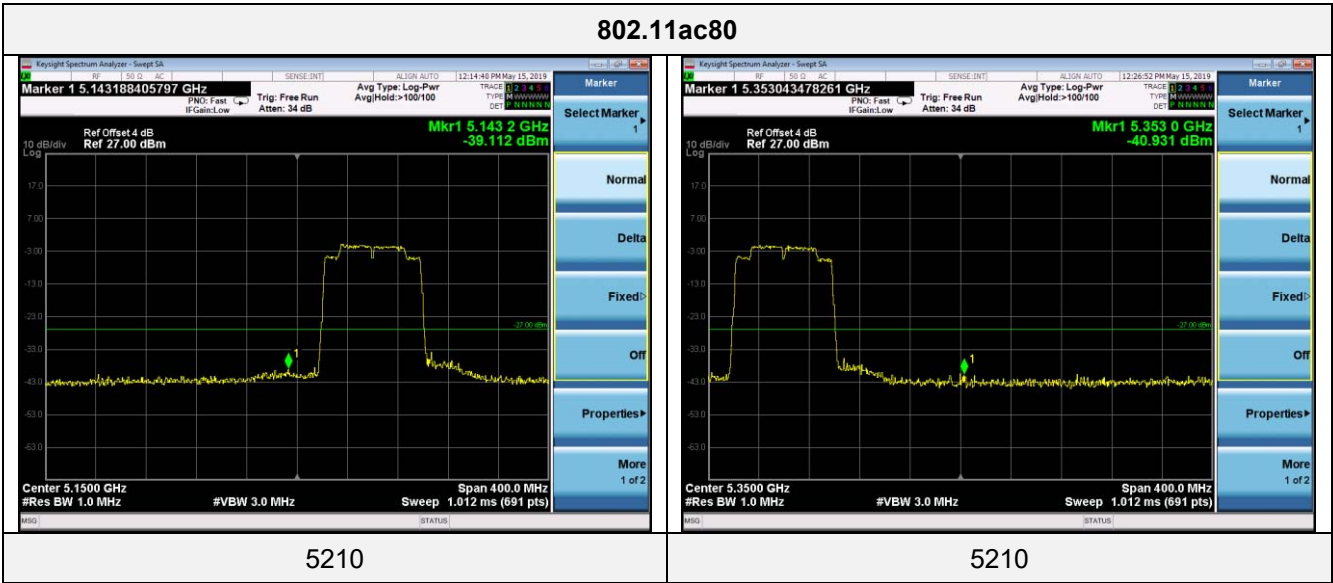


802.11n HT40

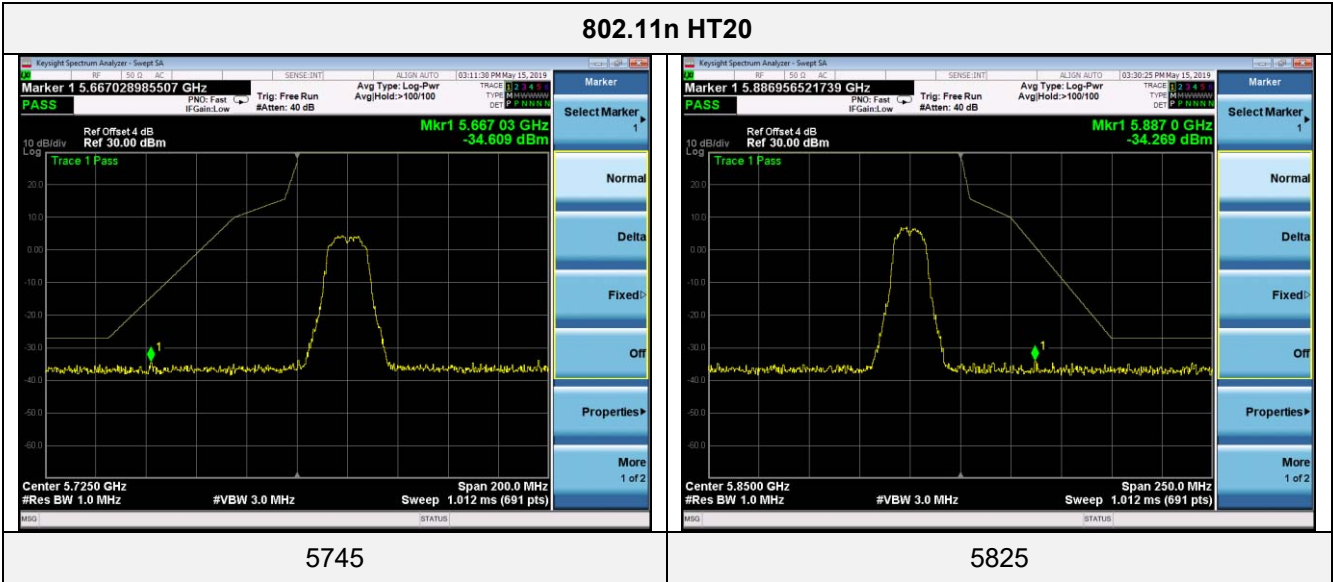
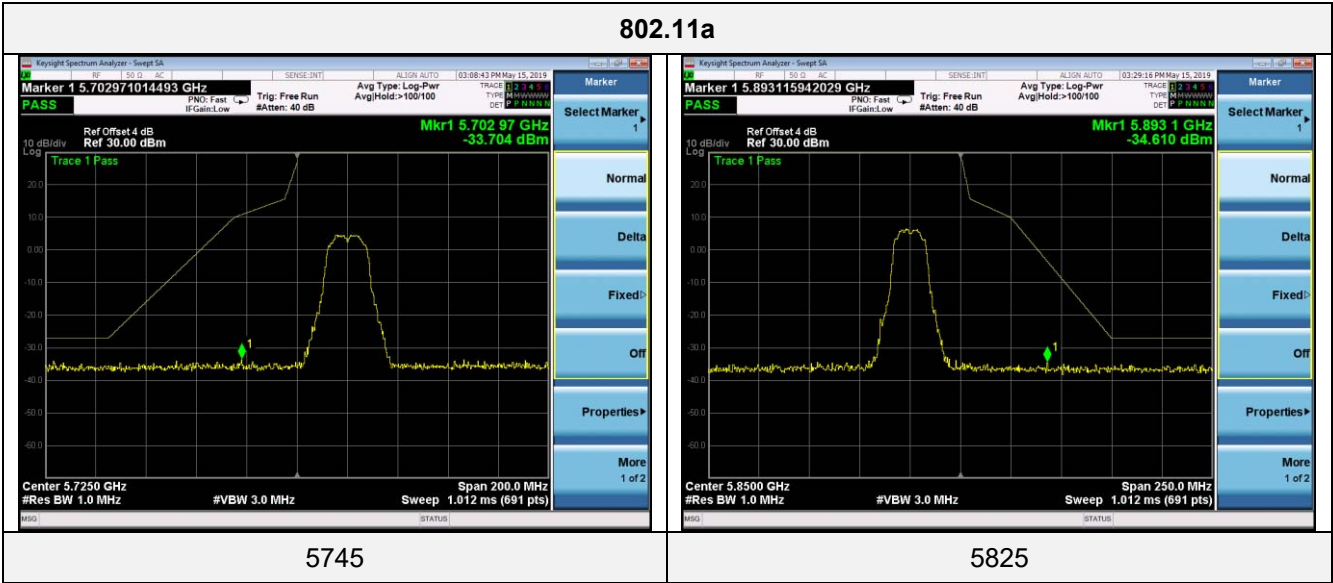


802.11ac40

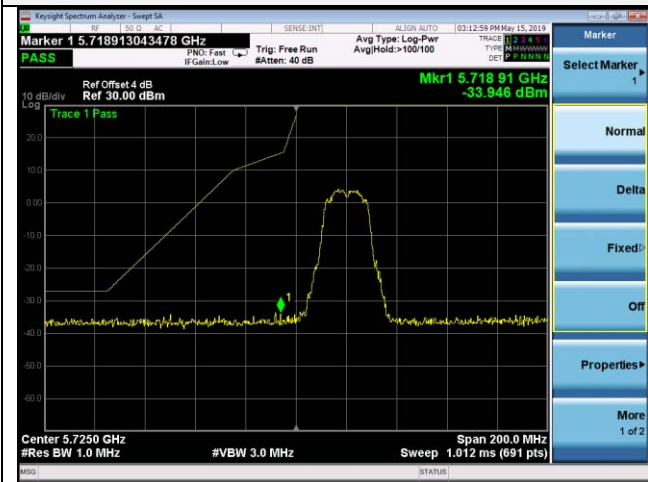




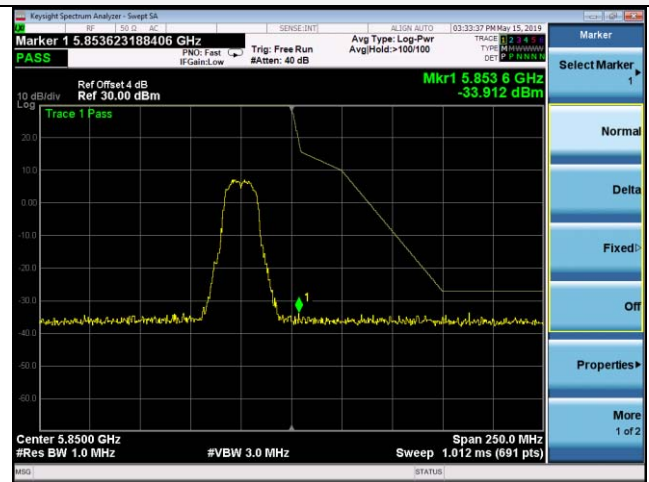
5725-5850MHz:



802.11ac20

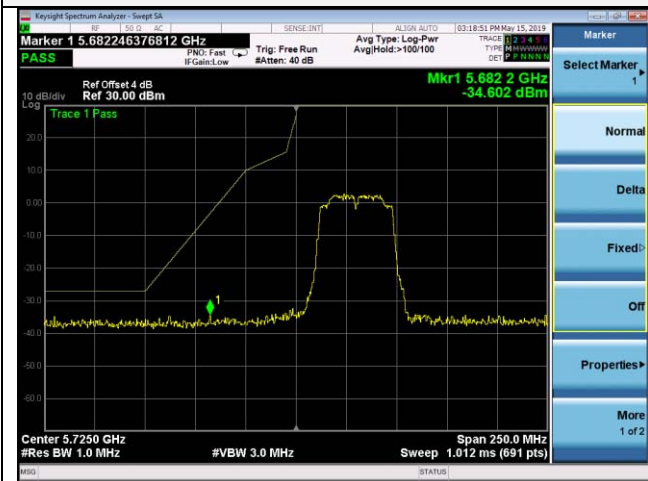


5745

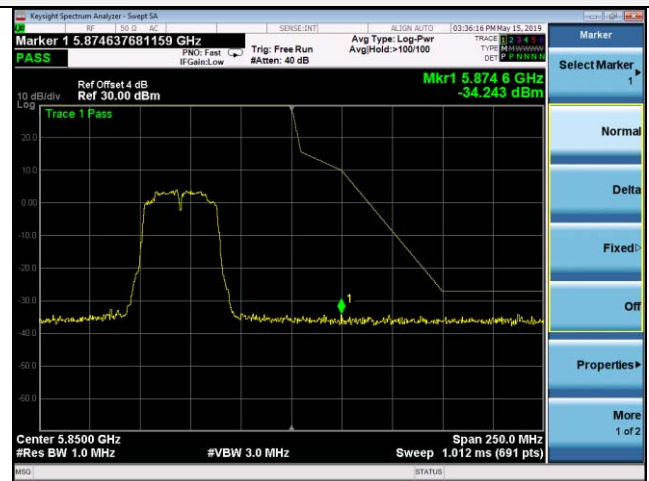


5825

802.11n HT40

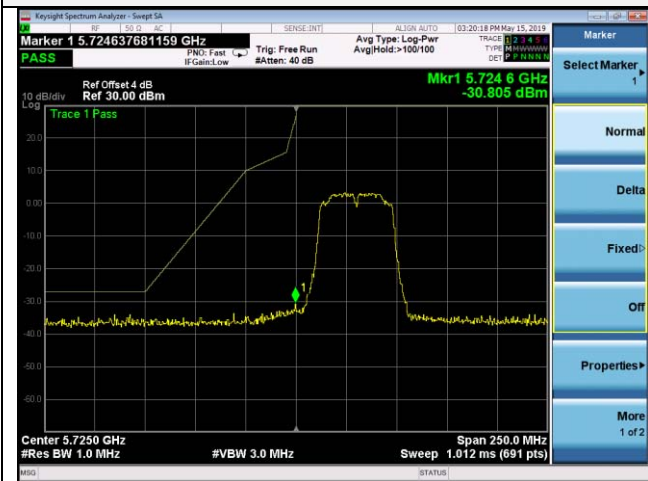


5755

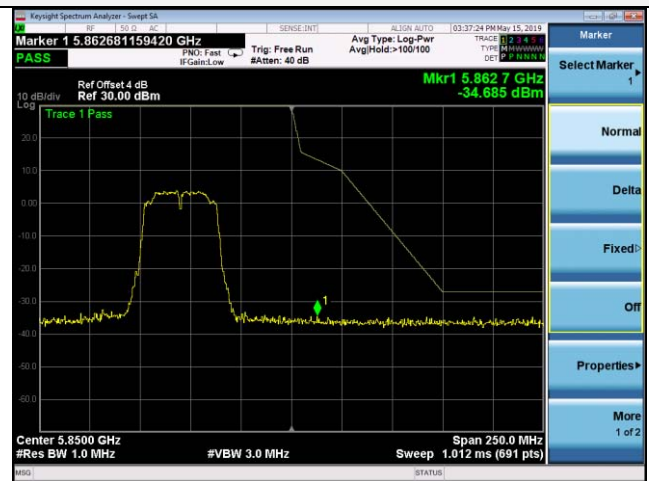


5795

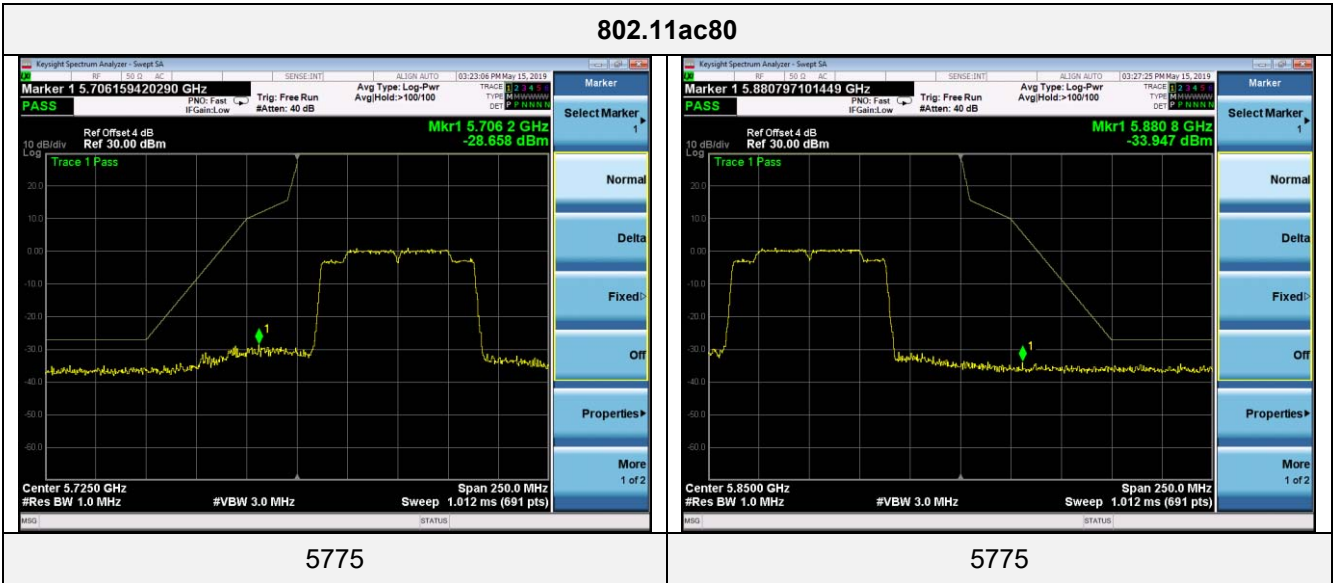
802.11ac40



5755

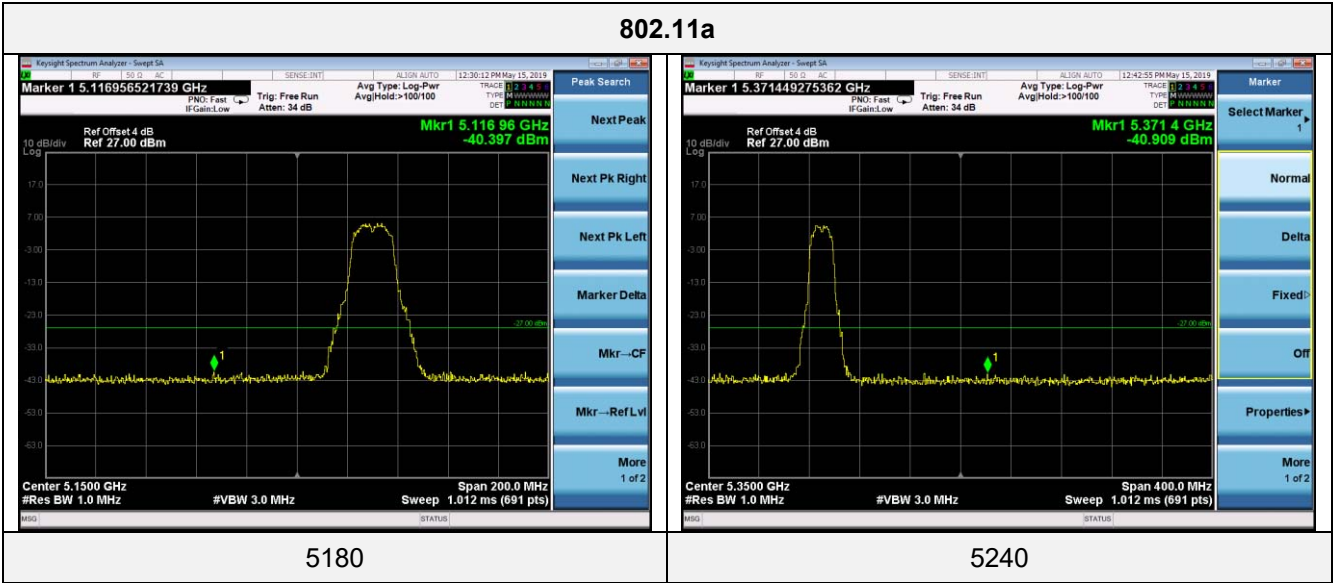


5795



Antenna 2

5150-5250MHz:



KeySight Spectrum Analyzer - Swept SA

Marker 1 5.371449275362 GHz

Ref Offset 4 dB
Ref 27.00 dBm

Mkr1 5.371 4 GHz
-40.909 dBm

Center 5.3500 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Sweep 1.012 ms (691 pts)

Marker

SelectMarker

Normal

Delta

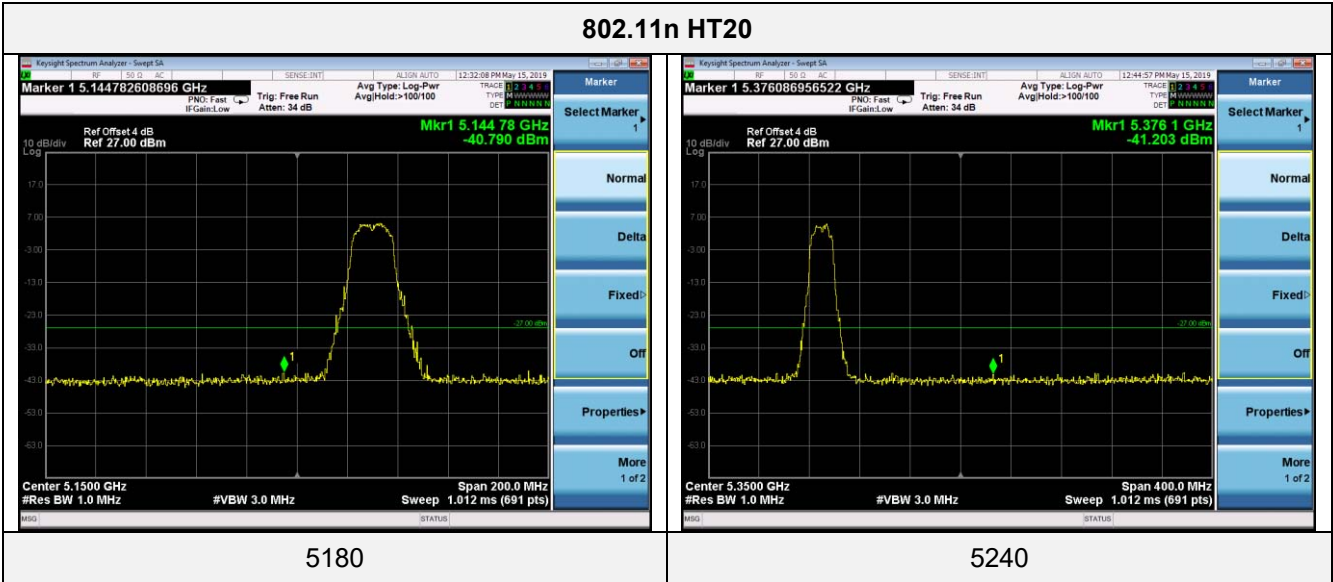
Fixed

Off

Properties

More

5240



KeySight Spectrum Analyzer - Swept SA

Marker 1 5.376086956522 GHz

Ref Offset 4 dB
Ref 27.00 dBm

Mkr1 5.376 1 GHz
-41.203 dBm

Center 5.3500 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Sweep 1.012 ms (691 pts)

Marker

SelectMarker

Normal

Delta

Fixed

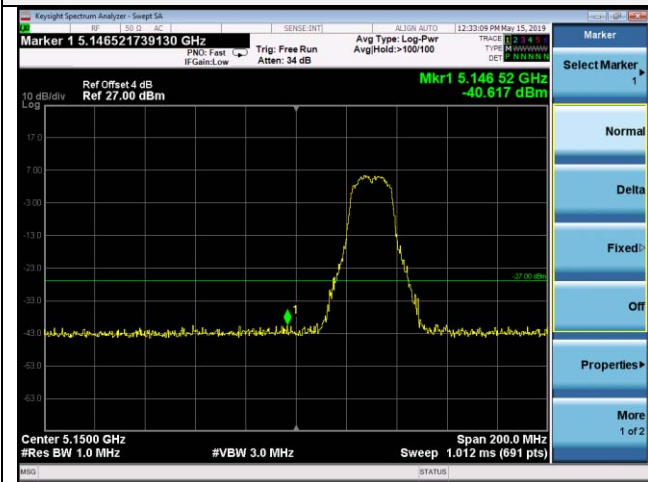
Off

Properties

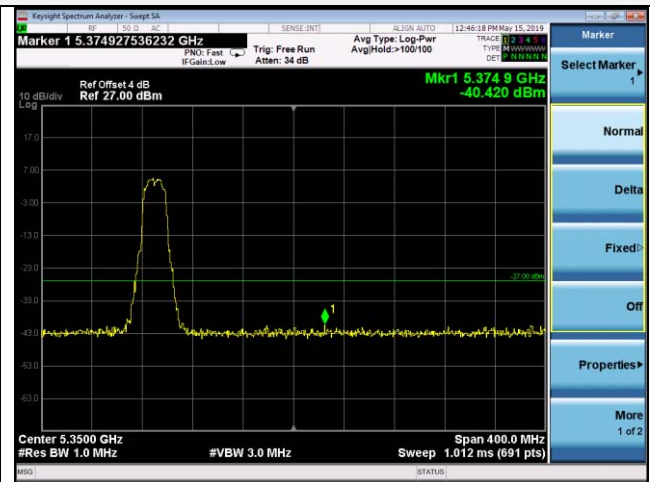
More

5240

802.11ac20

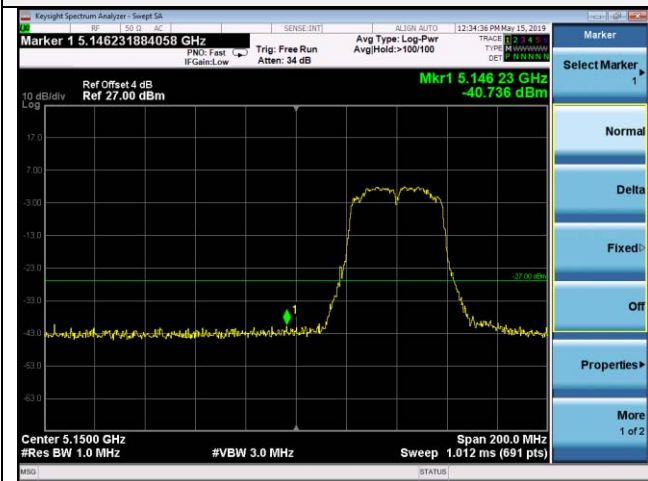


5180

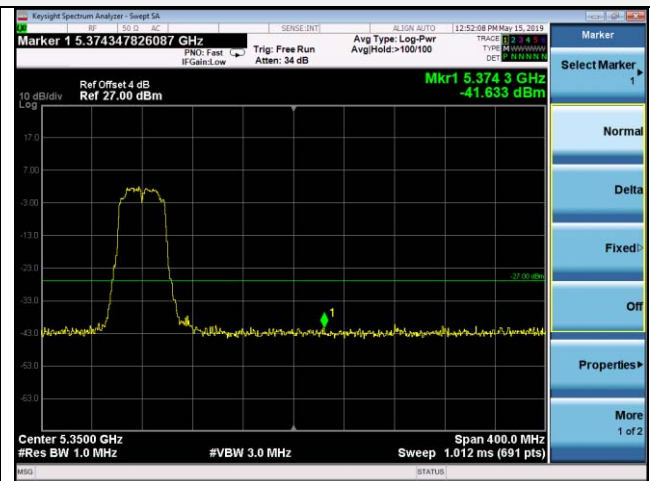


5240

802.11n HT40

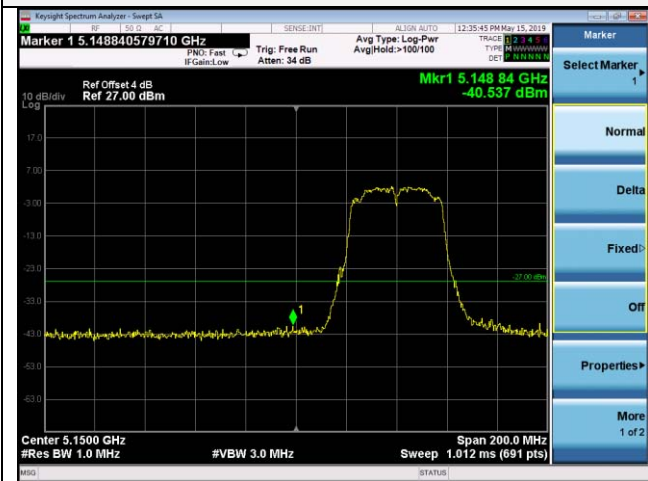


5190

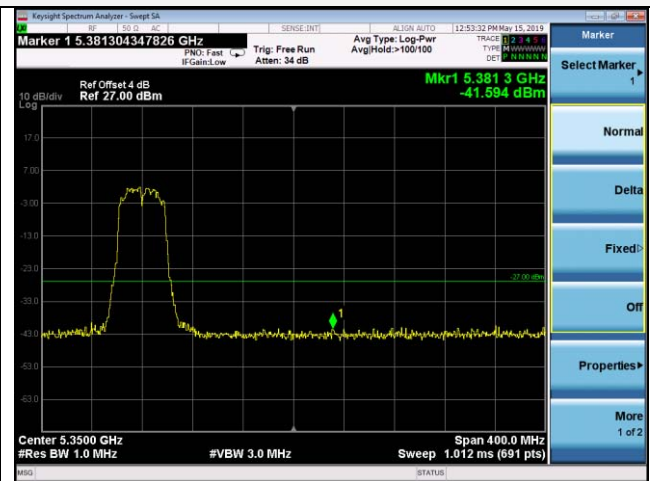


5230

802.11ac40

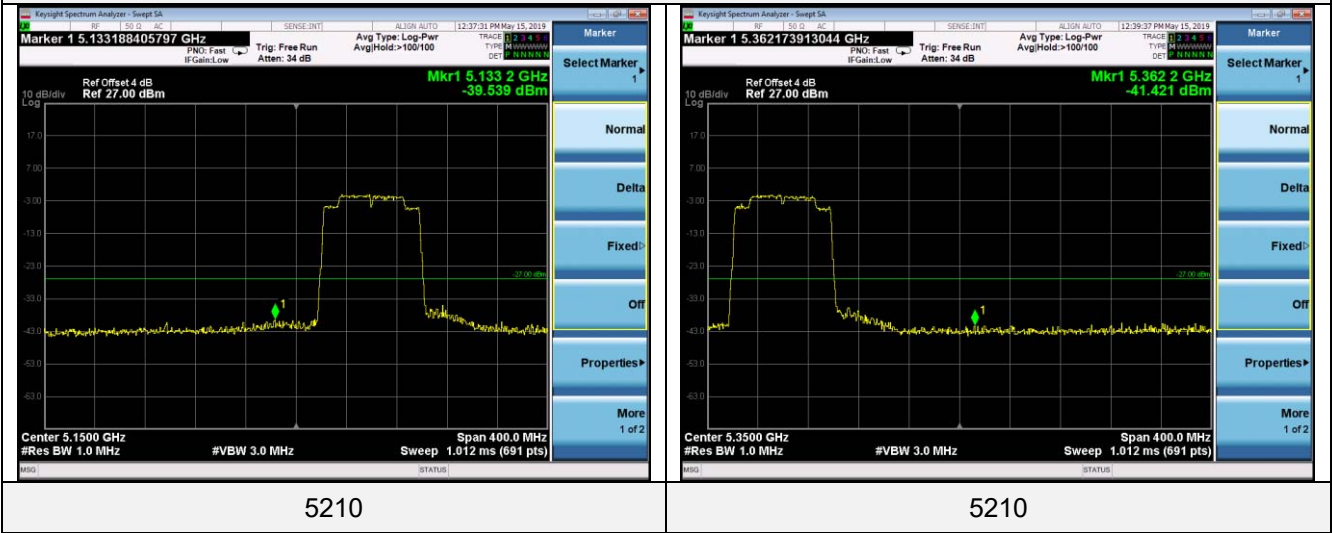


5190



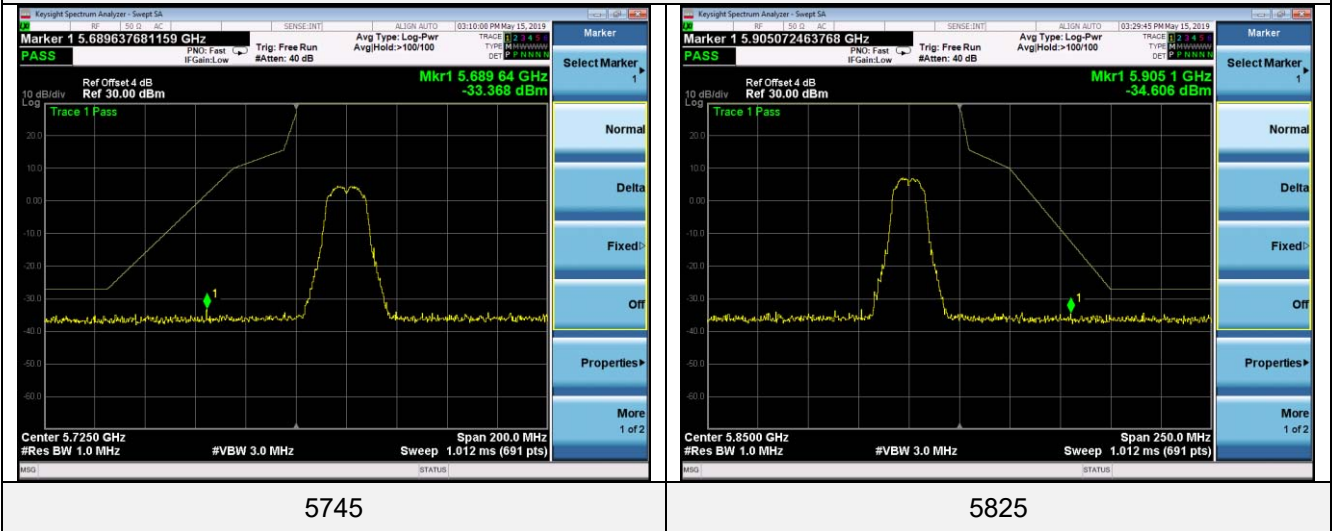
5230

802.11ac80

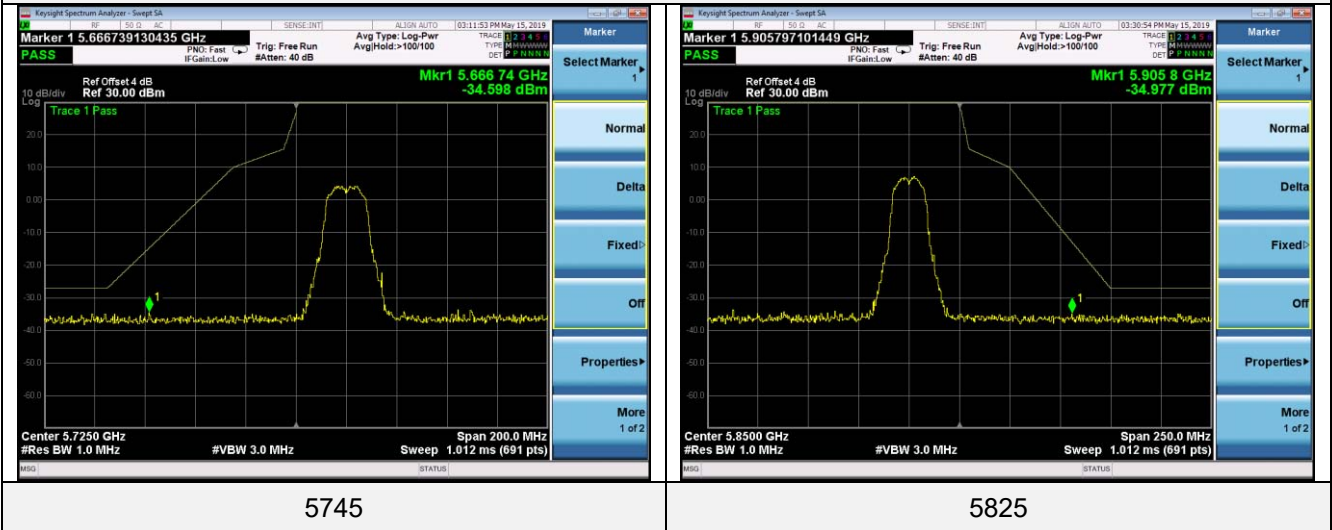


5725-5850MHz:

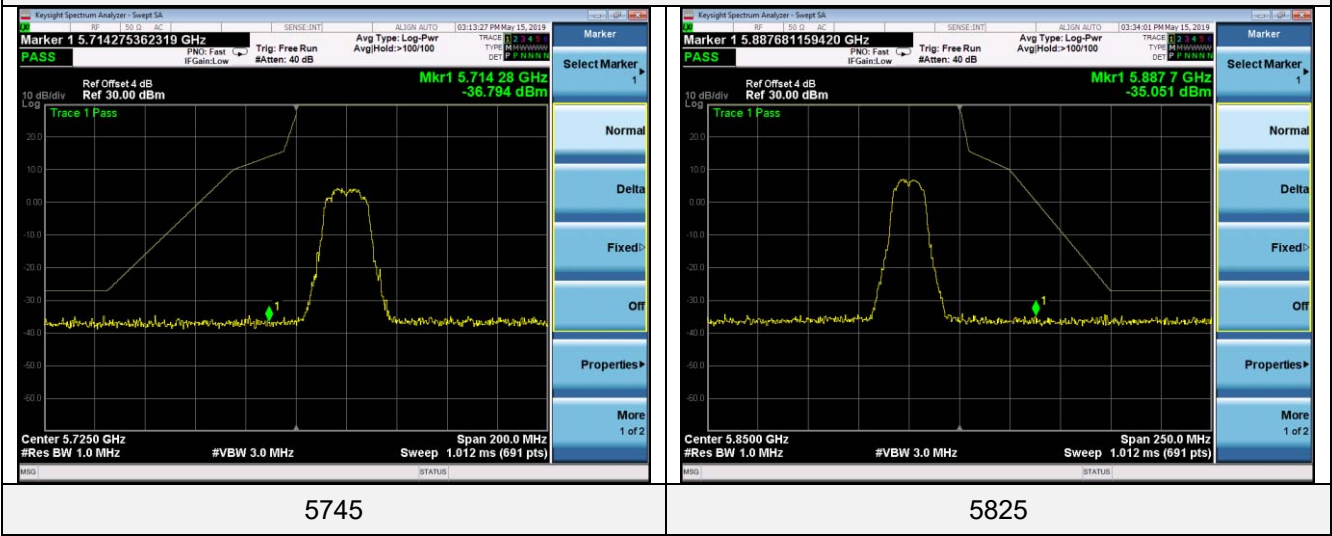
802.11a



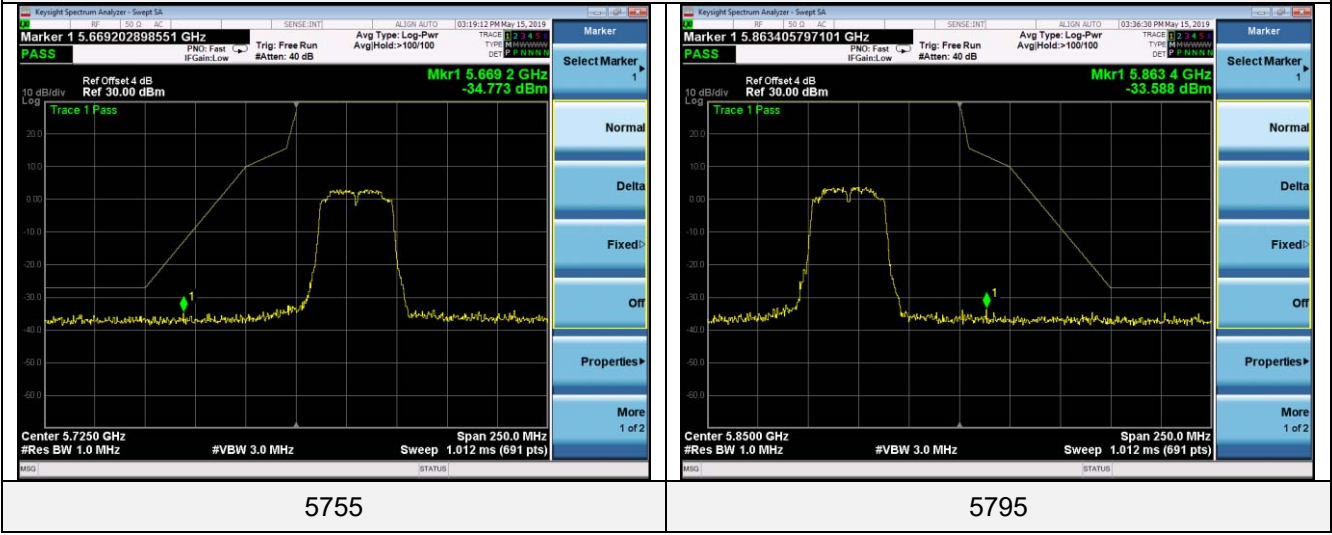
802.11n HT20



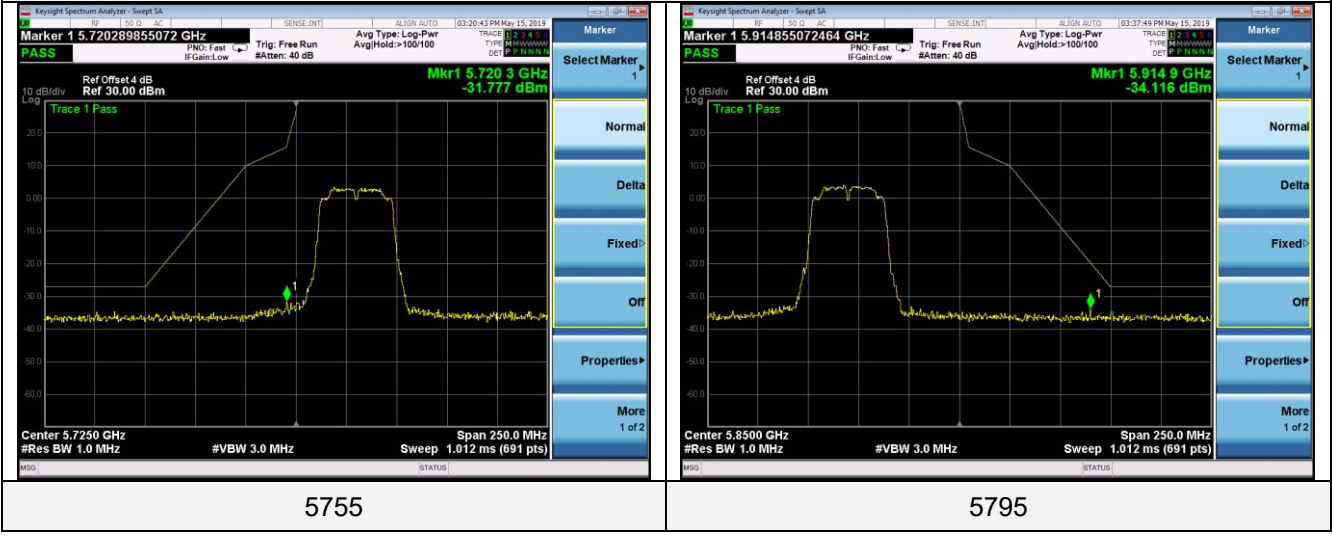
802.11ac20



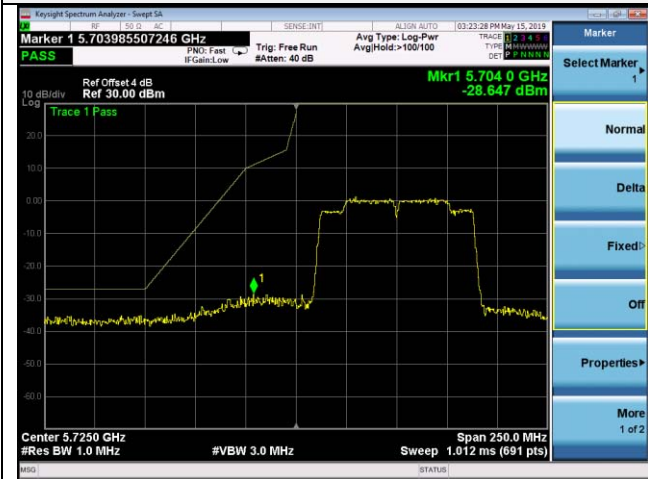
802.11n HT40



802.11ac40



802.11ac80



5775



5775

4.9. Antenna Requirement

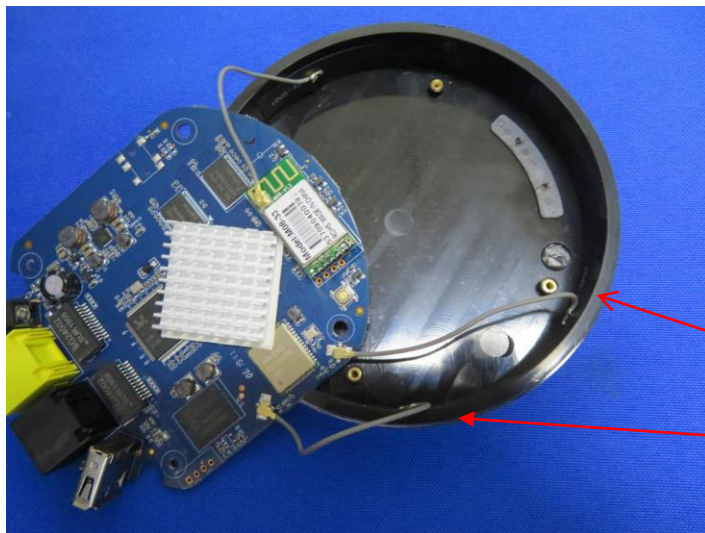
Standard Applicable

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.

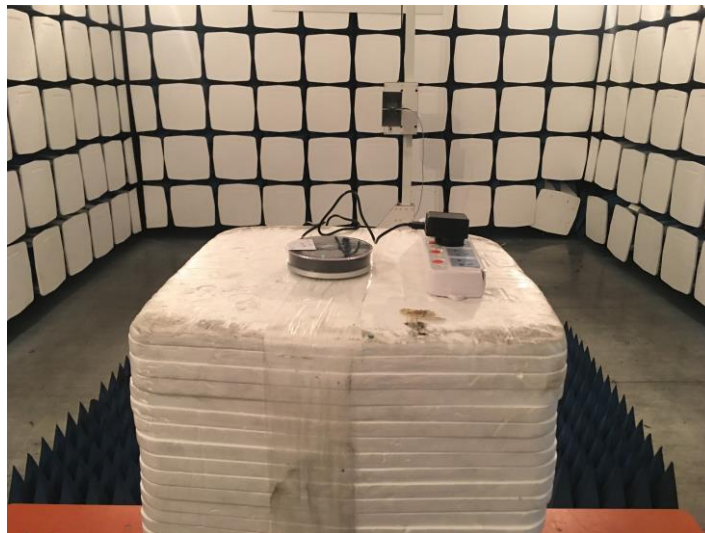
Antenna Information

The antenna is FPC antenna, through the buckle stretched out, The directional gains of antenna used for transmitting is 2dBi(each).



5G WIFI
Antennas

5. Test Setup Photos of the EUT



6. External and Internal Photos of the EUT

Reference to the test report No. GTS20190321004-1-6

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