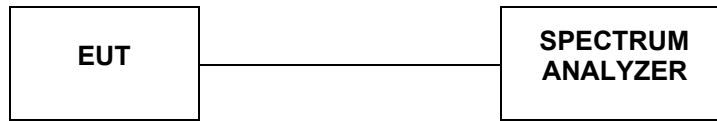


4.6. 6dB Bandwidth

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 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:

- a. Set RBW = 100 kHz.
- b. Set the video bandwidth (VBW) $\geq 3 \times$ 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 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

Antenna 0

Type	Channel	99%Bandwidth (MHz)	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	16.398	11.55	≥500	Pass
	157	16.397	13.37		
	165	16.385	14.04		
802.11nHT20	149	17.590	15.12	≥500	Pass
	157	17.612	16.92		
	165	17.591	15.13		
802.11ac20	149	17.600	17.60	≥500	Pass
	157	17.585	13.35		
	165	17.589	15.10		
802.11n40	151	35.900	35.06	≥500	Pass
	159	35.940	35.19		
802.11ac40	151	35.982	32.69	≥500	Pass
	159	35.988	30.34		
802.11ac80	155	75.154	74.12	≥500	Pass

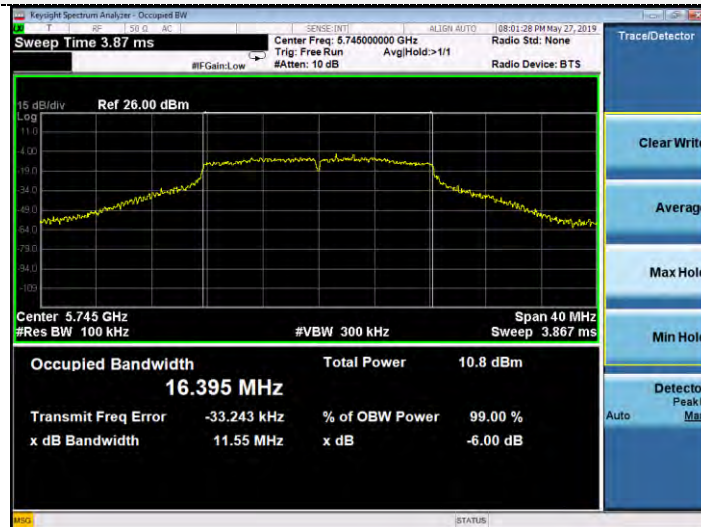
Antenna 1

Type	Channel	99%Bandwidth (MHz)	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	16.364	11.31	≥500	Pass
	157	16.370	15.05		
	165	16.382	11.70		
802.11nHT20	149	17.591	14.24	≥500	Pass
	157	17.611	10.71		
	165	17.594	12.96		
802.11ac20	149	17.591	14.65	≥500	Pass
	157	17.585	10.52		
	165	17.599	13.90		
802.11n40	151	35.946	32.58	≥500	Pass
	159	35.948	31.39		
802.11ac40	151	35.943	33.97	≥500	Pass
	159	35.979	33.97		
802.11ac80	155	75.140	74.92	≥500	Pass

Antenna 0

802.11a

802.11n HT20



CH149

CH149



CH157

CH157



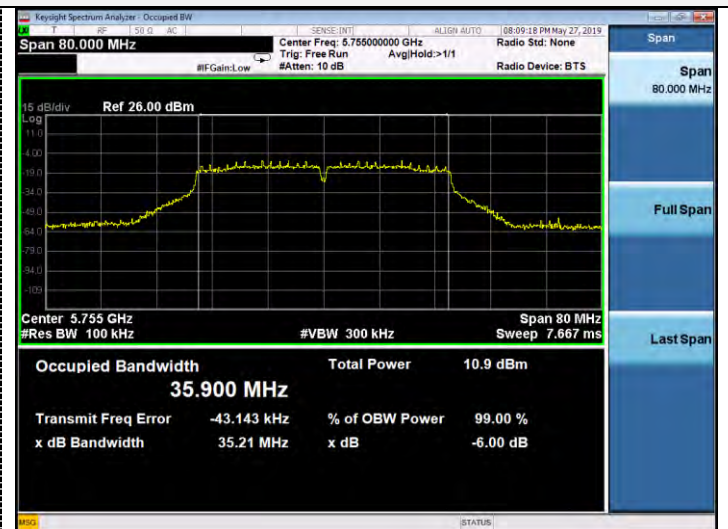
CH165

CH165

802.11ac20



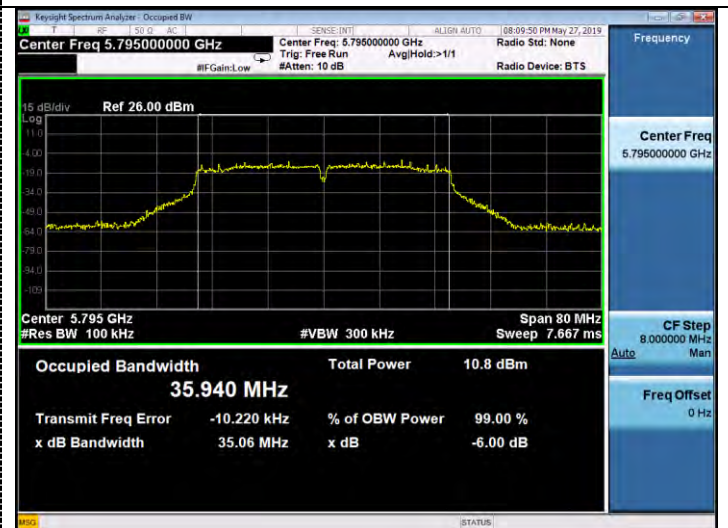
802.11n HT40



CH149



CH151



CH157



CH159



CH165



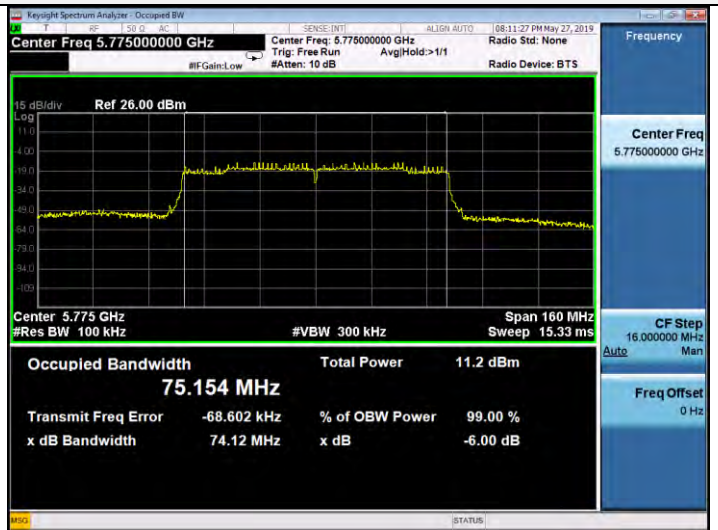
CH165



802.11ac40



802.11ac80



CH151



CH155



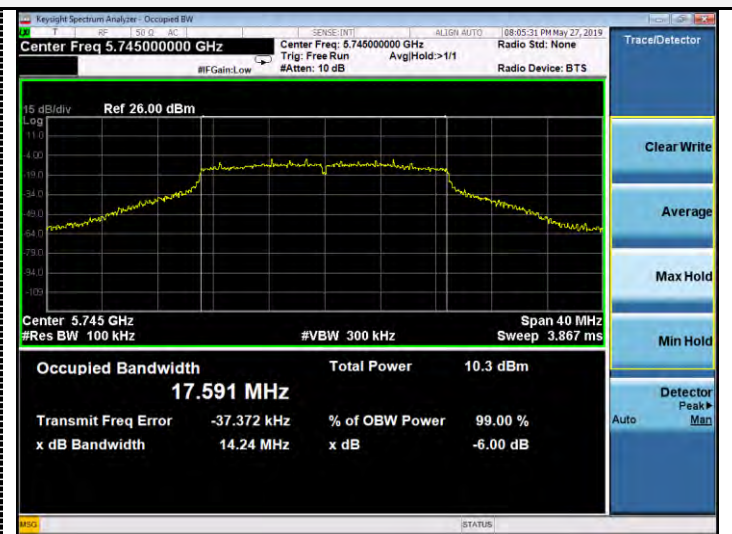
CH159



Antenna 1

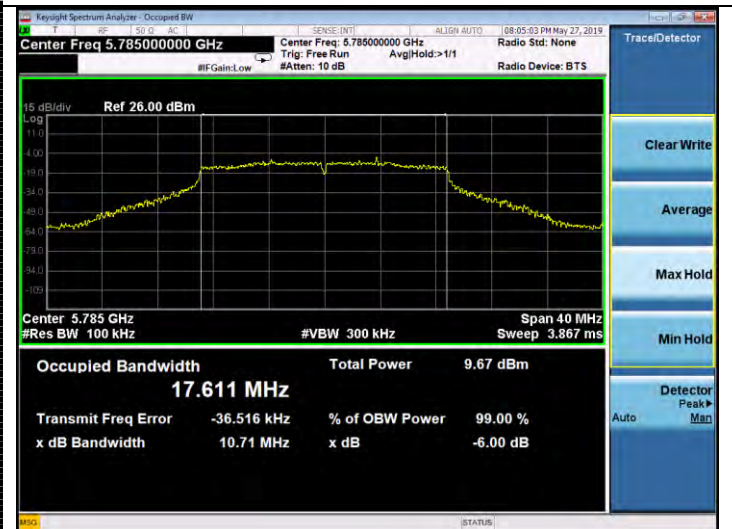
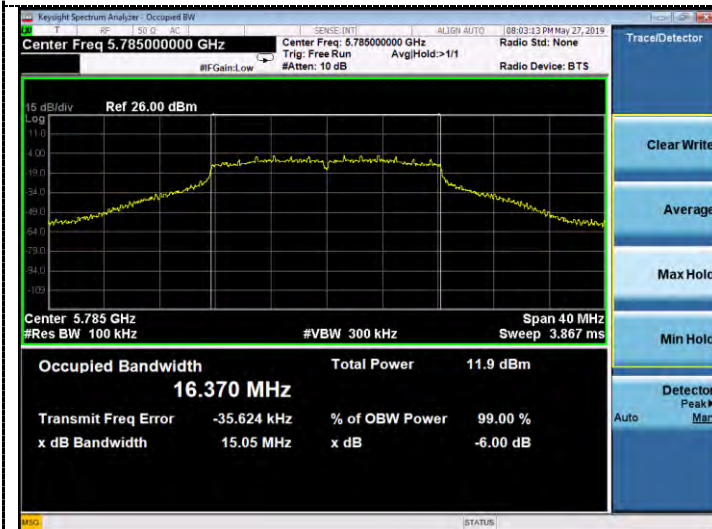
802.11a

802.11n HT20



CH149

CH149



CH157

CH157



CH165

CH165

802.11ac20



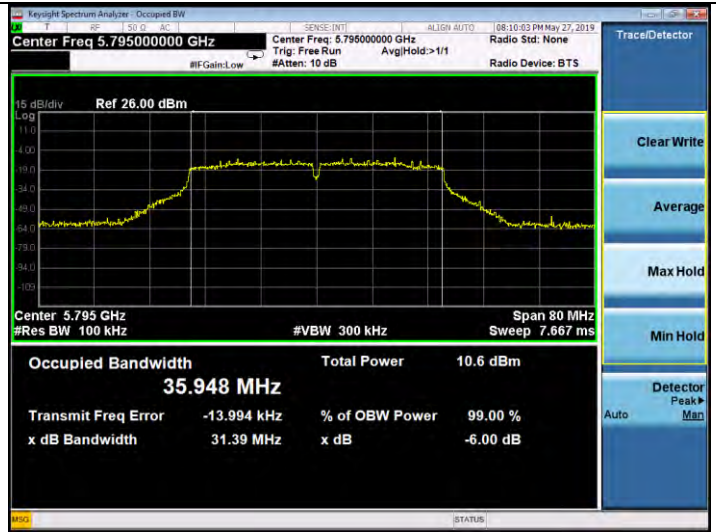
802.11n HT40



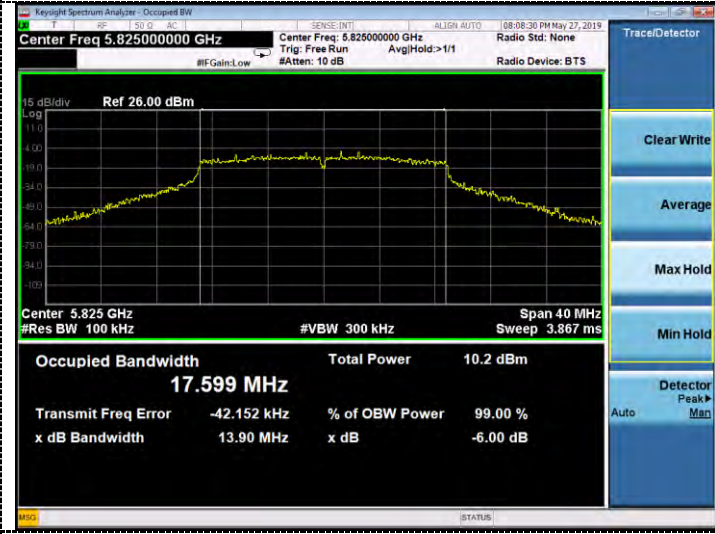
CH149



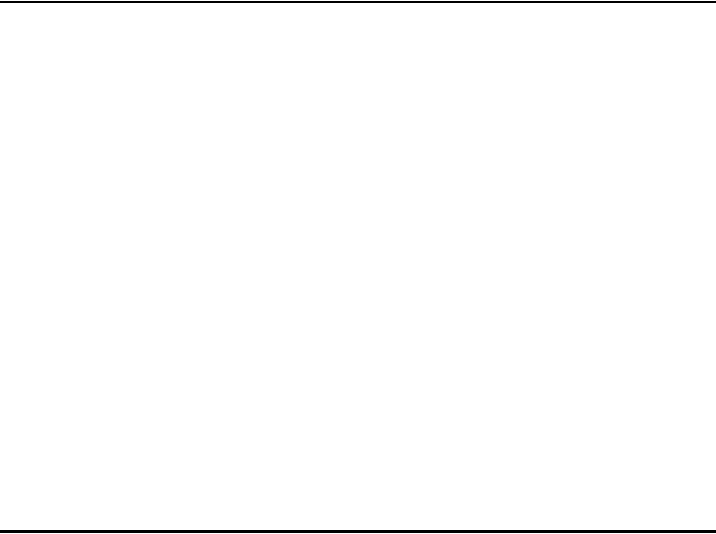
CH151



CH157



CH159



CH165



802.11ac40



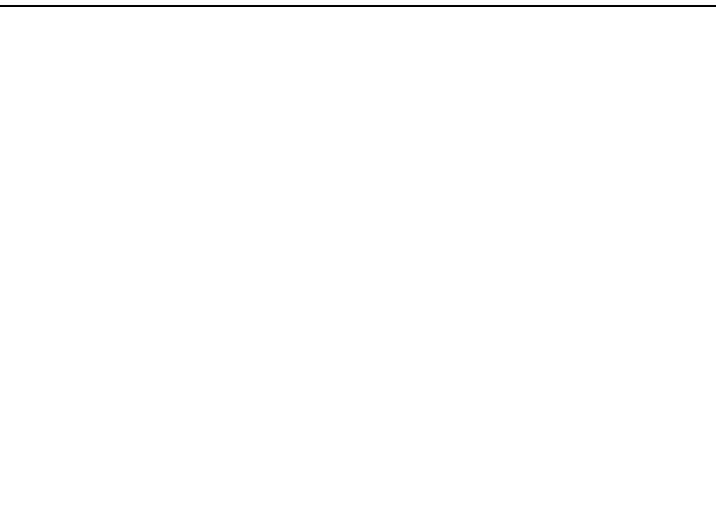
802.11ac80



CH151



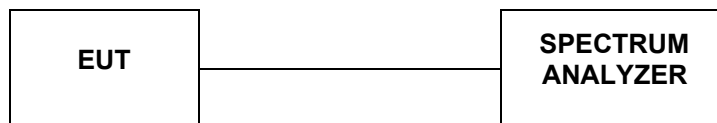
CH155



CH159

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	16.585	24.19	-	Pass
	157	16.481	23.04		
	165	16.454	23.09		
802.11nHT20	149	17.655	23.47	-	Pass
	157	17.682	22.10		
	165	17.679	23.23		
802.11ac20	149	17.369	22.04	-	Pass
	157	17.649	22.27		
	165	17.663	23.11		
802.11n40	151	36.158	43.36	-	Pass
	159	36.174	43.84		
802.11ac40	151	36.152	43.72	-	Pass
	159	36.082	42.54		
802.11ac80	155	75.171	81.52	-	Pass

Antenna 1

Type	Channel	99%Bandwidth (MHz)	26dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	16.523	22.89	-	Pass
	157	16.486	22.40		
	165	16.484	23.21		
802.11nHT20	149	17.666	22.94	-	Pass
	157	17.662	23.10		
	165	17.673	22.41		
802.11ac20	149	17.704	23.62	-	Pass
	157	17.666	22.95		
	165	17.671	22.83		
802.11n40	151	36.145	43.92	-	Pass
	159	36.128	44.04		
802.11ac40	151	36.165	44.36	-	Pass
	159	36.089	43.57		
802.11ac80	155	75.366	81.95	-	Pass

Antenna 0

802.11a

802.11n HT20



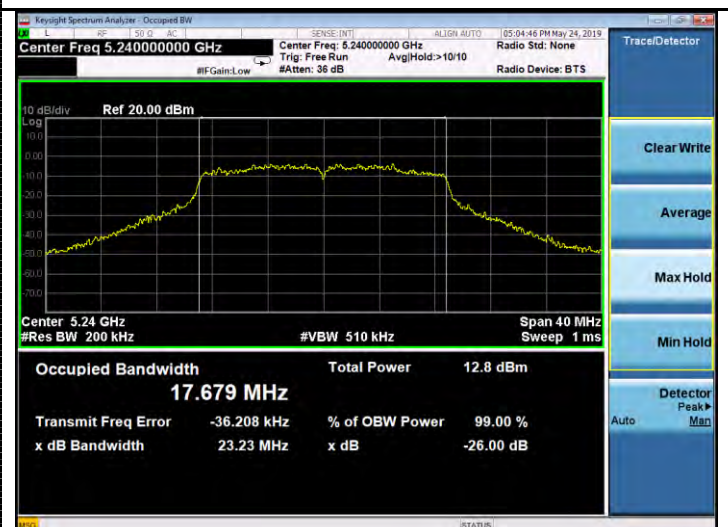
CH36

CH36



CH40

CH40



CH48

CH48

802.11ac20



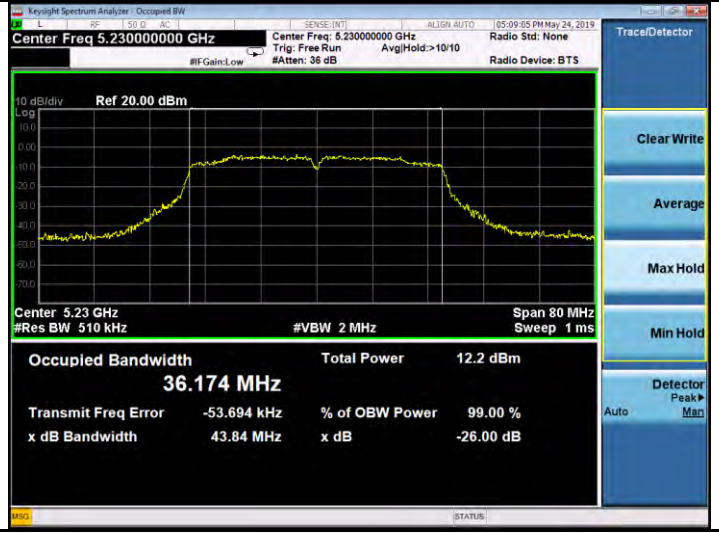
802.11n HT40



CH36



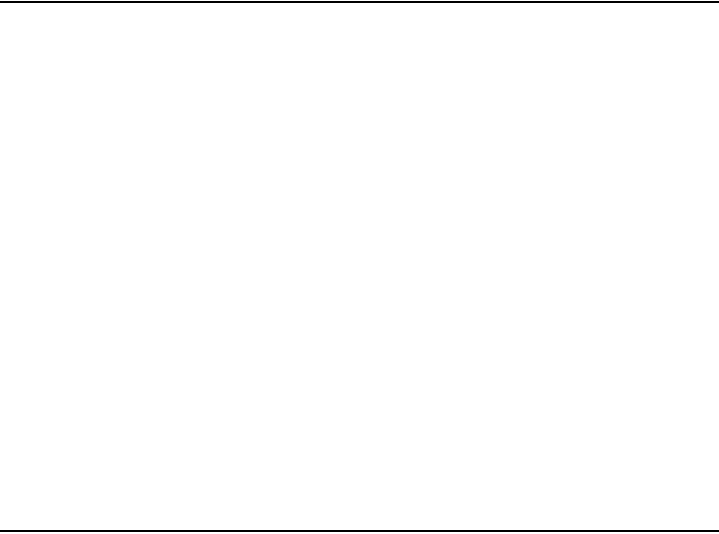
CH38



CH40

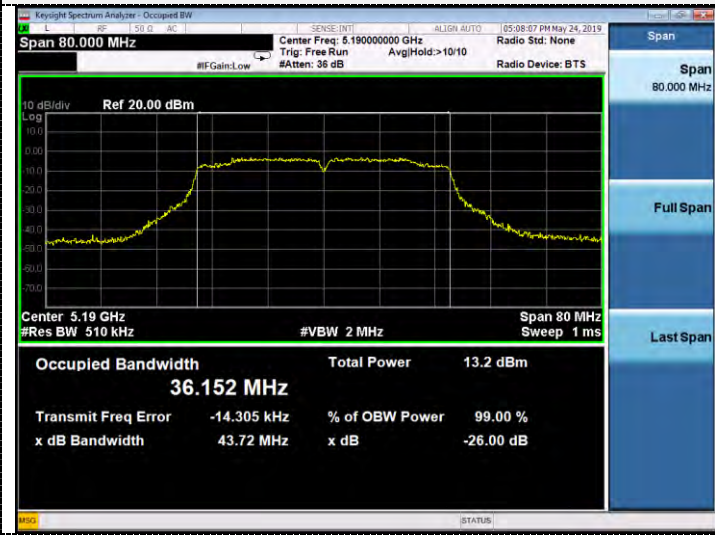


CH46



CH48

802.11ac40



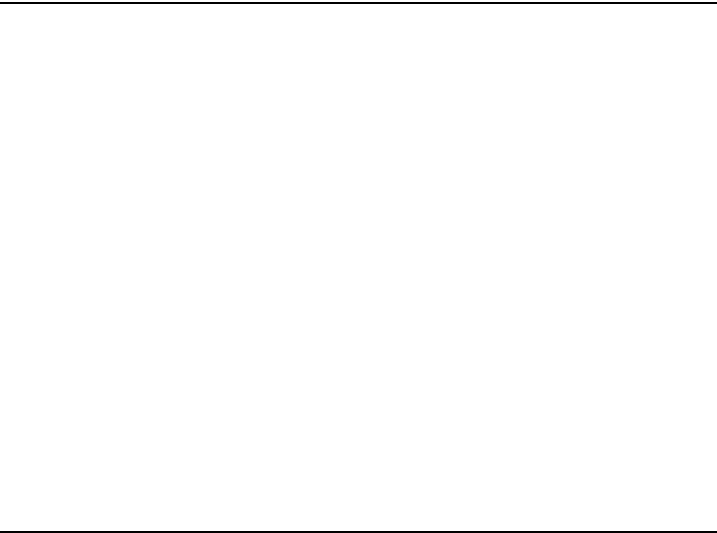
802.11ac80



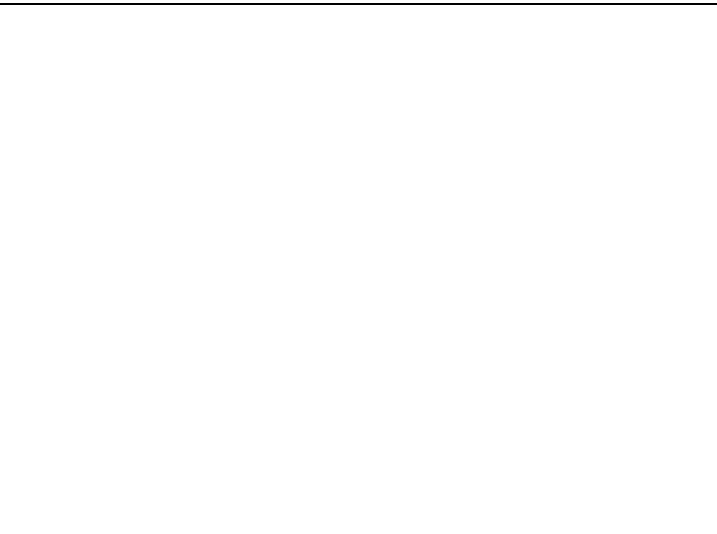
CH38



CH42



CH46



Antenna 1

802.11a



802.11n HT20



CH36



CH36



CH40



CH40



CH48

CH48

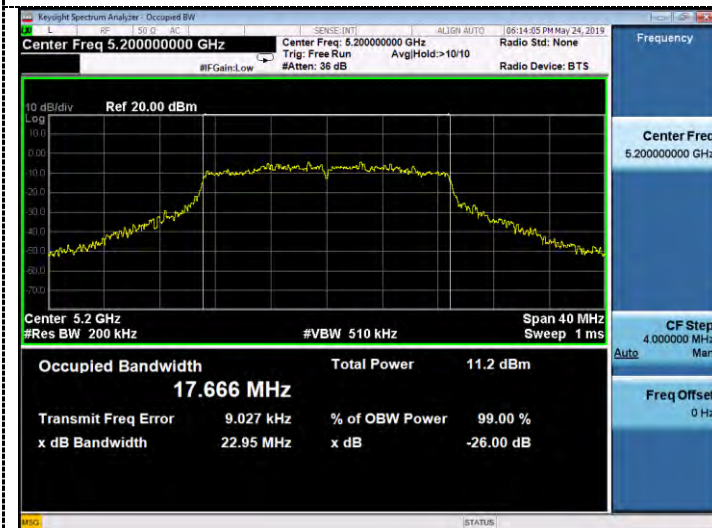
802.11ac20



802.11n HT40



CH36



CH38



CH40

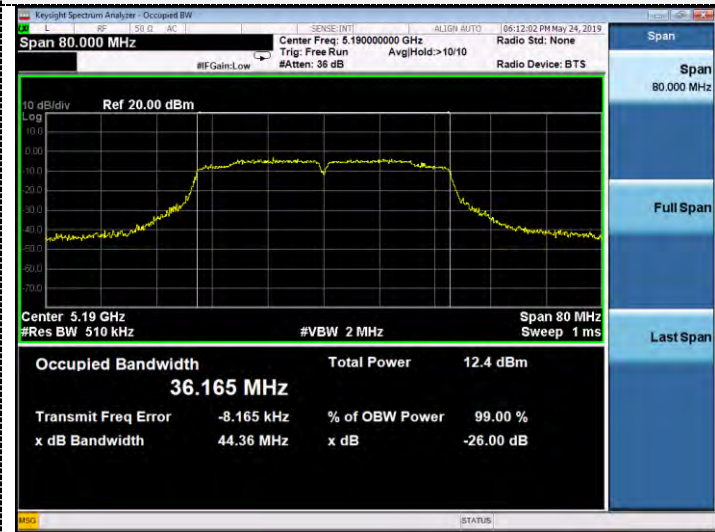


CH46



CH48

802.11ac40



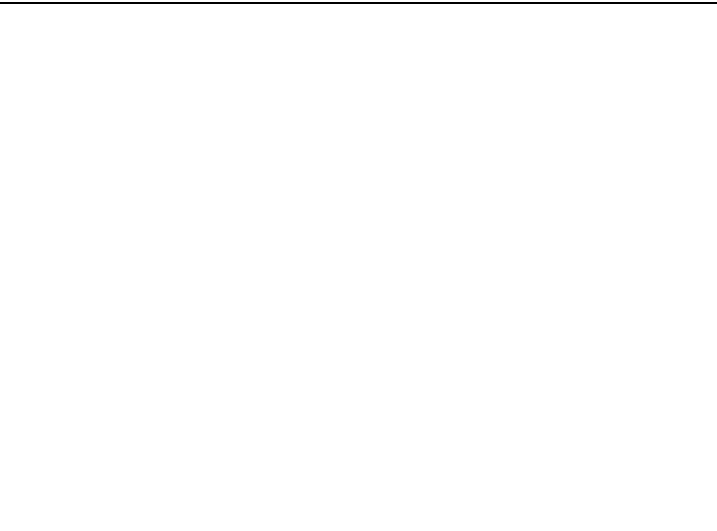
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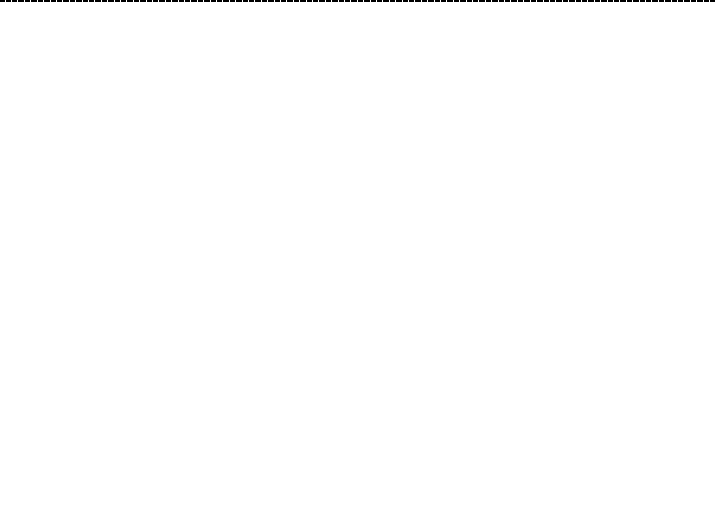
CH38



CH42

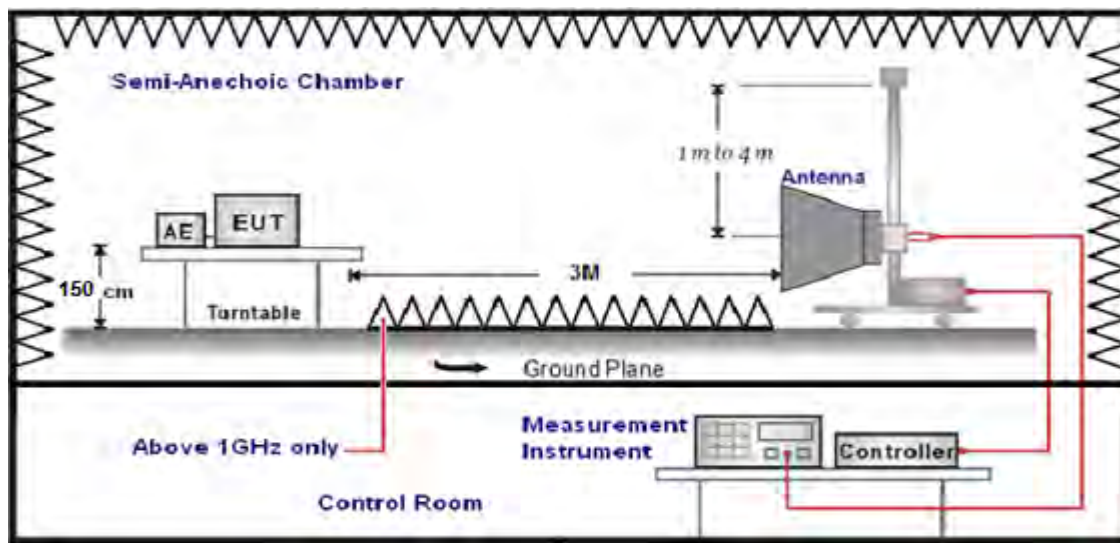


CH46



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	68.2
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 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	35.73	35.58	29.04	8.28	50.55	74	23.45	Peak	Horizontal
5148.26	25.16	35.58	29.04	8.28	39.98	54	14.02	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	34.95	35.58	29.04	8.28	49.77	74	24.23	Peak	Horizontal
5353.12	24.81	35.58	29.04	8.28	39.63	54	14.37	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
5698.44	39.73	35.29	29.13	8.65	54.54	104.55	50.01	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
5854.08	39.93	35.29	29.18	8.8	54.84	112.9	58.06	Peak	Horizontal

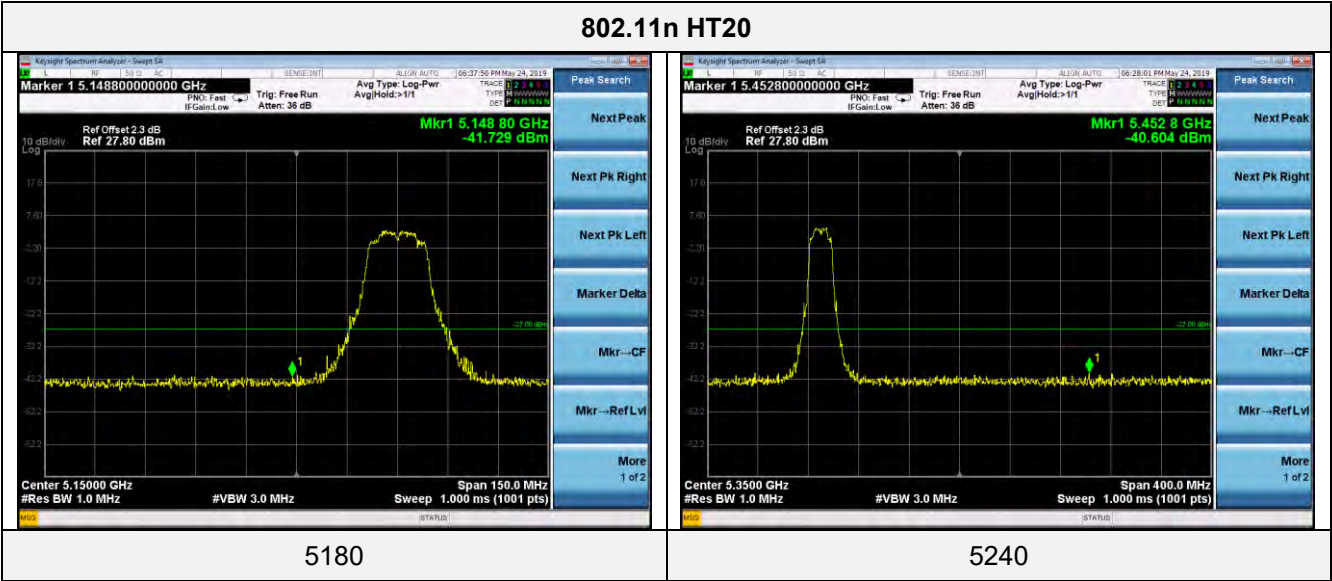
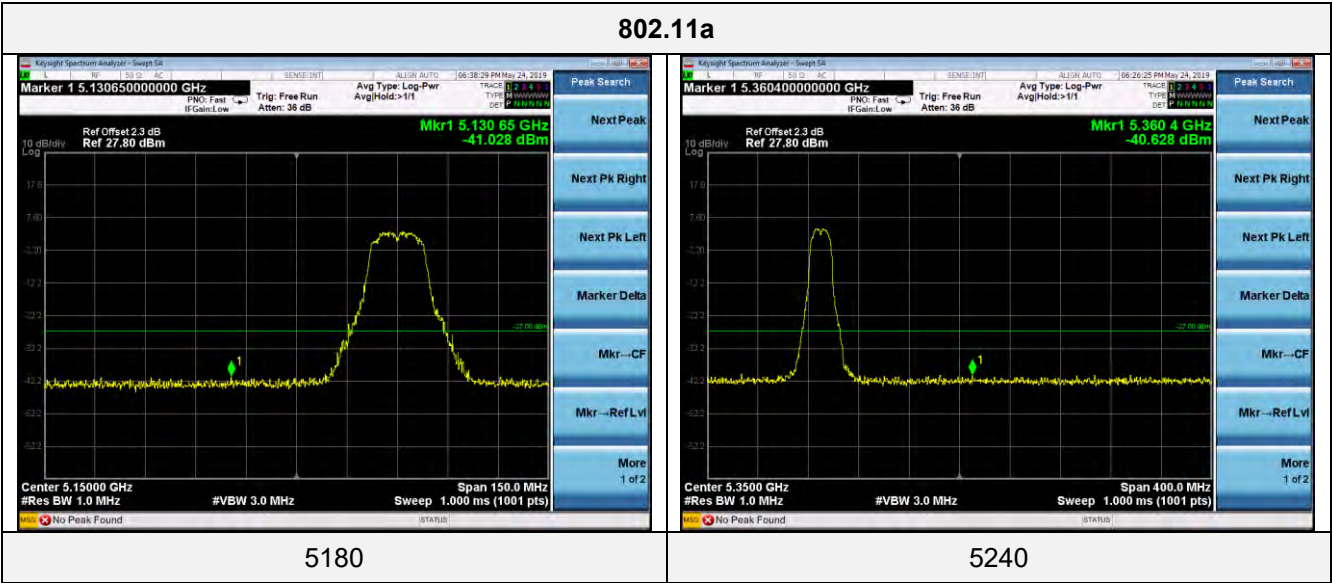
REMARKS:

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;

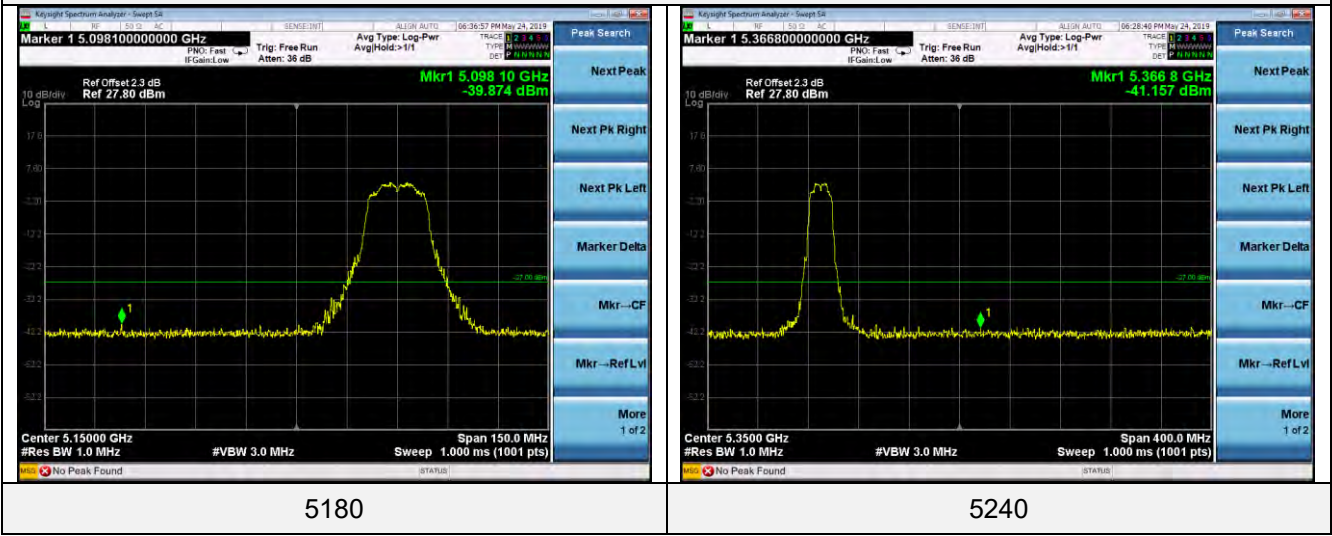
For Conducted Band edge Measurement

The test results have included the antenna gain

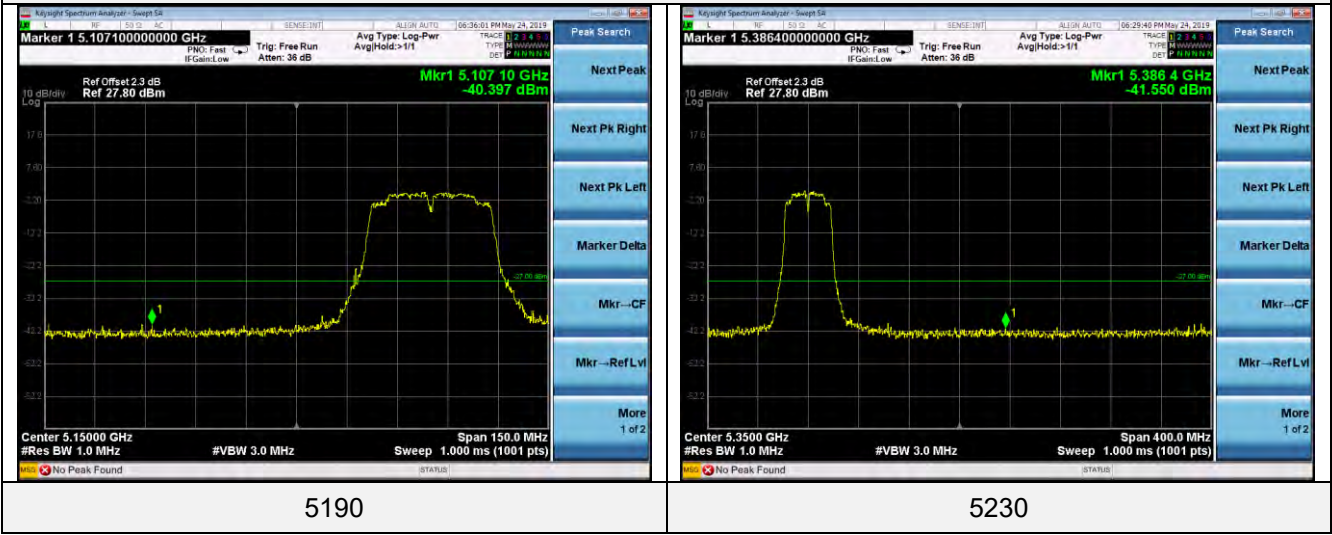
Antenna 0
5150-5250MHz:



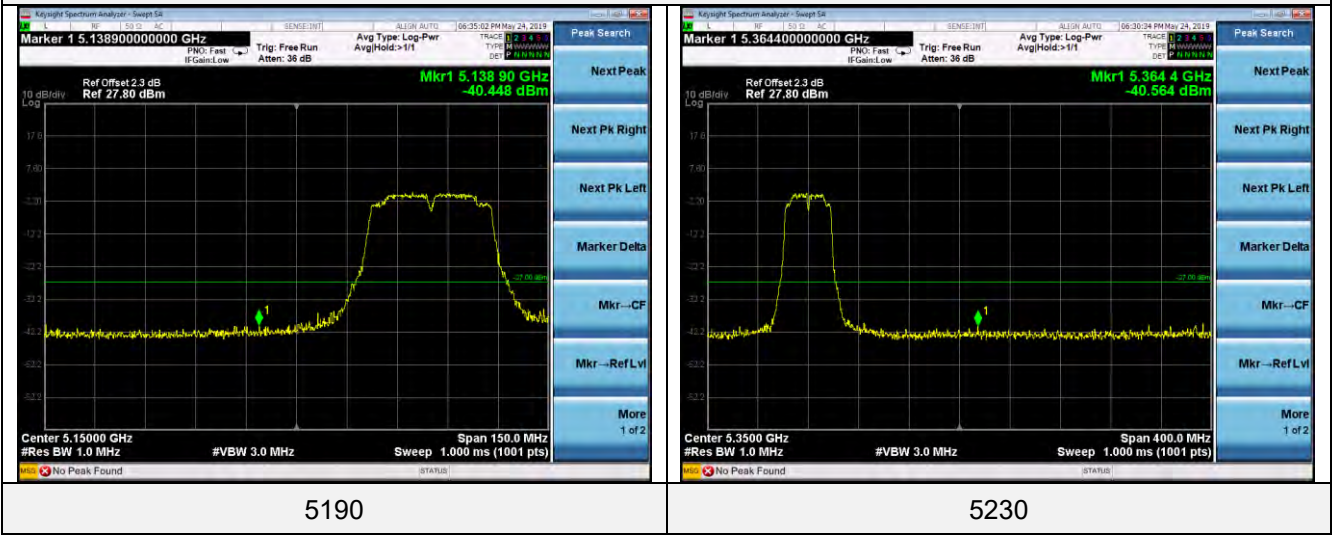
802.11ac20

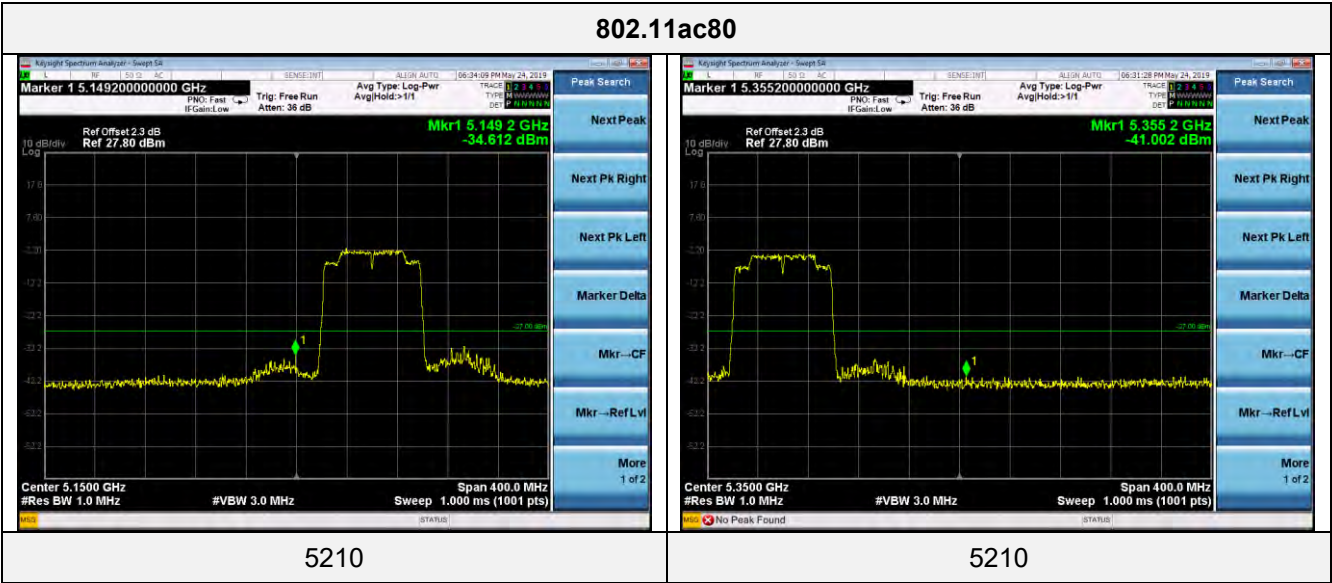


802.11n HT40

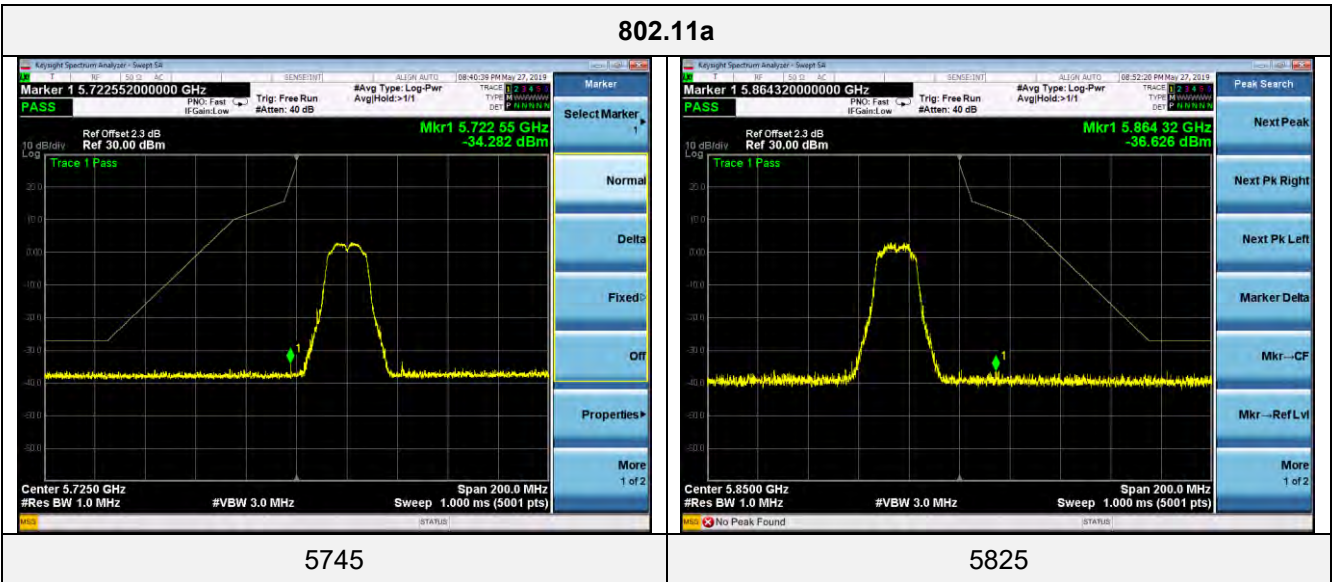


802.11ac40





5725-5850MHz:



KeySight Spectrum Analyzer - Sweep SA

Marker 1 5.864320000000 GHz

Ref Offset 2.3 dB
Ref 30.00 dBm

Mkr1 5.864 32 GHz
-36.626 dBm

Center 5.8500 GHz
#Res BW 1.0 MHz

#VBW 3.0 MHz

Sweep 1.000 ms (5001 pts)

Peak Search

Next Peak

Next Pk Right

Next Pk Left

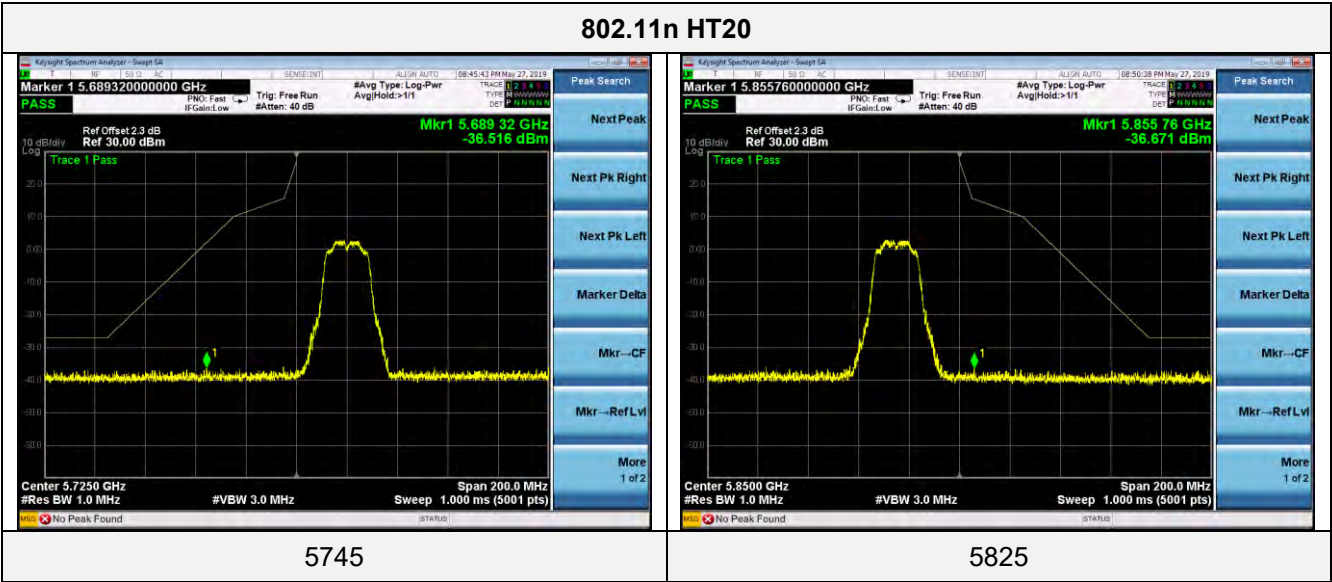
Marker Delta

Mkr--CF

Mkr--Ref Lvl

More 1 of 2

5825



KeySight Spectrum Analyzer - Sweep SA

Marker 1 5.857600000000 GHz

Ref Offset 2.3 dB
Ref 30.00 dBm

Mkr1 5.855 76 GHz
-36.671 dBm

Center 5.8500 GHz
#Res BW 1.0 MHz

#VBW 3.0 MHz

Sweep 1.000 ms (5001 pts)

Peak Search

Next Peak

Next Pk Right

Next Pk Left

Marker Delta

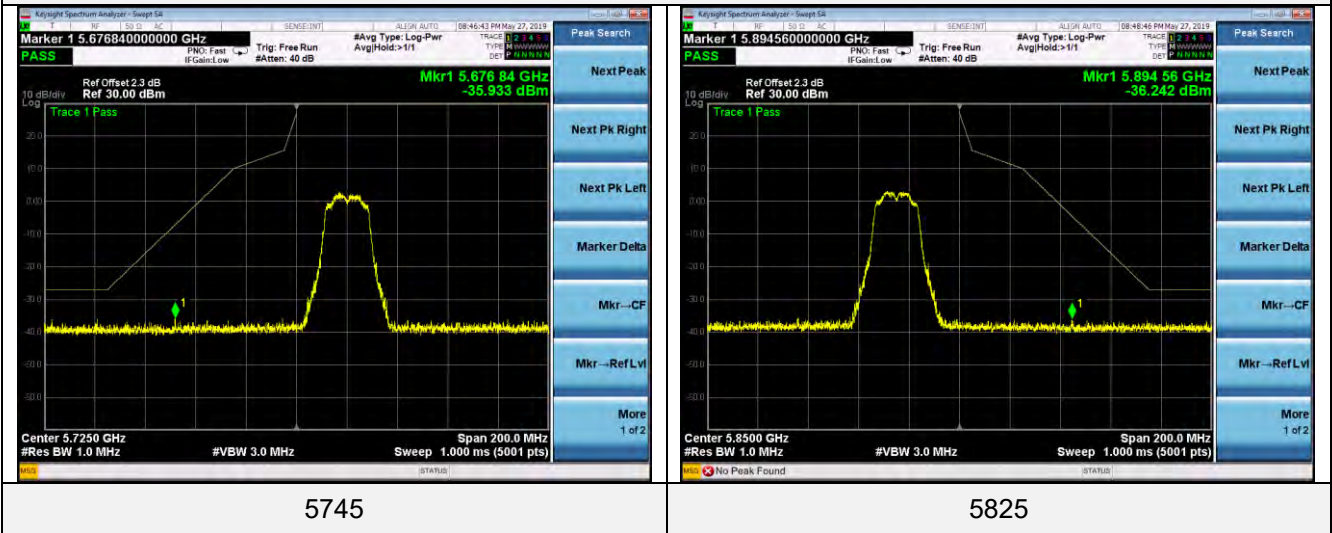
Mkr--CF

Mkr--Ref Lvl

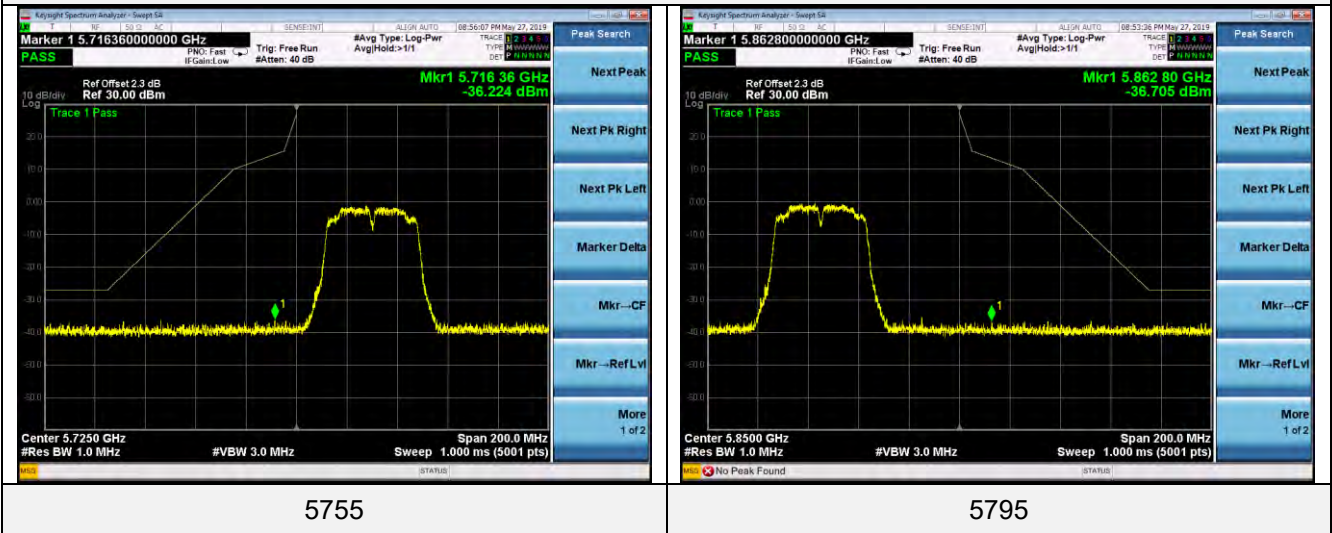
More 1 of 2

5825

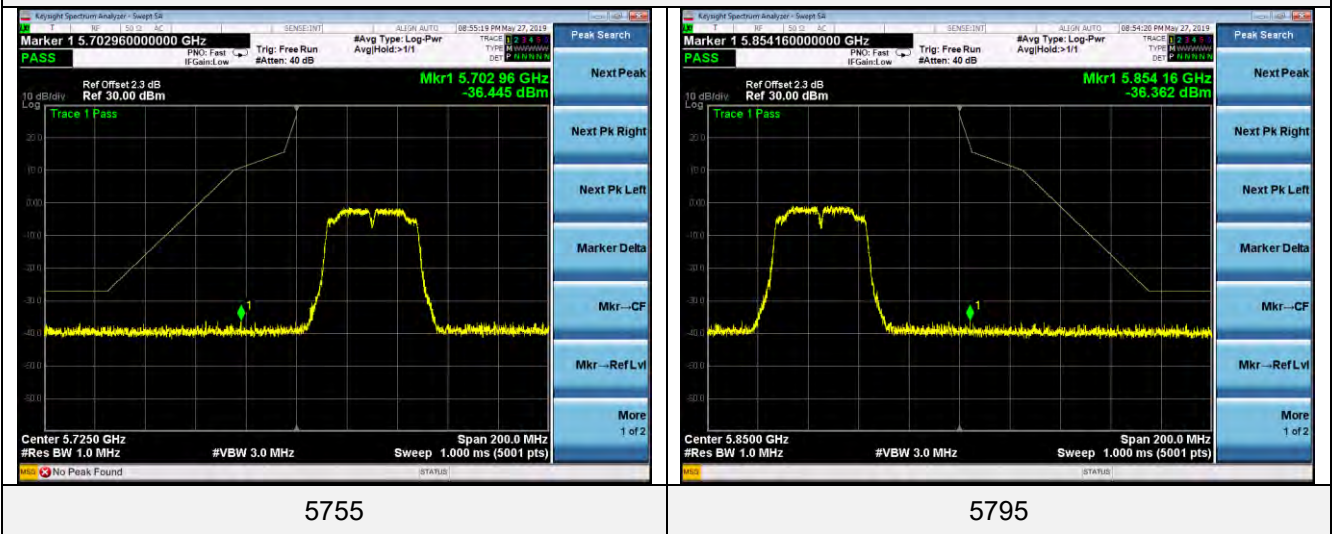
802.11ac20

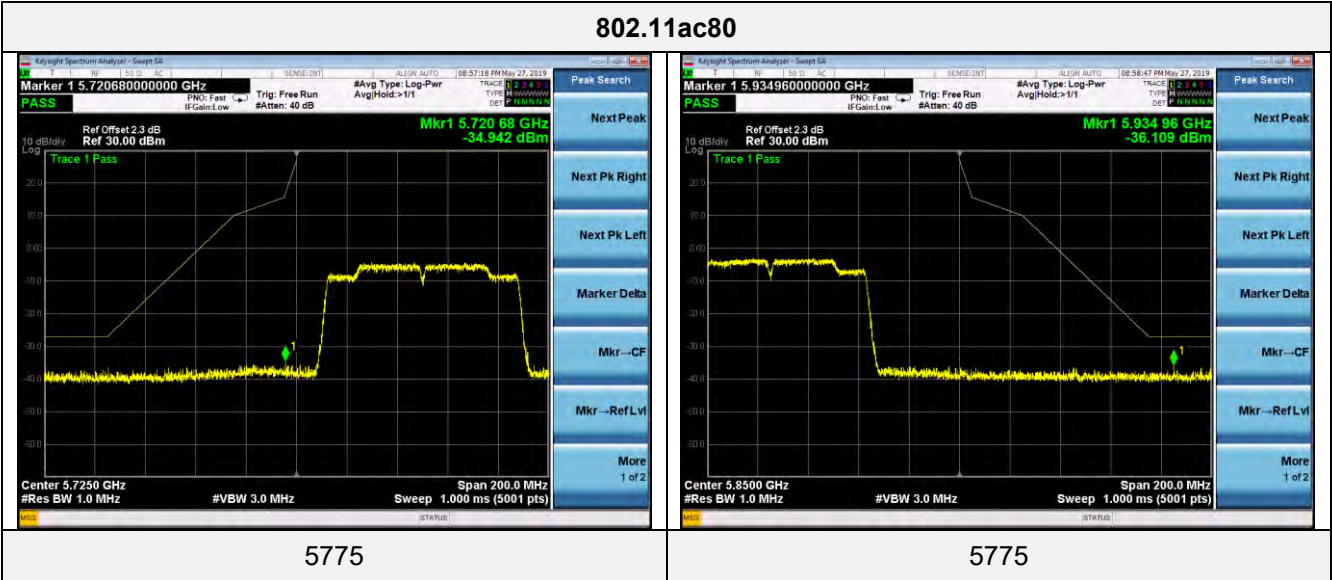


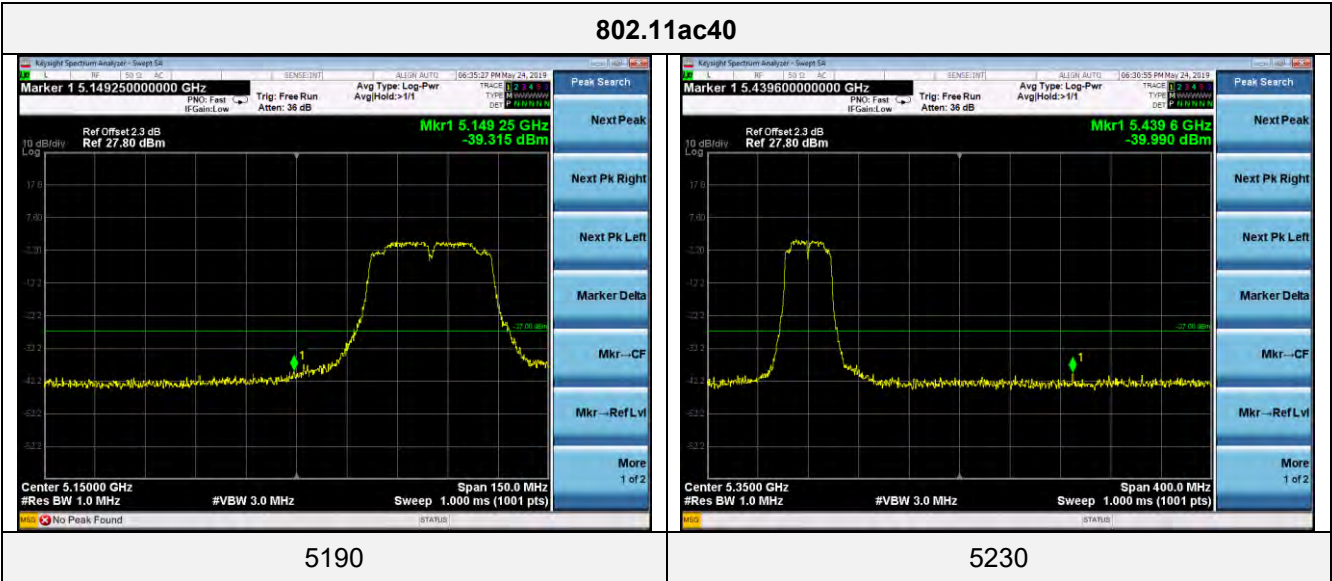
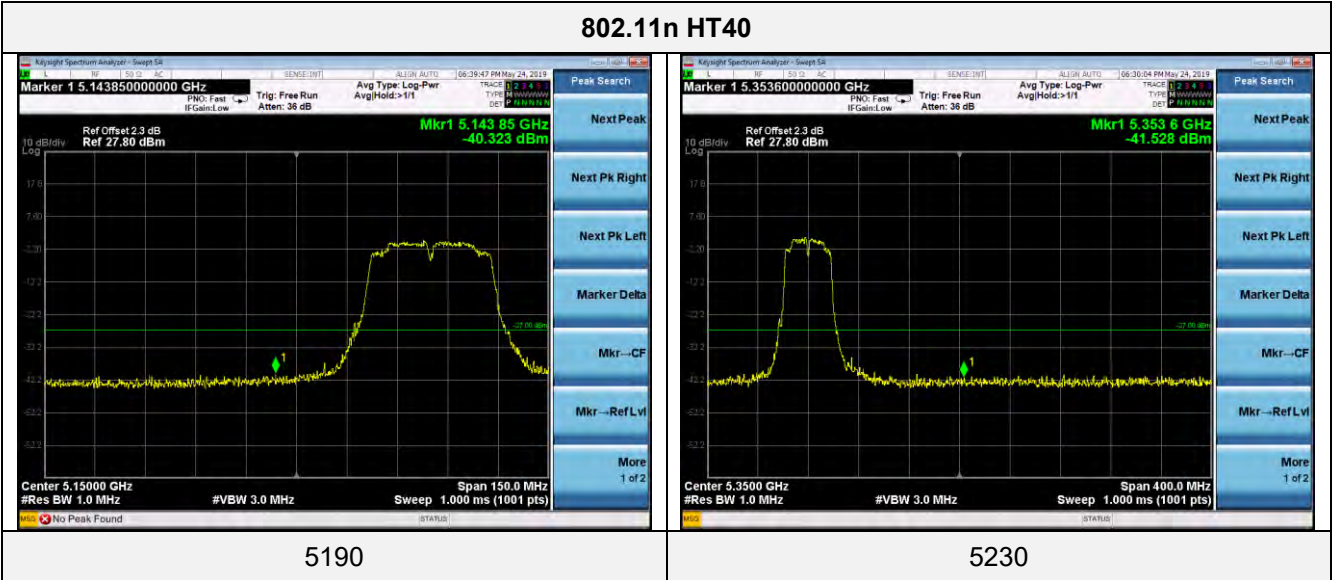
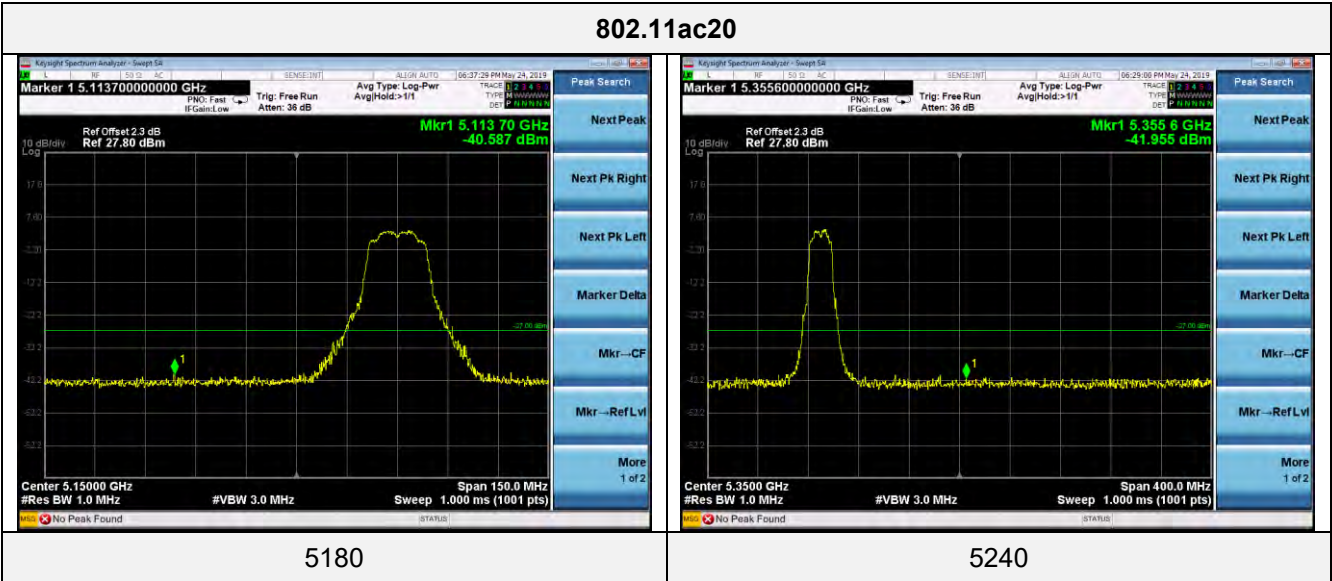
802.11n HT40



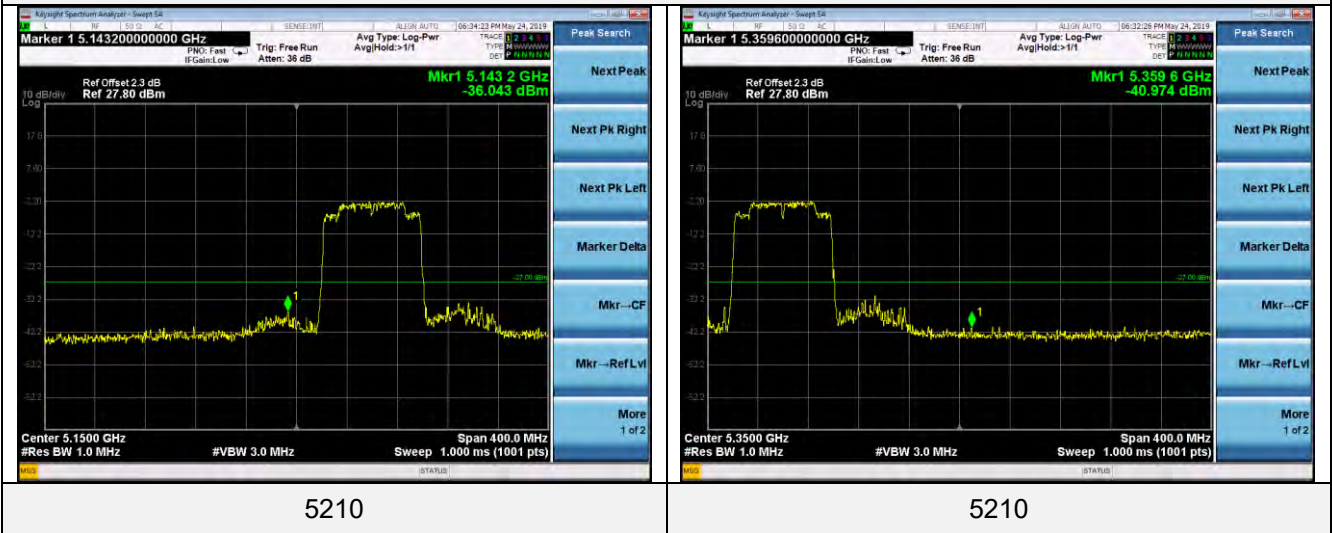
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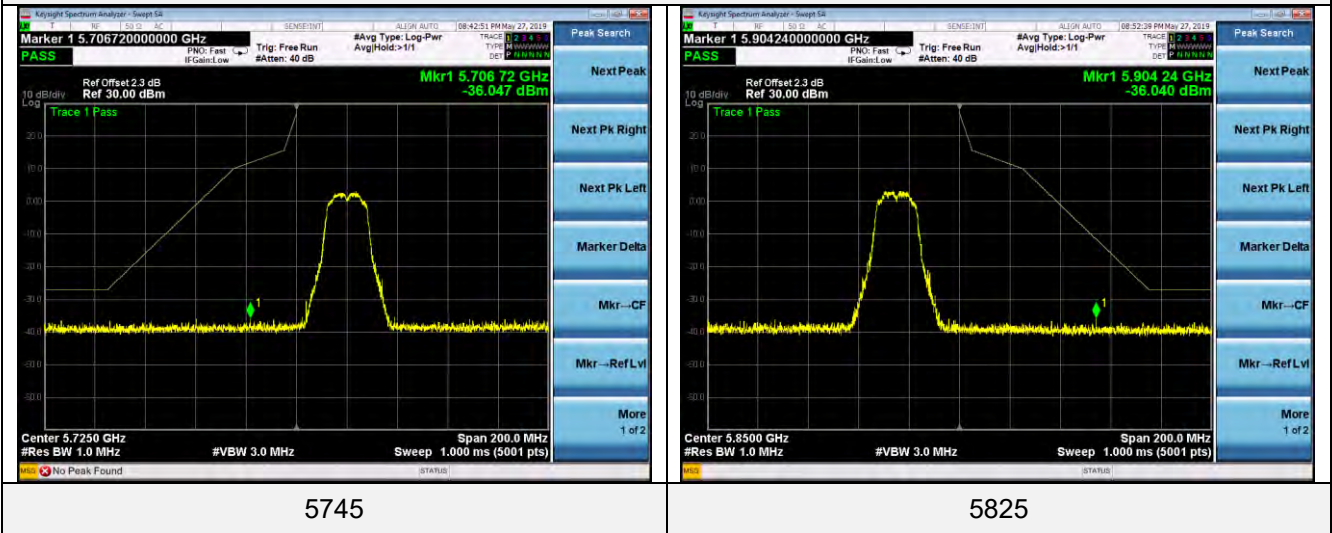


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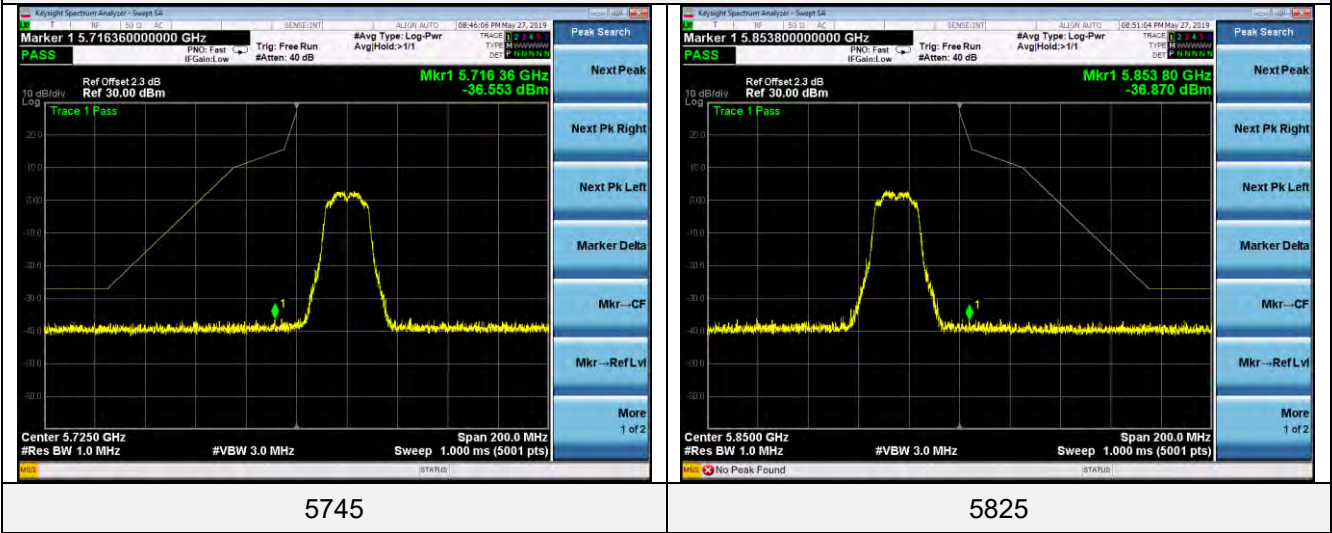


5725-5850MHz:

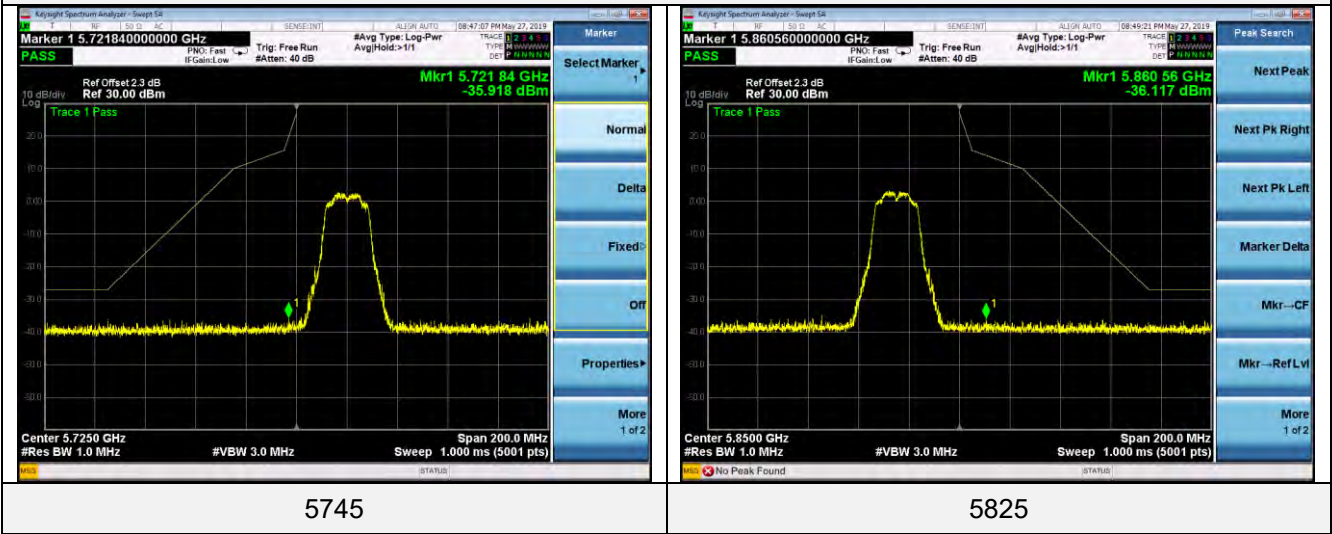
802.11a



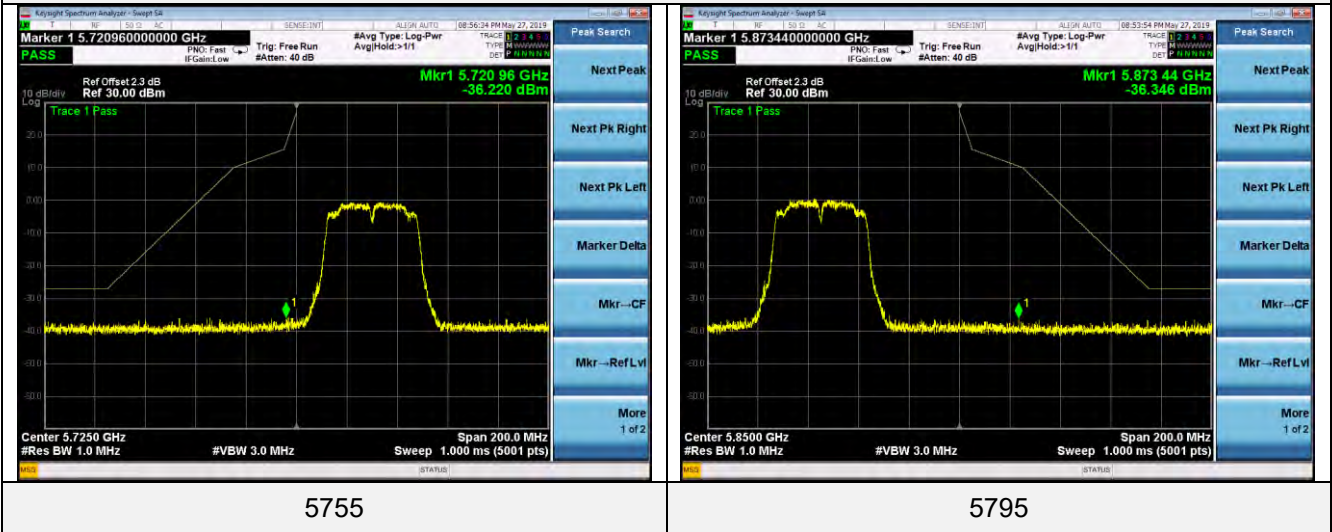
802.11n HT20



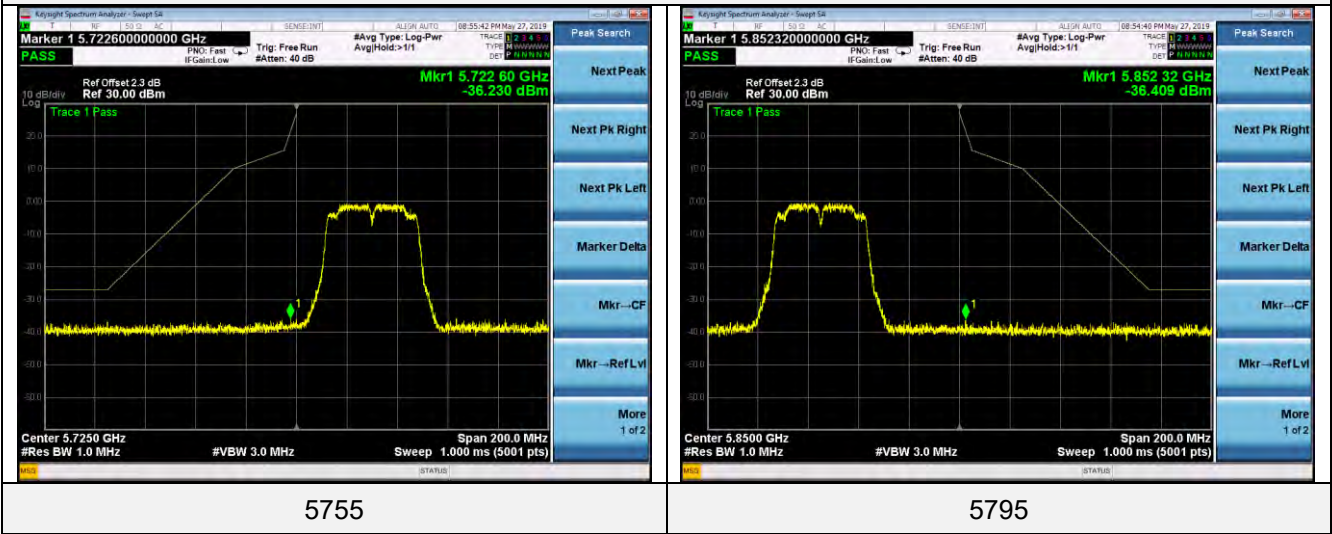
802.11ac20



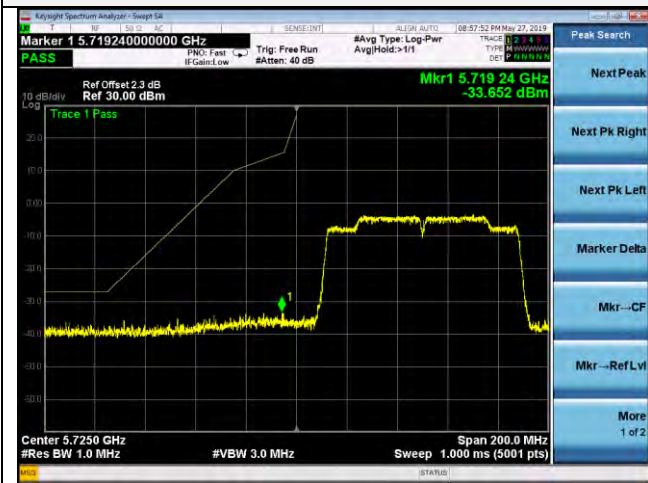
802.11n HT40



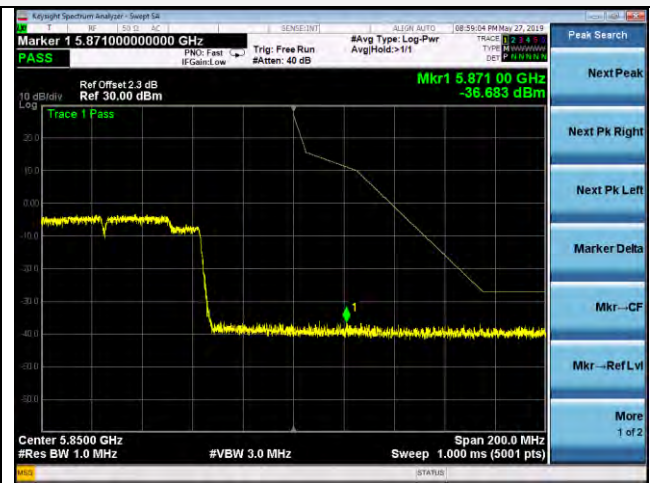
802.11ac40



802.11ac80



5775



5775

4.9. Antenna Requirement

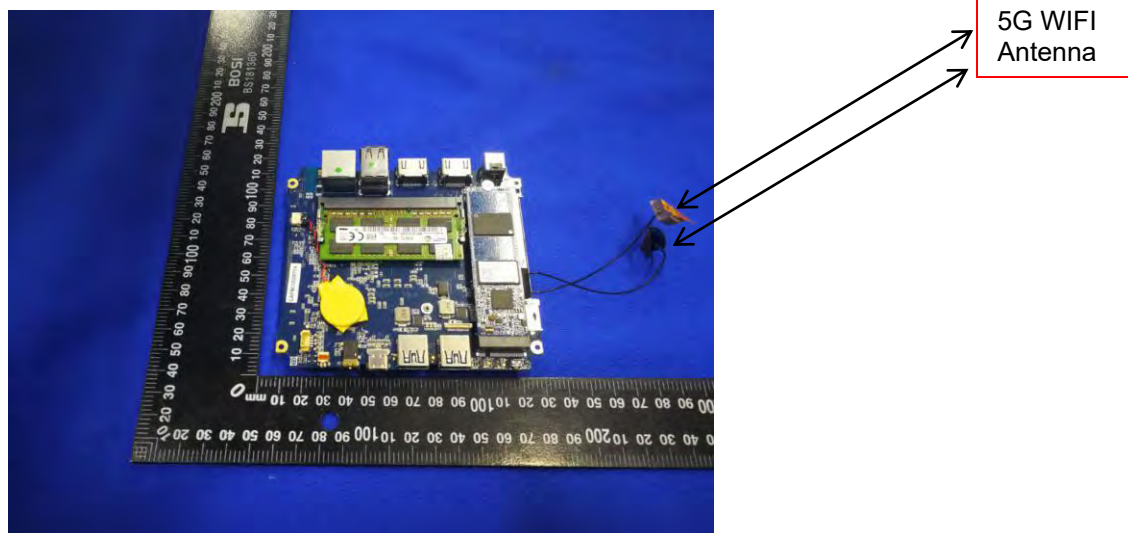
Standard Applicable

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 0.87dBi.



5. Test Setup Photos of the EUT



6. External and Internal Photos of the EUT

Reference to the test report No. **GTS20190329001-1-23**

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