

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

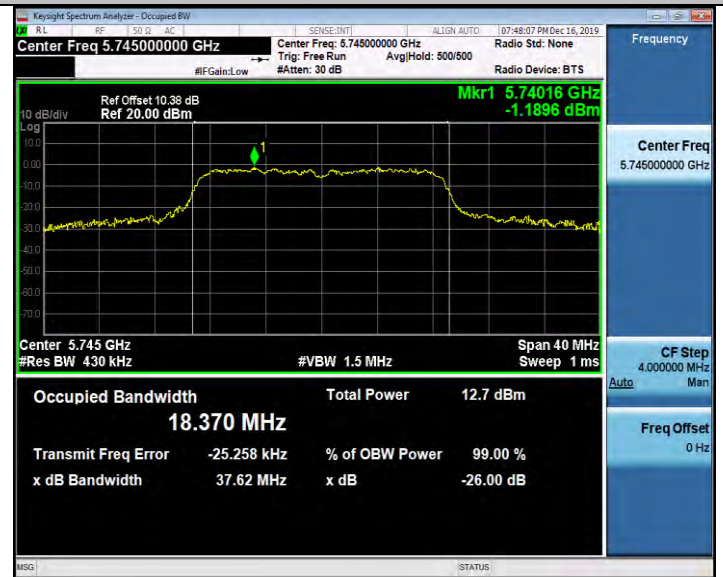
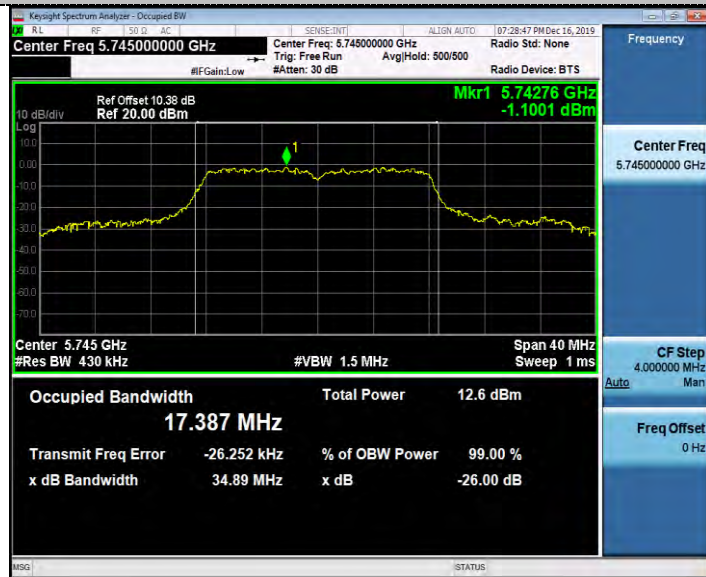
TEST RESULTS

Type	Channel	99%Bandwidth (MHz)	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	17.387	16.560	≥ 500	Pass
	157	17.216	16.560		
	165	17.158	16.560		
802.11nHT20	149	18.370	17.800	≥ 500	Pass
	157	18.161	17.720		
	165	18.039	17.720		
802.11ac20	149	18.327	17.760	≥ 500	Pass
	157	18.090	17.680		
	165	18.058	17.720		
802.11n40	151	37.478	36.560	≥ 500	Pass
	159	37.252	36.560		
802.11ac40	151	37.540	36.560	≥ 500	Pass
	159	37.255	36.560		
802.11ac80	155	76.134	76.320	≥ 500	Pass

99%Bandwidth

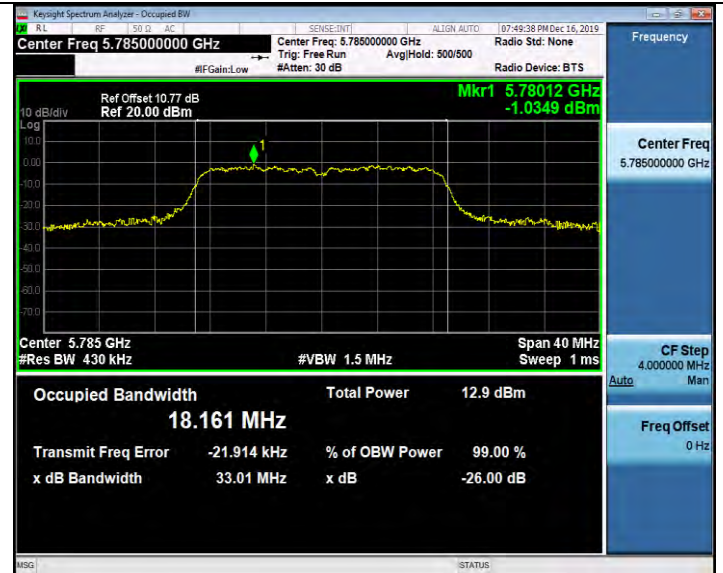
802.11a

802.11n HT20



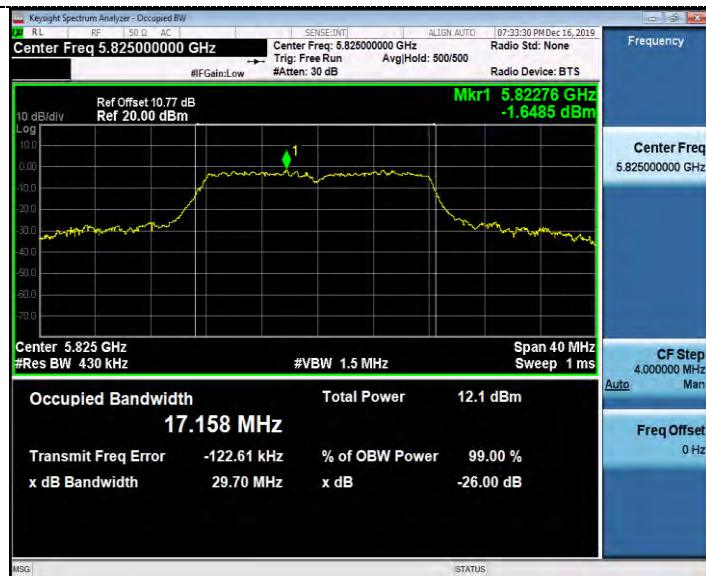
CH149

CH149



CH157

CH157



CH165

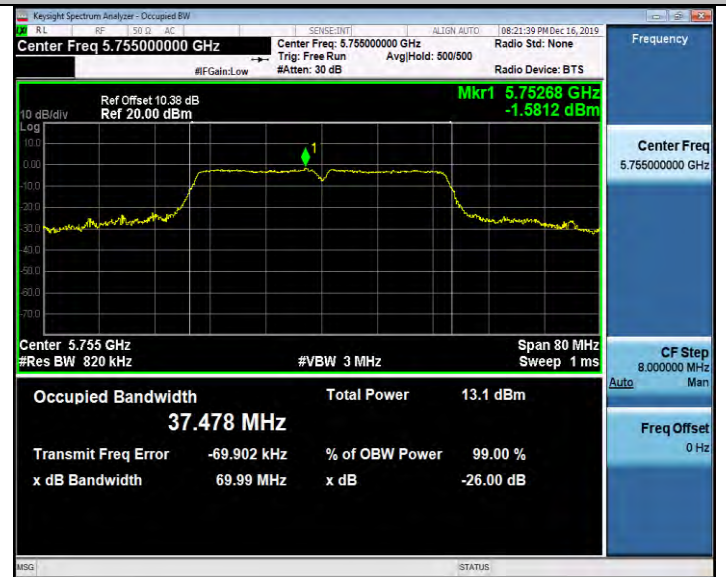
CH165

99%Bandwidth

802.11ac20



802.11n HT40



CH149



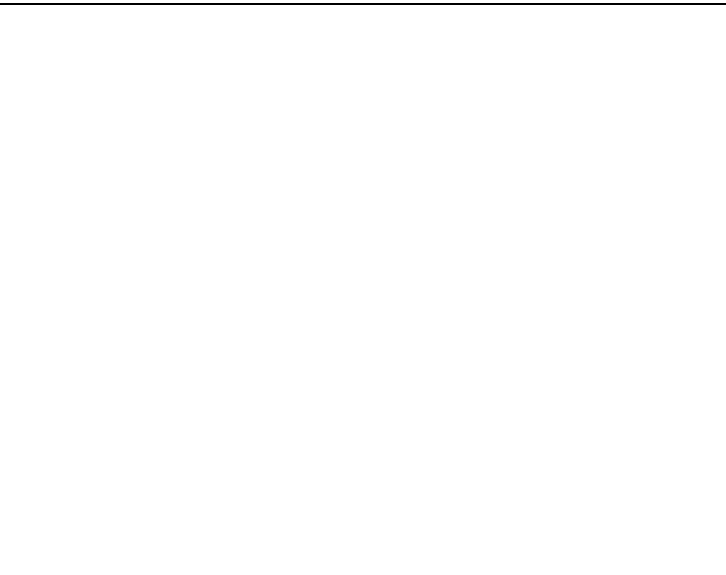
CH151



CH157



CH159



CH165



99%Bandwidth

802.11ac40

802.11ac80



CH151

CH155

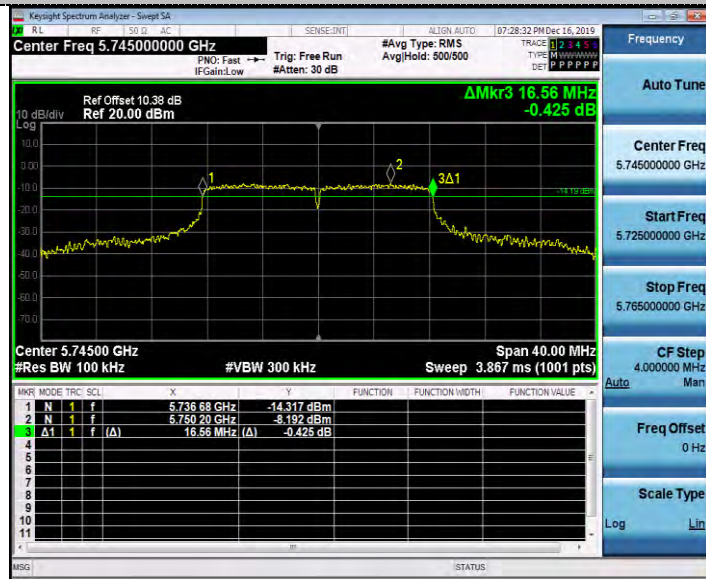


CH159

6dB Bandwidth

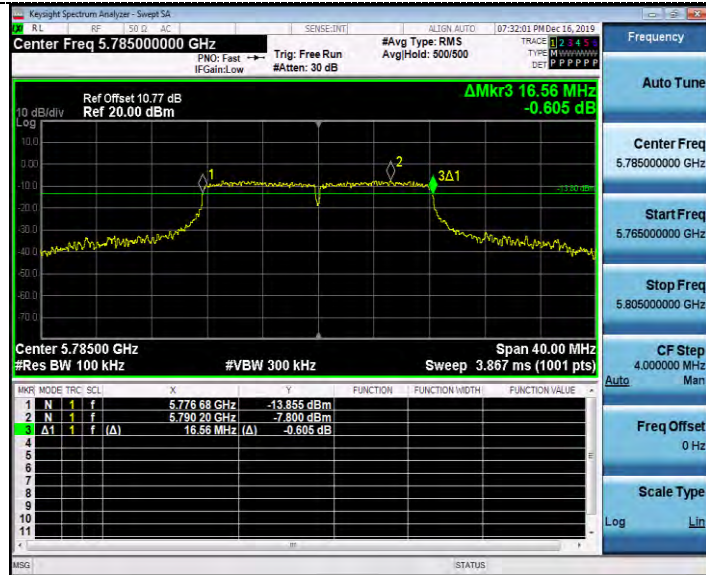
802.11a

802.11n HT20



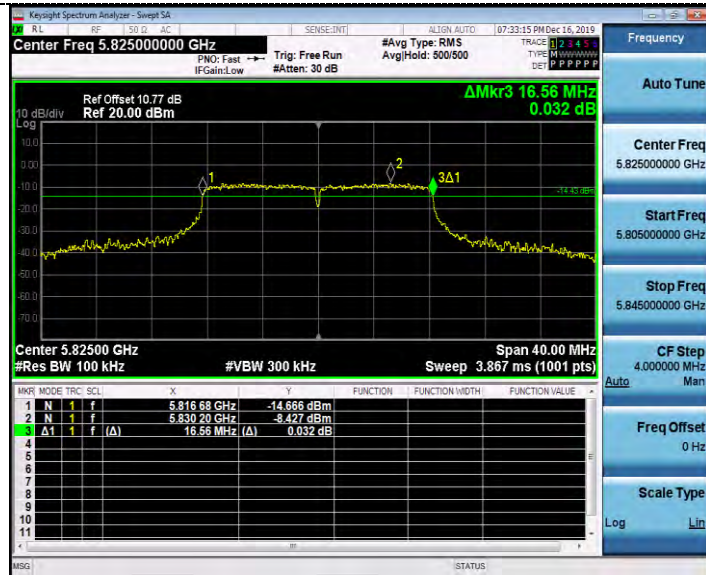
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CH157

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CH165

CH165

6dB Bandwidth

802.11ac20



802.11n HT40



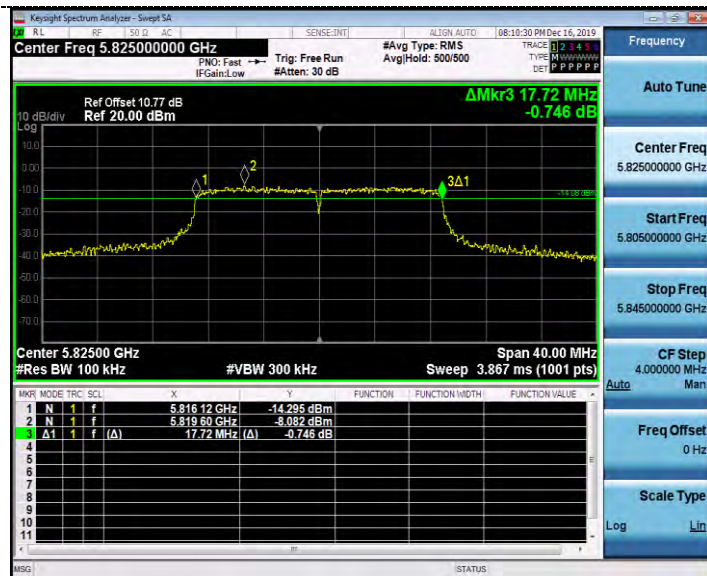
CH149



CH151



CH157



CH159

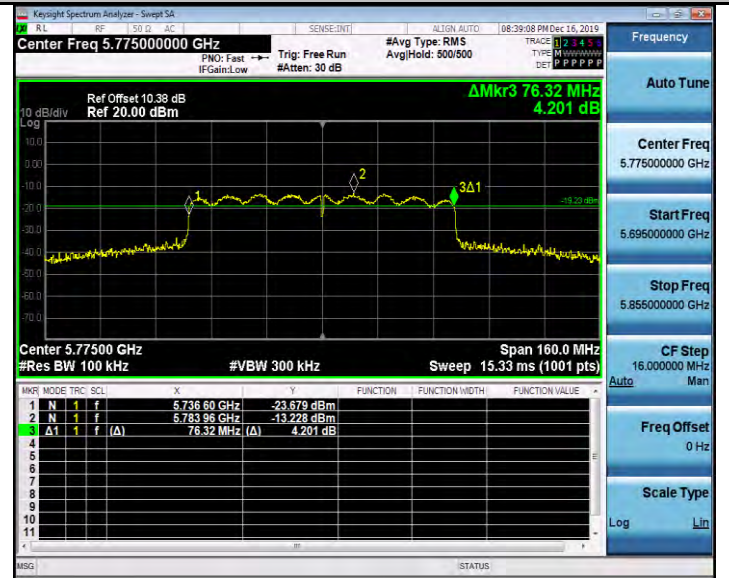
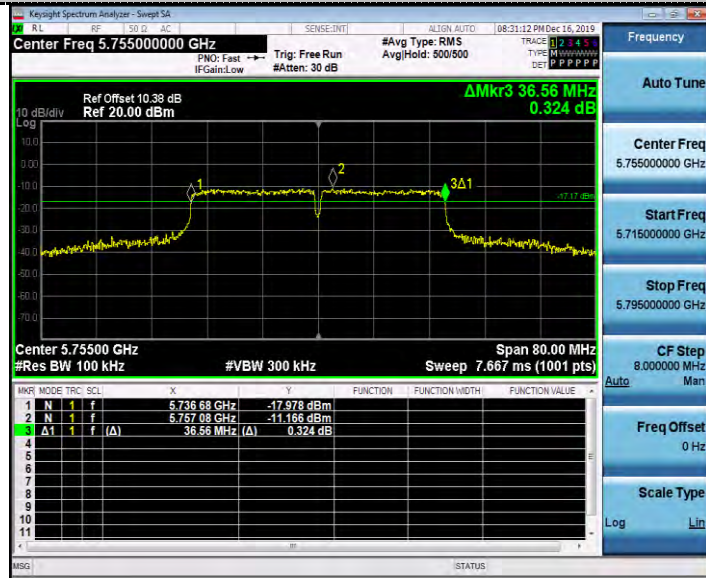


CH165

6dB Bandwidth

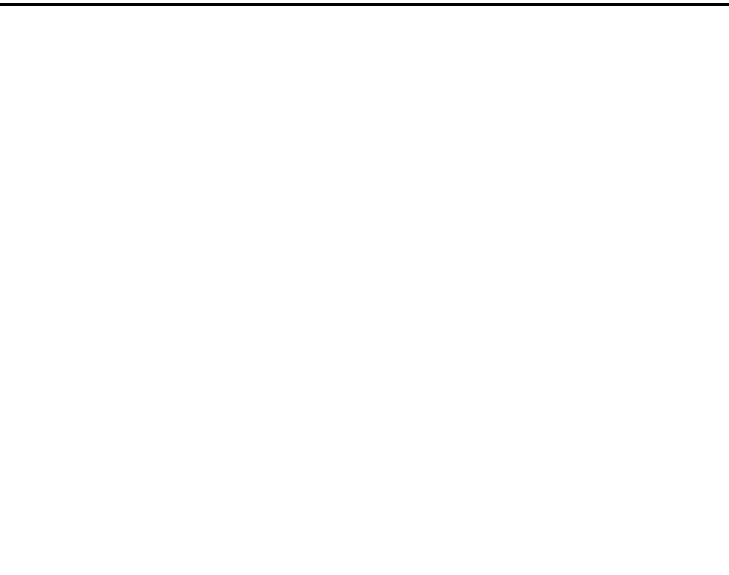
802.11ac40

802.11ac80



CH151

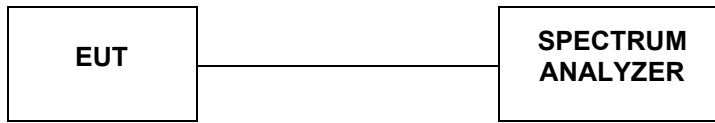
CH155



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 Bandwith

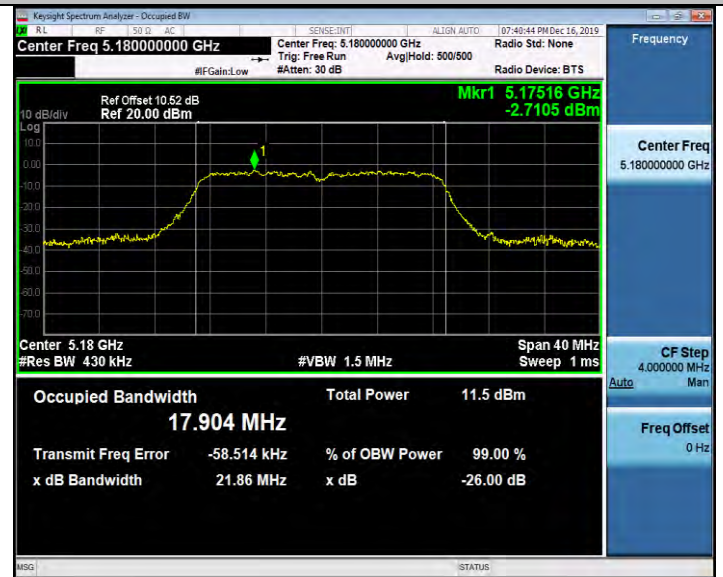
TEST RESULTS

Type	Channel	99%Bandwidth (MHz)	26dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	36	16.965	20.280	-	Pass
	40	16.996	21.000		
	48	16.940	21.160		
802.11nHT20	36	17.904	21.360	-	Pass
	40	17.899	21.440		
	48	17.893	21.280		
802.11ac20	36	17.898	21.400	-	Pass
	40	17.859	21.280		
	48	17.881	21.120		
802.11n40	38	36.998	43.360	-	Pass
	46	37.061	43.120		
802.11ac40	38	36.994	43.280	-	Pass
	46	37.073	43.520		
802.11ac80	155	75.677	83.680	-	Pass

99%Bandwidth

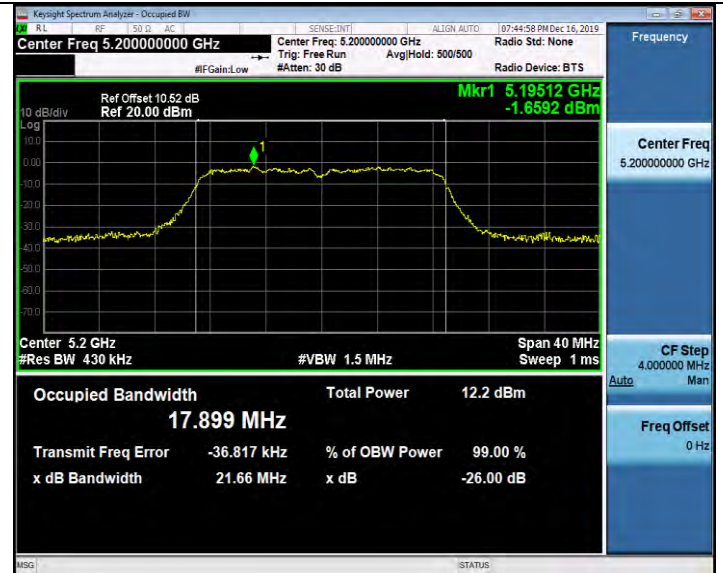
802.11a

802.11n HT20



CH36

CH36



CH40

CH40

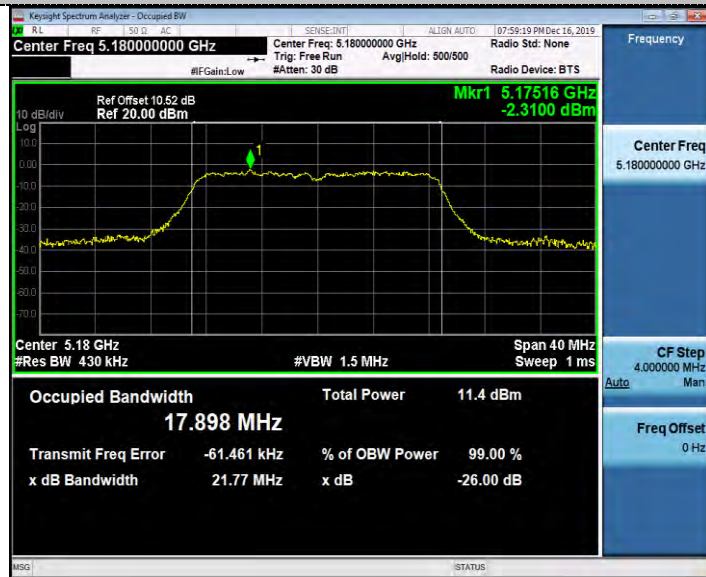


CH48

CH48

99%Bandwidth

802.11ac20



802.11n HT40



CH36



CH38



CH40



CH46



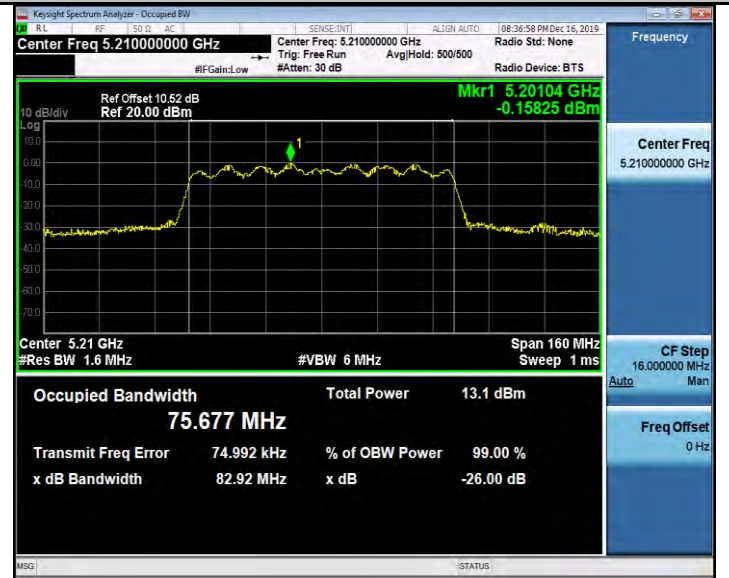
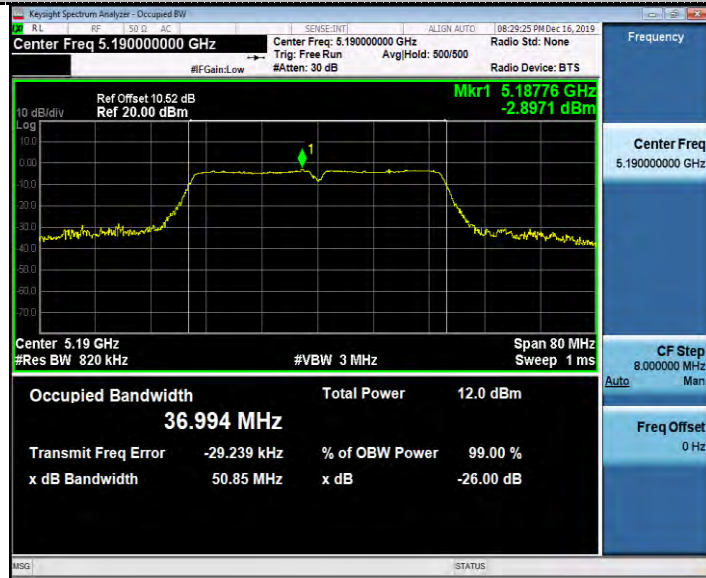
CH48



99%Bandwidth

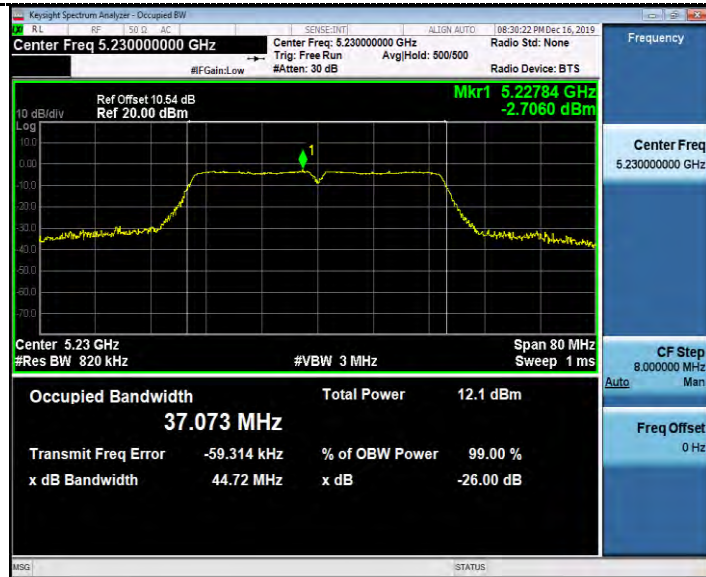
802.11ac40

802.11ac80



CH38

CH42



CH46

26dB Bandwidth

802.11a

802.11n HT20



CH36

CH36



CH40

CH40



CH48

CH48

26dB Bandwidth

802.11ac20



802.11n HT40



CH36



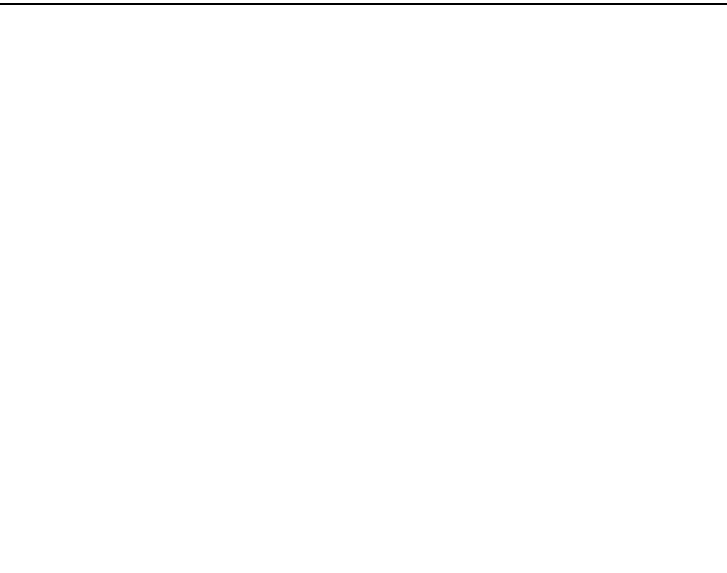
CH38



CH40



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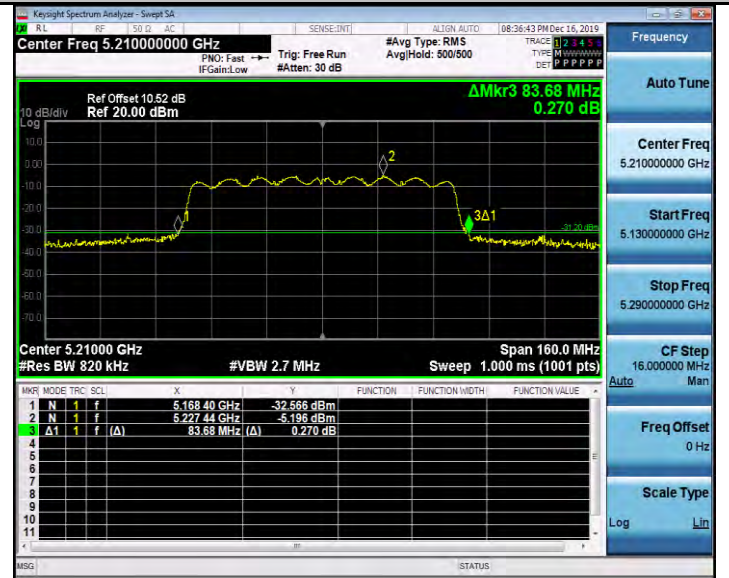


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26dB Bandwidth

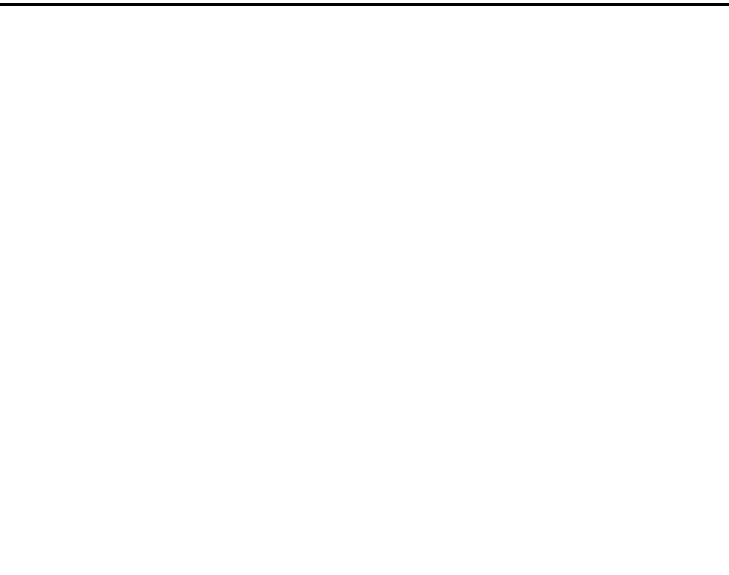
802.11ac40

802.11ac80



CH38

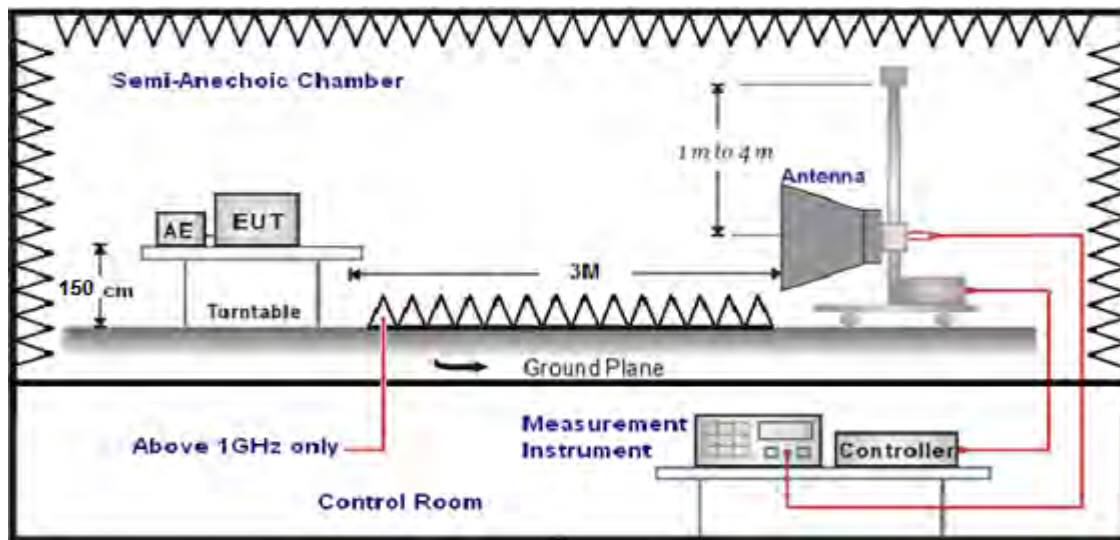
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CH46

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(KHz)
0.49-1.705	3	$20\log(24000/F(\text{KHz})) + 40\log(30/3)$	24000/F(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 802.11 a/802.11 ac/802.11 n mode, recorded worst case at 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
4500.0	35.08	35.58	29.04	8.28	49.90	68.20	-18.30	Peak	Horizontal
4500.0	30.29	35.58	29.04	8.28	45.11	54.00	-8.89	AV	Horizontal
5150.0	39.27	35.58	29.04	8.28	54.09	68.20	-14.11	Peak	Horizontal
5150.0	30.67	35.58	29.04	8.28	45.49	54.00	-8.51	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
5350.0	35.08	35.42	29.06	8.39	49.83	68.20	-18.37	Peak	Horizontal
5350.0	30.36	35.42	29.06	8.39	45.11	54.00	-8.89	AV	Horizontal
5460.0	39.20	35.42	29.06	8.39	53.95	68.20	-14.25	Peak	Horizontal
5460.0	30.67	35.42	29.06	8.39	45.42	54.00	-8.58	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
5650.0	35.14	35.29	29.13	8.65	49.95	68.20	-18.25	Peak	Horizontal
5700.0	30.22	35.29	29.13	8.65	45.03	68.20	-23.17	Peak	Horizontal
5720.0	39.29	35.29	29.13	8.65	54.10	68.20	-14.10	Peak	Horizontal
5725.0	30.67	35.29	29.13	8.65	45.48	68.20	-22.72	Peak	Horizontal

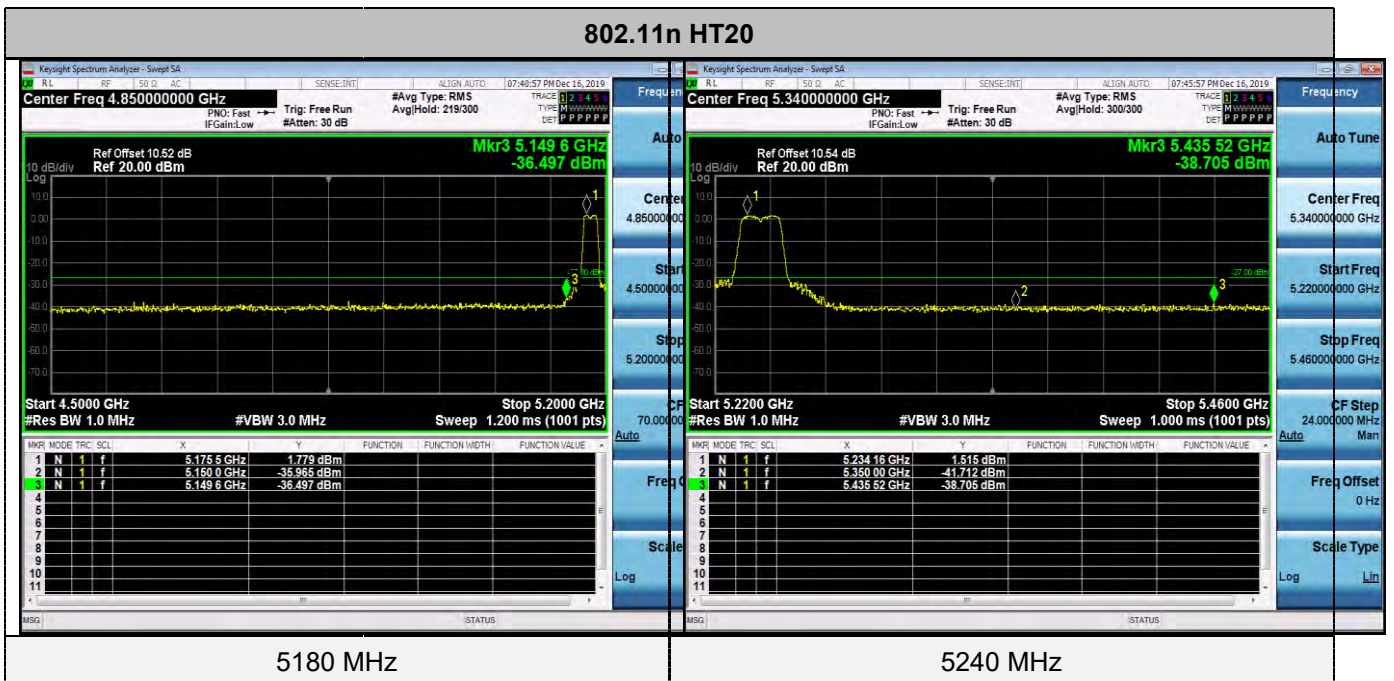
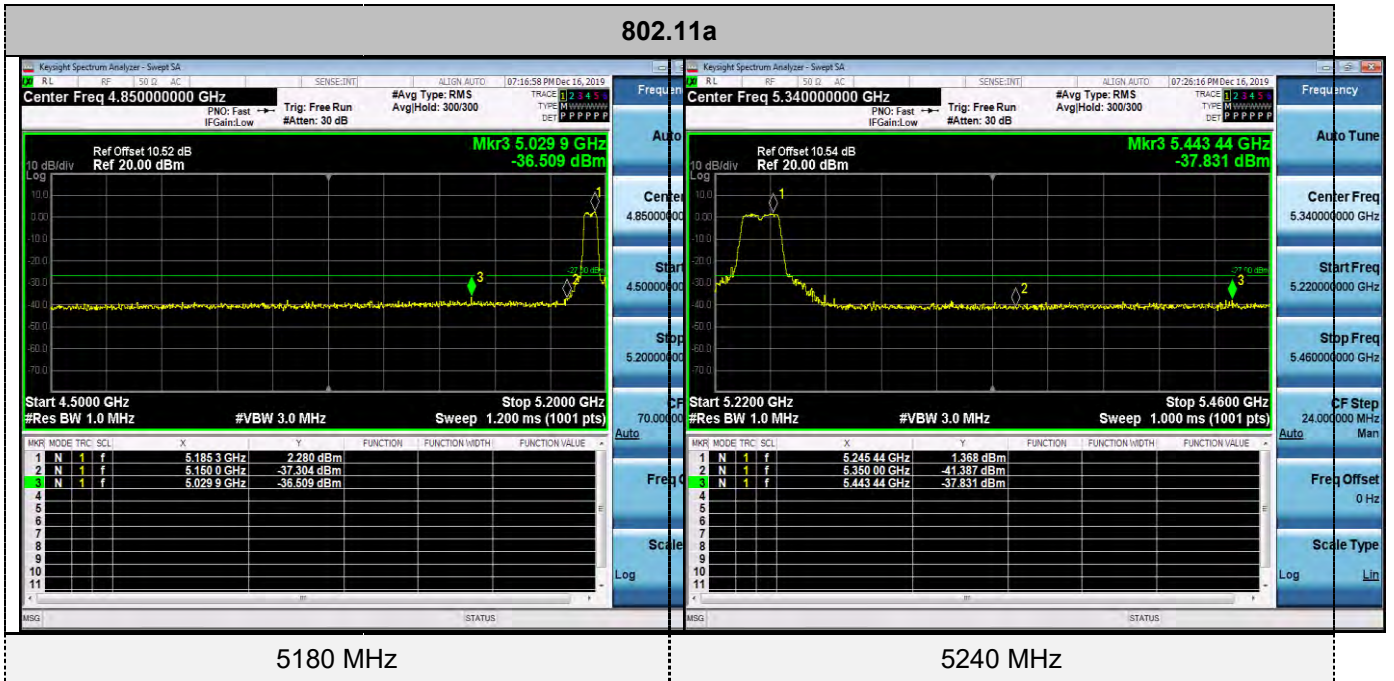
802.11 a/ Channel 165 :5825 MHz									
Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Margin (dB)	Detector	Polarization
5850.0	35.05	35.29	29.18	8.80	49.96	68.20	-18.24	Peak	Horizontal
5855.0	30.32	35.29	29.18	8.80	45.23	68.20	-22.97	Peak	Horizontal
5875.0	39.08	35.29	29.18	8.80	53.99	68.20	-14.21	Peak	Horizontal
5925.0	30.75	35.29	29.18	8.80	45.66	68.20	-22.54	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

5150-5250MHz:



802.11ac20



5180 MHz

5240 MHz

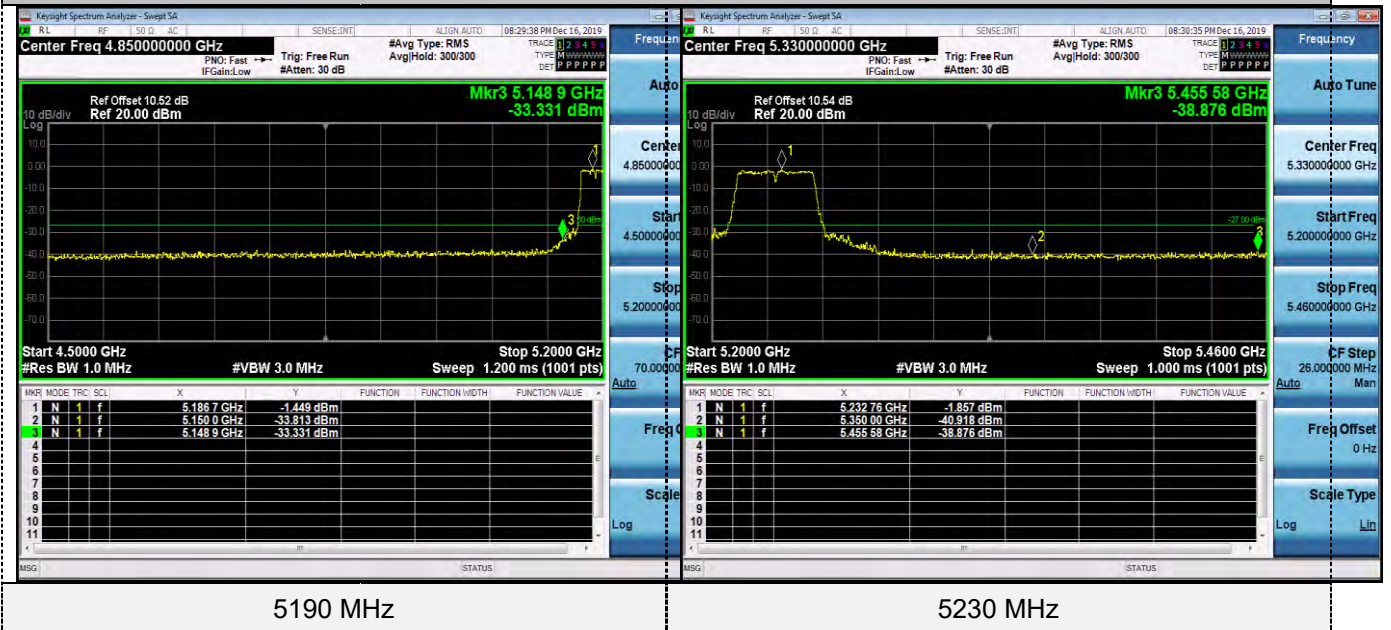
802.11n HT40



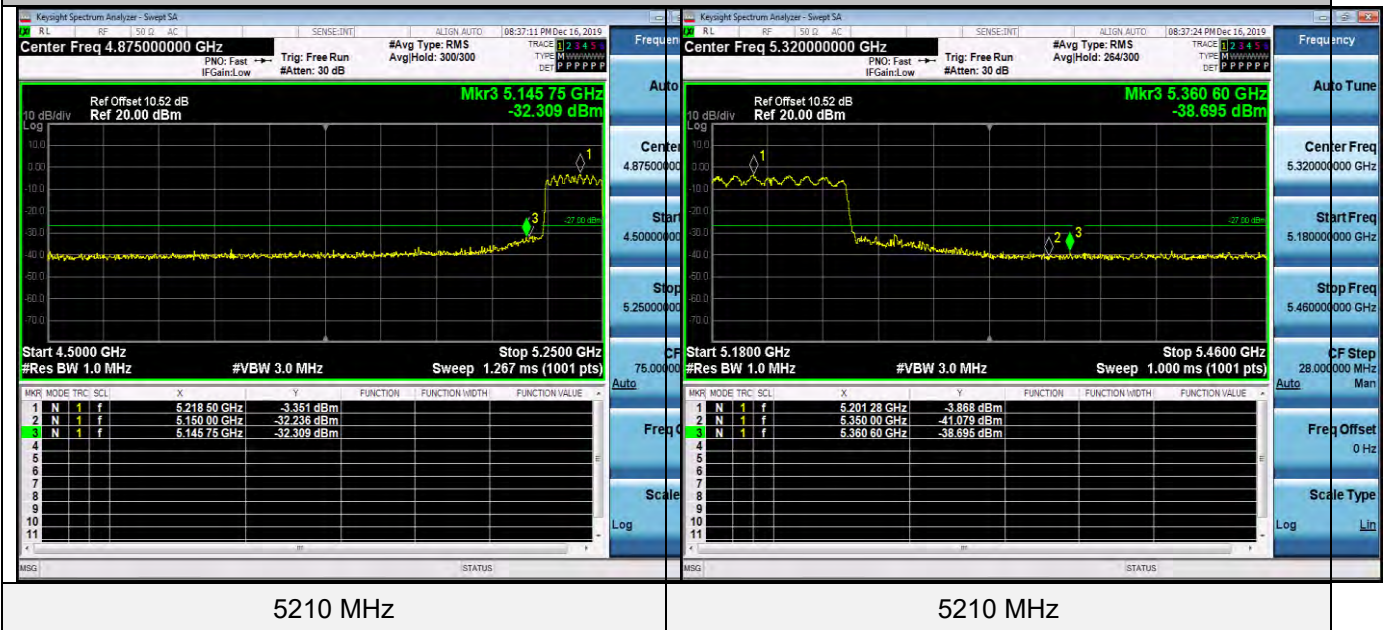
5190 MHz

5230 MHz

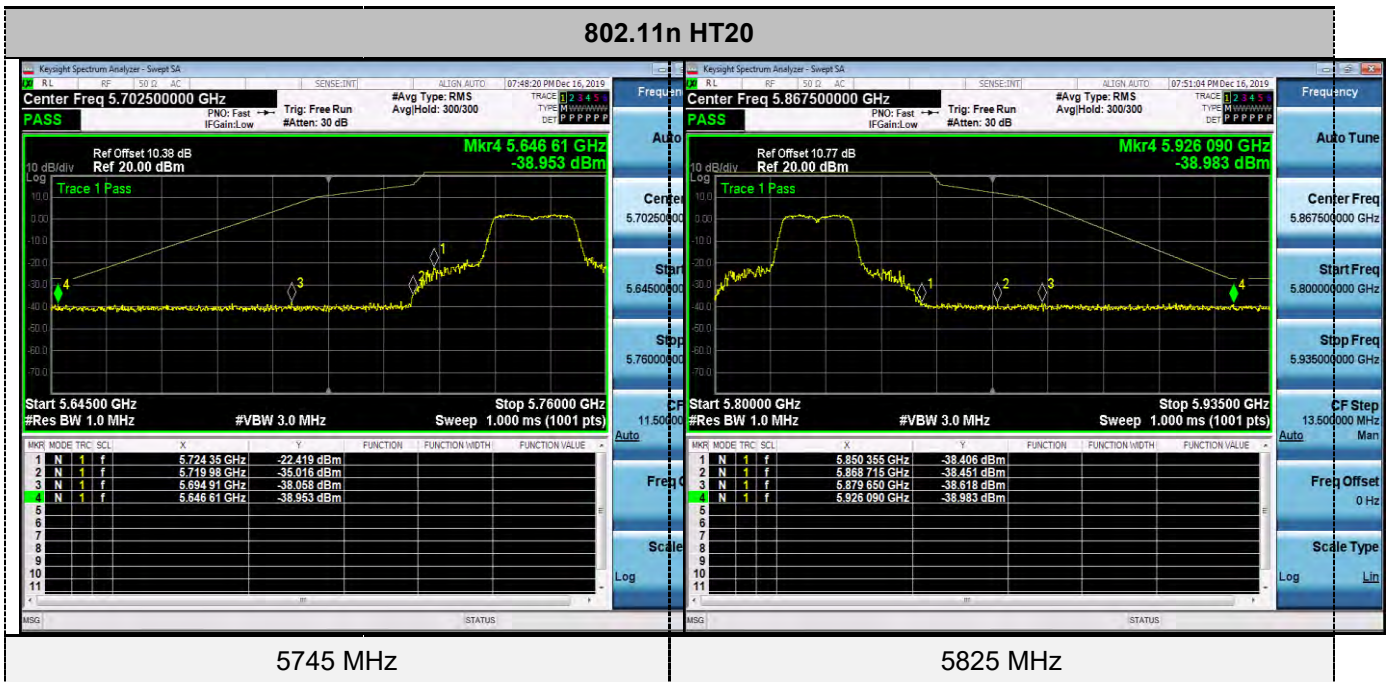
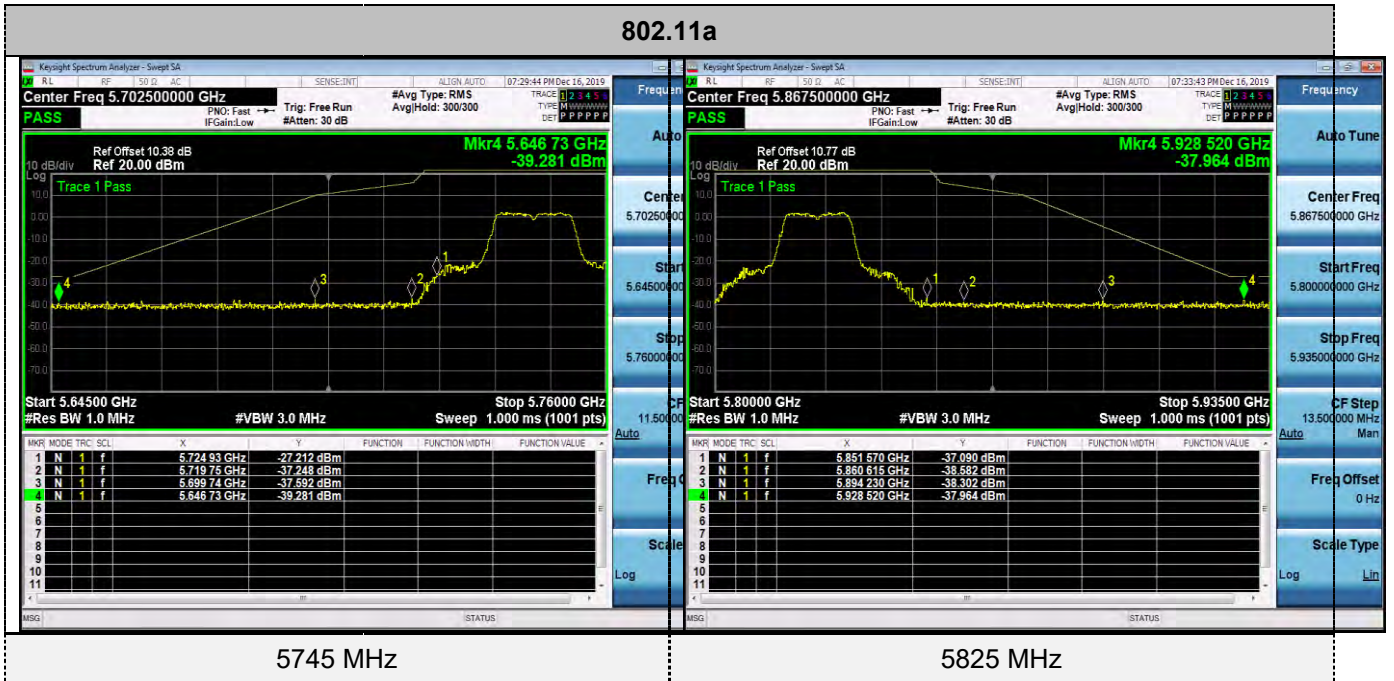
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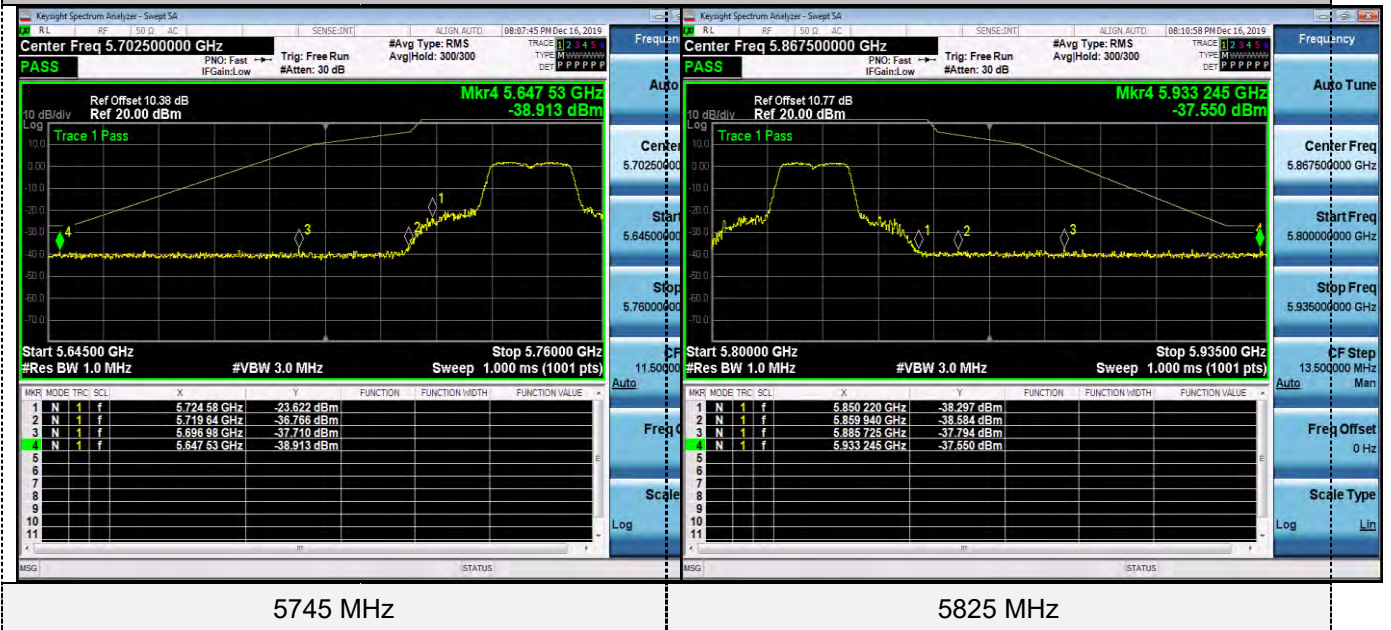
802.11ac80



5725-5850MHz:



802.11ac20



5745 MHz

5825 MHz

802.11n HT40



5755 MHz

5795 MHz

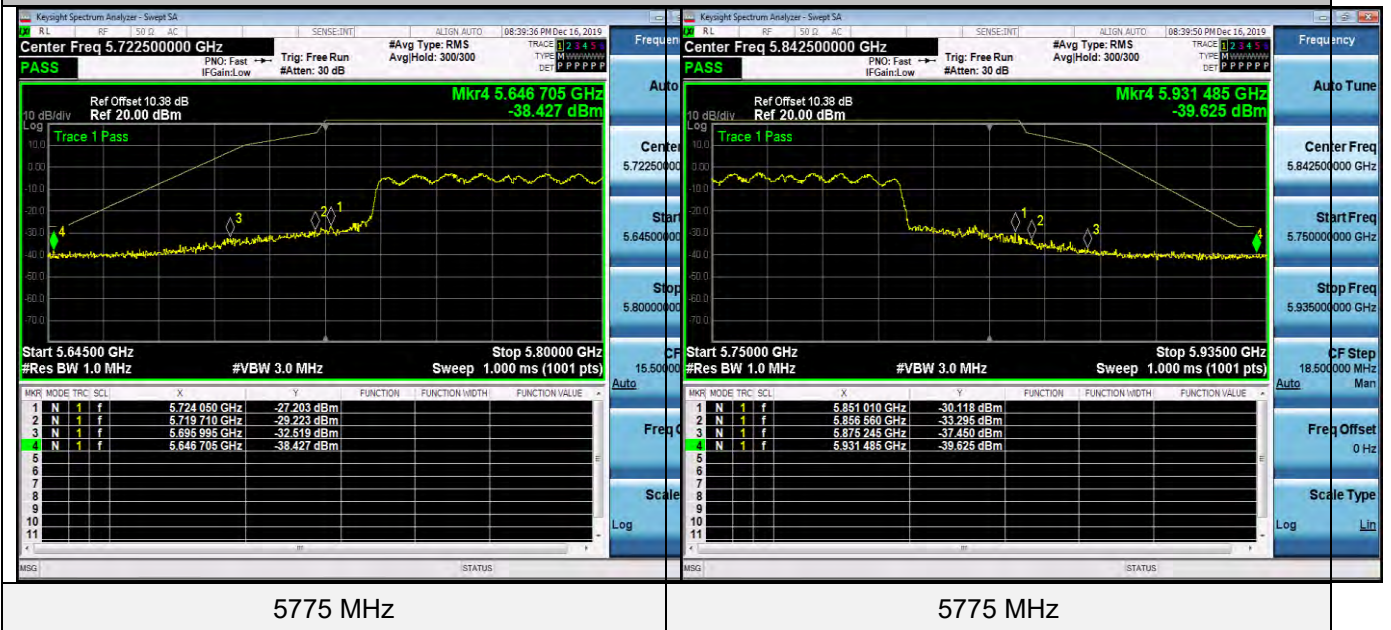
802.11ac40



5755 MHz

5795 MHz

802.11ac80



5775 MHz

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 External Antenna, through the buckle stretched out, The directional gains of antenna used for transmitting is 2.0Bi.

Reference to the test report No. **GTS20191209006-2-22**

5. TEST SETUP PHOTOS OF THE EUT

Reference to the TEST SETUP PHOTOS

6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Reference to the EXTERNAL AND INTERNAL PHOTOS

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