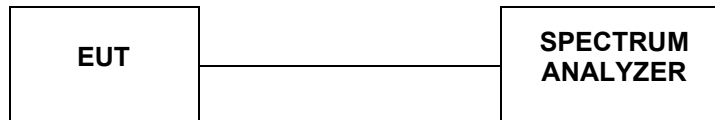


4.6. 6dB Bandwidth

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:

- 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

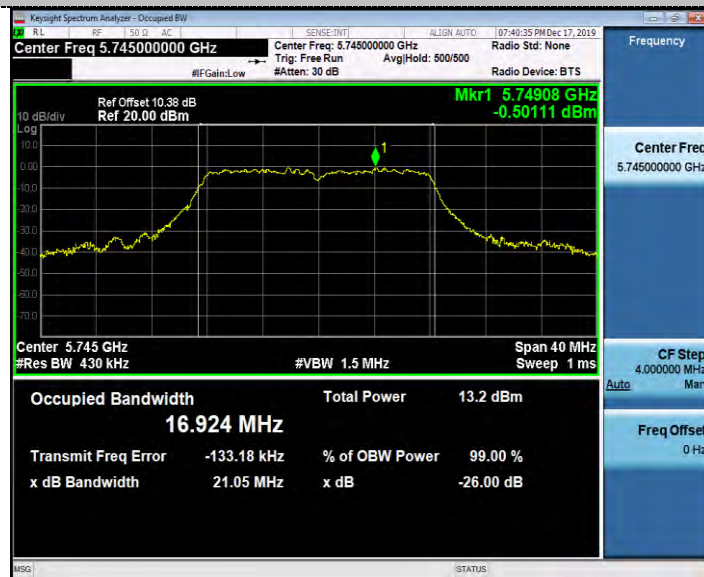
For Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz

TEST RESULTS

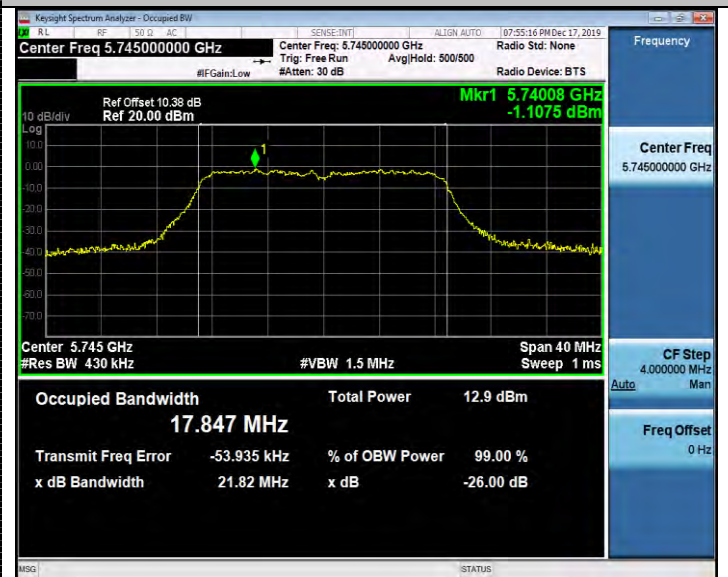
Type	Channel	99%Bandwidth (MHz)	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	16.924	16.560	≥ 500	Pass
	157	16.918	16.640		
	165	16.869	16.600		
802.11nHT20	149	17.847	17.680	≥ 500	Pass
	157	17.827	17.720		
	165	17.817	17.680		
802.11ac20	149	17.830	17.720	≥ 500	Pass
	157	17.834	17.680		
	165	17.800	17.680		
802.11n40	151	36.841	36.560	≥ 500	Pass
	159	36.816	36.560		
802.11ac40	151	36.894	36.560	≥ 500	Pass
	159	36.845	36.560		
802.11ac80	155	75.505	76.320	≥ 500	Pass

99%Bandwidth

802.11a



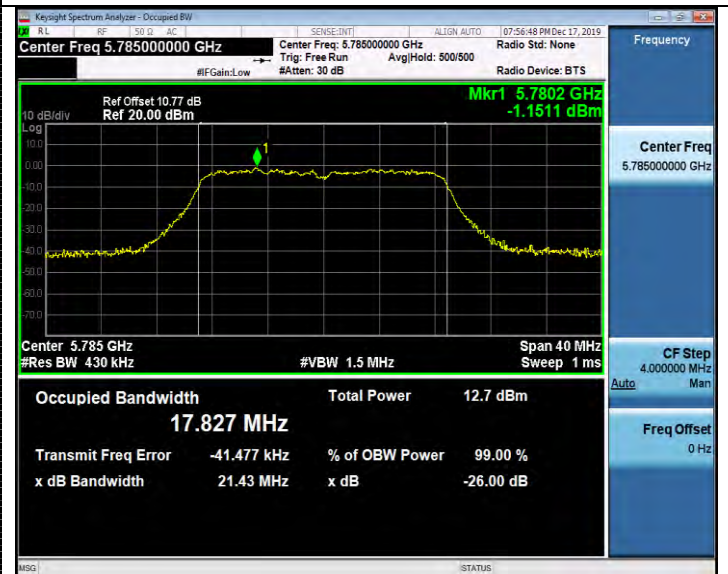
802.11n HT20



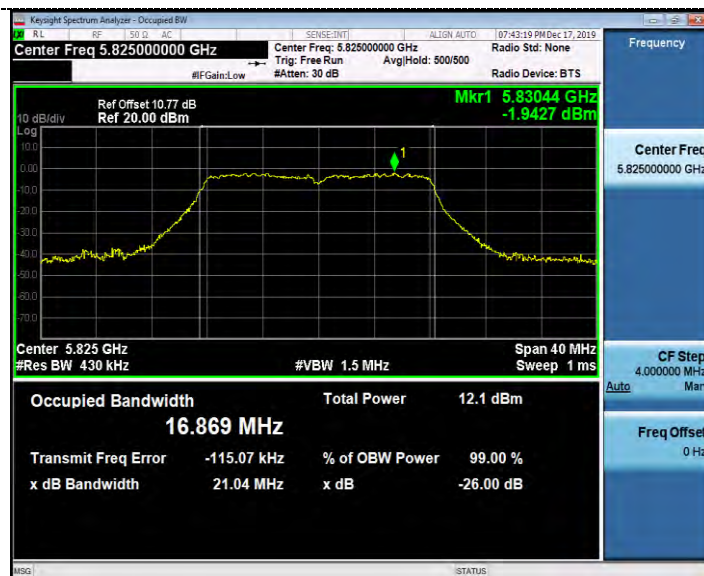
CH149



CH149



CH157



CH157

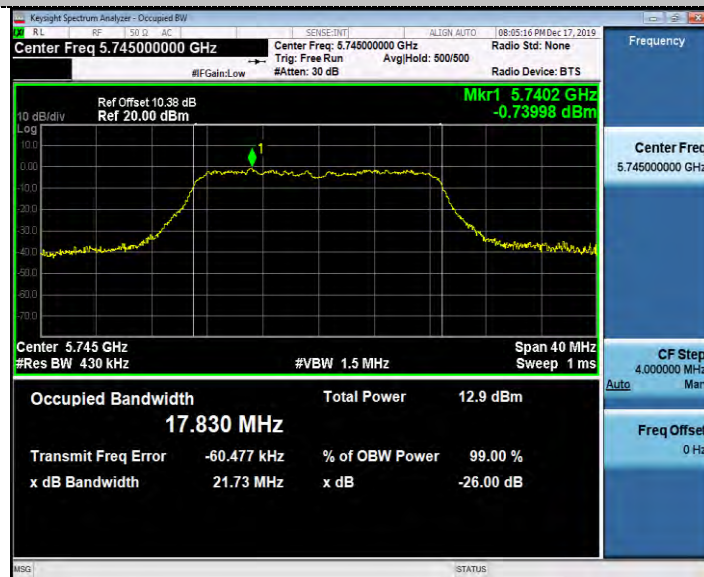


CH165

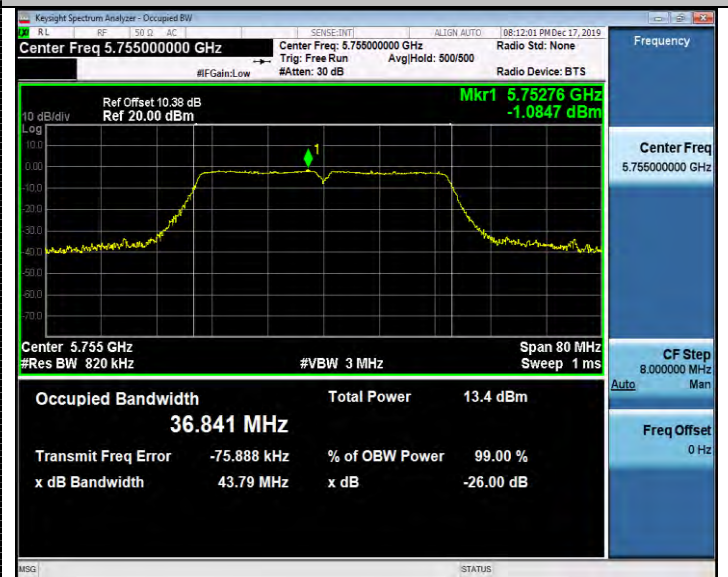
CH165

99%Bandwidth

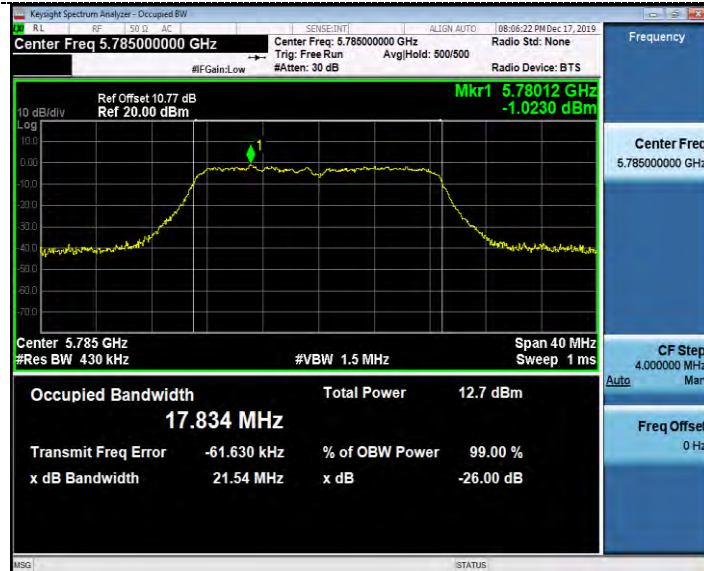
802.11ac20



802.11n HT40



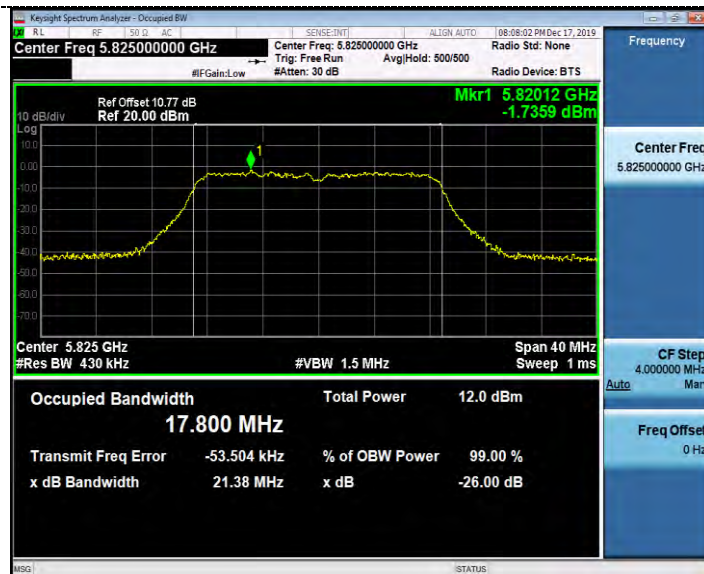
CH149



CH151



CH157



CH159



CH165

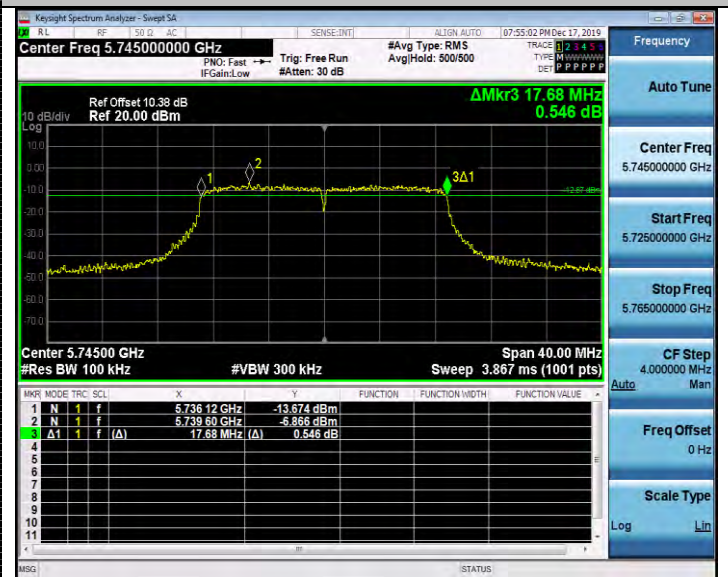


6dB Bandwidth

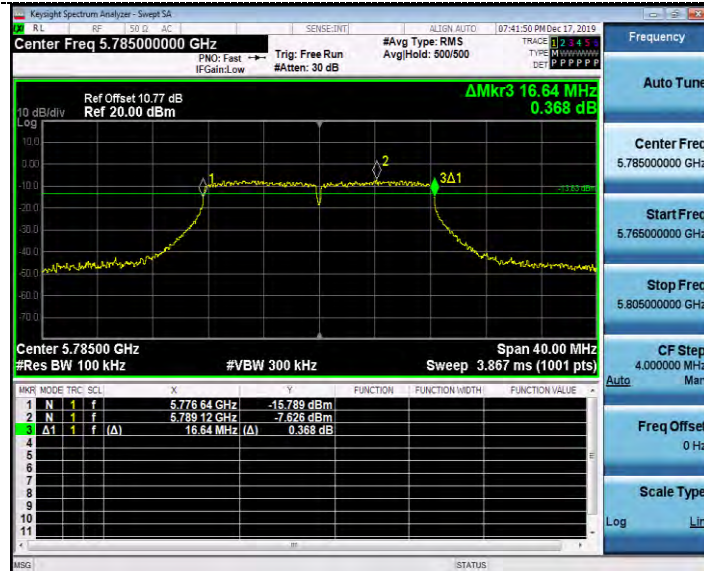
802.11a



802.11n HT20



CH149



CH149



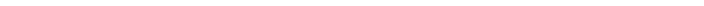
CH157



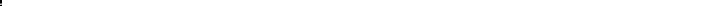
CH157



CH165



CH165

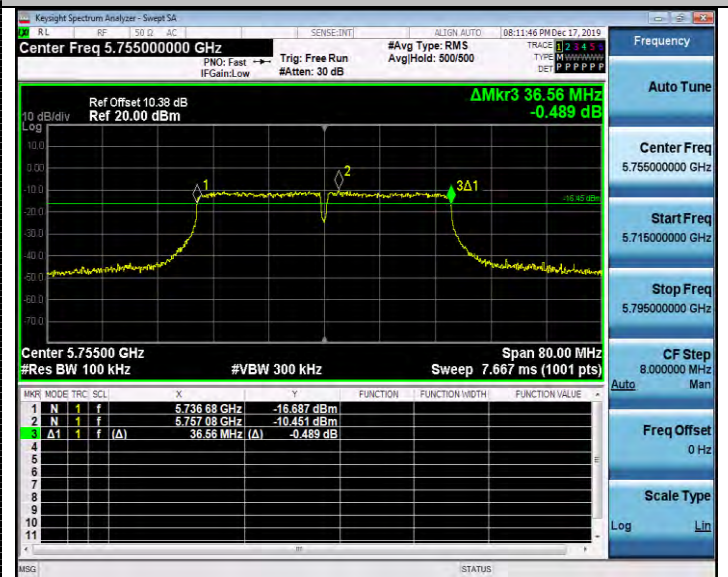


6dB Bandwidth

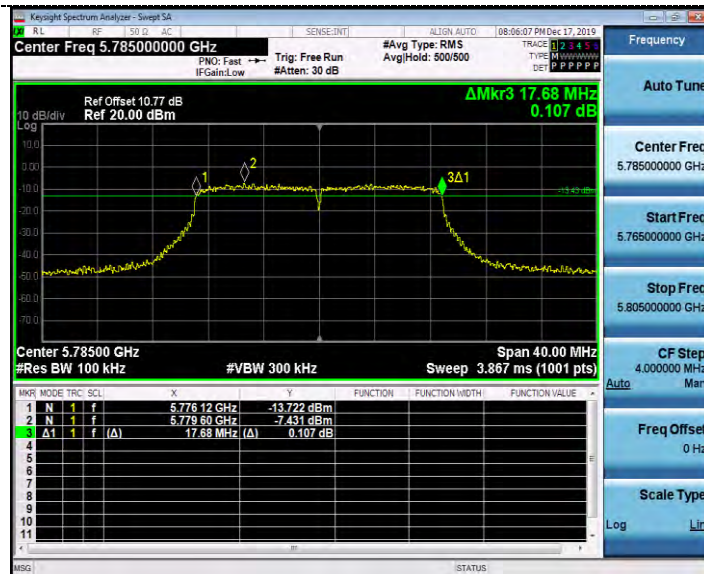
802.11ac20



802.11n HT40



CH149



CH151



CH157



CH159

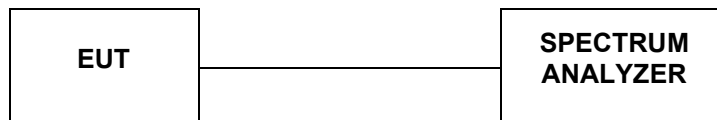


CH165



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:

- Set RBW = 300 kHz (approximately 1% of the emission bandwidth).
- Set the video bandwidth (VBW) = 1000 KHz (VBW > 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

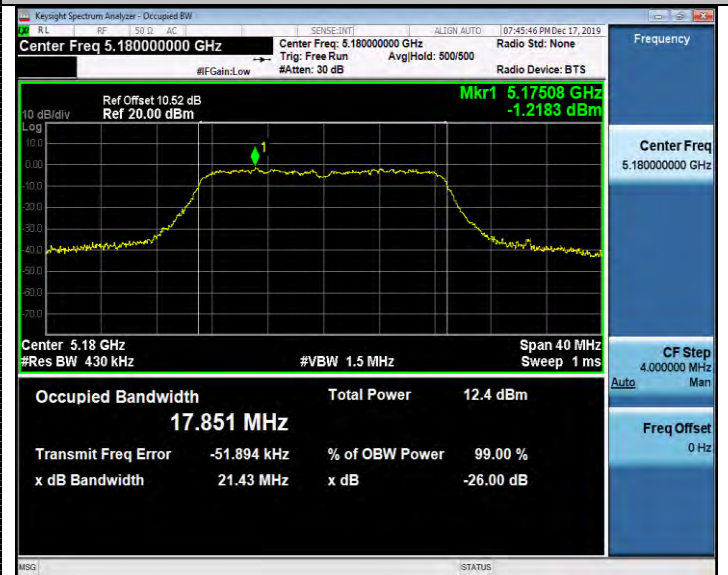
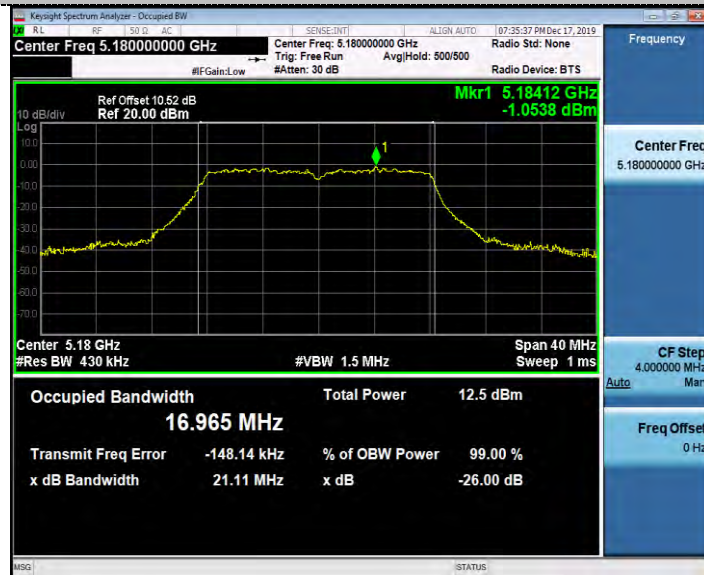
TEST RESULTS

Type	Channel	99%Bandwidth (MHz)	26dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	36	16.965	20.280	-	Pass
	40	16.948	20.120		
	48	16.822	20.120		
802.11nHT20	36	17.851	20.920	-	Pass
	40	17.850	21.160		
	48	17.831	21.080		
802.11ac20	36	17.812	20.920	-	Pass
	40	17.845	21.120		
	48	17.818	21.080		
802.11n40	38	36.889	42.960	-	Pass
	46	36.935	42.880		
802.11ac40	38	36.926	43.120	-	Pass
	46	36.966	43.360		
802.11ac80	155	75.502	83.360	-	Pass

99%Bandwidth

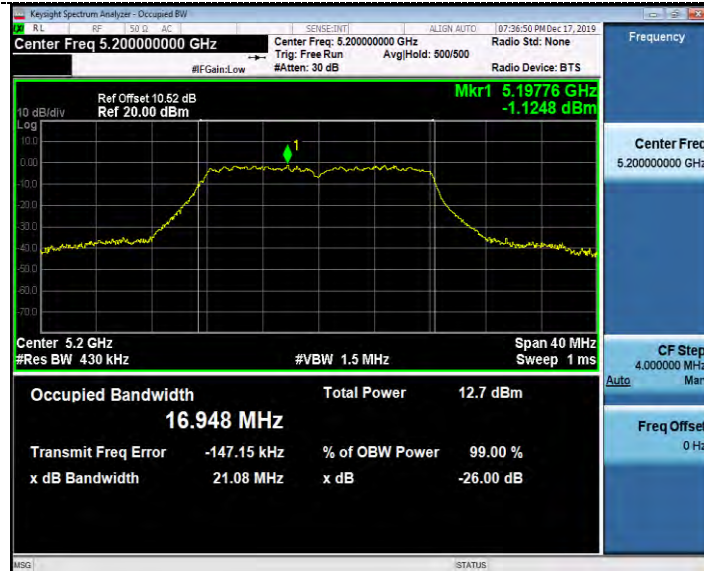
802.11a

802.11n HT20



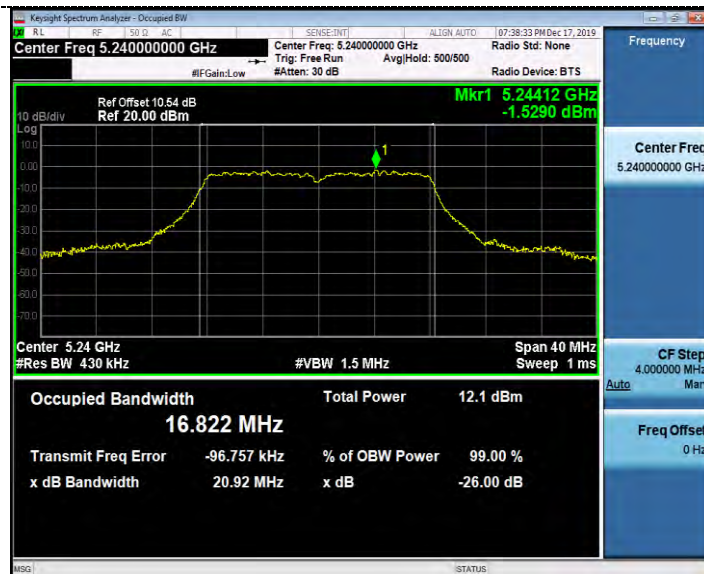
CH36

CH36



CH40

CH40

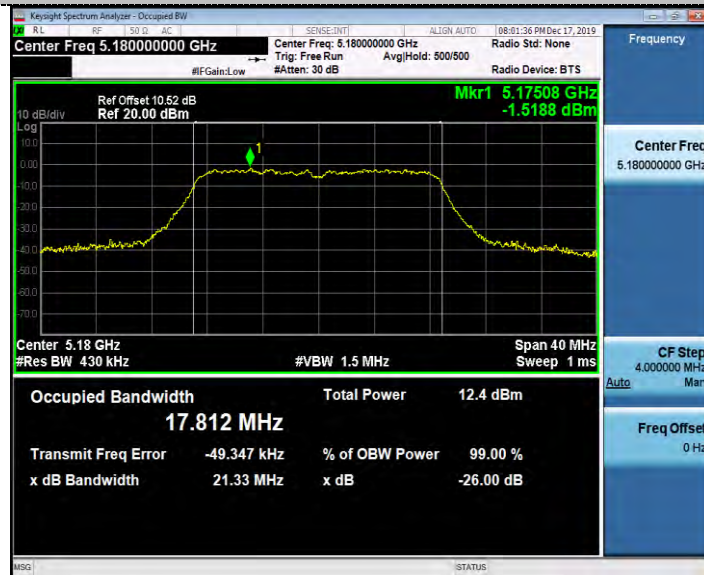


CH48

CH48

99%Bandwidth

802.11ac20



802.11n HT40



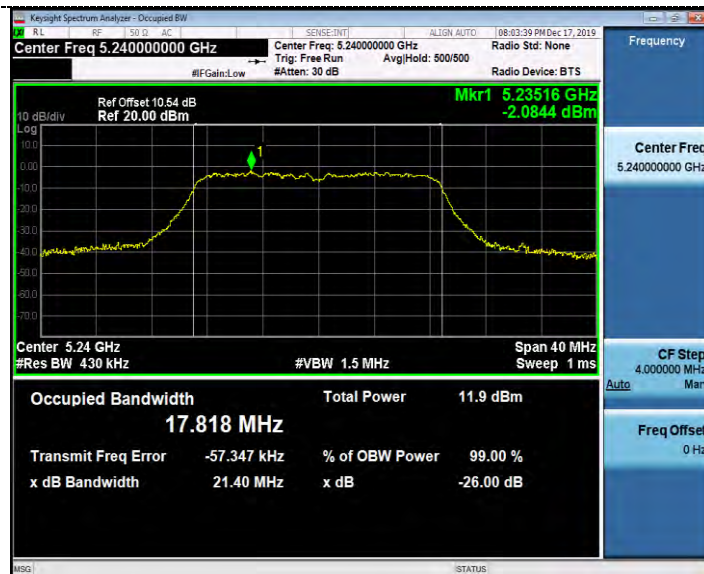
CH36



CH38



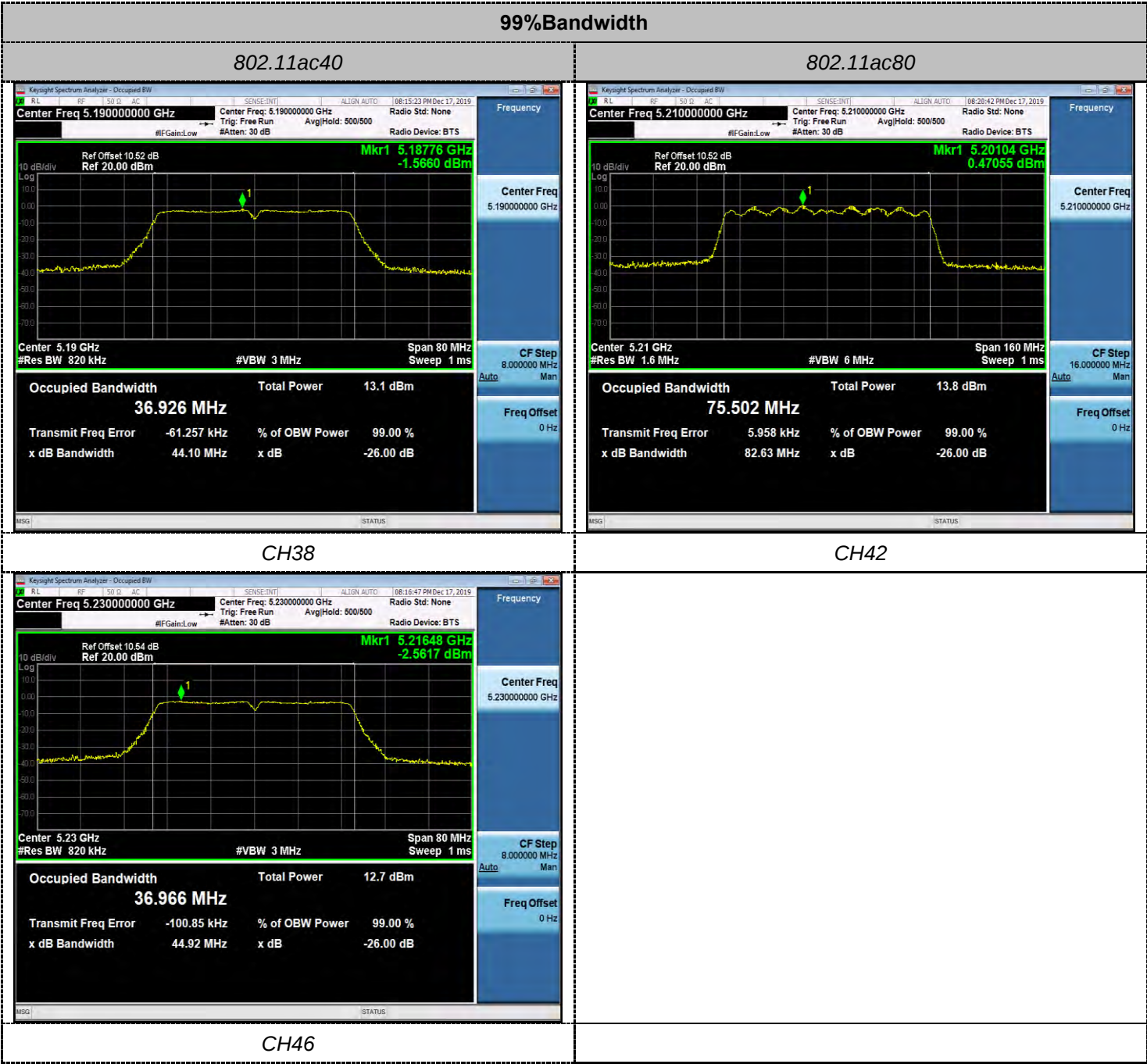
CH40



CH46



CH48



CH46

KeySight Spectrum Analyzer - Occupied BW

Center Freq 5.230000000 GHz

Center Freq: 5.230000000 GHz

Trig: Free Run

Avg/Hold: 500/500

Radio Std: None

Radio Device: BTS

Ref Offset 10.54 dB

Ref 20.00 dBm

Mkr1 5.21648 GHz

-2.5617 dBm

Center Freq 5.23 GHz

#Res BW 820 kHz

#VBW 3 MHz

Span 80 MHz

Sweep 1 ms

Occupied Bandwidth 36.966 MHz

Total Power 12.7 dBm

Transmit Freq Error -100.85 kHz

% of OBW Power 99.00 %

x dB Bandwidth 44.92 MHz

x dB -26.00 dB

Frequency

Center Freq 5.230000000 GHz

CF Step 8.0000000 MHz

Auto

Man

Freq Offset 0 Hz

MSG

STATUS

26dB Bandwidth

802.11a

802.11n HT20



CH36

CH36



CH40

CH40



CH48

CH48

26dB Bandwidth

802.11ac20



802.11n HT40



CH36



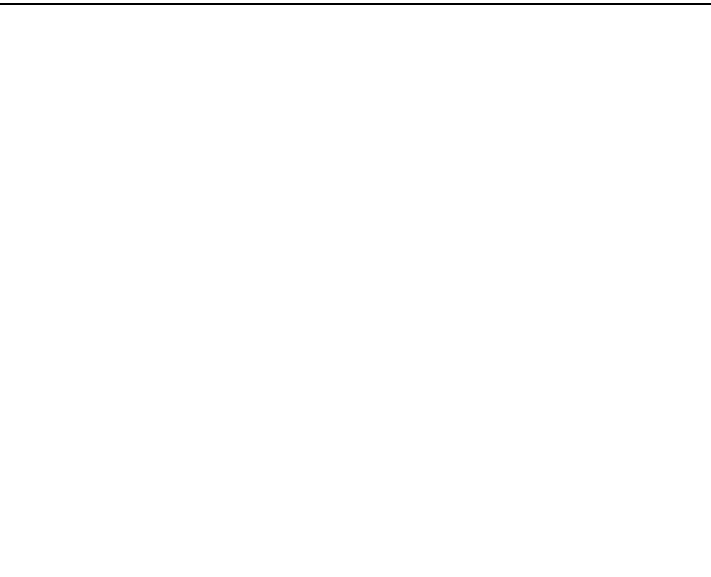
CH38



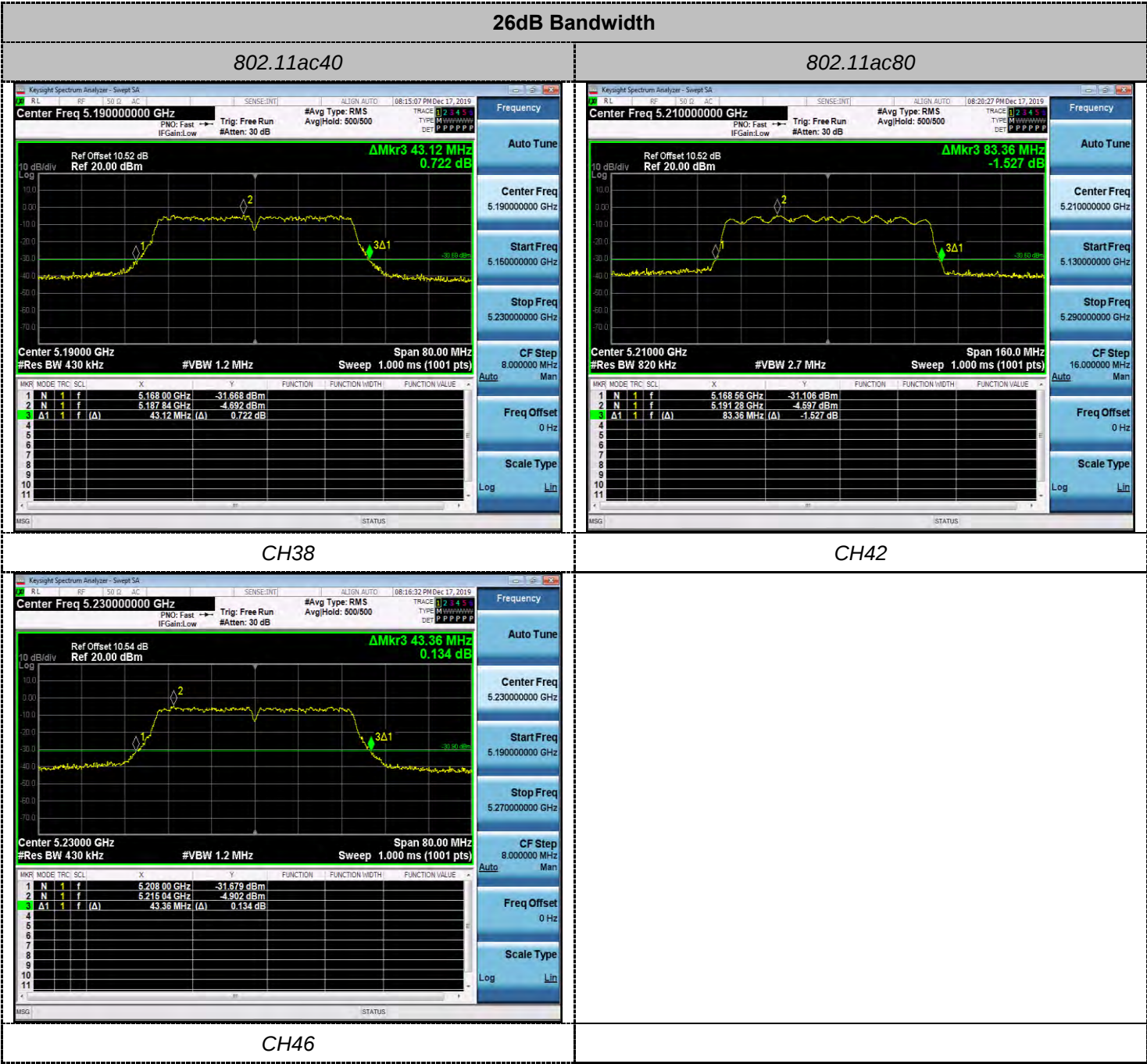
CH40



CH46

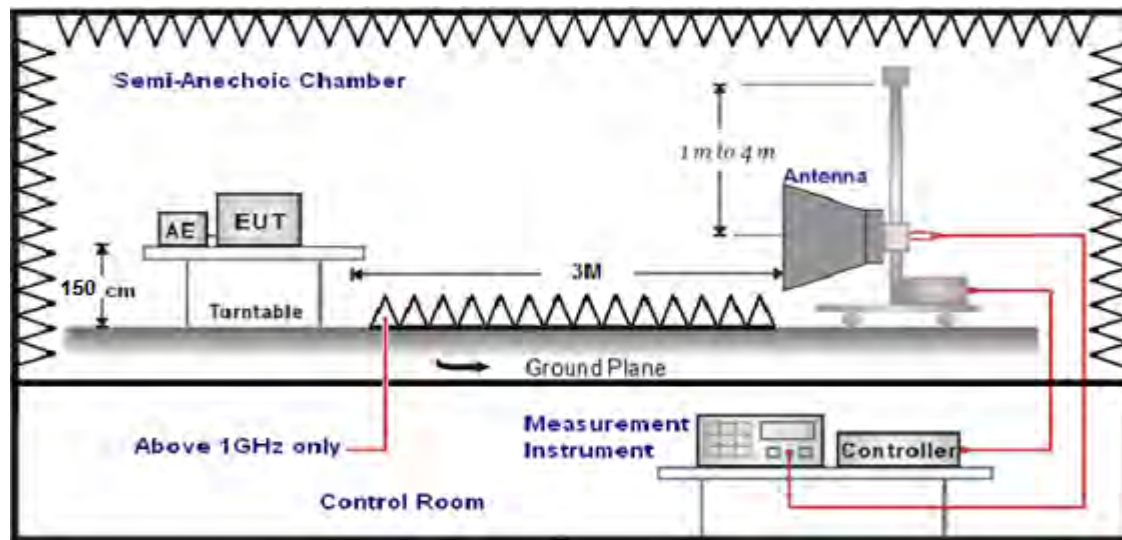


CH48



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 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	35.26	35.58	29.04	8.28	50.08	68.20	-18.12	Peak	Horizontal
4500.0	30.38	35.58	29.04	8.28	45.20	54.00	-8.80	AV	Horizontal
5150.0	39.00	35.58	29.04	8.28	53.82	68.20	-14.38	Peak	Horizontal
5150.0	30.69	35.58	29.04	8.28	45.51	54.00	-8.49	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	35.14	35.42	29.06	8.39	49.89	68.20	-18.31	Peak	Horizontal
5350.0	30.18	35.42	29.06	8.39	44.93	54.00	-9.07	AV	Horizontal
5460.0	39.21	35.42	29.06	8.39	53.96	68.20	-14.24	Peak	Horizontal
5460.0	30.70	35.42	29.06	8.39	45.45	54.00	-8.55	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	35.12	35.29	29.13	8.65	49.93	68.20	-18.27	Peak	Horizontal
5700.0	30.14	35.29	29.13	8.65	44.95	68.20	-23.25	Peak	Horizontal
5720.0	39.17	35.29	29.13	8.65	53.98	68.20	-14.22	Peak	Horizontal
5725.0	30.72	35.29	29.13	8.65	45.53	68.20	-22.67	Peak	Horizontal

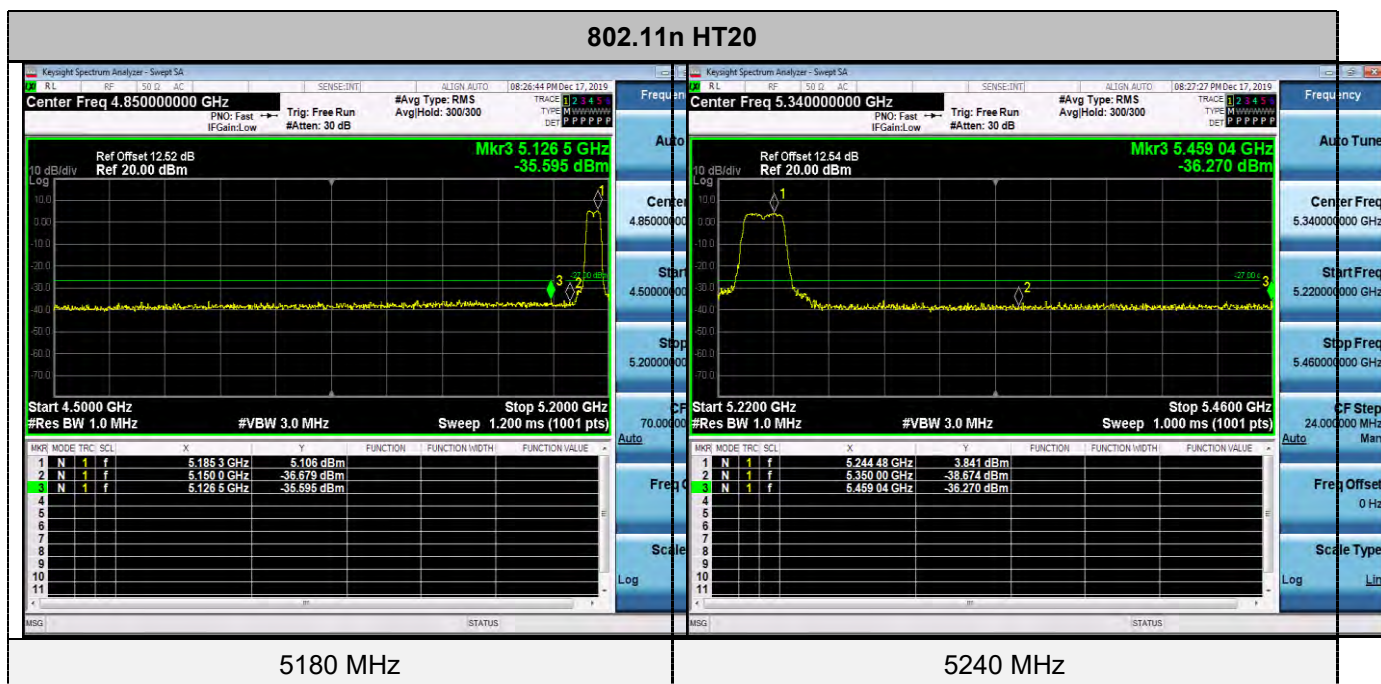
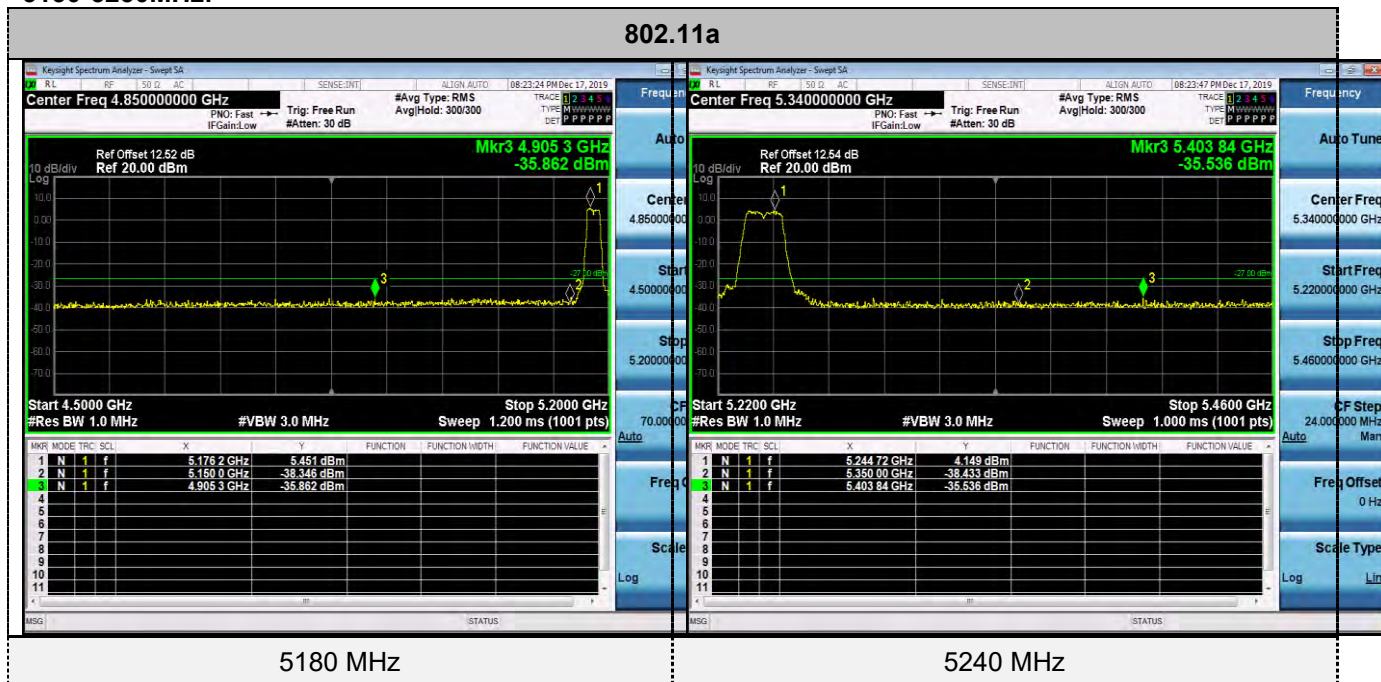
802.11 a/ Channel 165 :5825 MHz									
Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Margin (dB)	Detector	Polarization
5850.0	35.19	35.29	29.18	8.80	50.10	68.20	-18.10	Peak	Horizontal
5855.0	30.23	35.29	29.18	8.80	45.14	68.20	-23.06	Peak	Horizontal
5875.0	39.11	35.29	29.18	8.80	54.02	68.20	-14.18	Peak	Horizontal
5925.0	30.74	35.29	29.18	8.80	45.65	68.20	-22.55	Peak	Horizontal

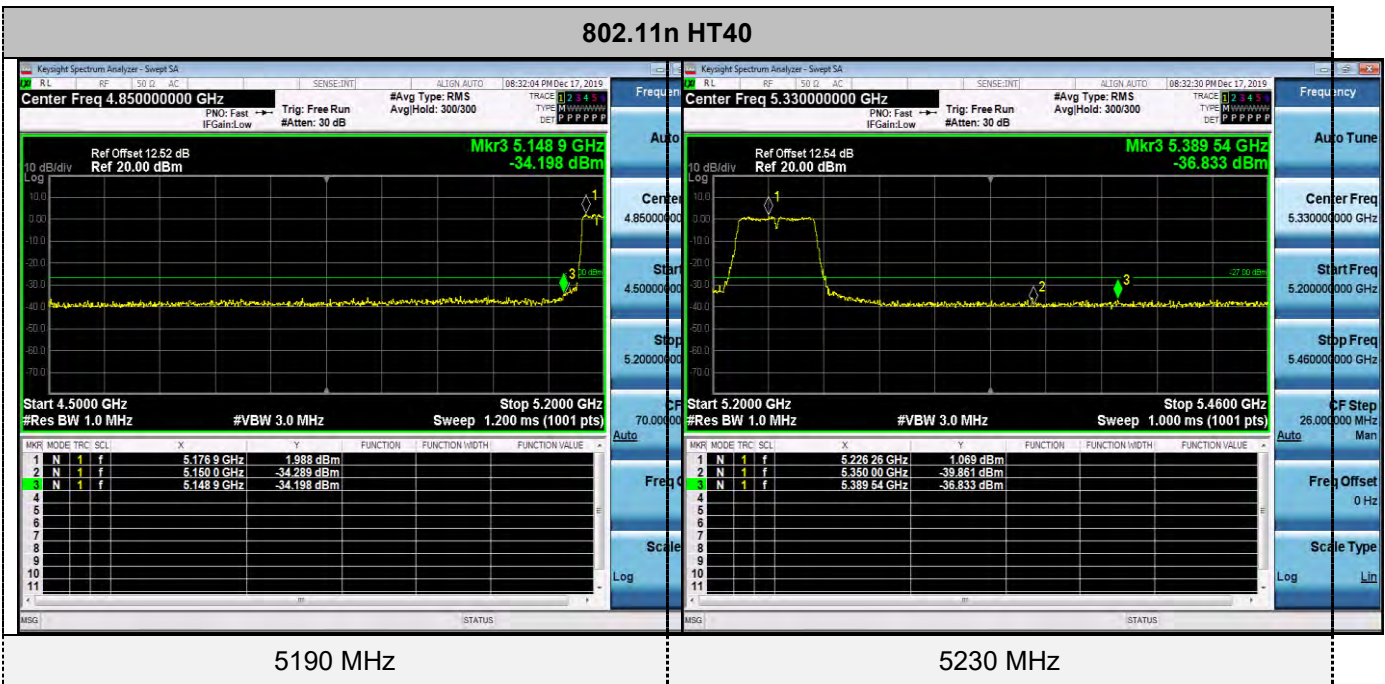
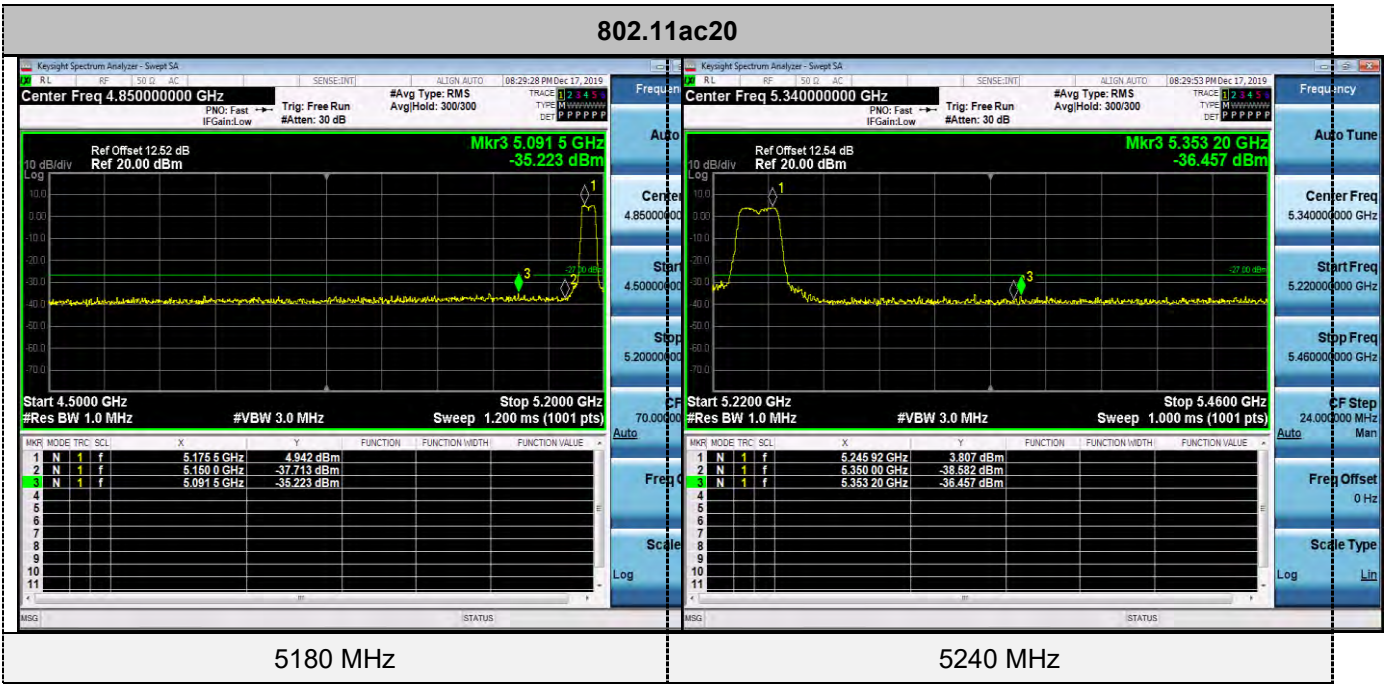
REMARKS:

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;

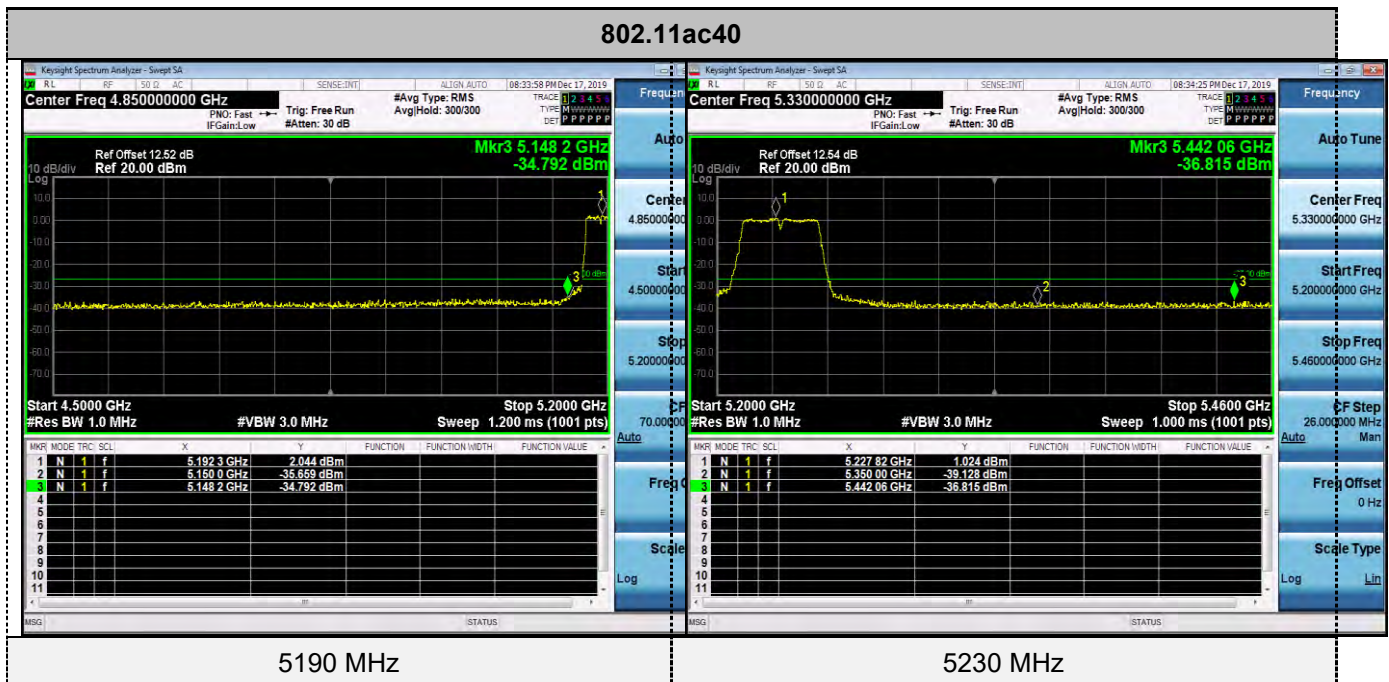
For Conducted Band edge Measurement
The test results have included the antenna gain

5150-5250MHz:

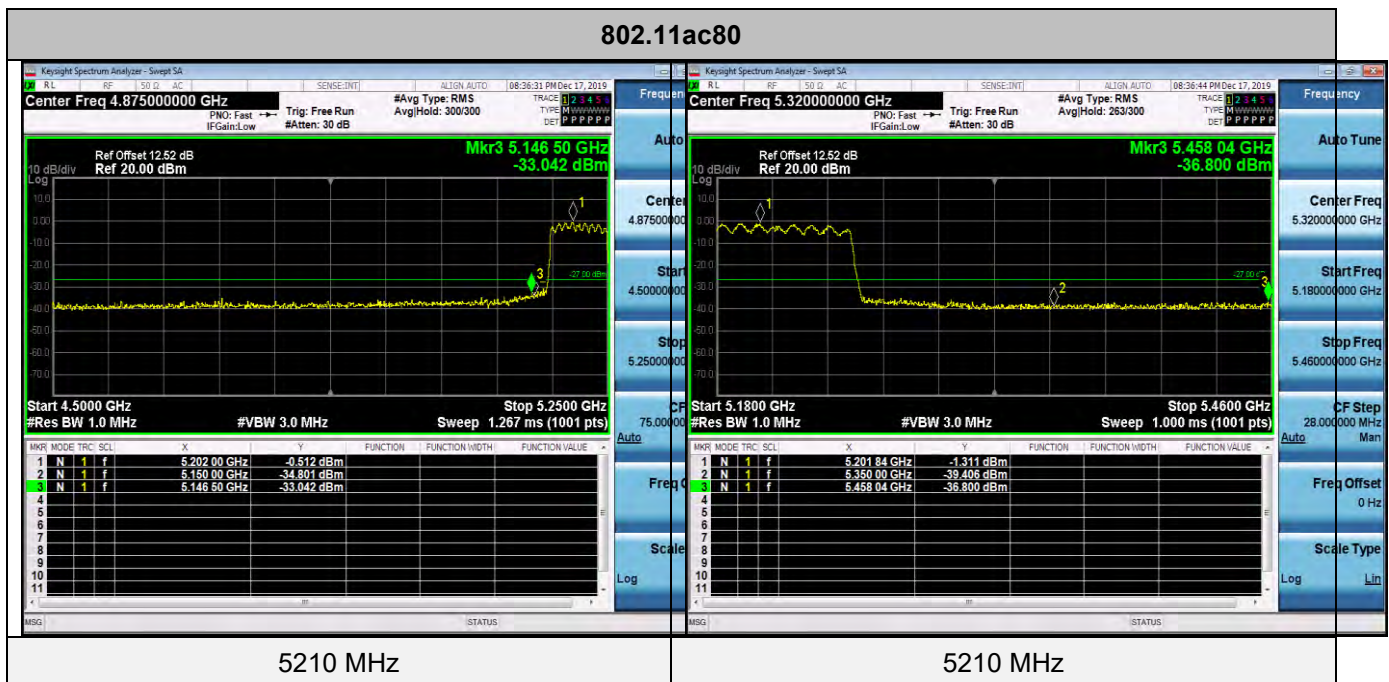




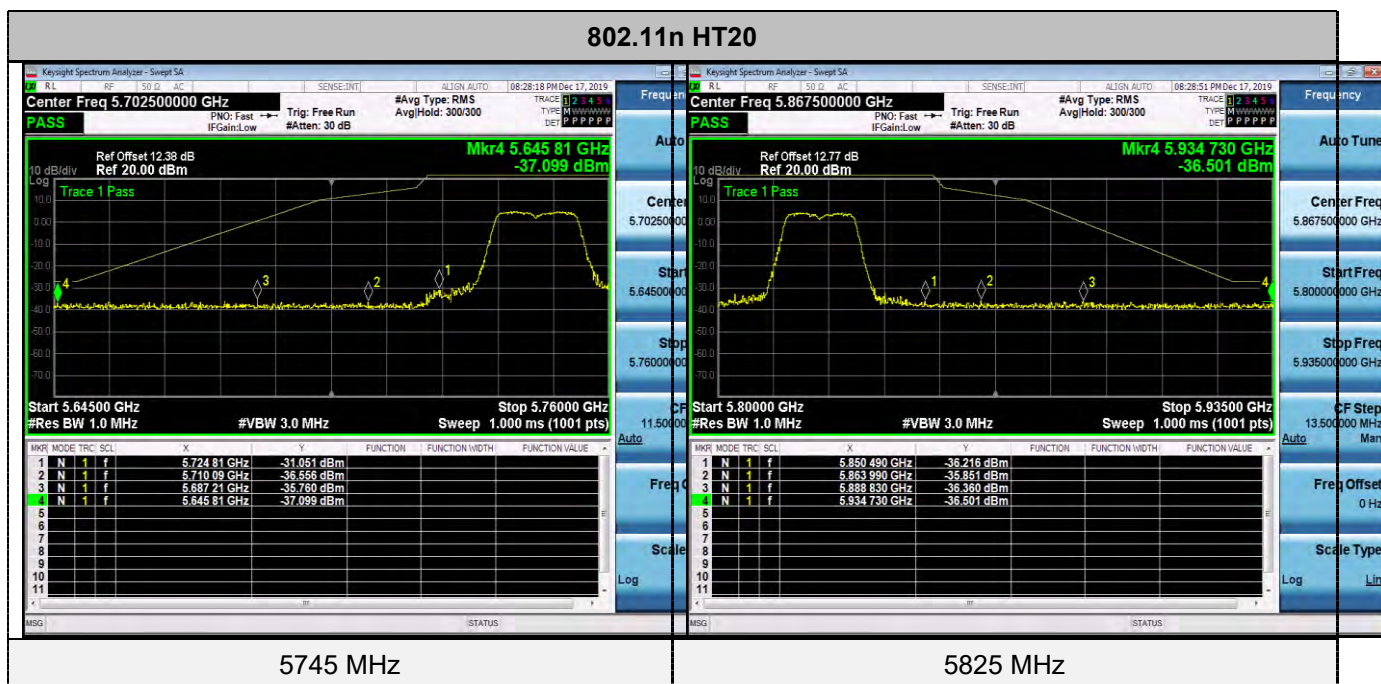
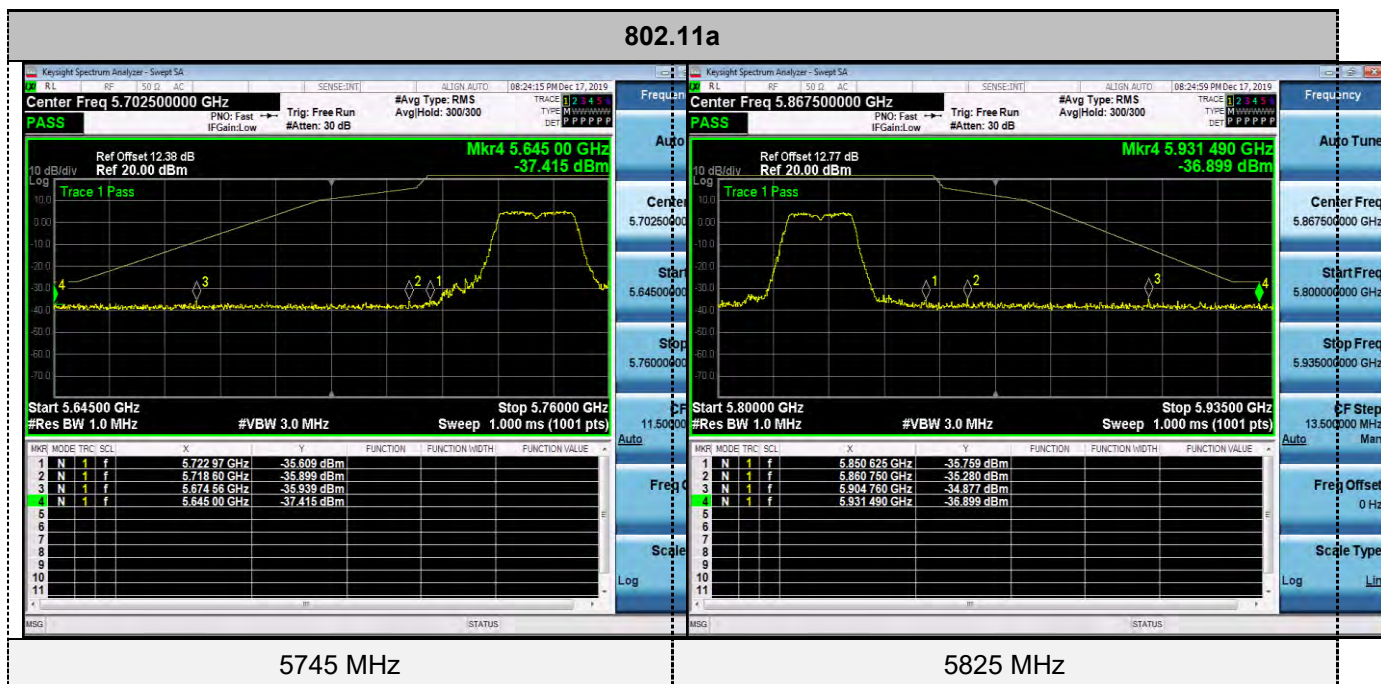
802.11ac40

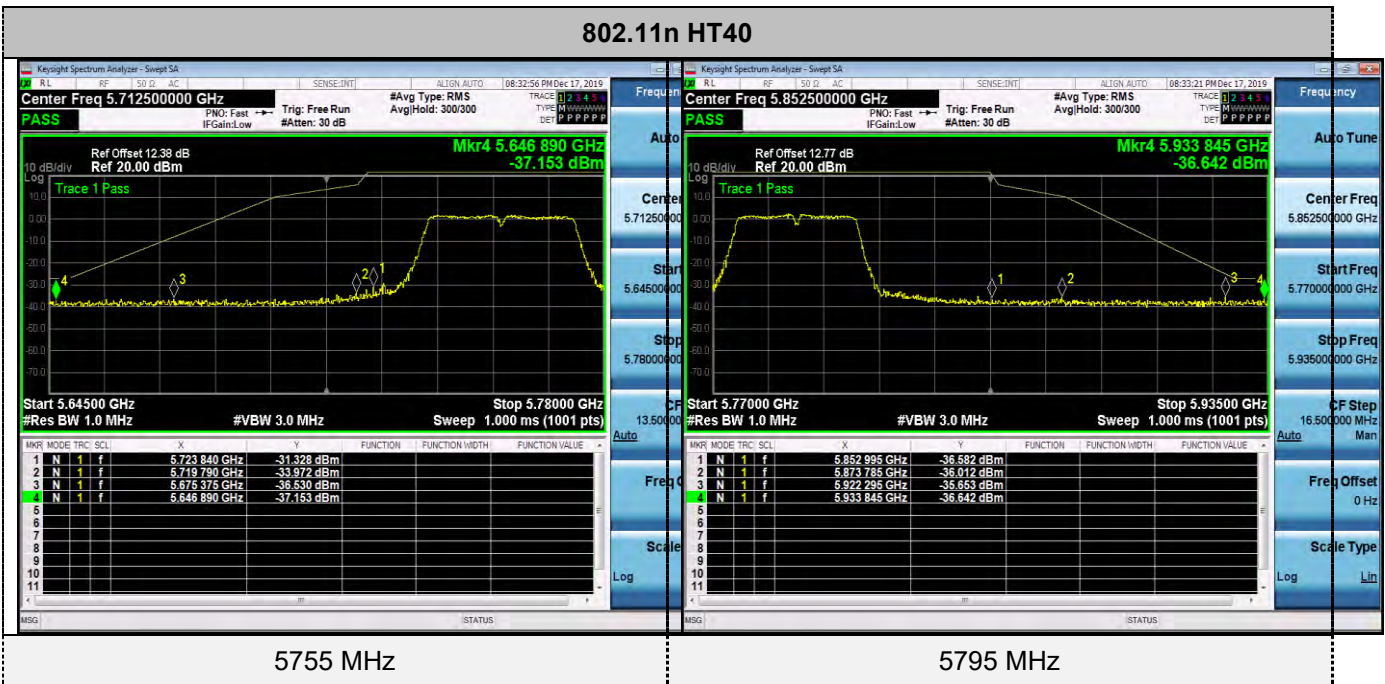
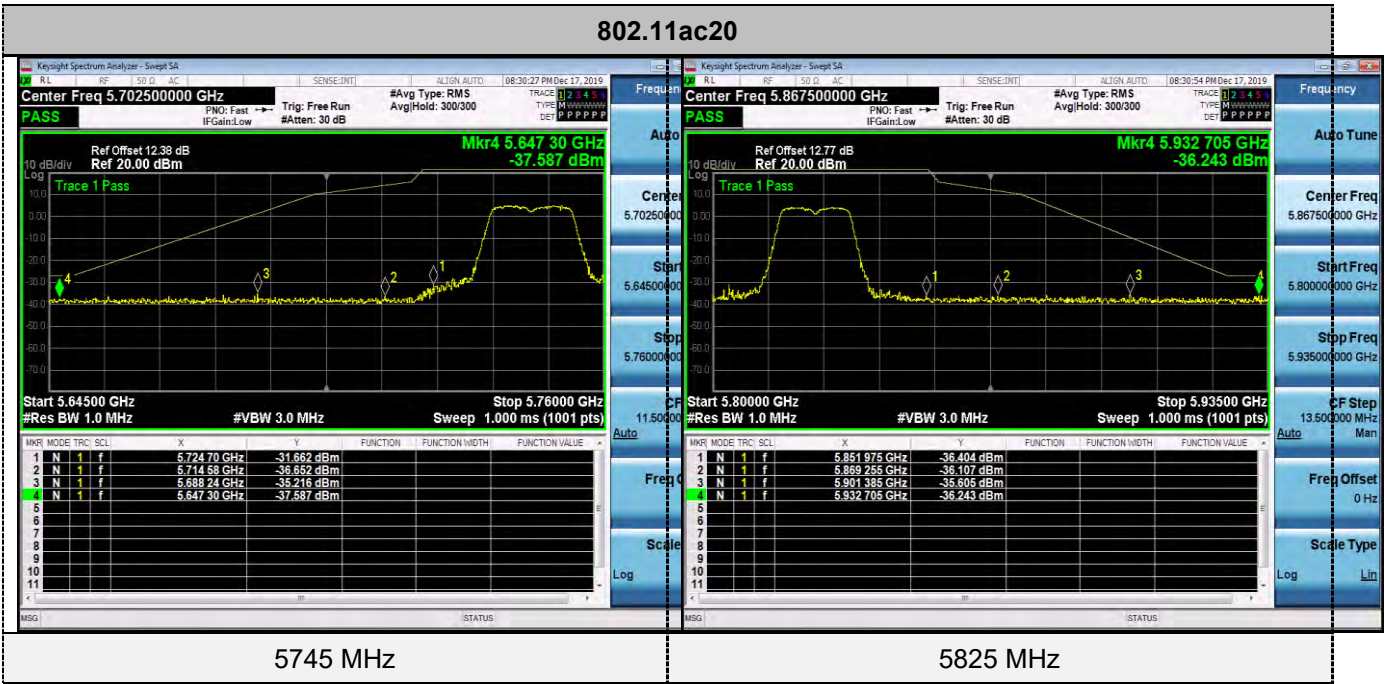


802.11ac80



5725-5850MHz:

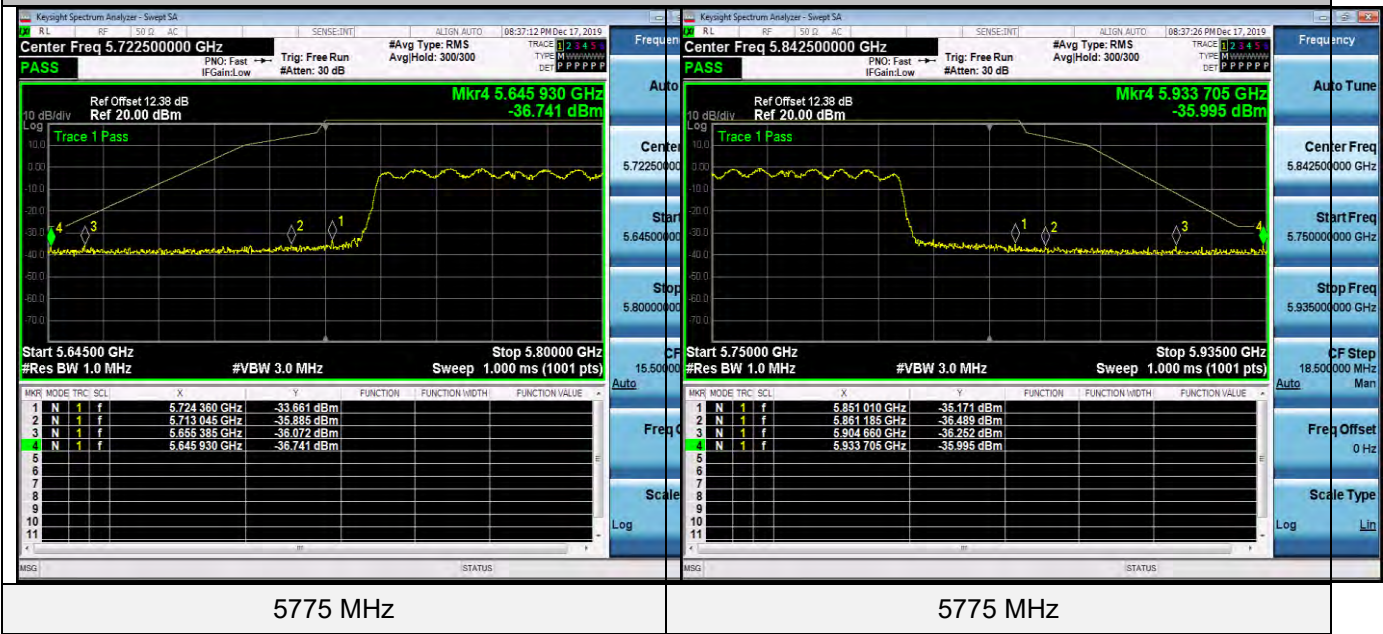




802.11ac40



802.11ac80



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. **GTS20191209006-2-34**

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.....