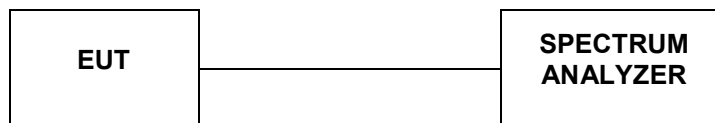


4.6. 6dB Bandwidth

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	Moon Tan	Configurations	IEEE 802.11a/n/ac

Type	Channel	99%Bandwidth (MHz)	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	17.339	16.440	≥500	Pass
	157	17.532	16.440		
	165	17.572	16.400		
802.11nHT20	149	18.378	17.680	≥500	Pass
	157	18.556	17.680		
	165	18.509	17.680		
802.11ac20	149	18.393	17.680	≥500	Pass
	157	18.492	17.680		
	165	18.509	17.640		
802.11n40	151	36.798	36.480	≥500	Pass
	159	37.147	36.480		
802.11ac40	151	36.840	36.480	≥500	Pass
	159	36.879	36.480		
802.11ac80	155	75.370	75.520	≥500	Pass

99%Bandwidth

802.11a

802.11n HT20



CH149

CH149



CH157

CH157



CH165

CH165

99%Bandwidth

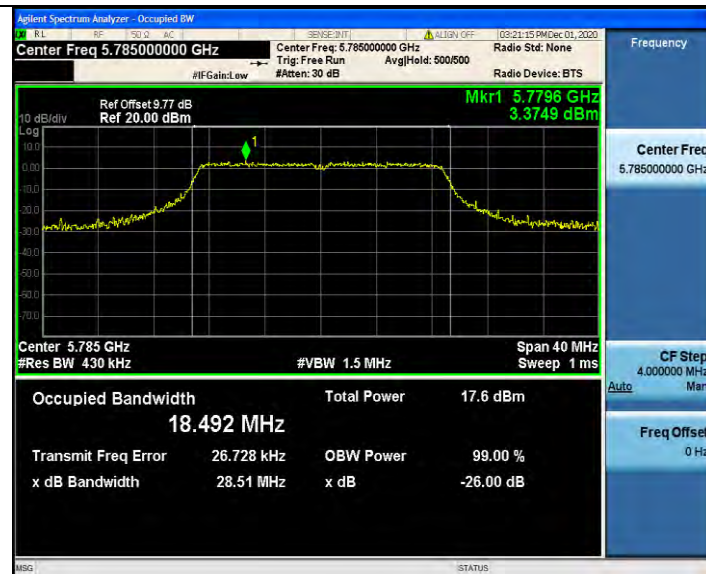
802.11ac20



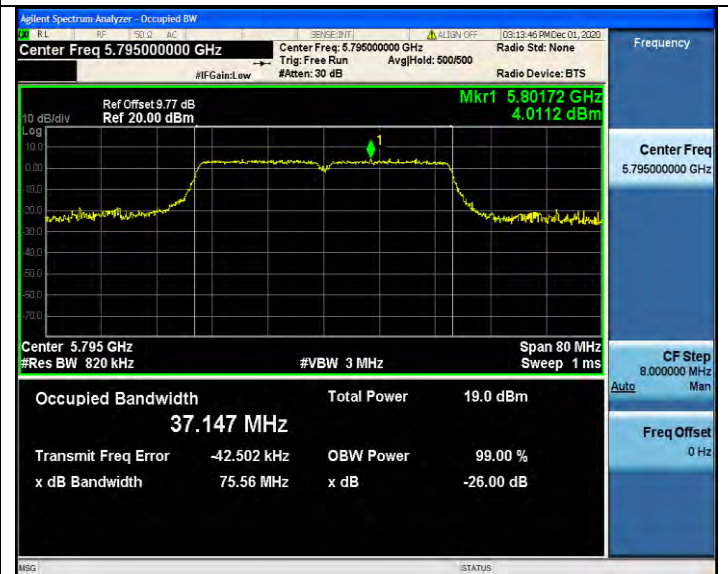
802.11n HT40



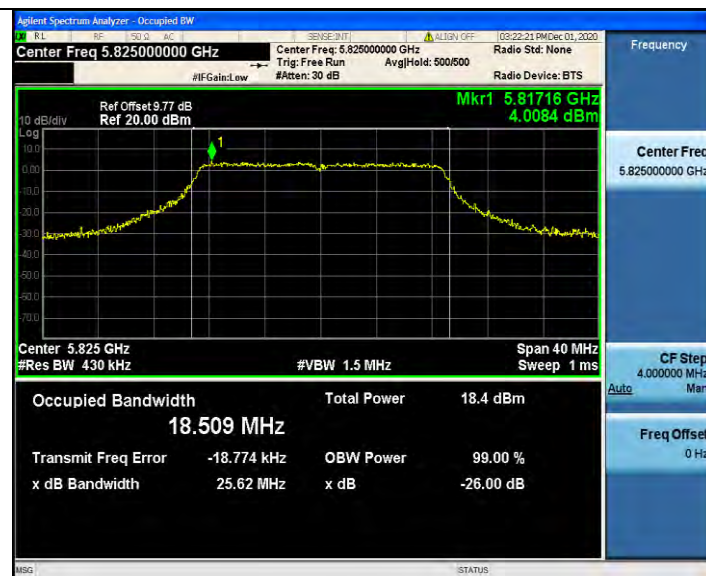
CH149



CH151

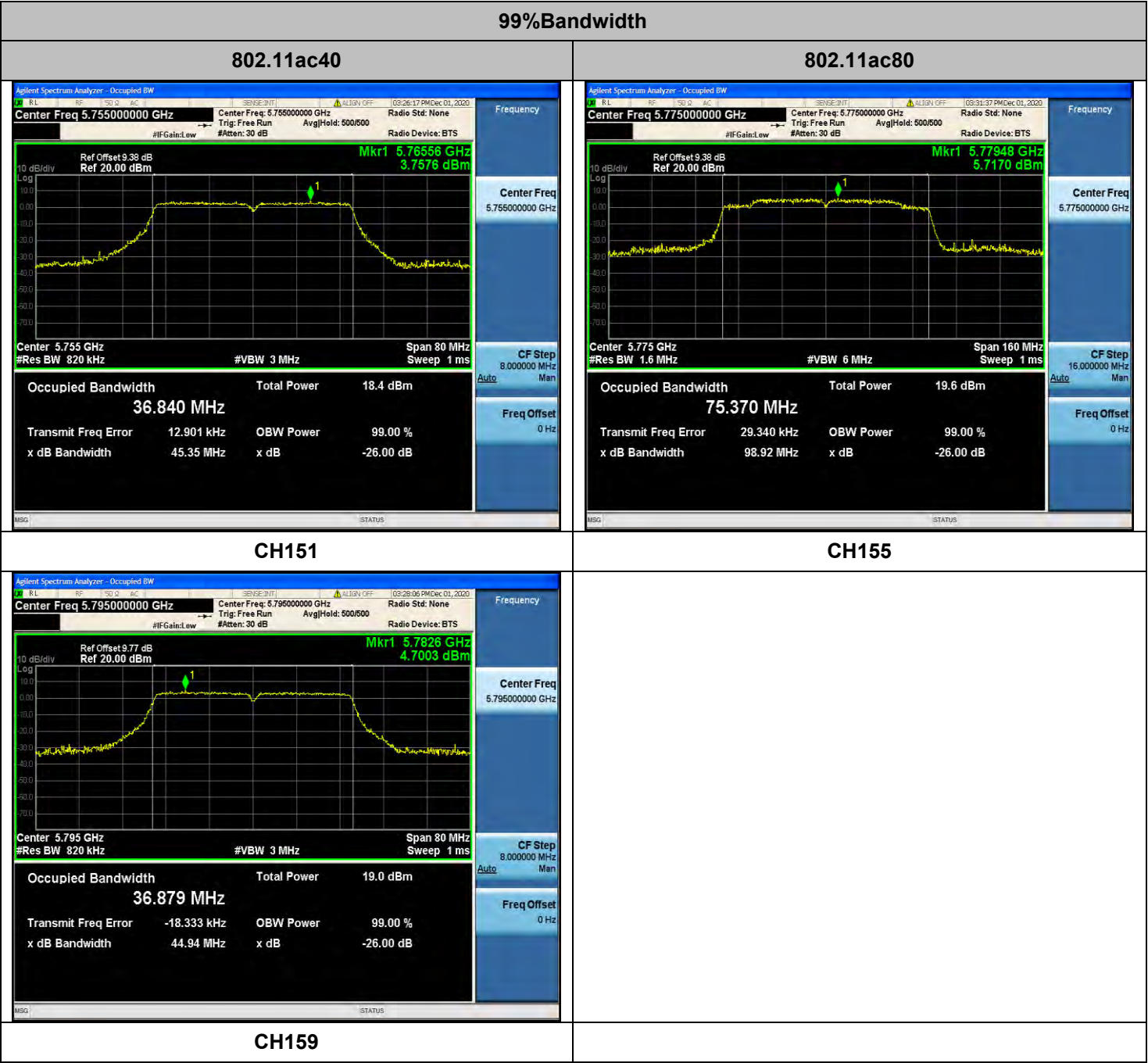


CH157



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

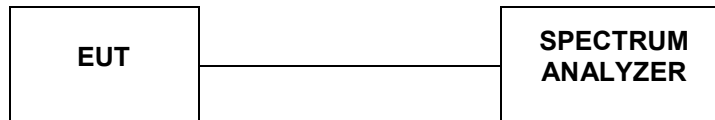


CH165



4.7. 26dBc Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

According to KDB789033 D02 General 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	Moon Tan	Configurations	IEEE 802.11a/n/ac

Type	Channel	99%Bandwidth (MHz)	26dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	36	17.300	23.320	-	Pass
	40	17.375	24.200		
	48	17.406	24.400		
802.11nHT20	36	18.400	23.960	-	Pass
	40	18.387	24.200		
	48	18.374	24.000		
802.11ac20	36	18.405	24.600	-	Pass
	40	18.426	24.680		
	48	18.409	24.480		
802.11n40	38	36.782	46.080	-	Pass
	46	36.754	45.600		
802.11ac40	38	36.813	46.320	-	Pass
	46	36.840	44.640		
802.11ac80	42	75.157	84.640	-	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

26dB Bandwidth

802.11ac20

802.11n HT40



CH36

CH38

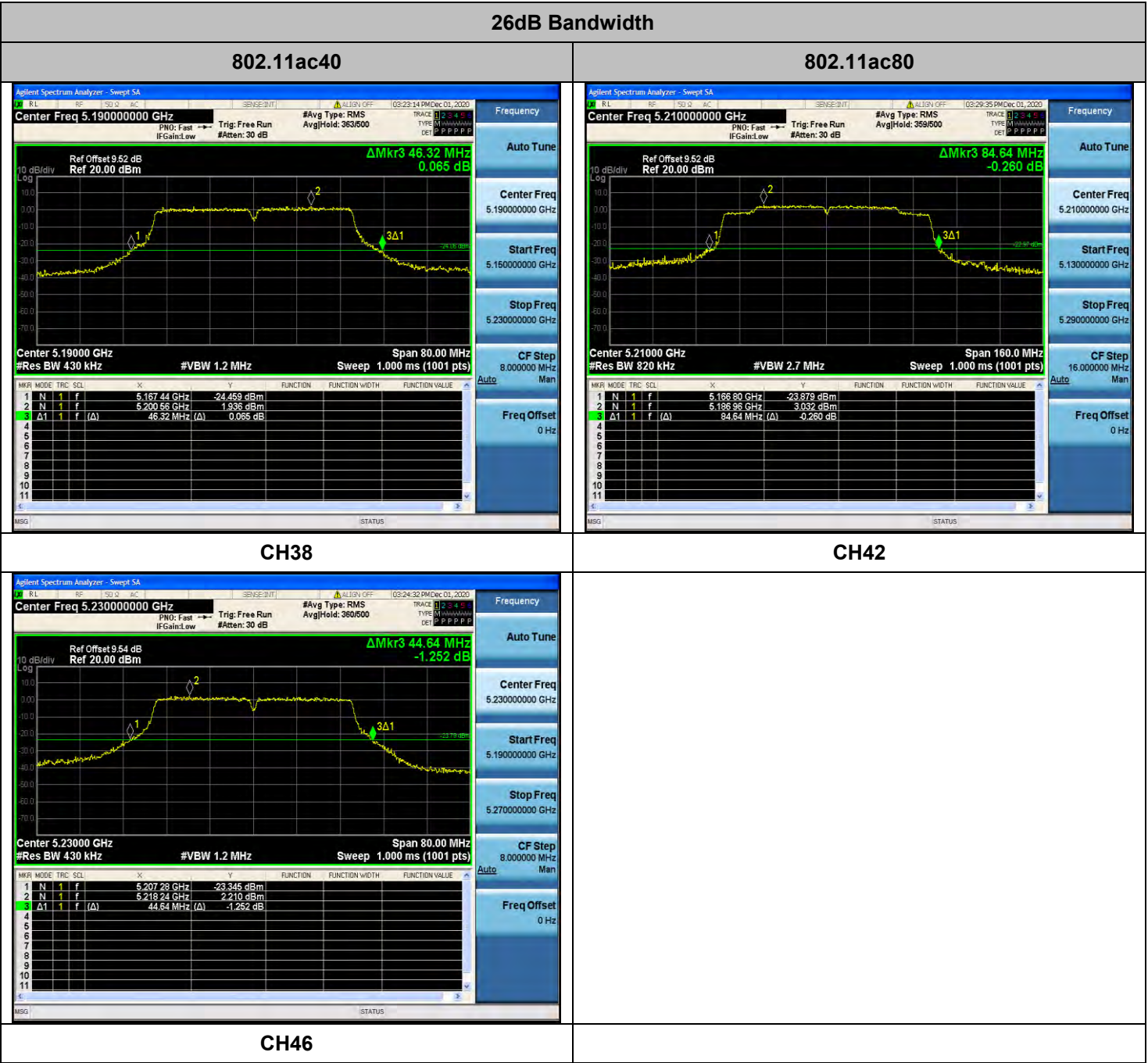


CH40

CH46

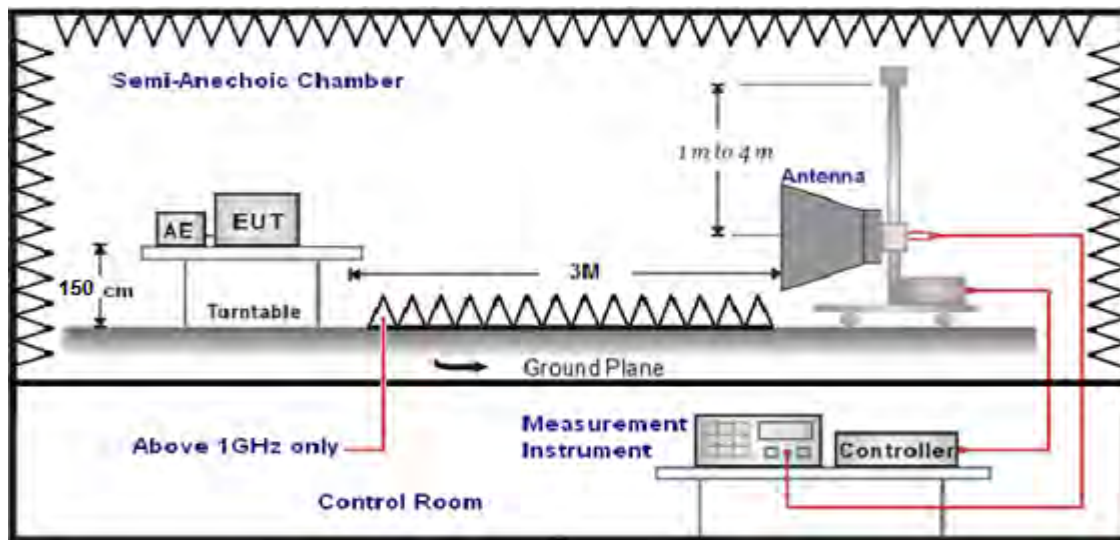


CH48



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 both mode, recorded worst case in antenna 0's 802.11 ac20 mode;

For Radiated Bandedge Measurement

Temperature	23.4°C	Humidity	54.5%
Test Engineer	Moon Tan	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	35.14	35.58	29.04	8.28	49.96	74.00	-24.04	Peak	Horizontal
4500.0	30.03	35.58	29.04	8.28	44.85	54.00	-9.15	AV	Horizontal
5150.0	39.20	35.58	29.04	8.28	54.02	74.00	-19.98	Peak	Horizontal
5150.0	30.69	35.58	29.04	8.28	45.51	54.00	-8.49	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	35.02	35.42	29.06	8.39	49.77	74.00	-24.23	Peak	Horizontal
5350.0	30.34	35.42	29.06	8.39	45.09	54.00	-8.91	AV	Horizontal
5460.0	39.08	35.42	29.06	8.39	53.83	74.00	-20.17	Peak	Horizontal
5460.0	30.55	35.42	29.06	8.39	45.30	54.00	-8.70	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	30.05	35.35	29.07	8.43	44.76	68.20	-23.44	Peak	Horizontal
5700.0	30.26	35.35	29.07	8.43	44.97	68.20	-23.23	Peak	Horizontal
5720.0	32.06	35.35	29.07	8.43	46.77	68.20	-21.43	Peak	Horizontal
5725.0	30.68	35.35	29.07	8.43	45.39	68.20	-22.81	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	30.06	35.3	29.11	8.51	44.76	68.20	-23.44	Peak	Horizontal
5855.0	30.33	35.3	29.11	8.51	45.03	68.20	-23.17	Peak	Horizontal
5875.0	32.16	35.3	29.11	8.51	46.86	68.20	-21.34	Peak	Horizontal
5925.0	30.61	35.3	29.11	8.51	45.31	68.20	-22.89	Peak	Horizontal

REMARKS:

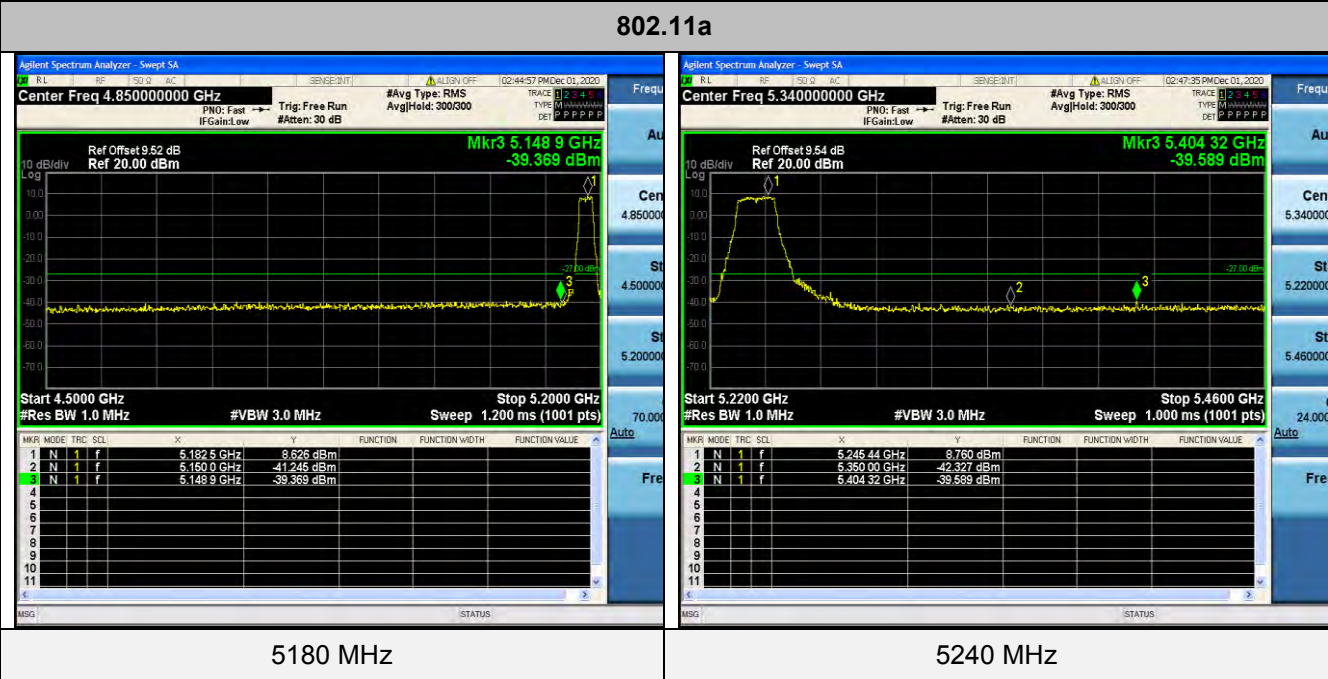
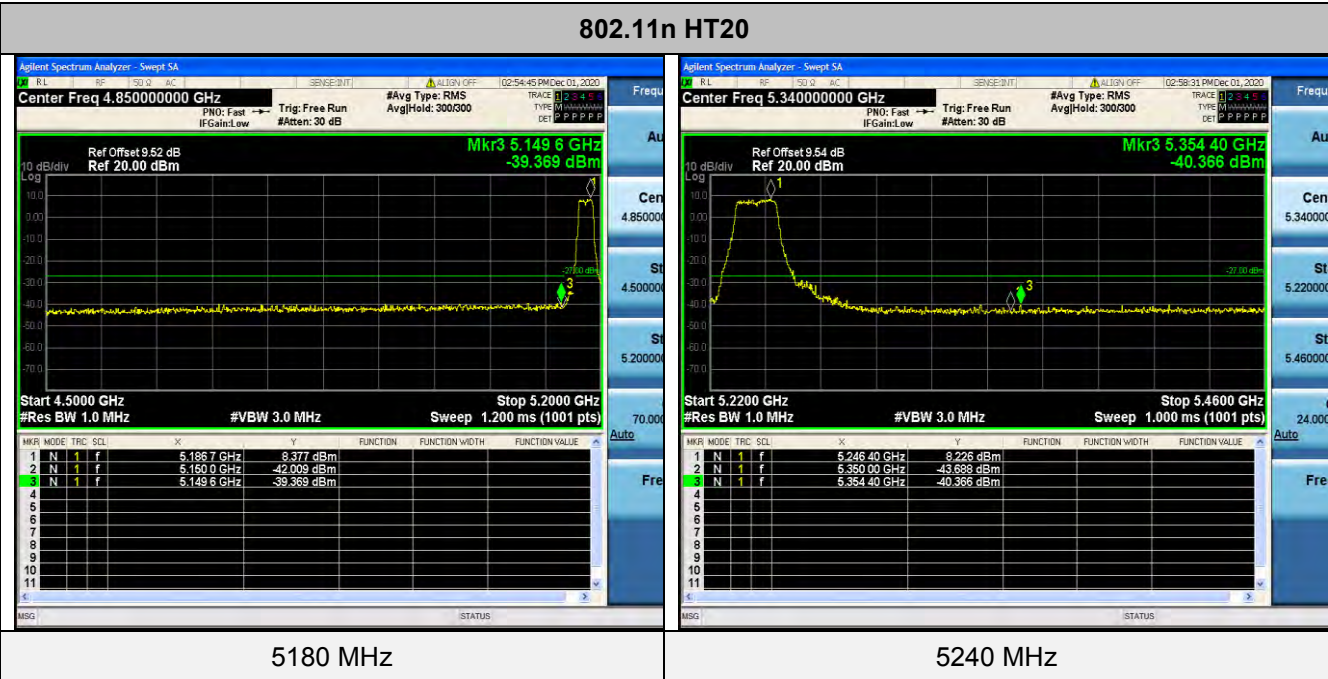
1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. Margin value = Result Level-Limit value.
2. The other emission levels were very low against the limit.
3. The average measurement was not performed when the peak measured data under the limit of average detection.
4. Detector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

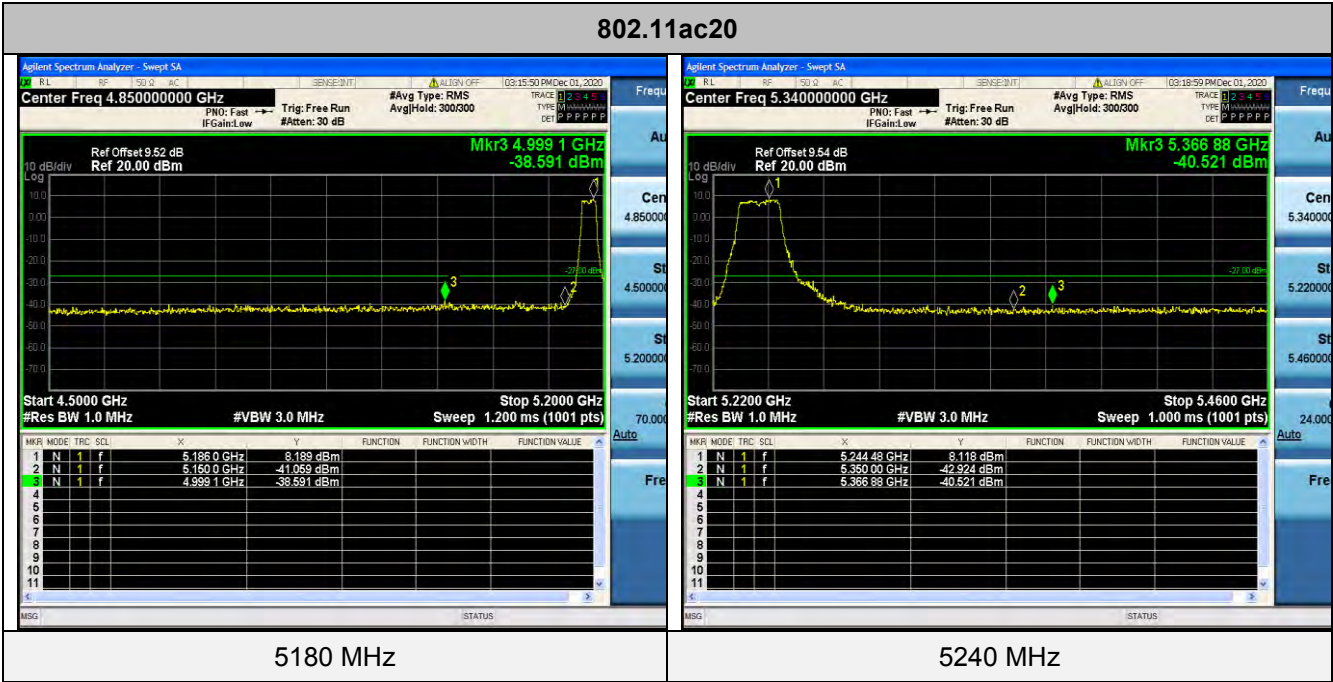
For Conducted Band edge Measurement

Temperature	23.6℃	Humidity	55.7%
Test Engineer	Moon Tan	Configurations	IEEE 802.11a/n/ac

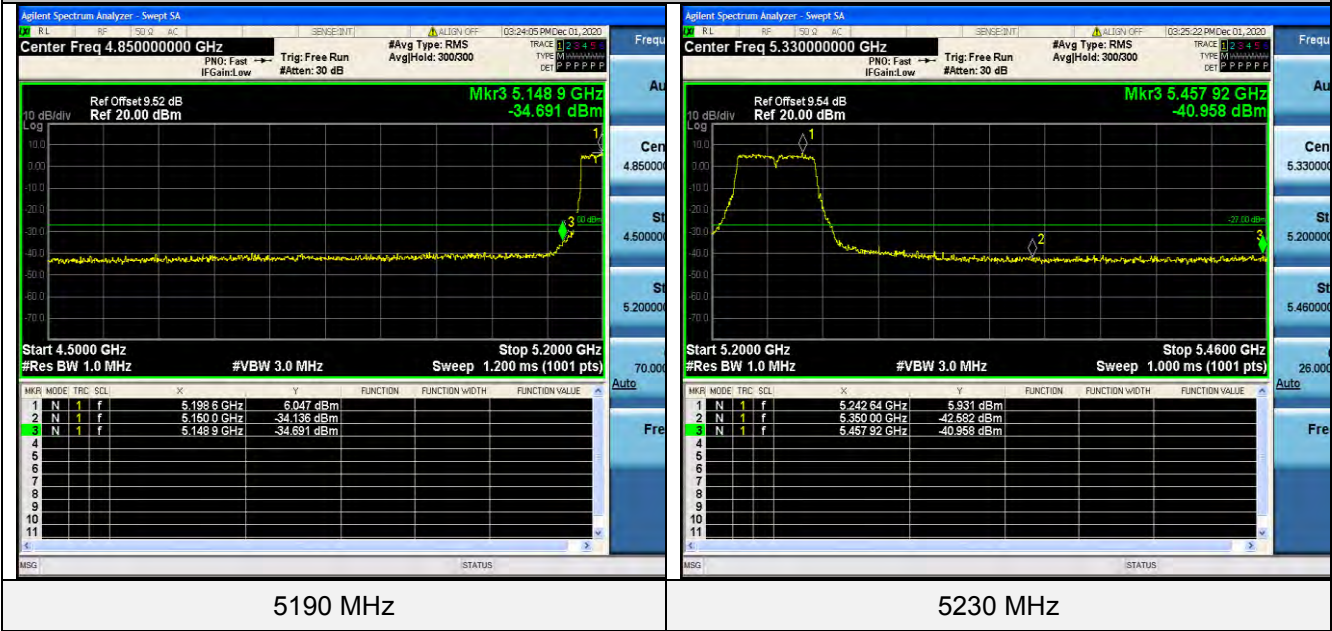
The test results have included the antenna gain

5150-5250MHz:

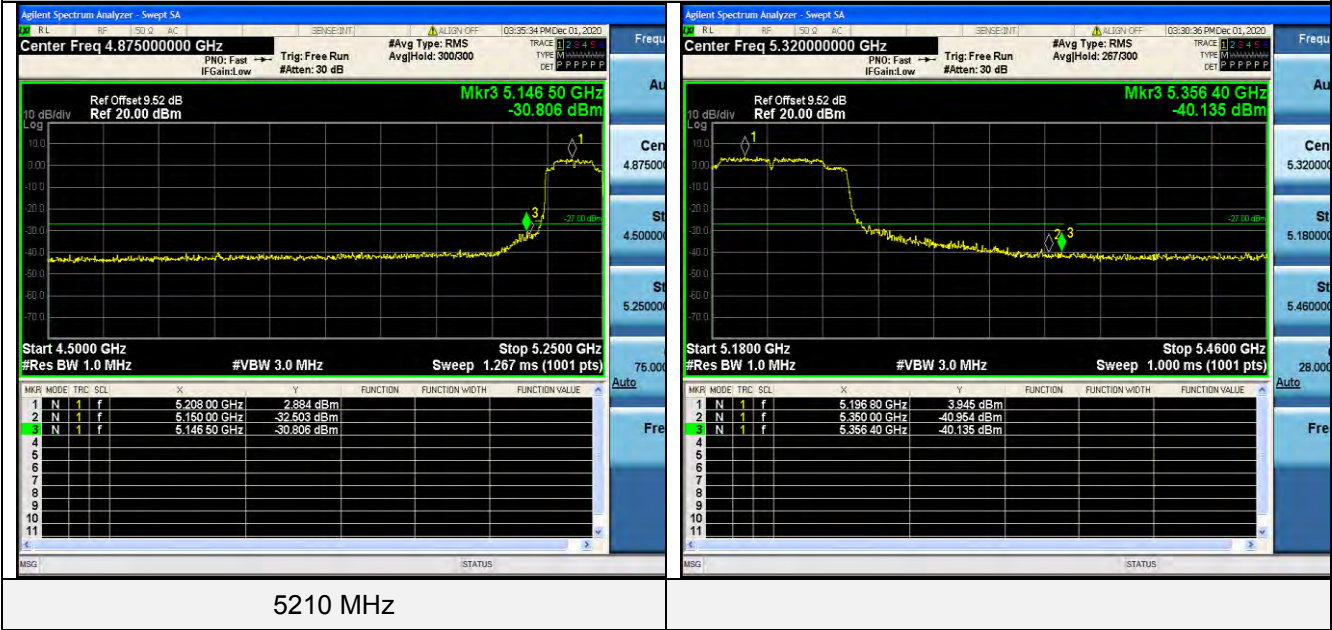




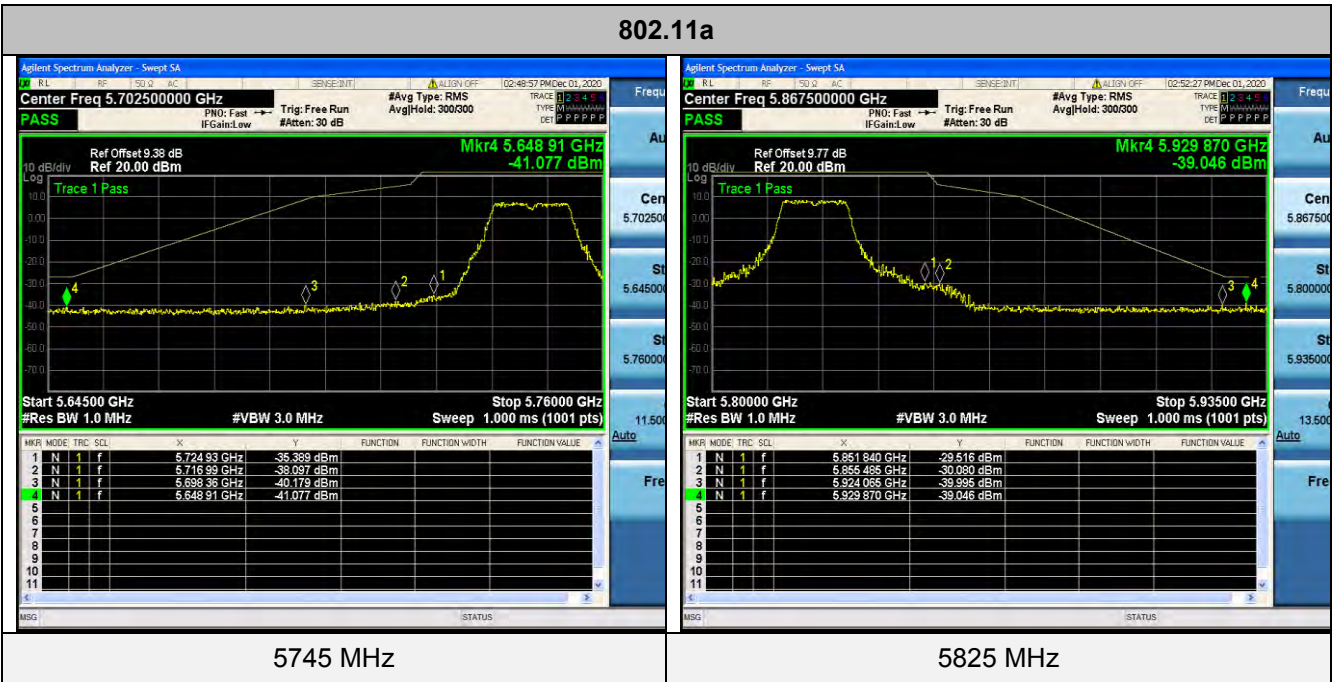
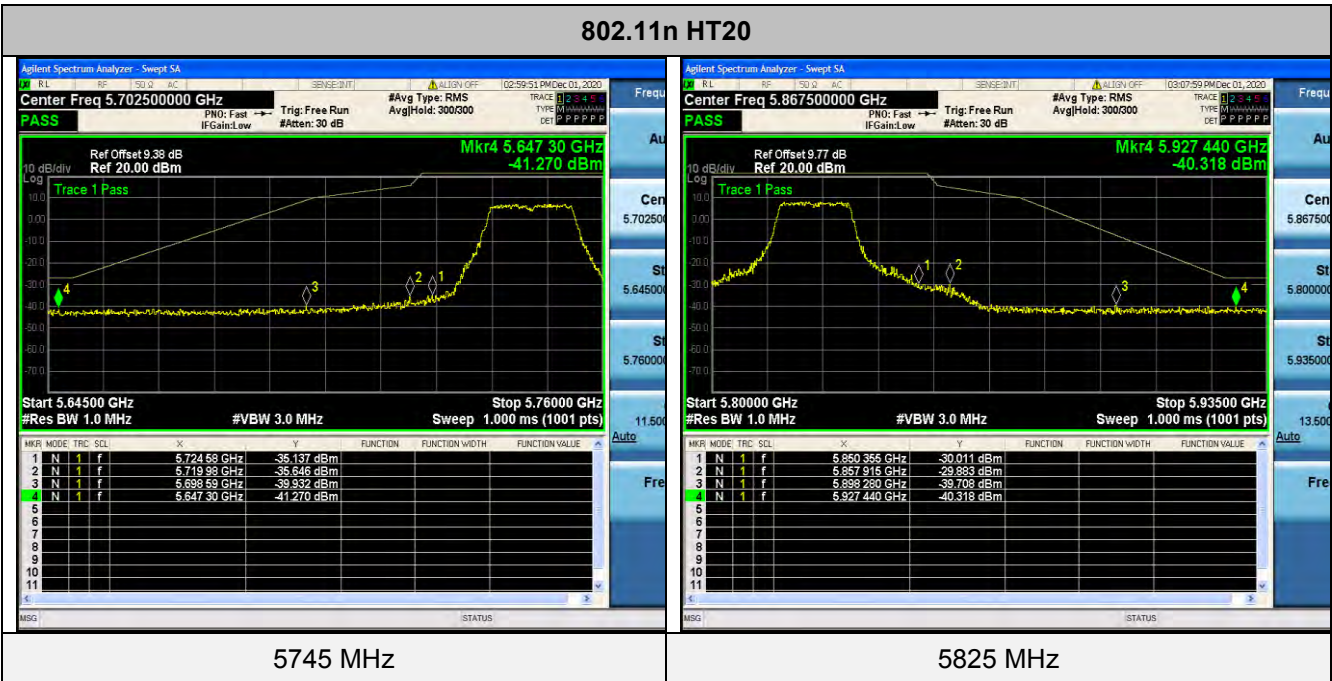
802.11ac40

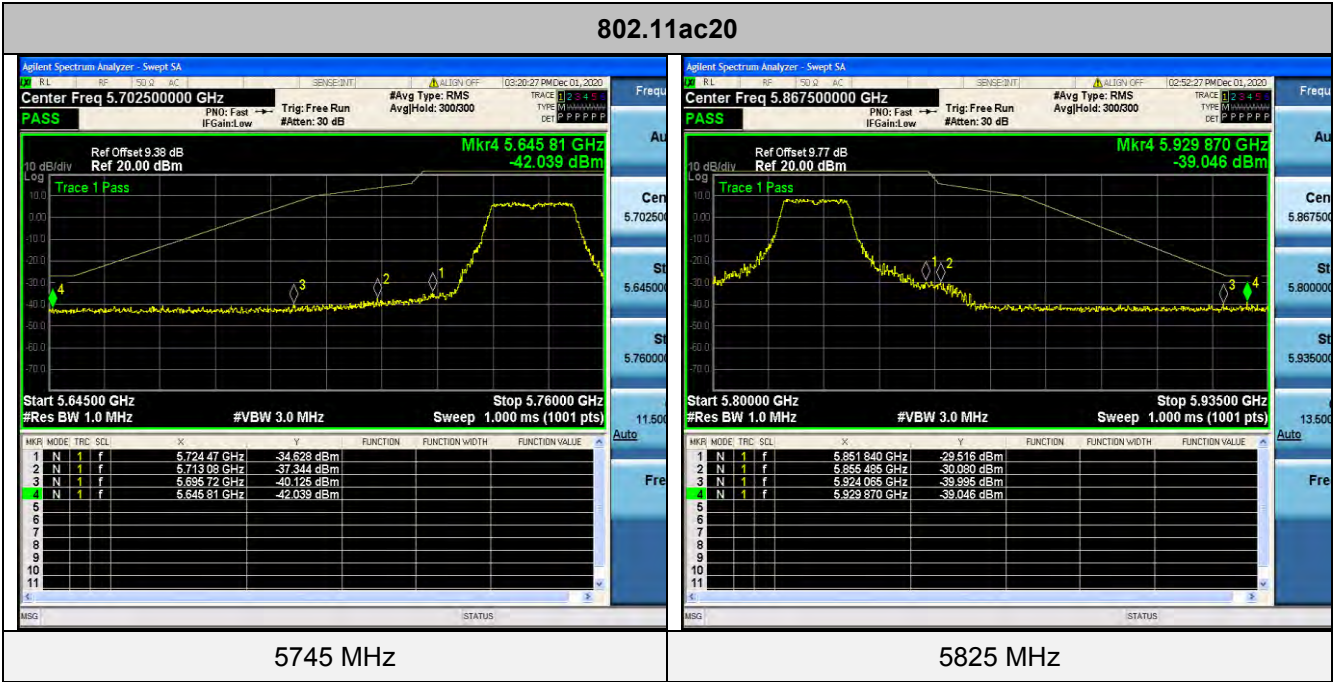


802.11ac80



5725-5850MHz:





802.11ac40



802.11ac80



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."

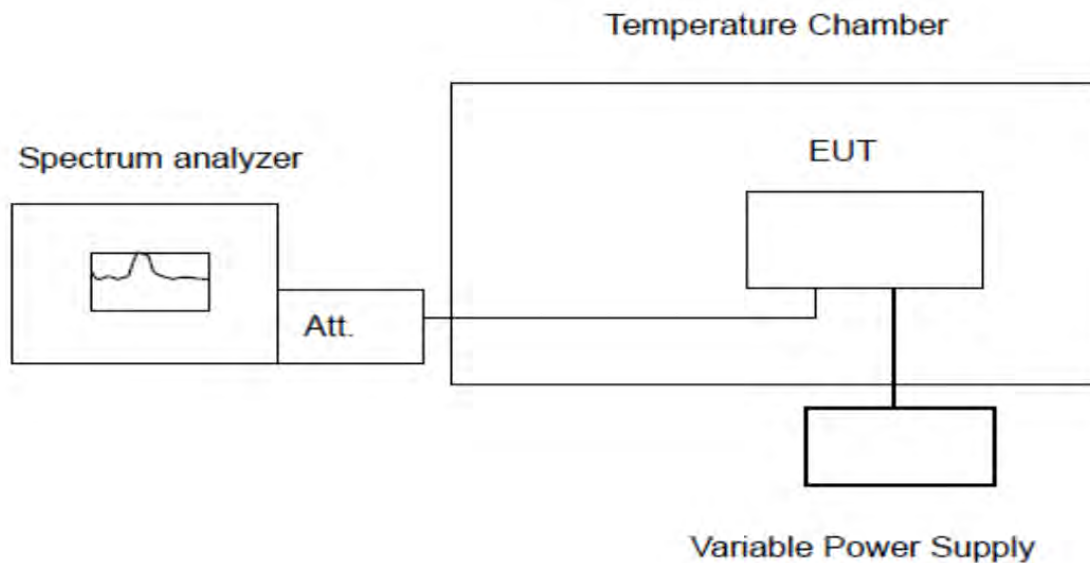
According to FCC §2.1055(a) "The frequency stability shall be measured with variation of ambient temperature as follows:"

(1) From -30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From -20° to + 50° 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° to + 50° 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 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 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	AC 132V	5179.994809	5150 – 5250	PASS
20	AC 108V	5180.023005	5150 – 5250	PASS
50	AC 120V	5179.977493	5150 – 5250	PASS
40	AC 120V	5180.025474	5150 – 5250	PASS
30	AC 120V	5179.997142	5150 – 5250	PASS
20	AC 120V	5180.019056	5150 – 5250	PASS
10	AC 120V	5179.985771	5150 – 5250	PASS
0	AC 120V	5179.994229	5150 – 5250	PASS
-10	AC 120V	5180.028785	5150 – 5250	PASS
-20	AC 120V	5180.003163	5150 – 5250	PASS
-30	AC 120V	5180.000402	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	AC 132V	5239.980832	5150 – 5250	PASS
20	AC 108V	5239.994270	5150 – 5250	PASS
50	AC 120V	5239.976821	5150 – 5250	PASS
40	AC 120V	5240.035755	5150 – 5250	PASS
30	AC 120V	5240.008813	5150 – 5250	PASS
20	AC 120V	5239.958124	5150 – 5250	PASS
10	AC 120V	5240.037104	5150 – 5250	PASS
0	AC 120V	5239.986168	5150 – 5250	PASS
-10	AC 120V	5239.988815	5150 – 5250	PASS
-20	AC 120V	5240.043513	5150 – 5250	PASS
-30	AC 120V	5239.961305	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	AC 132V	5745.003369	5725 – 5850	PASS
20	AC 108V	5744.986722	5725 – 5850	PASS
50	AC 120V	5744.975320	5725 – 5850	PASS
40	AC 120V	5745.024533	5725 – 5850	PASS
30	AC 120V	5744.987943	5725 – 5850	PASS
20	AC 120V	5745.009639	5725 – 5850	PASS
10	AC 120V	5745.005624	5725 – 5850	PASS
0	AC 120V	5744.990765	5725 – 5850	PASS
-10	AC 120V	5745.021986	5725 – 5850	PASS
-20	AC 120V	5745.013299	5725 – 5850	PASS
-30	AC 120V	5745.037910	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	AC 132V	5825.040291	5725 – 5850	PASS
20	AC 108V	5824.993385	5725 – 5850	PASS
50	AC 120V	5825.006708	5725 – 5850	PASS
40	AC 120V	5824.997536	5725 – 5850	PASS
30	AC 120V	5825.001032	5725 – 5850	PASS
20	AC 120V	5825.003731	5725 – 5850	PASS
10	AC 120V	5824.957803	5725 – 5850	PASS
0	AC 120V	5825.021426	5725 – 5850	PASS
-10	AC 120V	5824.995511	5725 – 5850	PASS
-20	AC 120V	5825.028243	5725 – 5850	PASS
-30	AC 120V	5825.002871	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 Internal antenna, through the buckle stretched out, The directional gains of antenna used for transmitting is 2.88dBi.

Reference to the Test Report: **GTS20201016002-1-1.**

5. TEST SETUP PHOTOS OF THE EUT

Reference to the test report No. GTS20201016002-1-1.

6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Reference to the test report No. GTS20201016002-1-1.

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