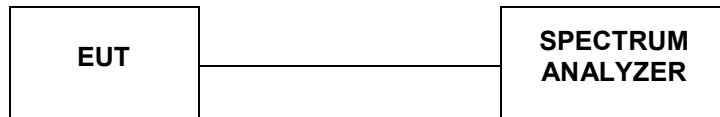


4.6. 6dB Bandwidth

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:

- 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

Temperature	23.6°C	Humidity	55.7%
Test Engineer	Oliver Ou	Configurations	IEEE 802.11a/n

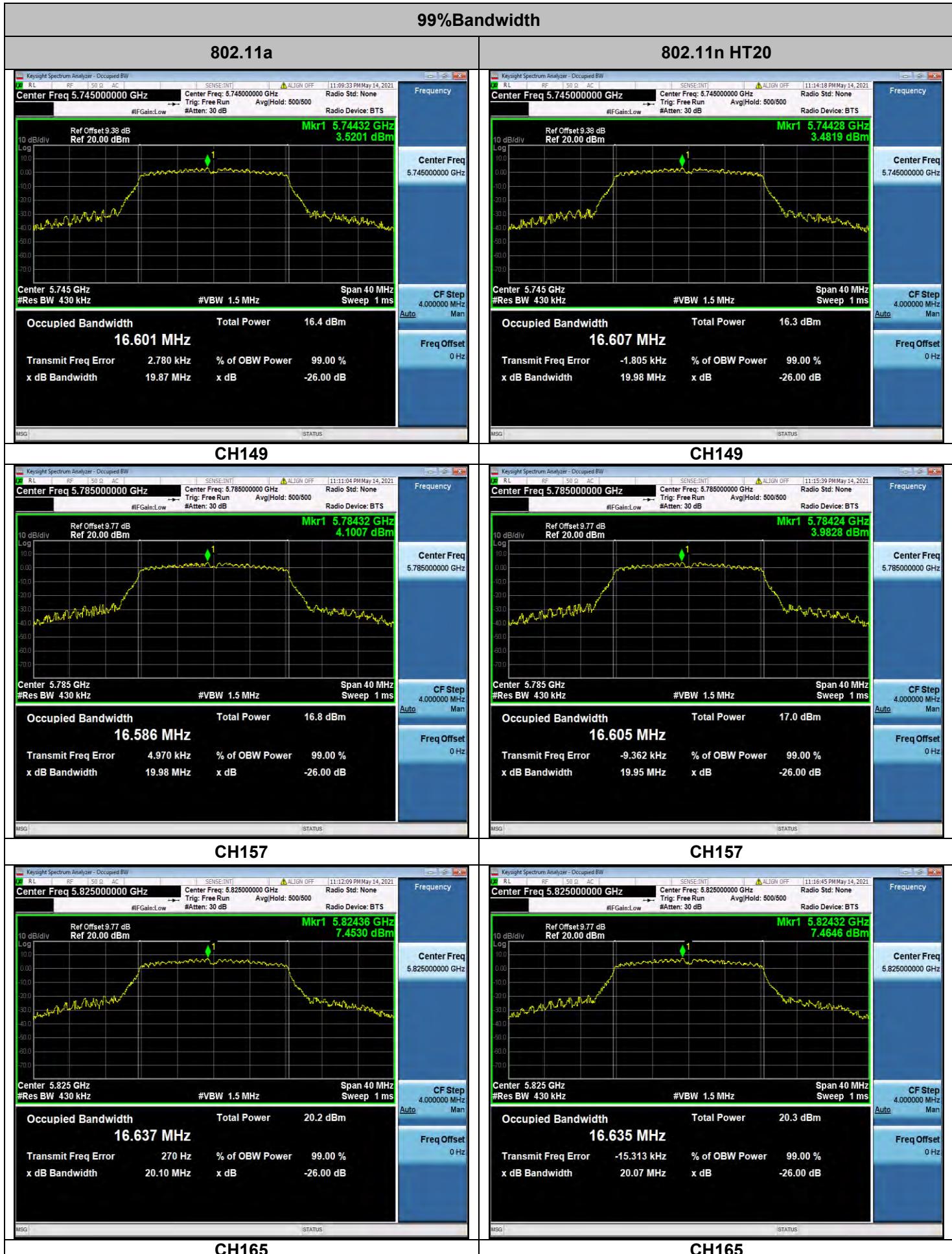
Antenna 0:

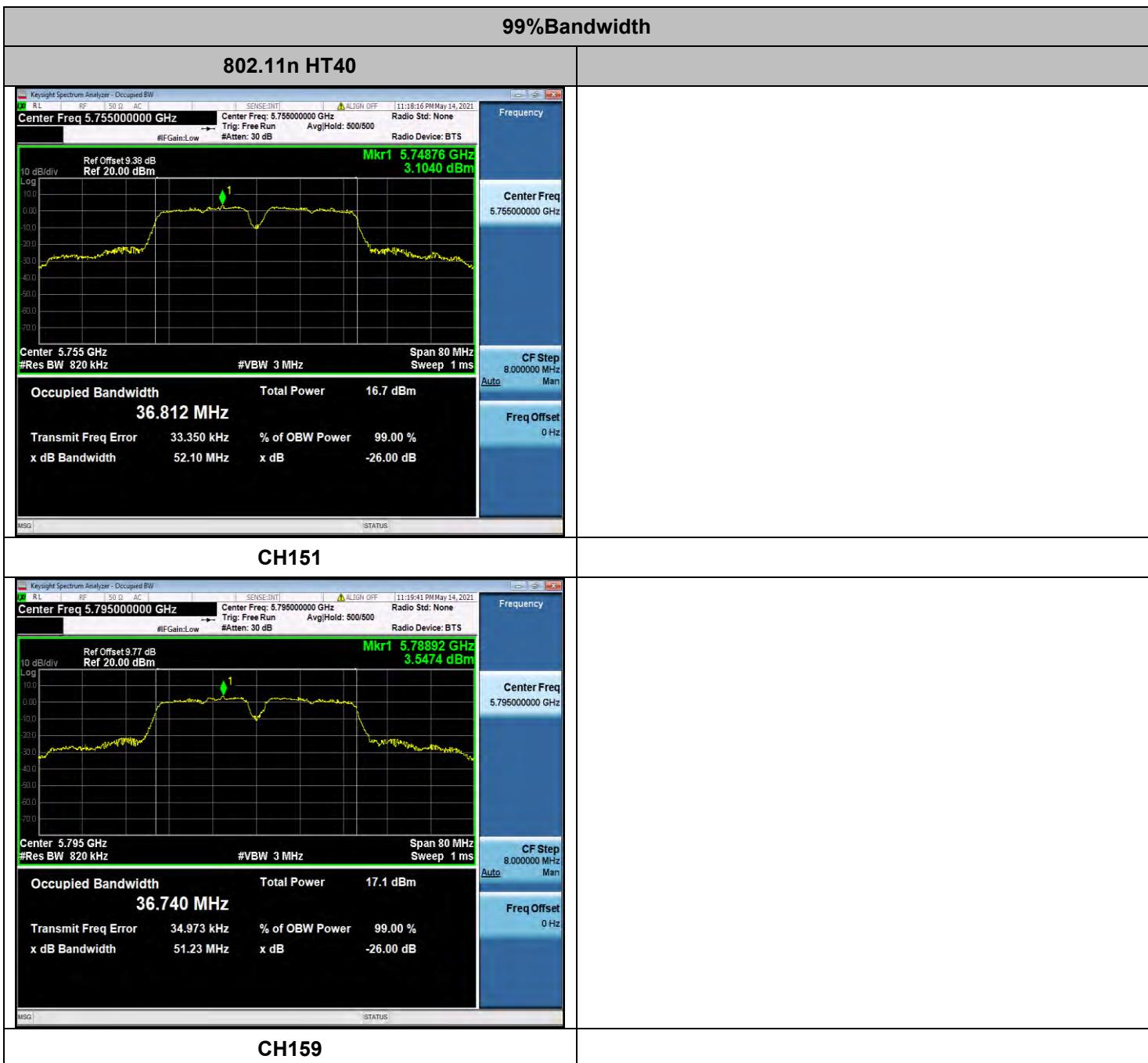
Type	Channel	99%Bandwidth (MHz)	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	16.601	16.360	≥500	Pass
	157	16.586	14.560		
	165	16.637	15.160		
802.11nHT20	149	16.607	15.400	≥500	Pass
	157	16.605	15.200		
	165	16.635	15.160		
802.11n40	151	36.812	35.200	≥500	Pass
	159	36.740	35.280		

Antenna 1:

Type	Channel	99%Bandwidth (MHz)	6dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	149	16.607	15.120	≥500	Pass
	157	16.606	15.160		
	165	16.656	15.200		
802.11nHT20	149	17.609	16.360	≥500	Pass
	157	17.626	15.800		
	165	17.600	16.400		
802.11n40	151	36.562	35.920	≥500	Pass
	159	36.600	35.840		

Antenna 0:





6dB Bandwidth

802.11a

802.11n HT20



CH149

CH149



CH157

CH157

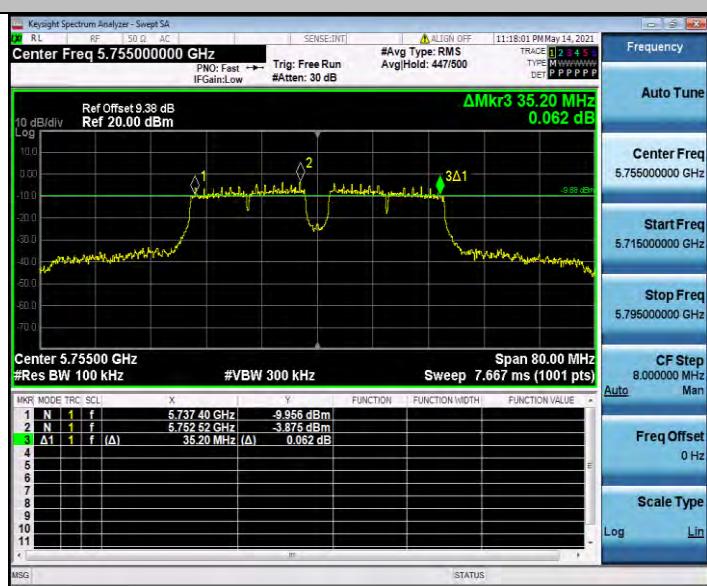


CH165

CH165

6dB Bandwidth

802.11n HT40



Frequency

Auto Tune

Center Freq 5.755000000 GHz

Start Freq 5.715000000 GHz

Stop Freq 5.795000000 GHz

CF Step 8.00000 MHz

Freq Offset 0 Hz

Scale Type Log Lin

CH151



Frequency

Auto Tune

Center Freq 5.795000000 GHz

Start Freq 5.755000000 GHz

Stop Freq 5.835000000 GHz

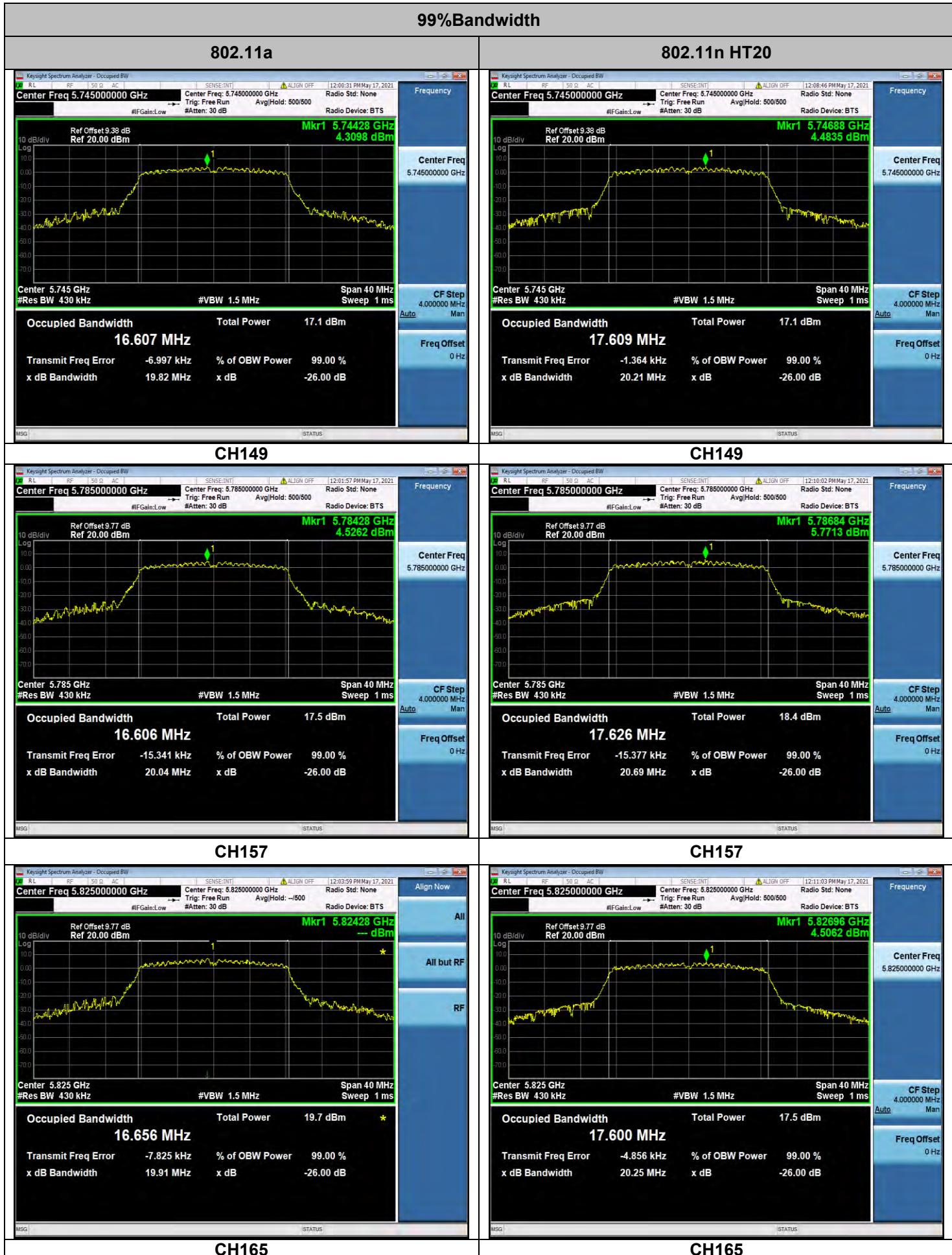
CF Step 8.00000 MHz

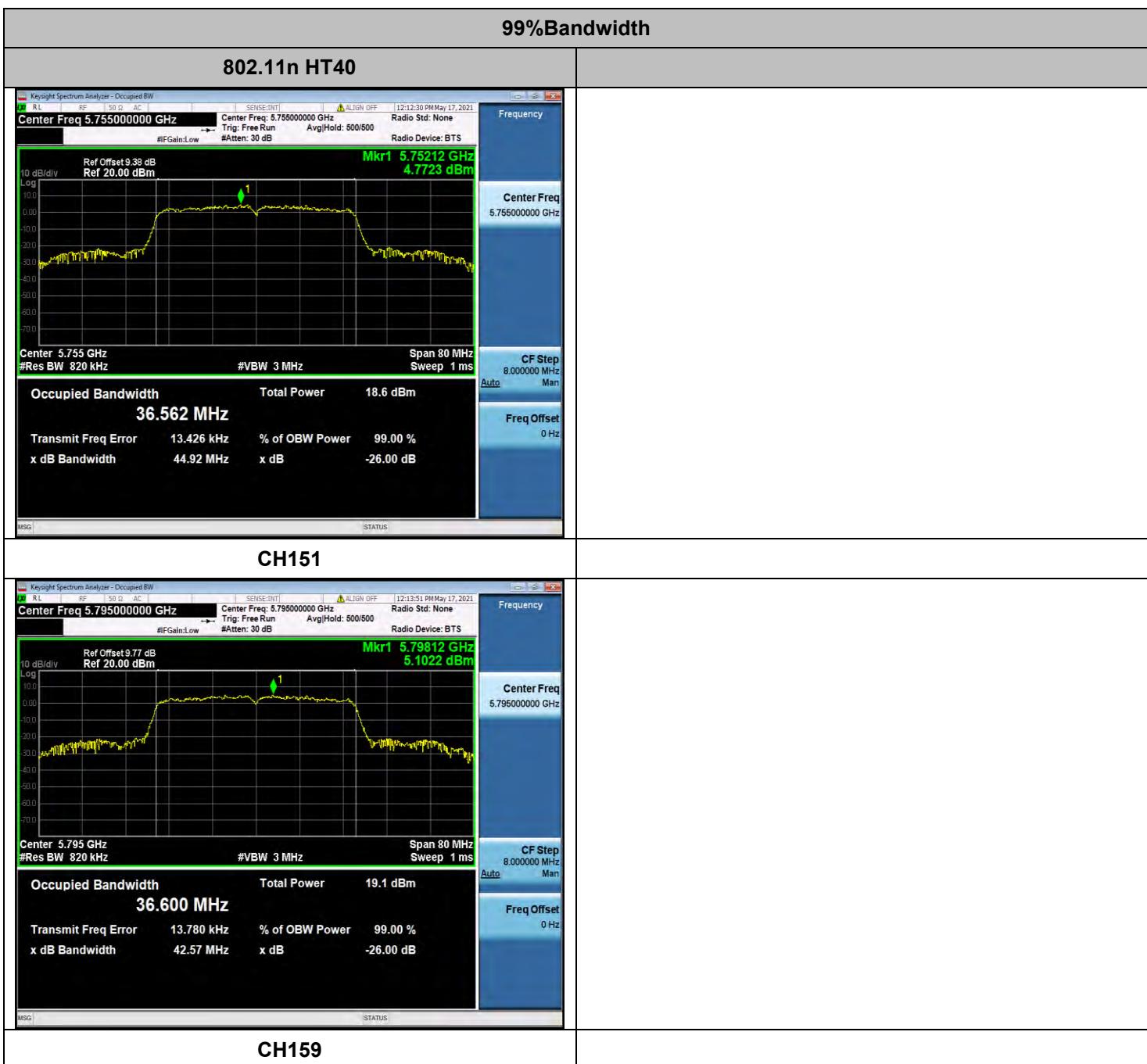
Freq Offset 0 Hz

Scale Type Log Lin

CH159

Antenna 1:

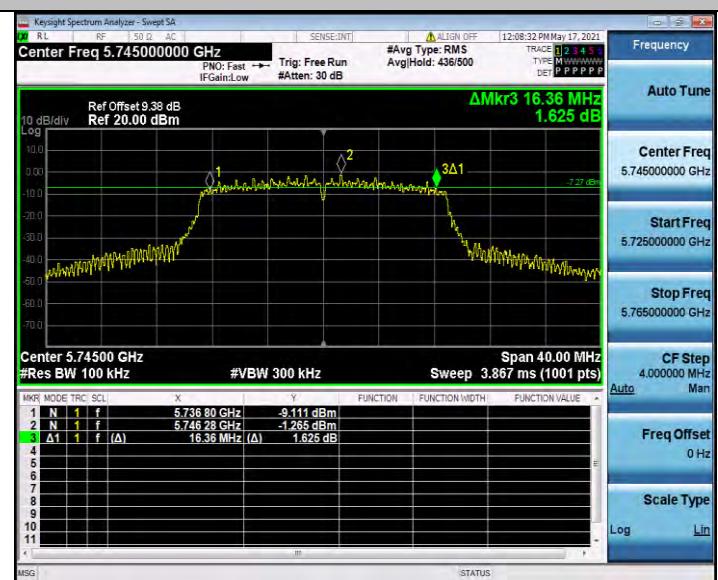




6dB Bandwidth

802.11a

802.11n HT20



CH149

CH149



CH157

CH157

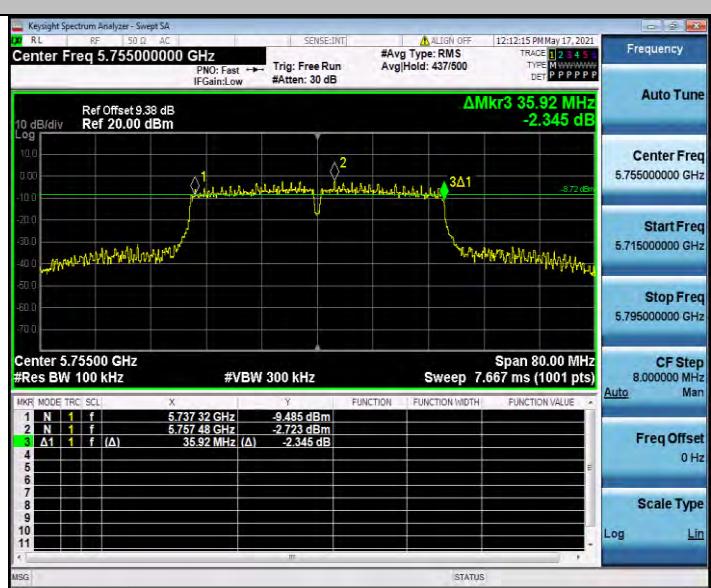


CH165

CH165

6dB Bandwidth

802.11n HT40



Frequency

Auto Tune

Center Freq 5.755000000 GHz

Start Freq 5.715000000 GHz

Stop Freq 5.795000000 GHz

CF Step 8.00000 MHz

Freq Offset 0 Hz

Scale Type Log Lin

CH151



Frequency

Auto Tune

Center Freq 5.795000000 GHz

Start Freq 5.755000000 GHz

Stop Freq 5.835000000 GHz

CF Step 8.00000 MHz

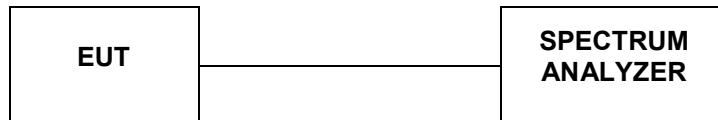
Freq Offset 0 Hz

Scale Type Log Lin

CH159

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:

- a. Set RBW = 220 kHz/430 kHz /820 kHz (approximately 1% of the emission bandwidth).
- b. Set the video bandwidth (VBW) = 3* 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

Temperature	23.6°C	Humidity	55.7%
Test Engineer	Oliver Ou	Configurations	IEEE 802.11a/n

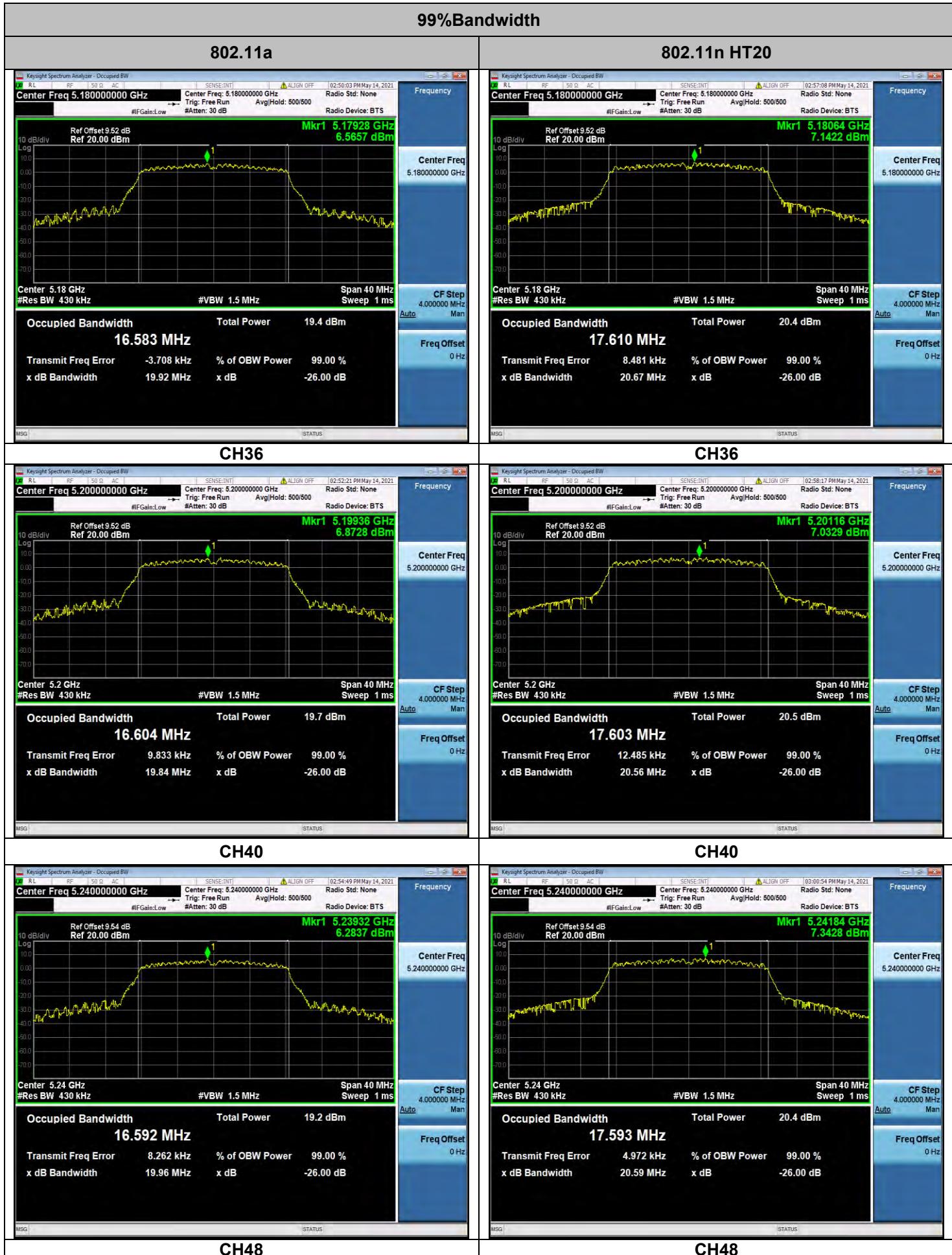
Antenna 0:

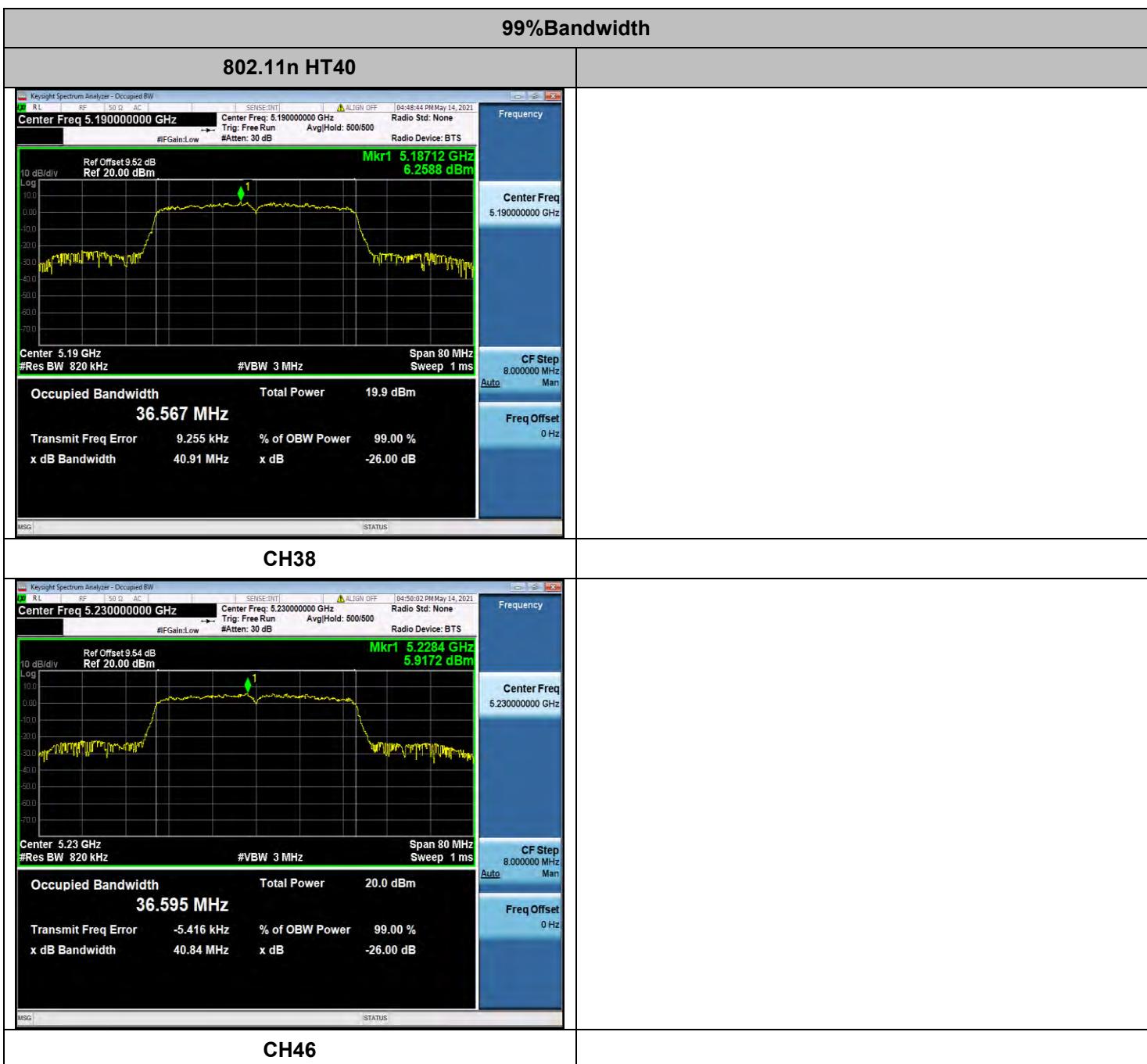
Type	Channel	99%Bandwidth (MHz)	26dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	36	16.583	19.560	-	Pass
	40	16.604	19.800		
	48	16.592	19.680		
802.11nHT20	36	17.610	20.160	-	Pass
	40	17.603	20.400		
	48	17.593	20.440		
802.11n40	38	36.567	40.160	-	Pass
	46	36.595	39.920		

Antenna 1:

Type	Channel	99%Bandwidth (MHz)	26dB Bandwidth (MHz)	Limit (KHz)	Result
802.11a	36	16.588	19.640	-	Pass
	40	16.617	19.640		
	48	16.634	19.640		
802.11nHT20	36	17.628	19.920	-	Pass
	40	17.645	20.240		
	48	17.632	20.680		
802.11n40	38	36.611	40.240	-	Pass
	46	36.623	40.400		

Antenna 0:

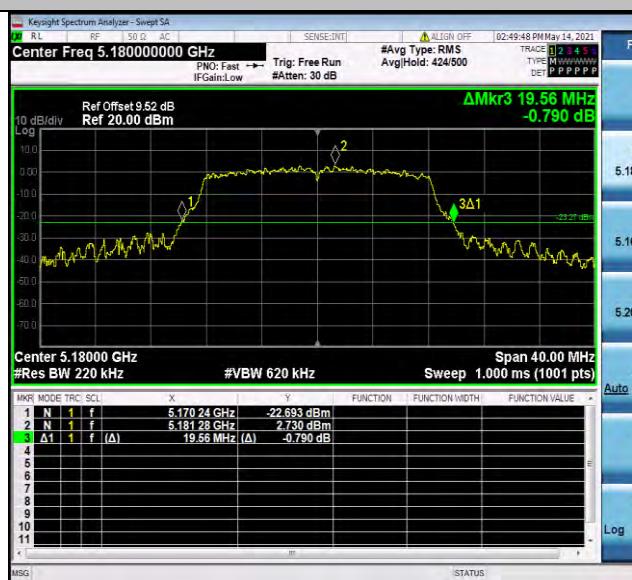




26dB Bandwidth

802.11a

802.11n HT20



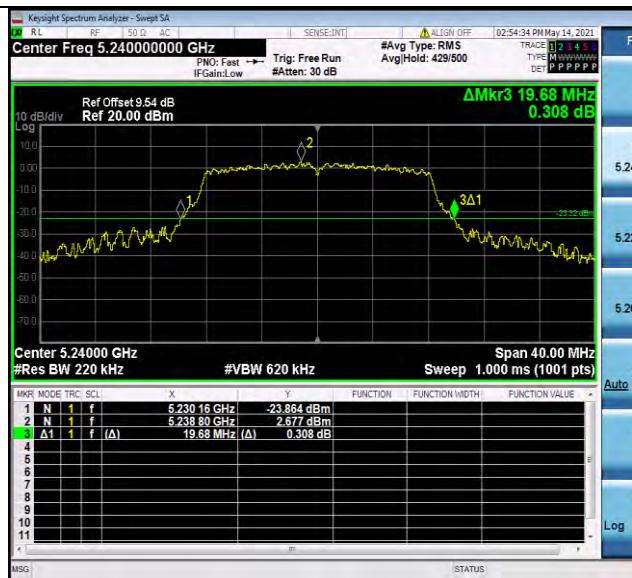
CH36

CH36



CH40

CH40

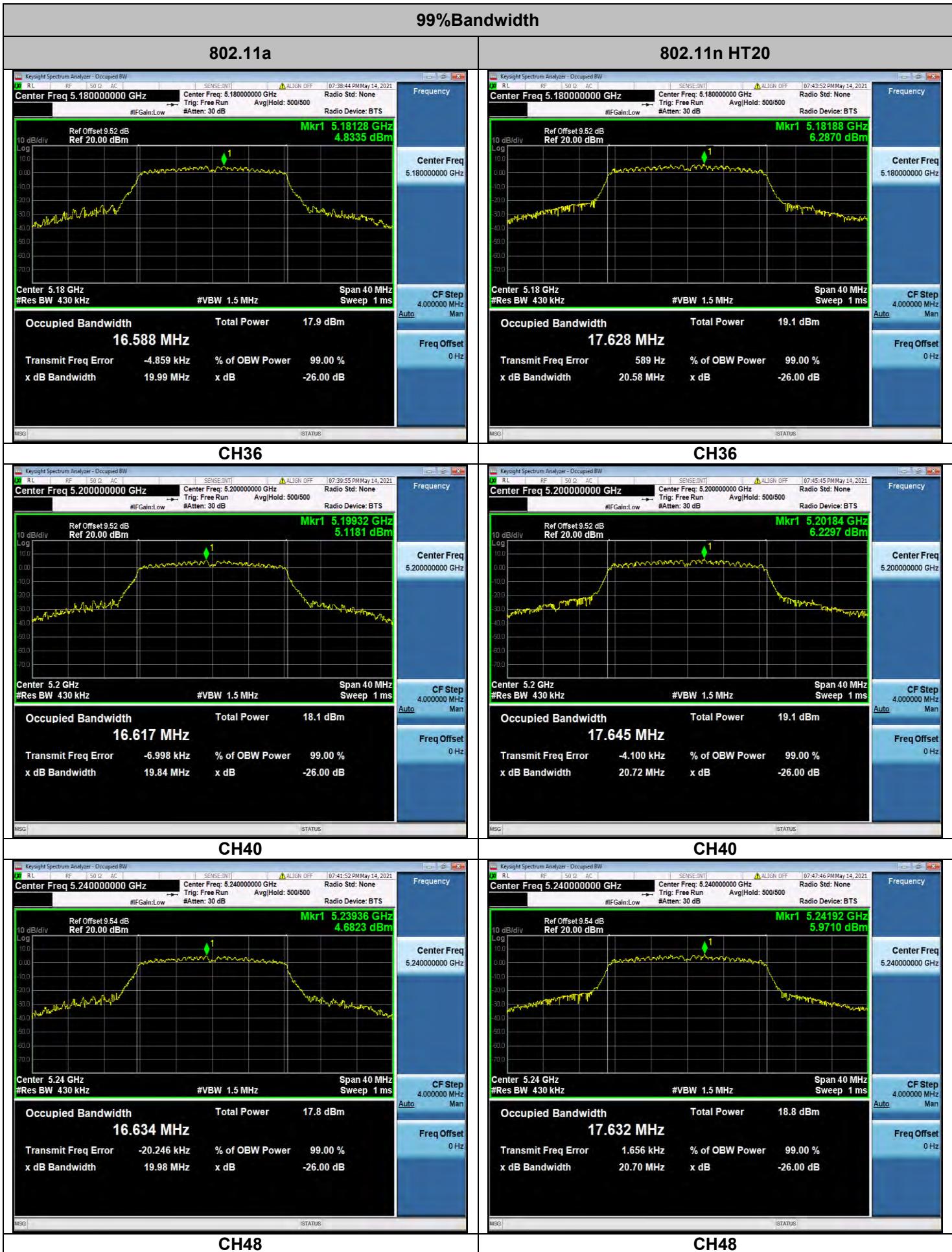


CH48

CH48



Antenna 1:



99% Bandwidth

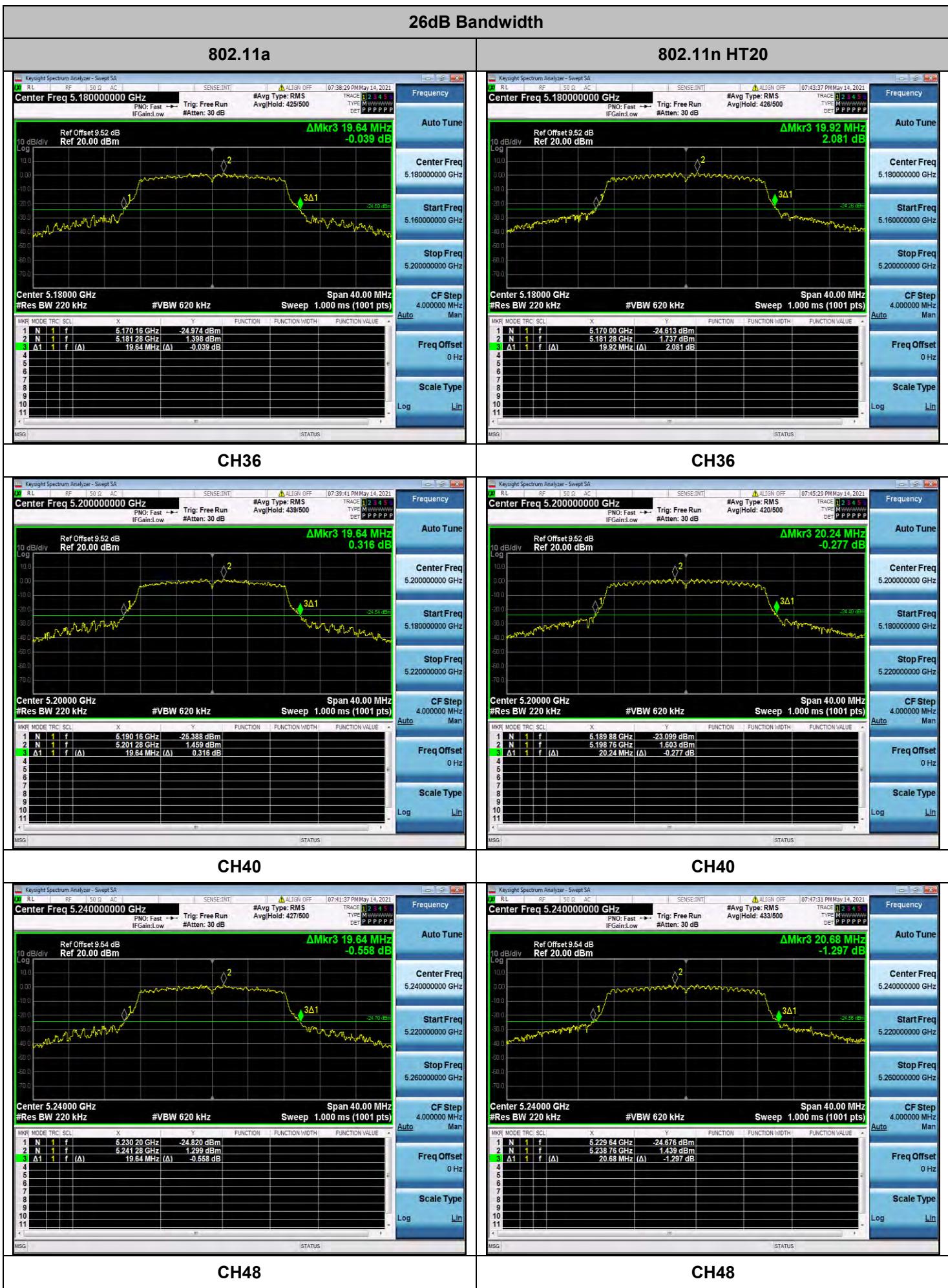
802.11n HT40



CH38



CH46

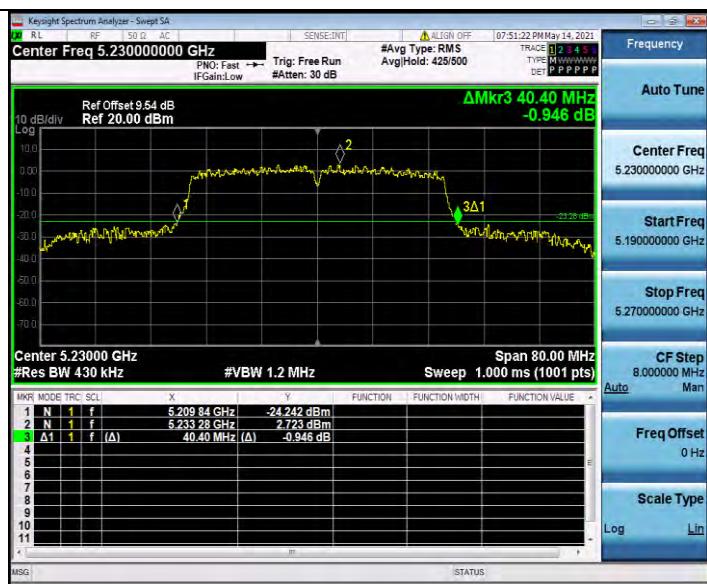


26dB Bandwidth

802.11n HT40



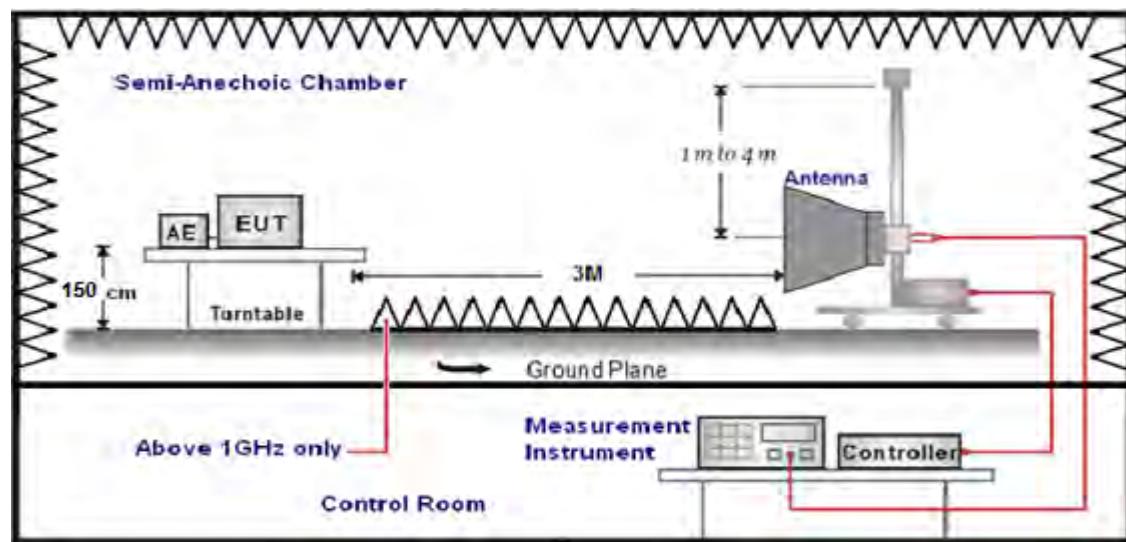
CH38



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 (dB μ V/m)	Radiated (μ V/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 (dB μ V/m)
5150-5250	-27	68.2
5250-5350	-27	68.2
5470-5725	-27	68.2
5725-5850	-27 (beyond 10MHz of the bandedge) -17 (within 10 MHz of band edge)	68.2 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

PASS

For Radiated Bandedge Measurement

Temperature	23.4°C	Humidity	54.5%
Test Engineer	Oliver Ou	Configurations	IEEE 802.11a/n

NOTE: All the modes have been tested and recorded worst mode in the report.(2*2MIMO)

802.11 n20/ Channel 36 :5180 MHz									
Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Margin (dB)	Detector	Polarization
4500.0	35.21	35.58	29.04	8.28	50.03	74.00	-23.97	Peak	Horizontal
4500.0	30.16	35.58	29.04	8.28	44.98	54.00	-9.02	AV	Horizontal
5150.0	39.15	35.58	29.04	8.28	53.97	74.00	-20.03	Peak	Horizontal
5150.0	30.61	35.58	29.04	8.28	45.43	54.00	-8.57	AV	Horizontal

802.11 n20/ Channel 48 :5240 MHz									
Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Margin (dB)	Detector	Polarization
5350.0	35.20	35.42	29.06	8.39	49.95	74.00	-24.05	Peak	Horizontal
5350.0	30.24	35.42	29.06	8.39	44.99	54.00	-9.01	AV	Horizontal
5460.0	39.20	35.42	29.06	8.39	53.95	74.00	-20.05	Peak	Horizontal
5460.0	30.46	35.42	29.06	8.39	45.21	54.00	-8.79	AV	Horizontal

802.11 n20/ Channel 149 :5745 MHz									
Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Margin (dB)	Detector	Polarization
5650.0	30.12	35.35	29.07	8.43	44.83	68.20	-23.37	Peak	Horizontal
5700.0	30.37	35.35	29.07	8.43	45.08	68.20	-23.12	Peak	Horizontal
5720.0	32.08	35.35	29.07	8.43	46.79	68.20	-21.41	Peak	Horizontal
5725.0	30.50	35.35	29.07	8.43	45.21	68.20	-22.99	Peak	Horizontal

802.11 n20/ Channel 165 :5825 MHz									
Freq (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Margin (dB)	Detector	Polarization
5850.0	30.17	35.3	29.11	8.51	44.87	68.20	-23.33	Peak	Horizontal
5855.0	30.38	35.3	29.11	8.51	45.08	68.20	-23.12	Peak	Horizontal
5875.0	32.12	35.3	29.11	8.51	46.82	68.20	-21.38	Peak	Horizontal
5925.0	30.63	35.3	29.11	8.51	45.33	68.20	-22.87	Peak	Horizontal

REMARKS:

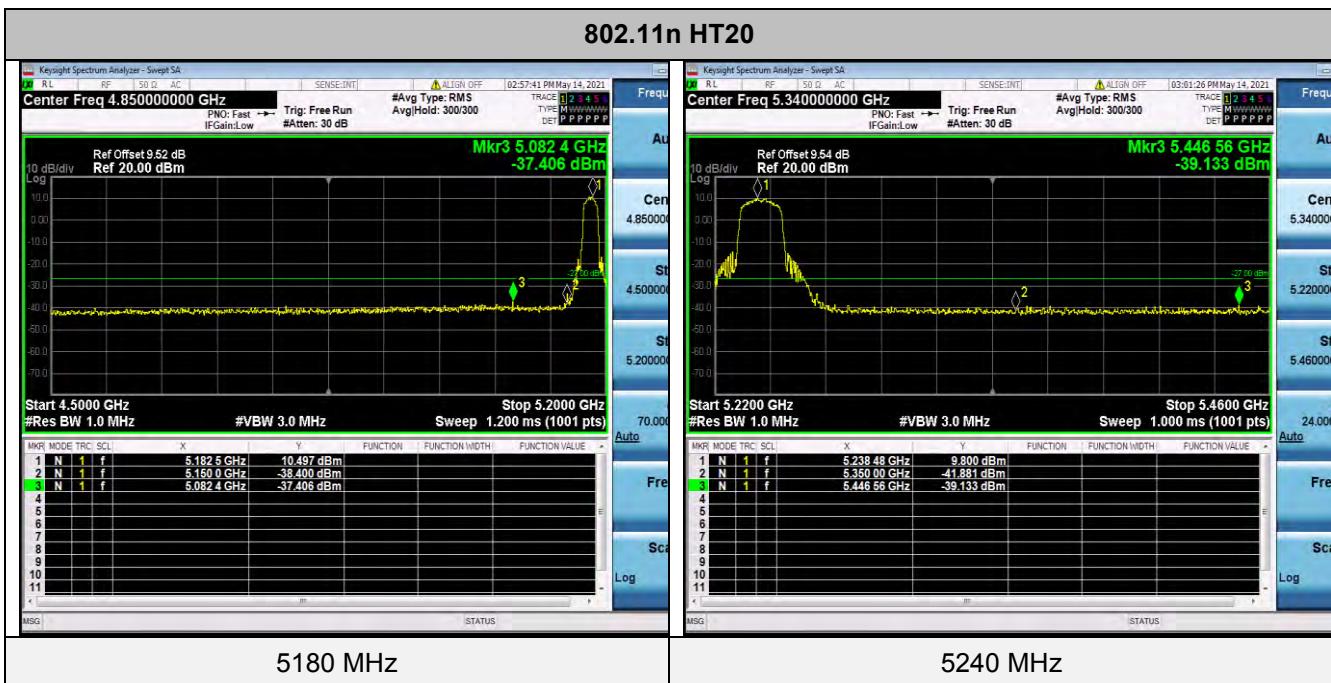
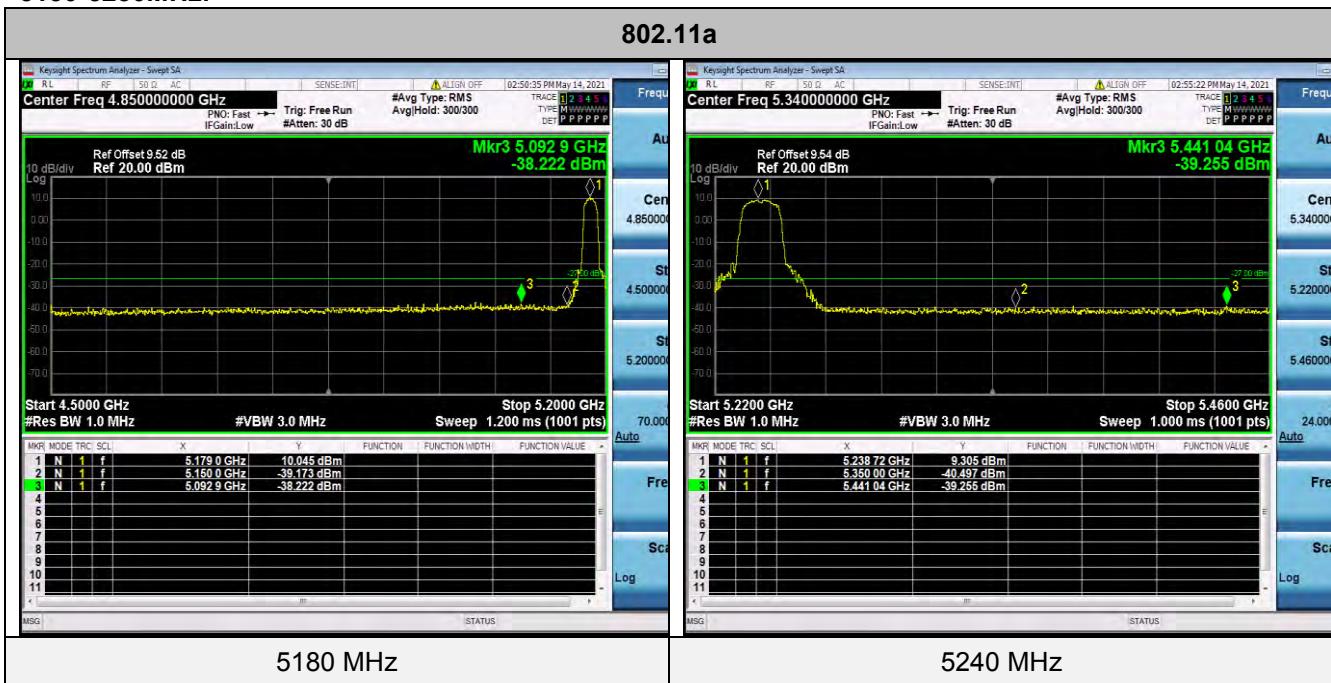
1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. Margin value = Result Level-Limit value.
3. The other emission levels were very low against the limit.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
4. Detector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

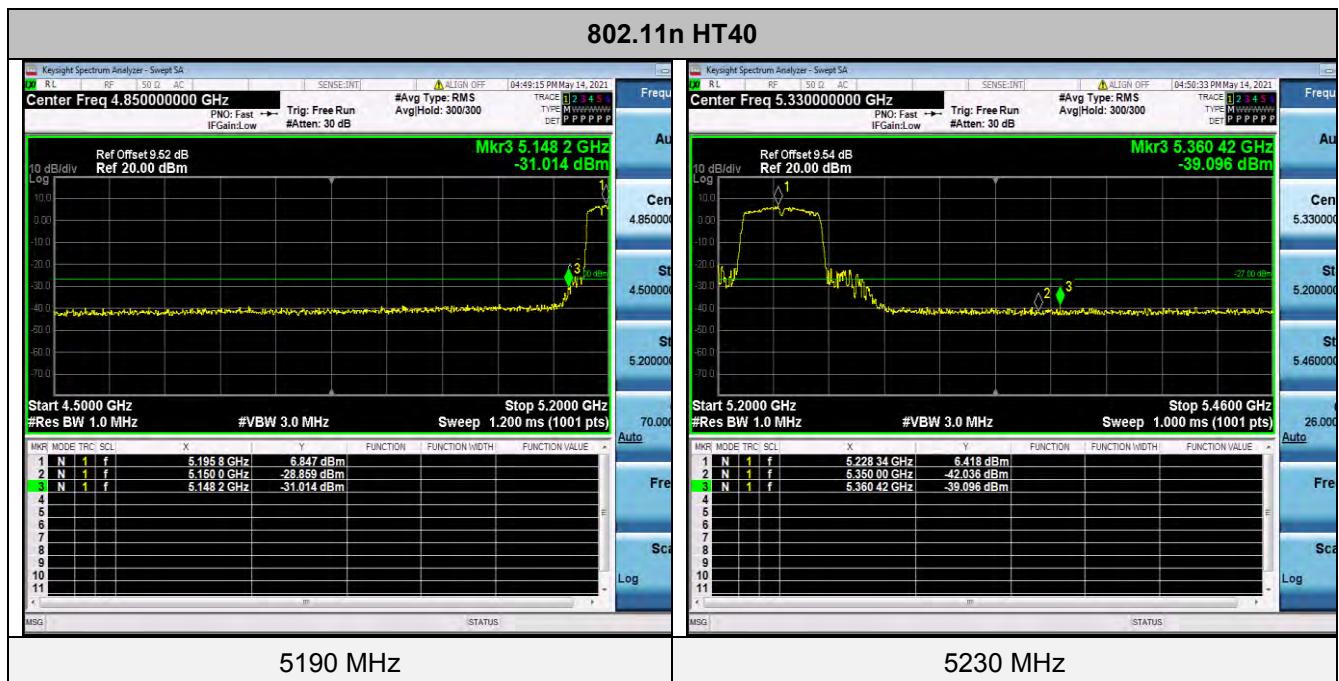
For Conducted Band edge Measurement

Temperature	23.6 °C	Humidity	55.7%
Test Engineer	Oliver Ou	Configurations	IEEE 802.11a/n

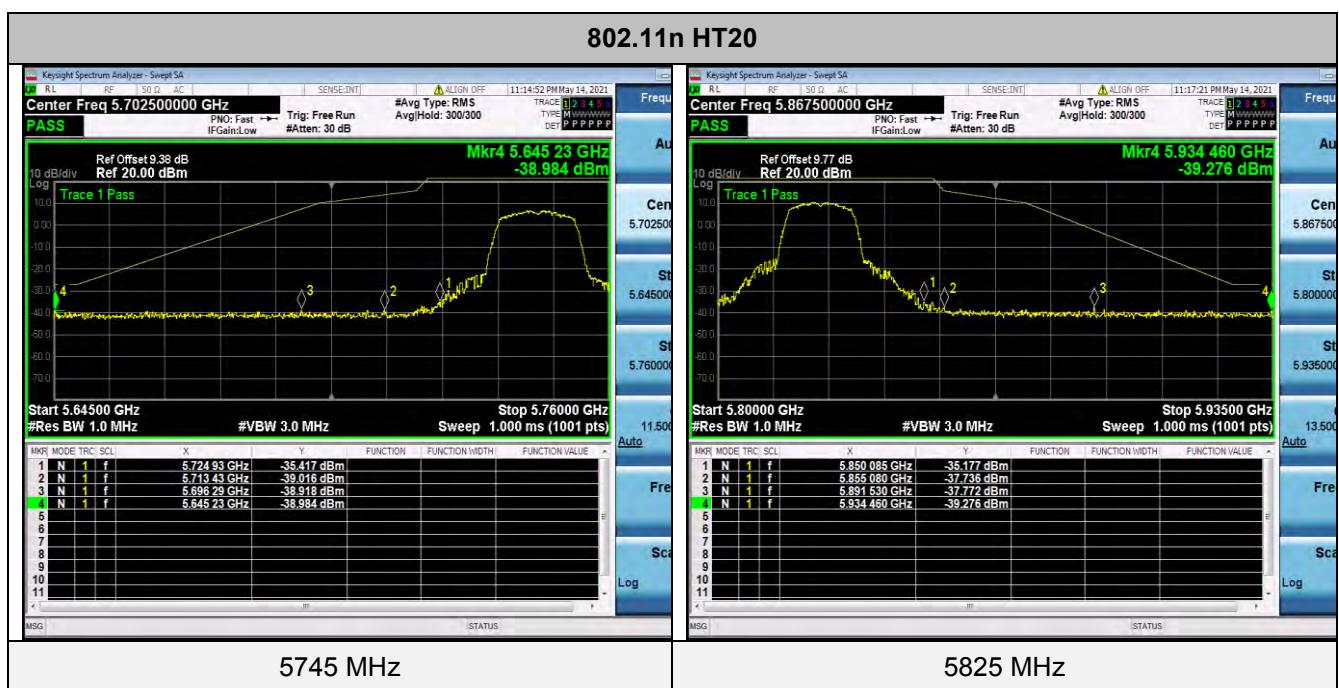
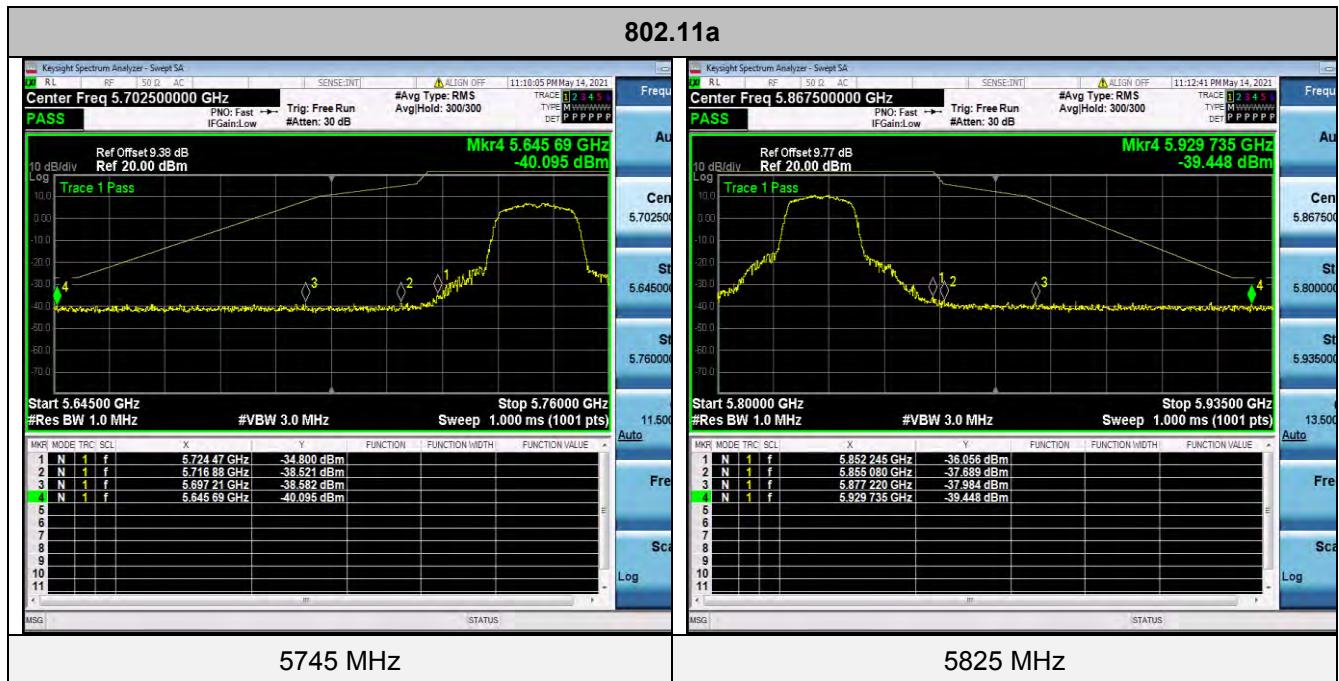
The test results have included the antenna gain

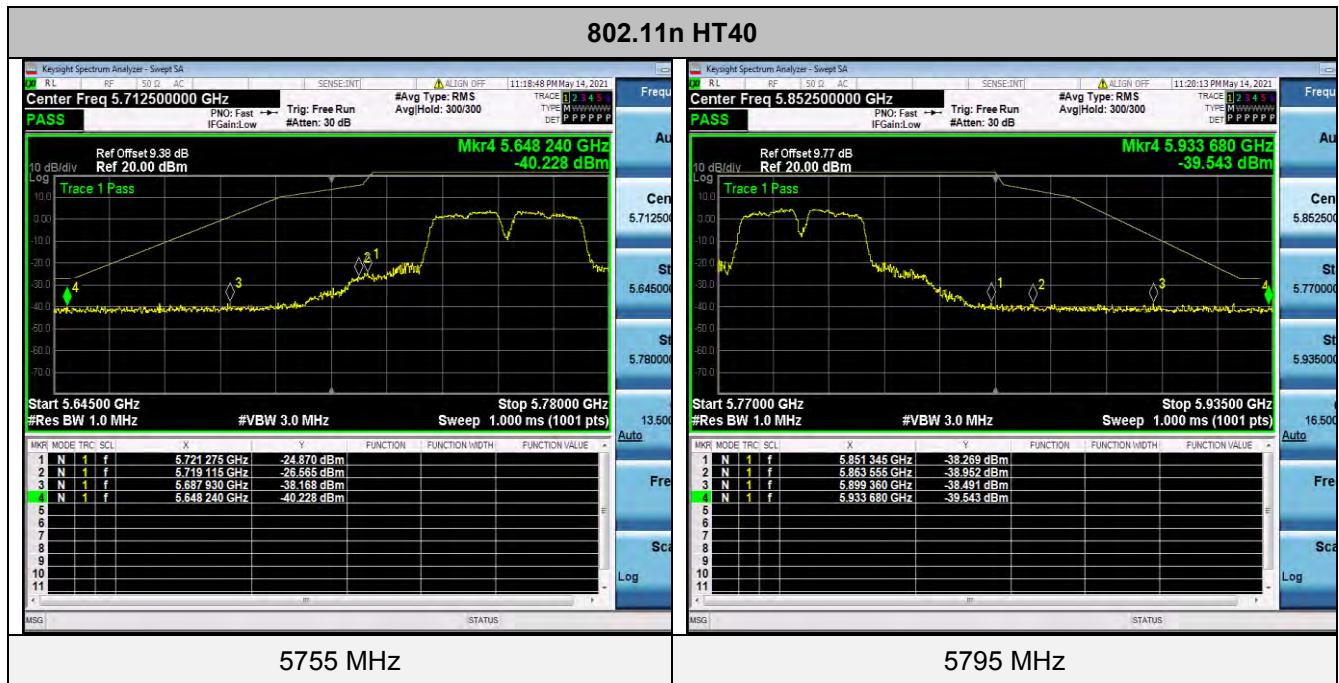
Antenna 0:
5150-5250MHz:





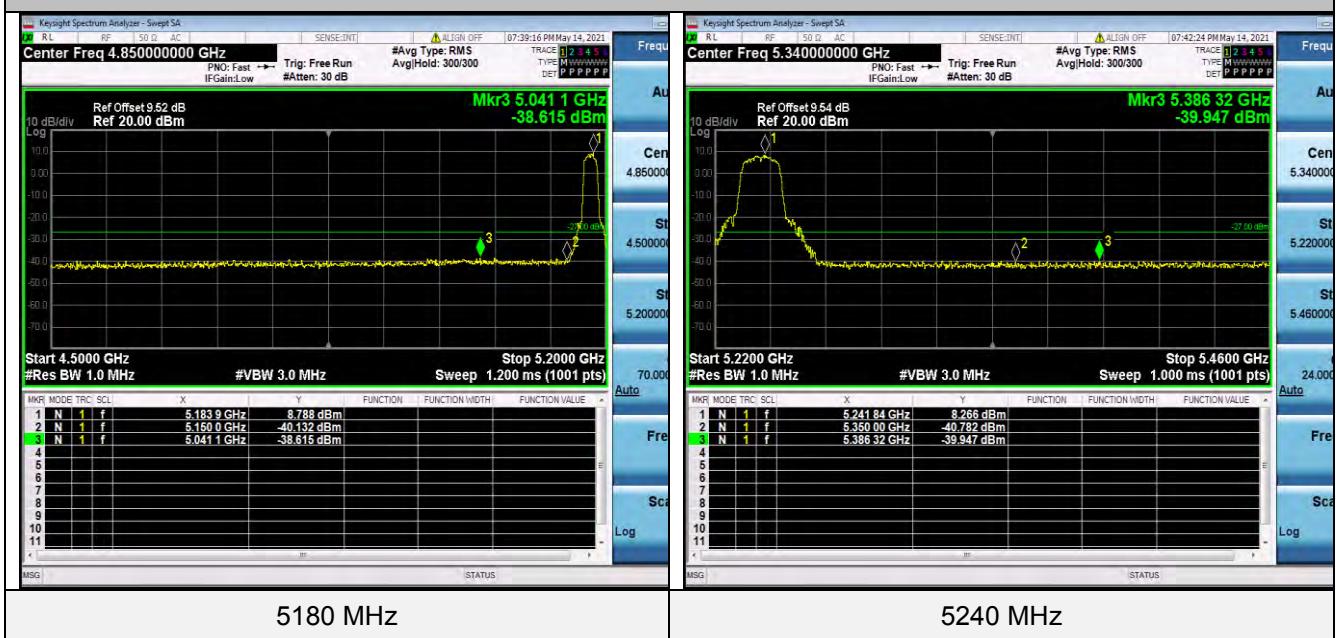
5725-5850MHz:



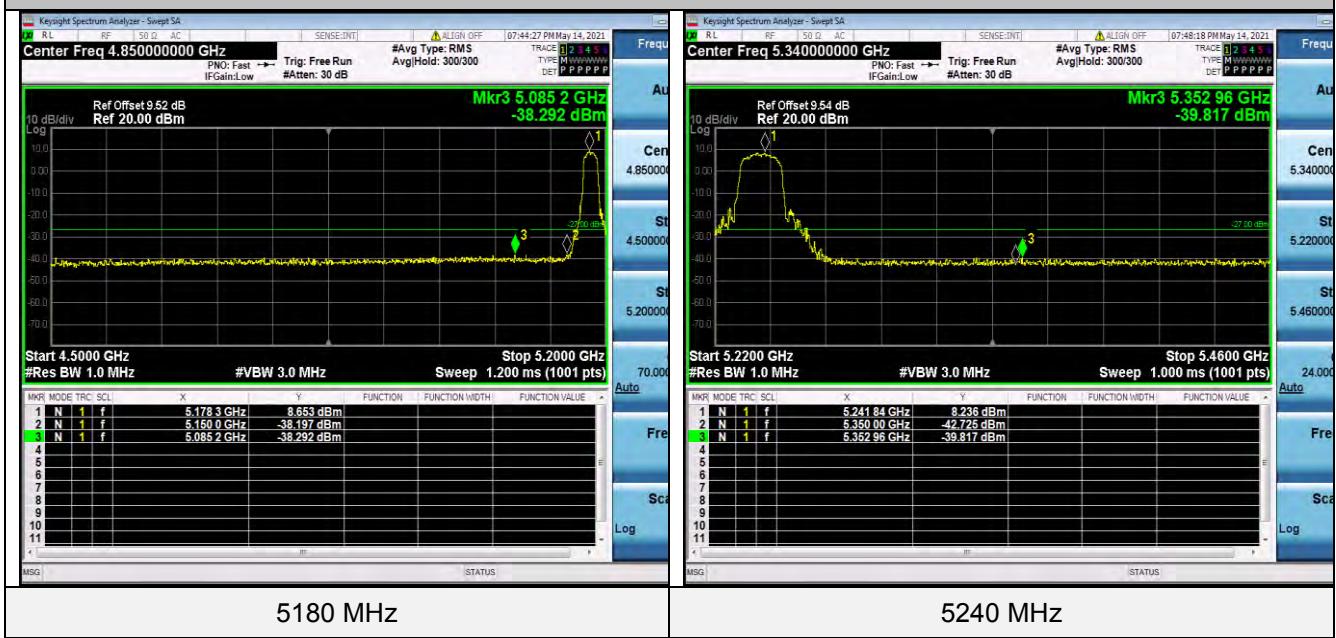


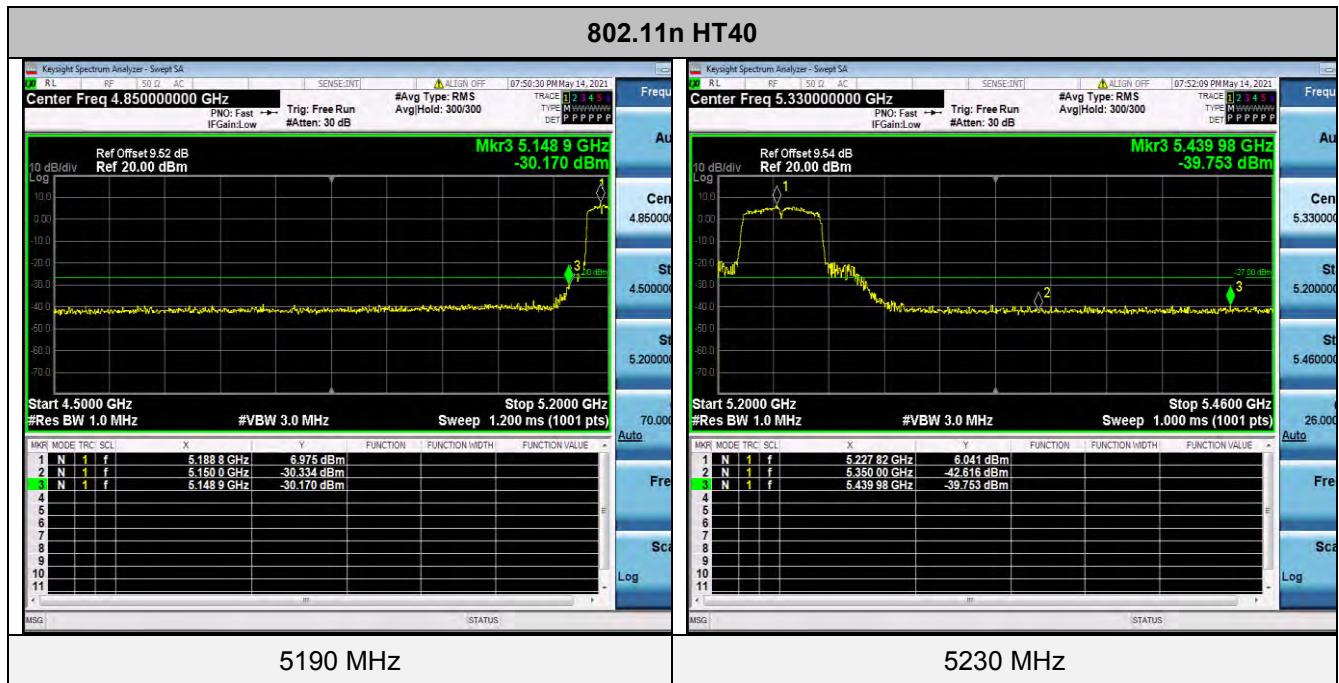
Antenna 1:
5150-5250MHz:

802.11a

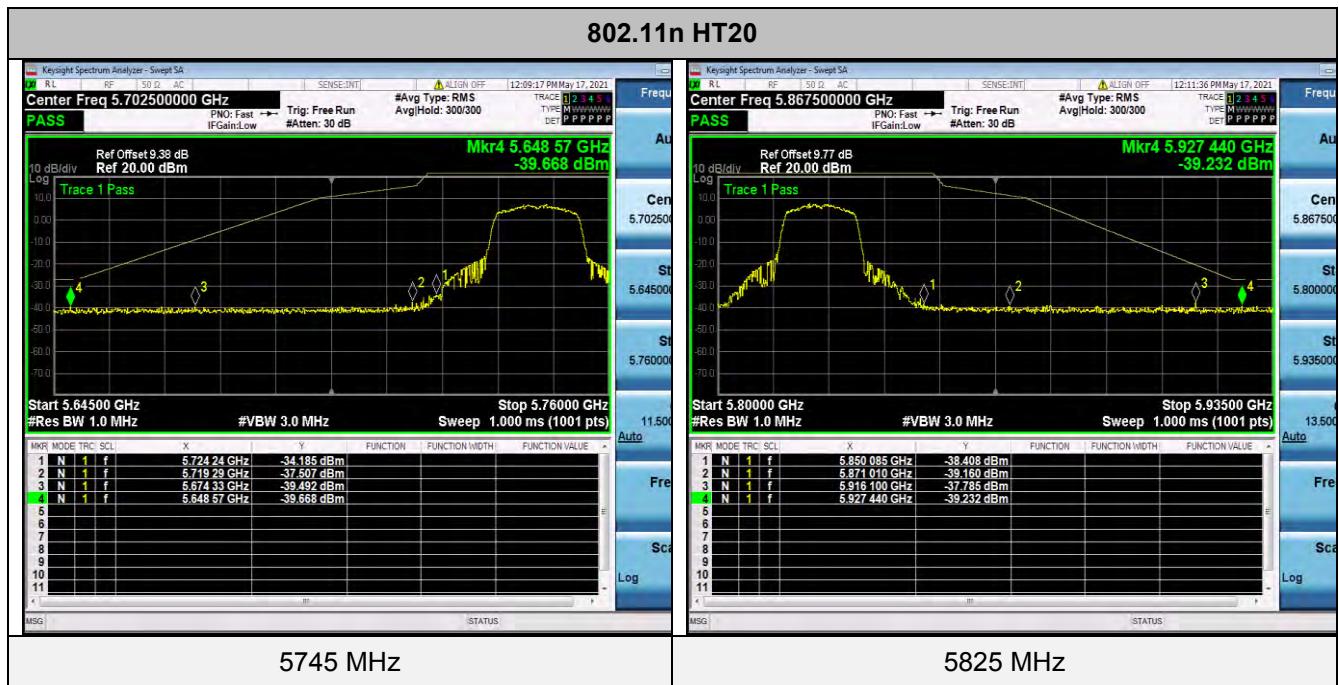
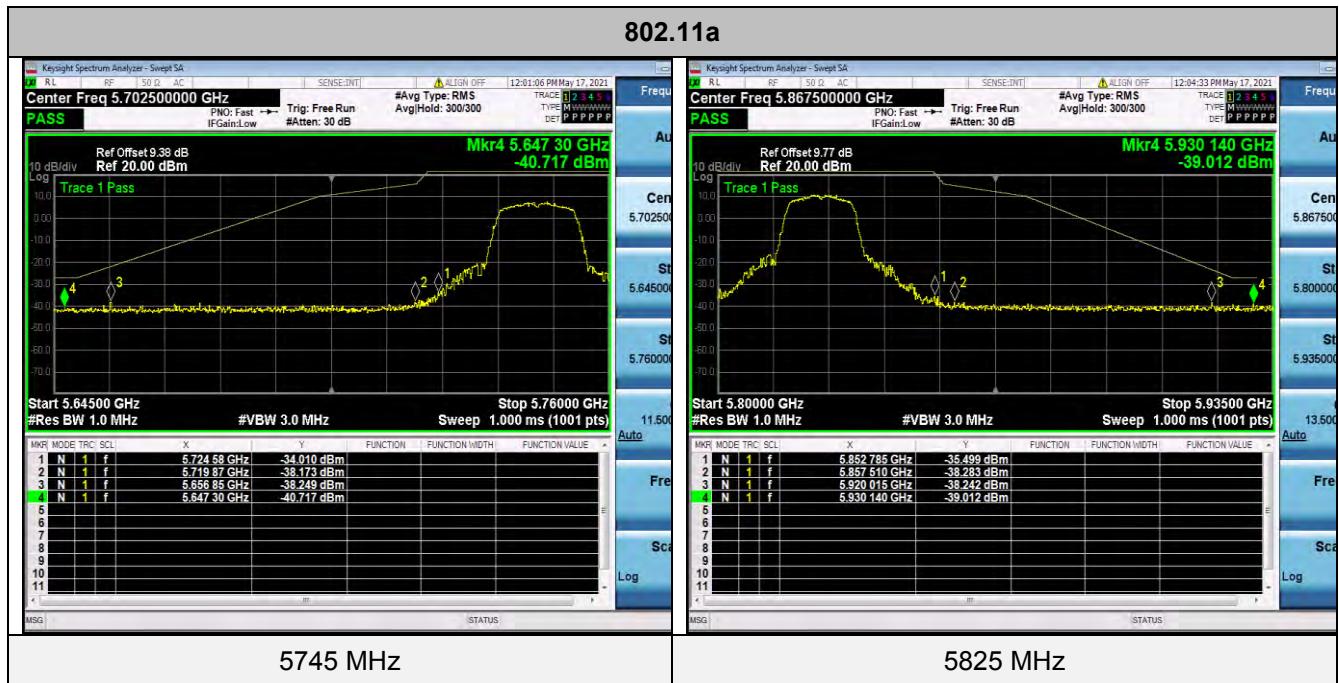


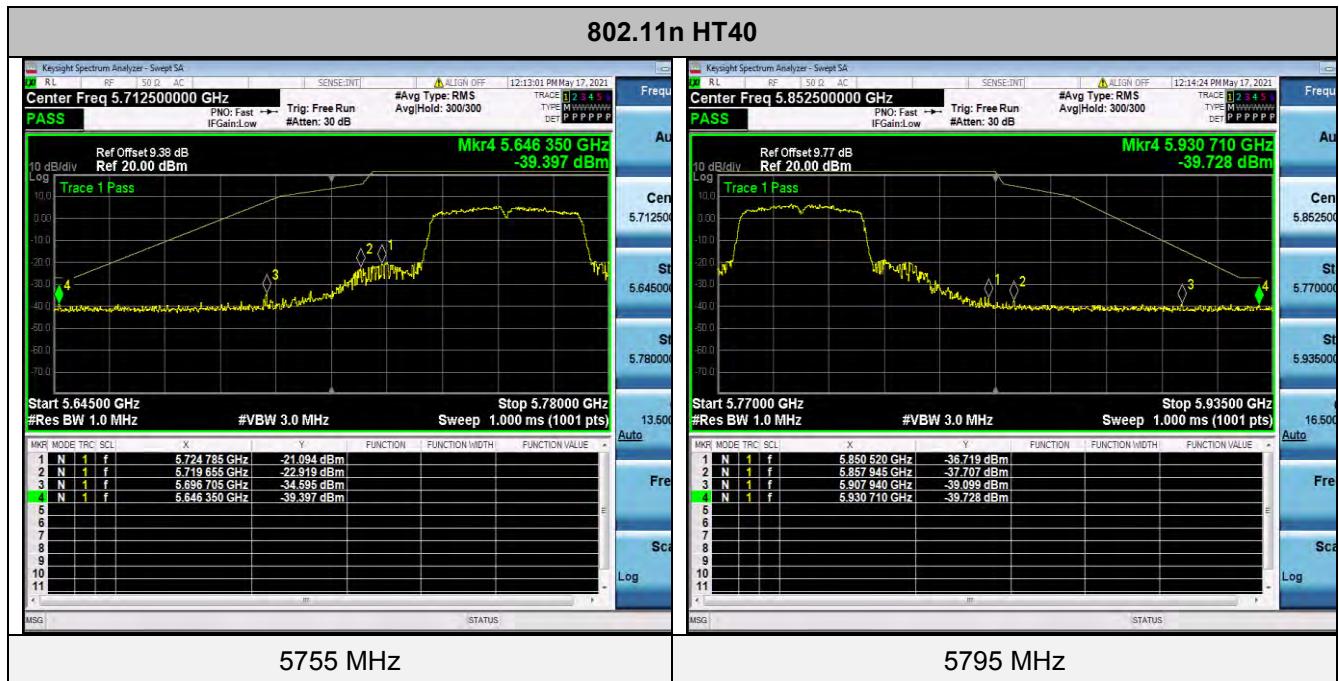
802.11n HT20





5725-5850MHz:





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."

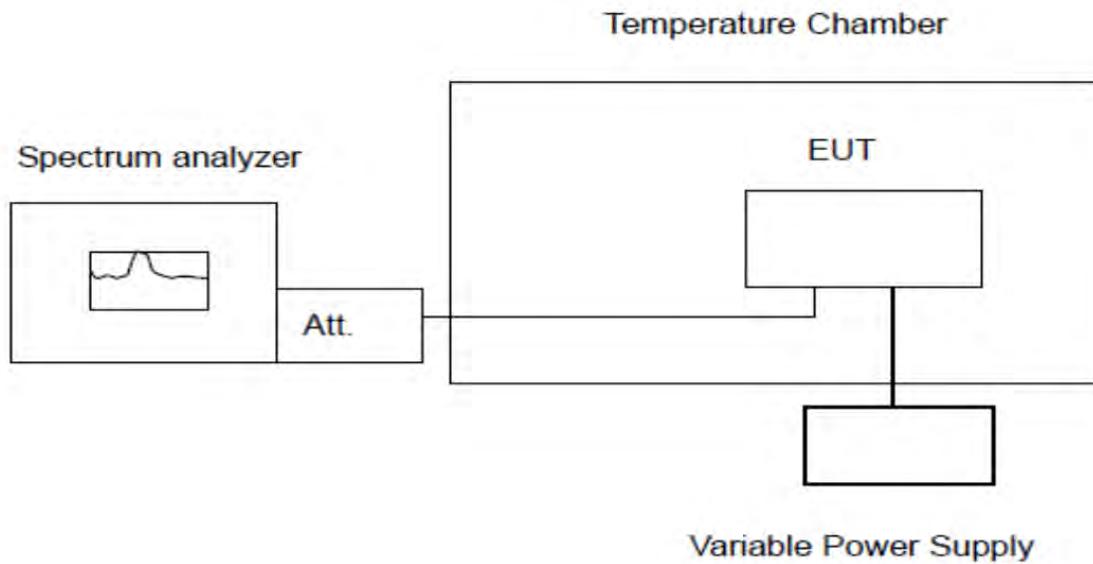
According to FCC §2.1055(a) "The frequency stability shall be measured with variation of ambient temperature as follows:"

(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 (Dregree)	Voltage (V)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	DC 5.5V	5180.001792	5150 – 5250	PASS
20	DC 4.5V	5180.003632	5150 – 5250	PASS
50	DC 5V	5180.009992	5150 – 5250	PASS
40	DC 5V	5180.020498	5150 – 5250	PASS
30	DC 5V	5179.996269	5150 – 5250	PASS
20	DC 5V	5179.963130	5150 – 5250	PASS
10	DC 5V	5179.991346	5150 – 5250	PASS
0	DC 5V	5179.990812	5150 – 5250	PASS
-10	DC 5V	5180.020878	5150 – 5250	PASS
-20	DC 5V	5180.002604	5150 – 5250	PASS
-30	DC 5V	5180.024790	5150 – 5250	PASS

IEEE 802.11a Mode / 5180 – 5240 MHz / 5240 MHz

Enviroment Temperature (Dregree)	Voltage (V)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	DC 5.5V	5240.007842	5150 – 5250	PASS
20	DC 4.5V	5240.001123	5150 – 5250	PASS
50	DC 5V	5239.992075	5150 – 5250	PASS
40	DC 5V	5239.986626	5150 – 5250	PASS
30	DC 5V	5240.006804	5150 – 5250	PASS
20	DC 5V	5239.982549	5150 – 5250	PASS
10	DC 5V	5239.996567	5150 – 5250	PASS
0	DC 5V	5239.987957	5150 – 5250	PASS
-10	DC 5V	5240.013140	5150 – 5250	PASS
-20	DC 5V	5239.969325	5150 – 5250	PASS
-30	DC 5V	5240.005452	5150 – 5250	PASS

IEEE 802.11a Mode / 5745 – 5825 MHz / 5745 MHz

Enviroment Temperature (Dregree)	Voltage (V)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	DC 5.5V	5745.010678	5725 – 5850	PASS
20	DC 4.5V	5745.001885	5725 – 5850	PASS
50	DC 5V	5745.010219	5725 – 5850	PASS
40	DC 5V	5744.999478	5725 – 5850	PASS
30	DC 5V	5744.982554	5725 – 5850	PASS
20	DC 5V	5744.981959	5725 – 5850	PASS
10	DC 5V	5744.969191	5725 – 5850	PASS
0	DC 5V	5745.034380	5725 – 5850	PASS
-10	DC 5V	5745.013034	5725 – 5850	PASS
-20	DC 5V	5744.972657	5725 – 5850	PASS
-30	DC 5V	5745.003027	5725 – 5850	PASS

IEEE 802.11a Mode / 5745 – 5825 MHz / 5825 MHz

Enviroment Temperature (Dregree)	Voltage (V)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	DC 5.5V	5824.996422	5725 – 5850	PASS
20	DC 4.5V	5825.021668	5725 – 5850	PASS
50	DC 5V	5825.006393	5725 – 5850	PASS
40	DC 5V	5825.013370	5725 – 5850	PASS
30	DC 5V	5825.008421	5725 – 5850	PASS
20	DC 5V	5824.995339	5725 – 5850	PASS
10	DC 5V	5825.019911	5725 – 5850	PASS
0	DC 5V	5824.981384	5725 – 5850	PASS
-10	DC 5V	5824.996791	5725 – 5850	PASS
-20	DC 5V	5824.998442	5725 – 5850	PASS
-30	DC 5V	5824.975181	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 External Aantenna, through the buckle stretched out, The directional gains of antenna used for transmitting is 2dBi.

Reference to the Test Report: **GTS20210430001-1-9.**

5. TEST SETUP PHOTOS OF THE EUT

Reference to the test report No. **GTS20210430001-1-9**.

6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Reference to the test report No. **GTS20210430001-1-9**.

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