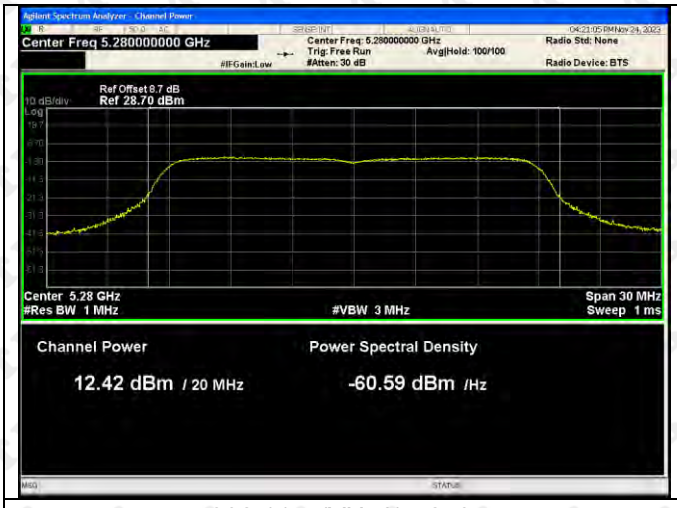
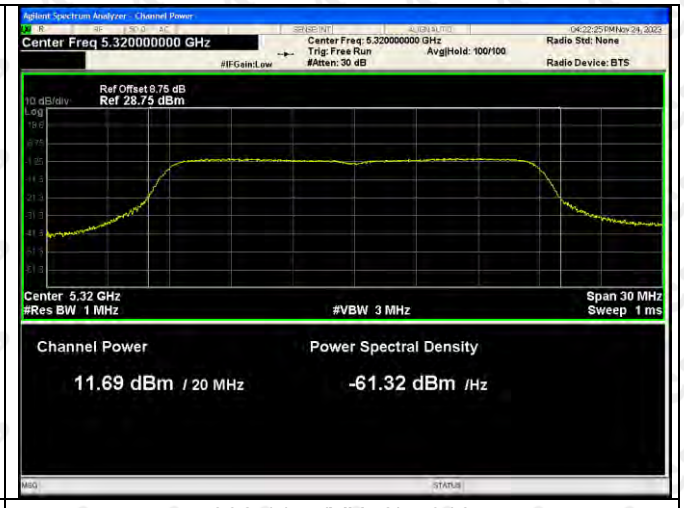
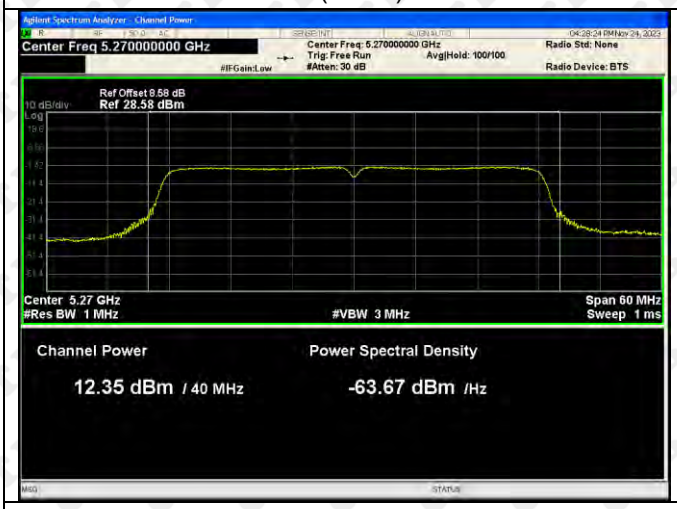


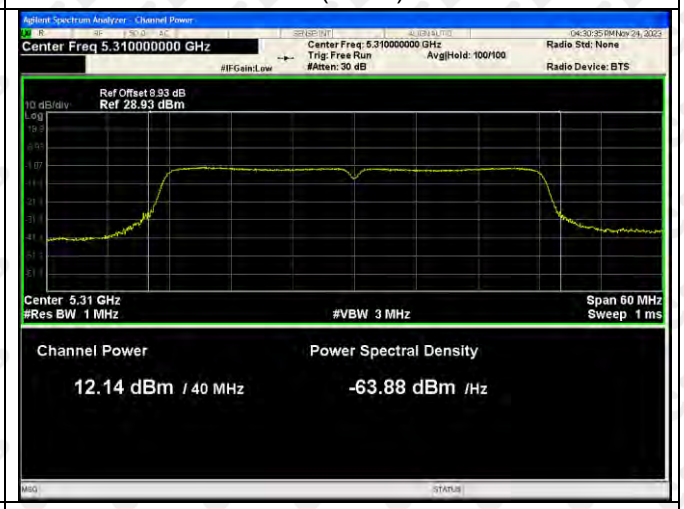
802.11ac(VH40)-5270



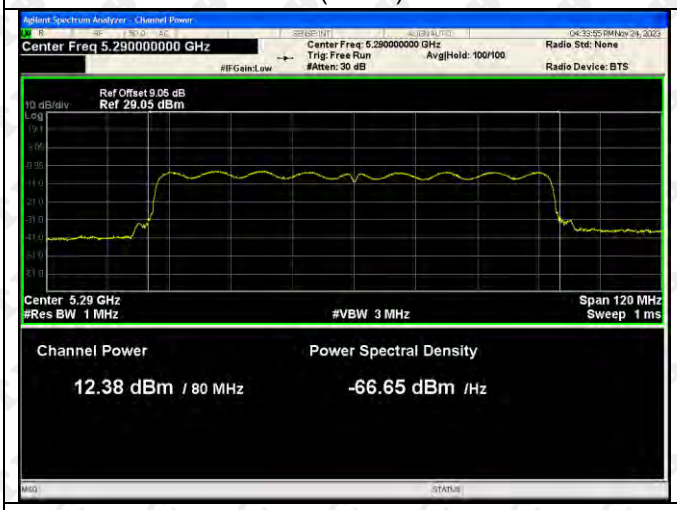
802.11ac(VH40)-5310



802.11ac(VH80)-5290

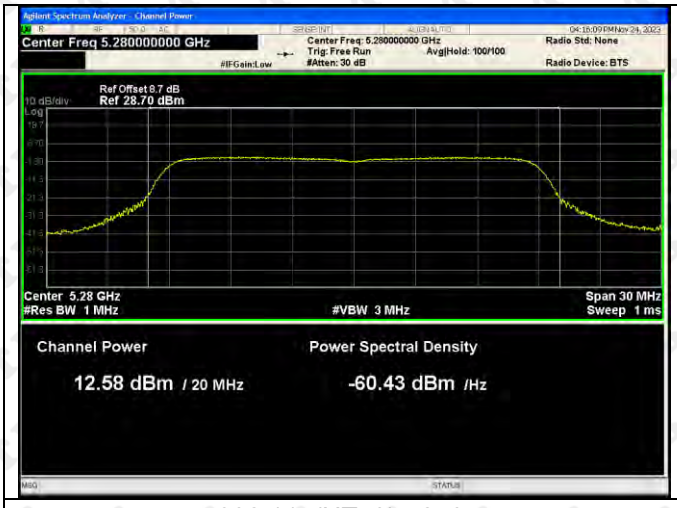


802.11n(HT20)-5260

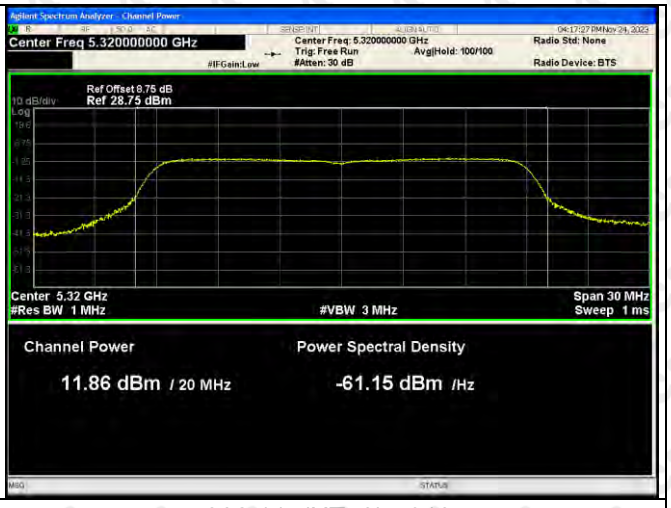


802.11n(HT20)-5280

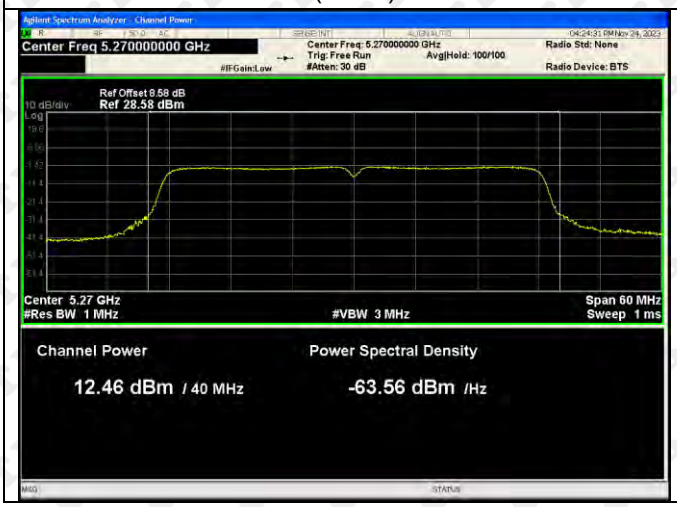
802.11n(HT20)-5320

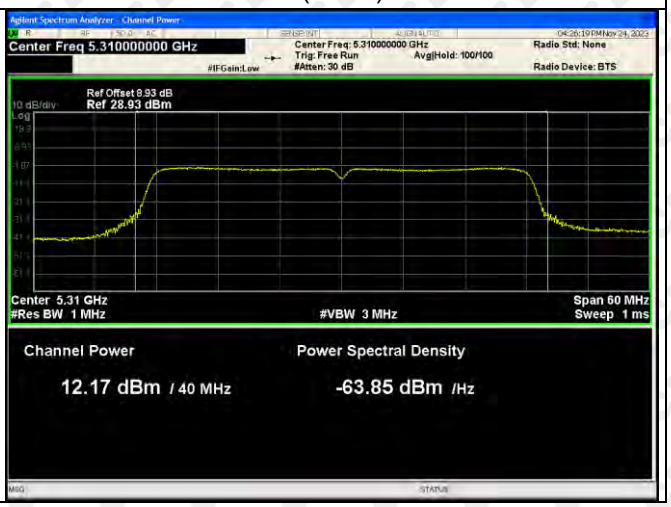


802.11n(HT40)-5270



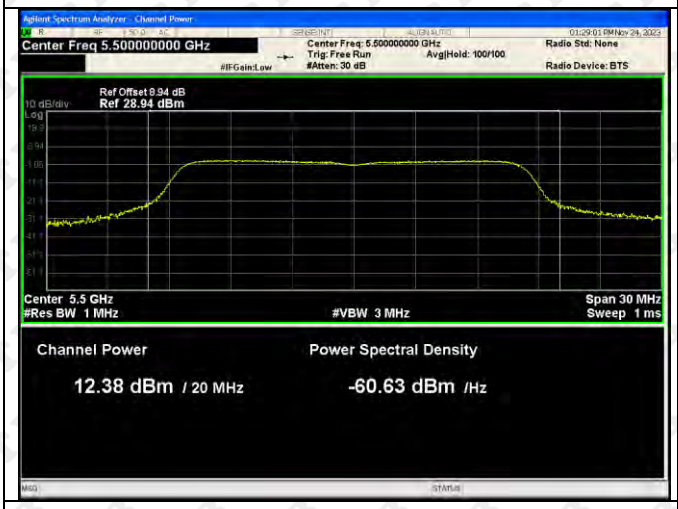
802.11n(HT40)-5310



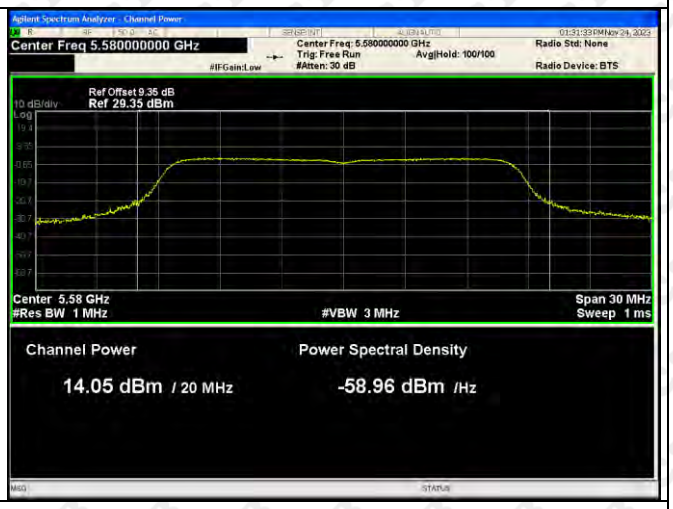


5470-5725MHz-Power
ANT1

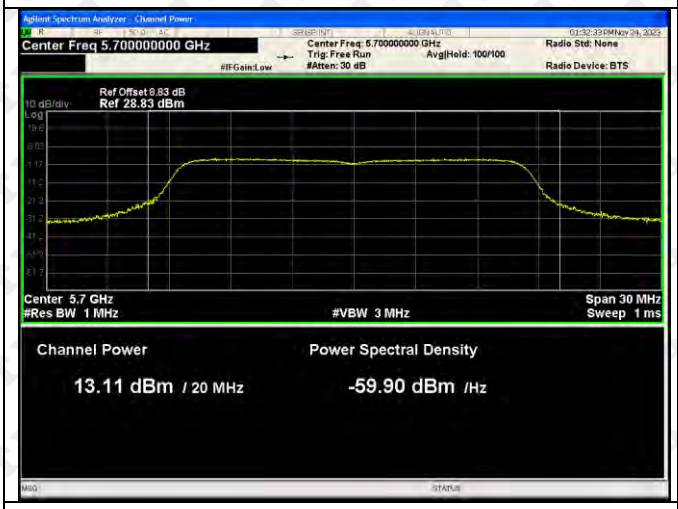
802.11a-5500



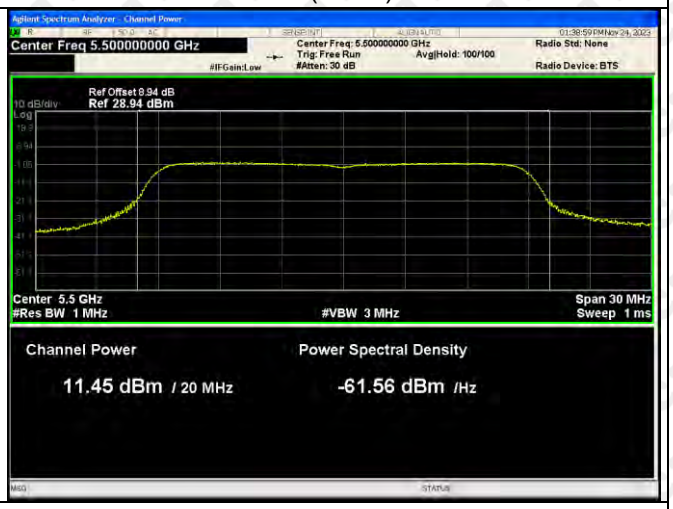
802.11a-5580



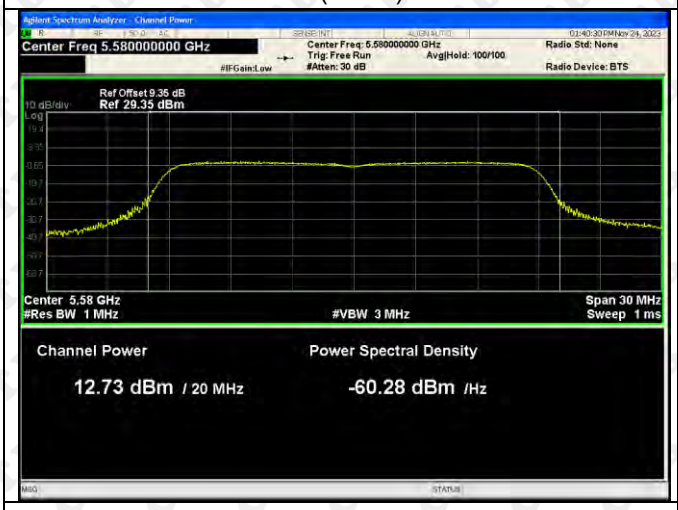
802.11a-5700



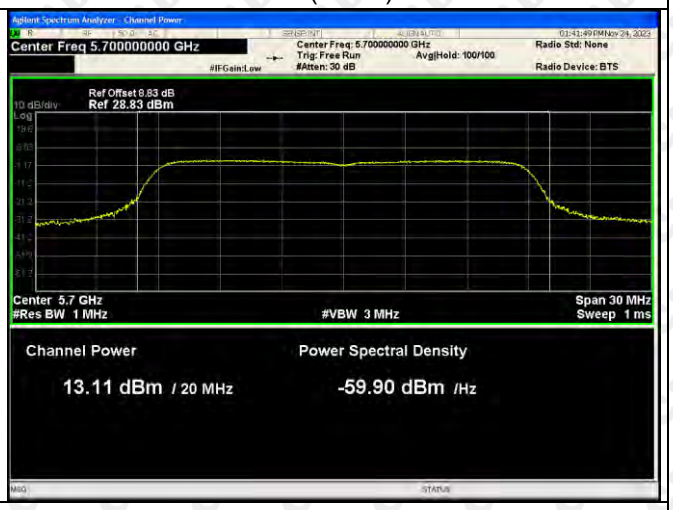
802.11ac(VH20)-5500



802.11ac(VH20)-5580

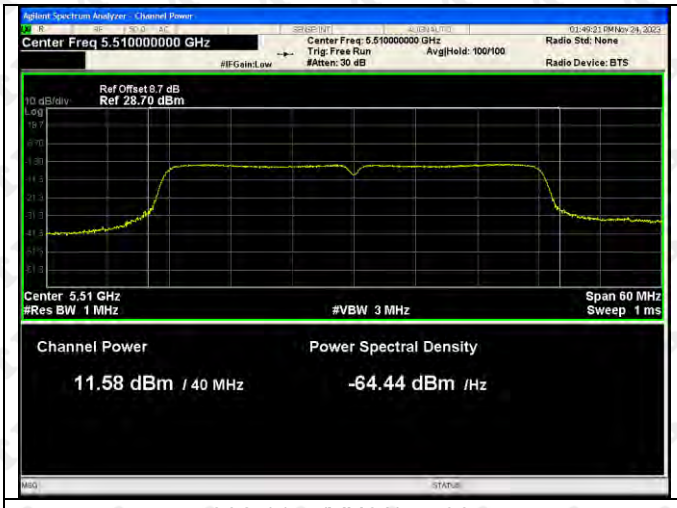


802.11ac(VH20)-5700

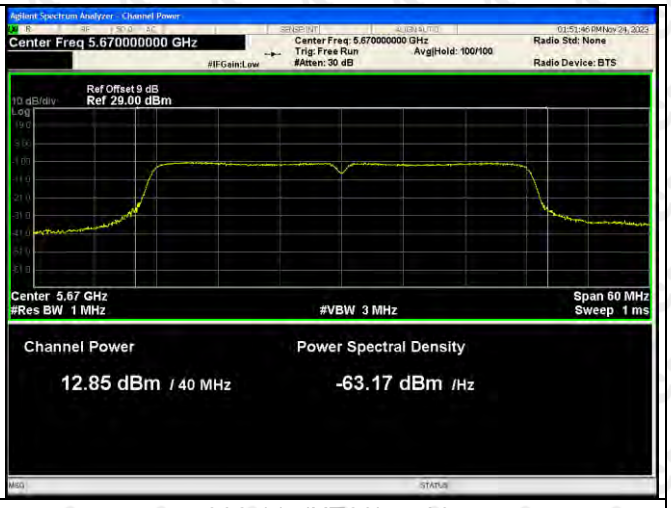


802.11ac(VH40)-5510

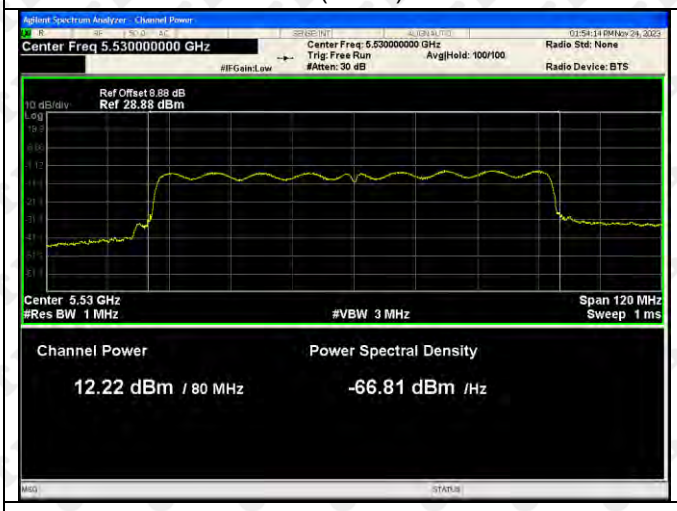
802.11ac(VH40)-5670



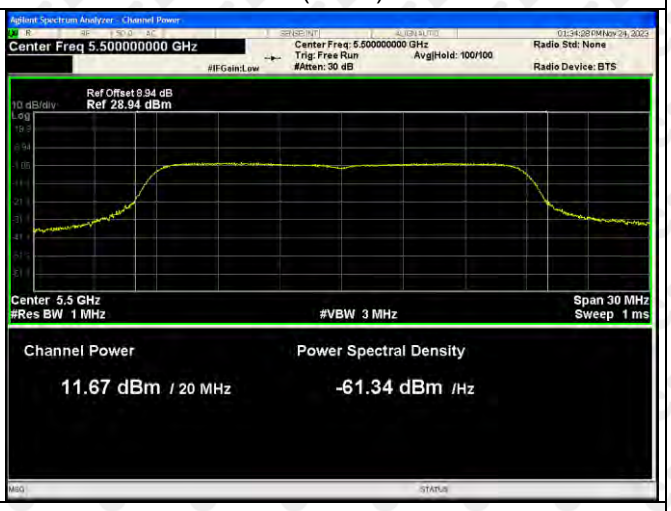
802.11ac(VH80)-5530



802.11n(HT20)-5500



802.11n(HT20)-5580



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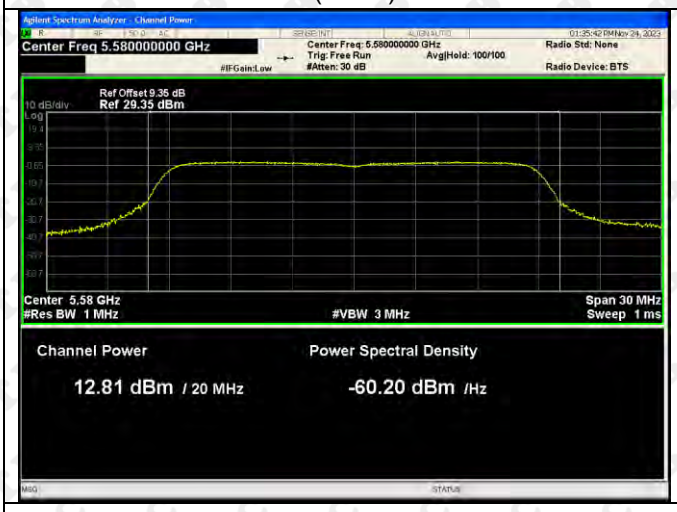
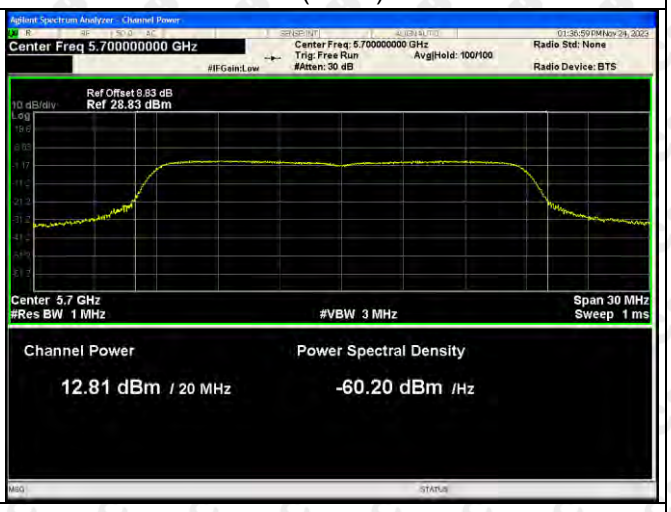
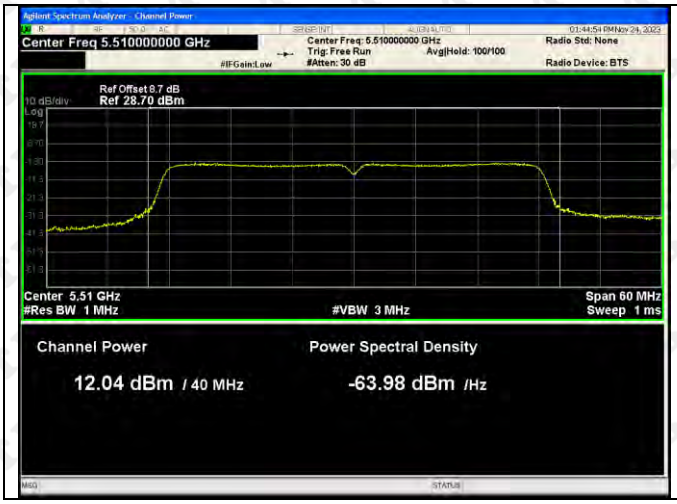
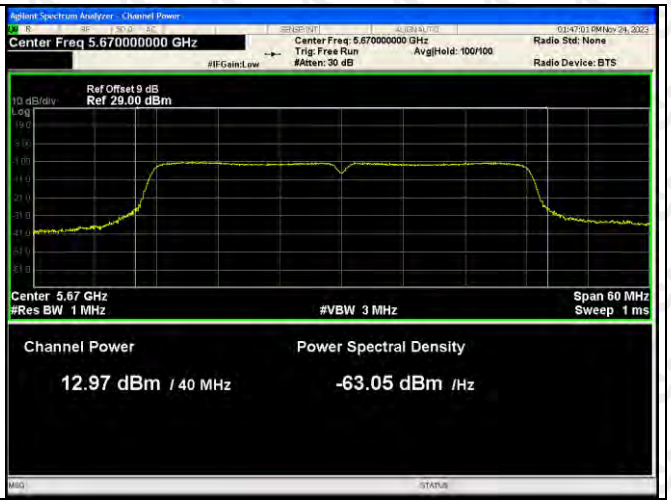


802.11n(HT40)-5510

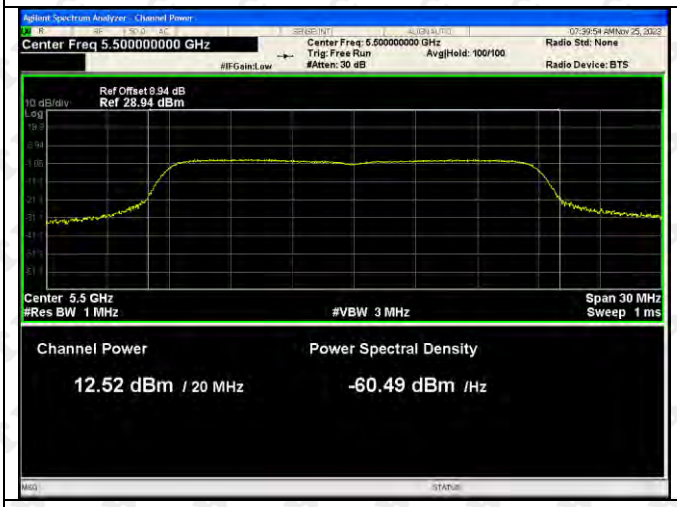
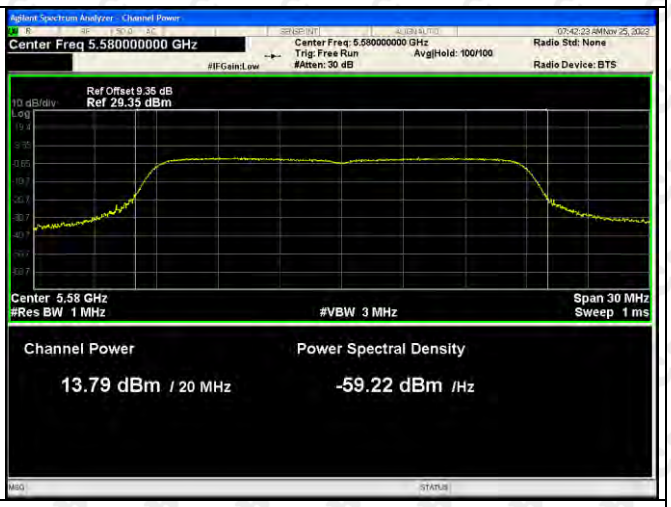
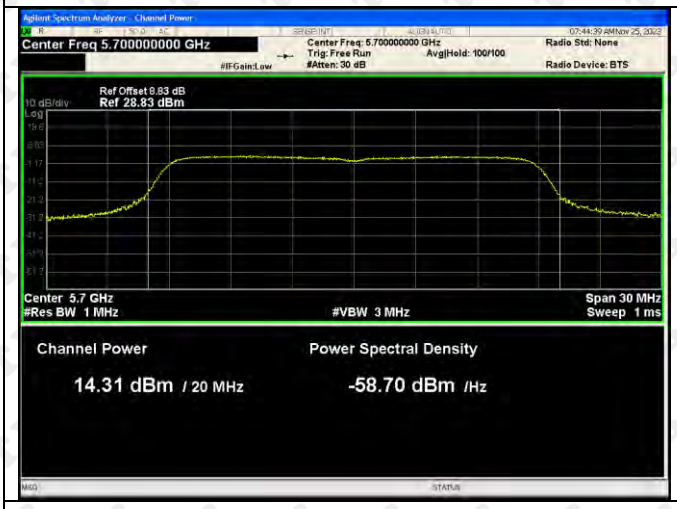
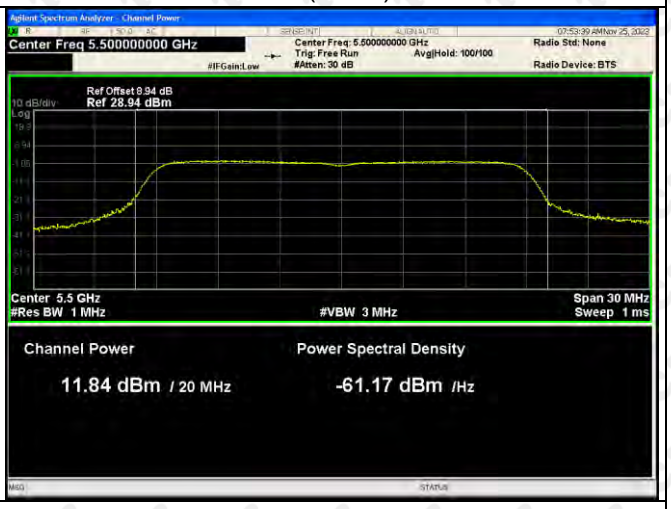


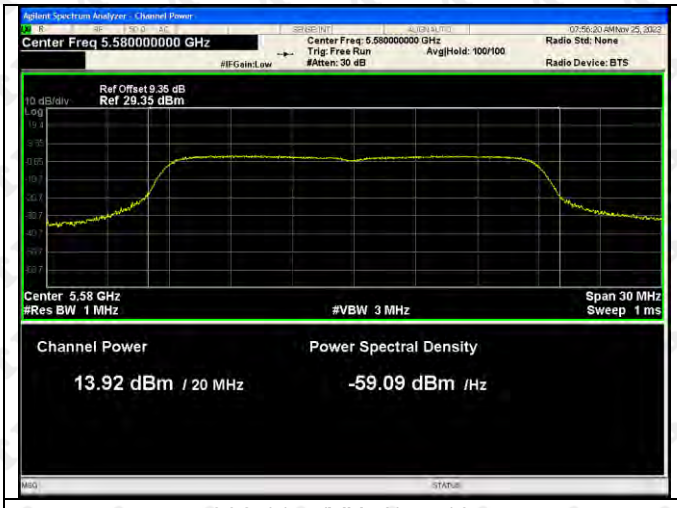
802.11n(HT40)-5670



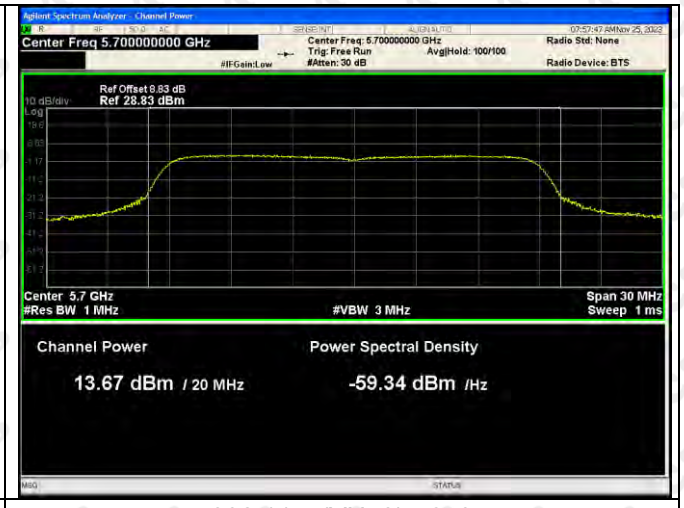


ANT2

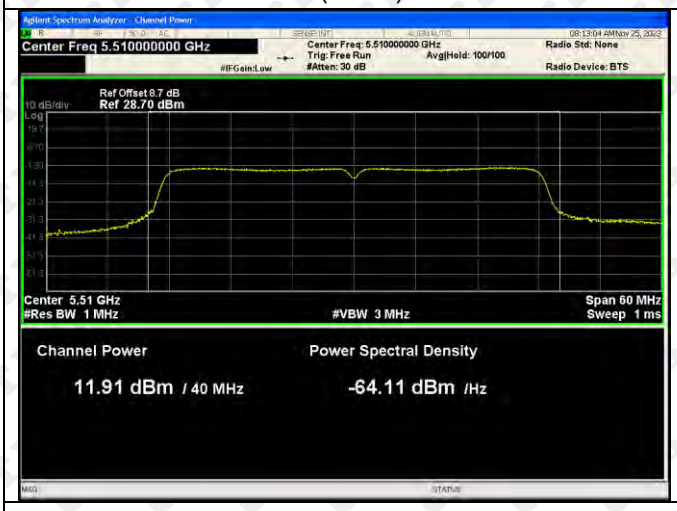
802.11a-5500	802.11a-5580
	
802.11a-5700	802.11ac(VH20)-5500
	
802.11ac(VH20)-5580	802.11ac(VH20)-5700



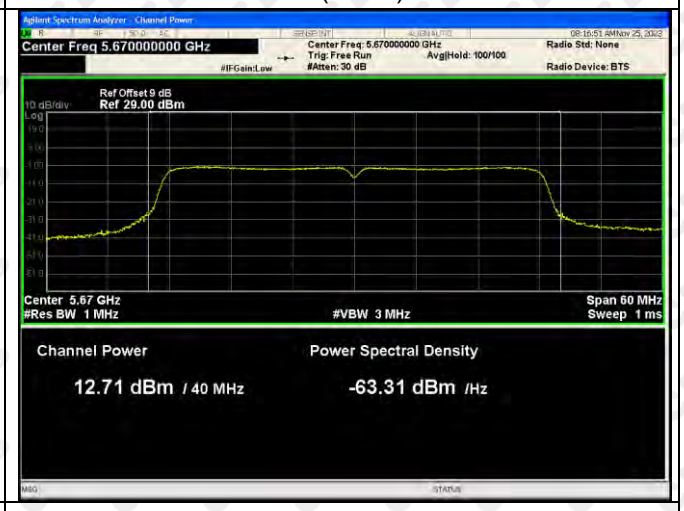
802.11ac(VH40)-5510



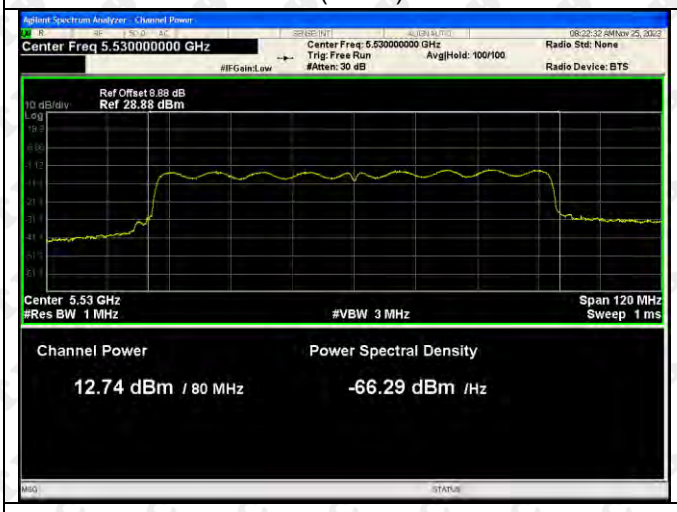
802.11ac(VH40)-5670



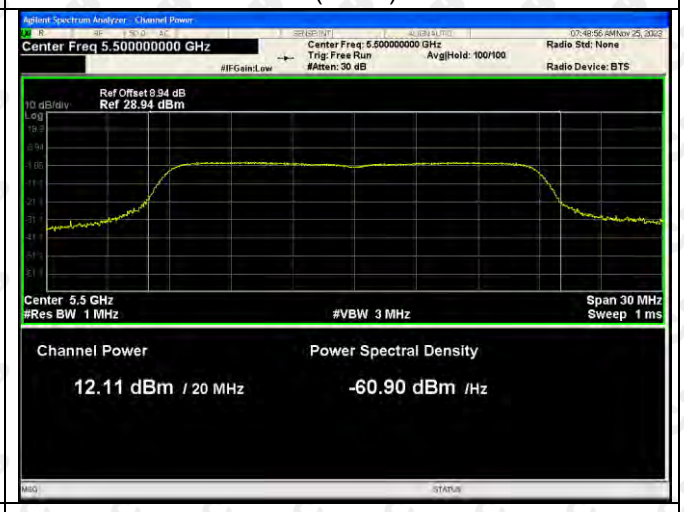
802.11ac(VH80)-5530



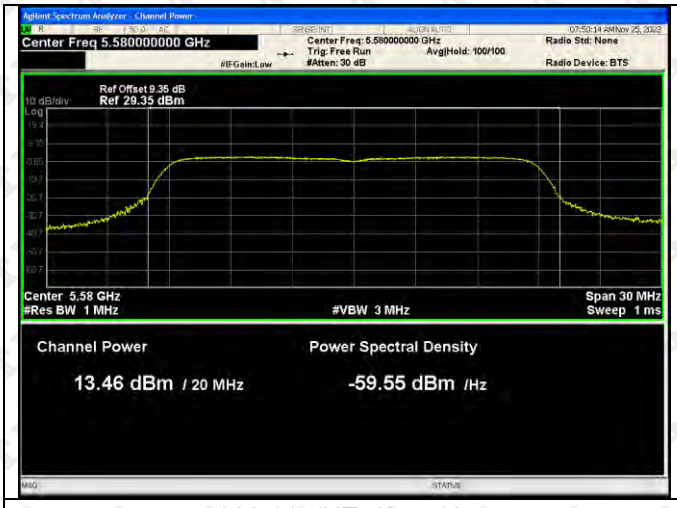
802.11n(HT20)-5500



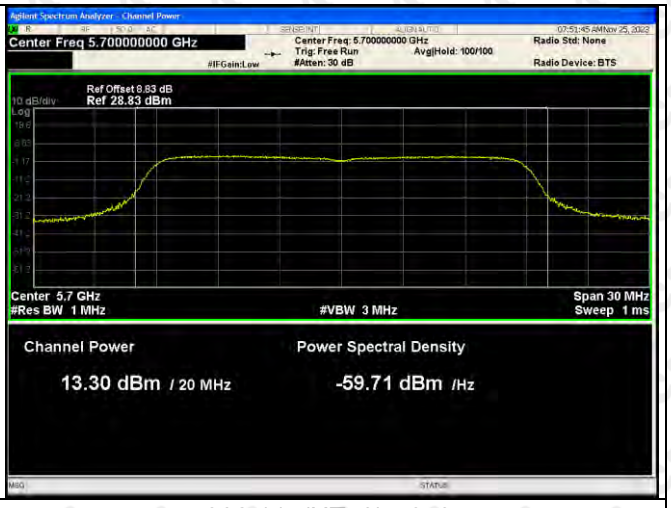
802.11n(HT20)-5580



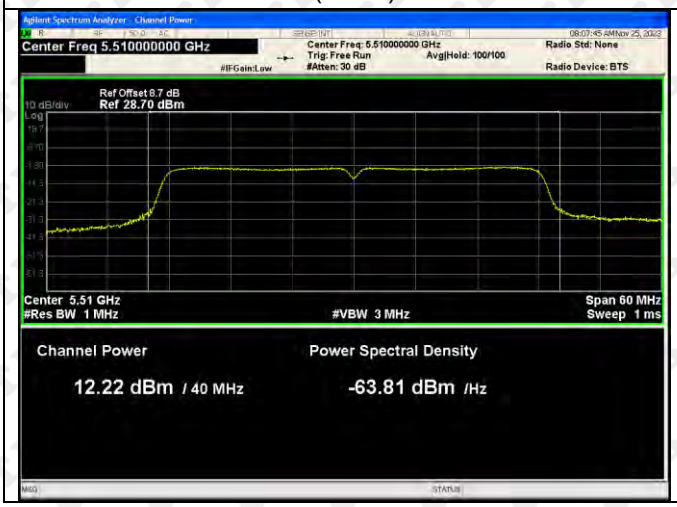
802.11n(HT20)-5700

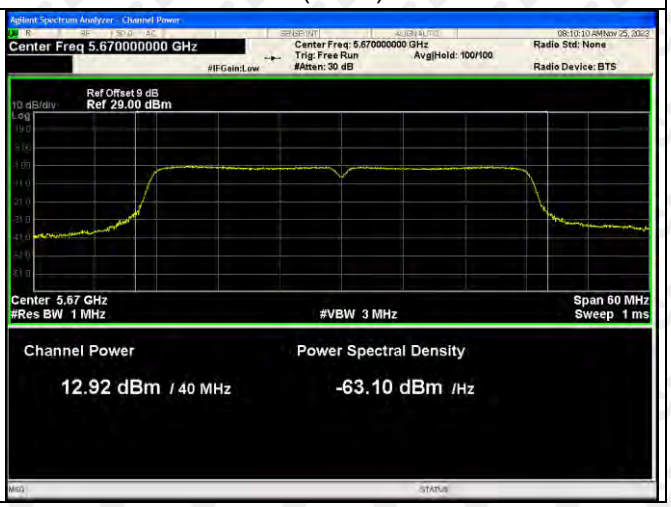


802.11n(HT40)-5510



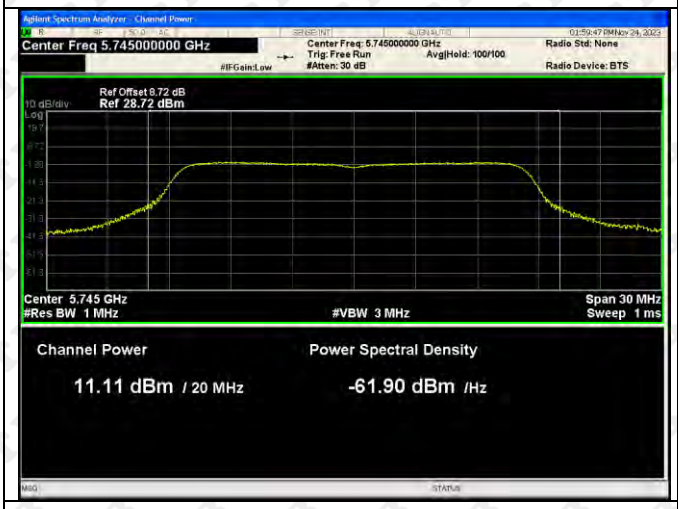
802.11n(HT40)-5670



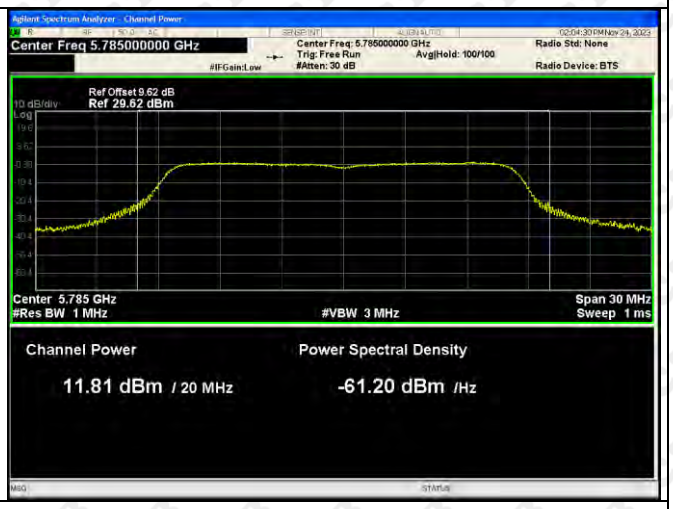


5725-5850MHz:-Power
ANT1

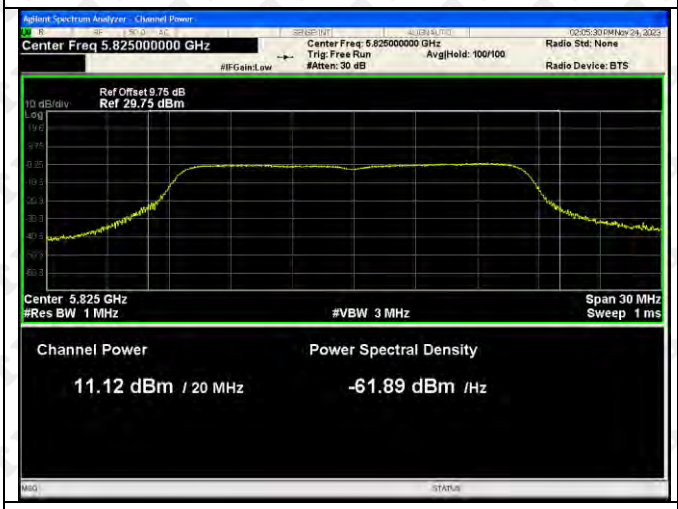
802.11a-5745



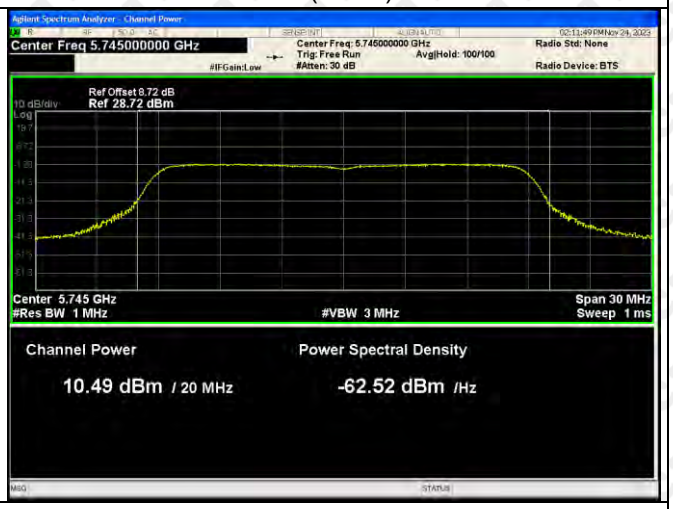
802.11a-5785



802.11a-5825

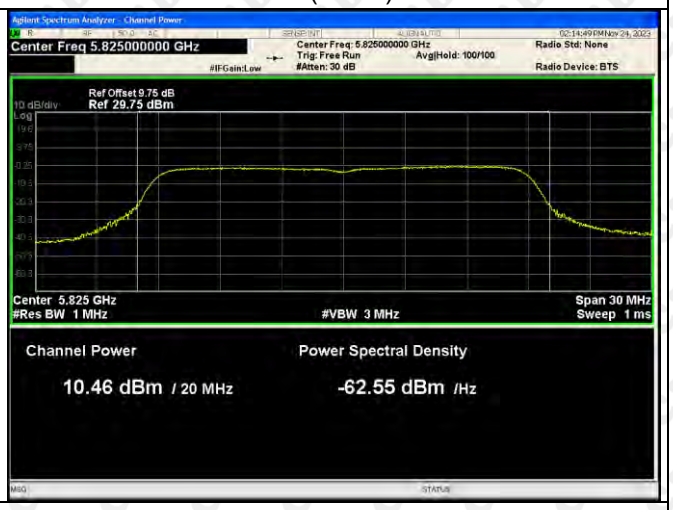


802.11ac(VH20)-5745



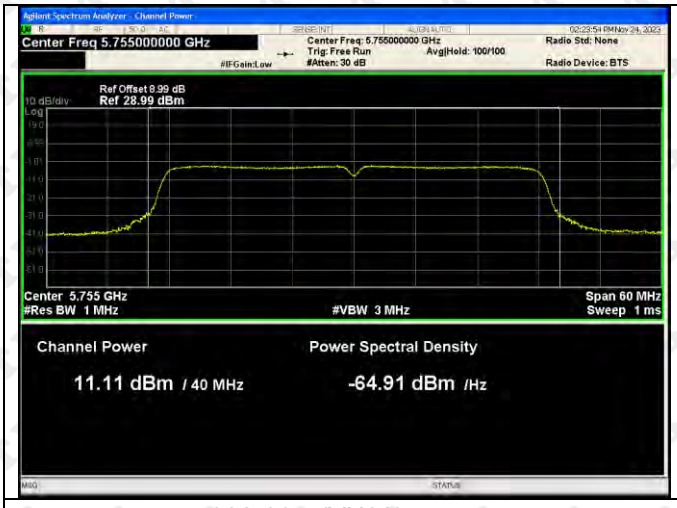
802.11ac(VH20)-5785

802.11ac(VH20)-5825

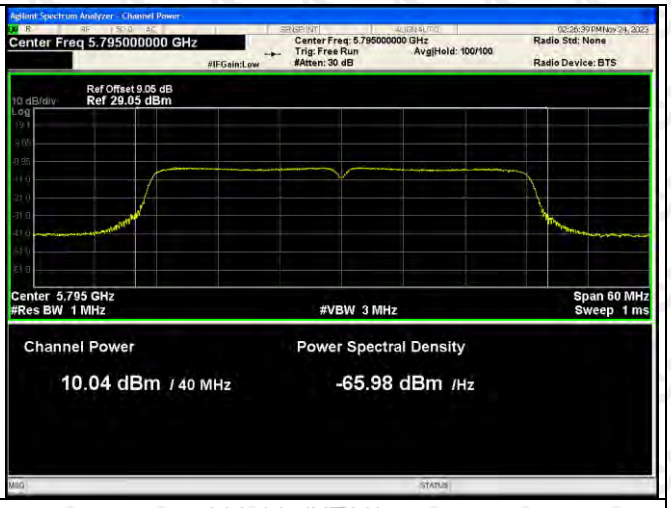


802.11ac(VH40)-5755

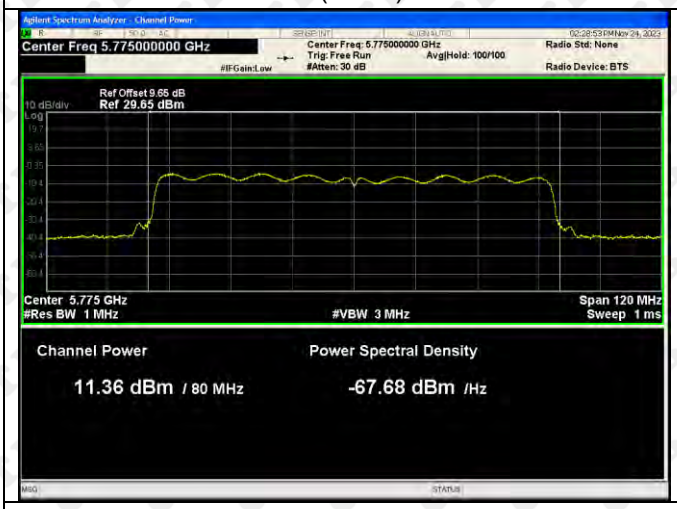
802.11ac(VH40)-5795



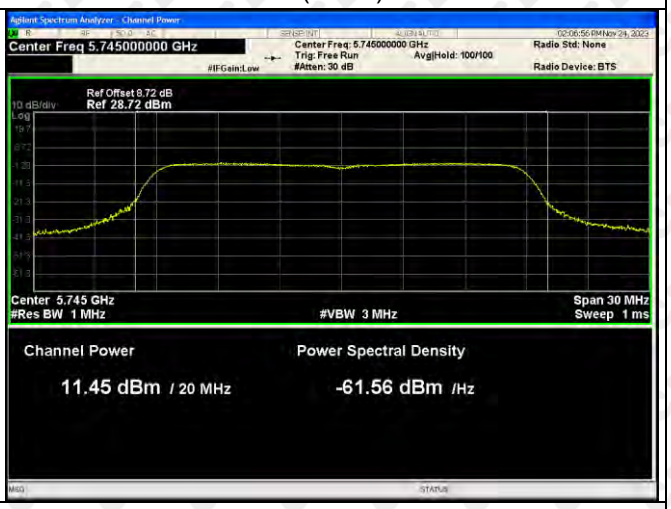
802.11ac(VH80)-5775



802.11n(HT20)-5745

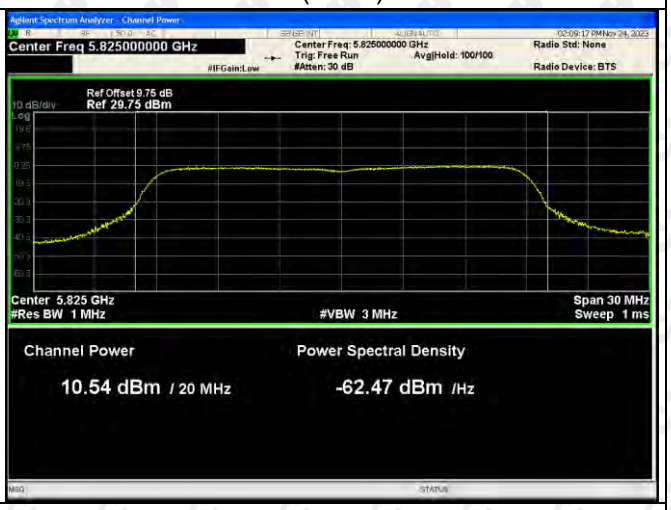


802.11n(HT20)-5785

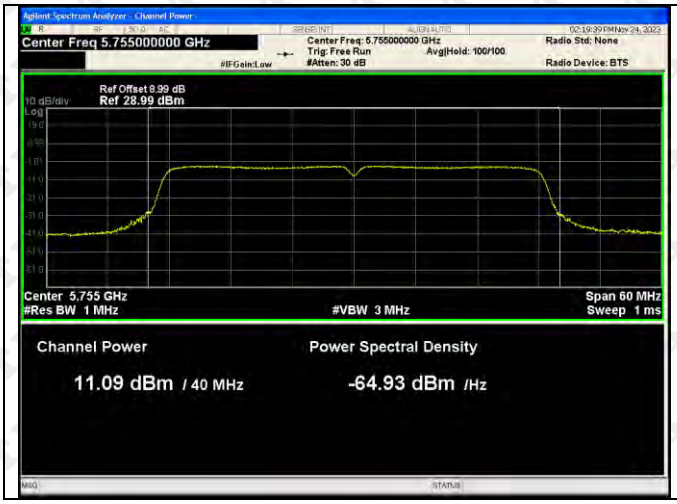


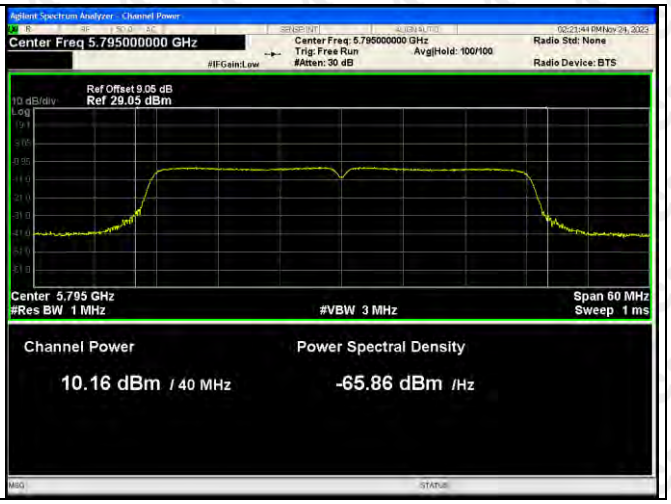
802.11n(HT20)-5825

802.11n(HT40)-5795

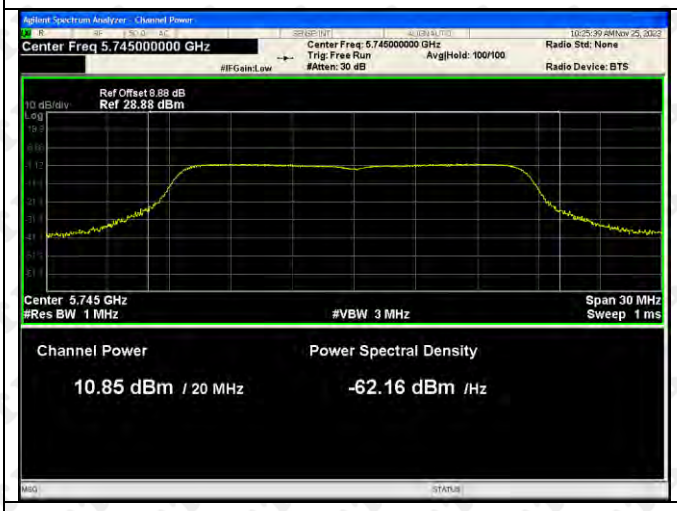
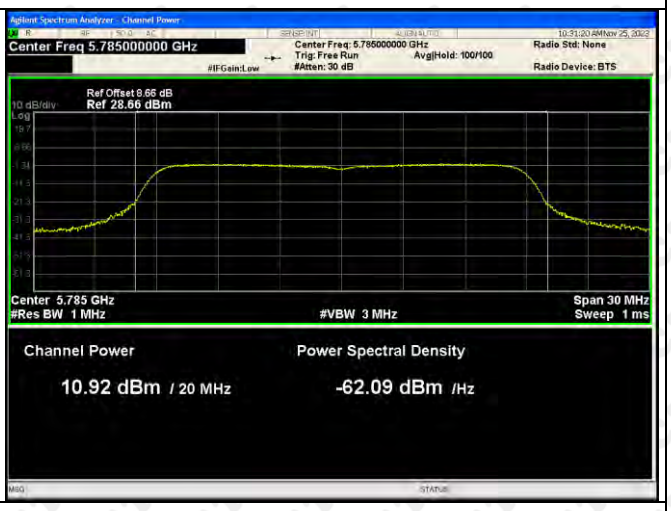
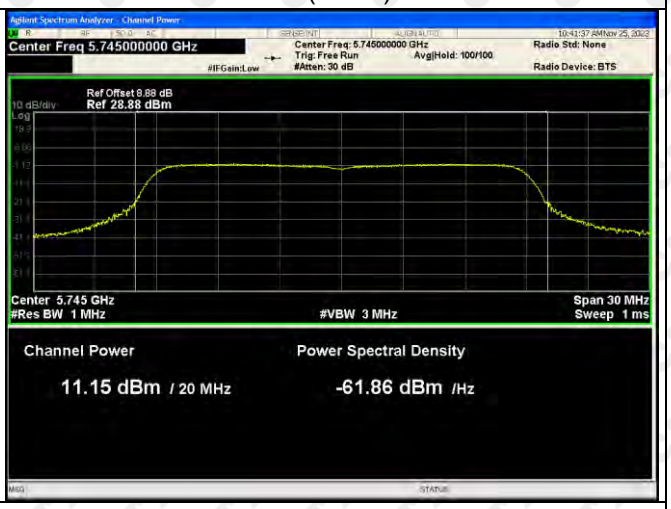


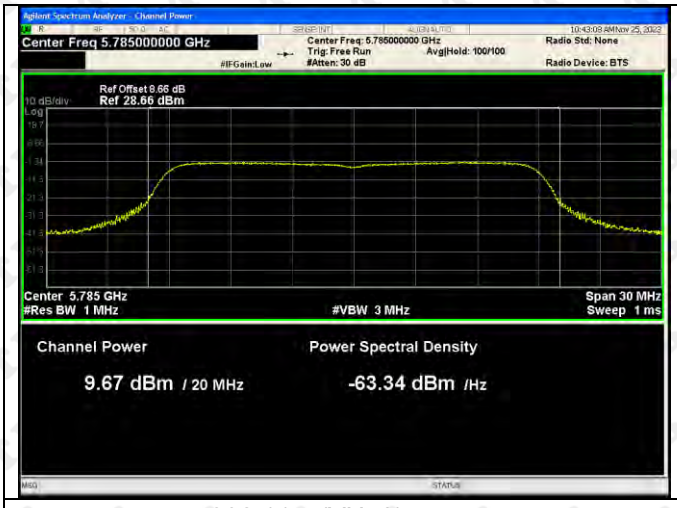
802.11n(HT40)-5825



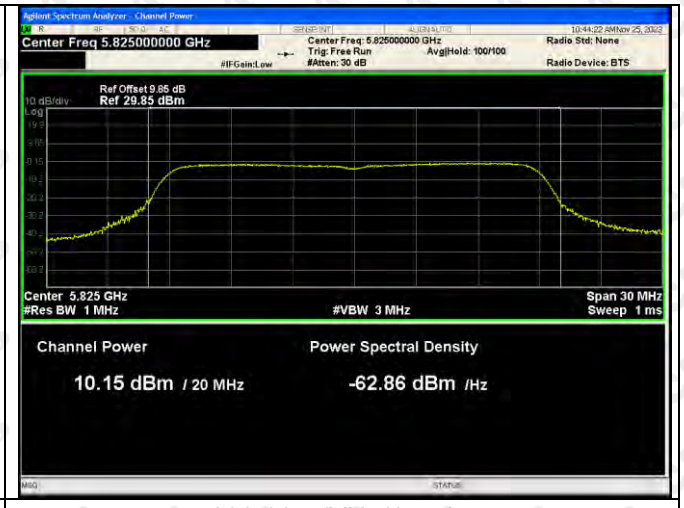


ANT2

802.11a-5745	802.11a-5785
	
802.11a-5825	802.11ac(VH20)-5745
	
802.11ac(VH20)-5785	802.11ac(VH20)-5825



802.11ac(VH40)-5755



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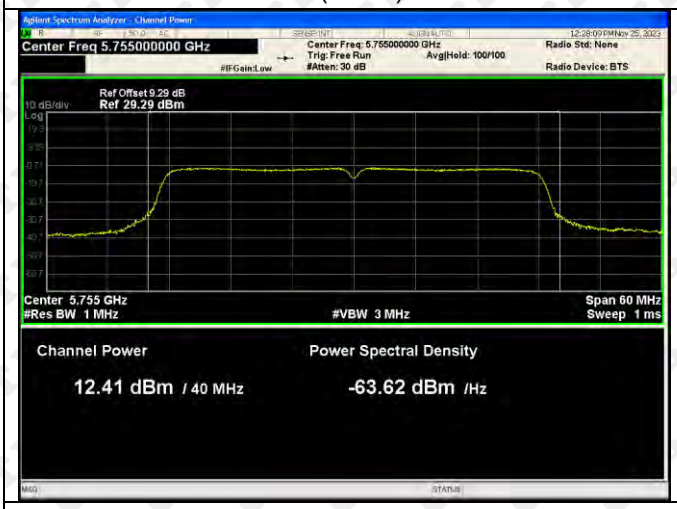

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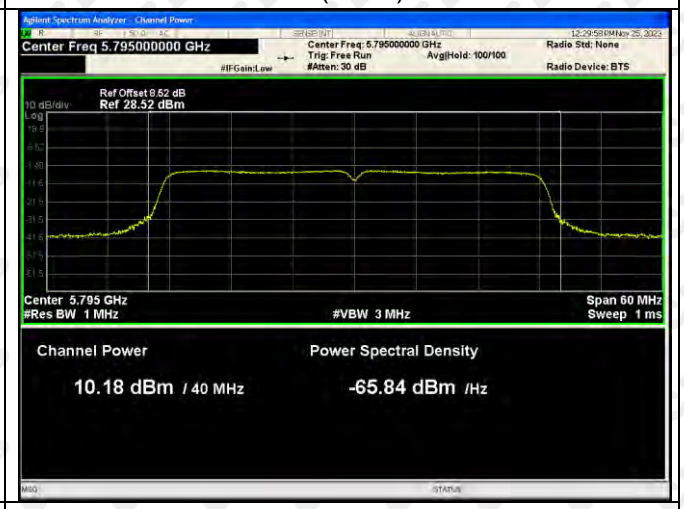

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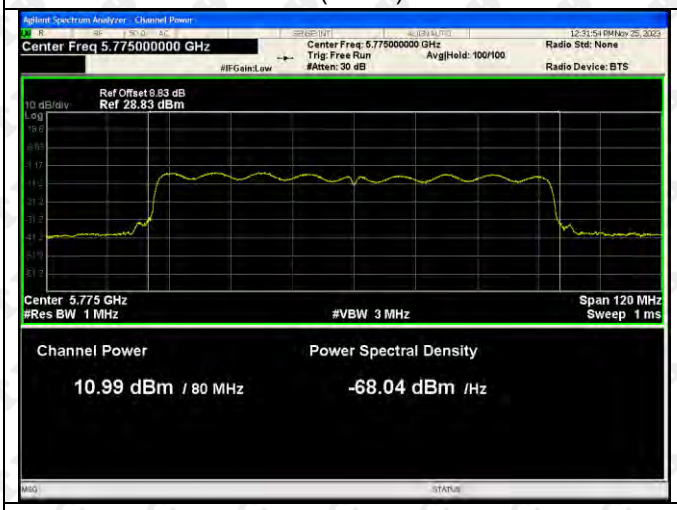

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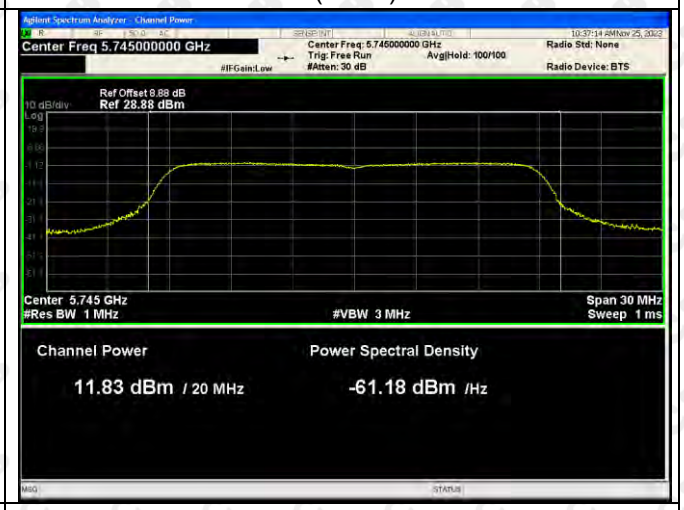

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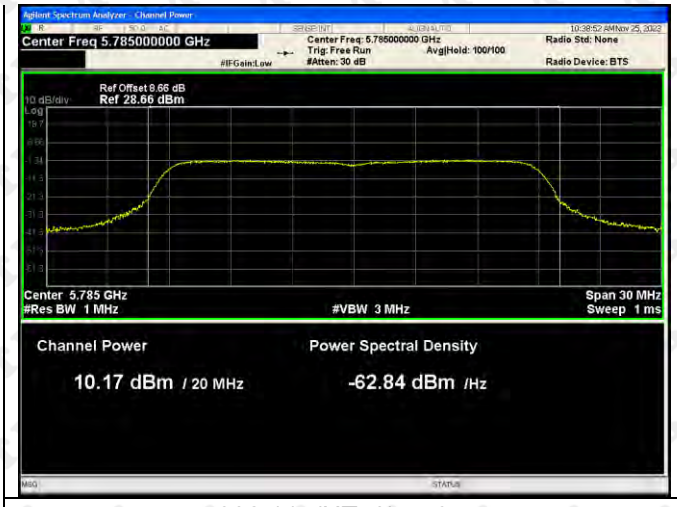
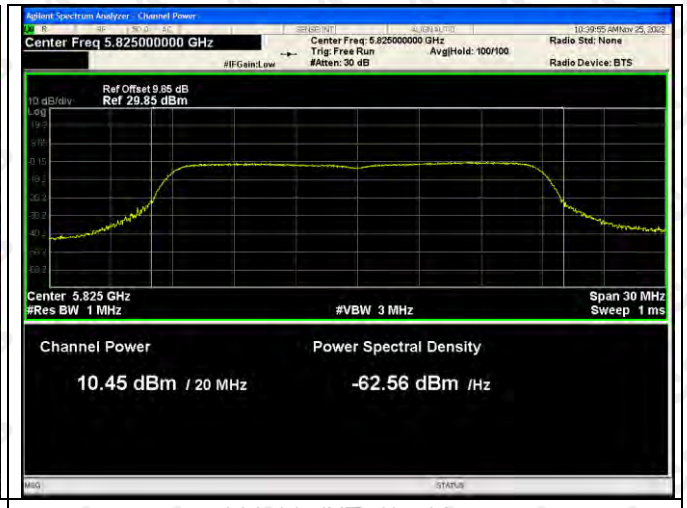


802.11n(HT40)-5795



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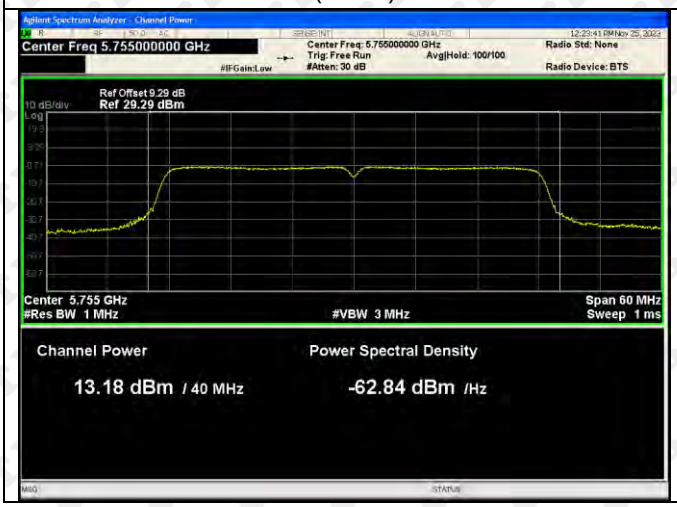
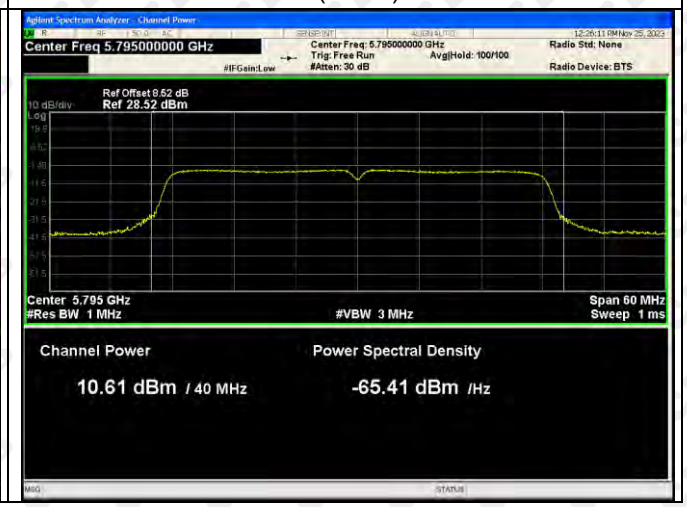
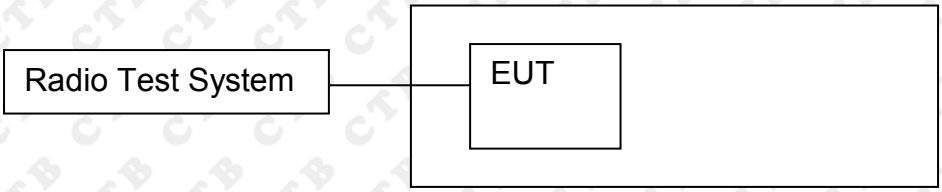




10. EMISSION BANDWIDTH& OCCUPIED BANDWIDTH

10.1 Block Diagram Of Test Setup



10.2 Limits

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.
(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

10.3 Test Procedure

According to KDB789033 D02v02r01 sectionE, the following is the measurement procedure.

1. Emission Bandwidth (EBW)
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) 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%.
2. Minimum Emission Bandwidth for the band 5.725−5.85 GHz
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the band 5.725−5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100 kHz.
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 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 in this section. For devices that use channel aggregation refer to III.A and III.C for determining emission bandwidth.

D. 99% Occupied Bandwidth

The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. Measurement of the 99% occupied bandwidth is *required* only as a condition for using the optional band-edge measurement techniques described in II.G.3.d). Measurements of 99% occupied bandwidth may also optionally be used in lieu of the EBW to define the minimum frequency range over which the 789033 D02 General UNII Test Procedures New Rules v02r01 Page 4 spectrum is integrated when measuring maximum conducted output power as described in II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with Section 15.407(a).
The following procedure shall be used for measuring (99%) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.

2. Set span = 1.5 times to 5.0 times the OBW.

3. Set RBW = 1% to 5% of the OBW

4. Set VBW ≥ 3 * RBW

5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

6. Use the 99% power bandwidth function of the instrument (if available).

7. If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

10.4 Test Results

5150-5250MHz:

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)&ANT1	26dB Bandwidth (MHz)&ANT2
802.11a	5180	20.971	21.133
	5200	21.333	21.122
	5240	21.133	21.085
802.11ac20	5180	21.686	21.809
	5200	21.728	21.759
	5240	21.602	21.572
802.11ac40	5190	41.061	41.824
	5230	41.587	41.56
802.11ac80	5210	80.675	80.081
802.11n(HT20)	5180	21.6	21.919
	5200	21.711	21.995
	5240	21.513	21.72
802.11n(HT40)	5190	41.168	41.808
	5230	41.27	40.941

5250-5350 MHz:

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)&ANT1	26dB Bandwidth (MHz)&ANT2
802.11a	5260	20.889	20.967
	5280	20.865	21.259
	5320	21.394	23.088
802.11ac20	5260	21.961	20.961
	5280	21.764	21.166
	5320	21.959	21.264
802.11ac40	5270	43.158	41.355
	5310	41.241	41.988
802.11ac80	5290	80.77	82.062
802.11n(HT20)	5260	21.838	21.83
	5280	21.322	21.667
	5320	21.796	21.74
802.11n(HT40)	5270	41.6	41.644
	5310	41.85	41.695

5470-5725MHz:

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)&ANT1	26dB Bandwidth (MHz)&ANT2
802.11a	5500	26.268	26.263
	5580	23.334	21.513
	5700	21.67	21.975
802.11ac20	5500	22.822	22.164
	5580	21.539	21.871
	5700	22.355	22.183
802.11ac40	5510	41.123	43.412
	5670	41.535	42.012
802.11ac80	5530	89.042	91.915
802.11n(HT20)	5500	22.599	25.066
	5580	21.836	21.844
	5700	22.051	21.773
802.11n(HT40)	5510	47.213	47.151
	5670	40.78	26.263

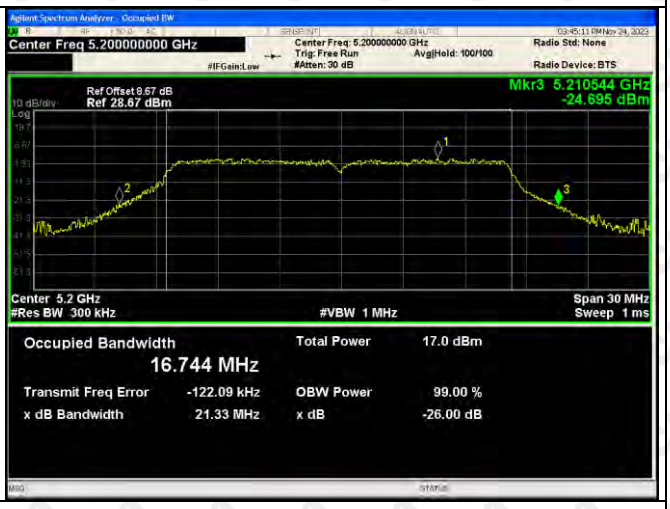
5725-5850MHz:

Test mode	Test Channel (MHz)	6dB Bandwidth (MHz)&ANT1	6dB Bandwidth (MHz)&ANT2
802.11a	5745	16.563	16.549
	5785	16.571	17.694
	5825	16.597	17.787
802.11ac20	5745	17.741	17.763
	5785	17.693	17.793
	5825	17.75	17.767
802.11ac40	5755	36.494	36.492
	5795	36.482	36.462
802.11ac80	5775	76.171	76.148
802.11n(HT20)	5745	17.737	17.707
	5785	17.794	17.732
	5825	17.764	17.741
802.11n(HT40)	5755	36.498	36.493
	5795	36.471	16.549

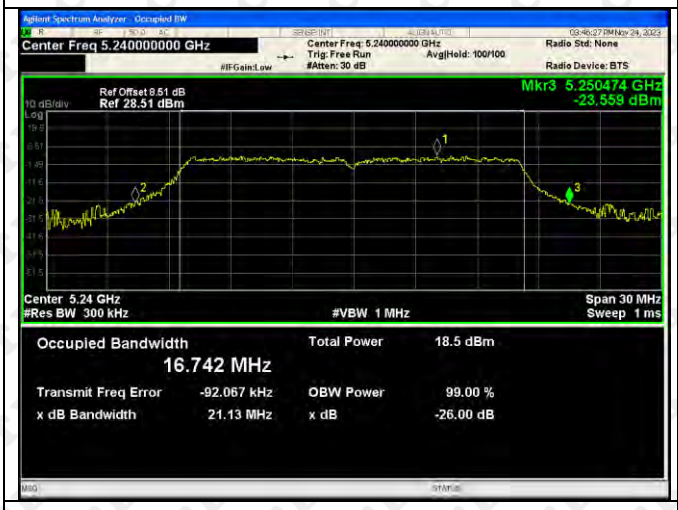
Test Graph:
5150-5250MHz-Power
ANT1

802.11a-5180

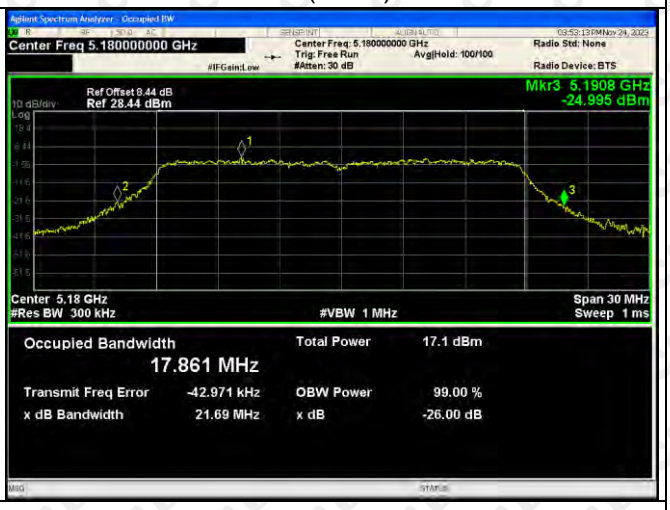
802.11a-5200



802.11a-5240

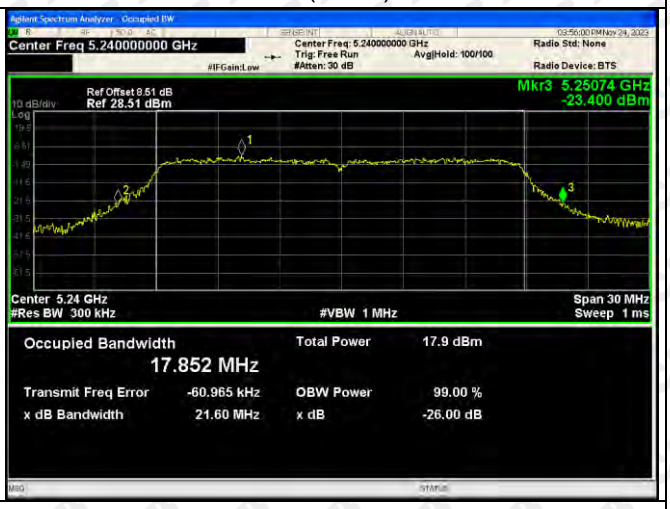


802.11ac(VH20)-5180



802.11ac(VH20)-5200

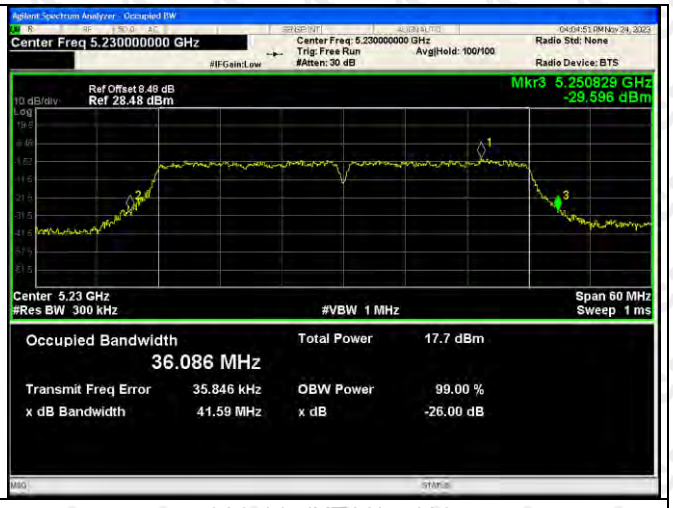
802.11ac(VH20)-5240



802.11ac(VH40)-5190

802.11ac(VH40)-5230

802.11ac(VH80)-5210



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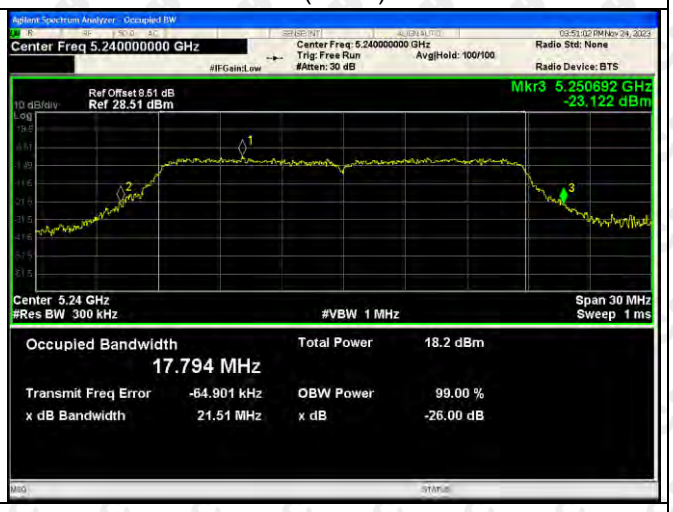
802.11n(HT20)-5200

802.11n(HT20)-5240

802.11n(HT40)-5190



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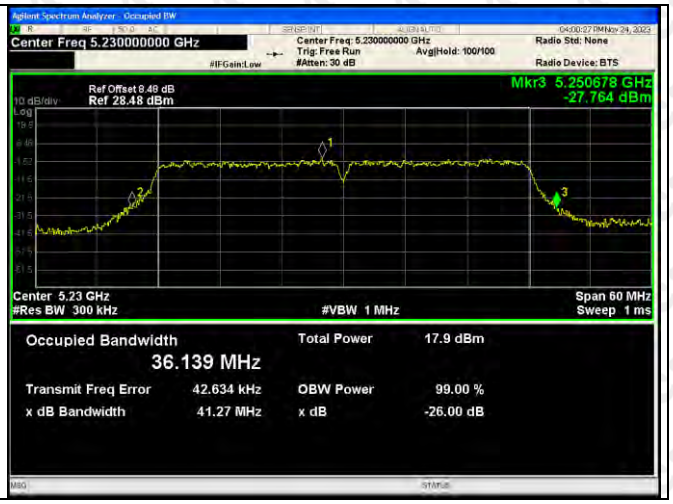
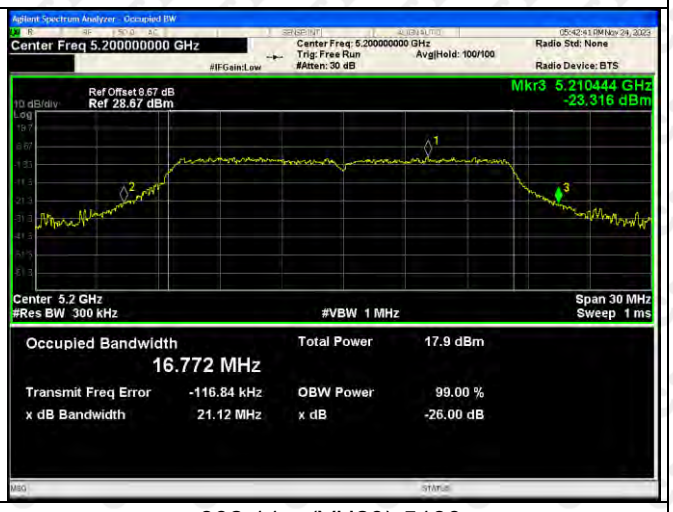


ANT2

802.11a-5180

802.11a-5200



802.11a-5240

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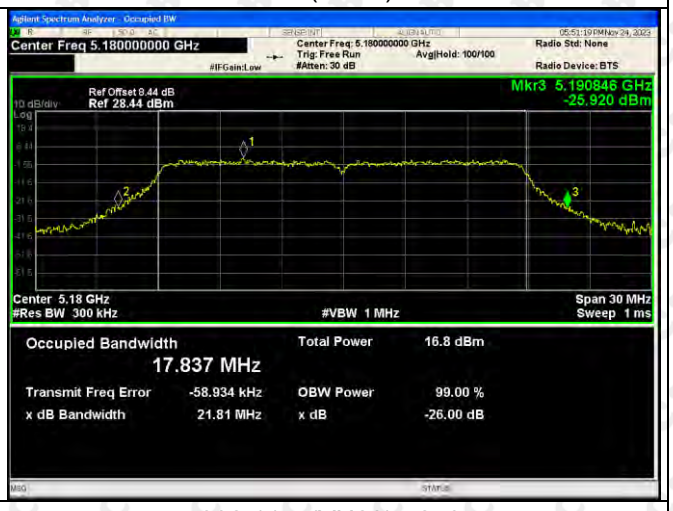


802.11ac(VH20)-5200

802.11ac(VH20)-5240

802.11ac(VH40)-5190

802.11ac(VH40)-5230

802.11ac(VH80)-5210

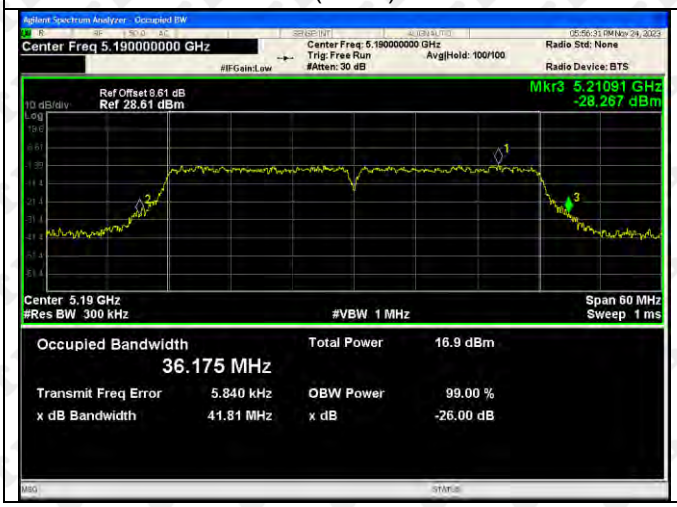
802.11n(HT20)-5180

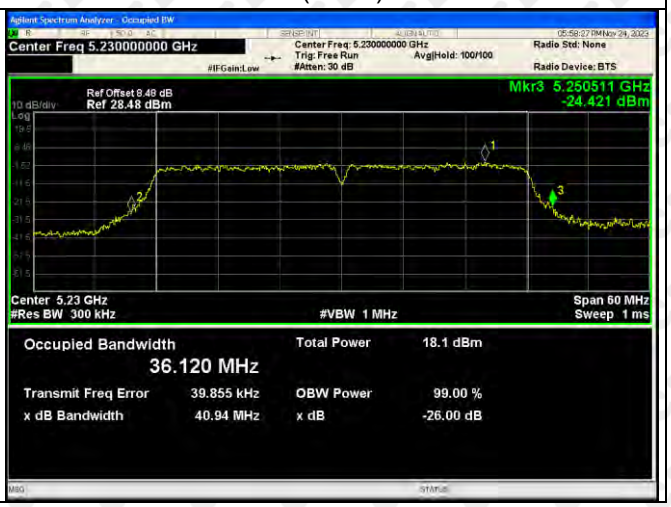
802.11n(HT20)-5200

802.11n(HT20)-5240

802.11n(HT40)-5190

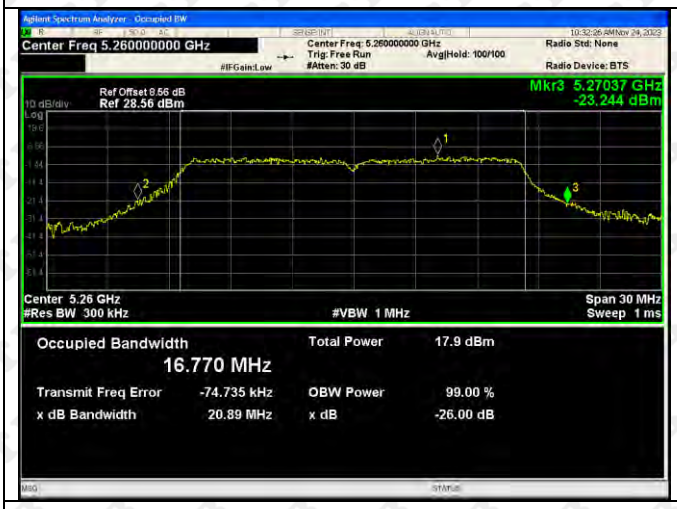
802.11n(HT40)-5230



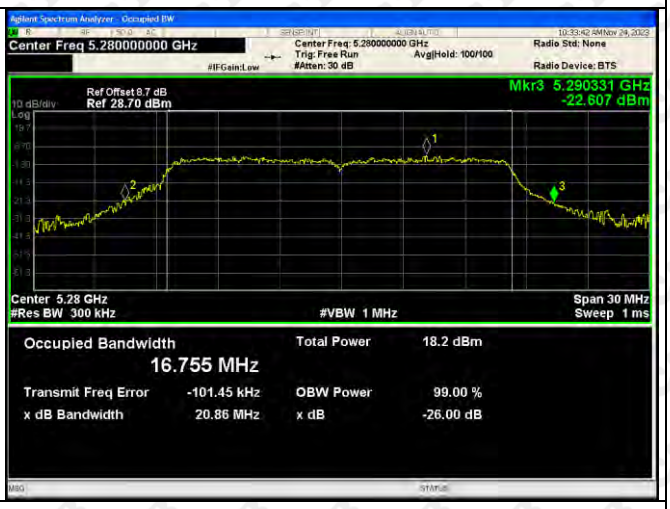


5250-5350MHz-Power
ANT1

802.11a-5260

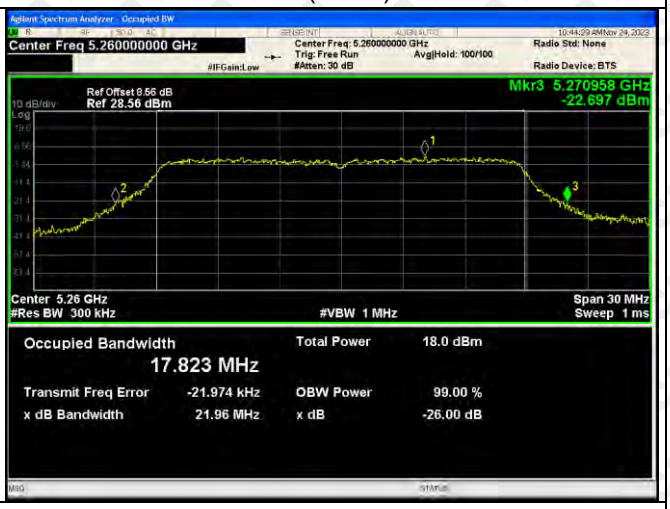


802.11a-5280

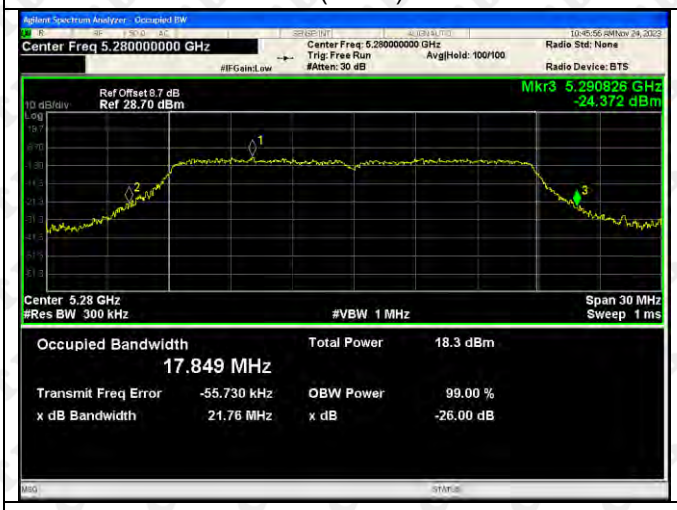


802.11a-5320

802.11ac(VH20)-5260



802.11ac(VH20)-5280



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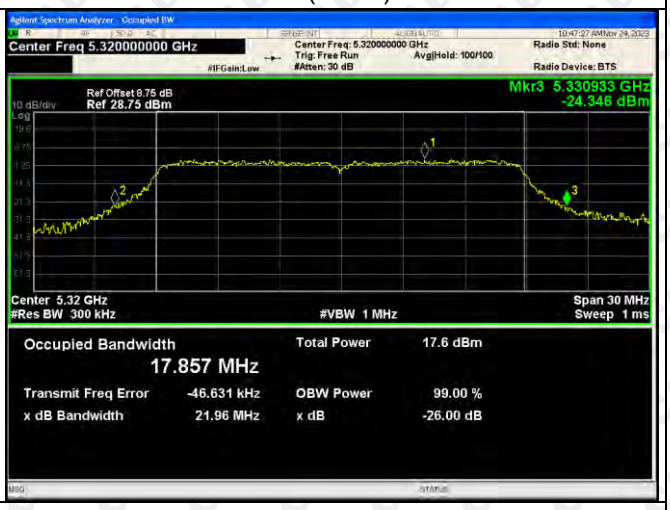


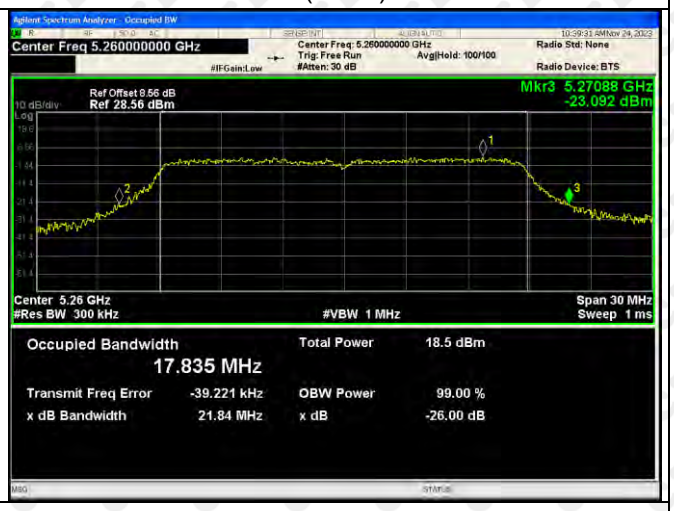
802.11ac(VH40)-5270

802.11ac(VH40)-5310

802.11ac(VH80)-5290

802.11n(HT20)-5260

802.11n(HT20)-5280



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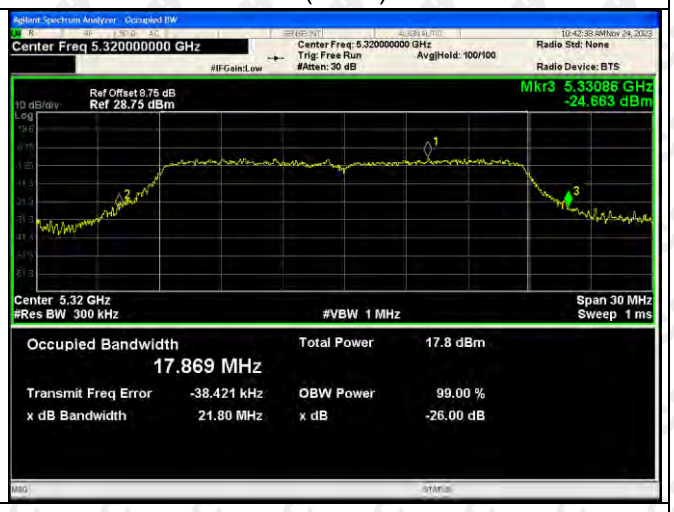
802.11n(HT40)-5270



802.11n(HT40)-5310

ANT2

802.11a-5260

802.11a-5280

802.11a-5320

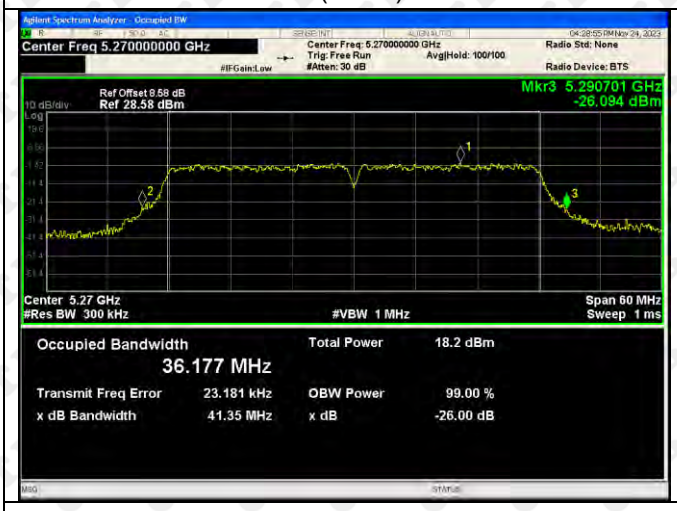
802.11ac(VH20)-5260

802.11ac(VH20)-5280

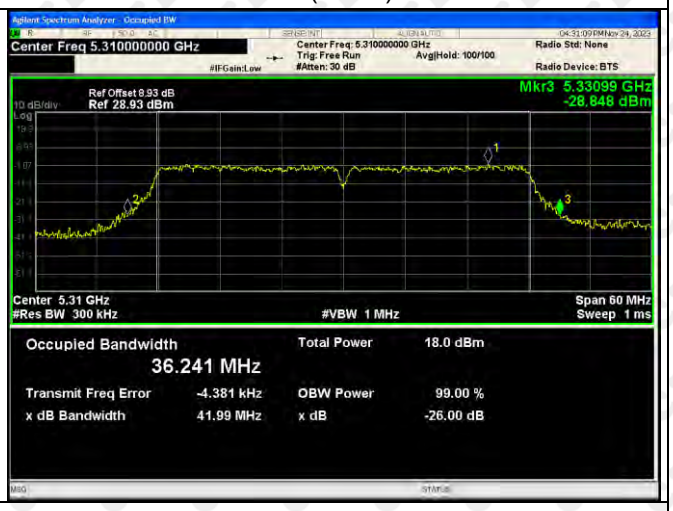
802.11ac(VH20)-5320

802.11ac(VH40)-5270

802.11ac(VH40)-5310

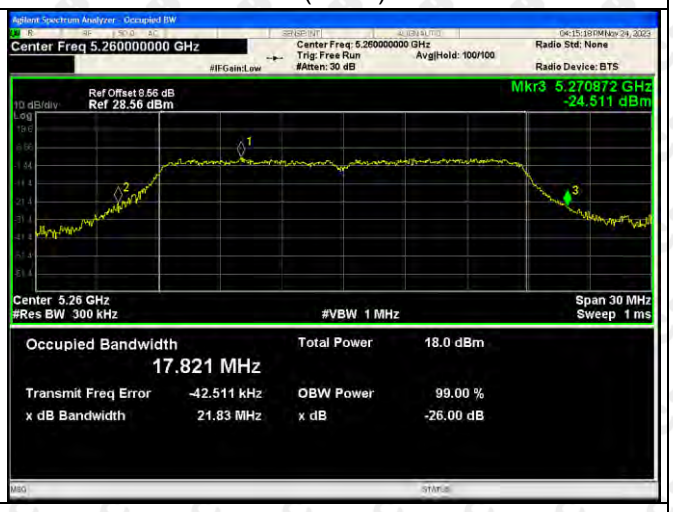


802.11ac(VH80)-5290



802.11n(HT20)-5260

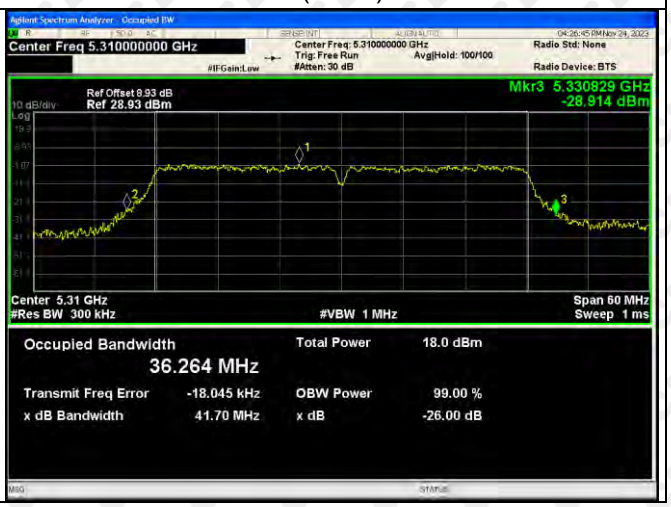
802.11n(HT20)-5280



802.11n(HT20)-5320

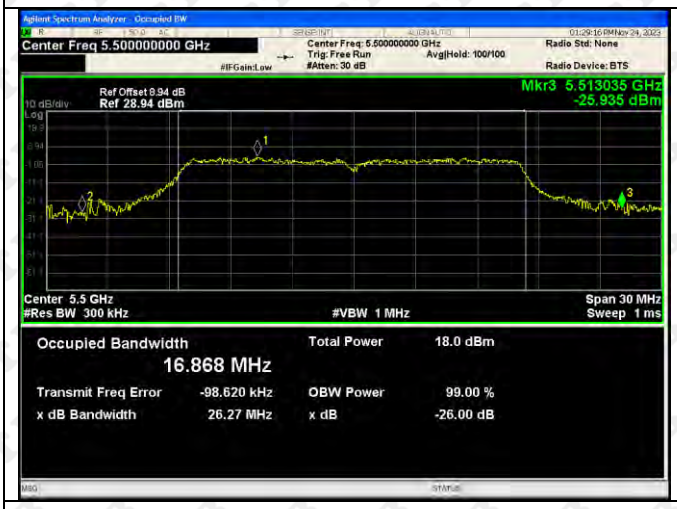
802.11n(HT40)-5270

802.11n(HT40)-5310

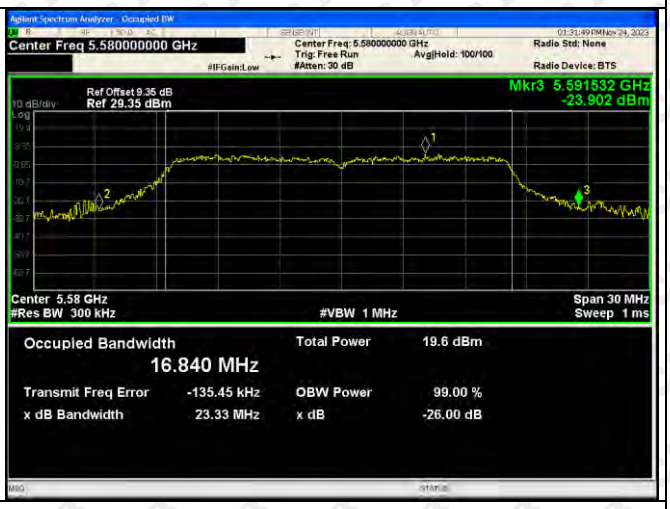


5470-5725MHz-Power
ANT1

802.11a-5500

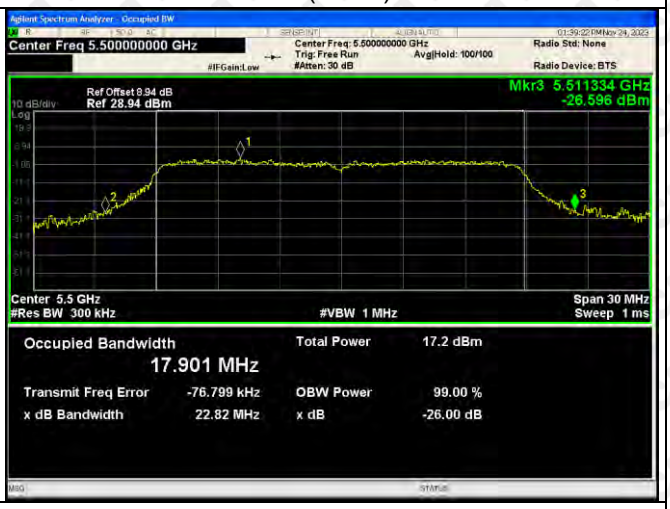


802.11a-5580

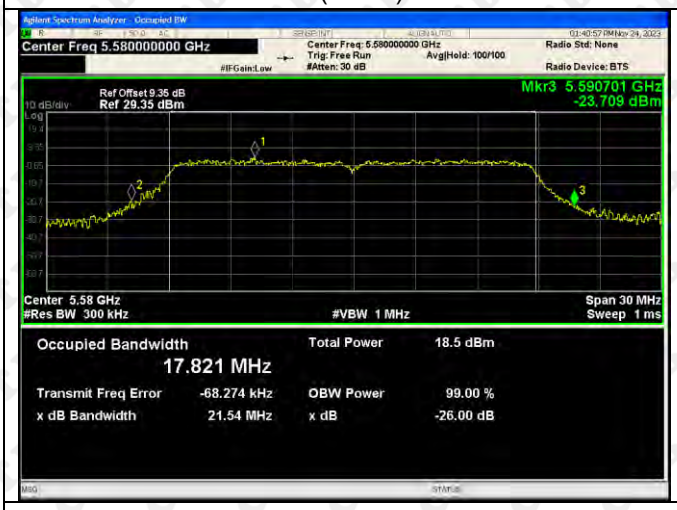


802.11a-5700

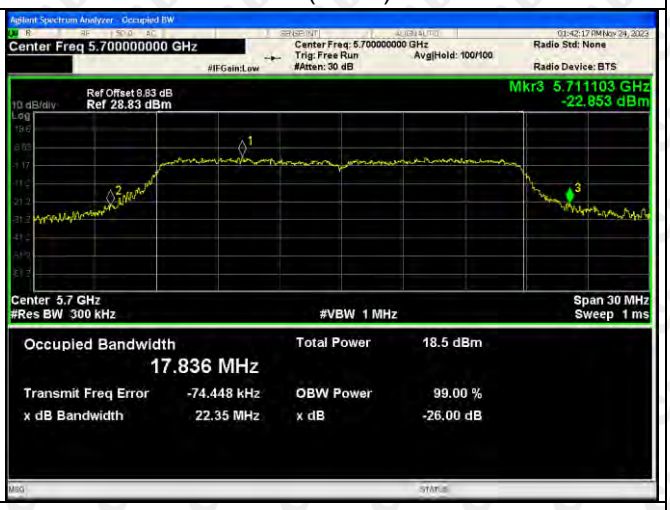
802.11ac(VH20)-5500



802.11ac(VH20)-5580

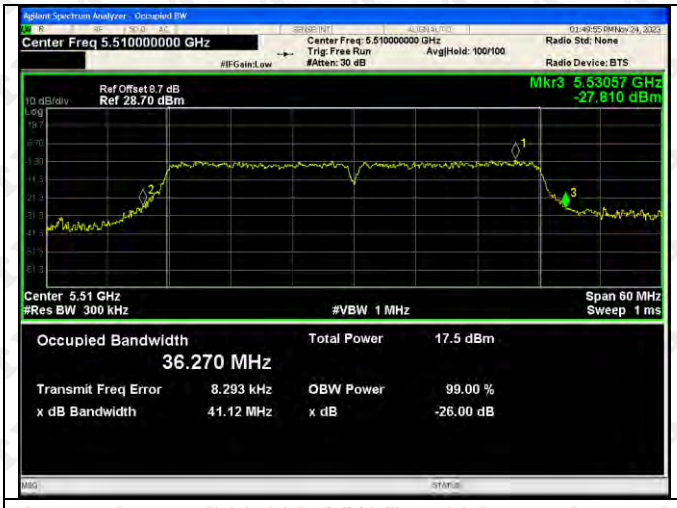


802.11ac(VH20)-5700



802.11ac(VH40)-5510

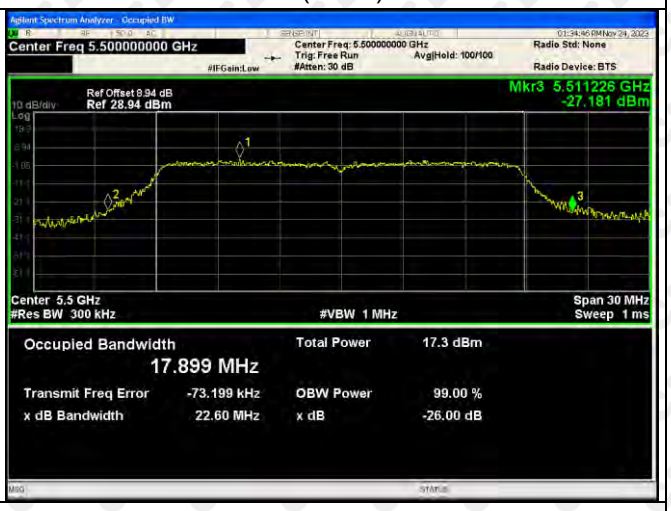
802.11ac(VH40)-5670



802.11ac(VH80)-5530

802.11n(HT20)-5500

802.11n(HT20)-5580



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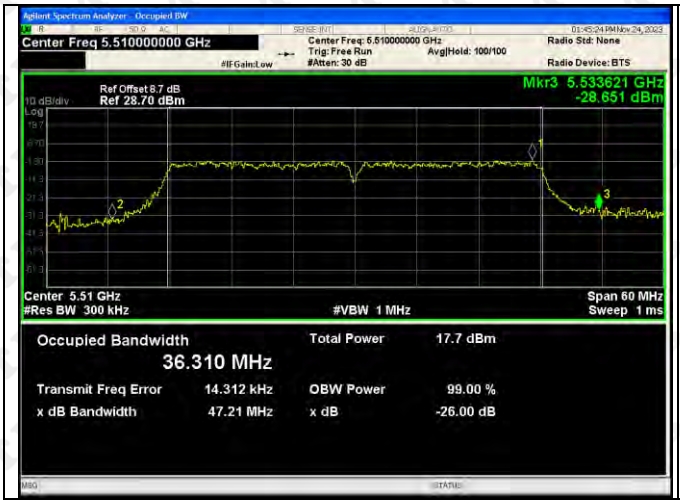
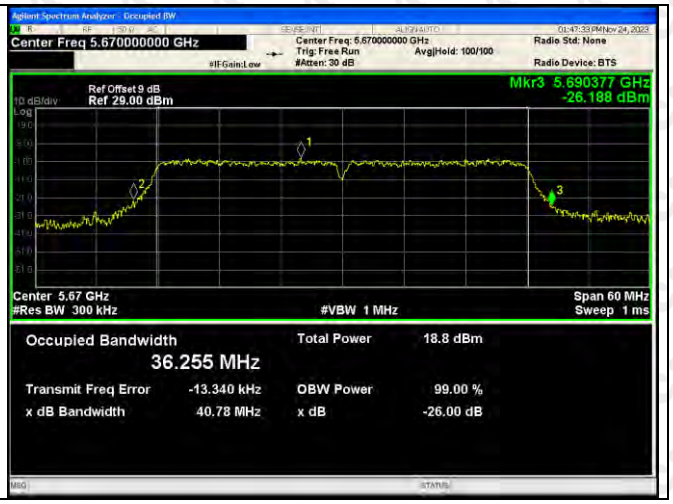
802.11n(HT40)-5510

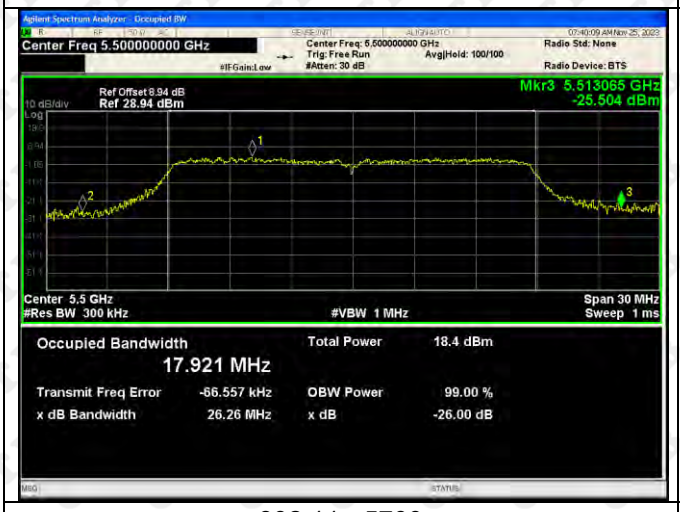
802.11n(HT40)-5670





ANT2

802.11a-5500



802.11a-5580

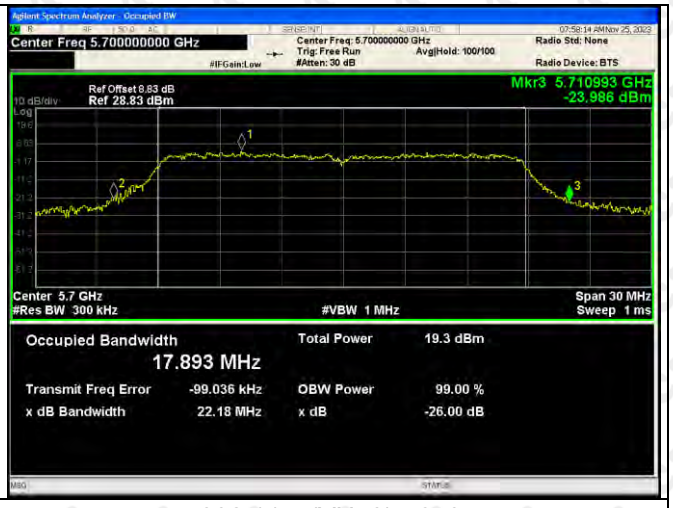
802.11a-5700

802.11ac(VH20)-5500

802.11ac(VH20)-5580

802.11ac(VH20)-5700

802.11ac(VH40)-5510

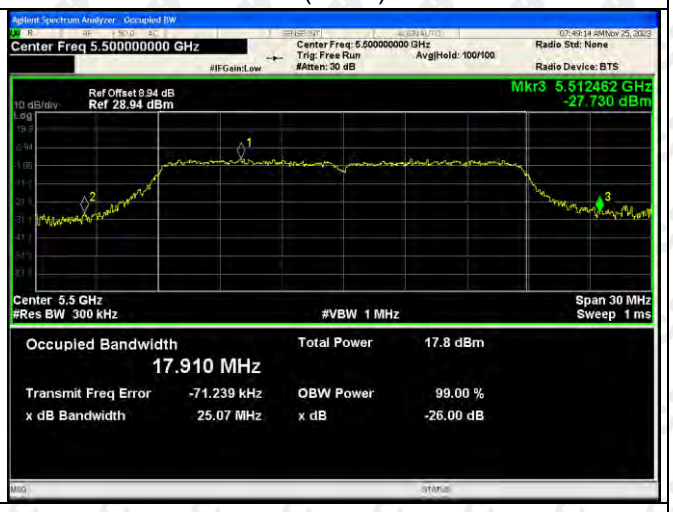


802.11ac(VH40)-5670

802.11ac(VH80)-5530

802.11n(HT20)-5500

802.11n(HT20)-5580



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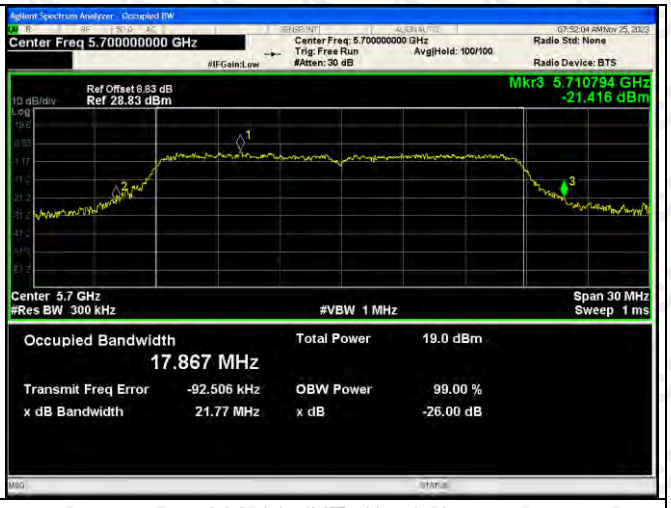
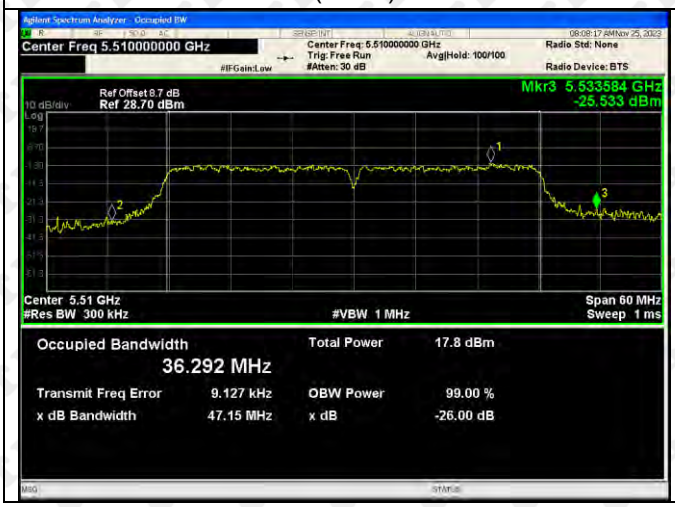
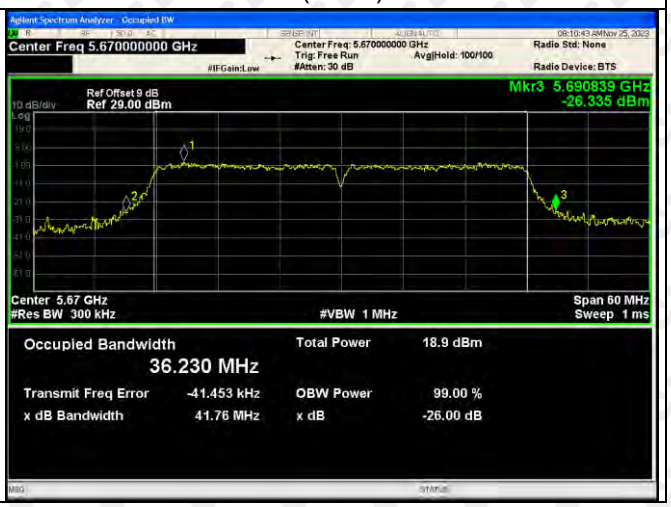
802.11n(HT40)-5510



802.11n(HT40)-5670

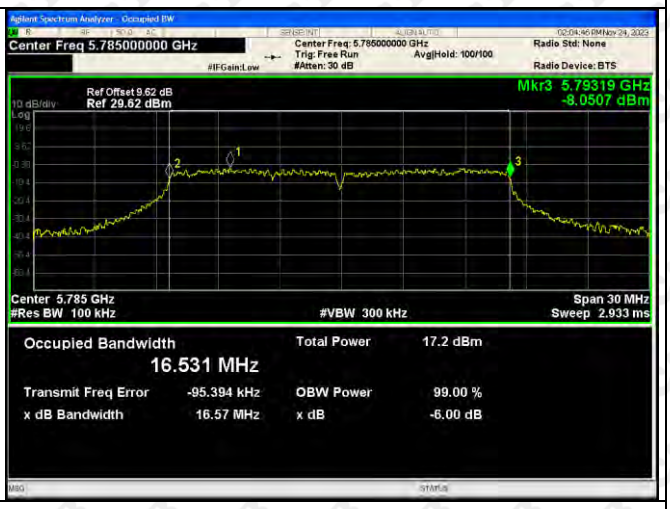




5725-5850MHz:-Power
ANT1

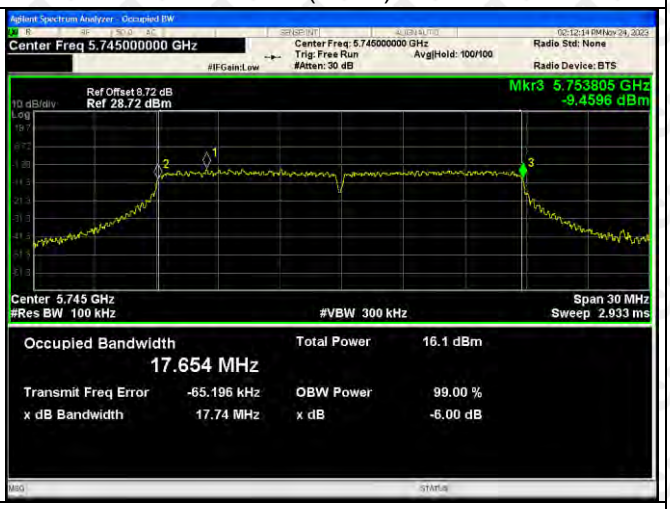
802.11a-5745

802.11a-5785

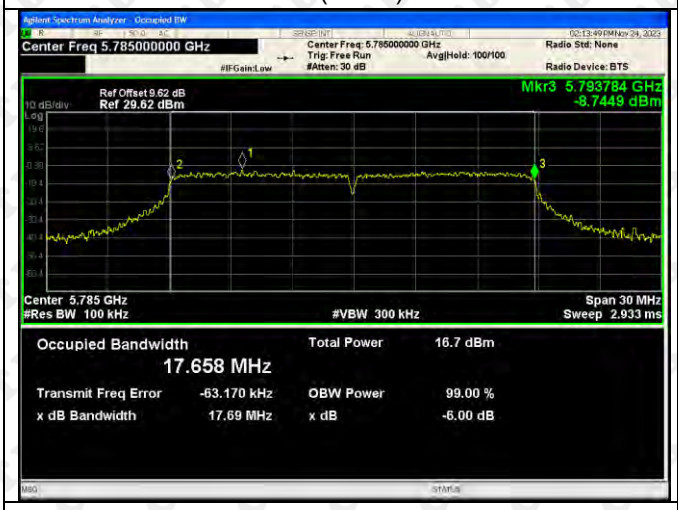


802.11a-5825

802.11ac(VH20)-5745



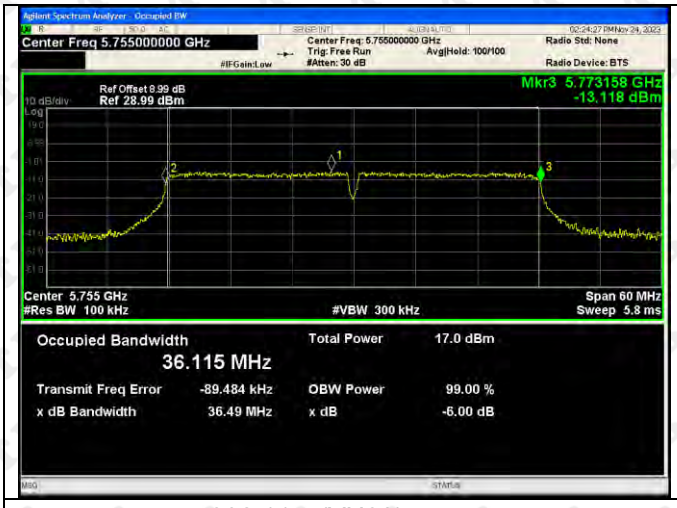
802.11ac(VH20)-5785



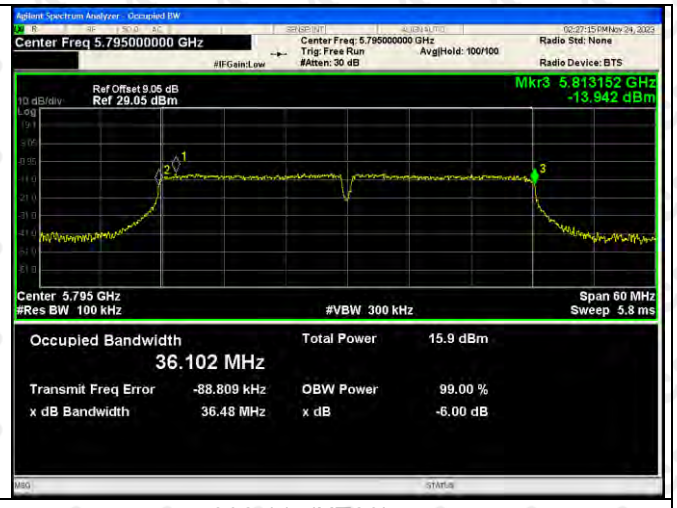
802.11ac(VH20)-5825

802.11ac(VH40)-5755

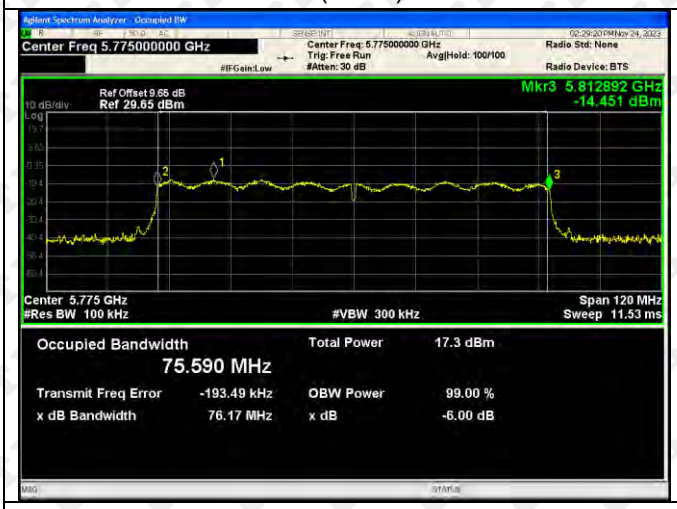
802.11ac(VH40)-5795



802.11ac(VH80)-5775

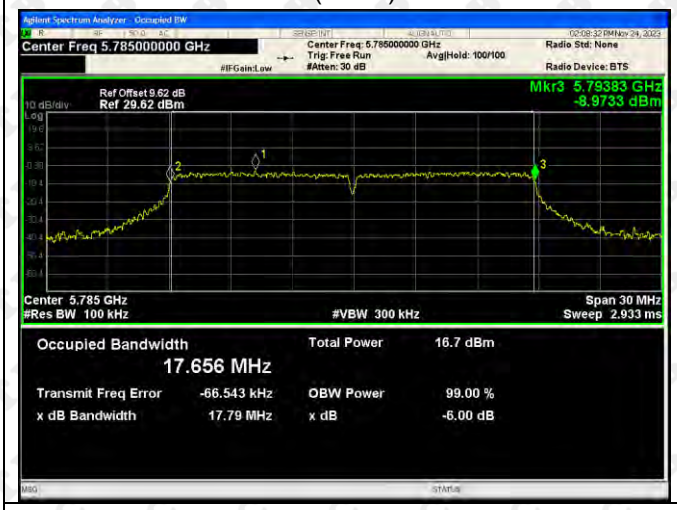


802.11n(HT20)-5745



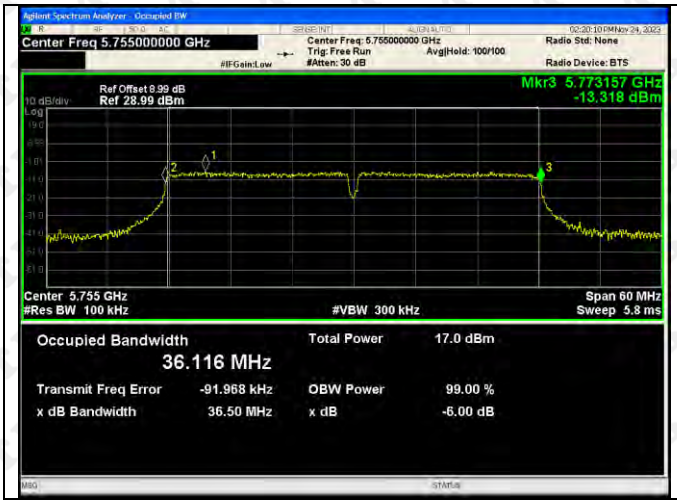
802.11n(HT20)-5785

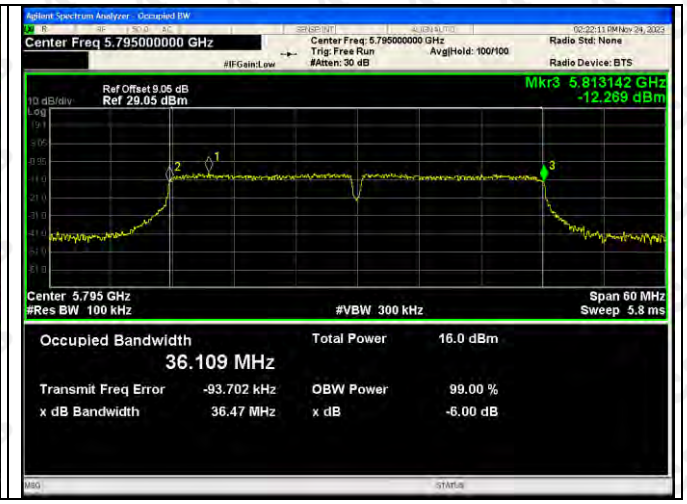
802.11n(HT20)-5825



802.11n(HT40)-5795

802.11n(HT40)-5825



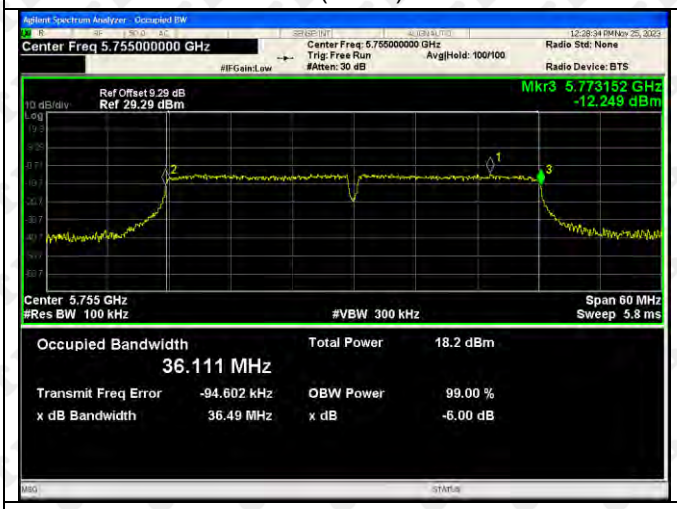


ANT2

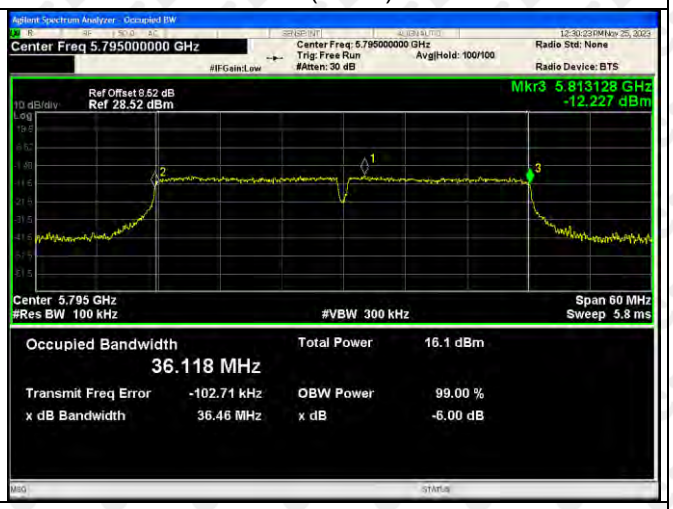
802.11a-5745	802.11a-5785
802.11a-5825	802.11ac(VH20)-5745
802.11ac(VH20)-5785	802.11ac(VH20)-5825

802.11ac(VH40)-5755

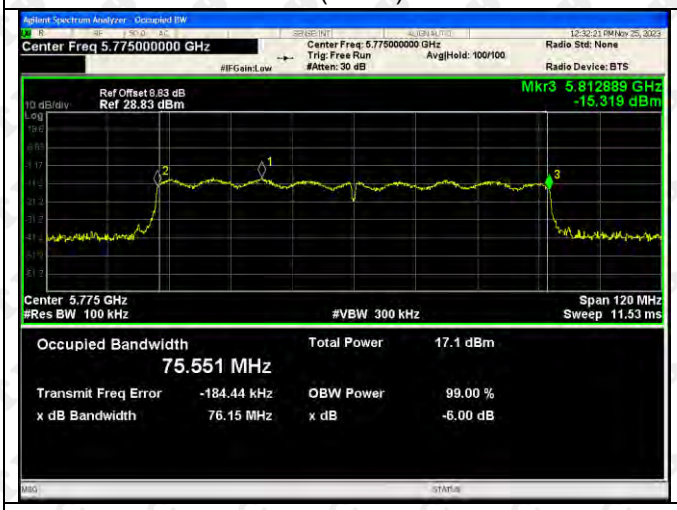
802.11ac(VH40)-5795



802.11ac(VH80)-5775



802.11n(HT20)-5745

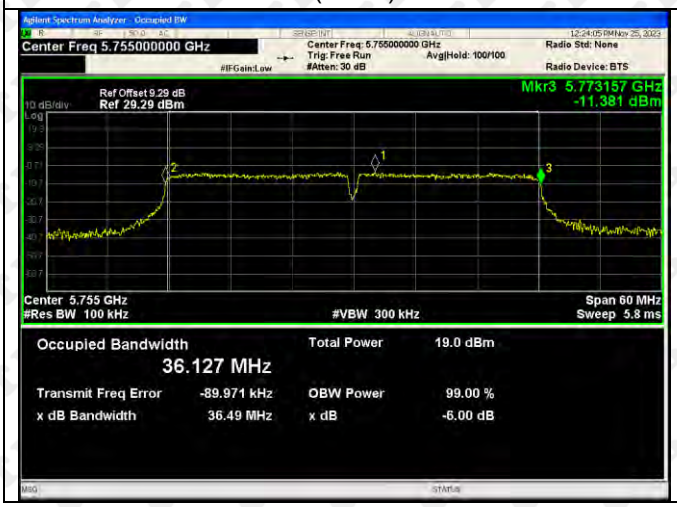


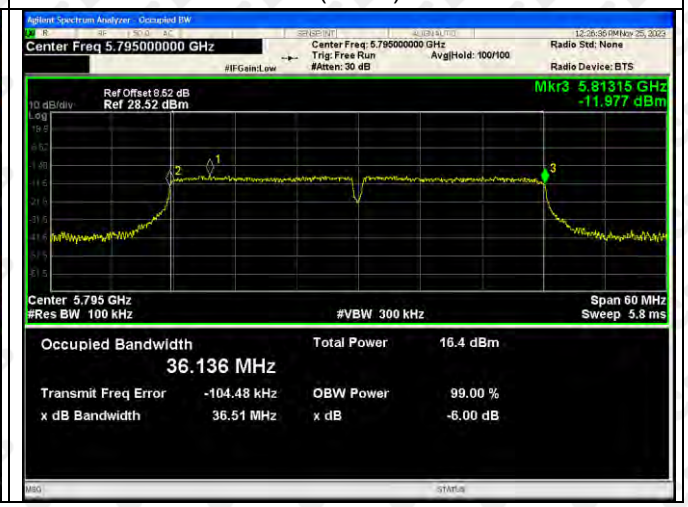
802.11n(HT20)-5785

802.11n(HT20)-5825

802.11n(HT40)-5795

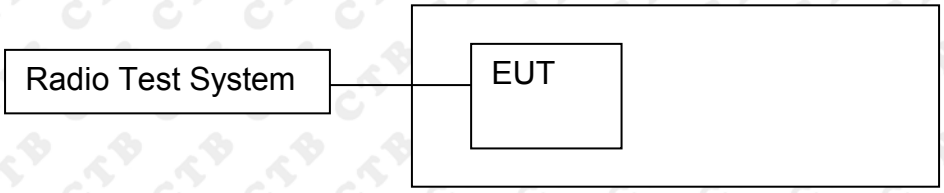
802.11n(HT40)-5825





11. POWER SPECTRAL DENSITY

11.1 Block Diagram Of Test Setup



11.2 Limit

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

11.3 Test procedure

According to KDB789033 D02v02r01 sectionE, the following is the measurement procedure.

For devices operating in the bands 5.15−5.25 GHz, 5.25−5.35 GHz, and 5.47−5.725 GHz, the preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725−5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
a) Set RBW ≥ 1/*T*, where *T* is defined in II.B.I.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the

measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.
Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the II.F.5.c) and II.F.5.d), since RBW=100 kHz is available on nearly all spectrum analyzers.

11.4 Test Result

5150-5250MHz:MHz
ANT1+ANT2

Test mode	Test Channel (MHz)	PSD [dBm/MHz] ANT 1	PSD [dBm/MHz] ANT 2	PSD [dBm/MHz] Total	Limit (dBm)	Result
802.11a	5180	1.285	0.315	/	11	Pass
	5200	0.238	1.089	/	11	Pass
	5240	1.663	1.5	/	11	Pass
802.11n(HT20)	5180	0.022	-0.052	2.995	11	Pass
	5200	0.195	0.067	3.142	11	Pass
	5240	1.152	1.049	4.111	11	Pass
802.11n(HT40)	5190	-2.878	-3.498	-0.167	11	Pass
	5230	-2.545	-2.685	0.396	11	Pass
802.11ac(VH20)	5210	-4.539	-4.467	-1.493	11	Pass
	5180	0.143	-0.195	2.988	11	Pass
	5200	0.445	-0.064	3.208	11	Pass
802.11ac(VH40)	5240	1.257	1.005	4.143	11	Pass
	5190	-3.002	-3.392	-0.182	11	Pass
802.11ac(VH80)	5230	-2.02	-2.073	0.964	11	Pass

5250-5350 MHzMHz
ANT1+ANT2

Test mode	Test Channel (MHz)	PSD [dBm/MHz] ANT 1	PSD [dBm/MHz] ANT 2	PSD [dBm/MHz] Total	Limit (dBm)	Result
802.11a	5260	1.311	1.708	/	11	Pass
	5280	1.479	1.85	/	11	Pass
	5320	1.22	0.99	/	11	Pass
802.11n(HT20)	5260	1.161	0.966	4.075	11	Pass
	5280	1.32	0.951	4.150	11	Pass
	5320	0.825	0.416	3.636	11	Pass
802.11n(HT40)	5270	-0.562	-2.109	1.743	11	Pass
	5310	-1.105	-1.943	1.506	11	Pass
802.11ac(VH20)	5260	-3.576	-4.128	-0.833	11	Pass
	5280	1.42	1.145	4.295	11	Pass
	5320	1.28	1.245	4.273	11	Pass
802.11ac(VH40)	5270	0.93	0.712	3.833	11	Pass
	5310	-0.461	-1.953	1.867	11	Pass
802.11ac(VH80)	5290	-1.066	-2.113	1.452	11	Pass