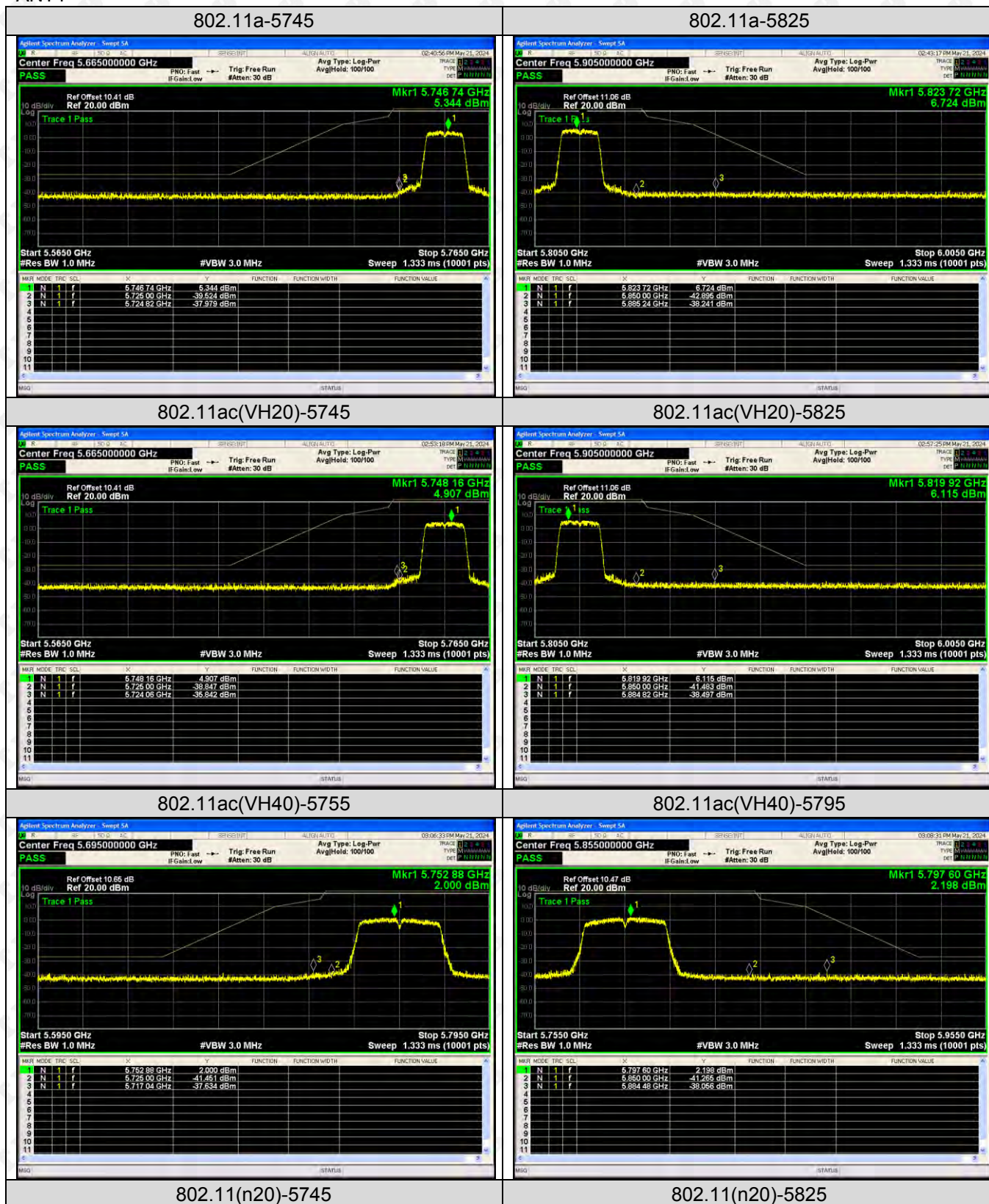
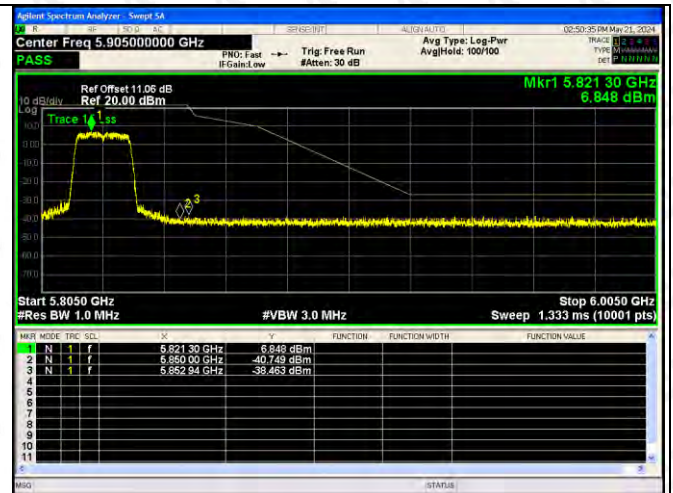


5725-5850MHz
ANT1

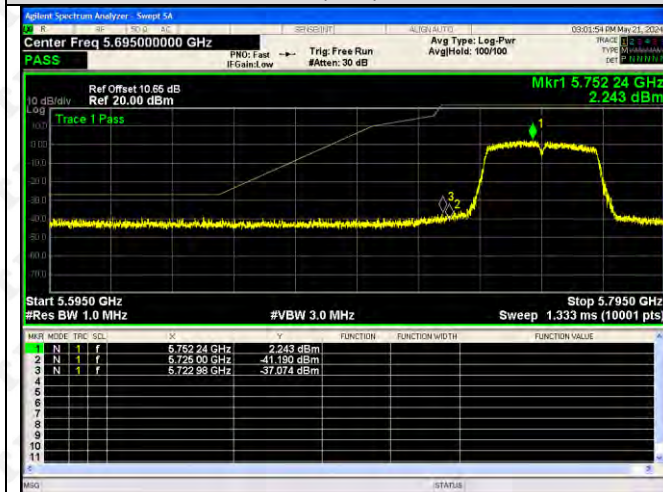




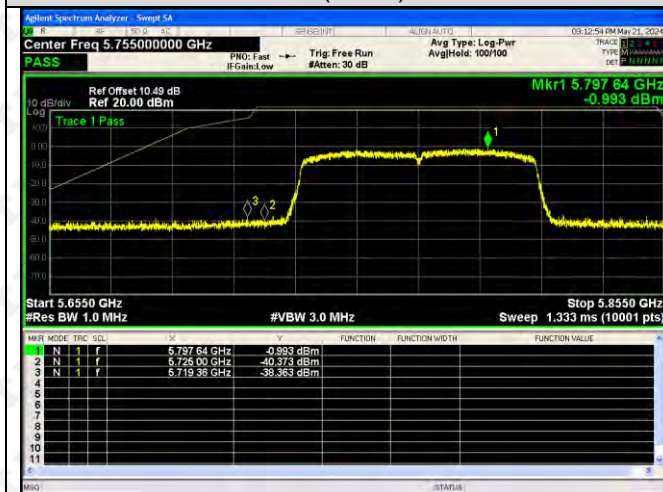
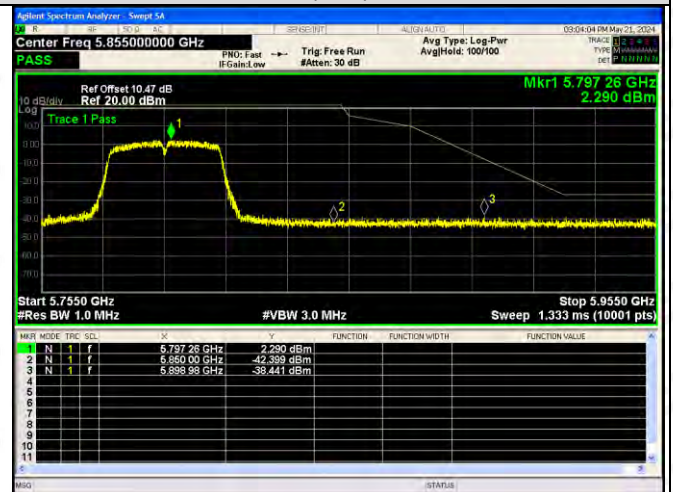
802.11(n40)-5755



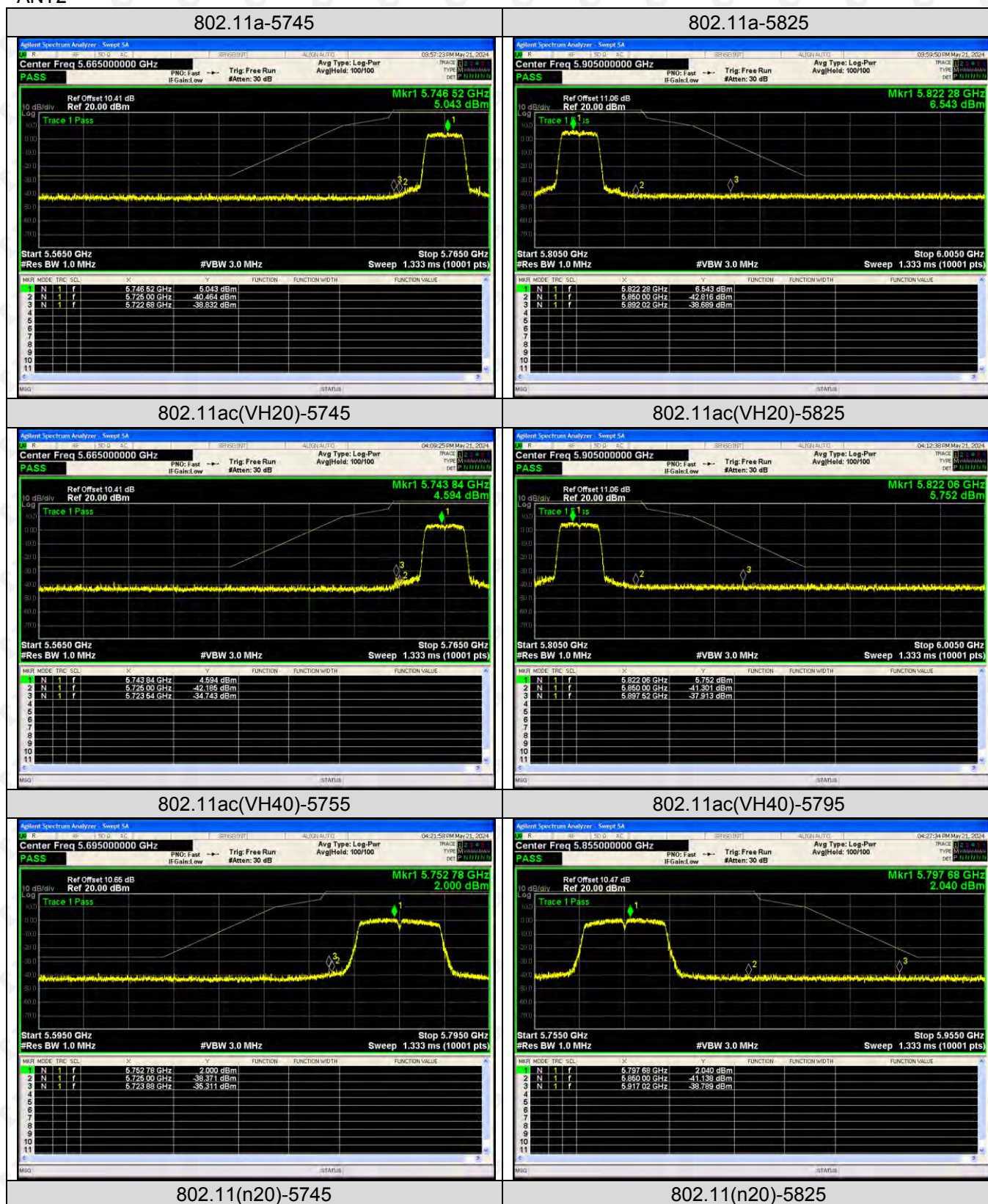
802.11(n40)-5795

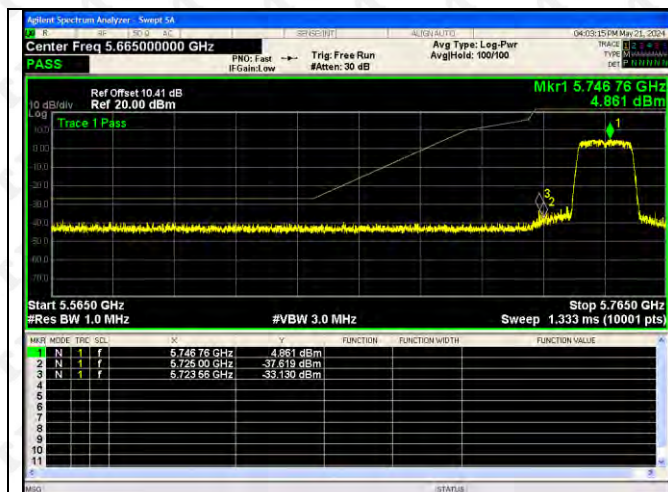


802.11ac(VH80)-5775

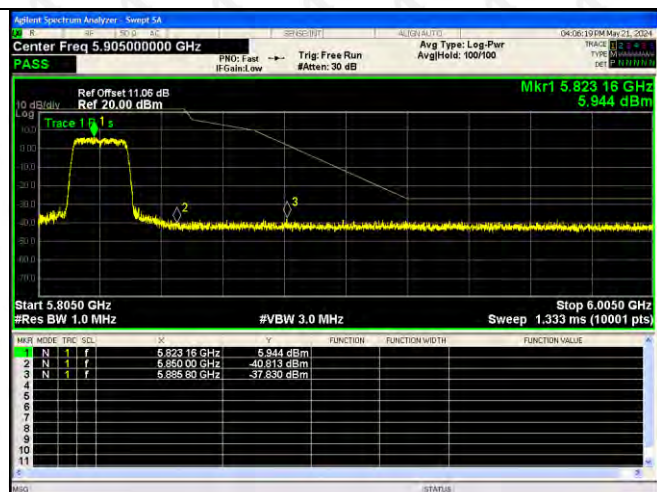


ANT2

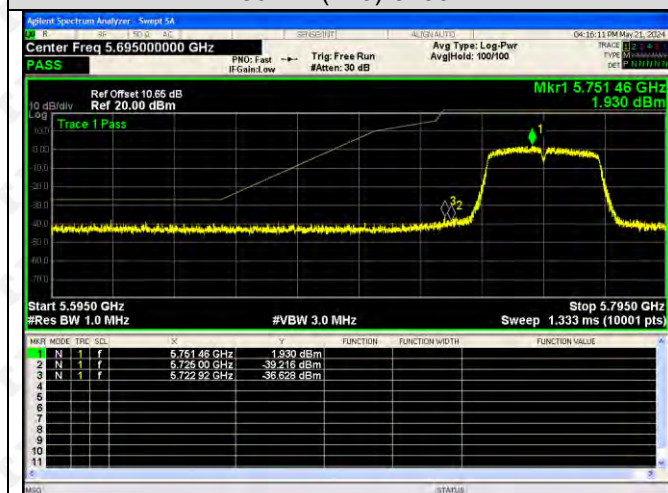




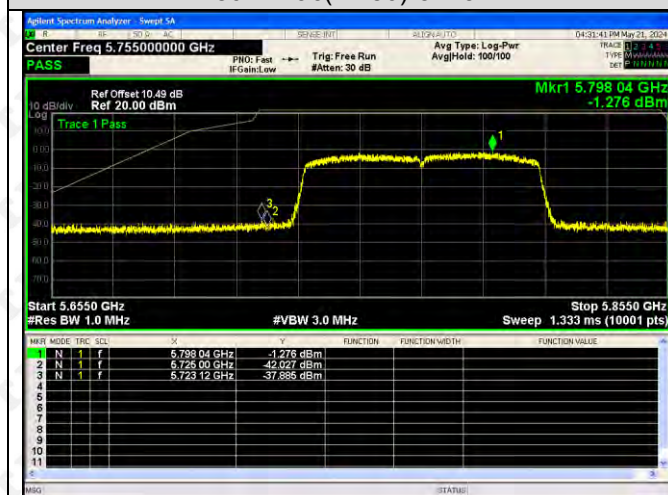
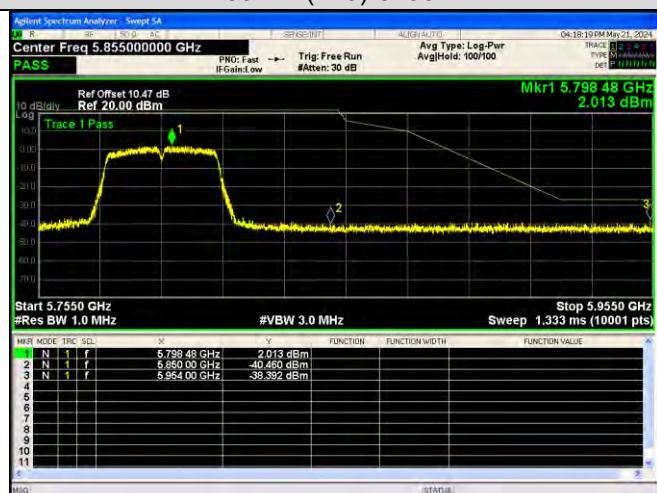
802.11(n40)-5755



802.11(n40)-5795

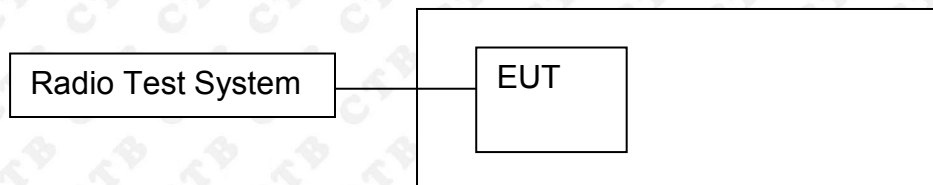


802.11ac(VH80)-5775



9. CONDUCTED PEAK OUTPUT POWER

9.1 Block Diagram Of Test Setup



9.2 Limit

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 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. The maximum e.i.r.p.

at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 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.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 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 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. 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.

(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 $11 \text{ dBm} + 10 \log B$, 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.

(4) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

(5) The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution

bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

(h) Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS).

(1) Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

9.3 Test procedure

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

(i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW $\geq$ 3 MHz.

(iv) Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$. (This ensures that bin-to-bin spacing is $\leq \text{RBW}/2$, so that narrowband signals are not lost between frequency bins.)

(v) Sweep time = auto.

(vi) Detector = power averaging (rms), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle $< 98\%$, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle $\geq 98\%$, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run."

(viii) Trace average at least 100 traces in power averaging (rms) mode.

(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

9.4 Test Result

5150-5250MHz:

Test mode1	Test Channel (MHz)	Output Power dBm ANT1	Output Power dBm ANT2	Output Power dBm Total	Limit dBm
802.11a	5180	13.238	13.323	/	30
	5200	13.062	13.047	/	30
	5240	12.948	12.873	/	30
802.11ac20	5180	13.548	13.239	16.407	30
	5200	13.363	13.194	16.290	30
	5240	13.118	13.116	16.127	30
802.11ac40	5190	12.817	13.031	15.936	30
	5230	12.117	12.509	15.328	30
802.11ac80	5210	10.510	12.401	14.568	30
802.11n(HT20)	5180	13.349	13.265	16.318	30
	5200	12.879	13.212	16.059	30
	5240	12.787	13.026	15.918	30
802.11n(HT40)	5190	12.830	12.987	15.920	30
	5230	12.642	12.538	15.601	30

5250-5350MHz:

Test mode1	Test Channel (MHz)	Output Power dBm ANT1	Output Power dBm ANT2	Output Power dBm Total	Limit dBm
802.11a	5260	12.733	13.165	/	23.98
	5280	12.102	12.838	/	23.98
	5320	11.019	13.791	/	23.98
802.11ac20	5260	13.598	13.635	16.627	23.98
	5280	12.787	12.927	15.868	23.98
	5320	11.958	13.639	15.890	23.98
802.11ac40	5270	12.516	12.137	15.341	23.98
	5310	11.552	11.191	14.386	23.98
802.11ac80	5290	11.861	10.593	14.283	23.98
802.11n(HT20)	5260	12.650	13.890	16.324	23.98
	5280	12.117	13.689	15.984	23.98
	5320	11.626	13.424	15.628	23.98
802.11n(HT40)	5270	12.502	12.588	15.556	23.98
	5310	11.609	12.769	15.238	23.98

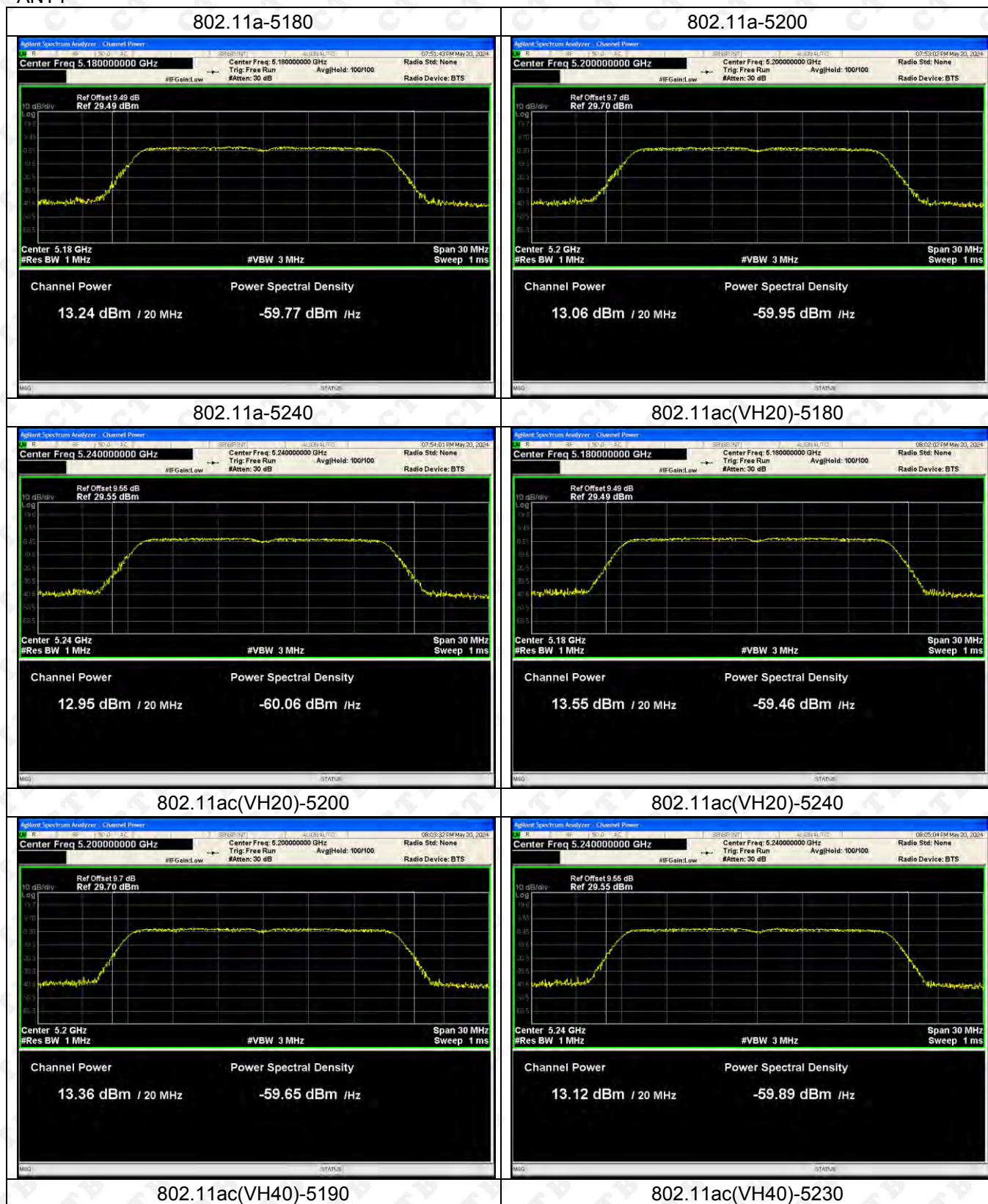
5470-5725MHz:

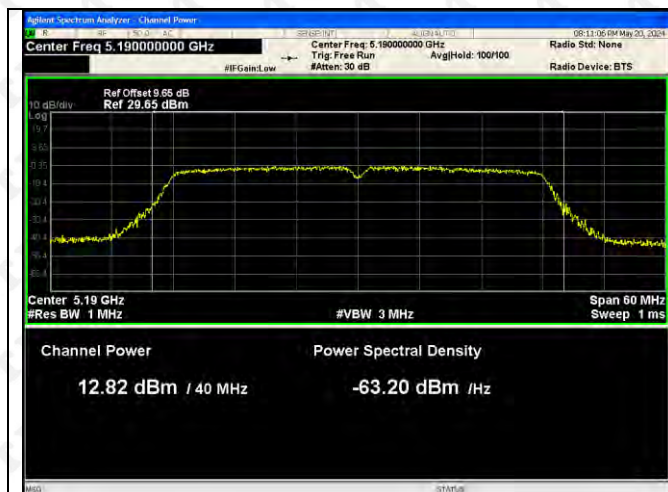
Test mode1	Test Channel (MHz)	Output Power dBm ANT1	Output Power dBm ANT2	Output Power dBm Total	Limit dBm
802.11a	5500	13.931	13.571	/	23.98
	5580	13.748	13.234	/	23.98
	5700	12.254	11.663	/	23.98
802.11ac20	5500	14.509	14.009	17.276	23.98
	5580	14.454	14.447	17.461	23.98
	5700	12.981	13.401	16.206	23.98
802.11ac40	5510	13.473	14.002	16.756	23.98
	5670	12.196	12.866	15.554	23.98
802.11ac80	5530	13.025	13.406	16.230	23.98
802.11n(HT20)	5500	14.378	13.447	16.948	23.98
	5580	14.285	13.377	16.865	23.98
	5700	13.257	12.098	15.726	23.98
802.11n(HT40)	5510	14.027	14.641	17.355	23.98
	5670	12.193	12.905	15.574	23.98

5725-5850MHz:

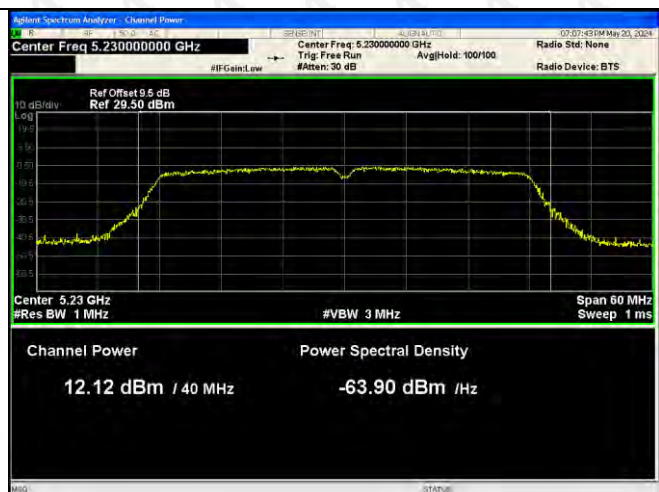
Test mode1	Test Channel (MHz)	Output Power dBm ANT1	Output Power dBm ANT2	Output Power dBm Total	Limit dBm
802.11a	5745	12.893	12.440	/	23.98
	5785	12.905	12.499	/	23.98
	5825	14.460	14.138	/	23.98
802.11ac20	5745	13.343	13.238	16.301	23.98
	5785	13.490	13.100	16.310	23.98
	5825	14.739	14.607	17.684	23.98
802.11ac40	5755	12.549	12.788	15.680	23.98
	5795	12.978	12.934	15.966	23.98
802.11ac80	5775	12.623	12.356	15.502	23.98
802.11n(HT20)	5745	13.017	13.067	16.052	23.98
	5785	13.567	13.128	16.363	23.98
	5825	14.528	14.666	17.608	23.98
802.11n(HT40)	5755	12.747	12.594	15.681	23.98
	5795	13.352	12.954	16.168	23.98

Test Graph:
5150-5250MHz-Power
ANT1

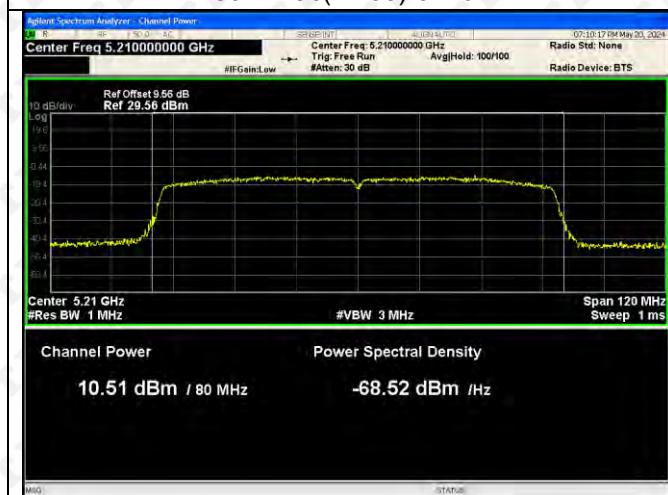




802.11ac(VH80)-5210



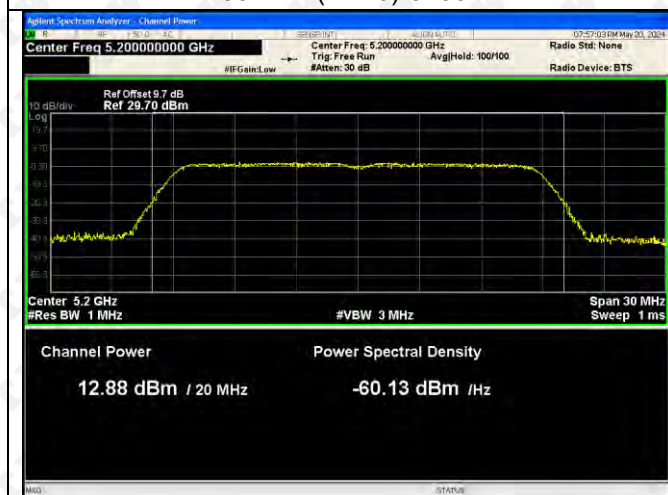
802.11n(HT20)-5180



802.11n(HT20)-5200



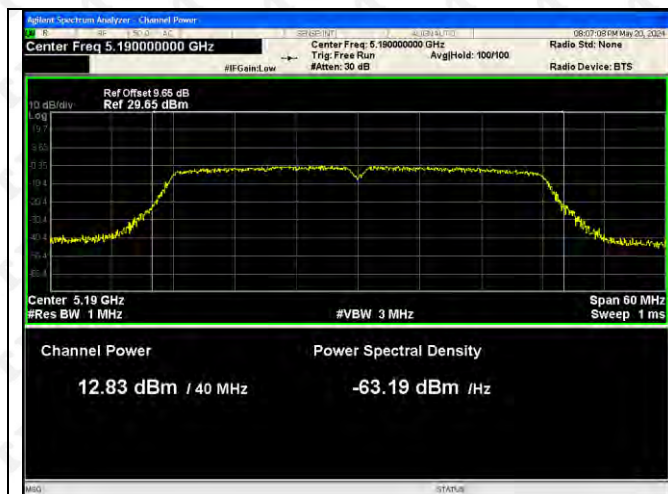
802.11n(HT20)-5240



802.11n(HT40)-5190

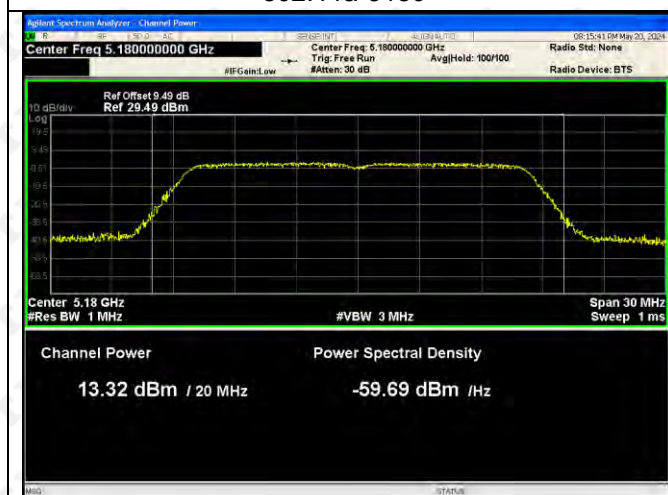


802.11n(HT40)-5230

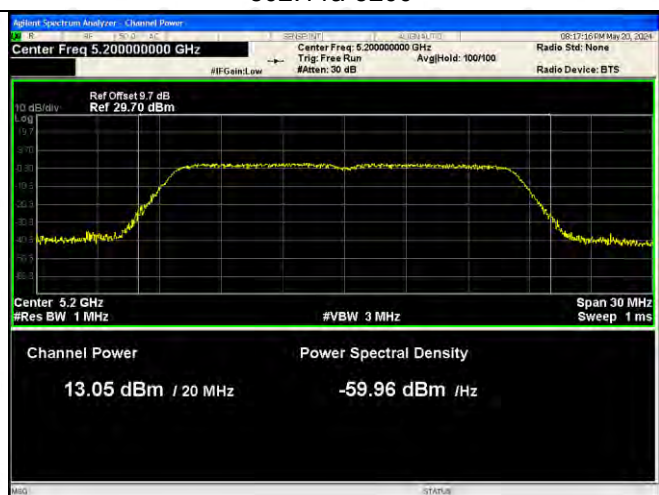


ANT2

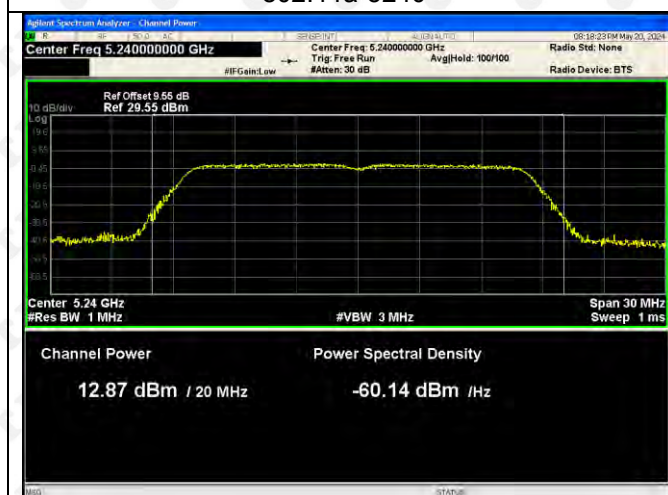
802.11a-5180



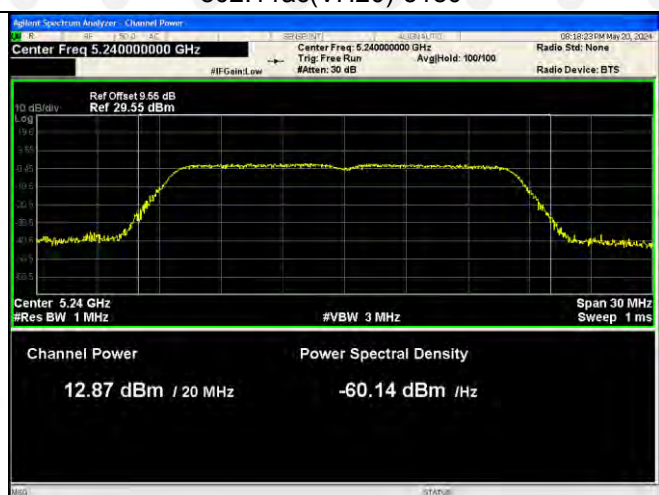
802.11a-5200



802.11a-5240



802.11ac(VH20)-5180



802.11ac(VH20)-5200

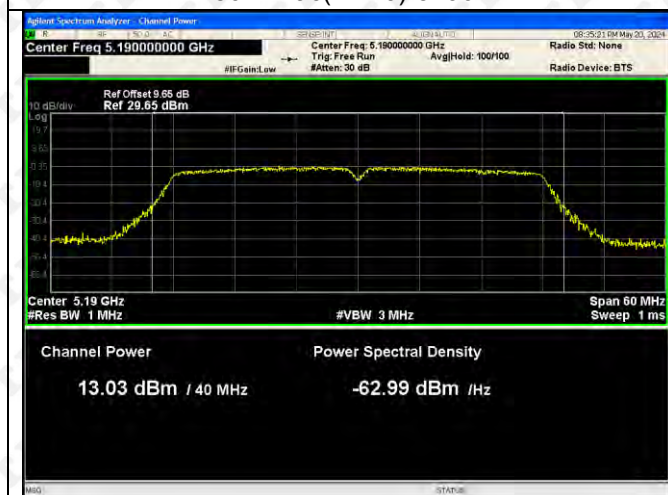
802.11ac(VH20)-5240



802.11ac(VH40)-5190



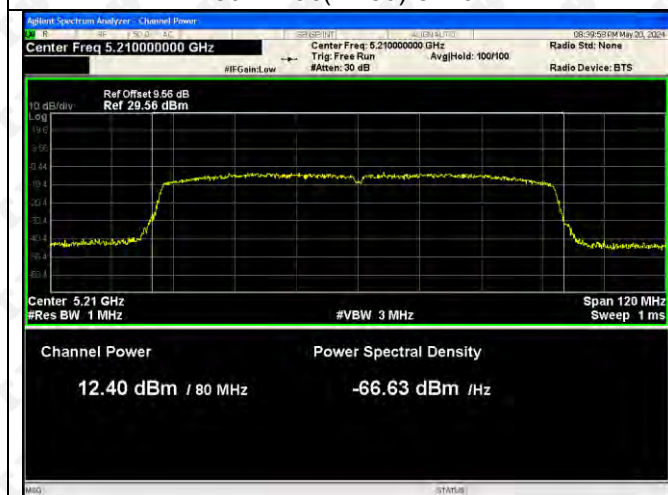
802.11ac(VH40)-5230



802.11ac(VH80)-5210



802.11n(HT20)-5180



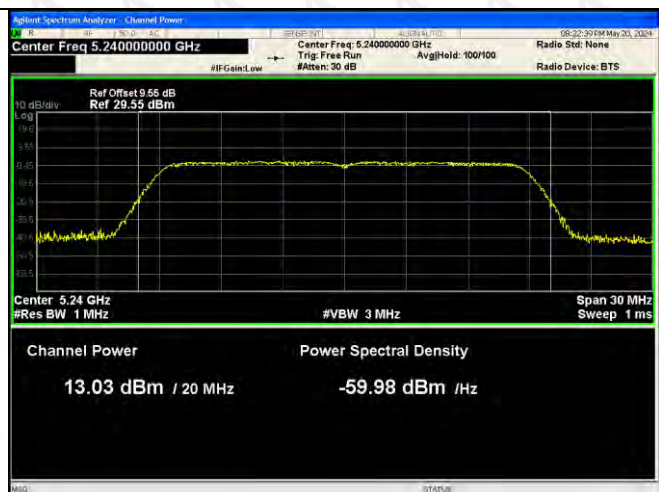
802.11n(HT20)-5200



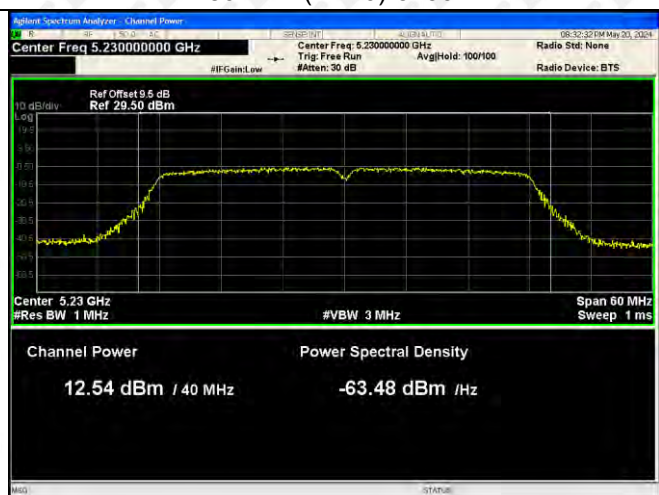
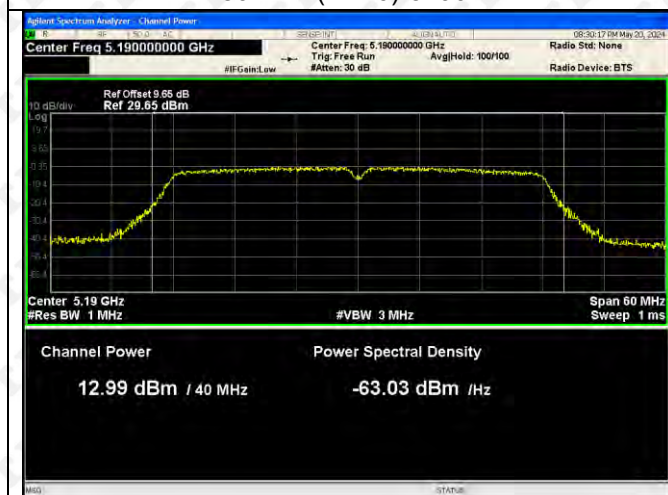
802.11n(HT20)-5240



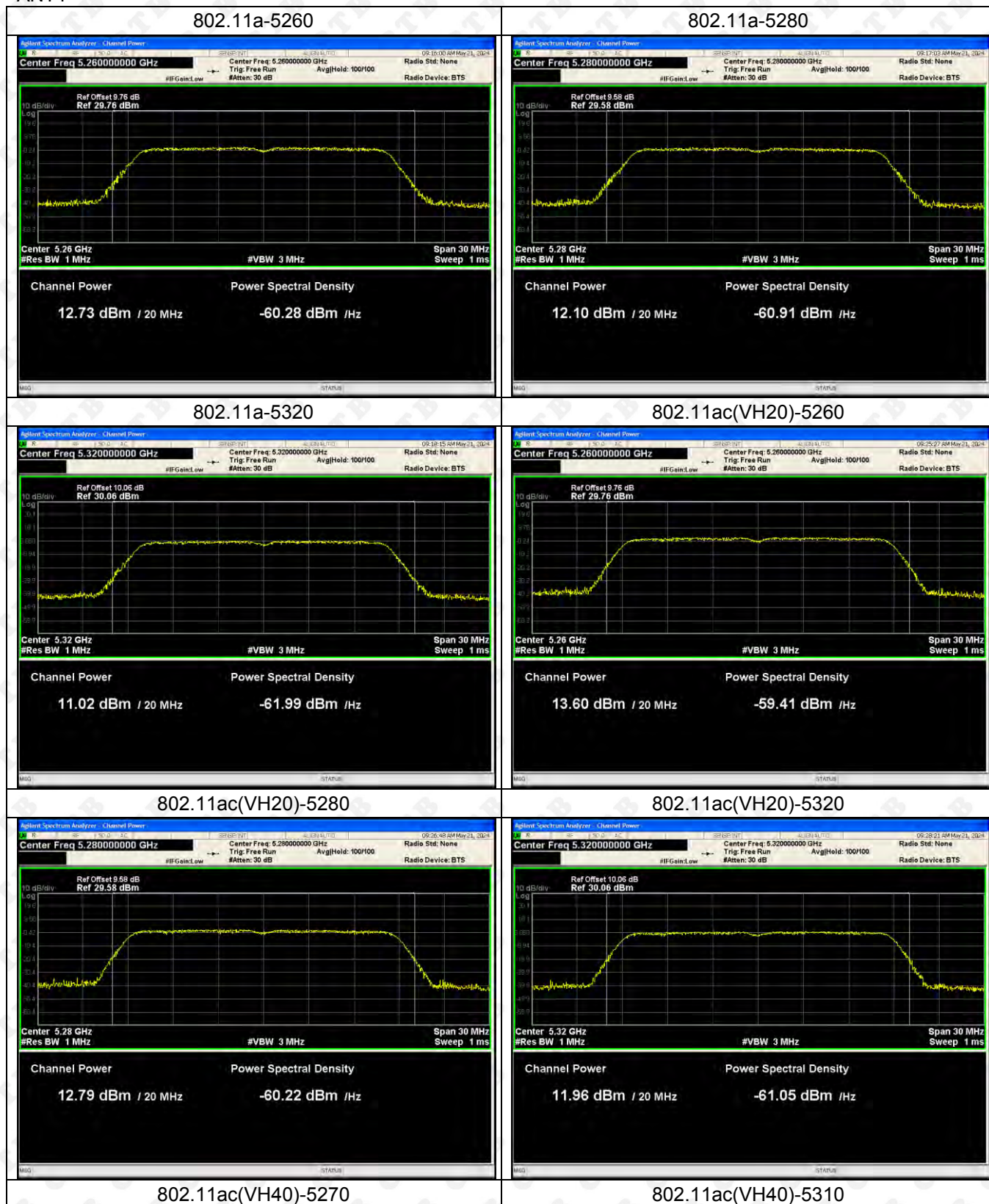
802.11n(HT40)-5190

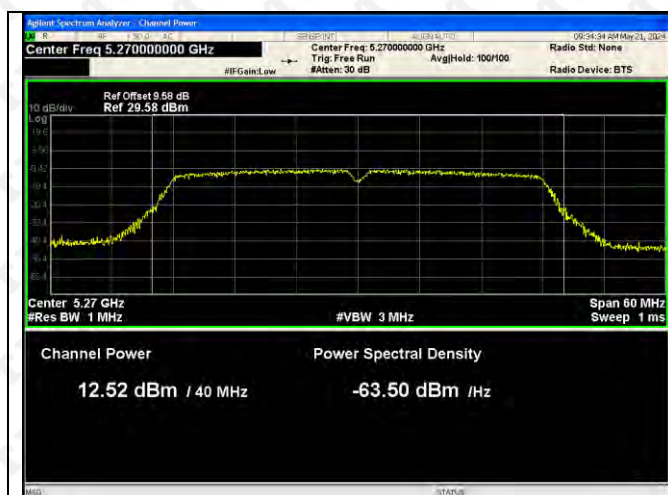


802.11n(HT40)-5230

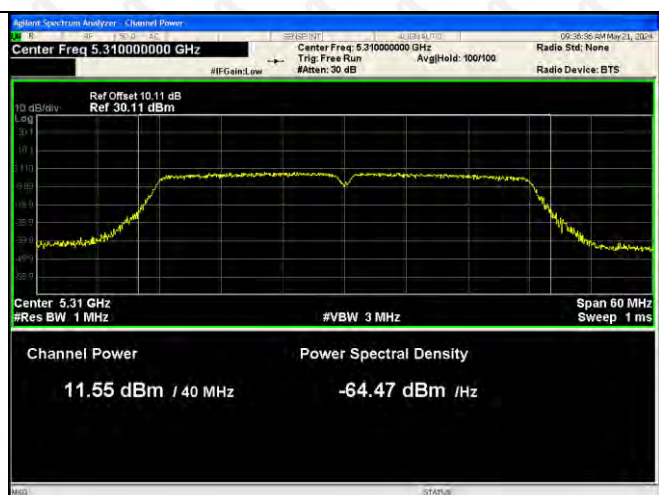


5250-5350MHz-Power ANT1

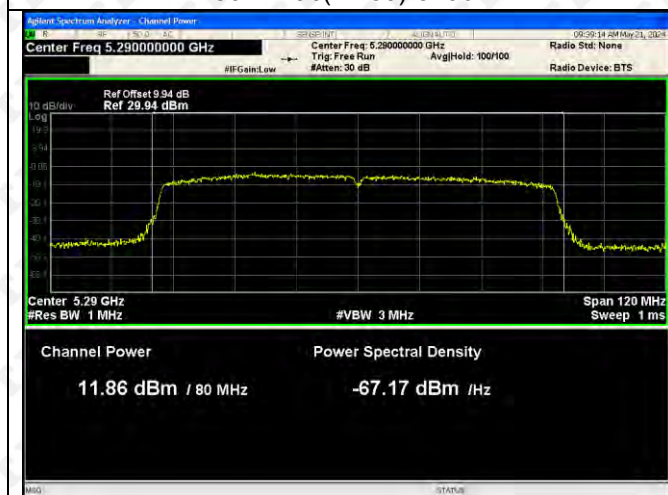




802.11ac(VH80)-5290



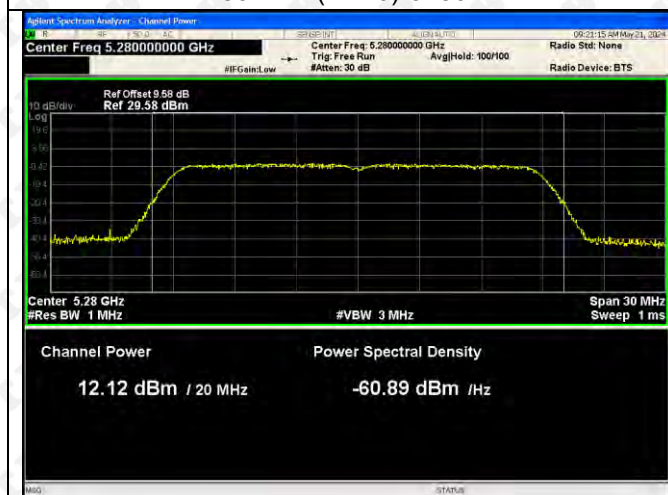
802.11n(HT20)-5260



802.11n(HT20)-5280



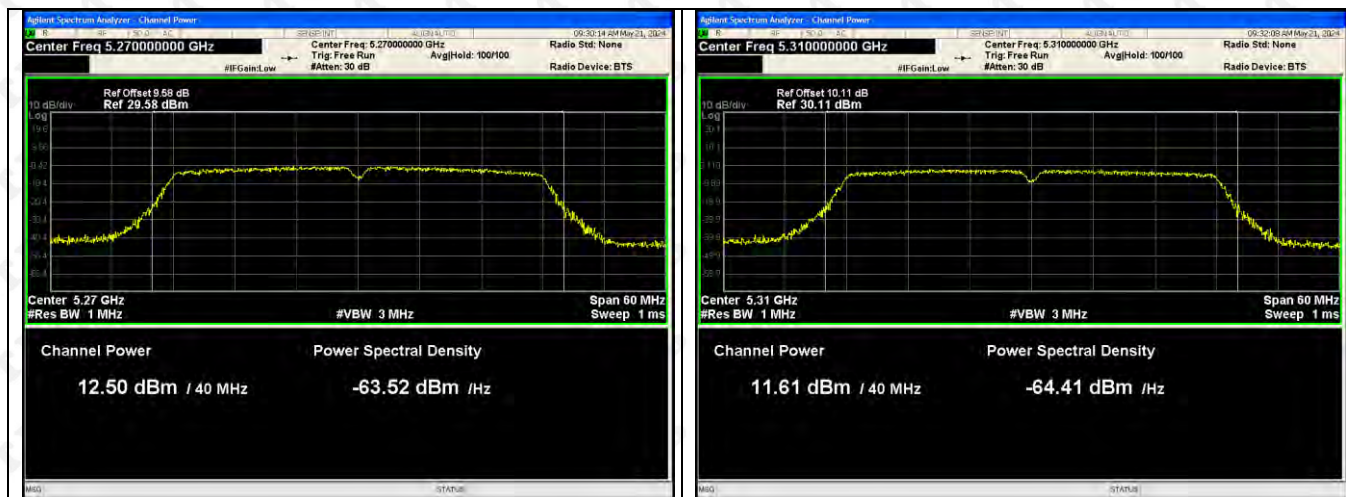
802.11n(HT20)-5320



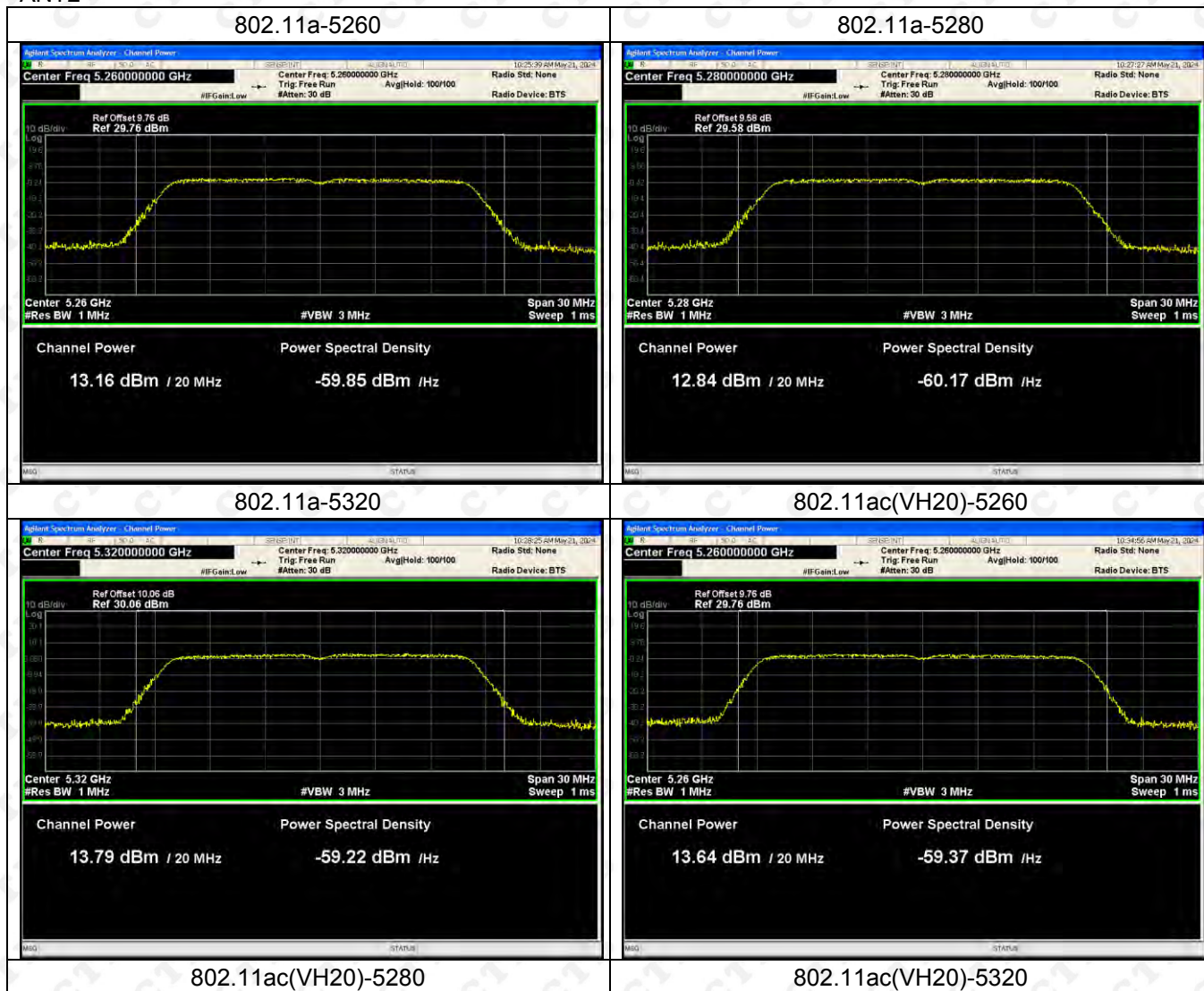
802.11n(HT40)-5270

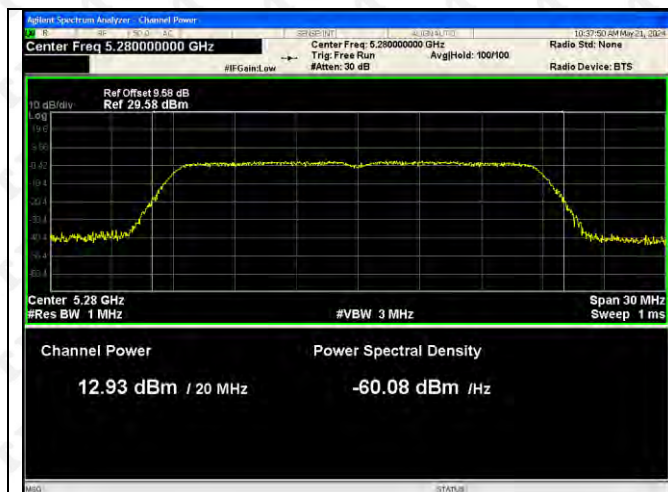


802.11n(HT40)-5310



ANT2

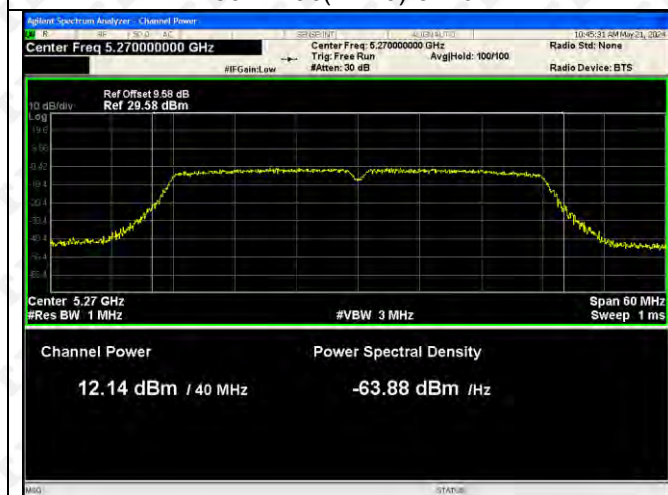




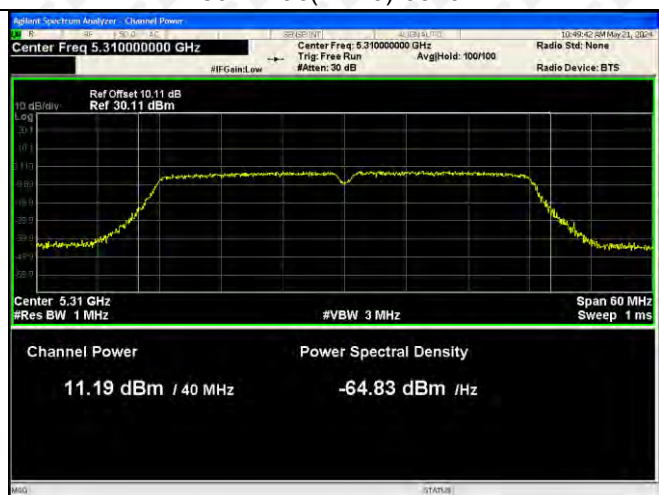
802.11ac(VH40)-5270



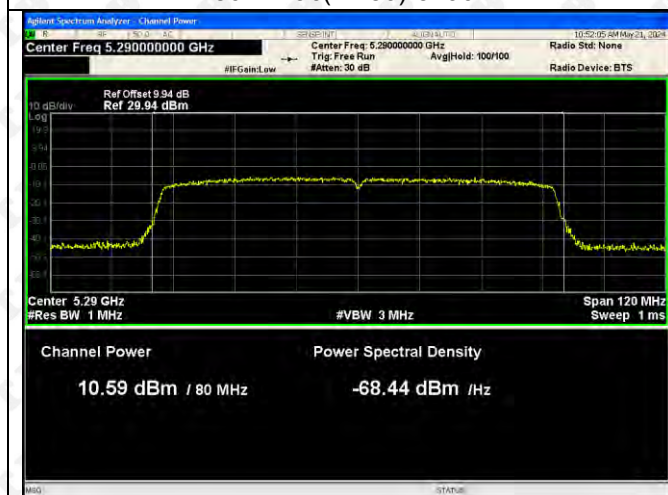
802.11ac(VH40)-5310



802.11ac(VH80)-5290



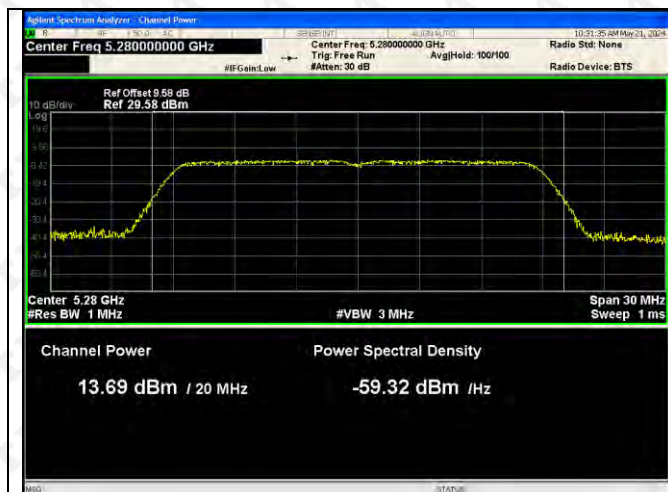
802.11n(HT20)-5260



802.11n(HT20)-5280



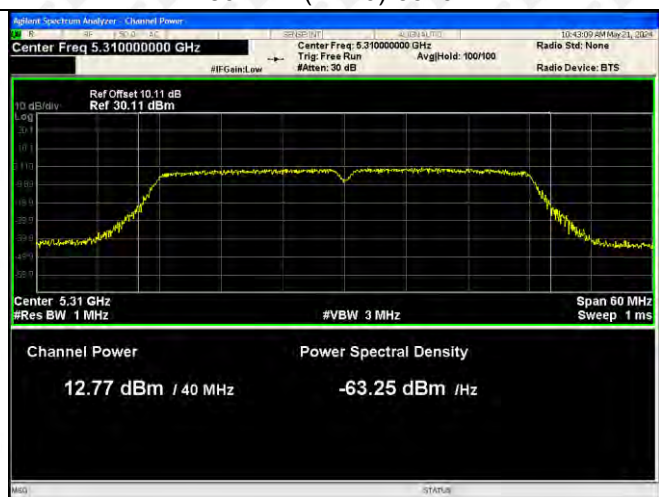
802.11n(HT20)-5320



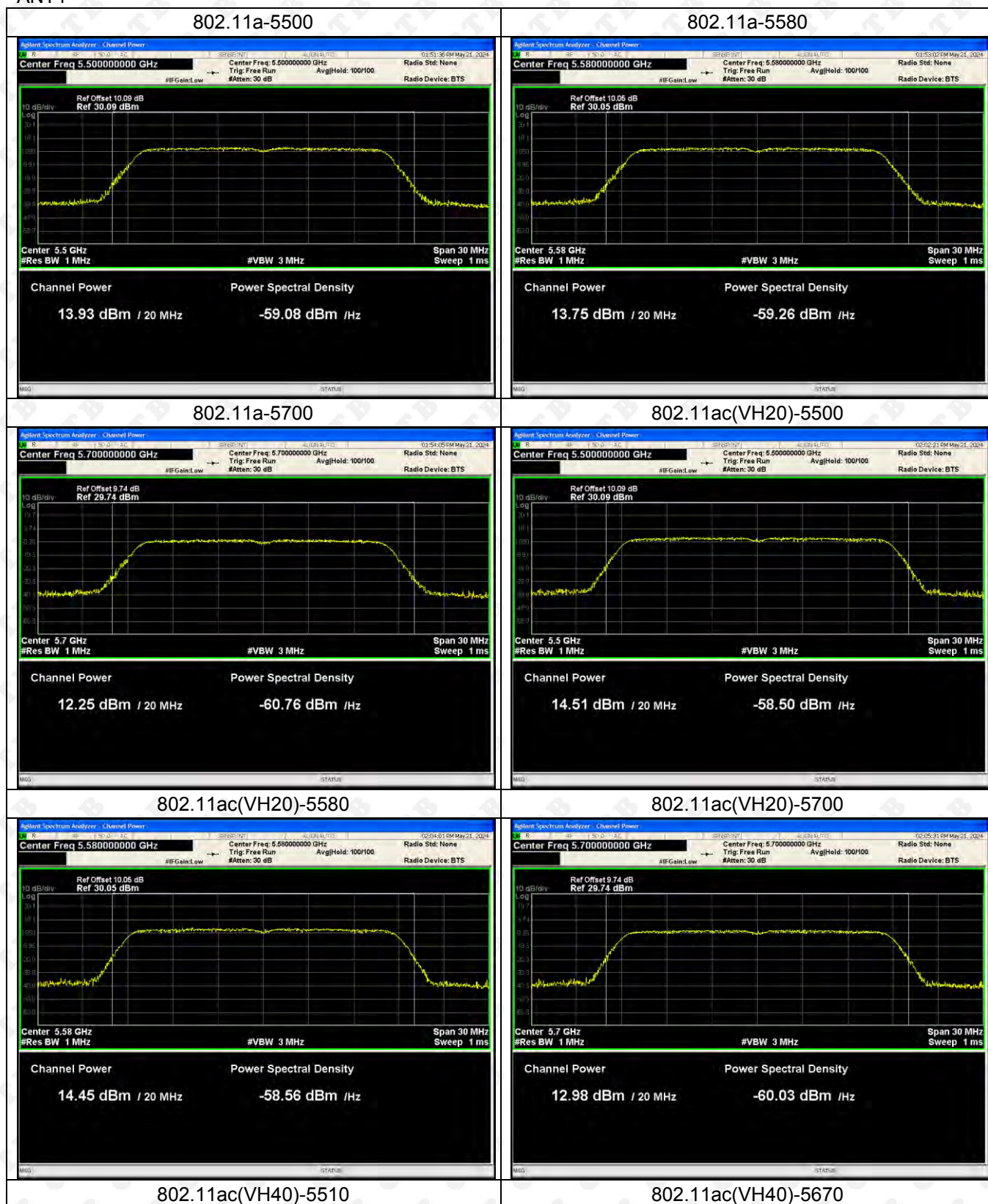
802.11n(HT40)-5270

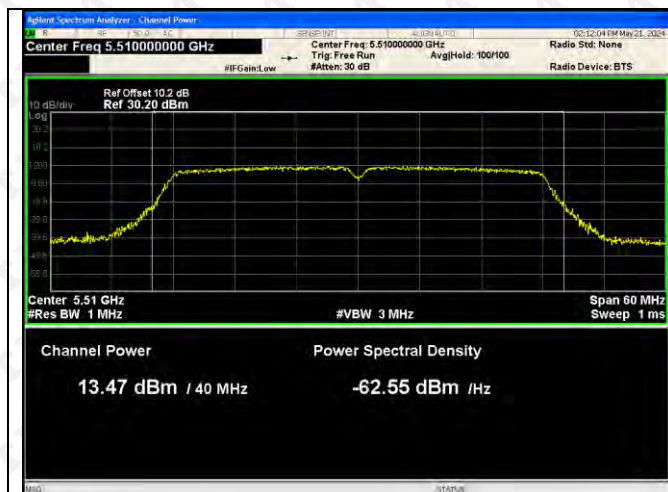


802.11n(HT40)-5310

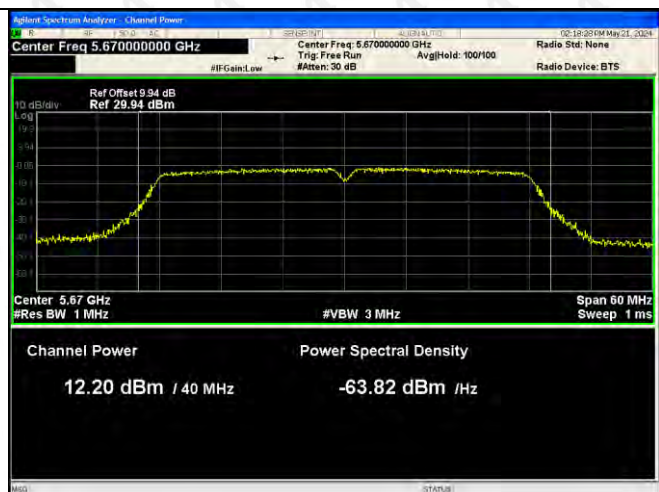


5470-5725MHz-Power ANT1

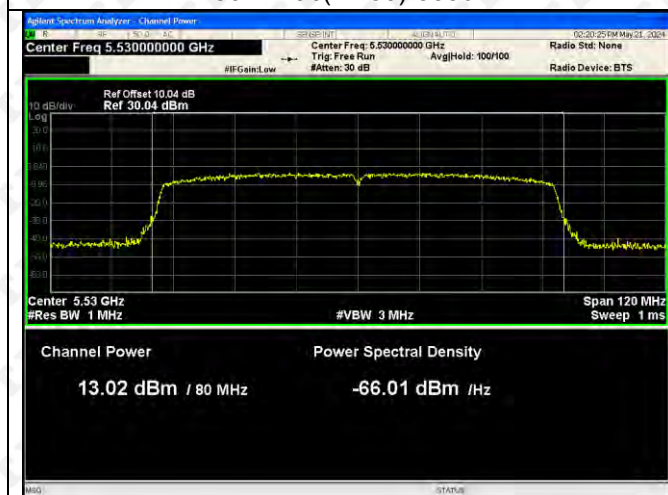




802.11ac(VH80)-5530



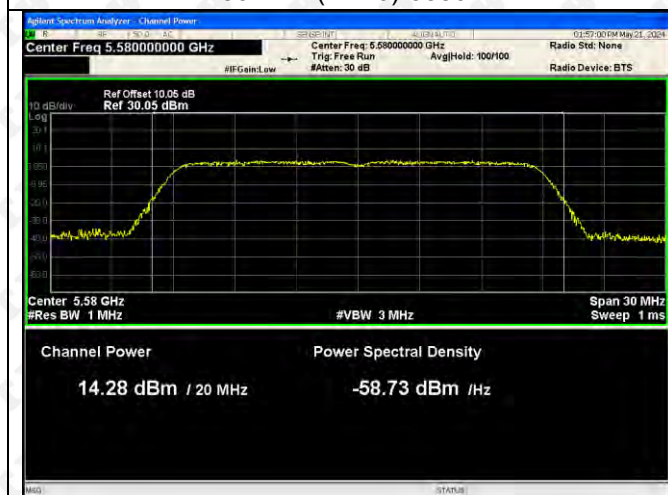
802.11n(HT20)-5500



802.11n(HT20)-5580



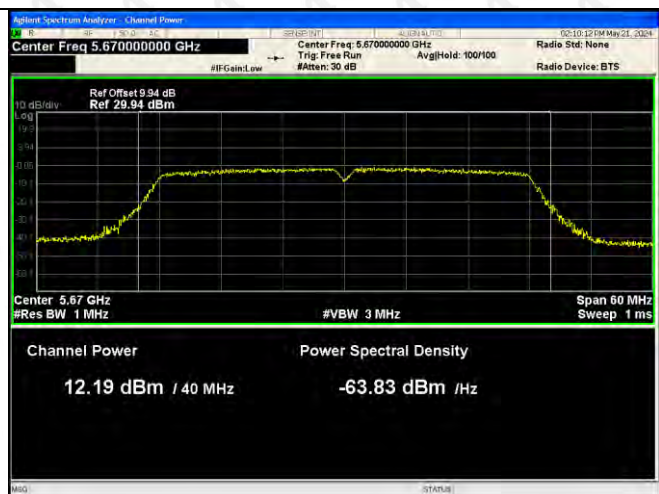
802.11n(HT20)-5700



802.11n(HT40)-5510



802.11n(HT40)-5670



ANT2

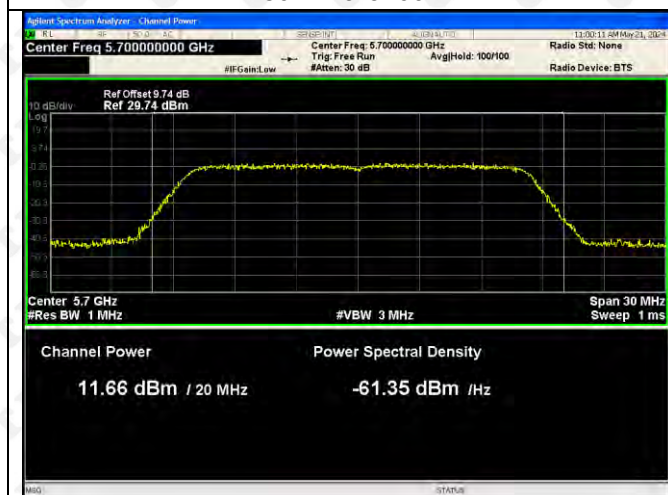
802.11a-5500



802.11a-5580



802.11a-5700



802.11ac(VH20)-5500



802.11ac(VH20)-5580

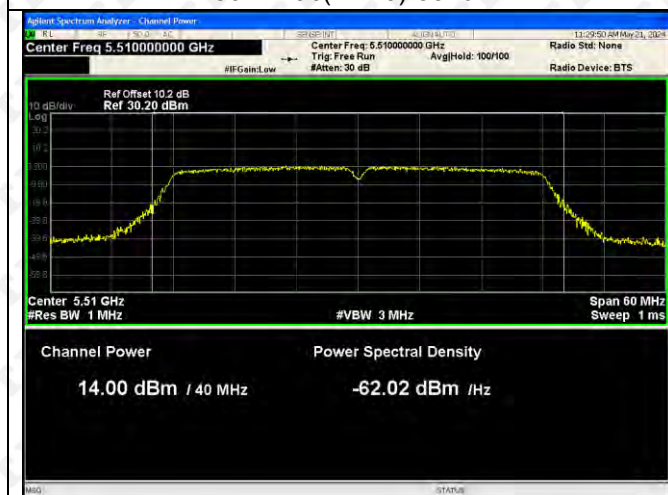
802.11ac(VH20)-5700



802.11ac(VH40)-5510



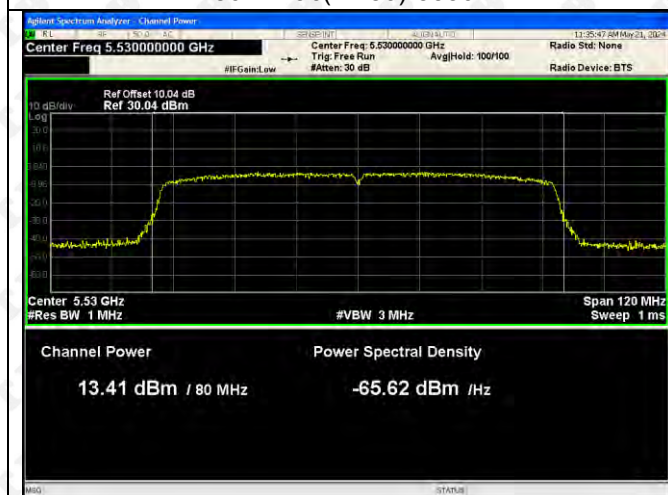
802.11ac(VH40)-5670



802.11ac(VH80)-5530



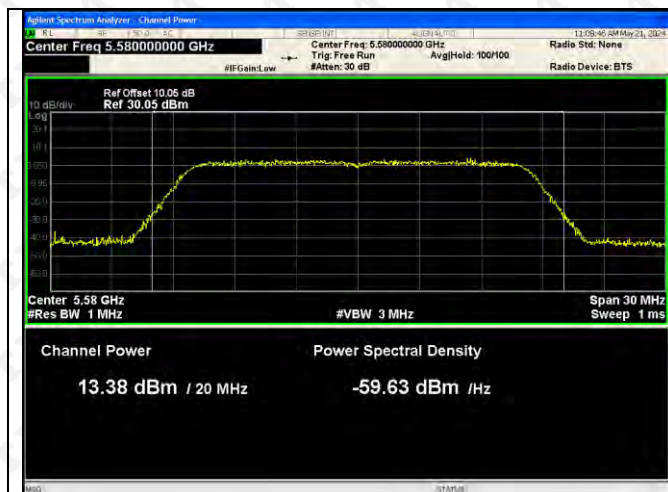
802.11n(HT20)-5500



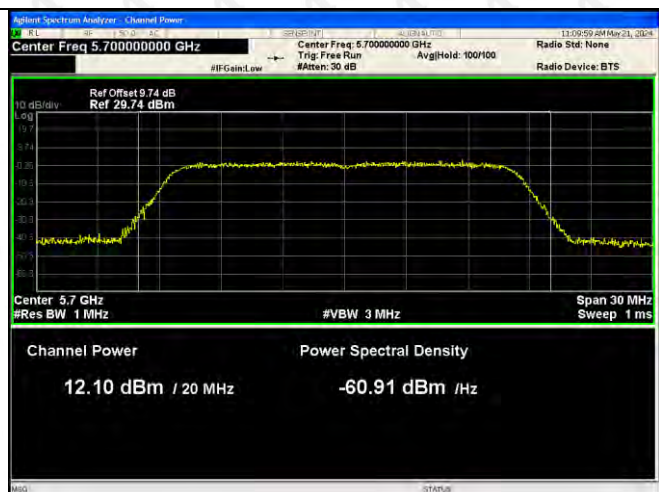
802.11n(HT20)-5580



802.11n(HT20)-5700



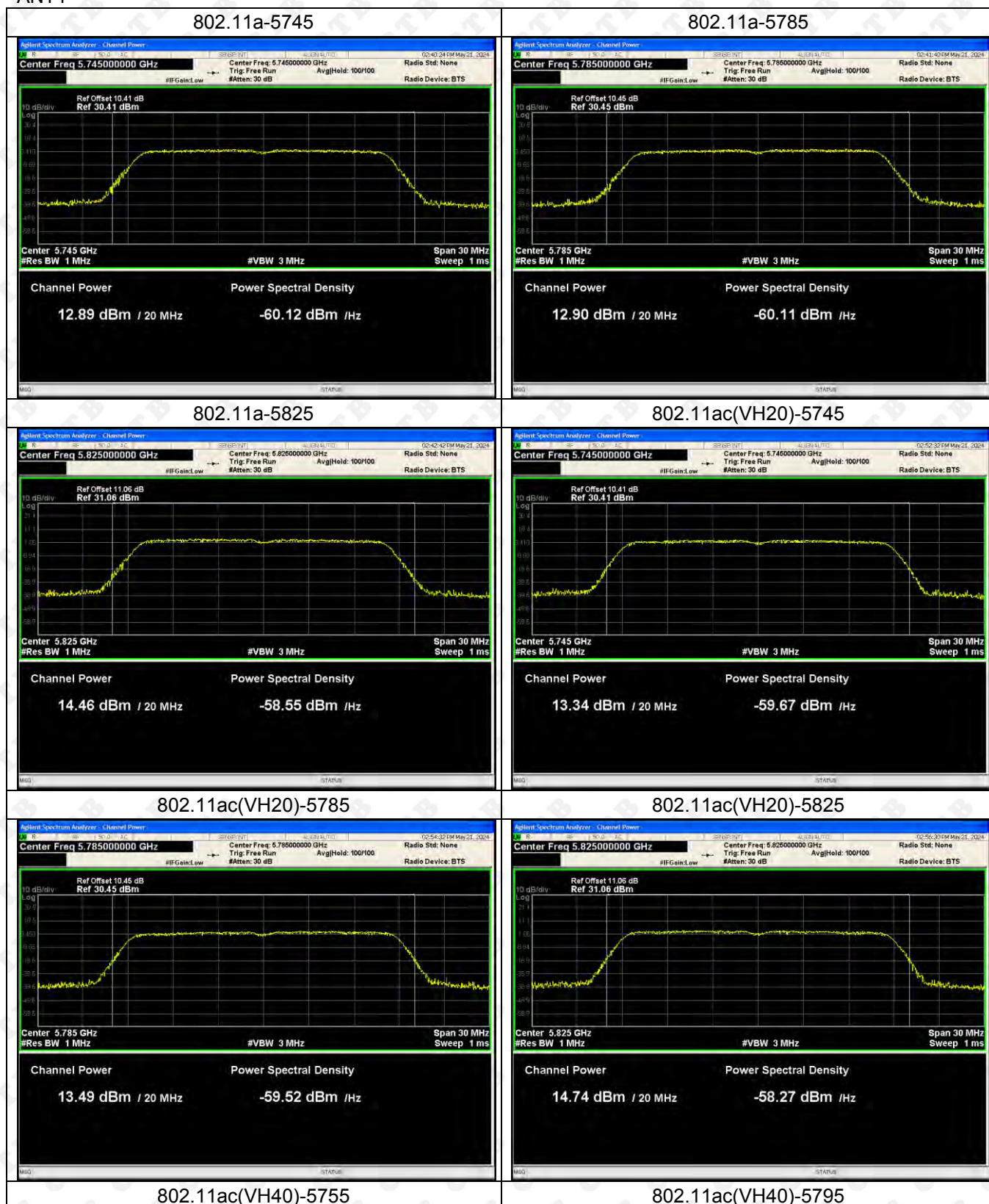
802.11n(HT40)-5510

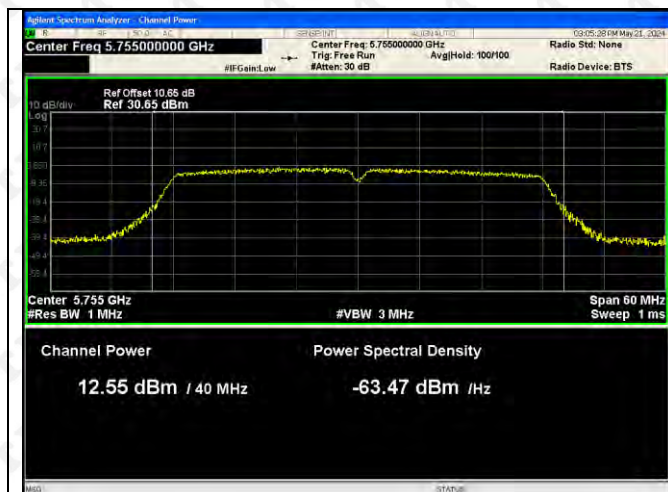


802.11n(HT40)-5670

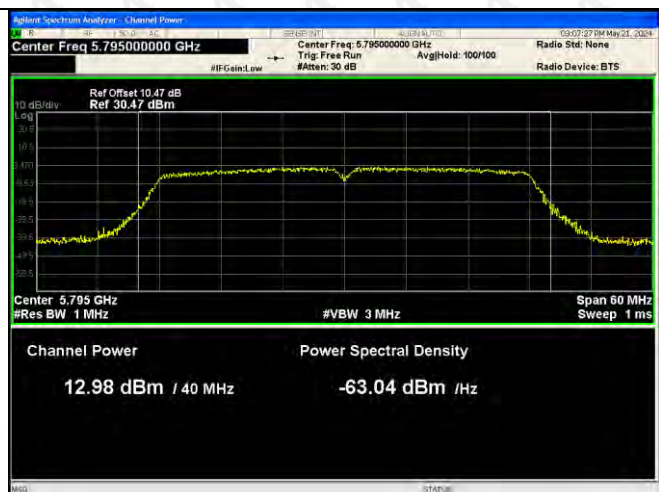


5725-5850MHz:-Power
ANT1

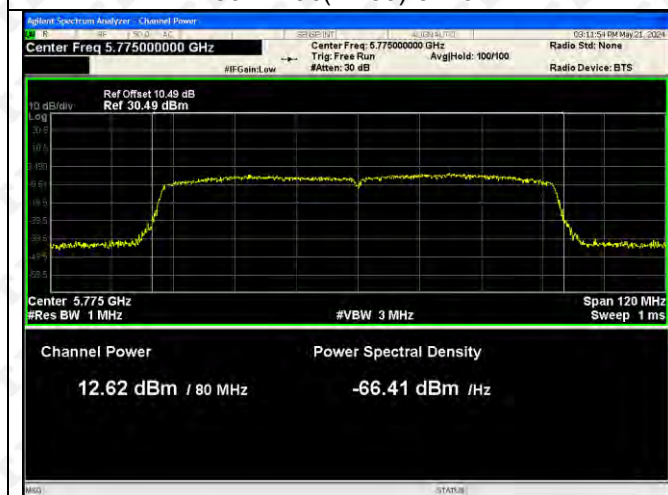




802.11ac(VH80)-5775



802.11n(HT20)-5745



802.11n(HT20)-5785



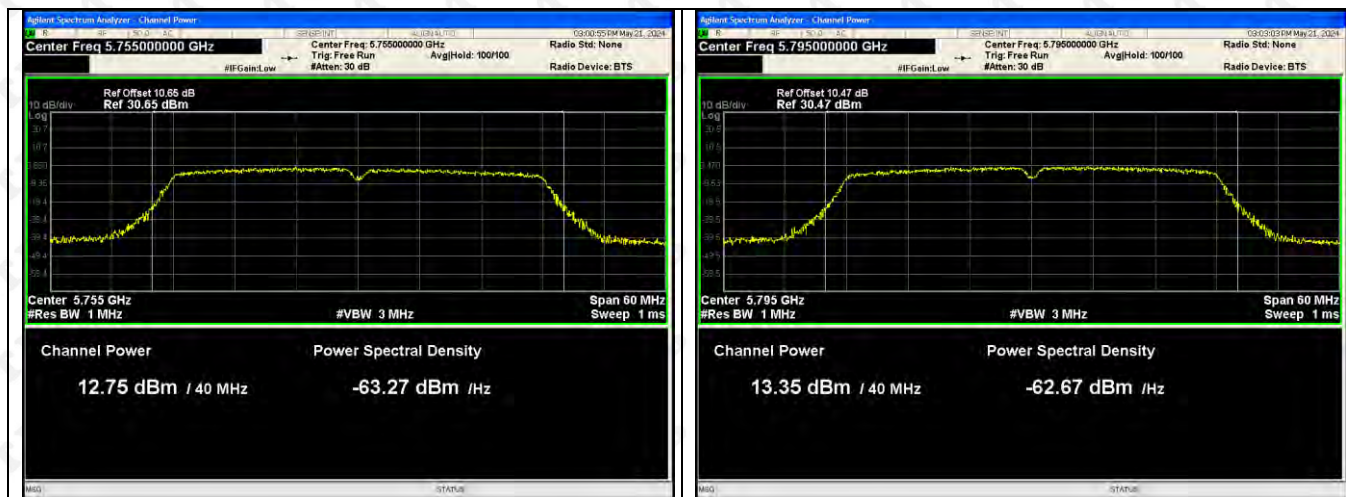
802.11n(HT20)-5745



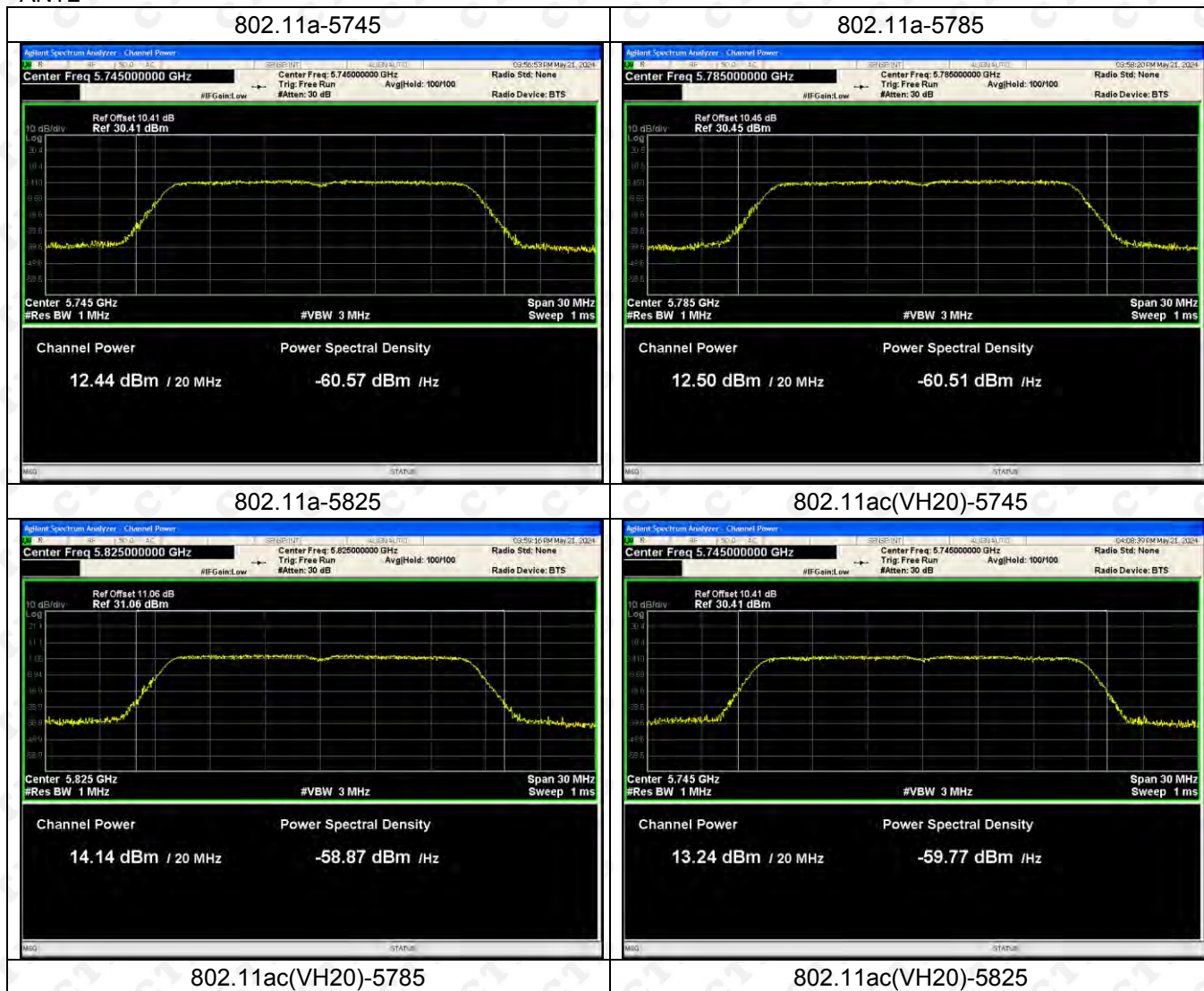
802.11n(HT40)-5795



802.11n(HT40)-5825

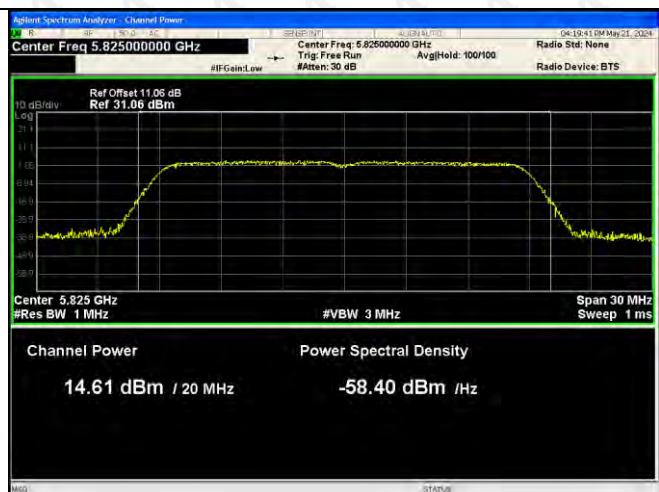


ANT2

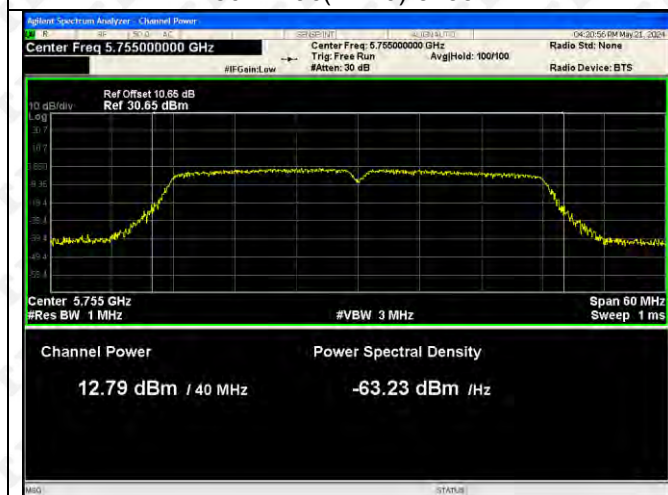




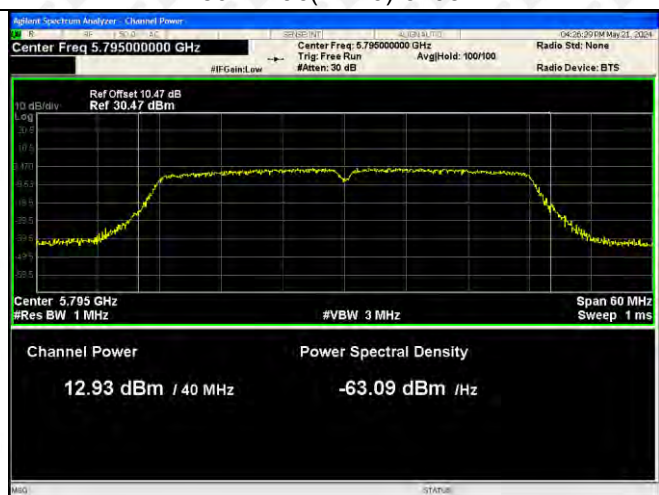
802.11ac(VH40)-5755



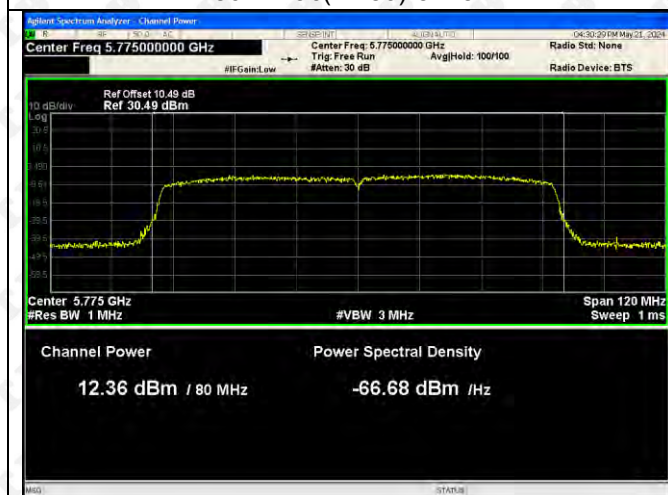
802.11ac(VH40)-5795



802.11ac(VH80)-5775



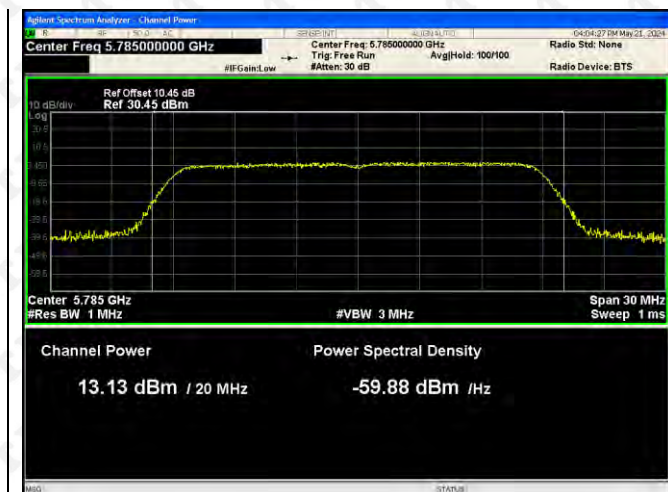
802.11n(HT20)-5745



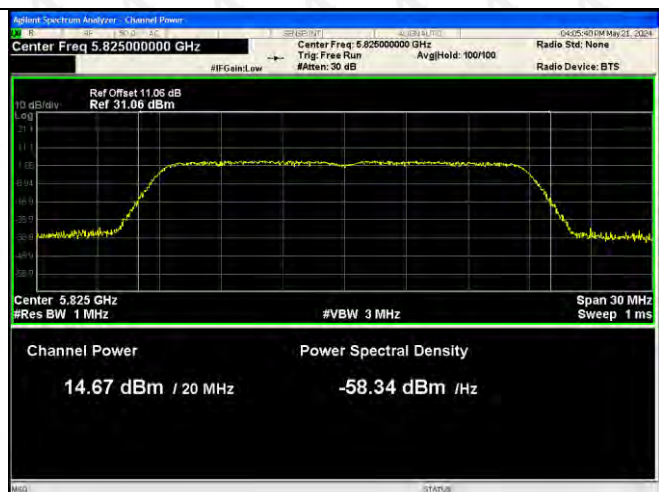
802.11n(HT20)-5785



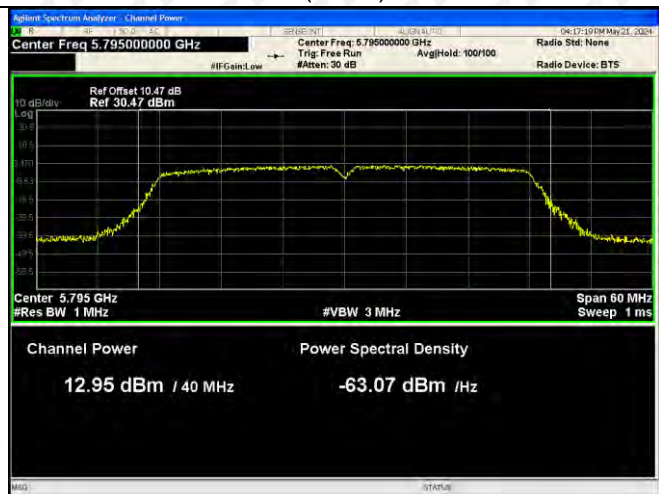
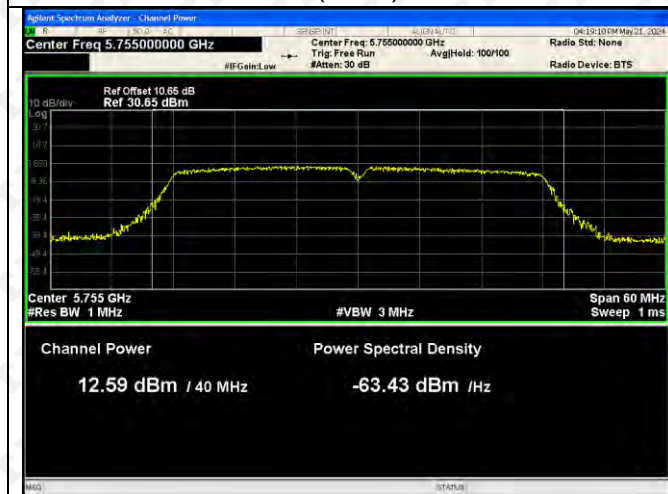
802.11n(HT20)-5825



802.11n(HT40)-5795

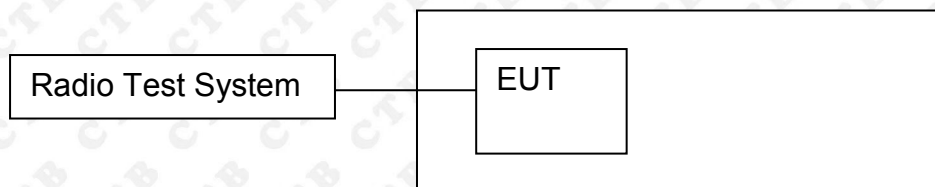


802.11n(HT40)-5825



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 $11 \text{ dBm} + 10 \log B$, 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) $\geq 3 * \text{RBW}$.

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 $\geq 3 * RBW$
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	18.690	18.550
	5200	18.642	18.717
	5240	18.465	18.539
802.11ac20	5180	19.466	19.597
	5200	19.510	19.553
	5240	19.515	19.616
802.11ac40	5190	40.567	40.109
	5230	39.771	40.173
802.11ac80	5210	79.232	78.818
802.11n(HT20)	5180	19.535	19.498
	5200	19.522	19.512
	5240	19.495	19.447
802.11n(HT40)	5190	40.182	40.002
	5230	39.849	40.125

5250-5350 MHz:

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)&ANT1	26dB Bandwidth (MHz)&ANT2
802.11a	5260	18.478	18.485
	5280	18.595	18.642
	5320	18.638	18.528
802.11ac20	5260	19.425	19.551
	5280	19.501	19.541
	5320	19.482	19.538
802.11ac40	5270	39.907	40.261
	5310	40.475	40.305
802.11ac80	5290	79.239	79.269
802.11n(HT20)	5260	19.420	19.533
	5280	19.507	19.515
	5320	19.544	19.522
802.11n(HT40)	5270	40.050	40.179
	5310	40.404	40.574

5470-5725MHz:

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)&ANT1	26dB Bandwidth (MHz)&ANT2
802.11a	5500	18.688	18.453
	5580	18.738	18.597
	5700	18.768	18.502
802.11ac20	5500	19.421	19.593
	5580	19.591	19.562
	5700	19.522	19.615
802.11ac40	5510	40.219	40.423
	5670	40.567	39.949
802.11ac80	5530	78.979	79.381
802.11n(HT20)	5500	19.494	18.444
	5580	19.583	18.501
	5700	19.532	18.395
802.11n(HT40)	5510	40.465	40.439
	5670	40.107	40.287

5725-5850MHz:

Test mode	Test Channel (MHz)	6dB Bandwidth (MHz)&ANT1	6dB Bandwidth (MHz)&ANT2
802.11a	5745	16.473	16.499
	5785	16.466	16.484
	5825	16.482	16.488
802.11ac20	5745	17.67	17.698
	5785	17.685	17.704
	5825	17.671	17.637
802.11ac40	5755	36.408	36.406
	5795	36.394	36.170
802.11ac80	5775	75.697	75.991
802.11n(HT20)	5745	17.669	17.686
	5785	17.704	17.691
	5825	17.674	17.681
802.11n(HT40)	5755	36.409	36.396
	5795	36.385	36.383

Test Graph:

5150-5250MHz-Power

ANT1





802.11ac(VH80)-5210



802.11n(HT20)-5180



802.11n(HT20)-5200



802.11n(HT20)-5240



802.11n(HT40)-5190

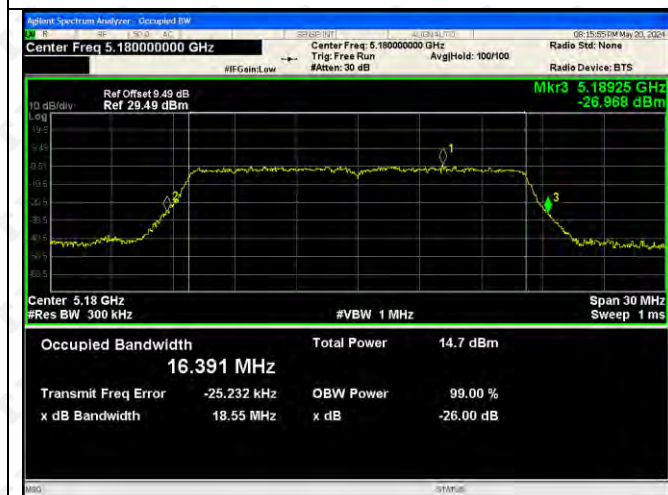


802.11n(HT40)-5230



ANT2

802.11a-5180



802.11a-5200



802.11a-5240

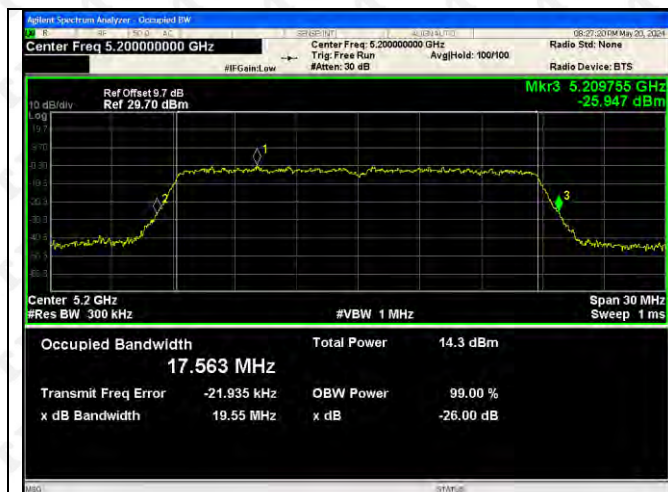


802.11ac(VH20)-5180



802.11ac(VH20)-5200

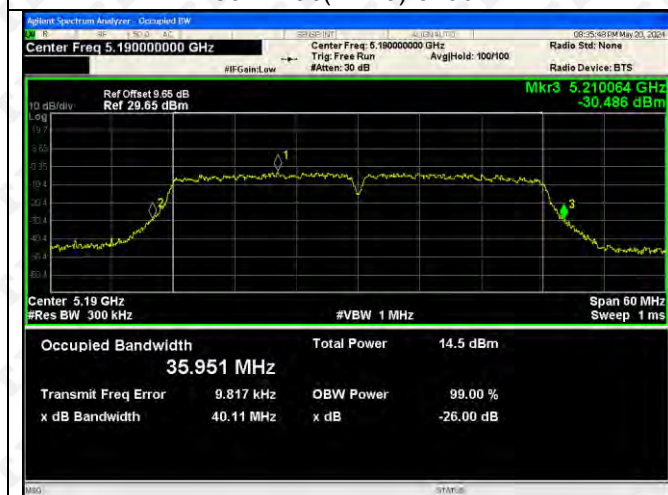
802.11ac(VH20)-5240



802.11ac(VH40)-5190



802.11ac(VH40)-5230



802.11ac(VH80)-5210



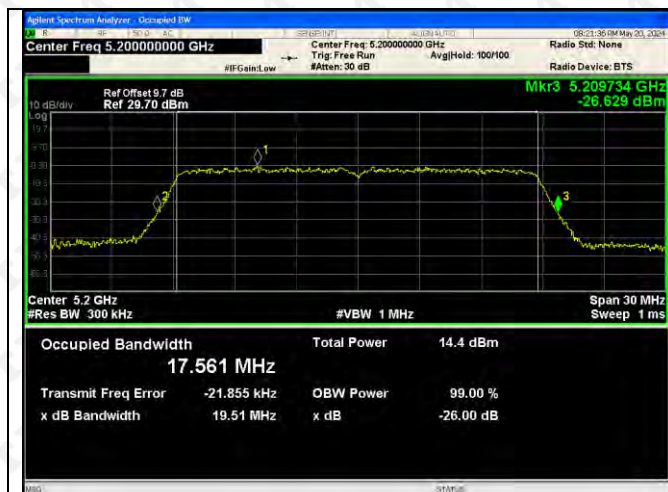
802.11ac(VH80)-5230



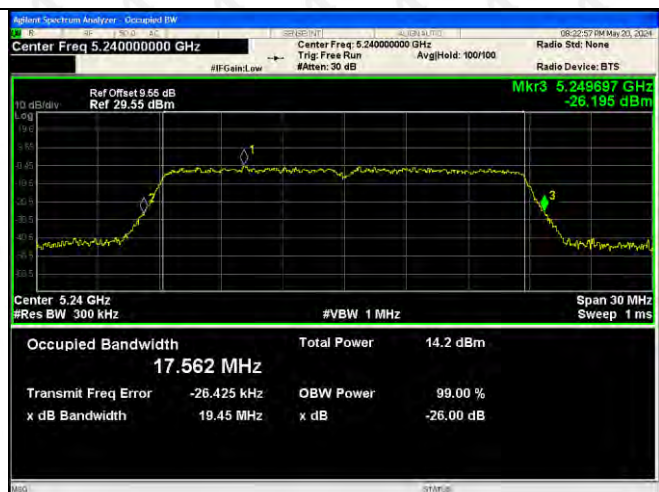
802.11n(HT20)-5200



802.11n(HT20)-5240



802.11n(HT40)-5190



802.11n(HT40)-5230



5250-5350MHz-Power ANT1





802.11ac(VH80)-5290



802.11n(HT20)-5260



802.11n(HT20)-5280



802.11n(HT20)-5320



802.11n(HT40)-5270



802.11n(HT40)-5310

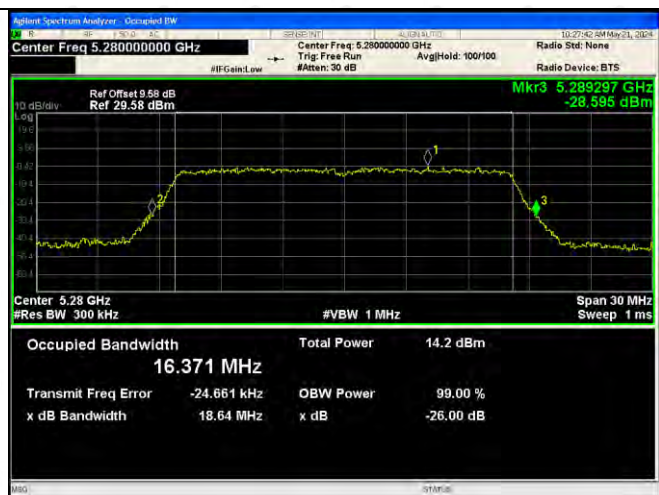


ANT2

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



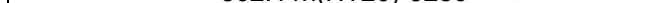
802.11ac(VH40)-5310



802.11ac(VH80)-5290



802.11n(HT20)-5260



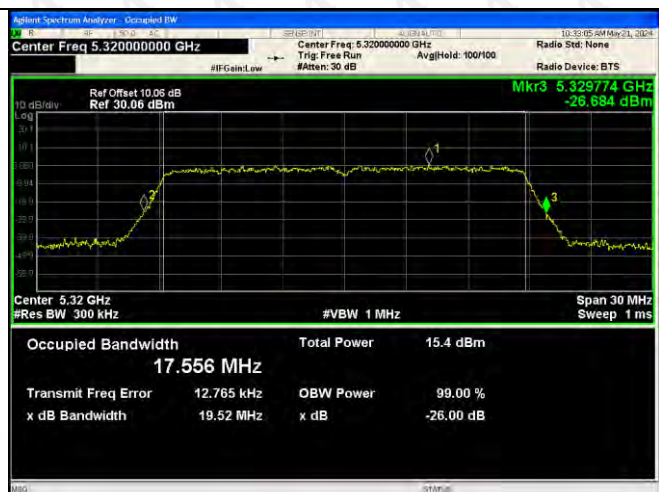
802.11n(HT20)-5280



802.11n(HT20)-5320



802.11n(HT40)-5270



802.11n(HT40)-5310



5470-5725MHz-Power ANT1





802.11ac(VH80)-5530



802.11n(HT20)-5500



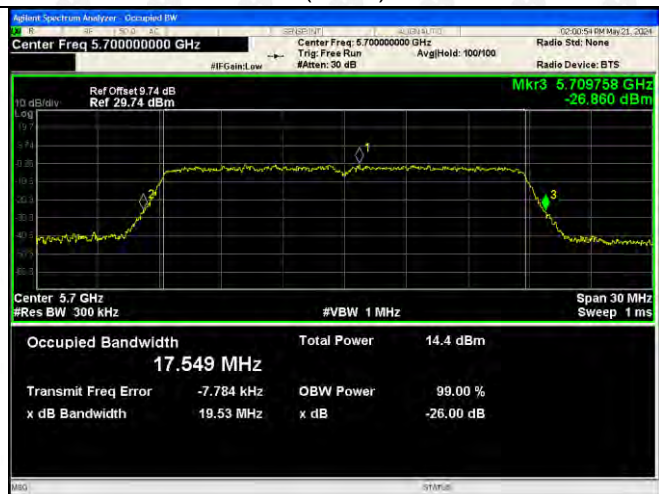
802.11n(HT20)-5580



802.11n(HT20)-5700



802.11n(HT40)-5510



802.11n(HT40)-5670