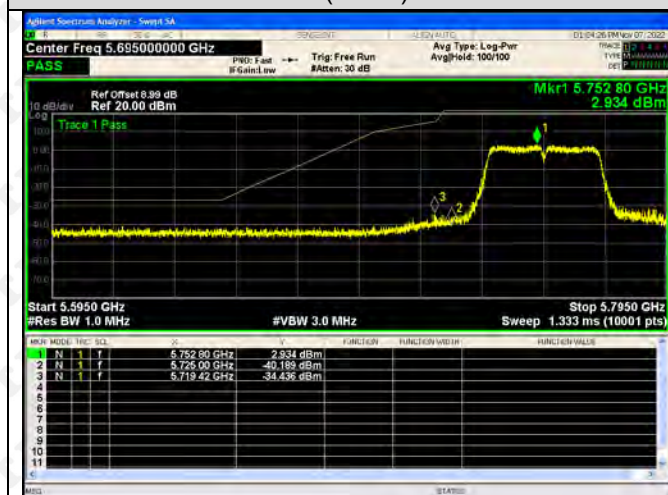




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802.11ac(VH40)-5795

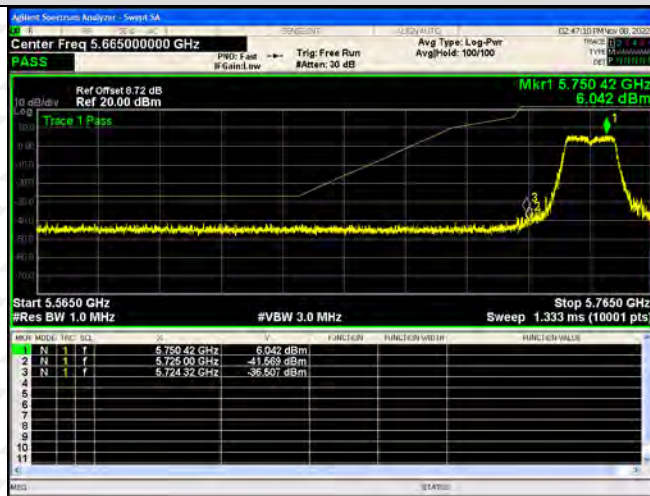


802.11ac(VH80)-5775



ANT2

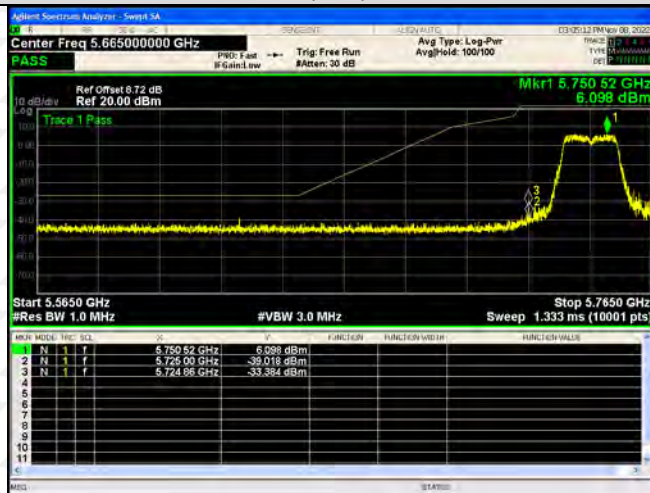
802.11a-5745



802.11a-5825



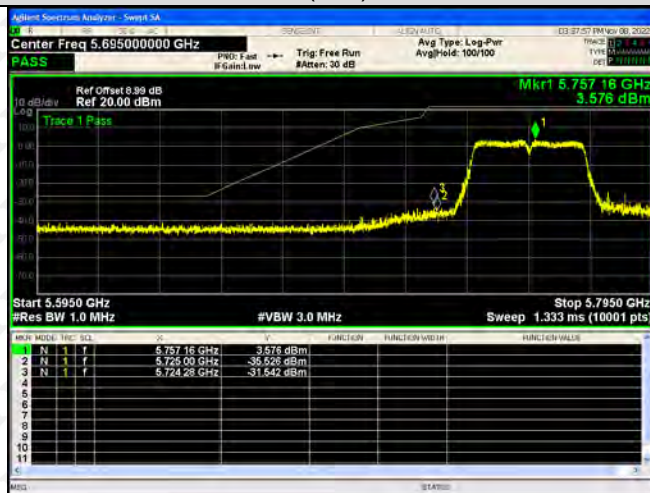
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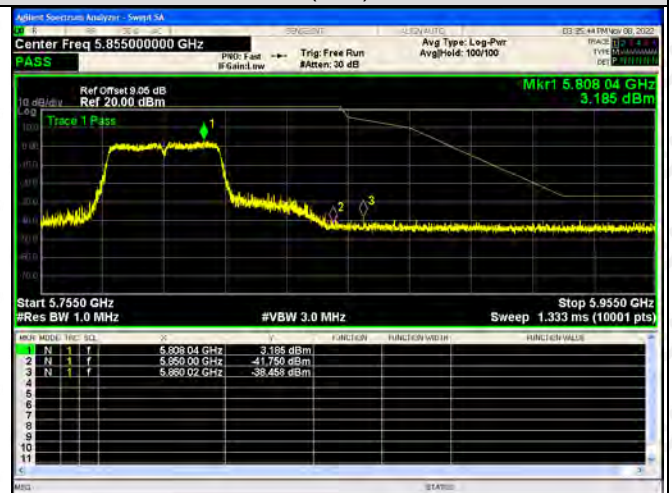
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802.11(n40)-5755

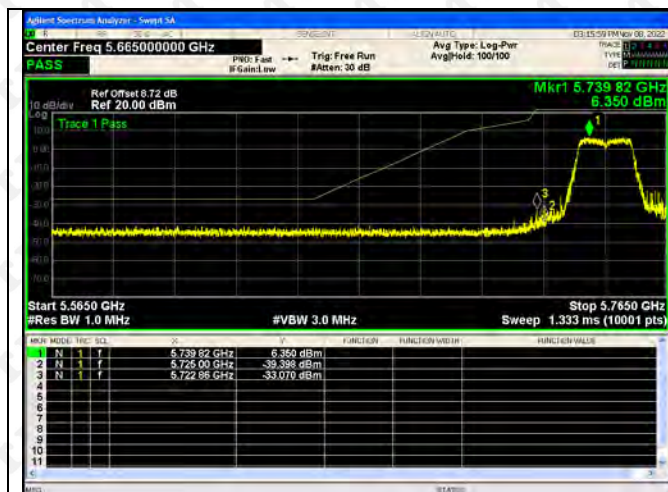


802.11(n40)-5795



802.11ac(VH20)-5745

802.11ac(VH20)-5825



802.11ac(VH40)-5755



802.11ac(VH40)-5795

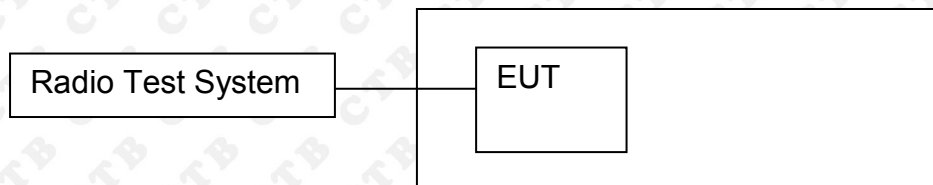


802.11ac(VH80)-5775



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	14.48	14.108	/	30
	5200	14.231	14.317	/	30
	5240	14.292	14.886	/	30
802.11ac20	5180	14.763	14.302	17.549	30
	5200	14.542	14.368	17.466	30
	5240	14.251	14.777	17.532	30
802.11ac40	5190	13.88	13.477	16.693	30
	5230	13.258	13.725	16.508	30
802.11ac80	5210	12.28	12.516	15.410	30
802.11n(HT20)	5180	14.082	14.068	17.085	30
	5200	14.639	14.274	17.471	30
	5240	14.533	14.602	17.578	30
802.11n(HT40)	5190	13.138	13.472	17.549	30
	5230	13.409	13.353	17.466	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	14.479	14.728	/	23.98
	5280	14.713	14.715	/	23.98
	5320	14.222	14.485	/	23.98
802.11ac20	5260	14.723	14.423	17.586	23.98
	5280	14.87	14.185	17.551	23.98
	5320	14.333	14.515	17.435	23.98
802.11ac40	5270	13.459	13.567	16.524	23.98
	5310	13.576	13.491	16.544	23.98
802.11ac80	5290	12.041	12.527	15.301	23.98
802.11n(HT20)	5260	14.538	14.446	17.503	23.98
	5280	14.781	14.873	17.838	23.98
	5320	14.481	14.462	17.482	23.98
802.11n(HT40)	5270	13.222	13.544	17.586	23.98
	5310	13.496	13.341	17.551	23.98

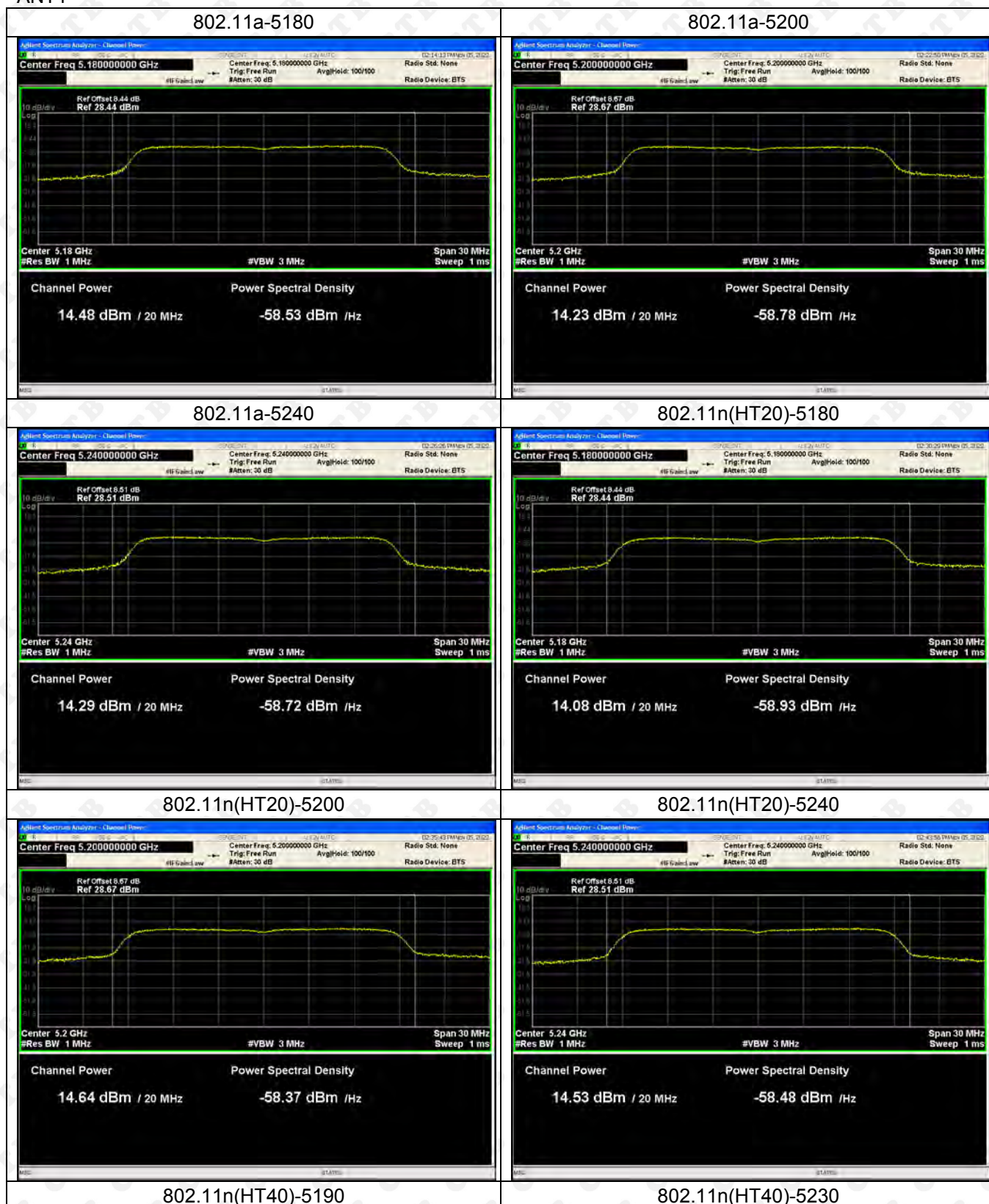
5470-5725MHz

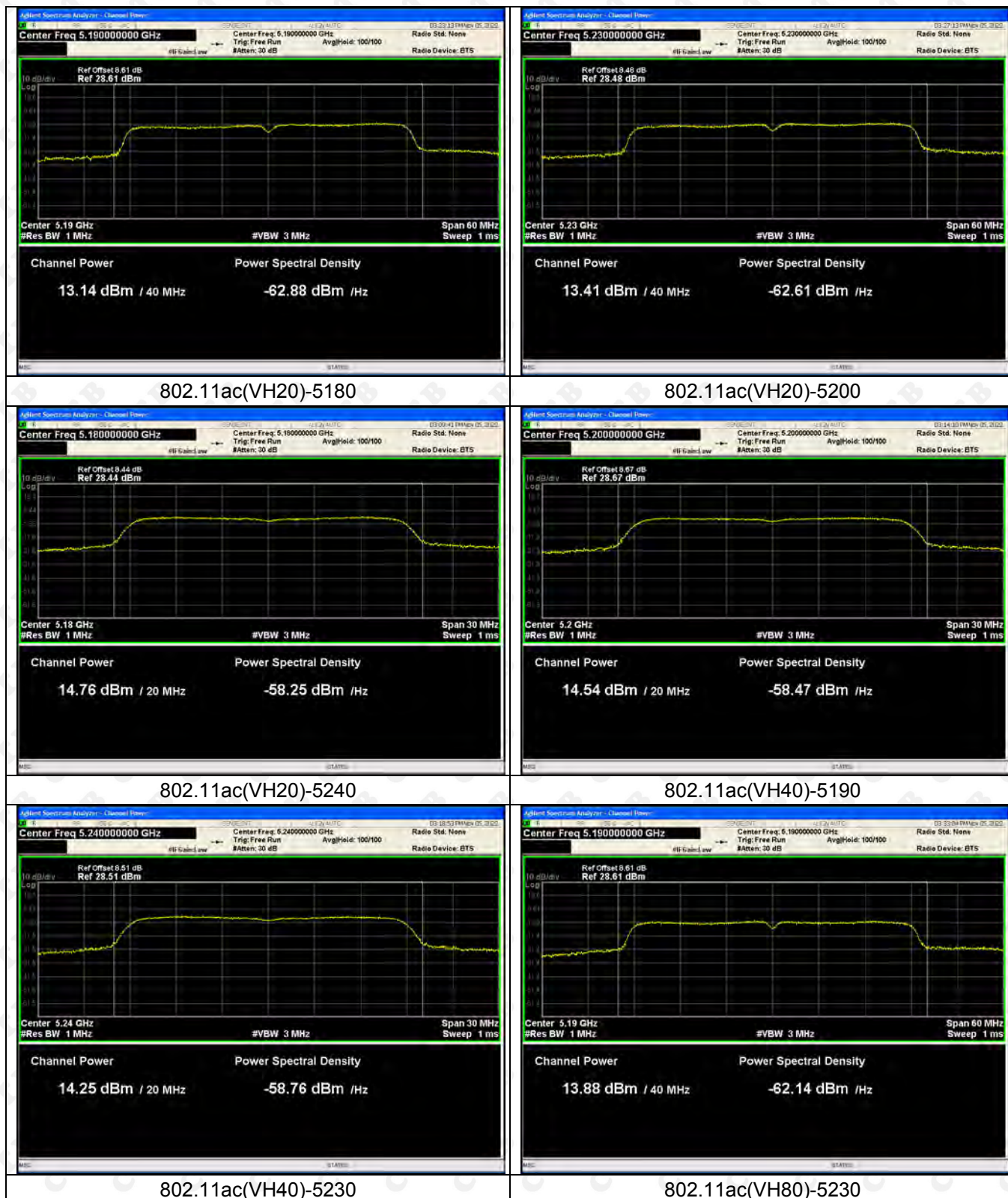
Test mode1	Test Channel (MHz)	Output Power dBm ANT1	Output Power dBm ANT2	Output Power dBm Total	Limit dBm
802.11a	5500	14.465	14.444	/	23.98
	5580	14.13	14.208	/	23.98
	5700	14.235	14.018	/	23.98
802.11ac20	5500	14.12	14.483	17.316	23.98
	5580	14.533	14.02	17.294	23.98
	5700	13.969	13.744	16.868	23.98
802.11ac40	5510	13.742	13.6	16.682	23.98
	5670	13.68	13.119	16.419	23.98
802.11ac80	5530	11.574	12.217	14.918	23.98
802.11n(HT20)	5500	14.296	14.557	17.439	23.98
	5580	14.047	14.13	17.099	23.98
	5700	14.023	14.077	17.060	23.98
802.11n(HT40)	5510	13.202	13.095	17.316	23.98
	5670	13.278	13.775	17.294	23.98

5745-5825MHz

Test mode1	Test Channel (MHz)	Output Power dBm ANT1	Output Power dBm ANT2	Output Power dBm Total	Limit dBm
802.11a	5745	14.242	14.031	/	23.98
	5785	14.059	14.113	/	23.98
	5825	14.782	14.607	/	23.98
802.11ac20	5745	14.539	14.323	17.443	23.98
	5785	14.597	14.462	17.540	23.98
	5825	14.305	14.828	17.585	23.98
802.11ac40	5755	13.59	13.44	16.526	23.98
	5795	13.412	13.704	16.571	23.98
802.11ac80	5745	12.787	12.248	15.536	23.98
802.11n(HT20)	5785	14.072	14.424	17.262	23.98
	5825	13.603	14.086	16.862	23.98
	5755	14.737	14.816	17.787	23.98
802.11n(HT40)	5795	13.622	13.563	17.443	23.98
	5775	13.425	13.495	17.540	23.98

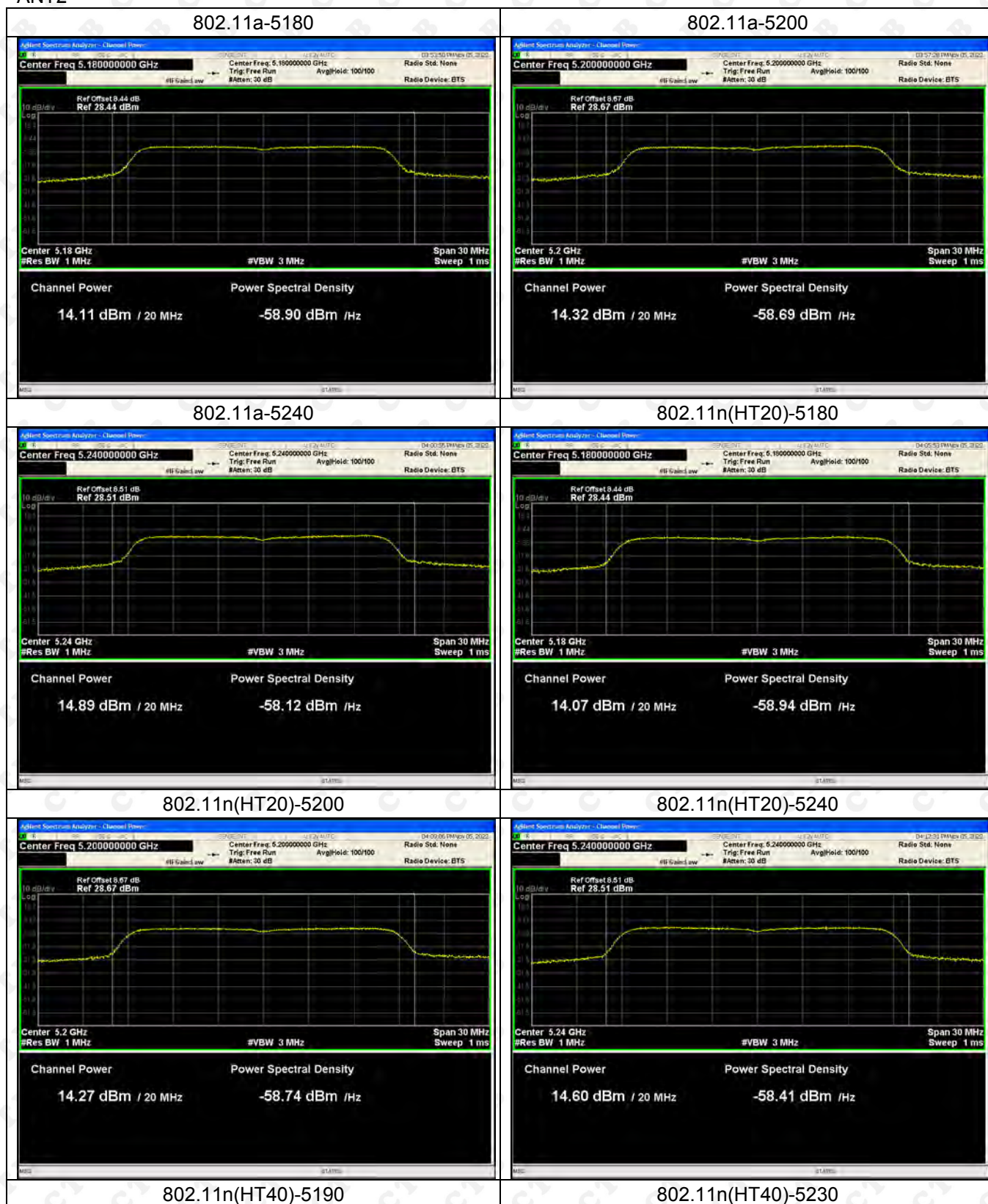
5150-5250MHz-Power ANT1

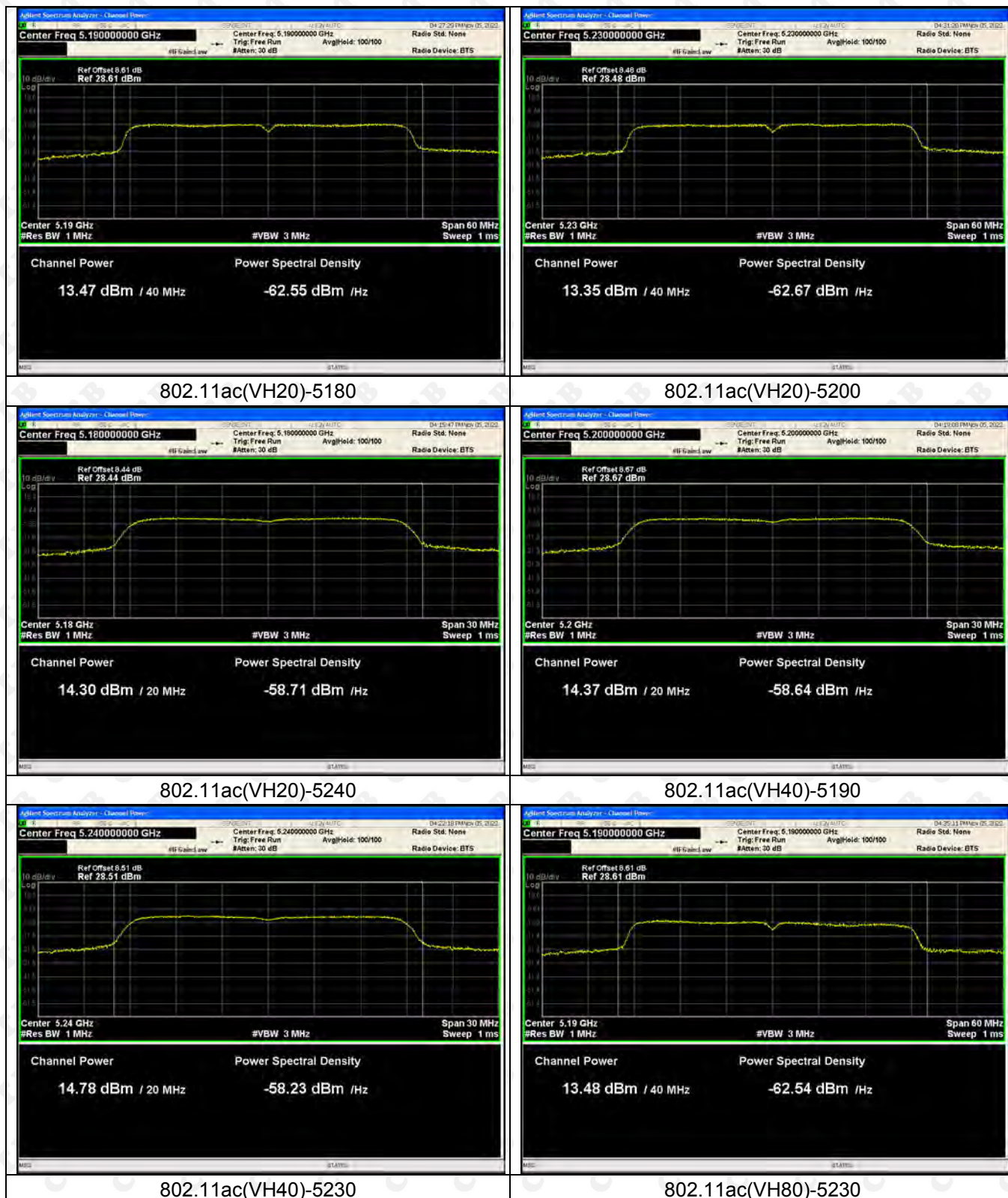


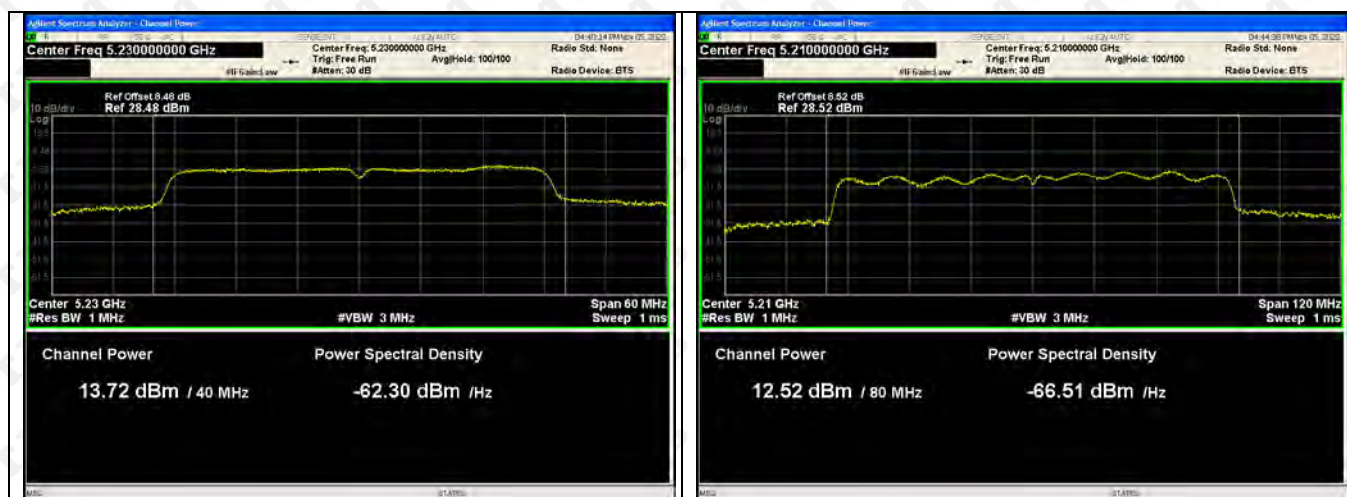




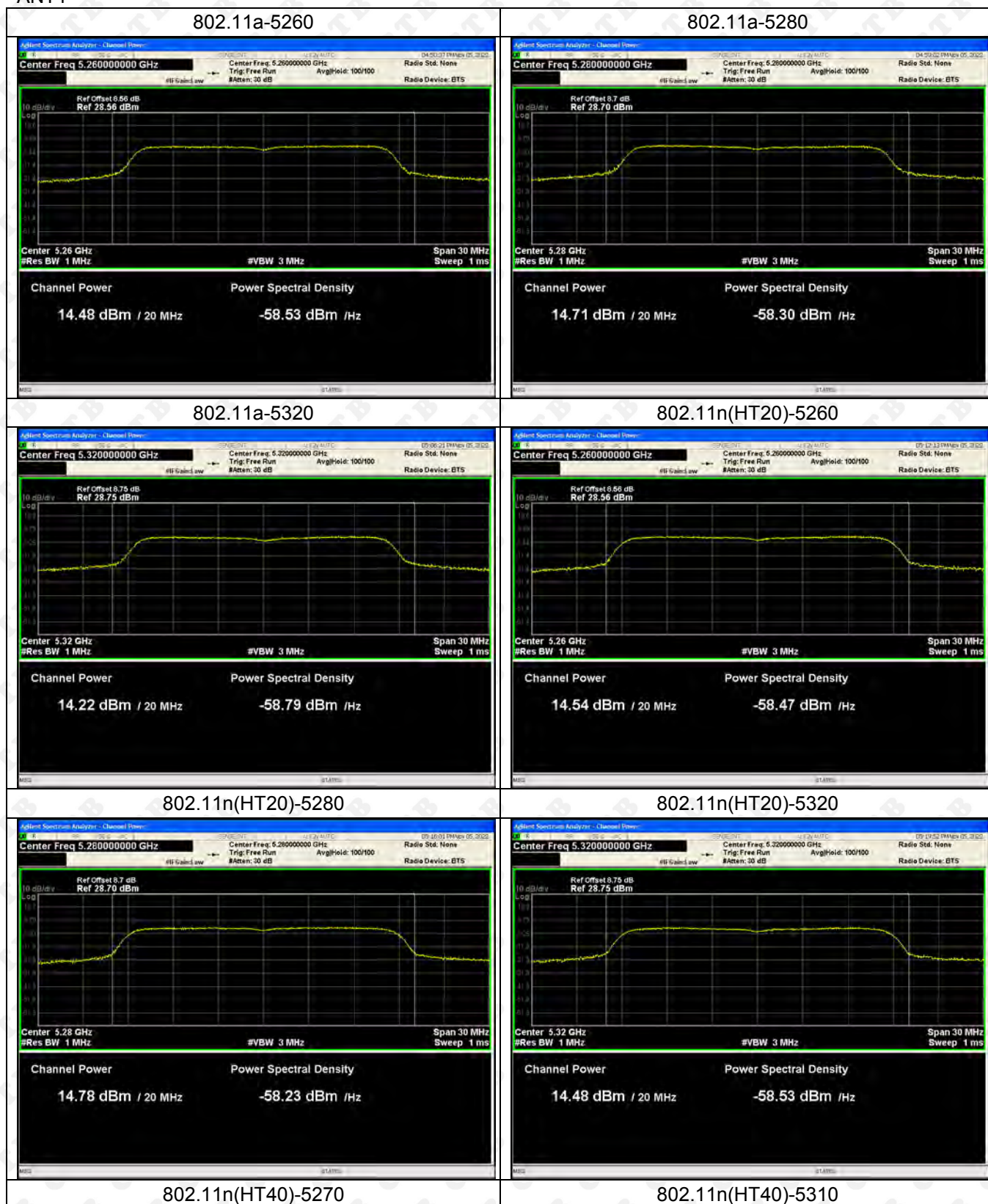
ANT2







5250-5350MHz-Power ANT1





802.11ac(VH20)-5260



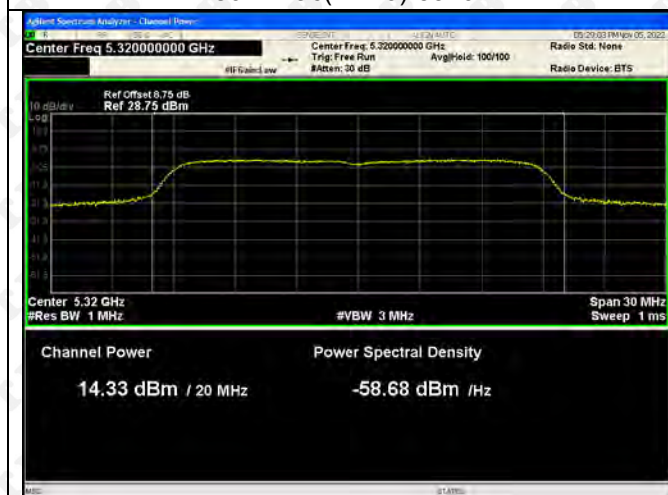
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802.11ac(VH20)-5320



802.11ac(VH40)-5270



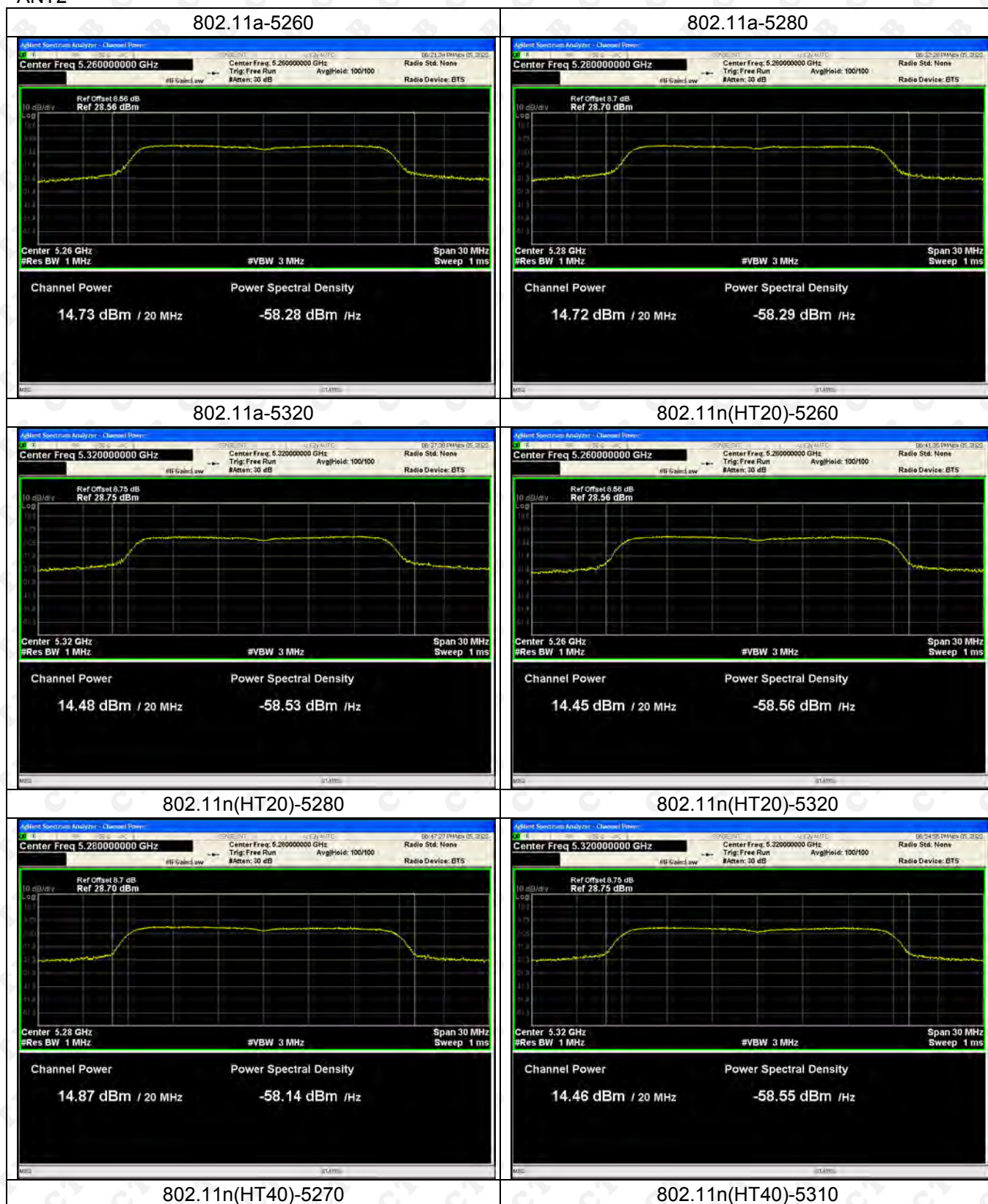
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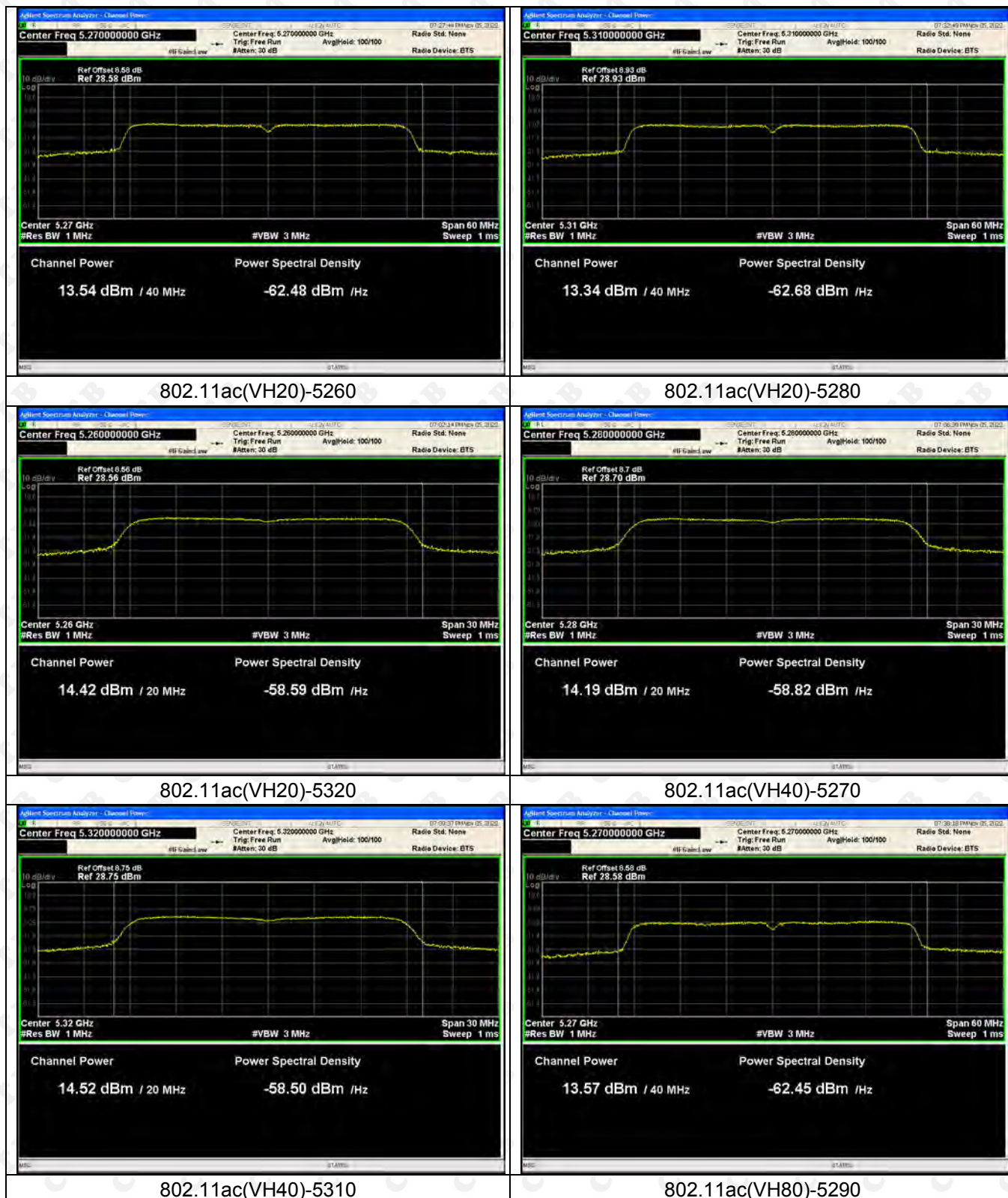


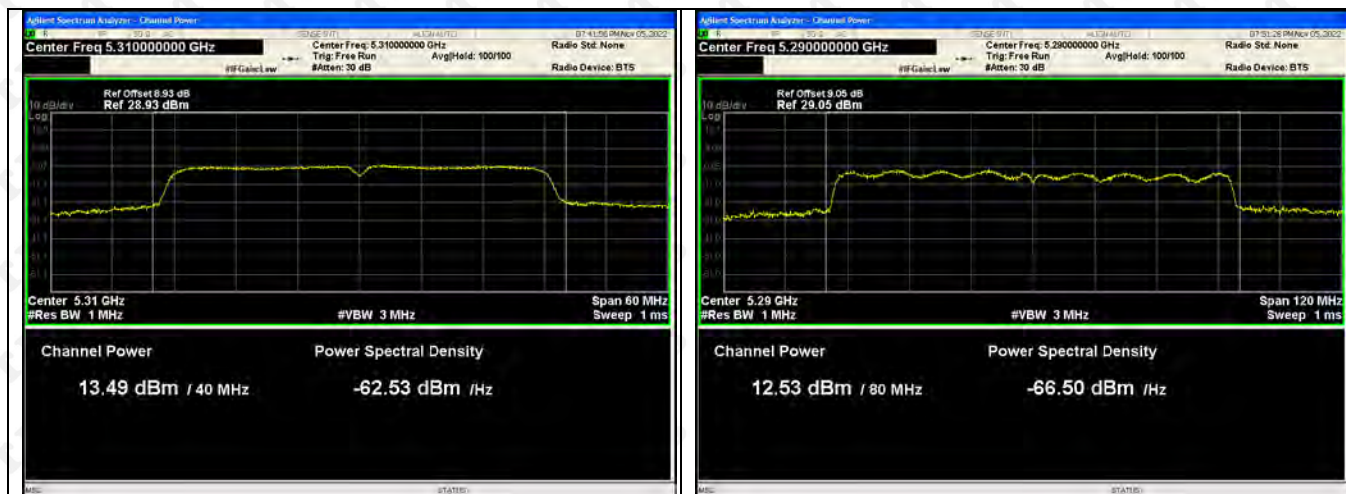
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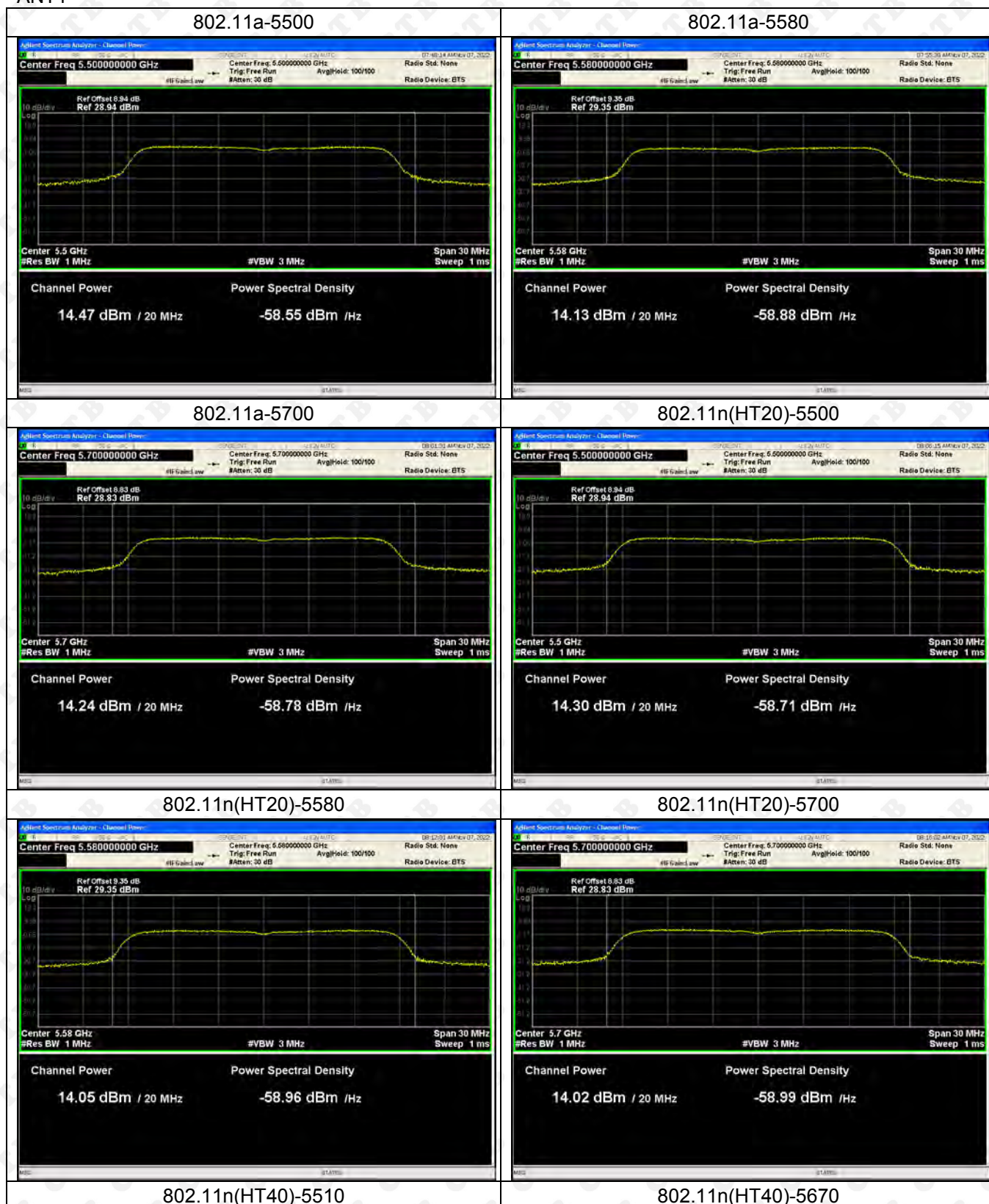
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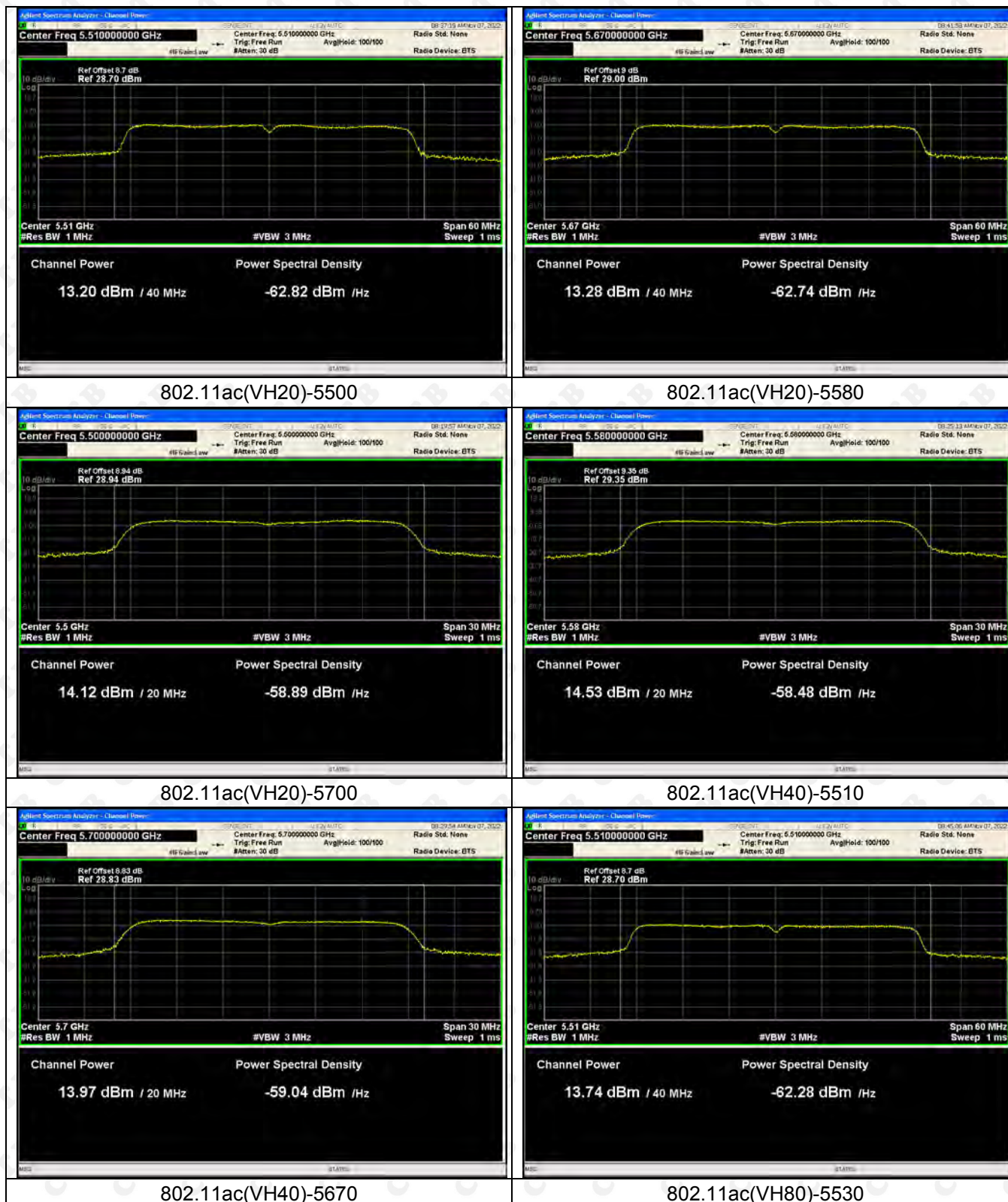






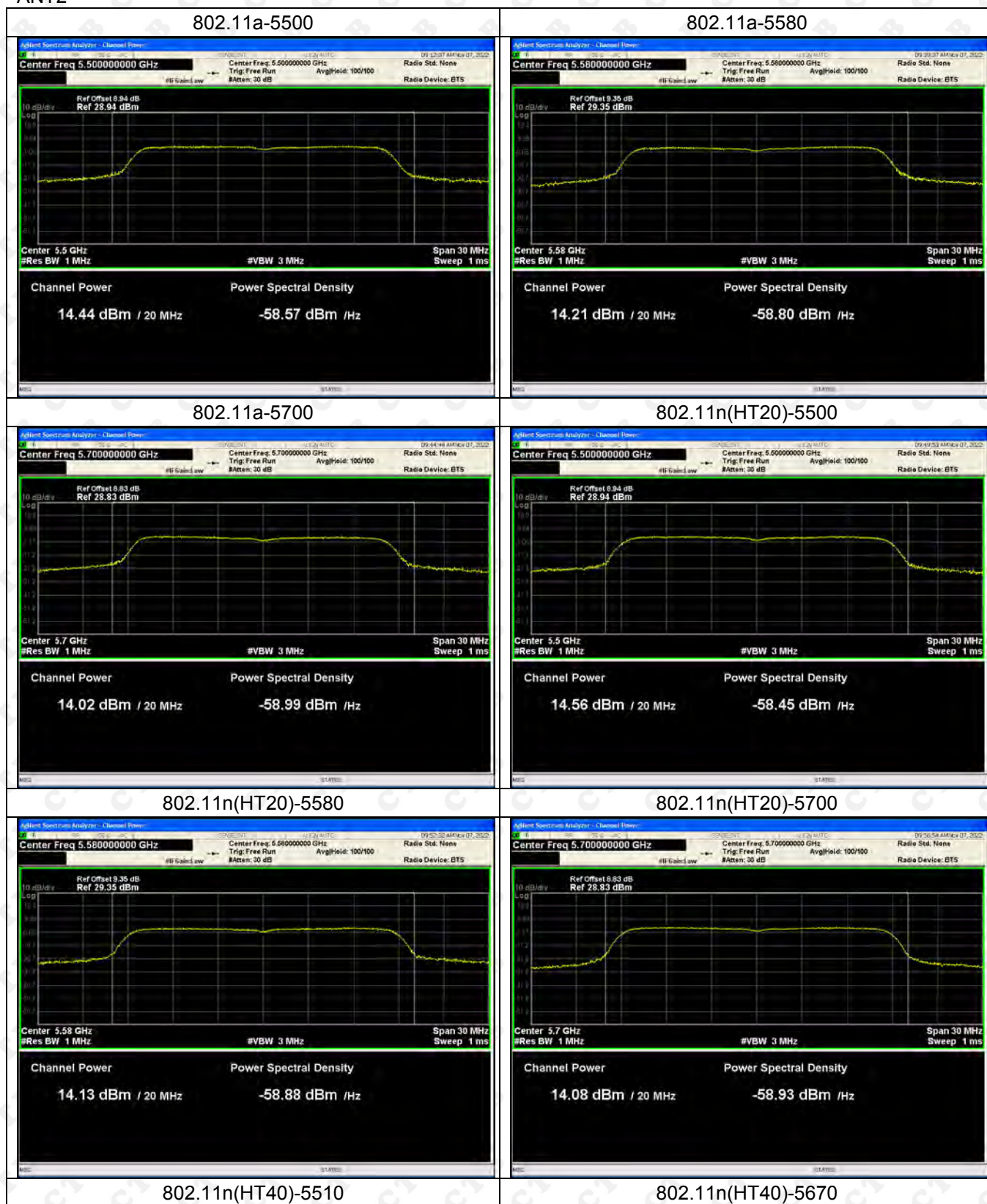
5470-5725MHz-Power ANT1

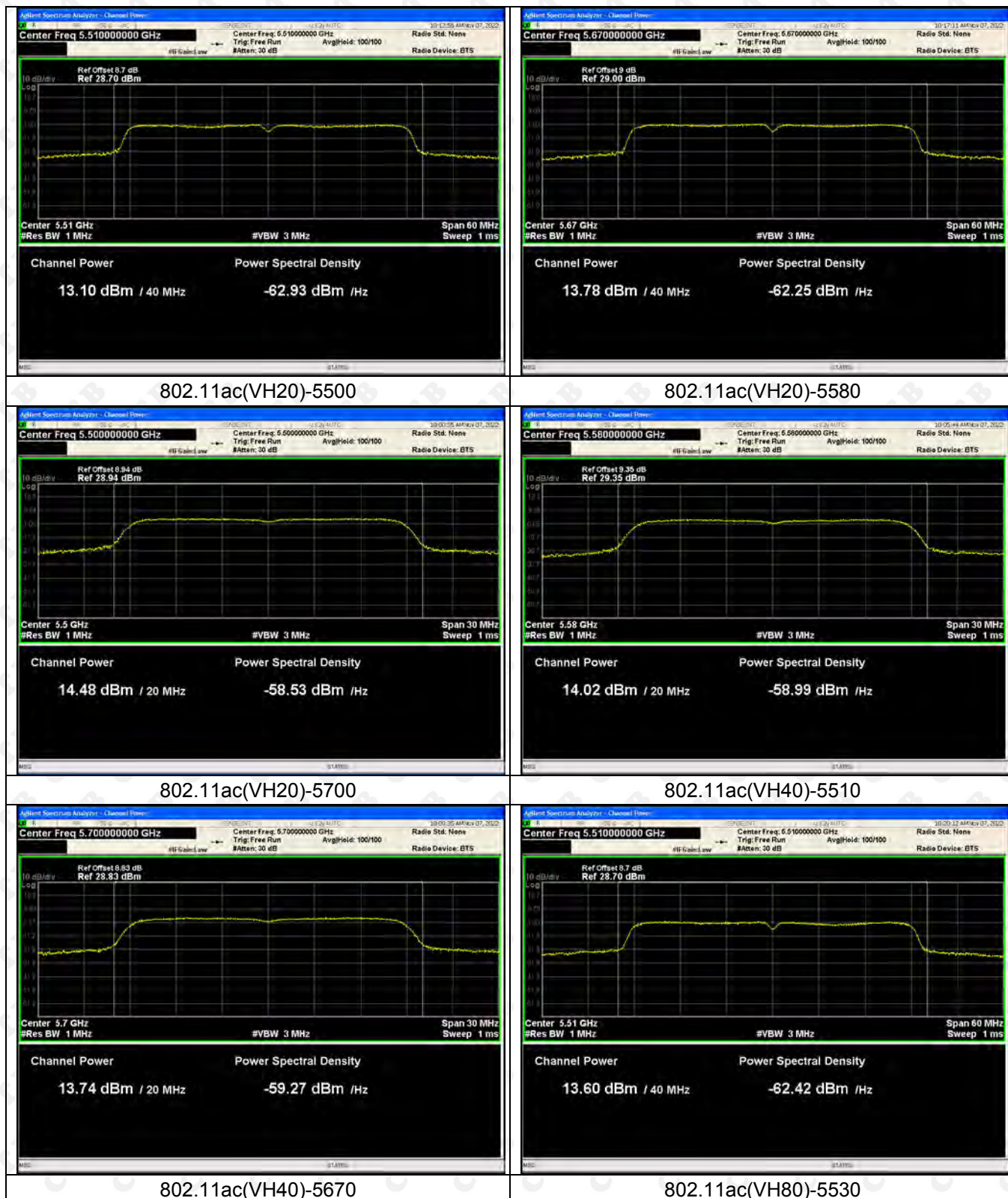






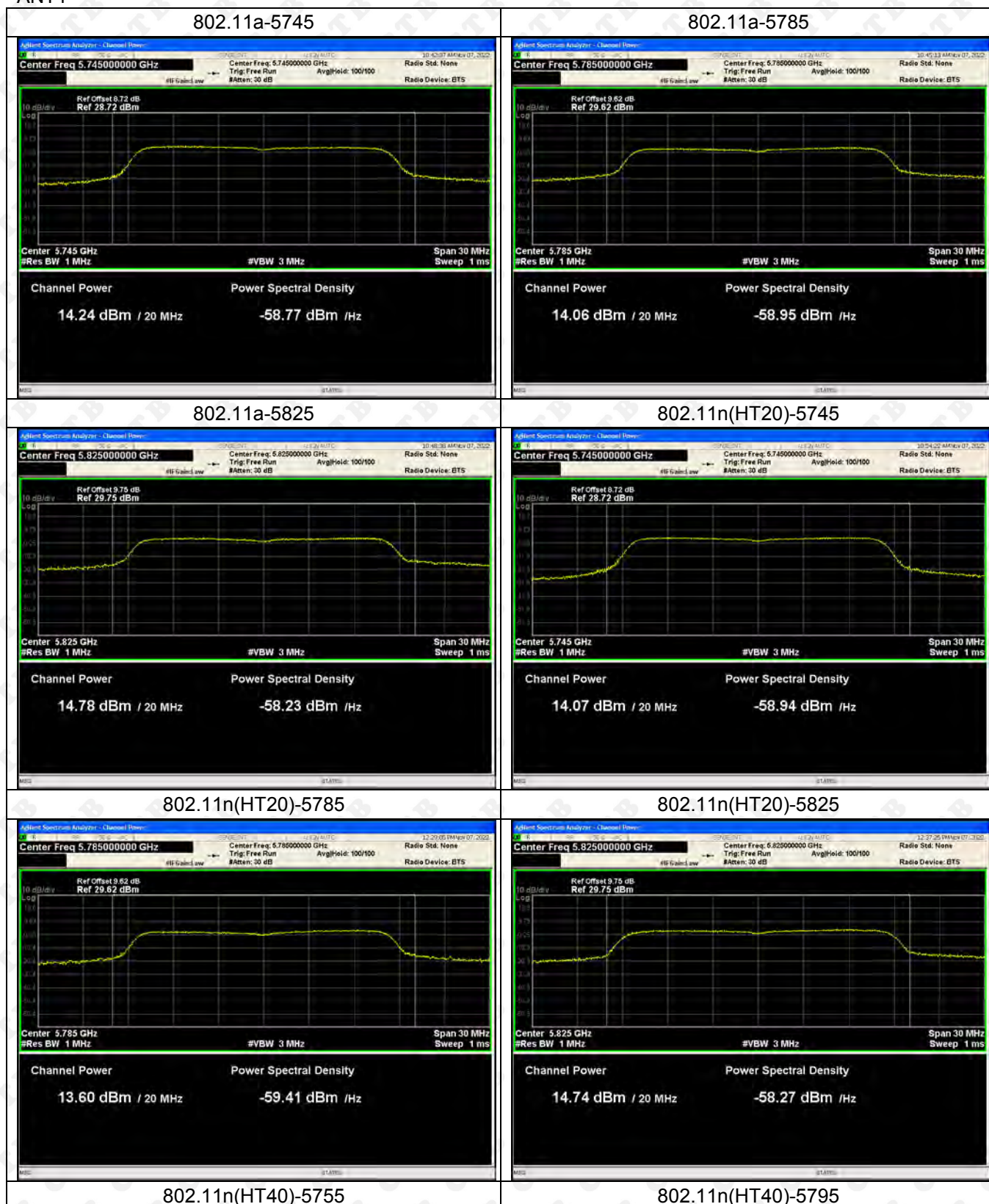
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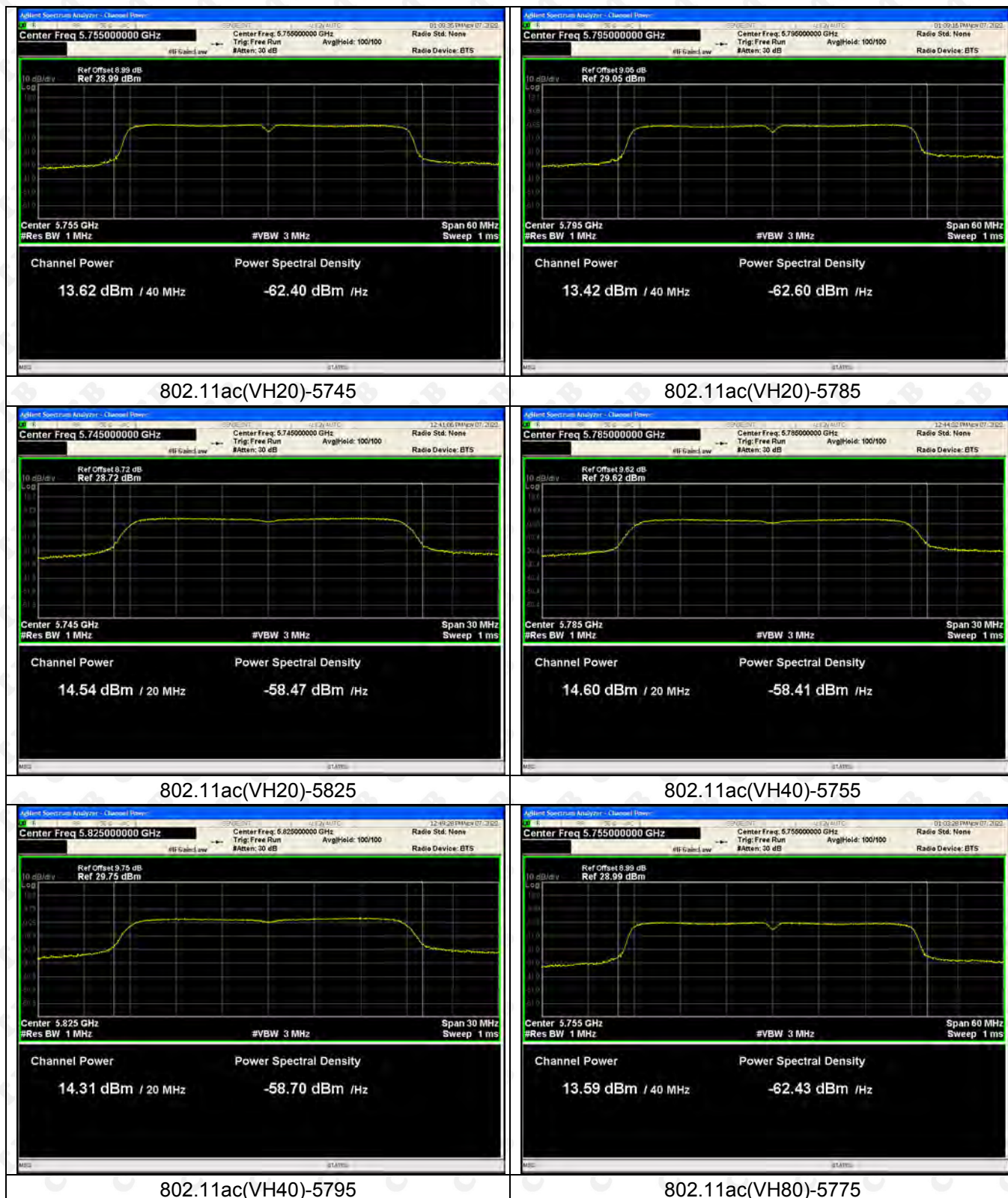






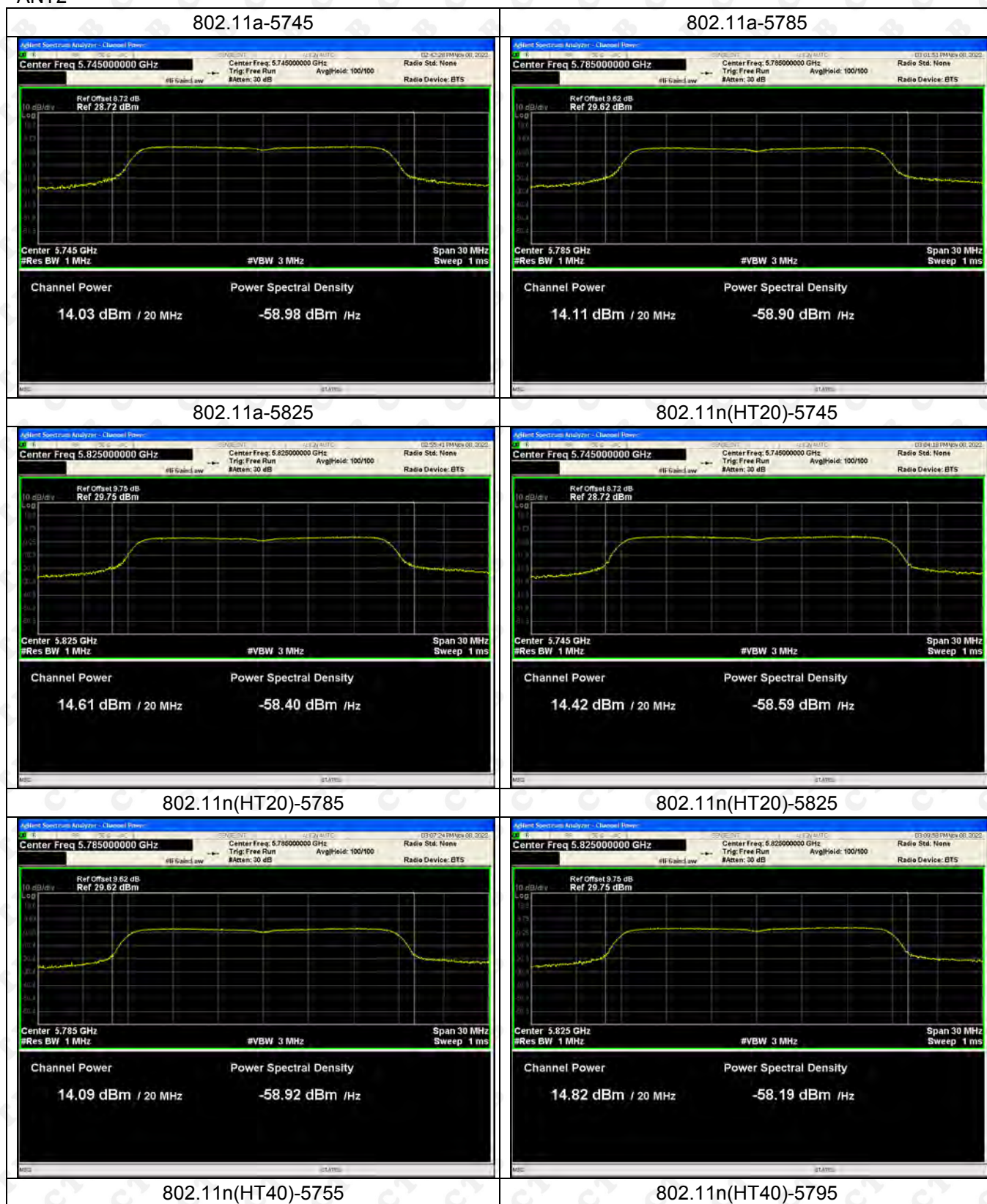
5745-5825MHz-Power ANT1

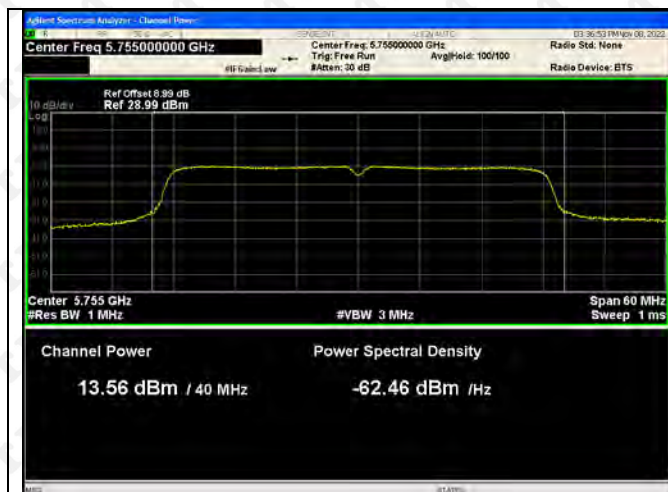






ANT2





802.11ac(VH20)-5745



802.11ac(VH20)-5785



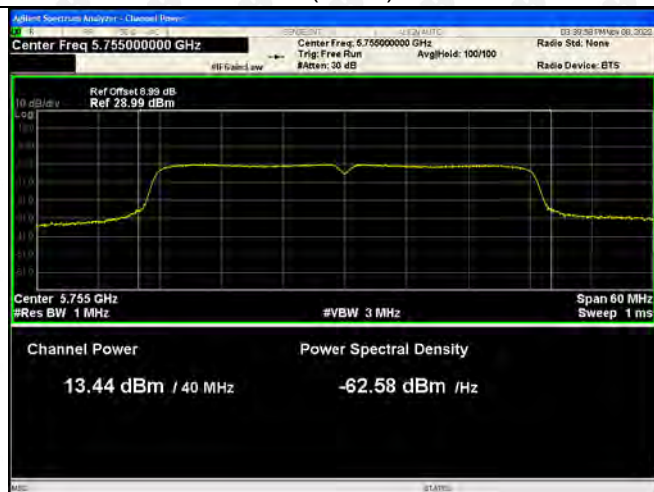
802.11ac(VH20)-5825



802.11ac(VH40)-5755



802.11ac(VH40)-5795

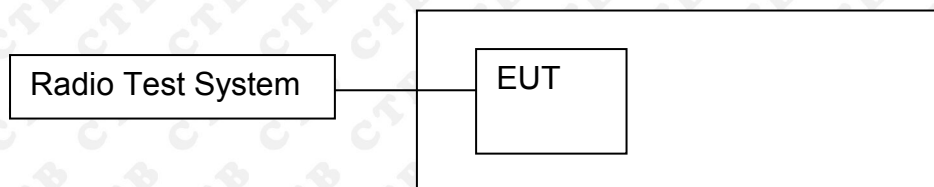


802.11ac(VH80)-5775



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)

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- 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:

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 * \text{RBW}$.
- Detector = Peak.
- 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

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)&ANT1	26dB Bandwidth (MHz)&ANT2
802.11a	5180	24.963	22.787
	5200	26.051	23.811
	5240	22.906	23.56
802.11ac20	5180	25.543	22.662
	5200	28.486	24.522
	5240	27.03	27.978
802.11ac40	5190	58.265	50.441
	5230	56.279	57.978
802.11ac80	5210	99.808	99.722
802.11n(HT20)	5180	23.946	21.854
	5200	25.726	25.367
	5240	25.494	22.994
802.11n(HT40)	5190	51.844	50.661
	5230	52.875	52.962

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)&ANT1	26dB Bandwidth (MHz)&ANT2
802.11a	5260	28.488	23.487
	5280	21.198	21.341
	5320	21.915	24.036
802.11ac20	5260	22.049	25.68
	5280	25.181	22.584
	5320	22.491	25
802.11ac40	5270	49.502	46.39
	5310	56.832	56.027
802.11ac80	5290	102.521	101.999
802.11n(HT20)	5260	22.758	22.039
	5280	21.581	25.45
	5320	24.279	21.507
802.11n(HT40)	5270	49.878	50.025
	5310	50.835	53.412

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)&ANT1	26dB Bandwidth (MHz)&ANT2
802.11a	5500	21.065	21.379
	5580	21.353	21.17
	5700	21.038	20.881
802.11ac20	5500	21.306	21.72
	5580	21.454	21.835
	5700	21.909	21.67
802.11ac40	5510	42.731	40.951
	5670	41.589	41.046
802.11ac80	5530	88.953	90.785
802.11n(HT20)	5500	21.698	21.557
	5580	21.995	21.409
	5700	21.815	21.256
802.11n(HT40)	5510	42.437	41.317
	5670	42.375	41.033

Test mode	Test Channel (MHz)	6dB Bandwidth (MHz)&ANT1	6dB Bandwidth (MHz)&ANT2
802.11a	5745	16.369	16.534
	5785	16.333	16.497
	5825	16.19	16.501
802.11ac20	5745	16.958	17.715
	5785	17.768	17.7
	5825	17.763	17.732
802.11ac40	5755	36.436	36.416
	5795	36.498	36.485
802.11ac80	5775	76.425	76.361
802.11n(HT20)	5745	16.349	17.767
	5785	16.402	17.772
	5825	16.426	17.758
802.11n(HT40)	5755	36.488	36.459
	5795	36.458	36.469

Test Graph 5180-5240MHz ANT1





802.11ac(VH20)-5180



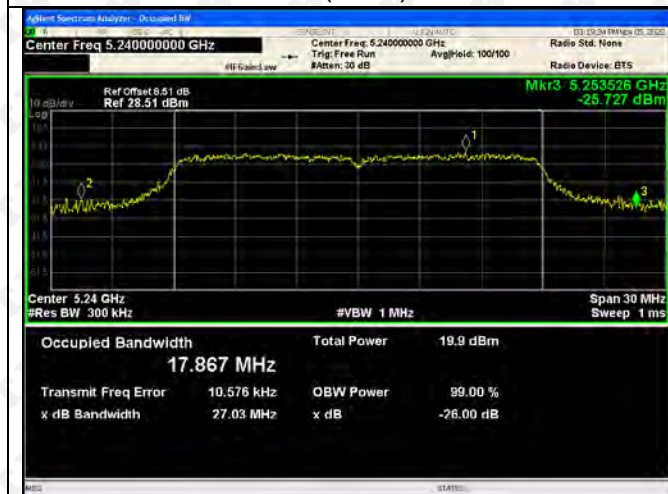
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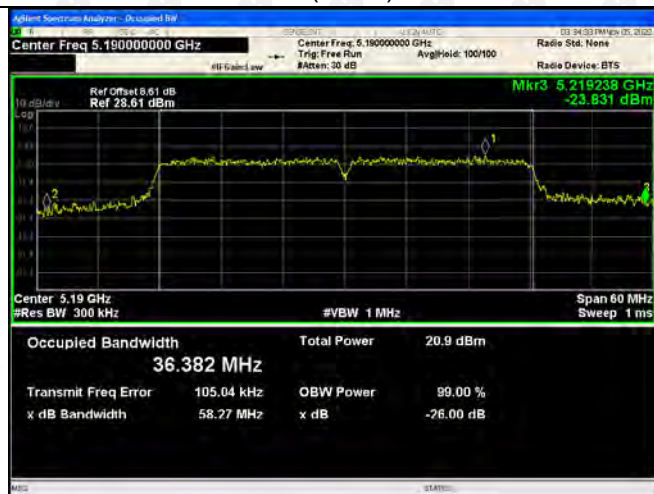
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802.11ac(VH40)-5190



802.11ac(VH40)-5230



802.11ac(VH80)-5210



ANT2





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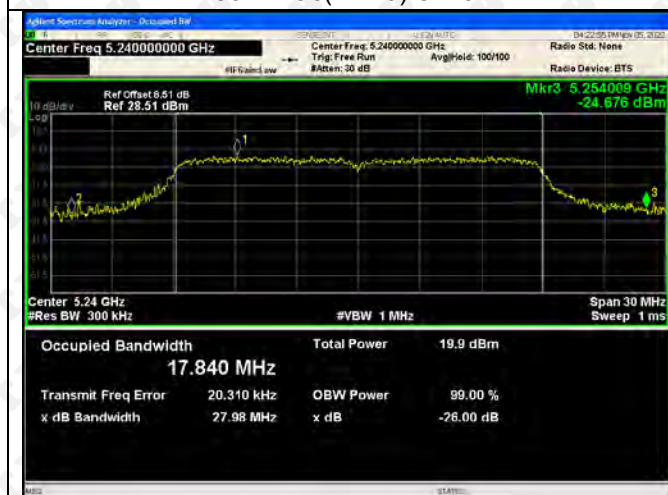
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802.11ac(VH20)-5240



802.11ac(VH40)-5190



802.11ac(VH40)-5230



802.11ac(VH80)-5210