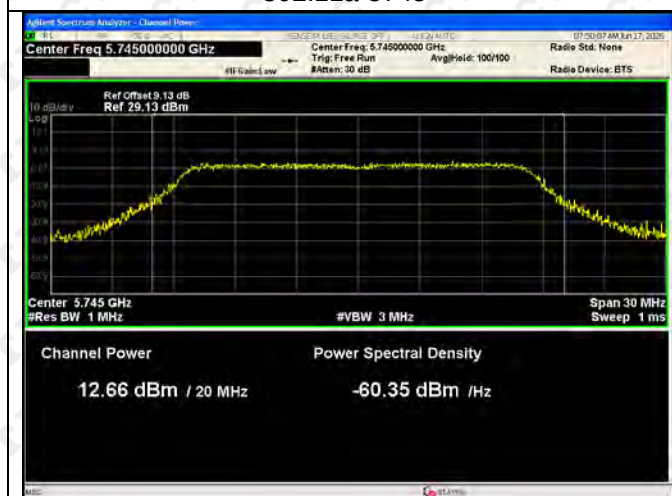


ANT1:

802.11a-5745



802.11a-5785



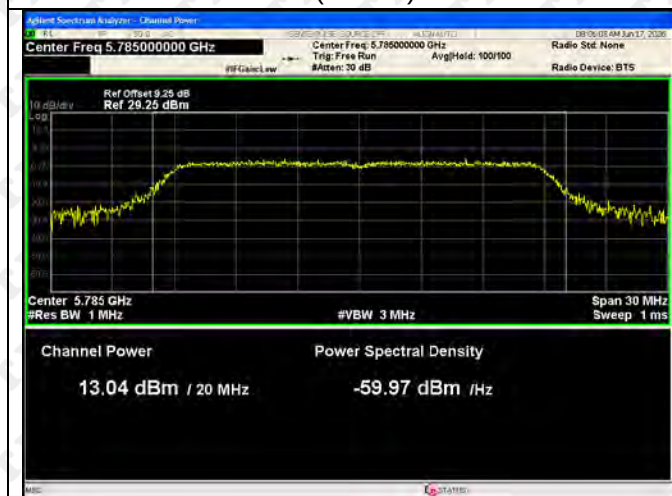
802.11a-5825



802.11ac(VHT20)-5745



802.11ac(VHT20)-5785

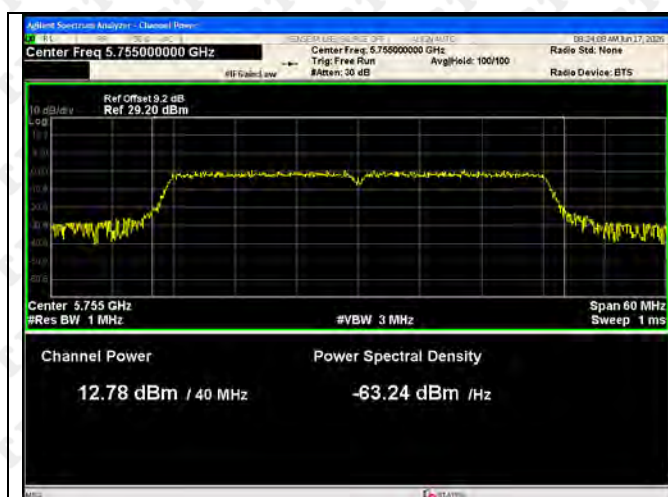


802.11ac(VHT20)-5825

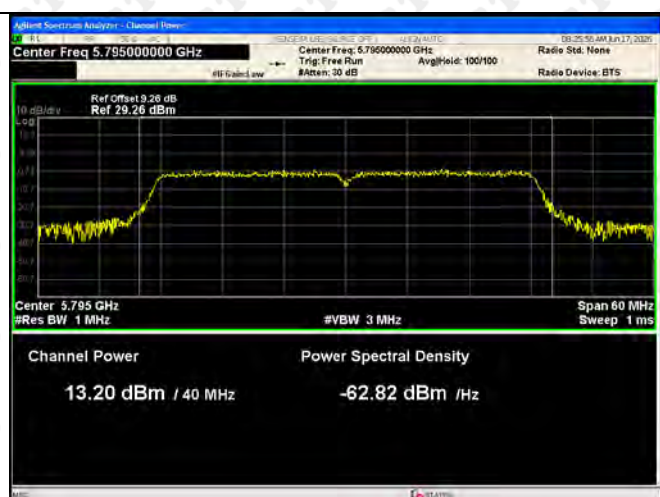


802.11ac(VHT40)-5755

802.11ac(VHT40)-5795



802.11ac(VHT80)-5775



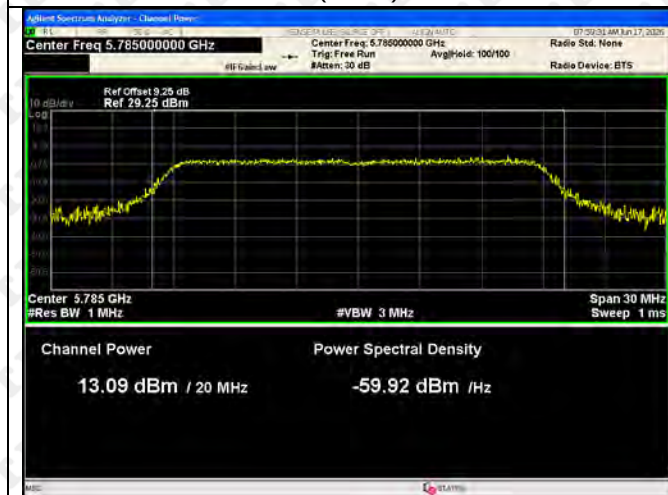
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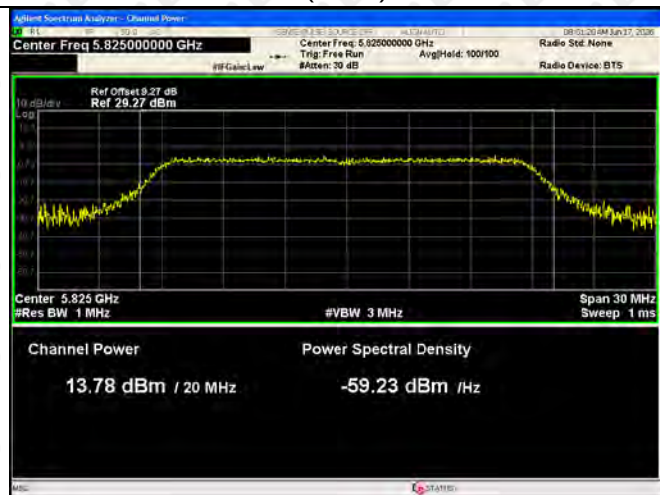
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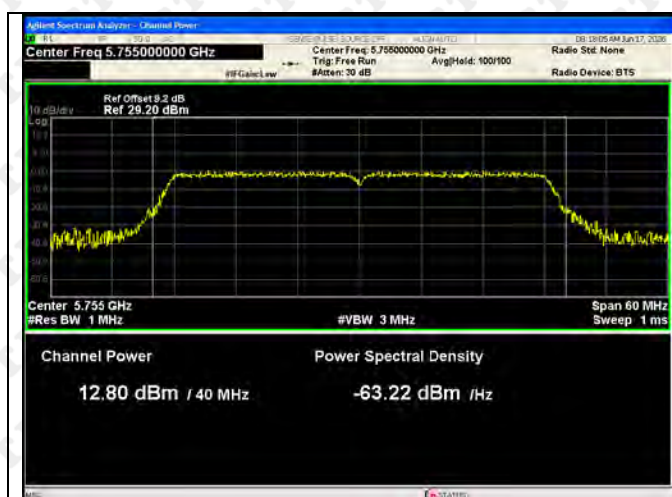
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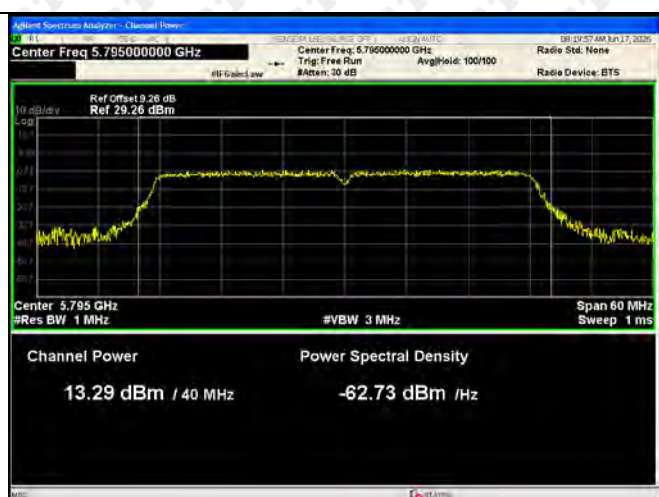
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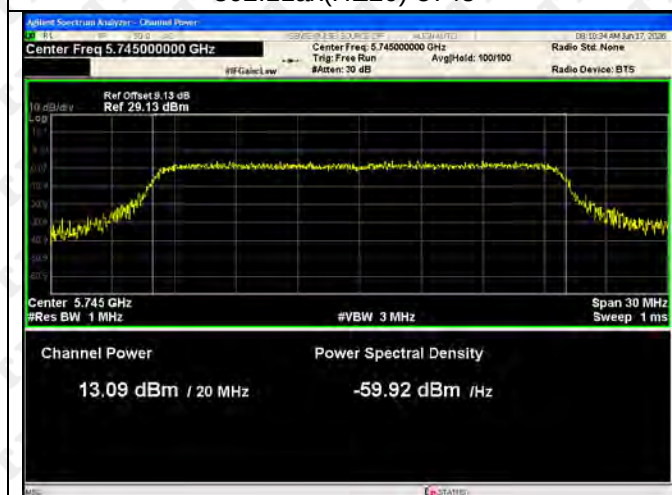
802.11n(HT40)-5795



802.11ax(HE20)-5745



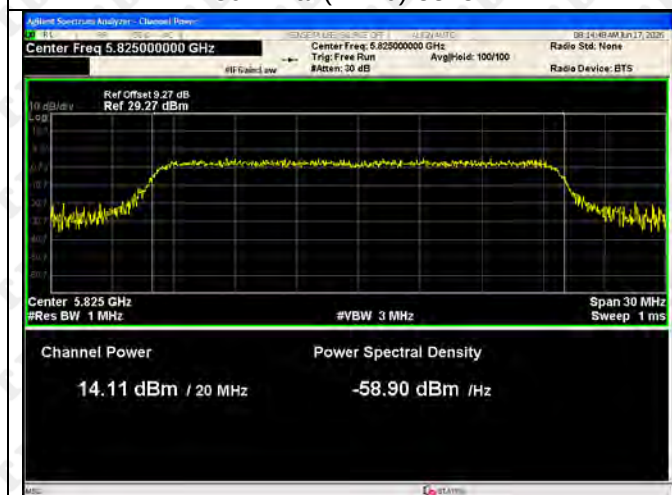
802.11ax(HE20)-5785



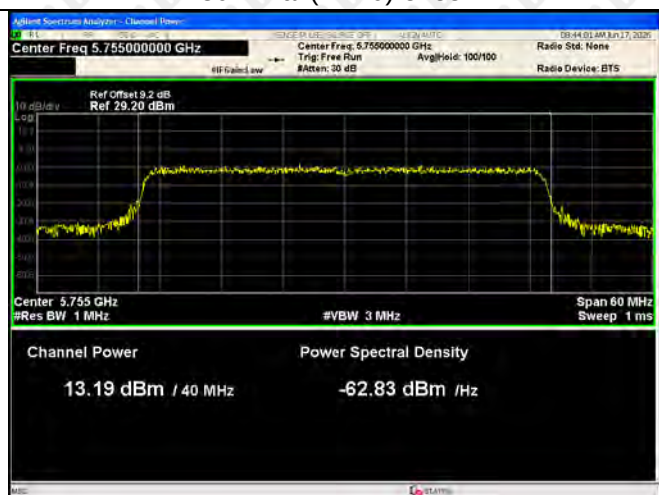
802.11ax(HE20)-5825



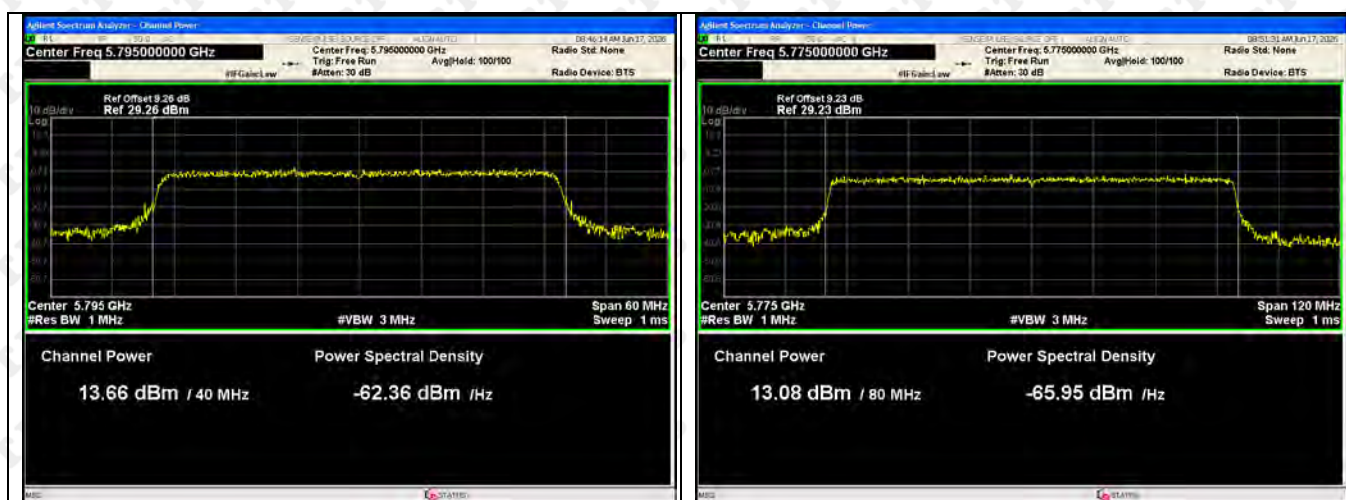
802.11ax(HE40)-5755



802.11ax(HE40)-5795



802.11ax(HE80)-5775



ANT 2

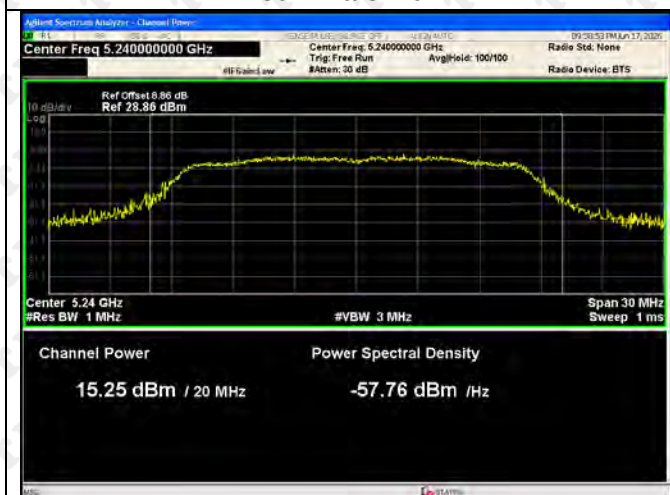
802.11a-5180



802.11a-5200



802.11a-5240



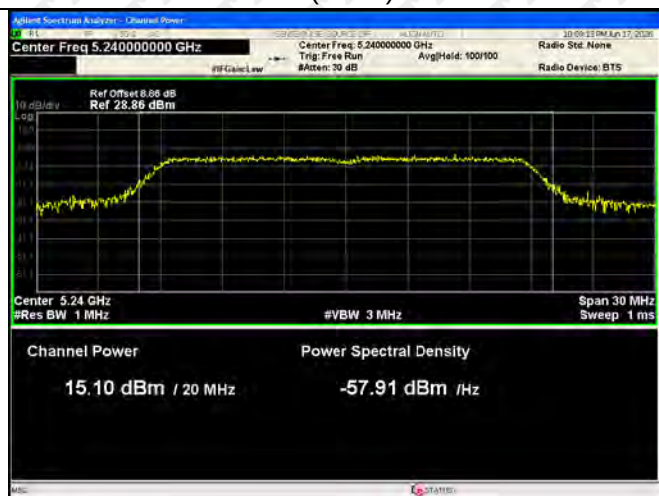
802.11ac(VHT20)-5180



802.11ac(VHT20)-5200

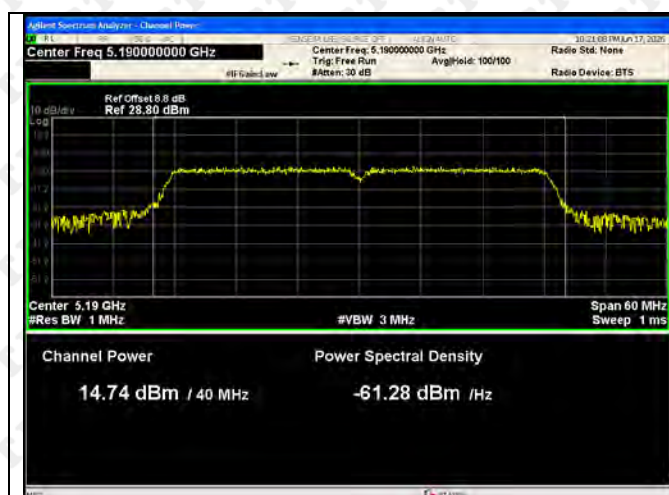


802.11ac(VH20)-5240

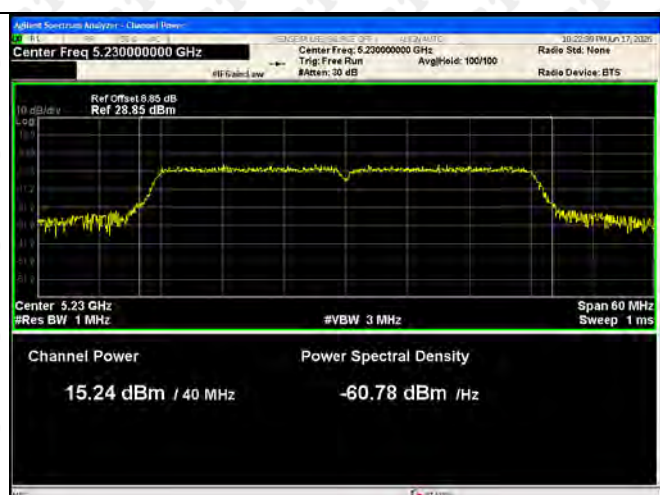


802.11ac(VHT40)-5190

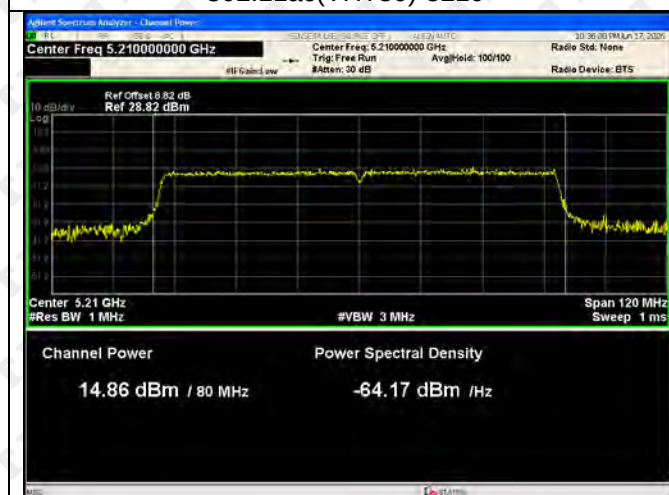
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802.11ac(VHT80)-5210



802.11n(HT20)-5180



802.11n(HT20)-5200



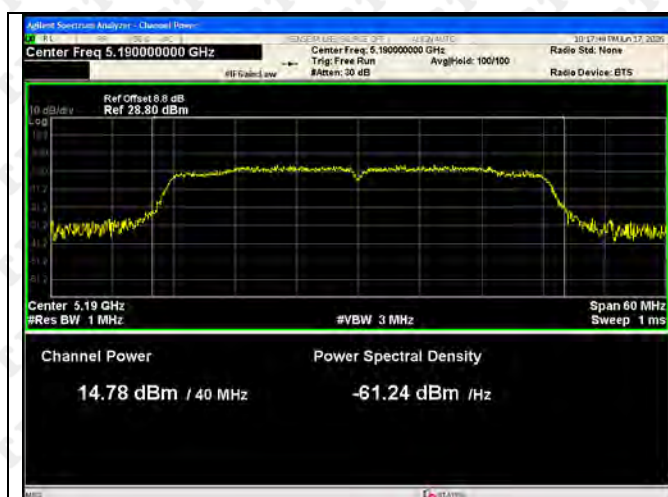
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802.11n(HT40)-5190



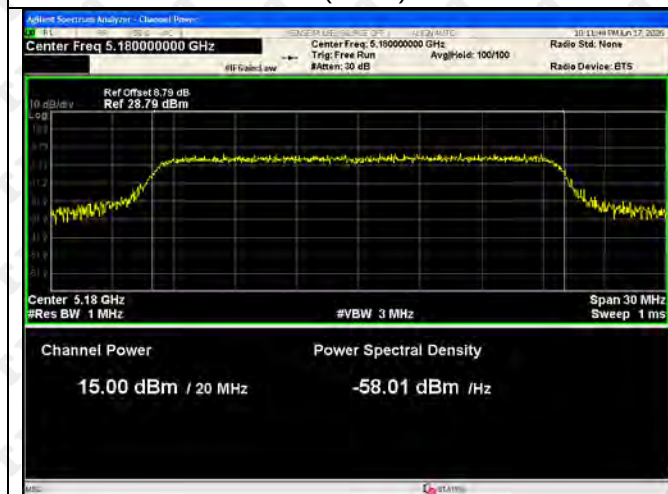
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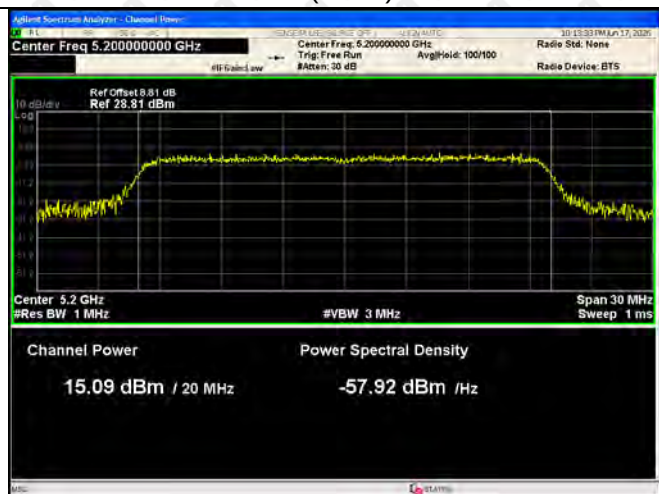
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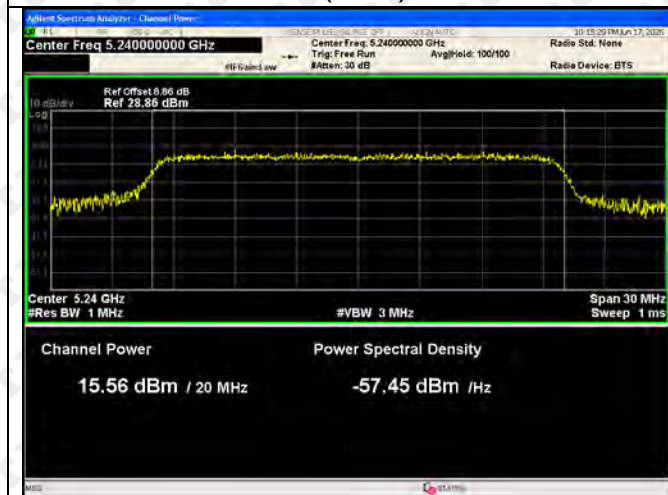
802.11ax(HE20)-5200



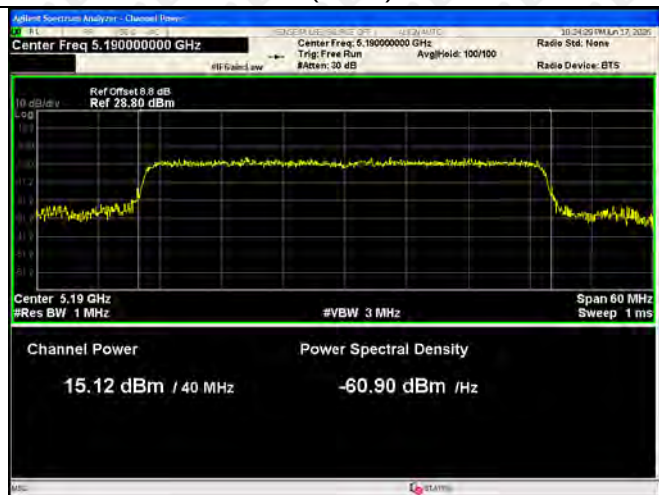
802.11ax(HE20)-5240



802.11ax(HE40)-5190



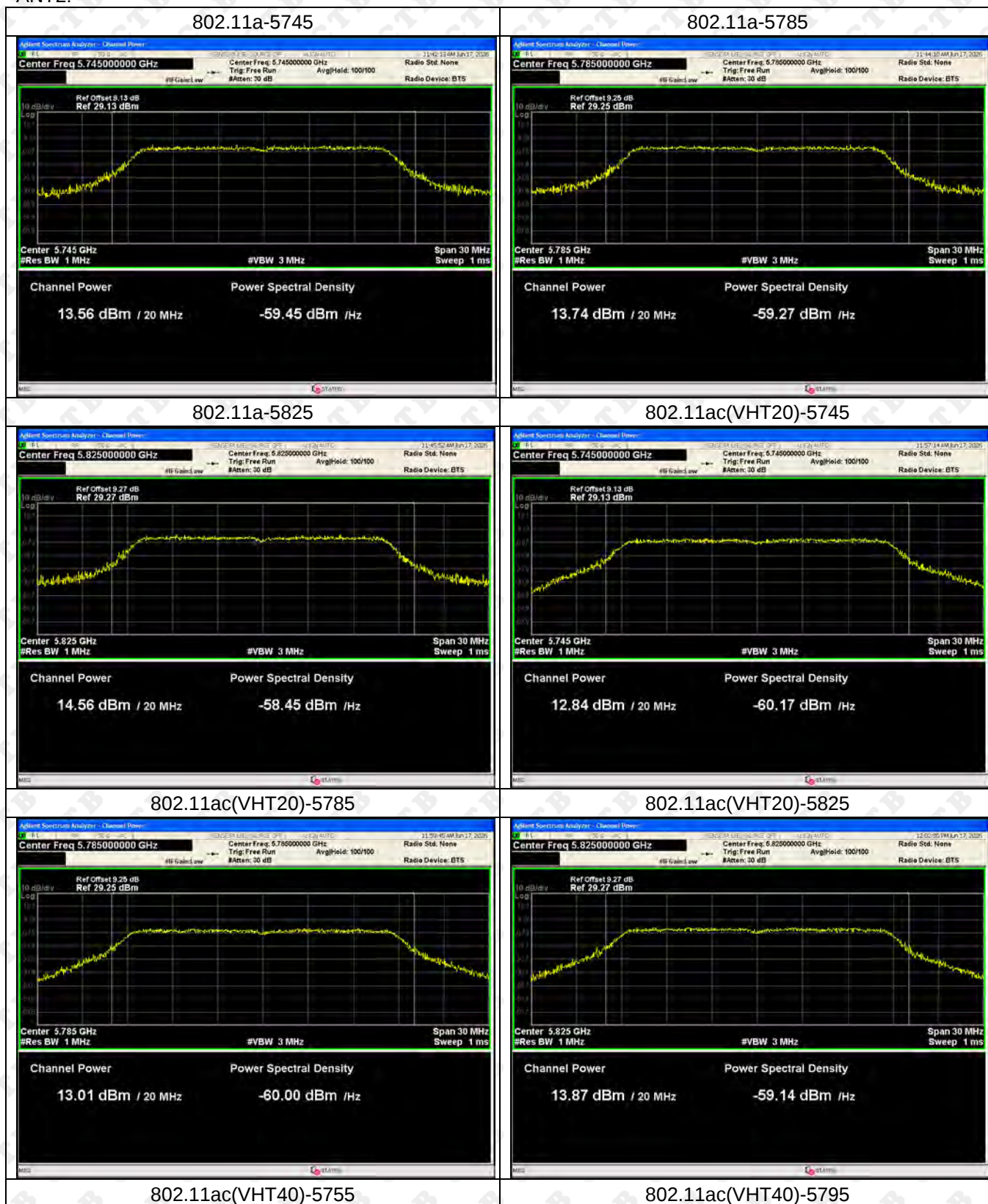
802.11ax(HE40)-5230

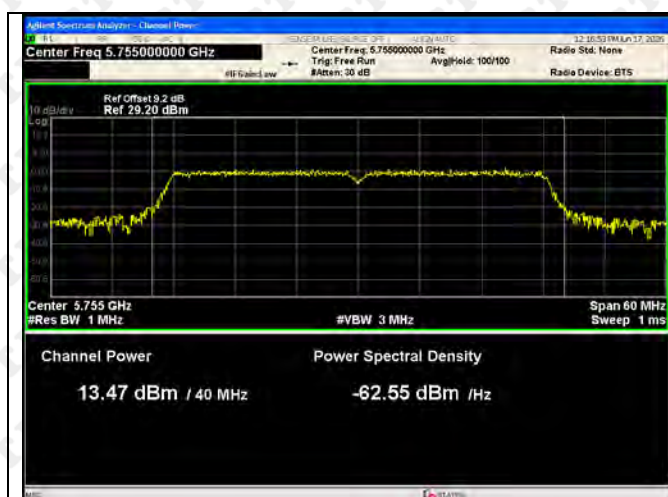


802.11ax(HE80)-5210

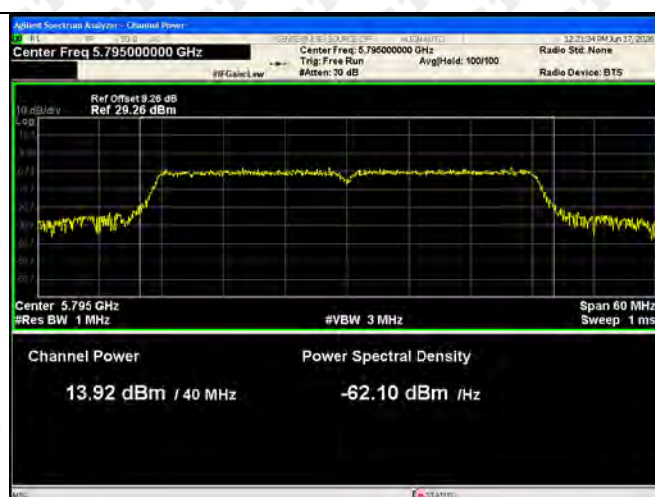


ANT2:





802.11ac(VHT80)-5775



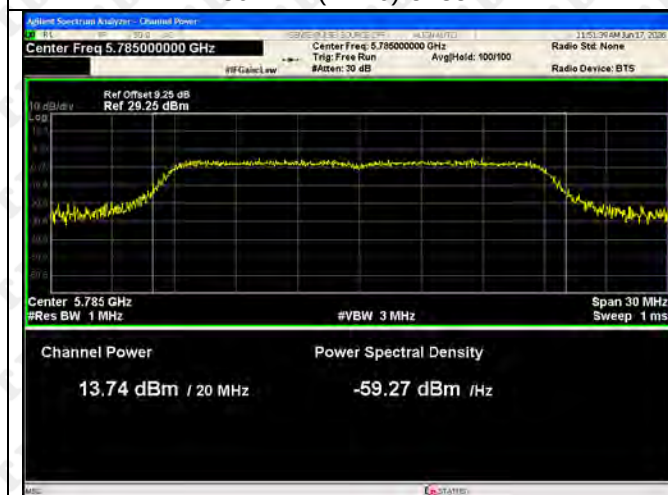
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802.11n(HT20)-5785



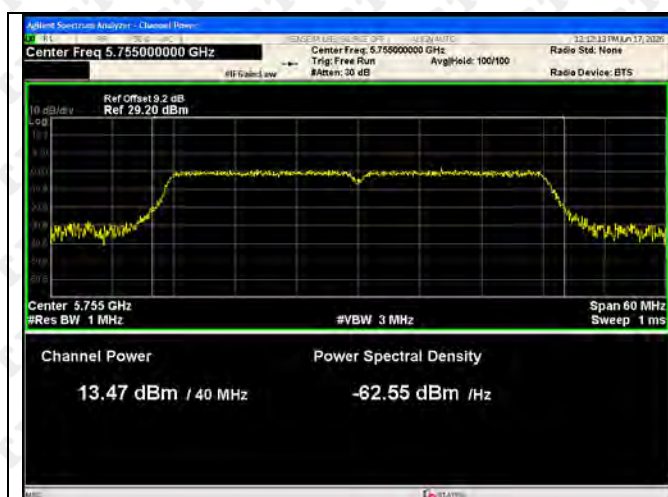
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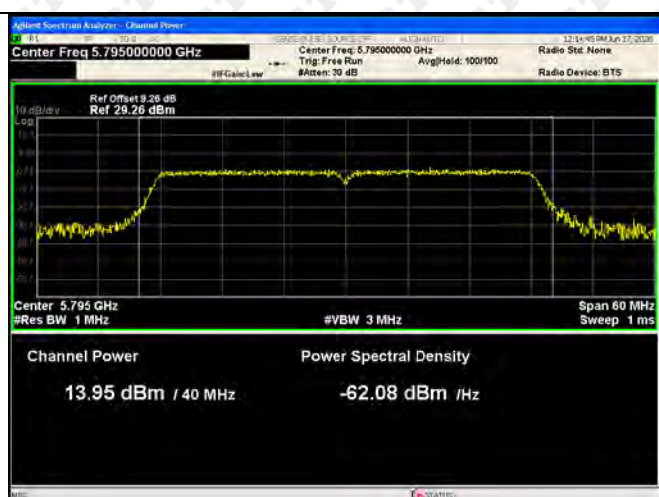
802.11n(HT40)-5755



802.11n(HT40)-5795



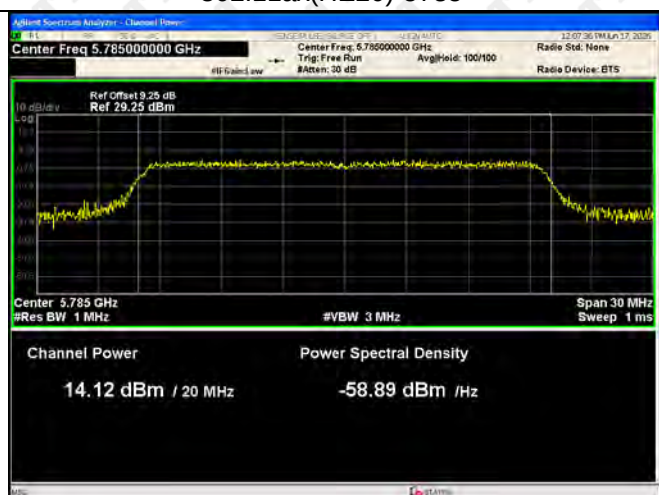
802.11ax(HE20)-5745



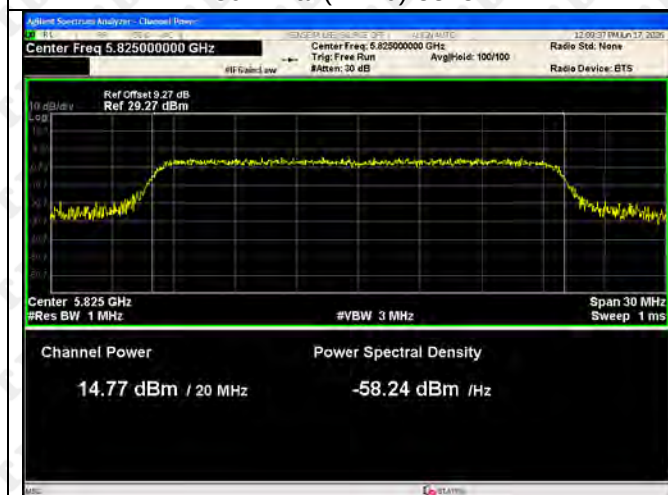
802.11ax(HE20)-5785



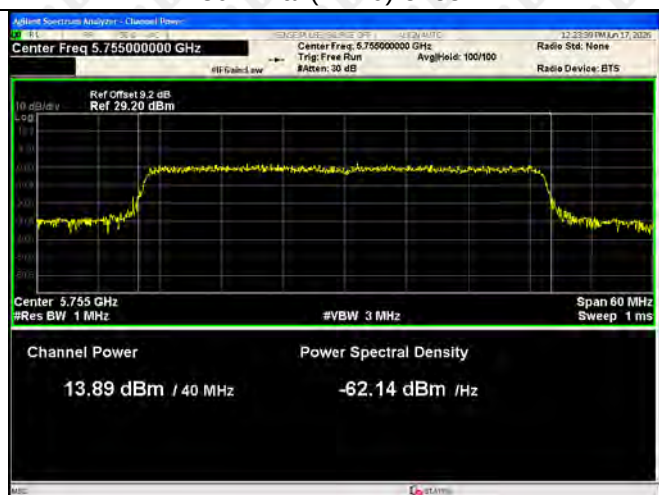
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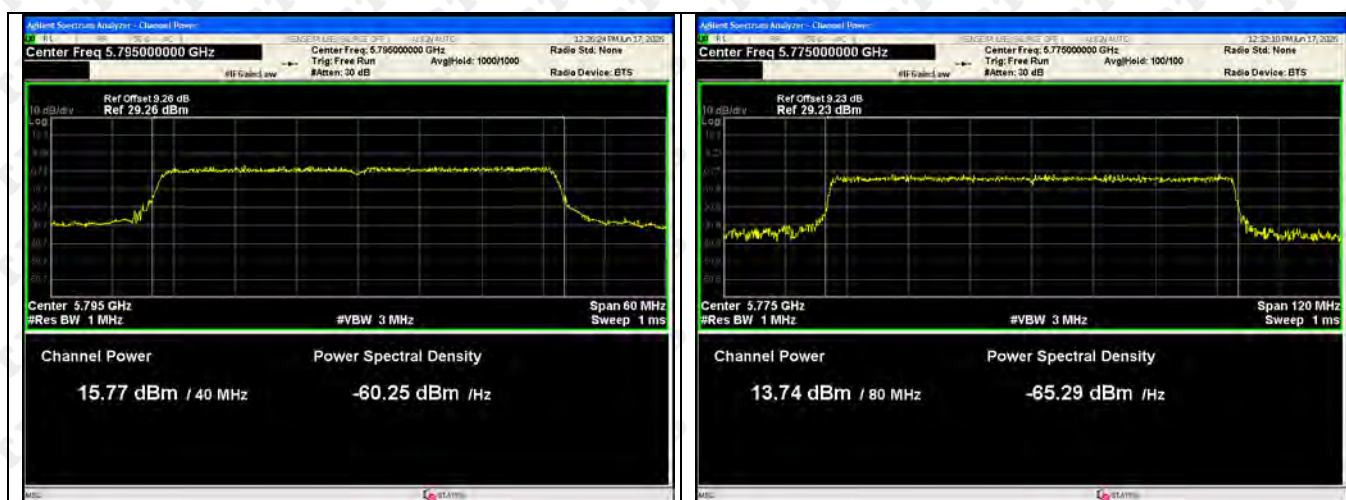
802.11ax(HE40)-5755



802.11ax(HE40)-5795



802.11ax(HE80)-5775



Duty cycle ANT1:









Duty cycle ANT1:



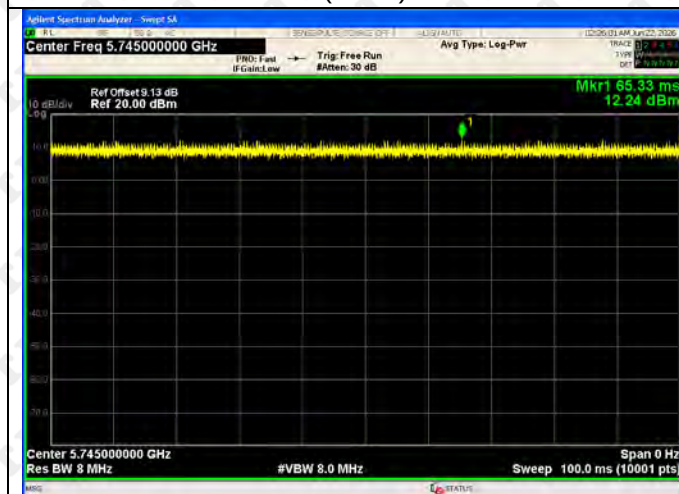




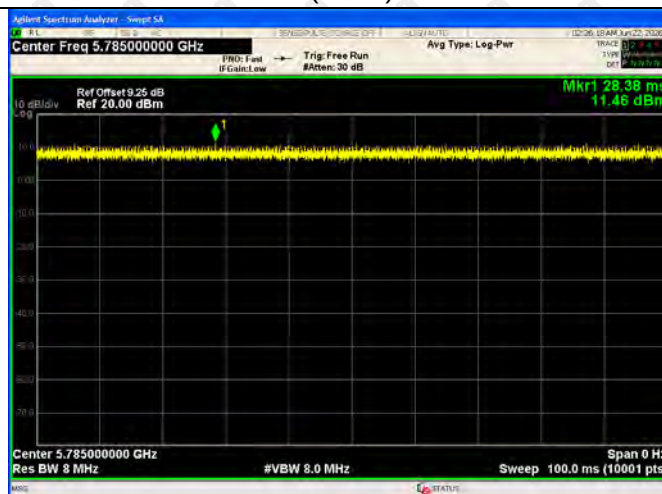
802.11ax(HE20)-5745



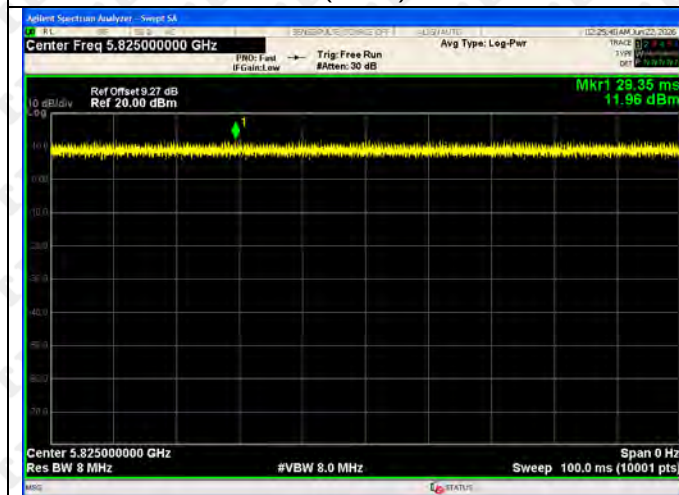
802.11ax(HE20)-5785



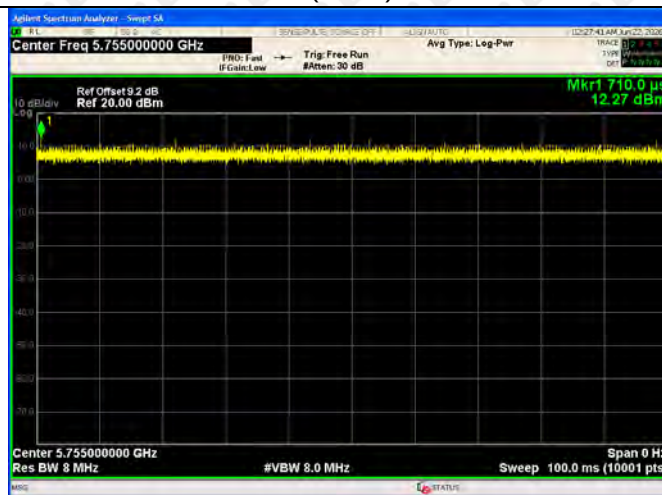
802.11ax(HE20)-5825



802.11ax(HE40)-5755



802.11ax(HE40)-5795



802.11ax(HE80)-5775



Duty cycle ANT2:



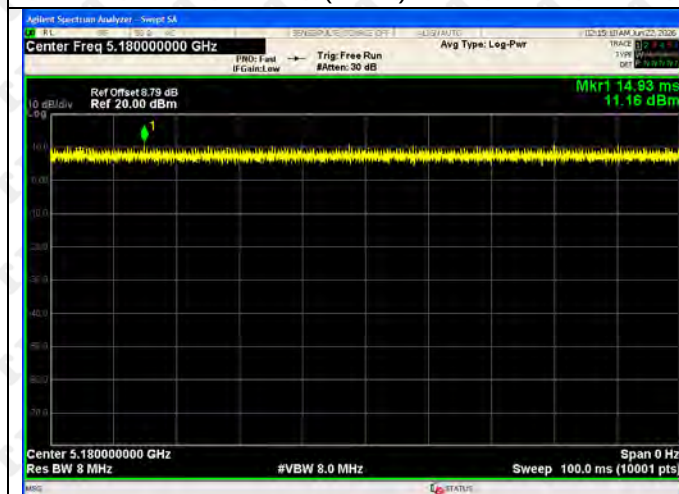




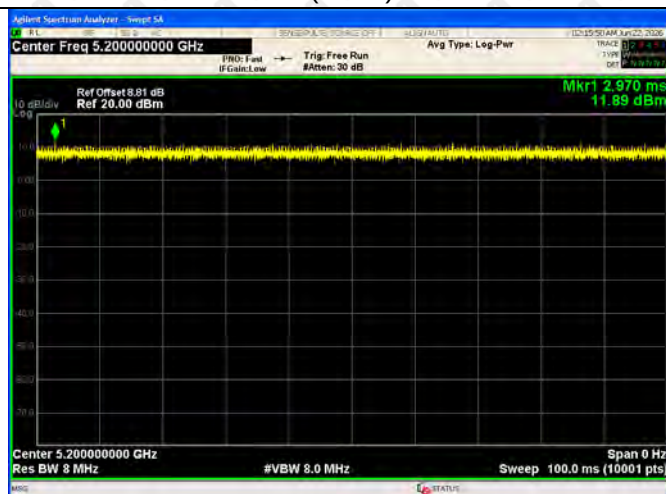
802.11ax(HE20)-5180



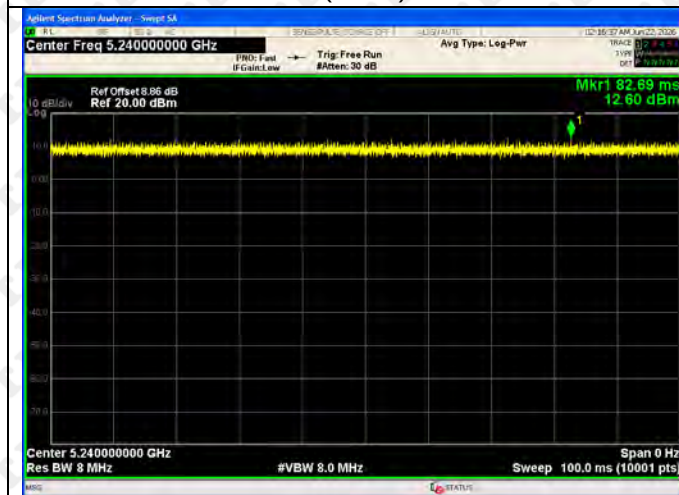
802.11ax(HE20)-5200



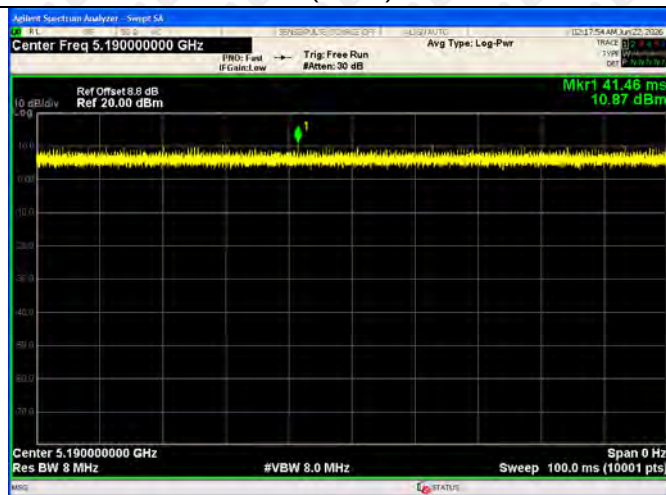
802.11ax(HE20)-5240



802.11ax(HE40)-5190



802.11ax(HE40)-5230



802.11ax(HE80)-5210



Duty cycle ANT2:



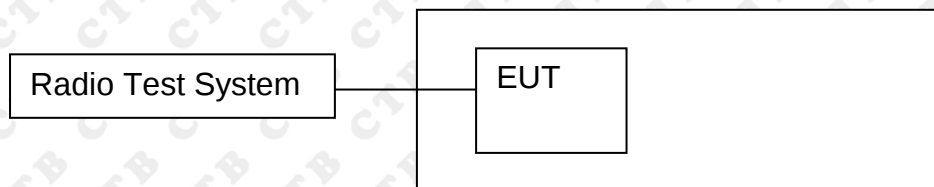






10. EMISSION BANDWIDTH& OCCUPIED BANDWIDTH

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) $\geq 3 * \text{RBW}$.

- 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 $\geq 3 \times$ 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 Ant 1	Test Channel (MHz)	26dB Bandwidth (MHz)
802.11a	5180	20.179
	5200	19.547
	5240	20.149
802.11ac(VHT20)	5180	21.453
	5200	23.111
	5240	21.547
802.11ac(VHT40)	5190	40.426
	5230	40.719
802.11ac(VHT80)	5210	80.984
802.11n(HT20)	5180	20.507
	5200	20.506
	5240	21.001
802.11n(HT40)	5190	38.862
	5230	39.088
802.11ax(HE20)	5180	25.475
	5200	21.25
	5240	21.472
802.11ax(HE40)	5190	40.987
	5230	40.545
802.11ax(HE80)	5210	80.334

Test mode Ant 2	Test Channel (MHz)	26dB Bandwidth (MHz)
802.11a	5180	19.954
	5200	19.592
	5240	19.193
802.11ac(VHT20)	5180	21.828
	5200	23.414
	5240	25.233
802.11ac(VHT40)	5190	40.834
	5230	40.669
802.11ac(VHT80)	5210	82.648
802.11n(HT20)	5180	20.535
	5200	20.926
	5240	21.675
802.11n(HT40)	5190	39.01
	5230	39.143
802.11ax(HE20)	5180	21.578
	5200	21.958
	5240	21.941
802.11ax(HE40)	5190	40.325
	5230	40.272
802.11ax(HE80)	5210	80.908

5725-5850 MHz

Test mode Ant 1	Test Channel (MHz)	6dB Bandwidth (MHz)	Result
802.11a	5745	16.506	Pass
	5785	16.484	Pass
	5825	16.447	Pass
802.11ac(VHT20)	5745	17.667	Pass
	5785	17.695	Pass
	5825	17.693	Pass
802.11ac(VHT40)	5755	36.48	Pass
	5795	36.46	Pass
802.11ac(VHT80)	5775	76.359	Pass
802.11n(HT20)	5745	17.739	Pass
	5785	17.747	Pass
	5825	17.672	Pass
802.11n(HT40)	5755	36.475	Pass
	5795	36.464	Result
802.11ax(HE20)	5745	18.908	Pass
	5785	18.996	Pass
	5825	18.998	Pass
802.11ax(HE40)	5755	38.085	Pass
	5795	38.12	Pass
802.11ax(HE80)	5775	78.016	Pass

Test mode Ant 2	Test Channel (MHz)	6dB Bandwidth (MHz)	Result
802.11a	5745	16.447	Pass
	5785	16.49	Pass
	5825	16.483	Pass
802.11ac(VHT20)	5745	17.568	Pass
	5785	17.552	Pass
	5825	17.574	Pass
802.11ac(VHT40)	5755	36.453	Pass
	5795	36.446	Pass
802.11ac(VHT80)	5775	76.48	Pass
802.11n(HT20)	5745	17.739	Pass
	5785	17.75	Pass
	5825	17.712	Pass
802.11n(HT40)	5755	36.484	Pass
	5795	36.475	Result
802.11ax(HE20)	5745	18.977	Pass
	5785	19.007	Pass
	5825	18.873	Pass
802.11ax(HE40)	5755	38.098	Pass
	5795	37.958	Pass
802.11ax(HE80)	5775	77.973	Pass

Test Graph 5150MHz ~5250MHz

ANT 1:





802.11ac(VHT80)-5210



802.11n(HT20)-5180



802.11n(HT20)-5200



802.11n(HT20)-5240



802.11n(HT40)-5190



802.11n(HT40)-5230



802.11ax(HE20)-5180



802.11ax(HE20)-5200



802.11ax(HE20)-5240



802.11ax(HE40)-5190



802.11ax(HE40)-5230

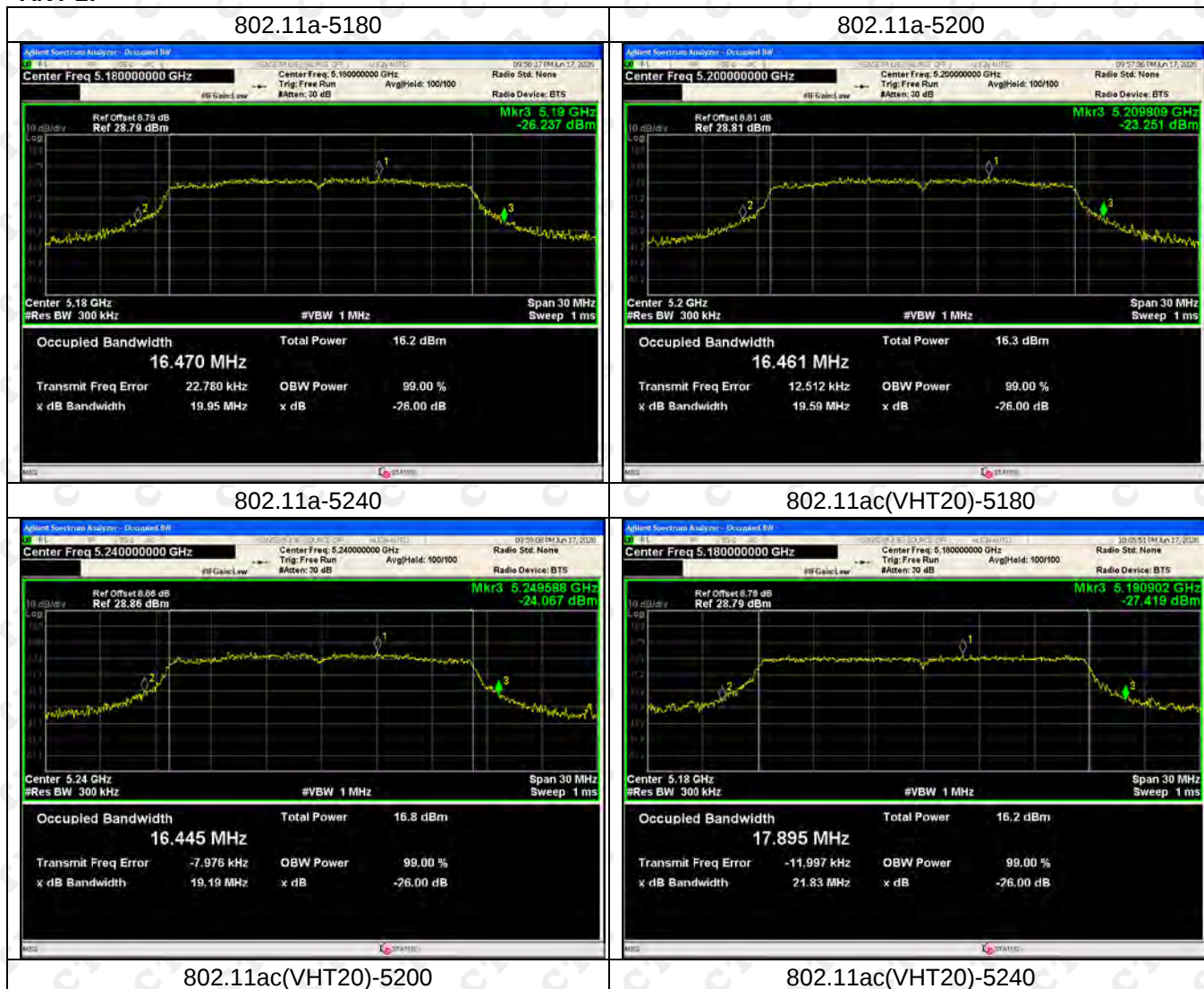


802.11ax(HE80)-5210



5150MHz ~5250MHz

ANT 2:





802.11ac(VHT40)-5190



802.11ac(VHT40)-5230



802.11ac(VHT80)-5210



802.11ac(VHT80)-5230



802.11n(HT20)-5180



802.11n(HT20)-5240



802.11n(HT40)-5190



802.11n(HT40)-5230



802.11ax(HE20)-5180



802.11ax(HE20)-5200



802.11ax(HE20)-5240



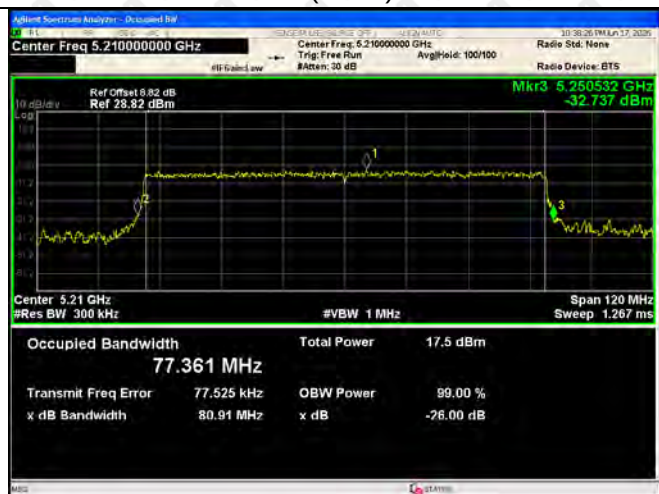
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802.11ax(HE40)-5230



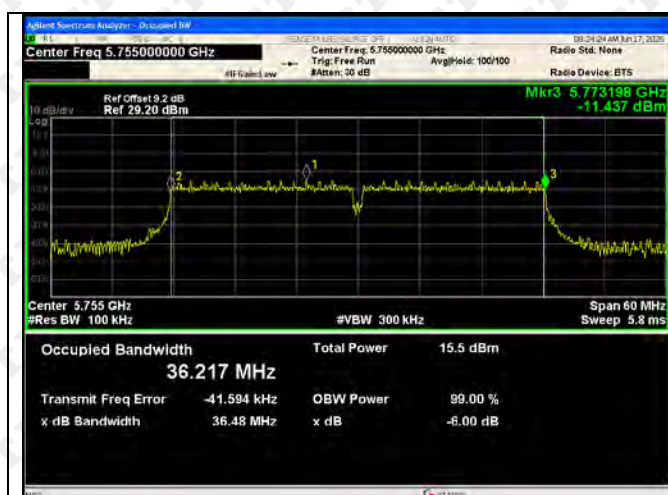
802.11ax(HE80)-5210



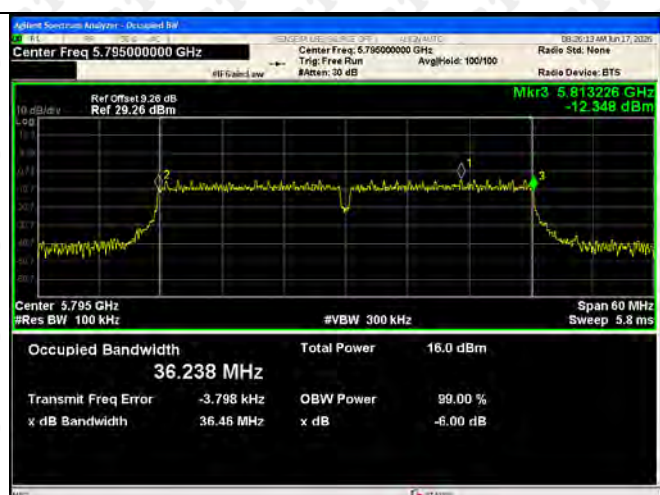
5725-5850MHz

ANT1:





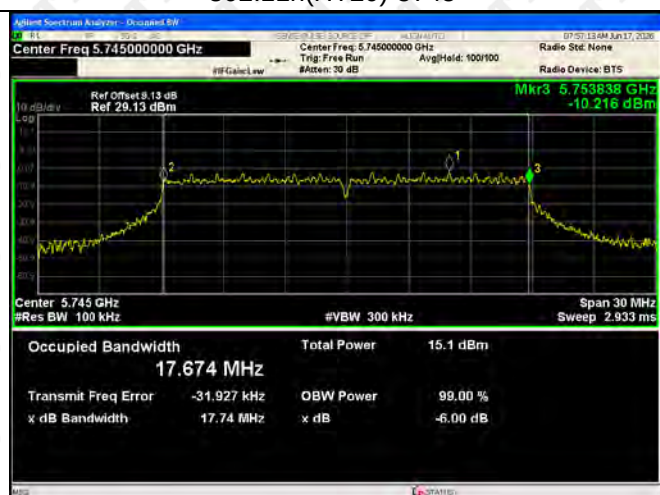
802.11ac(VHT80)-5775



802.11n(HT20)-5745



802.11n(HT20)-5785



802.11n(HT20)-5825



802.11n(HT40)-5755



802.11n(HT40)-5795



802.11ax(HE20)-5745



802.11ax(HE20)-5785



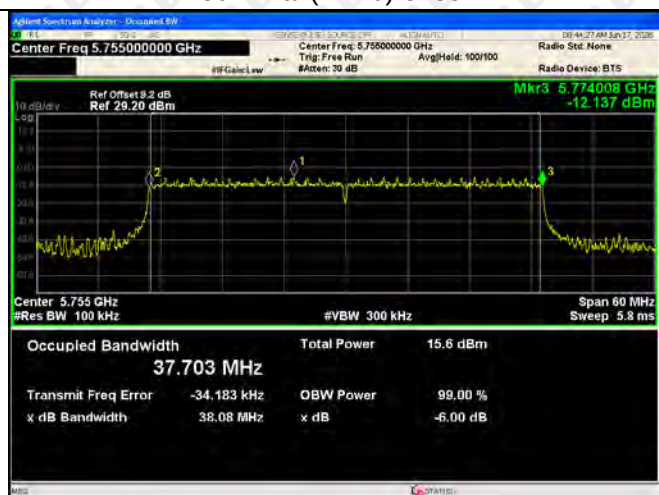
802.11ax(HE20)-5825



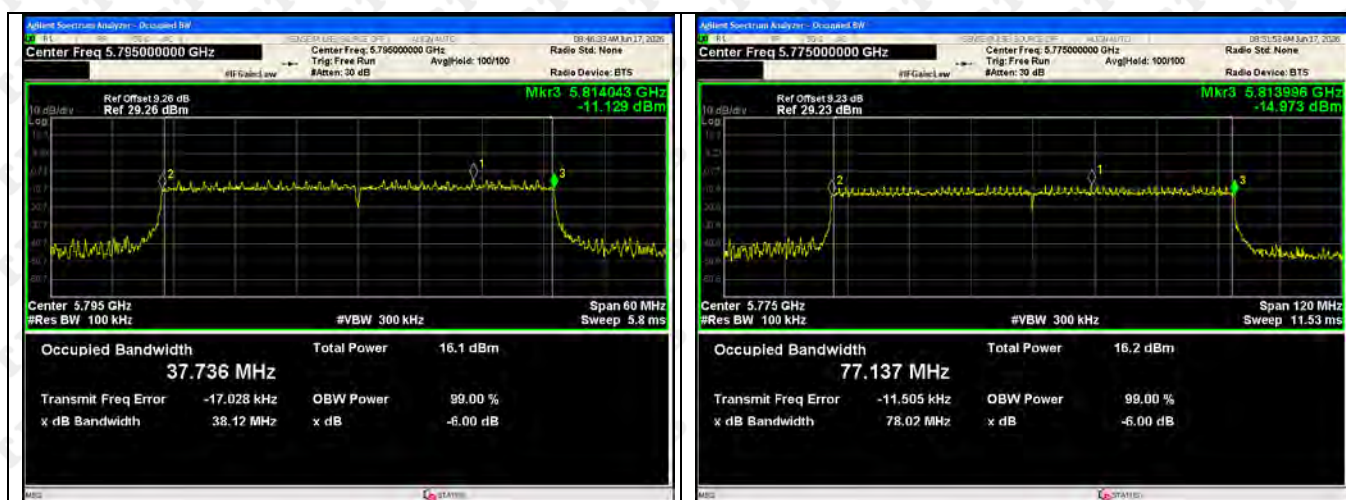
802.11ax(HE40)-5755



802.11ax(HE40)-5795



802.11ax(HE80)-5775



5725-5850MHz

ANT2:

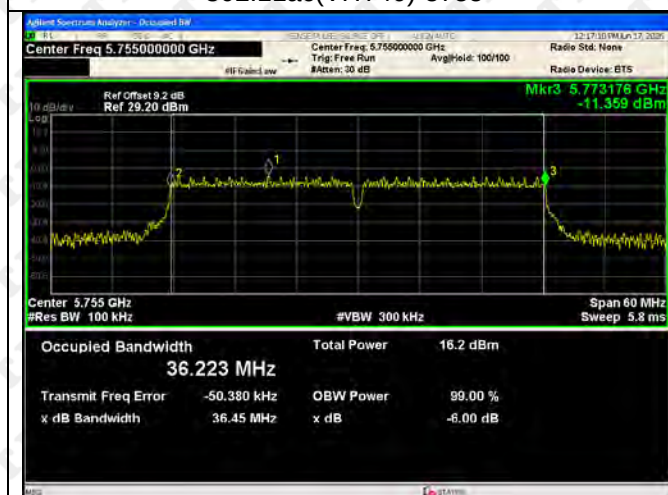




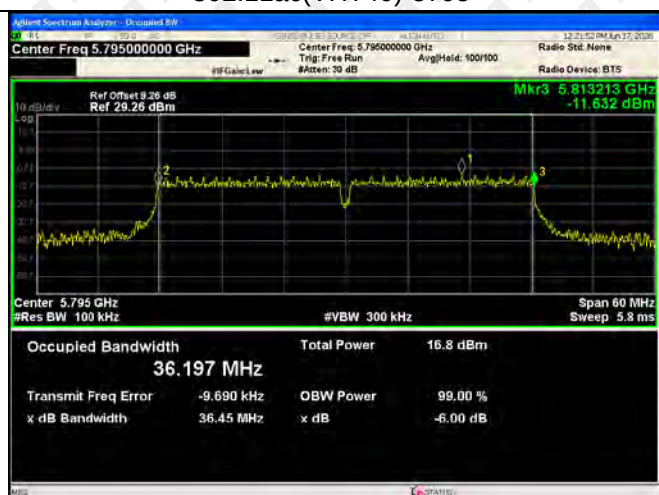
802.11ac(VHT40)-5755



802.11ac(VHT40)-5795



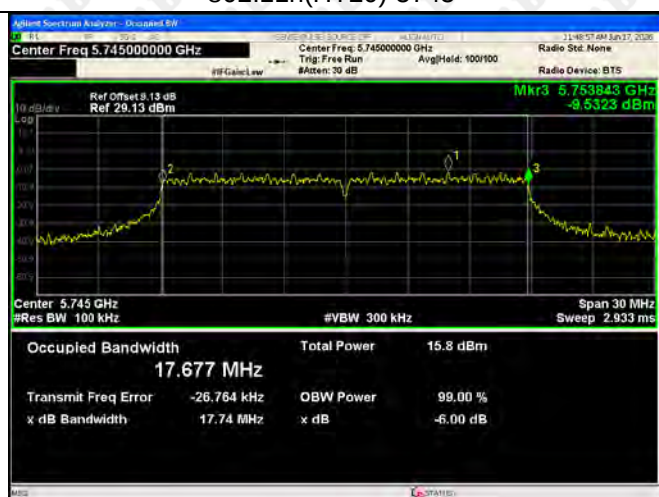
802.11ac(VHT80)-5775



802.11ac(VHT80)-5795



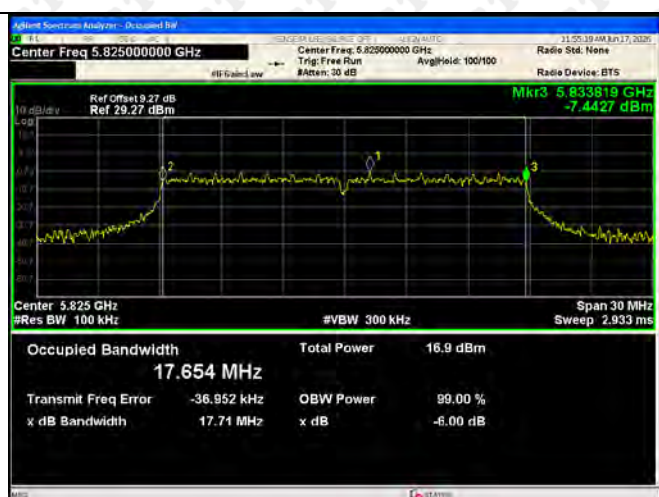
802.11n(HT20)-5785



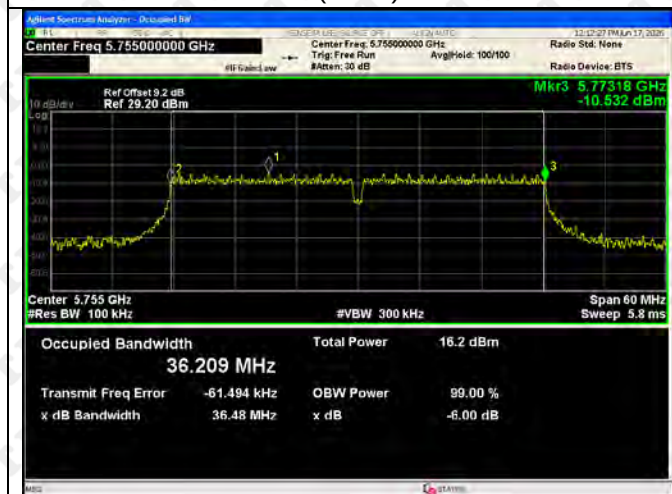
802.11n(HT20)-5825



802.11n(HT40)-5755



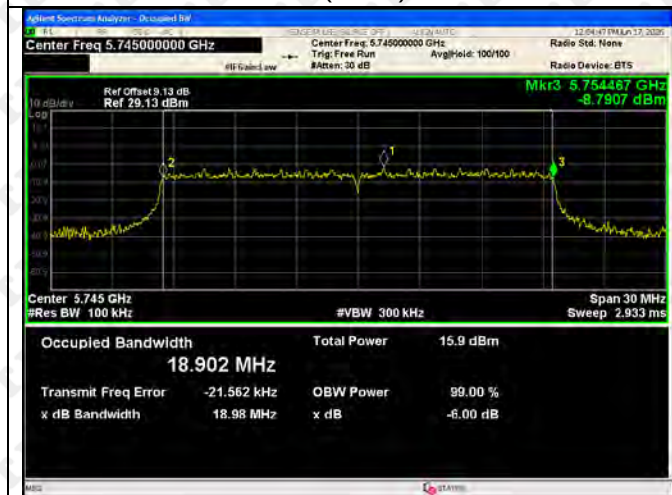
802.11n(HT40)-5795



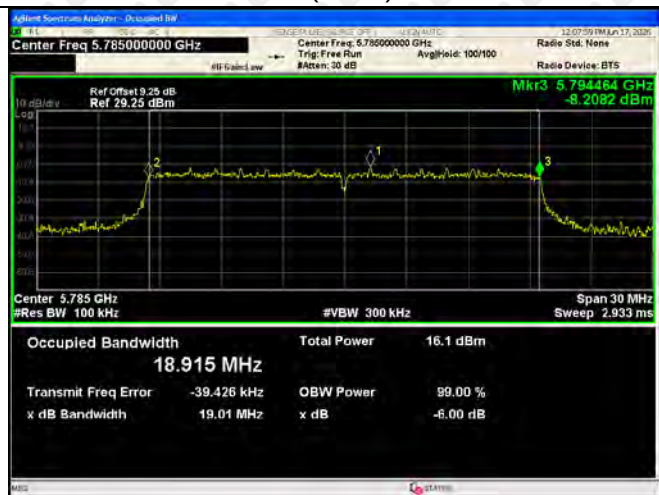
802.11ax(HE20)-5745



802.11ax(HE20)-5785



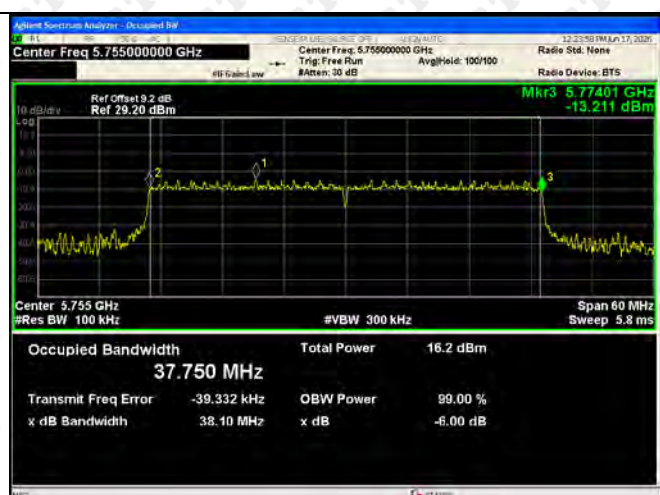
802.11ax(HE20)-5825



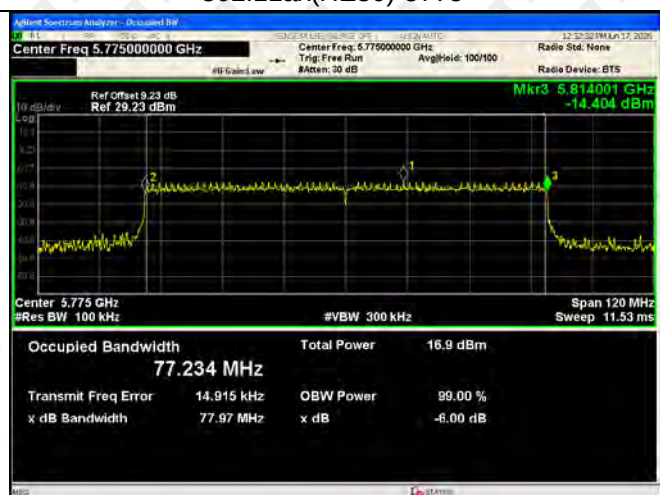
802.11ax(HE40)-5755



802.11ax(HE40)-5795

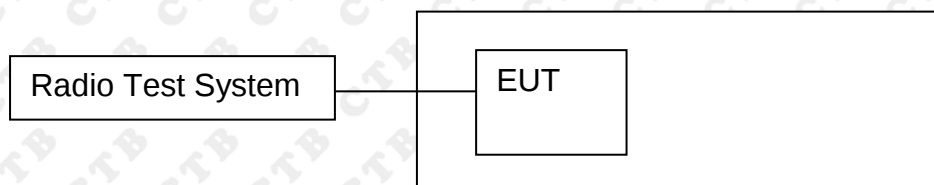


802.11ax(HE80)-5775



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

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 ($< 1 \text{ MHz}$, or $< 500 \text{ kHz}$) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

a) Set $\text{RBW} \geq 1/T$, where T is defined in II.B.I.a).

b) Set $\text{VBW} \geq 3 \text{ RBW}$.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log (500 \text{ kHz/RBW})$ to the measured result, whereas RBW ($< 500 \text{ kHz}$) 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 $10 \log (1 \text{ MHz/RBW})$ to the measured result, whereas RBW ($< 1 \text{ MHz}$) 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

ANT1+ANT2

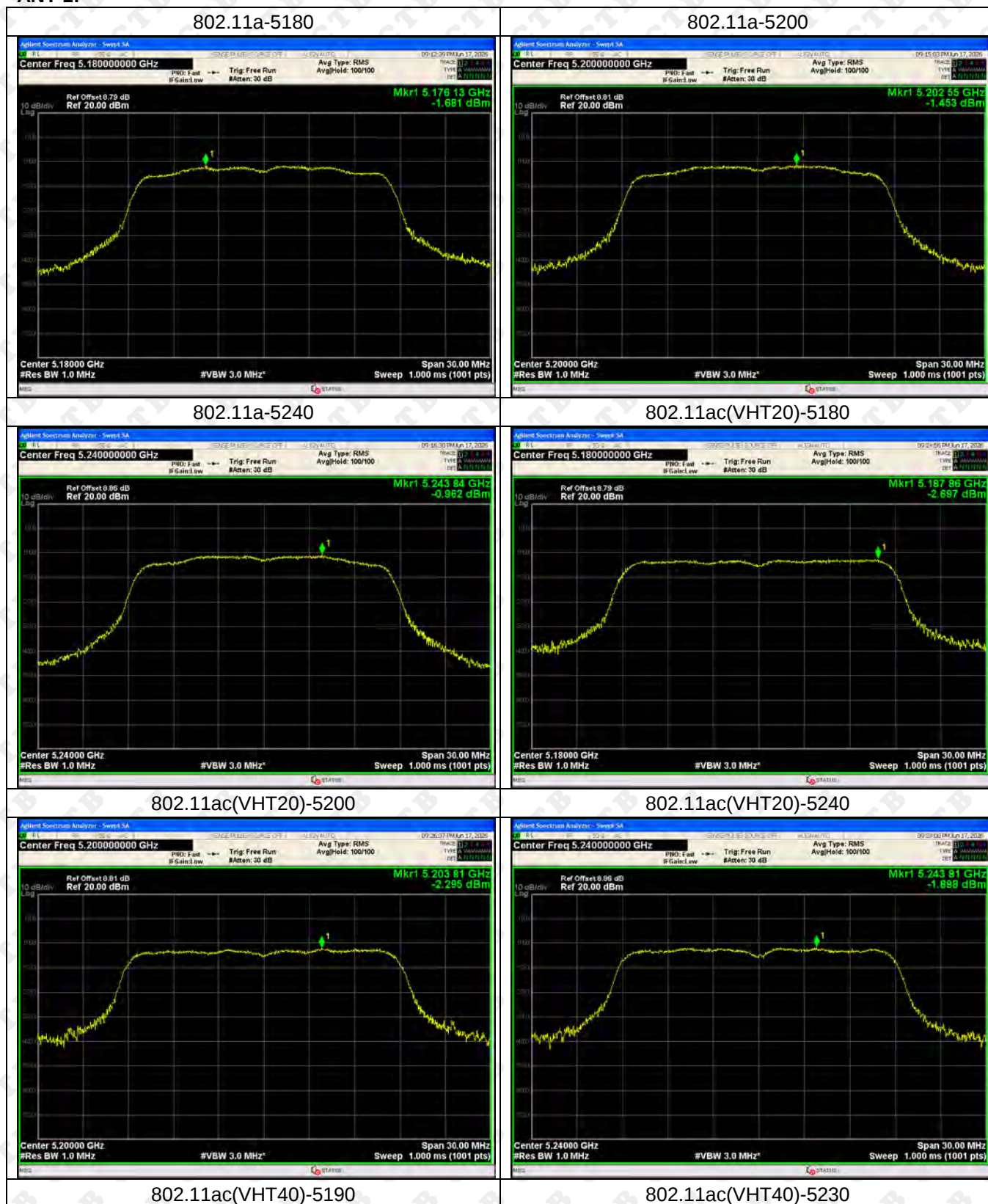
5150MHz ~5250MHz:

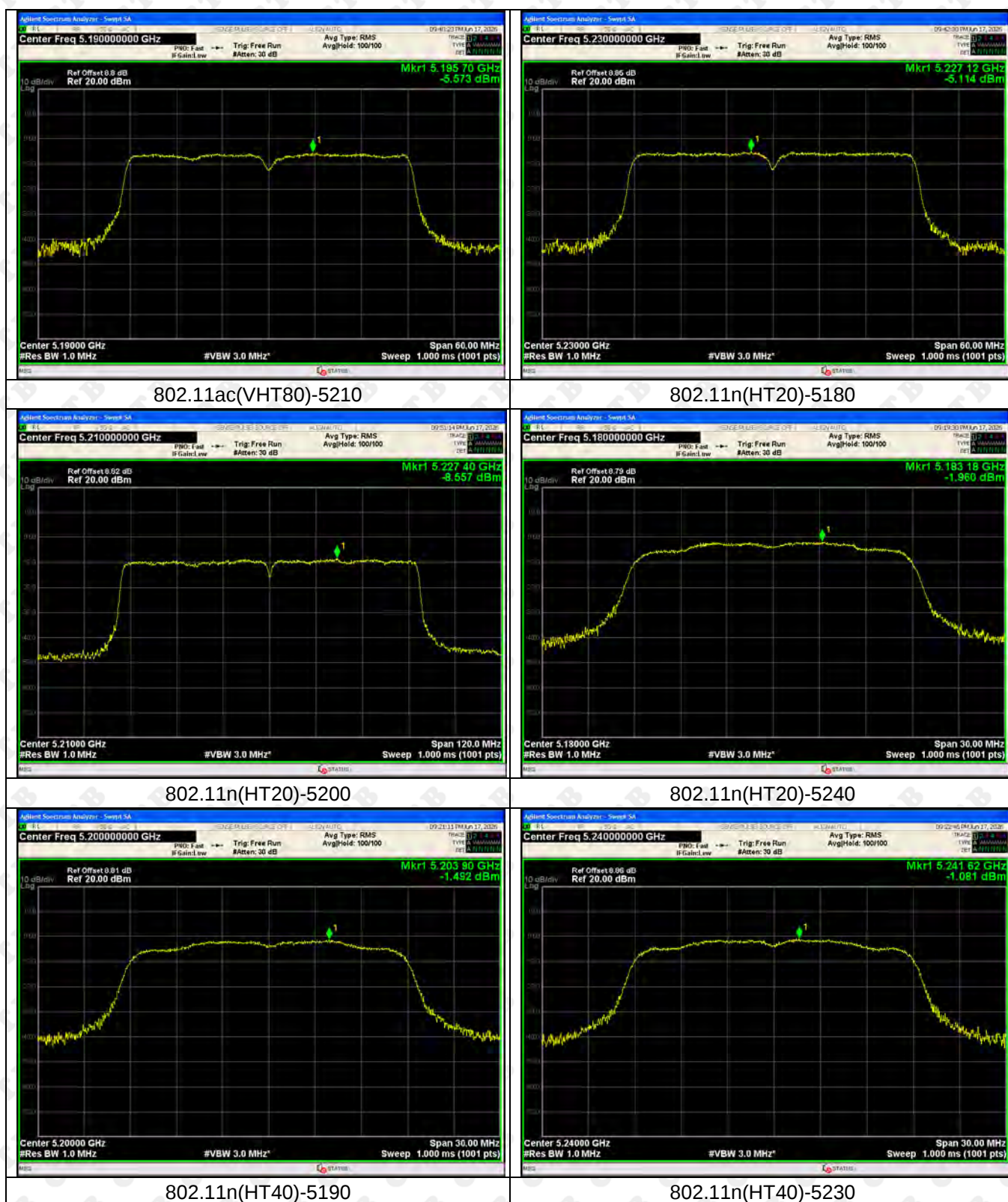
Test mode	Test Channel (MHz)	PSD [dBm/MHz] ANT 1	PSD [dBm/MHz] ANT 2	PSD [dBm/MHz] Total	Limit (dBm/MHz)	Result
802.11a	5180	-1.681	-1.099	/	11	Pass
	5200	-1.453	-1.252	/	11	Pass
	5240	-0.962	-0.584	/	11	Pass
802.11ac(VHT20)	5180	-2.697	-2.143	0.599	11	Pass
	5200	-2.295	-2	0.865	11	Pass
	5240	-1.898	-1.669	1.228	11	Pass
802.11ac(VHT40)	5190	-5.573	-5.317	-2.433	11	Pass
	5230	-5.114	-4.538	-1.806	11	Pass
802.11ac(VHT80)	5230	-8.557	-8.271	-5.401	11	Pass
802.11n(HT20)	5180	-1.96	-1.342	1.370	11	Pass
	5200	-1.492	-1.448	1.540	11	Pass
	5240	-1.081	-0.418	2.273	11	Pass
802.11n(HT40)	5190	-5.287	-4.495	-1.863	11	Pass
	5230	-4.289	-4.212	-1.240	11	Pass
802.11ax(HE20)	5180	-2.858	-2.132	0.530	11	Pass
	5200	-2.717	-2.445	0.431	11	Pass
	5240	-2.265	-1.919	0.922	11	Pass
802.11ax(HE40)	5190	-6.008	-5.636	-2.808	11	Pass
	5230	-5.507	-5.05	-2.262	11	Pass
802.11ax(HE80)	5210	-8.648	-8.082	-5.345	11	Pass

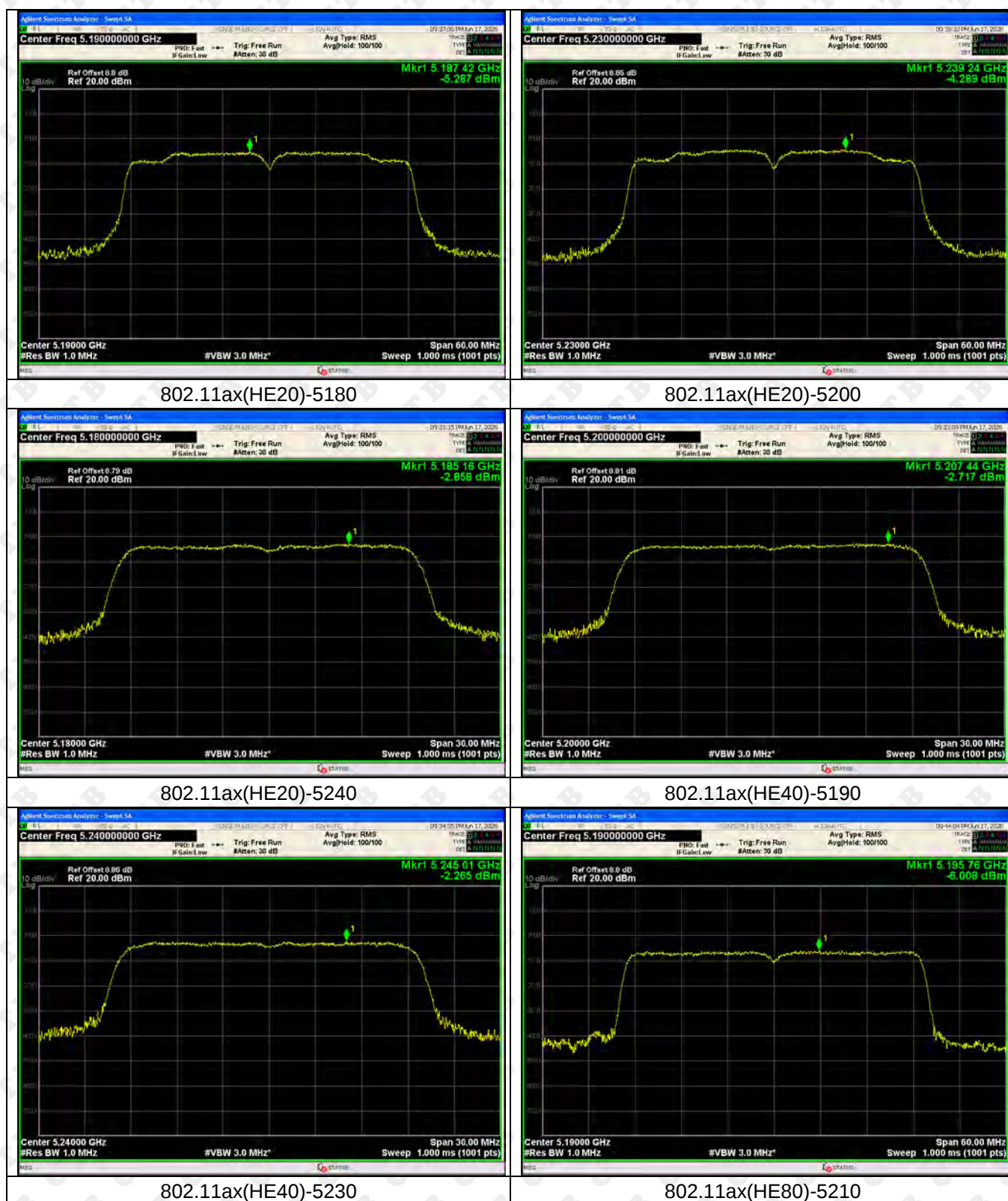
5725-5850MHz:

Test mode	Test Channel (MHz)	PSD [dBm/MHz] ANT 1	PSD [dBm/MHz] ANT 2	PSD [dBm/MHz] Total	Limit (dBm)	Result
802.11a	5745	-6.002	-6.118	/	30	Pass
	5785	-6.464	-5.685	/	30	Pass
	5825	-5.365	-4.851	/	30	Pass
802.11ac(VHT20)	5745	-6.767	-6.056	-3.387	30	Pass
	5785	-6.422	-6.116	-3.256	30	Pass
	5825	-5.924	-5.408	-2.648	30	Pass
802.11ac(VHT40)	5755	-9.64	-8.685	-6.126	30	Pass
	5795	-9.118	-8.756	-5.923	30	Pass
802.11ac(VHT80)	5795	-13.107	-12.672	-9.874	30	Pass
802.11n(HT20)	5745	-6.761	-5.943	-3.322	30	Pass
	5785	-6.281	-5.412	-2.815	30	Pass
	5825	-5.883	-4.998	-2.408	30	Pass
802.11n(HT40)	5755	-9.637	-8.989	-6.291	30	Pass
	5795	-9.23	-8.574	-5.879	30	Pass
802.11ax(HE20)	5745	-6.909	-6.196	-3.528	30	Pass
	5785	-6.775	-6.174	-3.454	30	Pass
	5825	-5.961	-5.237	-2.574	30	Pass
802.11ax(HE40)	5755	-9.914	-9.018	-6.433	30	Pass
	5795	-9.185	-8.974	-6.068	30	Pass
802.11ax(HE80)	5775	-13.077	-12.719	-9.884	30	Pass

ANT 1:









ANT 2:

