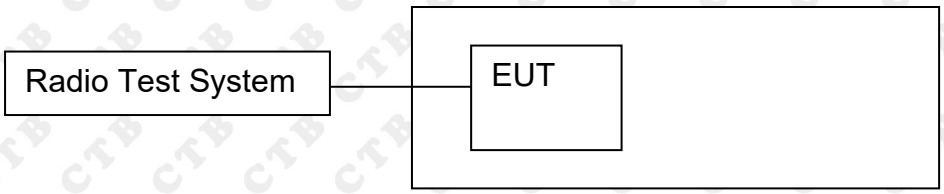
9. CONDUCTED PEAK OUTPUT POWER

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 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 ≥ 3 MHz.

(iv) Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ 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 ≥ 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

ANT 1

Test mode1	Test Channel (MHz)	Output Power dBm	Limit dBm
802.11a	5180	7.315	23.98
	5200	7.466	23.98
	5240	7.524	23.98
802.11ac20	5180	6.269	23.98
	5200	6.128	23.98
	5240	6.282	23.98
802.11ac40	5190	5.562	23.98
	5230	5.801	23.98
802.11ac80	5210	3.248	23.98
802.11n(HT20)	5180	6.495	23.98
	5200	6.062	23.98
	5240	6.317	23.98
802.11n(HT40)	5190	5.704	23.98
	5230	5.309	23.98

Test mode	Test Channel (MHz)	Output Power dBm	Limit dBm
802.11a	5745	7.638	23.98
	5785	7.507	23.98
	5825	7.189	23.98
802.11ac20	5745	6.242	23.98
	5785	6.709	23.98
	5825	6.476	23.98
802.11ac40	5755	5.015	23.98
	5795	5.582	23.98
802.11ac80	5775	3.182	23.98
802.11n(HT20)	5745	6.954	23.98
	5785	6.799	23.98
	5825	6.539	23.98
802.11n(HT40)	5755	5.736	23.98
	5795	5.315	23.98

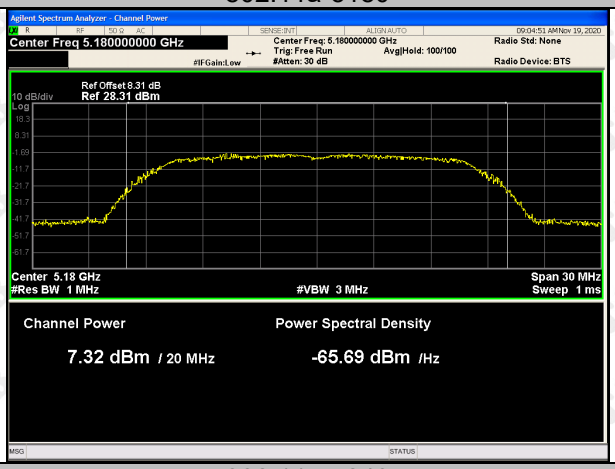
ANT 2+3

Test mode1	Test Channel (MHz)	Output Power dBm ANT2	Output Power dBm ANT3	Output Power dBm Total	Limit dBm
802.11a	5180	7.786	7.493	/	30
	5200	7.071	7.465	/	30
	5240	7.289	7.185	/	30
802.11ac20	5180	6.088	6.645	9.386	30
	5200	6.312	6.034	9.186	30
	5240	6.496	6.221	9.371	30
802.11ac40	5190	5.288	5.335	8.322	30
	5230	5.508	5.085	8.312	30
802.11ac80	5210	3.821	3.645	6.744	30
802.11n(HT20)	5180	6.305	6.293	9.309	30
	5200	6.851	6.888	9.880	30
	5240	6.553	6.389	9.482	30
802.11n(HT40)	5190	5.564	5.585	8.585	30
	5230	5.682	5.681	8.692	30

Test mode1	Test Channel (MHz)	Output Power dBm ANT2	Output Power dBm ANT3	Output Power dBm Total	Limit dBm
802.11a	5745	7.266	7.333	/	30
	5785	7.57	7.417	/	30
	5825	7.739	7.527	/	30
802.11ac20	5745	6.458	6.528	9.503	30
	5785	6.662	6.442	9.564	30
	5825	6.843	6.719	9.792	30
802.11ac40	5755	5.414	5.216	8.326	30
	5795	5.274	5.037	8.167	30
802.11ac80	5775	3.397	3.612	6.516	30
802.11n(HT20)	5745	6.091	6.157	9.134	30
	5785	6.477	6.552	9.525	30
	5825	6.604	6.033	9.338	30
802.11n(HT40)	5755	5.068	5.509	8.304	30
	5795	5.058	5.69	8.396	30

ANT 1

802.11a-5180



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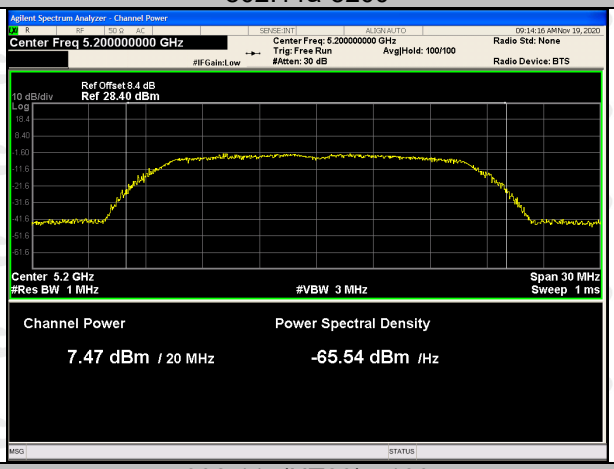

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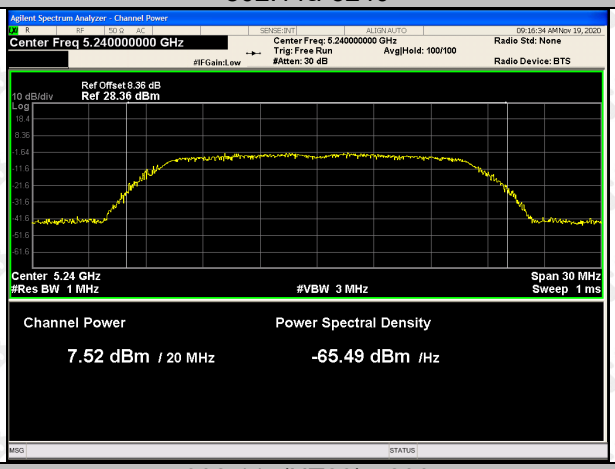

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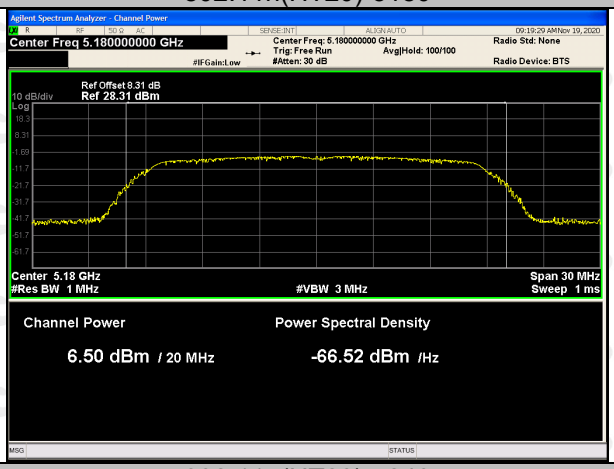

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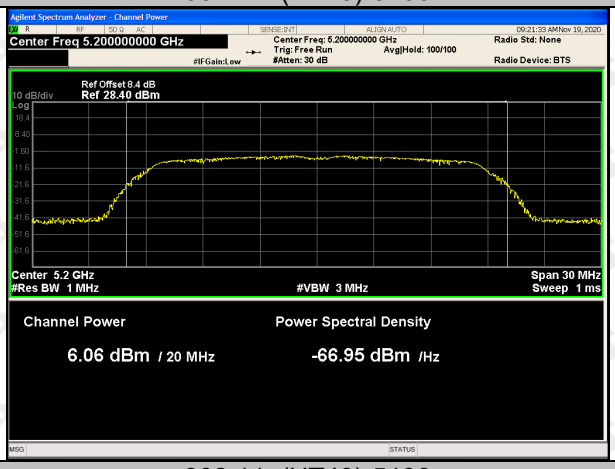

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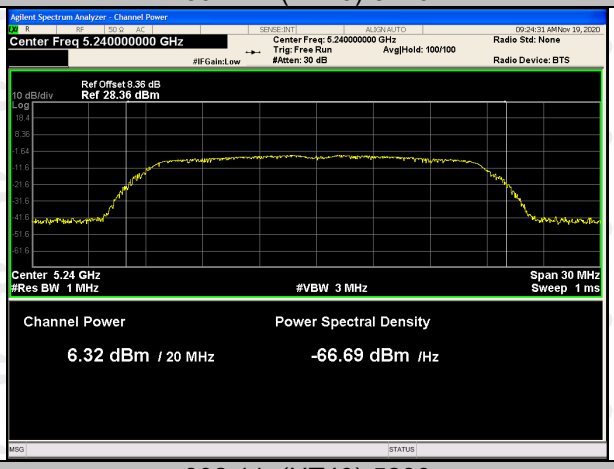

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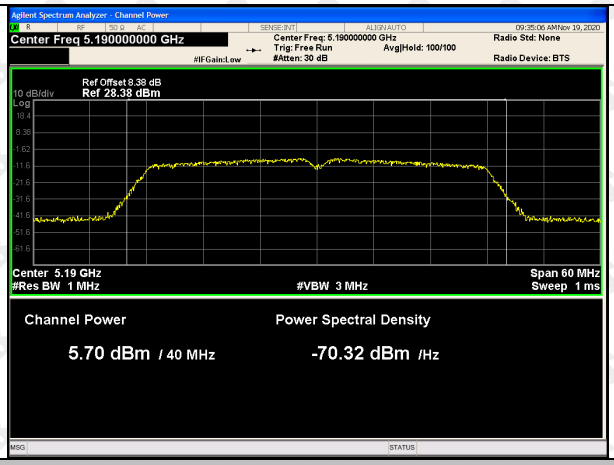

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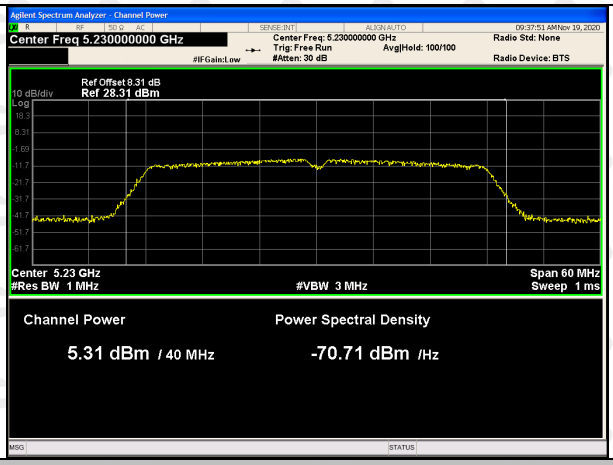

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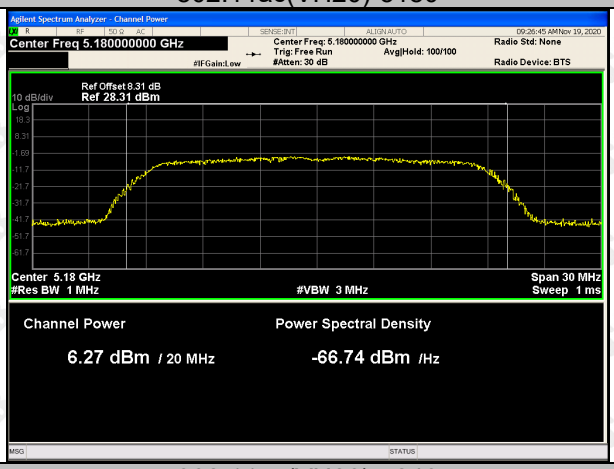

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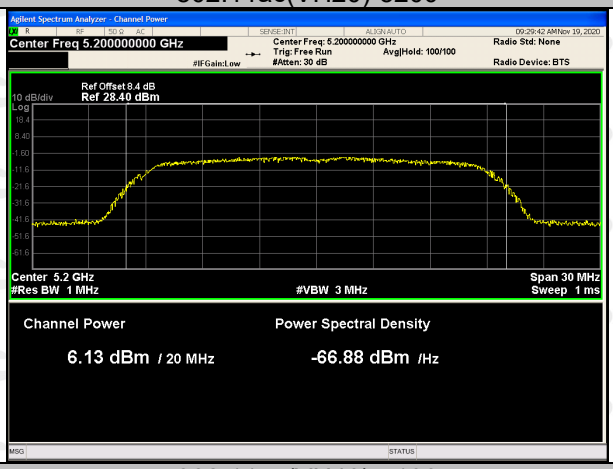

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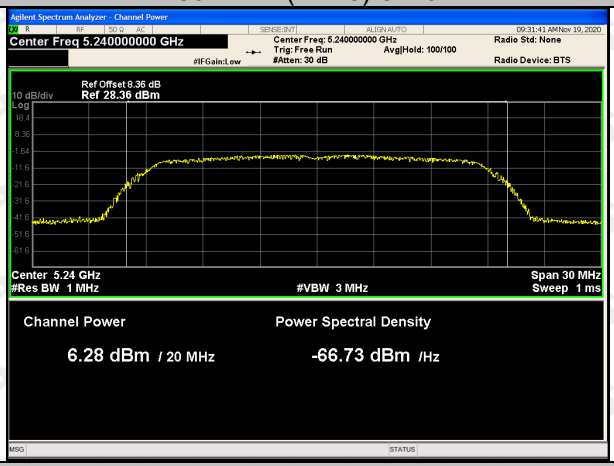

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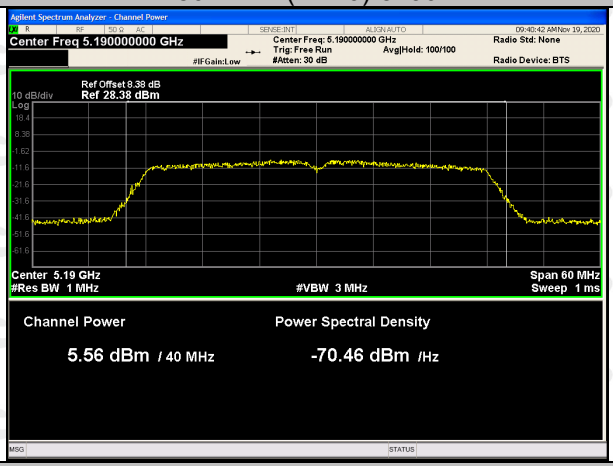

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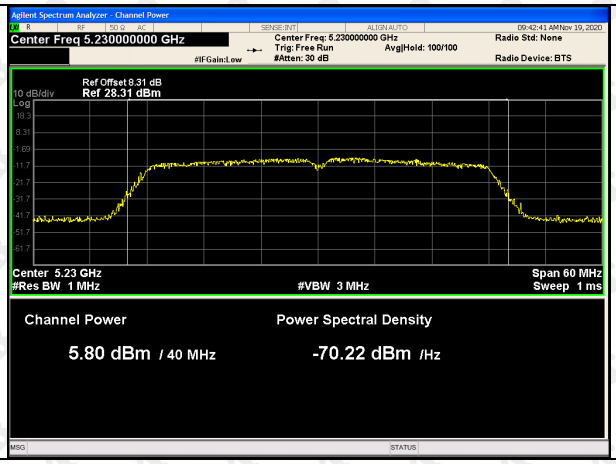
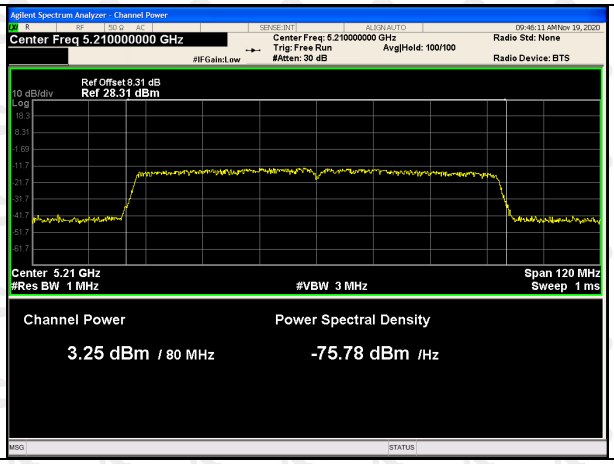


802.11a-5745



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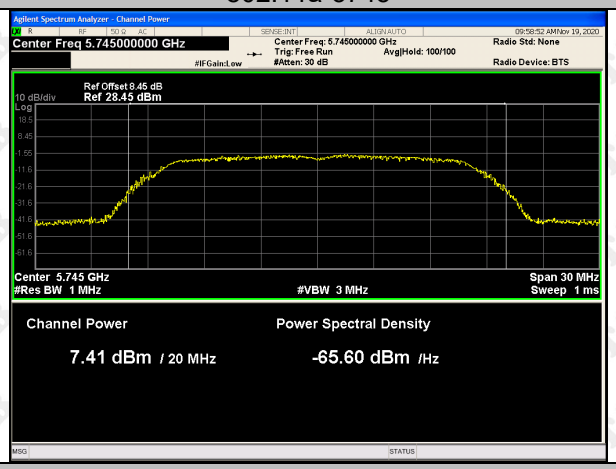

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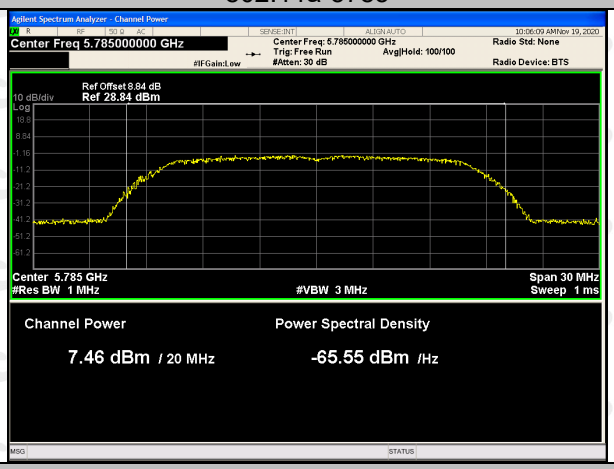

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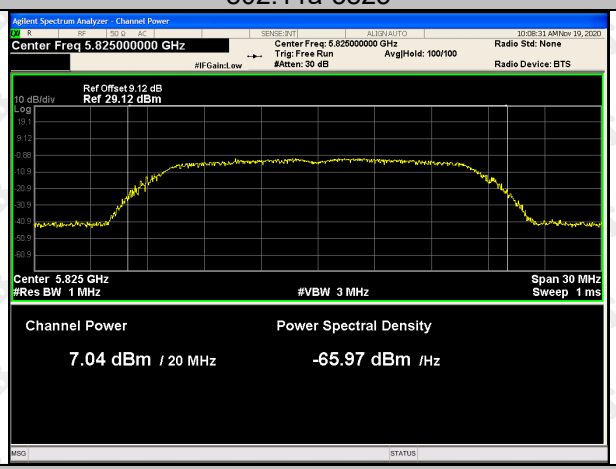

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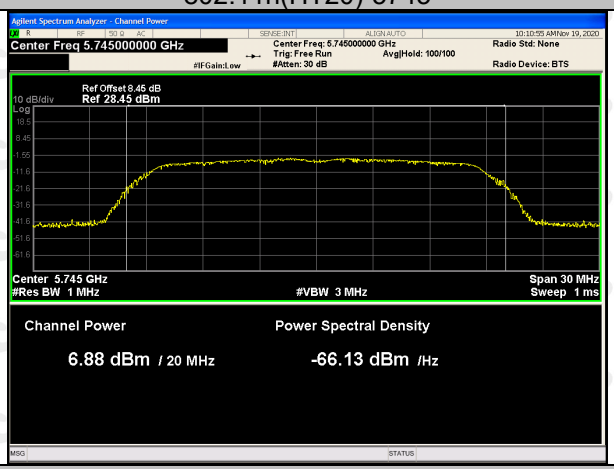

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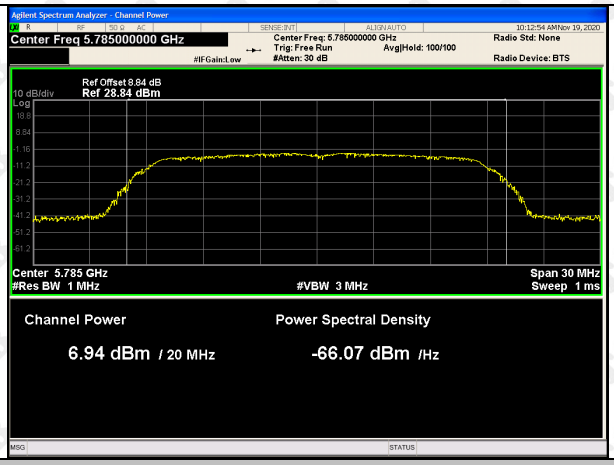

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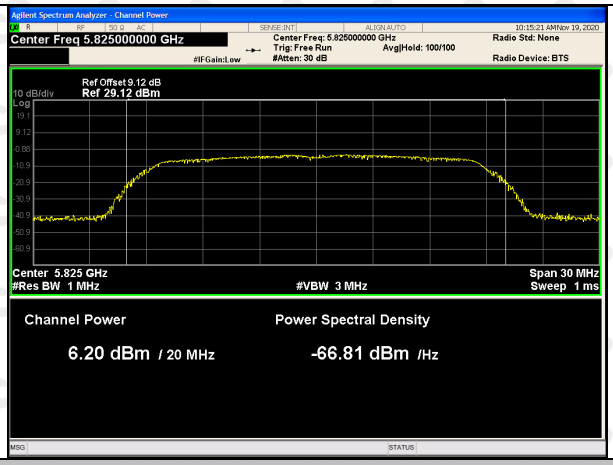

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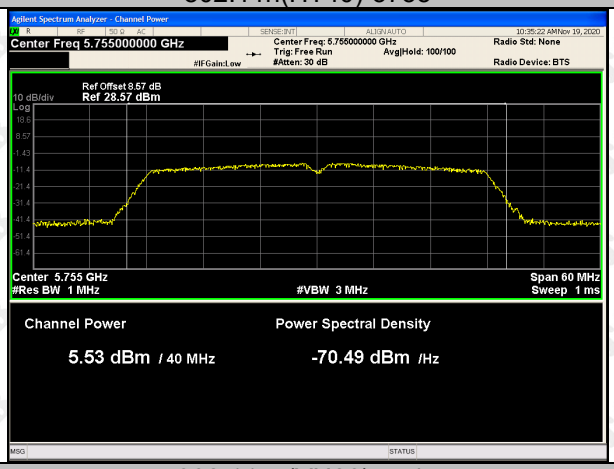

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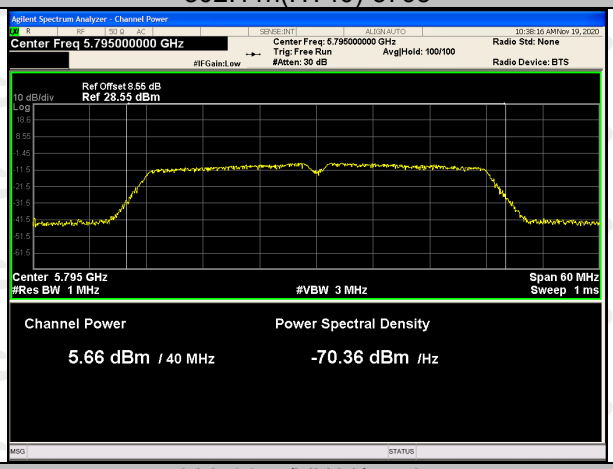

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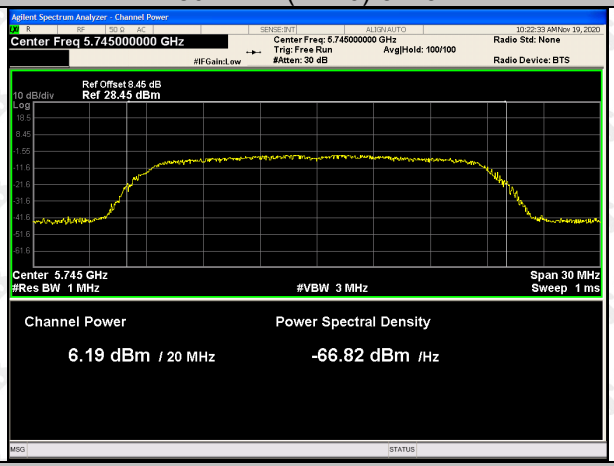

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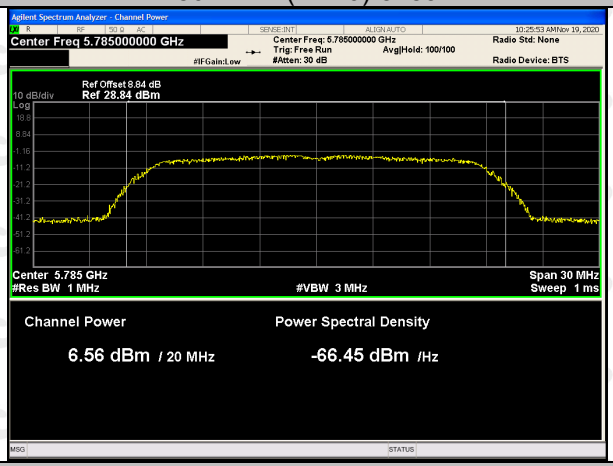

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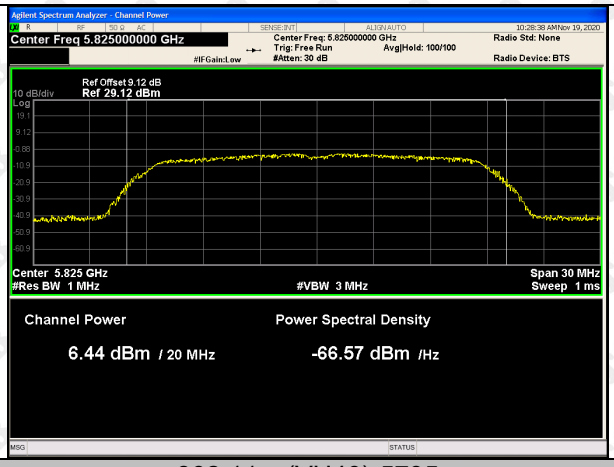

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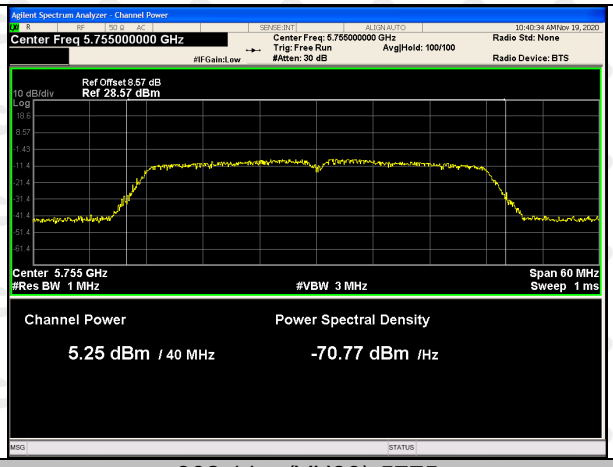

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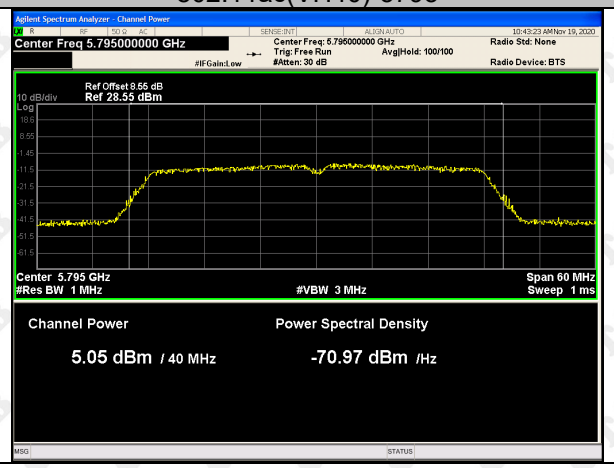
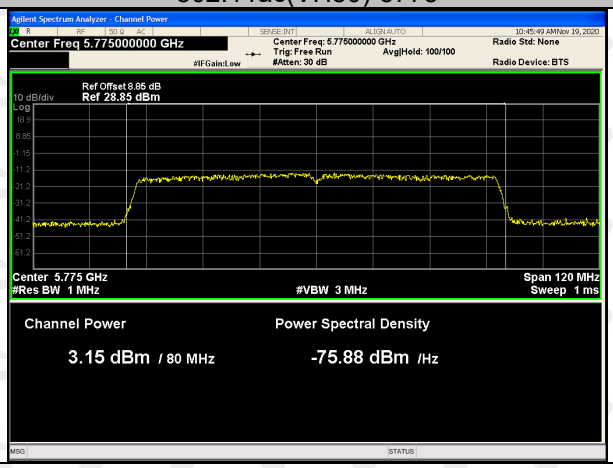
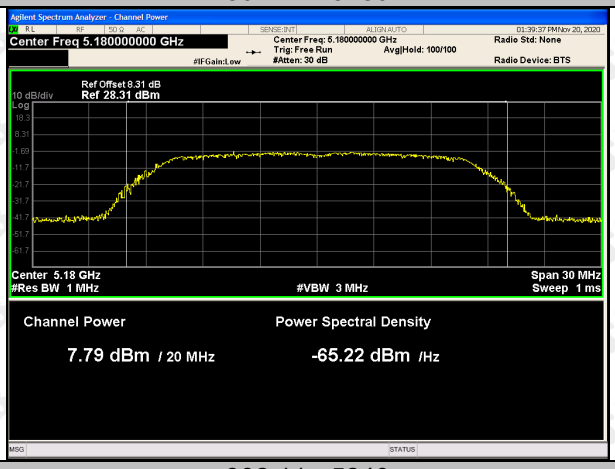




ANT 2

802.11a-5180



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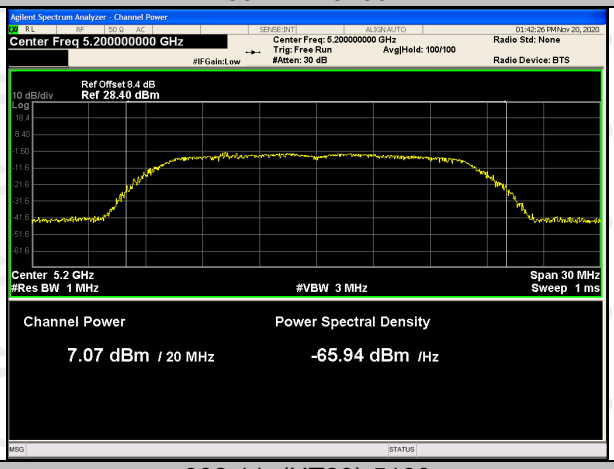
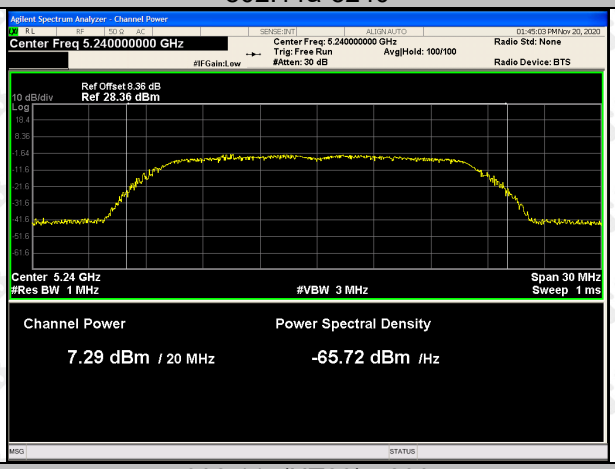


802.11a-5240



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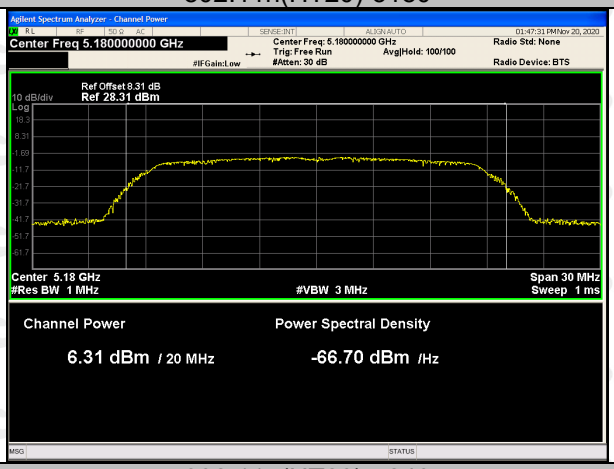

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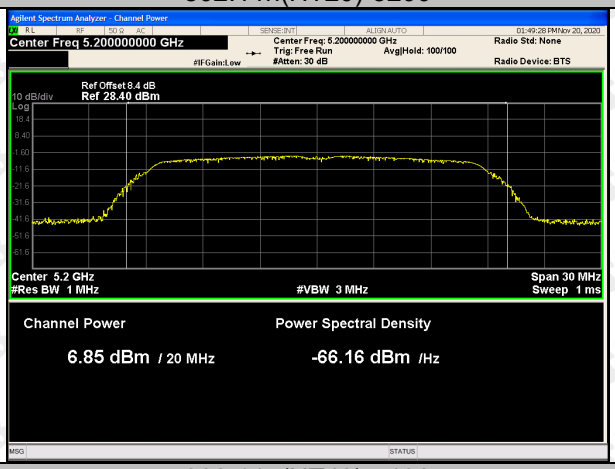

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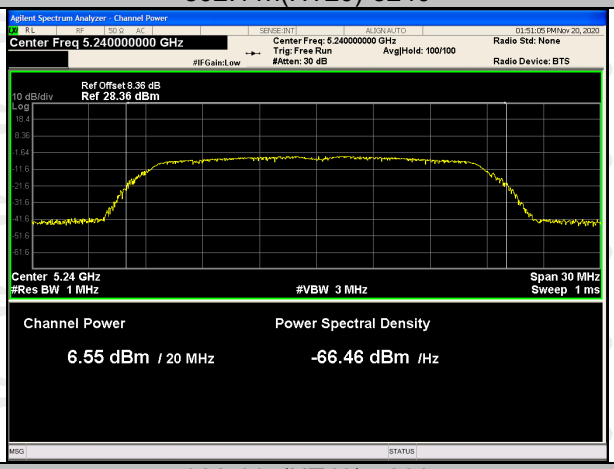

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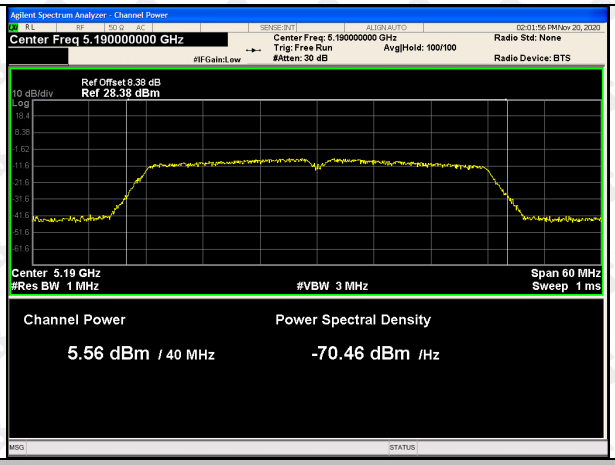

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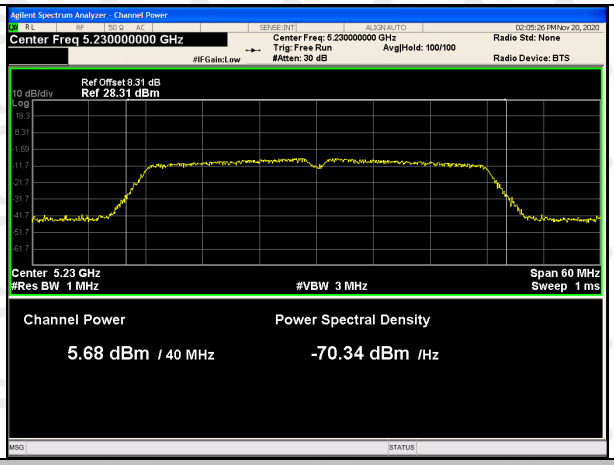

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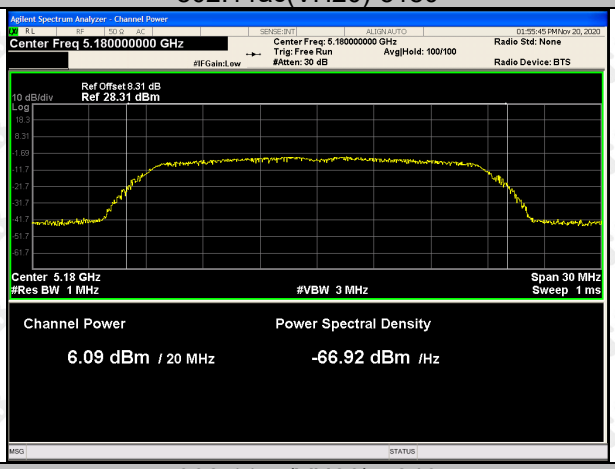

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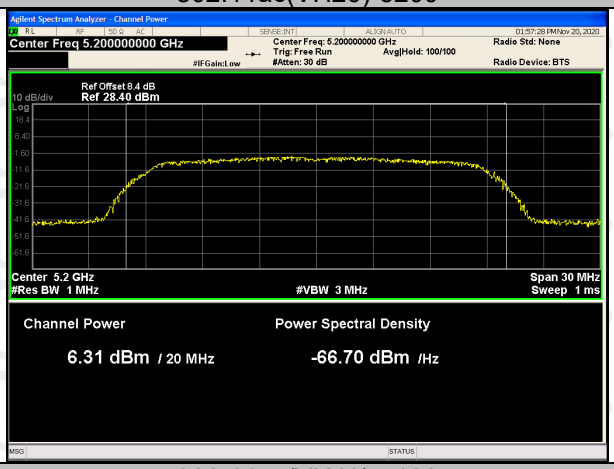

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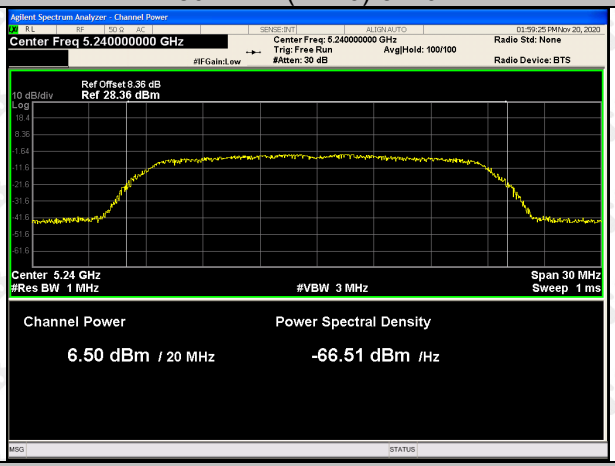

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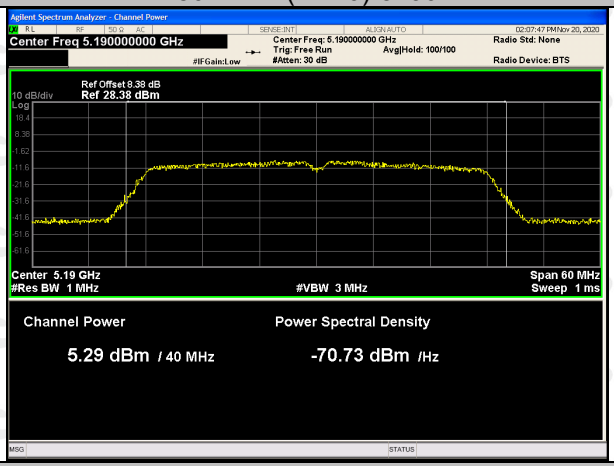

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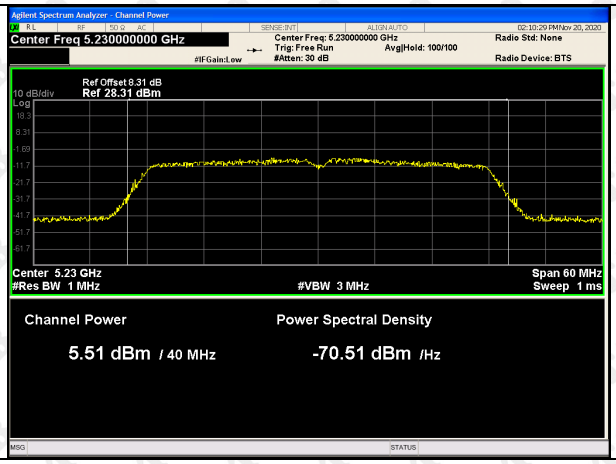
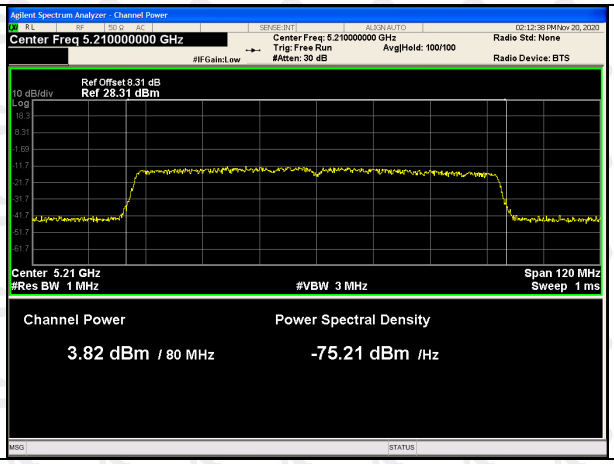
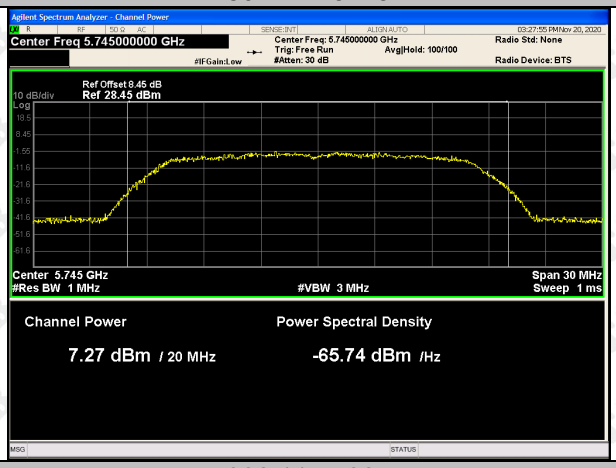
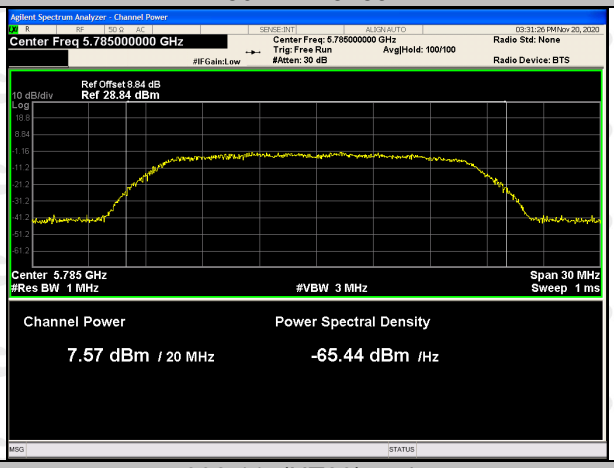




802.11a-5745 | 802.11a-5785





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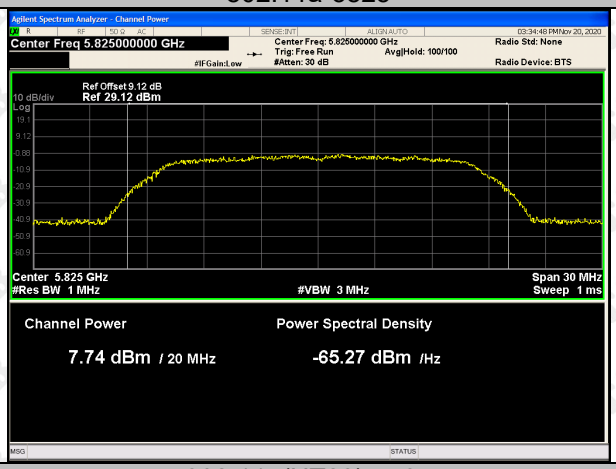

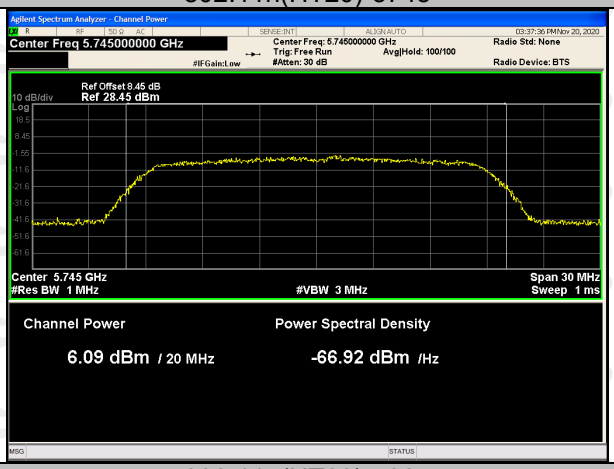

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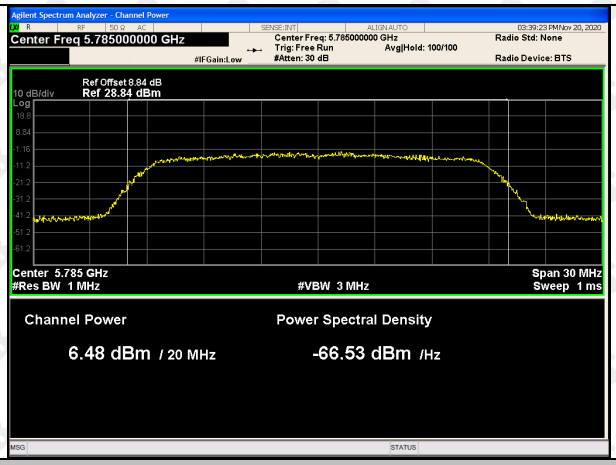

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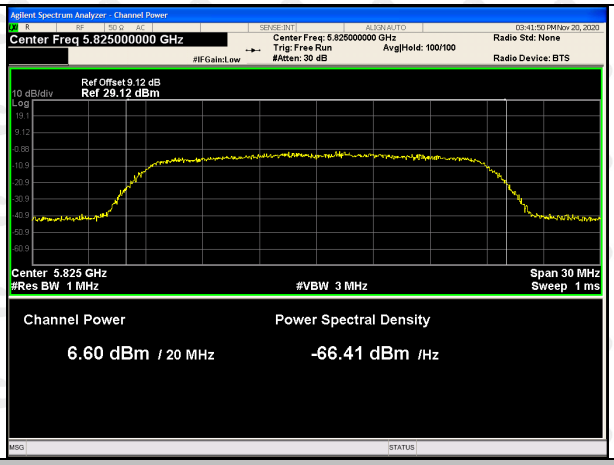

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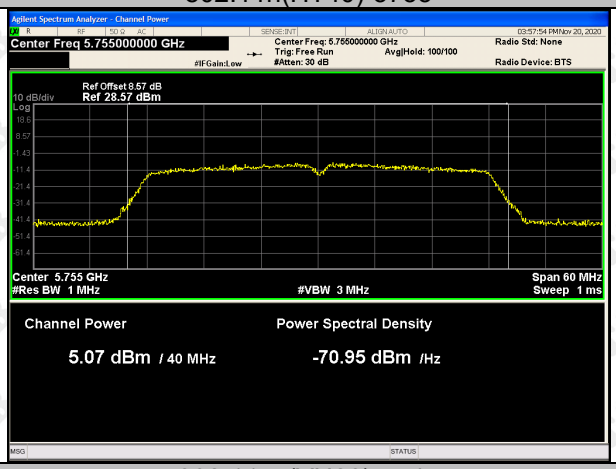

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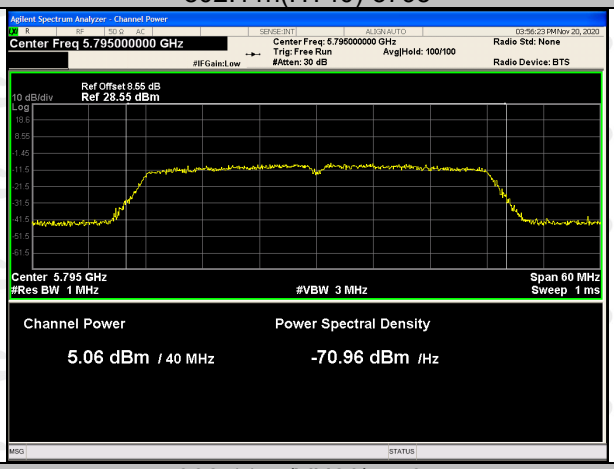

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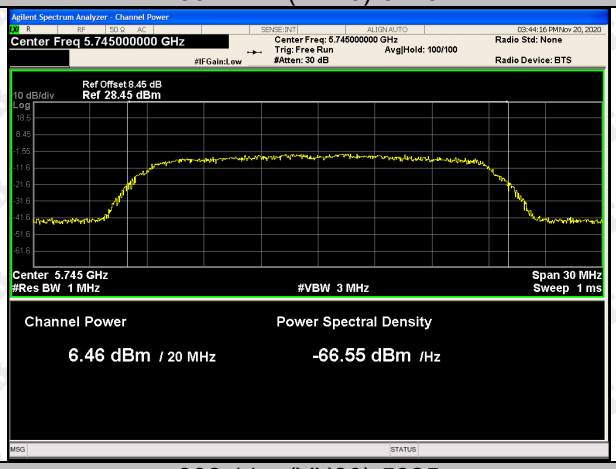

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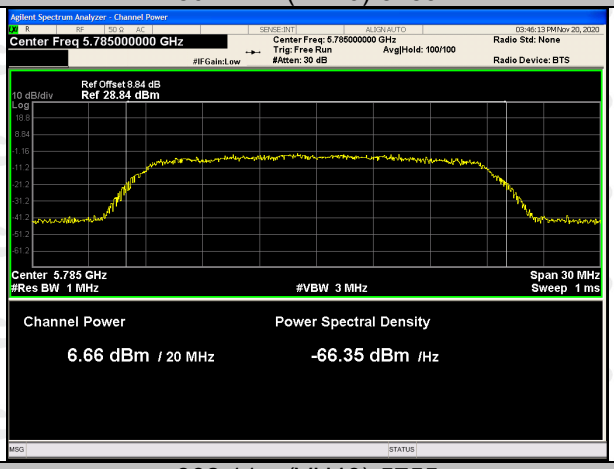

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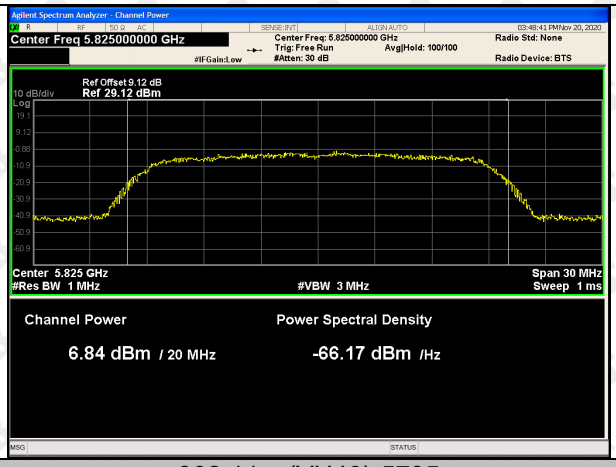

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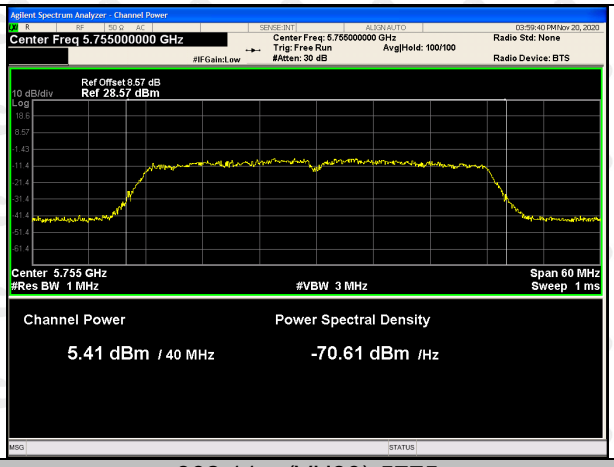

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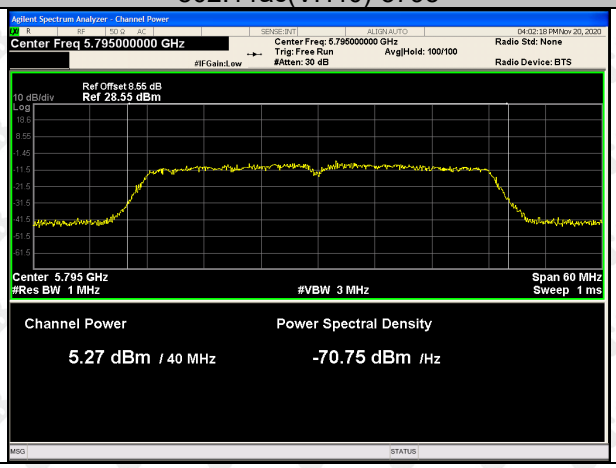
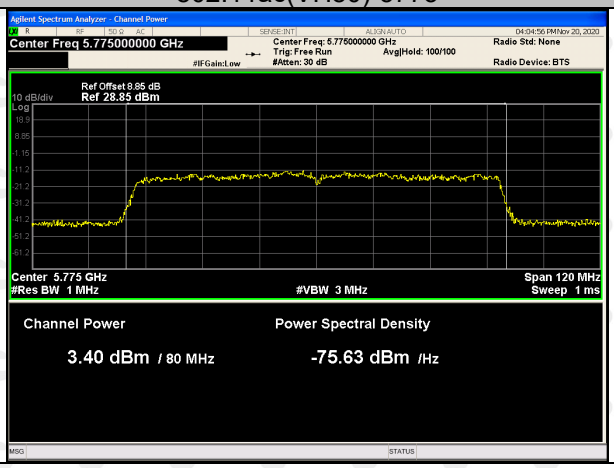
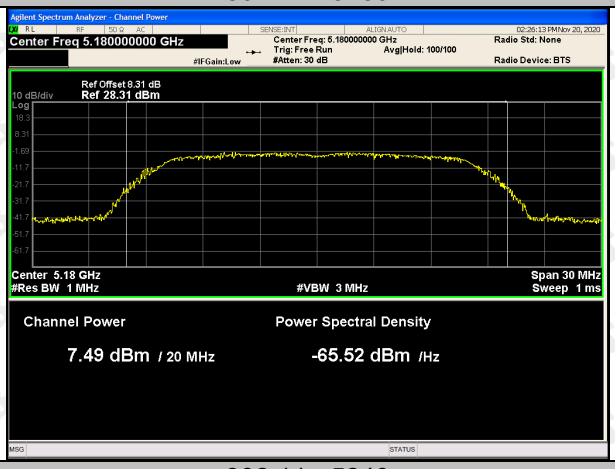




ANT 3

802.11a-5180



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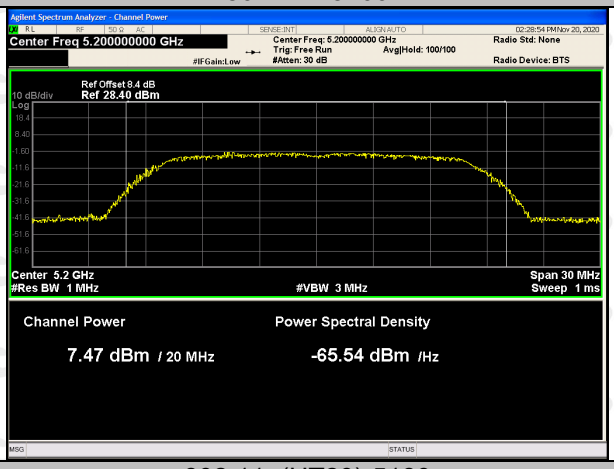

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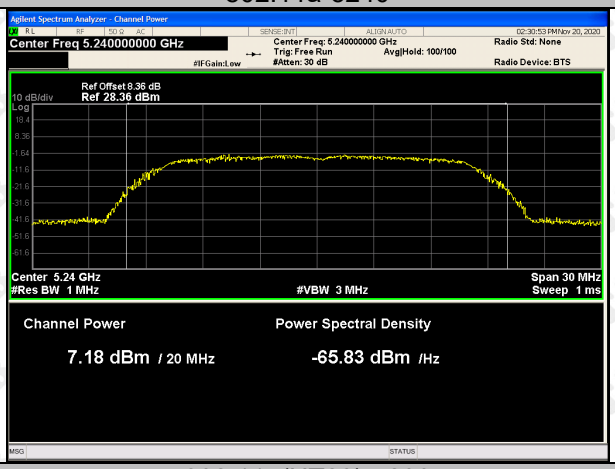

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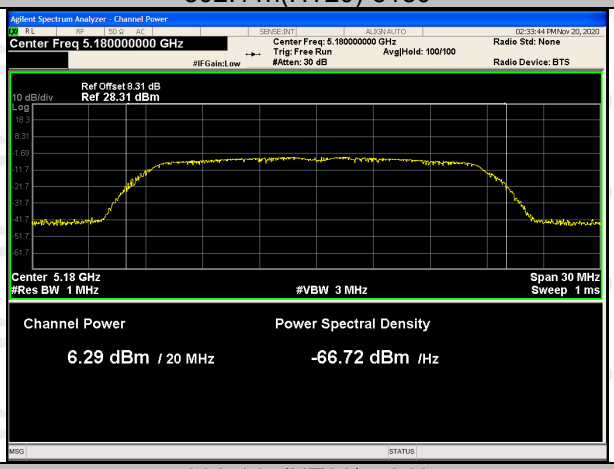

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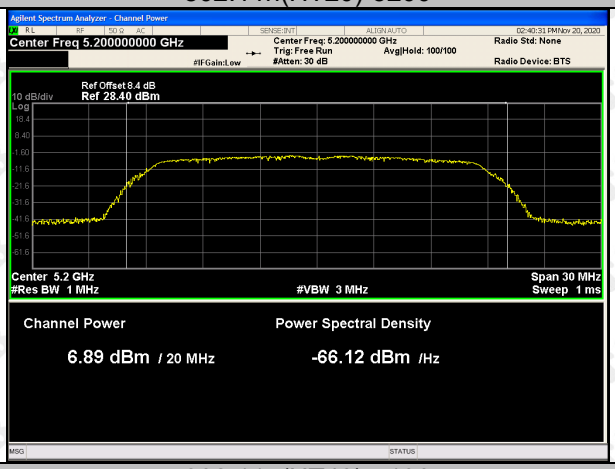

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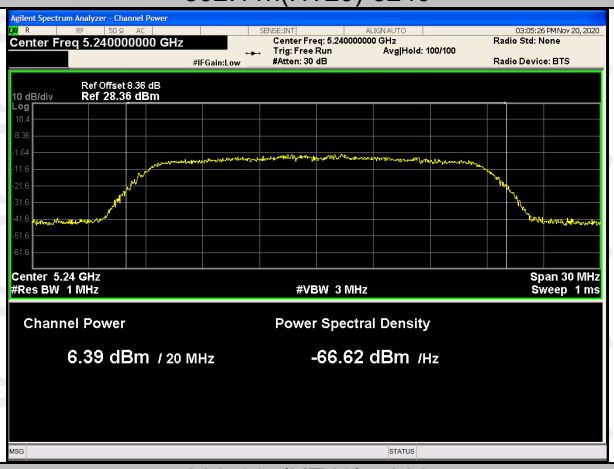

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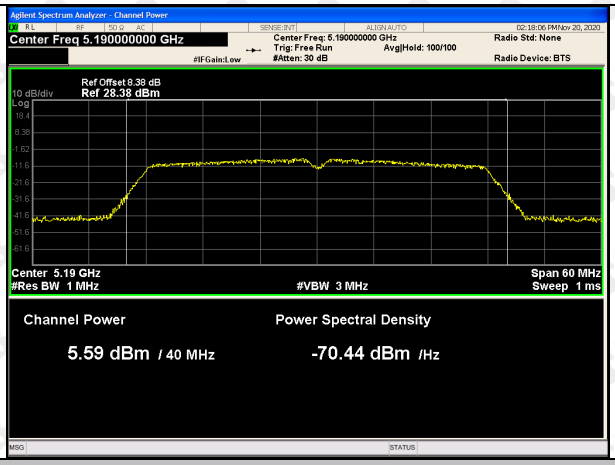
802.11n(HT40)-5230



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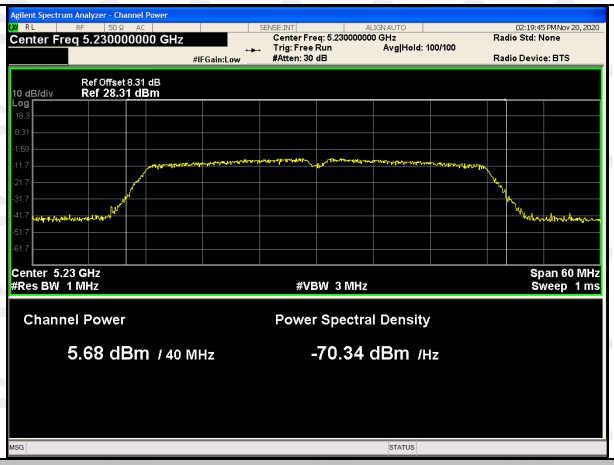

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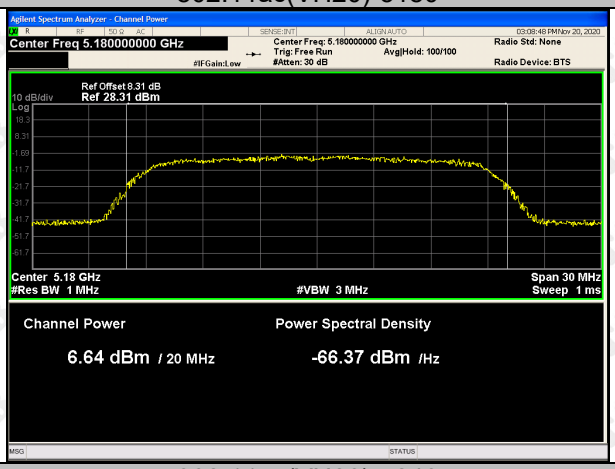

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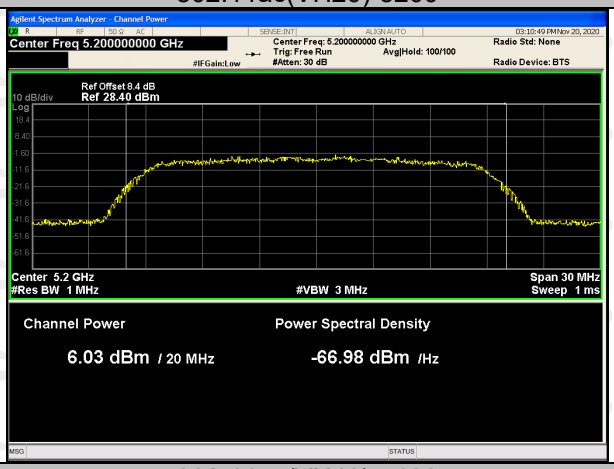

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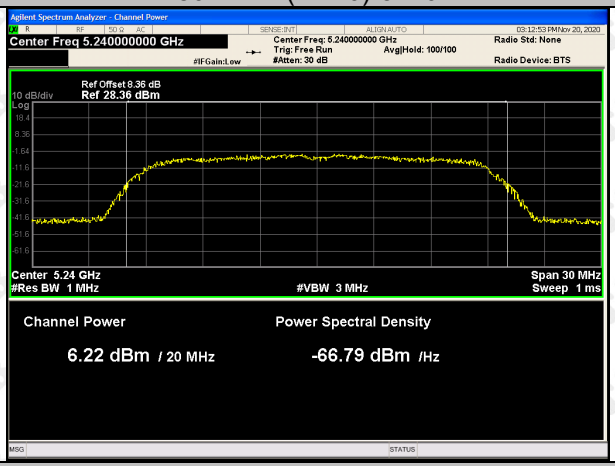

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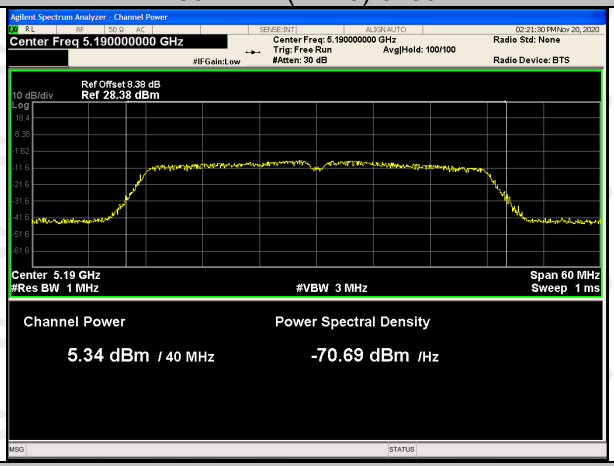

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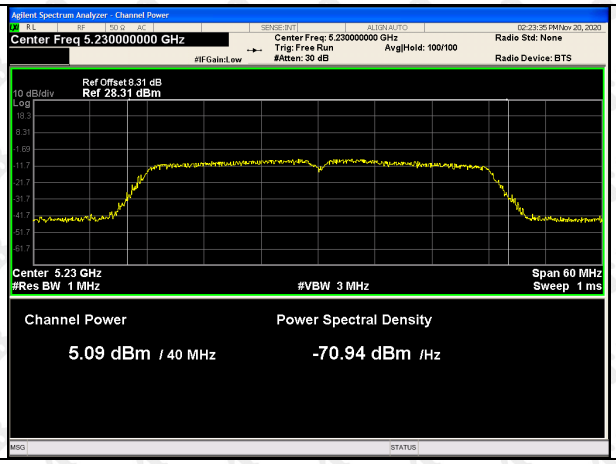

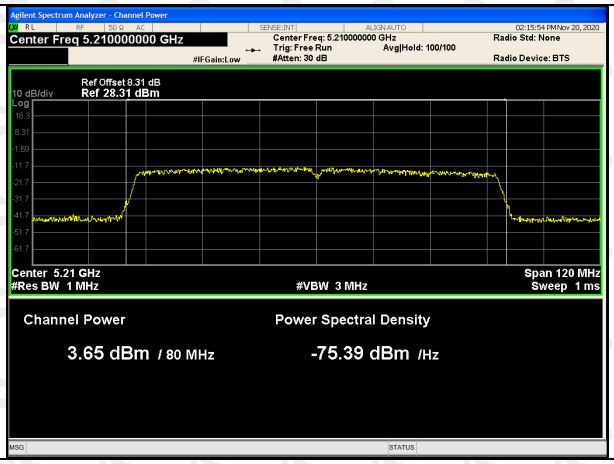

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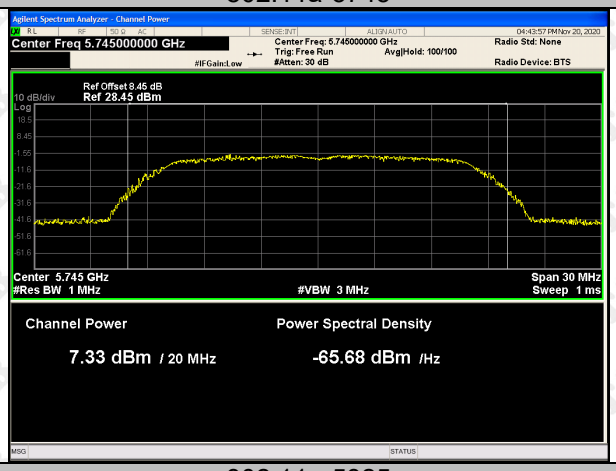

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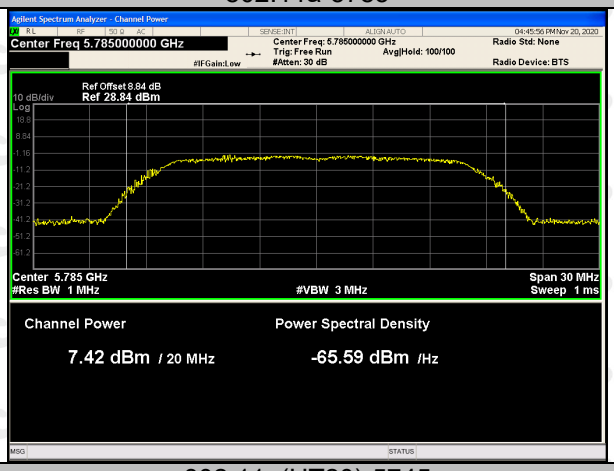

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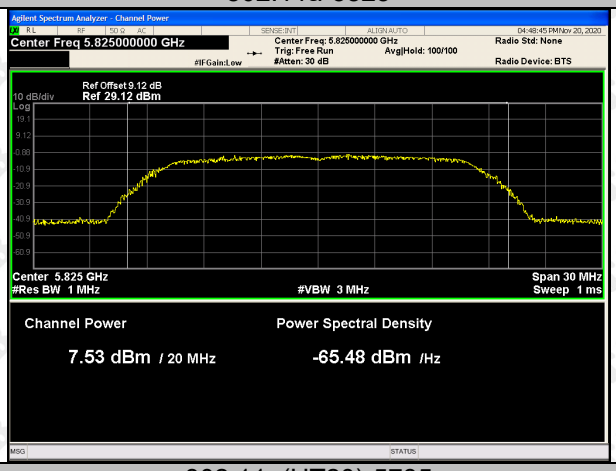

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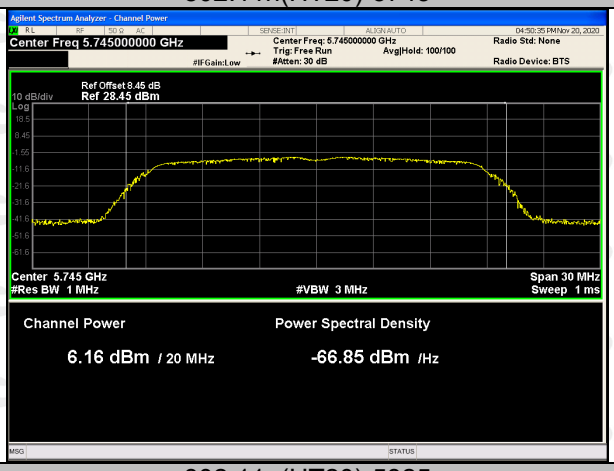

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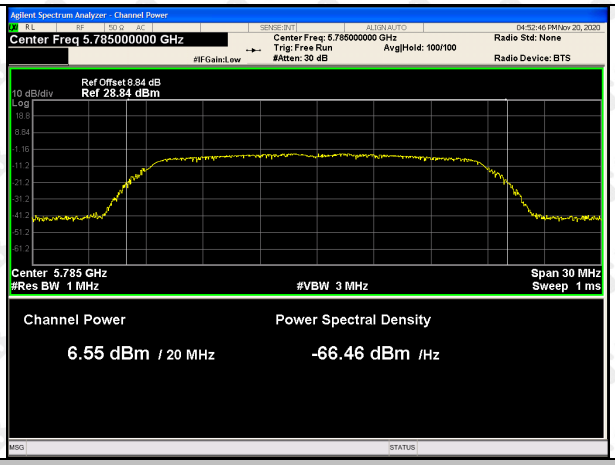

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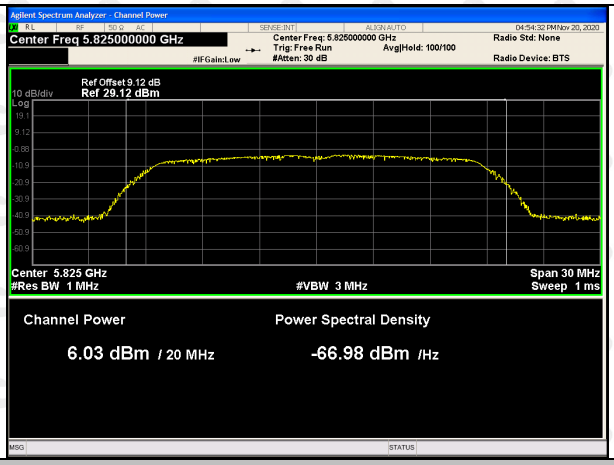

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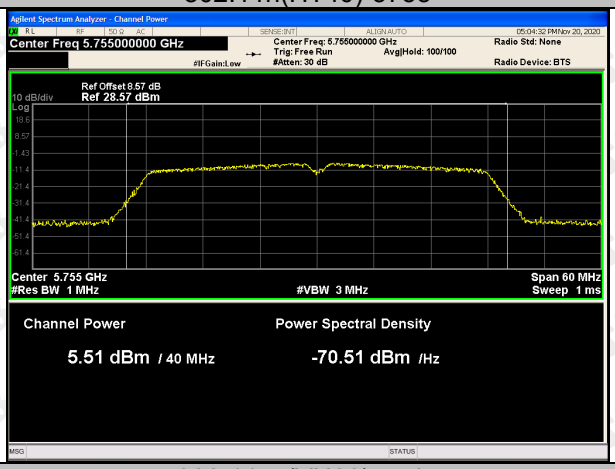

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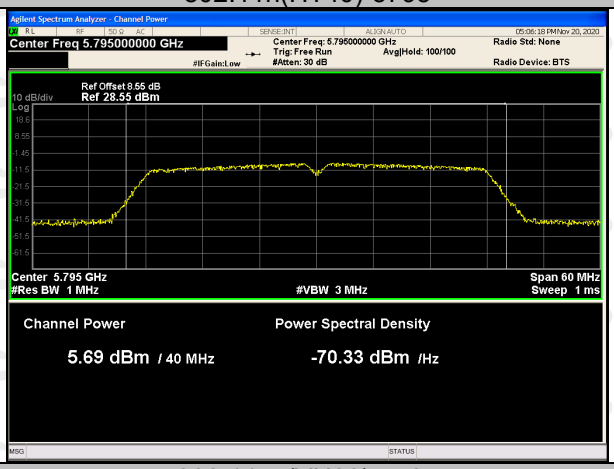

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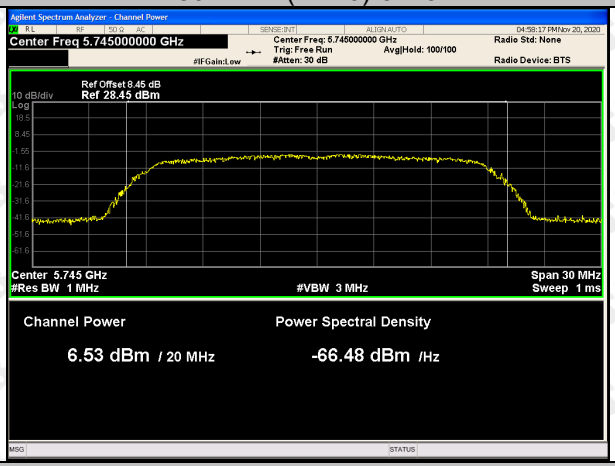

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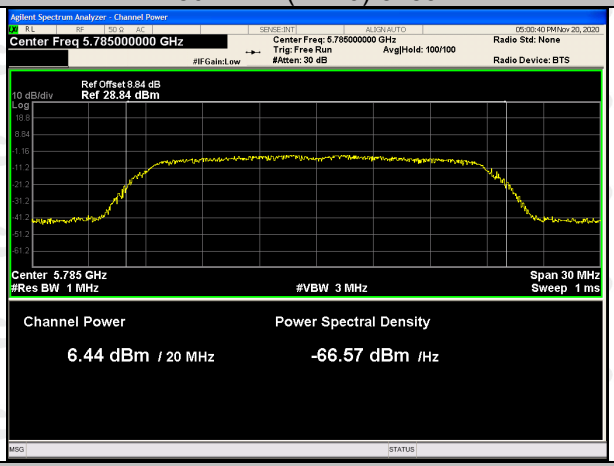

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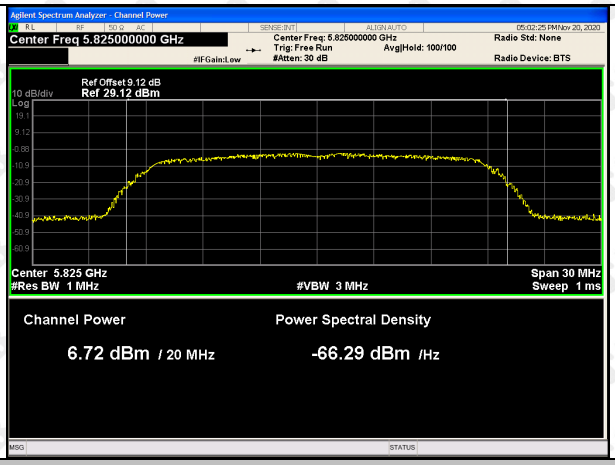

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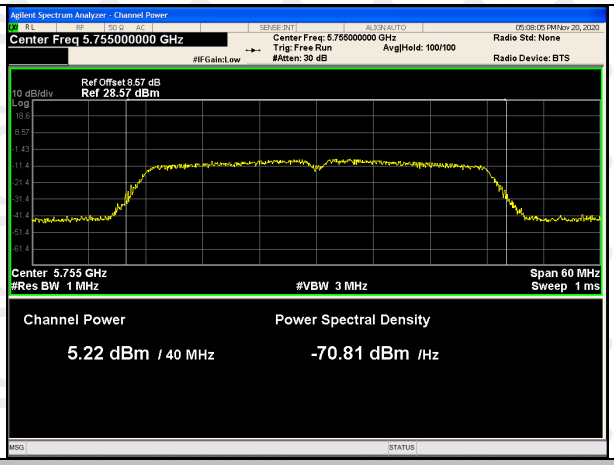

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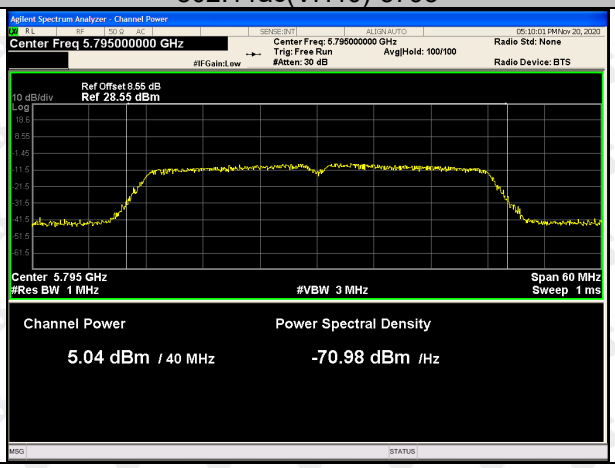
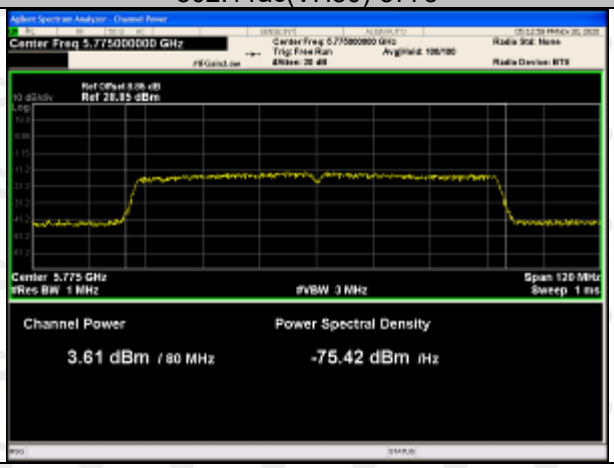
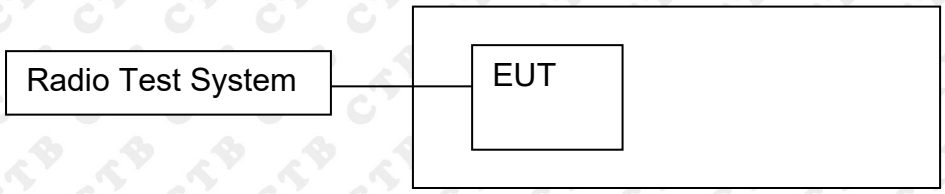




10. EMISSION BANDWIDTH& OCCUPIED BANDWIDTH

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

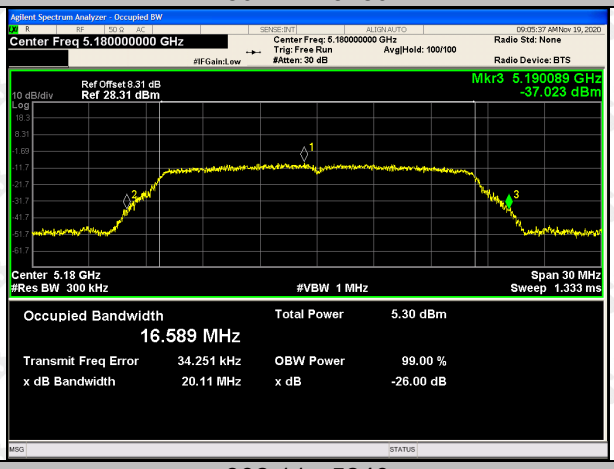
ANT 1

Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)	Limit (MHz)
802.11a	5180	20.109	≥0.5
	5200	19.954	≥0.5
	5240	20.069	≥0.5
802.11a20	5180	20.416	≥0.5
	5200	20.439	≥0.5
	5240	20.296	≥0.5
802.11a40	5190	39.646	≥0.5
	5230	39.617	≥0.5
802.11a80	5210	79.504	≥0.5
802.11n(HT20)	5180	20.569	≥0.5
	5200	20.382	≥0.5
	5240	20.286	≥0.5
802.11n(HT40)	5190	39.792	≥0.5
	5230	39.713	≥0.5

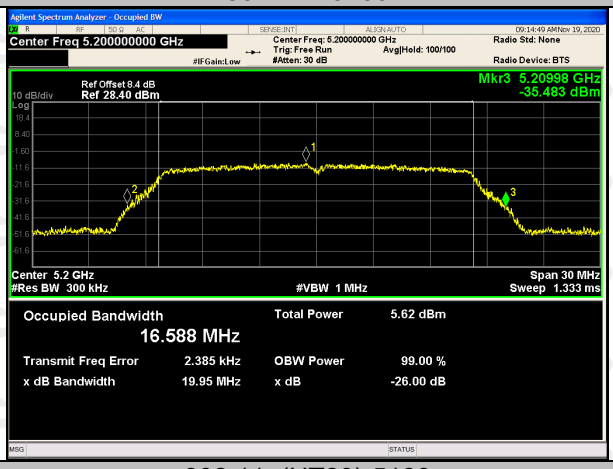
Test mode	Test Channel (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
802.11a	5745	16.127	≥0.5
	5785	16.184	≥0.5
	5825	16.143	≥0.5
802.11a20	5745	17.282	≥0.5
	5785	17.401	≥0.5
	5825	17.325	≥0.5
802.11a40	5755	35.433	≥0.5
	5795	35.804	≥0.5
802.11a80	5775	76.132	≥0.5
802.11n(HT20)	5745	17.258	≥0.5
	5785	17.544	≥0.5
	5825	17.192	≥0.5
802.11n(HT40)	5755	35.522	≥0.5
	5795	35.827	≥0.5

Test Graph1

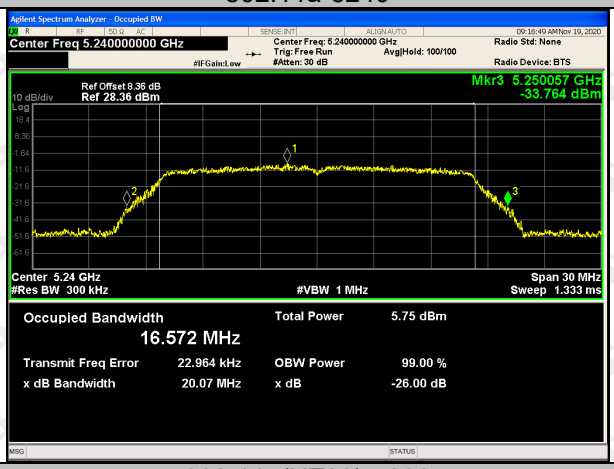
802.11a-5180



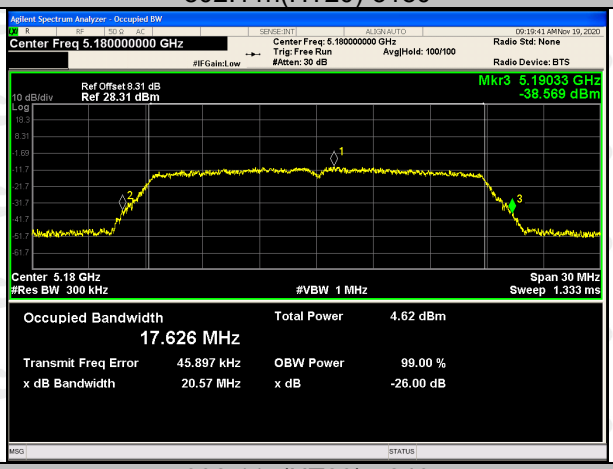
802.11a-5200



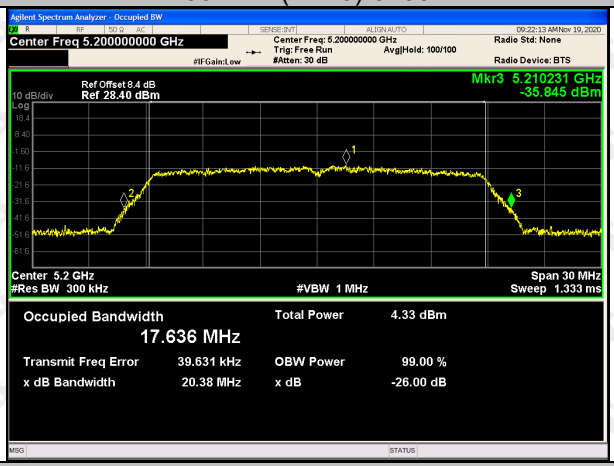
802.11a-5240



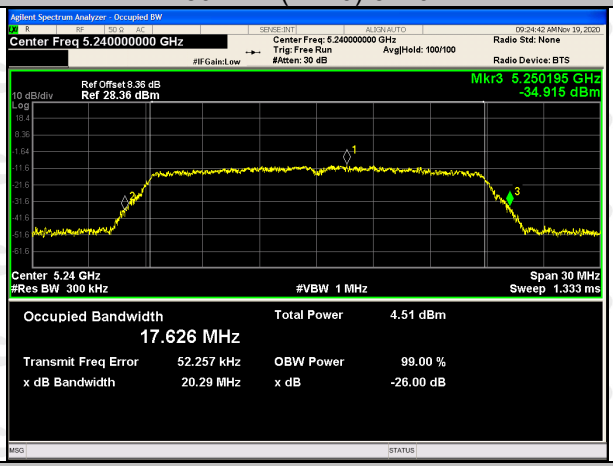
802.11n(HT20)-5180



802.11n(HT20)-5200

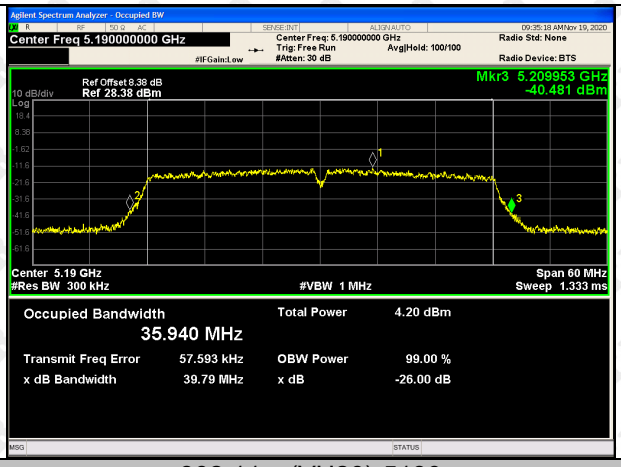


802.11n(HT20)-5240

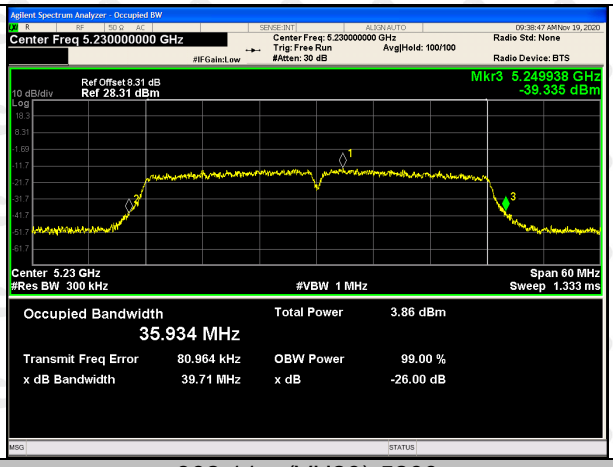


802.11n(HT40)-5190

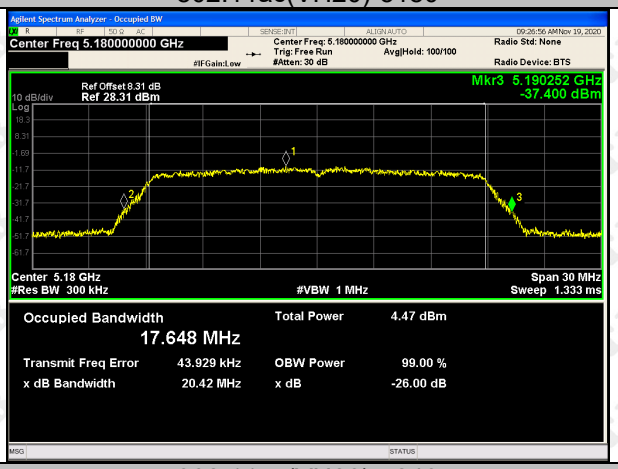
802.11n(HT40)-5230



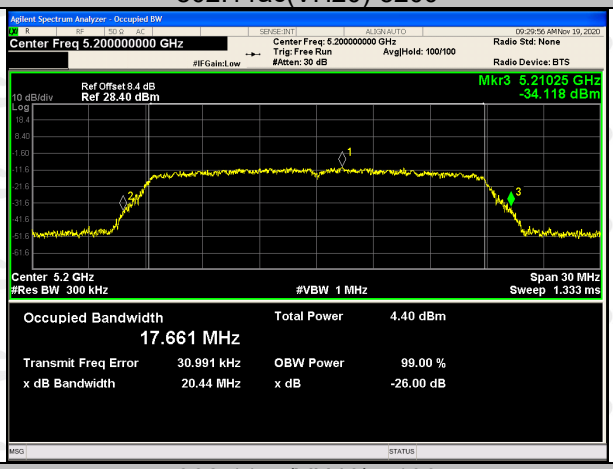
802.11ac(VH20)-5180



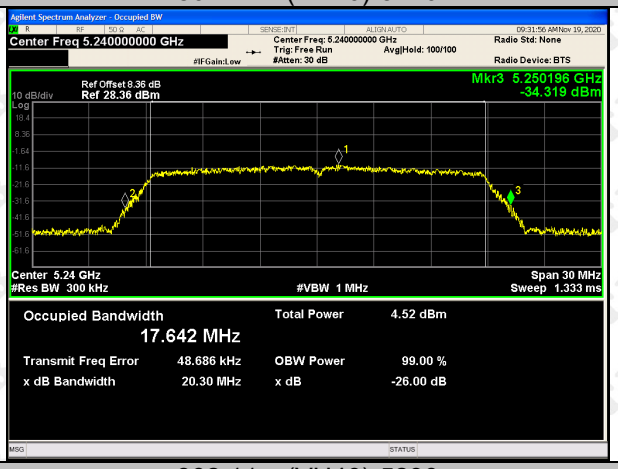
802.11ac(VH20)-5200



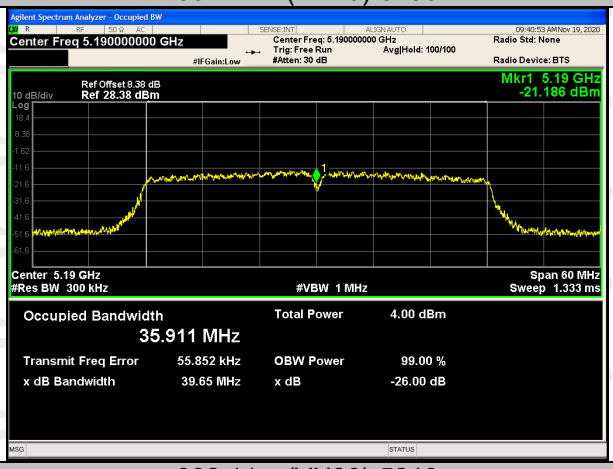
802.11ac(VH20)-5240



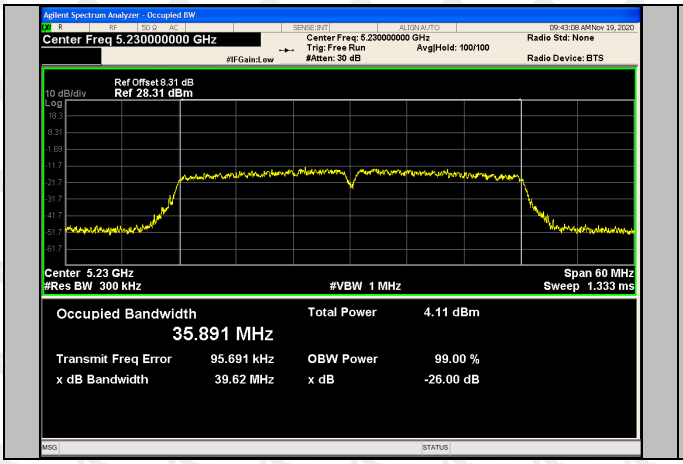
802.11ac(VH40)-5190

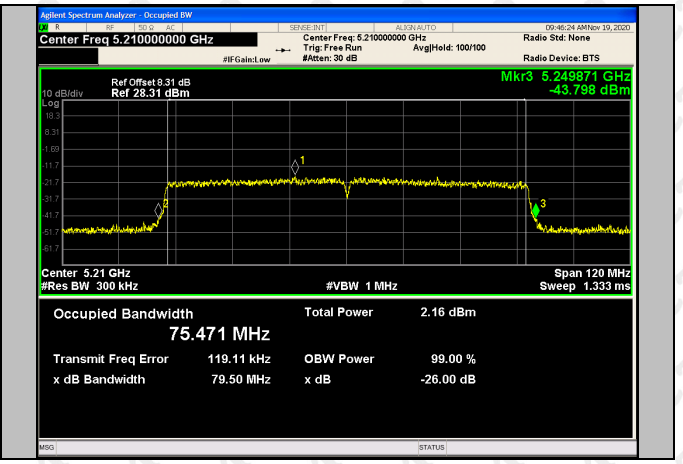


802.11ac(VH40)-5230



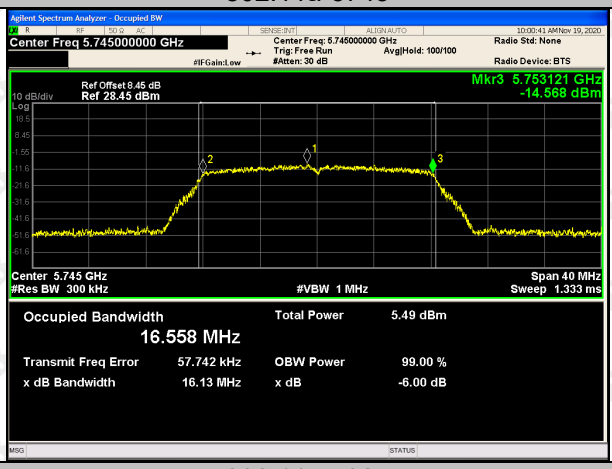
802.11ac(VH80)-5210



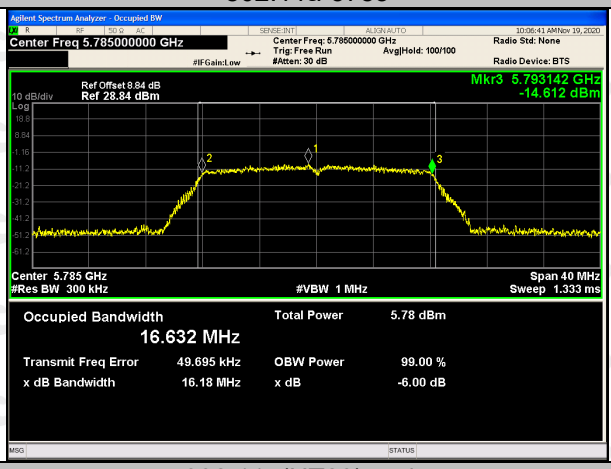


5725-5850MHz

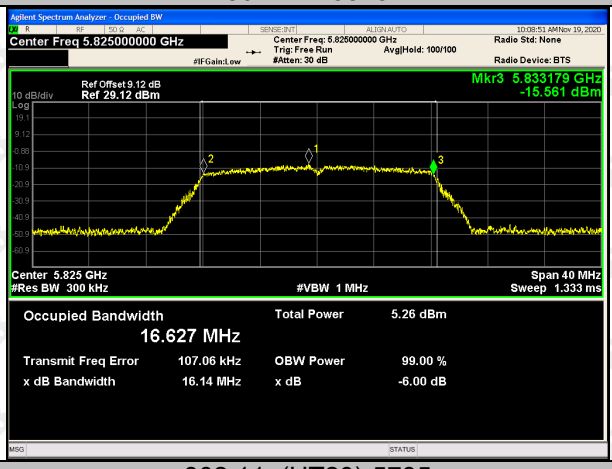
802.11a-5745



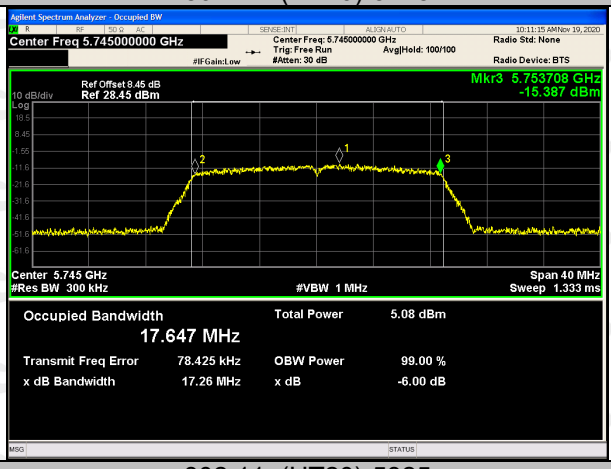
802.11a-5785



802.11a-5825

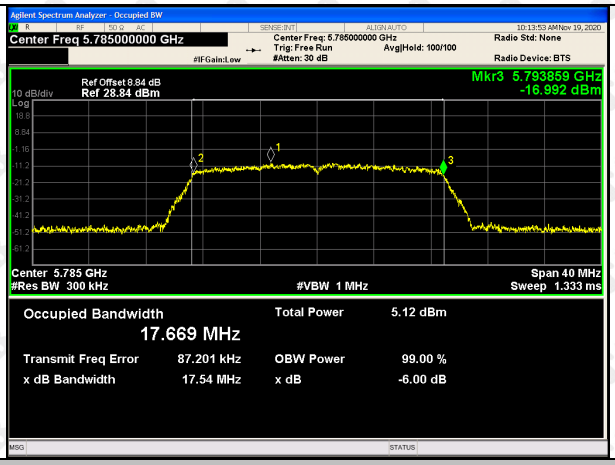


802.11n(HT20)-5745

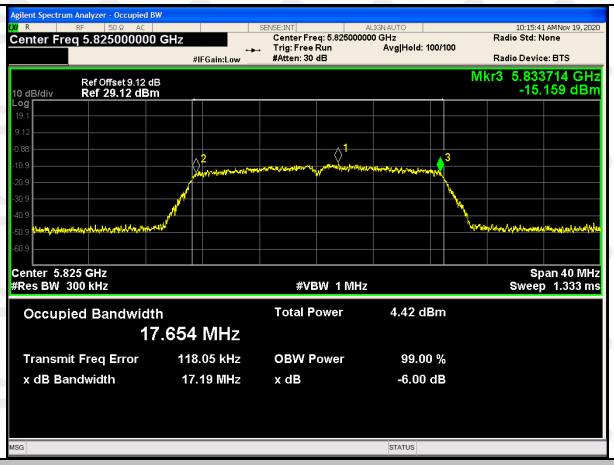


802.11n(HT20)-5785

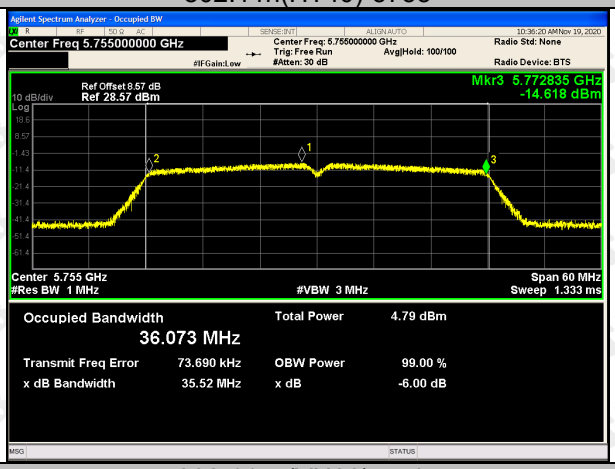
802.11n(HT20)-5825



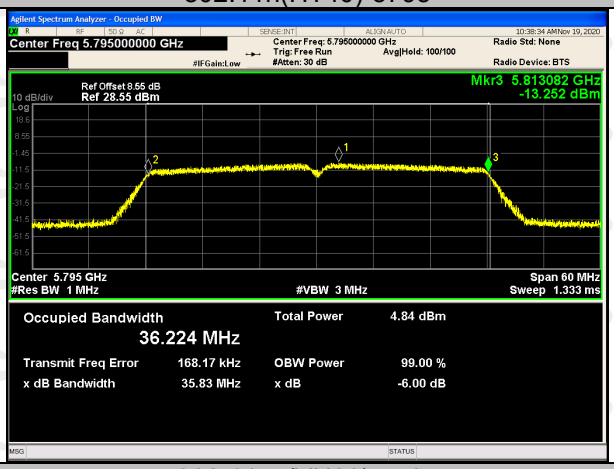
802.11n(HT40)-5755



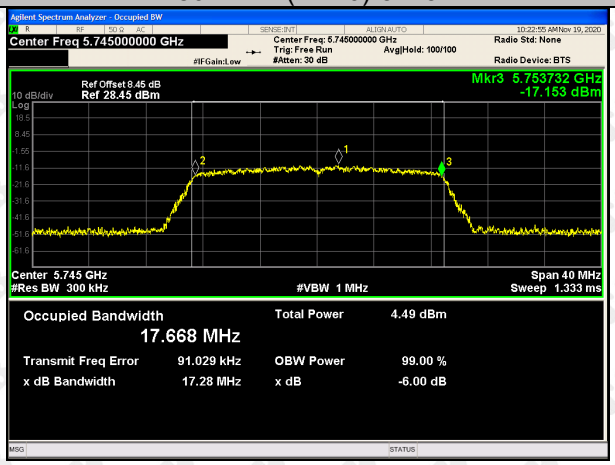
802.11n(HT40)-5795



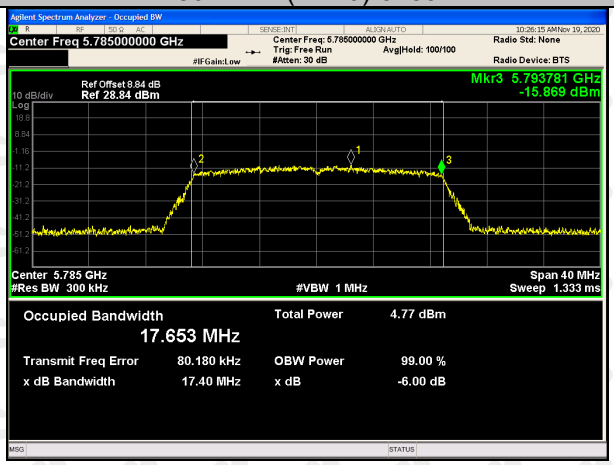
802.11ac(VH20)-5745



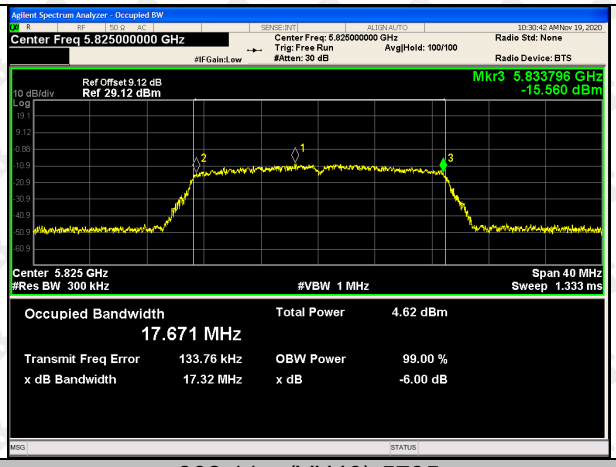
802.11ac(VH20)-5785



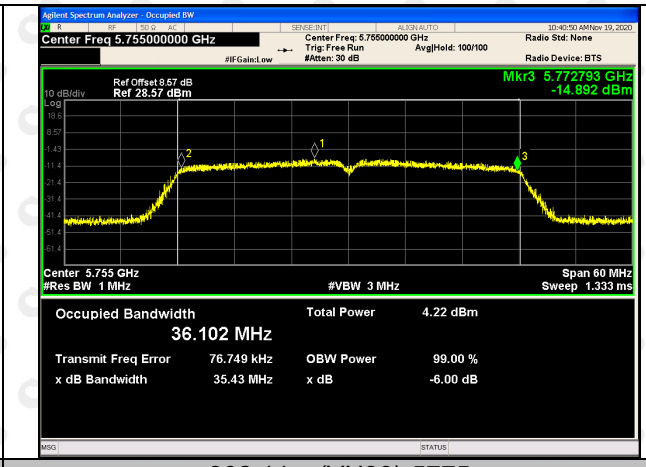
802.11ac(VH20)-5825



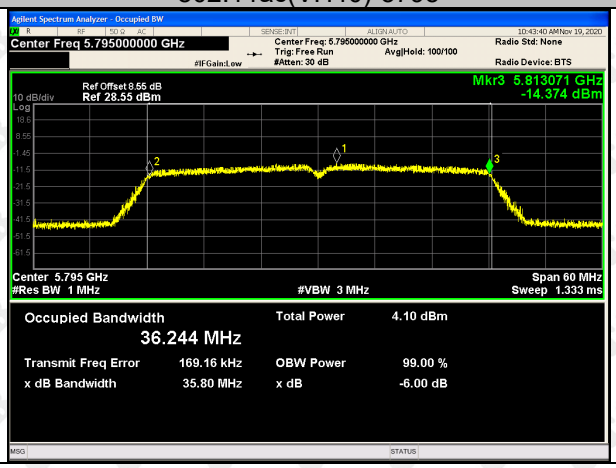
802.11ac(VH40)-5755

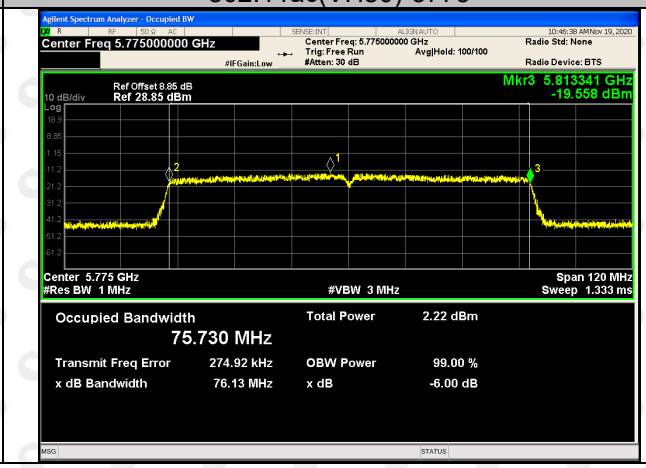


802.11ac(VH40)-5795



802.11ac(VH80)-5775

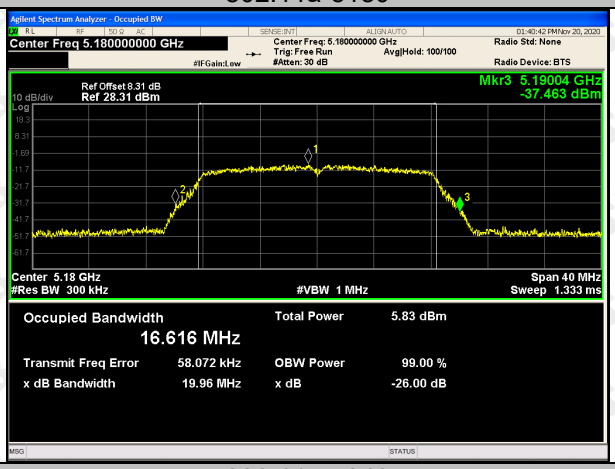




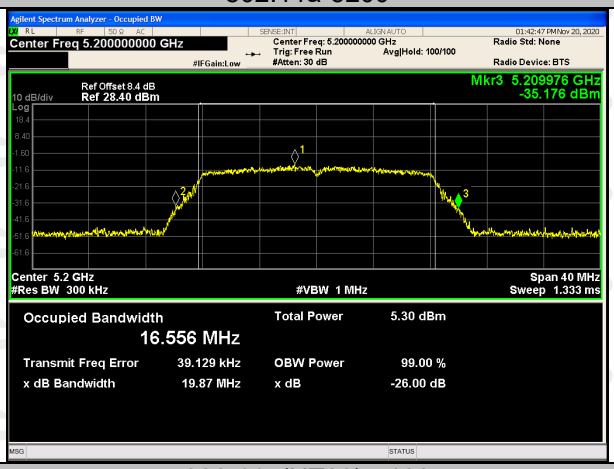
ANT 2	Test Channel (MHz)	26dB Bandwidth (MHz)	Limit (MHz)
802.11a	5180	19.964	≥0.5
	5200	19.873	≥0.5
	5240	19.819	≥0.5
802.11a20	5180	20.348	≥0.5
	5200	20.206	≥0.5
	5240	20.321	≥0.5
802.11a40	5190	41.51	≥0.5
	5230	41.412	≥0.5
802.11a80	5210	81.33	≥0.5
802.11n(HT20)	5180	20.229	≥0.5
	5200	20.434	≥0.5
	5240	20.46	≥0.5
802.11n(HT40)	5190	41.229	≥0.5
	5230	41.247	≥0.5

ANT 2	Test Channel (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
802.11a	5745	16.022	≥0.5
	5785	16.325	≥0.5
	5825	16.29	≥0.5
802.11a20	5745	16.596	≥0.5
	5785	17.585	≥0.5
	5825	17.134	≥0.5
802.11a40	5755	35.648	≥0.5
	5795	35.91	≥0.5
802.11a80	5775	76.208	≥0.5
802.11n(HT20)	5745	16.373	≥0.5
	5785	16.898	≥0.5
	5825	16.81	≥0.5
802.11n(HT40)	5755	35.732	≥0.5
	5795	35.449	≥0.5

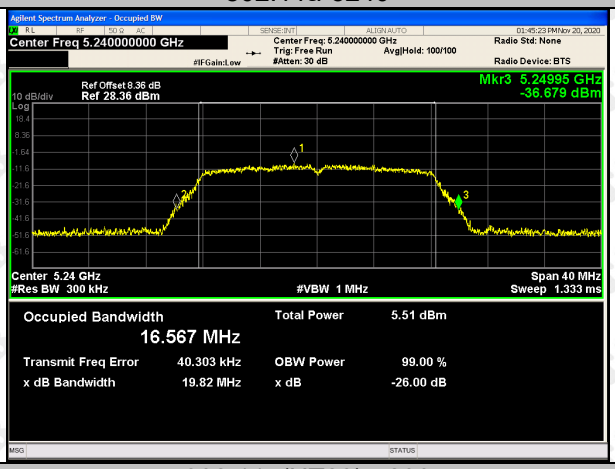
802.11a-5180



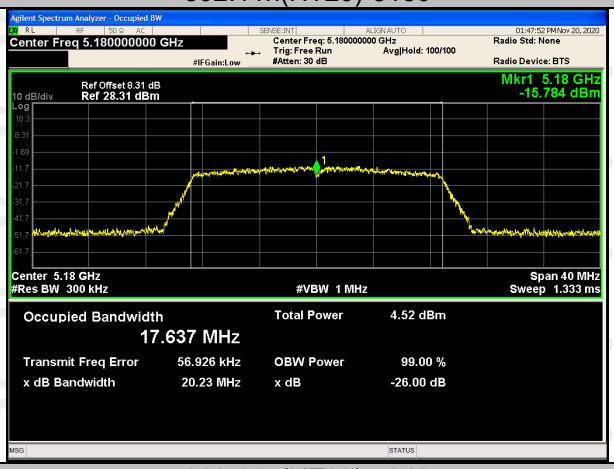
802.11a-5200



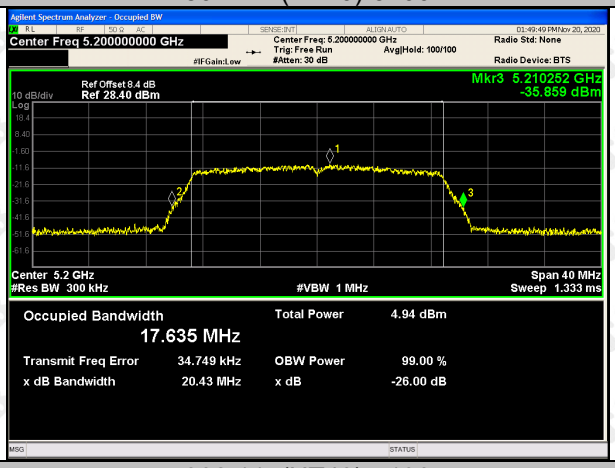
802.11a-5240



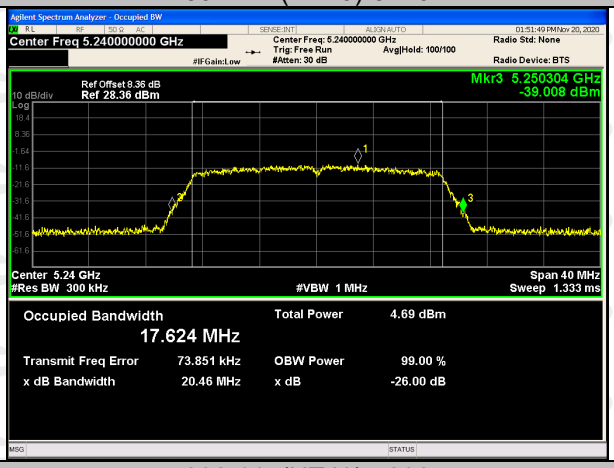
802.11n(HT20)-5180



802.11n(HT20)-5200

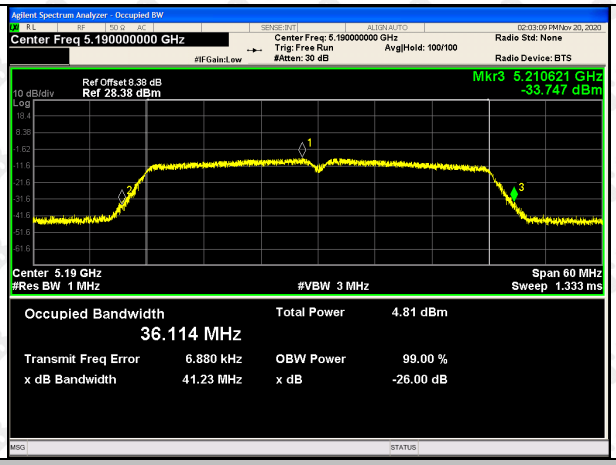


802.11n(HT20)-5240

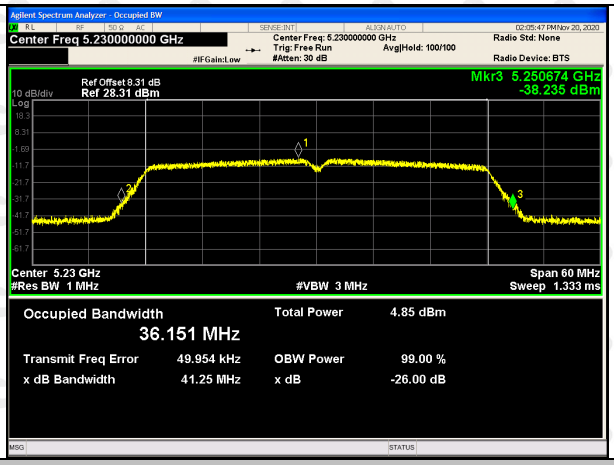


802.11n(HT40)-5190

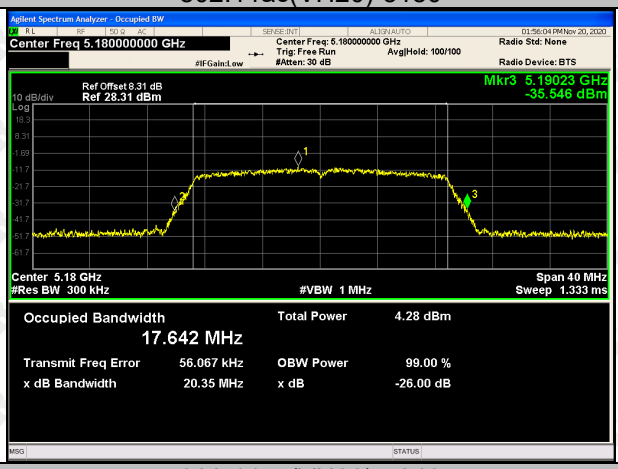
802.11n(HT40)-5230



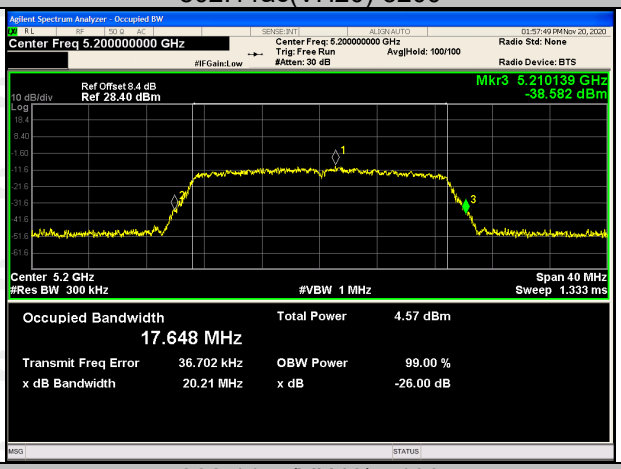
802.11ac(VH20)-5180



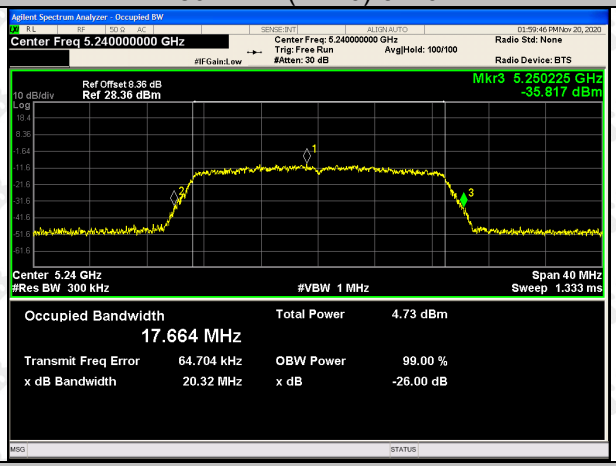
802.11ac(VH20)-5200



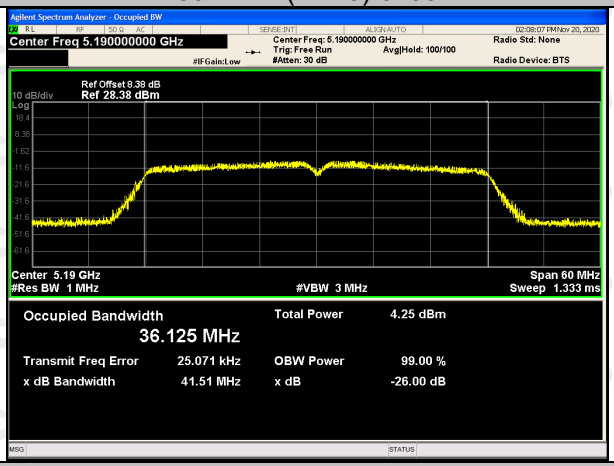
802.11ac(VH20)-5240



802.11ac(VH40)-5190



802.11ac(VH40)-5230



802.11ac(VH80)-5210