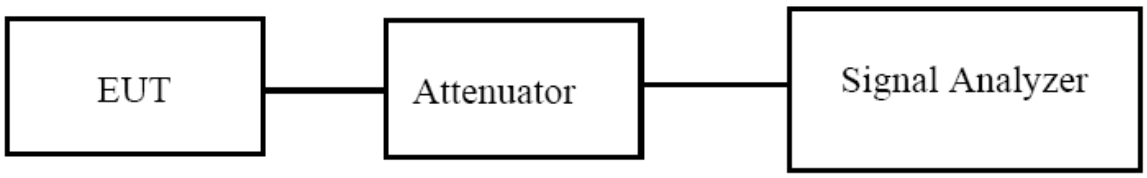
9. 26DB & 6DB & 99% EMISSION BANDWIDTH

9.1 Block Diagram Of Test Setup



9.2 Limit

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.

9.3 Test procedure

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%.
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.

9.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

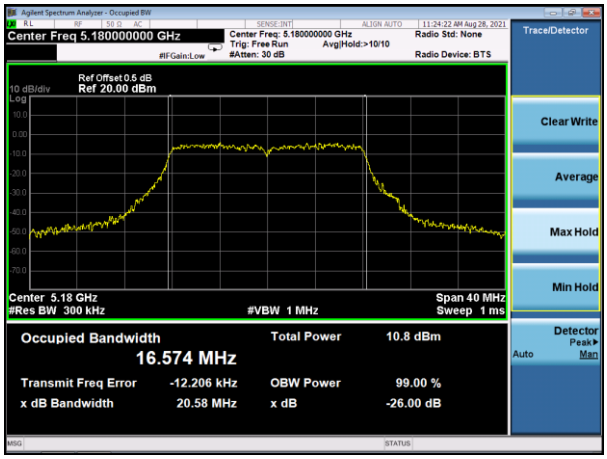
9.5 Test Result

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	DC 3.8V
Test Mode ：	TX Frequency U-NII-1 (5180-5240MHz)		

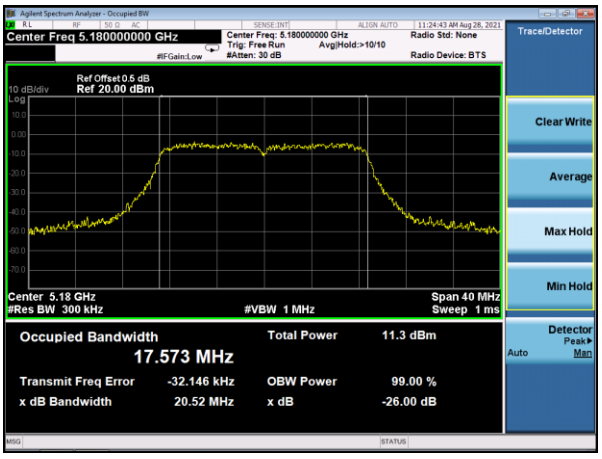
Mode	Channel	Frequency (MHz)	99% bandwidth(MHz)	26dB bandwidth(MHz)	Result
802.11a	CH36	5180	16.57	20.58	Pass
	CH40	5200	16.57	20.27	Pass
	CH48	5240	16.61	20.21	Pass
802.11 n20	CH36	5180	17.57	20.52	Pass
	CH40	5200	17.58	20.41	Pass
	CH48	5240	17.60	20.66	Pass
802.11 n40	CH 38	5190	36.79	44.06	Pass
	CH 46	5230	36.69	44.01	Pass
802.11 AC20	CH36	5180	17.58	20.93	Pass
	CH40	5200	17.59	20.81	Pass
	CH48	5240	17.60	20.60	Pass
802.11 AC40	CH 38	5190	36.68	43.61	Pass
	CH 46	5230	36.98	44.01	Pass
802.11 AC80	CH 42	5210	75.17	82.87	Pass

Test plot

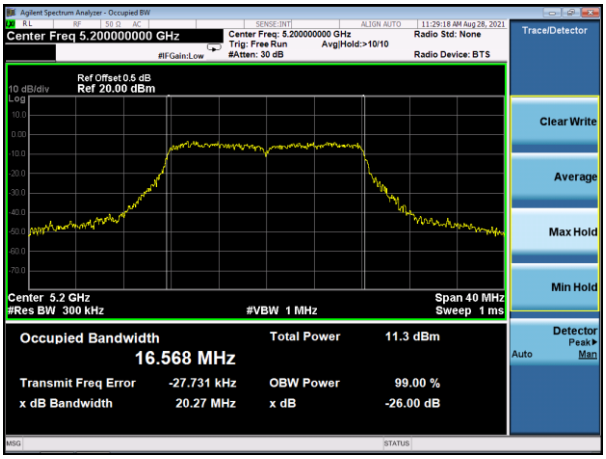
(802.11a) 26dB&99%Bandwidth plot on channel 36



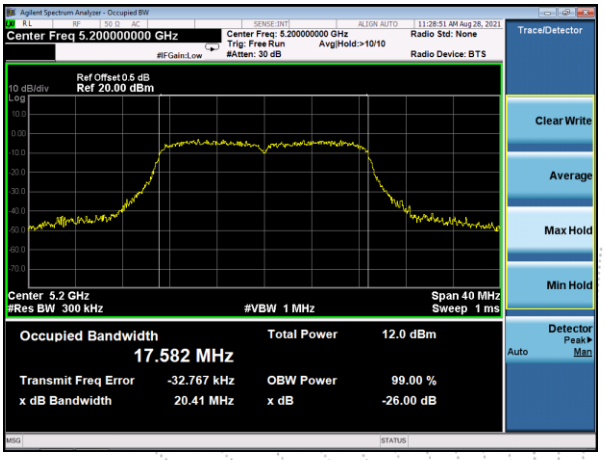
(802.11 n20) 26dB&99%Bandwidth plot on channel 36



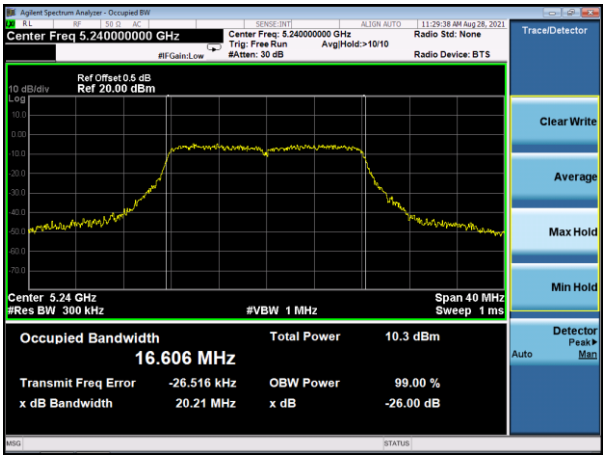
(802.11a) 26dB&99%Bandwidth plot on channel 40



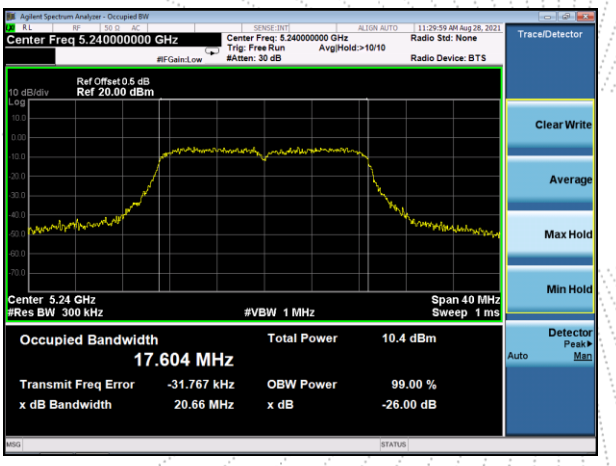
(802.11 n20) 26dB&99%Bandwidth plot on channel 40



(802.11a) 26dB&99%Bandwidth plot on channel 48



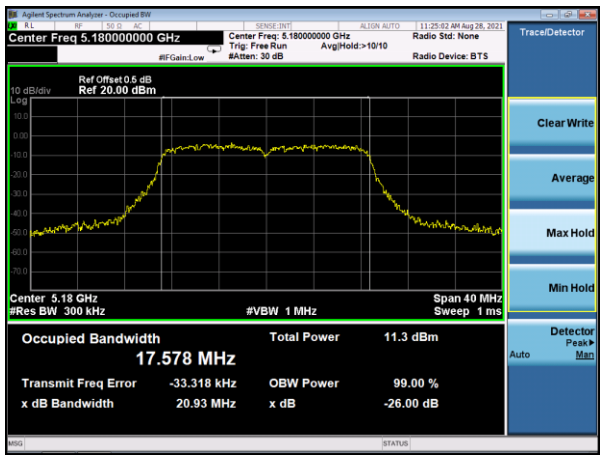
(802.11 n20) 26dB&99%Bandwidth plot on channel 48



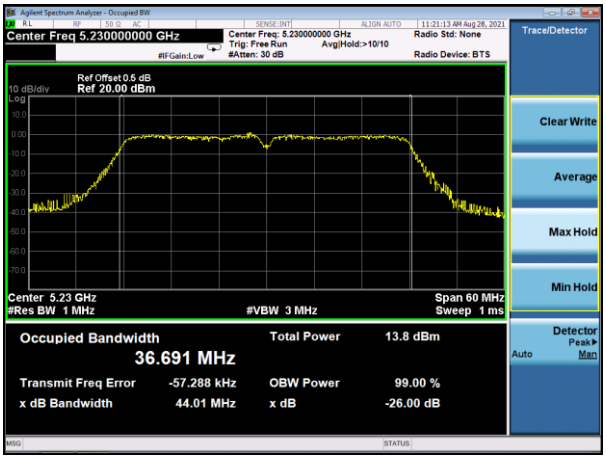
Test plot

(802.11 n40) 26dB&99%Bandwidth plot on channel 38

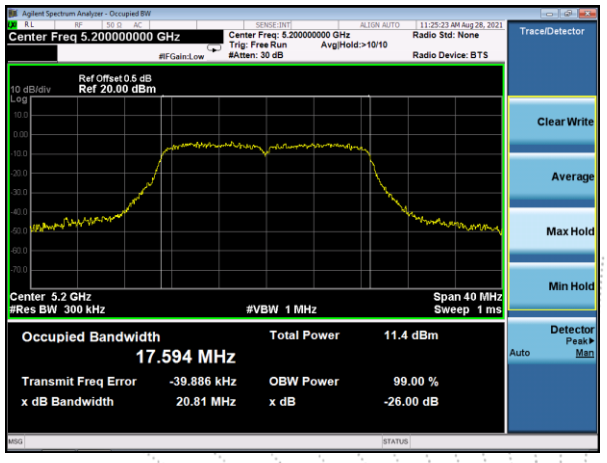
(802.11 AC20) -26dB&99%Bandwidth plot on channel 36



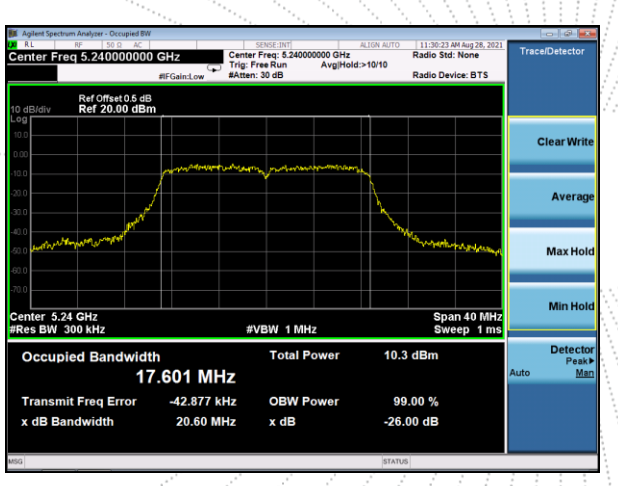
(802.11 n40) 26dB&99%Bandwidth plot on channel 46



(802.11 AC20) -26dB&99%Bandwidth plot on channel 40

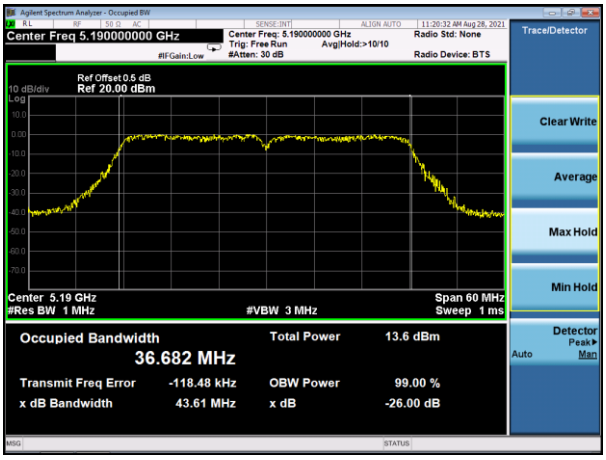


(802.11 AC20) -26dB&99%Bandwidth plot on channel 48

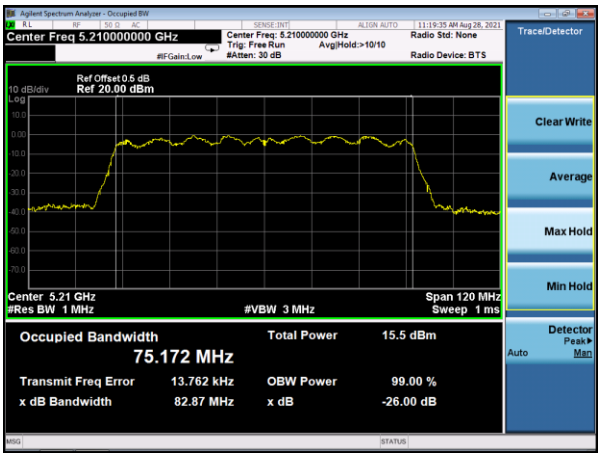


Test plot

(802.11 AC40) -26dB&99%Bandwidth plot on channel 38



(802.11 AC80) -26dB&99%Bandwidth plot on channel 42



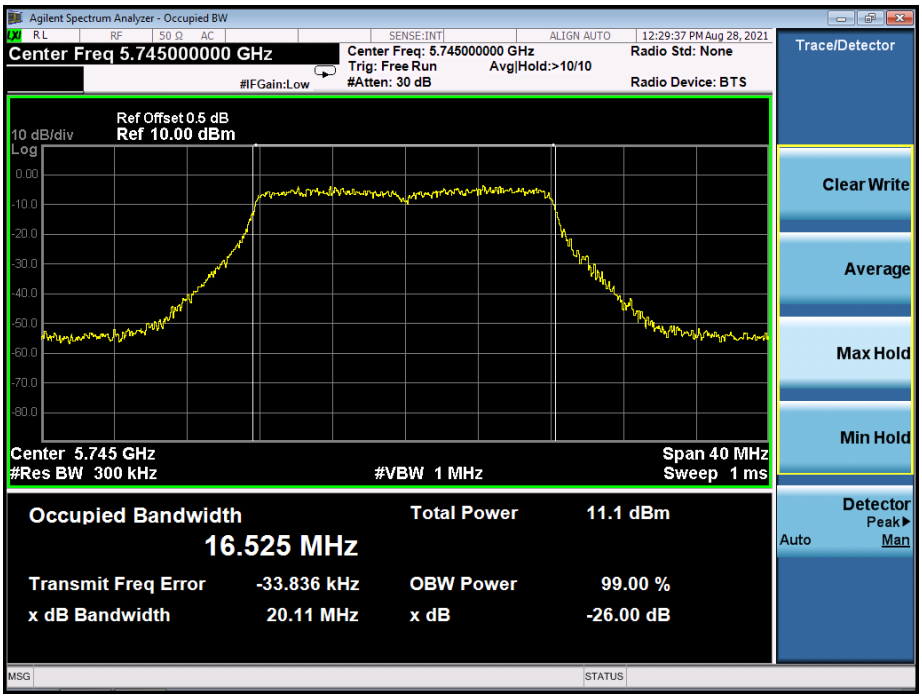
(802.11 AC40) -26dB&99%Bandwidth plot on channel 46

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX Frequency U-NII-3(5745-5825MHz)		

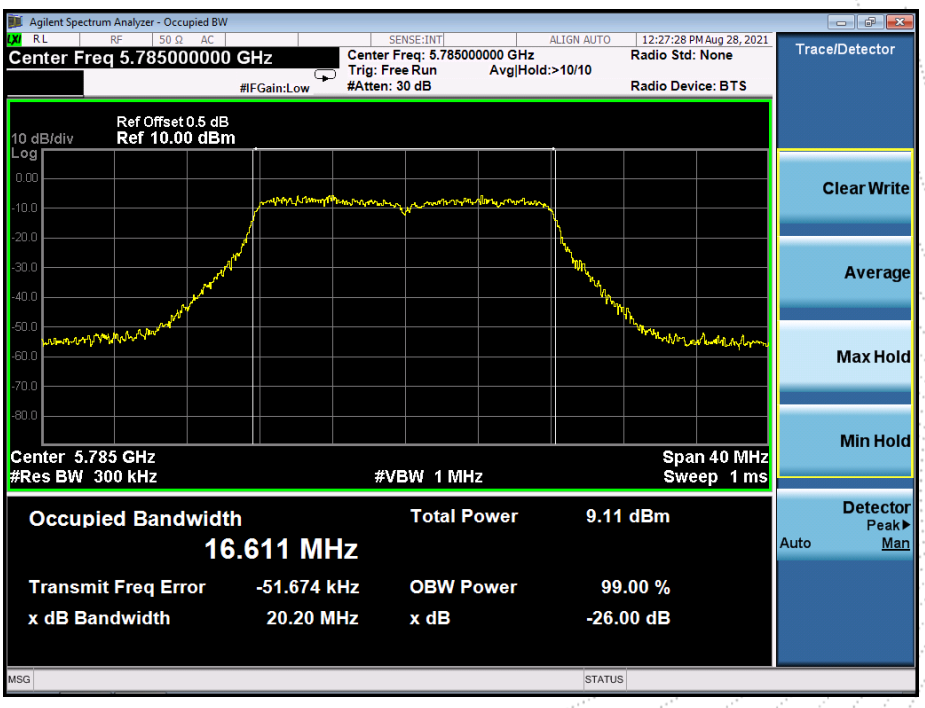
Mode	Channel	Frequency (MHz)	99% bandwidth(MHz)	6dB bandwidth(MHz)	Result
802.11a	CH149	5745	16.53	16.11	Pass
	CH157	5785	16.11	16.38	Pass
	CH165	5825	16.56	16.11	Pass
802.11 n20	CH149	5745	17.57	16.75	Pass
	CH157	5785	17.55	16.79	Pass
	CH165	5825	17.61	16.06	Pass
802.11 n40	CH151	5755	36.55	35.53	Pass
	CH159	5795	36.92	35.56	Pass
802.11 AC20	CH149	5745	17.60	16.09	Pass
	CH157	5785	17.61	16.33	Pass
	CH165	5825	17.61	16.86	Pass
802.11 AC40	CH151	5755	36.60	35.35	Pass
	CH159	5795	36.71	35.76	Pass
802.11 AC80	CH155	5775	75.19	75.10	Pass

Test plot

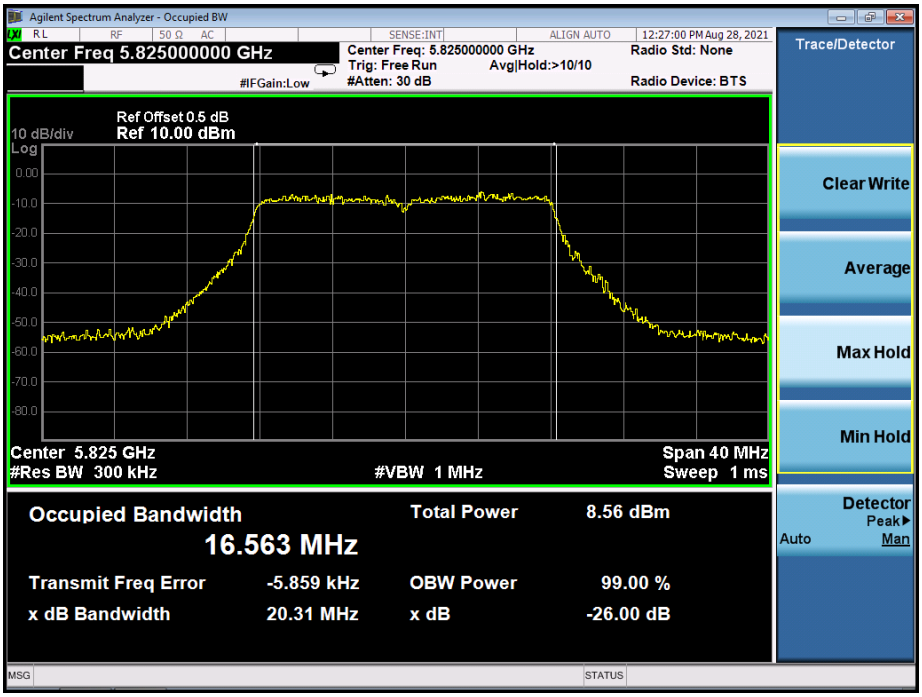
802.11a 5745MHz 99% bandwidth



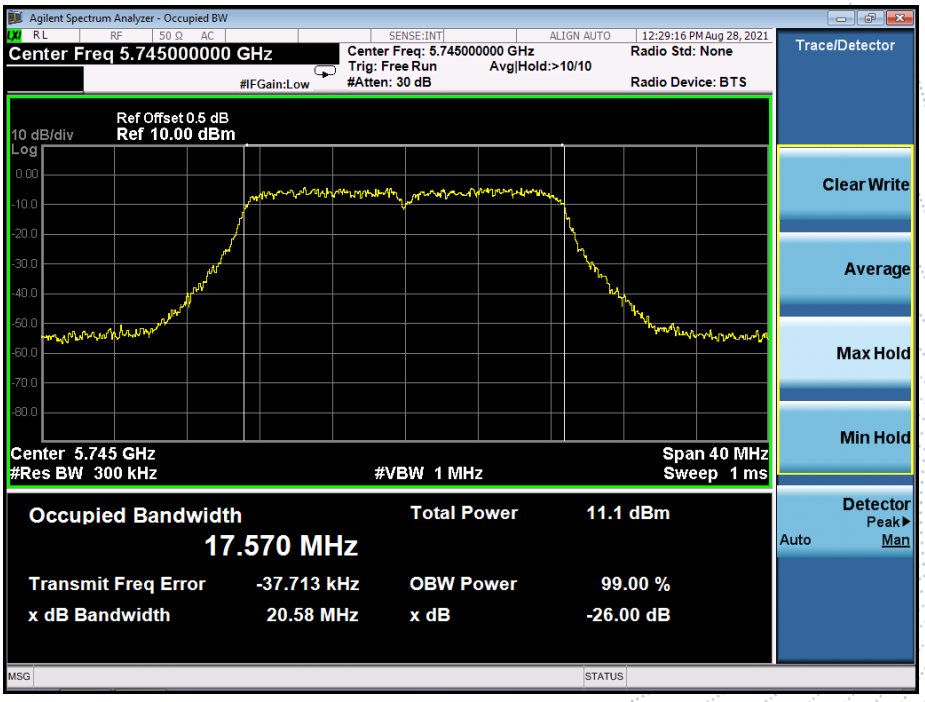
802.11a 5785MHz 99% bandwidth



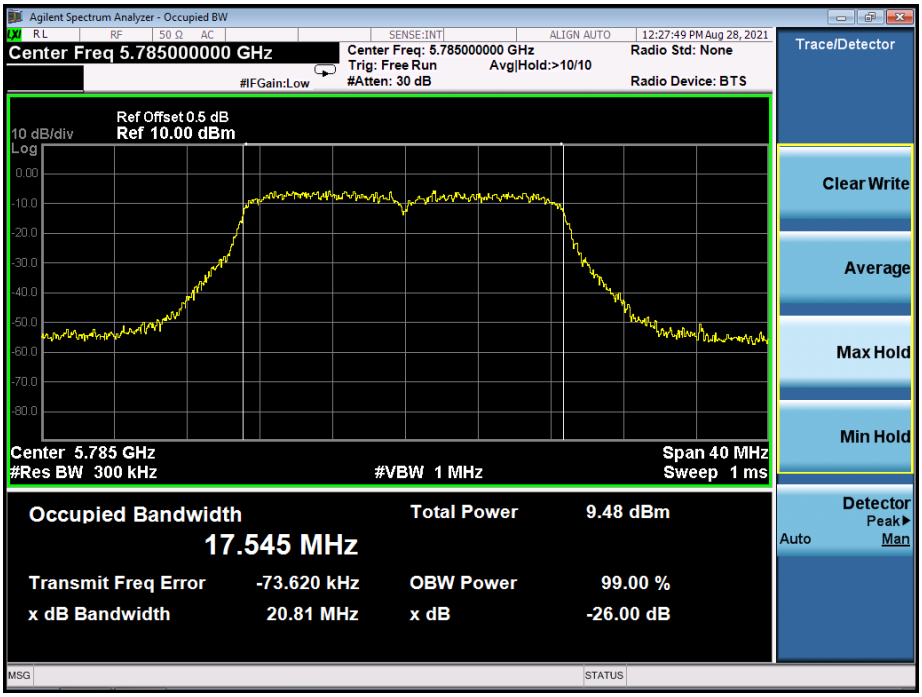
802.11a 5825MHz 99% bandwidth



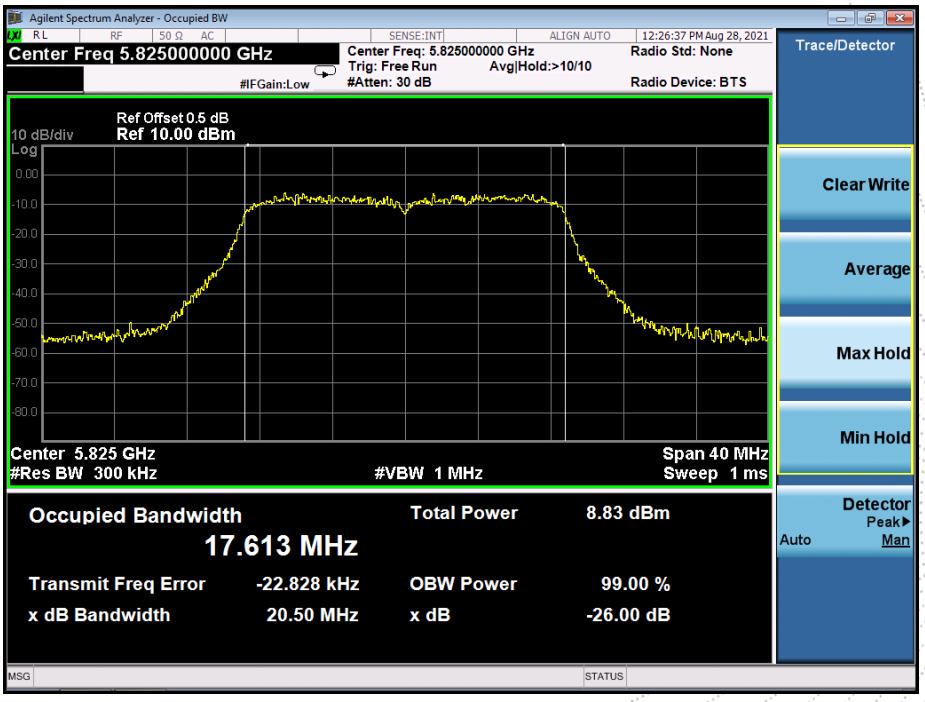
802.11n20 5745MHz 99% bandwidth



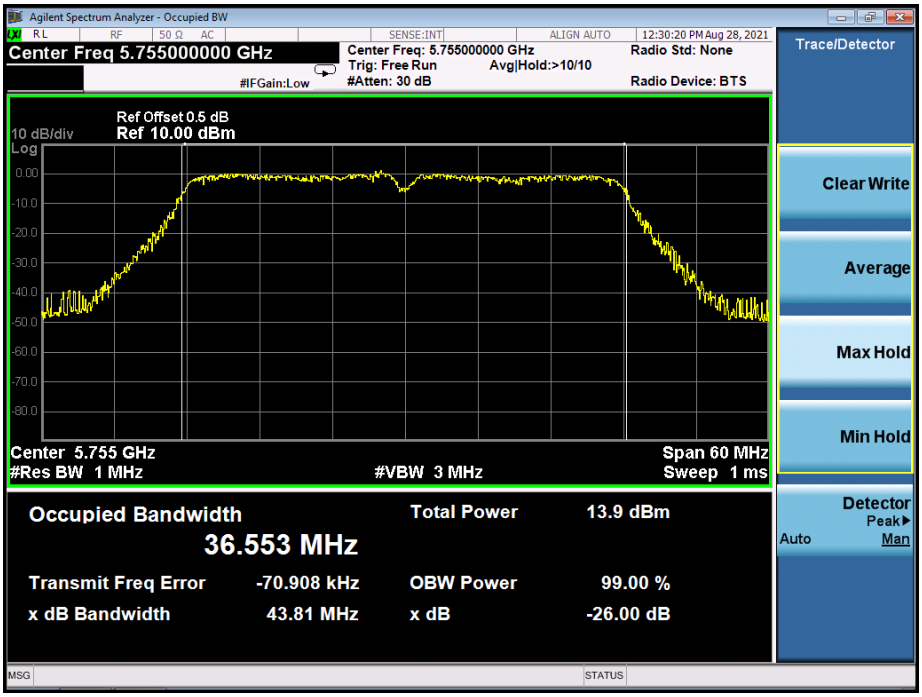
802.11n20 5785MHz 99% bandwidth



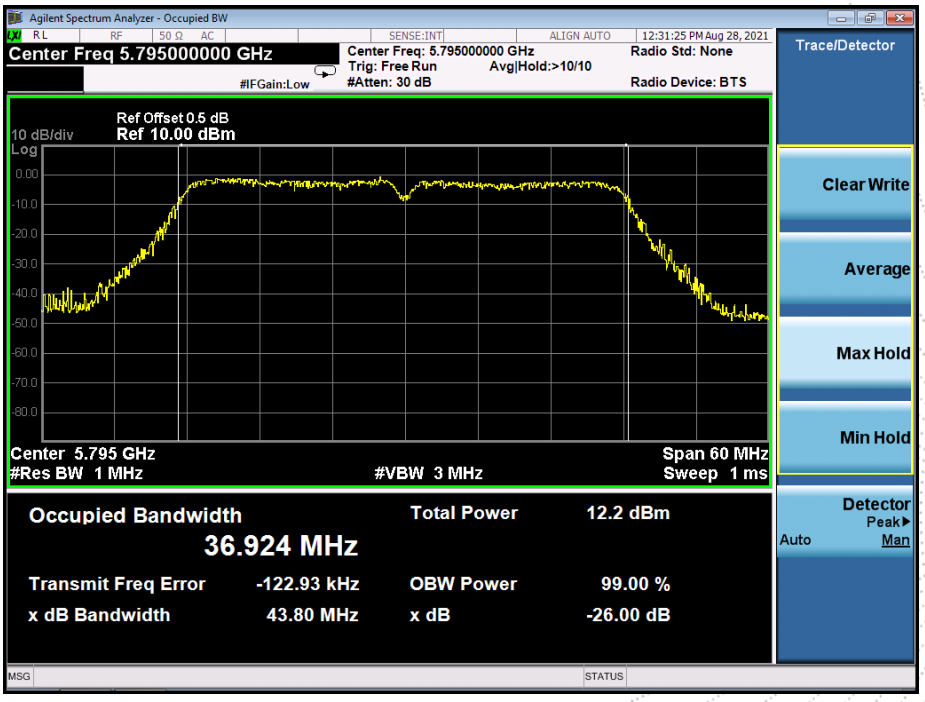
802.11n20 5825MHz 99% bandwidth



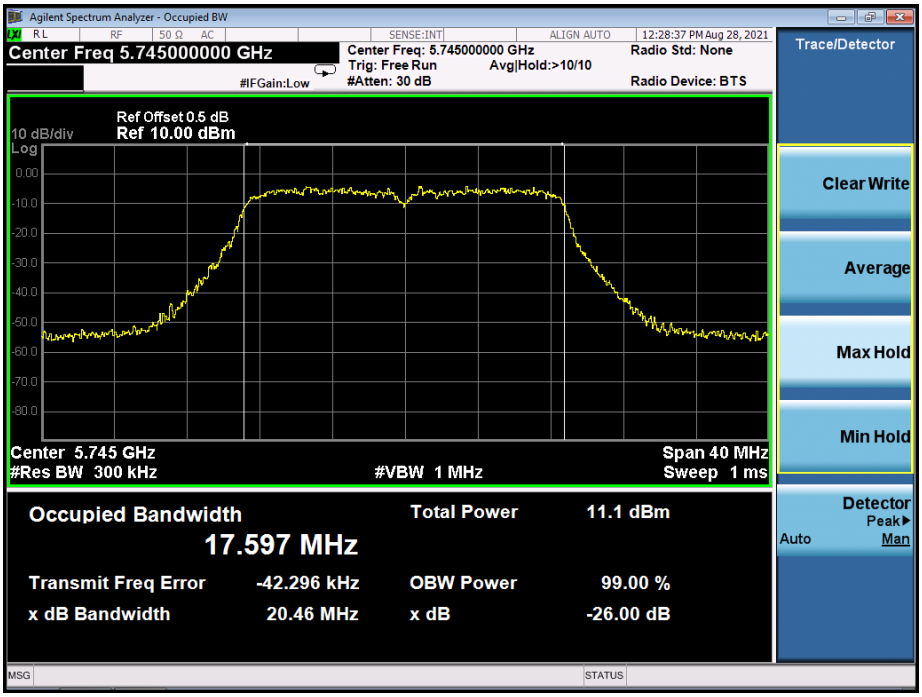
802.11 n40 5755MHz 99% bandwidth



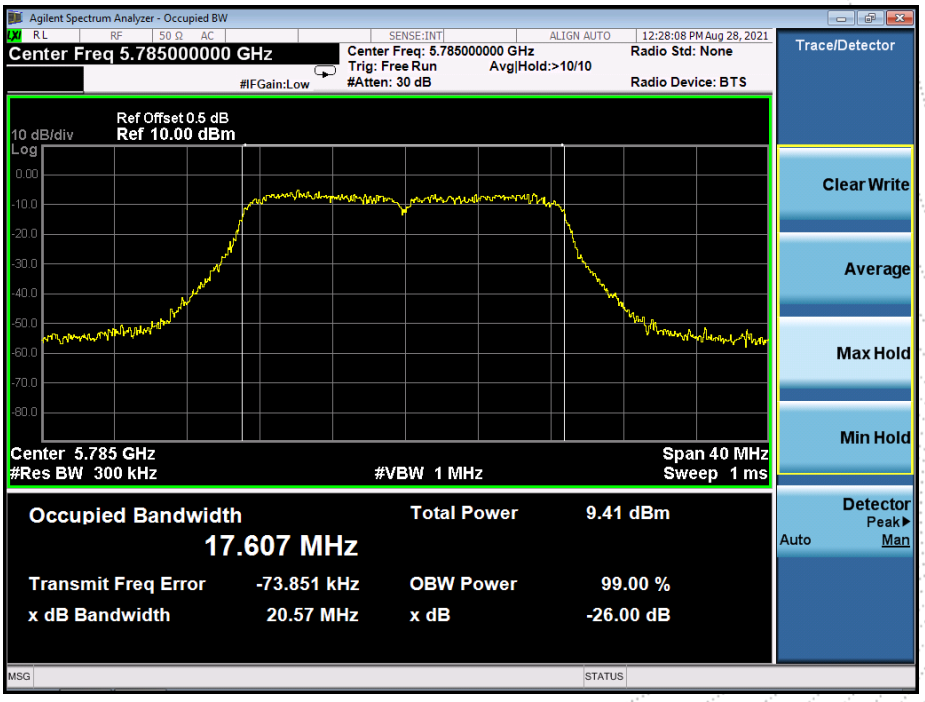
802.11 n40 5795MHz 99% bandwidth



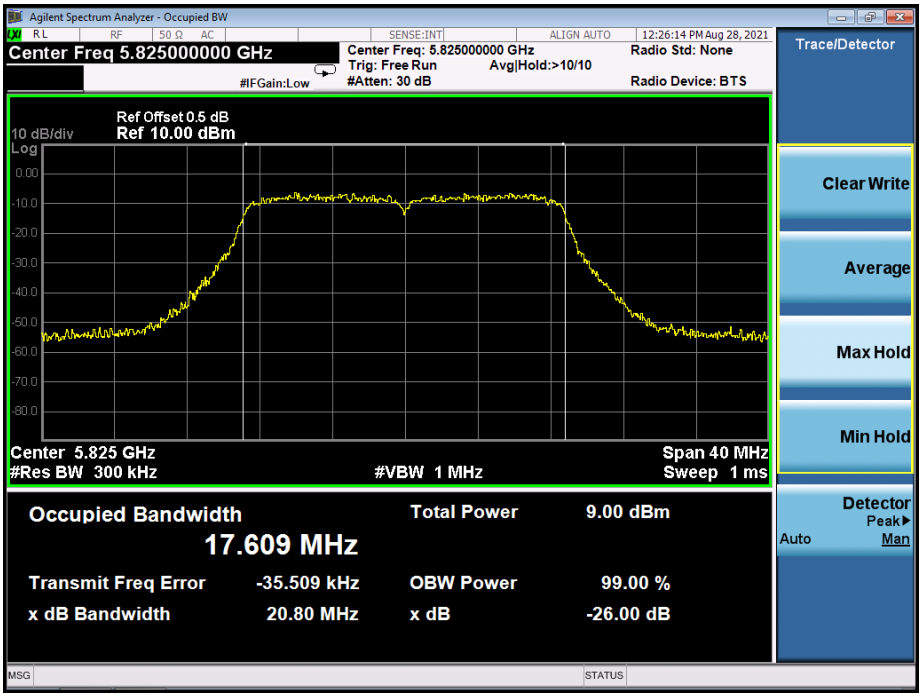
802.11ac20 5745MHz 99% bandwidth



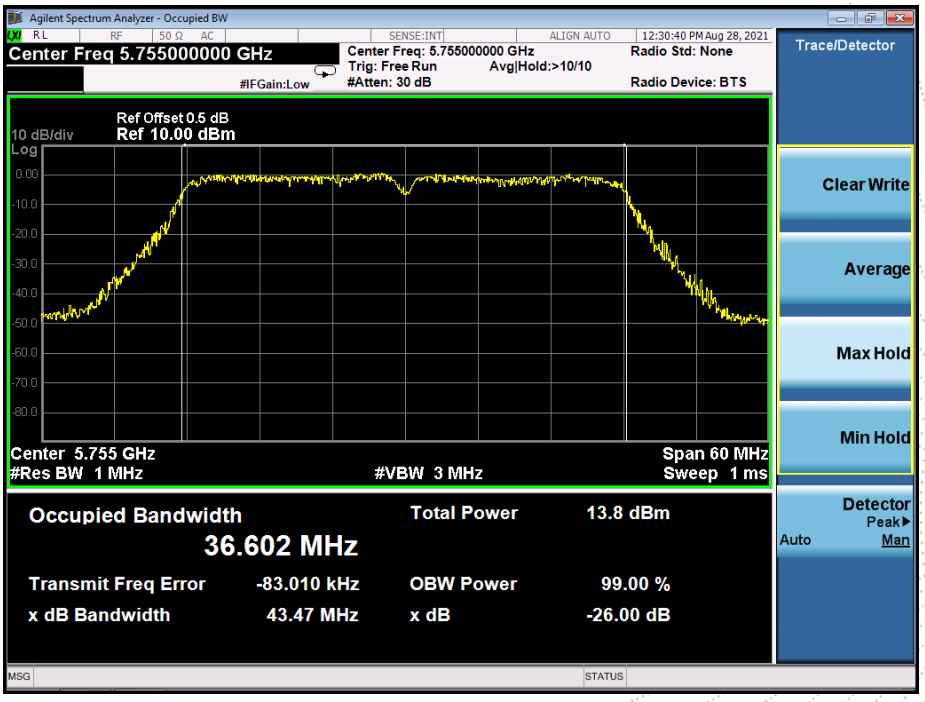
802.11ac20 5785MHz 99% bandwidth



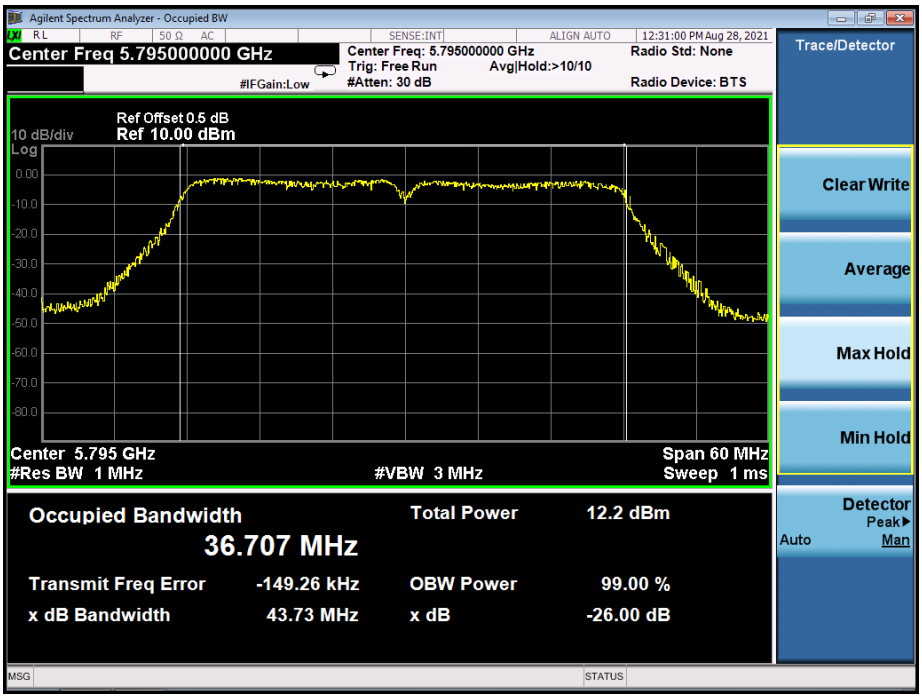
802.11ac20 5825MHz 99% bandwidth



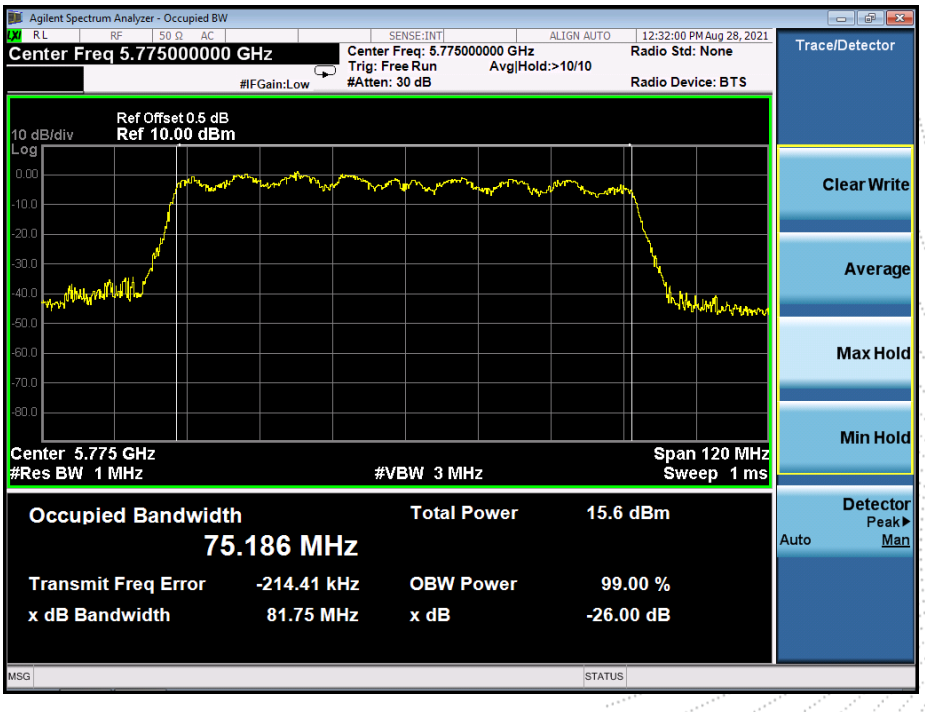
802.11 ac40 5755MHz 99% bandwidth



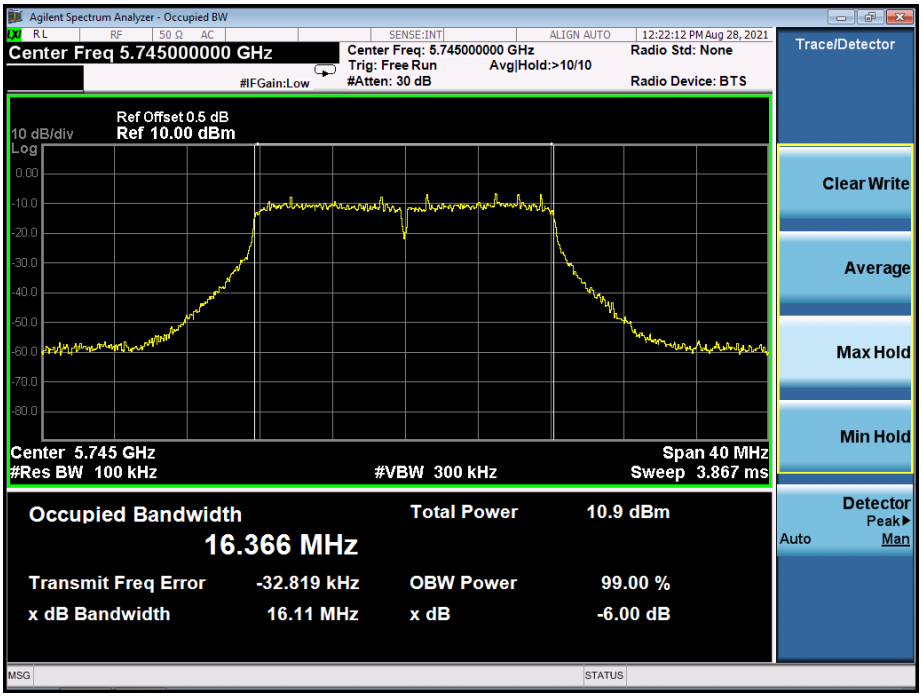
802.11 ac40 5795MHz 99% bandwidth



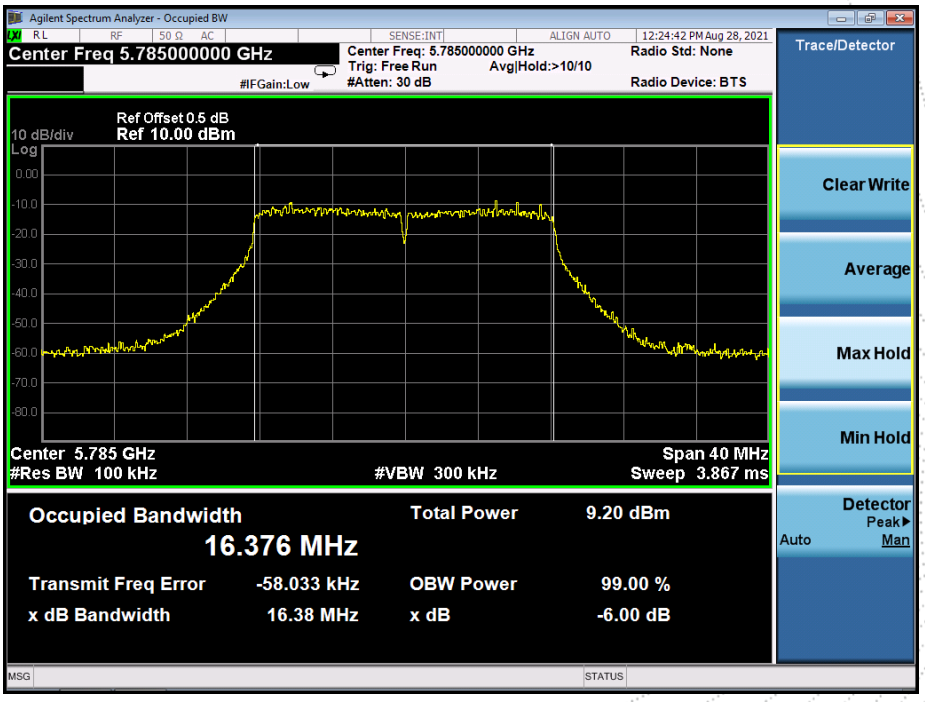
802.11 ac80 5775MHz 99% bandwidth



802.11a 5745MHz 6dB bandwidth

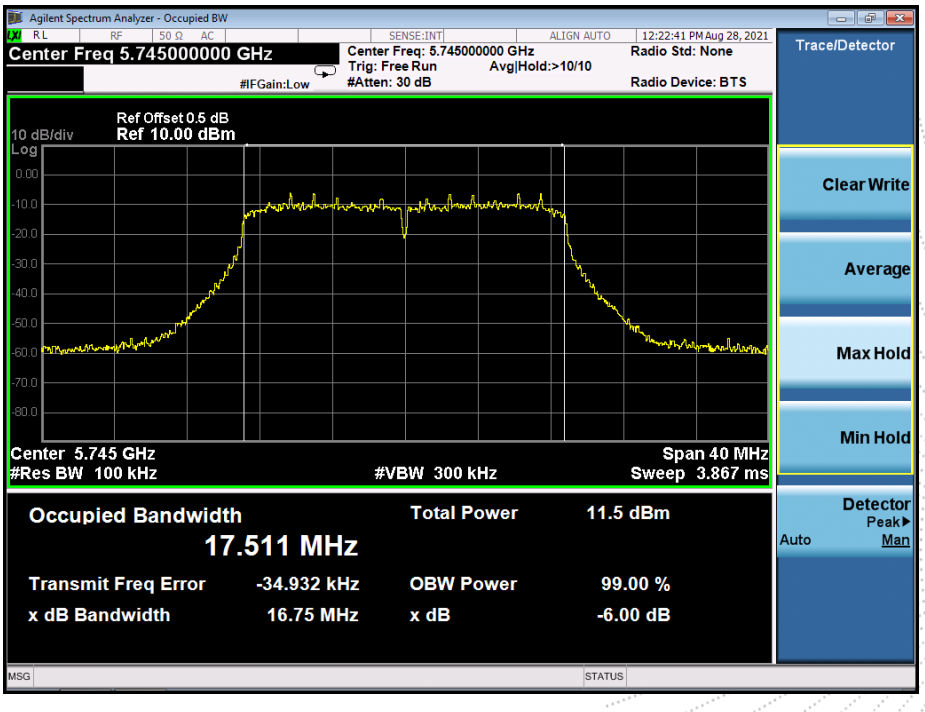


802.11a 5785MHz 6dB bandwidth

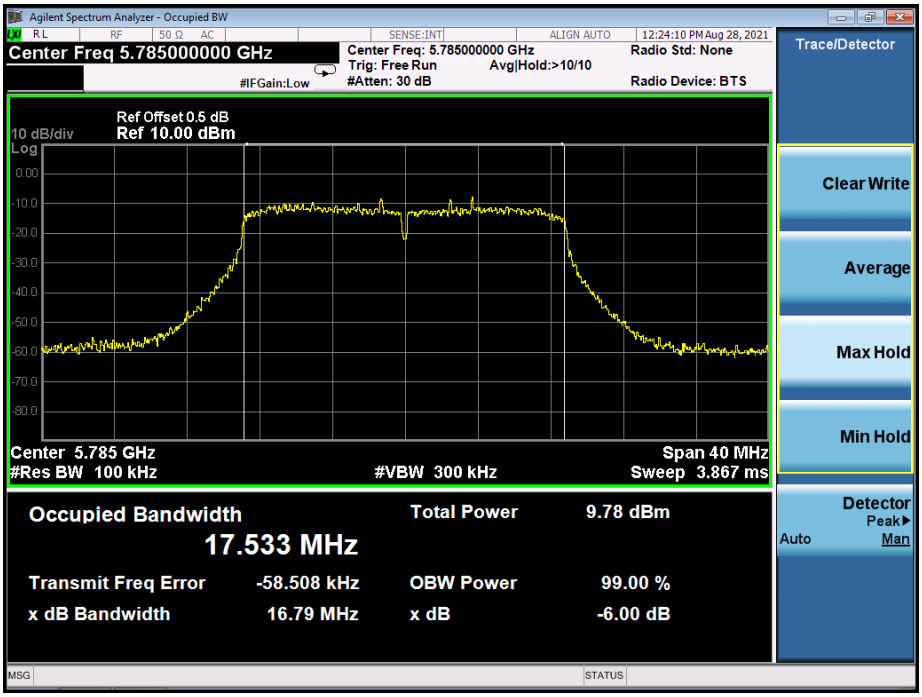


802.11a 5825MHz 6dB bandwidth

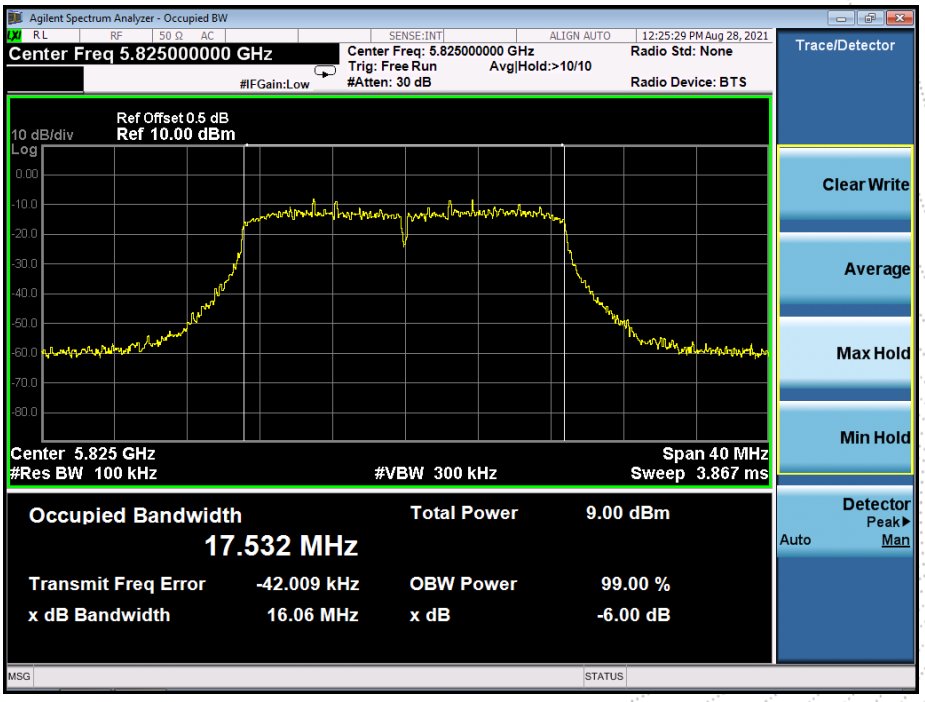
802.11n20 5745MHz 6dB bandwidth



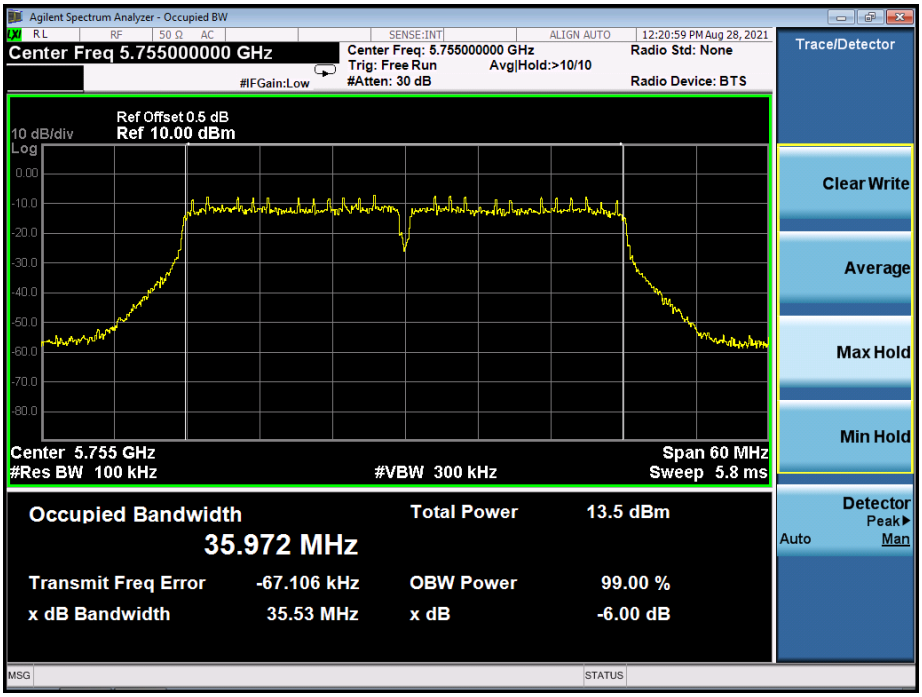
802.11n20 5785MHz 6dB bandwidth



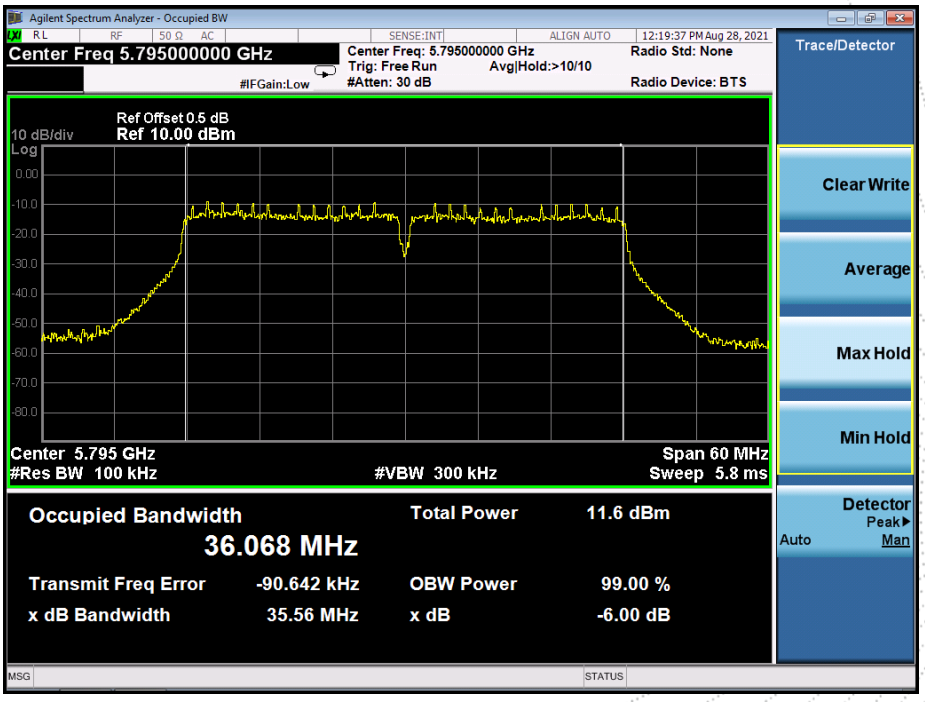
802.11n20 5825MHz 6dB bandwidth



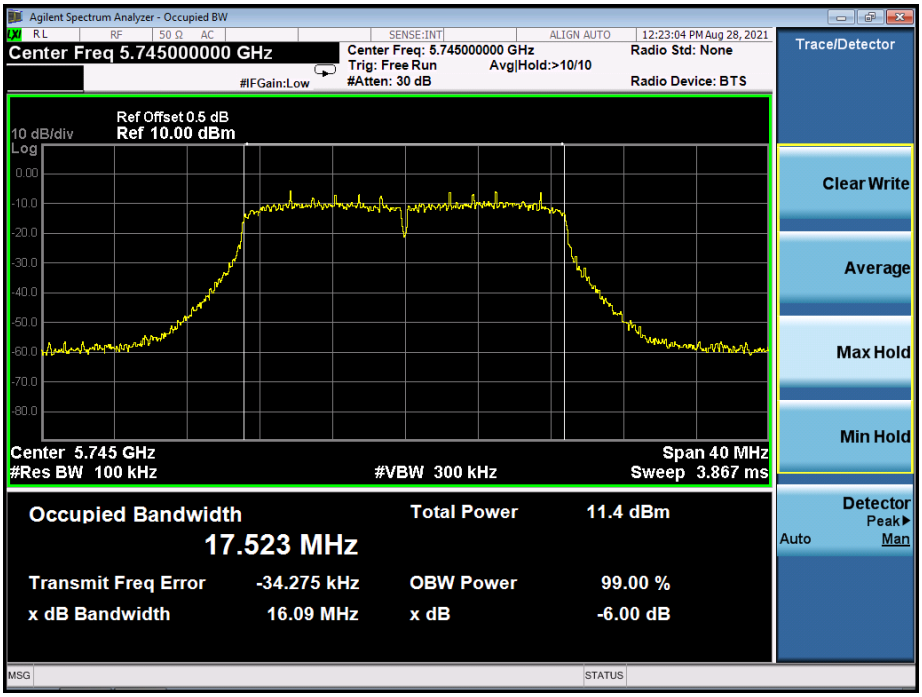
802.11 n40 5755MHz 6dB bandwidth



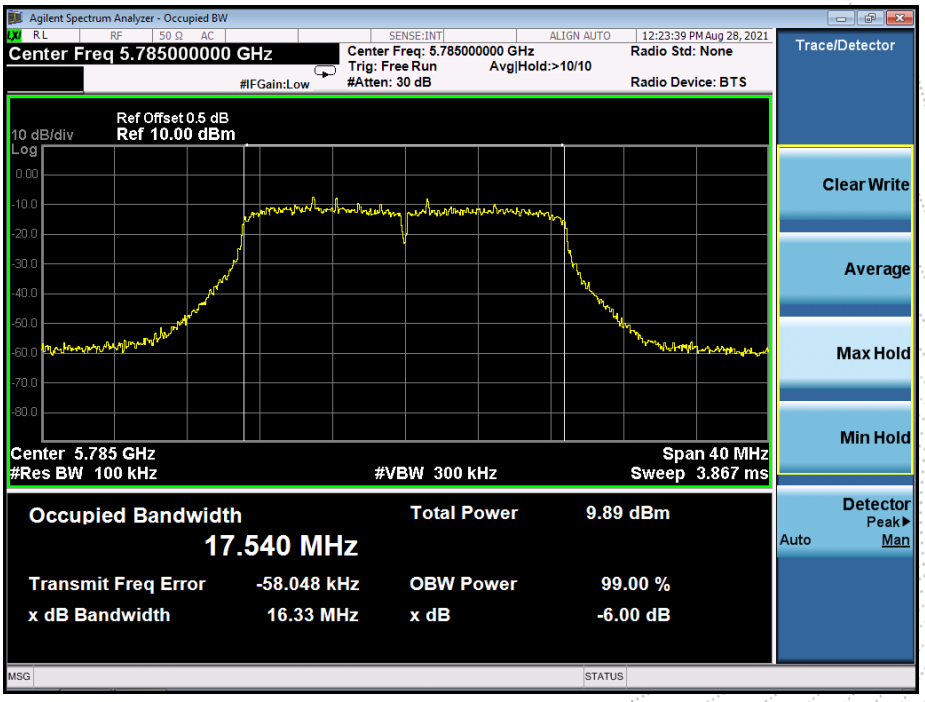
802.11 n40 5795MHz 6dB bandwidth



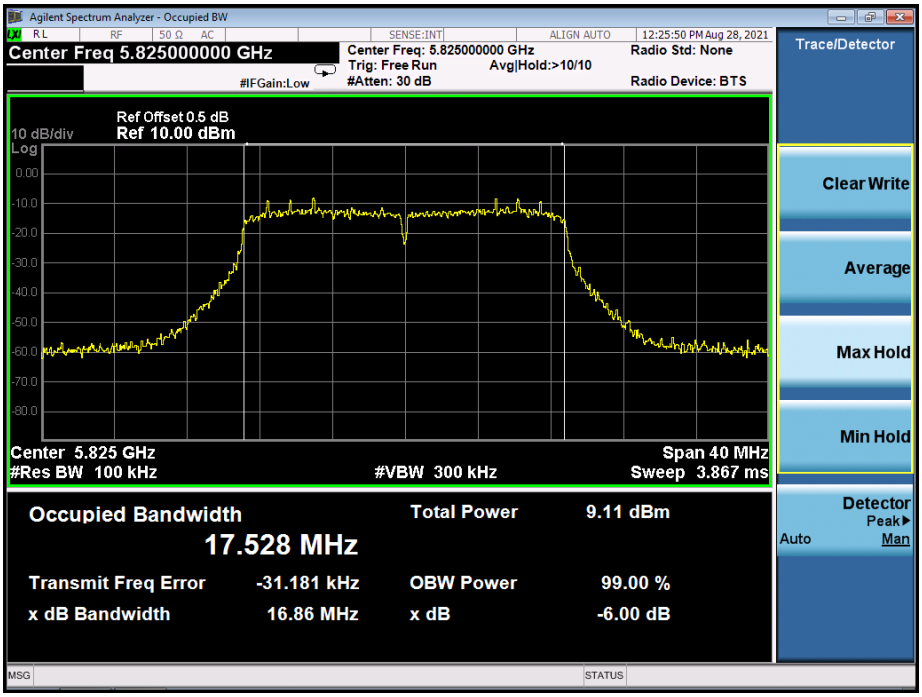
802.11ac20 5745MHz 6dB bandwidth



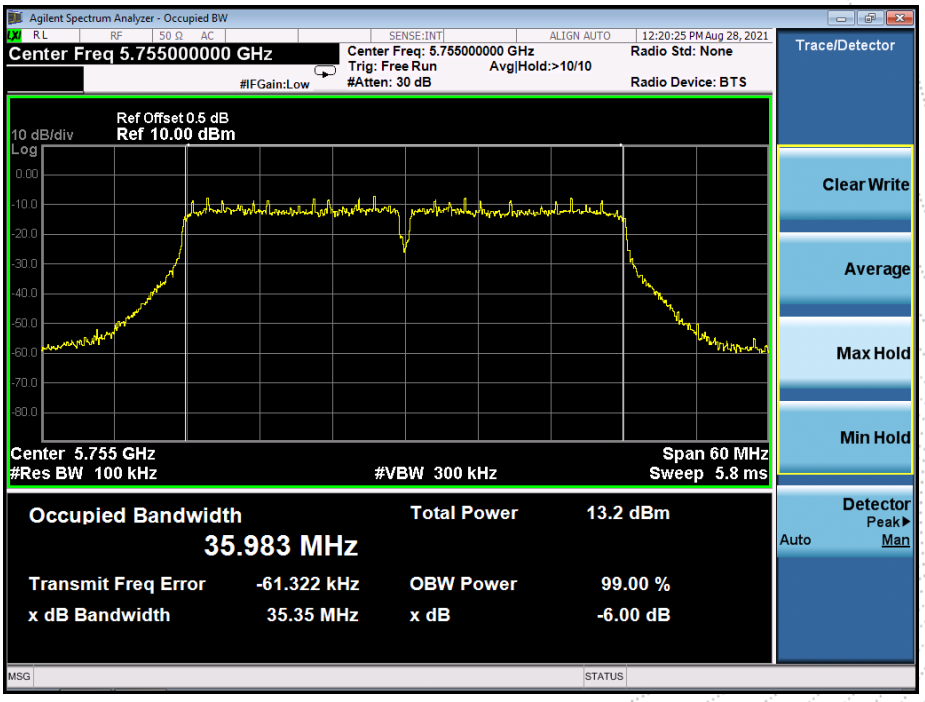
802.11ac20 5785MHz 6dB bandwidth



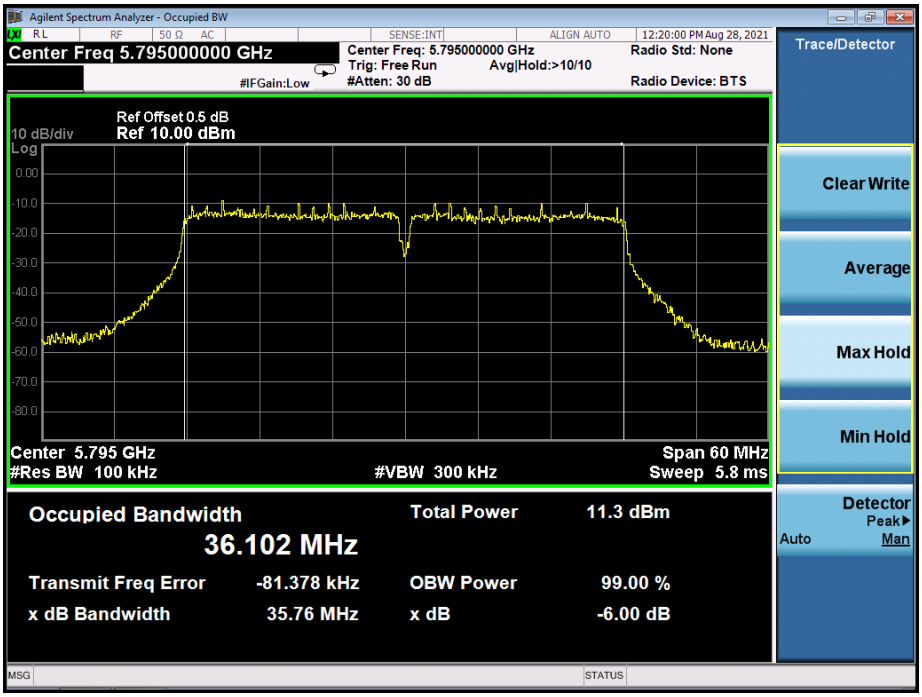
802.11ac20 5825MHz 6dB bandwidth



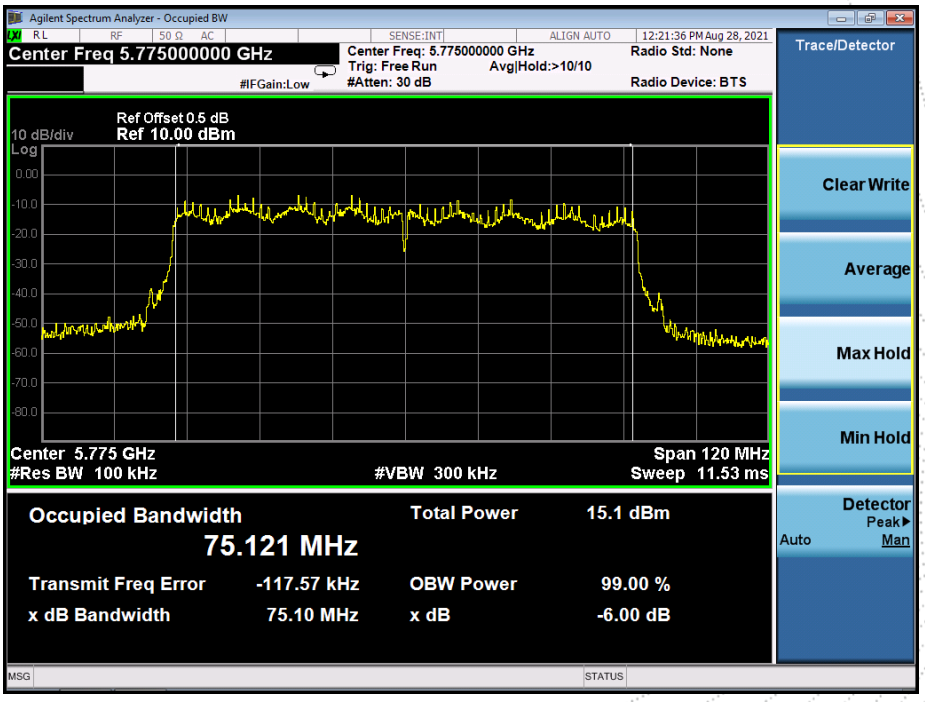
802.11 ac40 5755MHz 6dB bandwidth



802.11 ac40 5795MHz 6dB bandwidth

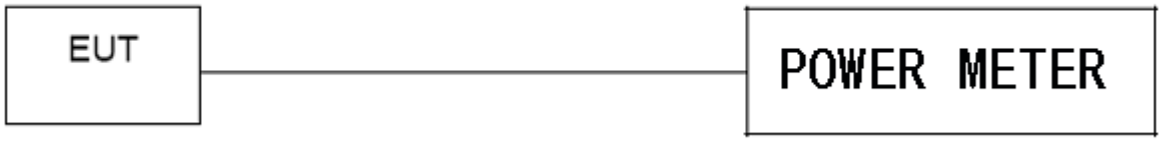


802.11 ac80 5775MHz 6dB bandwidth



10. MAXIMUM CONDUCTED OUTPUT POWER

10.1 Block Diagram Of Test Setup



10.2 Limit

According to FCC §15.407
The maximum conduced output power should not exceed:

Frequency Band(MHz)	Limit
5150~5250	1W
5725~5850	1W

10.3 Test procedure

Maximum conducted output power may be measured using a spectrum analyzer/EMI receiver or an RF power meter.

1. Device Configuration
If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level (see section II.B.).

a) The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

b) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level with the transmit duration as long as possible and the duty cycle as high as possible.

2. Measurement using a Spectrum Analyzer or EMI Receiver (SA)
Measurement of maximum conducted output power using a spectrum analyzer requires integrating the spectrum across a frequency span that encompasses, at a minimum, either the EBW or the 99-percent occupied bandwidth of the signal.1 However, the EBW must be used to determine bandwidth dependent limits on maximum conducted output power in accordance with § 15.407(a).

a) The test method shall be selected as follows: (i) Method SA-1 or SA-1 Alternative (averaging with the EUT transmitting at full power throughout each sweep) shall be applied if either of the following conditions can be satisfied:

• The EUT transmits continuously (or with a duty cycle ≥ 98 percent).

• Sweep triggering or gating can be implemented in a way that the device transmits at the maximum power control level throughout the duration of each of the instrument sweeps to be averaged. This condition can generally be achieved by triggering the instrument's sweep if the duration of the sweep (with the analyzer configured as in Method SA-1, below) is equal to or shorter than the duration T of each transmission from the EUT and if those transmissions exhibit full power throughout their durations.

(ii) Method SA-2 or SA-2 Alternative (averaging across on and off times of the EUT transmissions, followed by duty cycle correction) shall be applied if the conditions of (i) cannot be achieved and the transmissions exhibit a constant duty cycle during the measurement duration. Duty cycle will be considered to be constant if variations are less than ± 2 percent.

(iii) Method SA-3 (RMS detection with max hold) or SA-3 Alternative (reduced VBW with max hold) shall be applied if the conditions of (i) and (ii) cannot be achieved.

b) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep): (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 = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle < 98 percent, 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 percent, 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 (i.e., 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

10.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

10.5 Test Result

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX (5.1G) Mode Frequency U-NII-1 (5180-5240MHz)		

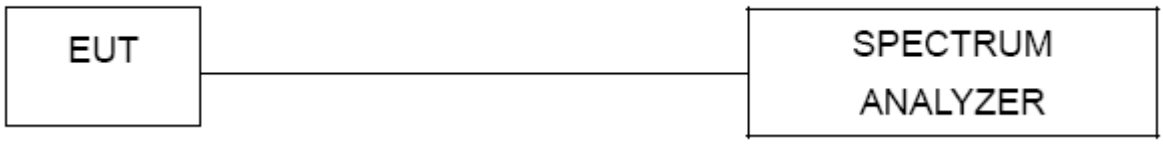
Test Channel	Frequency (MHz)	Maximum output power. Antenna port (AV) (dBm)	LIMIT dBm	Result
TX 802.11a Mode				
CH36	5180	7.116	23.98	Pass
CH40	5200	7.141	23.98	Pass
CH48	5240	7.341	23.98	Pass
TX 802.11 n20M Mode				
CH36	5180	6.346	23.98	Pass
CH40	5200	6.147	23.98	Pass
CH48	5240	6.11	23.98	Pass
TX 802.11 n40M Mode				
CH38	5190	5.663	23.98	Pass
CH46	5230	5.504	23.98	Pass
TX 802.11 AC20M Mode				
CH36	5180	6.515	23.98	Pass
CH40	5200	6.247	23.98	Pass
CH48	5240	6.178	23.98	Pass
TX 802.11 AC40M Mode				
CH38	5190	5.312	23.98	Pass
CH46	5230	4.904	23.98	Pass
TX 802.11 AC80M Mode				
CH42	5210	4.159	23.98	Pass

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX (5.8G) Mode Frequency U-NII-3 (5745-5825MHz)		

Test Channel	Frequency (MHz)	Maximum output power. Antenna port (AV) (dBm)	LIMIT dBm	Result
TX 802.11a Mode				
CH 149	5745	7.265	30	Pass
CH 157	5785	7.209	30	Pass
CH 165	5825	6.385	30	Pass
TX 802.11 n20M Mode				
CH 149	5745	6.447	30	Pass
CH 157	5785	6.205	30	Pass
CH 165	5825	5.559	30	Pass
TX 802.11 n40M Mode				
CH 151	5755	5.865	30	Pass
CH 159	5795	5.249	30	Pass
TX 802.11 AC20M Mode				
CH 149	5745	6.455	30	Pass
CH 157	5785	5.751	30	Pass
CH 165	5825	5.521	30	Pass
TX 802.11 AC40M Mode				
CH 151	5755	5.349	30	Pass
CH 159	5795	4.642	30	Pass
TX 802.11 AC80M Mode				
CH 155	5775	5.400	30	Pass

11. OUT OF BAND EMISSIONS

11.1 Block Diagram Of Test Setup



11.2 Limit

According to FCC §15.407(b)
Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

11.3 Test procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect
its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

11.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data

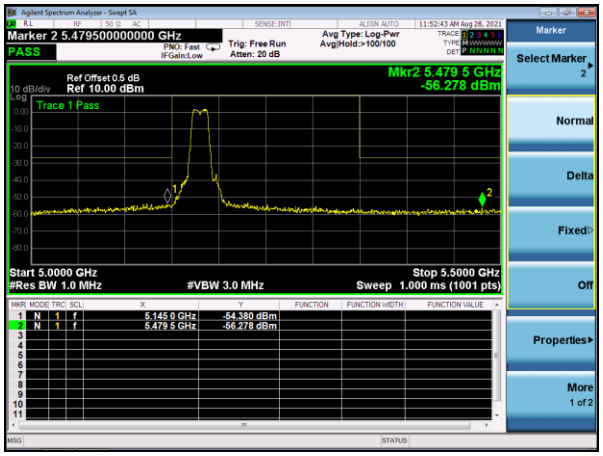
11.5 Test Result

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	AC 120V/60Hz

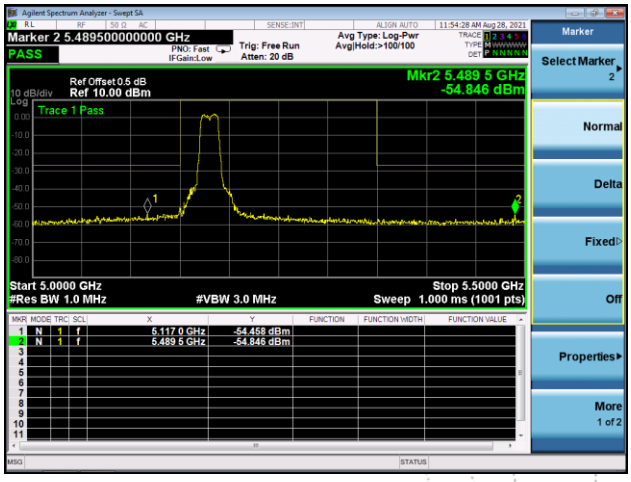
5.1G

5.180~5.240 GHz

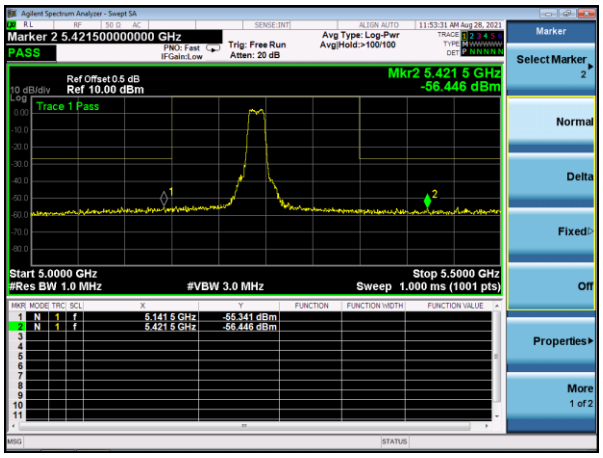
(802.11a) Band Edge, Left Side



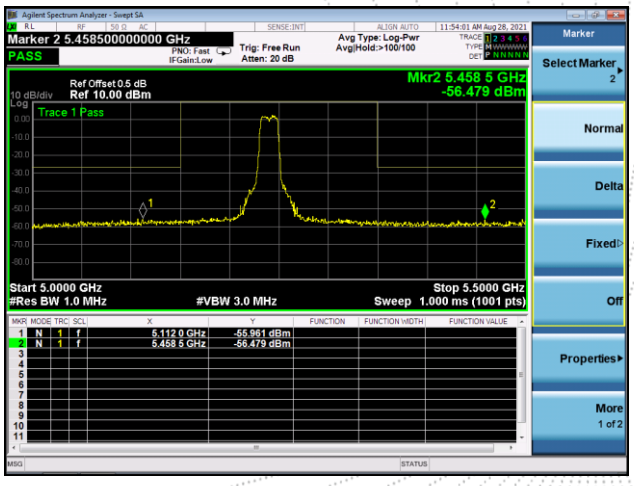
(802.11n20) Band Edge, Left Side



(802.11a) Band Edge, Right Side

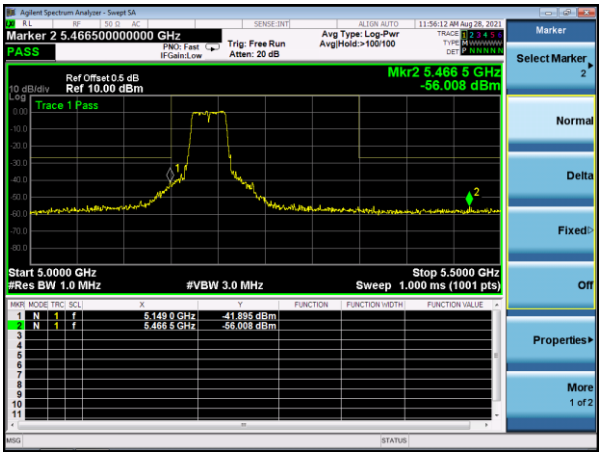


(802.11n20) Band Edge, Right Side

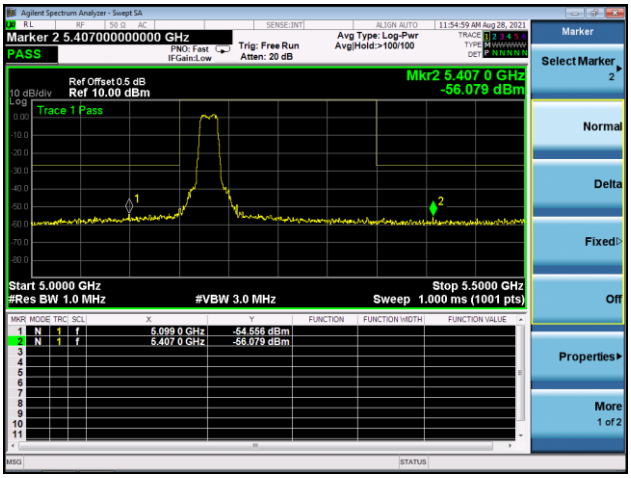


5.180~5.240 GHz

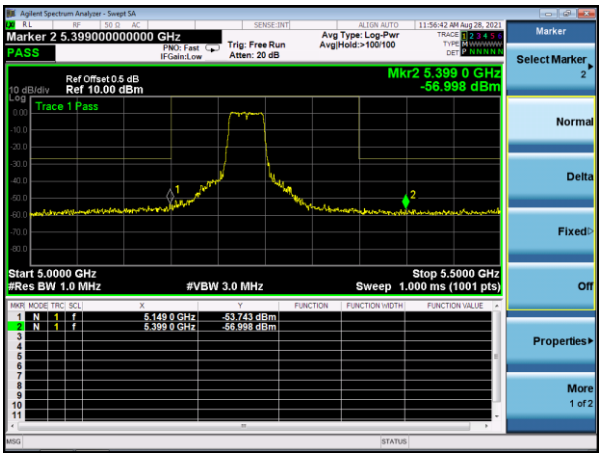
(802.11n40) Band Edge, Left Side



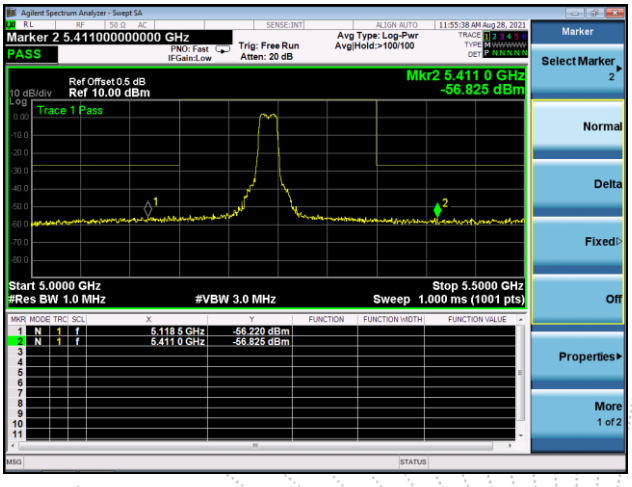
(802.11ac20) Band Edge, Left Side



(802.11n40) Band Edge, Right Side

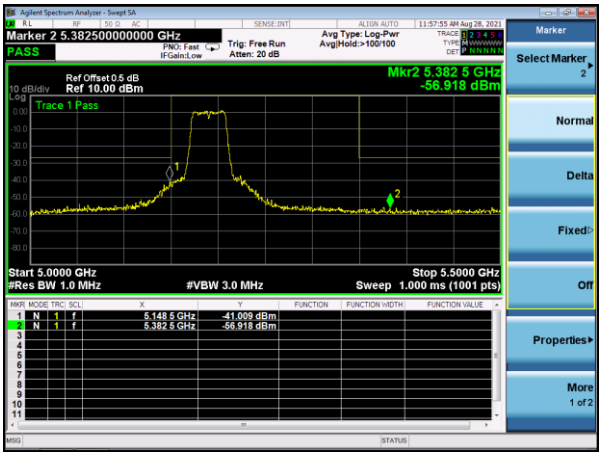


(802.11ac20) Band Edge, Right Side



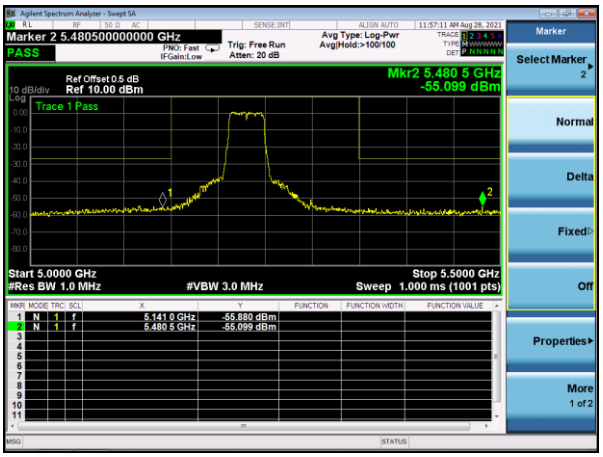
5.180~5.240 GHz

(802.11ac40) Band Edge, Left Side



(802.11ac80) Band Edge, Left Side

(802.11ac40) Band Edge, Right Side

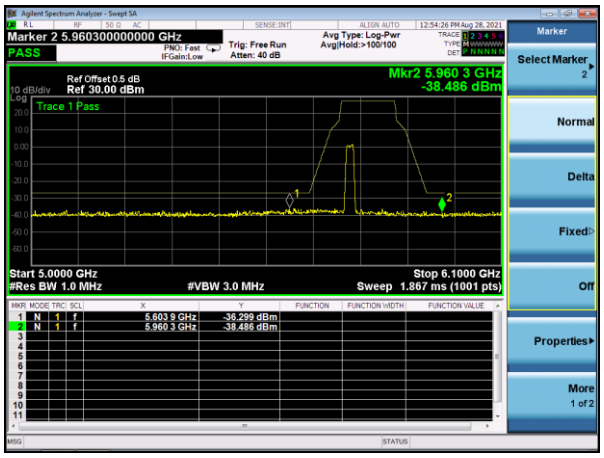


(802.11ac80) Band Edge, Right Side

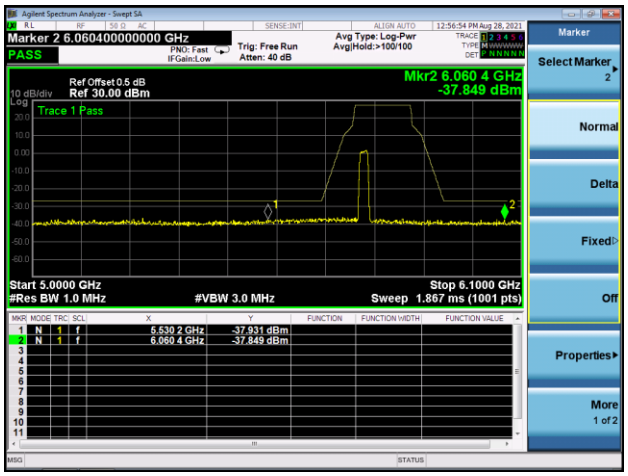
5.8G

5.745~5.825 GHz

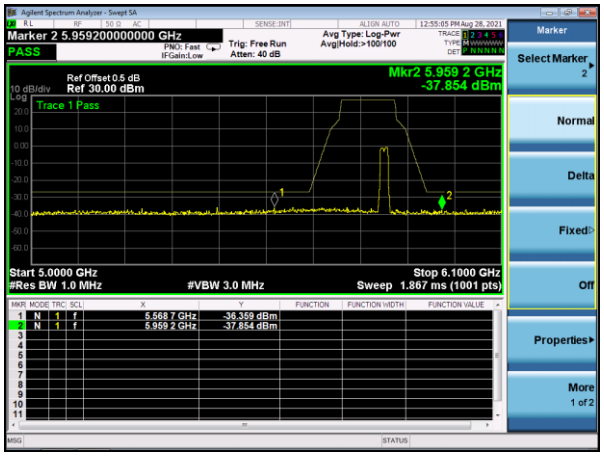
(802.11a) Band Edge, Left Side



(802.11n20) Band Edge, Left Side



(802.11a) Band Edge, Right Side



(802.11n20) Band Edge, Right Side