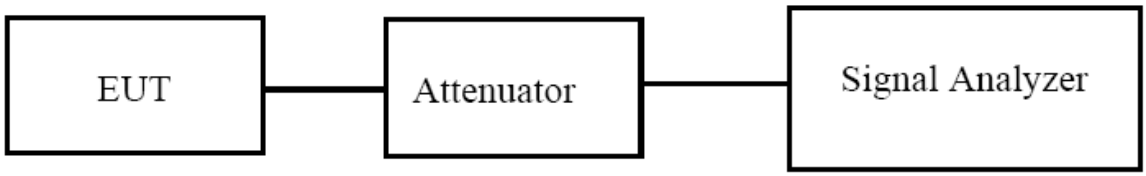
9. 26DB & 6DB & 99% EMISSION BANDWIDTH

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

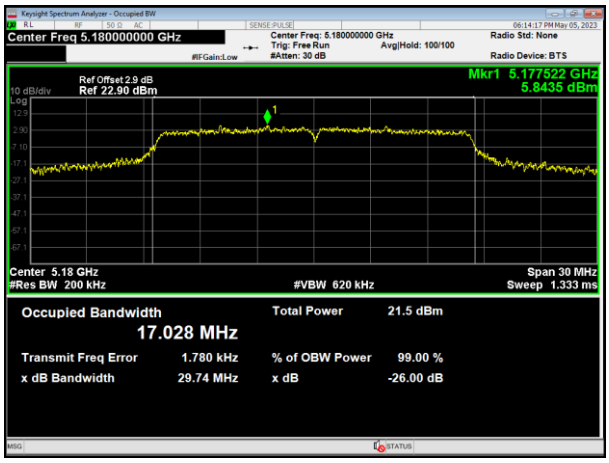
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage ：	AC120V/60Hz
Test Mode:	TX Frequency U-NII-1 (5180-5240MHz)		

Note: A(B) Represent the value of antenna A and B, The worst data is Antenna B, only shown Antenna B Plot.

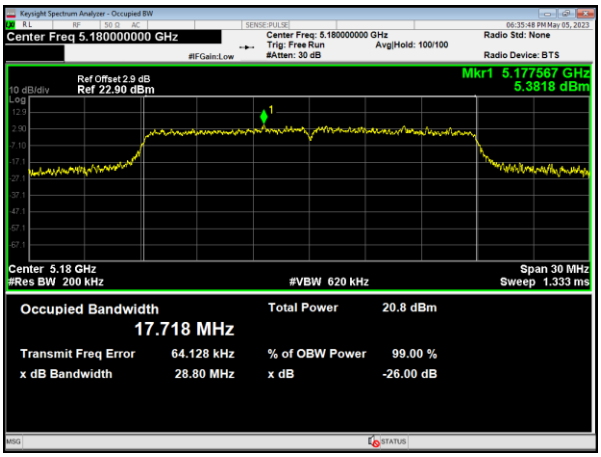
Mode	Channel	Frequency (MHz)	99% bandwidth(MHz)	26dB bandwidth (MHz)	Limit MHz	Result
			ANT B	ANT B		
802.11a	CH36	5180	17.028	29.991	N/A	Pass
	CH40	5200	17.05	29.962	N/A	Pass
	CH48	5240	20.631	30	N/A	Pass
802.11 n20	CH36	5180	17.617	29.807	N/A	Pass
	CH40	5200	17.612	29.554	N/A	Pass
	CH48	5240	17.675	30	N/A	Pass
802.11 n40	CH 38	5190	36.132	43.814	N/A	Pass
	CH 46	5230	36.598	60	N/A	Pass
802.11 ac20	CH36	5180	17.775	29.41	N/A	Pass
	CH40	5200	17.738	29.35	N/A	Pass
	CH48	5240	18.039	30	N/A	Pass
802.11 ac40	CH 38	5190	36.219	59.08	N/A	Pass
	CH 46	5230	37.035	60	N/A	Pass
802.11 AC80	CH 42	5210	75.54	118.781	N/A	Pass

Test plot

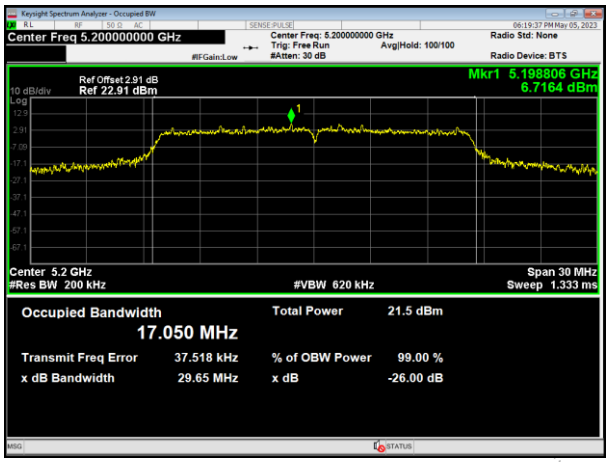
(802.11a) 26dB&99%Bandwidth plot on channel 36



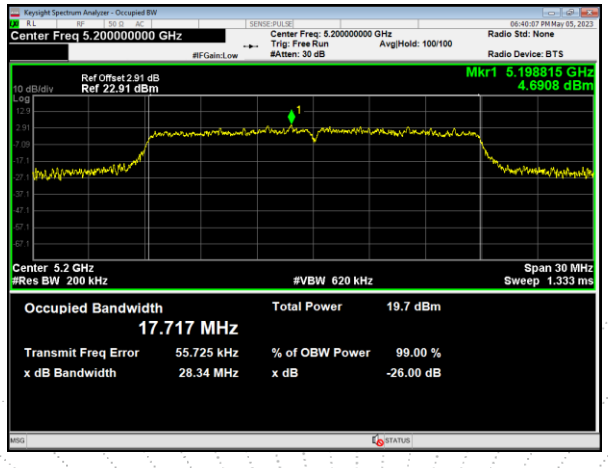
(802.11 n20) 26dB&99%Bandwidth plot on channel 36



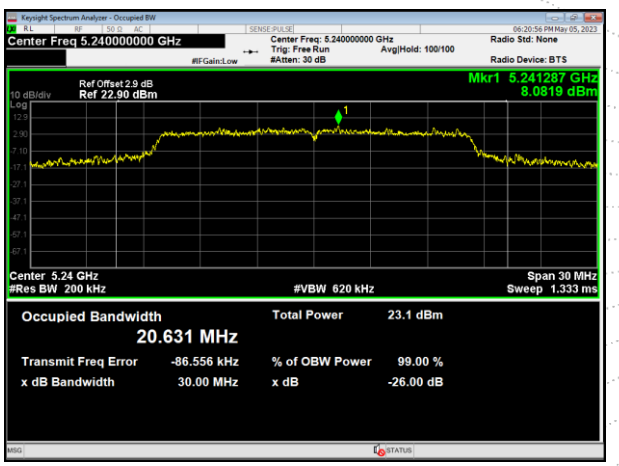
(802.11a) 26dB&99%Bandwidth plot on channel 40



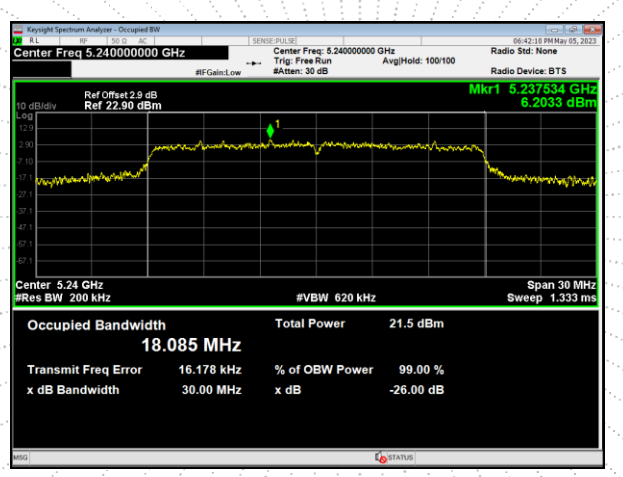
(802.11 n20) 26dB&99%Bandwidth plot on channel 40



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

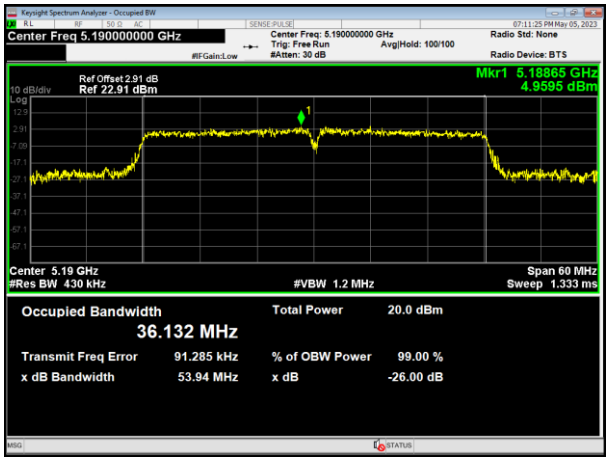


(802.11 n20) 26dB&99%Bandwidth plot on channel 48

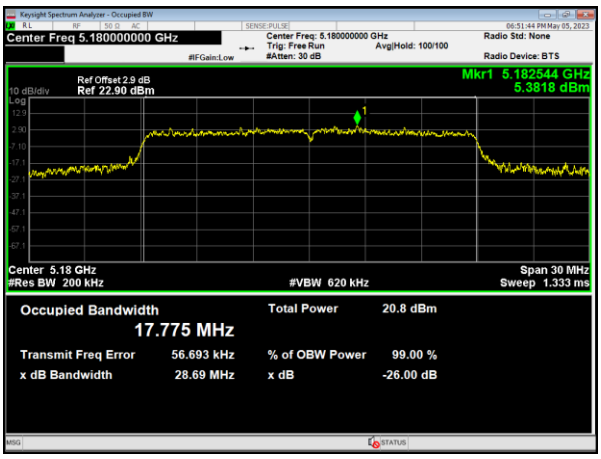


Test plot

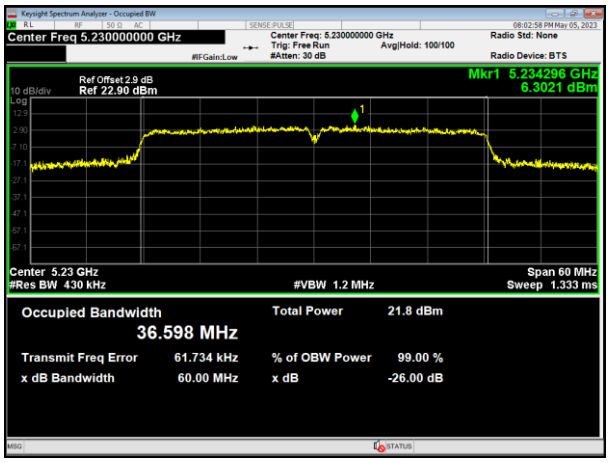
(802.11 n40) 26dB&99%Bandwidth plot on channel 38



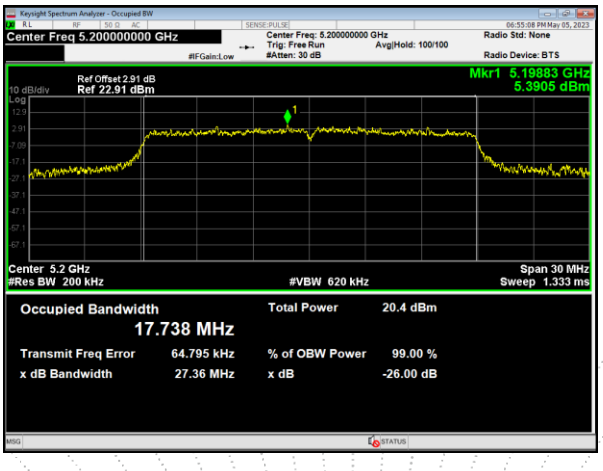
(802.11 AC20) 26dB&99%Bandwidth plot on channel 36



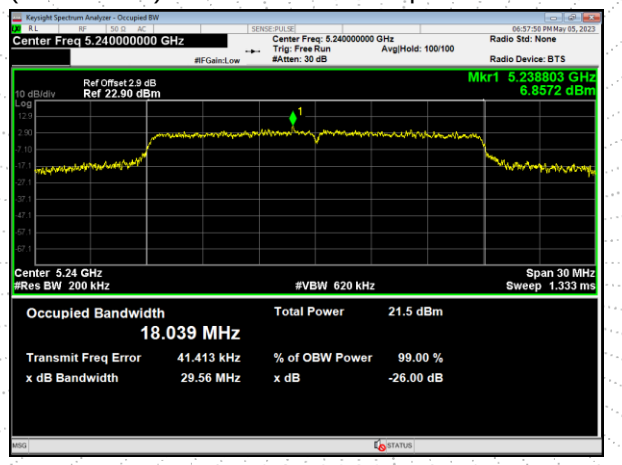
(802.11 n40) 26dB&99%Bandwidth plot on channel 46



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

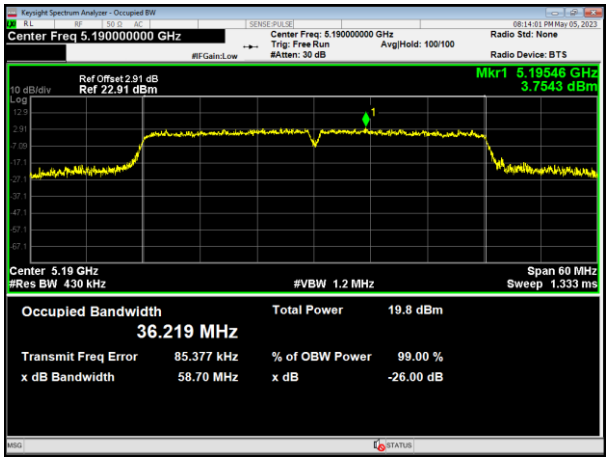


(802.11 AC20) 26dB&99%Bandwidth plot on channel 40

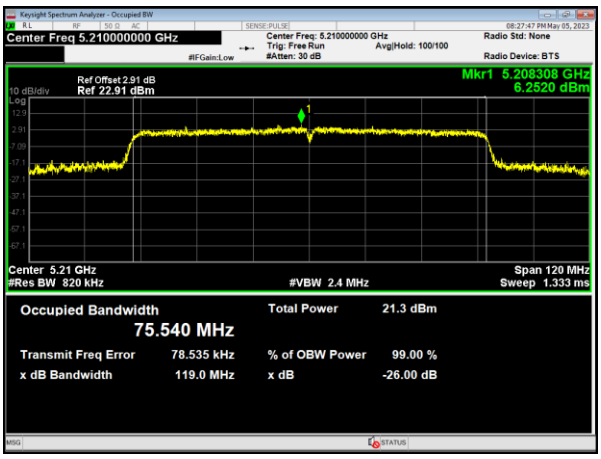


Test plot

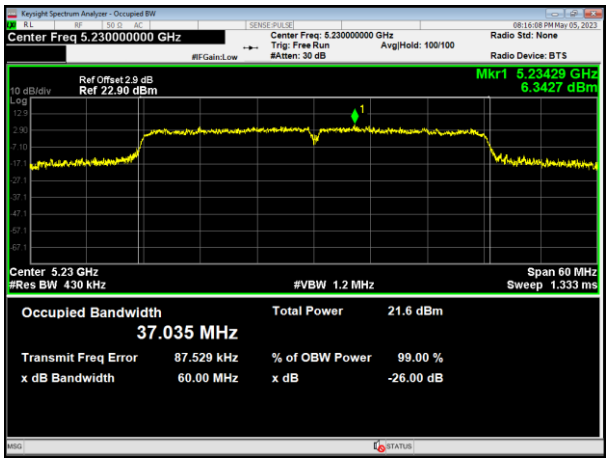
(802.11 AC40) 26dB&99%Bandwidth plot on channel 38



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



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

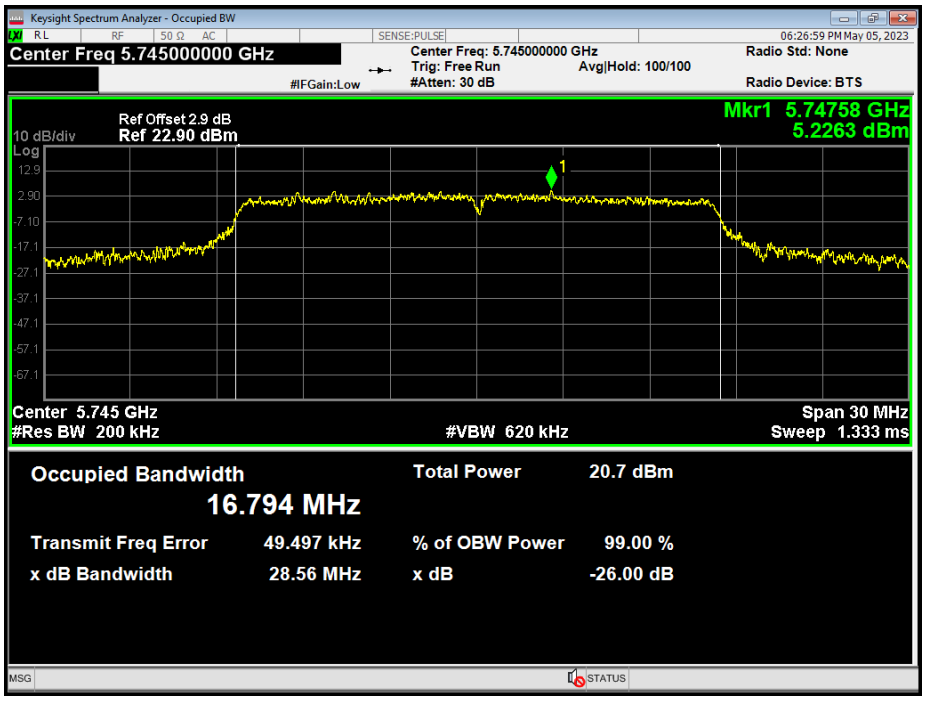


Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage ：	AC120V/60Hz
Test Mode:	TX Frequency U-NII-3(5745-5825MHz)		

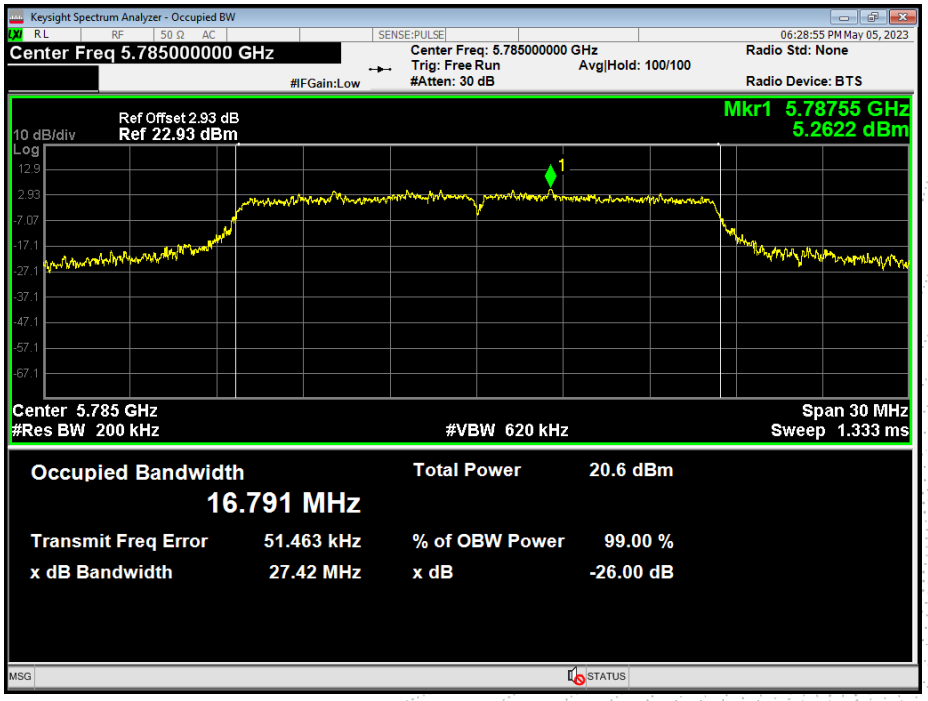
Note: A(B) Represent the value of antenna A and B, The worst data is Antenna B, only shown Antenna B Plot.

Mode	Channel	Frequency (MHz)	99% bandwidth(MHz)	6dB bandwidth (MHz)	Limit MHz	Result
			ANT B	ANT B		
802.11a	CH149	5745	16.794	16.32	≥500	Pass
	CH157	5785	16.791	16.14	≥500	Pass
	CH165	5825	16.807	16.147	≥500	Pass
802.11 n20	CH149	5745	17.699	16.928	≥500	Pass
	CH157	5785	17.685	16.896	≥500	Pass
	CH165	5825	17.669	14.739	≥500	Pass
802.11 n40	CH151	5755	36.19	35.102	≥500	Pass
	CH159	5795	36.101	35.146	≥500	Pass
802.11 ac20	CH149	5745	17.691	17.516	≥500	Pass
	CH157	5785	17.669	17.015	≥500	Pass
	CH165	5825	17.699	16.997	≥500	Pass
802.11 ac40	CH151	5755	36.189	35.103	≥500	Pass
	CH159	5795	36.119	35.042	≥500	Pass
802.11 AC80	CH155	5775	75.355	73.835	≥500	Pass

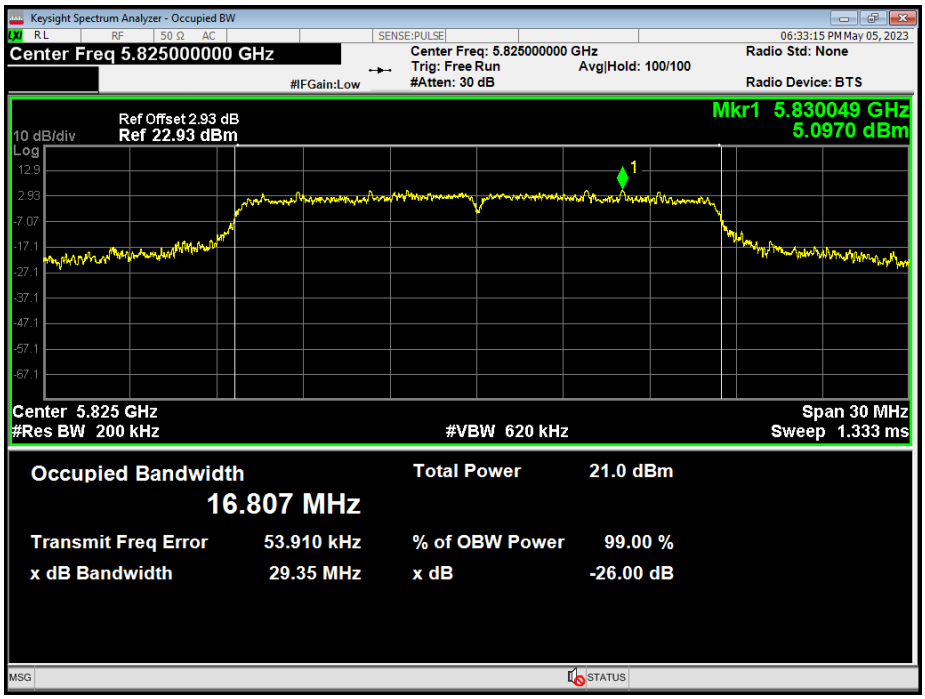
802.11a 5745MHz 99% bandwidth



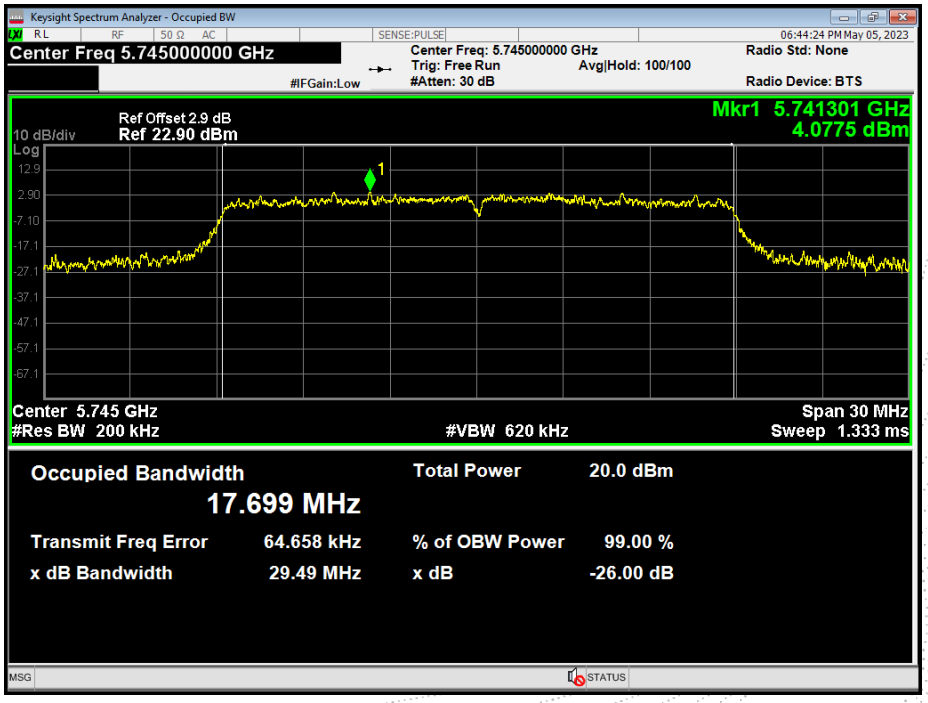
802.11a 5785MHz 99% bandwidth



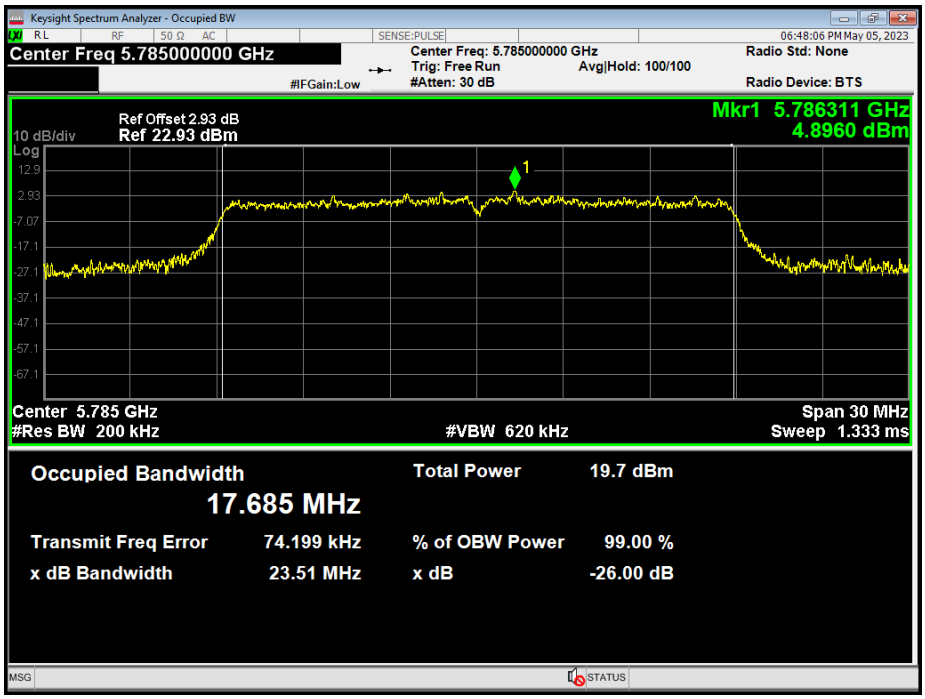
802.11a 5825MHz 99% bandwidth



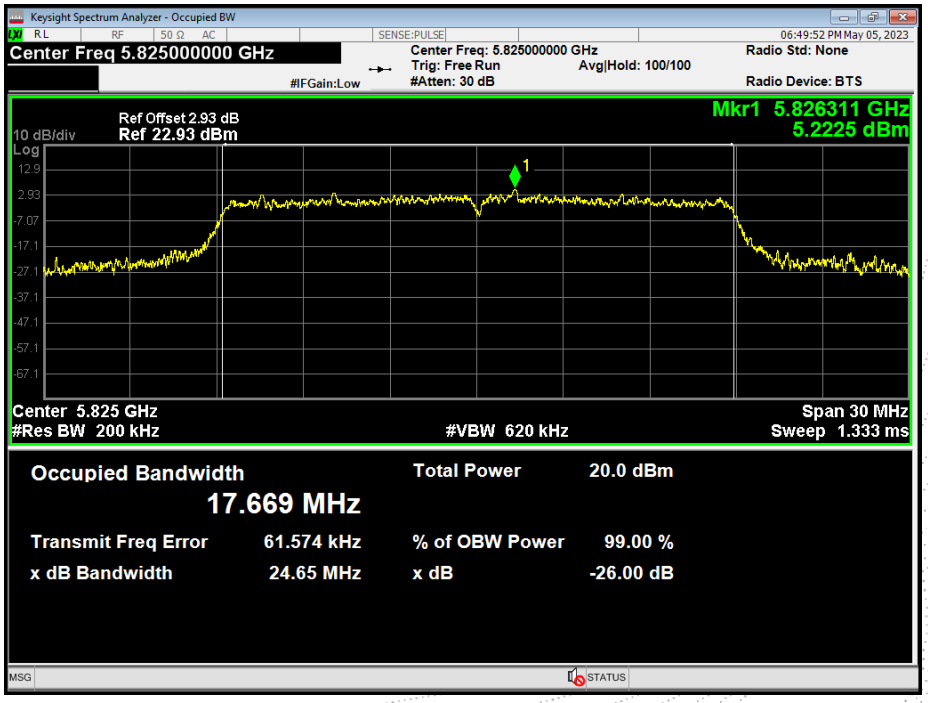
802.11n20 5745MHz 99% bandwidth



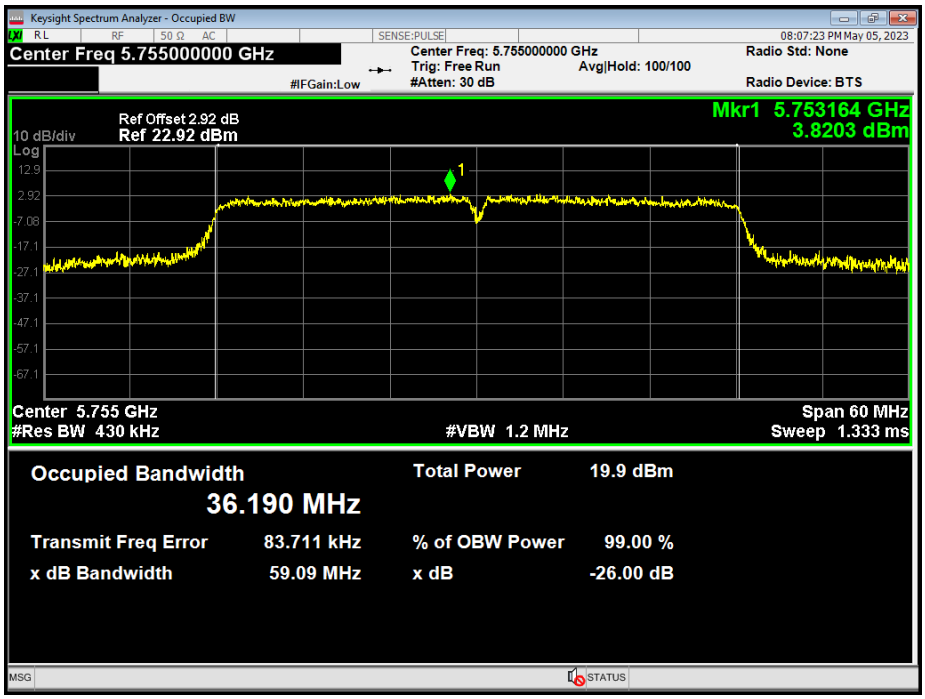
802.11n20 5785MHz 99% bandwidth



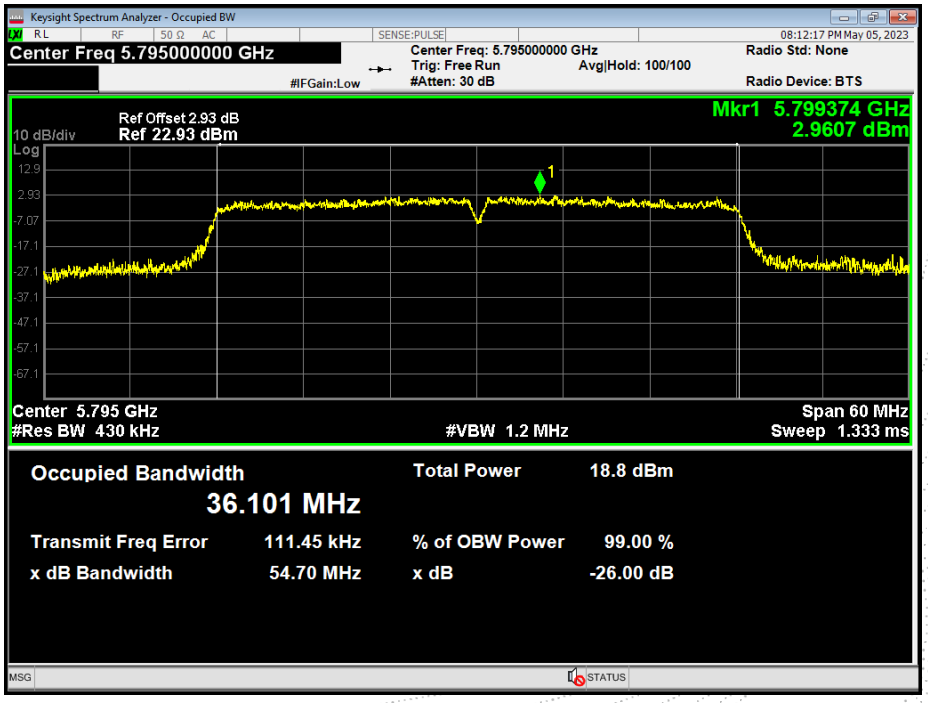
802.11n20 5825MHz 99% bandwidth



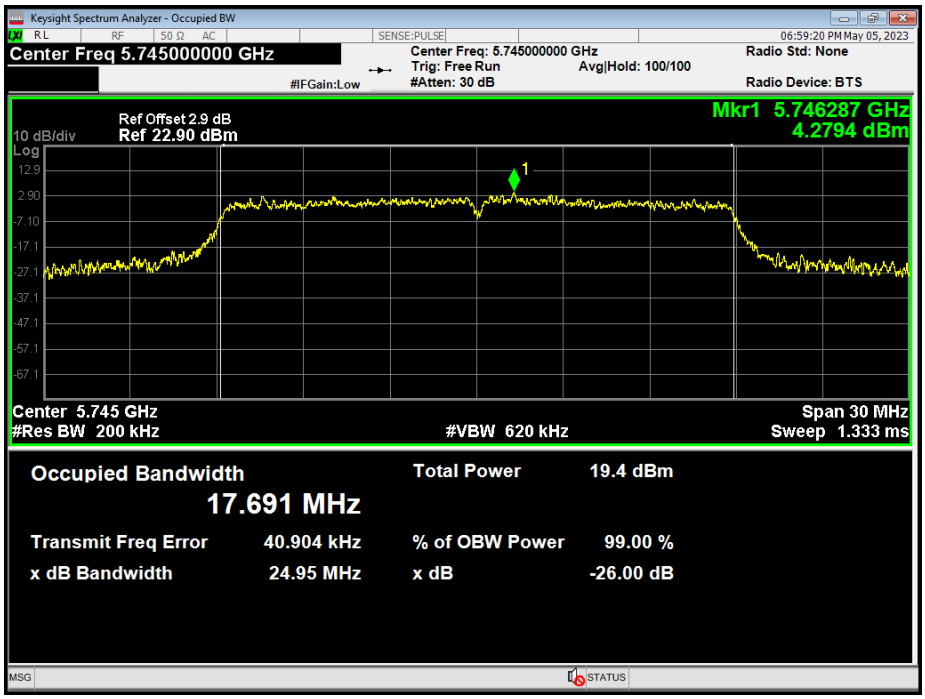
802.11 n40 5755MHz 99% bandwidth



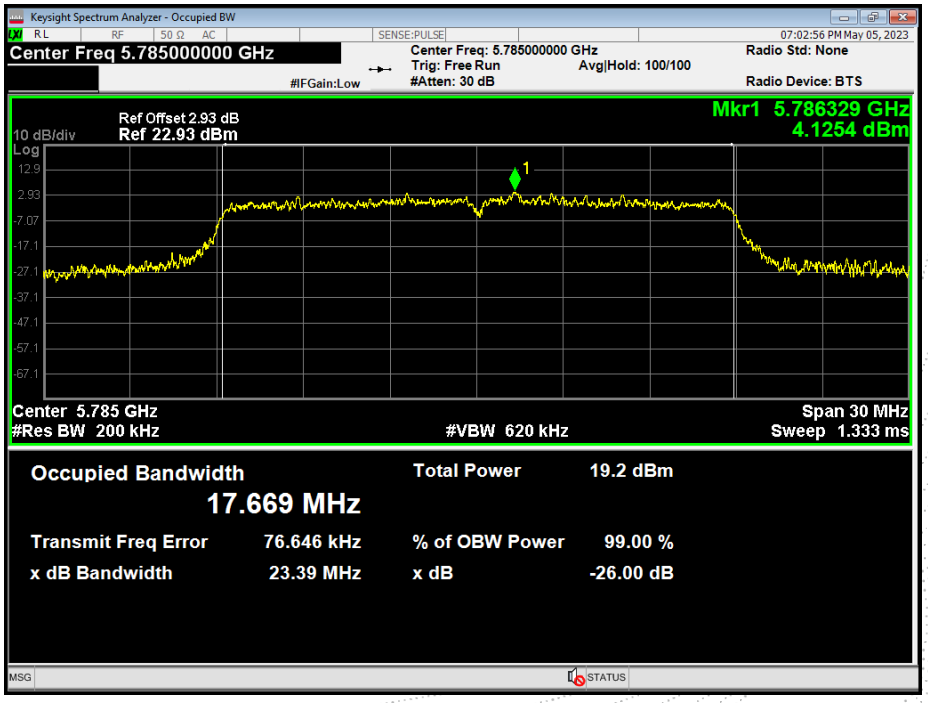
802.11 n40 5795MHz 99% bandwidth



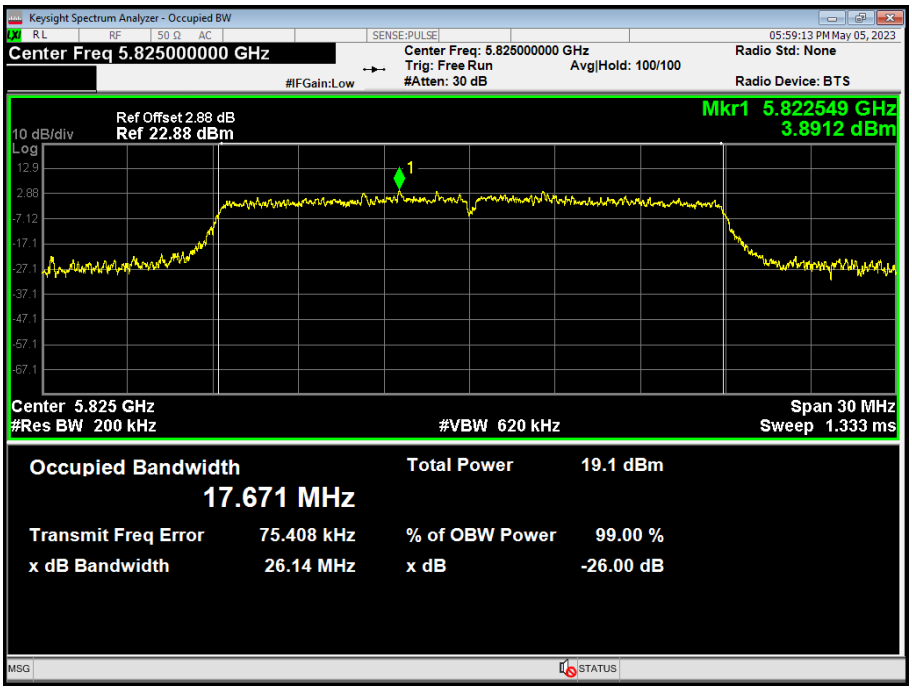
802.11ac20 5745MHz 99% bandwidth



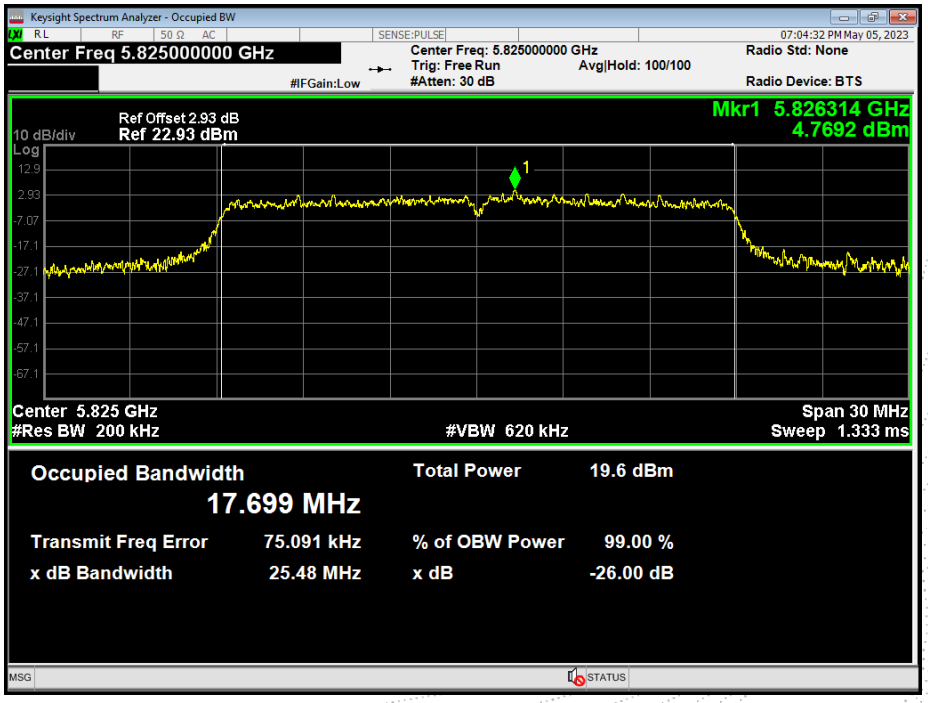
802.11ac20 5785MHz 99% bandwidth



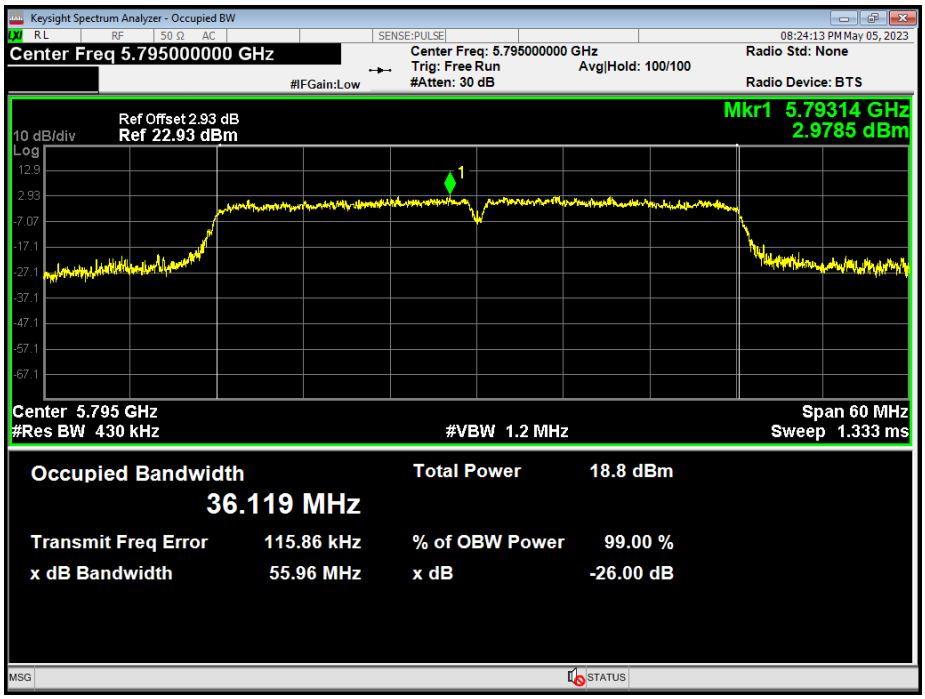
802.11ac20 5825MHz 99% bandwidth



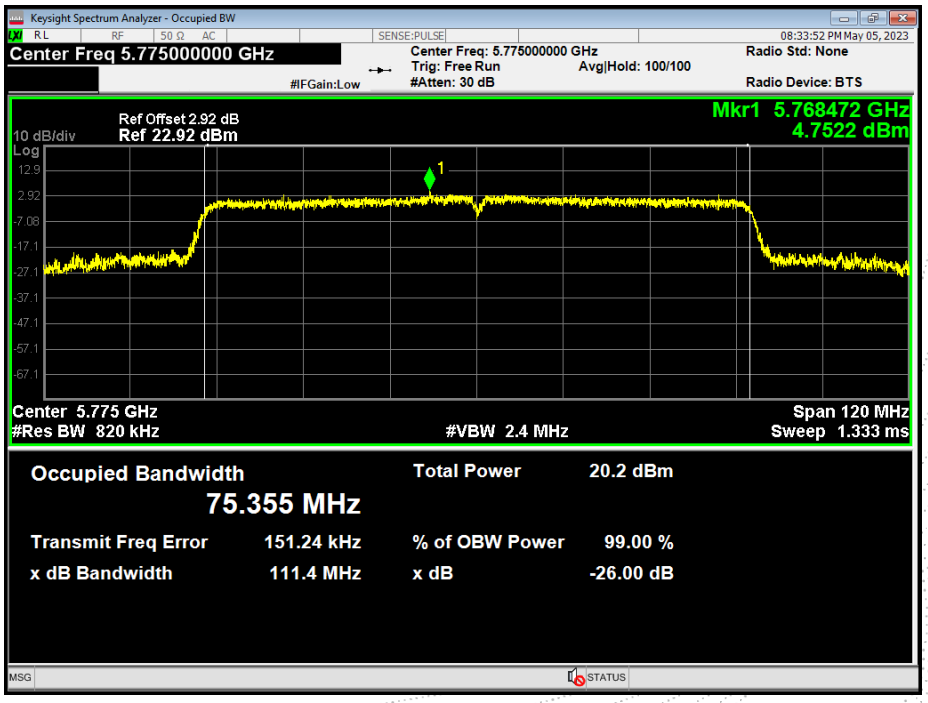
802.11 ac40 5755MHz 99% bandwidth



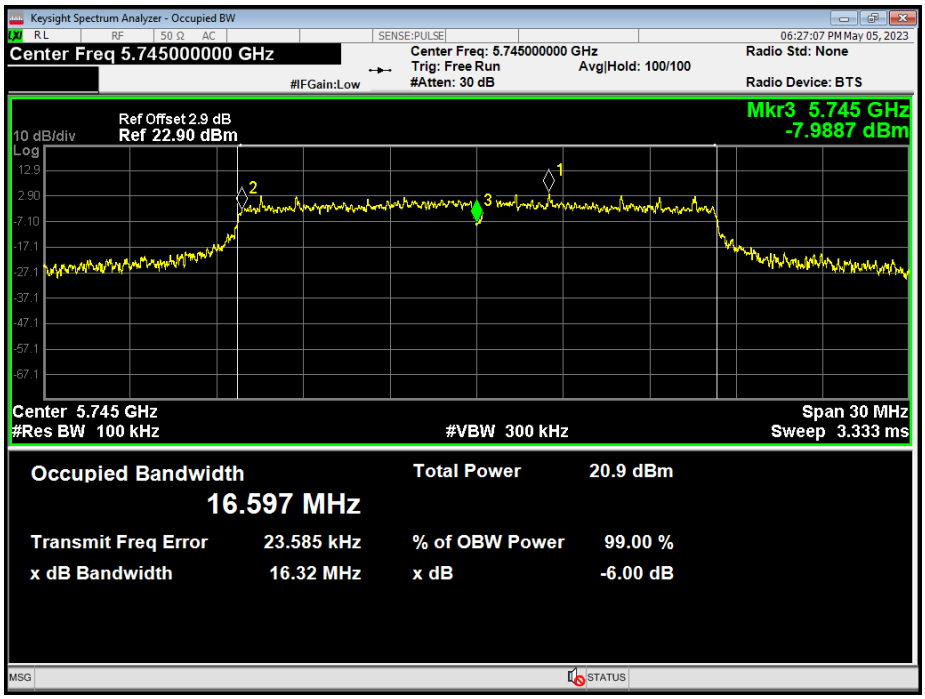
802.11 ac40 5795MHz 99% bandwidth



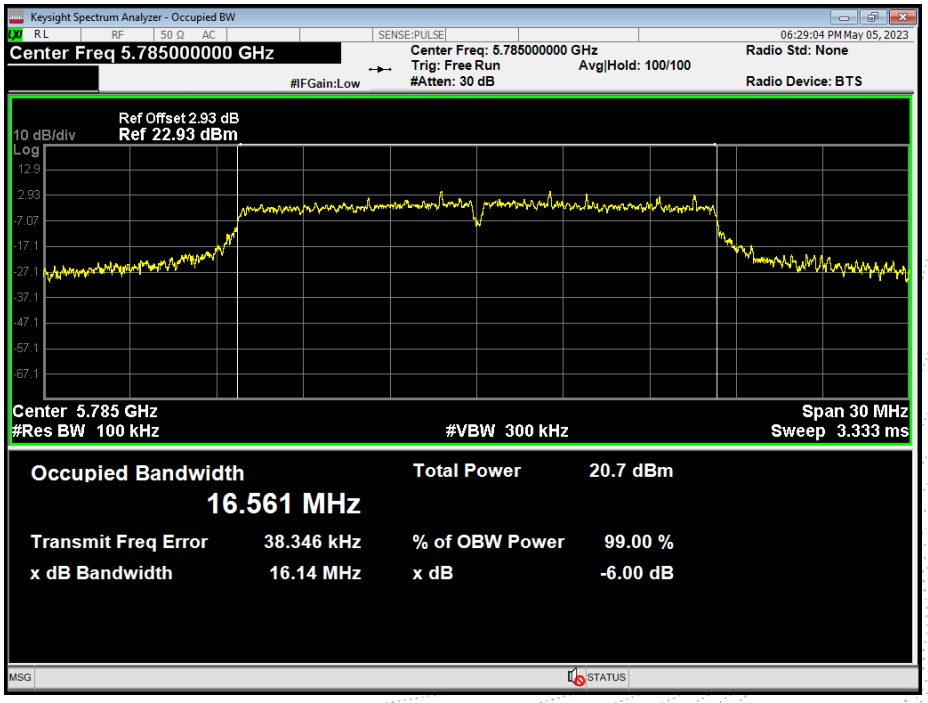
802.11 ac80 5775MHz 99% bandwidth



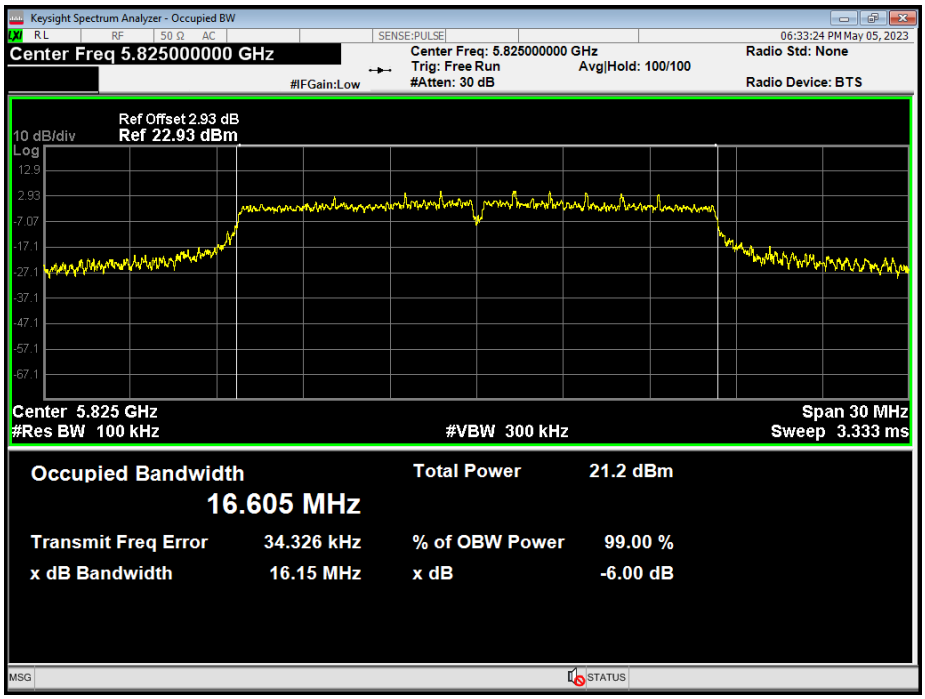
802.11a 5745MHz 6dB bandwidth



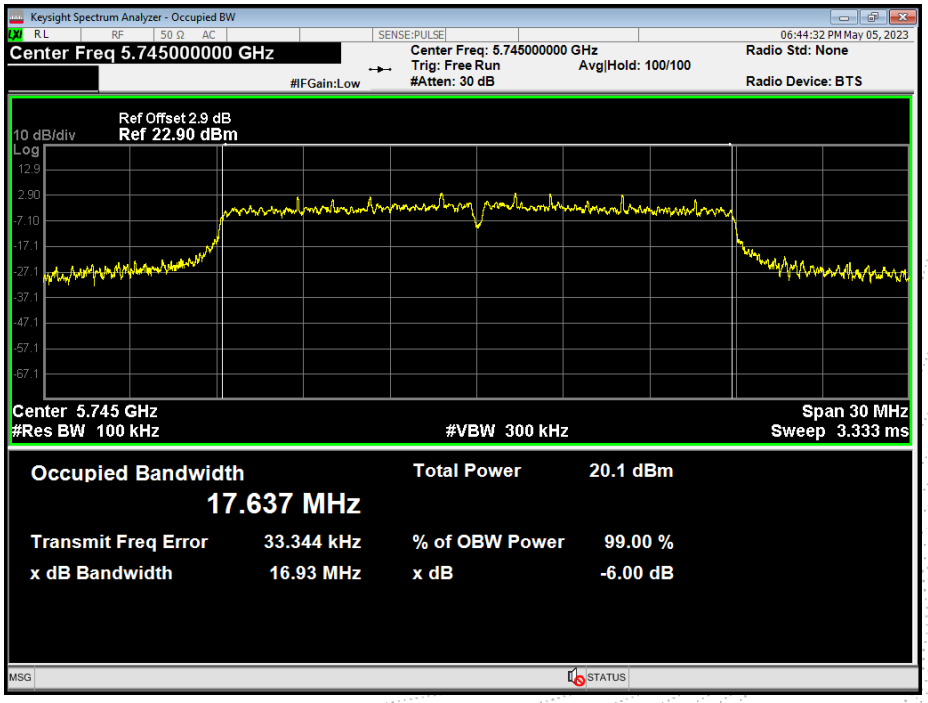
802.11a 5785MHz 6dB bandwidth



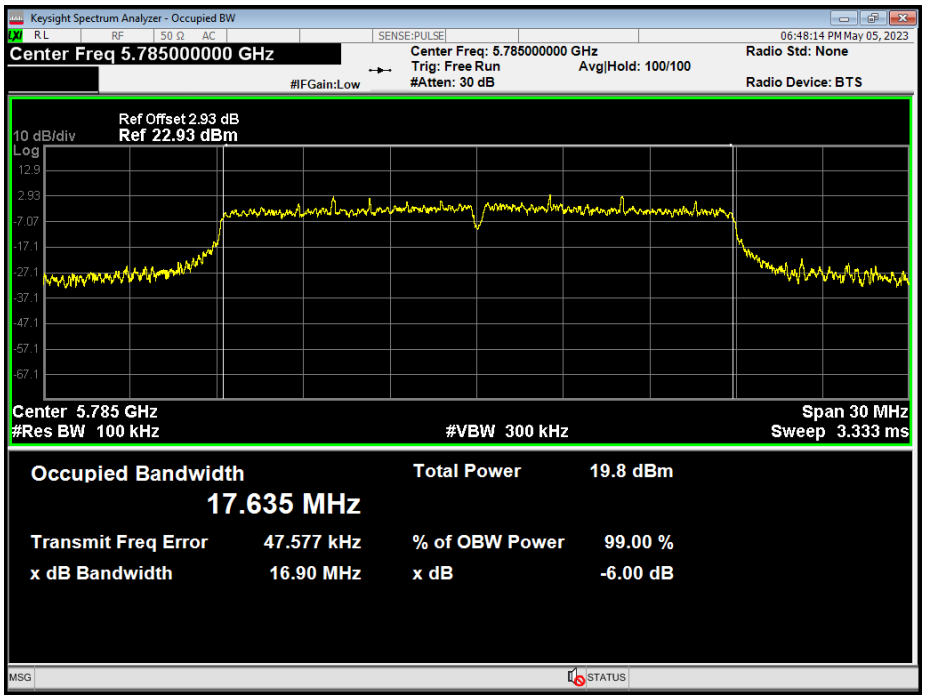
802.11a 5825MHz 6dB bandwidth



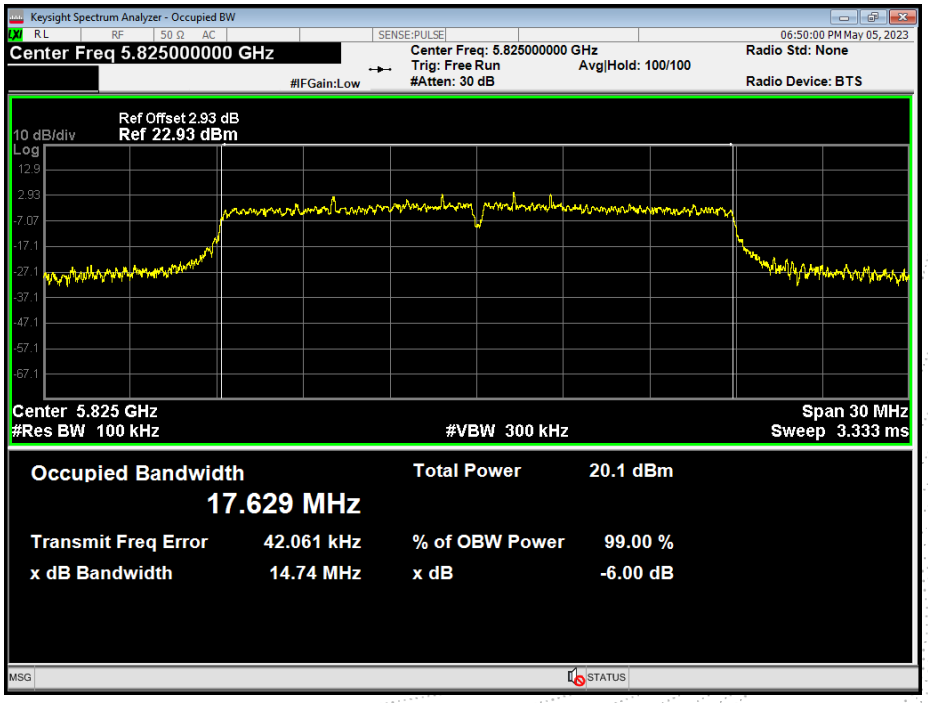
802.11n20 5745MHz 6dB bandwidth



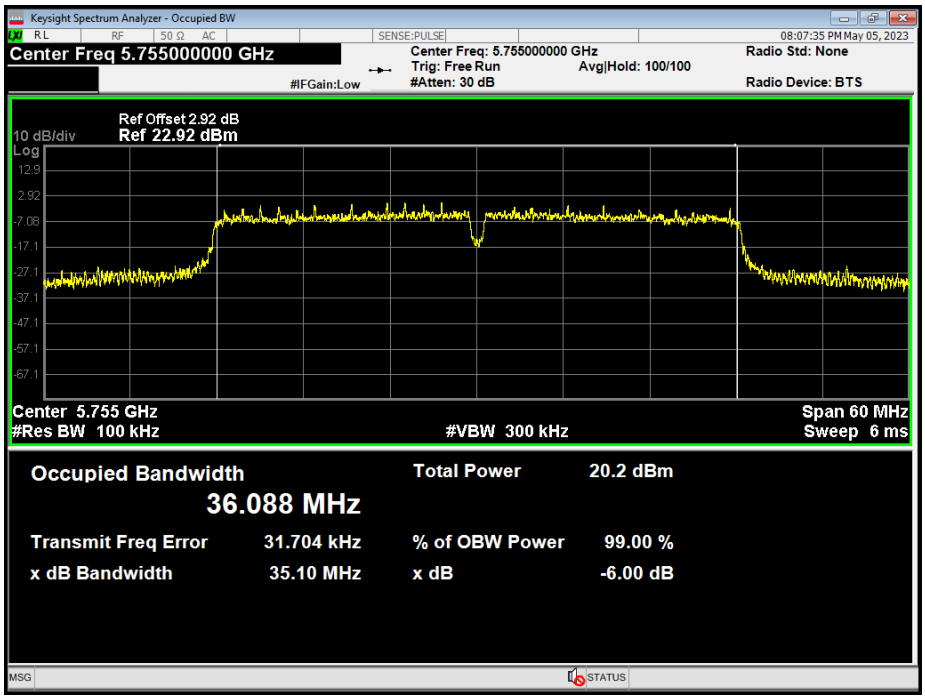
802.11n20 5785MHz 6dB bandwidth



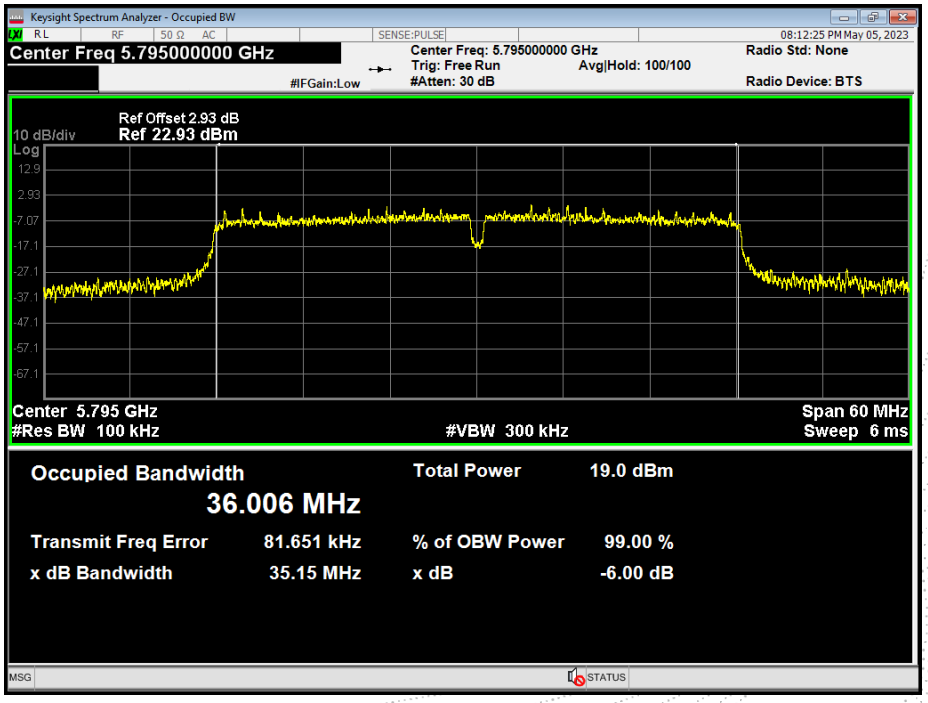
802.11n20 5825MHz 6dB bandwidth



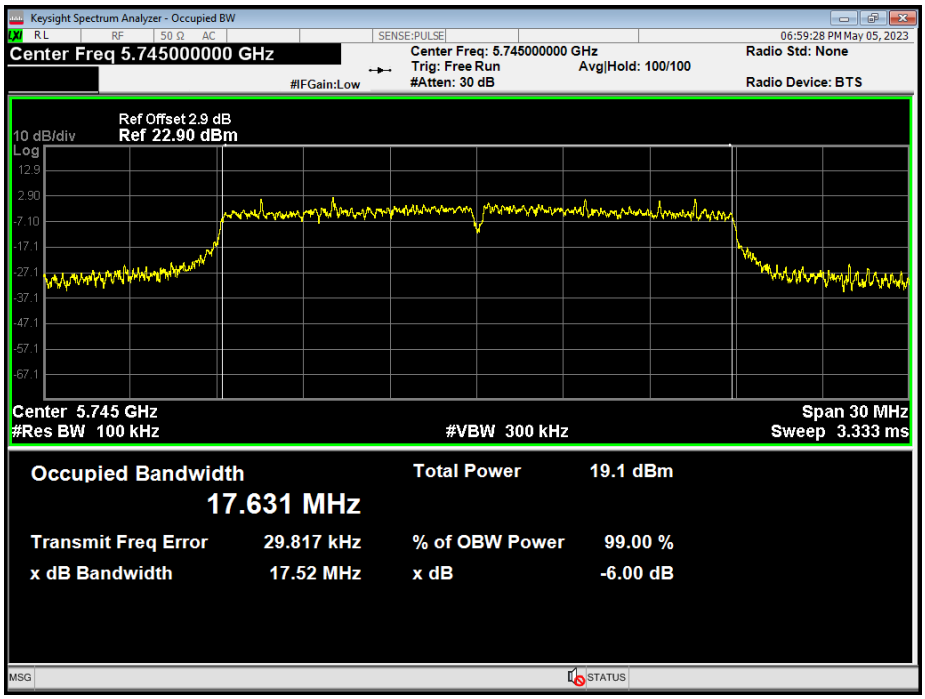
802.11 n40 5755MHz 6dB bandwidth



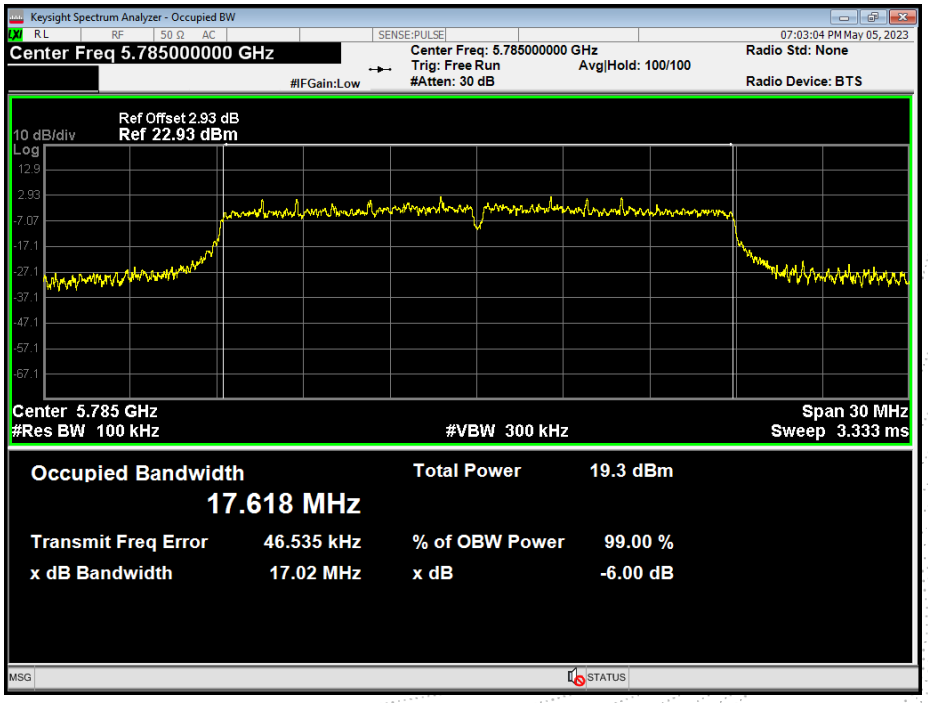
802.11 n40 5795MHz 6dB bandwidth



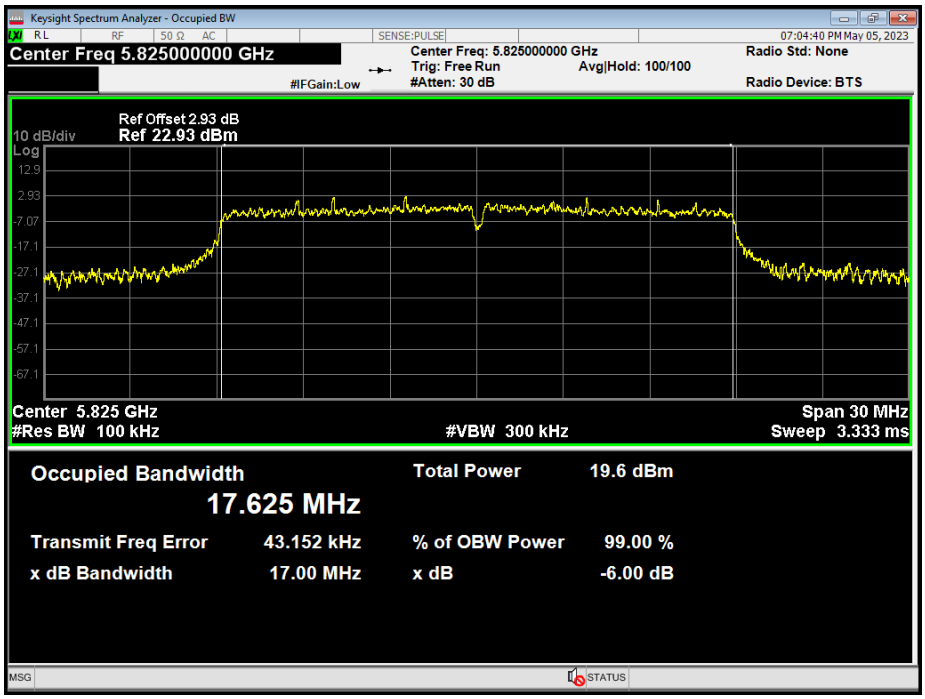
802.11ac20 5745MHz 6dB bandwidth



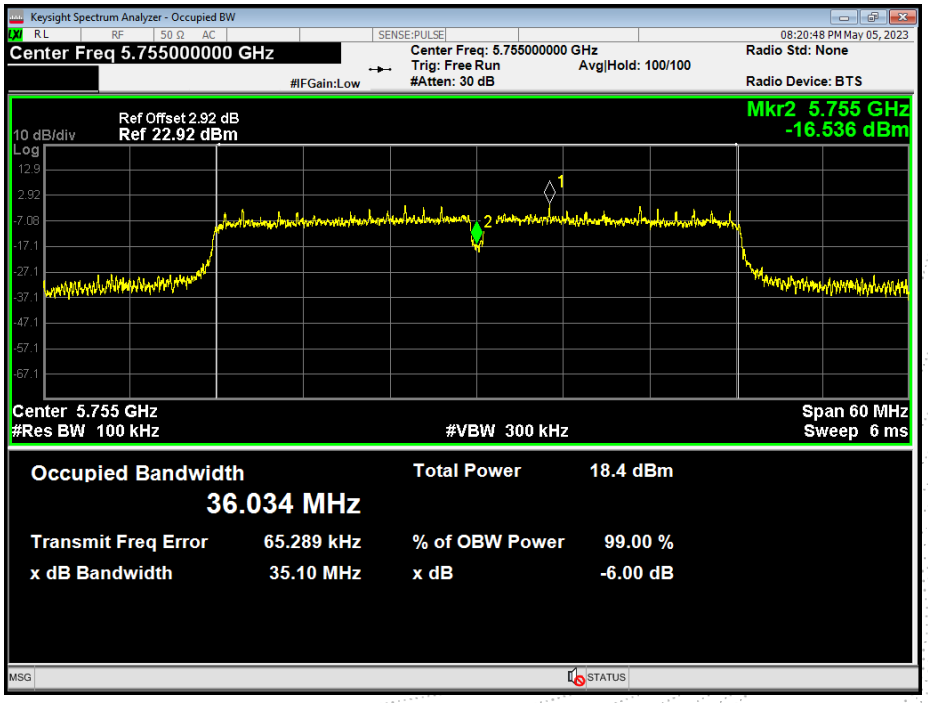
802.11ac20 5785MHz 6dB bandwidth



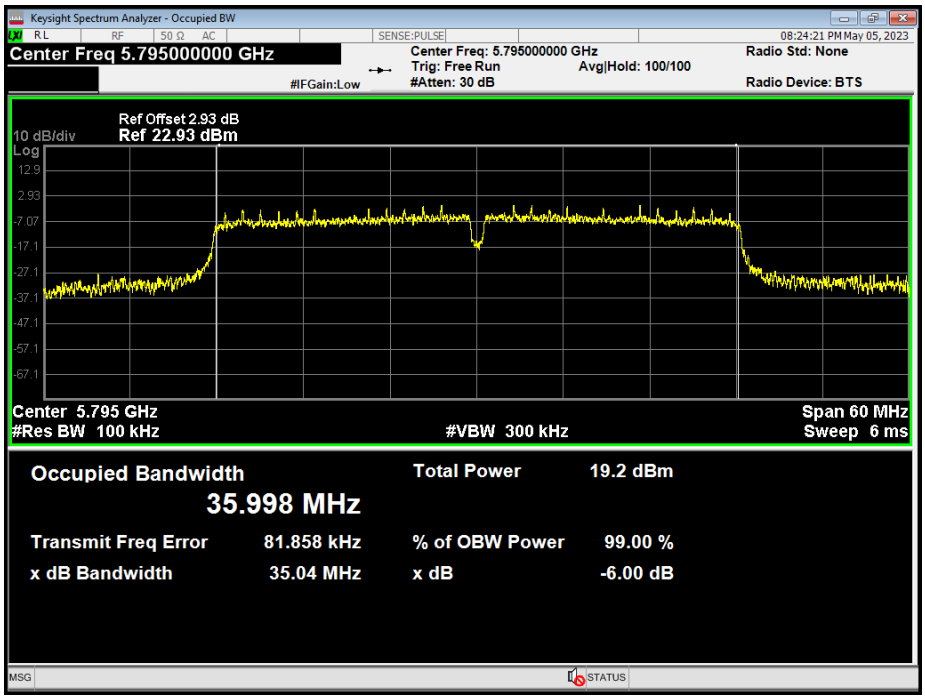
802.11ac20 5825MHz 6dB bandwidth



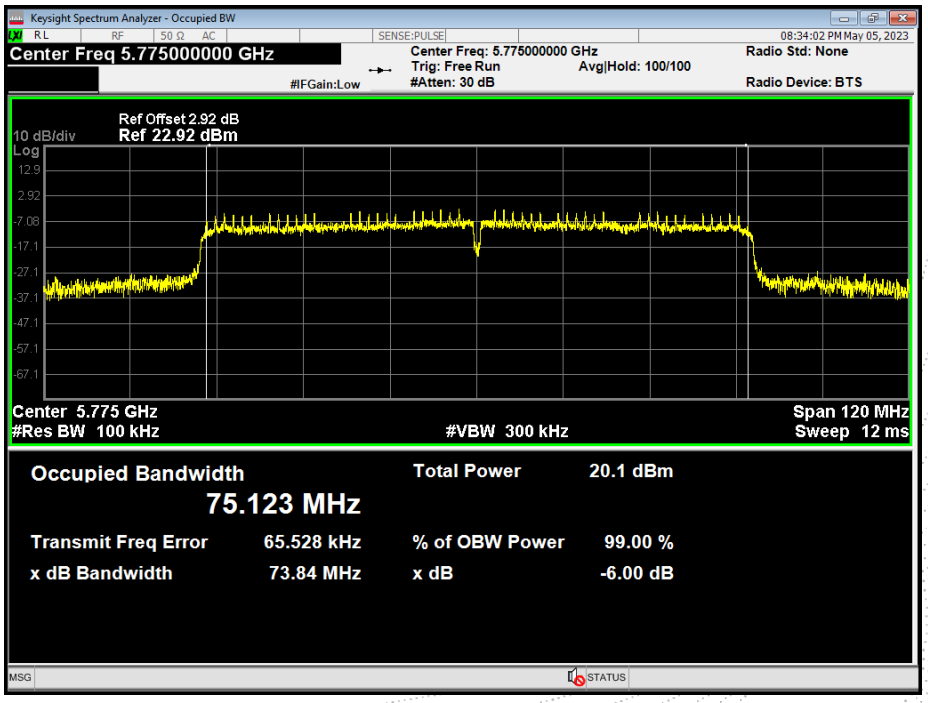
802.11 ac40 5755MHz 6dB bandwidth



802.11 ac40 5795MHz 6dB bandwidth

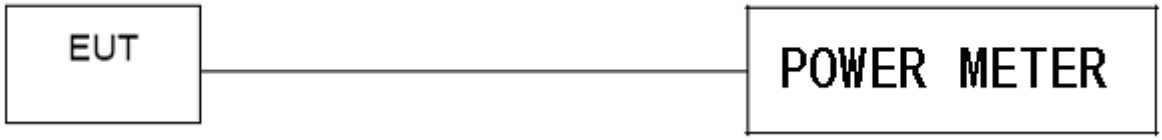


802.11 ac80 5775MHz 6dB bandwidth



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 ：	AC120V/60Hz
Test Mode:	TX (5.1G) Mode Frequency U-NII-1 (5180-5240MHz)		

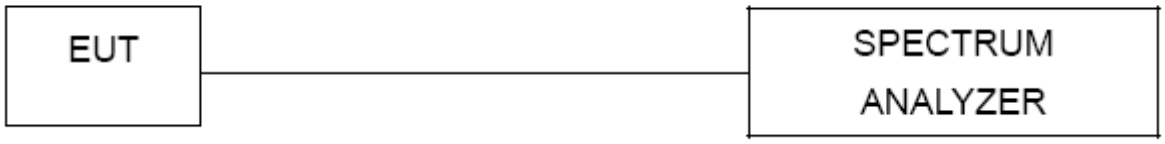
Test Channel	Frequency	Maximum output power. Antenna port (AV)			LIMIT	Result
	(MHz)	ANT A(dBm)	ANT B(dBm)	Total(dBm)	dBm	
TX 802.11a Mode						
CH36	5180	15.39	16.08	/	30	Pass
CH40	5200	15.21	16.22	/	30	Pass
CH48	5240	17.21	17.53	/	30	Pass
TX 802.11 n20M Mode						
CH36	5180	13.72	15.33	17.609	27.46	Pass
CH40	5200	13.89	14.24	17.078	27.46	Pass
CH48	5240	15.77	15.74	18.765	27.46	Pass
TX 802.11 n40M Mode						
CH38	5190	12.3	14.73	16.693	27.46	Pass
CH46	5230	12.72	16.59	18.082	27.46	Pass
TX 802.11 AC20M Mode						
CH36	5180	13.43	14.77	17.161	27.46	Pass
CH40	5200	13.71	15.05	17.441	27.46	Pass
CH48	5240	14.97	15.89	18.464	27.46	Pass
TX 802.11 AC40M Mode						
CH38	5190	12.64	13.74	16.235	27.46	Pass
CH46	5230	14.59	15.77	18.230	27.46	Pass
TX 802.11 AC80M Mode						
CH42	5210	12.79	14.81	16.926	27.46	Pass

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage ：	AC120V/60Hz
Test Mode:	TX (5.8G) Mode Frequency U-NII-3 (5745-5825MHz)		

Test Channel	Frequency	Maximum output power. Antenna port (AV)			LIMIT	Result
	(MHz)	ANT A(dBm)	ANT B(dBm)	Total(dBm)	dBm	
TX 802.11a Mode						
CH 149	5745	14.77	15.46	/	30	Pass
CH 157	5785	15.35	15.17	/	30	Pass
CH 165	5825	15.09	15.14	/	30	Pass
TX 802.11 n20M Mode						
CH 149	5745	13.5	14.31	16.934	27.46	Pass
CH 157	5785	13.85	14.13	17.002	27.46	Pass
CH 165	5825	13.54	14.45	17.029	27.46	Pass
TX 802.11 n40M Mode						
CH 151	5755	13.91	14.29	17.114	27.46	Pass
CH 159	5795	13.94	13.79	16.875	27.46	Pass
TX 802.11 AC20M Mode						
CH 149	5745	13.73	13.99	16.872	27.46	Pass
CH 157	5785	13.63	13.75	16.700	27.46	Pass
CH 165	5825	14.05	14.19	17.130	27.46	Pass
TX 802.11 AC40M Mode						
CH 151	5755	12.84	12.85	15.855	27.46	Pass
CH 159	5795	13.8	13.09	16.469	27.46	Pass
TX 802.11 AC80M Mode						
CH 155	5775	12.32	13.44	15.926	27.46	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

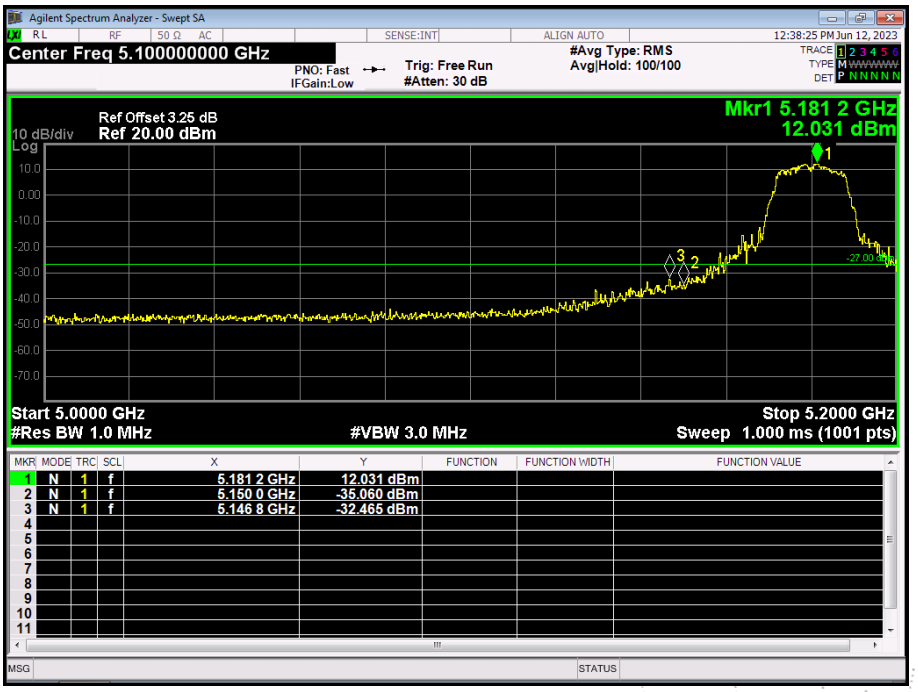
11.5 Test Result

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage ：	AC120V/60Hz

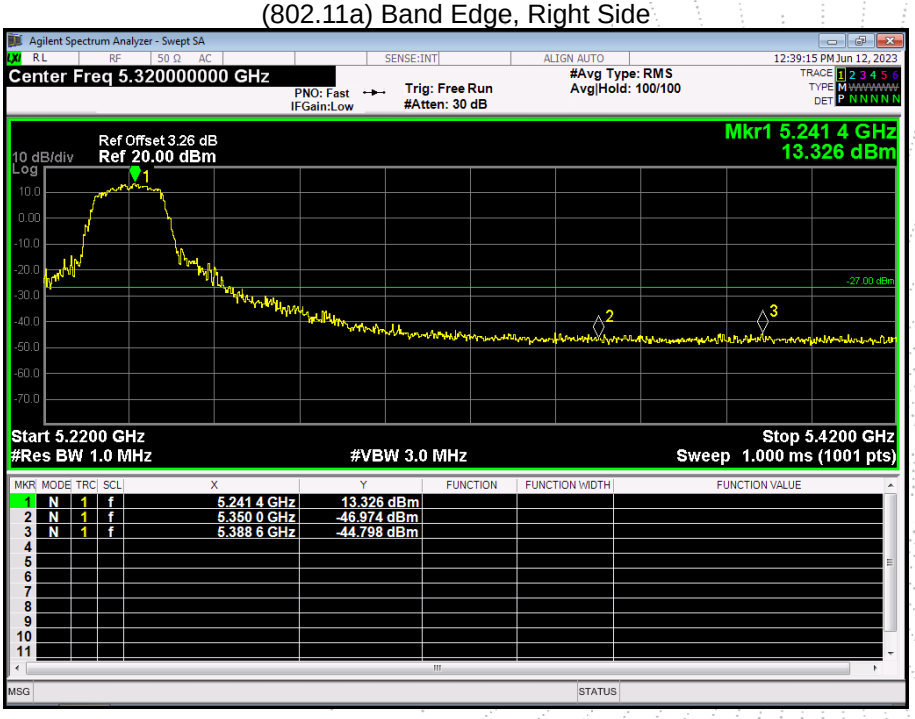
Note: A(B) Represent the value of antenna A and B, The worst data is Antenna B,only shown Antenna B Plot.

5.180~5.240 GHz

(802.11a) Band Edge, Left Side

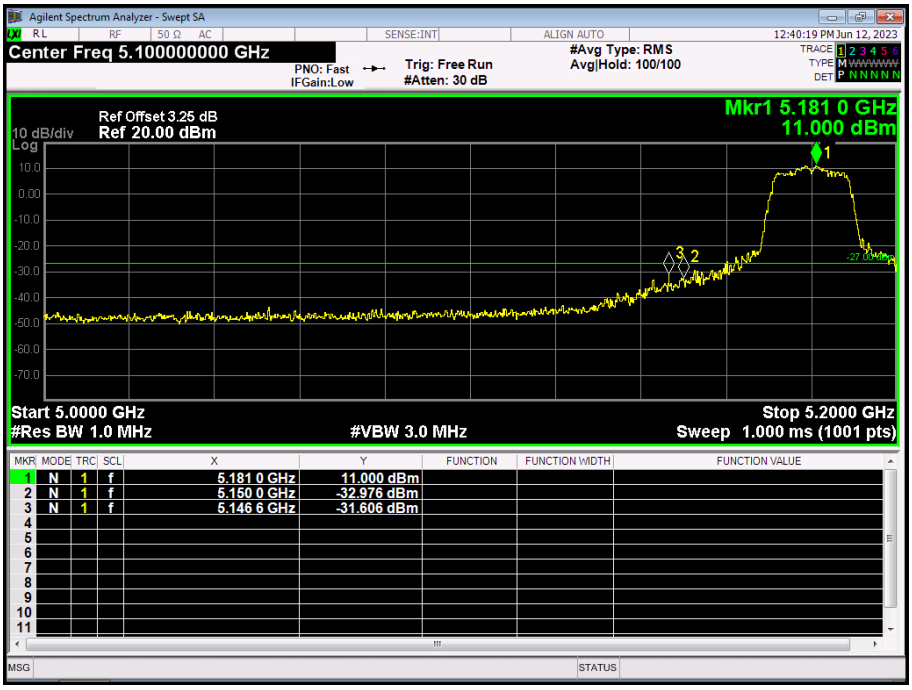


(802.11a) Band Edge, Right Side

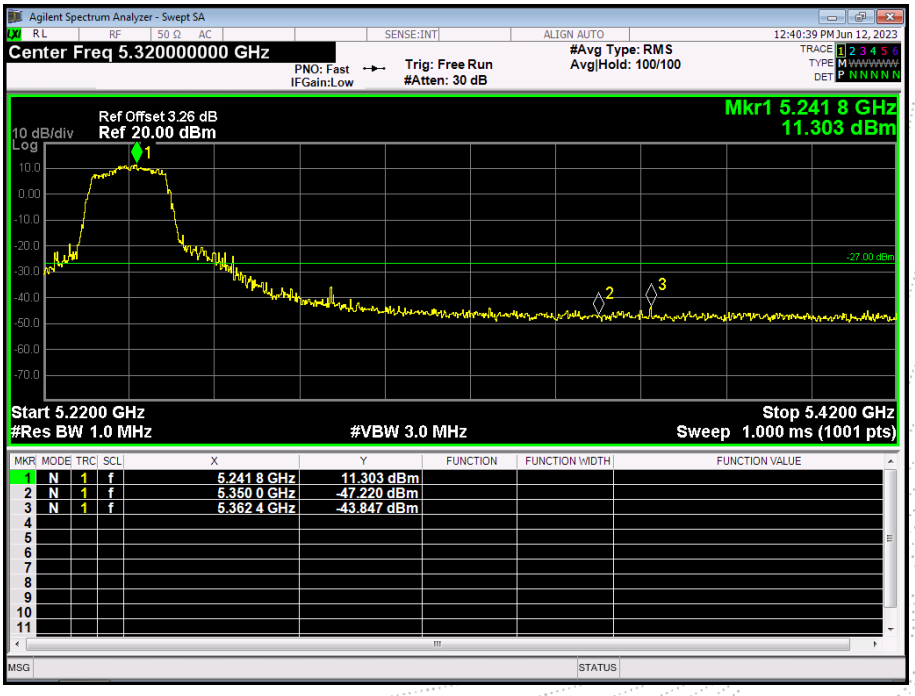


5.180~5.240 GHz

(802.11n20) Band Edge, Left Side

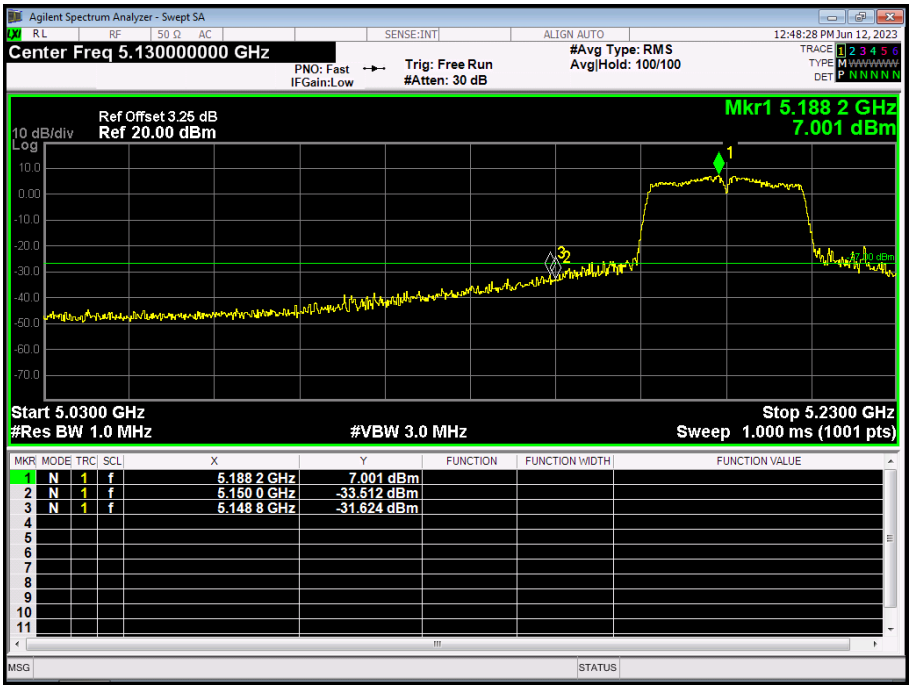


(802.11n20) Band Edge, Right Side

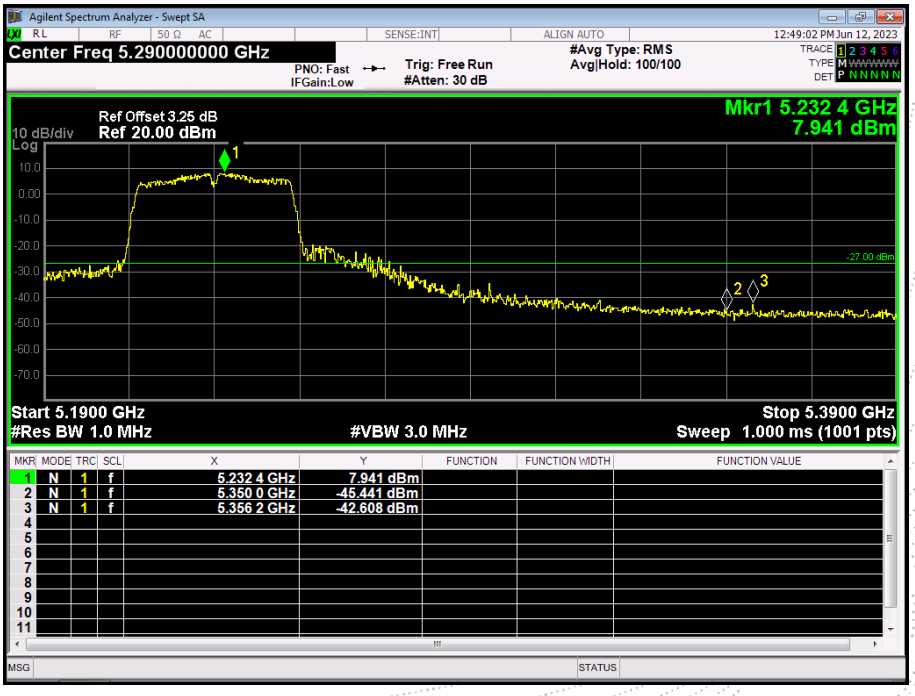


5.190~5.230 GHz

(802.11n40) Band Edge, Left Side

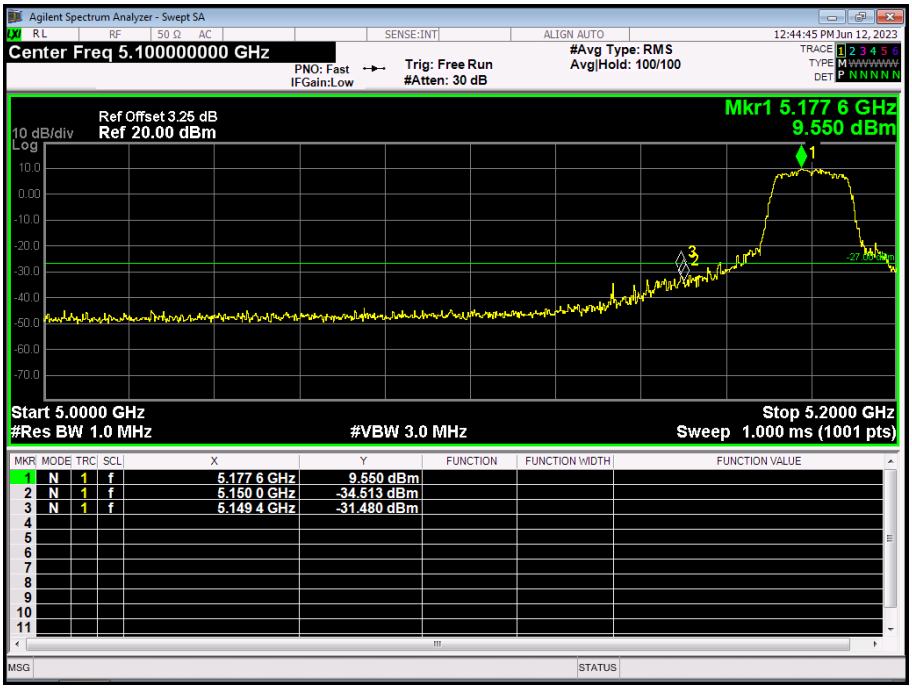


(802.11n40) Band Edge, Right Side

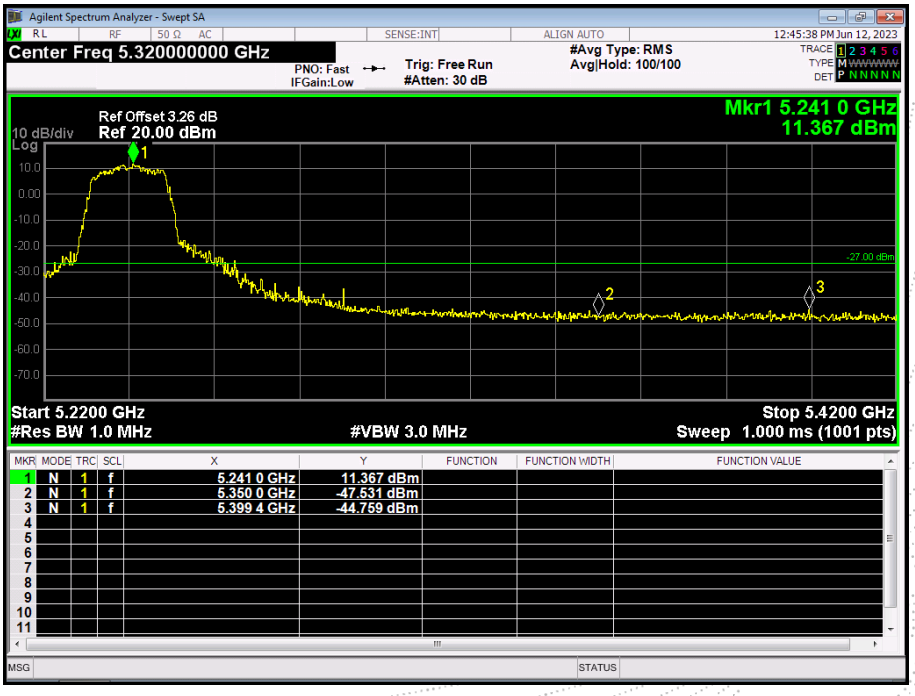


5.180~5.240 GHz

(802.11ac20) Band Edge, Left Side

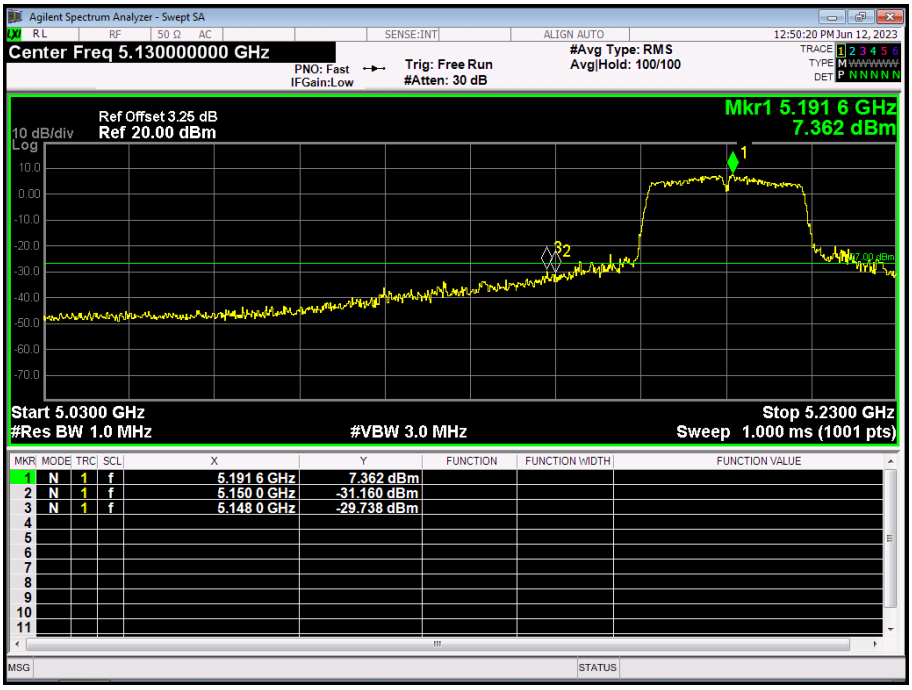


(802.11ac20) Band Edge, Right Side

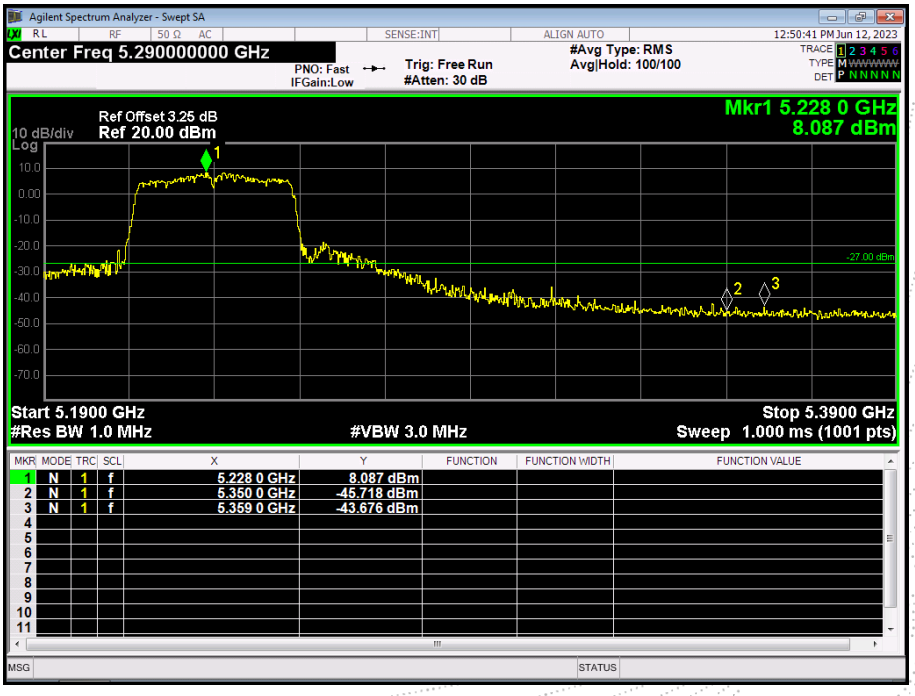


5.190~5.230 GHz

(802.11ac40) Band Edge, Left Side

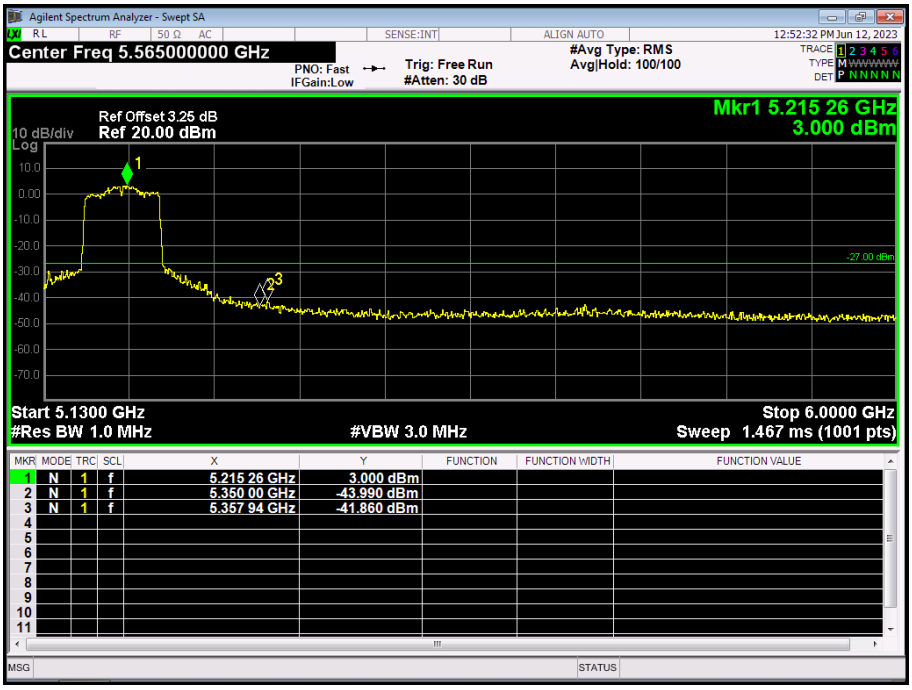


(802.11ac40) Band Edge, Right Side

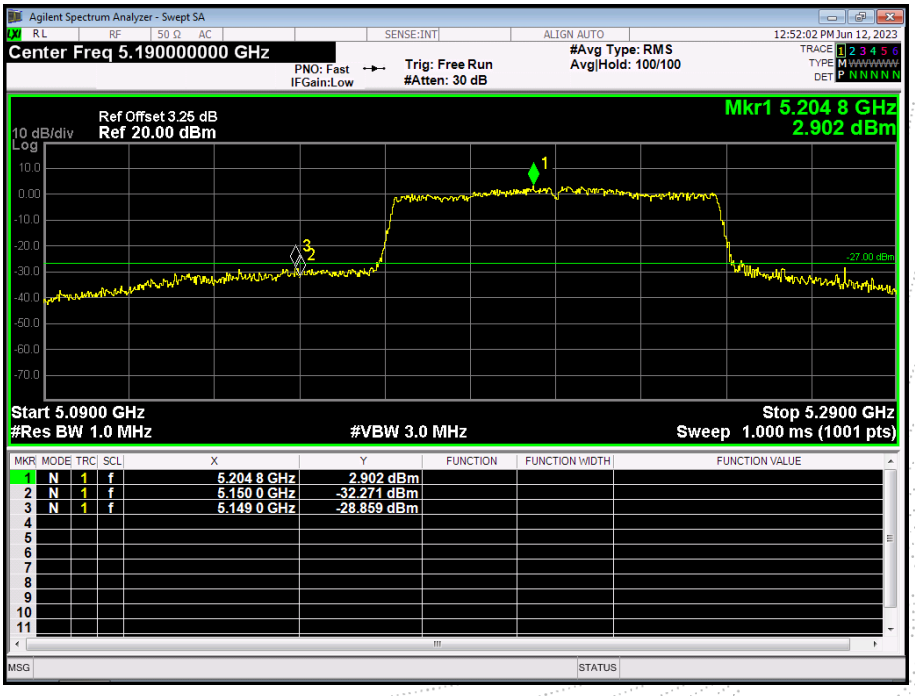


5.210GHz

(802.11ac80) Band Edge, Left Side

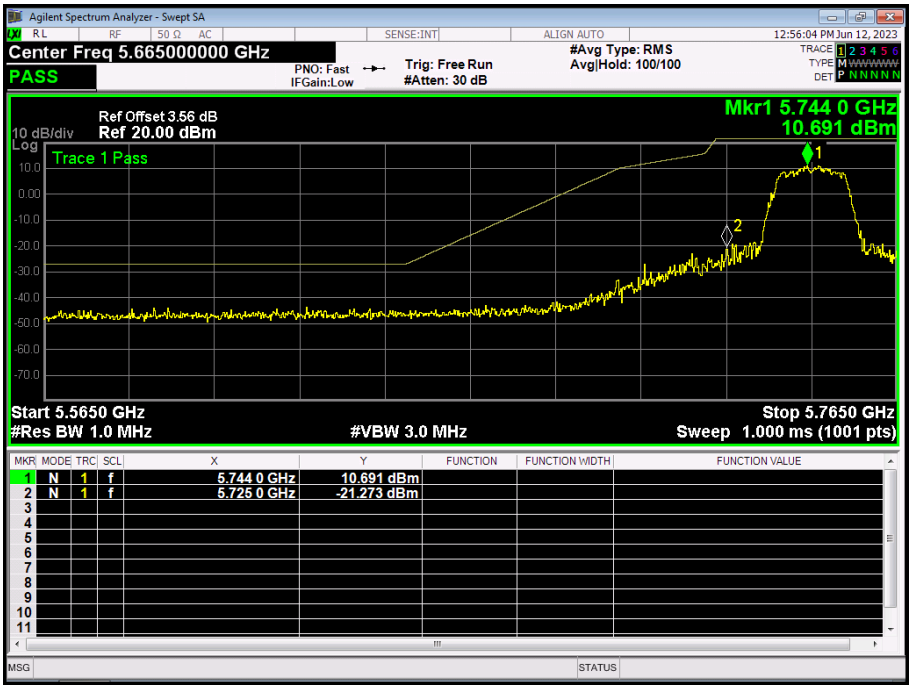


(802.11ac80) Band Edge, Right Side



5.745~5.825 GHz

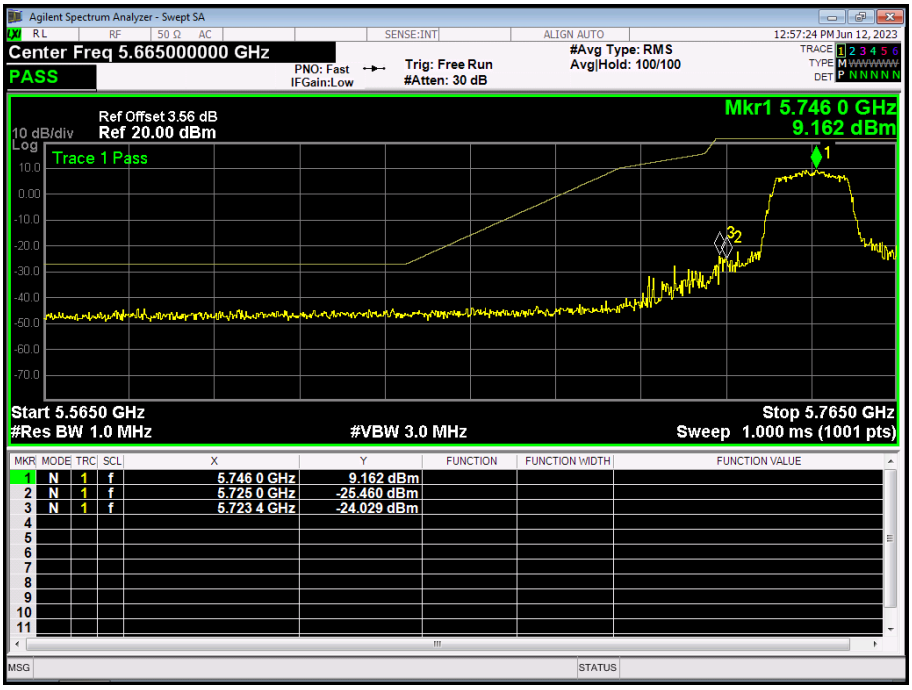
(802.11a) Band Edge, Left Side



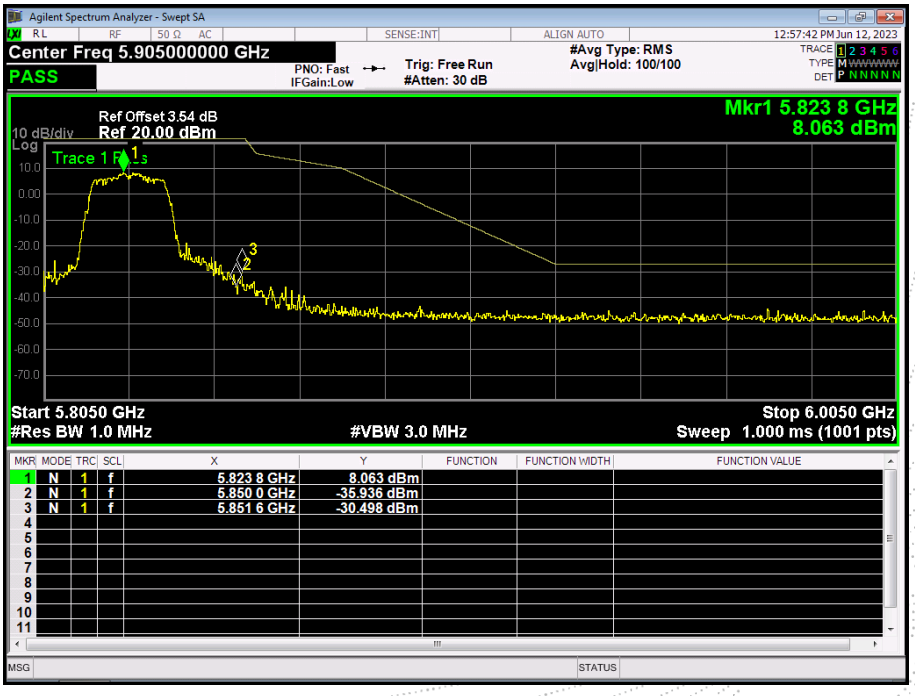
(802.11a) Band Edge, Right Side

5.745~5.825 GHz

(802.11n20) Band Edge, Left Side

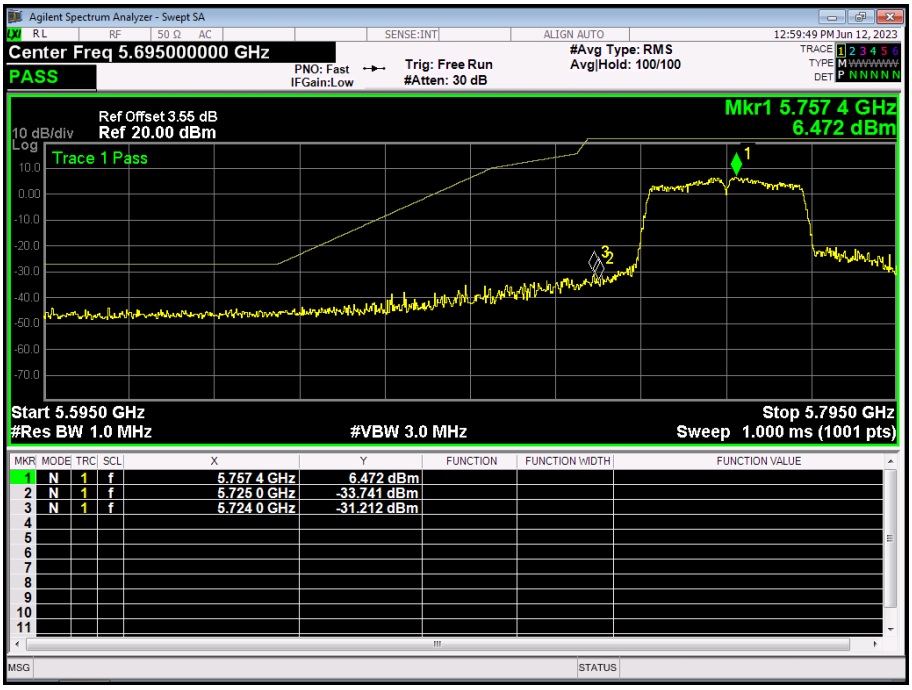


(802.11n20) Band Edge, Right Side



5755~5795GHz

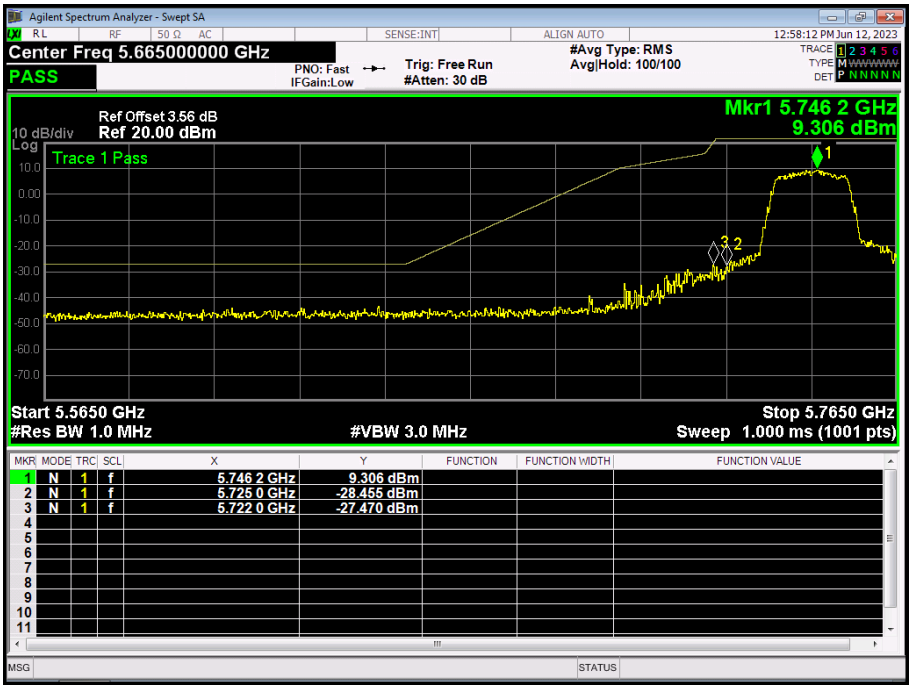
(802.11n40) Band Edge, Left Side



(802.11n40) Band Edge, Right Side

5.745~5.825 GHz

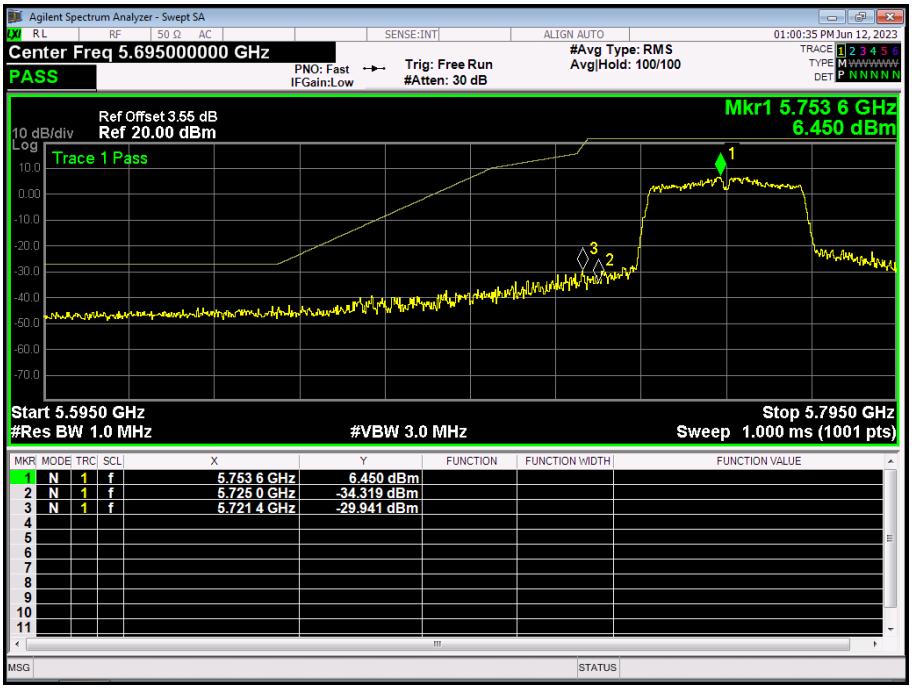
(802.11ac20) Band Edge, Left Side



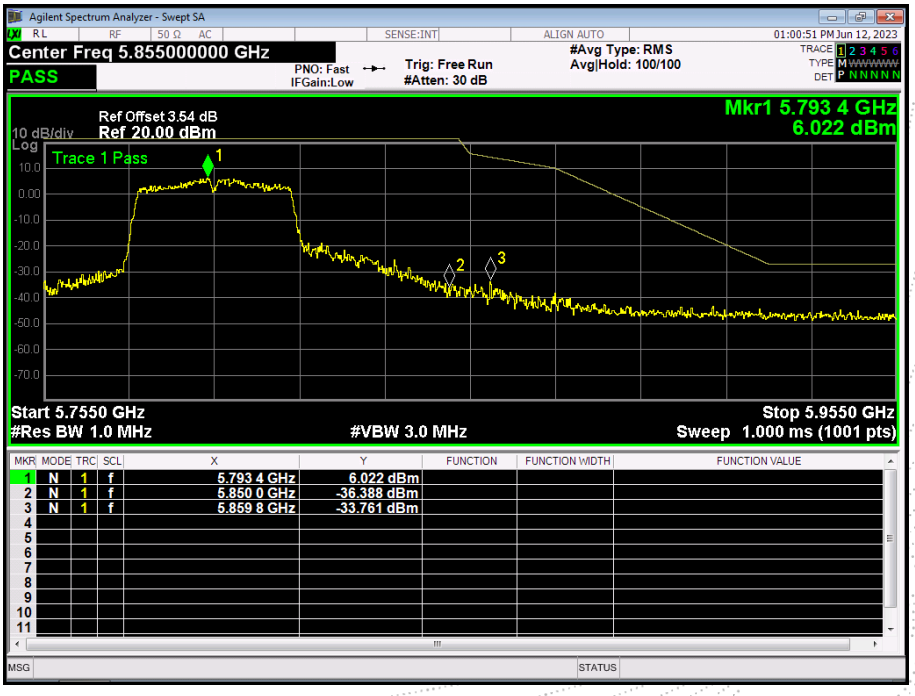
(802.11ac20) Band Edge, Right Side

5.755~5795 GHz

(802.11ac40) Band Edge, Left Side

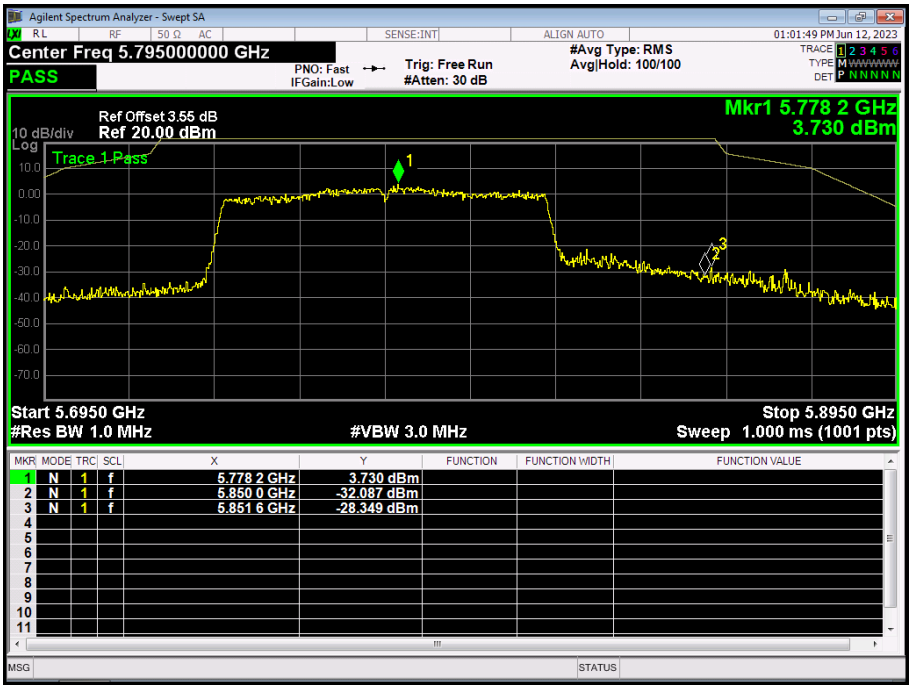


(802.11ac40) Band Edge, Right Side

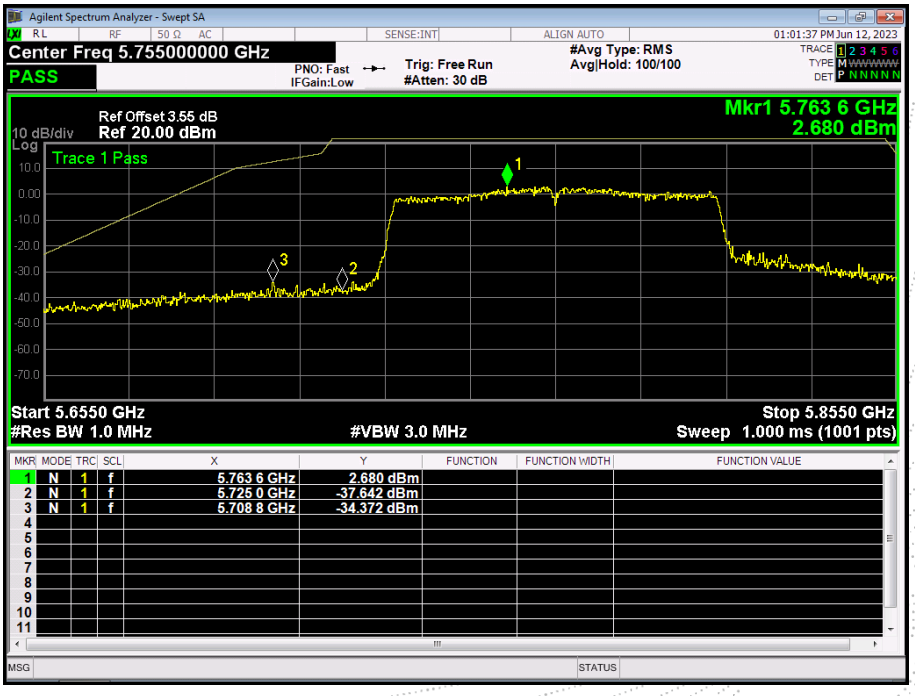


5775GHz

(802.11ac80) Band Edge, Left Side

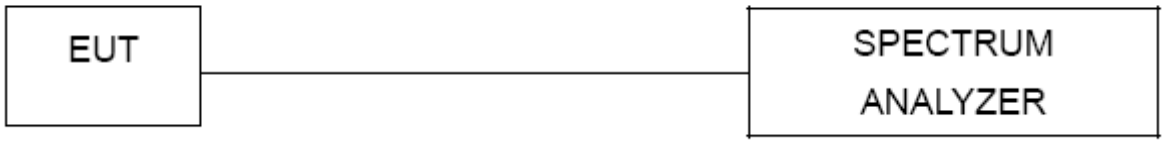


(802.11ac80) Band Edge, Right Side



12. Spurious RF Conducted Emissions

12.1 Block Diagram Of Test Setup



12.2 Limit

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)For transmitters operating in the 5.725-5.85 GHz band(i) 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..

12.3 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.

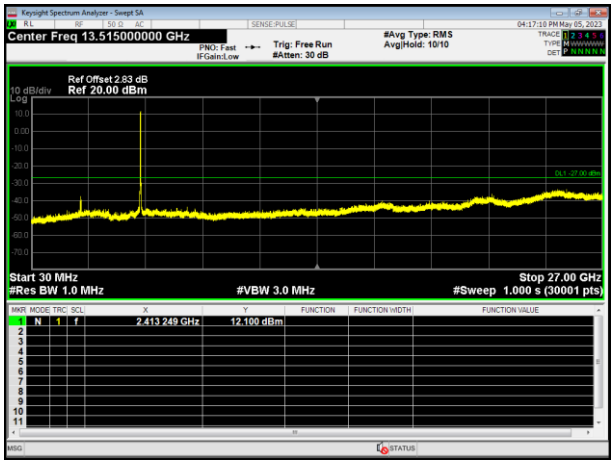
12.4 Test Result

Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.
About:26.5GHz-40GHz, The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Note: A(B) Represent the value of antenna A and B, The worst data is Antenna B, only shown Antenna B Plot.

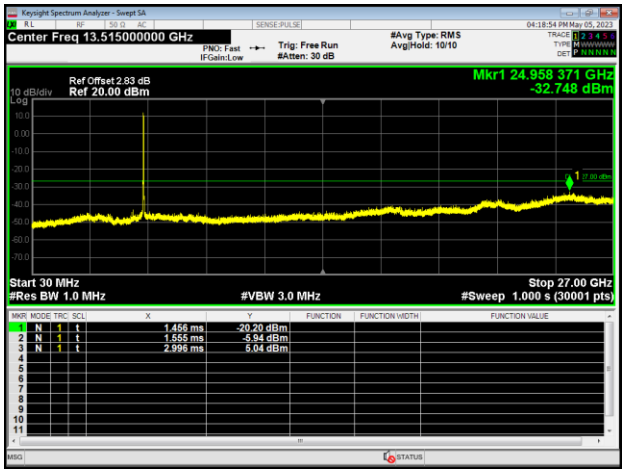
5.1G

Test Plot

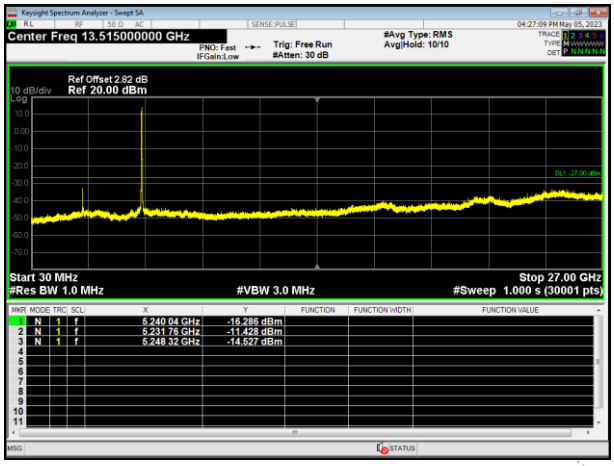
802.11a on channel 36



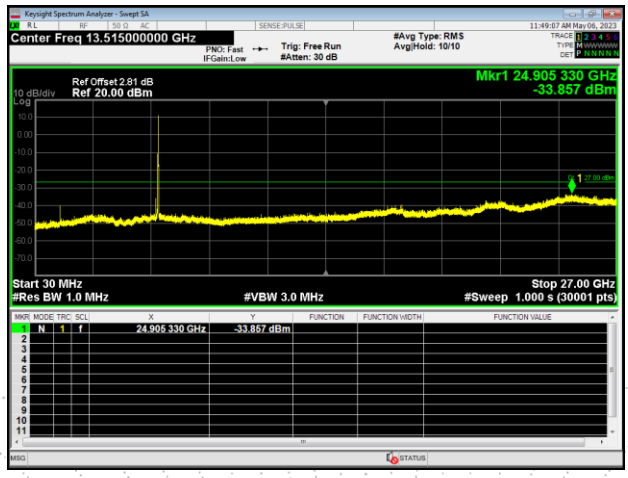
802.11a on channel 40



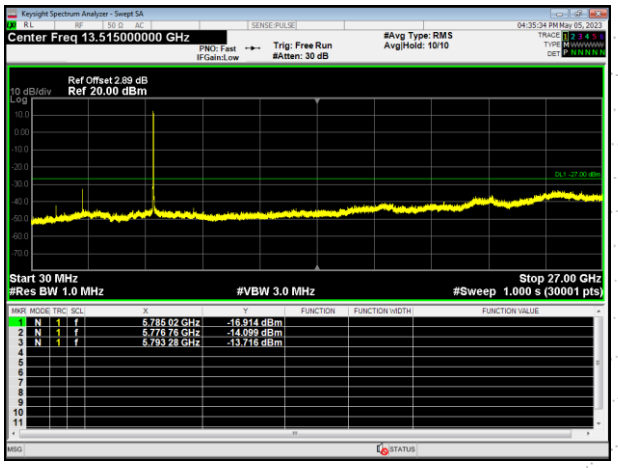
802.11a on channel 36



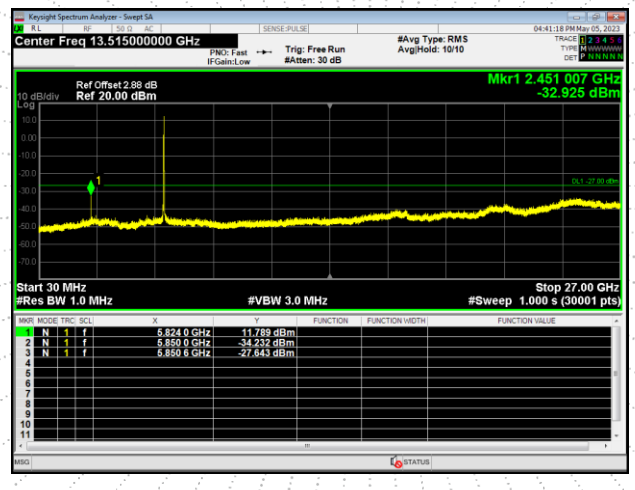
802.11a on channel 40



802.11a on channel 36

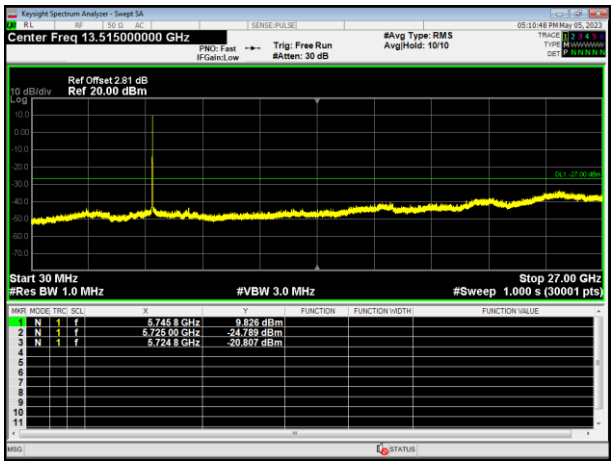


802.11a on channel 40

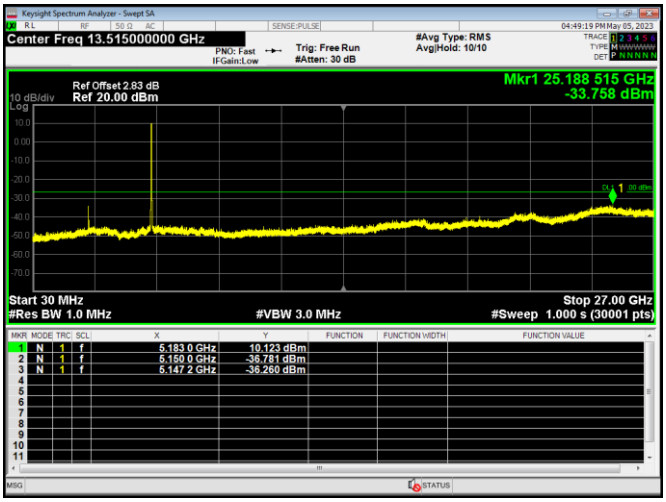


Test Plot

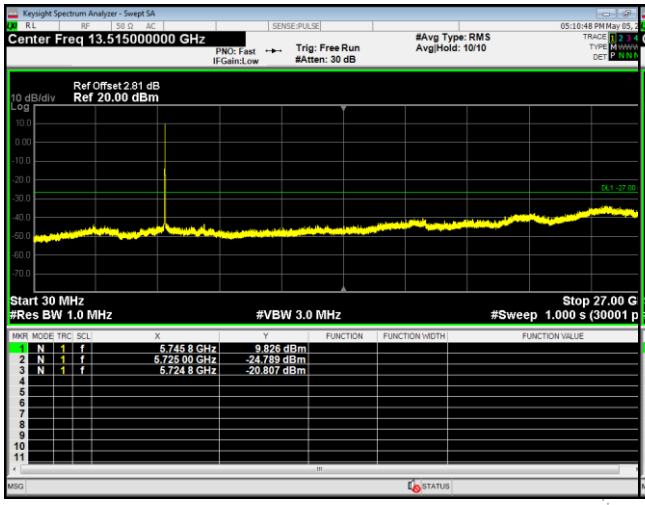
802.11n20 on channel 36



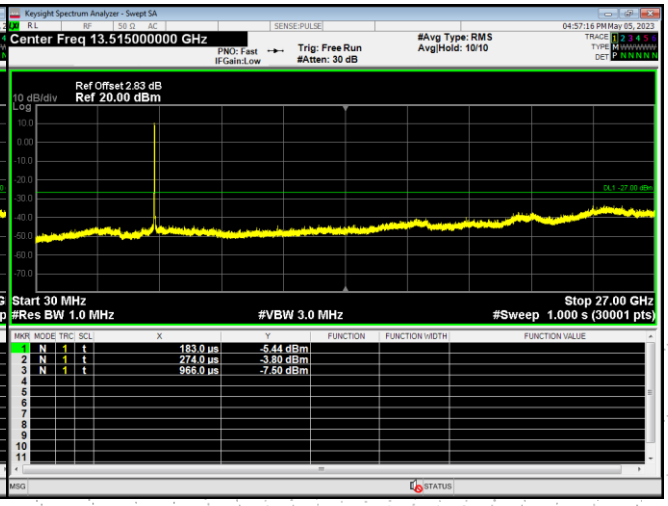
802.11n20 on channel 40



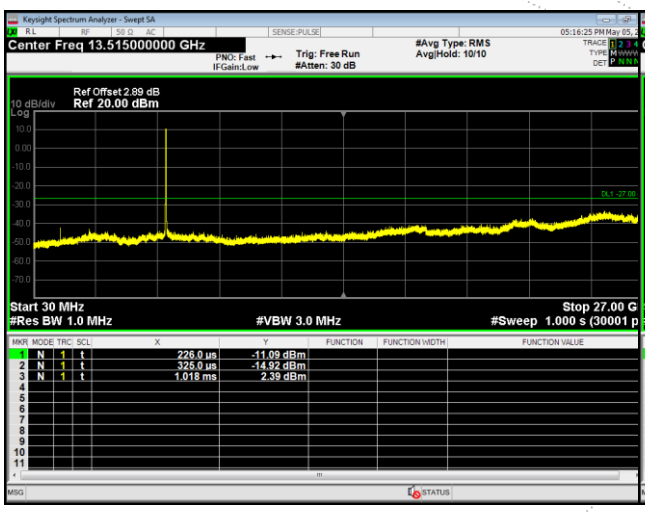
802.11n20 on channel 36



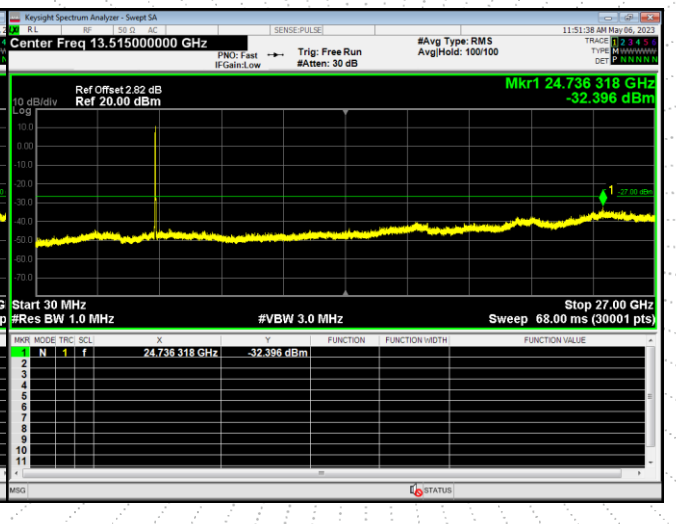
802.11n20 on channel 40



802.11n20 on channel 36

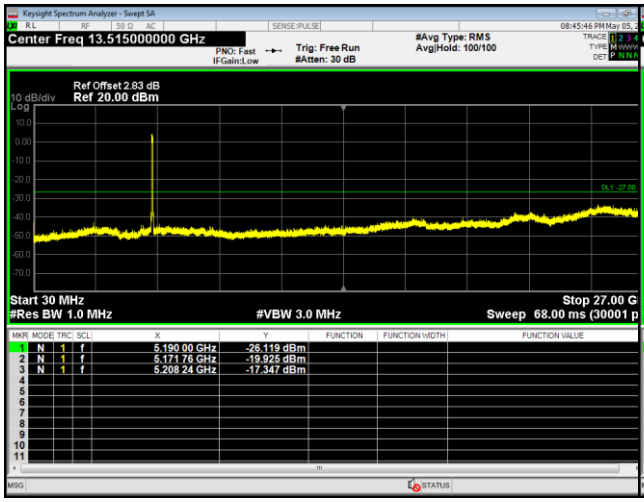


802.11n20 on channel 40

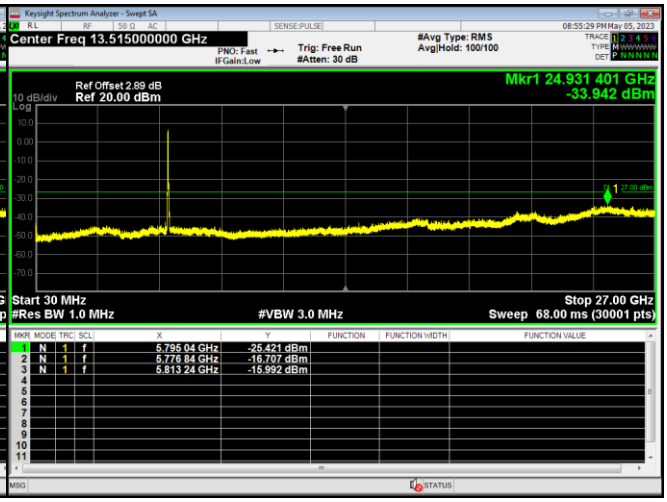


Test Plot

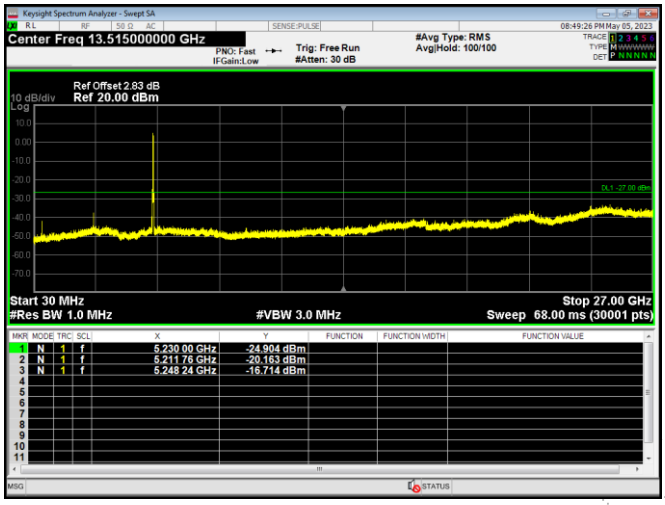
802.11n40 on channel 38



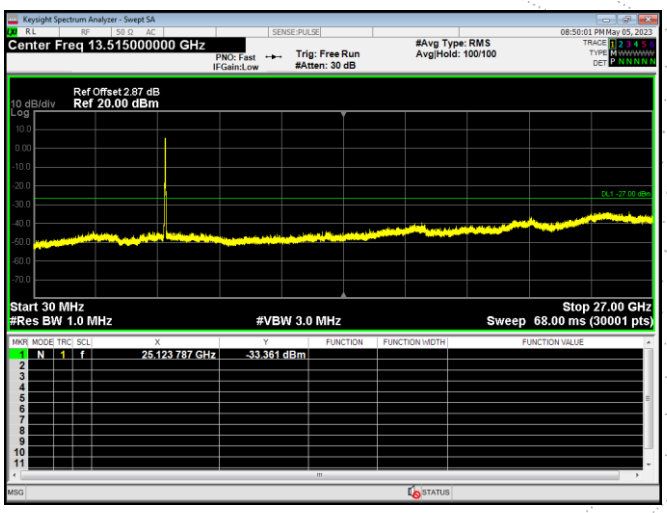
802.11n40 on channel 46



802.11n40 on channel 38

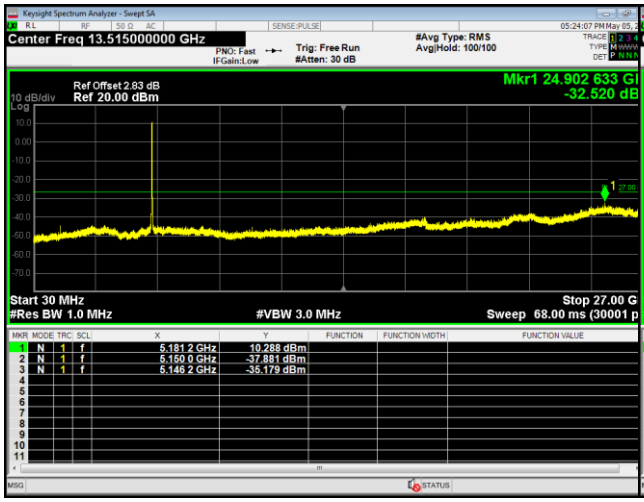


802.11n40 on channel 38

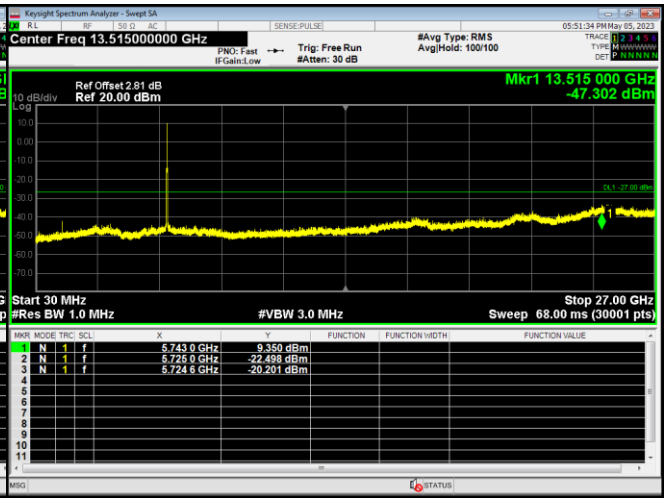


Test Plot

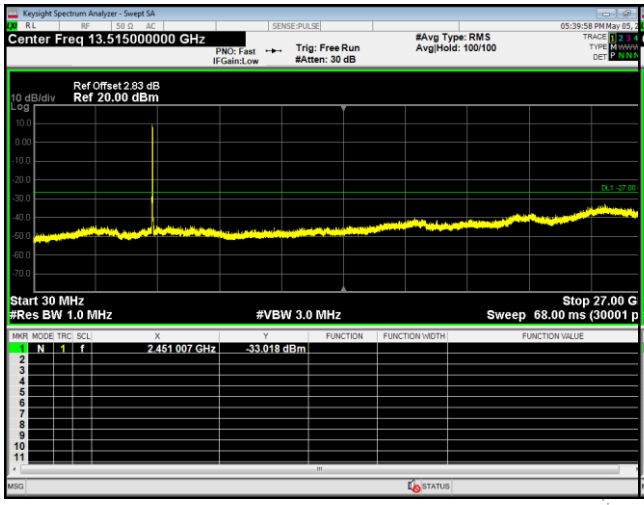
802.11ac20 on channel 36



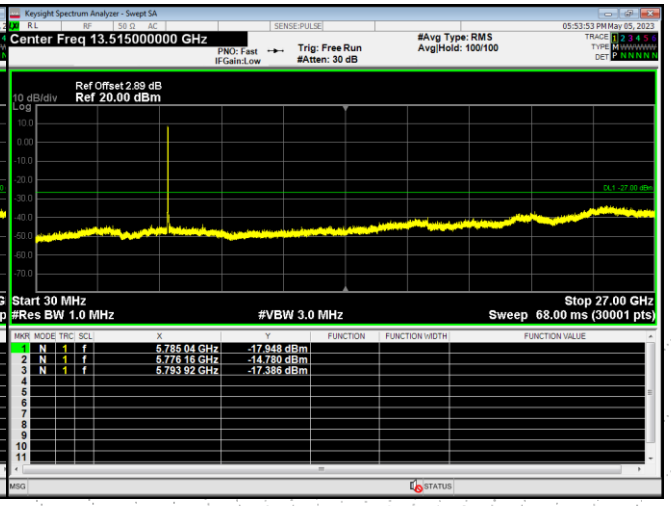
802.11ac20 on channel 40



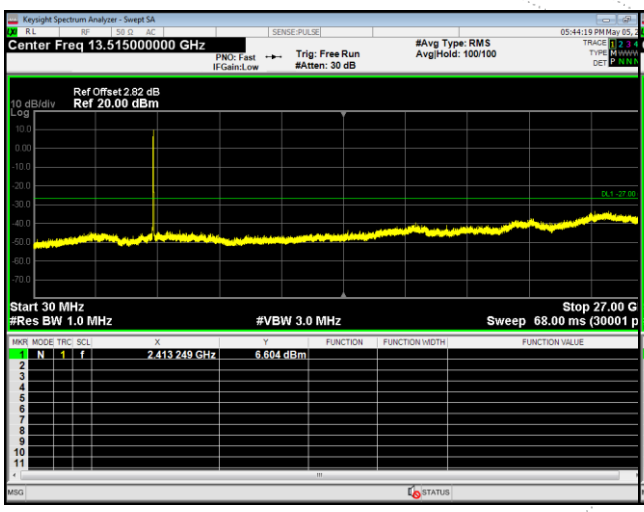
802.11ac20 on channel 36



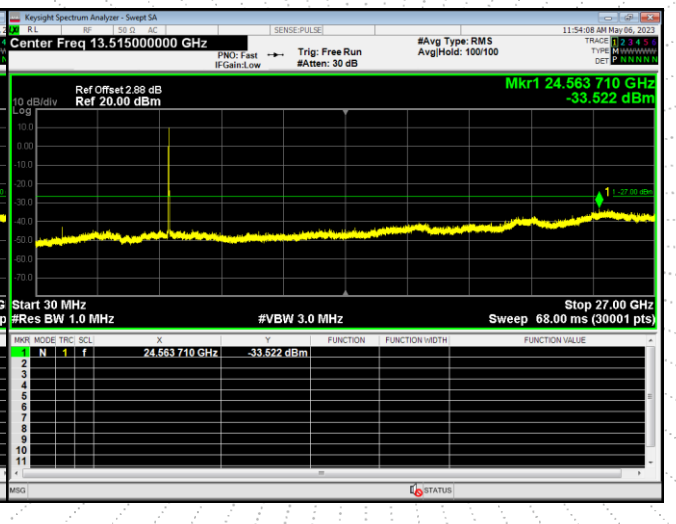
802.11ac20 on channel 40



802.11ac20 on channel 36

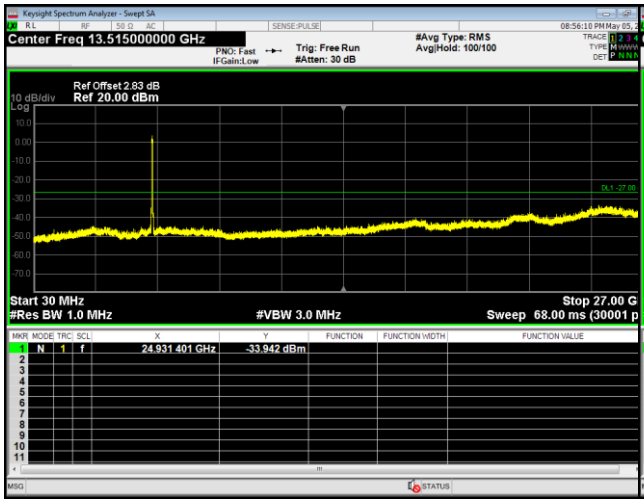


802.11ac20 on channel 40

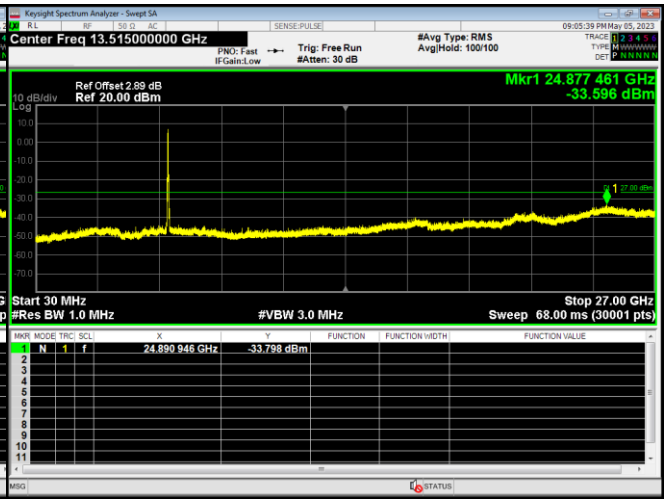


Test Plot

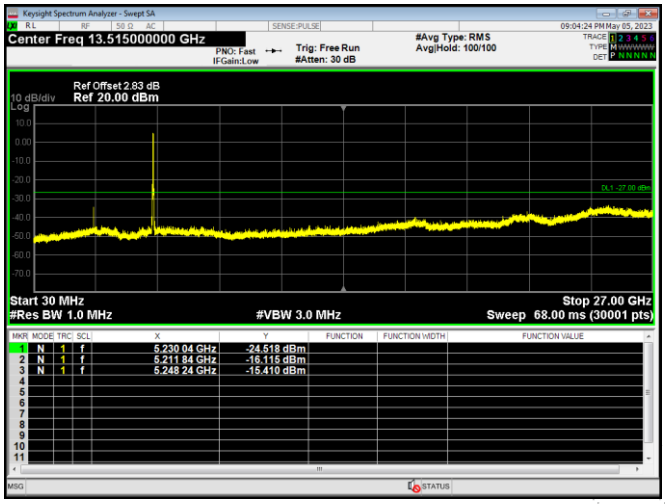
802.11ac20 on channel 40



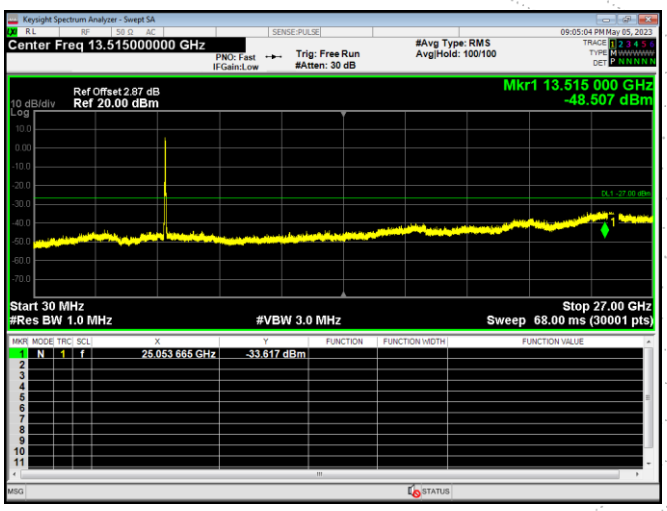
802.11ac40 on channel 36



802.11ac40 on channel 36

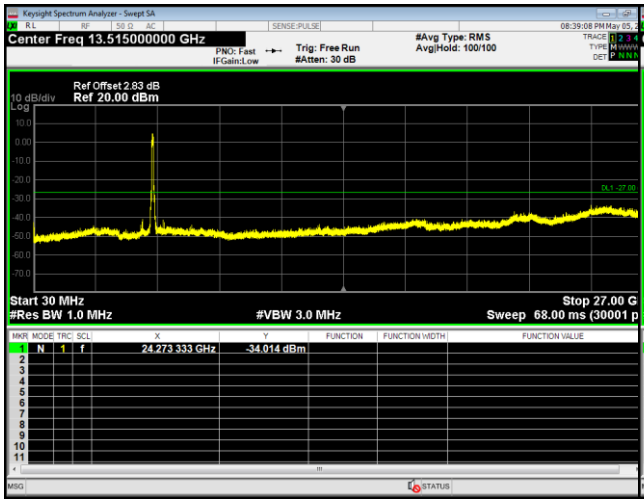


802.11ac40 on channel 36

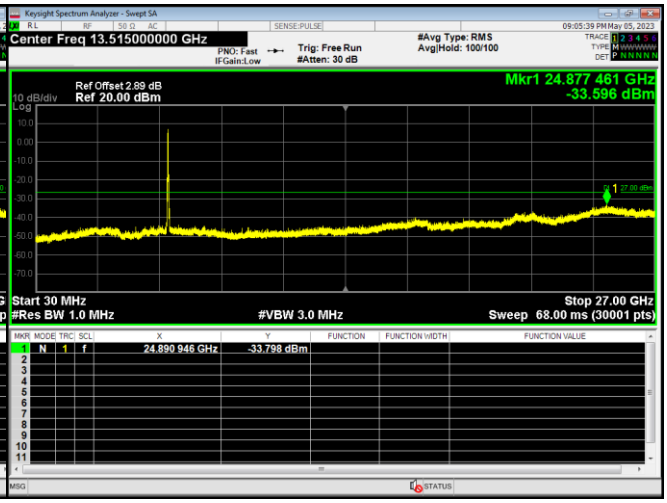


Test Plot

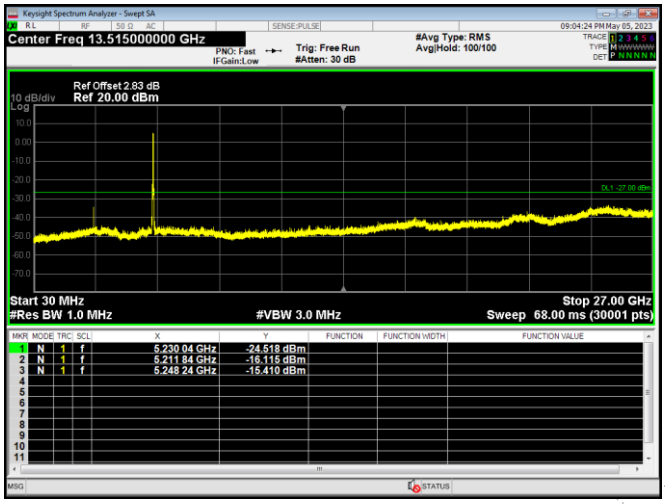
802.11ac40 on channel 46

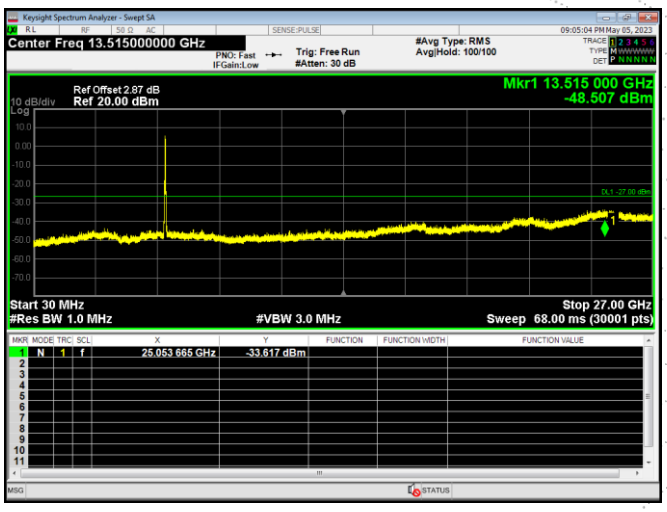


802.11ac80 on channel 42



802.11 ac40 on channel 46



802.11ac80 on channel 42

802.11 ac40 on channel 46