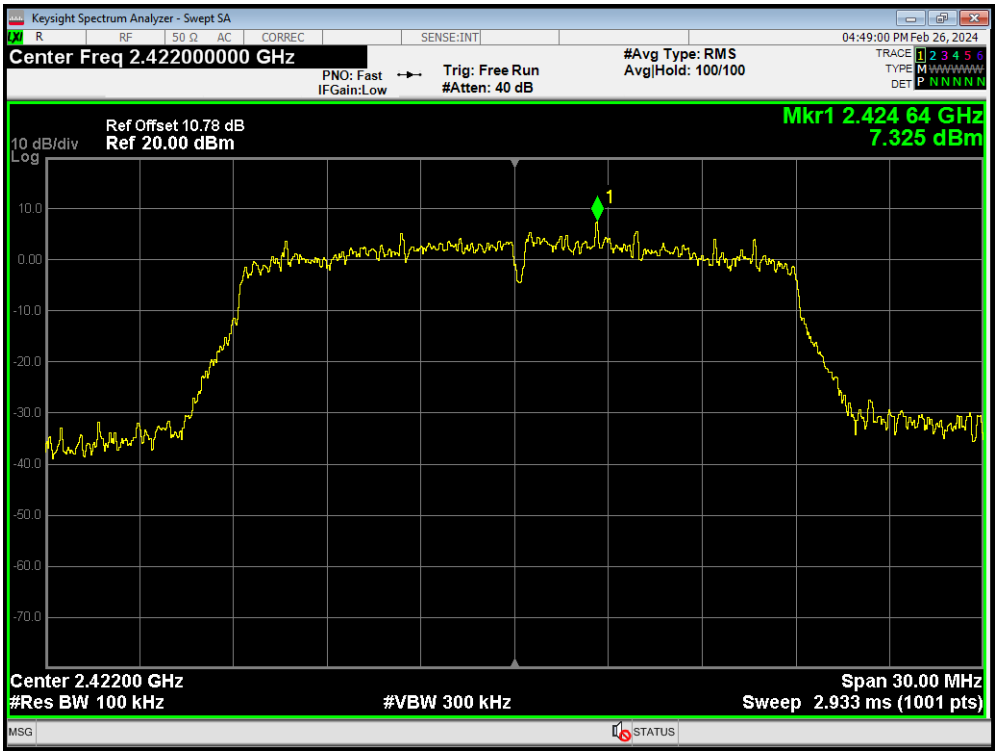
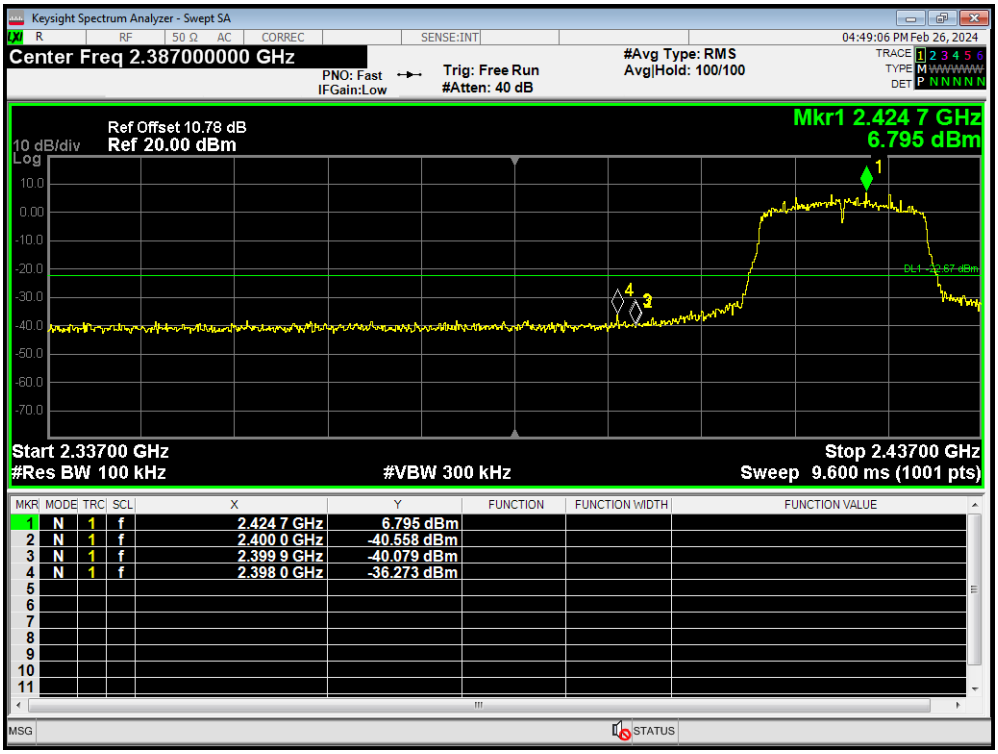
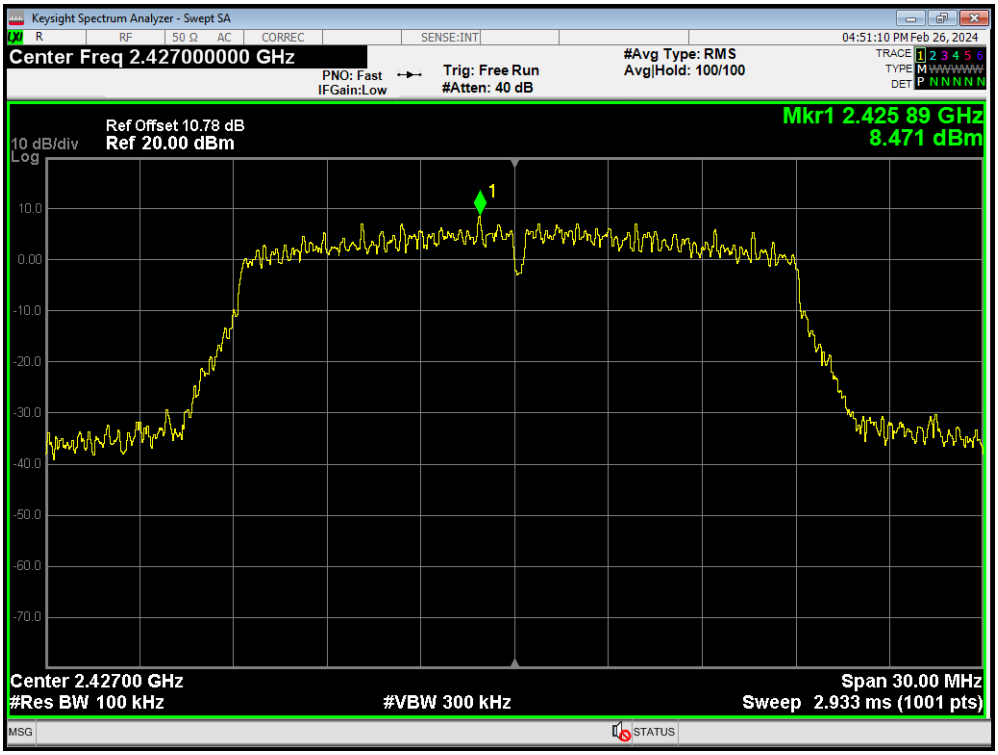
Band Edge 802.11n(HT20) 2422MHz Ref



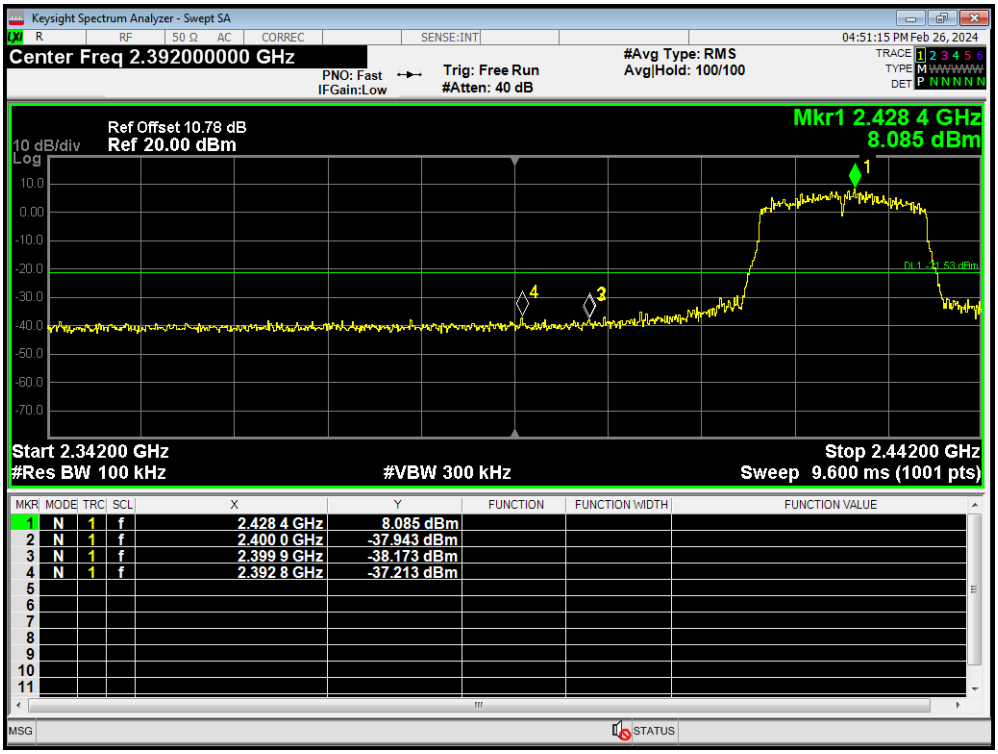
Band Edge 802.11n(HT20) 2422MHz Emission



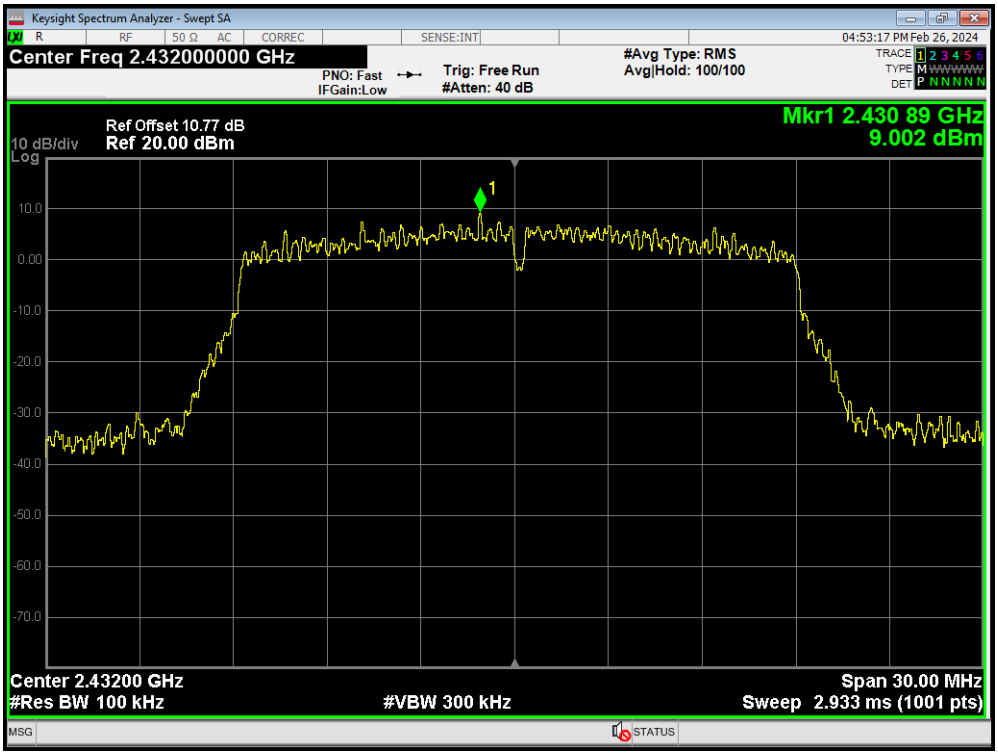
Band Edge 802.11n(HT20) 2427MHz Ref



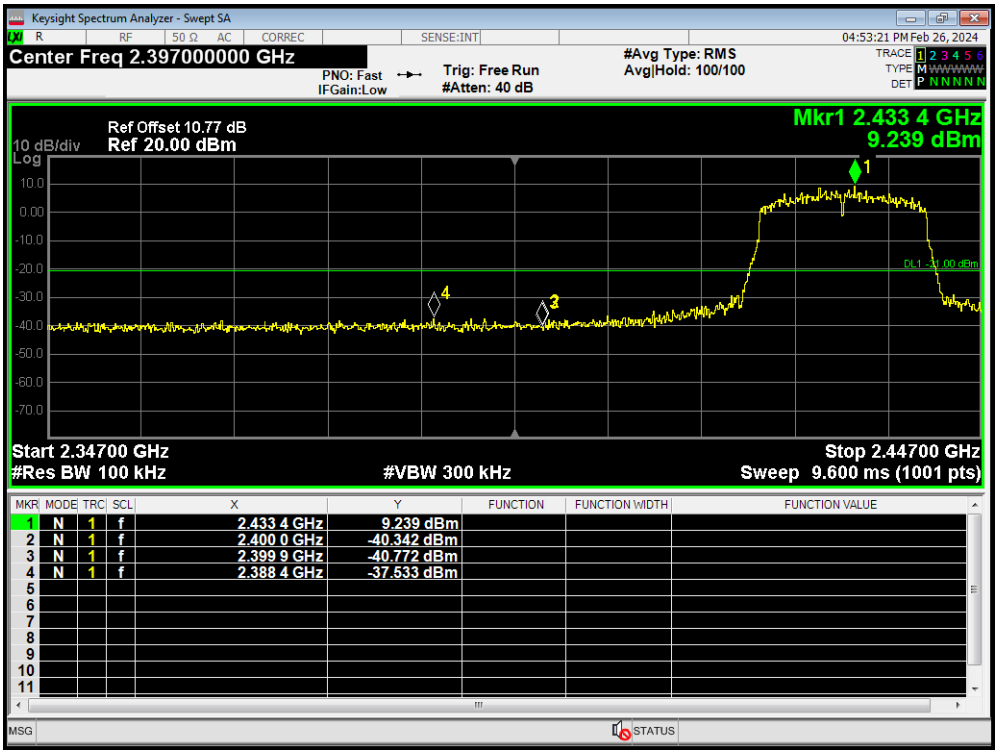
Band Edge 802.11n(HT20) 2427MHz Emission



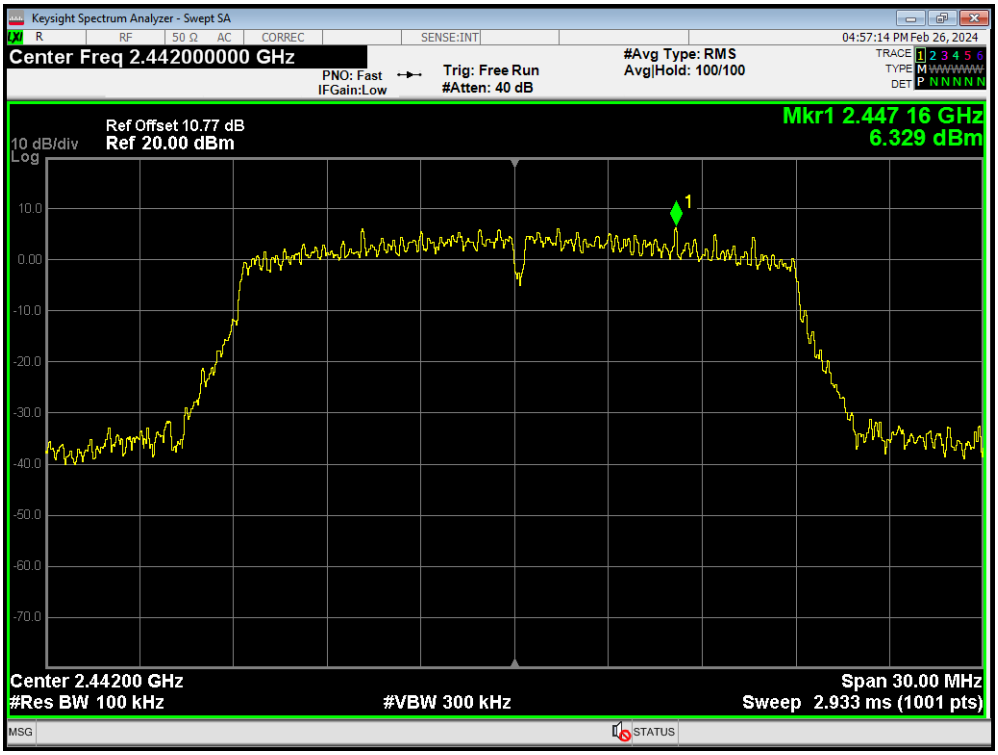
Band Edge 802.11n(HT20) 2432MHz Ref



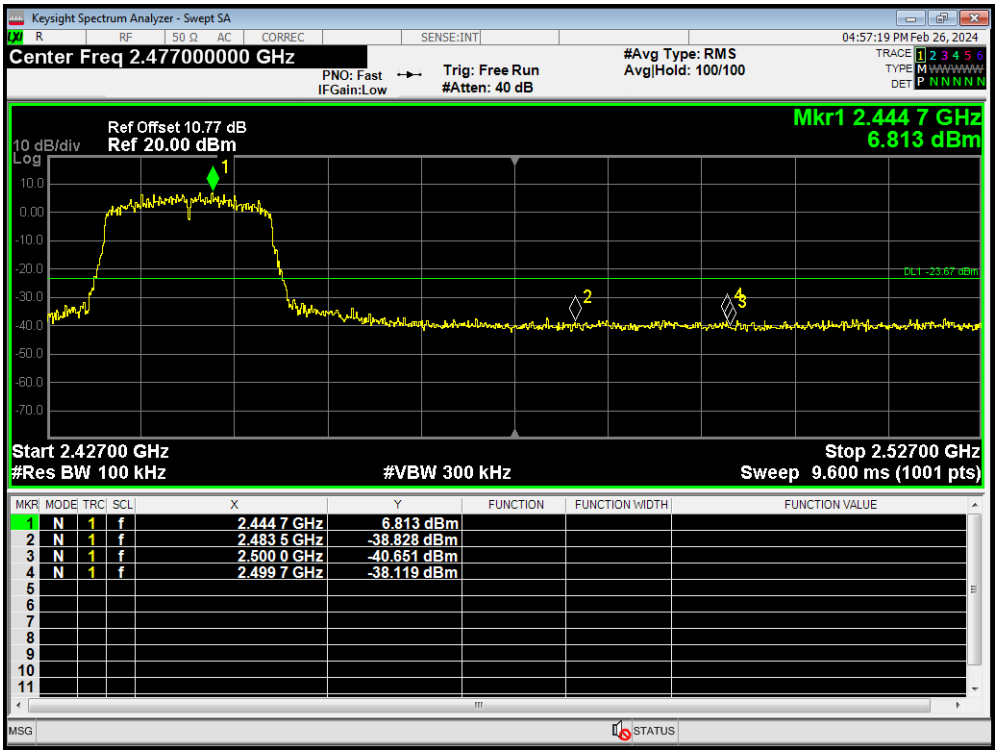
Band Edge 802.11n(HT20) 2432MHz Emission



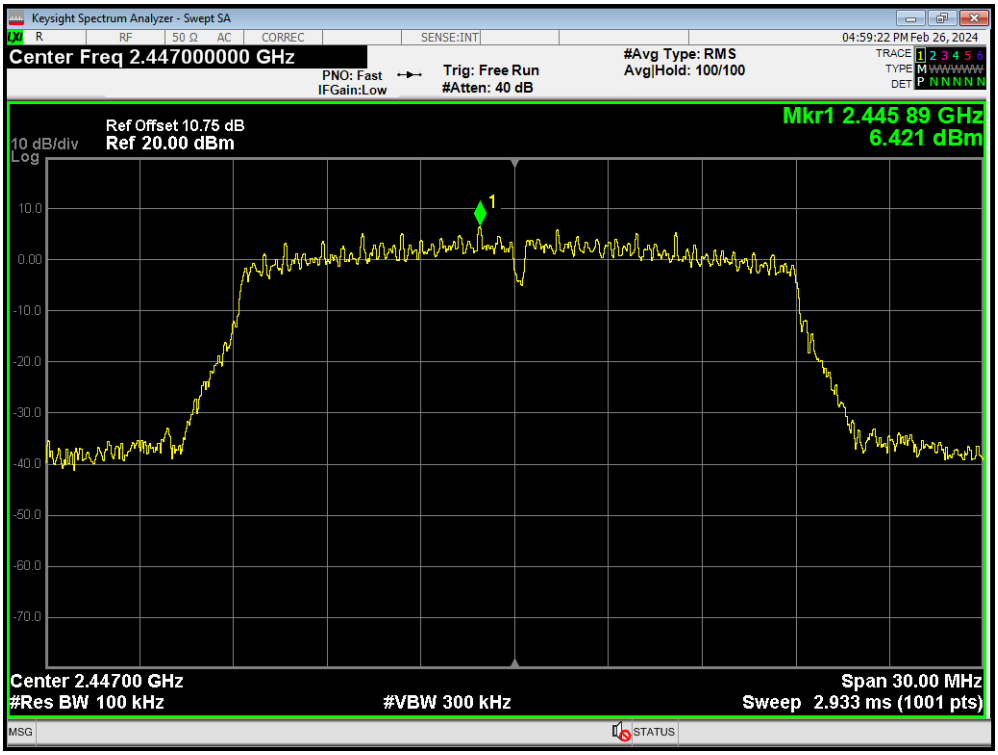
Band Edge 802.11n(HT20) 2442MHz Ref



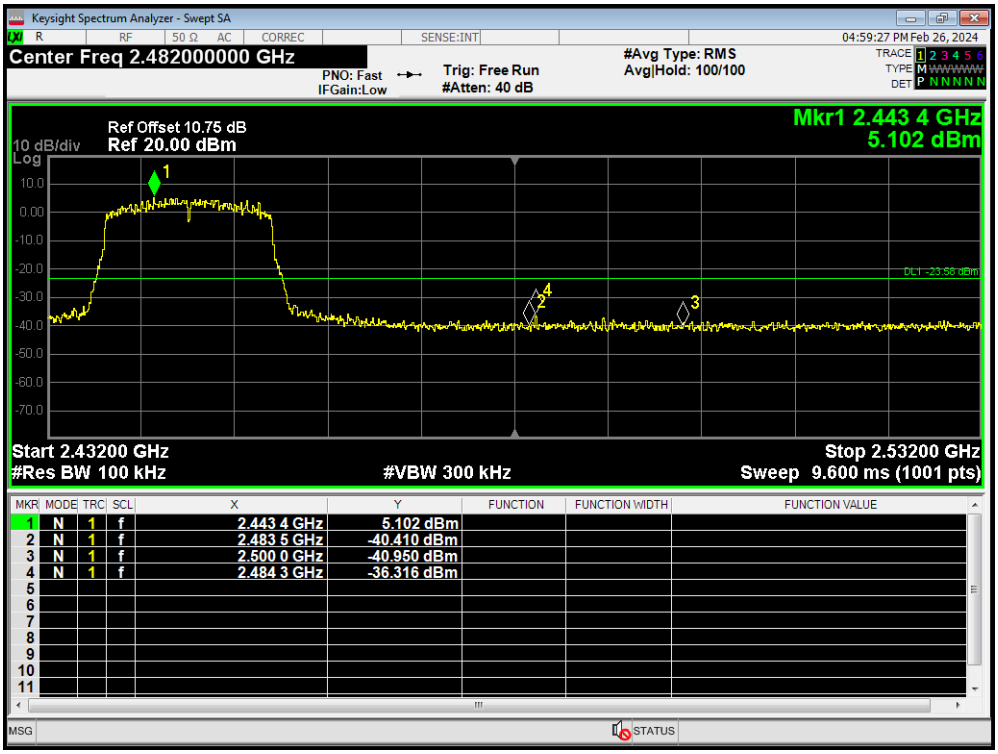
Band Edge 802.11n(HT20) 2442MHz Emission



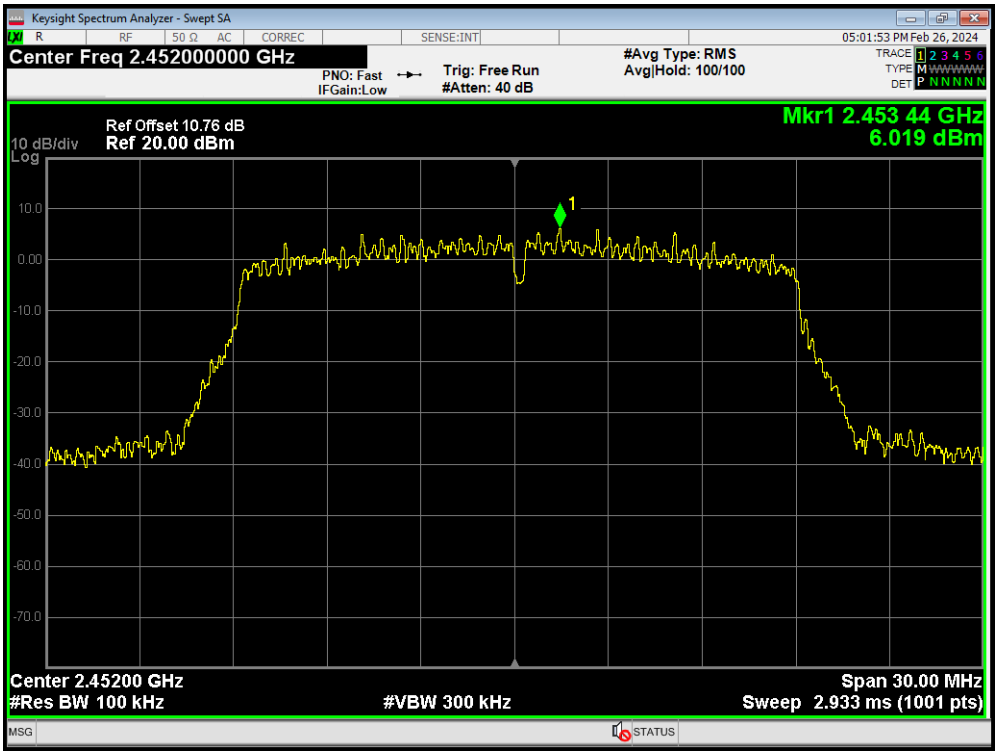
Band Edge 802.11n(HT20) 2447MHz Ref



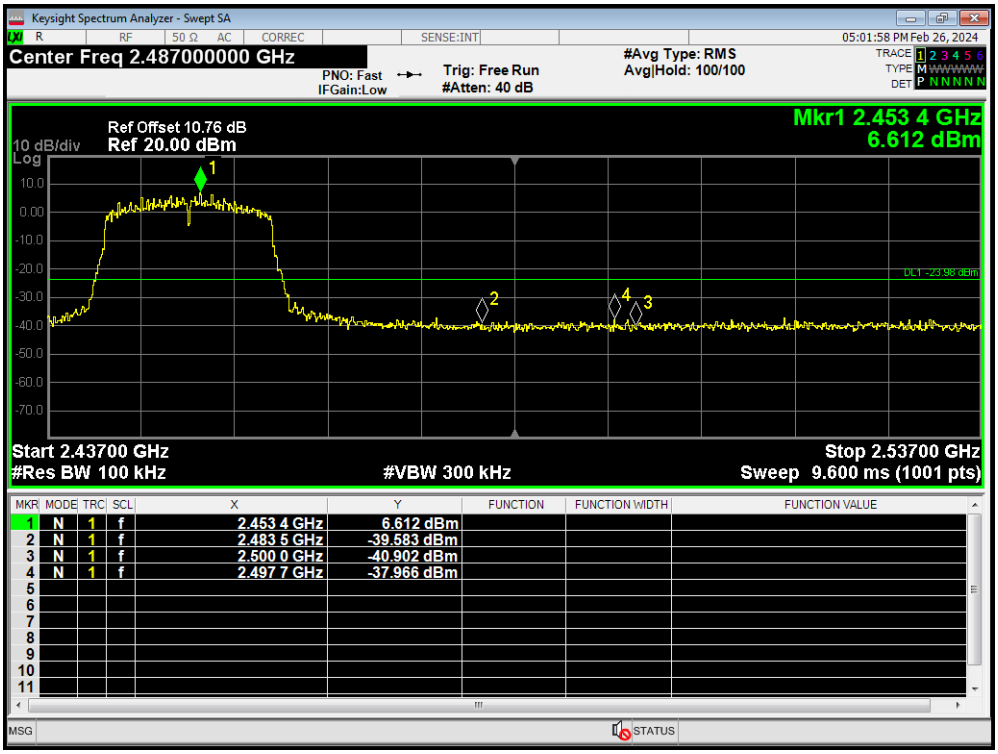
Band Edge 802.11n(HT20) 2447MHz Emission



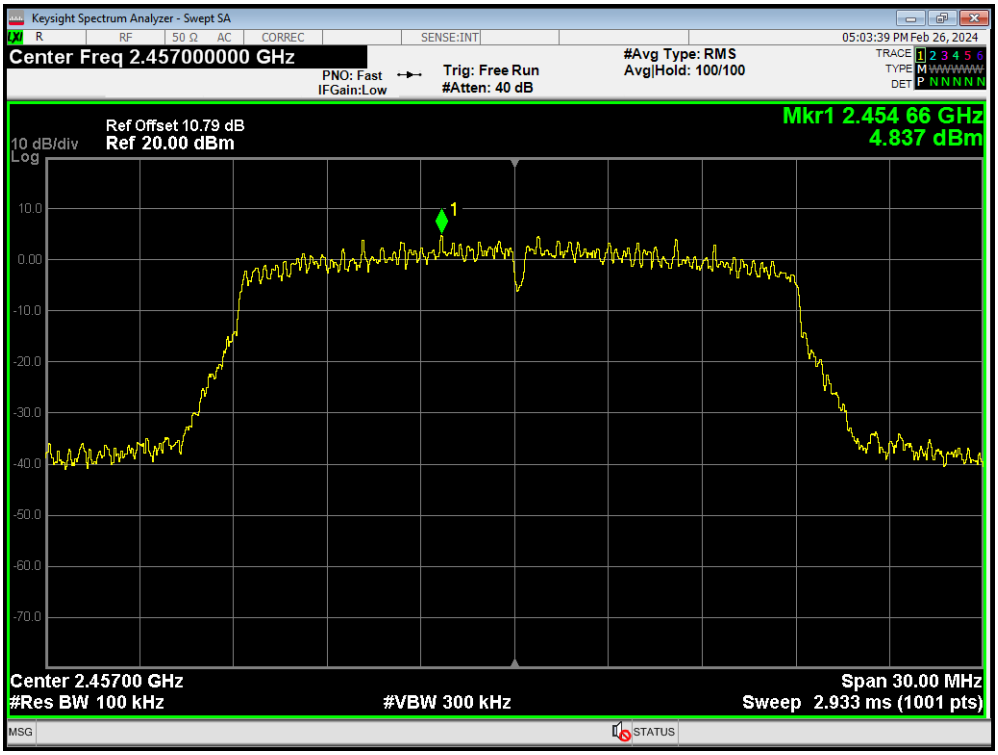
Band Edge 802.11n(HT20) 2452MHz Ref



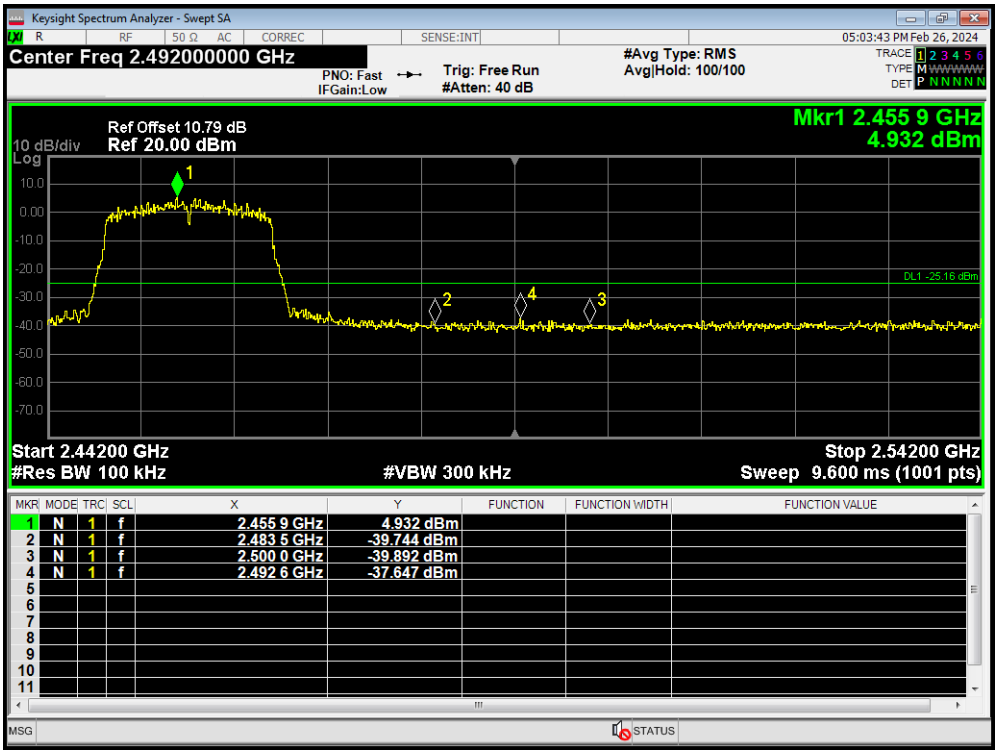
Band Edge 802.11n(HT20) 2452MHz Emission



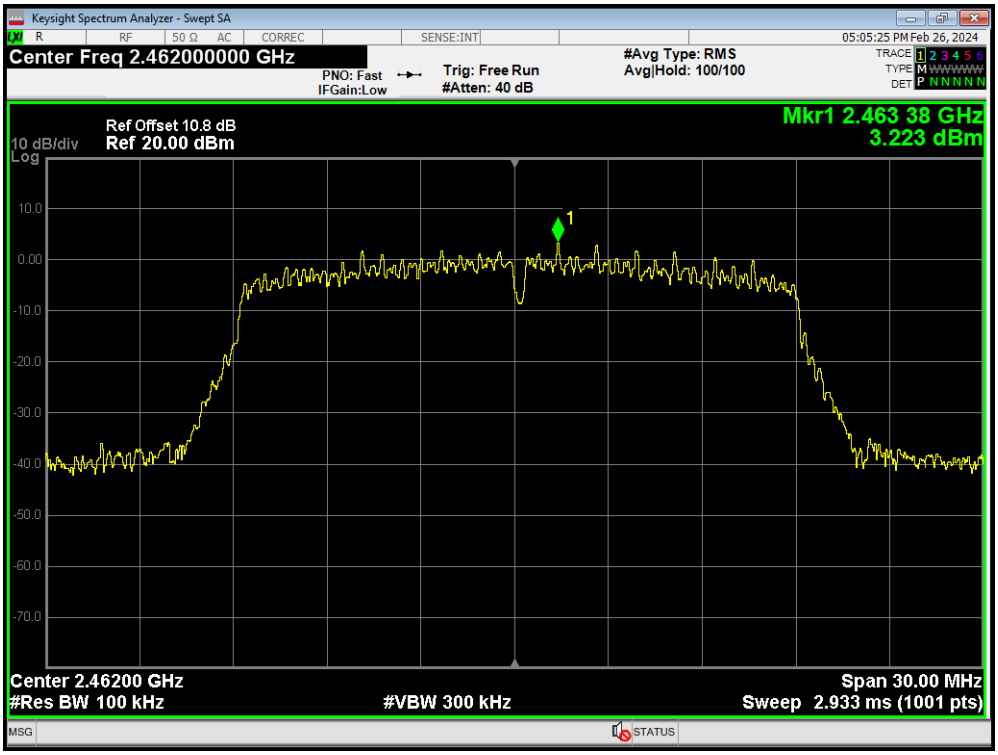
Band Edge 802.11n(HT20) 2457MHz Ref



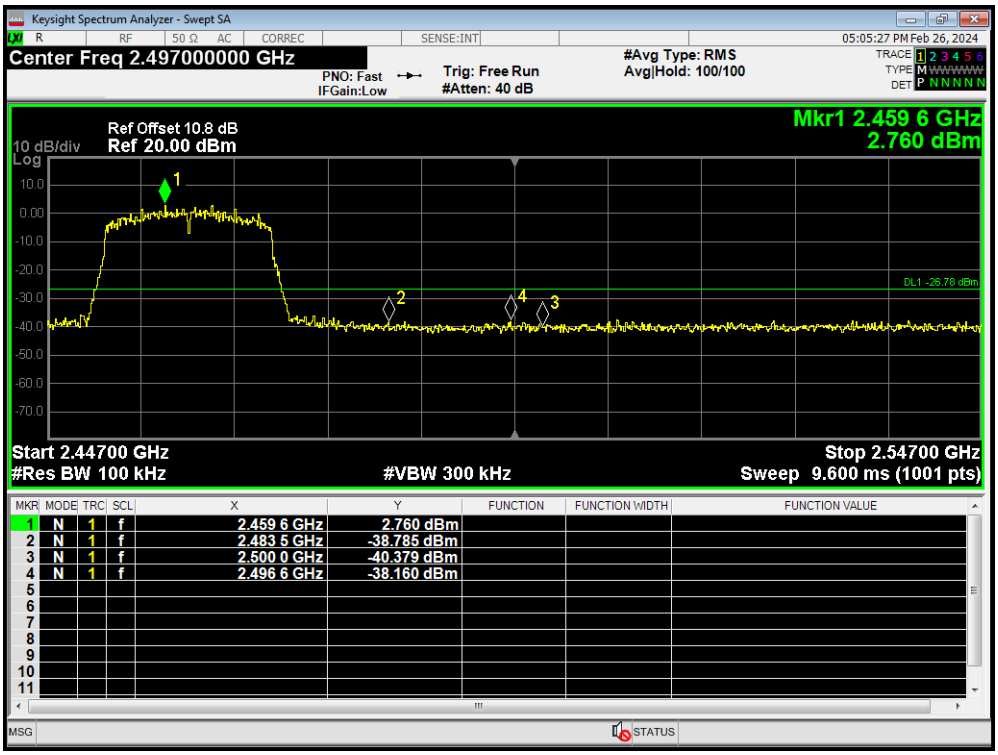
Band Edge 802.11n(HT20) 2457MHz Emission



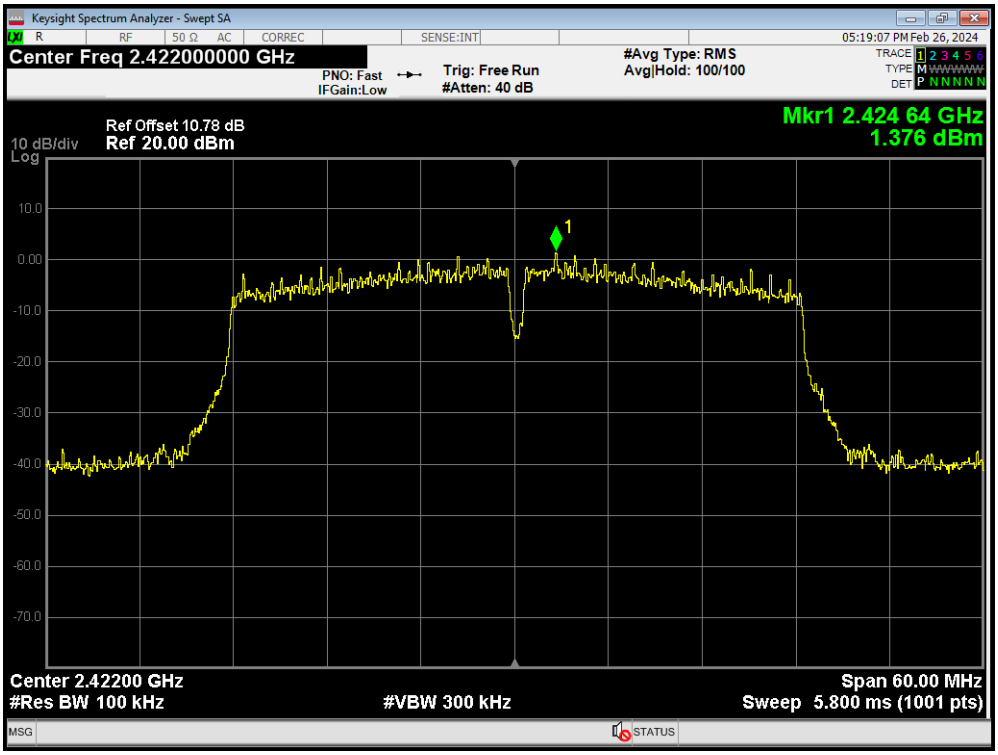
Band Edge 802.11n(HT20) 2462MHz Ref



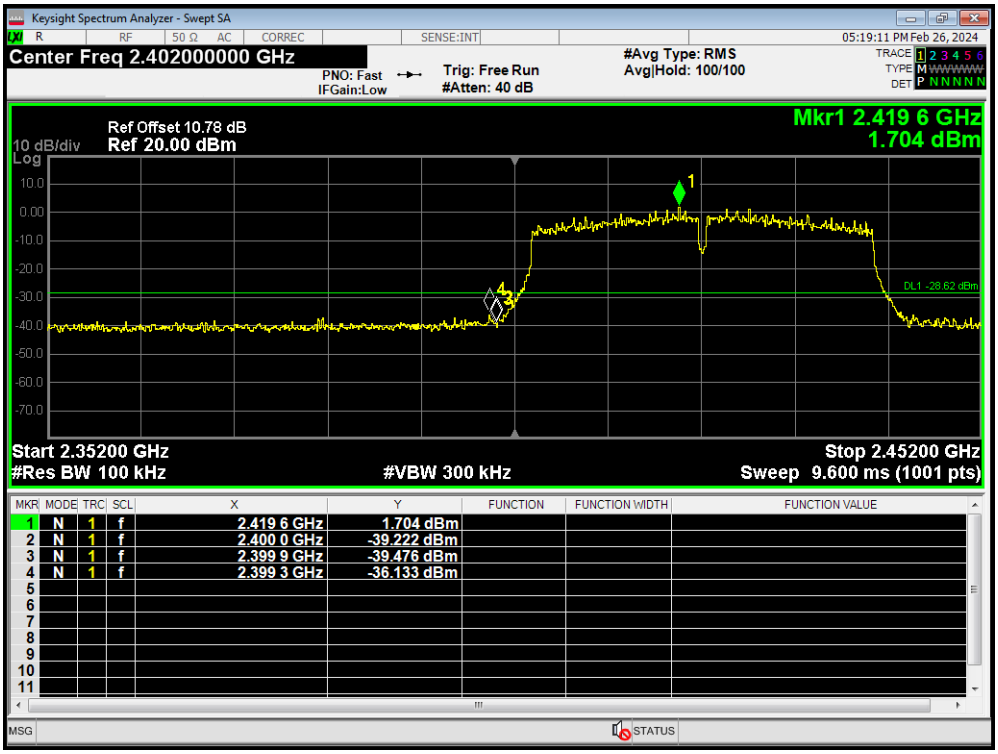
Band Edge 802.11n(HT20) 2462MHz Emission



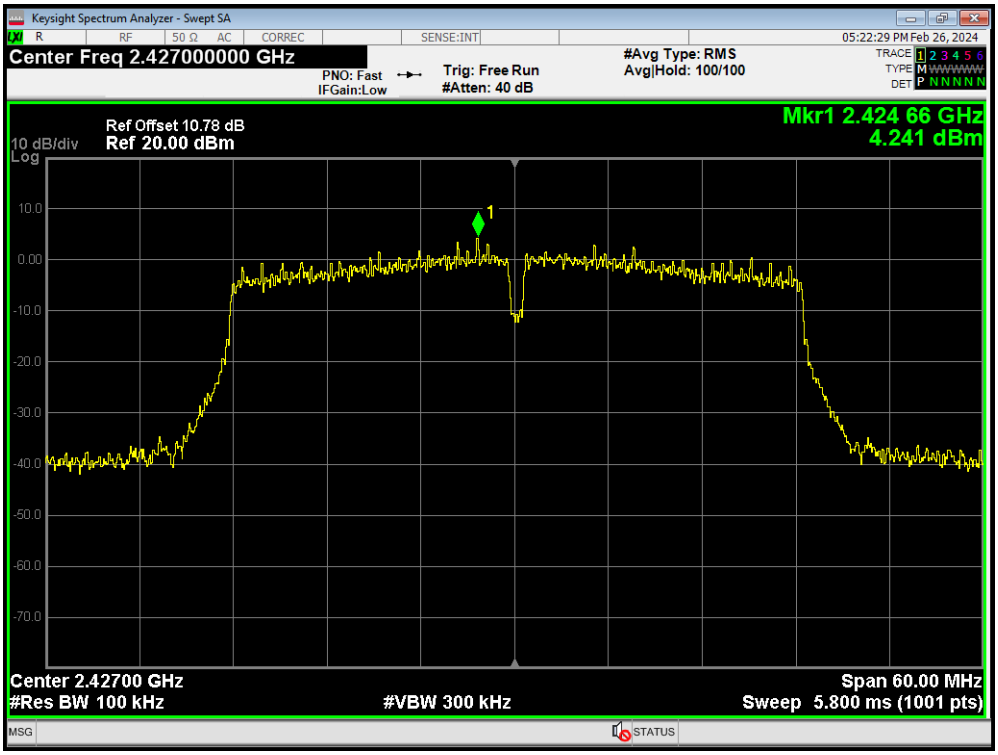
Band Edge 802.11n(HT40) 2422MHz Ref



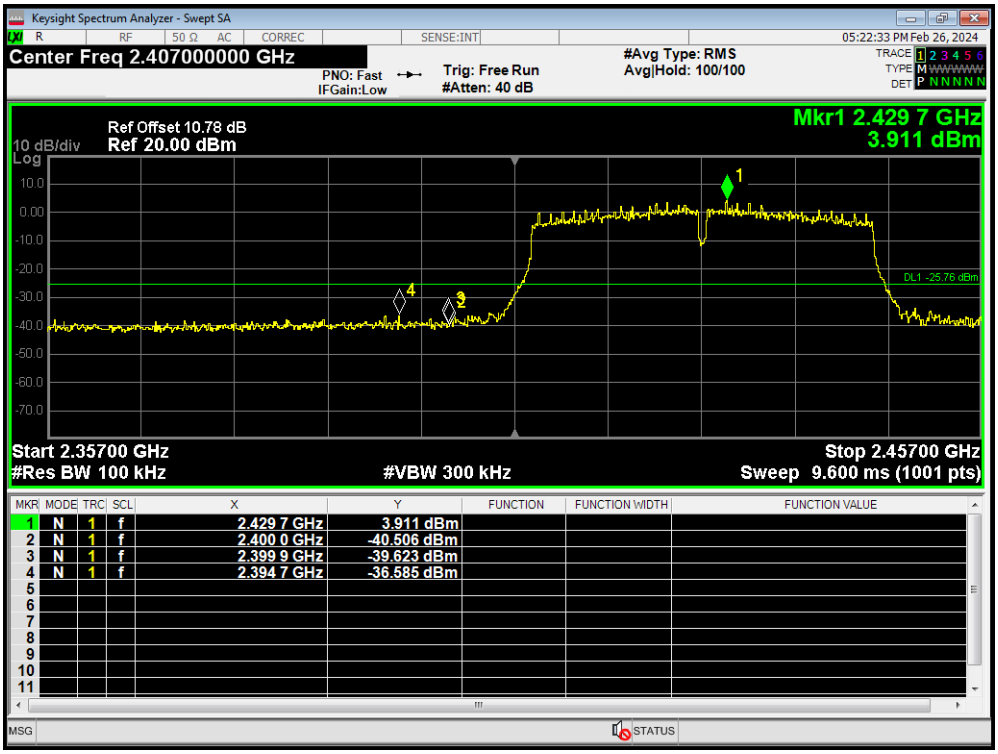
Band Edge 802.11n(HT40) 2422MHz Emission



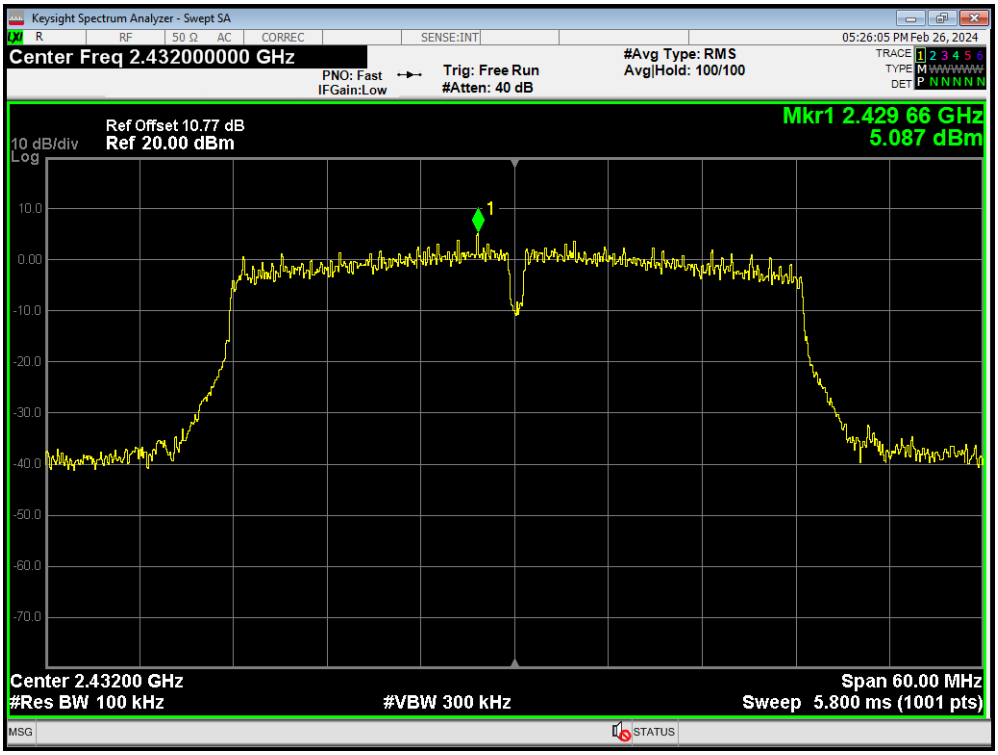
Band Edge 802.11n(HT40) 2427MHz Ref



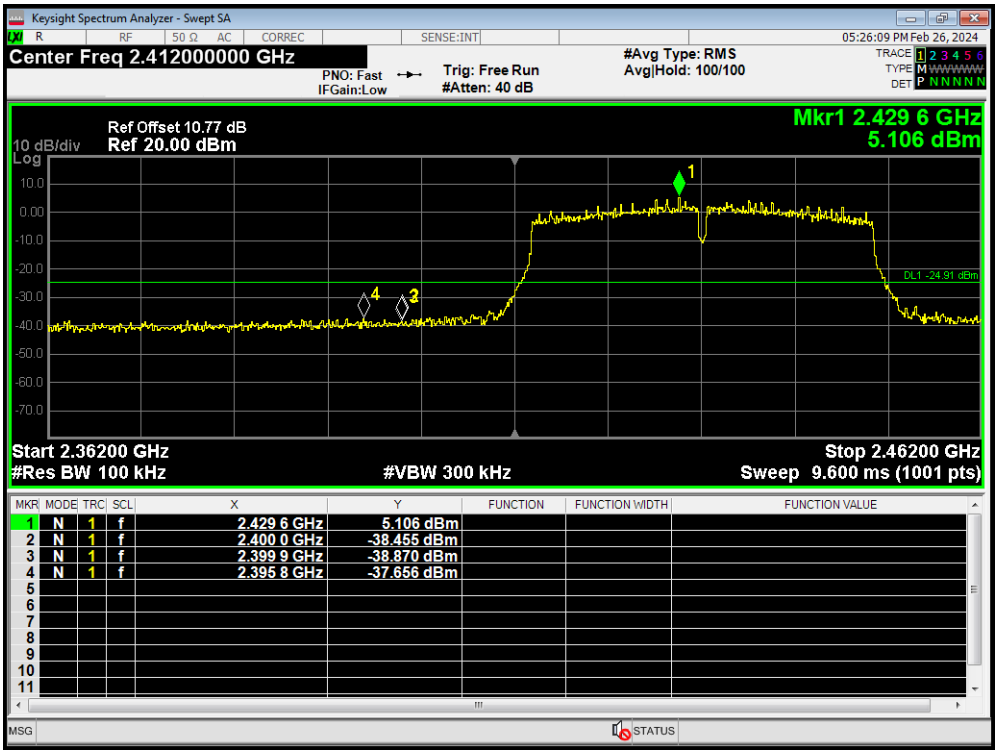
Band Edge 802.11n(HT40) 2427MHz Emission



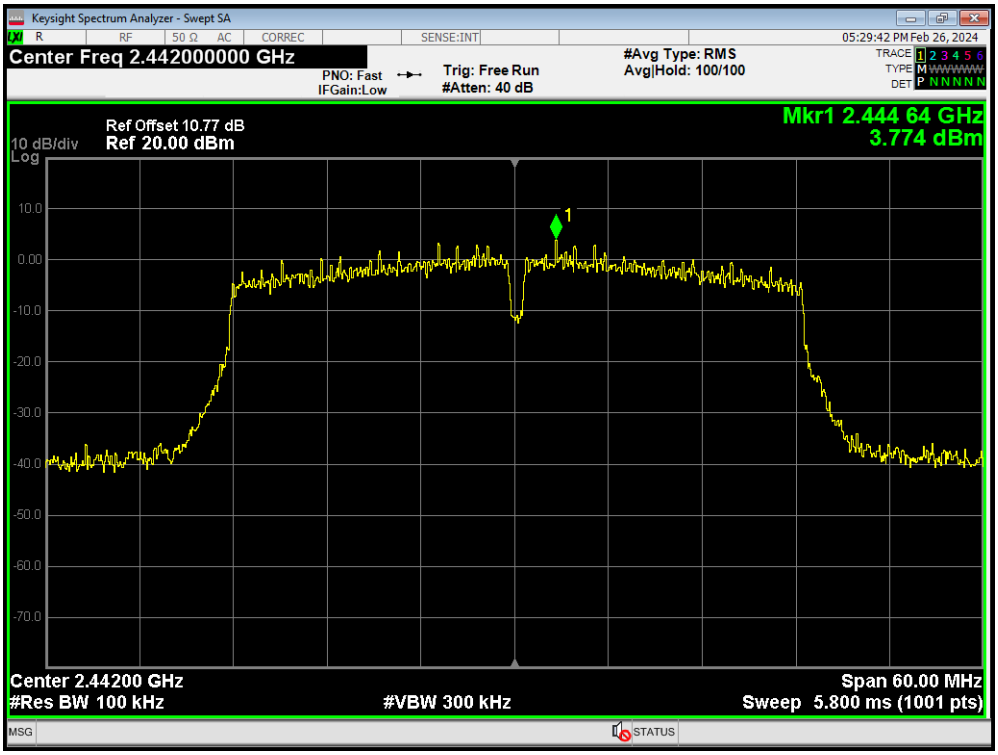
Band Edge 802.11n(HT40) 2432MHz Ref



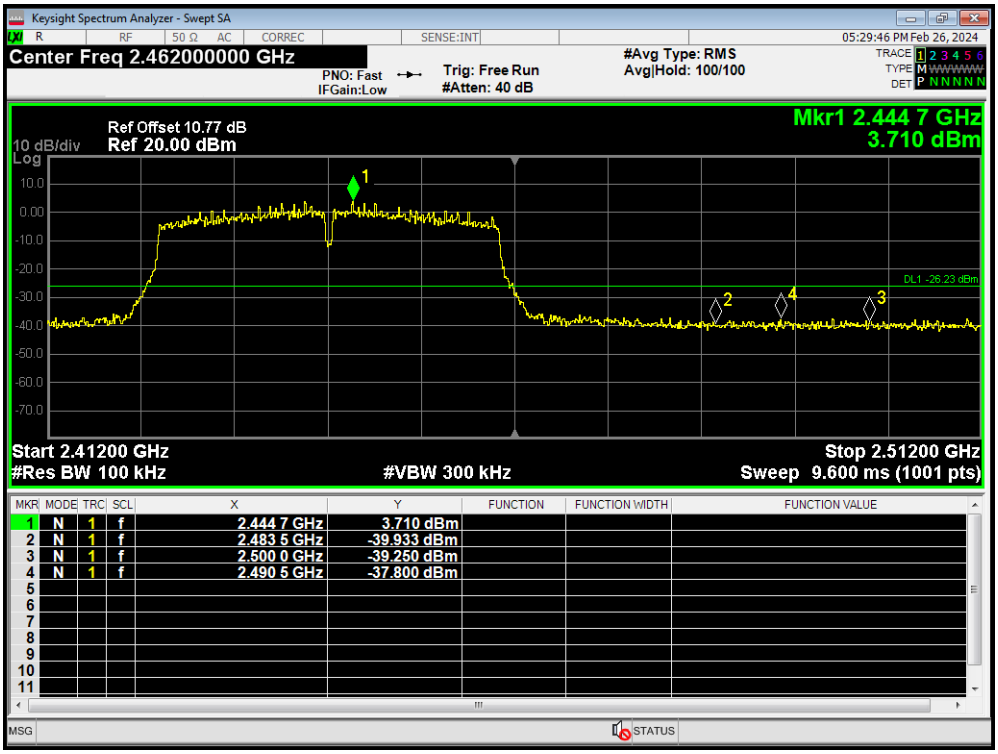
Band Edge 802.11n(HT40) 2432MHz Emission



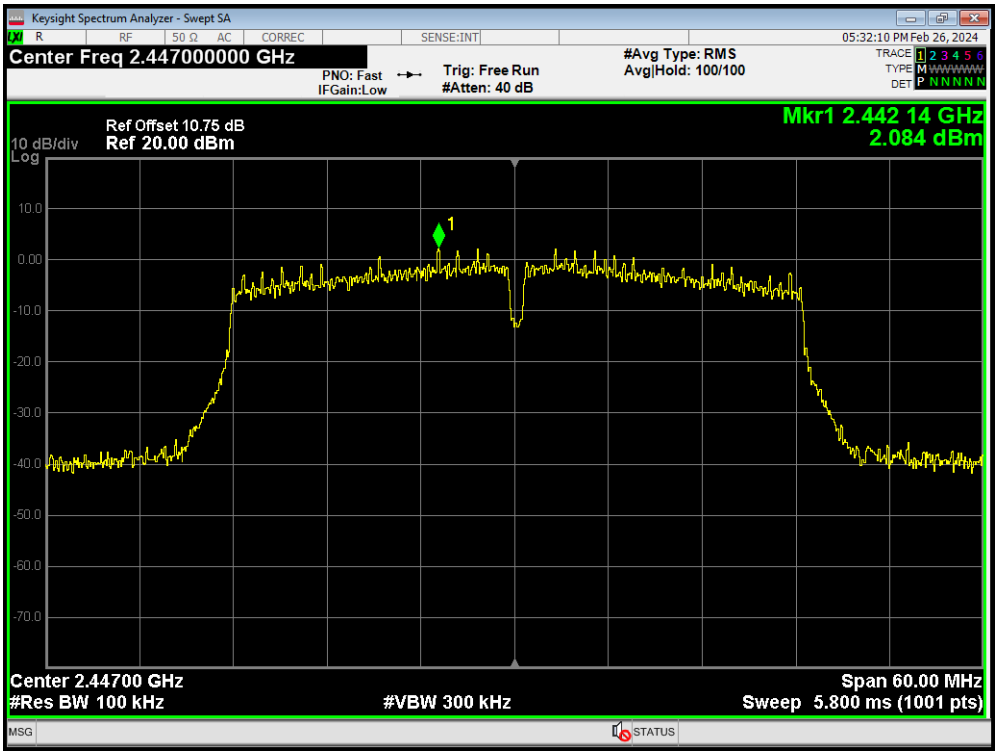
Band Edge 802.11n(HT40) 2442MHz Ref



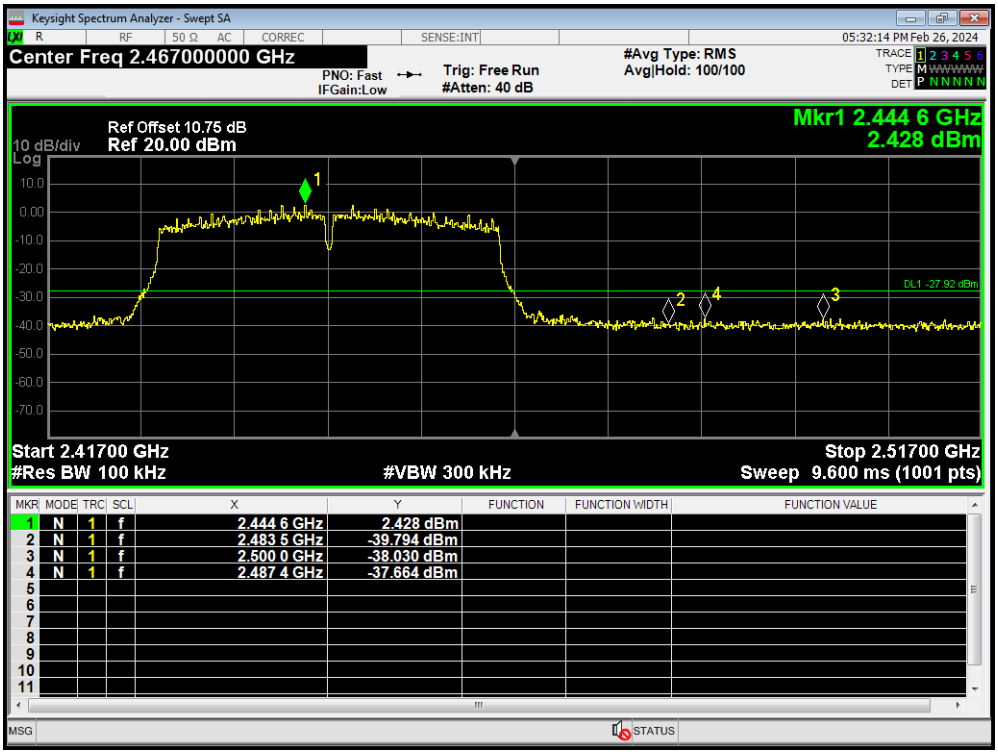
Band Edge 802.11n(HT40) 2442MHz Emission



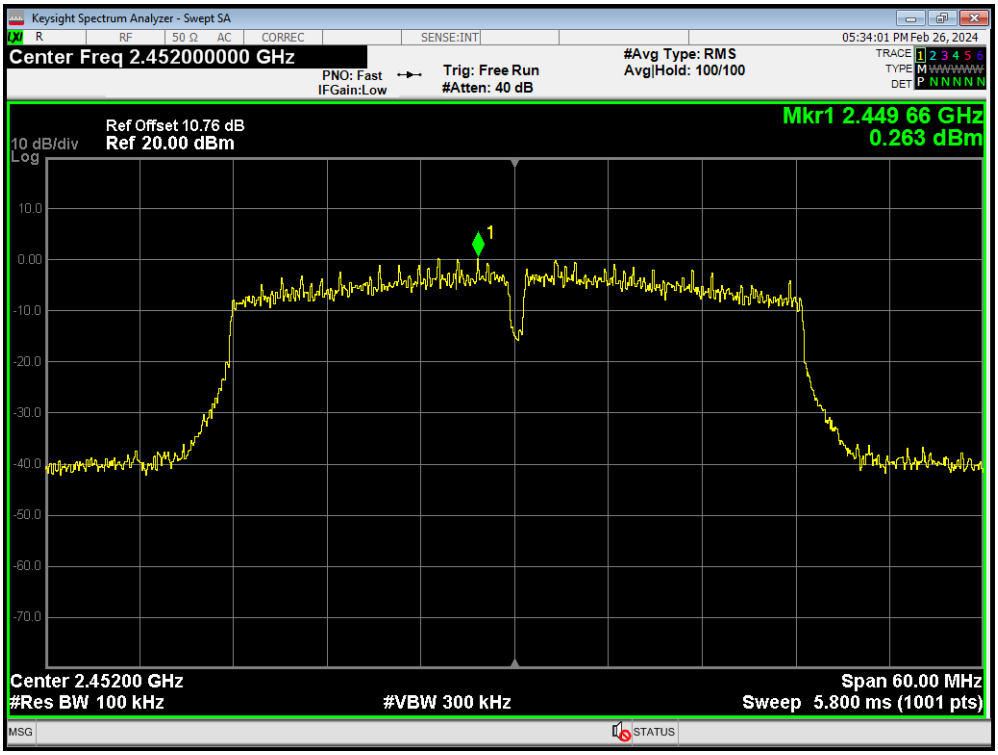
Band Edge 802.11n(HT40) 2447MHz Ref



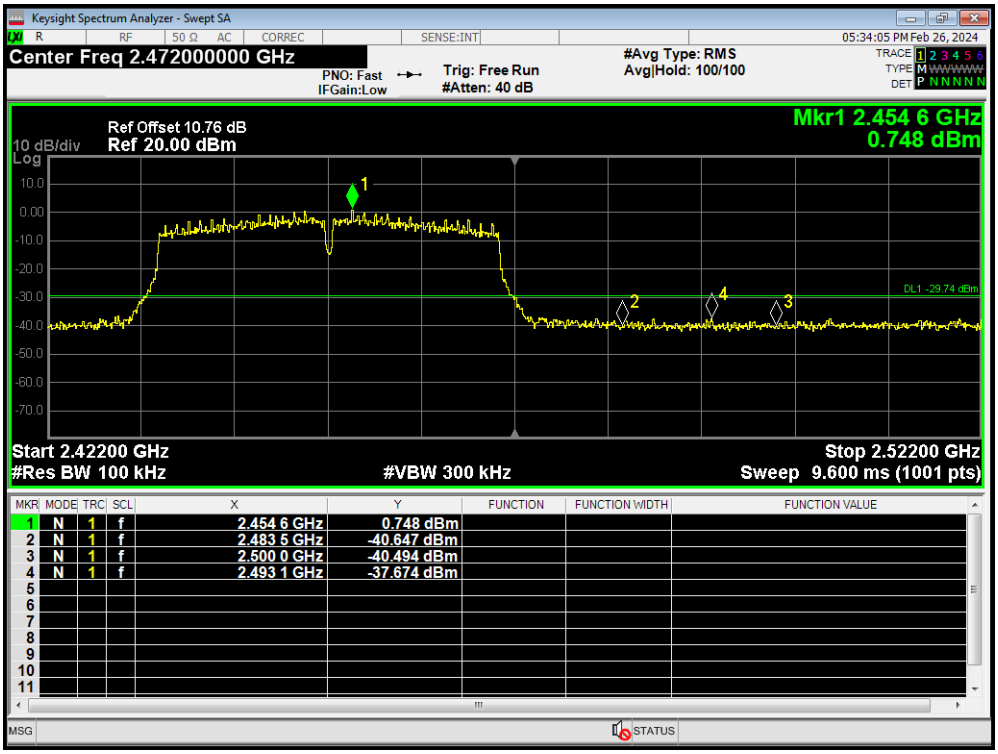
Band Edge 802.11n(HT40) 2447MHz Emission



Band Edge 802.11n(HT40) 2452MHz Ref



Band Edge 802.11n(HT40) 2452MHz Emission



5.4. Power Spectral Density

Ambient Condition

Temperature	Relative humidity
15°C ~ 35°C	20% ~ 80%

Method of Measurement

During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation.

Method AVGPSD-1 was used for this test.

a) Set instrument center frequency to DTS channel center frequency

b) Set span to at least 1.5 times the OBW

c) Set RBW to:3kHz≤RBW≤100kHz

d) Set VBW≥[3x RBW]

e) Detector=power averaging (rms) or sample detector (when rms not available)

f) Ensure that the number of measurement points in the sweep ≥ [2 X span/RBW]

g) Sweep time auto couple

h) Employ trace averaging (rms) mode over a minimum of 100 traces

i) Use the peak marker function to determine the maximum amplitude level.

j) If the measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced)

Method AVGPSD-2 was used for this test.

a) Measure the duty cycle (D)of the transmitter output signal as described in 11.6

b) Set instrument center frequency to DTS channel center frequency

c) Set span to at least 1.5 times the OBW

d) Set RBW to:3kHz≤RBW≤100kHz

e) Set VBW≥[3x RBW]

f) Detector= power averaging (rms) or sample detector (when rms not available)

g) Ensure that the number of measurement points in the sweep ≥ [2 X span/RBW]

h) Sweep time =auto couple

i) Do not use sweep triggering; allow sweep to "free run”

j) Employ trace averaging (rms) mode over a minimum of 100 traces

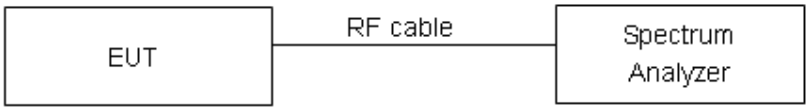
k) Use the peak marker function to determine the maximum amplitude level

l) Add [10 log(1/ D)], where D is the duty cycle measured in step a), to the measured PSD to compute the average PSD during the actual transmission time

m) If measured value exceeds requirement specified by regulatory agency then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced)

The conducted Power is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test setup



Limits

Rule Part 15.247(e) specifies that" For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. ''

Limits	≤ 8 dBm / 3kHz

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.75dB.

Test Results:

MIMO

Test Mode	Carrier frequency (MHz)/ Channel	Power Spectral Density				Total PSD	Limit (dBm / 3kHz)	Conclusion
		Antenna 1		Antenna 2				
		Read Value (dBm / 30kHz)	Power Spectral Density (dBm / 3kHz)	Read Value (dBm / 30kHz)	Power Spectral Density (dBm / 3kHz)	(dBm / 3kHz)		
802.11b	2412/CH 1	-1.11	-11.11	-0.45	-10.45	-7.76	8	PASS
	2417/CH 2	-0.08	-10.08	-0.08	-10.08	-7.07	8	PASS
	2422/CH 3	1.52	-8.48	1.31	-8.69	-5.57	8	PASS
	2427/CH 4	1.60	-8.40	1.62	-8.38	-5.38	8	PASS
	2432/CH 5	-0.20	-10.20	-0.26	-10.26	-7.22	8	PASS
	2437/CH 6	-0.38	-10.38	0.26	-9.74	-7.04	8	PASS
	2442/CH 7	0.21	-9.79	0.50	-9.50	-6.63	8	PASS
	2447/CH 8	-1.81	-11.81	-0.42	-10.42	-8.05	8	PASS
	2452/CH 9	0.89	-9.11	0.35	-9.65	-6.36	8	PASS
	2457/CH 10	-1.77	-11.77	-1.33	-11.33	-8.53	8	PASS
	2462/CH 11	-5.24	-15.24	-4.78	-14.78	-11.99	8	PASS
802.11g	2412/CH 1	-7.57	-17.10	-6.87	-16.40	-13.73	8	PASS
	2417/CH 2	-6.03	-15.56	-6.02	-15.55	-12.54	8	PASS
	2422/CH 3	-5.12	-14.65	-5.03	-14.56	-11.59	8	PASS
	2427/CH 4	-4.11	-13.64	-3.94	-13.47	-10.54	8	PASS
	2432/CH 5	-3.72	-13.25	-3.57	-13.10	-10.16	8	PASS
	2437/CH 6	-4.71	-14.24	-3.15	-12.68	-10.38	8	PASS
	2442/CH 7	-4.65	-14.18	-4.91	-14.44	-11.30	8	PASS
	2447/CH 8	-5.48	-15.01	-4.73	-14.26	-11.61	8	PASS
	2452/CH 9	-6.39	-15.92	-5.06	-14.59	-12.19	8	PASS
	2457/CH 10	-7.13	-16.66	-6.72	-16.25	-13.44	8	PASS
	2462/CH 11	-10.12	-19.65	-9.73	-19.26	-16.44	8	PASS
802.11n HT20	2412/CH 1	-7.87	-17.47	-6.40	-16.00	-13.66	8	PASS
	2417/CH 2	-6.64	-16.24	-5.88	-15.48	-12.83	8	PASS
	2422/CH 3	-5.79	-15.39	-4.73	-14.33	-11.82	8	PASS
	2427/CH 4	-4.41	-14.01	-3.94	-13.54	-10.76	8	PASS
	2432/CH 5	-4.02	-13.62	-3.28	-12.88	-10.22	8	PASS
	2437/CH 6	-4.67	-14.27	-3.70	-13.30	-10.75	8	PASS
	2442/CH 7	-5.95	-15.55	-4.32	-13.92	-11.65	8	PASS
	2447/CH 8	-6.15	-15.75	-5.92	-15.52	-12.62	8	PASS
	2452/CH 9	-6.43	-16.03	-5.48	-15.08	-12.52	8	PASS
	2457/CH 10	-7.45	-17.05	-6.93	-16.53	-13.77	8	PASS
	2462/CH 11	-10.16	-19.76	-8.98	-18.58	-16.12	8	PASS
802.11n HT40	2422/CH 3	-10.95	-20.18	-11.25	-20.48	-17.32	8	PASS
	2427/CH 4	-9.76	-18.99	-9.02	-18.25	-15.59	8	PASS
	2432/CH 5	-9.13	-18.36	-8.77	-18.00	-15.17	8	PASS

	2437/CH 6	-10.54	-19.77	-10.01	-19.24	-16.49	8	PASS
	2442/CH 7	-10.63	-19.86	-10.10	-19.33	-16.58	8	PASS
	2447/CH 8	-11.72	-20.95	-10.60	-19.83	-17.34	8	PASS
	2452/CH 9	-13.58	-22.81	-13.02	-22.25	-19.51	8	PASS

Note: 1.Power Spectral Density (dBm/3kHz) =Read Value+Duty cycle correction factor + 10*LOG10(3 / 30)

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),

the power spectral density=10log($10^{(\text{PSD antenna1 in dBm/10})}$+$10^{(\text{PSD antenna2 in dBm/10})}$)

3. The manufacturer declared that the directional gain = 4.84 <6dBi. So the PSD limit is 8 dBm.

Beamforming

Test Mode	Carrier frequency (MHz))/ Channel	Power Spectral Density				Total PSD	Limit (dBm / 3kHz)	Conclusion
		Antenna 1		Antenna 2				
		Read Value (dBm / 30kHz)	Power Spectral Density (dBm / 3kHz)	Read Value (dBm / 30kHz)	Power Spectral Density (dBm / 3kHz)	(dBm / 3kHz)		
802.11b	2412/CH 1	-1.33	-11.33	-0.62	-10.62	-7.95	8	PASS
	2417/CH 2	-0.14	-10.14	-0.13	-10.13	-7.12	8	PASS
	2422/CH 3	1.09	-8.91	1.61	-8.39	-5.63	8	PASS
	2427/CH 4	1.24	-8.76	1.45	-8.55	-5.64	8	PASS
	2432/CH 5	-0.29	-10.29	0.12	-9.88	-7.07	8	PASS
	2437/CH 6	-0.30	-10.30	0.22	-9.78	-7.02	8	PASS
	2442/CH 7	-0.34	-10.34	0.26	-9.74	-7.02	8	PASS
	2447/CH 8	-2.23	-12.23	-1.58	-11.58	-8.88	8	PASS
	2452/CH 9	-0.62	-10.62	0.21	-9.79	-7.17	8	PASS
	2457/CH 10	-2.08	-12.08	-1.70	-11.70	-8.88	8	PASS
	2462/CH 11	-5.69	-15.69	-5.45	-15.45	-12.56	8	PASS
802.11g	2412/CH 1	-7.83	-17.36	-7.35	-16.88	-14.10	8	PASS
	2417/CH 2	-6.54	-16.07	-5.92	-15.45	-12.74	8	PASS
	2422/CH 3	-5.58	-15.11	-5.13	-14.66	-11.87	8	PASS
	2427/CH 4	-4.38	-13.91	-4.25	-13.78	-10.83	8	PASS
	2432/CH 5	-3.85	-13.38	-3.64	-13.17	-10.26	8	PASS
	2437/CH 6	-5.05	-14.58	-4.67	-14.20	-11.38	8	PASS
	2442/CH 7	-5.56	-15.09	-5.29	-14.82	-11.94	8	PASS
	2447/CH 8	-5.46	-14.99	-5.29	-14.82	-11.89	8	PASS
	2452/CH 9	-6.10	-15.63	-5.35	-14.88	-12.23	8	PASS
	2457/CH 10	-7.49	-17.02	-6.76	-16.29	-13.63	8	PASS
	2462/CH 11	-9.98	-19.51	-9.32	-18.85	-16.16	8	PASS
802.11n HT20	2412/CH 1	-8.82	-18.42	-7.68	-17.28	-14.80	8	PASS
	2417/CH 2	-6.90	-16.50	-5.53	-15.13	-12.75	8	PASS
	2422/CH 3	-6.06	-15.66	-4.88	-14.48	-12.02	8	PASS
	2427/CH 4	-4.97	-14.57	-4.24	-13.84	-11.18	8	PASS
	2432/CH 5	-3.87	-13.47	-3.37	-12.97	-10.20	8	PASS
	2437/CH 6	-4.72	-14.32	-3.48	-13.08	-10.65	8	PASS

	2442/CH 7	-6.52	-16.12	-4.85	-14.45	-12.19	8	PASS
	2447/CH 8	-7.22	-16.82	-5.24	-14.84	-12.71	8	PASS
	2452/CH 9	-6.84	-16.44	-6.07	-15.67	-13.03	8	PASS
	2457/CH 10	-8.05	-17.65	-6.69	-16.29	-13.91	8	PASS
	2462/CH 11	-9.76	-19.36	-9.03	-18.63	-15.97	8	PASS
802.11n HT40	2422/CH 3	-11.82	-21.05	-11.31	-20.54	-17.78	8	PASS
	2427/CH 4	-10.22	-19.45	-10.10	-19.33	-16.38	8	PASS
	2432/CH 5	-8.93	-18.16	-8.96	-18.19	-15.16	8	PASS
	2437/CH 6	-11.17	-20.40	-10.18	-19.41	-16.87	8	PASS
	2442/CH 7	-11.06	-20.29	-10.23	-19.46	-16.84	8	PASS
	2447/CH 8	-12.17	-21.40	-11.44	-20.67	-18.01	8	PASS
	2452/CH 9	-13.92	-23.15	-13.31	-22.54	-19.82	8	PASS

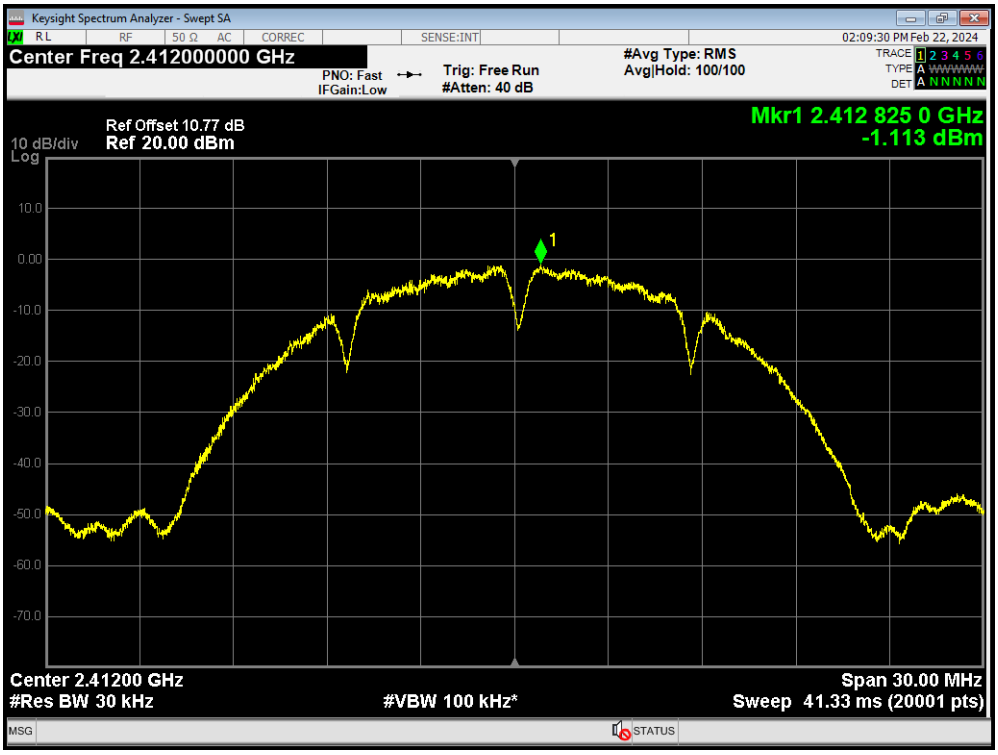
Note: 1.Power Spectral Density (dBm/3kHz) =Read Value+Duty cycle correction factor + 10*LOG10(3 / 30)

2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a),the power spectral density=10log($10^{(\text{PSD antenna1 in dBm/10})}+10^{(\text{PSD antenna2 in dBm/10})}$)

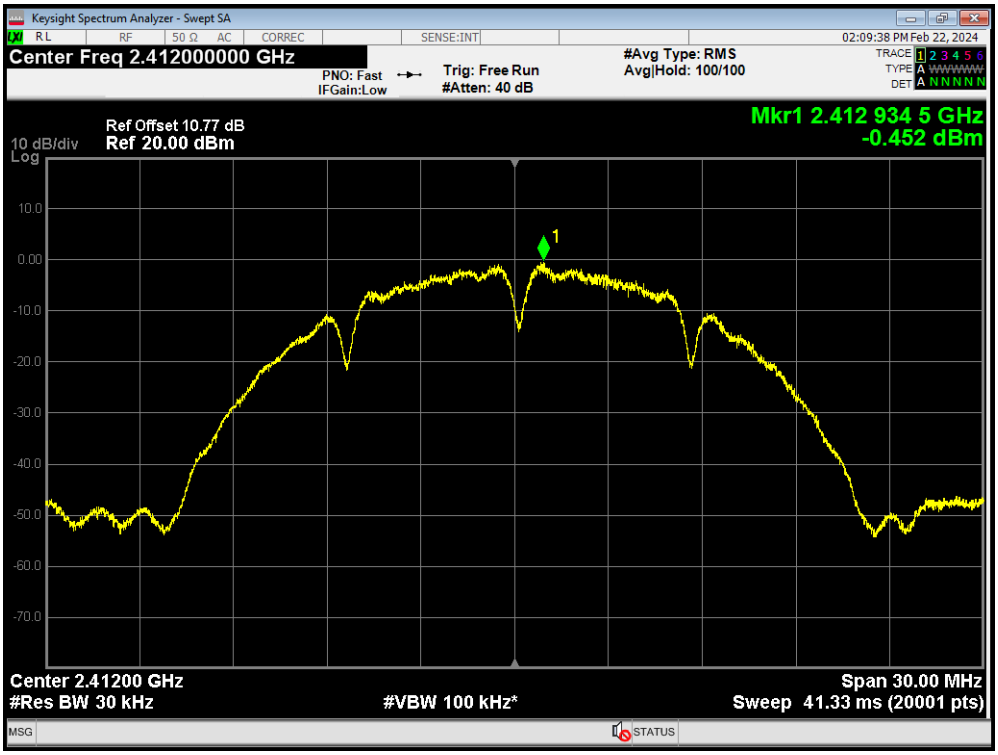
3. The manufacturer declared that the directional gain = 4.84 <6dBi. So the PSD limit is 8 dBm.

MIMO

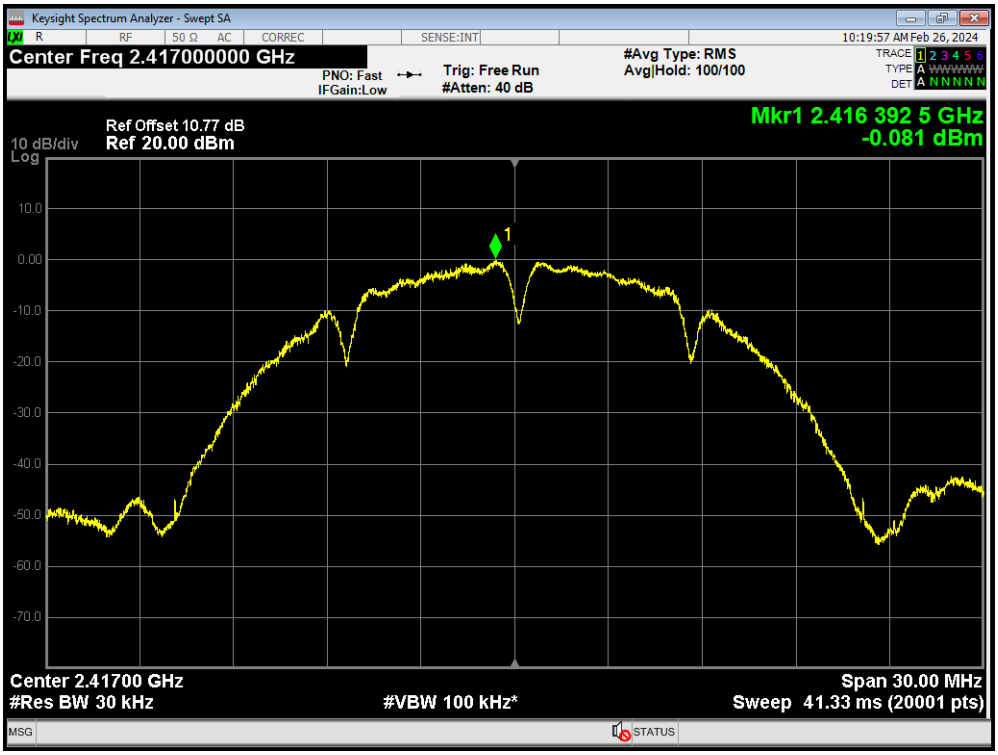
PSD 802.11b 2412MHz Ant1



PSD 802.11b 2412MHz Ant2



PSD 802.11b 2417MHz Ant1



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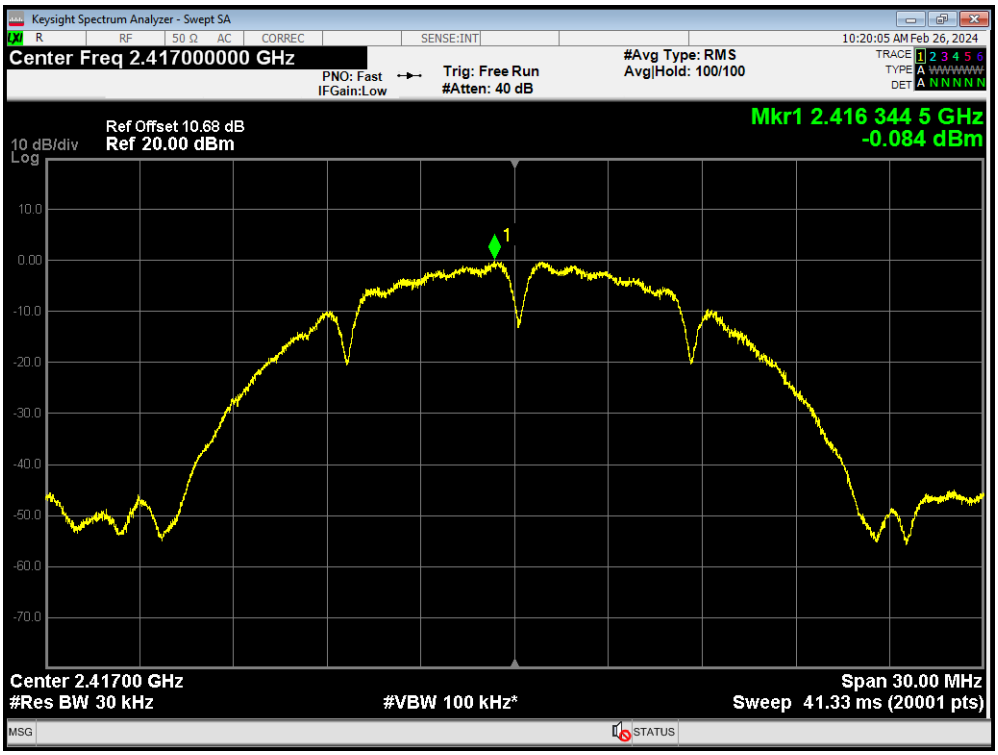
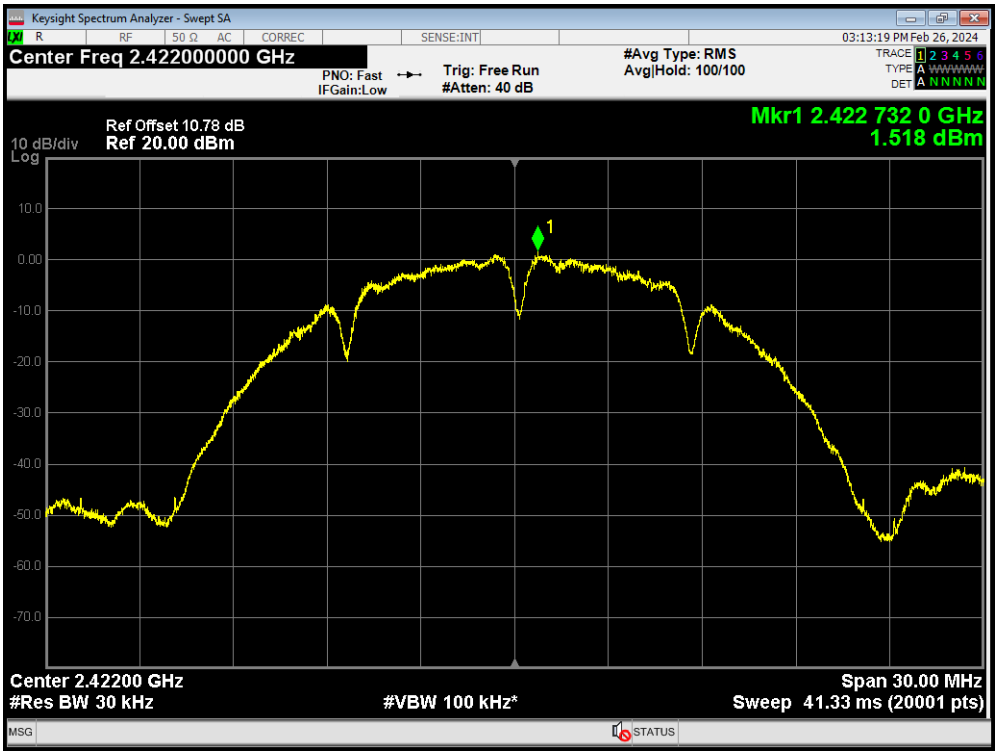


PSD 802.11b 2422MHz Ant1



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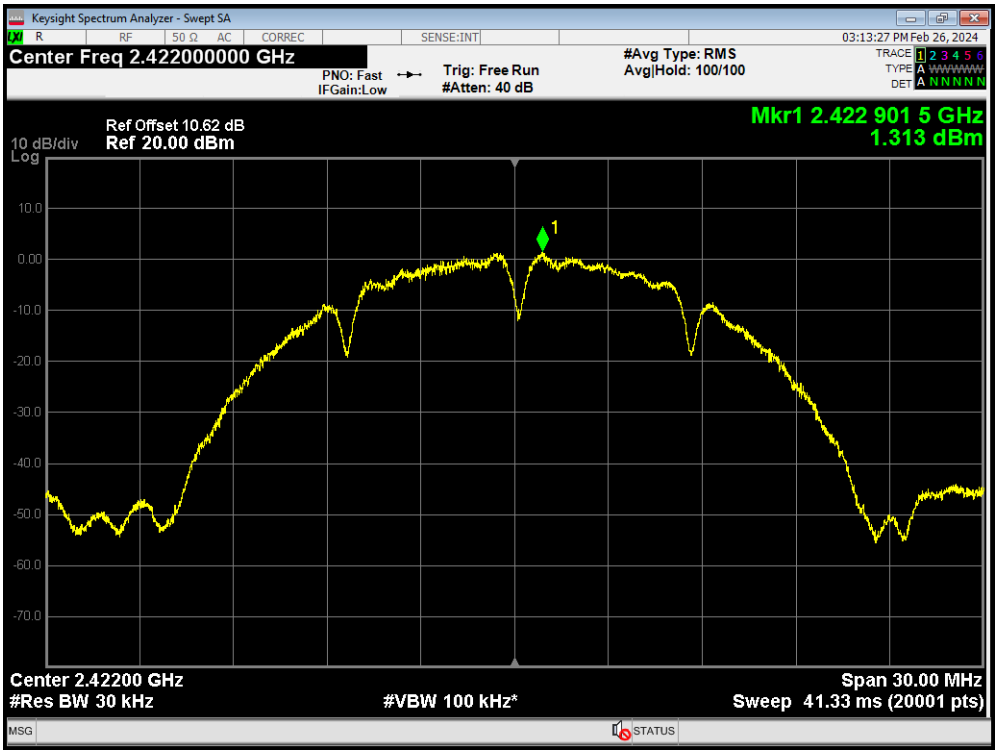
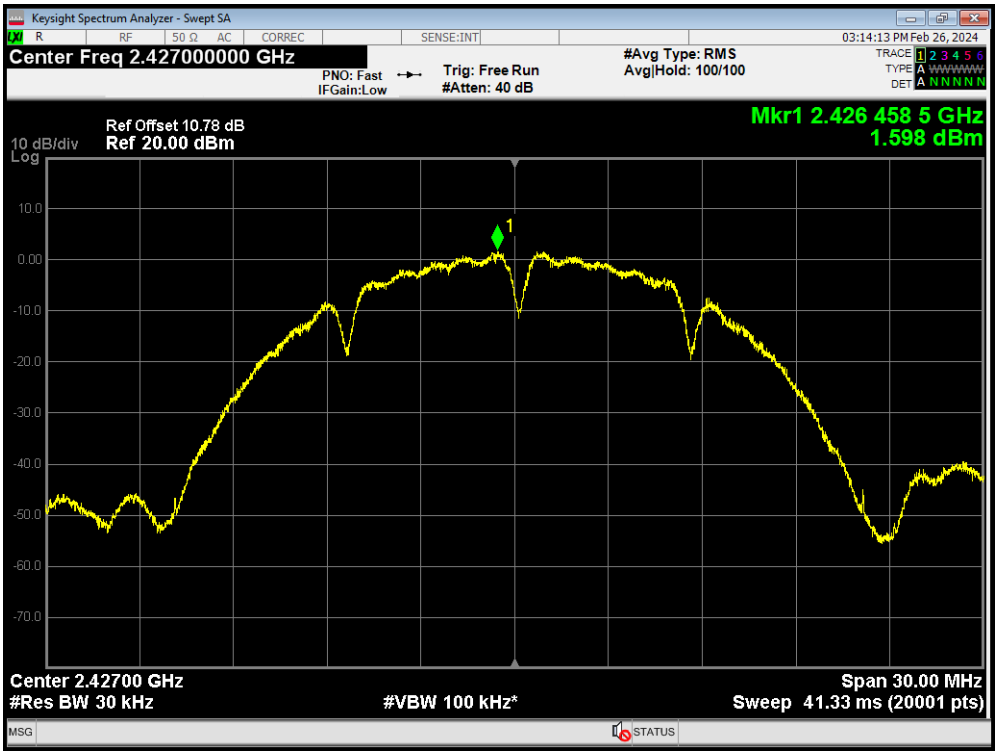


PSD 802.11b 2427MHz Ant1



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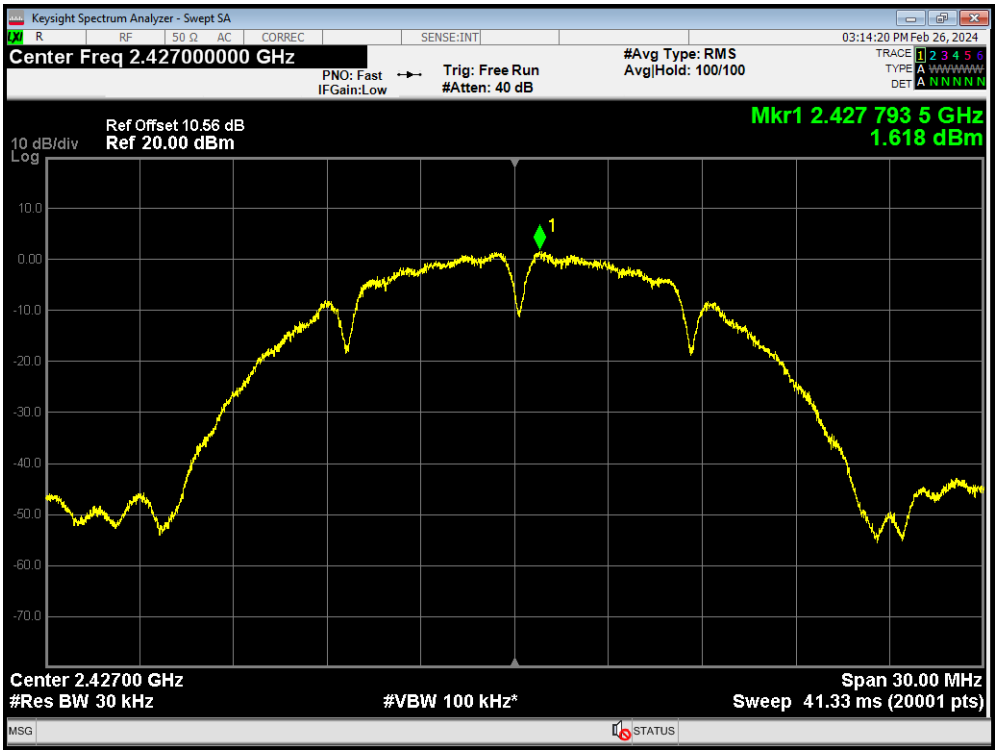
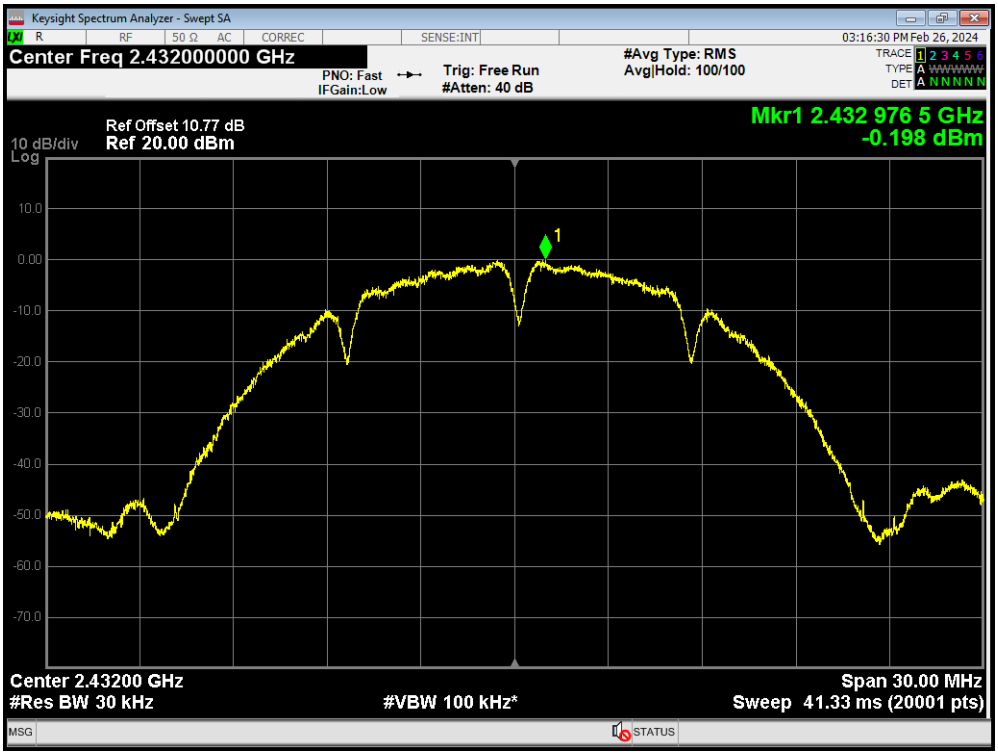


PSD 802.11b 2432MHz Ant1



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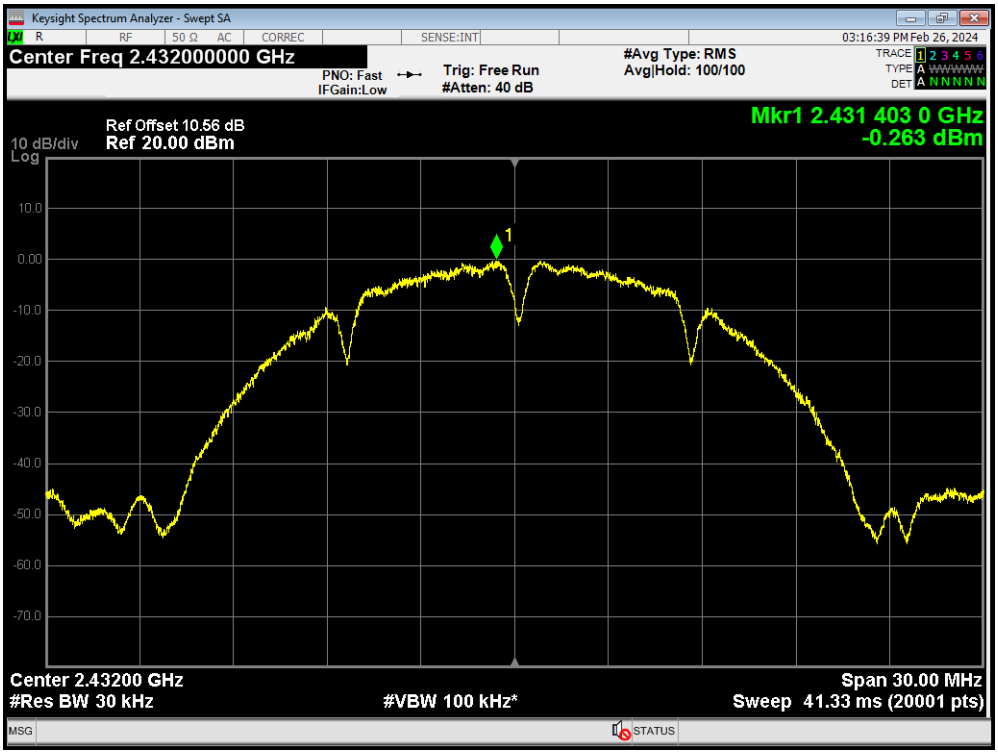
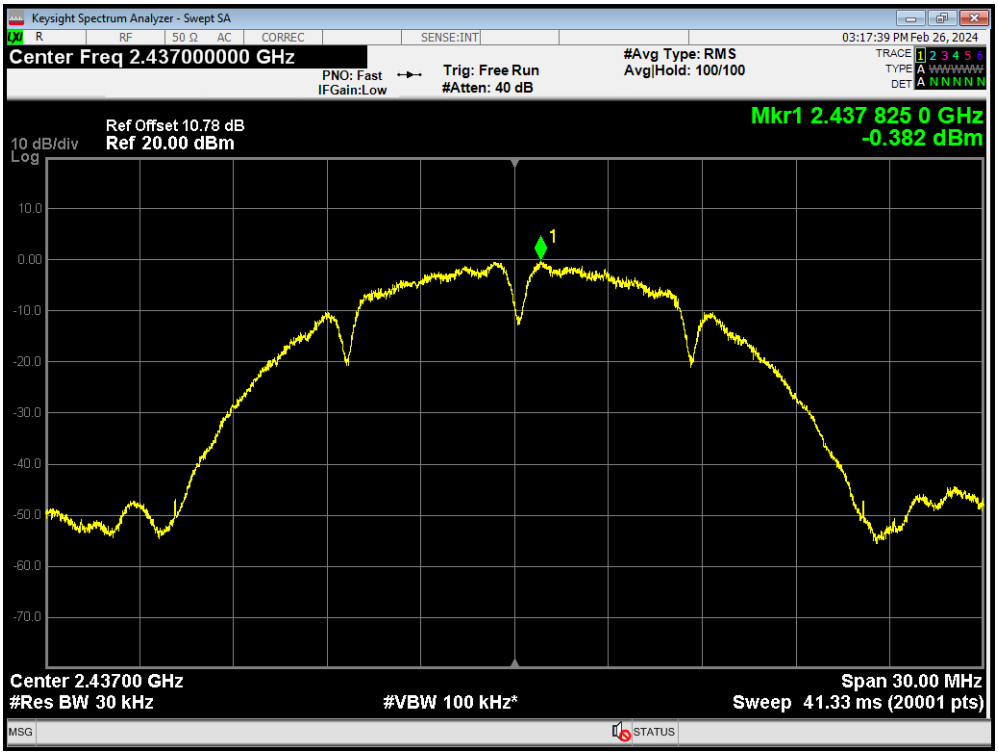


PSD 802.11b 2437MHz Ant1



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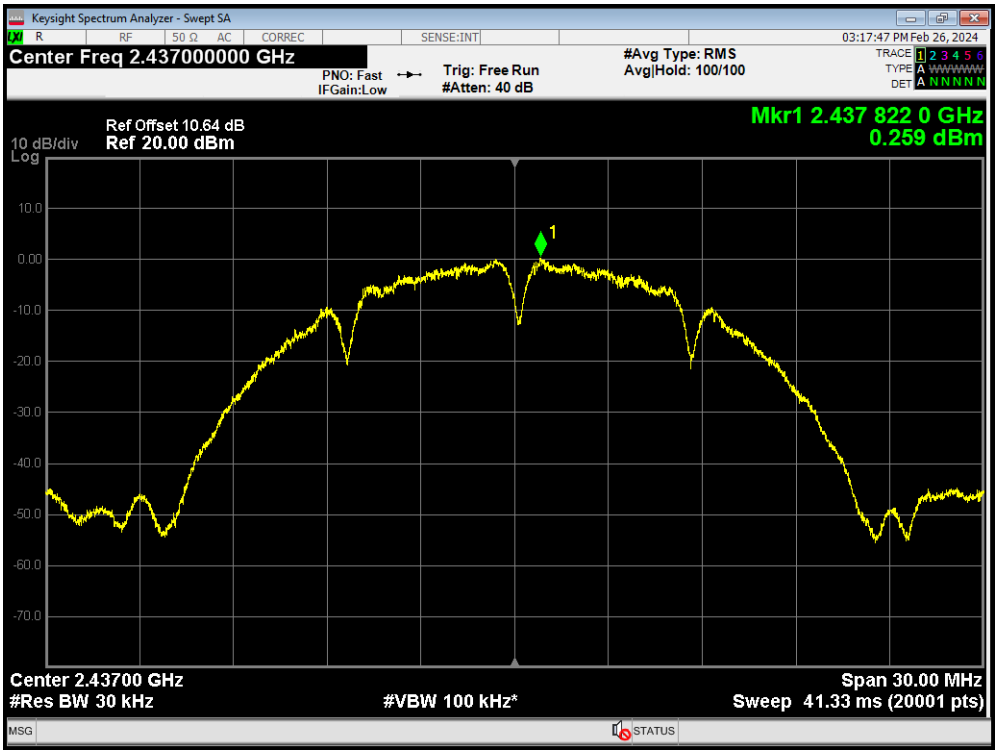

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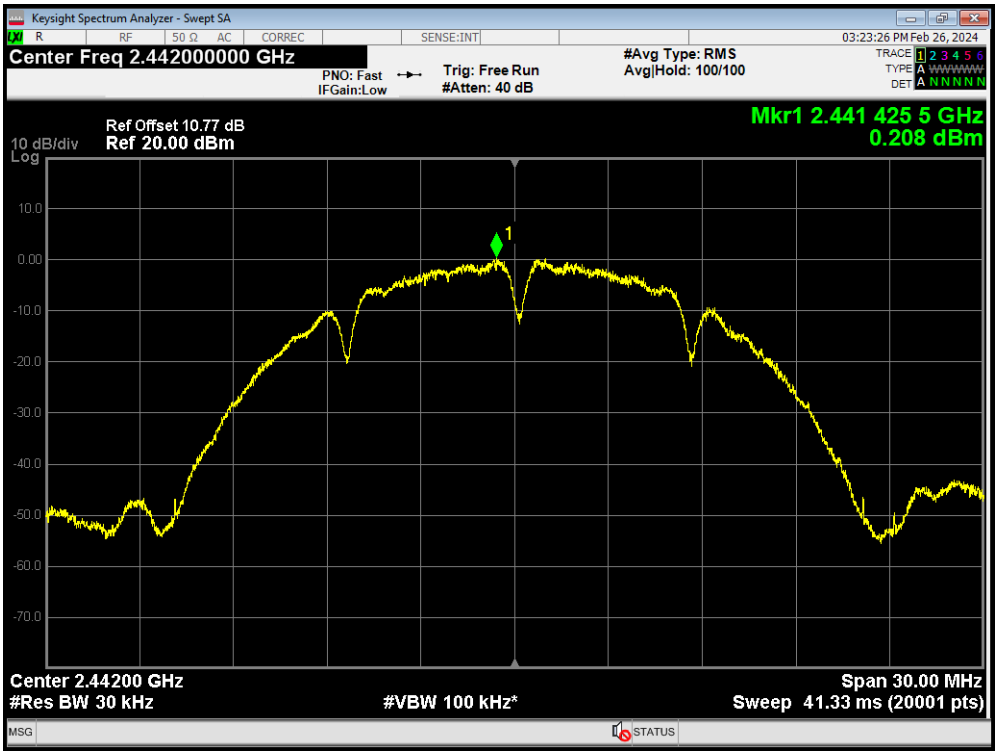

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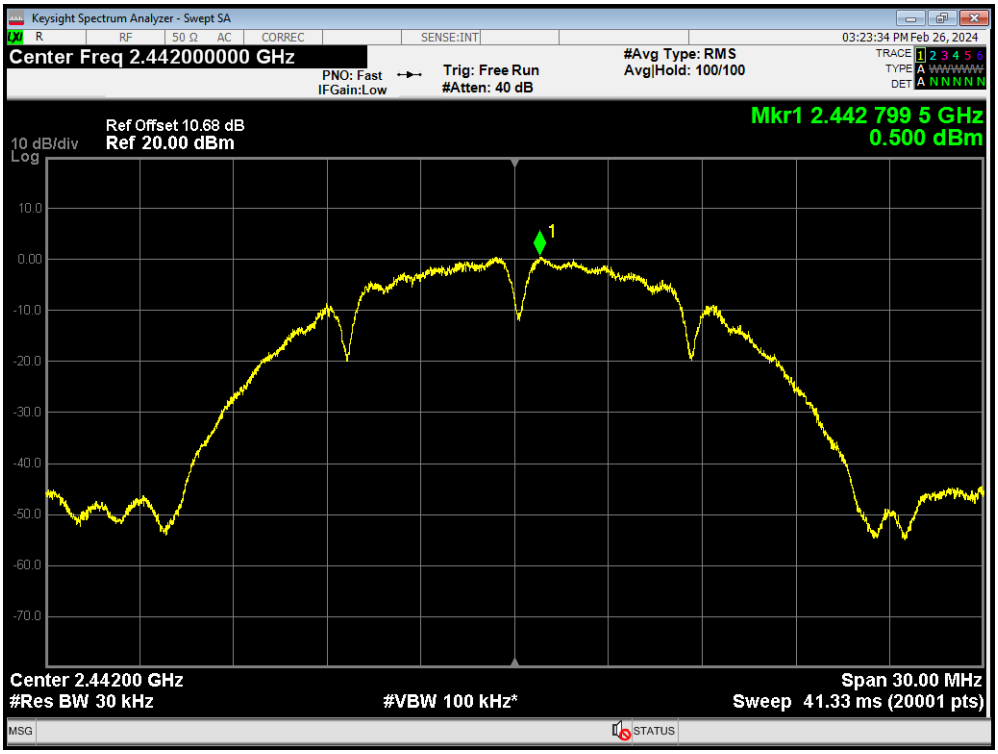
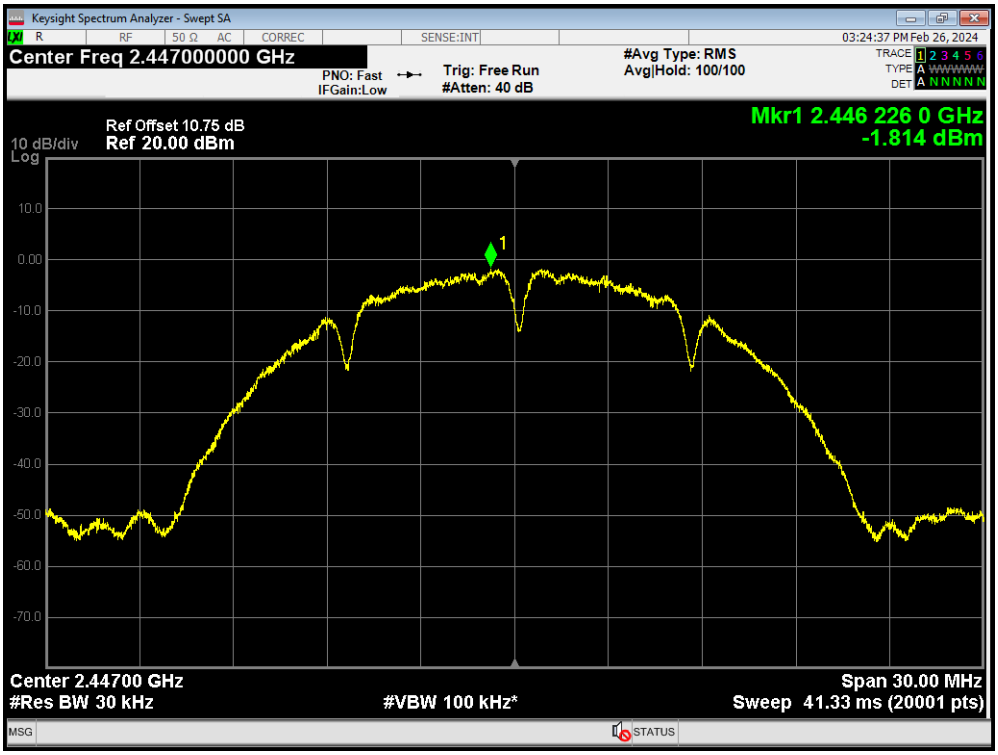
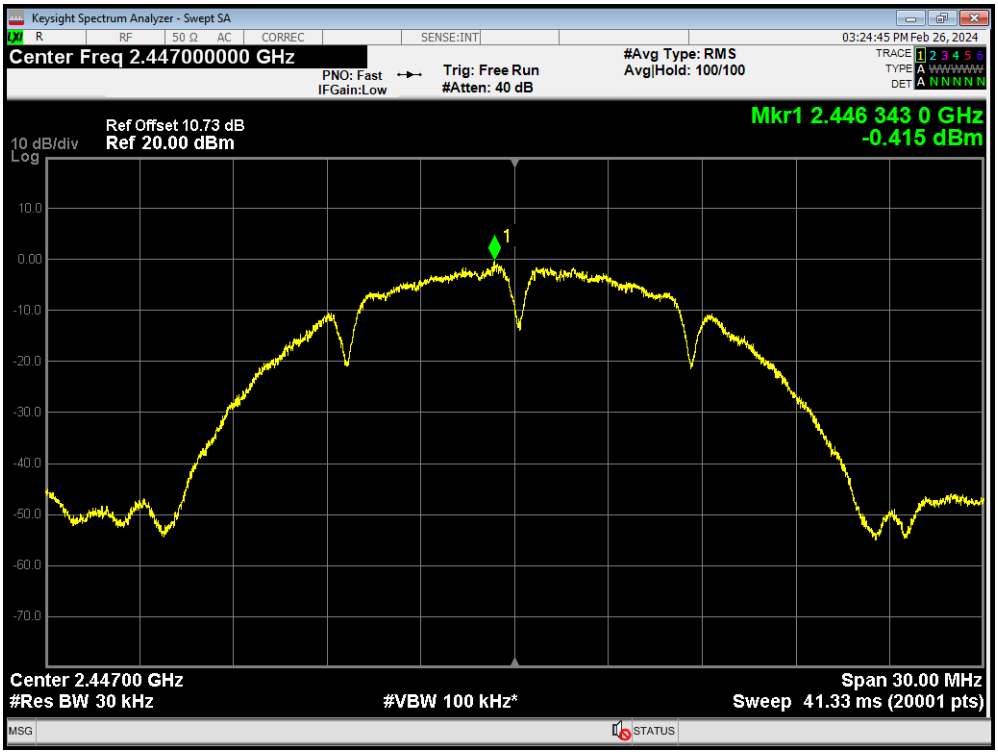


PSD 802.11b 2447MHz Ant1



PSD 802.11b 2447MHz Ant2



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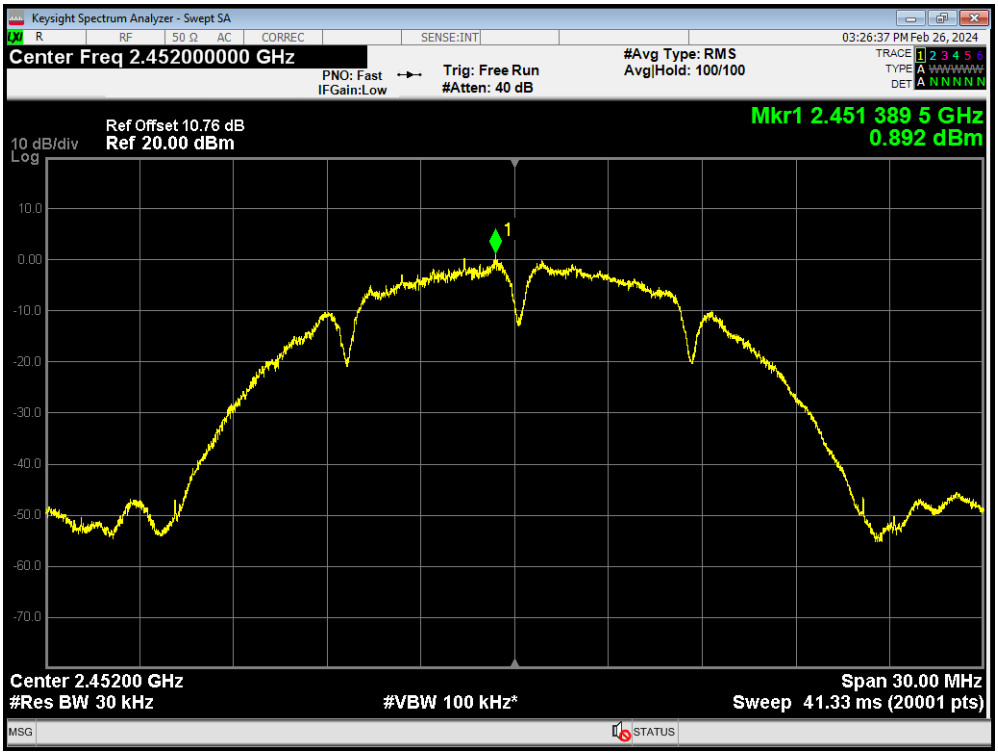

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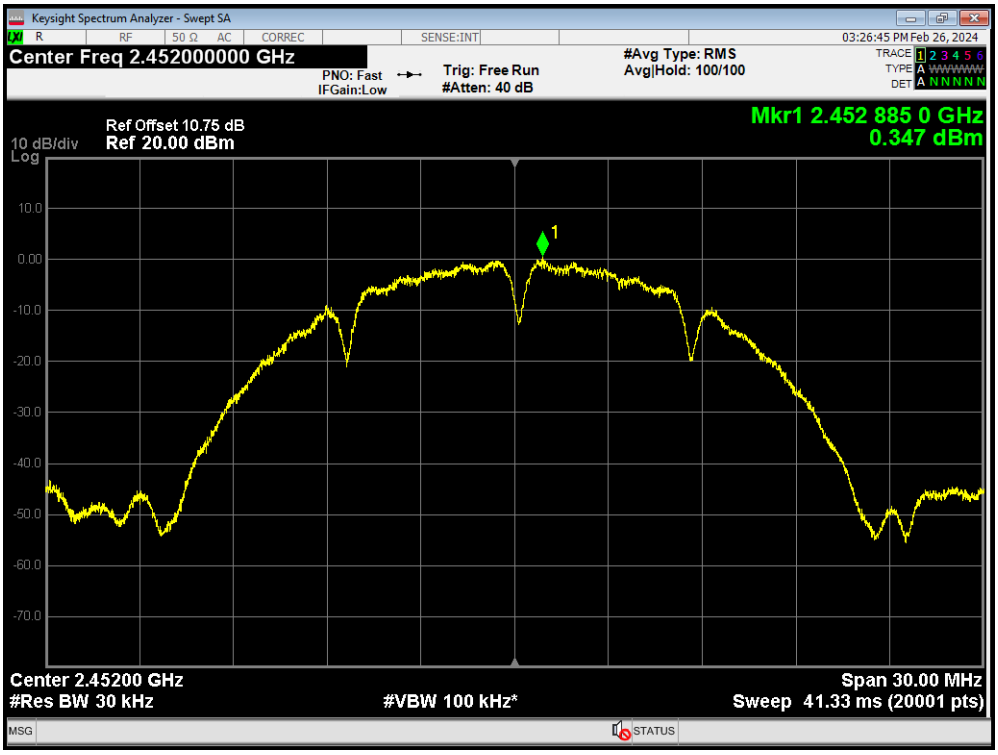

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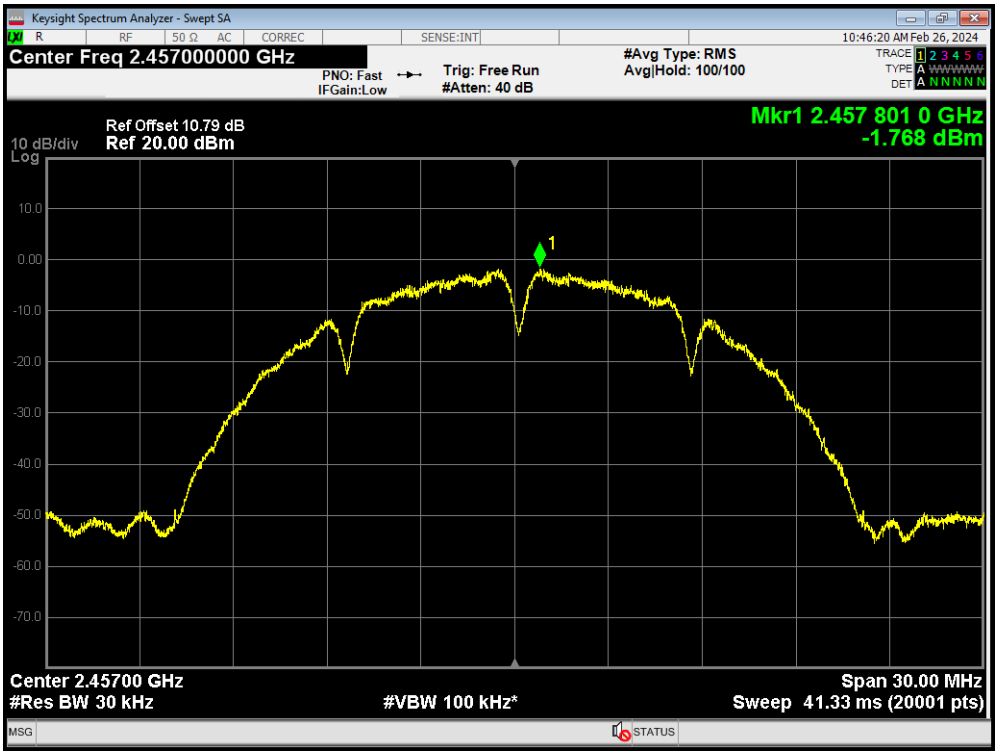

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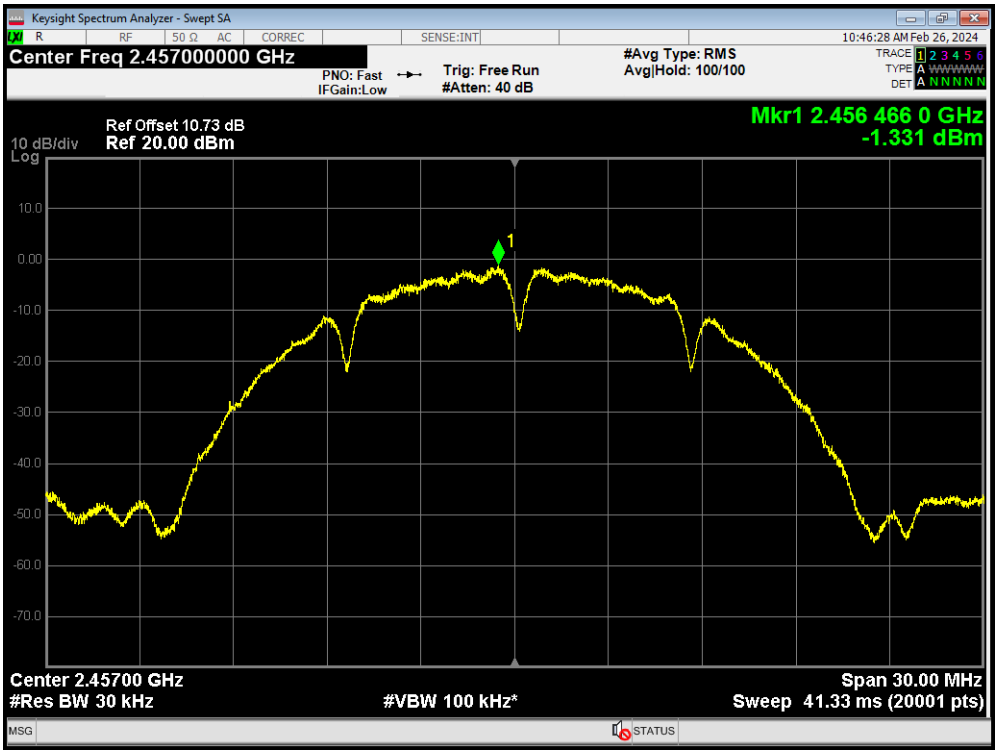
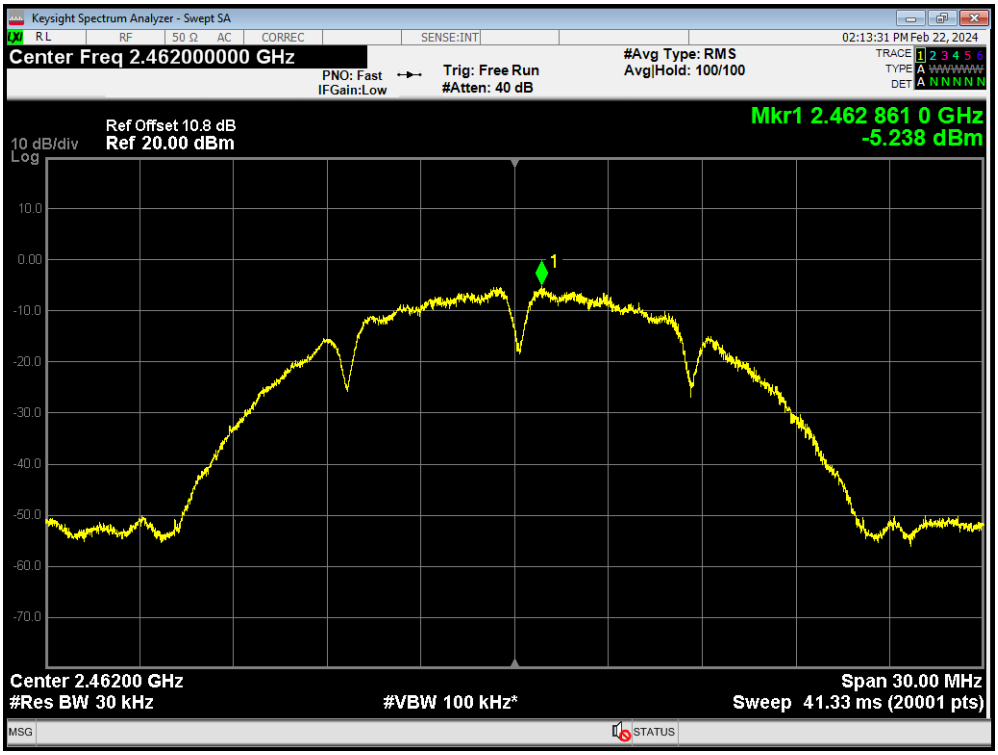


PSD 802.11b 2462MHz Ant1



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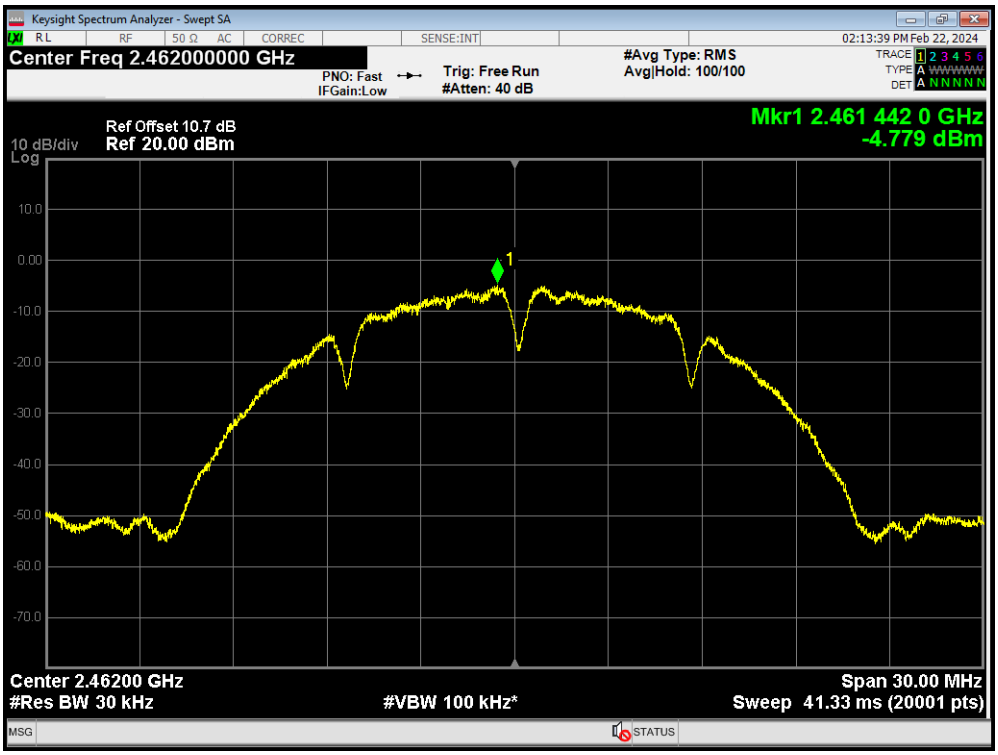
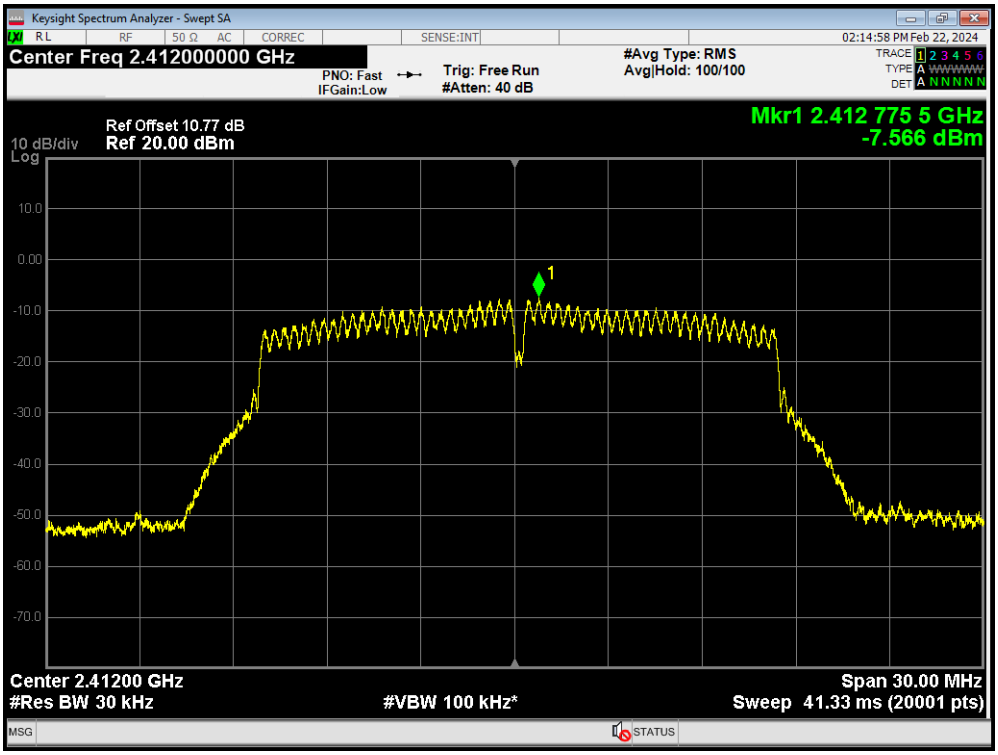


PSD 802.11g 2412MHz Ant1



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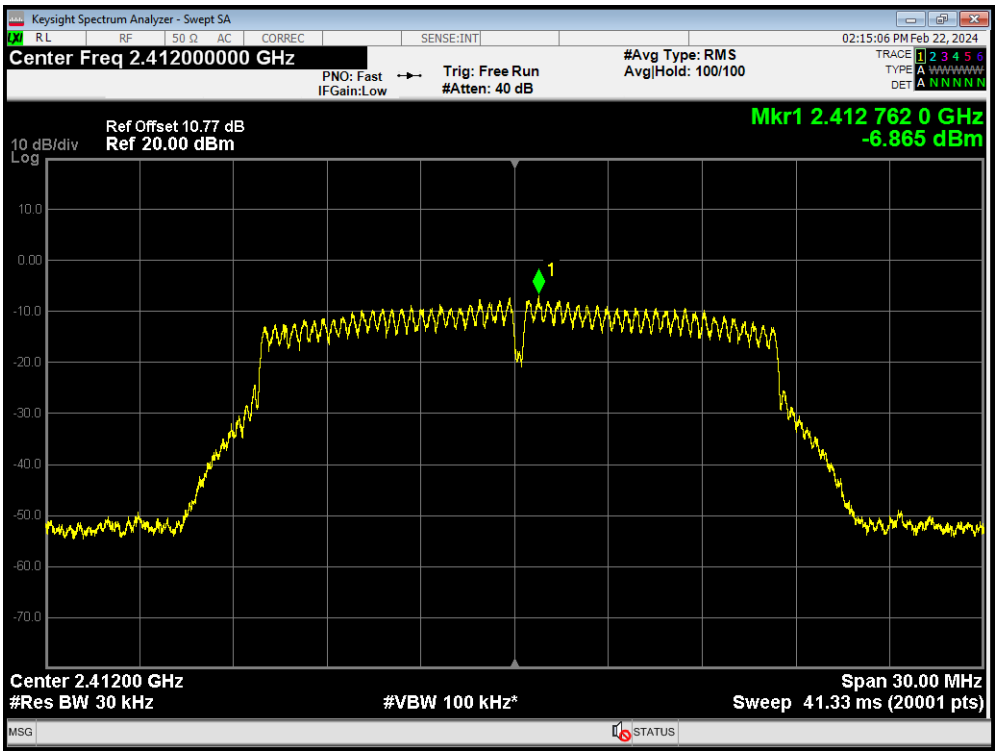

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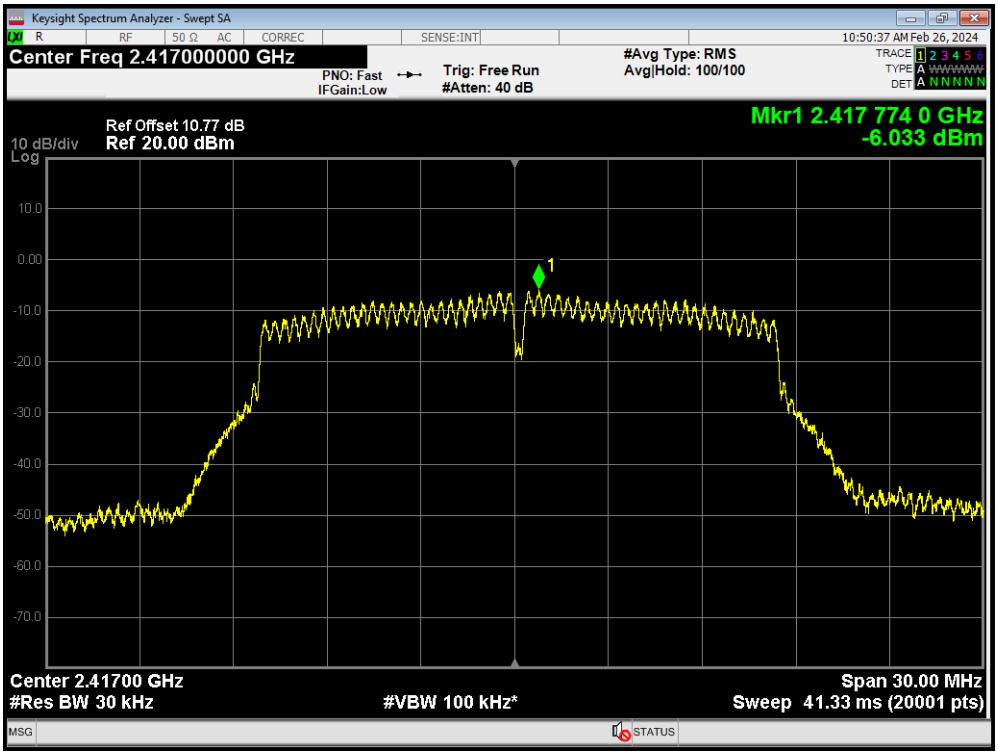

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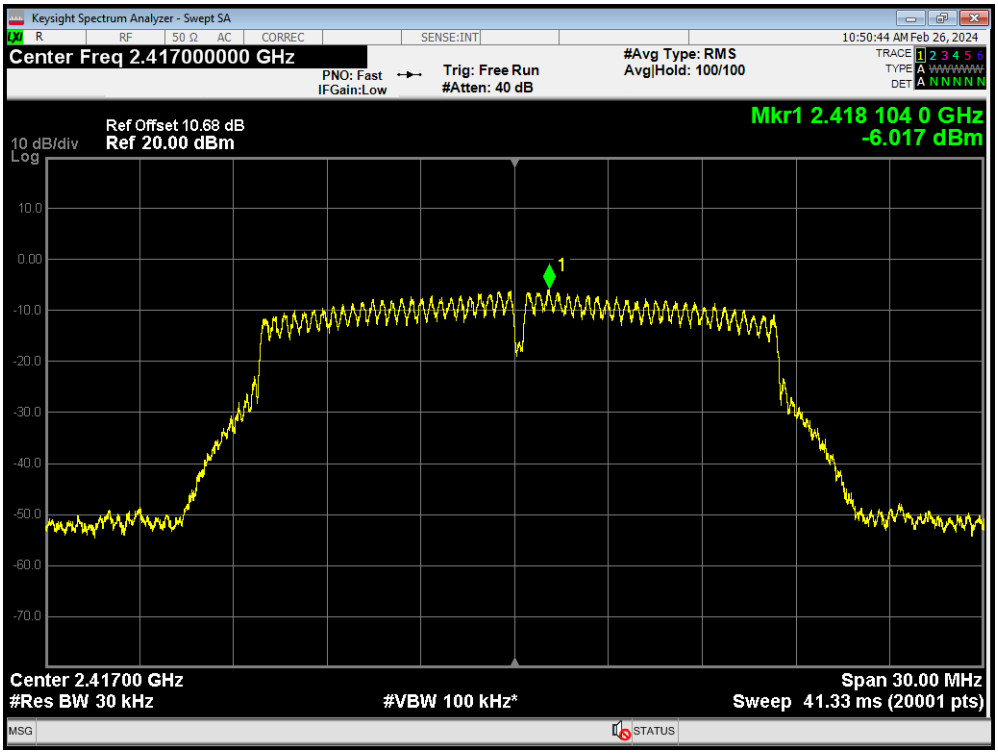

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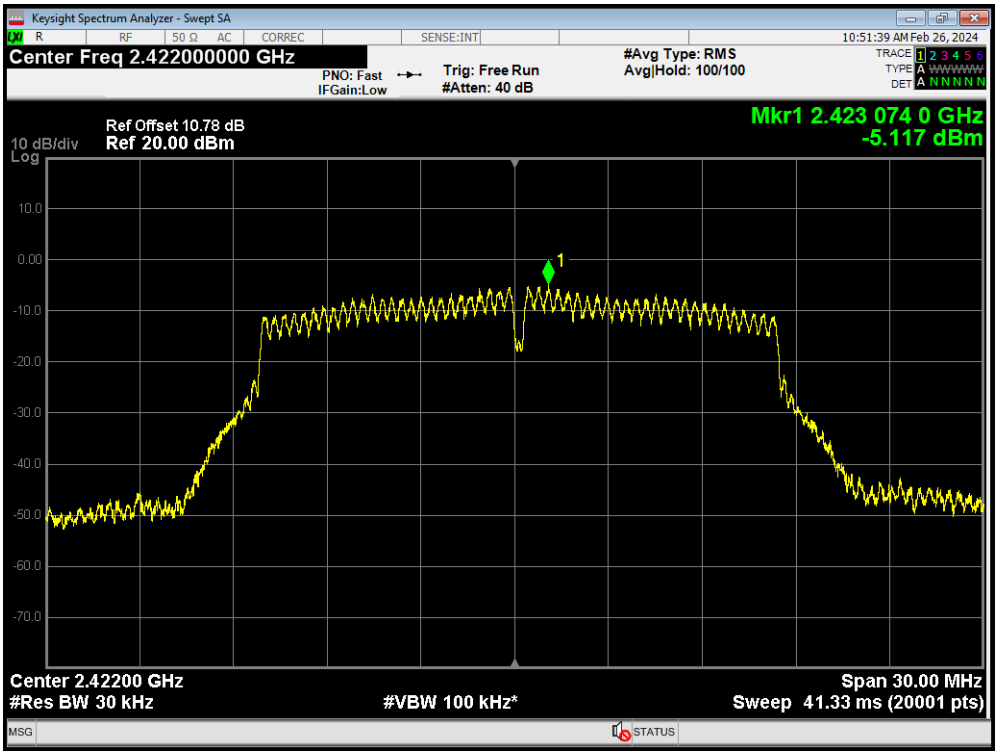

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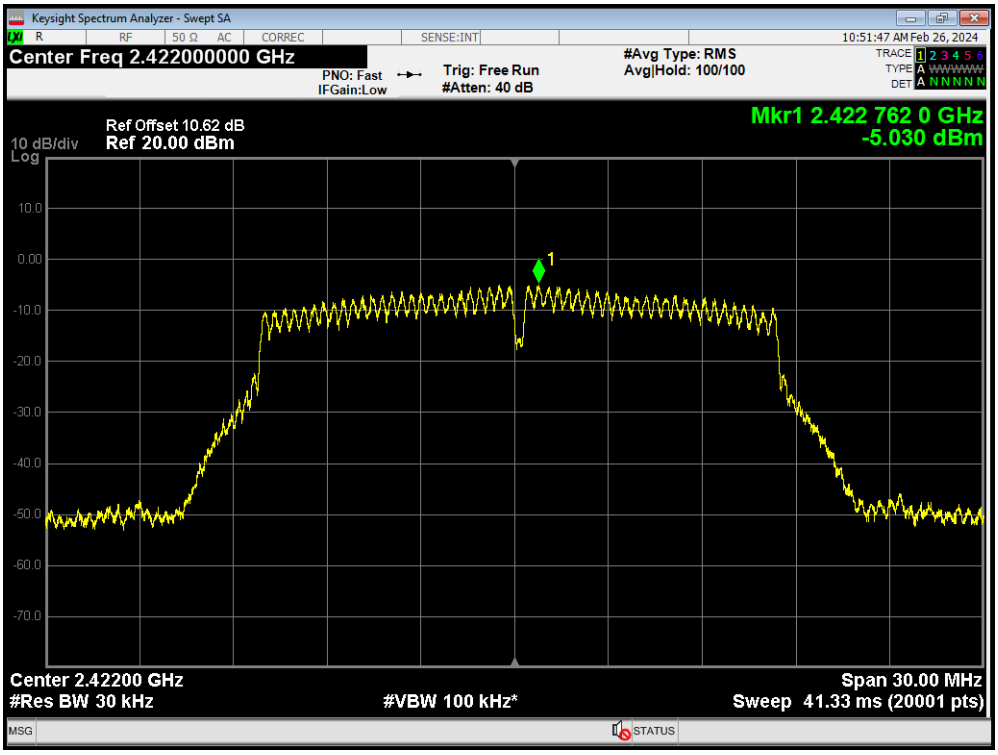
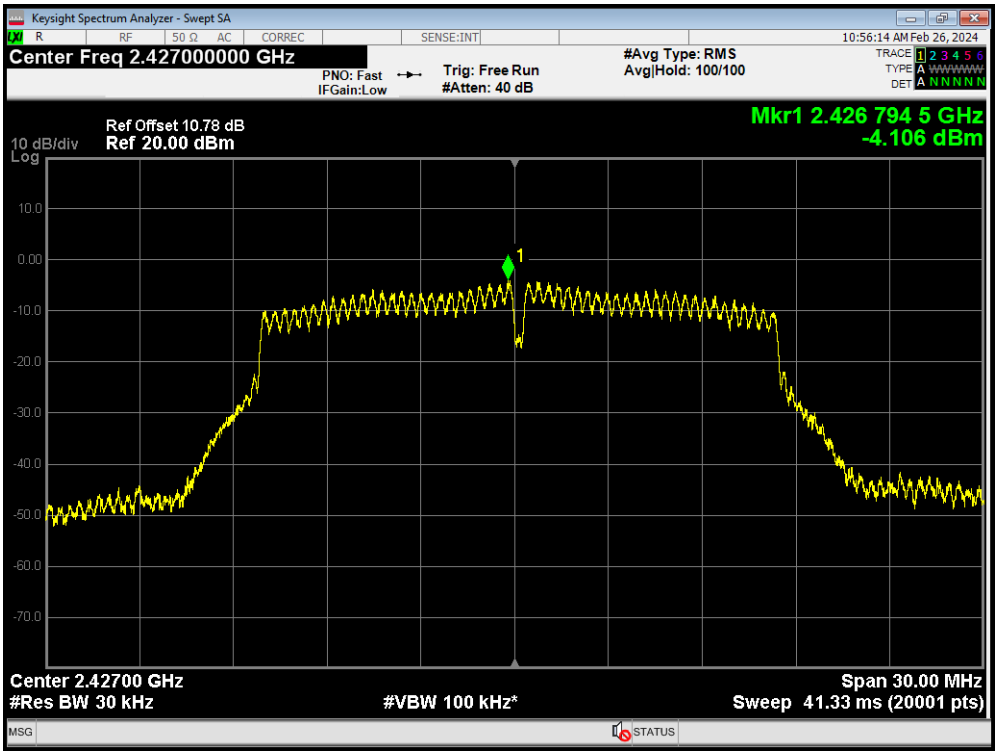


PSD 802.11g 2427MHz Ant1



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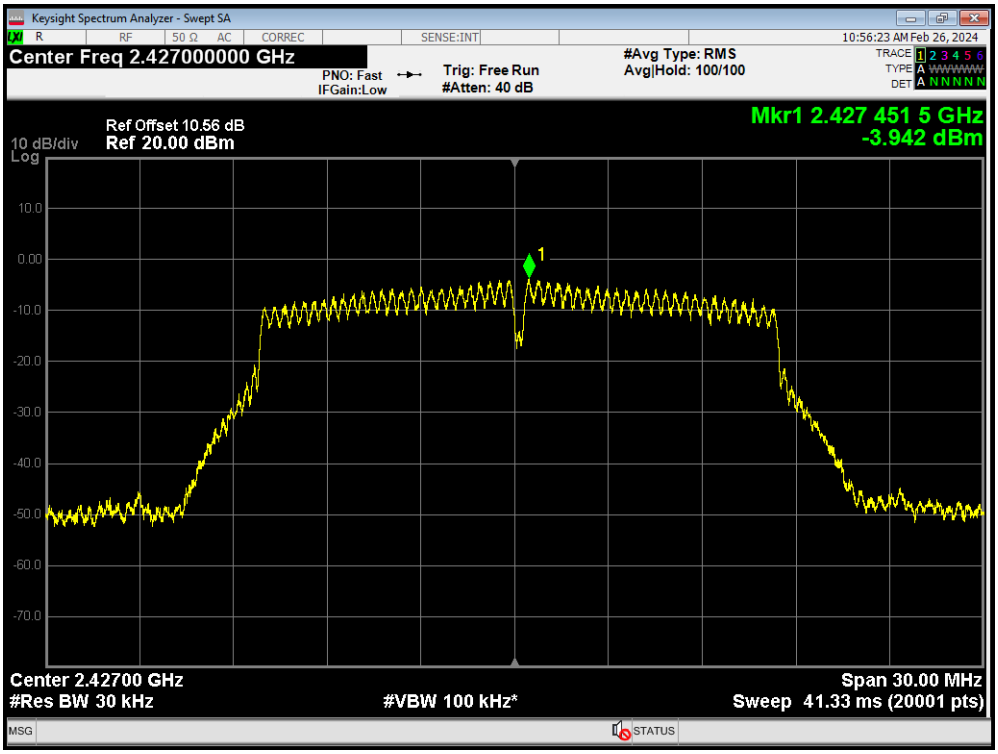

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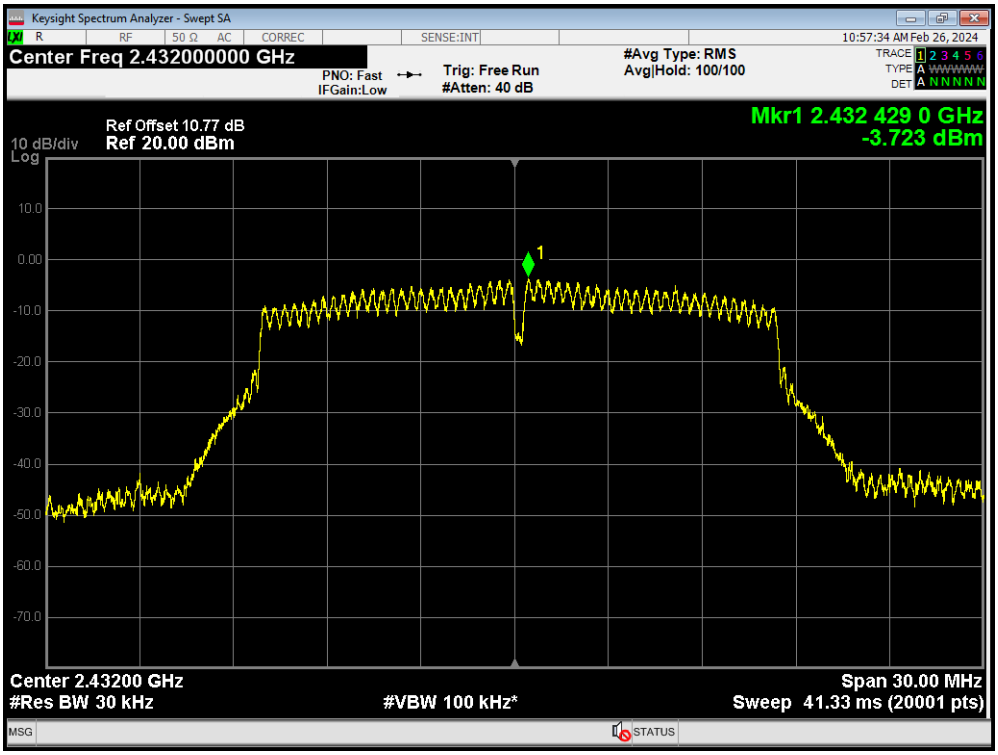

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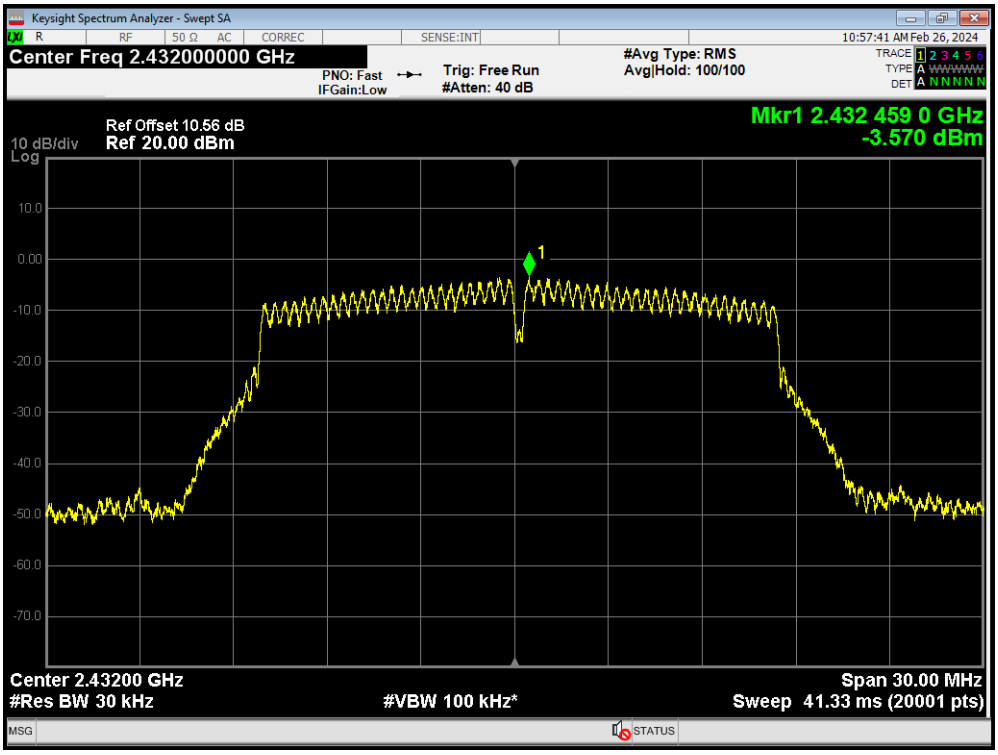
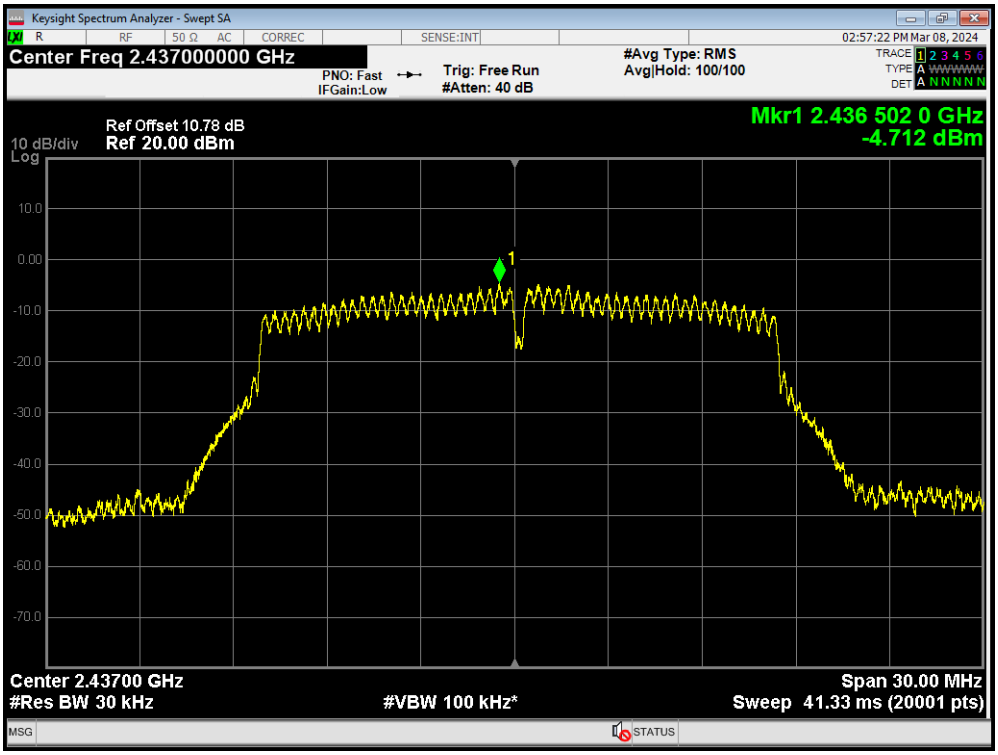
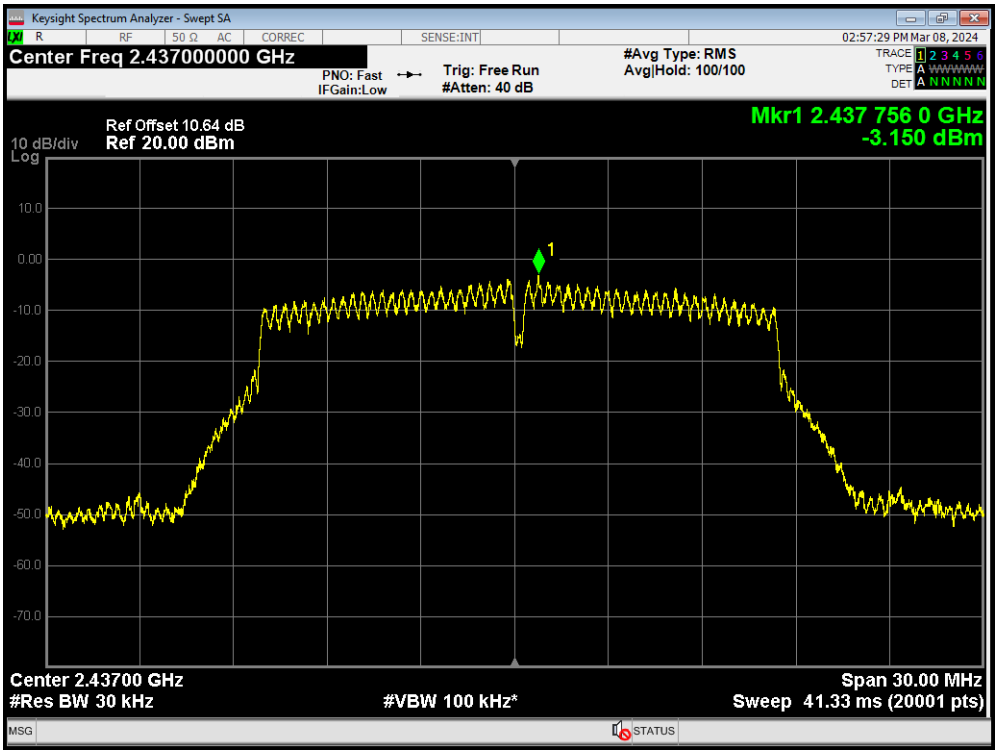


PSD 802.11g 2437MHz Ant1



PSD 802.11g 2437MHz Ant2



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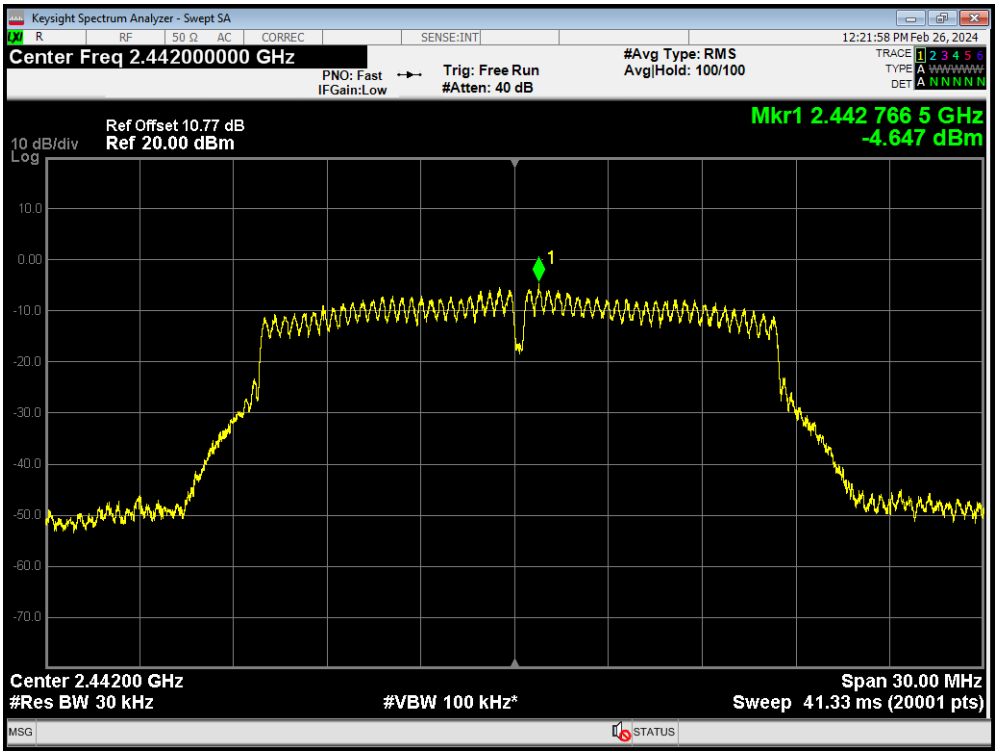

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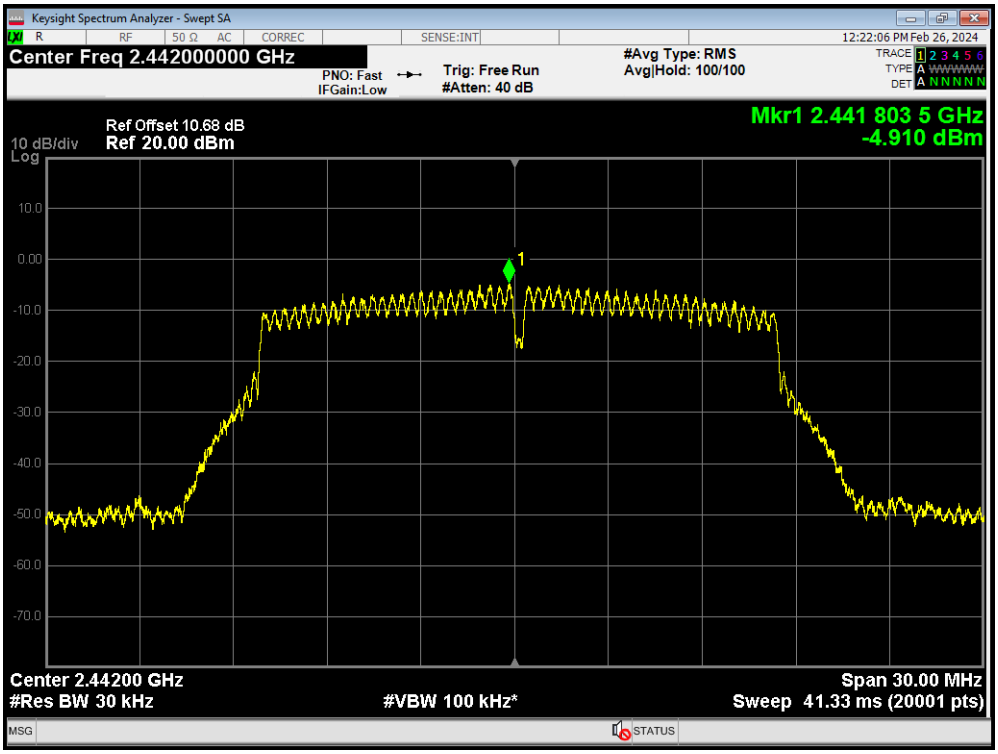

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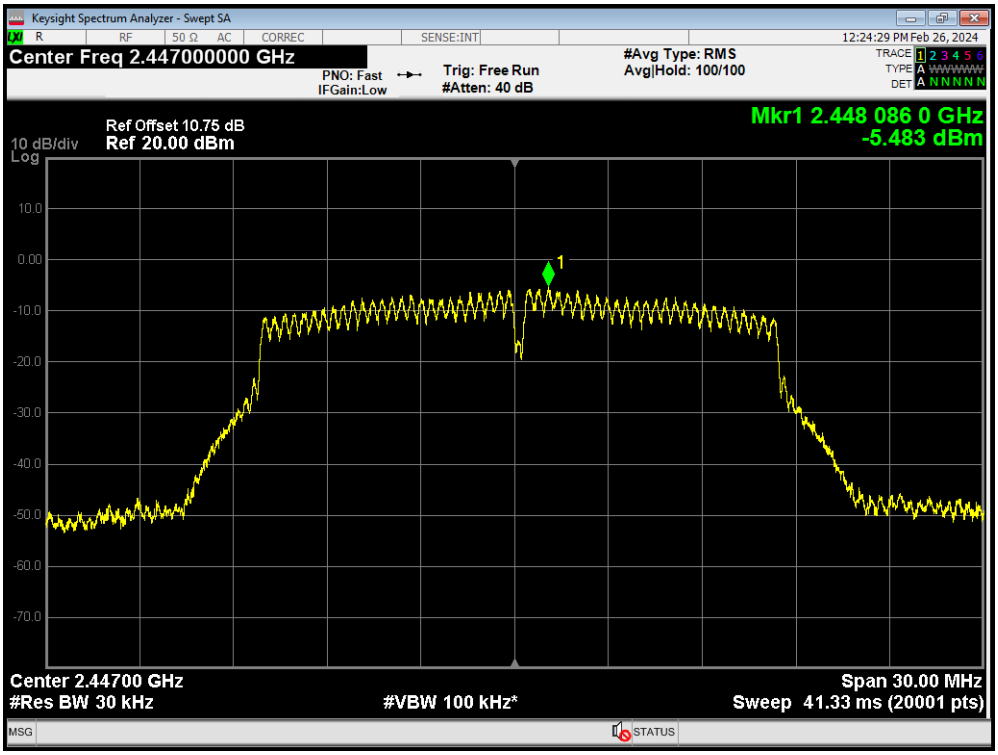

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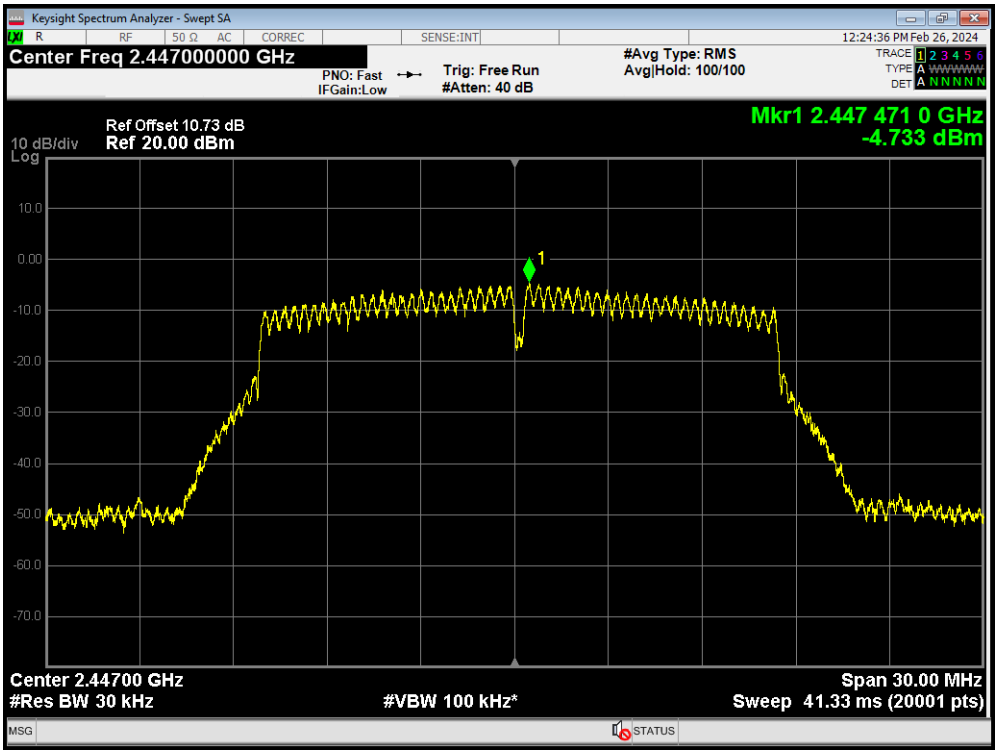

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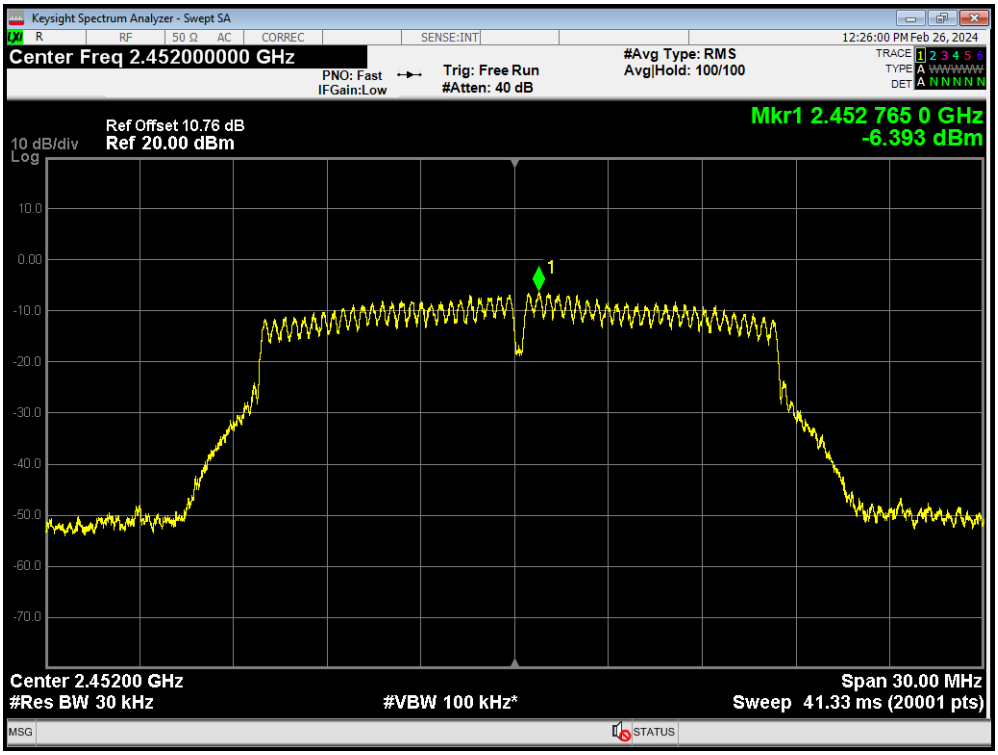

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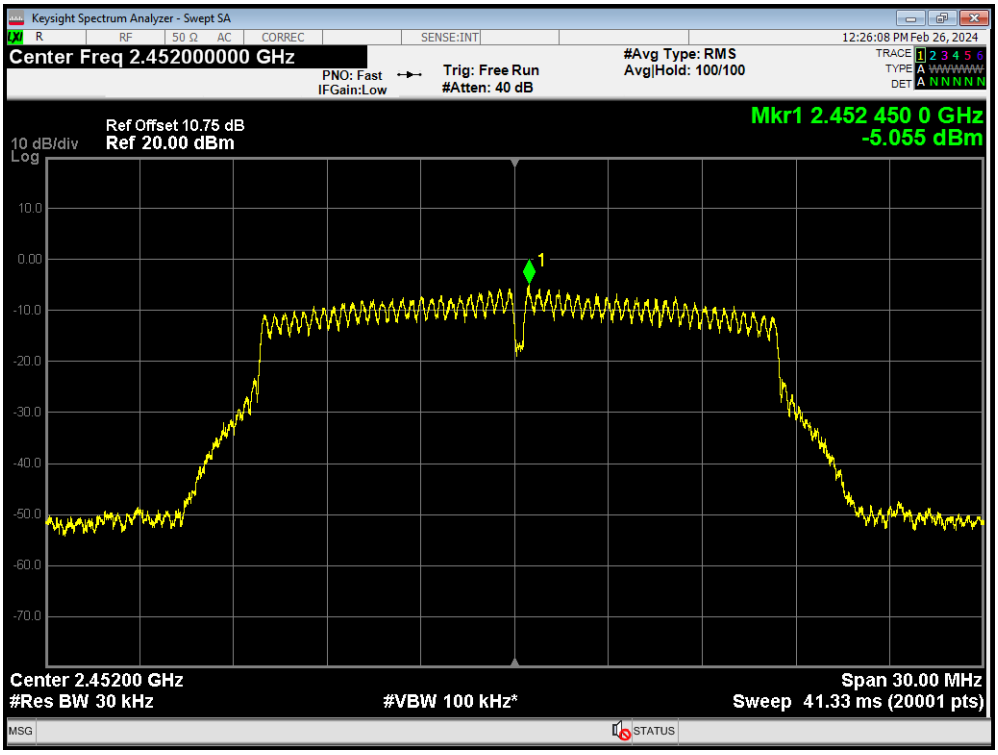

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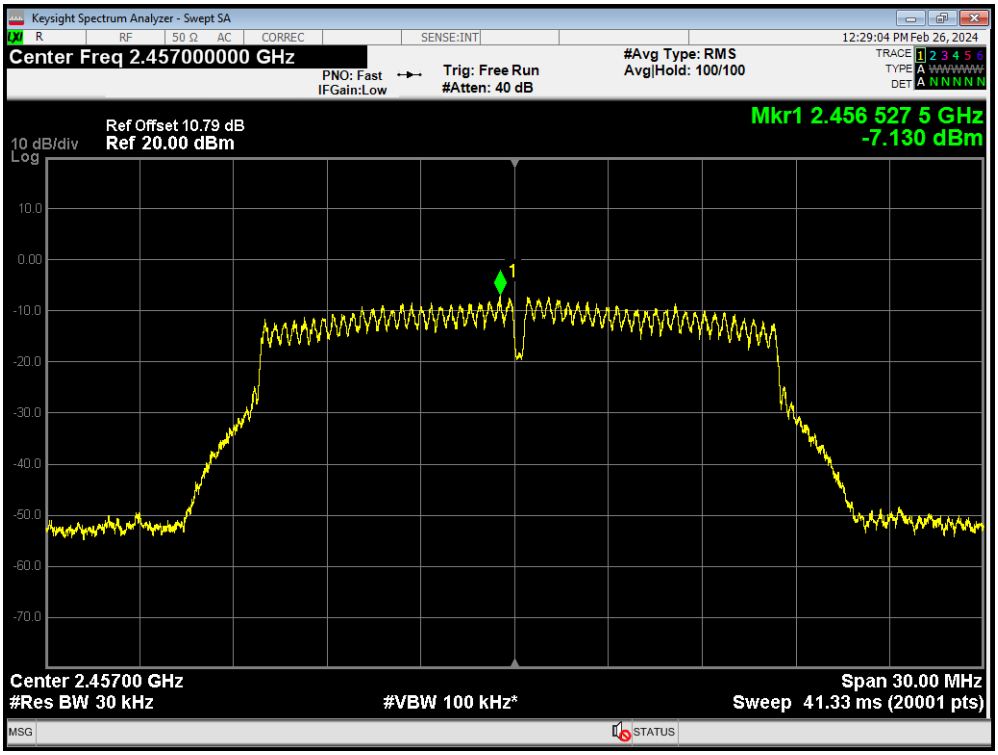

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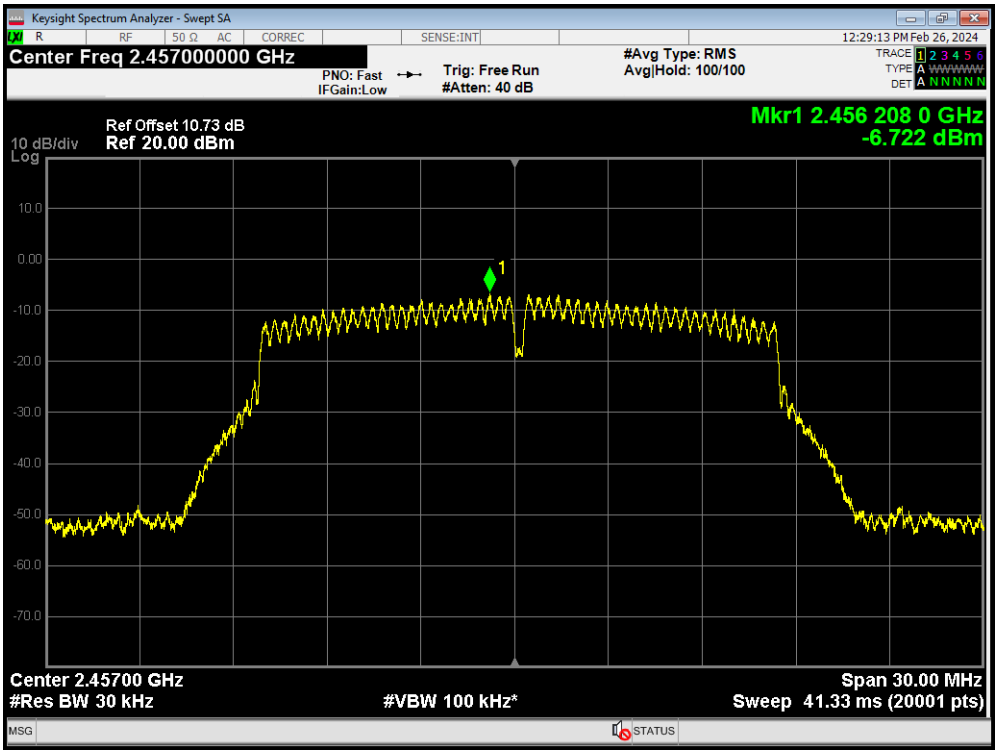

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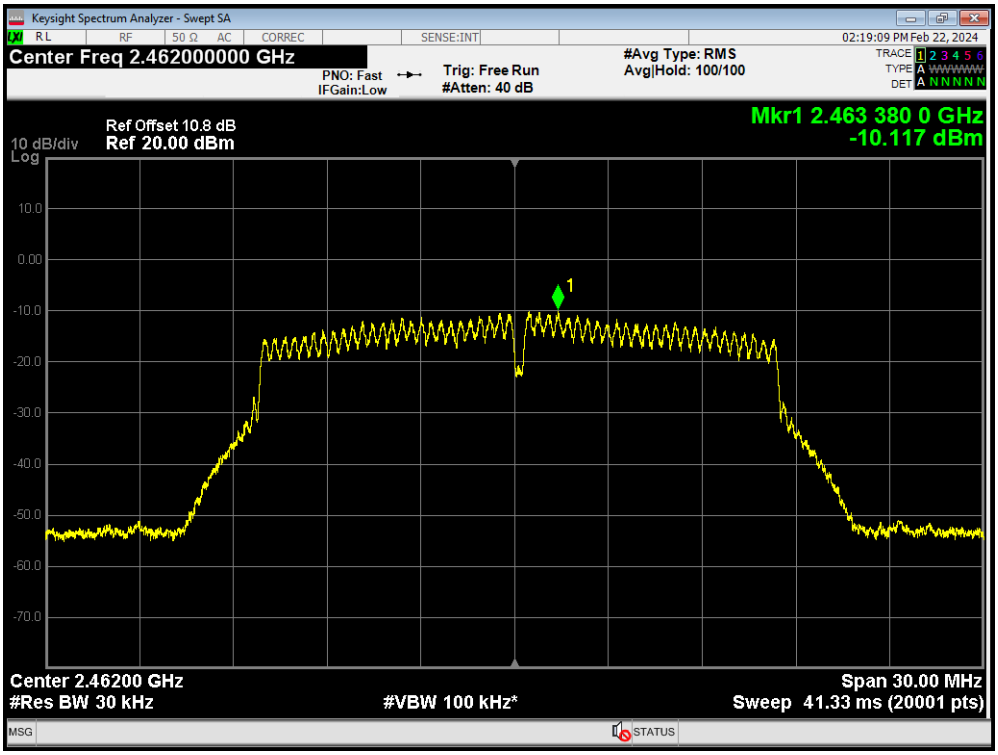

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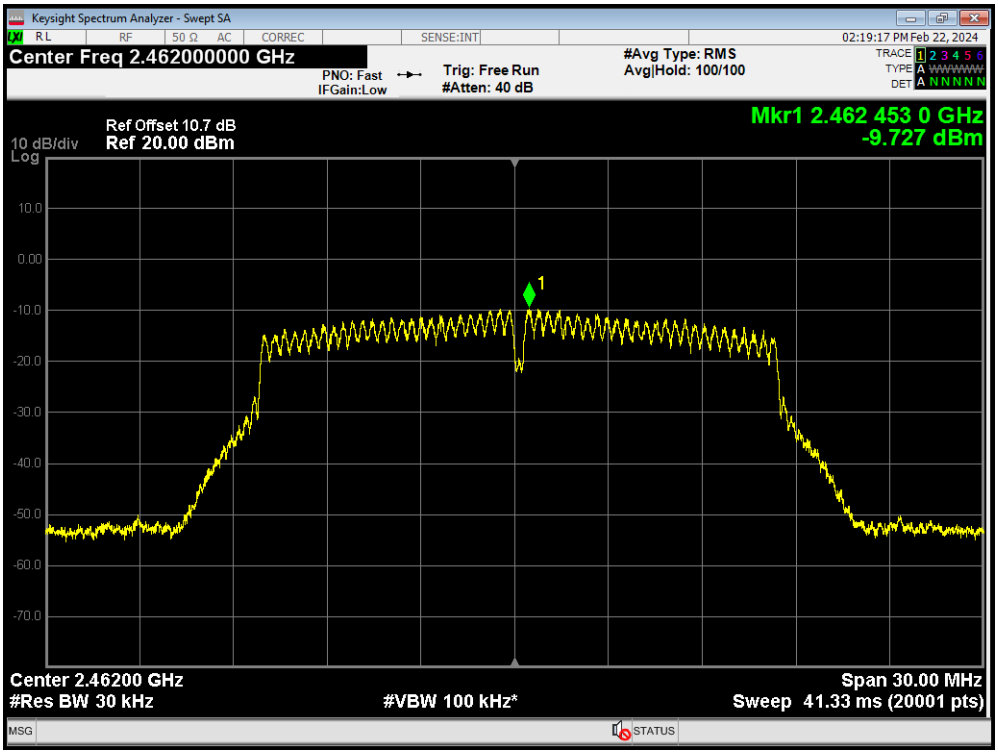
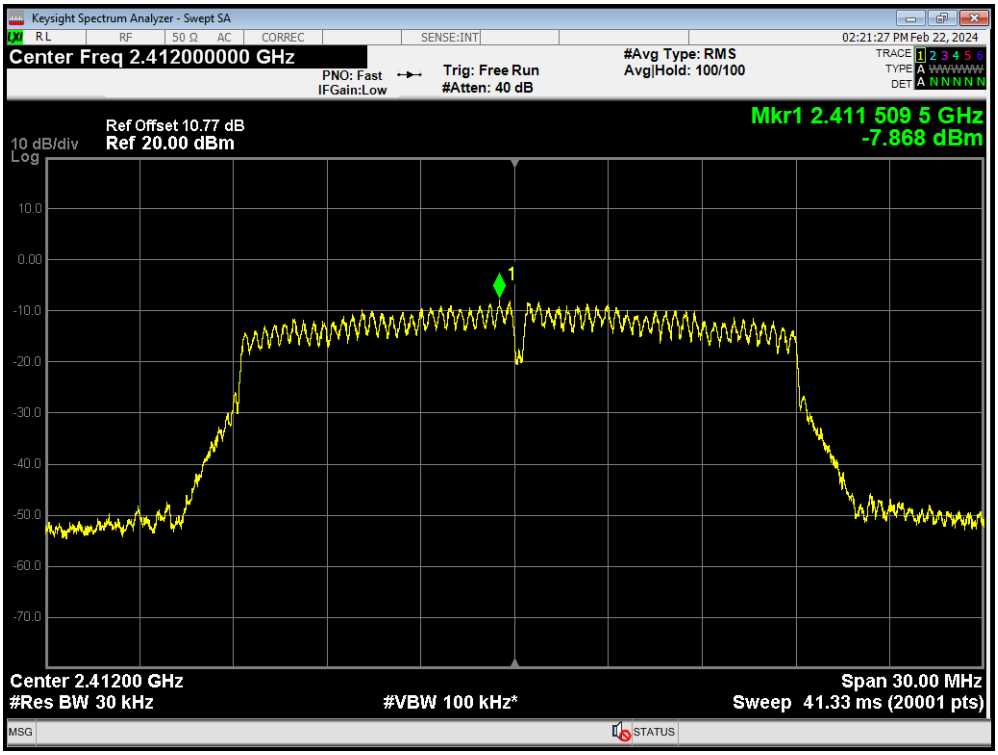


PSD 802.11n(HT20) 2412MHz Ant1



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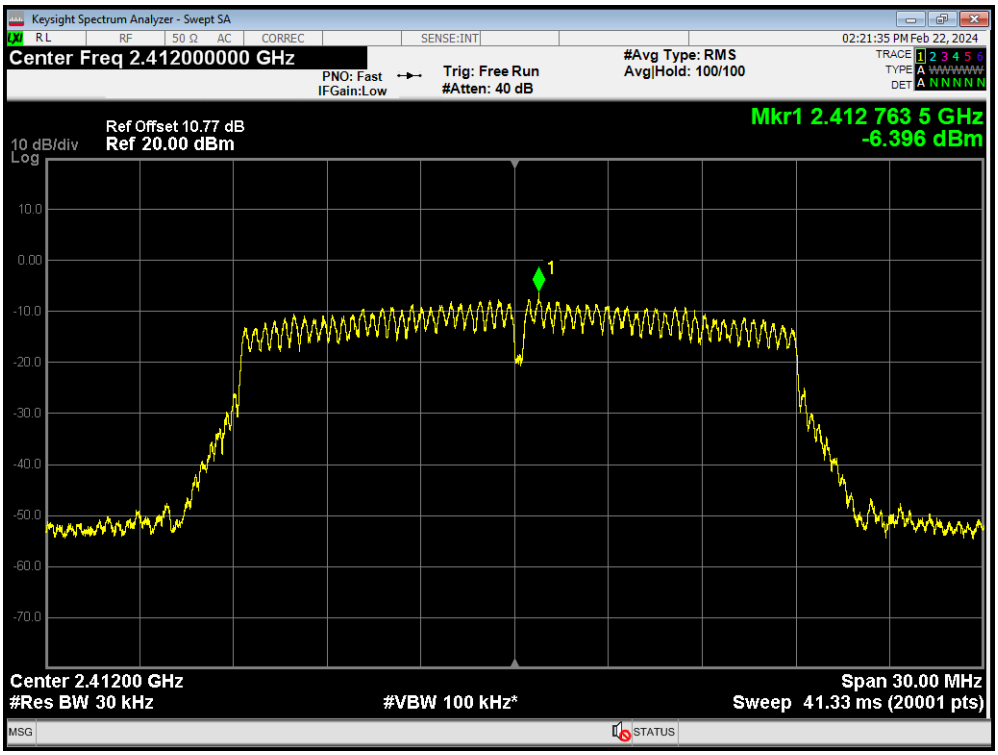

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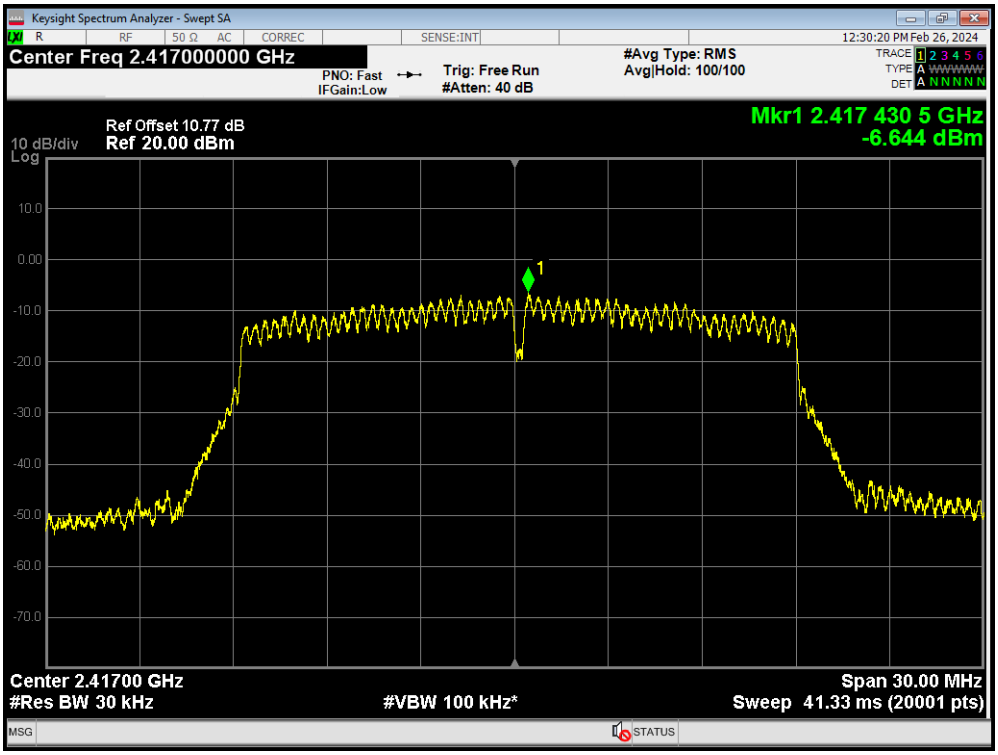

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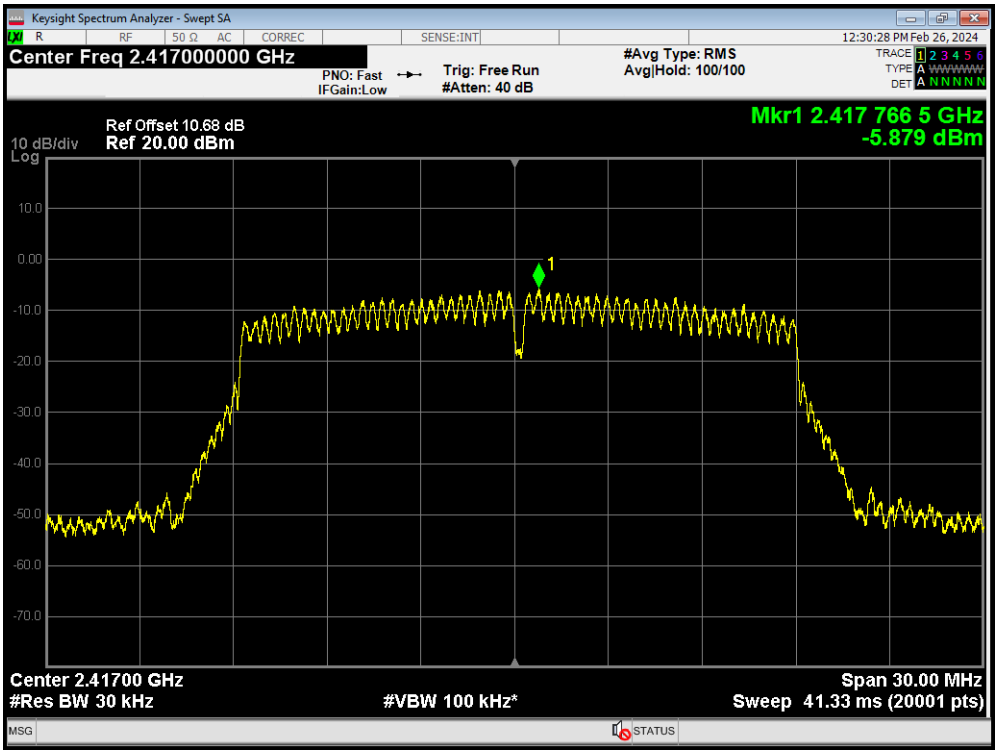

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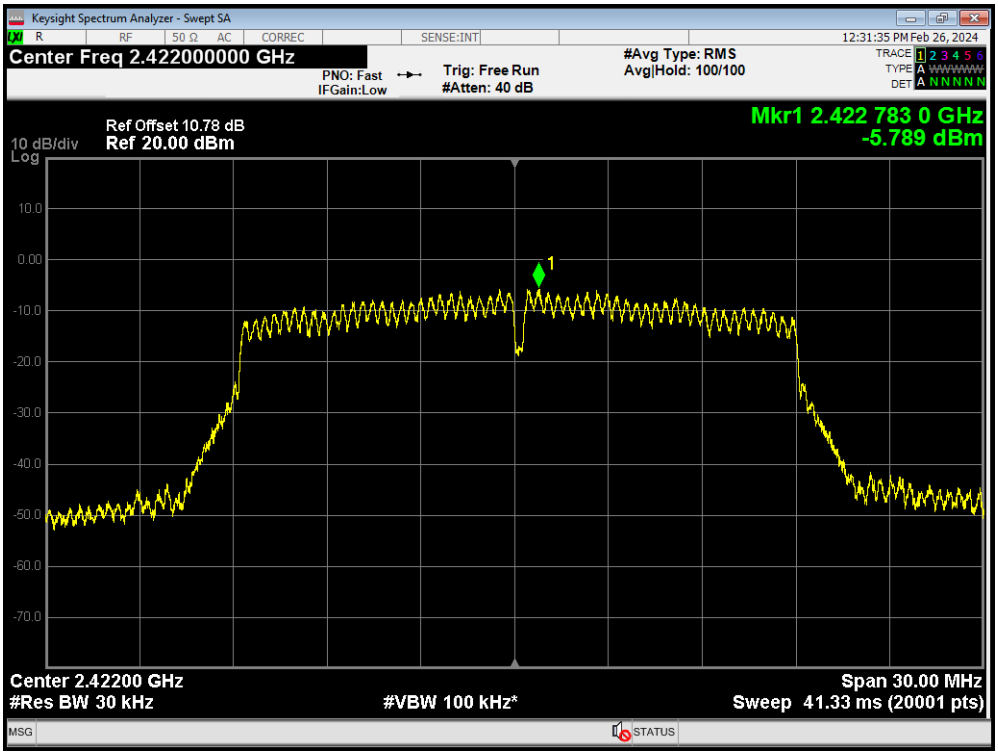

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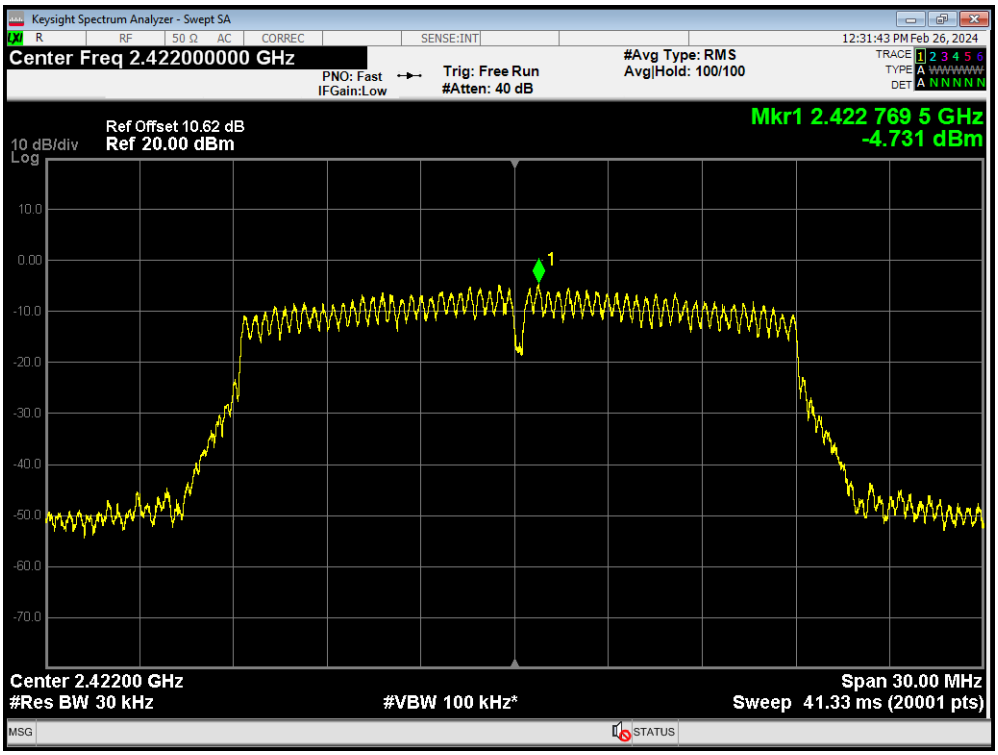

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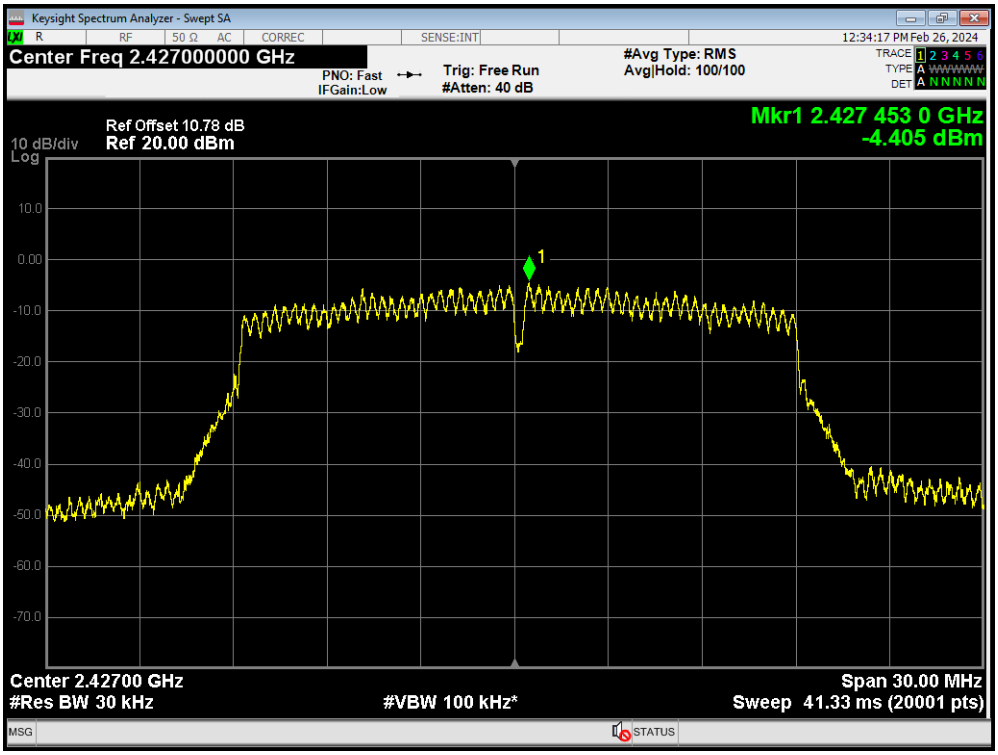
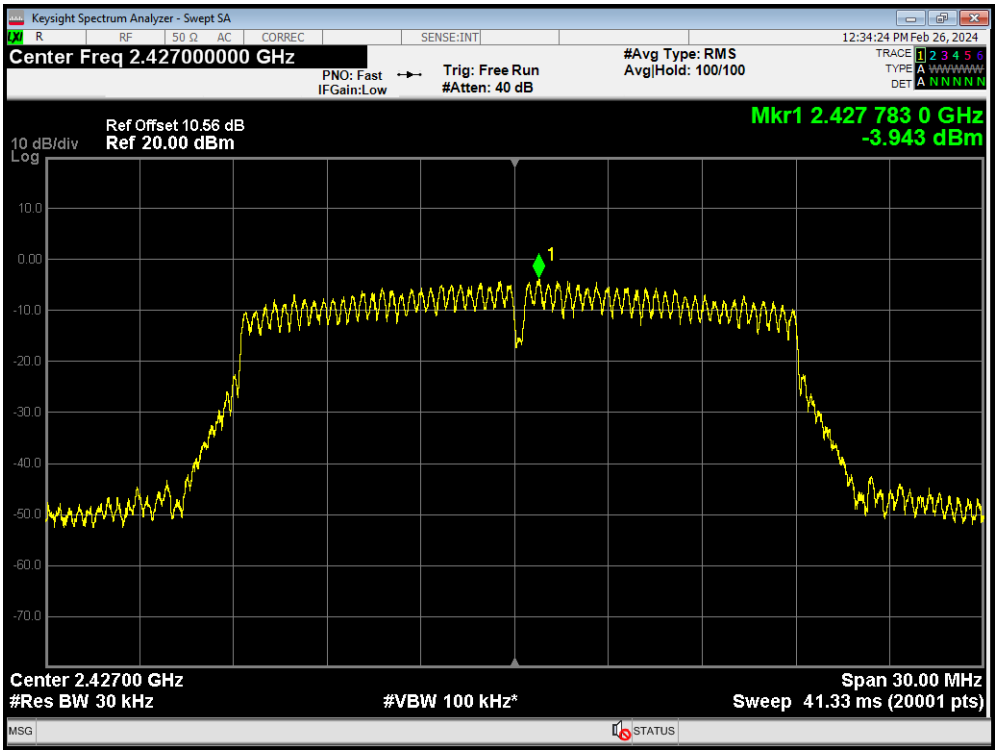


PSD 802.11n(HT20) 2427MHz Ant2



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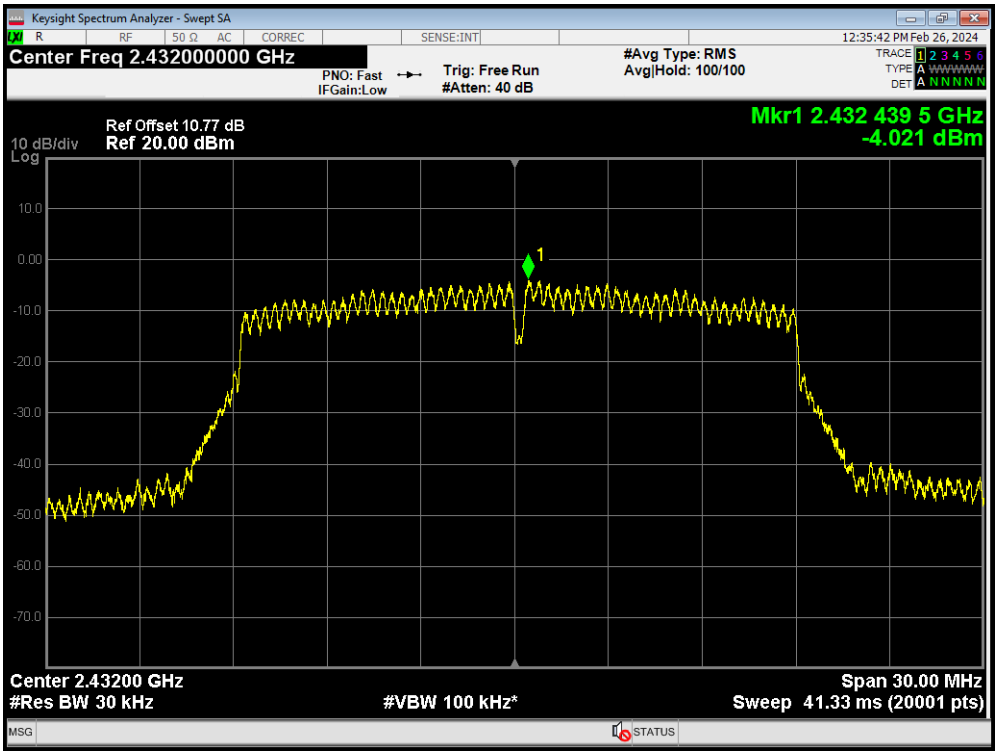

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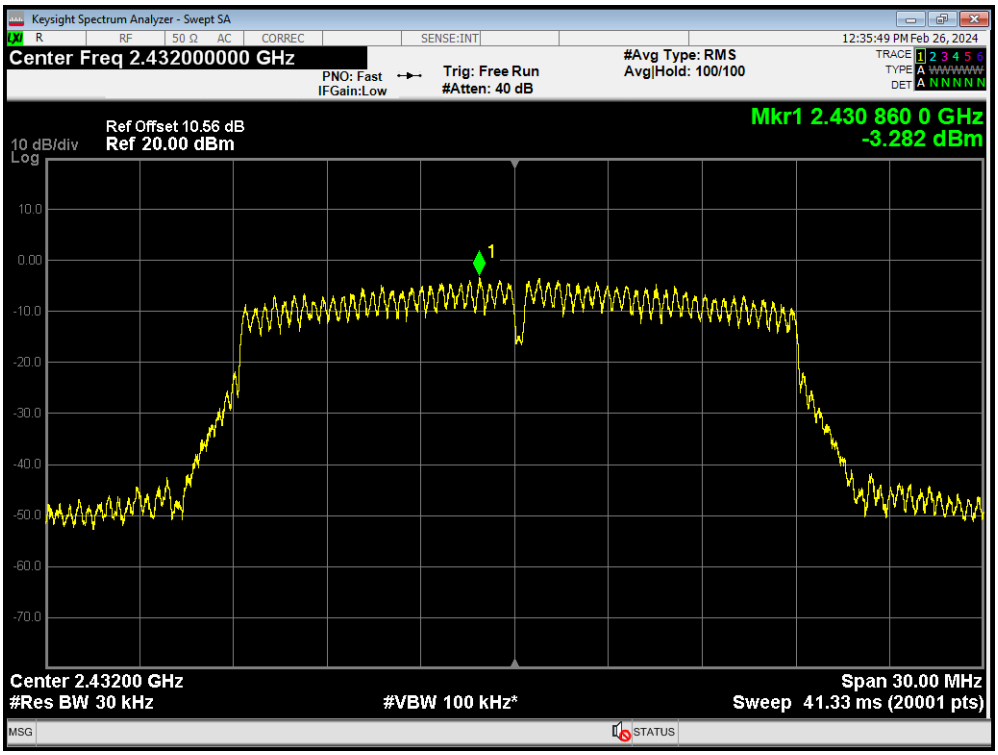
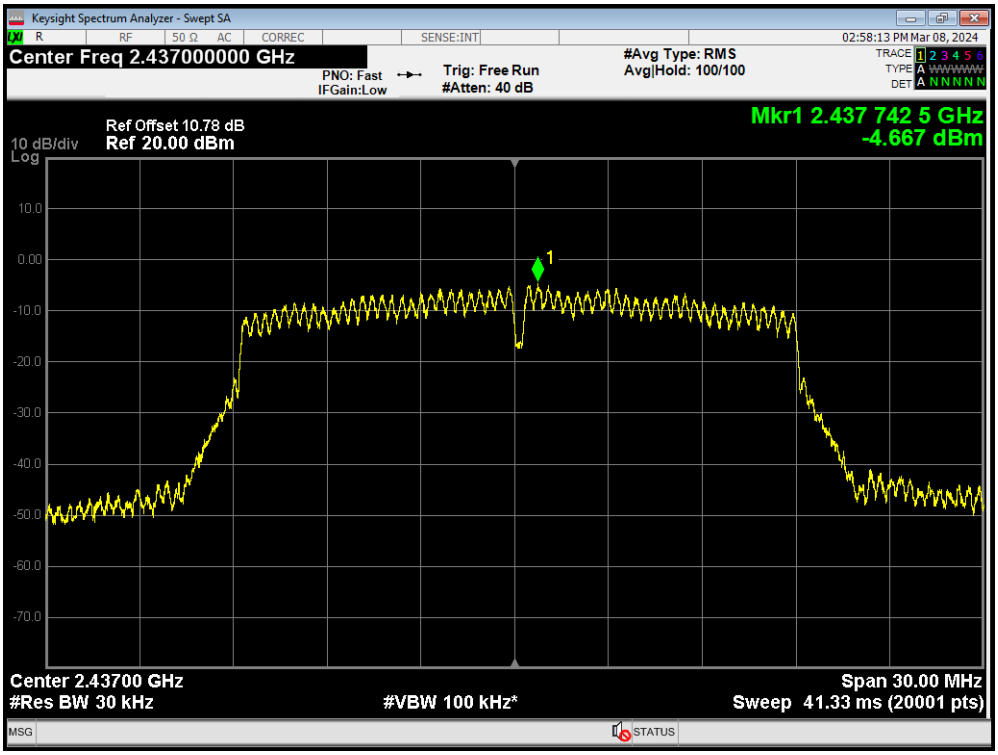
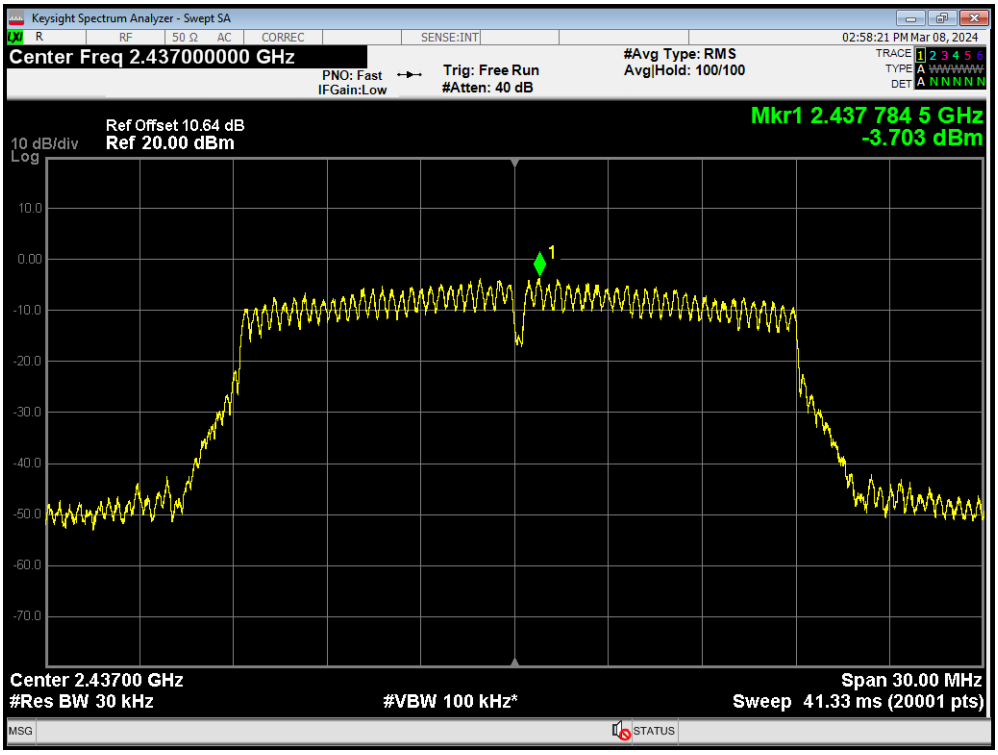


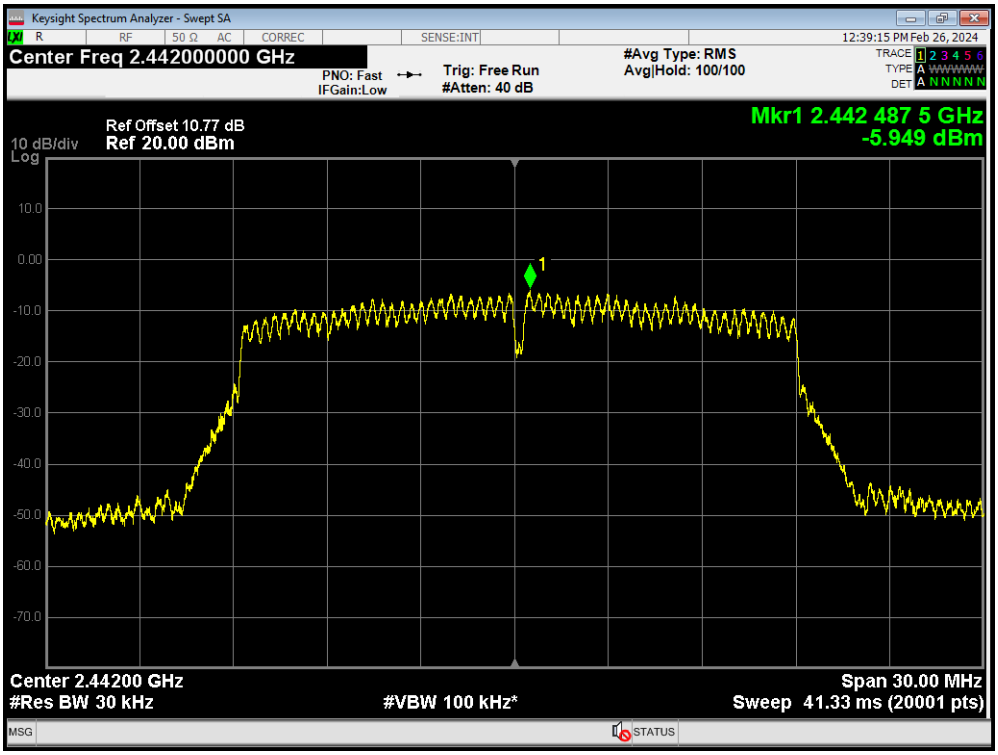
PSD 802.11n(HT20) 2437MHz Ant1



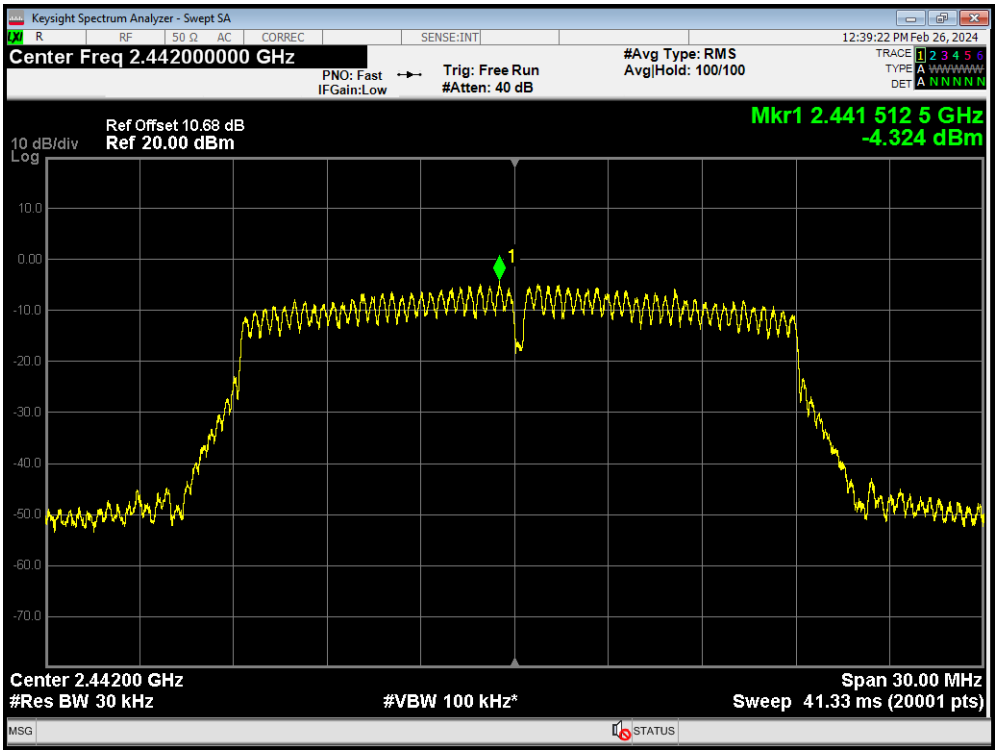
PSD 802.11n(HT20) 2437MHz Ant2



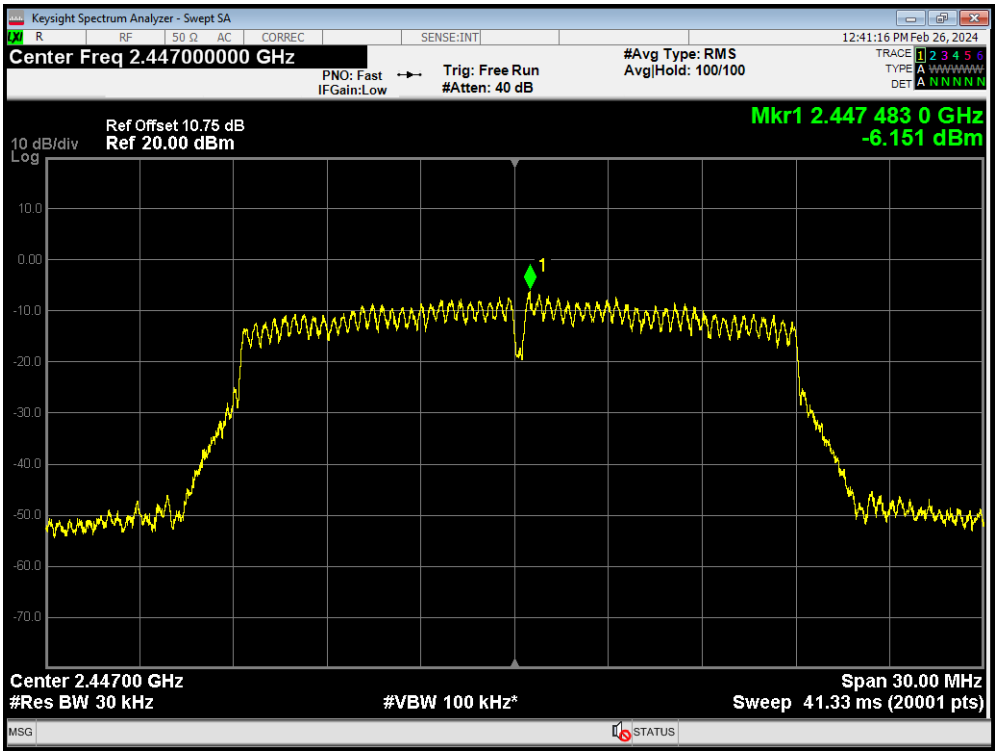
PSD 802.11n(HT20) 2442MHz Ant1



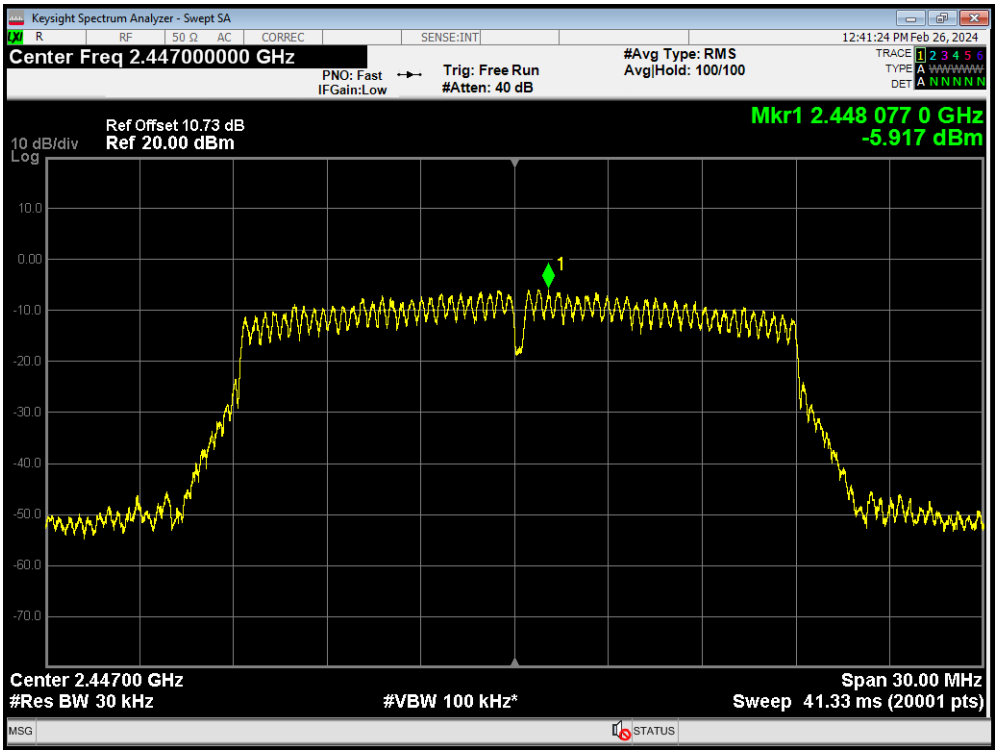
PSD 802.11n(HT20) 2442MHz Ant2



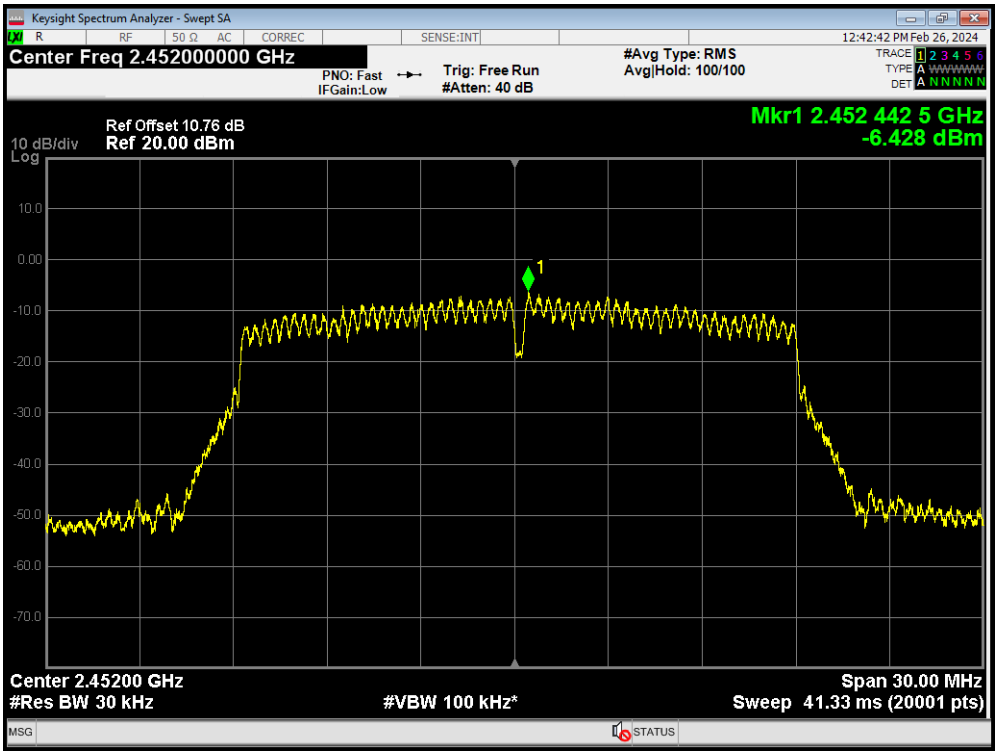
PSD 802.11n(HT20) 2447MHz Ant1



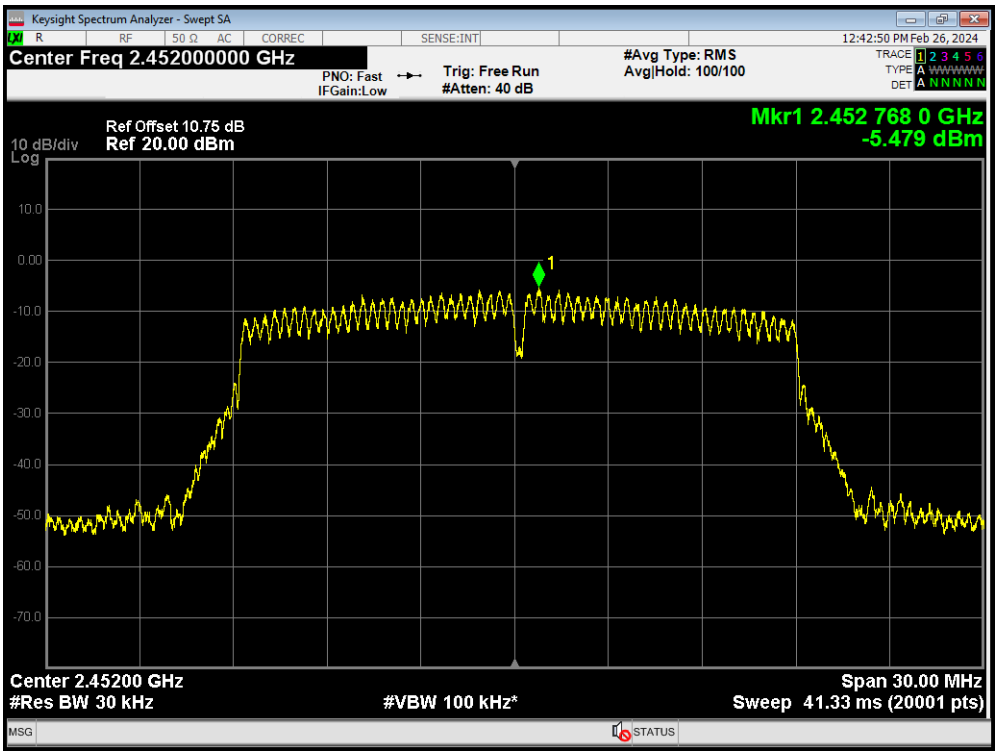
PSD 802.11n(HT20) 2447MHz Ant2



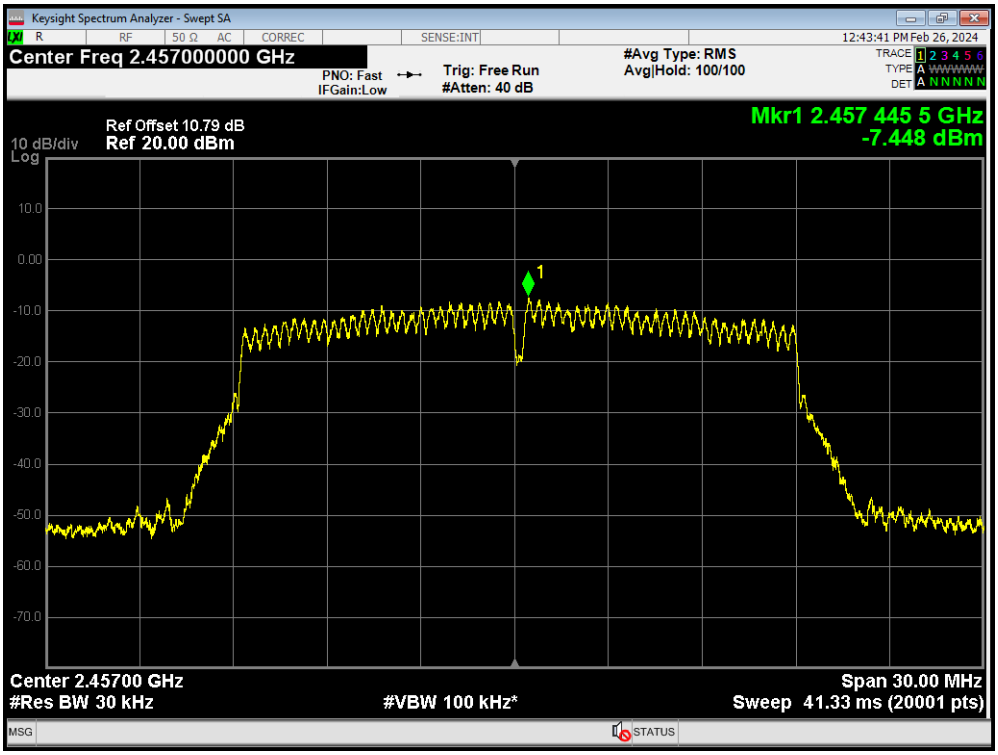
PSD 802.11n(HT20) 2452MHz Ant1



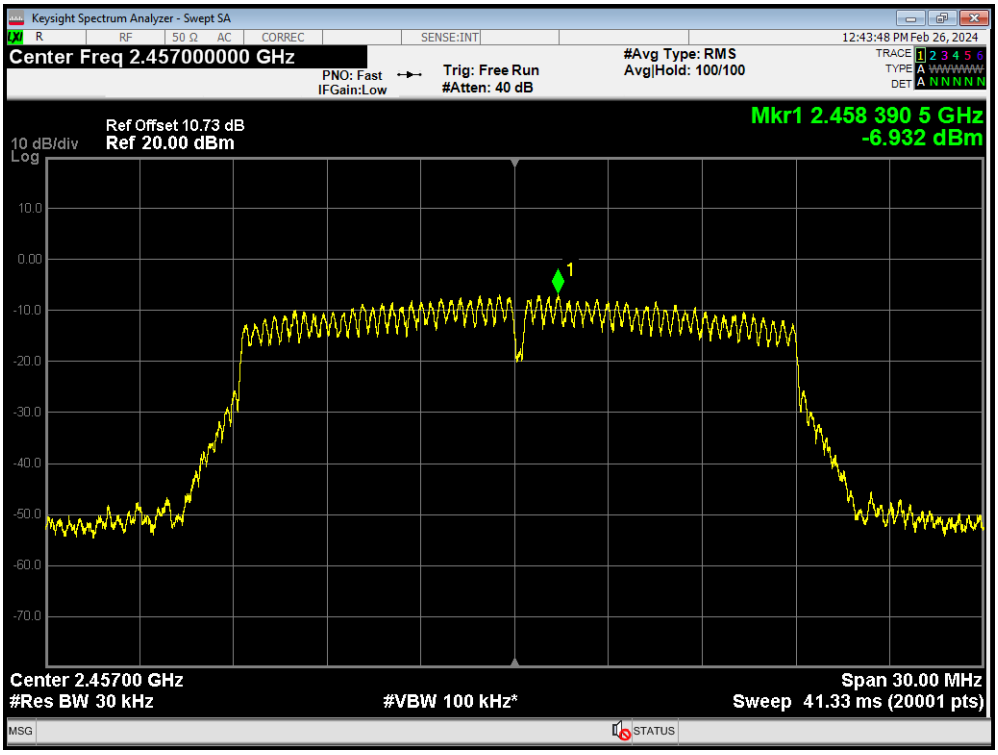
PSD 802.11n(HT20) 2452MHz Ant2



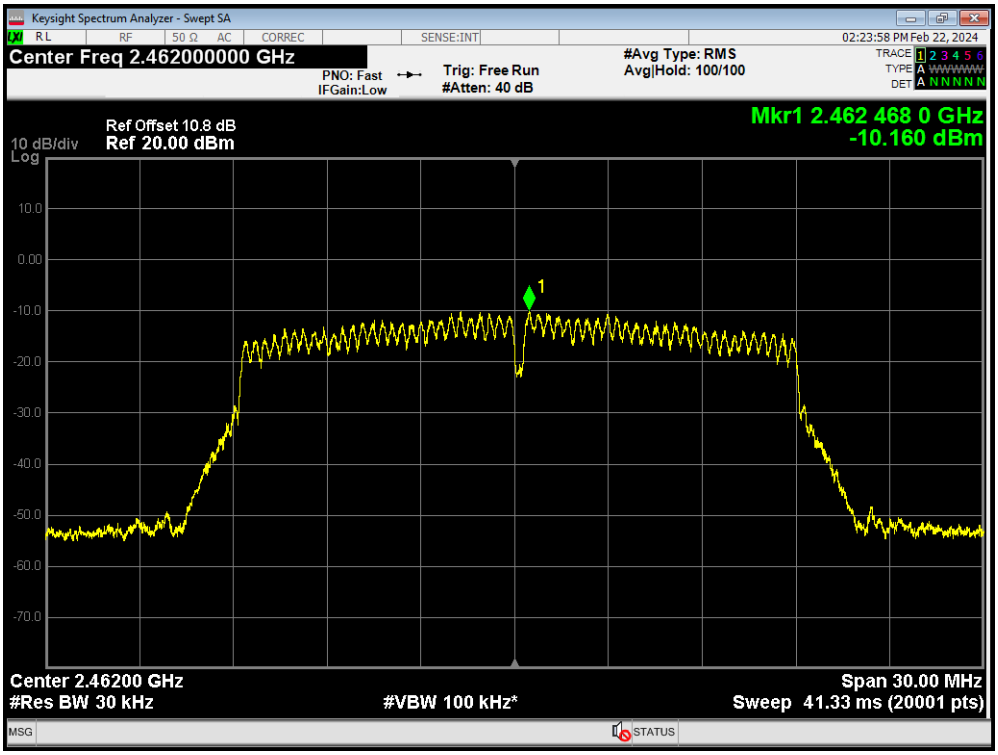
PSD 802.11n(HT20) 2457MHz Ant1



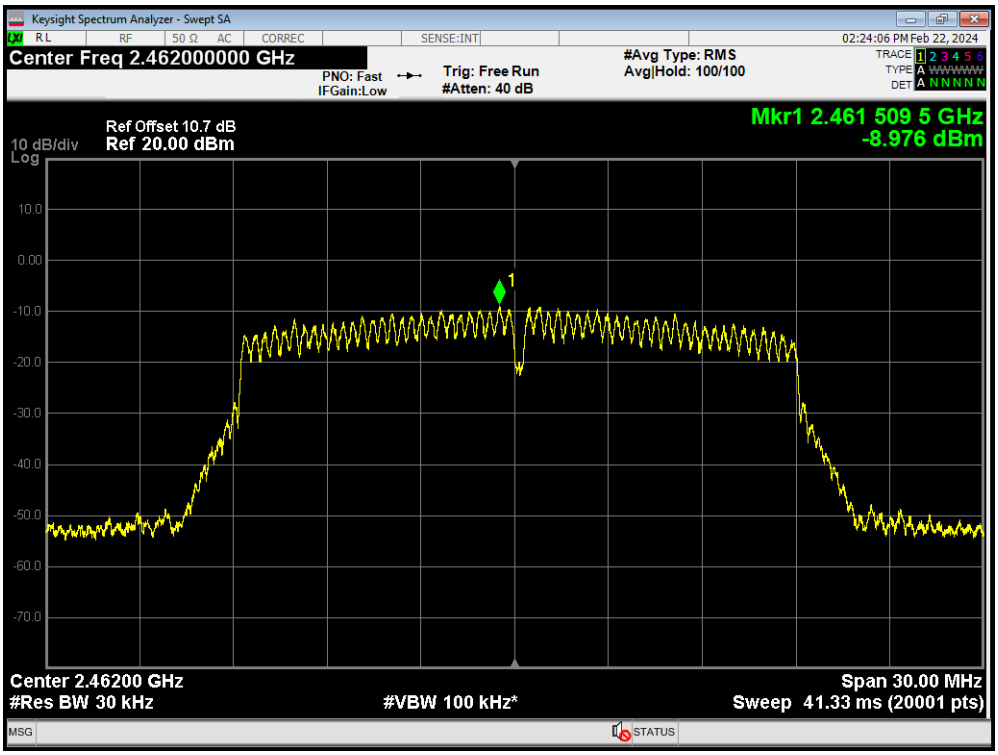
PSD 802.11n(HT20) 2457MHz Ant2



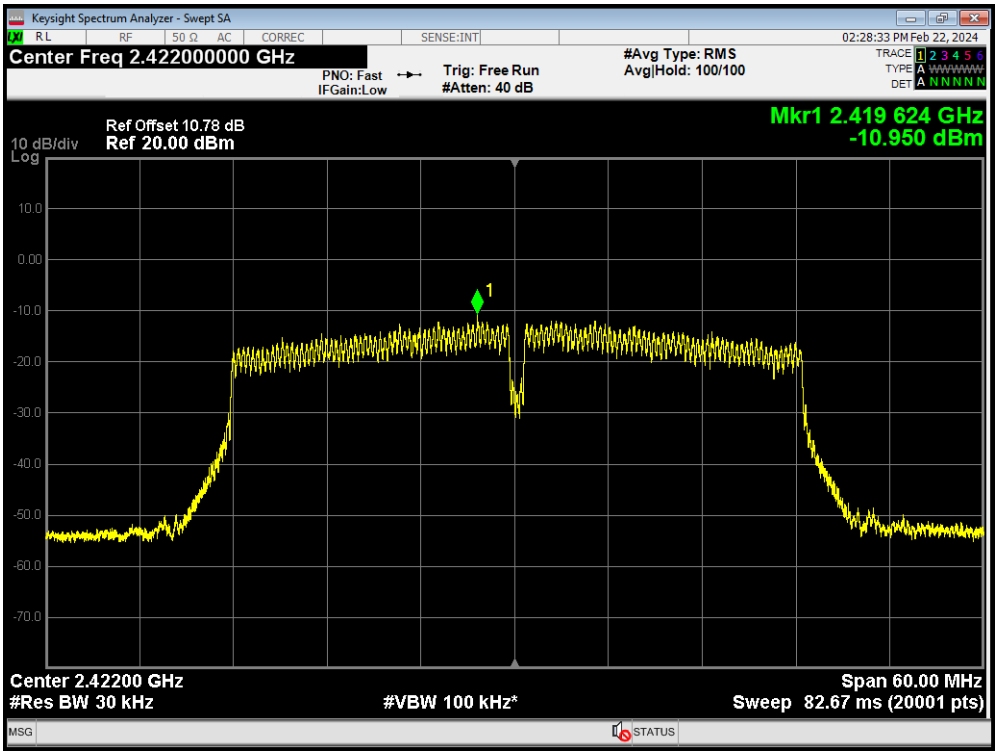
PSD 802.11n(HT20) 2462MHz Ant1



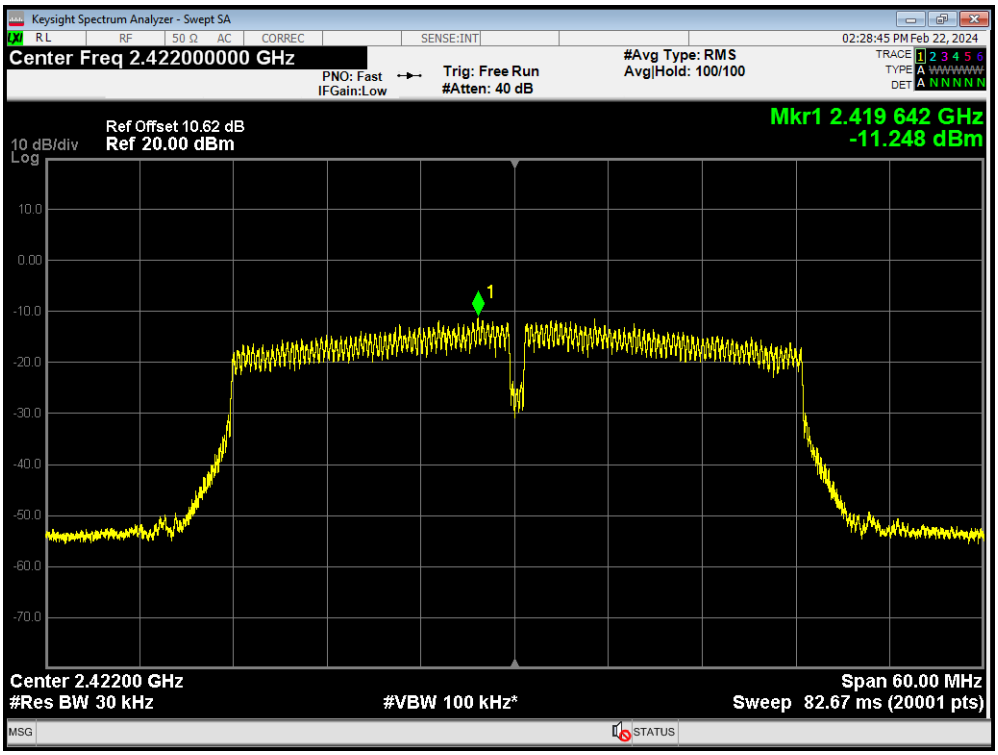
PSD 802.11n(HT20) 2462MHz Ant2



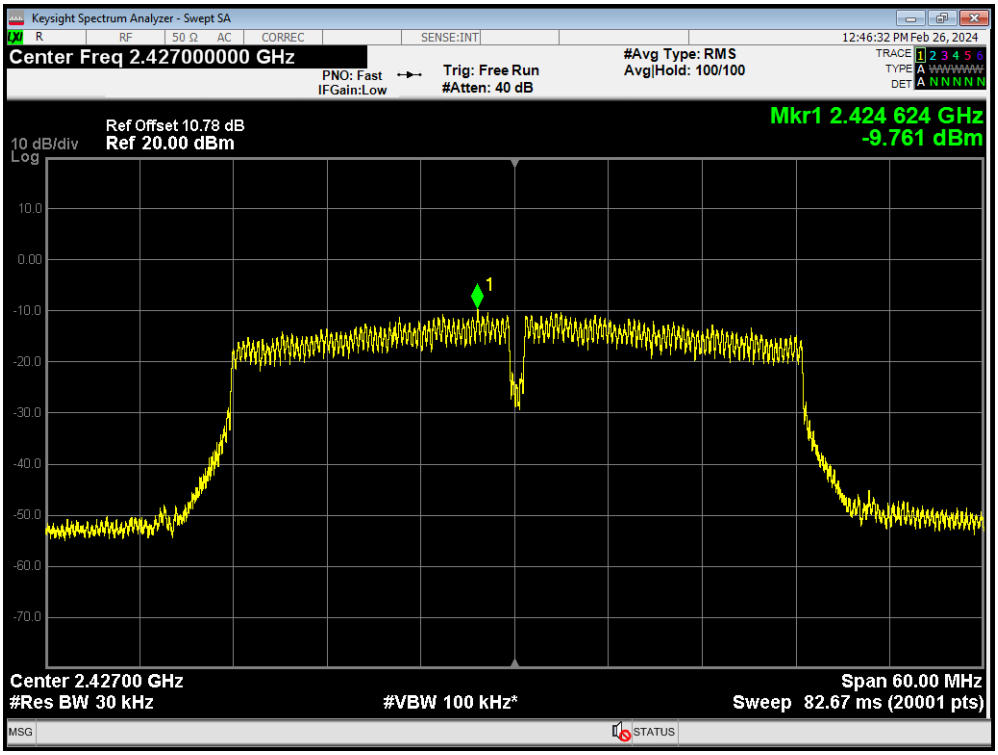
PSD 802.11n(HT40) 2422MHz Ant1



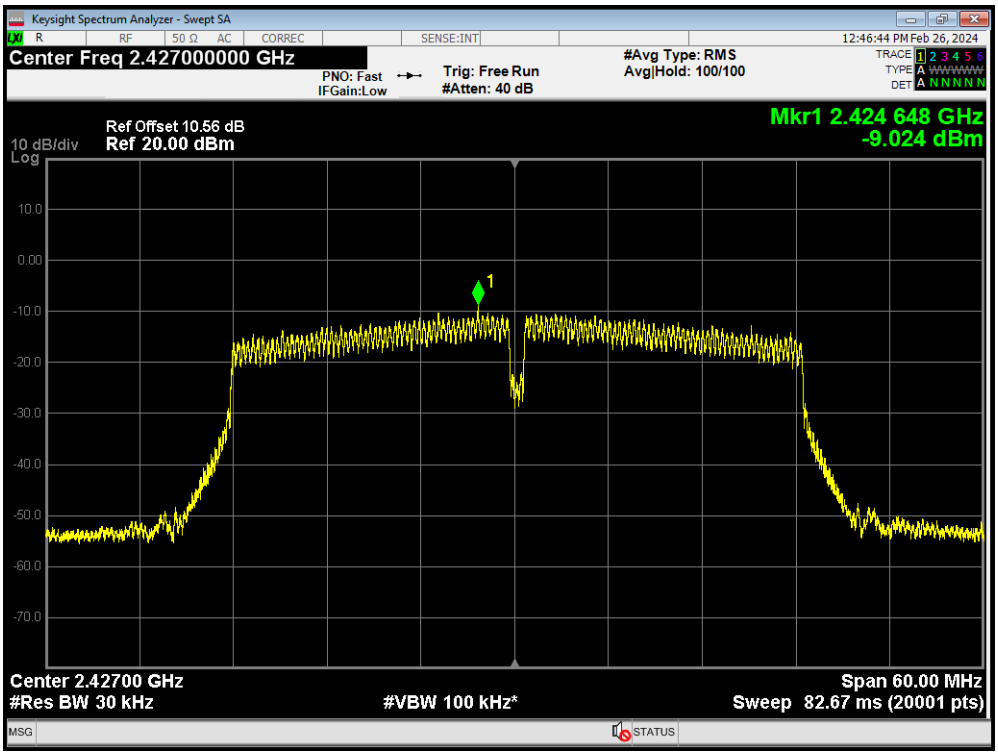
PSD 802.11n(HT40) 2422MHz Ant2



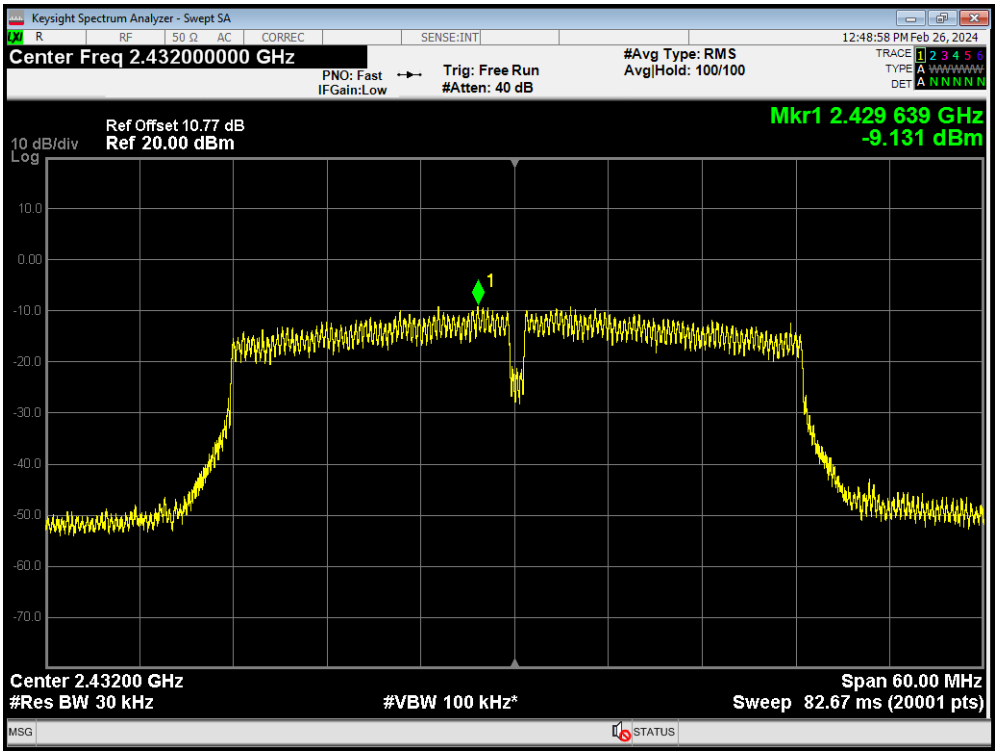
PSD 802.11n(HT40) 2427MHz Ant1



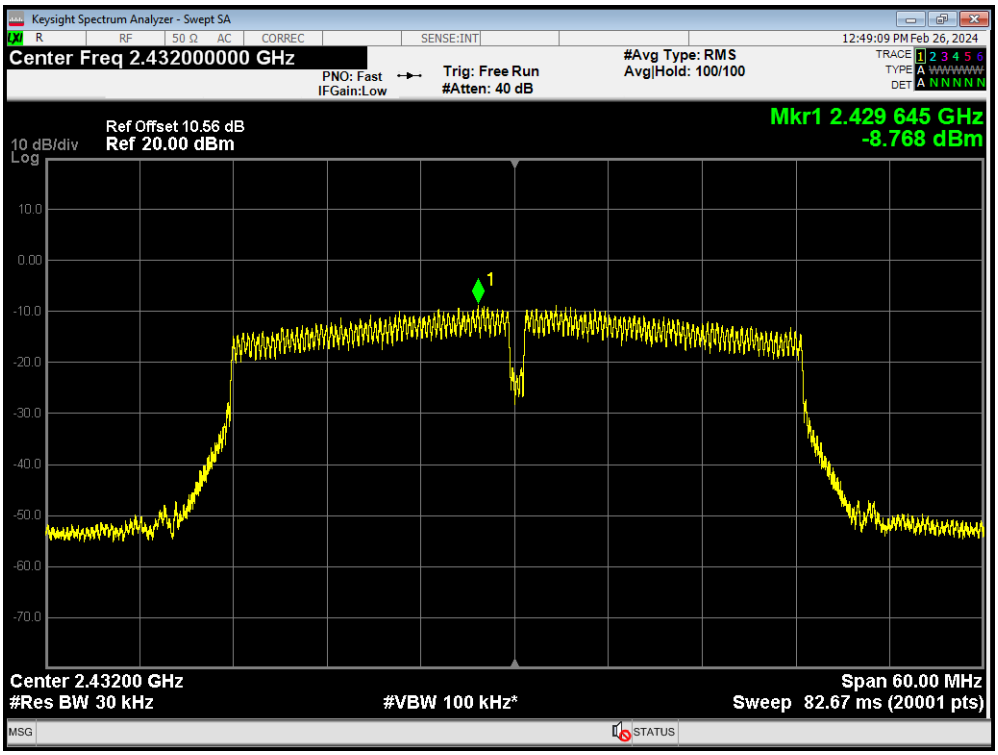
PSD 802.11n(HT40) 2427MHz Ant2



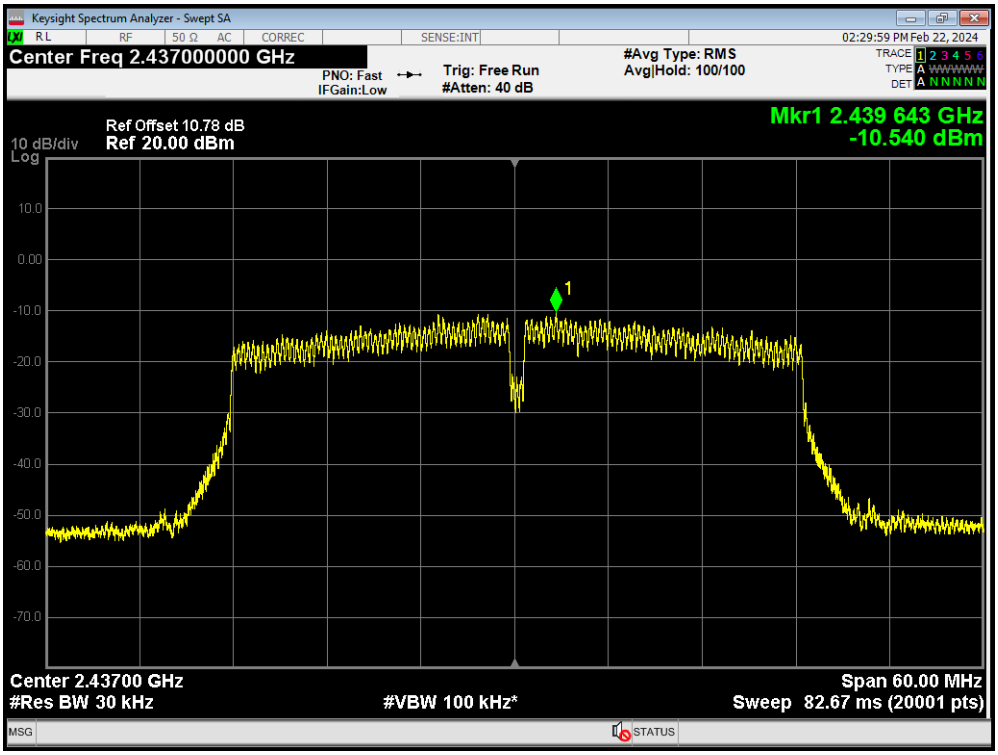
PSD 802.11n(HT40) 2432MHz Ant1



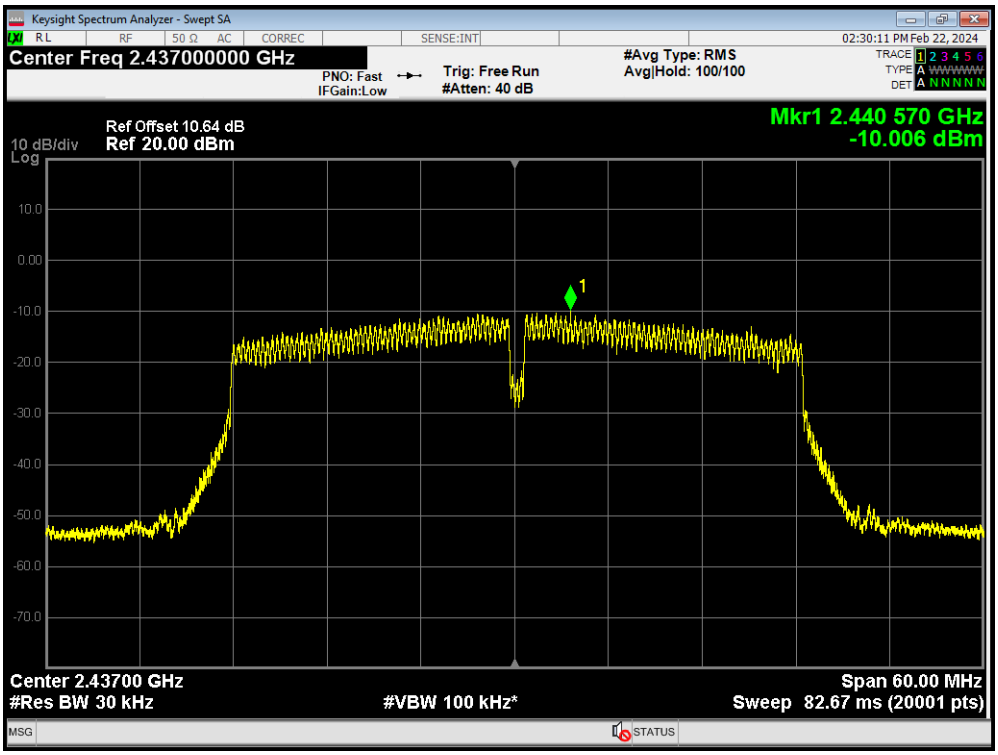
PSD 802.11n(HT40) 2432MHz Ant2



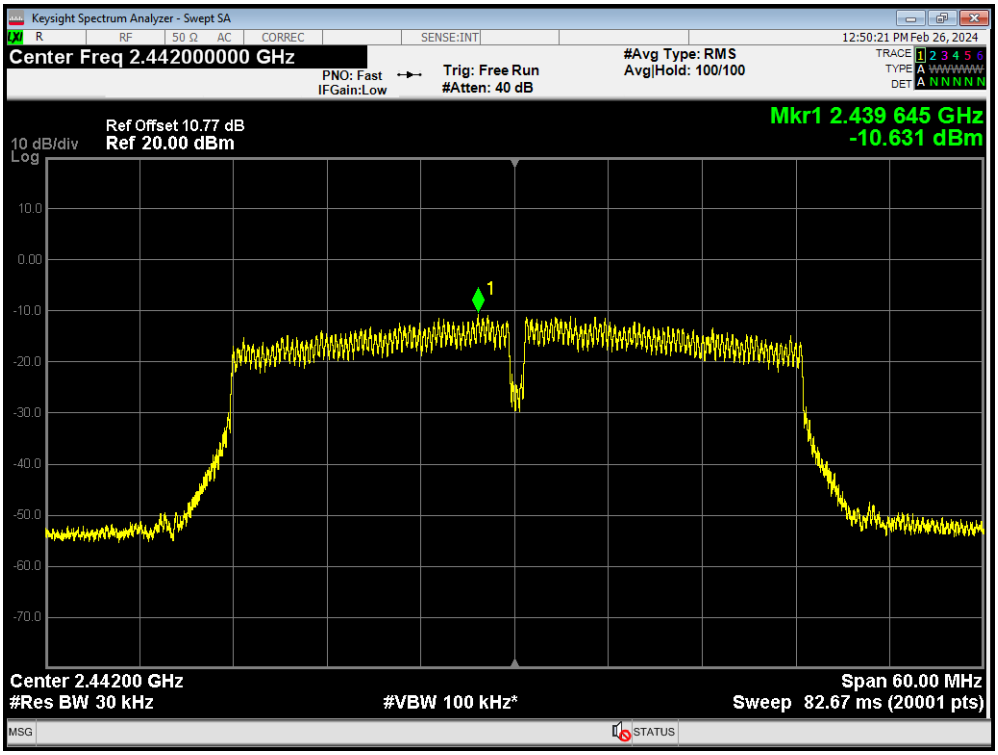
PSD 802.11n(HT40) 2437MHz Ant1



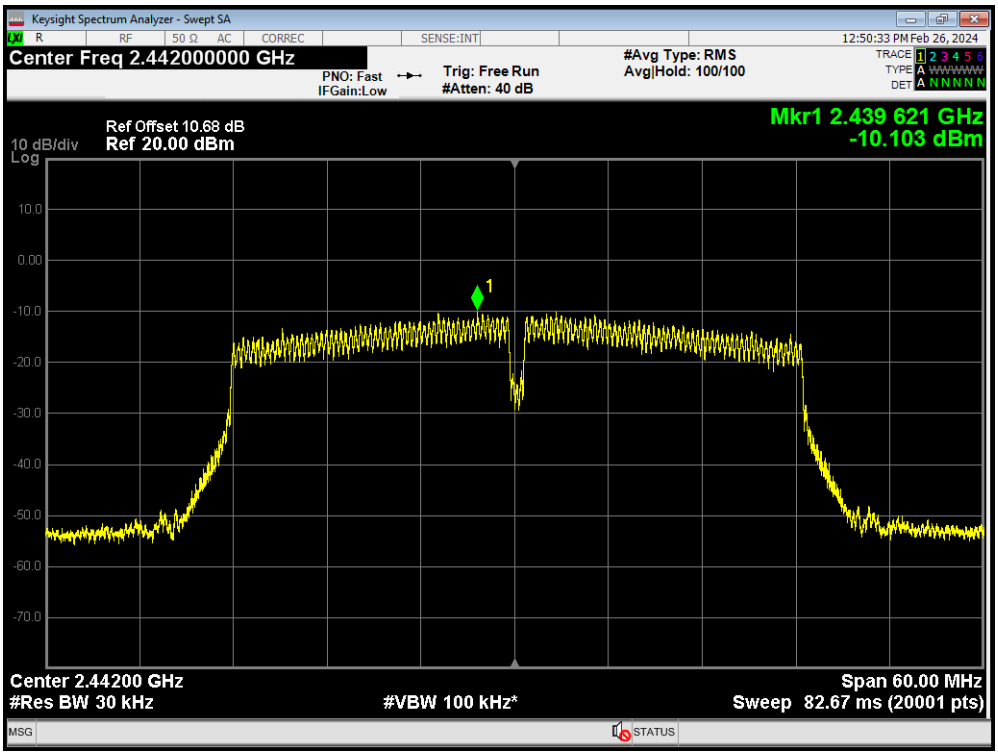
PSD 802.11n(HT40) 2437MHz Ant2



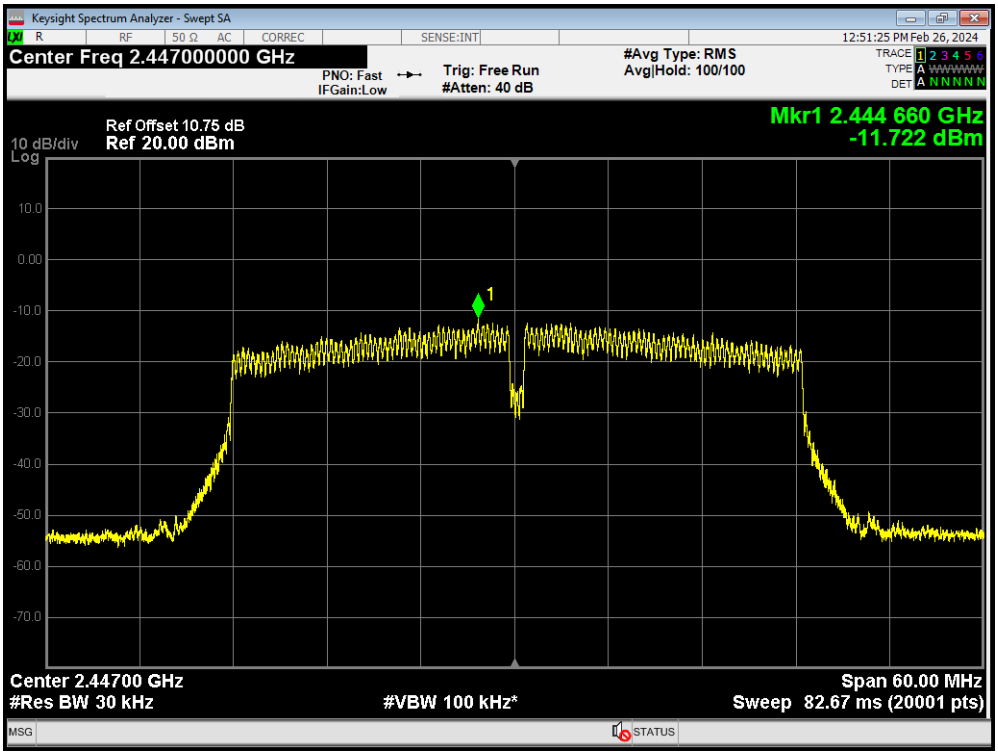
PSD 802.11n(HT40) 2442MHz Ant1



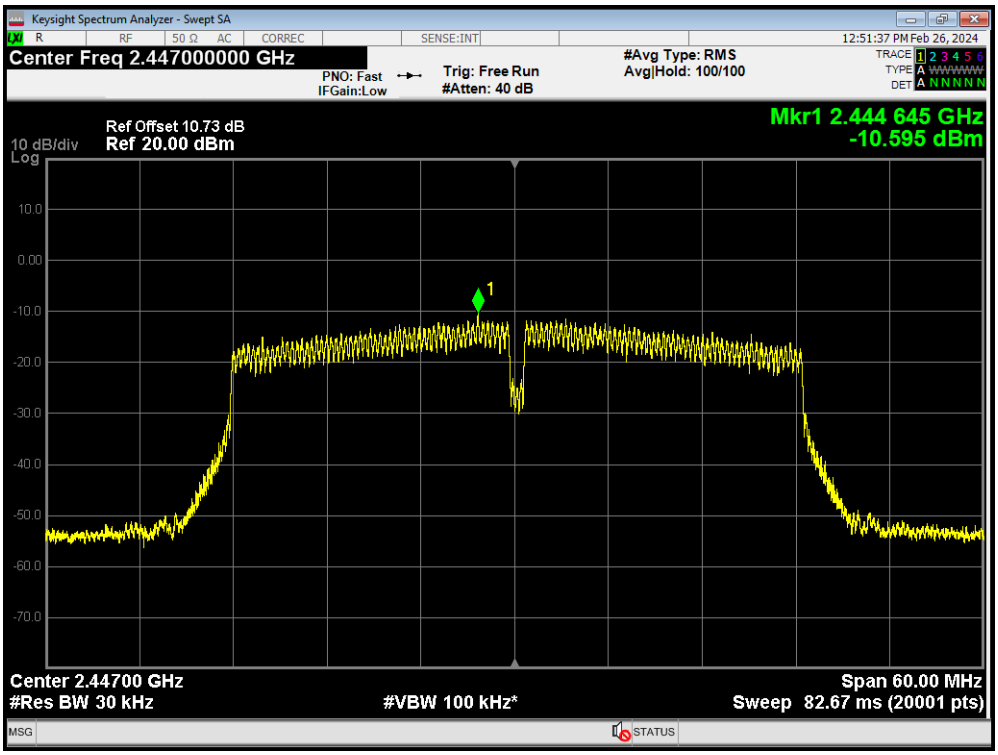
PSD 802.11n(HT40) 2442MHz Ant2



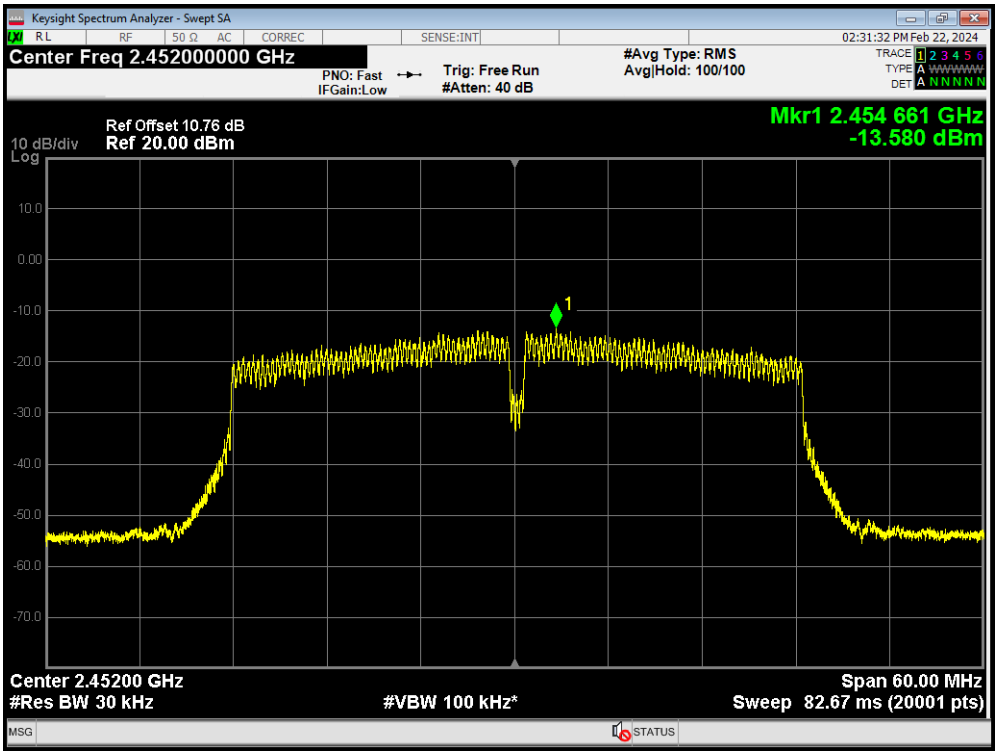
PSD 802.11n(HT40) 2447MHz Ant1



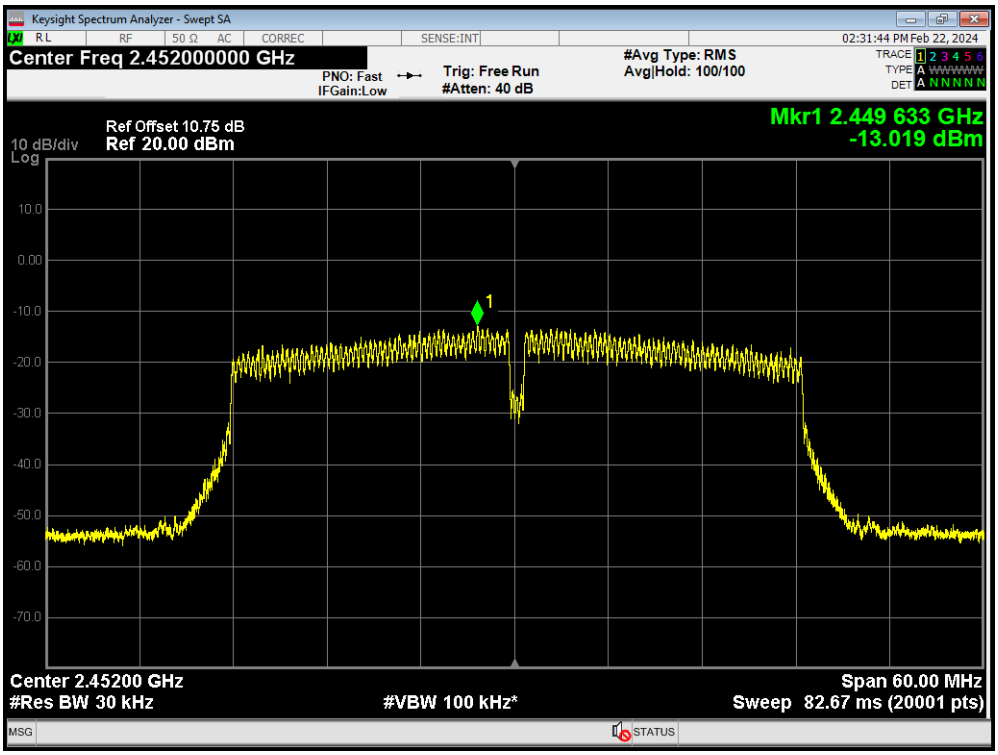
PSD 802.11n(HT40) 2447MHz Ant2



PSD 802.11n(HT40) 2452MHz Ant1

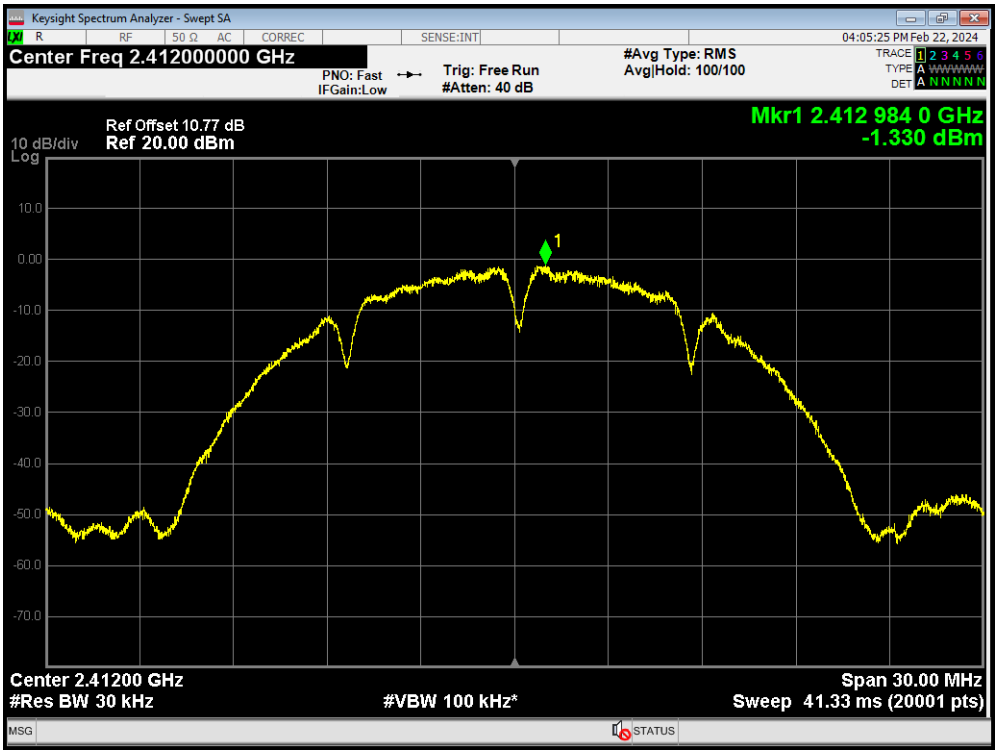


PSD 802.11n(HT40) 2452MHz Ant2

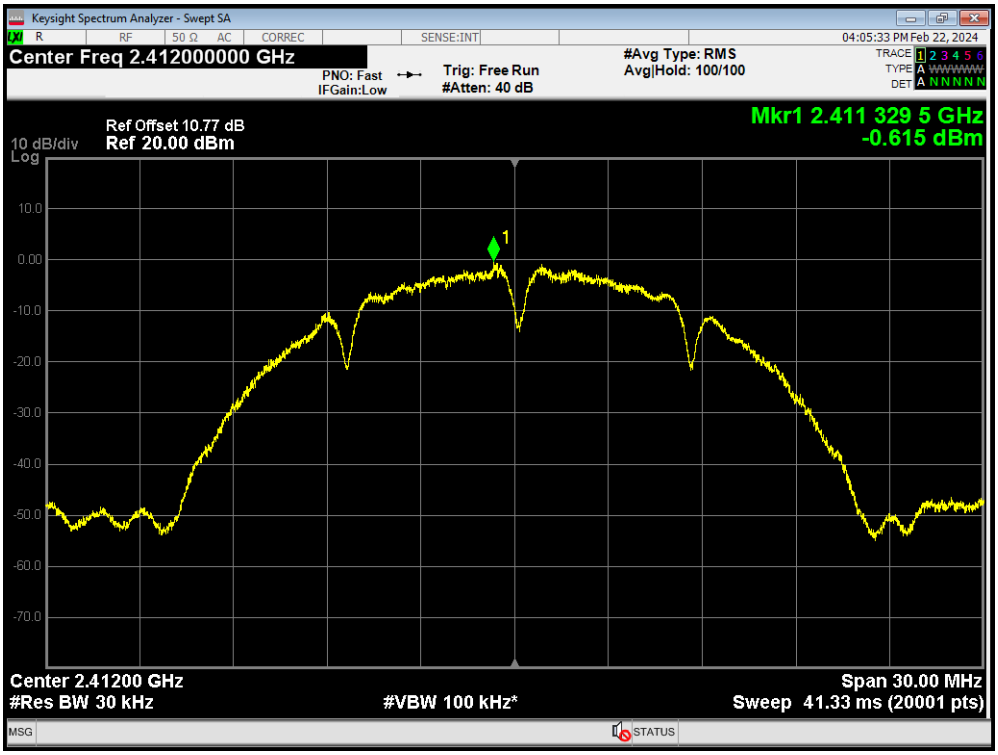


Beamforming

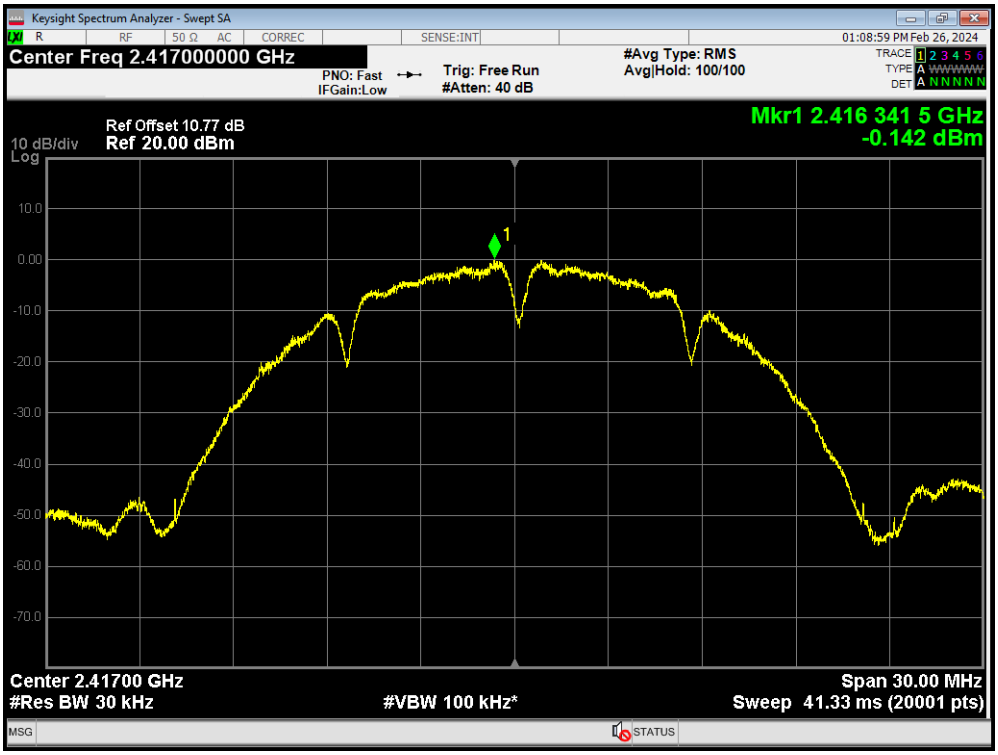
PSD 802.11b 2412MHz Ant1



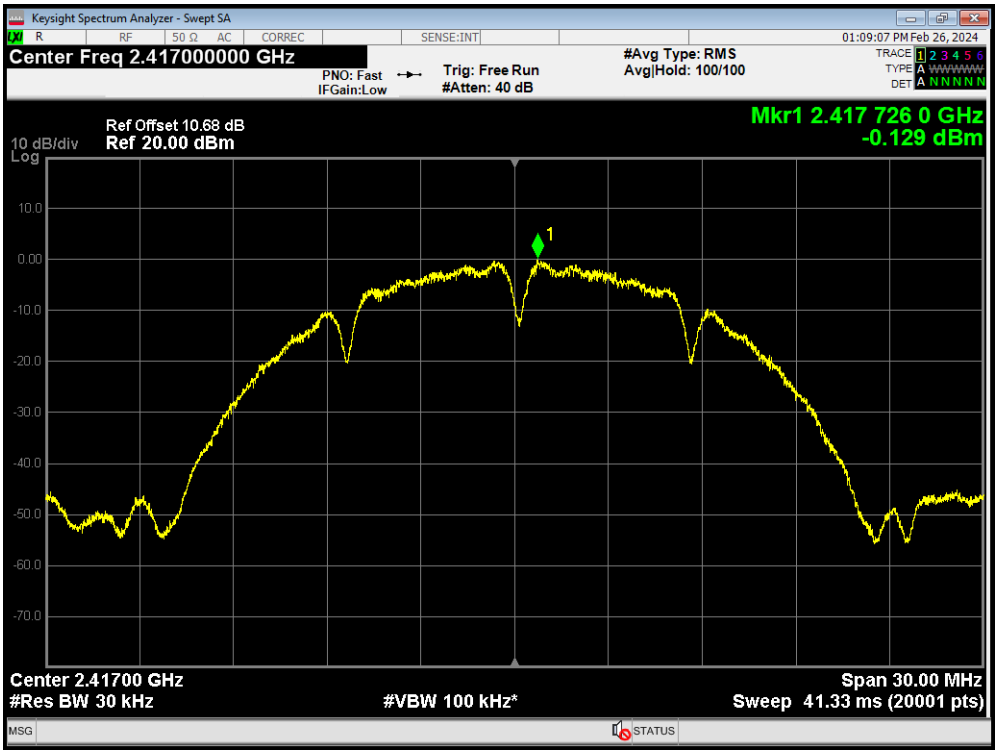
PSD 802.11b 2412MHz Ant2



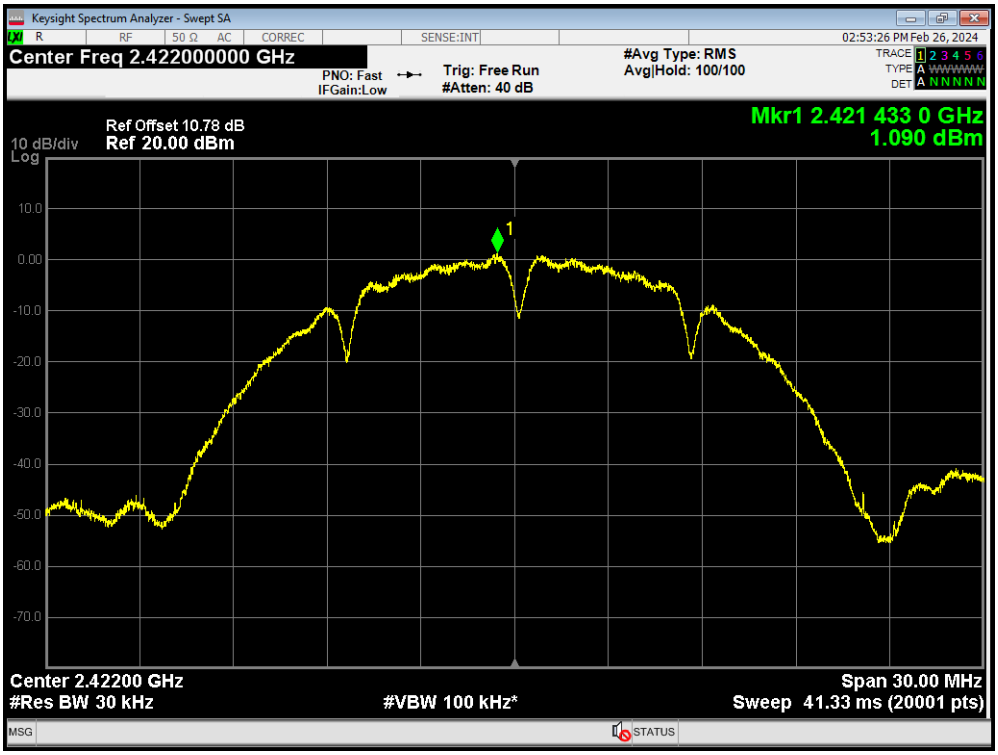
PSD 802.11b 2417MHz Ant1



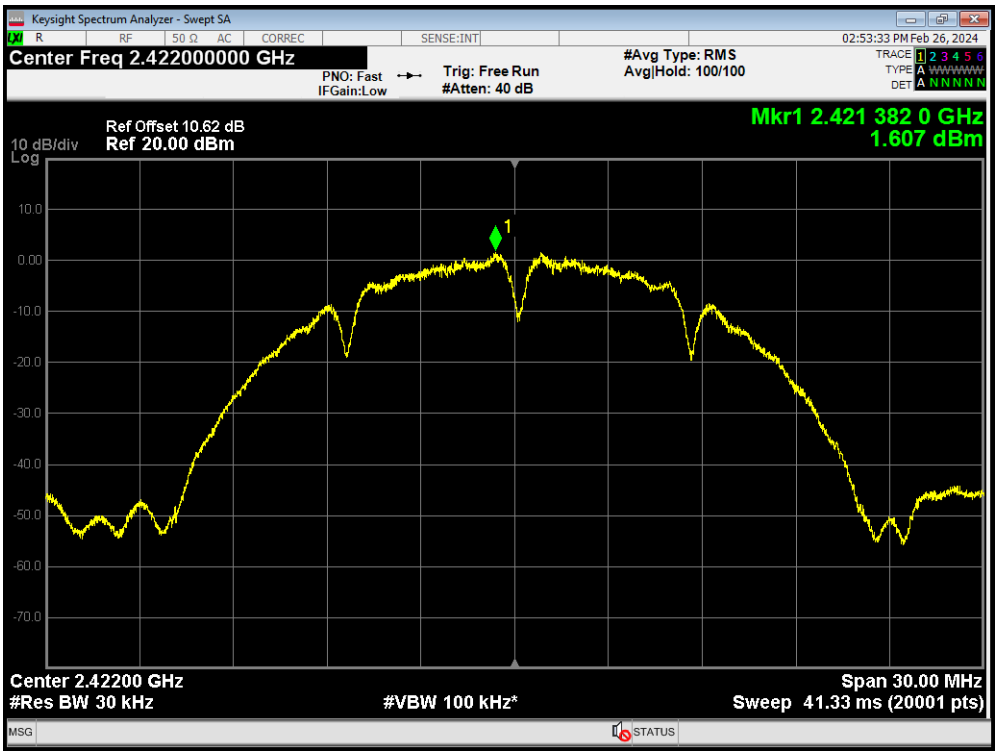
PSD 802.11b 2417MHz Ant2



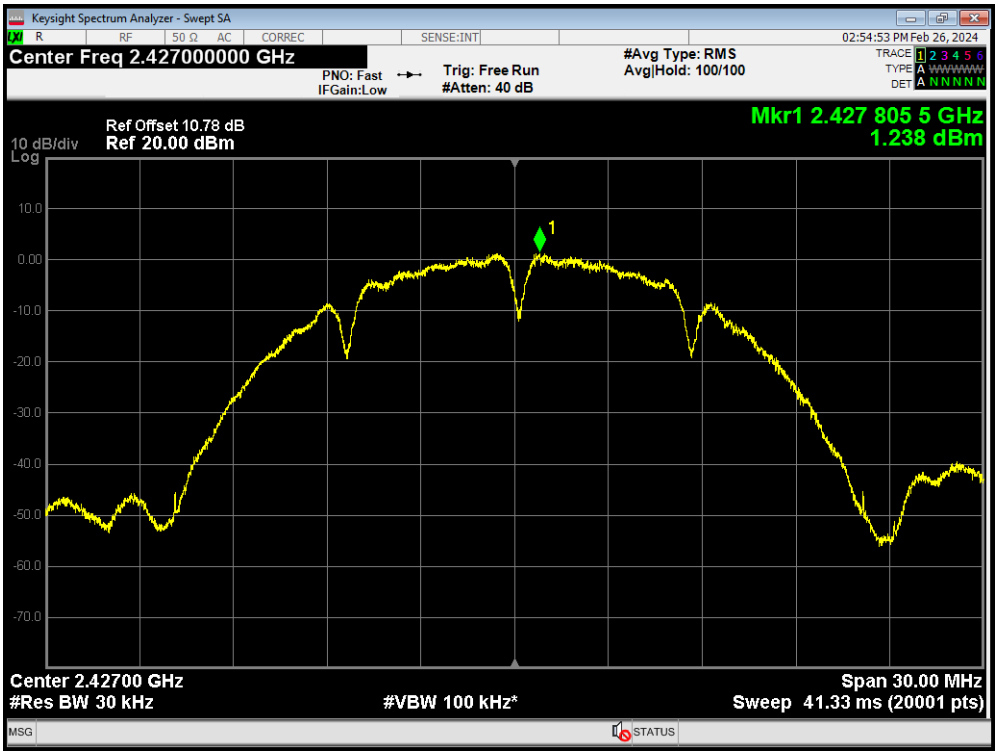
PSD 802.11b 2422MHz Ant1



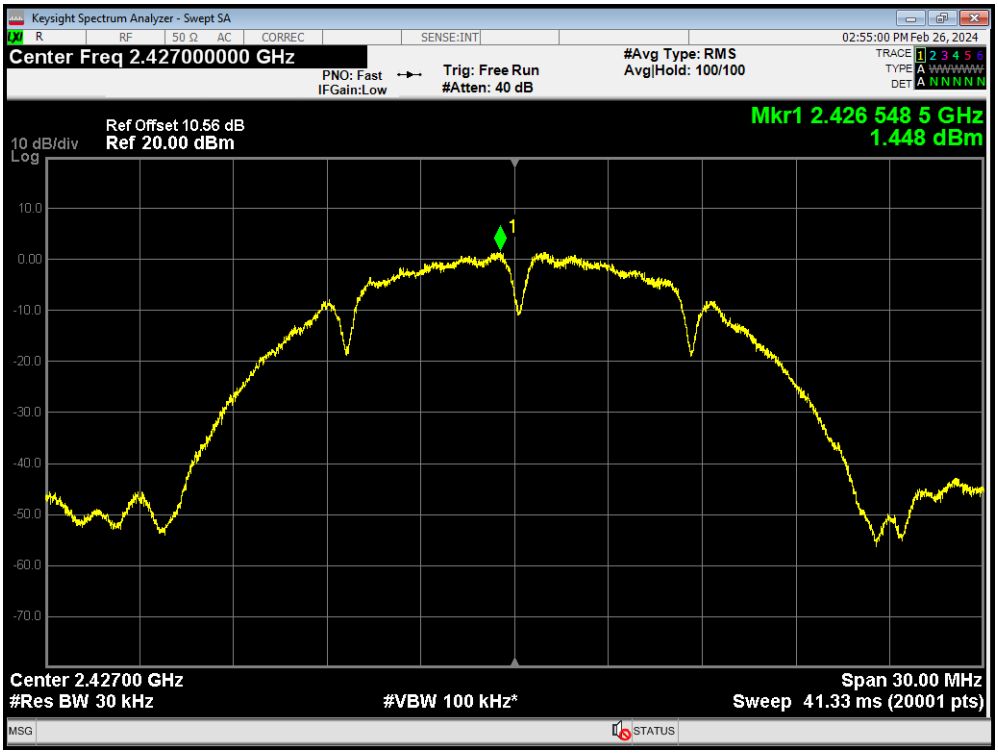
PSD 802.11b 2422MHz Ant2



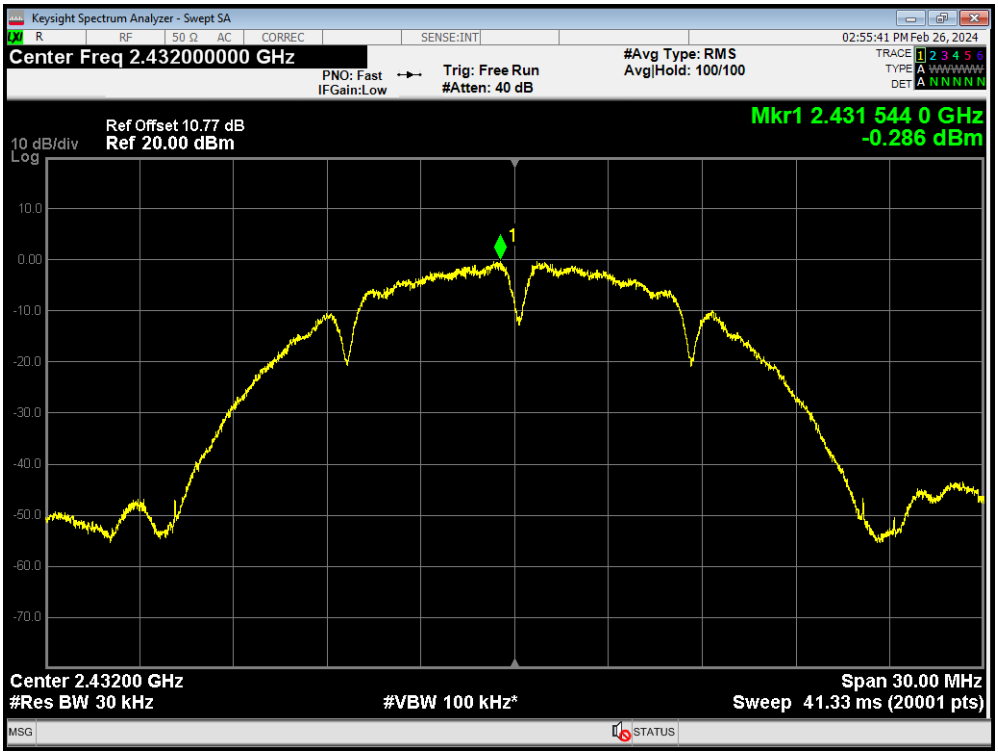
PSD 802.11b 2427MHz Ant1



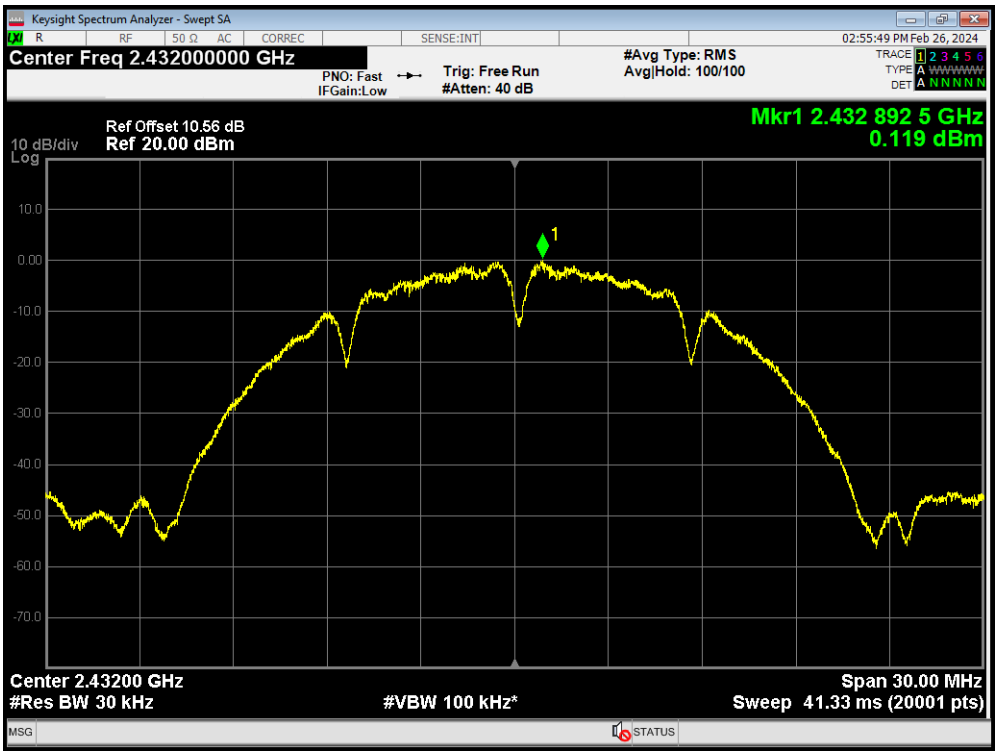
PSD 802.11b 2427MHz Ant2



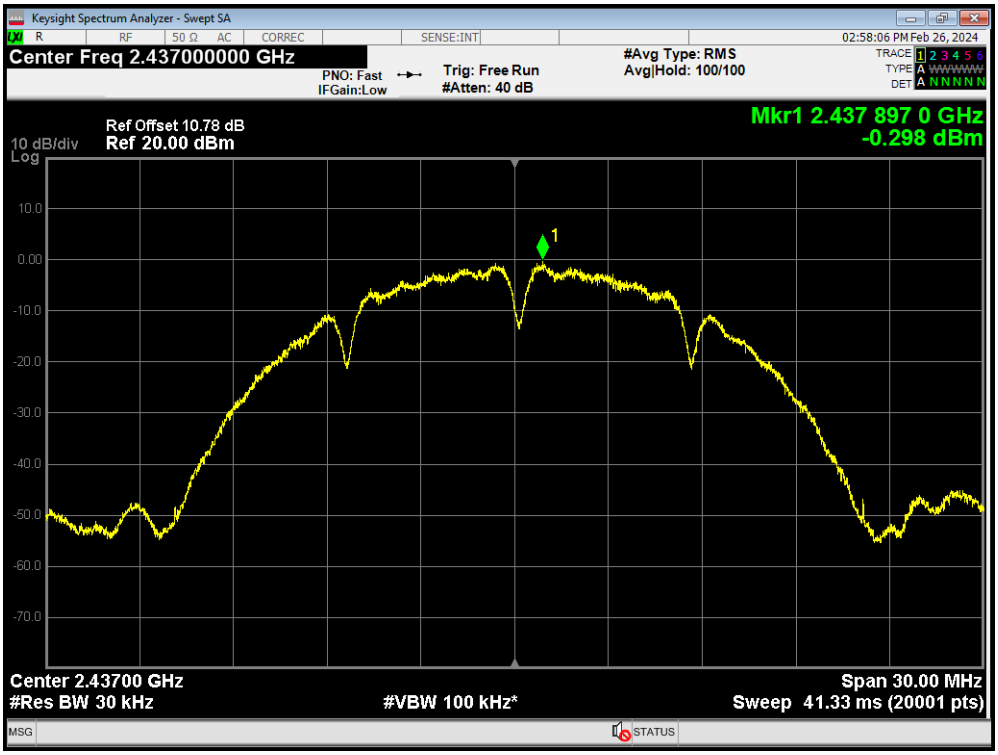
PSD 802.11b 2432MHz Ant1



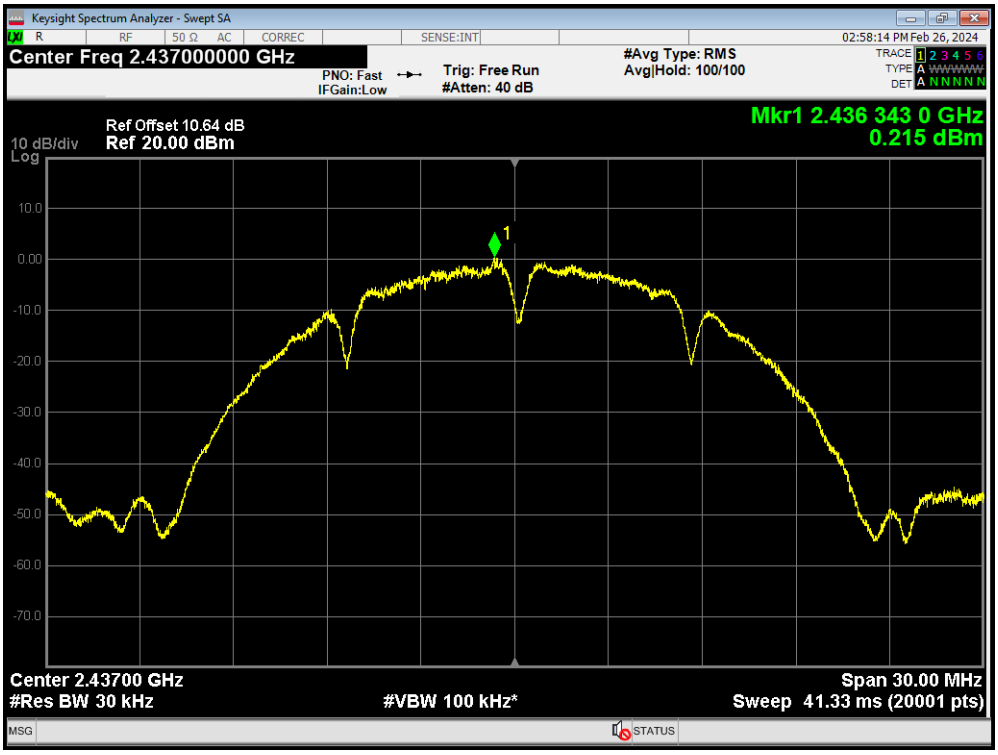
PSD 802.11b 2432MHz Ant2



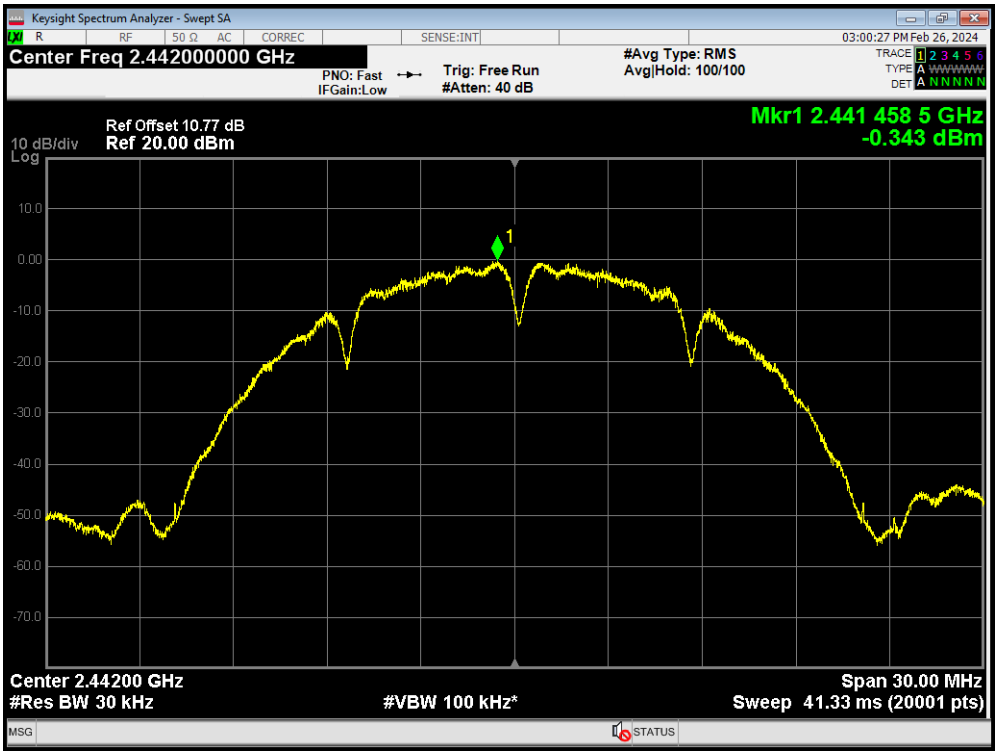
PSD 802.11b 2437MHz Ant1



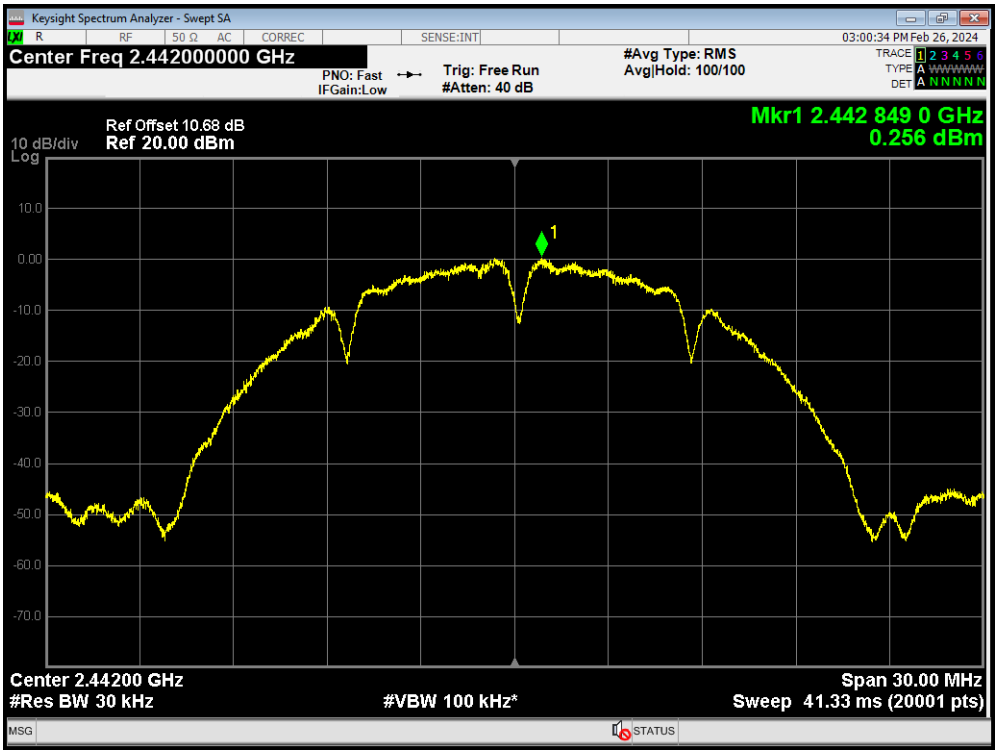
PSD 802.11b 2437MHz Ant2



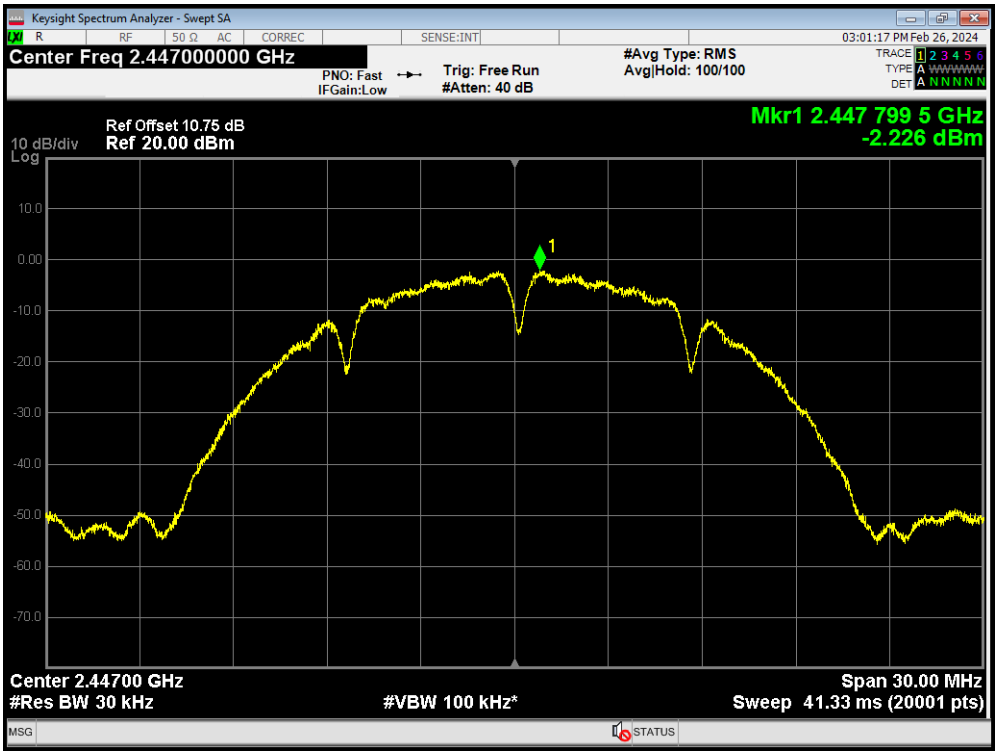
PSD 802.11b 2442MHz Ant1



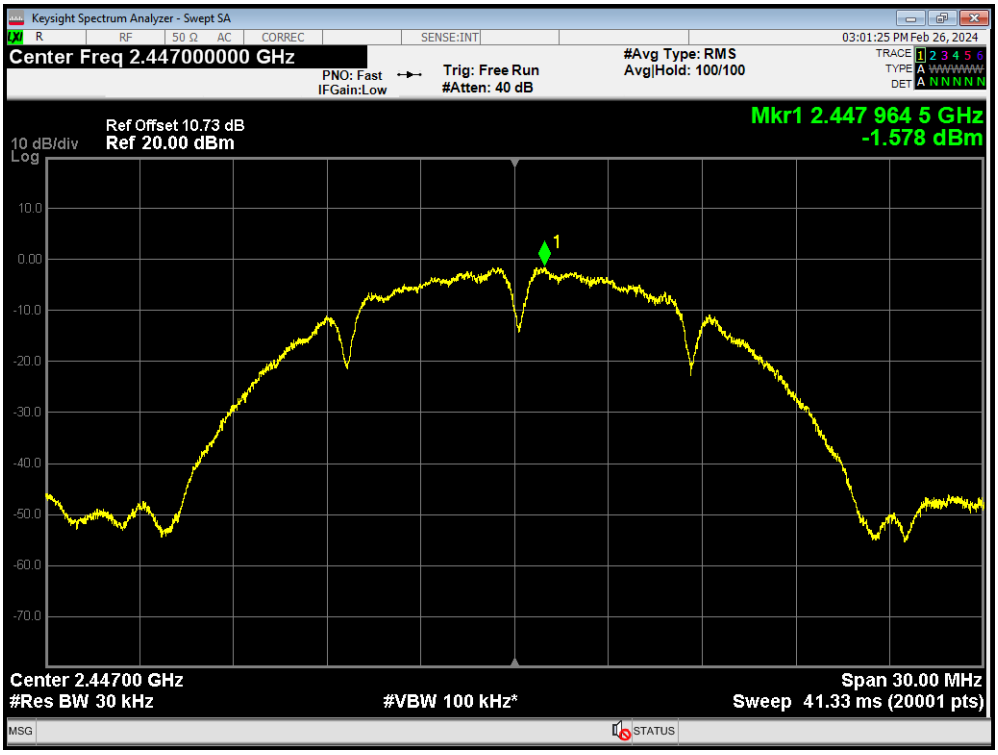
PSD 802.11b 2442MHz Ant2



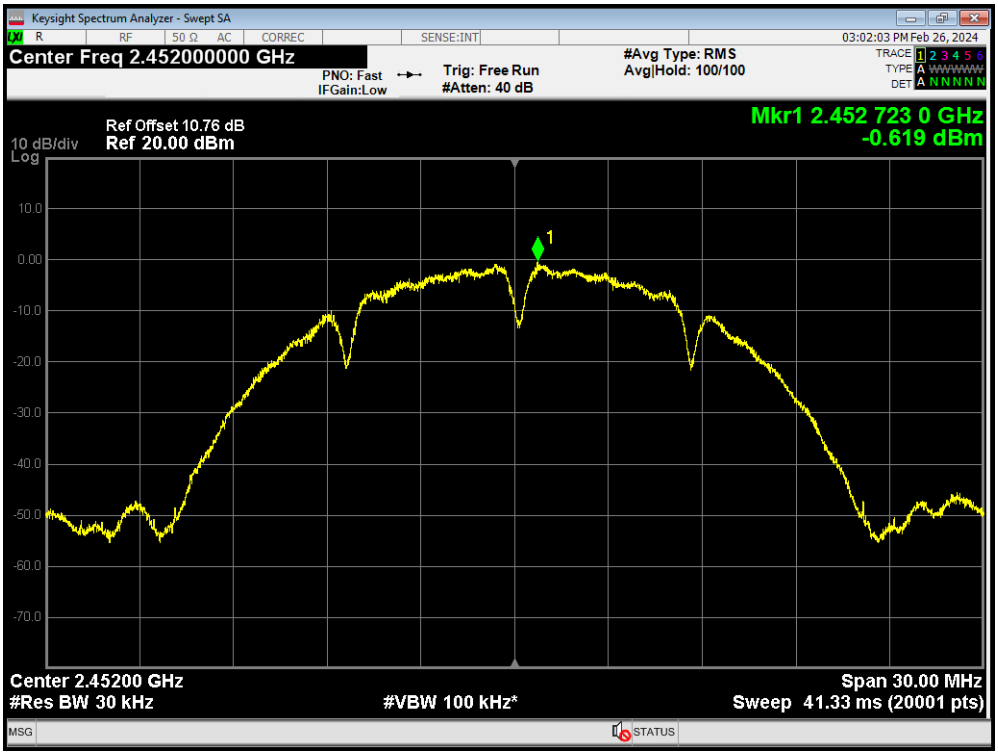
PSD 802.11b 2447MHz Ant1



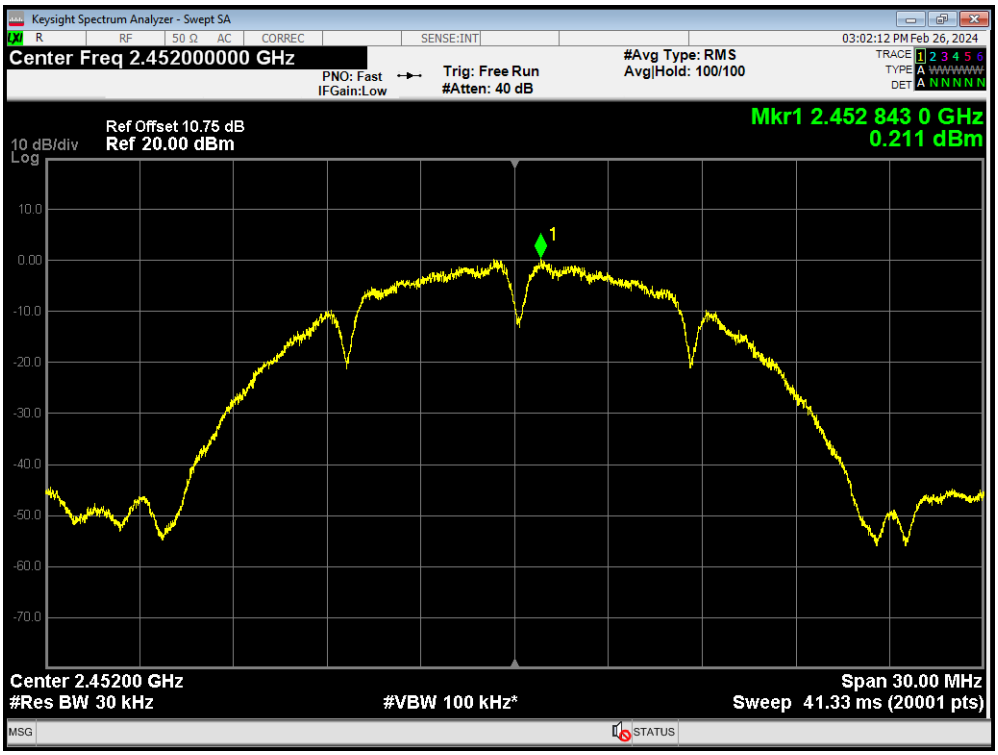
PSD 802.11b 2447MHz Ant2



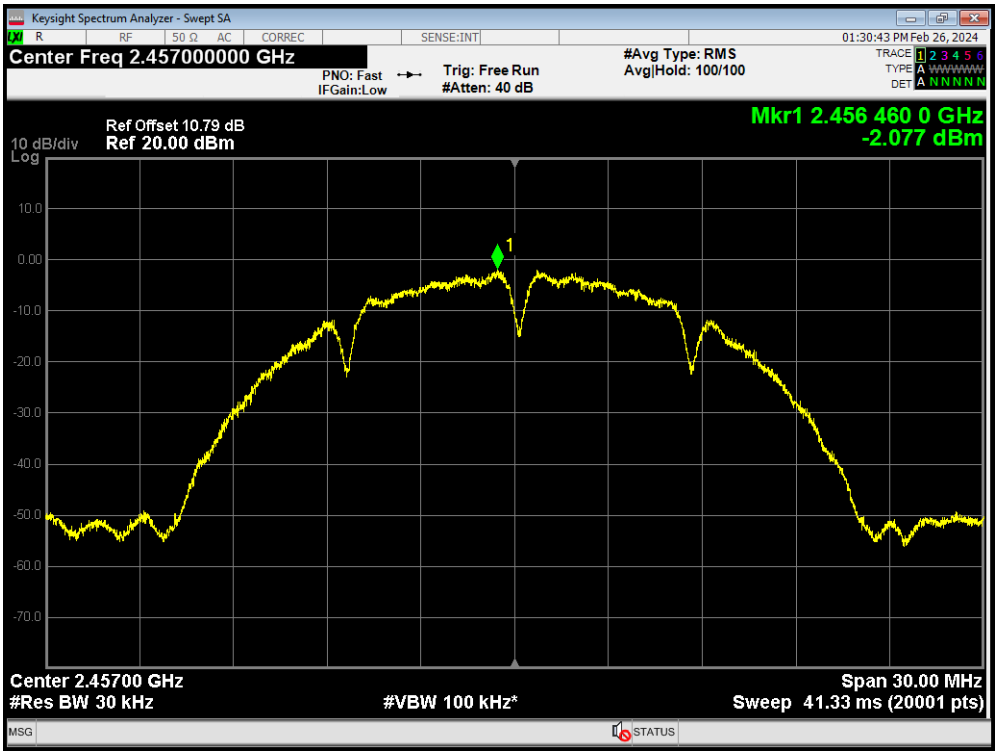
PSD 802.11b 2452MHz Ant1



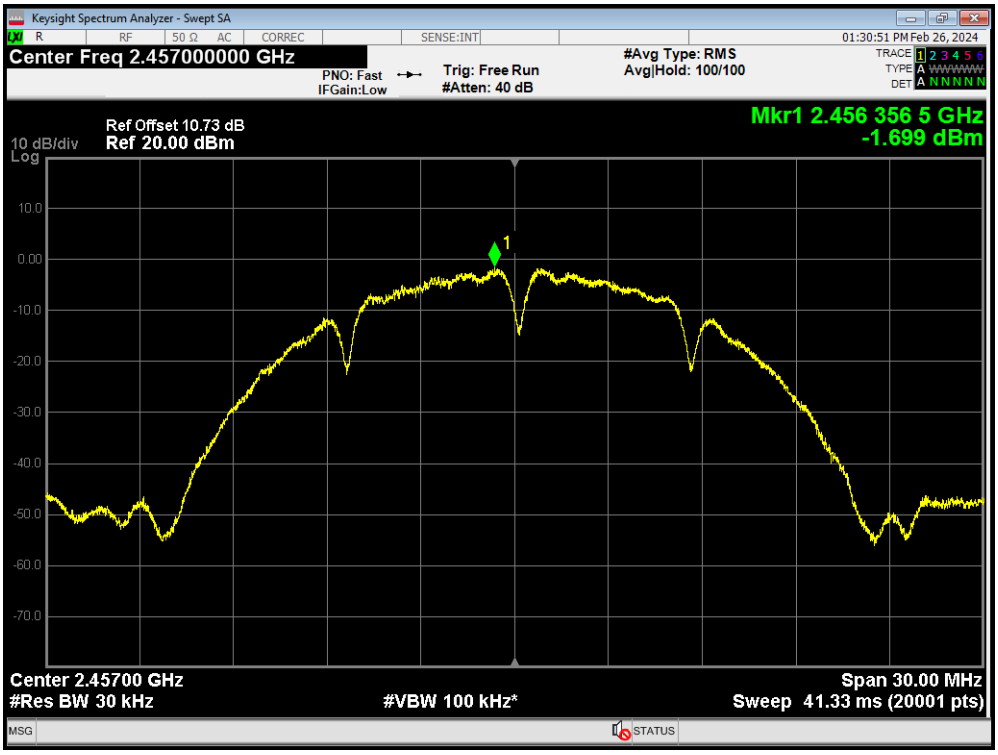
PSD 802.11b 2452MHz Ant2



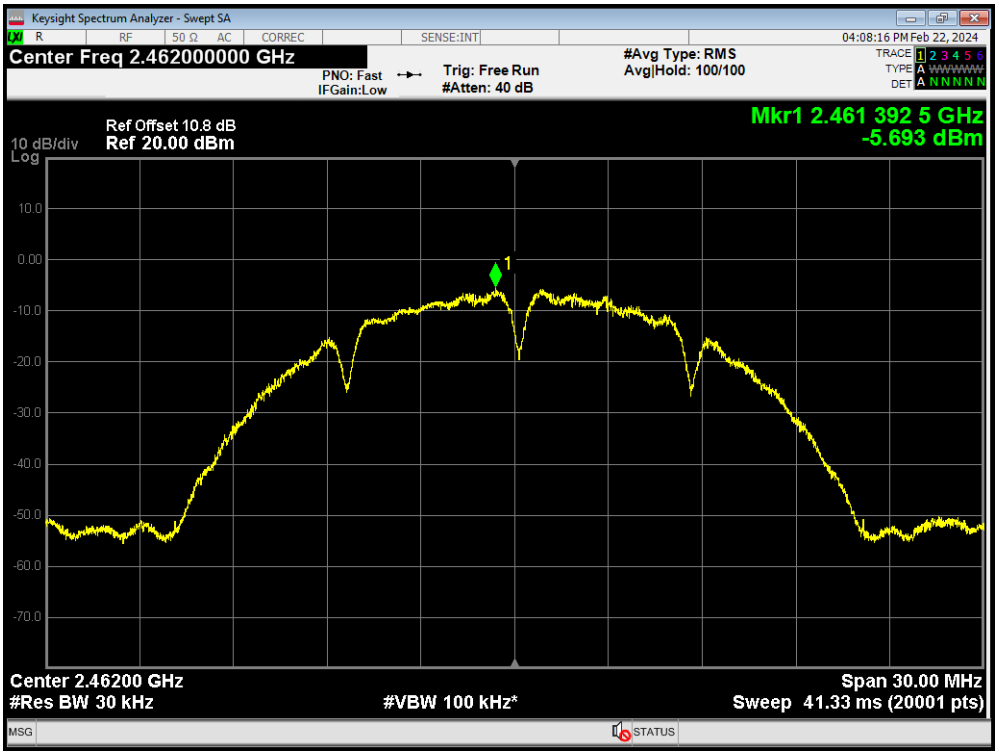
PSD 802.11b 2457MHz Ant1



PSD 802.11b 2457MHz Ant2



PSD 802.11b 2462MHz Ant1



PSD 802.11b 2462MHz Ant2