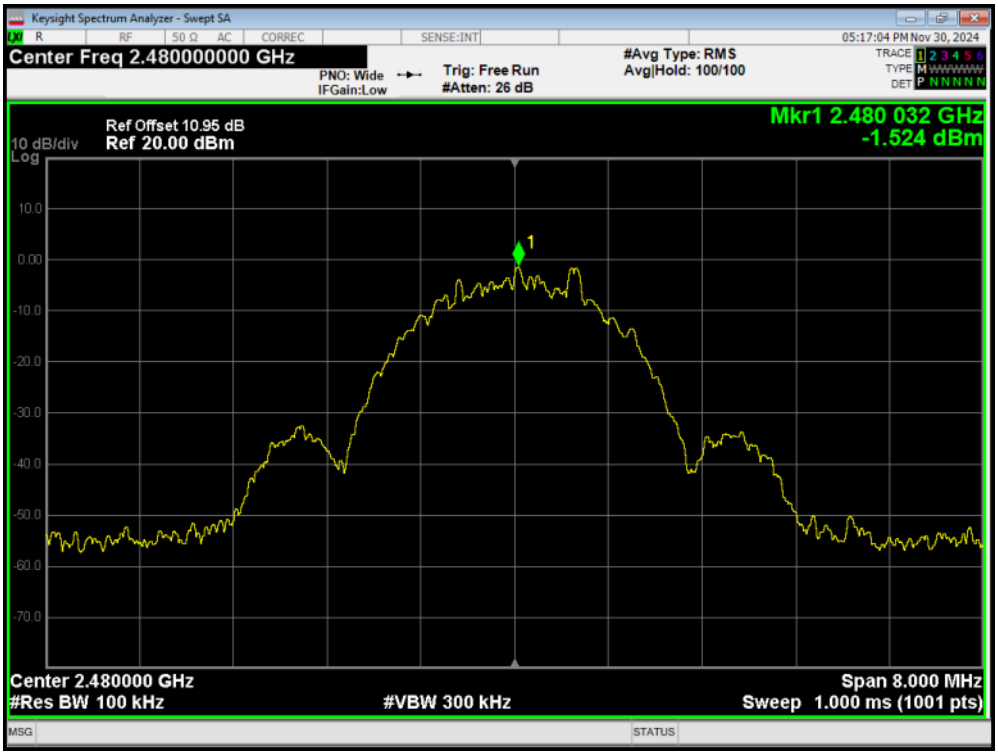
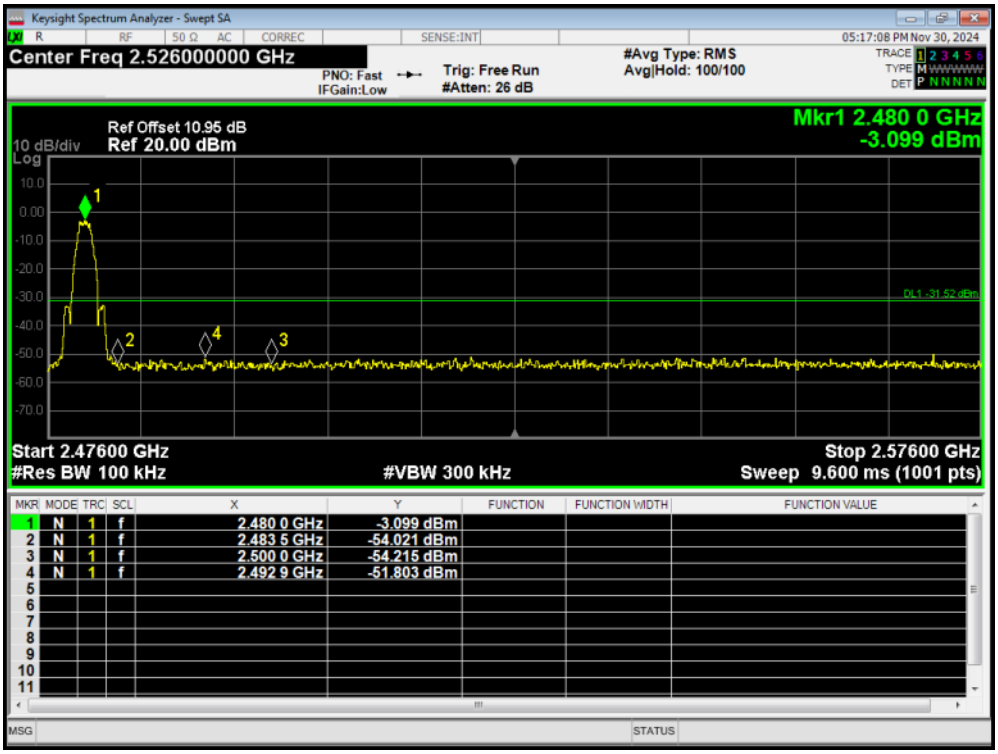
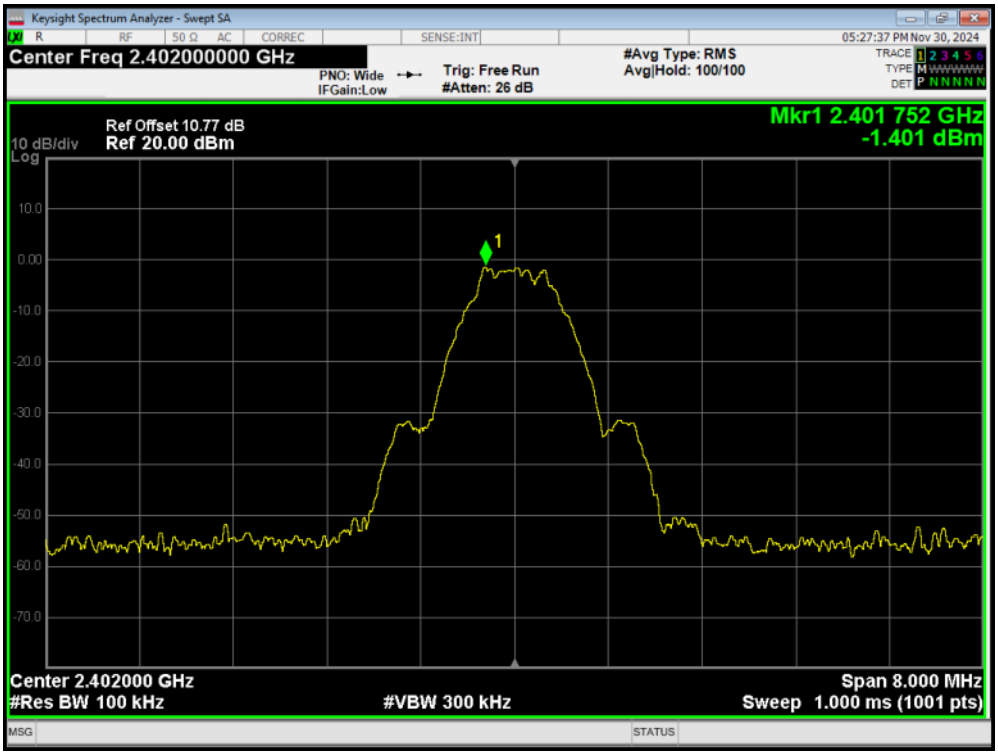
Band Edge BLE (2M) 2480MHz Ref



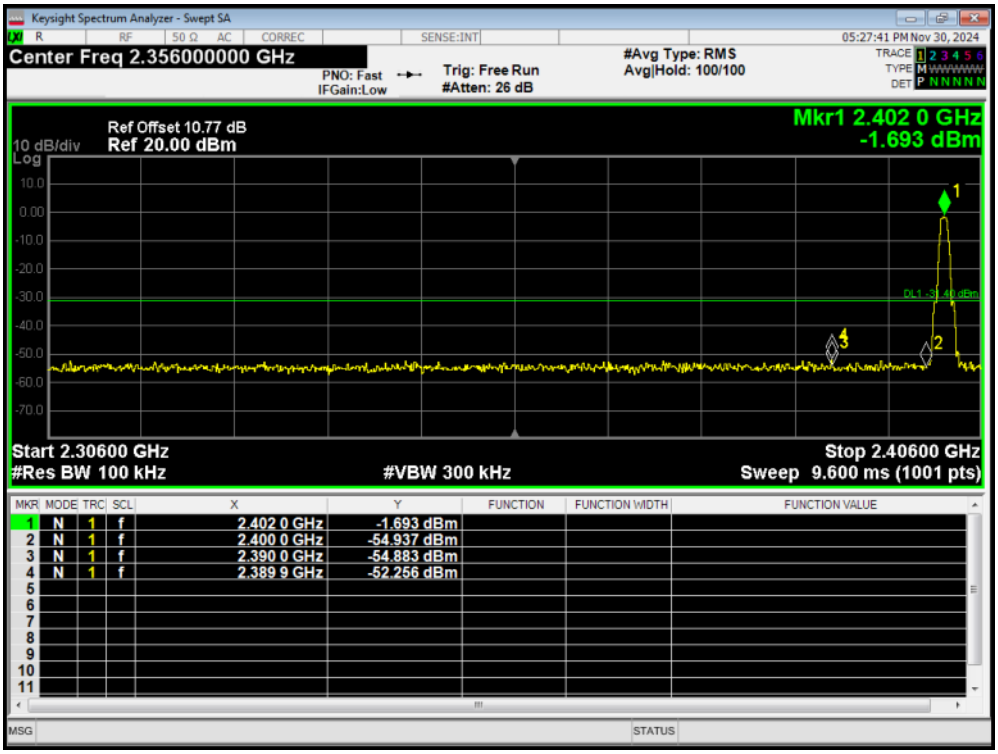
Band Edge BLE (2M) 2480MHz Emission



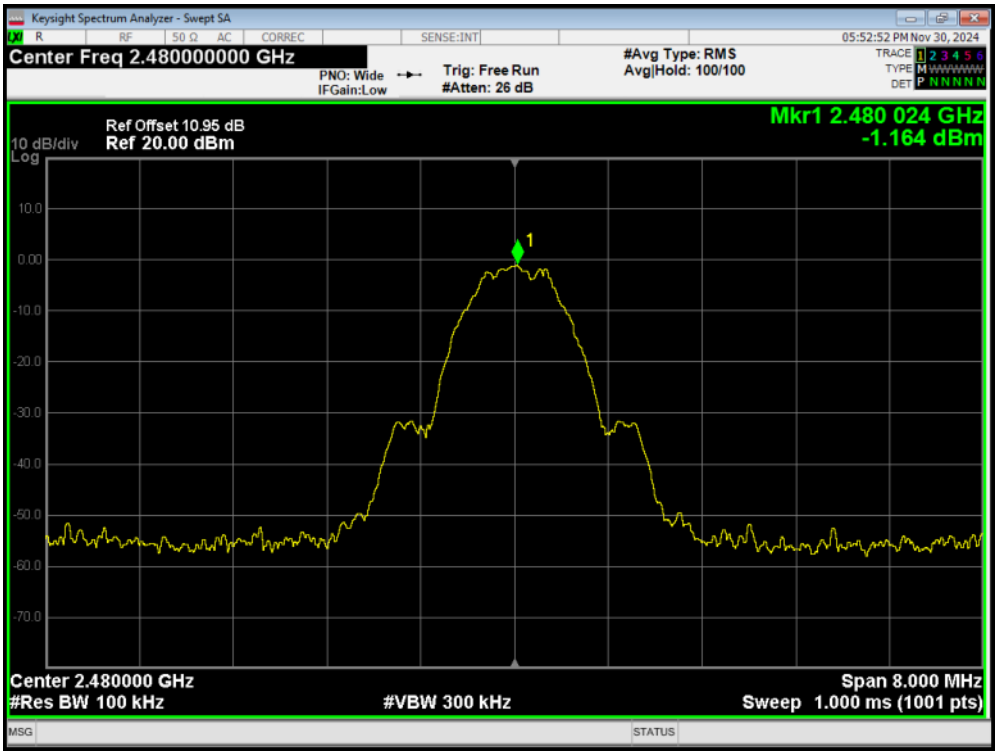
Band Edge BLE (S=2) 2402MHz Ref



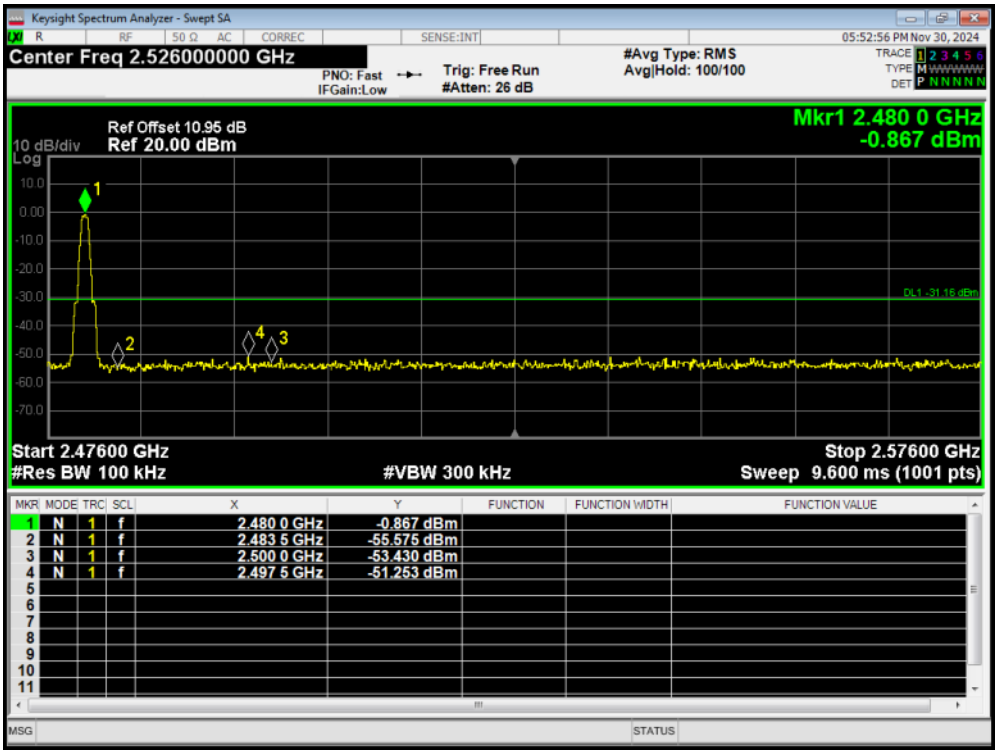
Band Edge BLE (S=2) 2402MHz Emission



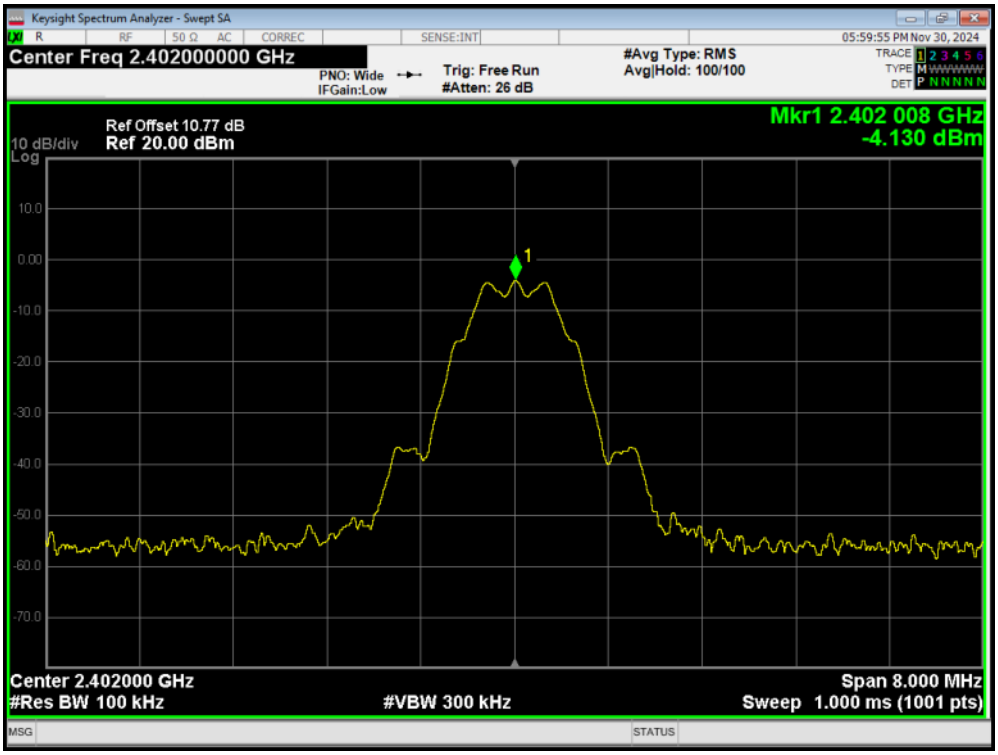
Band Edge BLE (S=2) 2480MHz Ref



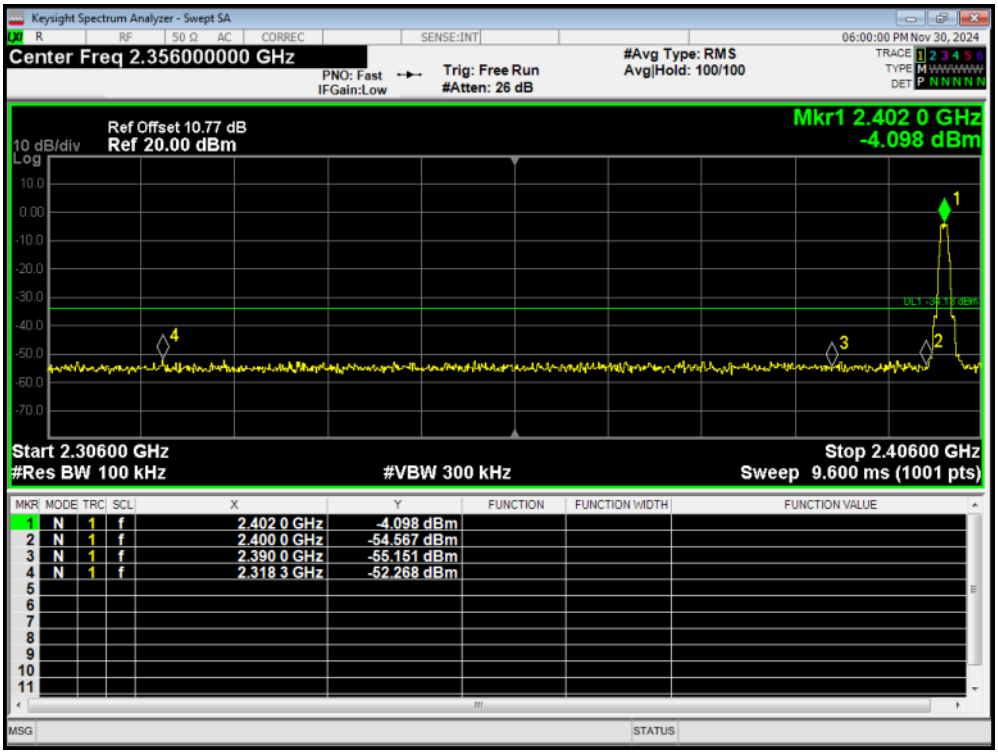
Band Edge BLE (S=2) 2480MHz Emission



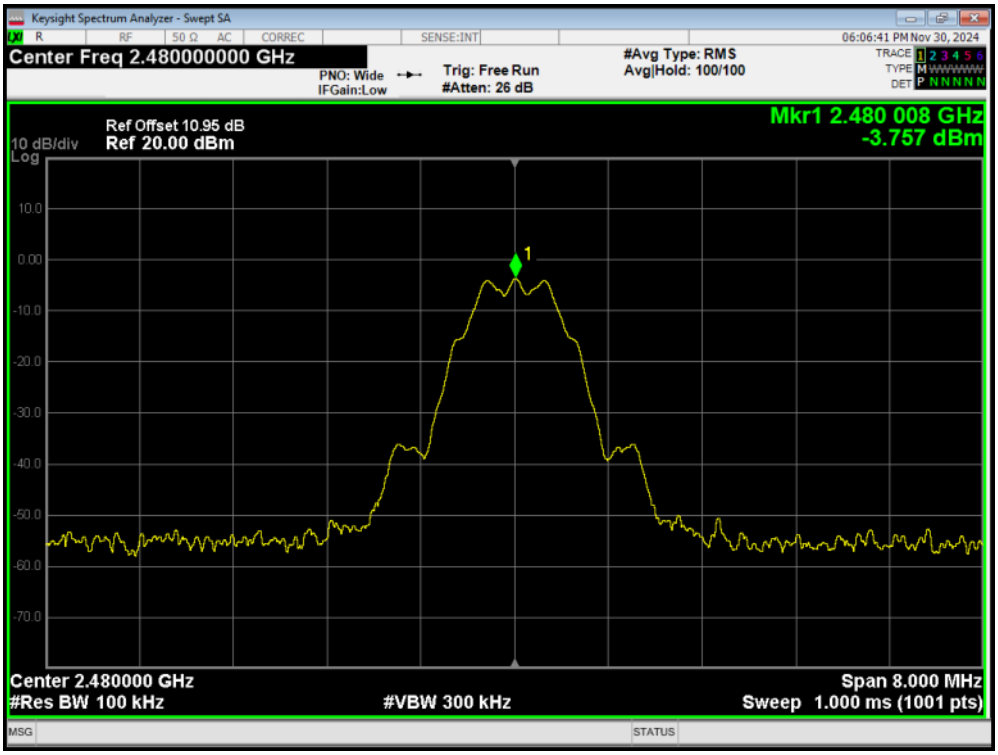
Band Edge BLE (S=8) 2402MHz Ref



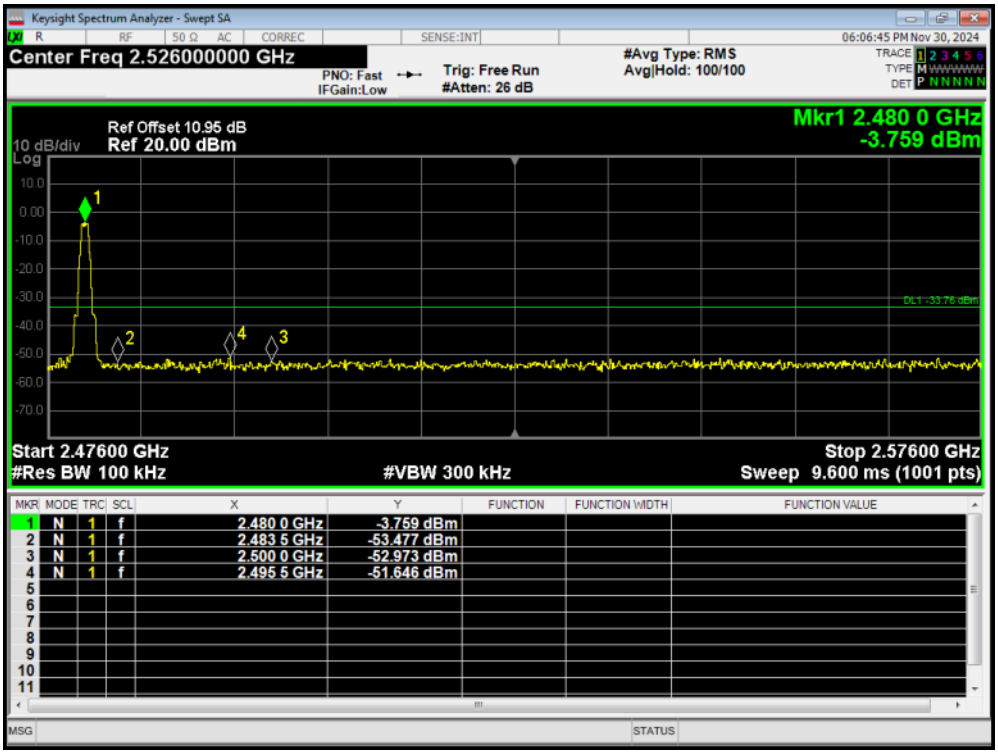
Band Edge BLE (S=8) 2402MHz Emission



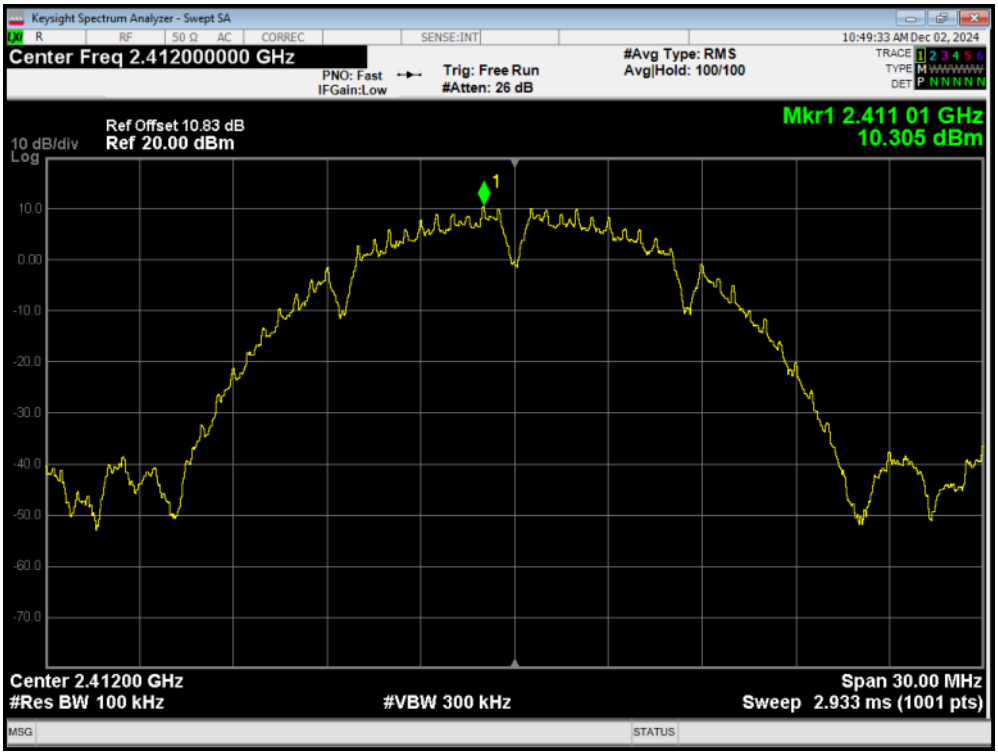
Band Edge BLE (S=8) 2480MHz Ref



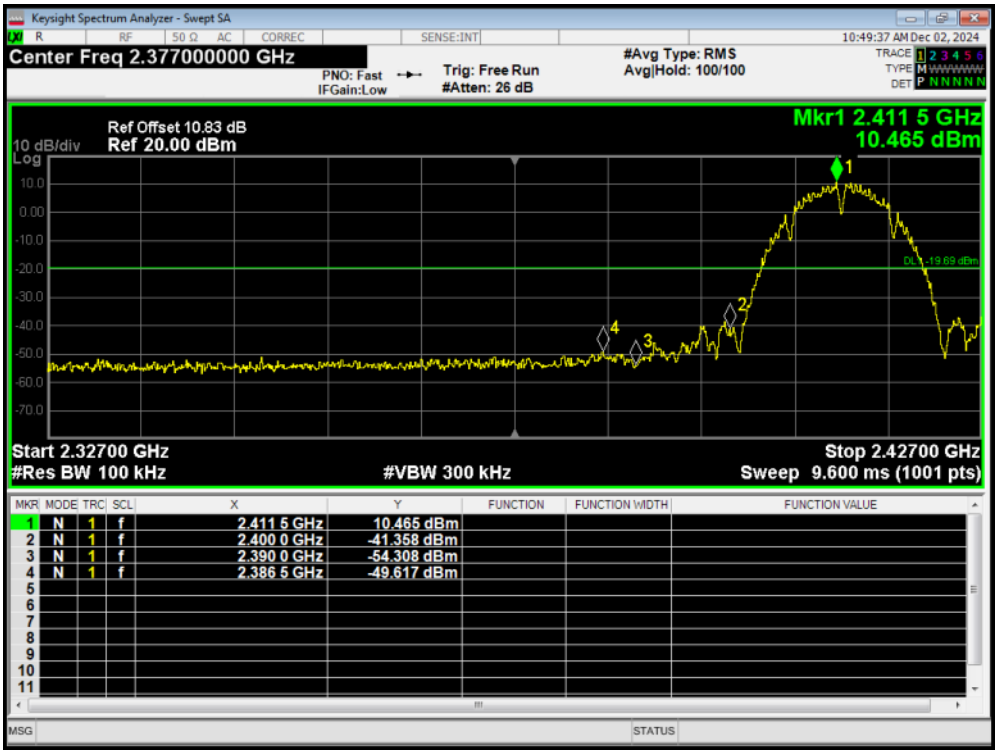
Band Edge BLE (S=8) 2480MHz Emission



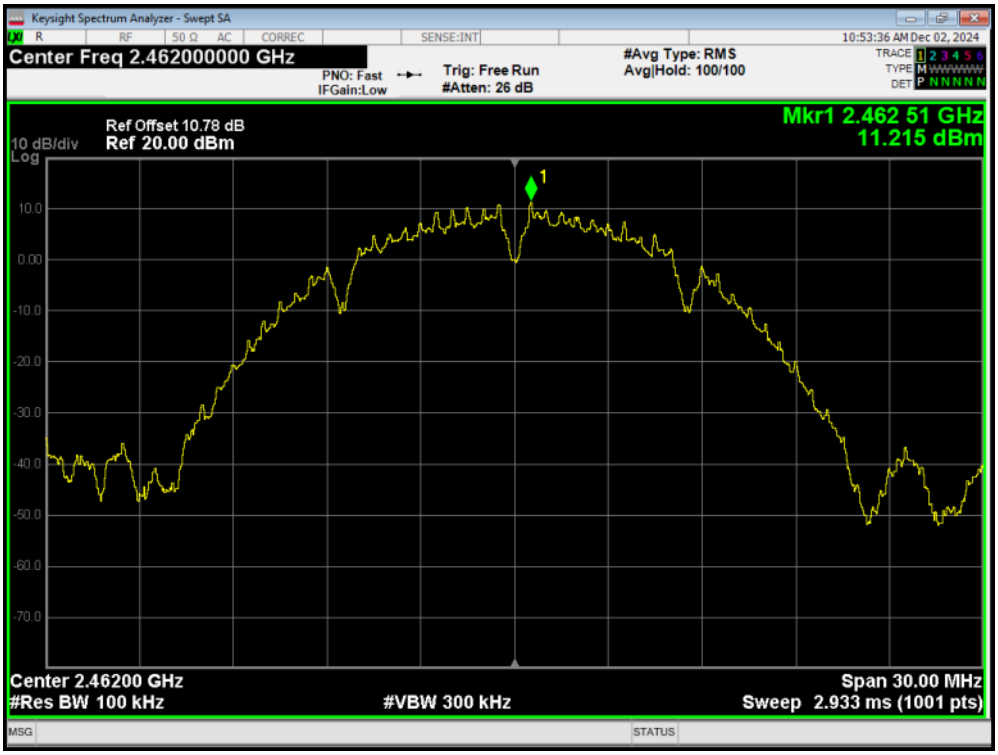
Band Edge 802.11b 2412MHz Ref



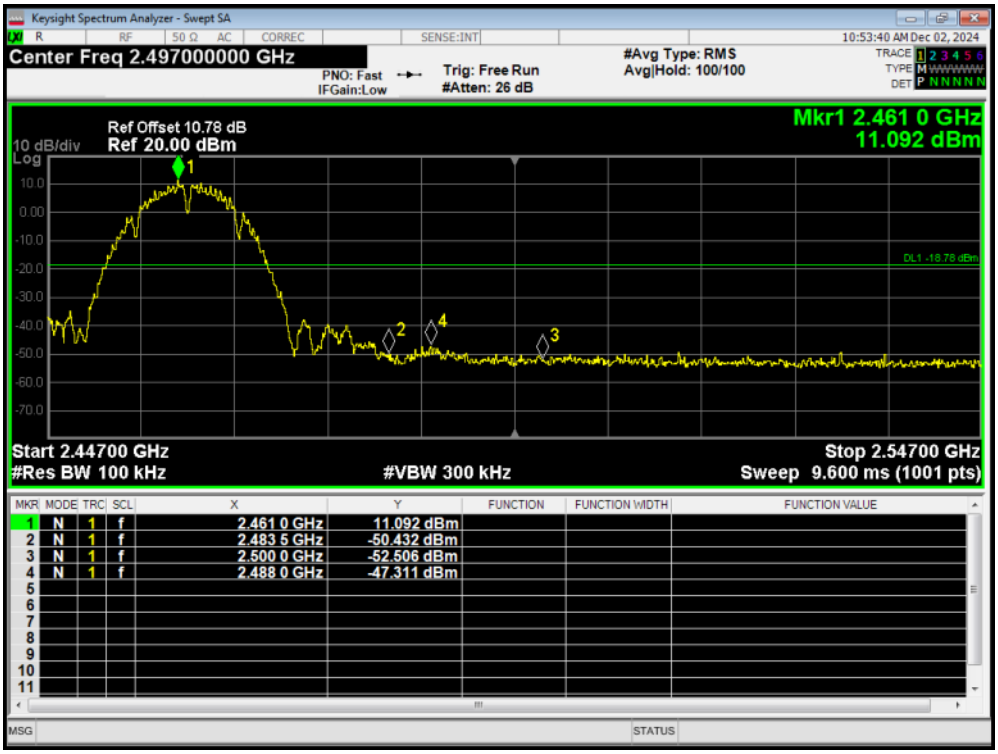
Band Edge 802.11b 2412MHz Emission



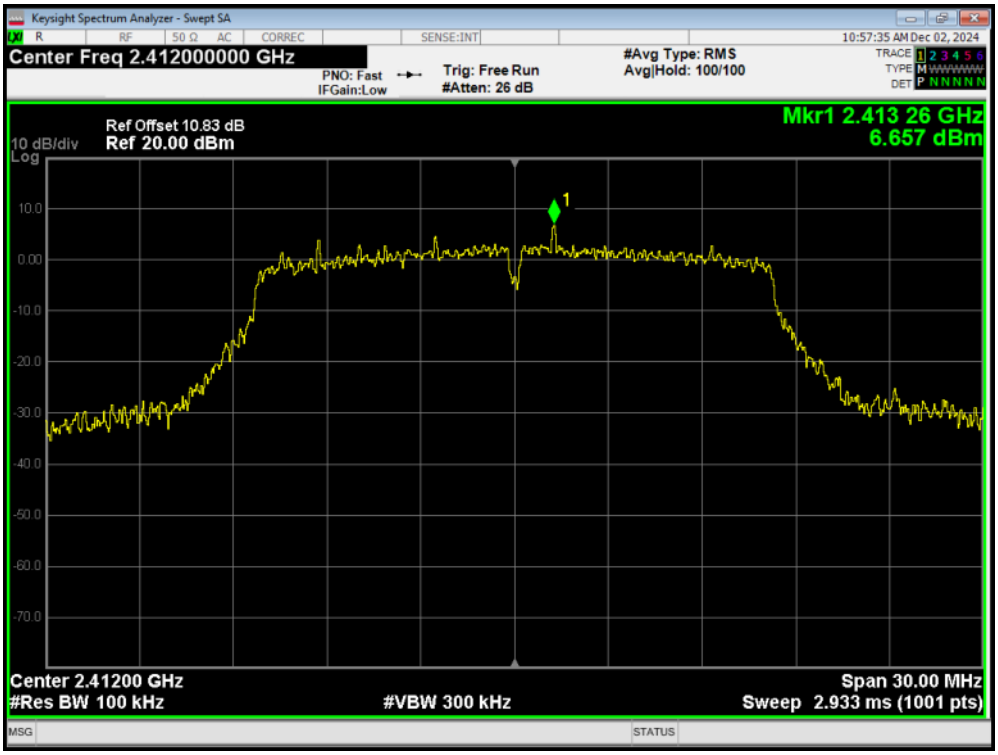
Band Edge 802.11b 2462MHz Ref



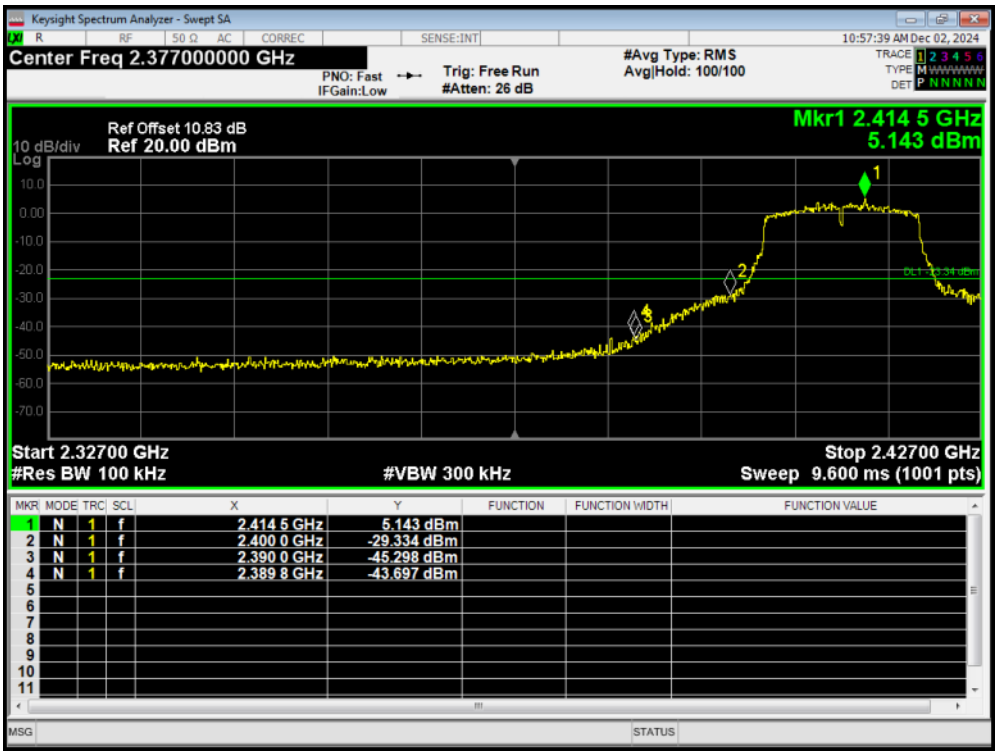
Band Edge 802.11b 2462MHz Emission



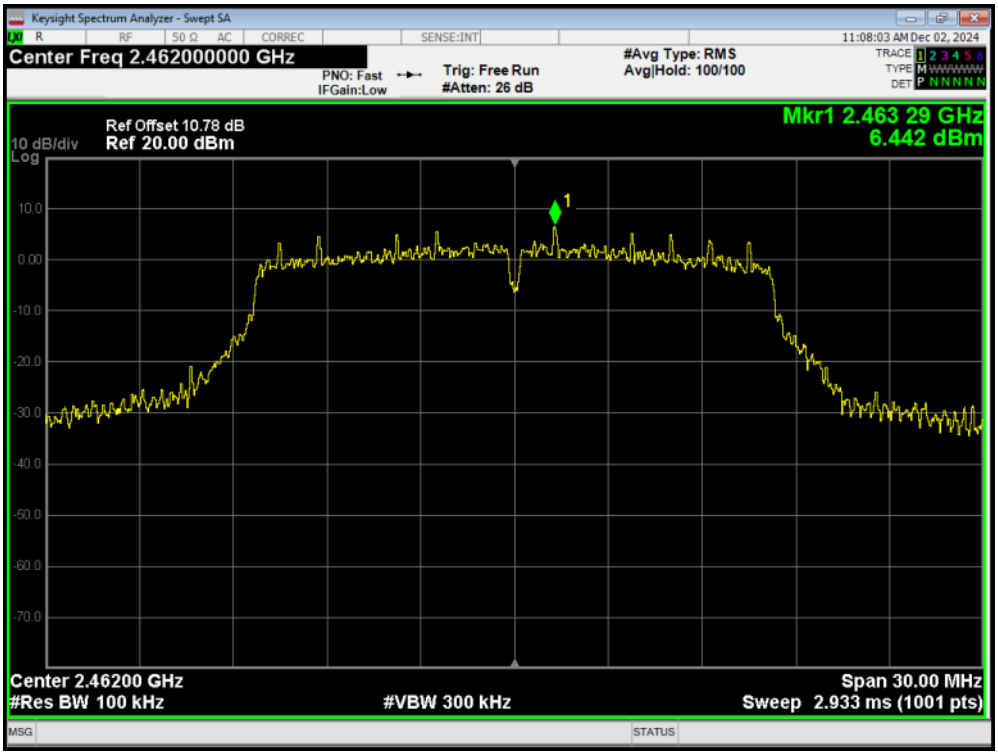
Band Edge 802.11g 2412MHz Ref



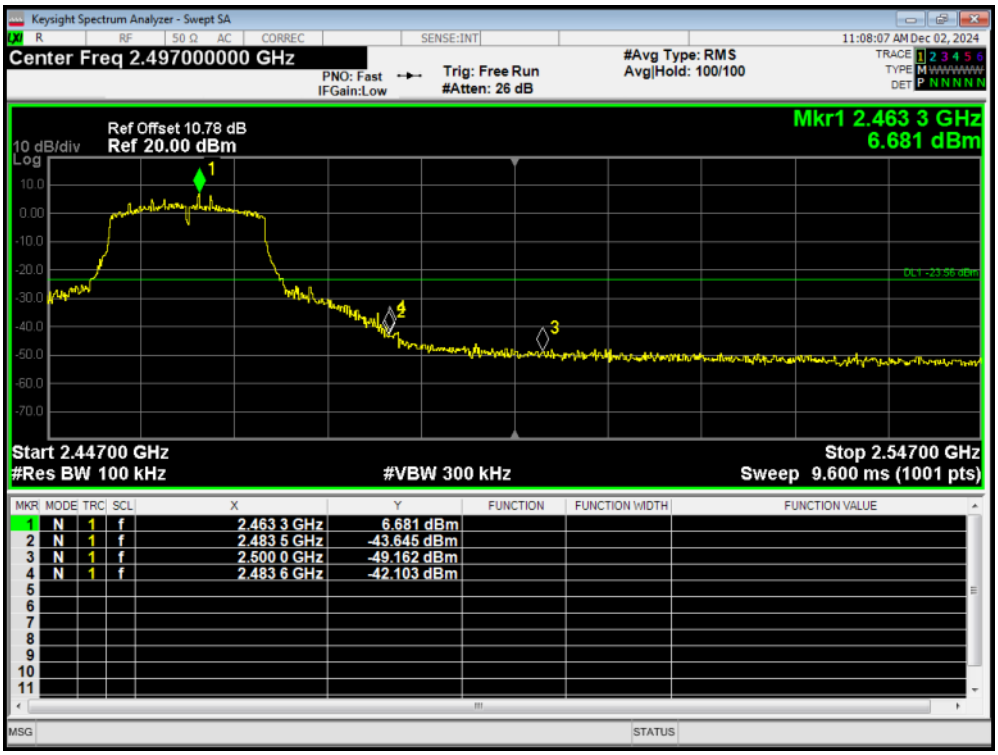
Band Edge 802.11g 2412MHz Emission



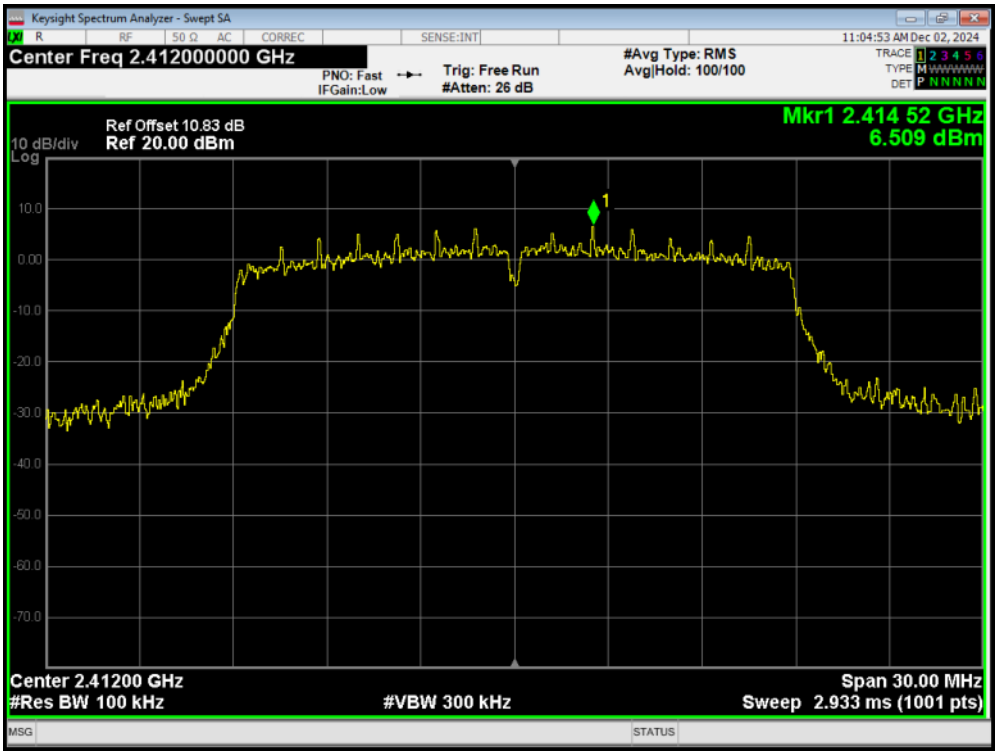
Band Edge 802.11g 2462MHz Ref



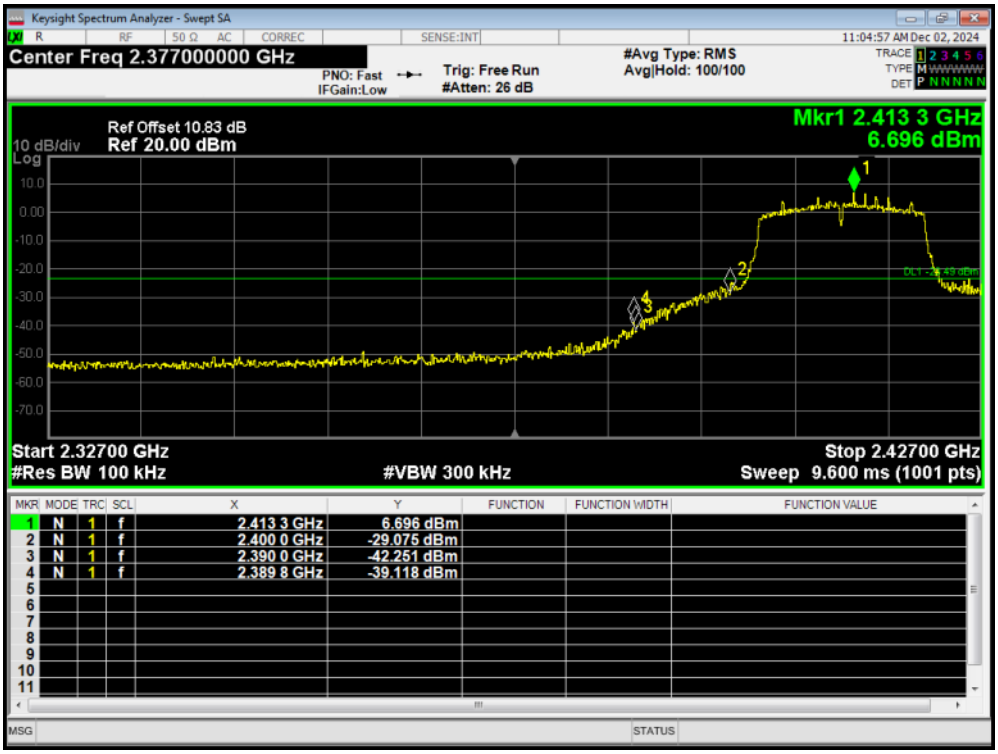
Band Edge 802.11g 2462MHz Emission



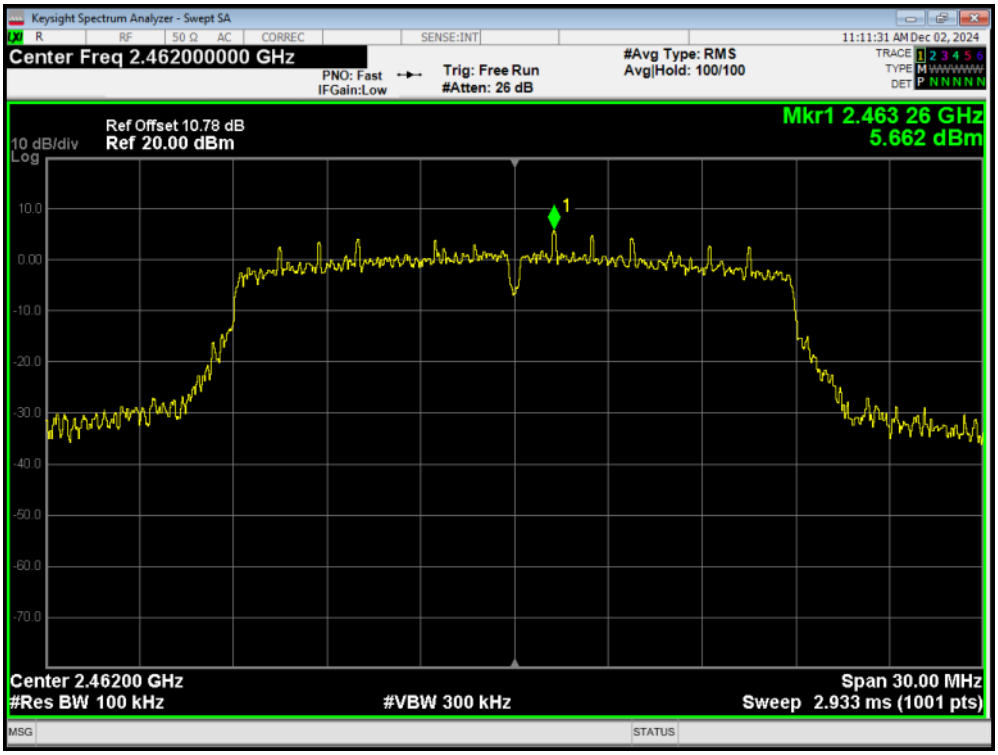
Band Edge 802.11n(HT20) 2412MHz Ref



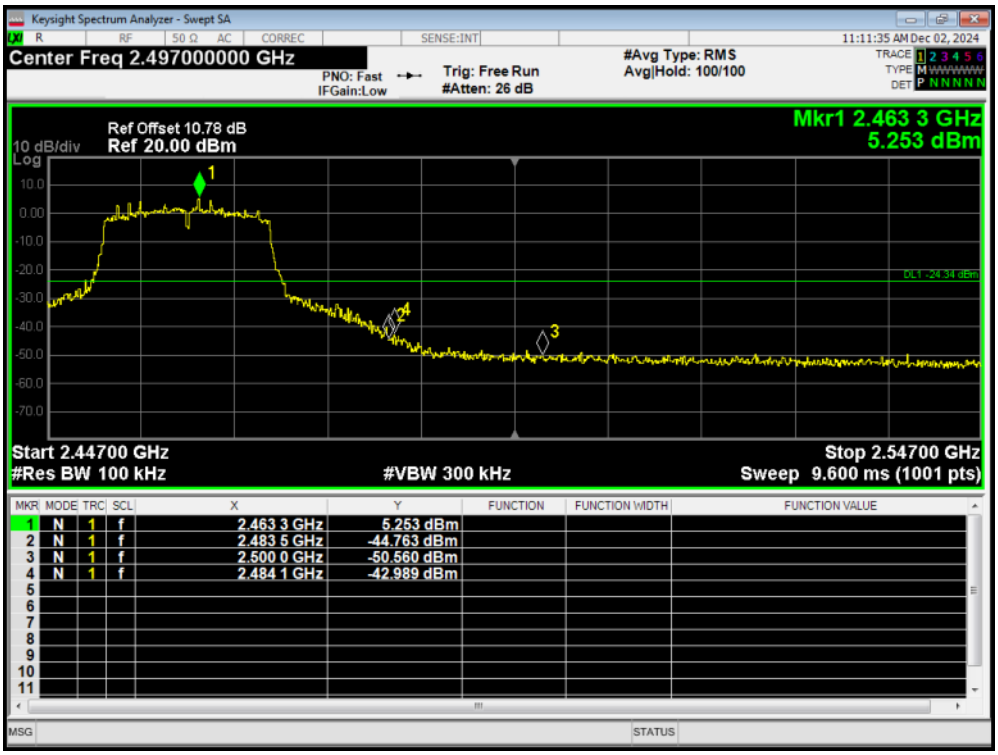
Band Edge 802.11n(HT20) 2412MHz Emission



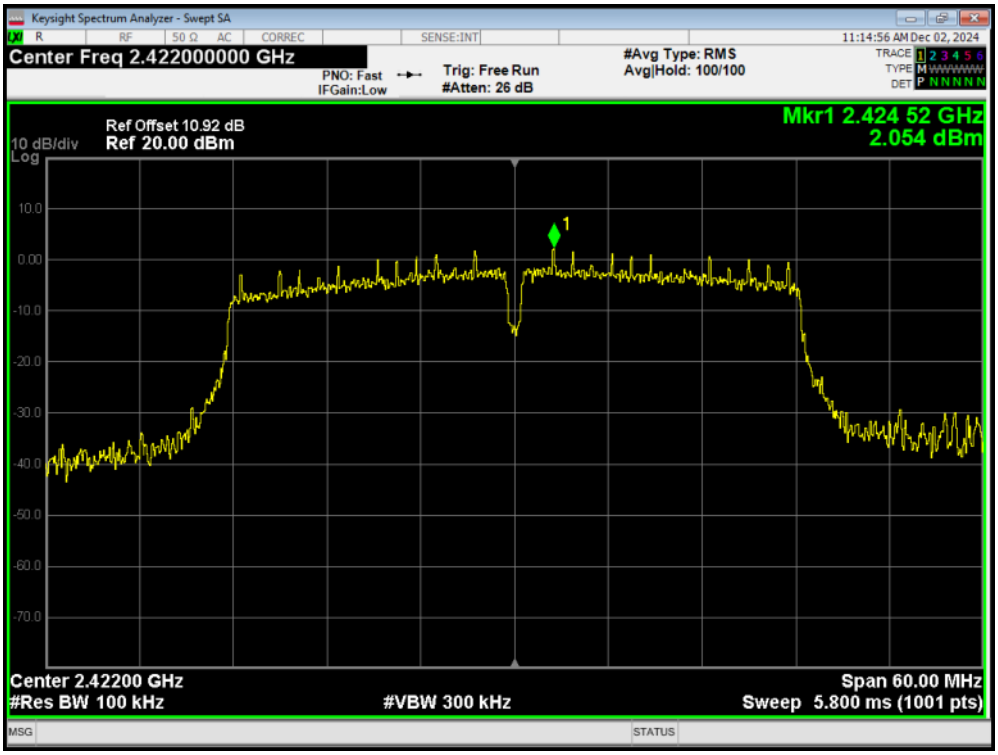
Band Edge 802.11n(HT20) 2462MHz Ref



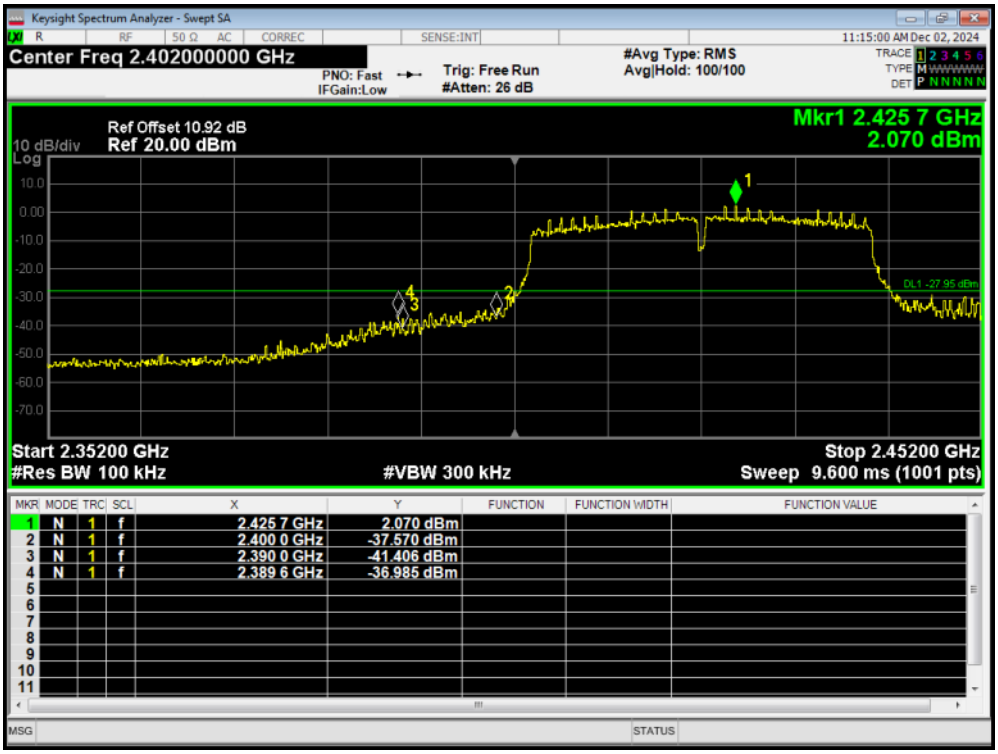
Band Edge 802.11n(HT20) 2462MHz Emission



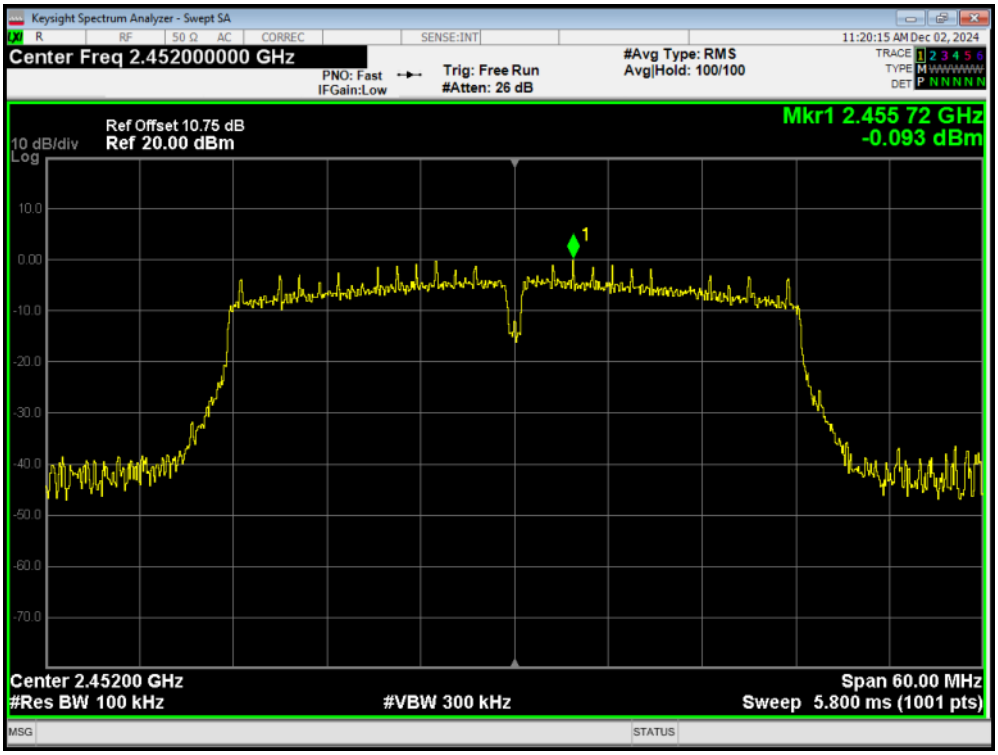
Band Edge 802.11n(HT40) 2422MHz Ref



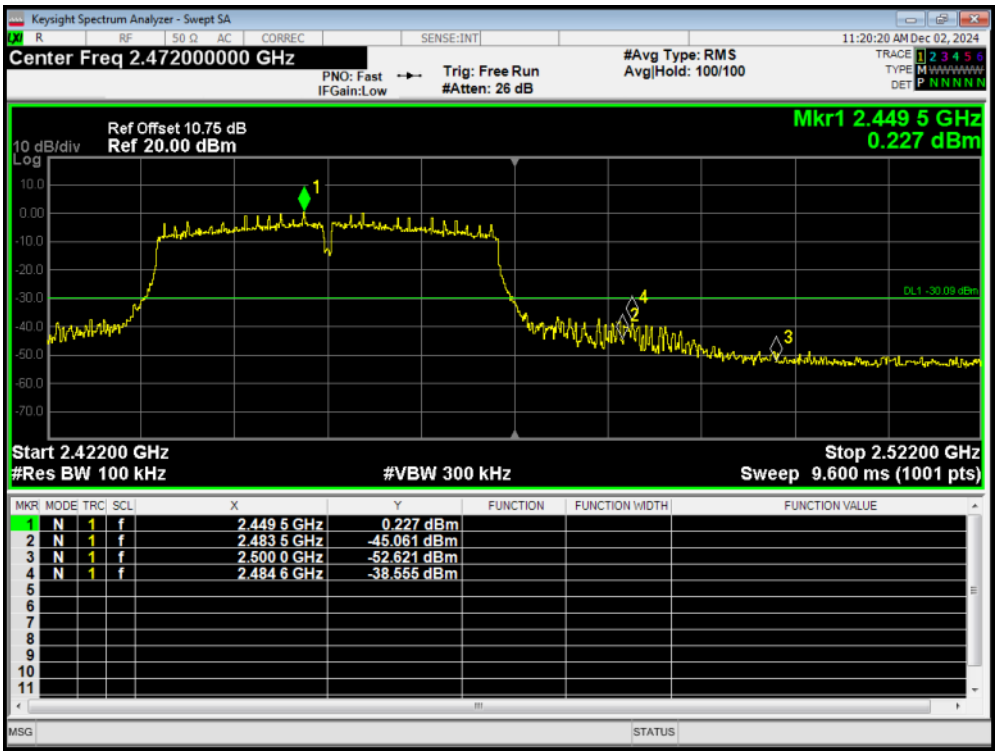
Band Edge 802.11n(HT40) 2422MHz Emission



Band Edge 802.11n(HT40) 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”

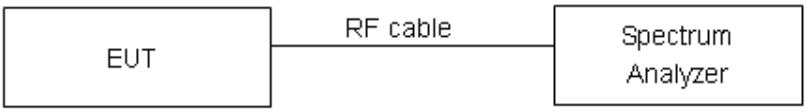
j) Employ trace averaging (rms) mode over a minimum of 100 traces

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)

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

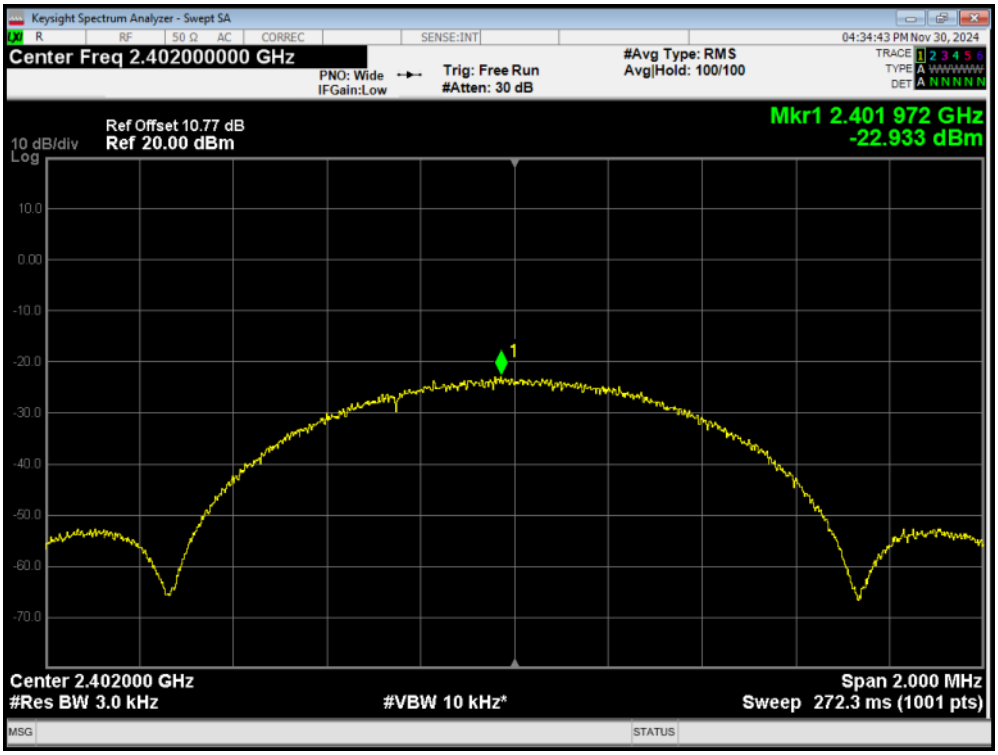
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.75dB.

Test Results:

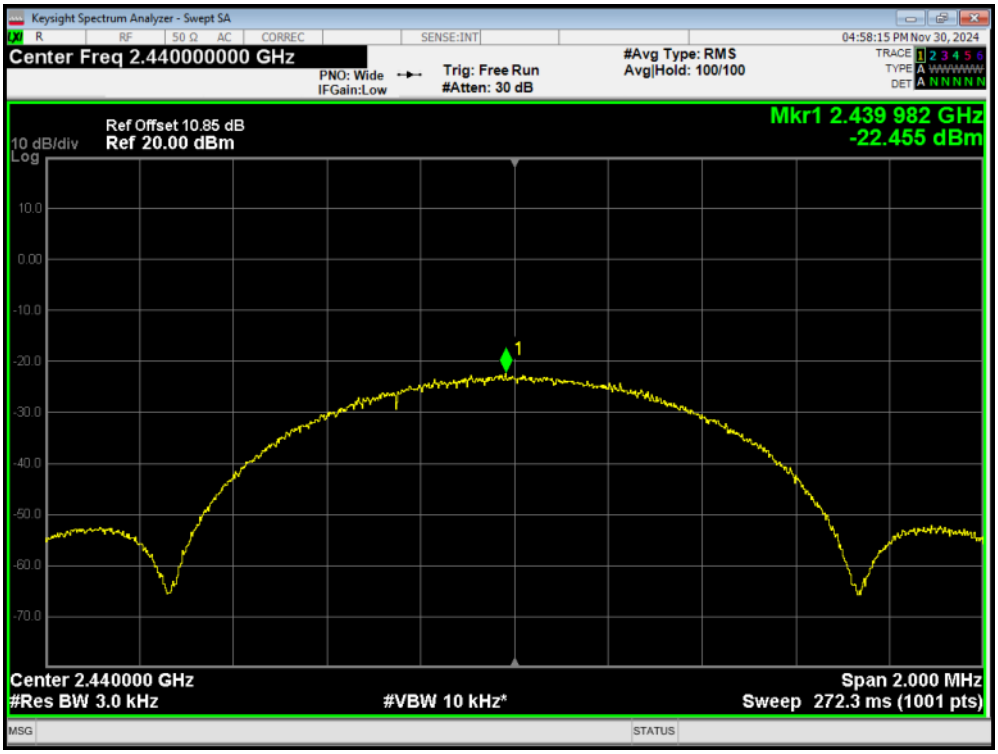
Test Mode	Carrier frequency (MHz)/ Channel	Read Value (dBm / 30kHz)	Power Spectral Density (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
802.11b	2412/CH 1	-2.18	-12.18	8	PASS
	2437/CH 6	-2.50	-12.50	8	PASS
	2462/CH11	-2.20	-12.20	8	PASS
802.11g	2412/CH 1	-7.12	-16.98	8	PASS
	2437/CH 6	-7.15	-17.01	8	PASS
	2462/CH11	-7.19	-17.05	8	PASS
802.11n HT20	2412/CH 1	-6.79	-16.65	8	PASS
	2437/CH 6	-6.98	-16.84	8	PASS
	2462/CH11	-8.51	-18.37	8	PASS
802.11n HT40	2422/CH3	-11.77	-21.48	8	PASS
	2437/CH6	-11.45	-21.16	8	PASS
	2452/CH9	-13.63	-23.34	8	PASS
Note: Power Spectral Density (dBm/3kHz) =Read Value+Duty cycle correction factor + 10*log10(3/30)					

Test Mode	Carrier frequency (MHz)/ Channel	Read Value (dBm / 3kHz)	Power Spectral Density (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
Bluetooth (Low Energy) (1M)	2402/CH0	-22.93	-22.23	8	PASS
	2440/CH19	-22.46	-21.76	8	PASS
	2480/CH39	-22.47	-21.77	8	PASS
Bluetooth (Low Energy) (2M)	2402/CH0	-26.87	-26.55	8	PASS
	2440/CH19	-26.18	-25.86	8	PASS
	2480/CH39	-26.72	-26.40	8	PASS
Bluetooth (Low Energy) (S=2)	2402/CH0	-18.20	-17.79	8	PASS
	2440/CH19	-18.21	-17.80	8	PASS
	2480/CH39	-17.93	-17.52	8	PASS
Bluetooth (Low Energy) (S=8)	2402/CH0	-7.80	-7.70	8	PASS
	2440/CH19	-7.71	-7.61	8	PASS
	2480/CH39	-7.88	-7.78	8	PASS
Note: Power Spectral Density =Read Value+Duty cycle correction factor					

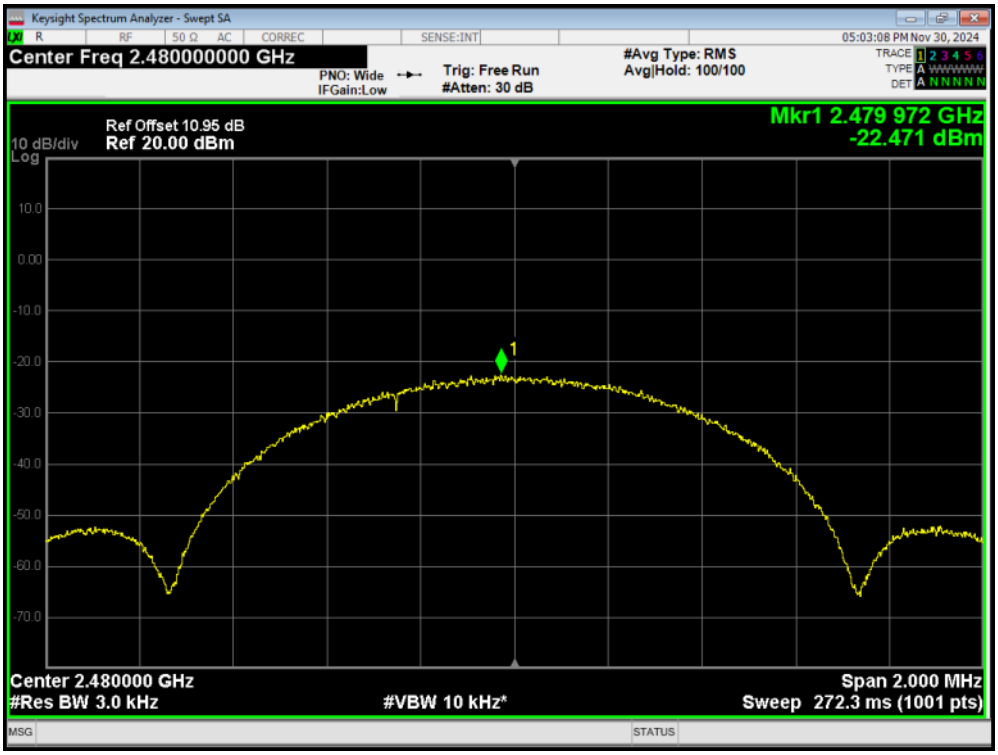
PSD BLE (1M) 2402MHz



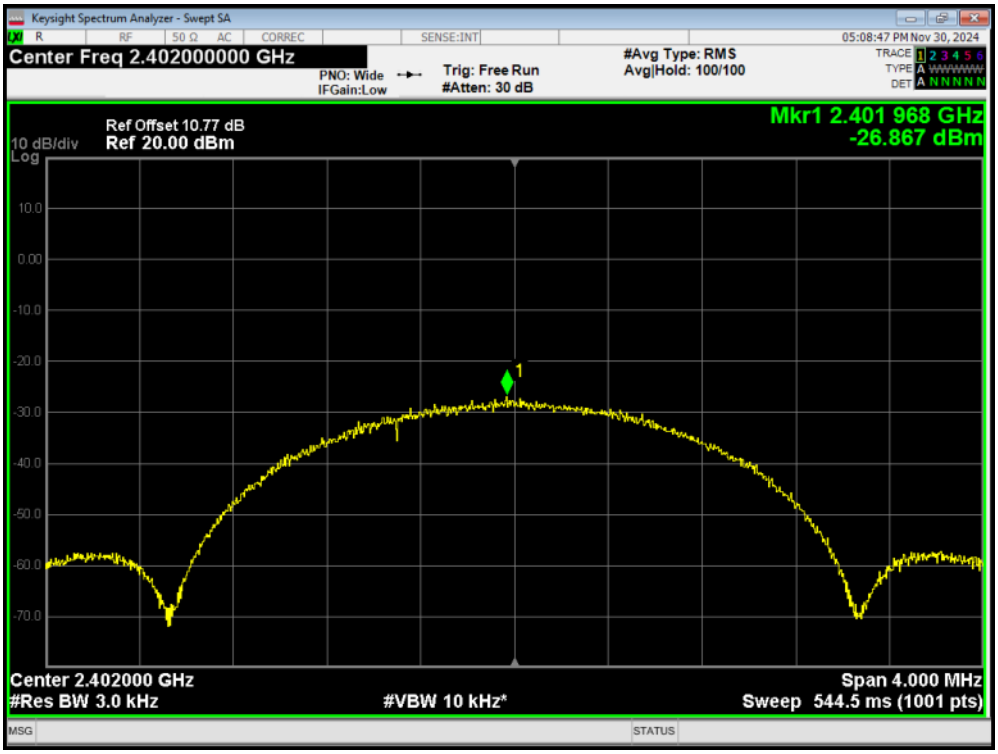
PSD BLE (1M) 2440MHz



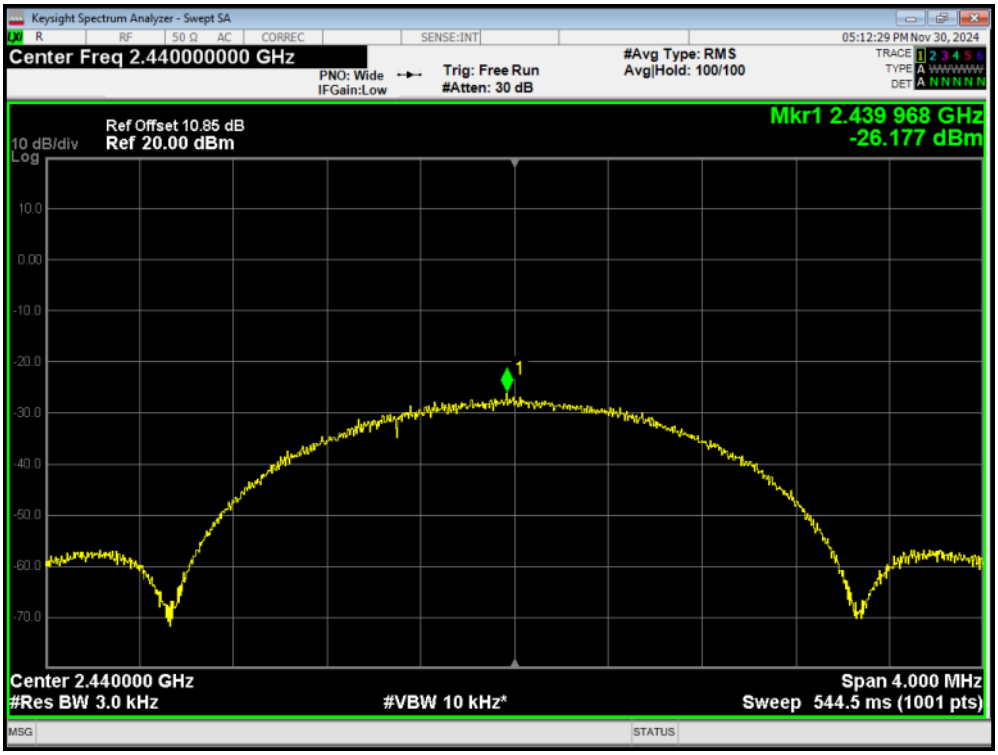
PSD BLE (1M) 2480MHz



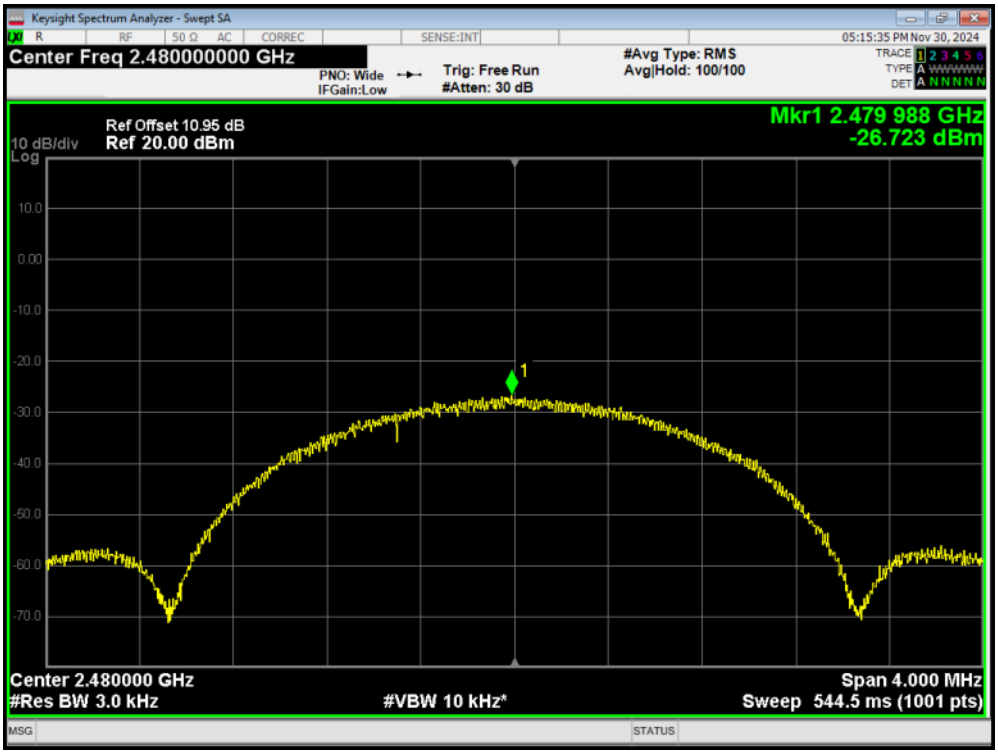
PSD BLE (2M) 2402MHz



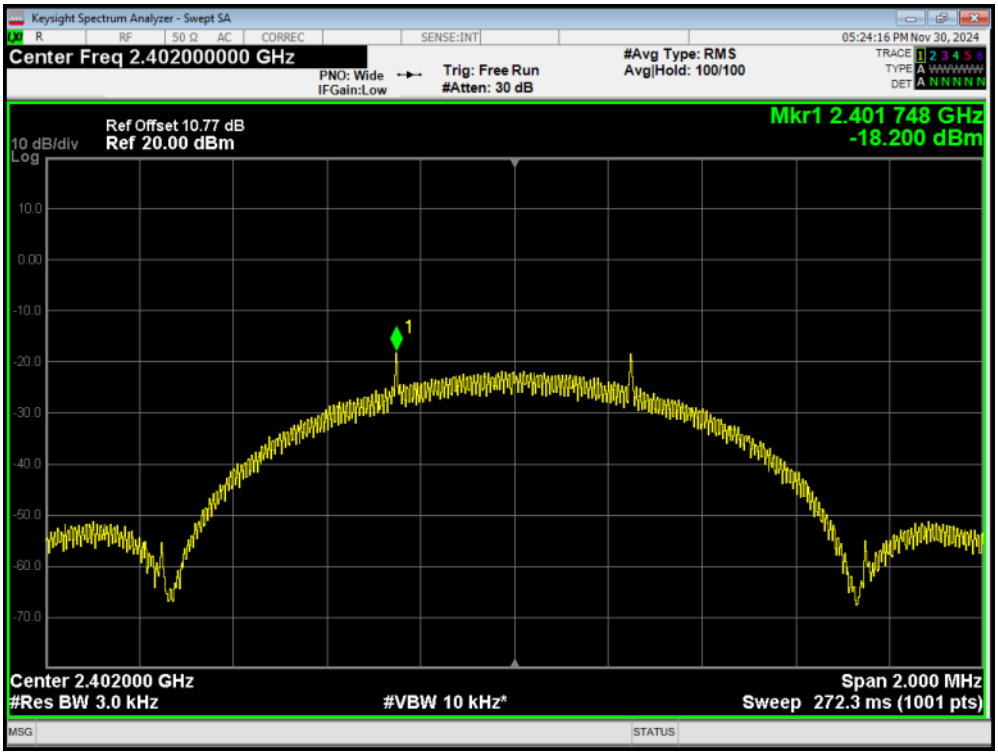
PSD BLE (2M) 2440MHz



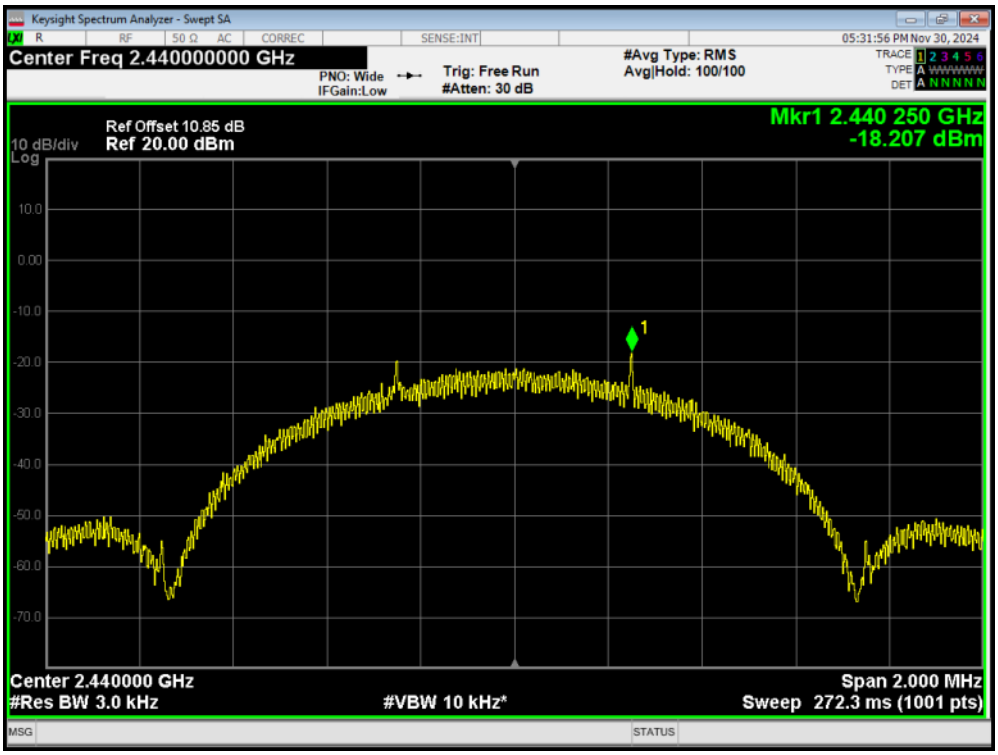
PSD BLE (2M) 2480MHz



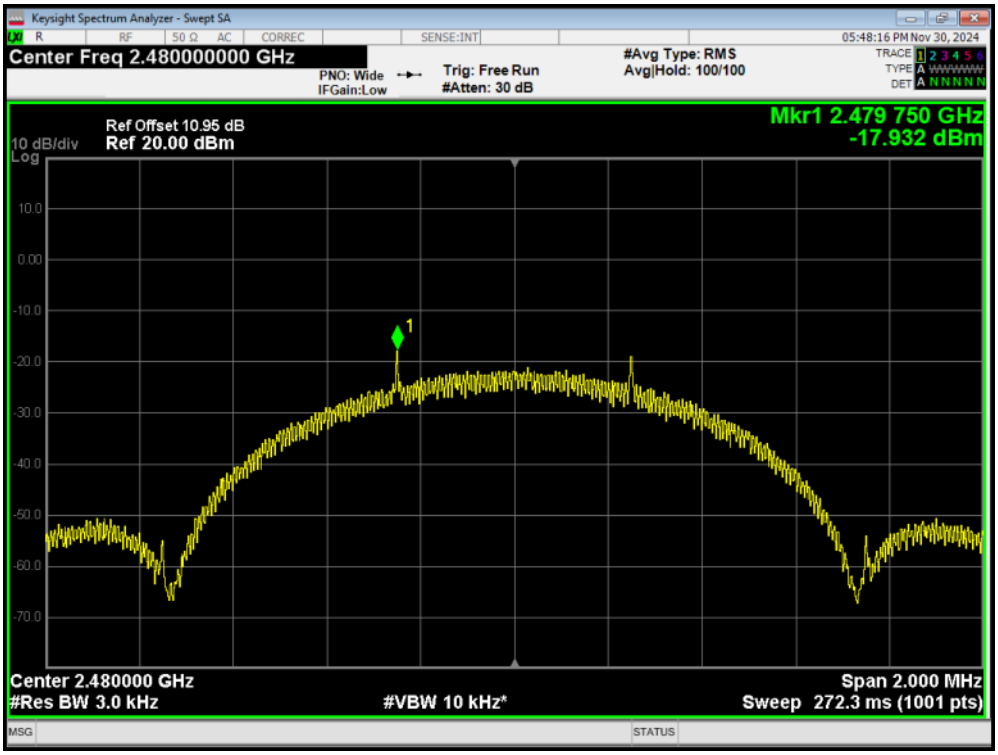
PSD BLE (S=2) 2402MHz



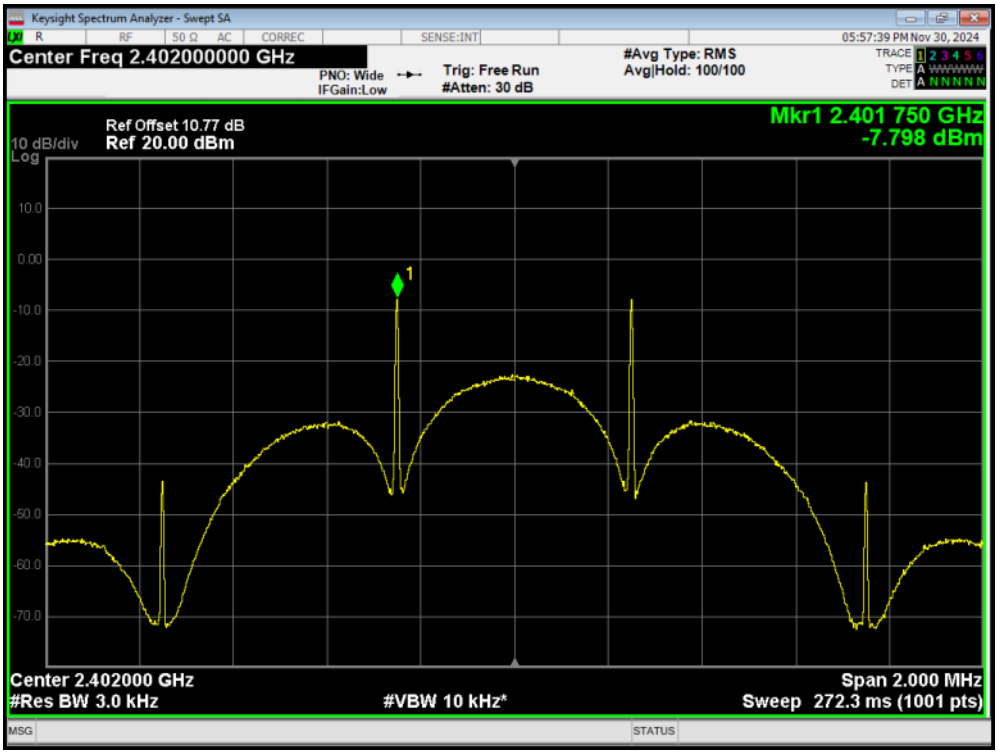
PSD BLE (S=2) 2440MHz



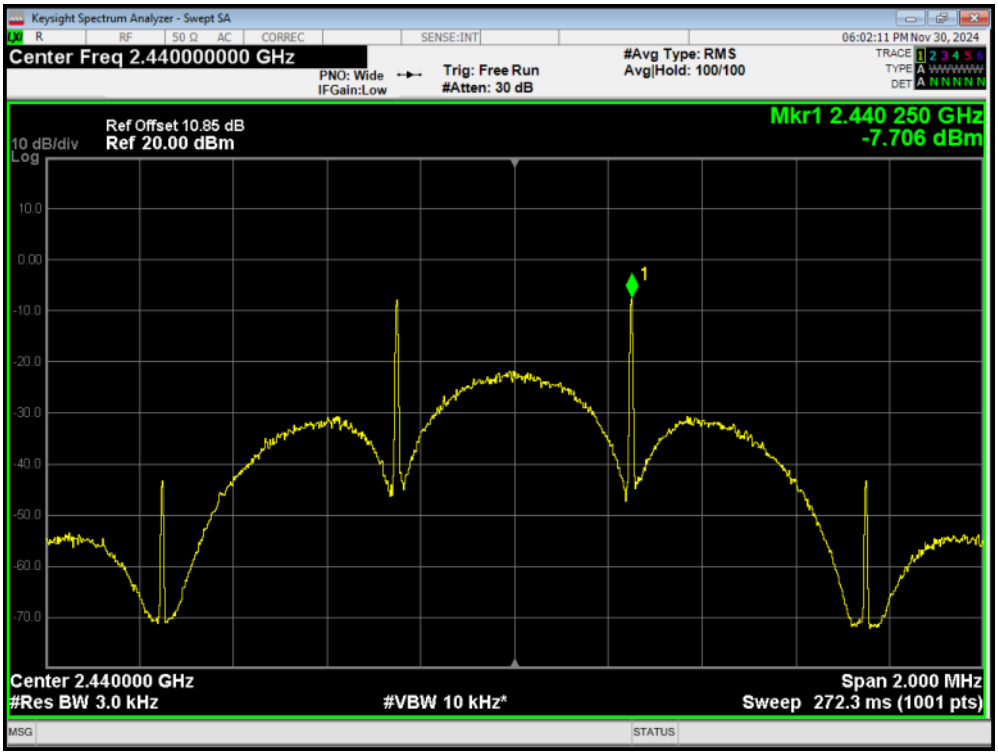
PSD BLE (S=2) 2480MHz



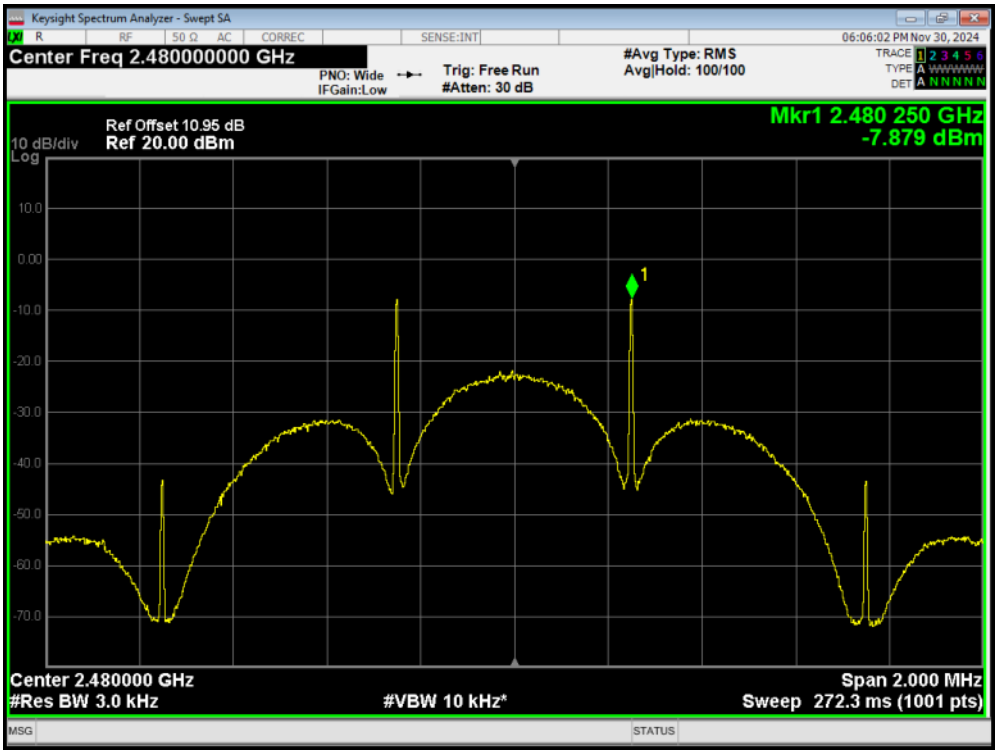
PSD BLE (S=8) 2402MHz



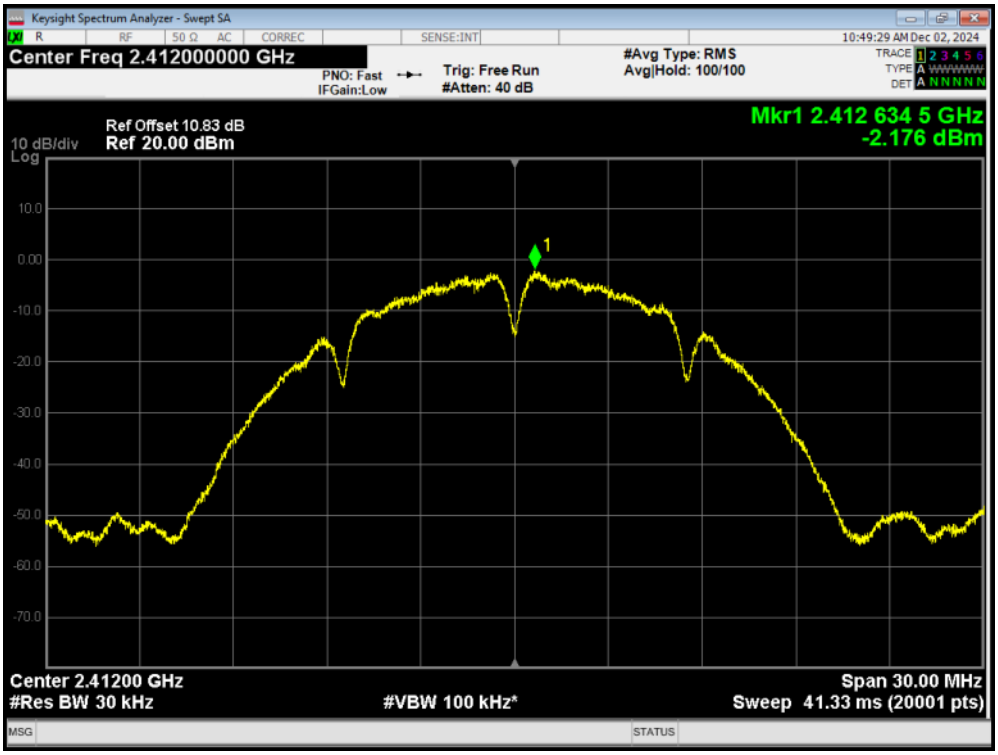
PSD BLE (S=8) 2440MHz



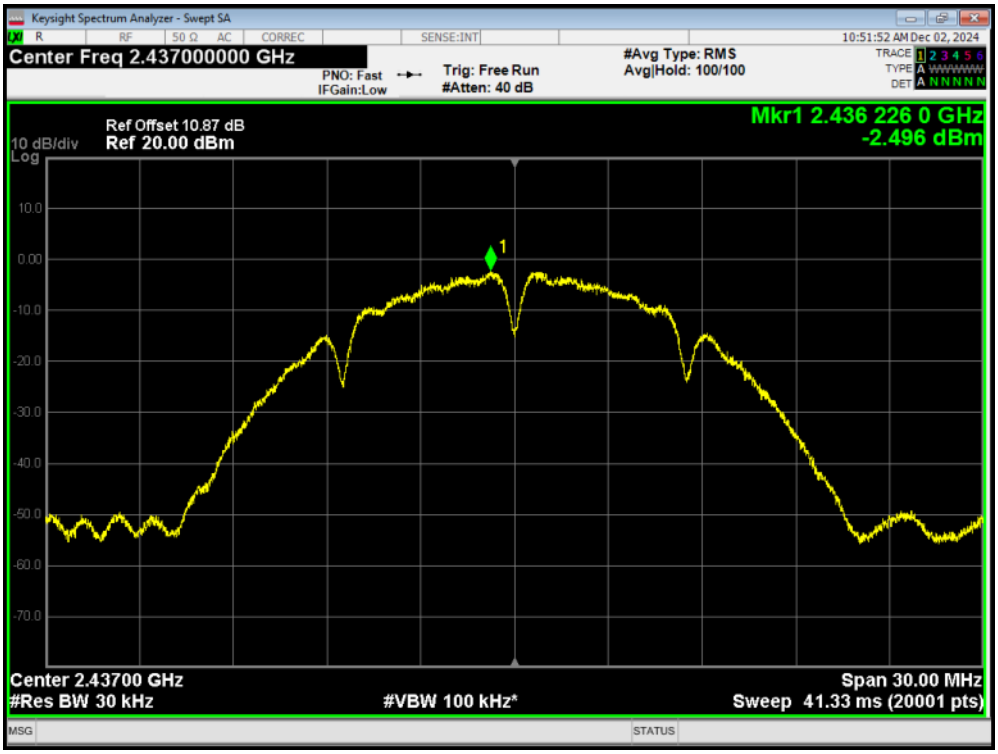
PSD BLE (S=8) 2480MHz



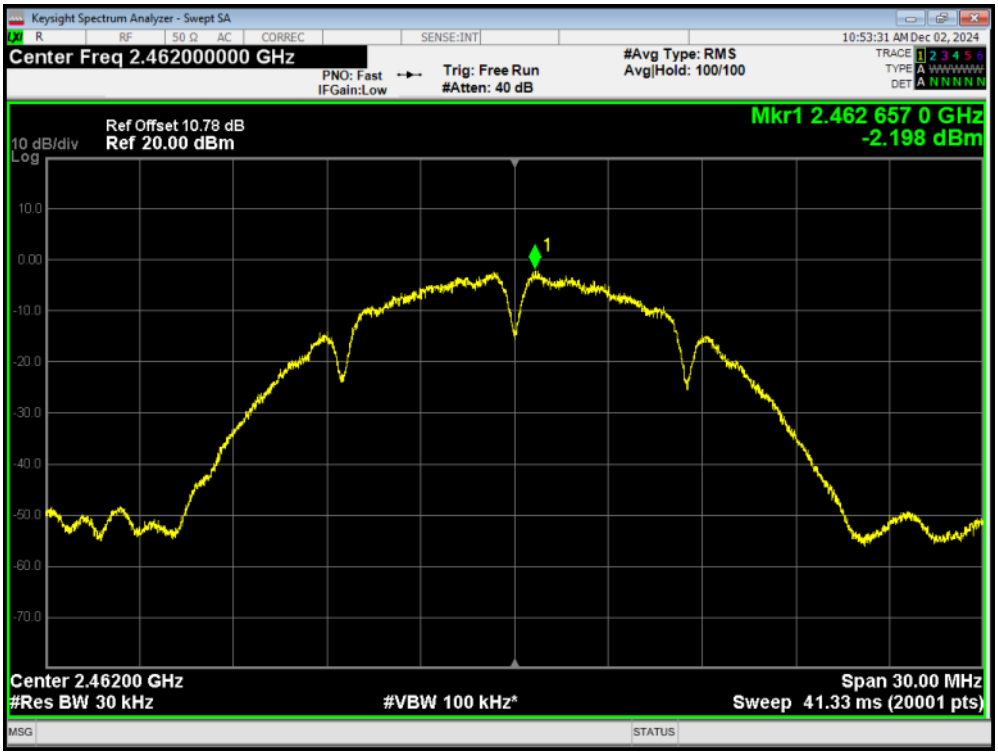
PSD 802.11b 2412MHz



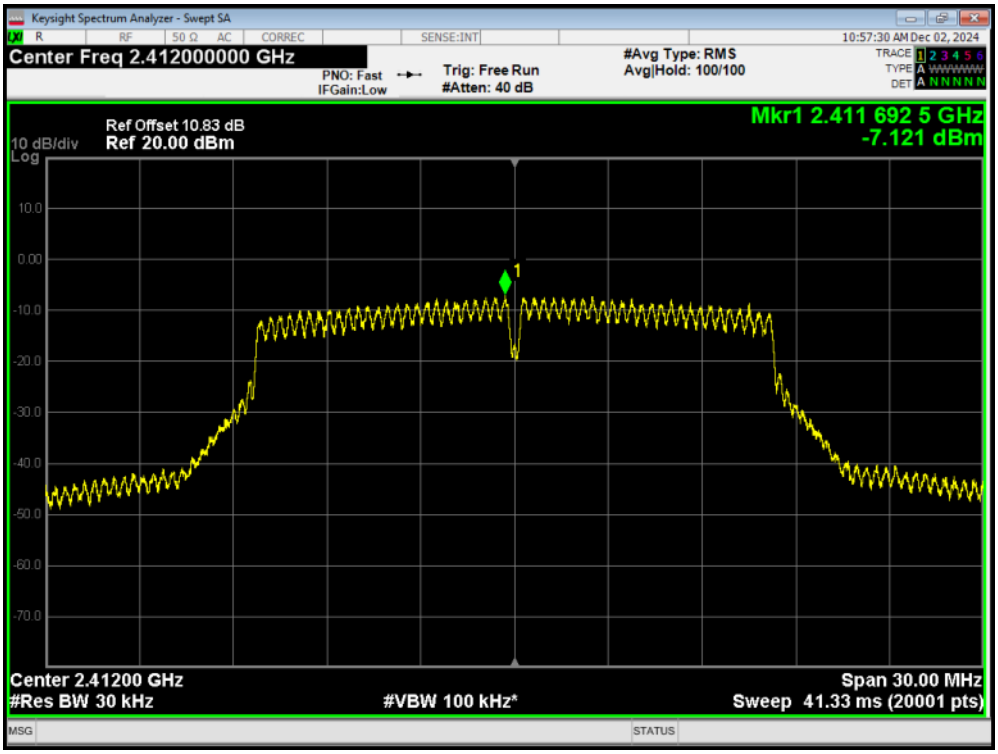
PSD 802.11b 2437MHz



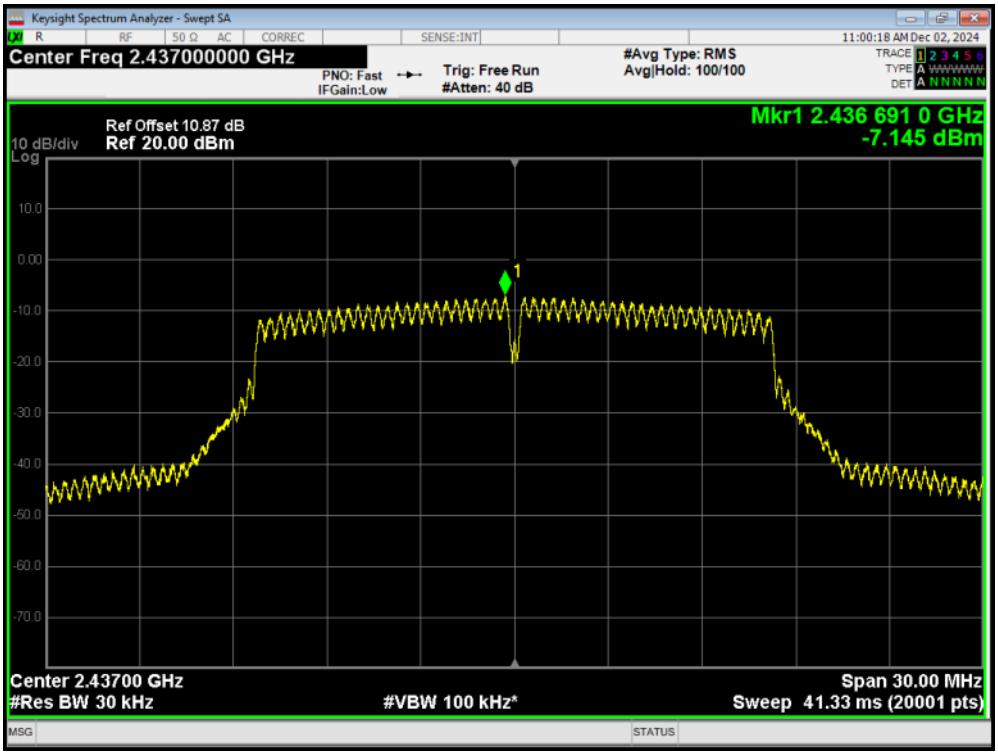
PSD 802.11b 2462MHz



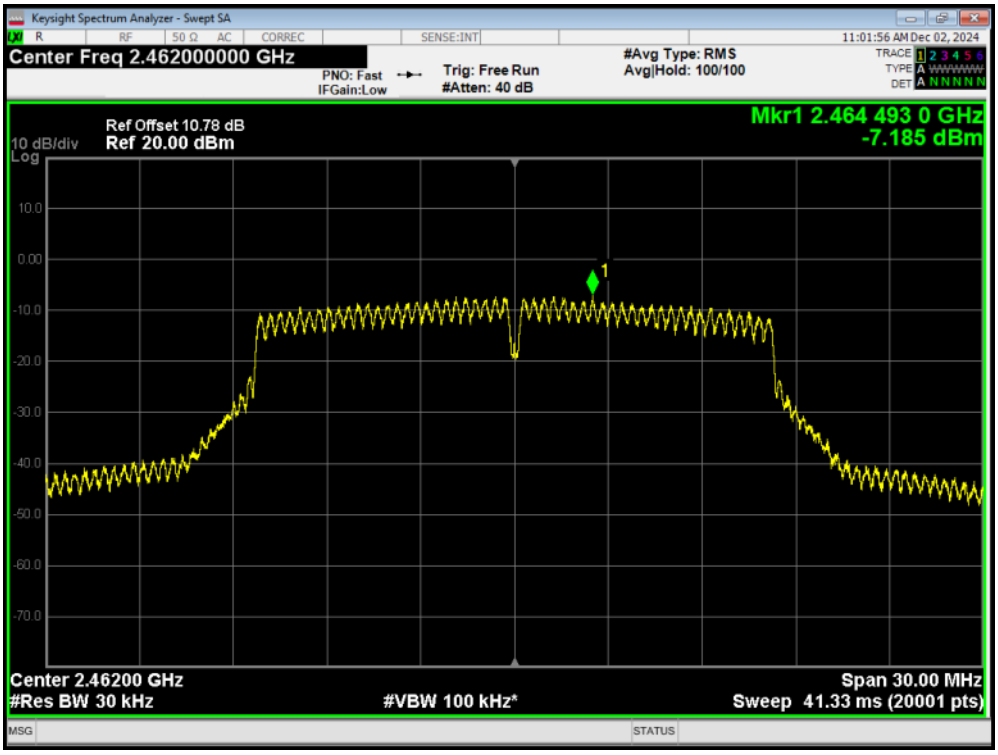
PSD 802.11g 2412MHz



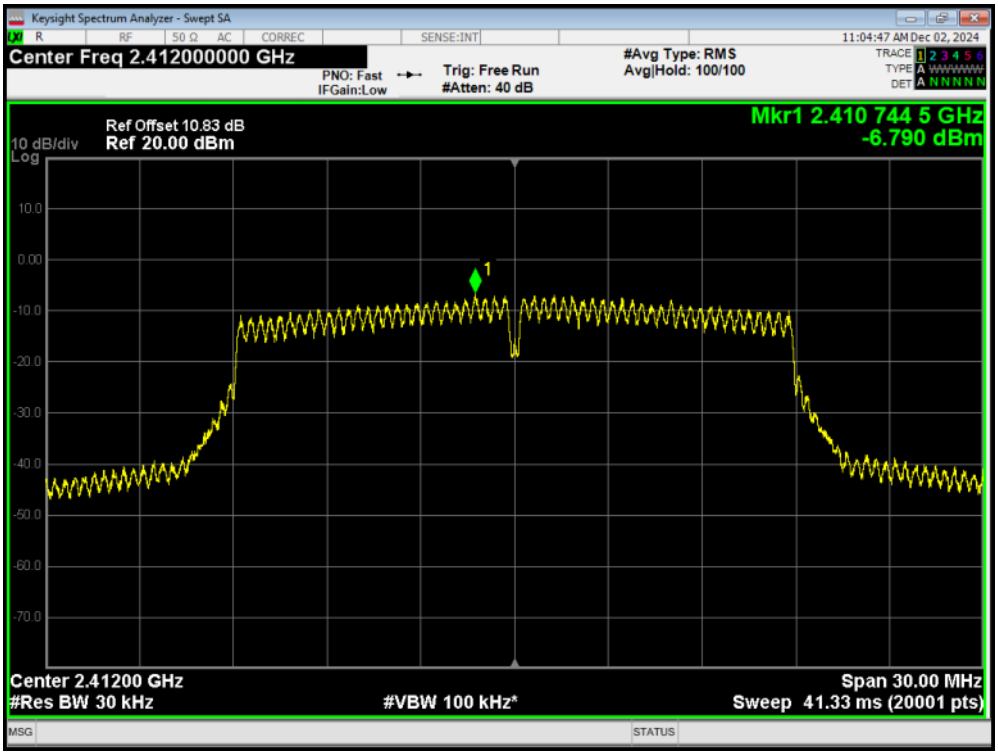
PSD 802.11g 2437MHz



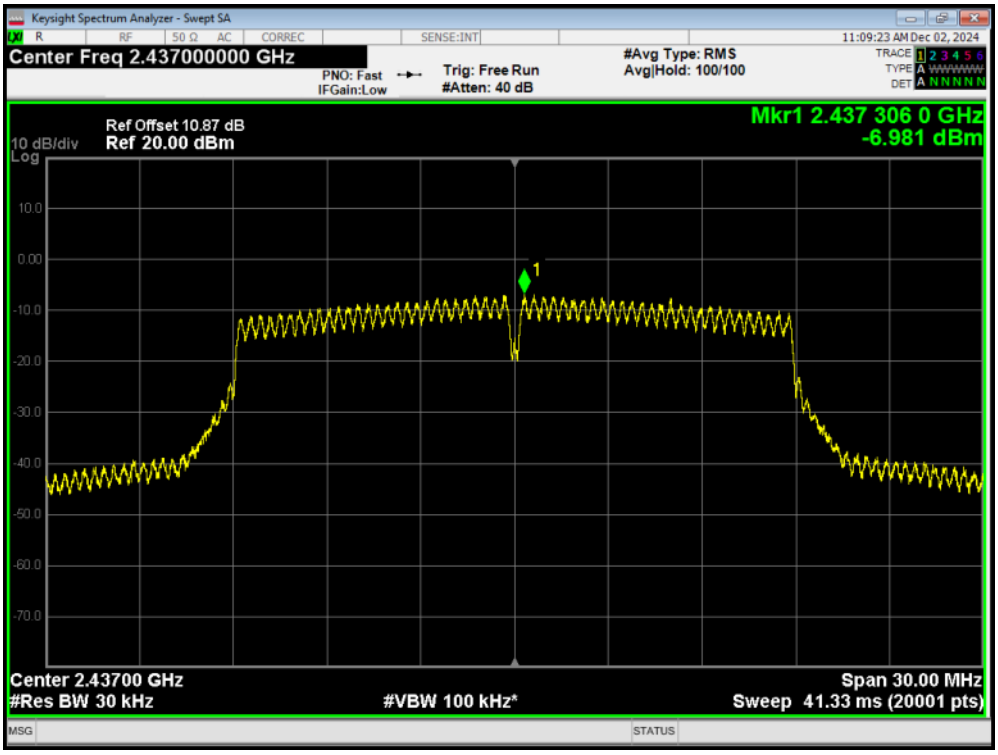
PSD 802.11g 2462MHz



PSD 802.11n(HT20) 2412MHz



PSD 802.11n(HT20) 2437MHz



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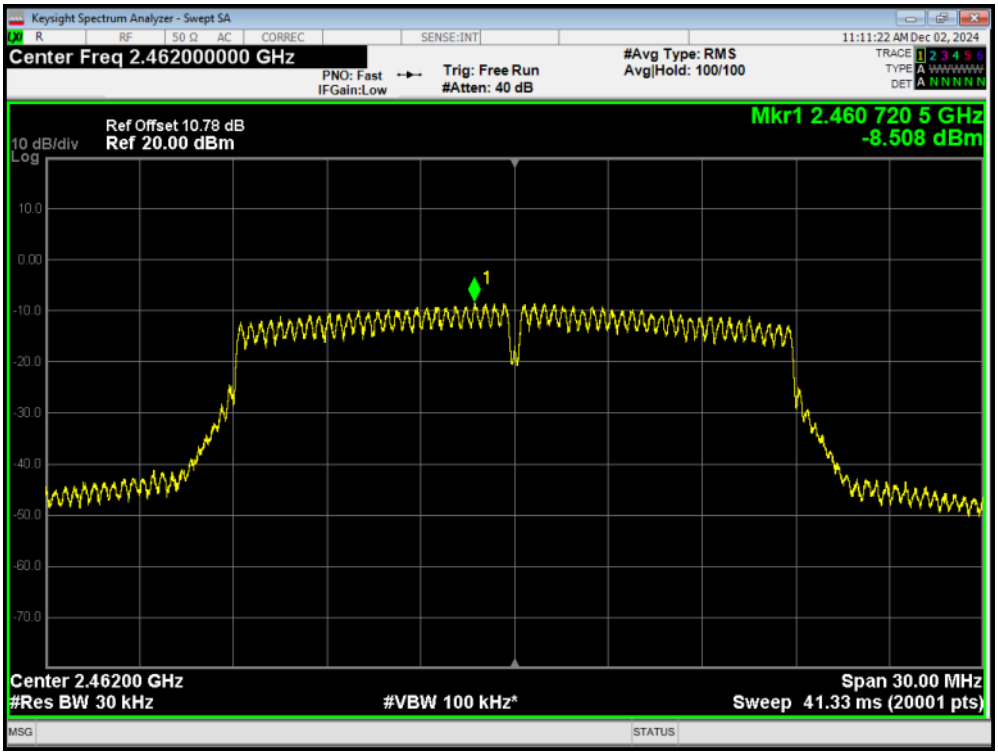

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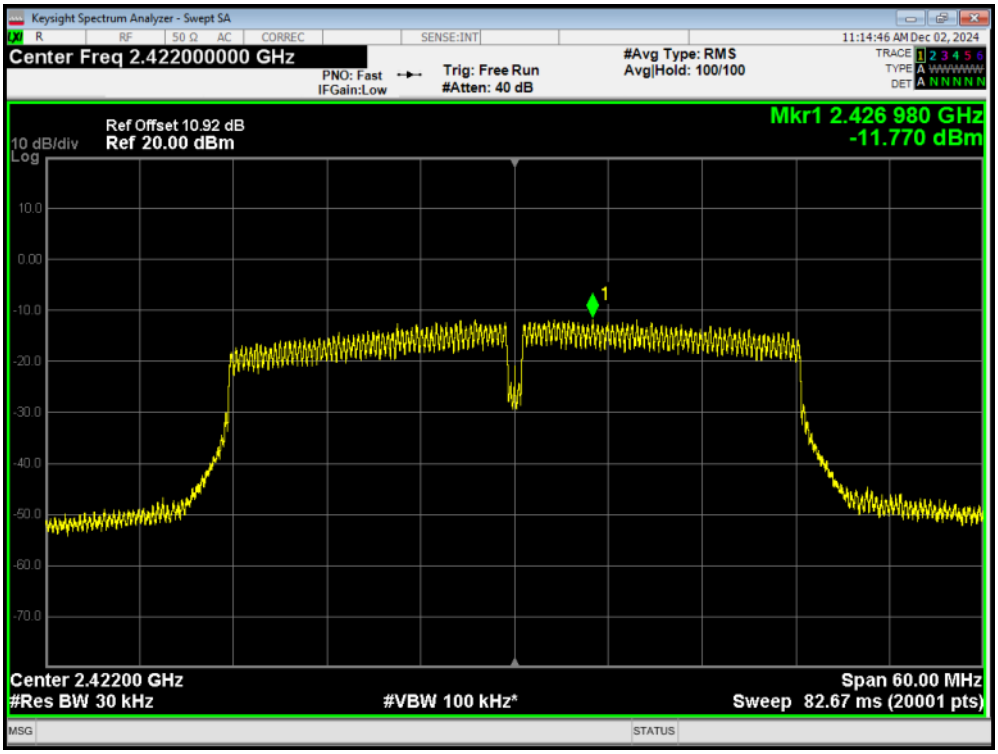

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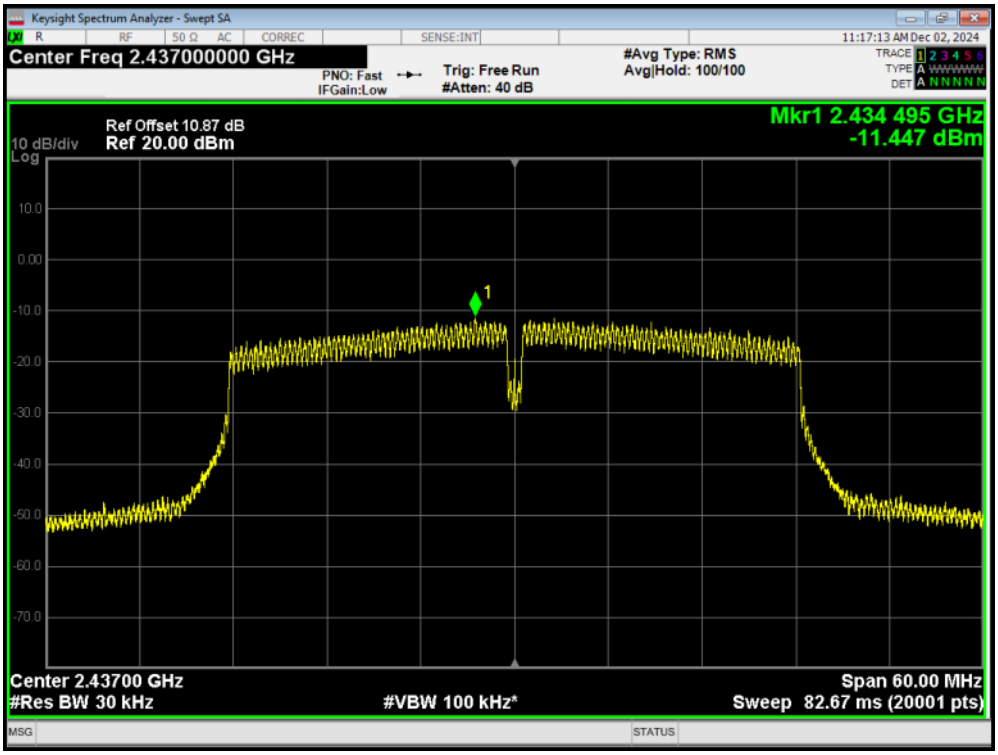
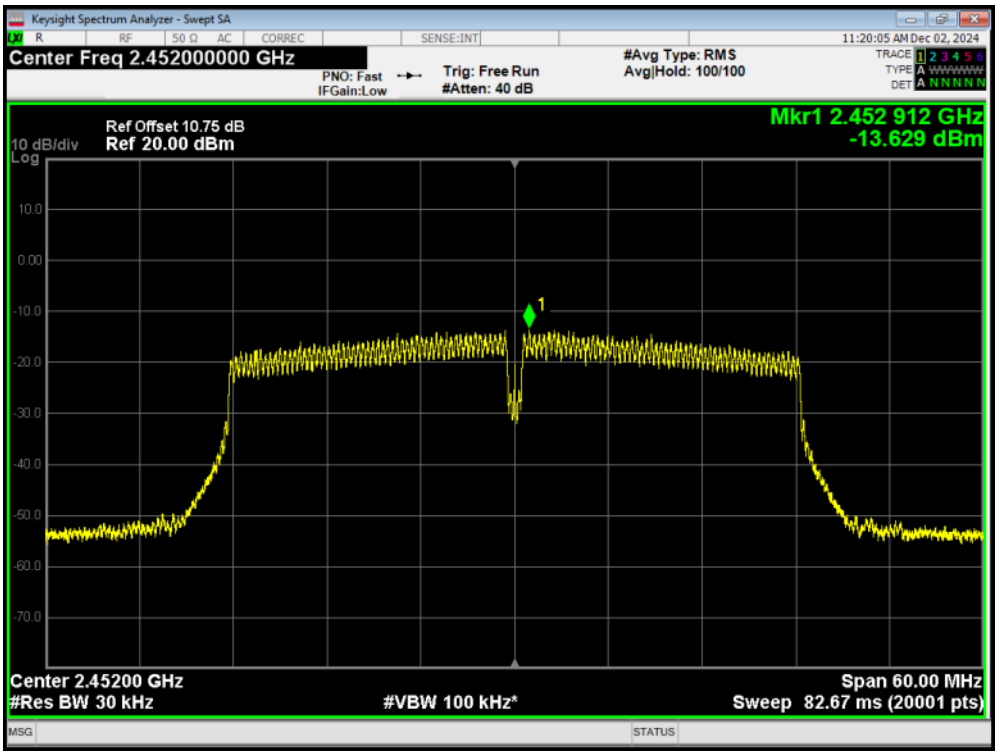


PSD 802.11n(HT40) 2452MHz



5.5. Spurious RF Conducted Emissions

Ambient Condition

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

Method of Measurement

The EUT was connected to the spectrum analyzer with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW to 100 kHz and VBW to 300 kHz, Sweep is set to AUTO.
The test is in transmitting mode.

Test Setup

Limits

Rule Part 15.247(d) pacifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. ”

Test Mode	Carrier frequency (MHz)	Reference value (dBm)	Limit
802.11b	2412	10.640	-19.36
	2437	10.590	-19.41
	2462	10.740	-19.26
802.11g	2412	5.860	-24.14
	2437	6.080	-23.92
	2462	6.350	-23.65
802.11n HT20	2412	5.900	-24.1
	2437	6.080	-23.92
	2462	4.110	-25.89
802.11n HT40	2422	1.840	-28.16
	2437	2.170	-27.83

	2452	-0.110	-30.11
Bluetooth (Low Energy) (1M)	2402	-1.340	-31.34
	2440	-1.100	-31.10
	2480	-0.730	-30.73
Bluetooth (Low Energy) (2M)	2402	-1.410	-31.41
	2440	-0.850	-30.85
	2480	-1.370	-31.37
Bluetooth (Low Energy) (S=2)	2402	-1.220	-31.22
	2440	-0.840	-30.84
	2480	-0.890	-30.89
Bluetooth (Low Energy) (S=8)	2402	-4.100	-34.10
	2440	-3.660	-33.66
	2480	-3.740	-33.74

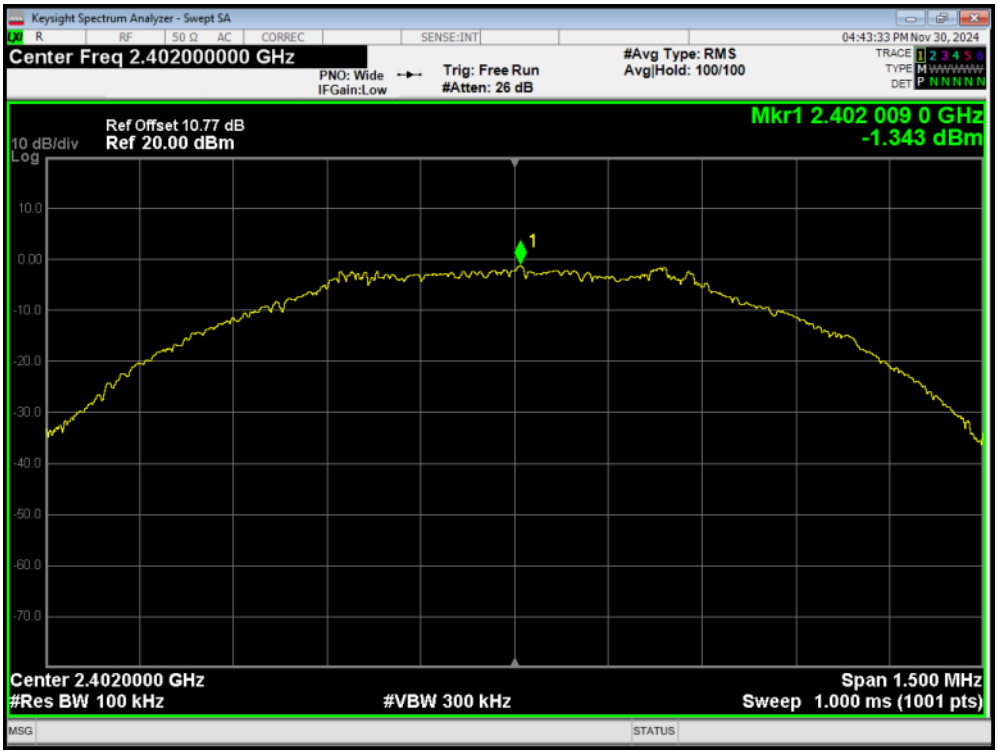
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96.

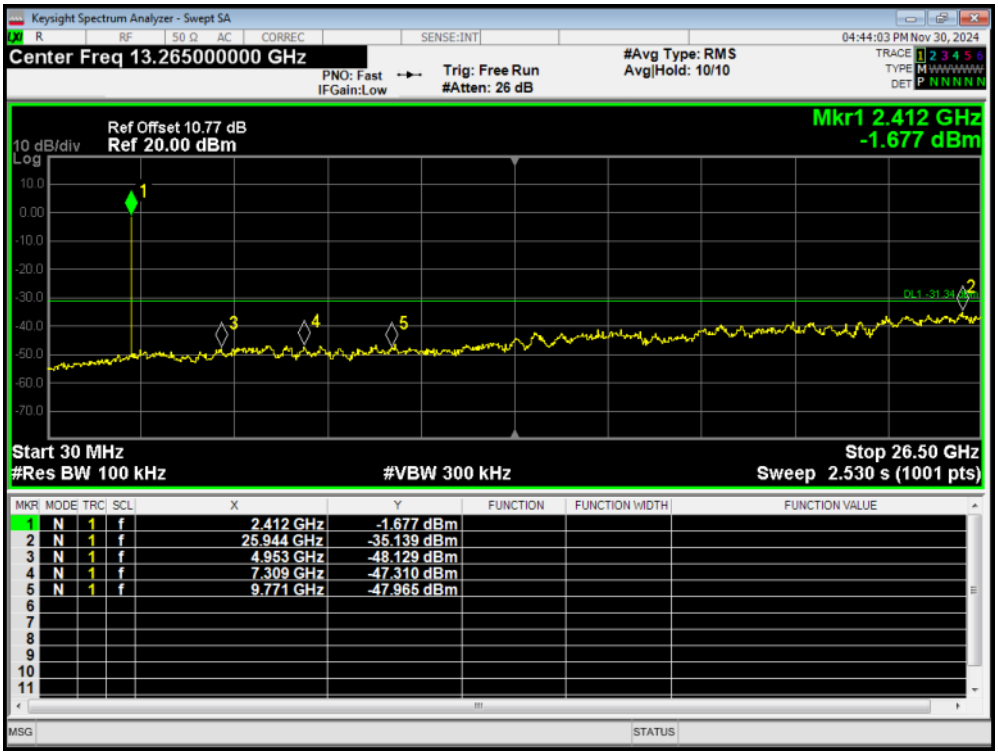
Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-26GHz	1.407 dB

Test Results:

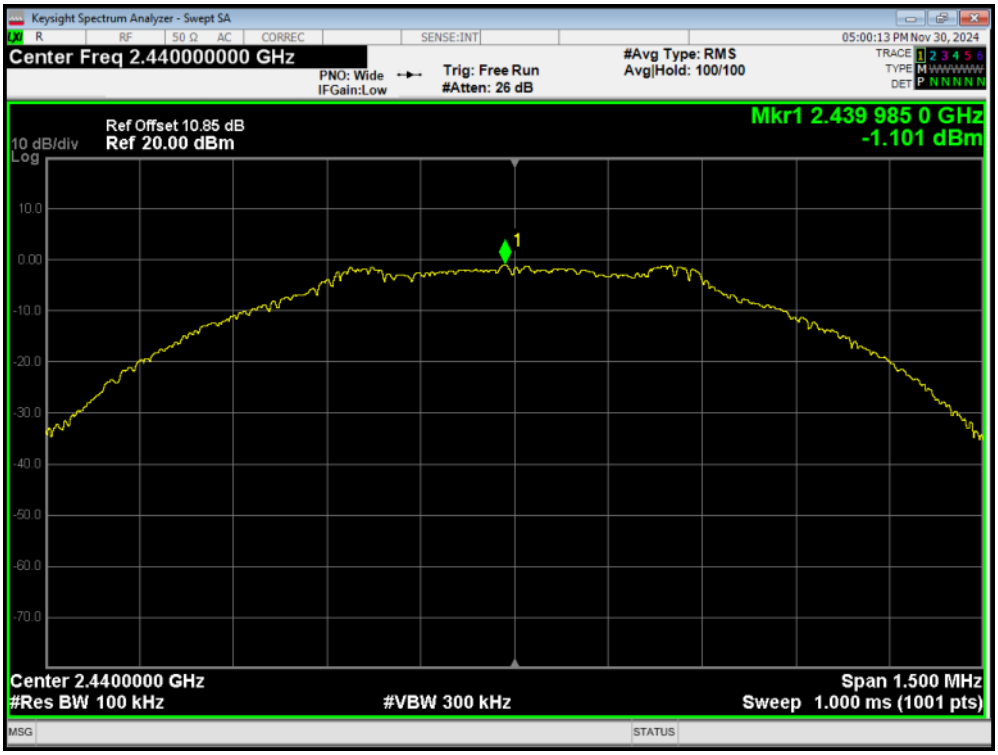
Tx. Spurious BLE (1M) 2402MHz Ref



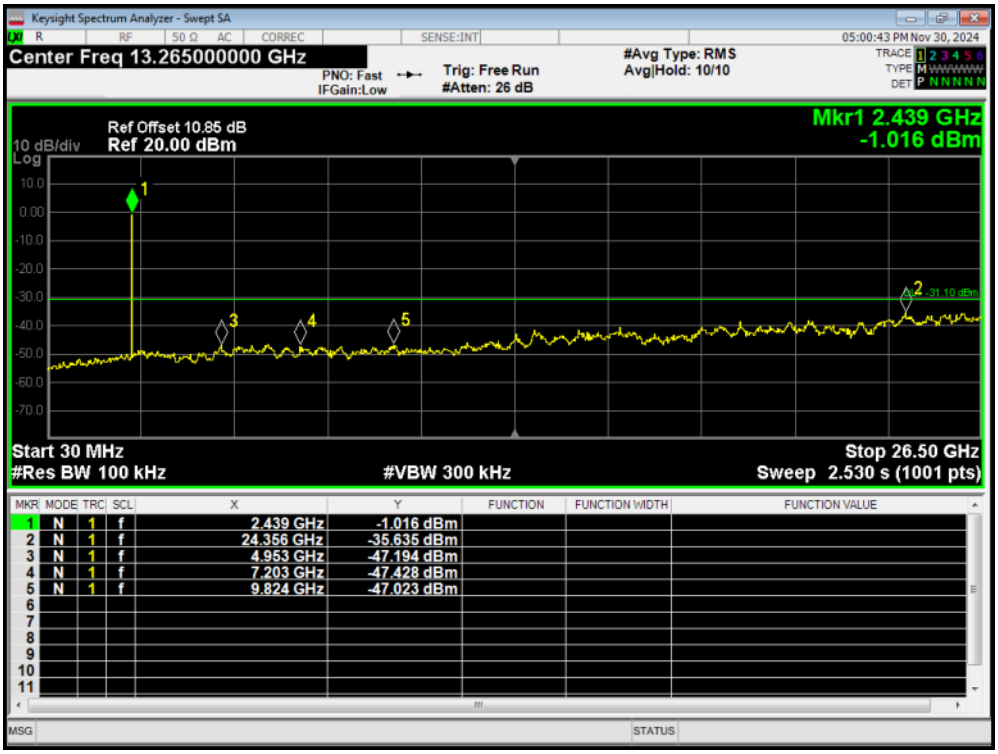
Tx. Spurious BLE (1M) 2402MHz Emission



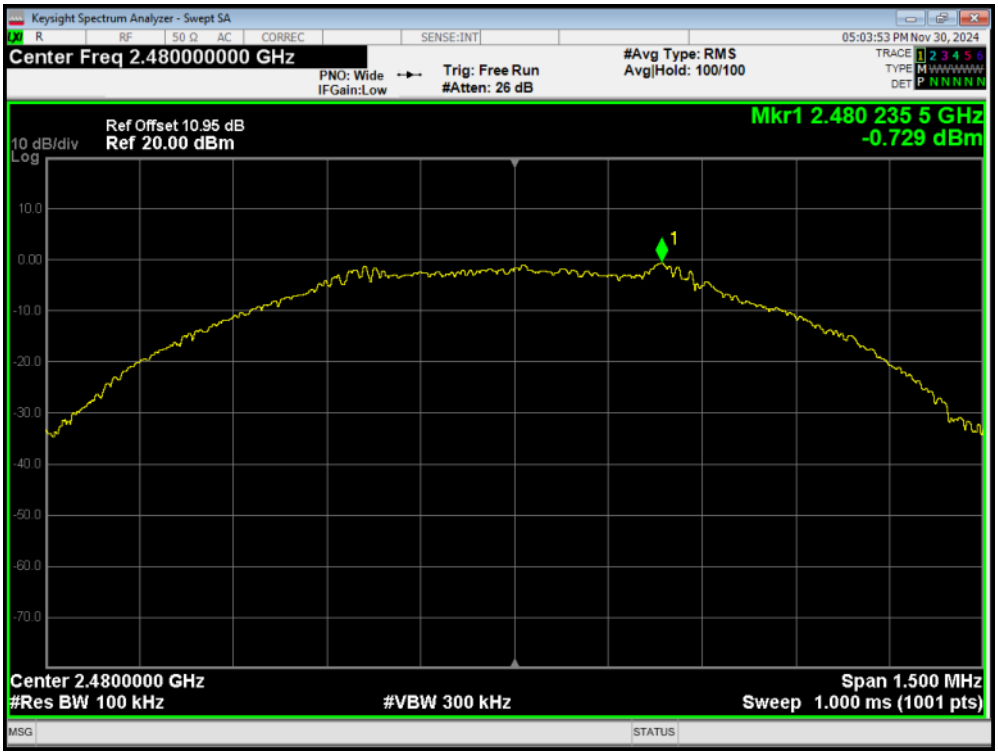
Tx. Spurious BLE (1M) 2440MHz Ref



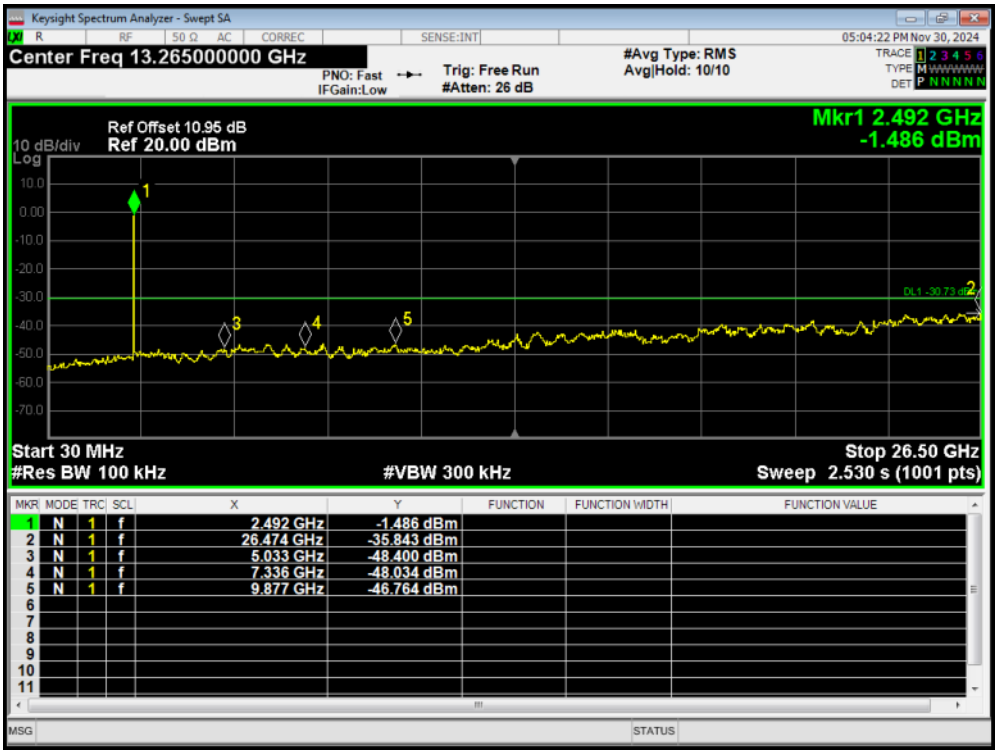
Tx. Spurious BLE (1M) 2440MHz Emission



Tx. Spurious BLE (1M) 2480MHz Ref

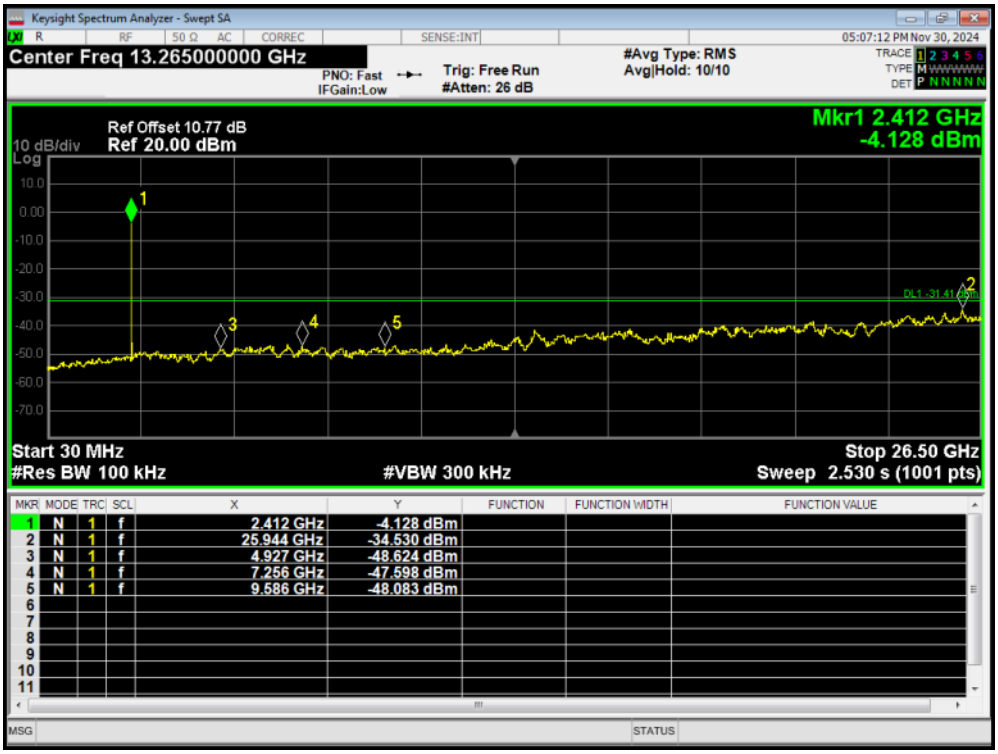


Tx. Spurious BLE (1M) 2480MHz Emission



Tx. Spurious BLE (2M) 2402MHz Ref

Tx. Spurious BLE (2M) 2402MHz Emission



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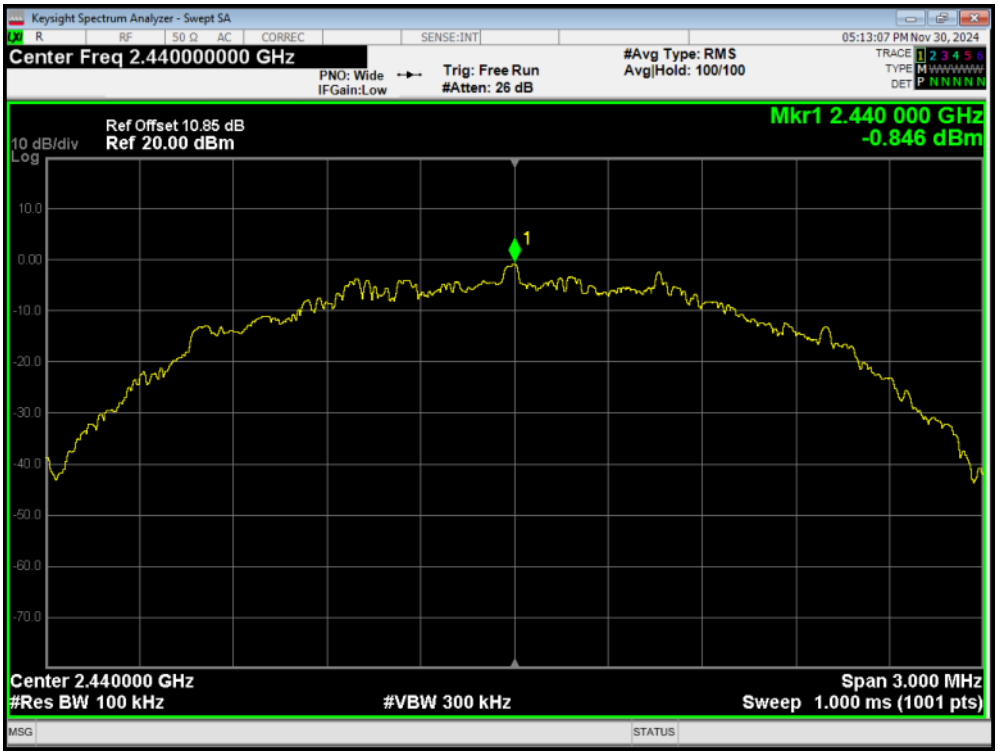

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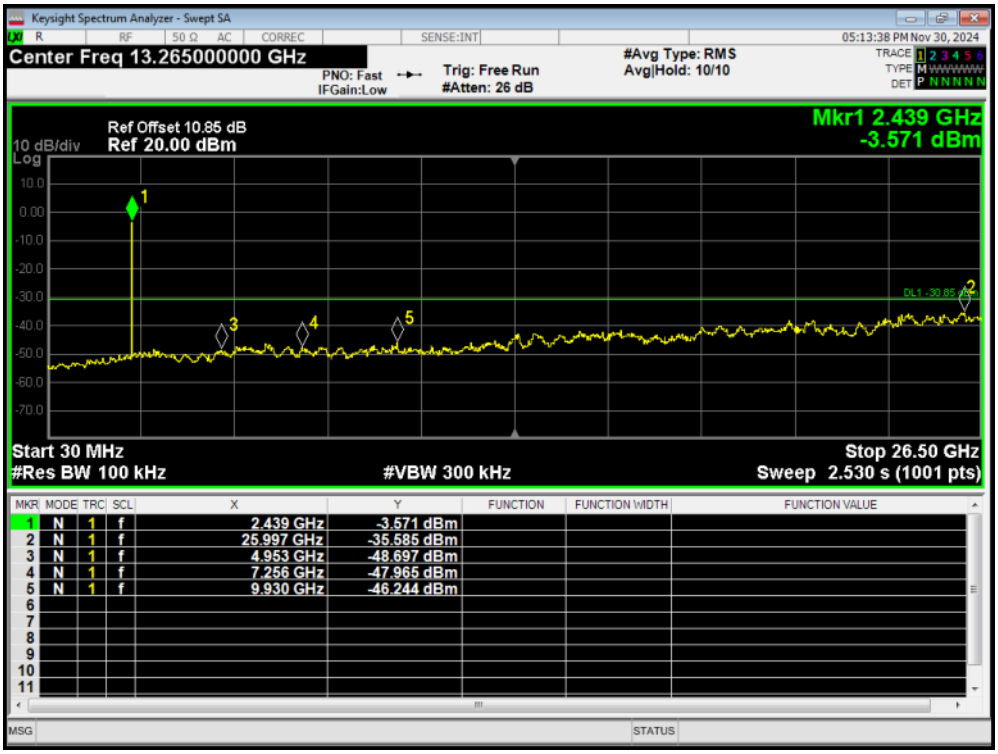
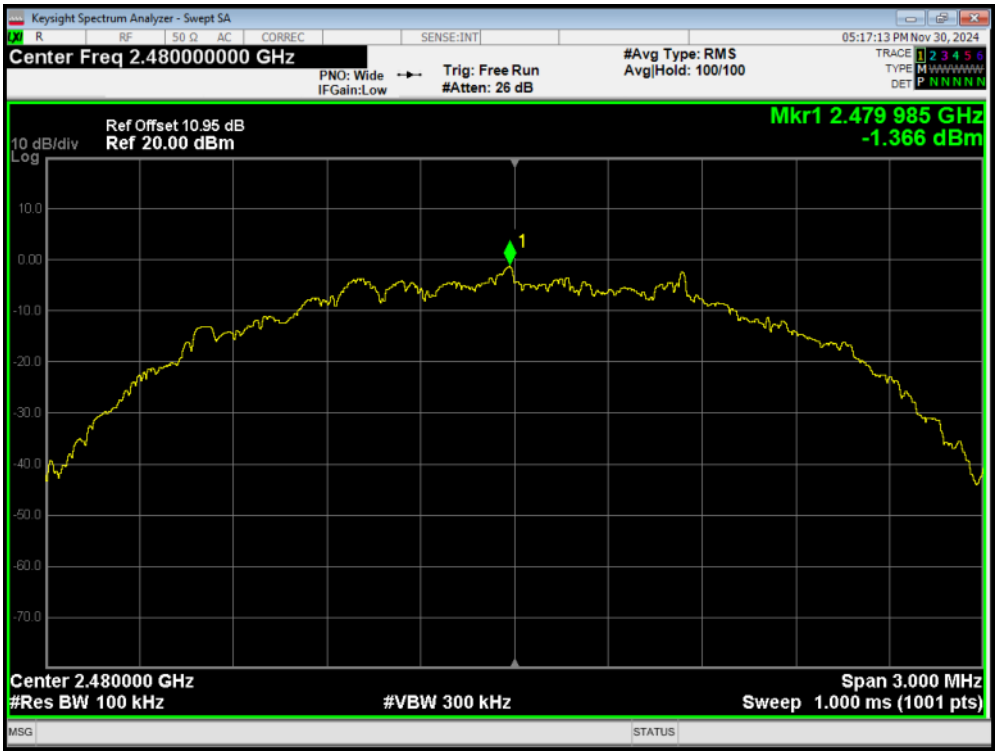
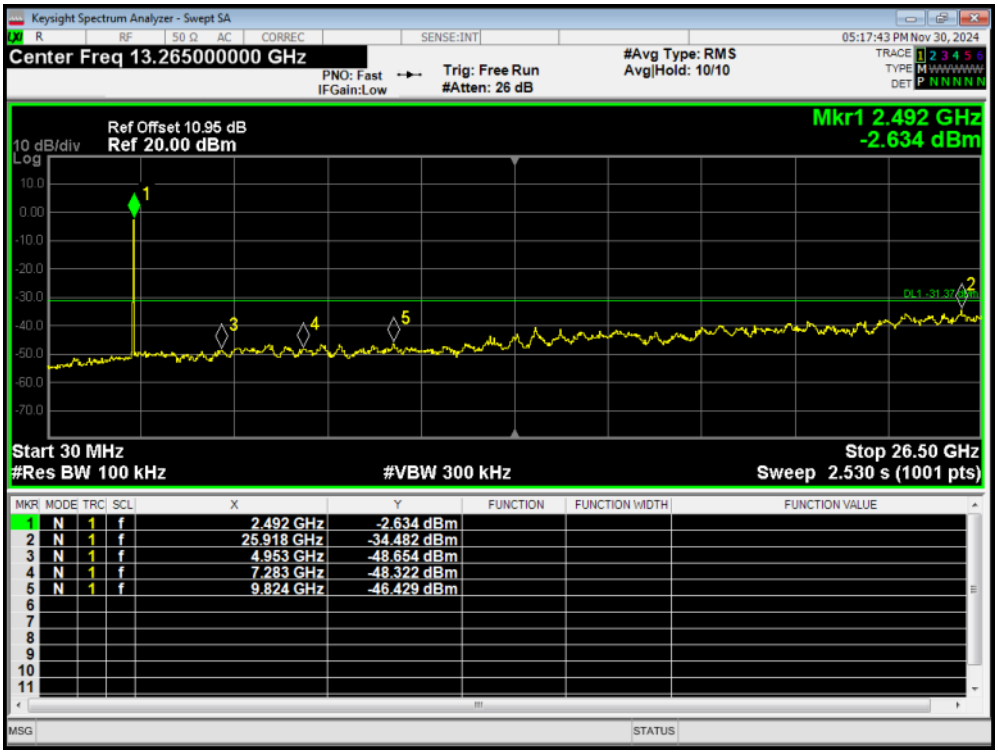


Tx. Spurious BLE (2M) 2480MHz Ref



Tx. Spurious BLE (2M) 2480MHz Emission



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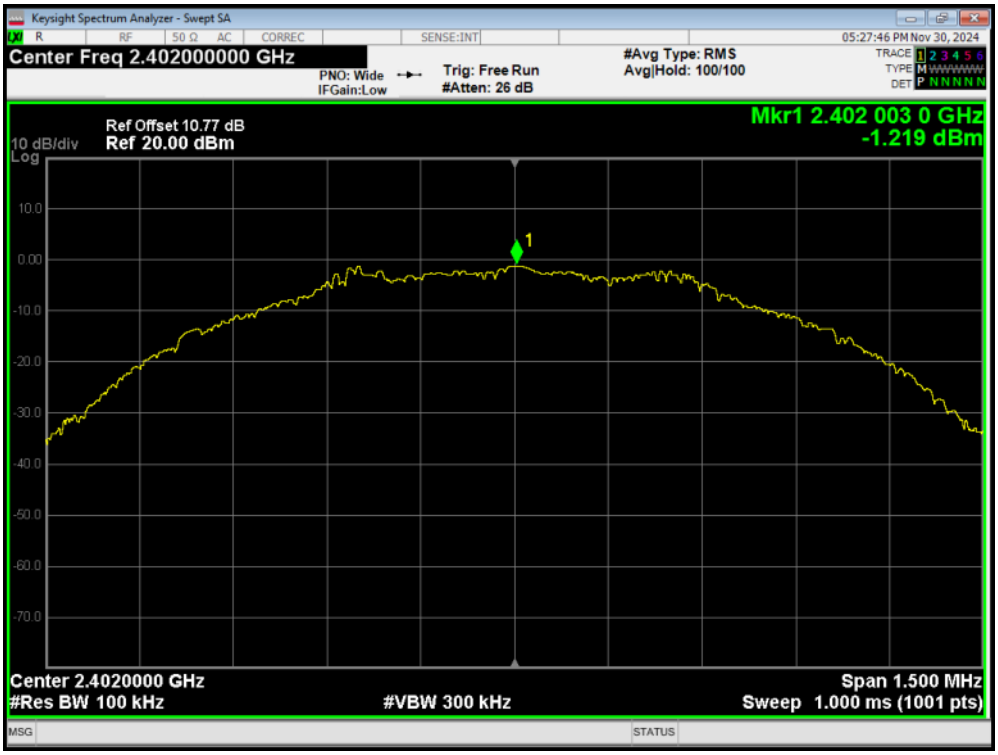
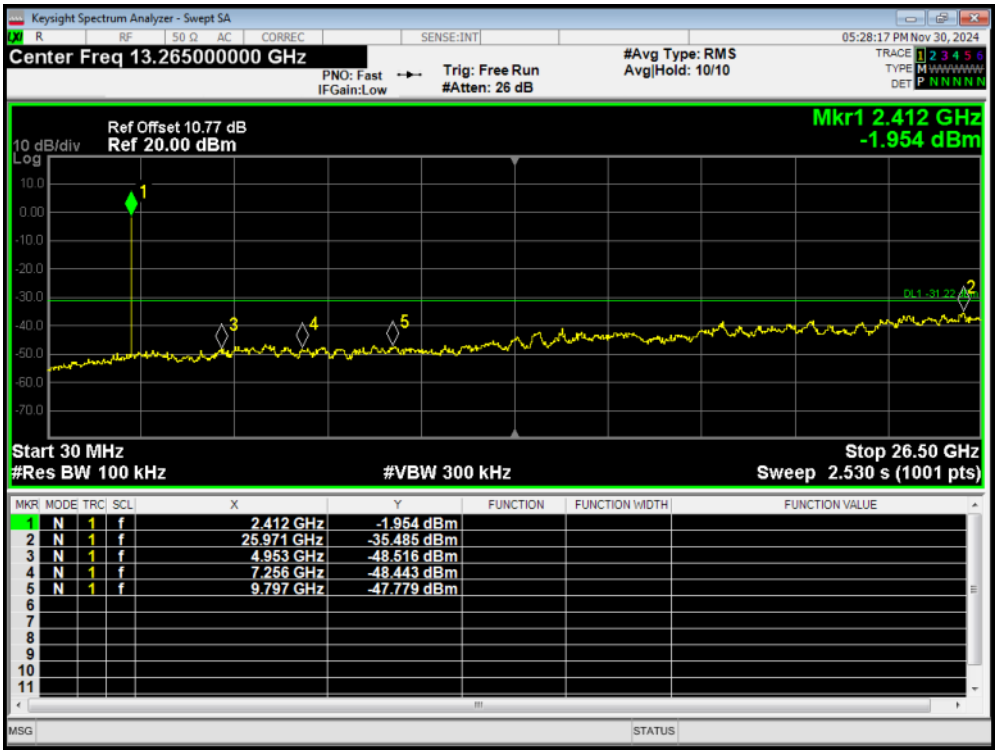


Tx. Spurious BLE (S=2) 2402MHz Emission



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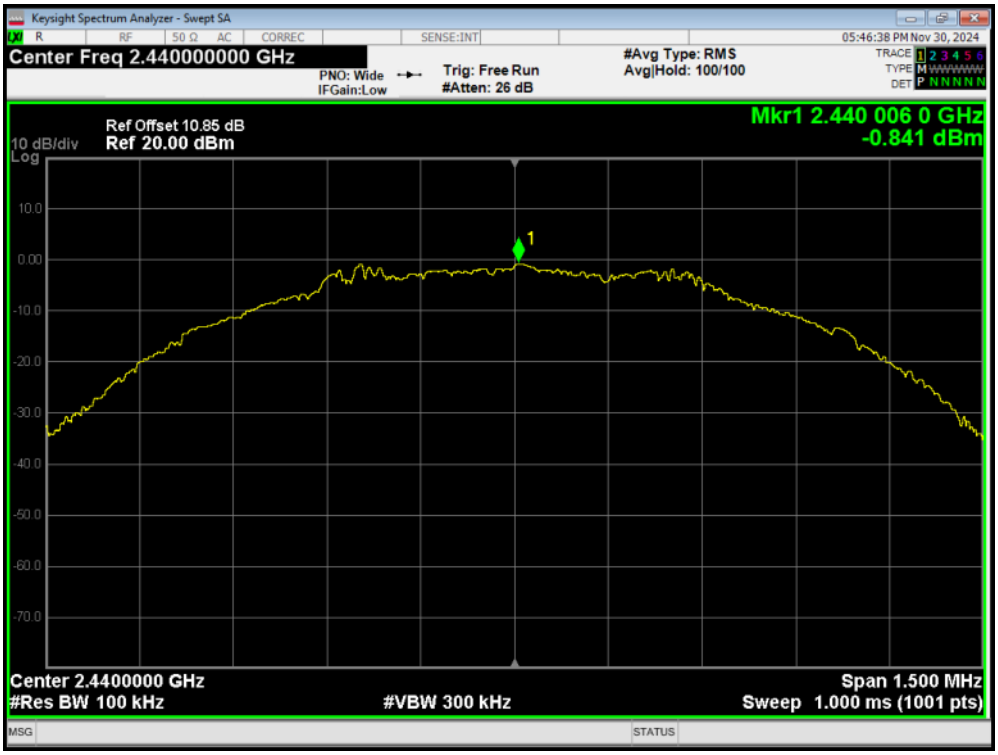

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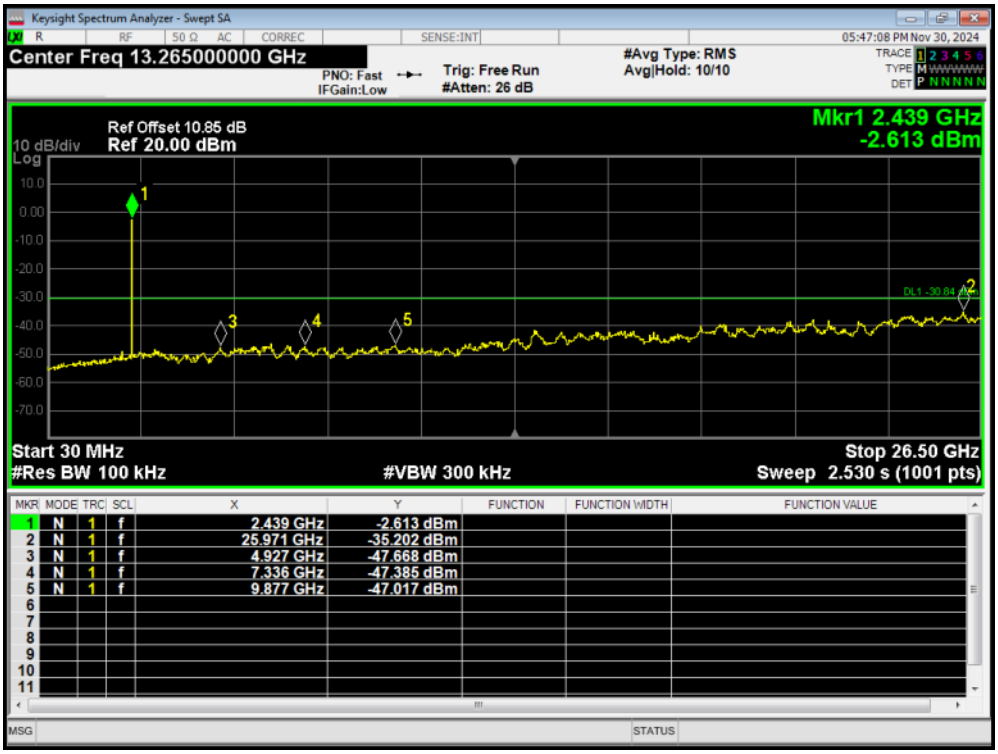

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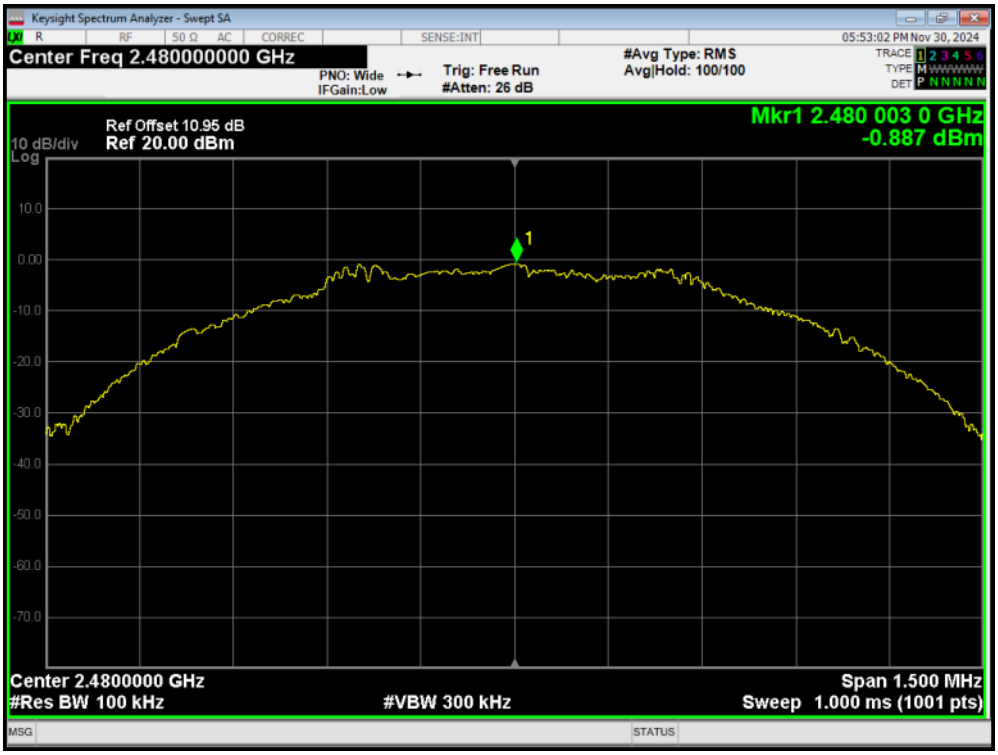
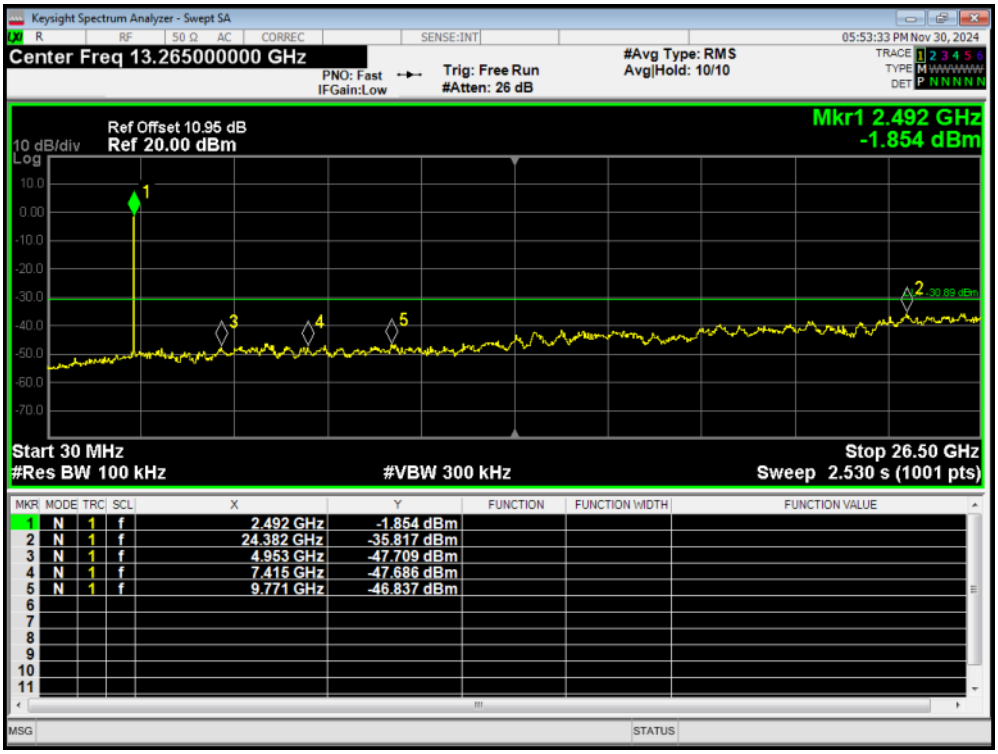
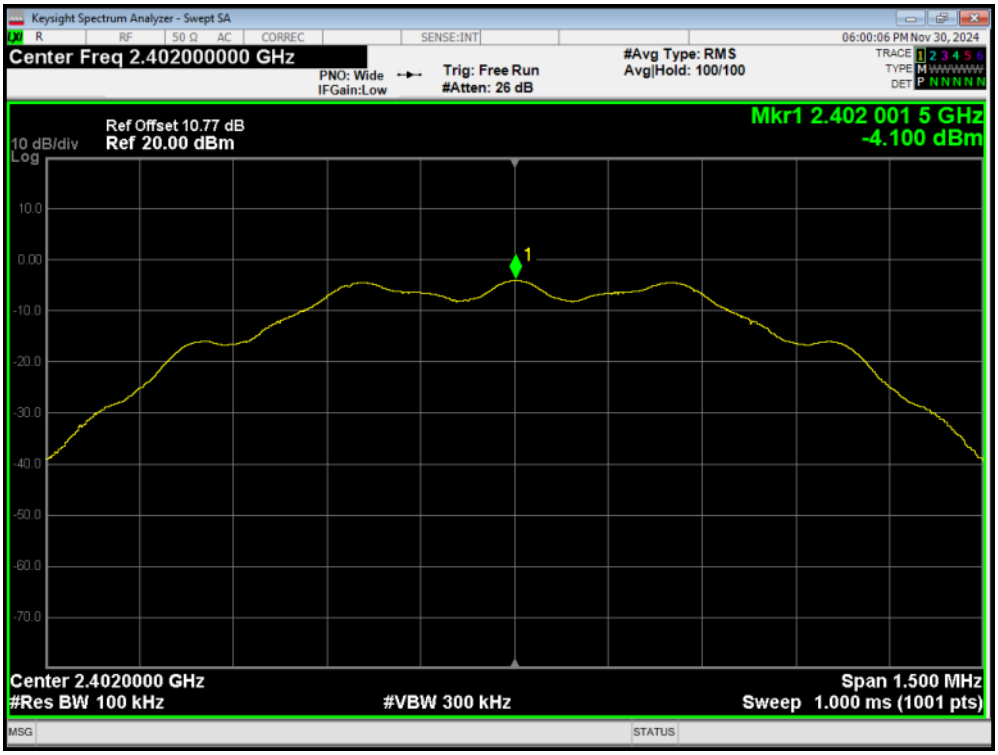


Tx. Spurious BLE (S=2) 2480MHz Emission



Tx. Spurious BLE (S=8) 2402MHz Ref



Tx. Spurious BLE (S=8) 2402MHz Emission