

RF TEST REPORT

Applicant Xiaomi Communications Co., Ltd.

FCC ID 2AFZZFRA65G

Product Mobile Phone

Brand Redmi

Model 2502FRA65G

Report No. R2410A1618-R5

Issue Date December 25, 2024

Eurofins TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2023)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	Maximum output power	15.247(b)(3)	PASS
2	99% Bandwidth and 6dB Bandwidth	15.247(a)(2) C63.10 6.9	PASS
3	Power spectral density	15.247(e)	PASS
4	Band Edge	15.247(d)	PASS
5	Spurious RF Conducted Emissions	15.247(d)	PASS
6	Unwanted Emissions	15.247(d), 15.205, 15.209	PASS
7	Conducted Emissions	15.207	PASS
Date of Testing: September 23, 2023 ~ October 7, 2023			
Date of Sample Received: September 20, 2023			
Note: All indications of Pass/Fail in this report are opinions expressed by Eurofins TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

2502FRA65G (Report No.: R2410A1618-R5) is a variant model of 23117RA68G (Report No.: R2309A0986-R5).

ID difference between 2502FRA65G and 23117RA68G: battery cover and Deco

The difference is derived from the ID set: Rear main camera bracket,

Motherboard bracket, flash shield, lens, Plastic & metal ring size changes.

Compared with the 23117RA68G, the 2502FRA65G adds a charging IC: SC6601A (Southchip)

Compared with N6, N6R adds NFC chip (THN31FGB1N), supplier: Beijing Tsingting

Microsystem Co., Ltd.

There is no additional test for variant in this report. Test values all duplicated from original report (Report No.: R2309A0986-R5).

The detailed product change description please refers to the *Difference Declaration Letter*.

1. Test Laboratory

1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **Eurofins TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test Facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3. Testing Location

Company: Eurofins TA Technology (Shanghai) Co., Ltd.
Address: Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City: Shanghai
Post code: 201201
Country: P. R. China
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Website: <https://www.eurofins.com/electrical-and-electronics>
E-mail: Kain.Xu@cpt.eurofinscn.com

2. General Description of Equipment Under Test

2.1. Applicant and Manufacturer Information

Applicant	Xiaomi Communications Co., Ltd.
Applicant address	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer	Xiaomi Communications Co., Ltd.
Manufacturer address	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

2.2. General Information

EUT Description				
Model	2502FRA65G			
IMEI	Original	Conducted	IMEI 1: 863357060096302 IMEI 2: 863357060096310	
		Radiated	Radiated Emission	IMEI 1: 863357060105648 IMEI 2: 863357060105655
			Conducted Emission	IMEI 1: 863357060104481 IMEI 2: 863357060106499
		Variant		IMEI 1: 866213070041589 IMEI 2: 866213070041597
	Hardware Version	135100N6R		
Software Version	Xiaomi Hyper OS1.0			
Antenna Type	PIFA Antenna			
Antenna Connector	A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)			
Antenna Gain	-3.6 dBi			
Additional Beamforming Gain	NA			
Operating Frequency Range(s)	802.11b/g/n(HT20): 2412 ~ 2462 MHz Bluetooth LE V5.2: 2402 ~2480 MHz			
Modulation Type	802.11b: DSSS 802.11g/n: OFDM Bluetooth LE: GFSK			
Max. Output Power	Wi-Fi 2.4G: 18.83 dBm Bluetooth LE: -1.01 dBm			
Note: 1. The EUT is sent from the applicant to Eurofins TA and the information of the EUT is declared by the applicant.				

3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards:

FCC CFR47 Part 15C (2023) Radio Frequency Devices

ANSI C63.10-2013

Reference standard:

KDB 558074 D01 15.247 Meas Guidance v05r02

4. Test Configuration

Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (Y axis) and the loop antenna is vertical, the others are vertical and horizontal. and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

Test Mode	Data Rate
Bluetooth(Low Energy)	1Mbps; 2Mbps
Bluetooth (Low Energy) (S=2)	500kbps
Bluetooth (Low Energy) (S=8)	125kbps
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0

5. Test Case Results

5.1. Maximum output power

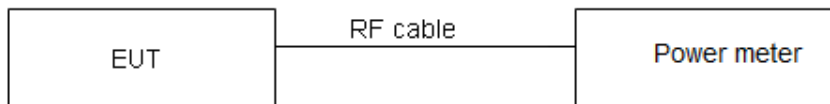
Ambient Condition

Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

Methods of Measurement

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

Test Setup



Limits

Rule Part 15.247 (b) (3) specifies that " For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz: 1 Watt."

Average Output Power	$\leq 1\text{W}$ (30dBm)
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.44$ dB.

Test Results

Bluetooth LE Power setting: default

Power Index			
Channel	802.11b	802.11g	802.11n HT20
CH1	19	18	18
CH6	19	18	18
CH11	19	18	18

Test Mode	Duty cycle	Duty cycle correction Factor (dB)
802.11b	0.997	0.000
802.11g	0.977	0.100
802.11n HT20	0.975	0.110
Bluetooth LE (1M)	0.851	0.700
Bluetooth LE (2M)	0.571	2.430
Bluetooth LE (S=2)	0.910	0.410
Bluetooth LE (S=8)	0.974	0.110
Note: when Duty cycle ≥ 0.98 , Duty cycle correction Factor not required.		

Test Mode	Carrier frequency (MHz))/ Channel	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11b	2412/CH 1	18.76	18.76	30	PASS
	2437/CH 6	18.83	18.83	30	PASS
	2462/CH11	18.73	18.73	30	PASS
802.11g	2412/CH 1	17.61	17.71	30	PASS
	2437/CH 6	17.95	18.05	30	PASS
	2462/CH11	17.81	17.92	30	PASS
802.11n HT20	2412/CH 1	17.51	17.62	30	PASS
	2437/CH 6	17.73	17.84	30	PASS
	2462/CH11	17.42	17.53	30	PASS
Bluetooth (Low Energy) (1M)	2402/CH0	-2.59	-1.89	30	PASS
	2440/CH19	-1.71	-1.01	30	PASS
	2480/CH39	-2.22	-1.52	30	PASS
Bluetooth (Low Energy) (2M)	2404/CH1	-4.29	-1.86	30	PASS
	2440/CH19	-3.58	-1.15	30	PASS
	2478/CH38	-3.99	-1.56	30	PASS
Bluetooth (Low Energy) (S=2)	2402/CH0	-2.38	-1.97	30	PASS
	2440/CH19	-1.46	-1.05	30	PASS
	2480/CH39	-2.17	-1.76	30	PASS
Bluetooth (Low Energy) (S=8)	2402/CH0	-2.08	-1.97	30	PASS
	2440/CH19	-1.17	-1.06	30	PASS
	2480/CH39	-1.80	-1.69	30	PASS

Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor

5.2. 99% Bandwidth and 6dB Bandwidth

Ambient Condition

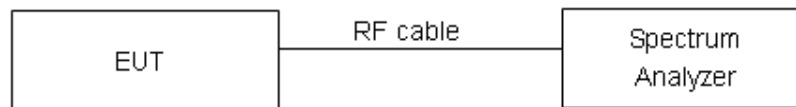
Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 100 kHz; VBW is set to 300 kHz on spectrum analyzer. Detector=Peak, Trace mode=max hold.

The EUT was connected to the spectrum analyzer through a known loss cable. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value.

Test Setup



Limits

Rule Part 15.247 (a) (2) specifies that “Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.”

minimum 6 dB bandwidth	≥ 500 kHz
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Measurement Uncertainty

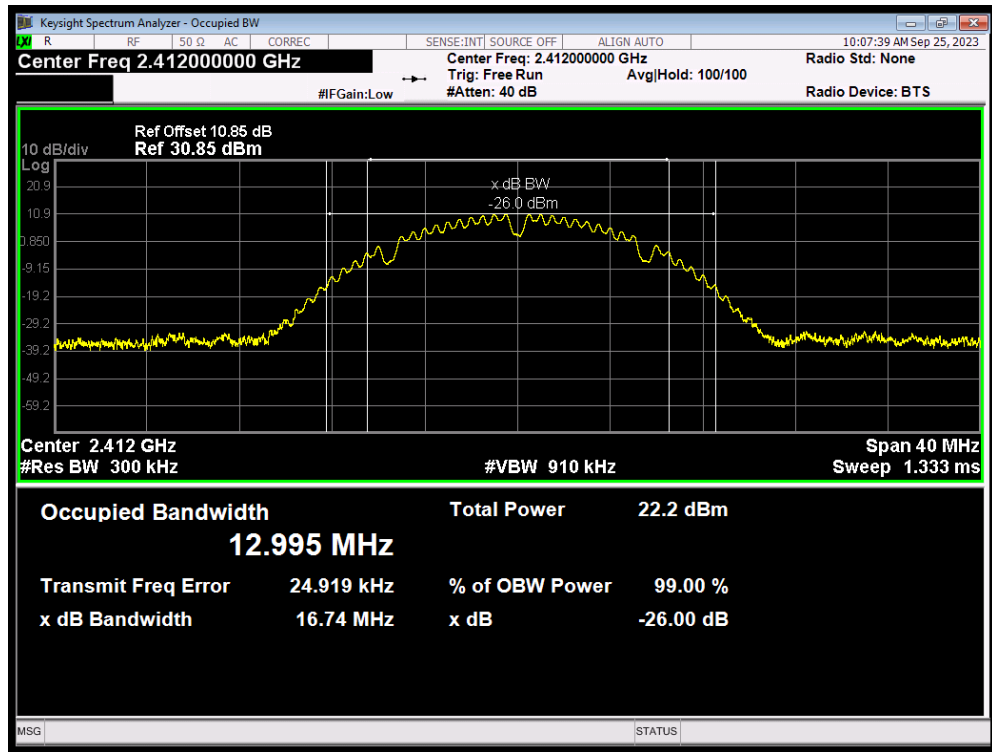
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936$ Hz.

Test Results:

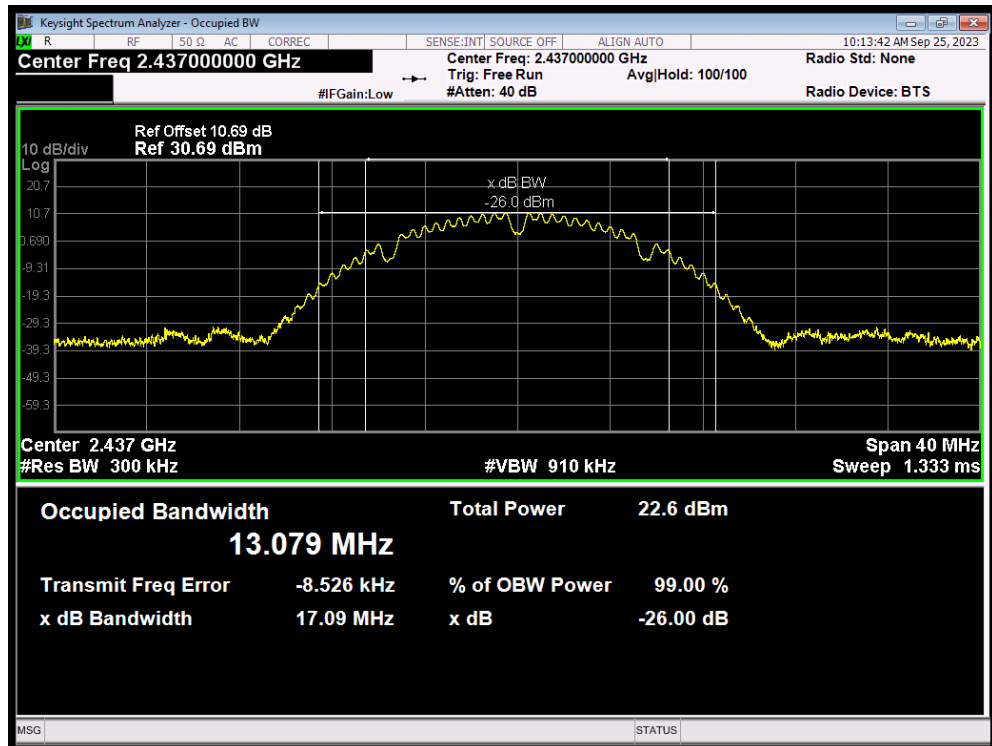
Test Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11b	2412	12.995	7.569	500	PASS
	2437	13.079	9.040	500	PASS
	2462	13.159	7.528	500	PASS
802.11g	2412	16.651	14.229	500	PASS
	2437	16.591	14.113	500	PASS
	2462	16.692	15.406	500	PASS
802.11n HT20	2412	17.739	15.918	500	PASS
	2437	17.700	15.112	500	PASS
	2462	17.763	14.988	500	PASS
Bluetooth (Low Energy) (1M)	2402	1.042	0.680	500	PASS
	2440	1.044	0.659	500	PASS
	2480	1.042	0.662	500	PASS
Bluetooth (Low Energy) (2M)	2404	2.080	1.268	500	PASS
	2440	2.079	1.308	500	PASS
	2478	2.087	1.166	500	PASS
Bluetooth (Low Energy) (S=2)	2402	1.031	0.690	500	PASS
	2440	1.029	0.665	500	PASS
	2480	1.022	0.675	500	PASS
Bluetooth (Low Energy) (S=8)	2402	1.057	0.683	500	PASS
	2440	1.054	0.682	500	PASS
	2480	1.059	0.682	500	PASS

99%bandwidth

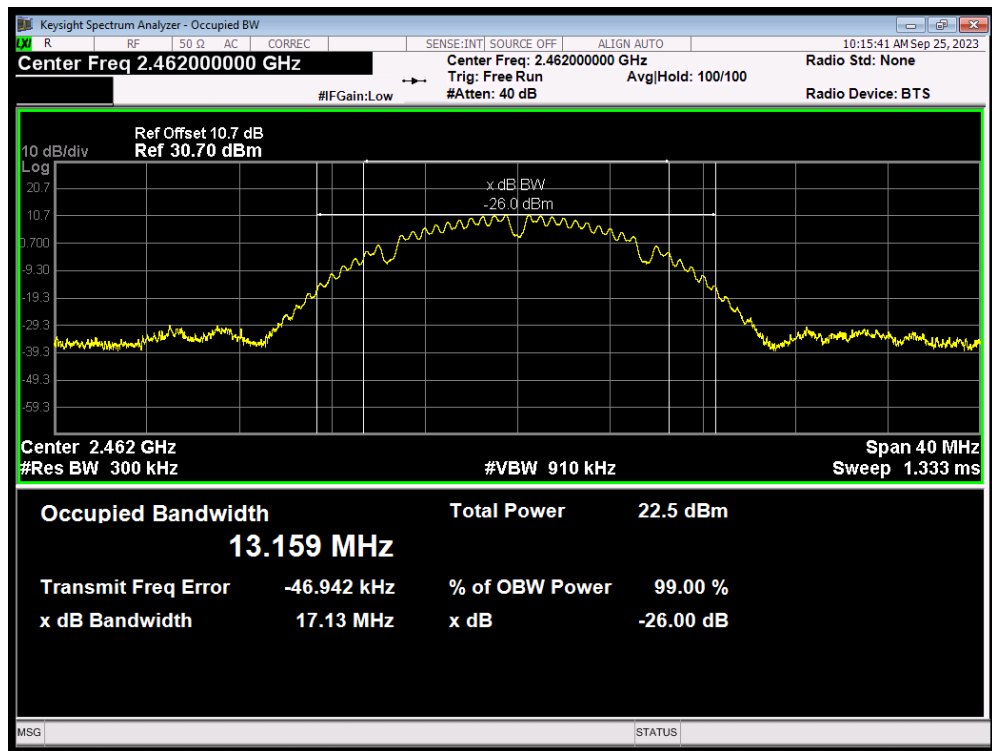
OBW 802.11b 2412MHz



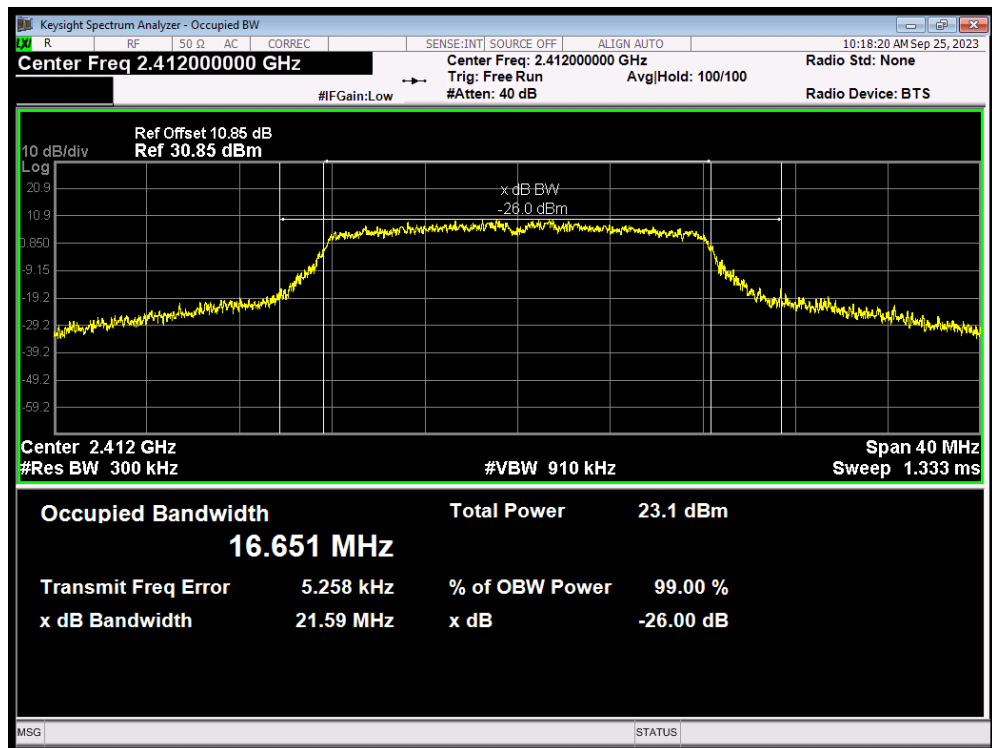
OBW 802.11b 2437MHz



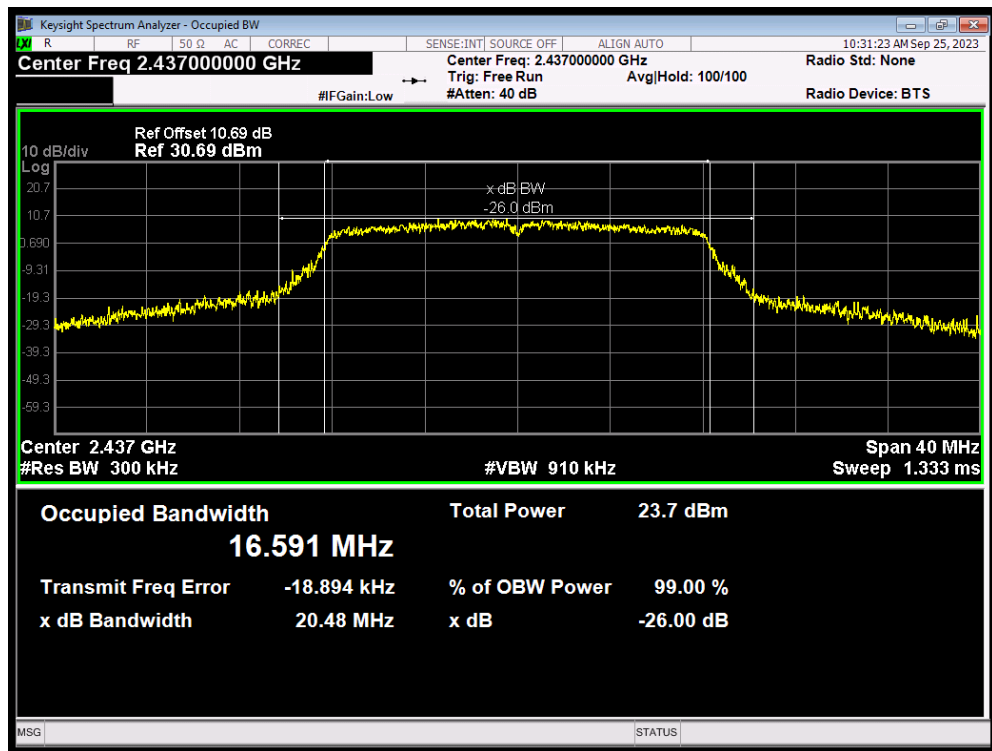
OBW 802.11b 2462MHz



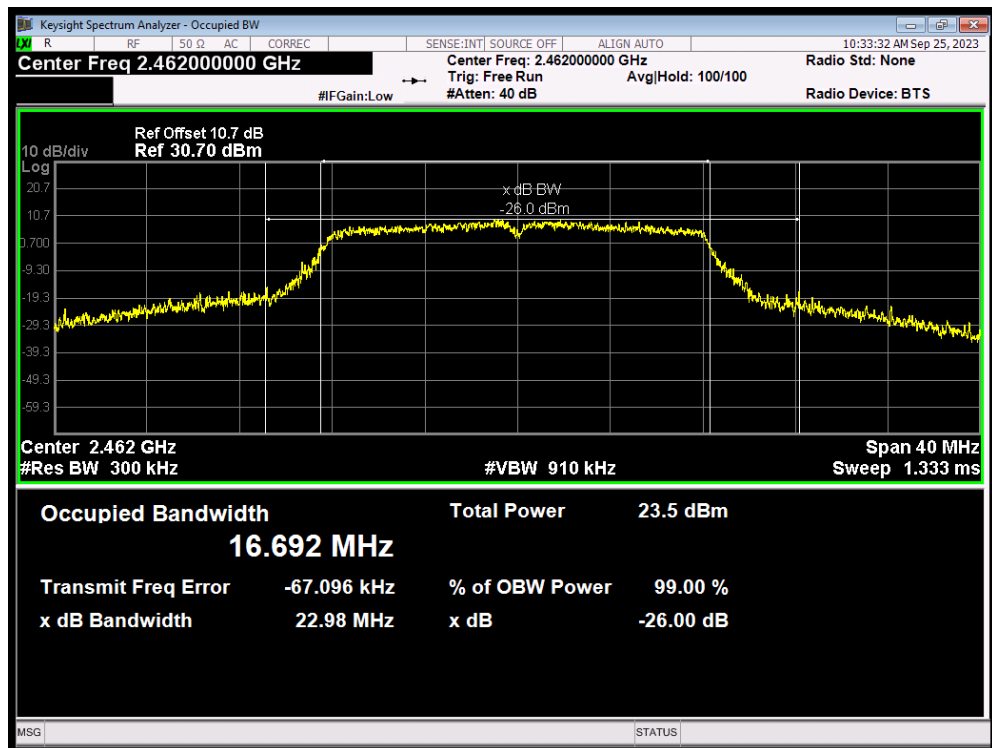
OBW 802.11g 2412MHz



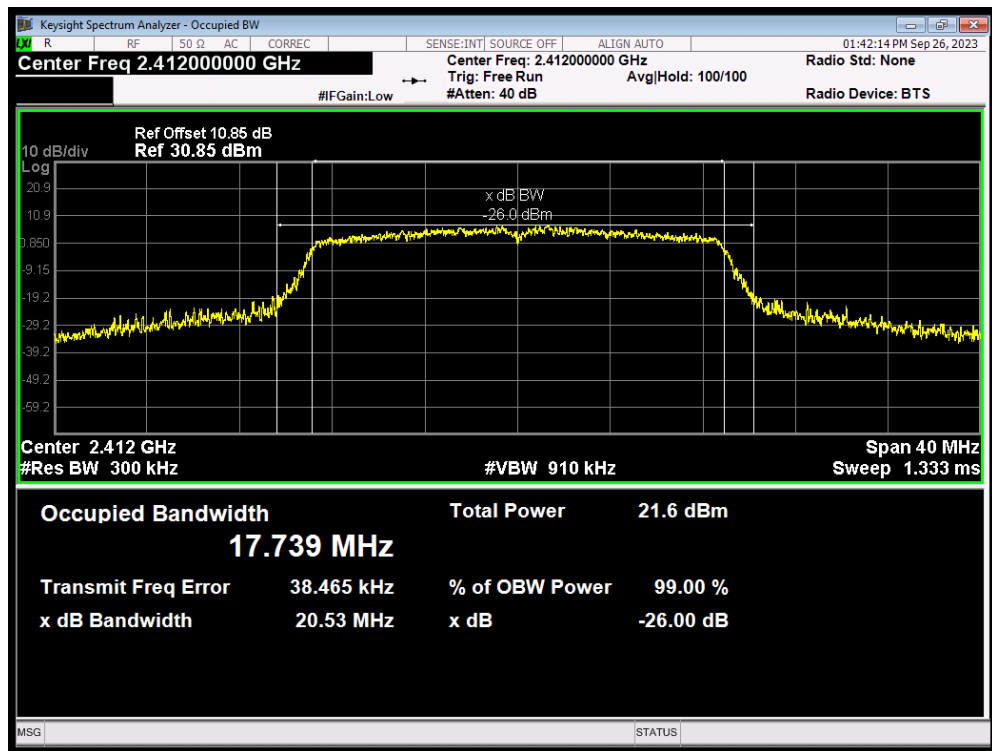
OBW 802.11g 2437MHz



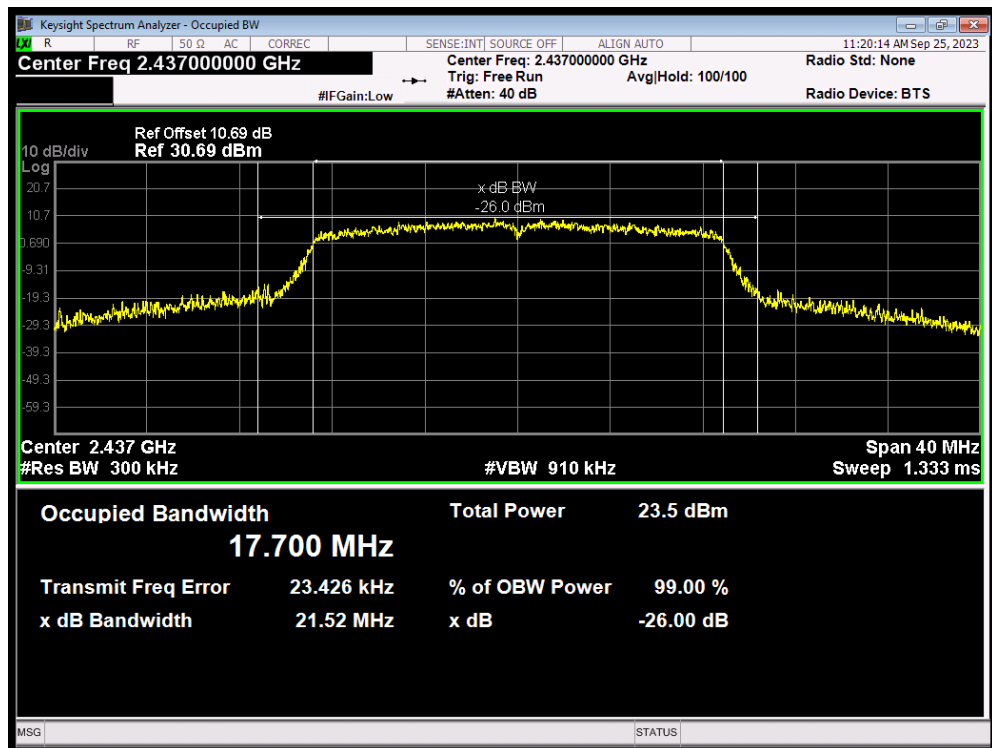
OBW 802.11g 2462MHz



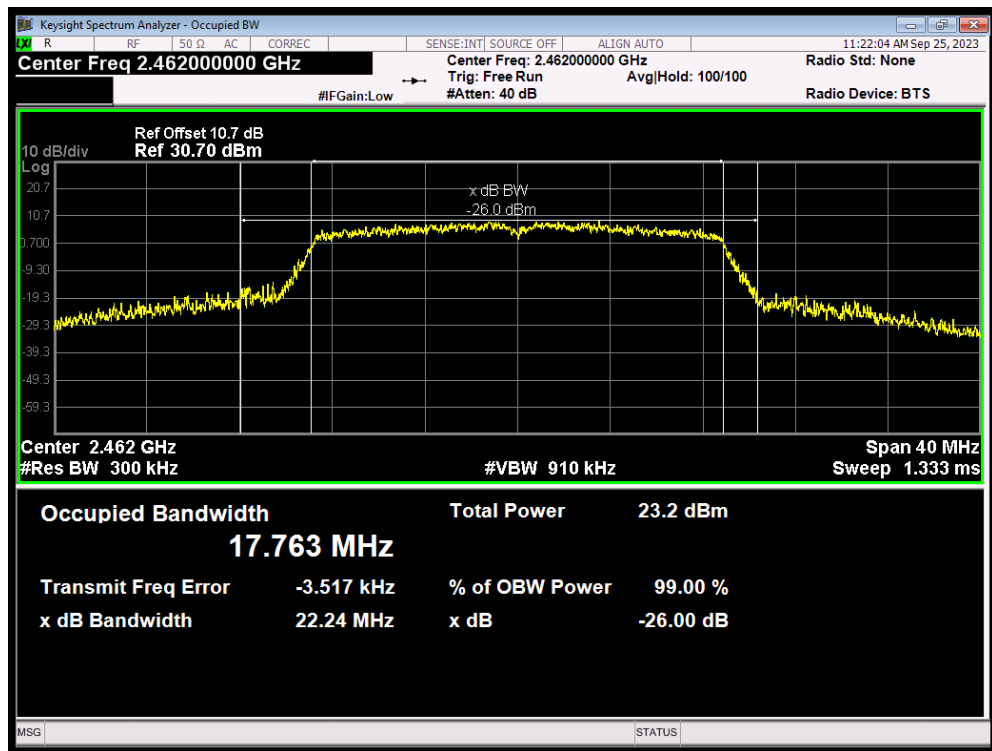
OBW 802.11n(HT20) 2412MHz



OBW 802.11n(HT20) 2437MHz



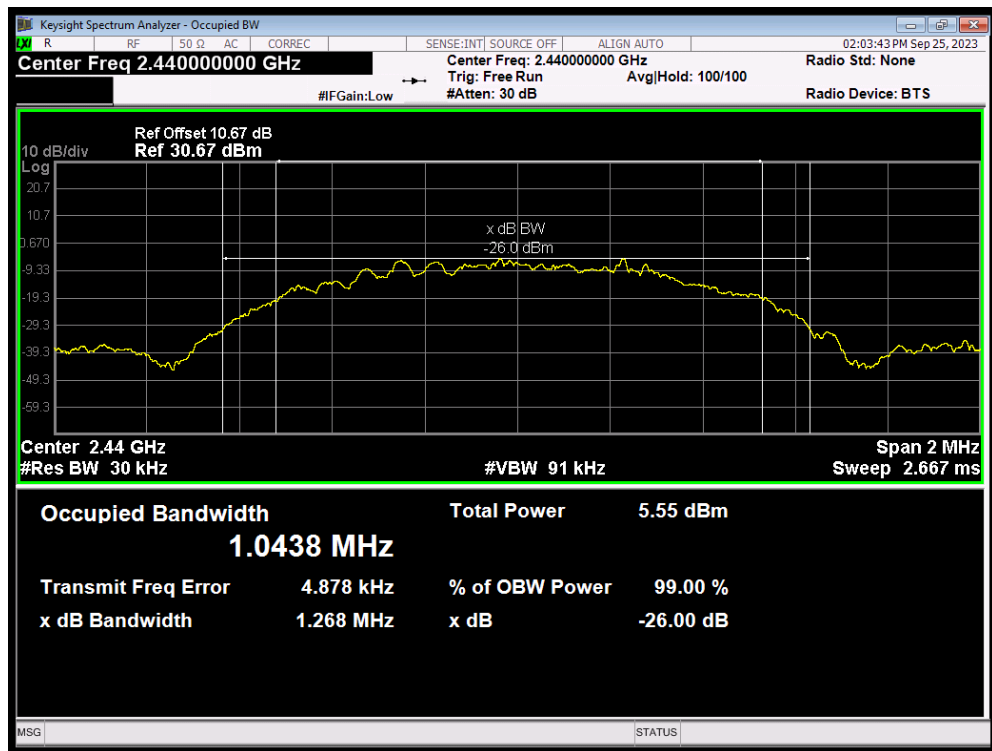
OBW 802.11n(HT20) 2462MHz



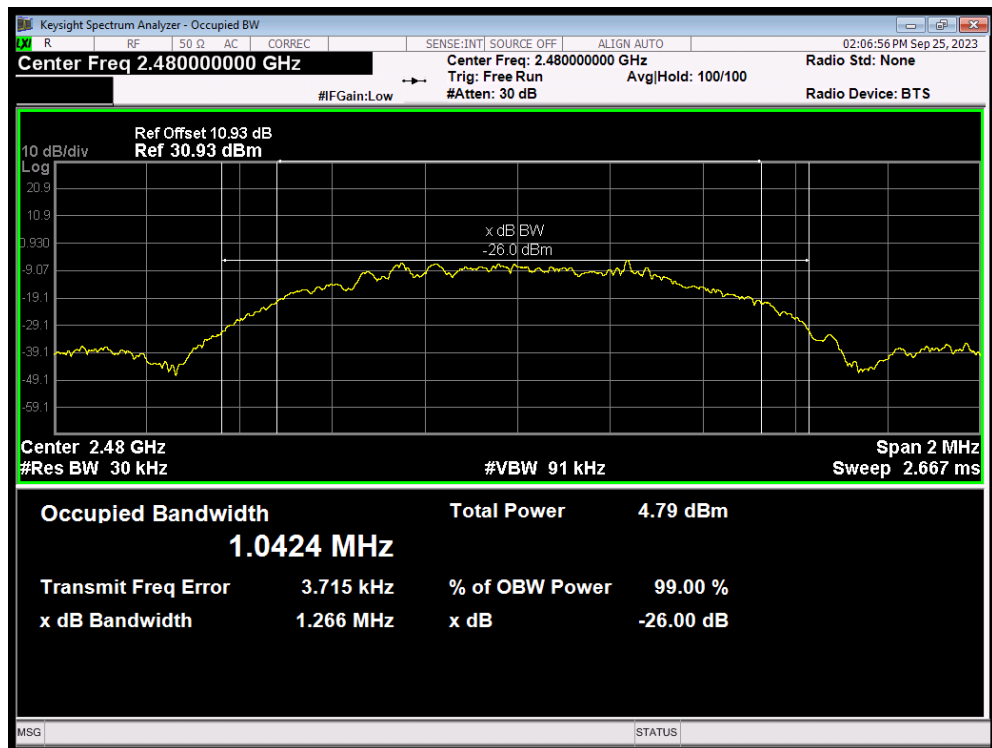
OBW BLE (1M) 2402MHz



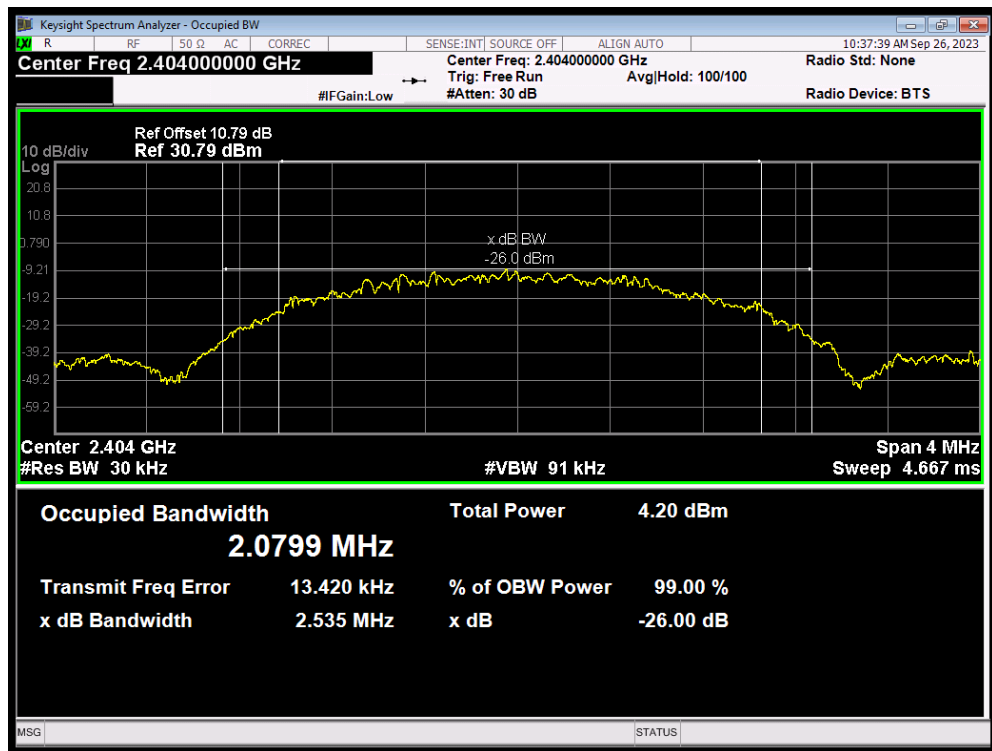
OBW BLE (1M) 2440MHz



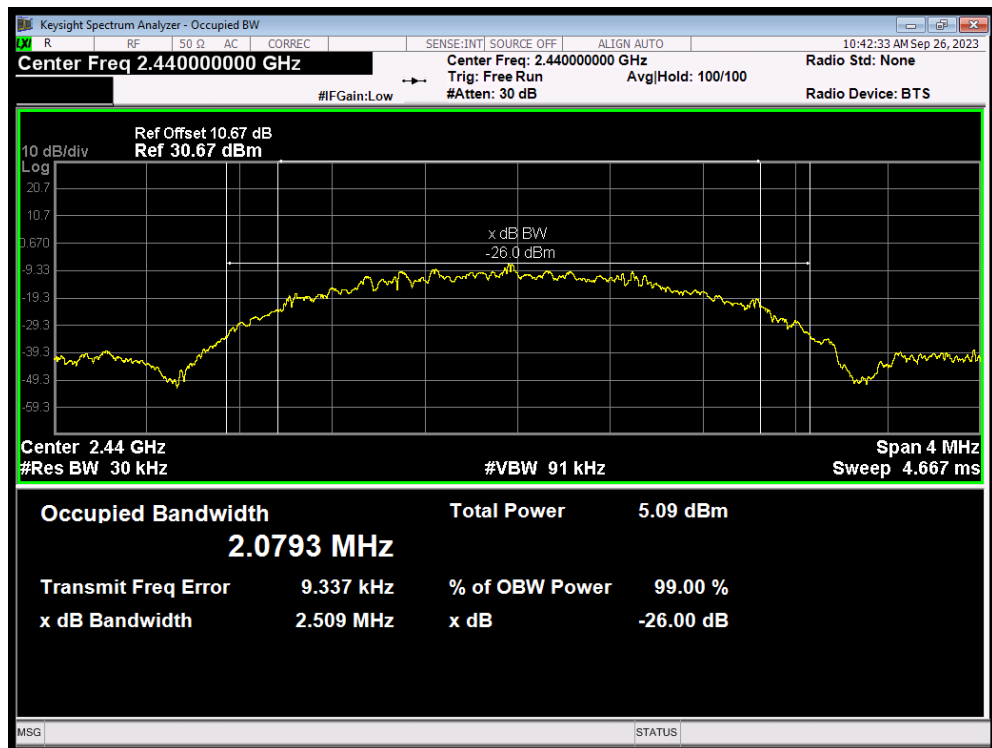
OBW BLE (1M) 2480MHz



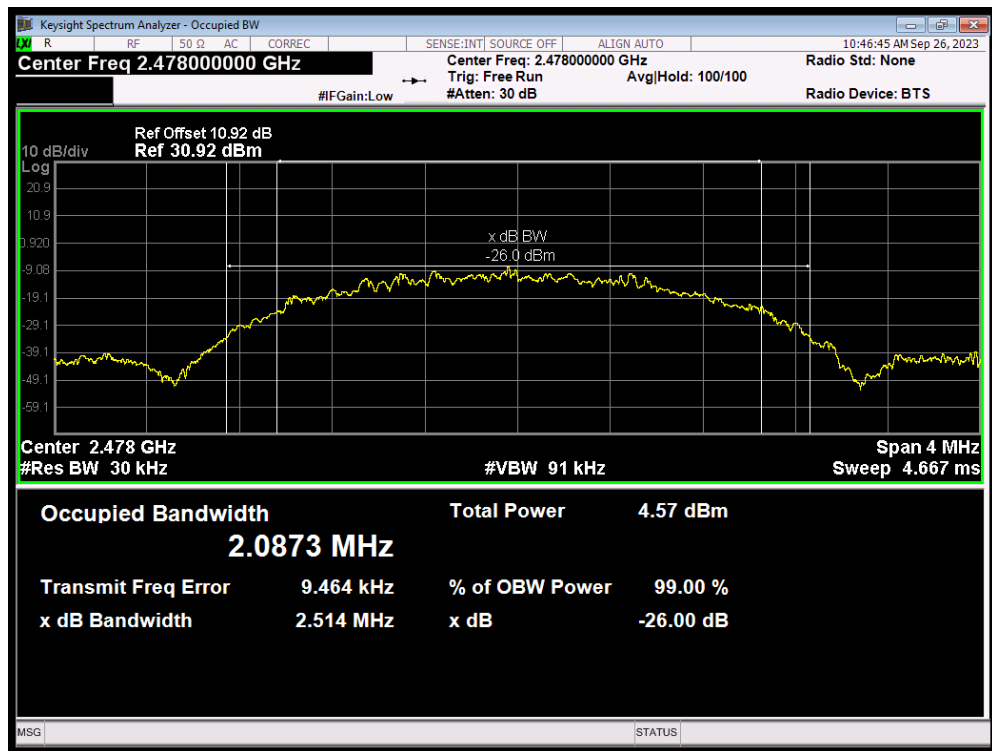
OBW BLE (2M) 2404MHz



OBW BLE (2M) 2440MHz



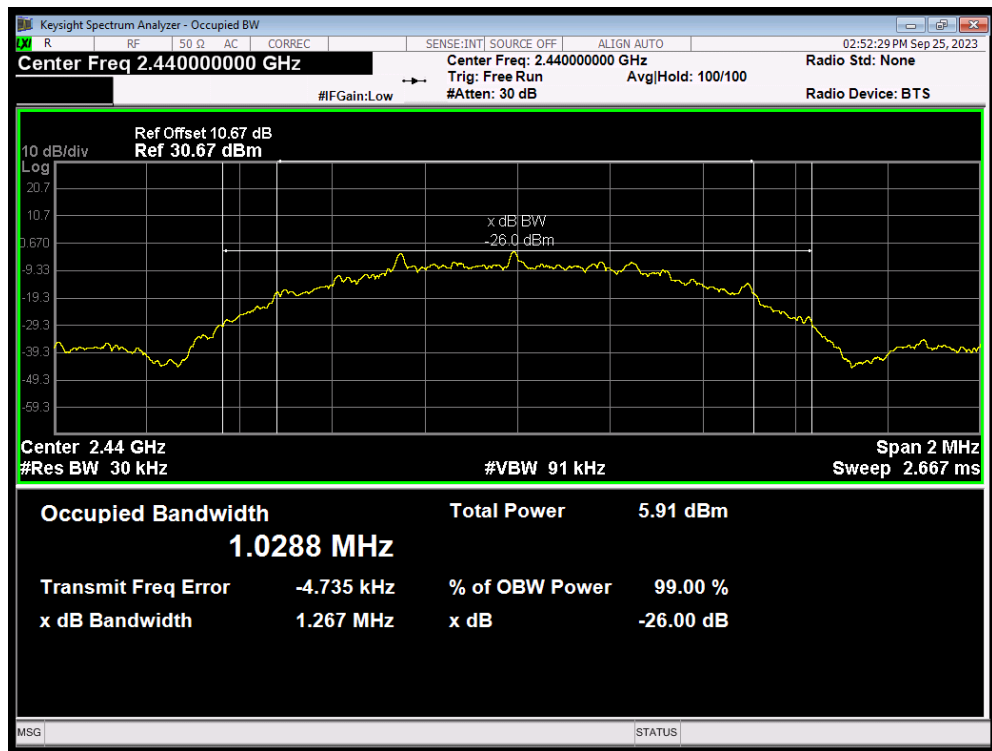
OBW BLE (2M) 2478MHz



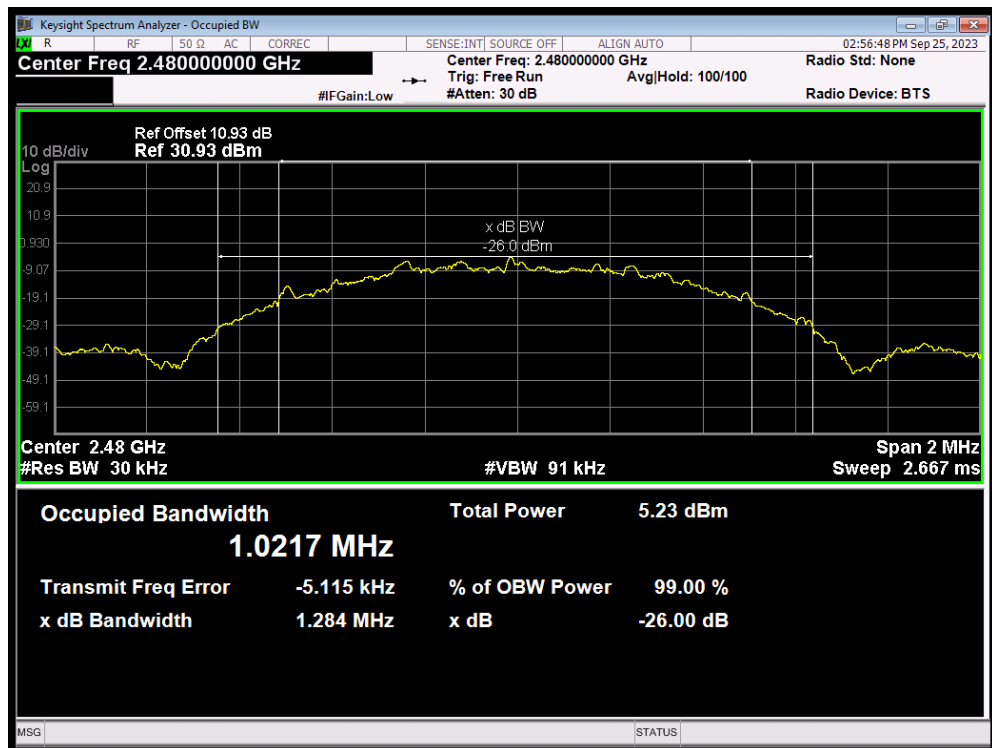
OBW BLE (S=2) 2402MHz



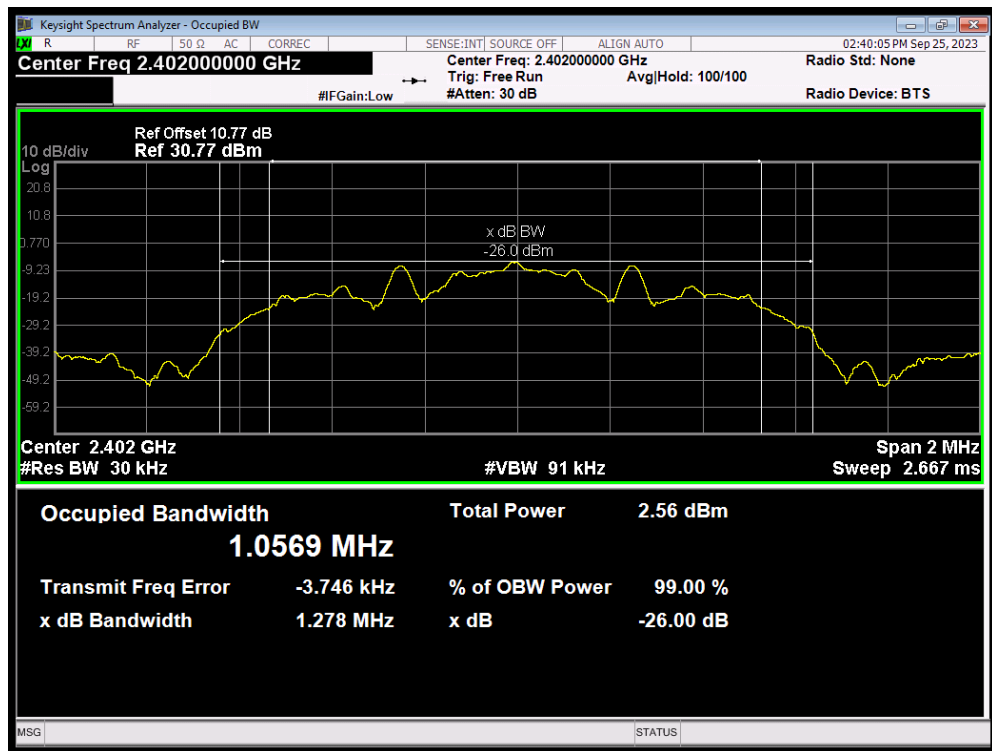
OBW BLE (S=2) 2440MHz



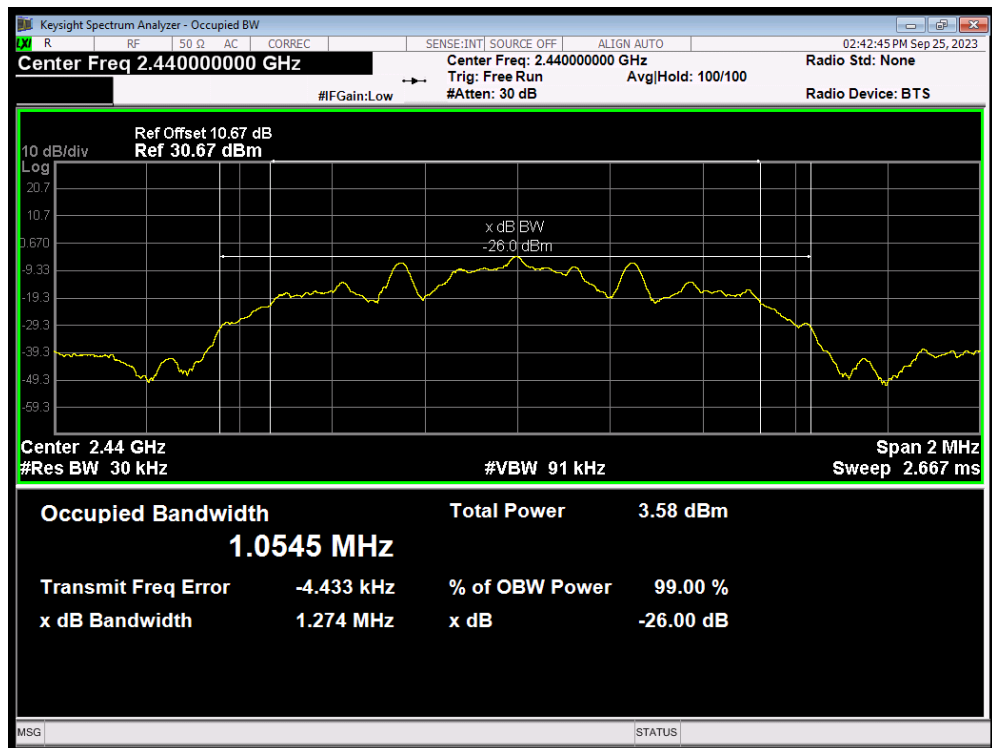
OBW BLE (S=2) 2480MHz



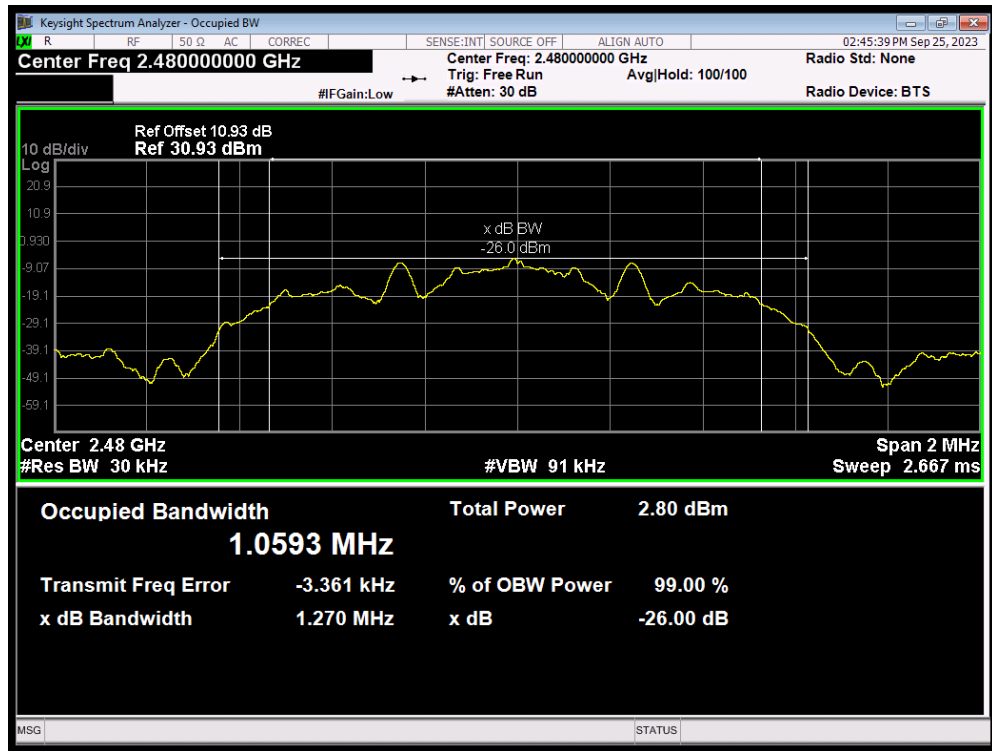
OBW BLE (S=8) 2402MHz



OBW BLE (S=8) 2440MHz

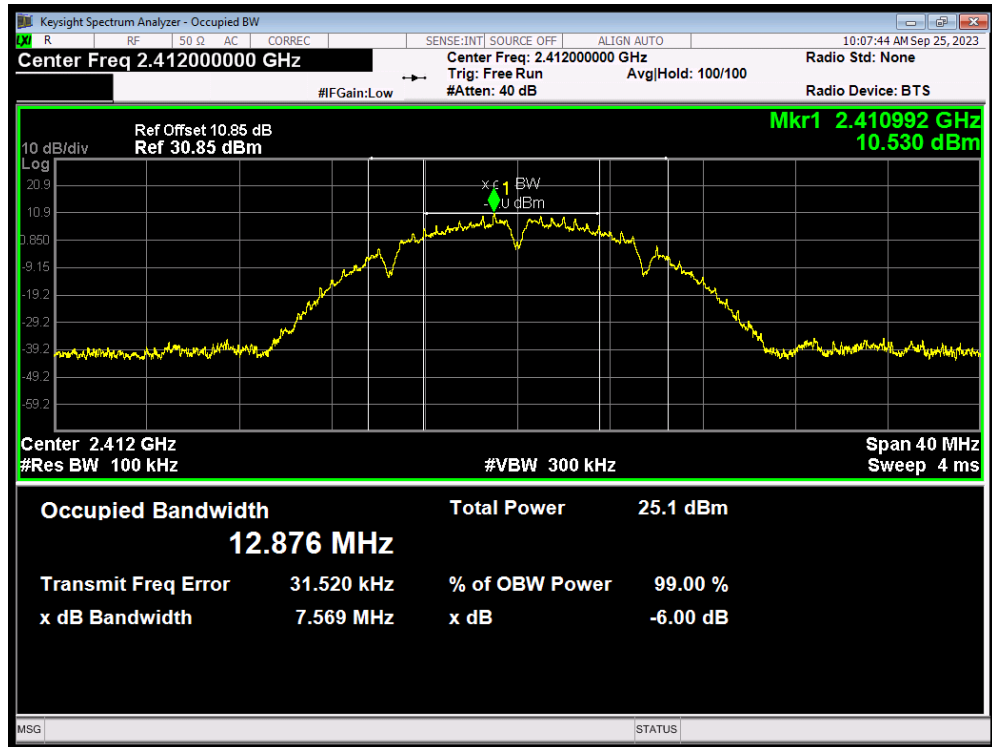


OBW BLE (S=8) 2480MHz

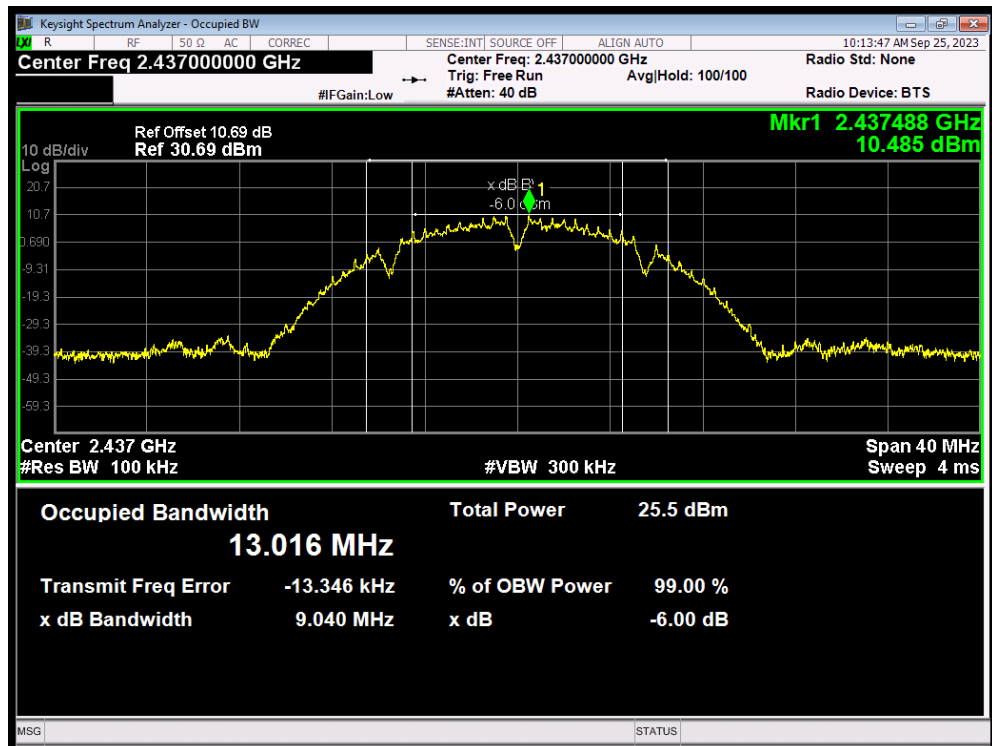


6 dB bandwidth

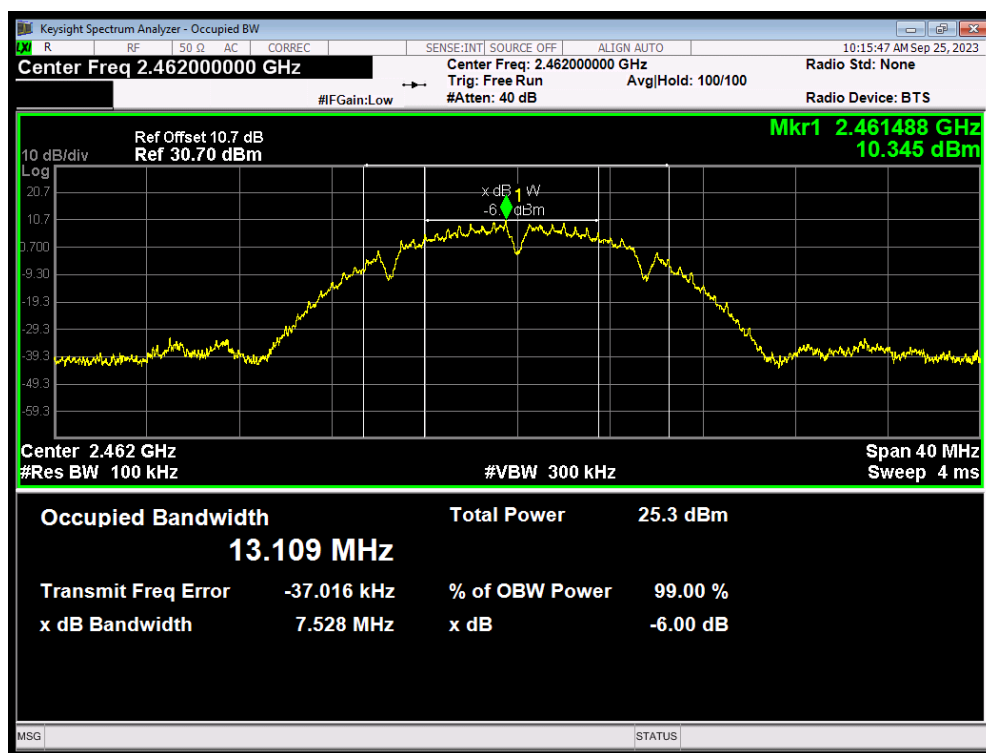
-6dB Bandwidth 802.11b 2412MHz



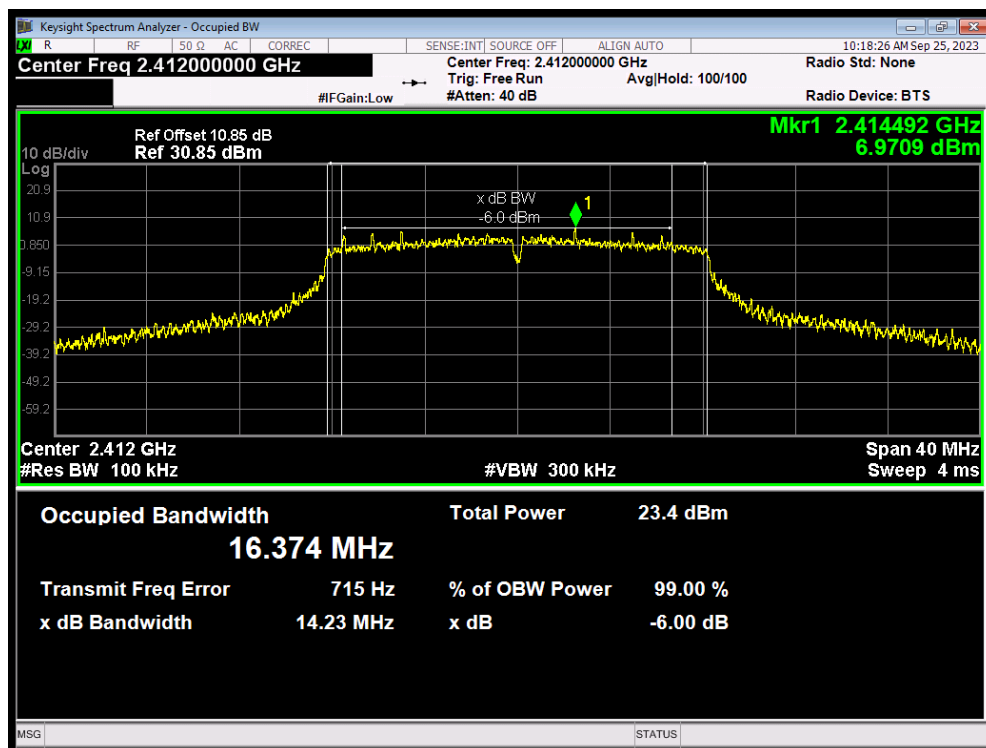
-6dB Bandwidth 802.11b 2437MHz



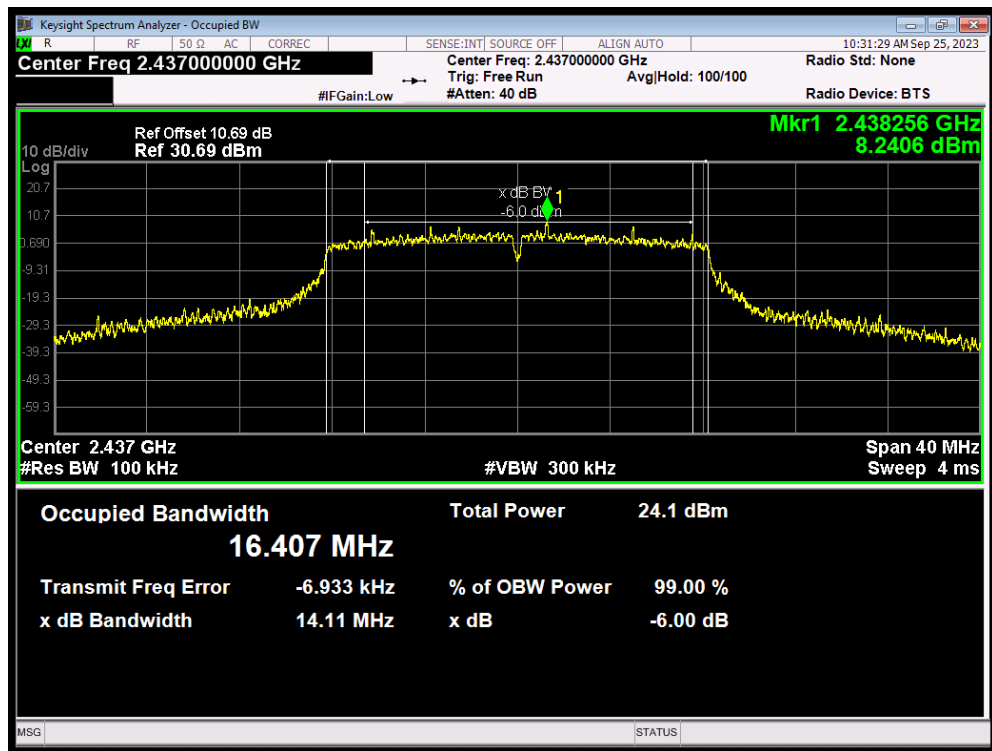
-6dB Bandwidth 802.11b 2462MHz



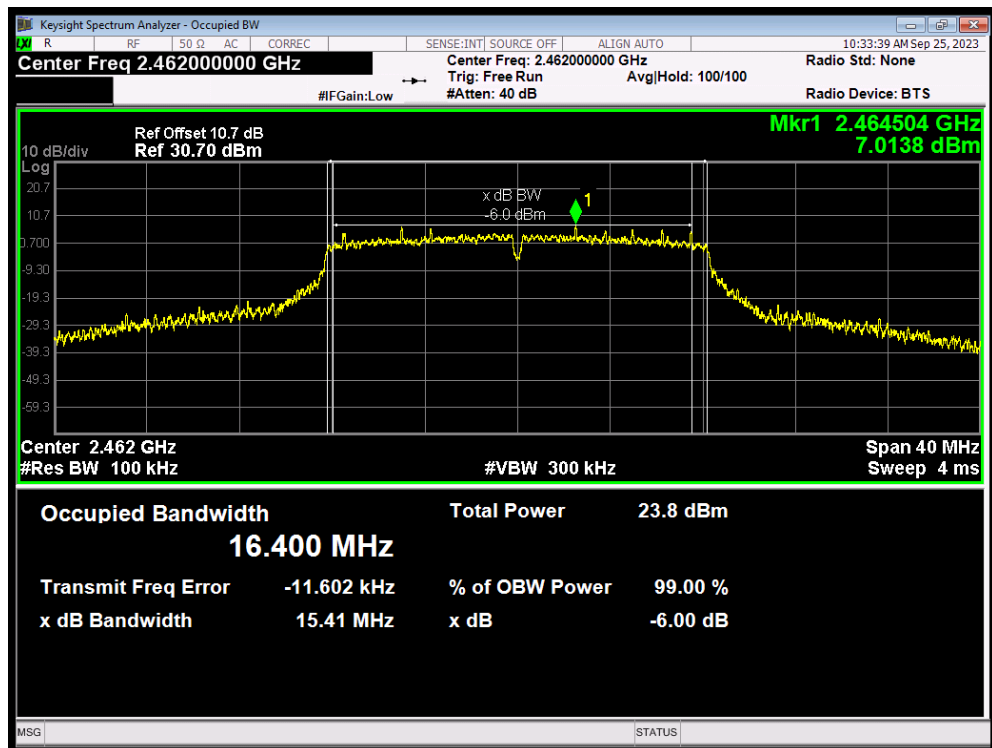
-6dB Bandwidth 802.11g 2412MHz



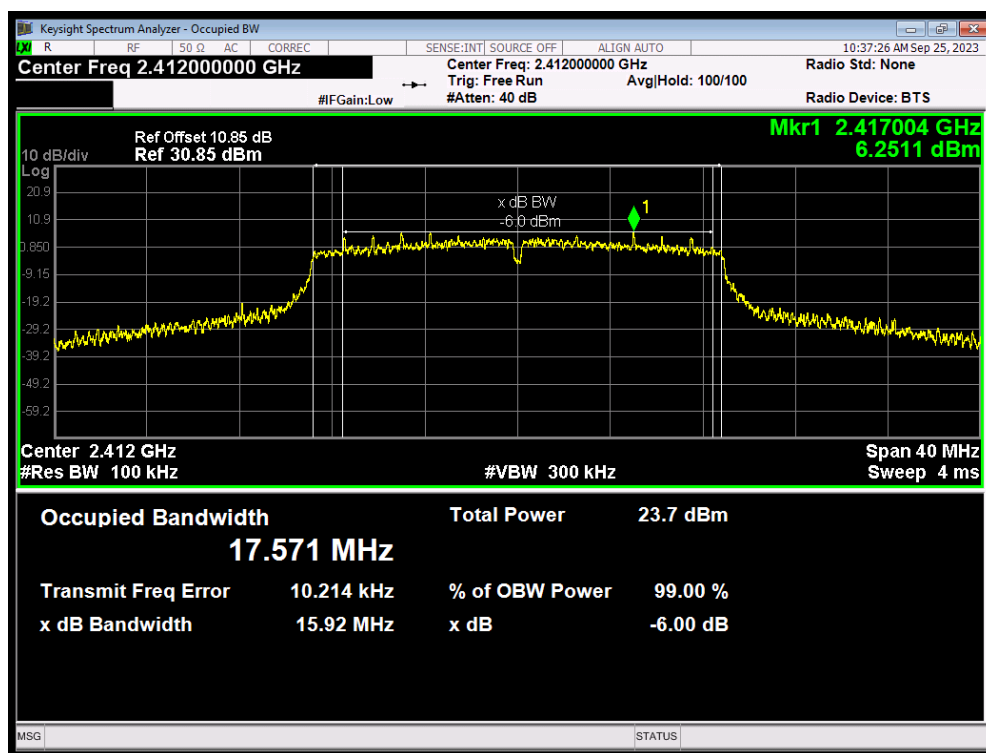
-6dB Bandwidth 802.11g 2437MHz



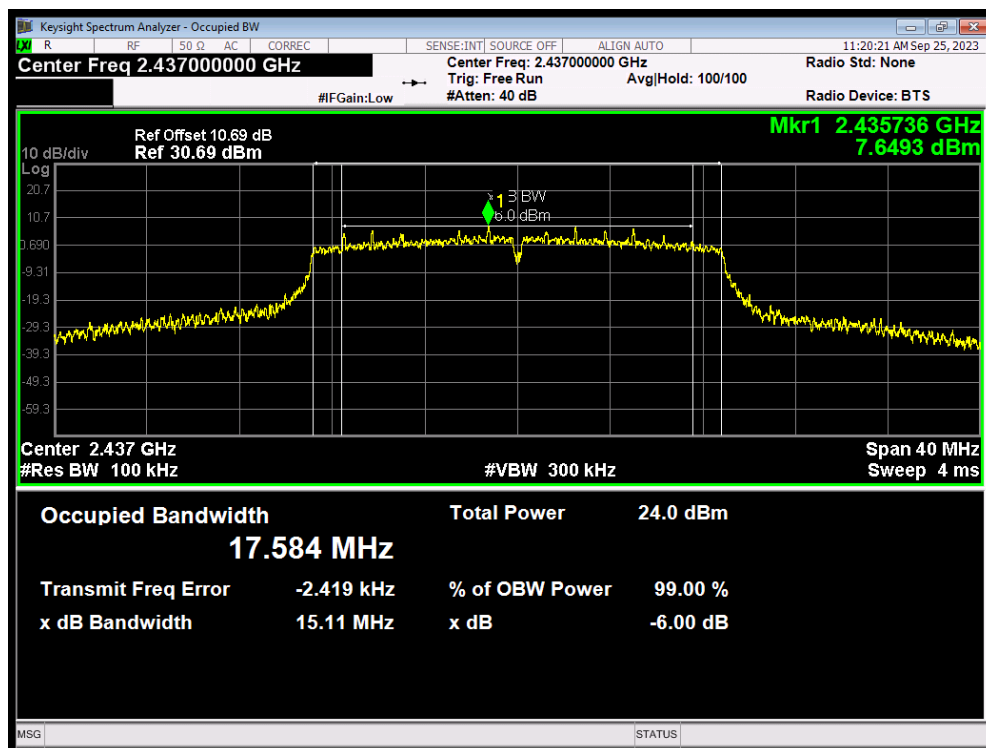
-6dB Bandwidth 802.11g 2462MHz



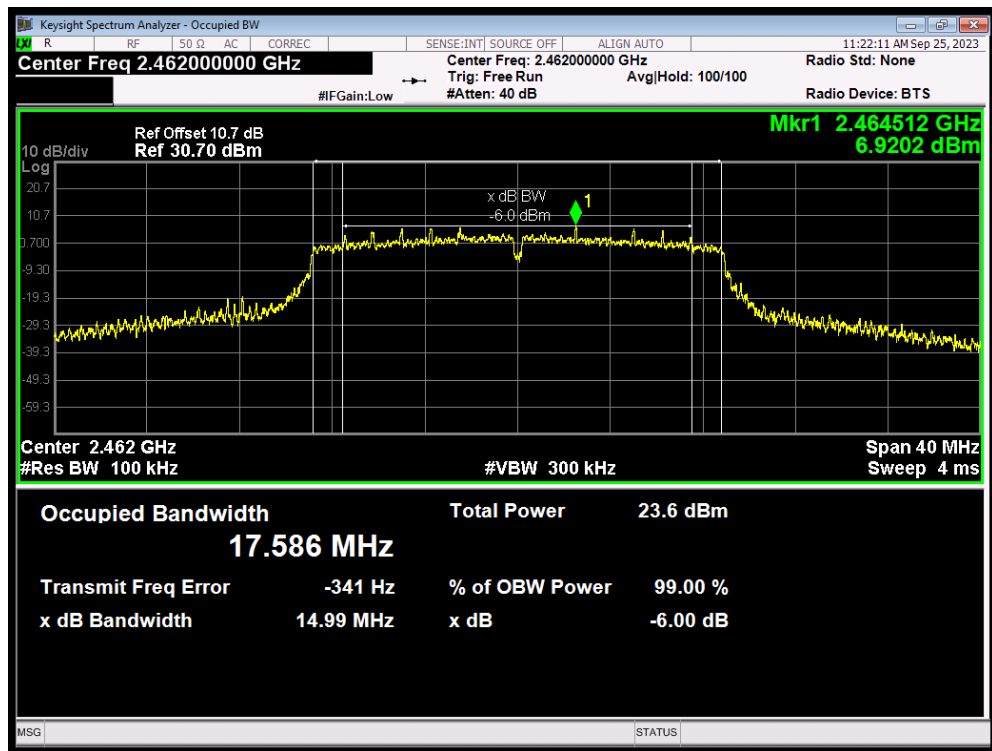
-6dB Bandwidth 802.11n(HT20) 2412MHz



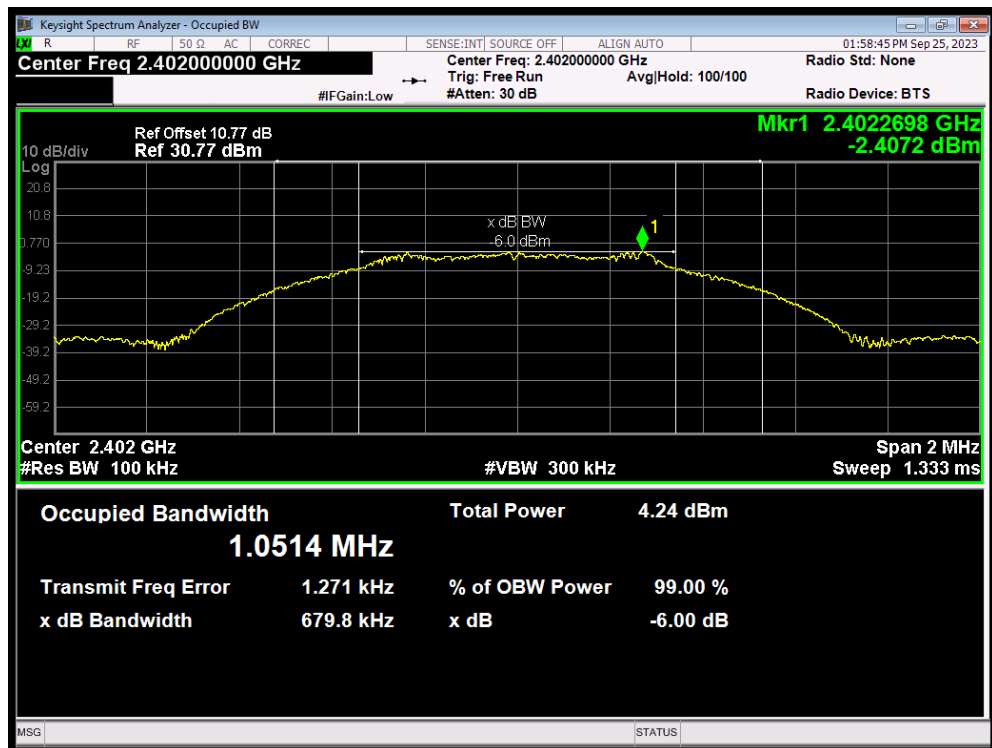
-6dB Bandwidth 802.11n(HT20) 2437MHz



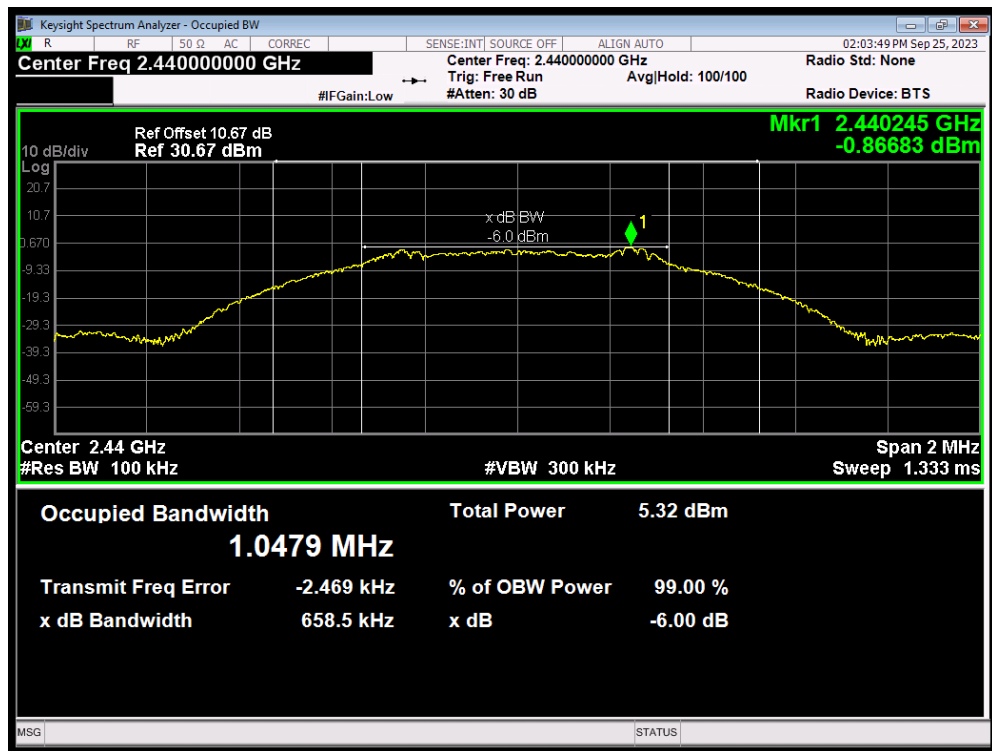
-6dB Bandwidth 802.11n(HT20) 2462MHz



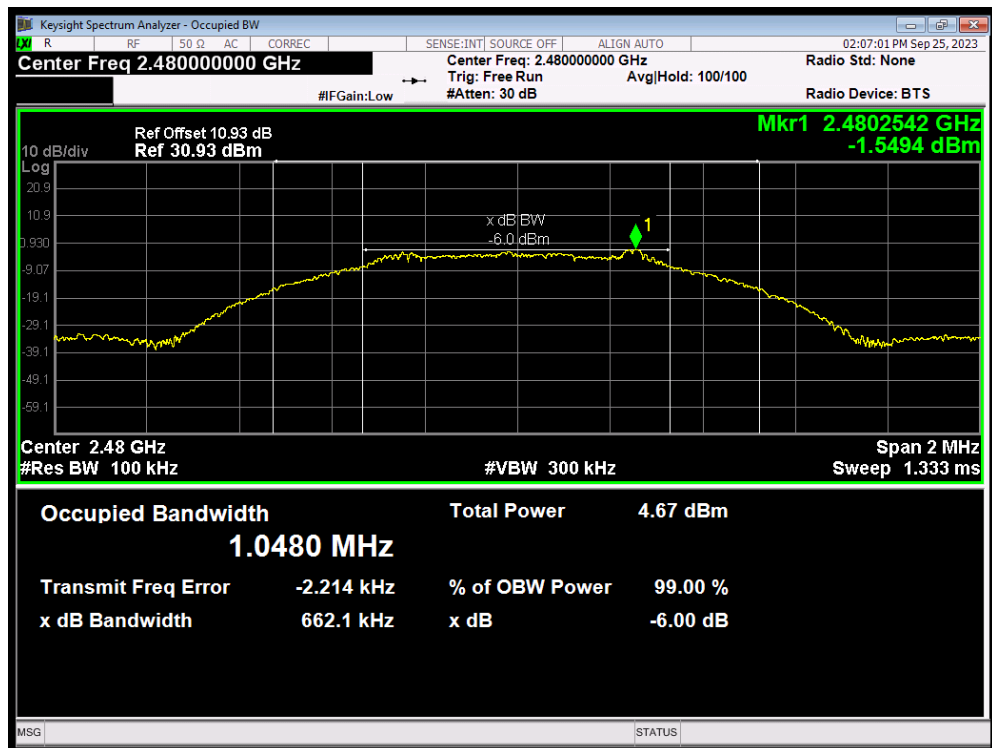
-6dB Bandwidth BLE (1M) 2402MHz



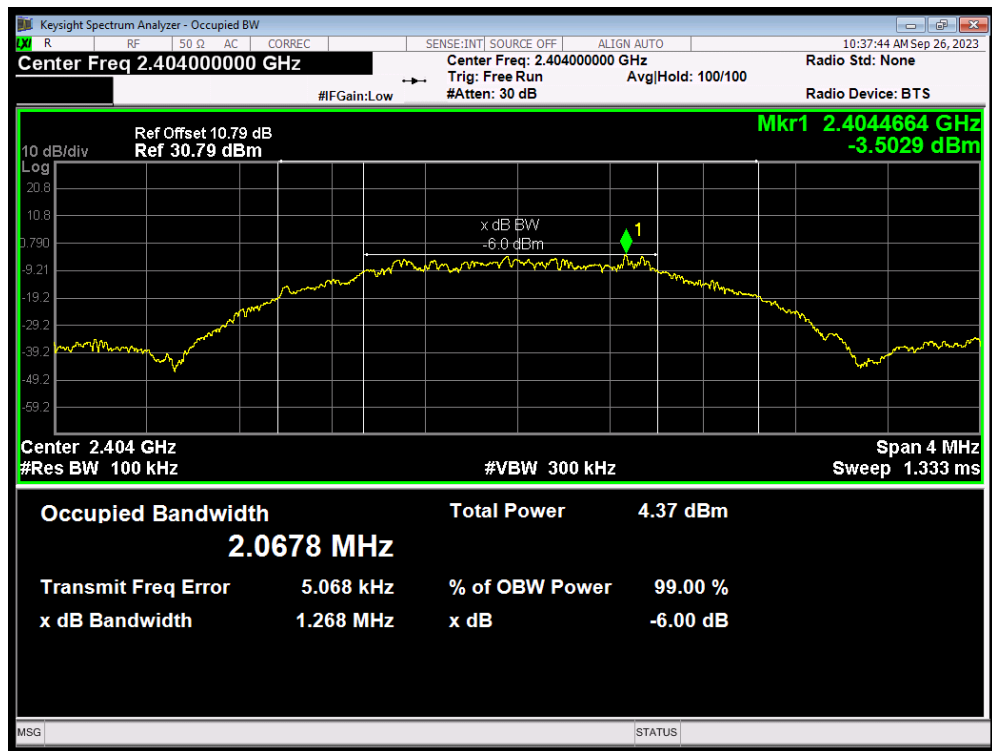
-6dB Bandwidth BLE (1M) 2440MHz



-6dB Bandwidth BLE (1M) 2480MHz



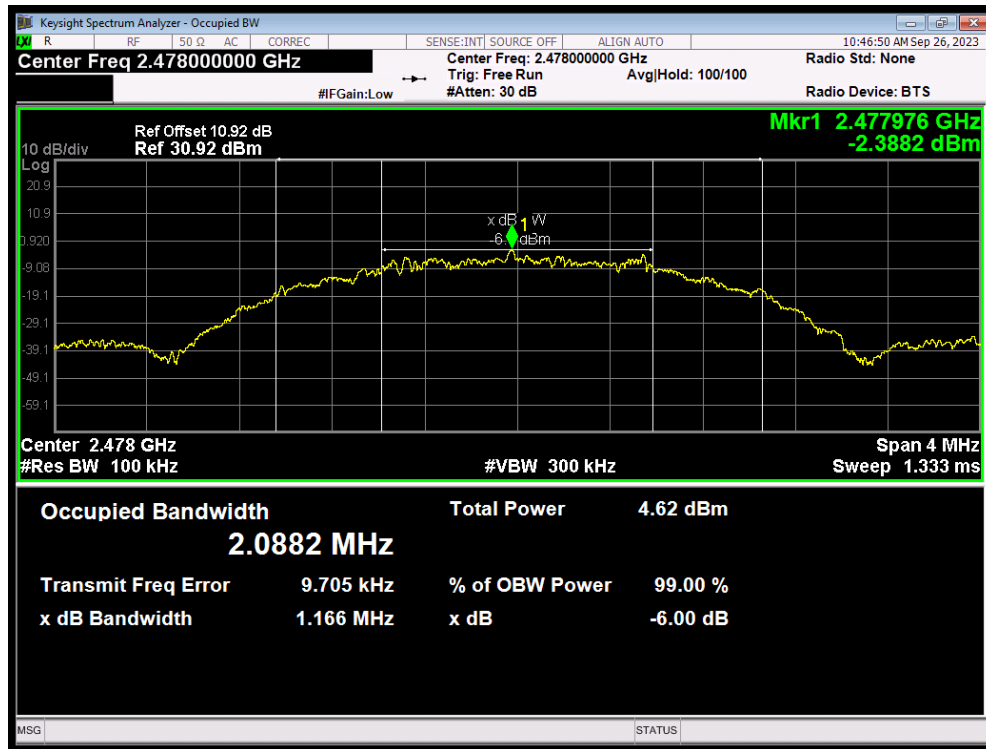
-6dB Bandwidth BLE (2M) 2404MHz



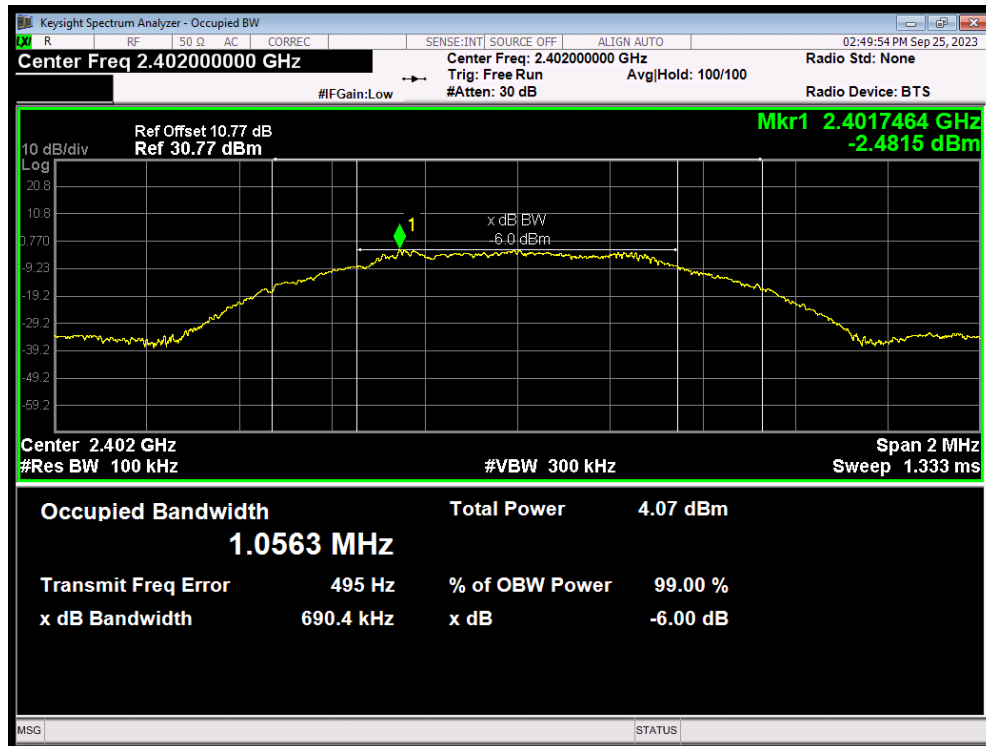
-6dB Bandwidth BLE (2M) 2440MHz



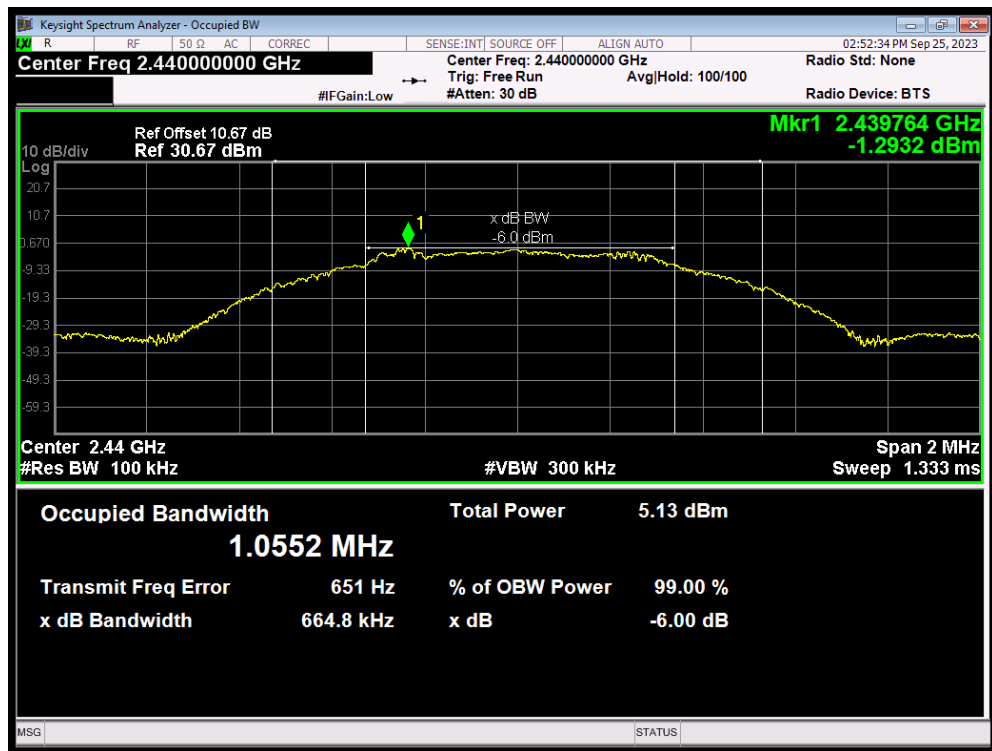
-6dB Bandwidth BLE (2M) 2478MHz



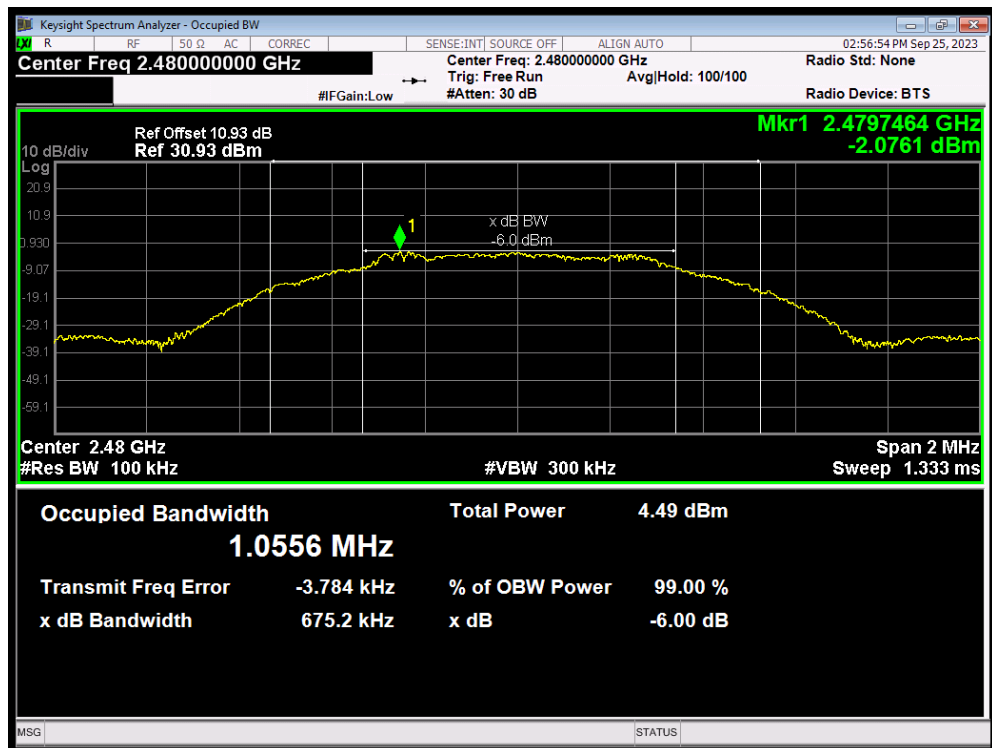
-6dB Bandwidth BLE (S=2) 2402MHz



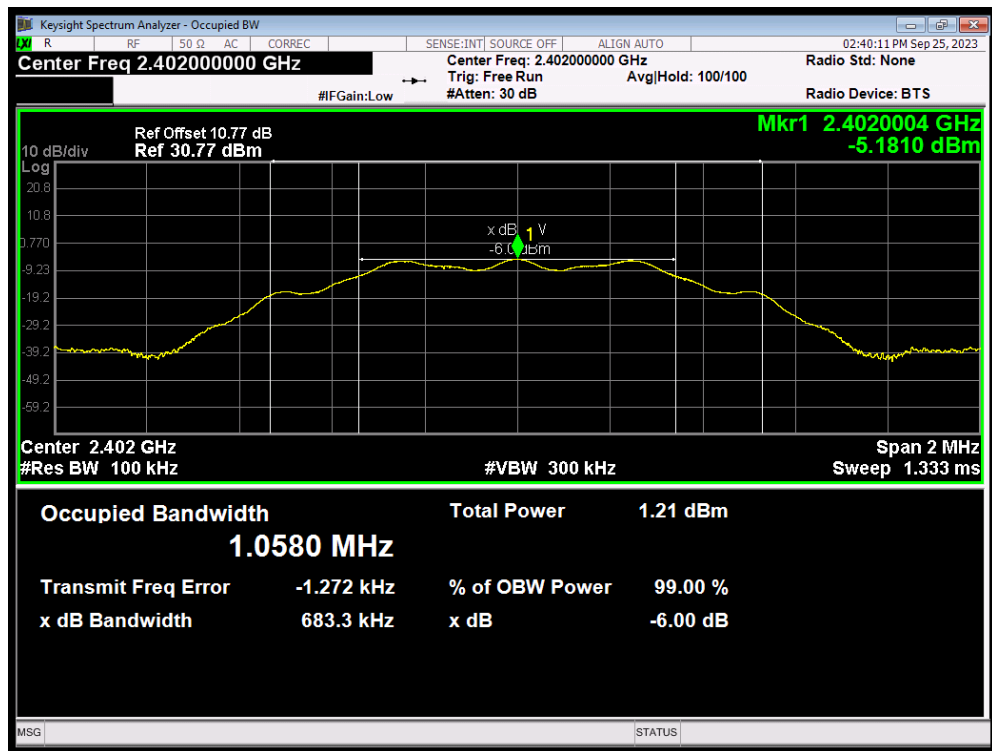
-6dB Bandwidth BLE (S=2) 2440MHz



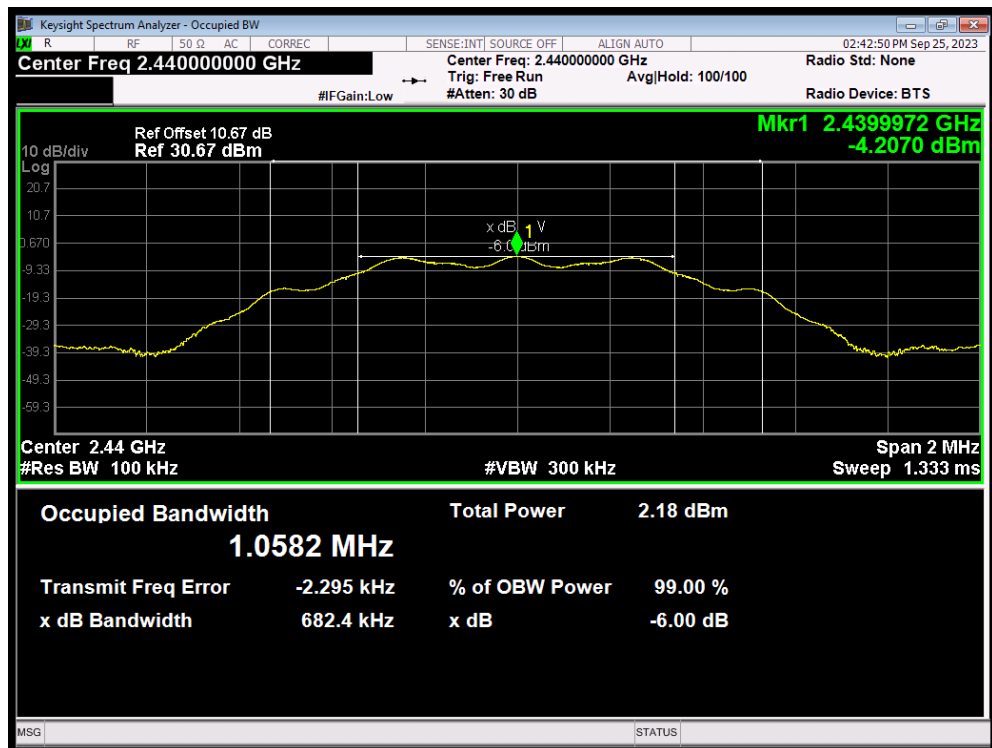
-6dB Bandwidth BLE (S=2) 2480MHz



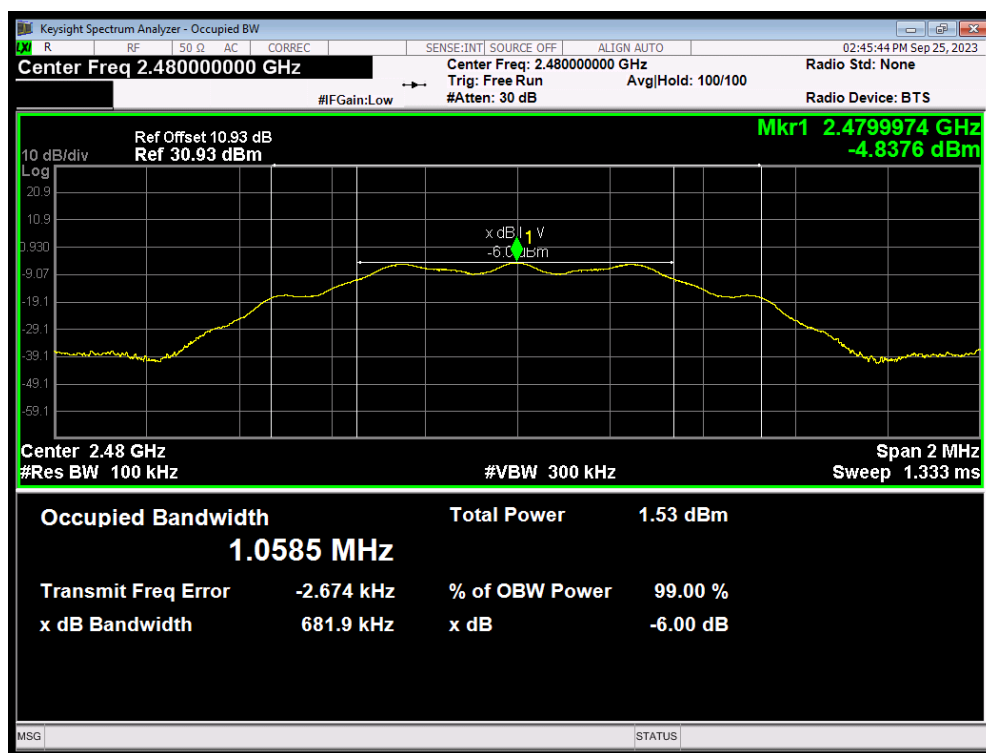
-6dB Bandwidth BLE (S=8) 2402MHz



-6dB Bandwidth BLE (S=8) 2440MHz



-6dB Bandwidth BLE (S=8) 2480MHz



5.3. Band Edge

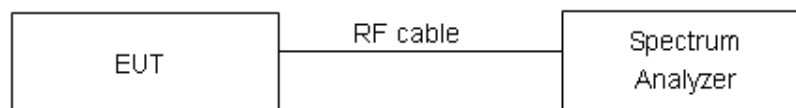
Ambient Condition

Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 15.247(d) specifies 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.”

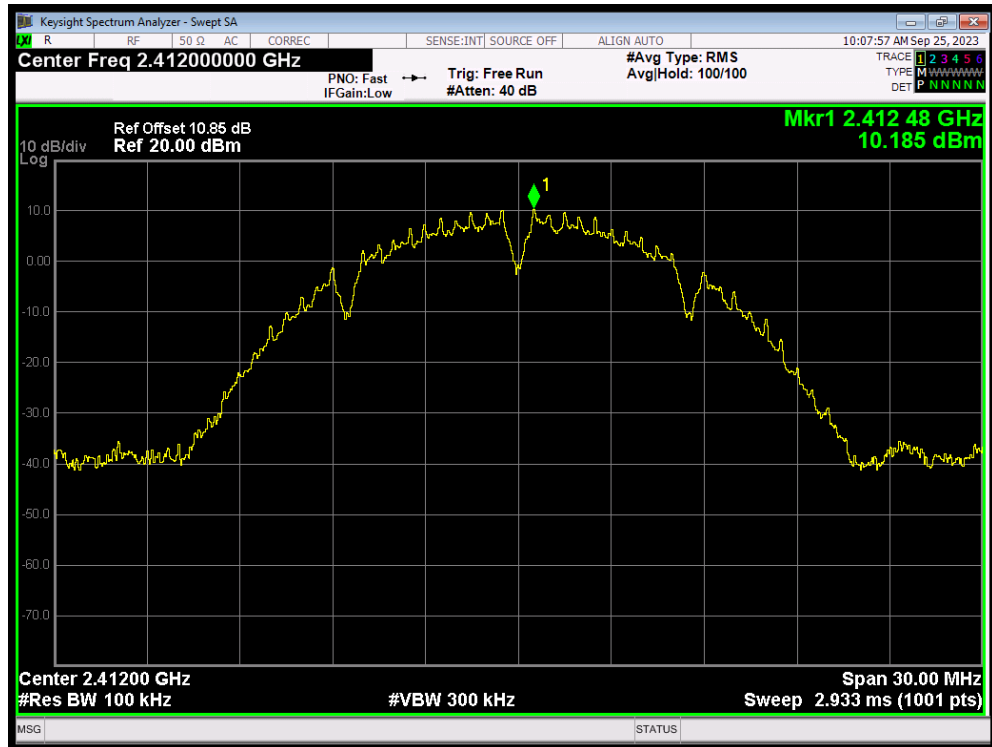
Measurement Uncertainty

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

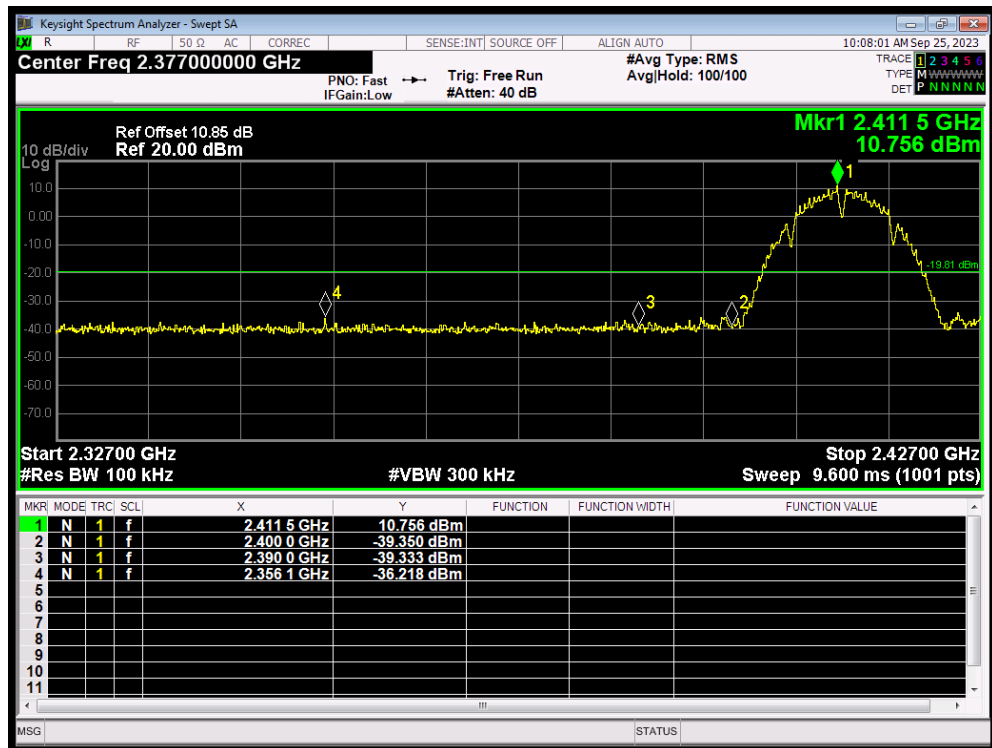
Frequency	Uncertainty
2GHz-3GHz	1.407 dB

Test Results: PASS

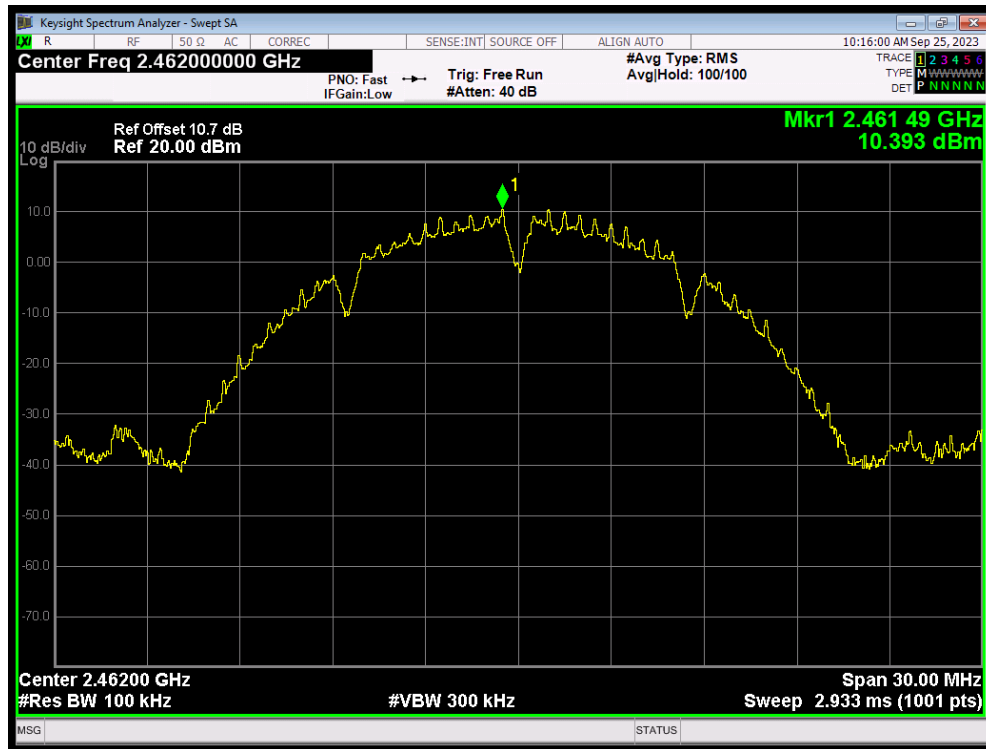
Band Edge 802.11b 2412MHz Ref



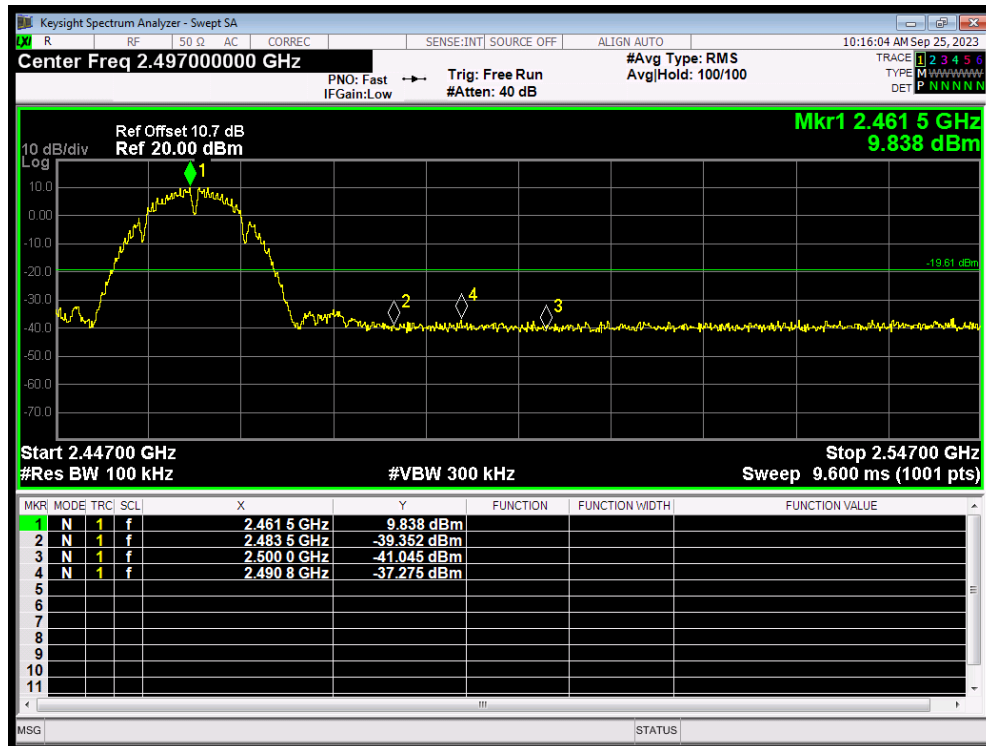
Band Edge 802.11b 2412MHz Emission



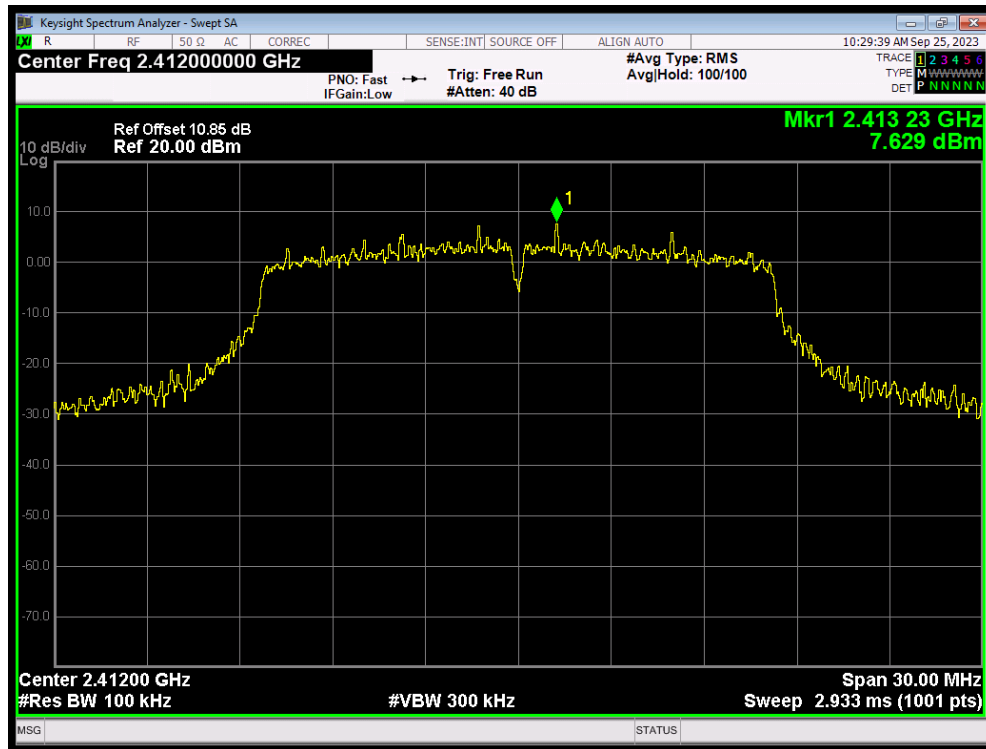
Band Edge 802.11b 2462MHz Ref



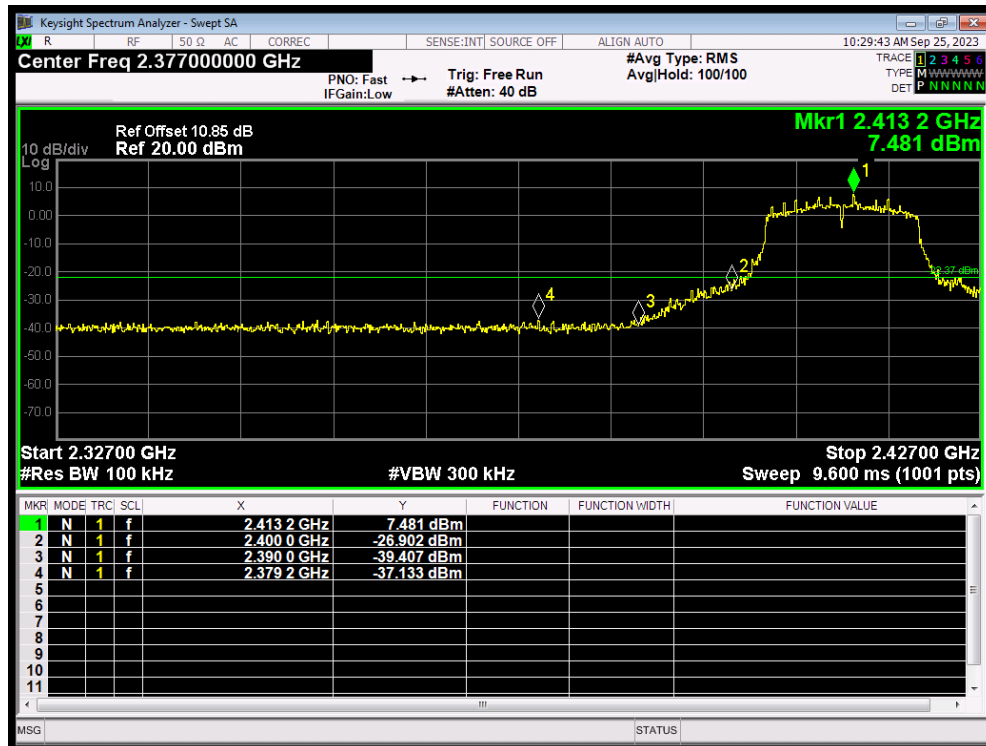
Band Edge 802.11b 2462MHz Emission



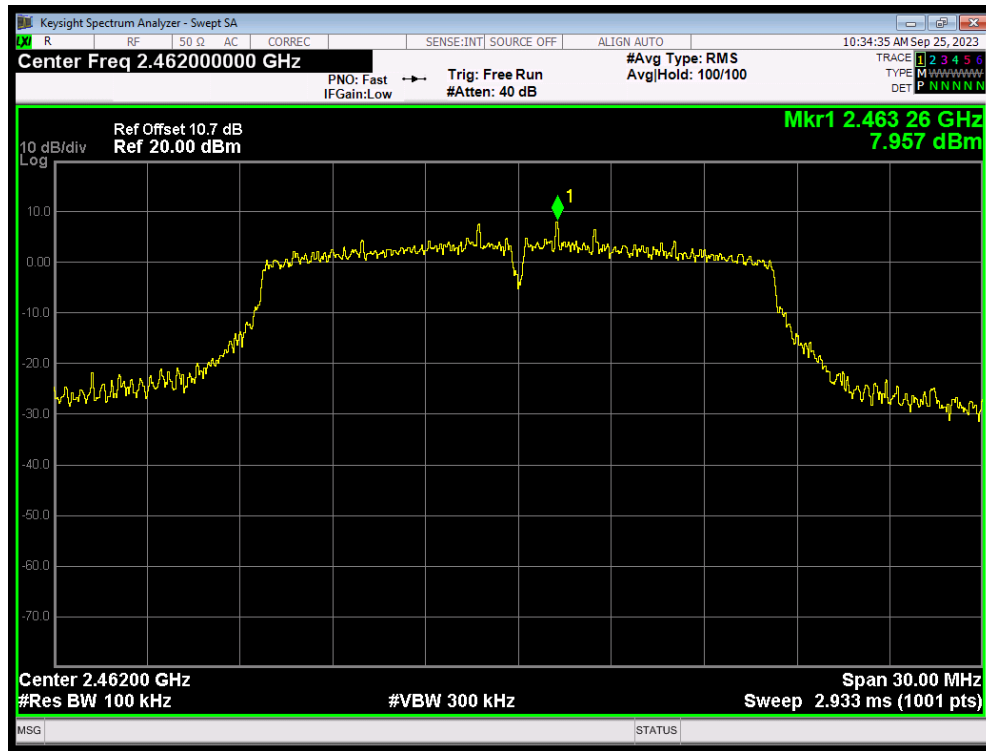
Band Edge 802.11g 2412MHz Ref



Band Edge 802.11g 2412MHz Emission



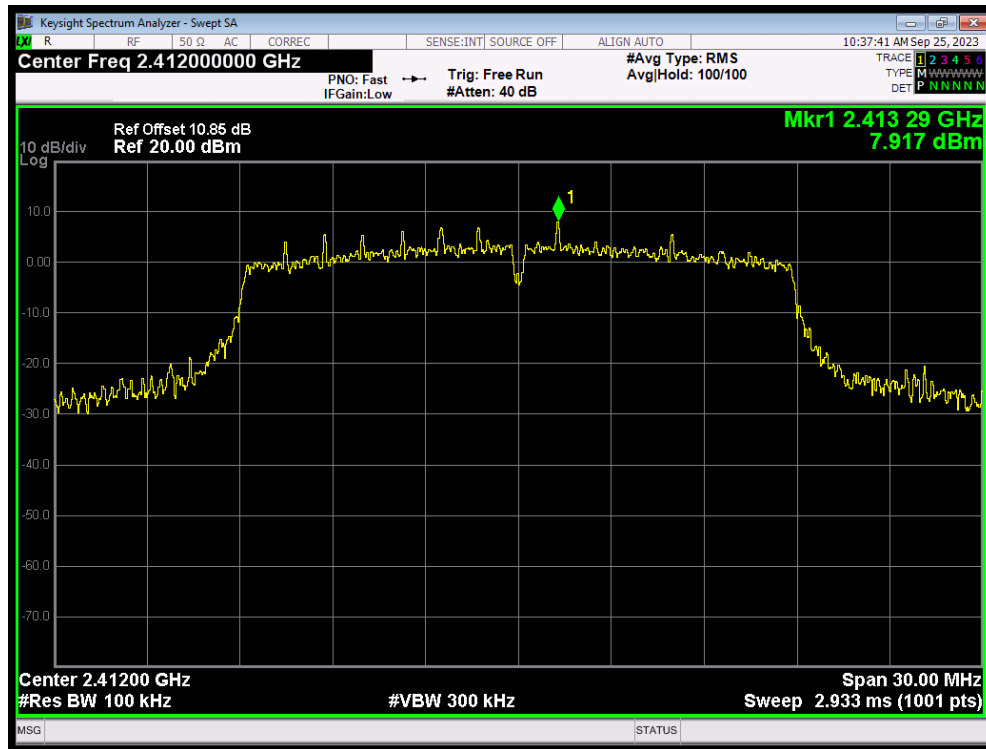
Band Edge 802.11g 2462MHz Ref



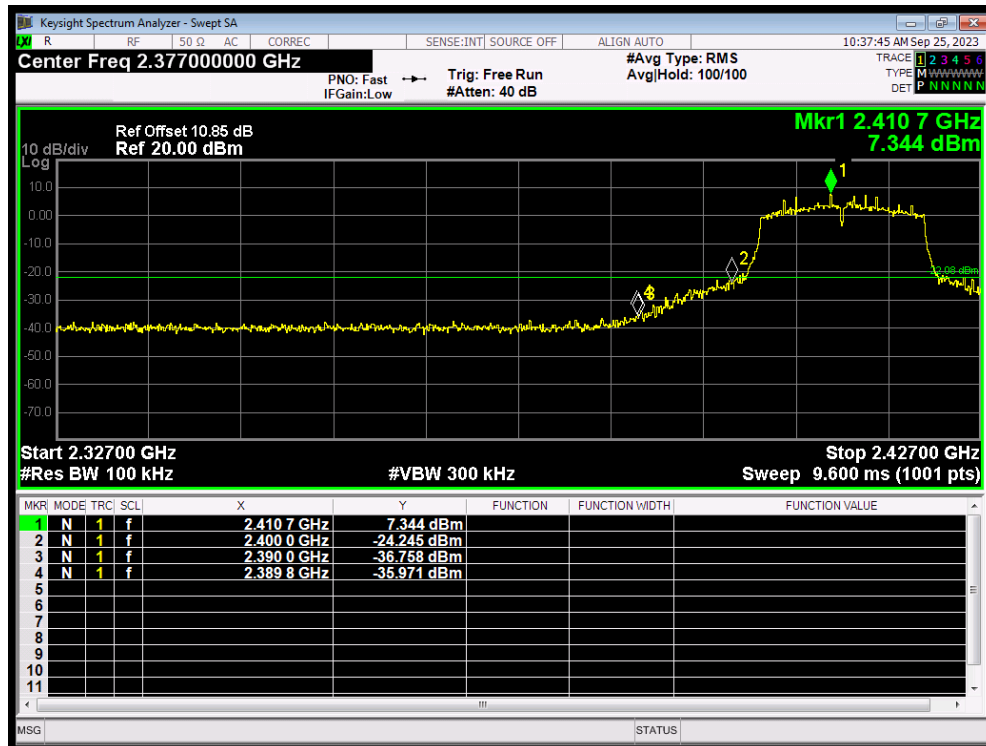
Band Edge 802.11g 2462MHz Emission



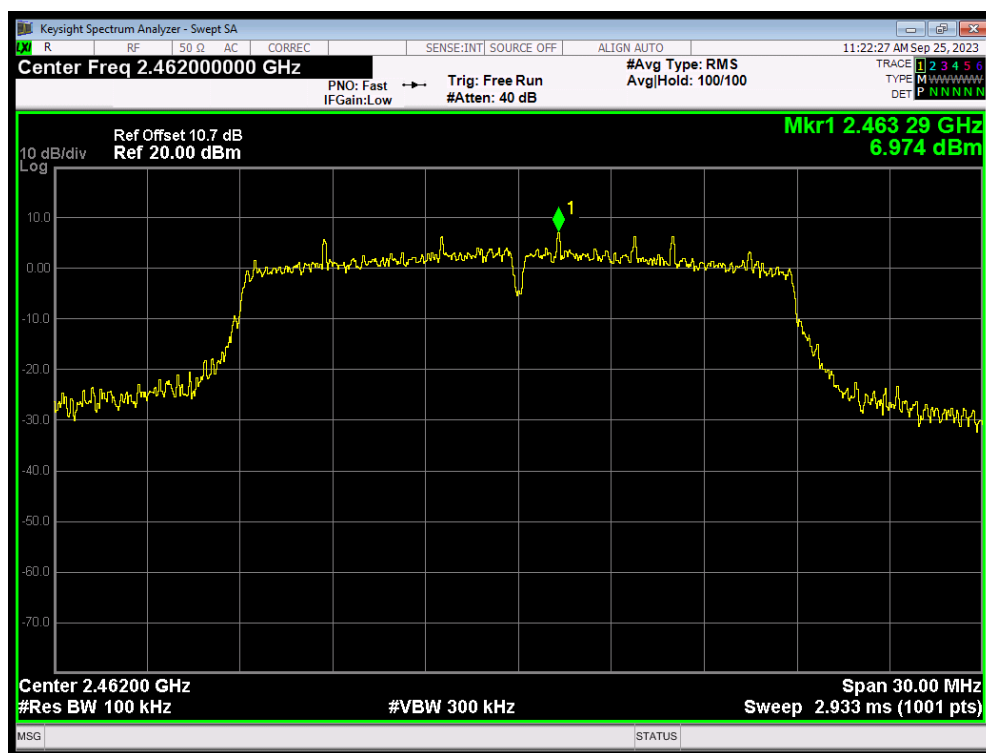
Band Edge 802.11n(HT20) 2412MHz Ref



Band Edge 802.11n(HT20) 2412MHz Emission



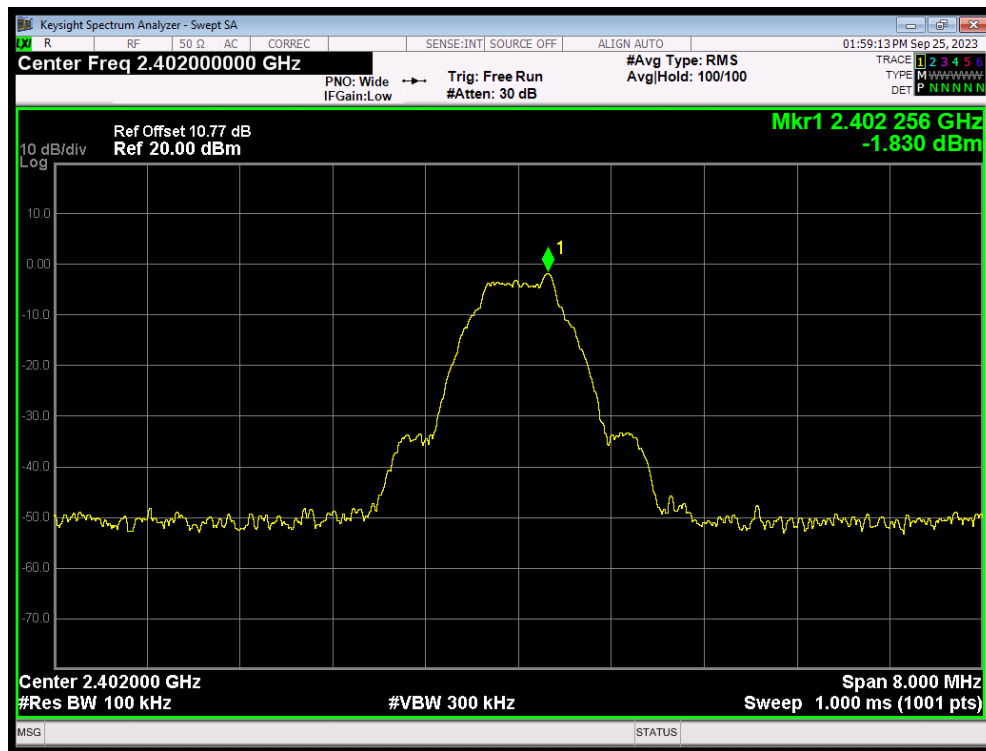
Band Edge 802.11n(HT20) 2462MHz Ref



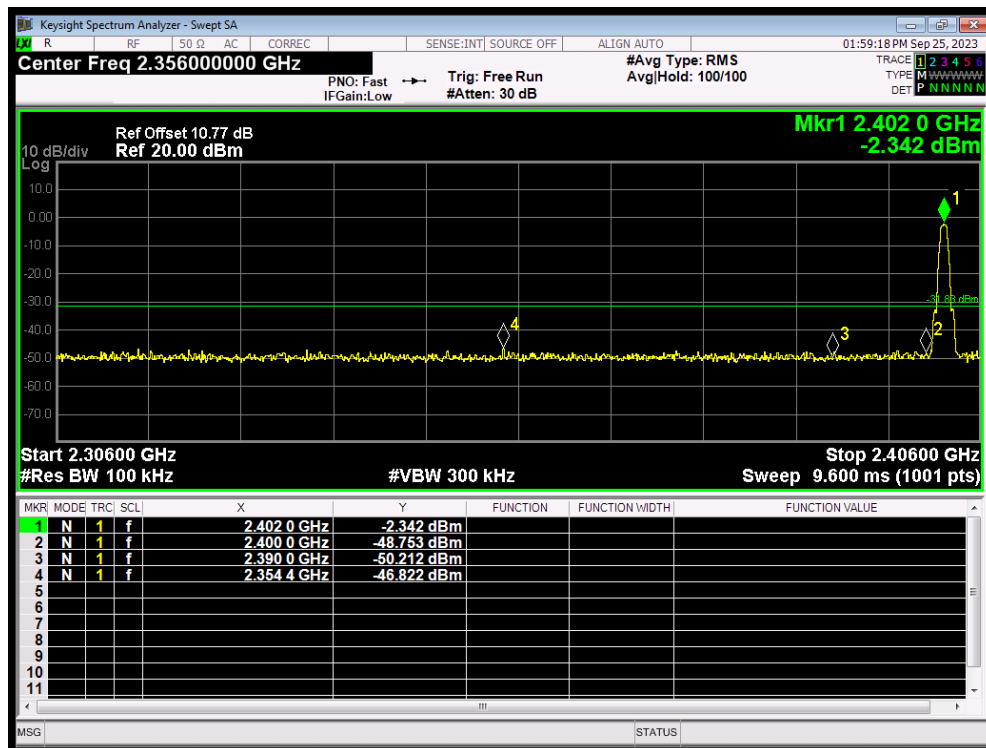
Band Edge 802.11n(HT20) 2462MHz Emission



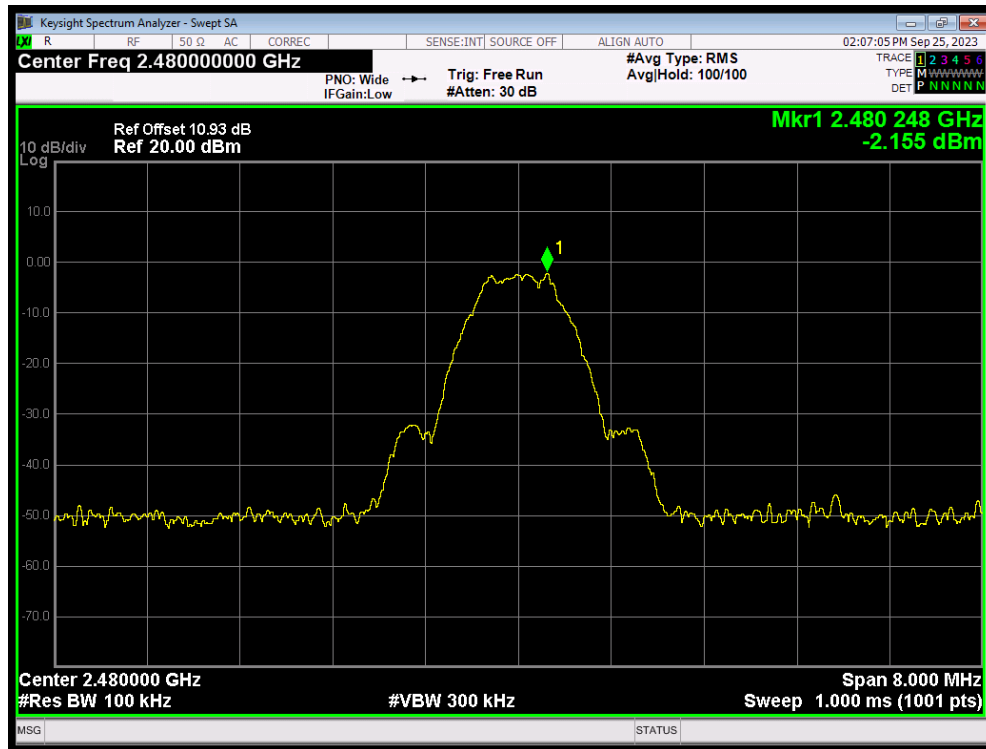
Band Edge BLE (1M) 2402MHz Ref



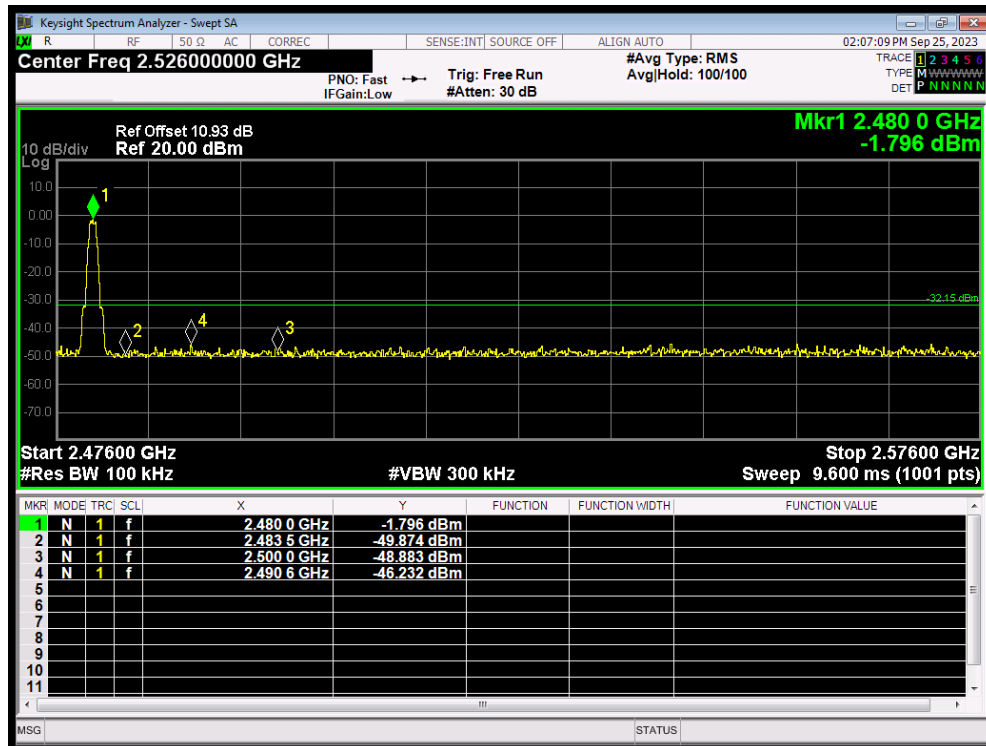
Band Edge BLE (1M) 2402MHz Emission



Band Edge BLE (1M) 2480MHz Ref



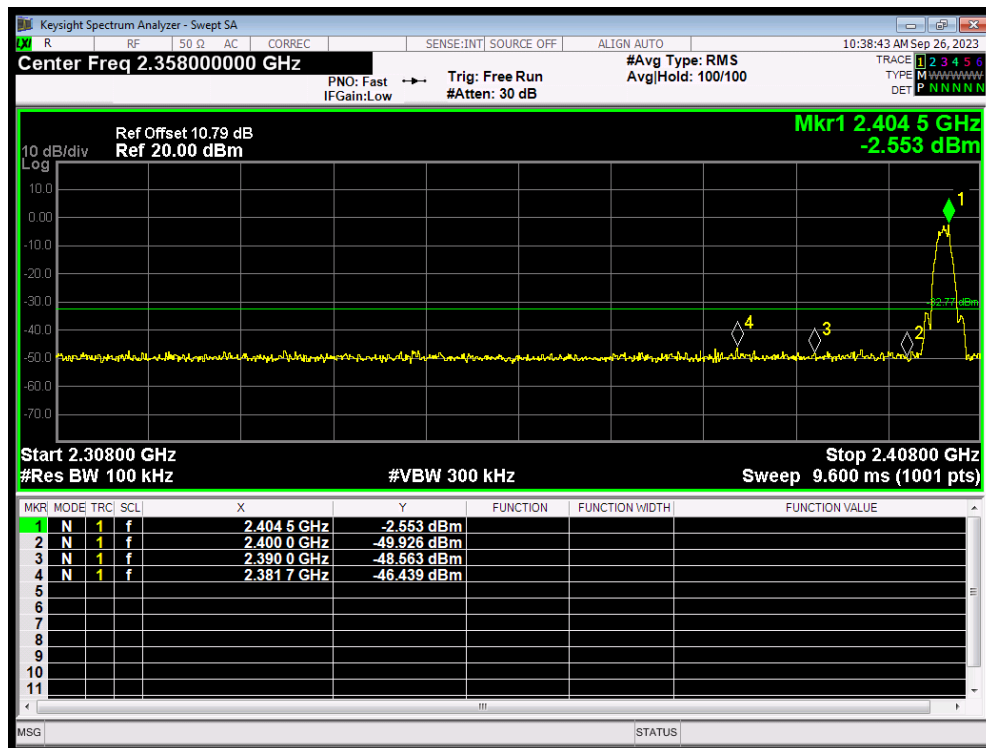
Band Edge BLE (1M) 2480MHz Emission



Band Edge BLE (2M) 2404MHz Ref



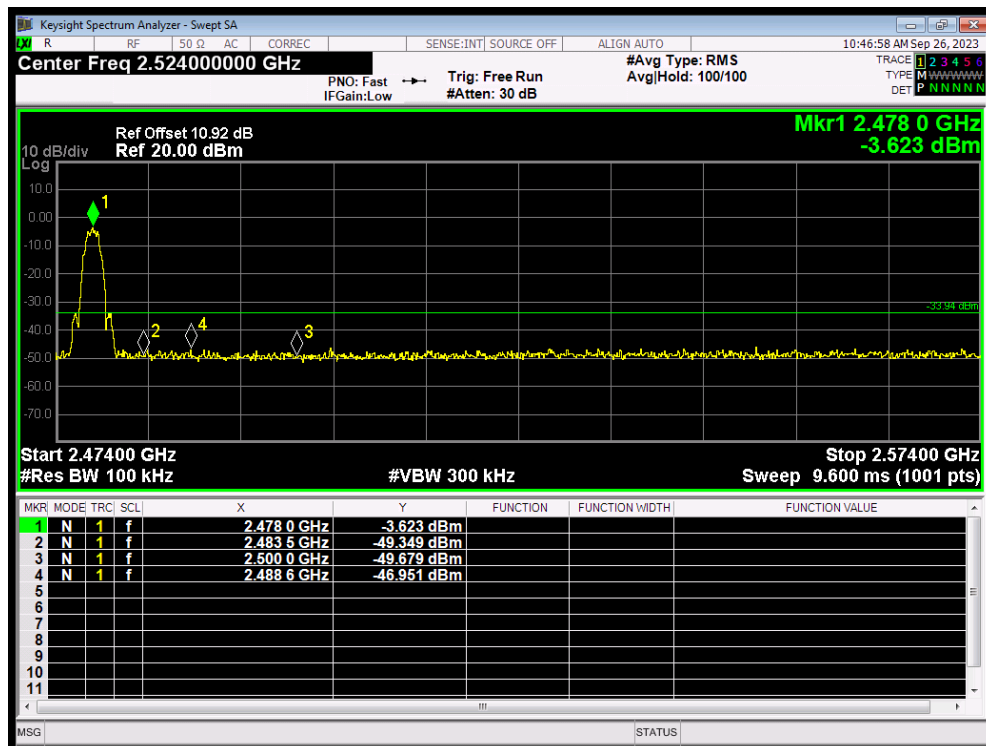
Band Edge BLE (2M) 2404MHz Emission



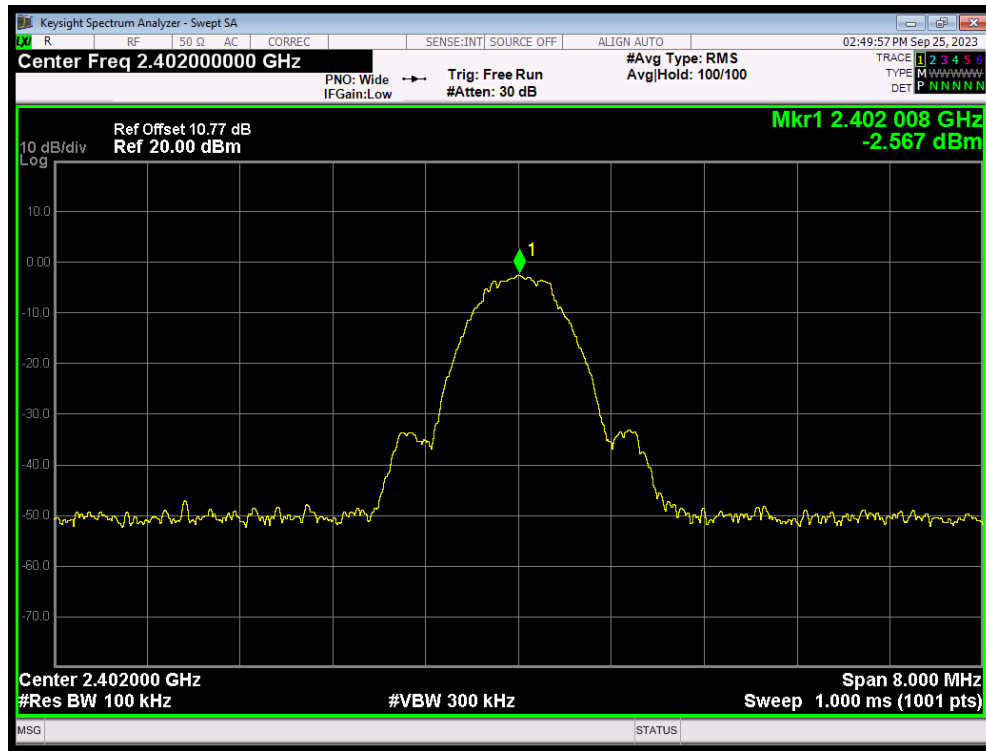
Band Edge BLE (2M) 2478MHz Ref



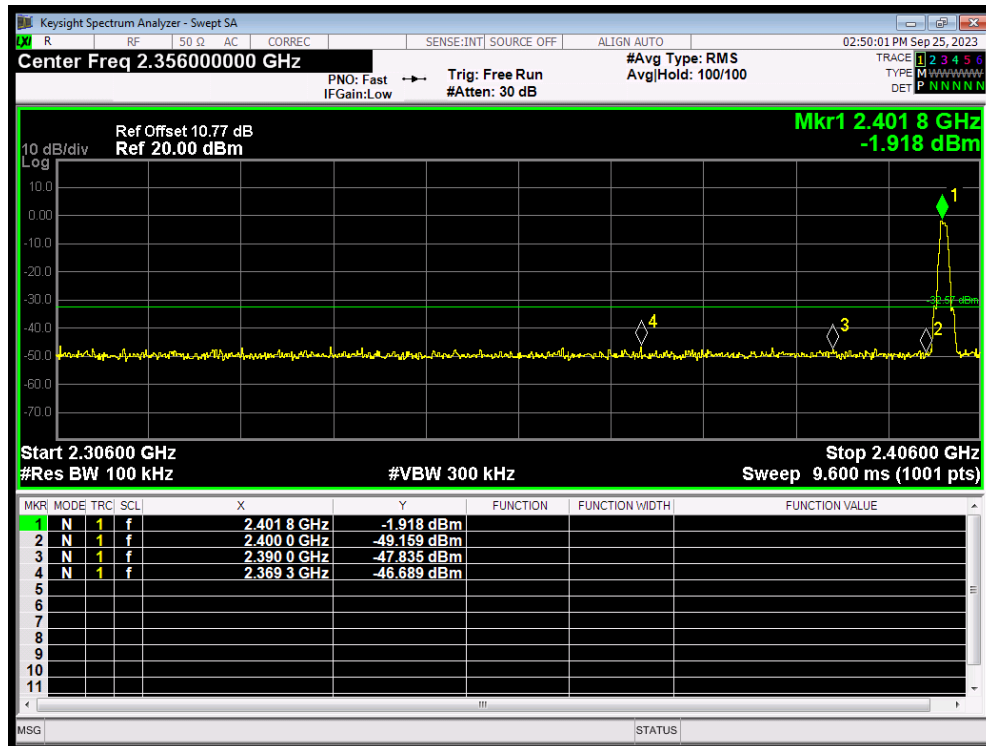
Band Edge BLE (2M) 2478MHz Emission



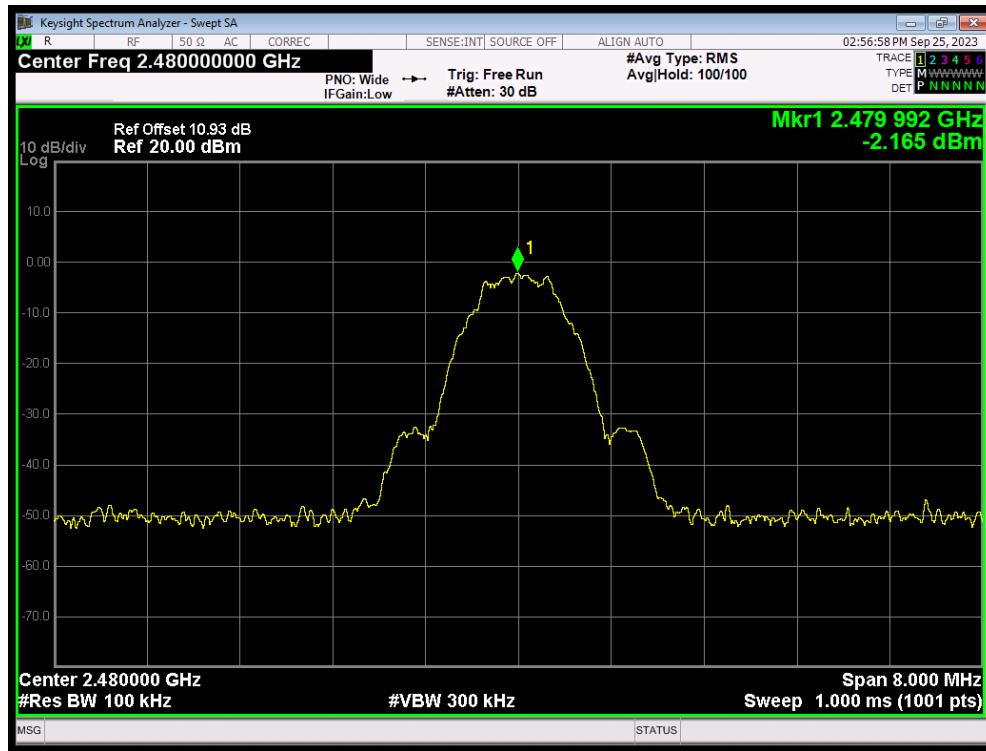
Band Edge BLE (S=2) 2402MHz Ref



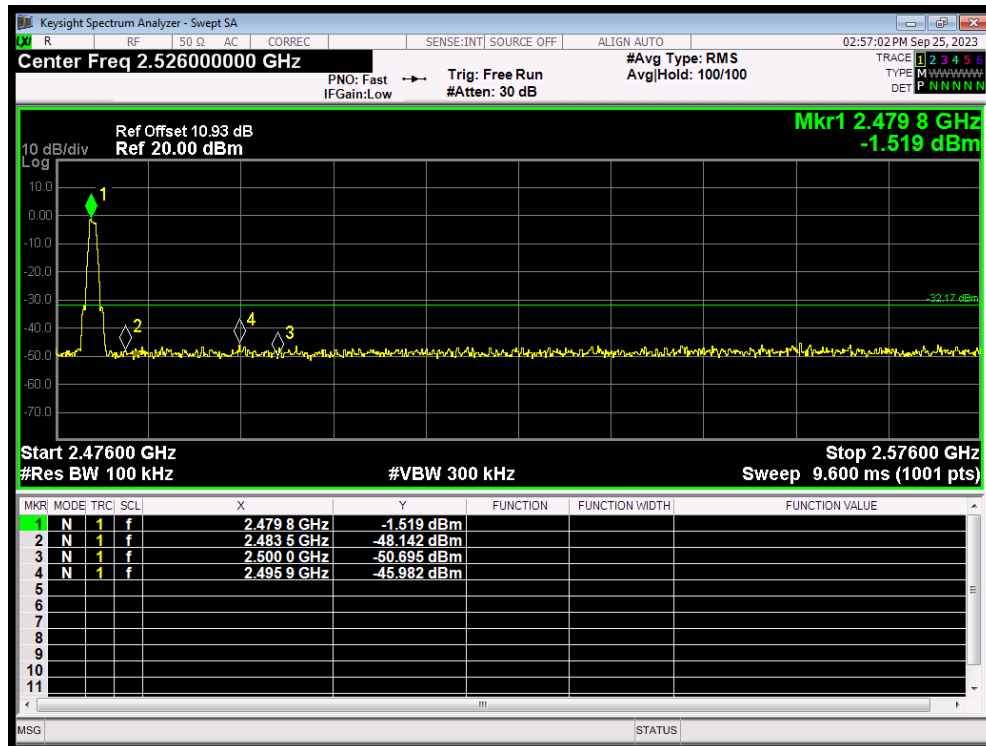
Band Edge BLE (S=2) 2402MHz Emission



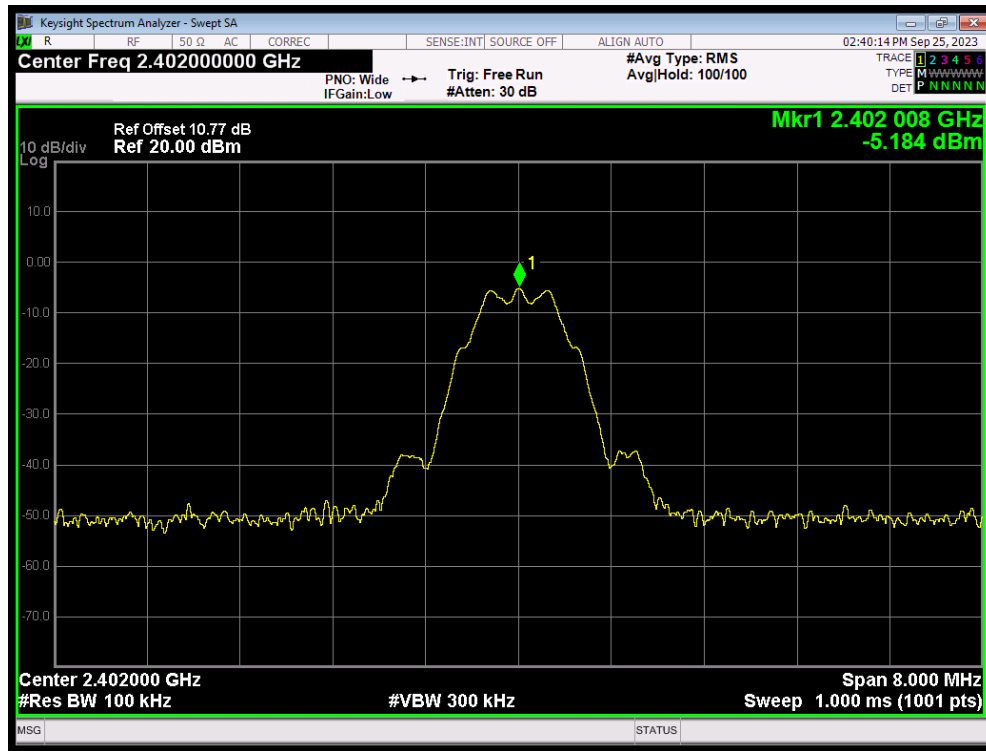
Band Edge BLE (S=2) 2480MHz Ref



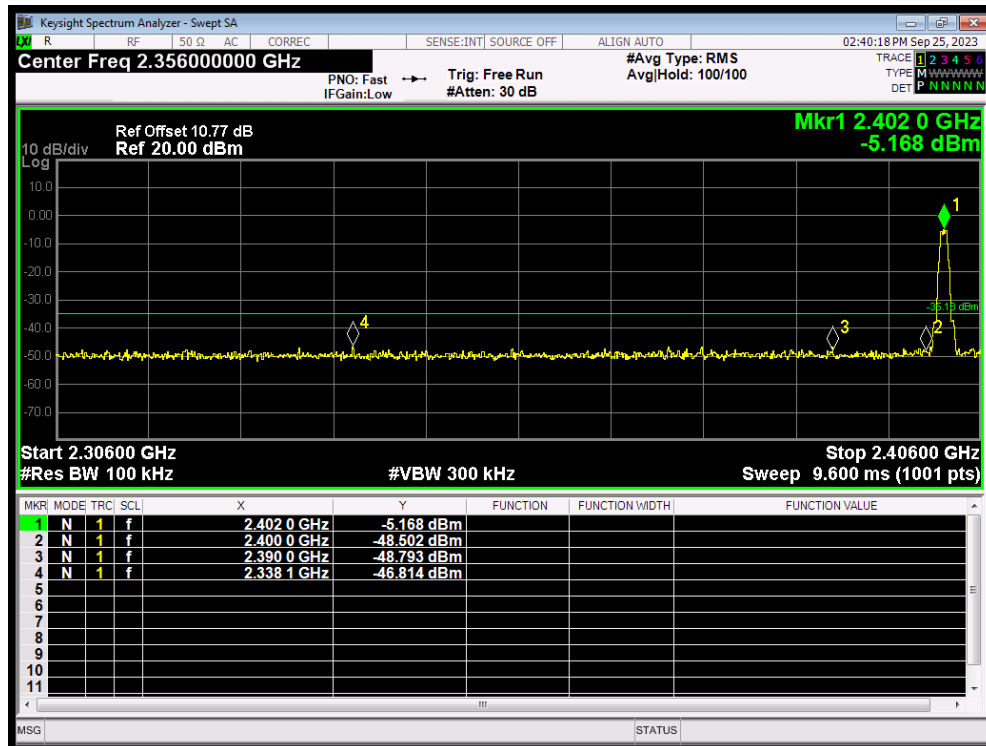
Band Edge BLE (S=2) 2480MHz Emission



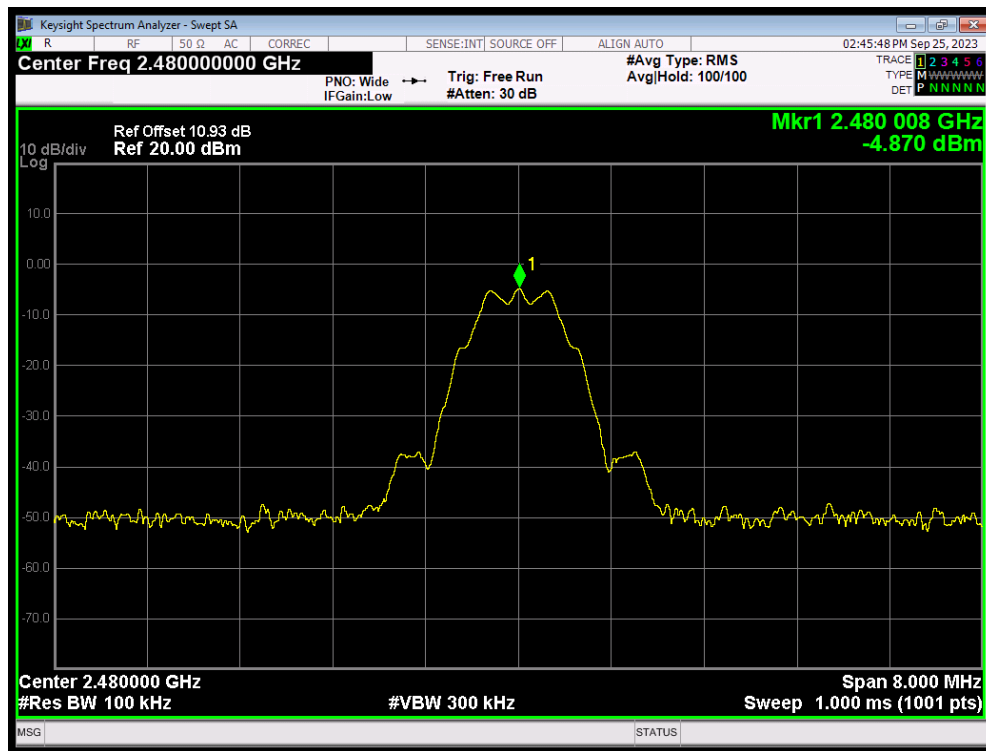
Band Edge BLE (S=8) 2402MHz Ref



Band Edge BLE (S=8) 2402MHz Emission



Band Edge BLE (S=8) 2480MHz Ref



Band Edge BLE (S=8) 2480MHz Emission

