

# TEST REPORT

**Report Number:** R14932101-E1b

**Applicant :** Microsoft Corporation  
1 Microsoft Way  
Redmond, WA 98052-8300, USA

**Model :** 2037

**FCC ID :** C3K2037

**IC :** 3048A-2037

**EUT Description :** Portable Computing Device

**Test Standard(s) :** FCC 47 CFR Part 15 Subpart C:2023  
ISED RSS-247 Issue 3:2023  
ISED RSS-GEN Issue 5 +A1+A2:2021

**Date Of Issue:**  
2024-04-16

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## REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
1	2024-02-29	Initial Issue	B. Kiewra
2	2024-03-21	Added note in each section stating which report the data was leveraged from	B. Kiewra
3	2024-04-16	Updated KDB reference in Section 3. Revised incorrect antenna gain in section 10.7	B. Kiewra

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# 1. ATTESTATION OF TEST RESULTS<sup>54</sup>

**COMPANY NAME:** Microsoft Corporation  
1 Microsoft Way  
Redmond, WA 98052-8300, USA

**EUT DESCRIPTION:** Portable Computing Device

**MODEL:** 2037

**SERIAL NUMBER:** 0F3B36H23383HJ, 0F3B36F23383HJ, A81245020002335A,  
2399649100000116, A81235010007335S, 0F3B36H23383HJ

**SAMPLE RECEIPT DATE:** 2023-10-10

**DATE TESTED:** 2023-10-11 to 2024-02-15

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C: 2023	Refer to Section 2
ISED RSS-247 Issue 3: 2023	Refer to Section 2
ISED RSS-GEN Issue 5+A1+A2: 2021	Refer to Section 2

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to ensure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document.

Approved & Released  
For UL LLC By:

Prepared By:



Michael Antola  
Staff Engineer  
Consumer, Medical and IT Segment  
UL LLC

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Project Engineer  
Consumer, Medical and IT Segment  
UL LLC

## 2. TEST RESULTS SUMMARY

This report contains data/info provided by the customer which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

Below is a list of the data/info provided by the customer:

- 1) Antenna gain and type (see section 6.3)

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Compliant	None
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power		
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Compliant	None
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions		
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions		
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions		

## 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC 47 CFR Part 2, FCC 47 CFR Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, KDB 484596 D01 Referencing Test Data v02r03, RSS-GEN Issue 5+A1+A2, and RSS-247 Issue 3.

## 4. FACILITIES AND ACCREDITATION

UL LLC is accredited A2LA, certification # 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
<input checked="" type="checkbox"/>	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A		27265	

## 5. DECISION RULES AND MEASUREMENT UNCERTAINTY

### 5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment used to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

### 5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
DC Supply voltages	1.70%
Time	3.39%

Uncertainty figures are valid to a confidence level of 95%.

### 5.4. SAMPLE CALCULATION

#### RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Final Voltage (dBuV)} = \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor (dB)} + \text{LISN Insertion Loss}$$

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$



## 6. EQUIPMENT UNDER TEST

### 6.1. EUT DESCRIPTION

The EUT is a Portable Computing Device.

### 6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE - C0	17.82	60.53
2402 - 2480	BLE - C1	17.52	56.49
2402 - 2480	BLE - 2Tx	17.33	54.08

### 6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

Chain	Frequency (MHz)	Gain (dBi)	Type
0	2400-2483.5	5.69	PIFA
1	2400-2483.5	4.66	PIFA
MIMO	2400-2483.5	6.74	PIFA

### 6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 1.0.3808.9500

### 6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power/PSD as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low and high or low, middle, and high channels. Spurious emissions performed only on modes with worst-case power and PSD.

The EUT is intended to operate in only one orientation, therefore, all final radiated testing was performed with the EUT in this intended orientation of operation.

All conducted testing, with the exception of power, done in SISO modes to cover MIMO. Power and radiated testing performed in both MIMO and SISO modes.

**6.6. DESCRIPTION OF TEST SETUP**  
**SUPPORT EQUIPMENT**

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Power Supply	Orting	2062	OT3100650	NA
USB Drive	PNY	16GB	NA	NA
Headphones	Sony	NA	NA	NA
USB C to Ethernet	TP-link	UE300C	2234082002838	NA
Switch	Linksys	EFAH05WVER.3	RA13048005308 EH1040 MA	NA
Support Laptop	Lenovo	ThinkPad	LR-0390B9	NA
Support Laptop	Lenovo	ThinkPad	LR-03N0JZ	NA
Support Laptop Charger	Lenovo	ThinkPad	38G337	NA
Support Laptop Charger	Lenovo	ThinkPad	38G337	NA
Support Laptop	Lenovo	ThinkPad	LR-0390B9	NA

**I/O CABLES**

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB-C	2	USB-C	Shielded	>3m	EUT to Power Supply
2	Aux	1	Aux	Shielded	<3m	Headphones
3	USB-A	1	USB-A	Shielded	<3m	EUT to USB Drive
4	USB-C	2	USB-C	Shielded	>3m	USB to Ethernet adapter Ethernet is unshielded

**TEST SETUP**

The EUT is setup as a standalone device.

**SETUP DIAGRAMS**

Please refer to R14932101-EP1b for setup diagrams

## 7. REUSE OF TEST DATA

### 7.1. INTRODUCTION

According to the manufacturer, models C3K2036 and C3K2037 unlicensed radios (WLAN/BT/BLE) are electrically identical. The C3K2036 test data shall remain representative of C3K2037 so, C3K2037 leverages test data from C3K2036.

The applicant takes full responsibility that the test data as referenced in this section represents compliance for this FCC ID.

Data being leveraged from C3K2036:

Duty Cycle

Output Power

6dB BW

99% BW

PSD

Conducted Spurious Emissions – Authorized and MIMO Restricted Band

### 7.2. DEVICES DIFFERENCES

Difference between C3K2036 and C3K2037:

Microsoft Corporation hereby declares that the radio circuitry of WLAN 2.4GHz, WLAN 5GHz, Bluetooth, is identical among models C3K2036 and C3K2037. Therefore, the following report/data of C3K2036 may represent C3K2037. Refer to manufacturer’s operational description for differences between C3K2036 and C3K2037.

### 7.3. REFERENCE DETAIL

Equipment Class	Reference FCC ID	Report Title/Section
DTS (BLE)	C3K2036	R14932101-E1a FCC ISED BLE REPORT 2036 / Section 9

### 7.4. SPOT CHECK VERIFICATION RESULTS SUMMARY

Spot check verification has been done on device C3K2037. The data from the application has been verified through appropriate spot checks to demonstrate compliance for this device as shown in the summary.

C3K2037 SPOT CHECK RESULTS					
Technology	Test Item	Channel	C3K2036 Reading	C3K2037 Reading	Difference <sup>2</sup> ≤0.25
BLE (GFSK)	Power <sup>1</sup>	2440	17.82	17.95	0.01
	PSD	2440	7.489	6.786	0.09
	CBE	2480	-48.631	-48.911	0.01
	CSE	2480	-38.294	-39.367	0.03

Note 1: Power was taken at max setting prior to any power tuning

Note 2: The ≤0.25 requirement can be found in KDB 484596.

Difference equation:

$$Difference = \frac{|spot\ check\ data - reference\ data|}{|reference\ data|}$$

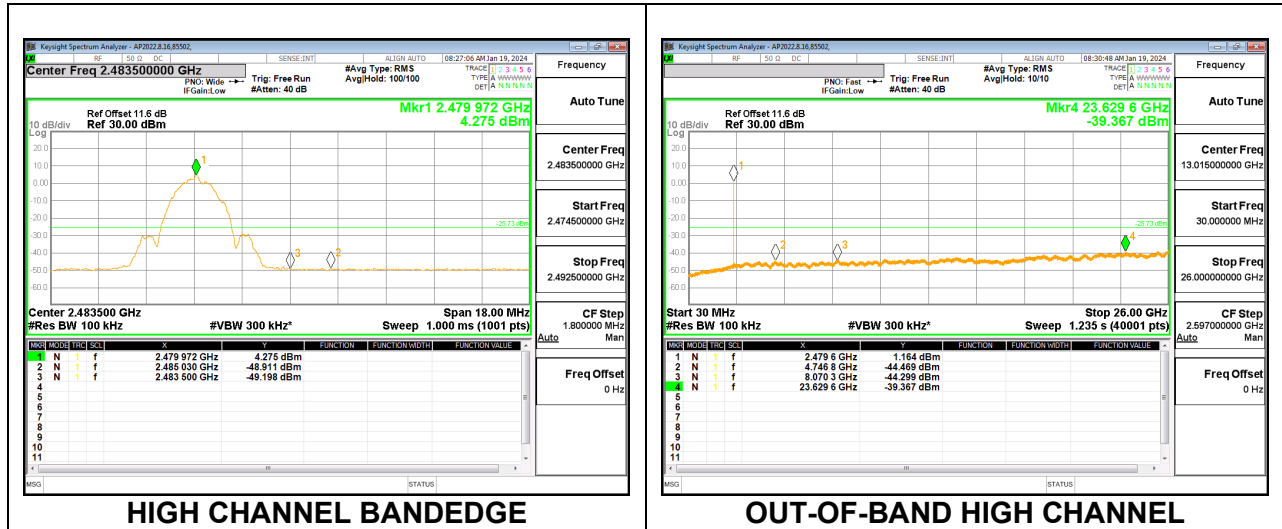
## 7.5. SPOT CHECK DATA

### 7.5.1. OUTPUT POWER

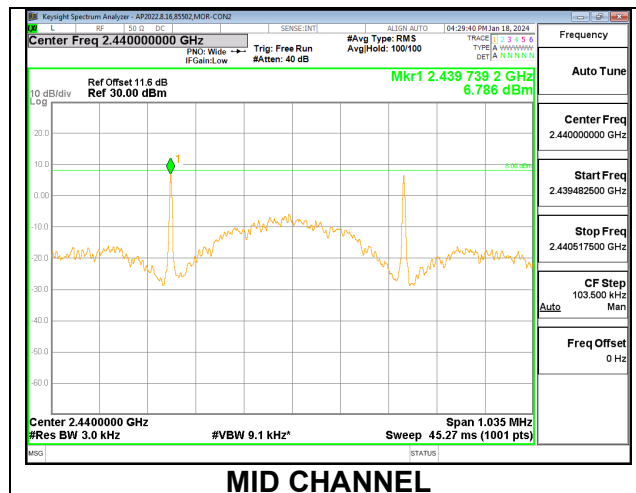
Tested By:	85502
Date:	2023-01-19

Channel	Frequency (MHz)	Output Power (dBm)
Middle	2441	17.95

### 7.5.2. CONDUCTED SPURIOUS EMISSIONS



### 7.5.3. POWER SPECTRAL DENSITY



## 8. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

### Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
90418	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2023-02-02	2024-02-02
90411	Spectrum Analyzer	Keysight Technologies	N9030A	2023-08-02	2024-08-02
90416	Spectrum Analyzer	Keysight Technologies	N9030A	2023-06-09	2024-06-30
179892	Environmental Meter	Fisher Scientific	15-077-963	2023-07-26	2024-07-31
134477	RF Power Meter	Keysight Technologies	N1912A	2023-08-04	2024-08-04
135124	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2023-07-12	2024-07-31
PWM005	RF Power Meter	Keysight Technologies	N1912A	2022-09-02	2024-09-02
238710	Environmental Meter	Fisher Scientific	15-077-963	2023-06-27	2024-06-27
90410	Spectrum Analyzer	Keysight Technologies	N9030A	2023-06-14	2024-06-14
SOFTEMI	Antenna Port Software	UL	Version 2022.8.16	NA	NA
226563	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2023-02-16	2024-02-16
226552	SMA Coaxial 20dB Attenuator 25MHz-18GHz	CentricRF	C18S2-20	2023-02-16	2024-02-16
226551	SMA Coaxial 20dB Attenuator 25MHz-18GHz	CentricRF	C18S2-20	2023-02-16	2024-02-16
Pad A	SMA Coaxial 20dB Attenuator 25MHz-18GHz	CentricRF	C18S2-20	2023-02-16	2024-02-29
Pad B	SMA Coaxial 20dB Attenuator 25MHz-18GHz	CentricRF	C18S2-20	2023-02-16	2024-02-29
CBL105	Micro-Coax UTiFLEX Cable Assembly, Low Loss	Carlisle Interconnect Technologies	UFB-197C-0-0160-300300	2023-02-17	2024-02-17
CBL031	SMA Male to SMA Male Cable Using PE-P141 Coax - 12"	Pasternack	Sucoflex 104PEA	2023-06-27	2024-06-27
CBL030	SMA Male to SMA Male Cable Using PE-P141 Coax - 12"	Pasternack	Sucoflex 104PEA	2023-06-27	2024-06-27
CBL012	Micro-Coax UTiFLEX Cable Assembly, Low Loss	Carlisle Interconnect Technologies	UFB293C-0-2400-300300	2023-01-05	2024-01-05
CBL091	Micro-Coax UTiFLEX Cable Assembly, Low Loss,40Ghz	Carlisle Interconnect Technologies	UFA147A-2-0360-200200	2023-02-17	2024-02-17

Note: All equipment within calibration at time of test.

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 4)

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
<b>1-18 GHz</b>					
89509	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2023-05-23	2025-05-23
<b>18-40 GHz</b>					
204704	Horn Antenna, 18-26.5GHz	Com-Power	AH-826	2023-07-20	2025-07-20
<b>Gain-Loss Chains</b>					
207640	Gain-loss string: 1-18GHz	Various	Various	2023-05-17	2024-05-17
225795	Gain-loss string: 18-40GHz	Various	Various	2023-05-17	2024-05-17
<b>Receiver &amp; Software</b>					
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2023-04-10	2024-04-10
90416	Spectrum Analyzer	Keysight	N9030A	2023-06-09	2024-06-30
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
<b>Additional Equipment used</b>					
200540	Environmental Meter	Fisher Scientific	15-077-963	2022-10-05	2023-10-31
241204	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05

Note: All equipment within calibration at time of test.

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
<b>0.009-30MHz</b>					
135144	Active Loop Antenna	ETS-Lindgren	6502	2023-01-17	2024-01-17
<b>30-1000 MHz</b>					
159203	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2023-01-23	2024-01-23
<b>1-18 GHz</b>					
206211	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2023-04-06	2024-04-06
<b>Gain-Loss Chains</b>					
91974	Gain-loss string: 0.009-30MHz	Various	Various	2023-05-16	2024-05-16
91976	Gain-loss string: 25-1000MHz	Various	Various	2023-05-16	2024-05-16
91979	Gain-loss string: 1-18GHz	Various	Various	2023-05-16	2024-05-16
<b>Receiver &amp; Software</b>					
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2023-03-24	2024-03-24
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
<b>Additional Equipment used</b>					
200539	Environmental Meter	Fisher Scientific	15-077-963	2022-10-05	2023-10-31
241205	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2023-04-04	2024-04-04
179892	Environmental Meter	Fisher Scientific	15-077-963	2023-07-26	2024-06-31
80391	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2023-07-31	2024-07-31
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2023-08-01	2024-08-01
52859	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2023-04-04	2024-04-04
PS214	AC Power Source	Elgar	CW2501M	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
91432	LISN, 50-ohm/50-uH, 2-conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	NA	NA

Note: All equipment within calibration at time of test.

## 9. MEASUREMENT METHOD

Duty Cycle: ANSI C63.10 Subclause -11.6

6 dB BW: ANSI C63.10 Subclause -11.8.1

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter  
ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11 and 6.10.4

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1 and 6.10.5

Radiated Spurious Emissions: ANSI C63.10-2013 Section 6.3 to 6.6

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.



# 10. ANTENNA PORT TEST RESULTS

## 10.1. ON TIME AND DUTY CYCLE

### LIMITS

None; for reporting purposes only.

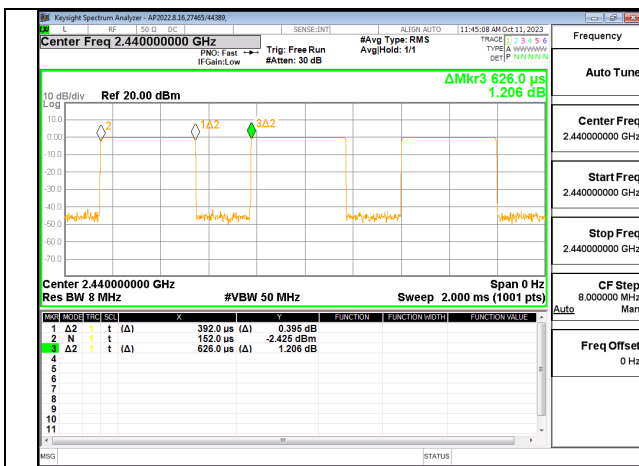
### PROCEDURE

ANSI C63.10 Subclause - 11.6 Zero Span

### ON TIME AND DUTY CYCLE RESULTS

Note: This data leveraged from R14932101-E1a

Mode	On Time (ms)	Period (ms)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
BLE - 1Mbps	0.392	0.626	0.6262	62.62%	4.07
BLE - 2Mbps	0.204	0.626	0.3259	32.59%	9.74
BLE - 125kbps	3.105	3.750	0.8280	82.80%	1.64
BLE - 500kbps	1.070	1.875	0.5707	57.07%	4.87



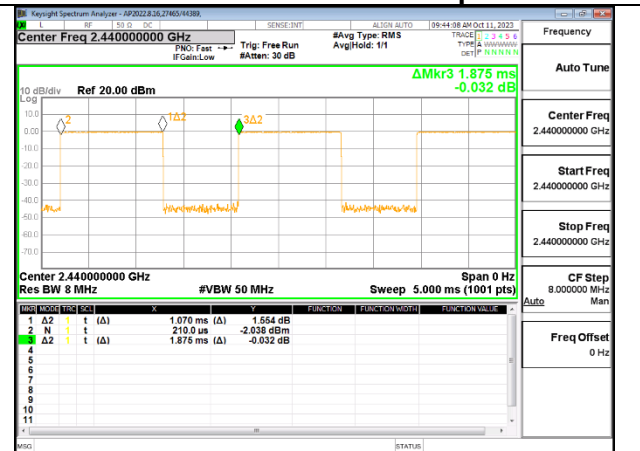
DUTY CYCLE BLE 1Mbps



DUTY CYCLE BLE 2Mbps



DUTY CYCLE BLE 125kbps



DUTY CYCLE BLE 500kbps

## 10.2. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

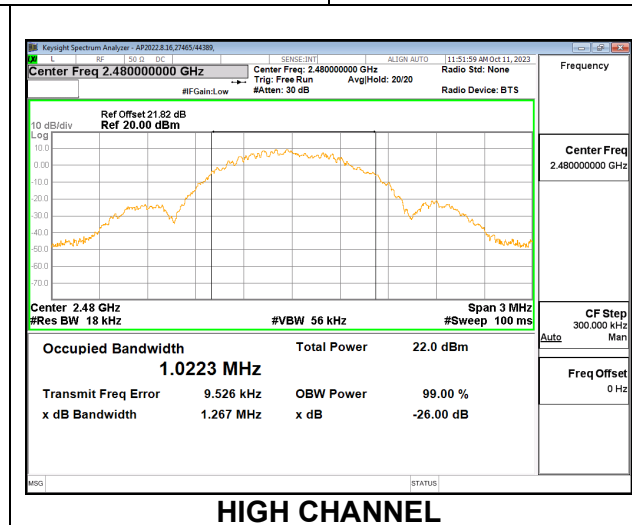
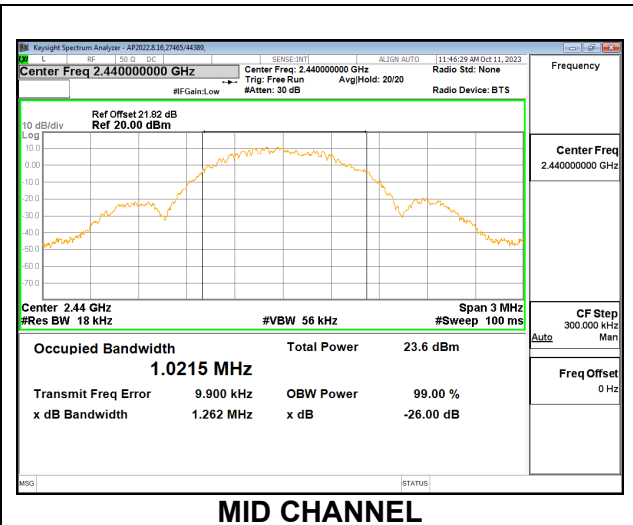
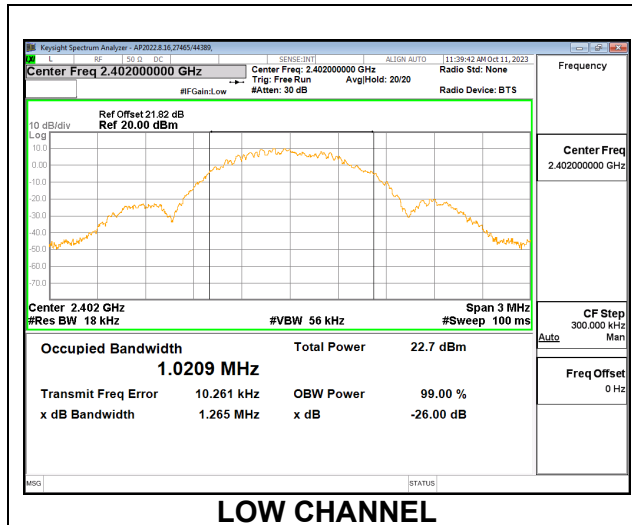
### RESULTS

Note: This data leveraged from R14932101-E1a

#### 10.2.1. BLE (1Mbps)

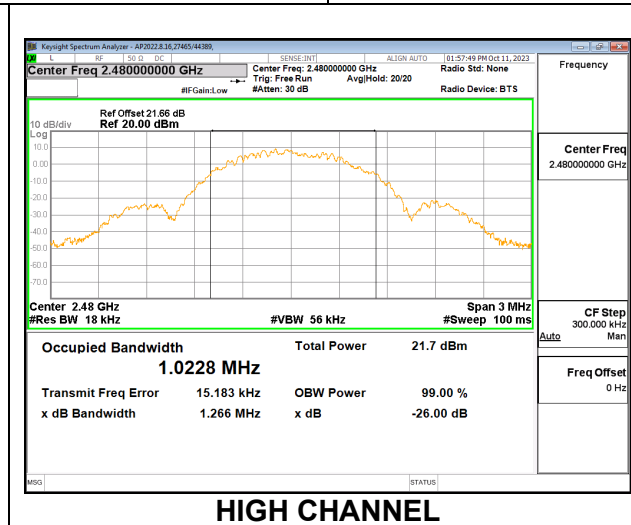
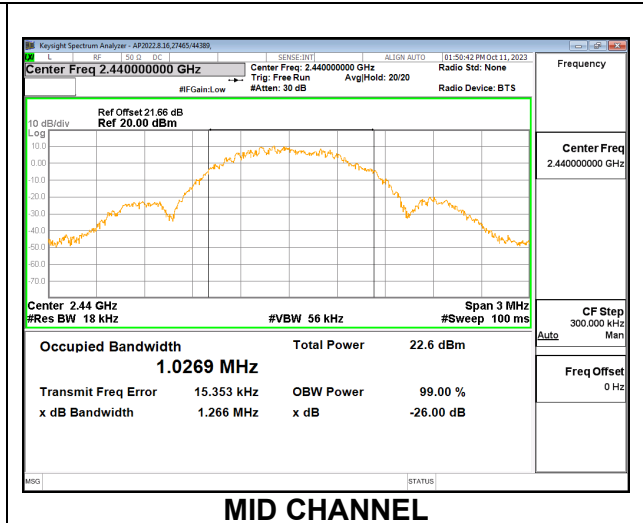
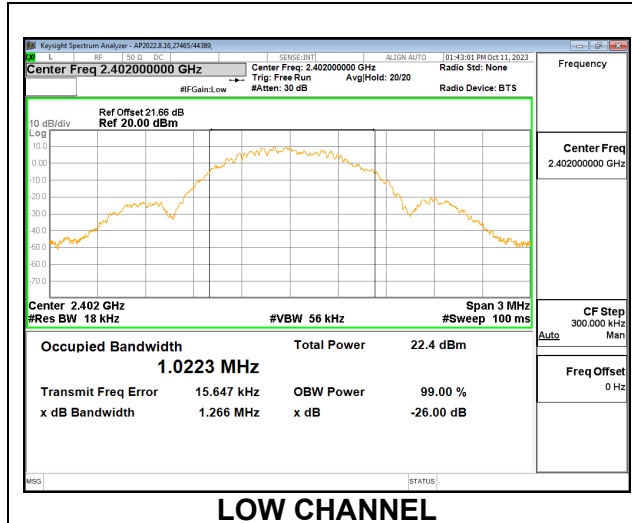
#### CHAIN 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0209
Middle	2440	1.0215
High	2480	1.0223



**CHAIN 1**

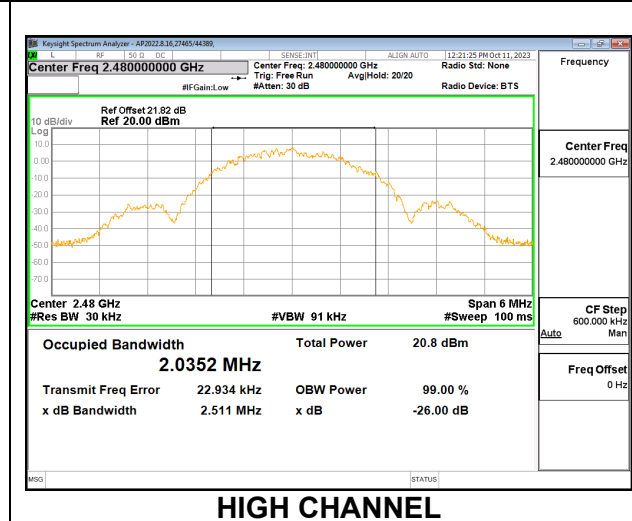
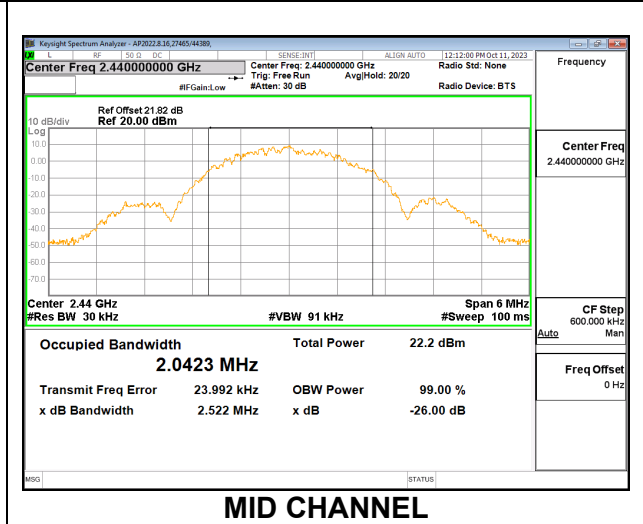
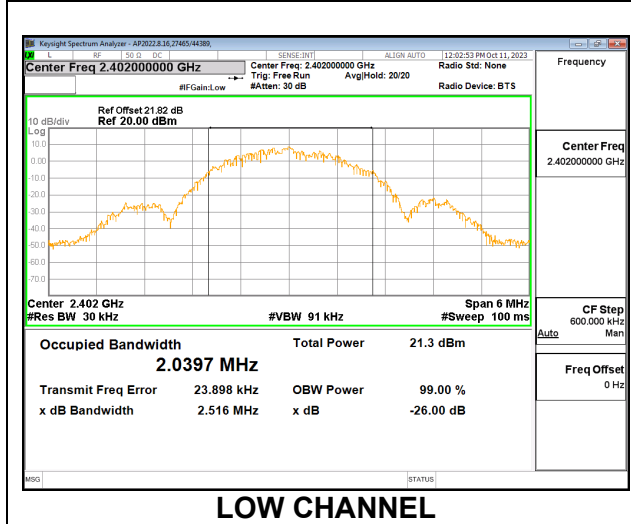
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0223
Middle	2440	1.0269
High	2480	1.0228



## 10.2.2. BLE (2Mbps)

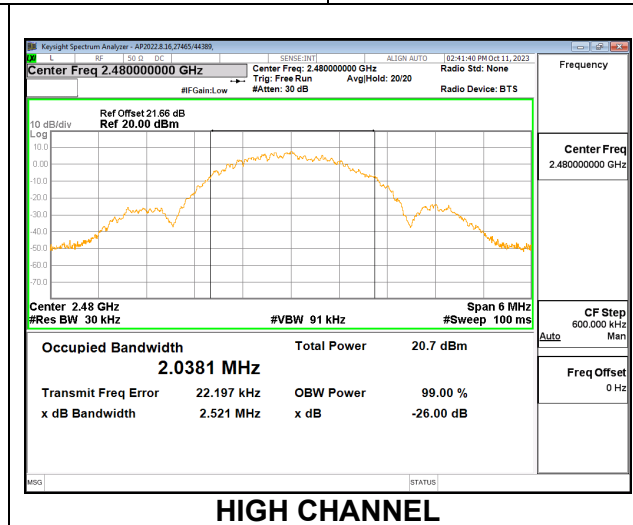
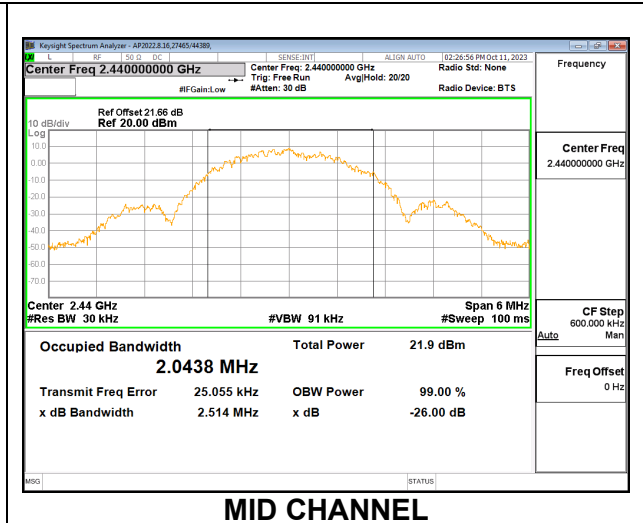
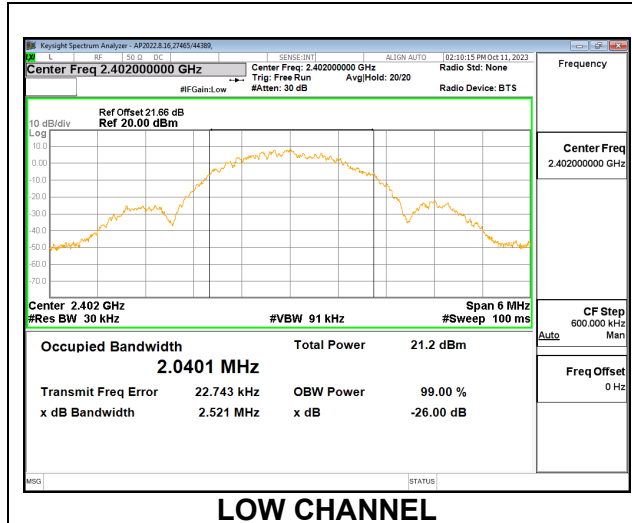
### CHAIN 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	2.0397
Middle	2440	2.0423
High	2480	2.0352



**CHAIN 1**

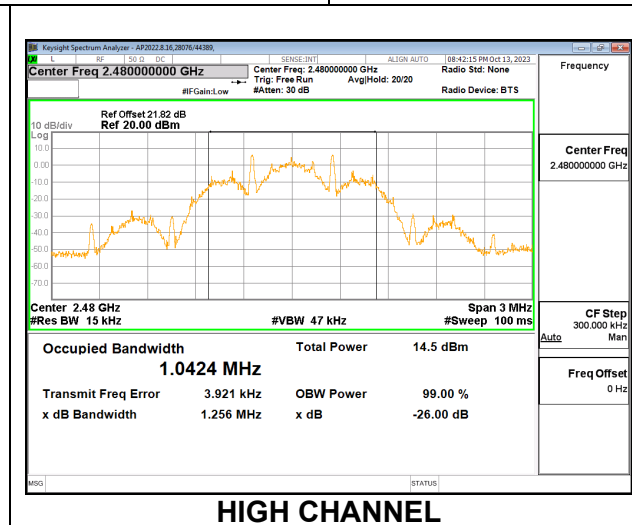
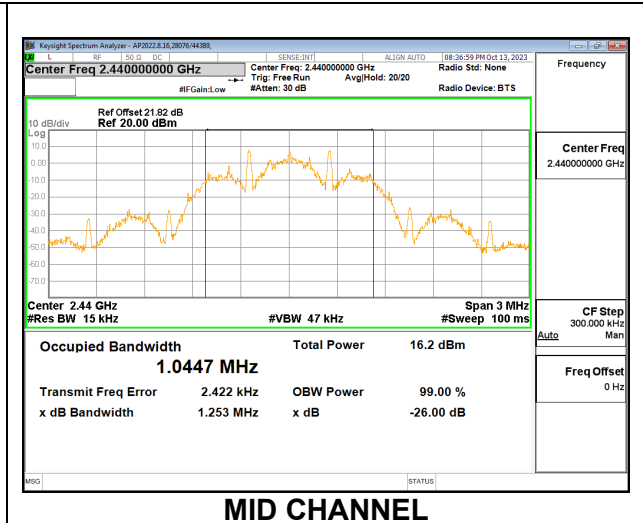
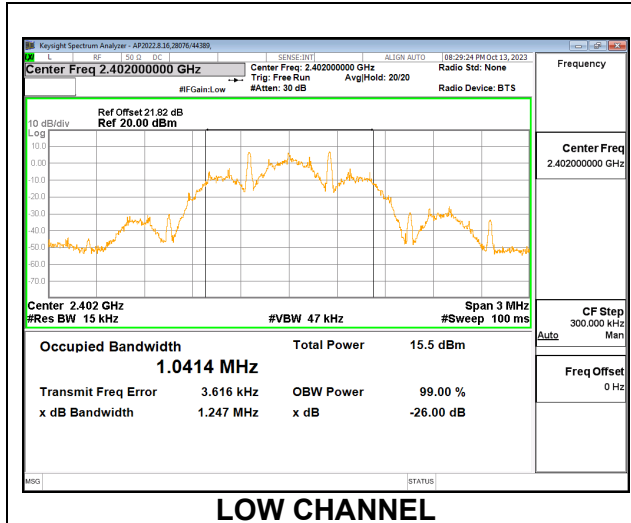
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	2.0401
Middle	2440	2.0438
High	2480	2.0381



### 10.2.3. BLE (125Kbps)

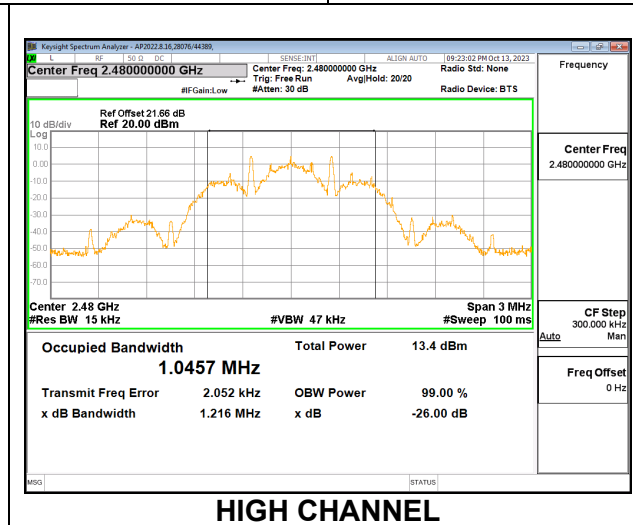
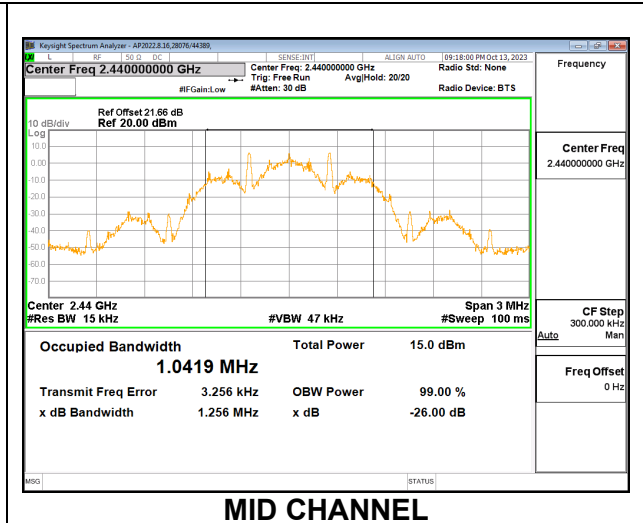
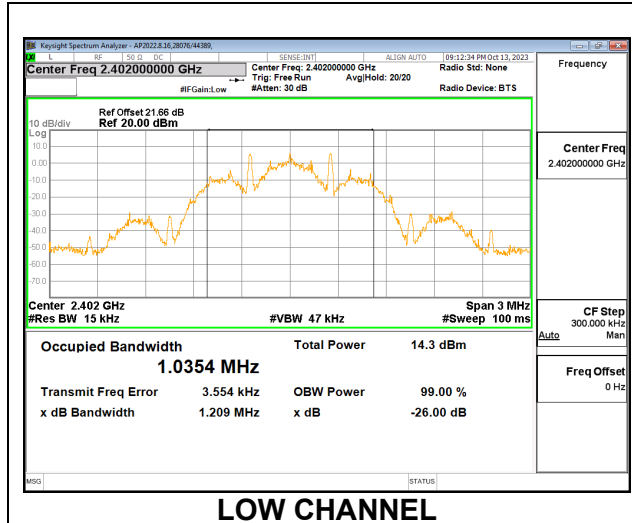
#### CHAIN 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0414
Middle	2440	1.0447
High	2480	1.0424



**CHAIN 1**

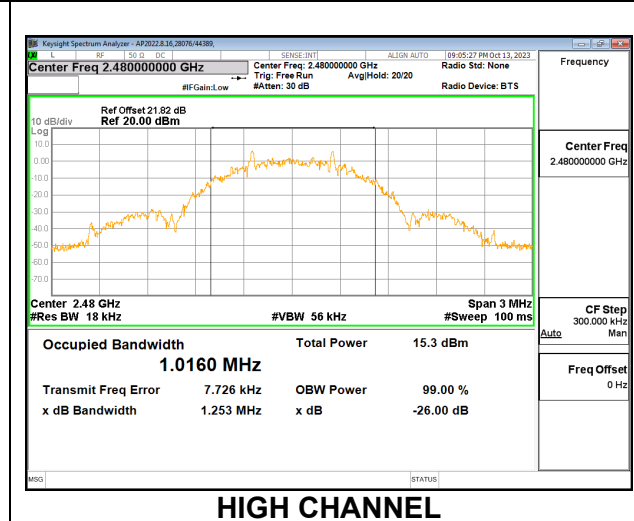
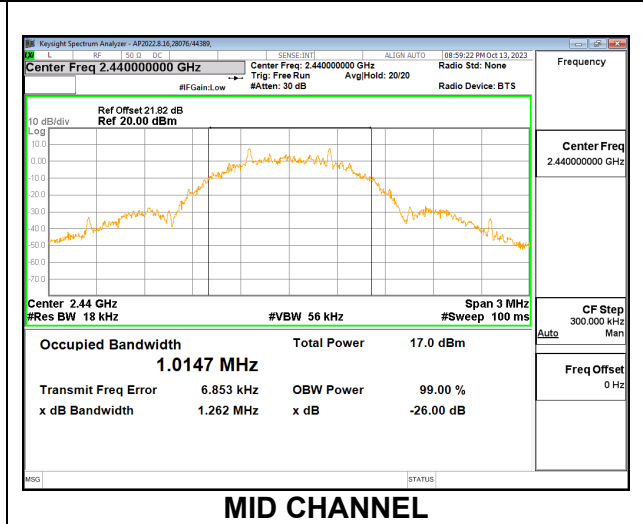
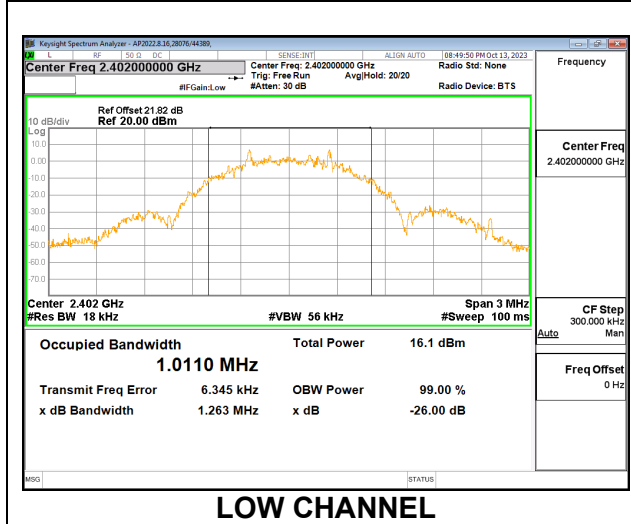
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0354
Middle	2440	1.0419
High	2480	1.0457



### 10.2.4. BLE (500Kbps)

#### CHAIN 0

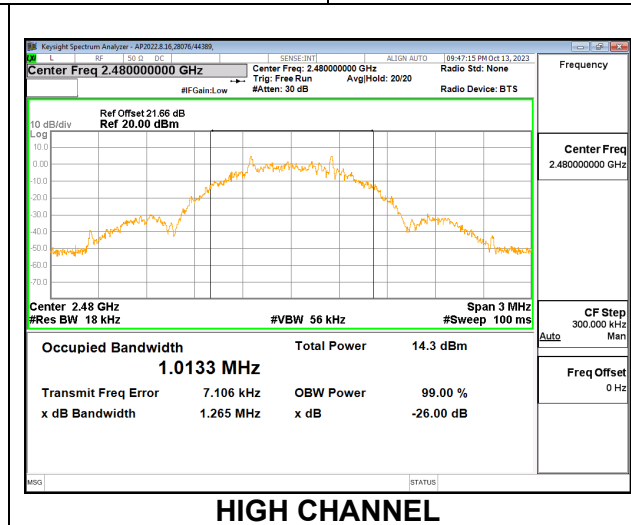
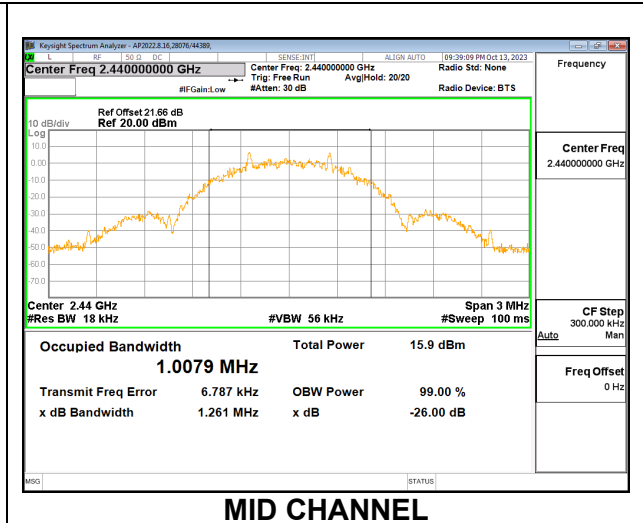
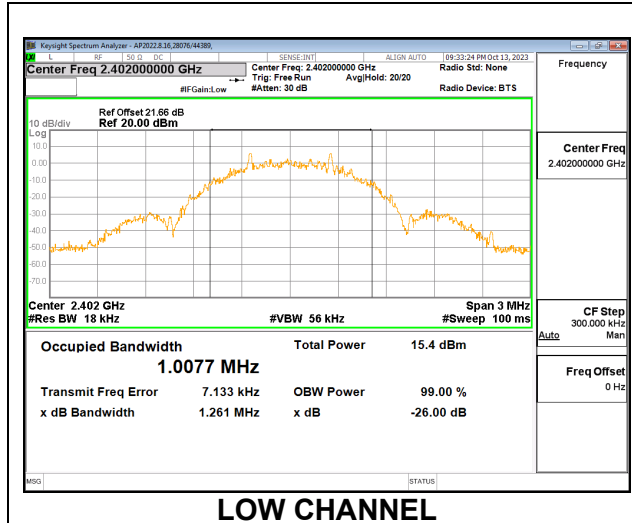
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0110
Middle	2440	1.0147
High	2480	1.0160





**CHAIN 1**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0077
Middle	2440	1.0079
High	2480	1.0133



### 10.3. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a)(2)  
 RSS-247 5.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

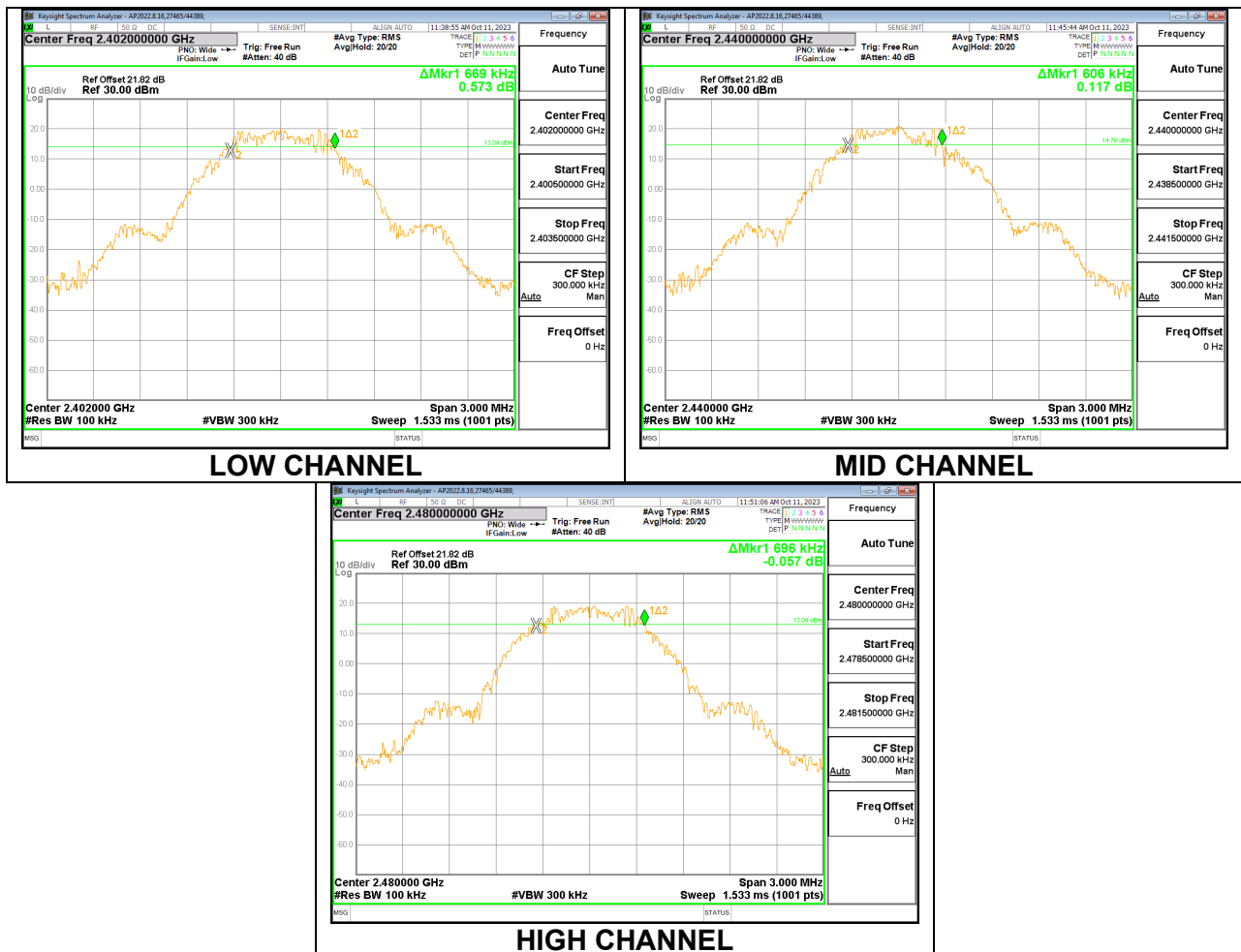
#### RESULTS

Note: This data leveraged from R14932101-E1a

#### 10.3.1. BLE (1Mbps)

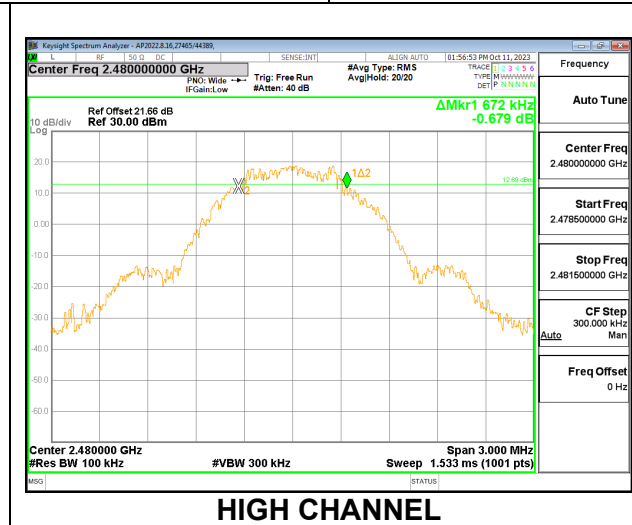
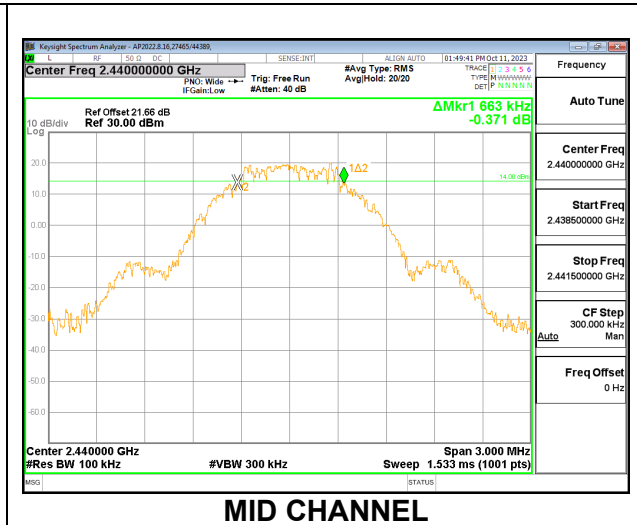
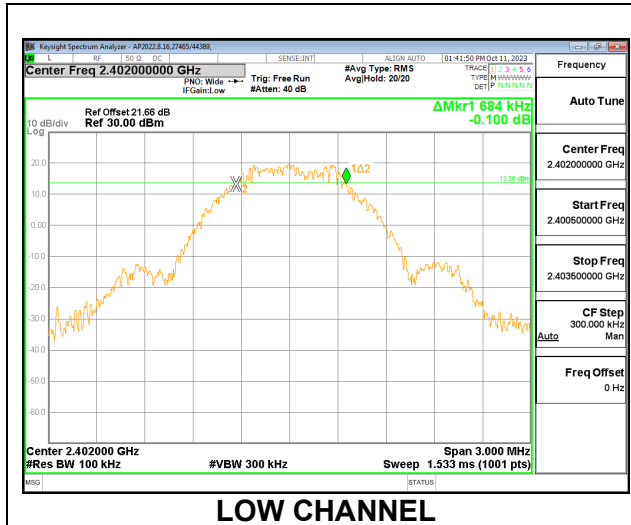
#### CHAIN 0

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.669	0.5
Middle	2440	0.606	0.5
High	2480	0.696	0.5



**CHAIN 1**

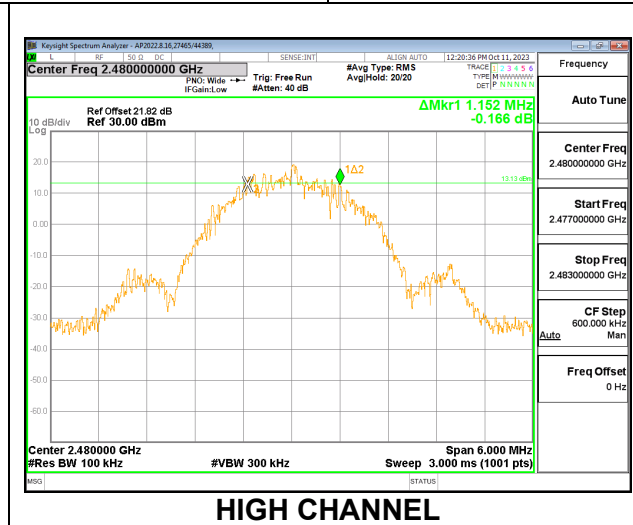
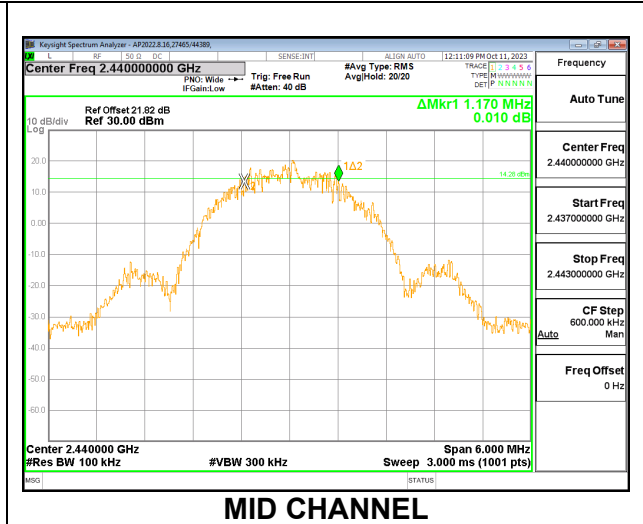
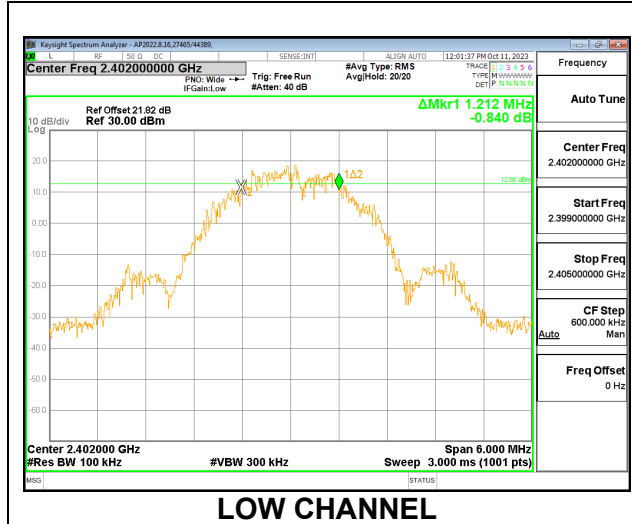
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.684	0.5
Middle	2440	0.663	0.5
High	2480	0.672	0.5



### 10.3.2. BLE (2Mbps)

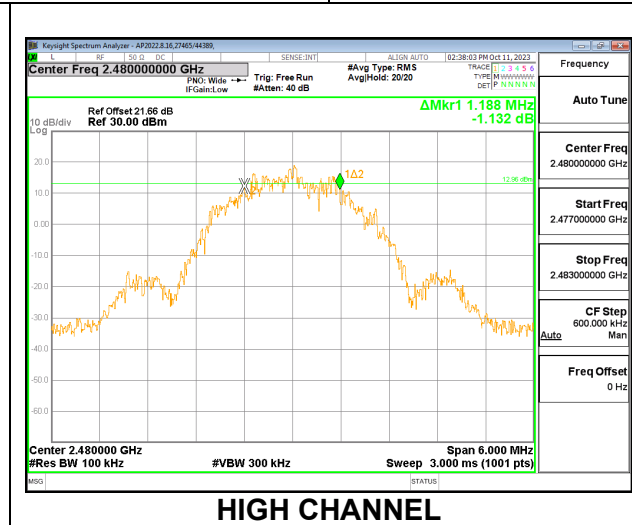
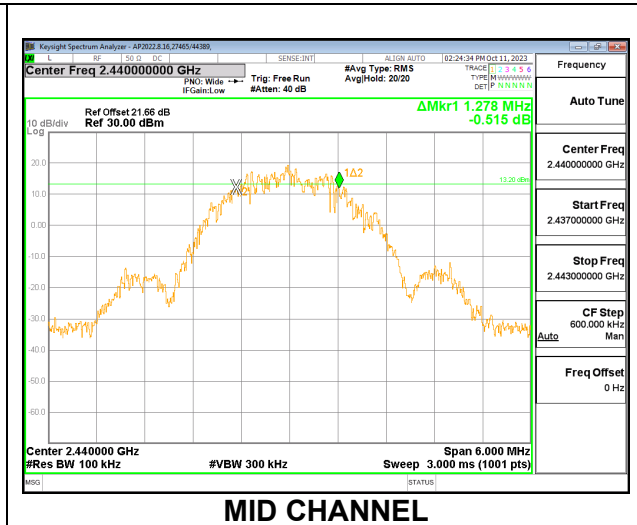
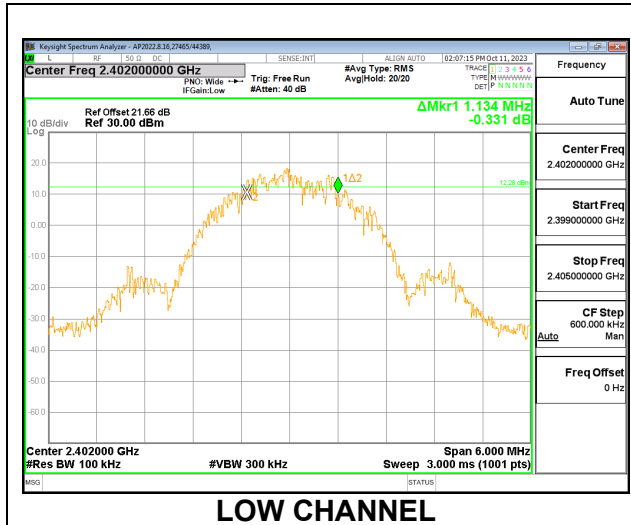
#### CHAIN 0

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	1.212	0.5
Middle	2440	1.170	0.5
High	2480	1.152	0.5



**CHAIN 1**

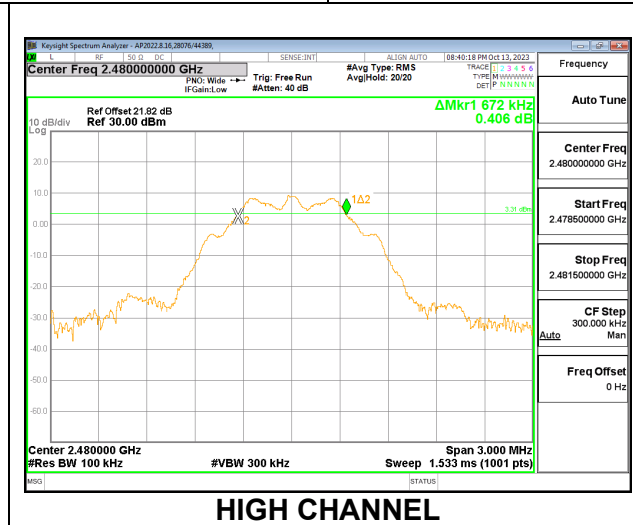
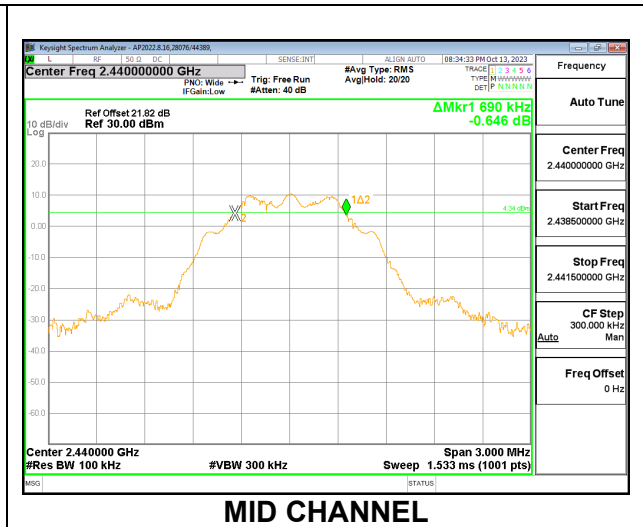
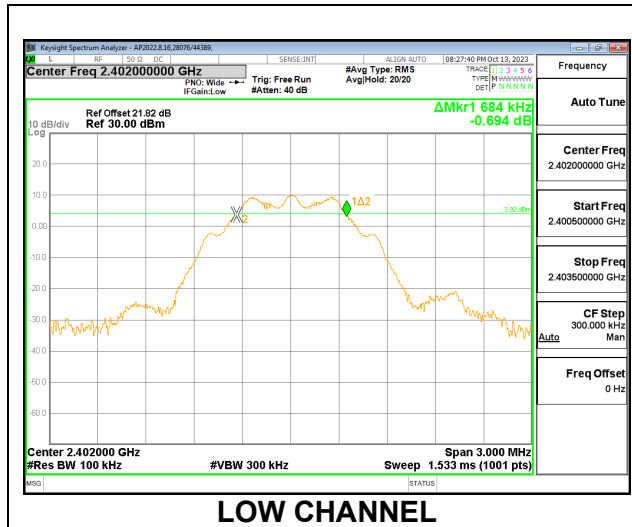
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	1.134	0.5
Middle	2440	1.278	0.5
High	2480	1.188	0.5



### 10.3.3. BLE (125Kbps)

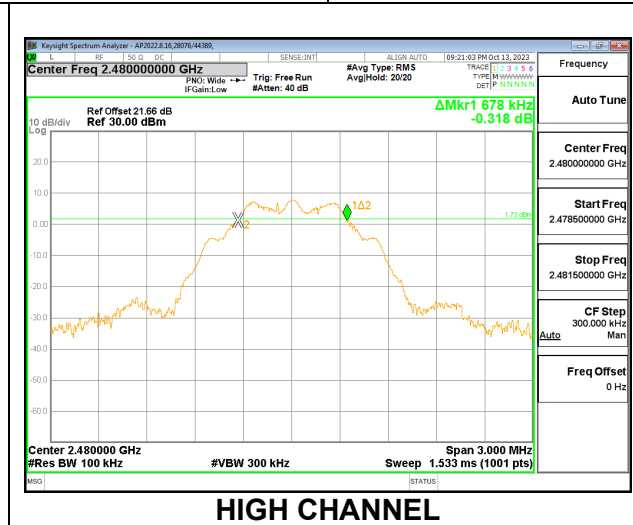
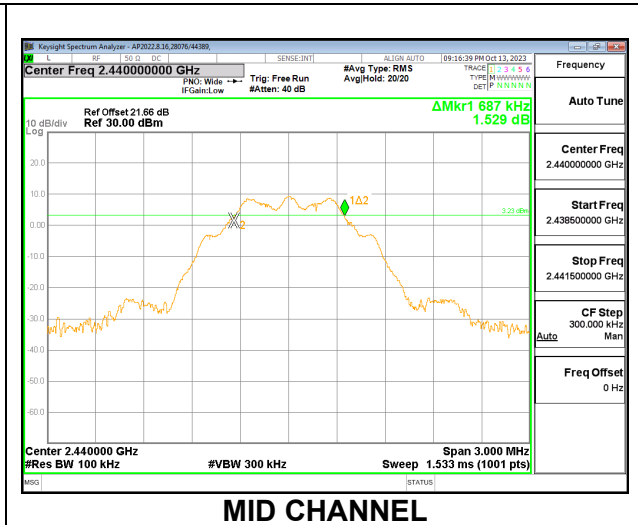
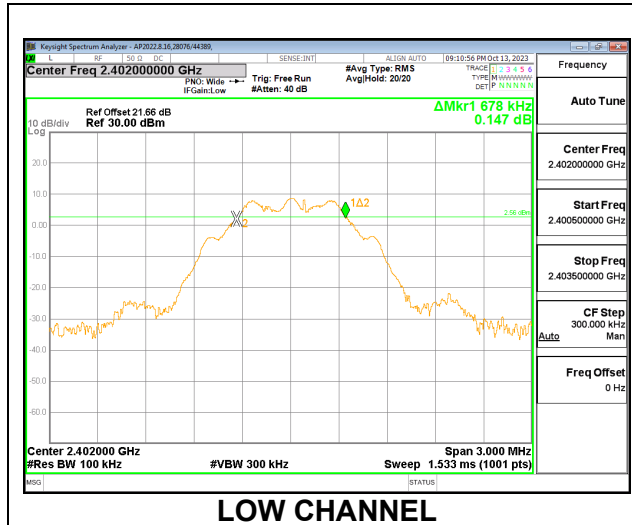
#### CHAIN 0

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.684	0.5
Middle	2440	0.690	0.5
High	2480	0.672	0.5



**CHAIN 1**

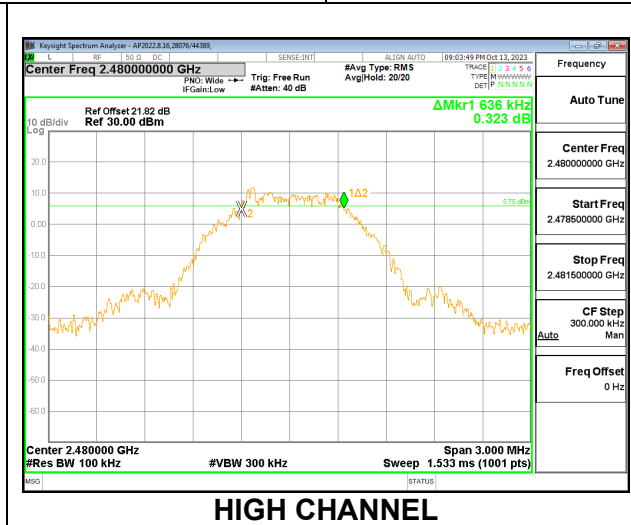
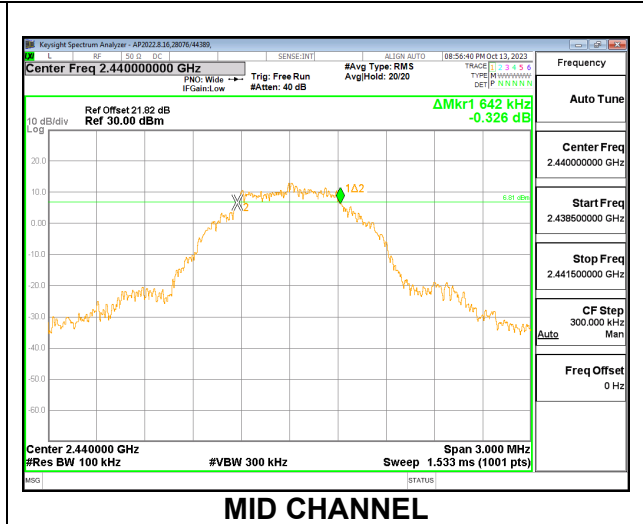
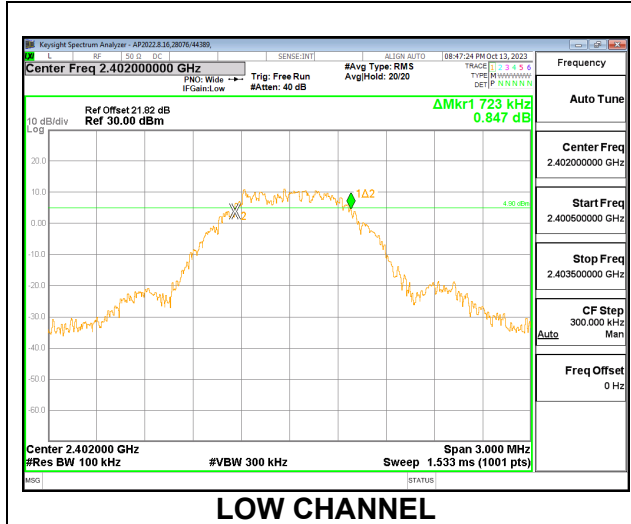
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.678	0.5
Middle	2440	0.687	0.5
High	2480	0.678	0.5



### 10.3.4. BLE (500Kbps)

#### CHAIN 0

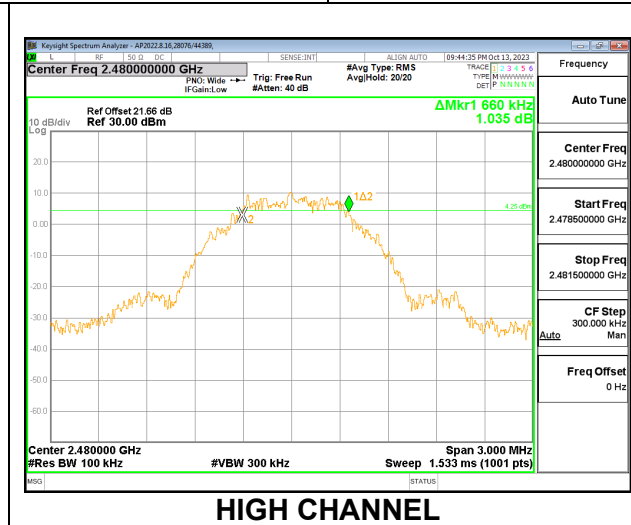
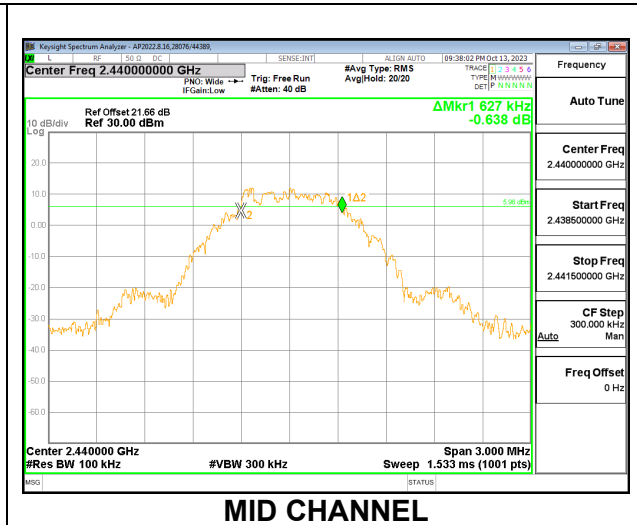
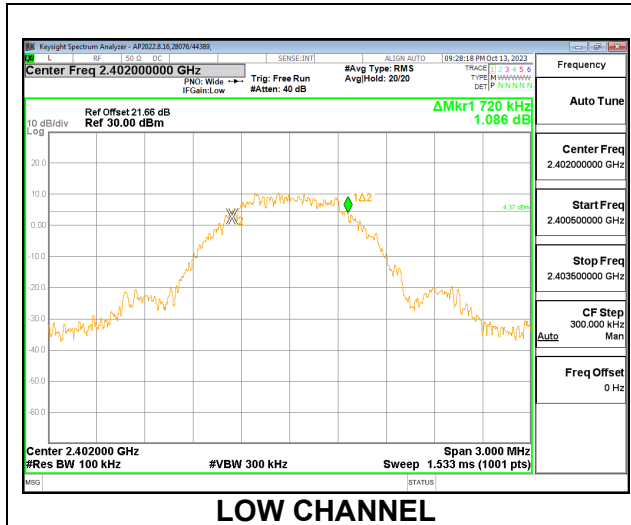
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.723	0.5
Middle	2440	0.642	0.5
High	2480	0.636	0.5





**CHAIN 1**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.720	0.5
Middle	2440	0.627	0.5
High	2480	0.660	0.5



## 10.4. OUTPUT POWER

### LIMITS

FCC §15.247 (b) (3)  
RSS-247 5.4 (d)

The maximum SISO antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm. For MIMO the gain is >6dBi, therefore the limit is reduced by the amount of the gain >6dBi, in this case 1.81dB.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion losses of 23.70dB (including 20.20 dB pad and 3.5dB cable) for chain 0 and 22.60dB (including 20.04 dB pad and 2.56dB cable) for chain 1 were entered as an offset in the power meter to allow for a peak reading of power.

The power output was measured on the EUT antenna port using SMA cable with 20dB attenuator connected to a power meter via wideband power sensor. Gated average output power was read directly from power meter.

### RESULTS

Note: This data leveraged from R14932101-E1a

#### 10.4.1. BLE (1Mbps)

##### CHAIN 0

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	AV power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	17.59	30	-12.41
Middle	2440	17.73	30	-12.27
High	2480	16.05	30	-13.95

**CHAIN 1**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	AV power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	16.80	30	-13.20
Middle	2440	17.13	30	-12.87
High	2480	16.08	30	-13.92

**2Tx MIMO**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	Chain 0 AV Power (dBm)	Chain 1 AV Power (dBm)	AV MIMO power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	14.11	13.74	16.94	28.19	-11.25
Middle	2440	14.26	14.11	17.20	28.19	-10.99
High	2480	12.53	12.72	15.64	28.19	-12.55

**10.4.2. BLE (2Mbps)**

**CHAIN 0**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	AV power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	17.51	30	-12.49
Middle	2440	17.82	30	-12.18
High	2480	16.46	30	-13.54

**CHAIN 1**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	AV power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	16.98	30	-13.02
Middle	2440	17.52	30	-12.48
High	2480	16.11	30	-13.89

**2Tx MIMO**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	Chain 0 AV Power (dBm)	Chain 1 AV Power (dBm)	AV MIMO power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	14.16	13.98	17.08	28.19	-11.11
Middle	2440	14.33	14.31	17.33	28.19	-10.86
High	2480	13.00	13.26	16.14	28.19	-12.05

**10.4.3. BLE (125Kbps)**

**CHAIN 0**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	AV power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	13.88	30	-16.12
Middle	2440	14.63	30	-15.37
High	2480	13.24	30	-16.76

**CHAIN 1**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	AV power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	13.99	30	-16.01
Middle	2440	14.35	30	-15.65
High	2480	12.99	30	-17.01

**2Tx MIMO**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	Chain 0 AV Power (dBm)	Chain 1 AV Power (dBm)	AV MIMO power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.23	10.40	13.33	28.19	-14.86
Middle	2440	10.68	10.82	13.76	28.19	-14.43
High	2480	9.48	9.40	12.45	28.19	-15.74

**10.4.4. BLE (500Kbps)**

**CHAIN 0**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	AV power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	13.99	30	-16.01
Middle	2440	14.29	30	-15.71
High	2480	13.38	30	-16.62

**CHAIN 1**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	AV power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	13.82	30	-16.18
Middle	2440	14.61	30	-15.39
High	2480	13.07	30	-16.93

**2Tx MIMO**

<b>Tested By:</b>	85502
<b>Date:</b>	2024-01-10

Channel	Frequency (MHz)	Chain 0 AV Power (dBm)	Chain 1 AV Power (dBm)	AV MIMO power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.04	10.46	13.27	28.19	-14.92
Middle	2440	10.72	10.85	13.80	28.19	-14.39
High	2480	9.59	9.47	12.54	28.19	-15.65

## 10.5. POWER SPECTRAL DENSITY

### LIMITS

FCC §15.247 (e)  
 RSS-247 (5.2) (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

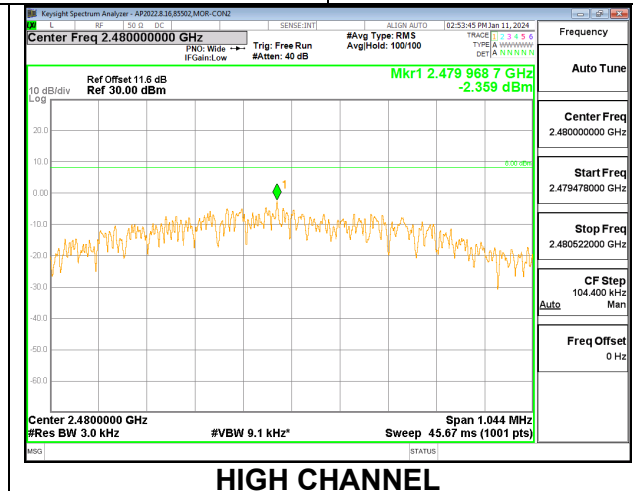
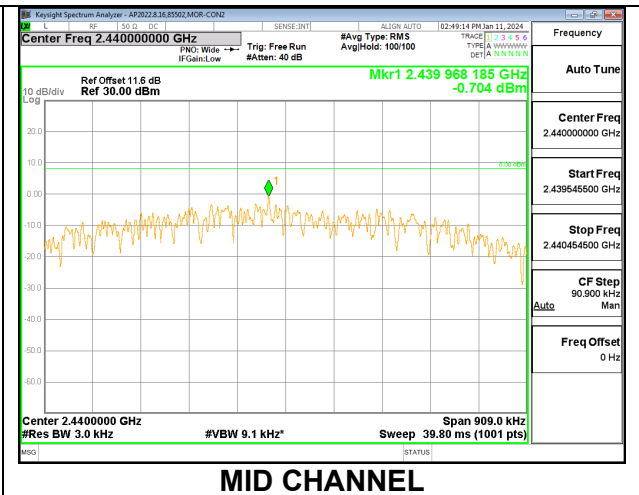
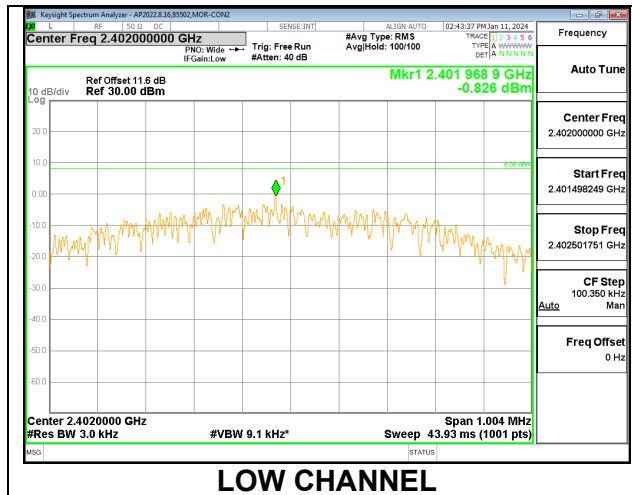
### RESULTS

Note: This data leveraged from R14932101-E1a

#### 10.5.1. BLE (1Mbps)

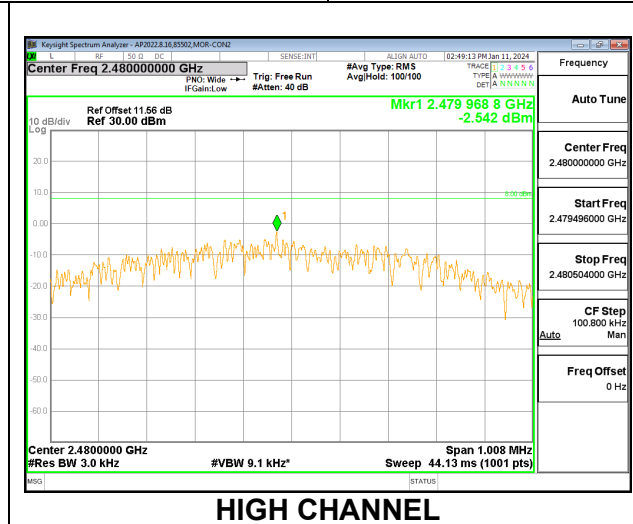
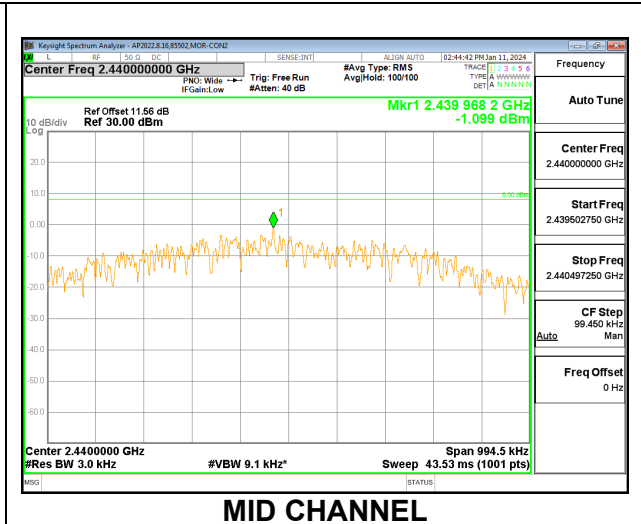
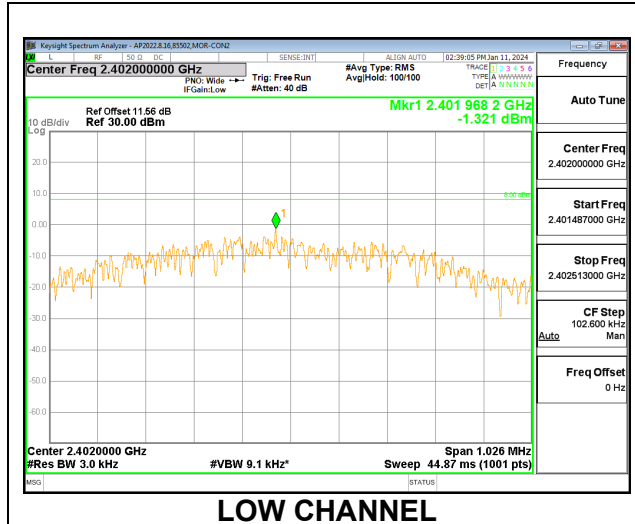
#### CHAIN 0

Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	DC Correction (dB)	Corrected PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-0.826	2.03	1.204	8	-6.80
Middle	2440	-0.704	2.03	1.326	8	-6.67
High	2480	-2.359	2.03	-0.329	8	-8.33



**CHAIN 1**

Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	DC Correction (dB)	Corrected PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-1.321	2.03	0.709	8	-7.29
Middle	2440	-1.099	2.03	0.931	8	-7.07
High	2480	-2.542	2.03	-0.512	8	-8.51

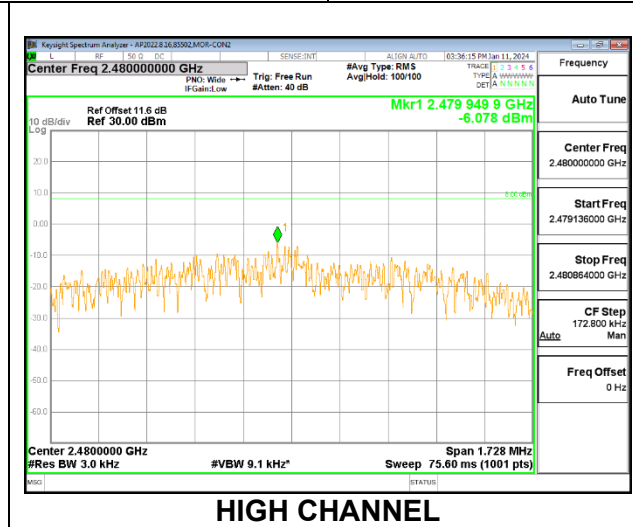
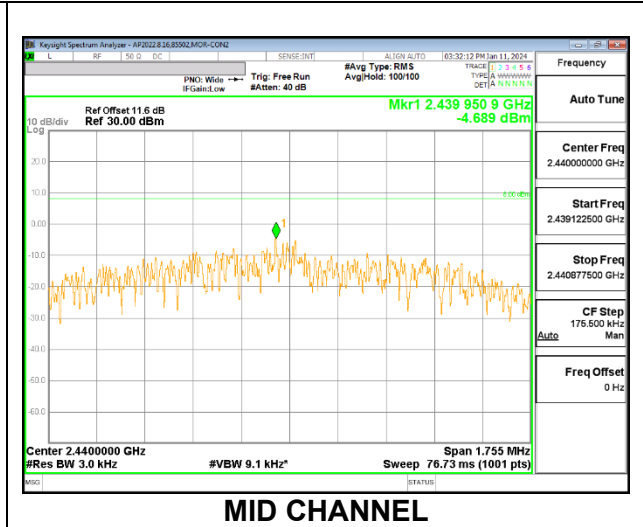
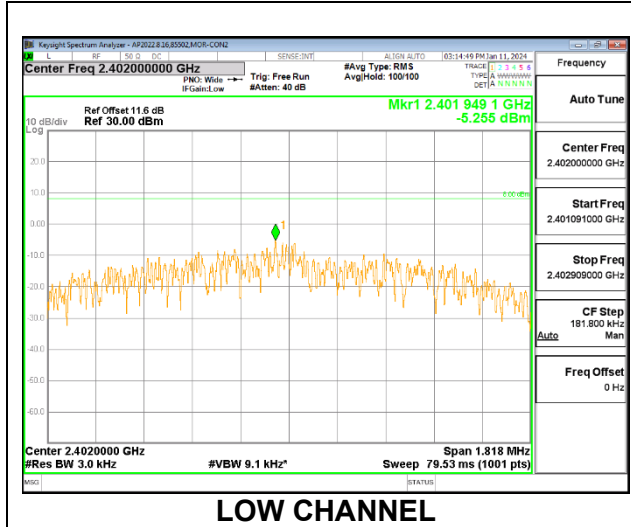




### 10.5.2. BLE (2Mbps)

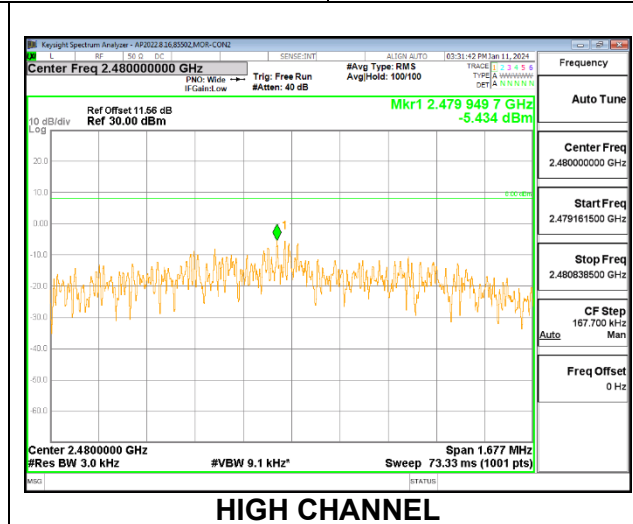
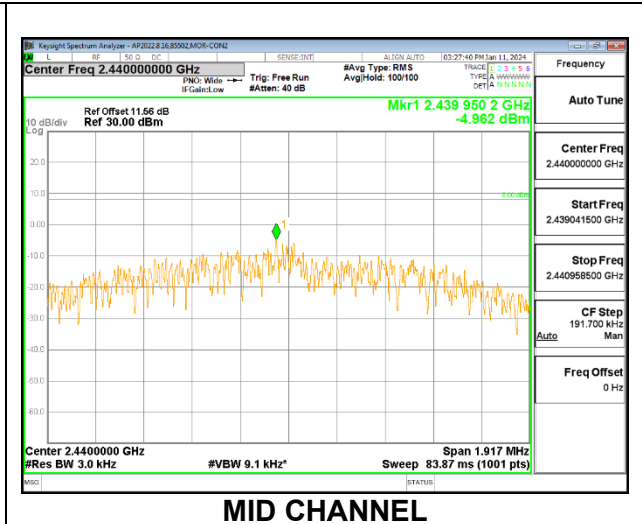
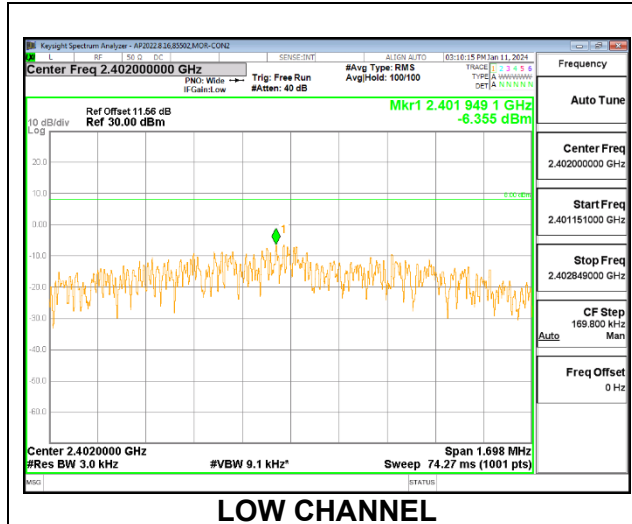
#### CHAIN 0

Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	DC Correction (dB)	Corrected PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-5.255	4.87	-0.385	8	-8.39
Middle	2440	-4.689	4.87	0.181	8	-7.82
High	2480	-6.078	4.87	-1.208	8	-9.21



**CHAIN 1**

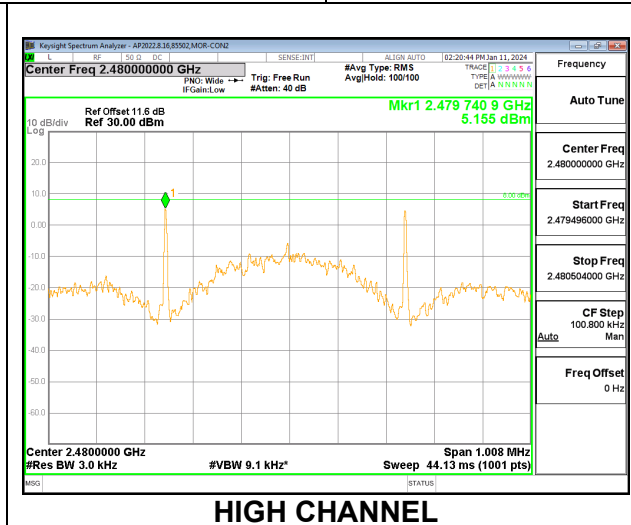
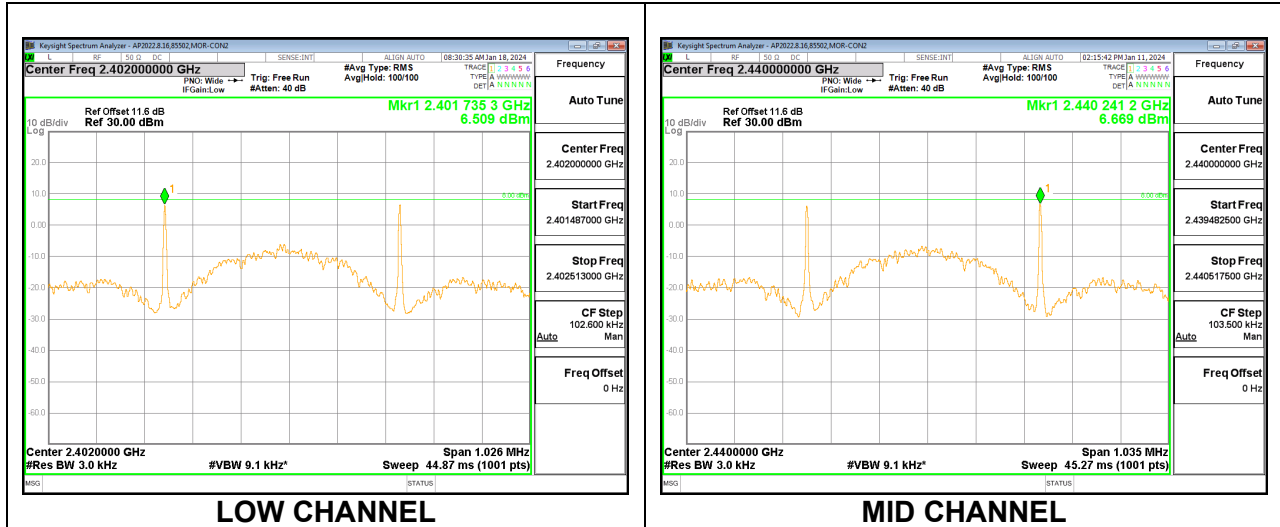
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	DC Correction (dB)	Corrected PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-6.355	4.87	-1.485	8	-9.49
Middle	2440	-4.962	4.87	-0.092	8	-8.09
High	2480	-5.434	4.87	-0.564	8	-8.56



### 10.5.3. BLE (125Kbps)

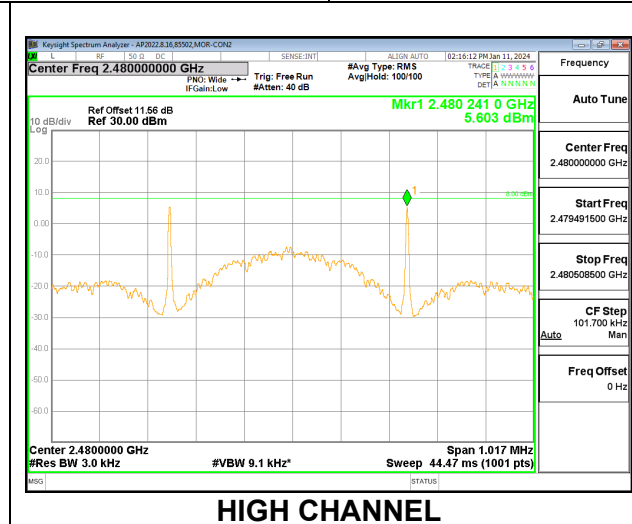
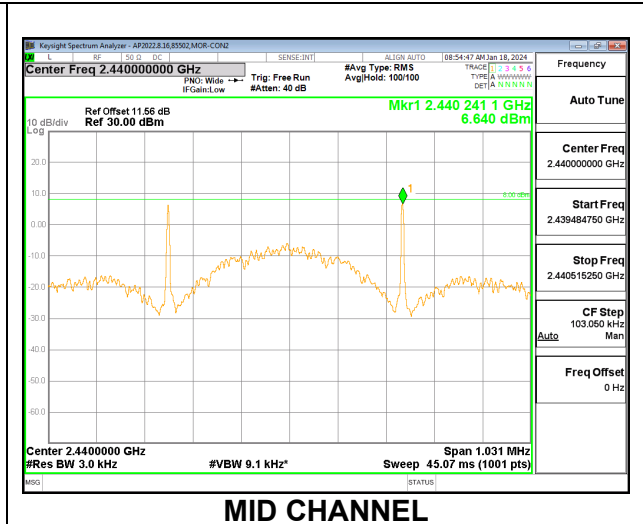
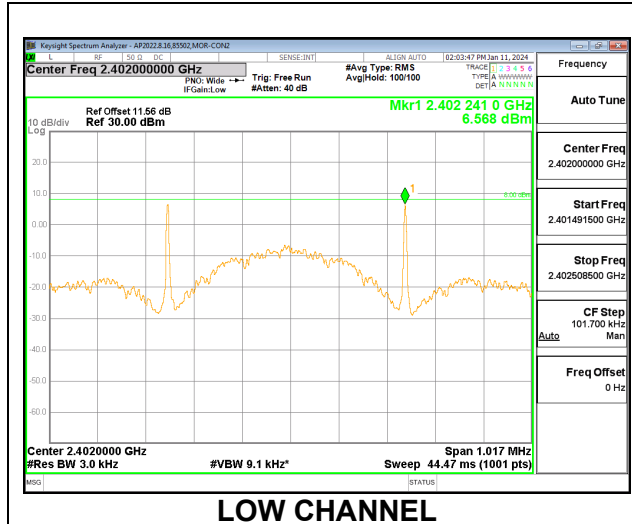
#### CHAIN 0

Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	DC Correction (dB)	Corrected PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	6.509	0.82	7.329	8	-0.67
Middle	2440	6.669	0.82	7.489	8	-0.51
High	2480	5.155	0.82	5.975	8	-2.03



**CHAIN 1**

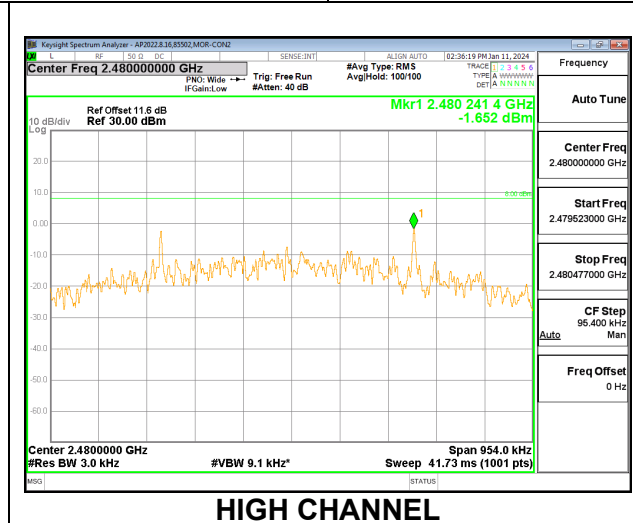
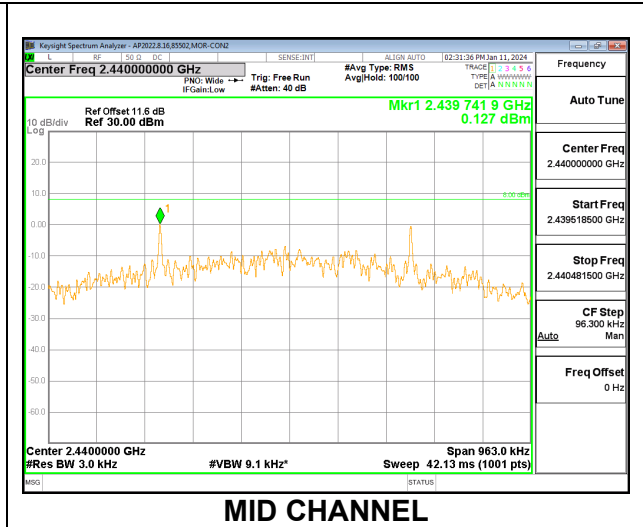
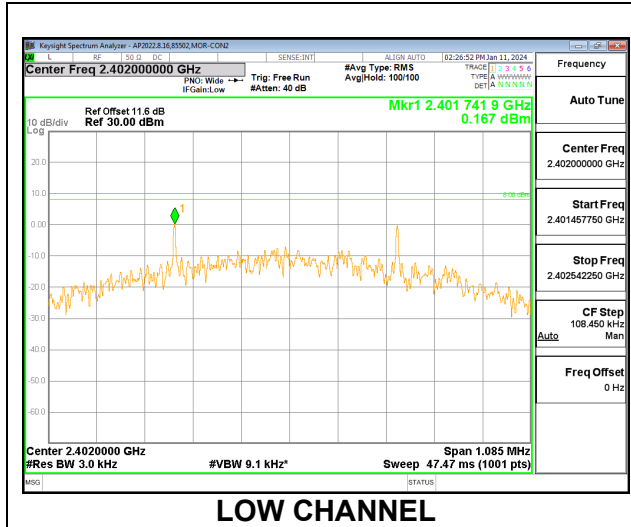
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	DC Correction (dB)	Corrected PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	6.568	0.82	7.388	8	-0.61
Middle	2440	6.640	0.82	7.460	8	-0.54
High	2480	5.603	0.82	6.423	8	-1.58



### 10.5.4. BLE (500Kbps)

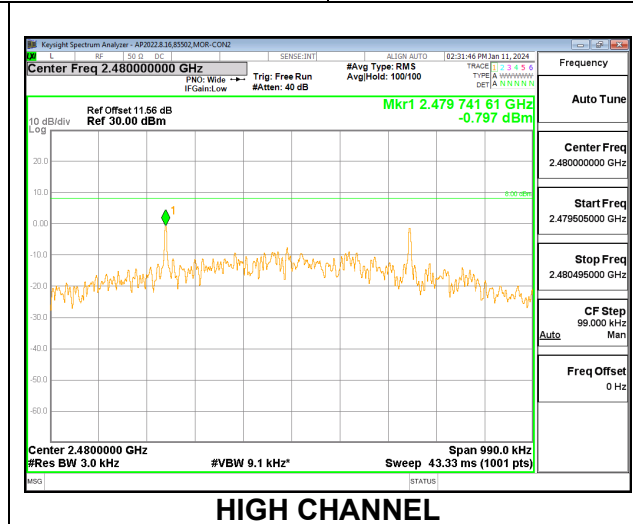
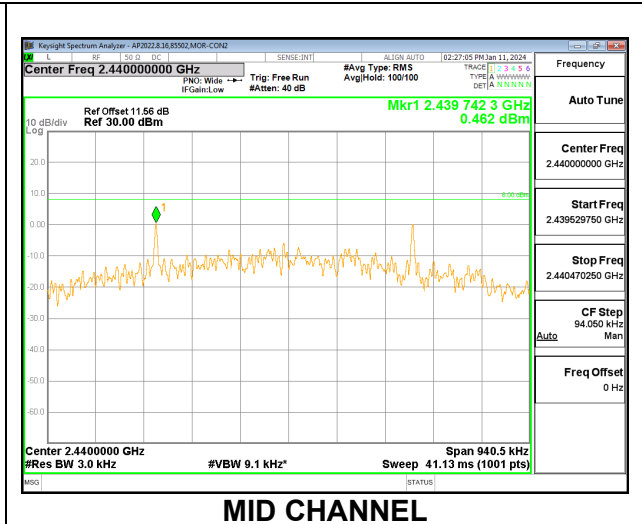
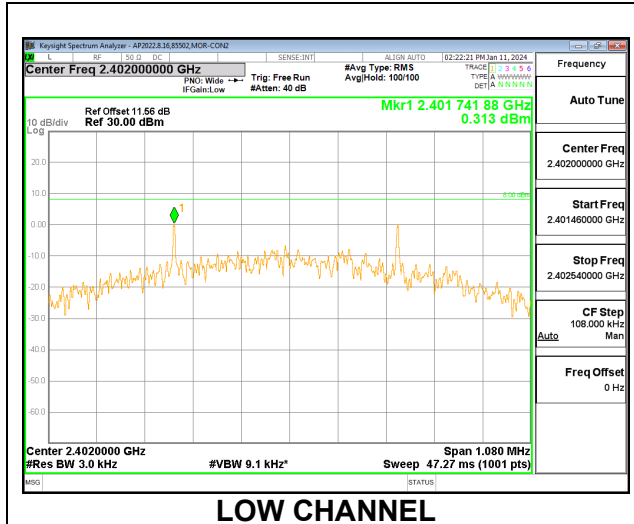
#### CHAIN 0

Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	DC Correction (dB)	Corrected PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	0.167	2.44	2.607	8	-5.39
Middle	2440	0.127	2.44	2.567	8	-5.43
High	2480	-1.652	2.44	0.788	8	-7.21



**CHAIN 1**

Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	DC Correction (dB)	Corrected PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	0.313	2.44	2.753	8	-5.25
Middle	2440	0.462	2.44	2.902	8	-5.10
High	2480	-0.797	2.44	1.643	8	-6.36



## 10.6. CONDUCTED SPURIOUS EMISSIONS – AUTHORIZED BAND

### LIMITS

FCC §15.247 (d)  
 RSS-247 5.5

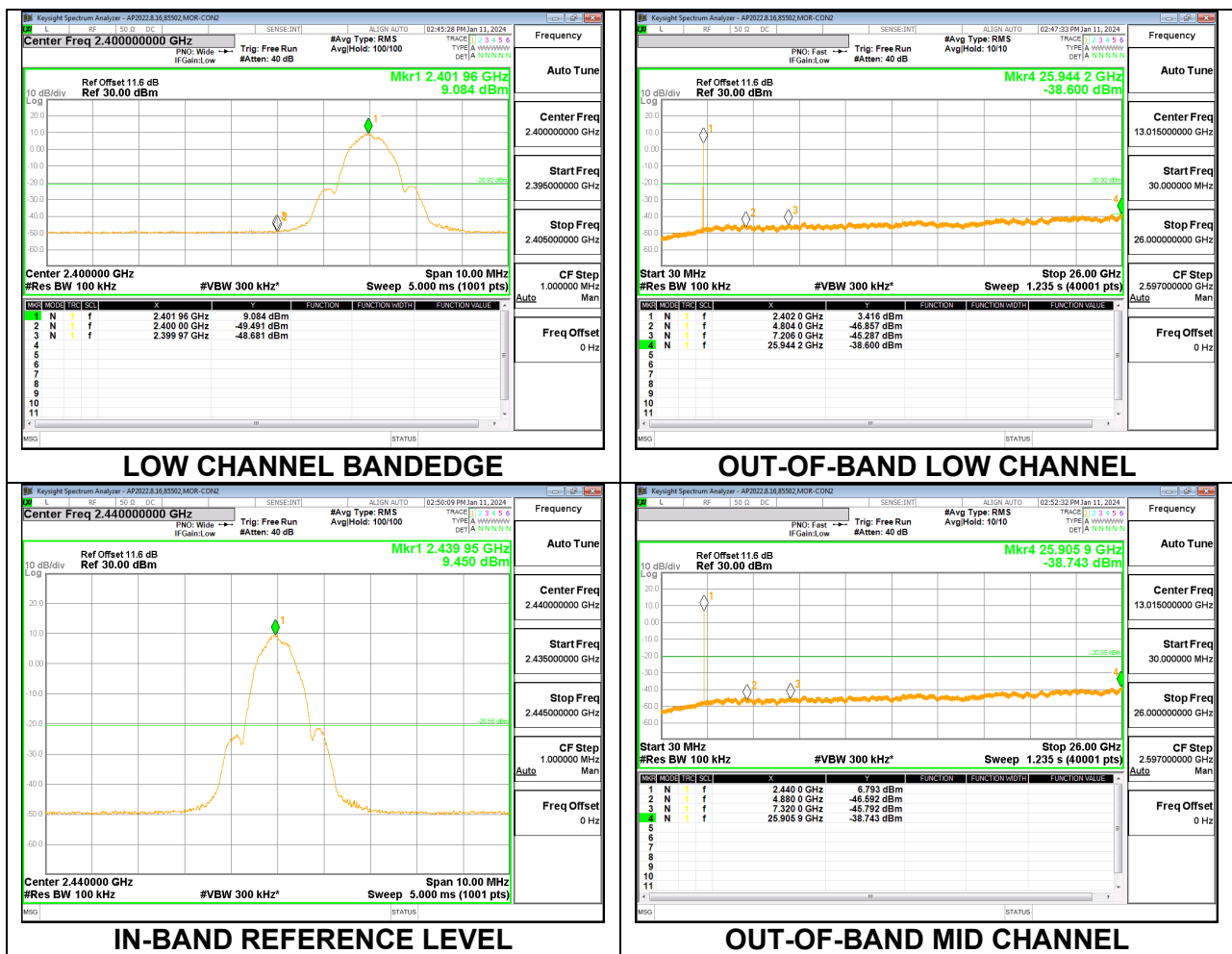
Output power was measured based on the use of an average measurement, therefore the required attenuation is -30dBc.

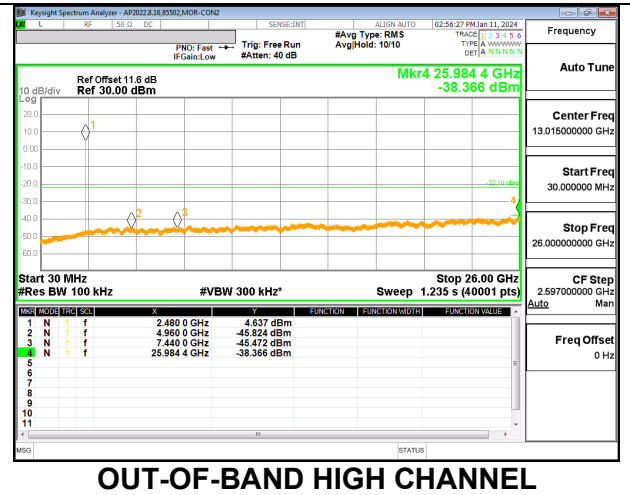
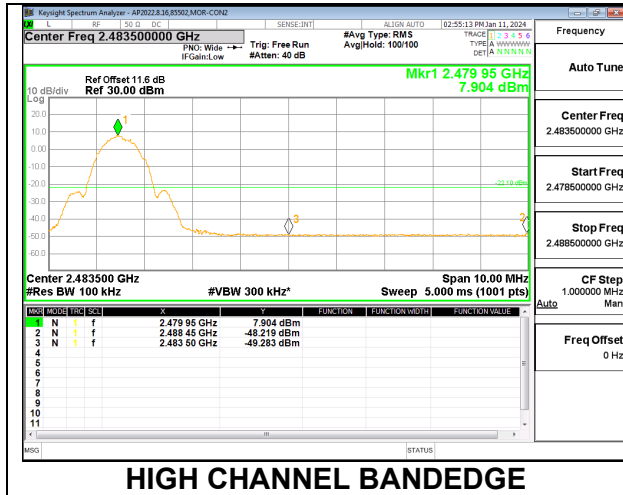
### RESULTS

Note: This data leveraged from R14932101-E1a

#### 10.6.1. BLE (1Mbps)

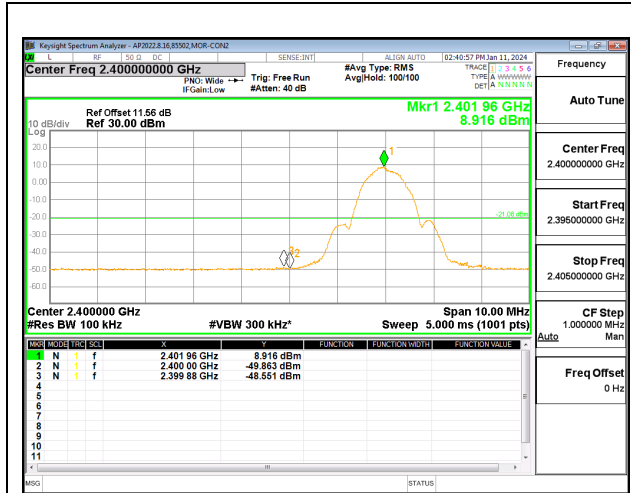
#### CHAIN 0



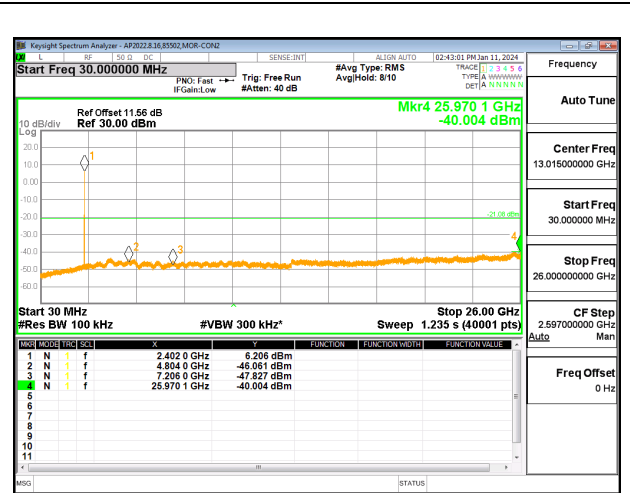




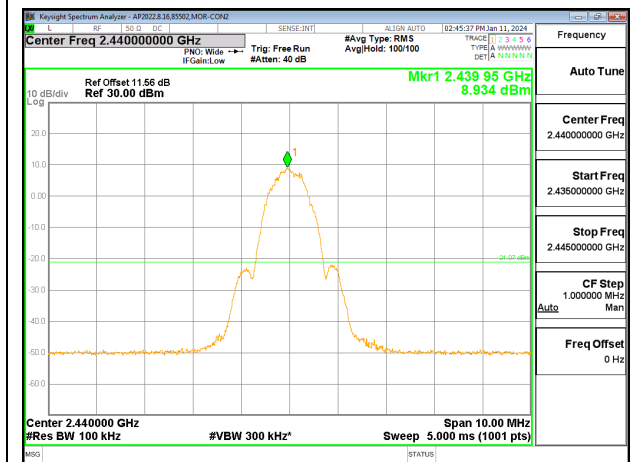
**CHAIN 1**



**LOW CHANNEL BANDEDGE**



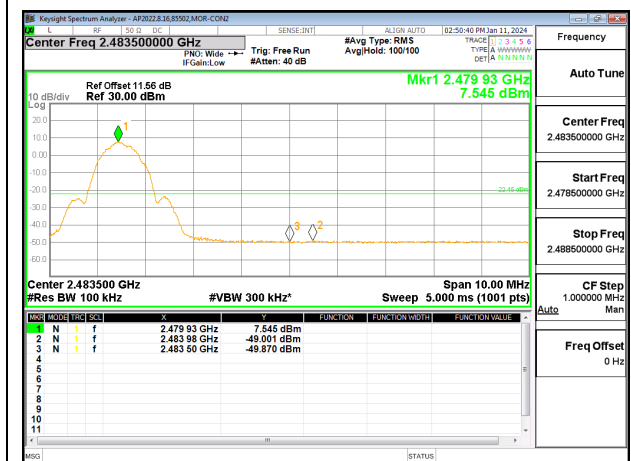
**OUT-OF-BAND LOW CHANNEL**



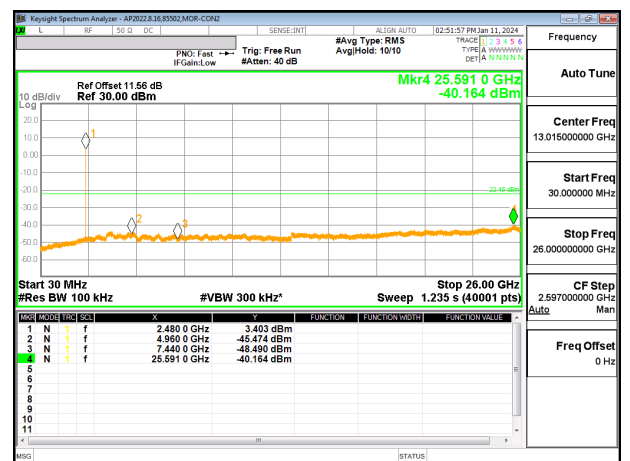
**IN-BAND REFERENCE LEVEL**



**OUT-OF-BAND MID CHANNEL**



**HIGH CHANNEL BANDEDGE**



**OUT-OF-BAND HIGH CHANNEL**