

TEST REPORT

Report Number: R15103618-E5

Applicant : Sony Corporation
1-7-1 Konan Minato-Ku
Tokyo, 108-0075, Japan

FCC ID : PY7-46195Y

EUT Description : LTE/5G Portable Data Transmitter with BT, DTS/UNII
a/b/g/n/ac/ax and GPS

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C: 2024

Date Of Issue:
2024-03-19

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2024-02-27	Initial Issue	Charles Moody
V2	2024-03-19	Corrected calculation error on p.60	B. Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Sony Corporation
1-7-1 Konan Minato-ku
Tokyo, 108-0075, Japan

EUT DESCRIPTION: LTE/5G Portable Data Transmitter with BT, DTS/UNII
a/b/g/n/ac/ax and GPS

SERIAL NUMBER: QV77000LJP, QV77006NLY, QV77009KLY

SAMPLE RECEIPT DATE: 2023-12-01 TO 2023-12-26

DATE TESTED: 2024-01-02 TO 2024-02-06

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C: 2024	See 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 assure 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:



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Consumer, Medical and IT Segment
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Prepared By:



Charles Moody
Engineer
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UL LLC

2. TEST RESULTS SUMMARY

This report contains data provided by the applicant 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 provided by the customer:

- 1) Antenna gain and type (see section 6.3)
- 2) Cable loss (see sections 9.3 and 9.4)

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	Complies	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	Complies	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.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by 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 utilized 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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – 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:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + 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 LTE/5G Portable Data Transmitter with BT, DTS/UNII a/b/g/n/ac/ax and GPS. This report covers the full emissions testing of the 2.4 WLAN radio.

6.2. MAXIMUM OUTPUT POWER

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

2.4GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2Tx			
2412 - 2462	802.11b	18.05	63.83
2412 - 2462	802.11g	21.17	130.92
2412 - 2462	802.11n HT20	20.95	124.45
2412 - 2462	802.11ax HE20 26T	20.56	113.76
2412 - 2462	802.11ax HE20 52T	22.41	174.18
2412 - 2462	802.11ax HE20 106T	23.98	250.03
2412 - 2462	802.11ax HE20 242T	23.92	246.60

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:
 The radio utilizes two antennas for diversity, with the following types and maximum gains:

Chain	Designation in Documentation	Type	Frequency Range (MHz)	Maximum Gain (dBi)
0	WLAN Main/Bluetooth#1	Monopole	2402-2480	-1.58
1	WLAN Sub/Bluetooth#2	Monopole	2402-2480	-3.32

6.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was 0.162.

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 power spectral density as worst-case scenario.

Radiated Band Edge was performed on all modes with the EUT set to transmit at the highest power on low and high channels. Radiated Spurious Emissions between 1GHz and 18GHz was performed with the EUT set to transmit at the highest power on low and high channels, with mid channel added at the worst-case modes based on average power and PSD. This was found to be 11b for the CCK modulation scheme and 11ax HE20 52T and 106T for the OFDMA modulation scheme.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

Worst-case data rates as provided by the client were:

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20 mode: MCS0 (Nss=1).
802.11ax HE20 mode: MCS0 (Nss=1).

Only the worst-case plot per mode was included within this report as an example plot for 6dB and PSD data. All tabular data has been included for each mode.

For PSD testing, PSD was performed on 802.11b, 802.11ax HE20 26T, 52T, and 106T in the place of all other modes as these identified modes had the highest power and narrowest bandwidth, making it a worst-case mode.

Note: All testing performed in 2Tx mode (Nss=1), where power per chain is equivalent to the 1Tx power on each chain. This allows 2Tx to cover all 1Tx testing.

Based on pretesting, full tone was worst-case over SU mode.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Support Laptop	Lenovo	T14 Gen3	PF4FKVWW	N/A
Support Laptop	Lenovo	T14 Gen3	PF4FKVZE	N/A
Support Laptop	Lenovo	Yoga 7	PF49WDF9	PD9AX211NG
Support Laptop	Dell	Inspiron 15	2SFMJP3	N/A
AC Adapter	Sony	XQZ-UC1	3223W09206247	N/A
AC Adapter	Sony	XQZ-UC1	1821W34209802	N/A
Laptop AC Adapter	Lenovo	ADLX65YDC2D	8SSA10R16970D1SG35A13LV	N/A
Laptop AC Adapter	Dell	DA65NM191	CN-0KPVMF-DES00-22N-A4N0-A00	N/A
RJ45 Adapter	Best Buy	BE-PA3U6E	N/A	N/A

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB-C	1	USB	Shielded	<1m	Used to Connect EUT to AC Mains.
2	RJ-45	1	RJ-45	Shielded	<3m	Connected from EUT to support laptop
3	HDMI	1	HDMI	Shielded	<3m	Connected from EUT to support laptop
4	USB-C	1	USB-C	Shielded	<3m	Connected from EUT to support laptop

TEST SETUP

The EUT is connected to a support laptop during testing. Test software exercised the radio card.

SETUP DIAGRAMS

Please refer to R15103618-EP3 for setup diagrams

7. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10, Section 11.6: Zero-Span Spectrum Analyzer Method.

6 dB BW: ANSI C63.10 Subclause -11.8.1

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 C63.10-2020 Section 6.3 to 6.6

AC Power Line Conducted Emissions: ANSI C63.10-2020, Section 6.2.

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.
	Common Equipment				
	Conducted Room 2				
90410	Spectrum Analyzer	Keysight Technologies	N9030A	2023-06-14	2024-06-14
238710	Environmental Meter	Fisher Scientific	15-077-963	2023-06-27	2024-06-27
211056	Real-Time Peak Power Sensor 50MHz to 8GHz	Boonton	RTP5000	2023-08-01	2024-08-01
211057	Real-Time Peak Power Sensor 50MHz to 8GHz	Boonton	RTP5000	2023-08-01	2024-08-01
SOFTEMI	Antenna Port Software	UL	Version 2022.8.16	NA	NA
Power Software	Boonton Power Analyzer	Boonton	Version 3.0.13.0	NA	NA
	Attenuators				
226561	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2023-02-16	2024-02-16
226563	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2023-02-16	2024-02-16
	Cables				
CBL091	Micro-Coax UTiFLEX Cable Assembly, Low Loss,40Ghz	Carlisle Interconnect Technologies	UFA147A-2-0360-200200	2023-02-17	2024-02-17
CBL092	Micro-Coax UTiFLEX Cable Assembly, Low Loss,40Ghz	Carlisle Interconnect Technologies	UFA147A-2-0360-200200	2023-02-17	2024-02-17

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)		
	Miscellaneous (if needed)				
84681	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2023-09-18	2024-09-18

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

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	18-40 GHz				
204704	Horn Antenna, 18-26.5GHz	Com-Power	AH-826	2023-07-20	2025-07-20
	Gain-Loss Chains				
225795	Gain-loss string: 18-40GHz	Various	Various	2023-05-17	2024-05-17
	Receiver & Software				
81018	Spectrum Analyzer	Agilent	E4446A	2023-08-01	2024-08-01
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
241204	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 2)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
86408	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2023-06-19	2025-06-19
	Gain-Loss Chains				
91977	Gain-loss string: 1-18GHz	Various	Various	2023-06-06	2024-06-06
	Receiver & Software				
**197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2023-02-02	2024-02-02
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
239540	Environmental Meter	Fisher Scientific	15-077-963	2023-07-19	2025-07-19

**NOTE: Testing on this equipment was performed prior to the equipment calibration expiring. Therefore, at the time of testing, all equipment was in calibration.

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

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
0.009-30MHz					
65682	Active Loop Antenna	ETS-Lindgren	6502	2023-10-03	2024-10-03
30-1000 MHz					
**159203	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2023-01-23	2024-01-31
1-18 GHz					
206211	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2023-04-06	2024-04-06
Gain-Loss Chains					
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
Receiver & Software					
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2023-03-24	2024-03-24
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
Additional Equipment used					
241205	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05

**NOTE: Testing on this equipment was performed prior to the equipment calibration expiring. Therefore, at the time of testing, all equipment was in calibration.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

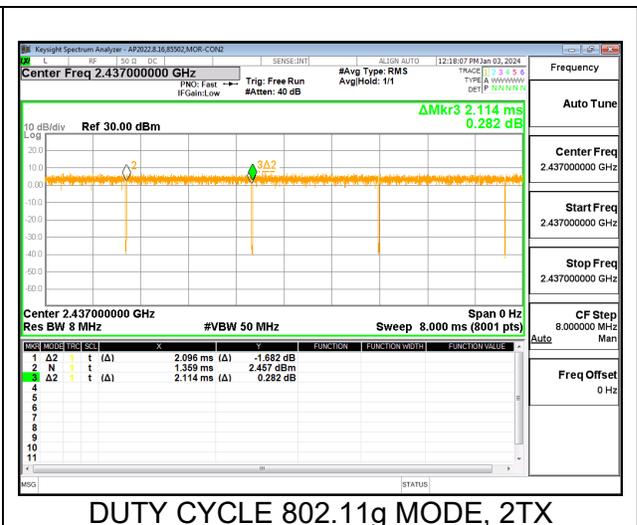
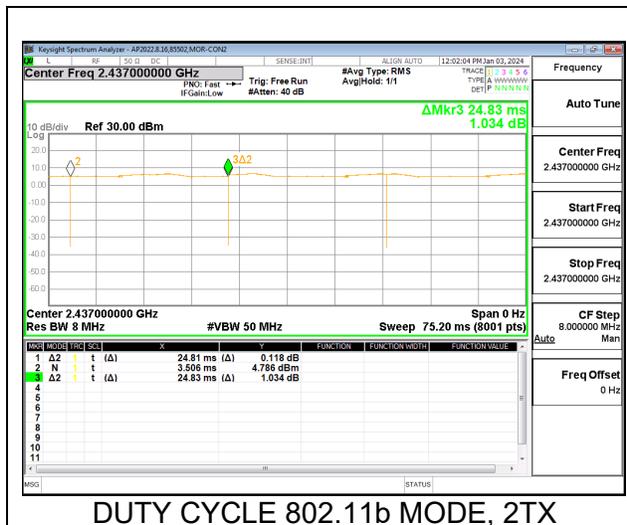
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

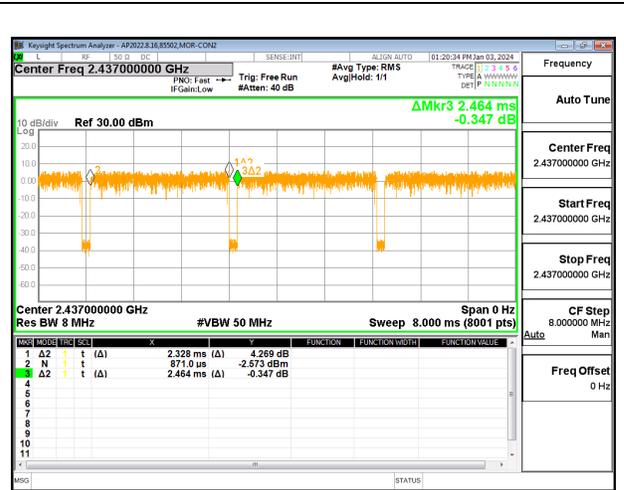
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
802.11b 2TX	24.810	24.830	0.999	99.92	0.00	0.010
802.11g 2TX	2.096	2.114	0.991	99.15	0.00	0.010
802.11n HT20 2TX	5.426	5.447	0.996	99.61	0.00	0.010
802.11ax HE20 26T 2TX	2.328	2.464	0.945	94.48	0.49	0.430
802.11ax HE20 52T 2TX	1.269	1.349	0.941	94.07	0.53	0.788
802.11ax HE20 106T 2TX	0.639	0.686	0.932	93.19	0.61	1.564
802.11ax HE20 242T 2TX	0.924	0.985	0.938	93.76	0.56	1.083

DUTY CYCLE PLOTS





DUTY CYCLE 802.11n HT20 MODE, 2TX



DUTY CYCLE 802.11ax HE20 26T MODE, 2TX



DUTY CYCLE 802.11ax HE20 52T MODE, 2TX



DUTY CYCLE 802.11ax HE20 106T MODE, 2TX



DUTY CYCLE 802.11ax HE20 242T MODE, 2TX

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9.2. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

RESULTS

9.2.1. 802.11b MODE

2TX Chain 0 + Chain 1 MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low 1	2412	7.12	7.20	0.5
Mid 6	2437	7.16	7.24	0.5
High 11	2462	7.24	7.72	0.5

LOW CHANNEL 1

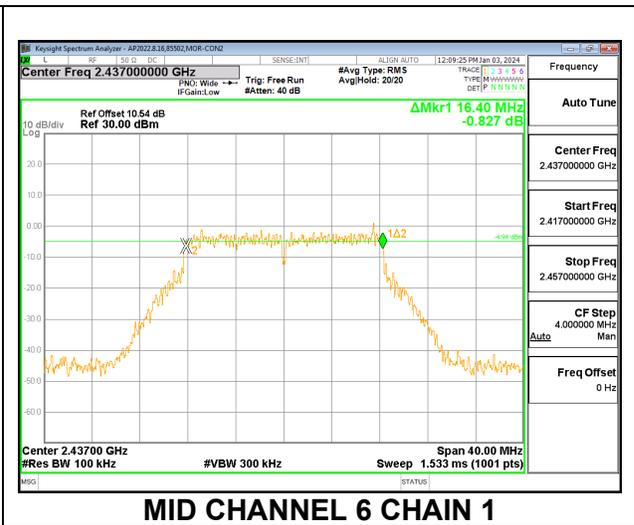
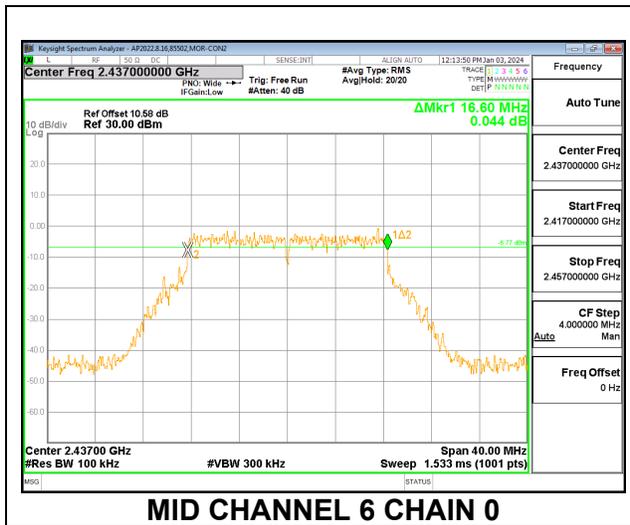


9.2.2. 802.11g MODE

2TX Chain 0 + Chain 1 MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low 1	2412	16.52	16.48	0.5
Mid 6	2437	16.60	16.40	0.5
High 11	2462	16.44	16.44	0.5

MID CHANNEL 6

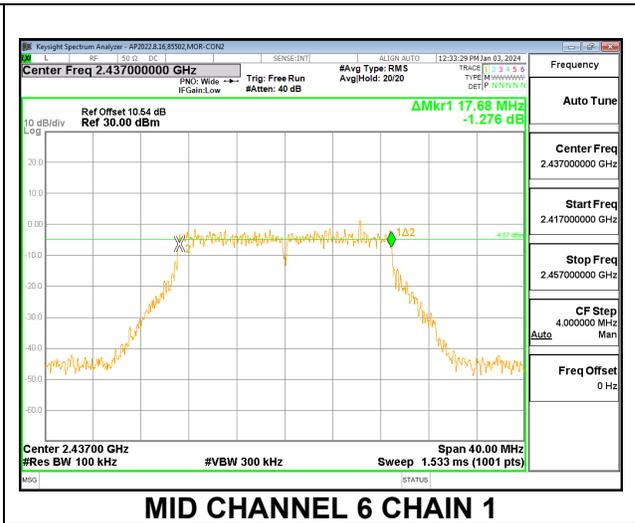
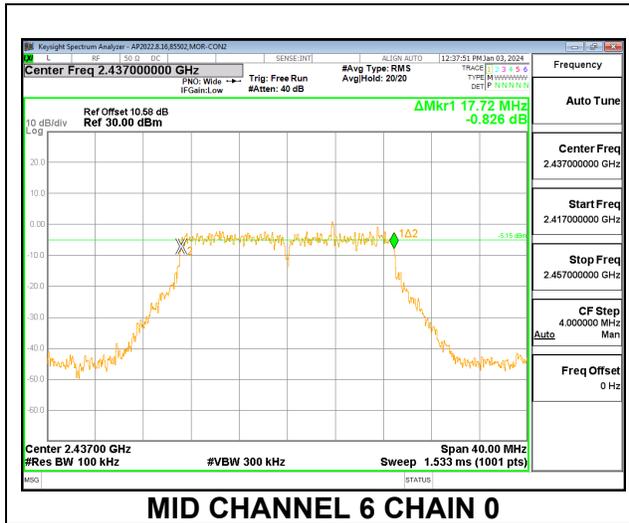


9.2.3. 802.11n HT20 MODE

2TX Chain 0 + Chain 1 MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low 1	2412	17.80	17.76	0.5
Mid 6	2437	17.72	17.68	0.5
High 11	2462	17.68	17.72	0.5

MID CHANNEL 6

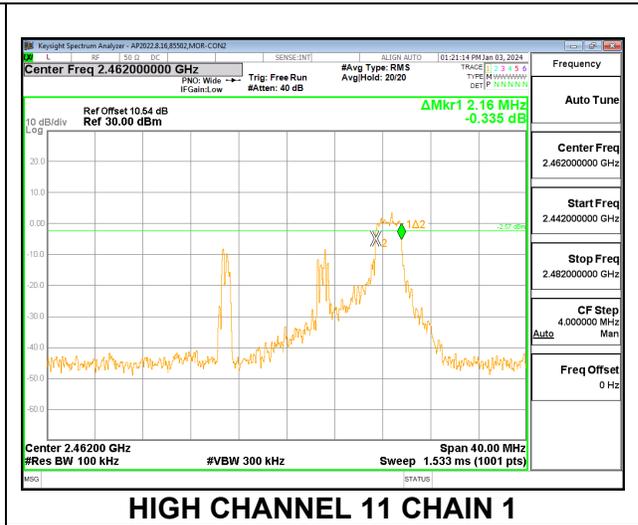
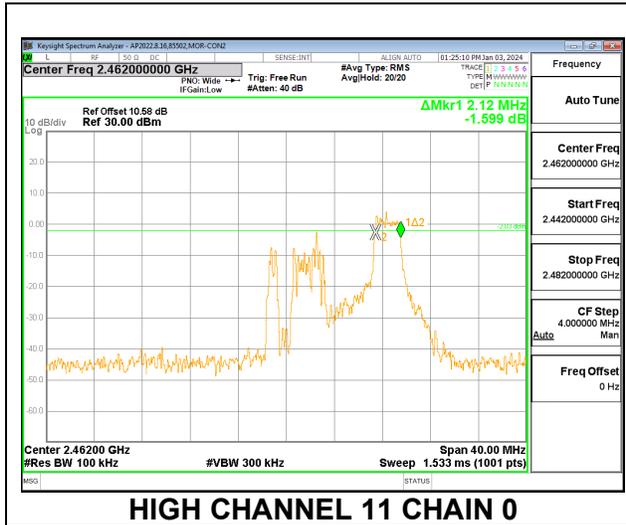


9.2.4. 802.11ax HE20 26T

2TX Chain 0 + Chain 1 MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low 1	2412	2.24	2.12	0.5
Mid 6	2437	2.60	2.64	0.5
High 11	2462	2.12	2.16	0.5

HIGH CHANNEL 11

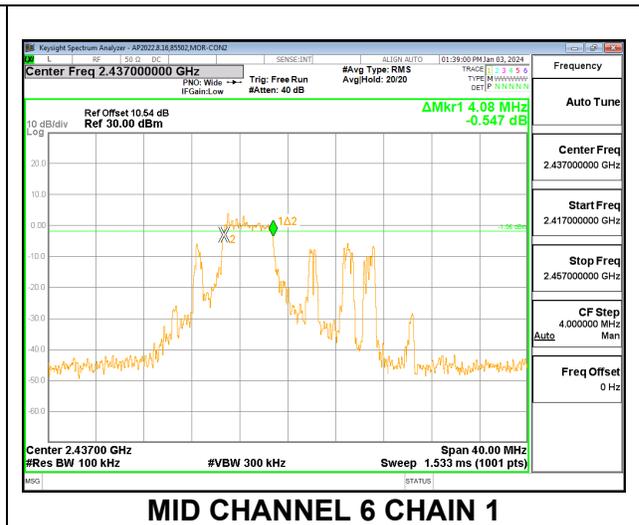


9.2.5. 802.11ax HE20 52T MODE

2TX Chain 0 + Chain 1 MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low 1	2412	4.12	4.12	0.5
Mid 6	2437	4.20	4.08	0.5
High 11	2462	4.20	4.08	0.5

MID CHANNEL 6

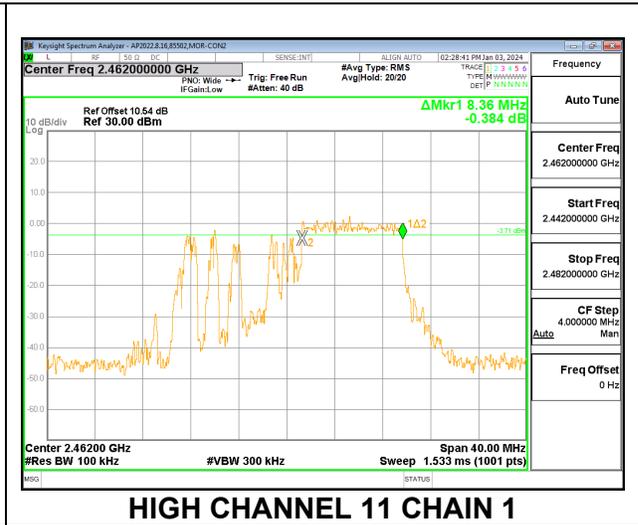
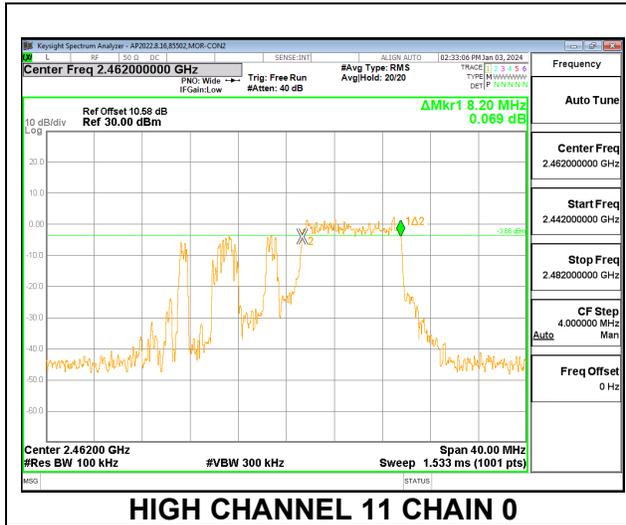


9.2.6. 802.11ax HE20 106T

2TX Chain 0 + Chain 1 MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low 1	2412	8.20	8.44	0.5
Mid 6	2437	8.36	8.24	0.5
High 11	2462	8.20	8.36	0.5

HIGH CHANNEL 11

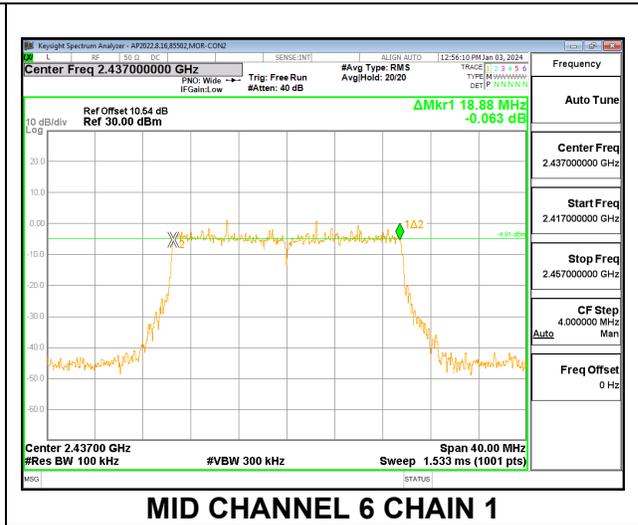
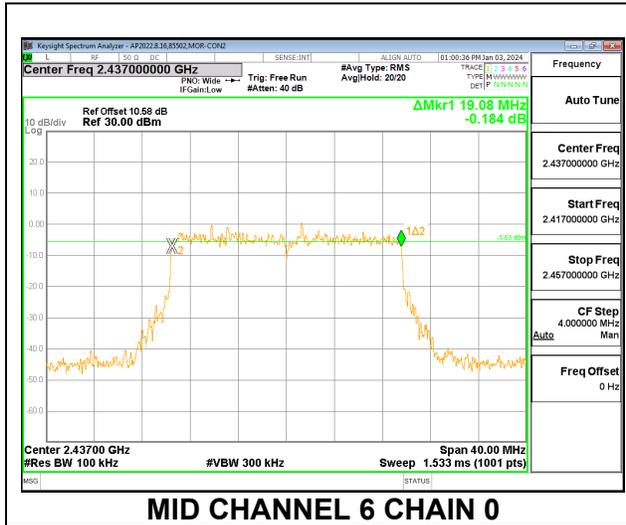


9.2.7. 802.11ax HE20 242T

2TX Chain 0 + Chain 1 MODE

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low 1	2412	19.20	19.12	0.5
Mid 6	2437	19.08	18.88	0.5
High 11	2462	18.92	19.04	0.5

MID CHANNEL 6



9.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.29dB (including 9.67 dB pad, 0.3 dB EUT cable and 0.32 dB test cable) was entered as an offset for chain 0 and 10.63 dB (9.68 dB pad, 0.3 dB EUT cable, and 0.65 dB test cable) was entered as an offset for chain 1, in the power meter to allow for a peak reading of power.

DIRECTIONAL ANTENNA GAIN

Tx chains are uncorrelated for power and correlated for PSD due to the device supporting CDD in all MIMO modes. The directional gains are as follows:

Band (GHz)	Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)	Correlated Chains Directional Gain (dBi)
2.4	-1.58	-3.32	-2.36	0.60

Directional gains for MIMO operations were determined using KDB662911 D01 Section F (2)(d)(i) and (ii) for unequal antenna gains, with equal transmit powers. The directional gains are calculated using the formulas for uncorrelated and correlated transmissions across the two transmit antennas.

- (i) Correlated gain = $10\log((10^{G1/20} + 10^{G2/20})^2 / N_{Ant})$
- (ii) Uncorrelated gain = $10\log((10^{G1/10} + 10^{G2/10}) / N_{Ant})$

Sample calculation, using 2 antennas:

$$\text{Correlated gain} = 10\log(10^{-1.58/20} + 10^{-3.32/20})^2/2) = 0.60\text{dBi}$$

$$\text{Uncorrelated gain} = 10\log(10^{-1.58/10} + 10^{-3.32/10})/2) = -2.36\text{dBi}$$

RESULTS

9.3.1. 802.11b MODE

2TX CHAIN 0 + CHAIN 1 MODE

Test Engineer:	33499/84740
Test Date:	2024-01-02

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)
Low 1	2412	-2.36	30.00	30.00
Mid 6	2437	-2.36	30.00	30.00
High 11	2462	-2.36	30.00	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	15.02	14.96	18.00	30.00	-12.00
Mid 6	2437	14.99	15.09	18.05	30.00	-11.95
High 11	2462	14.92	14.91	17.93	30.00	-12.07

9.3.2. 802.11g MODE

2TX Chain 0 + Chain 1 MODE

Test Engineer:	33499/84740
Test Date:	2024-01-02

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)
Low 1	2412	-2.36	30.00	30.00
Mid 6	2437	-2.36	30.00	30.00
High 11	2462	-2.36	30.00	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	17.50	17.48	20.50	30.00	-9.50
Mid 6	2437	17.51	17.61	20.57	30.00	-9.43
High 11	2462	18.12	18.20	21.17	30.00	-8.83

9.3.3. 802.11n HT20 MODE

2TX Chain 0 + Chain 1 MODE

Test Engineer:	33499/84740
Test Date:	2024-01-02

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)
Low 1	2412	-2.36	30.00	30.00
Mid 6	2437	-2.36	30.00	30.00
High 11	2462	-2.36	30.00	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	17.80	17.81	20.82	30.00	-9.18
Mid 6	2437	17.87	18.01	20.95	30.00	-9.05
High 11	2462	17.37	17.96	20.69	30.00	-9.31

9.3.4. 802.11ax HE20 MODE

2TX Chain 0 + Chain 1 MODE: 26T

Test Engineer:	33499/84740
Test Date:	2024-01-02

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)
Low 1	2412	-2.36	30.00	30.00
Mid 6	2437	-2.36	30.00	30.00
High 11	2462	-2.36	30.00	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	16.84	16.73	19.80	30.00	-10.20
Mid 6	2437	17.11	17.18	20.16	30.00	-9.84
High 11	2462	17.41	17.68	20.56	30.00	-9.44

2TX Chain 0 + Chain 1 MODE: 52T

Test Engineer:	33499/84740
Test Date:	2024-01-02

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)
Low 1	2412	-2.36	30.00	30.00
Mid 6	2437	-2.36	30.00	30.00
High 11	2462	-2.36	30.00	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	19.41	19.38	22.41	30.00	-7.59
Mid 6	2437	19.02	19.22	22.13	30.00	-7.87
High 11	2462	19.25	19.43	22.35	30.00	-7.65

2TX Chain 0 + Chain 1 MODE: 106T

Test Engineer:	33499/84740
Test Date:	2024-01-02

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)
Low 1	2412	-2.36	30.00	30.00
Mid 6	2437	-2.36	30.00	30.00
High 11	2462	-2.36	30.00	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	20.61	20.70	23.67	30.00	-6.33
Mid 6	2437	20.93	21.00	23.98	30.00	-6.02
High 11	2462	20.56	20.86	23.72	30.00	-6.28

2TX Chain 0 + Chain 1 MODE: 242T

Test Engineer:	33499/84740
Test Date:	2024-01-02

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)
Low 1	2412	-2.36	30.00	30.00
Mid 6	2437	-2.36	30.00	30.00
High 11	2462	-2.36	30.00	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	20.76	21.06	23.92	30.00	-6.08
Mid 6	2437	20.81	21.00	23.92	30.00	-6.08
High 11	2462	20.62	21.01	23.83	30.00	-6.17

9.4. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.29dB (including 9.67 dB pad, 0.3 dB EUT cable and 0.32 dB test cable) was entered as an offset for chain 0 and 10.63 dB (9.68 dB pad, 0.3 dB EUT cable, and 0.65 dB test cable) was entered as an offset for chain 1, in the power meter to allow for a gated average reading of power.

RESULTS

9.4.1. 802.11b MODE

2TX Chain 0 + Chain 1 MODE

Test Engineer:	33499/84740
Test Date:	2024-01-02

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low 1	2412	12.24	12.21	15.24
Mid 6	2437	12.25	12.23	15.25
High 11	2462	12.16	12.14	15.16

9.4.2. 802.11g MODE

2TX Chain 0 + Chain 1 MODE

Test Engineer:	33499/84740
Test Date:	2024-01-02

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low 1	2412	12.10	12.22	15.17
Mid 6	2437	12.36	12.31	15.35
High 11	2462	12.47	12.80	15.65

9.4.3. 802.11n HT20 MODE

2TX Chain 0 + Chain 1 MODE

Test Engineer:	33499/84740
Test Date:	2024-01-02

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low 1	2412	12.18	12.38	15.29
Mid 6	2437	12.39	12.39	15.40
High 11	2462	12.02	12.32	15.18

9.4.4. 802.11ax HE20 MODE

2TX Chain 0 + Chain 1 MODE: 26T

Test Engineer:	33499/84740
Test Date:	2024-01-02

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low 1	2412	8.21	8.57	11.40
Mid 6	2437	8.32	8.48	11.41
High 11	2462	8.43	8.61	11.53

2TX Chain 0 + Chain 1 MODE: 52T

Test Engineer:	33499/84740
Test Date:	2024-01-02

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low 1	2412	11.40	11.40	14.41
Mid 6	2437	11.26	11.31	14.30
High 11	2462	10.88	11.08	13.99

2TX Chain 0 + Chain 1 MODE: 106T

Test Engineer:	33499/84740
Test Date:	2024-01-02

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low 1	2412	12.36	12.54	15.46
Mid 6	2437	12.86	12.93	15.91
High 11	2462	12.43	12.61	15.53

2TX Chain 0 + Chain 1 MODE: 242T

Test Engineer:	33499/84740
Test Date:	2024-01-02

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low 1	2412	12.39	12.59	15.50
Mid 6	2437	12.59	12.63	15.62
High 11	2462	12.28	12.46	15.38

9.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

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

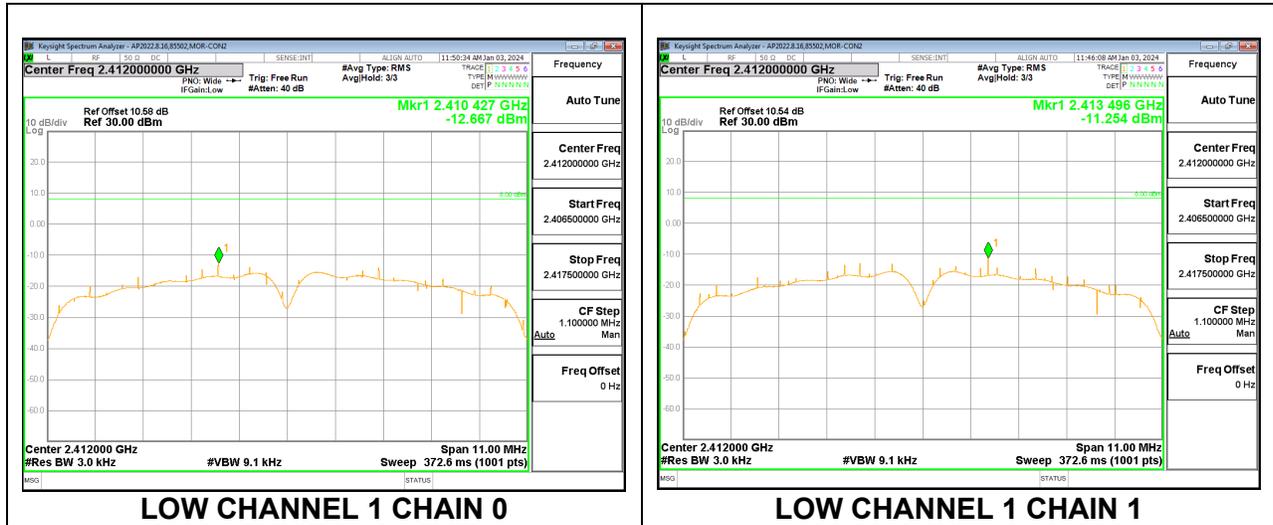
9.5.1. 802.11b MODE

2TX Chain 0 + Chain 1 MODE

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Chain 1 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-12.667	-11.254	-8.893	8.0	-16.9
Mid 6	2437	-13.305	-13.697	-10.486	8.0	-18.5
High 13	2472	-12.262	-13.938	-10.009	8.0	-18.0

LOW CHANNEL 1



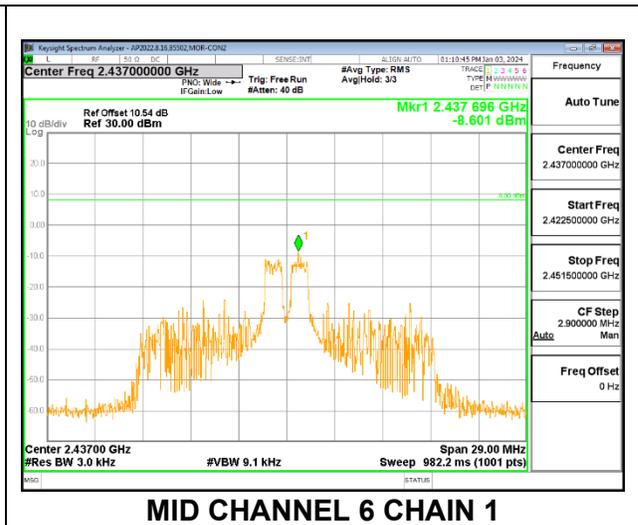
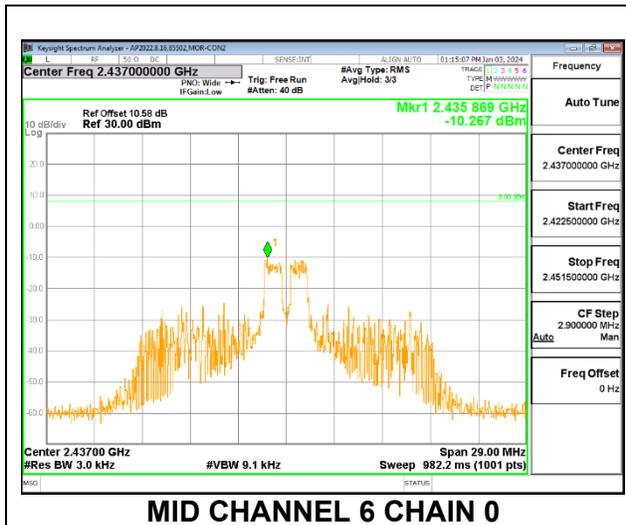
9.5.2. 802.11ax HE20 26T MODE

2TX Chain 0 + Chain 1 MODE

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Chain 1 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-9.719	-9.389	-6.541	8.0	-14.5
Mid 6	2437	-10.267	-8.601	-6.344	8.0	-14.3
High 13	2472	-10.102	-9.630	-6.849	8.0	-14.8

MID CHANNEL 6



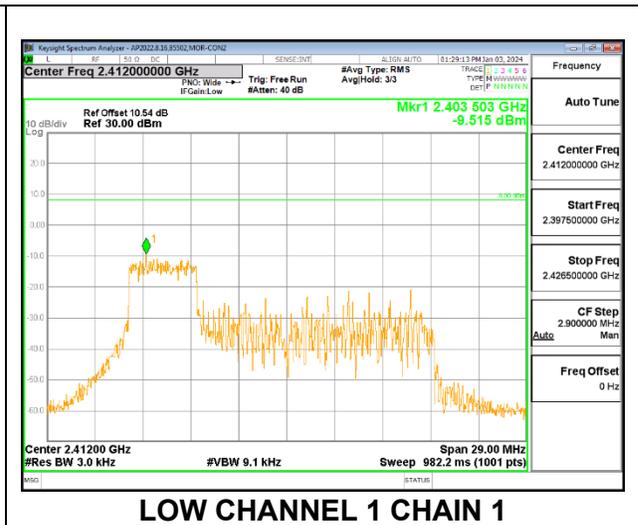
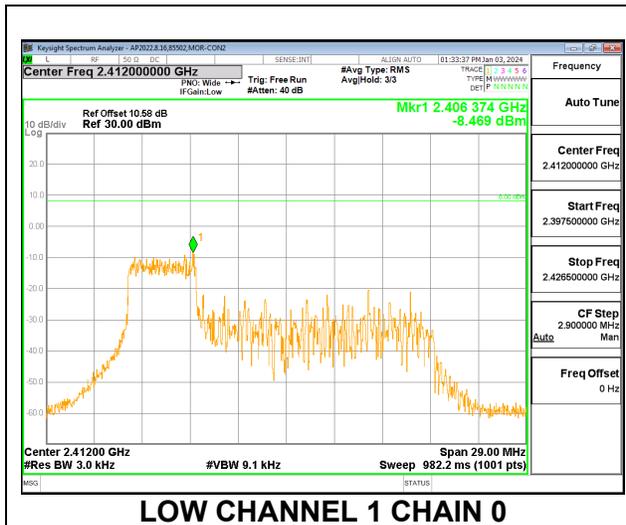
9.5.3. 802.11ax HE20 52T MODE

2TX Chain 0 + Chain 1 MODE

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Chain 1 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-8.469	-9.515	-5.950	8.0	-14.0
Mid 6	2437	-9.416	-9.952	-6.665	8.0	-14.7
High 13	2472	-8.918	-9.443	-6.162	8.0	-14.2

LOW CHANNEL 1



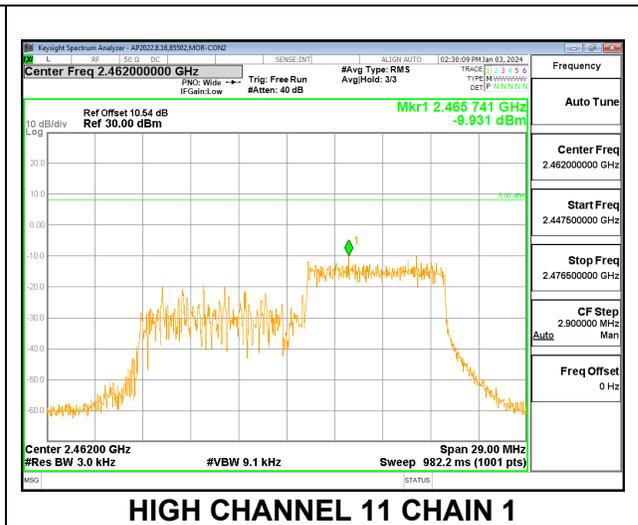
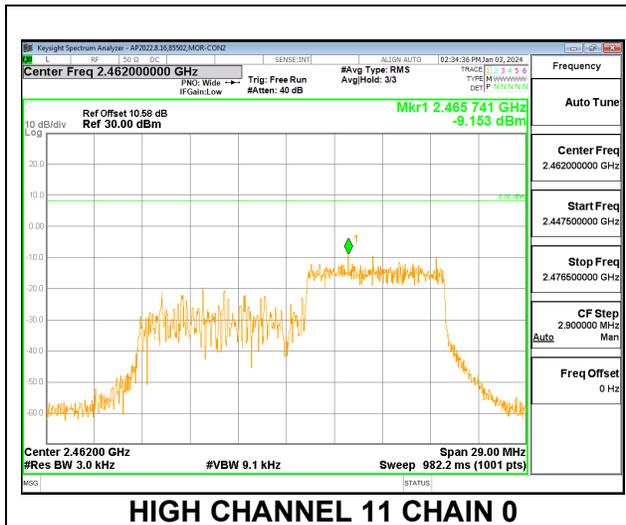
9.5.4. 802.11ax HE20 106T MODE

2TX Chain 0 + Chain 1 MODE

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm/ 3kHz)	Chain 1 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-11.872	-11.139	-8.480	8.0	-16.5
Mid 6	2437	-11.747	-11.053	-8.376	8.0	-16.4
High 13	2472	-9.153	-9.931	-6.514	8.0	-14.5

HIGH CHANNEL 11



9.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

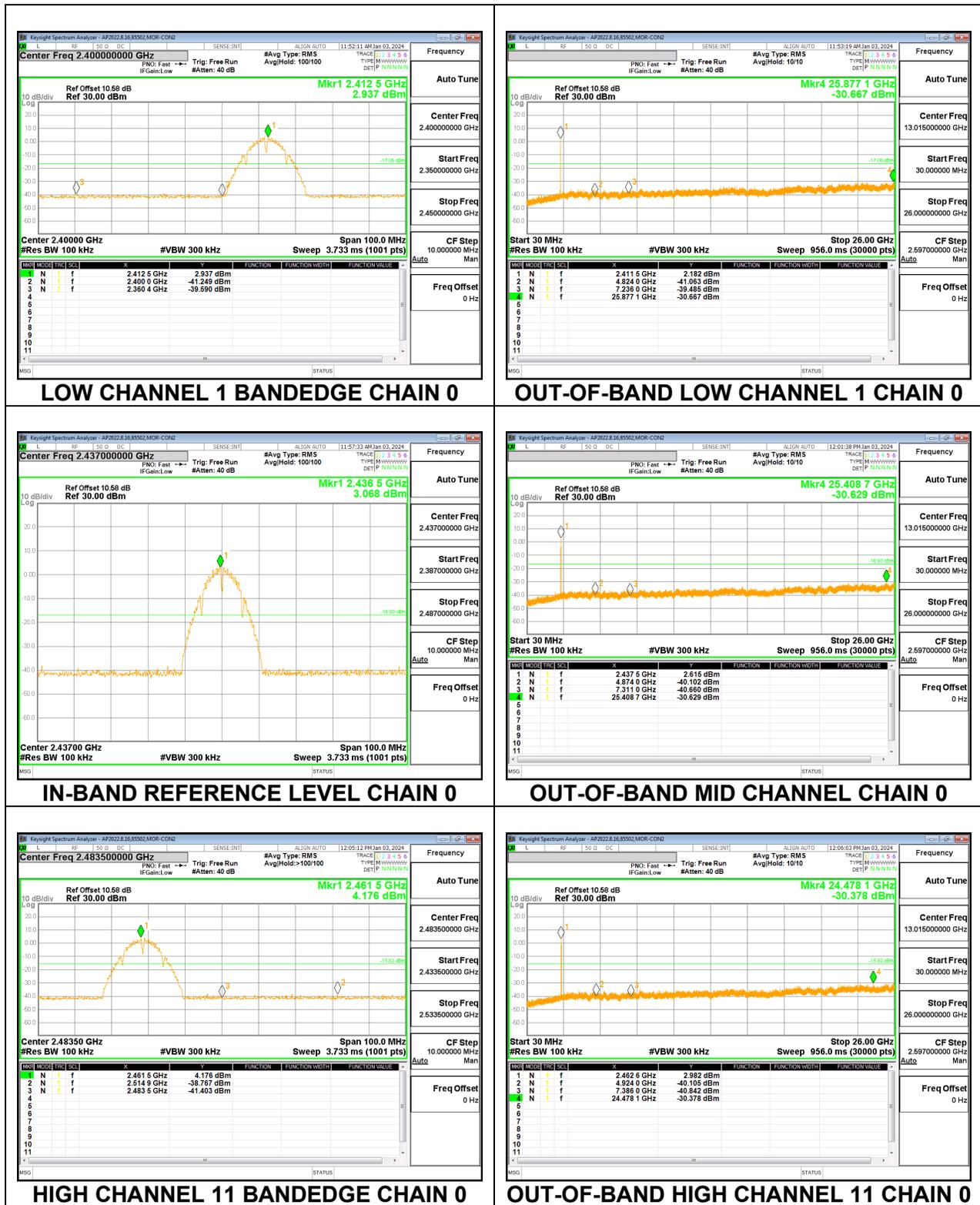
FCC §15.247 (d)

Output power was measured based on the use of peak measurement, therefore the required attenuation is -20 dBc.

RESULTS

9.6.1. 802.11b MODE

2TX Chain 0 + Chain 1 MODE

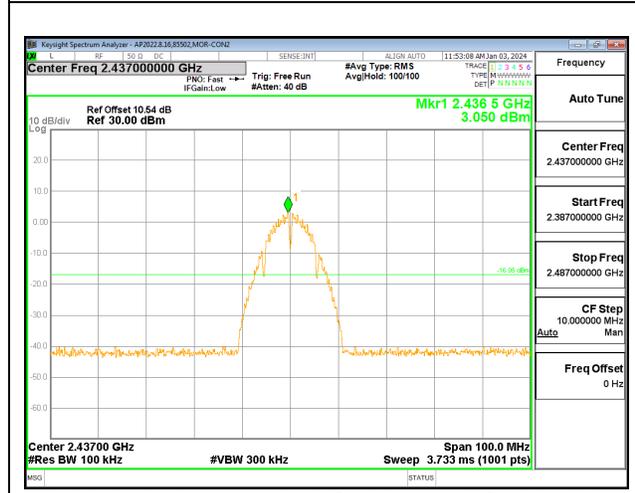




LOW CHANNEL 1 BANDEDGE CHAIN 1



OUT-OF-BAND LOW CHANNEL 1 CHAIN 1



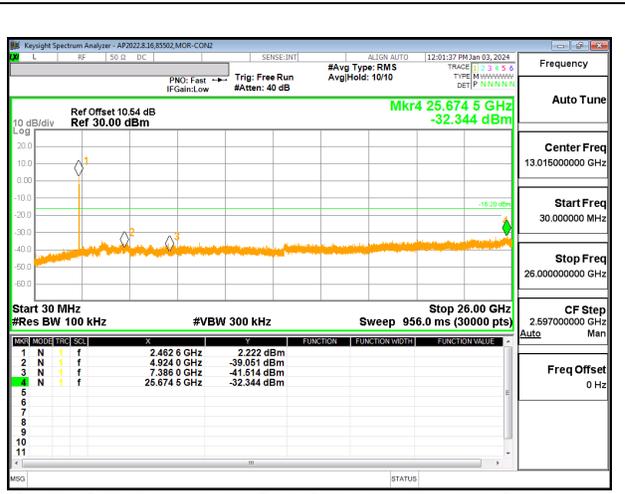
IN-BAND REFERENCE LEVEL CHAIN 1



OUT-OF-BAND MID CHANNEL 1 CHAIN 1



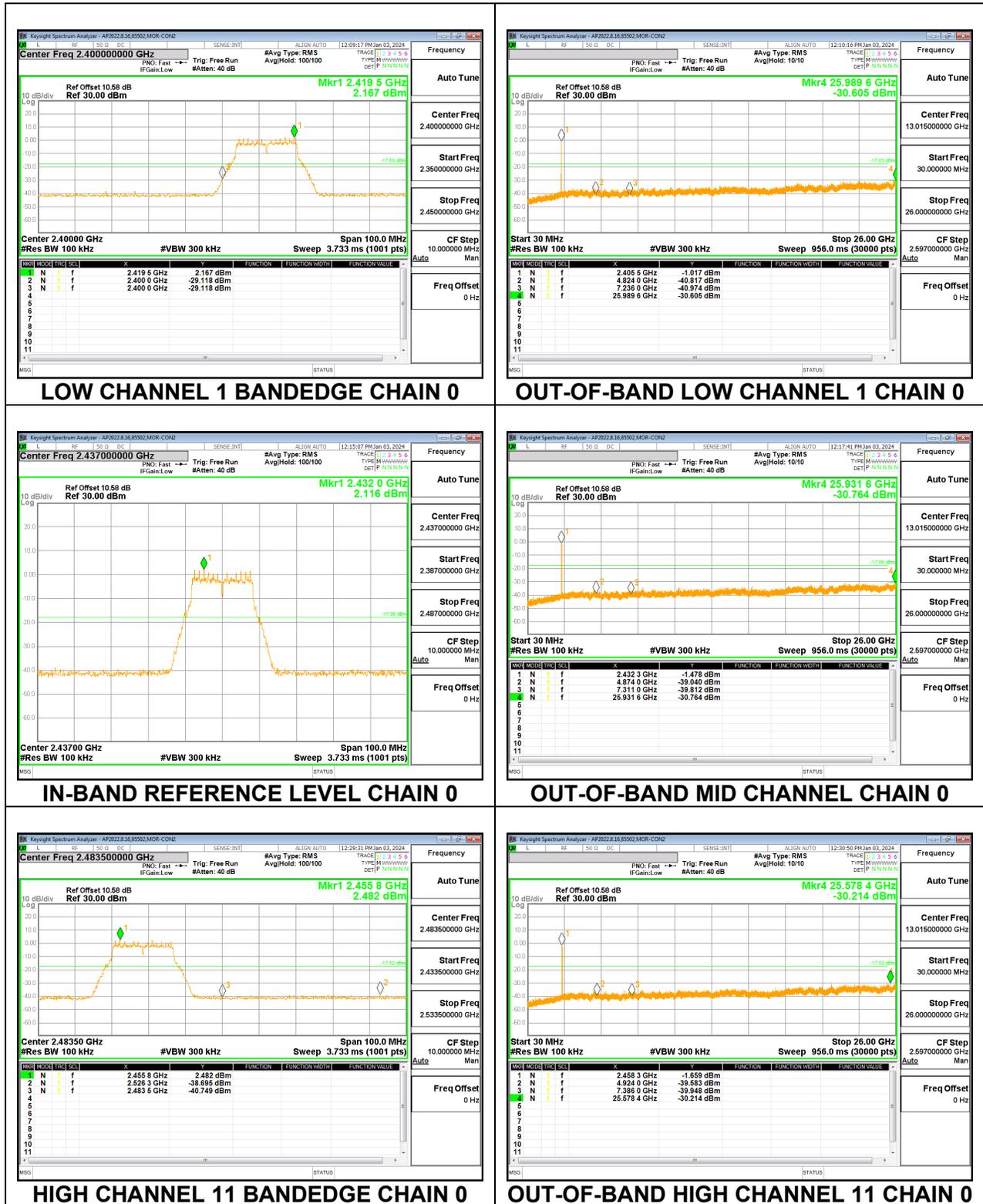
HIGH CHANNEL 11 BANDEDGE CHAIN 1



OUT-OF-BAND HIGH CHANNEL 11 CHAIN 1

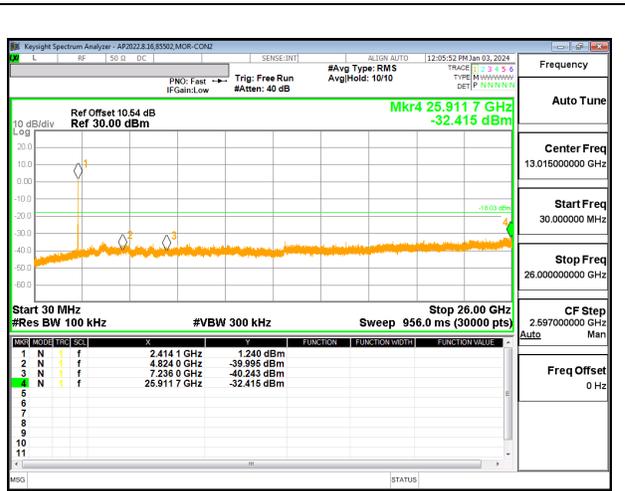
9.6.2. 802.11g MODE

2TX Chain 0 + Chain 1 MODE

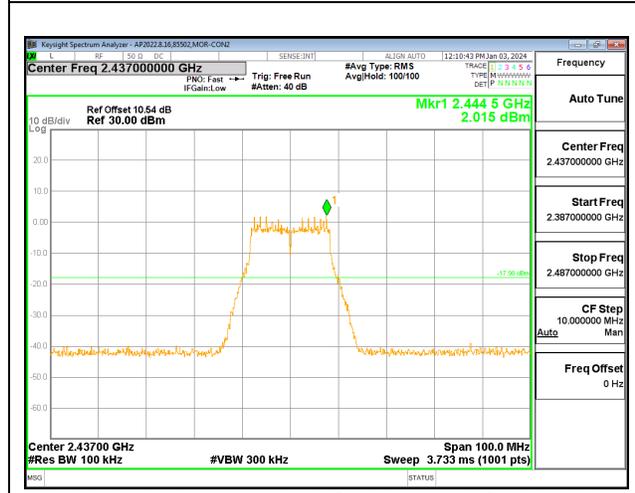




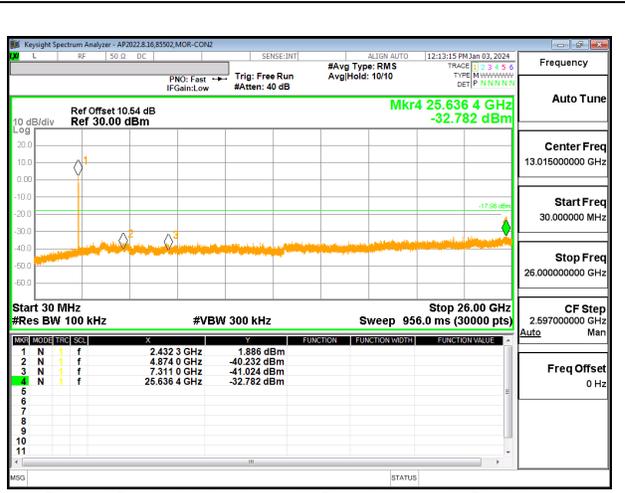
LOW CHANNEL 1 BANDEDGE CHAIN 1



OUT-OF-BAND LOW CHANNEL 1 CHAIN 1



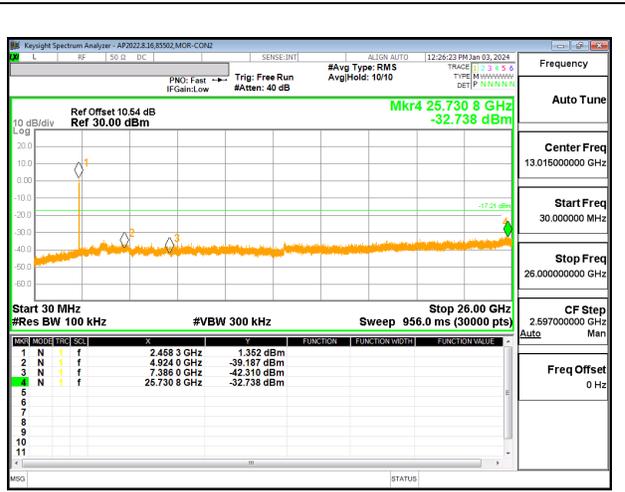
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OUT-OF-BAND MID CHANNEL 1 CHAIN 1



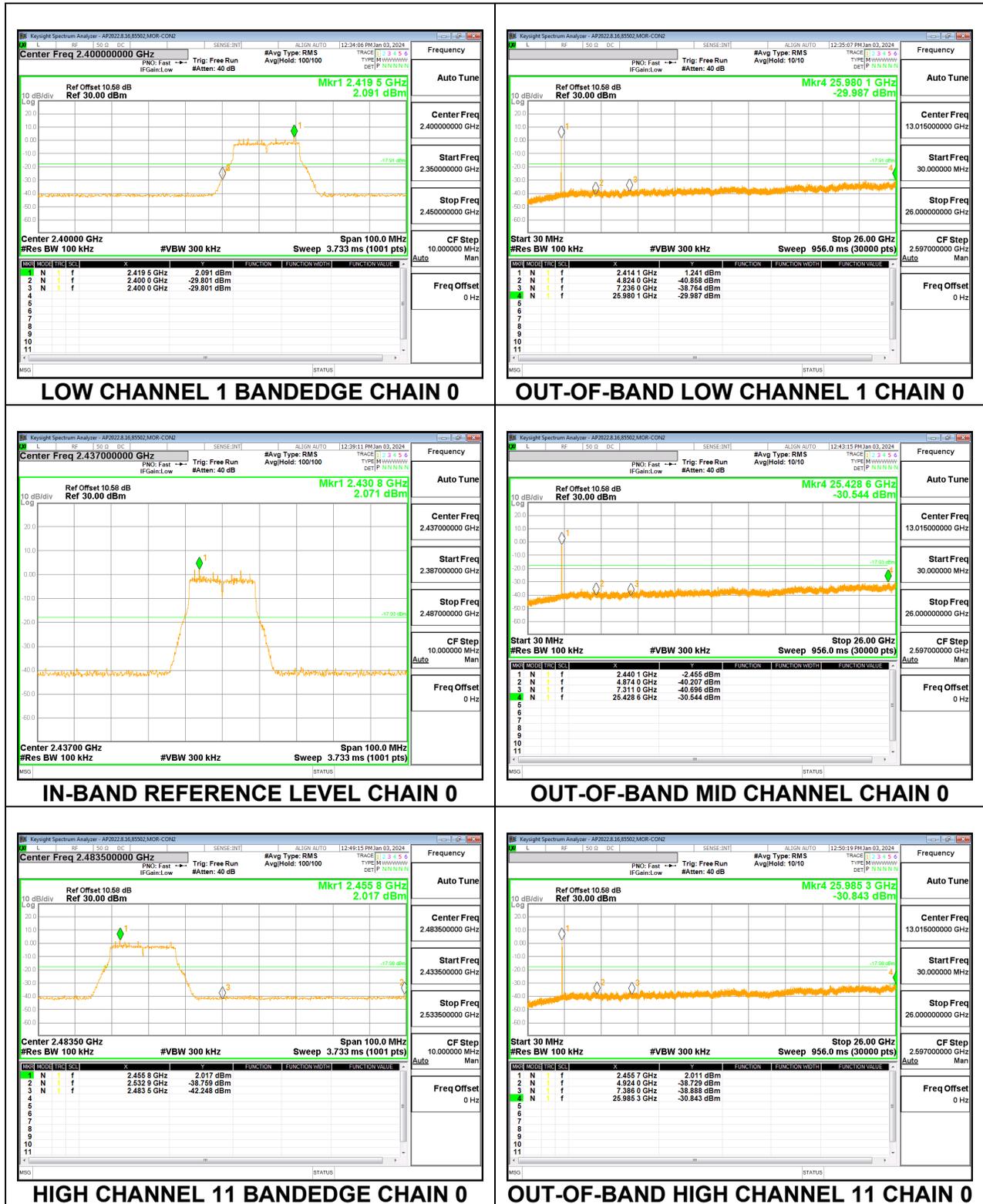
HIGH CHANNEL 11 BANDEDGE CHAIN 1

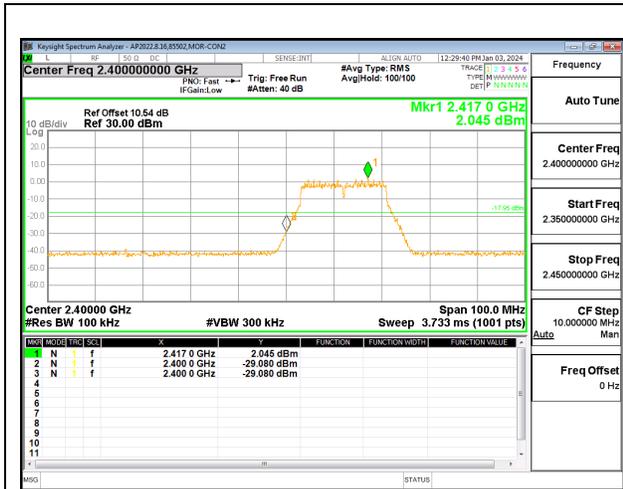


OUT-OF-BAND HIGH CHANNEL 11 CHAIN 1

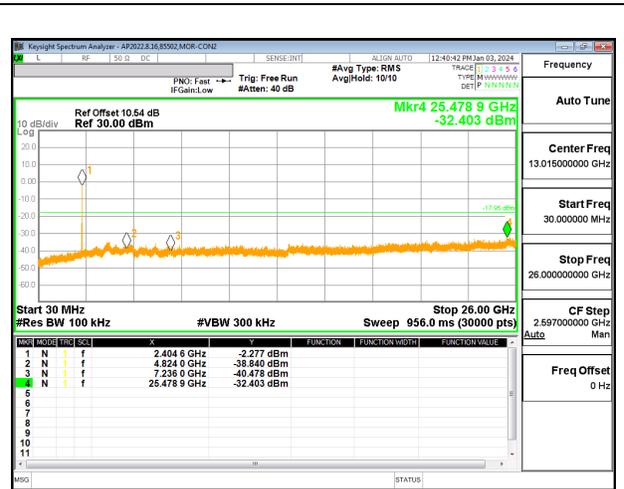
9.6.3. 802.11n HT20 MODE

2TX Chain 0 + Chain 1 MODE

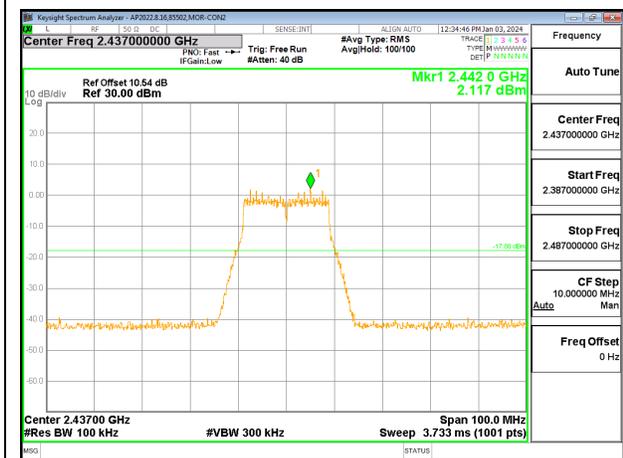




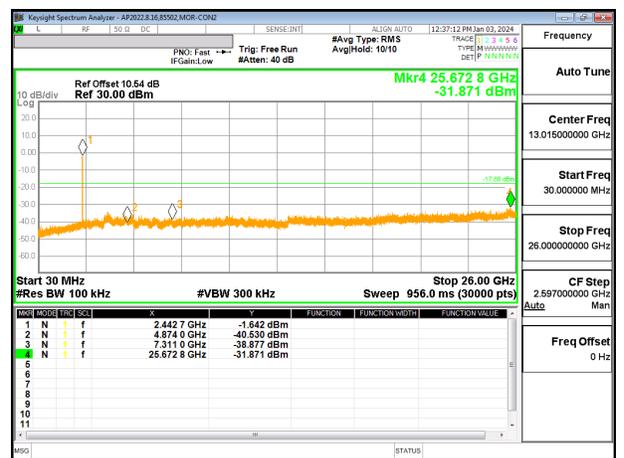
LOW CHANNEL 1 BANDEDGE CHAIN 1



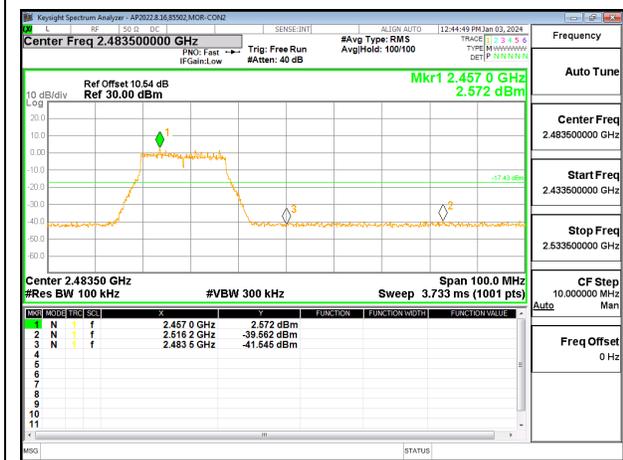
OUT-OF-BAND LOW CHANNEL 1 CHAIN 1



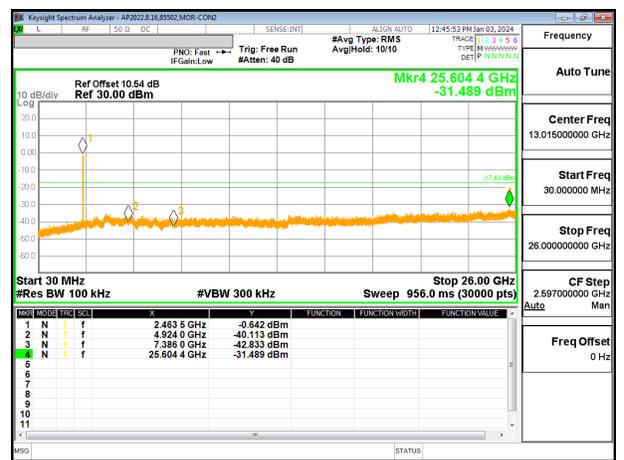
IN-BAND REFERENCE LEVEL CHAIN 1



OUT-OF-BAND MID CHANNEL 1 CHAIN 1



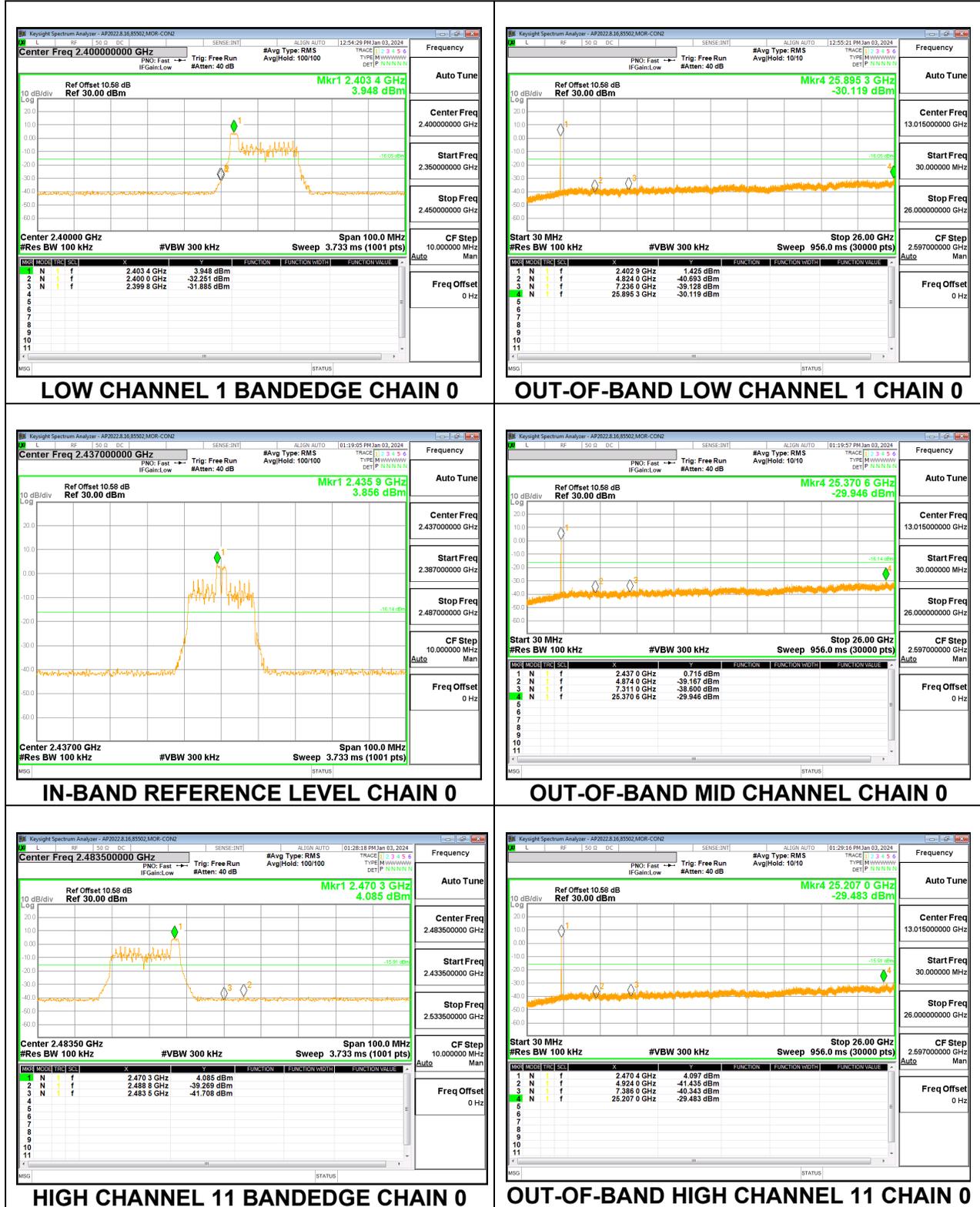
HIGH CHANNEL 11 BANDEDGE CHAIN 1



OUT-OF-BAND HIGH CHANNEL 11 CHAIN 1

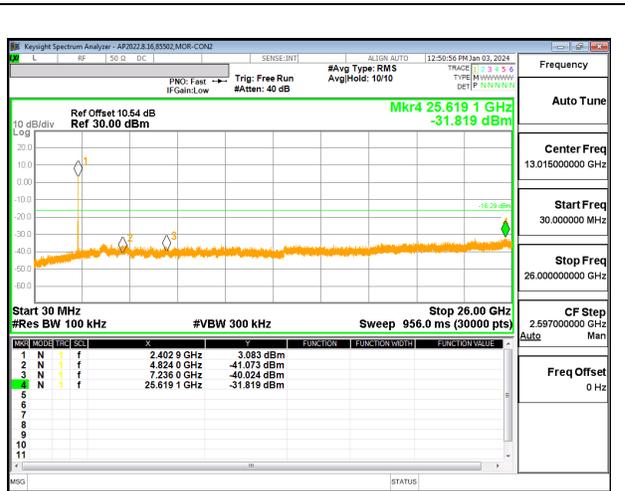
9.6.4. 802.11ax HE20 26T MODE

2TX Chain 0 + Chain 1 MODE

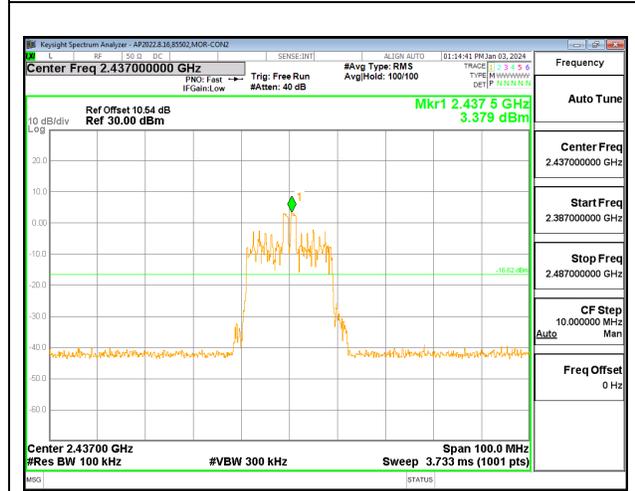




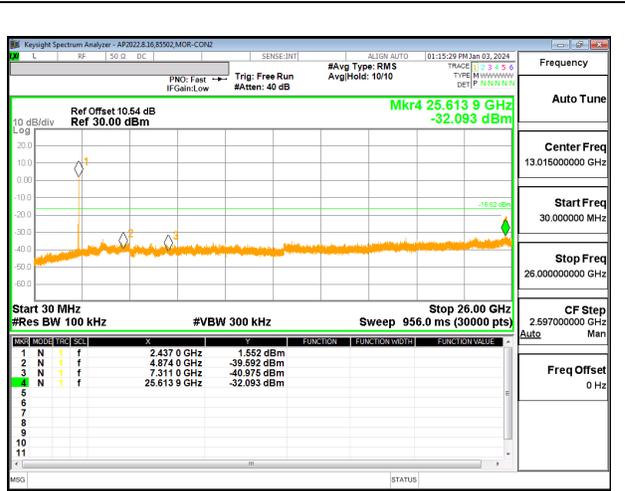
LOW CHANNEL 1 BANDEDGE CHAIN 1



OUT-OF-BAND LOW CHANNEL 1 CHAIN 1



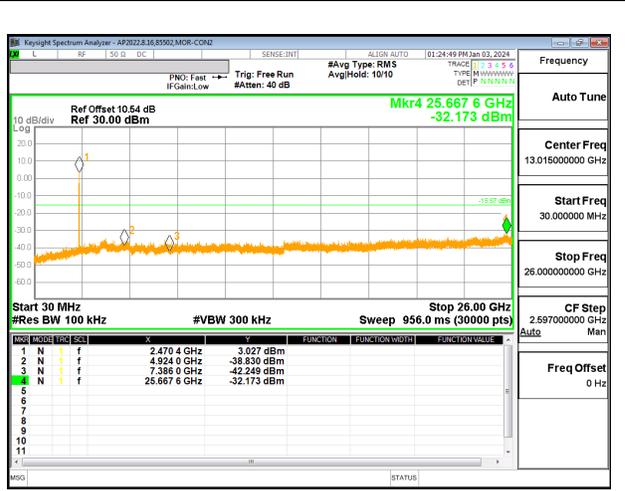
IN-BAND REFERENCE LEVEL CHAIN 1



OUT-OF-BAND MID CHANNEL CHAIN 1



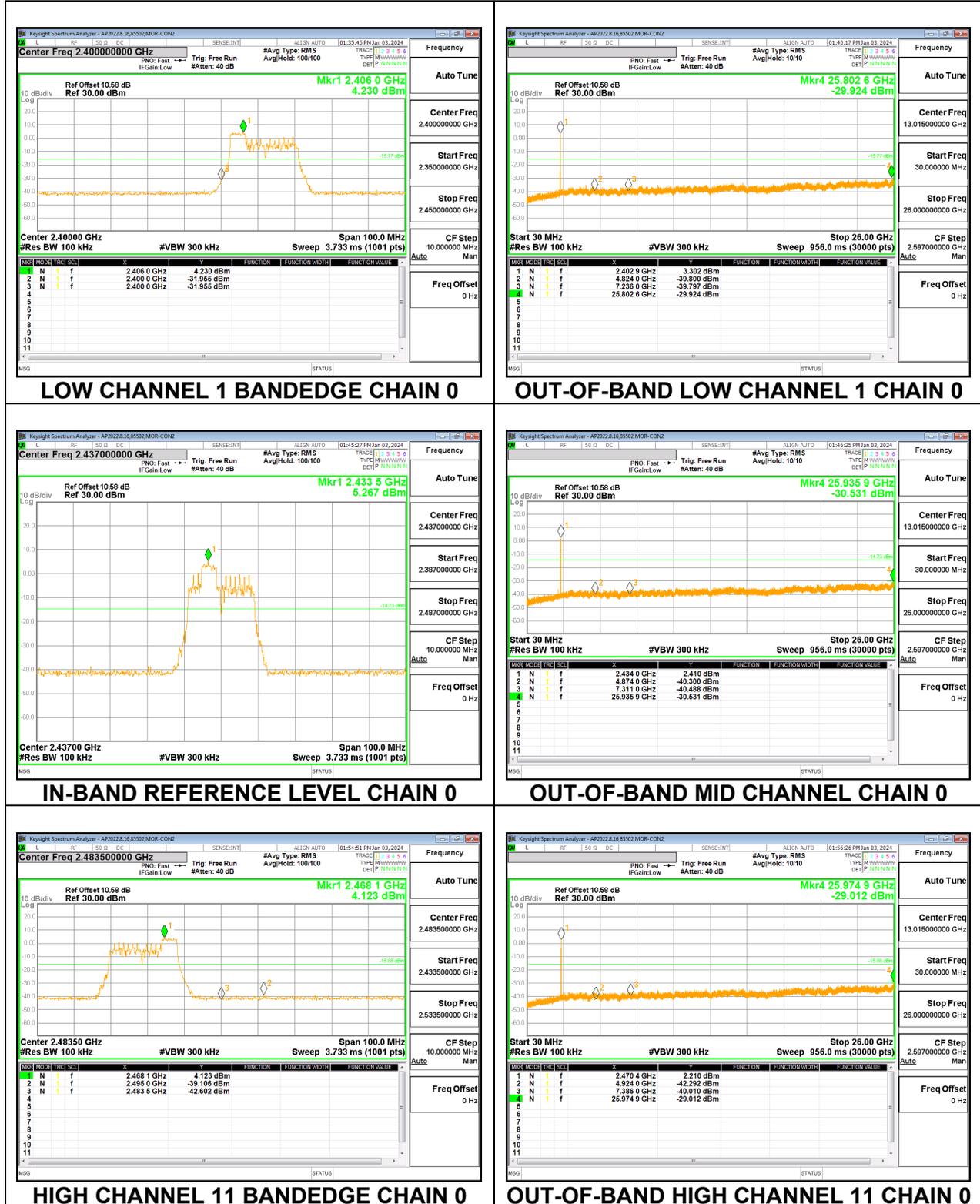
HIGH CHANNEL 11 BANDEDGE CHAIN 1

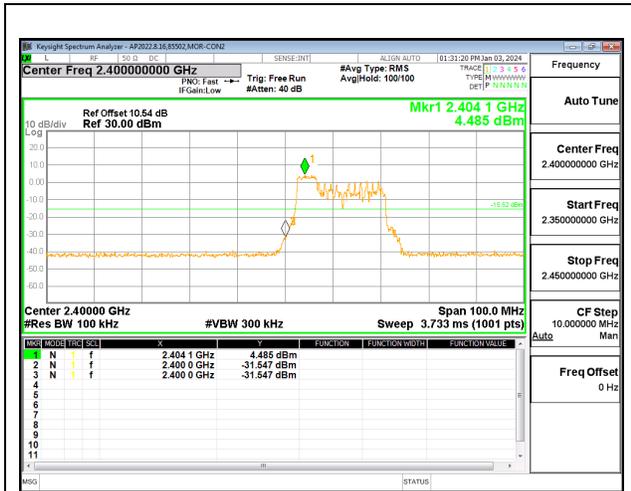


OUT-OF-BAND HIGH CHANNEL 11 CHAIN 1

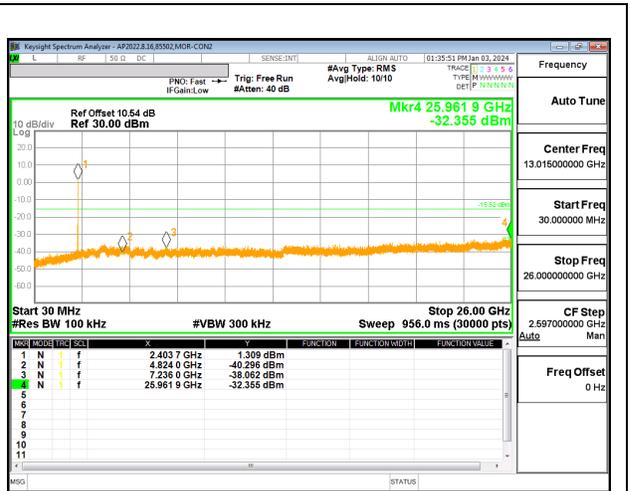
9.6.5. 802.11ax HE20 52T MODE

2TX Chain 0 + Chain 1 MODE

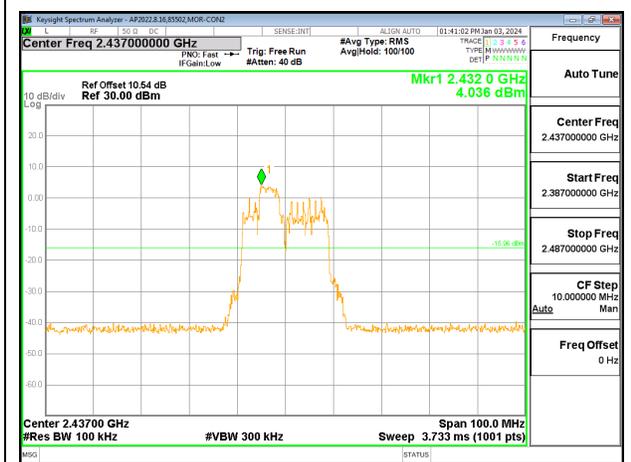




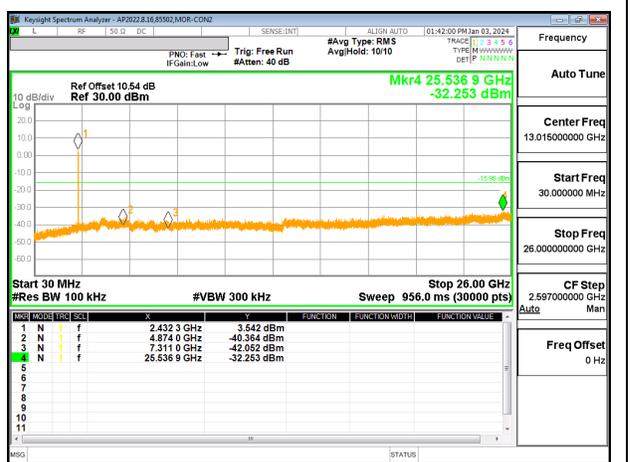
LOW CHANNEL 1 BANDEDGE CHAIN 1



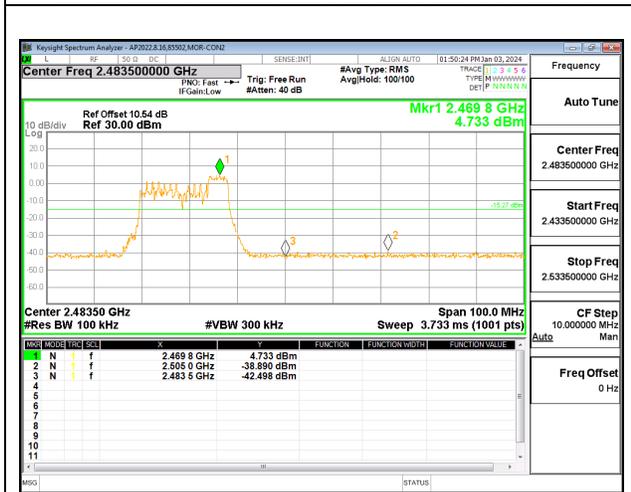
OUT-OF-BAND LOW CHANNEL 1 CHAIN 1



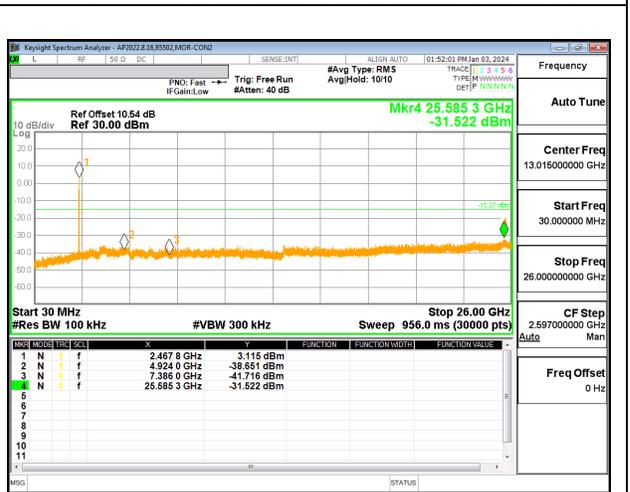
IN-BAND REFERENCE LEVEL CHAIN 1



OUT-OF-BAND MID CHANNEL CHAIN 1



HIGH CHANNEL 11 BANDEDGE CHAIN 1



OUT-OF-BAND HIGH CHANNEL 11 CHAIN 1