ELEMENT MATERIALS TECHNOLOGY,
Columbia MD
(formerly PCTEST)
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. 410.290.6652 / Fax 410.381.1520
http://www.element.com

MEASUREMENT REPORT
FCC PART 15.247 802.11ax (OFDMA)

Applicant Name:
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
10/29/2025-1/28/2026
Test Report Issue Date:
2/5/2026
Test Site/Location:
Element Lab., Columbia, MD, USA
Test Report Serial No.:
1M2512010100-15-R1.A3L

FCC ID:	**A3LSMA576JPN**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SC-54G
EUT Type:	Portable Handset
Frequency Range:	2412 – 2472MHz
Modulation Type:	OFDMA
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
FCC Test Procedure(s):	ANSI C63.10:2020 + Cor. 1:2023

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10:2020. Test results reported herein relate only to the item(s) tested.

This revised Test Report (S/N: 1M2512010100-15-R1.A3L) supersedes and replaces the previously issued test report (S/N: 1M2512010100-15.A3L) on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortanez
Executive Vice President

ACCREDITED
CERT #2041.01

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TEST REPORT REVISION HISTORY

Rev. No.	Description	Issue Date	Revised By
-	Initial Release	1/28/2026	WKR0000005883
1	Addressed comments made by TCB reviewer	2/5/2026	WKR0000005883

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Channel Bandwidth [MHz]	IEEE Mode	Tones	Tx Frequency [MHz]	MIMO			
				Avg. Conducted		Peak Conducted	
				Max. Power [mW]	Max. Power [dBm]	Max. Power [mW]	Max. Power [dBm]
20	802.11ax OFDMA	26T	2412 - 2472	14.60	11.64	189.13	22.77
	802.11ax OFDMA	52T	2412 - 2472	30.08	14.78	372.60	25.71
	802.11ax OFDMA	106T	2412 - 2472	58.86	17.70	594.54	27.74
	802.11ax OFDMA	242T	2412 - 2472	86.78	19.38	723.03	28.59

EUT Overview

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 Element Test Location

Measurements were conducted at the Element laboratory(ies) indicated in Section 1.3 below. All measurement facilities are compliant with the test site requirements specified in ANSI C63.4:2014 and KDB 414788 D01 v01r01.

1.3 Test Facility / Accreditations

Measurements were performed at Element lab located in Columbia, MD 21046, U.S.A.

- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- Element Washington DC LLC TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- Element Washington DC LLC facility is a registered test laboratory with the site description on file with ISED (Wireless Test Lab number 2451B) and FCC (Designation Number US1113).

- Element Washington DC LLC is a Recognized U.S. Certification Assessment Body (CAB # US0110) for ISED Canada as designated by NIST under the U.S. and Canada Mutual Recognition Agreements (MRAs).

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMA576JPN**. The test data contained in this report pertains only to the emissions due to the EUT's WLAN (DTS) transmitter.

The authorization for this device utilizes data referencing from FCC ID: A3LSMA576U as permitted per KDB 484596 D01 v03. Although data is referenced from the SM-A576U1, additional test data is provided herein, as applicable, for the additional channels 12 and 13 which are supported by this model. The data-referenced test results are included in Appendix A of this report.

Test Device Serial No.: 0545M, 0554M, 2256M, 2378M, 2417M

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR (FR1), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE), NFC, SCS

Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	12	2467
6	2437	13	2472
7	2442		

Table 2-1. Frequency/ Channel Operations

Notes:

1. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section 6.0 b) of ANSI C63.10:2020. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Band	Bandwidth	Tone Type	Tone Size	MIMO (1+2)	
				Duty Cycle [%]	Radiated DCCF [dB]
2.4GHz	20MHz	RU	26T	97.43	0.11
			52T	97.66	0.10
			106T	97.61	0.11
			242T	97.26	0.12

Table 2-2. Measured Duty Cycles

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2. The device employs MIMO technology. Below are the possible configurations.

WiFi Configurations		SISO		SDM		CDD	
		ANT1	ANT2	ANT1	ANT2	ANT1	ANT2
2.4GHz	11ax	✓	✓	✓	✓	✓	✓

Table 2-3. Antenna Configuration

✓= Support ; × = NOT Support
SISO = Single Input Single Output
SDM = Spatial Diversity Multiplexing – MIMO function
CDD = Cyclic Delay Diversity - 2Tx Function

3. The device supports the following data rates (shown in Mbps):

MCS Index	Spatial Stream	OFDMA (802.11ax)											
		26T			52T			106T			242T		
HE		0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI
0	1	0.9	0.8	0.8	1.8	1.7	1.5	3.8	3.5	3.2	8.6	8.1	7.3
1	1	1.8	1.7	1.5	3.5	3.3	3	7.5	7.1	6.4	17.2	16.3	14.6
2	1	2.6	2.5	2.3	5.3	5	4.5	11.3	10.6	9.6	25.8	24.4	21.9
3	1	3.5	3.3	3	7.1	6.7	6	15	14.2	12.8	34.4	32.5	29.3
4	1	5.3	5	4.5	10.6	10	9	22.5	21.3	19.1	51.6	48.8	43.9
5	1	7.1	6.7	6	14.1	13.3	12	30	28.3	25.5	68.8	65	58.5
6	1	7.9	7.5	6.8	15.9	15	13.5	33.8	31.9	28.7	77.4	73.1	65.8
7	1	8.8	8.3	7.5	17.6	16.7	15	37.5	35.4	31.9	86	81.3	73.1
8	1	10.6	10	9	21.2	20	18	45	42.5	38.3	103.2	97.5	87.8
9	1	11.8	11.1	10	23.5	22.2	20	50	47.2	42.5	114.7	108.3	97.5
10	1	13.2	12.5	11.3	26.5	25	22.5	56.3	53.1	47.8	129	121.9	109.7
11	1	14.7	13.9	12.5	29.4	27.8	25	62.5	59	53.1	143.4	135.4	121.9
0	2	1.8	1.7	1.5	3.5	3.3	3	7.5	7.1	6.4	17.2	16.3	14.6
1	2	3.5	3.3	3	7.1	6.7	6	15	14.2	12.8	34.4	32.5	29.3
2	2	5.3	5	4.5	10.6	10	9	22.5	21.3	19.1	51.6	48.8	43.9
3	2	7.1	6.7	6	14.1	13.3	12	30	28.3	25.5	68.8	65	58.5
4	2	10.6	10	9	21.2	20	18	45	42.5	38.3	103.2	97.5	87.8
5	2	14.1	13.3	12	28.2	26.7	24	60	56.7	51	137.6	130	117
6	2	15.9	15	13.5	31.8	30	27	67.5	63.8	57.4	154.9	146.3	131.6
7	2	17.6	16.7	15	35.3	33.3	30	75	70.8	63.8	172.1	162.5	146.3
8	2	21.2	20	18	42.4	40	36	90	85	76.5	206.5	195	175.5
9	2	23.5	22.2	20	47.1	44.4	40	100	94.4	85	229.4	216.7	195
10	2	26.5	25	22.5	52.9	50	45	112.5	106.3	95.6	258.1	243.8	219.4
11	2	29.4	27.8	25	58.8	55.6	50	125	118.1	106.3	286.8	270.8	243.8

Table 2-4. Supported Data Rates

2.3 Test Configuration

ANSI C63.10:2020 was used to reference the appropriate EUT setup for radiated spurious emissions testing. See Sections 7.7 for radiated emissions test setups, and 7.2, 7.3, 7.4, 7.5, and 7.6 for antenna port conducted emissions test setups.

2.4 Antenna Description

The manufacturer provided the antenna gains which can affect the validity of test results used for determination of compliance. The following antenna gains are used in this device per the "Unlicensed Band Antenna Gain" document provided by the client. This document is also included in the filing as a public exhibit.

Frequency [GHz]	Antenna-1 Gain [dBi]	Antenna-2 Gain [dBi]	Directional Gain [dBi]
2.4	-4.65	-5.26	-1.94

Table 2-5. Antenna Peak Gain

2.5 Software and Firmware

The test was conducted with software/firmware version A576U1UEU0AYK3 installed on the EUT.

2.6 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10:2020) was used in the measurement of the EUT.

Deviation from measurement procedure…….....None

3.2 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4:2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33 depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4:2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 414788 D01 v01r01.

3.3 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antennas of the EUT are **permanently attached.**
- There are no provisions for connections to an external antenna.

Conclusion:

The EUT unit complies with the requirement of §15.203.

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10:2020. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Line Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

Table 5-1. Measurement Uncertainty Budget

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurement antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	MD 1M 40	EMC Cable and Switch System	2/25/2025	Annual	2/25/2026	MD 1M 40
-	AP1-002	EMC Cable and Switch System	2/25/2025	Annual	2/25/2026	AP1-002
-	AP2-001	EMC Cable and Switch System	2/25/2025	Annual	2/25/2026	AP2-001
-	AP2-002	EMC Cable and Switch System	2/25/2025	Annual	2/25/2026	AP2-002
-	ETS-001	EMC Cable and Switch System	12/11/2024	Annual	12/11/2025	ETS-001
-	ETS-002	EMC Cable and Switch System	12/11/2024	Annual	12/11/2025	ETS-002
-	WL25-1	Conducted Cable Set (25GHz)	2/25/2025	Annual	2/25/2026	WL25-1
-	WL25-2	Conducted Cable Set (25GHz)	2/25/2025	Annual	2/25/2026	WL25-2
-	WL40-1	Conducted Cable Set (40GHz)	2/25/2025	Annual	2/25/2026	WL40-1
Agilent	N9038A	MXE EMI Receiver	11/10/2025	Annual	11/10/2026	MY51210133
Anritsu	MA24408A	POWER SENSOR	2/11/2025	Annual	2/11/2026	12776
EMCO	3115	Horn Antenna (1-18GHz)	9/6/2024	Biennial	9/6/2026	9704-5182
Espec	ESX-2CA	Environmental Chamber	11/20/2024	Biennial	11/20/2026	17620
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	6/4/2025	Biennial	6/4/2027	125518
ETS-Lindgren	3164-05	Quad Ridge Horn (Small) 2 - 18GHz	6/4/2025	Biennial	6/4/2027	208255
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	6/6/2025	Annual	6/6/2026	MY52350166
Keysight Technologies	N9020A	MXA Signal Analyzer	6/4/2025	Annual	6/4/2026	MY54500644
Keysight Technologies	N9030A	PXA Signal Analyzer	11/3/2025	Annual	11/3/2026	MY54490576
Rohde & Schwarz	ESW44	EMI Test Receiver 2Hz to 44 GHz	3/25/2025	Annual	3/25/2026	101716
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	10/16/2024	Annual	12/31/2025	100342
Rohde & Schwarz	180-422-KF	Horn (18 - 40GHz)	10/9/2024	Biennial	10/9/2026	U157403-01
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	9/11/2024	Biennial	9/11/2026	A051107
Sunol	JB6	Bi-Log Antenna (30M - 5GHz)	3/24/2025	Biennial	3/24/2027	A082816

Table 6-1. Test Equipment Calibration Table

Note:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
Equipment listed with “N/A under calibration information was not used to make calibrated measurements.

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Component	Serial Number
MegaPhase Cable TM26-S1S1-36	18160103 003
Pasternack 6dB Attenuator PE7005-6	N/A

Table 6-2. WL25-1 Conducted Cable Set Components

Component	Serial Number
MiniCircuirs Cable CBL-2FT-SMSM+	77743
MCL 6dB Attenuator BW-S6W2+	1314

Table 6-3. WL25-2 Conducted Cable Set Components

Component	Serial Number
MegaPhase Cable TM40K1K1-36	18160102 001
MCL 10dB Attenuator BW-K10 2W44+	1902

Table 6-4. WL40-1 Conducted Cable Set Components

Component	Serial Number
Pasternack Cable RG214/U	111815
MegaPhase (CAGE 1GVT4) Cable GR18-N5N5-24	14042714 001

Table 6-5. ETS-001 EMC Cable and Switch System Components

Component	Serial Number
MegaPhase (CAGE 1GVT4) Cable GR18-N5N5-24	14042714 001
MegaPhase (CAGE 1GVT4) Cable NC29-N1N1-324	20502201 001
Rohde & Schwarz SF Unit	102134
Minicircuits Cable CBL=0.5M-NMNM+	15440

Table 6-6. ETS-002 EMC Cable and Switch System Components

Component	Serial Number
Sucoflex 106A Cable	501992
MegaPhase Cable N29-N1N1-324	20335606 001
Rohde & Schwarz SF Unit	102133
MiniCircuits Cable CBL-2FT-SMSM+	77745
MegaPhase Cable 10511-1	15034701 001
MiniCircuits Switch RC 2SPDT-A18	11703270 041
Sucoflex 104 Cable	320259/4
Sucoflex 104 Cable	321999/4
Sucoflex 104 Cable	321995/4

Table 6-7. AP1-002 EMC Cable and Switch System Components

Component	Serial Number
Flex Cable	P2A-0001
Micro-Coax Utilfex Cable UFB311A-Q-3346-50U50U MFR 64639	231978-003
Chamber Passthrough	CP4/X12
Micro-Coax Utilfex Cable UFB311A-1-0629-50U50U MFR 64639	231986-003
Micro-Coax Utiflex Cable UFB142A-0-0629-5GU200 MFR 6463	232069-001
Rohde & Schwarz TS-PR8 Pre-Amplifier	102335
Rohde & Schwarz OSP130 Open Switch and Control Unit	101181

Table 6-8. AP2-001 EMC Cable and Switch System Components

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Component	Serial Number
MiniCircuits Cable CBL-0.5M-SMNM+	47261
Micro-Coax Utilfex Cable UFB311A-Q-3346-50U50U MFR 64639	231978-001
Micro-Coax Utilfex Cable UFB311A-1-0629-50U50U MFR 64639	231986-002
MegaPhase (CAGE 1GVT4) Cable NC29-N1N1-324	19046401 001
Megaphase (CAGE 1GVT4) Flex Cable 10511-1	15044701-006
Micro-Coax Utiflex Cable UFB311A-Q-3346-50U50U MFR 64639	231978-002
Micro-Coax Utilfex Cable UFB311A-1-0629-50U50U MFR 64639	231986-004
Micro-Coax Utiflex Cable UFB142A-0-0629-5GU200 MFR 64639	232069-001
Rohde & Schwarz SF Unit	102138
Rohde & Schwarz OSP130 Open Switch and Control Unit	101181
Micro-Coax Utilfex Cable UFB311A-Q-3346-50U50U MFR 64639	231978-003
· Micro-Coax Utilfex Cable UFB311A-1-0629-50U50U MFR 64639	231986-003
Rohde & Schwarz TS-PR8 Pre-Amplifier	102335

Table 6-9. AP2-002 EMC Cable and Switch System Components

Component	Serial Number
MegaPhase Cable TM40-K1K1-30	20233002-004
UTIPLEX Cable	64639 232063-001
Rohde & Schwarz Pre-amp RS-PR1840 18G-40G	9037.7670.02

Table 6-10. MD 1M 18-40 EMC Cable and Switch System Components

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7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.
FCC ID: A3LSMA576JPN
FCC Classification: Digital Transmission System (DTS)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference	Data Referencing
15.247(a)(2)	6dB Bandwidth	The minimum 6 dB bandwidth shall be at least 500 kHz.	CONDUCTED	PASS	Section 7.2	Yes
15.247(b)(3)	Transmitter Output Power*	shall not exceed 1 W		PASS	Section 7.3	Yes
N/A	e.i.r.p.*	Shall not exceed 4 W		PASS	Section 7.3	Yes
15.247(e)	Transmitter Power Spectral Density	shall not be greater than 8 dBm in any 3 kHz band		PASS	Section 7.4	Yes
15.247(d)	Band Edge* / Out-of-Band Emissions	≥ 20dBc		PASS	Sections 7.5, 7.6	Yes
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])	RADIATED	PASS	Section 7.7	Yes

Table 7-1. Summary of Test Results

* Data referencing is applicable to this test; however, additional test data is provided to address channels 12 and 13, which are supported by this model.

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst-case emissions.
2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is Element “WLAN Automation,” Version 3.5.
5) For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is Element “Chamber Automation,” Version 1.3.1.
6) 802.11ax OFDMA testing was performed for all signal tone configurations as specified by the 802.11ax standard. Worst case results are determined and reported per the guidance provided at the October 2018 TCB Workshop.
7) Data was referenced from model SM-A576U1 for the certification of SC-54G. See Section 9.0 for spotcheck results.

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7.2 6dB Bandwidth & Occupied Bandwidth Measurement

Test Overview and Limit

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the transmitter antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated and the worst-case configuration results are reported in this section.

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

Test Procedure Used

ANSI C63.10:2020 – Section 11.8.2

Test Settings - 6dB Bandwidth

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 100kHz
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize

Test Settings - Occupied Bandwidth

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

1. Based on preliminary measurements, it was determined that, of all the tone configurations, the 26T configuration produced the worst case 6dB Bandwidth measurement. Only the worst-case data is included in this section.

2. The 6dB bandwidth for each channel was measured with the RU index showing the highest conducted power.

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6dB Bandwidth Measurements

Frequency [MHz]	Channel No.	802.11 Mode	Tones	Data Rate [Mbps]	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
2412	1	ax	26T	MCS0	2.085	0.500
2437	6	ax	26T	MCS0	2.706	0.500
2462	11	ax	26T	MCS0	2.092	0.500
2412	1	ax	242T	MCS0	18.96	0.500
2437	6	ax	242T	MCS0	18.95	0.500
2462	11	ax	242T	MCS0	18.85	0.500

Table 7-2. Conducted 6dB Bandwidth Measurements MIMO ANT 1

Frequency [MHz]	Channel No.	802.11 Mode	Tones	Data Rate [Mbps]	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
2412	1	ax	26T	MCS0	2.080	0.500
2437	6	ax	26T	MCS0	2.693	0.500
2462	11	ax	26T	MCS0	2.073	0.500
2412	1	ax	242T	MCS0	18.83	0.500
2437	6	ax	242T	MCS0	18.53	0.500
2462	11	ax	242T	MCS0	18.78	0.500

Table 7-3. Conducted 6dB Bandwidth Measurements MIMO ANT 2

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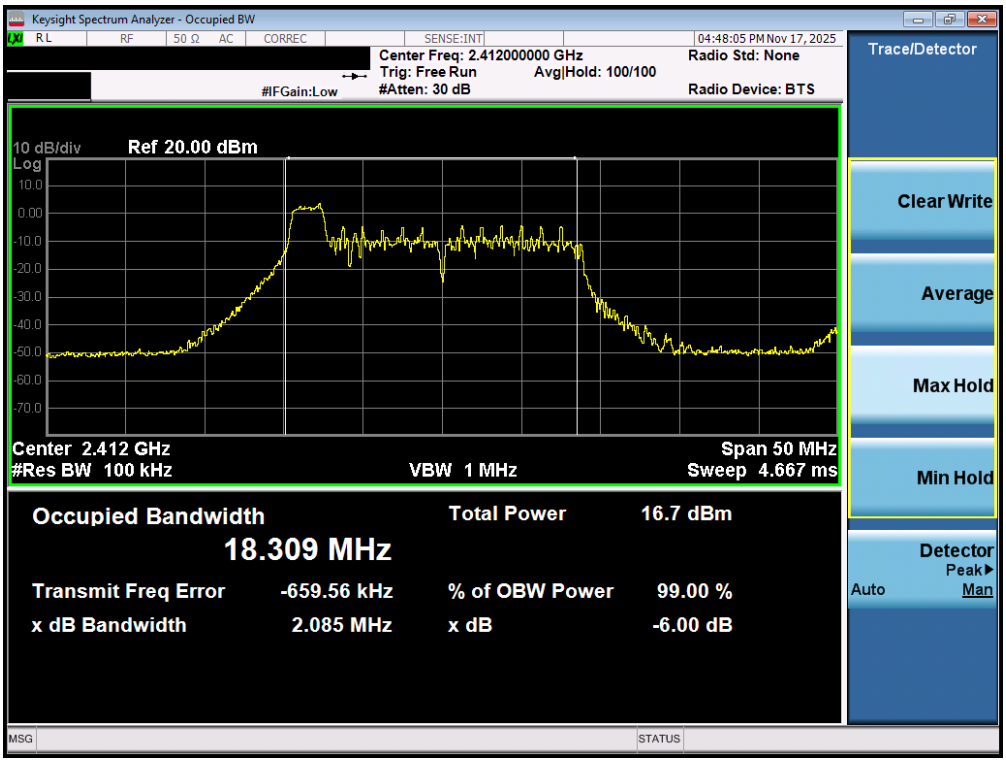
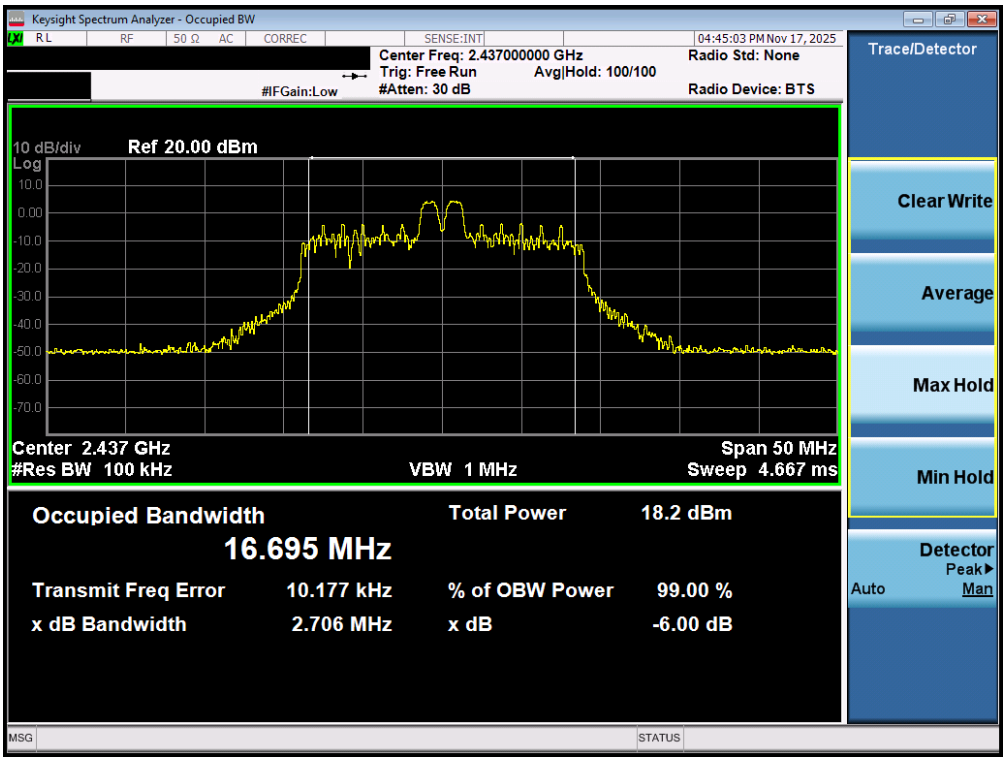
7.2.1 MIMO 6 dB Bandwidth Measurements



Plot 7-1. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-2. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 6)

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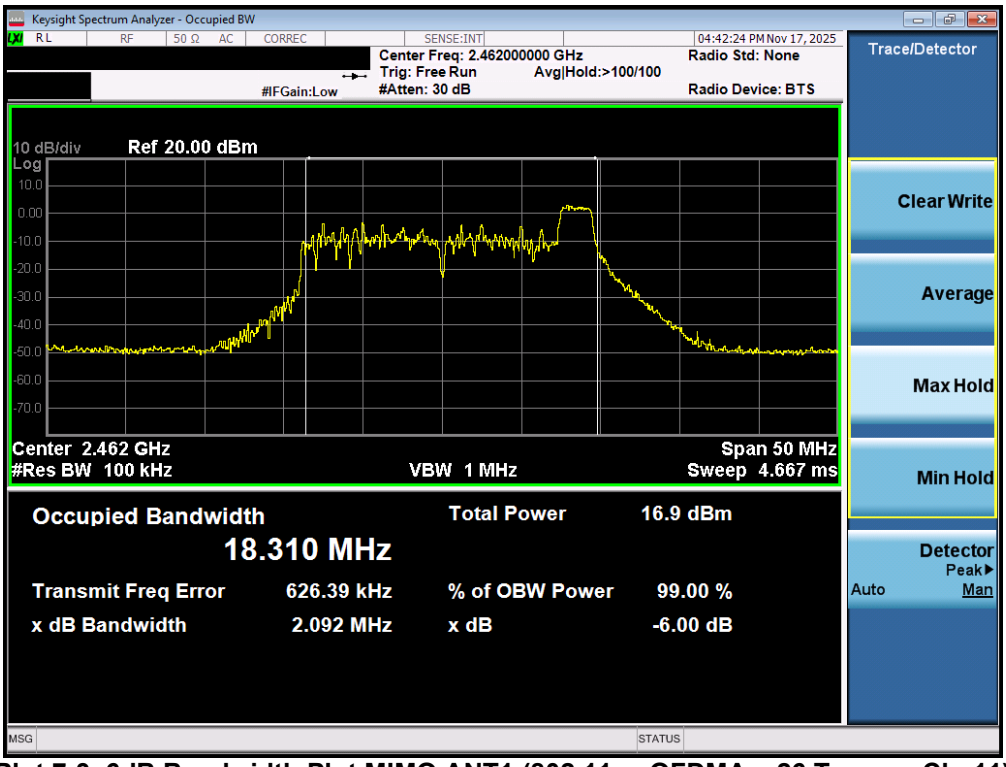
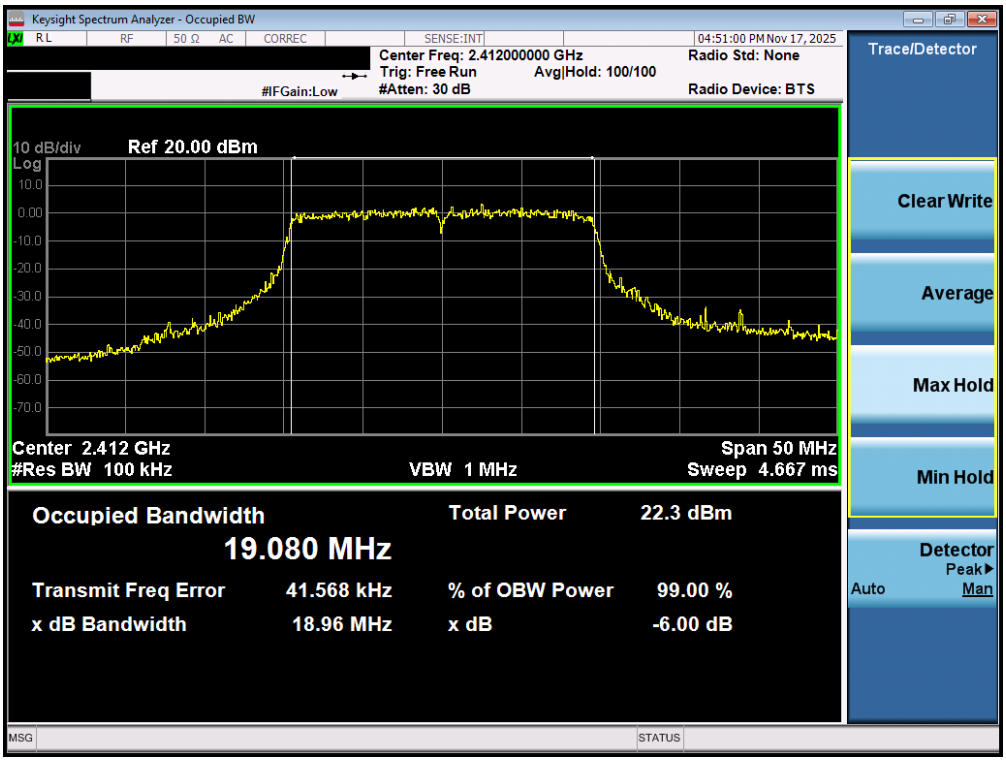


Plot 7-3. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-4. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)

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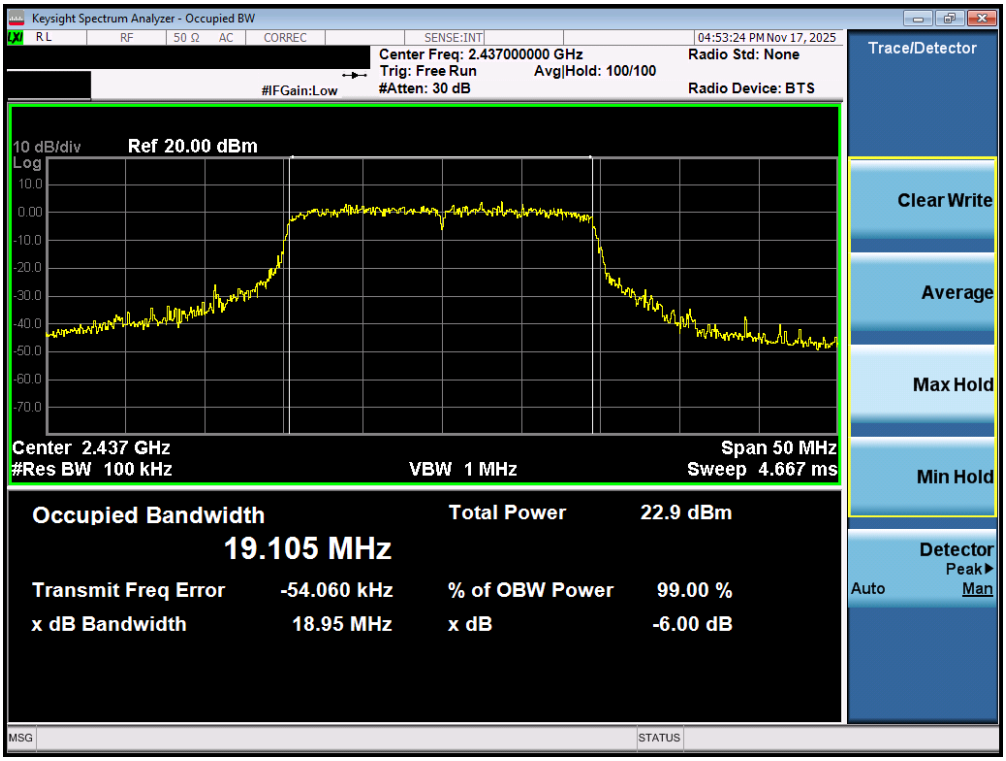
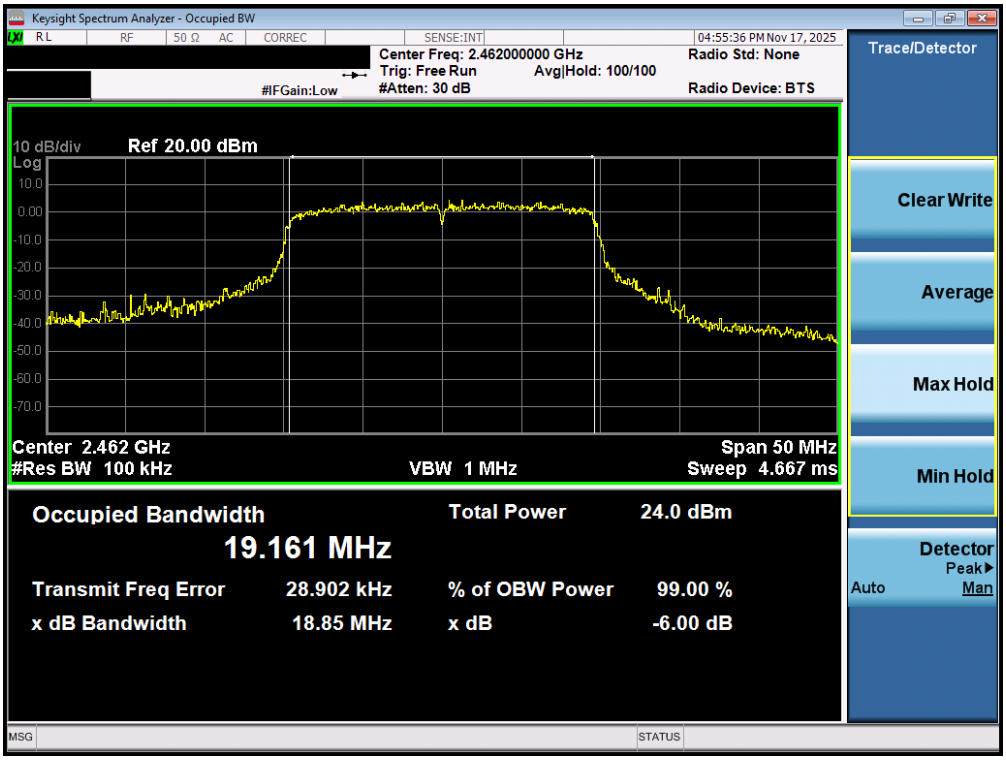


Plot 7-5. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-6. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)

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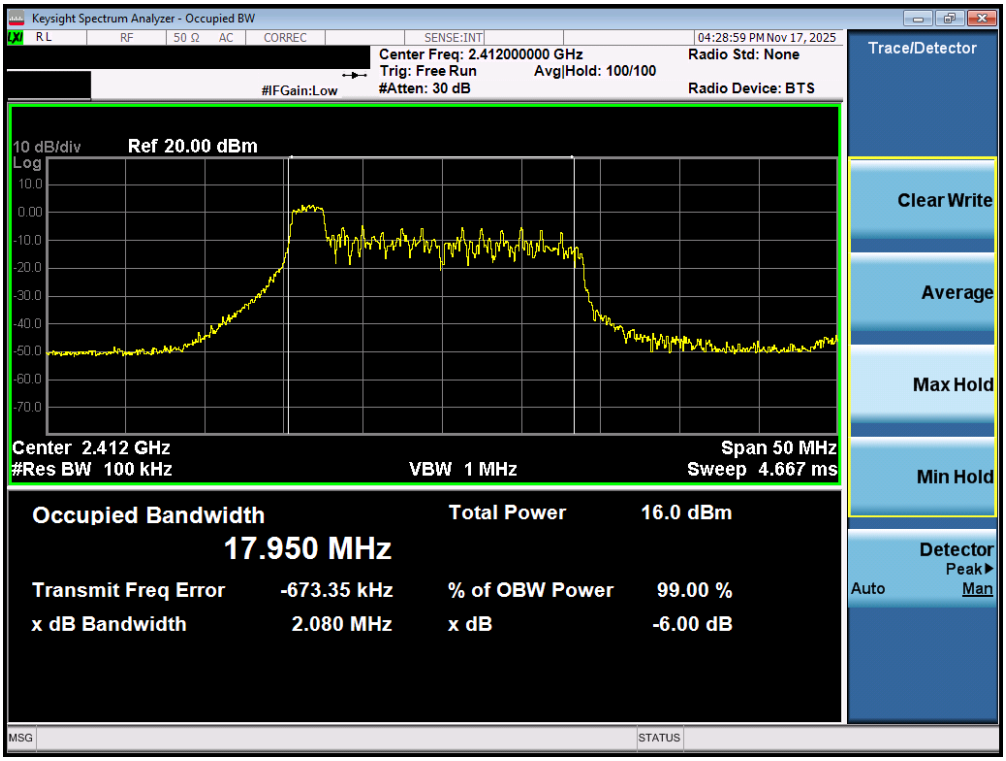
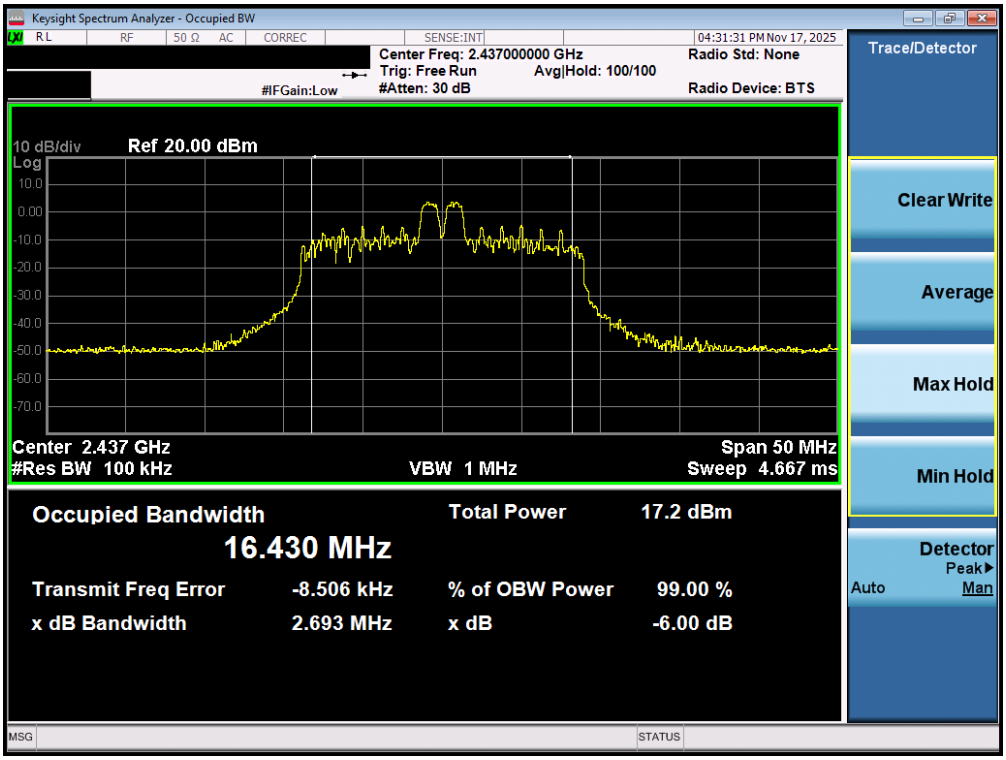


Plot 7-7. 6dB Bandwidth Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-8. 6dB Bandwidth Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 6)

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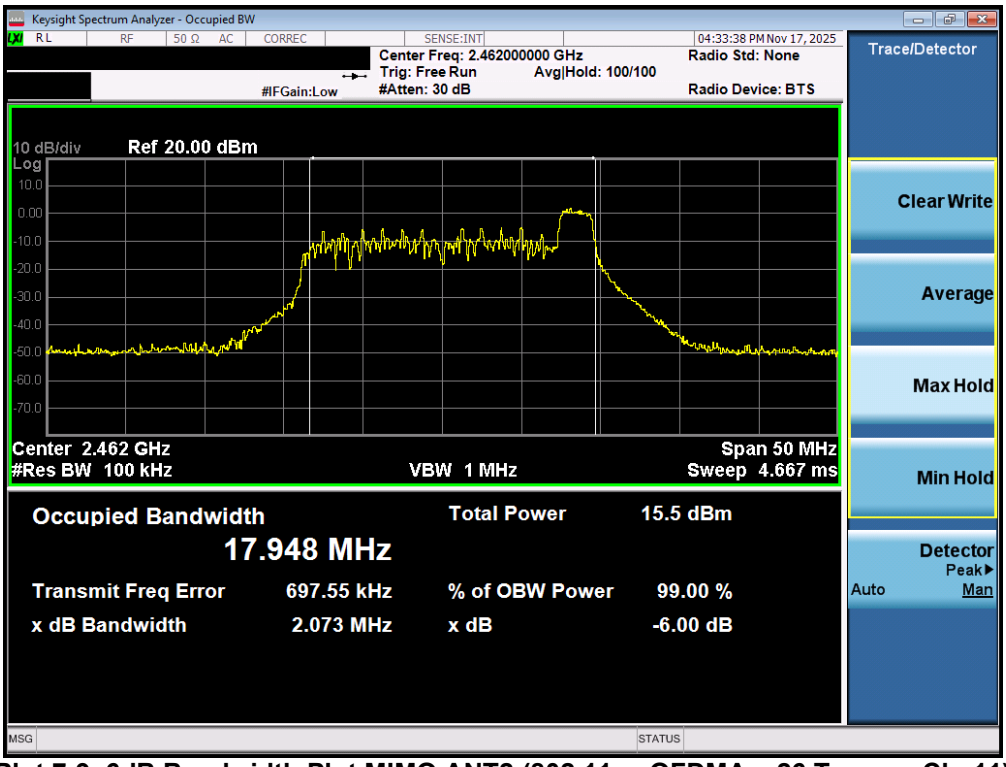
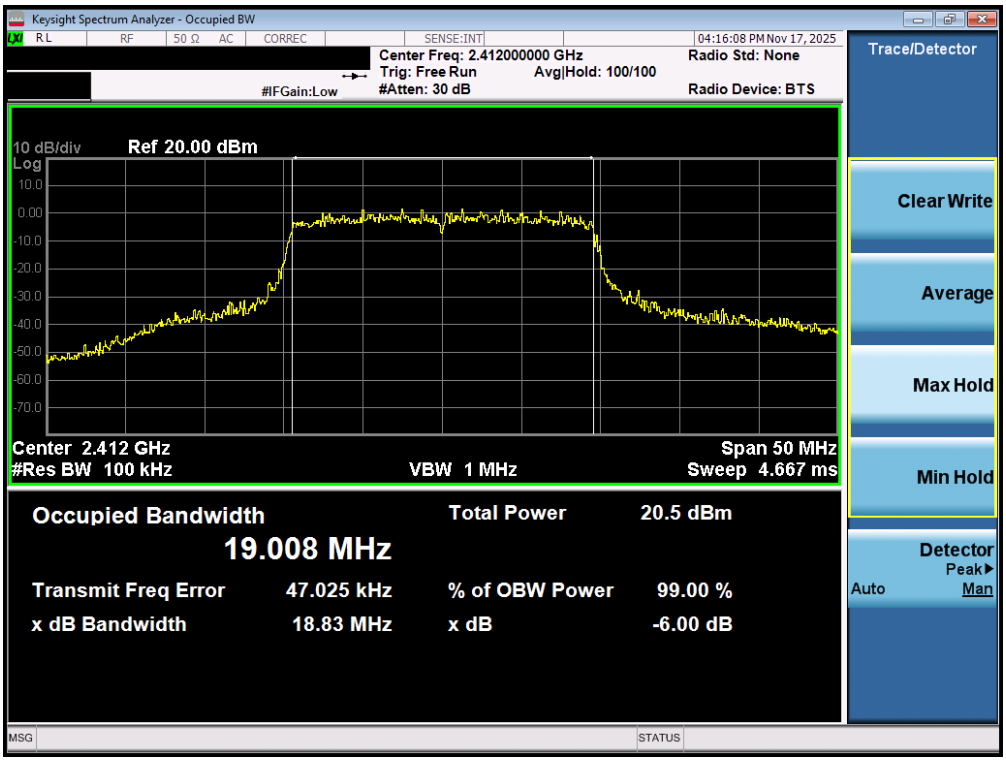


Plot 7-9. 6dB Bandwidth Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-10. 6dB Bandwidth Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 1)

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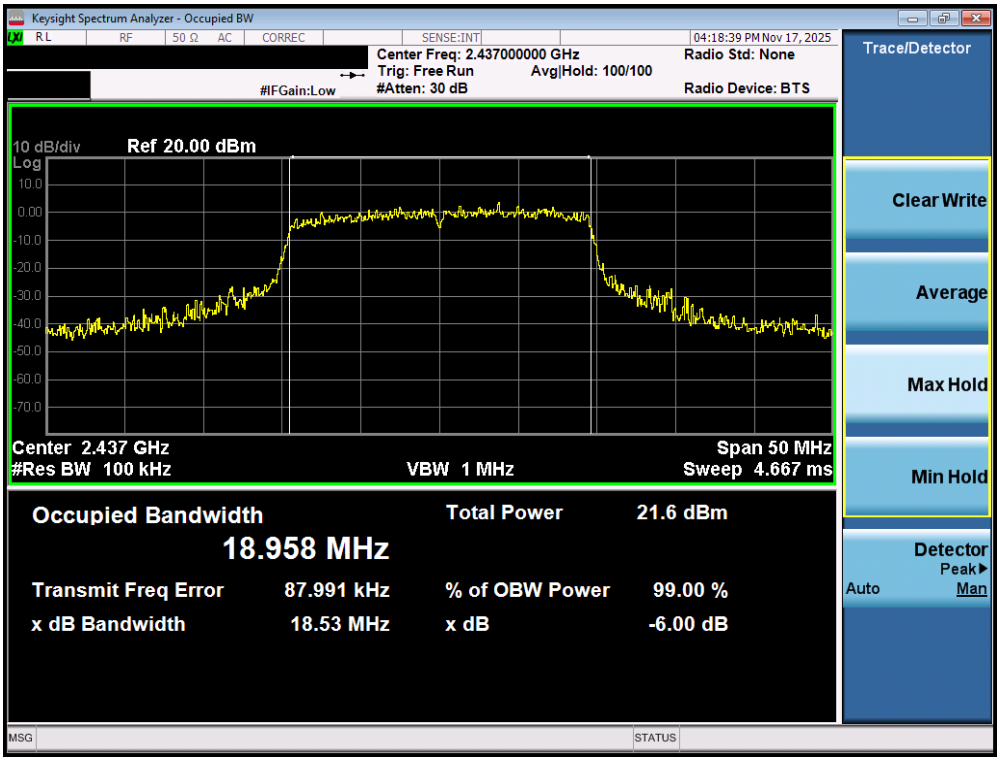
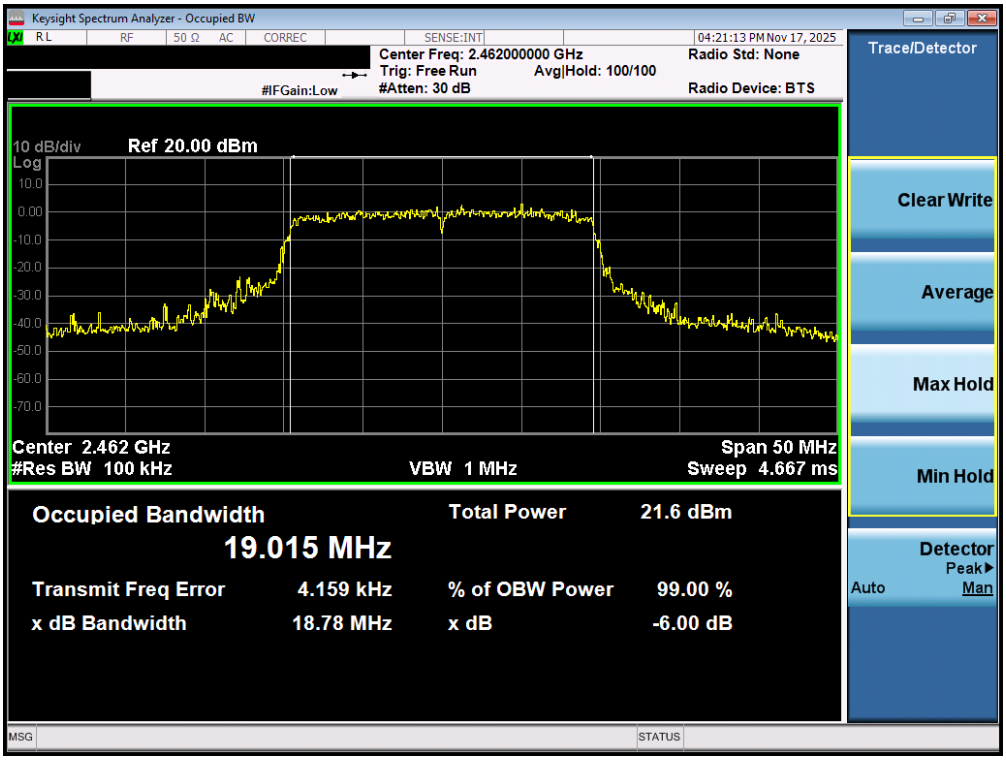


Plot 7-11. 6dB Bandwidth Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-12. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)

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OBW Measurements

Frequency [MHz]	Channel	802.11 MODE	Tones	Antenna-1 OBW [MHz]	Antenna-2 OBW [MHz]
2412	1	ax (20MHz)	26T	18.89	18.45
2437	6	ax (20MHz)	26T	16.63	16.35
2462	11	ax (20MHz)	26T	19.01	18.61
2412	1	ax (20MHz)	242T	19.34	19.35
2437	6	ax (20MHz)	242T	19.35	19.37
2462	11	ax (20MHz)	242T	19.41	19.35

Table 7-4. Conducted OBW Measurements MIMO

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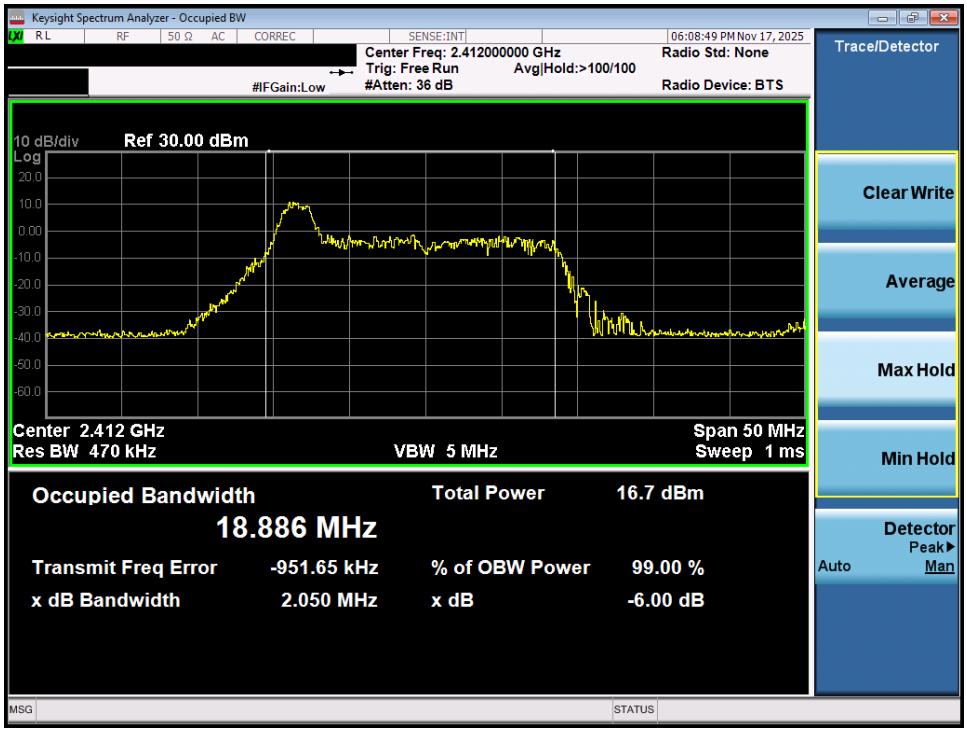
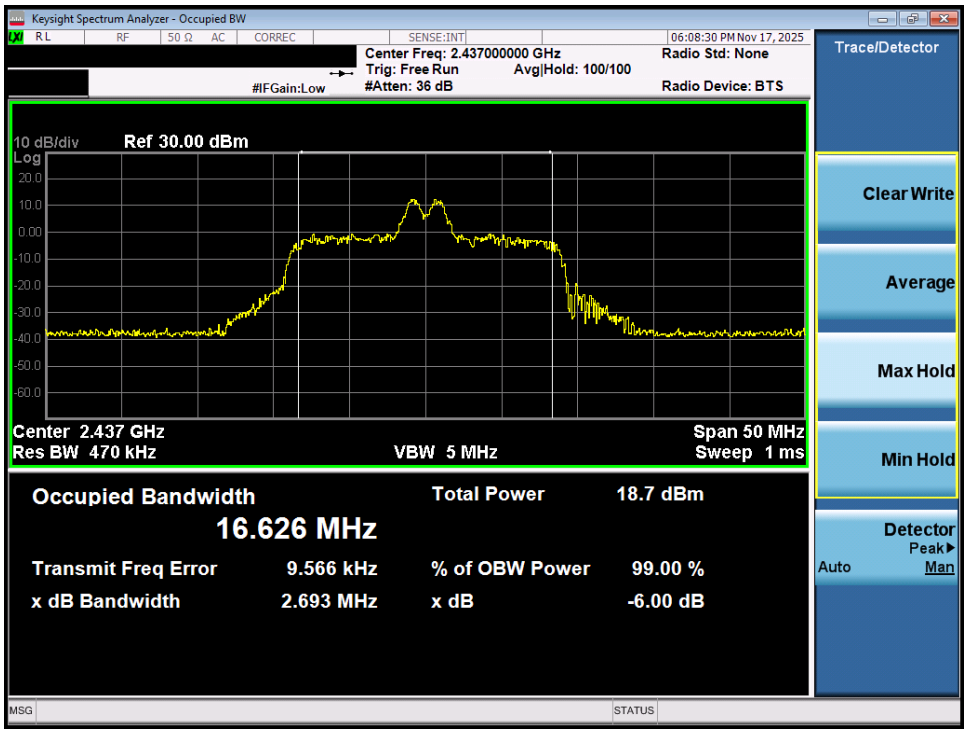
7.2.2 MIMO OBW Measurements



Plot 7-13. OBW Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-14. OBW Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 6)

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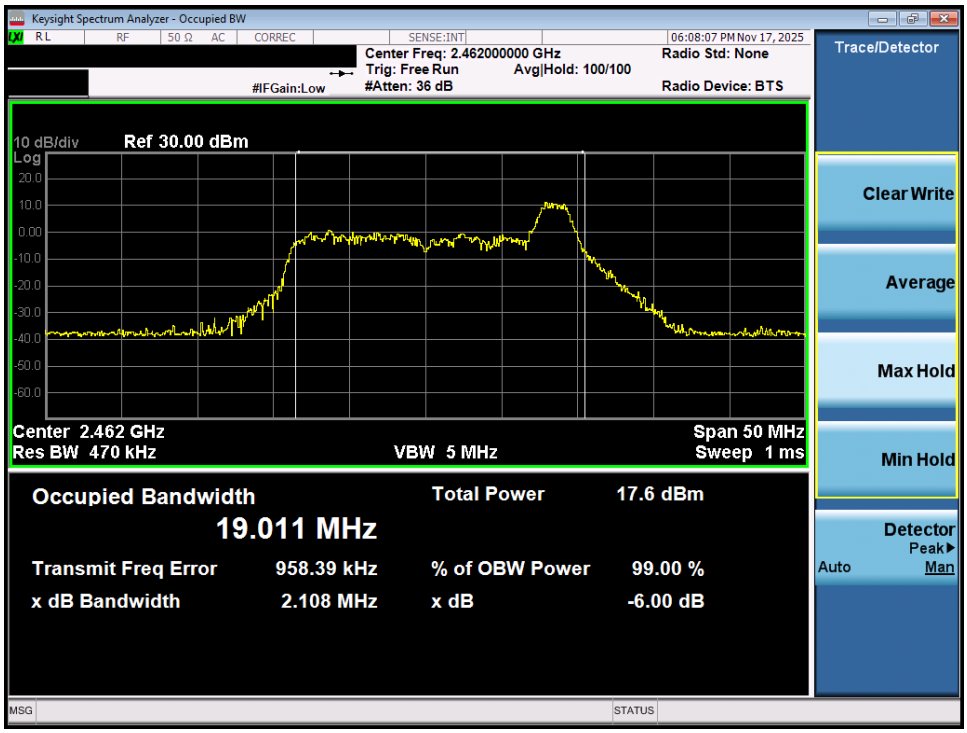
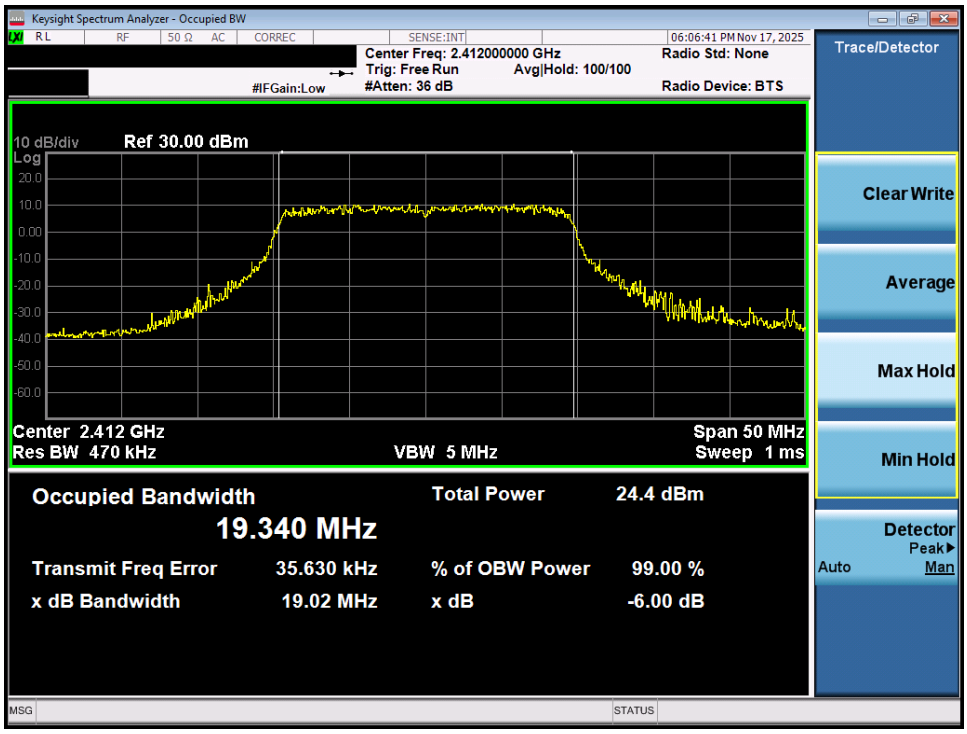


Plot 7-15. OBW Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-16. OBW Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)

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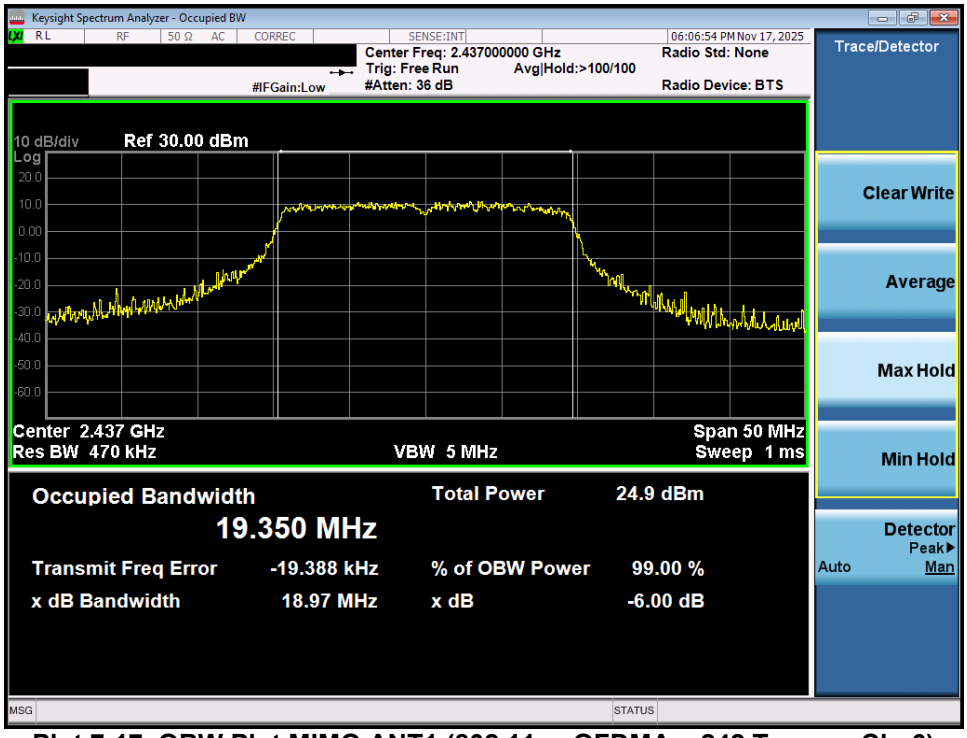
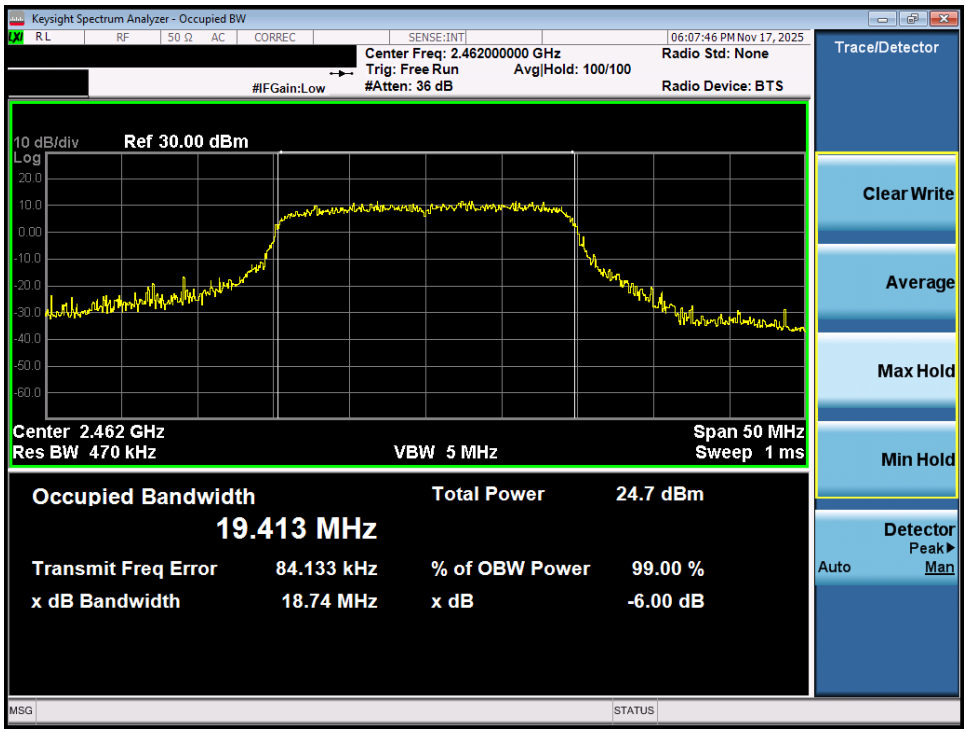


Plot 7-17. OBW Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-18. OBW Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)

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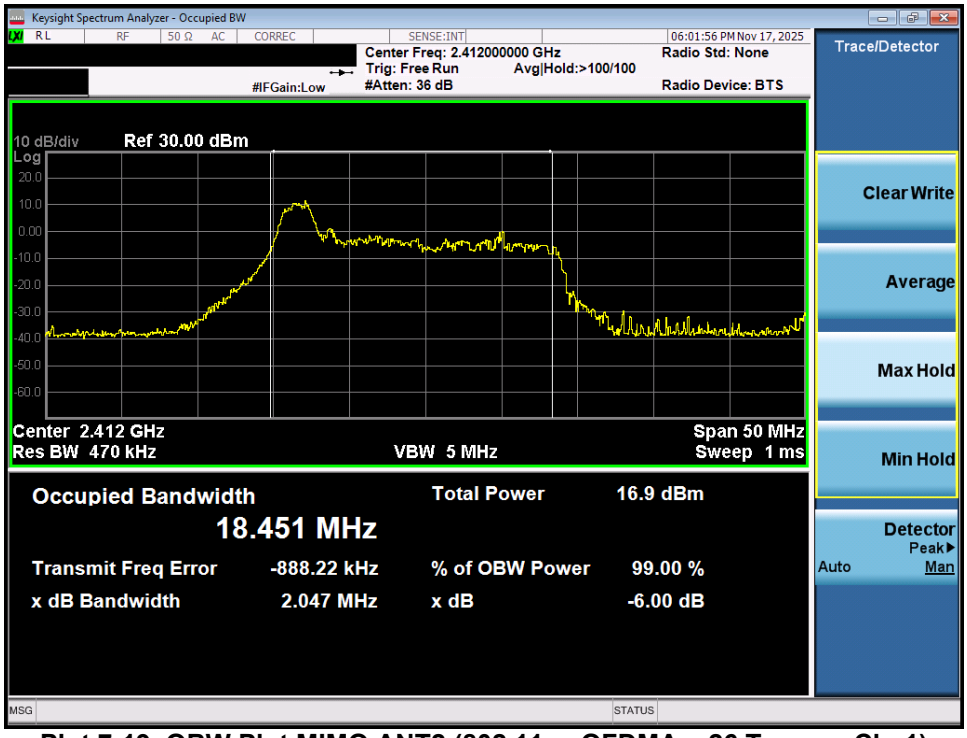
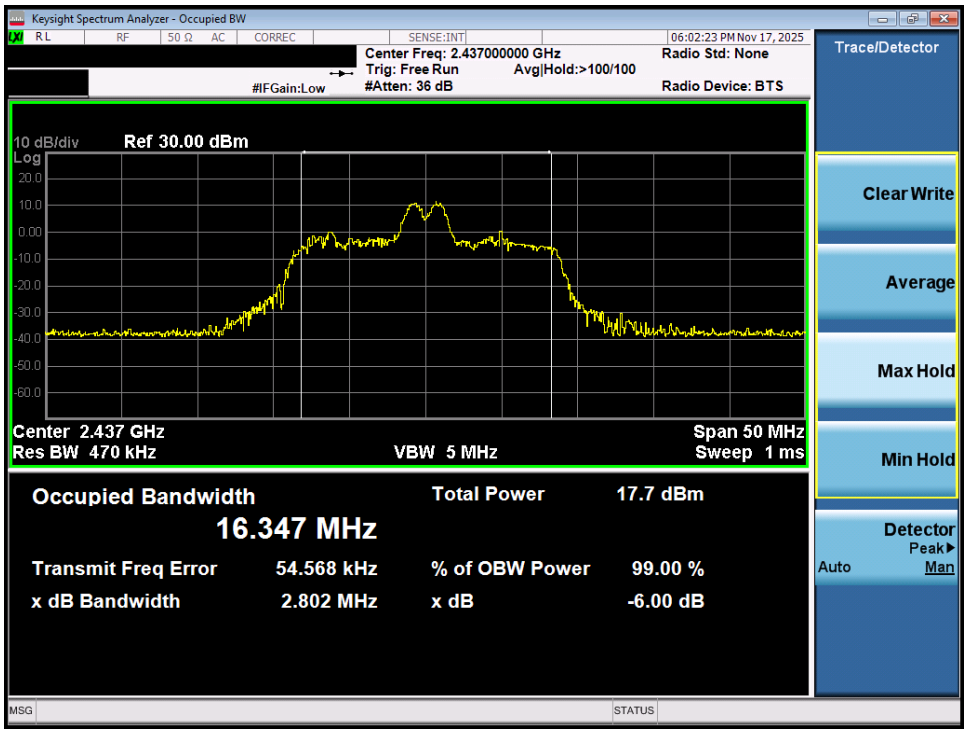


Plot 7-19. OBW Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-20. OBW Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 6)

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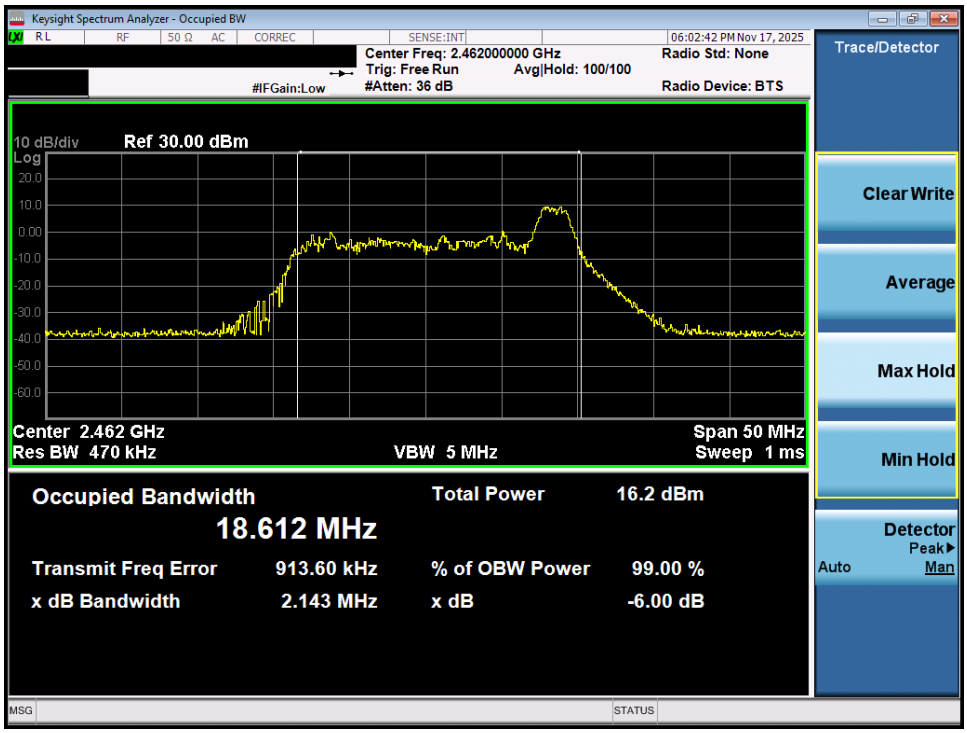
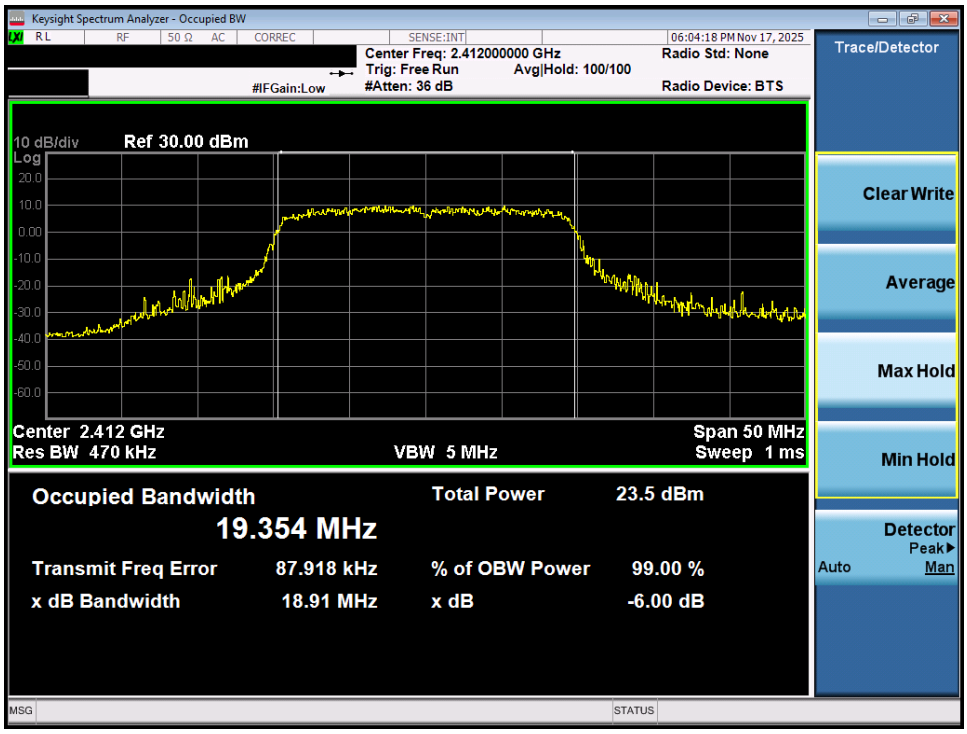


Plot 7-21. OBW Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-22. OBW Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 1)

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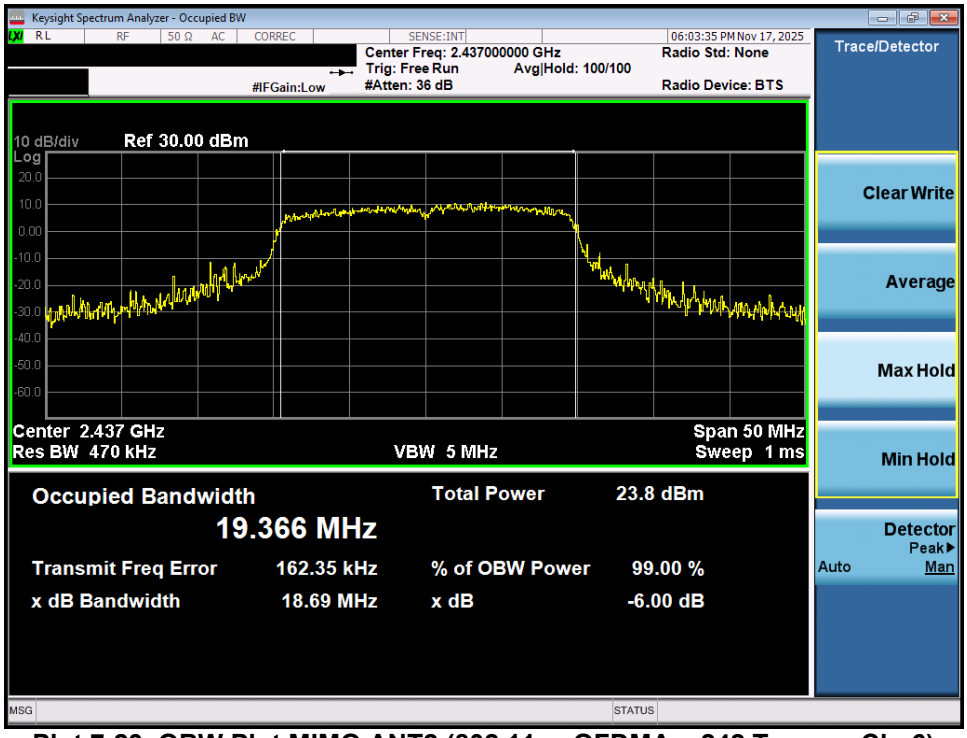
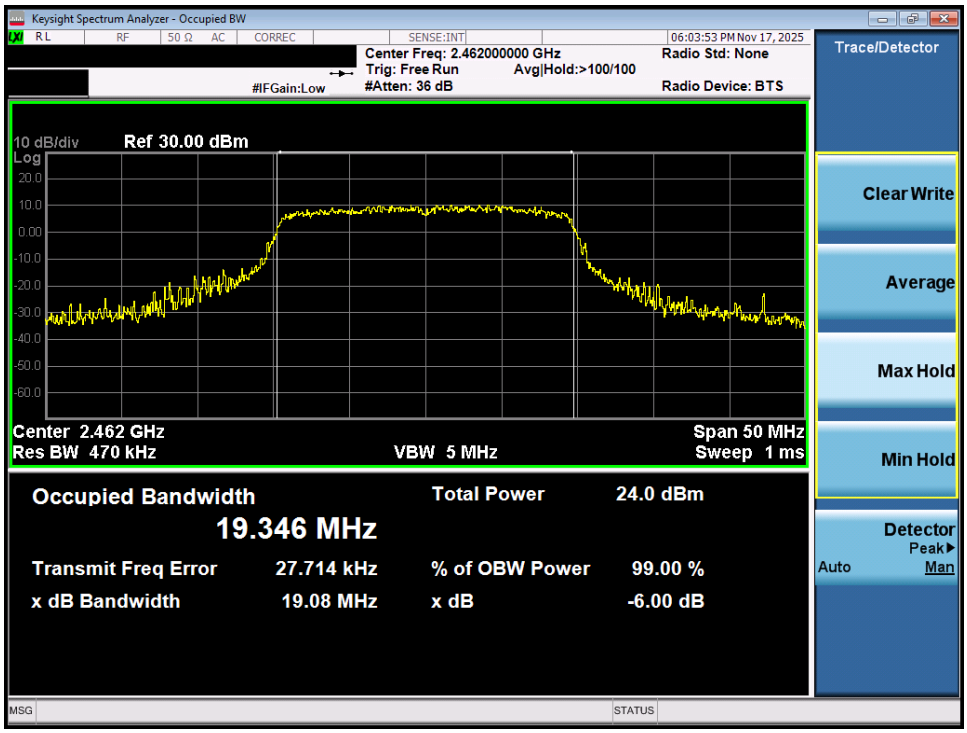


Plot 7-23. OBW Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-24. OBW Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 11)

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7.3 Output Power Measurement

Test Overview and Limits

A transmitter antenna terminal of EUT is connected to the input of an RF power sensor. Measurement is made using a broadband power meter capable of making peak and average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt per 15.247 and RSS-247. The e.i.r.p. shall not exceed 4 W per RSS-247.

Test Procedure Used

ANSI C63.10:2020 – Section 11.9.1.2 PKPM1 Peak Power Method
ANSI C63.10:2020 – Section 11.9.2.3.2 Method AVGPM-G
ANSI C63.10:2020 – Section 14.5.2.3 Measure-and-Sum Technique

Test Settings

Method PKPM1 (Peak Power Measurement)

Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

Method AVGPM-G (Average Power Measurement)

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

Test Setup

The EUT and measurement equipment were set up as shown in the diagrams below.

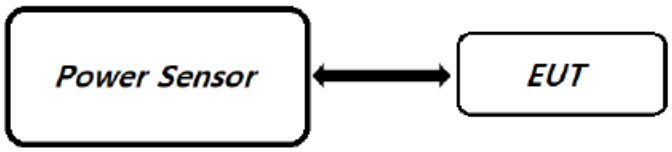

Figure 7-2. Test Instrument & Measurement Setup for Power Meter Measurements

Test Notes

None.

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Freq [MHz]	Channel	Tones	RU Index	Conducted Power [dBm]						Conducted Power Limit [dBm]	Avg Conducted Power Margin [dB]	Peak Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
				Antenna-1		Antenna-2		MIMO								
				AVG	PEAK	AVG	PEAK	AVG	PEAK							
2412	1	26T	0	8.01	19.77	6.40	17.82	10.29	21.91	30.00	-19.71	-8.09	-1.94	8.35	36.02	-27.67
			4	8.25	19.09	7.80	17.97	11.04	21.58	30.00	-18.96	-8.42	-1.94	9.10	36.02	-26.92
			8	8.85	20.46	6.90	18.21	10.99	22.49	30.00	-19.01	-7.51	-1.94	9.05	36.02	-26.97
2437	6	26T	0	9.25	20.63	6.25	17.71	11.01	22.42	30.00	-18.99	-7.58	-1.94	9.08	36.02	-26.94
			4	8.80	19.45	7.70	18.32	11.30	21.93	30.00	-18.70	-8.07	-1.94	9.36	36.02	-26.66
			8	8.85	10.19	6.45	17.63	10.82	18.35	30.00	-19.18	-11.65	-1.94	8.88	36.02	-27.14
2462	11	26T	0	9.70	21.15	6.40	17.45	11.37	22.69	30.00	-18.63	-7.31	-1.94	9.43	36.02	-26.59
			4	9.40	21.01	7.70	17.99	11.64	22.77	30.00	-18.36	-7.23	-1.94	9.70	36.02	-26.32
			8	8.50	20.23	6.50	17.88	10.62	22.22	30.00	-19.38	-7.78	-1.94	8.69	36.02	-27.33
2467	12	26T	0	-9.45	-0.09	-10.82	-2.35	-7.07	1.94	30.00	-37.07	-28.06	-1.94	-9.01	36.02	-45.03
			4	-9.16	0.04	-9.03	-0.19	-6.08	2.94	30.00	-36.08	-27.06	-1.94	-8.02	36.02	-44.04
			8	-10.23	-0.07	-11.62	-3.26	-7.86	1.63	30.00	-37.86	-28.37	-1.94	-9.80	36.02	-45.82
2472	13	26T	0	-10.37	0.41	-9.88	1.15	-7.11	3.80	30.00	-37.11	-26.20	-1.94	-9.05	36.02	-45.07
			4	-9.48	1.78	-9.11	2.10	-6.28	4.95	30.00	-36.28	-25.05	-1.94	-8.22	36.02	-44.24
			8	-11.10	0.45	-10.82	0.25	-7.95	3.36	30.00	-37.95	-26.64	-1.94	-9.89	36.02	-45.91

Table 7-5. Conducted Output Power Measurements MIMO (26 Tones)

Freq [MHz]	Channel	Tones	RU Index	Conducted Power [dBm]						Conducted Power Limit [dBm]	Avg Conducted Power Margin [dB]	Peak Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
				Antenna-1		Antenna-2		MIMO								
				AVG	PEAK	AVG	PEAK	AVG	PEAK							
2412	1	52T	37	11.55	22.21	10.10	20.15	13.90	24.31	30.00	-16.10	-5.69	-1.94	11.96	36.02	-24.06
			38	12.20	22.76	10.70	20.96	14.52	24.96	30.00	-15.48	-5.04	-1.94	12.59	36.02	-23.43
			40	12.10	23.18	9.75	20.09	14.09	24.91	30.00	-15.91	-5.09	-1.94	12.15	36.02	-23.87
2437	6	52T	37	12.00	23.49	9.65	20.25	13.99	25.17	30.00	-16.01	-4.83	-1.94	12.05	36.02	-23.97
			38	12.60	23.83	10.75	21.17	14.78	25.71	30.00	-15.22	-4.29	-1.94	12.84	36.02	-23.18
			40	11.70	23.12	9.90	20.62	13.90	25.06	30.00	-16.10	-4.94	-1.94	11.96	36.02	-24.06
2462	11	52T	37	12.70	23.60	9.55	19.57	14.41	25.05	30.00	-15.59	-4.95	-1.94	12.48	36.02	-23.54
			38	12.90	23.27	9.85	19.85	14.65	24.90	30.00	-15.35	-5.10	-1.94	12.71	36.02	-23.31
			40	11.80	22.88	9.80	20.57	13.92	24.89	30.00	-16.08	-5.11	-1.94	11.99	36.02	-24.03
2467	12	52T	37	-9.26	-0.12	-10.71	-1.66	-6.91	2.19	30.00	-36.91	-27.81	-1.94	-8.85	36.02	-44.87
			38	-9.08	-0.09	-9.35	-0.22	-6.20	2.86	30.00	-36.20	-27.14	-1.94	-8.14	36.02	-44.16
			40	-9.94	0.11	-11.15	-1.65	-7.49	2.33	30.00	-37.49	-27.67	-1.94	-9.43	36.02	-45.45
2472	13	52T	37	-10.31	-1.33	-9.11	-0.25	-6.66	2.25	30.00	-36.66	-27.75	-1.94	-8.60	36.02	-44.62
			38	-9.77	-1.15	-10.17	-1.03	-6.96	1.92	30.00	-36.96	-28.08	-1.94	-8.89	36.02	-44.91
			40	-10.61	-0.88	-10.81	-1.77	-7.70	1.71	30.00	-37.70	-28.29	-1.94	-9.64	36.02	-45.66

Table 7-6. Conducted Output Power Measurements MIMO (52 Tones)

Freq [MHz]	Channel	Tones	RU Index	Conducted Power [dBm]						Conducted Power Limit [dBm]	Avg Conducted Power Margin [dB]	Peak Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
				Antenna-1		Antenna-2		MIMO								
				AVG	PEAK	AVG	PEAK	AVG	PEAK							
2412	1	106T	53	15.05	25.65	13.45	13.41	17.33	25.90	30.00	-12.67	-4.10	-1.94	15.39	36.02	-20.63
			54	14.85	25.55	13.90	23.72	17.41	27.74	30.00	-12.59	-2.26	-1.94	15.47	36.02	-20.55
2437	6	106T	53	15.90	25.87	13.00	21.71	17.70	27.28	30.00	-12.30	-2.72	-1.94	15.76	36.02	-20.26
			54	15.20	25.88	13.55	22.03	17.46	27.38	30.00	-12.54	-2.62	-1.94	15.52	36.02	-20.50
2457	10	106T	53	14.95	25.51	13.70	22.37	17.38	27.23	30.00	-12.62	-2.77	-1.94	15.44	36.02	-20.58
			54	15.80	25.91	13.15	22.44	17.68	27.52	30.00	-12.32	-2.48	-1.94	15.75	36.02	-20.27
2462	11	106T	53	14.63	25.33	12.20	21.14	16.59	26.73	30.00	-13.41	-3.27	-1.94	14.65	36.02	-21.37
			54	15.20	25.79	12.49	21.18	17.06	27.08	30.00	-12.94	-2.92	-1.94	15.12	36.02	-20.90
2467	12	106T	53	-9.08	0.05	-9.72	-0.86	-6.38	2.63	30.00	-36.38	-27.37	-1.94	-8.32	36.02	-44.34
			54	-9.70	-0.42	-10.26	-1.34	-6.96	2.15	30.00	-36.96	-27.85	-1.94	-8.90	36.02	-44.92
2472	13	106T	53	-9.80	-0.78	-9.08	0.29	-6.41	2.80	30.00	-36.41	-27.20	-1.94	-8.35	36.02	-44.37
			54	-9.82	-0.89	-10.06	-1.42	-6.93	1.86	30.00	-36.93	-28.14	-1.94	-8.87	36.02	-44.89

Table 7-7. Conducted Output Power Measurements MIMO (106Tones)

Freq [MHz]	Channel	Tones	RU Index	Conducted Power [dBm]						Conducted Power Limit [dBm]	Avg Conducted Power Margin [dB]	Peak Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
				Antenna-1		Antenna-2		MIMO								
				AVG	PEAK	AVG	PEAK	AVG	PEAK							
2412	1	242T	61	16.90	26.77	15.35	23.94	19.20	28.59	30.00	-10.80	-1.41	-1.94	17.26	36.02	-18.76
2437	6	242T	61	17.50	26.50	14.85	23.12	19.38	28.14	30.00	-10.62	-1.86	-1.94	17.45	36.02	-18.57
2457	10	242T	61	16.83	26.11	15.25	23.33	19.12	27.95	30.00	-10.88	-2.05	-1.94	17.18	36.02	-18.84
2462	11	242T	61	14.60	24.50	12.49	21.01	16.68	26.11	30.00	-13.32	-3.89	-1.94	14.74	36.02	-21.28
2467	12	242T	61	-9.16	0.35	-10.00	-1.01	-6.55	2.73	30.00	-36.55	-27.27	-1.94	-8.49	36.02	-44.51
2472	13	242T	61	-9.56	-0.68	-9.52	-0.78	-6.53	2.28	30.00	-36.53	-27.72	-1.94	-8.47	36.02	-44.49

Table 7-8. Conducted Output Power Measurements MIMO (242 Tones)

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Note:

Per ANSI C63.10:2020 Section 14.5.2.3, the conducted powers at Antenna 1 and Antenna 2 were first measured separately during MIMO transmission as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Sample MIMO Calculation:

At 2412MHz the average conducted power was measured to be 16.90 dBm for Antenna 1 and 15.35 dBm for Antenna 2.

Antenna 1 + Antenna 2 = MIMO

(16.90 dBm + 15.35 dBm) = (0.049 mW + 0.034 mW) = 0.083 mW = 19.20 dBm

Sample e.i.r.p Calculation:

At 2412MHz, the average MIMO conducted power was calculated to be 19.20 dBm with directional gain of -1.94 dBi.

e.i.r.p. (dBm) = Conducted Power (dBm) + Ant gain (dBi)

19.20 dBm + -1.94 dBi = 17.26 dBm

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7.4 Power Spectral Density

Test Overview and Limit

The peak power density is measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates, tones configurations, and RU indices were investigated and the worst-case configuration results are reported in this section.

The maximum permissible power spectral density shall not be greater than 8 dBm in any 3 kHz band.

Test Procedure Used

ANSI C63.10:2020 – Section 11.10.2 Method PKPSD
ANSI C63.10:2020 – Section 14.5.2.3 Measure-and-Sum Technique

Test Settings

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 3kHz
4. VBW = 1MHz
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-3. Test Instrument & Measurement Setup

Test Notes

1. Based on preliminary measurements, it was determined that, of all of the tone configurations, the 26T configuration produced the worst case power spectral density measurement for partial loaded case. Therefore, only the 26 Tone configuration and 242 Tone data is included in this section.
2. The power spectral density for each channel was measured with the RU index showing the highest conducted power.

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Power Spectral Density Measurements

Frequency [MHz]	Channel No.	802.11 Mode	Tones	Data Rate [Mbps]	ANT 1 Power Spectral Density [dBm]	ANT 2 Power Spectral Density [dBm]	Summed MIMO Power Spectral Density [dBm]	Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]	Pass / Fail
2412	1	ax	26T	MCS0	-10.99	-10.35	-7.64	8.00	-15.64	Pass
2437	6	ax	26T	MCS0	-8.26	-9.06	-5.63	8.00	-13.63	Pass
2462	11	ax	26T	MCS0	-9.96	-11.32	-7.58	8.00	-15.58	Pass
2412	1	ax	242T	MCS0	-10.52	-11.13	-7.80	8.00	-15.80	Pass
2437	6	ax	242T	MCS0	-9.56	-9.50	-6.52	8.00	-14.52	Pass
2462	11	ax	242T	MCS0	-9.62	-9.82	-6.71	8.00	-14.71	Pass

Table 7-9. Conducted Power Spectral Density Measurements MIMO

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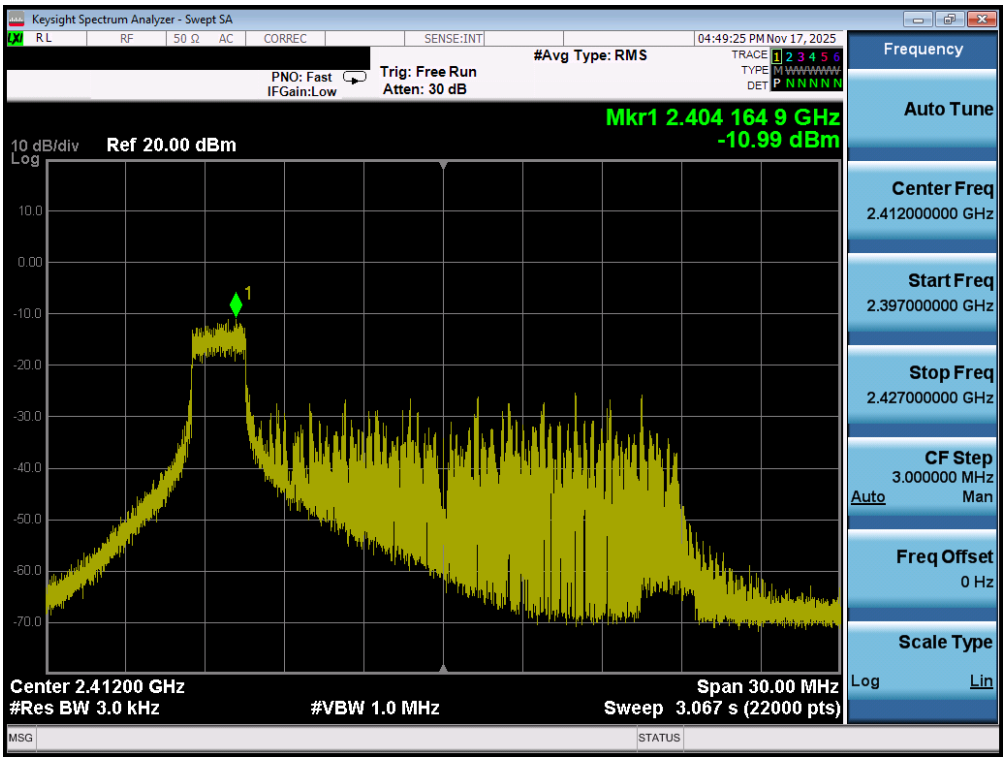
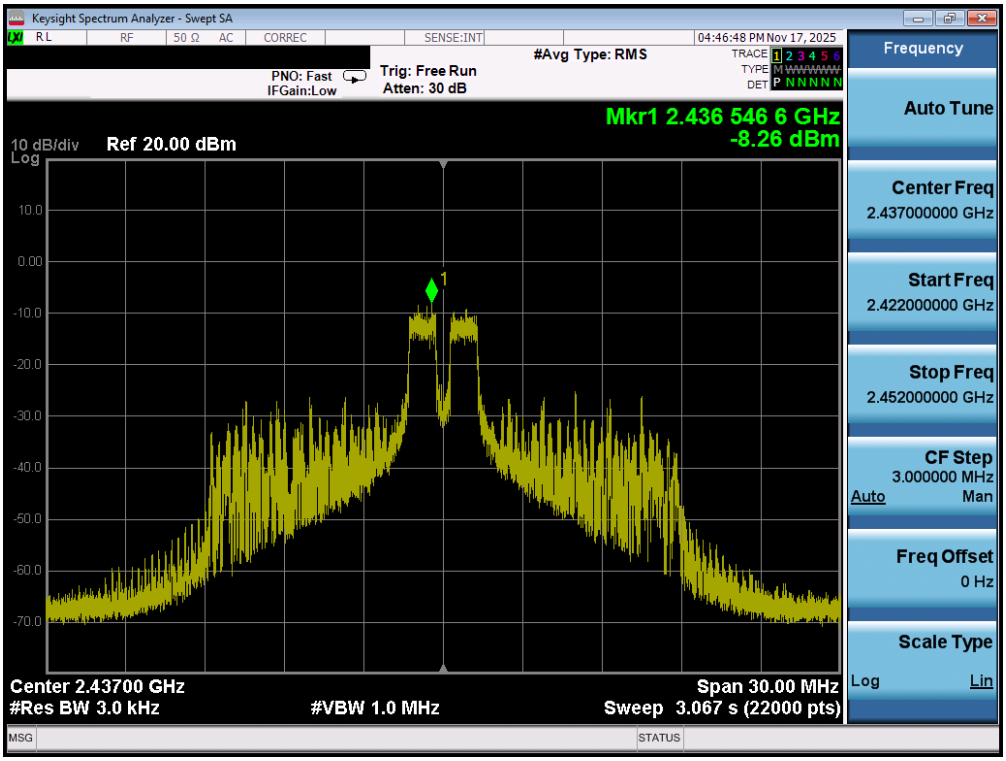
7.4.1 MIMO Power Spectral Density Measurements



Plot 7-25. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-26. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 6)

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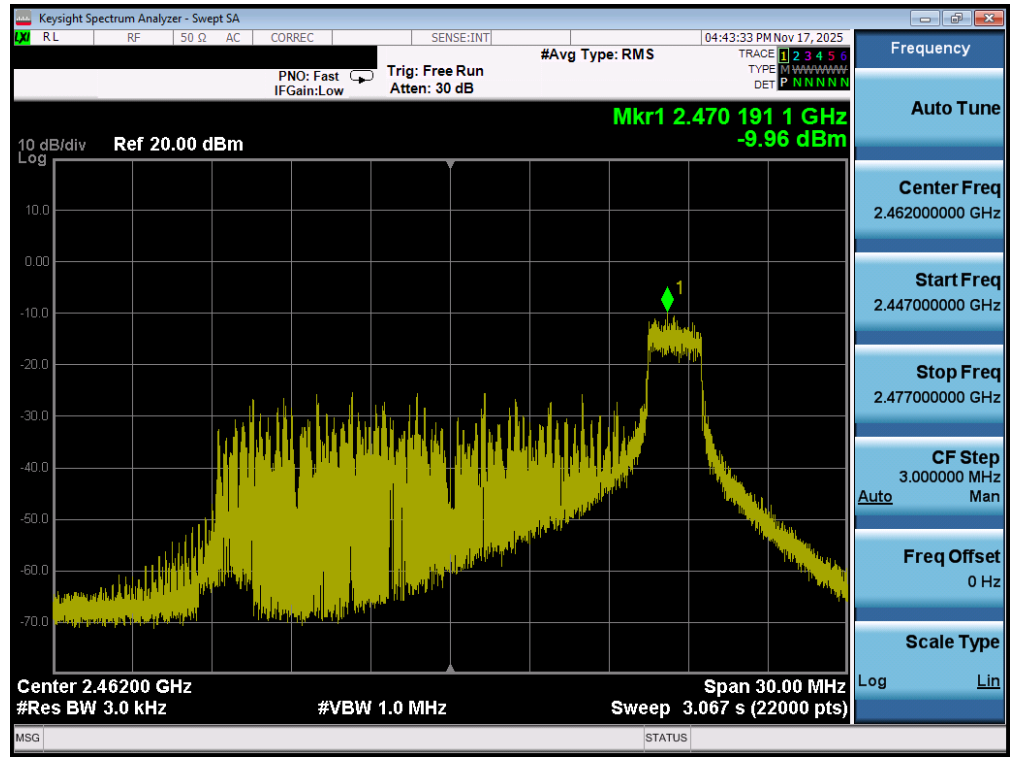
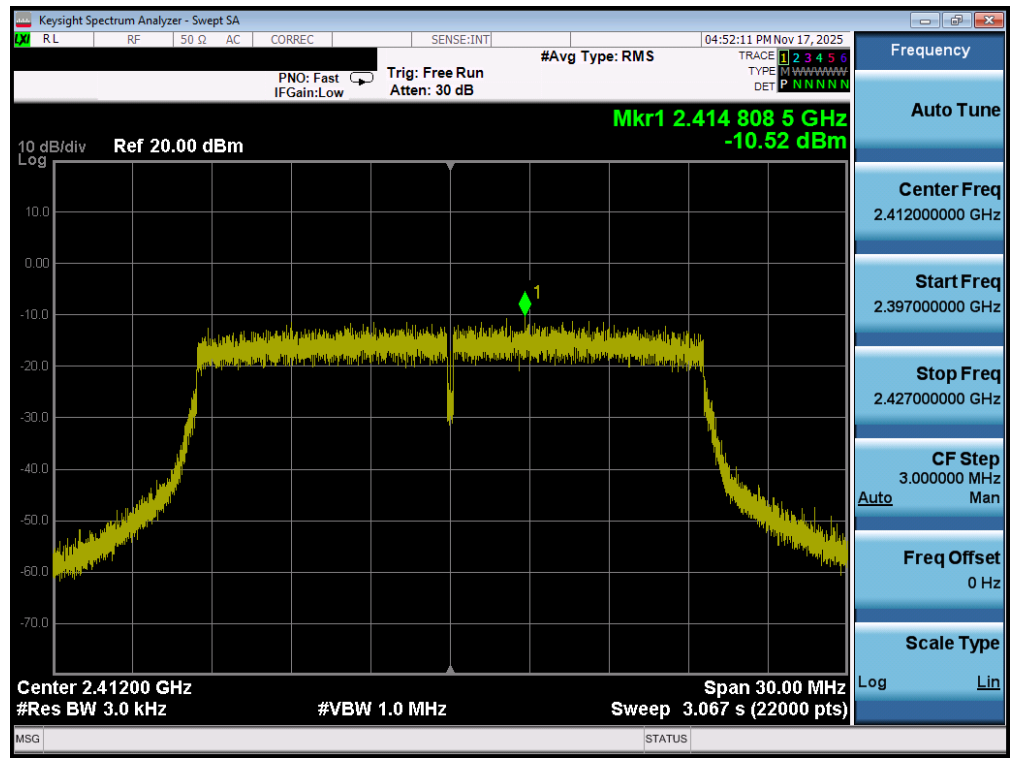


Plot 7-27. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-28. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)

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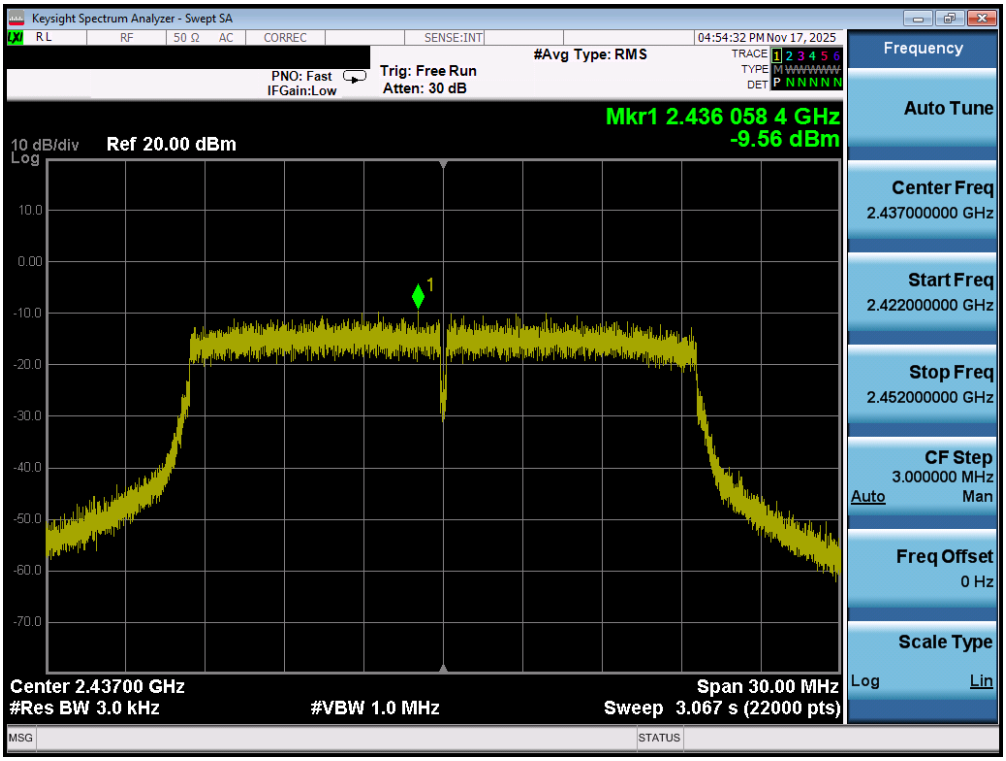
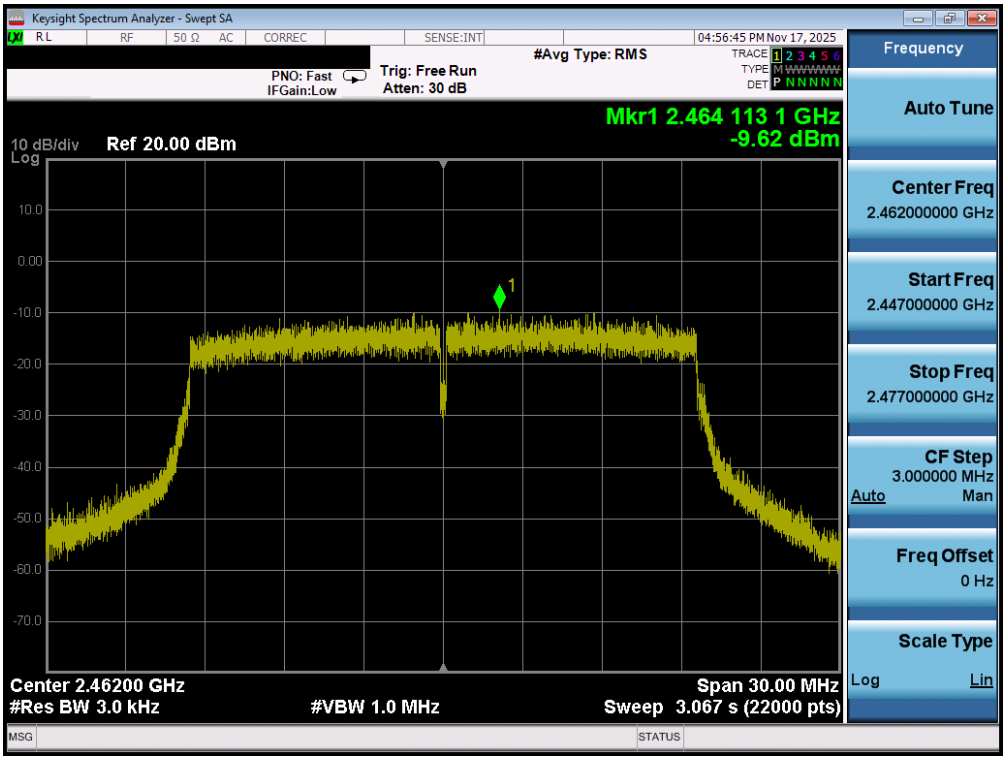


Plot 7-29. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-30. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)

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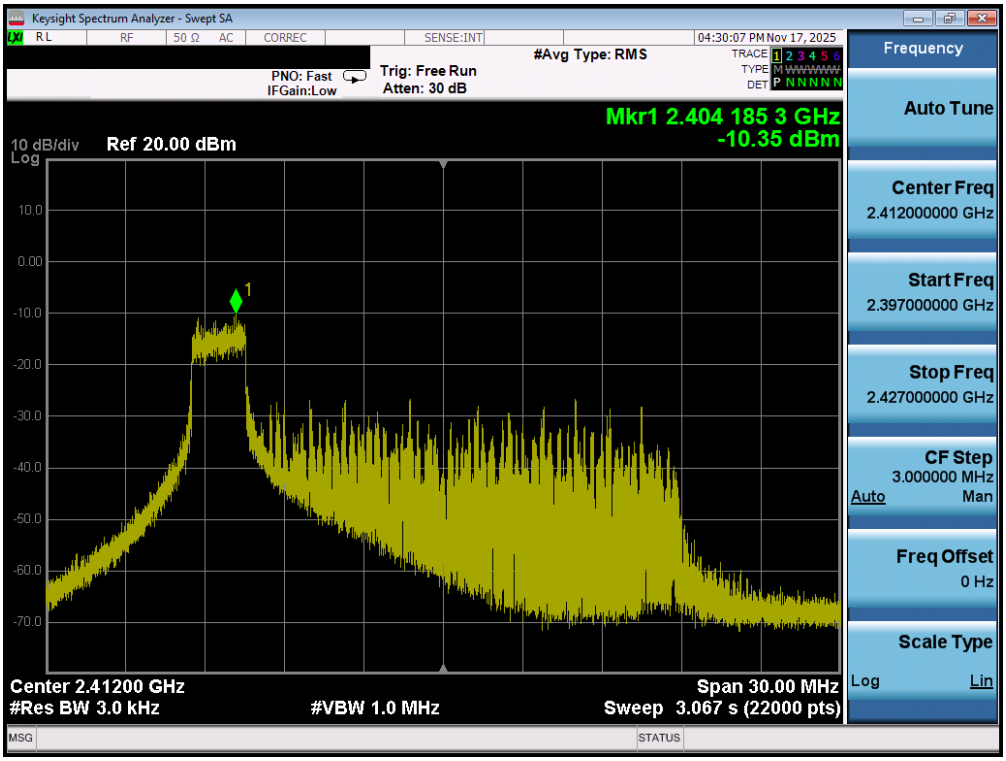
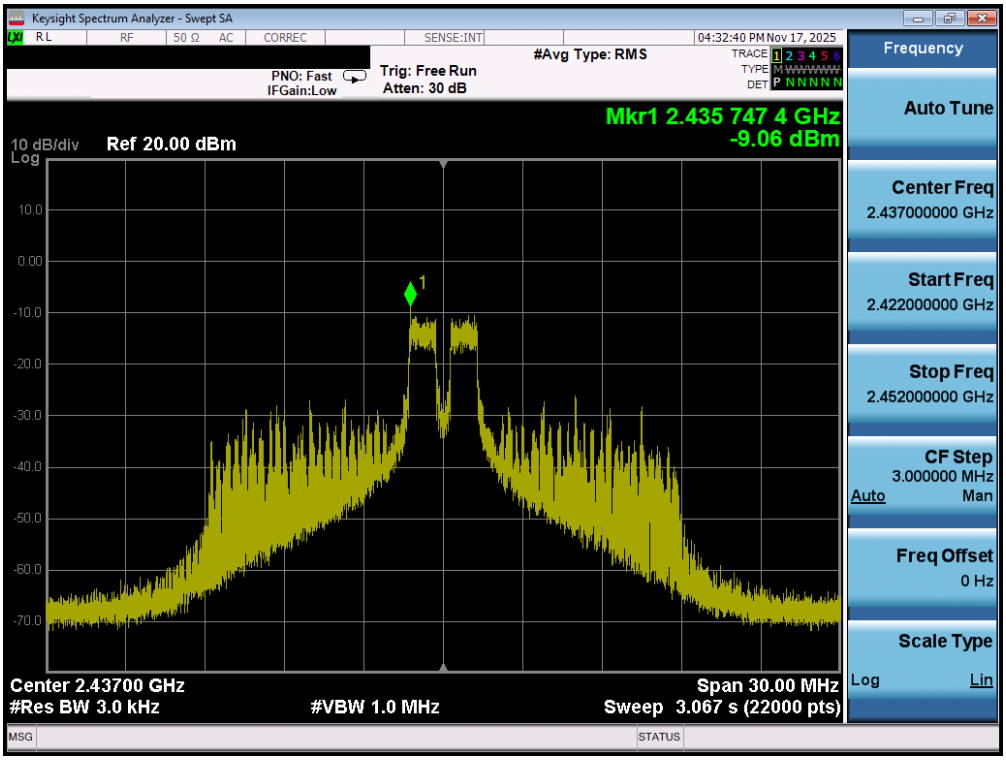


Plot 7-31. Power Spectral Density Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-32. Power Spectral Density Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 6)

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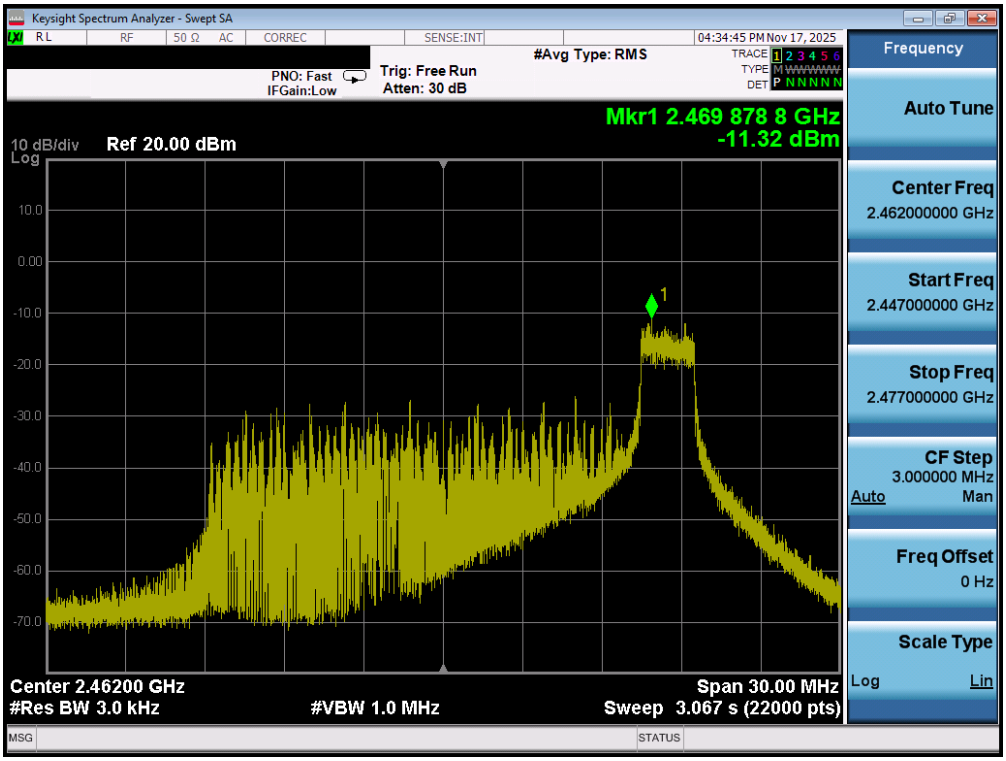
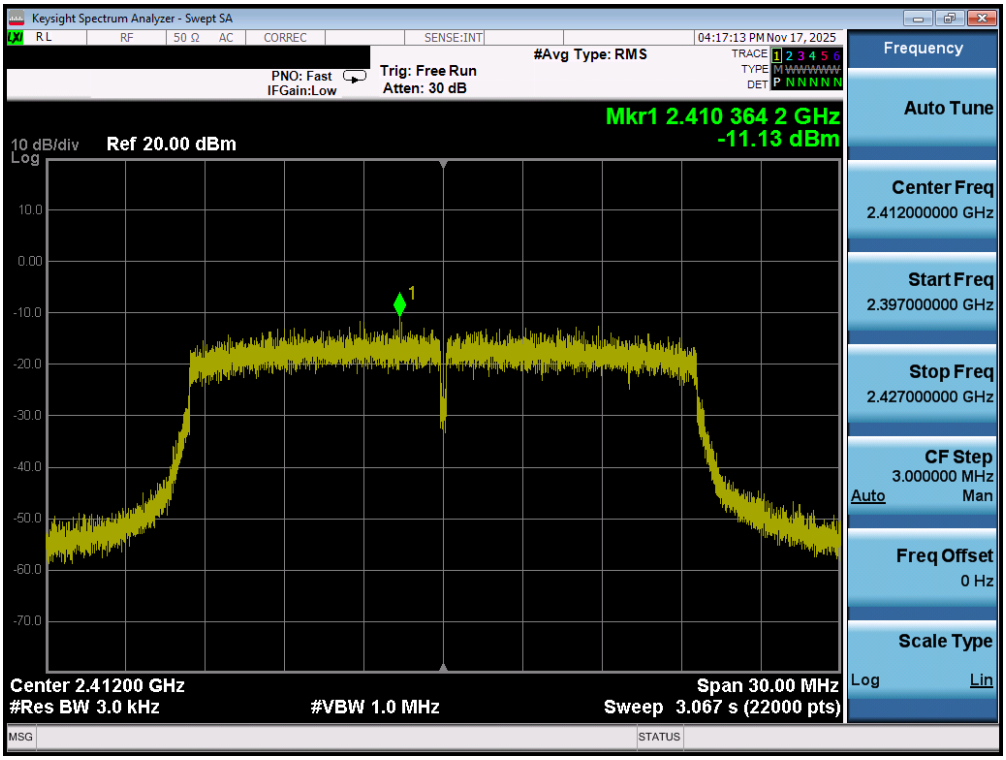


Plot 7-33. Power Spectral Density Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-34. Power Spectral Density Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 1)

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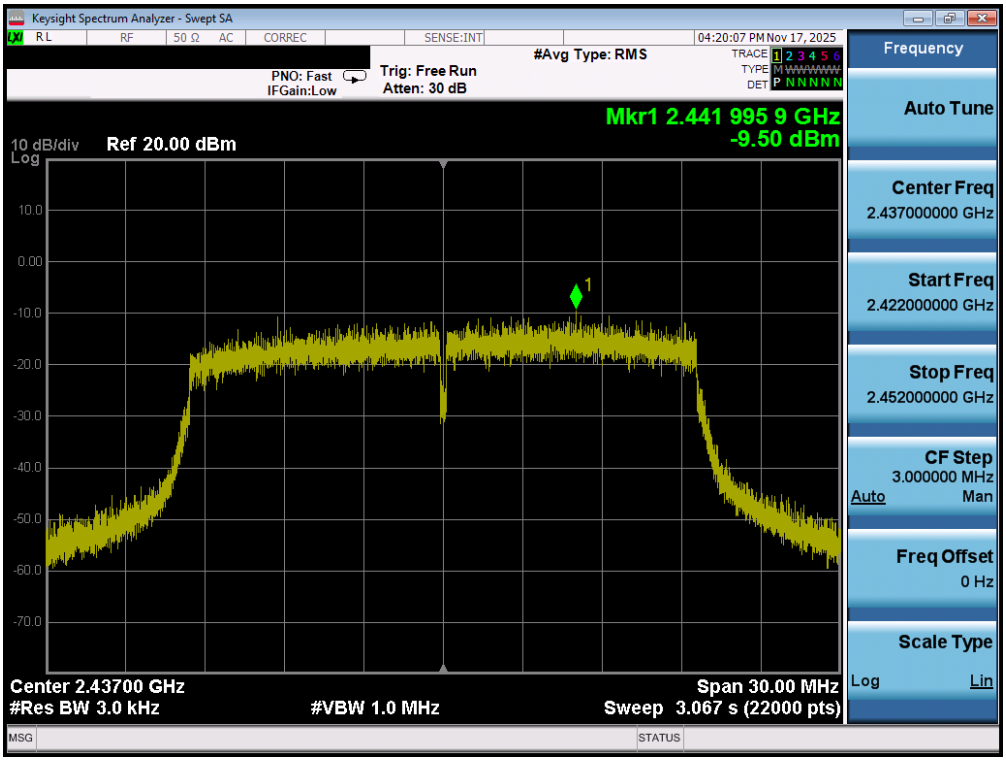
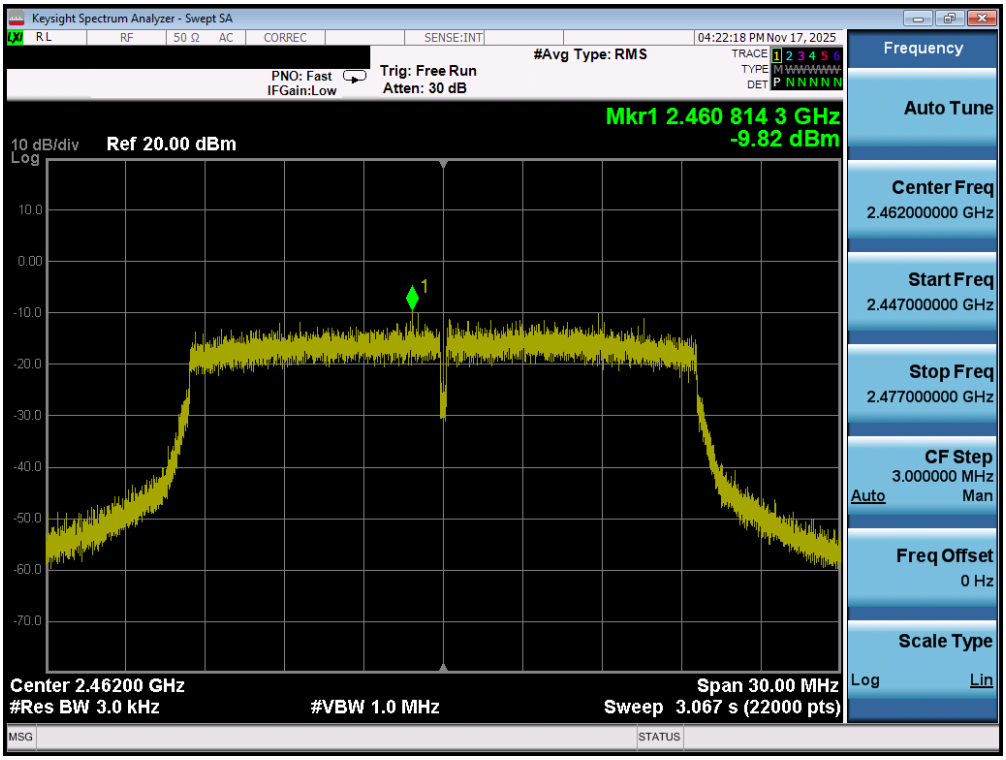


Plot 7-35. Power Spectral Density Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-36. Power Spectral Density Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 11)

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Note:

Per ANSI C63.10:2020 Section 14.5.2.3, the power spectral density at Antenna 1 and Antenna 2 were first measured separately as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Sample MIMO Calculation:

At 2412MHz the average conducted power spectral density was measured to be -10.99 dBm for Antenna 1 and -10.35 dBm for Antenna 2.

Antenna 1 + Antenna 2 = MIMO

(-10.99 dBm + -10.35 dBm) = (0.080 mW + 0.092 mW) = 0.172 mW = -7.64 dBm

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7.5 Conducted Band Edge Emissions

Test Overview and Limit

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates, tone configurations, and RU indices were investigated to determine the worst-case configuration. For the following out of band conducted emissions plots at the band edge, the EUT was set to a data rate of MCS0 in 802.11ax mode as this setting produced the worst-case emissions.

The limit for out-of-band spurious emissions at the band edge is 30dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the PSD procedure (Section 7.4).

Test Procedure Used

ANSI C63.10:2020 – Section 11.11.3

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 100kHz
4. VBW = 1MHz
5. Detector = Peak
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = max hold
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-4. Test Instrument & Measurement Setup

Test Notes

None.

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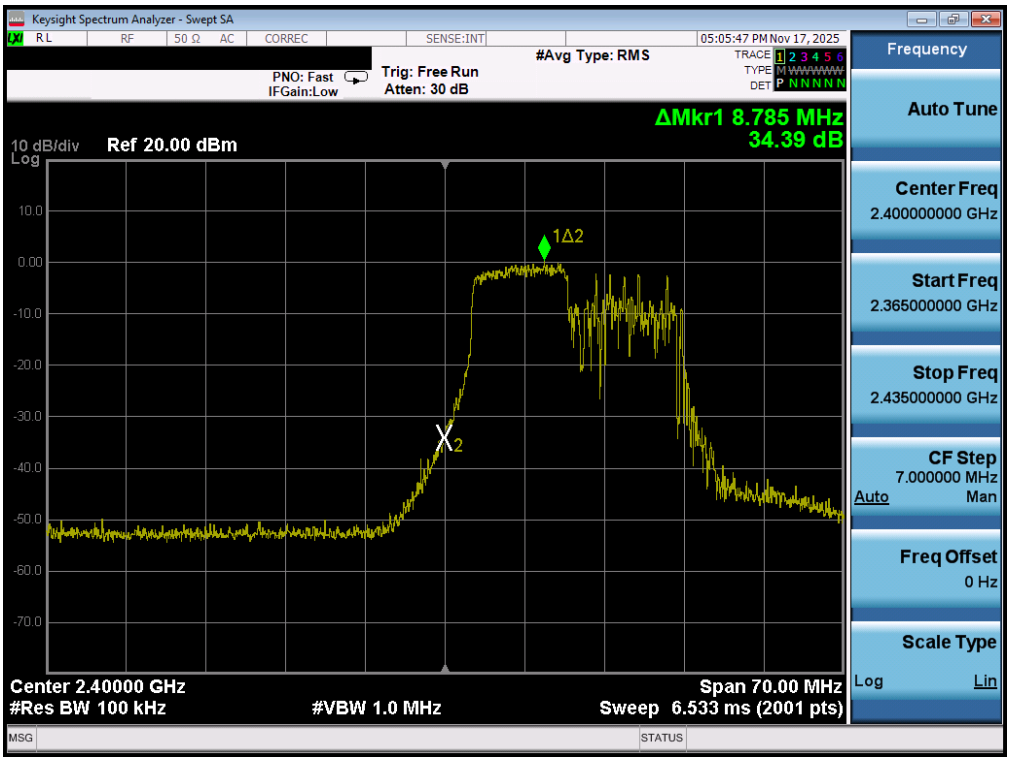
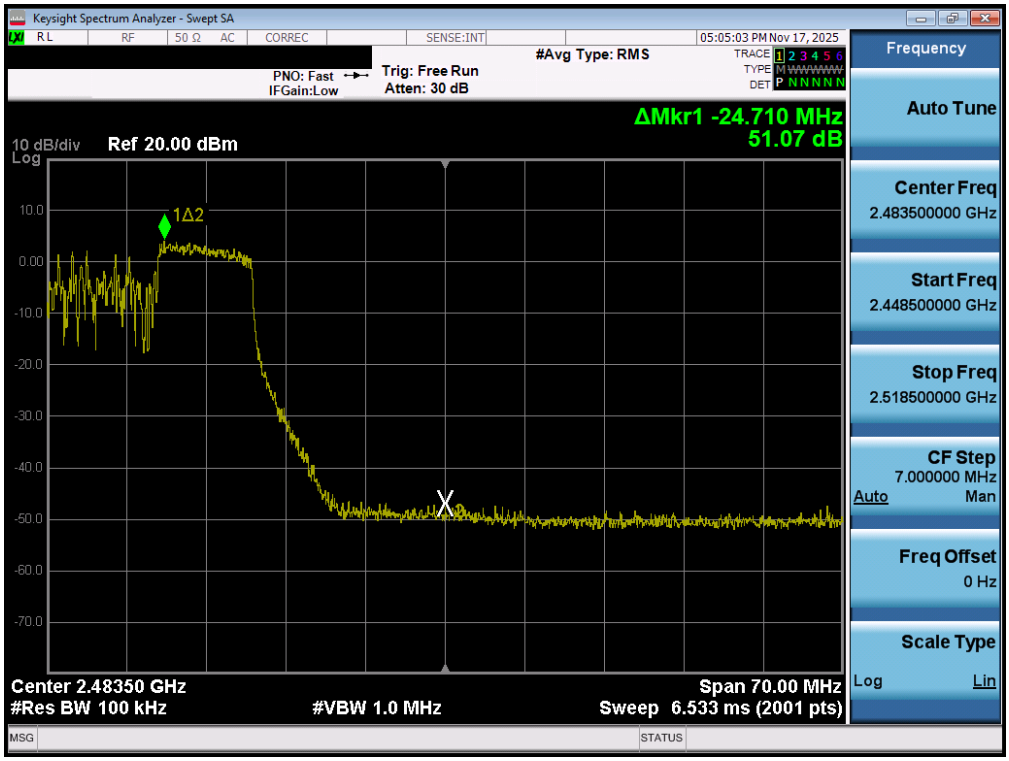
7.5.1 MIMO Conducted Band Edge Emissions



Plot 7-37. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 1)



Plot 7-38. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 10)

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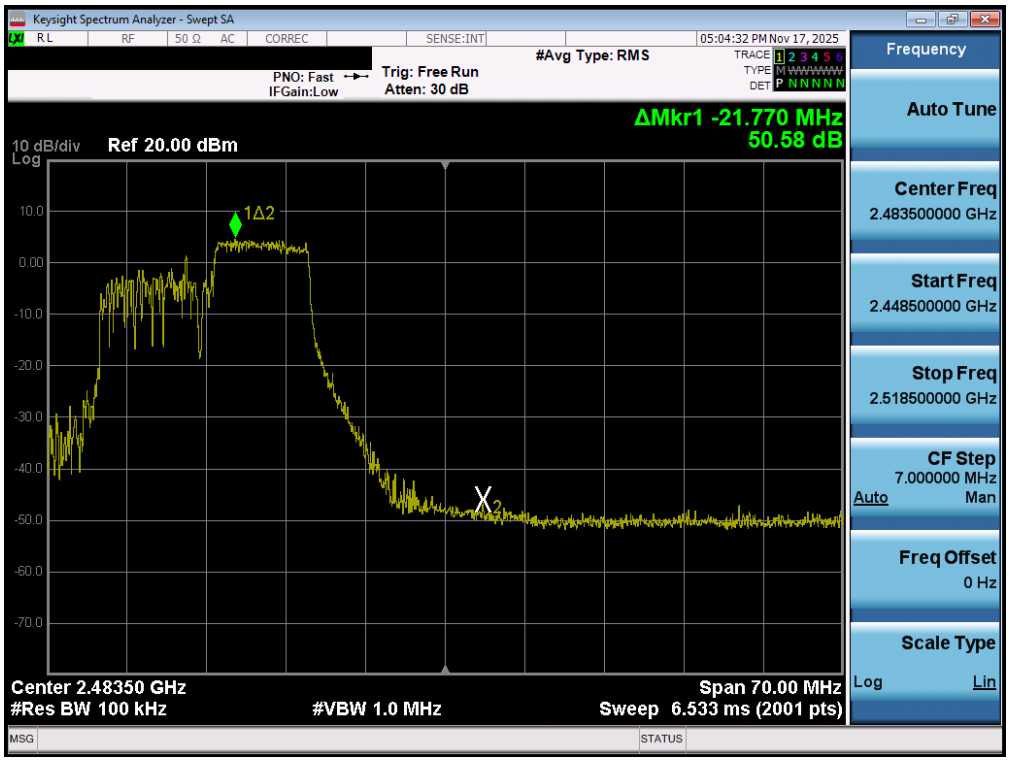
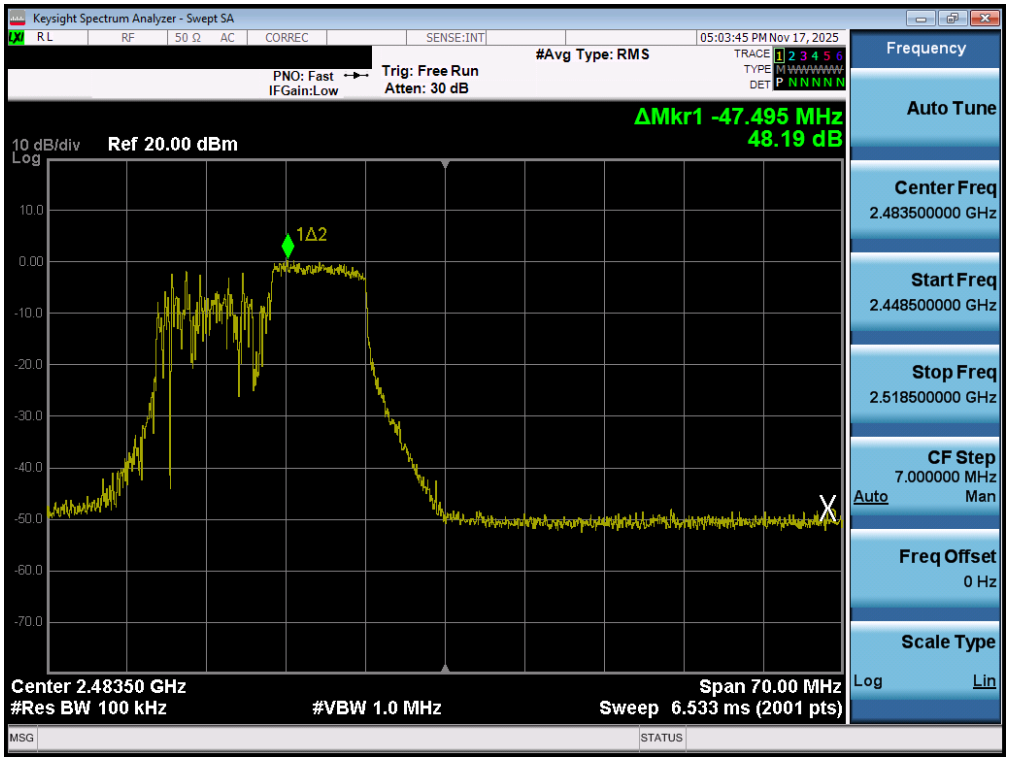


Plot 7-39. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 11)



Plot 7-40. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 12)

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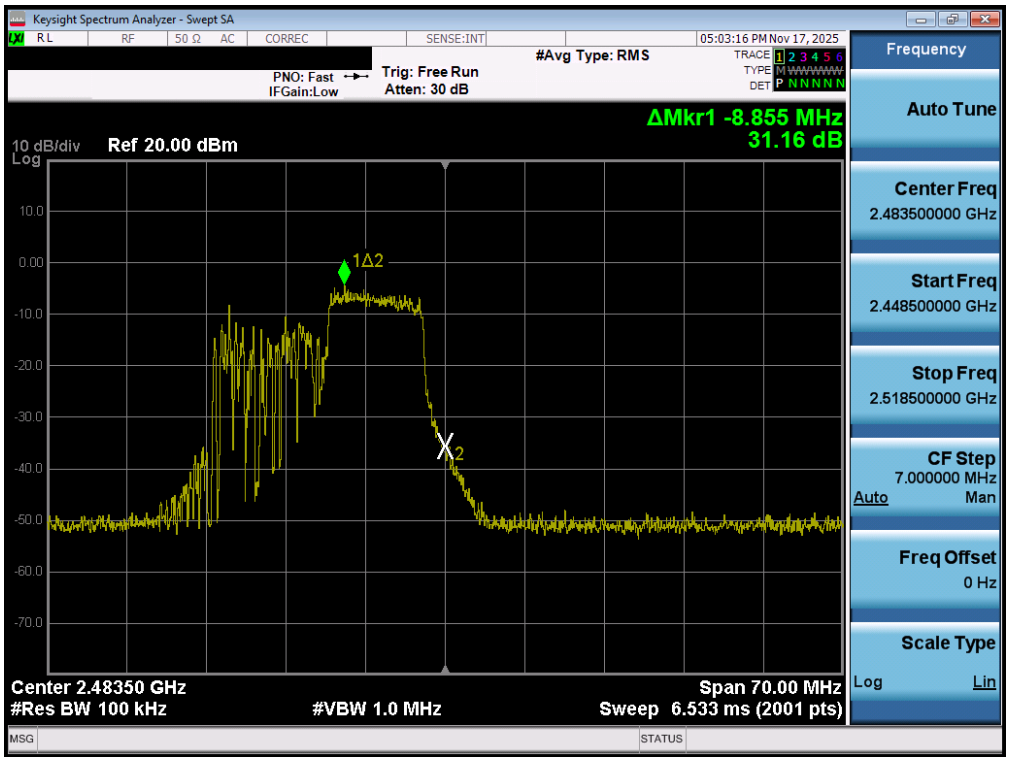
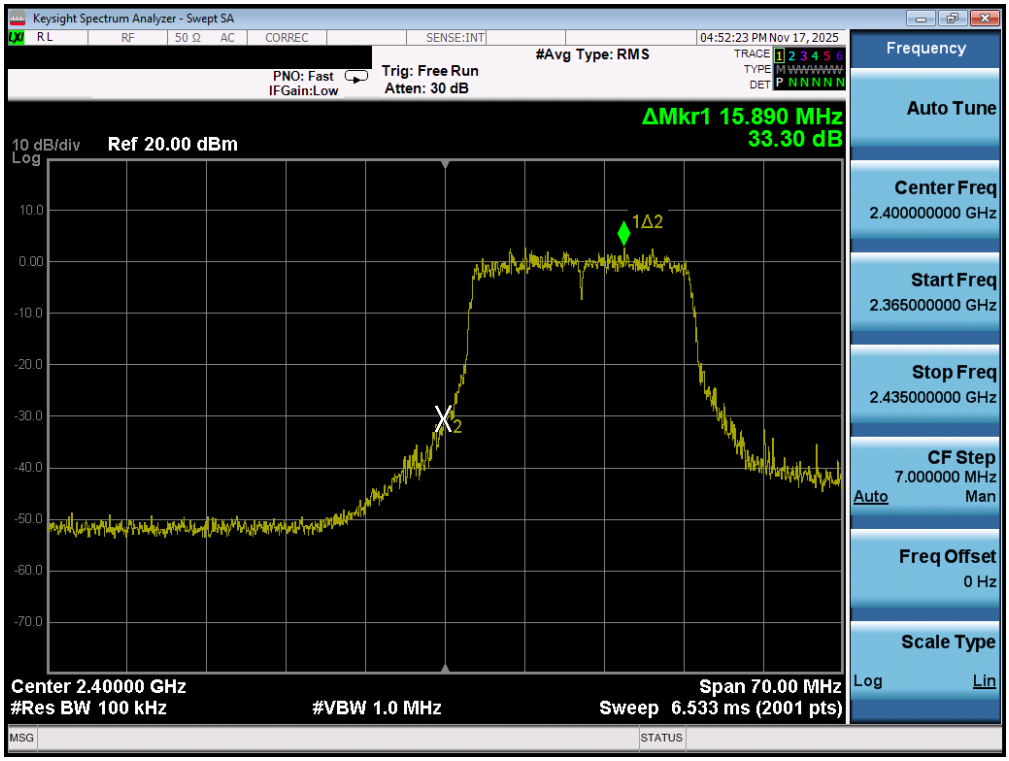


Plot 7-41. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 13)



Plot 7-42. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)

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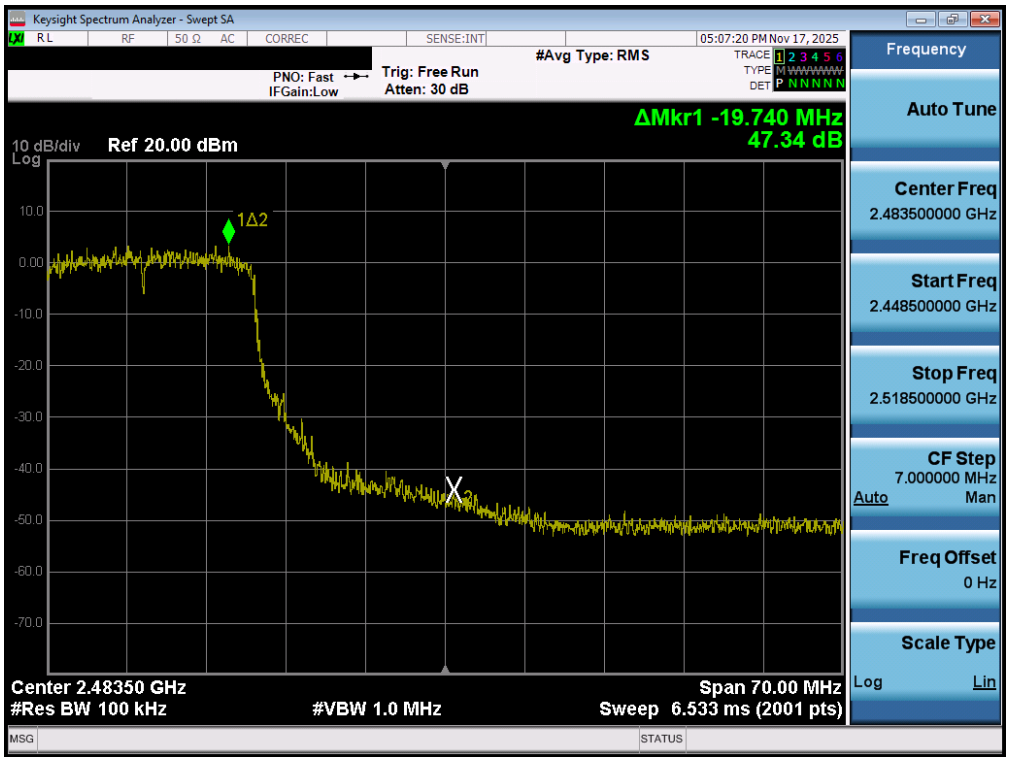
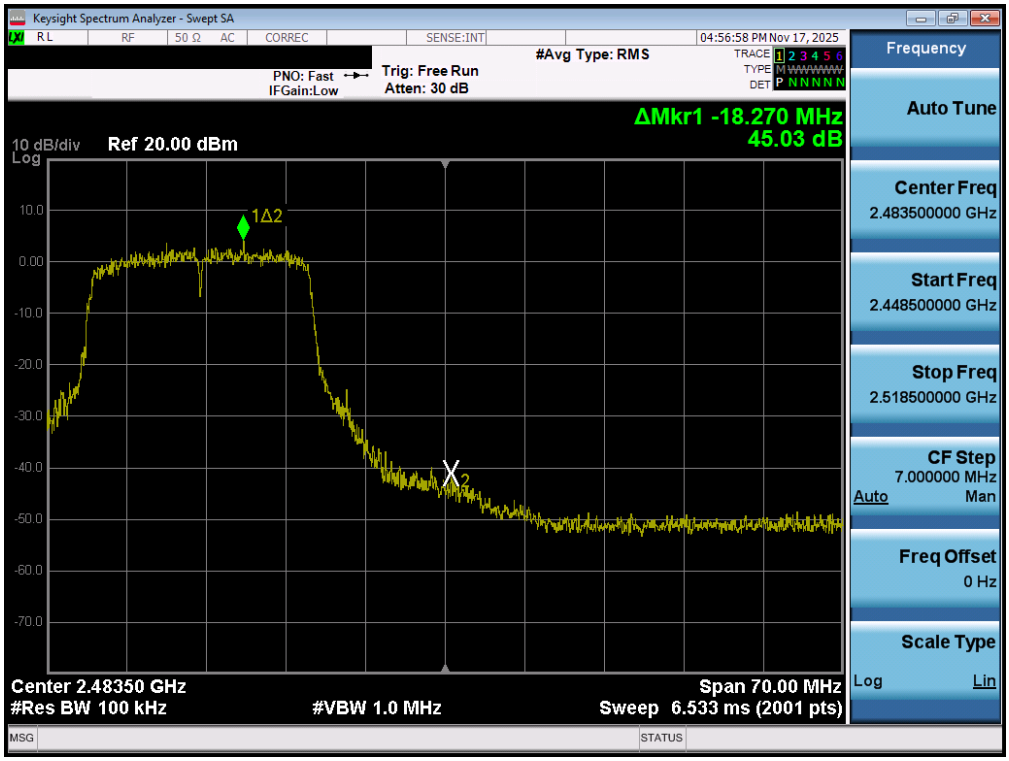


Plot 7-43. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 10)



Plot 7-44. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)

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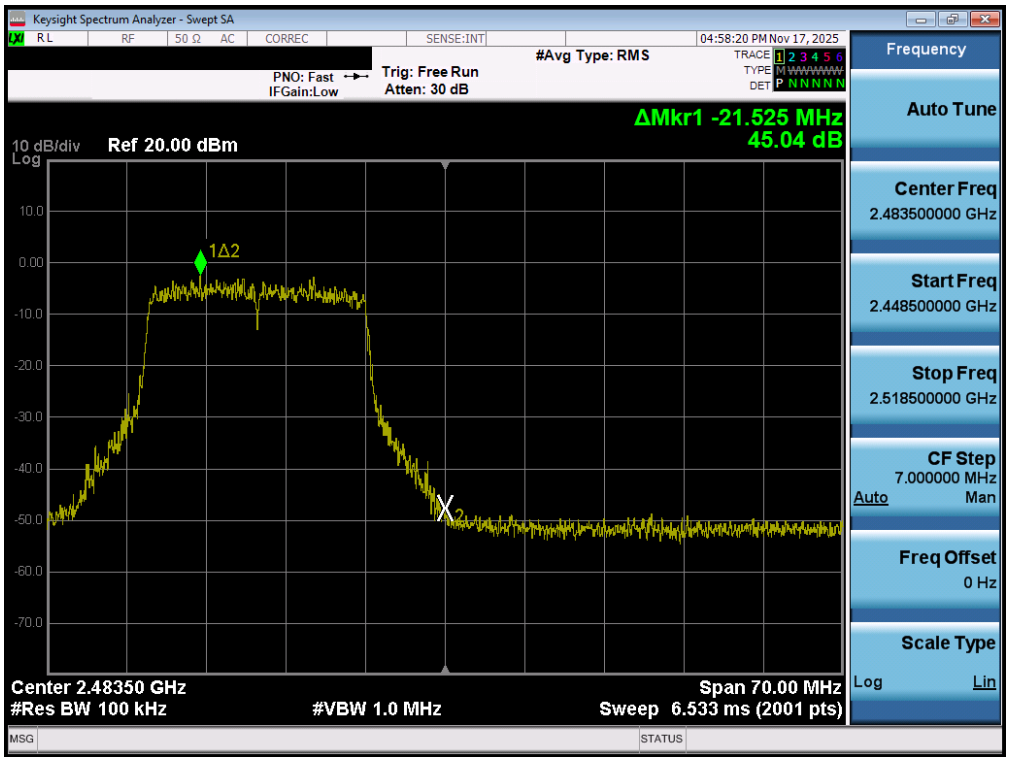
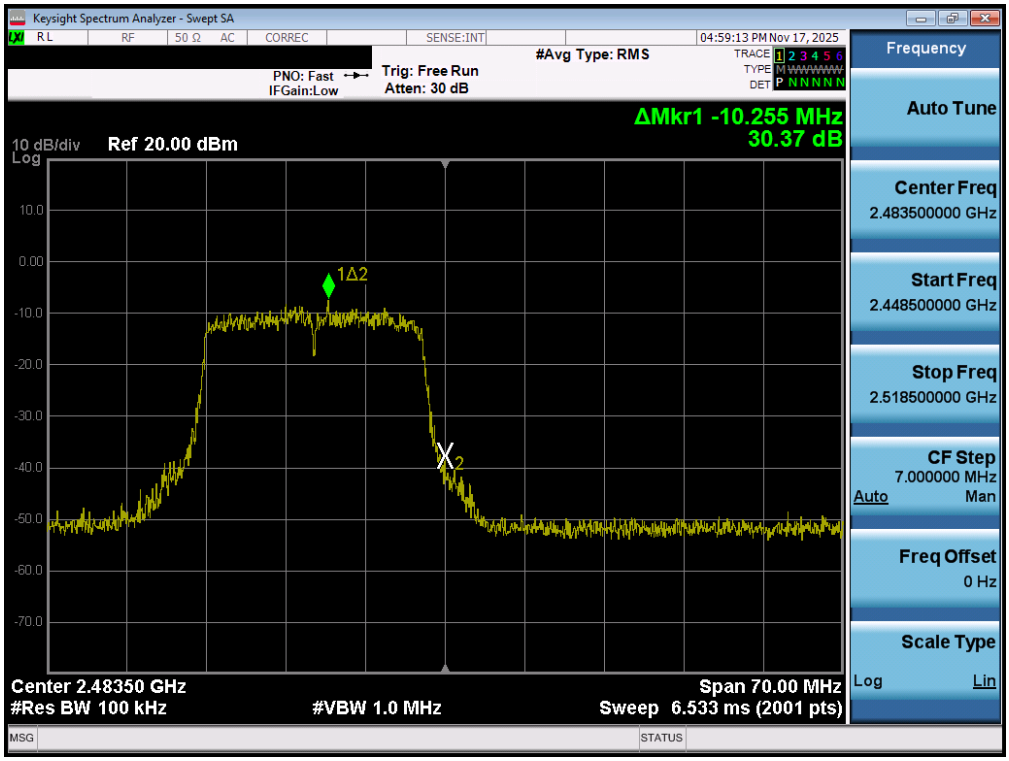


Plot 7-45. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 12)



Plot 7-46. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 13)

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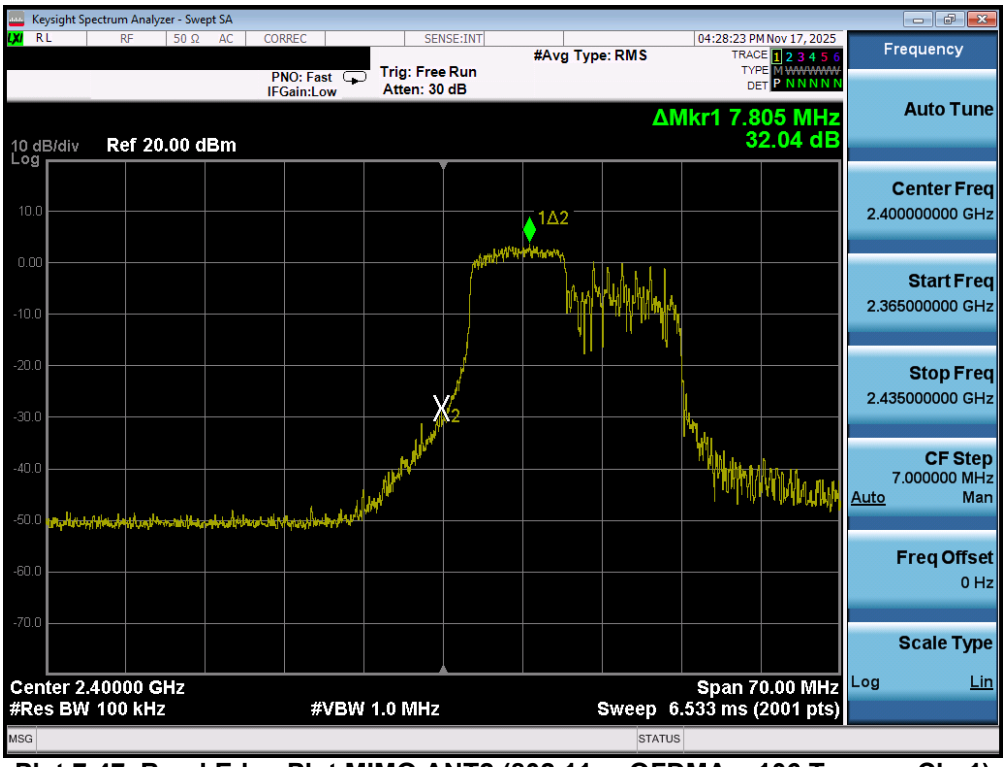
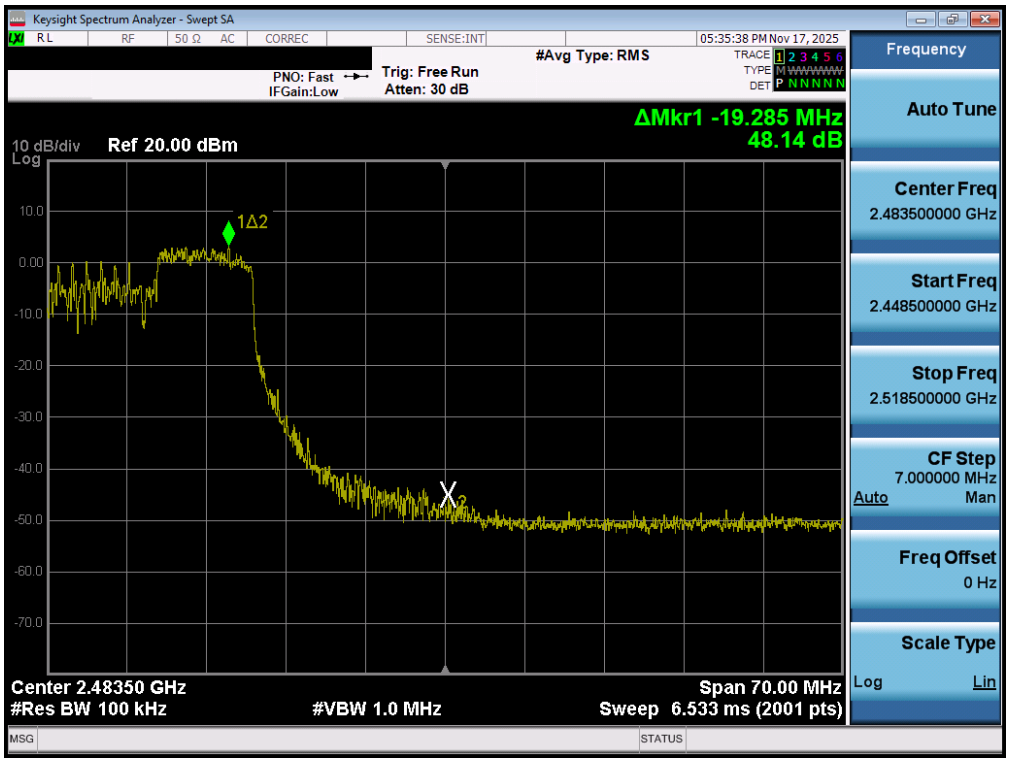


Plot 7-47. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 1)



Plot 7-48. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 10)

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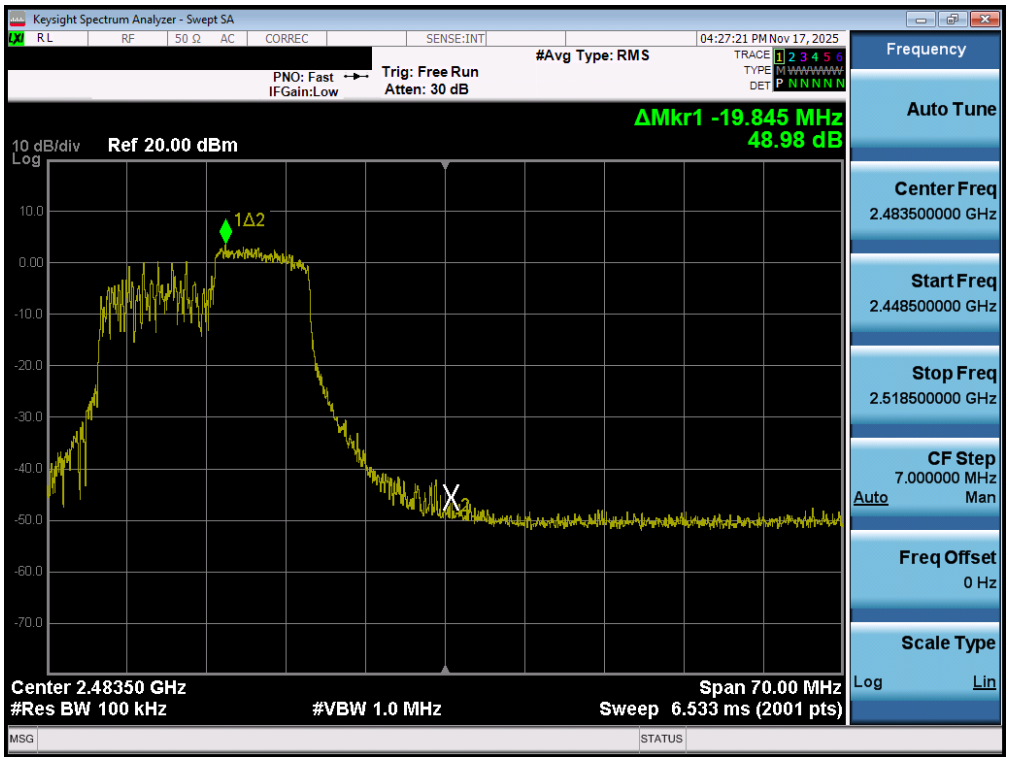
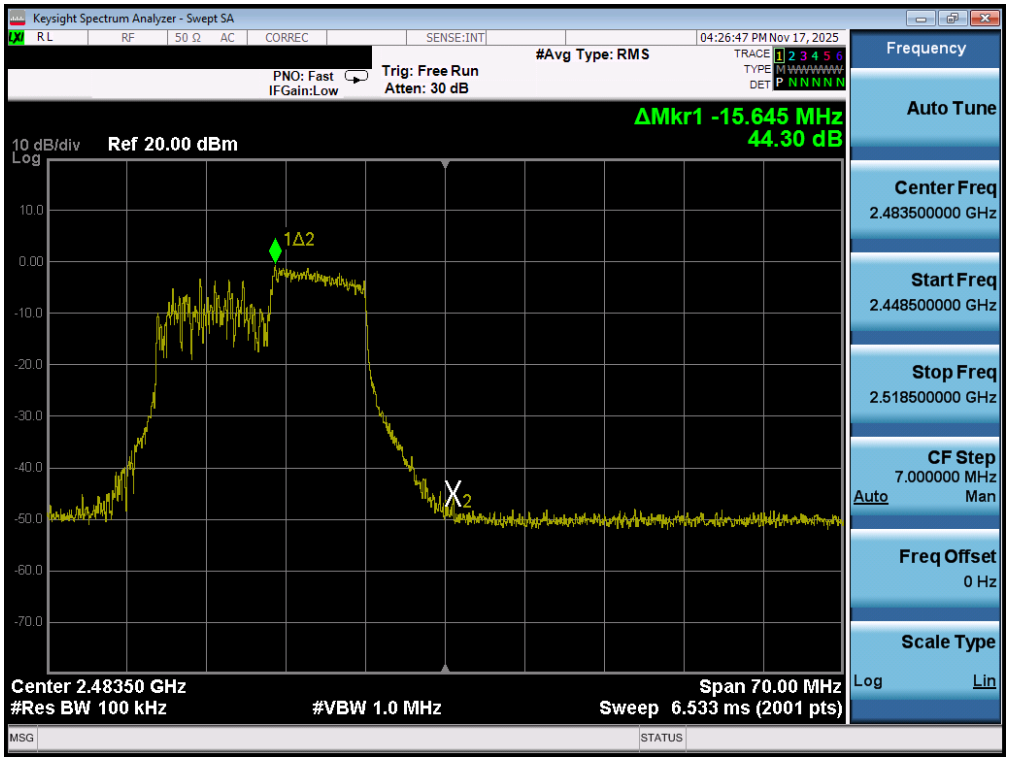


Plot 7-49. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 11)



Plot 7-50. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 12)

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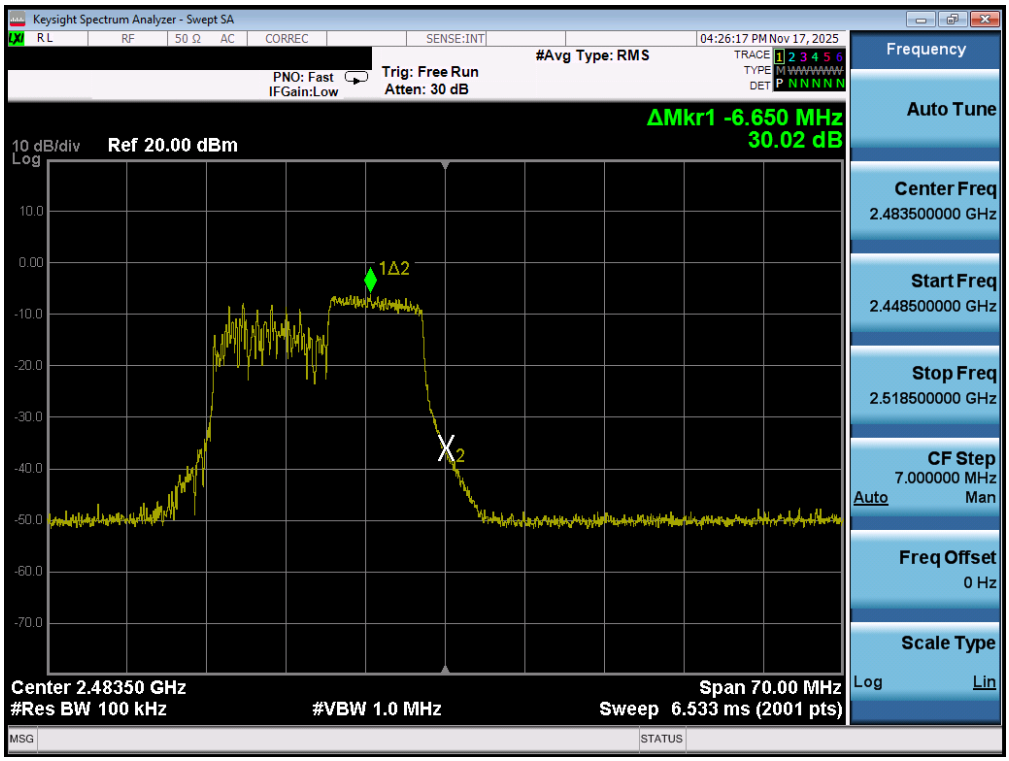
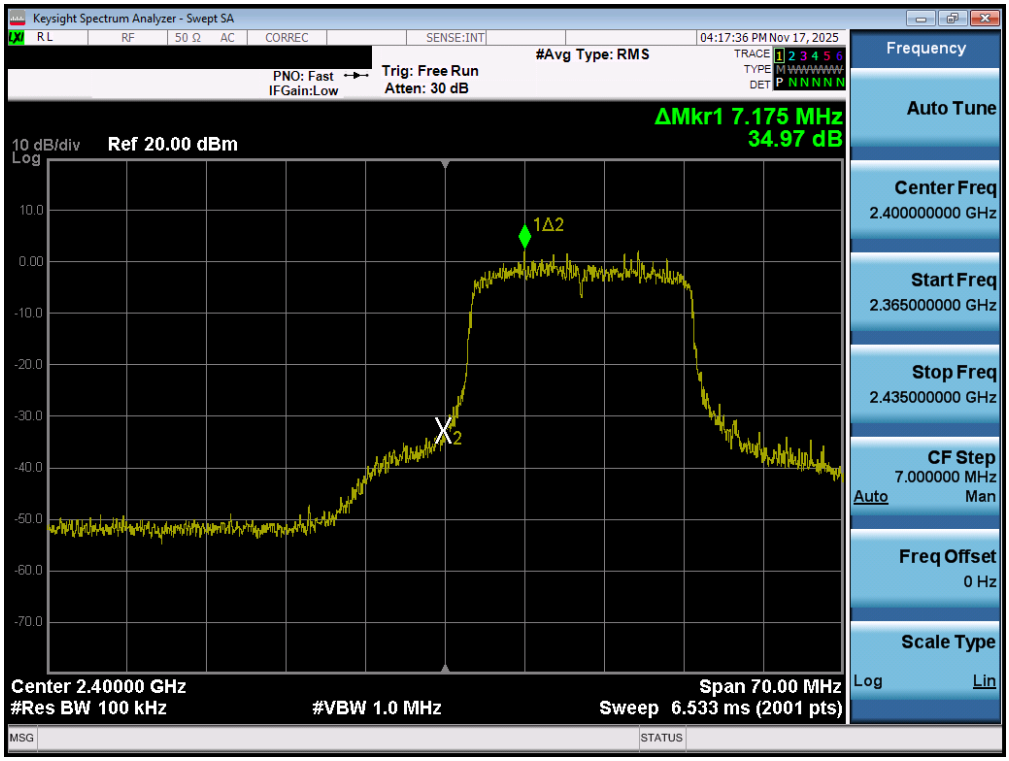


Plot 7-51. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 13)



Plot 7-52. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 1)

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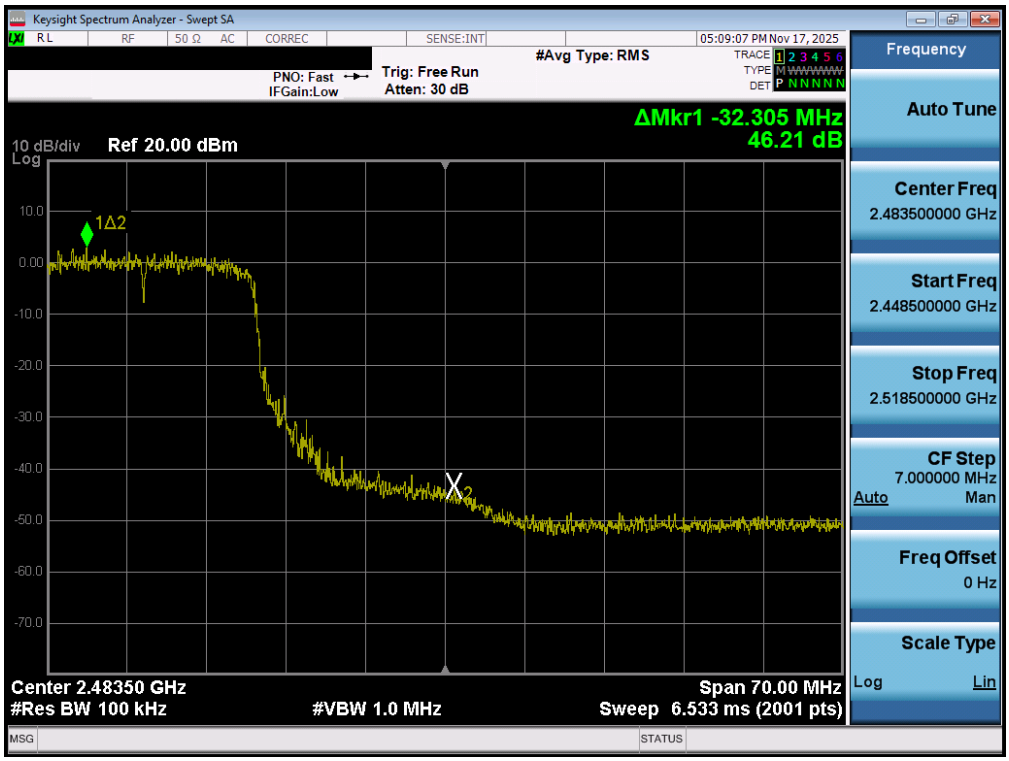
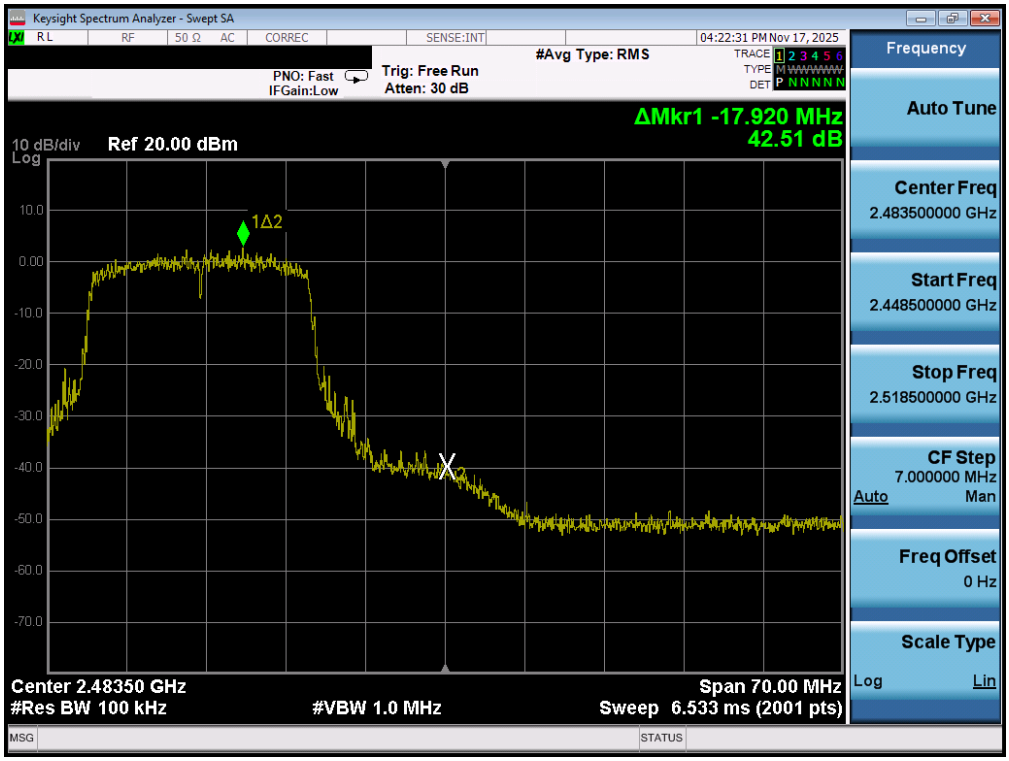


Plot 7-53. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 10)



Plot 7-54. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 11)

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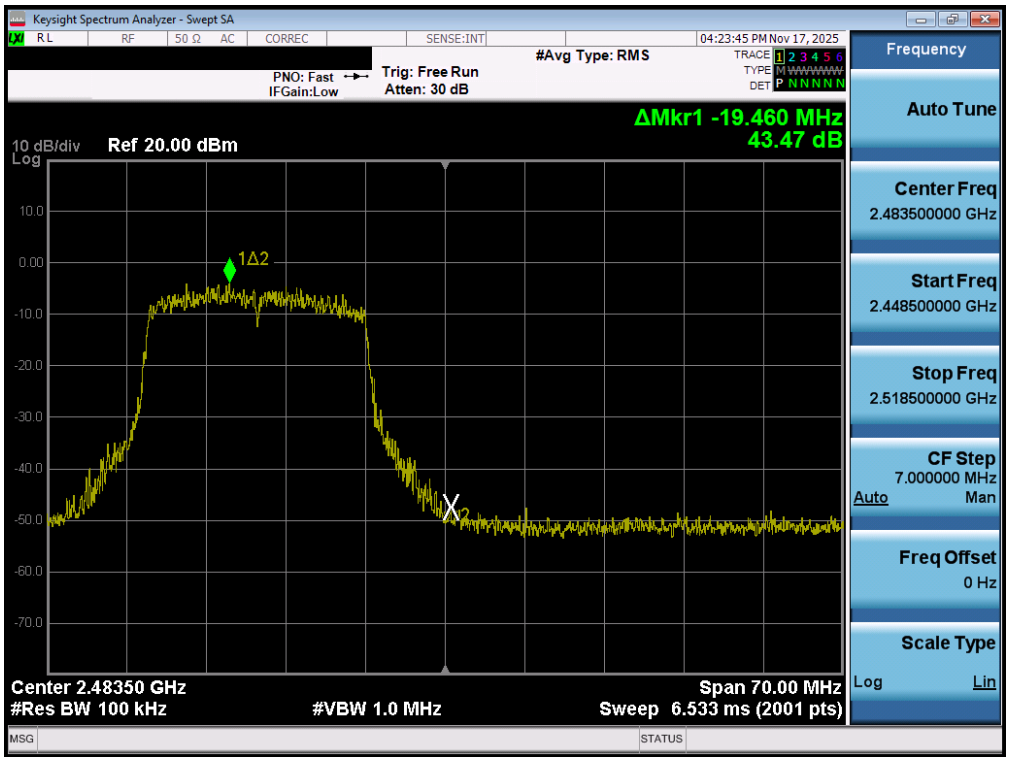
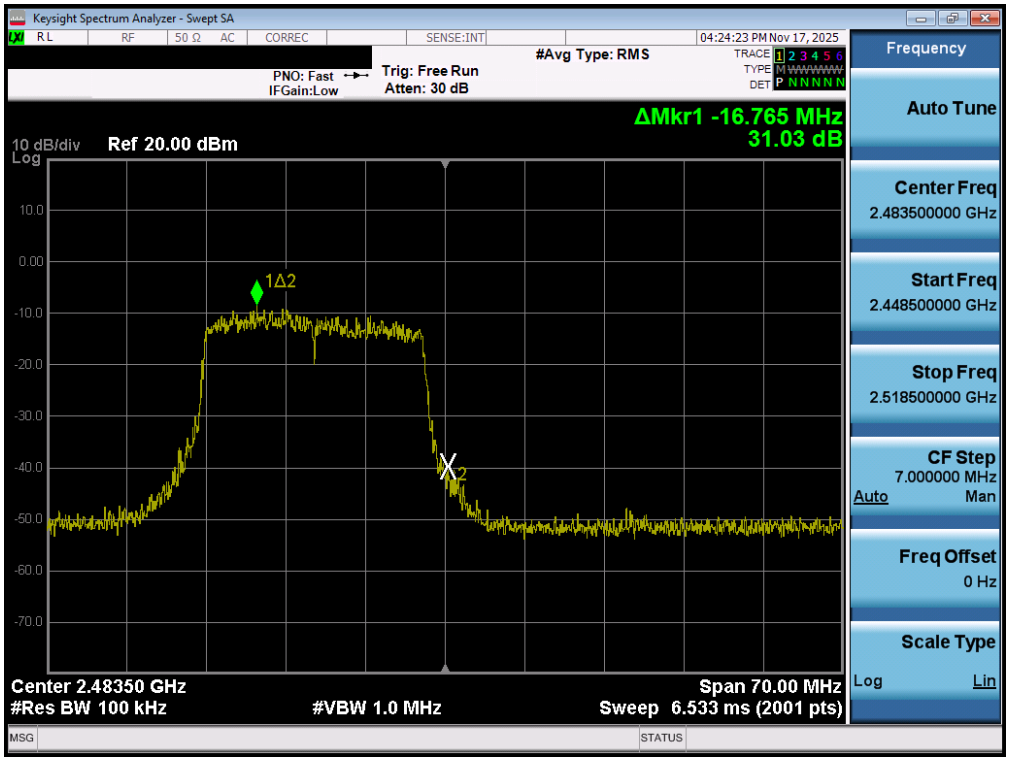


Plot 7-55. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 12)



Plot 7-56. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 13)

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7.6 Conducted Spurious Emissions

Test Overview and Limit

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates, tone configurations, and RU indices were investigated to determine the worst-case configuration. For the following out of band conducted emissions plots, the EUT was set to a data rate of MCS0 in 802.11ax mode as this setting produced the worst-case emissions.

The limit for out-of-band spurious emissions at the band edge is 30dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the procedure in Section 11.11.3 of ANSI C63.10:2020.

Test Procedure Used

ANSI C63.10:2020 – Section 11.11.3
ANSI C63.10:2020 – Section 14.5.2.3

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 25GHz (separated into two plots per channel)
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-5. Test Instrument & Measurement Setup

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Test Notes

1. RBW was set to 1MHz rather than 100kHz in order to increase the measurement speed.

2. The display line shown in the following plots denotes the limit at 30dB below the fundamental emission level measured in a 100kHz bandwidth. However, since the traces in the following plots are measured with a 1MHz RBW, the display line may not necessarily appear to be 30dB below the level of the fundamental in a 1MHz bandwidth.

3. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present.

4. The conducted spurious emissions were measured to relative limits. Therefore, in accordance with ANSI C63.10:2020 Section 14.5.2.3, it was unnecessary to show compliance through the summation of test results of the individual outputs.

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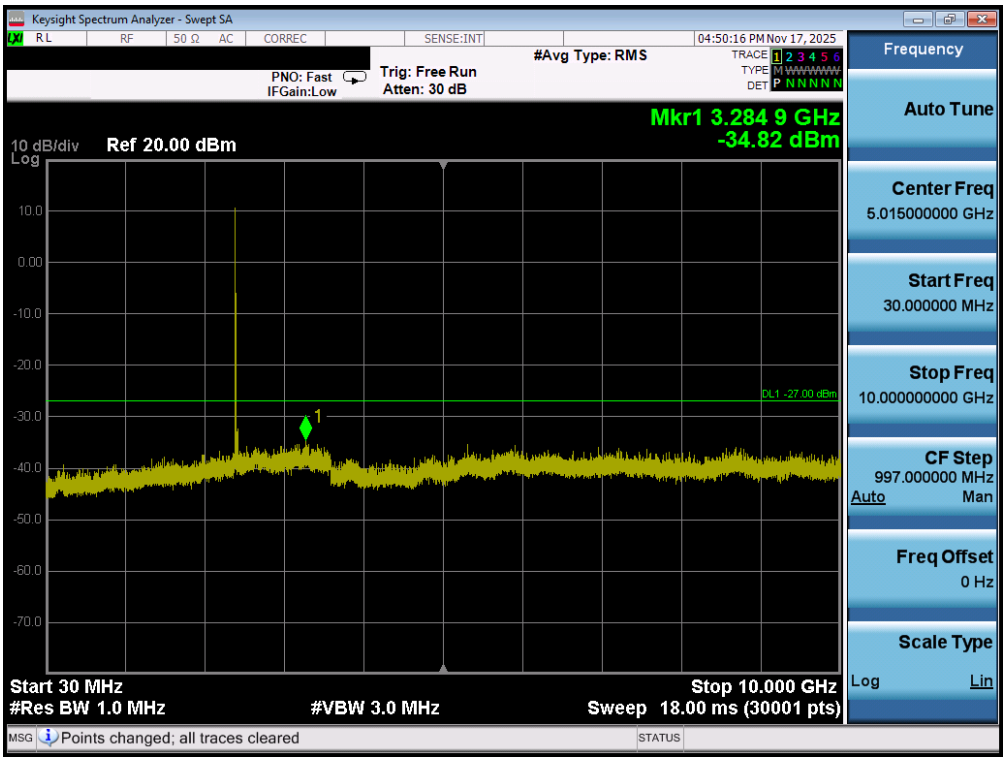
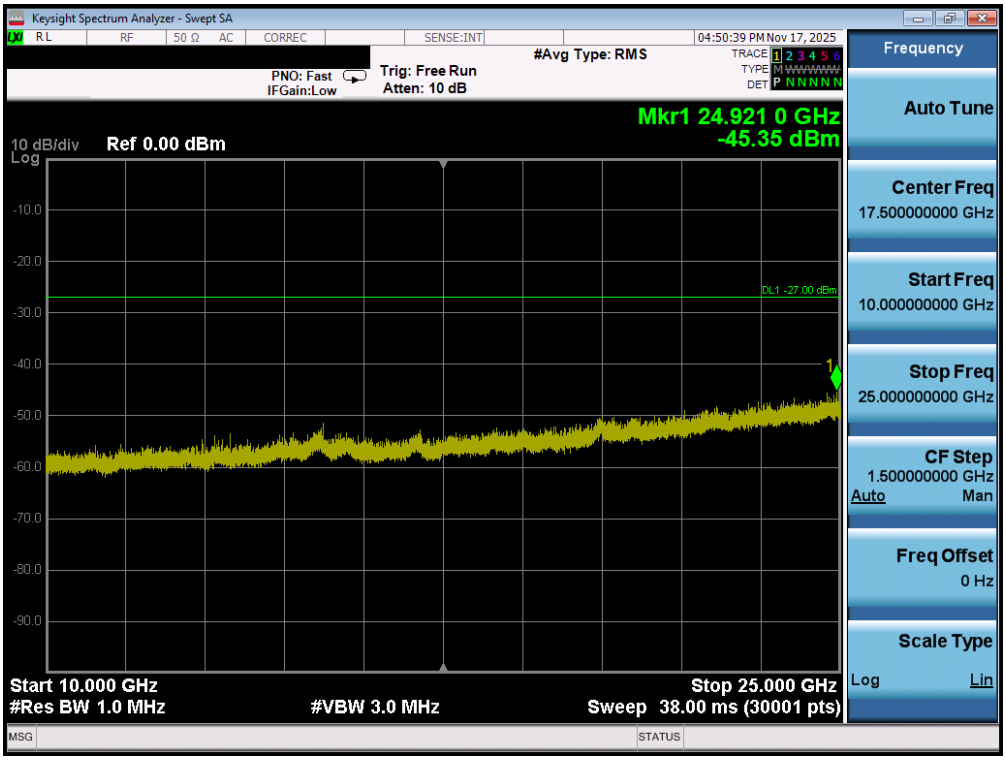
7.6.1 MIMO Conducted Spurious Emissions



Plot 7-57. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-58. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)

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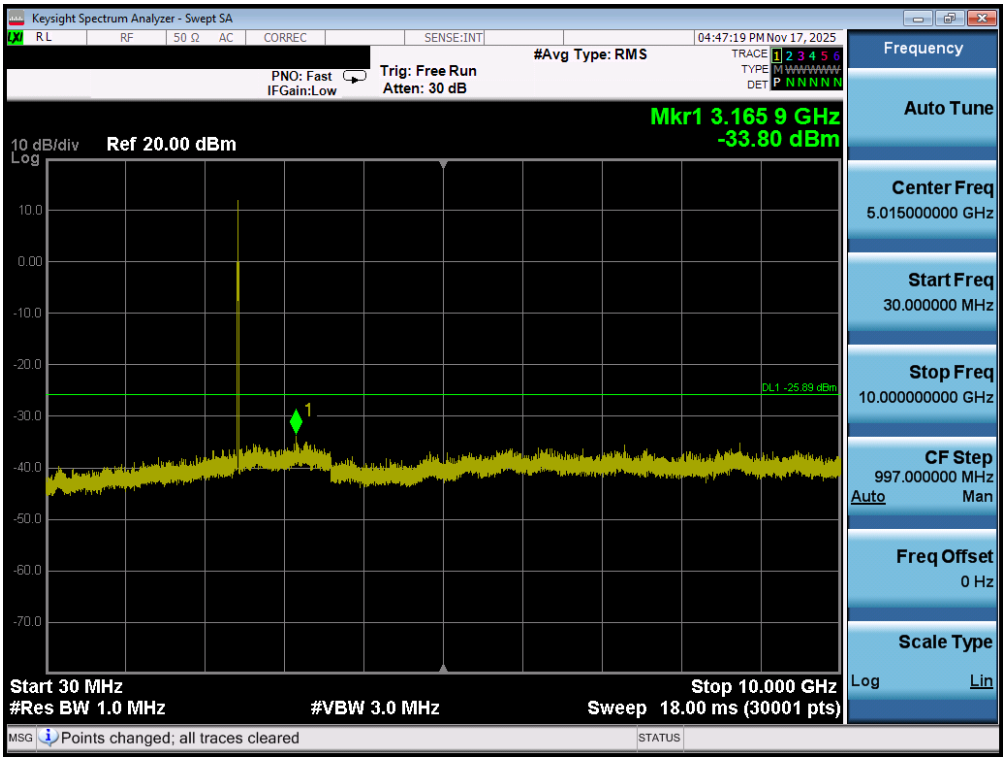
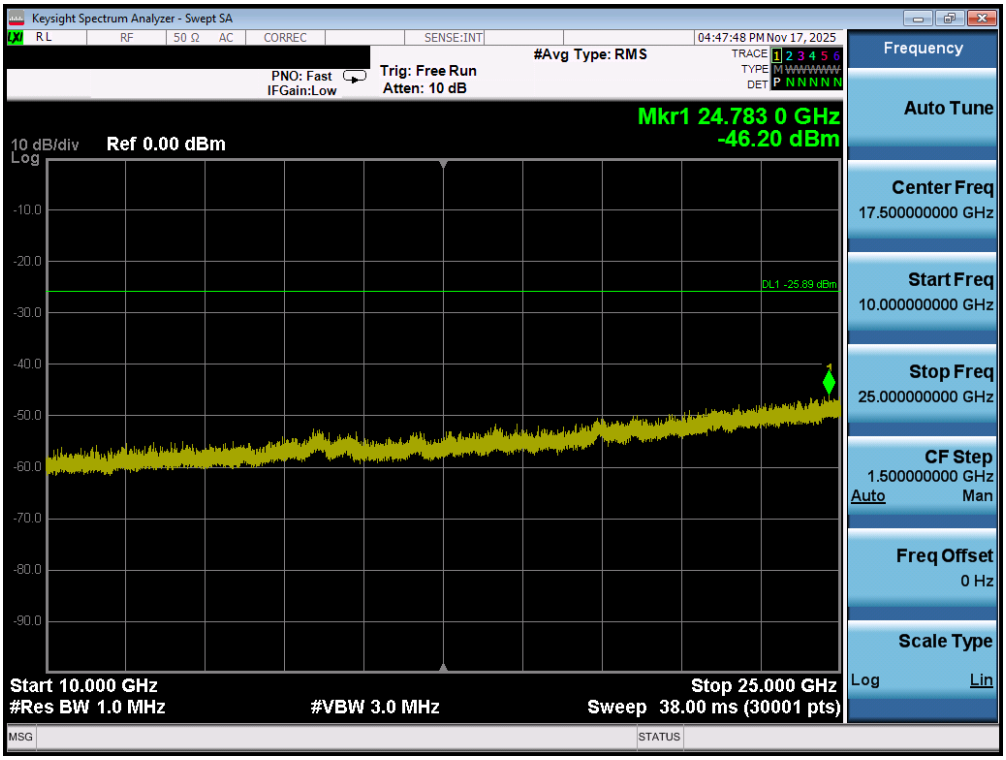


Plot 7-59. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 6)



Plot 7-60. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 6)

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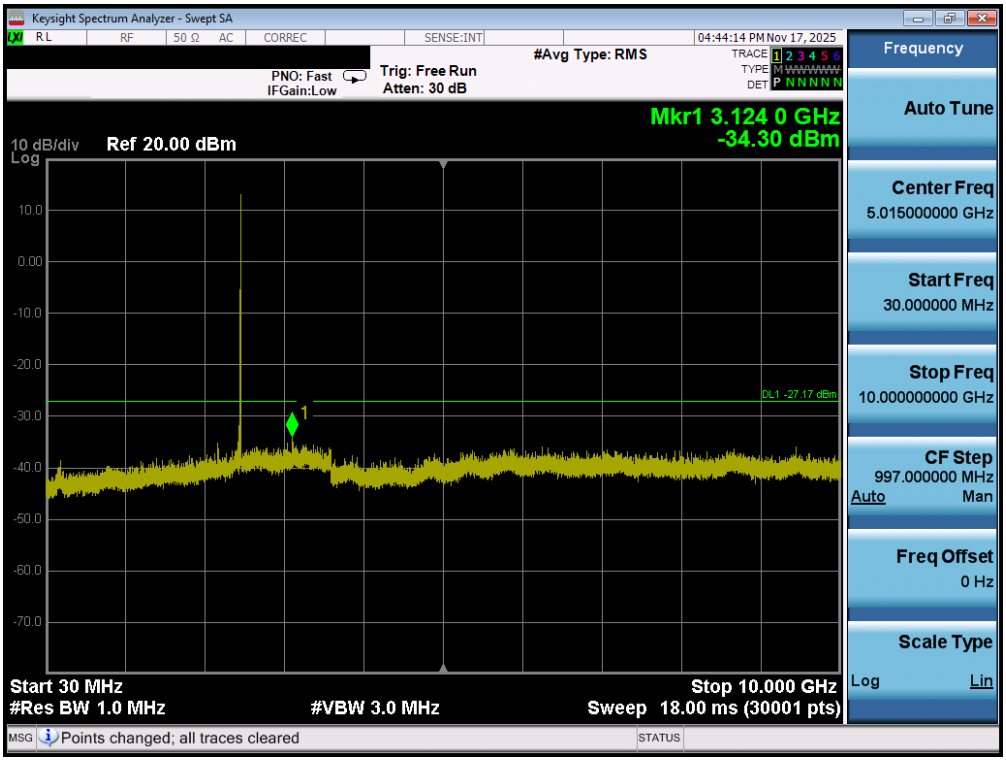
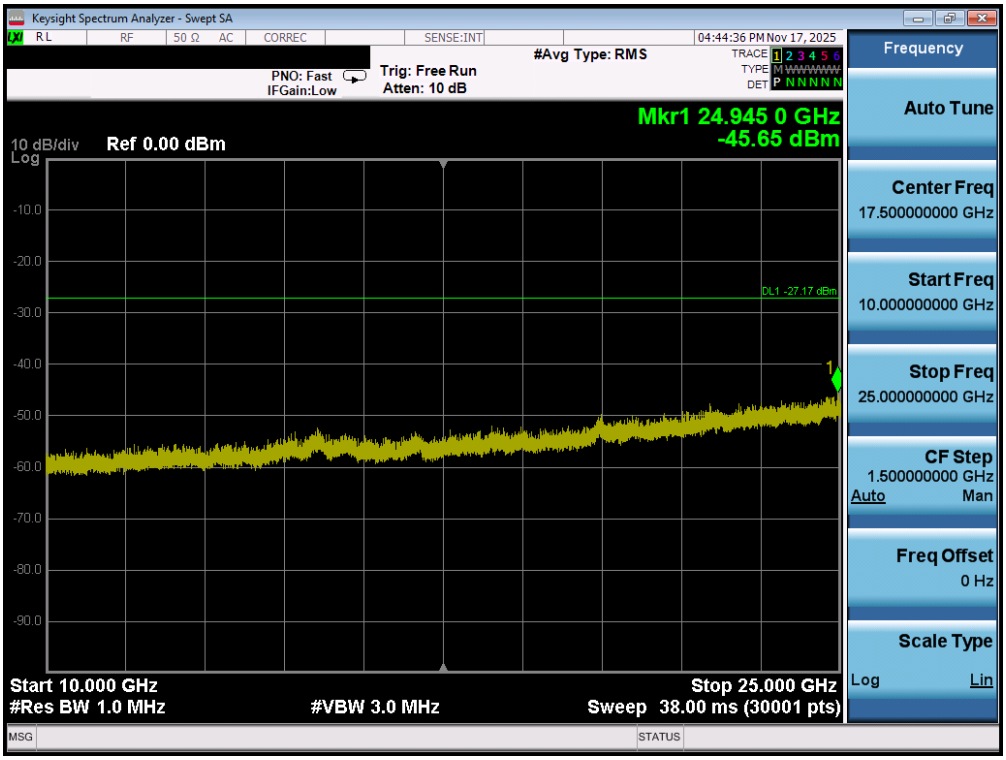


Plot 7-61. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-62. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)

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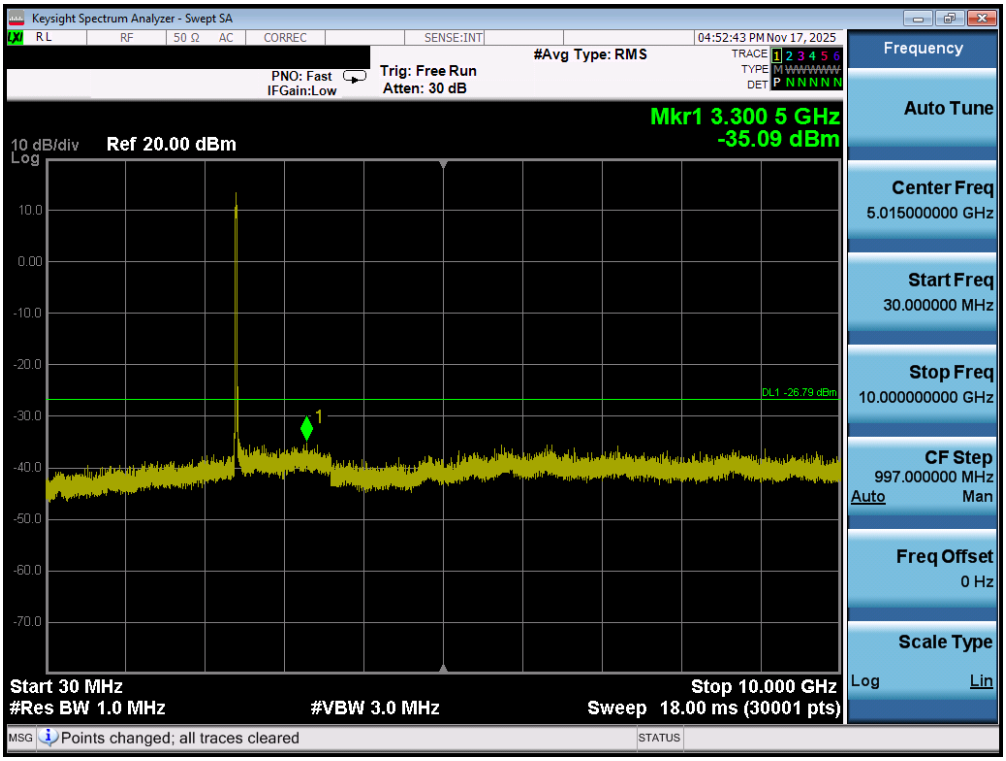
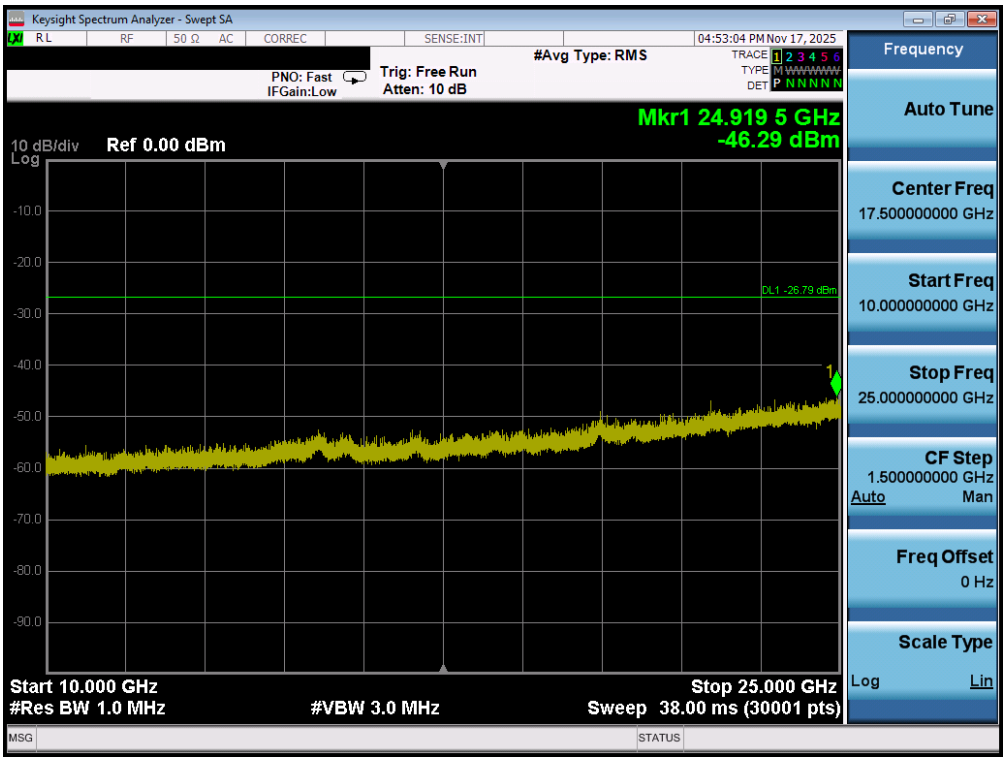


Plot 7-63. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)



Plot 7-64. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)

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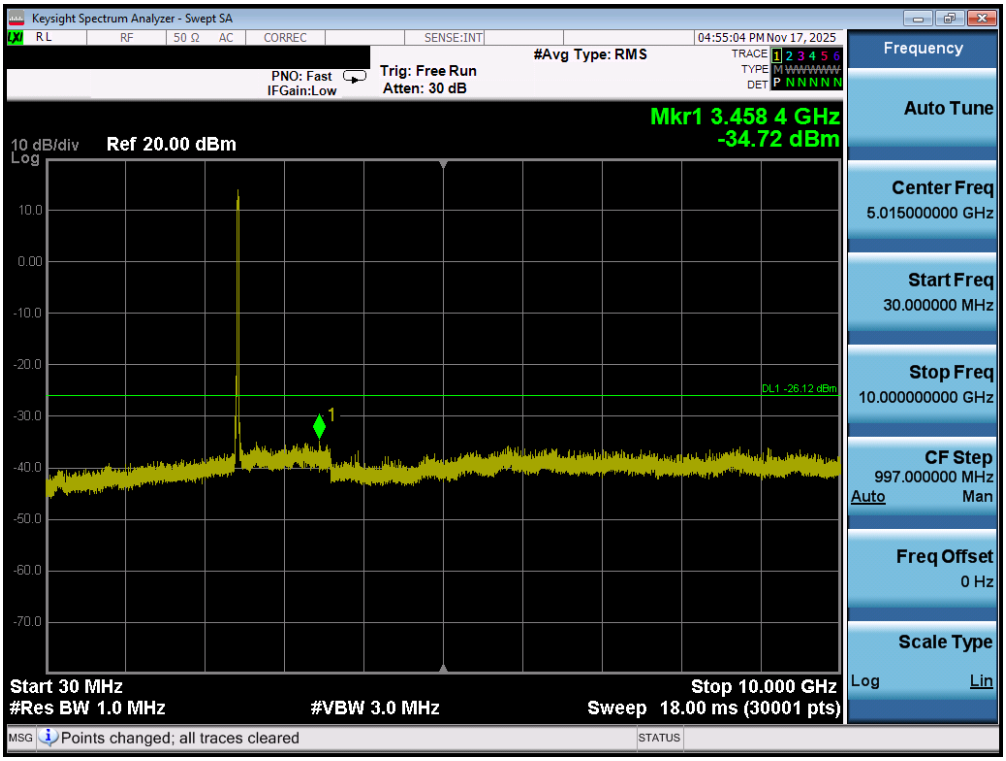
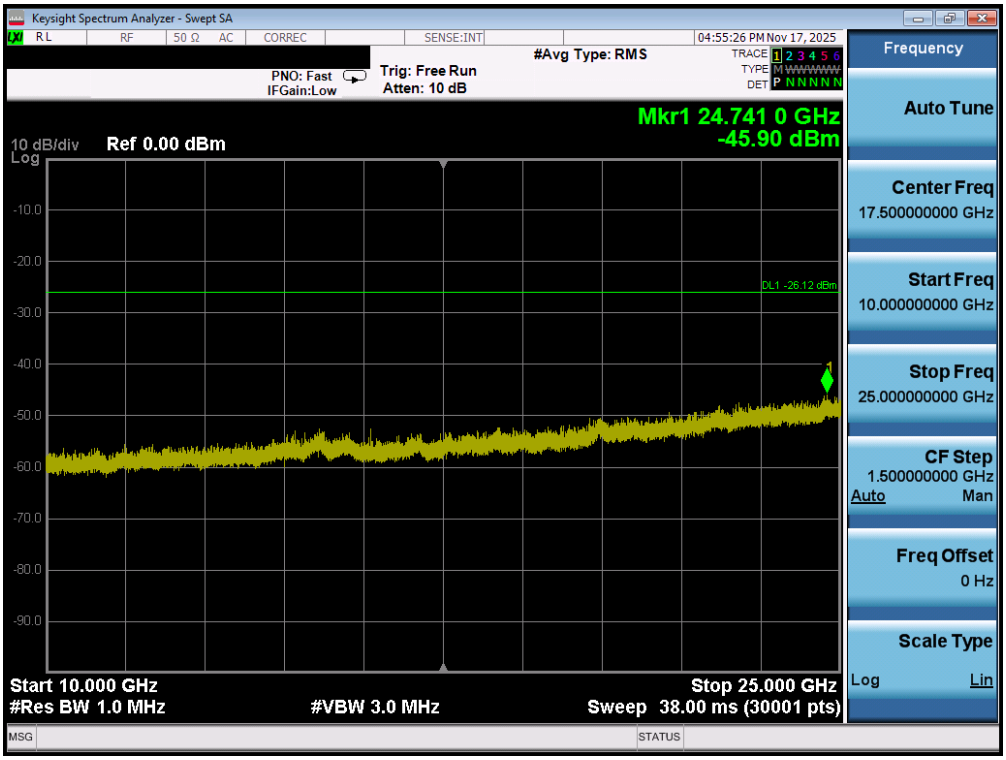


Plot 7-65. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-66. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 6)

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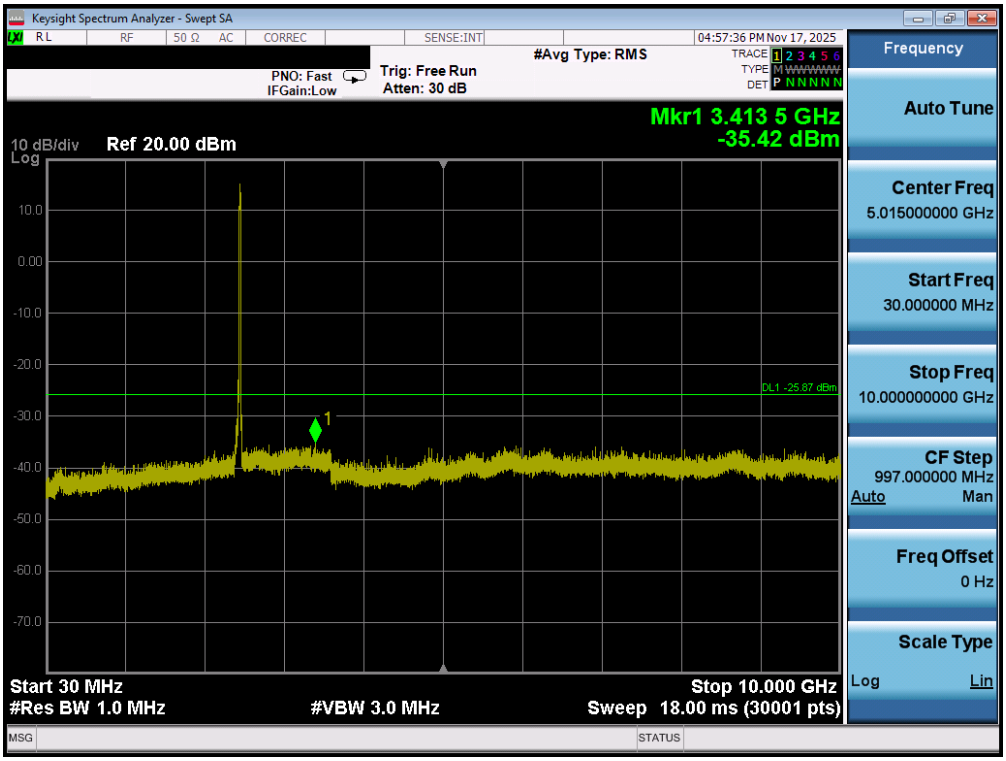
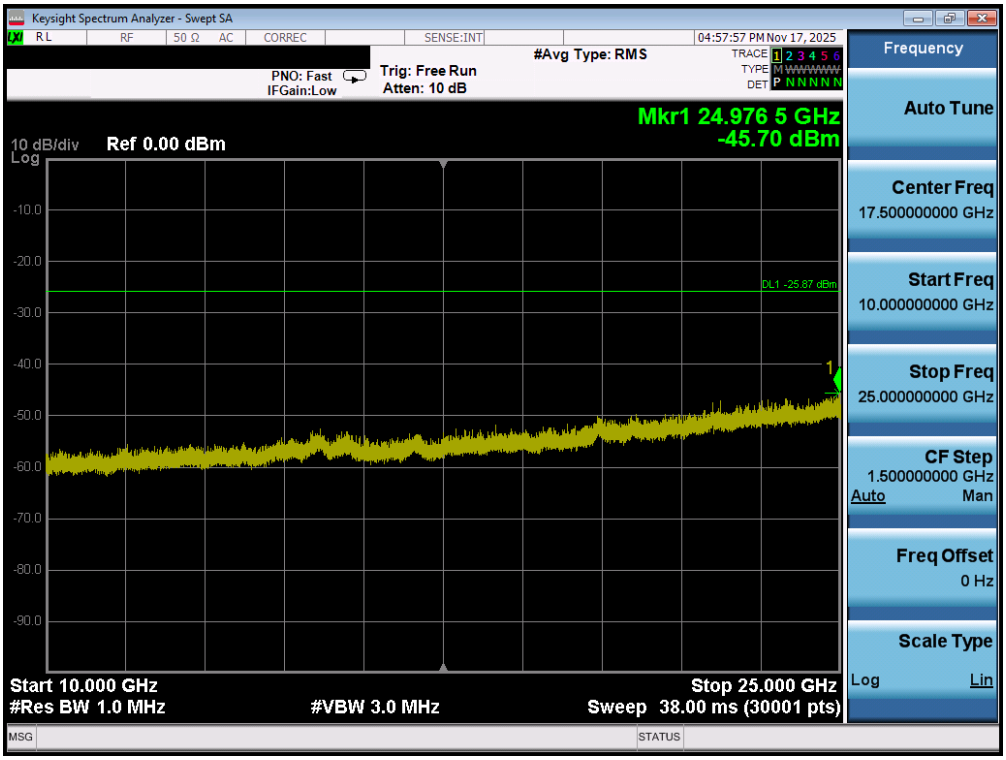


Plot 7-67. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)



Plot 7-68. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)

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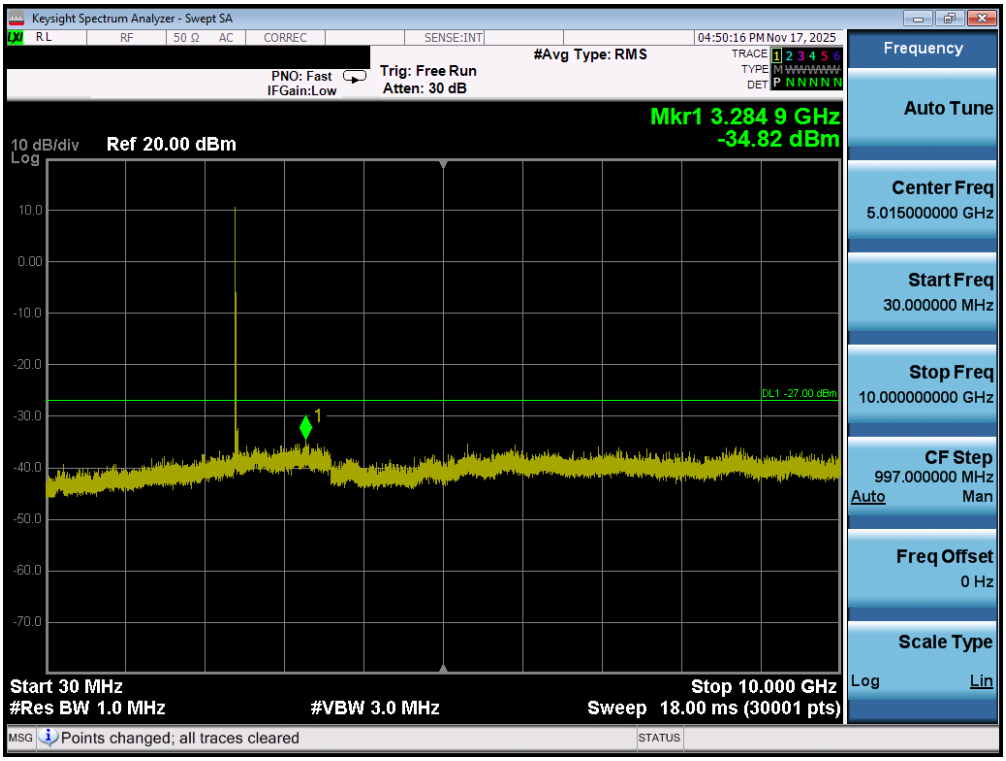
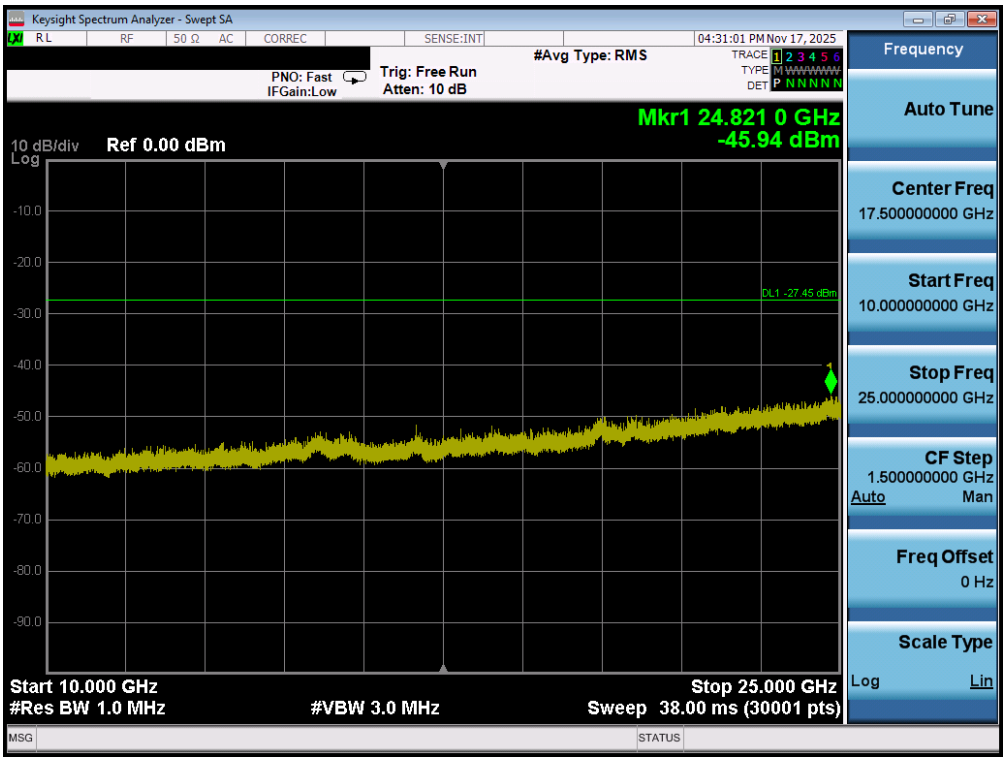


Plot 7-69. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-70. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 1)

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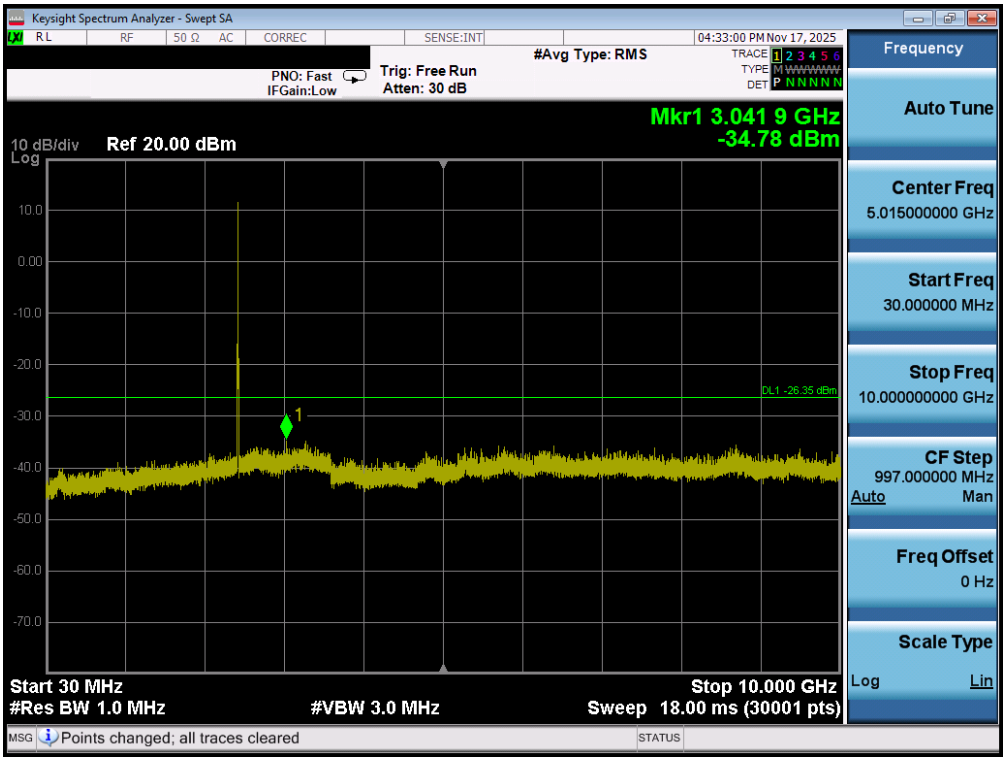
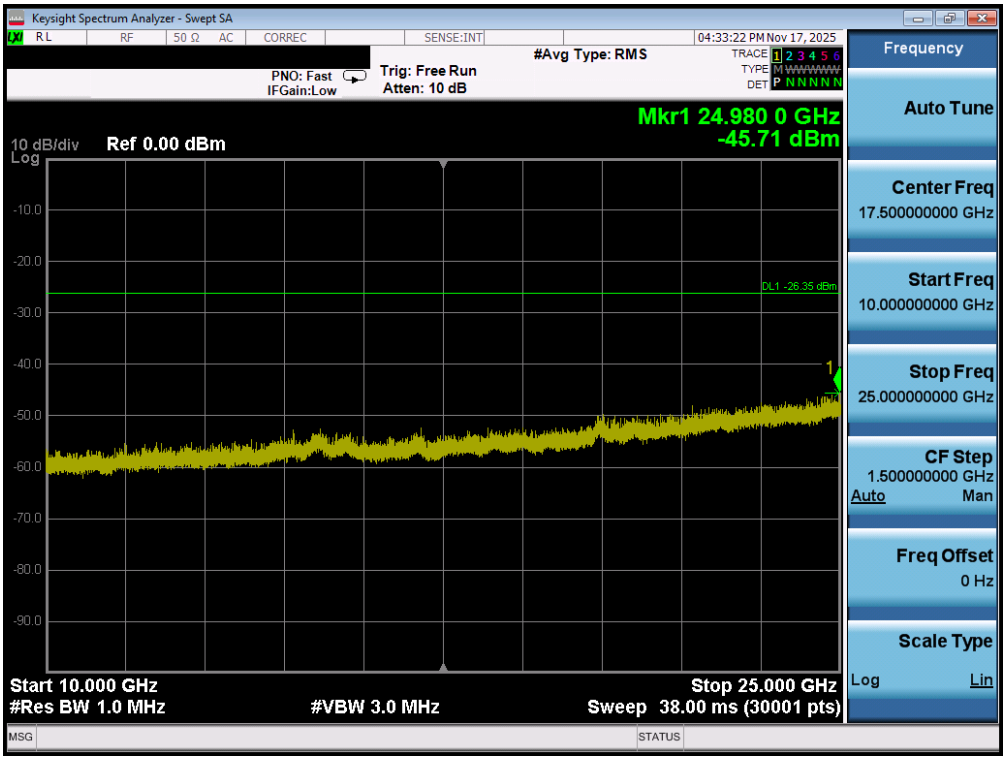


Plot 7-71. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 6)



Plot 7-72. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 6)

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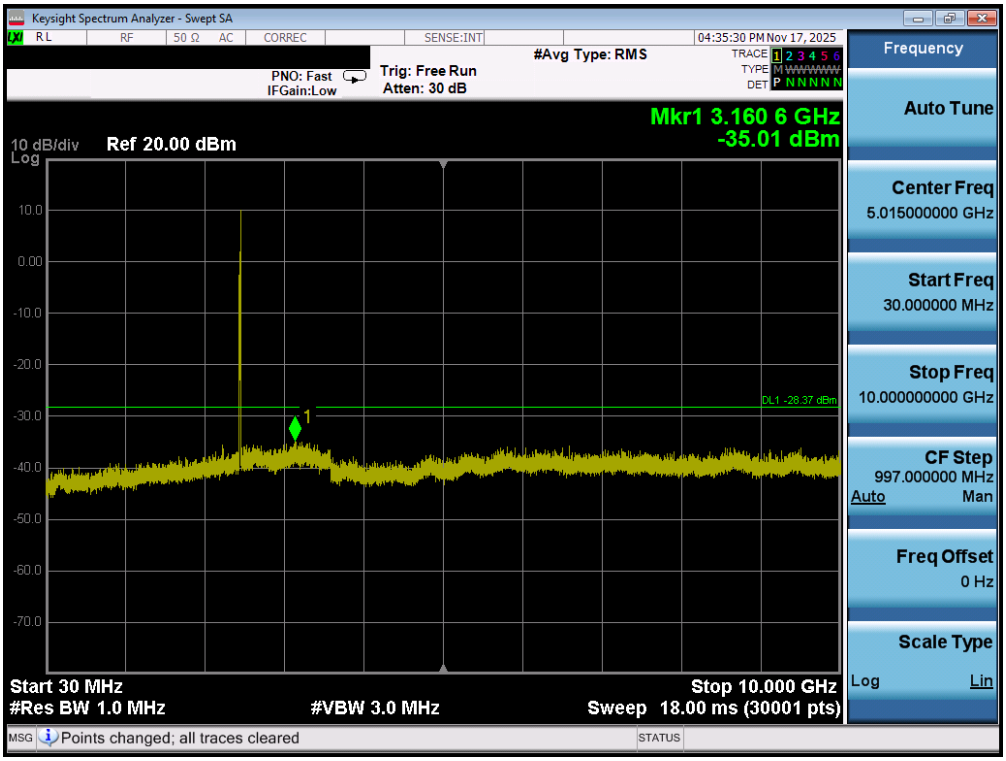
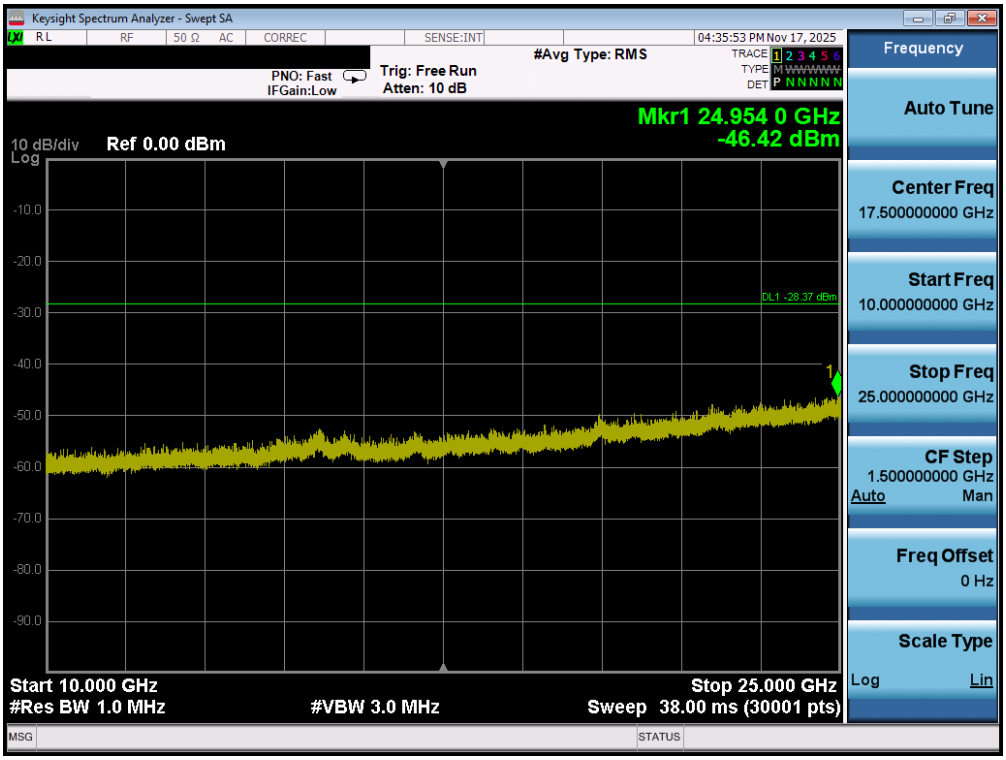


Plot 7-73. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-74. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 11)

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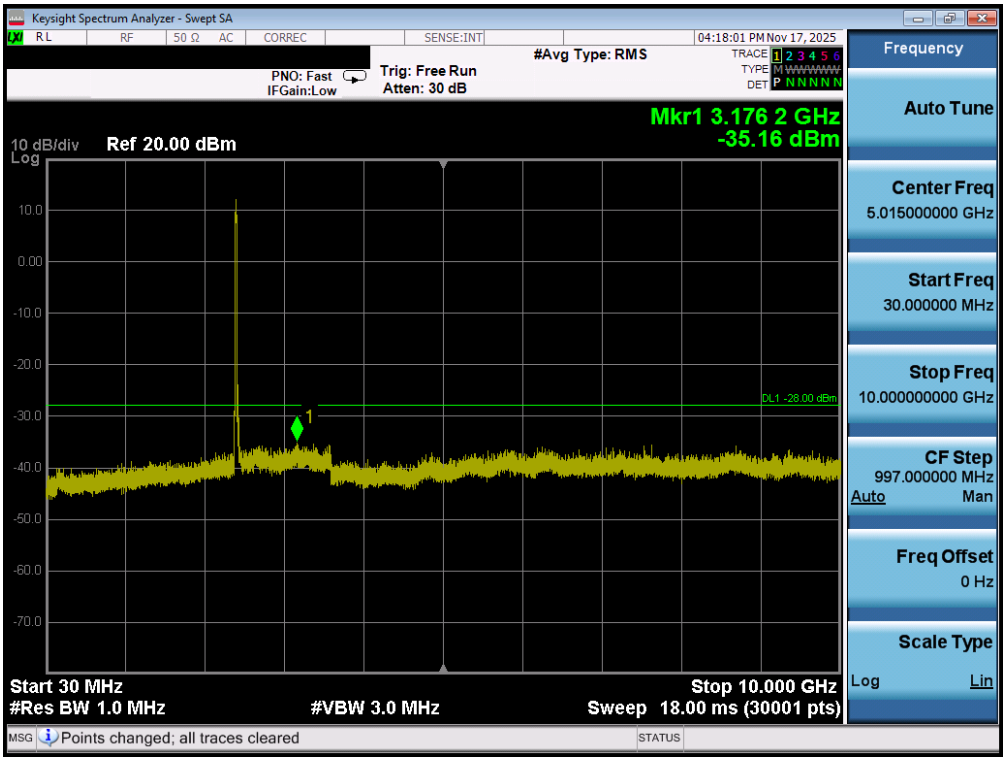
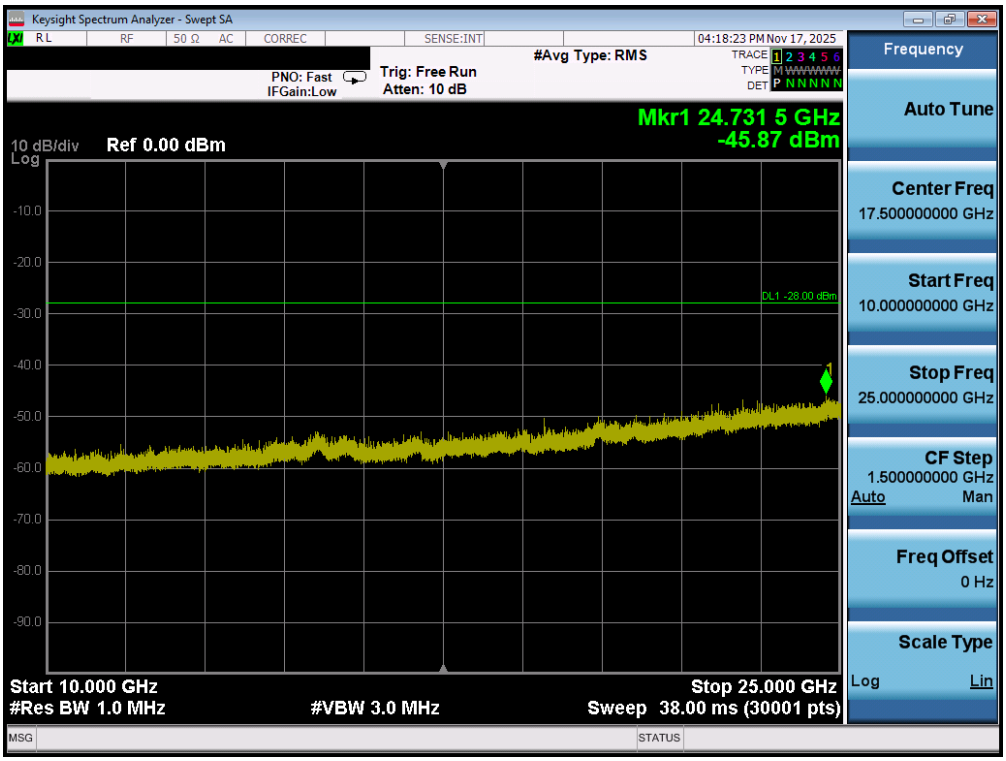


Plot 7-75. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 1)



Plot 7-76. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 1)

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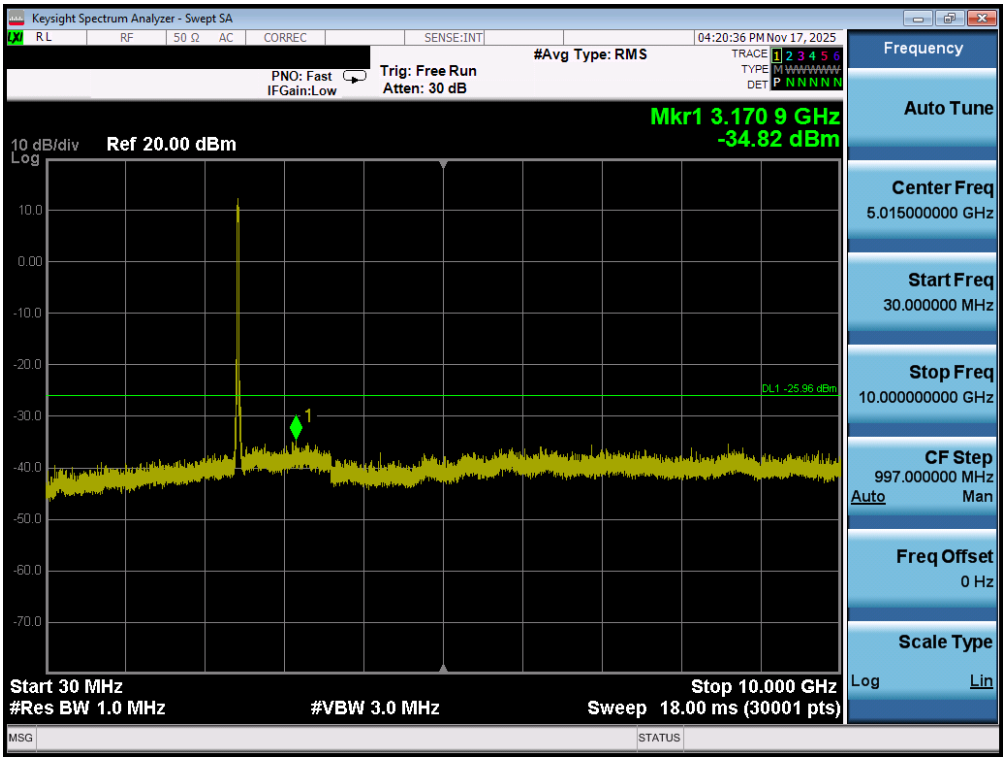
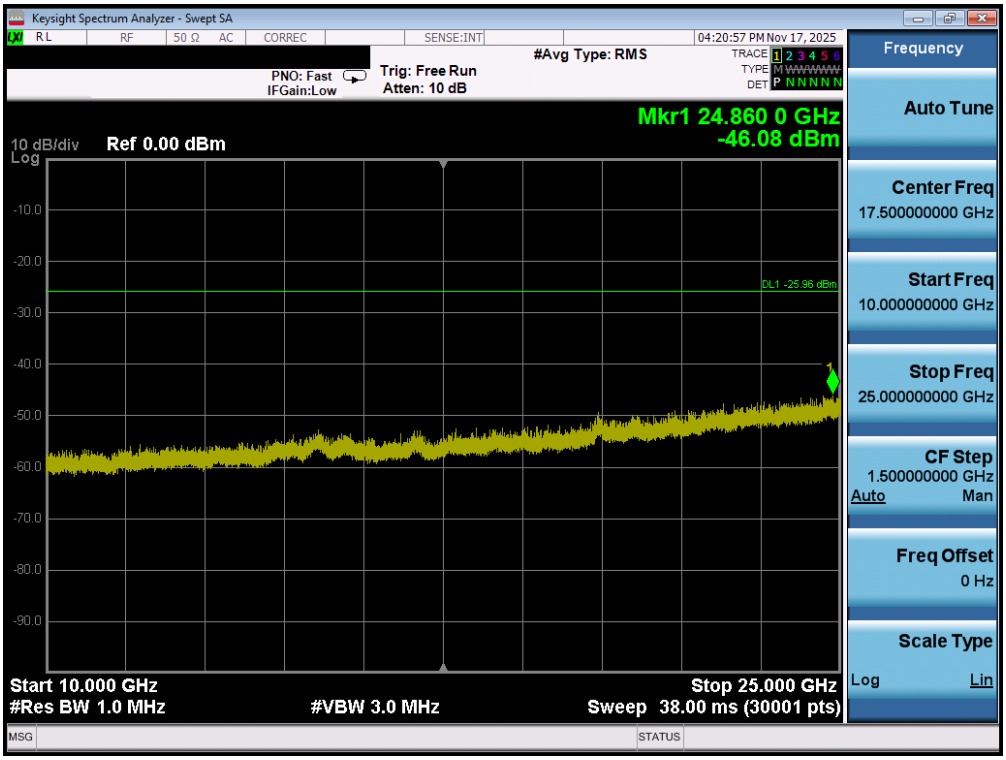


Plot 7-77. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-78. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 6)

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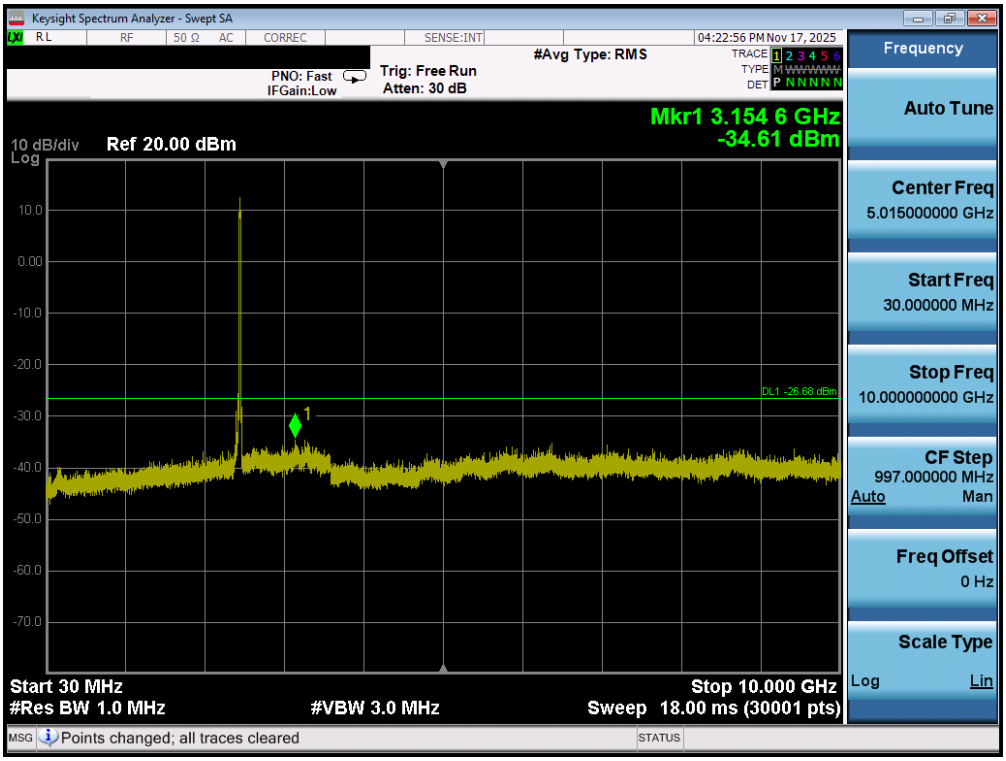
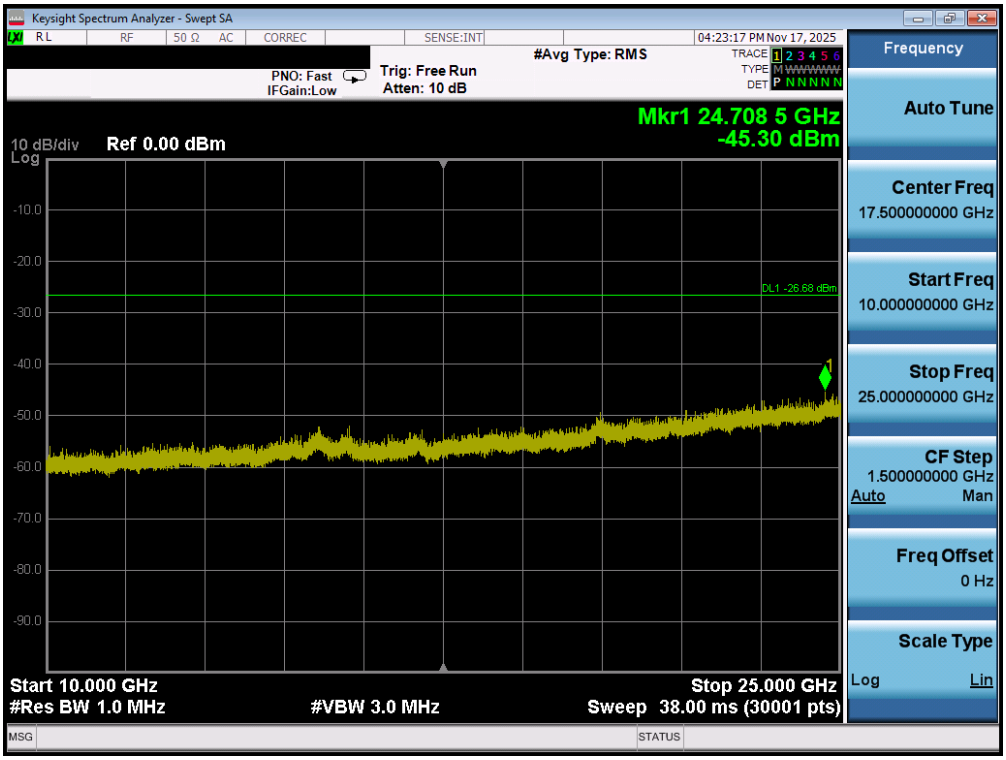


Plot 7-79. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 11)



Plot 7-80. Conducted Spurious Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 11)

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7.7 Radiated Emission Measurements

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in FCC §15.205 of the Title 47 CFR and Table 6 of RSS-Gen (8.10) must not exceed the limits shown FCC §15.209 and RSS-Gen (8.9).

Frequency	Field Strength [µV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-10. Radiated Limits

Test Procedures Used

ANSI C63.10:2020 – Section 6.6.4.3

Test Settings

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points = 1001 (Number of points must be ≥ 2 x span/RBW)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces

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Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

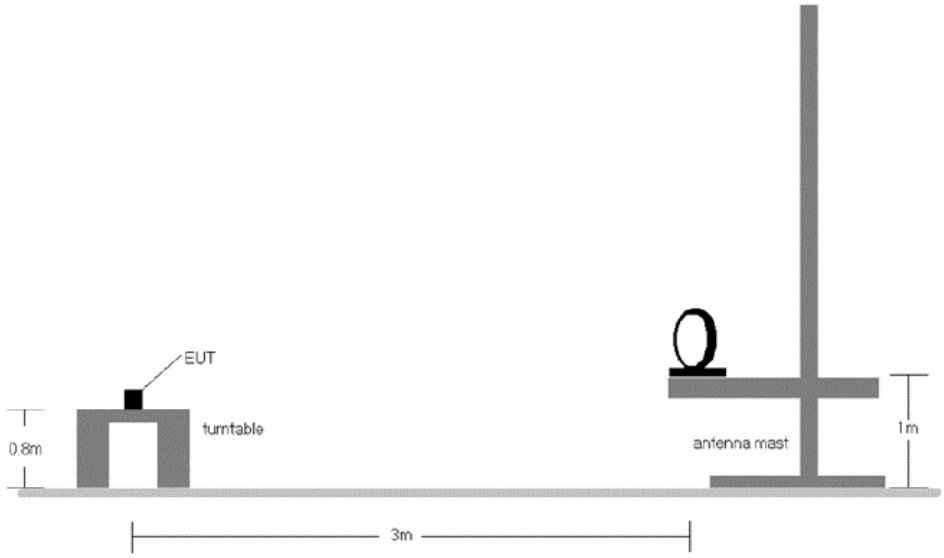

Figure 7-6. Radiated Test Setup < 30MHz

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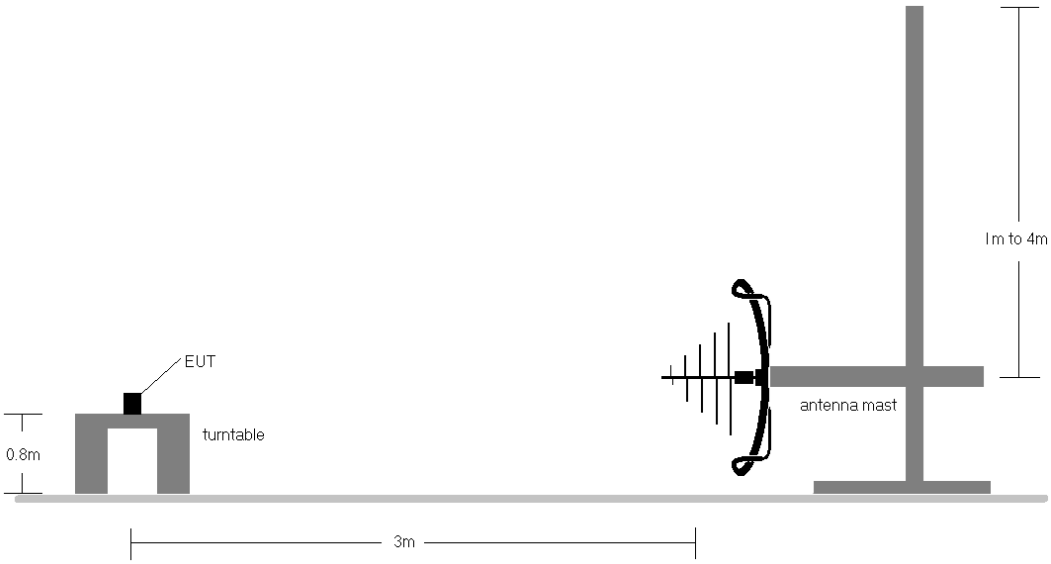

Figure 7-7. Radiated Test Setup < 1GHz

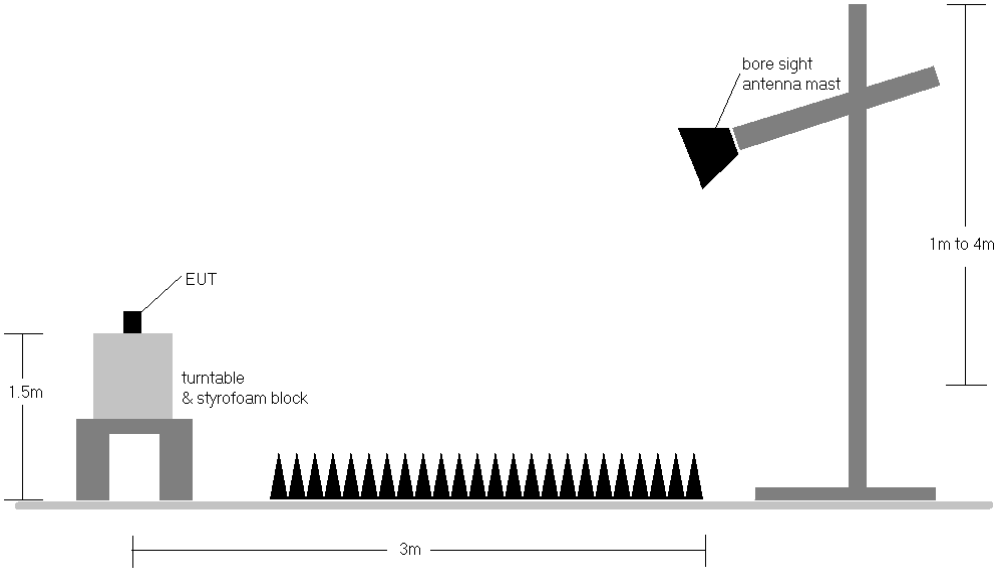

Figure 7-8. Test Instrument & Measurement Setup

Test Notes

1. The optional test procedures for antenna port conducted measurements of unwanted emissions per the guidance of ANSI C63.10:2020 Section 11.12.2 were not used to evaluate this device for compliance to radiated limits. All radiated spurious emissions levels were measured in a radiated test setup.
2. All emissions lying in restricted bands specified in §15.205 and Section 8.10 of RSS-Gen are below the limits shown in §15.209.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.

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4. This unit was tested with its standard battery.
5. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
6. Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. Any emissions found to be within 20dB of the limit are fully investigated and the results are shown in this section.
8. The "-" shown in the following RSE tables are used to denote a noise floor measurement.
9. Some band edge measurements were performed using a channel integration method to determine compliance with the out of band average radiated spurious emissions limit in the 2483.5 – 2500MHz band. A measurement was performed using a RBW of 100kHz at the frequency with highest emission outside of band edge. For integration that does not start at 2483.5MHz, consideration was taken to ensure the worst-case emission is in the 1MHz spectrum. The results were integrated up to the 1MHz reference bandwidth to show compliance with the 15.209 radiated limit for emissions greater than 1GHz.
10. For radiated measurements, emissions were investigated for the fully-loaded RU configuration and for all the partially-loaded RU configurations. Among all of the available partially-loaded RU configurations, only the configuration with the worst case emissions is reported.
11. In this section, plots showing measurements shown as "channel power" are recorded using the integration methods described in Section 11.12.3.2 of ANSI C63.10:2020 for average and peak measurements as allowed per Section 12.7.4.4.1. Also, the average measurements include the duty cycle correction factor shown in Section 2.2 of this report.

Sample Calculations

Determining Spurious Emissions Levels

- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

Radiated Band Edge Measurement Offset

- The amplitude offset shown in the radiated restricted band edge plots in Section 7.7 was calculated using the formula:
  Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

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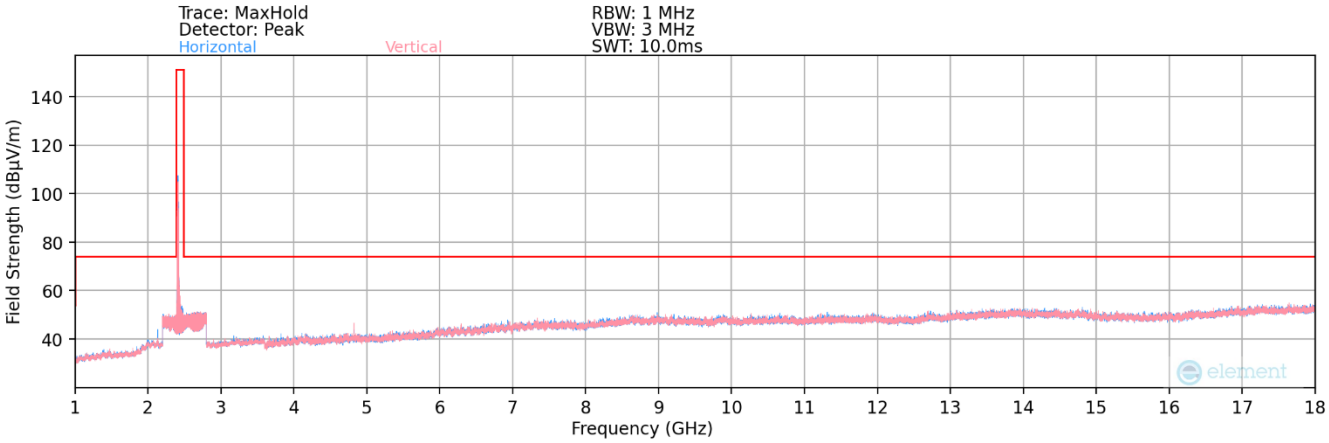
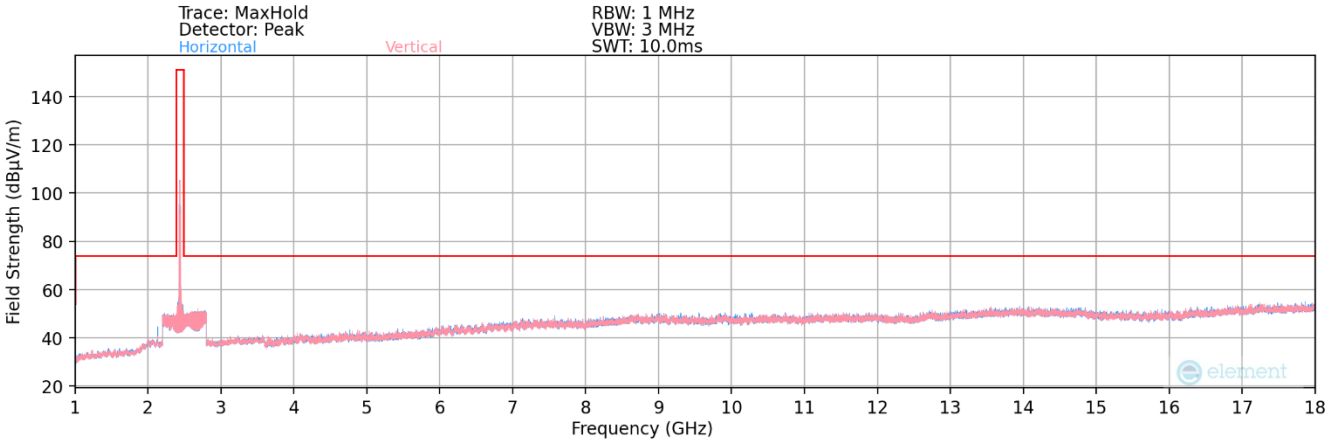
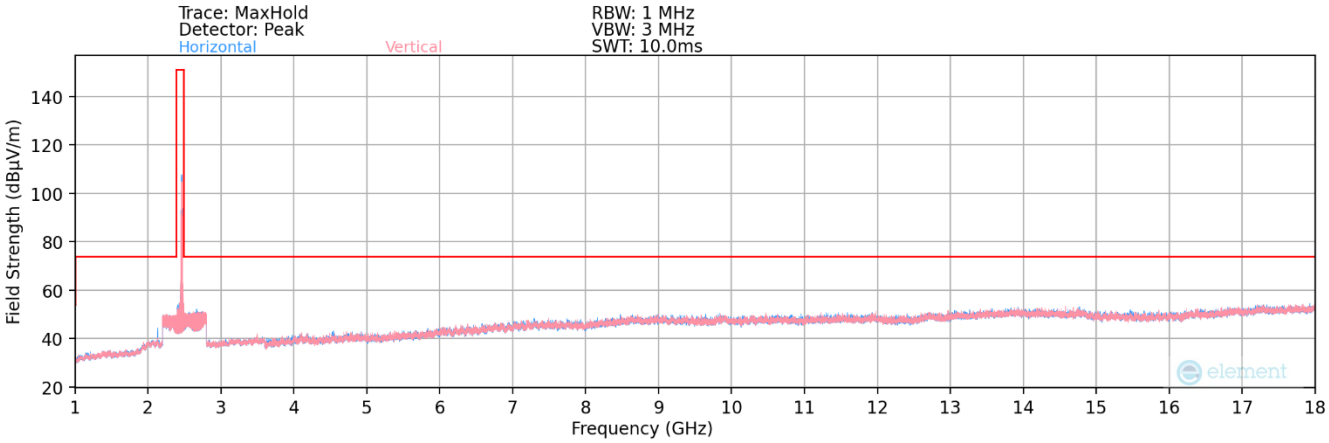
7.7.1 MIMO Radiated Spurious Emission Measurements



Plot 7-81. Radiated Spurious Plot above 1GHz MIMO (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-82. Radiated Spurious Plot above 1GHz MIMO (802.11ax OFDMA – 26 Tones – Ch. 6)



Plot 7-83. Radiated Spurious Plot above 1GHz MIMO (802.11ax OFDMA – 26 Tones – Ch. 11)

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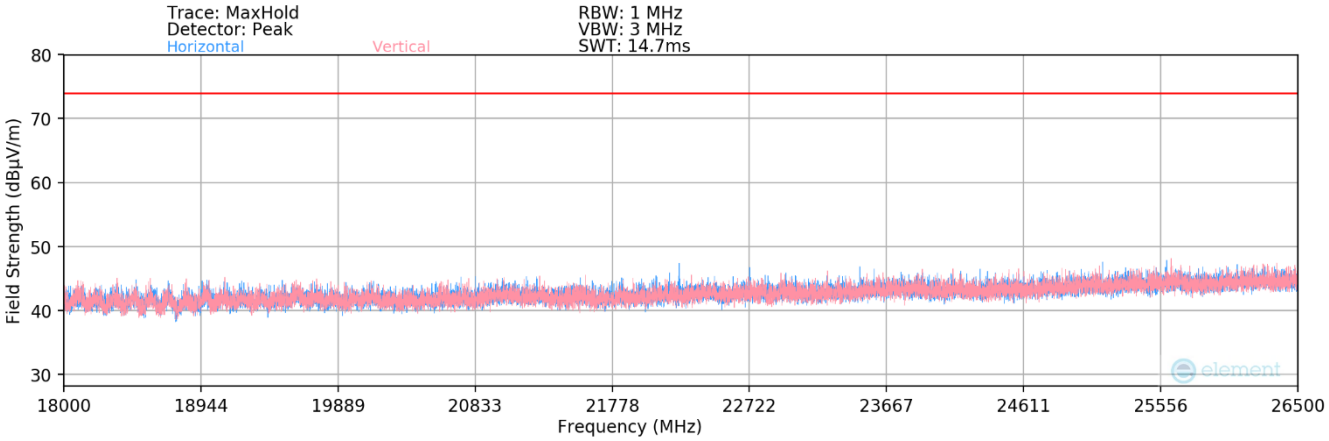

Plot 7-84. Radiated Spurious Plot above 18GHz MIMO (802.11ax OFDMA – 26 Tones)

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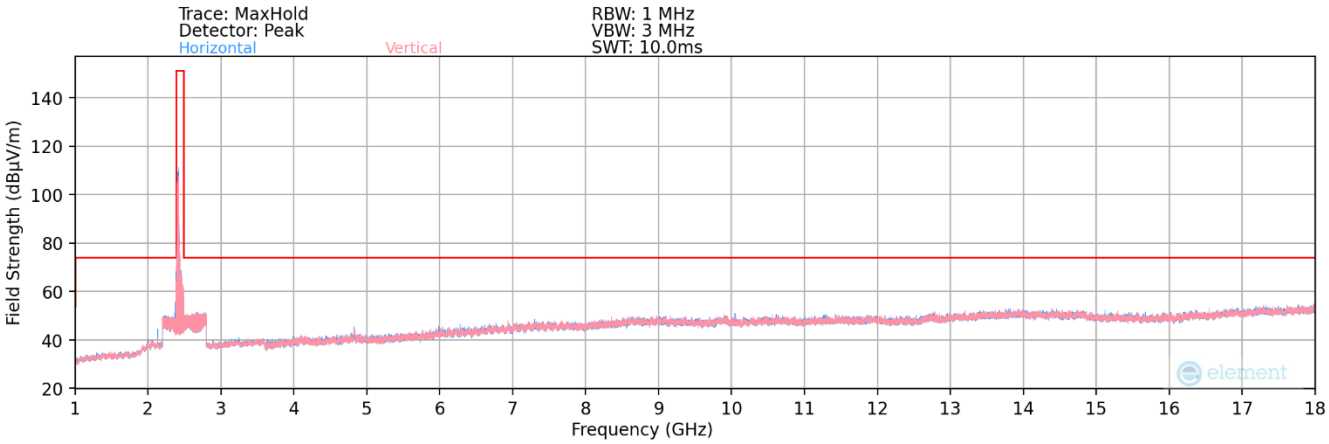
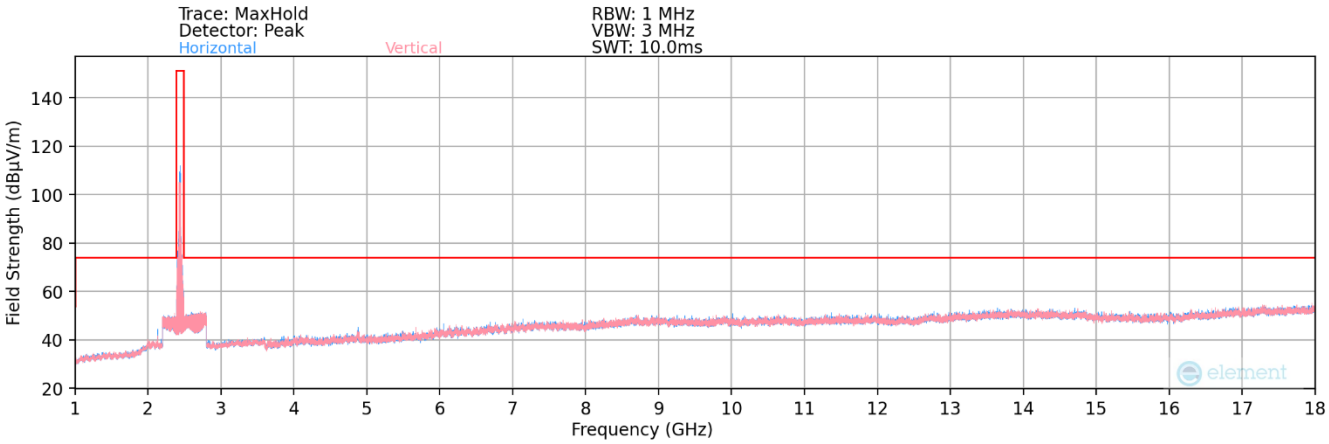
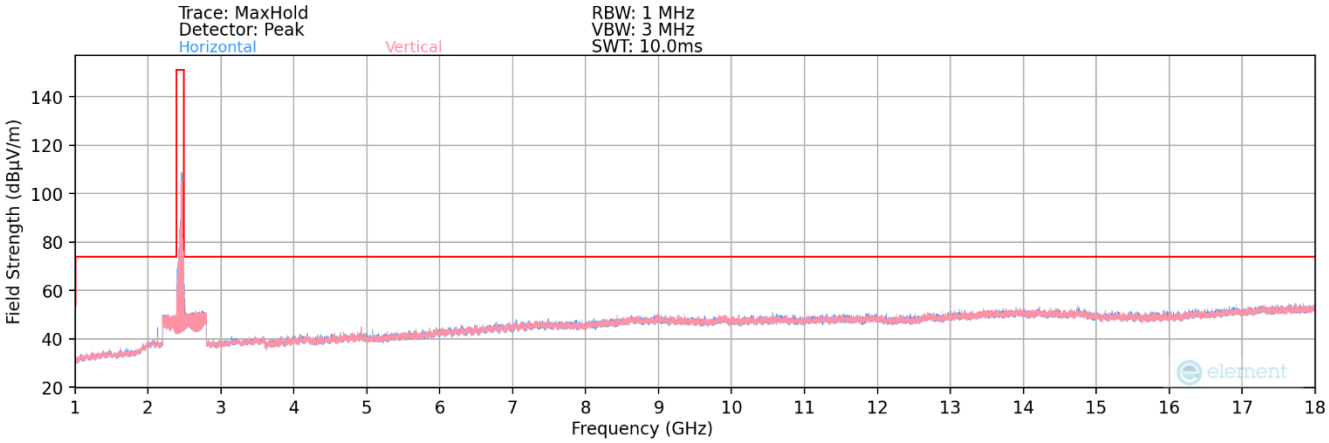


Plot 7-85. Radiated Spurious Plot above 1GHz MIMO (802.11ax OFDMA – 242 Tones – Ch. 1)



Plot 7-86. Radiated Spurious Plot above 1GHz MIMO (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-87. Radiated Spurious Plot above 1GHz MIMO (802.11ax OFDMA – 242 Tones – Ch. 11)

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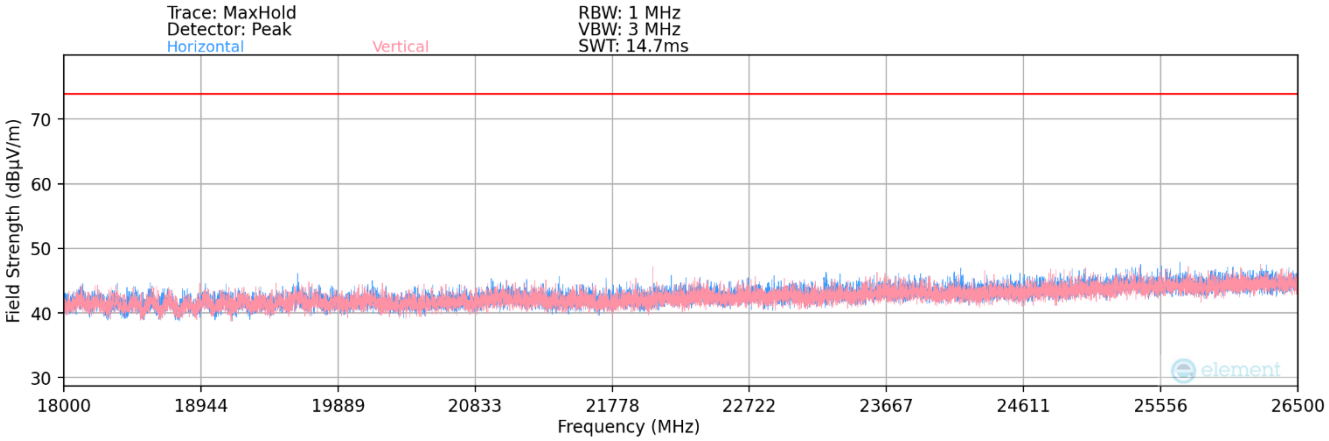

Plot 7-88. Radiated Spurious Plot above 18GHz MIMO (802.11ax OFDMA – 242 Tones)

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MIMO Radiated Spurious Emission Measurements

Worst Case Mode: 802.11ax OFDMA
Worst Case Transfer Rate: MCS0
RU Index: 4
Distance of Measurements: 3 Meters
Operating Frequency: 2412MHz
Channel: 1

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4824.00	Avg	H	254	301	-75.40	2.60	34.20	53.98	-19.78
4824.00	Peak	H	254	301	-63.01	2.60	46.59	73.98	-27.39
12060.00	Avg	H	-	-	-81.50	12.87	38.37	53.98	-15.61
12060.00	Peak	H	-	-	-69.23	12.87	50.64	73.98	-23.34

Table 7-11. Radiated Measurements MIMO (26 Tones)

Worst Case Mode: 802.11ax OFDMA
Worst Case Transfer Rate: MCS0
RU Index: 4
Distance of Measurements: 3 Meters
Operating Frequency: 2437MHz
Channel: 6

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4874.00	Avg	H	136	298	-75.77	3.08	34.31	53.98	-19.67
4874.00	Peak	H	136	298	-62.56	3.08	47.52	73.98	-26.46
7311.00	Avg	H	-	-	-79.71	9.38	36.67	53.98	-17.31
7311.00	Peak	H	-	-	-67.31	9.38	49.07	73.98	-24.91
12185.00	Avg	H	-	-	-82.17	13.11	37.94	53.98	-16.03
12185.00	Peak	H	-	-	-70.10	13.11	50.01	73.98	-23.96

Table 7-12. Radiated Measurements MIMO (26 Tones)

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Worst Case Mode: 802.11ax OFDMA
Worst Case Transfer Rate: MCS0
RU Index: 4
Distance of Measurements: 3 Meters
Operating Frequency: 2462MHz
Channel: 11

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4924.00	Avg	H	139	298	-74.71	2.81	35.10	53.98	-18.88
4924.00	Peak	H	139	298	-61.98	2.81	47.83	73.98	-26.15
7386.00	Avg	H	-	-	-79.45	9.17	36.72	53.98	-17.26
7386.00	Peak	H	-	-	-67.77	9.17	48.40	73.98	-25.58
12310.00	Avg	H	-	-	-81.80	13.44	38.64	53.98	-15.34
12310.00	Peak	H	-	-	-70.13	13.44	50.31	73.98	-23.67

Table 7-13. Radiated Measurements MIMO (26 Tones)

Worst Case Mode: 802.11ax OFDMA
Worst Case Transfer Rate: MCS0
RU Index: 61
Distance of Measurements: 3 Meters
Operating Frequency: 2412MHz
Channel: 1

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4824.00	Avg	H	138	286	-75.83	2.60	33.77	53.98	-20.21
4824.00	Peak	H	138	286	-62.94	2.60	46.66	73.98	-27.32
12060.00	Avg	H	-	-	-81.48	12.87	38.39	53.98	-15.59
12060.00	Peak	H	-	-	-69.57	12.87	50.30	73.98	-23.68

Table 7-14. Radiated Measurements MIMO (242 Tones)

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