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MEASUREMENT REPORT
FCC PART 15.247 WLAN OFDMA

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

Date of Testing:
6/3/2022-7/28/2022
Test Report Issue Date:
7/29/2022
Test Site/Location:
Element, Columbia, MD, USA
Test Report Serial No.:
1M2205240063-14.PY7

FCC ID:	**PY7-76056F**
APPLICANT:	**Sony Corporation**

Application Type:	Certification
EUT Type:	Portable Handset
Frequency Range:	2412 – 2462MHz
Modulation Type:	CCK/DSSS/OFDMA
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01 v05r02, KDB 662911 D01 v02r01, KDB 648474 D03 v01r04

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 C63.10-2013 and KDB 558074 D01 v05r02. Test results reported herein relate only to the item(s) tested.

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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MEASUREMENT REPORT

Mode	Tones	Tx Frequency [MHz]	MIMO			
			Avg Conducted		Peak Conducted	
			Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
802.11ax OFDMA	26T	2412 - 2462	14.531	11.62	83.857	19.24
802.11ax OFDMA	52T	2412 - 2462	30.638	14.86	202.411	23.06
802.11ax OFDMA	106T	2412 - 2462	54.410	17.36	366.694	25.64
802.11ax OFDMA	242T	2412 - 2462	57.095	17.57	318.917	25.04

EUT Overview

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

These measurement tests were conducted at the Element laboratory located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

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 (2451B) test laboratory with the site description on file with ISED.

- 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).

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Sony Portable Handset FCC ID: PY7-76056F**. The test data contained in this report pertains only to the emissions due to the EUT's WLAN (DTS) transmitter.

Test Device Serial No.: 94922, 99666

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900, WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR FR1, 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5 and 6 GHz), Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer

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

Table 2-1. Frequency/ Channel Operations

Note: 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 C63.10-2013 and KDB 558074 D01 v05r02. 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:

Mode	Antenna	Tone	Duty Cycle
802.11ax DTS RU	1	26T	98.7
		52T	98.7
		106T	98.6
		242T	99.2
802.11ax DTS RU	2	26T	98.8
		52T	98.7
		106T	98.6
		242T	99.4

Table 2-2. Measured Duty Cycles

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

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

Table 2-3. Frequency / Channel Operations

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

This device supports simultaneous transmission operation, which allows for two SISO channels to operate independent of one another in the 2.4GHz and 5GHz bands simultaneously on each antenna. The following tables show the worst case configurations determined during testing. The data for these configurations is contained in the UNII test report.

Configuration 1: ANT1 and ANT2 both transmitting in 2.4GHz and 5GHz modes simultaneously

Description	2.4 GHz Emission	5 GHz Emission
Antenna	1, 2	1, 2
Channel	6	100
Operating Frequency (MHz)	2437	5500
Data Rate (Mbps)	6	MCS0
Mode	802.11g	802.11ax

Table 2-4. Config-1 (MIMO 2.4GHz & 5GHz)

Configuration 2: ANT1 and ANT2 both transmitting in 2.4GHz and 6GHz modes simultaneously

Description	2.4 GHz Emission	6 GHz Emission
Antenna	1, 2	1, 2
Channel	6	1
Operating Frequency (MHz)	2437	5955
Data Rate (Mbps)	6	6
Mode	802.11g	802.11a

Table 2-5. Config-2 (MIMO 2.4GHz & 6GHz)

2.3 Test Configuration

The EUT was tested per the guidance of KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing. See Sections 3.2 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

Following antenna was used for the testing.

Frequency [GHz]	Antenna 1 Gain [dBi]	Antenna 2 Gain [dBi]
2.4	-1.3	-8.7

Table 2-6. Antenna Peak Gain

2.5 Software and Firmware

The test was conducted with software/firmware version 3.103 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.

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 C63.10-2013) and the guidance provided in KDB 558074 D01 v05r02 were 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 474788 D01 v01r01.

3.3 Environmental Conditions

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

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.

5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. 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

6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements 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
-	WL25-1	Conducted Cable Set (25GHz)	12/19/2021	Annual	12/19/2022	WL25-1
-	WL25-2	Conducted Cable Set (25GHz)	12/19/2021	Annual	12/19/2022	WL25-2
-	ETS-001	EMC Cable and Switch System	12/9/2021	Annual	12/9/2022	ETS-001
-	AP2-001	EMC Cable and Switch System	1/4/2022	Annual	1/4/2023	AP2-001
Agilent	N9020A	MXA Signal Analyzer	3/4/2022	Annual	3/4/2023	US46470561
Emco	3115	Horn Antenna (1-18GHz)	6/18/2020	Biennial	7/25/2022	9704-5182
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	8/3/2021	Annual	8/3/2022	100342
Rohde & Schwarz	ESW44	EMI Test Receiver 2Hz to 44 GHz	3/282022	Annual	3/28/2023	101716
Sunol	DRH-118	Horn Antenna (1-18GHz)	2/14/2022	Biennial	2/14/2024	A050307
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	7/27/2020	Biennial	7/27/2022	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

Notes:

1. 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.
2. Equipment with a calibration date of “N/A” shown in this list was not used to make direct calibrated measurements.

7.0 TEST RESULTS

7.1 Summary

Company Name: Sony Corporation

FCC ID: PY7-76056F

FCC Classification: Digital Transmission System (DTS)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	6dB Bandwidth	> 500kHz	CONDUCTED	PASS	Section 7.2
15.247(b)(3)	Transmitter Output Power	< 1 Watt		PASS	Sections 7.3
15.247(e)	Transmitter Power Spectral Density	< 8dBm / 3kHz Band		PASS	Section 7.4
15.247(d)	Band Edge / Out-of-Band Emissions	≥ 20dBc		PASS	Sections 7.5, 7.6
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	RADIATED	PASS	Section 7.7

Table 7-1. Summary of Test Results

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 PCTEST "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 PCTEST "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.

7.2 6dB Bandwidth Measurement

§15.247(a.2)

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 permissible 6dB bandwidth is 500 kHz.

Test Procedure Used

ANSI C63.10-2013 – Section 11.8.2 Option 2
KDB 558074 D01 v05r02 – Section 8.2

Test Settings

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 Setup

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

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

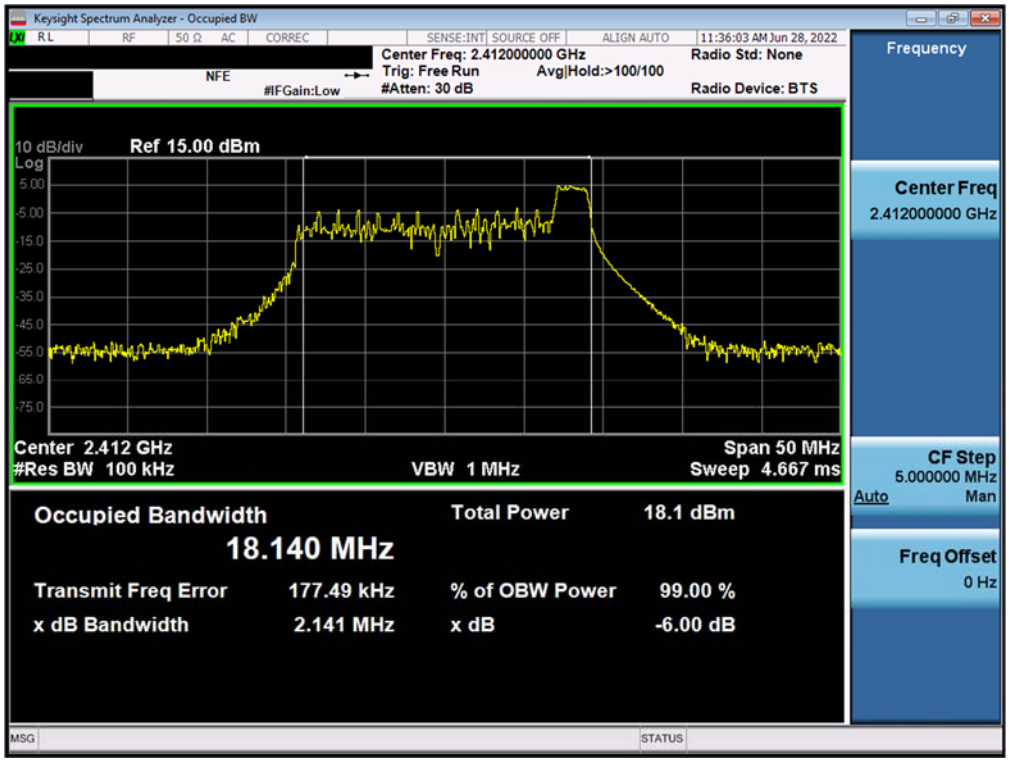
1. Based on preliminary measurements, it was determined that, of all the tone configurations, the 26T configuration produced the worst case 6dB Bandwidth measurement. Only the worst case data is included in this section.

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

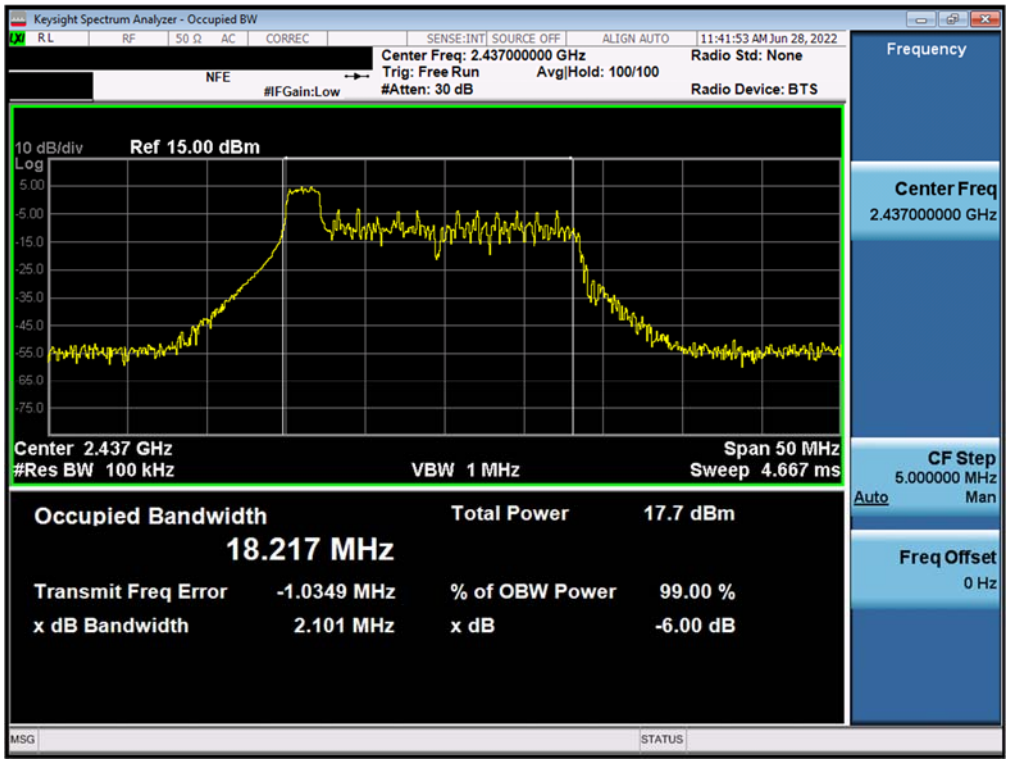
MIMO Antenna-1 6 dB Bandwidth Measurements

Frequency [MHz]	Channel No.	802.11 Mode	Tones	Data Rate [Mbps]	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
2412	1	ax	26T	MCS0	2.141	0.500
2437	6	ax	26T	MCS0	2.101	0.500
2462	11	ax	26T	MCS0	2.723	0.500
2412	1	ax	242T	MCS0	18.79	0.500
2437	6	ax	242T	MCS0	19.07	0.500
2462	11	ax	242T	MCS0	19.06	0.500

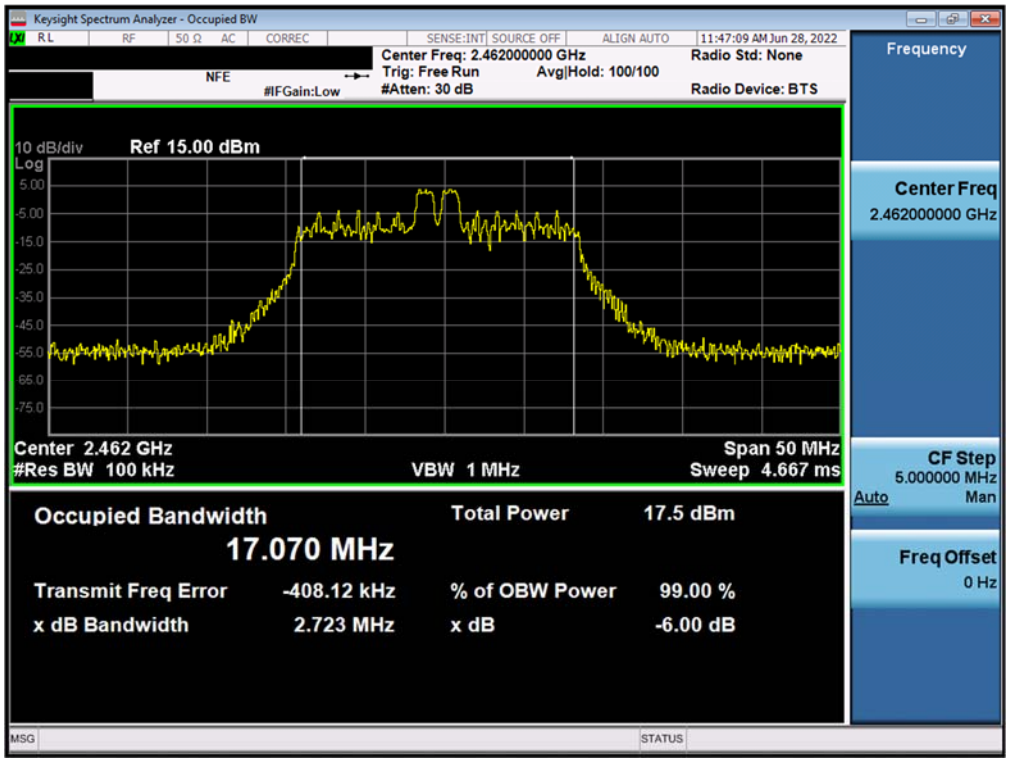
Table 7-2. Conducted Bandwidth Measurements MIMO ANT1



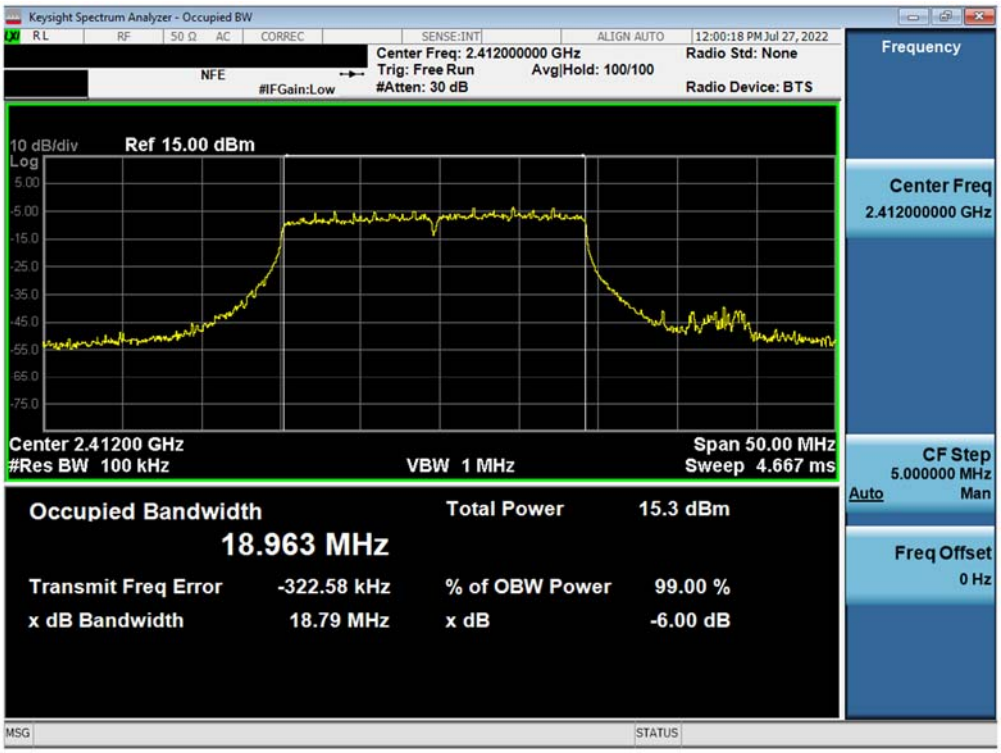
Plot 7-1. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



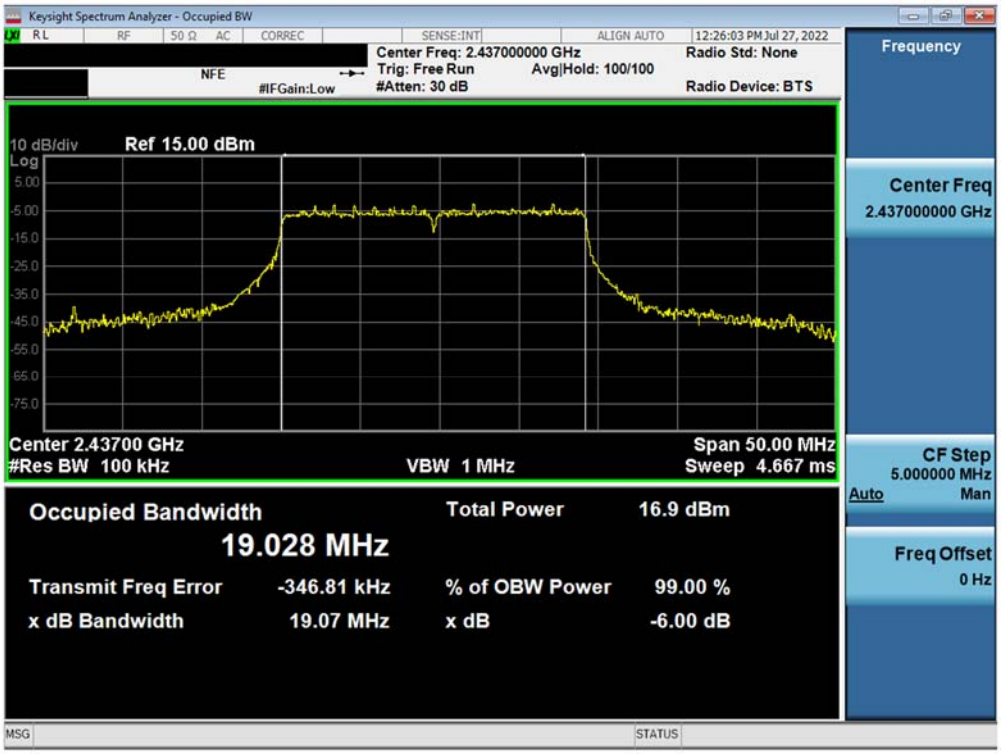
Plot 7-2. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 6)



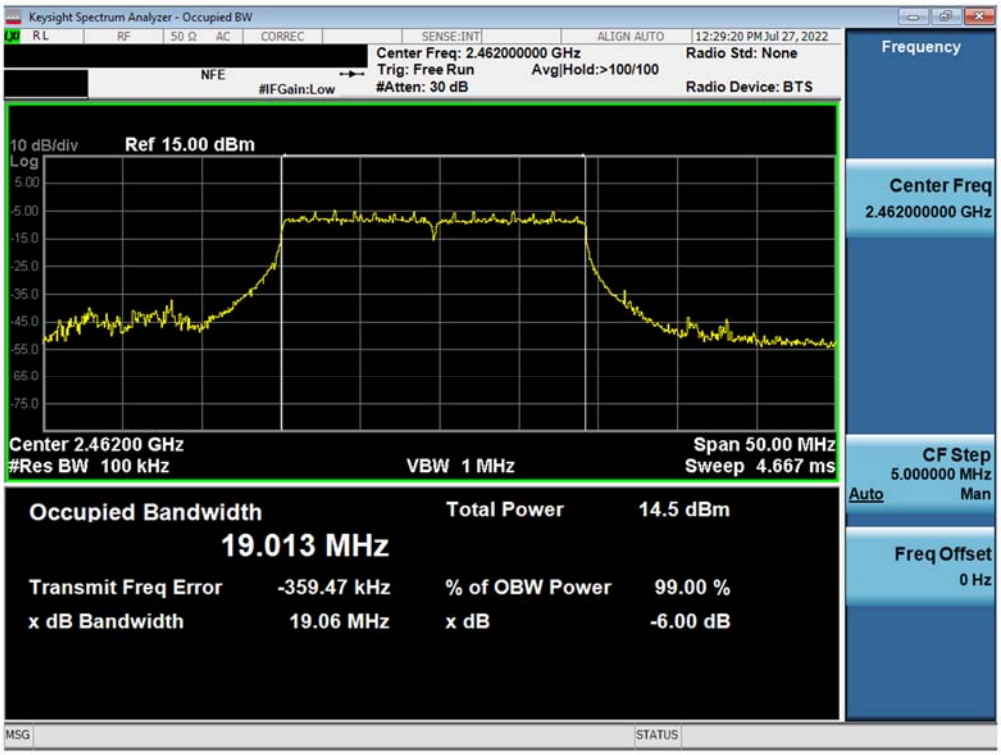
Plot 7-3. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)



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



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

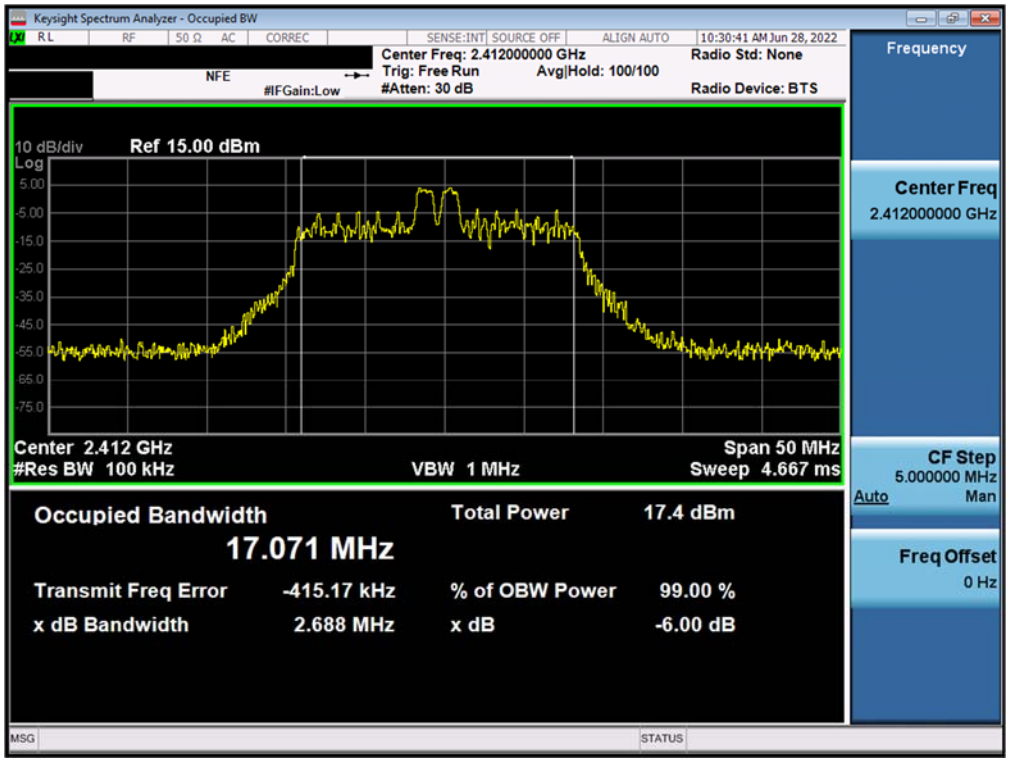


Plot 7-6. 6dB Bandwidth Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)

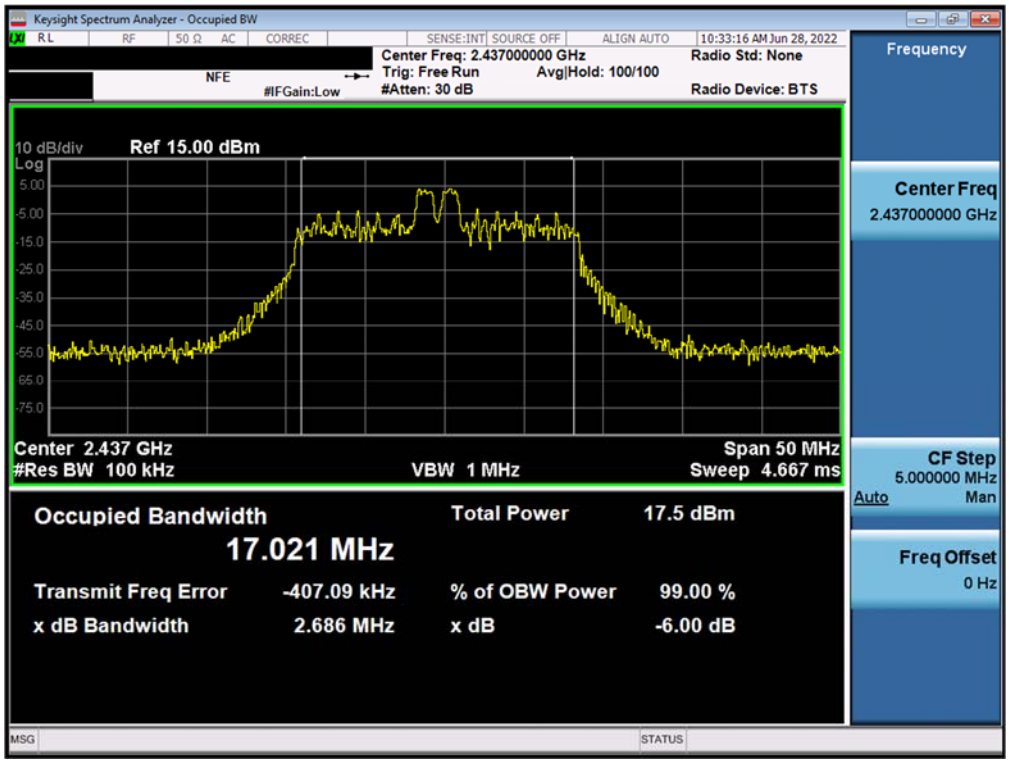
MIMO Antenna-2 6 dB Bandwidth Measurements

Frequency [MHz]	Channel No.	802.11 Mode	Tones	Data Rate [Mbps]	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
2412	1	ax	26T	MCS0	2.688	0.500
2437	6	ax	26T	MCS0	2.686	0.500
2462	11	ax	26T	MCS0	2.056	0.500
2412	1	ax	242T	MCS0	18.27	0.500
2437	6	ax	242T	MCS0	18.49	0.500
2462	11	ax	242T	MCS0	17.74	0.500

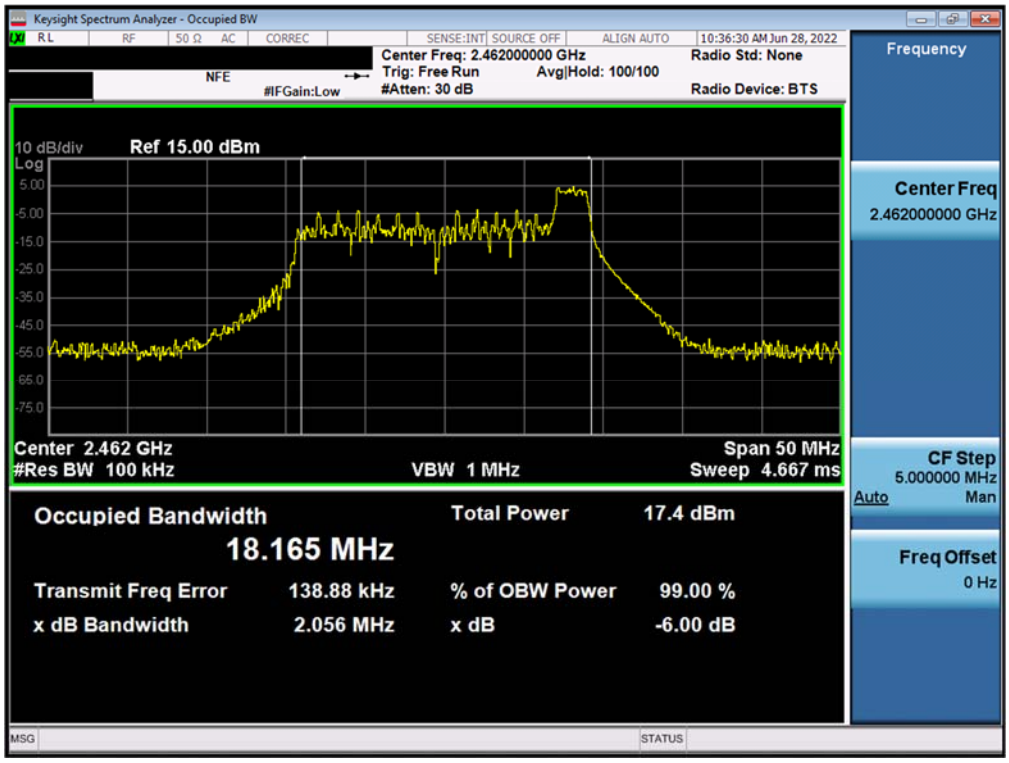
Table 7-3. Conducted Bandwidth Measurements MIMO ANT2



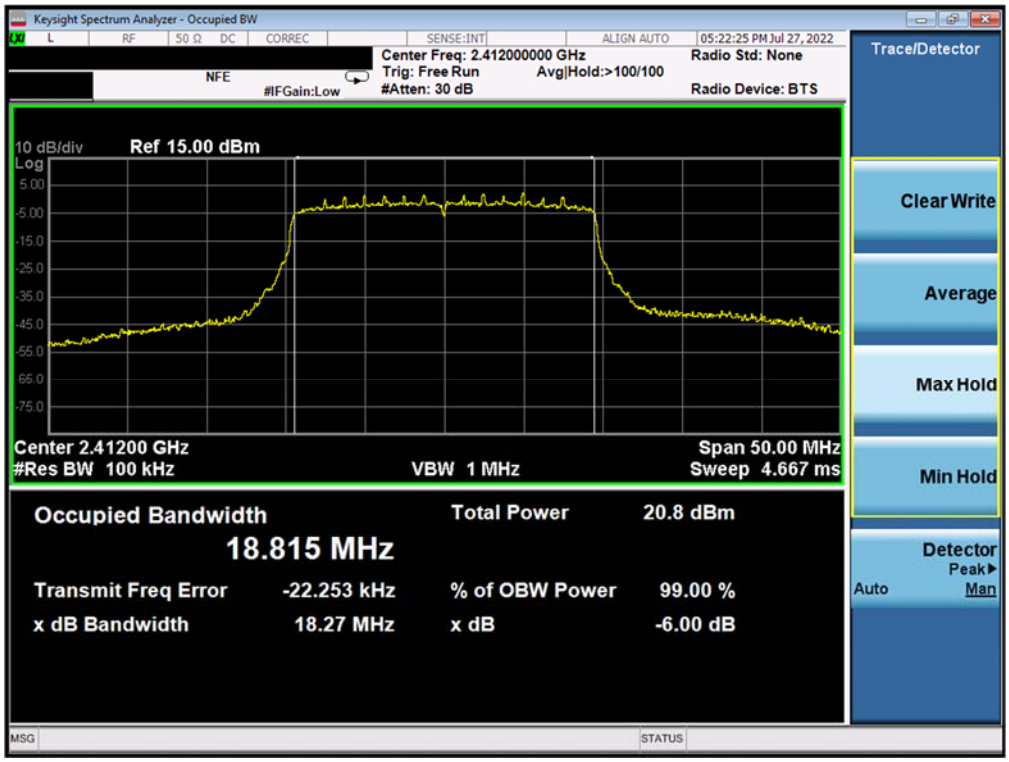
Plot 7-7. 6dB Bandwidth Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 1)



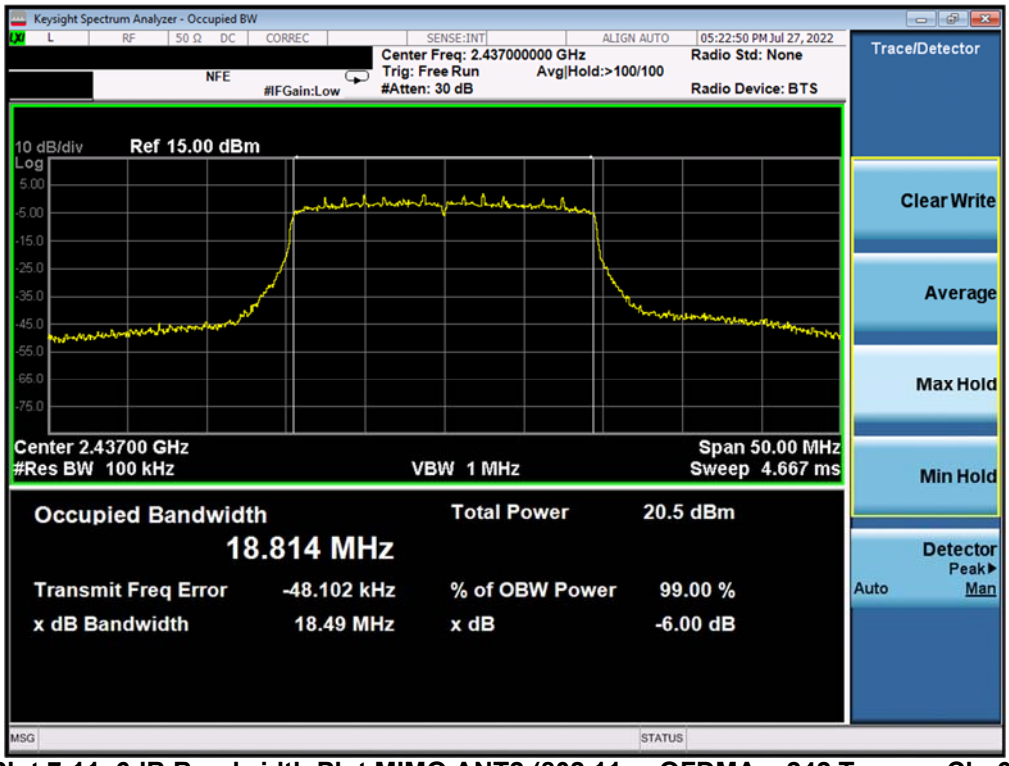
Plot 7-8. 6dB Bandwidth Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 6)



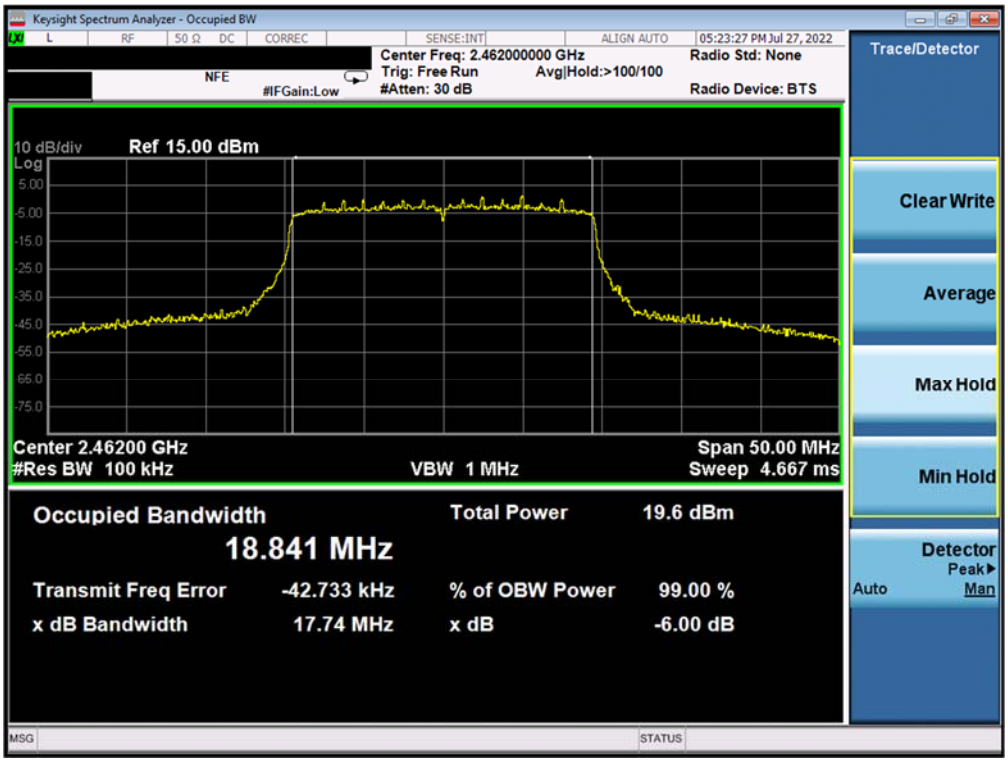
Plot 7-9. 6dB Bandwidth Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 11)



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



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



Plot 7-12. 6dB Bandwidth Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 11)

7.3 Output Power Measurement

§15.247(b.3)

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.

Test Procedure Used

ANSI C63.10-2013 – Section 11.9.1.3 PKPM1 Peak Power Method
KDB 558074 D01 v05r02 – Section 8.3.1.3 PKPM1 Peak-reading Power Meter Method
ANSI C63.10-2013 – Section 11.9.2.3.2 Method AVGPM-G
KDB 558074 D01 v05r02 – Section 8.3.2.3 Measurement using a Power Meter (PM)
ANSI C63.10-2013 – Section 14.2 Measure-and-Sum Technique
KDB 662911 D01 v02r01 – Section E)1) 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

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]
						ANT1	ANT2	MIMO		
2.4GHz	2412	1	26T	0	AVG	8.01	8.01	11.02	30.00	-18.98
					PEAK	15.33	15.28	18.32	30.00	-11.68
				4	AVG	8.36	8.57	11.48	30.00	-18.52
					PEAK	16.14	16.11	19.14	30.00	-10.86
				8	AVG	8.93	8.27	11.62	30.00	-18.38
					PEAK	16.25	16.20	19.24	30.00	-10.76
	2437	6	26T	0	AVG	8.90	8.19	11.57	30.00	-18.43
					PEAK	16.24	15.78	19.03	30.00	-10.97
				4	AVG	8.33	8.47	11.41	30.00	-18.59
					PEAK	15.83	16.11	18.98	30.00	-11.02
				8	AVG	8.02	8.02	11.03	30.00	-18.97
					PEAK	15.59	15.49	18.55	30.00	-11.45
	2462	11	26T	0	AVG	8.10	8.26	11.19	30.00	-18.81
					PEAK	15.82	15.93	18.89	30.00	-11.11
				4	AVG	8.25	8.33	11.30	30.00	-18.70
					PEAK	15.77	15.80	18.80	30.00	-11.20
				8	AVG	7.72	8.41	11.09	30.00	-18.91
					PEAK	15.31	16.09	18.73	30.00	-11.27

Table 7-4. Conducted Output Power Measurements MIMO (26 Tones)

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]
						ANT1	ANT2	MIMO		
2.4GHz	2412	1	52T	37	AVG	11.09	11.43	14.27	30.00	-15.73
					PEAK	18.52	19.09	21.82	30.00	-8.18
				38	AVG	11.31	11.88	14.61	30.00	-15.39
					PEAK	18.92	19.13	22.04	30.00	-7.96
				40	AVG	11.99	11.71	14.86	30.00	-15.14
					PEAK	19.34	19.12	22.24	30.00	-7.76
	2437	6	52T	37	AVG	11.67	11.72	14.71	30.00	-15.29
					PEAK	19.22	20.75	23.06	30.00	-6.94
				38	AVG	11.56	11.81	14.70	30.00	-15.30
					PEAK	18.81	19.19	22.01	30.00	-7.99
				40	AVG	11.04	11.33	14.20	30.00	-15.80
					PEAK	18.71	18.64	21.69	30.00	-8.31
	2462	11	52T	37	AVG	11.38	11.54	14.47	30.00	-15.53
					PEAK	18.74	19.14	21.95	30.00	-8.05
				38	AVG	11.37	11.56	14.48	30.00	-15.52
					PEAK	18.81	19.03	21.93	30.00	-8.07
				40	AVG	10.87	11.63	14.28	30.00	-15.72
					PEAK	18.47	19.33	21.93	30.00	-8.07

Table 7-5. Conducted Output Power Measurements MIMO (52 Tones)

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]
						ANT1	ANT2	MIMO		
2.4GHz	2412	1	106T	53	AVG	13.74	14.00	16.88	30.00	-13.12
					PEAK	20.96	21.30	24.14	30.00	-5.86
				54	AVG	14.46	14.23	17.36	30.00	-12.64
					PEAK	23.31	21.83	25.64	30.00	-4.36
	2437	6	106T	53	AVG	14.22	14.17	17.21	30.00	-12.79
					PEAK	21.58	21.50	24.55	30.00	-5.45
				54	AVG	13.58	13.90	16.75	30.00	-13.25
					PEAK	20.93	21.33	24.14	30.00	-5.86
	2462	11	106T	53	AVG	13.98	14.08	17.04	30.00	-12.96
					PEAK	21.26	21.47	24.38	30.00	-5.62
				54	AVG	13.60	14.10	16.87	30.00	-13.13
					PEAK	20.95	21.42	24.20	30.00	-5.80

Table 7-6. Conducted Output Power Measurements MIMO (106 Tones)

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]
						ANT1	ANT2	MIMO		
2.4GHz	2412	1	242T	61	AVG	13.13	13.21	16.18	30.00	-13.82
					PEAK	20.15	20.21	23.19	30.00	-6.81
	2437	6	242T	61	AVG	14.48	14.63	17.57	30.00	-12.43
					PEAK	22.48	21.52	25.04	30.00	-4.96
	2462	11	242T	61	AVG	12.28	12.69	15.50	30.00	-14.50
					PEAK	19.24	19.70	22.49	30.00	-7.51

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

Note:

Per ANSI C63.10-2013 and KDB 662911 D01 v02r01 Section E)1), 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 output power was measured to be 14.58 dBm for Antenna 1 and 14.58 dBm for Antenna 2.

Antenna 1 + Antenna 2 = MIMO

(14.58 dBm + 14.58 dBm) = (28.71 mW + 28.71 mW) = 57.42 mW = 17.59 dBm

7.4 Power Spectral Density

§15.247(e)

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 is 8 dBm in any 3 kHz band.

Test Procedure Used

ANSI C63.10-2013 – Section 11.10.2 Method PKPSD
KDB 558074 D01 v05r02 – Section 8.4 DTS Maximum Power Spectral Density level in the fundamental emission
ANSI C63.10-2013 – Section 14.3.2.2 Measure-and-Sum Technique
KDB 662911 D01 v02r01 – Section E)2) 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

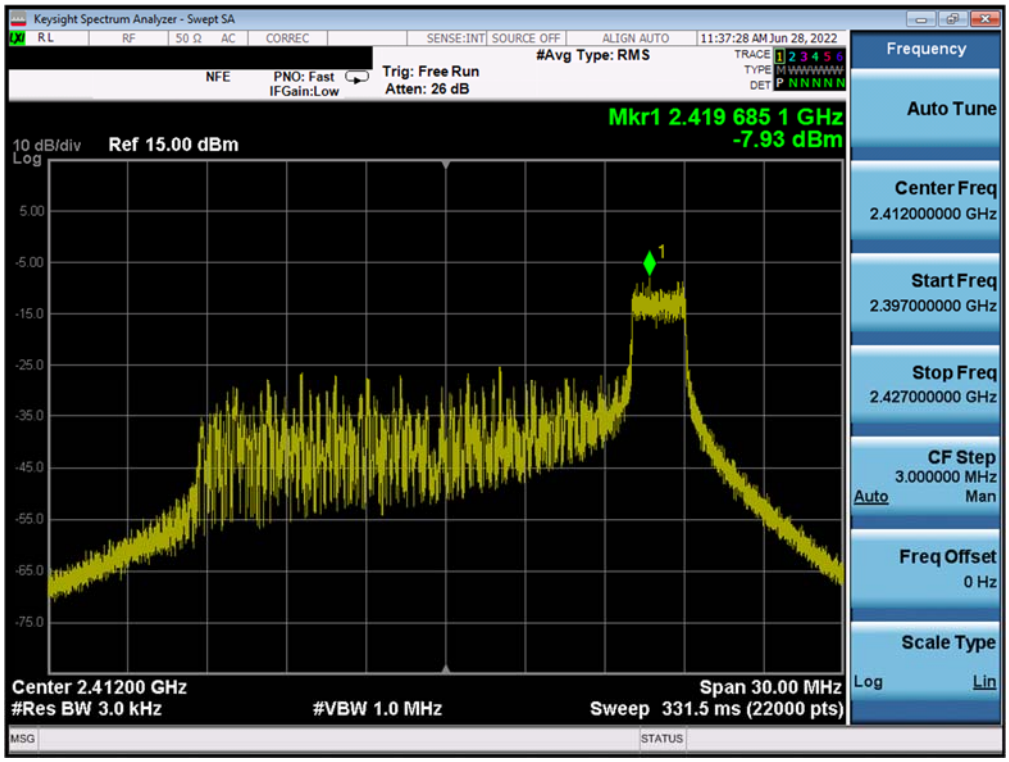
1. Based on preliminary measurements, it was determined that, of all of the tone configurations, the 26T configuration produced the worst case power spectral density measurement for partial loaded case. Therefore, only the 26 Tone configuration and 242 Tone data is included in this section.

2. The power spectral density for each channel was measured with the RU index showing the highest conducted power.

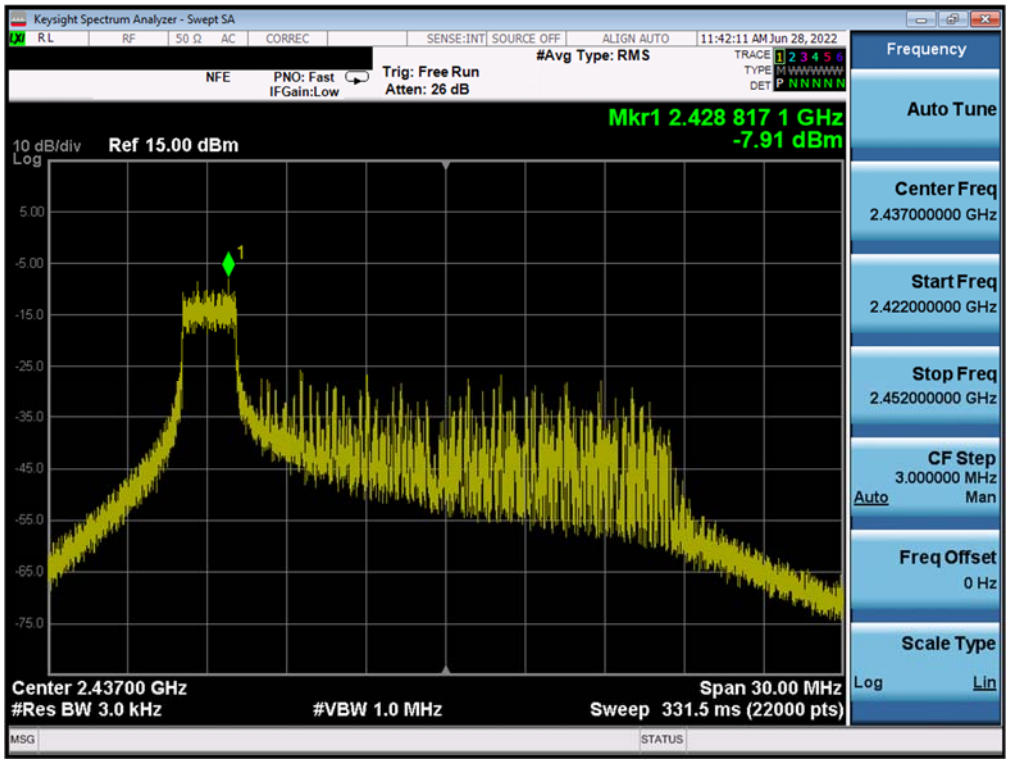
MIMO Power Spectral Density Measurements

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	-7.93	-9.19	-5.50	8.00	-13.50	Pass
2437	6	ax	26T	MCS0	-7.91	-9.10	-5.45	8.00	-13.45	Pass
2462	11	ax	26T	MCS0	-8.62	-8.39	-5.49	8.00	-13.49	Pass
2412	1	ax	242T	MCS0	-12.89	-13.53	-10.19	8.00	-18.19	Pass
2437	6	ax	242T	MCS0	-11.16	-11.58	-8.35	8.00	-16.35	Pass
2462	11	ax	242T	MCS0	-13.11	-13.66	-10.37	8.00	-18.37	Pass

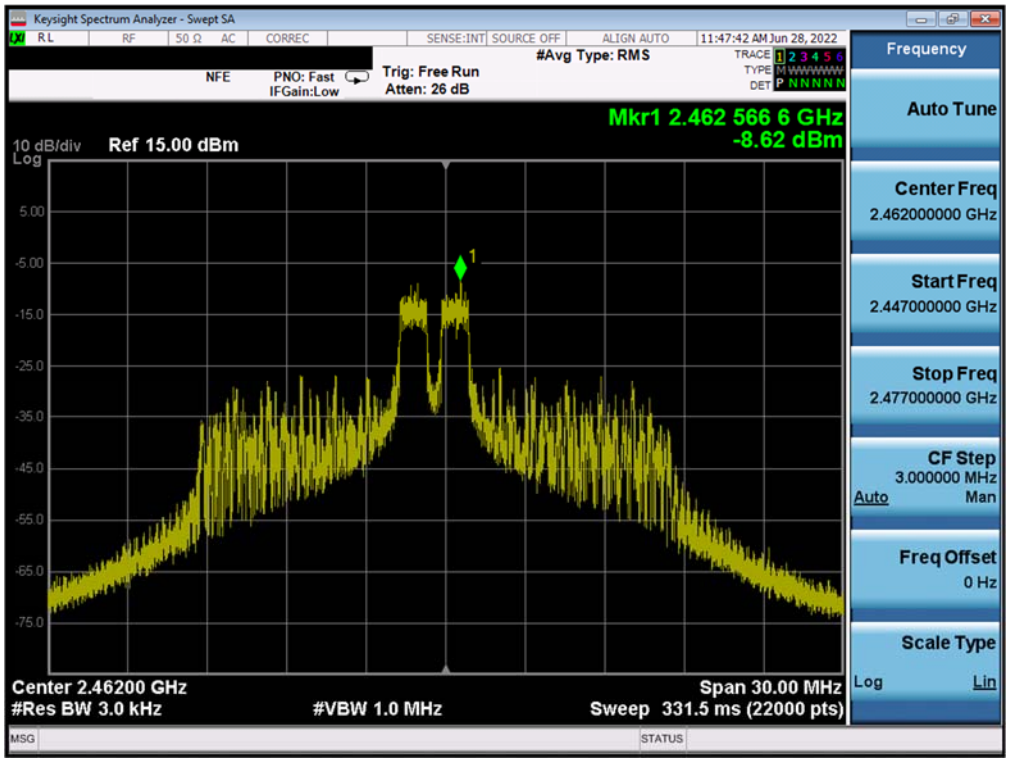
Table 7-8.MIMO Conducted Power Density Measurements



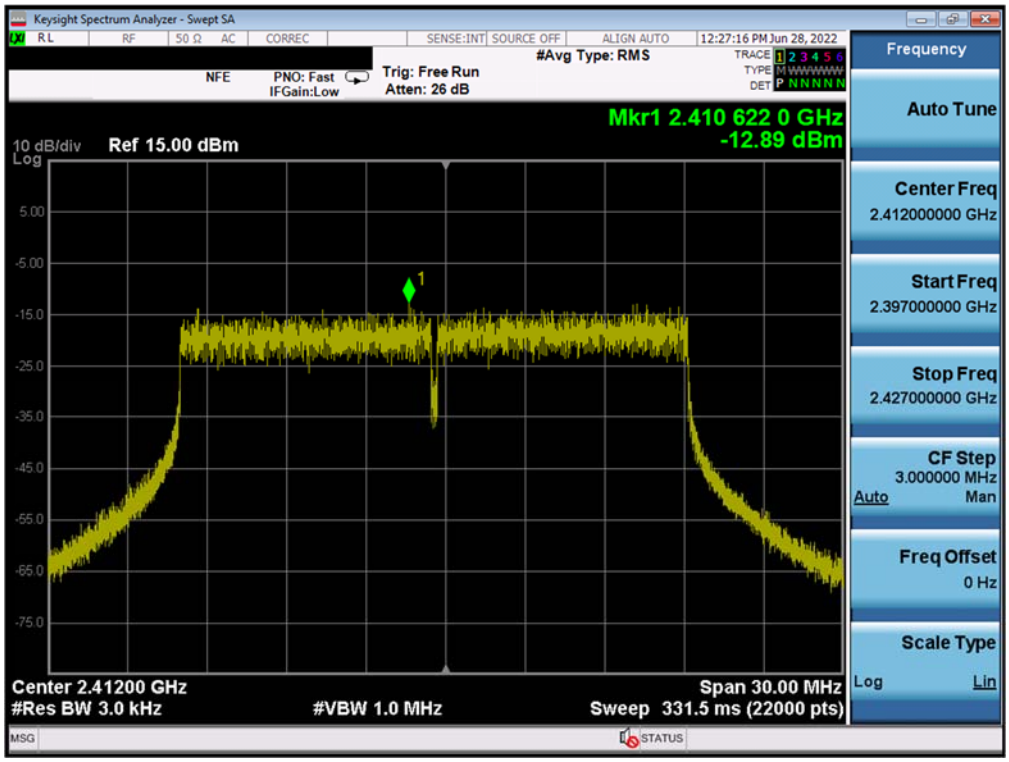
Plot 7-13. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



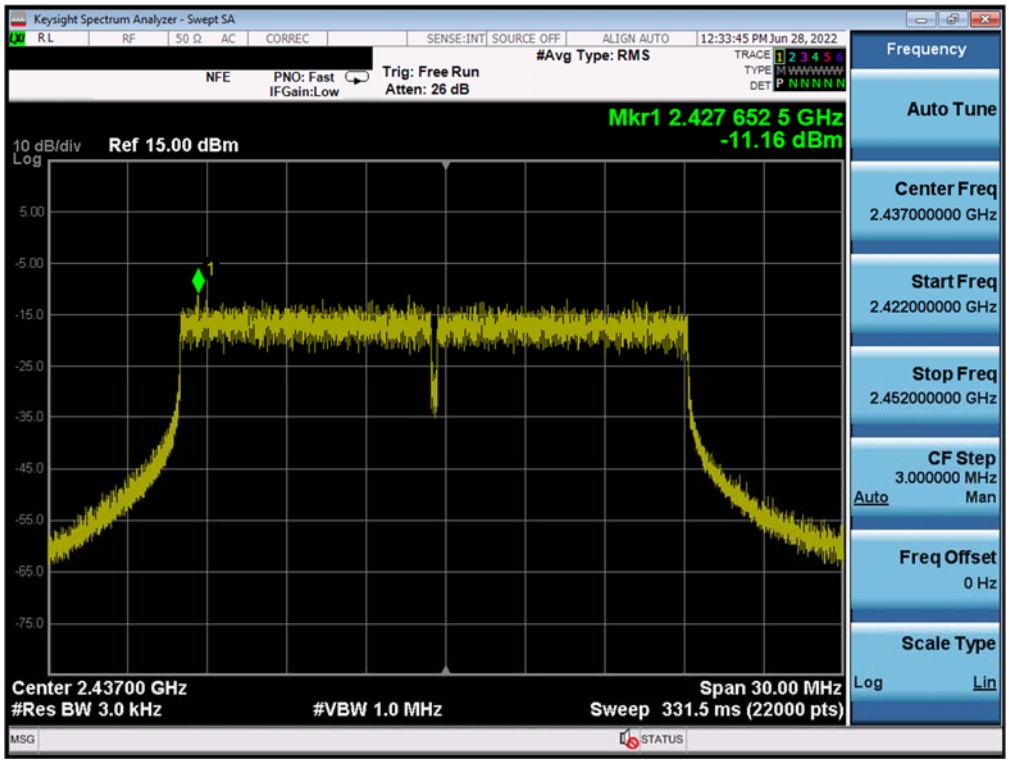
Plot 7-14. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 6)



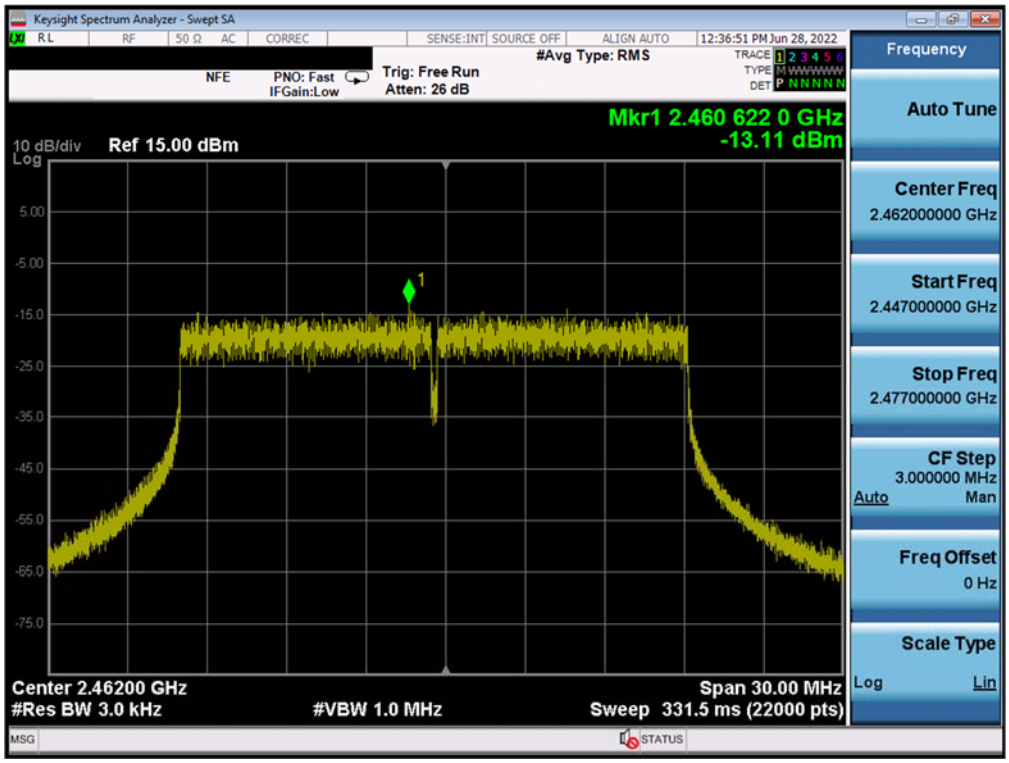
Plot 7-15. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)



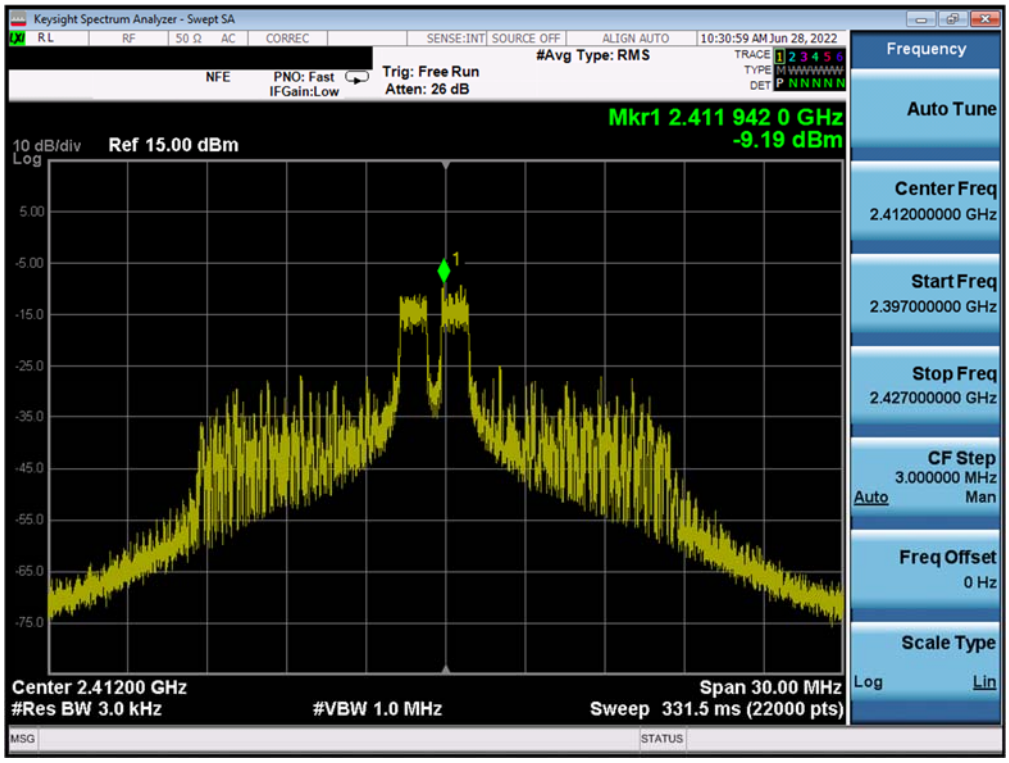
Plot 7-16. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)



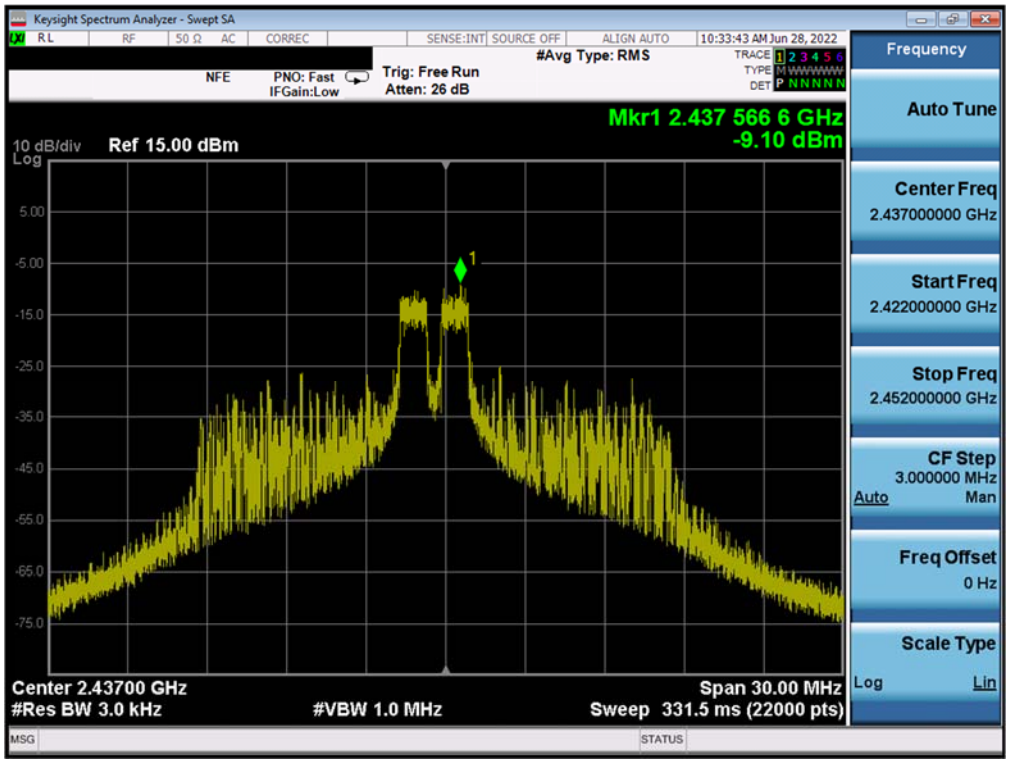
Plot 7-17. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 6)



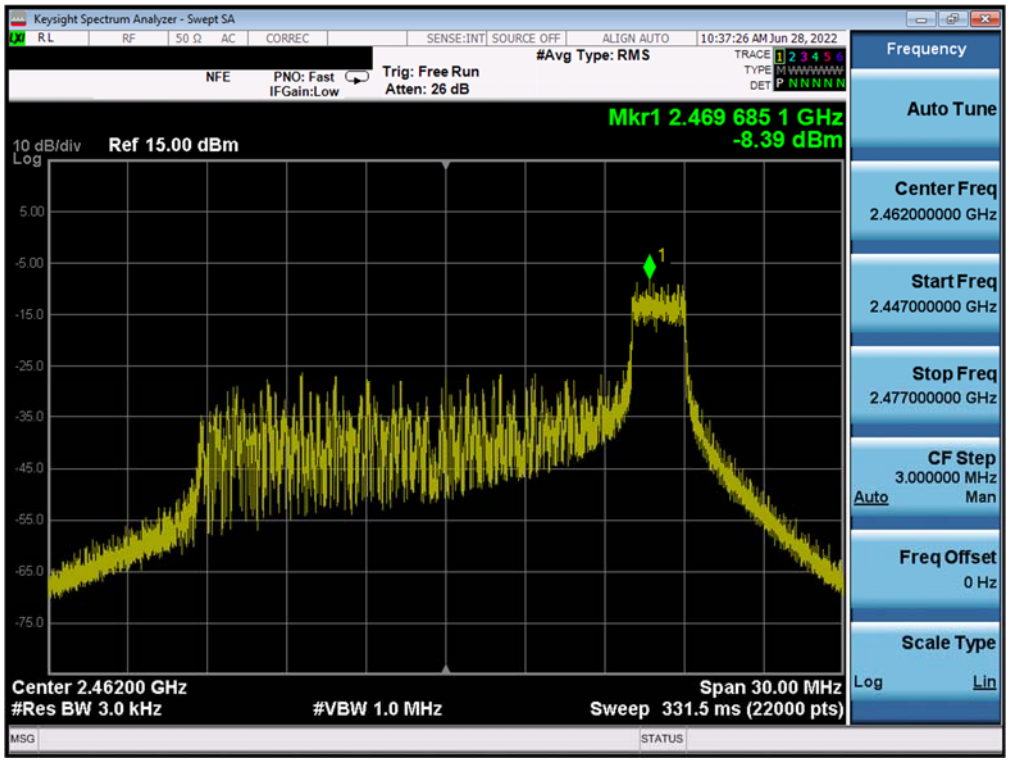
Plot 7-18. Power Spectral Density Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)



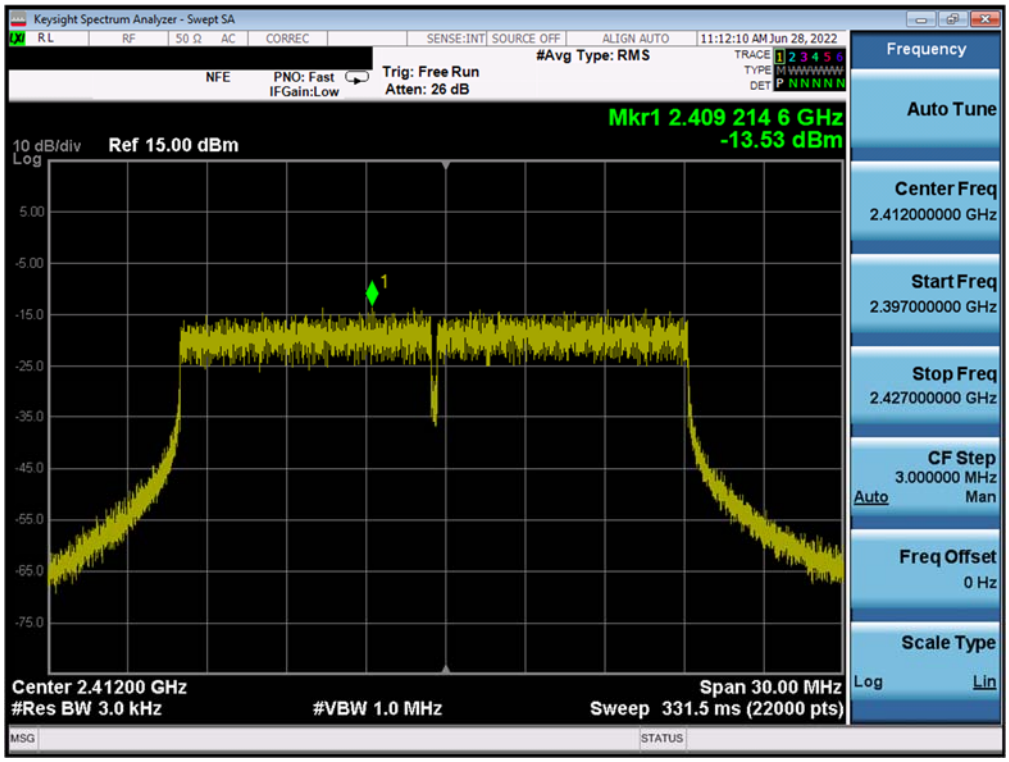
Plot 7-19. Power Spectral Density Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 1)



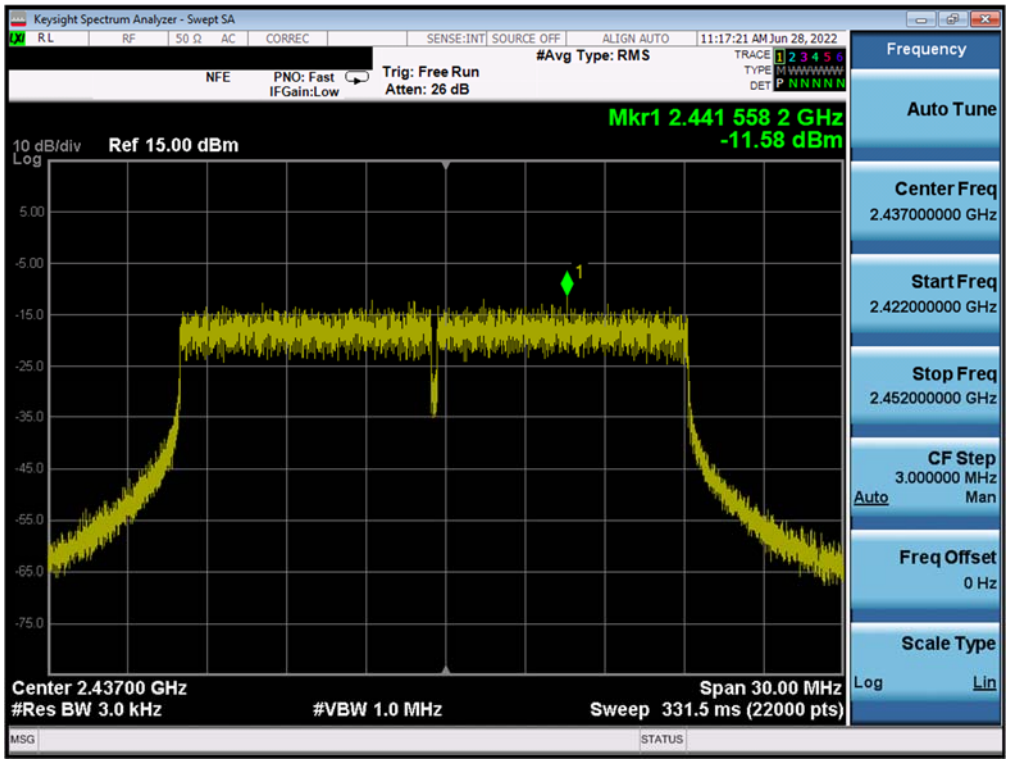
Plot 7-20. Power Spectral Density Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 6)



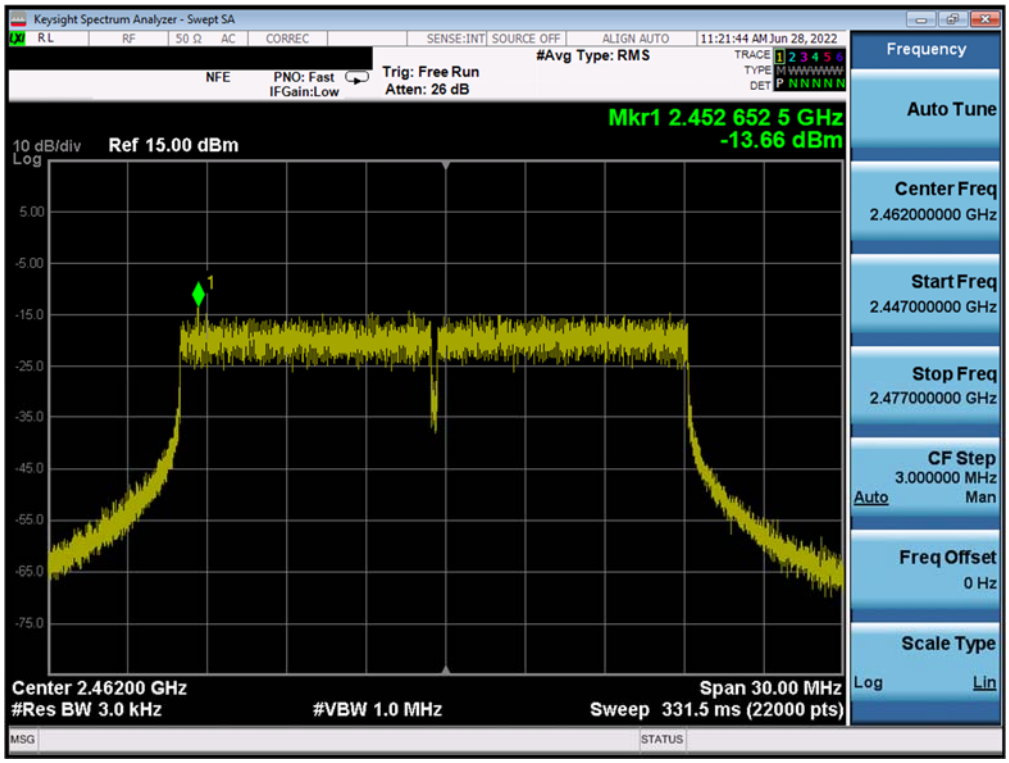
Plot 7-21. Power Spectral Density Plot MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 11)



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



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



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

Note:

Per ANSI C63.10-2013 Section 14.3.2.2 and KDB 662911 D01 v02r01 Section E)2), 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 -7.08 dBm for Antenna 1 and -7.59 dBm for Antenna 2.

Antenna 1 + Antenna 2 = MIMO

(-7.08 dBm + -7.59 dBm) = (0.20 mW + 0.17 mW) = 0.37 mW = -4.32 dBm

7.5 Conducted Emissions at the Band Edge

§15.247(d)

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 C63.10-2013 – Section 11.11.3
KDB 558074 D01 v05r02 – Section 8.7.2

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

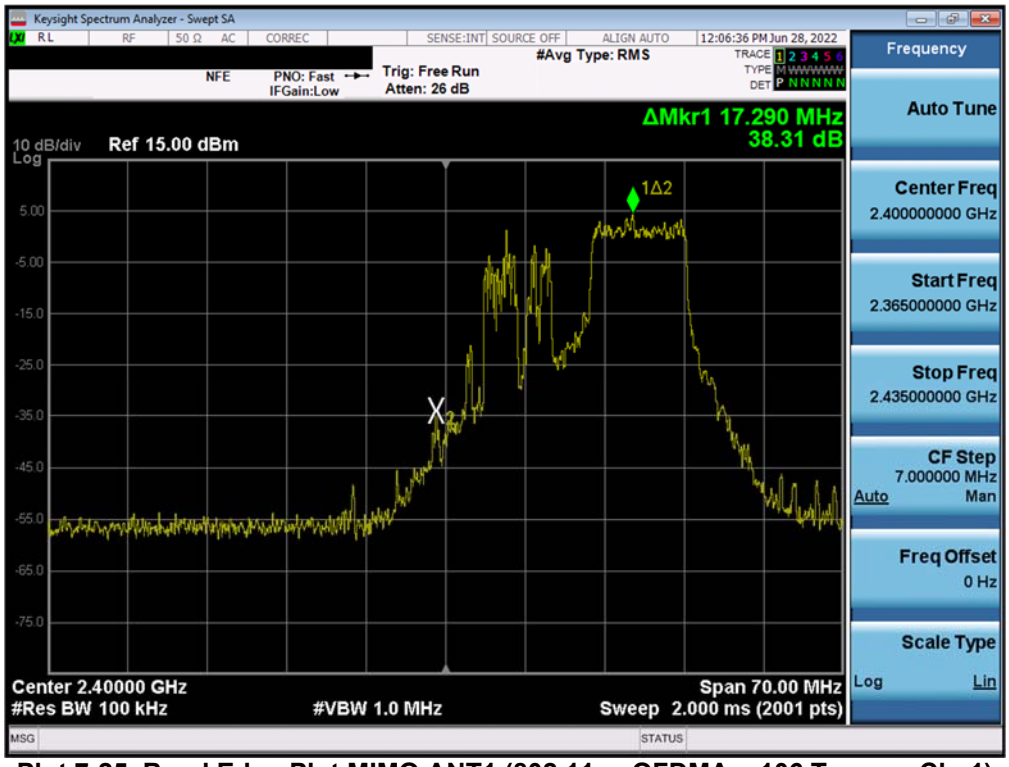
The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-4. Test Instrument & Measurement Setup

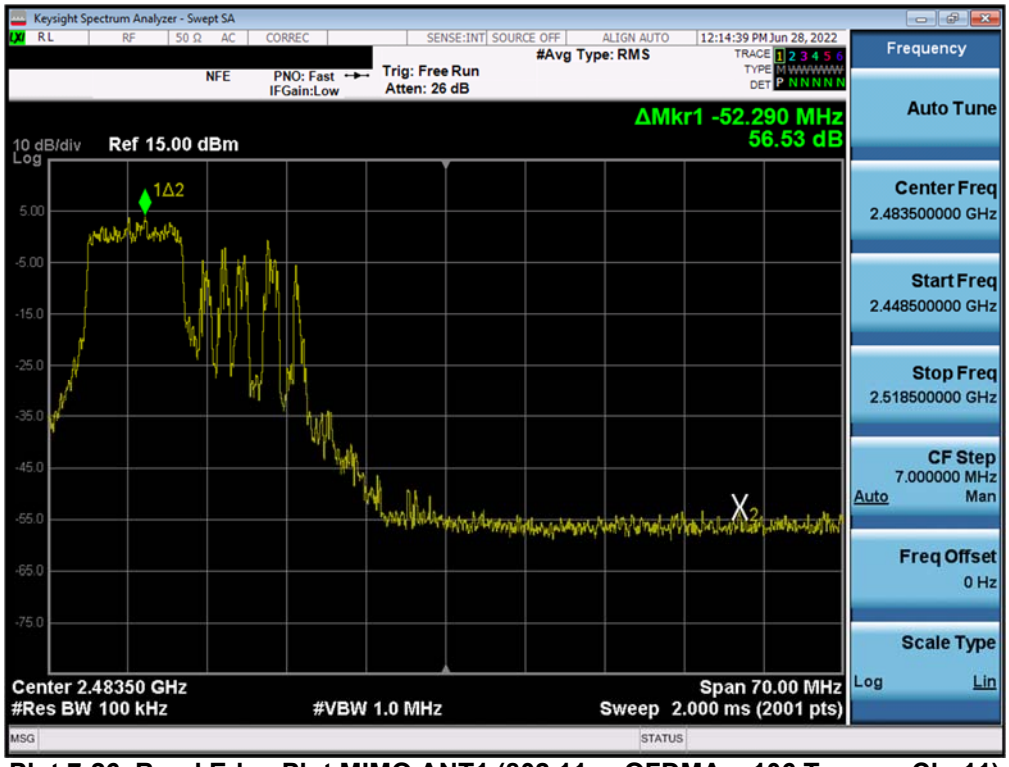
Test Notes

None

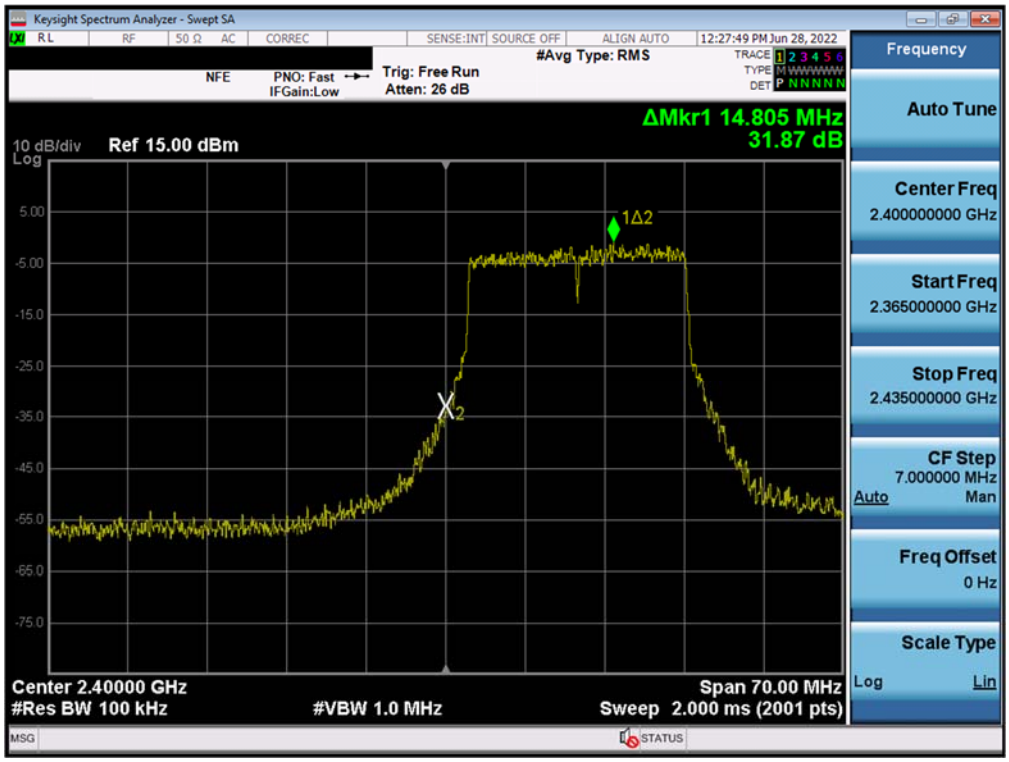
MIMO Antenna-1 Conducted Emissions at the Band Edge



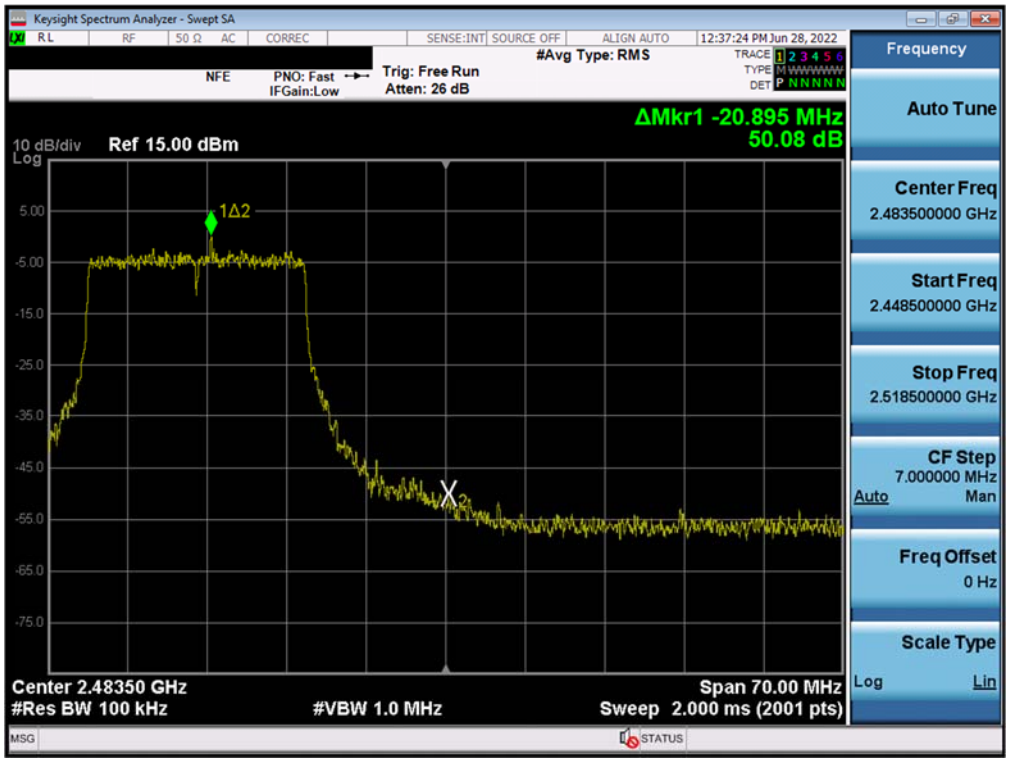
Plot 7-25. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 1)



Plot 7-26. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 11)

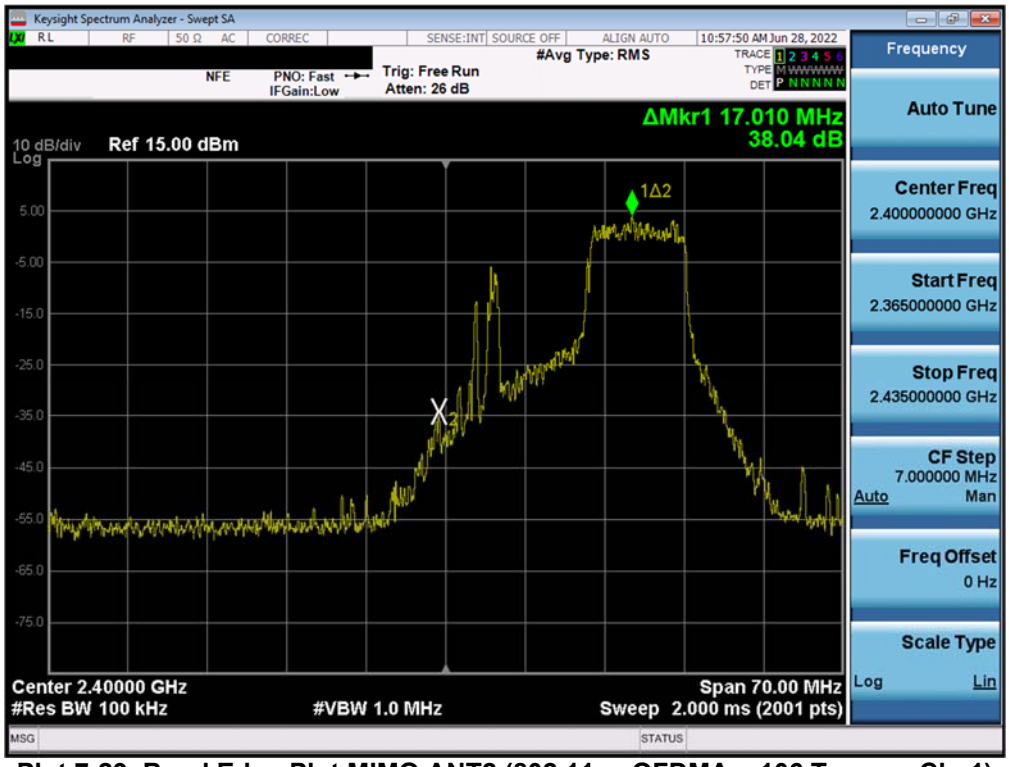


Plot 7-27. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)

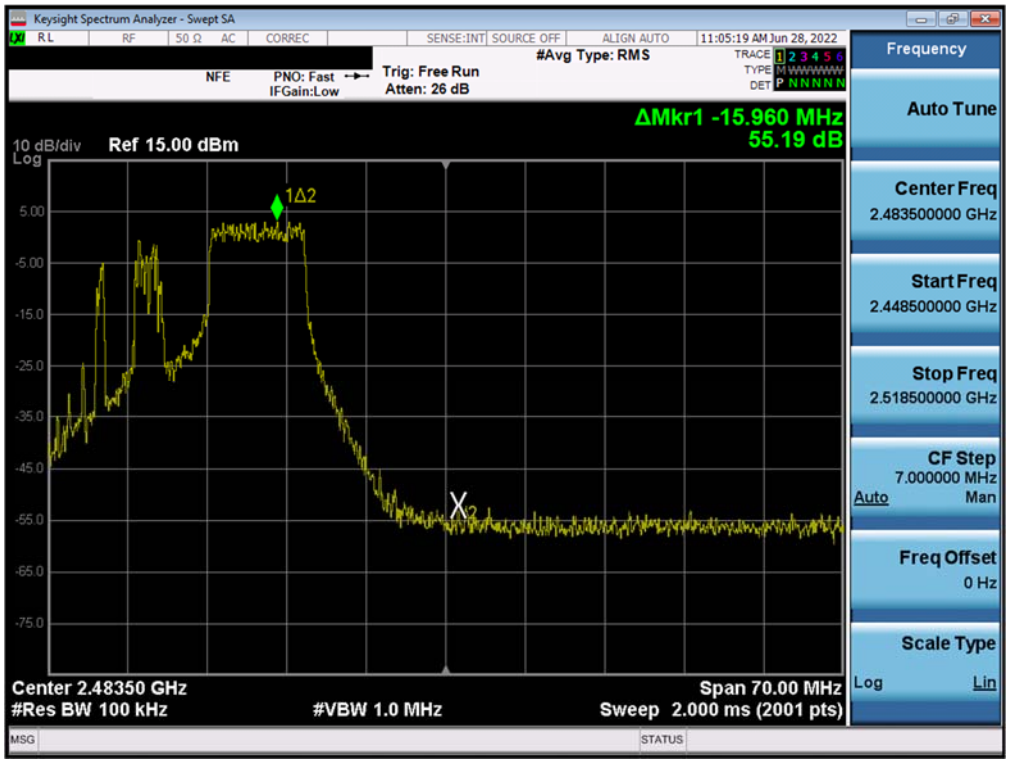


Plot 7-28. Band Edge Plot MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)

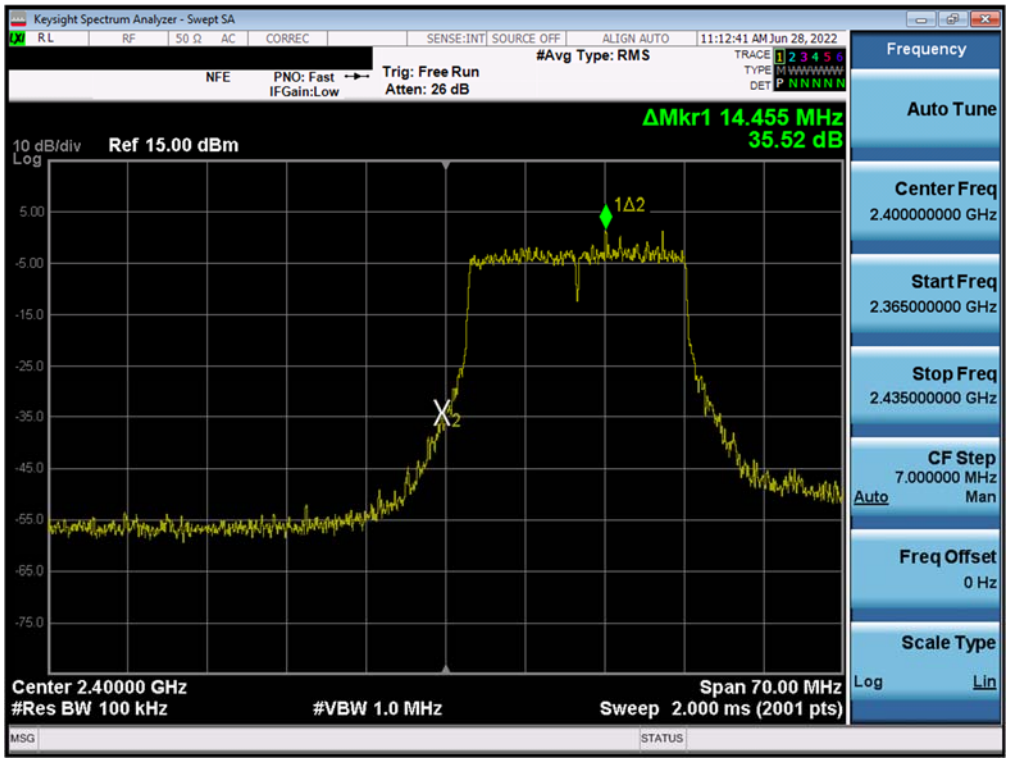
MIMO Antenna-2 Conducted Emissions at the Band Edge



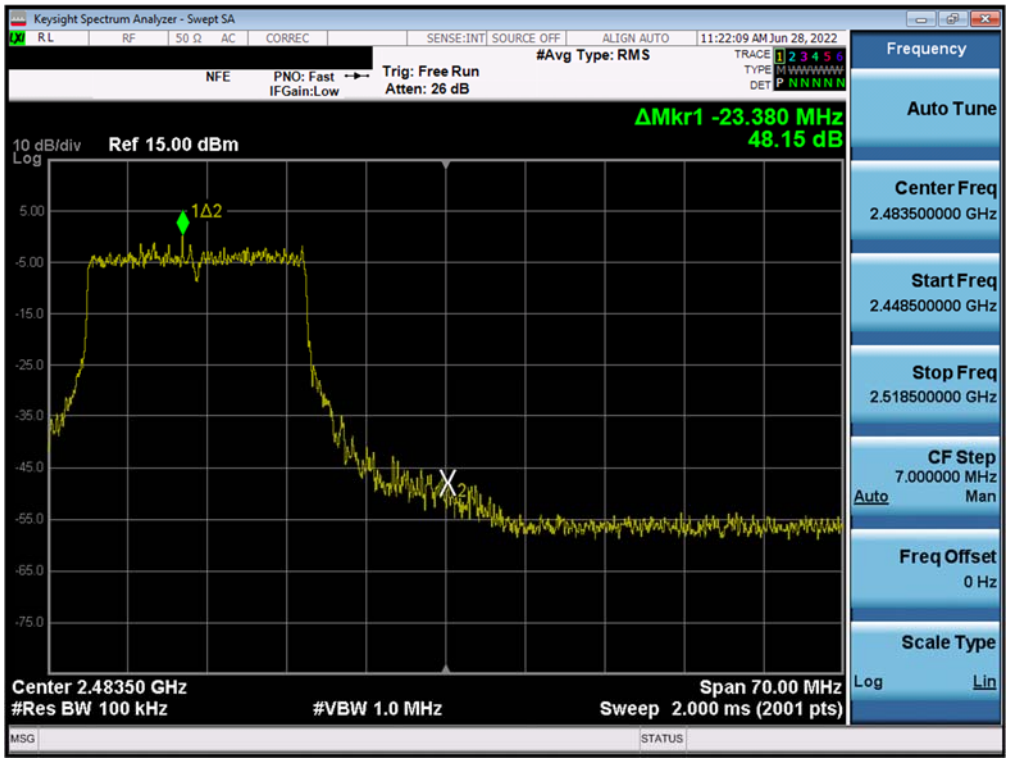
Plot 7-29. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 1)



Plot 7-30. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 11)



Plot 7-31. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 1)



Plot 7-32. Band Edge Plot MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 11)

7.6 Conducted Spurious Emissions

§15.247(d)

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 11.1 of ANSI C63.10-2013 and KDB 558074 D01 v05r02.

Test Procedure Used

ANSI C63.10-2013 – Section 11.11.3
KDB 558074 D01 v05r02 – Section 8.5
ANSI C63.10-2013 – Section 14.3.3
KDB 662911 D01 v02r01 – Section E)3)b)

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

Test Notes

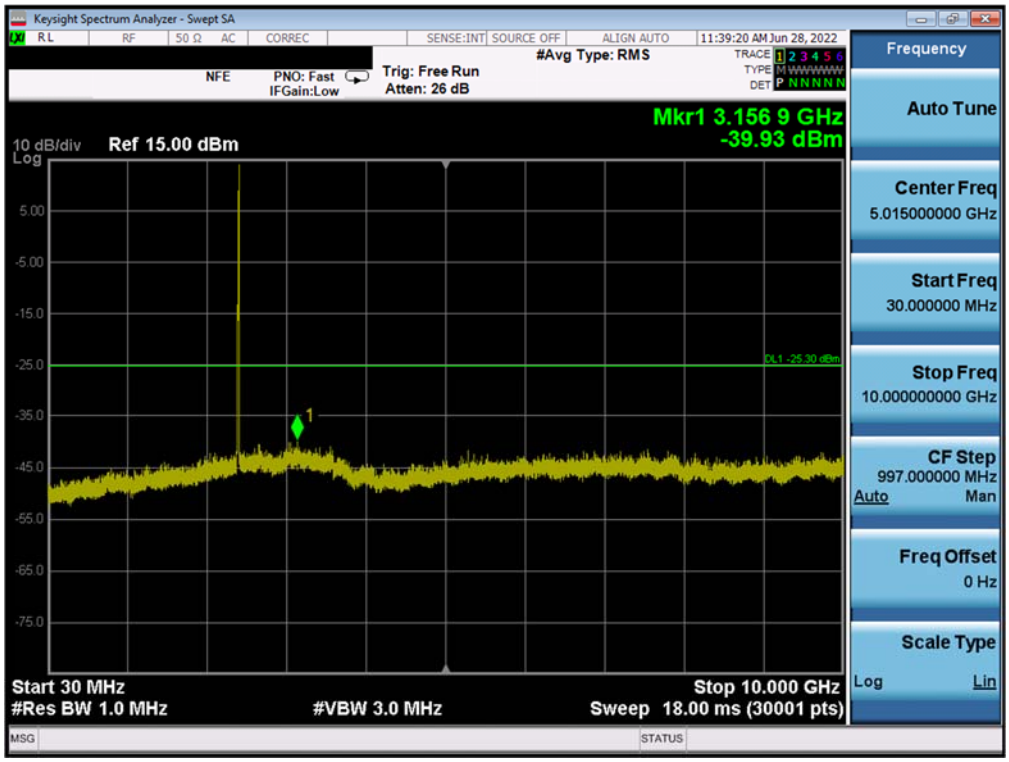
1. RBW was set to 1MHz rather than 100kHz in order to increase the measurement speed.

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.

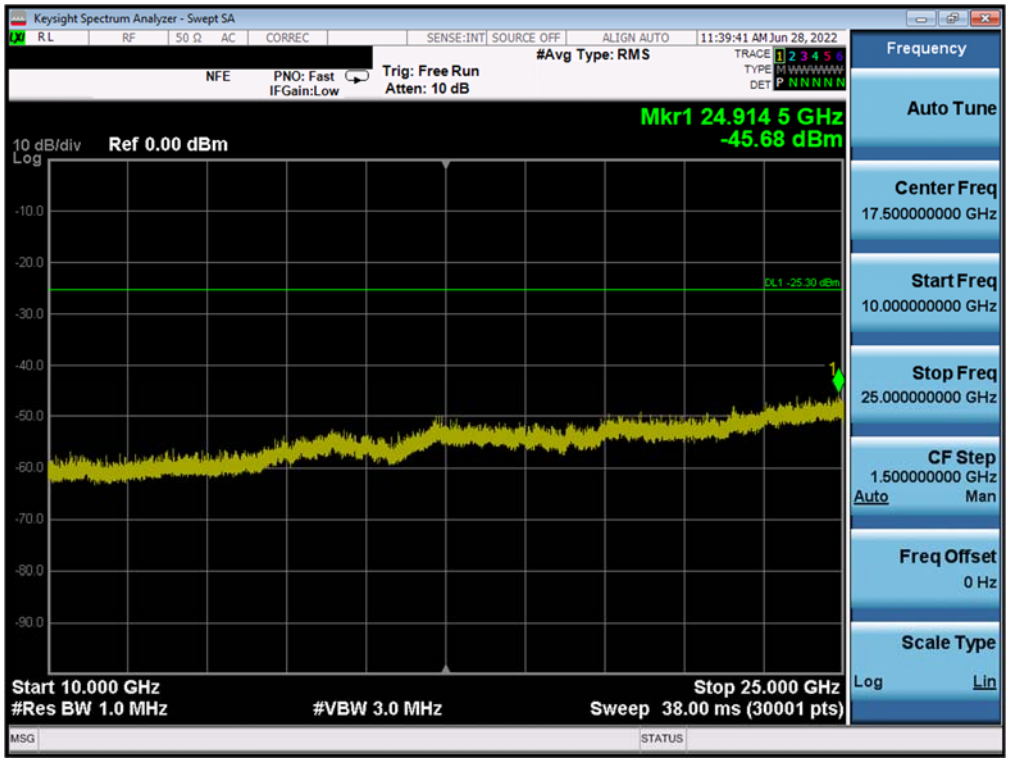
3. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present.

4. The conducted spurious emissions were measured to relative limits. Therefore, in accordance with ANSI C63.10-2013 and KDB 662911 D01 v02r01 Section E)3)b), it was unnecessary to show compliance through the summation of test results of the individual outputs.

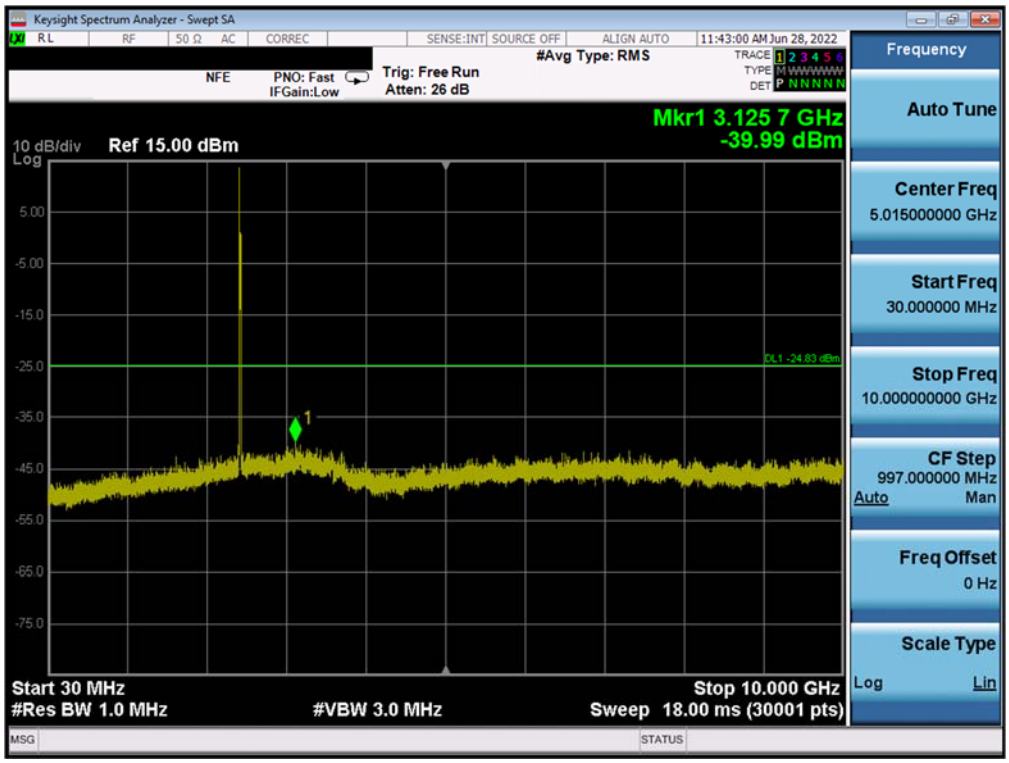
MIMO Antenna-1 Conducted Spurious Emission



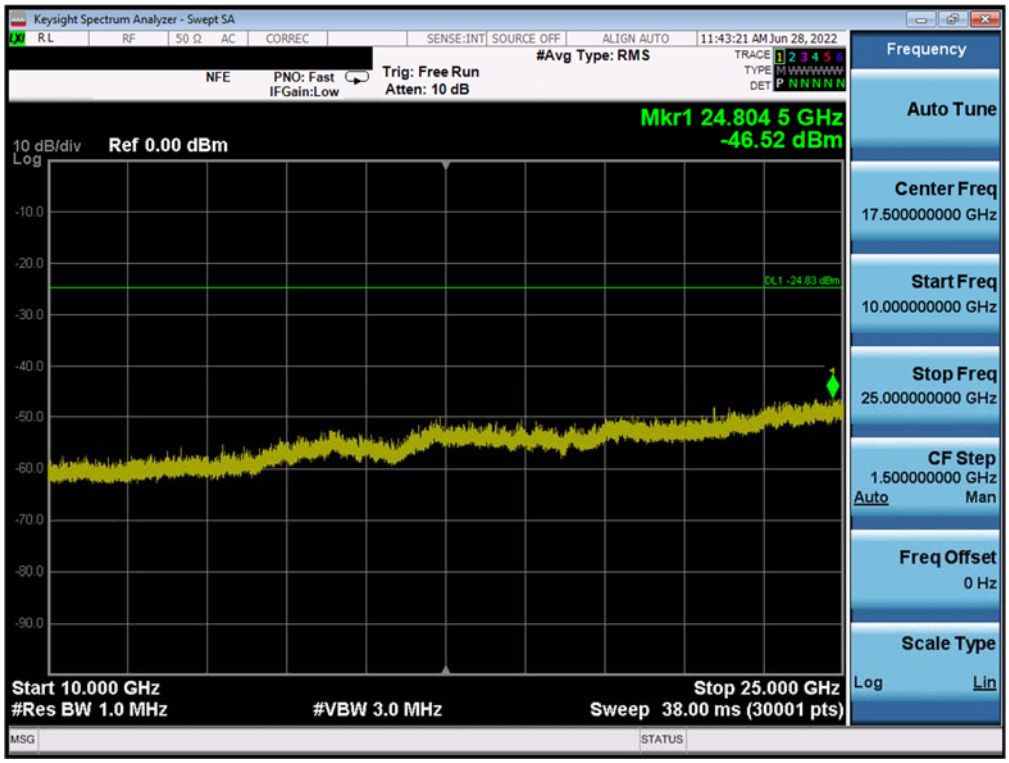
Plot 7-33. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



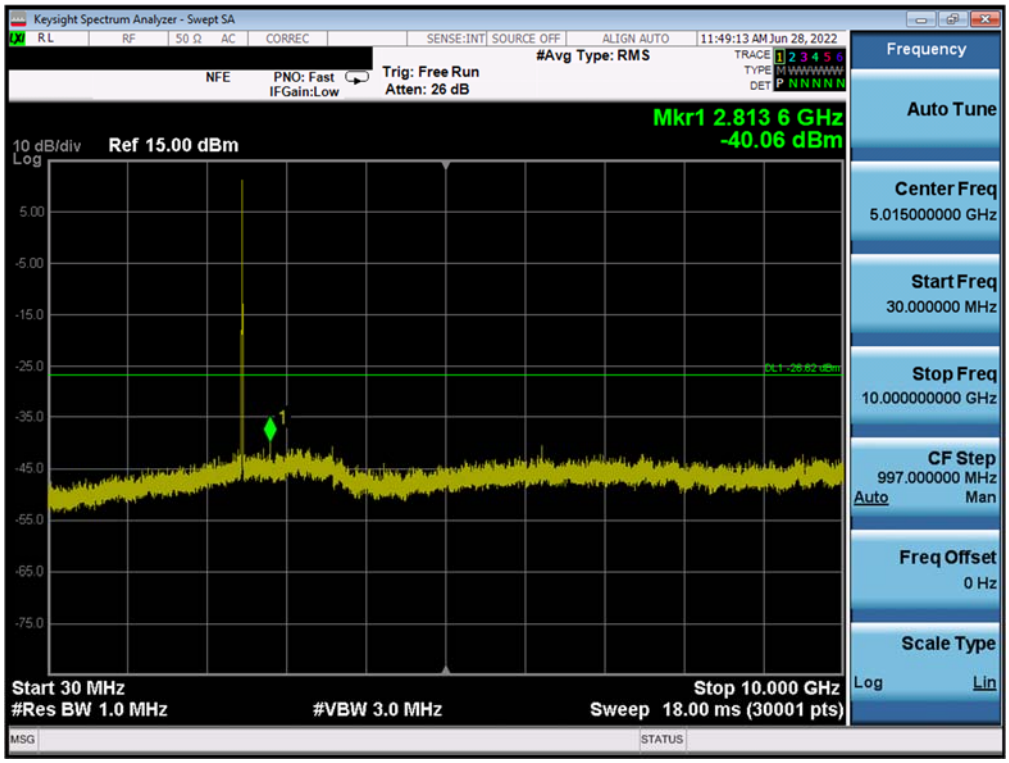
Plot 7-34. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



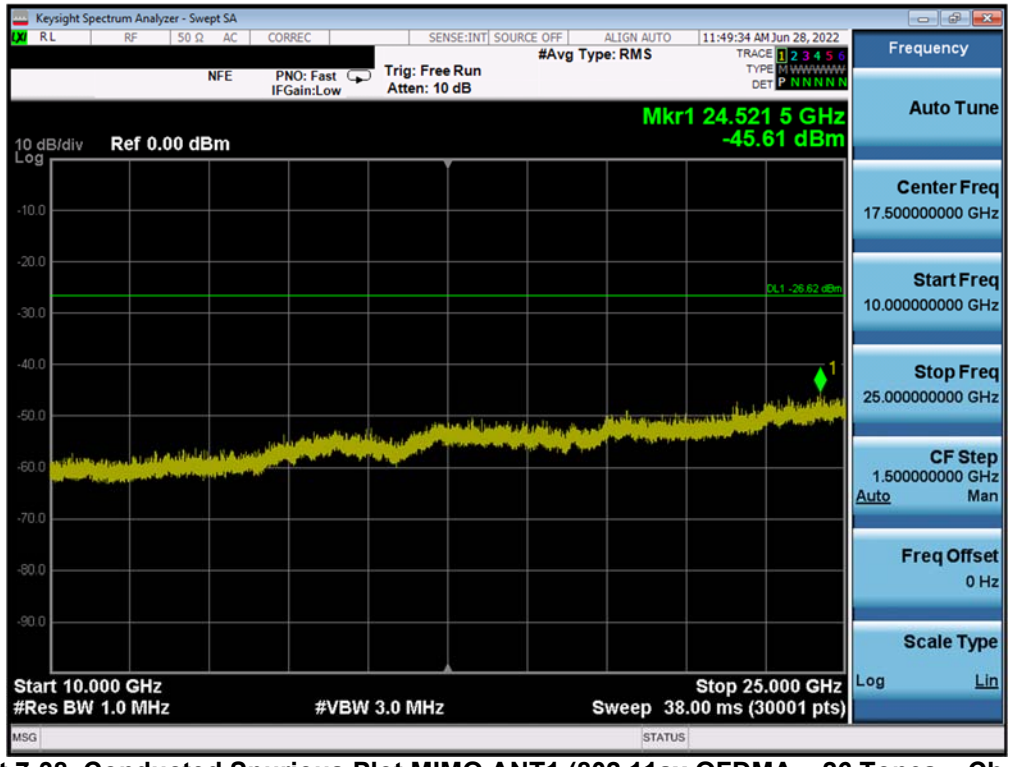
Plot 7-35. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 6)



Plot 7-36. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 6)



Plot 7-37. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-38. Conducted Spurious Plot MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)