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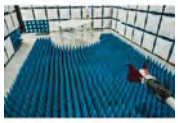

MEASUREMENT REPORT
FCC PART 15.247 / ISED RSS-247 WLAN 802.11ax OFDMA

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

Date of Testing:
10/31/2018-1/09/2019
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M1810250197-05.A3L

FCC ID:	**A3LSMG975U**
IC:	**649E-SMG975U**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-G975U
Additional Model(s):	SM-G975U1, SM-G975W, SM-G975XU
HVIN:	SM-G975W
EUT Type:	Portable Handset
Frequency Range:	2412 – 2462MHz
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
ISED Specification:	RSS-247 Issue 2
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01 v05, 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 v05. 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.

Randy Ortanez
President

ACCREDITED
TESTING CERT#2041.01

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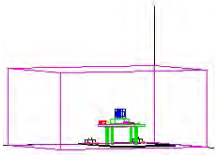
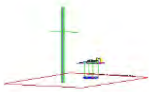


MEASUREMENT REPORT



Mode	Tones	Tx Frequency [MHz]	ANT1				ANT2				MIMO			
			Avg Conducted		Peak Conducted		Avg Conducted		Peak Conducted		Avg Conducted		Peak Conducted	
			Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
802.11ax OFDMA	26T	2412 - 2462	23.933	13.79	134.896	21.30	25.003	13.98	138.038	21.40	24.838	13.95	143.275	21.56
802.11ax OFDMA	52T	2412 - 2462	31.046	14.92	187.499	22.73	30.620	14.86	174.985	22.43	31.434	14.97	182.193	22.61
802.11ax OFDMA	106T	2412 - 2462	37.931	15.79	216.272	23.35	39.084	15.92	204.644	23.11	37.951	15.79	241.120	23.82
802.11ax OFDMA	242T	2412 - 2462	44.771	16.51	241.546	23.83	47.206	16.74	219.786	23.42	45.202	16.55	248.776	23.96

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 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility 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 PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST is an ISO 17025-2005 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.

- PCTEST 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).

- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMG975U**. The test data contained in this report pertains only to the emissions due to the EUT's WLAN (DTS) transmitter.

Test Device Serial No.: 0505M, 0218M, 0193M, 0181M, 0543M

2.2 Device Capabilities

This device contains the following capabilities:

800/850/1900 CDMA/EvDO Rev0/A, 1x Advanced (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE), NFC, ANT+

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 v05. 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 RU DTS	1	26T	99.6
		52T	99.6
		106T	99.6
		242T	99.6
802.11ax RU DTS	2	26T	99.6
		52T	99.6
		106T	99.6
		242T	99.6
802.11ax RU DTS	MIMO CDD	26T	99.2
		52T	99.2
		106T	99.1
		242T	99.6

Table 2-2. Measured Duty Cycles

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

WiFi Configurations		SISO		SDM		CDD/MIMO	
		ANT1	ANT2	ANT1	ANT2	ANT1	ANT2
2.4GHz	11b	✓	✓	×	×	×	×
	11g	✓	✓	×	×	✓	✓
	11n	✓	✓	✓	✓	✓	✓
	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 transmitting in 2.4GHz mode and ANT2 in 5GHz mode

Description	2.4 GHz Emission	5 GHz Emission
Antenna	1	2
Channel	6	144
Operating Frequency (MHz)	2437	5720
Data Rate (Mbps)	1	6
Mode	802.11b	802.11a

Table 2-4. Config-1 (ANT1 2.4GHz & ANT2 5GHz)

Configuration 2: ANT1 transmitting in 5GHz mode and ANT2 in 2.4GHz mode

Description	2.4 GHz Emission	5 GHz Emission
Antenna	2	1
Channel	6	144
Operating Frequency (MHz)	2437	5720
Data Rate (Mbps)	1	6
Mode	802.11b	802.11a

Table 2-5. Config-2 (ANT1 5GHz & ANT2 2.4GHz)

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Configuration 3: 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	157
Operating Frequency (MHz)	2437	5785
Data Rate (Mbps)	6	6
Mode	802.11g	802.11a

Table 2-6. Config-3 (ANT1 MIMO & ANT2 MIMO)

2.3 Test Configuration

The EUT was tested per the guidance of KDB 558074 D01 v05. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing. See Sections 7.7 and 7.8 for radiated emissions test setups and 7.2, 7.3, 7.4, 7.5, and 7.6 for antenna port conducted emissions test setups.

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT placed on an authorized wireless charging pad (WCP) Model: EP-N5100 while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

2.4 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 C63.10-2013) and the guidance provided in KDB 558074 D01 v05 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.

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).

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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 C63.10-2013. 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

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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)	1/23/2018	Annual	1/23/2019	WL25-1
Agilent	N9020A	MXA Signal Analyzer	1/24/2018	Annual	1/24/2019	US46470561
Agilent	N9030A	PXA Signal Analyzer (44GHz)	5/25/2018	Annual	5/25/2019	MY52350166
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	846215
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2017	Biennial	10/10/2019	121034
COM-Power	PAM-103	Pre-Amplifier (1-1000MHz)	9/17/2018	Annual	9/17/2019	441119
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
Emco	3116	Horn Antenna (18 - 40GHz)	6/7/2018	Triennial	6/7/2021	9203-2178
Huber + Suhner	Sucoflex 102A	40GHz Radiated Cable Set	1/23/2018	Annual	1/23/2019	251425001
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	5/21/2018	Annual	5/21/2019	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	8/9/2018	Annual	8/9/2019	100348
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	6/18/2018	Annual	6/18/2019	102134
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	6/25/2018	Annual	6/25/2019	102133
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	1/24/2018	Annual	1/24/2019	100040
Sunol	DRH-118	Horn Antenna (1-18GHz)	8/11/2017	Biennial	8/11/2019	A050307
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	4/19/2018	Biennial	4/19/2020	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

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7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMG975U

FCC Classification: Digital Transmission System (DTS)

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	> 500kHz	CONDUCTED	PASS	Section 7.2
15.247(b)(3)	RSS-247 [5.4]	Transmitter Output Power	< 1 Watt		PASS	Sections 7.3
15.247(e)	RSS-247 [5.2]	Transmitter Power Spectral Density	< 8dBm / 3kHz Band		PASS	Section 7.4
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	≥ 20dBc		PASS	Sections 7.5, 7.6
15.205 15.209	RSS-Gen [8.9]	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	Sections 7.7, 7.8
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen[8.8])	LINE CONDUCTED	PASS	See WLAN Test Report

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 0.2.16.
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.

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7.2 6dB Bandwidth Measurement

§15.247(a.2); RSS-247 [5.2]

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 v05 – 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

None

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SISO 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	2.660	0.500
2437	6	ax	26T	MCS0	2.716	0.500
2462	11	ax	26T	MCS0	2.680	0.500
2412	1	ax	52T	MCS0	6.65	0.500
2437	6	ax	52T	MCS0	10.36	0.500
2462	11	ax	52T	MCS0	10.38	0.500
2412	1	ax	106T	MCS0	17.18	0.500
2437	6	ax	106T	MCS0	17.18	0.500
2462	11	ax	106T	MCS0	17.20	0.500
2412	1	ax	242T	MCS0	19.10	0.500
2437	6	ax	242T	MCS0	19.04	0.500
2462	11	ax	242T	MCS0	18.98	0.500

Table 7-2. Conducted Bandwidth Measurements SISO ANT1

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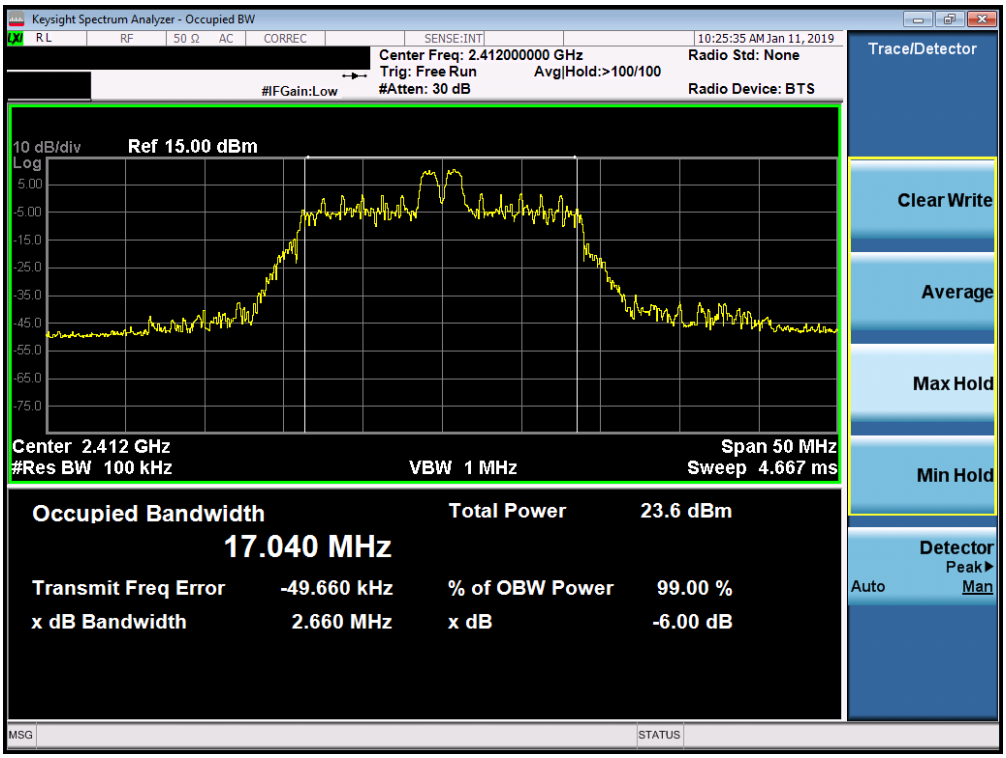
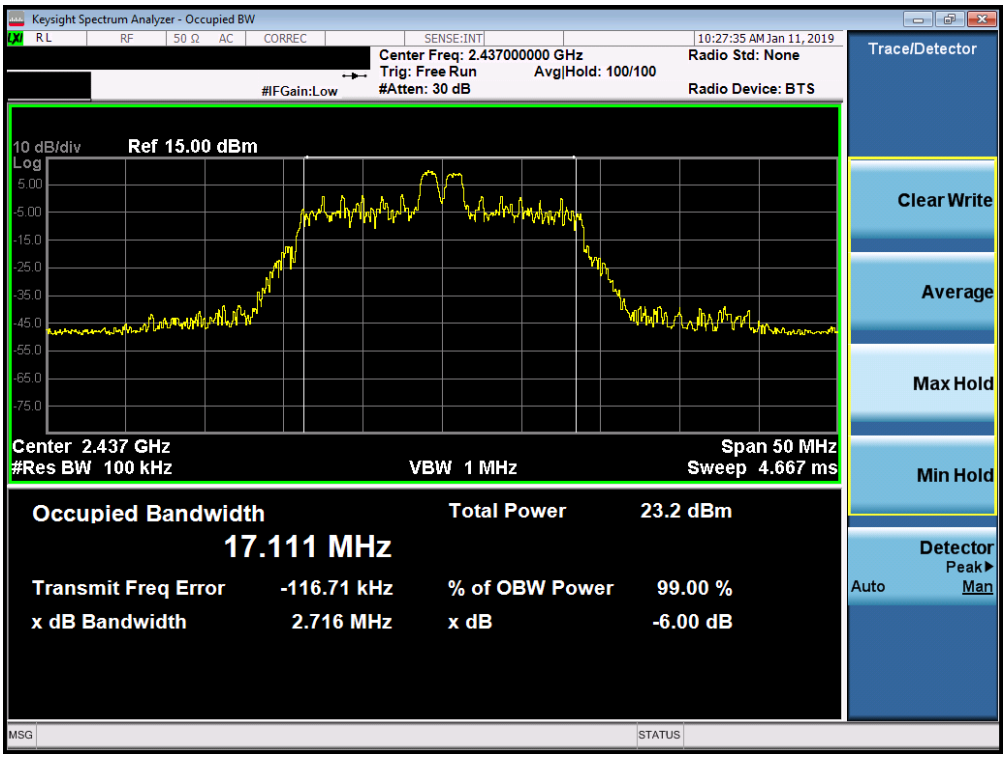


Plot 7-1. 6dB Bandwidth Plot SISO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



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

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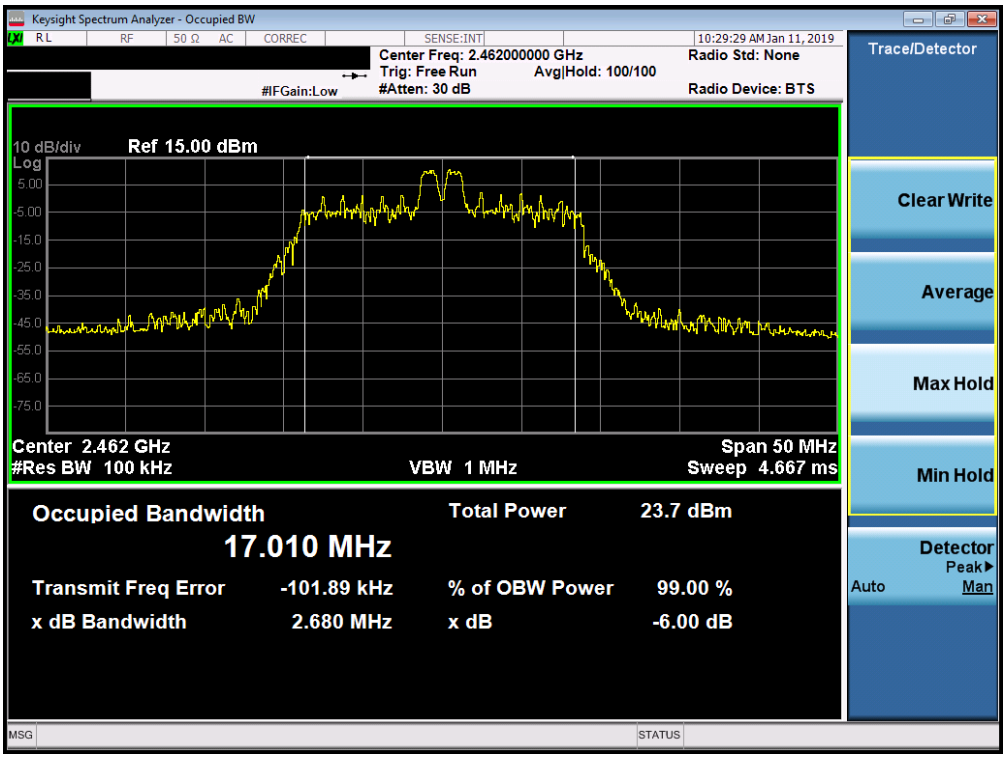
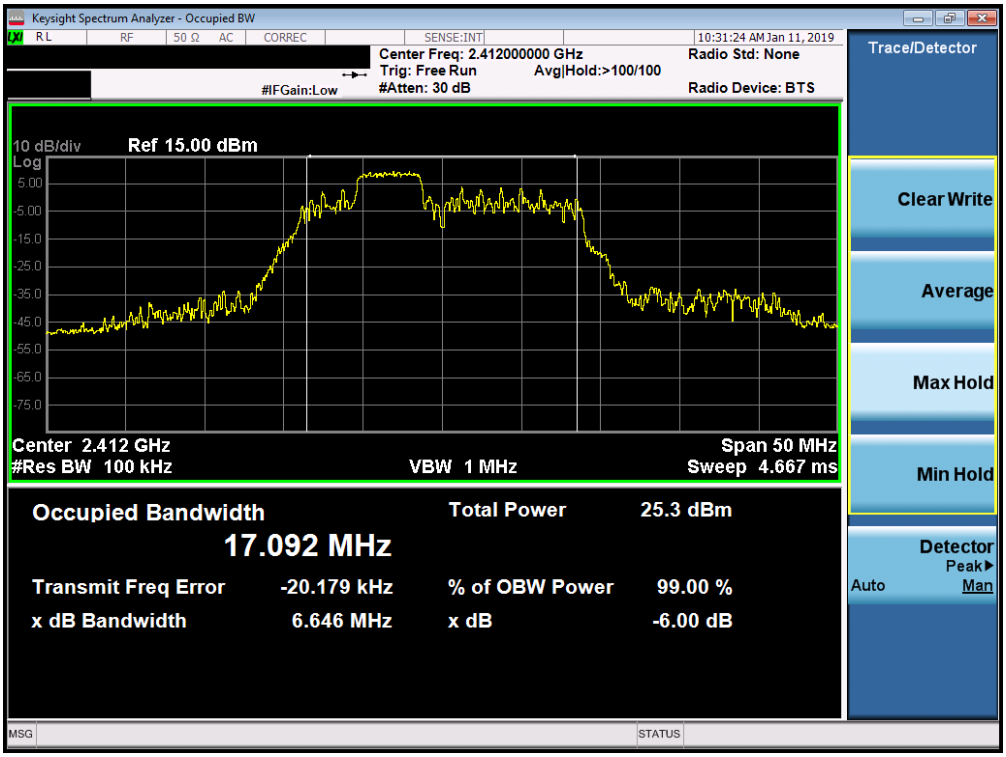


Plot 7-3. 6dB Bandwidth Plot SISO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-4. 6dB Bandwidth Plot SISO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 1)

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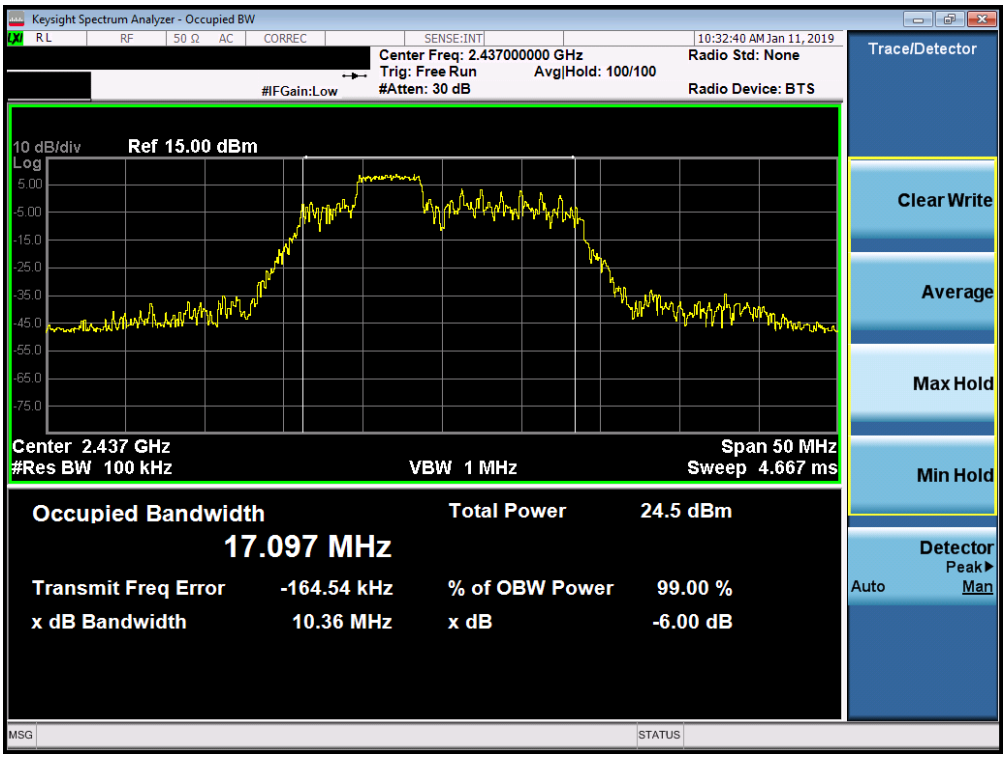
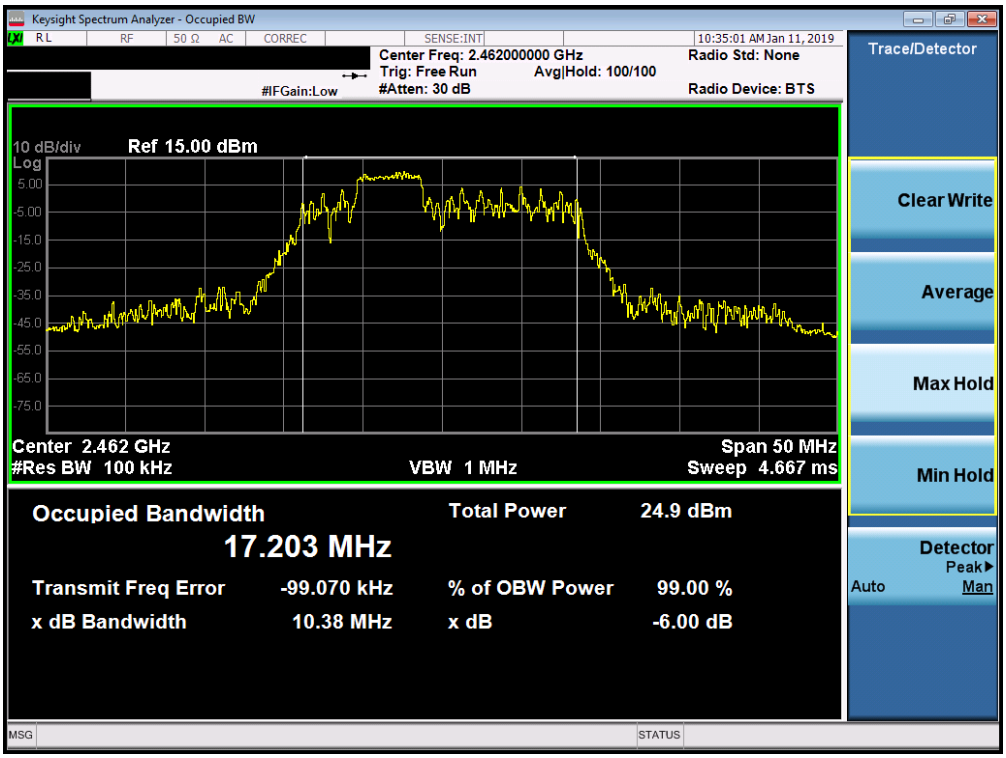


Plot 7-5. 6dB Bandwidth Plot SISO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 6)



Plot 7-6. 6dB Bandwidth Plot SISO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 11)

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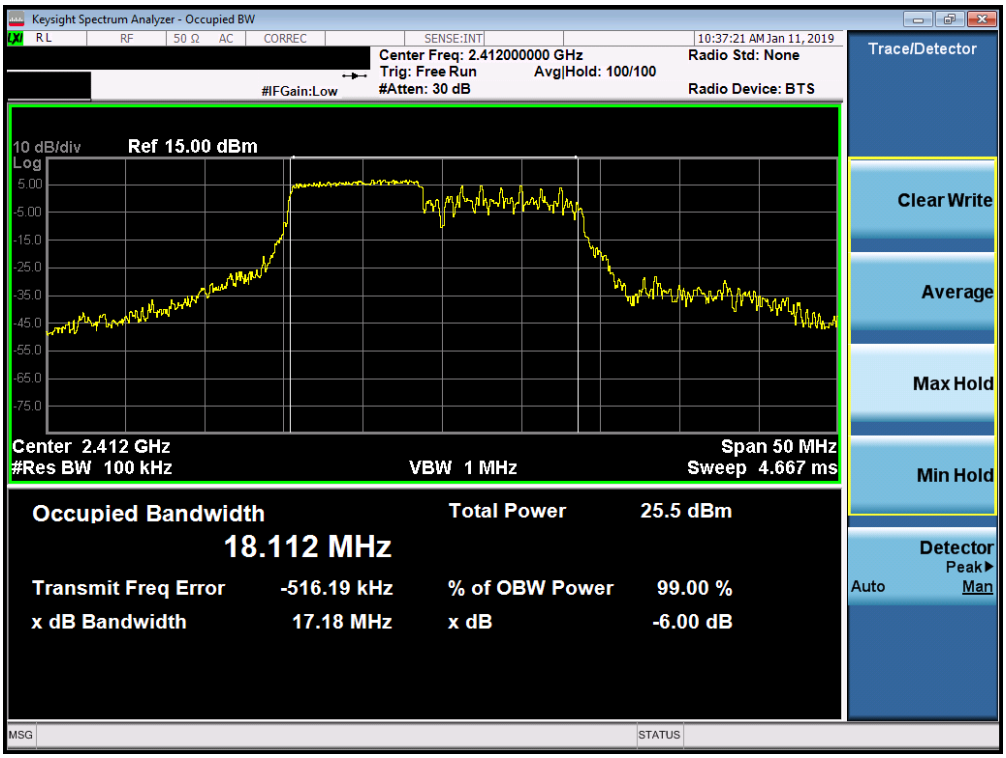
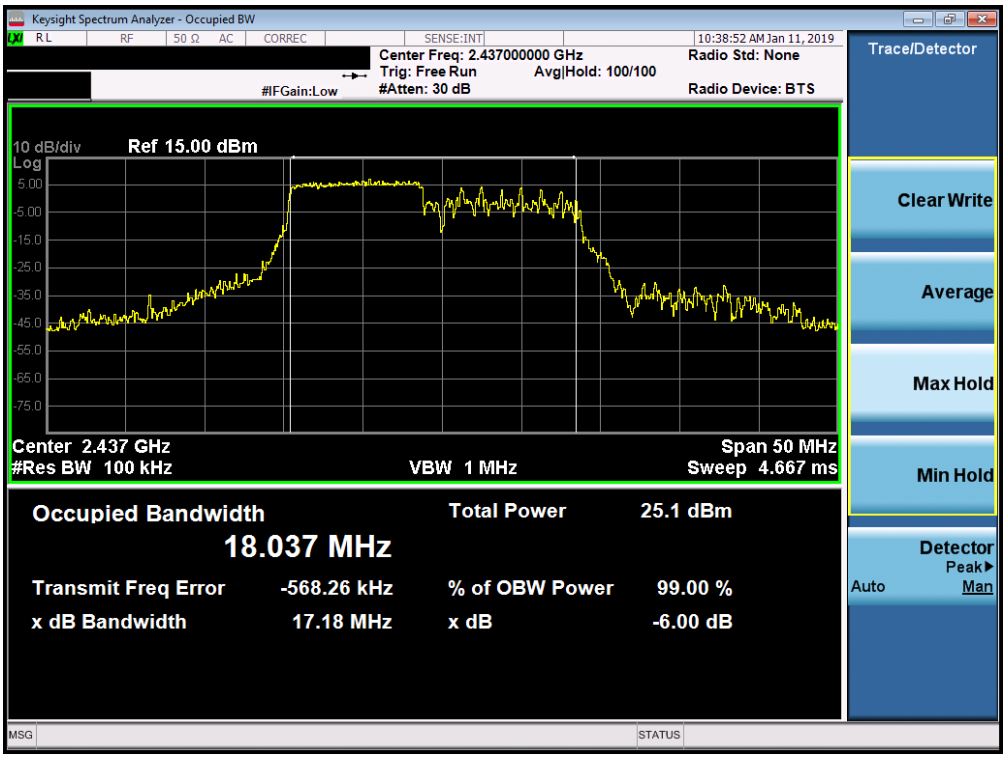


Plot 7-7. 6dB Bandwidth Plot SISO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 1)



Plot 7-8. 6dB Bandwidth Plot SISO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 6)

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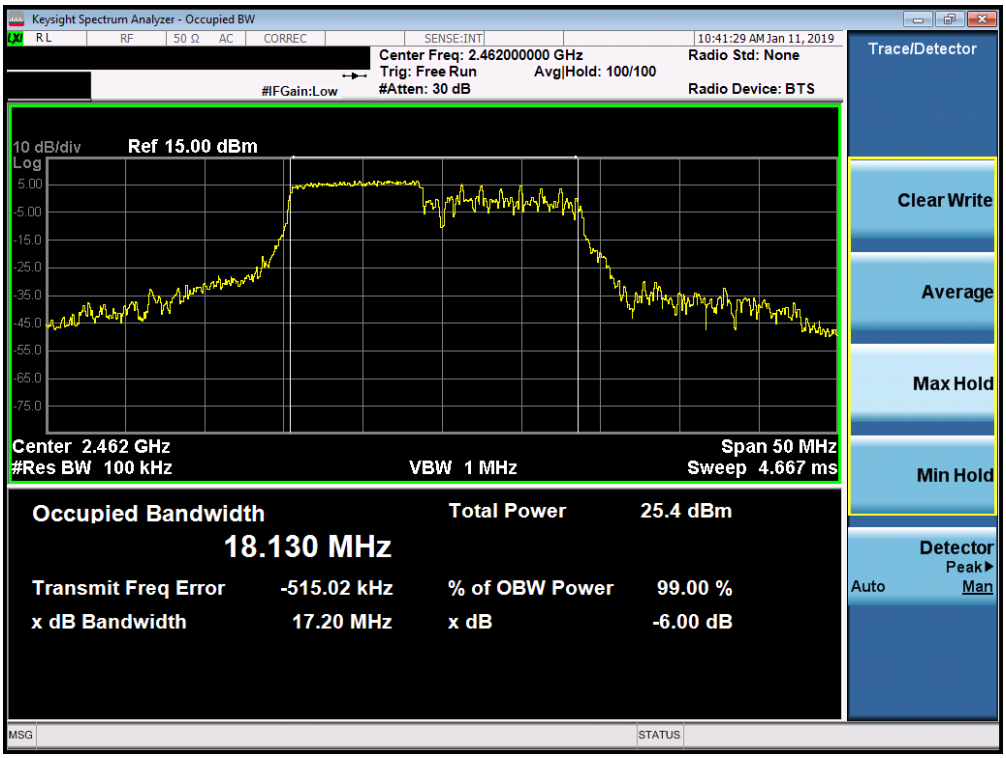
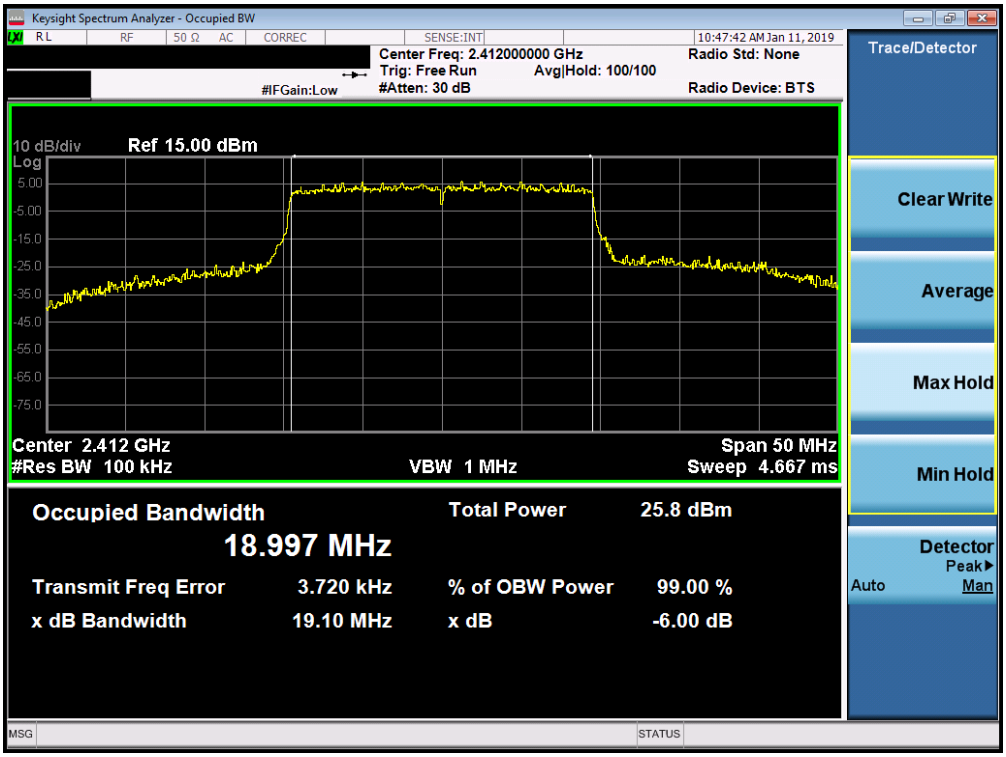


Plot 7-9. 6dB Bandwidth Plot SISO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 11)



Plot 7-10. 6dB Bandwidth Plot SISO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)

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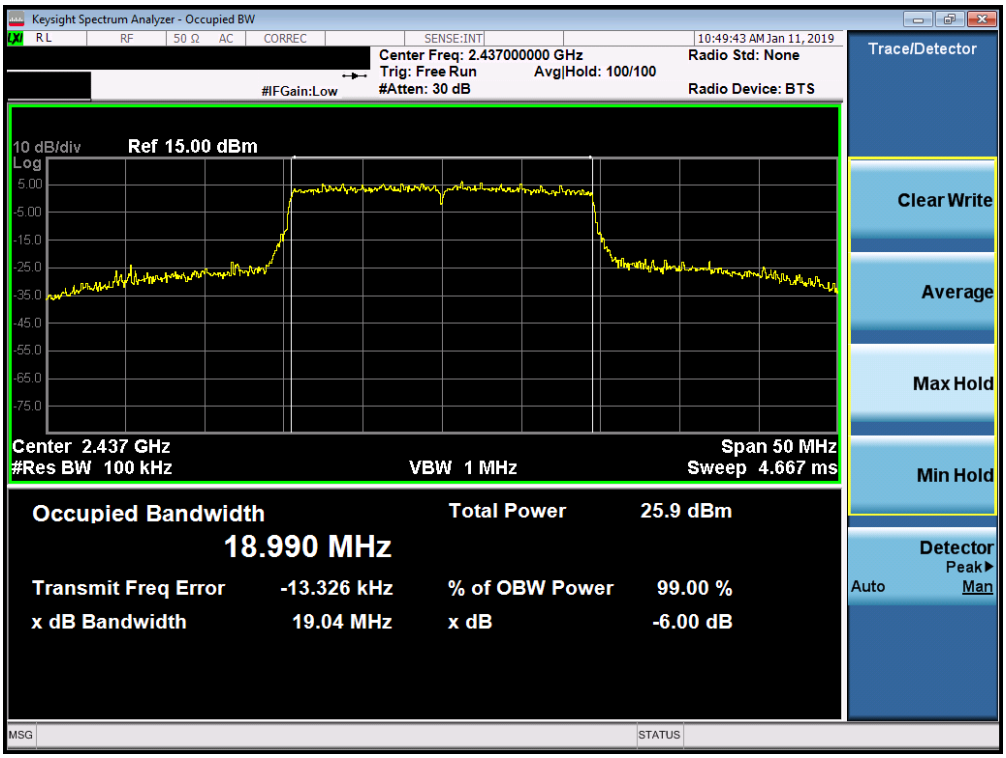
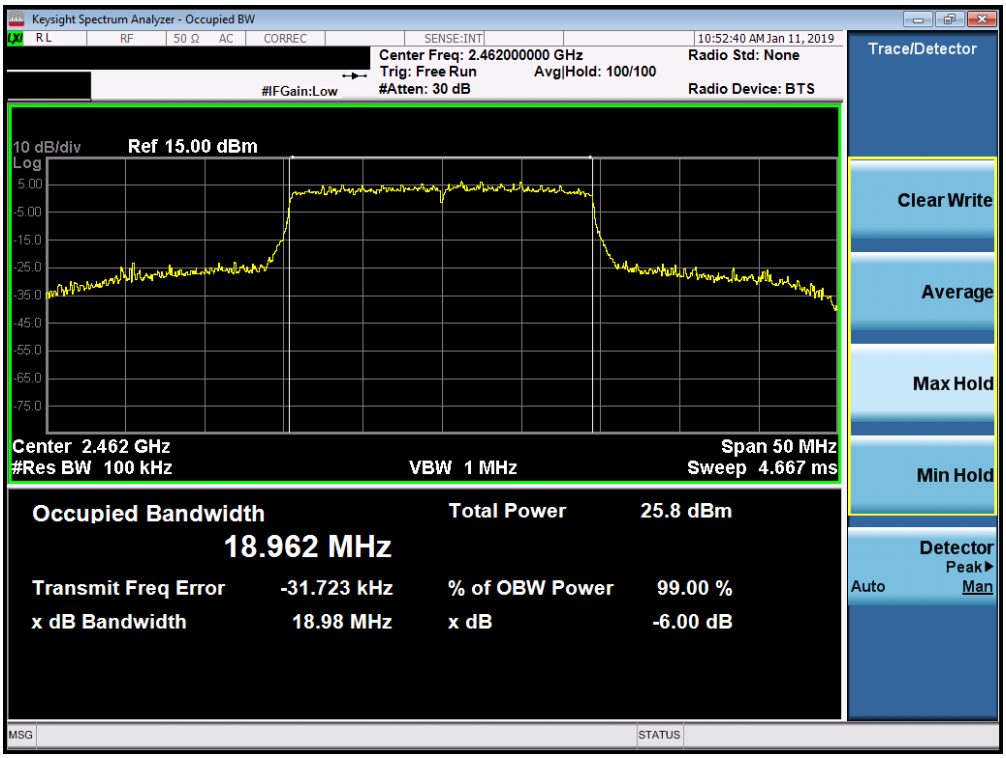


Plot 7-11. 6dB Bandwidth Plot SISO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 6)



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

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SISO 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	2.679	0.500
2437	6	ax	26T	MCS0	2.130	0.500
2462	11	ax	26T	MCS0	2.133	0.500
2412	1	ax	52T	MCS0	17.04	0.500
2437	6	ax	52T	MCS0	14.55	0.500
2462	11	ax	52T	MCS0	13.35	0.500
2412	1	ax	106T	MCS0	17.13	0.500
2437	6	ax	106T	MCS0	17.20	0.500
2462	11	ax	106T	MCS0	17.19	0.500
2412	1	ax	242T	MCS0	18.94	0.500
2437	6	ax	242T	MCS0	19.03	0.500
2462	11	ax	242T	MCS0	18.99	0.500

Table 7-3. Conducted Bandwidth Measurements SISO ANT2

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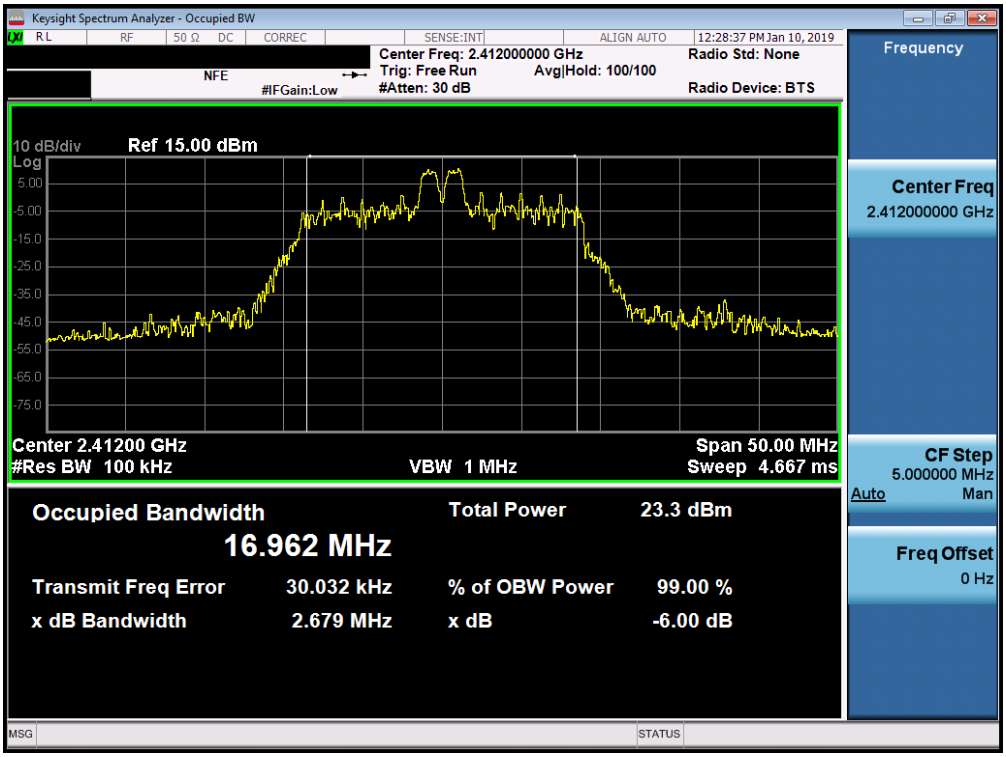
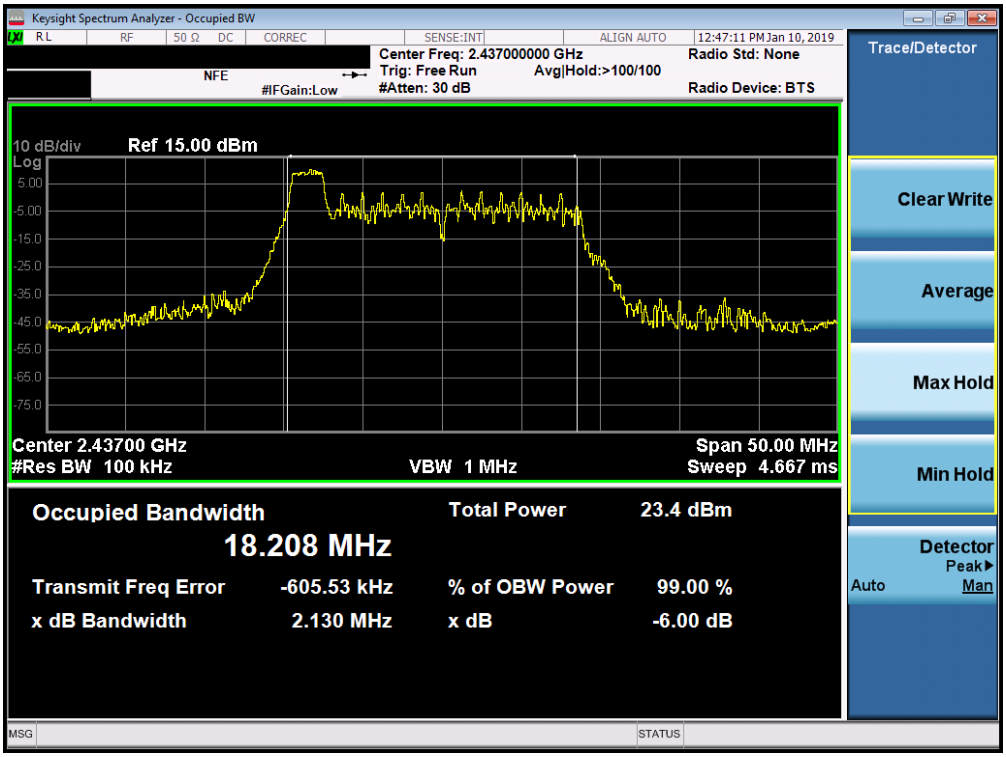


Plot 7-13. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-14. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 6)

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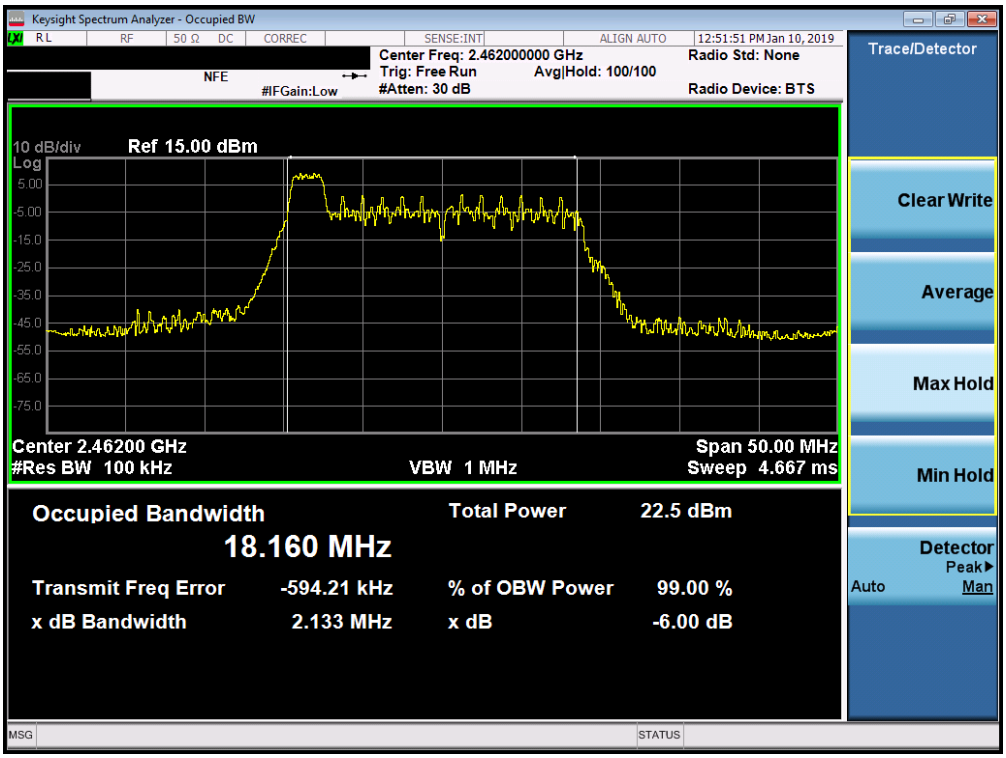
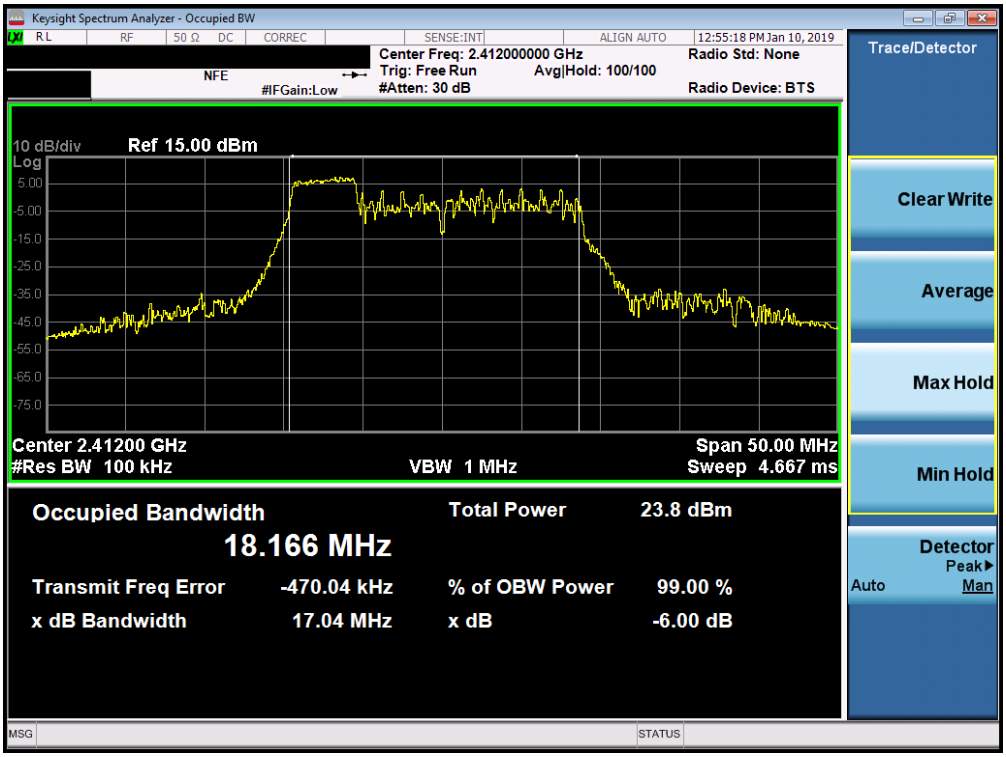


Plot 7-15. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-16. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 52 Tones – Ch. 1)

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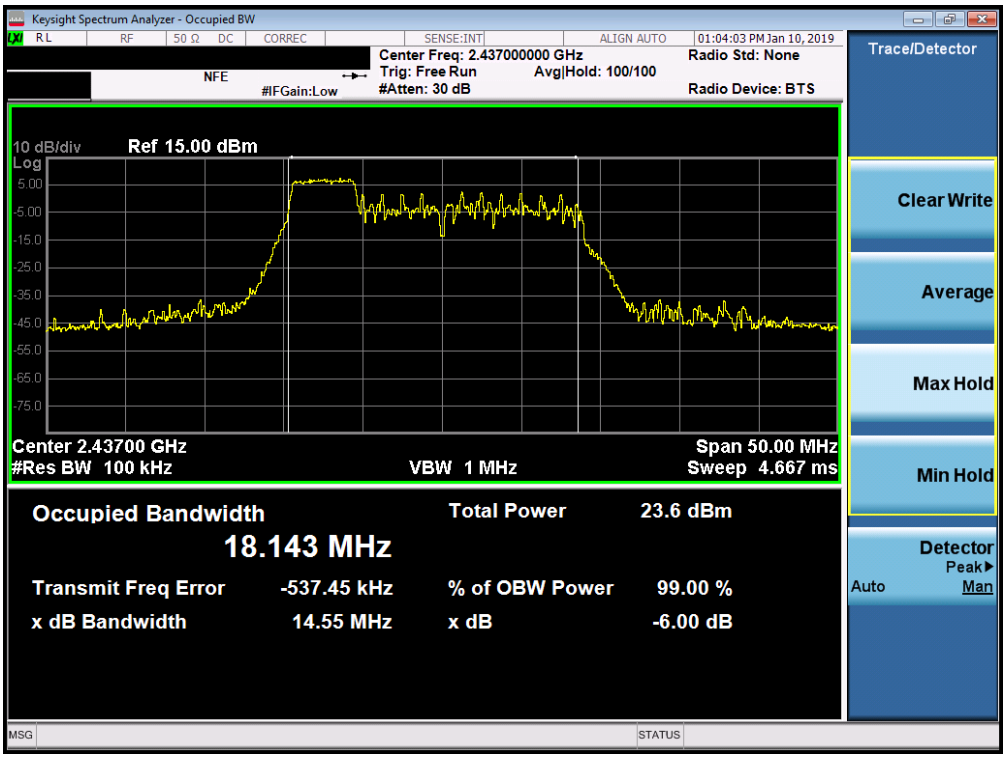
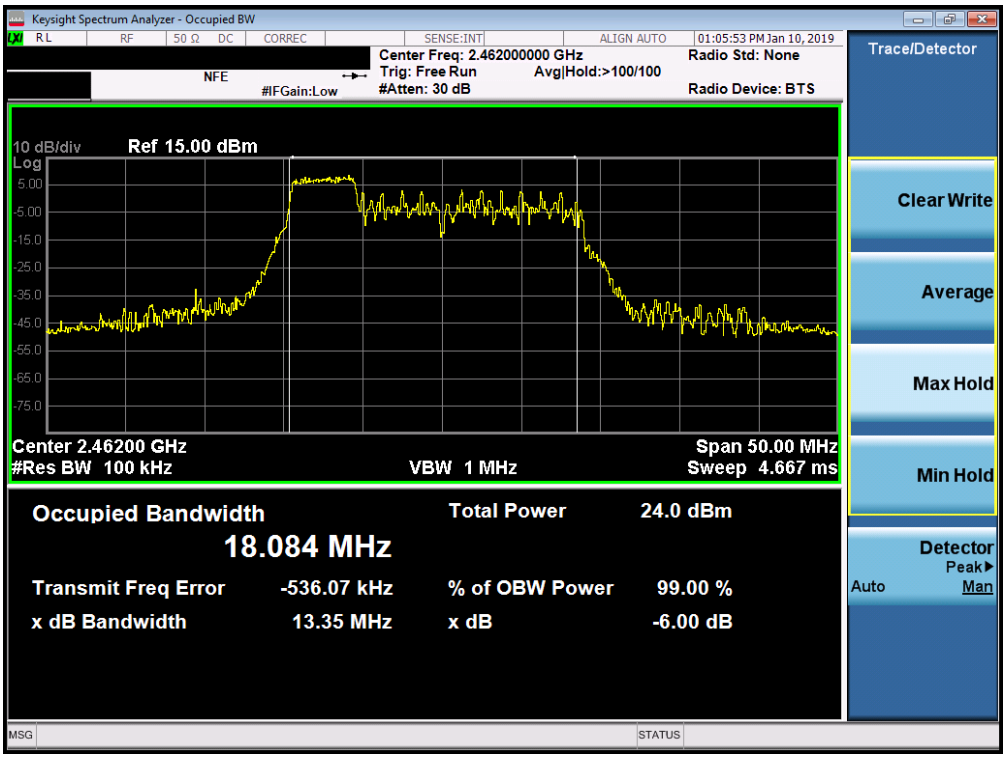


Plot 7-17. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 52 Tones – Ch. 6)



Plot 7-18. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 52 Tones – Ch. 11)

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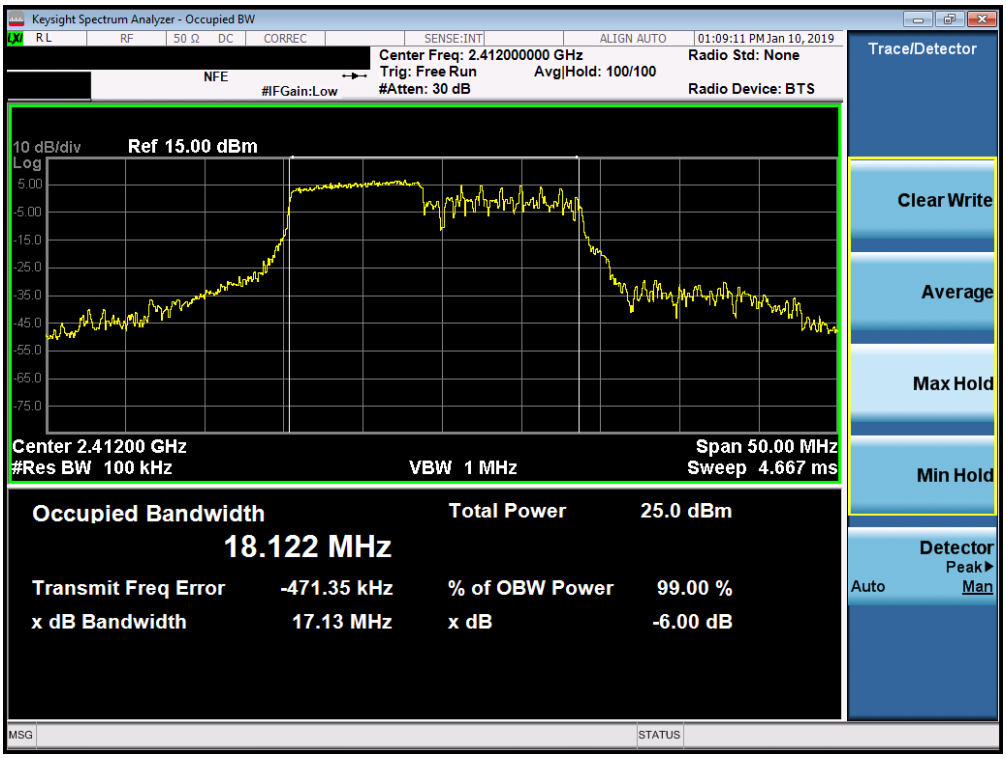
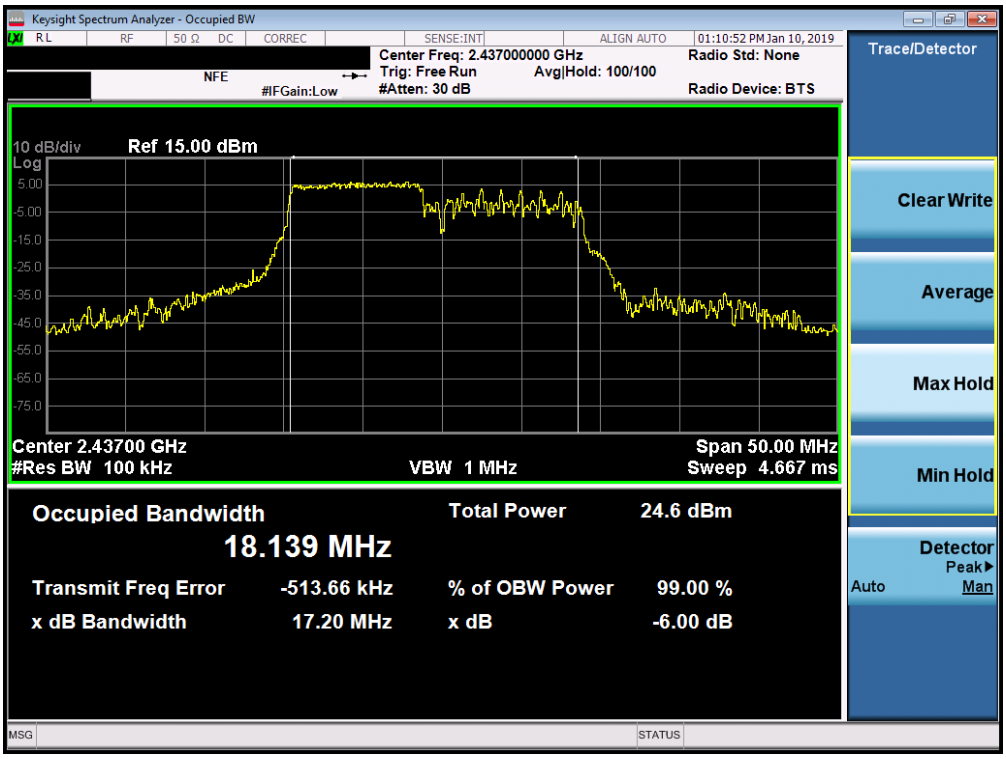


Plot 7-19. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 1)



Plot 7-20. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 6)

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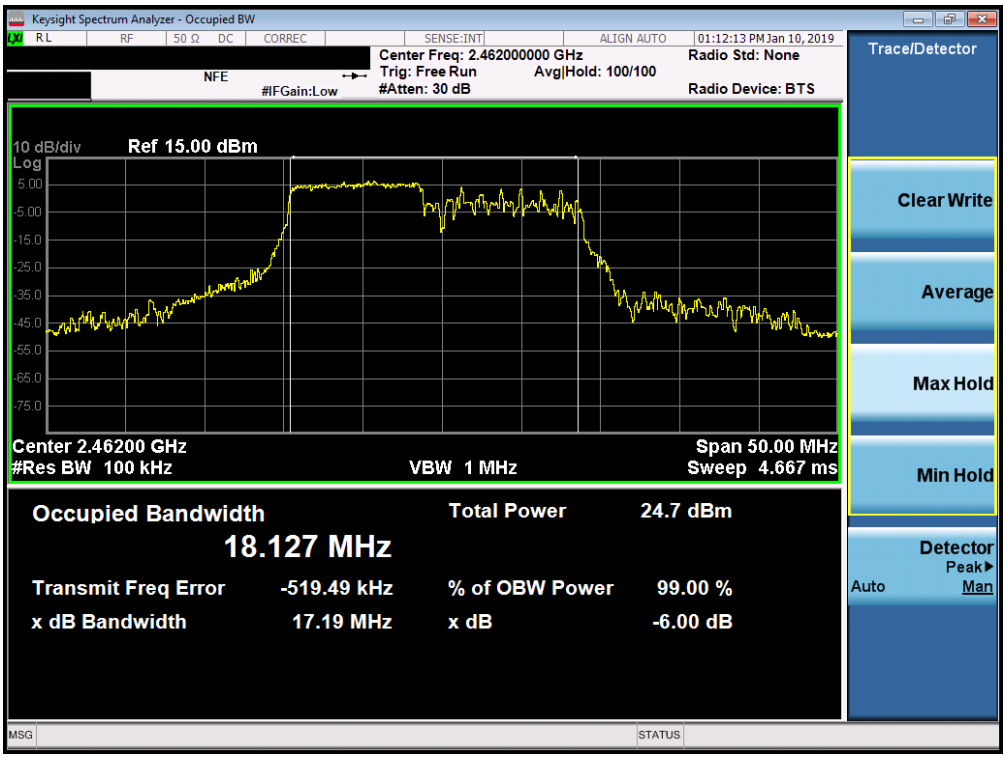
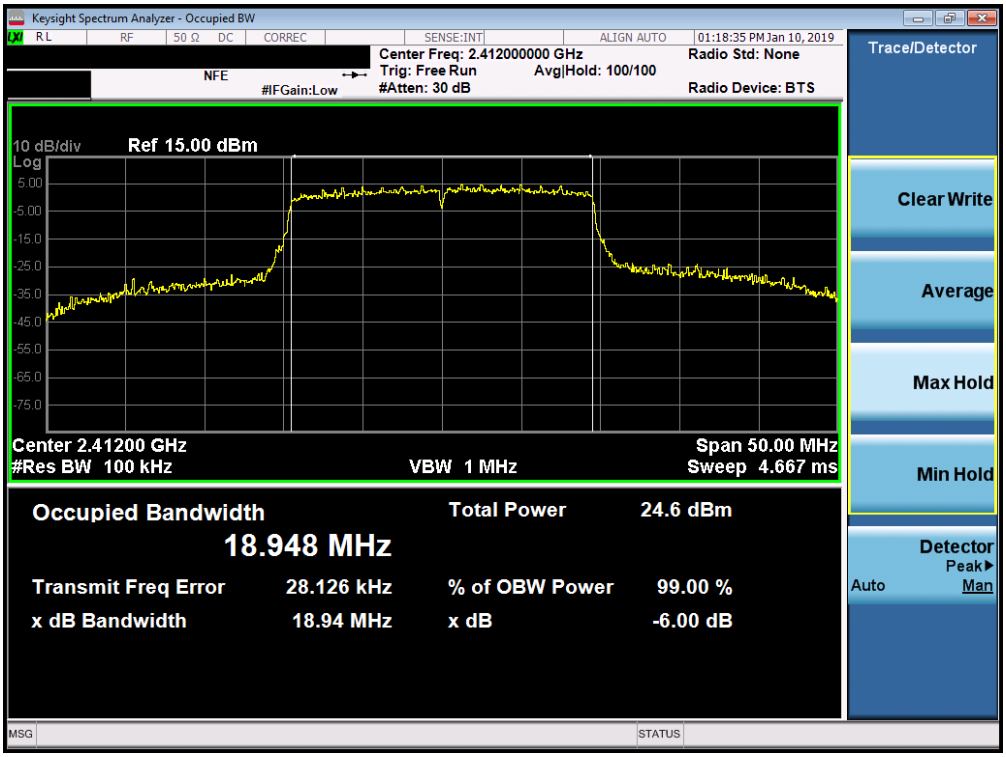


Plot 7-21. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 11)



Plot 7-22. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 1)

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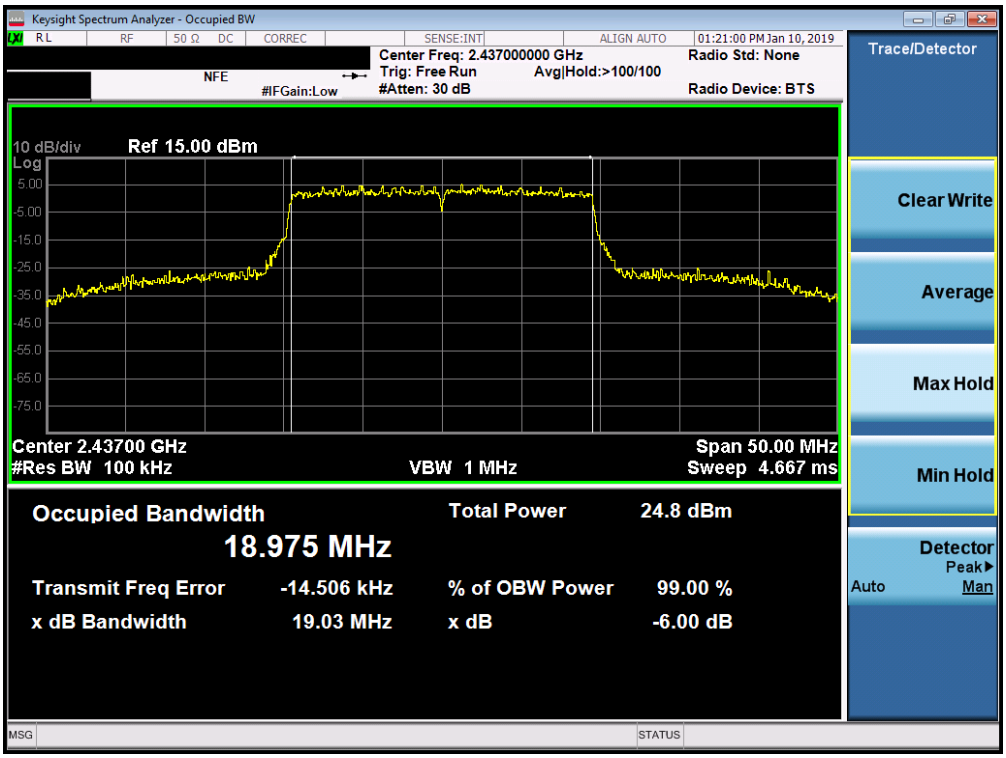
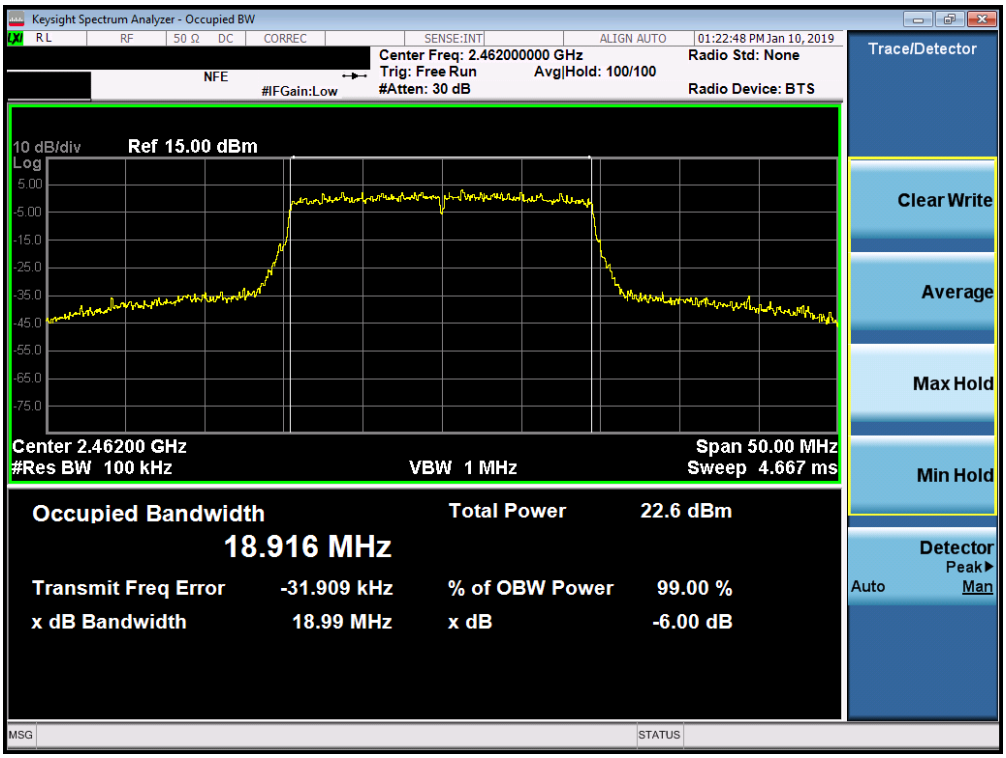


Plot 7-23. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-24. 6dB Bandwidth Plot SISO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 11)

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7.3 Output Power Measurement

§15.247(b.3); RSS-247 [5.4]

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 v05 – 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 v05 – 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

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Antenna-1

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Powers (dBm)	Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
2.4GHz	2412	1	26T	0	AVG	13.70	30.00	-16.30	-8.06	5.64	36.02	-30.38
					PEAK	21.09	30.00	-8.91	-8.06	13.03	36.02	-22.99
				4	AVG	13.67	30.00	-16.33	-8.06	5.61	36.02	-30.41
					PEAK	21.02	30.00	-8.98	-8.06	12.96	36.02	-23.06
				8	AVG	13.45	30.00	-16.55	-8.06	5.39	36.02	-30.63
					PEAK	20.97	30.00	-9.03	-8.06	12.91	36.02	-23.11
	2437	6	26T	0	AVG	13.63	30.00	-16.37	-6.55	7.08	36.02	-28.94
					PEAK	20.97	30.00	-9.03	-6.55	14.42	36.02	-21.60
				4	AVG	13.58	30.00	-16.42	-6.55	7.03	36.02	-28.99
					PEAK	21.01	30.00	-8.99	-6.55	14.46	36.02	-21.56
				8	AVG	13.49	30.00	-16.51	-6.55	6.94	36.02	-29.08
					PEAK	21.05	30.00	-8.95	-6.55	14.50	36.02	-21.52
	2462	11	26T	0	AVG	13.35	30.00	-16.65	-6.42	6.93	36.02	-29.09
					PEAK	20.80	30.00	-9.20	-6.42	14.38	36.02	-21.64
				4	AVG	13.69	30.00	-16.31	-6.42	7.27	36.02	-28.75
					PEAK	21.09	30.00	-8.91	-6.42	14.67	36.02	-21.35
				8	AVG	13.79	30.00	-16.21	-6.42	7.37	36.02	-28.65
					PEAK	21.30	30.00	-8.70	-6.42	14.88	36.02	-21.14

Table 7-4. Conducted Output Power Measurements SISO ANT1 (26 Tones)

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Powers (dBm)	Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
2.4GHz	2412	1	52T	37	AVG	14.84	30.00	-15.16	-8.06	6.78	36.02	-29.24
					PEAK	22.63	30.00	-7.37	-8.06	14.57	36.02	-21.45
				38	AVG	14.43	30.00	-15.57	-8.06	6.37	36.02	-29.65
					PEAK	21.83	30.00	-8.17	-8.06	13.77	36.02	-22.25
				40	AVG	14.92	30.00	-15.08	-8.06	6.86	36.02	-29.16
					PEAK	22.73	30.00	-7.27	-8.06	14.67	36.02	-21.35
	2437	6	52T	37	AVG	14.63	30.00	-15.37	-6.55	8.08	36.02	-27.94
					PEAK	22.20	30.00	-7.80	-6.55	15.65	36.02	-20.37
				38	AVG	14.69	30.00	-15.31	-6.55	8.14	36.02	-27.88
					PEAK	22.13	30.00	-7.87	-6.55	15.58	36.02	-20.44
				40	AVG	14.55	30.00	-15.45	-6.55	8.00	36.02	-28.02
					PEAK	22.43	30.00	-7.57	-6.55	15.88	36.02	-20.14
	2462	11	52T	37	AVG	14.88	30.00	-15.12	-6.42	8.46	36.02	-27.56
					PEAK	22.63	30.00	-7.37	-6.42	16.21	36.02	-19.81
				38	AVG	14.65	30.00	-15.35	-6.42	8.23	36.02	-27.79
					PEAK	22.29	30.00	-7.71	-6.42	15.87	36.02	-20.15
				40	AVG	14.52	30.00	-15.48	-6.42	8.10	36.02	-27.92
					PEAK	21.98	30.00	-8.02	-6.42	15.56	36.02	-20.46

Table 7-5. Conducted Output Power Measurements SISO ANT1 (52 Tones)

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	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Powers (dBm)	Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
2.4GHz	2412	1	106T	53	AVG	15.32	30.00	-14.68	-8.06	7.26	36.02	-28.76
					PEAK	22.99	30.00	-7.01	-8.06	14.93	36.02	-21.09
				54	AVG	15.70	30.00	-14.30	-8.06	7.64	36.02	-28.38
					PEAK	23.34	30.00	-6.66	-8.06	15.28	36.02	-20.74
	2437	6	106T	53	AVG	15.79	30.00	-14.21	-6.55	9.24	36.02	-26.78
					PEAK	23.35	30.00	-6.65	-6.55	16.80	36.02	-19.22
				54	AVG	15.54	30.00	-14.46	-6.55	8.99	36.02	-27.03
					PEAK	23.17	30.00	-6.83	-6.55	16.62	36.02	-19.40
	2462	11	106T	53	AVG	15.59	30.00	-14.41	-6.42	9.17	36.02	-26.85
					PEAK	23.23	30.00	-6.77	-6.42	16.81	36.02	-19.21
				54	AVG	15.41	30.00	-14.59	-6.42	8.99	36.02	-27.03
					PEAK	22.73	30.00	-7.27	-6.42	16.31	36.02	-19.71

Table 7-6. Conducted Output Power Measurements SISO ANT1 (106 Tones)

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Powers (dBm)	Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
2.4GHz	2412	1	242T	61	AVG	15.41	30.00	-14.59	-8.06	7.35	36.02	-28.67
					PEAK	22.72	30.00	-7.28	-8.06	14.66	36.02	-21.36
	2417	2			AVG	16.65	30.00	-13.35	-8.06	8.59	36.02	-27.43
					PEAK	23.75	30.00	-6.25	-8.06	15.69	36.02	-20.33
	2437	6			AVG	16.51	30.00	-13.49	-6.55	9.96	36.02	-26.06
					PEAK	23.83	30.00	-6.17	-6.55	17.28	36.02	-18.74
	2457	10			AVG	16.78	30.00	-13.22	-6.42	10.36	36.02	-25.66
					PEAK	23.89	30.00	-6.11	-6.42	17.47	36.02	-18.55
	2462	11			AVG	14.79	30.00	-15.21	-6.42	8.37	36.02	-27.65
					PEAK	22.25	30.00	-7.75	-6.42	15.83	36.02	-20.19

Table 7-7. Conducted Output Power Measurements SISO ANT1 (242 Tones)

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Antenna-2

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Powers (dBm)	Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
2.4GHz	2412	1	26T	0	AVG	13.53	30.00	-16.47	-7.46	6.07	36.02	-29.95
					PEAK	20.94	30.00	-9.06	-7.46	13.48	36.02	-22.54
				4	AVG	13.63	30.00	-16.37	-7.46	6.17	36.02	-29.85
					PEAK	21.17	30.00	-8.83	-7.46	13.71	36.02	-22.31
				8	AVG	13.98	30.00	-16.02	-7.46	6.52	36.02	-29.50
					PEAK	21.40	30.00	-8.60	-7.46	13.94	36.02	-22.08
	2437	6	26T	0	AVG	13.87	30.00	-16.13	-7.85	6.02	36.02	-30.00
					PEAK	21.28	30.00	-8.72	-7.85	13.43	36.02	-22.59
				4	AVG	13.82	30.00	-16.18	-7.85	5.97	36.02	-30.05
					PEAK	21.24	30.00	-8.76	-7.85	13.39	36.02	-22.63
				8	AVG	13.73	30.00	-16.27	-7.85	5.88	36.02	-30.14
					PEAK	21.03	30.00	-8.97	-7.85	13.18	36.02	-22.84
	2462	11	26T	0	AVG	13.71	30.00	-16.29	-6.32	7.39	36.02	-28.63
					PEAK	21.33	30.00	-8.67	-6.32	15.01	36.02	-21.01
				4	AVG	13.89	30.00	-16.11	-6.32	7.57	36.02	-28.45
					PEAK	21.33	30.00	-8.67	-6.32	15.01	36.02	-21.01
				8	AVG	13.87	30.00	-16.13	-6.32	7.55	36.02	-28.47
					PEAK	21.19	30.00	-8.81	-6.32	14.87	36.02	-21.15

Table 7-8. Conducted Output Power Measurements SISO ANT2 (26 Tones)

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Powers (dBm)	Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
2.4GHz	2412	1	52T	37	AVG	14.56	30.00	-15.44	-7.46	7.10	36.02	-28.92
					PEAK	22.03	30.00	-7.97	-7.46	14.57	36.02	-21.45
				38	AVG	14.60	30.00	-15.40	-7.46	7.14	36.02	-28.88
					PEAK	21.99	30.00	-8.01	-7.46	14.53	36.02	-21.49
				40	AVG	14.72	30.00	-15.28	-7.46	7.26	36.02	-28.76
					PEAK	22.43	30.00	-7.57	-7.46	14.97	36.02	-21.05
	2437	6	52T	37	AVG	14.58	30.00	-15.42	-7.85	6.73	36.02	-29.29
					PEAK	22.23	30.00	-7.77	-7.85	14.38	36.02	-21.64
				38	AVG	14.86	30.00	-15.14	-7.85	7.01	36.02	-29.01
					PEAK	22.40	30.00	-7.60	-7.85	14.55	36.02	-21.47
				40	AVG	14.79	30.00	-15.21	-7.85	6.94	36.02	-29.08
					PEAK	22.30	30.00	-7.70	-7.85	14.45	36.02	-21.57
	2462	11	52T	37	AVG	14.49	30.00	-15.51	-6.32	8.17	36.02	-27.85
					PEAK	22.09	30.00	-7.91	-6.32	15.77	36.02	-20.25
				38	AVG	14.82	30.00	-15.18	-6.32	8.50	36.02	-27.52
					PEAK	22.32	30.00	-7.68	-6.32	16.00	36.02	-20.02
				40	AVG	14.65	30.00	-15.35	-6.32	8.33	36.02	-27.69
					PEAK	22.05	30.00	-7.95	-6.32	15.73	36.02	-20.29

Table 7-9. Conducted Output Power Measurements SISO ANT2 (52 Tones)

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	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Powers (dBm)	Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
2.4GHz	2412	1	106T	53	AVG	15.84	30.00	-14.16	-7.46	8.38	36.02	-27.64
					PEAK	22.97	30.00	-7.03	-7.46	15.51	36.02	-20.51
				54	AVG	15.46	30.00	-14.54	-7.46	8.00	36.02	-28.02
					PEAK	22.87	30.00	-7.13	-7.46	15.41	36.02	-20.61
	2437	6	106T	53	AVG	15.92	30.00	-14.08	-7.85	8.07	36.02	-27.95
					PEAK	23.11	30.00	-6.89	-7.85	15.26	36.02	-20.76
				54	AVG	15.37	30.00	-14.63	-7.85	7.52	36.02	-28.50
					PEAK	22.88	30.00	-7.12	-7.85	15.03	36.02	-20.99
	2462	11	106T	53	AVG	15.79	30.00	-14.21	-6.32	9.47	36.02	-26.55
					PEAK	23.06	30.00	-6.94	-6.32	16.74	36.02	-19.28
				54	AVG	15.57	30.00	-14.43	-6.32	9.25	36.02	-26.77
					PEAK	22.67	30.00	-7.33	-6.32	16.35	36.02	-19.67

Table 7-10. Conducted Output Power Measurements SISO ANT2 (106 Tones)

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Powers (dBm)	Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
2.4GHz	2412	1	242T	61	AVG	15.69	30.00	-14.31	-7.46	8.23	36.02	-27.79
					PEAK	22.78	30.00	-7.22	-7.46	15.32	36.02	-20.70
	2417	2			AVG	16.73	30.00	-13.27	-7.46	9.27	36.02	-26.75
					PEAK	23.45	30.00	-6.55	-7.46	15.99	36.02	-20.03
	2437	6			AVG	16.74	30.00	-13.26	-7.85	8.89	36.02	-27.13
					PEAK	23.42	30.00	-6.58	-7.85	15.57	36.02	-20.45
	2457	10			AVG	16.73	30.00	-13.27	-6.32	10.41	36.02	-25.61
					PEAK	23.49	30.00	-6.51	-6.32	17.17	36.02	-18.85
	2462	11			AVG	14.73	30.00	-15.27	-6.32	8.41	36.02	-27.61
					PEAK	21.83	30.00	-8.17	-6.32	15.51	36.02	-20.51

Table 7-11. Conducted Output Power Measurements SISO ANT2 (242 Tones)

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MIMO

	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
						ANT1	ANT2	MIMO						
2.4GHz	2412	1	26T	0	AVG	11.42	10.05	13.80	30.00	-16.20	-4.74	9.05	36.02	-26.97
					PEAK	18.82	17.32	21.14	30.00	-8.86	-4.74	16.40	36.02	-19.62
				4	AVG	11.22	10.06	13.69	30.00	-16.31	-4.74	8.94	36.02	-27.08
					PEAK	18.45	17.62	21.07	30.00	-8.93	-4.74	16.32	36.02	-19.70
				8	AVG	10.98	9.86	13.47	30.00	-16.53	-4.74	8.72	36.02	-27.30
					PEAK	18.43	17.40	20.96	30.00	-9.04	-4.74	16.21	36.02	-19.81
	2437	6	26T	0	AVG	11.03	10.35	13.71	30.00	-16.29	-4.17	9.55	36.02	-26.47
					PEAK	18.73	17.79	21.30	30.00	-8.70	-4.17	17.13	36.02	-18.89
				4	AVG	11.10	10.09	13.63	30.00	-16.37	-4.17	9.47	36.02	-26.55
					PEAK	18.51	17.76	21.16	30.00	-8.84	-4.17	17.00	36.02	-19.02
				8	AVG	11.03	10.85	13.95	30.00	-16.05	-4.17	9.79	36.02	-26.23
					PEAK	18.66	18.44	21.56	30.00	-8.44	-4.17	17.40	36.02	-18.62
	2462	11	26T	0	AVG	11.13	10.71	13.94	30.00	-16.06	-3.36	10.58	36.02	-25.44
					PEAK	18.42	17.13	20.83	30.00	-9.17	-3.36	17.47	36.02	-18.55
				4	AVG	11.34	9.57	13.55	30.00	-16.45	-3.36	10.20	36.02	-25.83
					PEAK	18.79	17.23	21.09	30.00	-8.91	-3.36	17.73	36.02	-18.29
				8	AVG	10.28	10.52	13.41	30.00	-16.59	-3.36	10.05	36.02	-25.97
					PEAK	17.84	18.10	20.98	30.00	-9.02	-3.36	17.62	36.02	-18.40

Table 7-12. 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]	Directional Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
						ANT1	ANT2	MIMO						
2.4GHz	2412	1	52T	37	AVG	12.15	10.91	14.58	30.00	-15.42	-4.74	9.84	36.02	-26.18
					PEAK	19.95	18.45	22.27	30.00	-7.73	-4.74	17.53	36.02	-18.49
				38	AVG	12.27	11.48	14.90	30.00	-15.10	-4.74	10.16	36.02	-25.86
					PEAK	19.88	19.29	22.61	30.00	-7.39	-4.74	17.86	36.02	-18.16
				40	AVG	11.66	11.45	14.57	30.00	-15.43	-4.74	9.82	36.02	-26.20
					PEAK	19.32	19.37	22.36	30.00	-7.64	-4.74	17.61	36.02	-18.41
	2437	6	52T	37	AVG	12.34	11.16	14.80	30.00	-15.20	-4.17	10.63	36.02	-25.39
					PEAK	20.18	18.89	22.59	30.00	-7.41	-4.17	18.43	36.02	-17.59
				38	AVG	11.94	11.01	14.51	30.00	-15.49	-4.17	10.34	36.02	-25.68
					PEAK	19.55	18.76	22.18	30.00	-7.82	-4.17	18.02	36.02	-18.00
				40	AVG	10.93	11.37	14.17	30.00	-15.83	-4.17	10.00	36.02	-26.02
					PEAK	18.86	19.17	22.03	30.00	-7.97	-4.17	17.86	36.02	-18.16
	2462	11	52T	37	AVG	12.10	10.69	14.46	30.00	-15.54	-3.36	11.10	36.02	-24.92
					PEAK	19.93	18.45	22.26	30.00	-7.74	-3.36	18.90	36.02	-17.12
				38	AVG	12.23	11.68	14.97	30.00	-15.03	-3.36	11.61	36.02	-24.41
					PEAK	19.70	19.45	22.59	30.00	-7.41	-3.36	19.23	36.02	-16.79
				40	AVG	11.30	11.05	14.19	30.00	-15.81	-3.36	10.83	36.02	-25.19
					PEAK	18.85	18.90	21.89	30.00	-8.11	-3.36	18.53	36.02	-17.49

Table 7-13. 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]	Directional Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
						ANT1	ANT2	MIMO						
2.4GHz	2412	1	106T	53	AVG	12.46	12.81	15.65	30.00	-14.35	-4.74	10.90	36.02	-25.12
					PEAK	20.01	20.60	23.33	30.00	-6.67	-4.74	18.58	36.02	-17.44
				54	AVG	12.65	12.91	15.79	30.00	-14.21	-4.74	11.05	36.02	-24.97
					PEAK	20.18	20.63	23.42	30.00	-6.58	-4.74	18.68	36.02	-17.34
	2437	6	106T	53	AVG	12.68	11.49	15.14	30.00	-14.86	-4.17	10.97	36.02	-25.05
					PEAK	20.30	21.27	23.82	30.00	-6.18	-4.17	19.66	36.02	-16.36
				54	AVG	12.04	13.23	15.69	30.00	-14.31	-4.17	11.52	36.02	-24.50
					PEAK	19.79	21.09	23.50	30.00	-6.50	-4.17	19.33	36.02	-16.69
	2462	11	106T	53	AVG	12.50	12.74	15.63	30.00	-14.37	-3.36	12.27	36.02	-23.75
					PEAK	20.21	20.53	23.38	30.00	-6.62	-3.36	20.02	36.02	-16.00
				54	AVG	12.33	12.73	15.54	30.00	-14.46	-3.36	12.19	36.02	-23.84
					PEAK	19.93	20.49	23.23	30.00	-6.77	-3.36	19.87	36.02	-16.15

Table 7-14. Conducted Output Power Measurements MIMO (106 Tones)

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	Freq [MHz]	Channel	Tones	RU Index	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
						ANT1	ANT2	MIMO						
2.4GHz	2412	1	242T	61	AVG	12.60	12.88	15.75	30.00	-14.25	-4.74	11.01	36.02	-25.01
					PEAK	20.00	20.51	23.27	30.00	-6.73	-4.74	18.53	36.02	-17.49
	2417	2			AVG	13.33	14.01	16.69	30.00	-13.31	-4.74	11.95	36.02	-24.07
					PEAK	20.67	21.43	24.08	30.00	-5.92	-4.74	19.33	36.02	-16.69
	2437	6			AVG	13.09	13.95	16.55	30.00	-13.45	-4.17	12.39	36.02	-23.63
					PEAK	20.68	21.20	23.96	30.00	-6.04	-4.17	19.79	36.02	-16.23
	2457	10			AVG	13.84	13.84	16.85	30.00	-13.15	-3.36	13.49	36.02	-22.53
					PEAK	21.23	21.43	24.34	30.00	-5.66	-3.36	20.98	36.02	-15.04
	2462	11			AVG	11.80	11.59	14.71	30.00	-15.29	-3.36	11.35	36.02	-24.67
					PEAK	18.62	19.34	22.01	30.00	-7.99	-3.36	18.65	36.02	-17.37

Table 7-15. Conducted Output Power Measurements MIMO (242 Tones)

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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:

Assuming the average conducted output power was measured to be 11.42 dBm for Antenna-1 and 10.05 dBm for Antenna-2.

Antenna 1 + Antenna 2 = MIMO

(11.42 dBm + 10.05 dBm) = (13.87 mW + 10.12 mW) = 23.99 mW = 13.80 dBm

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7.4 Power Spectral Density

§15.247(e); RSS-247 [5.2]

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 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 v05 – 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 = 10kHz
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

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

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SISO Antenna-1 Power Spectral Density Measurements

Frequency [MHz]	Channel No.	802.11 Mode	Tones	Data Rate [Mbps]	Measured Power Spectral Density [dBm]	Maximum Permissible Power Density	Margin [dB]	Pass / Fail
2412	1	ax	26T	MCS0	-4.00	8.00	-12.00	Pass
2437	6	ax	26T	MCS0	-3.63	8.00	-11.63	Pass
2462	11	ax	26T	MCS0	-3.06	8.00	-11.06	Pass
2412	1	ax	52T	MCS0	-3.86	8.00	-11.86	Pass
2437	6	ax	52T	MCS0	-5.35	8.00	-13.35	Pass
2462	11	ax	52T	MCS0	-4.52	8.00	-12.52	Pass
2412	1	ax	106T	MCS0	-6.82	8.00	-14.82	Pass
2437	6	ax	106T	MCS0	-6.74	8.00	-14.74	Pass
2462	11	ax	106T	MCS0	-6.16	8.00	-14.16	Pass
2412	1	ax	242T	MCS0	-8.93	8.00	-16.93	Pass
2437	6	ax	242T	MCS0	-9.30	8.00	-17.30	Pass
2462	11	ax	242T	MCS0	-9.04	8.00	-17.04	Pass

Table 7-16. Conducted Power Density Measurements SISO ANT1

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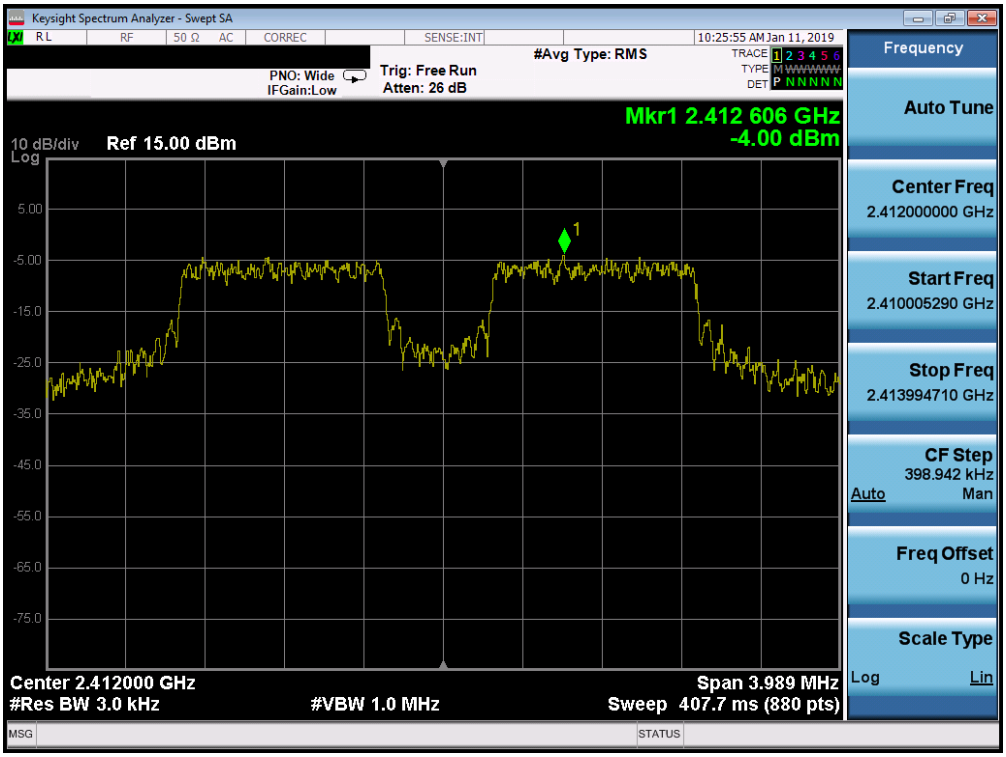
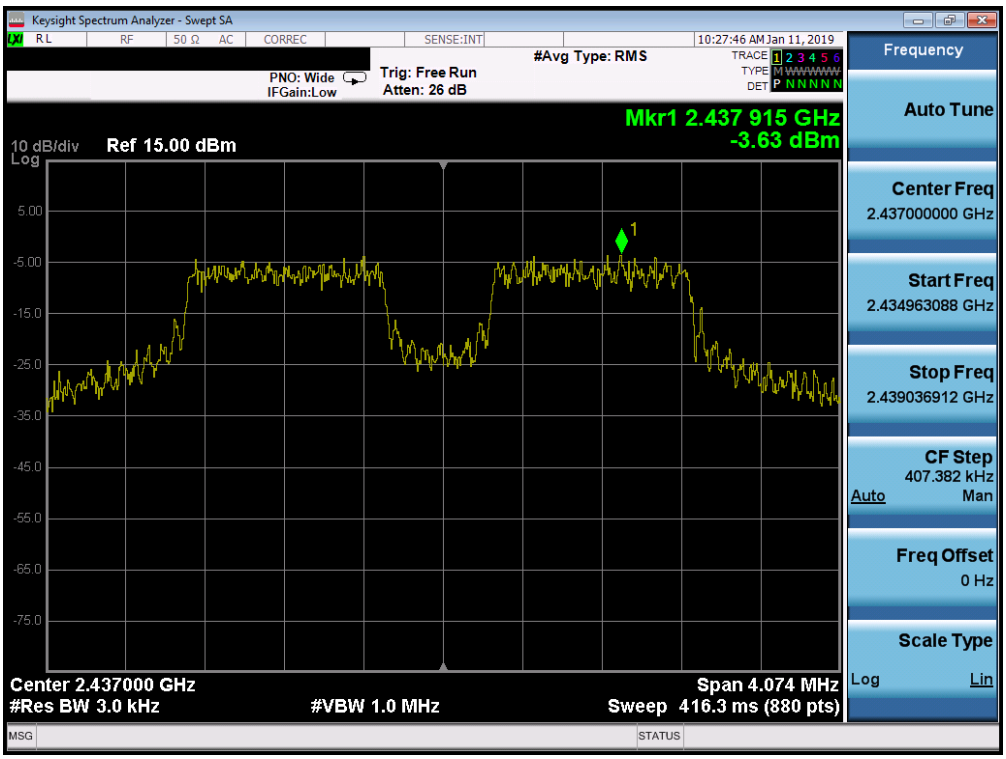


Plot 7-25. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



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

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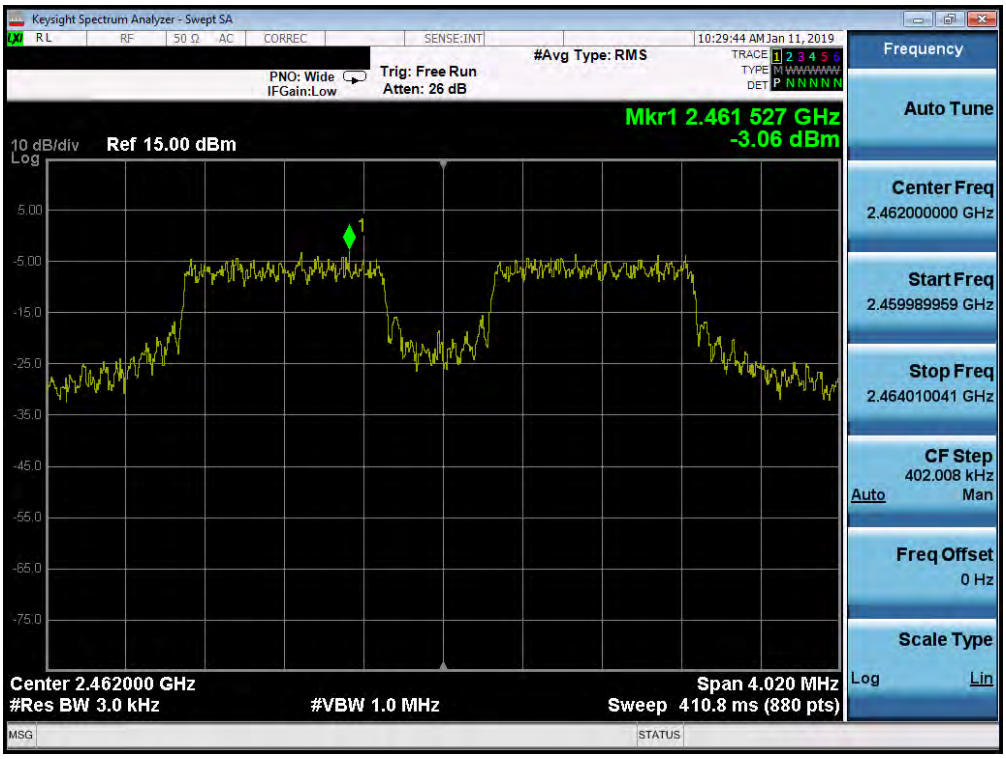
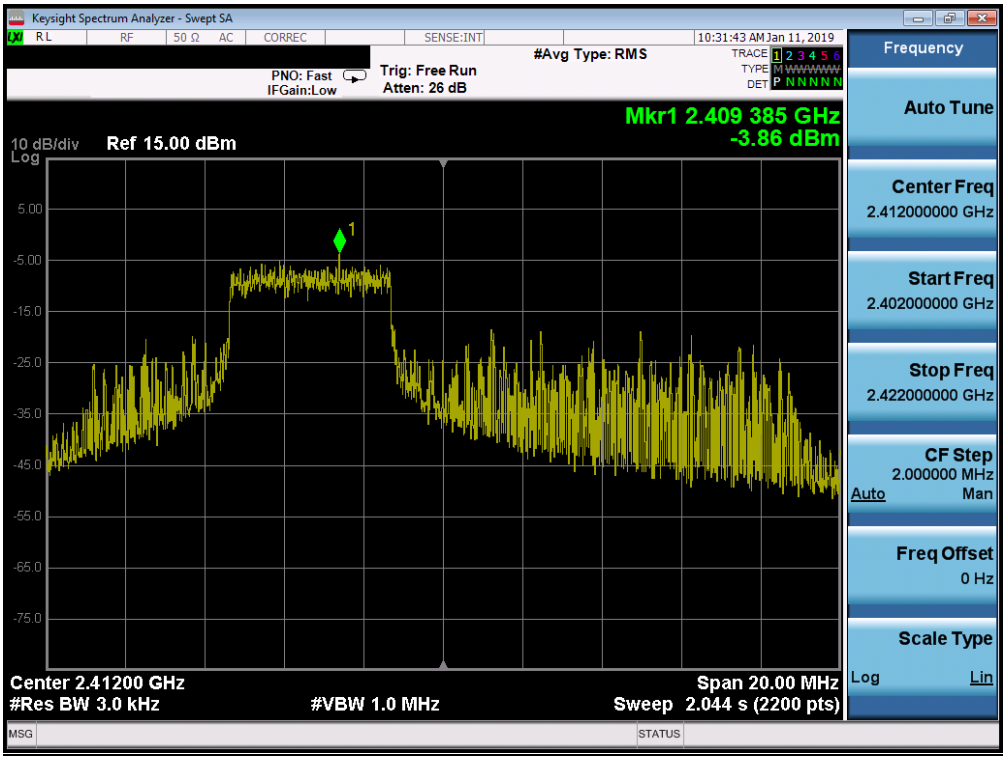


Plot 7-27. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-28. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 1)

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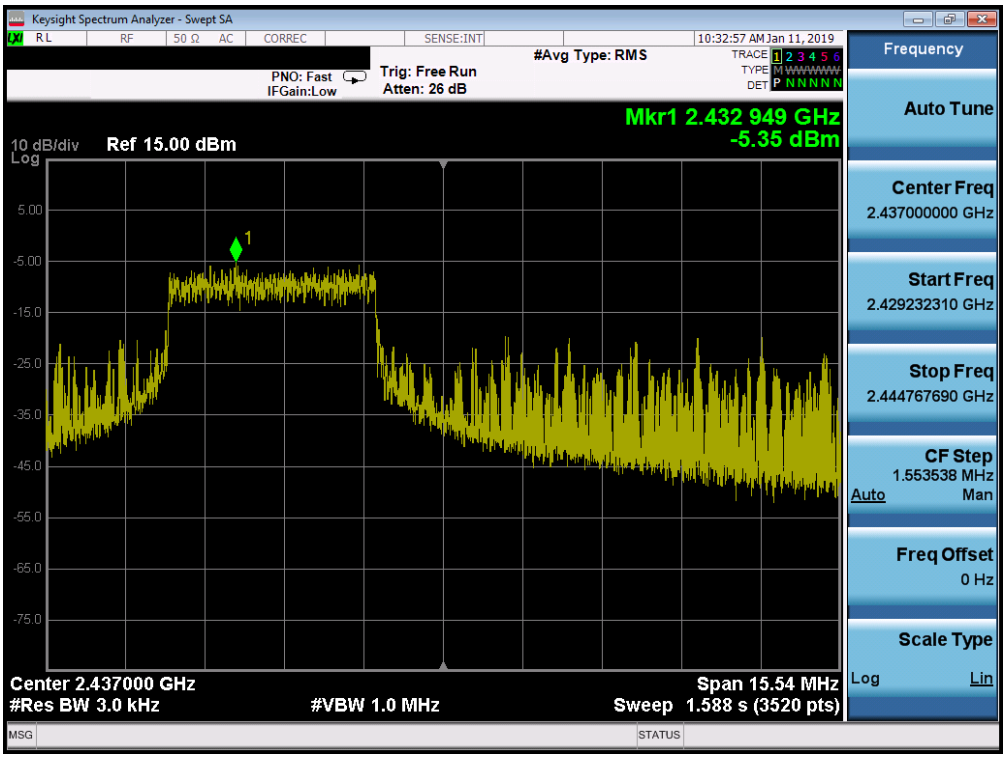
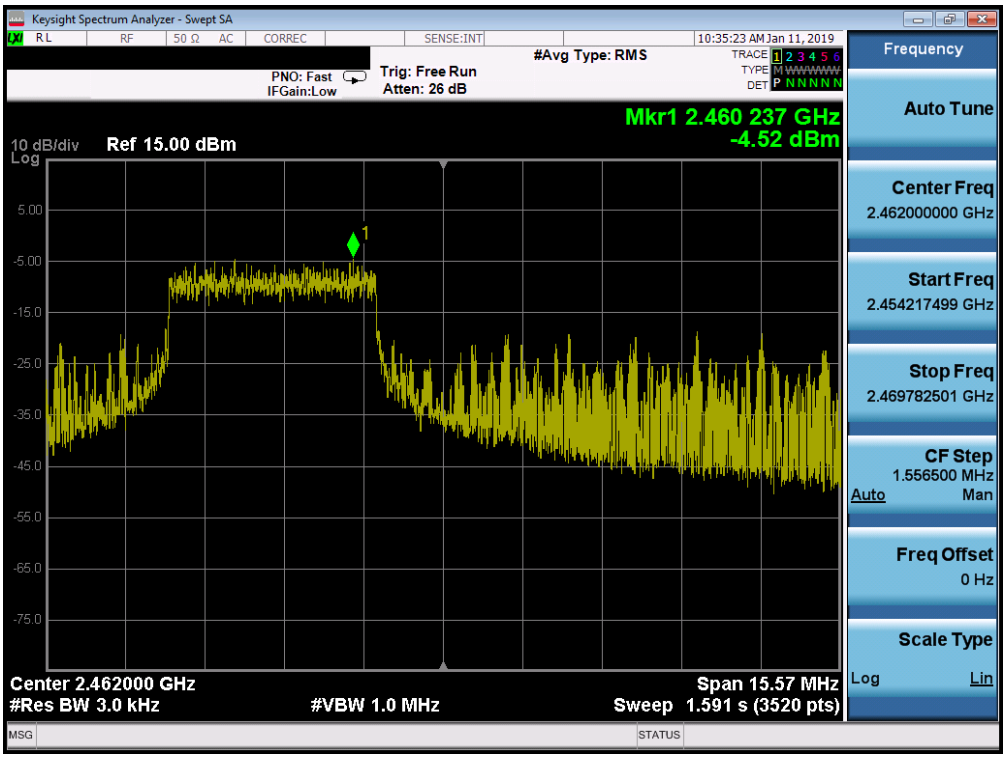


Plot 7-29. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 6)



Plot 7-30. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 11)

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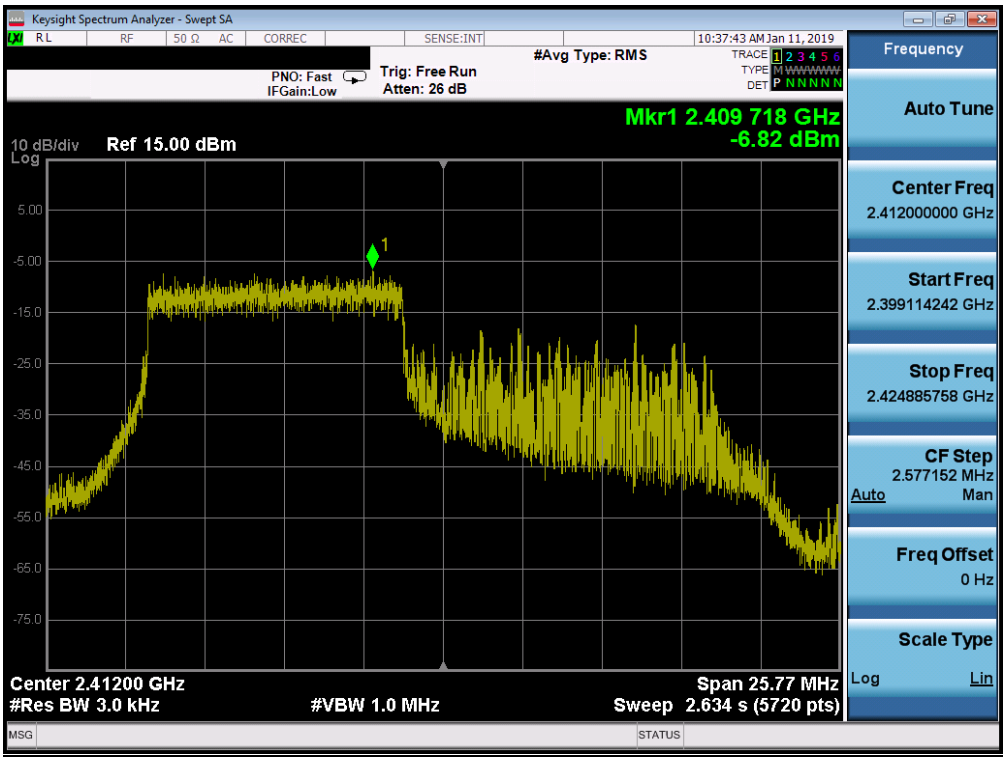
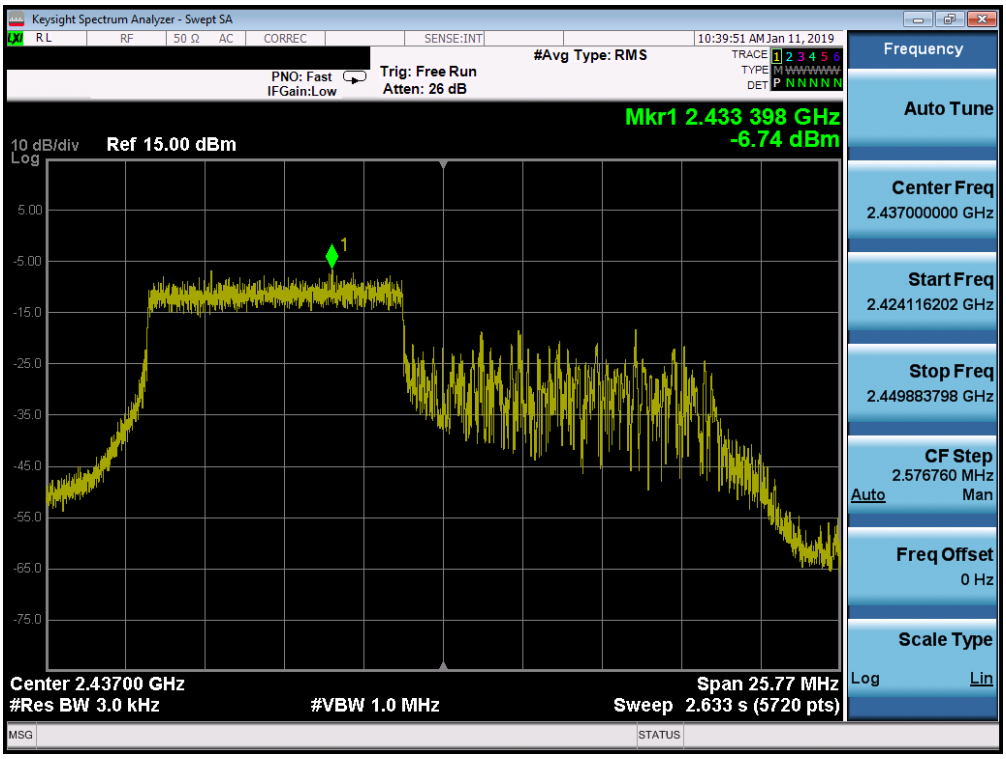


Plot 7-31. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 1)



Plot 7-32. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 6)

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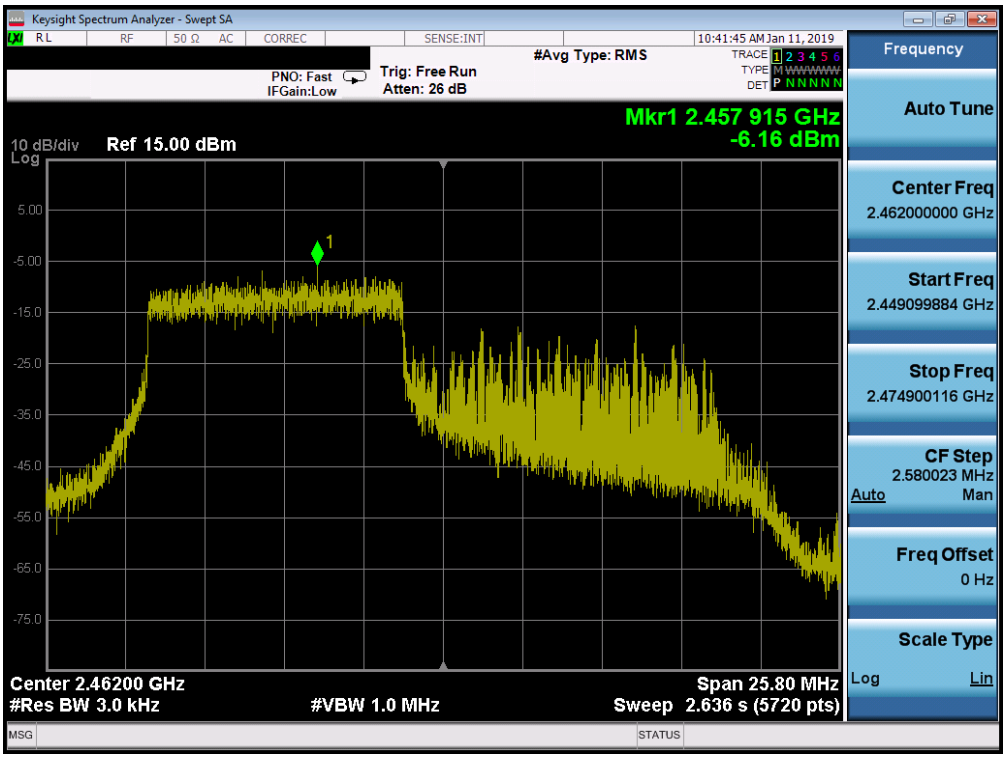
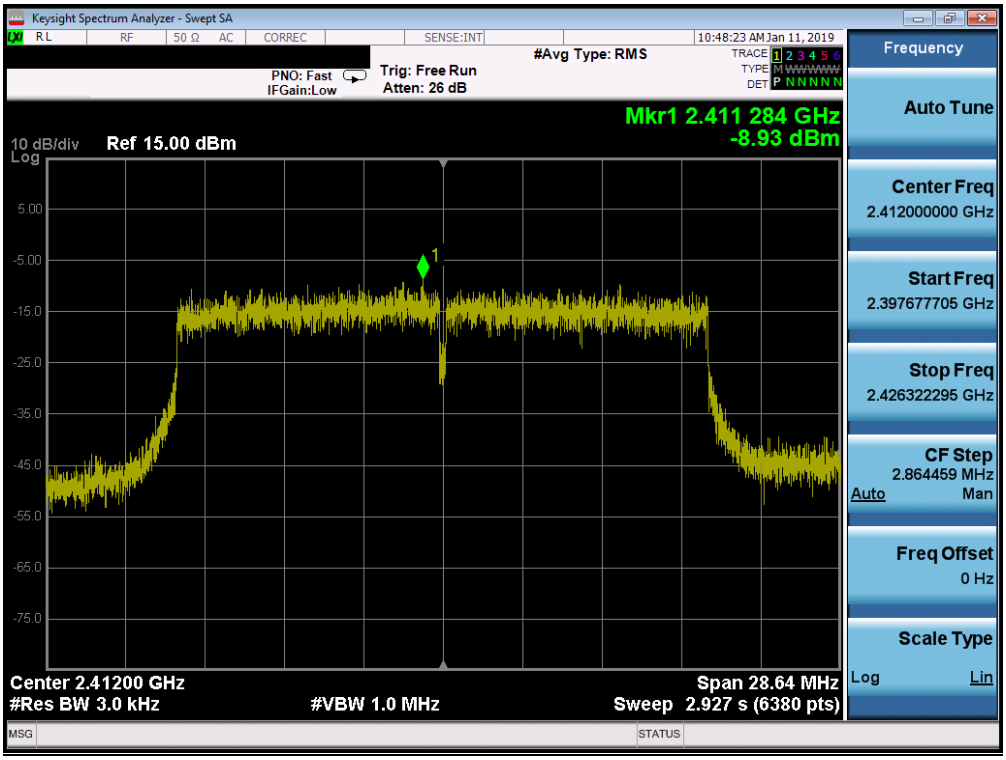


Plot 7-33. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 11)



Plot 7-34. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)

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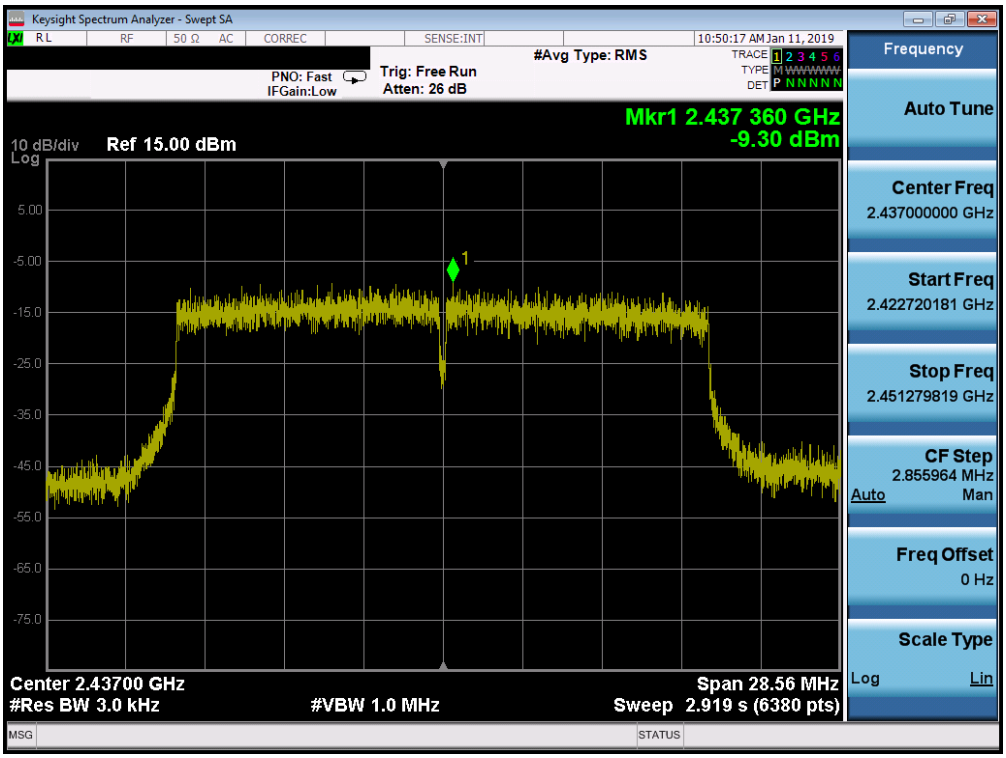
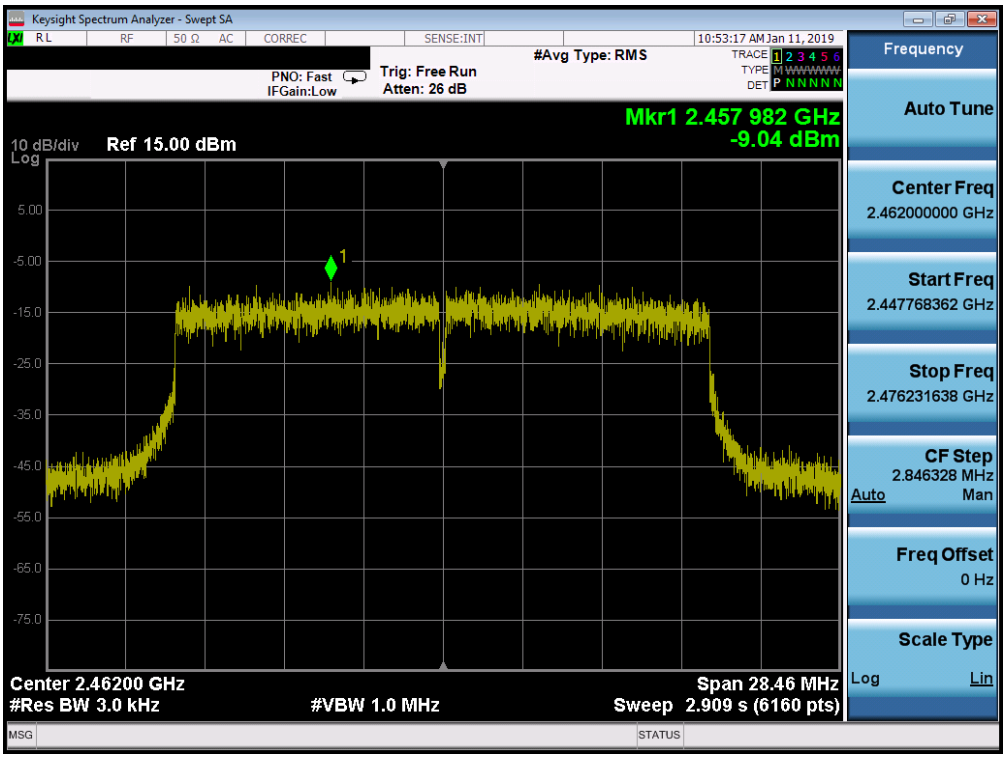


Plot 7-35. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-36. Power Spectral Density Plot SISO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)

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SISO Antenna-2 Power Spectral Density Measurements

Frequency [MHz]	Channel No.	802.11 Mode	Tones	Data Rate [Mbps]	Measured Power Spectral Density	Maximum Permissible Power Density	Margin [dB]	Pass / Fail
2412	1	ax	26T	MCS0	-3.70	8.00	-11.70	Pass
2437	6	ax	26T	MCS0	-3.99	8.00	-11.99	Pass
2462	11	ax	26T	MCS0	-4.23	8.00	-12.23	Pass
2412	1	ax	52T	MCS0	-4.85	8.00	-12.85	Pass
2437	6	ax	52T	MCS0	-6.00	8.00	-14.00	Pass
2462	11	ax	52T	MCS0	-5.82	8.00	-13.82	Pass
2412	1	ax	106T	MCS0	-6.36	8.00	-14.36	Pass
2437	6	ax	106T	MCS0	-7.02	8.00	-15.02	Pass
2462	11	ax	106T	MCS0	-7.13	8.00	-15.13	Pass
2412	1	ax	242T	MCS0	-10.72	8.00	-18.72	Pass
2437	6	ax	242T	MCS0	-8.63	8.00	-16.63	Pass
2462	11	ax	242T	MCS0	-10.54	8.00	-18.54	Pass

Table 7-17. Conducted Power Density Measurements SISO ANT2

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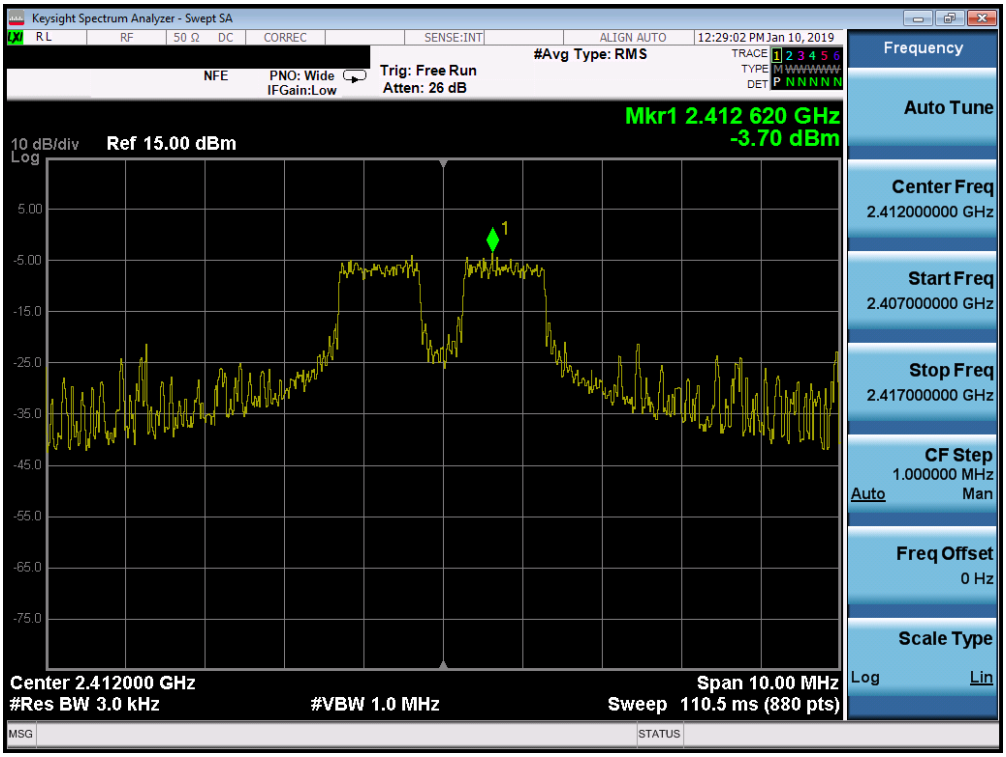
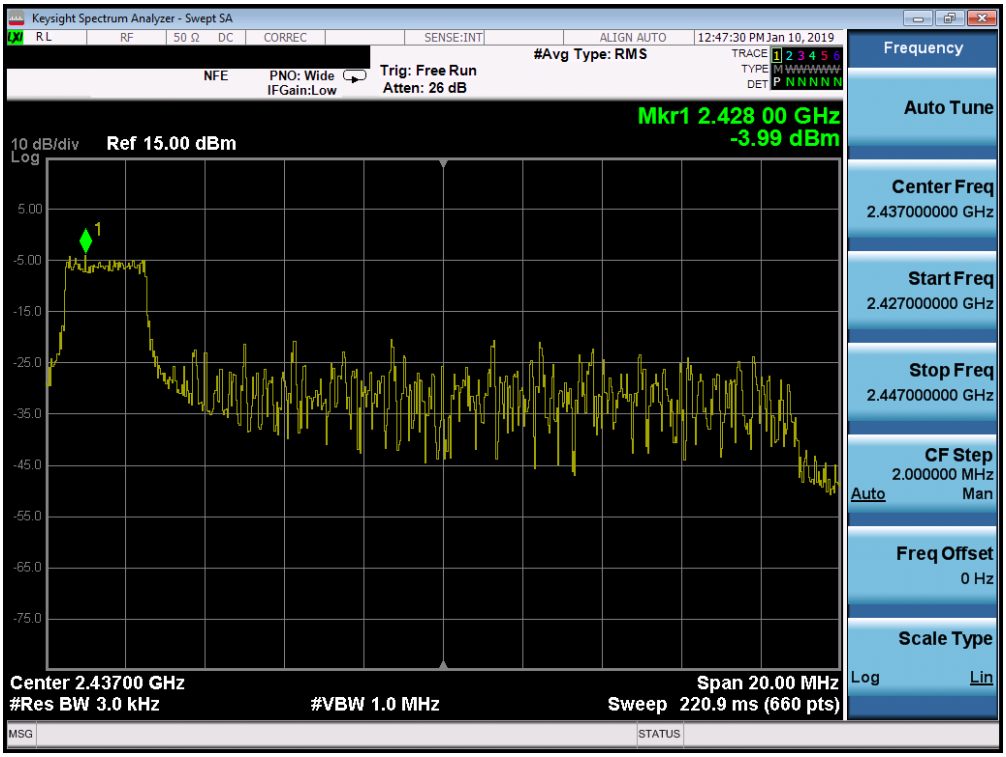


Plot 7-37. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-38. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 6)

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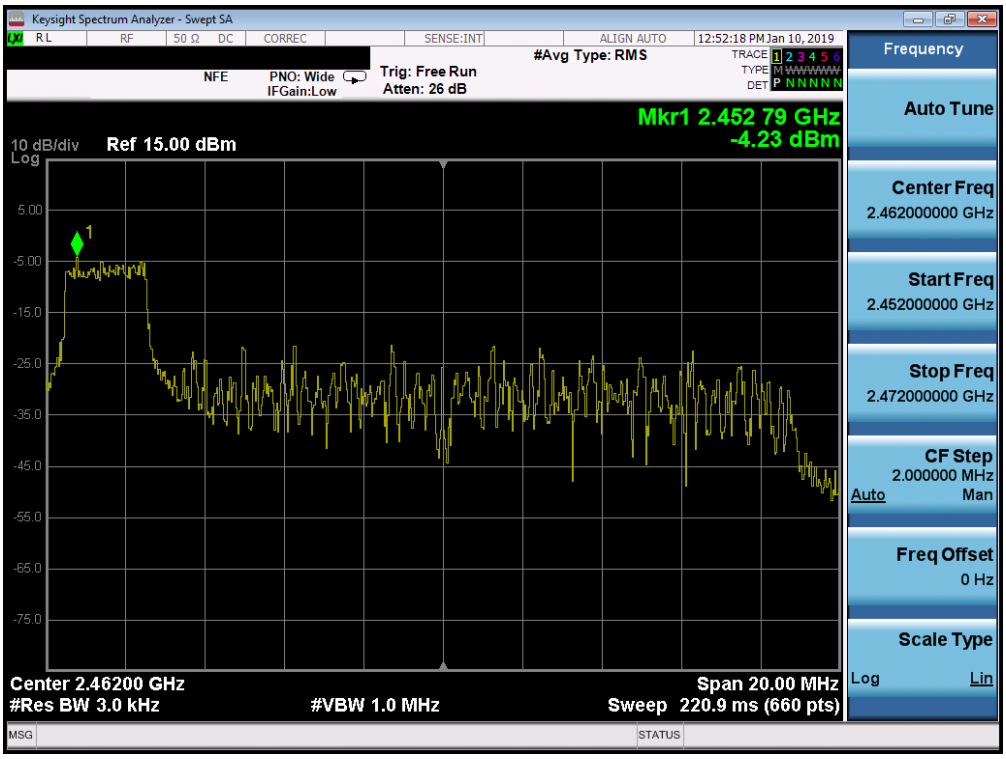
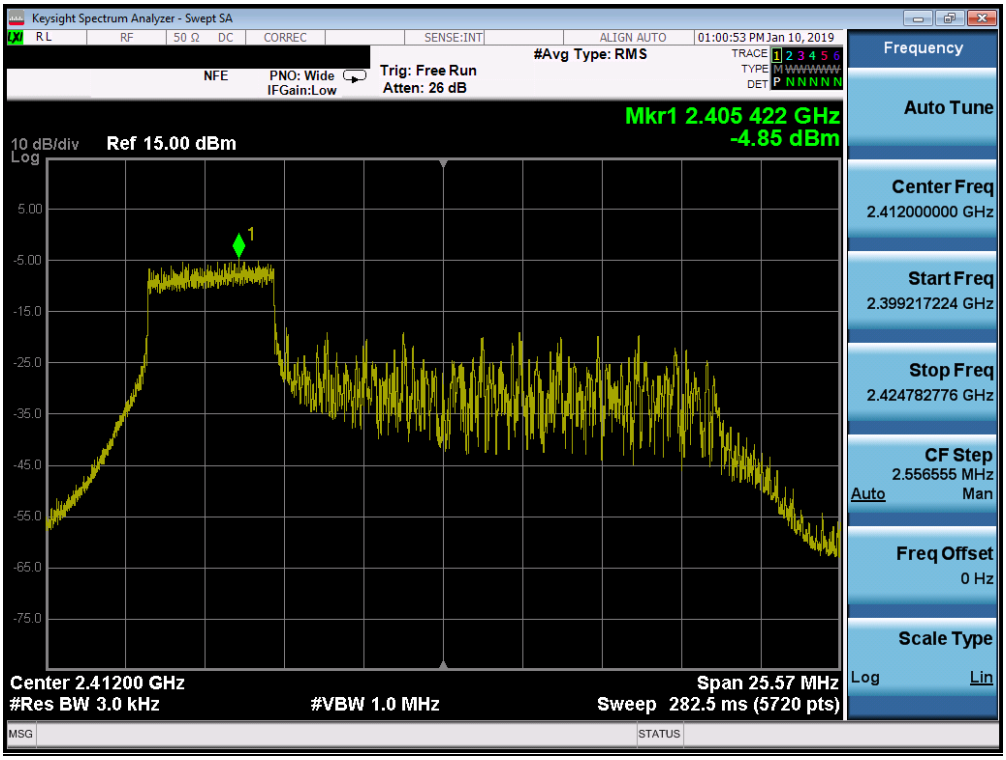


Plot 7-39. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 11)



Plot 7-40. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 52 Tones – Ch. 1)

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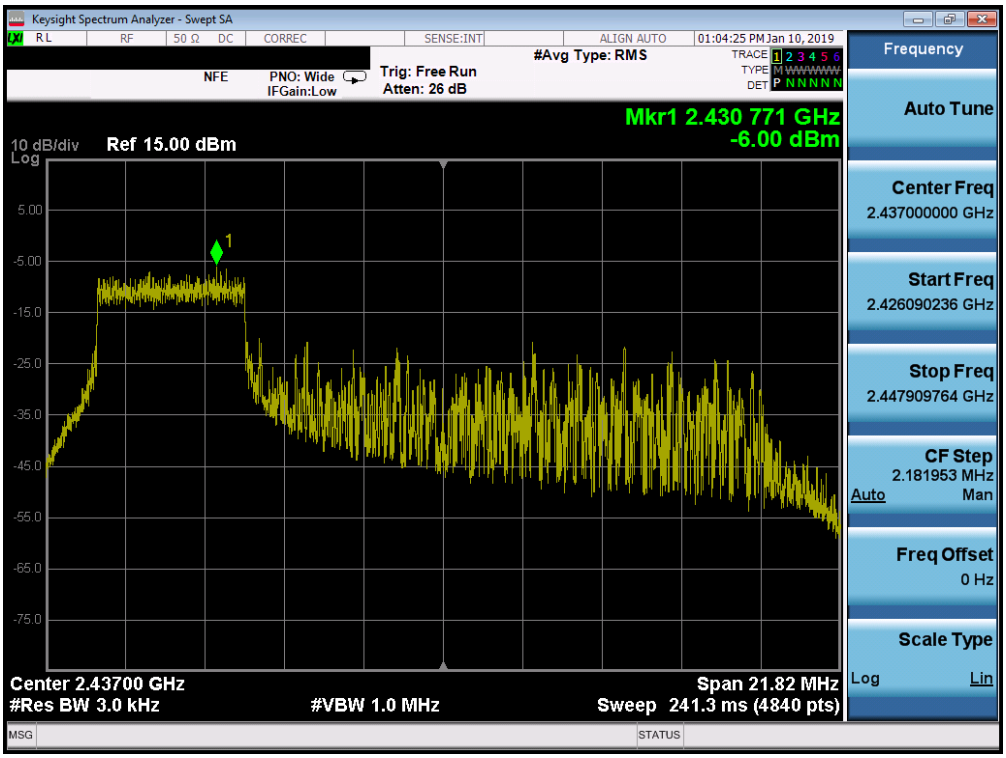
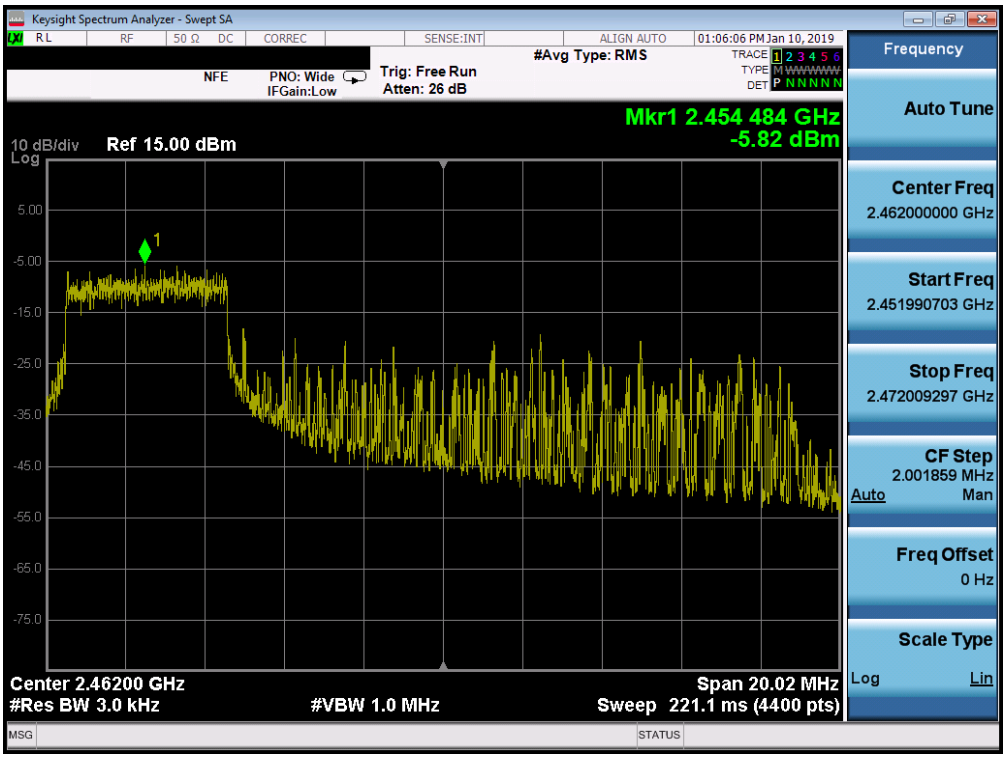


Plot 7-41. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 52 Tones – Ch. 6)



Plot 7-42. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 52 Tones – Ch. 11)

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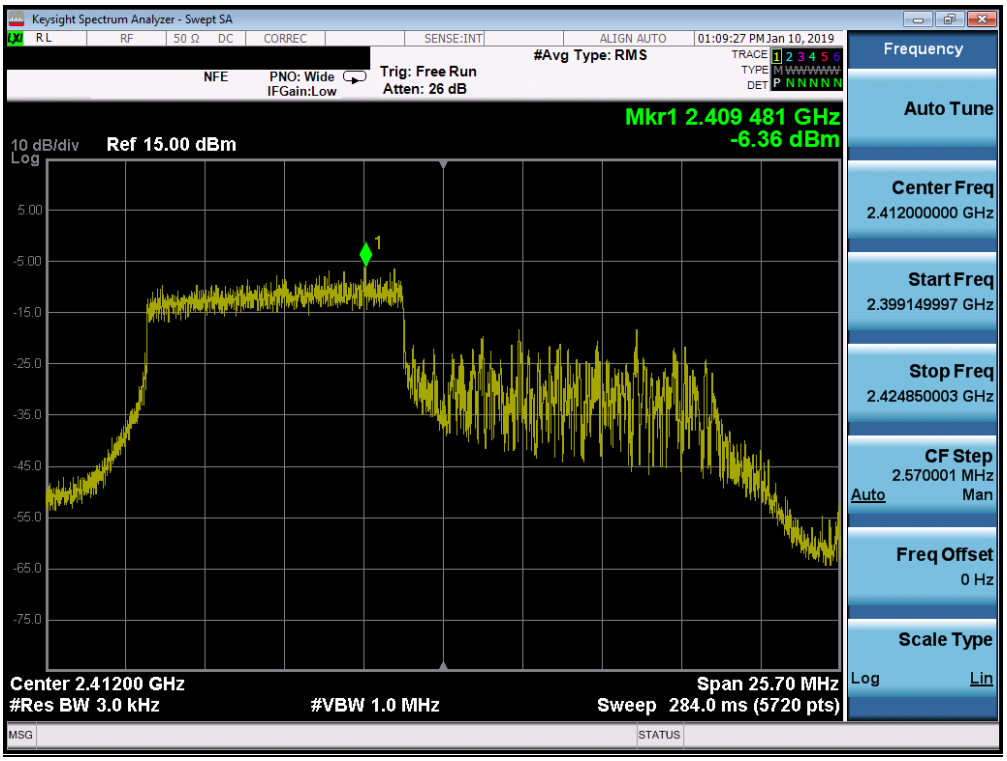
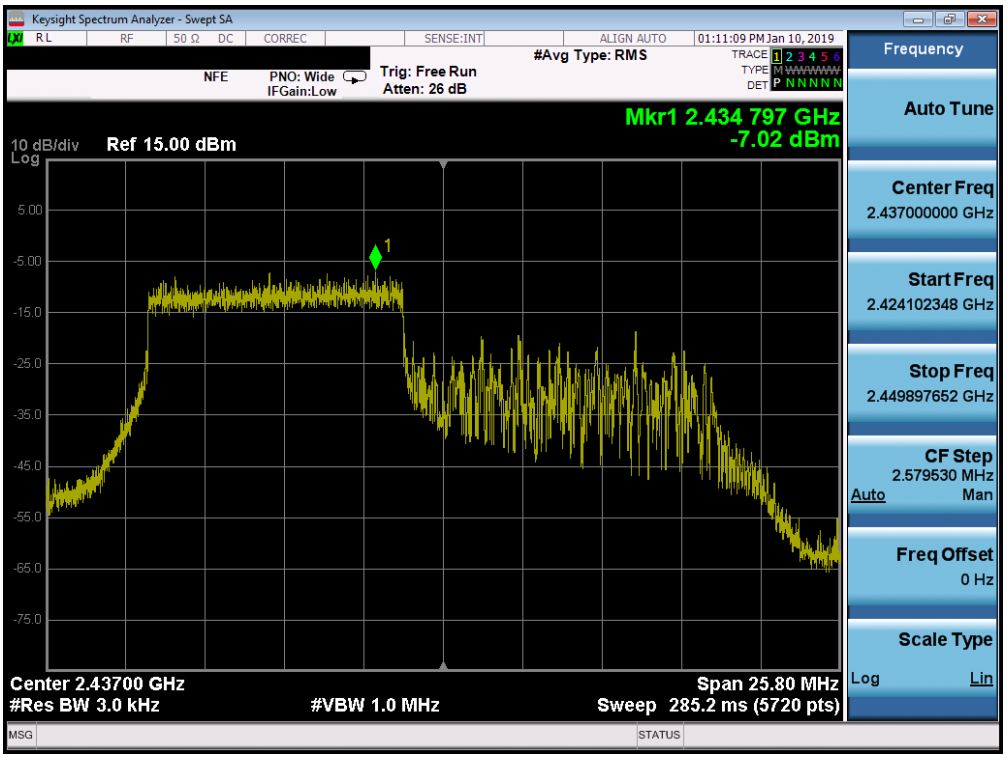


Plot 7-43. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 1)



Plot 7-44. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 6)

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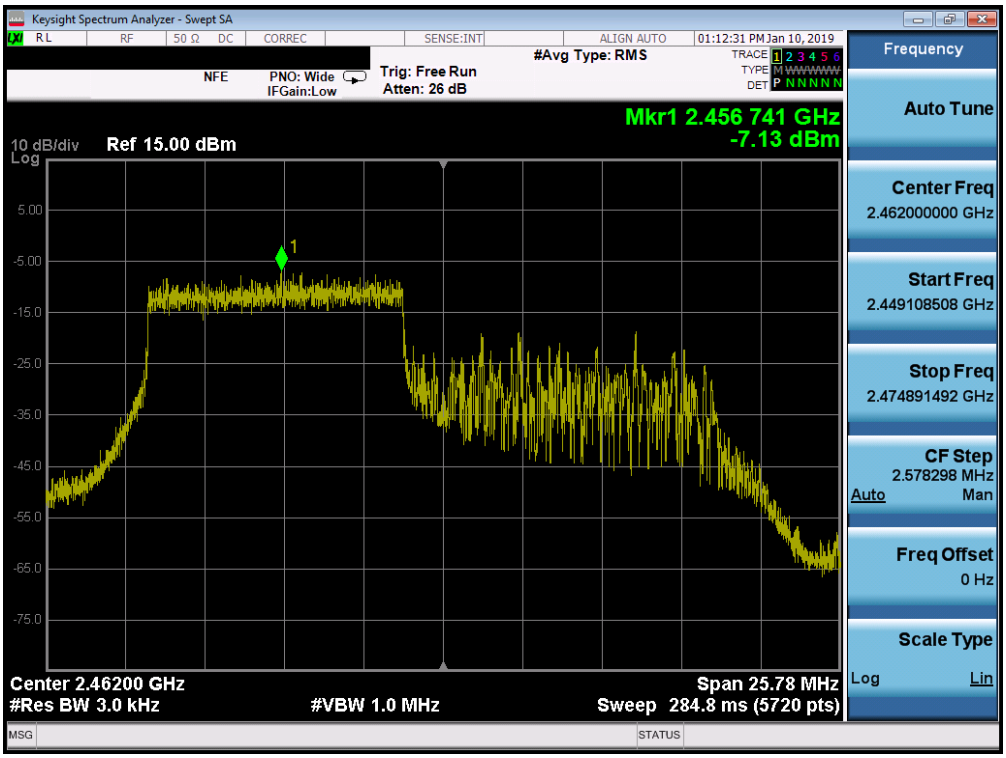
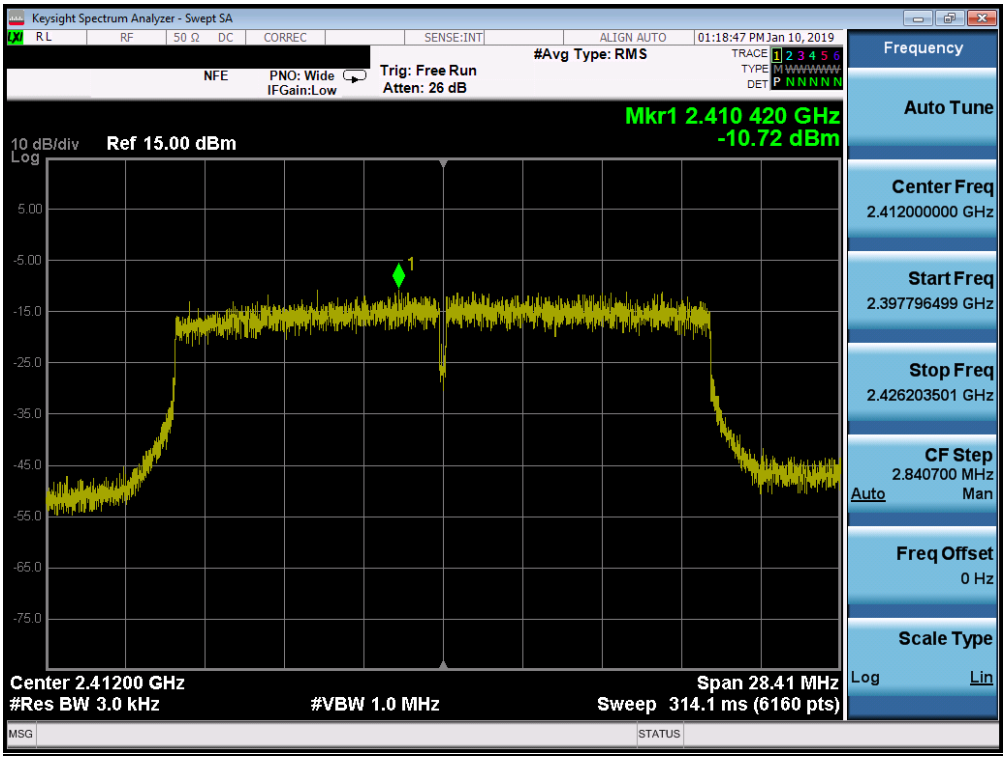


Plot 7-45. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 11)



Plot 7-46. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 1)

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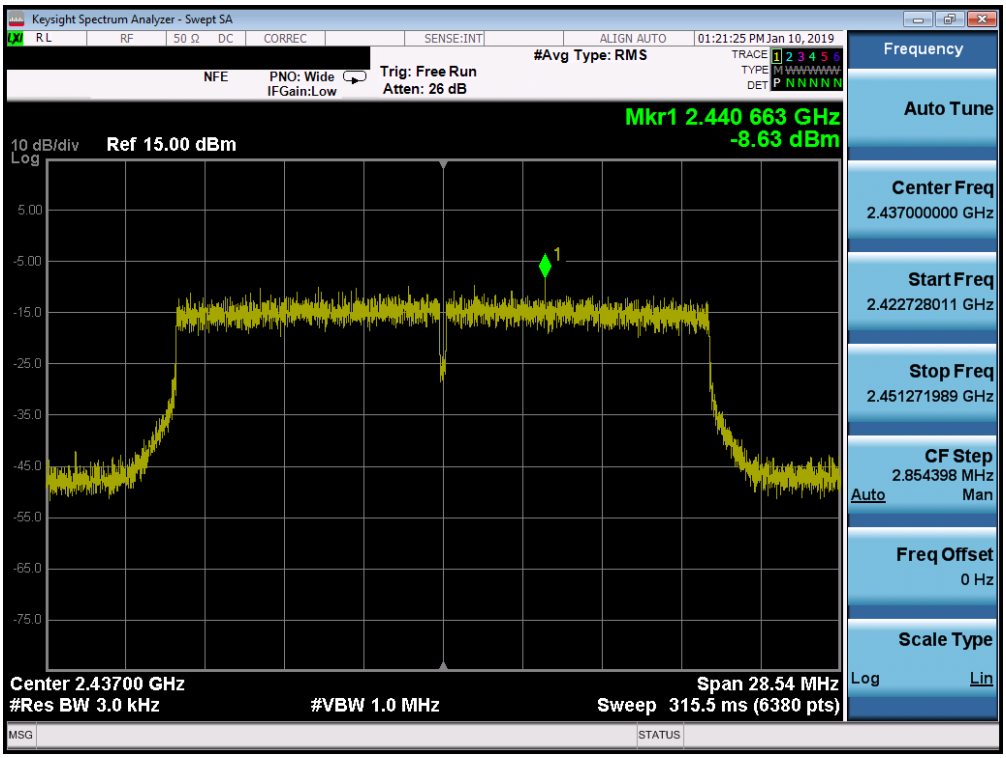
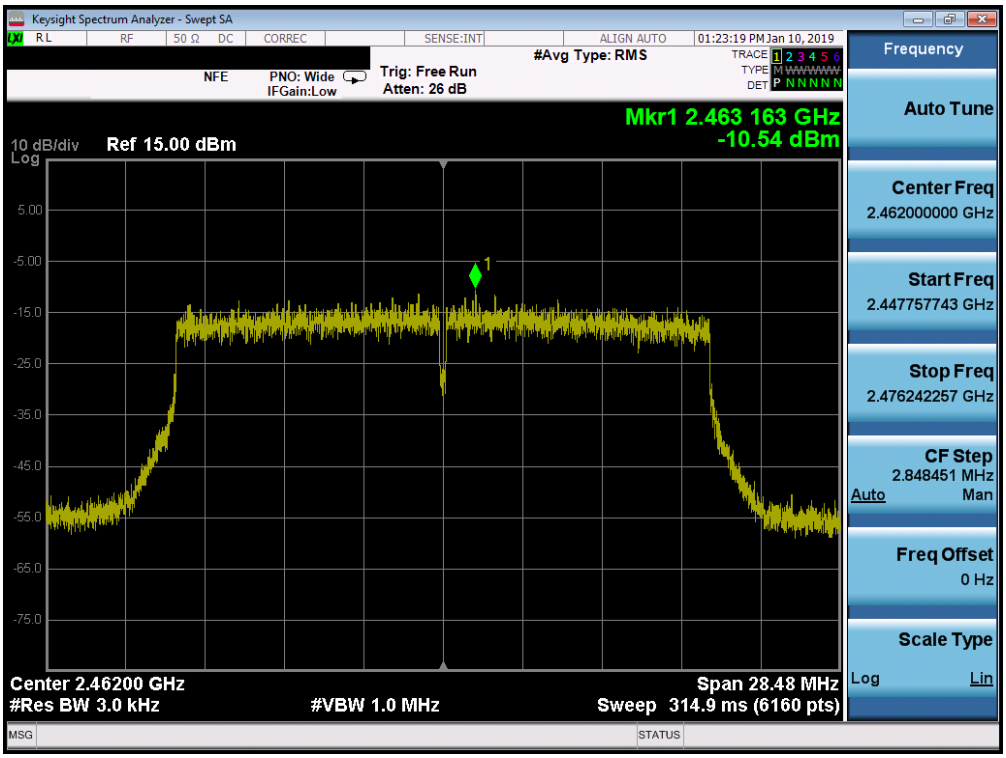


Plot 7-47. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 6)



Plot 7-48. Power Spectral Density Plot SISO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 11)

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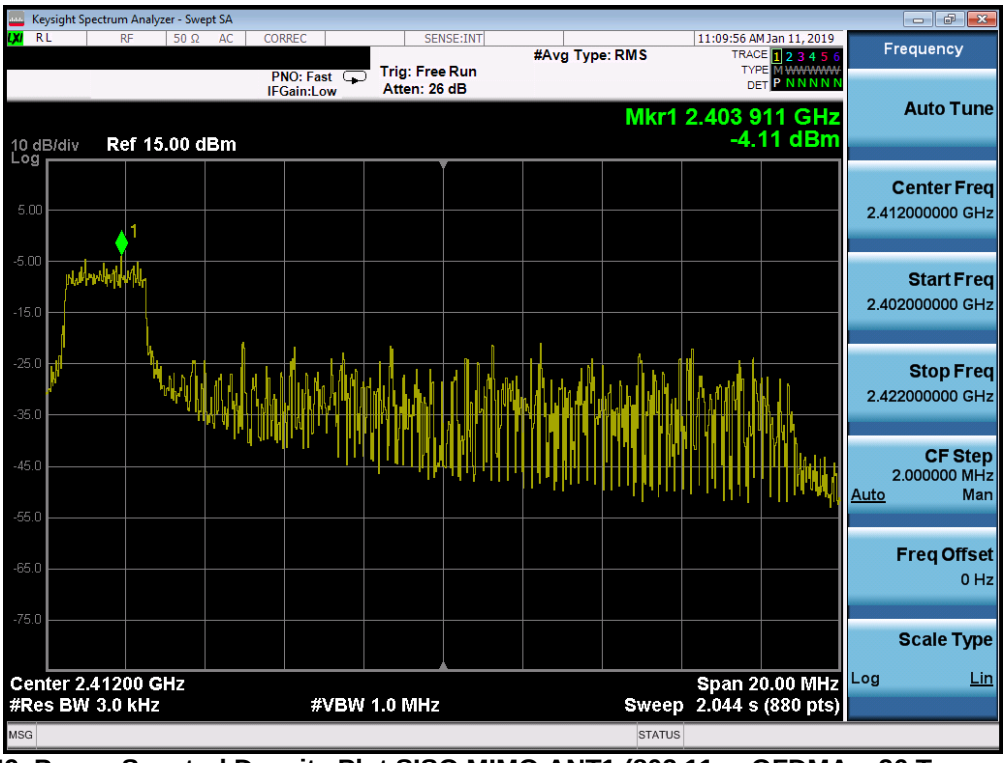
MIMO Power Spectral Density Measurements

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	-4.11	-4.90	-1.48	8.00	-9.48	Pass
2437	6	ax	26T	MCS0	-5.62	-8.73	-3.89	8.00	-11.89	Pass
2462	11	ax	26T	MCS0	-5.92	-3.92	-1.80	8.00	-9.80	Pass
2412	1	ax	52T	MCS0	-4.99	-5.81	-2.37	8.00	-10.37	Pass
2437	6	ax	52T	MCS0	-9.25	-11.83	-7.34	8.00	-15.34	Pass
2462	11	ax	52T	MCS0	-5.94	-5.77	-2.84	8.00	-10.84	Pass
2412	1	ax	106T	MCS0	-8.33	-9.04	-5.66	8.00	-13.66	Pass
2437	6	ax	106T	MCS0	-9.39	-9.28	-6.32	8.00	-14.32	Pass
2462	11	ax	106T	MCS0	-9.26	-9.25	-6.24	8.00	-14.24	Pass
2412	1	ax	242T	MCS0	-12.73	-13.11	-9.91	8.00	-17.91	Pass
2437	6	ax	242T	MCS0	-16.31	-12.93	-11.29	8.00	-19.29	Pass
2462	11	ax	242T	MCS0	-11.01	-11.83	-8.39	8.00	-16.39	Pass

Table 7-18.MIMO Conducted Power Density Measurements



Plot 7-49. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)

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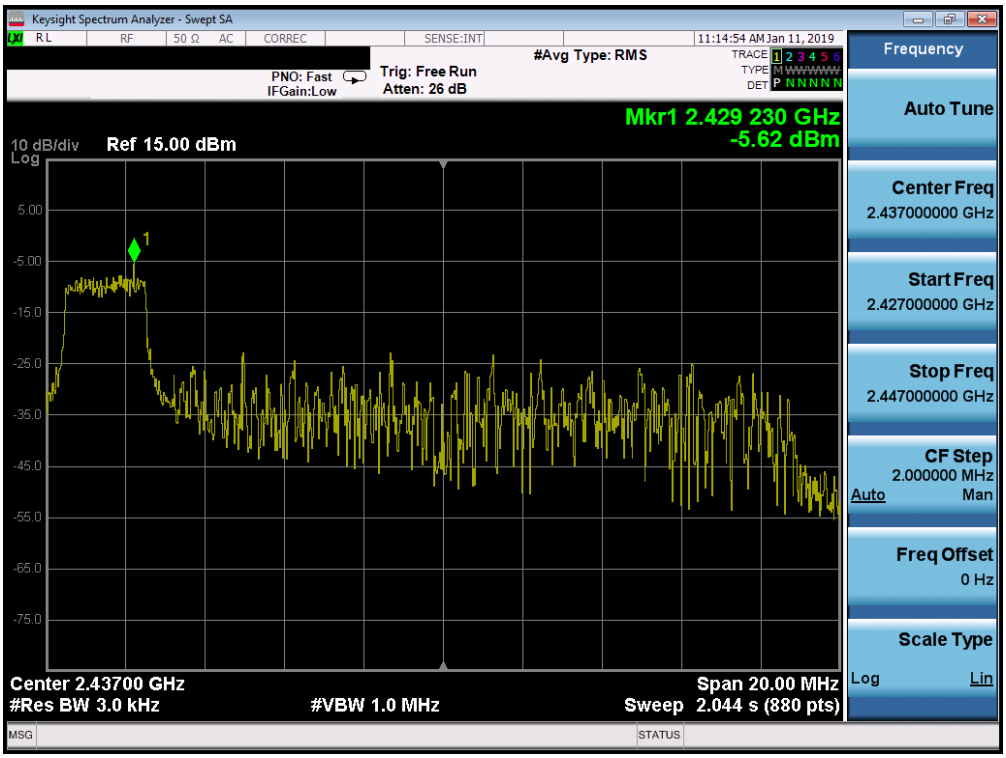
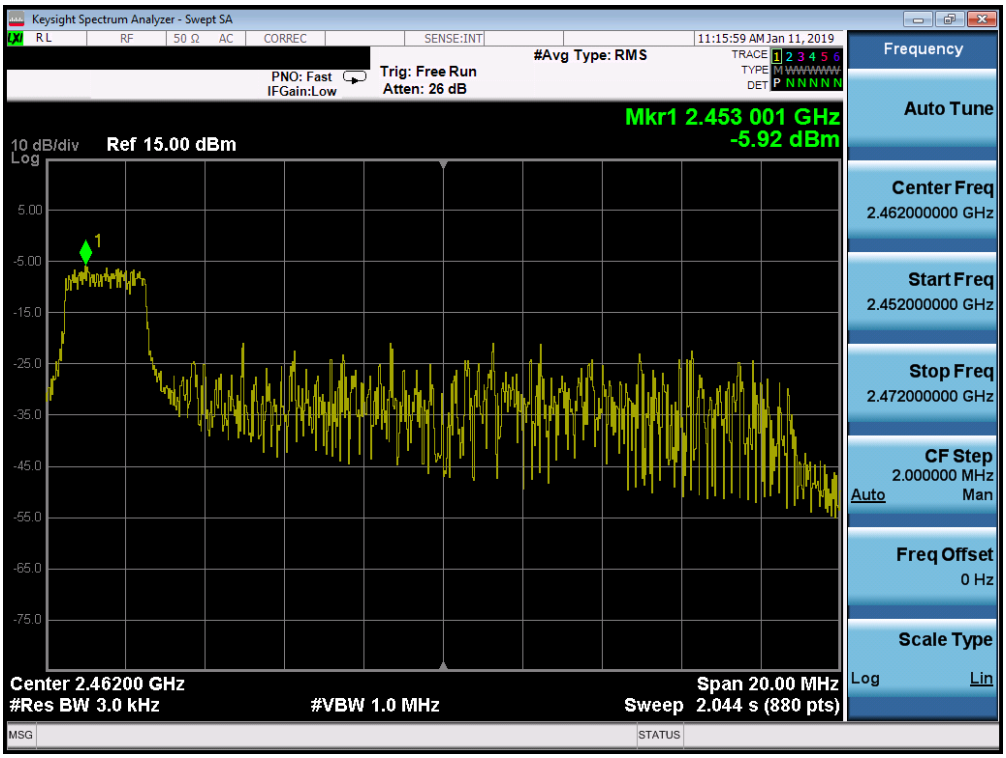


Plot 7-50. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 6)



Plot 7-51. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)

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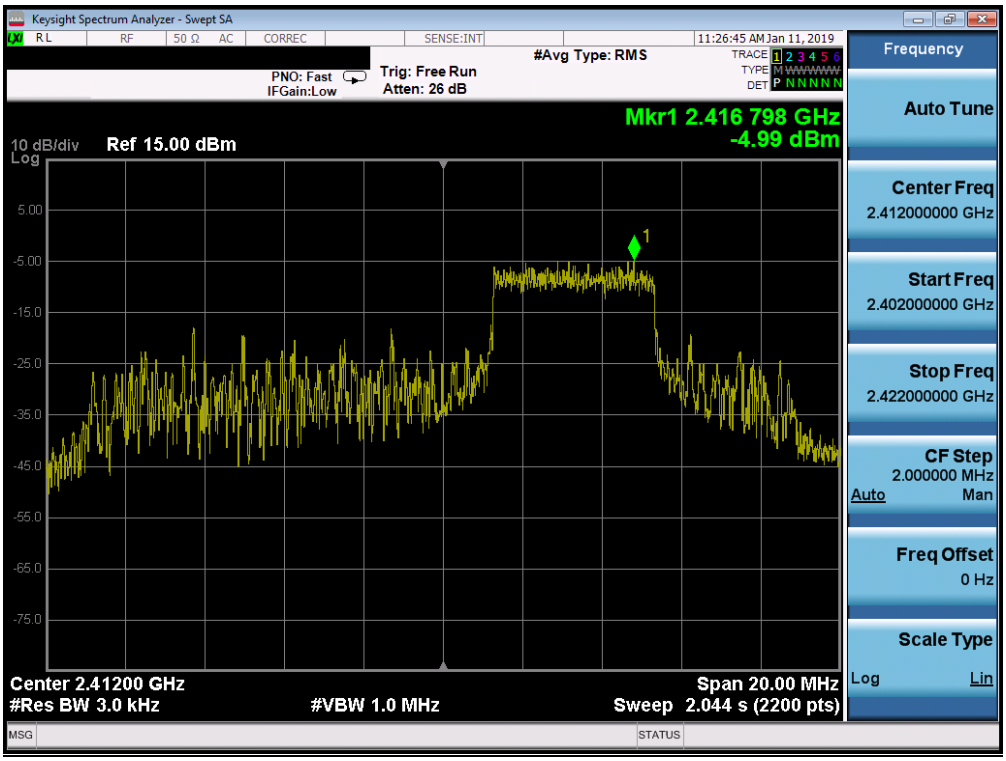
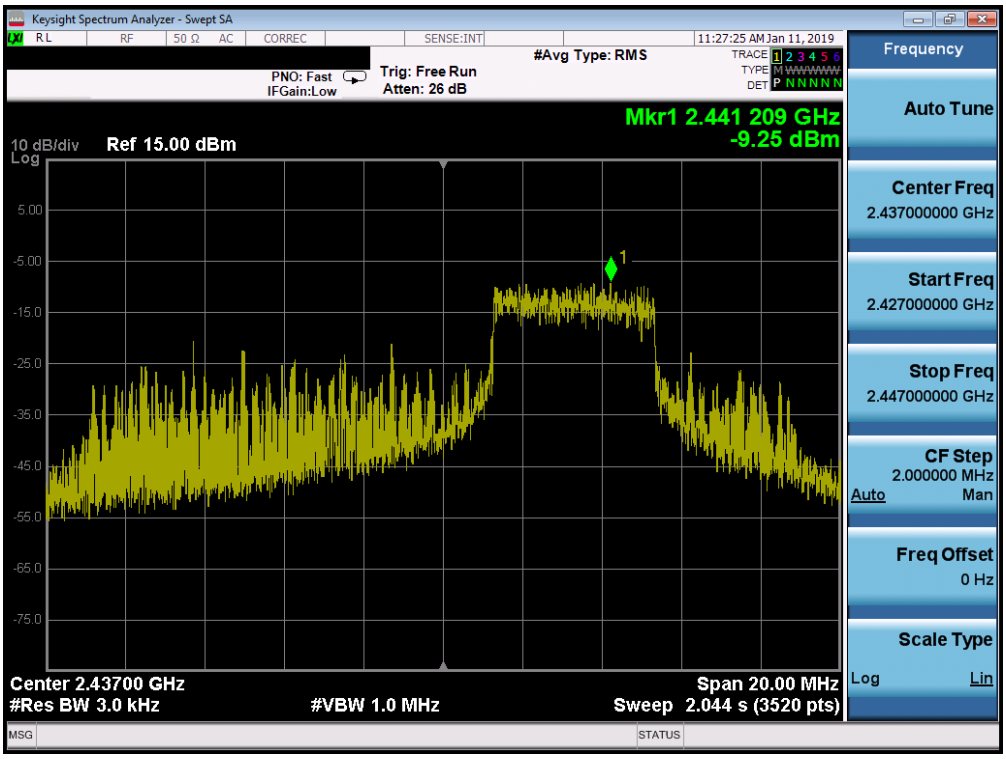


Plot 7-52. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 1)



Plot 7-53. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 6)

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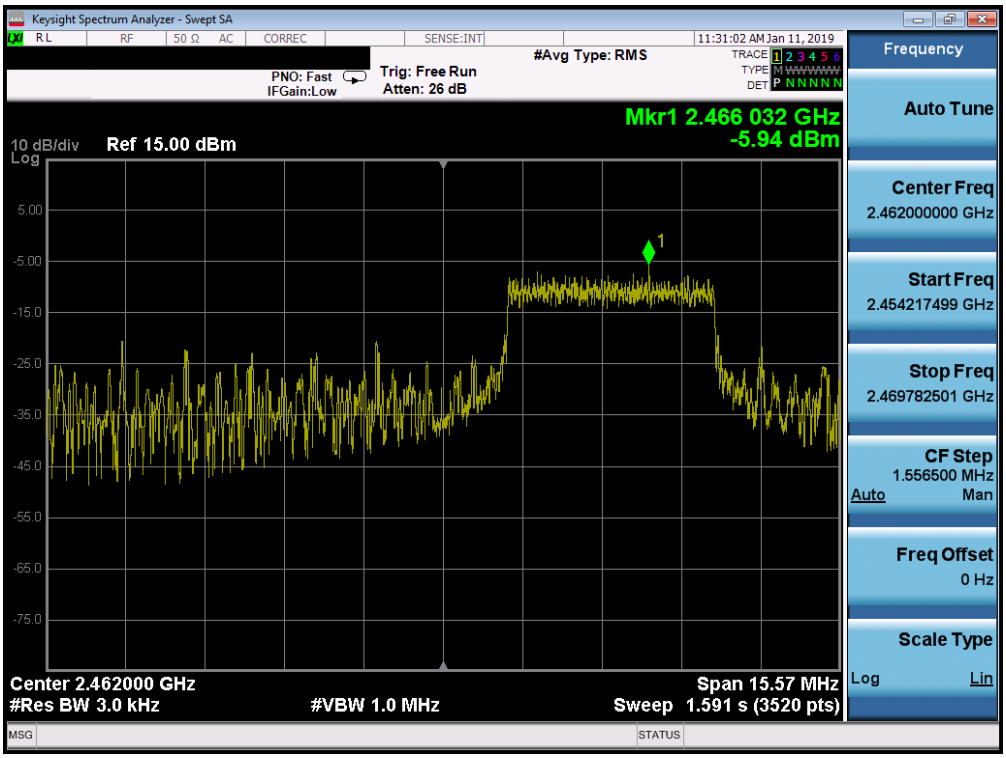
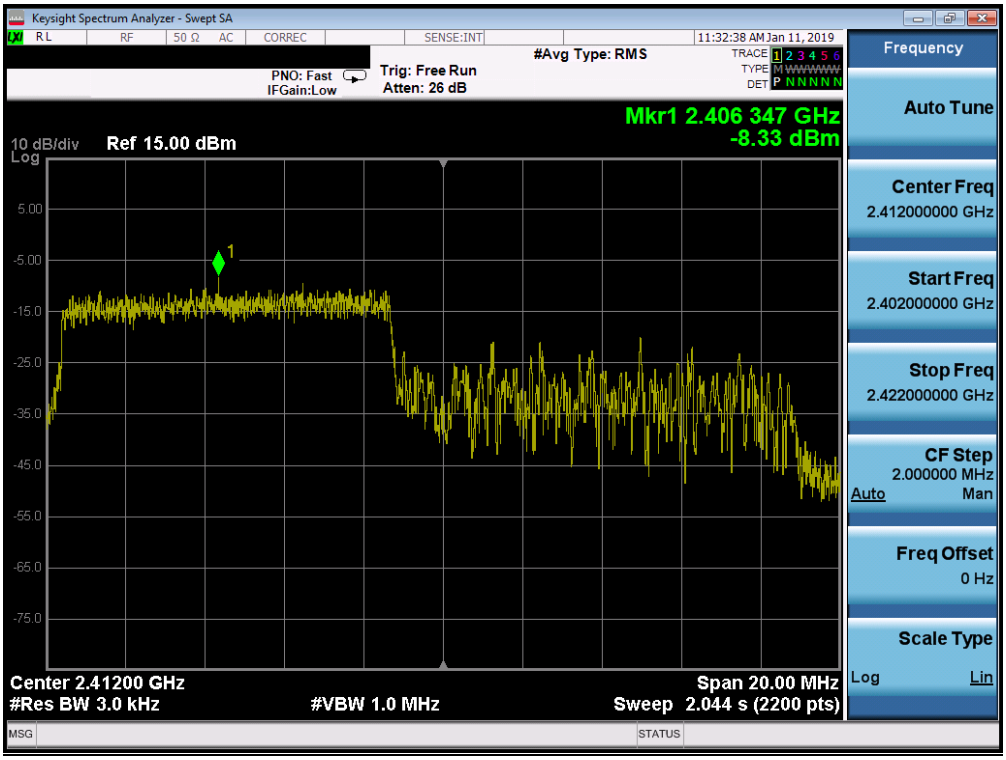


Plot 7-54. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 11)



Plot 7-55. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 1)

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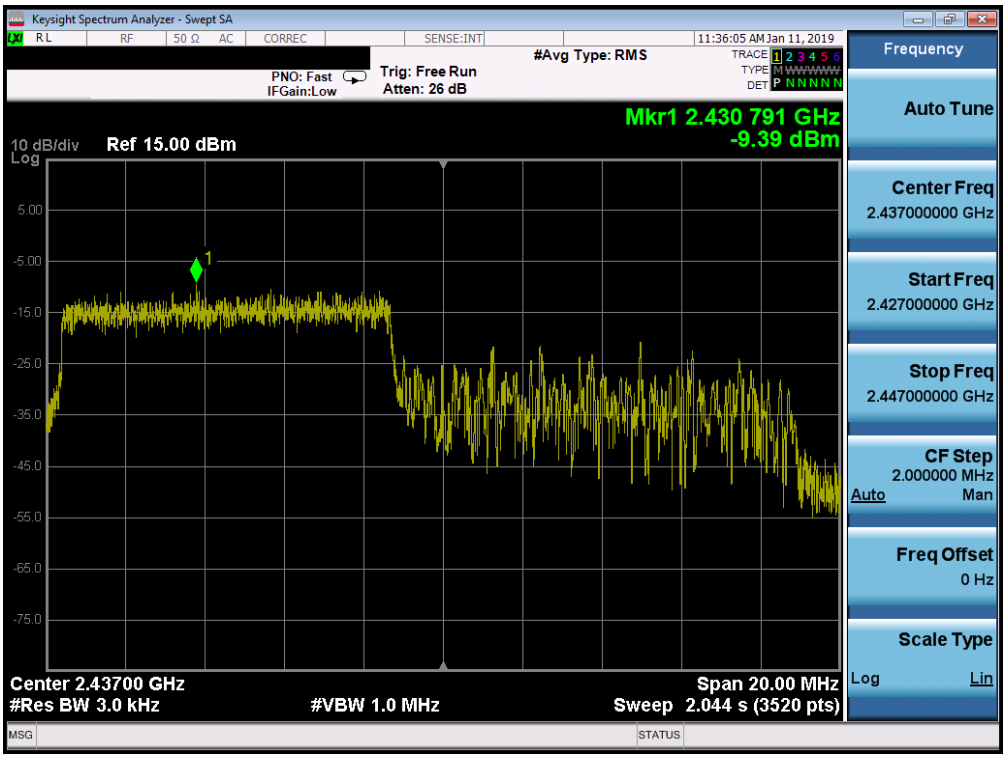
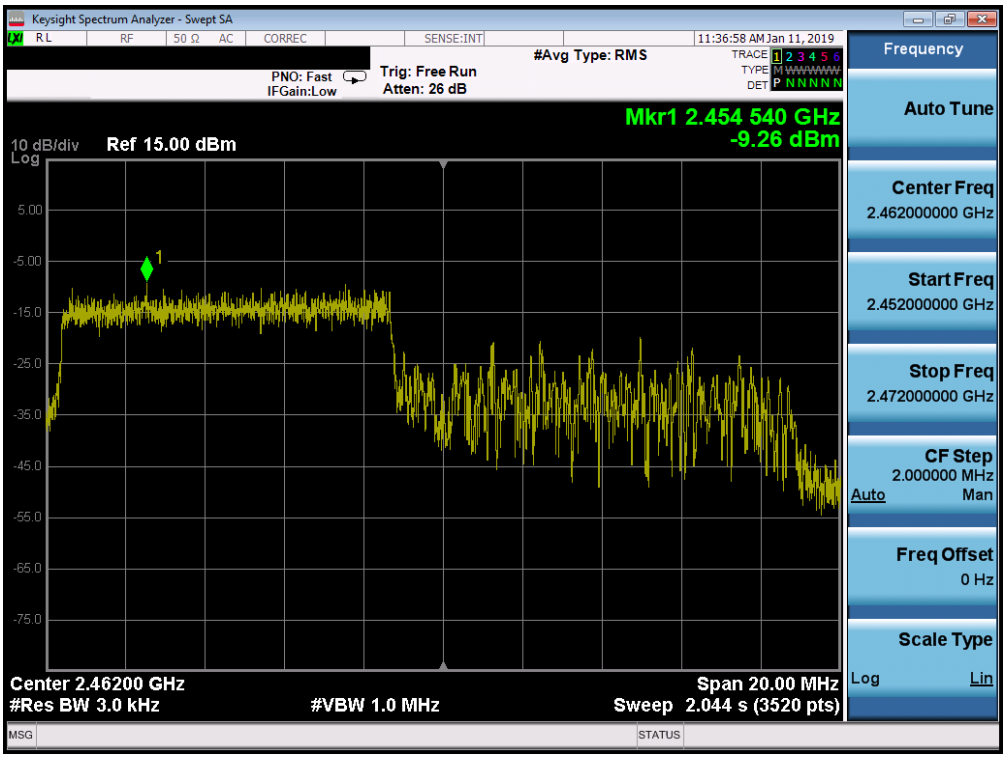


Plot 7-56. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 6)



Plot 7-57. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 11)

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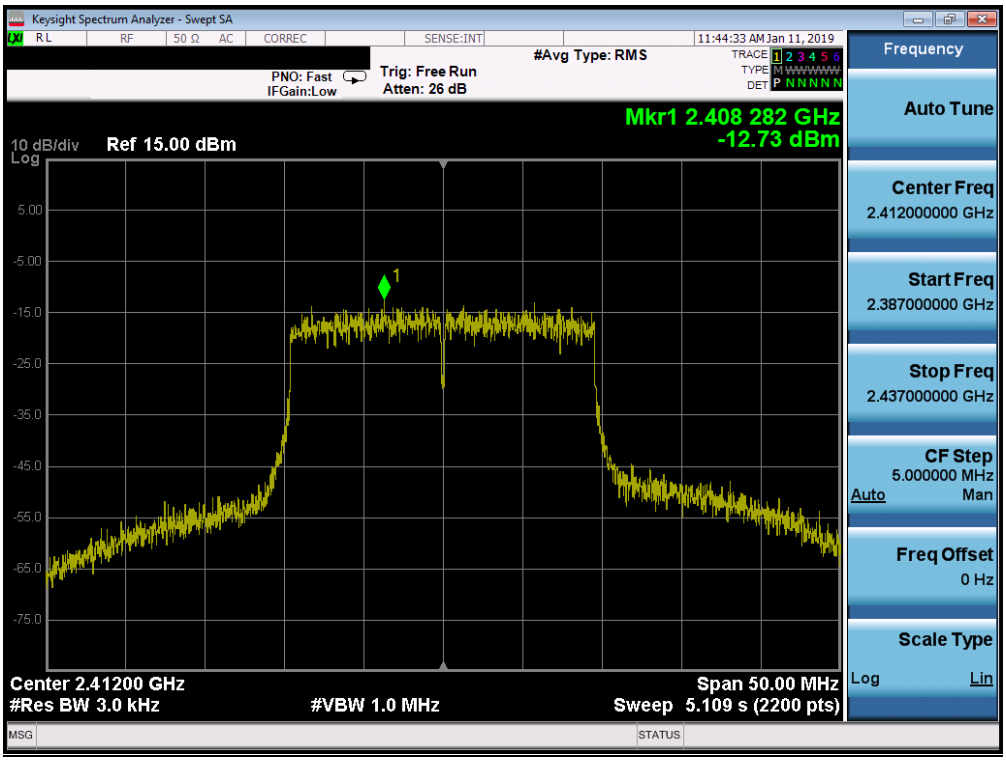
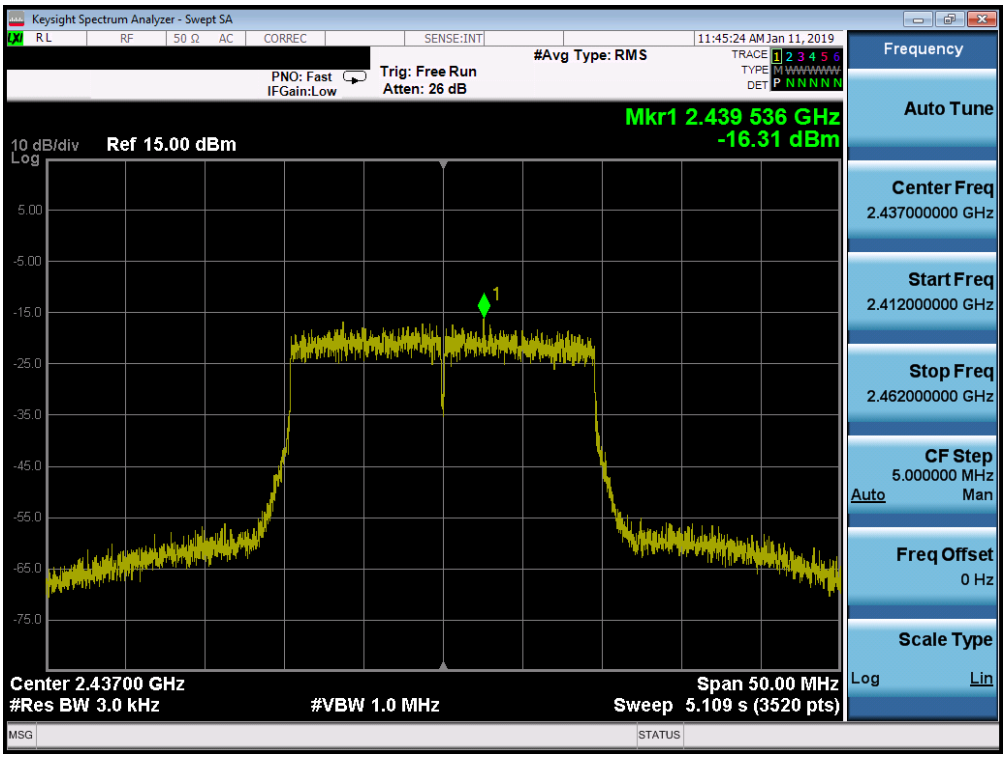


Plot 7-58. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)



Plot 7-59. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 6)

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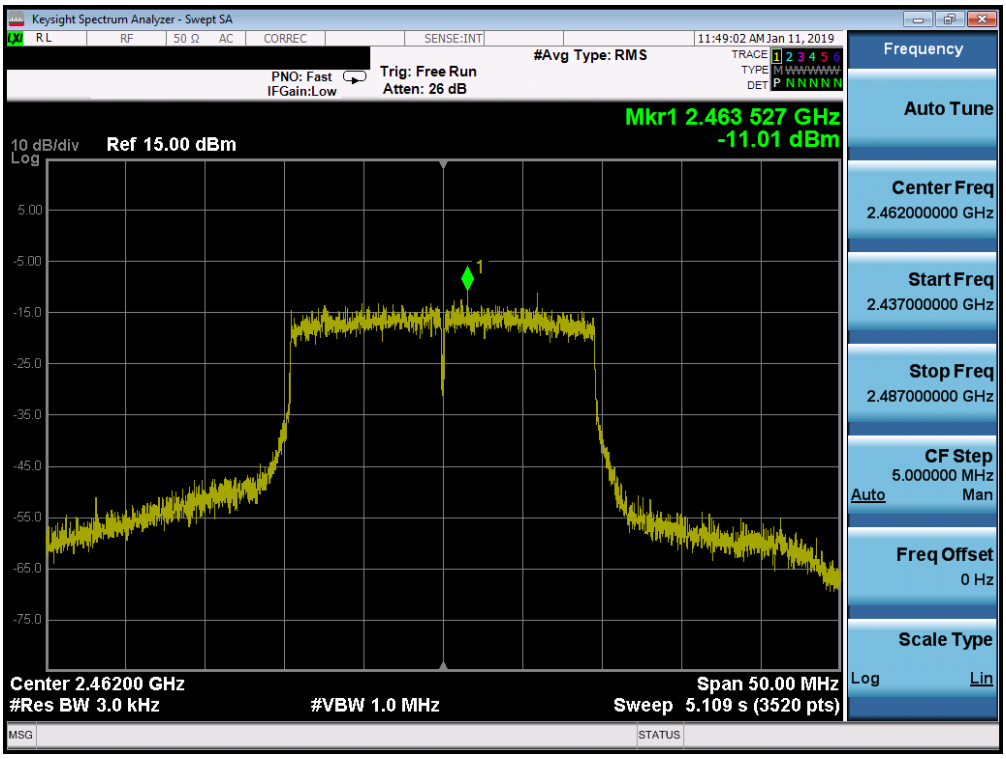
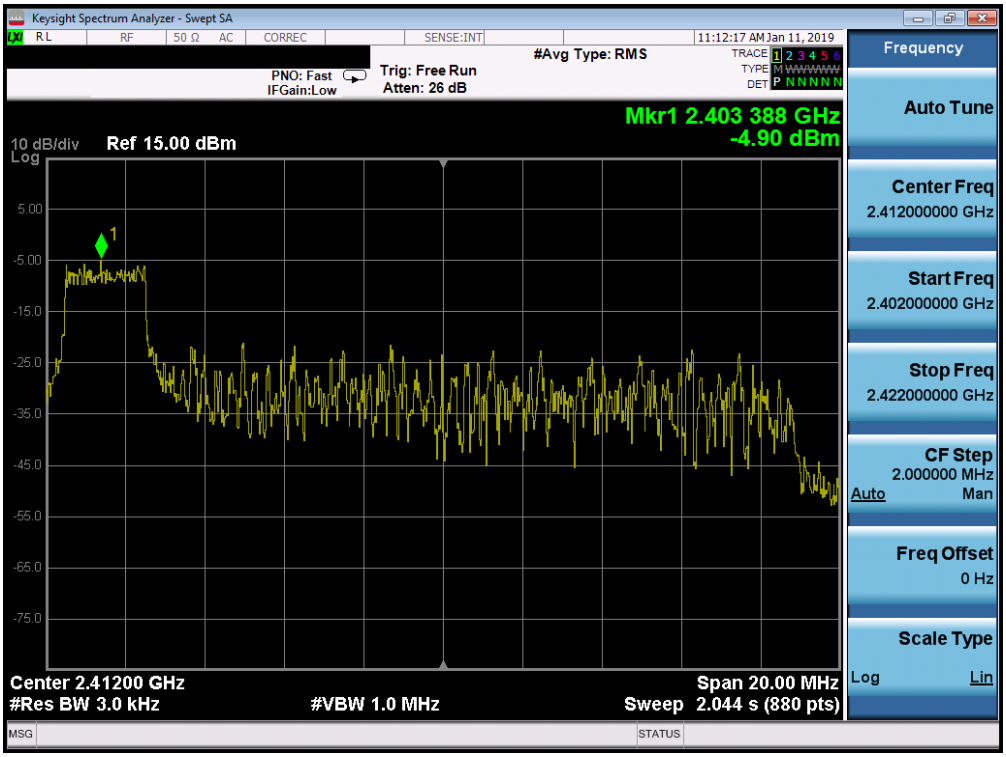


Plot 7-60. Power Spectral Density Plot SISO MIMO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)



Plot 7-61. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 1)

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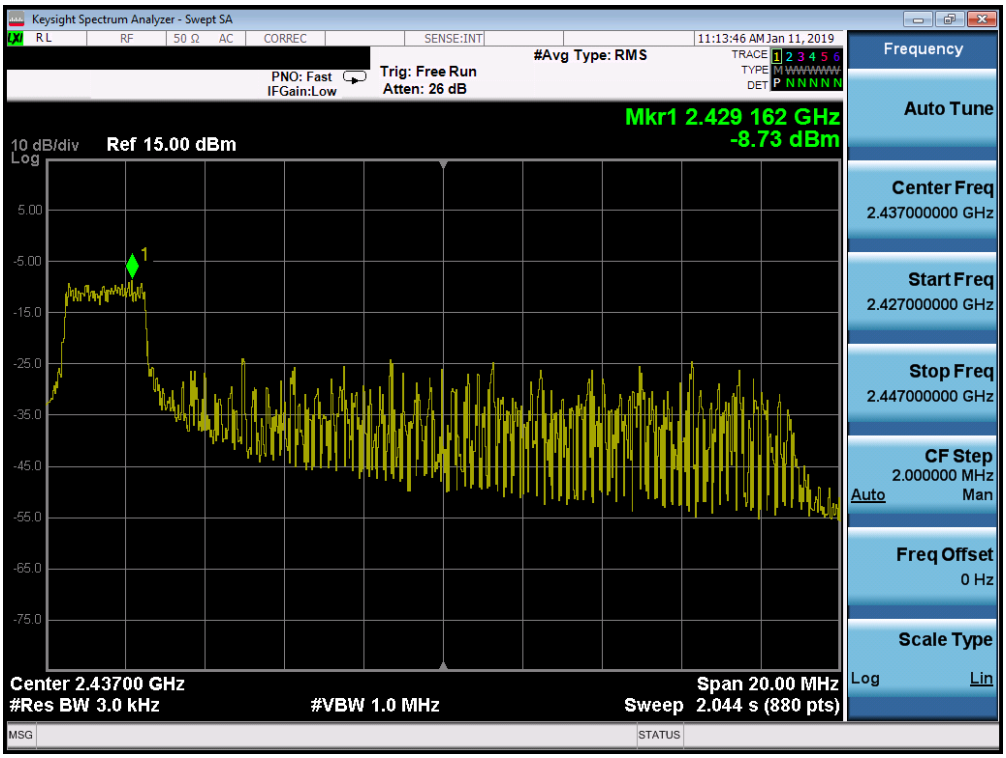
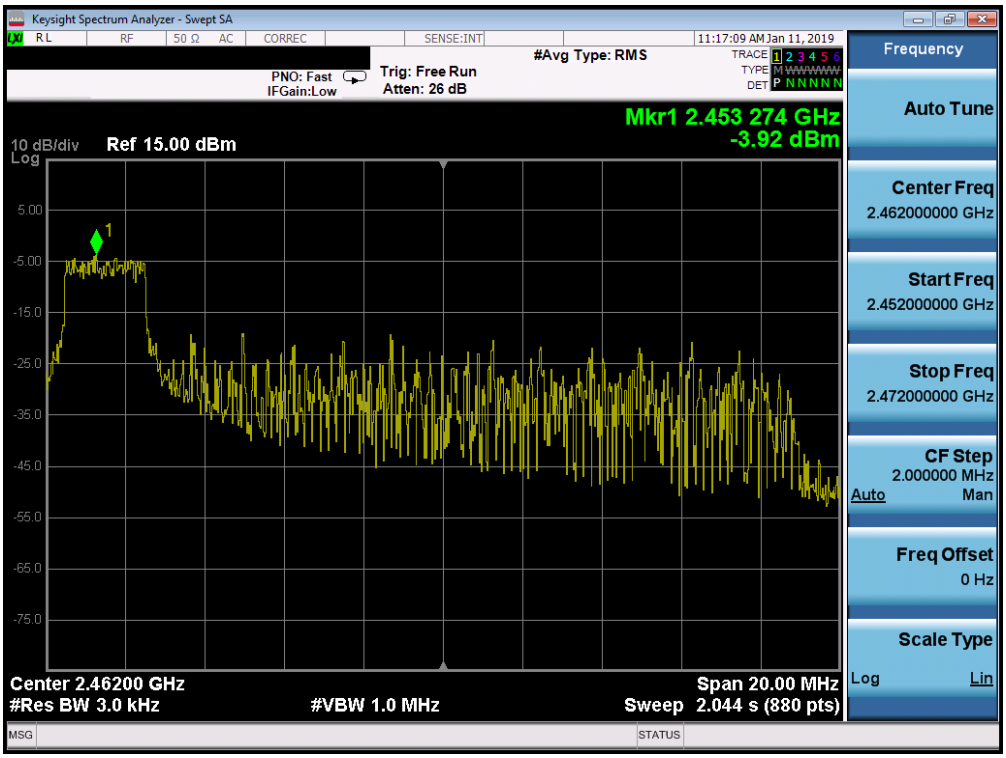


Plot 7-62. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 6)



Plot 7-63. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 26 Tones – Ch. 11)

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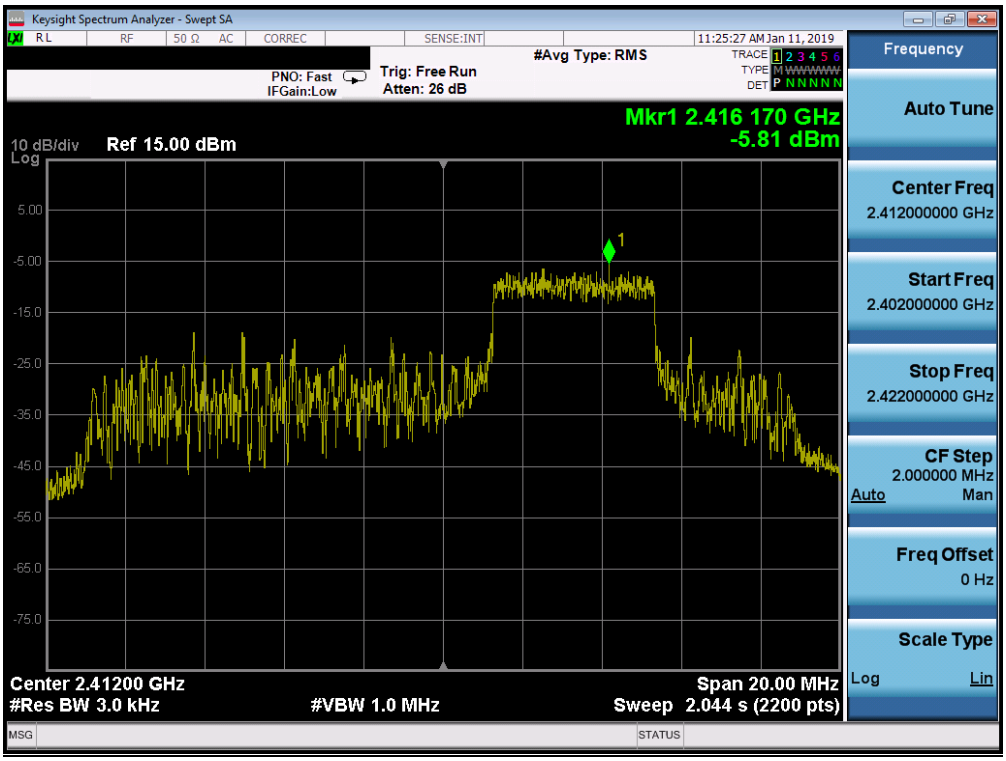
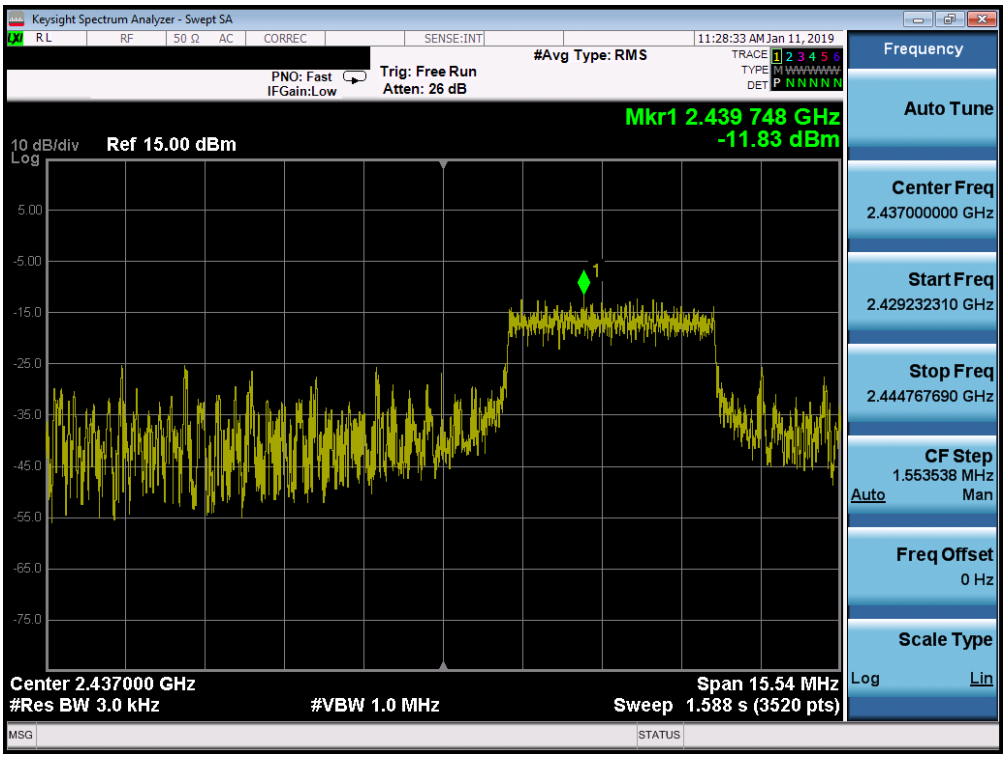


Plot 7-64. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 52 Tones – Ch. 1)



Plot 7-65. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 52 Tones – Ch. 6)

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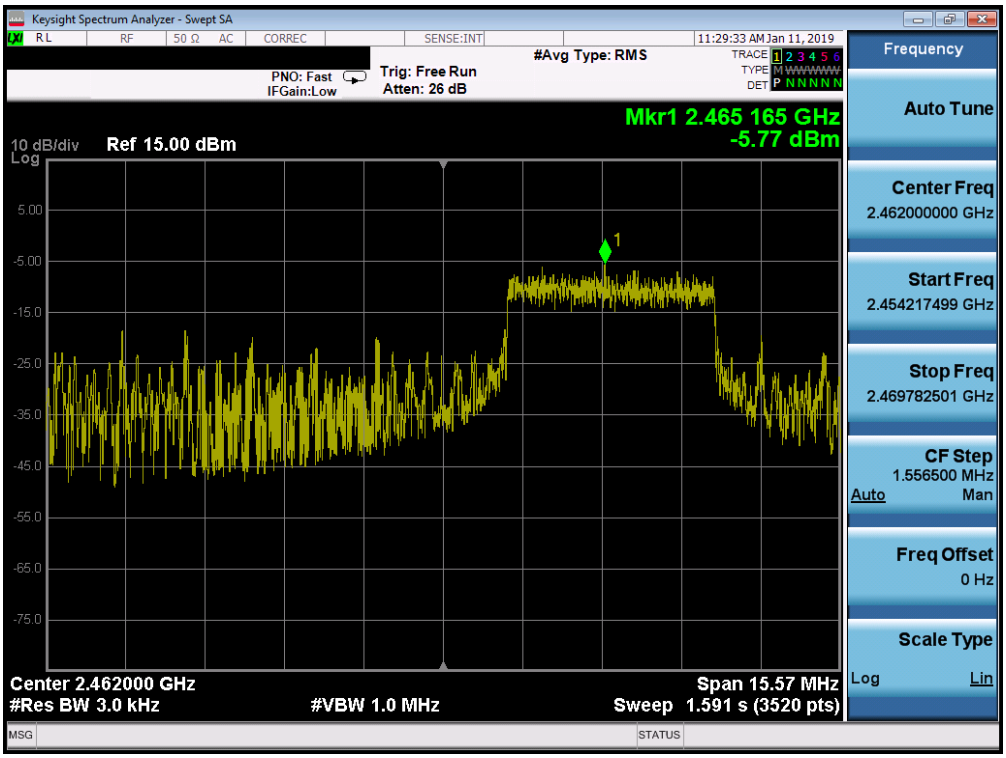
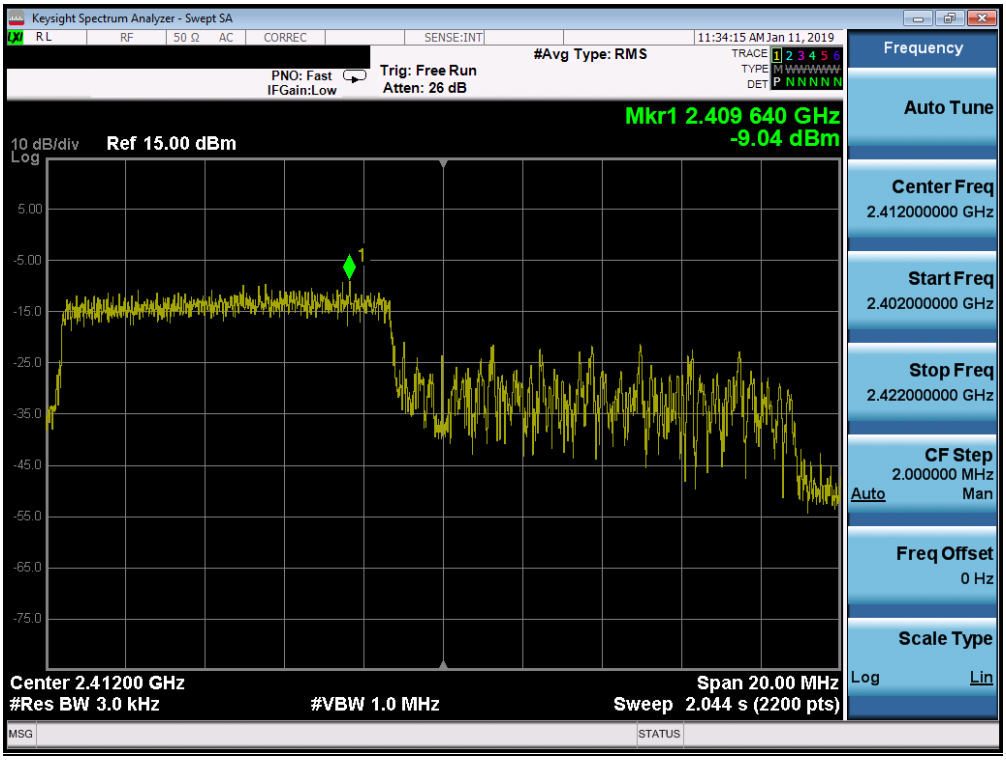


Plot 7-66. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 52 Tones – Ch. 11)



Plot 7-67. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 1)

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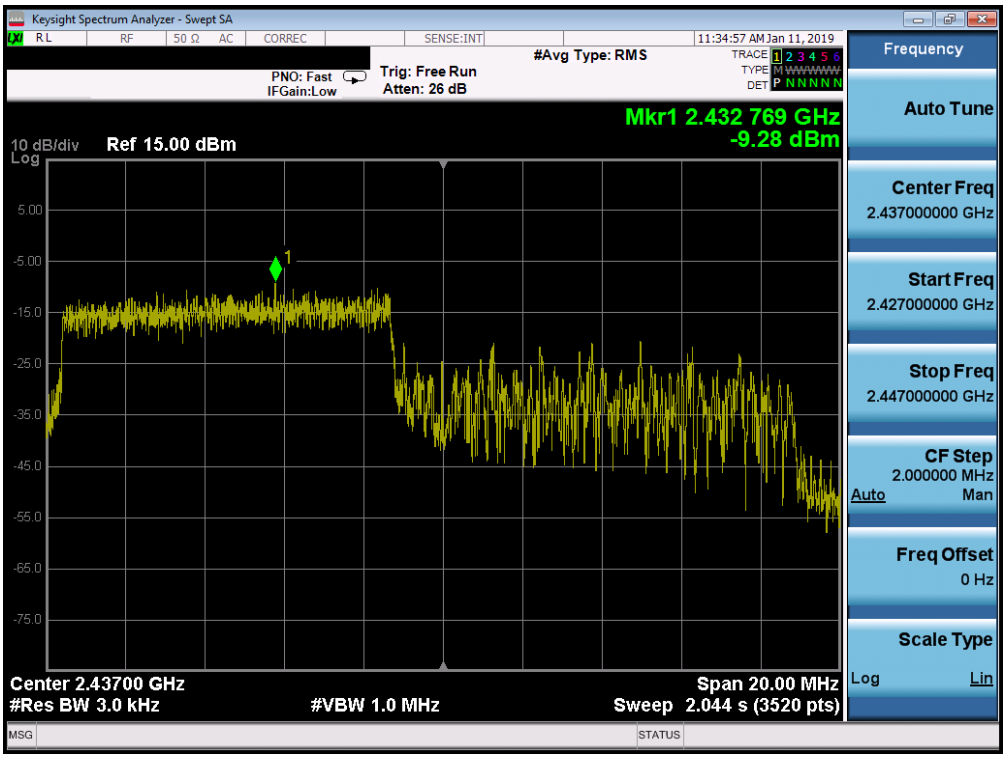
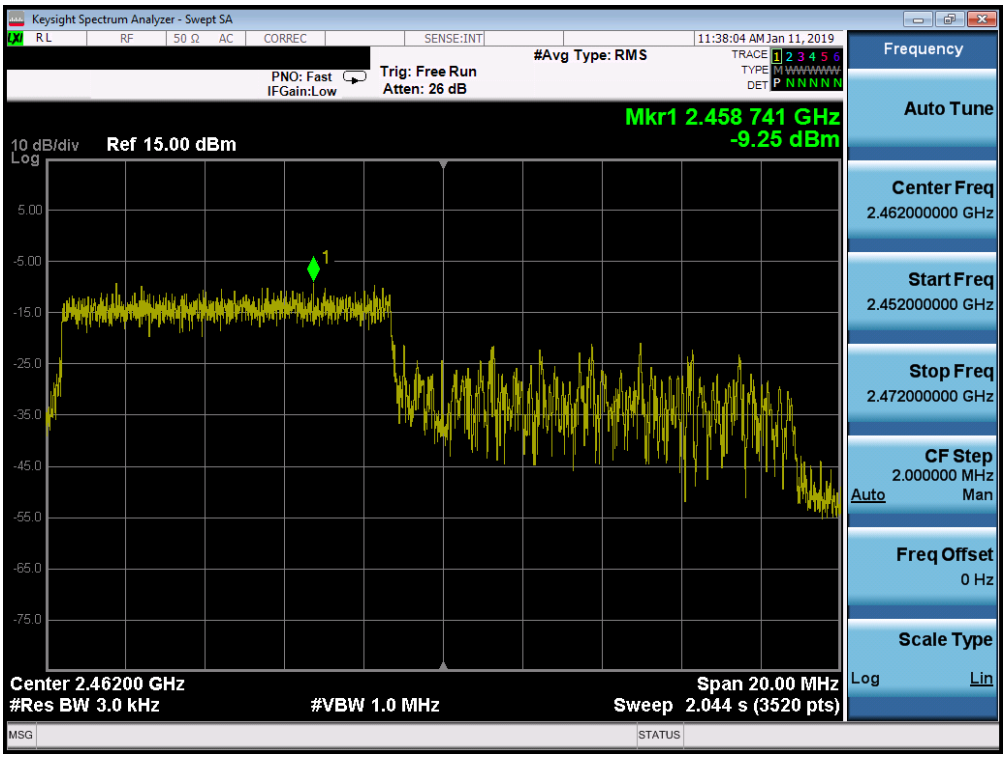


Plot 7-68. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 6)



Plot 7-69. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 106 Tones – Ch. 11)

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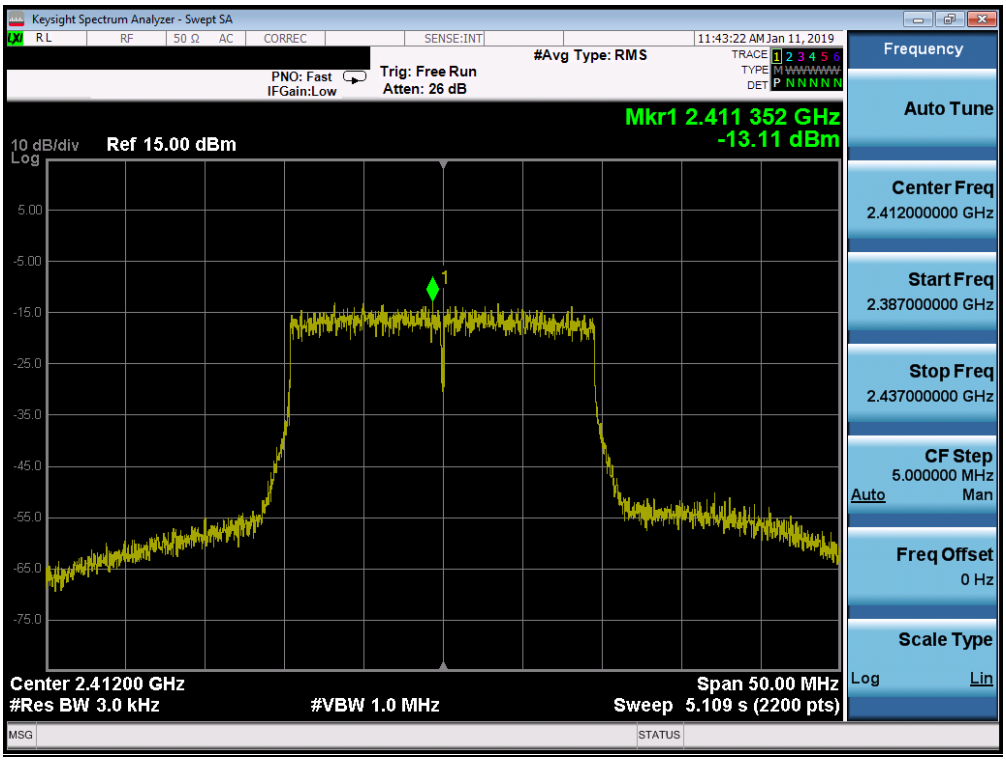
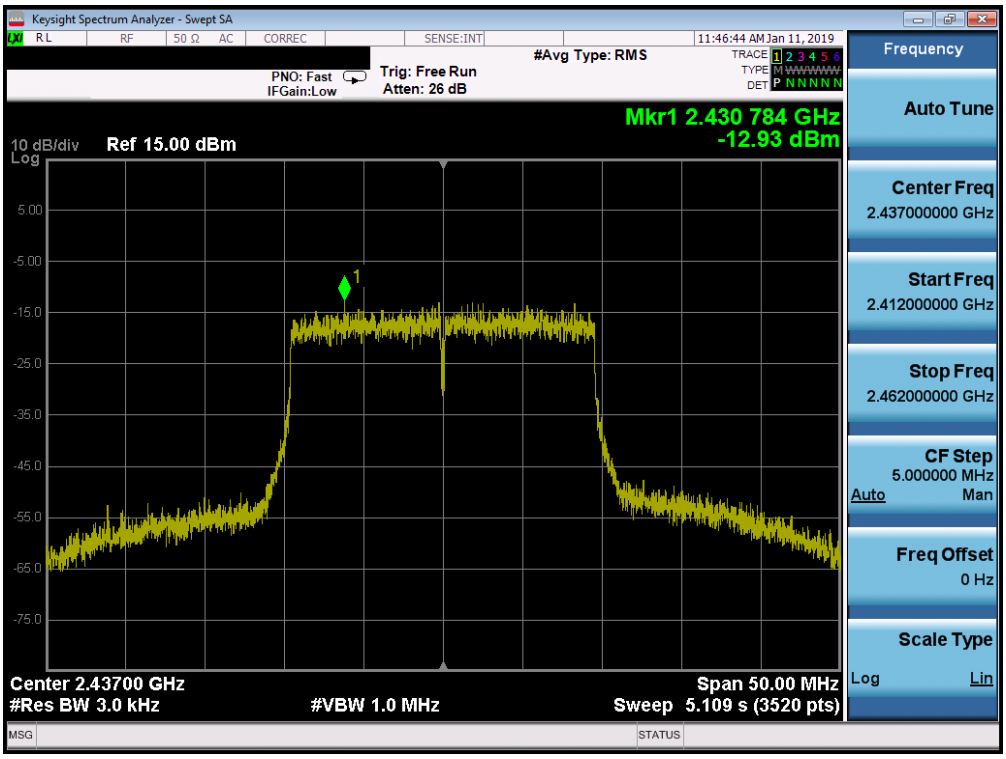


Plot 7-70. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 1)



Plot 7-71. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 6)

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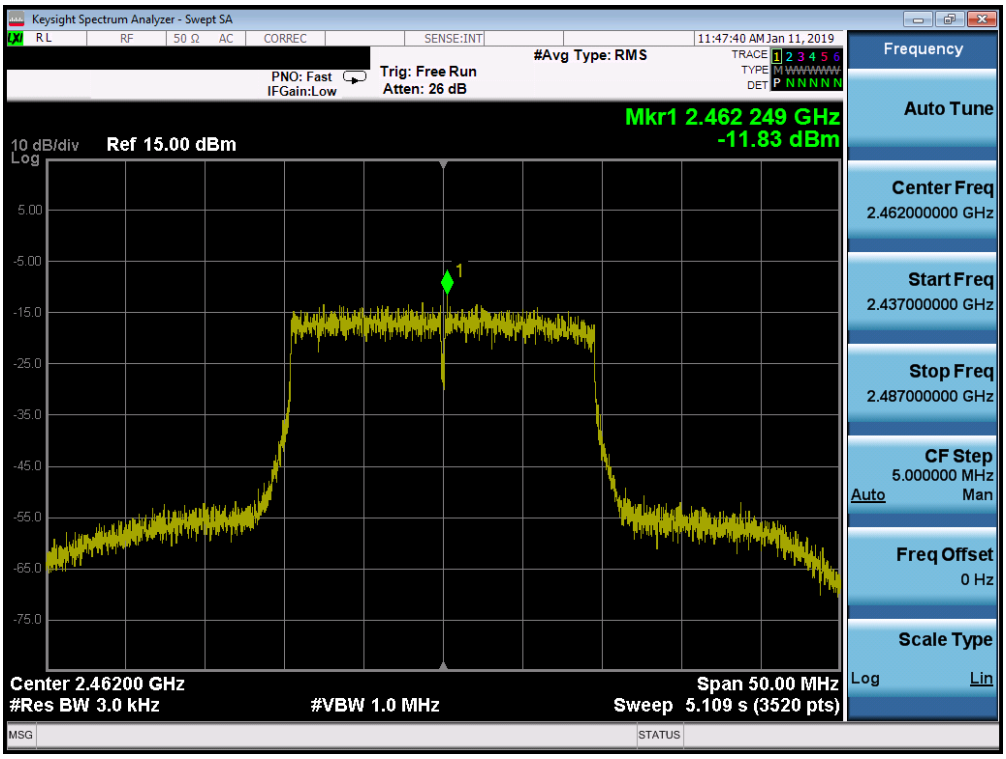

Plot 7-72. Power Spectral Density Plot SISO MIMO ANT2 (802.11ax OFDMA – 242 Tones – Ch. 11)

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:

Assuming the average conducted power spectral density was measured to be -2.95 dBm for Antenna-1 and -2.95 dBm for Antenna-2.

Antenna 1 + Antenna 2 = MIMO

(-2.95 dBm + -2.95 dBm) = (0.51 mW + 0.51 mW) = 1.02 mW = 0.06 dBm

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7.5 Conducted Emissions at the Band Edge

§15.247(d); RSS-247 [5.5]

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 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 20dB 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 v05 – 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

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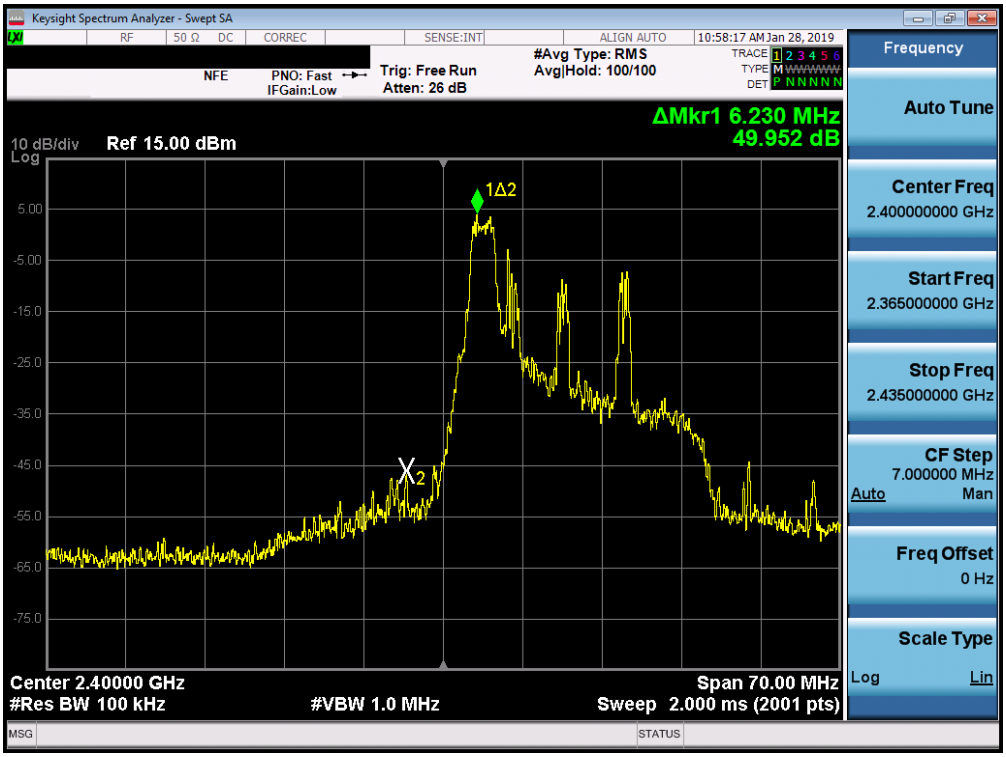
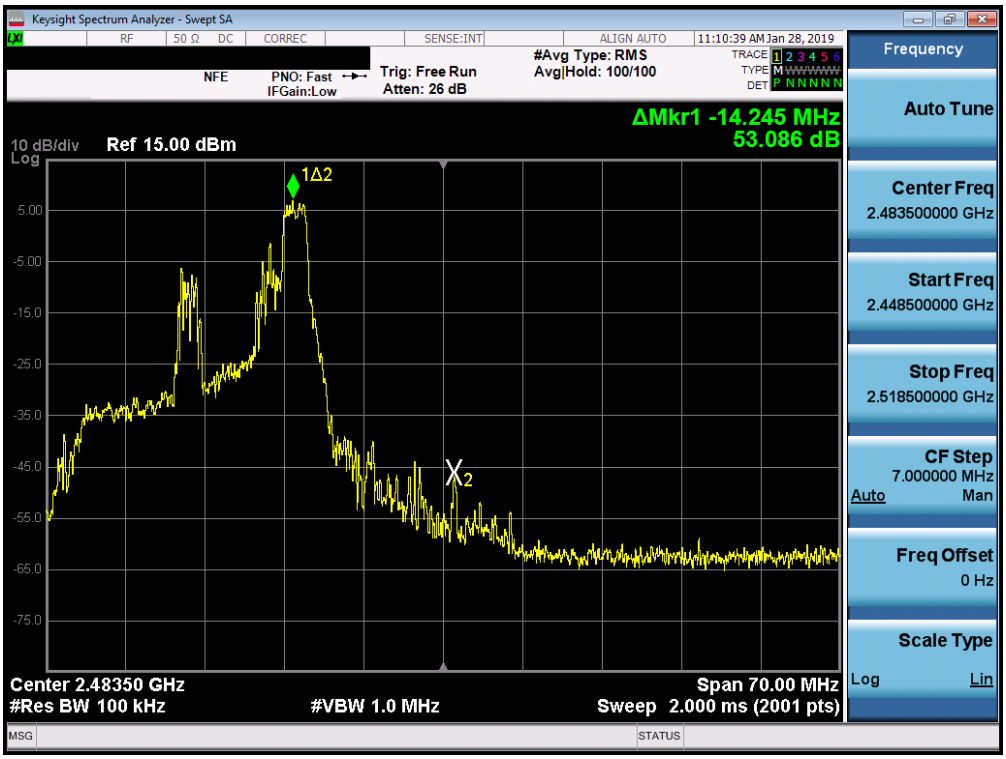
SISO Antenna-1 Conducted Emissions at the Band Edge



Plot 7-73. Band Edge Plot SISO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 1)



Plot 7-74. Band Edge Plot SISO ANT1 (802.11ax OFDMA – 26 Tones – Ch. 11)

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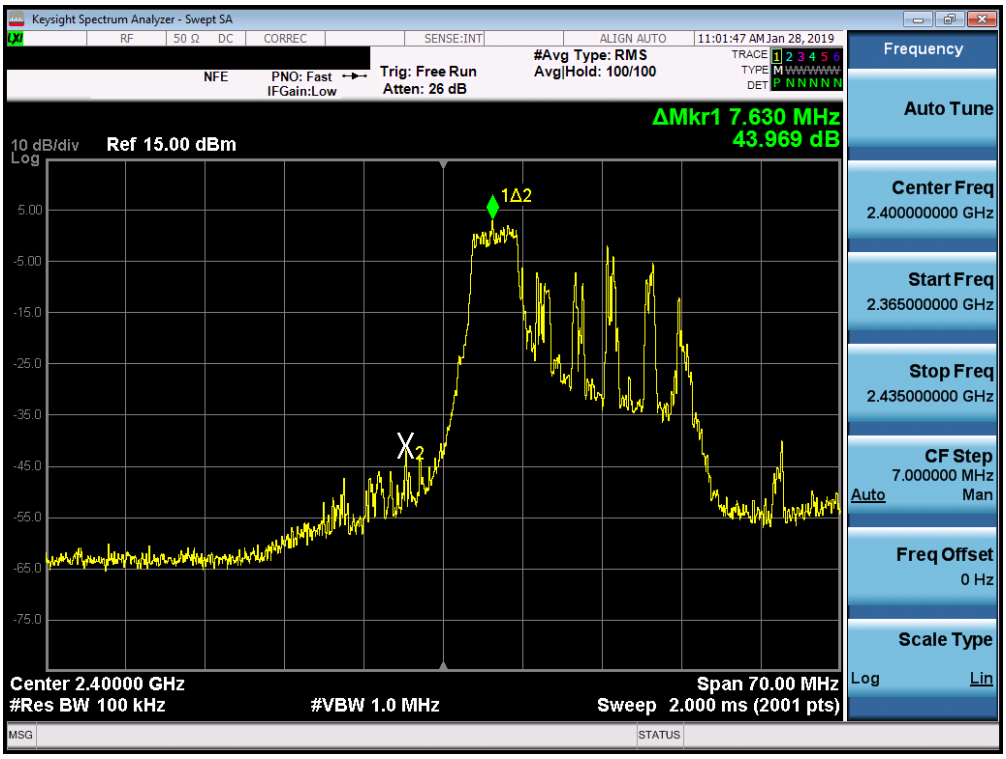
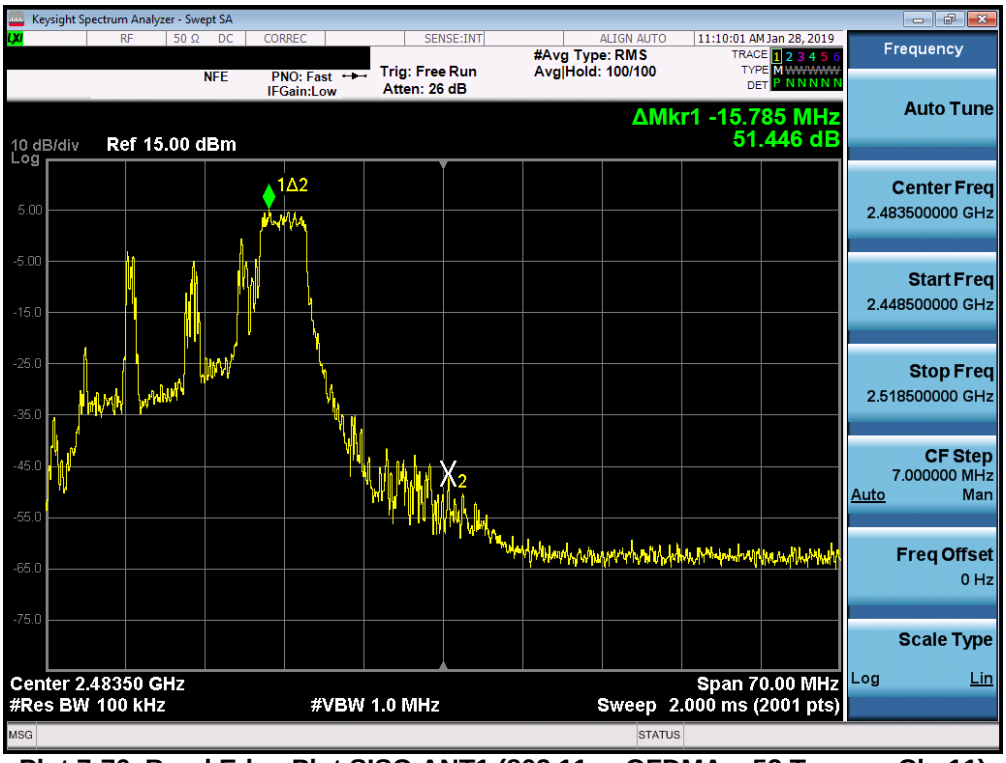


Plot 7-75. Band Edge Plot SISO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 1)



Plot 7-76. Band Edge Plot SISO ANT1 (802.11ax OFDMA – 52 Tones – Ch. 11)

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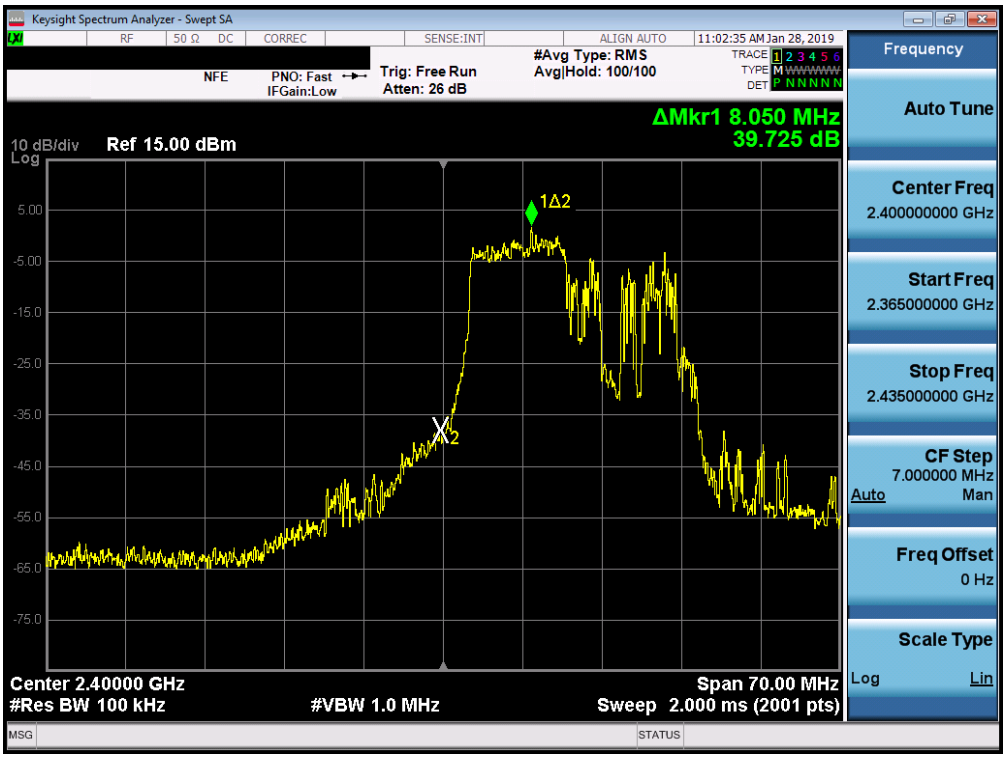
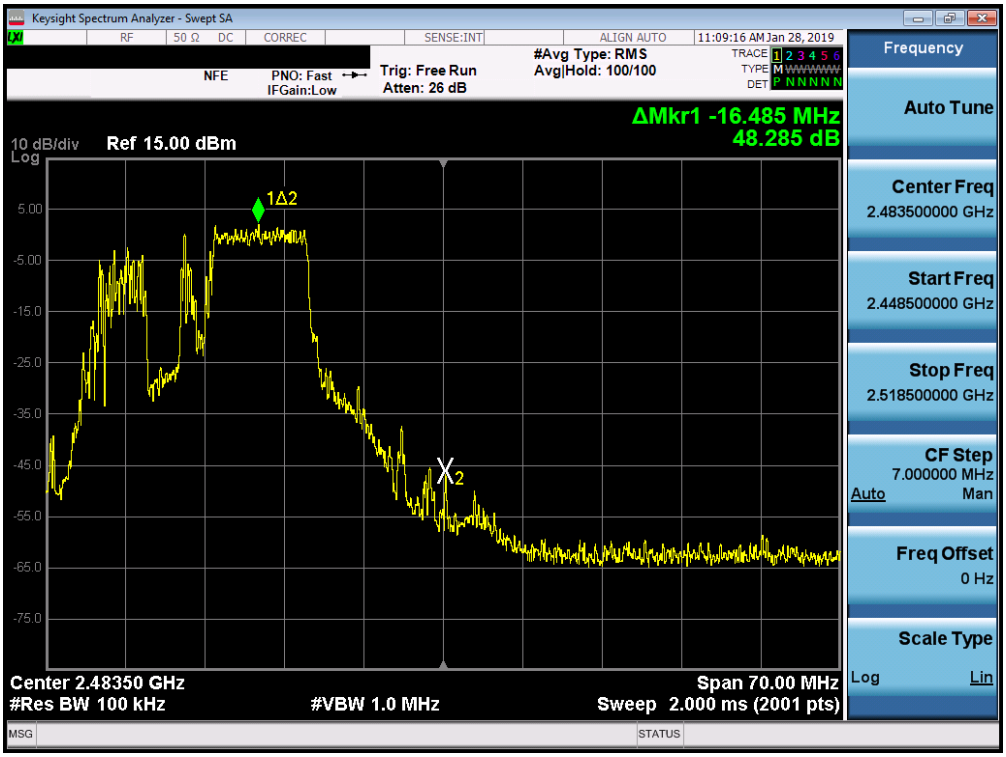


Plot 7-77. Band Edge Plot SISO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 1)



Plot 7-78. Band Edge Plot SISO ANT1 (802.11ax OFDMA – 106 Tones – Ch. 11)

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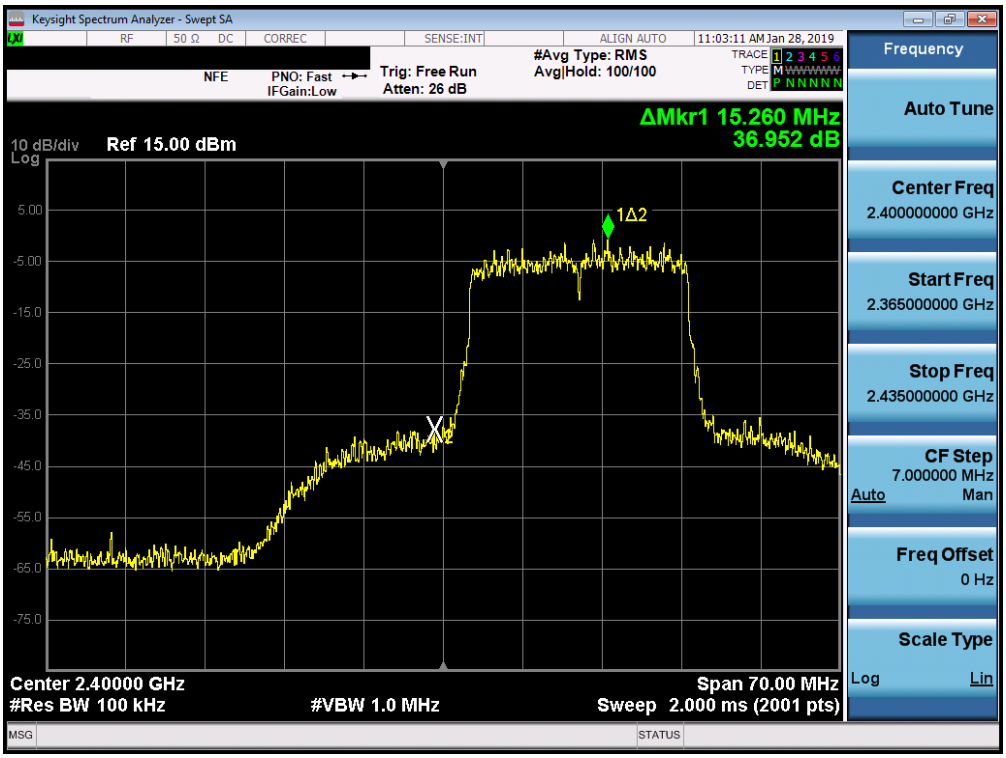
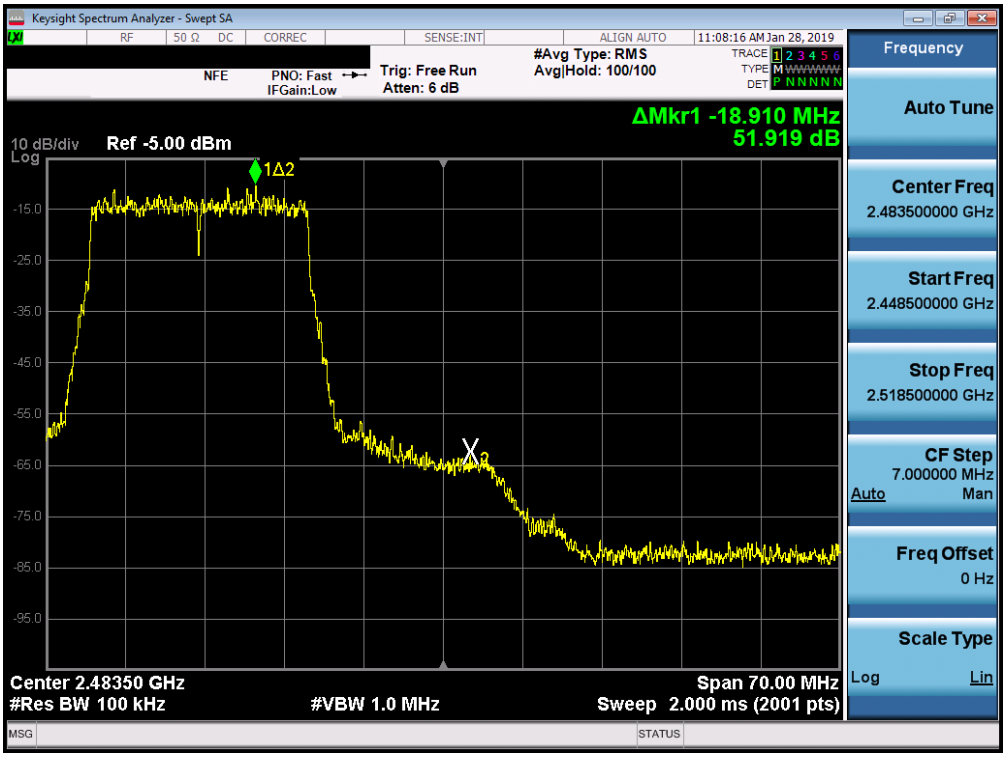


Plot 7-79. Band Edge Plot SISO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 1)



Plot 7-80. Band Edge Plot SISO ANT1 (802.11ax OFDMA – 242 Tones – Ch. 11)

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