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MEASUREMENT REPORT
FCC Part 15.407 802.11a/ax WIFI 6E

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

Date of Testing:
9/03/2022 – 11/11/2022
Test Report Issue Date:
11/14/2022
Test Site/Location:
Element Washington DC LLC. Columbia, MD, USA
Test Report Serial No.:
1M2209010098-18.A3L

FCC ID:	**A3LSMS918U**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
FCC ID:	SM-S918U
Additional Model(s):	SM-S918U1
EUT Type:	Portable Handset
Frequency Range:	5935 – 7115MHz
Modulation Type:	OFDM
FCC Classification:	15E 6GHz Low Power Dual Client (6CD)
Test Procedure(s):	ANSI C63.10-2013,KDB 648474 D03 v01r04, KDB 987594 D02 v01r03,

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 789033 D02 v02r01. 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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Channel Bandwidth [MHz]	UNII Band	Tx Frequency [MHz]	MIMO	
			Max. Power [mW]	Max. Power [dBm]
20	5	5935 - 6415	30.409	14.83
	6	6435 - 6515	31.189	14.94
	7	6535 - 6875	31.550	14.99
	8	6895 - 7115	31.117	14.93
40	5	5965 - 6405	31.333	14.96
	6	6445 - 6525	29.242	14.66
	7	6565 - 6845	30.130	14.79
	8	6885 - 7085	29.309	14.67
80	5	5985 - 6385	29.376	14.68
	6	6465	28.774	14.59
	7	6545 - 6865	29.242	14.66
	8	6945 - 7025	28.973	14.62
160	5	6025 - 6345	30.690	14.87
	6	6505	30.061	14.78
	7	6665 - 6825	29.854	14.75
	8	6985	28.576	14.56

EUT Overview

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1.0 INTRODUCTION

1.1 Scope

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

1.2 Element Test Location

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 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 Agreement.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC: A3LSMS918U**. The test data contained in this report pertains only to the emissions due to the EUT's UNII transmitter while operating in the 6GHz band.

Test Device Serial No.: 0137M, 0128M, 1553M, 1521M

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 and FR2), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5,6GHz), Bluetooth (1x, EDR, LE), NFC, UWB, Wireless Power Transfer

Band 5		Band 6		Band 7		Band 8	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
2	5935	97	6435	117	6535	189	6895
:	:	:	:	:	:	:	:
45	6175	105	6475	149	6695	209	6995
:	:	:	:	:	:	:	:
93	6415	113	6515	185	6875	233	7115

Table 2-1. 802.11a / 802.11ax (20MHz) Frequency / Channel Operations

Band 5		Band 6		Band 7		Band 8	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
3	5965	99	6445	123	6565	187	6885
:	:	:	:	:	:	:	:
43	6165	107	6485	155	6725	211	7005
:	:	:	:	:	:	:	:
91	6405	115	6525	179	6845	227	7085

Table 2-2. 802.11ax (40MHz BW) Frequency / Channel Operations

Band 5		Band 6		Band 7		Band 8	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
7	5985	103	6465	119	6545	199	6945
:	:			:	:	:	:
39	6145			151	6705	215	7025
:	:			:	:		
87	6385			183	6865		

Table 2-3. 802.11ax (80MHz BW) Frequency / Channel Operations

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Band 5		Band 6		Band 7		Band 8	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
15	6025	111	6505	143	6665	207	6985
47	6185			175	6825		
79	6345						

Table 2-4. 802.11ax (160MHz BW) Frequency / Channel Operations

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Notes:

1. 6GHz NII operation is possible in 20MHz, and 40MHz, and 80MHz and 160MHz channel bandwidths. 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 B)2)b) of ANSI C63.10-2013 and KDB 789033 D02 v02r01. 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:

802.11 Mode/Band		MIMO Duty Cycle [%]
6GHz	a	93.85
	ax (HT20)	99.71
	ax (HT40)	99.69
	ax (HT80)	99.71
	ax (HT160)	99.71

Table 2-5. Measured Duty Cycles

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

WiFi Configurations		SISO		CDD		SDM	
		ANT1	ANT2	ANT1	ANT2	ANT1	ANT2
6GHz	11a	×	×	✓	✓	×	×
	11ax (20MHz)	×	×	✓	✓	✓	✓
	11ax (40MHz)	×	×	✓	✓	✓	✓
	11ax (80MHz)	×	×	✓	✓	✓	✓
	11ax (160MHz)	×	×	✓	✓	✓	✓

Table 2-6. Frequency / Channel Operations

✓= Support ; ×= NOT Support
SDM = Spatial Diversity Multiplexing – MIMO function
CDD = Cyclic Delay Diversity – 2Tx Function

2.3 Antenna Description

The following antenna gains are used in this device per the "Unlicensed Band Antenna Gain" document provided by the client. This document is also included in the filing as a public exhibit.

	Ant1 Peak Gain [dBi]	Ant2 Peak Gain [dBi]	Directional Gain [dBi]
5925 – 6425 MHz	-7.27	-4.65	-2.85
6425 – 6525 MHz	-9.94	-5.97	-4.72
6525 – 6875 MHz	-7.45	-6.36	-3.88
6875 – 7125 MHz	-5.75	-5.78	-2.75

Table 2-7. Antenna Peak Gain

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2.4 Test Configuration

The EUT was tested per the guidance of KDB 987594 D02 v01r01 and KDB 789033 D02 v02r01. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 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 operation under control of either a low-power indoor access point or standard power access point. Target powers remain identical for both modes of operation for OFDM operation; indoor limits are applied. The worst-case emissions data is shown in this report.

This device operates in the 5.925-7.125 GHz band when under control of a low power indoor access point. Additionally, the device may operate in the 5.925-6.425 GHz and 6.525-6.875 GHz bands when under control of a standard power access point.

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 lying flat on an authorized wireless charging pad (WCP) 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.

2.5 Software and Firmware

The test was conducted with firmware version S918USQU0AVJH installed on the EUT.

2.6 EMI Suppression Device(s)/Modifications

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

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 789033 D02 v02r01, KDB 987594 D02 v01r01 were used in the measurement of the EUT**.**

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

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by ETS Lindgren RF Enclosures. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

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 RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.9. The EMI Receiver mode of the Agilent MXE was used to perform AC line conducted emissions testing.

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3.3 Radiated Emissions

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

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

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

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

3.4 Environmental Conditions

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

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4.0 ANTENNA REQUIREMENTS

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

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

Conclusion:

The EUT 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)
Contention Based Protocol Conducted Measurements	0.86
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
-	ETS-001	EMC Cable and Switch System	8/11/2022	Annual	8/11/2023	ETS-001
-	ETS-002	EMC Cable and Switch System	8/11/2022	Annual	8/11/2023	ETS-002
-	AP2-001	EMC Cable and Switch System	8/11/2022	Annual	8/11/2023	AP2-001
-	AP2-002	EMC Cable and Switch System	8/11/2022	Annual	8/11/2023	AP2-002
-	WL25-1	Conducted Cable Set (25GHz)	7/29/2022	Annual	7/29/2023	WL25-1
-	WL25-2	Conducted Cable Set (25GHz)	7/29/2022	Annual	7/29/2023	WL25-2
-	WL25-3	Conducted Cable Set (25GHz)	7/29/2022	Annual	7/29/2023	WL25-3
-	WL25-4	Conducted Cable Set (25GHz)	7/29/2022	Annual	7/29/2023	WL25-4
-	WL40-1	Conducted Cable Set (40GHz)	7/29/2022	Annual	7/29/2023	WL40-1
Agilent	N9038A	MXE EMI Receiver	1/21/2022	Annual	1/21/2023	MY51210133
Agilent	N9020A	MXA Signal Analyzer	3/4/2022	Annual	3/4/2023	US46470561
Agilent	N9030A	PXA Signal Analyzer (44GHz)	8/18/2022	Annual	8/18/2023	MY49430494
Anritsu	ML2495A	Power Meter	5/9/2022	Annual	5/9/2023	1328004
Anritsu	ML2495A	Power Meter	3/17/2022	Annual	3/17/2023	941001
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	4/13/2022	Biennial	4/13/2024	121034
Emco	3115	Horn Antenna (1-18GHz)	8/8/2022	Biennial	8/8/2024	9704-5182
Emco	3116	Horn Antenna (18 - 40GHz)	7/20/2021	Biennial	7/20/2023	9203-2178
ETS-Lindgren	3816/2NM	Line Impedance Stabilization Network	8/11/2022	Biennial	8/11/2024	114451
Keysight Technologies	N9030A	PXA Signal Analyzer (3Hz-26.5GHz)	9/6/2022	Annual	9/6/2023	MY54490576
Keysight Technologies	N9020A	MXA Signal Analyzer	3/15/2022	Annual	3/15/2023	MY54500644
Pasternack	NMLC-2	Line Conducted Emissions Cable (NM)	12/19/2021	Annual	12/19/2022	NMLC-2
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	8/29/2022	Annual	8/29/2023	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	8/25/2022	Annual	8/25/2023	100348
Sunol	DRH-118	Horn Antenna (1-18GHz)	2/14/2022	Biennial	2/14/2024	A050307
Sunol	DRH-118	Horn Antenna (1-18 GHz)	1/14/2022	Biennial	1/14/2024	A042511
Sunol	JB6	Bi-Log Antenna (30M - 6GHz)	11/13/2020	Biennial	11/13/2022	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

Note:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

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7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.
FCC ID: A3LSMS918U
FCC Classification: 15E 6GHz Low Power Dual Client (6CD)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1046, 15.407(a)(11)	Maximum Conducted Output Power	N/A	CONDUCTED	PASS	Section 7.3
2.1049, 15.407(a)(10)	Occupied Bandwidth/ 26dB Bandwidth	99% of the occupied bandwidth of any channel must be contained within each of its respective U-NII sub bands The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 megahertz.		PASS	Section 7.2
15.407(a)(8)	Maximum Power Spectral Density	< -1dBm/MHz e.i.r.p.		PASS	Section 7.4
15.407(a)(8)	Maximum Radiated Output Power	< 24dBm over the frequency band of operation		PASS	Section 7.3
15.407(b)(7)	In-Band Emissions	EUT must meet the limits detailed in 15.407(b)(7)		PASS	Section 7.5
15.407(b)(6)	Undesirable Emissions	< -27dBm/MHz e.i.r.p. outside of the 5.925 – 7.125GHz band	RADIATED	PASS	Section 7.7
15.407(d)(6)	Contention Based Protocol	EUT must detect AWGN signal with 90% (or better) certainty		PASS	Section 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		PASS	Section 7.7, 7.8
15.407(b)(9)	AC Conducted Emissions (150kHz – 30MHz)	< FCC 15.207 limits	LINE CONDUCTED	PASS	Section 7.9

Table 7-1. Summary of Test Results

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Notes:

1) All channels, modes, and modulations/data rates were investigated among all UNII bands. 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) Per 15.407(a)(7), a device operating under the control of a standard power access point in 5.925-6.425 GHz and 6.525-6.875 GHz bands must not have the maximum power spectral density exceed 17 dBm/MHz e.i.r.p., must limit the maximum e.i.r.p. over the frequency band of operation not exceed 30 dBm, and must limit its power to no more than 6 dB below its associated standard power access point's authorized transmit power. Compliance to this clause is addressed via submission of an attestation following Appendix B of KDB 987594 D01 v01r03.
5) 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 "UNII Automation," Version 4.7.
6) 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.

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7.2 26dB Bandwidth Measurement – 802.11a/ax

2.1049, 15.407(a)(10)

Test Overview and Limit

The bandwidth at 26dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2013 and KDB 789033 D02 v02r01, and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26dB bandwidth.

The 26dB bandwidth is used to determine the conducted power limits.

Test Procedure Used

ANSI C63.10-2013 – Section 12.4
KDB 789033 D02 v02r01 – Section C
KDB 987594 D02 v01r01

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth
3. VBW $\geq$ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold

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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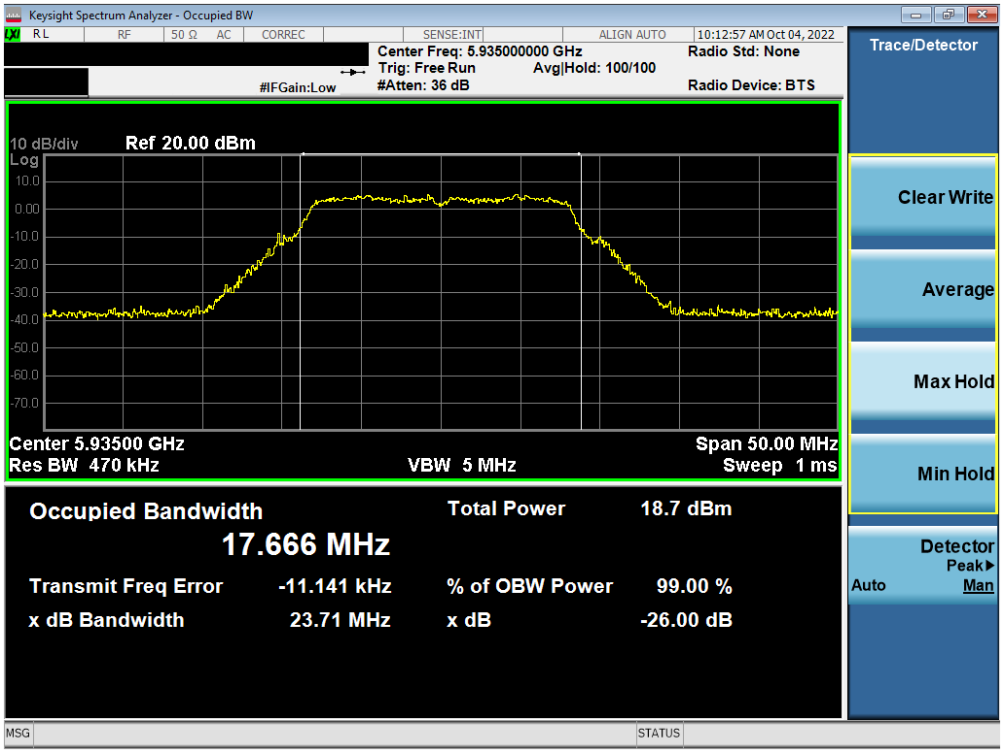
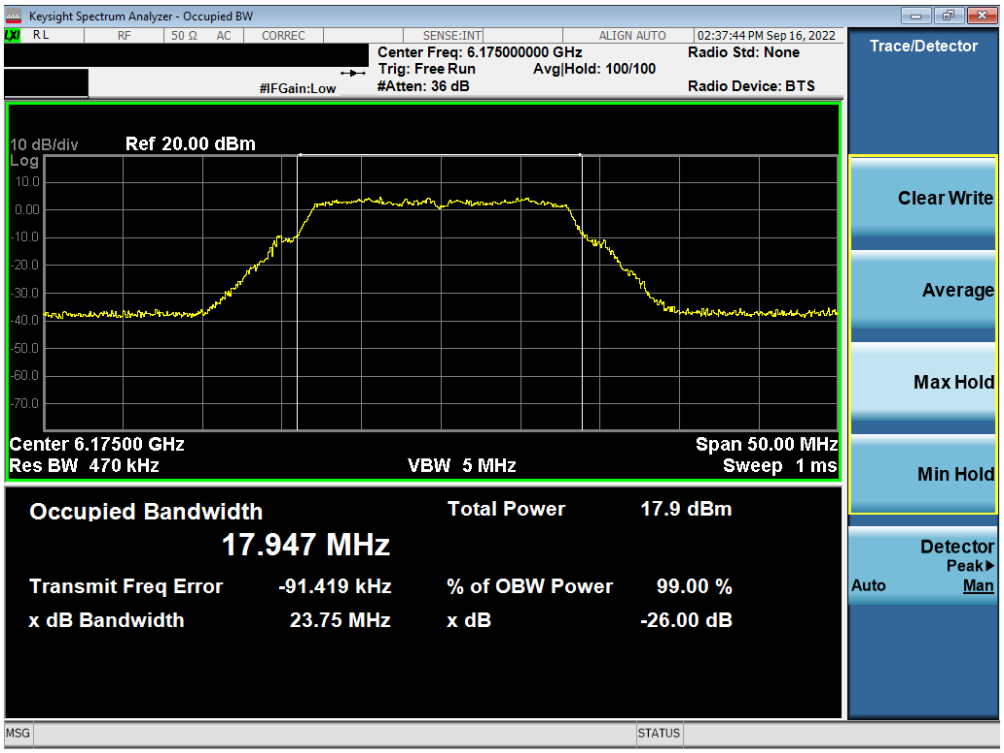
MIMO Antenna-1 26 dB Bandwidth Measurements - (UNII Band 5)



Plot 7-1. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 5) – Ch. 2)



Plot 7-2. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 5) – Ch. 45)

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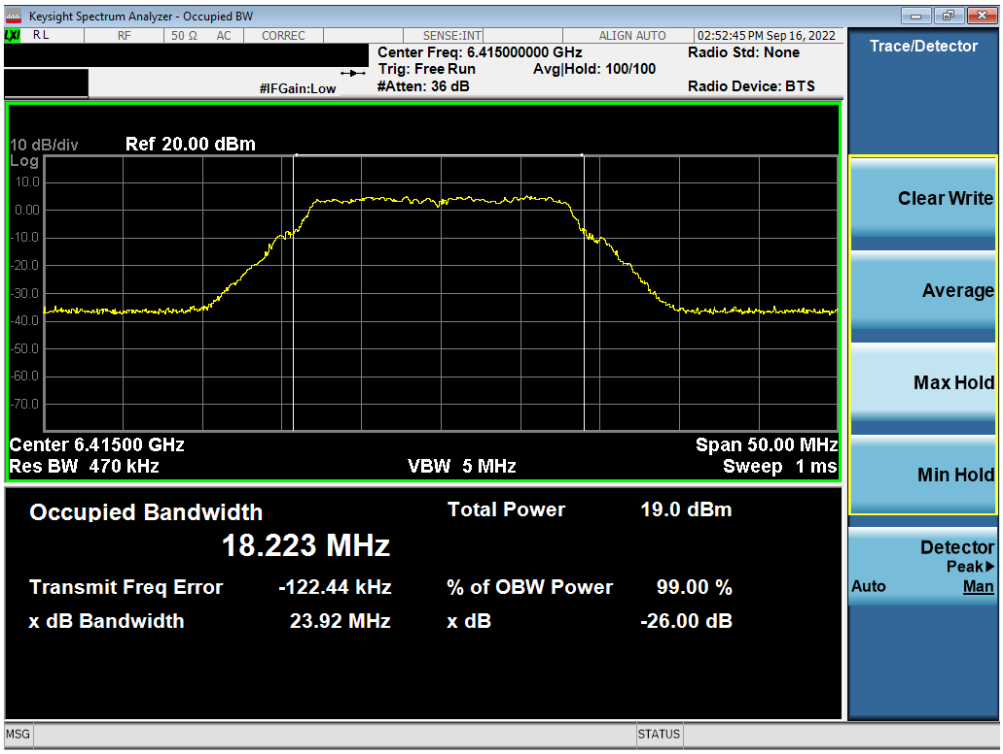
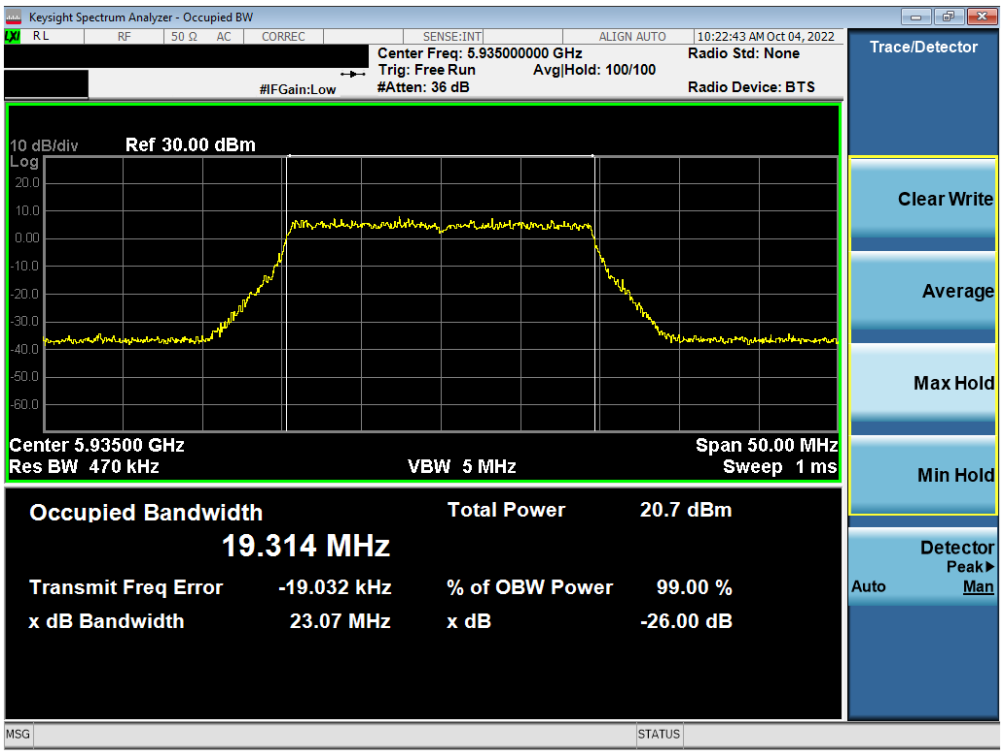


Plot 7-3. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 5) – Ch. 93)



Plot 7-4. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 5) – Ch. 2)

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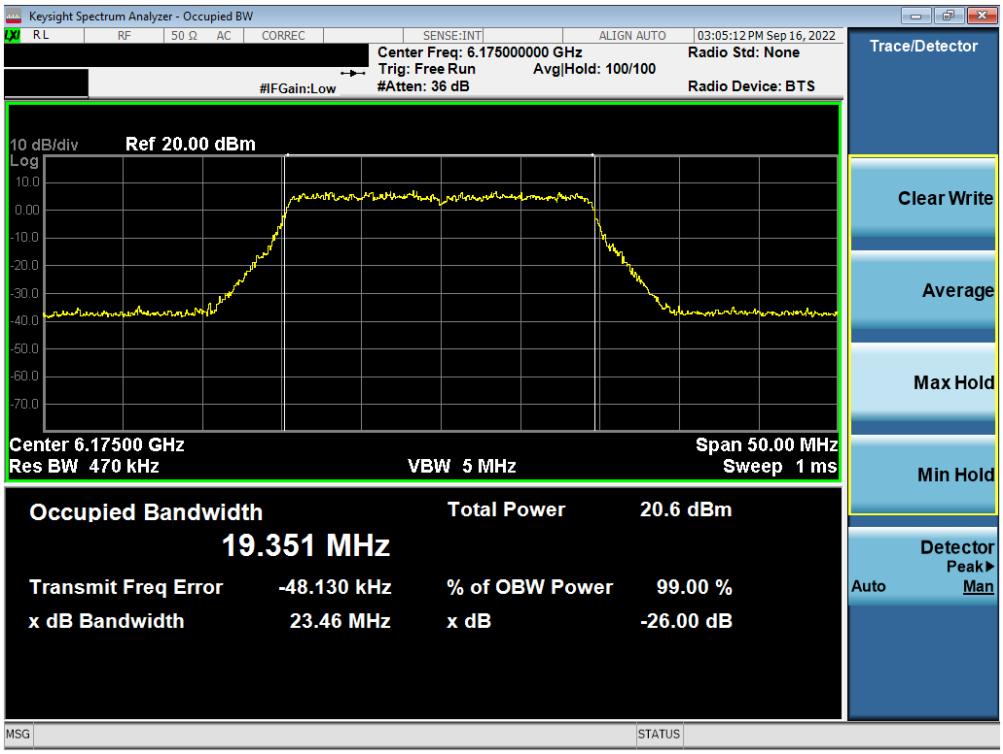
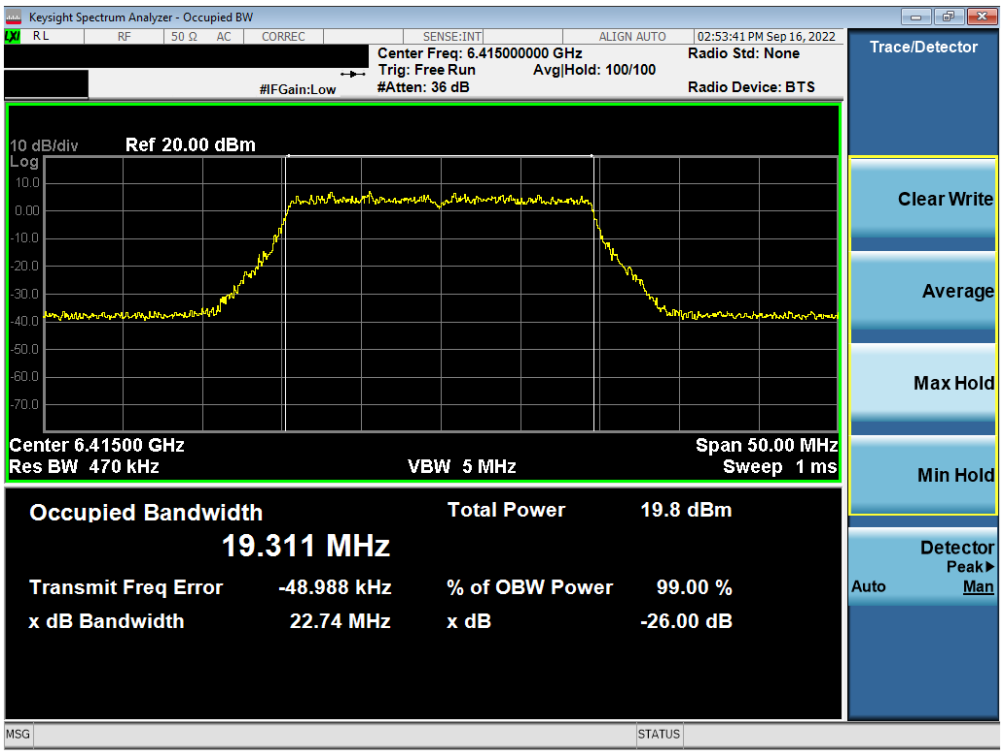


Plot 7-5. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 5) – Ch. 45)



Plot 7-6. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 5) – Ch. 93)

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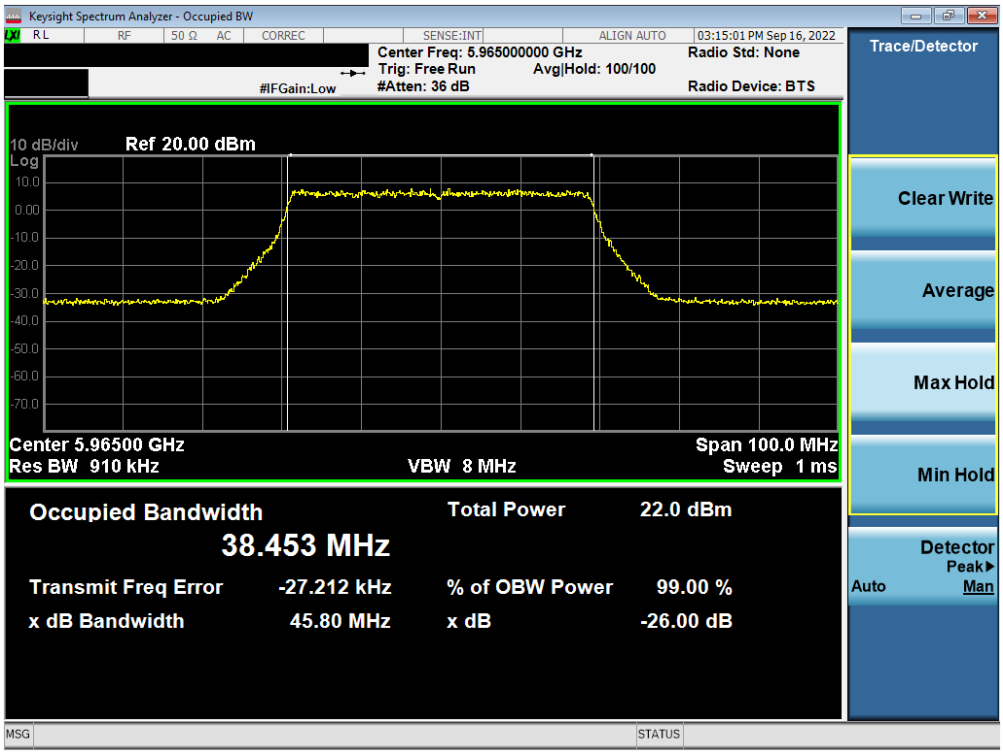
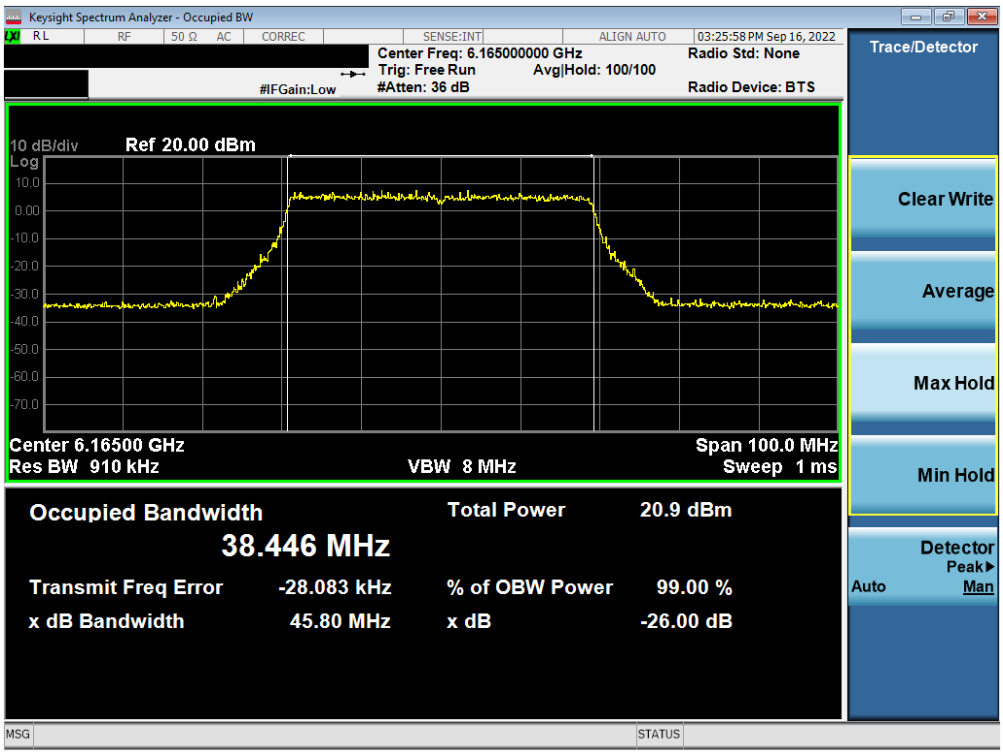


Plot 7-7. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 5) – Ch. 3)



Plot 7-8. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 5) – Ch. 43)

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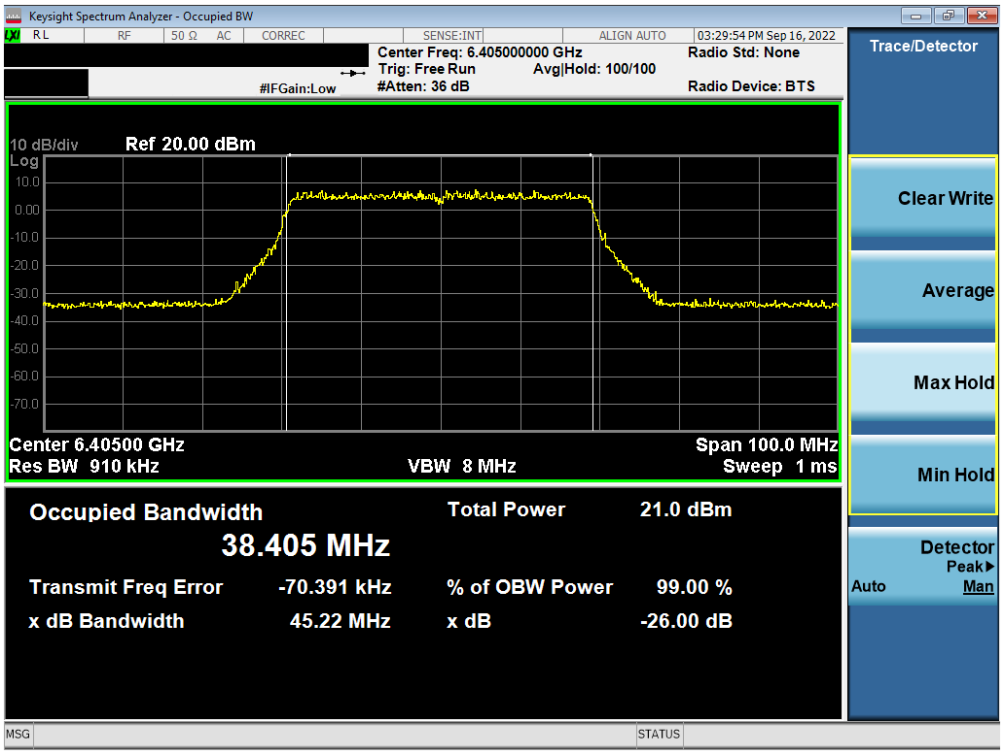
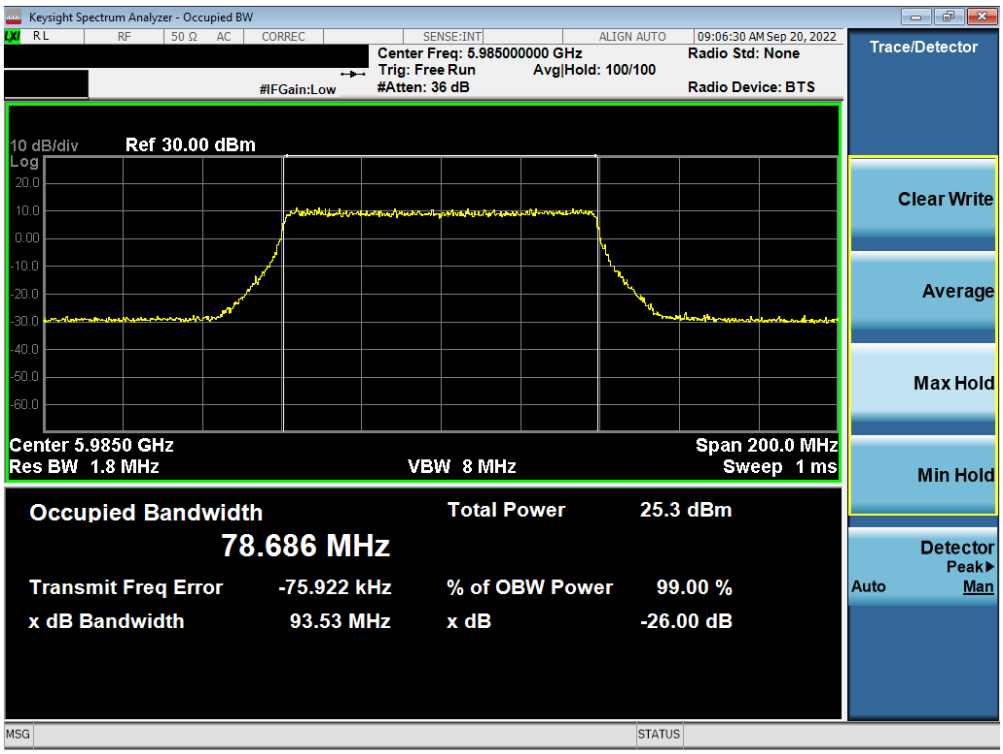


Plot 7-9. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 5) – Ch. 91)



Plot 7-10. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 5) – Ch. 7)

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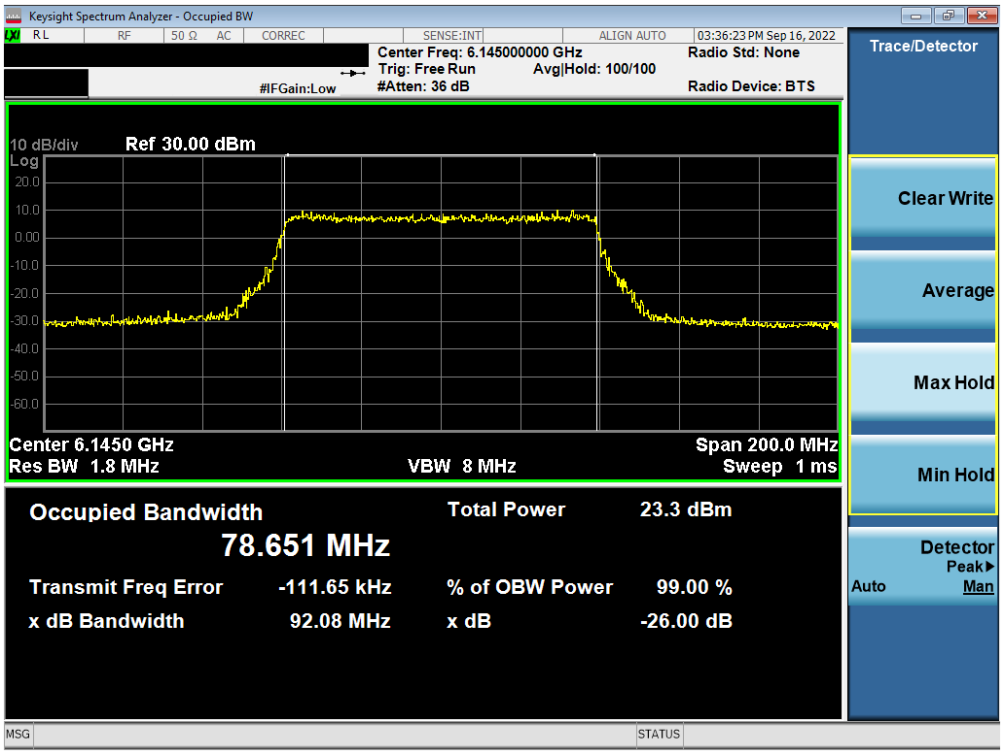
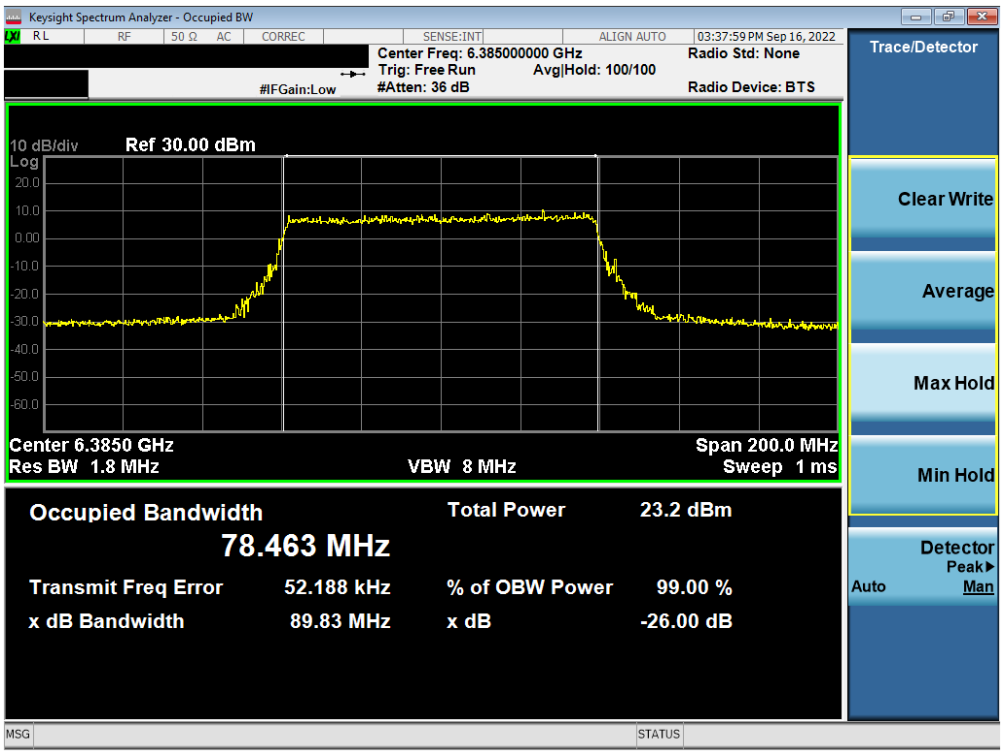


Plot 7-11. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 5) – Ch. 39)



Plot 7-12. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 5) – Ch. 87)

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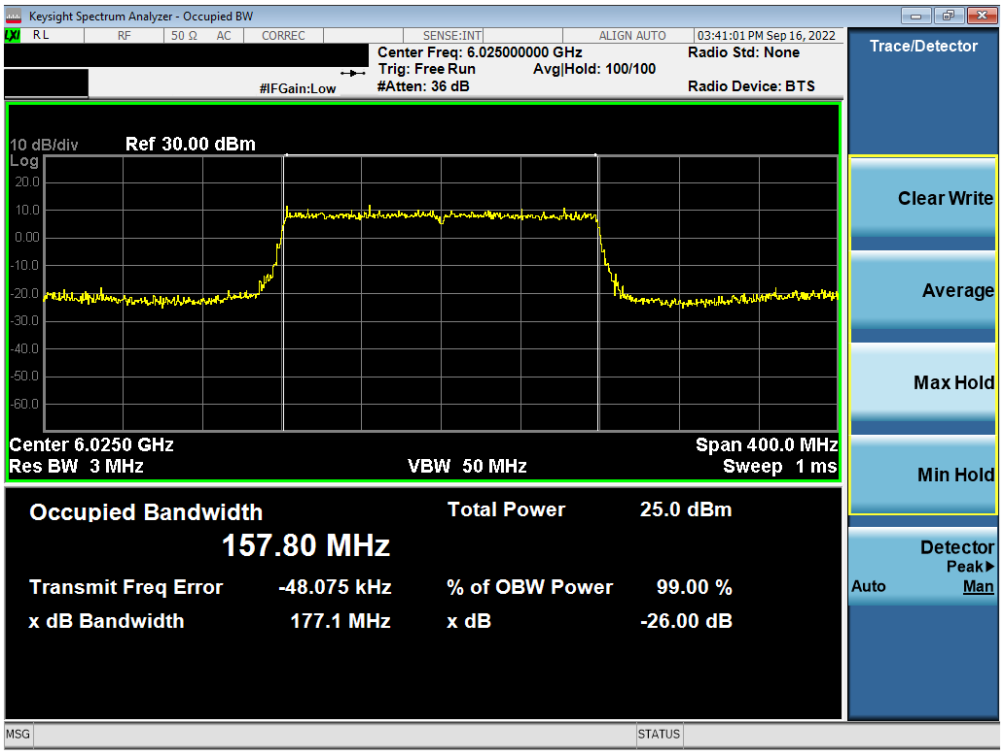
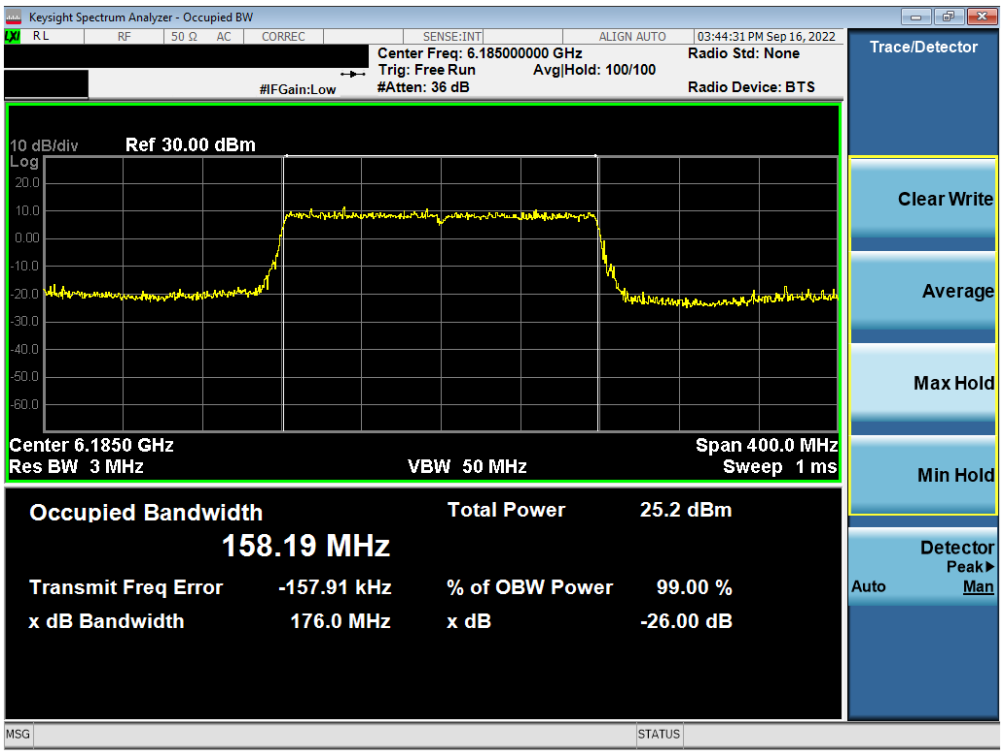


Plot 7-13. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 5) – Ch. 15)



Plot 7-14. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 5) – Ch. 47)

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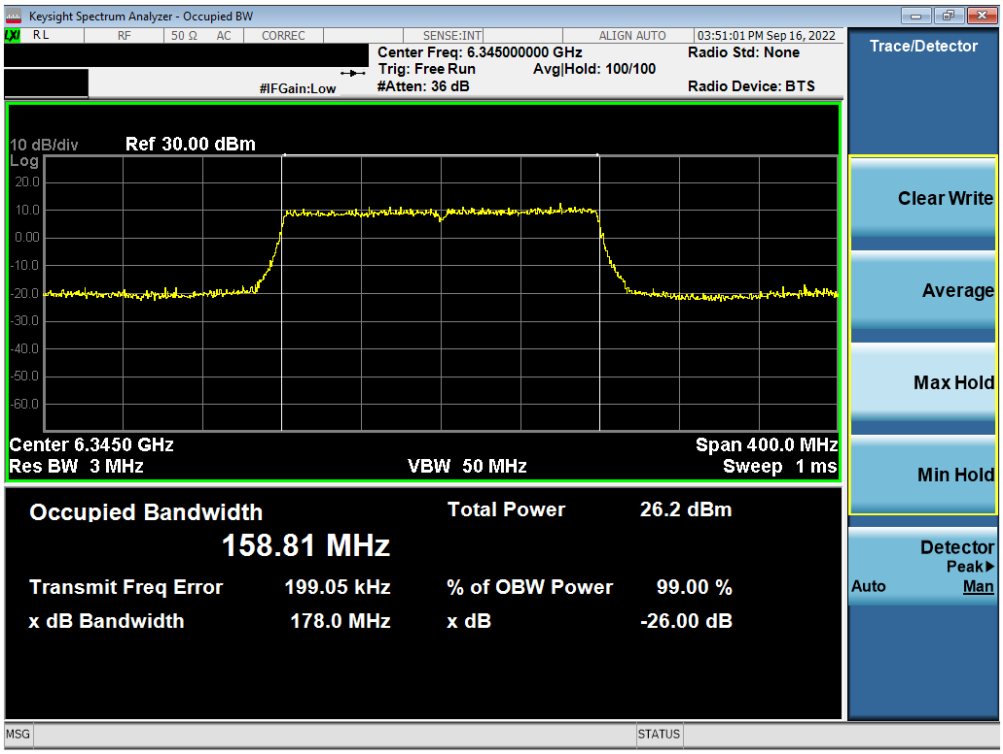

Plot 7-15. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 5) – Ch. 79)

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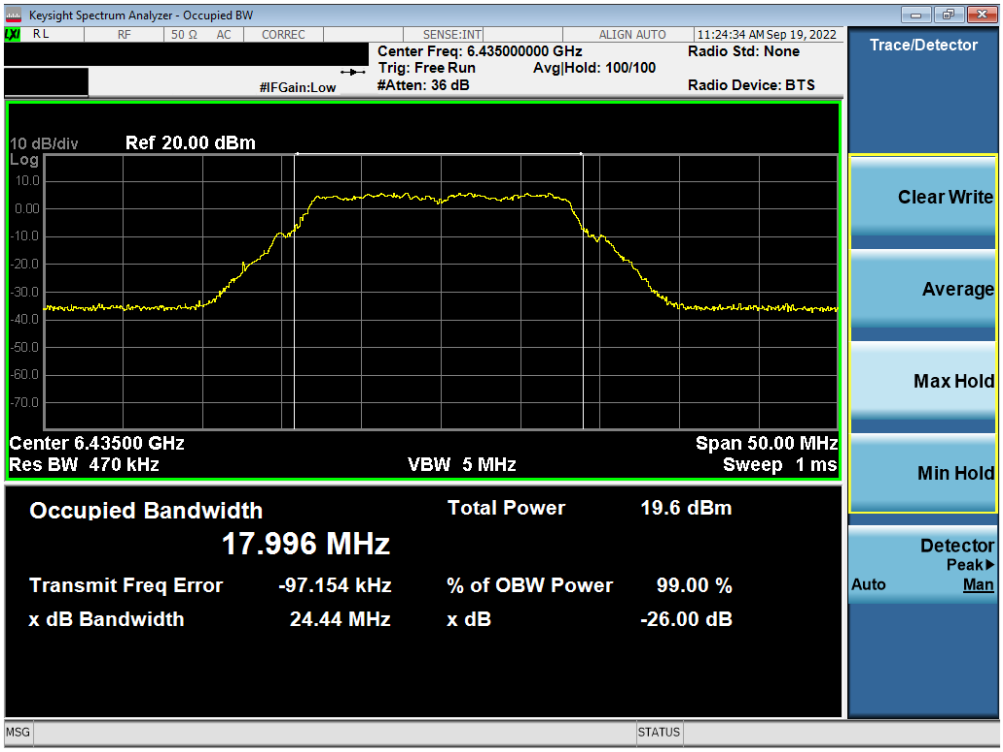
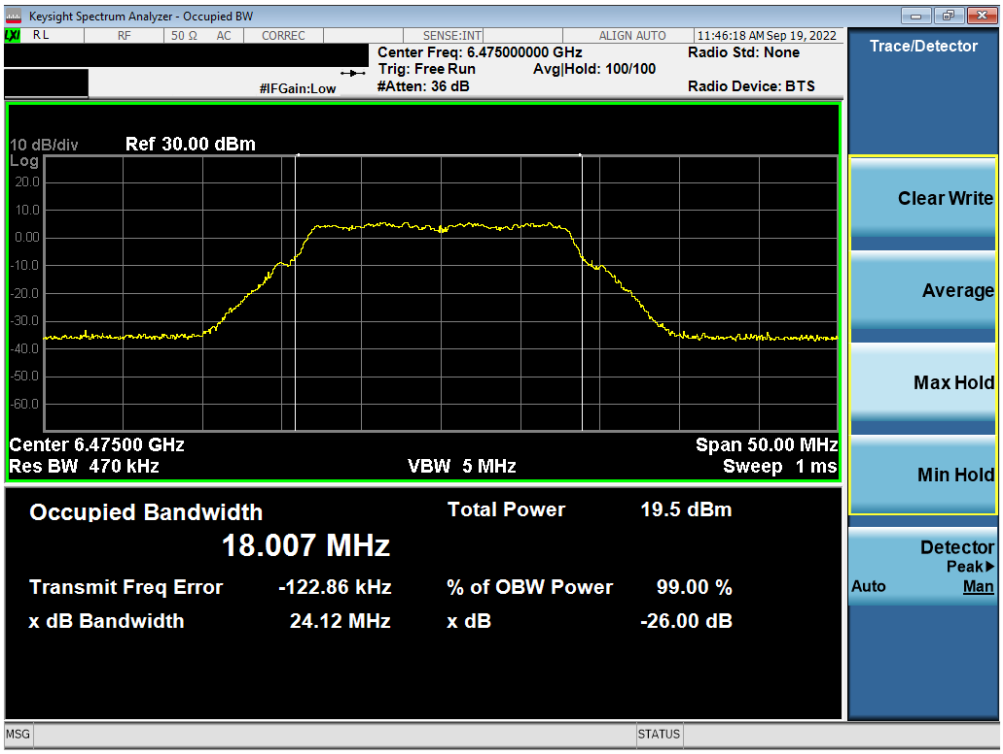
MIMO Antenna-1 26 dB Bandwidth Measurements - (UNII Band 6)



Plot 7-16. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 6) – Ch. 97)



Plot 7-17. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 6) – Ch. 105)

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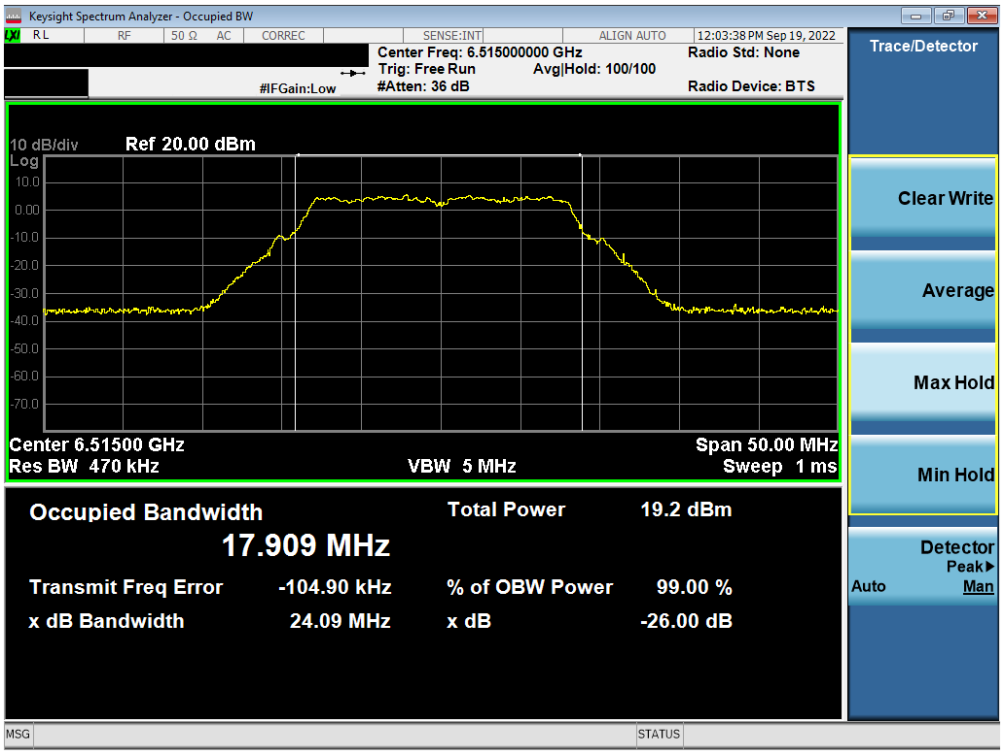
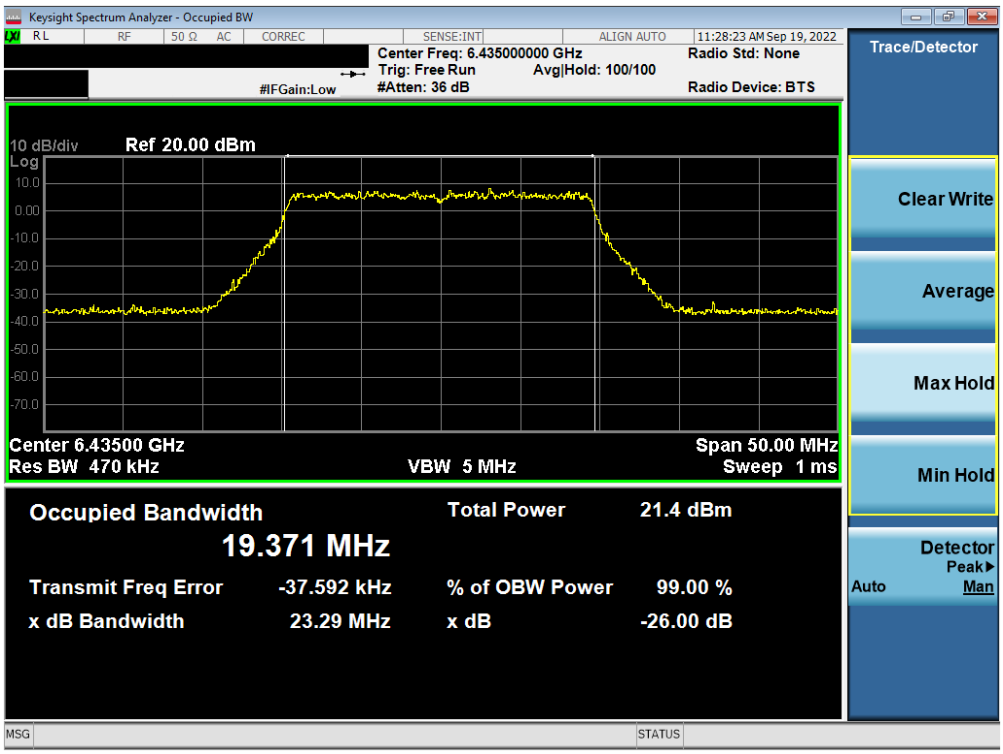


Plot 7-18. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 6) – Ch. 113)



Plot 7-19. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 6) – Ch. 97)

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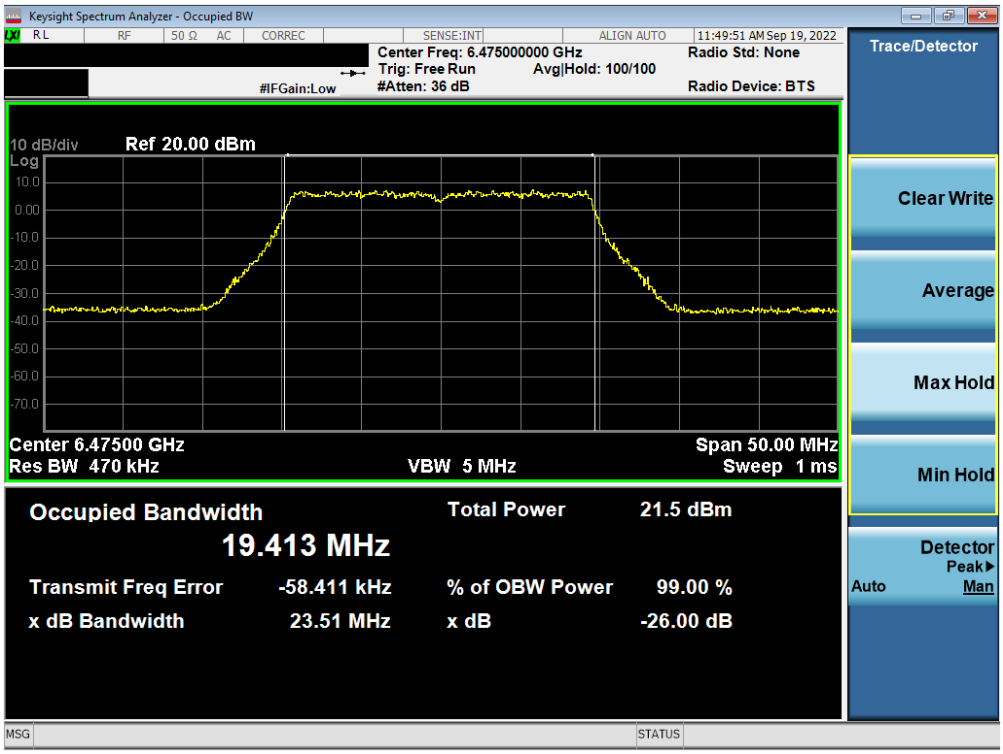
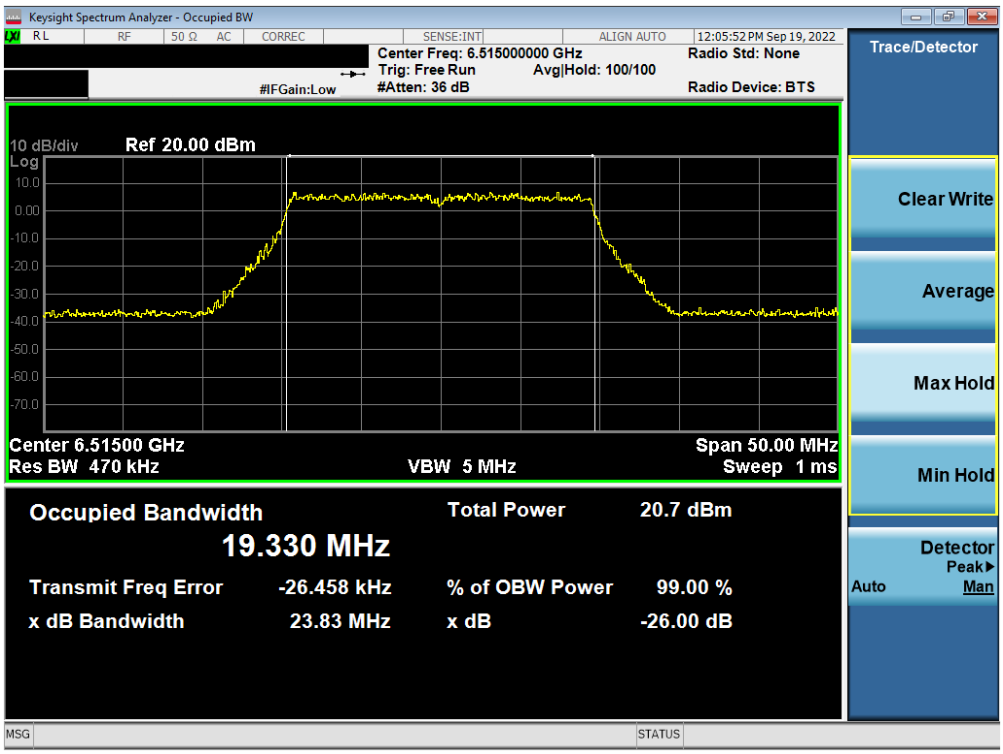


Plot 7-20. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 6) – Ch. 105)



Plot 7-21. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 6) – Ch. 113)

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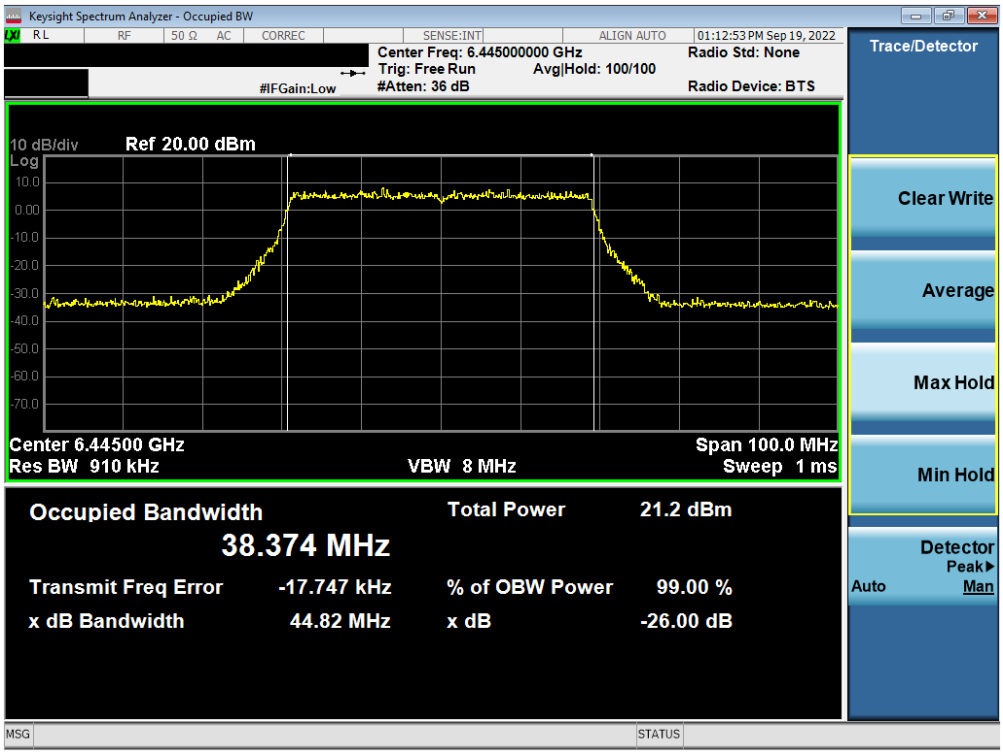
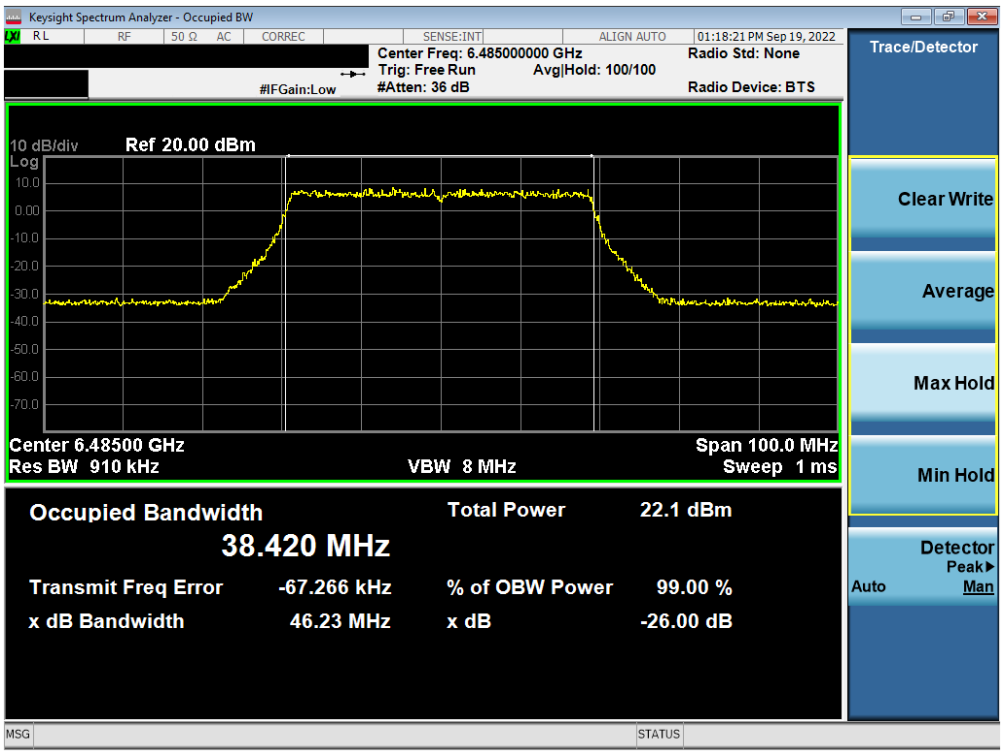


Plot 7-22. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 6) – Ch. 99)



Plot 7-23. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 6) – Ch. 107)

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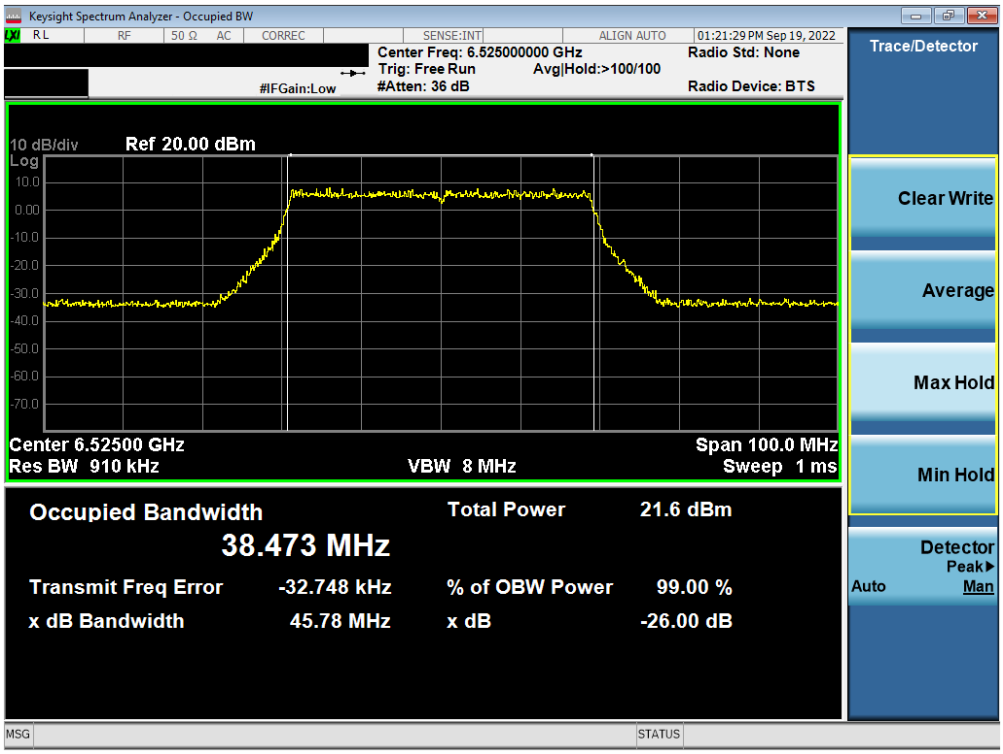
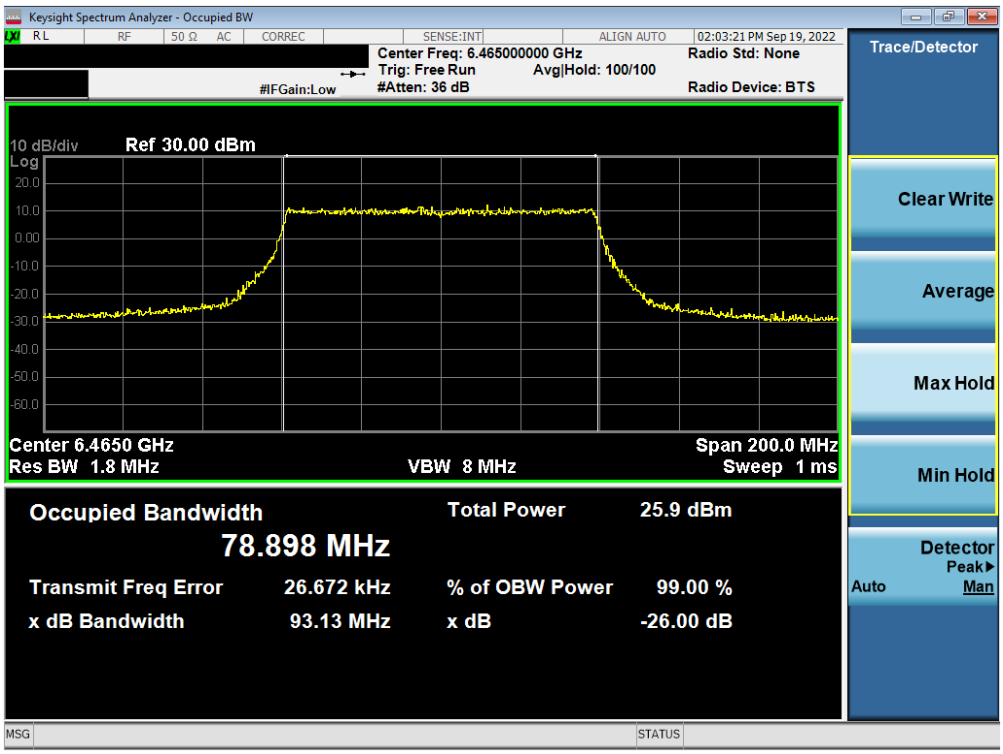


Plot 7-24. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 6) – Ch. 115)



Plot 7-25. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 6) – Ch. 103)

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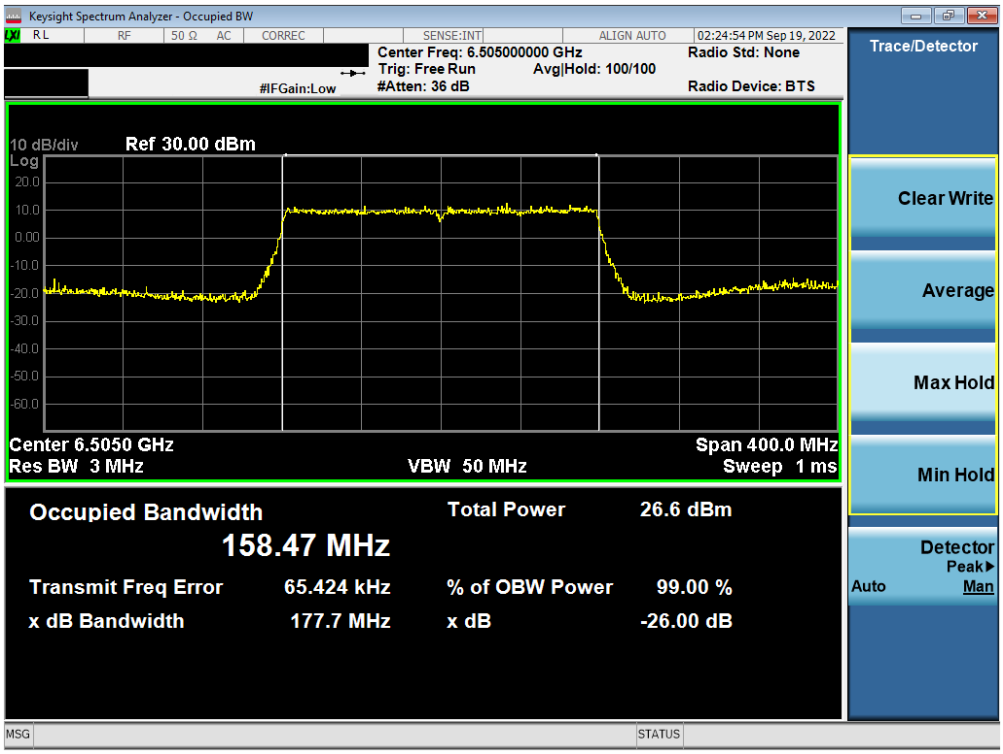

Plot 7-26. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 6) – Ch. 111)

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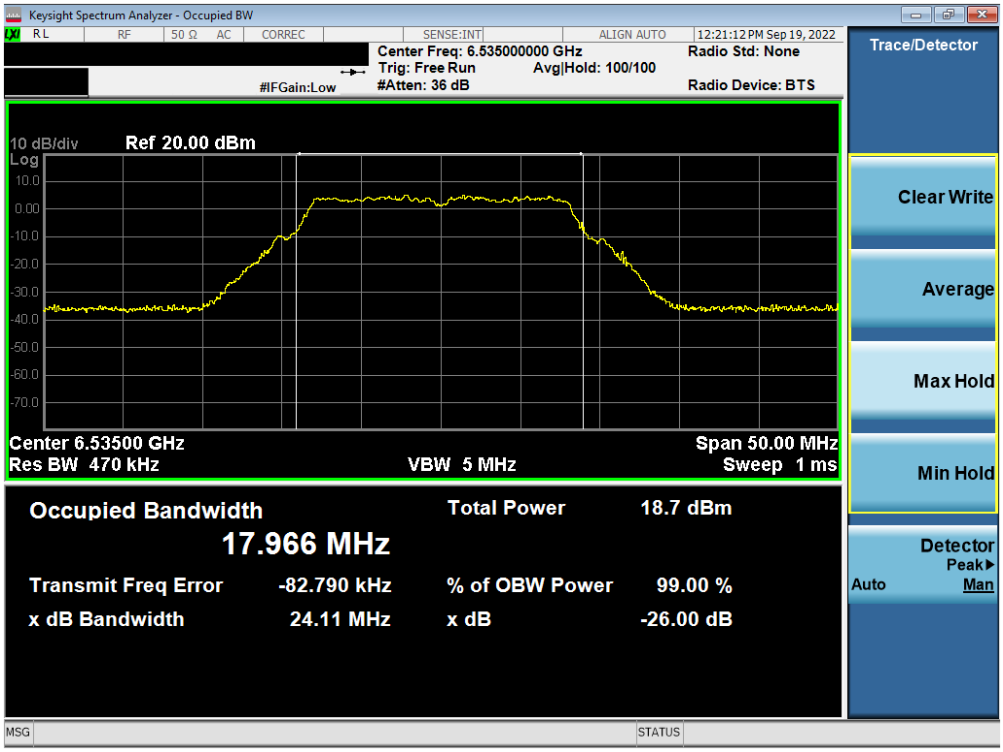
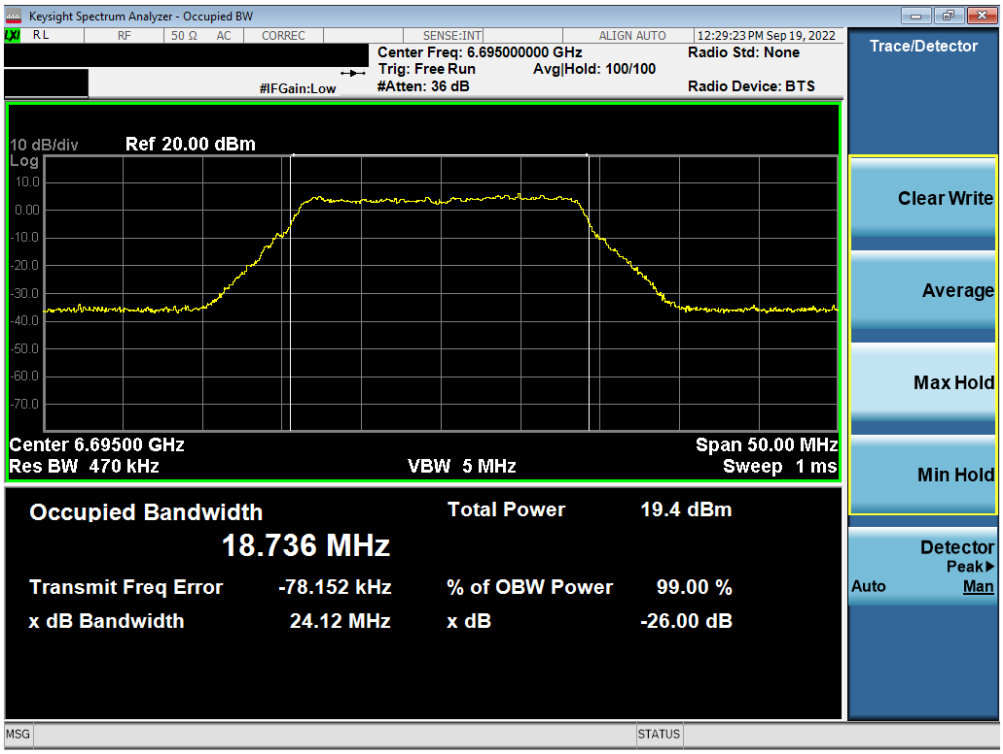
MIMO Antenna-1 26 dB Bandwidth Measurements - (UNII Band 7)



Plot 7-27. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 7) – Ch. 117)



Plot 7-28. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 7) – Ch. 149)

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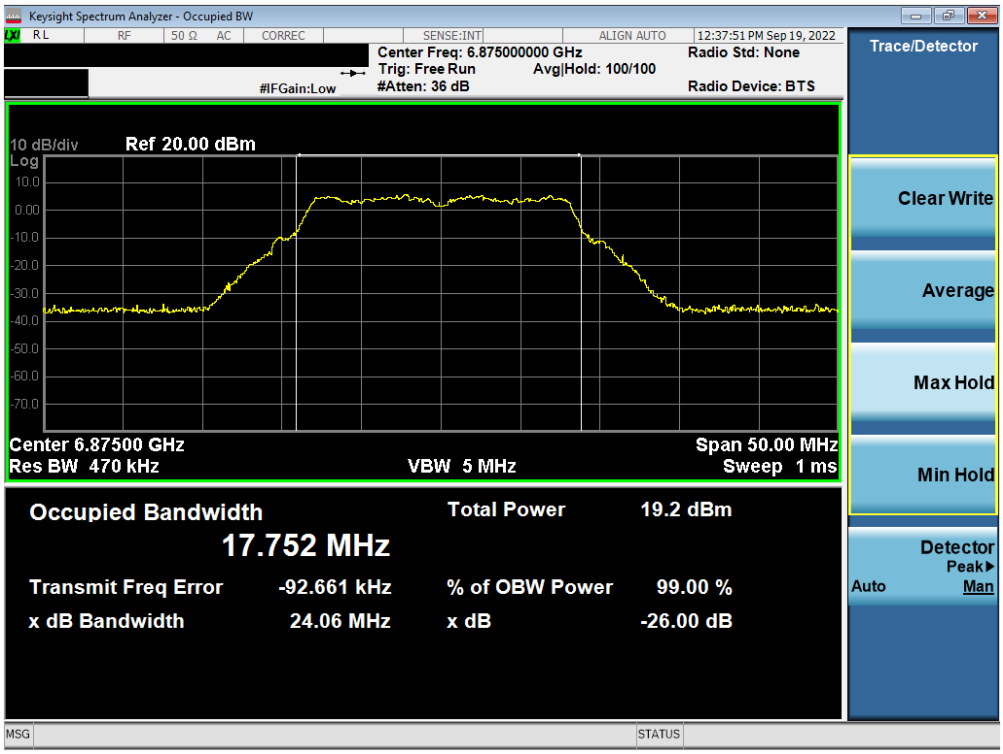
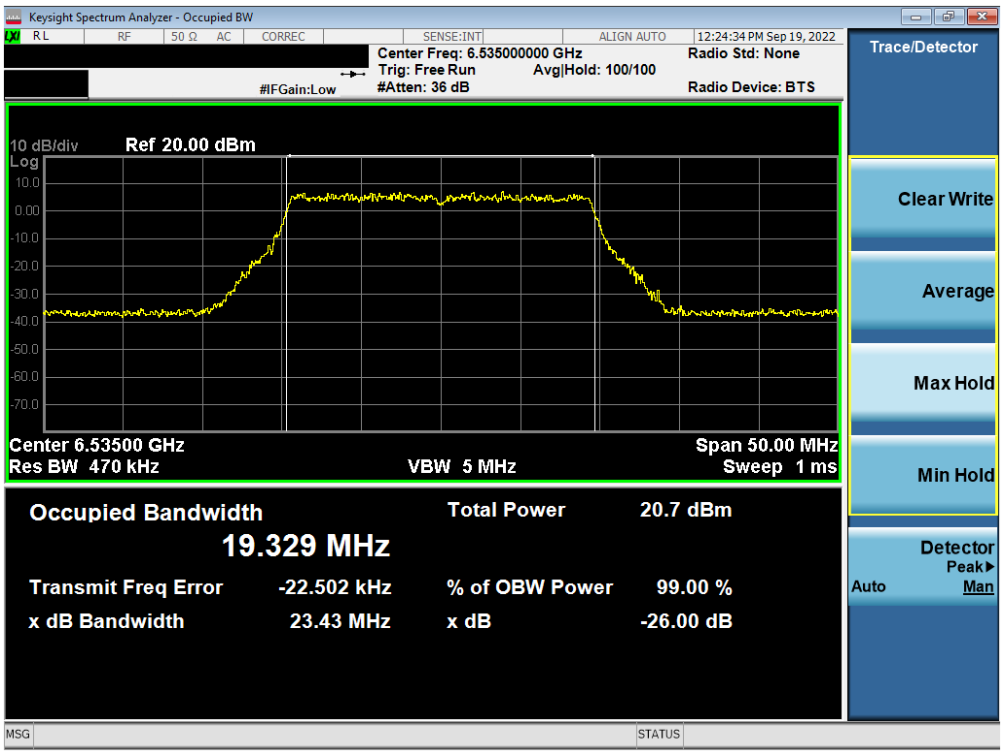


Plot 7-29. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 7) – Ch. 185)



Plot 7-30. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 7) – Ch. 117)

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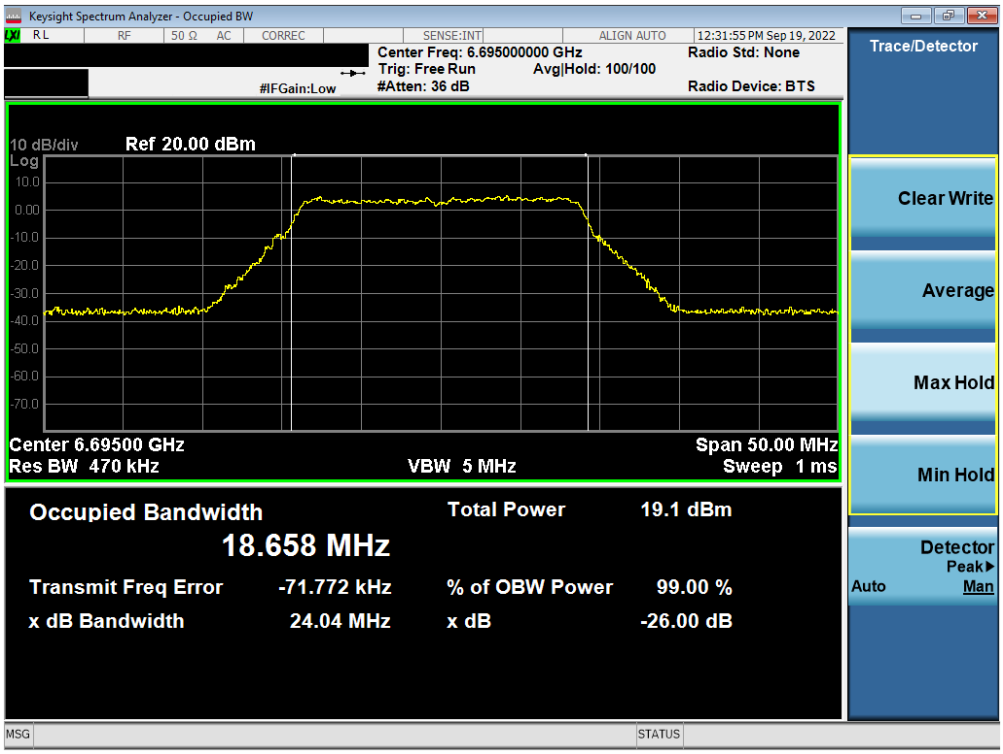
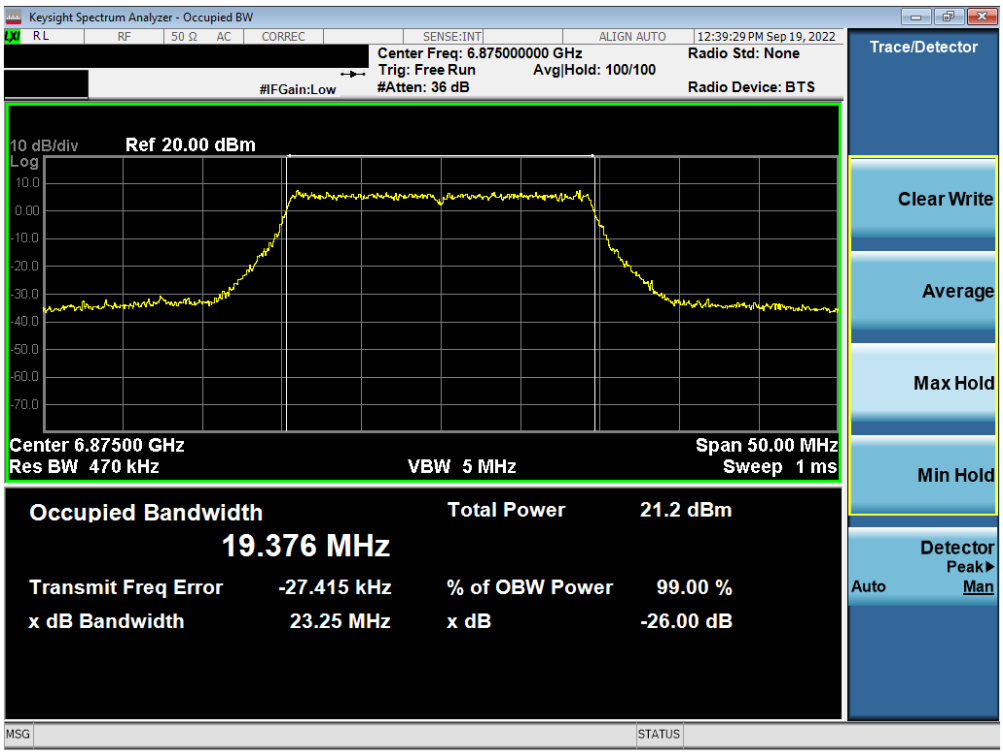


Plot 7-31. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 7) – Ch. 149)



Plot 7-32. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 7) – Ch. 185)

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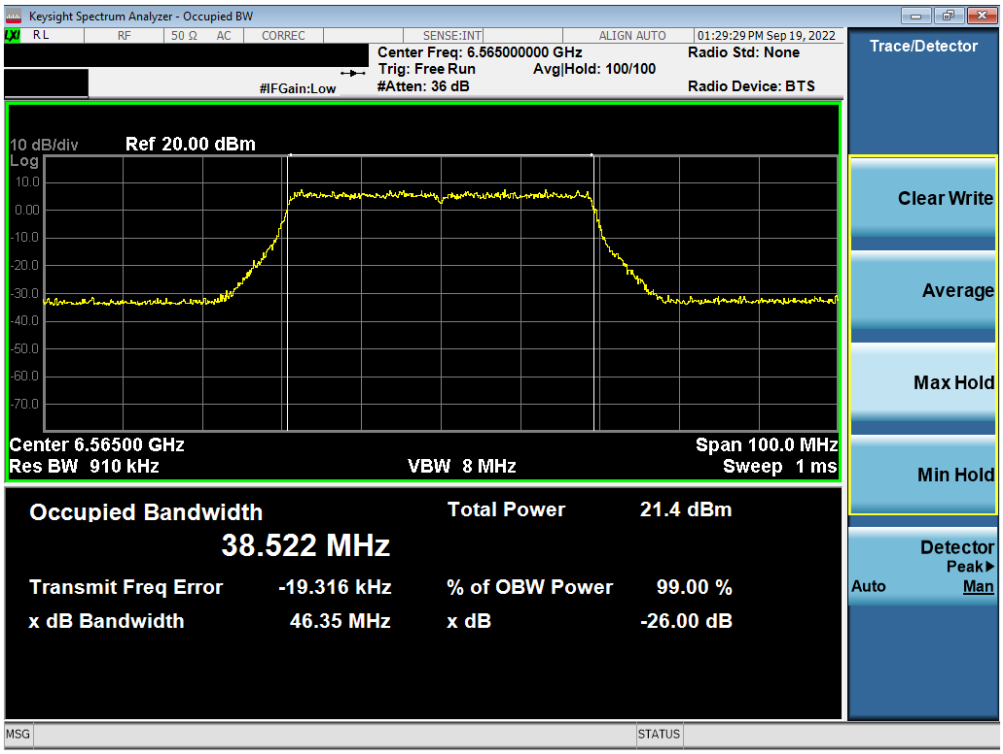
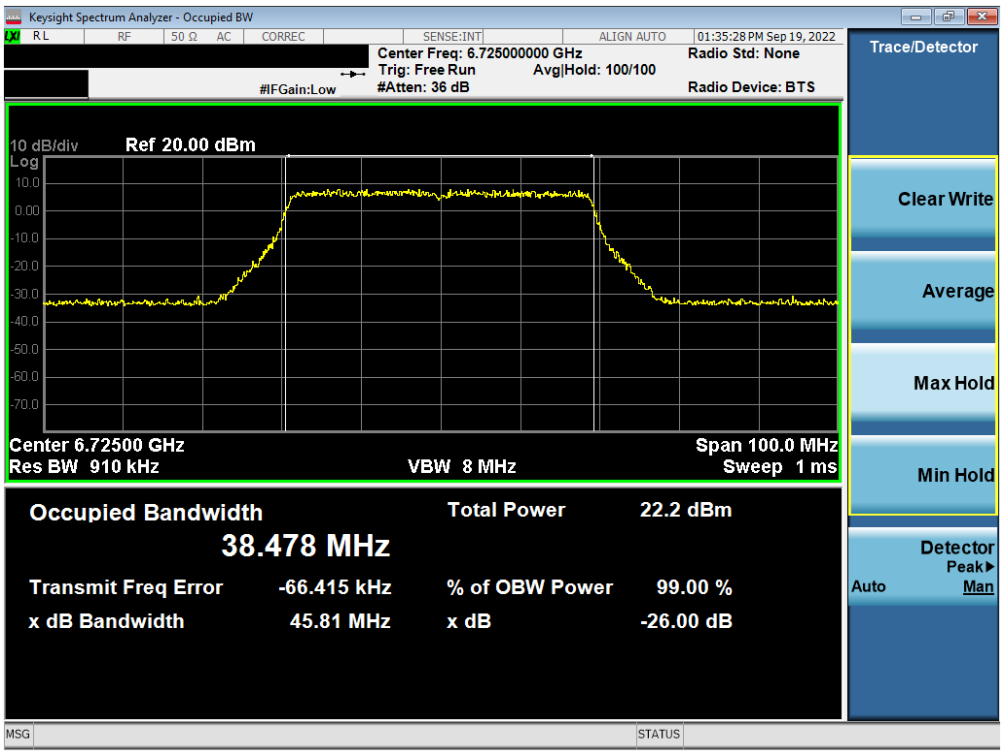


Plot 7-33. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 7) – Ch. 123)



Plot 7-34. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 7) – Ch. 155)

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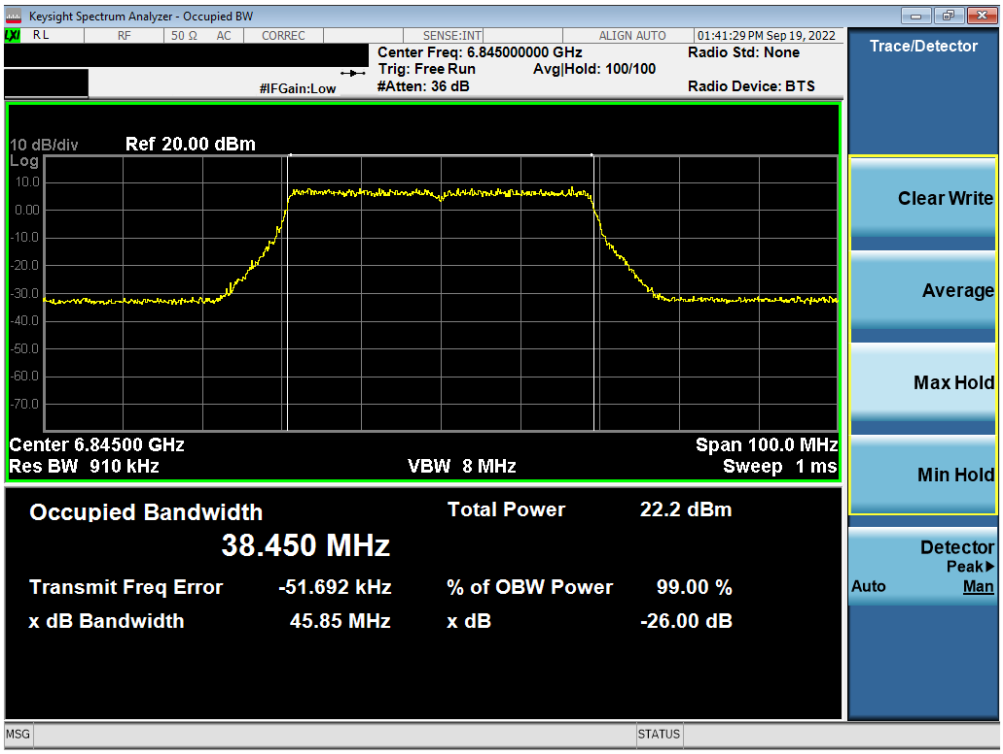
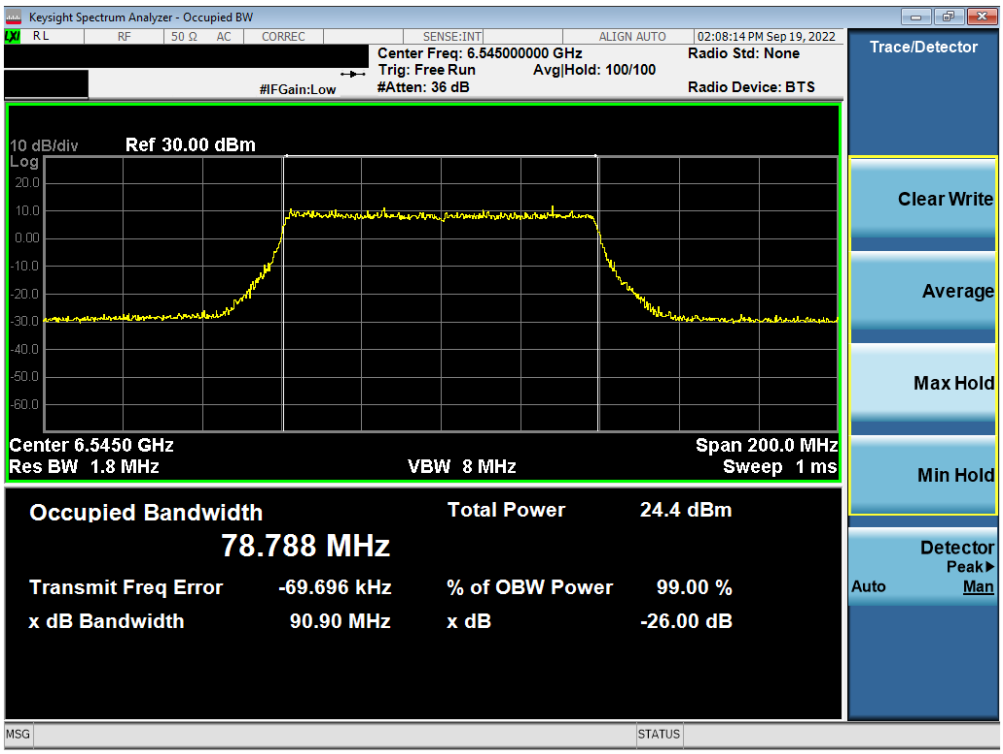


Plot 7-35. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 7) – Ch. 179)



Plot 7-36. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 7) – Ch. 119)

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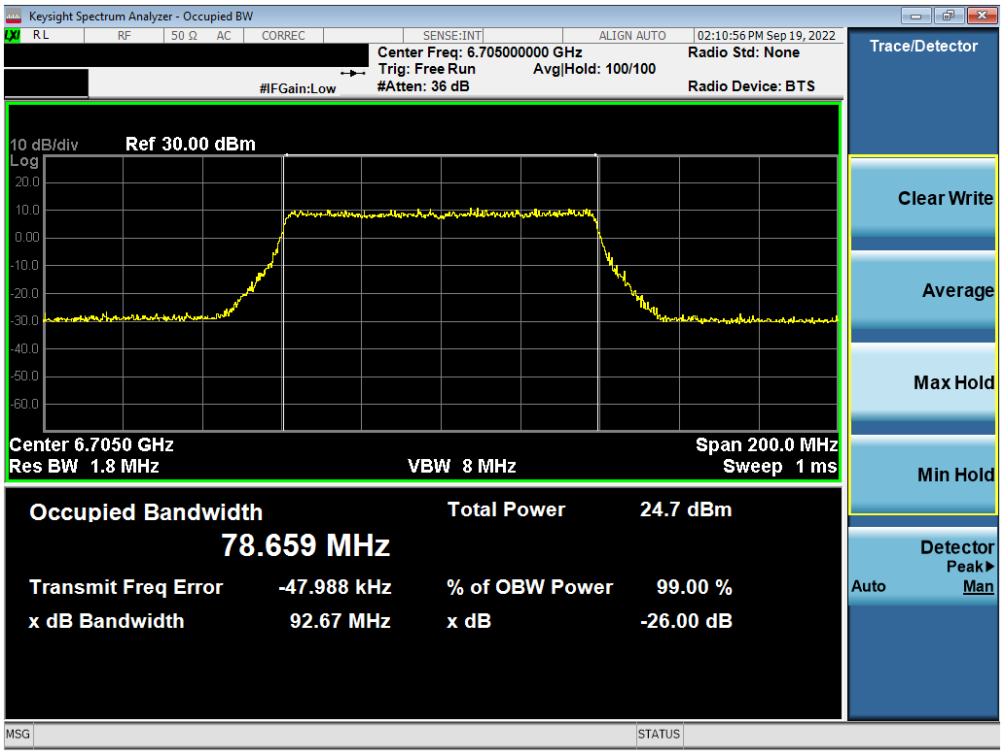
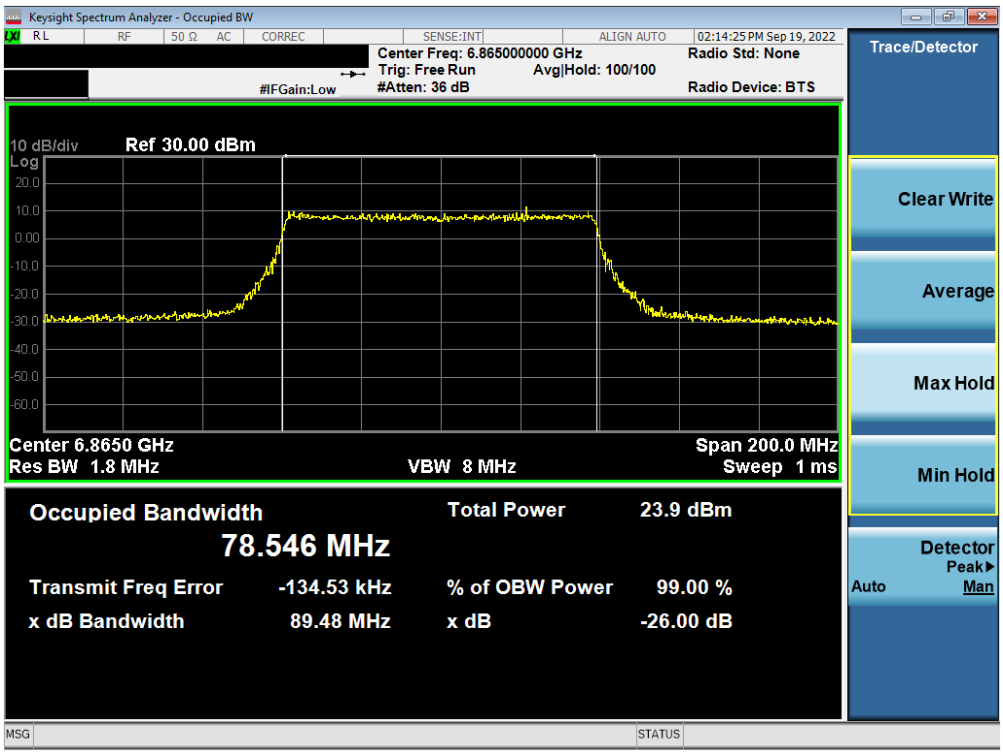


Plot 7-37. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 7) – Ch. 151)



Plot 7-38. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 7) – Ch. 183)

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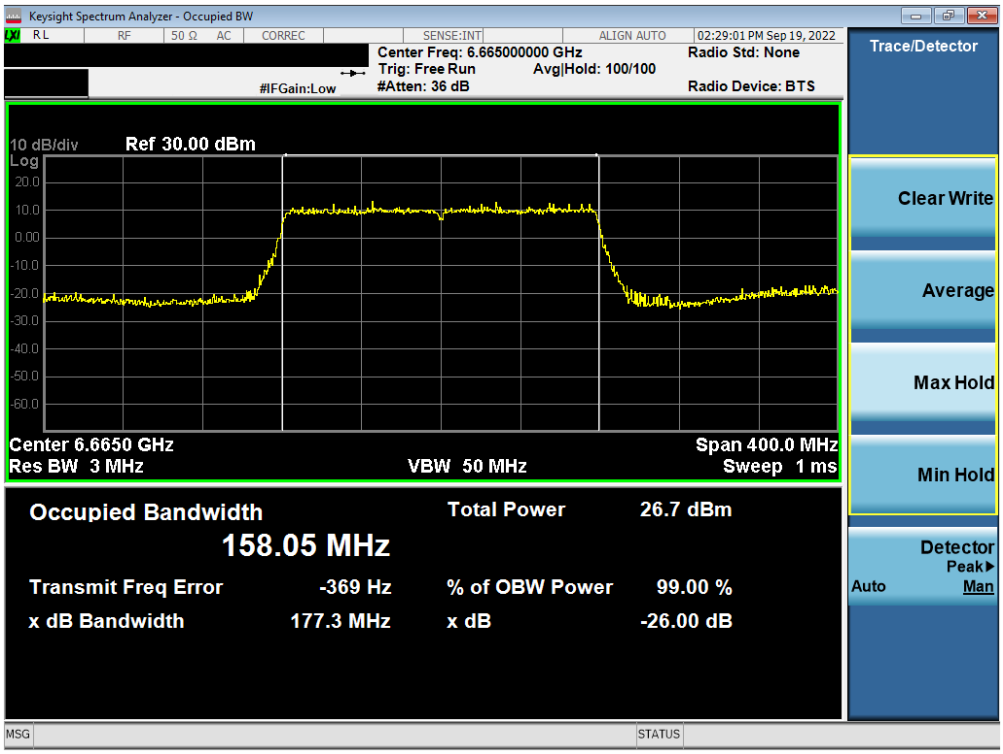
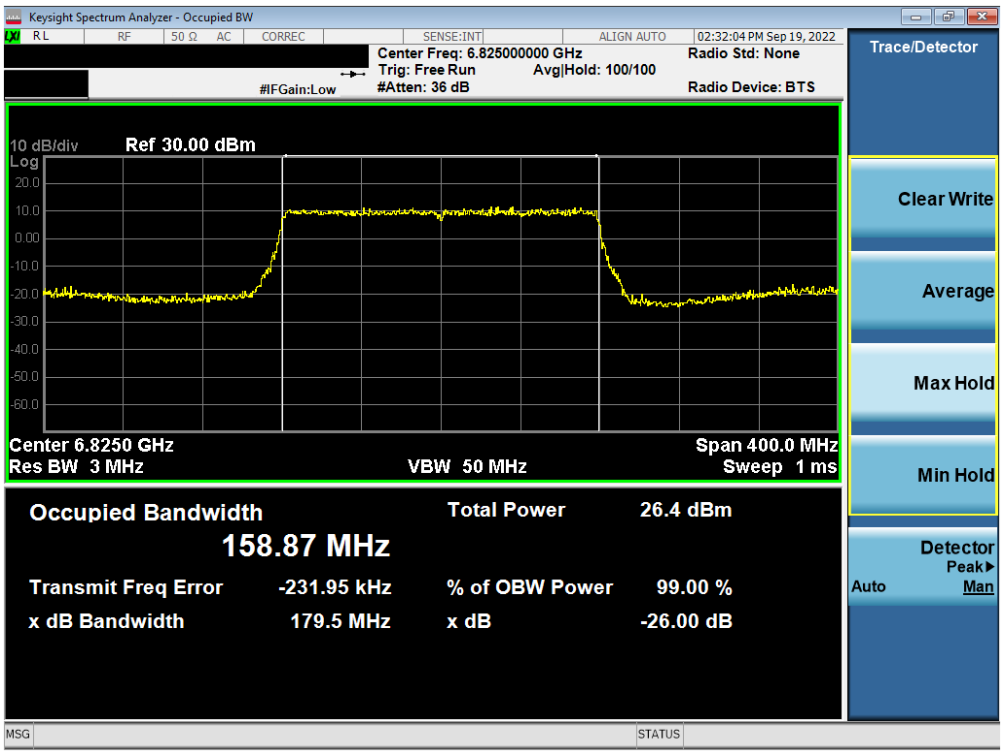


Plot 7-39. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 7) – Ch. 143)



Plot 7-40. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 7) – Ch. 175)

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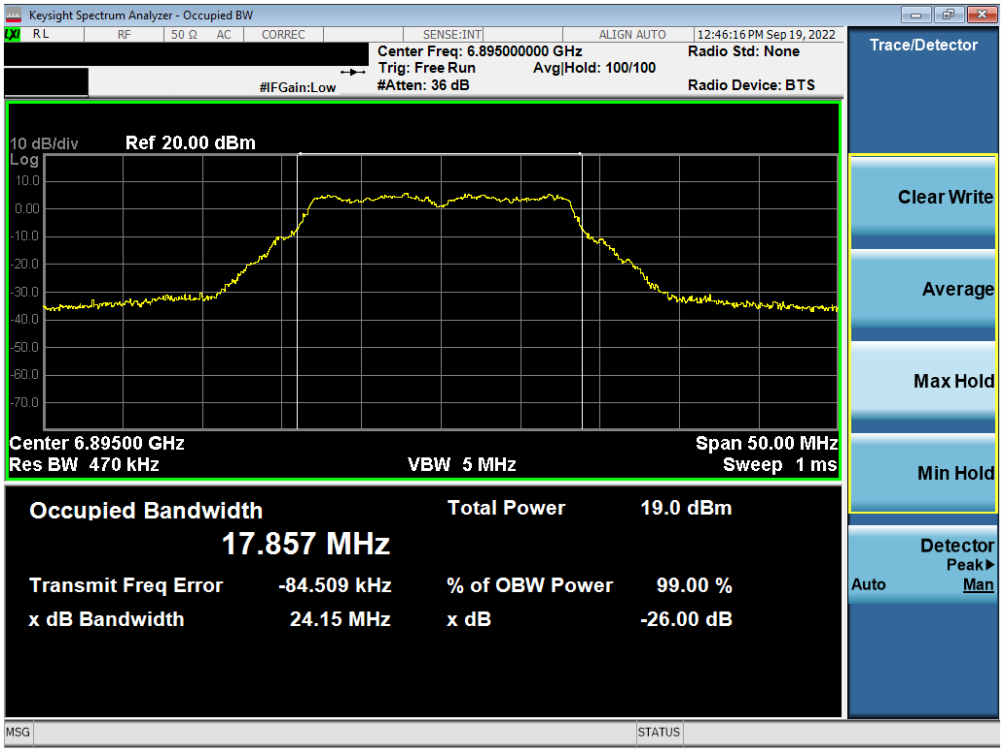
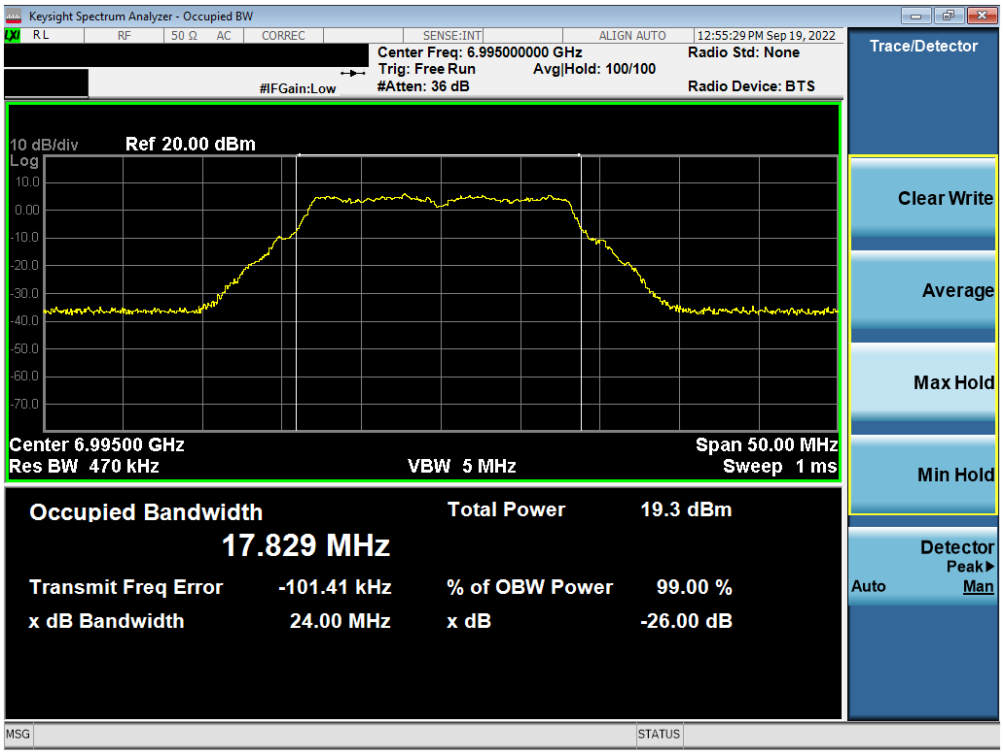
MIMO Antenna-1 26 dB Bandwidth Measurements - (UNII Band 8)



Plot 7-41. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 8) – Ch. 189)



Plot 7-42. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 8) – Ch. 209)

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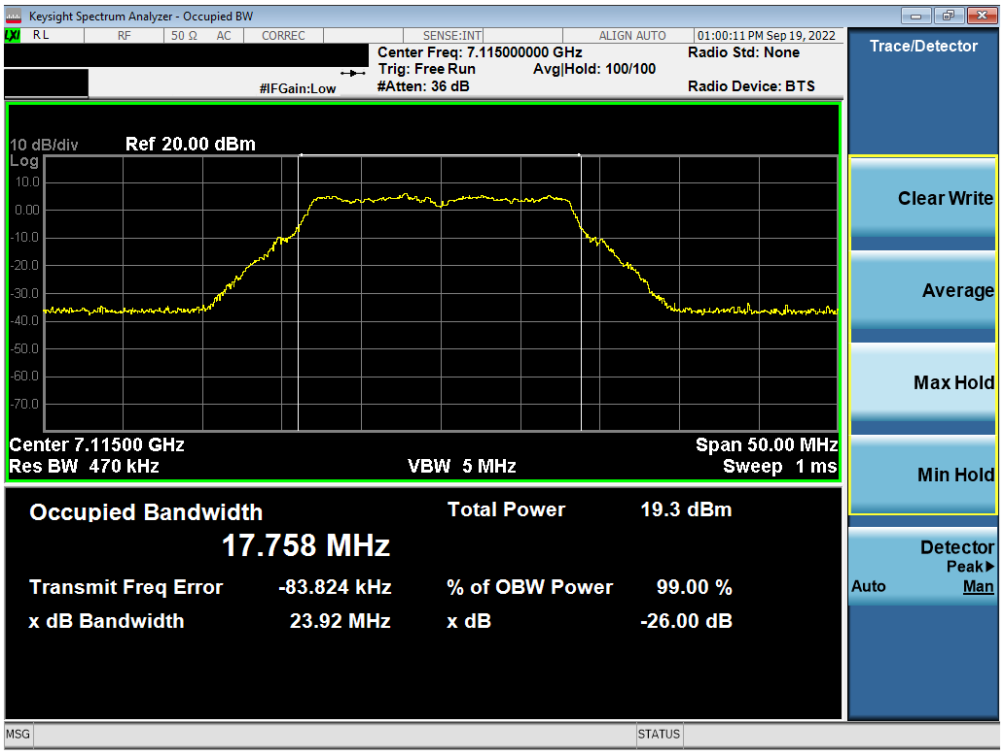
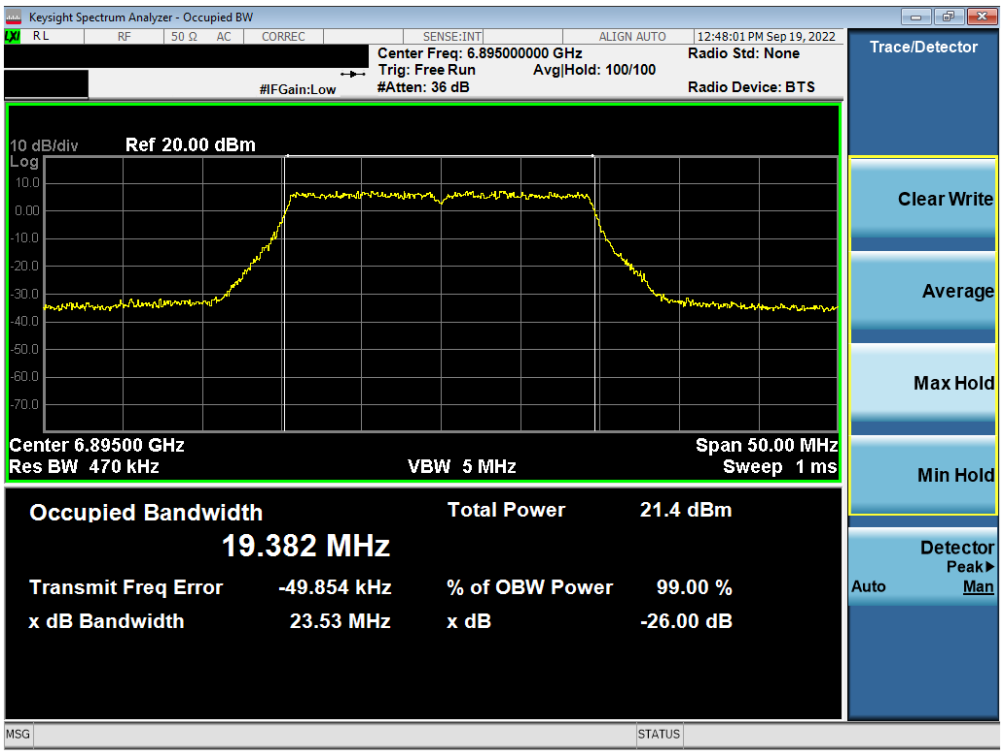


Plot 7-43. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 8) – Ch. 233)



Plot 7-44. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 8) – Ch. 189)

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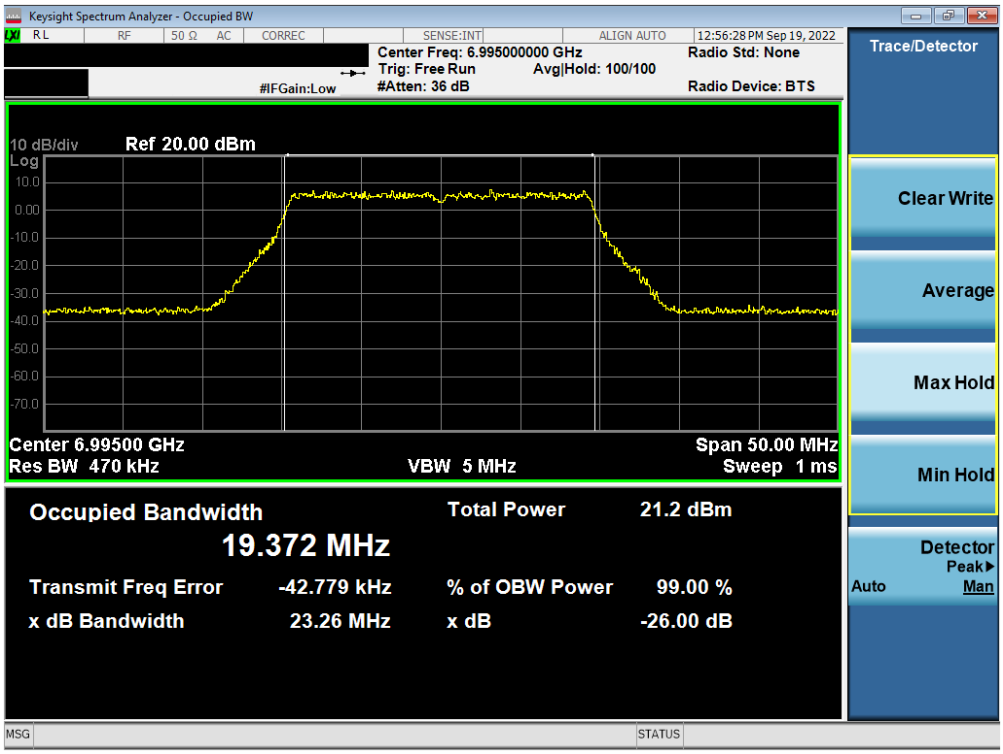
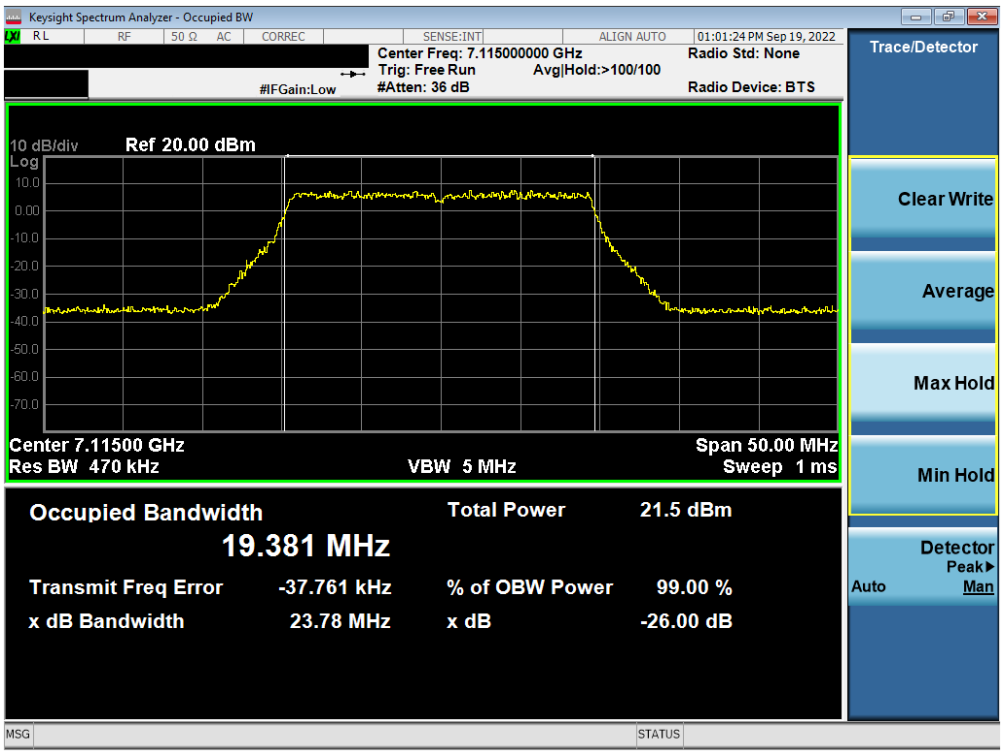


Plot 7-45. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 8) – Ch. 209)



Plot 7-46. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 8) – Ch. 233)

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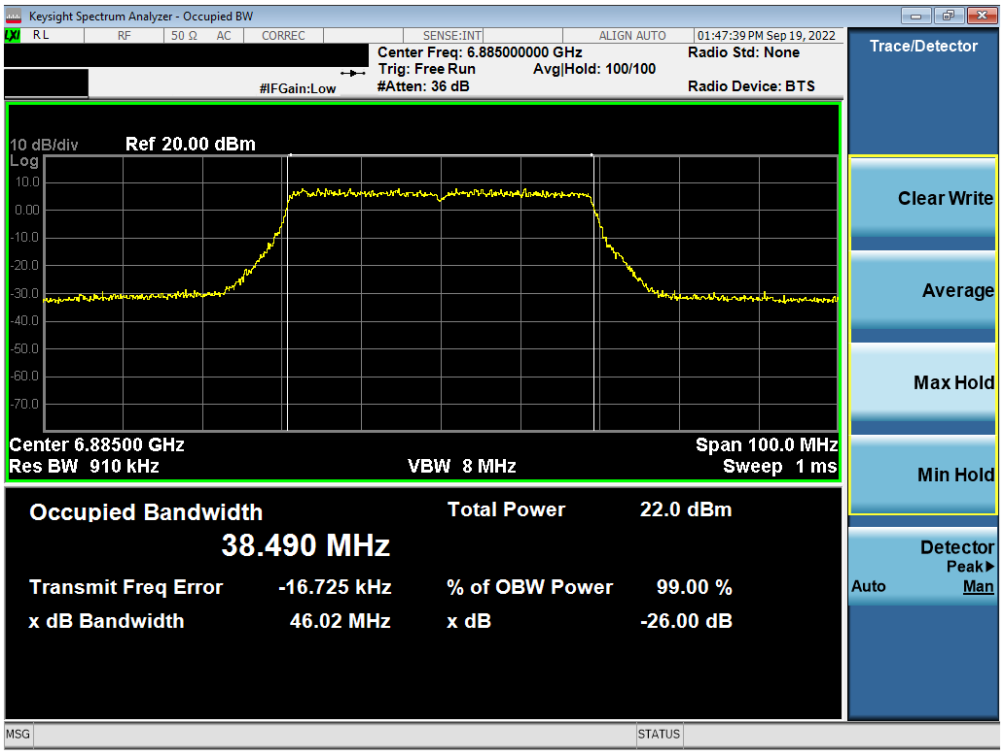
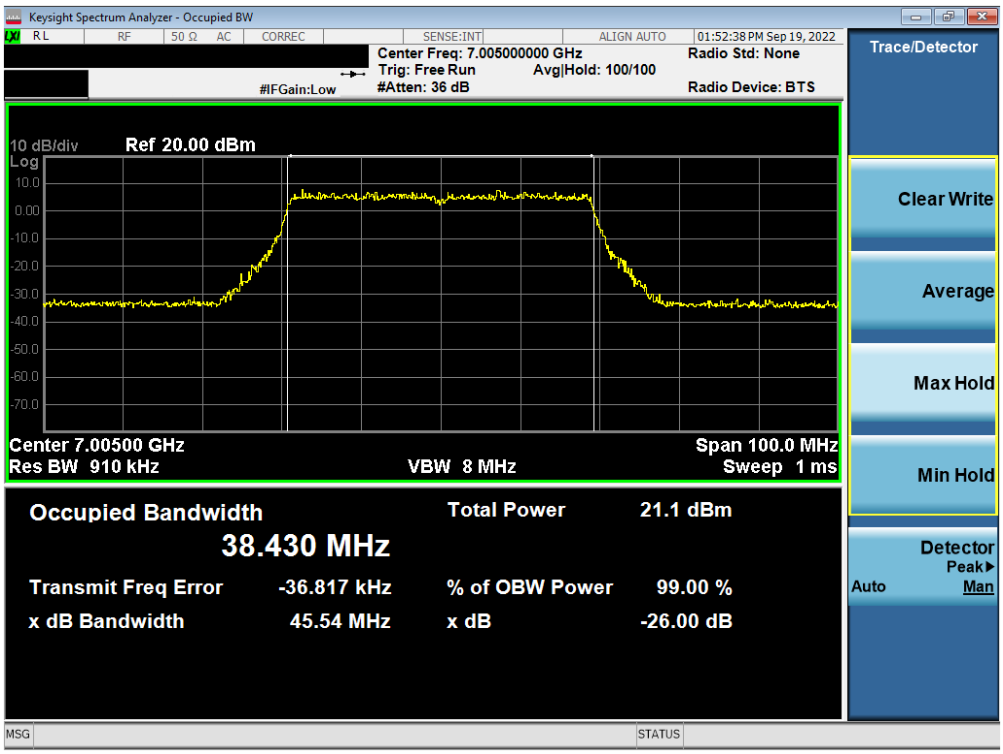


Plot 7-47. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 8) – Ch. 187)



Plot 7-48. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 8) – Ch. 211)

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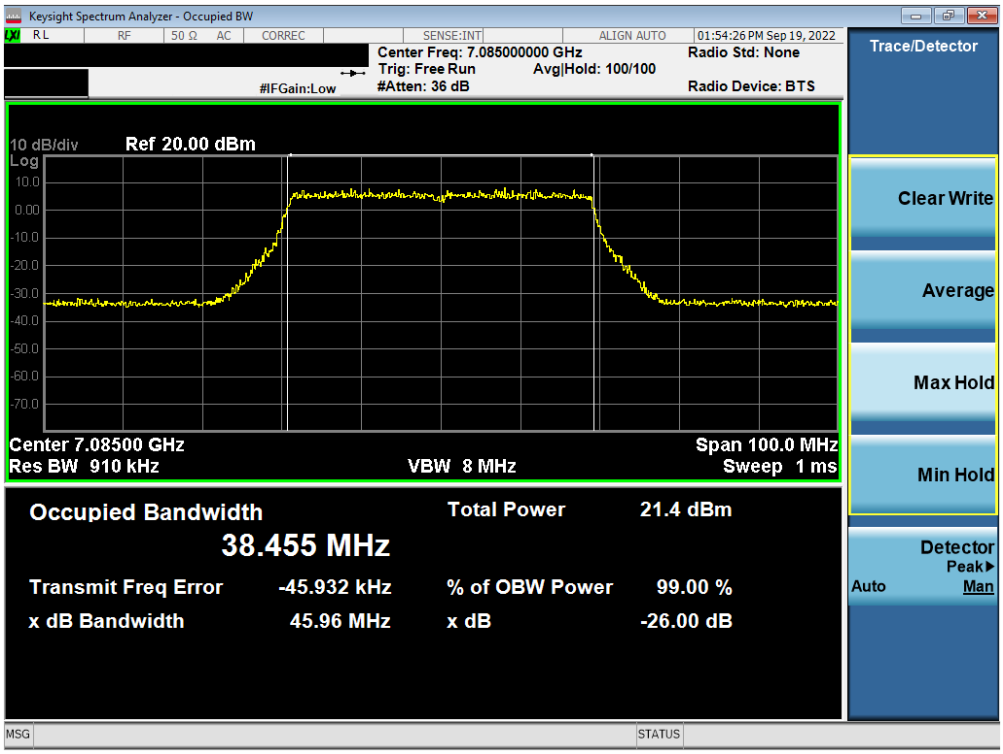
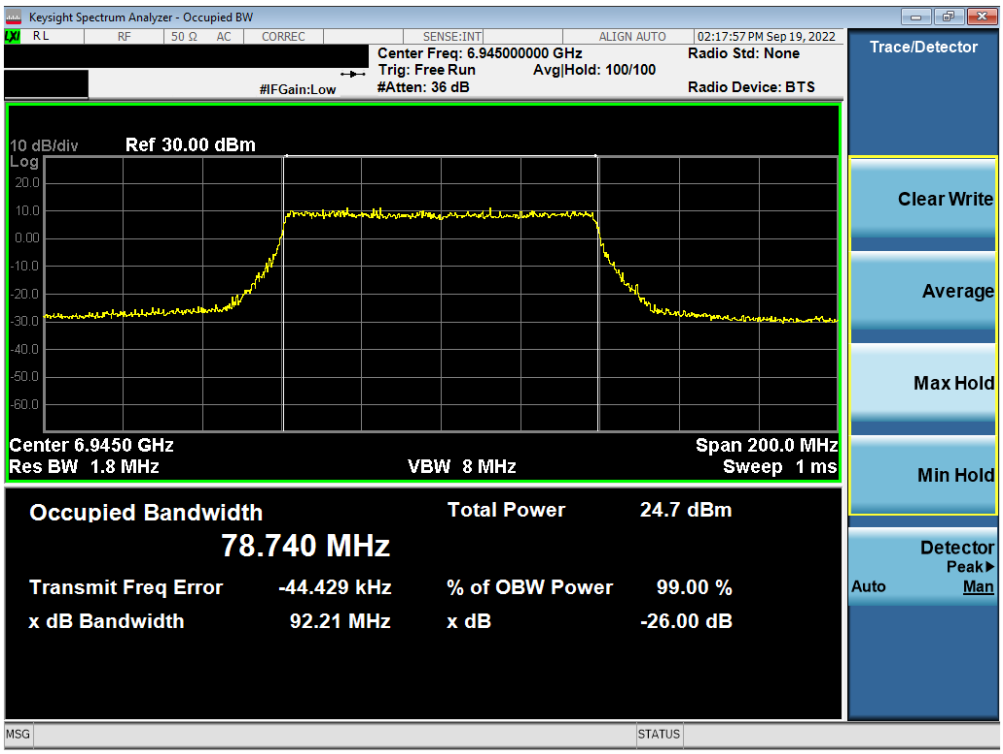


Plot 7-49. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 8) – Ch. 227)



Plot 7-50. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 8) – Ch. 199)

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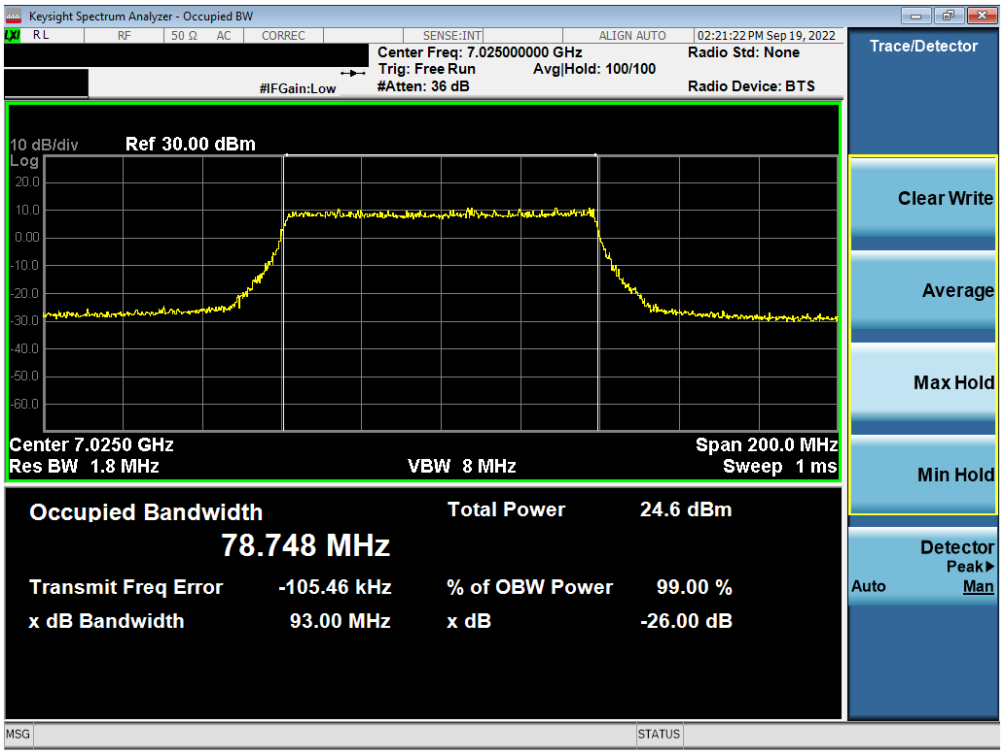
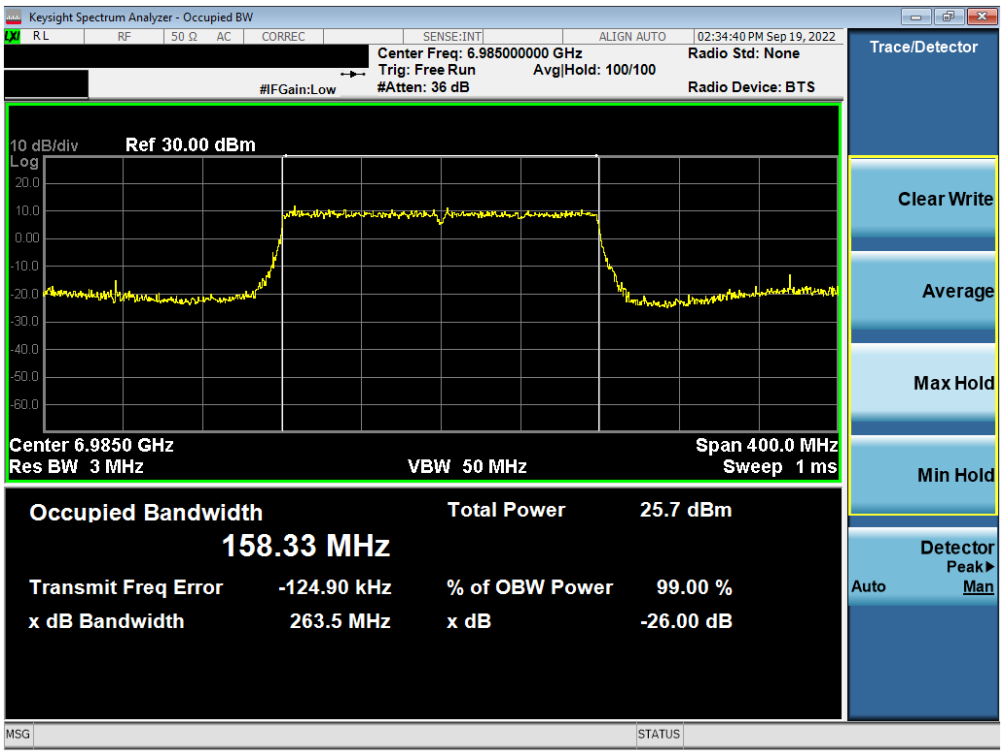


Plot 7-51. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 8) – Ch. 215)



Plot 7-52. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 8) – Ch. 207)

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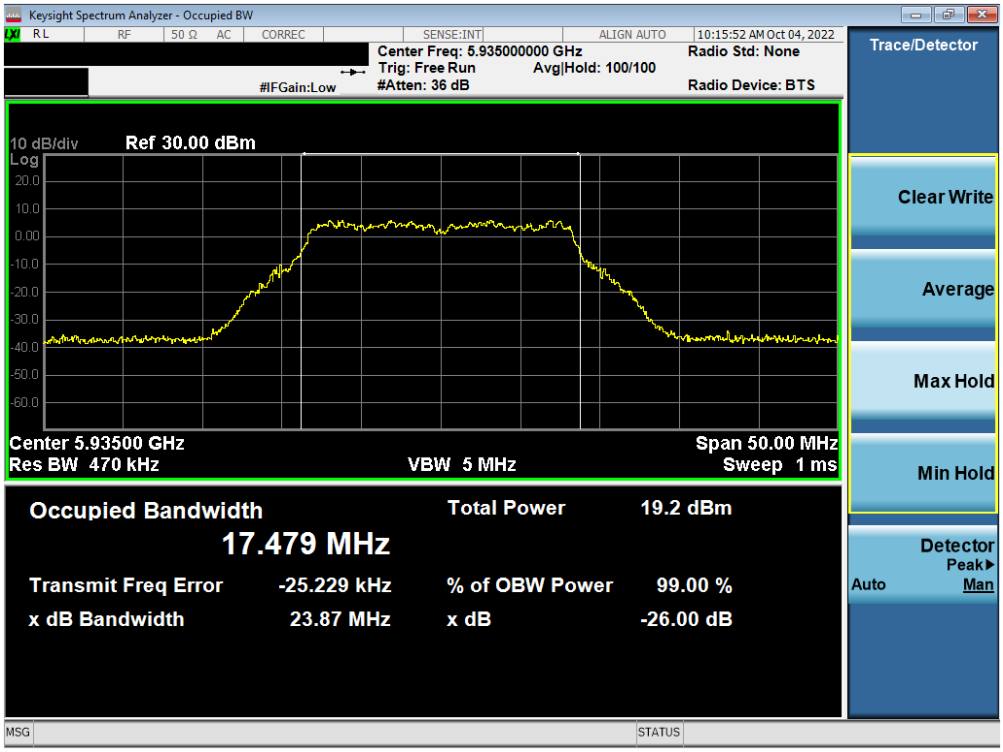
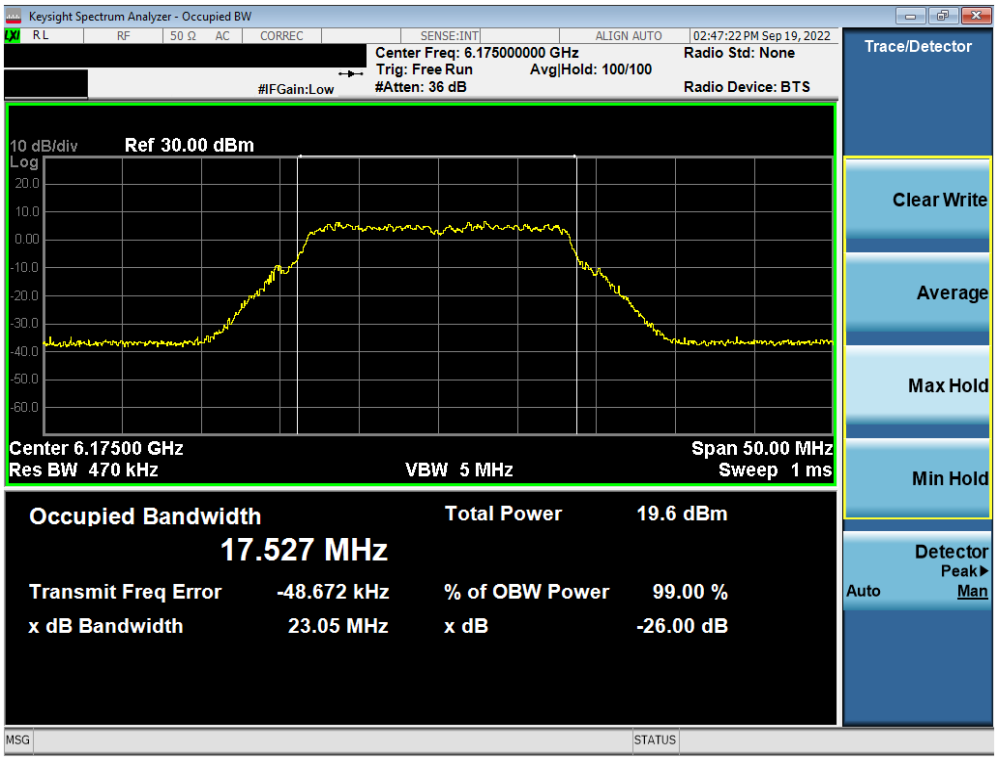
MIMO Antenna-2 26 dB Bandwidth Measurements - (UNII Band 5)



Plot 7-53. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 5) – Ch. 2)



Plot 7-54. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 5) – Ch. 45)

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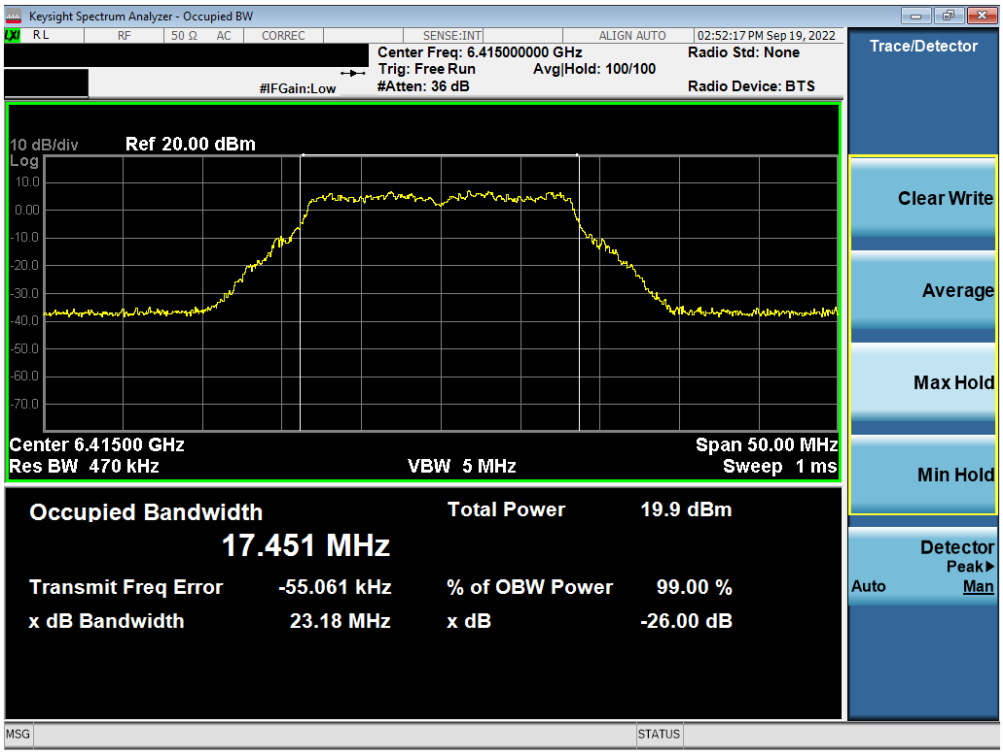
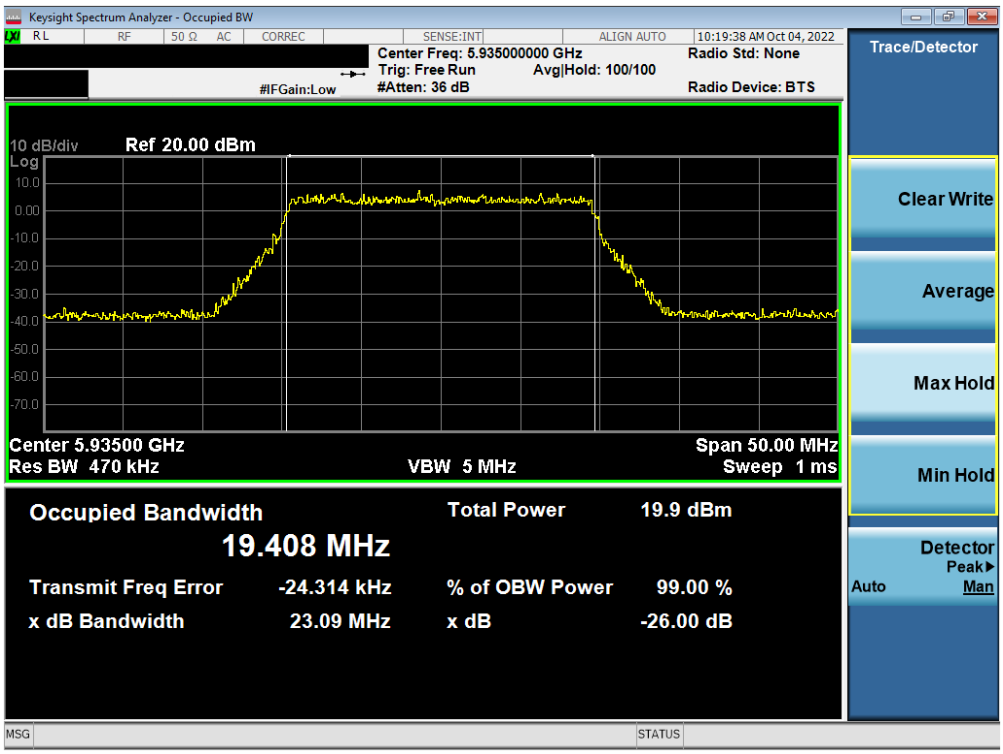


Plot 7-55. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 5) – Ch. 93)



Plot 7-56. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 5) – Ch. 2)

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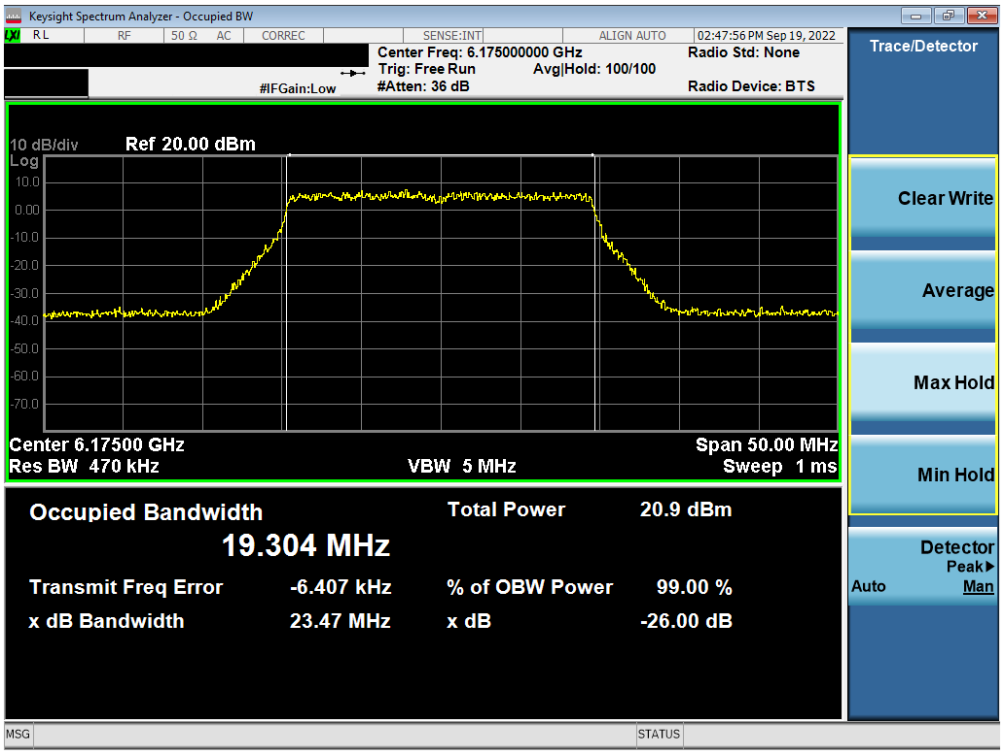
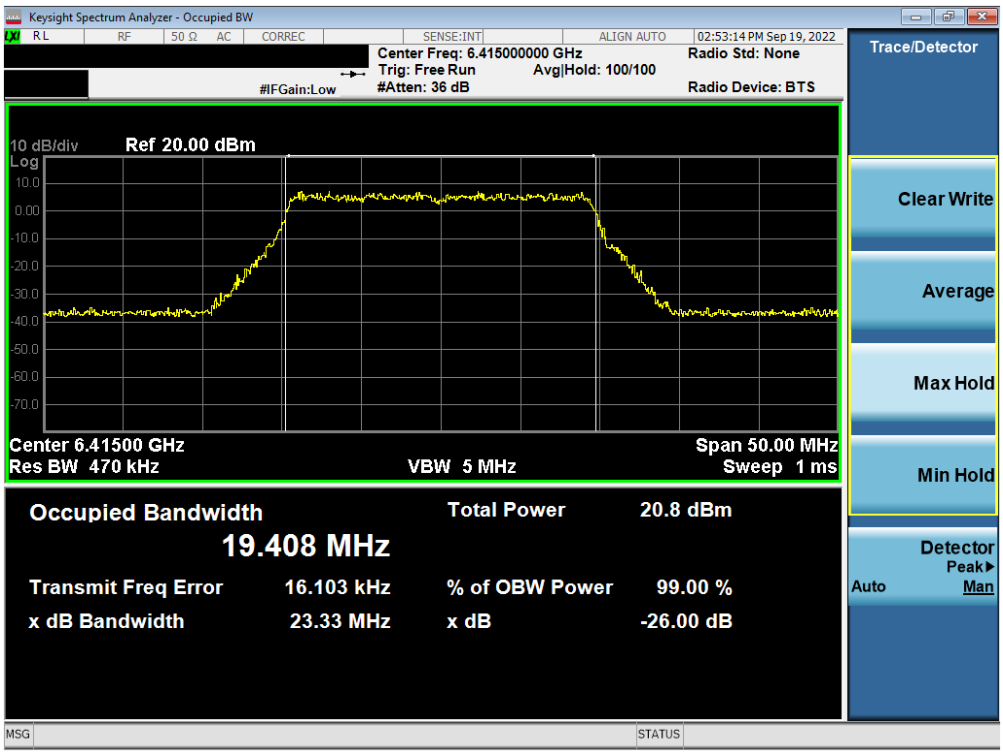


Plot 7-57. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 5) – Ch. 45)



Plot 7-58. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 5) – Ch. 93)

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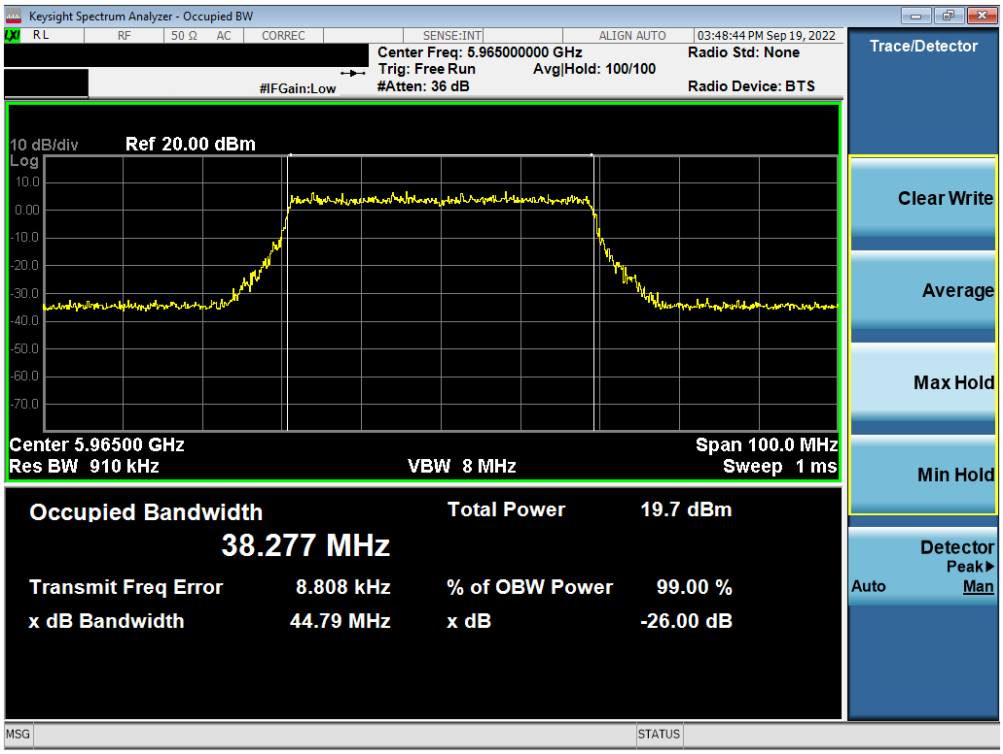
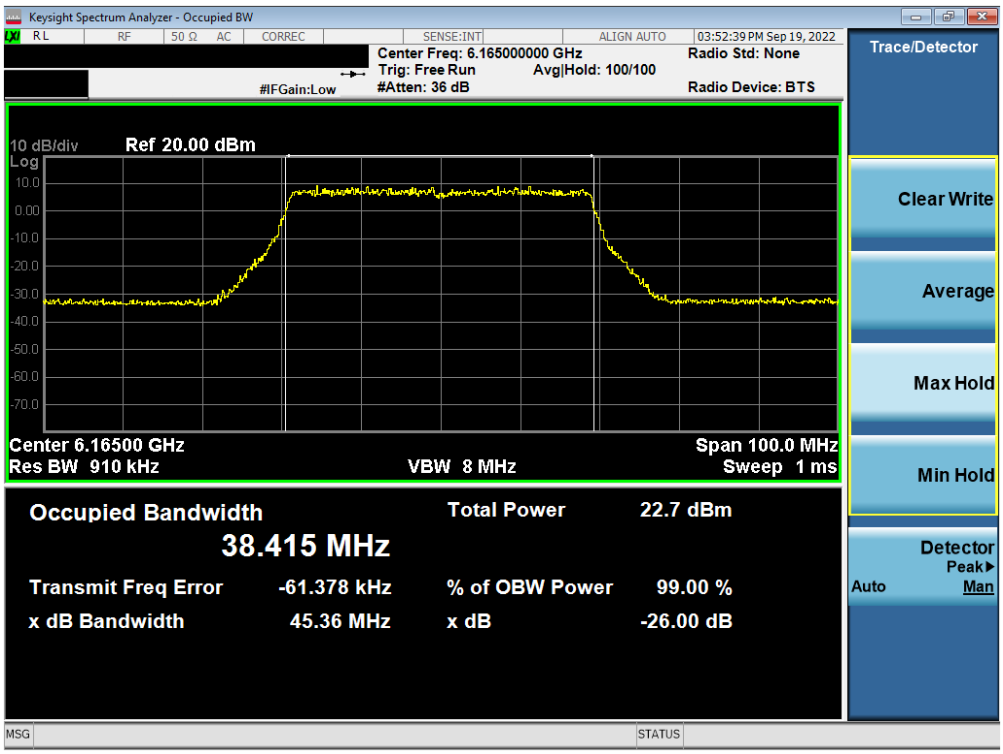


Plot 7-59. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 5) – Ch. 3)



Plot 7-60. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 5) – Ch. 43)

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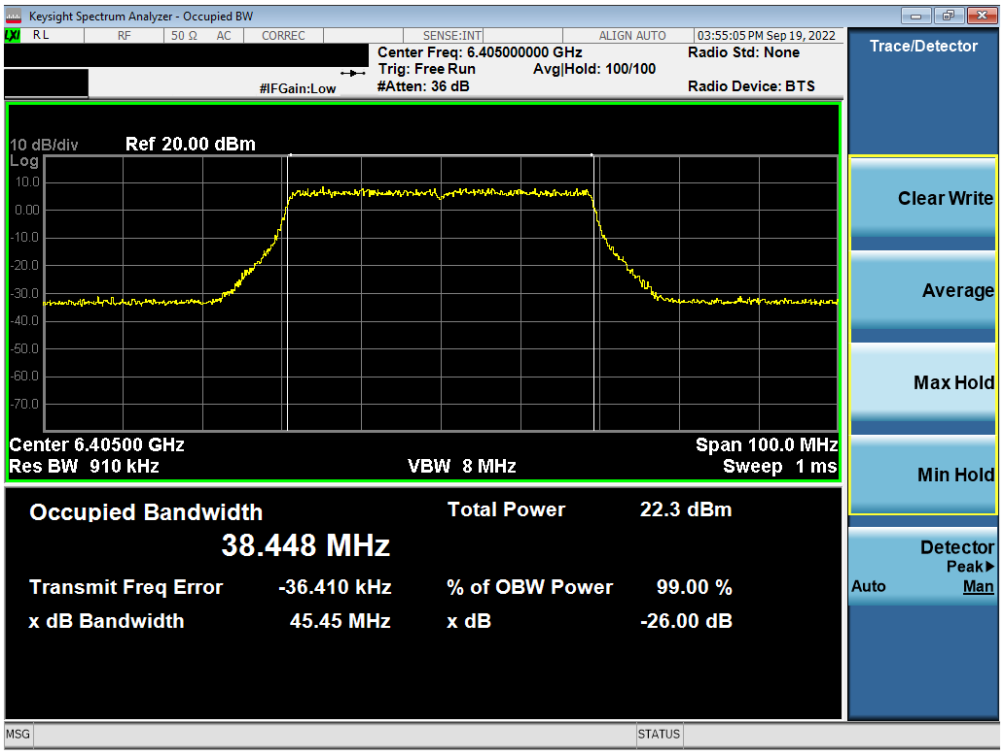
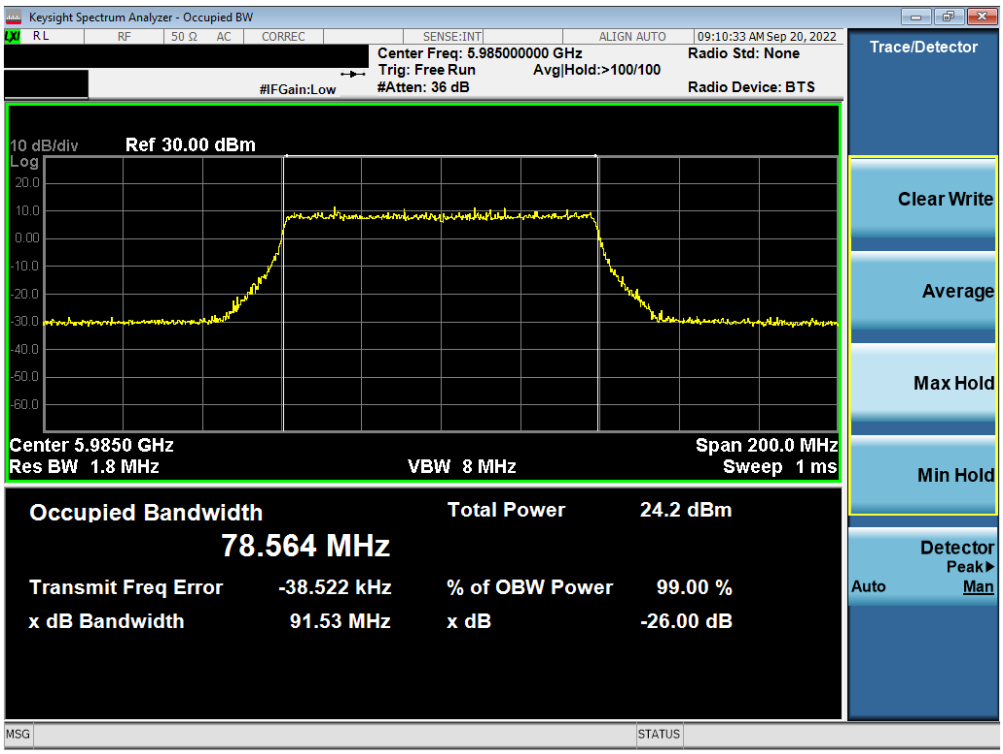


Plot 7-61. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 5) – Ch. 91)



Plot 7-62. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 5) – Ch. 7)

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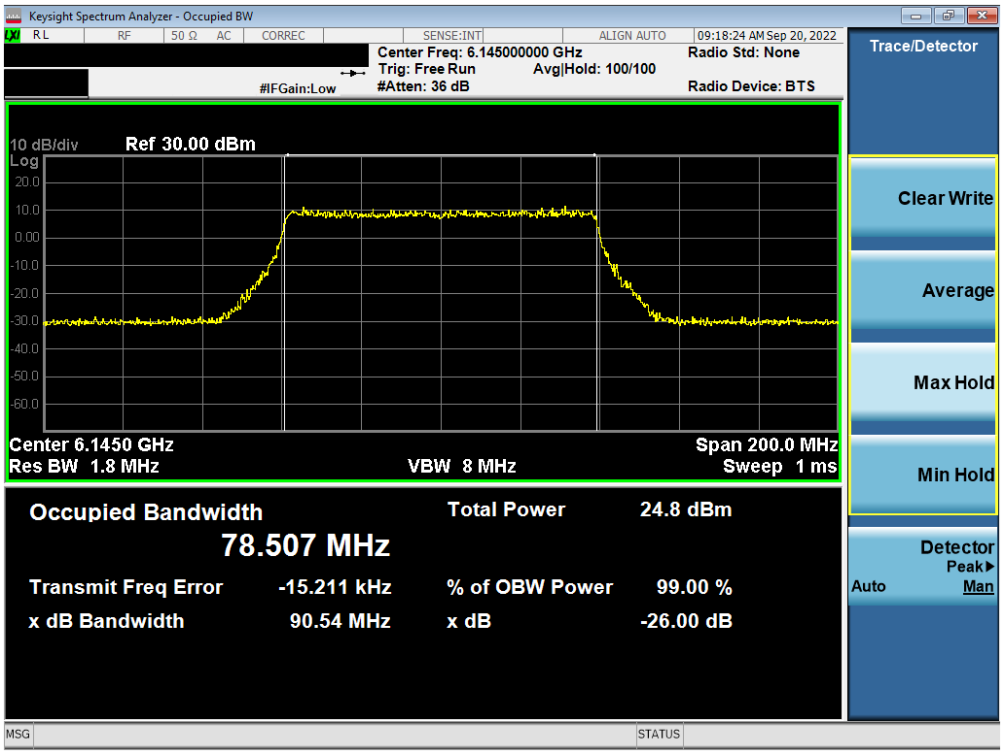
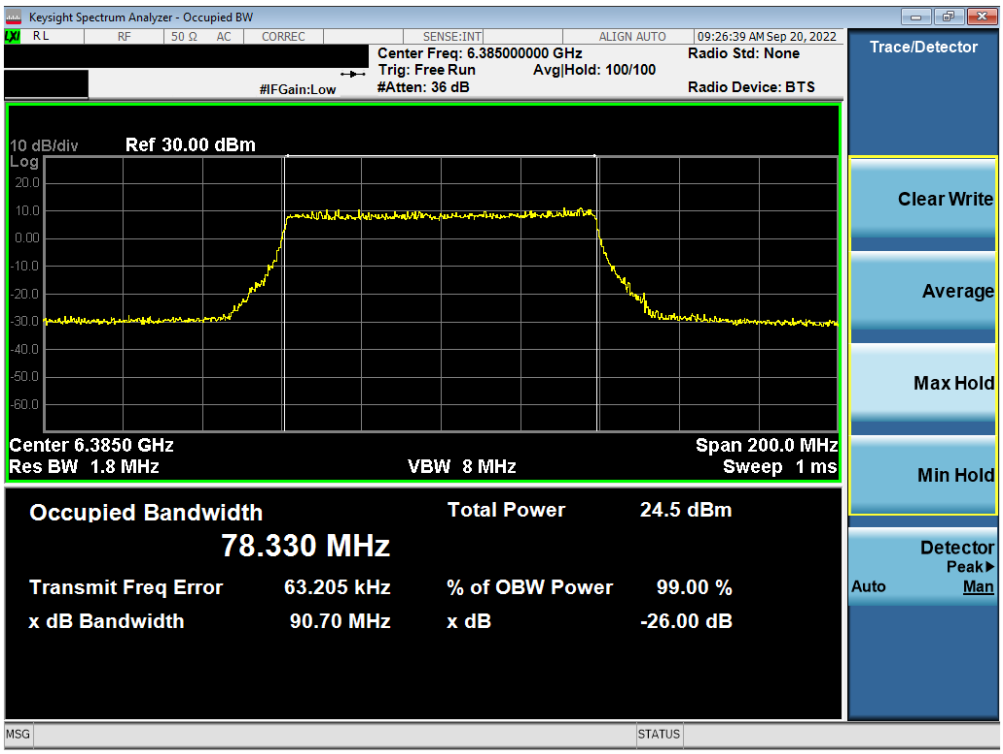


Plot 7-63. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 5) – Ch. 39)



Plot 7-64. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 5) – Ch. 87)

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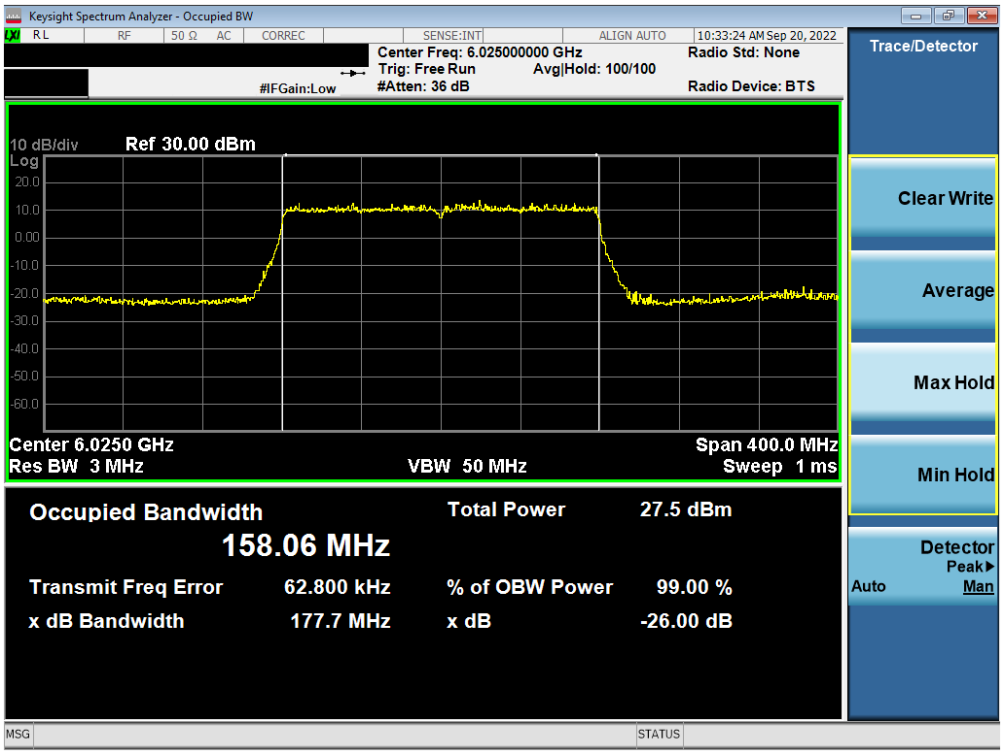
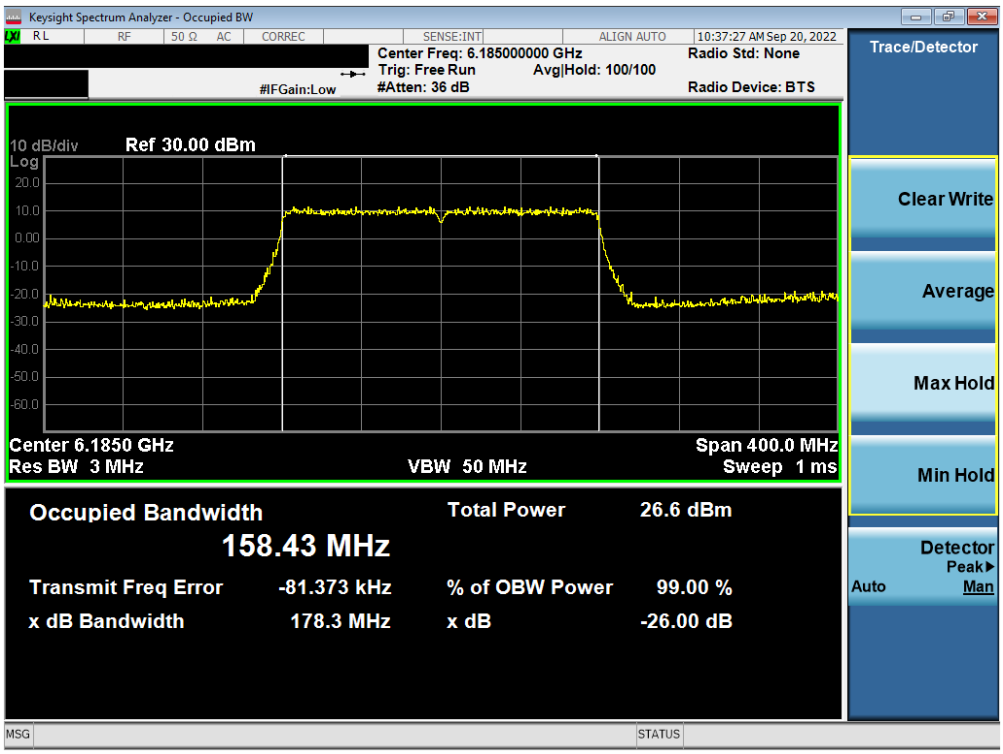


Plot 7-65. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 5) – Ch. 15)



Plot 7-66. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 5) – Ch. 47)

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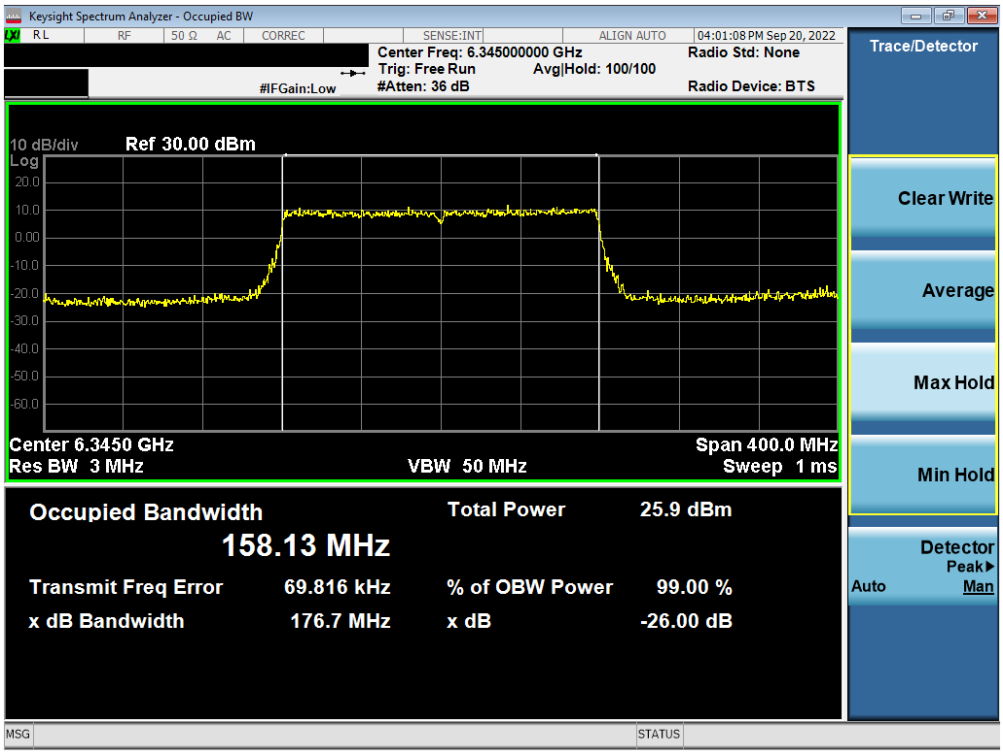

Plot 7-67. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 5) – Ch. 79)

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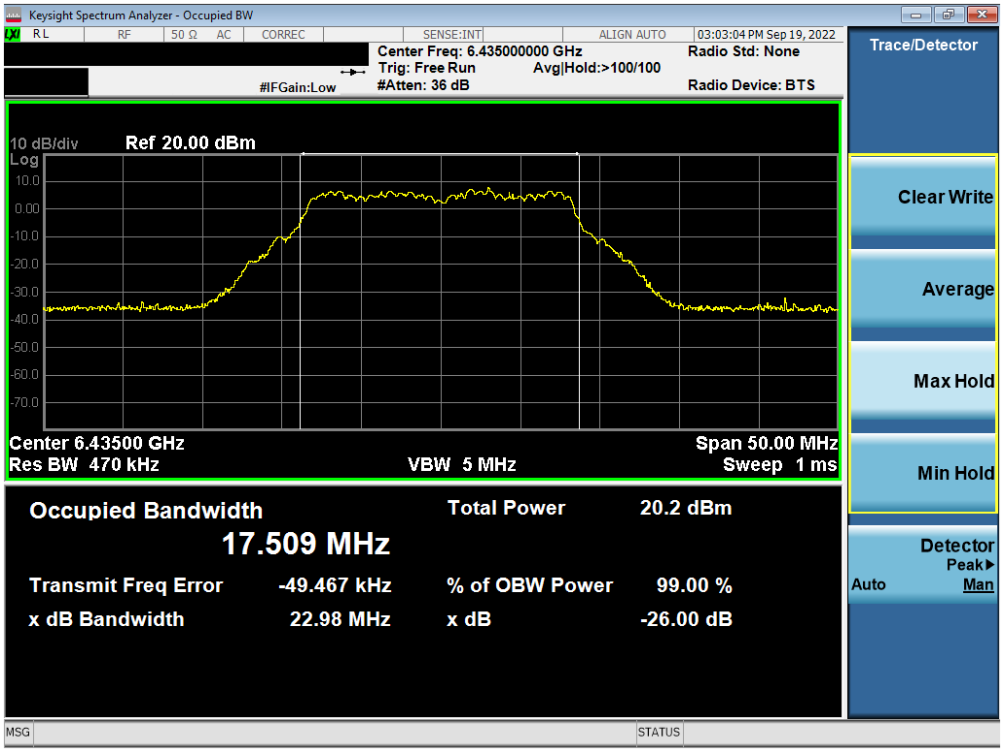
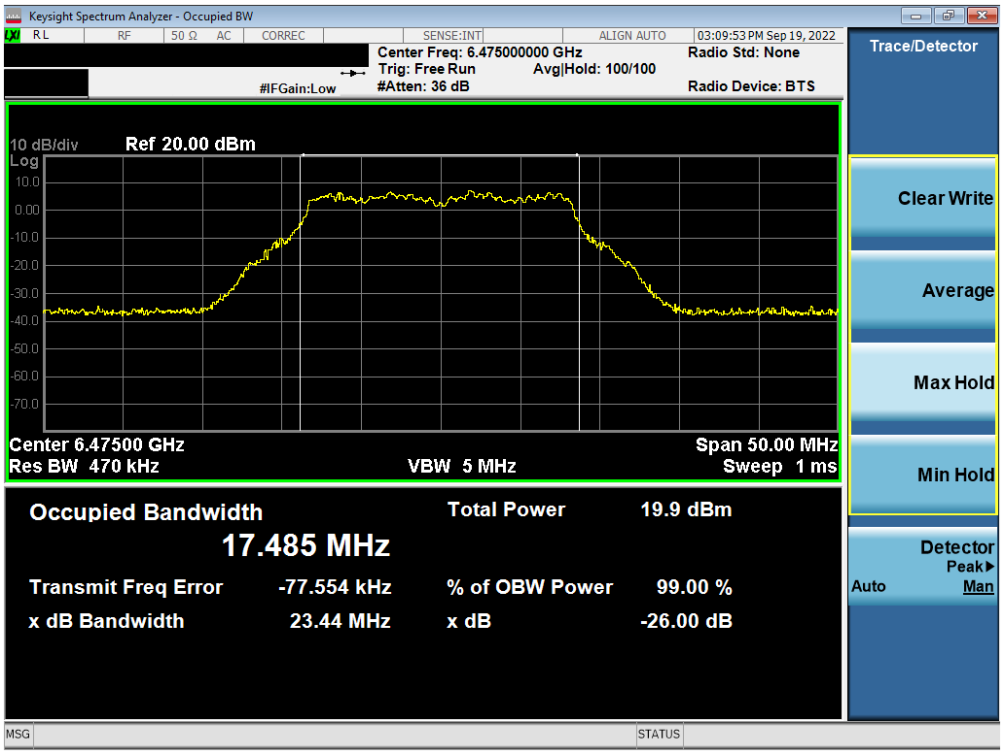
MIMO Antenna-2 26 dB Bandwidth Measurements - (UNII Band 6)



Plot 7-68. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 6) – Ch. 97)



Plot 7-69. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 6) – Ch. 105)

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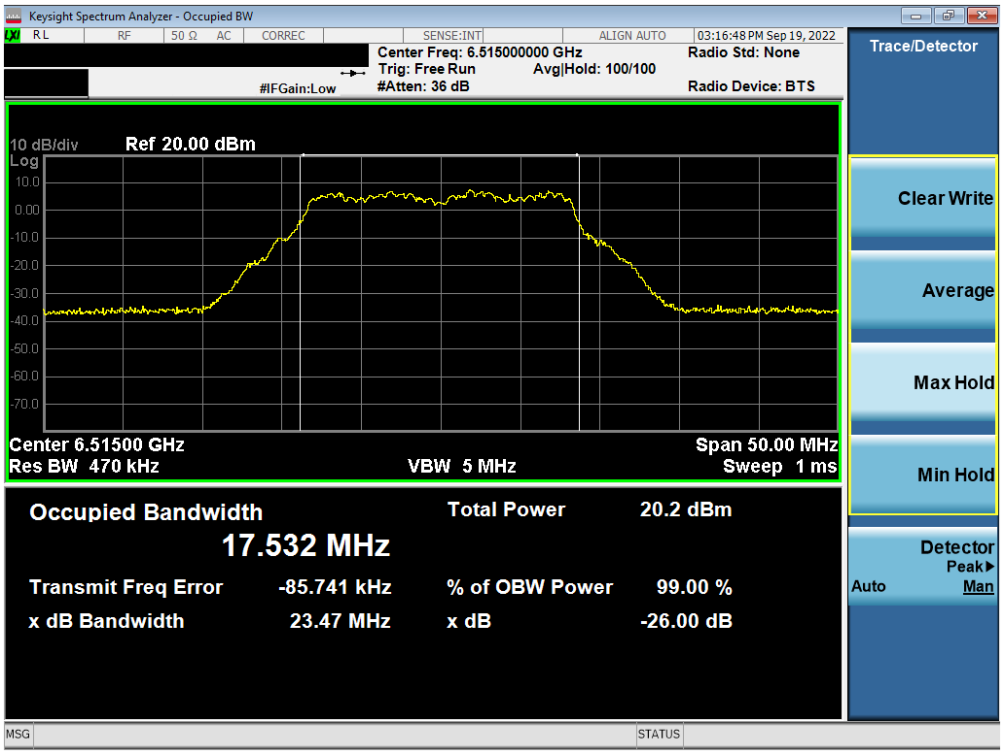
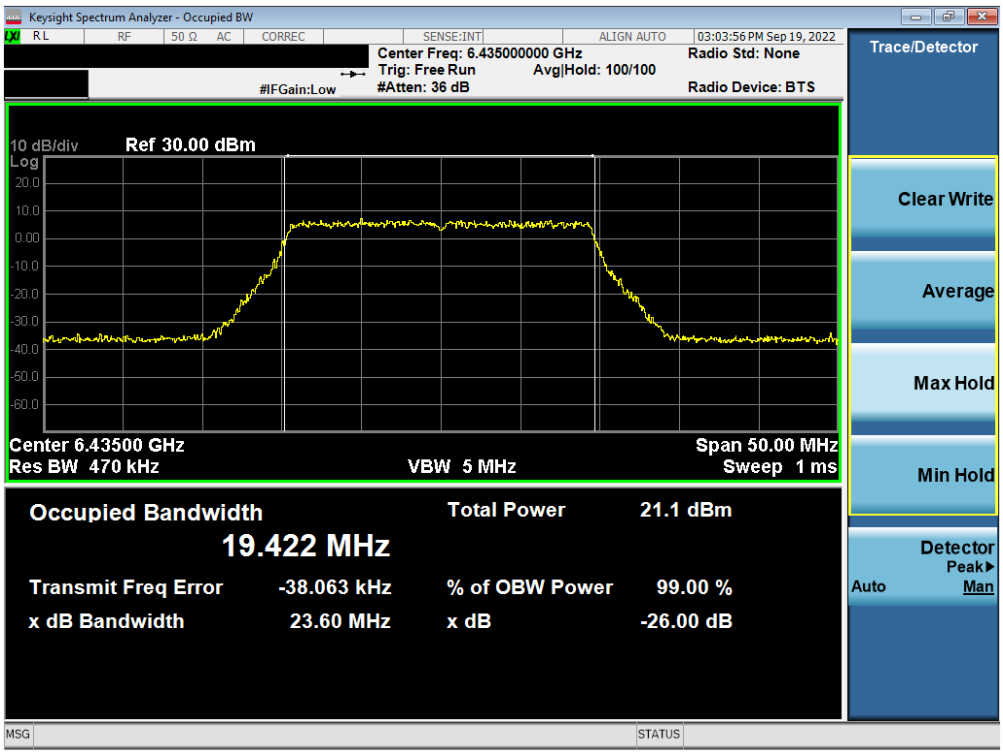


Plot 7-70. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 6) – Ch. 113)



Plot 7-71. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 6) – Ch. 97)

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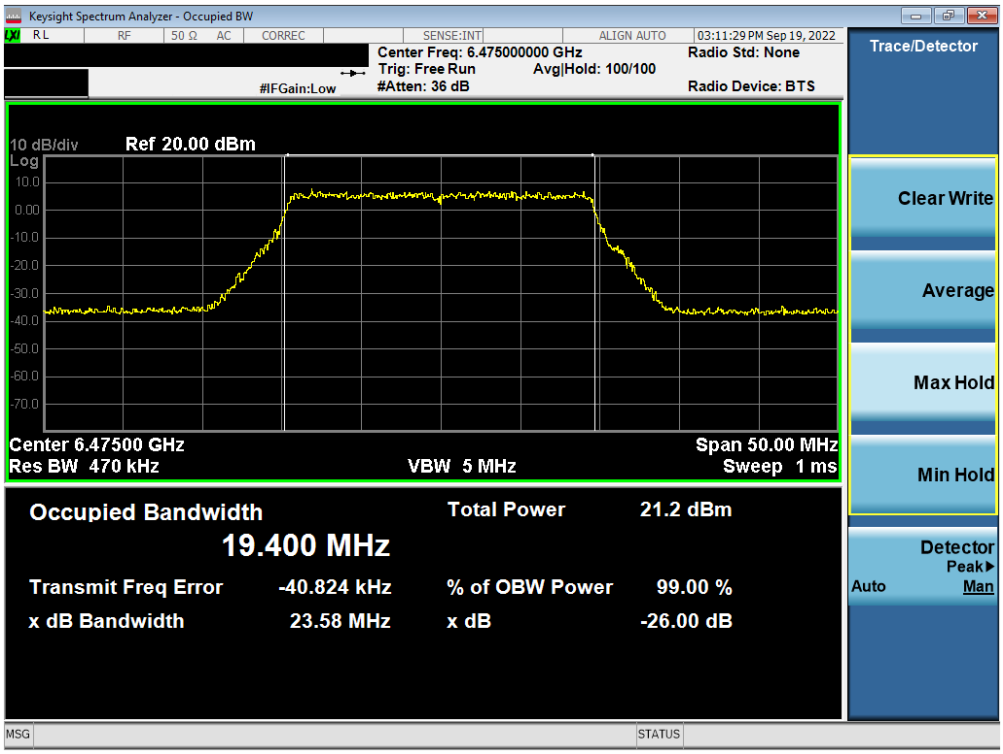
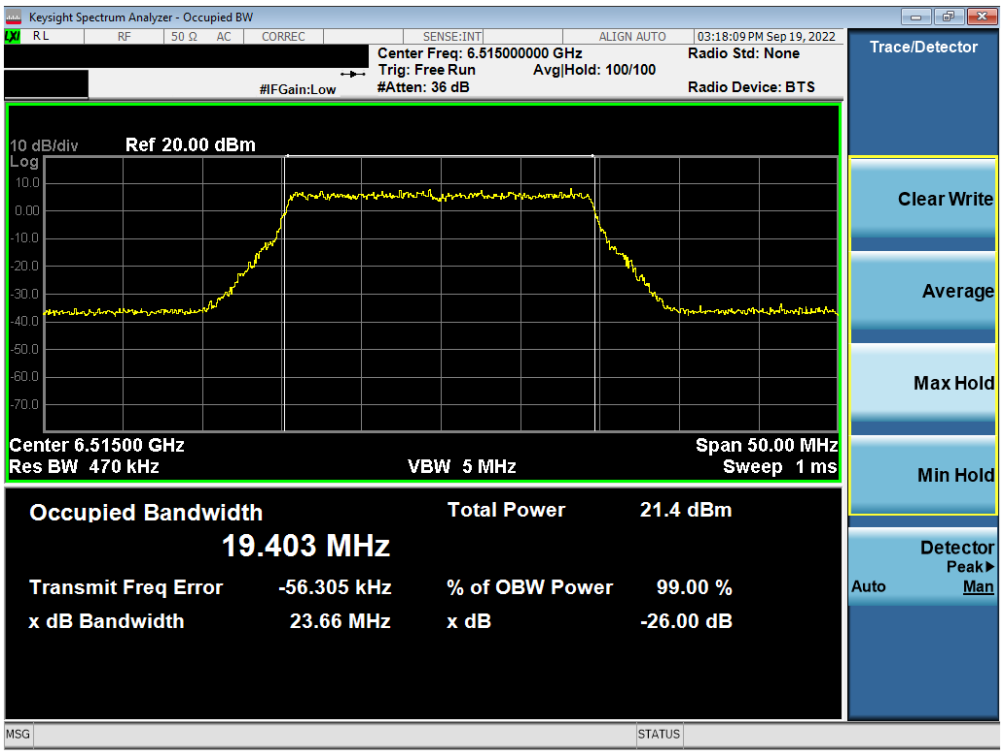


Plot 7-72. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 6) – Ch. 105)



Plot 7-73. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 6) – Ch. 113)

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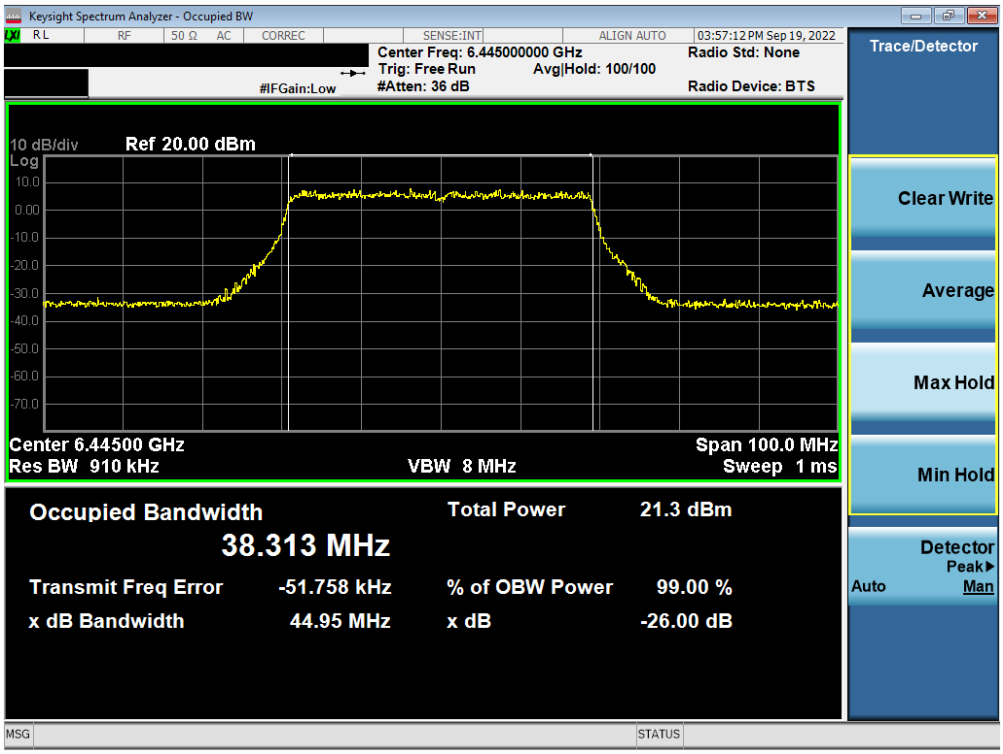
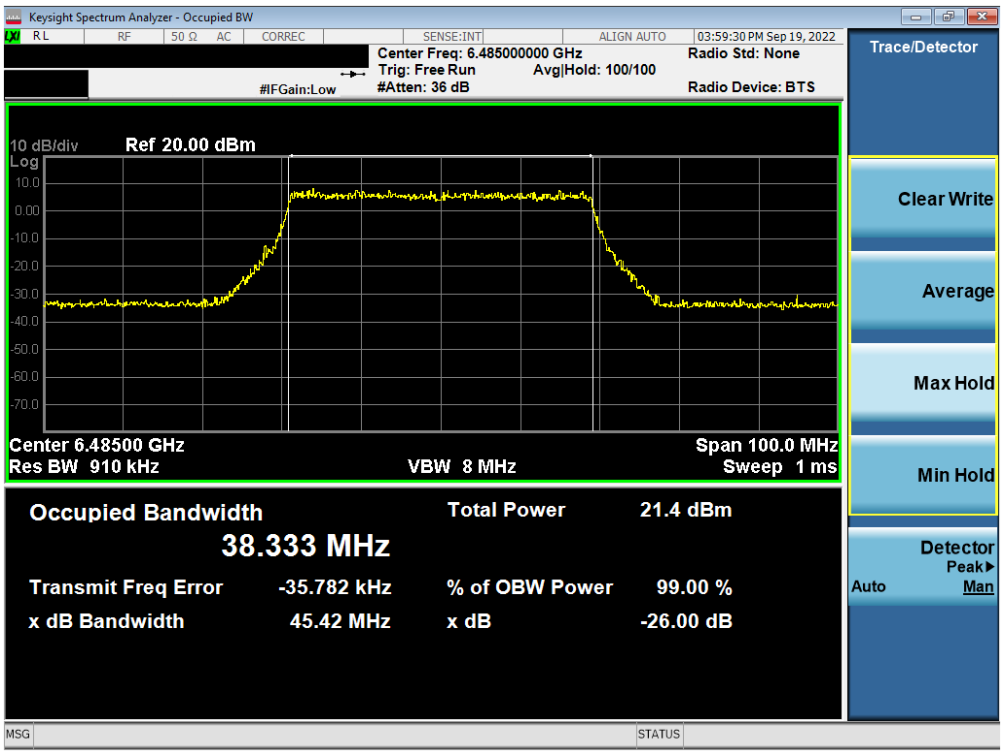


Plot 7-74. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 6) – Ch. 99)



Plot 7-75. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 6) – Ch. 107)

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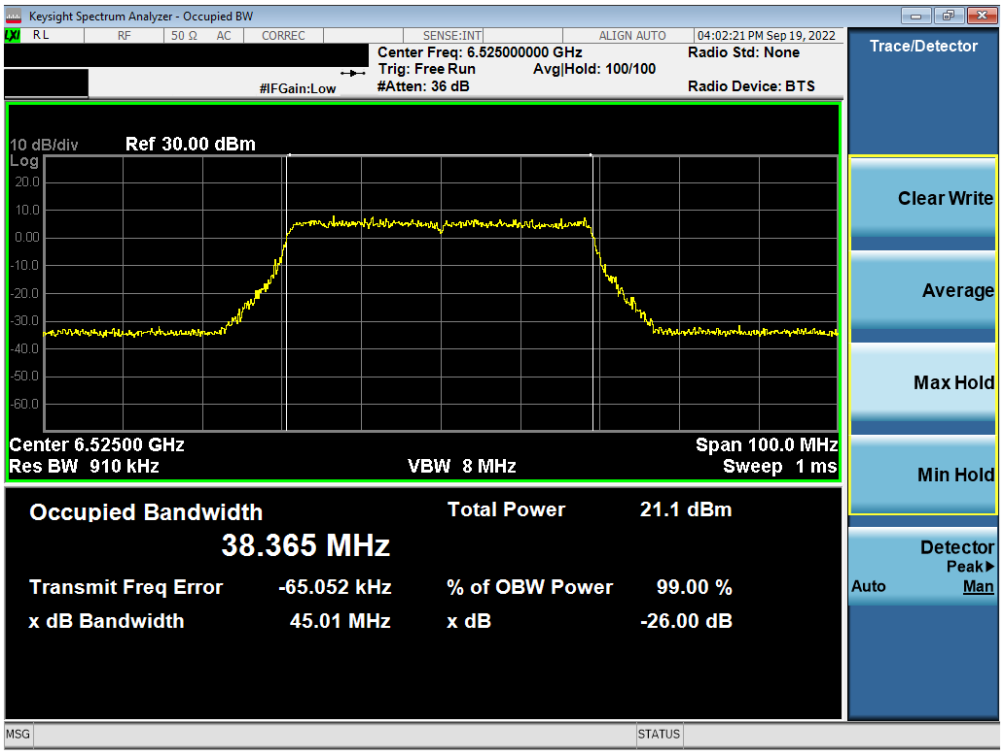
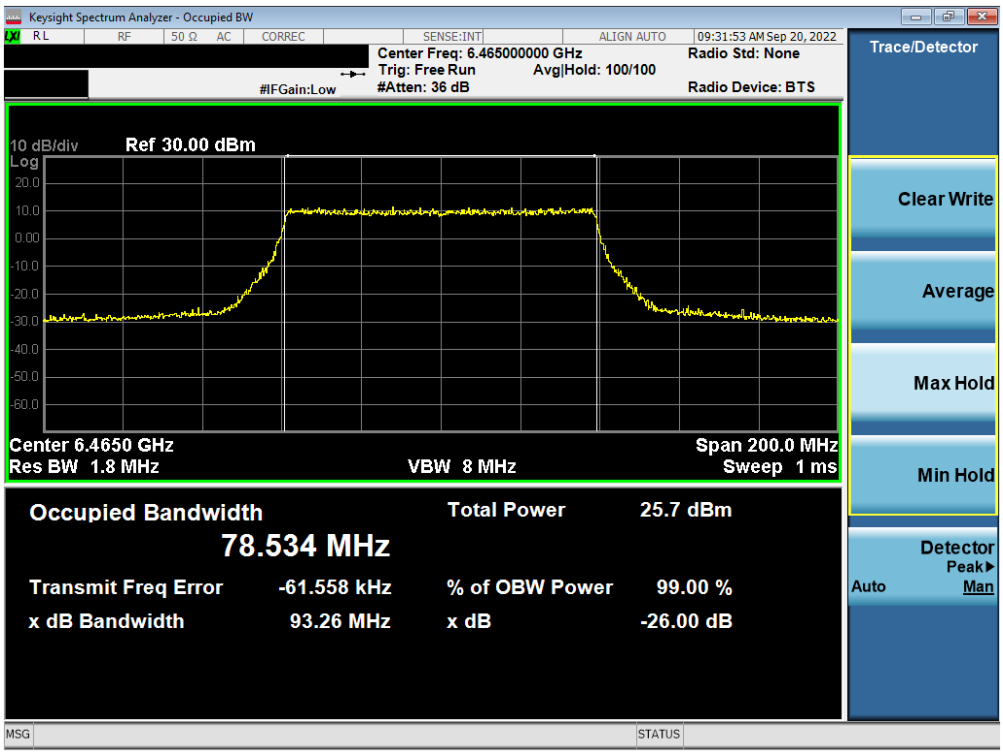


Plot 7-76. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 6) – Ch. 115)



Plot 7-77. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 6) – Ch. 103)

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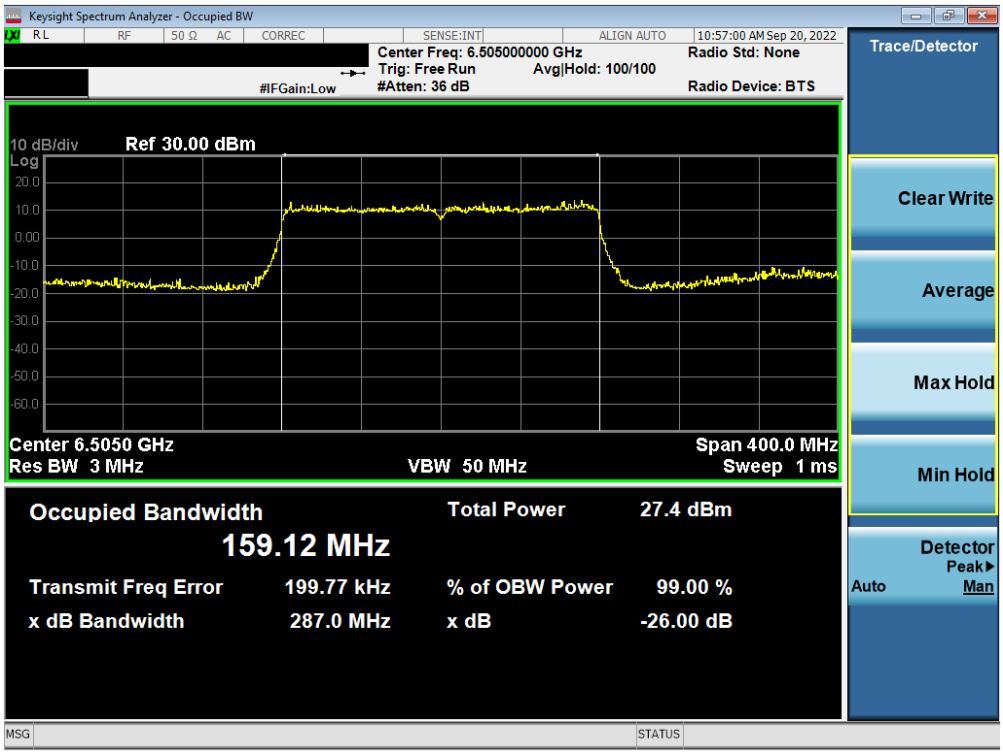

Plot 7-78. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 6) – Ch. 111)

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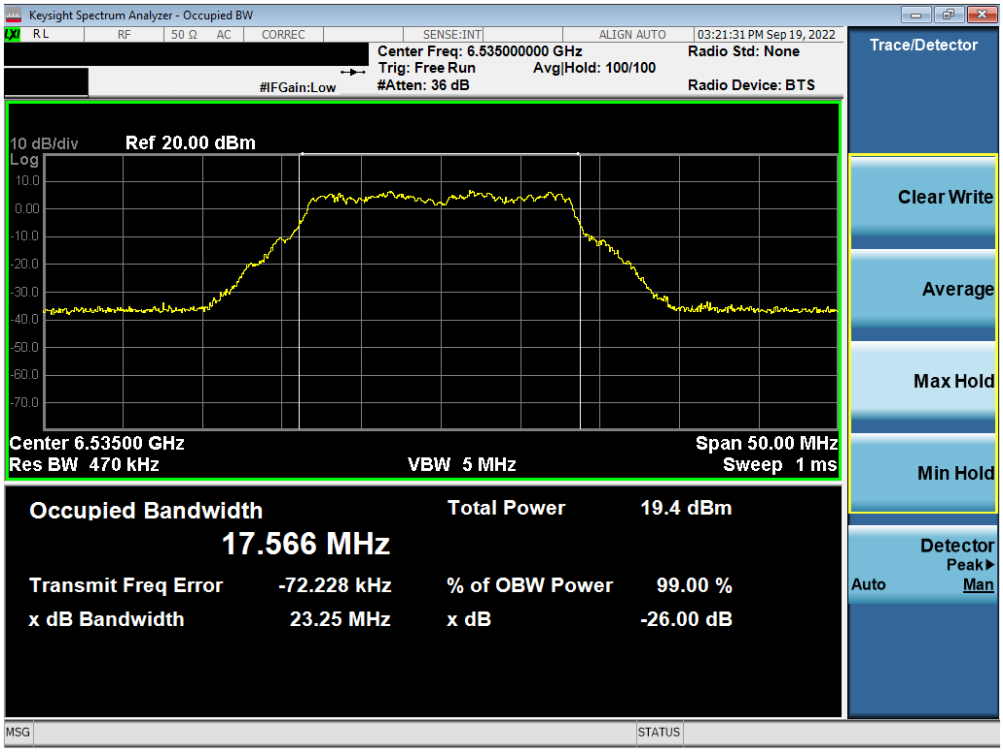
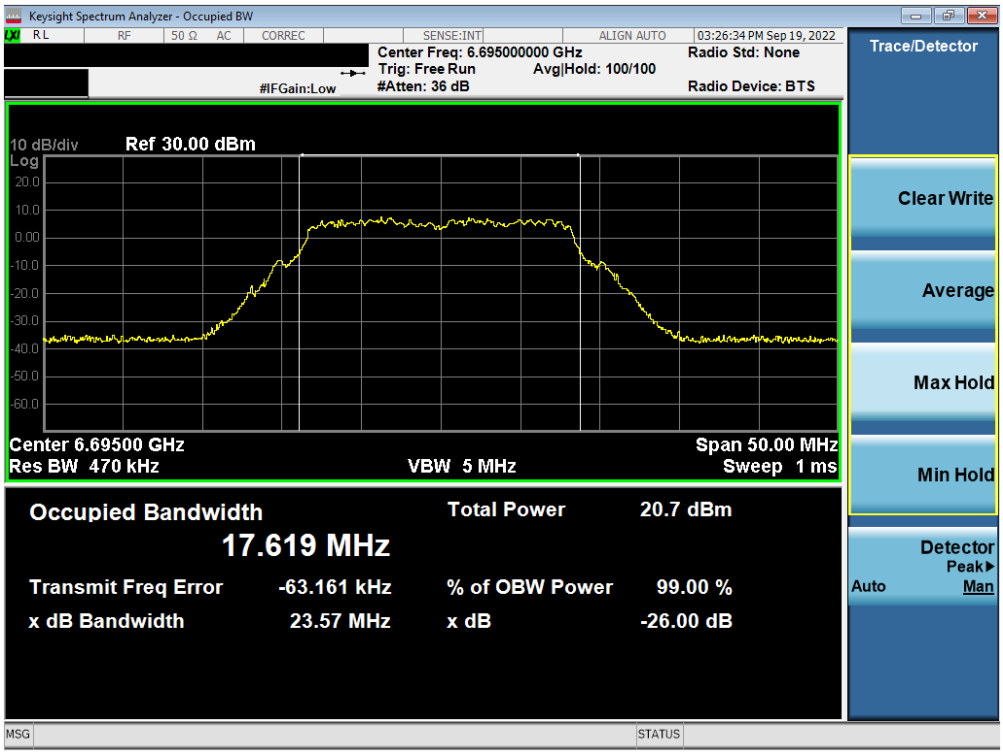
MIMO Antenna-2 26 dB Bandwidth Measurements - (UNII Band 7)



Plot 7-79. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 7) – Ch. 117)



Plot 7-80. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 7) – Ch. 149)

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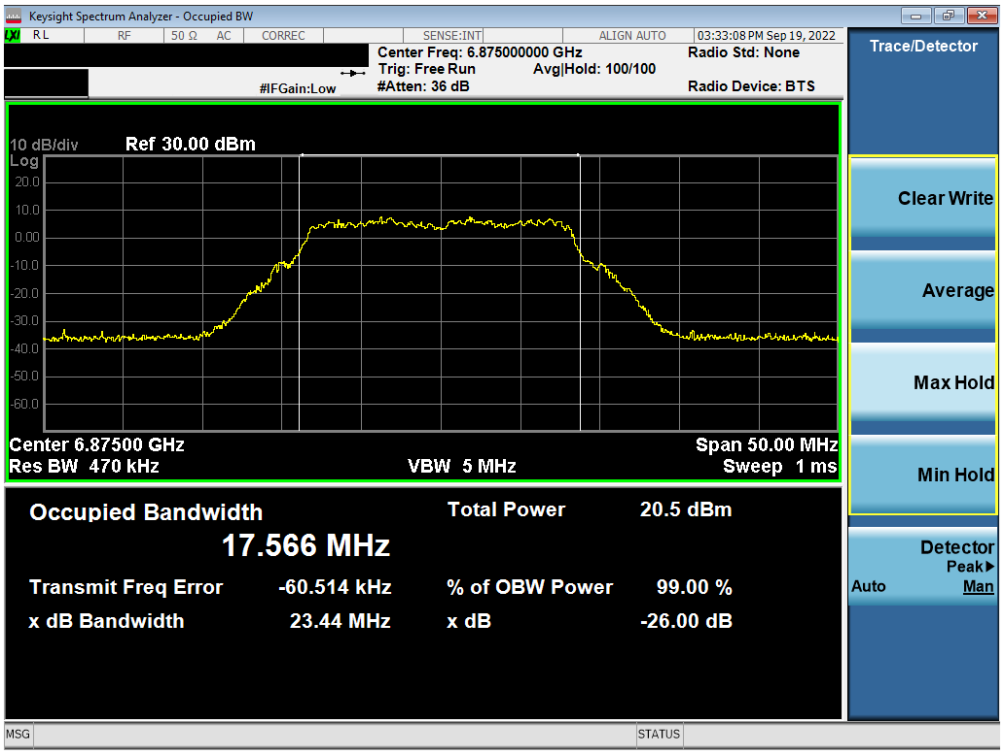
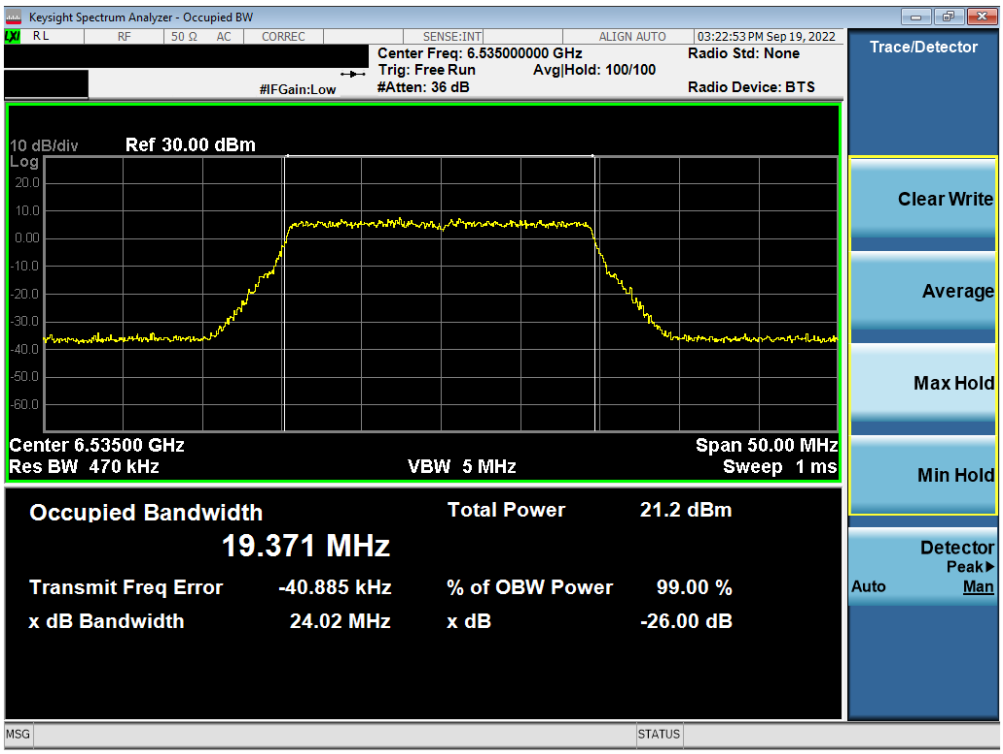


Plot 7-81. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 7) – Ch. 185)



Plot 7-82. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 7) – Ch. 117)

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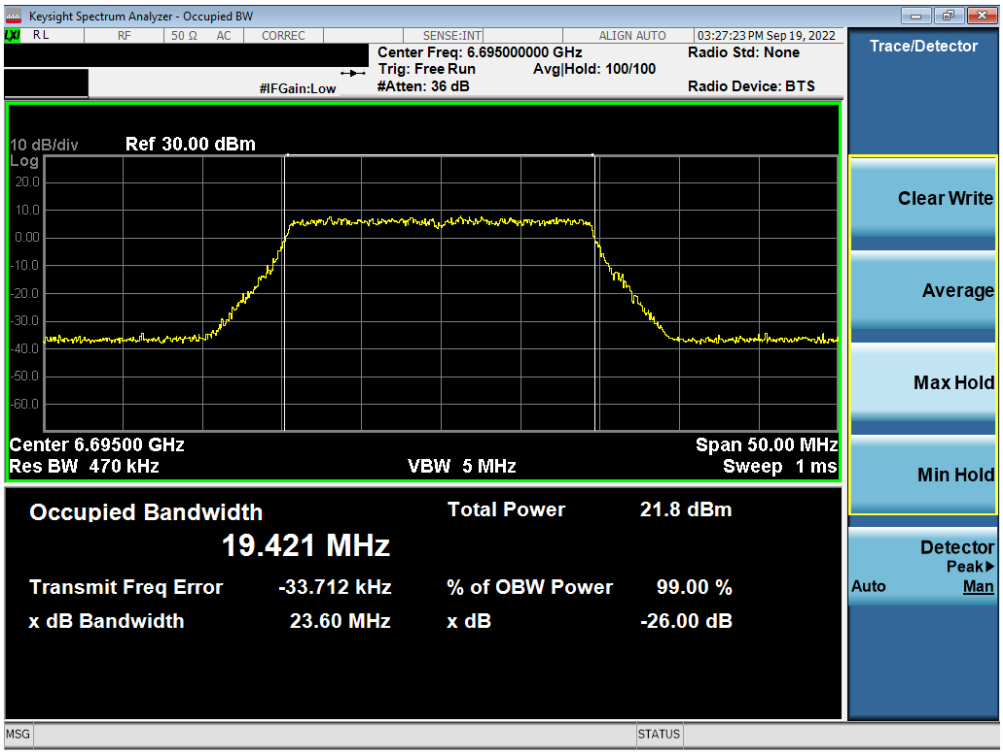
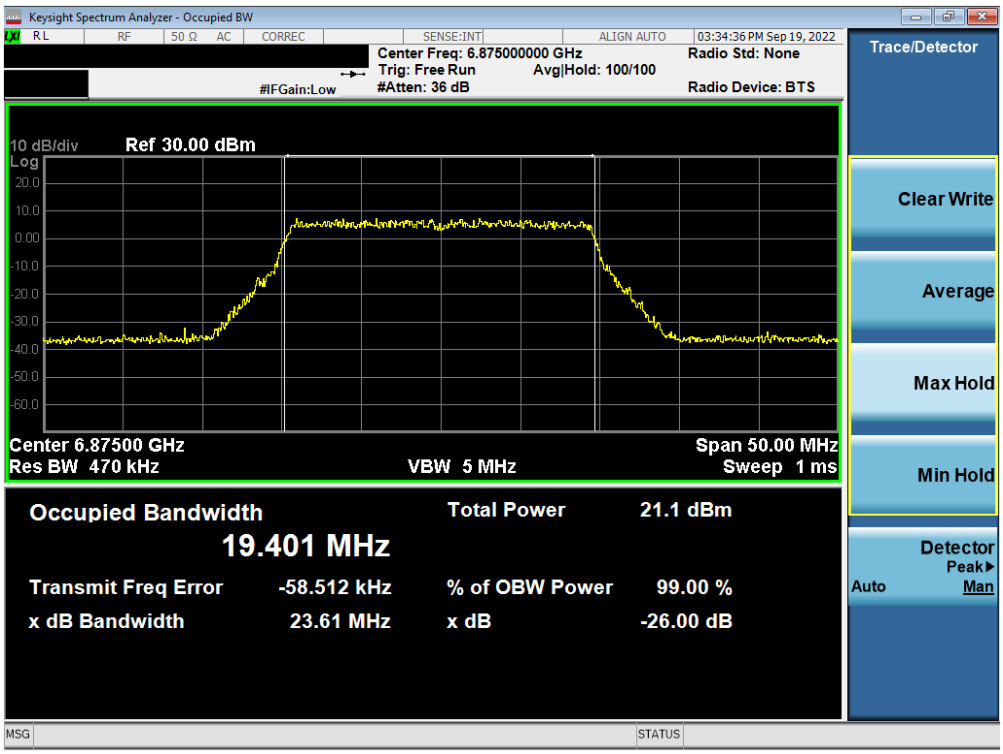


Plot 7-83. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 7) – Ch. 149)



Plot 7-84. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 7) – Ch. 185)

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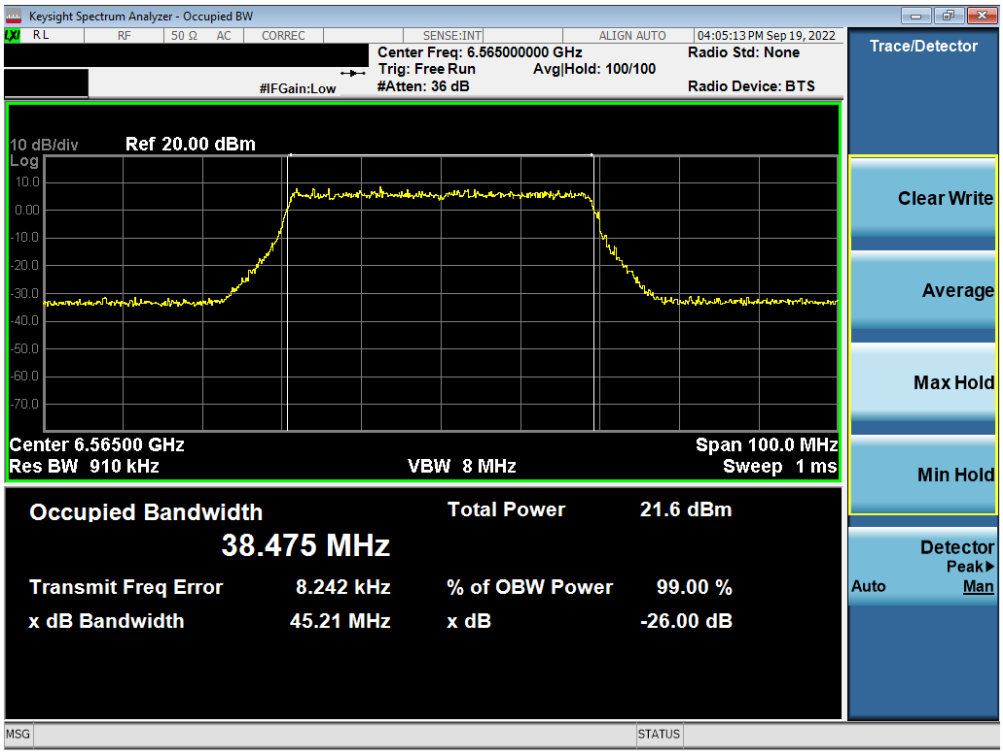
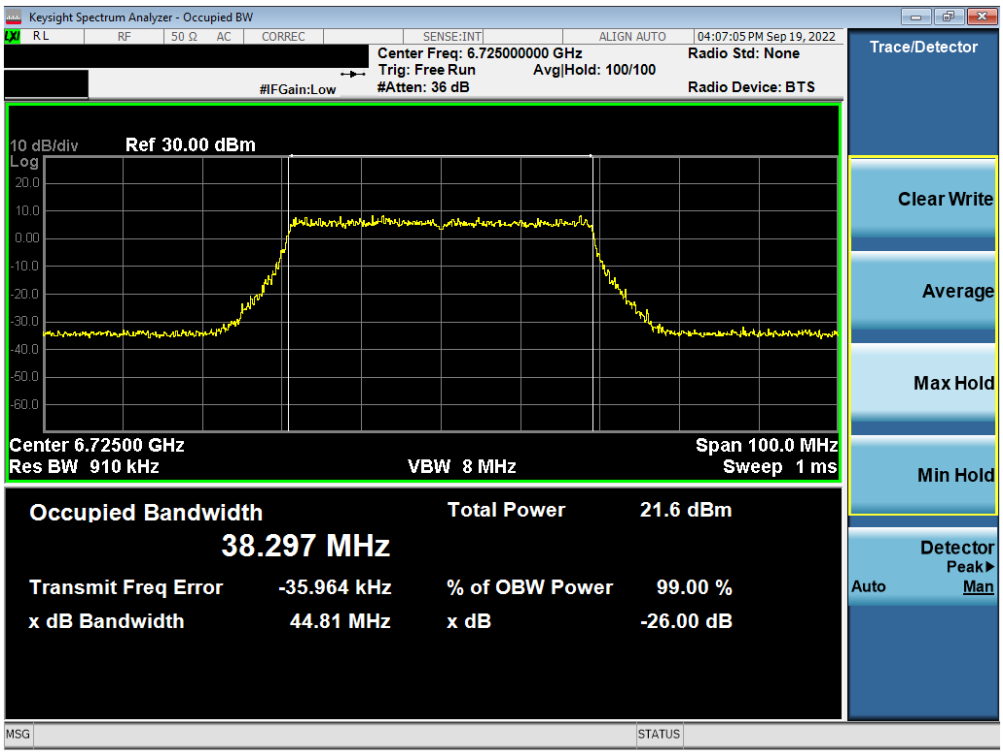


Plot 7-85. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 7) – Ch. 123)



Plot 7-86. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 7) – Ch. 155)

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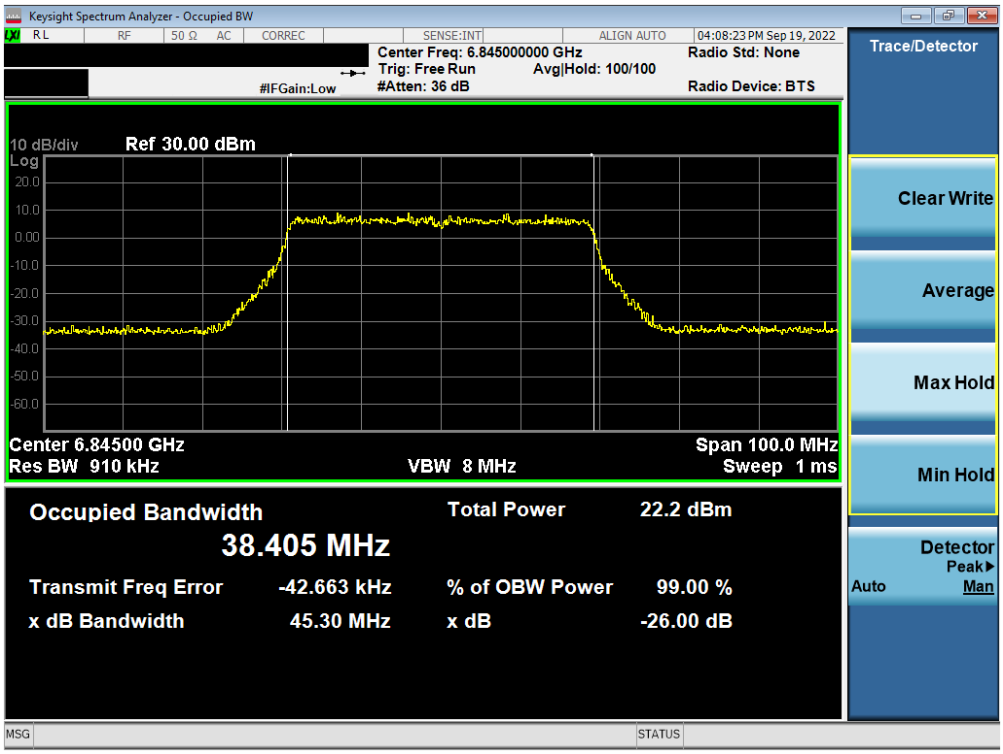
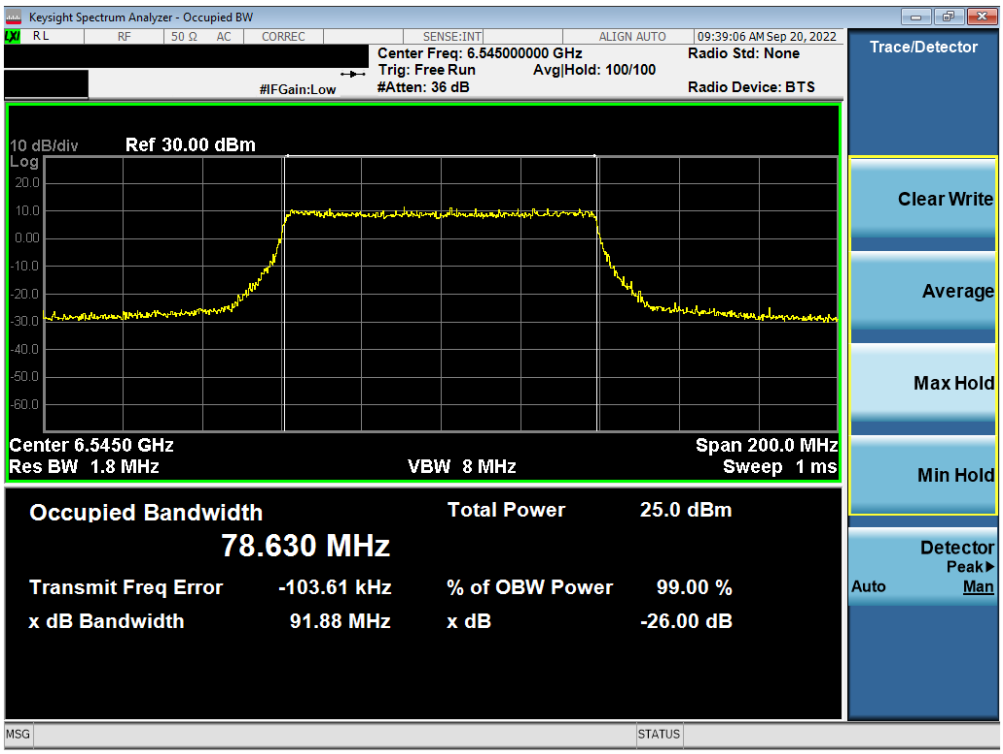


Plot 7-87. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 7) – Ch. 179)



Plot 7-88. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 7) – Ch. 119)

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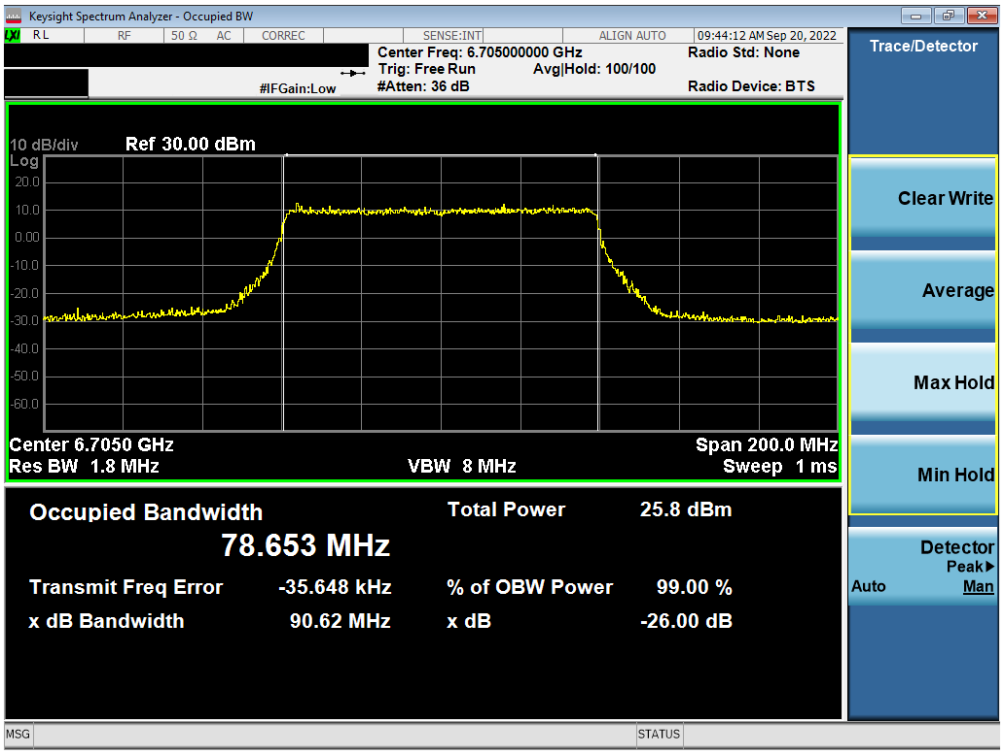
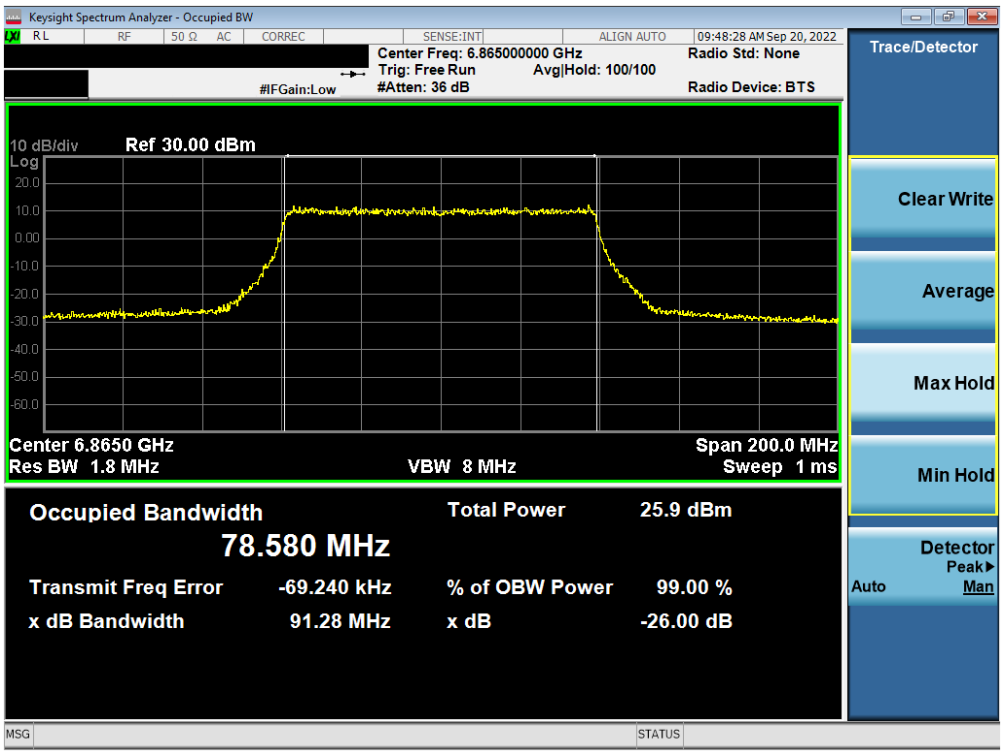


Plot 7-89. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 7) – Ch. 151)



Plot 7-90. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 7) – Ch. 183)

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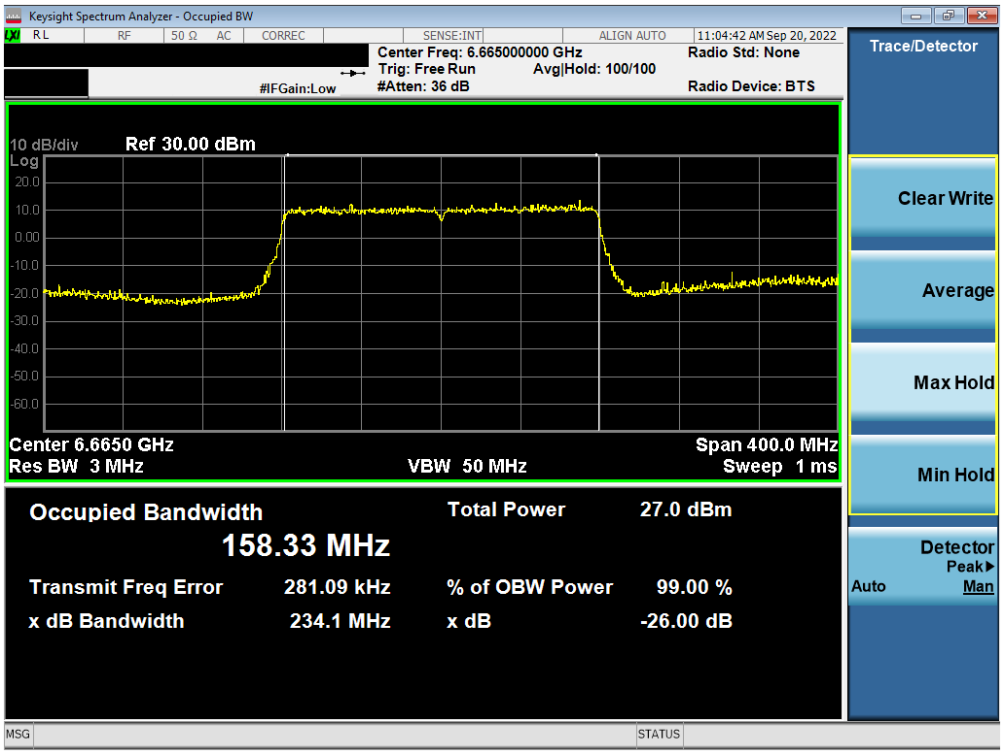
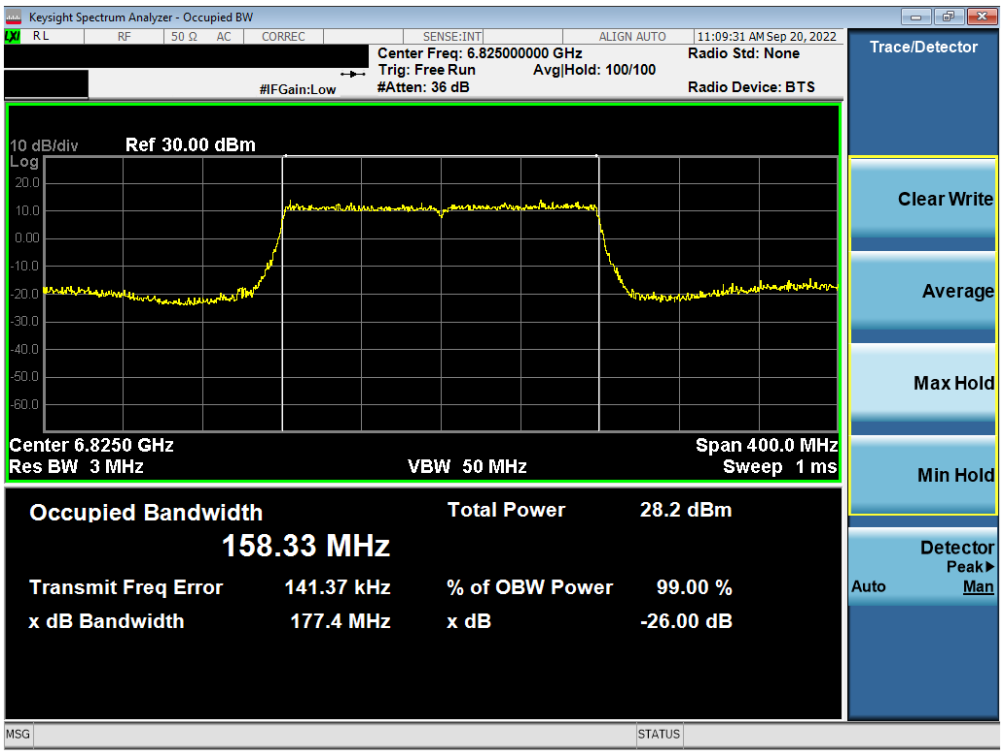


Plot 7-91. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 7) – Ch. 143)



Plot 7-92. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 7) – Ch. 175)

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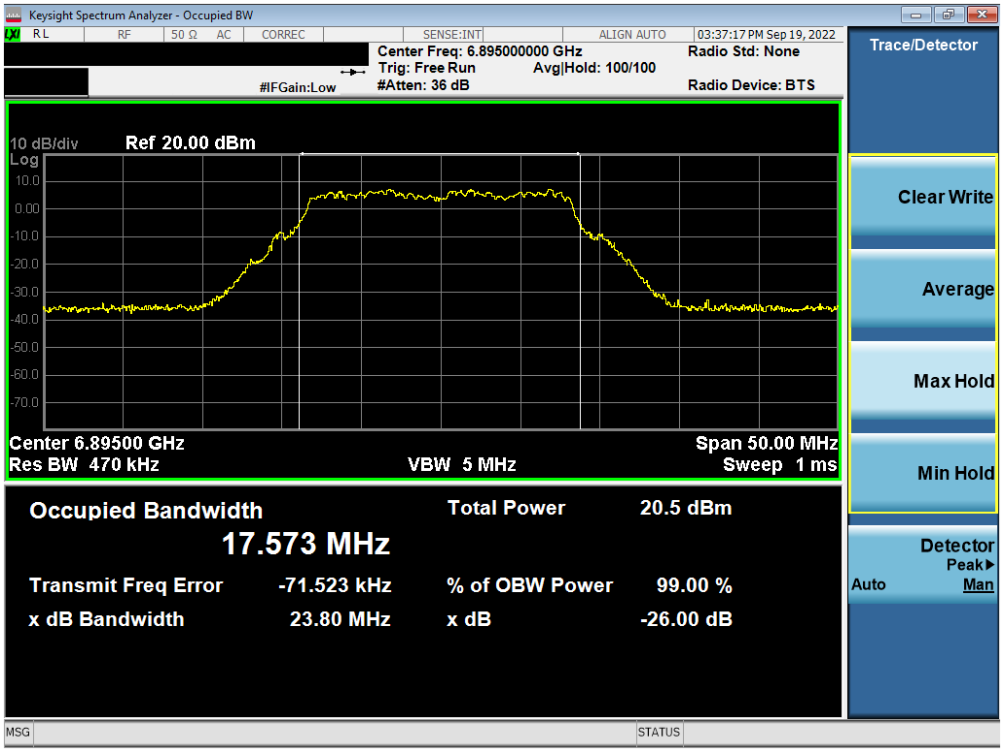
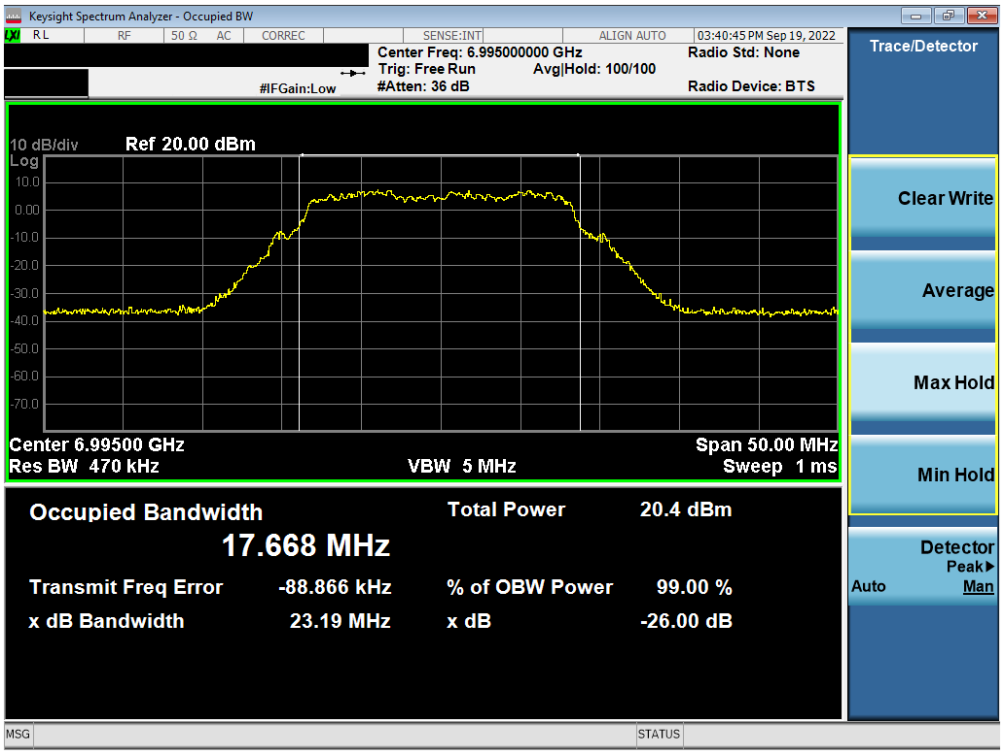
MIMO Antenna-2 26 dB Bandwidth Measurements - (UNII Band 8)



Plot 7-93. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 8) – Ch. 189)



Plot 7-94. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 8) – Ch. 209)

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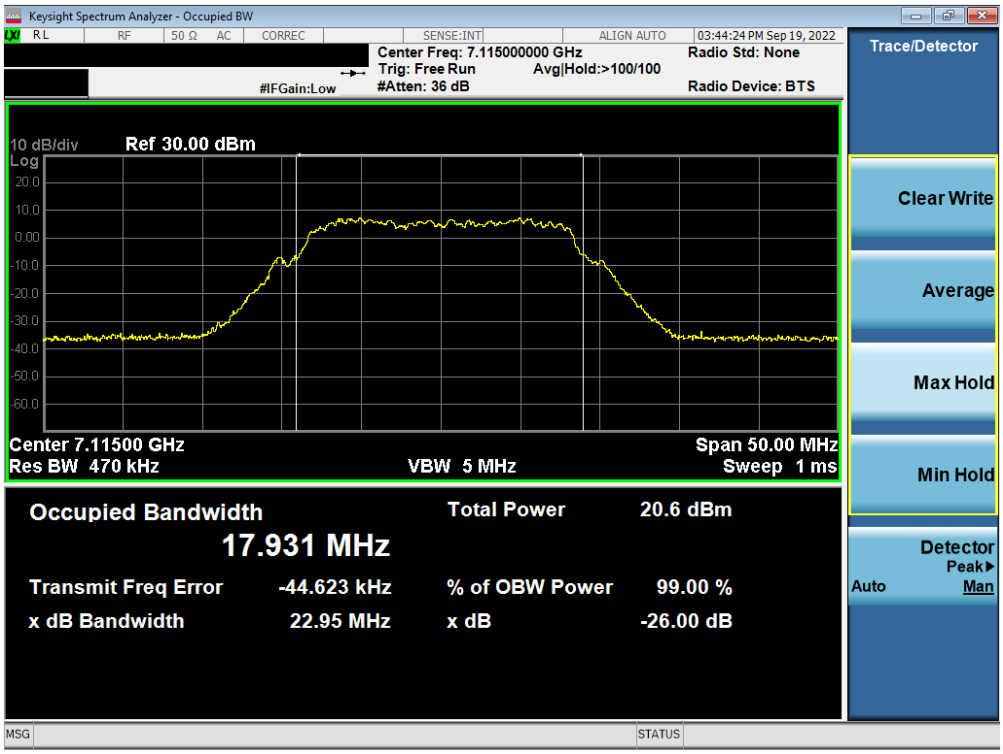
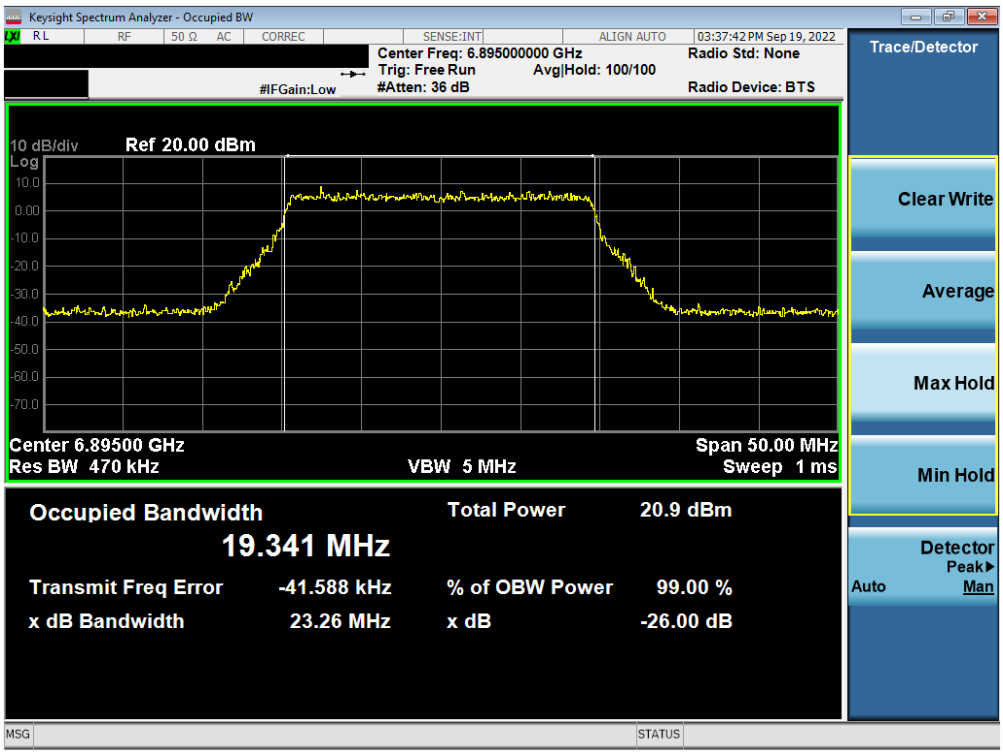


Plot 7-95. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 8) – Ch. 233)



Plot 7-96. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 8) – Ch. 189)

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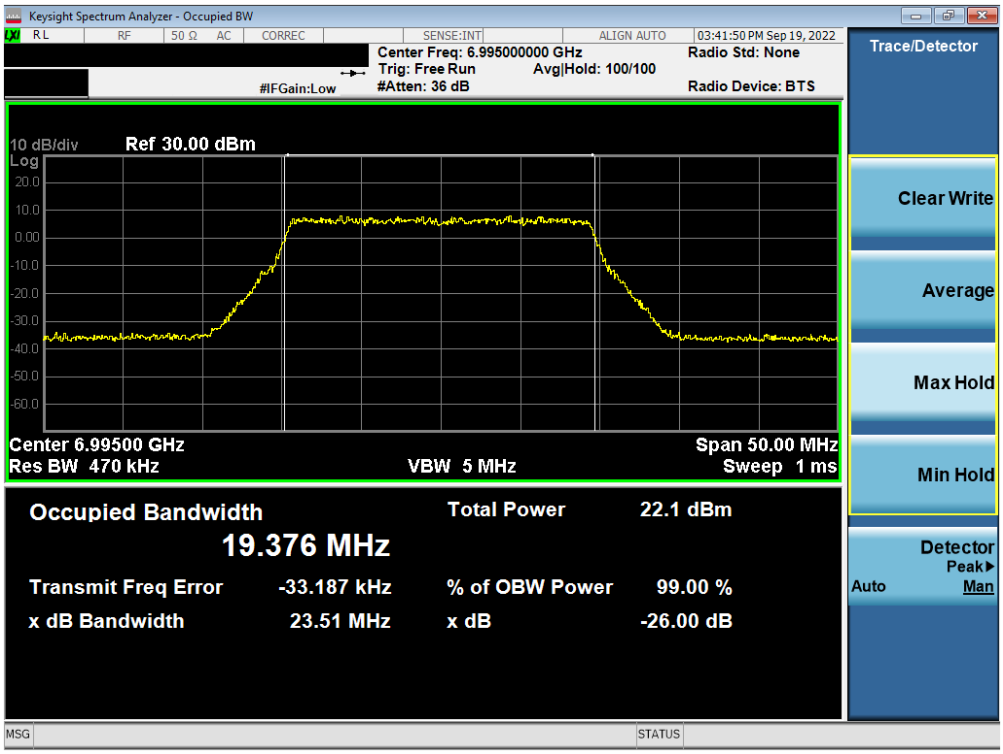
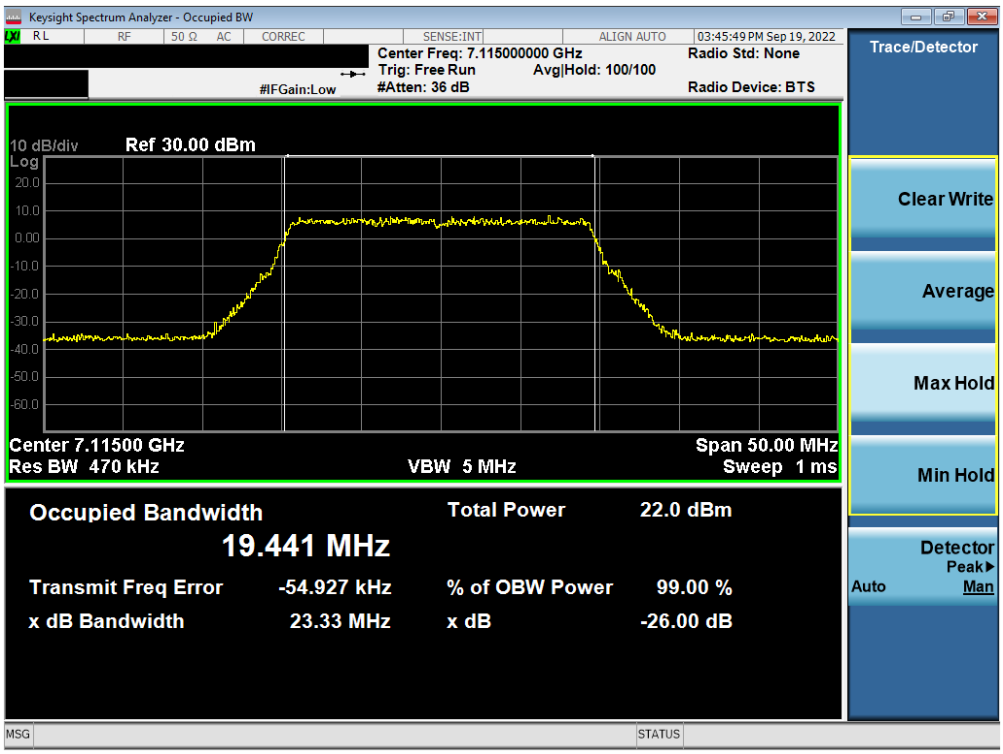


Plot 7-97. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 8) – Ch. 209)



Plot 7-98. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 8) – Ch. 233)

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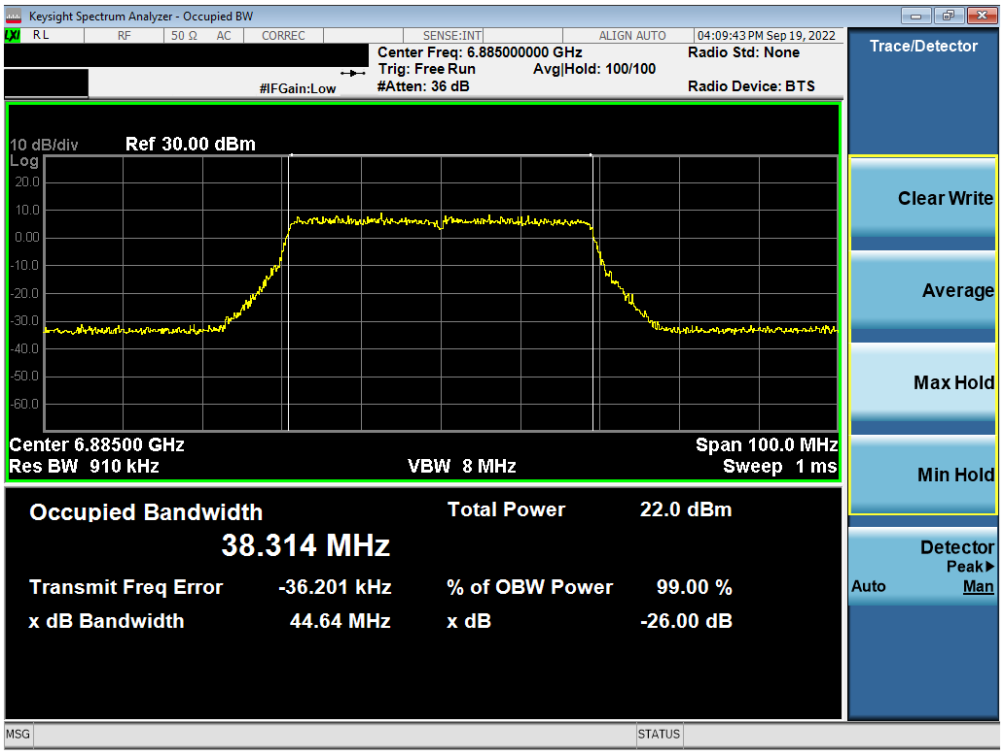
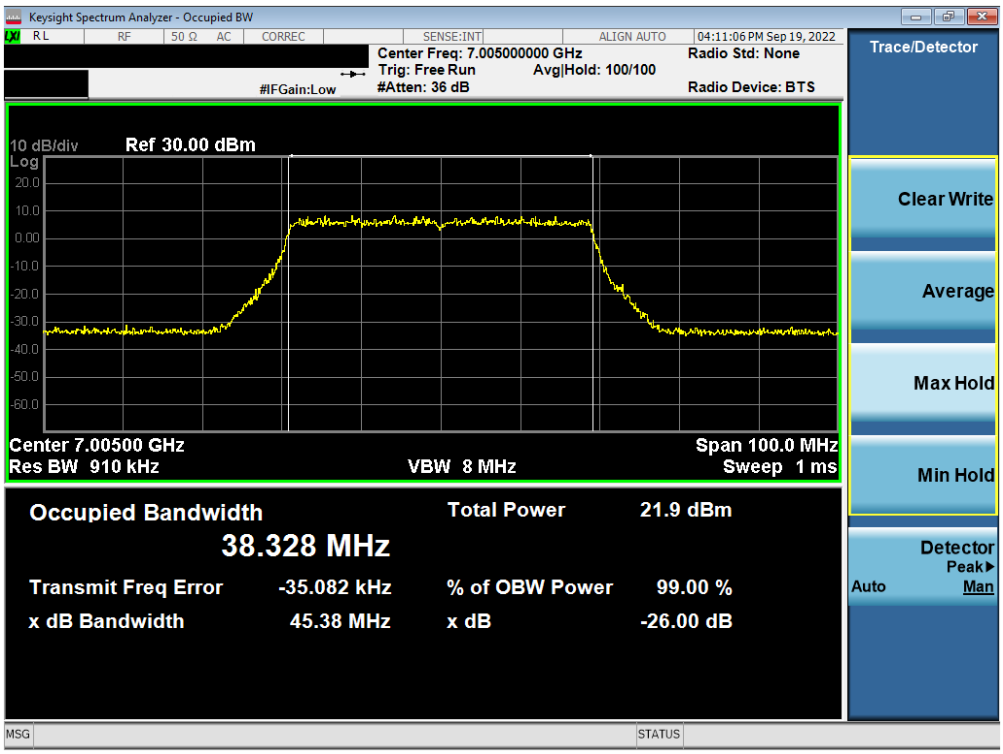


Plot 7-99. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 8) – Ch. 187)



Plot 7-100. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 8) – Ch. 211)

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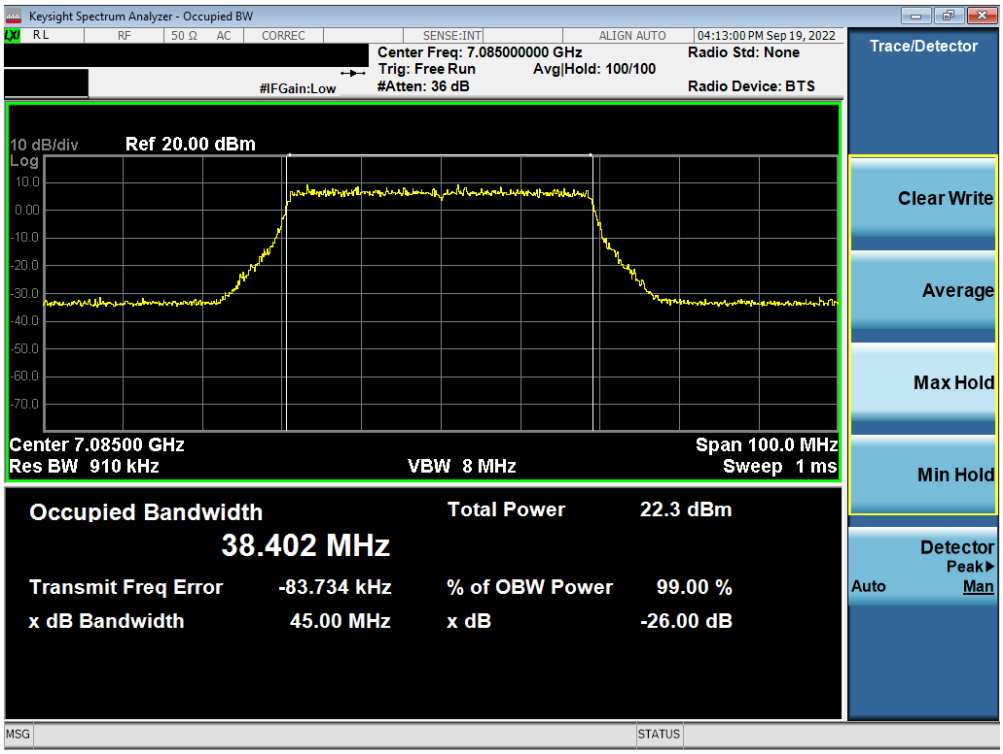
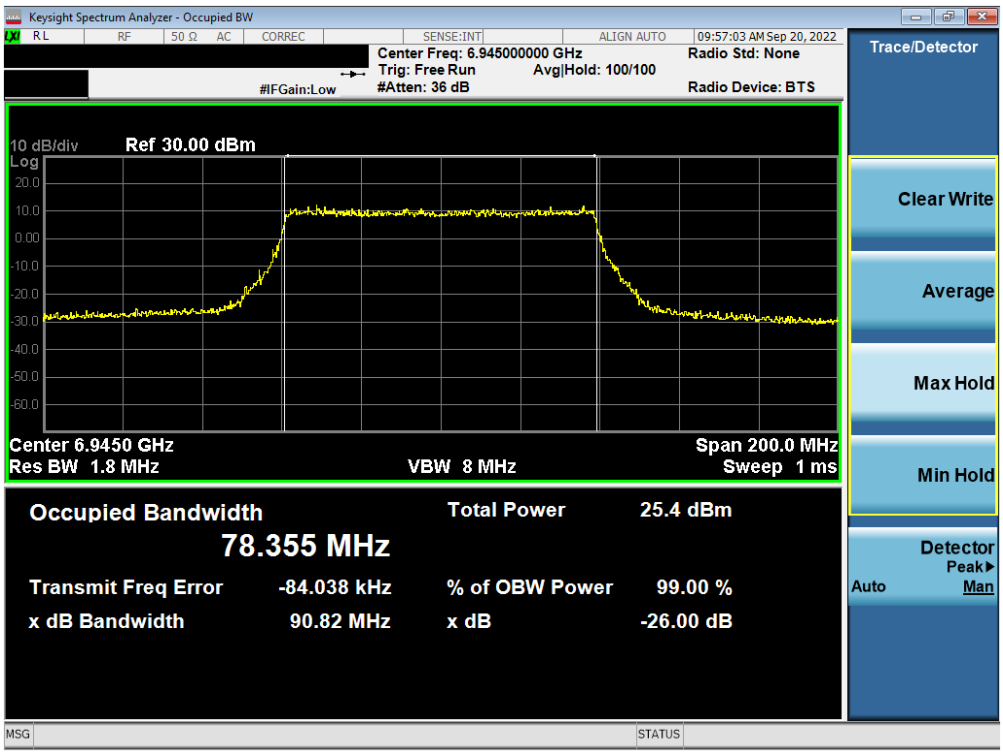


Plot 7-101. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 8) – Ch. 227)



Plot 7-102. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 8) – Ch. 199)

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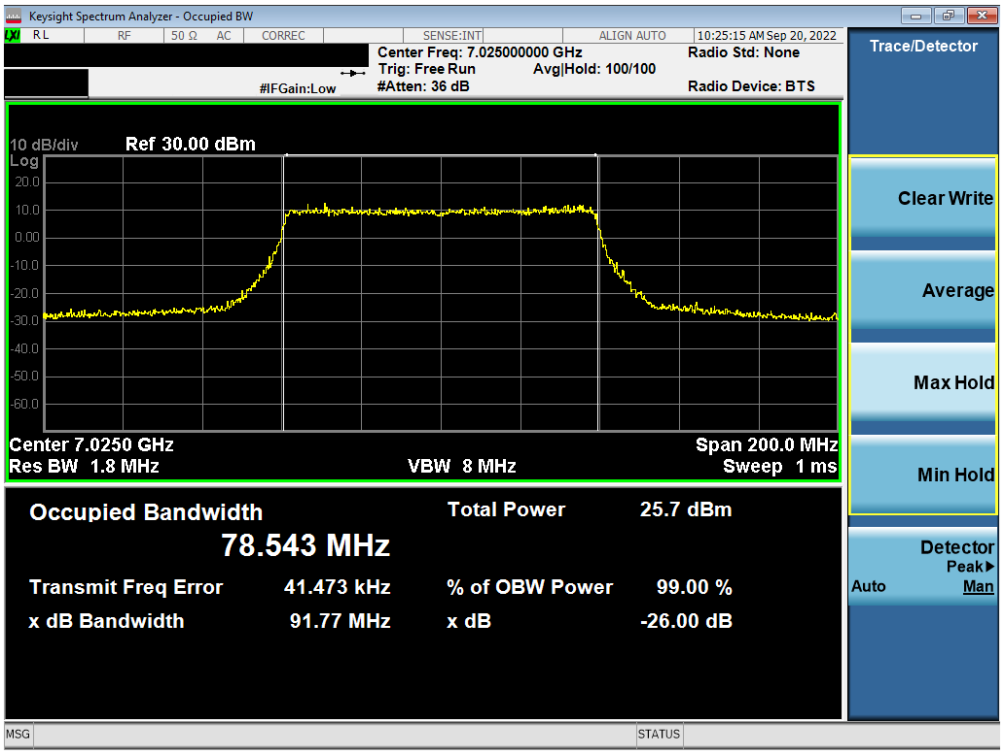
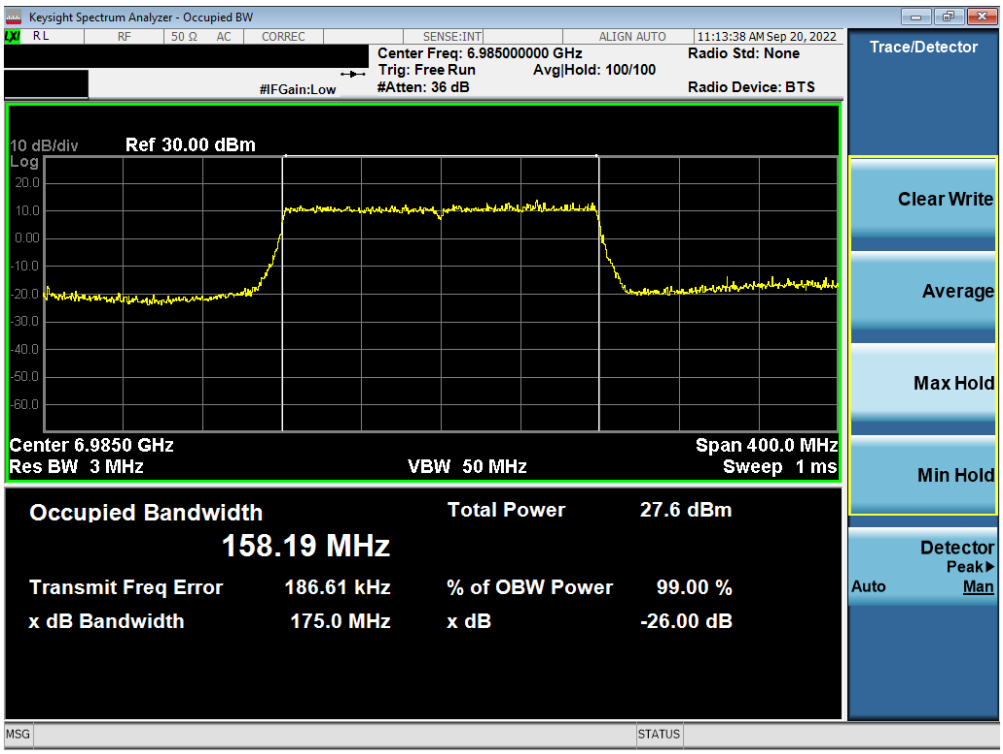


Plot 7-103. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 8) – Ch. 215)



Plot 7-104. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 8) – Ch. 207)

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7.3 UNII Output Power Measurement – 802.11a/ax

§ 2.1046, §15.407(a)(11), §15.407(a)(8)

Test Overview and Limits

A transmitter antenna terminal of the EUT is connected to the input of an RF pulse power sensor. Measurement is made using a broadband average power meter while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2013 and KDB 789033 D02 v02r01, and at the appropriate frequencies.

For client devices operating under the control of an indoor access point in the 5.925-7.125 GHz bands, the maximum e.i.r.p. over the frequency band of operation must not exceed 24 dBm. For client devices operating under the control of a standard power access point, the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm and the device must limit its power to no more than 6 dB below its associated standard power access point's authorized transmit power.

Test Procedure Used

ANSI C63.10-2013 – Section 12.3.3.2 Method PM-G
KDB 789033 D02 v02r01 – Section E)3)b) Method PM-G
ANSI C63.10-2013 – Section 14.2 Measure-and-Sum Technique
KDB 662911 v02r01 – Section E)1) Measure-and-Sum Technique

Test Settings

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 diagram below.

Figure 7-2. Test Instrument & Measurement Setup

Test Notes

1. Compliance for this device while operating under the control of either an indoor low power access point or a standard power access point is demonstrated by applying the tighter low power indoor access point limit of 24dBm e.i.r.p. for both cases.

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MIMO Maximum Conducted Output Power Measurements

6GHz (20MHz Bandwidth)	6GHz (20MHz) 802.11a Conducted Power [dBm]								
	Freq [MHz]	Channel	ANT1	ANT2	MIMO	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	Max e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5935	2	11.86	11.62	14.75	-2.85	11.90	24.00	-12.10
	6075	25	11.54	11.73	14.64	-2.85	11.79	24.00	-12.21
	6175	45	11.72	11.44	14.59	-2.85	11.74	24.00	-12.26
	6275	65	11.69	11.49	14.60	-2.85	11.75	24.00	-12.25
	6415	93	11.52	11.63	14.59	-2.85	11.74	24.00	-12.26
	6435	97	11.89	11.52	14.72	-4.72	10.00	24.00	-14.00
	6475	105	11.87	11.67	14.78	-4.72	10.06	24.00	-13.94
	6515	113	11.96	11.90	14.94	-4.72	10.22	24.00	-13.78
	6535	117	11.96	11.99	14.99	-3.88	11.11	24.00	-12.89
	6675	145	11.56	11.85	14.72	-3.88	10.84	24.00	-13.16
	6695	149	11.47	11.88	14.69	-3.88	10.81	24.00	-13.19
	6875	185	11.69	11.93	14.82	-3.88	10.94	24.00	-13.06
	6895	189	11.52	11.85	14.70	-2.75	11.95	24.00	-12.05
	6995	209	11.34	11.52	14.44	-2.75	11.69	24.00	-12.31
	7115	233	11.89	11.94	14.93	-2.75	12.18	24.00	-11.82

Table 7-2. MIMO 20MHz BW 802.11a (UNII) Maximum Conducted Output Power

6GHz (20MHz Bandwidth)	6GHz (20MHz) 802.11ax Conducted Power [dBm]								
	Freq [MHz]	Channel	ANT1	ANT2	MIMO	Directional Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
	5935	2	11.89	11.75	14.83	-2.85	11.98	24.00	-12.02
	6075	25	11.76	11.69	14.74	-2.85	11.89	24.00	-12.11
	6175	45	11.85	11.59	14.73	-2.85	11.88	24.00	-12.12
	6275	65	11.86	11.67	14.78	-2.85	11.93	24.00	-12.07
	6415	93	11.78	11.32	14.57	-2.85	11.72	24.00	-12.28
	6435	97	11.74	11.41	14.59	-4.72	9.87	24.00	-14.13
	6475	105	11.69	11.32	14.52	-4.72	9.80	24.00	-14.20
	6515	113	11.78	11.99	14.90	-4.72	10.18	24.00	-13.82
	6535	117	11.69	11.89	14.80	-3.88	10.92	24.00	-13.08
	6675	145	11.38	11.72	14.56	-3.88	10.68	24.00	-13.32
	6695	149	11.32	11.75	14.55	-3.88	10.67	24.00	-13.33
	6875	185	11.49	11.79	14.65	-3.88	10.77	24.00	-13.23
	6895	189	11.32	11.71	14.53	-2.75	11.78	24.00	-12.22
	6995	209	11.69	11.99	14.85	-2.75	12.10	24.00	-11.90
	7115	233	11.09	11.44	14.28	-2.75	11.53	24.00	-12.47

Table 7-3. MIMO 20MHz BW 802.11ax (UNII) Maximum Conducted Output Power

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6GHz (40MHz Bandwidth)	6GHz (40MHz) 802.11ax Conducted Power [dBm]								
	Freq [MHz]	Channel	ANT1	ANT2	MIMO	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	Max e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5965	3	11.57	11.31	14.45	-2.85	11.60	24.00	-12.40
	6085	27	11.41	11.81	14.62	-2.85	11.77	24.00	-12.23
	6165	43	11.36	11.59	14.49	-2.85	11.64	24.00	-12.36
	6285	67	11.67	11.22	14.46	-2.85	11.61	24.00	-12.39
	6405	91	11.98	11.91	14.96	-2.85	12.11	24.00	-11.89
	6445	99	11.71	11.18	14.46	-4.72	9.74	24.00	-14.26
	6485	107	11.81	11.23	14.54	-4.72	9.82	24.00	-14.18
	6525	115	11.57	11.73	14.66	-4.72	9.94	24.00	-14.06
	6565	123	11.50	11.84	14.68	-3.88	10.80	24.00	-13.20
	6685	147	11.21	11.89	14.57	-3.88	10.69	24.00	-13.31
	6725	155	11.56	11.93	14.76	-3.88	10.88	24.00	-13.12
	6845	179	11.62	11.94	14.79	-3.88	10.91	24.00	-13.09
	6885	187	11.33	11.63	14.49	-2.75	11.74	24.00	-12.26
	7005	211	11.41	11.89	14.67	-2.75	11.92	24.00	-12.08
	7085	227	11.36	11.86	14.63	-2.75	11.88	24.00	-12.12

Table 7-4. MIMO 40MHz BW 802.11ax (UNII) Maximum Conducted Output Power

6GHz (80MHz Bandwidth)	6GHz (80MHz) 802.11ax Conducted Power [dBm]								
	Freq [MHz]	Channel	ANT1	ANT2	MIMO	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	Max e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5985	7	11.82	11.44	14.64	-2.85	11.79	24.00	-12.21
	6065	23	11.48	11.65	14.58	-2.85	11.73	24.00	-12.27
	6145	39	11.63	11.51	14.58	-2.85	11.73	24.00	-12.27
	6305	71	11.67	11.66	14.68	-2.85	11.83	24.00	-12.17
	6385	87	11.60	11.53	14.58	-2.85	11.73	24.00	-12.27
	6465	103	11.75	11.40	14.59	-4.72	9.87	24.00	-14.13
	6545	119	11.64	11.66	14.66	-3.88	10.78	24.00	-13.22
	6705	151	11.19	11.82	14.53	-3.88	10.65	24.00	-13.35
	6785	167	11.12	11.48	14.31	-3.88	10.43	24.00	-13.57
	6865	183	11.15	11.49	14.33	-3.88	10.45	24.00	-13.55
	6945	199	11.29	11.55	14.43	-2.75	11.68	24.00	-12.32
	7025	215	11.39	11.81	14.62	-2.75	11.87	24.00	-12.13

Table 7-5. MIMO 80MHz BW 802.11ax (UNII) Maximum Conducted Output Power

6GHz (160MHz Bandwidth)	6GHz (160MHz) 802.11ax Conducted Power [dBm]								
	Freq [MHz]	Channel	ANT1	ANT2	MIMO	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	Max e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	6025	15	11.91	11.73	14.83	-2.85	11.98	24.00	-12.02
	6185	47	11.91	11.81	14.87	-2.85	12.02	24.00	-11.98
	6345	79	11.61	11.82	14.73	-2.85	11.88	24.00	-12.12
	6505	111	11.64	11.89	14.78	-4.72	10.06	24.00	-13.94
	6665	143	11.44	11.86	14.67	-3.88	10.79	24.00	-13.21
	6825	175	11.48	11.98	14.75	-3.88	10.87	24.00	-13.13
	6985	207	11.44	11.67	14.56	-2.75	11.81	24.00	-12.19

Table 7-6. MIMO 160MHz BW 802.11ax (UNII) Maximum Conducted Output Power

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Sample MIMO Calculation:

At 5935MHz in 802.11a (20MHz BW) mode, the average conducted output power was measured to be 11.86 dBm for Antenna-1 and 11.62 dBm for Antenna-2.

Antenna 1 + Antenna 2 = MIMO

(11.86 dBm + 11.62 dBm) = (15.35 mW + 14.52 mW) = 29.87 mW = 14.75 dBm

Sample Directional Gain Calculation:

Per ANSI C63.10-2013 Section 14.4.3, the directional gain is calculated using the following formula, where GN is the gain of the nth antenna and NANT, the total number of antennas used.

$$\text{Directional gain} = 10 \log[(10^{G_1/20} + 10^{G_2/20} + \ldots + 10^{G_N/20})^2 / N_{ANT}] \text{ dBi}$$

Sample e.i.r.p. Calculation:

At 5935MHz in 802.11a (20MHz BW) mode, the average MIMO conducted power was calculated to be dBm with directional gain of -2.85 dBi.
e.i.r.p. (dBm) = Conducted Power (dBm) + Ant gain (dBi)

14.75 dBm + -2.85 dBi = 11.90 dBm

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7.4 Maximum Power Spectral Density – 802.11a/ax

§15.407(a)(8)

Test Overview and Limit

The spectrum analyzer was connected to the antenna terminal while the EUT was operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2013 and KDB 789033 D02 v02r01, and at the appropriate frequencies. Method SA-1, as defined in ANSI C63.10-2013 and KDB 789033 D02 v02r01, was used to measure the power spectral density for 802.11a/ax.

In the 5.925-7.125 GHz bands, the maximum power spectral density must not exceed −1 dBm e.i.r.p. in any 1-megahertz band. For client devices, except for fixed client devices as defined in this subpart, operating under the control of a standard power access point in 5.925-6.425 GHz and 6.525-6.875 GHz bands, the maximum power spectral density must not exceed 17 dBm/MHz e.i.r.p.

Test Procedure Used

ANSI C63.10-2013 – Section 12.3.2.2
KDB 789033 D02 v02r01 – Section F
ANSI C63.10-2013 – Section 14.3.2.2 Measure-and-Sum Technique
KDB 662911 v02r01 – Section E)2) Measure-and-Sum Technique

Test Settings

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire emission bandwidth of the signal
3. RBW = 1MHz
4. VBW = 3MHz
5. Number of sweep points $\geq$ 2 x (span/RBW)
6. Sweep time = auto
7. Detector = power averaging (RMS)
8. Trigger was set to free run for all modes
9. Trace was averaged over 100 sweeps
10. The peak search function of the spectrum analyzer was used to find the peak of the spectrum.

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. Compliance for this device while operating under the control of either an indoor low power access point or a standard power access point is demonstrated by applying the tighter low power indoor access point limit of -1dBm/MHz e.i.r.p. for both cases.

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MIMO Power Spectral Density Measurements

	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 Power Density [dBm]	Antenna-2 Power Density [dBm]	Antenna-1 Gain [dBi]	Antenna-2 Gain [dBi]	Summed MIMO Power Density [dBm/MHz]	Directional Gain [dBi]	e.i.r.p Density [dBm/MHz]	Max EIRP Density [dBm/MHz]	Margin [dB]
Band 5	5935	2	a	-1.13	-1.30	-7.27	-4.65	1.80	-2.85	-1.05	-1	-0.05
	6175	45	a	-1.30	-1.21	-7.27	-4.65	1.75	-2.85	-1.10	-1	-0.10
	6415	93	a	-1.45	-0.93	-7.27	-4.65	1.83	-2.85	-1.02	-1	-0.02
	5935	2	ax (20MHz)	-1.39	-1.85	-7.27	-4.65	1.40	-2.85	-1.46	-1	-0.46
	6175	45	ax (20MHz)	-1.61	-0.87	-7.27	-4.65	1.79	-2.85	-1.06	-1	-0.06
	6415	93	ax (20MHz)	-1.77	-1.27	-7.27	-4.65	1.49	-2.85	-1.36	-1	-0.36
	5965	3	ax (40MHz)	-3.38	-3.53	-7.27	-4.65	-0.44	-2.85	-3.30	-1	-2.30
	6165	43	ax (40MHz)	-3.73	-2.51	-7.27	-4.65	-0.06	-2.85	-2.91	-1	-1.91
	6405	91	ax (40MHz)	-3.60	-2.61	-7.27	-4.65	-0.07	-2.85	-2.92	-1	-1.92
	5985	7	ax (80MHz)	-3.46	-3.53	-7.27	-4.65	-0.48	-2.85	-3.33	-1	-2.33
	6145	39	ax (80MHz)	-3.58	-2.33	-7.27	-4.65	0.10	-2.85	-2.75	-1	-1.75
	6385	87	ax (80MHz)	-7.40	-2.34	-7.27	-4.65	-1.16	-2.85	-4.02	-1	-3.02
	6025	15	ax (160MHz)	-5.25	-4.32	-7.27	-4.65	-1.75	-2.85	-4.60	-1	-3.60
	6185	47	ax (160MHz)	-4.80	-4.35	-7.27	-4.65	-1.56	-2.85	-4.41	-1	-3.41
	6345	79	ax (160MHz)	-5.06	-4.10	-7.27	-4.65	-1.54	-2.85	-4.39	-1	-3.39
Band 6	6435	97	a	-0.71	0.06	-9.94	-5.97	2.70	-4.72	-2.02	-1	-1.02
	6475	105	a	-0.87	0.03	-9.94	-5.97	2.61	-4.72	-2.11	-1	-1.11
	6515	113	a	-0.77	-0.05	-9.94	-5.97	2.62	-4.72	-2.10	-1	-1.10
	6435	97	ax (20MHz)	0.14	0.30	-9.94	-5.97	3.23	-4.72	-1.49	-1	-0.49
	6475	105	ax (20MHz)	-0.11	0.06	-9.94	-5.97	2.99	-4.72	-1.73	-1	-0.73
	6515	113	ax (20MHz)	-0.09	0.04	-9.94	-5.97	2.98	-4.72	-1.74	-1	-0.74
	6445	99	ax (40MHz)	-2.66	-2.78	-9.94	-5.97	0.29	-4.72	-4.43	-1	-3.43
	6485	107	ax (40MHz)	-2.83	-2.87	-9.94	-5.97	0.16	-4.72	-4.56	-1	-3.56
	6525	115	ax (40MHz)	-2.76	-2.84	-9.94	-5.97	0.21	-4.72	-4.51	-1	-3.51
	6465	103	ax (80MHz)	-2.23	-2.64	-9.94	-5.97	0.58	-4.72	-4.14	-1	-3.14
	6505	111	ax (160MHz)	-4.44	-3.96	-9.94	-5.97	-1.19	-4.72	-5.91	-1	-4.91
Band 7	6535	117	a	-0.98	0.08	-7.45	-6.36	2.59	-3.88	-1.29	-1	-0.29
	6695	149	a	-1.92	-0.63	-7.45	-6.36	1.78	-3.88	-2.10	-1	-1.10
	6875	185	a	-1.34	-0.06	-7.45	-6.36	2.36	-3.88	-1.52	-1	-0.52
	6535	117	ax (20MHz)	-0.44	0.05	-7.45	-6.36	2.82	-3.88	-1.06	-1	-0.06
	6695	149	ax (20MHz)	-1.21	-0.25	-7.45	-6.36	2.31	-3.88	-1.57	-1	-0.57
	6875	185	ax (20MHz)	-1.25	-0.25	-7.45	-6.36	2.29	-3.88	-1.59	-1	-0.59
	6565	123	ax (40MHz)	-3.98	-3.15	-7.45	-6.36	-0.54	-3.88	-4.41	-1	-3.41
	6725	155	ax (40MHz)	-2.88	-2.16	-7.45	-6.36	0.50	-3.88	-3.37	-1	-2.37
	6845	179	ax (40MHz)	-2.80	-2.02	-7.45	-6.36	0.62	-3.88	-3.26	-1	-2.26
	6545	119	ax (80MHz)	-3.50	-2.74	-7.45	-6.36	-0.09	-3.88	-3.97	-1	-2.97
	6705	151	ax (80MHz)	-3.30	-1.80	-7.45	-6.36	0.53	-3.88	-3.35	-1	-2.35
	6865	183	ax (80MHz)	-3.08	-2.10	-7.45	-6.36	0.45	-3.88	-3.43	-1	-2.43
	6665	143	ax (160MHz)	-4.60	-3.67	-7.45	-6.36	-1.10	-3.88	-4.98	-1	-3.98
	6825	175	ax (160MHz)	-4.64	-3.52	-7.45	-6.36	-1.03	-3.88	-4.91	-1	-3.91
Band 8	6895	189	a	-1.89	-0.87	-5.75	-5.78	1.67	-2.75	-1.09	-1	-0.09
	6995	209	a	-1.92	-0.82	-5.75	-5.78	1.67	-2.75	-1.08	-1	-0.08
	7115	233	a	-1.70	-1.04	-5.75	-5.78	1.65	-2.75	-1.10	-1	-0.10
	6895	189	ax (20MHz)	-2.49	-1.99	-5.75	-5.78	0.78	-2.75	-1.97	-1	-0.97
	6995	209	ax (20MHz)	-2.51	-1.80	-5.75	-5.78	0.87	-2.75	-1.88	-1	-0.88
	7115	233	ax (20MHz)	-2.32	-1.48	-5.75	-5.78	1.13	-2.75	-1.62	-1	-0.62
	6885	187	ax (40MHz)	-3.08	-2.28	-5.75	-5.78	0.35	-2.75	-2.41	-1	-1.41
	7005	211	ax (40MHz)	-3.15	-2.33	-5.75	-5.78	0.29	-2.75	-2.47	-1	-1.47
	7085	227	ax (40MHz)	-3.03	-2.12	-5.75	-5.78	0.46	-2.75	-2.30	-1	-1.30
	6945	199	ax (80MHz)	-3.26	-2.41	-5.75	-5.78	0.19	-2.75	-2.56	-1	-1.56
	7025	215	ax (80MHz)	-3.11	-2.23	-5.75	-5.78	0.36	-2.75	-2.39	-1	-1.39
	6985	207	ax (160MHz)	-4.79	-3.74	-5.75	-5.78	-1.22	-2.75	-3.98	-1	-2.98

Table 7-7. MIMO e.i.r.p. Conducted Power Spectral Density Measurements

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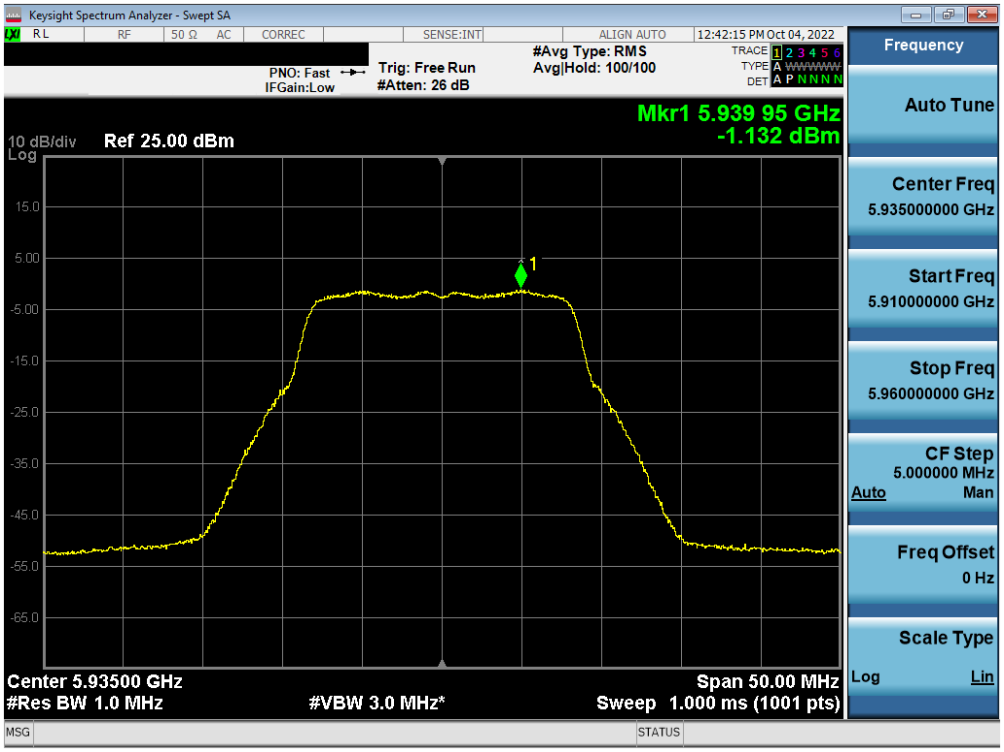
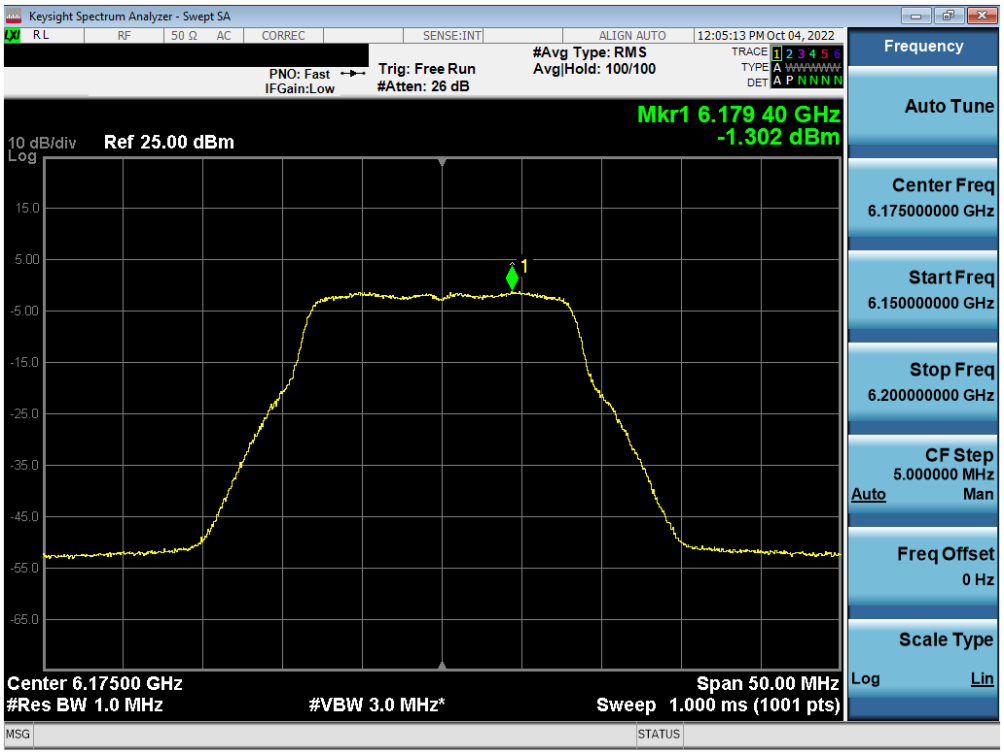
MIMO Antenna-1 Power Spectral Density Measurement - (UNII Band 5)



Plot 7-105. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11a (UNII Band 5) – Ch. 2)



Plot 7-106. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11a (UNII Band 5) – Ch. 45)

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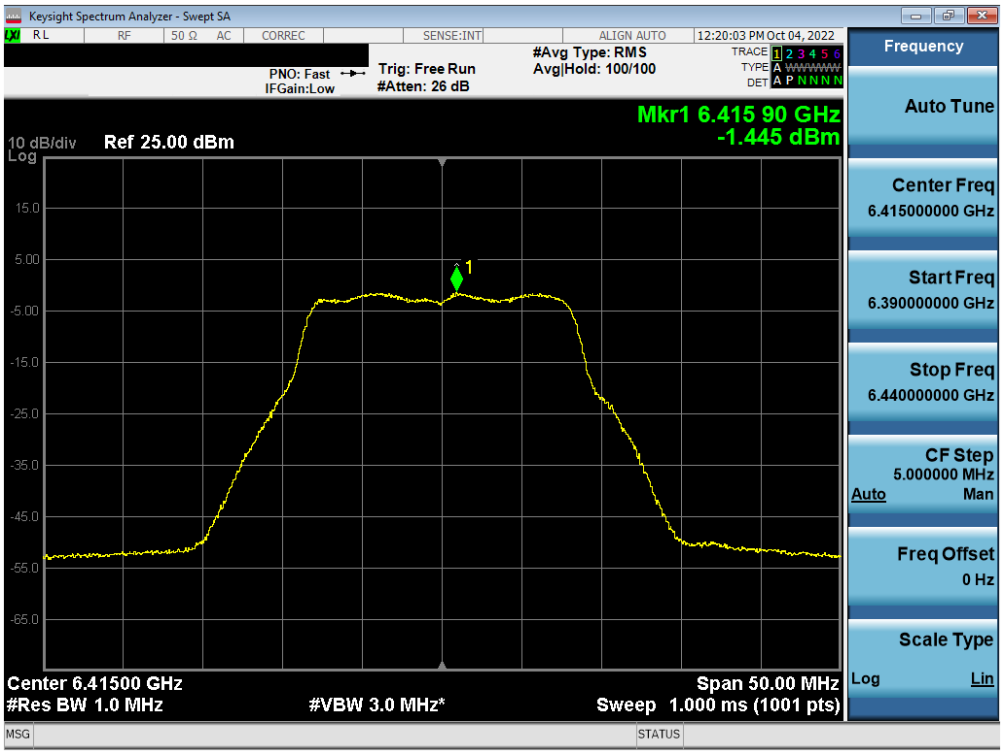
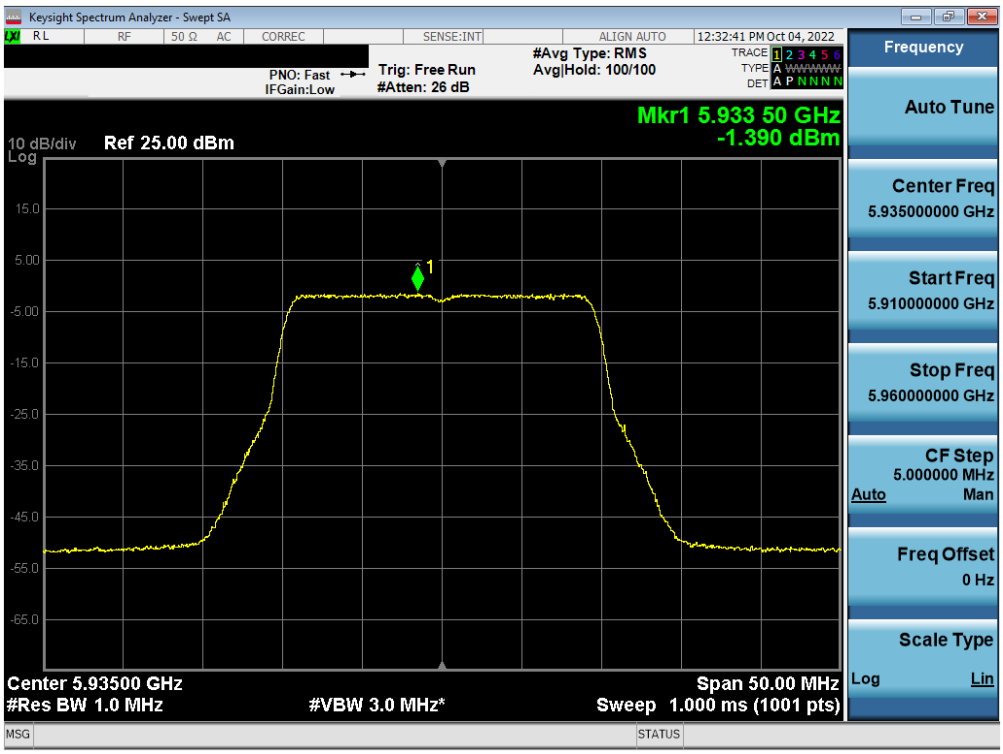


Plot 7-107. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11a (UNII Band 5) – Ch. 93)



Plot 7-108. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11ax (UNII Band 5) – Ch. 2)

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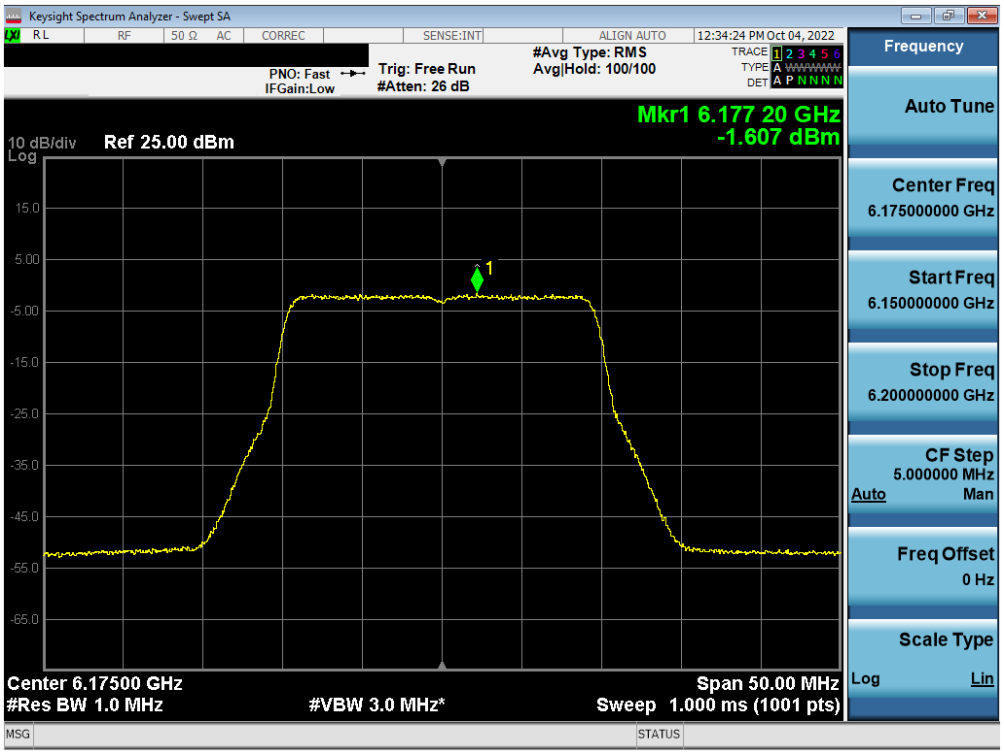
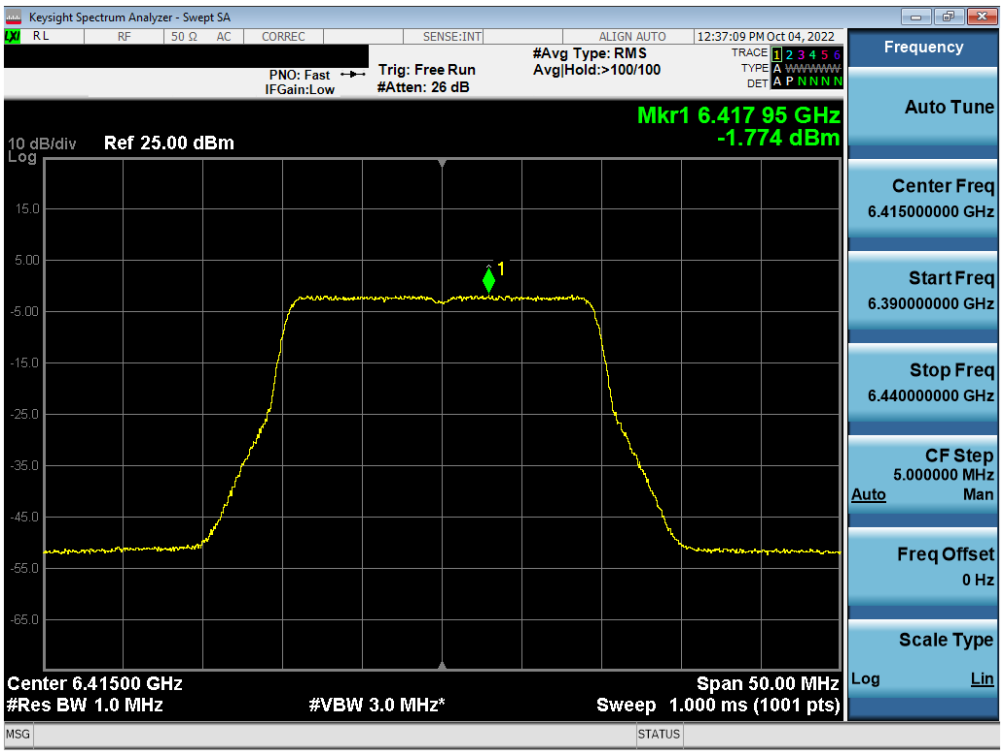


Plot 7-109. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11ax (UNII Band 5) – Ch. 45)



Plot 7-110. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11ax (UNII Band 5) – Ch. 93)

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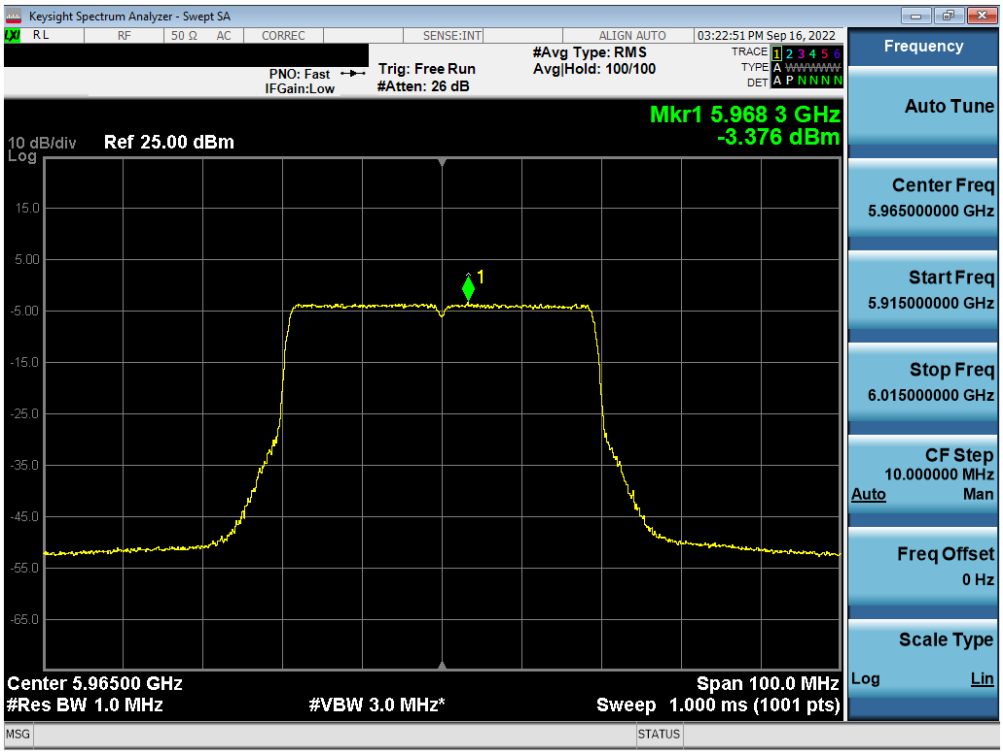
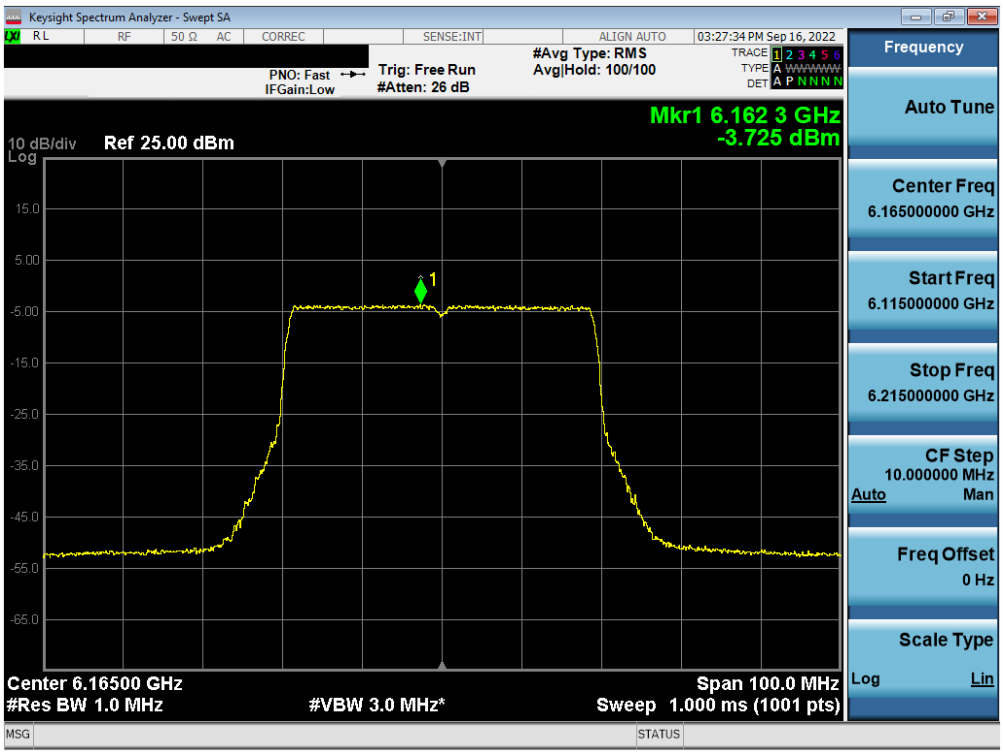


Plot 7-111. Power Spectral Density Measurement MIMO ANT1 (40MHz 802.11ax (UNII Band 5) – Ch. 3)



Plot 7-112. Power Spectral Density Measurement MIMO ANT1 (40MHz 802.11ax (UNII Band 5) – Ch. 43)

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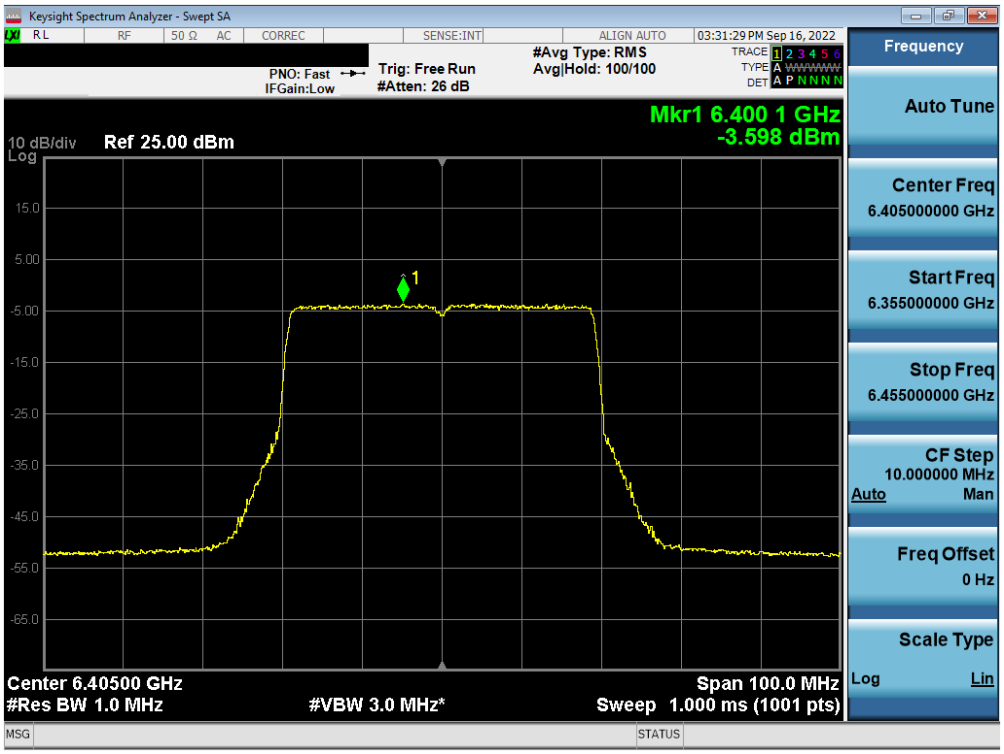
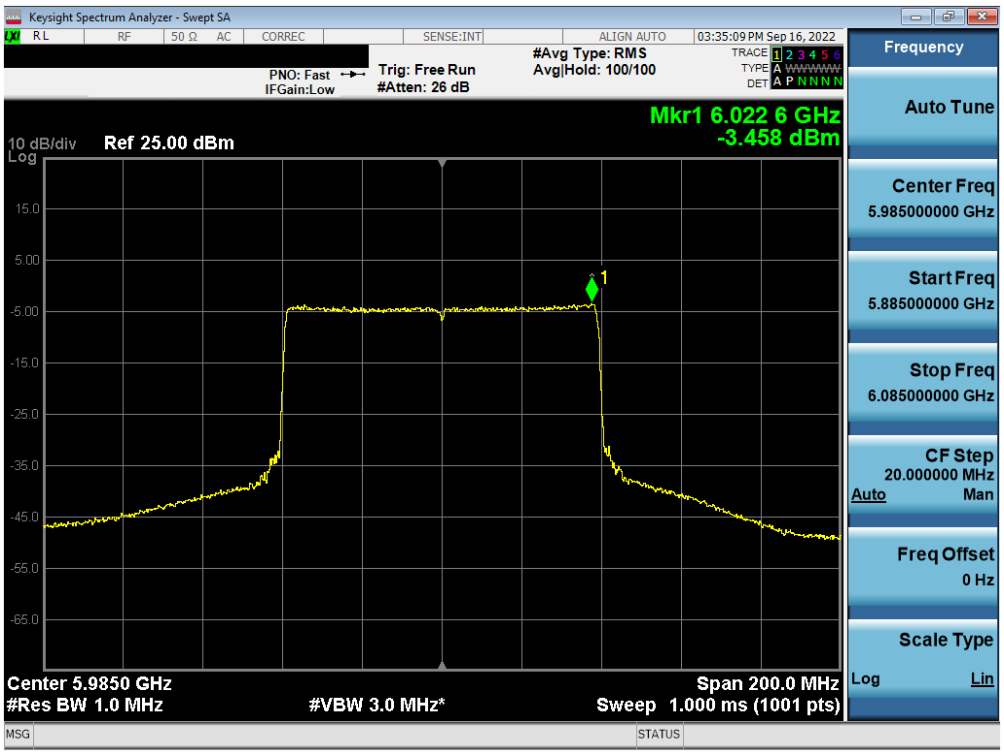


Plot 7-113. Power Spectral Density Measurement MIMO ANT1 (40MHz 802.11ax (UNII Band 5) – Ch. 91)



Plot 7-114. Power Spectral Density Measurement MIMO ANT1 (80MHz 802.11ax (UNII Band 5) – Ch. 7)

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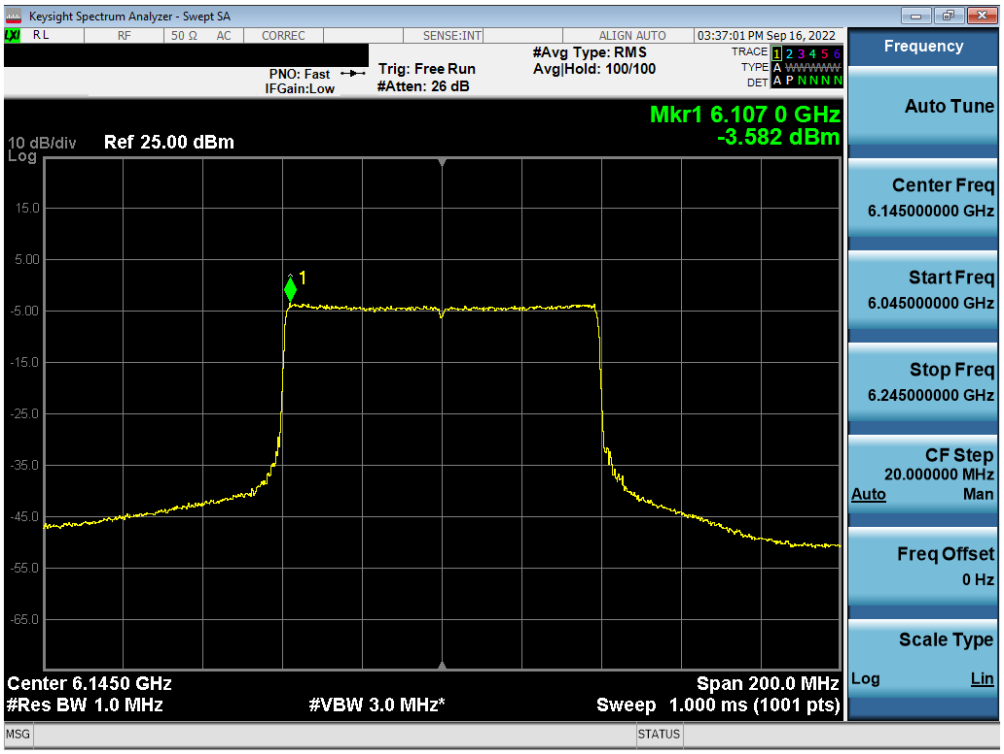
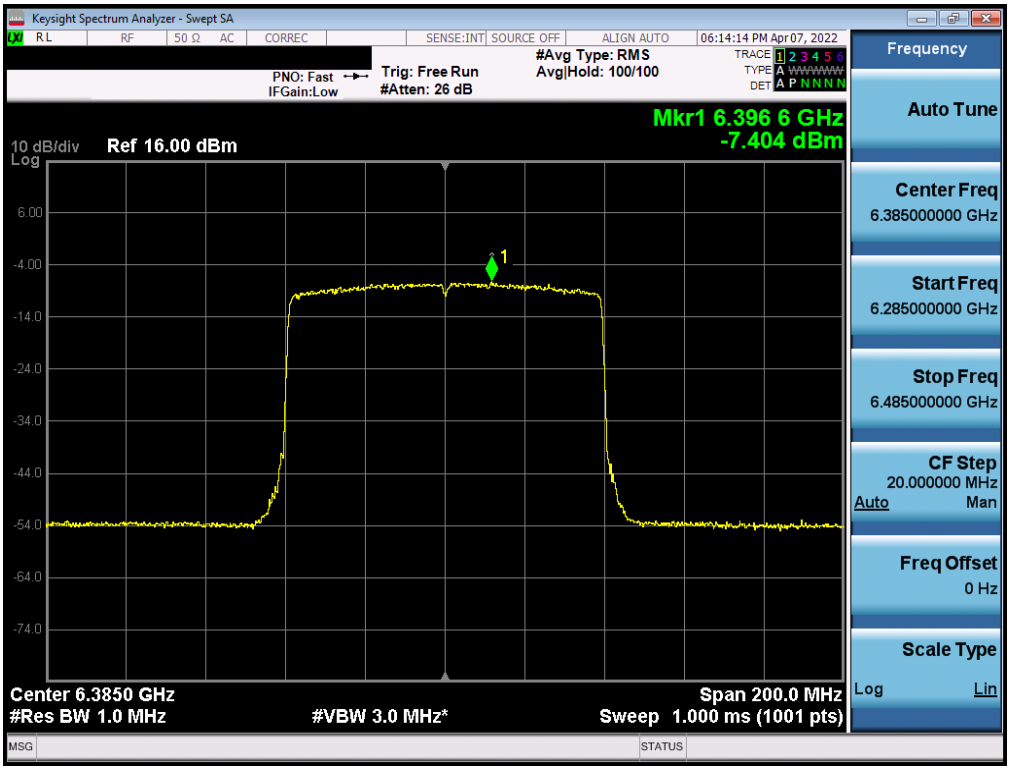


Plot 7-115. Power Spectral Density Measurement MIMO ANT1 (80MHz 802.11ax (UNII Band 5) – Ch. 39)



Plot 7-116. Power Spectral Density Measurement MIMO ANT1 (80MHz 802.11ax (UNII Band 5) – Ch. 87)

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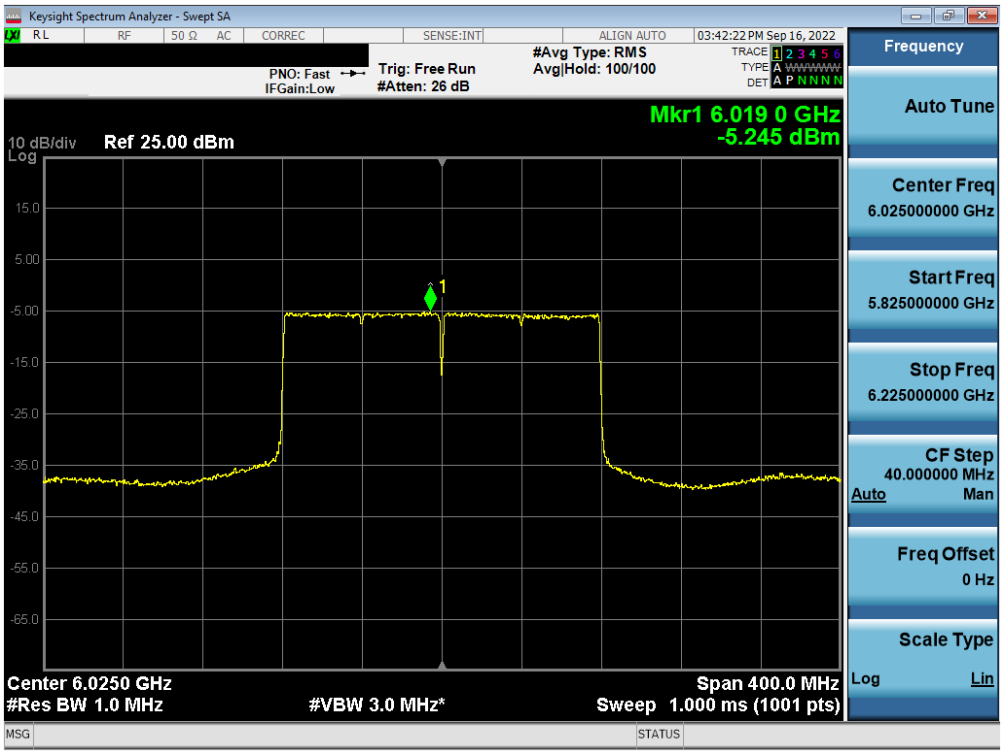
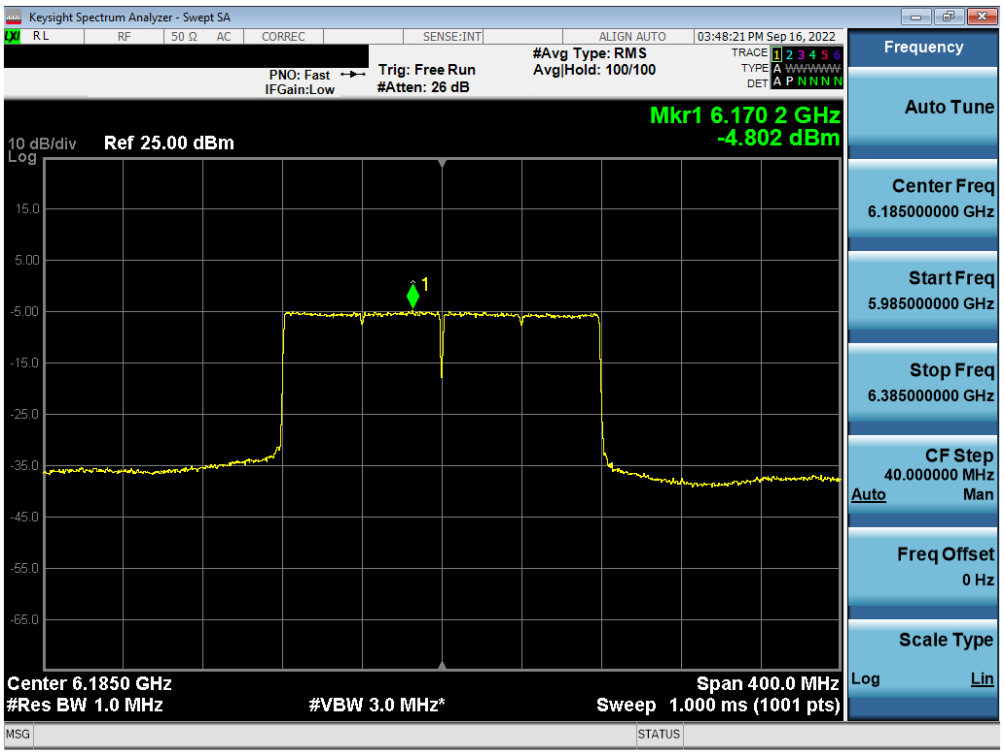


Plot 7-117. Power Spectral Density Measurement MIMO ANT1 (160MHz 802.11ax (UNII Band 5) – Ch. 15)



Plot 7-118. Power Spectral Density Measurement MIMO ANT1 (160MHz 802.11ax (UNII Band 5) – Ch. 47)

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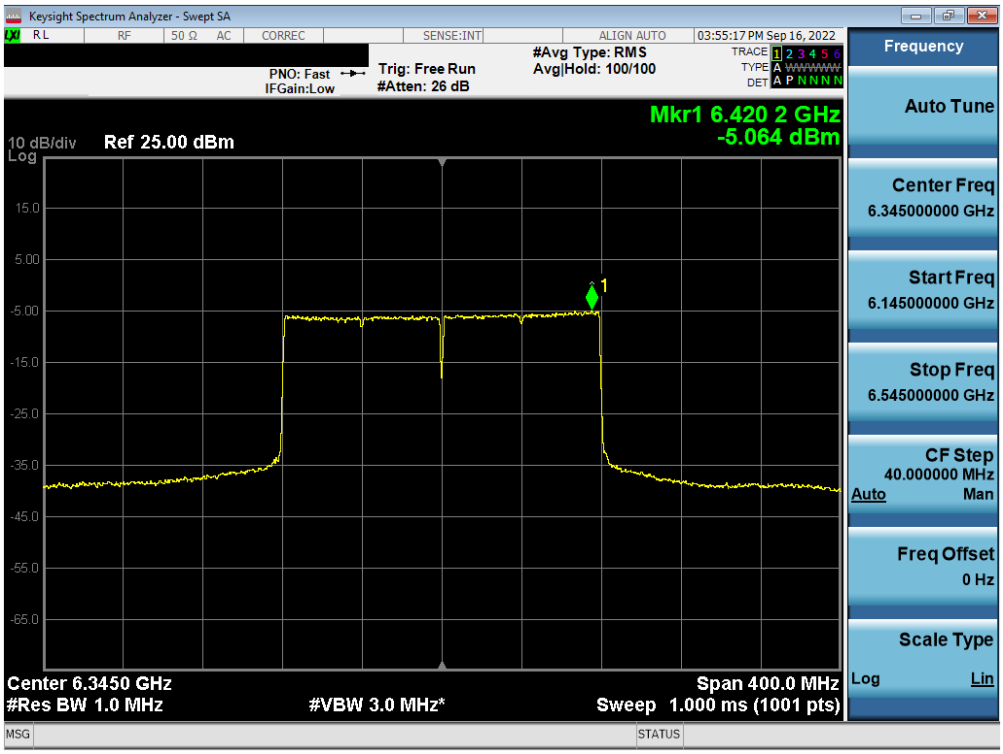

Plot 7-119. Power Spectral Density Measurement MIMO ANT1 (160MHz 802.11ax (UNII Band 5) – Ch. 79)

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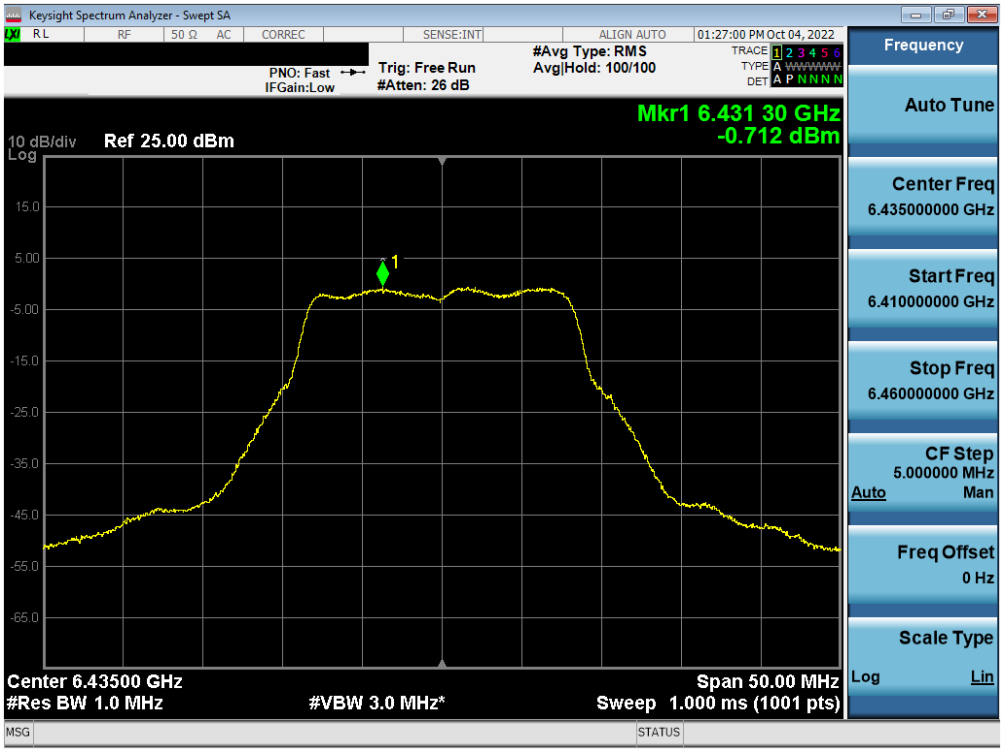
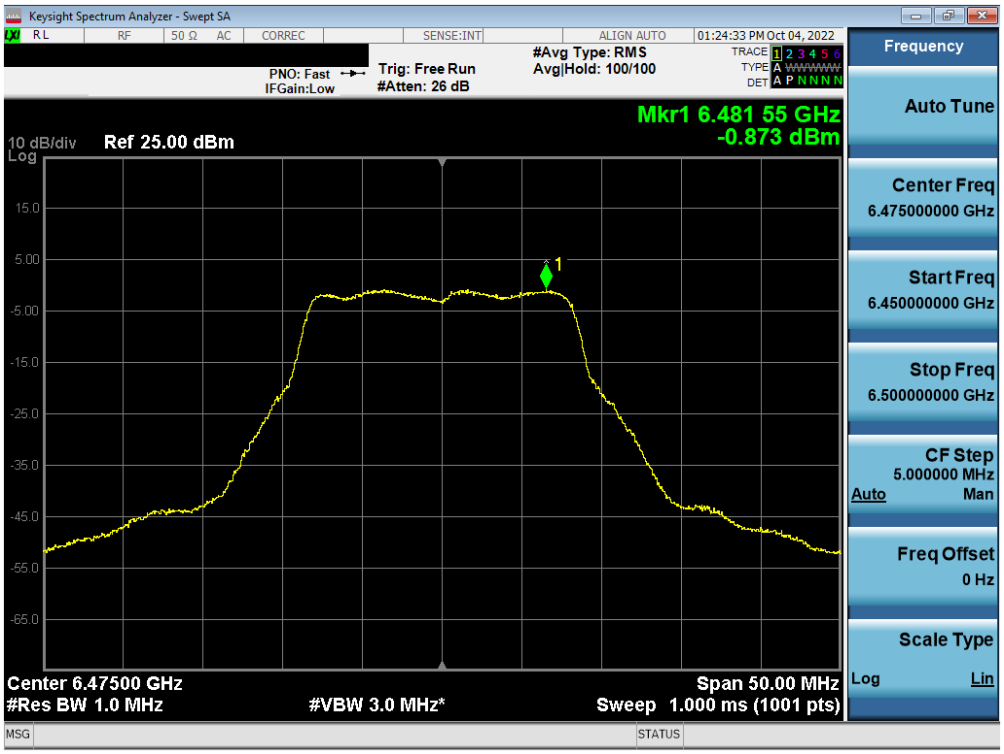
MIMO Antenna-1 Power Spectral Density Measurement - (UNII Band 6)



Plot 7-120. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11a (UNII Band 6) – Ch. 97)



Plot 7-121. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11a (UNII Band 6) – Ch. 105)

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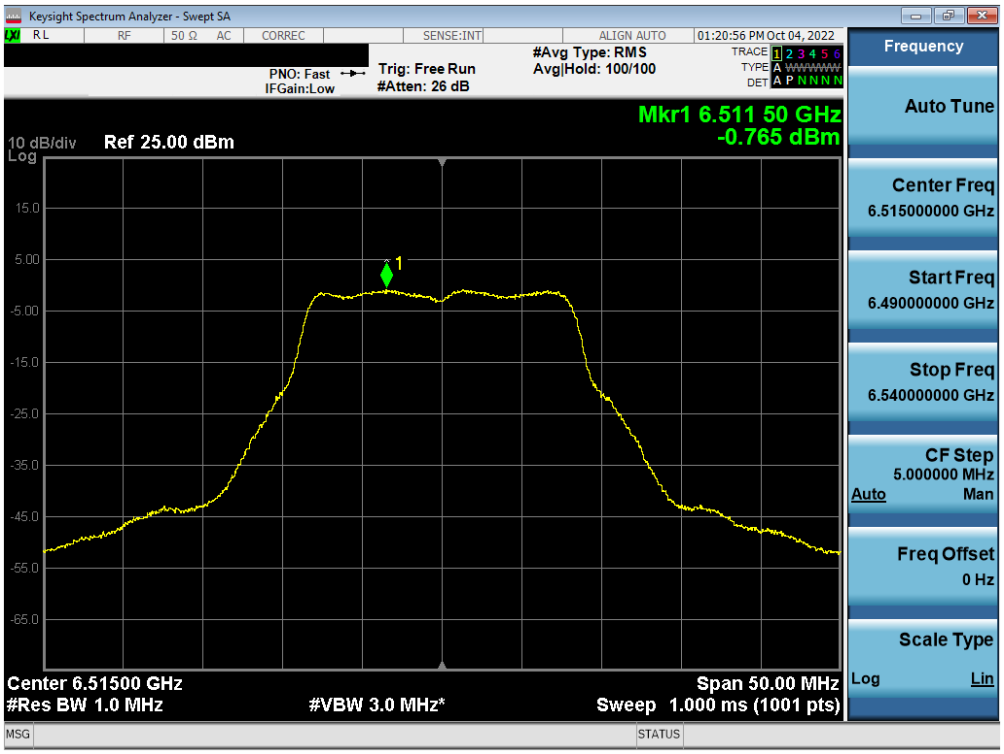
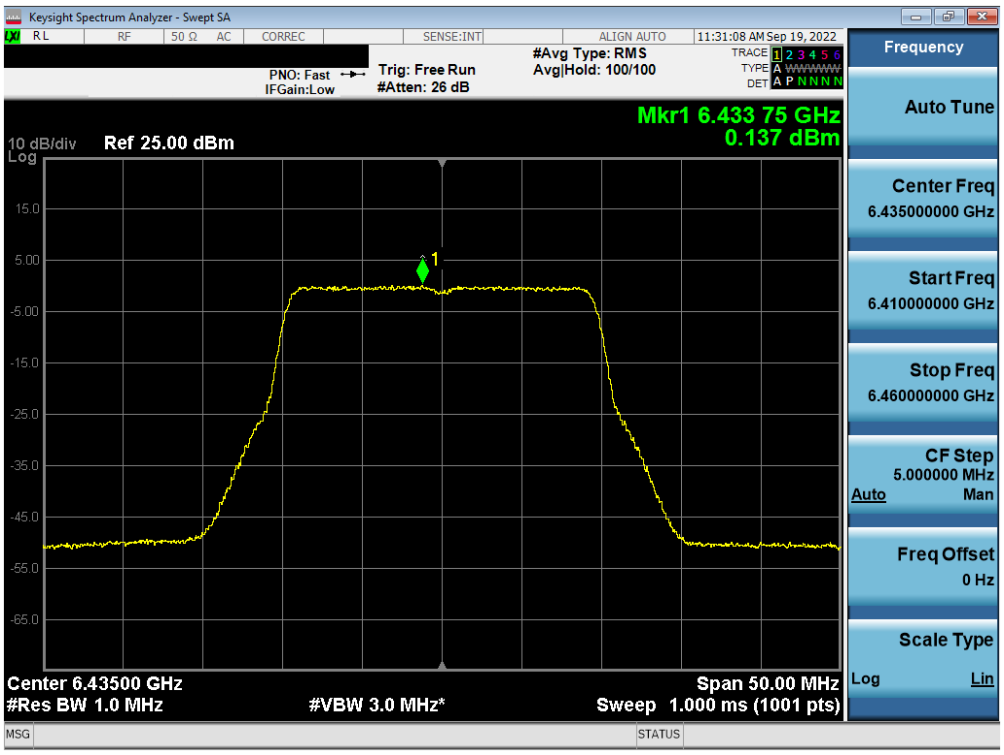


Plot 7-122. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11a (UNII Band 6) – Ch. 113)



Plot 7-123. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11ax (UNII Band 6) – Ch. 97)

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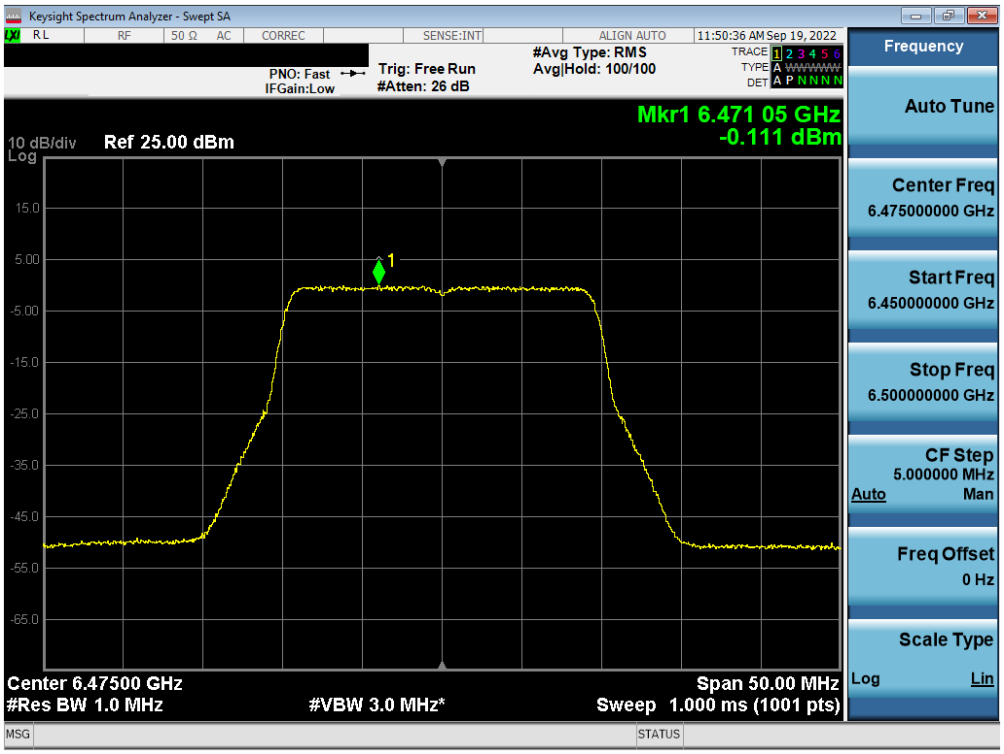
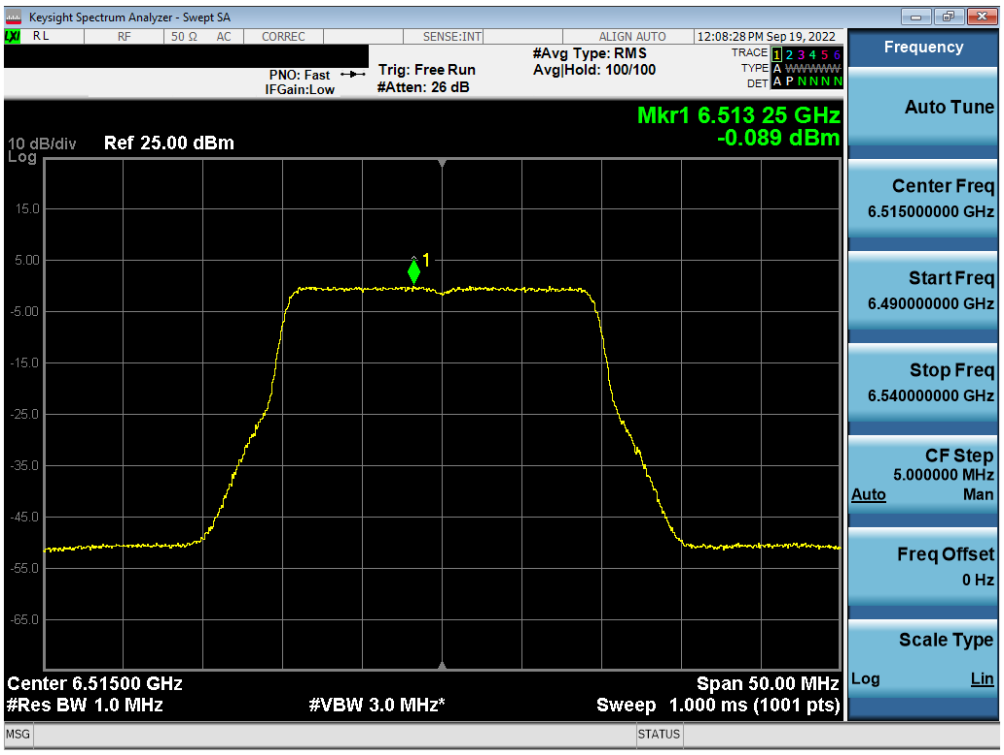


Plot 7-124. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11ax (UNII Band 6) – Ch. 105)



Plot 7-125. Power Spectral Density Measurement MIMO ANT1 (20MHz 802.11ax (UNII Band 6) – Ch. 113)

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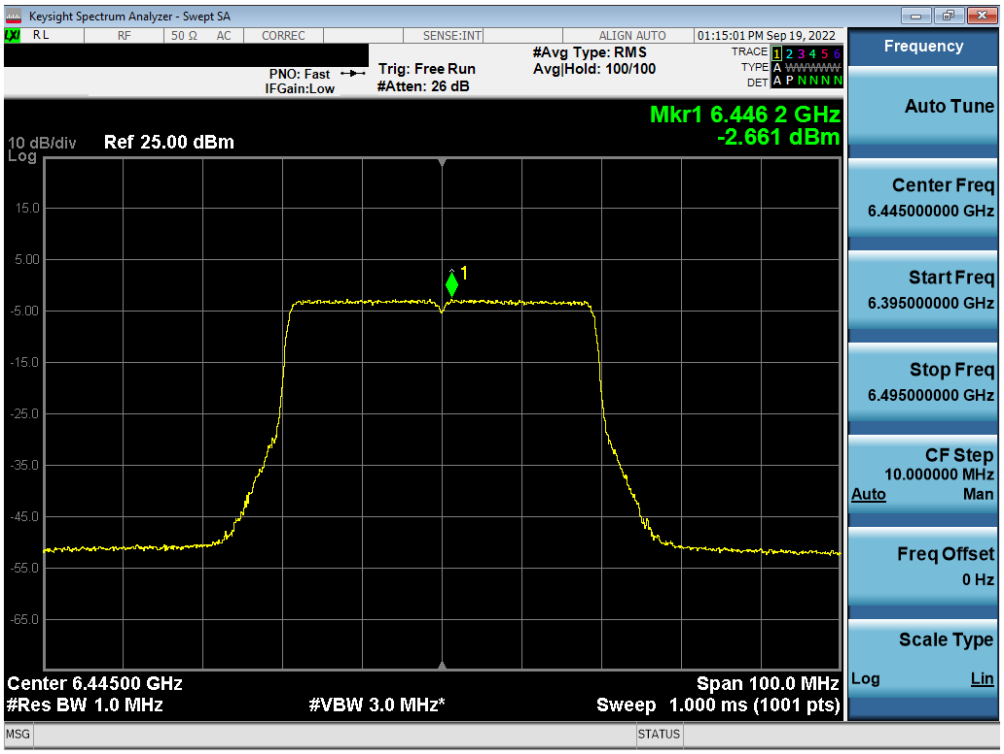
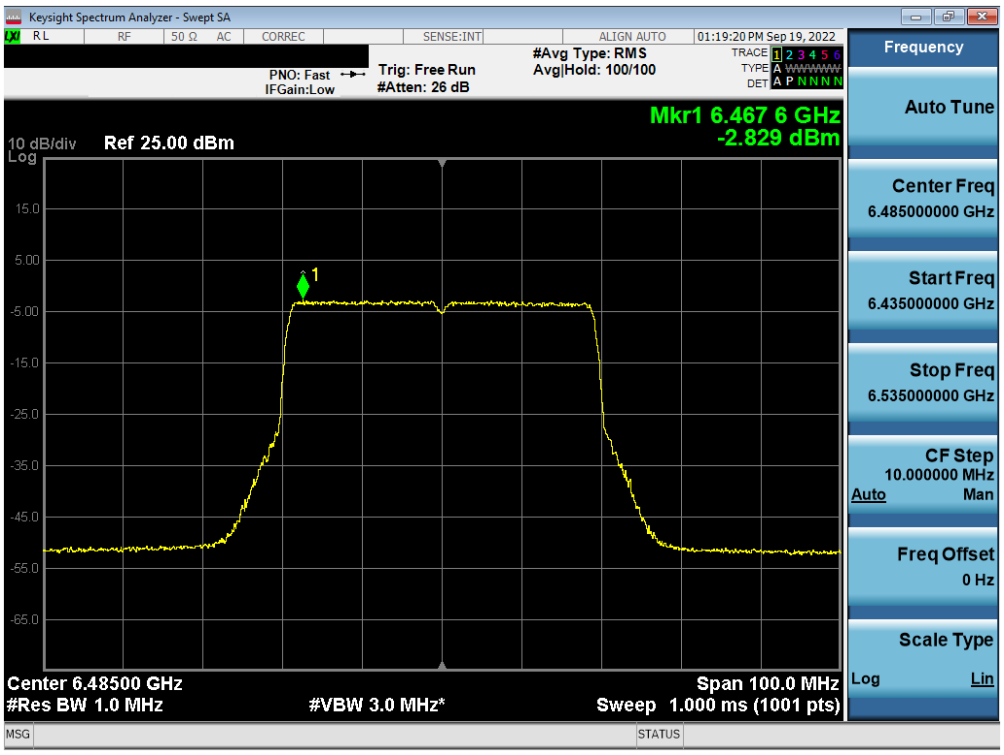


Plot 7-126. Power Spectral Density Measurement MIMO ANT1 (40MHz 802.11ax (UNII Band 6) – Ch. 99)



Plot 7-127. Power Spectral Density Measurement MIMO ANT1 (40MHz 802.11ax (UNII Band 6) – Ch. 107)

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