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MEASUREMENT REPORT
FCC PART 15.407 802.11ax/be (OFDMA)

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

Date of Testing:
03/26/2023 - 04/24/2024
Test Report Issue Date:
5/10/2024
Test Site/Location:
Element lab., Columbia, MD, USA
Test Report Serial No.:
1M2403190019-08.A3L

FCC ID:	**A3LNP940XMA**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	NP940XMA
Additional Models:	NP944XMA
EUT Type:	Portable Computing Device
Frequency Range:	5180 – 5885MHz
Modulation Type:	OFDMA
FCC Equipment Class:	Unlicensed National Information Infrastructure TX (NII)
FCC Rule Part(s):	Part 15 Subpart E (15.407)
Test Procedure(s):	ANSI C63.10-2013

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. 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	1	5180 - 5240	27.99	14.47
	2A	5260 - 5320	29.13	14.64
	2C	5500 - 5720	31.23	14.95
	3	5745 - 5825	31.55	14.99
	4	5845 - 5885	65.67	18.17
40	1	5190 - 5230	27.42	14.38
	2A	5270 - 5310	30.33	14.82
	2C	5510 - 5710	29.26	14.66
	3	5755 - 5795	29.26	14.66
	4	5835 - 5875	62.25	17.94
80	1	5210	28.35	14.53
	2A	5290	28.24	14.51
	2C	5530 - 5690	30.41	14.83
	3	5775	29.97	14.77
	4	5855	62.25	17.94
160	1/2A	5250	28.36	14.53
	2C	5570	29.97	14.77
	3/4	5815	63.08	18.00

EUT Overview

Note: The UNII Band 4 max power values shown in the above table are e.i.r.p values.

1.0 INTRODUCTION

1.1 Scope

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

1.2 Element Test Location

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

1.3 Test Facility / Accreditations

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

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

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

- Element Washington DC LLC facility is a registered (2451B) test laboratory with the site description on file with ISED.

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

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Computing Device FCC ID: A3LNP940XMA**. The test data contained in this report pertains only to the emissions due to the EUT's UNII transmitter.

Test Device Serial No.: 0260A, 0270X, 0015V, 0243M, 0032M

2.2 Device Capabilities

This device contains the following capabilities:

802.11b/g/n/ax/be WLAN, 802.11a/n/ac/ax/be UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE)

Band 1		Band 2A		Band 2C		Band 3		Band 3/4	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
36	5180	52	5260	100	5500	149	5745	169	5845
:	:	:	:	:	:	:	:	:	:
40	5200	56	5280	120	5600	157	5785	173	5865
:	:	:	:	:	:	:	:	:	:
48	5240	64	5320	144	5720	165	5825	177	5885

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

Band 1		Band 2A		Band 2C		Band 3		Band 3/4	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
38	5190	54	5270	102	5510	151	5755	167	5835
:	:	:	:	:	:	:	:	:	:
46	5230	62	5310	118	5590	159	5795	175	5875
				:	:				
				142	5710				

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

Band 1		Band 2A		Band 2C		Band 3		Band 3/4	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
42	5210	58	5290	106	5530	155	5775	167	5835
				:	:				
				122	5610				
				:	:				
				138	5690				

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

Band 1/2A		Band 2C		Band 3/4	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
50	5250	114	5570	163	5815

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

Notes:

1. 5GHz NII operation is possible in 20MHz, 40MHz, 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. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Band	Bandwidth	Tone Type	Tone Size	MIMO (1+2) Duty Cycle [%]
5GHz	20MHz	RU	26T	99.63
			52T	99.63
			106T	99.39
			242T	98.04
		MRU	52+26T	99.49
			106+26T	99.21
	40MHz	RU	26T	99.16
			52T	99.18
			106T	99.39
			242T	98.58
			484T	97.43
	80MHz	RU	26T	99.02
			52T	99.04
			106T	99.39
			242T	98.58
			484T	97.43
			996T	97.40
		MRU	484+242T	98.05
	160MHz	RU	26T	99.65
			52T	99.67
			106T	99.35
			242T	98.58
			484T	97.42
			996T	97.39
			2x996T	99.69
		MRU	996+484T	98.02

Table 2-5. Measured Duty Cycles – 11ax/be

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

WiFi Configurations		SDM		CDD	
		ANT1	ANT2	ANT1	ANT2
5GHz	11a	✖	✖	✓	✓
	11n	✓	✓	✓	✓
	11ac	✓	✓	✓	✓
	11ax	✓	✓	✓	✓
	11be	✓	✓	✓	✓

Table 2-6. Frequency / Channel Operations

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

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

MCS Index	Spatial Stream	OFDMA (802.11ax)																					
		26T			52T			106T			242T			484T			996T			2x996T			
HE		0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI
0	1	0.9	0.8	0.8	1.8	1.7	1.5	3.8	3.5	3.2	8.6	8.1	7.3	17.2	16.3	14.6	36	34	30.6	72.1	68.1	61.3
1	1	1.8	1.7	1.5	3.5	3.3	3	7.5	7.1	6.4	17.2	16.3	14.6	34.4	32.5	29.3	72.1	68.1	61.3	144.1	136.1	122.5
2	1	2.6	2.5	2.3	5.3	5	4.5	11.3	10.6	9.6	25.8	24.4	21.9	51.6	48.8	43.9	108.1	102.1	91.9	216.2	204.2	183.8
3	1	3.5	3.3	3	7.1	6.7	6	15	14.2	12.8	34.4	32.5	29.3	68.8	65	58.5	144.1	136.1	122.5	288.2	272.2	245
4	1	5.3	5	4.5	10.6	10	9	22.5	21.3	19.1	51.6	48.8	43.9	103.2	97.5	87.8	216.2	204.2	183.8	432.4	408.3	367.5
5	1	7.1	6.7	6	14.1	13.3	12	30	28.3	25.5	68.8	65	58.5	137.6	130	117	288.2	272.2	245	576.5	544.4	490
6	1	7.9	7.5	6.8	15.9	15	13.5	33.8	31.9	28.7	77.4	73.1	65.8	154.9	146.3	131.6	324.3	306.3	275.6	648.5	612.5	551.3
7	1	8.8	8.3	7.5	17.6	16.7	15	37.5	35.4	31.9	86	81.3	73.1	172.1	162.5	146.3	360.3	340.3	306.3	720.6	680.6	612.5
8	1	10.6	10	9	21.2	20	18	45	42.5	38.3	103.2	97.5	87.8	206.5	195	175.5	432.4	408.3	367.5	864.7	816.7	735
9	1	11.8	11.1	10	23.5	22.2	20	50	47.2	42.5	114.7	108.3	97.5	229.4	216.7	195	480.4	453.7	408.3	960.8	907.4	816.7
10	1	13.2	12.5	11.3	26.5	25	22.5	56.3	53.1	47.8	129	121.9	109.7	258.1	243.8	219.4	540.4	510.4	459.4	1080.9	1020.8	918.8
11	1	14.7	13.9	12.5	29.4	27.8	25	62.5	59	53.1	143.4	135.4	121.9	286.8	270.8	243.8	600.5	567.1	510.4	1201	1134.3	1020.8
0	2	1.8	1.7	1.5	3.5	3.3	3	7.5	7.1	6.4	17.2	16.3	14.6	34.4	32.5	29.3	72.1	68.1	61.3	144.1	136.1	122.5
1	2	3.5	3.3	3	7.1	6.7	6	15	14.2	12.8	34.4	32.5	29.3	68.8	65	58.5	144.1	136.1	122.5	288.2	272.2	245
2	2	5.3	5	4.5	10.6	10	9	22.5	21.3	19.1	51.6	48.8	43.9	103.2	97.5	87.8	216.2	204.2	183.8	432.4	408.3	367.5
3	2	7.1	6.7	6	14.1	13.3	12	30	28.3	25.5	68.8	65	58.5	137.6	130	117	288.2	272.2	245	576.5	544.4	490
4	2	10.6	10	9	21.2	20	18	45	42.5	38.3	103.2	97.5	87.8	206.5	195	175.5	432.4	408.3	367.5	864.7	816.7	735
5	2	14.1	13.3	12	28.2	26.7	24	60	56.7	51	137.6	130	117	275.3	260	234	576.5	544.4	490	1152.9	1088.9	980
6	2	15.9	15	13.5	31.8	30	27	67.5	63.8	57.4	154.9	146.3	131.6	309.7	292.5	263.3	648.5	612.5	551.3	1297.1	1225	1102.5
7	2	17.6	16.7	15	35.3	33.3	30	75	70.8	63.8	172.1	162.5	146.3	344.1	325	292.5	720.6	680.6	612.5	1441.2	1361.1	1225
8	2	21.2	20	18	42.4	40	36	90	85	76.5	206.5	195	175.5	412.9	390	351	864.7	816.7	735	1729.4	1633.3	1470
9	2	23.5	22.2	20	47.1	44.4	40	100	94.4	85	229.4	216.7	195	458.8	433.3	390	960.8	907.4	816.7	1921.6	1814.8	1633.3
10	2	26.5	25	22.5	52.9	50	45	112.5	106.3	95.6	258.1	243.8	219.4	516.2	487.5	438.8	1080.9	1020.8	918.8	2161.8	2041.7	1837.5
11	2	29.4	27.8	25	58.8	55.6	50	125	118.1	106.3	286.8	270.8	243.8	573.5	541.7	487.5	1201	1134.3	1020.8	2402	2268.5	2041.7

Table 2-7. Supported Data Rates

4. This device supports simultaneous transmission operation, which allows for two SISO channels to operate independent of one another in the 2.4GHz (WLAN & BT) 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 this test report. The BT + 5GHz case is not considered as worst case since the BT power is lower than the 2.4GHz WLAN power.

Configuration 1: MIMO transmitting in 2.4GHz mode and MIMO in 5GHz mode

Description	2.4 GHz Emission	5 GHz Emission
Antenna	1, 2	1, 2
Channel	6	120
Operating Frequency (MHz)	2437	5600
Data Rate (Mbps)	1Mbps	6Mbps
Mode	802.11b	802.11a

Table 2-8. Config-1 (MIMO 2.4GHz & MIMO 5GHz)

Configuration 2: MIMO transmitting in 2.4GHz mode and MIMO in 6GHz mode

Description	2.4 GHz Emission	6 GHz Emission
Antenna	1, 2	1, 2
Channel	6	2
Operating Frequency (MHz)	2437	5935
Data Rate (Mbps)	1Mbps	6Mbps
Mode	802.11b	802.11a

Table 2-9. Config-2 (MIMO 2.4GHz & MIMO 6GHz)

2.3 Antenna Description

The following antenna gains were used for the testing.

Frequency [GHz]	Antenna 1 Gain [dBi]	Antenna 2 Gain [dBi]	Directional Ant. Gain [dBi]
5.20	0.29	-0.47	2.93
5.30	0.50	-0.85	2.86
5.60	0.21	-0.09	3.07
5.80	0.26	0.03	3.16
5.90	0.60	0.14	3.38

Table 2-10. Antenna Peak Gain

2.4 Test Configuration

ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See 5GHz UNII OFDM report for AC line conducted emissions test setups, 7.6 for radiated emissions test setups, and 7.2, 7.2.2, 7.3.3, and 7.5 for antenna port conducted emissions test setups.

2.5 Software and Firmware

The test was conducted with software version Windows 11 and firmware version REV 1.0installed on the EUT.

2.6 EMI Suppression Device(s) / Modifications

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

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) was used in the measurement of the EUT**.**

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

3.2 Radiated Emissions

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

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

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

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

3.3 Environmental Conditions

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

4.0 ANTENNA REQUIREMENTS

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

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

Conclusion:

The EUT complies with the requirement of §15.203.

5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

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

6.0 TEST EQUIPMENT CALIBRATION DATA

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

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
N/A	WL25-1	Conducted Cable Set (25GHz)	11/15/2023	Annual	11/15/2024	WL25-1
N/A	WL25-2	Conducted Cable Set (25GHz)	11/15/2023	Annual	11/15/2024	WL25-2
N/A	WL40-1	Conducted Cable Set (40GHz)	11/15/2023	Annual	11/15/2024	WL40-1
N/A	ETS-001	EMC Cable and Switch Systems	11/15/2023	Annual	11/15/2024	ETS-001
N/A	ETS-002	EMC Cable and Switch Systems	11/15/2023	Annual	11/15/2024	ETS-002
N/A	AP1-002	EMC Cable and Switch Systems	11/15/2023	Annual	11/15/2024	AP1-002
N/A	AP2-001	EMC Cable and Switch Systems	11/15/2023	Annual	11/15/2024	AP2-001
N/A	AP2-001	EMC Cable and Switch Systems	11/15/2023	Annual	11/15/2024	AP2-001
Anritsu	MA2411B	Pulse Power Sensor	11/8/2023	Annual	11/8/2024	1027293
Anritsu	MA2411B	Pulse Power Sensor	6/14/2023	Annual	6/14/2024	1911105
Com-Power	AL-130	9khZ-30MHz Loop Antenna	4/13/2022	Biennial	4/13/2025	121034
Keysight Technologies	N9038A	MXE EMI Reciever	8/30/2023	Annual	8/30/2024	MY51210133
Keysight Technologies	N9038A	PXA Signal Analyzer	2/29/2023	Annual	3/1/2025	MY55410501
Keysight Technologies	N6020A	MXA Signal Analyzer	3/22/2024	Annual	3/22/2025	US46470561
Keysight Technologies	N9030B	PXA Signal Analyzer	9/7/2023	Annual	9/7/2024	MY57141001
Pasternack	NMLC-2	Line Conducted Emissions Cable (NM)	11/15/2023	Annual	11/15/2024	NMLC-2
Rohde & Schwarz	ESU26	EMI Test Reciever (26.5GHz)	9/25/2023	Annual	9/25/2023	100342
Rohde & Schwarz	ESU40	EMI Test Reciever (40GHz)	9/11/2023	Annual	9/11/2024	100348
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	2/15/2024	Annual	2/15/2025	103200
Rohde & Schwarz	SFUNIT-RX	Shielded Filter Unit	3/15/2023	Annual	3/15/2025	102136
Rohde & Schwarz	SFUNIT-RX	Shielded Filter Unit	3/15/2023	Annual	3/15/2025	102132
Rohde & Schwarz	SFUNIT-RX	Shielded Filter Unit	1/11/2024	Annual	1/11/2025	102151
Sunol Sciences	DRH-118	Horn (Small)	2/21/2024	Biennial	2/21/2026	A050307
Sunol Sciences	JB5	Bi-Log Antenna (30M-5GHz)	8/30/2022	Biennial	8/30/2024	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.

7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.
FCC ID: A3LNP940XMA
FCC Classification: Unlicensed National Information Infrastructure (UNII)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
N/A	26dB Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
15.407(e)	6dB Bandwidth	>500kHz (5725-5850MHz and 5850 – 5895MHz)		PASS	Section 7.3
15.407 (a)(1)(iv), (a)(2), (a)(3)	Maximum Conducted Output Power	Maximum conducted powers must meet the limits detailed in 15.407 (a) (RSS-247 [6.2])		PASS	Section 7.4
15.407 (a)(1)(iv), (a)(2), (a)(3)	Maximum Power Spectral Density	Maximum power spectral density must meet the limits detailed in 15.407 (a) (RSS-247 [6.2])		PASS	Section 7.5
15.407(h)	Dynamic Frequency Selection	See DFS Test Report		PASS	See DFS Test Report
15.407(b)(1), (b)(2), (b)(3), (b)(4)	Undesirable Emissions	Undesirable emissions must meet the limits detailed in 15.407(b) (RSS-247 [6.2])	RADIATED	PASS	Section 7.6
15.205, 15.407(b)(1), (b)(4), (b)(5), (b)(6)	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])		PASS	Section 7.6, 7.7

Table 7-1. Summary of Test Results

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) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is Element "EMC Software Tool," Version 1.2.1.
5) For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is Element "Chamber Automation," Version 1.6.4.
6) 802.11ax/be OFDMA testing was performed for all signal tone configurations as specified by the 802.11ax standard. Worst case results are determined and reported per the guidance provided at the October 2018 TCB Workshop.
7) Only one RU index could be selected at a time, so no contiguous or non-contiguous RUs were considered for testing.

7.2 26dB Bandwidth Measurement

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 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

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

The 26dB Bandwidth measurement for each channel was measured with the RU index showing the highest conducted power.

MIMO 26dB Bandwidth Measurements

	Frequency [MHz]	802.11 MODE	Channel	Antenna-1 26dB Bandwidth [MHz]	Antenna-2 26dB Bandwidth [MHz]
Band 1	5180	be (20MHz)	36	19.20	18.86
	5200	be (20MHz)	40	19.65	16.07
	5240	be (20MHz)	48	18.15	18.89
	5190	be (40MHz)	38	27.56	23.29
	5230	be (40MHz)	46	23.27	13.72
	5210	be (80MHz)	42	27.82	29.50
Band 1/2A	5250	be (160MHz)	50	36.53	34.78
Band 2A	5260	be (20MHz)	52	9.95	19.92
	5280	be (20MHz)	56	19.76	15.74
	5320	be (20MHz)	64	16.52	18.26
	5270	be (40MHz)	54	19.30	25.43
	5310	be (40MHz)	62	26.43	23.70
	5290	be (80MHz)	58	26.98	27.37
Band 2C	5500	be (20MHz)	100	19.82	14.42
	5600	be (20MHz)	120	19.98	18.67
	5720	be (20MHz)	144	19.80	16.76
	5510	be (40MHz)	102	19.70	24.01
	5590	be (40MHz)	118	12.81	23.20
	5710	be (40MHz)	142	24.41	23.86
	5530	be (80MHz)	106	25.13	33.37
	5610	be (80MHz)	122	19.04	30.24
	5690	be (80MHz)	138	28.52	28.11
	5570	be (160MHz)	114	35.50	37.16

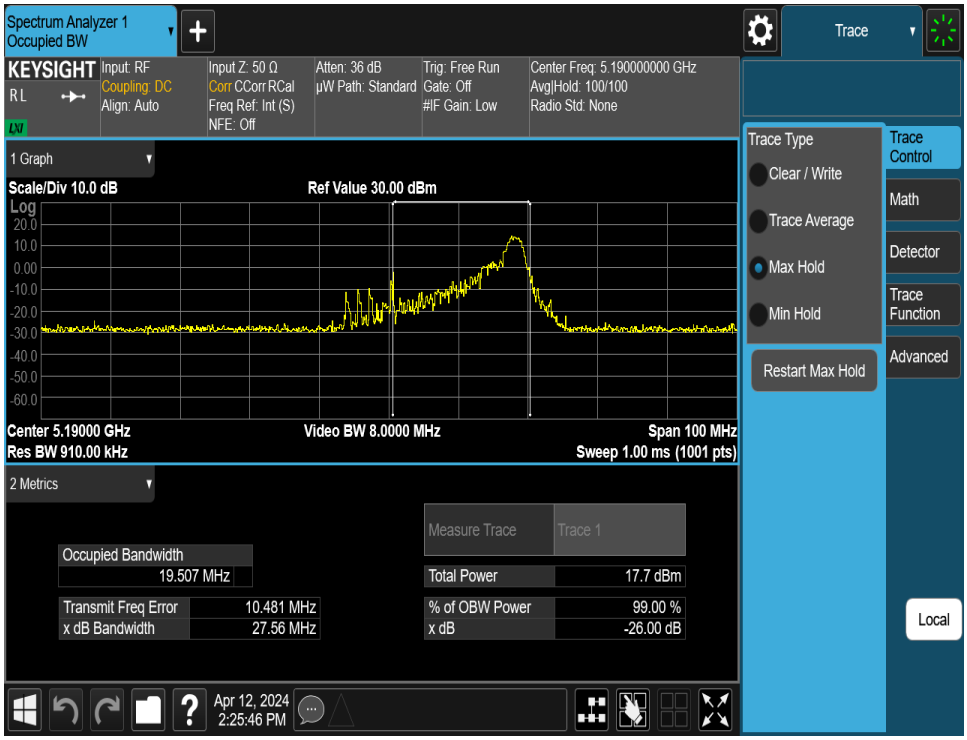
Table 7-2. Bands 1, 2A, 2C Conducted 26dB Bandwidth Measurements MIMO ANT1/2 (26 Tones)

	Frequency [MHz]	802.11 MODE	Channel	Antenna-1 26dB Bandwidth [MHz]	Antenna-2 26dB Bandwidth [MHz]
Band 1	5180	be (20MHz)	36	21.15	21.28
	5200	be (20MHz)	40	21.48	21.11
	5240	be (20MHz)	48	21.59	21.51
	5190	be (40MHz)	38	42.17	41.91
	5230	be (40MHz)	46	42.18	41.54
	5210	be (80MHz)	42	87.22	85.44
Band 1/2A	5250	be (160MHz)	50	174.92	175.78
Band 2A	5260	be (20MHz)	52	21.21	21.01
	5280	be (20MHz)	56	21.40	21.43
	5320	be (20MHz)	64	21.09	21.22
	5270	be (40MHz)	54	43.27	42.42
	5310	be (40MHz)	62	42.02	41.88
	5290	be (80MHz)	58	93.08	86.08
Band 2C	5500	be (20MHz)	100	21.25	20.89
	5600	be (20MHz)	120	21.25	21.40
	5720	be (20MHz)	144	21.39	21.37
	5510	be (40MHz)	102	43.30	43.01
	5590	be (40MHz)	118	42.23	42.10
	5710	be (40MHz)	142	42.63	42.12
	5530	be (80MHz)	106	88.13	89.49
	5610	be (80MHz)	122	86.10	85.76
	5690	be (80MHz)	138	86.60	84.47
	5570	be (160MHz)	114	176.15	176.70

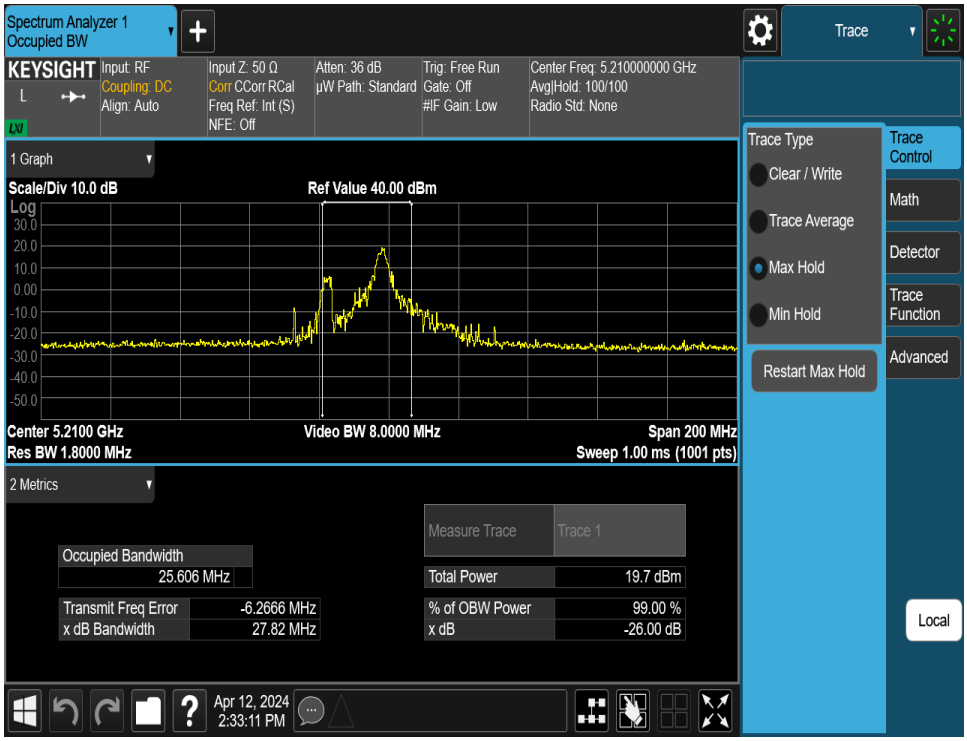
Table 7-3. Bands 1, 2A, 2C Conducted 26dB Bandwidth Measurements MIMO ANT1/2 (Full Tones)

7.2.1 MIMO Antenna-1 26dB Bandwidth Measurements

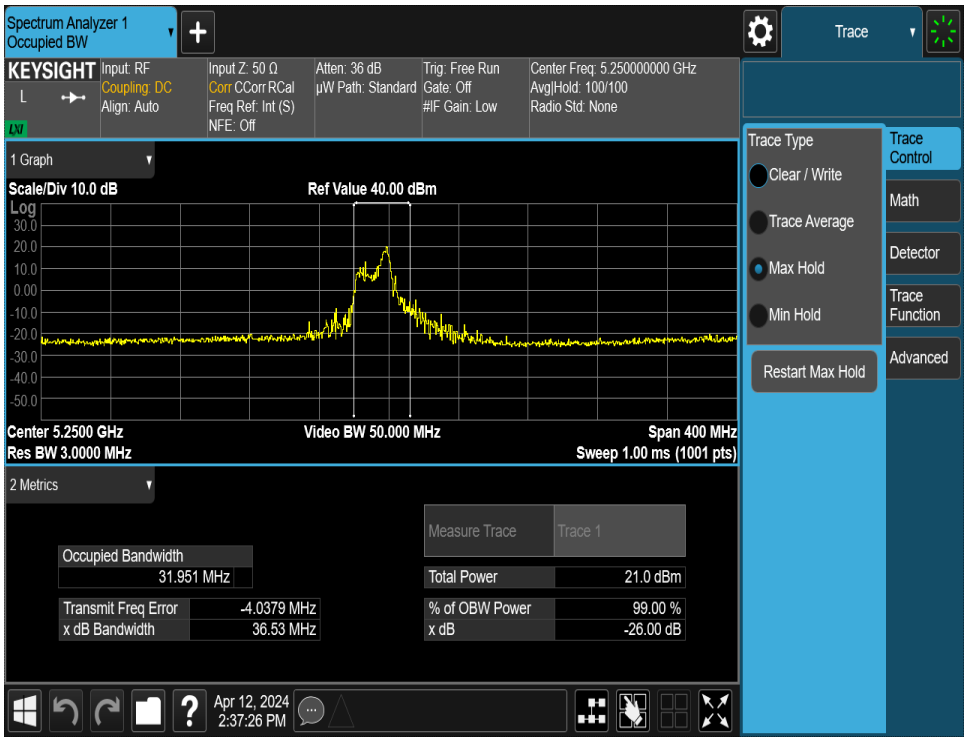
Plot 7-1. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11be – 26 Tones (UNII Band 1) – Ch. 40)



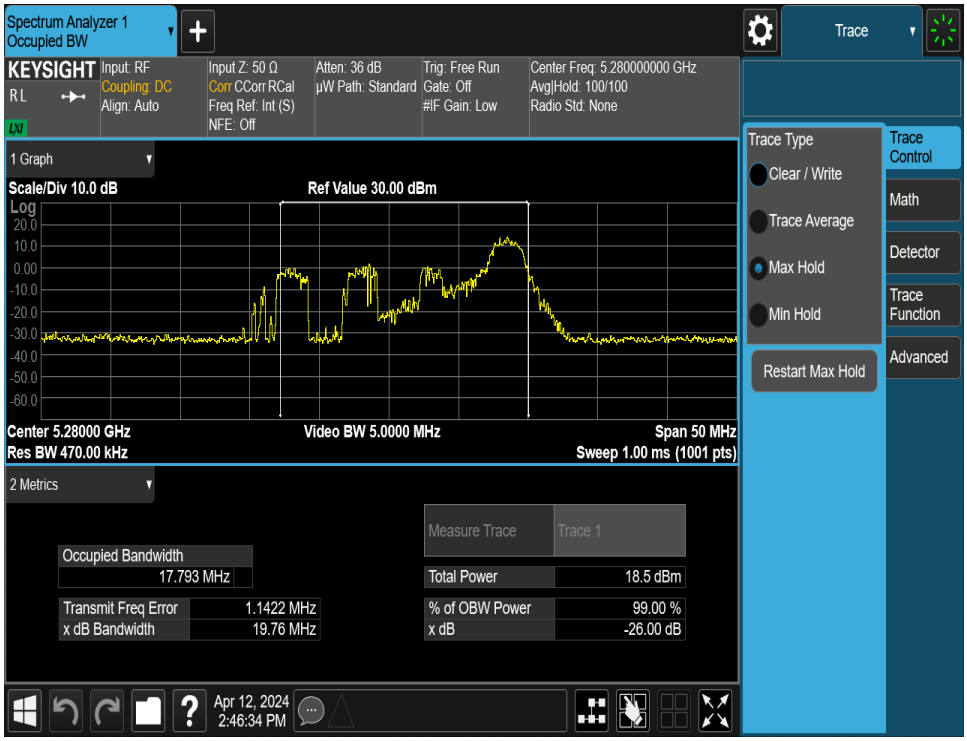
Plot 7-2. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11be – 26 Tones (UNII Band 1) – Ch. 38)



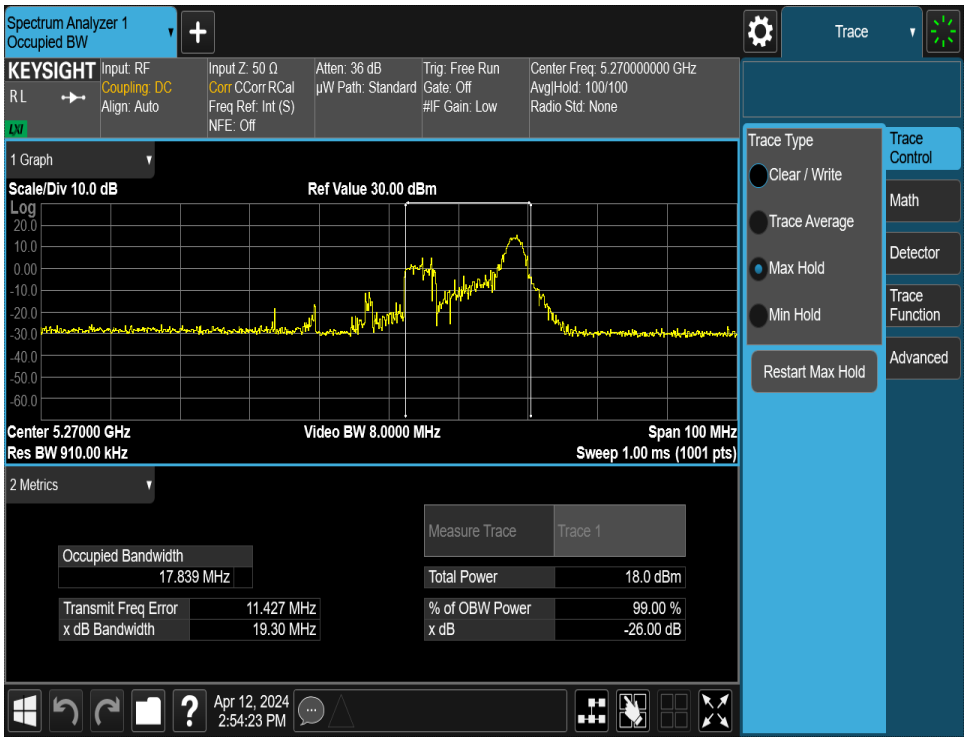
Plot 7-3. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11be – 26 Tones (UNII Band 1) – Ch. 42)



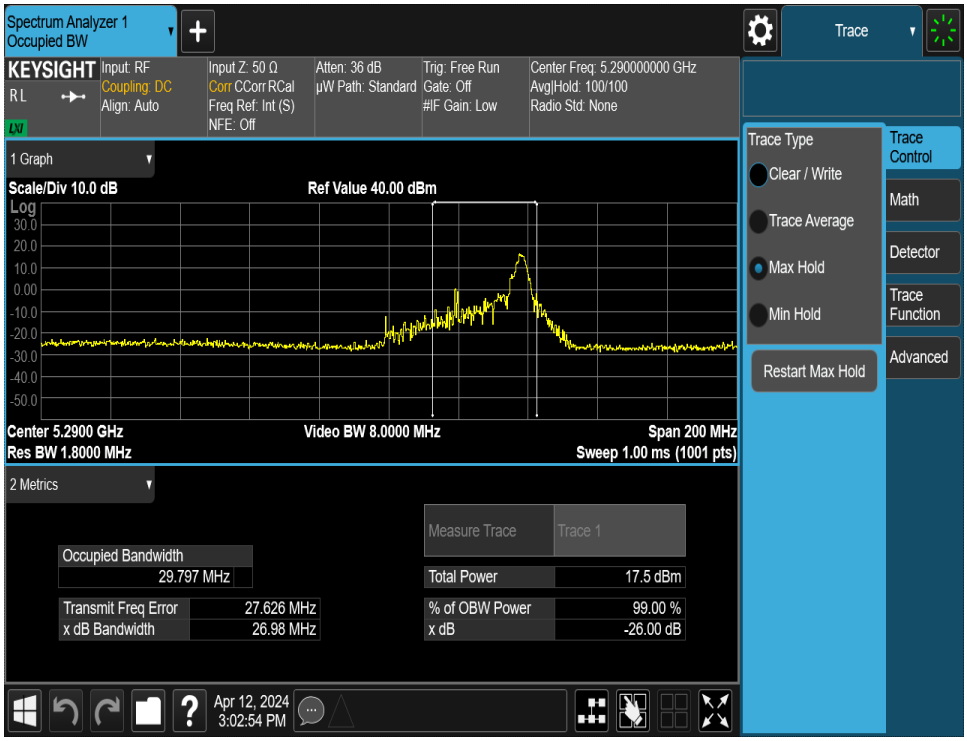
Plot 7-4. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11be – 26 Tones (UNII Band 1/2A) – Ch. 50)



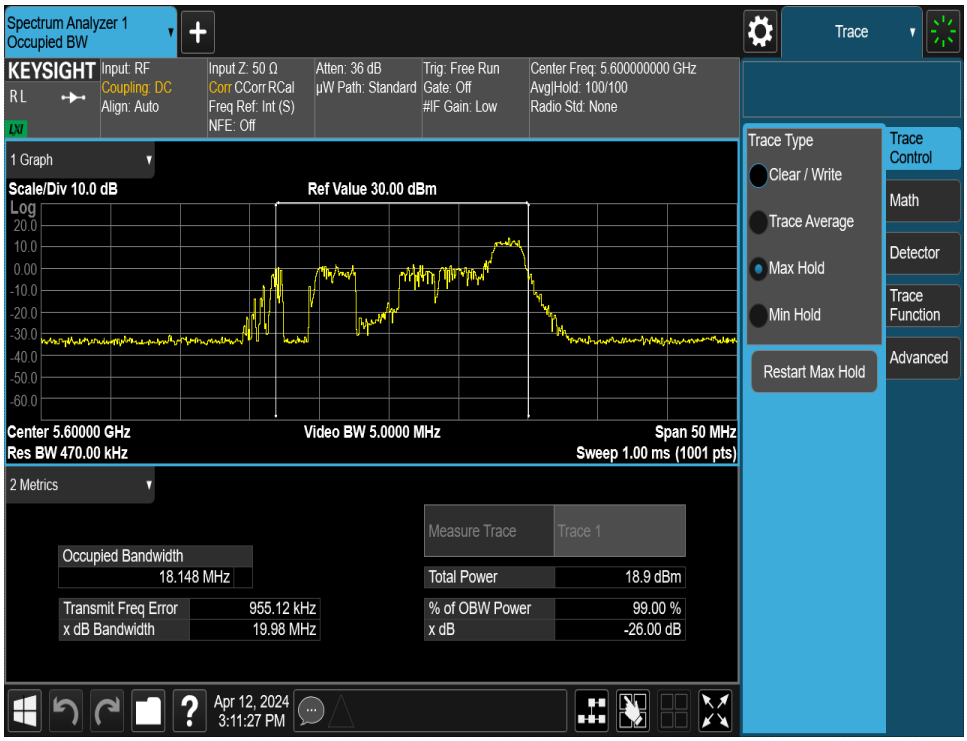
Plot 7-5. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11be – 26 Tones (UNII Band 2A) – Ch. 56)



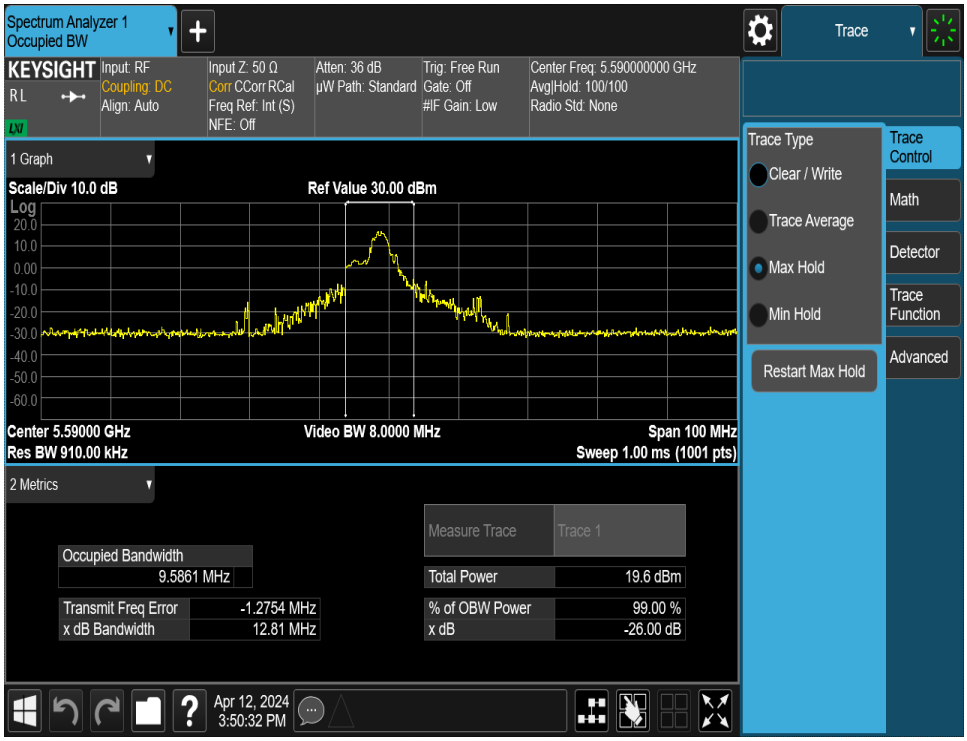
Plot 7-6. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11be – 26 Tones (UNII Band 2A) – Ch. 54)



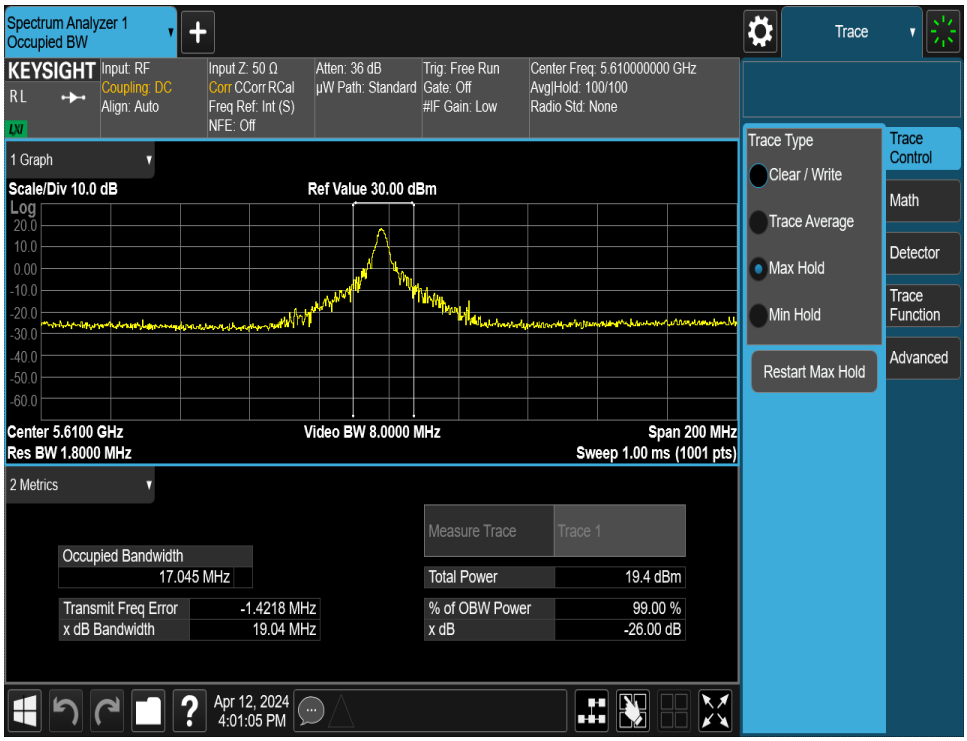
Plot 7-7. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11be – 26 Tones (UNII Band 2A) – Ch. 58)



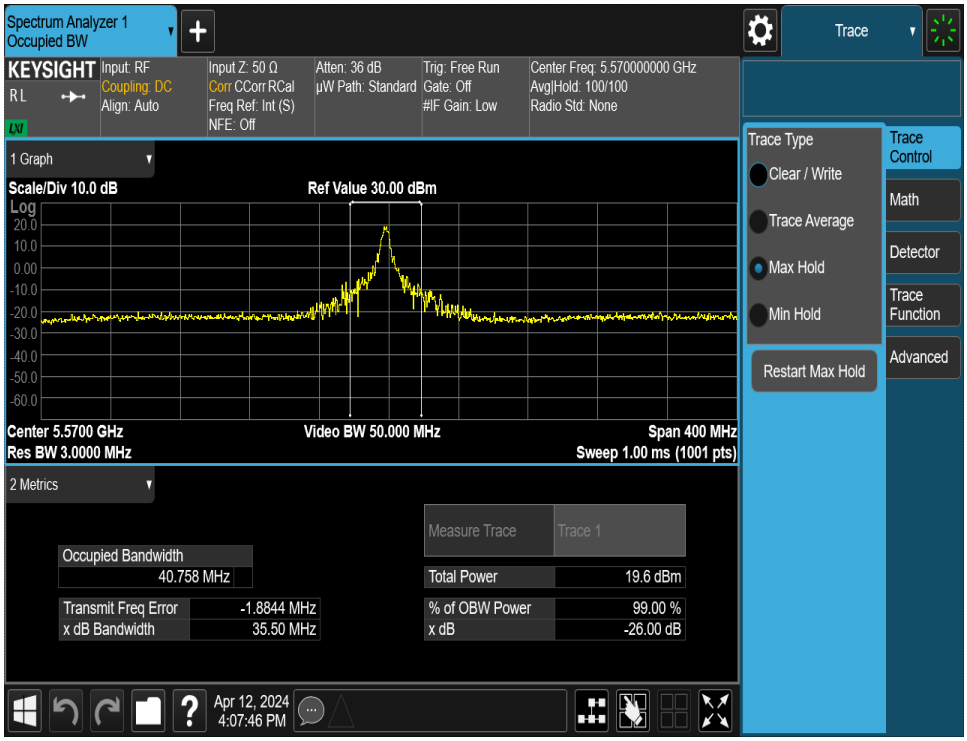
Plot 7-8. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11be – 26 Tones (UNII Band 2C) – Ch. 120)



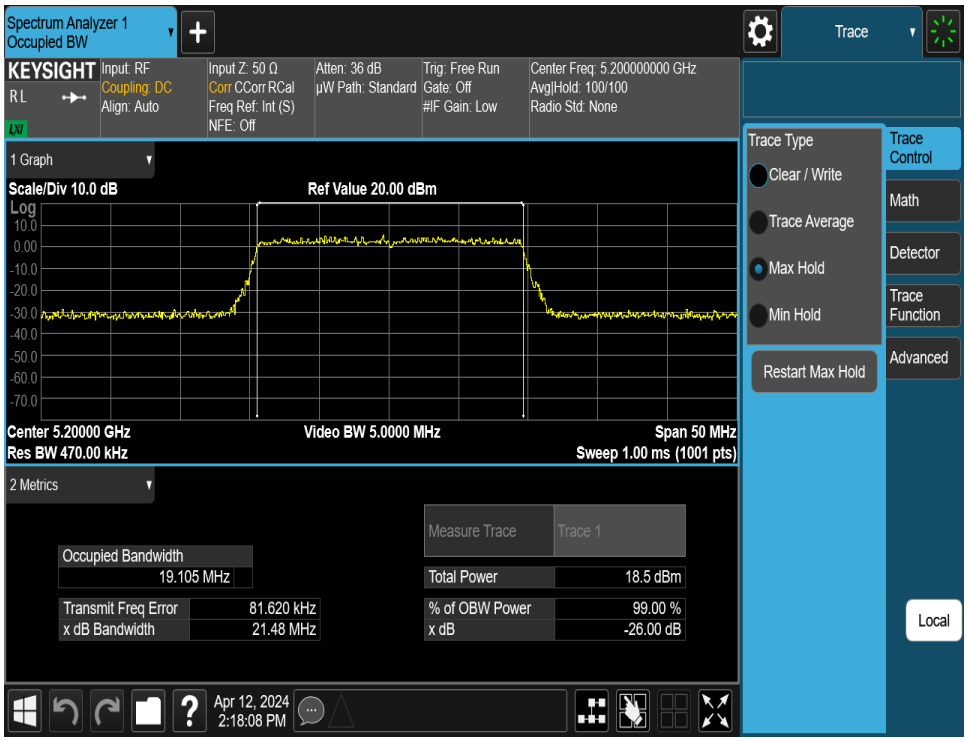
Plot 7-9. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11be – 26 Tones (UNII Band 2C) – Ch. 118)



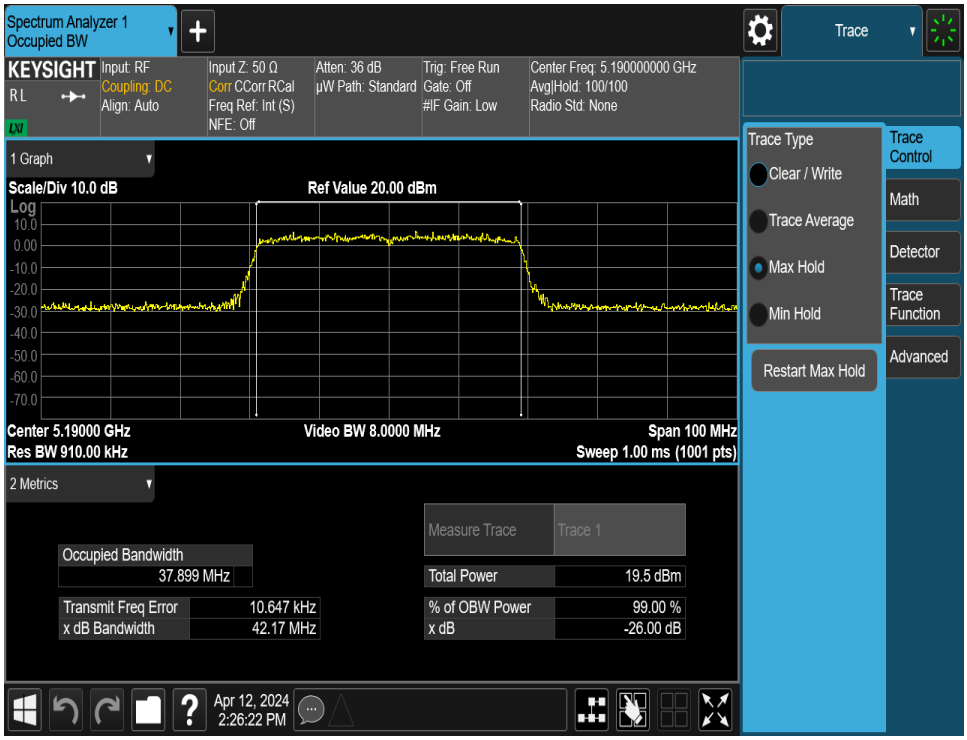
Plot 7-10. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11be – 26 Tones (UNII Band 2C) – Ch. 122)



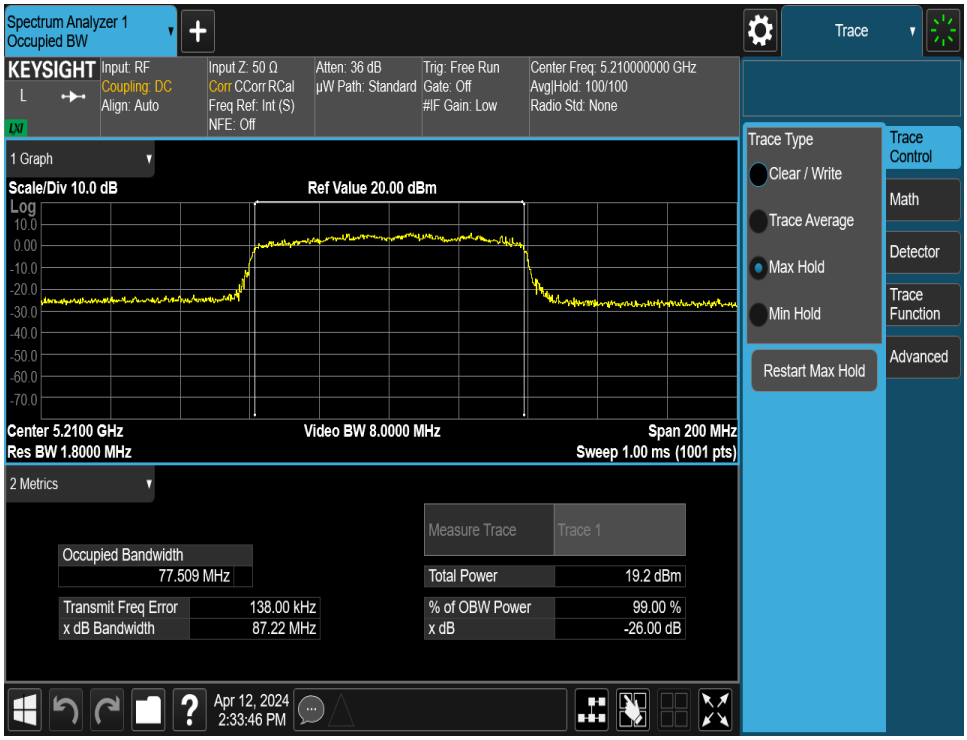
Plot 7-11. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11be – 26 Tones (UNII Band 2C) – Ch. 114)



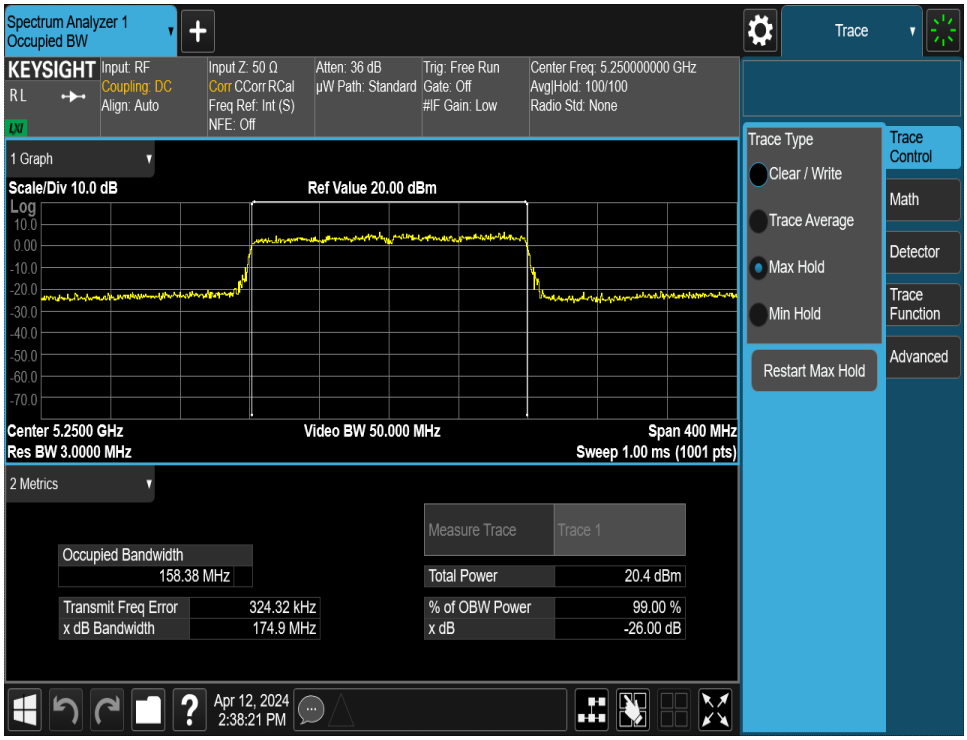
Plot 7-12. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11be – 242 Tones (UNII Band 1) – Ch. 40)



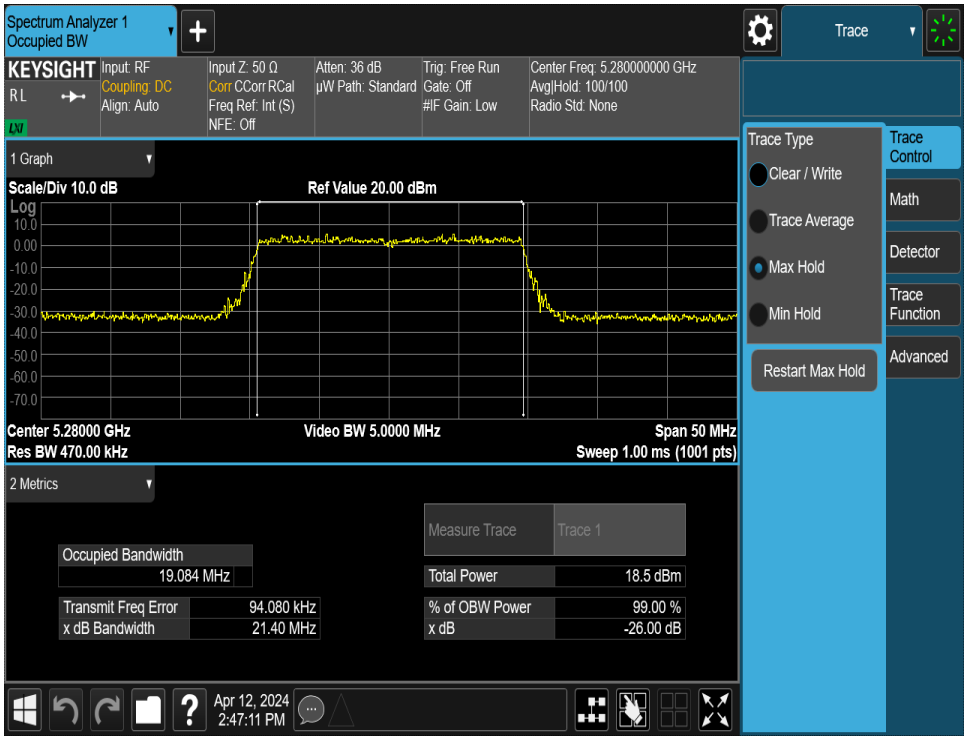
Plot 7-13. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11be – 484 Tones (UNII Band 1) – Ch. 38)



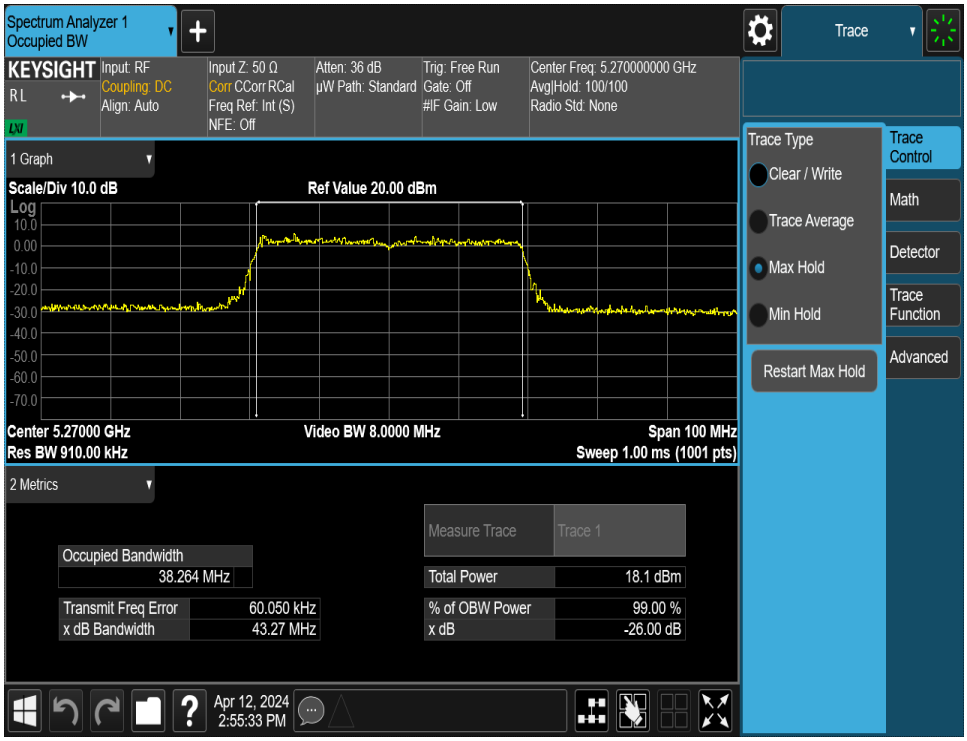
Plot 7-14. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11be – 996 Tones (UNII Band 1) – Ch. 42)



Plot 7-15. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11be – 2x996 Tones (UNII Band 1/2A) – Ch. 50)

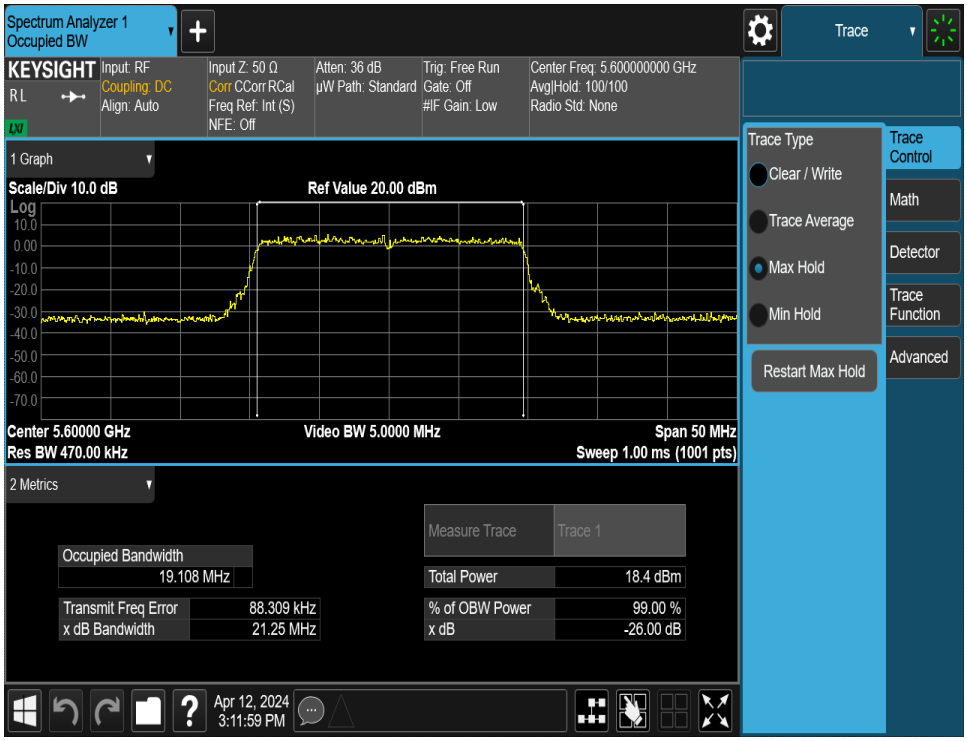


Plot 7-16. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11be – 242 Tones (UNII Band 2A) – Ch. 56)

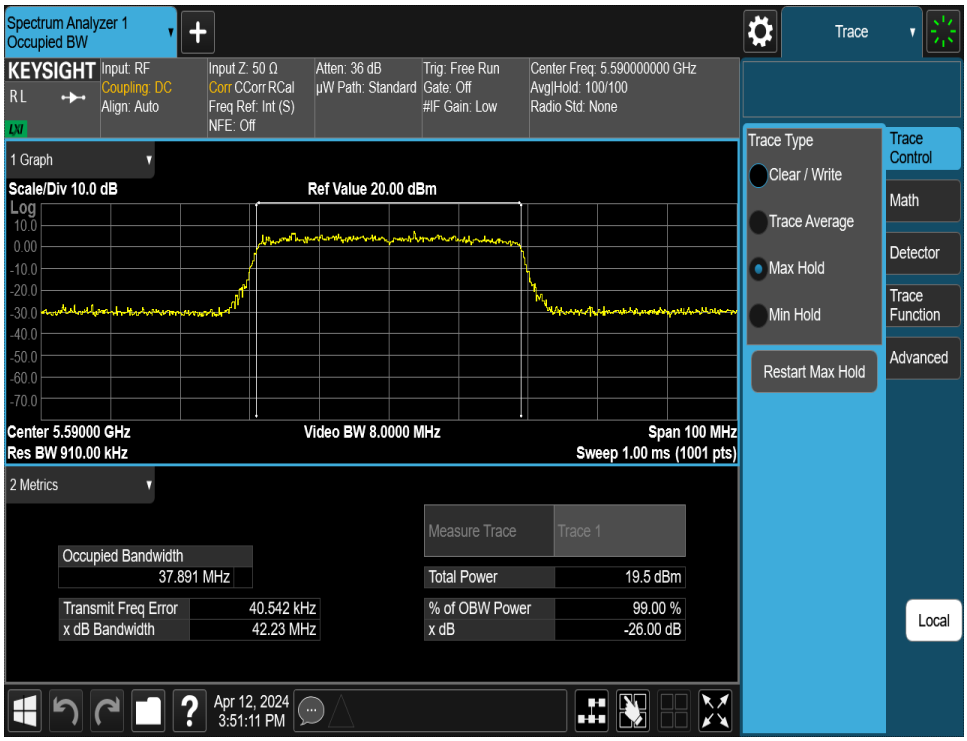


Plot 7-17. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11be – 484 Tones (UNII Band 2A) – Ch. 54)

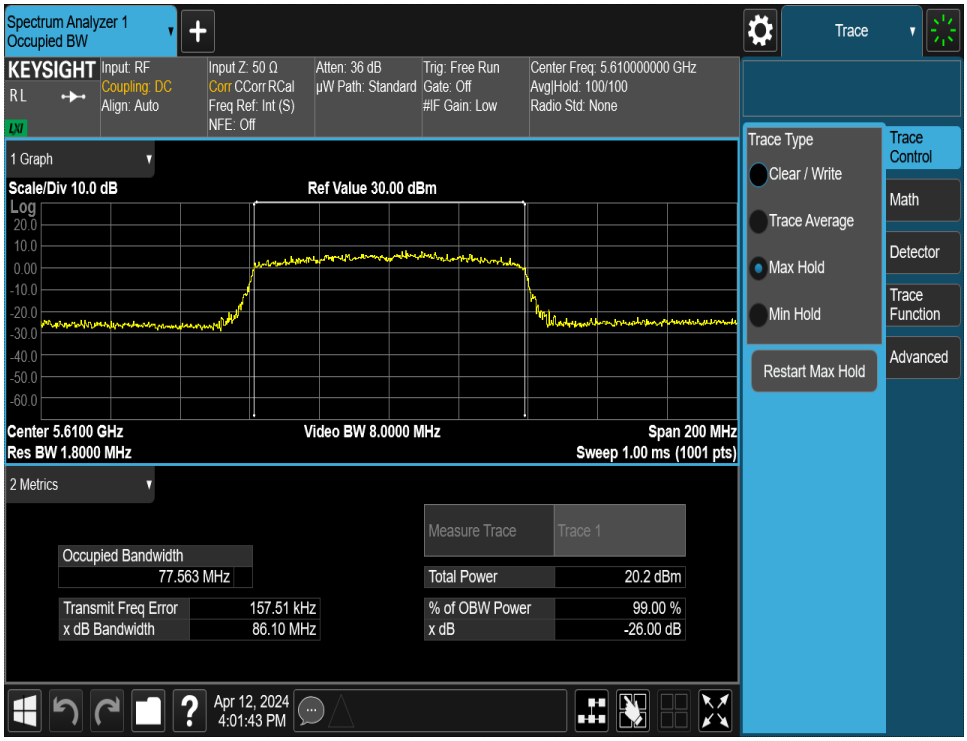
Plot 7-18. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11be – 996 Tones (UNII Band 2A) – Ch. 58)



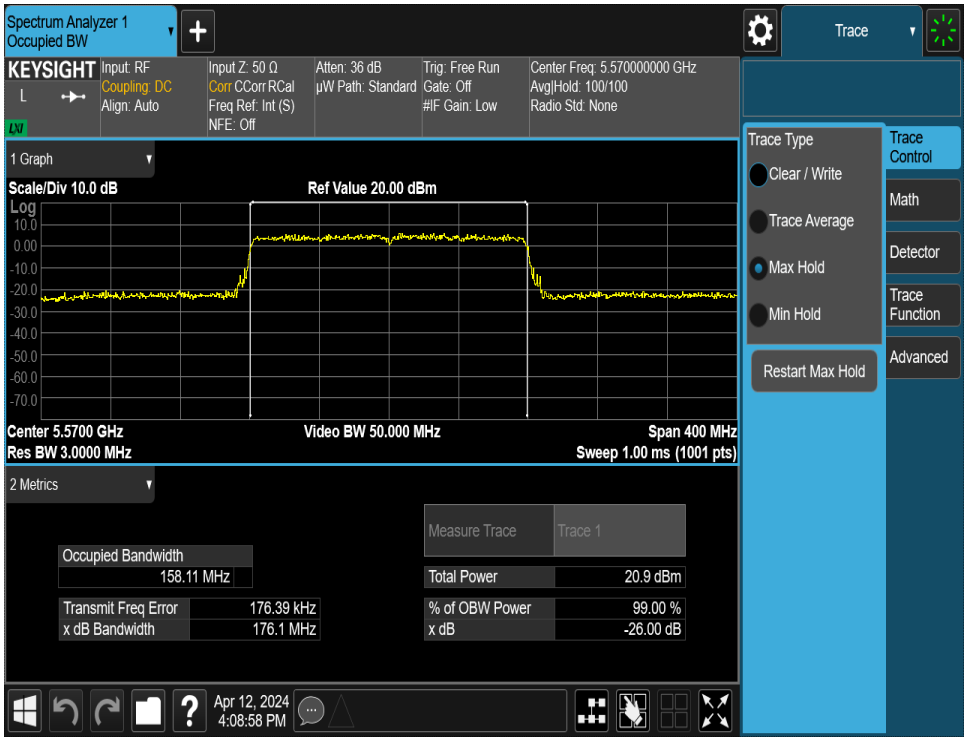
Plot 7-19. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11be – 242 Tones (UNII Band 2C) – Ch. 120)



Plot 7-20. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11be – 484 Tones (UNII Band 2C) – Ch. 118)



Plot 7-21. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11be – 996 Tones (UNII Band 2C) – Ch. 122)



Plot 7-22. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11be – 2x996 Tones (UNII Band 2C) – Ch. 114)

7.3 6dB Bandwidth Measurement

Test Overview and Limit

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the 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 at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 6dB bandwidth.

In the 5.725 – 5.850GHz and 5.850-5.895GHz bands, the 6dB bandwidth must be ≥ 500 kHz.

Test Procedure Used

ANSI C63.10-2013 – Section 6.9.2

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. 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 = 100 kHz
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple

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

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

MIMO 6dB Bandwidth Measurements

	Frequency [MHz]	802.11 MODE	Channel	Antenna-1 6dB Bandwidth [MHz]	Antenna-2 6dB Bandwidth [MHz]
Band 3	5745	be (20MHz)	149	2.09	2.09
	5785	be (20MHz)	157	2.18	2.11
	5825	be (20MHz)	165	2.04	2.09
	5755	be (40MHz)	151	2.17	2.21
	5795	be (40MHz)	159	2.12	2.13
	5775	be (80MHz)	155	2.32	2.30

Table 7-4. Band 3 Conducted 6dB Bandwidth Measurements MIMO ANT1/2 (26 Tones)

	Frequency [MHz]	802.11 MODE	Channel	Antenna-1 6dB Bandwidth [MHz]	Antenna-2 6dB Bandwidth [MHz]
Band 3/4	5845	be (20MHz)	169	2.09	2.09
Band 4	5865	be (20MHz)	173	2.13	2.08
	5885	be (20MHz)	177	2.11	2.10
Band 3/4	5835	be (40MHz)	167	7.32	2.16
Band 4	5875	be (40MHz)	175	2.19	2.18
Band 3/4	5855	be (80MHz)	171	2.34	2.31
	5815	be (160MHz)	163	2.58	2.51

Table 7-5. Bands 3/4 Conducted 6dB Bandwidth Measurements MIMO ANT1/2 (26 Tones)

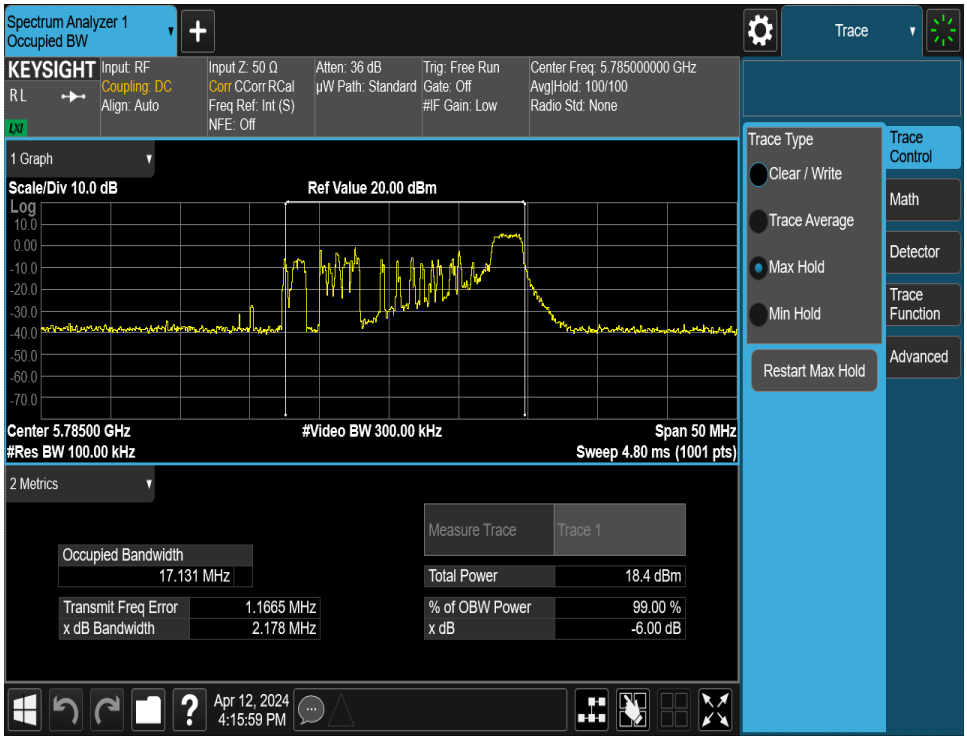
	Frequency [MHz]	802.11 MODE	Channel	Antenna-1 6dB Bandwidth [MHz]	Antenna-2 6dB Bandwidth [MHz]
Band 3	5745	be (20MHz)	149	19.04	18.79
	5785	be (20MHz)	157	18.92	18.91
	5825	be (20MHz)	165	18.99	18.82
	5755	be (40MHz)	151	36.38	35.92
	5795	be (40MHz)	159	36.88	37.04
	5775	be (80MHz)	155	75.10	75.16

Table 7-6. Band 3 Conducted 6dB Bandwidth Measurements MIMO ANT1/2 (Full Tones)

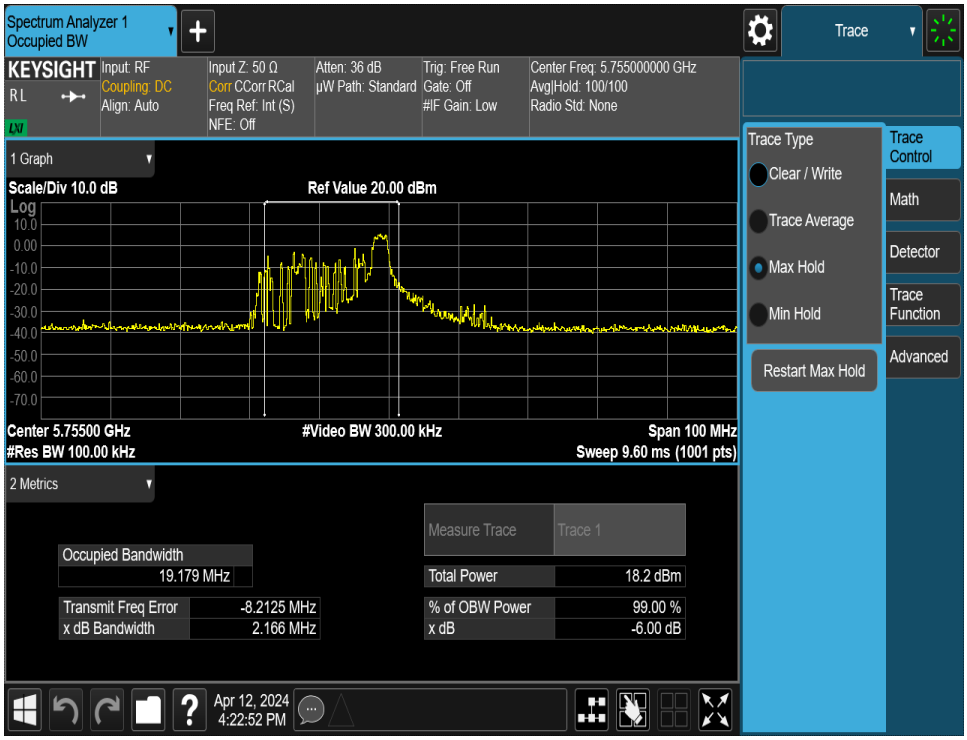
	Frequency [MHz]	802.11 MODE	Channel	Antenna-1 6dB Bandwidth [MHz]	Antenna-2 6dB Bandwidth [MHz]
Band 3/4	5845	be (20MHz)	169	18.84	18.88
Band 4	5865	be (20MHz)	173	19.03	18.77
	5885	be (20MHz)	177	19.01	19.01
Band 3/4	5835	be (40MHz)	167	37.02	37.29
Band 4	5875	be (40MHz)	175	37.12	37.33
Band 3/4	5855	be (80MHz)	171	75.26	75.24
	5815	be (160MHz)	163	157.87	158.07

Table 7-7. Bands 3/4 Conducted 6dB Bandwidth Measurements MIMO ANT1/2 (Full Tones)

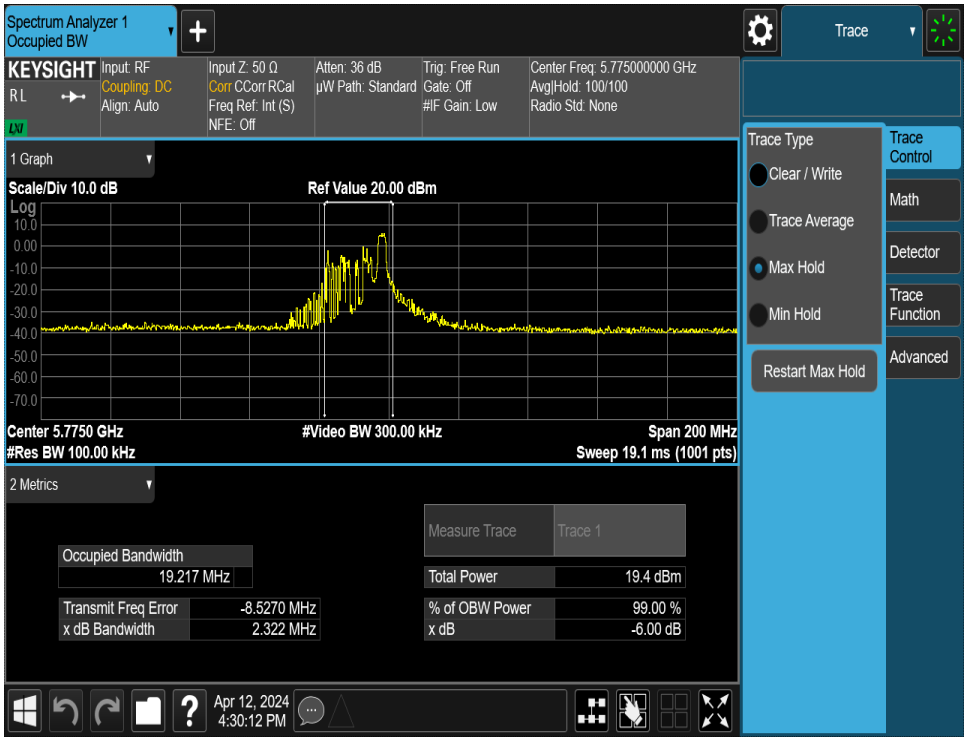
7.3.1 MIMO Antenna-1 6dB Bandwidth Measurements



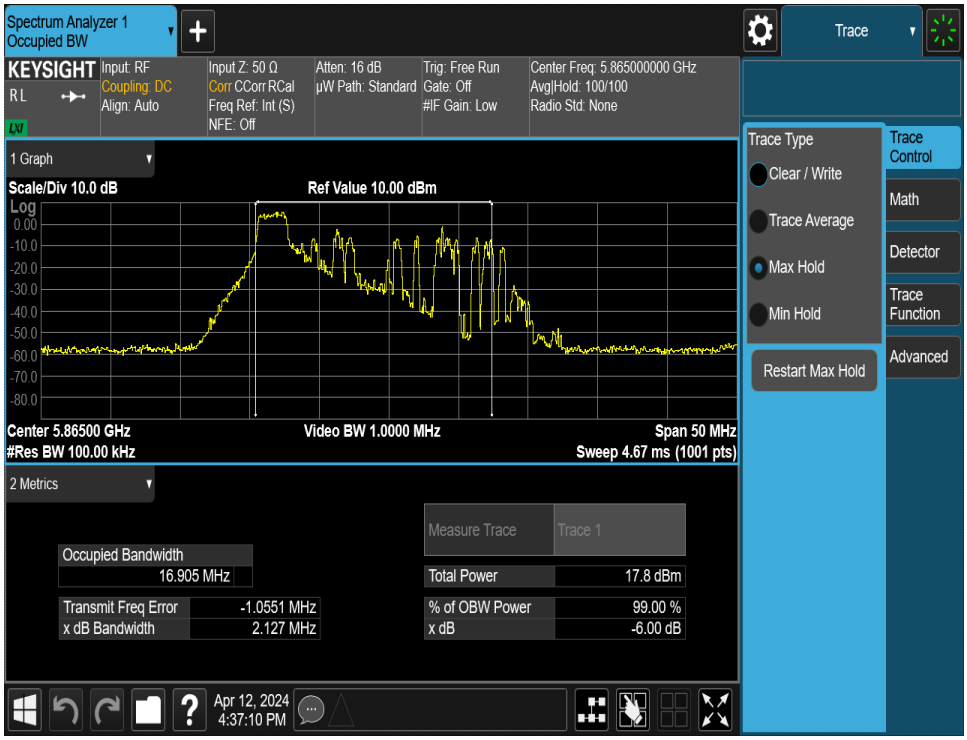
Plot 7-23. 6dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11be – 26 Tones (UNII Band 3) – Ch. 157)



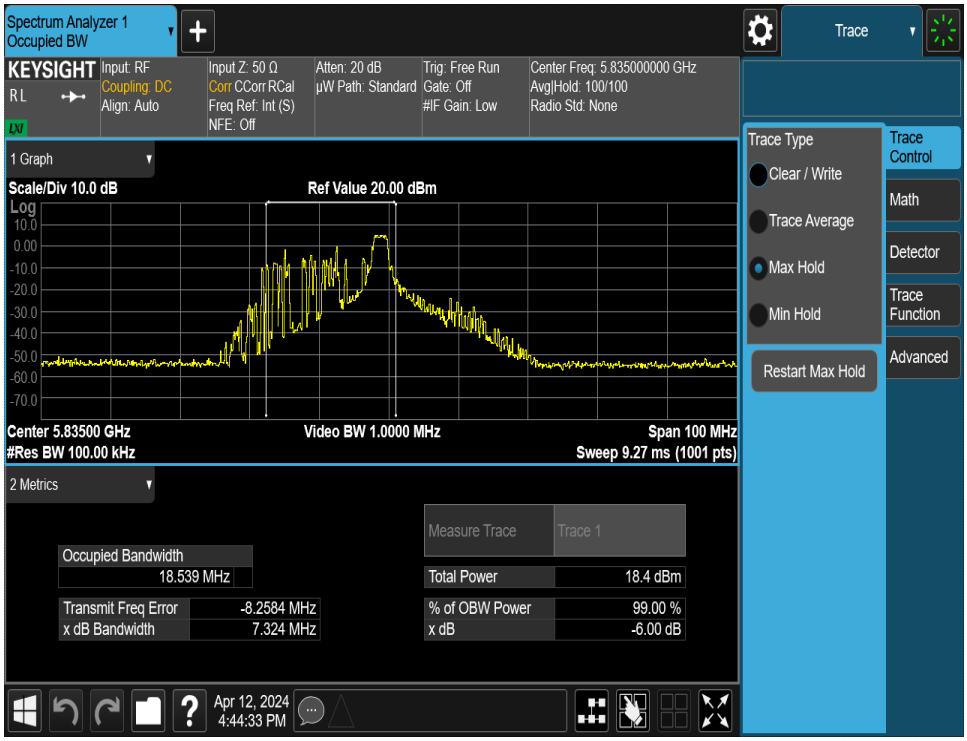
Plot 7-24. 6dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11be – 26 Tones (UNII Band 3) – Ch. 151)



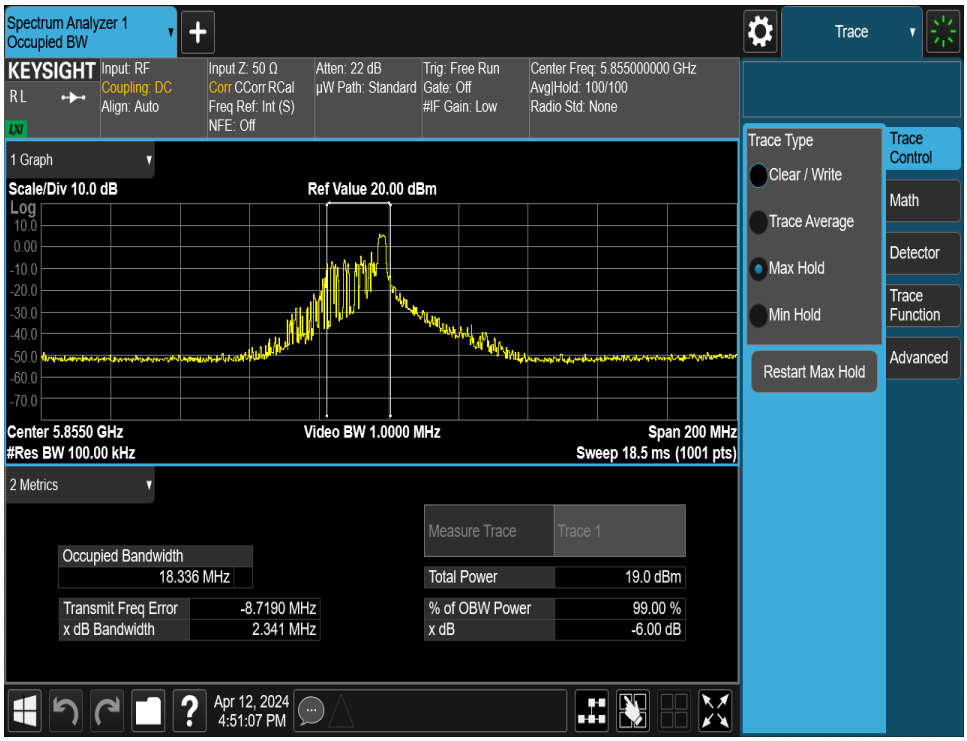
Plot 7-25. 6dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11be – 26 Tones (UNII Band 3) – Ch. 155)



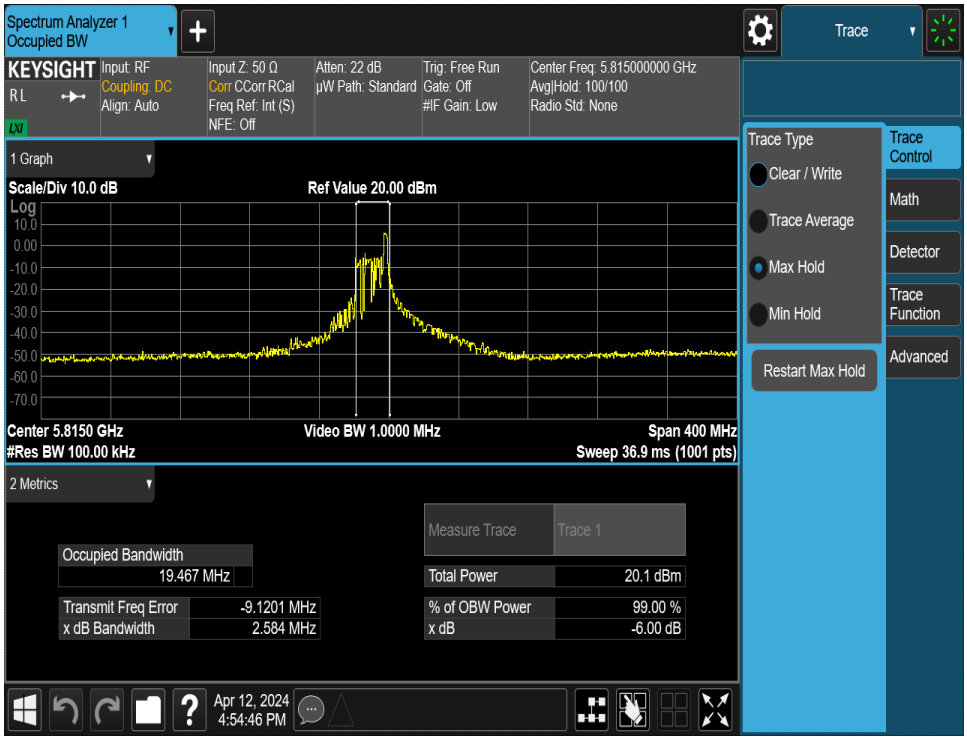
Plot 7-26. 6dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11be – 26 Tones (UNII Band 4) – Ch. 173)



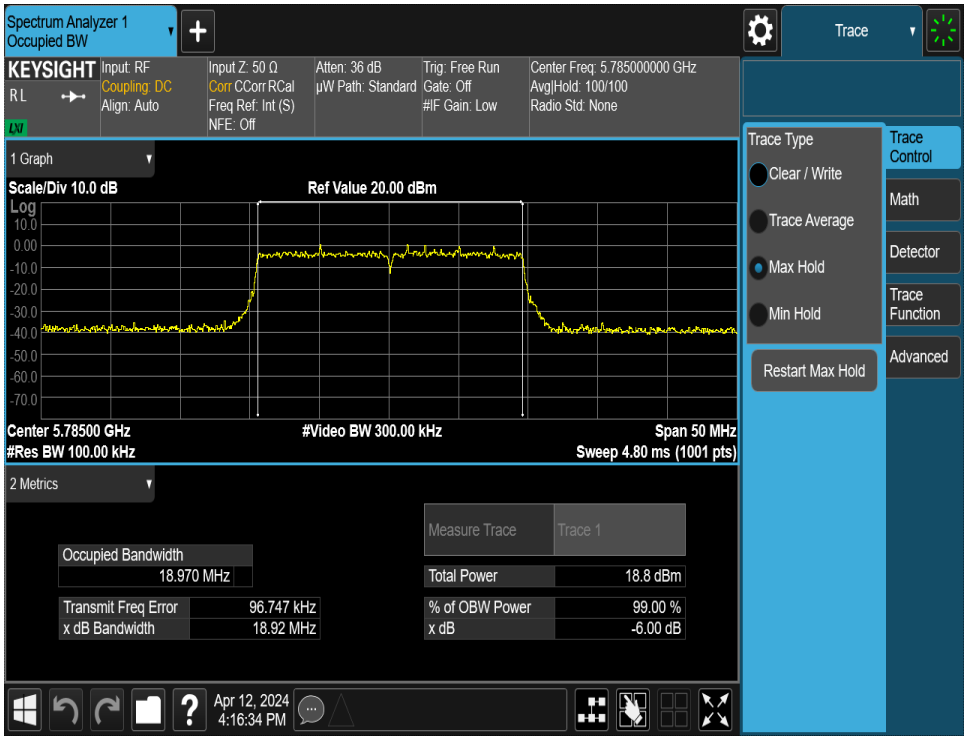
Plot 7-27. 6dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11be – 26 Tones (UNII Band 3/4) – Ch. 167)



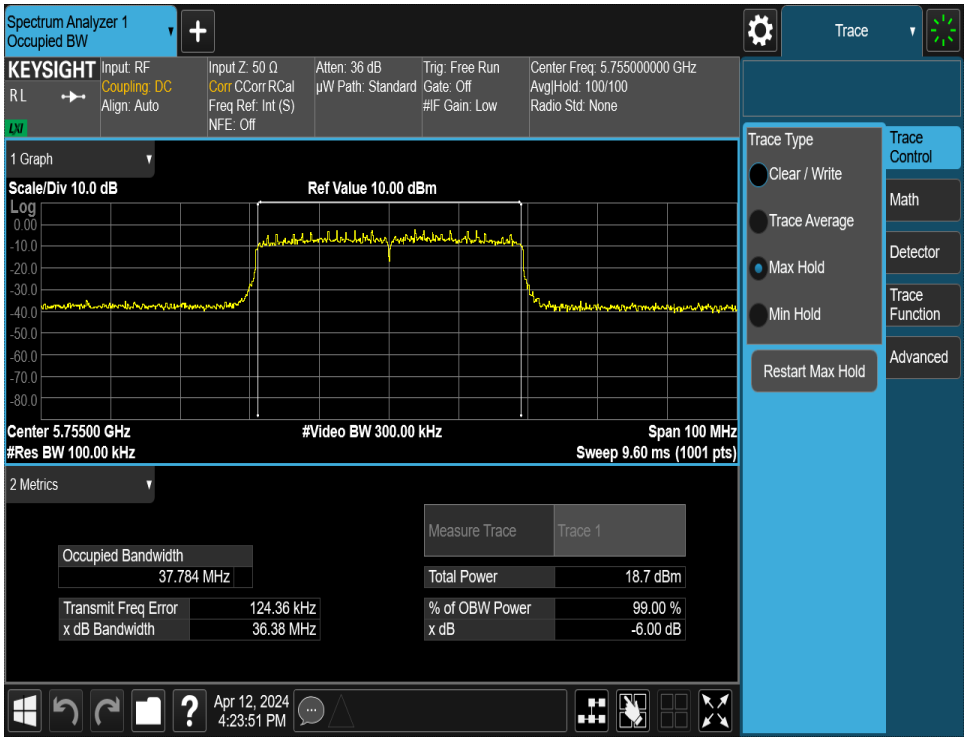
Plot 7-28. 6dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11be – 26 Tones (UNII Band 3/4) – Ch. 171)



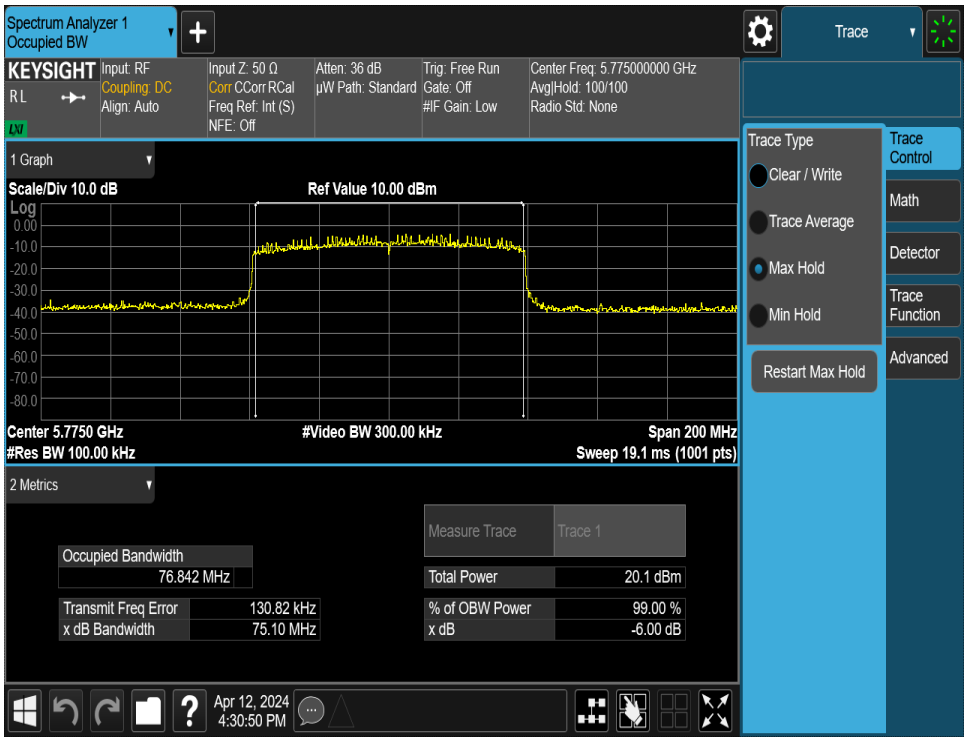
Plot 7-29. 6dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11be – 26 Tones (UNII Band 3/4) – Ch. 163)



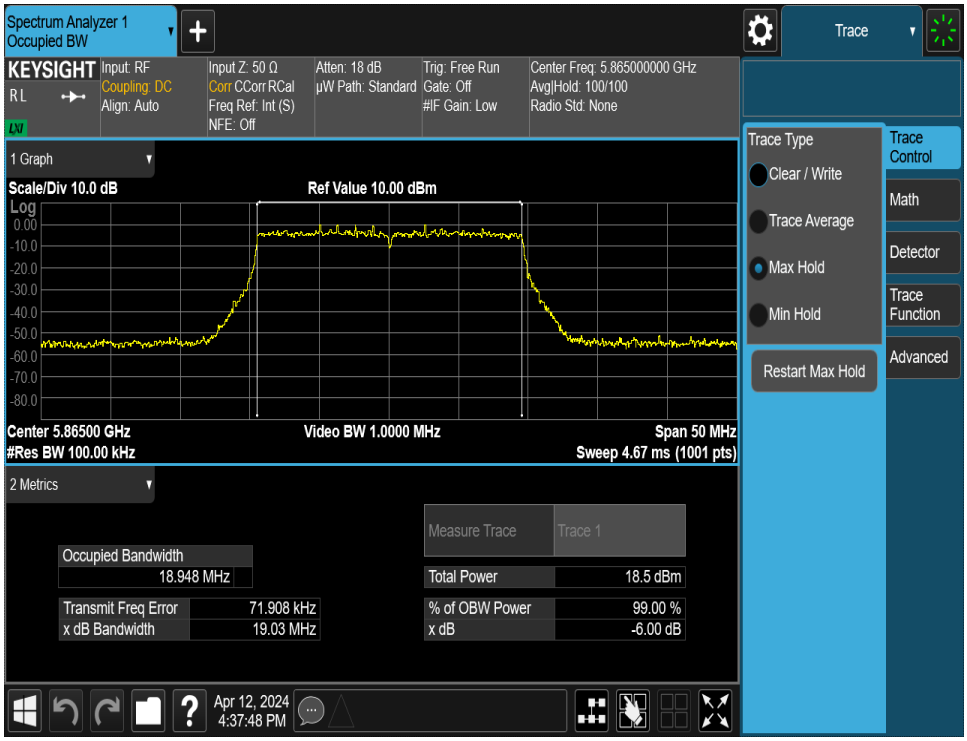
Plot 7-30. 6dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11be – 242 Tones (UNII Band 3) – Ch. 157)



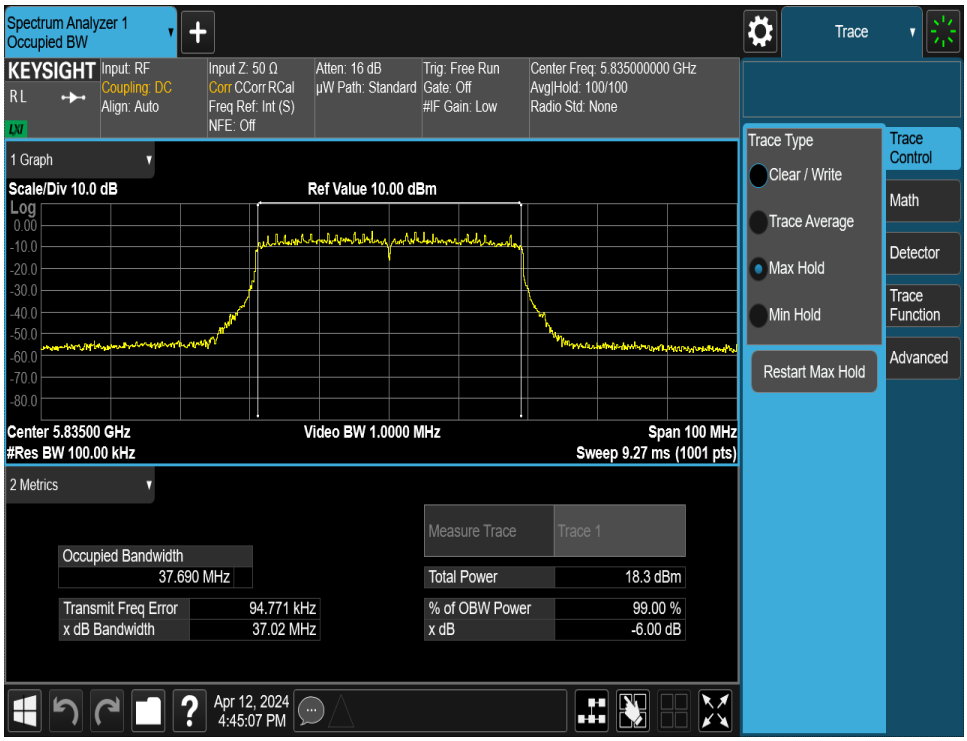
Plot 7-31. 6dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11be – 484 Tones (UNII Band 3) – Ch. 151)



Plot 7-32. 6dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11be – 996 Tones (UNII Band 3) – Ch. 155)

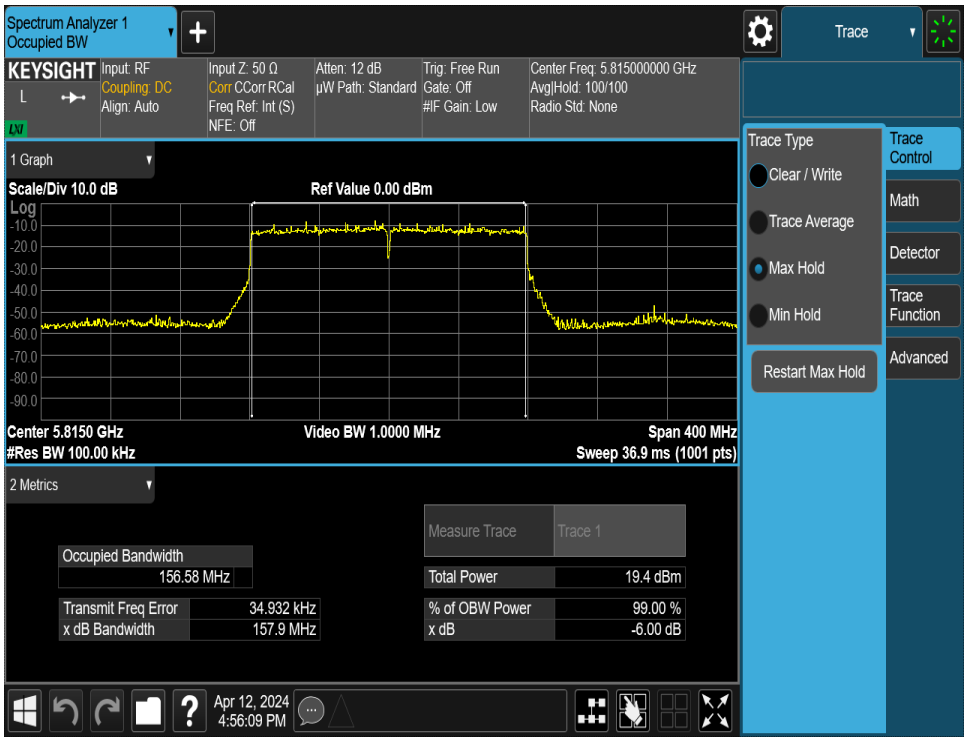


Plot 7-33. 6dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11be – 242 Tones (UNII Band 4) – Ch. 173)



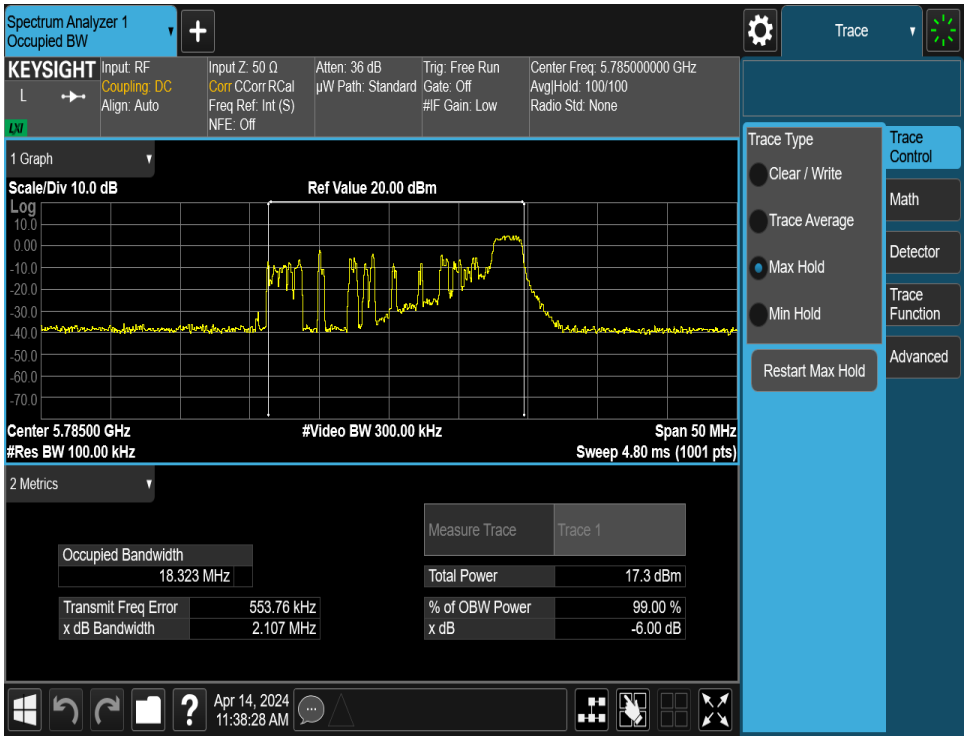
Plot 7-34. 6dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11be – 484 Tones (UNII Band 3/4) – Ch. 167)

Plot 7-35. 6dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11be – 996 Tones (UNII Band 3/4) – Ch. 171)

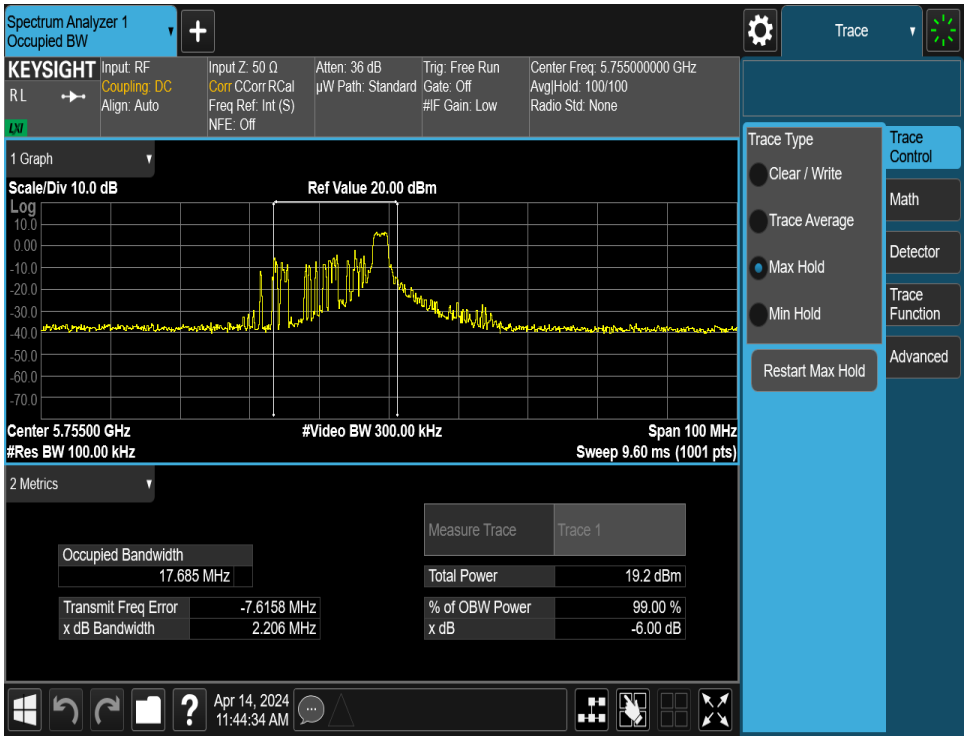


Plot 7-36. 6dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11be – 996*2 Tones (UNII Band 3/4) – Ch. 163)

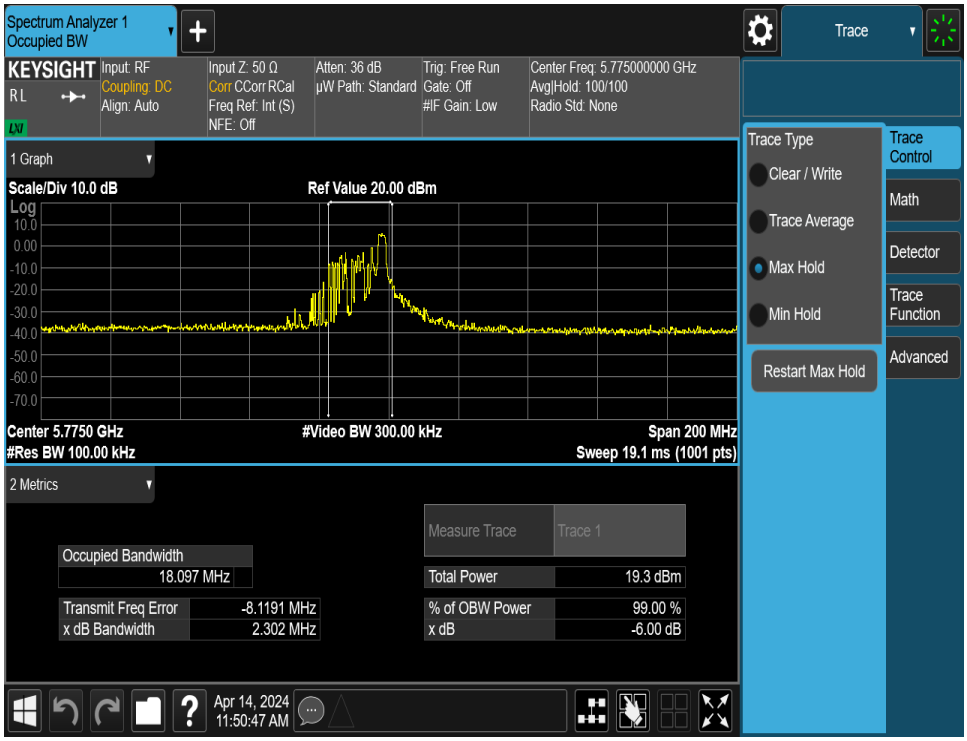
7.3.2 MIMO Antenna-2 6dB Bandwidth Measurements



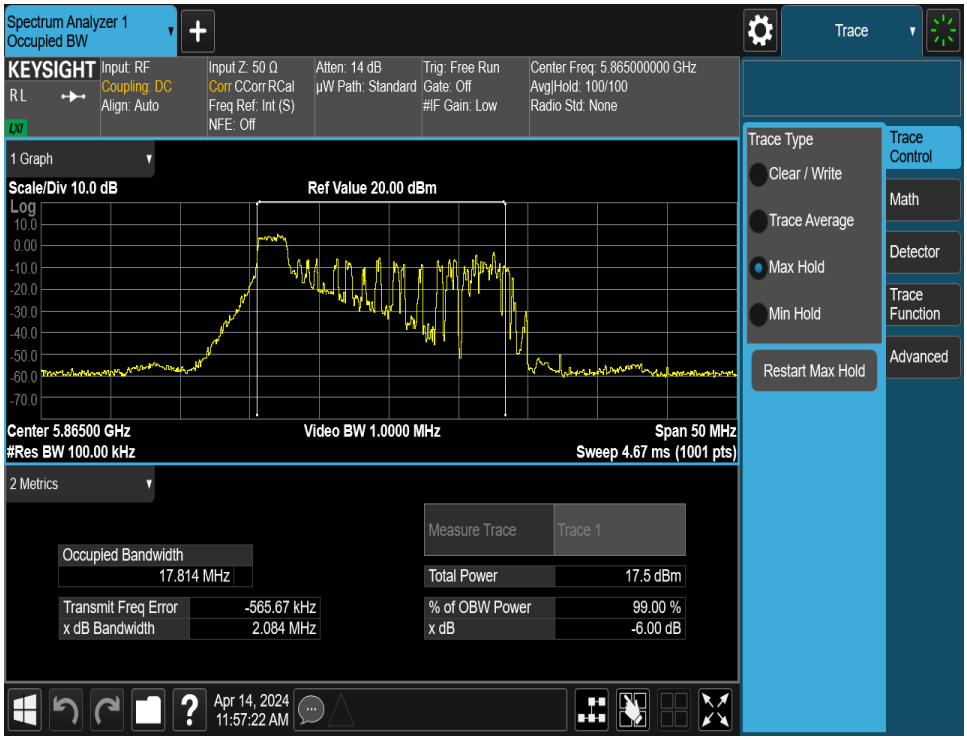
Plot 7-37. 6dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11be – 26 Tones (UNII Band 3) – Ch. 157)



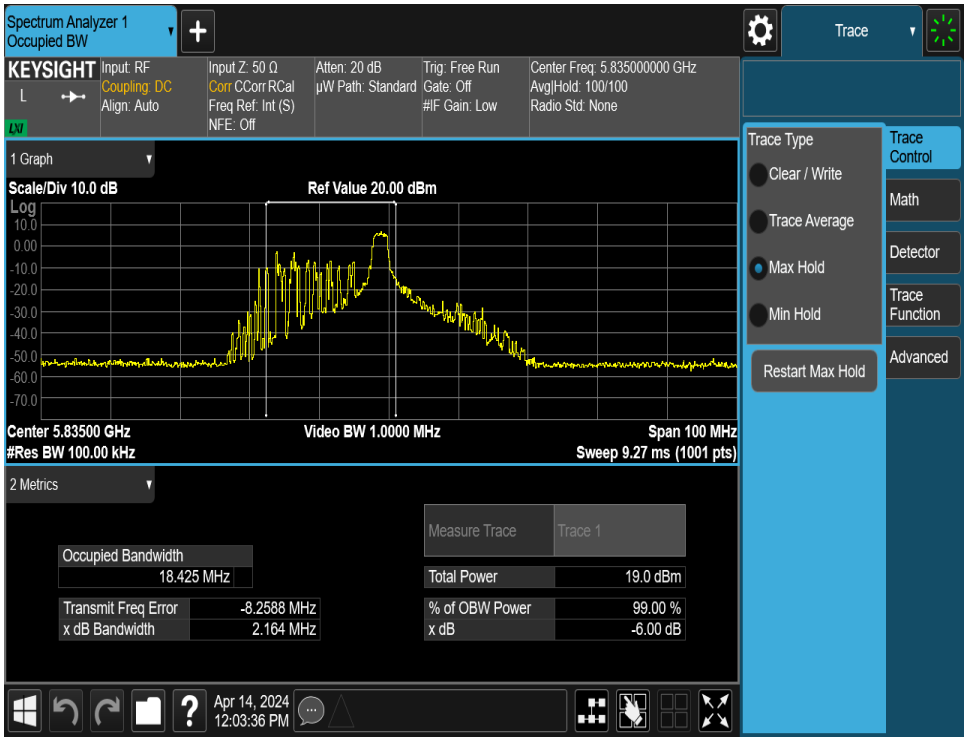
Plot 7-38. 6dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11be – 26 Tones (UNII Band 3) – Ch. 151)



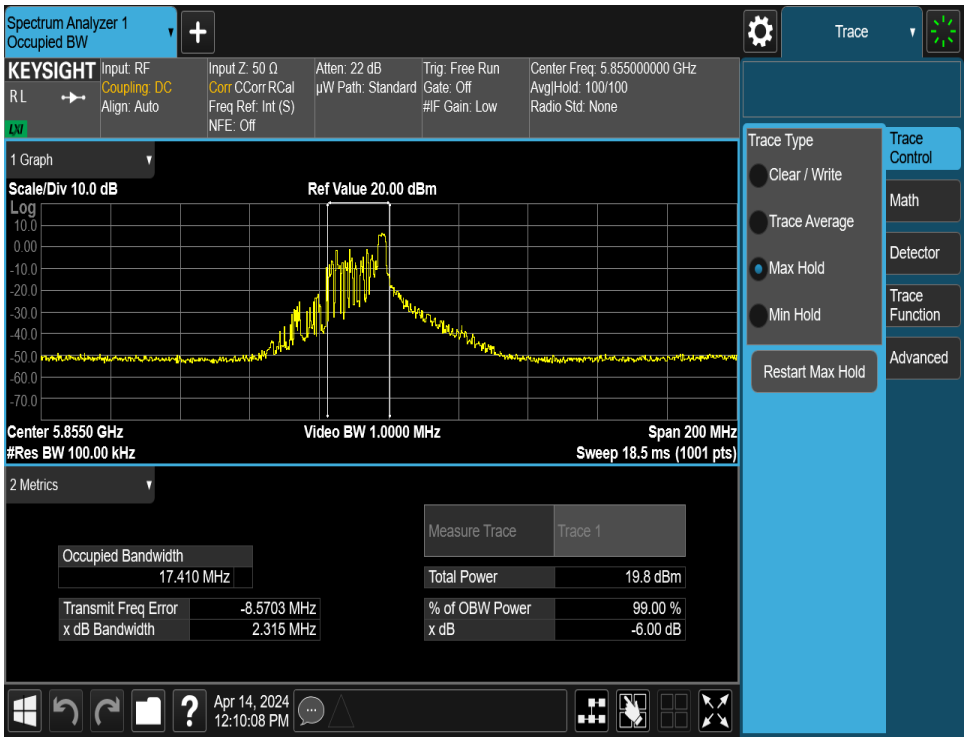
Plot 7-39. 6dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11be – 26 Tones (UNII Band 3) – Ch. 155)



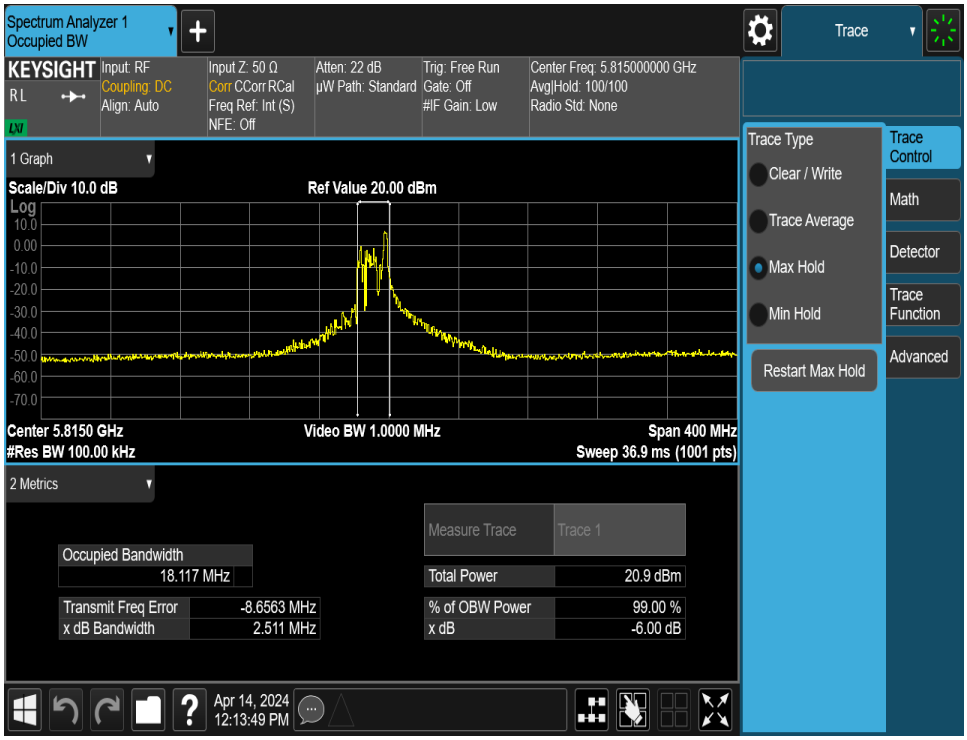
Plot 7-40. 6dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11be – 26 Tones (UNII Band 4) – Ch. 173)



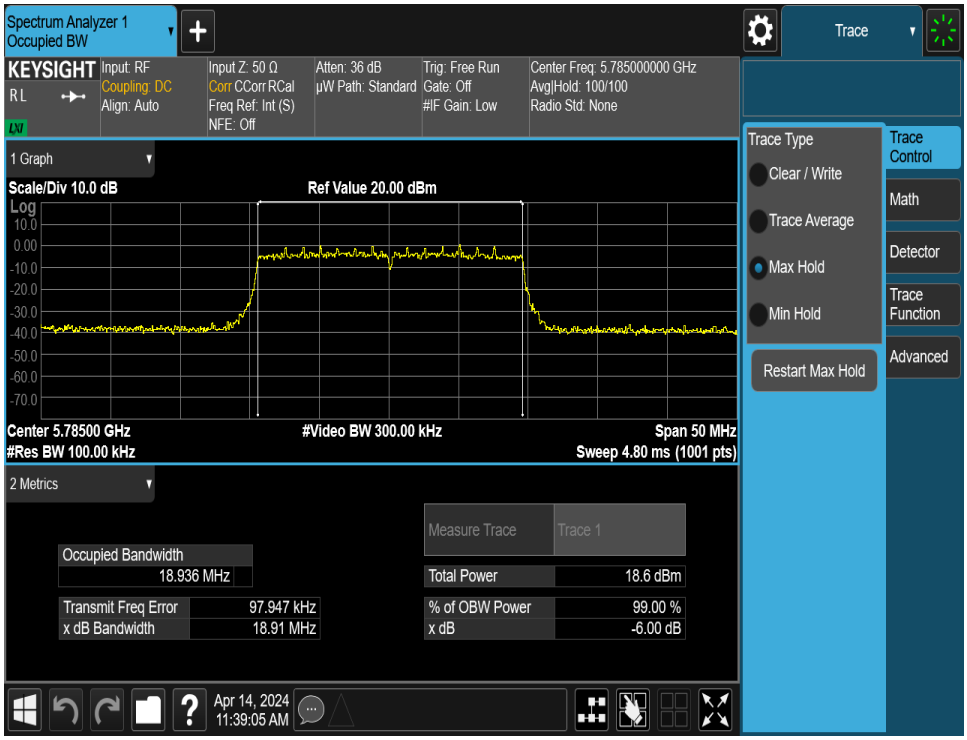
Plot 7-41. 6dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11be – 26 Tones (UNII Band 3/4) – Ch. 167)



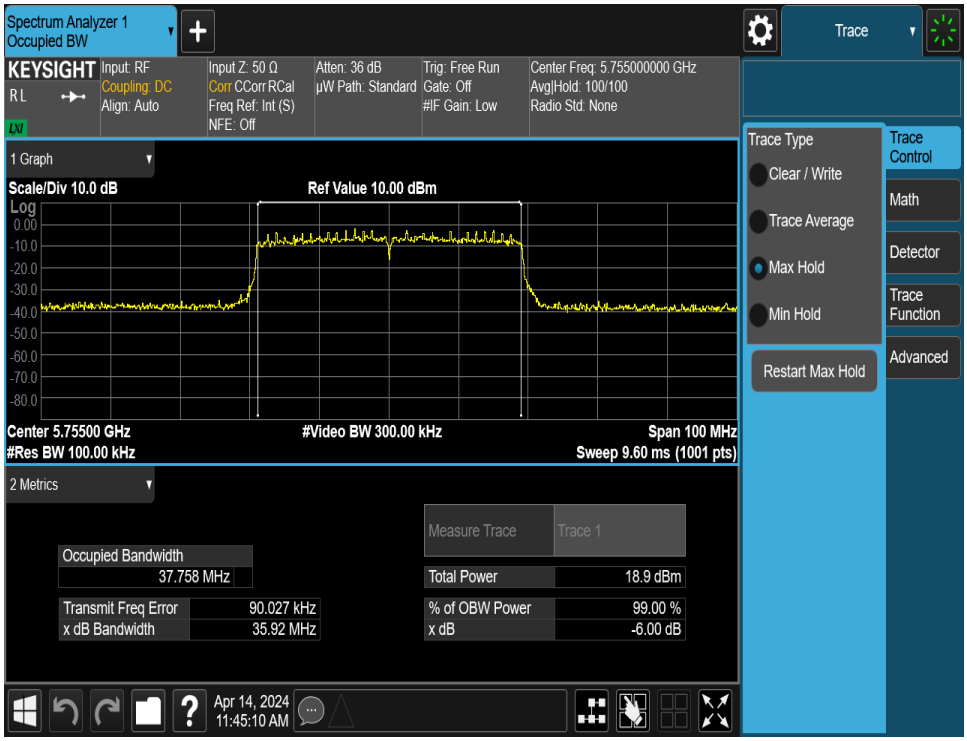
Plot 7-42. 6dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11be – 26 Tones (UNII Band 3/4) – Ch. 171)



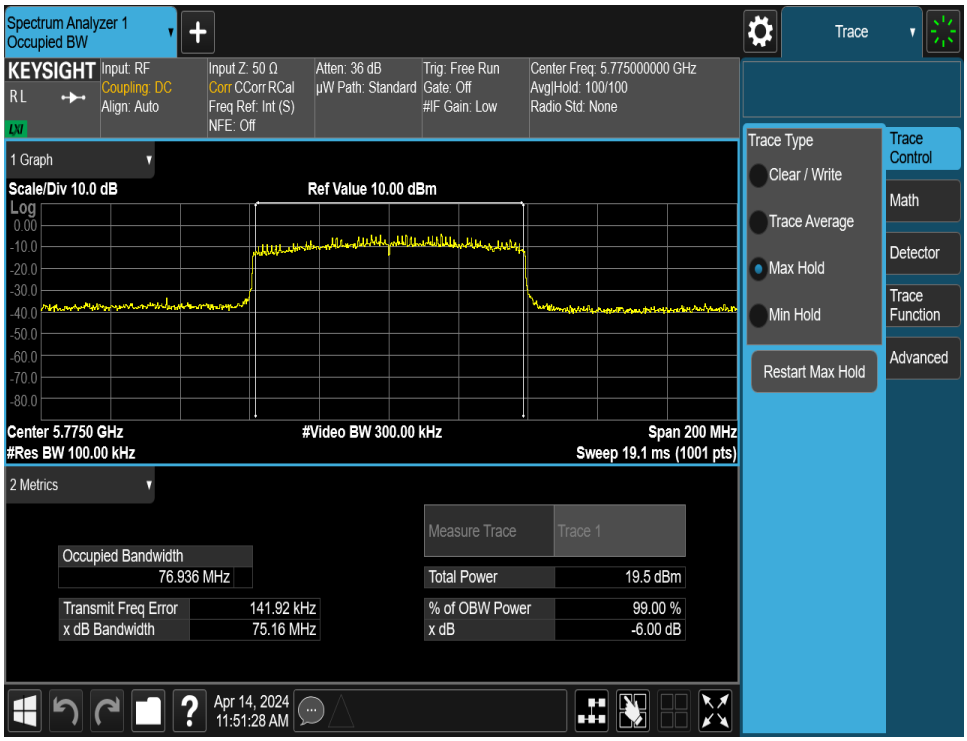
Plot 7-43. 6dB Bandwidth Plot MIMO ANT2 (160MHz BW 802.11be – 26 Tones (UNII Band 3/4) – Ch. 163)



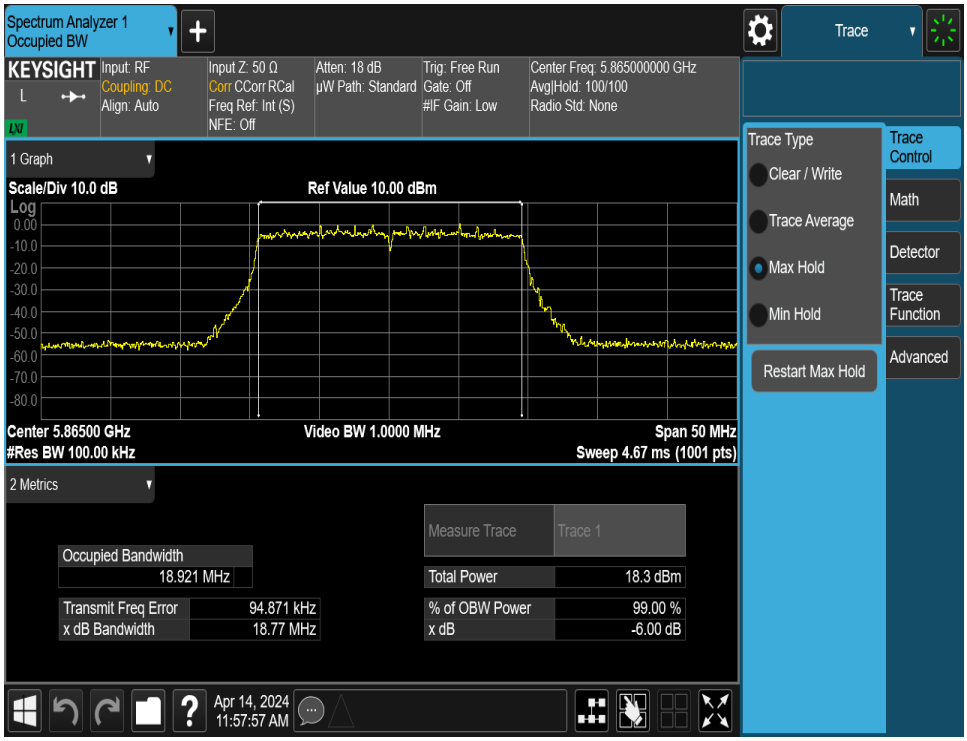
Plot 7-44. 6dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11be – 242 Tones (UNII Band 3) – Ch. 157)



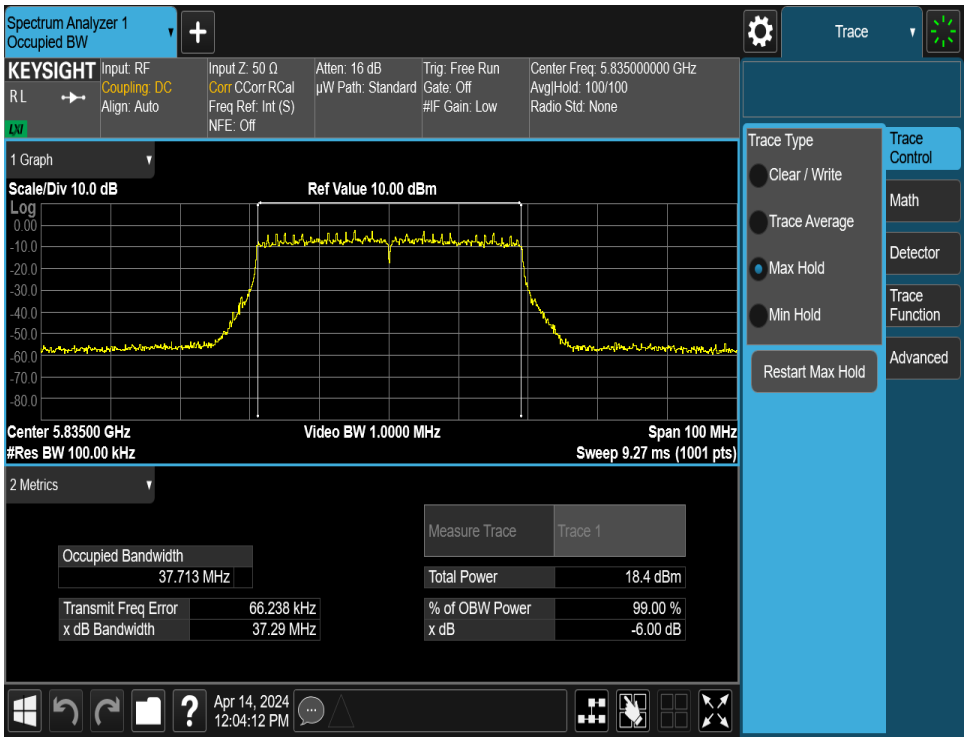
Plot 7-45. 6dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11be – 484 Tones (UNII Band 3) – Ch. 151)



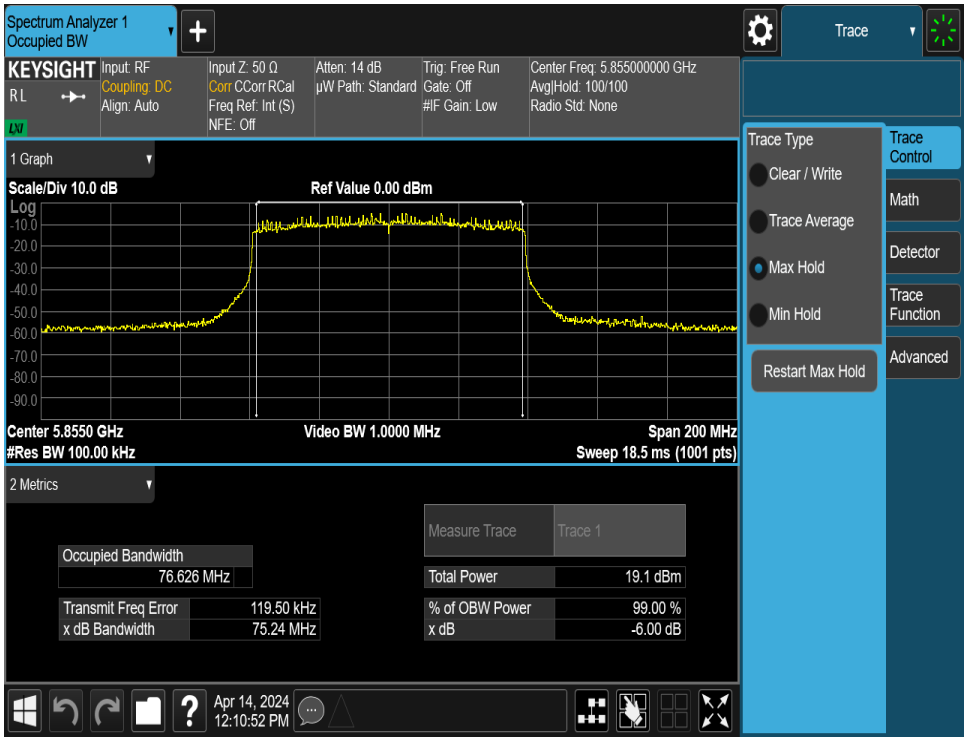
Plot 7-46. 6dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11be – 996 Tones (UNII Band 3) – Ch. 155)



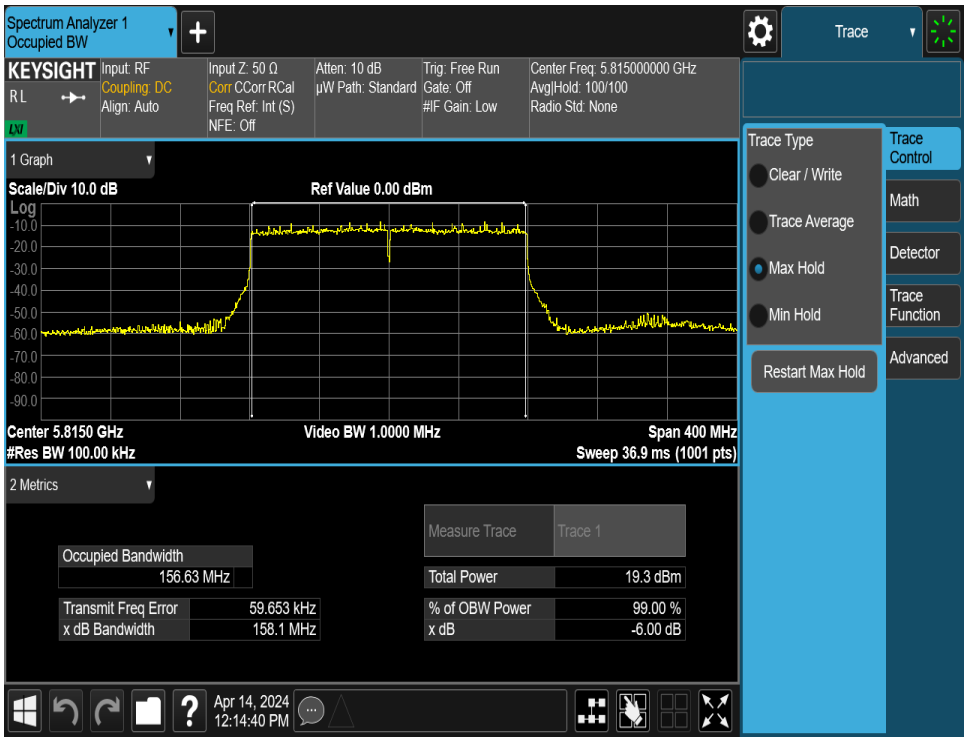
Plot 7-47. 6dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11be – 242 Tones (UNII Band 4) – Ch. 173)



Plot 7-48. 6dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11be – 484 Tones (UNII Band 3/4) – Ch. 167)



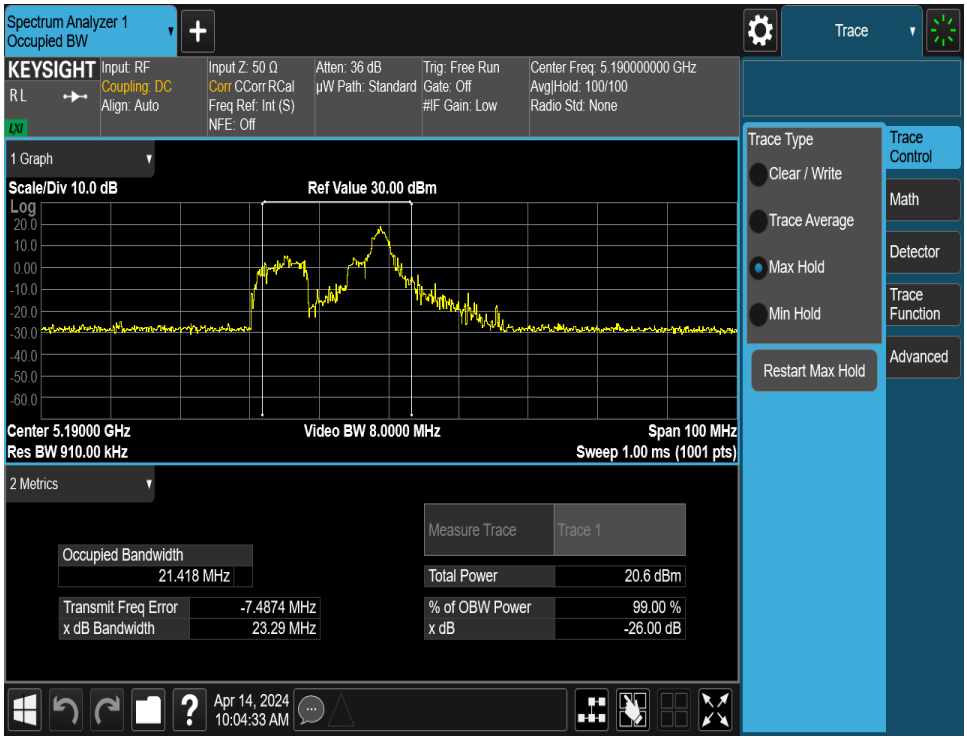
Plot 7-49. 6dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11be – 996 Tones (UNII Band 3/4) – Ch. 171)



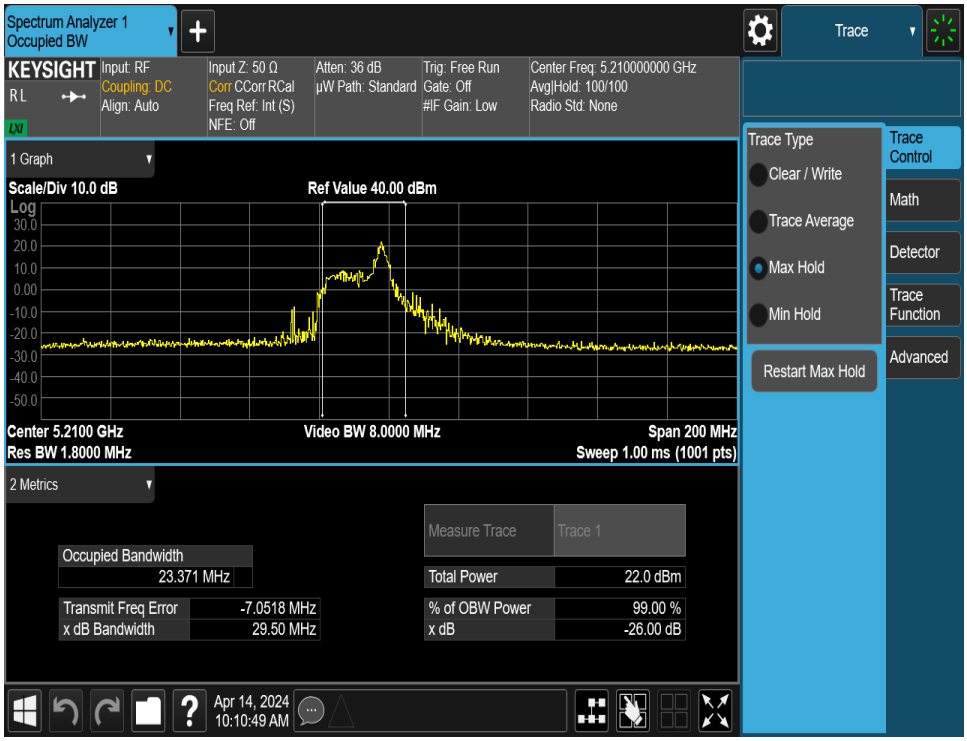
Plot 7-50. 6dB Bandwidth Plot MIMO ANT2 (160MHz BW 802.11be – 996*2 Tones (UNII Band 3/4) – Ch. 163)

7.3.3 MIMO Antenna-2 26dB Bandwidth Measurements

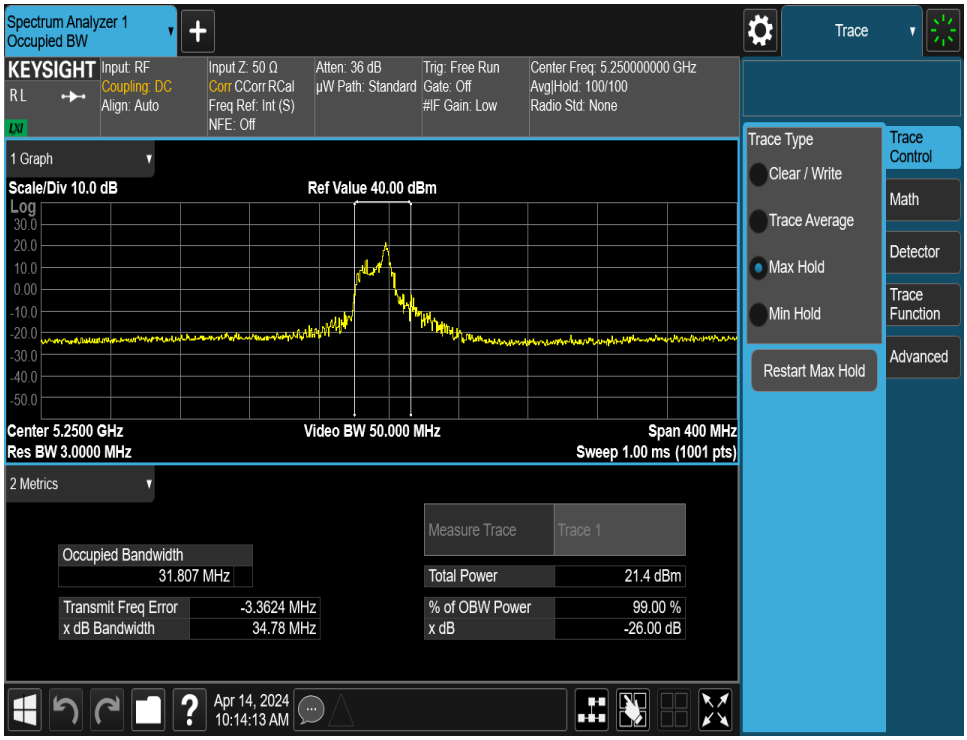
Plot 7-51. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11be – 26 Tones (UNII Band 1) – Ch. 40)



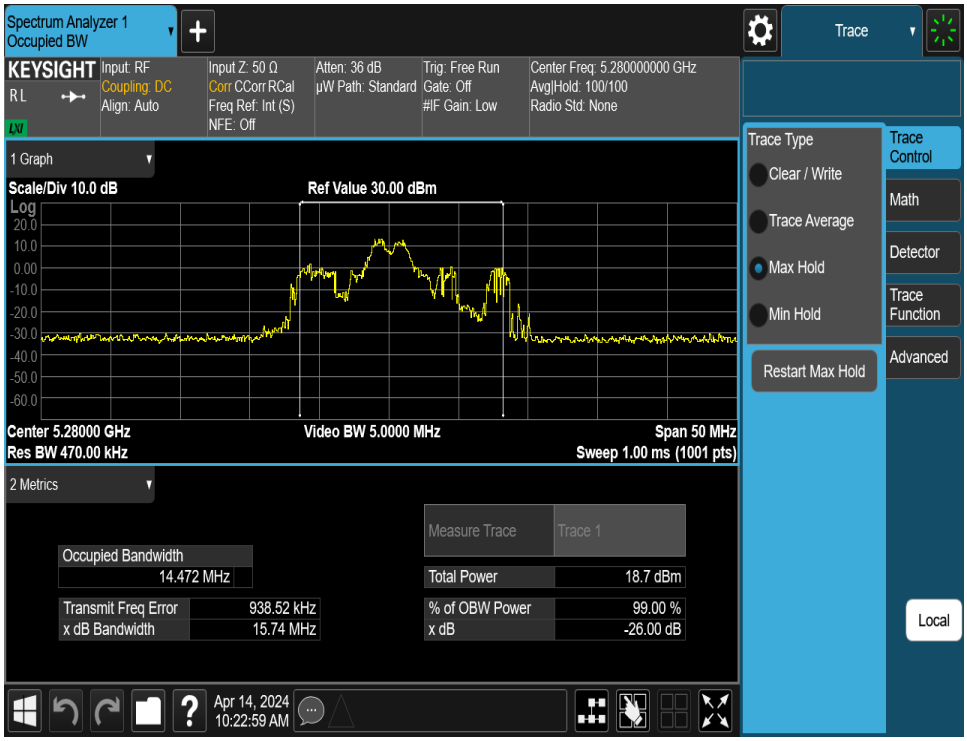
Plot 7-52. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11be – 26 Tones (UNII Band 1) – Ch. 38)



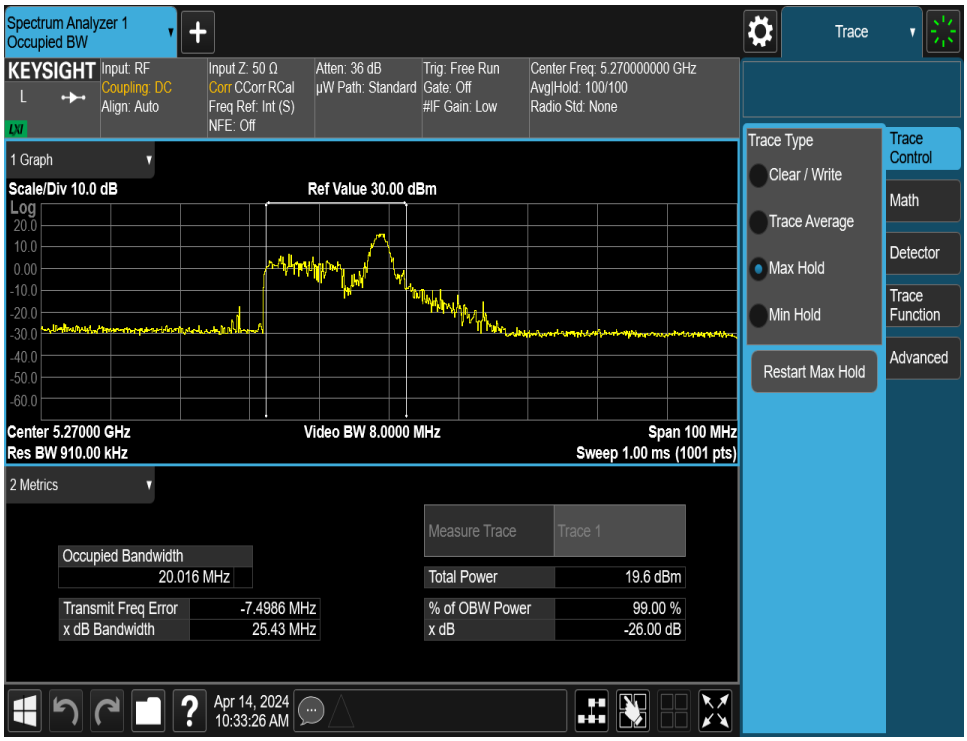
Plot 7-53. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11be – 26 Tones (UNII Band 1) – Ch. 42)



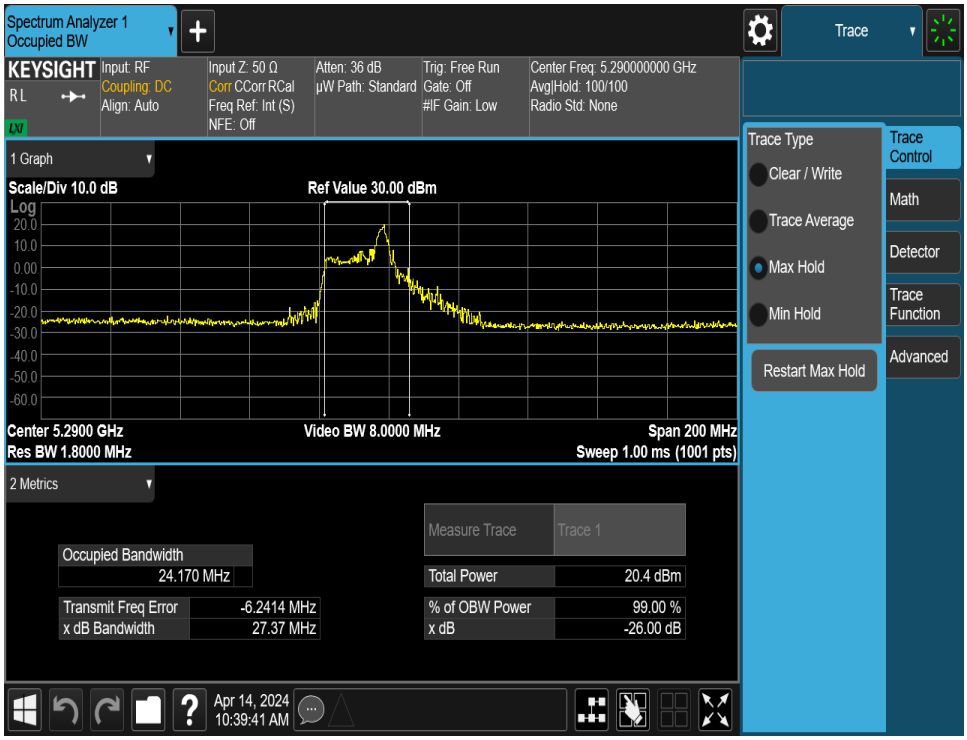
Plot 7-54. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW 802.11be – 26 Tones (UNII Band 1/2A) – Ch. 50)



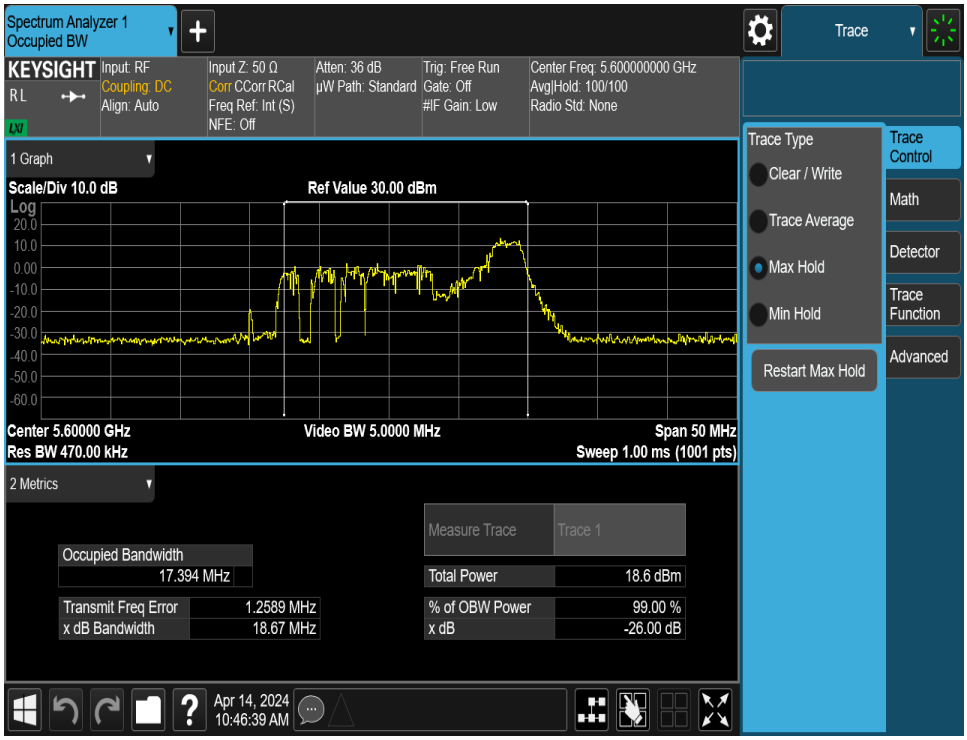
Plot 7-55. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11be – 26 Tones (UNII Band 2A) – Ch. 56)



Plot 7-56. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11be – 26 Tones (UNII Band 2A) – Ch. 54)



Plot 7-57. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11be – 26 Tones (UNII Band 2A) – Ch. 58)



Plot 7-58. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11be – 26 Tones (UNII Band 2C) – Ch. 120)