

MEASUREMENT REPORT
FCC PART 15.407 802.11a/n/ac/ax/be (OFDM)

Applicant Name:

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

Date of Testing:

8/21/2023 - 11/10/2023

Test Report Issue Date:

11/10/2023

Test Site/Location:

Element lab., Columbia, MD, USA

Test Report Serial No.:

1M2308210093-13.A3L

FCC ID:

A3LSMS928B

APPLICANT:

Samsung Electronics Co., Ltd.

Application Type:

Certification

Model:

SM-S928B/DS

Additional Model(s):

SM-S928B

EUT Type:

Portable Handset

Frequency Range:

5180 – 5885MHz

Modulation Type:

OFDM

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, KDB 648474 D03 v01r04

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. 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



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Channel Bandwidth [MHz]	UNII Band	Tx Frequency [MHz]	MIMO	
			Max. Power [mW]	Max. Power [dBm]
20	1	5180 - 5240	121.62	20.85
	2A	5260 - 5320	121.06	20.83
	2C	5500 - 5720	117.49	20.70
	3	5745 - 5825	120.81	20.82
	4	5845 - 5885	105.82	20.25
40	1	5190 - 5230	72.11	18.58
	2A	5270 - 5310	77.09	18.87
	2C	5510 - 5710	74.47	18.72
	3	5755 - 5795	71.94	18.57
	4	5835 - 5875	68.24	18.34
80	1	5210	57.41	17.59
	2A	5290	62.66	17.97
	2C	5530 - 5690	73.74	18.68
	3	5775	73.29	18.65
	4	5855	65.32	18.15
160	1/2A	5250	48.31	16.84
	2C	5570	59.52	17.75
	3/4	5815	51.62	17.13

EUT Overview

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

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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 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).

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMS928B**. The test data contained in this report pertains only to the emissions due to the EUT's UNII transmitter.

Test Device Serial No.: 0735M, 0734M, 1498M, 1133M

2.2 Device Capabilities

This device contains the following capabilities:

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

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. 802.11a/n/ac/ax/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. 802.11n/ac/ax/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. 802.11ac/ax/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. 802.11ac/ax/be (160MHz BW) Frequency / Channel Operations

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Notes:

- 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:

802.11 Mode/Band		ANT1		ANT2		MIMO (1+2)	
		Duty Cycle [%]	Radiated DCCF [dB]	Duty Cycle [%]	Radiated DCCF [dB]	Duty Cycle [%]	Radiated DCCF [dB]
5GHz	a	96.59	0.15	96.52	0.15	96.62	0.15
	n (HT20)	98.02	N/A	98.06	N/A	98.03	N/A
	ac (VHT20)	98.04	N/A	98.16	N/A	98.08	N/A
	ax (HE20)	99.09	N/A	99.07	N/A	99.62	N/A
	be (EHT20)	99.82	N/A	99.56	N/A	99.63	N/A
	n (HT40)	98.16	N/A	98.20	N/A	98.01	N/A
	ac (VHT40)	98.03	N/A	98.48	N/A	96.13	0.17
	ax (HE40)	99.67	N/A	99.52	N/A	99.69	N/A
	be (EHT40)	99.67	N/A	99.69	N/A	99.67	N/A
	ac (VHT80)	95.82	0.19	95.60	0.20	91.48	0.39
	ax (HE80)	99.60	N/A	99.62	N/A	99.67	N/A
	be (EHT80)	99.73	N/A	99.67	N/A	99.67	N/A
	ac (HT160)	92.19	0.35	92.11	0.36	92.23	0.35
	ax (HE160)	99.76	N/A	99.85	N/A	99.67	N/A
be (EHT160)	99.67	N/A	99.85	N/A	99.67	N/A	

Table 2-5. Measured Duty Cycles

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

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

Table 2-6. Antenna / Technology Configuration

✓ = Support ; ✗ = NOT Support

SISO = Single Input Single Output

SDM = Spatial Diversity Multiplexing – MIMO function

CDD = Cyclic Delay Diversity – 2Tx Function

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

802.11a	MCS Index				Spatial Stream	OFDM (802.11n/802.11ac)				OFDM (802.11ac)				OFDM (802.11ax/be)												
						20MHz		40MHz		80MHz		160MHz		20MHz			40MHz			80MHz			160MHz			
	HT	VHT	HE	EHT		0.8µs GI	0.4µs GI	0.8µs GI	0.4µs GI	0.8µs GI	0.4µs GI	0.8µs GI	0.4µs 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	
6	0	0	0	0	1	6.5	7.2	13.5	15	29.3	32.5	58.5	65	8.6	8.1	7.3	17.2	16.3	14.6	36	34	30.6	72.1	68.1	61.3	61.3
9	1	1	1	1	1	13	14.4	27	30	58.5	65	117	130	17.2	16.3	14.6	34.4	32.5	29.3	72.1	68.1	61.3	144.1	136.1	122.5	122.5
12	2	2	2	2	1	19.5	21.7	40.5	45	87.8	97.5	175.5	195	25.8	24.4	21.9	51.6	48.8	43.9	108.1	102.1	91.9	216.2	204.2	183.8	183.8
18	3	3	3	3	1	26	28.9	54	60	117	130	234	260	34.4	32.5	29.3	68.8	65	58.5	144.1	136.1	122.5	288.2	272.2	245	245
24	4	4	4	4	1	39	43.3	81	90	175.5	195	351	390	51.6	48.8	43.9	103.2	97.5	87.8	216.2	204.2	183.8	432.4	408.3	367.5	367.5
36	5	5	5	5	1	52	57.8	108	120	234	260	468	520	68.8	65	58.5	137.6	130	117	288.2	272.2	245	576.5	544.4	490	490
48	6	6	6	6	1	58.5	65	121.5	135	263.3	292.5	526.5	585	77.4	73.1	65.8	154.9	146.3	131.6	324.3	306.3	275.6	648.5	612.5	551.3	551.3
54	7	7	7	7	1	65	72.2	135	150	292.5	325	585	650	86	81.3	73.1	172.1	162.5	146.3	360.3	340.3	306.3	720.6	680.6	612.5	612.5
		8	8	8	1	78	86.7	162	180	351	390	702	780	103.2	97.5	87.8	206.5	195	175.5	432.4	408.3	367.5	864.7	816.7	735	735
		9	9	9	1	N/A	N/A	180	200	390	433.3	780	866.7	114.7	108.3	97.5	229.4	216.7	195	480.4	453.7	408.3	960.8	907.4	816.7	816.7
			10	10	1									129	121.9	109.7	258.1	243.8	219.4	540.4	510.4	459.4	1080.9	1020.8	918.8	918.8
				11	1									143.4	135.4	121.9	286.8	270.8	243.8	600.5	567.1	510.4	1201	1134.3	1020.8	1020.8
					12	1								154.9	146.3	131.6	309.7	292.5	263.3	648.5	612.5	551.3	1297.1	1225	1102.5	1102.5
						13	1							172.1	162.5	146.3	344.1	325	292.5	720.6	680.6	612.5	1441.2	1361.1	1225	1225
6	8	0	0	0	2	13	14.4	27	30	58.5	65	117	130	17.2	16.3	14.6	34.4	32.5	29.3	72.1	68.1	61.3	144.1	136.1	122.5	122.5
9	9	1	1	1	2	26	28.9	54	60	117	130	234	260	34.4	32.5	29.3	68.8	65	58.5	144.1	136.1	122.5	288.2	272.2	245	245
12	10	2	2	2	2	39	43.3	81	90	175.5	195	351	390	51.6	48.8	43.9	103.2	97.5	87.8	216.2	204.2	183.8	432.4	408.3	367.5	367.5
18	11	3	3	3	2	52	57.8	108	120	234	260	468	520	68.8	65	58.5	137.6	130	117	288.2	272.2	245	576.5	544.4	490	490
24	12	4	4	4	2	78	86.7	162	180	351	390	702	780	103.2	97.5	87.8	206.5	195	175.5	432.4	408.3	367.5	864.7	816.7	735	735
36	13	5	5	5	2	104	115.6	216	240	468	520	936	1040	137.6	130	117	275.3	260	234	576.5	544.4	490	1152.9	1088.9	980	980
48	14	6	6	6	2	117	130	243	270	526.5	585	1053	1170	154.9	146.3	131.6	309.7	292.5	263.3	648.5	612.5	551.3	1297.1	1225	1102.5	1102.5
54	15	7	7	7	2	130	144.4	270	300	585	650	1170	1300	172.1	162.5	146.3	344.1	325	292.5	720.6	680.6	612.5	1441.2	1361.1	1225	1225
		8	8	8	2	156	173.3	324	360	702	780	1404	1560	206.5	195	175.5	412.9	390	351	864.7	816.7	735	1729.4	1633.3	1470	1470
		9	9	9	2	N/A	N/A	360	400	780	866.7	1560	1733.3	229.4	216.7	195	458.8	433.3	390	960.8	907.4	816.7	1921.6	1814.8	1633.3	1633.3
			10	10	2									258.1	243.8	219.4	516.2	487.5	438.8	1080.9	1020.8	918.8	2161.8	2041.7	1837.5	1837.5
				11	2									286.8	270.8	243.8	573.5	541.7	487.5	1201	1134.3	1020.8	2402	2268.5	2041.7	2041.7
					12	2								309.7	292.5	263.3	619.4	585	526.5	1297.1	1225	1102.5	2594.1	2450	2205	2205
						13	2							344.1	325	292.5	688.2	650	585	1441.2	1361.1	1225	2882.4	2722.2	2450	2450

Table 2-7. Supported Data Rates

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

Configuration 1: ANT1 and ANT2 transmitting in 2.4GHz mode and 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 and MIMO 5GHz)

Configuration 2: ANT1 and ANT2 transmitting in 2.4GHz mode and 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 and MIMO 6GHz)

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2.3 Antenna Description

The following antenna gains were used for the testing.

Frequency [MHz]	Antenna 1 Gain (dBi)	Antenna 2 Gain (dBi)	Directional Gain (dBi)
5150	-5.10	-5.25	-2.16
5200	-3.93	-4.26	-1.08
5220	-3.75	-4.39	-1.05
5250	-3.87	-3.55	-0.70
5280	-4.13	-2.62	-0.33
5300	-3.46	-3.14	-0.29
5350	-4.08	-2.60	-0.30
5400	-3.42	-2.19	0.23
5500	-5.69	-2.77	-1.10
5600	-3.02	-3.07	-0.03
5700	-3.66	-3.62	-0.63
5785	-3.57	-3.89	-0.72
5800	-3.61	-4.18	-0.88
5805	-3.59	-3.78	-0.67
5850	-4.02	-3.62	-0.81
5885	-3.78	-3.44	-0.60
5895	-3.88	-3.29	-0.57

Table 2-10. Antenna Peak Gain per Frequency

Frequency [MHz]	Antenna 1 Gain (dBi)	Antenna 2 Gain (dBi)	Directional Gain (dBi)
5200	-4.13	-2.62	-0.33
5300	-3.46	-3.14	-0.29
5500	-3.42	-2.19	0.23
5800	-3.66	-3.62	-0.63
5850	-3.88	-3.29	-0.57

Table 2-11. 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 Sections 3.2 for AC line conducted emissions test setups, 7.6 for radiated emissions test setups, and 7.2, 7.3, 7.4, and 7.5 for antenna port conducted emissions test setups.

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT 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 software/firmware version S928BXXU0AWH9 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) was 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 7.7. 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 (\pm dB)
Conducted Bench Top Measurements	1.13
Line Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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6.0 TEST EQUIPMENT CALIBRATION DATA

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

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	AP2-001	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	AP2-001
-	ETS-001	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	ETS-001
-	ETS-002	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	ETS-002
-	MD 1M 18-40	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	MD 1M 18-40
-	WL40-1	Conducted Cable Set (40GHz)	1/12/2023	Annual	1/12/2024	WL40-1
-	WL25-1	Conducted Cable Set (25GHz)	1/12/2023	Annual	1/12/2024	WL25-1
Anritsu	MA24406A	Microwave Peak Power Sensor	9/7/2023	Annual	9/7/2024	11240
Emco	3115	Horn Antenna (1-18GHz)	8/8/2022	Biennial	8/8/2024	9704-5182
Emco	3116	Horn Antenna (18 - 40GHz)	7/5/2022	Biennial	7/5/2024	9203-2178
Pastemack	MNLC-2	Line Conducted Emission Cable (NM)	1/11/2023	Annual	1/11/2024	MNLC-2
ETS-Lindgren	3816/2NM	Line Impedance Stabilization Network	8/11/2022	Biennial	8/11/2024	114451
ETS Lindgren	3116C	1-18 GHz DRG Horn Antenna	2/27/2023	Biennial	2/27/2024	00218893
ETS Lindgren	3115	Double Ridged Guide Horn	4/12/2022	Biennial	4/12/2024	82333
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	4/13/2022	Biennial	4/13/2025	121034
Keysight Technologies	N9020A	MXA Signal Analyzer	3/15/2023	Annual	3/15/2024	MY54500644
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	3/15/2023	Annual	3/15/2024	MY52350166
Keysight Technologies	N9030A	PXA Signal Analyzer	1/31/2023	Annual	1/31/2024	MY55410501
Keysight Technologies	N9030B	PXA Signal Analyzer, Multi-touch	9/7/2023	Annual	9/7/2024	MY57141001
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	9/25/2023	Annual	9/25/2024	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	9/11/2023	Annual	9/11/2024	100348
Rohde & Schwarz	ESW44	EMI Test Receiver 2Hz to 44 GHz	3/1/2023	Annual	3/1/2024	101716
Rohde & Schwarz	FSW26	2Hz-26.5GHz Signal and Spectrum Analyzer	11/6/2022	Annual	11/6/2023	103187
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	1/13/2023	Annual	1/13/2024	103200
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	2/21/2023	Biennial	2/21/2025	A051107
Sunol	JB6	LB6 Antenna	3/2/2023	Biennial	3/2/2025	A082816

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: A3LSMS928B
 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)		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)		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)	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		PASS	Section 7.6
15.407	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits	LINE CONDUCTED	PASS	Section 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 “UNII Automation,” Version 4.7.
- 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 1.5.0.

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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

All Cases were investigated; a subset of the taken plots were included to represent relevant settings and measurements.

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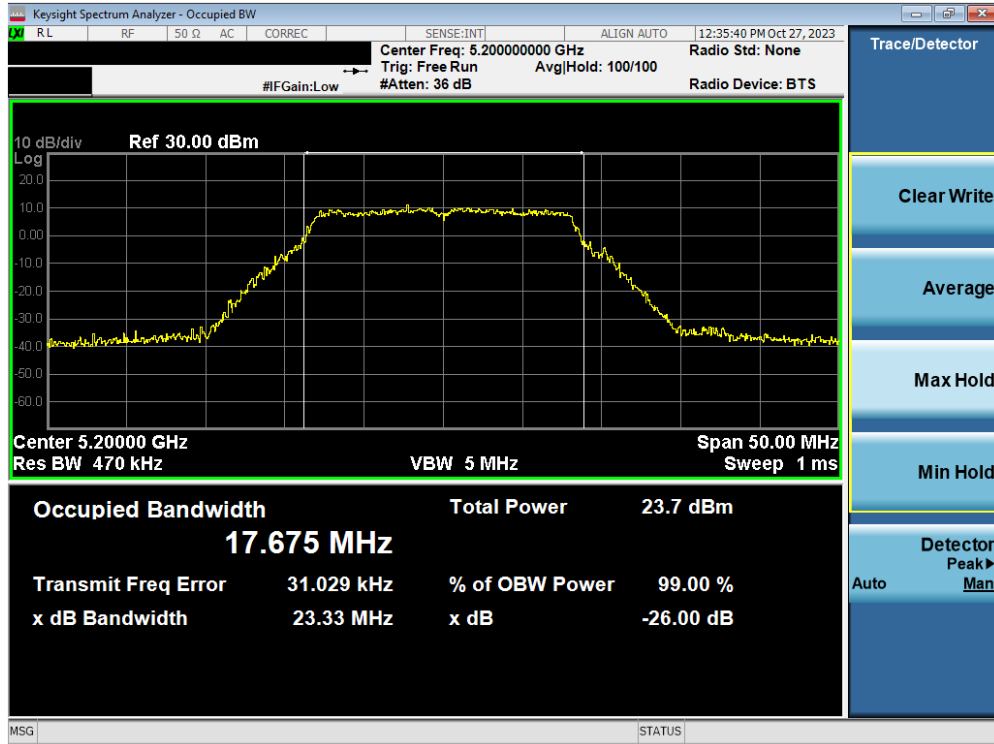
MIMO 26dB Bandwidth Measurements

	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 26dB Bandwidth [MHz]	Antenna-2 26dB Bandwidth [MHz]
Band 1	5180	36	a	23.64	22.84
	5200	40	a	23.33	23.19
	5240	48	a	23.91	22.94
	5180	36	n	23.76	23.98
	5200	40	n	23.61	23.94
	5240	48	n	23.83	23.47
	5180	36	ac	23.71	23.19
	5200	40	ac	24.02	23.53
	5240	48	ac	24.01	23.56
	5180	36	ax/be SU	23.95	22.99
	5200	40	ax/be SU	23.05	23.65
	5240	48	ax/be SU	23.37	23.81
	5190	38	n	46.16	45.77
	5230	46	n	47.07	45.66
	5190	38	ac	46.37	45.93
5230	46	ac	46.01	46.34	
5190	38	ax/be SU	44.66	44.47	
5230	46	ax/be SU	44.19	44.09	
5210	42	ac	92.90	91.29	
5210	42	ax/be SU	91.66	90.25	
Band 1/A	5250	50	ac	177.80	173.52
	5250	50	ax/be SU	173.50	173.31
Band 2A	5260	52	a	23.53	22.80
	5280	56	a	23.06	23.57
	5320	64	a	23.76	23.05
	5260	52	n	23.36	23.82
	5280	56	n	23.57	23.56
	5320	64	n	24.16	23.83
	5260	52	ac	24.17	23.21
	5280	56	ac	23.93	23.87
	5320	64	ac	23.83	23.29
	5260	52	ax/be SU	23.51	22.95
	5280	56	ax/be SU	23.28	23.07
	5320	64	ax/be SU	23.01	22.96
	5270	54	n	45.64	45.38
	5310	62	n	46.54	45.34
	5270	54	ac	44.89	45.68
	5310	62	ac	46.04	45.71
	5270	54	ax/be SU	43.84	44.21
	5310	62	ax/be SU	44.61	44.07
	5290	58	ac	93.33	90.35
	5290	58	ax/be SU	91.83	89.06
Band 2C	5500	100	a	23.48	23.36
	5600	120	a	23.70	22.94
	5720	144	a	23.10	22.80
	5500	100	n	24.24	23.97
	5600	120	n	23.78	23.85
	5720	144	n	23.74	23.63
	5500	100	ac	23.84	23.30
	5600	120	ac	23.76	23.71
	5720	144	ac	23.77	23.16
	5500	100	ax/be SU	22.68	23.16
	5600	120	ax/be SU	23.19	23.33
	5720	144	ax/be SU	23.50	22.99
	5510	102	n	46.46	45.61
	5590	118	n	46.65	45.81
	5710	142	n	46.59	46.60
	5510	102	ac	45.96	46.01
	5590	118	ac	46.83	44.79
	5710	142	ac	46.92	44.21
	5510	102	ax/be SU	45.20	43.99
	5590	118	ax/be SU	44.35	44.58
	5710	142	ax/be SU	45.67	44.67
	5530	106	ac	93.72	91.93
	5610	122	ac	91.27	90.40
	5690	138	ac	92.35	90.62
	5530	106	ax/be SU	88.98	89.53
5610	122	ax/be SU	89.85	90.41	
5690	138	ax/be SU	90.67	87.95	
5570	114	ac	174.85	173.55	
5570	114	ax/be SU	173.81	175.44	

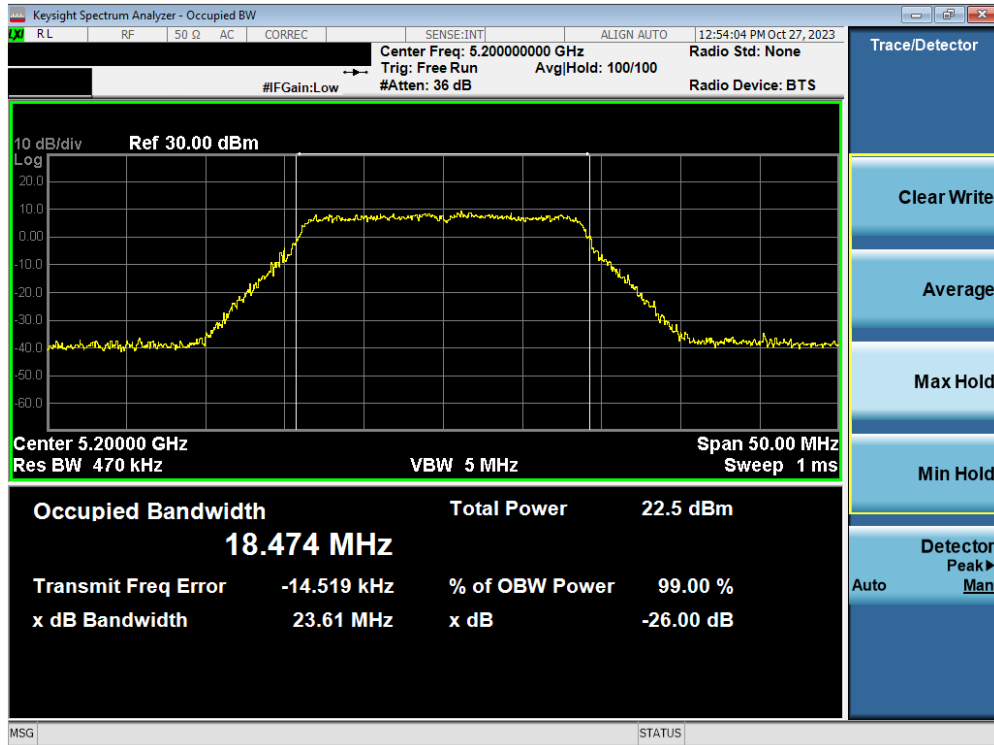
Table 7-2. Bands 1, 2A, 2C Conducted 26dB Bandwidth Measurements MIMO

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7.2.1 MIMO Antenna-1 26dB Bandwidth Measurements

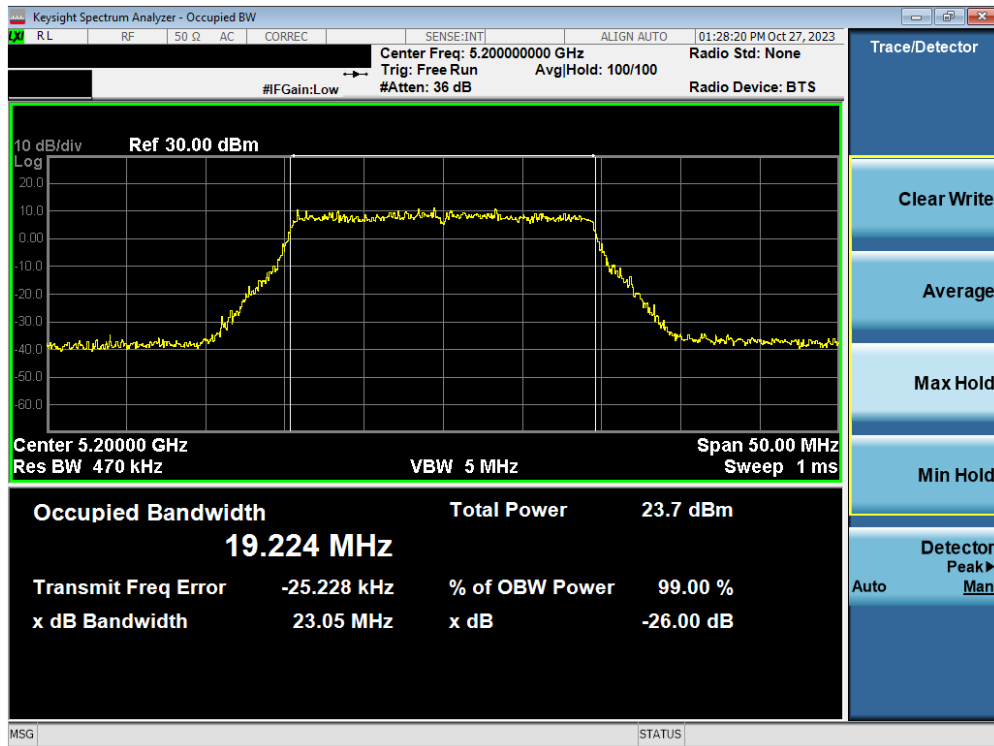


Plot 7-1. 26dB Bandwidth Plot MIMO ANT1 (802.11a (UNII Band 1) – Ch. 40)

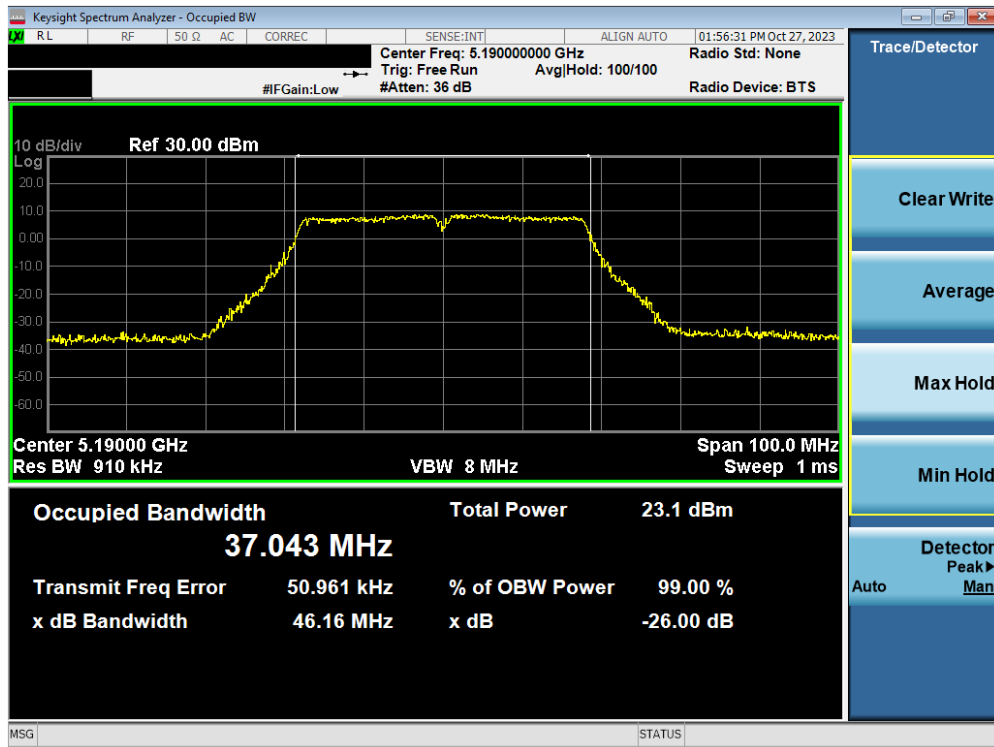


Plot 7-2. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 1) – Ch. 40)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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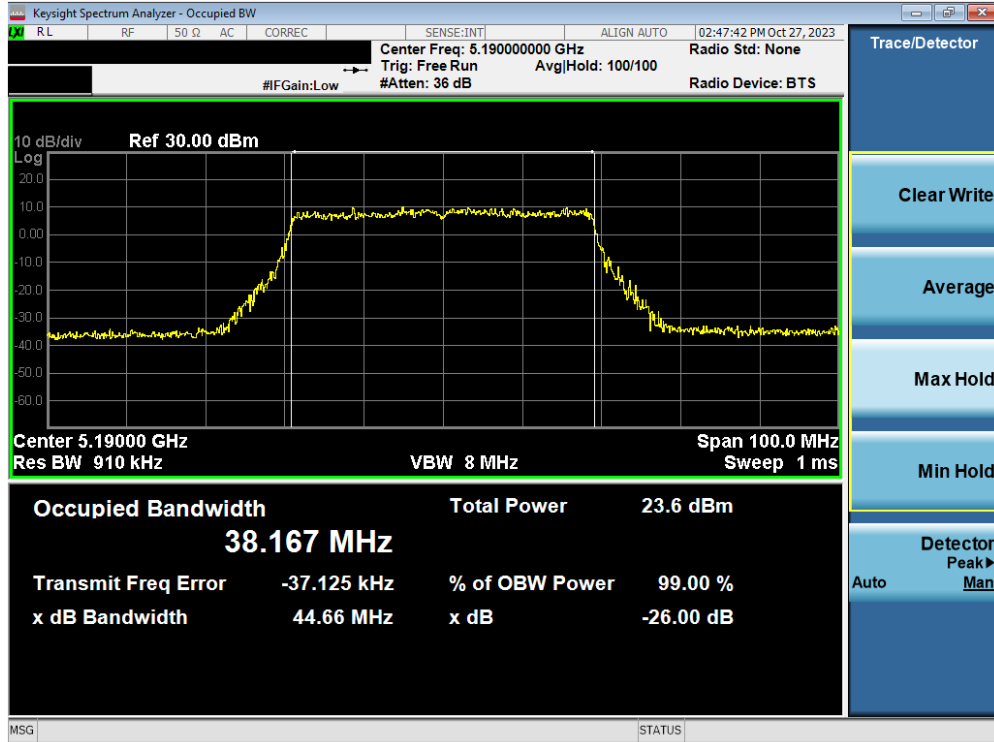


Plot 7-3. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax/be (UNII Band 1) – Ch. 40)

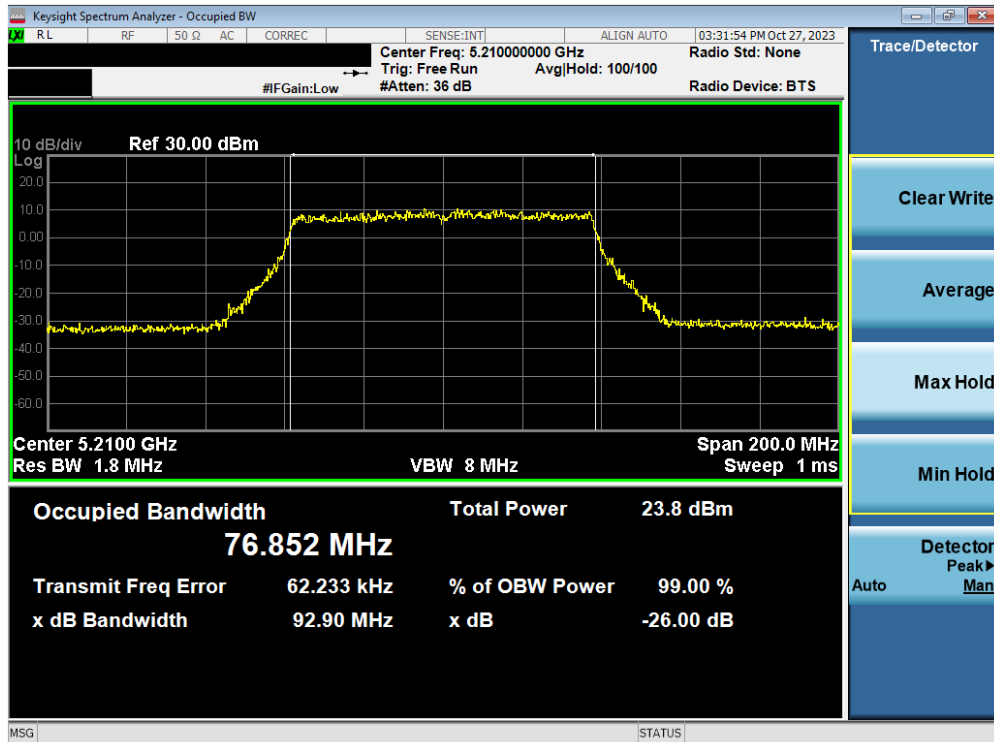


Plot 7-4. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 1) – Ch. 38)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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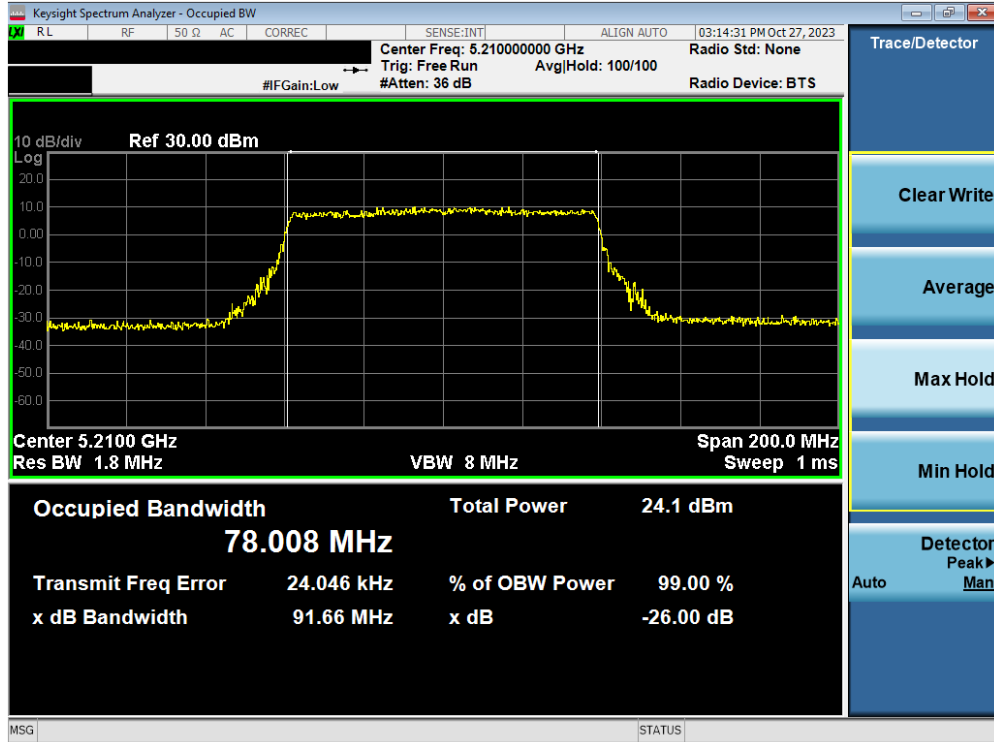


Plot 7-5. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax/be (UNII Band 1) – Ch. 38)

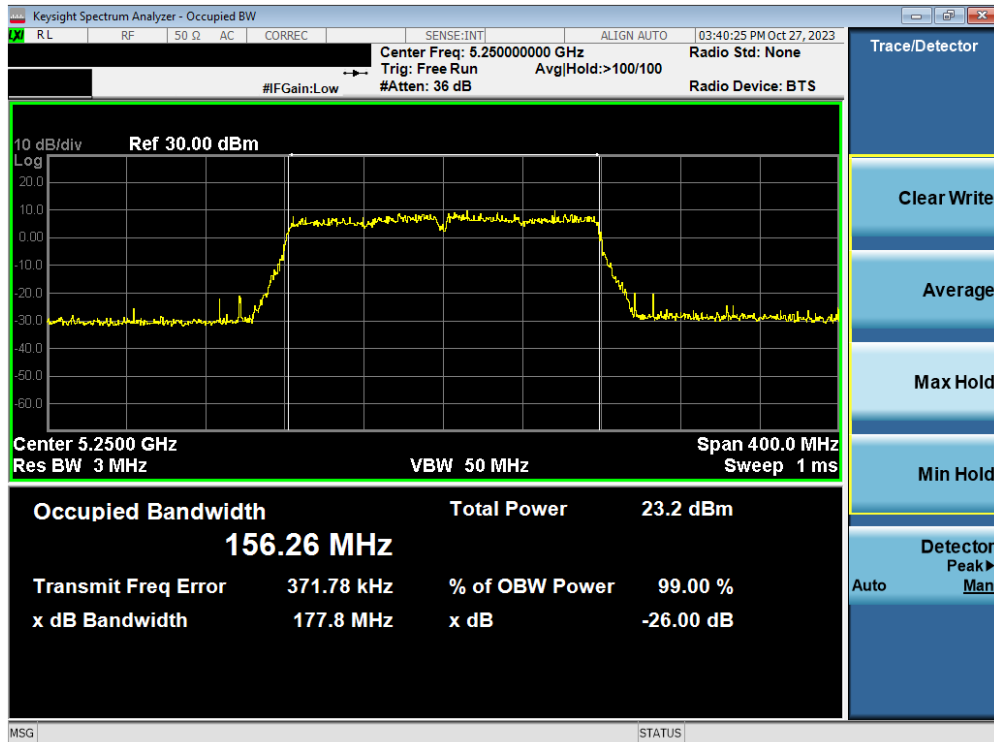


Plot 7-6. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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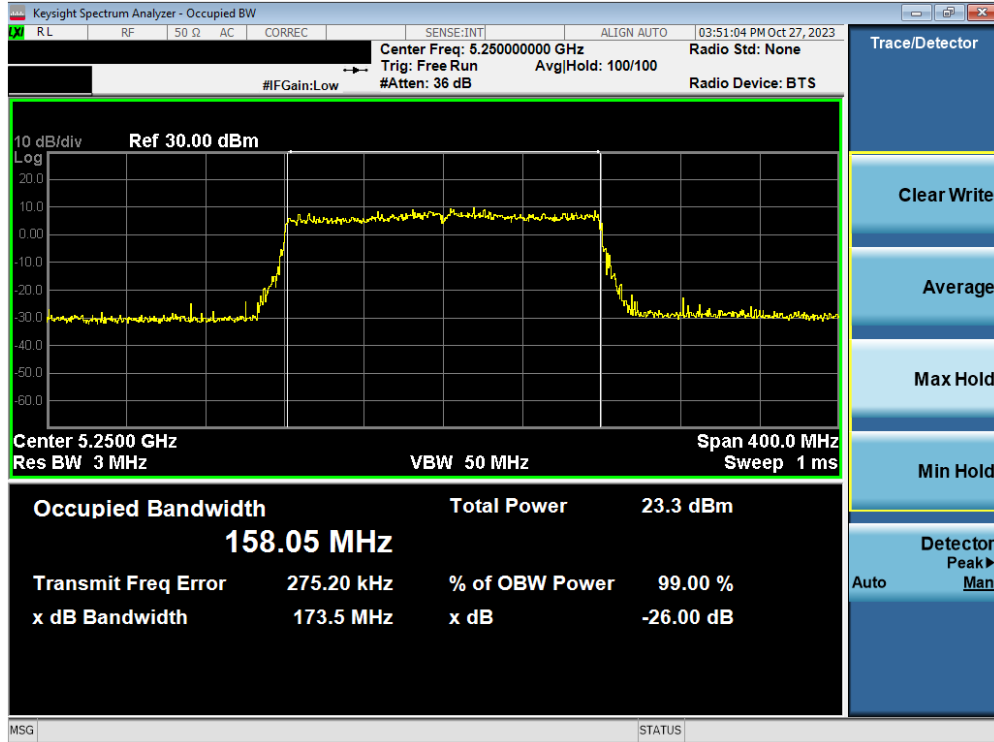


Plot 7-7. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax/be (UNII Band 1) – Ch. 42)

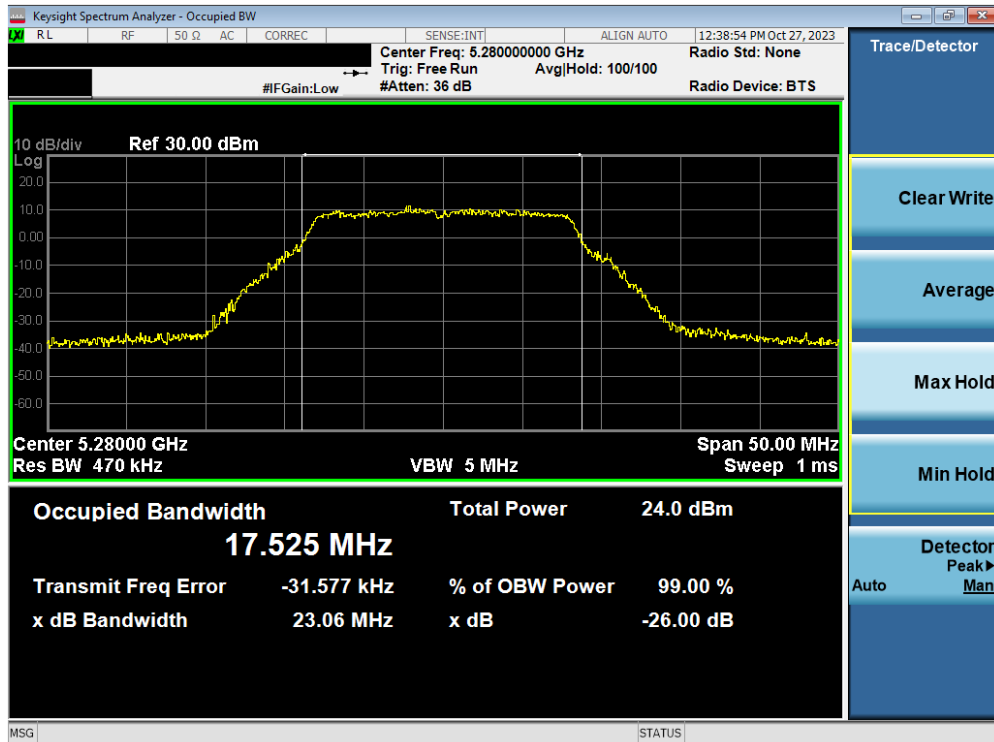


Plot 7-8. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11ac (UNII Band 1/2A) – Ch. 50)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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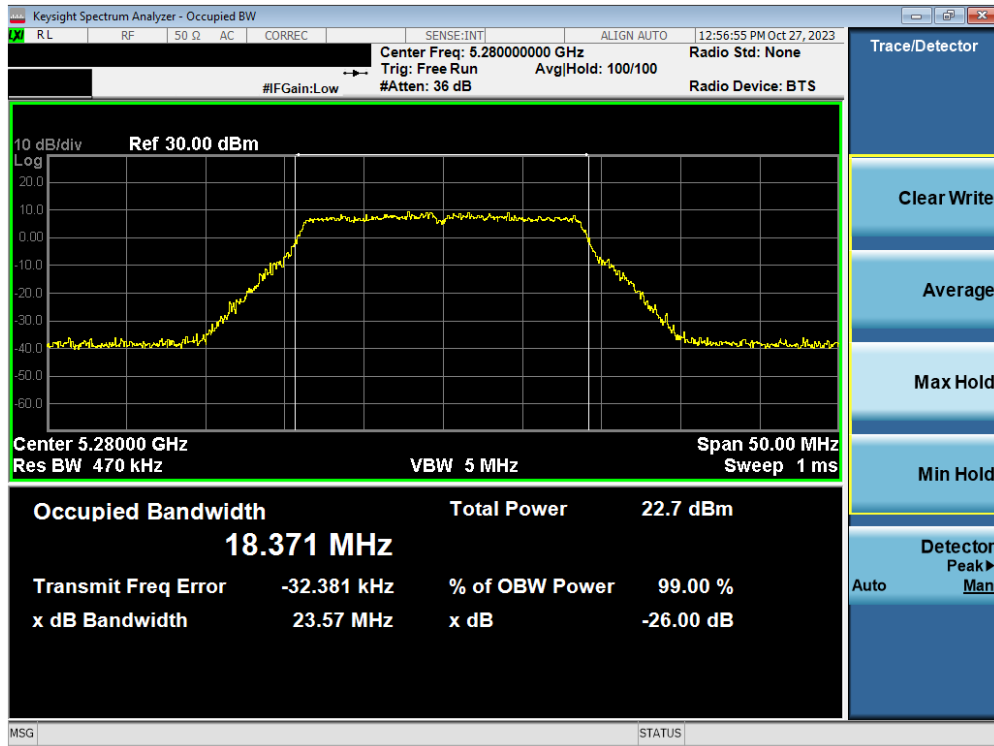


Plot 7-9. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11ax/be (UNII Band 1/2A) – Ch. 50)

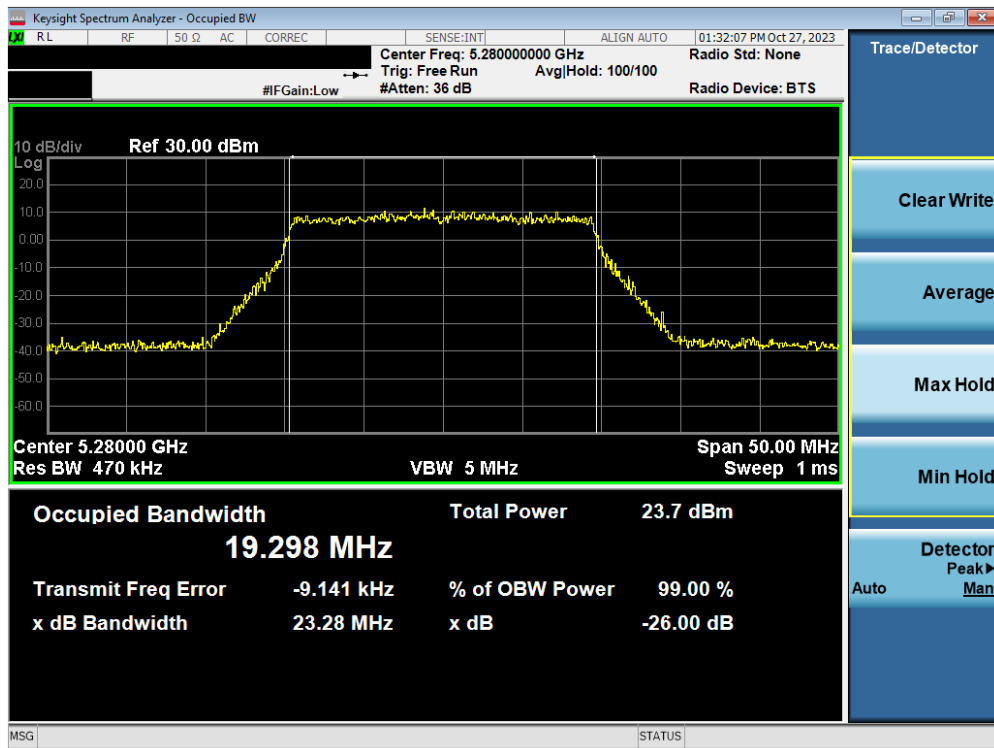


Plot 7-10. 26dB Bandwidth Plot MIMO ANT1 (802.11a (UNII Band 2A) – Ch. 56)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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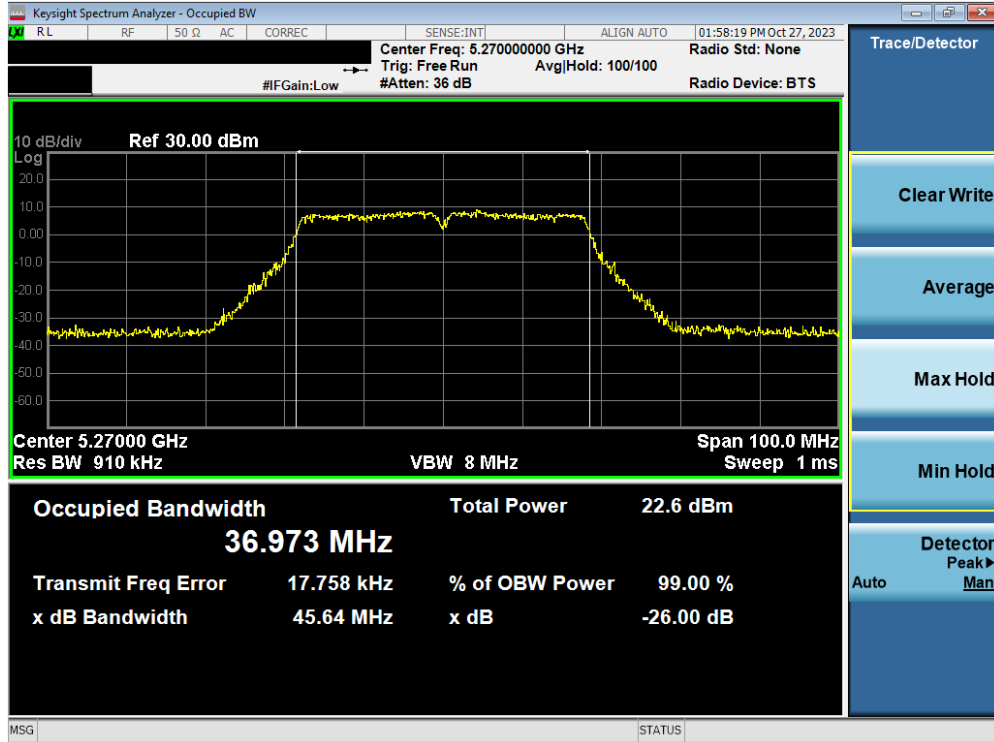


Plot 7-11. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)

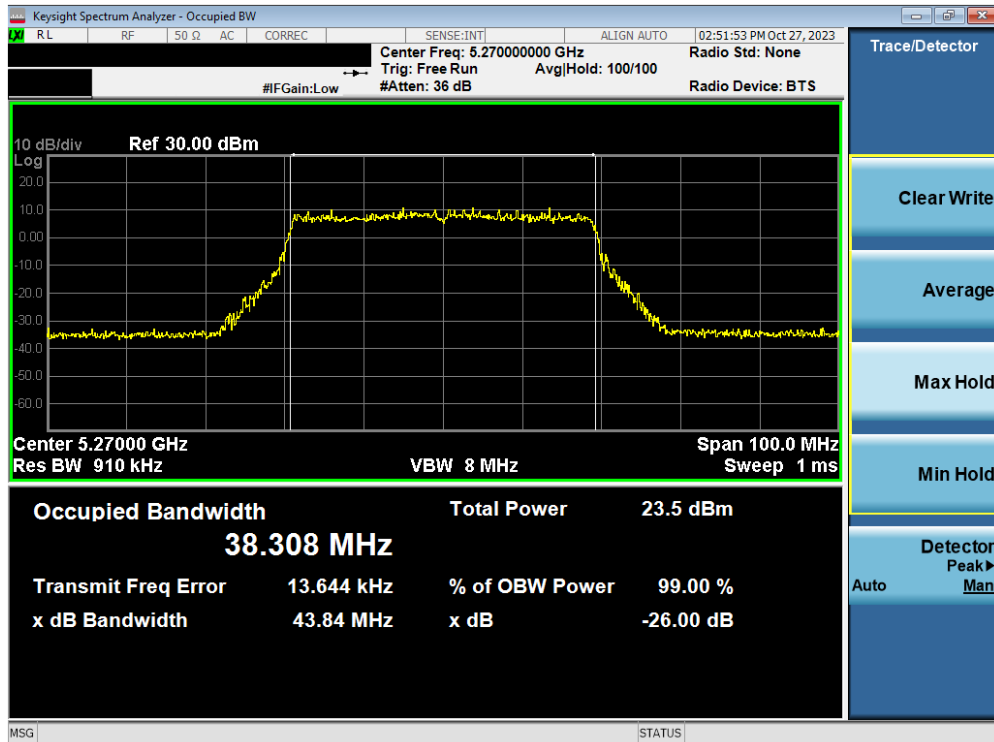


Plot 7-12. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax/be (UNII Band 2A) – Ch. 56)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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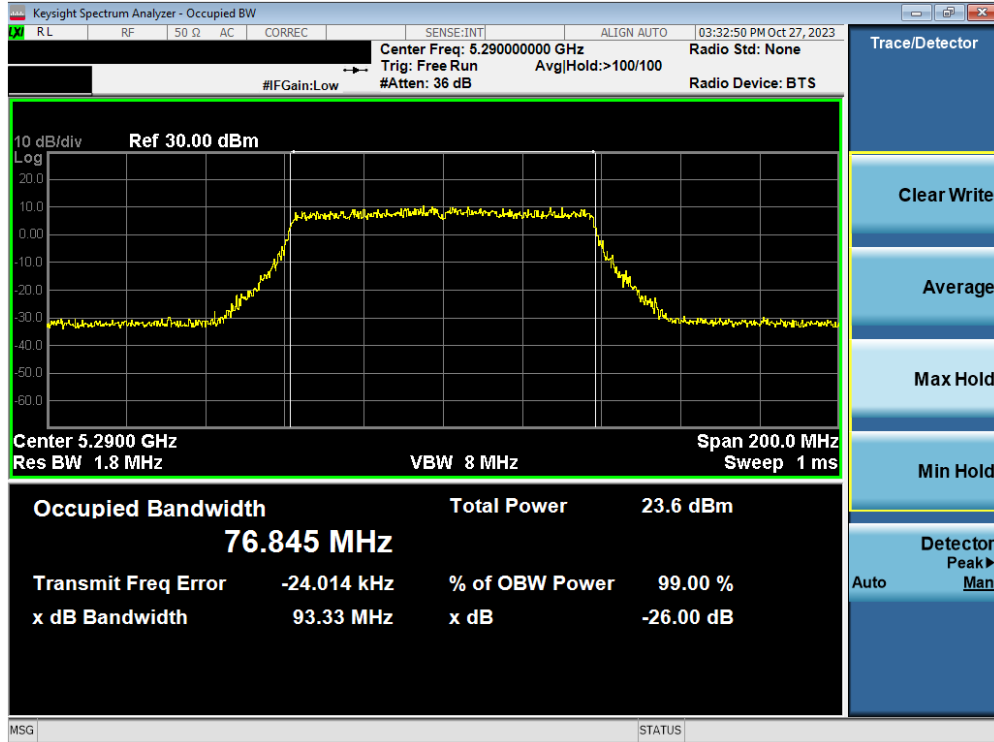


Plot 7-13. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)

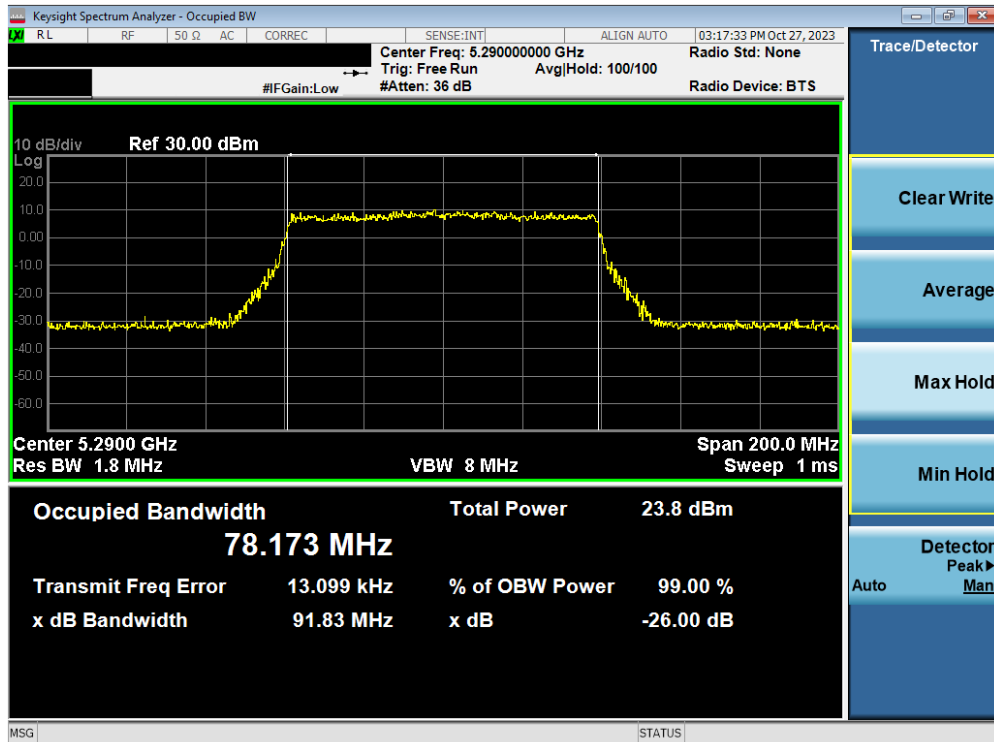


Plot 7-14. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax/be (UNII Band 2A) – Ch. 54)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 23 of 168

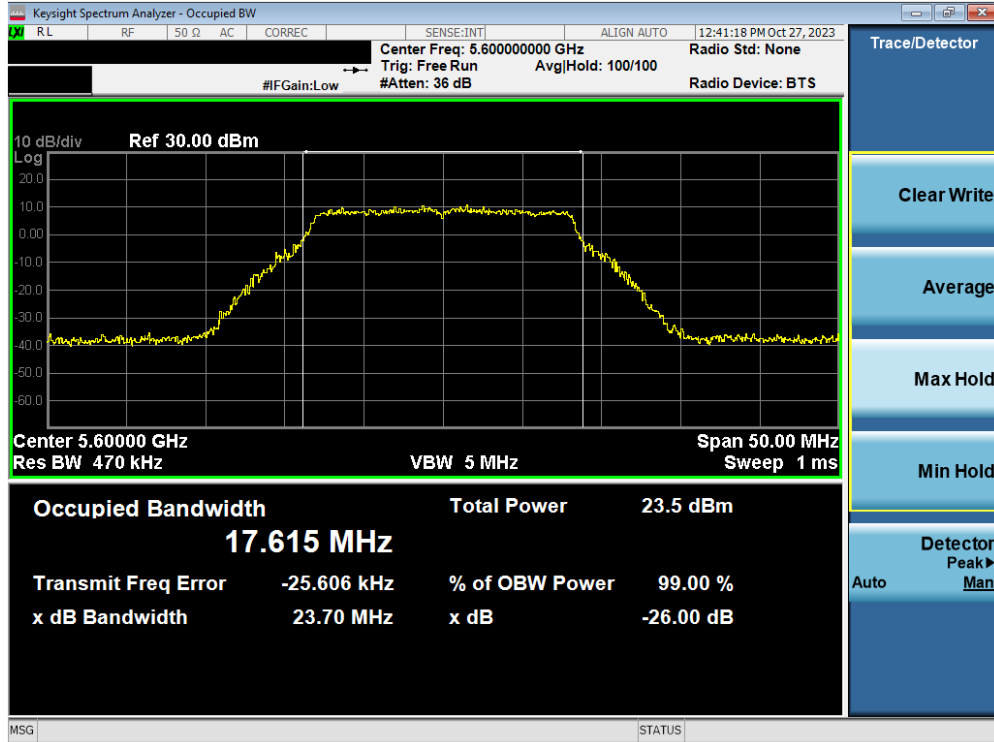


Plot 7-15. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 2A) – Ch. 58)

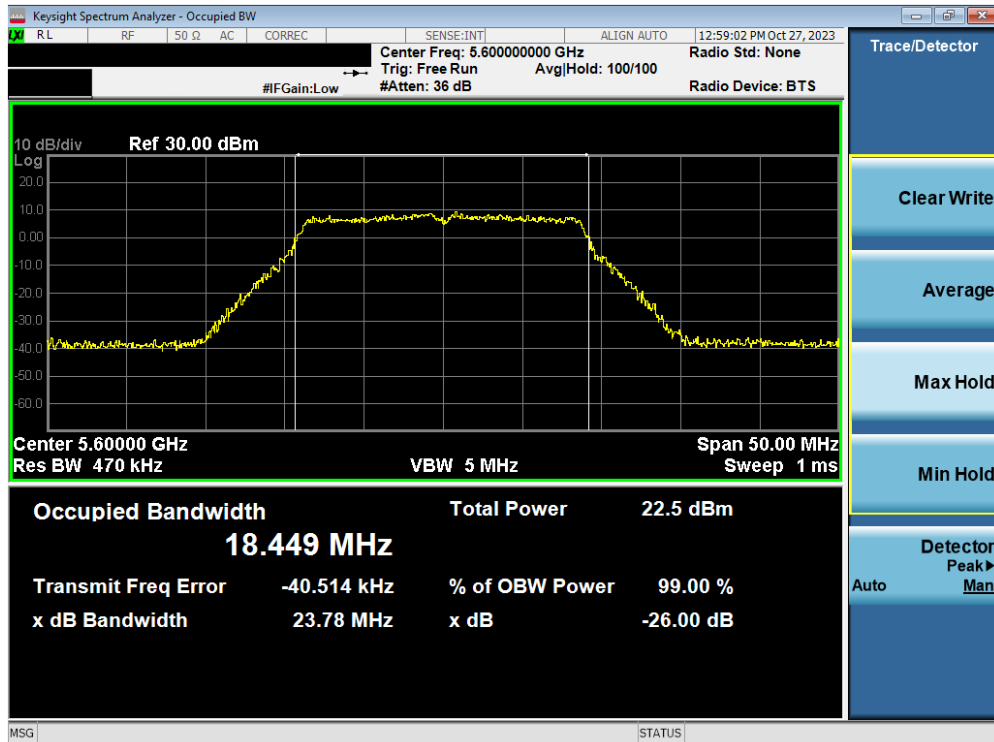


Plot 7-16. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax/be (UNII Band 2A) – Ch. 58)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 24 of 168

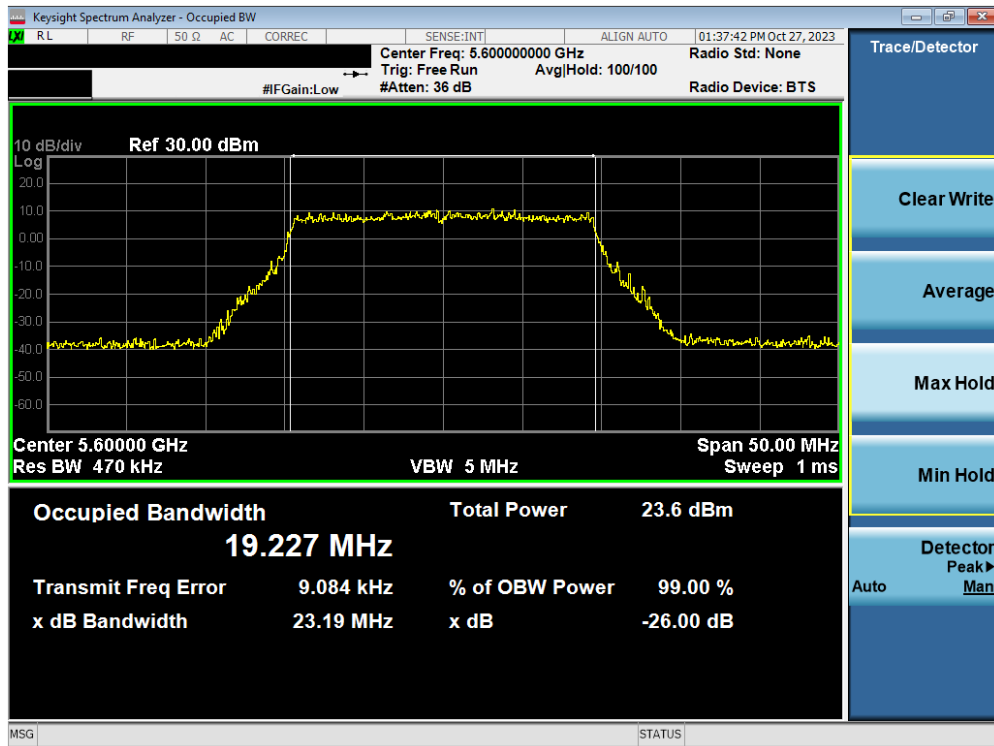


Plot 7-17. 26dB Bandwidth Plot MIMO ANT1 (802.11a (UNII Band 2C) – Ch. 120)

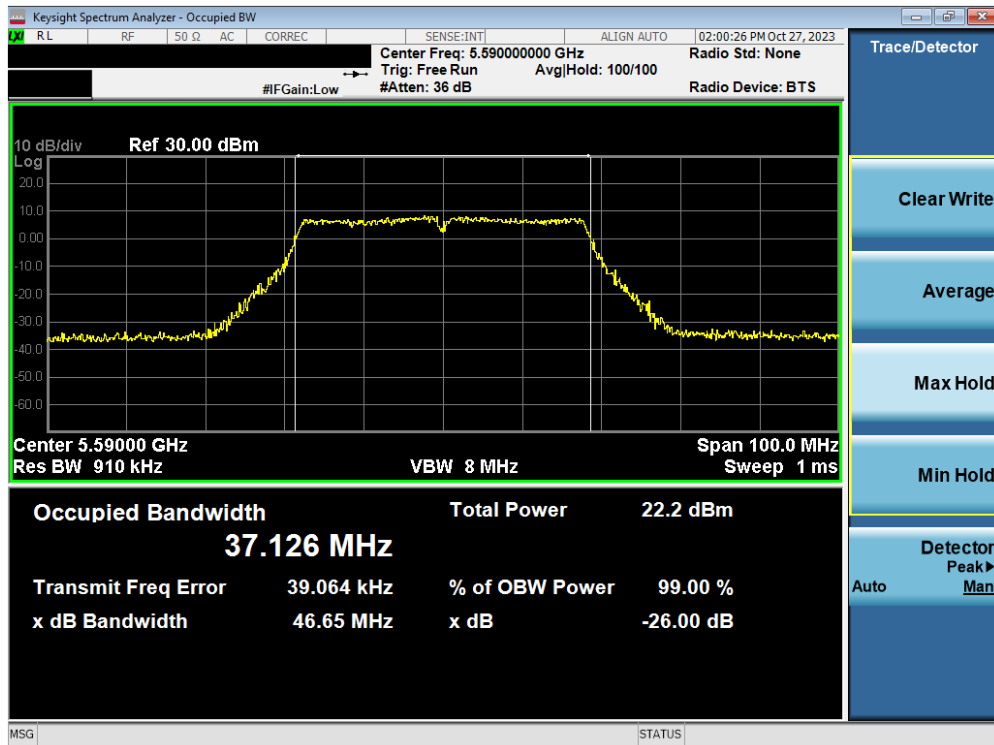


Plot 7-18. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 2C) – Ch. 120)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 25 of 168

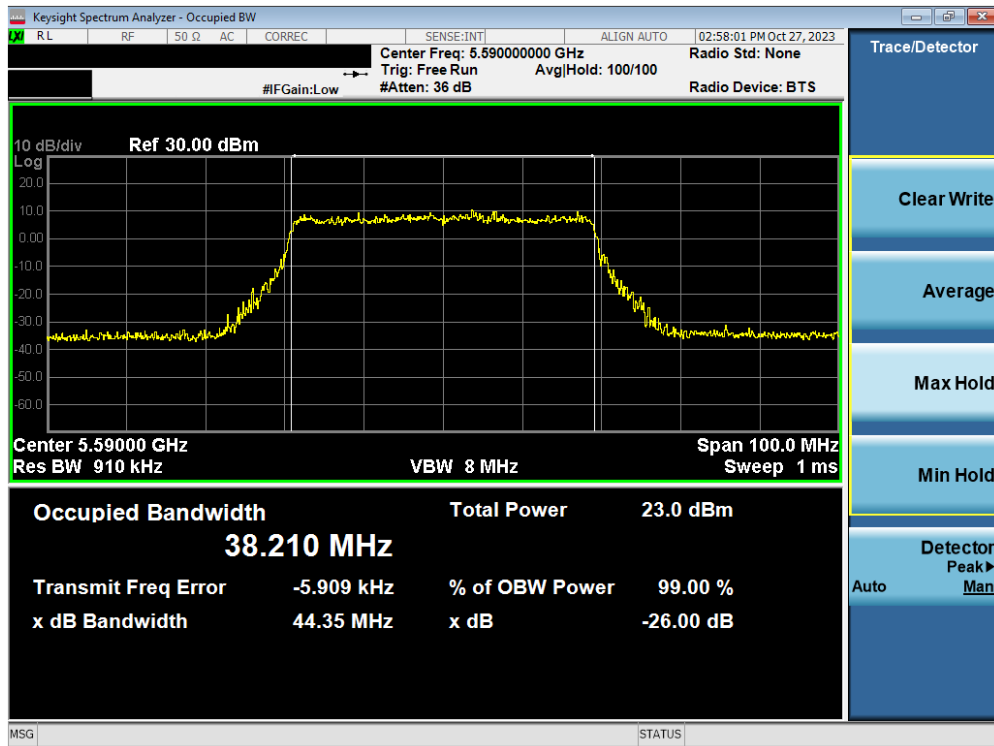


Plot 7-19. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax/be (UNII Band 2C) – Ch. 120)

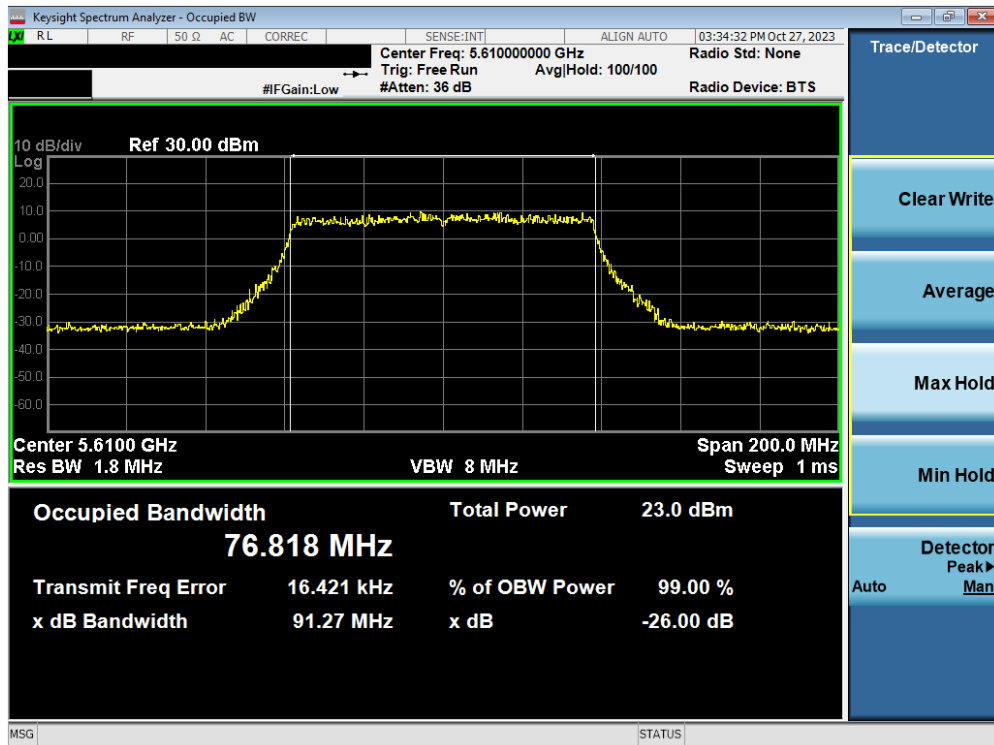


Plot 7-20. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 2C) – Ch. 118)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 26 of 168

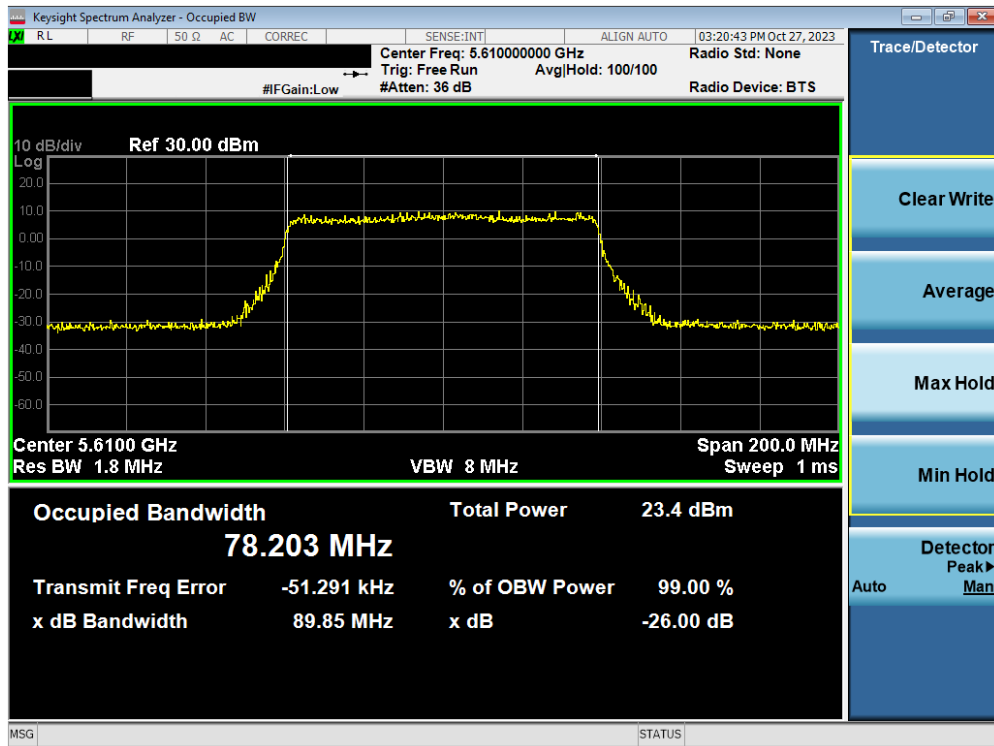


Plot 7-21. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax/be (UNII Band 2C) – Ch. 118)

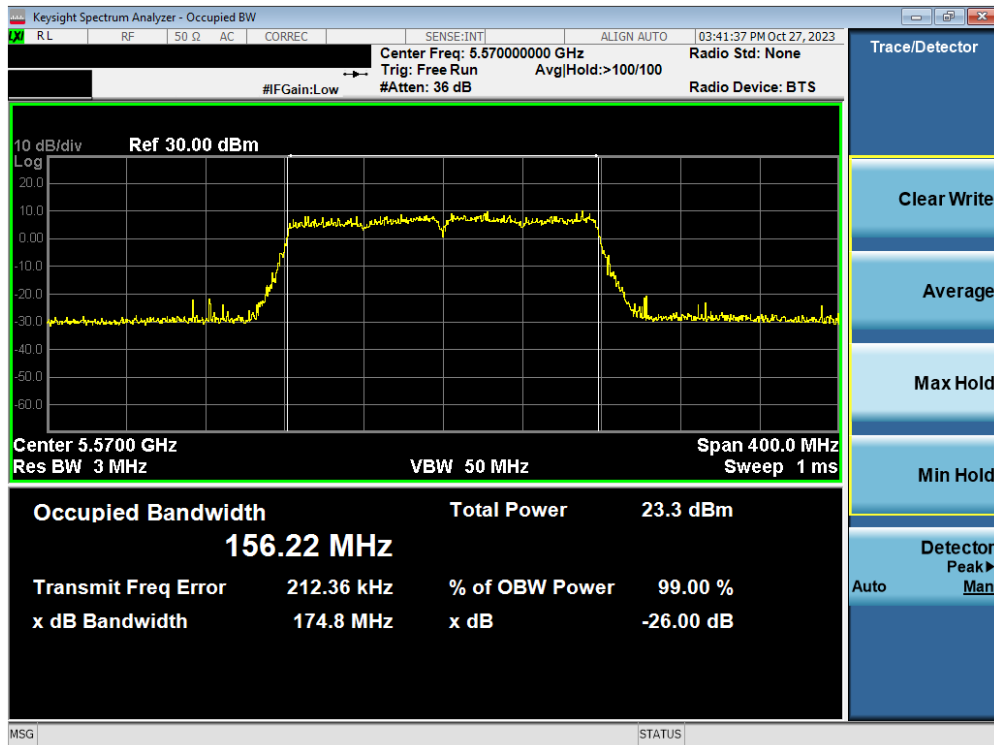


Plot 7-22. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 2C) – Ch. 122)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 27 of 168

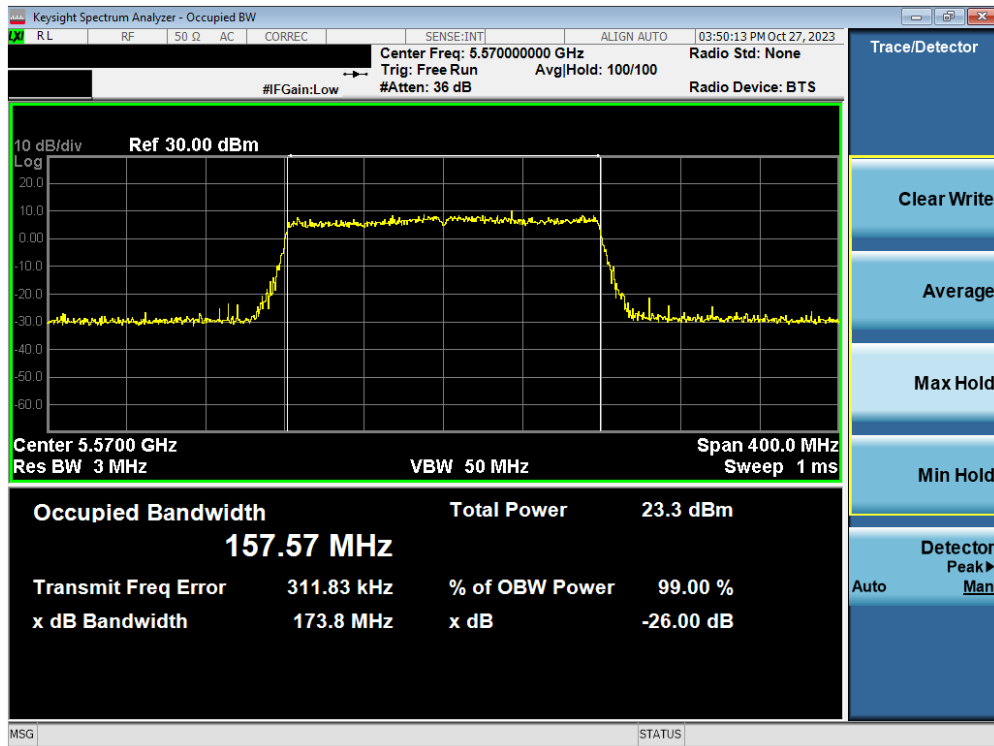


Plot 7-23. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax/be (UNII Band 2C) – Ch. 122)



Plot 7-24. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11ac (UNII Band 2C) – Ch. 114)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 28 of 168



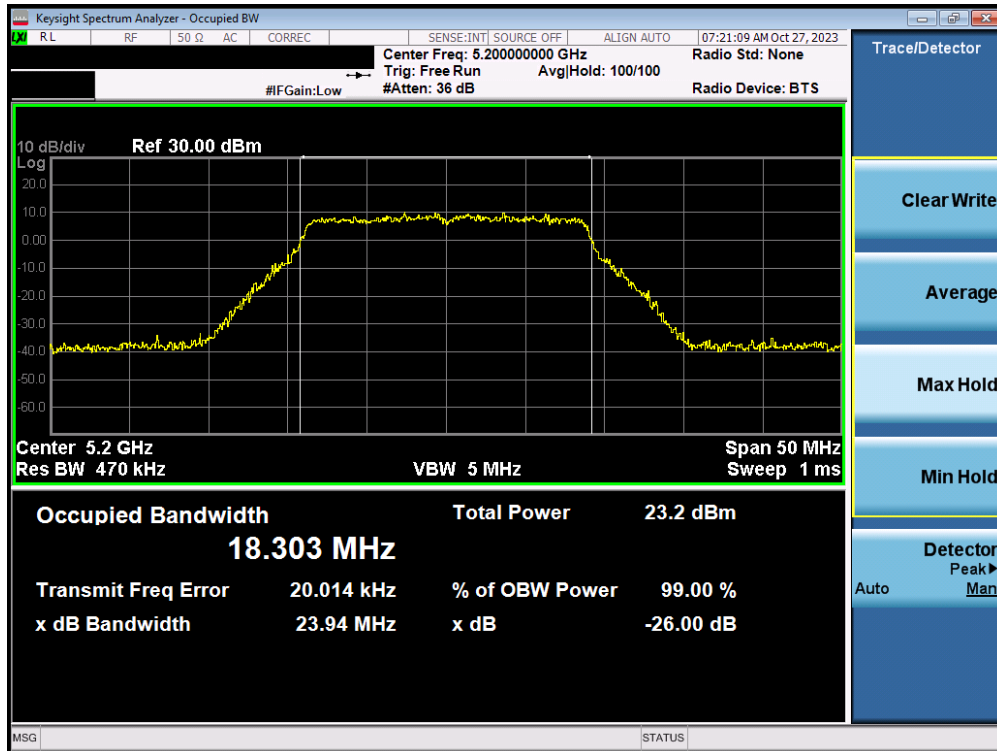
Plot 7-25. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11ax/be (UNII Band 2C) – Ch. 114)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 29 of 168

7.2.2 MIMO Antenna-2 26dB Bandwidth Measurements

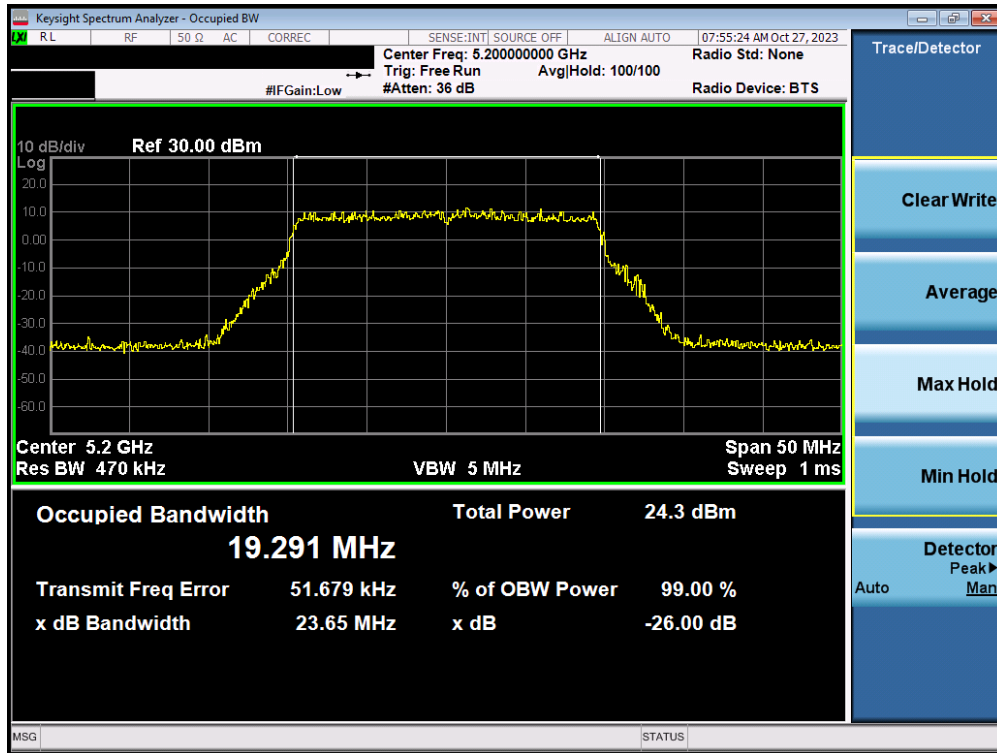


Plot 7-26. 26dB Bandwidth Plot MIMO ANT2 (802.11a (UNII Band 1) – Ch. 40)

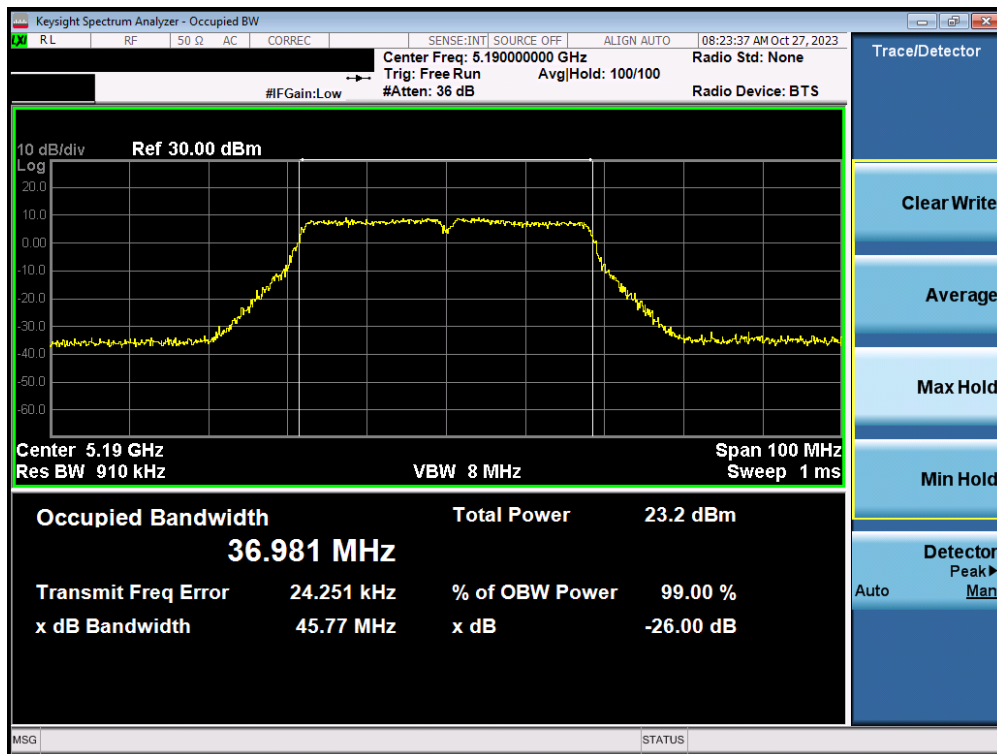


Plot 7-27. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 1) – Ch. 40)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 30 of 168

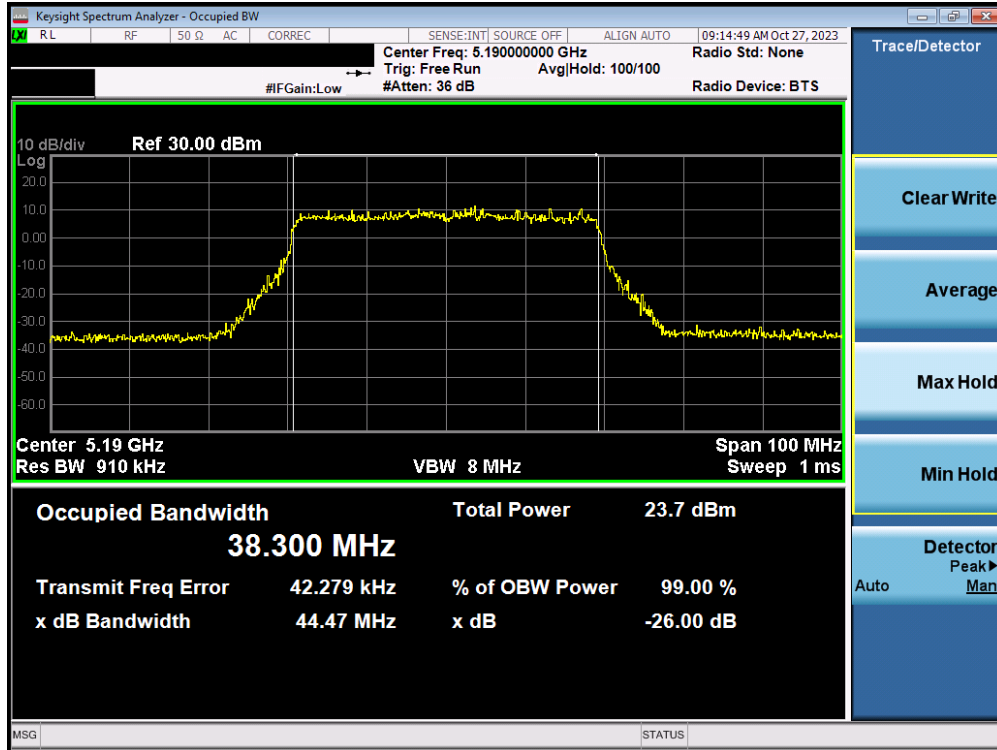


Plot 7-28. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax/be (UNII Band 1) – Ch. 40)

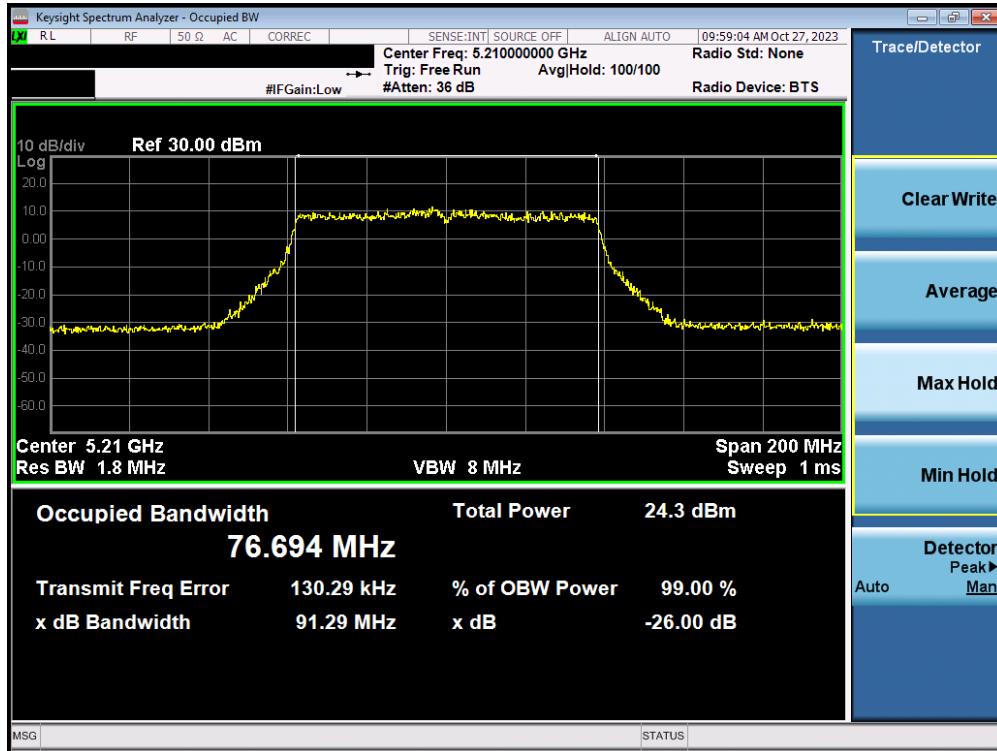


Plot 7-29. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 1) – Ch. 38)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 31 of 168

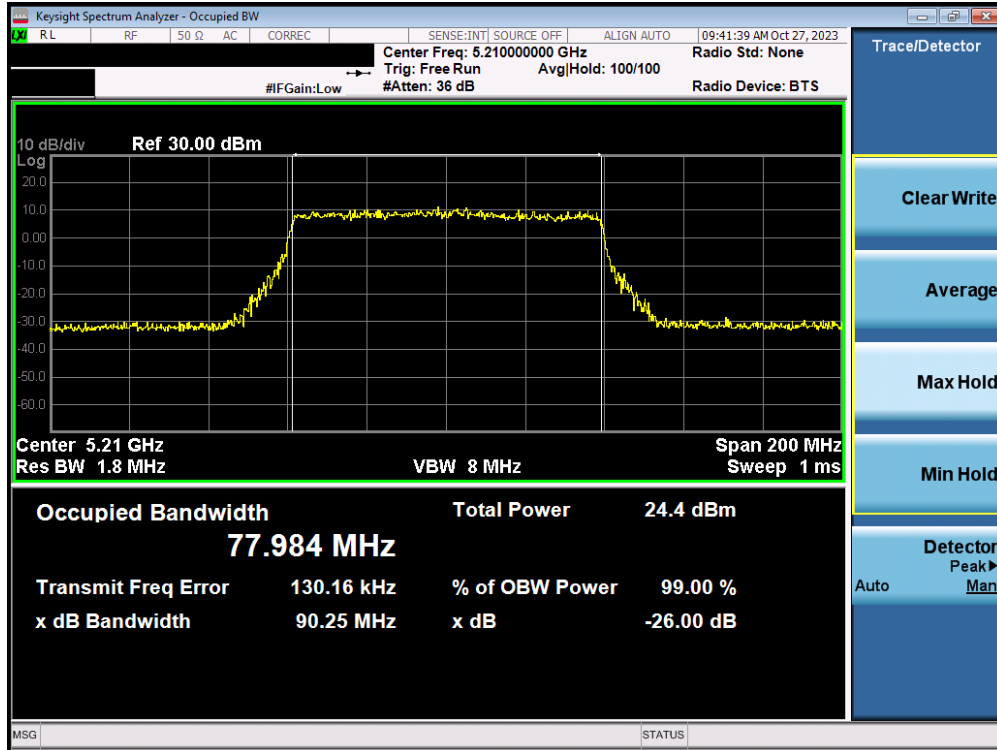


Plot 7-30. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax/be (UNII Band 1) – Ch. 38)

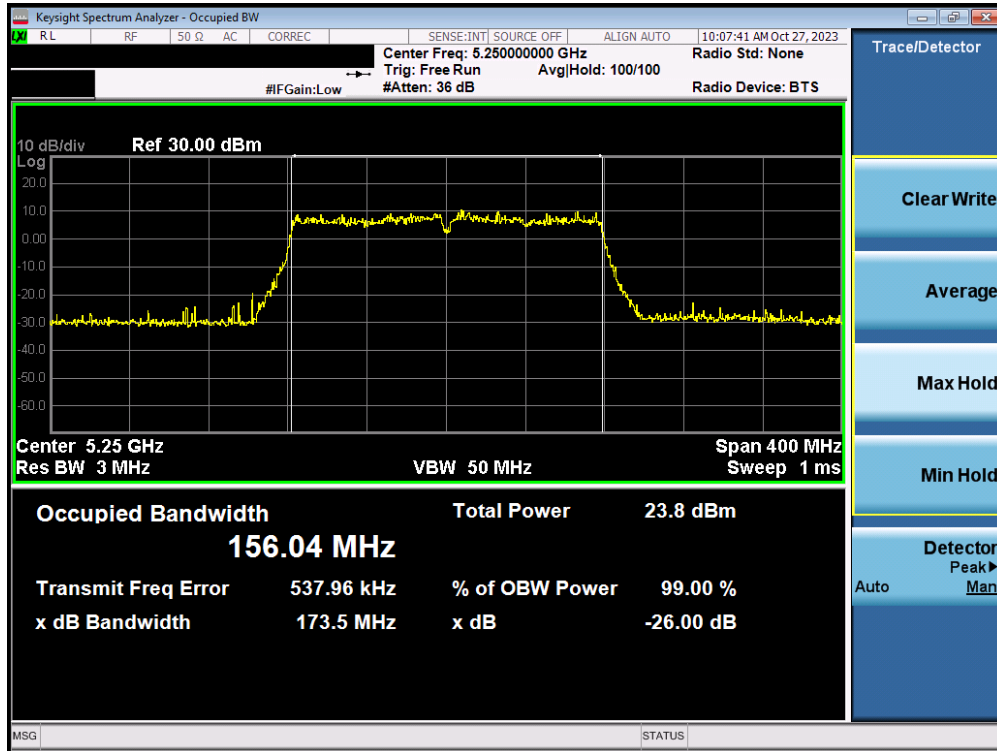


Plot 7-31. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 32 of 168

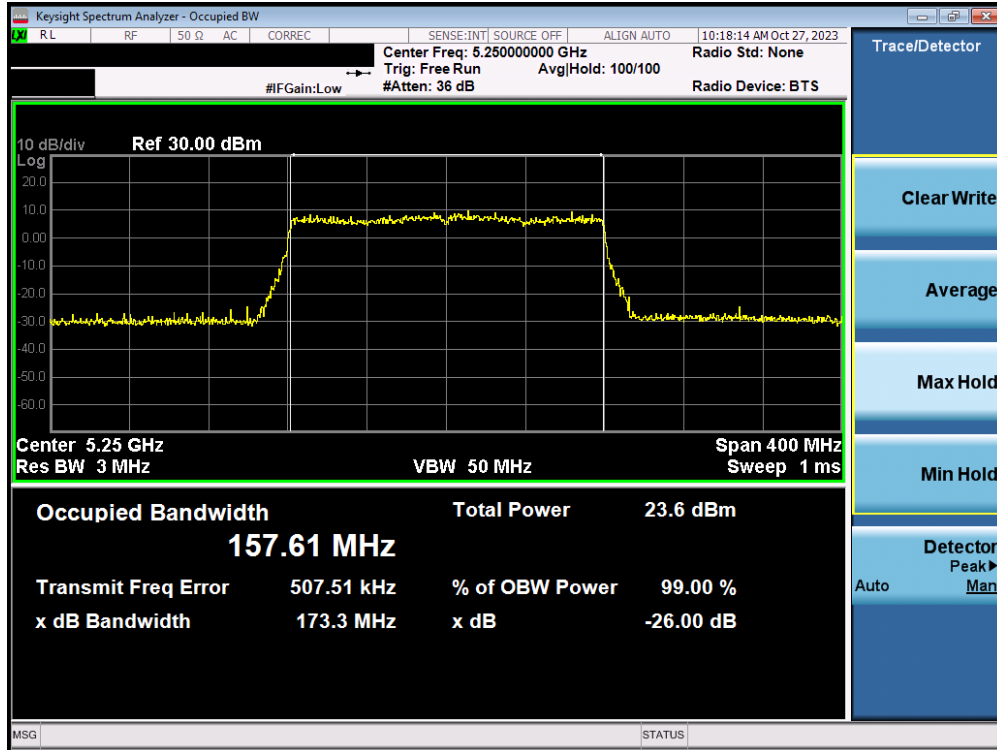


Plot 7-32. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax/be (UNII Band 1) – Ch. 42)

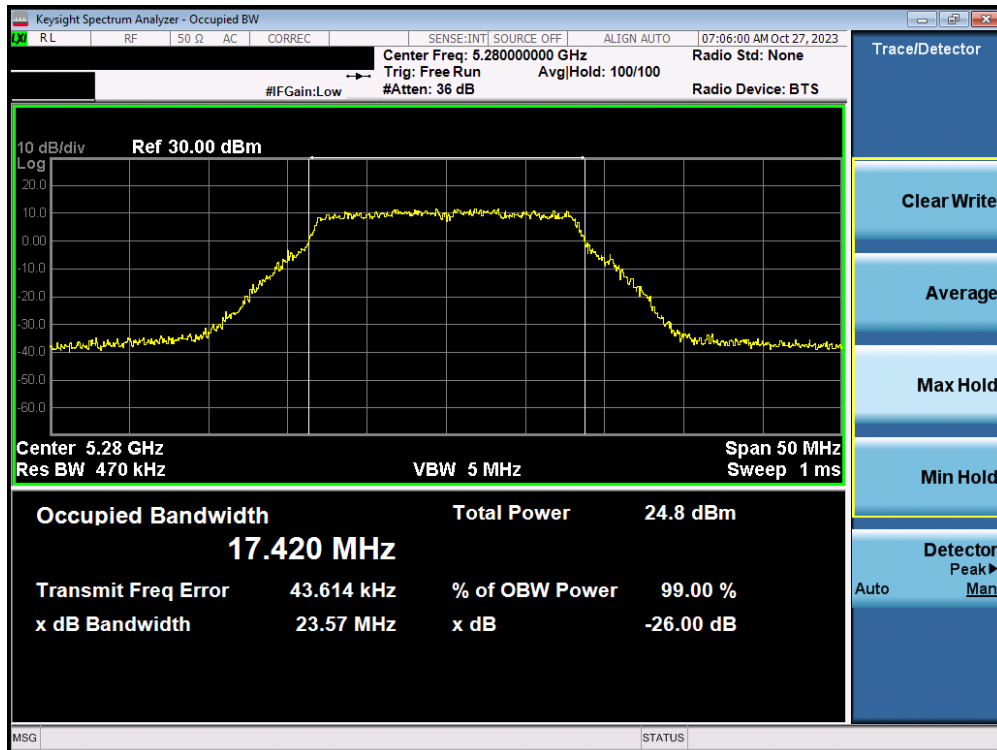


Plot 7-33. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW 802.11ac (UNII Band 1/2A) – Ch. 50)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 33 of 168

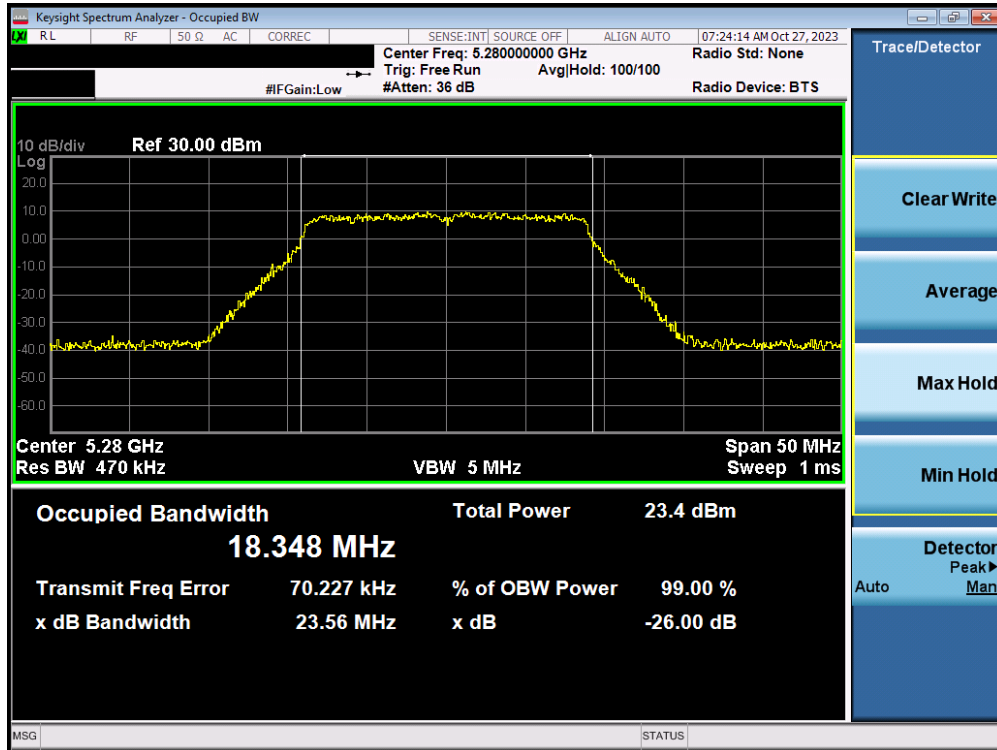


Plot 7-34. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW 802.11ax/be (UNII Band 1/2A) – Ch. 50)

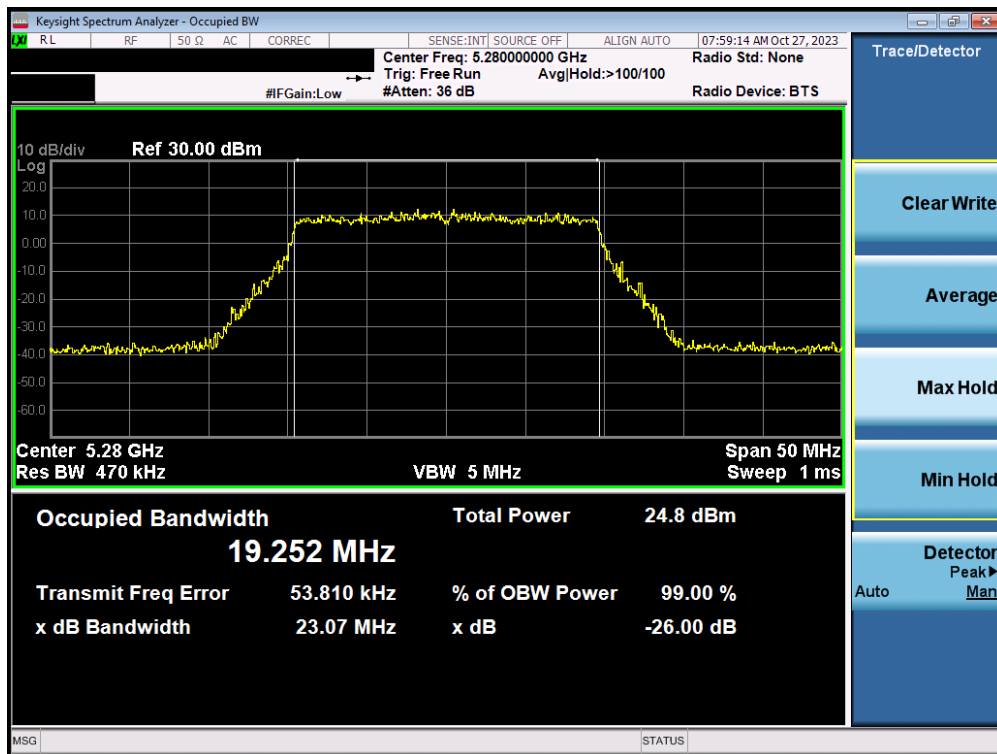


Plot 7-35. 26dB Bandwidth Plot MIMO ANT2 (802.11a (UNII Band 2A) – Ch. 56)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 34 of 168

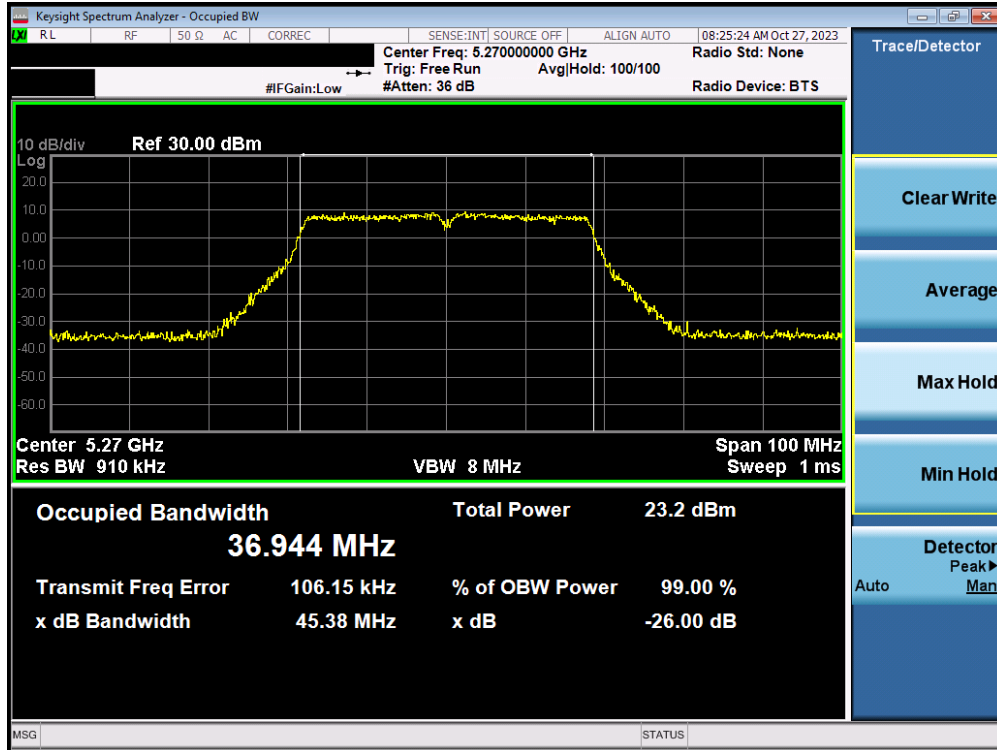


Plot 7-36. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)

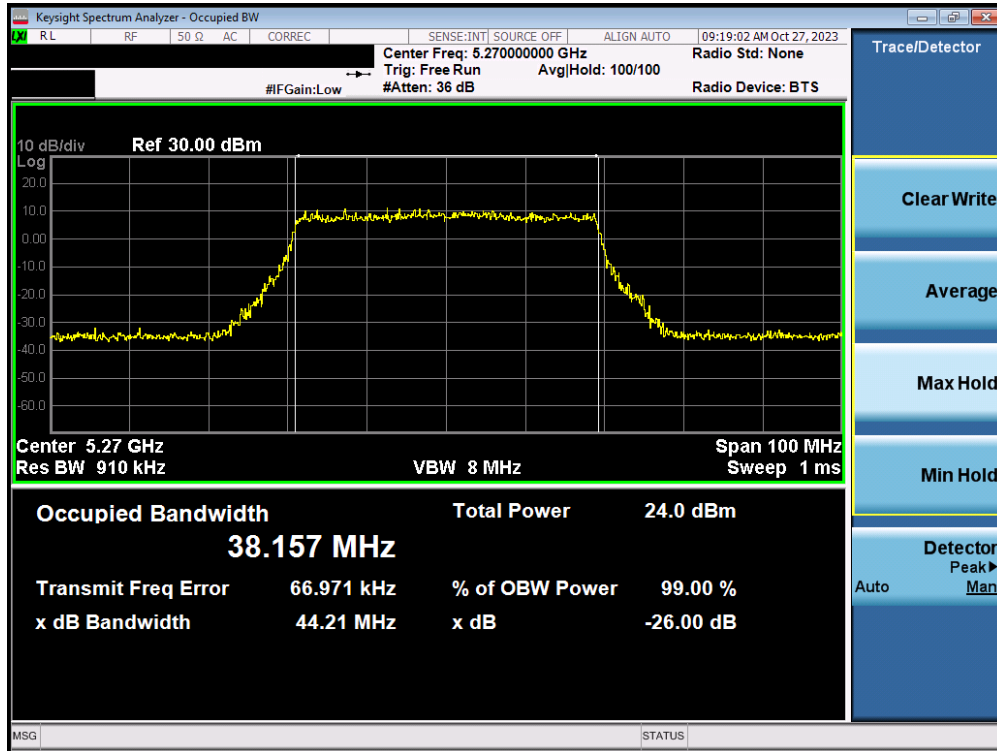


Plot 7-37. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax/be (UNII Band 2A) – Ch. 56)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 35 of 168

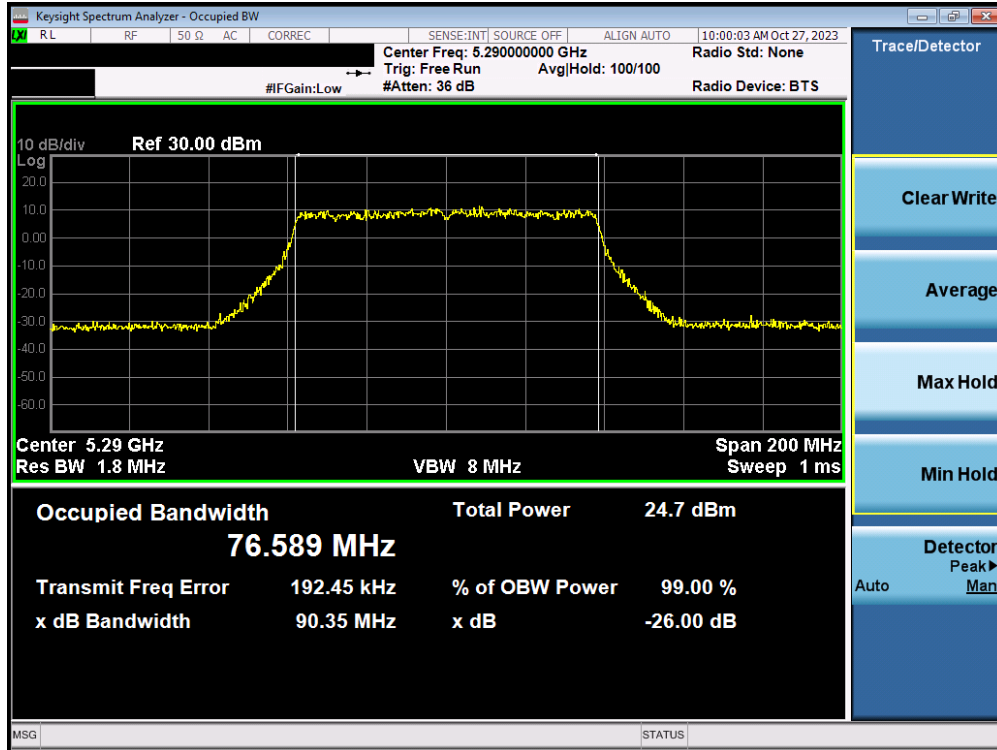


Plot 7-38. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)

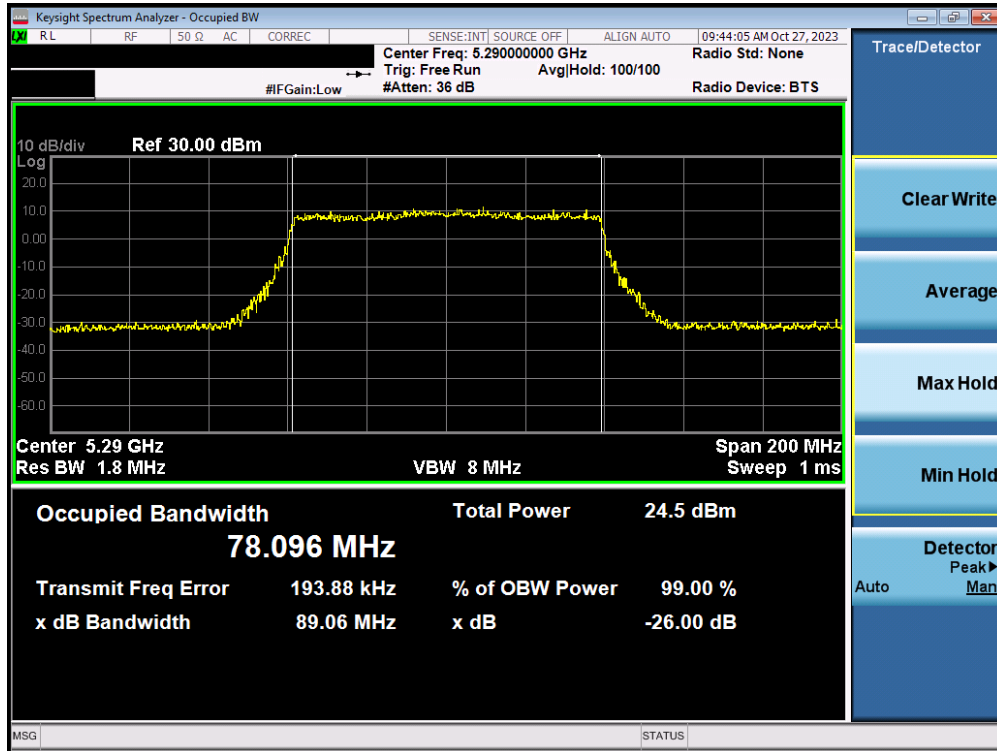


Plot 7-39. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax/be (UNII Band 2A) – Ch. 54)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 36 of 168

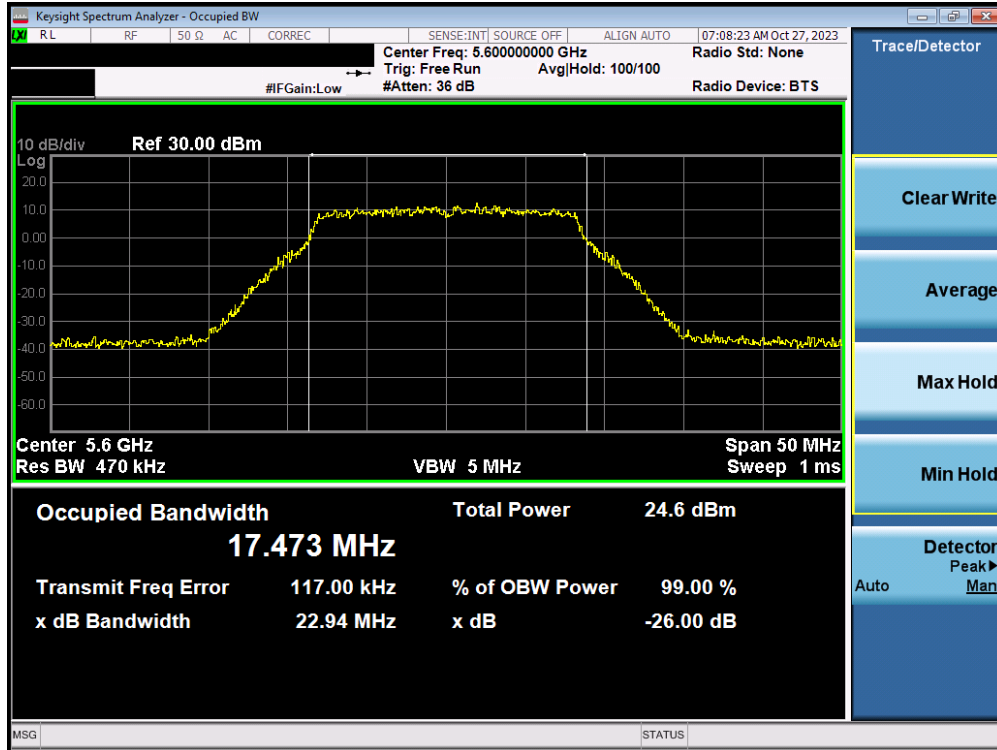


Plot 7-40. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 2A) – Ch. 58)

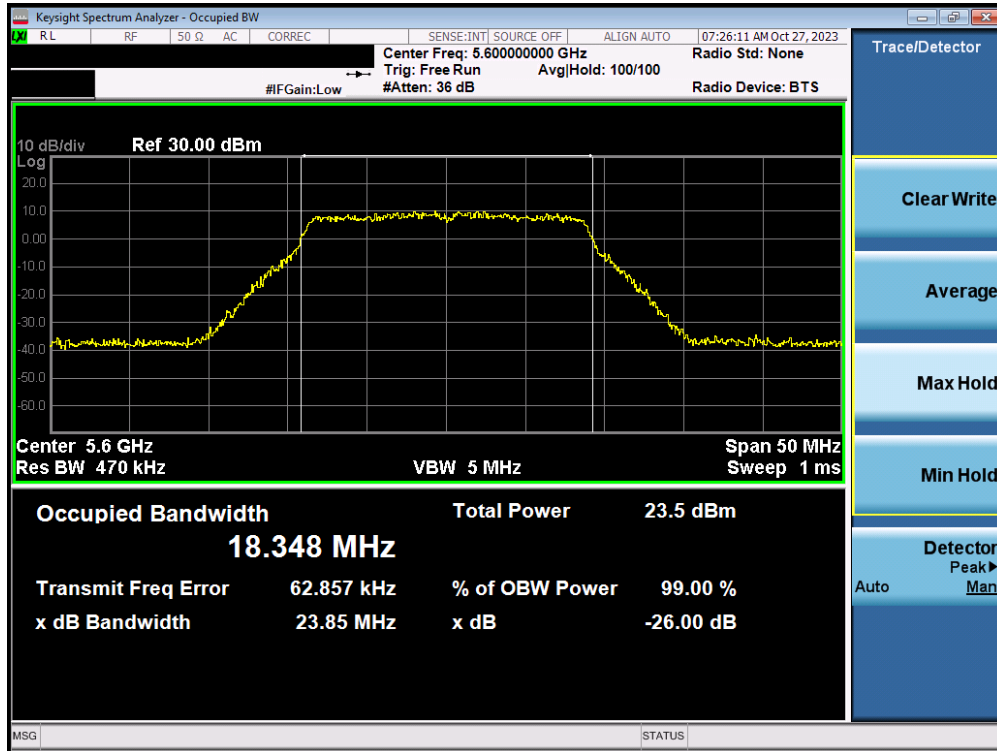


Plot 7-41. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax/be (UNII Band 2A) – Ch. 58)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 37 of 168

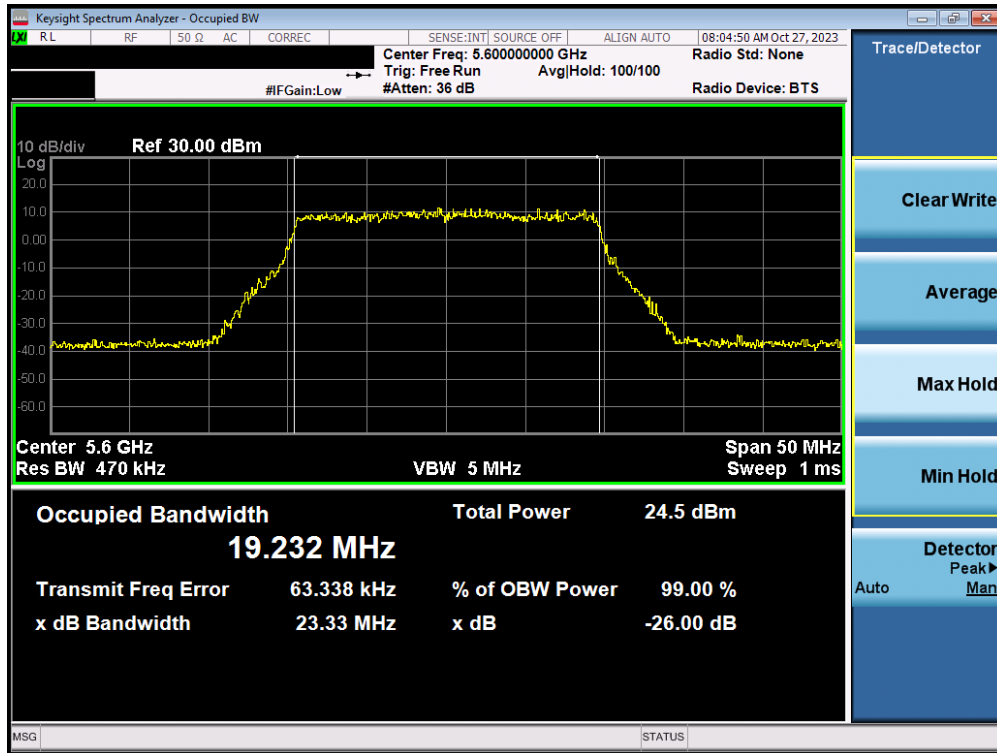


Plot 7-42. 26dB Bandwidth Plot MIMO ANT2 (802.11a (UNII Band 2C) – Ch. 120)

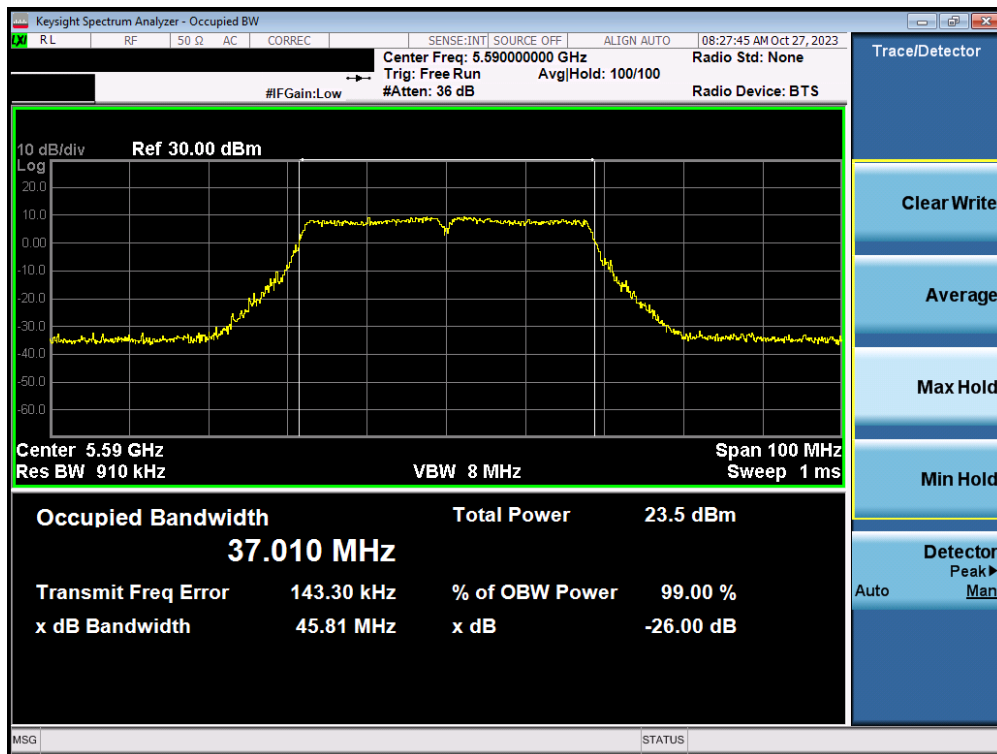


Plot 7-43. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 2C) – Ch. 120)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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Plot 7-44. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax/be (UNII Band 2C) – Ch. 120)

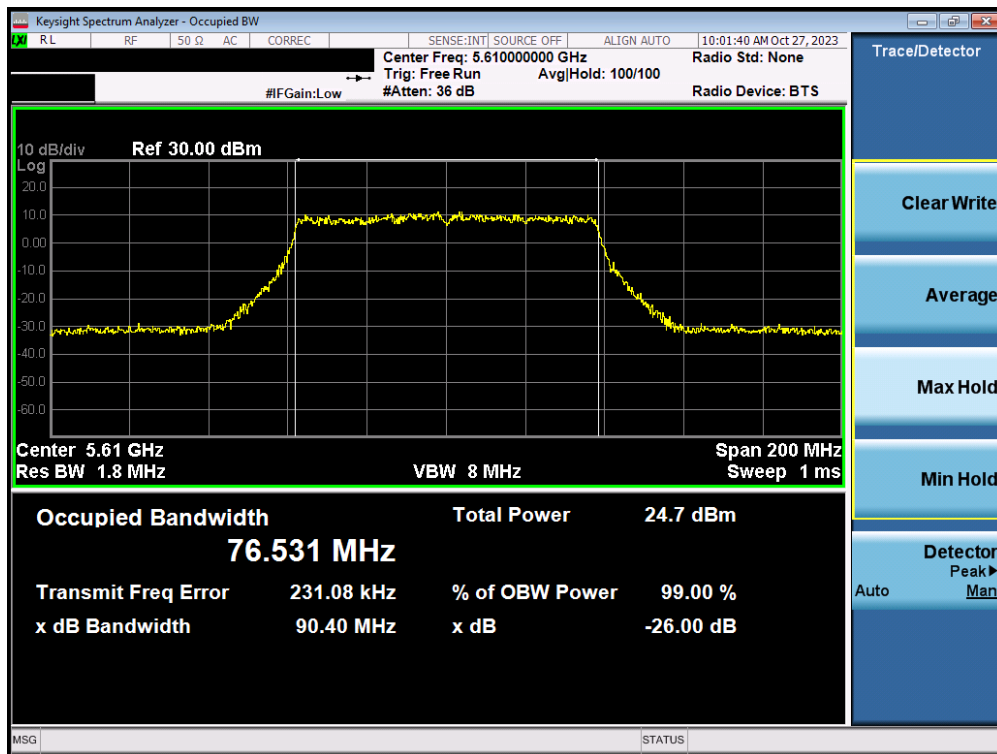


Plot 7-45. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 2C) – Ch. 118)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 39 of 168

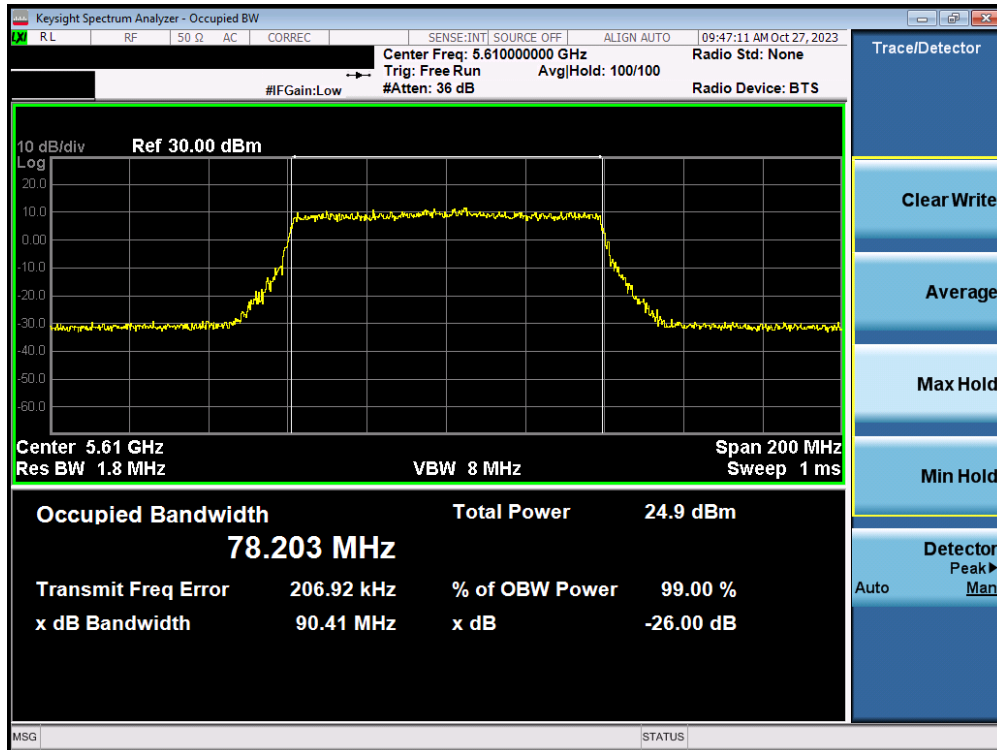


Plot 7-46. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax/be (UNII Band 2C) – Ch. 118)

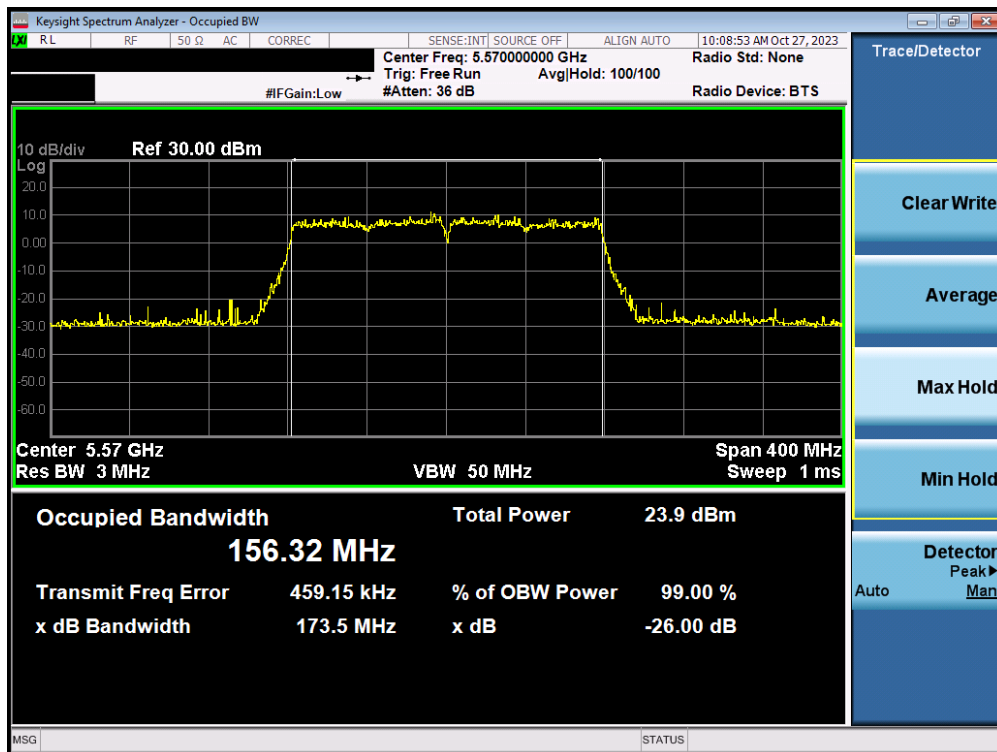


Plot 7-47. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 2C) – Ch. 122)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 40 of 168

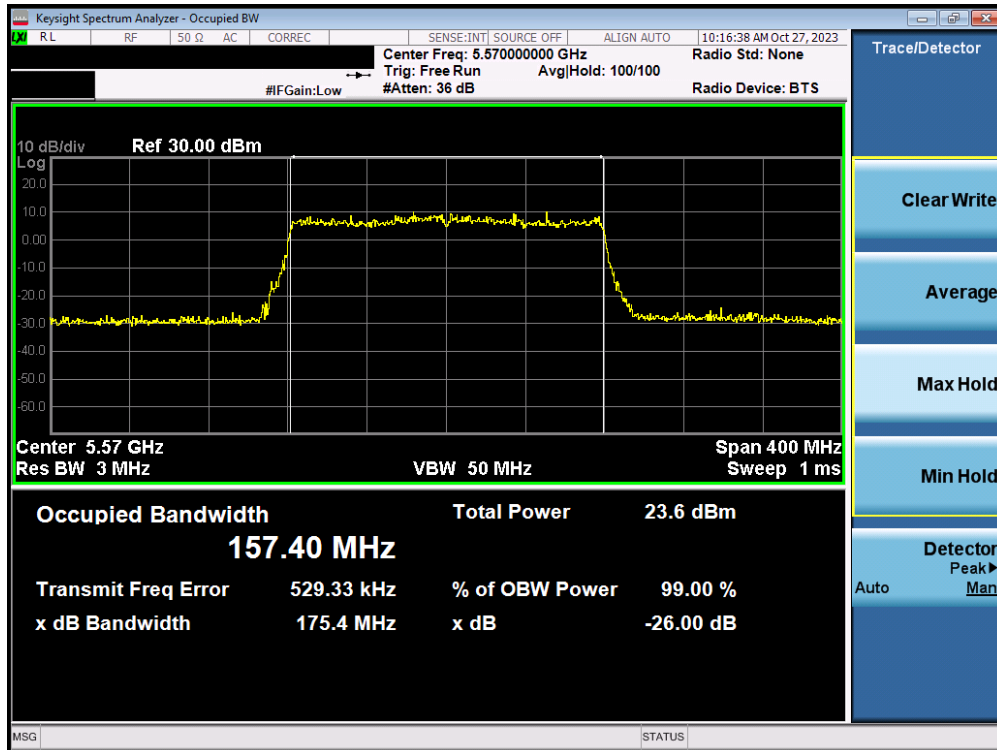


Plot 7-48. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax/be (UNII Band 2C) – Ch. 122)



Plot 7-49. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW 802.11ac (UNII Band 2C) – Ch. 114)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 41 of 168



Plot 7-50. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW 802.11ax/be (UNII Band 2C) – Ch. 114)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 42 of 168

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 band and 5.850 – 5.895GHz band, the 6dB bandwidth must be \geq 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 $\geq 3 \times$ 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

All Cases were investigated; a subset of the taken plots were included to represent relevant settings and measurements.

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MIMO 6dB Bandwidth Measurements

	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 6dB Bandwidth [MHz]	Antenna-2 6dB Bandwidth [MHz]
Band 3	5745	149	a	16.41	16.36
	5785	157	a	16.37	16.42
	5825	165	a	16.07	16.36
	5745	149	n	17.61	17.61
	5785	157	n	17.61	17.60
	5825	165	n	17.59	17.65
	5745	149	ac	17.61	17.62
	5785	157	ac	17.66	17.65
	5825	165	ac	17.63	17.60
	5745	149	ax/be SU	18.92	18.81
	5785	157	ax/be SU	18.91	19.01
	5825	165	ax/be SU	19.10	18.80
	5755	151	n	36.38	36.48
	5795	159	n	36.45	36.49
	5755	151	ac	36.45	36.43
	5795	159	ac	36.37	36.49
	5755	151	ax/be SU	38.08	38.18
	5795	159	ax/be SU	38.04	38.18
5775	155	ac	76.41	76.03	
5775	155	ax/be SU	77.95	78.08	

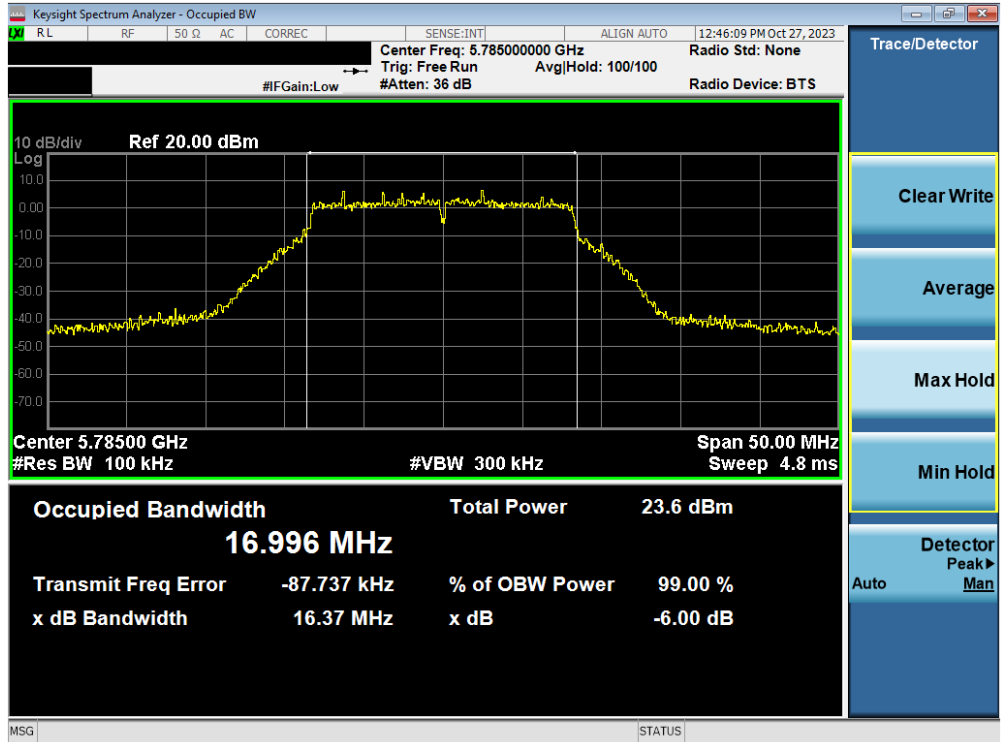
Table 7-3. Band 3 Conducted 6dB Bandwidth Measurements MIMO

	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 6dB Bandwidth [MHz]	Antenna-2 6dB Bandwidth [MHz]
Band 3/4	5845	169	a	16.34	16.37
Band 4	5865	173	a	16.36	16.41
	5885	177	a	16.39	16.36
Band 3/4	5845	169	n	17.65	17.65
Band 4	5865	173	n	17.63	17.66
	5885	177	n	17.62	17.61
Band 3/4	5845	169	ac	17.62	17.65
Band 4	5865	173	ac	17.67	17.66
	5885	177	ac	17.64	17.62
Band 3/4	5845	169	ax/be SU	19.00	19.05
Band 4	5865	173	ax/be SU	18.99	18.83
	5885	177	ax/be SU	19.16	19.06
Band 3/4	5835	167	n	36.45	36.42
Band 4	5875	175	n	36.39	36.40
Band 3/4	5835	167	ac	36.38	36.50
Band 4	5875	175	ac	36.18	36.49
Band 3/4	5835	167	ax/be SU	38.25	38.10
Band 4	5875	175	ax/be SU	38.23	38.12
Band 3/4	5855	171	ac	75.78	76.43
	5855	171	ax/be SU	78.09	78.03
	5815	163	ac	155.86	156.11
	5815	163	ax/be SU	158.16	158.13

Table 7-4. Bands 3/4 Conducted 6dB Bandwidth Measurements MIMO

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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7.3.1 MIMO Antenna-1 6dB Bandwidth Measurements



Plot 7-51. 6dB Bandwidth Plot MIMO ANT1 (802.11a (UNII Band 3) – Ch. 157)



Plot 7-52. 6dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 3) – Ch. 157)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 45 of 168

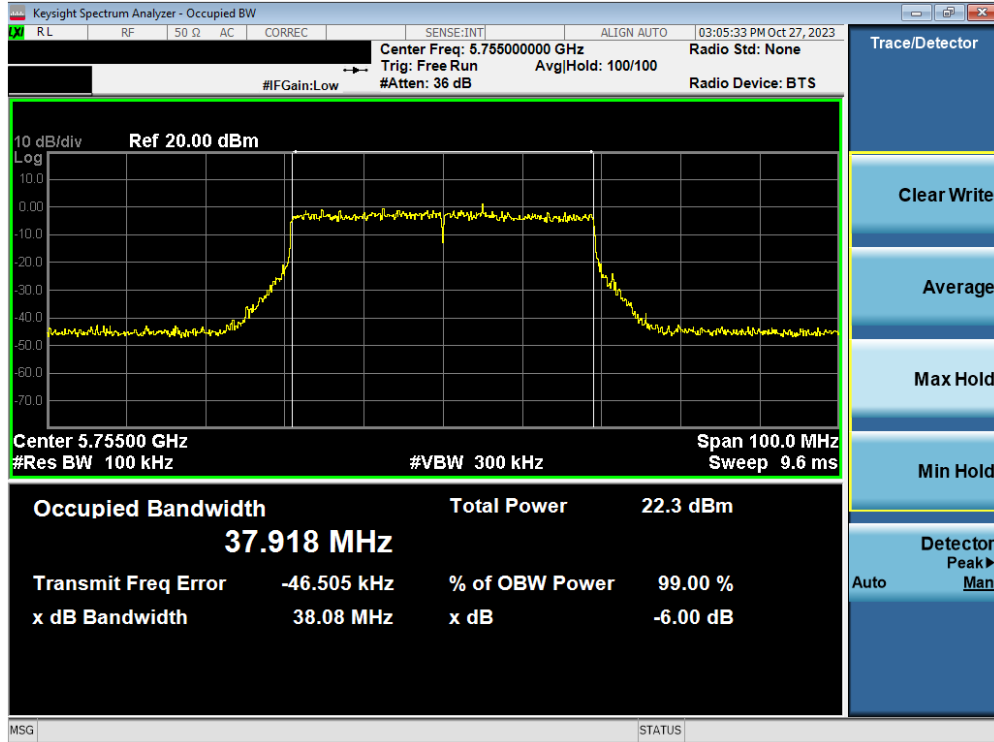


Plot 7-53. 6dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax/be (UNII Band 3) – Ch. 157)

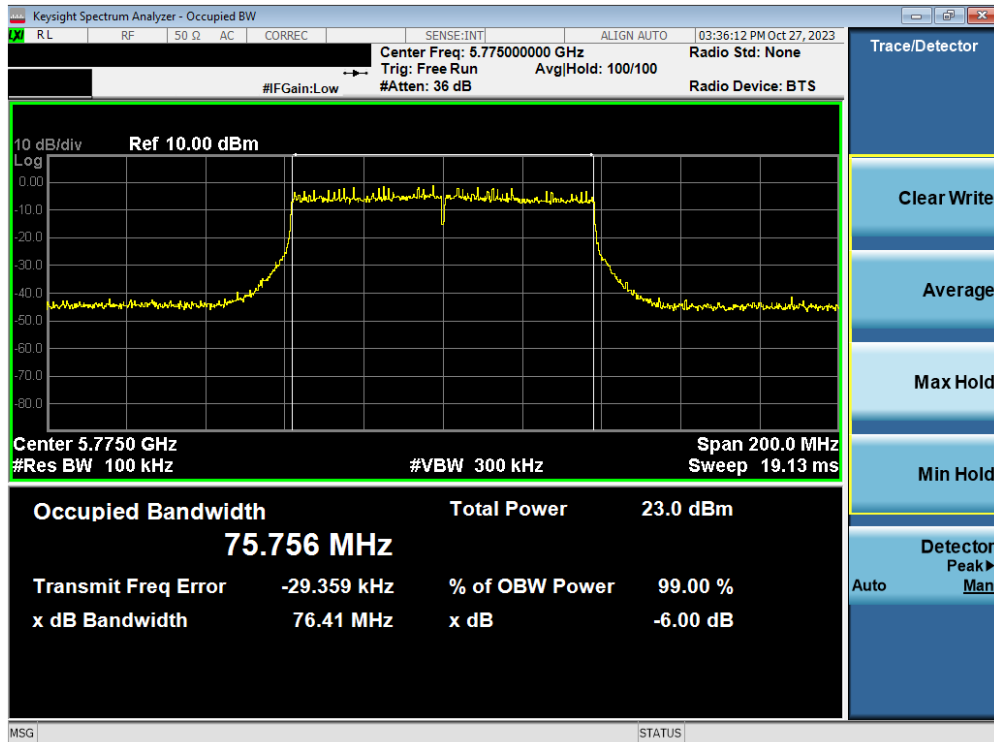


Plot 7-54. 6dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 3) – Ch. 151)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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Plot 7-55. 6dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax/be (UNII Band 3) – Ch. 151)

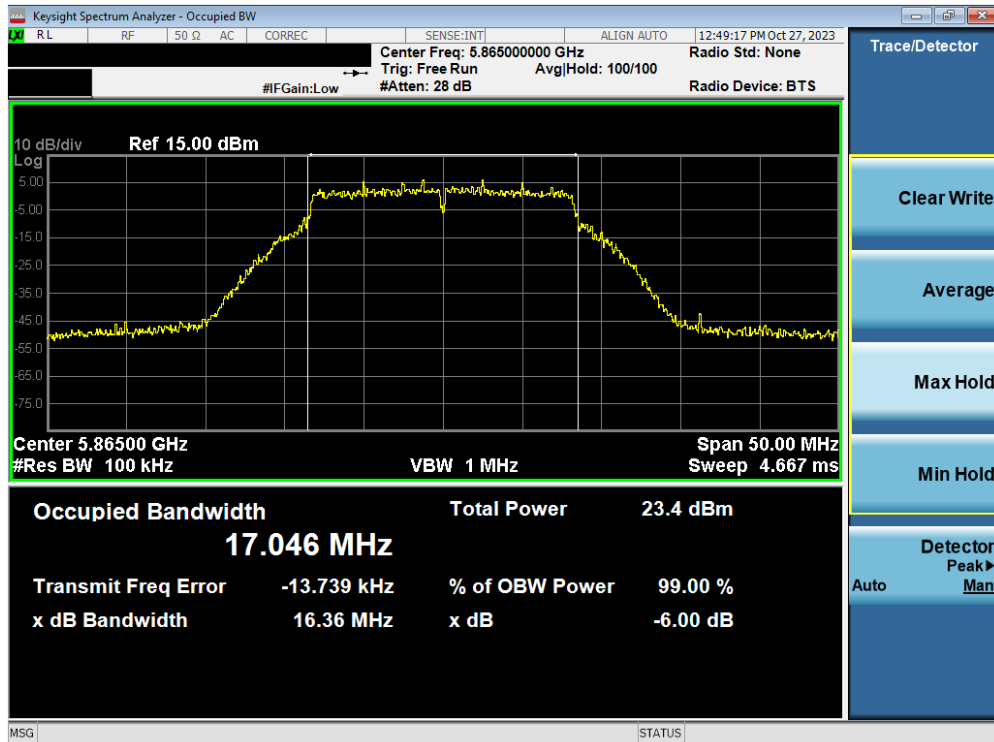


Plot 7-56. 6dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 3) – Ch. 155)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 47 of 168

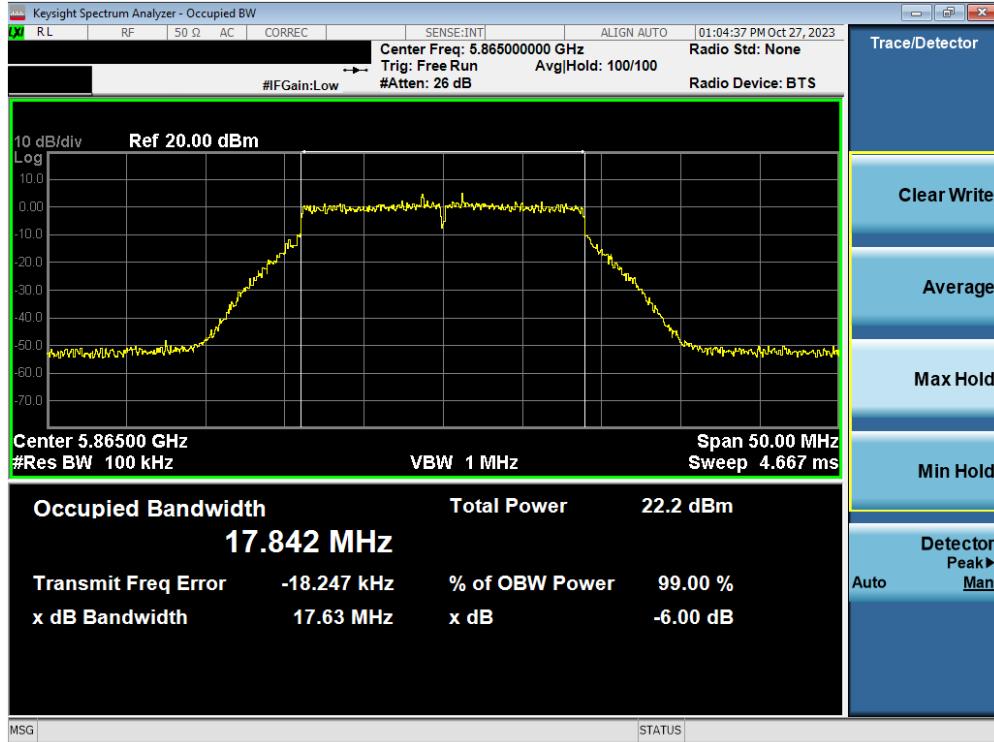


Plot 7-57. 6dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax/be (UNII Band 3) – Ch. 155)

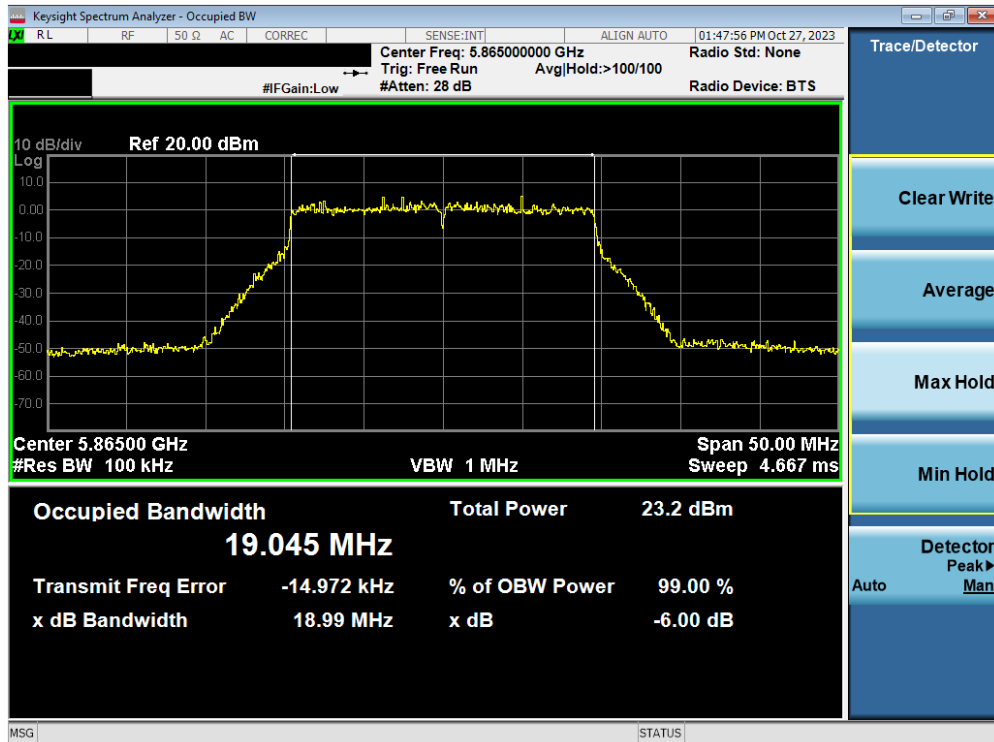


Plot 7-58. 6dB Bandwidth Plot MIMO ANT1 (802.11a (UNII Band 4) – Ch. 173)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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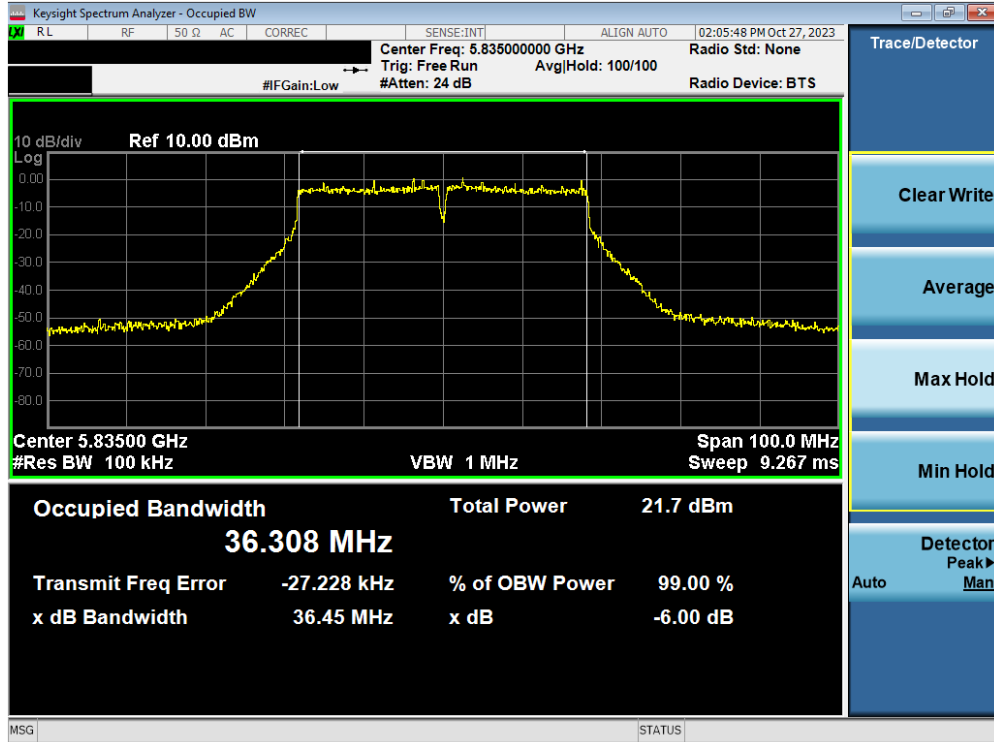


Plot 7-59. 6dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 4) – Ch. 173)

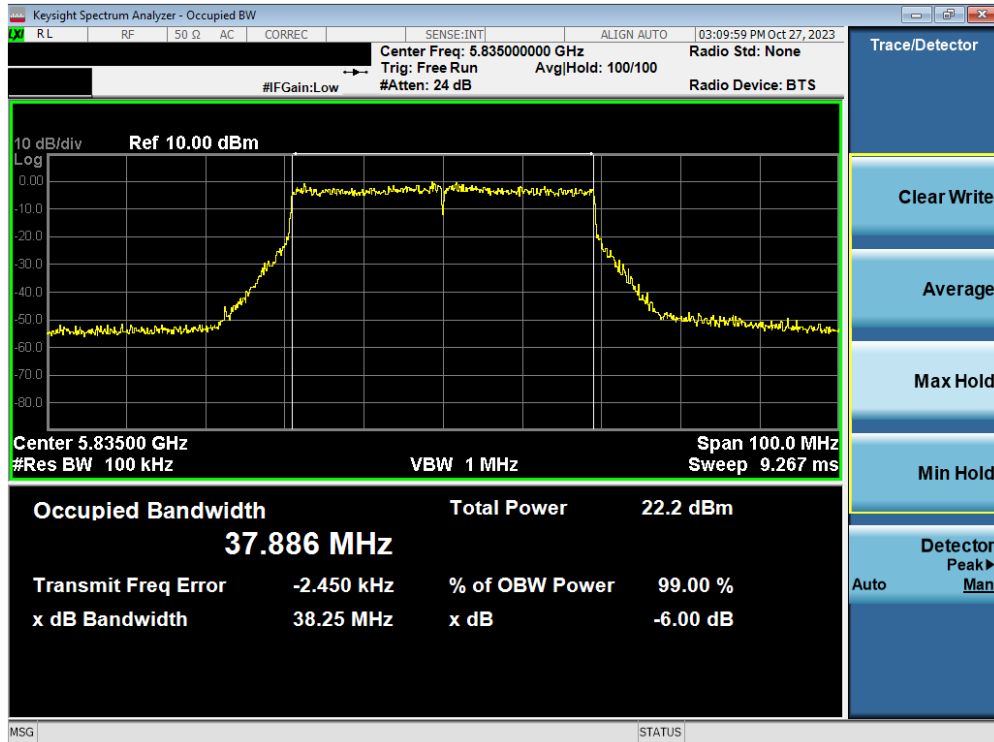


Plot 7-60. 6dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax/be (UNII Band 4) – Ch. 173)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 49 of 168

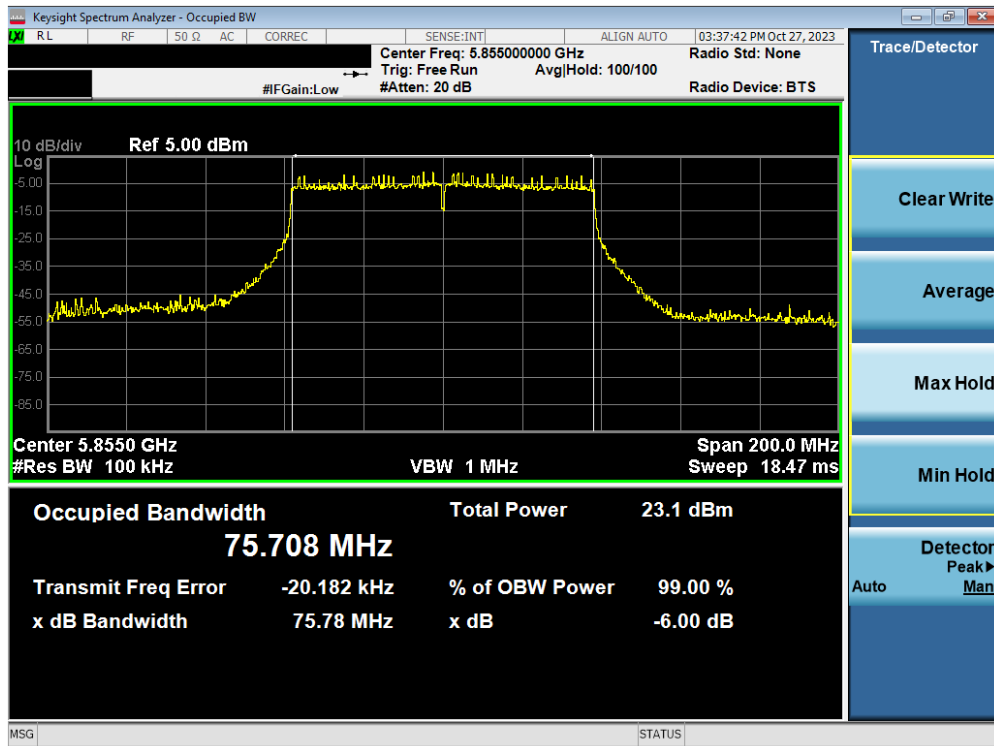


Plot 7-61. 6dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 3/4) – Ch. 167)

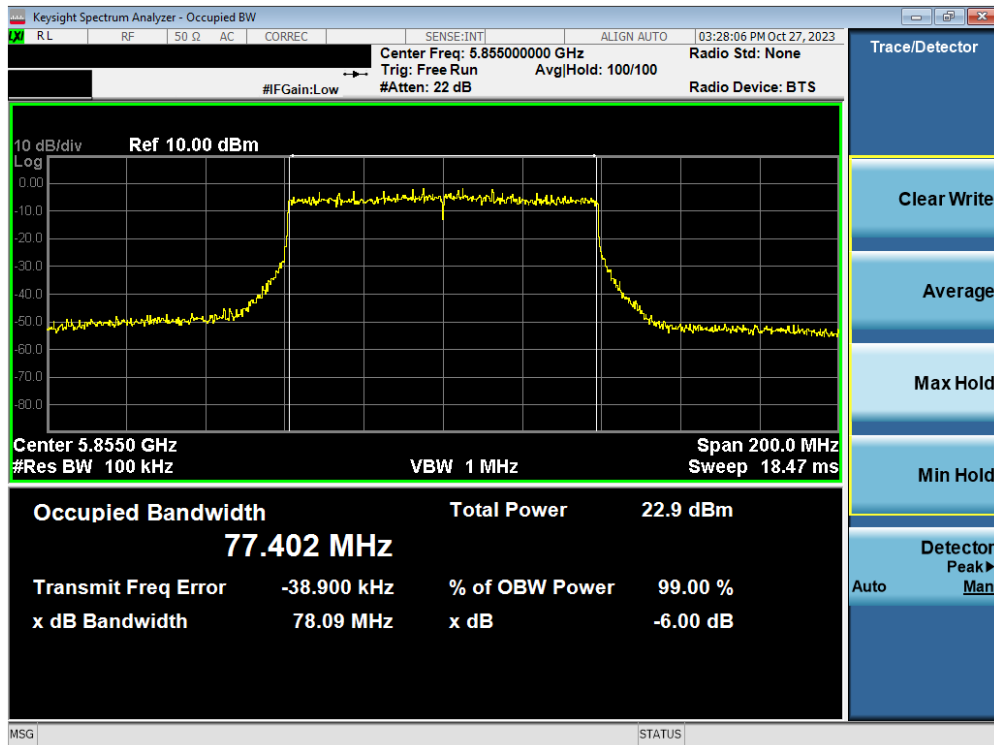


Plot 7-62. 6dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax/be (UNII Band 3/4) – Ch. 167)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 50 of 168

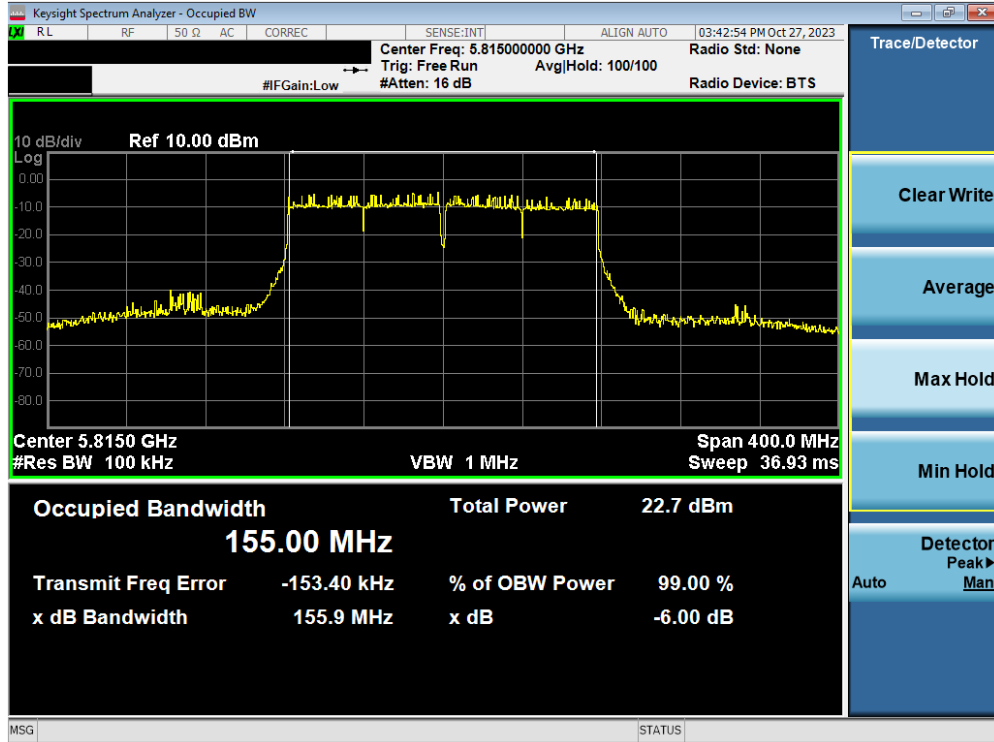


Plot 7-63. 6dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 3/4) – Ch. 171)

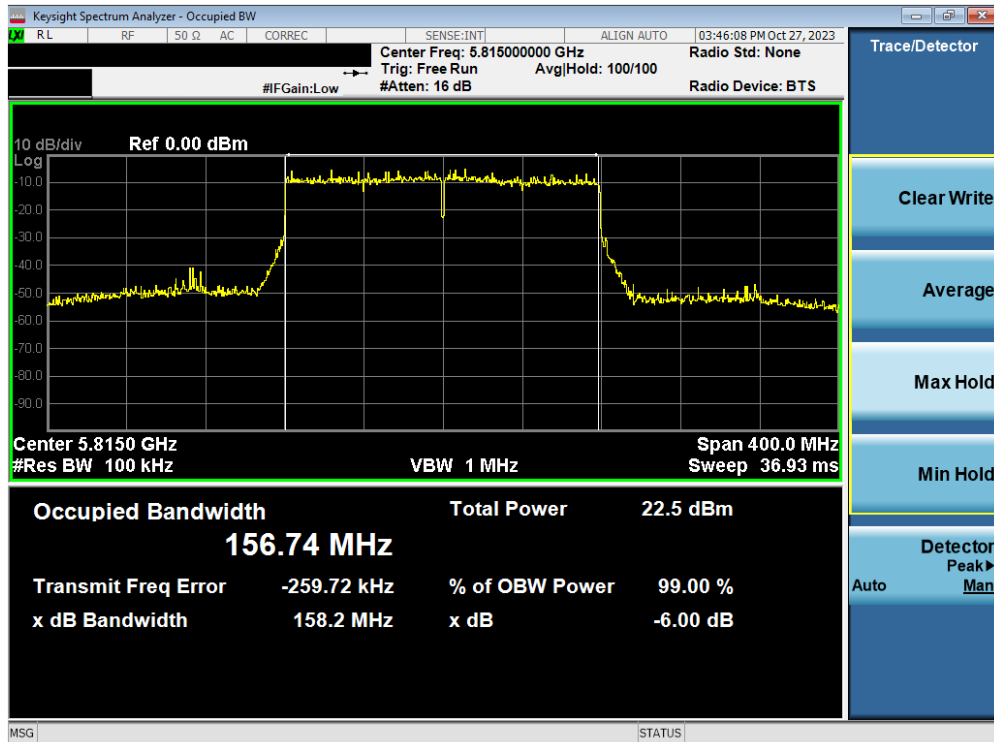


Plot 7-64. 6dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax/be (UNII Band 3/4) – Ch. 171)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 51 of 168



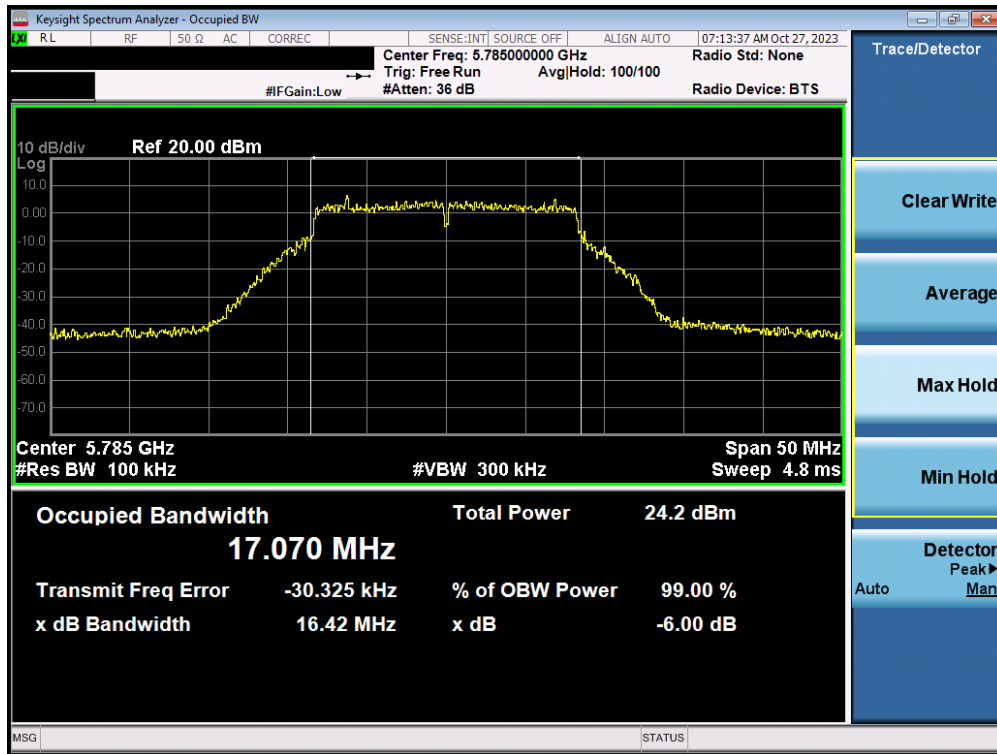
Plot 7-65. 6dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11ac (UNII Band 3/4) – Ch. 163)



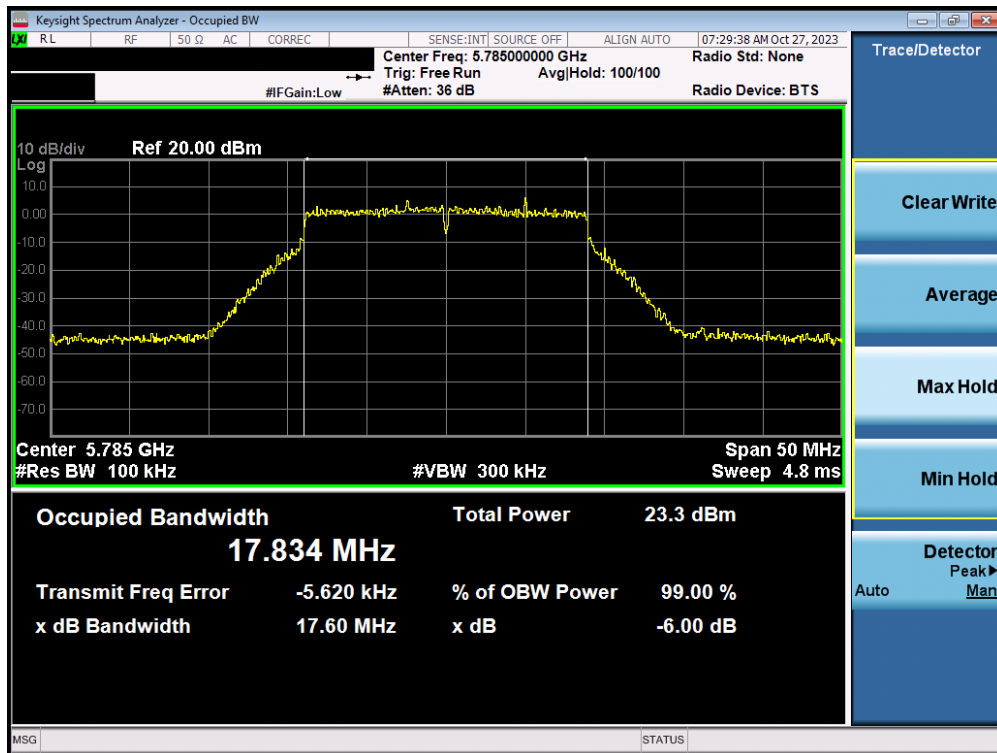
Plot 7-66. 6dB Bandwidth Plot MIMO ANT1 (160MHz BW 802.11ax/be (UNII Band 3/4) – Ch. 163)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 52 of 168

7.3.2 MIMO Antenna-2 6dB Bandwidth Measurements



Plot 7-67. 6dB Bandwidth Plot MIMO ANT2 (802.11a (UNII Band 3) – Ch. 157)



Plot 7-68. 6dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 3) – Ch. 157)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 53 of 168

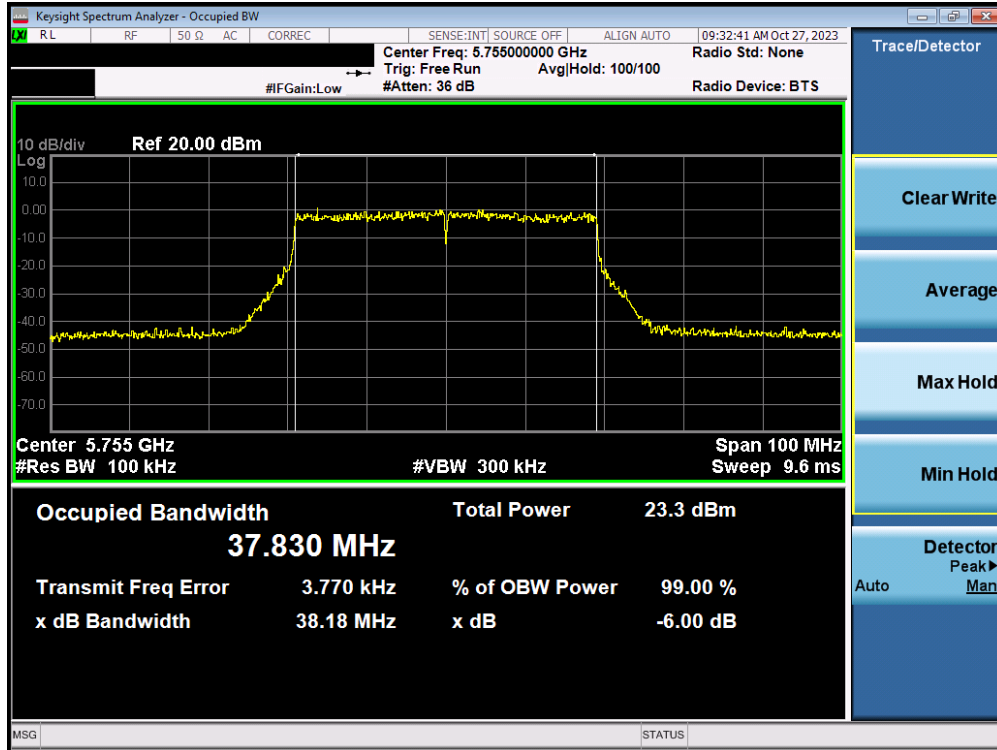


Plot 7-69. 6dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax/be (UNII Band 3) – Ch. 157)

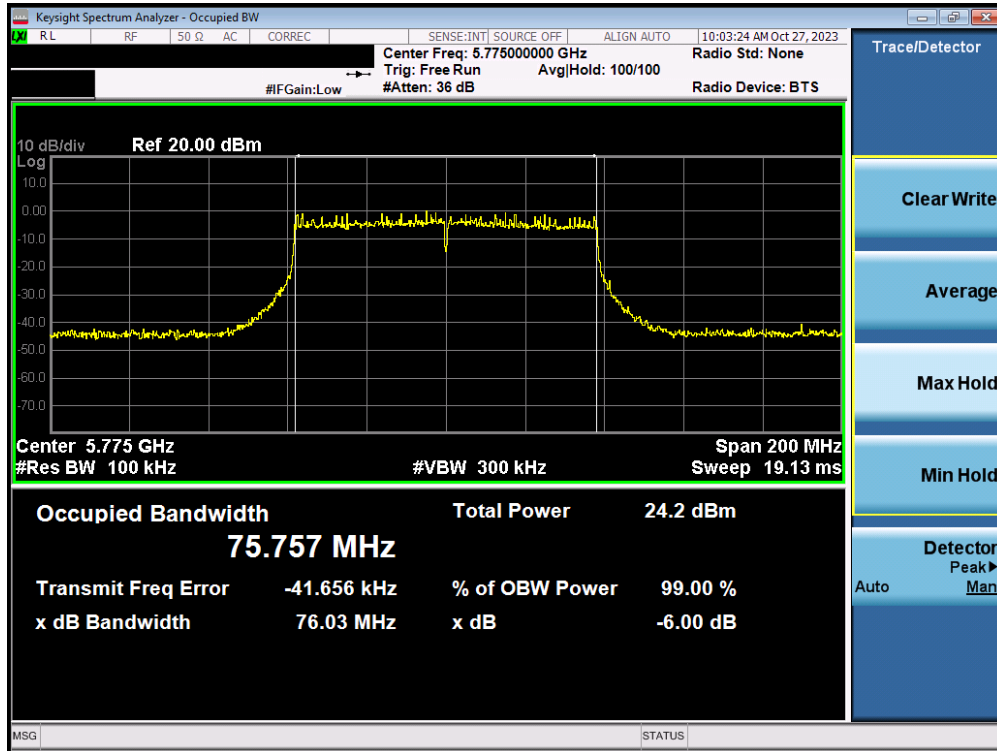


Plot 7-70. 6dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 3) – Ch. 151)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 54 of 168

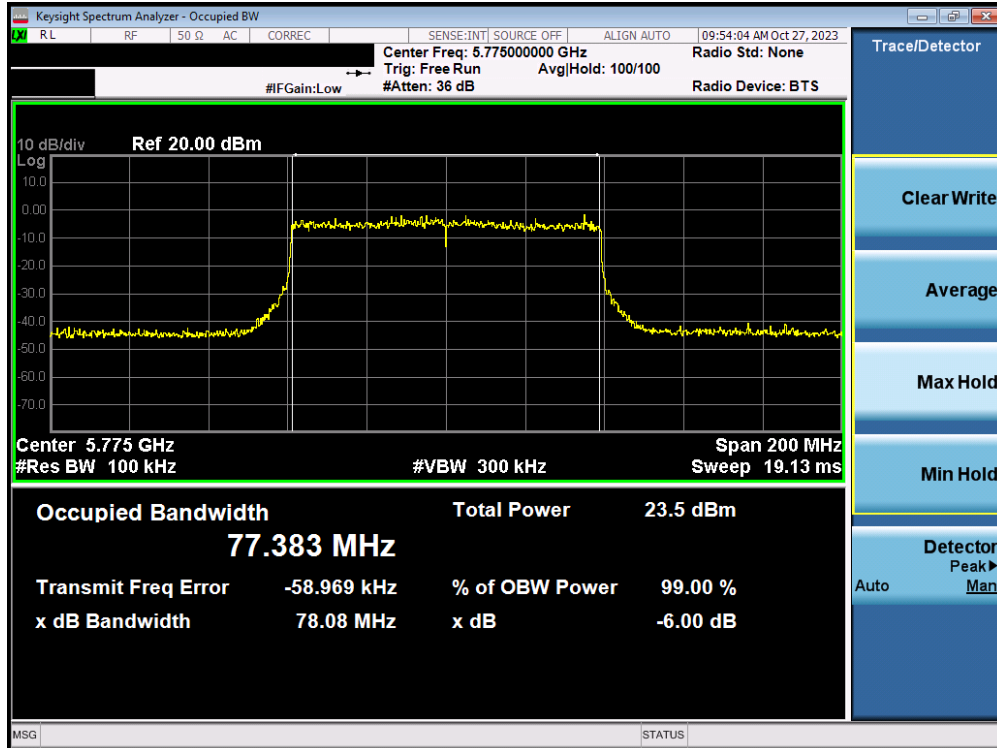


Plot 7-71. 6dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax/be (UNII Band 3) – Ch. 151)

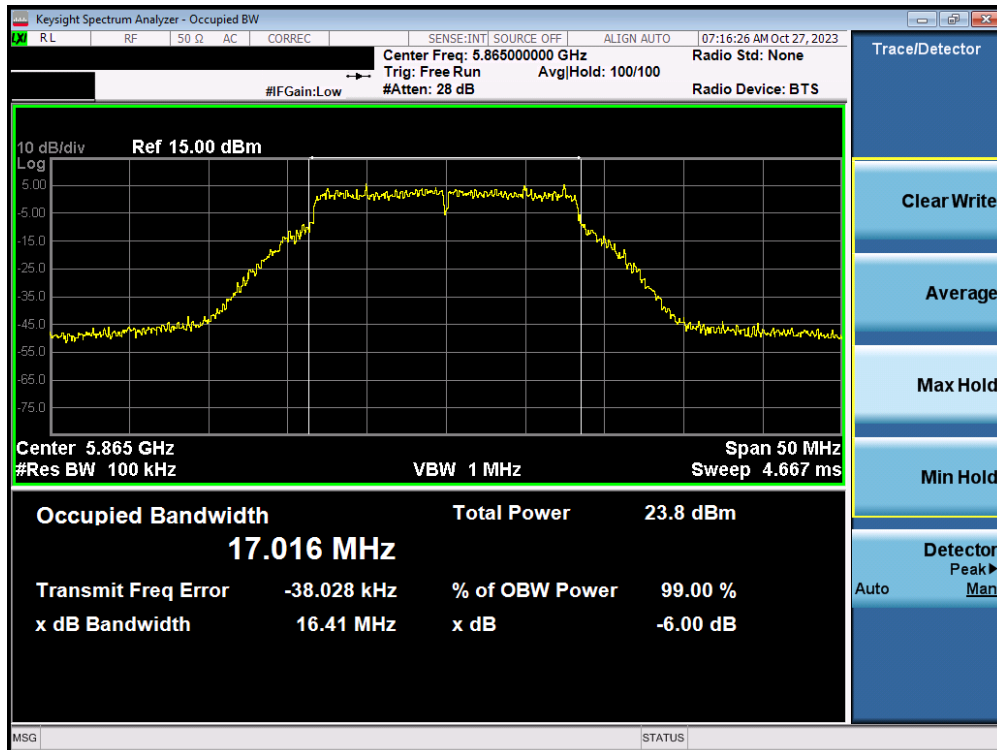


Plot 7-72. 6dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 3) – Ch. 155)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 55 of 168

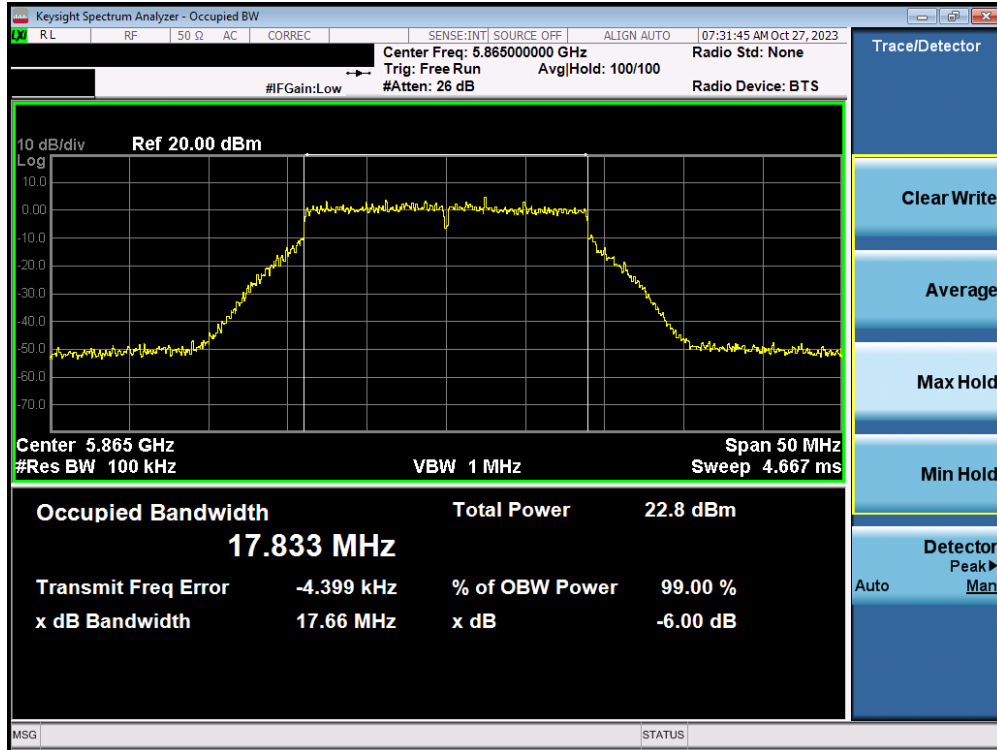


Plot 7-73. 6dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax/be (UNII Band 3) – Ch. 155)

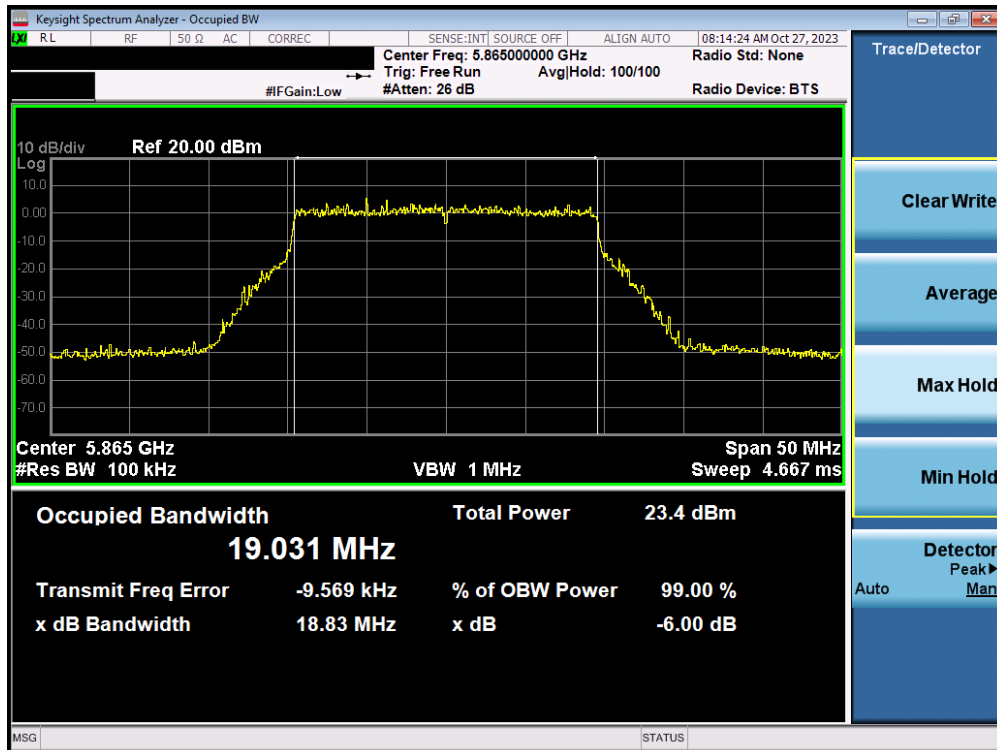


Plot 7-74. 6dB Bandwidth Plot MIMO ANT2 (802.11a (UNII Band 4) – Ch. 173)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 56 of 168

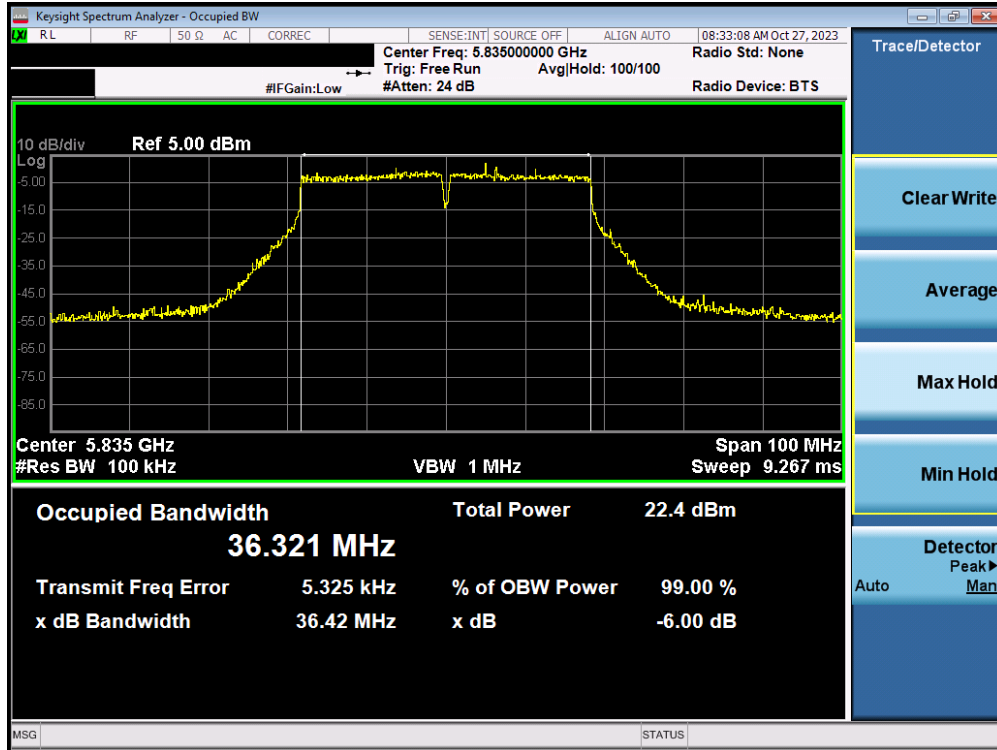


Plot 7-75. 6dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 4) – Ch. 173)

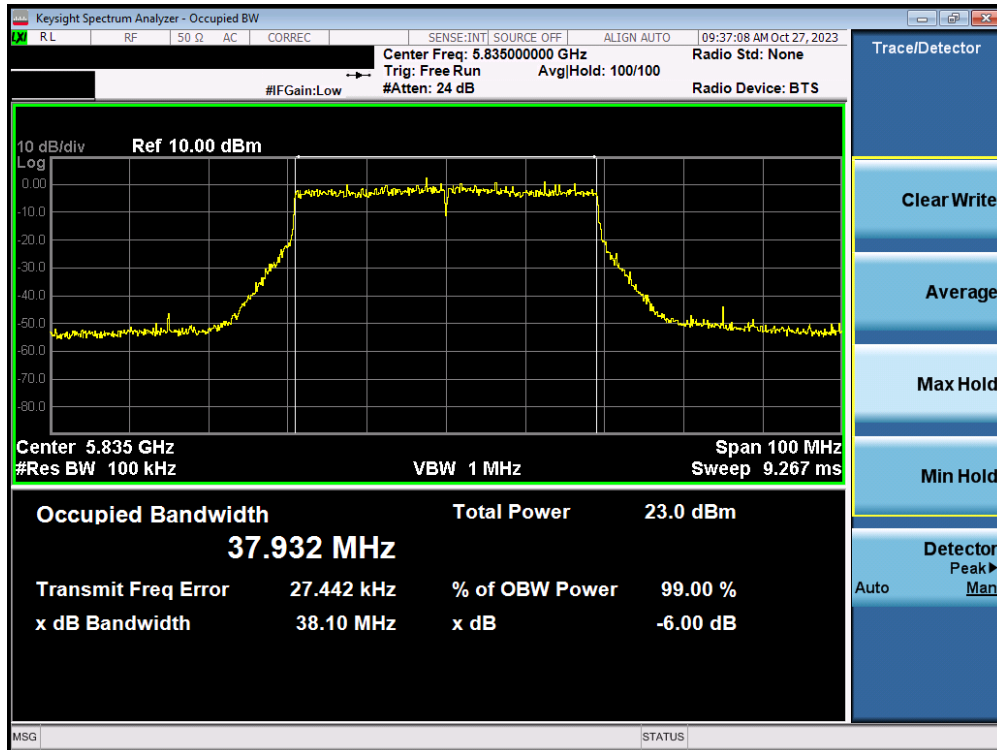


Plot 7-76. 6dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax/be (UNII Band 4) – Ch. 173)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 57 of 168

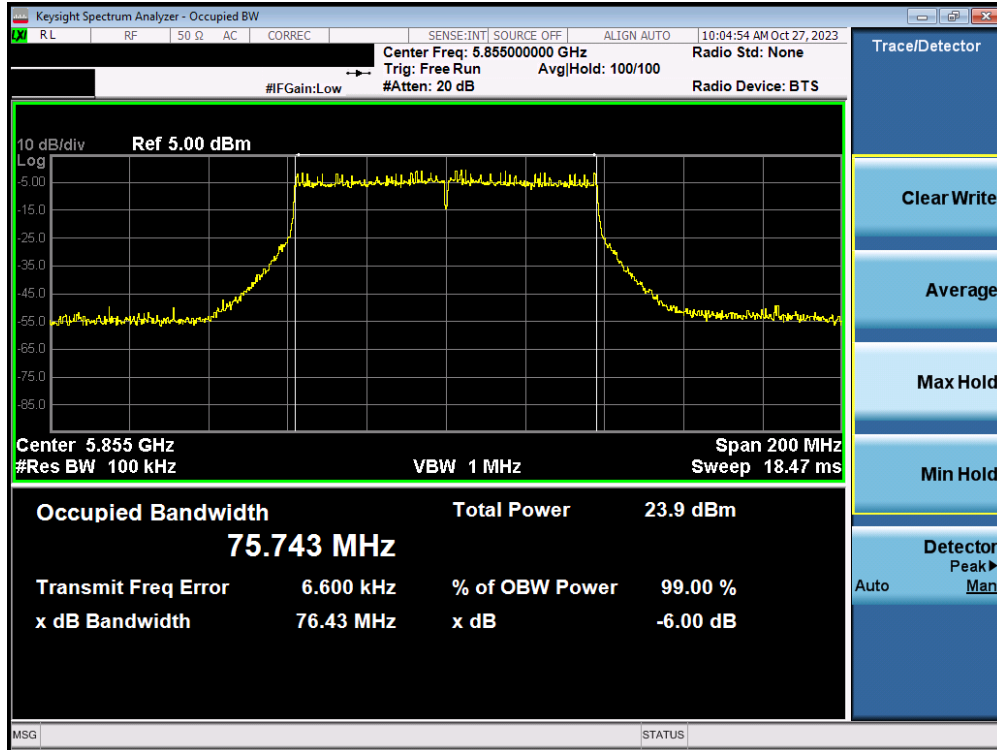


Plot 7-77. 6dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 3/4) – Ch. 167)

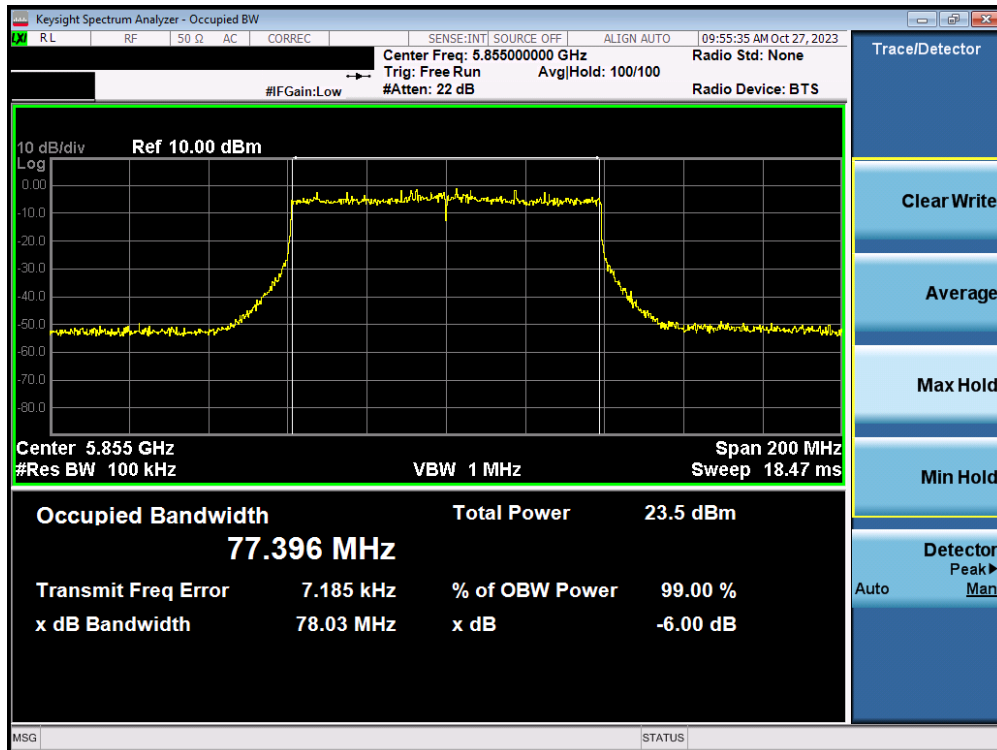


Plot 7-78. 6dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax/be (UNII Band 3/4) – Ch. 167)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 58 of 168

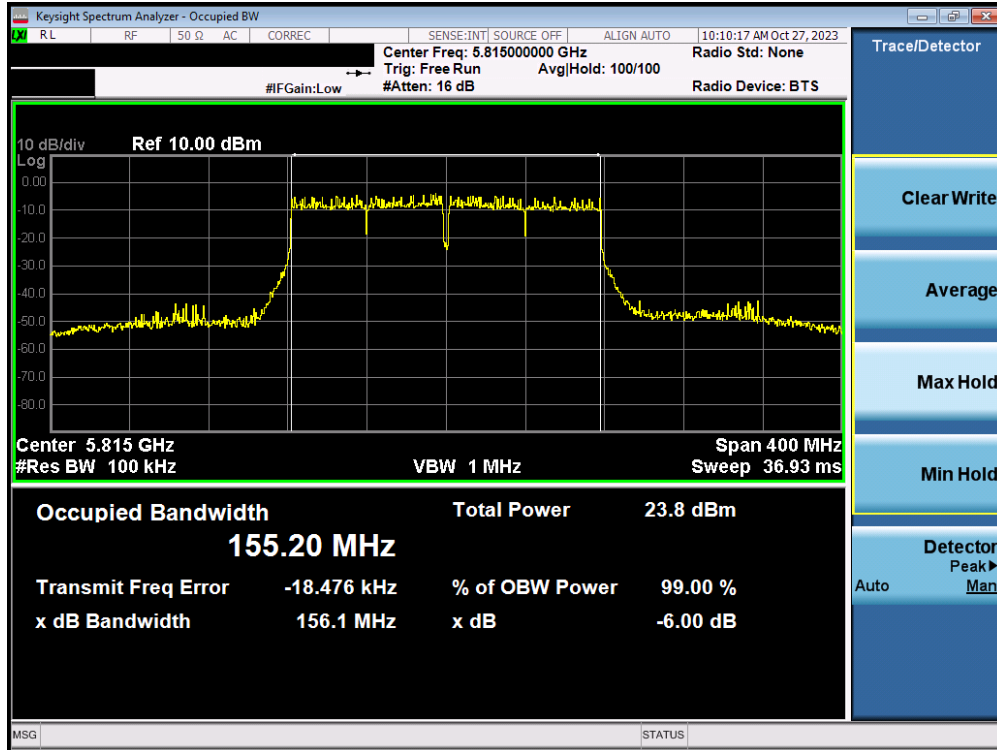


Plot 7-79. 6dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 3/4) – Ch. 171)

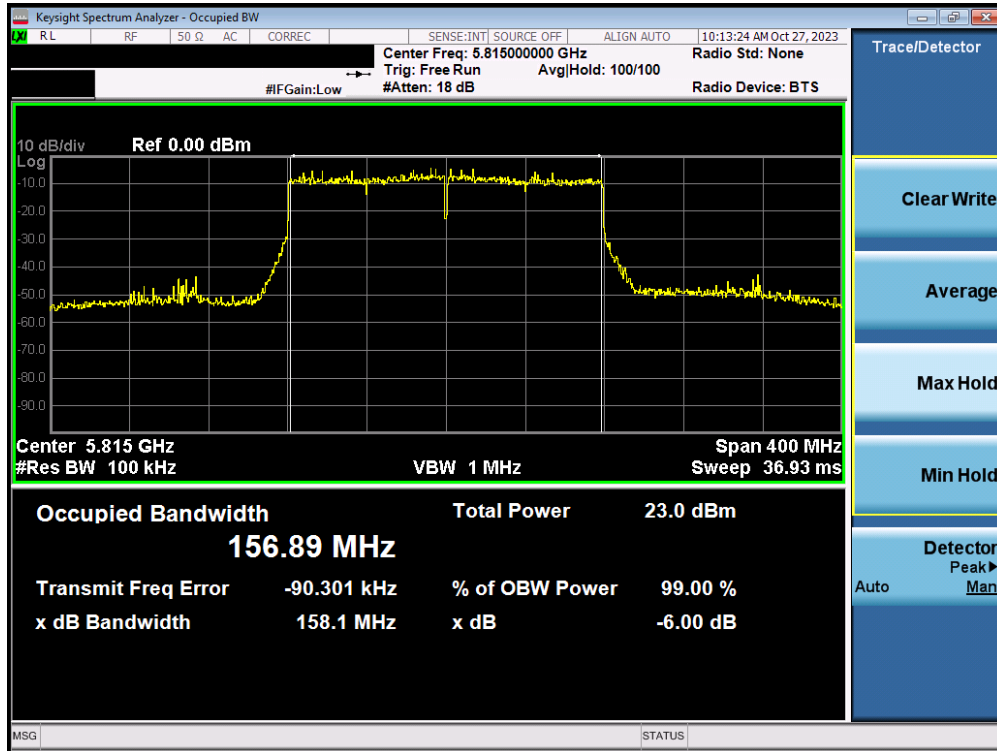


Plot 7-80. 6dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax/be (UNII Band 3/4) – Ch. 171)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 59 of 168



Plot 7-81. 6dB Bandwidth Plot MIMO ANT2 (160MHz BW 802.11ac (UNII Band 3/4) – Ch. 163)



Plot 7-82. 6dB Bandwidth Plot MIMO ANT2 (160MHz BW 802.11ax/be (UNII Band 3/4) – Ch. 163)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 60 of 168

7.4 UNII Output Power Measurement

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 at the appropriate frequencies.

The output power limits are as specified in the tables below.

UNII Band	Frequency Range	Maximum Conducted Power Limit	Maximum e.i.r.p
		FCC	FCC
UNII 1	5.15 – 5.25GHz	23.98dBm (250mW)	N/A
UNII 2A	5.25 – 5.35GHz	The lesser of 23.98dBm (250mW) or 11dBm + 10log ₁₀ B	N/A
UNII 2C	5.47 – 5.725GHz		
UNII 3	5.725 – 5.850GHz	30dBm (1W)	N/A
UNII 4	5.850 – 5.895GHz	N/A	30dBm (1W)

Test Procedure Used

ANSI C63.10-2013 – Section 12.3.3.2 Method PM-G
ANSI C63.10-2013 – Section 14.2 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 7-3. Test Instrument & Measurement Setup

Test Notes

None.

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 61 of 168

MIMO Maximum Conducted Output Power Measurements

5GHz WIFI (20MHz 802.11a MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5180	36	17.89	17.19	20.56	23.98	-3.42	-0.33	20.23	30.00	-9.77
	5200	40	17.99	17.59	20.80	23.98	-3.18	-0.33	20.47	30.00	-9.53
	5220	44	17.74	17.93	20.85	23.98	-3.13	-0.33	20.52	30.00	-9.48
	5240	48	17.69	17.95	20.83	23.98	-3.15	-0.33	20.50	30.00	-9.50
UNII-2A	5260	52	17.02	17.62	20.34	23.98	-3.64	-0.29	20.05	30.00	-9.95
	5280	56	17.73	17.90	20.83	23.98	-3.15	-0.29	20.54	30.00	-9.46
	5300	60	17.31	17.64	20.49	23.98	-3.49	-0.29	20.20	30.00	-9.80
	5320	64	17.34	17.62	20.49	23.98	-3.49	-0.29	20.20	30.00	-9.80
UNII-2C	5500	100	17.87	17.51	20.70	23.98	-3.28	0.23	20.93	30.00	-9.07
	5600	120	17.82	17.09	20.48	23.98	-3.50	0.23	20.71	30.00	-9.29
	5620	124	17.70	17.08	20.41	23.98	-3.57	0.23	20.64	30.00	-9.36
	5720	144	17.57	16.75	20.19	23.98	-3.79	0.23	20.42	30.00	-9.58
UNII-3	5745	149	17.73	16.90	20.35	30.00	-9.65	-0.63	19.72	36.00	-16.28
	5785	157	17.89	17.47	20.70	30.00	-9.30	-0.63	20.07	36.00	-15.93
	5825	165	17.89	17.73	20.82	30.00	-9.18	-0.63	20.19	36.00	-15.81
UNII-4	5845	169	17.82	17.79	20.82	-	-	-0.57	20.25	30.00	-9.75
	5865	173	17.74	17.71	20.74	-	-	-0.57	20.17	30.00	-9.83
	5885	177	17.79	17.74	20.78	-	-	-0.57	20.21	30.00	-9.79

Table 7-5. MIMO 20MHz BW 802.11a (UNII) Maximum Conducted Output Power

5GHz WIFI (20MHz 802.11n MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5180	36	16.85	16.19	19.54	23.98	-4.44	-0.33	19.21	30.00	-10.79
	5200	40	16.85	16.57	19.72	23.98	-4.26	-0.33	19.39	30.00	-10.61
	5220	44	16.50	16.24	19.38	23.98	-4.60	-0.33	19.05	30.00	-10.95
	5240	48	16.15	16.43	19.30	23.98	-4.68	-0.33	18.97	30.00	-11.03
UNII-2A	5260	52	16.18	16.72	19.47	23.98	-4.51	-0.29	19.18	30.00	-10.82
	5280	56	16.79	16.59	19.70	23.98	-4.28	-0.29	19.41	30.00	-10.59
	5300	60	16.32	16.68	19.51	23.98	-4.47	-0.29	19.22	30.00	-10.78
	5320	64	16.36	16.63	19.51	23.98	-4.47	-0.29	19.22	30.00	-10.78
UNII-2C	5500	100	16.91	16.57	19.75	23.98	-4.23	0.23	19.98	30.00	-10.02
	5600	120	16.87	16.12	19.52	23.98	-4.46	0.23	19.75	30.00	-10.25
	5620	124	16.67	16.13	19.42	23.98	-4.56	0.23	19.65	30.00	-10.35
	5720	144	16.49	15.77	19.16	23.98	-4.82	0.23	19.38	30.00	-10.62
UNII-3	5745	149	16.68	15.82	19.28	30.00	-10.72	-0.63	18.65	36.00	-17.35
	5785	157	16.89	16.48	19.70	30.00	-10.30	-0.63	19.07	36.00	-16.93
	5825	165	16.79	16.83	19.82	30.00	-10.18	-0.63	19.19	36.00	-16.81
UNII-4	5845	169	16.79	16.86	19.84	-	-	-0.57	19.27	30.00	-10.73
	5865	173	16.62	16.71	19.68	-	-	-0.57	19.11	30.00	-10.89
	5885	177	16.66	16.77	19.73	-	-	-0.57	19.16	30.00	-10.84

Table 7-6. MIMO 20MHz BW 802.11n (UNII) Maximum Conducted Output Power

5GHz WIFI (20MHz 802.11ac MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5180	36	16.85	16.16	19.53	23.98	-4.45	-0.33	19.20	30.00	-10.80
	5200	40	16.98	16.54	19.78	23.98	-4.20	-0.33	19.45	30.00	-10.55
	5220	44	16.23	16.17	19.21	23.98	-4.77	-0.33	18.88	30.00	-11.12
	5240	48	16.08	16.44	19.27	23.98	-4.71	-0.33	18.94	30.00	-11.06
UNII-2A	5260	52	16.18	16.72	19.47	23.98	-4.51	-0.29	19.18	30.00	-10.82
	5280	56	16.83	16.61	19.73	23.98	-4.25	-0.29	19.44	30.00	-10.56
	5300	60	16.29	16.62	19.47	23.98	-4.51	-0.29	19.18	30.00	-10.82
	5320	64	16.29	16.59	19.45	23.98	-4.53	-0.29	19.16	30.00	-10.84
UNII-2C	5500	100	16.83	16.53	19.69	23.98	-4.29	0.23	19.92	30.00	-10.08
	5600	120	16.76	16.02	19.42	23.98	-4.56	0.23	19.64	30.00	-10.36
	5620	124	16.59	16.05	19.34	23.98	-4.64	0.23	19.57	30.00	-10.43
	5720	144	16.90	16.26	19.60	23.98	-4.38	0.23	19.83	30.00	-10.17
UNII-3	5745	149	16.63	15.79	19.24	30.00	-10.76	-0.63	18.61	36.00	-17.39
	5785	157	16.95	16.49	19.74	30.00	-10.26	-0.63	19.11	36.00	-16.89
	5825	165	16.83	16.75	19.80	30.00	-10.20	-0.63	19.17	36.00	-16.83
UNII-4	5845	169	16.77	16.83	19.81	-	-	-0.57	19.24	30.00	-10.76
	5865	173	16.61	16.73	19.68	-	-	-0.57	19.11	30.00	-10.89
	5885	177	16.61	16.73	19.68	-	-	-0.57	19.11	30.00	-10.89

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

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 62 of 168

5GHz WIFI (20MHz 802.11ax MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5180	36	16.94	16.37	19.67	23.98	-4.31	-0.33	19.34	30.00	-10.66
	5200	40	16.98	16.75	19.88	23.98	-4.10	-0.33	19.55	30.00	-10.45
	5220	44	16.28	16.34	19.32	23.98	-4.66	-0.33	18.99	30.00	-11.01
	5240	48	16.14	16.65	19.41	23.98	-4.57	-0.33	19.08	30.00	-10.92
UNII-2A	5260	52	16.26	16.91	19.61	23.98	-4.37	-0.29	19.32	30.00	-10.68
	5280	56	16.93	16.79	19.87	23.98	-4.11	-0.29	19.58	30.00	-10.42
	5300	60	16.45	16.86	19.67	23.98	-4.31	-0.29	19.38	30.00	-10.62
	5320	64	16.40	16.81	19.62	23.98	-4.36	-0.29	19.33	30.00	-10.67
UNII-2C	5500	100	16.54	16.19	19.38	23.98	-4.60	0.23	19.61	30.00	-10.39
	5600	120	16.94	16.21	19.60	23.98	-4.38	0.23	19.83	30.00	-10.17
	5620	124	16.77	16.32	19.56	23.98	-4.42	0.23	19.79	30.00	-10.21
	5720	144	16.59	15.91	19.27	23.98	-4.71	0.23	19.50	30.00	-10.50
UNII-3	5745	149	16.89	16.06	19.51	30.00	-10.49	-0.63	18.88	36.00	-17.12
	5785	157	16.56	16.24	19.41	30.00	-10.59	-0.63	18.78	36.00	-17.22
	5825	165	16.45	16.43	19.45	30.00	-10.55	-0.63	18.82	36.00	-17.18
UNII-4	5845	169	16.45	16.44	19.46	-	-	-0.57	18.89	30.00	-11.11
	5865	173	16.83	16.94	19.90	-	-	-0.57	19.33	30.00	-10.67
	5885	177	16.93	16.97	19.96	-	-	-0.57	19.39	30.00	-10.61

Table 7-8. MIMO 20MHz BW 802.11ax (UNII) Maximum Conducted Output Power

5GHz WIFI (20MHz 802.11be MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5180	36	16.94	16.37	19.67	23.98	-4.31	-0.33	19.34	30.00	-10.66
	5200	40	16.98	16.75	19.88	23.98	-4.10	-0.33	19.55	30.00	-10.45
	5220	44	16.28	16.34	19.32	23.98	-4.66	-0.33	18.99	30.00	-11.01
	5240	48	16.14	16.65	19.41	23.98	-4.57	-0.33	19.08	30.00	-10.92
UNII-2A	5260	52	16.26	16.91	19.61	23.98	-4.37	-0.29	19.32	30.00	-10.68
	5280	56	16.93	16.79	19.87	23.98	-4.11	-0.29	19.58	30.00	-10.42
	5300	60	16.45	16.86	19.67	23.98	-4.31	-0.29	19.38	30.00	-10.62
	5320	64	16.40	16.81	19.62	23.98	-4.36	-0.29	19.33	30.00	-10.67
UNII-2C	5500	100	16.54	16.19	19.38	23.98	-4.60	0.23	19.61	30.00	-10.39
	5600	120	16.94	16.21	19.60	23.98	-4.38	0.23	19.83	30.00	-10.17
	5620	124	16.77	16.32	19.56	23.98	-4.42	0.23	19.79	30.00	-10.21
	5720	144	16.59	15.91	19.27	23.98	-4.71	0.23	19.50	30.00	-10.50
UNII-3	5745	149	16.89	16.06	19.51	30.00	-10.49	-0.63	18.88	36.00	-17.12
	5785	157	16.56	16.24	19.41	30.00	-10.59	-0.63	18.78	36.00	-17.22
	5825	165	16.45	16.43	19.45	30.00	-10.55	-0.63	18.82	36.00	-17.18
UNII-4	5845	169	16.45	16.44	19.46	-	-	-0.57	18.89	30.00	-11.11
	5865	173	16.83	16.94	19.90	-	-	-0.57	19.33	30.00	-10.67
	5885	177	16.93	16.97	19.96	-	-	-0.57	19.39	30.00	-10.61

Table 7-9. MIMO 20MHz BW 802.11be (UNII) Maximum Conducted Output Power

5GHz WIFI (40MHz 802.11n MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5190	38	15.44	15.29	18.38	23.98	-5.60	-0.33	18.05	30.00	-11.95
	5230	46	15.86	14.80	18.37	23.98	-5.61	-0.33	18.04	30.00	-11.96
	5270	54	15.85	15.87	18.87	23.98	-5.11	-0.29	18.58	30.00	-11.42
UNII-2A	5310	62	15.47	15.82	18.66	23.98	-5.32	-0.29	18.37	30.00	-11.63
	5510	102	15.65	15.14	18.41	23.98	-5.57	0.23	18.64	30.00	-11.36
UNII-2C	5590	118	15.99	15.26	18.65	23.98	-5.33	0.23	18.88	30.00	-11.12
	5630	126	15.89	15.30	18.62	23.98	-5.36	0.23	18.85	30.00	-11.15
	5710	142	15.91	15.38	18.66	23.98	-5.32	0.23	18.89	30.00	-11.11
UNII-3	5755	151	15.81	14.95	18.41	30.00	-11.59	-0.63	17.78	36.00	-18.22
	5795	159	15.71	15.28	18.51	30.00	-11.49	-0.63	17.88	36.00	-18.12
UNII-4	5835	167	15.61	15.36	18.50	-	-	-0.57	17.93	30.00	-12.07
	5875	175	15.78	15.73	18.77	-	-	-0.57	18.20	30.00	-11.80

Table 7-10. MIMO 40MHz BW 802.11n (UNII) Maximum Conducted Output Power

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5GHz WIFI (40MHz 802.11ac MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5190	38	15.44	15.25	18.36	23.98	-5.62	-0.33	18.03	30.00	-11.97
	5230	46	15.84	14.71	18.32	23.98	-5.66	-0.33	17.99	30.00	-12.01
UNII-2A	5270	54	15.84	15.86	18.86	23.98	-5.12	-0.29	18.57	30.00	-11.43
	5310	62	15.46	15.79	18.64	23.98	-5.34	-0.29	18.35	30.00	-11.65
UNII-2C	5510	102	15.61	15.04	18.34	23.98	-5.64	0.23	18.57	30.00	-11.43
	5590	118	15.98	15.20	18.62	23.98	-5.36	0.23	18.85	30.00	-11.15
	5630	126	15.85	15.29	18.59	23.98	-5.99	0.23	18.82	30.00	-11.18
	5710	142	15.68	14.75	18.25	23.98	-5.73	0.23	18.48	30.00	-11.52
UNII-3	5755	151	15.79	14.91	18.38	30.00	-11.62	-0.63	17.75	36.00	-18.25
	5795	159	15.65	15.24	18.46	30.00	-11.54	-0.63	17.83	36.00	-18.17
UNII-4	5835	167	15.48	15.35	18.43	-	-	-0.57	17.86	30.00	-12.14
	5875	175	15.71	15.75	18.74	-	-	-0.57	18.17	30.00	-11.83

Table 7-11. MIMO 40MHz BW 802.11ac (UNII) Maximum Conducted Output Power

5GHz WIFI (40MHz 802.11ax MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5190	38	15.58	15.38	18.49	23.98	-5.49	-0.33	18.16	30.00	-11.84
	5230	46	15.52	15.19	18.37	23.98	-5.61	-0.33	18.04	30.00	-11.96
UNII-2A	5270	54	15.67	15.76	18.73	23.98	-5.25	-0.29	18.44	30.00	-11.56
	5310	62	15.60	15.91	18.77	23.98	-5.21	-0.29	18.48	30.00	-11.52
UNII-2C	5510	102	15.68	15.14	18.43	23.98	-5.55	0.23	18.66	30.00	-11.34
	5590	118	15.49	14.84	18.19	23.98	-5.79	0.23	18.42	30.00	-11.58
	5630	126	15.99	15.42	18.72	23.98	-5.26	0.23	18.95	30.00	-11.05
	5710	142	15.82	14.94	18.41	23.98	-5.57	0.23	18.64	30.00	-11.36
UNII-3	5755	151	15.95	15.06	18.54	30.00	-11.46	-0.63	17.91	36.00	-18.09
	5795	159	15.76	15.34	18.57	30.00	-11.43	-0.63	17.94	36.00	-18.06
UNII-4	5835	167	15.61	15.49	18.56	-	-	-0.57	17.99	30.00	-12.01
	5875	175	15.86	15.90	18.89	-	-	-0.57	18.32	30.00	-11.68

Table 7-12. MIMO 40MHz BW 802.11ax (UNII) Maximum Conducted Output Power

5GHz WIFI (40MHz 802.11be MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5190	38	15.34	15.18	18.27	23.98	-5.71	-0.33	17.94	30.00	-12.06
	5230	46	15.74	15.40	18.58	23.98	-5.40	-0.33	18.25	30.00	-11.75
UNII-2A	5270	54	15.71	15.76	18.75	23.98	-5.23	-0.29	18.46	30.00	-11.54
	5310	62	15.39	15.72	18.57	23.98	-5.41	-0.29	18.28	30.00	-11.72
UNII-2C	5510	102	15.52	14.94	18.25	23.98	-5.73	0.23	18.48	30.00	-11.52
	5590	118	15.89	15.08	18.51	23.98	-5.47	0.23	18.74	30.00	-11.26
	5630	126	15.72	15.11	18.44	23.98	-5.54	0.23	18.67	30.00	-11.33
	5710	142	15.63	14.67	18.19	23.98	-5.79	0.23	18.42	30.00	-11.58
UNII-3	5755	151	15.73	14.80	18.30	30.00	-11.70	-0.63	17.67	36.00	-18.33
	5795	159	15.69	15.14	18.43	30.00	-11.57	-0.63	17.80	36.00	-18.20
UNII-4	5835	167	15.93	15.86	18.91	-	-	-0.57	18.34	30.00	-11.66
	5875	175	15.67	15.66	18.68	-	-	-0.57	18.11	30.00	-11.89

Table 7-13. MIMO 40MHz BW 802.11be (UNII) Maximum Conducted Output Power

5GHz WIFI (80MHz 802.11ac MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5210	42	14.39	14.76	17.59	23.98	-6.39	-0.33	17.26	30.00	-12.74
UNII-2A	5290	58	14.93	14.98	17.97	23.98	-6.01	-0.29	17.68	30.00	-12.32
	5530	106	15.85	15.41	18.65	23.98	-5.33	0.23	18.88	30.00	-11.12
UNII-2C	5610	122	15.72	15.18	18.47	23.98	-5.51	0.23	18.70	30.00	-11.30
	5690	138	15.80	15.21	18.53	23.98	-5.45	0.23	18.76	30.00	-11.24
UNII-3	5775	155	15.45	14.91	18.20	30.00	-11.80	-0.63	17.57	36.00	-18.43
UNII-4	5885	171	15.73	15.68	18.72	-	-	-0.57	18.15	30.00	-11.85

Table 7-14. MIMO 80MHz BW 802.11ac (UNII) Maximum Conducted Output Power

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5GHz WIFI (80MHz 802.11ax MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5210	42	14.35	14.34	17.36	23.98	-6.62	-0.33	17.03	30.00	-12.97
UNII-2A	5290	58	14.61	14.65	17.64	23.98	-6.34	-0.29	17.35	30.00	-12.65
	5530	106	15.58	14.86	18.25	23.98	-5.73	0.23	18.48	30.00	-11.52
UNII-2C	5610	122	15.93	15.13	18.56	23.98	-5.42	0.23	18.79	30.00	-11.21
	5690	138	15.99	15.19	18.62	23.98	-5.36	0.23	18.85	30.00	-11.15
UNII-3	5775	155	15.49	14.89	18.21	30.00	-11.79	-0.63	17.58	36.00	-18.42
UNII-4	5885	171	15.52	15.21	18.38	-	-	-0.57	17.81	30.00	-12.19

Table 7-15. MIMO 80MHz BW 802.11ax (UNII) Maximum Conducted Output Power

5GHz WIFI (80MHz 802.11be MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1	5210	42	14.35	14.34	17.36	23.98	-6.62	-0.33	17.03	30.00	-12.97
UNII-2A	5290	58	14.61	14.65	17.64	23.98	-6.34	-0.29	17.35	30.00	-12.65
	5530	106	15.58	14.86	18.25	23.98	-5.73	0.23	18.48	30.00	-11.52
UNII-2C	5610	122	15.93	15.13	18.56	23.98	-5.42	0.23	18.79	30.00	-11.21
	5690	138	15.99	15.19	18.62	23.98	-5.36	0.23	18.85	30.00	-11.15
UNII-3	5775	155	15.49	14.89	18.21	30.00	-11.79	-0.63	17.58	36.00	-18.42
UNII-4	5885	171	15.52	15.21	18.38	-	-	-0.57	17.81	30.00	-12.19

Table 7-16. MIMO 80MHz BW 802.11be (UNII) Maximum Conducted Output Power

5GHz WIFI (160MHz 802.11ac MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1/2A	5250	50	13.92	13.73	16.84	23.98	-7.14	-0.29	16.55	30.00	-13.45
UNII-2C	5570	114	14.78	14.13	17.48	23.98	-6.50	0.23	17.71	30.00	-12.29
UNII-3/4	5815	163	14.68	14.17	17.44	30.00	-12.56	-0.57	16.87	30.00	-13.13

Table 7-17. MIMO 160MHz BW 802.11ac (UNII) Maximum Conducted Output Power

5GHz WIFI (160MHz 802.11ax MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1/2A	5250	50	13.89	13.67	16.79	23.98	-7.19	-0.29	16.50	30.00	-13.50
UNII-2C	5570	114	14.92	14.07	17.53	23.98	-6.45	0.23	17.76	30.00	-12.24
UNII-3/4	5815	163	14.85	14.37	17.63	30.00	-12.37	-0.57	17.06	30.00	-12.94

Table 7-18. MIMO 160MHz BW 802.11ax (UNII) Maximum Conducted Output Power

5GHz WIFI (160MHz 802.11be MIMO)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
Band	Freq [MHz]	Channel	Avg. Conducted Powers [dBm]								
			ANT1	ANT2	MIMO						
UNII-1/2A	5250	50	13.84	13.68	16.77	23.98	-7.21	-0.29	16.48	30.00	-13.52
UNII-2C	5570	114	14.76	14.07	17.44	23.98	-6.54	0.23	17.67	30.00	-12.33
UNII-3/4	5815	163	14.61	14.13	17.39	30.00	-12.61	-0.57	16.82	30.00	-13.18

Table 7-19. MIMO 160MHz BW 802.11be (UNII) Maximum Conducted Output Power

80MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm)									Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					Puncture Case														
					90			91											
					ANT1	ANT2	MIMO	ANT1	ANT2	MIMO									
1	5210	42	484+242T	14.26	14.62	17.46	14.16	14.56	17.37	23.98	-6.52	-0.33	17.12	30.00	-12.88				
2A	5290	58	484+242T	14.81	14.99	17.91	14.62	14.91	17.78	23.98	-6.07	-0.29	17.62	30.00	-12.38				
2C	5530	106	484+242T	15.32	15.99	18.68	15.21	15.92	18.59	23.98	-5.30	0.23	18.90	30.00	-11.10				
3	5775	155	484+242T	15.26	15.99	18.65	15.04	15.86	18.48	30	-11.35	-0.63	18.02	36.00	-17.98				
4	5885	171	484+242T	14.87	15.82	18.38	15.29	15.75	18.54	-	-	-0.57	17.97	30.00	-12.03				

Table 7-20. MIMO 80MHz BW 802.11be (UNII) Maximum Conducted Output Power - Punctured

160MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm)									Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					Puncture Case														
					94			95											
					ANT1	ANT2	MIMO	ANT1	ANT2	MIMO									
1/2A	5250	50	996+484T	13.45	13.99	16.74	13.20	13.64	16.44	23.98	-7.24	-0.29	16.45	30.00	-13.55				
2C	5570	114	996+484T	14.46	14.99	17.74	14.35	14.99	17.69	23.98	-6.24	0.23	17.97	30.00	-12.03				
3/4	5815	163	996+484T	14.37	14.98	17.70	14.08	14.78	17.46	-	-	-0.57	17.13	30.00	-12.87				

Table 7-21. MIMO 160MHz BW 802.11be (UNII) Maximum Conducted Output Power - Punctured

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160MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm)						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					Puncture Case											
					96			99								
					ANT1	ANT2	MIMO	ANT1	ANT2	MIMO						
1/2A	5250	50	996*484*242T	13.37	13.81	16.60	13.24	13.65	16.46	23.98	-7.38	-0.29	16.32	30.0	-13.68	
2C	5570	114	996*484*242T	14.47	14.99	17.75	14.36	14.99	17.70	23.98	-6.23	0.23	17.97	30.0	-12.03	
3/4	5815	163	996*484*242T	14.27	14.89	17.60	14.09	14.77	17.45	-	-	-0.57	17.03	30.0	-12.97	

Table 7-22. MIMO 160MHz BW 802.11be (UNII) Maximum Conducted Output Power - Punctured

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Note:

Per ANSI C63.10-2013, the conducted powers at Antenna 1 and Antenna 2 were first measured separately during MIMO transmission as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Per ANSI C63.10-2013 Section 14.4.3, the directional gain is calculated using the following formula, where G_N is the gain of the nth antenna and N_{ANT} , the total number of antennas used.

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

Sample MIMO Calculation:

At 5180MHz in 802.11n (20MHz BW) mode, the average conducted output power was measured to be 16.85 dBm for Antenna 1 and 16.19 dBm for Antenna 2.

$$\text{Antenna 1} + \text{Antenna 2} = \text{MIMO}$$

$$(16.85 \text{ dBm} + 16.19 \text{ dBm}) = (48.417 \text{ mW} + 41.591 \text{ mW}) = 90.008 \text{ mW} = 19.54 \text{ dBm}$$

Sample e.i.r.p Calculation:

At 5180MHz in 802.11n (20MHz BW) mode, the average MIMO conducted power was calculated to be 19.54 dBm with directional gain of -0.70 dBi.

$$\text{e.i.r.p. (dBm)} = \text{Conducted Power (dBm)} + \text{Ant gain (dBi)}$$

$$19.54 \text{ dBm} + -0.70 \text{ dBi} = 18.84 \text{ dBm}$$

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7.5 Maximum Power Spectral Density

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 at the appropriate frequencies. Method SA-1, as defined in ANSI C63.10-2013, was used to measure the power spectral density.

The output power density limits are as specified in the tables below.

UNII Band	Frequency Range	Maximum Conducted Power Limit
		FCC
UNII 1	5.15 – 5.25GHz	11dBm/MHz
UNII 2A	5.25 – 5.35GHz	
UNII 2C	5.47 – 5.725GHz	
UNII 3	5.725 – 5.850GHz	30dBm/500kHz
UNII 4	5.850 – 5.895GHz	14dBm/MHz e.i.r.p

Test Procedure Used

ANSI C63.10-2013 – Section 12.3.2.3 (Method SA-2)

ANSI C63.10-2013 – Section 14.3.2.2 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 $\geq 2 \times$ (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 7-4. Test Instrument & Measurement Setup

Test Notes

All Cases were investigated; a subset of the taken plots were included to represent relevant settings and measurements.

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Summed MIMO Power Spectral Density Measurements

	Frequency [MHz]	Channel	802.11 MODE	Antenna 1 PSD [dBm]	Antenna 2 PSD [dBm]	DCCF [dB]	MIMO Summed PSD [dBm]	Max PSD [dBm]	Margin [dB]
Band 1	5180	36	a	6.01	6.56	0.15	9.45	11.00	-1.55
	5200	40	a	6.32	6.55	0.15	9.60	11.00	-1.40
	5240	48	a	6.60	6.60	0.15	9.76	11.00	-1.24
	5180	36	n	4.70	5.42	0.00	8.08	11.00	-2.92
	5200	40	n	4.80	5.44	0.00	8.14	11.00	-2.86
	5240	48	n	5.45	5.43	0.00	8.45	11.00	-2.55
	5180	36	ac	4.48	5.29	0.00	7.91	11.00	-3.09
	5200	40	ac	5.17	5.27	0.00	8.23	11.00	-2.77
	5240	48	ac	5.61	5.45	0.00	8.54	11.00	-2.46
	5180	36	ax/be SU	4.34	5.23	0.00	7.82	11.00	-3.18
	5200	40	ax/be SU	4.96	5.57	0.00	8.28	11.00	-2.72
	5240	48	ax/be SU	5.46	5.40	0.00	8.44	11.00	-2.56
	5190	38	n	1.39	1.67	0.00	4.54	11.00	-6.46
	5230	46	n	0.00	1.36	0.00	3.74	11.00	-7.26
	5190	38	ac	1.17	1.47	0.17	4.51	11.00	-6.49
	5230	46	ac	0.27	1.42	0.17	4.06	11.00	-6.94
	5190	38	ax/be SU	1.24	1.27	0.00	4.26	11.00	-6.74
	5230	46	ax/be SU	-0.22	1.06	0.00	3.48	11.00	-7.52
	5210	42	ac	-1.74	-1.19	0.39	1.94	11.00	-9.06
	5210	42	ax/be SU	-1.71	-1.44	0.00	1.44	11.00	-9.56
Band 1/2A	5250	50	ac	-5.37	-5.21	0.35	-1.92	11.00	-12.92
	5250	50	ax/be SU	-5.64	-5.29	0.00	-2.45	11.00	-13.45
Band 2A	5260	52	a	6.72	6.87	0.15	9.95	11.00	-1.05
	5280	56	a	6.66	6.85	0.15	9.92	11.00	-1.08
	5320	64	a	7.09	7.19	0.15	10.30	11.00	-0.70
	5260	52	n	5.51	5.71	0.00	8.62	11.00	-2.38
	5280	56	n	4.96	5.76	0.00	8.39	11.00	-2.61
	5320	64	n	5.43	6.09	0.00	8.78	11.00	-2.22
	5260	52	ac	5.55	5.63	0.00	8.60	11.00	-2.40
	5280	56	ac	5.00	5.65	0.00	8.35	11.00	-2.65
	5320	64	ac	5.35	5.92	0.00	8.65	11.00	-2.35
	5260	52	ax/be SU	5.54	5.71	0.00	8.64	11.00	-2.36
	5280	56	ax/be SU	4.69	5.72	0.00	8.24	11.00	-2.76
	5320	64	ax/be SU	5.36	5.83	0.00	8.61	11.00	-2.39
	5270	54	n	1.33	1.63	0.00	4.49	11.00	-6.51
	5310	62	n	1.53	2.09	0.00	4.83	11.00	-6.17
	5270	54	ac	0.96	1.51	0.17	4.42	11.00	-6.58
	5310	62	ac	1.24	1.79	0.17	4.71	11.00	-6.29
	5270	54	ax/be SU	0.82	1.54	0.00	4.20	11.00	-6.80
	5310	62	ax/be SU	1.29	1.98	0.00	4.66	11.00	-6.34
	5290	58	ac	-2.37	-1.27	0.39	1.61	11.00	-9.39
	5290	58	ax/be SU	-2.30	-1.65	0.00	1.05	11.00	-9.95
Band 2C	5500	100	a	6.76	7.44	0.15	10.27	11.00	-0.73
	5600	120	a	6.25	6.70	0.15	9.64	11.00	-1.36
	5720	144	a	6.49	7.46	0.15	10.16	11.00	-0.84
	5500	100	n	5.48	6.45	0.00	9.01	11.00	-1.99
	5600	120	n	4.87	5.65	0.00	8.29	11.00	-2.71
	5720	144	n	5.26	6.40	0.00	8.88	11.00	-2.12
	5500	100	ac	5.62	6.14	0.00	8.90	11.00	-2.10
	5600	120	ac	4.68	5.61	0.00	8.18	11.00	-2.82
	5720	144	ac	5.34	6.08	0.00	8.74	11.00	-2.26
	5500	100	ax/be SU	5.40	6.01	0.00	8.72	11.00	-2.28
	5600	120	ax/be SU	4.65	5.38	0.00	8.04	11.00	-2.96
	5720	144	ax/be SU	5.32	6.20	0.00	8.79	11.00	-2.21
	5510	102	n	1.54	2.32	0.00	4.96	11.00	-6.04
	5590	118	n	0.82	1.85	0.00	4.38	11.00	-6.62
	5710	142	n	1.37	2.38	0.00	4.91	11.00	-6.09
	5510	102	ac	1.57	2.42	0.17	5.19	11.00	-5.81
	5590	118	ac	1.85	1.64	0.17	4.93	11.00	-6.07
	5710	142	ac	1.04	2.22	0.17	4.85	11.00	-6.15
	5510	102	ax/be SU	1.07	1.93	0.00	4.53	11.00	-6.47
	5590	118	ax/be SU	0.54	1.68	0.00	4.16	11.00	-6.84
5710	142	ax/be SU	0.74	2.01	0.00	4.43	11.00	-6.57	
5530	106	ac	-1.90	-1.05	0.39	1.95	11.00	-9.05	
5610	122	ac	-2.96	-1.32	0.39	1.34	11.00	-9.66	
5690	138	ac	-2.36	-1.06	0.39	1.74	11.00	-9.26	
5530	106	ax/be SU	-2.19	-1.26	0.00	1.31	11.00	-9.69	
5610	122	ax/be SU	-2.80	-1.31	0.00	1.02	11.00	-9.98	
5690	138	ax/be SU	-2.51	-1.24	0.00	1.18	11.00	-9.82	
5570	114	ac	-5.52	-5.32	0.35	-2.06	11.00	-13.06	
5570	114	ax/be SU	-5.24	-5.07	0.00	-2.14	11.00	-13.14	

Table 7-23. Bands 1, 2A, 2C MIMO Conducted Power Spectral Density Measurements

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	Frequenc y [MHz]	Channel	802.11 MODE	Antenna 1 PSD [dBm]	Antenna 2 PSD [dBm]	DCCF [dB]	MIMO Summed PSD [dBm]	Max PSD [dBm]	Margin [dB]
Band 3	5745	149	a	3.84	5.12	0.15	7.69	11.00	-3.31
	5785	157	a	3.64	4.29	0.15	7.13	11.00	-3.87
	5825	165	a	3.59	4.13	0.15	7.03	11.00	-3.97
	5745	149	n	2.81	3.78	0.00	6.33	11.00	-4.67
	5785	157	n	2.58	3.00	0.00	5.80	11.00	-5.20
	5825	165	n	2.13	2.87	0.00	5.53	11.00	-5.47
	5745	149	ac	2.57	3.69	0.00	6.18	11.00	-4.82
	5785	157	ac	2.31	2.90	0.00	5.63	11.00	-5.37
	5825	165	ac	2.25	2.50	0.00	5.39	11.00	-5.61
	5745	149	ax/be SU	2.55	3.64	0.00	6.14	11.00	-4.86
	5785	157	ax/be SU	2.19	2.92	0.00	5.58	11.00	-5.42
	5825	165	ax/be SU	2.07	2.64	0.00	5.37	11.00	-5.63
	5755	151	n	-1.38	-0.24	0.00	2.24	11.00	-8.76
	5795	159	n	-1.60	-0.87	0.00	1.79	11.00	-9.21
	5755	151	ac	-1.79	-0.19	0.17	2.26	11.00	-8.74
	5795	159	ac	-1.74	-0.63	0.17	2.03	11.00	-8.97
	5755	151	ax/be SU	-1.87	-0.67	0.00	1.78	11.00	-9.22
	5795	159	ax/be SU	-1.93	-1.34	0.00	1.39	11.00	-9.61
5775	155	ac	-4.72	-3.69	0.39	-0.78	11.00	-11.78	
5775	155	ax/be SU	-4.79	-3.64	0.00	-1.16	11.00	-12.16	

Table 7-24. Band 3 MIMO Conducted Power Spectral Density Measurements

	Frequenc y [MHz]	Channel	802.11 MODE	Antenna 1 PSD [dBm]	Antenna 2 PSD [dBm]	MIMO Summed PSD [dBm]	Directional Antenna Gain [dBi]	DCCF [dB]	EIRP PSD [dBm]	Max EIRP PSD [dBm]	Margin [dB]
Band 3/4	5845	169	a	6.20	6.70	9.47	-0.57	0.15	9.05	14.00	-4.95
Band 4	5865	173	a	6.17	6.72	9.47	-0.57	0.15	9.05	14.00	-4.95
	5885	177	a	6.27	6.95	9.63	-0.57	0.15	9.21	14.00	-4.79
Band 3/4	5845	169	n	5.12	5.68	8.42	-0.57	0.00	7.85	14.00	-6.15
Band 4	5865	173	n	4.92	5.42	8.19	-0.57	0.00	7.62	14.00	-6.38
	5885	177	n	4.96	5.35	8.17	-0.57	0.00	7.60	14.00	-6.40
Band 3/4	5845	169	ac	4.87	5.45	8.18	-0.57	0.00	7.61	14.00	-6.39
Band 4	5865	173	ac	4.95	5.71	8.35	-0.57	0.00	7.78	14.00	-6.22
	5885	177	ac	4.96	5.46	8.23	-0.57	0.00	7.66	14.00	-6.34
Band 3/4	5845	169	ax/be SU	5.00	5.54	8.29	-0.57	0.00	7.72	14.00	-6.28
Band 4	5865	173	ax/be SU	4.83	5.17	8.01	-0.57	0.00	7.44	14.00	-6.56
	5885	177	ax/be SU	4.87	5.51	8.21	-0.57	0.00	7.64	14.00	-6.36
Band 3/4	5835	167	n	1.30	2.08	4.72	-0.57	0.00	4.15	14.00	-9.85
Band 4	5875	175	n	0.80	1.43	4.14	-0.57	0.00	3.57	14.00	-10.43
Band 3/4	5835	167	ac	0.89	1.69	4.32	-0.57	0.17	3.92	14.00	-10.08
Band 4	5875	175	ac	0.73	1.34	4.06	-0.57	0.17	3.66	14.00	-10.34
Band 3/4	5835	167	ax/be SU	0.83	1.51	4.19	-0.57	0.00	3.62	14.00	-10.38
Band 4	5875	175	ax/be SU	0.61	1.12	3.88	-0.57	0.00	3.32	14.00	-10.68
Band 3/4	5855	171	ac	-2.16	-1.29	1.31	-0.57	0.39	1.13	14.00	-12.87
	5855	171	ax/be SU	-2.41	-1.52	1.07	-0.57	0.00	0.50	14.00	-13.50
	5815	163	ac	-5.61	-4.98	-2.27	-0.57	0.35	-2.49	14.00	-16.49
Band 3/4	5815	163	ax/be SU	-5.70	-4.97	-2.31	-0.57	0.00	-2.88	14.00	-16.88

Table 7-25. Bands 3/4 MIMO Conducted Power Spectral Density Measurements

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	Frequency [MHz]	Channel	802.11 MODE	Punctured Cases	Antenna 1 PSD [dBm]	Antenna 2 PSD [dBm]	DCCF [dB]	MIMO Summed PSD [dBm]	Max PSD [dBm]	Margin [dB]
Band 1	5210	42	be SU	484+242T	-0.19	-0.28	0.00	2.78	11.00	-8.22
Band 1/2A	5250	50	be SU	996+484T	-4.44	-4.44	0.00	-1.43	11.00	-12.43
	5250	50	be SU	996+484+242T	-4.84	-5.17	0.00	-1.99	11.00	-12.99
Band 2A	5290	58	be SU	484+242T	-0.90	-0.28	0.00	2.43	11.00	-8.57
Band 2C	5530	106	be SU	484+242T	-0.94	-0.37	0.00	2.37	11.00	-8.63
	5570	114	be SU	996+484T	-4.58	-4.18	0.00	-1.36	11.00	-12.36
	5570	114	be SU	996+484+242T	-4.98	-4.62	0.00	-1.79	11.00	-12.79

Table 7-26. Bands 1, 2A, 2C MIMO Conducted Power Spectral Density Measurements - Punctured

	Frequency [MHz]	Channel	802.11 MODE	Punctured Cases	Antenna 1 PSD [dBm]	Antenna 2 PSD [dBm]	DCCF [dB]	MIMO Summed PSD [dBm]	Max PSD [dBm]	Margin [dB]
Band 3	5775	155	be SU	484+242T	-3.61	-2.31	0.00	0.10	11.00	-10.90

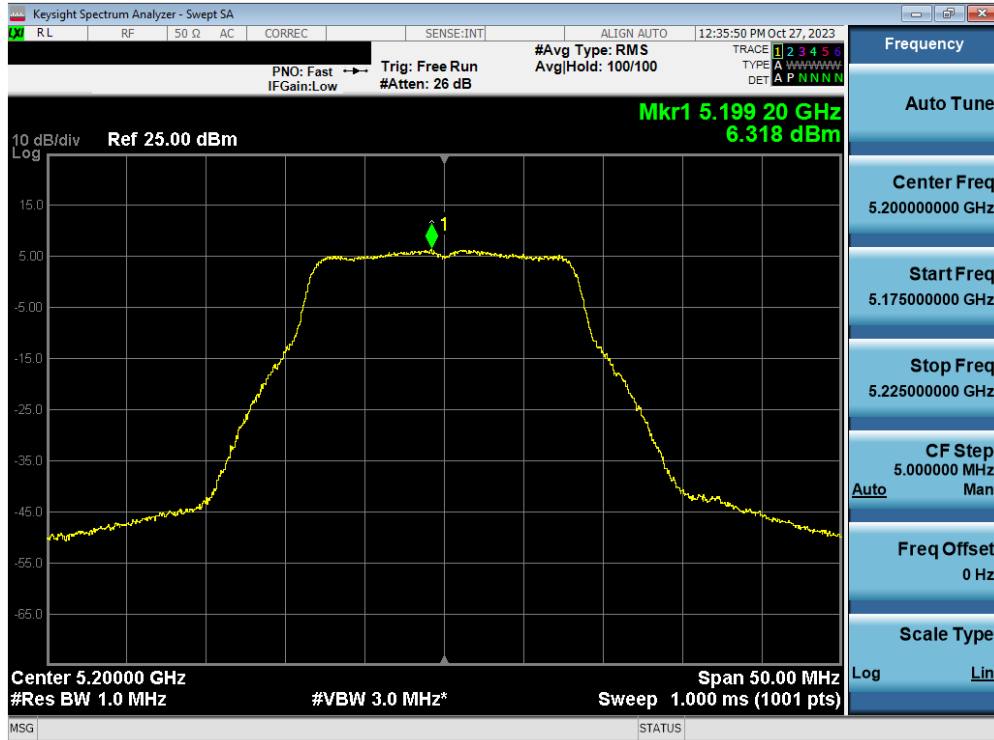
Table 7-27. Band 3 MIMO Conducted Power Spectral Density Measurements - Punctured

	Frequency [MHz]	Channel	802.11 MODE	Punctured Cases	Antenna 1 PSD [dBm]	Antenna 2 PSD [dBm]	MIMO Summed PSD [dBm]	Directional Antenna Gain [dBi]	DCCF [dB]	EIRP PSD [dBm]	Max EIRP PSD [dBm]	Margin [dB]
Band 3/4	5855	171	be SU	484+242T	-0.67	0.00	2.69	-0.57	0.00	2.12	14.00	-11.88
	5815	163	be SU	996+484T	-4.31	-3.78	-1.03	-0.57	0.00	-1.60	14.00	-15.60
	5815	163	be SU	996+484+242T	-4.70	-4.45	-1.56	-0.57	0.00	-2.13	14.00	-16.13

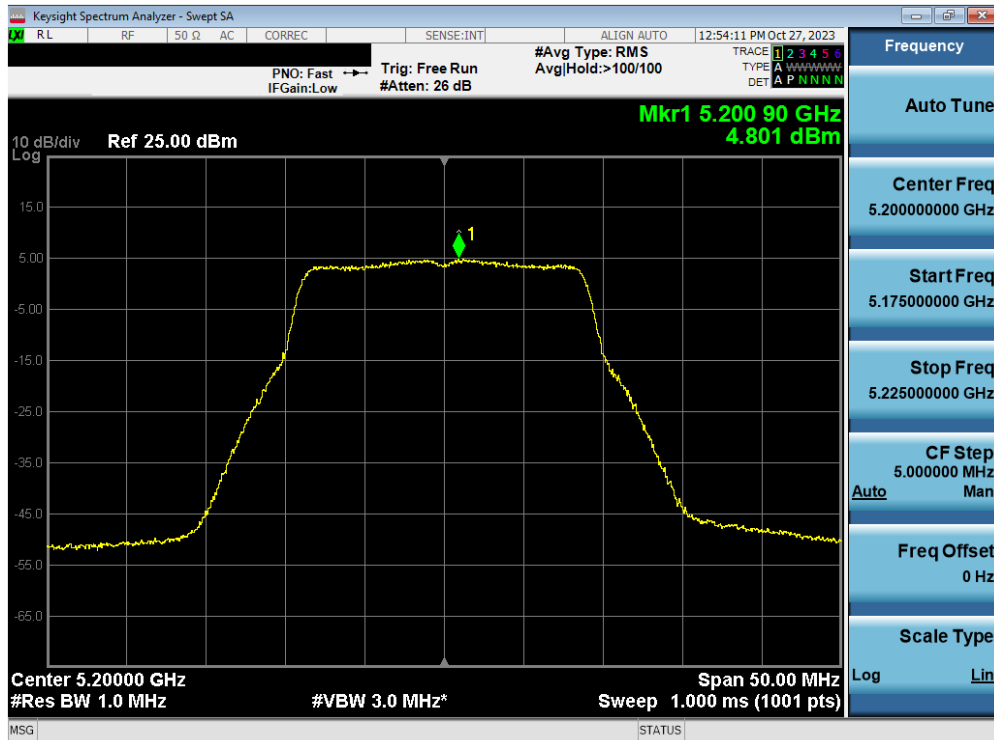
Table 7-28. Bands 3/4 MIMO Conducted Power Spectral Density Measurements - Punctured

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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7.5.1 MIMO Antenna-1 Power Spectral Density Measurements

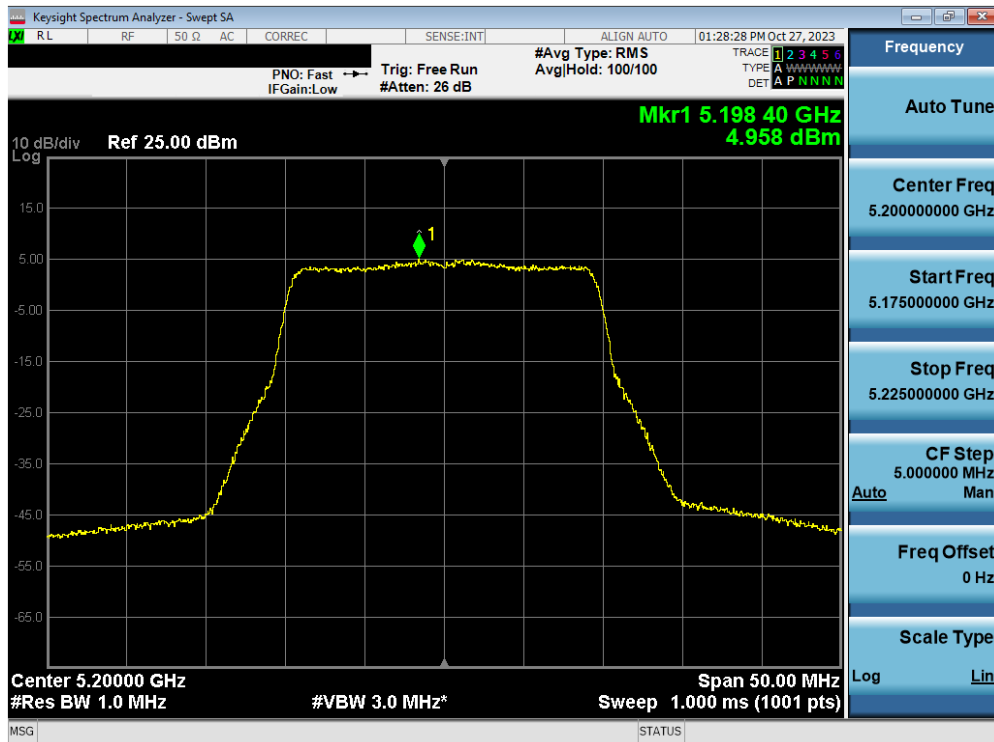


Plot 7-83. Power Spectral Density Plot MIMO ANT1 (802.11a (UNII Band 1) – Ch. 40)

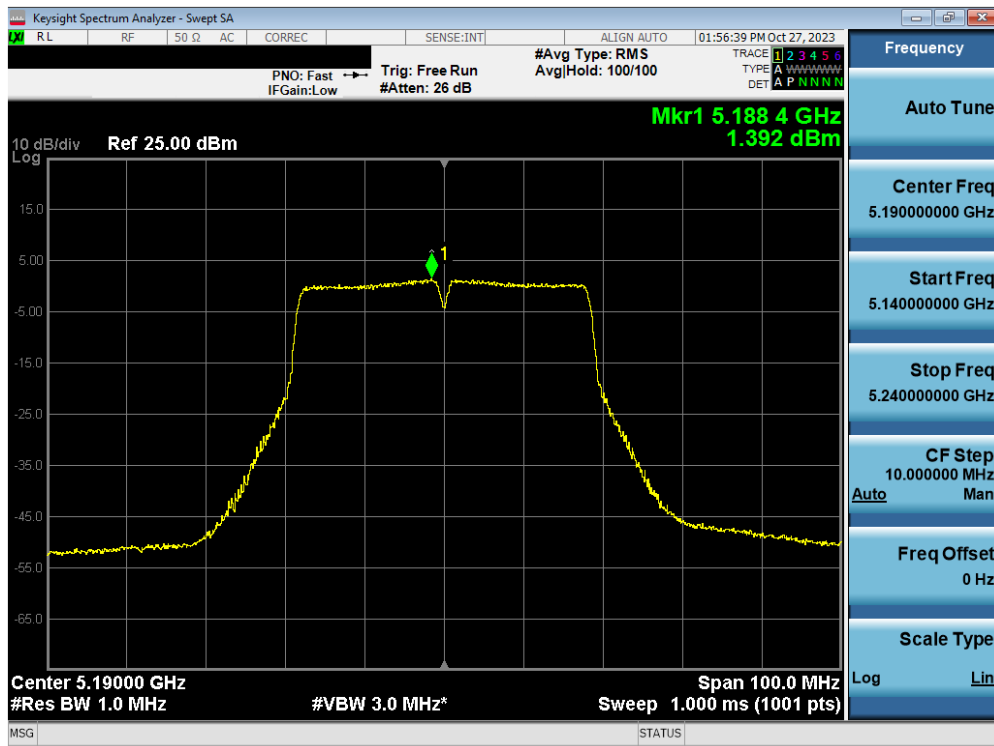


Plot 7-84. Power Spectral Density Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 1) – Ch. 40)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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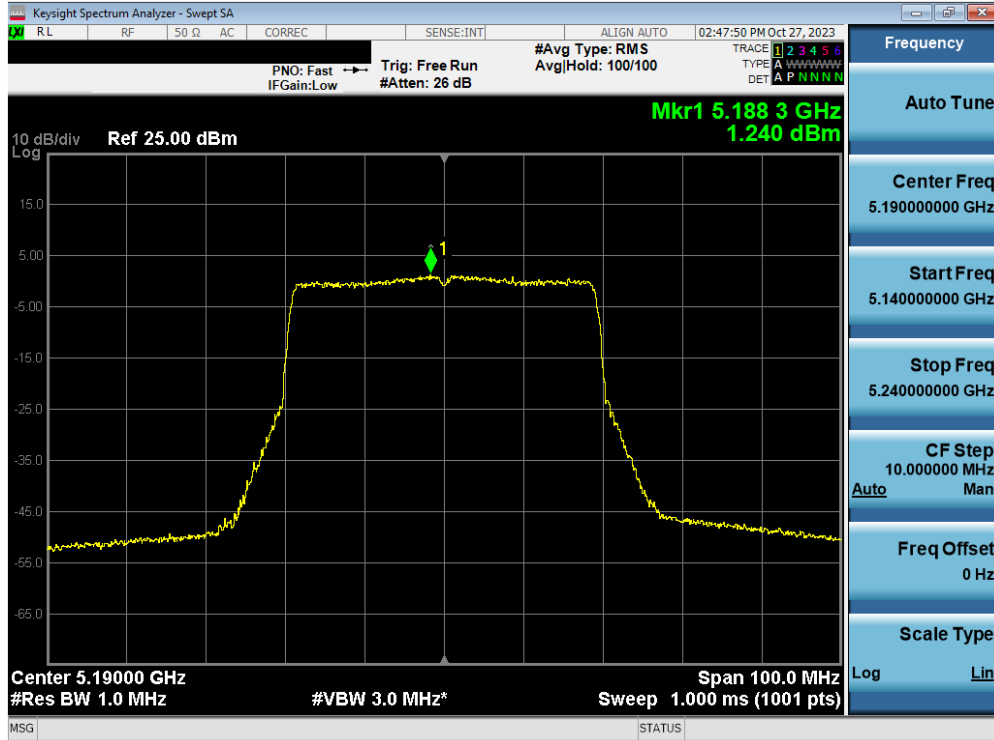


Plot 7-85. Power Spectral Density Plot MIMO ANT1 (20MHz BW 802.11be (UNII Band 1) – Ch. 40)

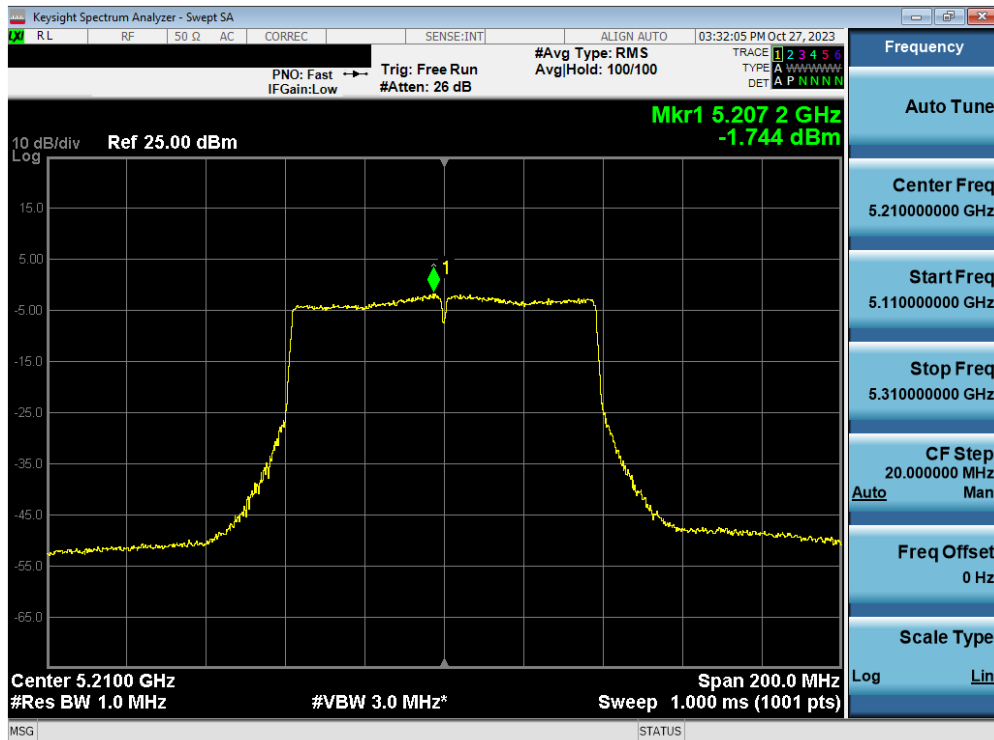


Plot 7-86. Power Spectral Density Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 1) – Ch. 38)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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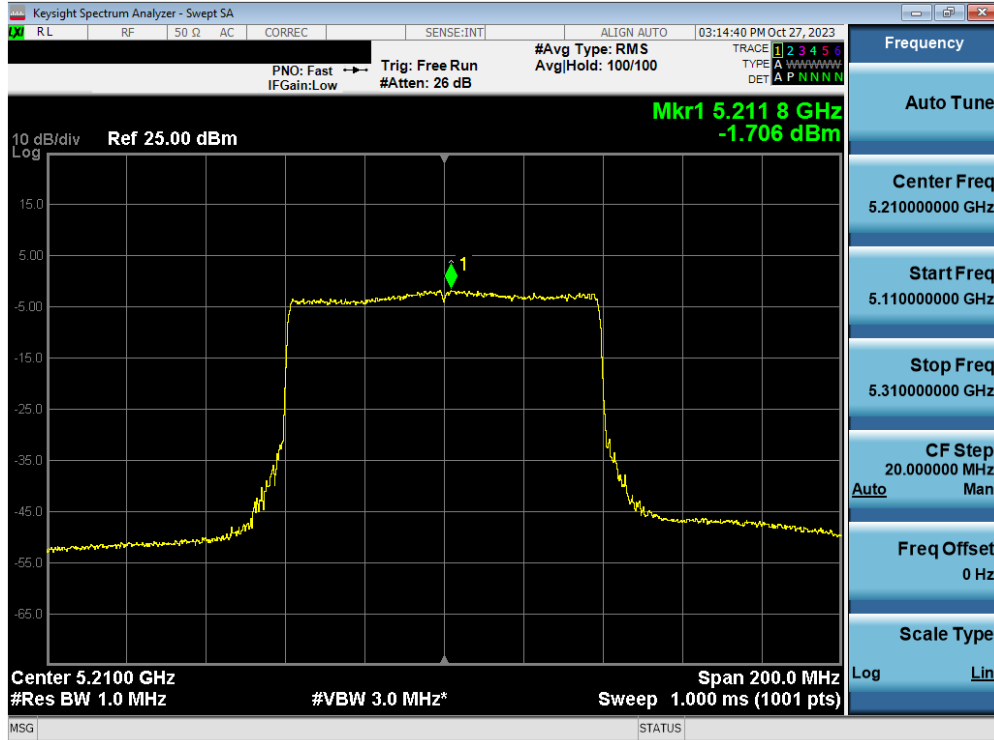


Plot 7-87. Power Spectral Density Plot MIMO ANT1 (40MHz BW 802.11be (UNII Band 1) – Ch. 38)

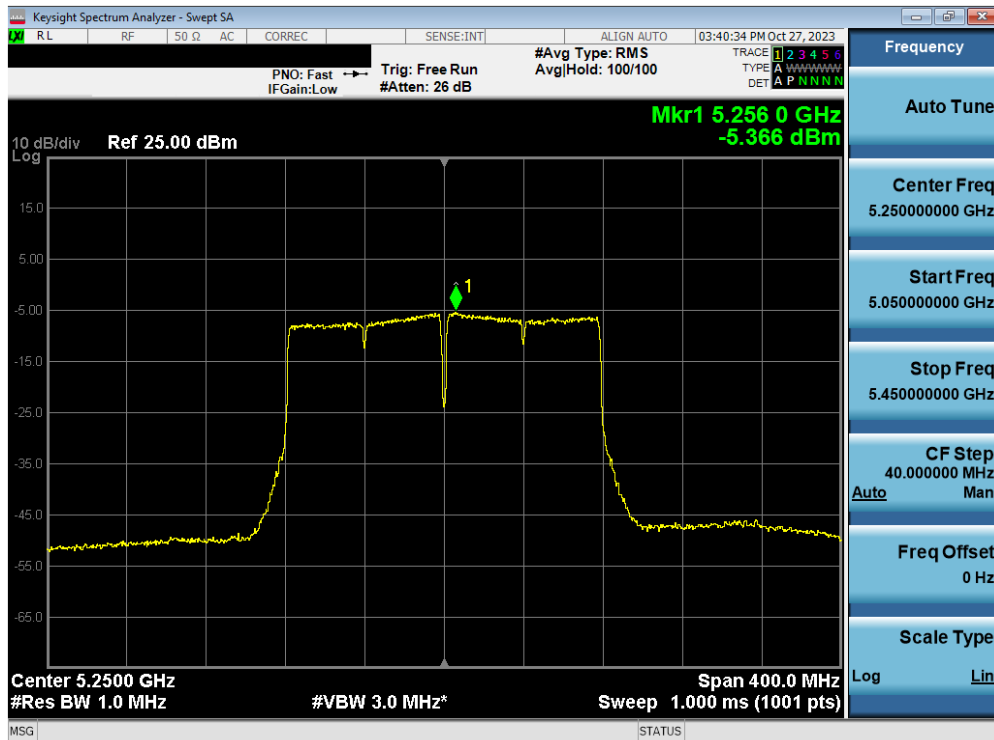


Plot 7-88. Power Spectral Density Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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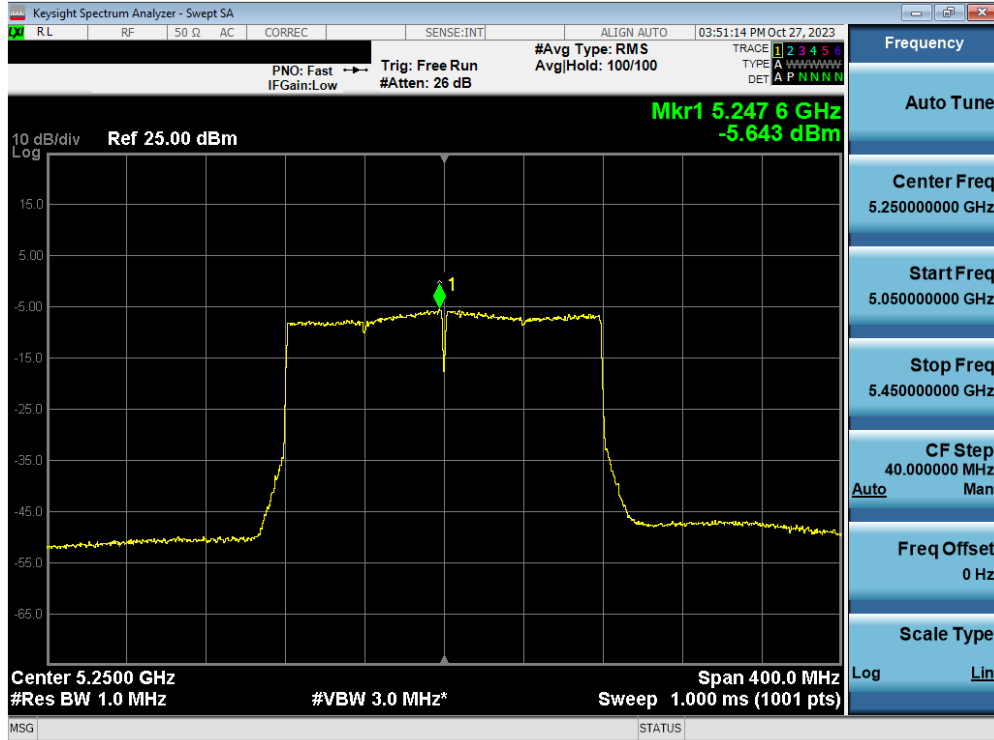


Plot 7-89. Power Spectral Density Plot MIMO ANT1 (80MHz BW 802.11be (UNII Band 1) – Ch. 42)

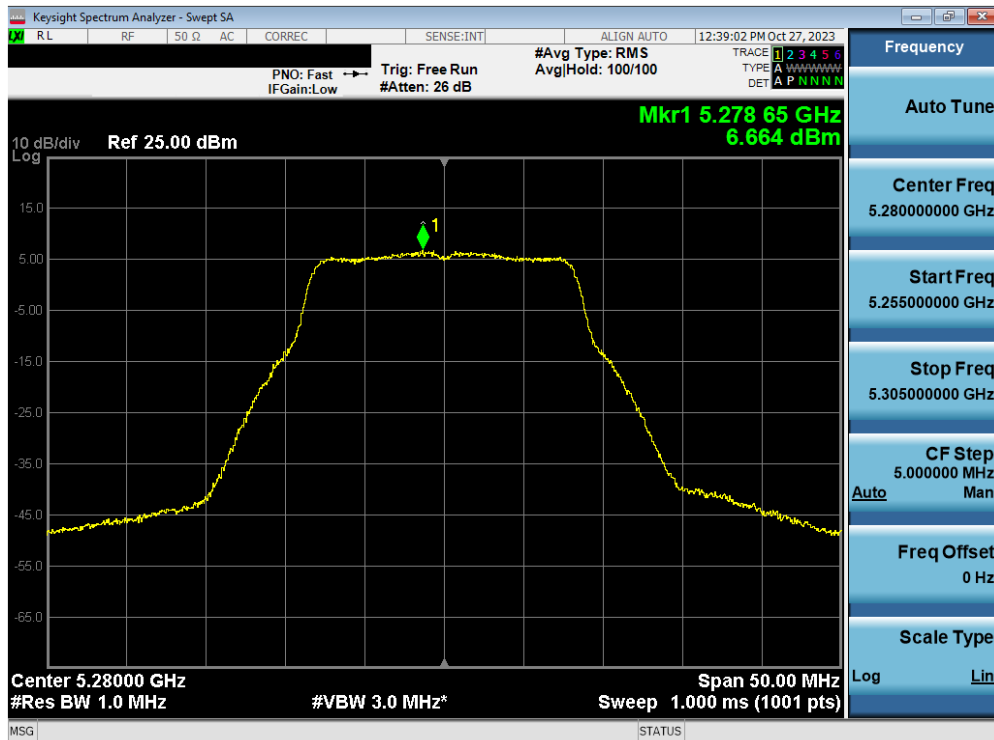


Plot 7-90. Power Spectral Density Plot MIMO ANT1 (160MHz BW 802.11ac (UNII Band 1/2A) – Ch. 50)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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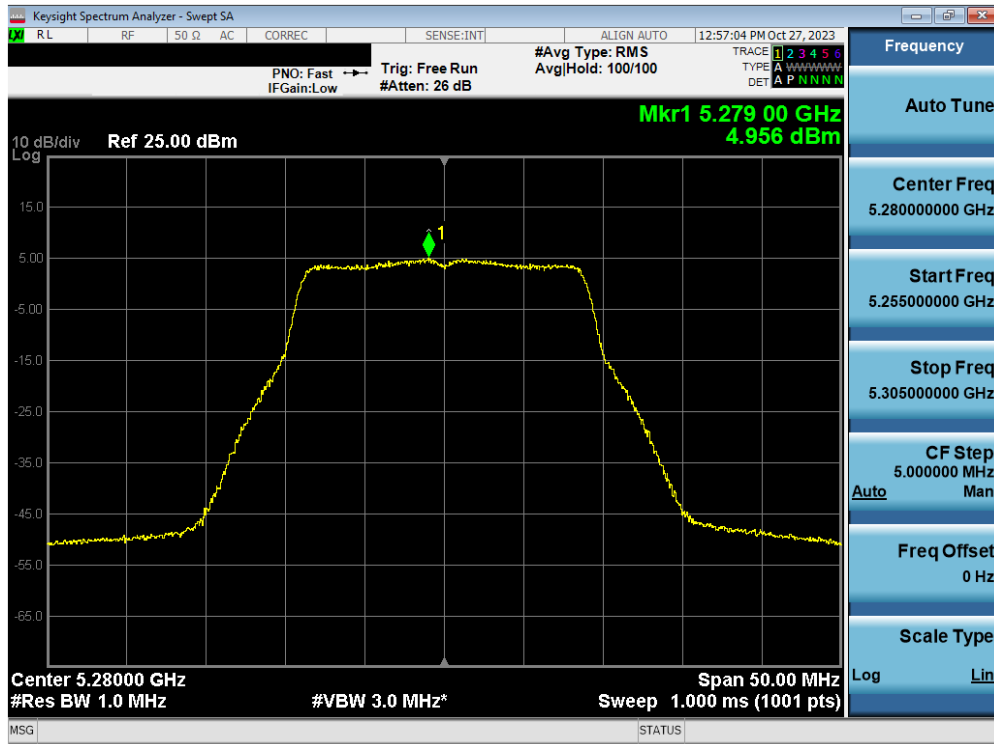


Plot 7-91. Power Spectral Density Plot MIMO ANT1 (160MHz BW 802.11be (UNII Band 1/2A) – Ch. 50)

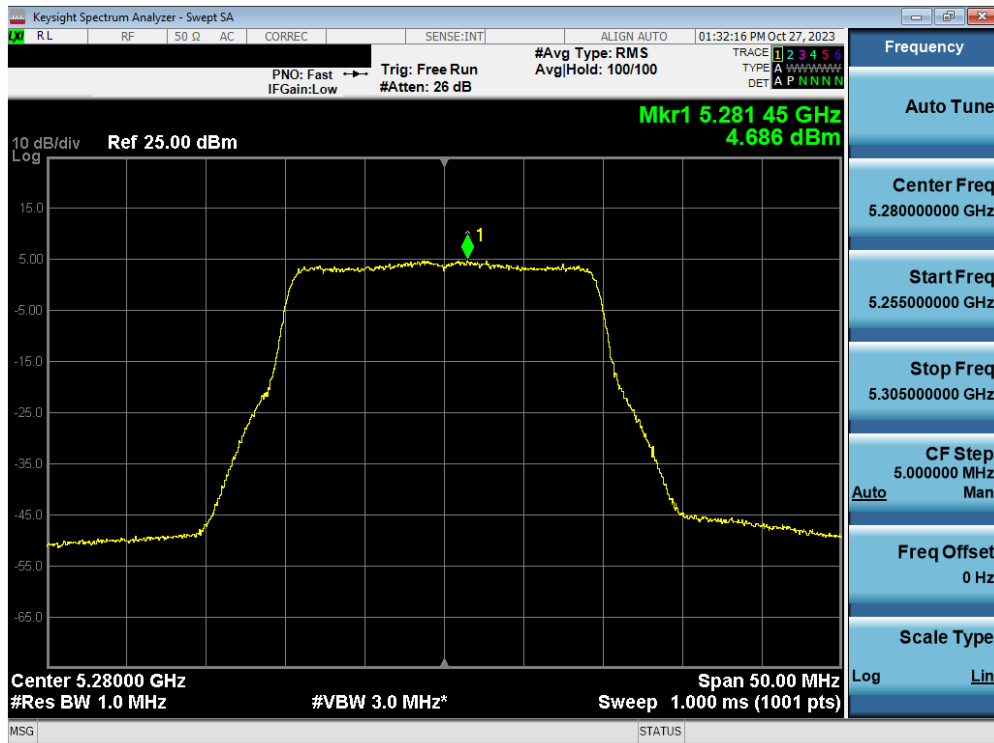


Plot 7-92. Power Spectral Density Plot MIMO ANT1 (802.11a (UNII Band 2A) – Ch. 56)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 76 of 168

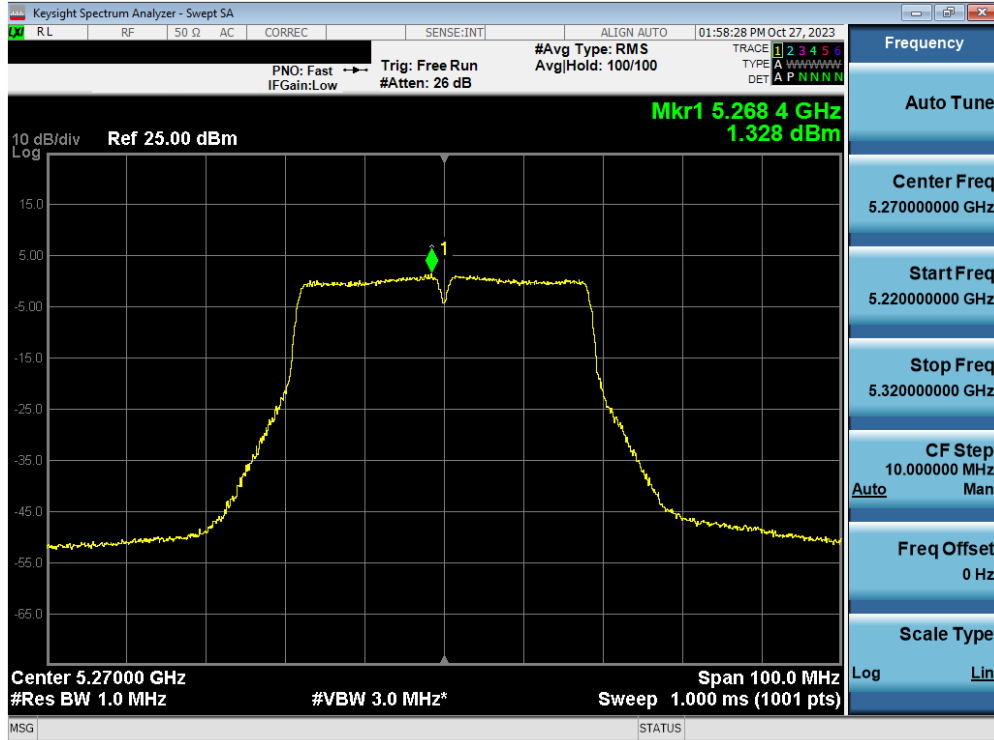


Plot 7-93. Power Spectral Density Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)

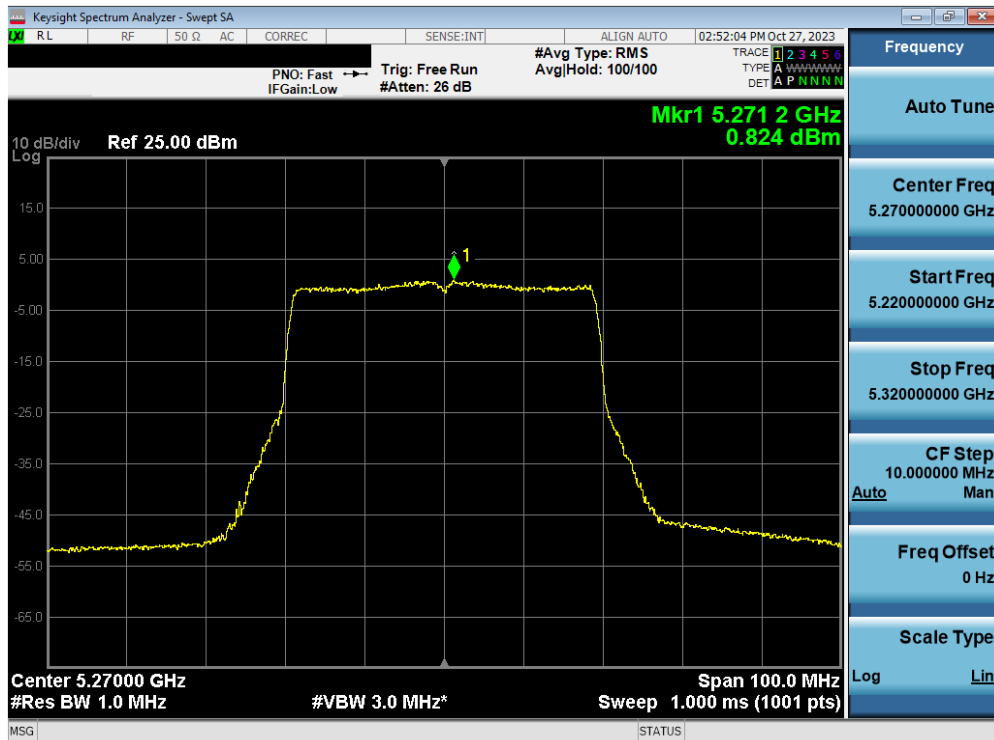


Plot 7-94. Power Spectral Density Plot MIMO ANT1 (20MHz BW 802.11be (UNII Band 2A) – Ch. 56)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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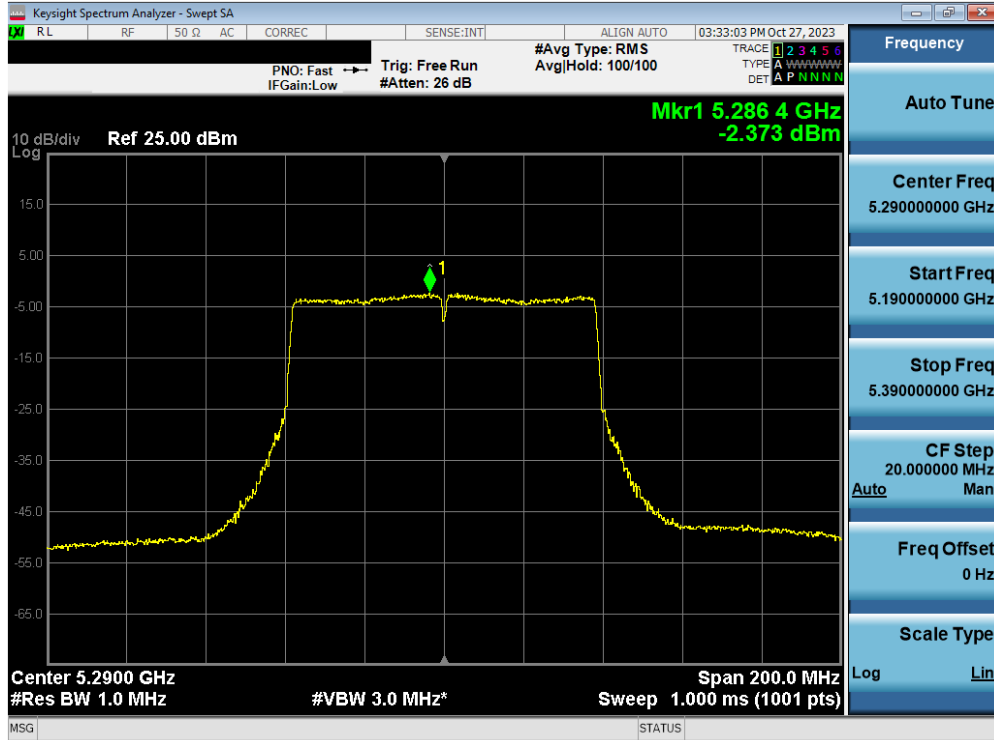


Plot 7-95. Power Spectral Density Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)

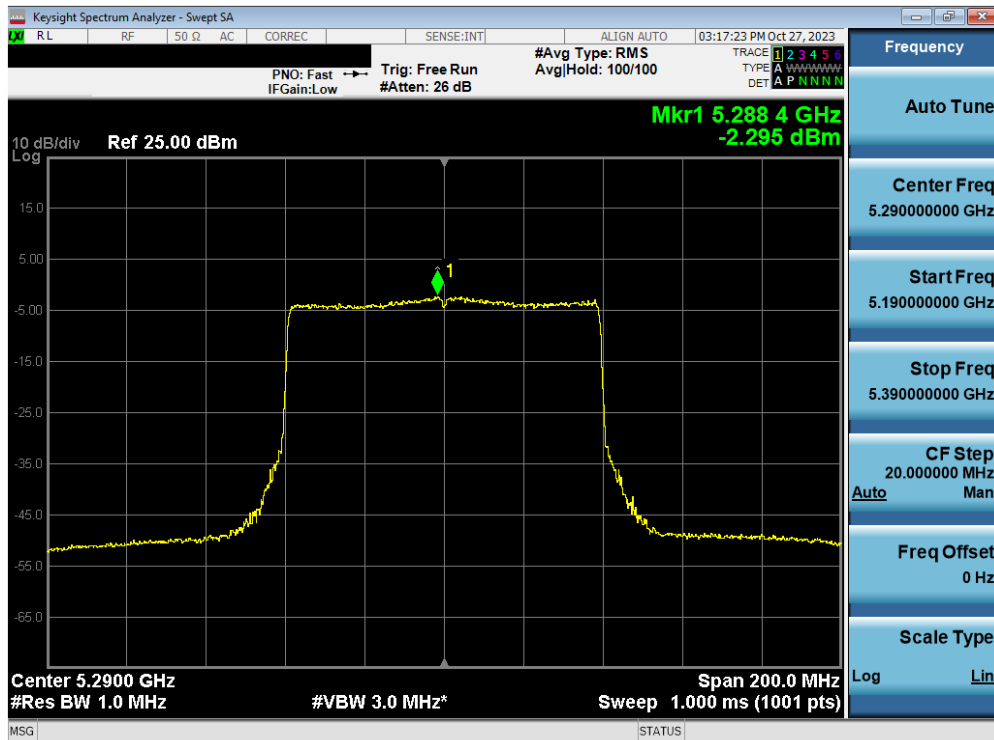


Plot 7-96. Power Spectral Density Plot MIMO ANT1 (40MHz BW 802.11be (UNII Band 2A) – Ch. 54)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 78 of 168

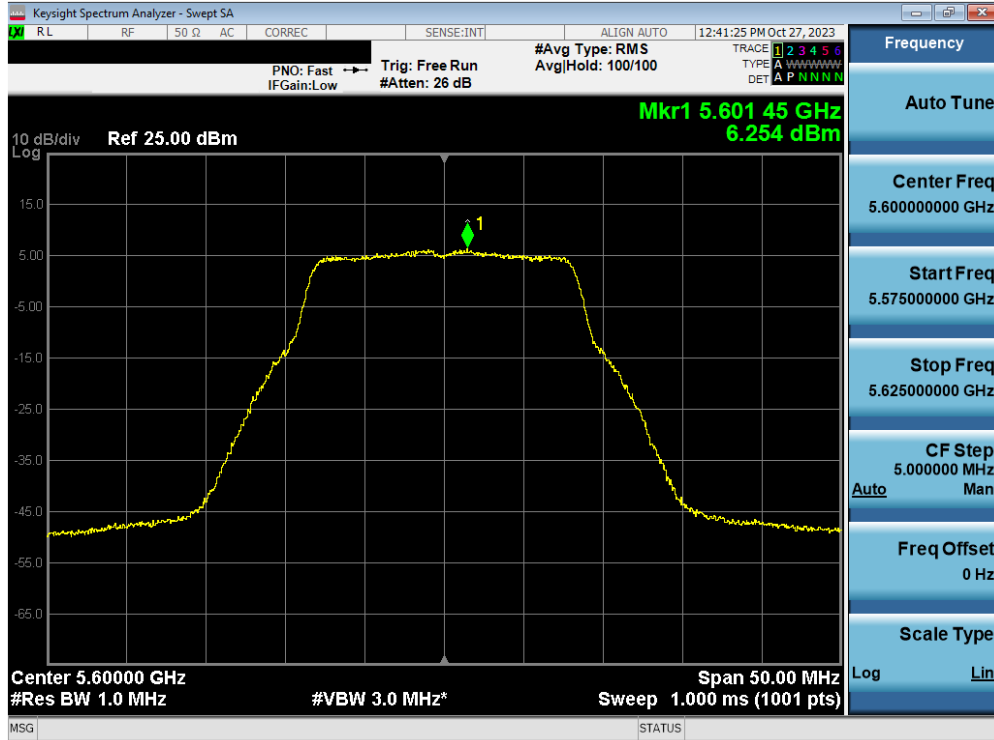


Plot 7-97. Power Spectral Density Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 2A) – Ch. 58)

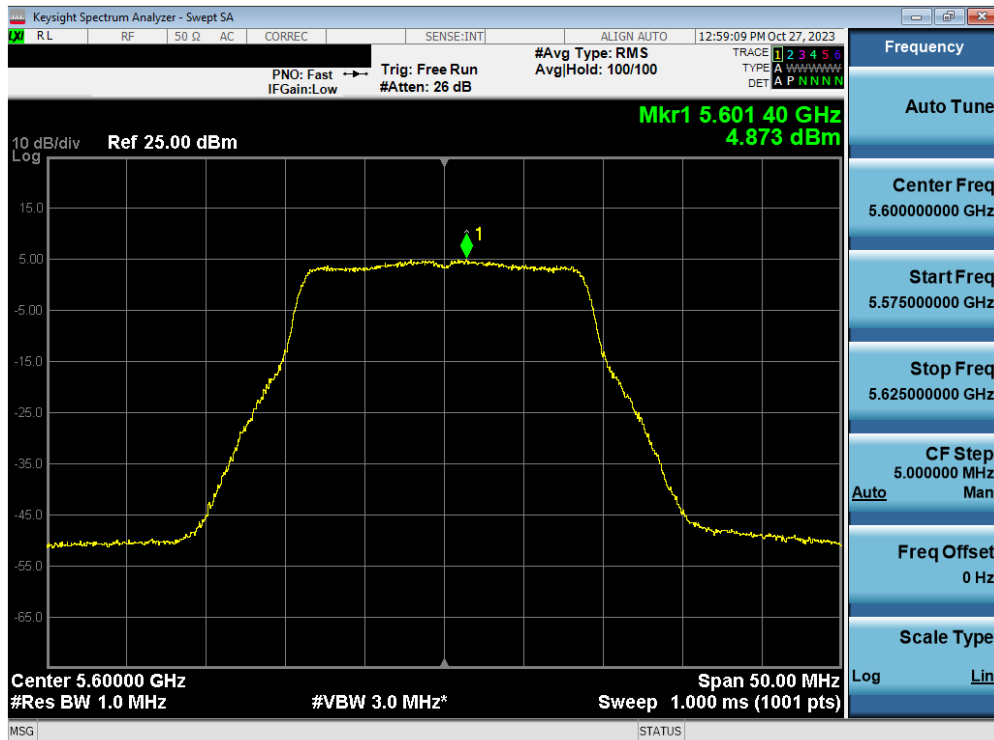


Plot 7-98. Power Spectral Density Plot MIMO ANT1 (80MHz BW 802.11be (UNII Band 2A) – Ch. 58)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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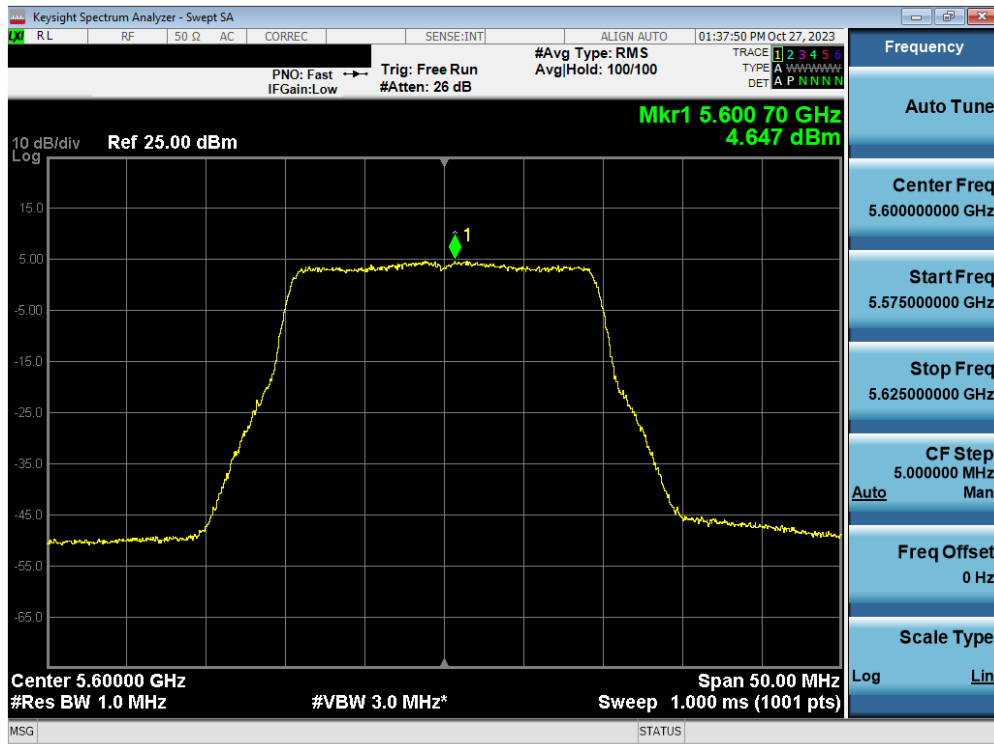


Plot 7-99. Power Spectral Density Plot MIMO ANT1 (802.11a (UNII Band 2C) – Ch. 120)

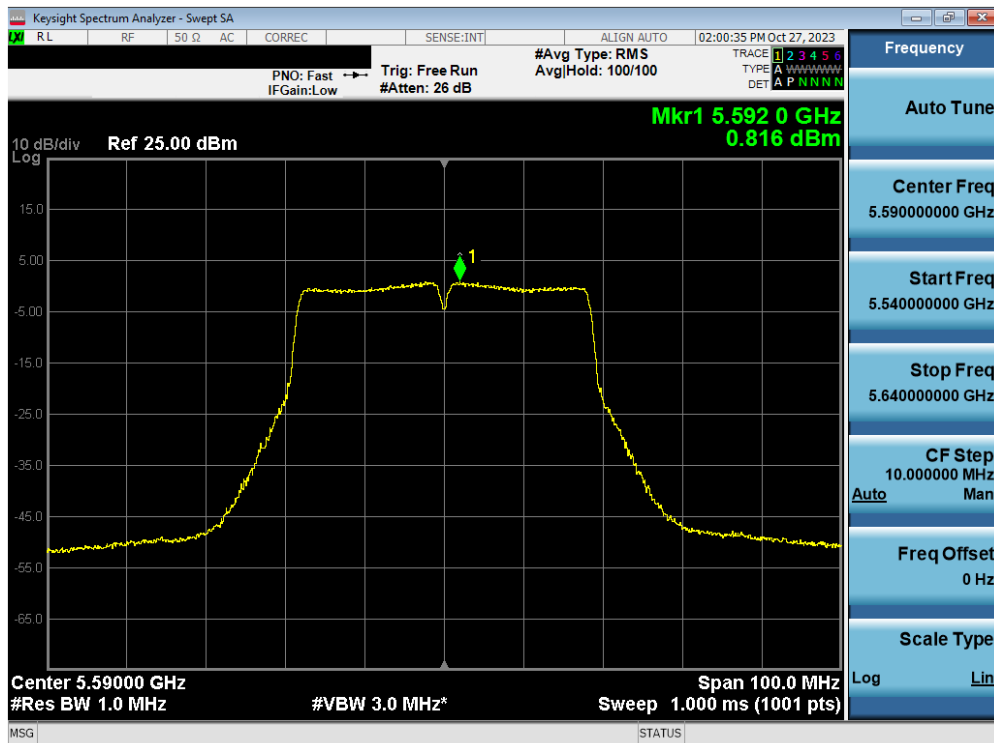


Plot 7-100. Power Spectral Density Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 2C) – Ch. 120)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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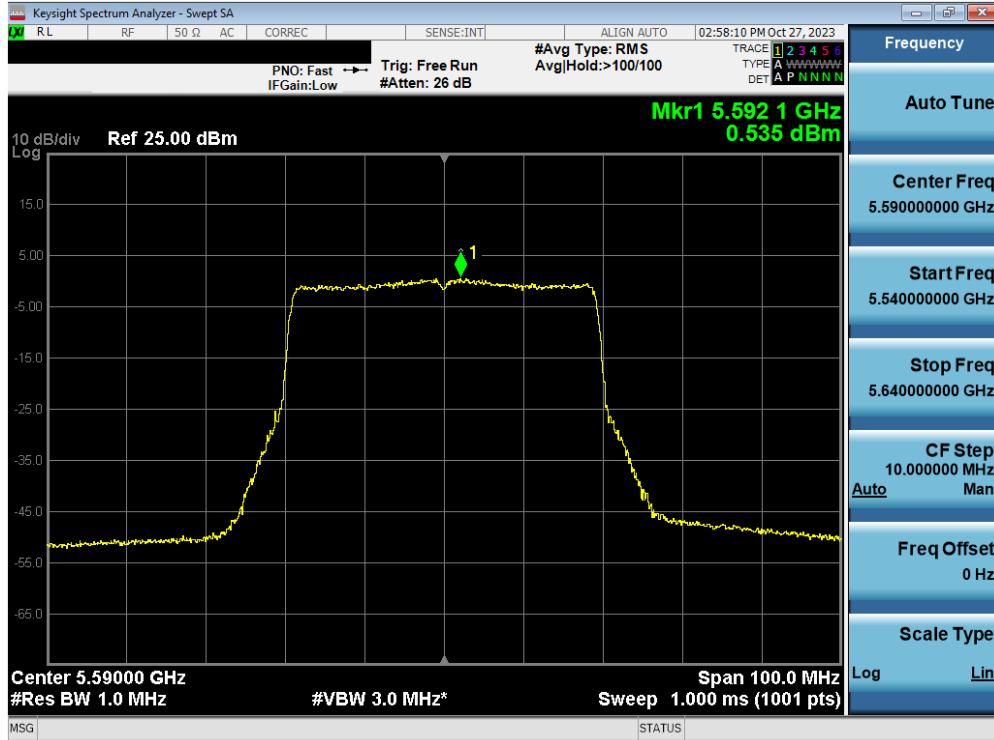


Plot 7-101. Power Spectral Density Plot MIMO ANT1 (20MHz BW 802.11be (UNII Band 2C) – Ch. 120)

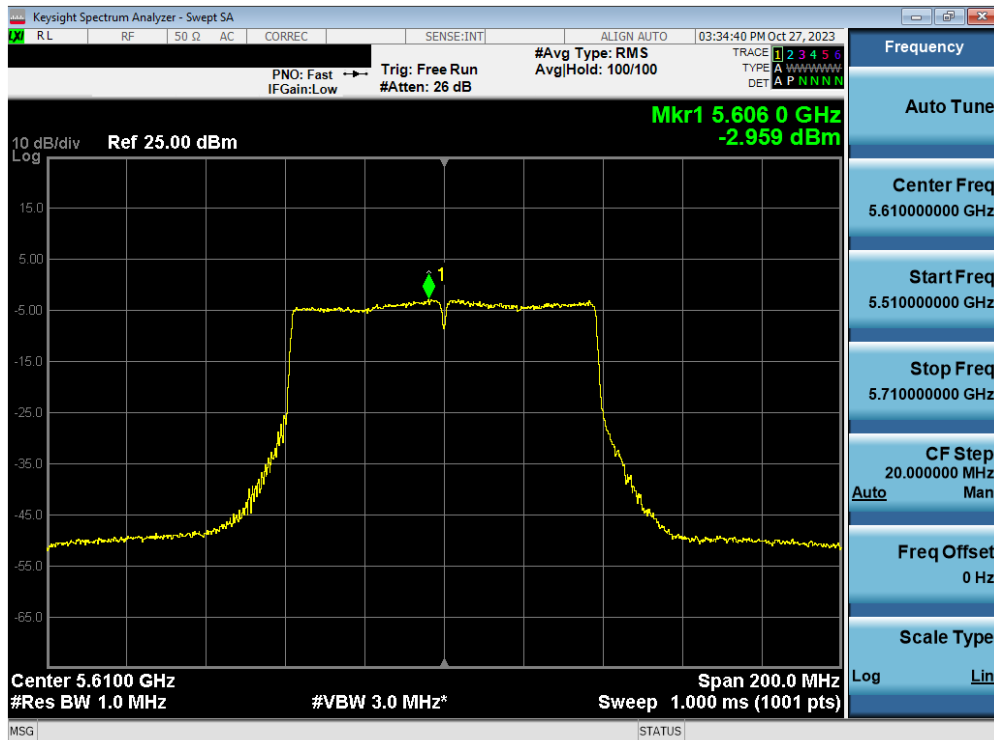


Plot 7-102. Power Spectral Density Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 2C) – Ch. 118)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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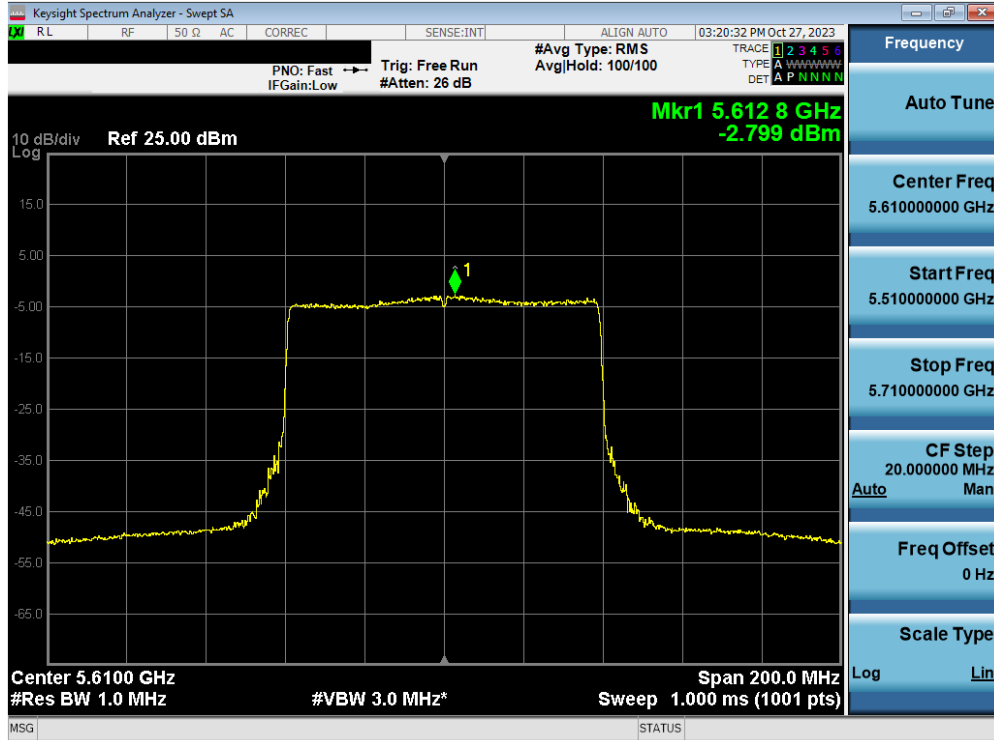


Plot 7-103. Power Spectral Density Plot MIMO ANT1 (40MHz BW 802.11be (UNII Band 2C) – Ch. 118)

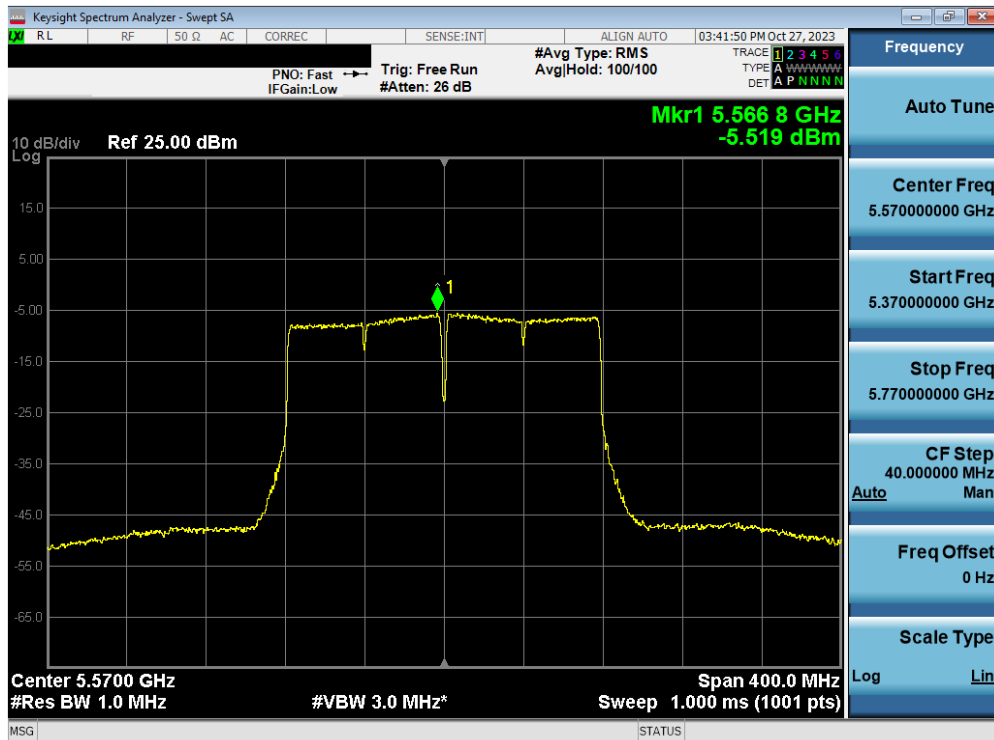


Plot 7-104. Power Spectral Density Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 2C) – Ch. 122)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2308210093-13.A3L	Test Dates: 8/21/2023 - 11/10/2023	EUT Type: Portable Handset	Page 82 of 168

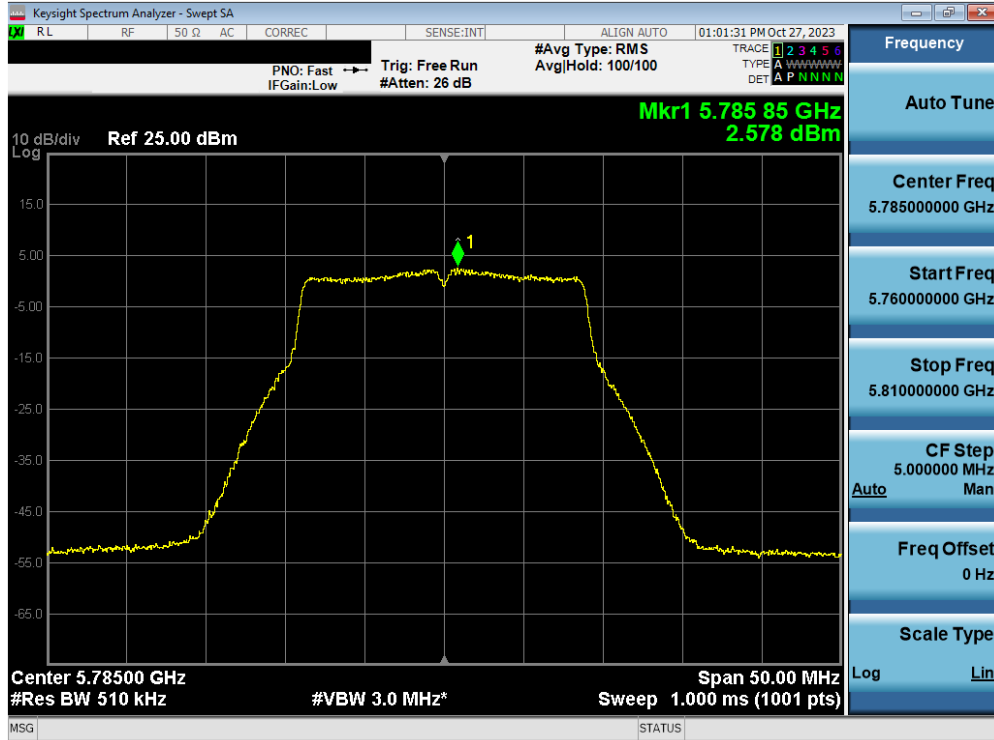


Plot 7-105. Power Spectral Density Plot MIMO ANT1 (80MHz BW 802.11be (UNII Band 2C) – Ch. 122)

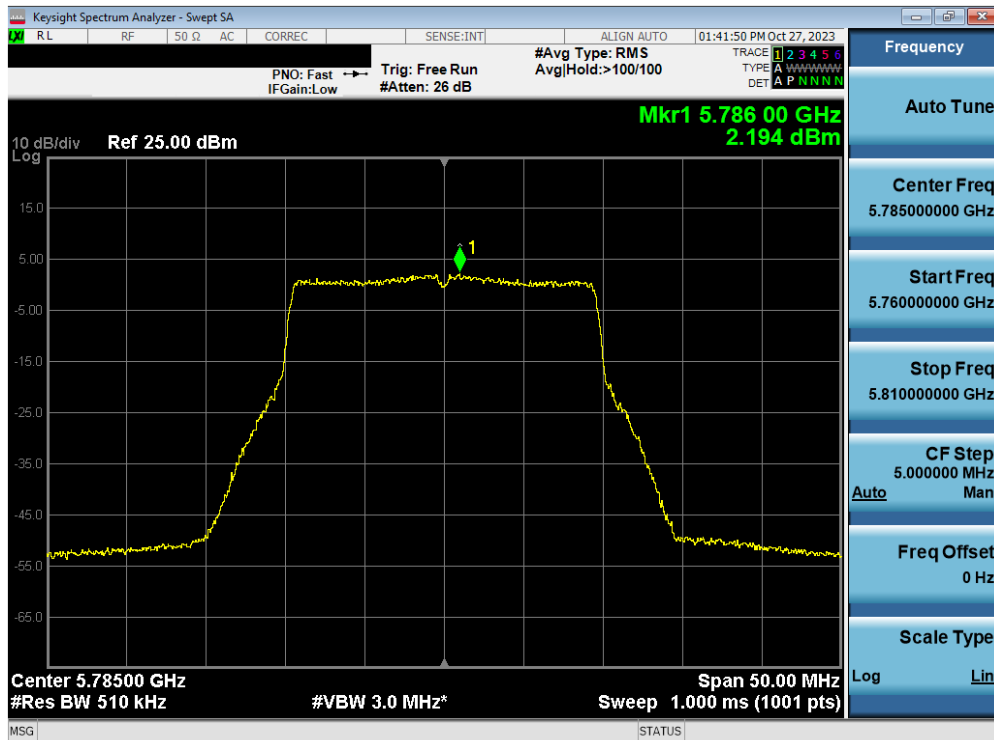


Plot 7-106. Power Spectral Density Plot MIMO ANT1 (160MHz BW 802.11ac (UNII Band 2C) – Ch. 114)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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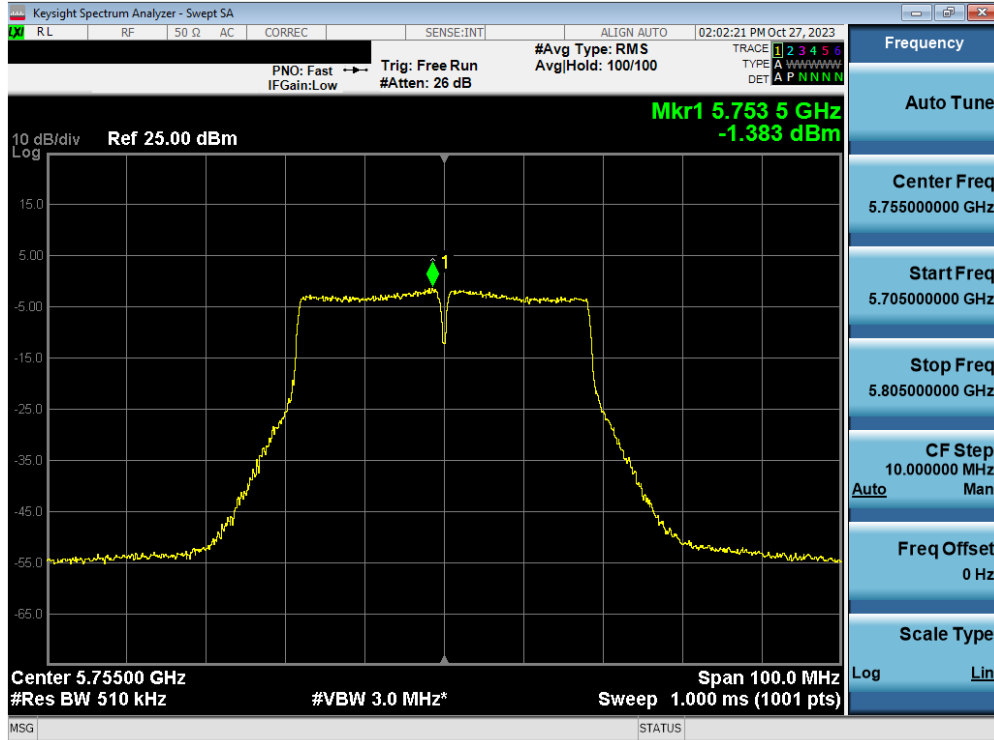


Plot 7-109. Power Spectral Density Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 3) – Ch. 157)

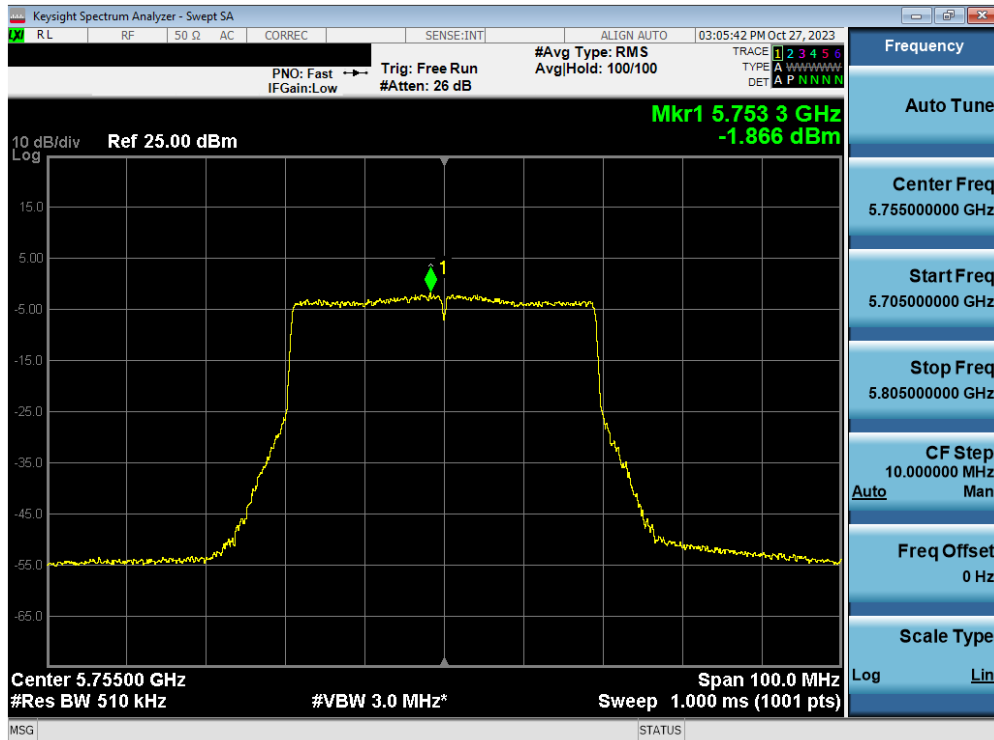


Plot 7-110. Power Spectral Density Plot MIMO ANT1 (20MHz BW 802.11be (UNII Band 3) – Ch. 157)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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Plot 7-111. Power Spectral Density Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 3) – Ch. 151)



Plot 7-112. Power Spectral Density Plot MIMO ANT1 (40MHz BW 802.11be (UNII Band 3) – Ch. 151)

FCC ID: A3LSMS928B	MEASUREMENT REPORT		Approved by: Technical Manager
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